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This manual is intended to assist operating personnel in becoming familiar with the product and as guidance in ordering necessary parts inclusive of Axiline's warranty requirements. Maximum operating efficiency and life of any Axiline Precision Product will be attained through complete understanding of the instructions and recommendations contained within this manual.

WARNING

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Introduction

About This Manual

This manual is provided for informational use only and should not be construed as a commitment by SuperFlow Technologies Group. The software described within this manual is subject to upgrades requiring updated information.

Product Features

- **Automated Test Profiles:** The Test Profile Editor features menus that contain all the test profile commands. This eases the learning process by limiting the need to memorize a command language. In almost all cases, commands are entered into the test profile script by the computer after the programmer selects from a menu. This minimizes the chance of syntax errors.
- **Calibration and Autozero:** The sensors used in the SuperFlow Data Acquisition System require periodic calibration to ensure accurate measurements. Zeroing the sensors ensures the measurements are referenced properly to changing atmospheric conditions.
- **Control Panel:** The WinDyn dynamometer can be controlled through the WinDyn Control Panel which displays useful status information, all of which is available in other places.
- **Custom Configuration:** The SuperFlow test system is completely configured by the WinDyn software. After WinDyn is installed, a system configuration is installed. The configuration files appropriate for this system type are then installed in the main system directories. These files can be the standard default files for that system type or custom files developed for a specific application.
- **Custom Displays:** WinDyn allows you to design 10 current data windows for each particular screen setup. You may create as many setups as desired. It is feasible to have different screen designs for each size of engine and for each type of test. This allows you to scale all the screen graphs appropriately for the test type and engine size.
- **Custom Tools:** The WinDyn Tools menu provides direct access to frequently used WinDyn functions or other programs outside of WinDyn that are on the computer. It is essentially a shortcut feature to programs.
- **Customer Data Pack:** The Customer Data Pack feature creates a single data pack file to give your customer. The data pack contains customer data files, plus the same WinDyn Data Viewer program you use to view, graph, and print test data.
- **Data Recording, Saving and Analysis:** View, print, and plot current and saved test data in the Stored Data Viewer. Current data is stored in the data acquisition system's memory (the dyno's memory). Saved data is stored on the computer's hard drive or other selected location.
- **Password Protection:** The WinDyn administrator can limit individual access to specific WinDyn features. The software is configured to allow certain access to users depending upon their user accounts which contain the user's name, login identification, password, and access privileges.
- **Playback Data:** The Playback command enables you to replay recorded data (current test) or a stored test (saved data). Use this feature to review a previously run test with any display file and show customers how their engine or vehicle performed on the dynamometer.
- **ProFilter:** The ProFilter feature enhances acceleration test data for engine and chassis dynamometers. With ProFilter, your "accel" test data is automatically saved at even-increment engine speed points.
- **System Log:** WinDyn provides a system log feature that maintains a permanent record of important test system activity over days, weeks, or months.

How to Use This Manual

This manual is intended to be used by skilled operators trained in the operation of the associated equipment by a SuperFlow representative.

The information in this manual is organized as follows:

- **Chapter 1: What's New/Prerequisites**

New features added, feature upgrades from older WinDyn versions, computer requirements, release notes, and known issues.

- **Chapter 2: Getting Started**

A basic overview that includes WinDyn terminology and definitions, how to install WinDyn, the WinDyn menu and status bar, setting user preferences (including password protection), and backing up files.

- **Chapter 3: Testing with WinDyn**

Installing and designing test groups; setting up WinDyn tests; installing, editing, and saving specifications; selecting the channel order; and managing information and files using SuperFlow Explorer.

- **Chapter 4: WinDyn Features**

ProFilter testing requirements and setup, playback data and functions, creating a customer data pack, accessing the control panel, adding menu entries for your own programs to the tools menu, and calibrating and autozeroing the SuperFlow data acquisition system.

- **Chapter 5: WinDyn Stored Data Viewer**

Stored Data Viewer features; speed tips; using the Stored Data Viewer menus, toolbars, settings, and preferences; viewing data during and after testing; using the test description feature; printing and plotting test data; and comparing, averaging, post processing, and exporting test data.

- **Chapter 6: WinDyn Safety Limits**

Limits applications, functions, and features; using the Limits Editor menus and tools; Limits channels list symbol and column definitions; channel properties; alarms, warnings, and the four levels of protection; the Editor Information Pane feature; and basic and advanced limits applications examples.

- **Chapter 7: Configuration Utility**

Configuration file purpose, using the Configuration Utility (DEFTool), customizing the configuration display, searching the configuration, and printing configuration information.

- **Chapter 8: WComNet Communication**

Installing the network card and network cable, NetBEUI communications with the Microsoft® Windows® operating system, and configuring WinDyn.

- **Chapter 9: WinDyn Database Manager**

Covers the WinDyn DataLib database navigation, test sequences, database reporting, and searching and sorting the database.

- **Chapter 10: Software Architecture**

Contains a listing of file-extension references, charts detailing executable and non-executable components with their graphic display, and an explanation of the system configuration file structure.

- **Chapter 11: Configuration Editor**

Covers the measured channel, calculated channel, specification channel, interpolation table, and system channel types and explains how to configure measured sensor channels, specification channels, calculated channels, and interpolation tables.

- **Chapter 12: Display Editor**

How to use the custom tools and current data screens; design panel meters, bar graphs, X-Y graphs, and strip charts; configure the status indicator, switches, and status indicator with switches; and display background images and X-Y reference plots.

- **Chapter 13: Test Editor**

Covers the five topics fundamental to understanding test profiles:

- Test profile structure
- Test profile functions
- System definition considerations for developing test profiles
- Test profile operator interaction
- Test profile data management

- **Chapter 14: Set File Editor**

How to create a Set file to customize the data acquisition and control box for your specific application and configure the LCD display configuration, specification files, test profiles, limit files, tables, and reports.

- **Chapter 15: Switch Editor**

Covers the SWED menu command, switch equation syntax, creating switch files, switch functions, editing existing switch files, and help files.

- **Appendix A: WinDyn Calibration Files**

Purpose of the calibration file, creating and using calibration files, deleting corrupt files, and changing calibration coefficients.

- **Appendix B: Quick Reference and How To Guide**

Contains tables with WinDyn keyboard shortcuts, test description keyboard commands, plot and graph shortcut keys. Describes how to set up WinDyn to run a test, run a current data display using a different configuration file, modify a WinDyn calculated channel, and completely remove WinDyn from a computer.

- **Appendix C: Troubleshooting and Error Codes**

A quick-reference troubleshooting guide for errors involving C:/Windyn/Database/Data_lib.mdx and errors involving WinDyn.

Manual Conventions

The following conventions indicate items of interest or concern:



WARNING: Failure to take or avoid a specific action could result in physical harm to the user or the hardware.



CAUTION: Failure to take or avoid a specific action could result in loss of data or equipment.



IMPORTANT: Essential operating information.

NOTE: *Helpful information that may provide insight to the user/operator.*

TIP: *Additional information that may provide convenient workarounds or solutions.*



Cross-references refer the reader to additional information in the chapter, manual, or other sources (including Web sites).

Other Manual Information

The following computer terms are defined for beginning users:

- **Click:** Press the left mouse button once.
- **Double-click:** Quickly press the left mouse button twice.
- **Right-click:** Press the right mouse button once.
- **Select:** Move the mouse pointer to the desired option and press the left mouse button to select it.
- **Drag:** Hold the left mouse button down and move the mouse until the pointer moves to the desired location.
- **Drop:** Release the mouse button to place a selection in a new location.
- **Check box or option:** A square box that is selected or cleared to turn an option on or off. More than one check box can be selected.
- **Option button:** A round circle that is selected or cleared to turn an option on or off. Sometimes referred to as a **radio button**. More than one option button can be selected.
- **Toolbar:** A group of task buttons. A standard or main toolbar is usually the default for basic tasks such as opening and printing a file. Other toolbars can be opened and viewed.
- **Menu:** A list of selections that appears when a user makes a toolbar selection or in a window where the user selects a feature, program, or option.
- **Keys:** Refers to the keys on a keyboard. For instance, “press **F1**” means press the **F1** key above the row of numbered keys on the keyboard. “Press **CTRL+ALT+ DELETE**” means press all three keys on the keyboard simultaneously.

Contents

Chapter 1: What's New and Prerequisites

Before Starting	1-3
Computer Requirements	1-3
Release Notes	1-5
New Features	1-5
What's New in WinDyn	1-6
What's New in WinDyn	1-7
WinDyn Upgrade Notes	1-7
Known Issues	1-8

Chapter 2: Getting Started

WinDyn™ Terminology	2-3
Installing WinDyn	2-4
System Configuration	2-9
NetBEUI Communications	2-11
Computer Settings	2-11
The WinDyn Menu	2-12
Status Bar	2-14
System Preferences	2-15
Toolbars	2-15
Test Report Headings	2-16
Data Analysis	2-17
Test Database Manager	2-18
Password Protection	2-18
System File Paths	2-19
Auto-incrementing File Names	2-20
Backing Up Files	2-21

Chapter 3: Testing with WinDyn

Introduction	3-3
Test Groups	3-3
Installing Test Groups	3-4
Designing Test Groups	3-4
Channel Order	3-6
WinDyn Test Setup	3-9
Test Setup Menu	3-10
Test Data Names	3-11
Test Data Location	3-12
Data Printouts	3-13
Data Analysis	3-15
Test Notes	3-16
Activating the Data Acquisition Setup	3-16

Specifications	3-17
Editing Specifications	3-17
Saved Specifications	3-18
Installing Specification Files	3-18
Zeroing Sensors	3-19
Analyzing Data	3-20
SuperFlow Explorer	3-21
Data Management	3-21
Unique Features	3-23
Test Data	3-24
Hidden Files	3-25
Multiple Views	3-25
Compatibility	3-25
Test Setup	3-26

Chapter 4: Special Features

Autoloading a Test Group	4-3
Calibrating and Autozeroing	4-4
Calibrating Channels	4-4
Zeroing a Single Channel	4-5
Zeroing All Channels	4-5
Saving the Calibration	4-6
Control Panel	4-6
Tools Editor	4-7
Customer Data Pack	4-9
Playback Data	4-11
Playing Back Test Data	4-11
Playback Data Menu	4-12
Playback Functions	4-13
ProFilter	4-14
Testing Requirements	4-14
ProFilter Setup	4-15
System Log	4-16
Password-protected Features	4-20
System Menu	4-20
Individual WinDyn Access Features	4-23

Chapter 5: Stored Data Viewer

Introduction	5-3
Features	5-3
Speed Tips	5-4
Using the Stored Data Viewer	5-4
Main Menu	5-4
Toolbar	5-5
Status Bar	5-5
Preferred Settings	5-6
Viewing Test Data	5-8
Viewing Data after Testing	5-8
Viewing Data during Testing	5-9
Channel Order	5-9
Closing the Viewer	5-11
Test Description	5-12
Printing Test Data	5-13
Plotting Test Data	5-15
Plot Main Menu	5-16
Plotting a Test	5-16
Printing a Plot	5-17
Plot Preferences	5-18
Plot Settings	5-19
Plot Customization	5-25
Zooming in on Plots	5-29
Using the Plot Data Cursor	5-29
Displaying Specification Values	5-30
Viewing Test Notes	5-31
Viewing Channel Maximums	5-32
Plot Mouse and Keyboard Commands	5-33
Comparing Test Data	5-34
Overlaying Tests	5-34
Atypical Comparisons	5-34
Plot Percent Change	5-35
Plot Difference	5-35
Numerically Comparing Tests	5-35
Exporting Data	5-36
Exporting Data to a CSV File	5-36
Exporting a Plot as a Graphic File	5-37
Exporting Plot Data	5-38
Averaging Test Data	5-40
Averaging Test Data by Columns	5-40
Averaging Data from Multiple Tests	5-41
Post Processing Test Data	5-44
Updating Specification Values	5-45

Chapter 6: WinDyn Safety Limits

Introduction	6-3
Applications	6-4
Functions and Features	6-4
Limit Response Actions	6-5
Operator Limits Monitoring	6-5
Limits Editor	6-6
Limits Editor Main Menu	6-8
Limits Channel List	6-11
Symbol Definitions	6-11
Column Definitions	6-12
List Operations	6-12
Quick-Edit Mode	6-12
Column Settings	6-13
Channel Properties	6-13
Alarms and Warnings	6-16
Trip Delay Enable	6-16
Trip Value	6-16
Actions	6-17
Alarm and Warning Actions	6-19
File Properties	6-20
Information Pane	6-23
Limits Application Examples	6-24
Basic Examples	6-24
Advanced Examples	6-28

Chapter 7: Configuration Utility

Configuration Files	7-3
Configuration Utility	7-3
Customizing the Configuration Display	7-7
Searching the Configuration	7-8
Printing Configuration Information	7-8

Chapter 8: WinDyn Communications

Introduction	8-3
Communication Requirements	8-3
Configuring WinDyn Communications	8-4
Installing Hardware Components	8-6
Installing the Network Card	8-6
Installing Network Cable	8-6
NetBEUI Communications	8-9
Windows XP and Vista	8-9
Windows 95/98/2000/NT	8-10
Connecting Multiple WinDyn Computers	8-11
Communication Troubleshooting	8-14

Chapter 9: Database Manager

Introduction	9-3
Database Navigation	9-4
Using the Database	9-6
Database Field Descriptions	9-6
Adding New Data Files	9-12
Adding Existing Data Files to the Database	9-13
Modifying a Database Record	9-13
Deleting a Record from the Database	9-14
Database Reporting	9-14
Concise Reports	9-14
Column Reports	9-16
Searching the Database	9-17
Sorting the Database	9-17

Chapter 10: Software Architecture

Introduction.....	10-3
File Extension Reference	10-3
Executable Components.....	10-4
Non-executable Components.....	10-6
System Configuration File Structure	10-8
File Relationships	10-9

Chapter 11: Configuration Editor

Introduction.....	11-3
Channel Types	11-4
Measured Channels	11-4
Specification Channels	11-6
Calculated Channels	11-6
Interpolation Tables	11-8
System Channels	11-8
Designing a Configuration File	11-10
Defining Data Channels	11-12
Designing Console Data Screens	11-24
Designing the Control System	11-27
Saving and Exiting	11-30
Installing Configuration Files	11-31
Metric Configurations	11-31

Chapter 12: Display Editor

Introduction.....	12-3
Designing Test Screens.....	12-3
Screen Editing Mode Preferences	12-4
Selecting Objects for a Screen Design	12-5
Resizing Objects	12-5
Selecting Channels	12-6
Selecting Color Ranges	12-7
Selecting Annotations	12-8
Selecting Object Styles	12-9
Digital Display Configuration	12-10
Designing Analog Meters	12-12
Designing Bar Graphs	12-14
Designing X-Y Graphs	12-16
Designing Strip Charts	12-22
Status Indicator	12-23
Switches	12-24
Status Indicator with Switches	12-25
Background Images	12-26
X-Y Reference Plots	12-28

Chapter 13: Test Editor

Developing Test Profiles.....	13-3
Writing the Test Profile	13-3
Editor Interface	13-3
File Size	13-3
Test Profile Functions.....	13-4
Device Control	13-4
Data Control	13-5
Display Control	13-5
Program Branching	13-5
Considerations for Developing Test Profiles.....	13-6
Configuration Assignment	13-6
Sensors and Controllers	13-6
Channel Monitoring	13-6
Set of Files	13-7
Data Management.....	13-8
Disk Space	13-8
Data Space	13-8
Data File Names	13-8
Printing	13-9
Operator Interaction	13-9
Using the Test Editor	13-10
Opening a Test Profile	13-11
Saving Test Profiles	13-12
Toolbar	13-12
Menu Bar	13-13
Test Description and Control	13-15
Test Profile Command Entry/Editing	13-17
Information Pane	13-18

Test Profile Commands	13-20
Test Documentation	13-21
Controller Actions	13-23
Data Recording	13-32
Operator Display	13-36
Safety Limits	13-41
Switch Actions	13-42
Test Branches	13-44
Test Values	13-47
Optional Events	13-51
Example Test Profile	13-58

Chapter 14: WinDyn Set File Editor

Introduction.....	14-3
Set File Menu Commands	14-4
Description Block	14-5
Sending the Set File to the NGE System	14-5
LCD Configuration.....	14-6
Specification Files	14-7
Test Profiles	14-8
Limit Files.....	14-9
Tables	14-10
Reports	14-12

Chapter 15: Switch File Editor

Introduction.....	15-3
SWED Menu Commands	15-6
Switch Equation Syntax	15-9
Creating Switch Files	15-11
Switch Functions	15-12
Editing Existing Switch Files	15-17
Help Files	15-18

Appendix A: WinDyn Calibration Files

Calibration (.cal) Files	A-3
Creating the Calibration File	A-3
Using the Calibration File	A-5
Corrupt Calibration Files	A-6
Changing Calibration Coefficients	A-7
Calibration Viewer	A-8

Appendix B: Quick-Reference and How-to Guide

WinDyn Keyboard Shortcuts	B-3
Test Description Keyboard Commands	B-4
Graph Shortcut Keys	B-5
How to	B-6
Set Up WinDyn to Run a Test	B-6
Change the Default Channel Order	B-10
Modify a WinDyn Calculated Channel	B-12
Change the Handheld and Console Displays	B-14
Customize the Plot View	B-17
Completely Remove WinDyn from a Computer	B-19

Appendix C: Troubleshooting and Error Codes

Troubleshooting Guide	C-3
Troubleshooting Procedures	C-6
No WinDyn Communication	C-6

Acronyms & Abbreviations

Glossary

Index

CHAPTER 1

WHAT'S NEW AND PREREQUISITES

IN THIS CHAPTER

- **Before Starting**
 - Computer Requirements
 - Release Notes
 - New Features
 - What's New in WinDyn
 - WinDyn Upgrade Notes
 - Known Issues



1.1 Before Starting

Please follow these steps prior to using SuperFlow's WinDyn™ Data Acquisition and Display software package.

NOTE: Extensive on-line help documentation is included with WinDyn. To view **Help** any time while using WinDyn, press the **F1** key (or click the **Help** buttons that appear while using the software).

Installation Instructions

Carefully follow the WinDyn installation instructions located in the section titled "Installing WinDyn" on page 2-4 in Chapter 2. WinDyn requires a system configuration installation. After installing WinDyn from the CD-ROM, you must install the System Configuration disk that came with the WinDyn CD.



If you did not receive a System Configuration disk, please contact SuperFlow Customer Service.

ReadMe Notes

For the latest information about this release of WinDyn, please read all the WinDyn ReadMe Notes included with the software. Click **Start**, select **Programs>>SuperFlow WinDyn**, and then click each of the notepad pictures labeled **ReadMe** for each product.

New Features

If upgrading from a previous version of WinDyn, review the new features for WinDyn (open the **What's New.htm** file on the CD or click the WinDyn tools menu).

Note that this same information is also located in section 1.1.2, "Release Notes," on page 1-5, but the online Help file provides more details about the new features.

Tutorial

A tutorial is included as part of the WinDyn software. Access it through the Help menu (press **F1**). Follow the steps in the tutorial to learn how to use many of the advanced features.

1.1.1 Computer Requirements

This section lists the minimum computer and printer requirements for systems using WinDyn.

The computer specifications listed in this section are general guidelines for SuperFlow customers purchasing their own computer systems for use with the latest version of WinDyn. The minimum specifications are those required to use SuperFlow WinDyn. The recommended specifications are those designed to get the most power and flexibility from SuperFlow WinDyn and all related software tools.

Minimum Computer Requirements

Table 1-1. SuperFlow WinDyn Computer Requirements

Configuration	Minimum*	Recommended
System	PC-compatible	PC-compatible
Processor	Pentium™ 333 MHz or equivalent	Latest Pentium or equivalent
Read-Only Memory (RAM)	32 megabytes (MB); 128 MB for Microsoft® Windows® XP	128 MB or more
Video RAM	2 MB	4 MB or more
Hard Disk Drive	6.4 Gigabytes (GB); 32 MB of free space	8.0 GB or more
Serial	Not required†	1 RS-232 serial port
USB	Not required‡	2.0 Root Hub
Parallel	Standard 25-pin parallel I/O port	Standard 25-pin parallel I/O port
Network**	10/100Base-T compatible (RJ-45)	10/100Base-T compatible (RJ-45)
Monitor Size	15"	17" or larger
Monitor Resolution	800x600	1024x768, small fonts
Colors	High color (16-bit)	True color (32-bit)
Operating System	Windows 95/98/NT4.0 SP5/ME/2000/XP	Windows XP Professional
Modem	56.6 Kbps fax/modem	56.6 Kbps fax/modem
CD Drive	8X CD ROM	CD R/W
Floppy Drive	None	None
Mouse	Standard two-button	Microsoft IntelliMouse® with wheel
Keyboard	Standard 101-key keyboard	Standard 104-key keyboard
Sound	None	16-bit Soundblaster™ audio
Printer	Any Microsoft Windows-supported	Windows-compatible color inkjet
Internet Access	None	None
Additional Software	None	None

* SuperFlow is not responsible for problems associated with any computer that does not meet the specified minimum standards.

† Alternative for FlowCom; required for SF-901, SF-7100, and XTest systems.

‡ Alternative for FlowCom.

** Not required for flowbench, SF-901, SF-7100, or XTest systems.

The computer should be dedicated for use only with SuperFlow dynamometer systems.



IMPORTANT: SuperFlow will not be responsible for problems associated with using the computer for applications other than the dyno or flowbench.



Contact SuperFlow Customer Service to determine the current version for the product application, or visit the SuperFlow Web site at **www.superflow.com** for a list of currently recommended computer requirements.

Free Disk Space Requirement

WinDyn requires 30 MB of free disk space for installation, even when installing a version upgrade. This ensures a reasonable amount of working space for the installation and normal operation of WinDyn.

Minimum Printer Requirements

Use any Microsoft Windows-compatible, parallel-port, laser, or inkjet graphics printer with the WinDyn software.

1.1.2 Release Notes

These WinDyn release notes are general. Be sure to also read the “readme” notes specific to the system type (for example, AutoDyn, XConsole, etc.). These system-specific notes are located on the System Install disk. After installation, read the notes by selecting **Start>>Programs>>SuperFlow WinDyn**, then click each of the notepad symbols labeled **ReadMe** for each system.

1.1.3 New Features

If upgrading from an older version of WinDyn, it is helpful to review these newer features.

To read about WinDyn’s new features in detail, from the **WinDyn** main menu select **Tools>>Read What's New**.

- **Windows XP support:** WinDyn was updated to run on all versions of Microsoft Windows XP.
- **Test Profile Editor:** WinDyn now has a Windows-based Test Profile editor that allows for scripting of automatic tests.
- **Calibration Viewer:** A new Calibration Viewer (installs on the Tools menu) displays and prints the calibration coefficient for all defined measured channels in the system.
- **Current Data Screen Editor Enhancements:** The display screen editor is now more powerful. Create, edit, and manage your WinDyn display screens in a fraction of the time required by previous versions.
- **Current Data Screen Display Enhancements:** New display screen color and style settings are now available.
- **Test Data Plotting Enhancements:** Many features requested by SuperFlow customers were added to the WinDyn graphing tools.
- **Test Data Viewing Enhancements:** This new feature allows you to compare tests numerically in side-by-side data columns.
- **Test Data Printing Enhancements:** WinDyn now prints test data in a modernized, professional style.
- **Test Data Management Enhancements:** WinDyn V2.7 includes the SuperFlow Explorer test data manager, a new tool that allows you to effectively manage your test data and operates like the familiar Windows Explorer.
- **Test Data Analysis Enhancements:** The new ProFilter data processor improves test repeatability and displays test data at even-increment speed points.

1.1.4 What's New in WinDyn

The following features were added. To read about these new features in detail, from the **WinDyn** main menu select **Tools>>Read What's New**.

- **Express Test Setup:** The operator can now view and adjust the most common WinDyn test preferences from a single location, using the new Test Setup dialog box. This feature replaces the specifications editor used in previous versions of WinDyn.
- **Customer Data Pack:** The Customer Data Pack feature creates a single data pack file you can give your customer. The data pack contains the customer's data files, plus the same WinDyn Data Viewer program you use to view, graph, and print test data. This feature replaces the customer data diskettes feature in previous versions of WinDyn.
- **Edit Test Notes with SuperFlow Explorer:** The SuperFlow Explorer test data manager now allows users to edit test description notes (SFD or SFP files only).
- **Print Company Logo:** WinDyn now supports the option to print a custom graphic on test data reports. This is intended for your company logo and appears in the header portion at the top of each data page printed.
- **Show Channel Maximums On Graph:** Test data plots now support the option to display the maximum value of each channel graphed. The maximum value is written directly on the plot next to the channel's annotation name.
- **Test Date:** The WinDyn test data viewer now displays the test execution date. This date appears in the status bar (for example, **Tested on: 4/14/2005 at 13:29**). This date information is a permanent record of when the test was started (meaning, when the first data line was recorded) and cannot be changed. The **Tested on** date also appears on the first page of all data printouts.
- **Graph Annotations Always Visible:** Plot annotations (channel names written directly on the graph) now appear in all possible display modes (%Change, Difference, View-Maximums, etc.).
- **Y-Axis Mode Shortcut Key:** The **Y** keyboard key can now be used to toggle between the graph's single and dual y-axis modes.
- **New Test Profile Commands:** Numerous new commands are available in the Test Profile editor to enhance the operation of automatic tests.
- **On-screen Digital Inputs & Outputs:** Three of the available current data screen virtual instruments now support access to the Relay Net digital expansion hardware. These instruments are the status indicator, push-button switch, and the indicator/switch combo which provide clear, onscreen status and control of Relay Net devices.
- **New High-resolution Timer:** System channel Timer2 (channel number 211) is now a high-resolution autotest timer intended for use as a reliable time X-axis when graphing test data.
- **New Date Channels:** Four new date-related system channels are now available to specify the date a data line is recorded and are valid for all past and future NGE data files. This date information is a permanent record of the test execution date and cannot be changed.

1.1.5 What's New in WinDyn

The following is new for WinDyn:

- **Test Groups:** Adds support for installing SET files as part of a test group.
- **Test Groups:** New option for motoring dynos that allows you to disable the default End Test Ramp behavior.
 - New command: Load Safety Limits from Set file.
 - New command: Capture encoder knob positions.
 - The **Controller Action** command syntax now always shows the associated controller's name, regardless of the selected control mode.
- **Configuration Viewer:** Now displays the new **date** system channels (Year, Month, Day, DayWk)
- **Main:** Main window size not saved across sessions if maximized when closed.
- **Plots:** Changed the **Compare Mode** shortcut key to **SHIFT+F2**.
- **Product Defaults:**
 - Changed main window default tool bars to **Advanced and Analysis-Saved**
 - Changed default plot grid-shade to **DARK**
 - Changed default plot legend style to **SIMPLE**
 - Changed SuperFlow Explorer default window state to **MAXIMIZED**
 - Changed SuperFlow Explorer default file pane view mode to **DETAILS**

1.1.6 WinDyn Upgrade Notes

WinDyn is compatible with all 1942/2620-based or 2242-based data acquisition electronics. All dynamometer systems shipped after March 2005 have the 2620-based system.

If upgrading to WinDyn, the data acquisition system may require an Operating System (OS) software update. Directions to update the software is indicated in instructions received with the software.



Contact SuperFlow Customer Service if you are unsure of what electronic board set is in your system or for software upgrade assistance.

Screen Group File Backups

The screen group file format (*.cdf) has changed. WinDyn automatically backs up an existing screen file in the original format it was created in if the file was created using earlier versions of WinDyn and then uses a numeric extension (for example, the **screen.cdf** file might be backed up as **screen.000** or **screen.005**, etc.). This allows you to revert to a previous version of WinDyn without losing any customized screens.

1.1.7 Known Issues

Mouse Behaves Erratically in DOS Editors (Windows XP/2000)

The mouse behaves erratically when using the DOS editors. This includes the System Configuration and Switch Configuration (SWED) editors. Therefore, when running WinDyn on Windows XP or Windows 2000, use the keyboard for all DOS editor operations. This problem does not occur in Windows 98/ME.

Switch Editor

The DOS Switch Editor (SWED) does not initially display as a full screen. To enable full-screen mode, open the editor, then press **ALT+ENTER** on the keyboard (meaning, press the **ENTER** key while holding down the **ALT** key).

CHAPTER 2

GETTING STARTED

IN THIS CHAPTER

- **WinDyn™ Terminology**
- **Installing WinDyn**
 - System Configuration
 - NetBEUI Communications
- **The WinDyn Menu**
 - Status Bar
- **System Preferences**
 - Toolbars
 - Test Report Headings
 - Data Analysis
 - Test Database Manager
 - Password Protection
 - System File Paths
 - Auto-incrementing File Names
- **Backing Up Files**



2.1 WinDyn Terminology

It is important to understand the following WinDyn™ terms to achieve maximum software performance during all phases of testing.

- **Calibration Coefficients:** The conversion factors that determine measured reading from a data sensor such as a load cell, pressure transducer, or magnetic pickup. The coefficient is based on two points — a zero offset and a full-scale value.
- **Channel Order:** The selection of channels that are displayed, printed, and plotted when viewing WinDyn data. The default channel order is defined in the test group.
- **Configuration Files:** Master files that determine how WinDyn will collect and calculate data. They also determine the channel selection on the operators console or remote handheld display screens and which channels are used for closed-loop control.
- **Control Parameters:** Also referred to as Proportional, Integral, and Derivative (PID) values, control parameters provide closed-loop control for dyno load and electronic throttle in automatic testing. The data channels selected for control are defined in the configuration file.
- **Current Data:** Data that is recorded and stored in temporary memory. Once this data is erased or the sensor box is turned off, the data cannot be recovered.
- **Interpolation Tables:** Used to determine values from devices with non-linear signal outputs such as flow turbines. Can also be used to calculate correction-factors-based data from a measured data channel.
- **Limits Profile:** Determines how the dyno will respond to selected channels going above or below a specified value. Also referred to as safety limits.
- **Saved Data:** Data that is saved and stored in a file (*.sfd) on the computer hard drive or other memory media. The data is stored with the channel configuration and channel order used for the test. The test description notes are embedded in the file. The data can be viewed with the Stored Data Viewer program or with SuperFlow Explorer.
- **Screen Group:** A group of up to 10 screens saved in one file. Each screen is made up of multiple WinDyn virtual instrument display objects (meters, digital displays, bar graphs, etc.)
- **Specifications:** Values that commonly change from engine to engine, vehicle to vehicle, or from test to test, such as engine bore (EngBor), engine stroke (EngStr), vehicle weight (VehWt), or test start speed. These may also be referred to as constants.
- **Status Bar:** Located at the bottom of the WinDyn screen, the status bar provides useful information about the configuration profile being used, the current test, and other relevant test parameters.
- **Test Groups:** A powerful feature that *quickly* and *completely* configures the data acquisition system for testing. A test group can be constructed to install multiple WinDyn files to configure the system for a specific test. The test group also establishes the channel order for viewing and printing test data.
- **Test Profile (or Autotest):** A user-defined series of commands which automatically performs test system functions.
- **WComNet:** A program that provides communication between SuperFlow computer programs and SuperFlow test systems using NetBEUI network communication protocols.

2.2 Installing WinDyn

If the computer was purchased from SuperFlow, it was configured for WinDyn at the factory. The following steps are necessary only for computers *not* pre-installed with WinDyn. Be sure to keep the software disks stored in a safe and secure location.



CAUTION: Before installing WinDyn, SuperFlow strongly recommends closing all other programs, including virus scanners.

Restricted user- or administrator-controlled computers may have some difficulty accessing all WinDyn functions, particularly the Configuration editor. Other functions require writing to the registry. System administrators should ensure that WinDyn operators have full access to the registry.

1. Insert the WinDyn CD into the CD-ROM drive.
 - For Windows Vista, click **Run SETUP.EXE**. The **AutoPlay** dialog box appears.



NOTE: If the dialog box does not appear, browse to the CD-ROM root menu and select **SETUP**.

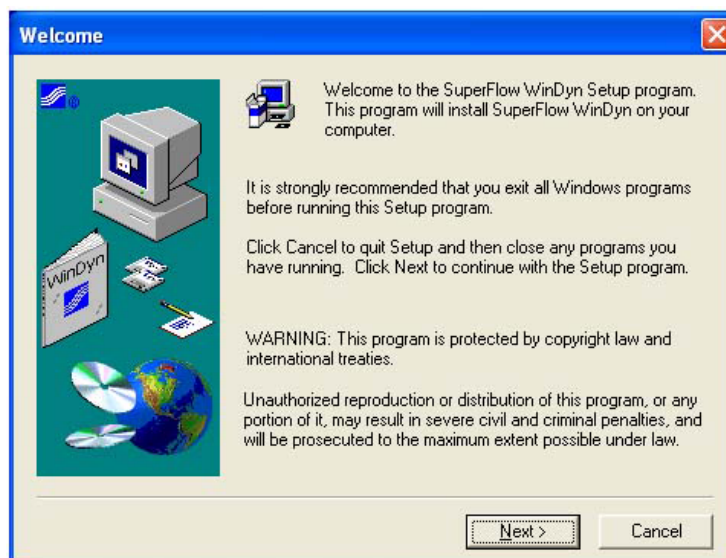
When the message appears, click **Allow**. The **SuperFlow WinDyn CD-ROM Main Menu** appears.

- For Windows 98, 2000, ME, and XP, the **SuperFlow WinDyn CD-ROM Main Menu** automatically appears.



NOTE: If the Main Menu does not appear, click **Start**, select **Run**, type **X:\Setup.exe** (where **X** is the letter of your CD drive), and click **OK**.

2. Click **Install WinDyn**.
3. The **Welcome** window appears. Click **Next**.



4. The **Registration** dialog box appears. Type your **Name** and **Company** name in the text boxes provided.



5. Click **Next**.
6. The **Registration Confirmation** dialog box appears. If the information provided is correct, click **Yes**.



NOTE: If the registration information is incorrect, click **No** to return to the **Registration** dialog box.

7. The **Choose Destination Location** dialog box appears. Select where to install WinDyn in the directory.



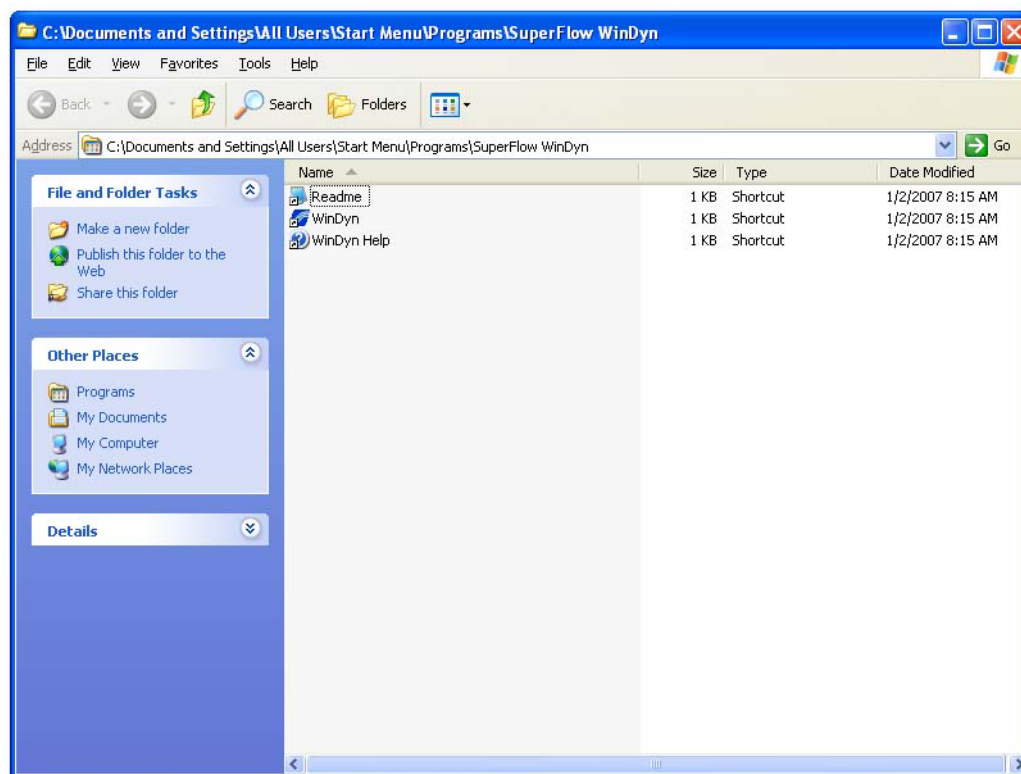
IMPORTANT: SuperFlow strongly recommends installing WinDyn in the default location (C:\windyn\). Contact SuperFlow Customer Service for instruction if you must install WinDyn in a different location.

8. Click **Next**. It may take several minutes for the software to install.
9. An **Information** dialog box appears stating the installation was successful and reminding you to install a system configuration before running WinDyn.



10. Click **OK**.

A directory opens displaying the WinDyn shortcut files.




11. Shortcuts are automatically loaded to the desktop. Copy shortcuts to other locations as needed and then close the window.

Other features on the CD include a video presentation of WinDyn, operation manuals, and product brochures.

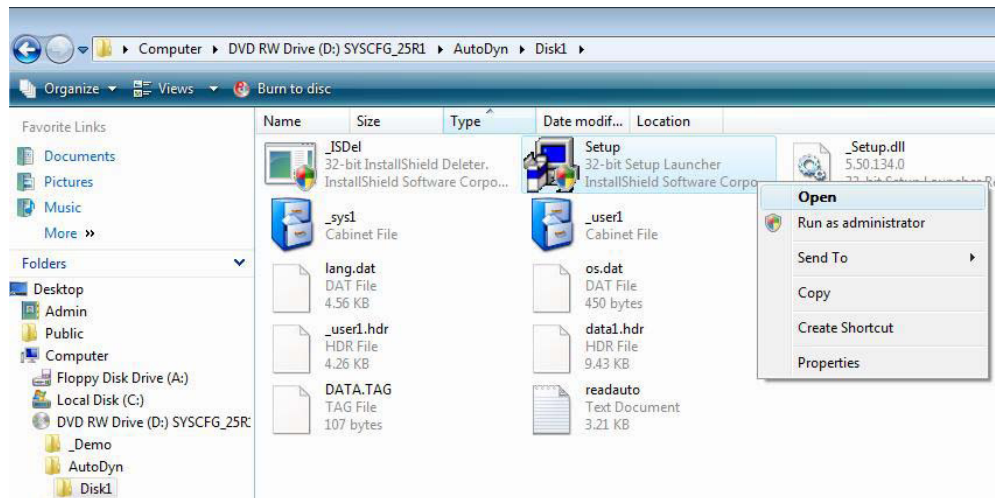
2.2.1 System Configuration

After installing WinDyn from the CD-ROM, you must install the System Configuration disk that came with the WinDyn CD-ROM. This disk configures WinDyn for your particular product. One disk is provided for each product owned. The example below demonstrates the XConsole System Configuration.

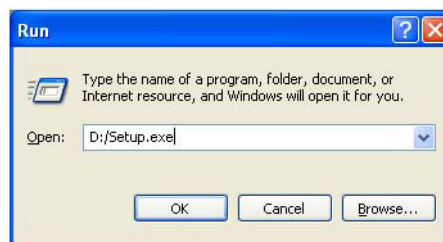
 If you did not receive a System Configuration disk, please contact SuperFlow Customer Service.

1. Insert the system configuration disk into the appropriate drive.

- For Windows Vista, locate **Setup** (32-bit Setup Launcher), right-click it, and select **Open**.



- When the message appears, click **Allow**.
- When the **Welcome** window appears, go to step 3 to complete the installation.
- For Windows 98, 2000, ME, and XP:
 - If the program automatically starts, go to step 3.
 - If the program does not automatically start, click **Start** and point to **Run**.

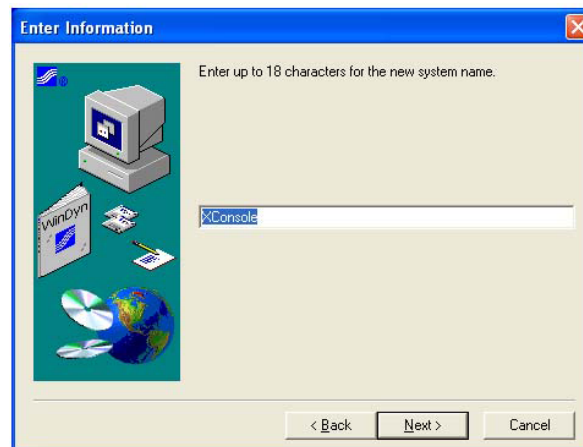


2. Type **X:\Setup.exe** (X refers to the letter of your CD drive) to begin the installation.

3. The **Welcome** window appears.



4. Click **Next**. The **Enter Information** dialog box appears with a default name in the text box.



5. Click **Next**, or type a new system name and click **Next**. The **Setup Complete** window appears.



6. Click **Finish**.

2.2.2 NetBEUI Communications

WinDyn requires the NetBEUI network communication protocol which is automatically set up when installing WinDyn on Windows XP. NetBEUI must be set up manually on Windows 98, Windows 2000, Windows ME, and Windows Vista.



Refer to the computer system operator manual for instructions. Contact the computer vendor for assistance if needed. For information on the NetBEUI setup, refer to section 8.4, "NetBEUI Communications," on page 8-9.

2.2.3 Computer Settings

Adjusting some basic computer settings will make using WinDyn easier and better for the operator. It is completely at the discretion of the operator to decide whether to use them.

NOTE: *If you do not understand how to apply these settings, it will not affect your system at all. These settings are only for appearance.*

Most of the settings are part of the computer properties accessed through the Control Panel, My Computer, or Windows Explorer.

Display Properties Dialog Box

- **Settings Tab**
 - **Screen resolution:** 1280 by 1024 pixels
 - **Color quality:** Highest
- **Appearance Tab**
 - **Font size:** Large Fonts

Taskbar Properties

- Right-click the taskbar and select **Properties**.
- Select:
 - **Keep the taskbar on top of other windows**
 - **Group similar taskbar buttons**
 - **Show Quick Launch**
 - **Show the clock**
- Ensure **Hide inactive icons** is cleared
- Add WinDyn to the quick launch bar:
 - Click the **WinDyn** icon on the desktop and drag it to the taskbar
 - The taskbar must be unlocked (right-click the taskbar and select the lock/unlock option)

WinDyn File Directory

Open **Windows Explorer** and select **View>>Details**.

WinDyn Display Properties

Adjust the WinDyn screen images to fit in the monitor screen (see section 12.2.3, "Resizing Objects," on page 12-5).

2.3 The WinDyn Menu

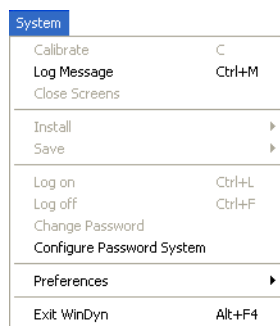
The WinDyn main menu toolbar contains several command categories.



Figure 2-1. WinDyn Main Menu

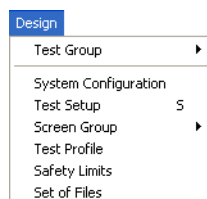
Click a menu name to see the drop-down menu. Gray menu items are not available until WinDyn is connected to a system and ready to accept information from or send commands to the system.

System Menu



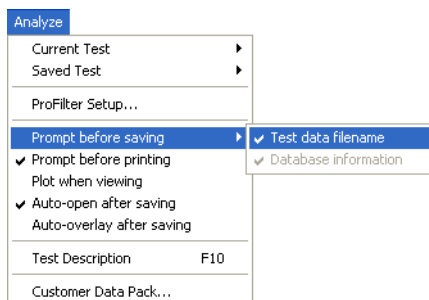
- Calibrate the data sensors
- Enter a message into the system log
- Install and save files from the test system (for example, configuration files, test files, and calibration files)
- Log on or off when password protection is enabled
- Change password protection options
- Set up system preferences
- Select the desired system when the computer is connected to more than one SuperFlow Data Acquisition system
- Exit WinDyn

Design Menu



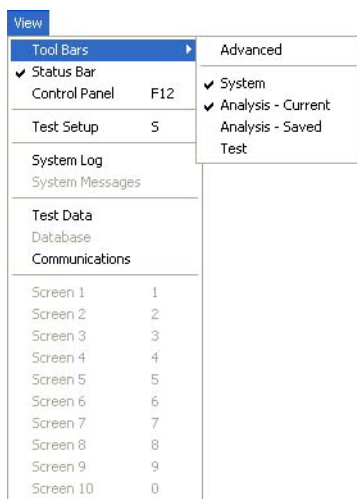
- The Design menu provides access to the system file editors.

Analyze



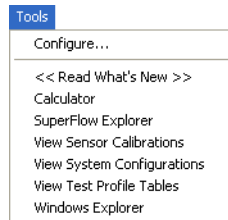
- Analyze test data
- Input test comments
- Set up ProFilter
- Select data viewer preferences
- Create a disk containing test data and the WinDyn viewer

View



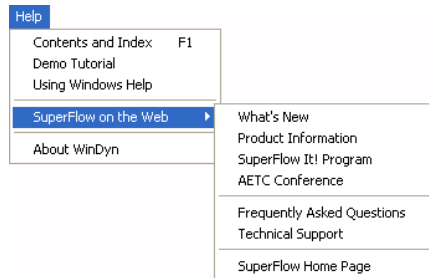
- Select which toolbars to turn on and off
- Turn the Status Bar on and off
- Turn the Control Panel on and off
- View the:
 - Active specifications
 - System log
 - Current test data
 - Database (if enabled)
 - WComNet communications display
 - Ten real-time data display screens

Tools



- This menu provides direct access to frequently used WinDyn functions or other programs outside of WinDyn on the computer. The list can be edited as needed.

Help



- The Help menu provides context-sensitive help for all WinDyn programs and functions. It also includes several links to interesting topics on SuperFlow's Web site.

NOTE: The **Help>>About WinDyn** function includes the option to view and print a detailed version report that lists all WinDyn components with their version number and date stamp. When contacting SuperFlow Customer Service, you may be asked for this information for better assistance.

2.3.1 Status Bar

A status bar located at the bottom of the screen provides useful information about how the system is set up.

- **System:** Name of the system WinDyn is connected to. This name is assigned during system setup configuration when the system is installed.
- **Spec:** Current specification file installed. If no specification file is installed, the same name as the configuration displays.
- **Config:** Name of the configuration file installed. If **offline** displays in the box, the system is turned off or is not communicating.
- **Test:** Name of the autotest file installed.
- **Limits:** Name of the limits file installed.
- **Display:** Name of the screen group file installed.

If a box displays **none**, no file of that type is installed.

2.4 System Preferences

The user should set several WinDyn feature preferences. You do not need to set preferences again unless you desire a change.

2.4.1 Toolbars

The first row of the WinDyn menu contains command functions. The next row contains a series of toolbar shortcut buttons representing the most common WinDyn tasks. You can perform many of these tasks by clicking the button rather than navigating through the normal hierarchy of menus and commands.

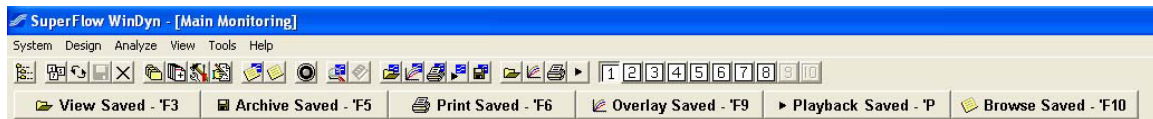
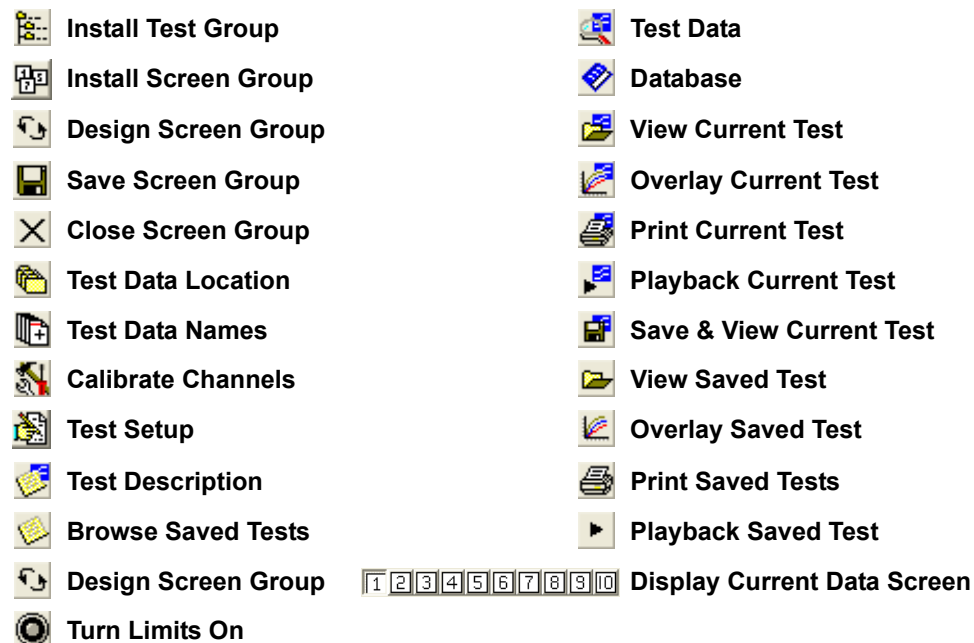


Figure 2-2. SuperFlow WinDyn Toolbar

To view a toolbar, from the WinDyn menu select **View>>Tool Bars**. The check marks appearing next to the toolbar name indicates which ones are selected. Select a toolbar in the menu to turn it on or off. The menu closes after each selection is made. Select **View>>Tool Bars** again to display the menu.



The buttons are grouped together based on the type of function they perform:

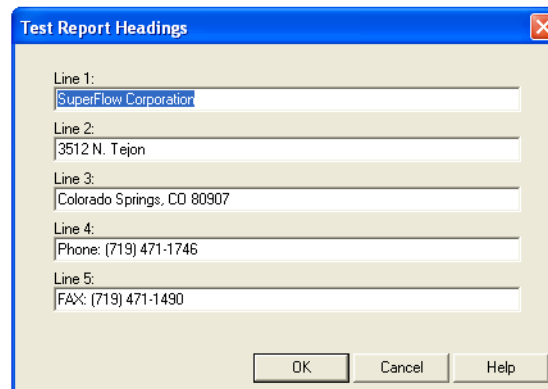
- Advanced
- System
- Analysis – Current
- Analysis – Saved
- Test

The most common toolbars to use are **Advanced** and **Analysis – Saved**. The WinDyn screen displays may require modification if multiple tool bars are used.

2.4.2 Test Report Headings

Use the **Test Report Headings** dialog box to edit the customer heading banner that appears on the test data printouts and reports. Up to five lines of text may be entered.

From the **WinDyn** main menu select **System>>Preferences>>Test Report Headings**.



Test Report Headings

Line 1:
SuperFlow Corporation

Line 2:
3512 N. Tejon

Line 3:
Colorado Springs, CO 80907

Line 4:
Phone: (719) 471-1746

Line 5:
FAX: (719) 471-1490

OK Cancel Help



See “Company Header Tab” on page 3-14 for more details on this feature.

2.4.3 Data Analysis

Several settings are available for automatically viewing, plotting, printing, and saving data after a test is complete and the data transfers to the computer. Once set, the settings are permanent until changed. Access these settings from the WinDyn main menu **Analyze** command or from the **WinDyn Test Setup** dialog box in the **Data Printout** section.

- **Test data filename:** Select **Analyze>>Prompt before saving>>Test data filename** to place a check mark on the menu item. This activates a request to enter a file name for an **Operator Saves Data** command which is used for manual tests where the operator saves the data through WinDyn.

The default name that appears is the name specified in the Test Data Name text box in the WinDyn Test Setup dialog box (to access, press the **S** key or the click the **Test Setup** toolbar button). If the Test data name menu item is not checked, the system saves the data and uses the default file name.

The WinDyn Test Setup dialog box contains the following fields and sections:

- Buttons:** Activate - F2, Cancel - Esc, Recall - F3, Memorize - F4, Refresh - F5.
- Test Data Name:** A text box containing "DATA".
- Start At:** A numeric spinner box set to "1".
- Test Data Location:** A text box containing "C:\windyn\Demo\data Demo".
- Browse:** A button to open a file explorer.
- SuperFlow TECHNOLOGIES GROUP:** A logo on the right side.
- Specifications:** A tabbed section with three tabs: Specifications, Data Printouts, and Data Analysis. The Specifications tab is active, showing a table with the following data:

Num	Name	Value	Units	Description
77	EngBor	0.000	inches	
78	EngStr	0.000	inches	
79	EngCyl	0	number	
82	EngCyc	0	cycles	
85	FuelSG	0.000	ratio	
89	VapPrs	0.00	InHg	
90	Start	0	RPM	
91	StopAt	0	RPM	
92	StepTm	0	Second	
93	StpSiz	0	RPM	
97	IntLng	0	inches	
99	StrTst	0	second	

- Test Notes - F12:** A text area with the prompt "Enter any Test Description notes here...".
- Status Bar:** Shows "Test group: Demo", "Last data:", and "Date: 01/03/2007".

- **Database information:** Select **Analyze>>Prompt before saving>>Database information** to place a check mark on the menu item. This prompt is active only if the Database Manager is turned on. If the **Database information** menu item is checked, the database entry dialog box displays after data is saved. (For more information, refer to Chapter 9, "Database Manager.")
- **Prompt before printing:** Select **Analyze>>Prompt before printing** to place a check mark on the menu item. If the **Prompt before printing** menu item is checked, the **Print Setup** dialog box displays during a print command so the operator can change settings if necessary. If the menu item is not checked, the system prints the data based on the current settings.
- **Plot when viewing:** If this menu item is checked, a plot opens when current or saved data is viewed with the Stored Data Viewer. It displays a plot of page 1 of the channel order. If the menu item is not checked, then page one 1 of the data displays.

- **Auto-open after saving:** When this menu item is checked, the data viewer opens and displays the data that was just saved.
- **Auto-overlay after saving:** When this menu item is checked, the just-saved data overlays previous tests if **Plot when viewing** and **Auto-open after saving** is checked and the plot for the previous test is still open.

2.4.4 Test Database Manager

The WinDyn database was designed as a method to identify and organize the data files (.sfd) stored on the computer. In some situations, using the test database may be useful, but carefully consider using this feature. By default it is disabled when WinDyn is installed. Turn it on and off by selecting **System>>Preferences>>Test Database Manager** from the **WinDyn** main menu.



For more information, refer to Chapter 9, “Database Manager.”

2.4.5 Password Protection

The WinDyn program is a highly configurable software application that provides flexibility in customizing your system. You may want to limit access to the configurable features and other program functions for specific individuals. The WinDyn administrator can limit individual access to specific WinDyn features. The software is configured to allow certain access to users depending upon their user accounts which contain the user’s name, login identification, password, and access privileges.

With protection enabled, when WinDyn is started, all access privileges are blocked, and the **Login** dialog box appears. Users must log in with a password to access their appropriate privileges. The program can be configured for various levels of access including a default access of “Basic User.” Basic User privileges are enabled without requiring a user to log in. Users would only need to log in to gain access to other features such as calibration and design functions.

The password protection feature could be useful in these examples:

1. In large shops with many dyno operators where strict control of the dyno setup is necessary to prevent unauthorized changes.
2. In situations where the operators feel more comfortable exploring the many features of WinDyn without worrying about accidentally accessing a vital area that could corrupt the system, resulting in unnecessary down time.

WinDyn is installed with the password protection feature disabled.

NOTE: The WinDyn administrator can easily disable the password protection system. When WinDyn starts with the password protection system disabled, all features are accessible.



For more information, refer to section 4.9, “Password-protected Features,” on page 4-20.

2.4.6 System File Paths

The current settings in the System File Paths dialog box determine where WinDyn searches and save files in each of the categories listed. To access the **System File Paths** dialog box (Figure 2-3), from the **WinDyn** main menu select **System>>Preferences>>System File Paths** or press **F** to use the keyboard shortcut.

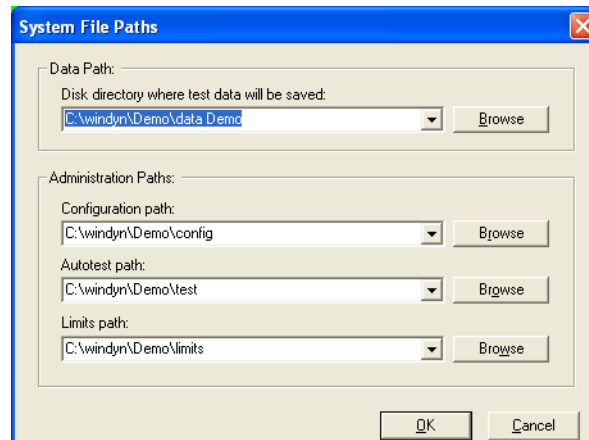


Figure 2-3. System File Paths

NOTE: The test data is stored in and read from the first category: **Data Path**. To store test data to a particular folder, type the new path in the **Data Path** text box or click **Browse** to locate the path. If the typed path does not exist, WinDyn creates it.

You may also set the data file location in the **WinDyn Test Setup** dialog box (see section 3.3, “WinDyn Test Setup,” on page 3-9). Changing the path in the Test Setup dialog box also changes the path in the System File Path dialog box. SuperFlow recommends using the Test Setup dialog box to set the data file location.

Store all WinDyn files in the provided default folders, or create as many subfolders as needed. It is advantageous to store the test data in various subfolders related to the customer or the test device.

Administration paths are the locations where WinDyn looks for critical system files. These paths are set when WinDyn is installed based on the type of system (AutoDyn, CycleDyn, SF-902, etc.)



WARNING: Changing the Administration paths can result in system failure or cause the system to operate improperly. The Administration paths lock out all unauthorized users when the password protection feature is enabled.

2.4.7 Auto-incrementing File Names

The WinDyn Auto-Increment Filename feature lets the operator specify the default names used for storing test data. The names entered here auto-increment numerically each time data is saved which streamlines saving test data—especially when making many consecutive runs. The file names can be up to 256 characters. The **Start At** number to the right of the **File Name** text box is the value that starts the incrementing sequence.

Example:

A **Start At** number of **1** is entered next to the file name **My Test Data**. Each time data is saved, the name automatically increments from **My Test Data1** to **My Test Data2**, and so on.

When WinDyn saves data, if it finds a file name that already exists, then it finds the next available number to attach to the file name and uses that name and number. Existing test data is never overwritten without operator consent.

To access the **Auto-Increment Filenames** dialog box (Figure 2-4), from the **WinDyn** main menu select **System>>Preferences>> Auto-Increment Filenames**, or use the shortcut key (press **A** on the keyboard). Only change the file name in the **Autotest Saves Data** area (in the middle of the dialog box) because that is the name autotests use.

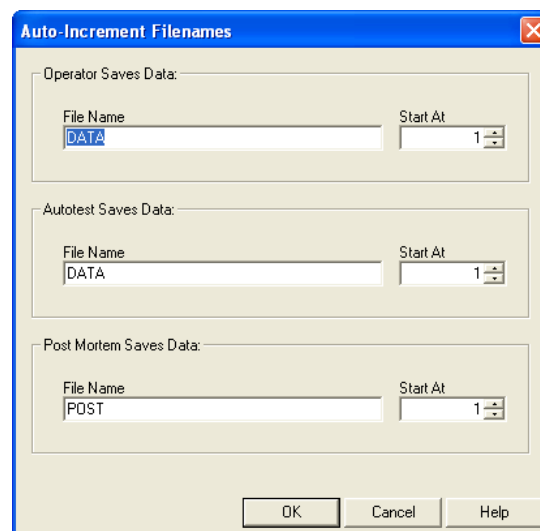


Figure 2-4. Auto-Increment Filenames

SuperFlow recommends using the WinDyn Test Setup dialog box (see section 3.3, "WinDyn Test Setup," on page 3-9) to set the data file names because it sets all three save types with the same name and changes the names entered through the Auto-Increment Filenames dialog box.

2.5 Backing Up Files

Superflow recommends periodically backing up the files generated by WinDyn, including the site-specific configuration files and data files. This ensures your information is not lost if the computer hard drive should crash. Use any type of storage media; it is best to use media external to the computer such as a recordable CD, a flash drive, or a network server.

Configuration Files

Configuration files are specific to the system. They contain information such as the channel definitions, calculation formulas, safety limits, and test profiles. The files are located in three folders:

C:\Windyn\xxxx\Config*.*

C:\Windyn\xxxx\Limits*.*

C:\Windyn\xxxx\Test*.*

xxxx is the system type (such as AutoDyn, CycleDyn, XConsole, etc.)

Data Files

Data files contain the data recorded by the system during testing. They also include any test description notes. The operator designates the location of data files, so they can reside anywhere on the computer hard drive. The most common location is:

C:\Windyn\xxxx\Dataxxxx\yyyy*.*

xxxx is the system type

yyyy are possible subfolders specific to the engine, vehicle, or customer

If the computer must be reformatted or replaced, re-install the primary WinDyn program and the System Configuration using the disks supplied by SuperFlow. Then copy your backup files to their respective folders. If done properly, you only lose the information collected since the last backup.

CHAPTER 3

TESTING WITH WINDYN

IN THIS CHAPTER

- **Introduction**
- **Test Groups**
 - Installing Test Groups
 - Designing Test Groups
 - Channel Order
- **WinDyn Test Setup**
 - Test Setup Menu
 - Test Data Names
 - Test Data Location
 - Data Printouts
 - Data Analysis
 - Test Notes
- **Specifications**
 - Editing Specifications
 - Saved Specifications
 - Installing Specification Files
 - Zeroing Sensors
- **Analyzing Data**
- **SuperFlow Explorer**
 - Data Management
 - Unique Features
 - Hidden Files
 - Multiple Views
 - Compatibility
- **Setting Up for a Test**



3.1 Introduction

WinDyn has many features that provide tools for running tests, analyzing data, and managing the system. This chapter details the most commonly used features.

3.2 Test Groups

WinDyn test groups are a useful and convenient tool for quickly configuring the dynamometer for a specific application or series of tests. When you install a test group from WinDyn, WinDyn automatically installs all the files necessary to completely configure the system for your requirements. A single test group can consist of one or more of the following system elements (files):

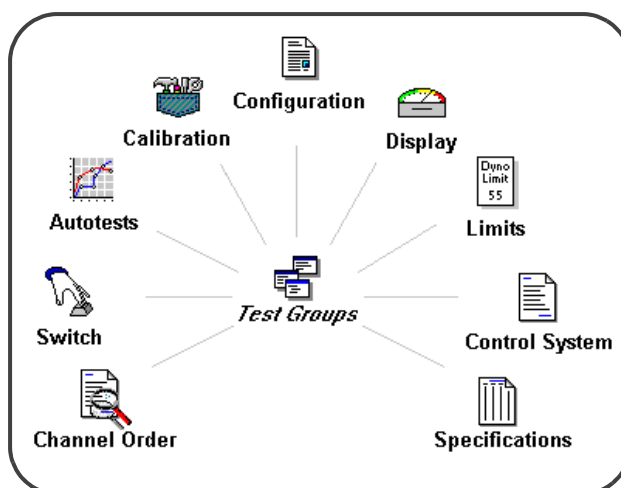


Figure 3-1. Test Groups

The test group also determines the **channel order**, which is the display order of the data channels for analysis and printouts in the **Stored Data Viewer**. The channel order is always dependent upon a configuration file. If the configuration file is changed, the same changes appear in the channel order. For example, if speed becomes an airflow channel, airflow would now appear in the position of all the channel order pages where speed was located.

You can design many test groups for each configuration file. For example, one channel order can be designed for power tests and a second one for endurance tests. A third may be used for engine break-in cycles. Name each one appropriately and load it prior to starting the test.

By utilizing this feature, a single test group can be installed for a particular type of test. It will automatically install the necessary files and channel order for that test combination.

A test group can only access files that exist in the system configuration folder in the computer.

3.2.1 Installing Test Groups

Test groups can be installed in many ways (refer to the “Test Group” definition on page 2-3 for more information). Two common methods are used to automatically install test groups using the Auto-install Test Group feature or manually by the operator.

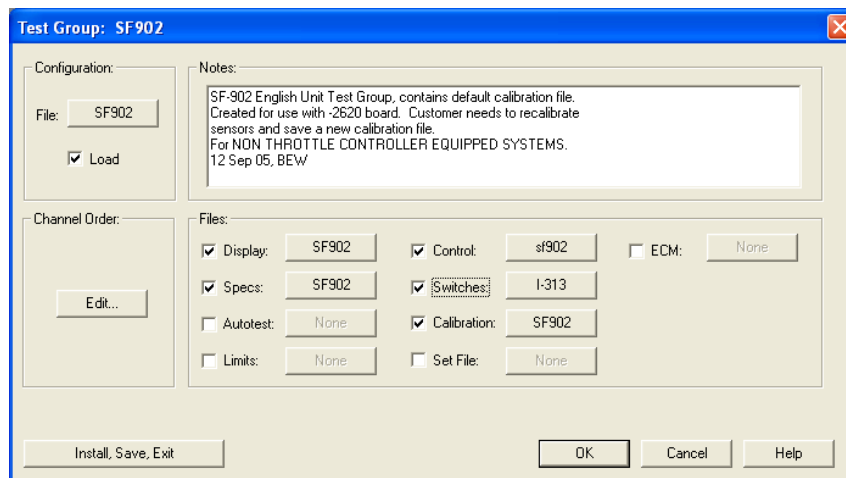
To manually install a test group:

1. From the **WinDyn** main menu select **System>>Install>>Test Group**, press the **F2** key, or click the **Install Test Group** toolbar button.
2. Select a test group.
3. Click **Open**.

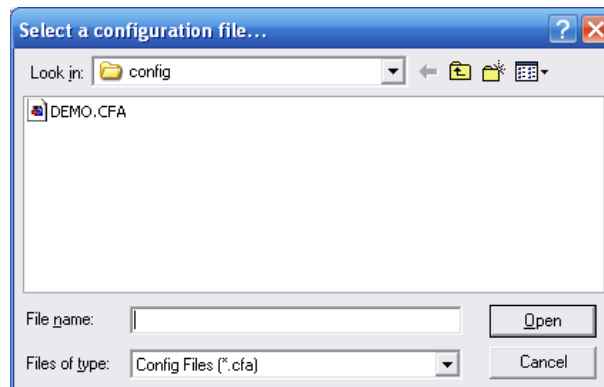
3.2.2 Designing Test Groups

Use the **Test Group** dialog box to modify an existing or design a new test group. From the **WinDyn** main menu, select **Design>>Test Group>>New**. The **Test Group: [Name]** dialog box appears.

Or select **Design>>Test Group>>Open** or press **SHIFT+F2**. The **Design Test Group** dialog box appears. Select a test group file and click **OK**.



- **Configuration:** Select the configuration by clicking the **File** button (with the current test group name). The **Select a configuration file...** dialog box appears.



Select a file name and click **Open**. The selected configuration file name displays on the file button.

To automatically load this configuration file each time the test group is loaded, place a check mark in the **Load** check box beneath the button. A configuration file must be selected whether it is loaded or not.

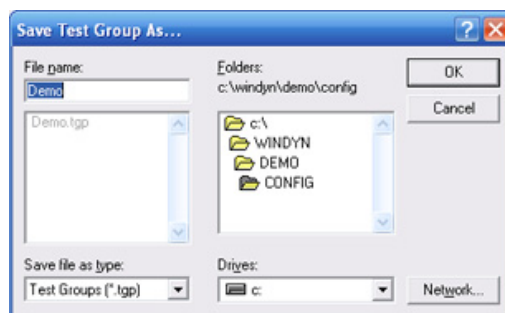
- **Notes:** Type any information you want saved with the test group to easily identify the purpose of the test group.
- **Install:** These three areas display load boxes with buttons for selecting the **Display, Specifications, Autotest, Limits, Control, Switches, Calibration, Set File,** and **ECM** files to include in the test group.
 - To automatically load the selected file each time the test group is loaded, ensure each corresponding load box option is selected with a check mark in the box.
 - To select a file, click the associated button and select a file in the list displayed in that file's dialog box. Then click **OK**.
 - If the load box is gray, the system you are using does not utilize this file type.
- **Channel Order:** Click the **Edit** button to display the **Channel Order** dialog box where you can select which channels to display, print, and plot when viewing test data.

3.2.2.1 Saving and Renaming Test Groups

When the test group design is finished, click **OK** to enter a file name for this test group. Or select **Install, Save, & Exit** to load the test group into the dynamometer system, save it to a disk with the existing name, and exit the dialog box.

To use an existing test group as a model for others, open that test group, make changes, then save it using a different name.

To rename an existing test group, click the **OK** button on the **Test Group: Name** dialog box. The **Save Test Group As...** dialog box appears.



Type a name in the **File name** text box and click **OK**.

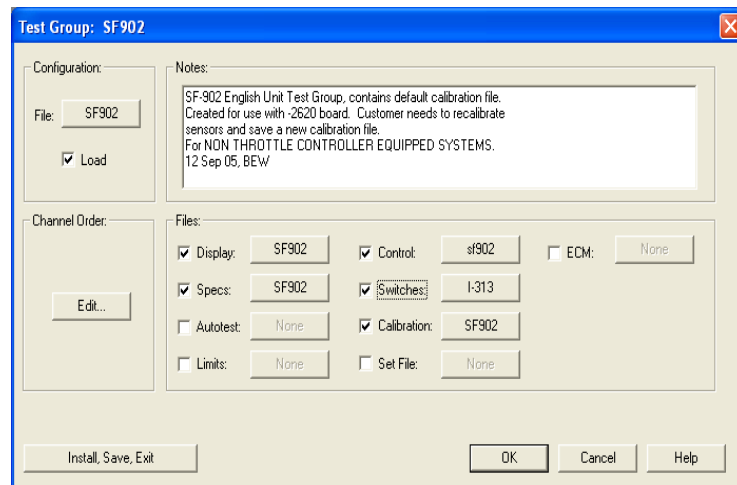
NOTE: SuperFlow always recommends making a backup copy before modifying a test group file.

3.2.3 Channel Order

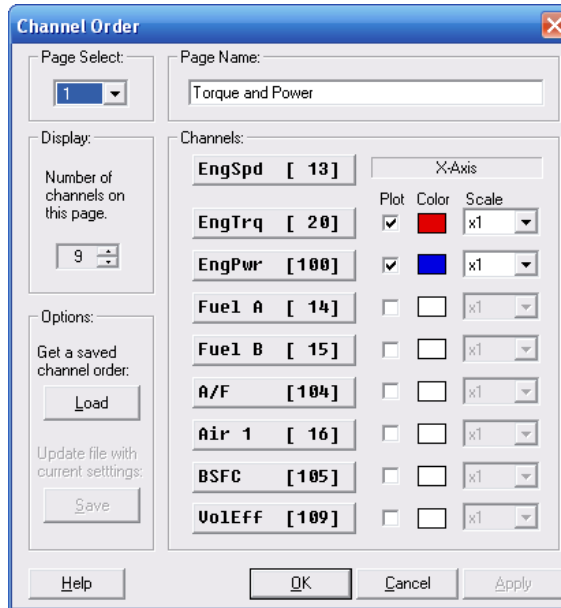
The **channel order** determines the analysis, printing, and plotting data channel display order. For example, you could have Speed in Column 1, Torque in Column 2, Power in Column 3, and so on. Each page provides up to ten pages of column designs and up to nine channels to select.

The channel order is specifically assigned to a test group. Each test group has a channel order that becomes the default for data files saved while that test group is active and becomes imbedded in the data file when it is saved. You can change the channel order for a saved data file while viewing the data. The next test that is run will revert to the default channel order in the test group.

Select **Design>>Test Group>>Open** and select a test group. The **Test Group: [Name]** dialog box appears.



Click the **Edit** button next to **Channel Order** (in the center area) to open the **Channel Order** dialog box.

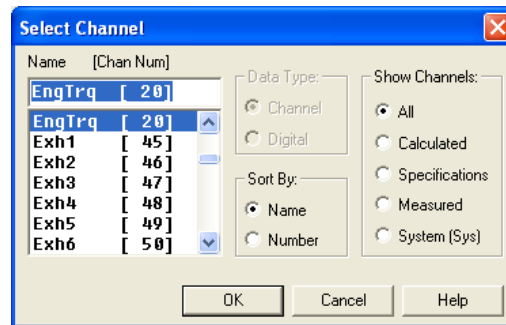


Select which channels to display and plot when viewing WinDyn data.

- **Page Select:** To modify a stored data page, select the desired page using the drop-down list. Ten pages are available.
- **Page Name:** Each page can have a unique name which displays in the headings of the WinDyn **Stored Data** and **Plot** view screens and on the data and plot prints.
- **Display:** Select the number of data channels to display on the page using the **UP/DOWN** arrows, or type a number in the text box.

To use the same channel order with a new test group, open the existing test group, modify it, then save it as a new test group (see “Saving and Renaming Test Groups” on page 3-5).

- **Channels:** For each channel on the page, select the channel to display by clicking a channel button. The **Select Channel** dialog box appears. Use the slide bar or **UP/DOWN** arrows to scroll through the list and select the channel. The first channel at the top of the list is always the X-axis (the axis across the bottom) on the graphs.



The channel order can be changed in a viewed test for a particular application. After closing the data window, all new tests will have the default channel order.



For more information on changing the channel order on saved test and plots, refer to section 5.3.3, “Channel Order,” on page 5-9.

NOTE: A shortcut for finding a desired channel is to enter the first letter of the channel name in the dialog box. The channel will then appear in the list.

- **Plot:** To plot a particular channel, select the associated check box. The first channel at the top of the list is always the X-axis. The channels selected will be on the left or right Y-axis depending upon the settings in the Plot preferences.



See section 5.6, “Plotting Test Data,” on page 5-15 for more information on plotting graphs.

- **Color:** A wide range of colors can be selected for the plot lines. Click the **Color** box to display the dialog box with selections.
- **Scale:** To plot a channel multiplied by a scale factor, select the desired scale factor in the **Scale** drop-down list for that channel. The indicated Y-axis scale equals the actual value times the scale factor. For example, if the scale factor for engine speed is 0.01 and the real speed range is 0–10000 rpm, engine speed will be plotted with a Y-axis scale of 0–100.
- **Save:** The Save button permanently saves channel order changes to the currently viewed data file or to the active test group if viewing *current data* (data currently recorded in the remote). The Save button is not active when editing test groups; it is only available when viewing the Channel Order dialog box from the **Stored Data** dialog box in **File>>Preferences** or from the Plot dialog box in **Plot>>Preferences**.
- **Load:** Click the **Load** button to retrieve a saved channel order from a data file (*.sfd) or a test group (*.tgp) so the channel order can be matched. This way you do not need to enter all the channel order information manually. The loaded channel order can then be saved with the current test group file.

3.3 WinDyn Test Setup

Dyno operators can use the Test Setup feature to view and edit the most common WinDyn test preferences from a single location. From the **WinDyn** main menu select **Design>>Test Setup**, click the **Test Setup** toolbar button, or press the **S** key.

The WinDyn Test Setup dialog box contains the following elements:

- Buttons:** Activate - F2, Cancel - Esc, Recall - F3, Memorize - F4, Refresh - F5.
- Test Data Name:** A dropdown menu showing 'DATA' and a 'Start At' spinner set to '1'.
- Test Data Location:** A text field showing 'C:\windyn\Demo\data Demo' and a 'Browse' button.
- Logo:** SuperFlow TECHNOLOGIES GROUP.
- Specifications Table:**

Num	Name	Value	Units	Description
77	EngBor	0.000	inches	
78	EngStr	0.000	inches	
79	EngCyl	0	number	
82	EngCyc	0	cycles	
85	FuelSG	0.000	ratio	
89	VapPrs	0.00	InHg	
90	Start	0	RPM	
91	StopAt	0	RPM	
92	StepTm	0	Second	
93	StpSiz	0	RPM	
97	IntLng	0	inches	
99	StrTst	0	second	
- Test Notes - F12:** A text area with the prompt 'Enter any Test Description notes here...'.
- Status Bar:** Test group: Demo, Last data:, Date: 01/03/2007.

Figure 3-2. WinDyn Test Setup dialog box

Use this dialog box to include test notes, specifications, test data name/location, report headings, print preferences, and plot settings, and add a company logo to the data printouts. Test preferences can be placed into memory and retrieved later for similar test scenarios.

3.3.1 Test Setup Menu

The top line of the Test Setup dialog box contains a toolbar with various commands for managing the setup actions. To execute a command, click the toolbar button or press the appropriate keyboard shortcut.

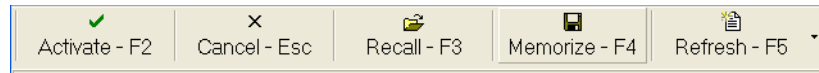
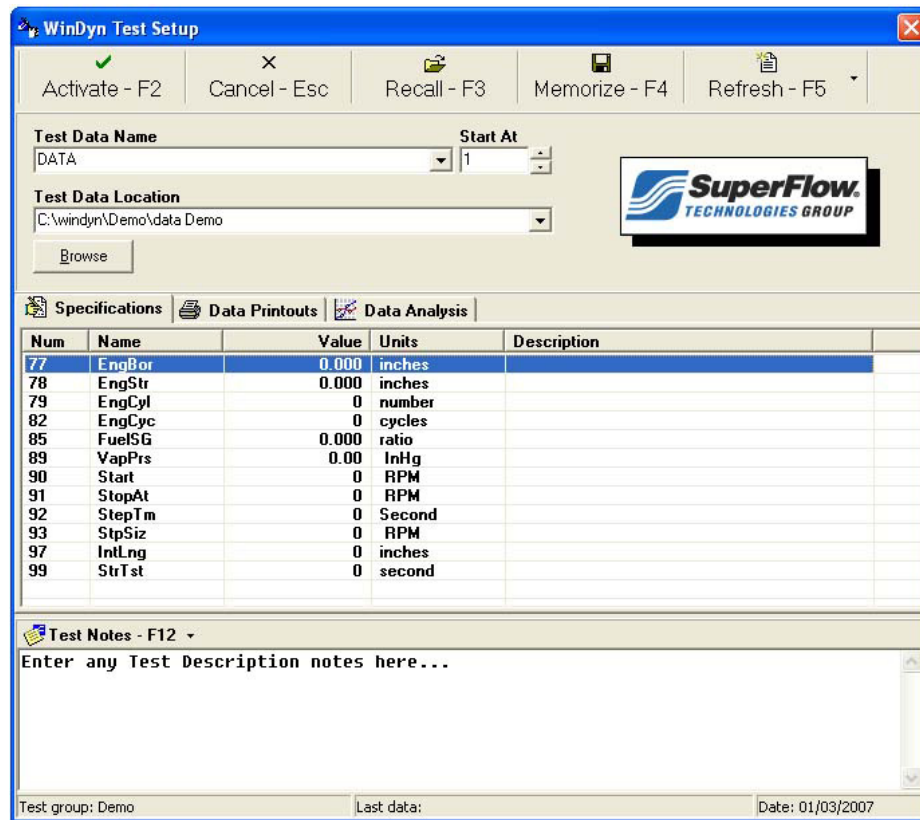


Figure 3-3. Test Setup Toolbar Buttons

- **Activate – F2:** Sends all the settings in the Test Setup to the Data Acquisition system and makes them active. If no changes were made, the system takes no action other than closing the window.
- **Cancel – Esc:** Rejects any changes made without activating them and closes the window.
- **Recall – F3:** Opens a memorized (saved) WinDyn Preferences file which then imports the desired setup from that file.
- **Memorize – F4:** A WinDyn Preferences file contains settings for the Test Setup in a stored file on the computer hard drive in the same folder as the system configuration files. The operator selects how to memorize the settings and can quickly reconfigure the test setup without having to enter or select all the values again.
- **Refresh – F5:** Imports (refreshes) the window from the active settings in the data acquisition system or resets the settings to the factory defaults.

3.3.2 Test Data Names

Use the WinDyn **Test Setup** dialog box to specify the default names used for storing test and post-mortem data. From the **WinDyn** main menu, select **View>>Test Setup**, click the **Test Setup** toolbar button, or press **A** on the keyboard. The **WinDyn Test Setup** dialog box appears.



The WinDyn Test Setup dialog box features a toolbar with icons for Activate (F2), Cancel (Esc), Recall (F3), Memorize (F4), and Refresh (F5). Below the toolbar, there are input fields for 'Test Data Name' (currently 'DATA') and 'Start At' (currently '1'). A 'Test Data Location' field shows 'C:\windyn\Demo\data Demo' with a 'Browse' button. The SuperFlow Technologies Group logo is displayed on the right. A tabbed interface at the bottom includes 'Specifications', 'Data Printouts', and 'Data Analysis'. The 'Specifications' tab contains a table with columns: Num, Name, Value, Units, and Description. Below the table is a 'Test Notes - F12' section with a text area for notes. The status bar at the bottom shows 'Test group: Demo', 'Last data:', and 'Date: 01/03/2007'.

Num	Name	Value	Units	Description
77	EngBor	0.000	inches	
78	EngStr	0.000	inches	
79	EngCyl	0	number	
82	EngCyc	0	cycles	
85	FuelSG	0.000	ratio	
89	VapPrs	0.00	InHg	
90	Start	0	RPM	
91	StopAt	0	RPM	
92	StepTm	0	Second	
93	StpSiz	0	RPM	
97	IntLng	0	inches	
99	StrTst	0	second	

Type the name in the **Test Data Name** text box. Because autotests only use the **Autotest Saves Data** information, you only need to change the entries in that area.

The names entered in this text box auto-increment numerically each time data is saved. This feature streamlines saving test data, especially when making many consecutive runs. These file names can be any up to 256 characters. The **Start At** number to the right of each file name is the value that starts the incrementing sequence.

Example:

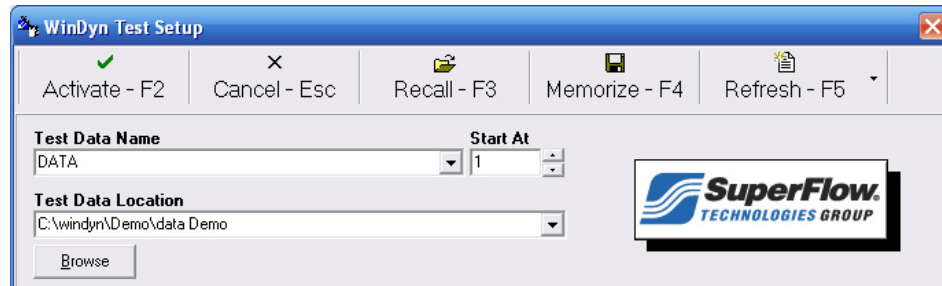
If you type **My Test Data** in the file name text box and type or select **1** in the **Start At** drop-down list, each time data is saved, the name automatically increments from **My Test Data1** to **My Test Data2**, and so on.

When WinDyn saves data, if a file name already exists, WinDyn finds the next available number to attach to the file name and use it. WinDyn never overwrites existing test data.

3.3.3 Test Data Location

The setting in the WinDyn Test Setup dialog box determines where WinDyn will save and search for data files. To store test data in a particular folder, type the path in the **Test Data Location** text box, or click the **Browse** button to select a path. If the typed path does not exist, WinDyn creates it. When adding a new location, add the new folder name to the end of the string. When adding a new folder with a name that already exists, a warning appears with a message asking whether to replace the existing folder.

Store all WinDyn files in the provided default folders, or create as many subfolders as needed. It is advantageous to store the test data in various subfolders related to the customer or the test device.

Example:

Note that **Data [System Name]** is the primary folder. What follows is the folder where the data will be stored. Data files can be stored anywhere on the computer hard drive, a removable storage device (flash drive, CD, zip disk, etc.), or a network server. However, if using a removable storage device or network server, be certain the device is installed or the network server is connected. If not, a conflict occurs and the program may lock up or crash.

3.3.4 Data Printouts

Click the **Data Printouts** tab to set preferences for printing the test data.

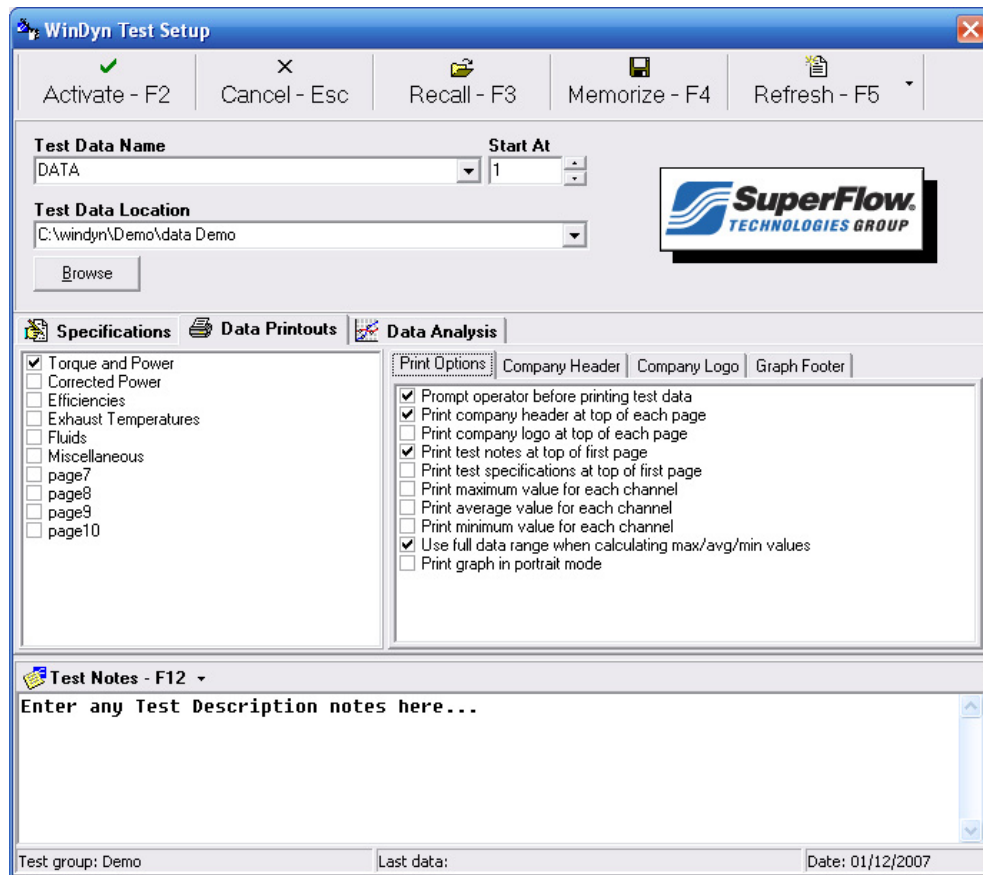


Figure 3-4. Data Printouts tab

The list in the left pane displays the available pages to print. Select any combination of pages by clicking the appropriate check box.

Print Options Tab

Some of these options can also be accessed from the WinDyn main menu by selecting **Analyze**.

- **Prompt operator before printing test data:** Displays the Print Setup dialog box (see section 5.5, “Printing Test Data,” on page 5-13).
- **Print company header at top of each page:** Displays the header information (see “Company Header Tab” on page 3-14).
- **Print company logo at top of each page:** Displays the company logo (see “Company Logo Tab” on page 3-14).
- **Print test notes at top of first page:** Displays the notes on the first page only (see “Test Notes” on page 3-16).
- **Print test specifications at top of first page:** Displays the specification values on the first page only.

- **Print maximum/average/minimum value for each channel:** Displays the appropriate values at the bottom of the last page.
- **Use full data range when calculating max/avg/min values:** Uses all the data points recorded to calculate the minimum, average, and maximum values. If cleared, it uses the range specified in the Column Averages dialog box (see section 5.9.1, “Averaging Test Data by Columns,” on page 5-40).
- **Print graph in portrait mode:** Prints the graph in portrait (tall) format which uses only half the page. Landscape (wide) format uses the entire page.

Company Header Tab

The information in this tab displays in a header at the top of the first page or every page depending upon the option selected in the Print Options dialog box. It replaces the Test Report Headings information in **System>>Preferences** on the WinDyn main menu (see section 2.4.2, “Test Report Headings,” on page 2-16).

Company Logo Tab

A bitmap image can be printed on the data printout with the company header. This image prints on the left side of the header with the company information on the right. To import the image file and size it, right-click the tab and select an option from the menu.

Graph Footer Tab

Click the tab and type text in the text box. The text then prints at the bottom of the data plots directly above the SuperFlow WinDyn trademark name. This is ideal for displaying the company name and showing where the data sheet came from.

3.3.5 Data Analysis

Click the **Data Analysis** tab to set the preferences for plotting test data.

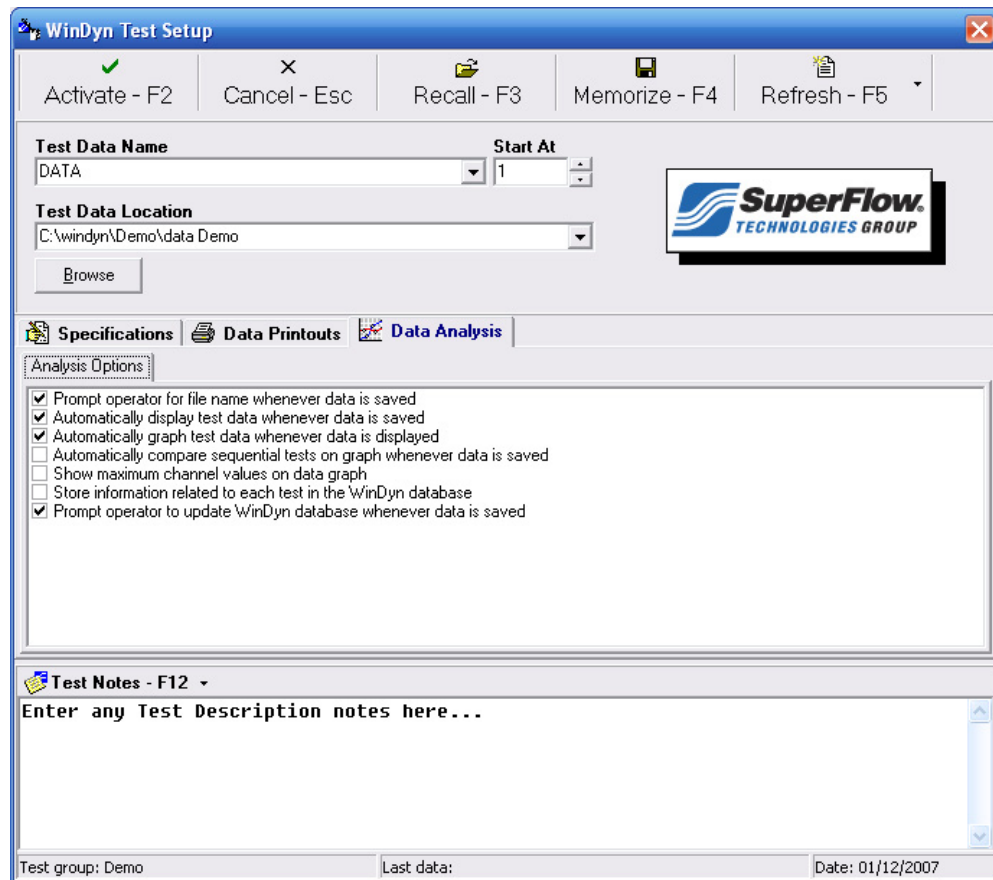


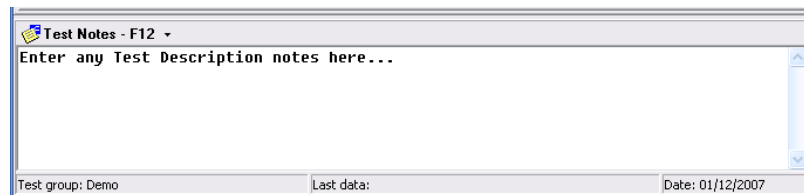
Figure 3-5. Data Analysis tab

- **Prompt operator for file name whenever data is saved:** Displays a **Save As** dialog box when current data is saved through the **Analyze** menu. This does not apply to data saved automatically by a test.
- **Automatically display test data whenever data is saved:** Displays the data file created after saving.
- **Automatically graph test data whenever data is displayed:** Displays a plot from the data file created after saving.
- **Automatically compare sequential tests on graph whenever data is saved:** Overlays the data file created after saving an open plot which can be minimized to view the WinDyn windows.
- **Show maximum channel values on data graph:** Displays the maximum value of each channel shown on the plot.

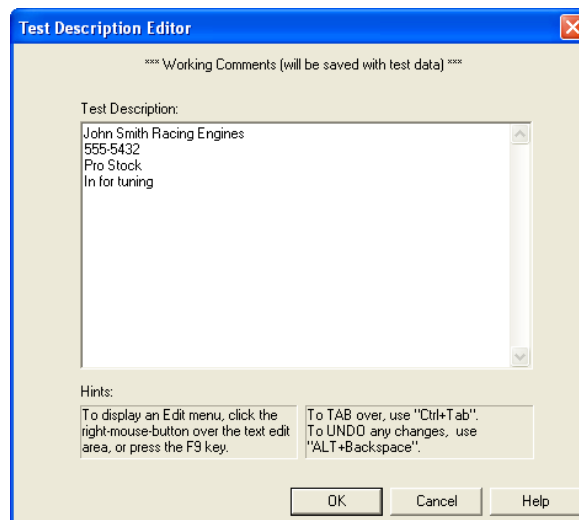
- **Store information related to each test in the WinDyn database:** When selected and the Database Manager is activated, this option creates a new record in the WinDyn database after a new data file is created. The database manager must be activated first (see section 2.4.4, "Test Database Manager," on page 2-18).
- **Prompt operator to update WinDyn database whenever data is saved:** When selected and the Database Manager is activated, this option prompts the operator to enter information for a new record in the database.

3.3.6 Test Notes

Use the **Test Notes** area (referred to as Test Description in previous versions of WinDyn) in the Test Setup dialog box to attach notes for each test. These notes can include details on the test device, owner contact information, reasons for testing the device, test results, and so on. The information is saved with the stored test data (*.sfd) files. Test notes can contain a maximum of 5,280 characters and be printed as part of the report header on the data printout.



Once the data is stored, additional information may be added to the file later by pressing the F10 key and using the Stored Data Viewer program (for more information, see section 5.6.10, "Viewing Test Notes," on page 5-31).



3.3.7 Activating the Data Acquisition Setup

After entering all information, you must activate the setup in the Data Acquisition system by clicking the **Activate** button (on the toolbar) or pressing **F2**.

3.4 Specifications

Specification channels (constants) are used to define values that will remain constant throughout a test. These values are typically associated with a particular engine, vehicle, or test. The specification channels are defined in the configuration file (CFA/CFD) channels 77 through 99.



See section 11.3.1.2, “Configuring Specification Channels,” on page 11-17 for a description of the standard specification channels defined in your system.

3.4.1 Editing Specifications

Use the Specifications tab on the WinDyn Test Setup dialog box to enter the specification channel values in effect during testing. When you open the WinDyn Test Setup dialog box, the currently active set of specifications are imported from the Data Acquisition System. These specification values were installed through a test group, specification file, or perhaps carried over from a previous test.

The displayed values are the values currently active in the test system and will be used for the test. Click the column headings (**Num**, **Name**, **Value**, etc.) to sort the display according to that column. The **Description** column is included for planned future use.

To edit a channel, select a channel in the list and double-click or press **ENTER**. A dialog box appears for the selected channel. Type the desired value in the text box and click **Accept** or press **ENTER**. If desired, press **F2** before closing the window to immediately activate the new value. Otherwise, the changes do not take effect until the Test Setup is activated.

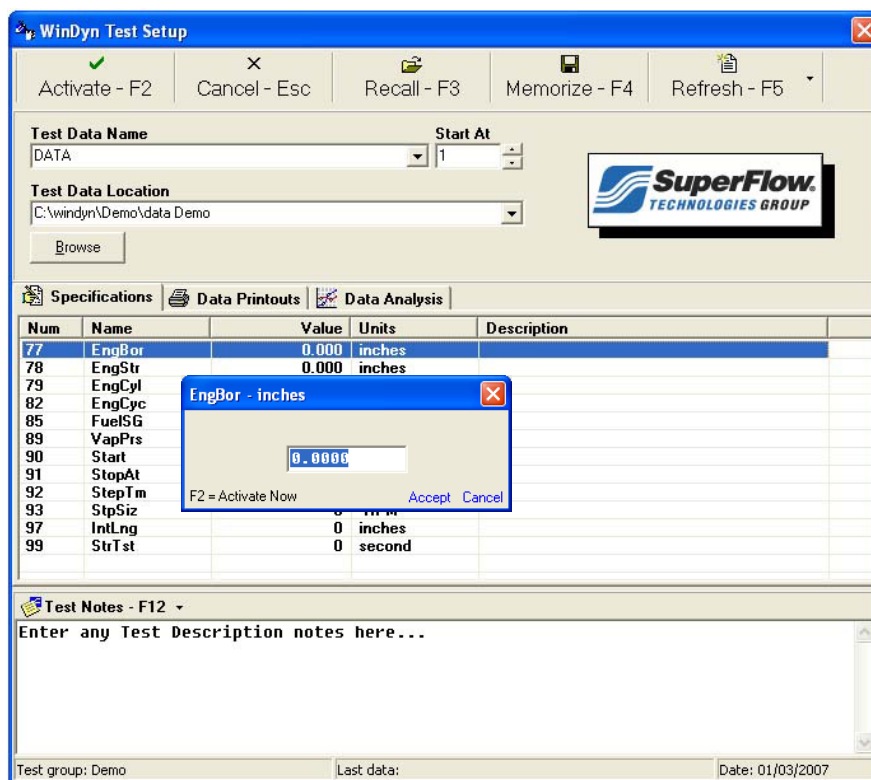
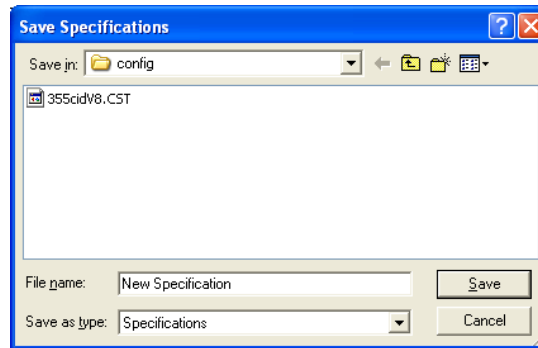


Figure 3-6. Specifications

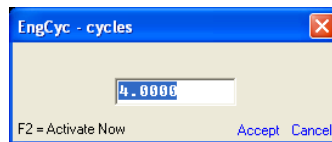
3.4.2 Saved Specifications

Specification values can be modified and saved as a group (file) and stored in a separate specifications file (CST) for easy retrieval. To save a file, place the mouse pointer in the **Specifications** area, right-click, and select **Save**. The **Save Specifications** dialog box appears.



Type a new name in the **File name** text box and click **Save**.

To edit a specifications file, place the mouse pointer in the **Specifications** area, right-click, and select **Edit**. The **[Specification Name]** dialog box appears.



Type the information in the text box and click **Accept** in the bottom right corner.

Specifications can also be saved by memorizing a WinDyn Preferences file (WDP) in the Test Setup dialog box and retrieving it later.

3.4.3 Installing Specification Files

You may install a saved specification file (*.cst) in the system to set all the active constant values simultaneously. Two methods are used:

- From the main **WinDyn** main menu, select **System>>Install>>Specifications**.
- Include a specification file as part of a test group.

Specification files can be assigned to test groups, thereby setting all the specification channel values when the test group is loaded. Therefore, multiple configuration files are *not* needed to set different values for the specification channels. Instead, use a single configuration file and multiple test groups, with each test group using the same configuration and a different specification file.

NOTE: All specification channels are reset to their configuration file default values each time a configuration file is installed in the test system.

3.4.4 Zeroing Sensors

Zeroing sensors adjusts the reference on selected measured channels for current atmospheric conditions (barometric pressure). Typically these channels are the torque (load cell) and pressure sensors, but others may be adjusted as well. In most cases this operation is not necessary because the Zero reference is set during the calibration process and is saved in the calibration file (cal). The Zero offset is then set in the system when the calibration file is installed through the test group.

Only zero the sensors when a substantial difference in the torque and pressure sensors occurs. If this difference is greater than 5%, review the calibration process.

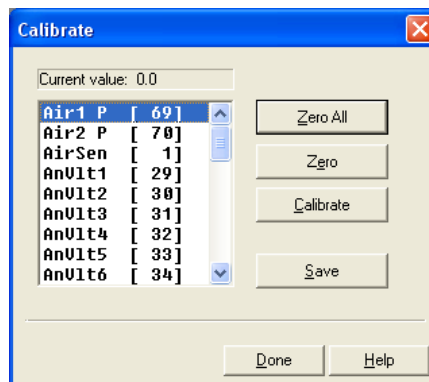


CAUTION: If a sensor channel is zeroed with an active value applied (pressure, torque, etc.) the system will reference that value as zero (0) for the channel.

Two methods are used to zero sensors:

From WinDyn

1. From the **WinDyn** main menu select **System>>Calibrate**, click the **Calibrate Channels** toolbar button, or press **C** on the keyboard to open the **Calibrate** dialog box.



2. Click the **Zero All** button. A new dialog box appears prompting you to confirm the zero action.
3. Click **Yes**; the channel values are now zero.
4. When finished, click **Done**. On some dynamometer systems, measured channels cannot be zeroed while the engine is running or rollset is turning.

From the Operators Console or Remote Handheld Controller

- **Console:**
 - Press the **Calibrate Sensors** button (**F1** key), then press **Zero**.
 - Press **OK** to confirm.
 - Press **Exit**.
- **Wired Handheld Controller:**
 - From the main screen, select **AUTOZERO**.
 - Select **All Channels**.
- **Wireless Handheld:**
 - Press the **Calibrate Sensors** button (**F1** key), then press **Zero**.
 - Press **OK** to confirm.
 - Press **Exit**.

3.5 Analyzing Data

All test profiles provided by SuperFlow save the test data automatically on the computer as directed by the Test Data Location (see section 3.3.3, “Test Data Location,” on page 3-12). View, print, and plot current and saved test data in the Stored Data Viewer. Current data is stored in the data acquisition system's memory (the dyno's memory). Saved data is stored on the computer's hard drive or other selected location.

To display current data, from the **WinDyn** main menu select **Analyze>>Current Test>>View** or press **F3**. You may also save the data to a specific location with a unique file name. To display saved data, select **Analyze>>Saved Test>>View** or press **SHIFT+F3**.

You may configure up to ten channel groups (pages) to view, print, or plot data. Each channel group can display up to nine different data channels. You may also change the channel order of the displayed data channels and resave the file with the changes. View and print a graphical plot of data with any recorded channel selected on either the X or Y axis.



See Chapter 5, “Stored Data Viewer” for detailed information.

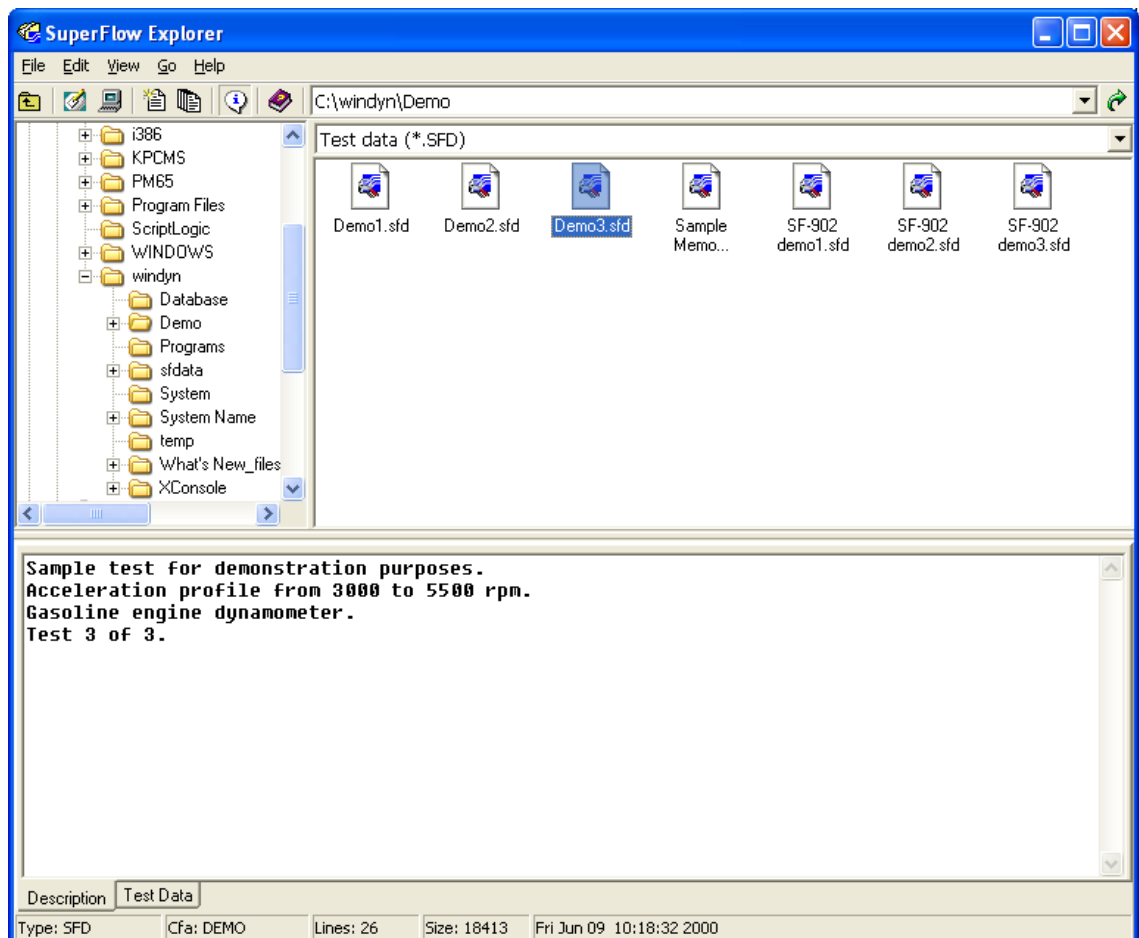
3.6 SuperFlow Explorer

Managing data files is crucial to finding data files belonging to customers and their engine or vehicle. SuperFlow Explorer uses a combination of file naming, file locations, and test notes that makes it easy to quickly locate and identify test files.

3.6.1 Data Management

Use the SuperFlow Explorer tool to browse files and manage test data files directly. This program is identical to the Microsoft® Windows® Explorer in look and functionality. It can browse all folders, networks, and the desktop and create, rename, copy, move, delete, and manage all system folders.


To access SuperFlow Explorer, on the main **WinDyn** toolbar select **Tools>>SuperFlow Explorer**. If desired, place shortcuts to this program anywhere in the Windows environment including the desktop or Start menu.



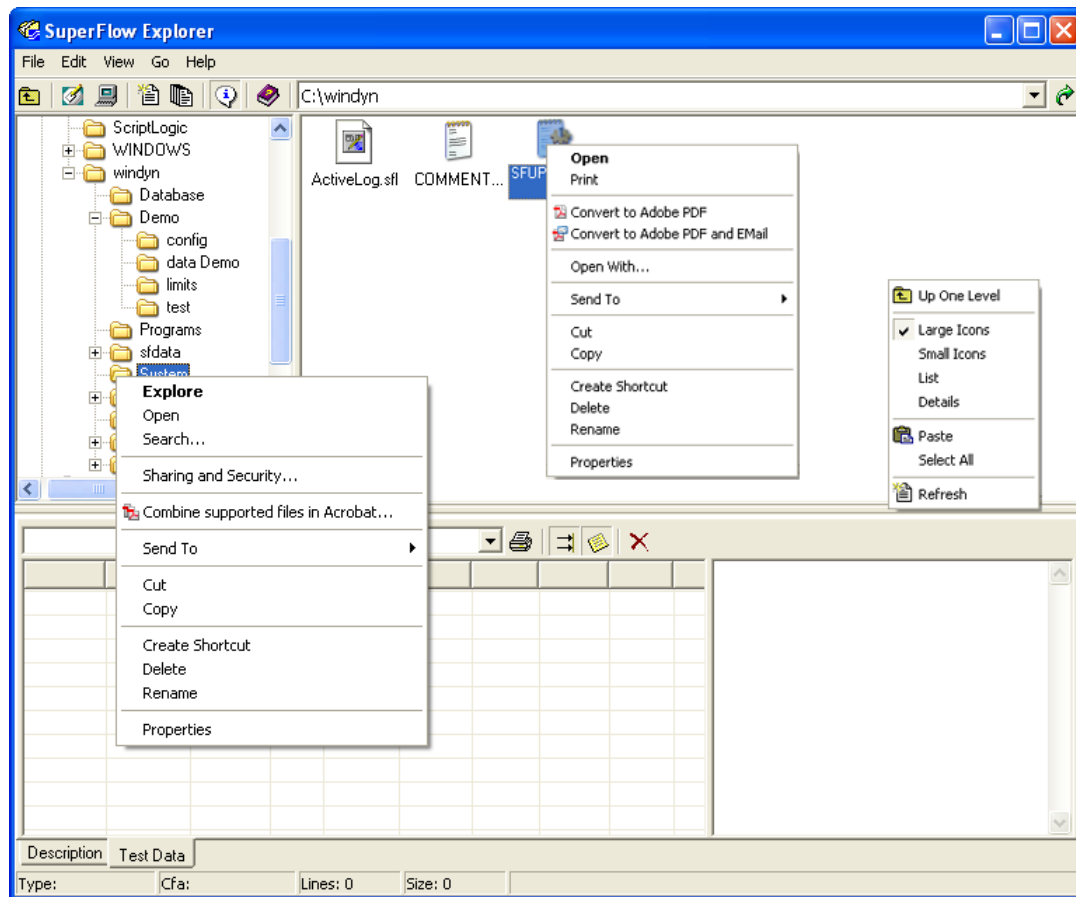
To see the folders in a list format, from the **WinDyn** main menu select **View>>Details**.

Folder Pane

In the left pane, right-click a folder to view a pop-up menu.

The folder-tree pane can be hidden, if desired; it is easy to navigate the system using only the right pane and the **Up One Level**  toolbar button.

To hide the folder-tree pane, from the **SuperFlow Explorer** menu select **View>>Folder Tree** and click **Folder Tree** to select or clear the check mark on the menu item.



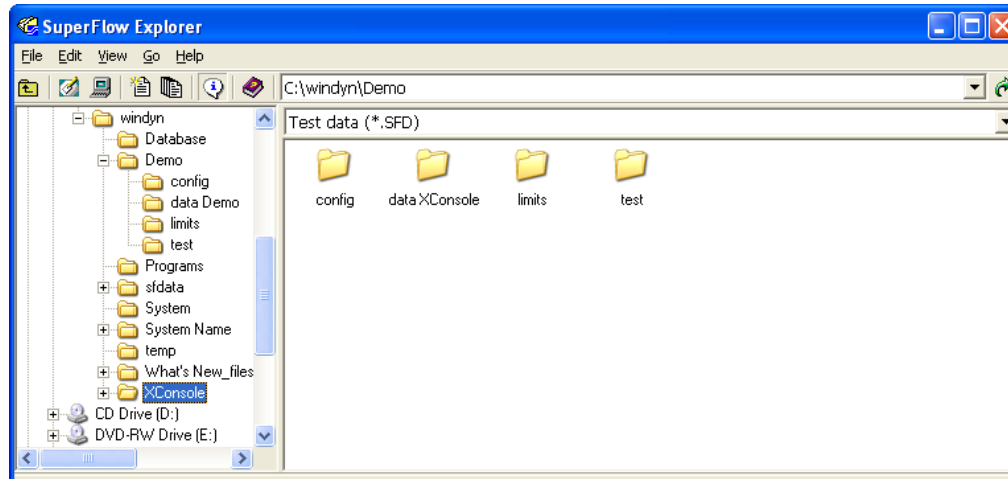
File Pane

To rename, copy, move, delete, and manage system files, right-click anywhere in the right pane to view a pop-up menu.

Right-click directly on a file name to view a pop-up menu of commands for the currently selected file.

3.6.2 Unique Features

If a check mark appears next to the **File Filter** menu option (from the **WinDyn** main menu select **View>>File Filter**), two drop-down lists display at the top of the right pane.



Click the directory drop-down arrow to see a history list of the 10 folder locations you last visited. Select a path to go to that location.

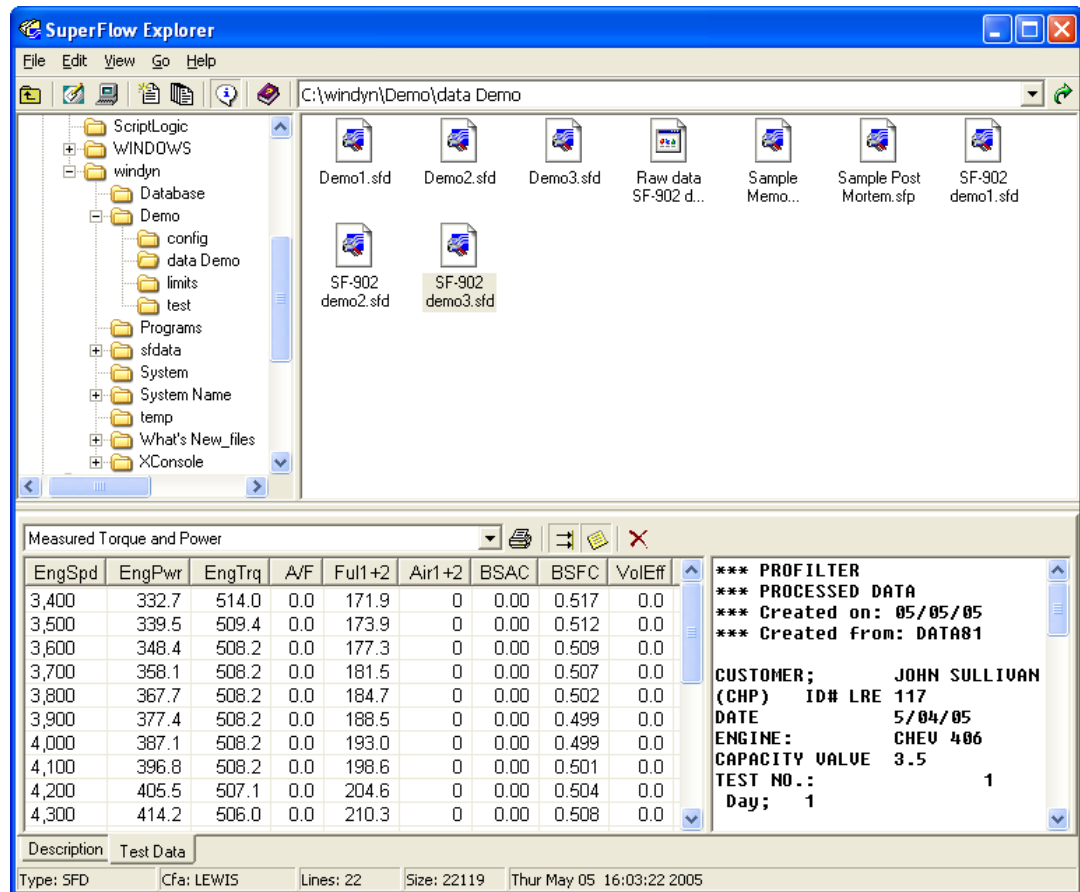
The second drop-down list is a file filter that lets you restrict the right pane to show only files of a specified type. This example shows the filter displaying only data (*.sfd) files. Click the drop-down arrow to select other types in the folder.

Microsoft Windows Explorer does not have these two features.

3.6.3 Test Data

Two tabs are located at the bottom left of the SuperFlow Explorer window:

- **Description:** Displays the notes for the currently selected file. These may be test notes from an SFD data file, notes from a test profile, or the entire text from any TXT file. The default is Description only.
- **Test Data:** Displays the same notes as the Description tab along with the actual test data from SuperFlow test data (*.sfd) files. Edit the notes here if desired (data files only).



In the lower pane of the SuperFlow Explorer window, four toolbar buttons appear next to the test data drop-down list. Click the arrow on the drop-down list to view one of the available ten channel groups.



Print Data

Print the currently displayed test data. The printout is identical to the printouts produced by the stored application.



Word Wrap

Click to wrap text around in the Notes box.



Show Descriptions

Click to see the Notes text box; if this button is not selected, the notes are hidden.



Delete Selected Data Lines

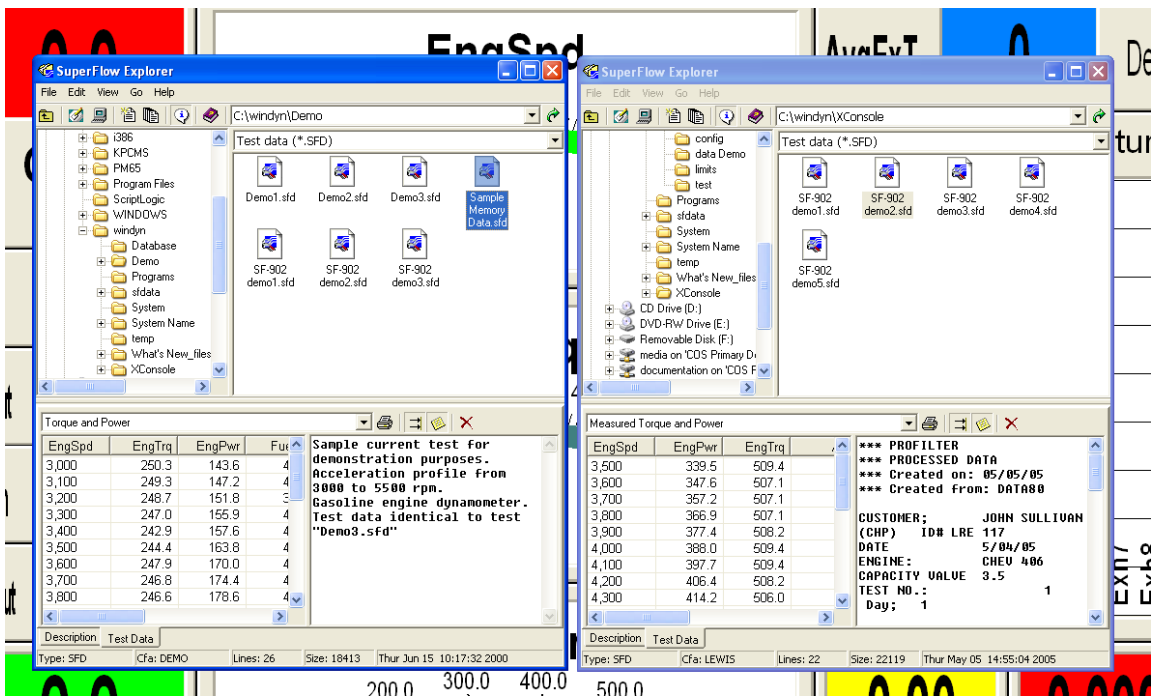
Select to delete lines of test data.

3.6.4 Hidden Files

By default, SuperFlow Explorer does not show hidden files. If you are browsing for files you know exist, but they do not display in SuperFlow Explorer, the files probably have the DOS hidden attribute set true. To view hidden files in SuperFlow Explorer, from the **WinDyn** main menu, hold down the **SHIFT** key while selecting **View>>Hidden Files**.

3.6.5 Multiple Views

Open as many SuperFlow Explorer windows as desired. Because you can view test data in SuperFlow Explorer, you can compare two different tests side by side.



WinDyn can compare tests numerically, in side-by-side columns (see section 5.7.5, “Numerically Comparing Tests” on page 5-35 for more detail). Because SuperFlow Explorer can browse the information stored in text (*.txt) files, you can use SuperFlow Explorer to look at the side-by-side data columns generated by WinDyn.

3.6.6 Compatibility

SuperFlow Explorer works on any Microsoft Windows computer with WinDyn 32-bit (V2.2), WinDyn 16-bit, or no WinDyn installed. However, if you use SuperFlow Explorer on a computer that does **not** have WinDyn 32-bit (V2.2) installed, the test data display feature is not supported; all the data columns will be blank. However, you can still browse the test notes and use the many other features.

3.7 Test Setup

Prior to running a test, you must check and prepare the system for testing and organize your data files. This helps identify the data files for quick search and retrieval.

Performing these checks before testing ensures accurate test data. The shortcut key for each step is listed in Table 3-1; press the keyboard shortcut key to perform the associated step.

NOTE: *The test group set for auto-install may be the desired setup for testing. Therefore, installing a test group prior to testing is unnecessary.*

Table 3-1. Test Setup Steps

Step	Action	Keyboard Shortcut
1	Install test group	F2
3	Specify test data names	S
2	Specify test data location	S
4	Review test specifications	S
5	Review test notes	S
6	Zero sensors	C

Now start the engine and start testing.

CHAPTER 4

SPECIAL FEATURES

IN THIS CHAPTER

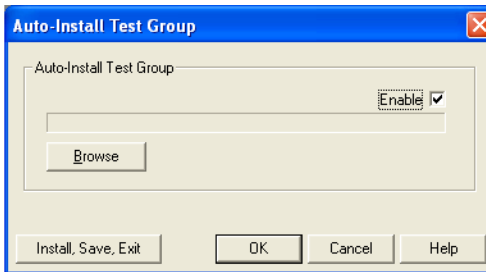
- Autoloading a Test Group
- Calibrating and Autozeroing
- Control Panel
- Tools Editor
- Customer Data Pack
- Playback Data
- ProFilter
- System Log
- Password-protected Features



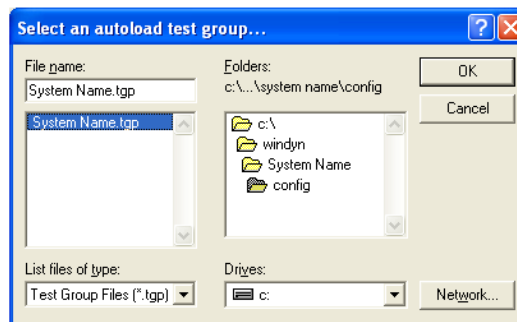
4.1 Autoloading a Test Group

You may specify a test group that will be installed automatically whenever WinDyn is started and establishes communication with the test system.

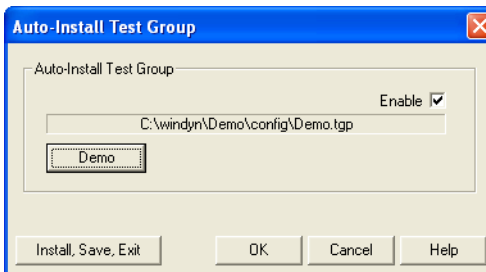
1. From the **WinDyn** main menu select **System>>Preferences>>Auto-Install Test Group**. To automatically install a test group, select the **Enable** option.



2. Click the **Browse** button to display a list of all test groups located in the **config** folder.



3. Select the desired test group and click **OK**. The name of the selected test group will replace the name of the **Browse** button in the **Auto-Install Test Group** dialog box.

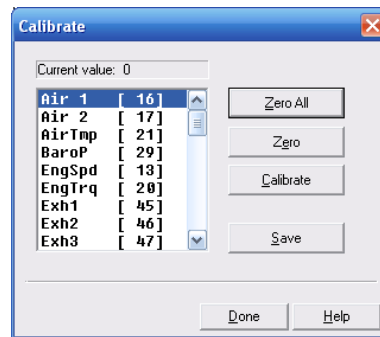


4. Click **OK** to save your selection, or click **Install, Save, Exit** to immediately install the selected test group and save your settings.

4.2 Calibrating and Autozeroing

The sensors used in the SuperFlow Data Acquisition system require periodic calibration to ensure accurate measurements. Zeroing the sensors ensures the measurements are referenced properly to changing atmospheric conditions. Each measured channel is defined to be calibrated or zeroed in the configuration file.

From the **WinDyn** main menu, select **System>>Calibrate**, click the **Calibrate Channels** toolbar button, or press **C** on the keyboard. Use the **Calibrate** dialog box to both calibrate and zero measured data channels.



See the maintenance chapter in the specific SuperFlow operators manual on your system for more specific instructions on calibration.

4.2.1 Calibrating Channels

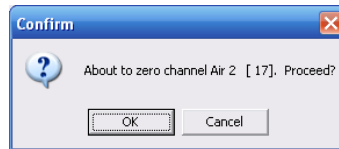
1. In the **Calibrate** dialog box, select a channel from the list of available channels. The current value for the selected channel displays. Ensure that an accurate value is applied to the sensor (torque, pressure, etc.)
2. Click the **Calibrate** button. The **Channel Calibrate** dialog box appears.



3. Type the new channel value in the **Enter new value for channel ____ in ____** text box.
4. Click **OK** to activate the new calibration value. A zero (0) is not an acceptable value and will be rejected by the system.
5. After calibrating one or more channels, click the **Done** button.

4.2.2 Zeroing a Single Channel

1. In the **Calibrate** dialog box, select a channel from the list of available channels. The current value for the selected channel displays.
2. Click the **Zero** button. A **Confirm** dialog box appears with a message asking whether to proceed with zeroing the selected channel.



3. Click **OK**; the channel value is now zero.
4. After you zero one or more channels, click the **Done** button

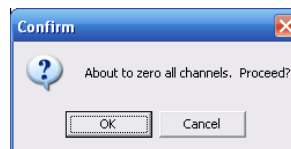
On some dynamometer systems, measured channels cannot be zeroed while the dynamometer is turning.



CAUTION: If a sensor channel is zeroed with an active value applied (pressure, torque, etc.), the system will reference that value as zero (0) for the channel.

4.2.3 Zeroing All Channels

1. In the **Calibrate** dialog box, click the **Zero All** button.
2. A **Confirm** dialog box appears with a message asking whether to proceed with zeroing all channels.



3. Click **Yes**; all channel values are now zero.
4. Click the **Done** button.

On some dynamometer systems, measured channels cannot be zeroed while the dynamometer is turning.



CAUTION: If a sensor channel is zeroed with an active value applied (pressure, torque, etc.), the system will reference that value as zero (0) for the channel.

4.2.4 Saving the Calibration

When the calibration is complete, save a new calibration (cal) file. To save a new file, from the **WinDyn** main menu select **System>>Save>>System Calibration** or click the **Save** button on the **Calibrate** dialog box.

Follow the prompts to complete the process. The file is saved with the same name as the configuration file and should replace the existing file. The calibration file is then included in the test group to be installed.

4.3 Control Panel

The WinDyn dynamometer can be controlled through the WinDyn Control Panel which displays useful status information available in other places. However, this feature is usually not used because the system is normally controlled using the remote handheld controller or the operators console.

To display the control panel, from the **WinDyn** main menu select **View>>Control Panel**, press **F12** on the keyboard, or right-click while the mouse pointer is over an existing WinDyn window.

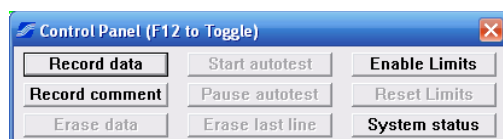


Figure 4-1. Control Panel

Click any of the available buttons – that is, any button not gray – to see the information or control associated with each button. The gray buttons are not yet available.

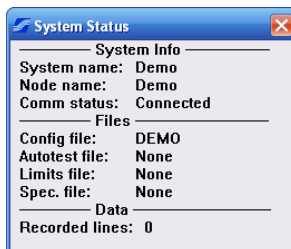


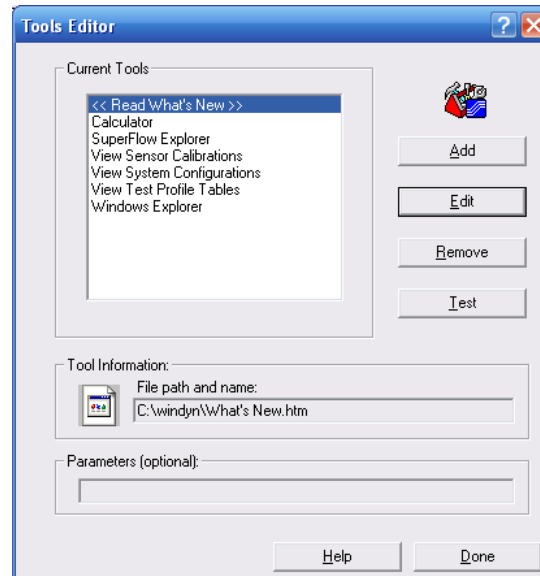
Figure 4-2. System Status window

To close the control panel, press **F12**, select **View>>Control Panel**, or right-click the mouse again.

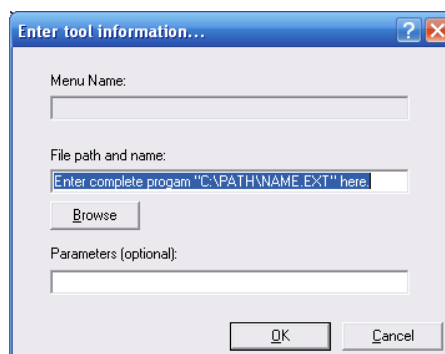
4.4 Tools Editor

The **Tools** menu item on the WinDyn main menu provides direct access to frequently used WinDyn functions or other programs outside of WinDyn that are on the computer. It is essentially a shortcut feature to programs. For example, the calculator is a Windows program, but WinDyn provides quick access to it without having to navigate through standard Windows menus.

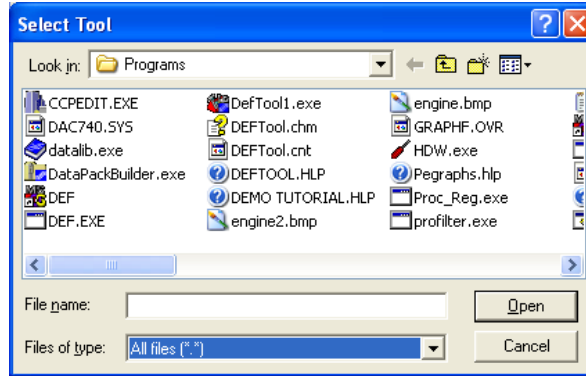
Use the **Tools** menu to add menu entries for your own programs to WinDyn. From the **WinDyn** main menu, select **Tools>>Configure** to display the **Tools Editor** dialog box.



- **Add:** Click to add a new program to the WinDyn Tools menu.
 - The **Enter tool information...** dialog box appears when you click the **Add** or **Edit** button.



- Type the program path and name of the tool in the **File path and name** text box or click **Browse** to select the tool and path. The tool name appears in the **Menu Name** text box. Type notes in the optional **Parameters** text box, if desired.



NOTE: When adding items to the WinDyn Tools menu, make sure **Files of type:** is set to **All**, or you will not see files such as **WinDyn.chm** as possible choices. Default file selection is **xxx.exe**.

- **Edit:** Click to edit the information in the **Enter tool information** dialog box.
- **Remove:** Deletes a program shortcut from the menu.
- **Test:** Runs the selected program. This ensures the program will run as expected when accessed from the WinDyn Tools menu.
- **Tool Information:** Displays the tool name and file path selected.
- **Parameters:** Displays notes entered about the tool.
- **Help:** Click to access online Help for this feature.
- **Done:** Closes the Tools Editor dialog box.

4.5 Customer Data Pack

The Customer Data Pack feature creates a single data pack file to give customers. The data pack contains customer data files, plus the same WinDyn Data Viewer program you use to view, graph, and print test data.

When the customer opens the data pack file on a computer, the Data Viewer automatically installs and copies the files.



IMPORTANT: This program will not install on a computer that already has WinDyn installed. In this situation, all the customer needs the data file (SFD) because WinDyn already contains the Stored Viewer program.

The customer can then easily review and analyze the test data your shop generated for him. This feature replaces the customer data diskettes feature used in previous versions of WinDyn.

1. To open the **Customer Data Pack** dialog box, from the **WinDyn** main menu, select **Analyze>> Customer Data Pack**.

Name	Date	Location
Duramax1.sfd	Thu Jan 13 17:23:54 2005	C:\windyn\AutoDyn\data AutoDyn\H...
Duramax2.sfd	Thu Jan 13 17:27:36 2005	C:\windyn\AutoDyn\data AutoDyn\H...
Duramax3.sfd	Mon Oct 10 21:23:33 2005	C:\windyn\AutoDyn\data AutoDyn\H...

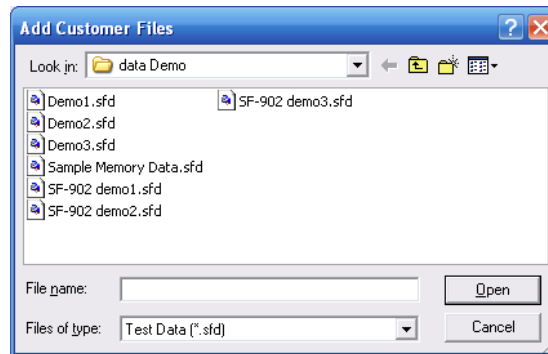
PROFILER PROCESSED DATA
Created on: 01/13/05
Created from: Duramax1

Duramax Testing

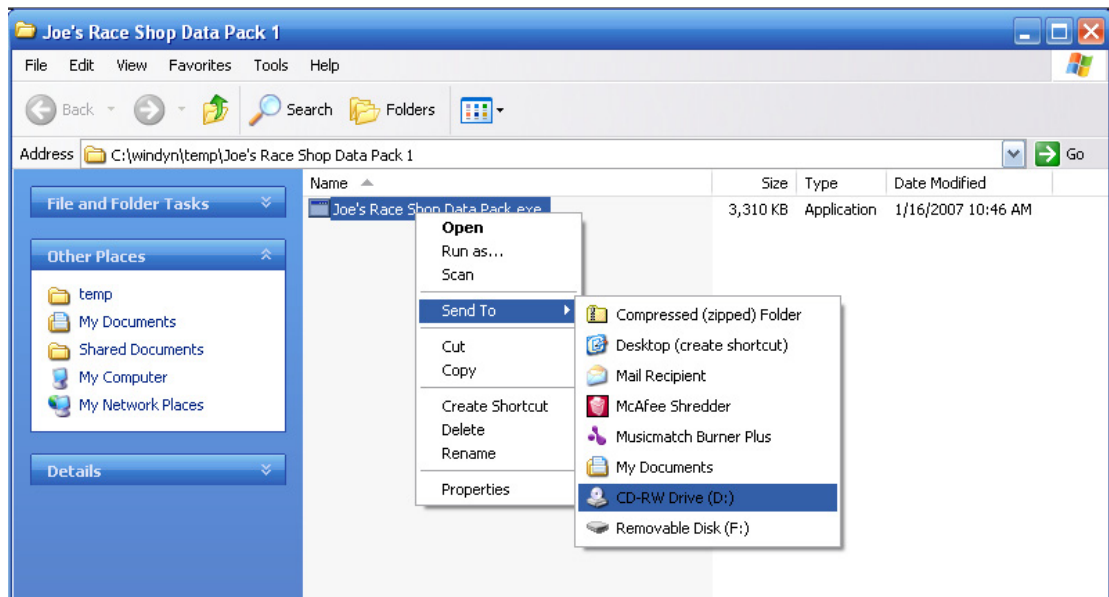
Pro-Inertia test
Standard

2. In the **Customer Name** text box, type the business or contact name.

3. To add files, click the **Customer Files** area where it says **(click here to add files)** or press the **INSERT** key on the keyboard. The **Add Customer Files** dialog box appears.



4. Use the **Look in** drop-down list to select files, then click **Open**.
5. On the Customer Data Pack dialog box, click the **Create** button to make the data pack.
6. The data pack is saved as a ZIP file and stored in the **C:\Windyn\Temp** folder where you can transfer the file to a removable storage device and send or e-mail to the customer.
7. To distribute the data pack to your customer, right-click the data pack file, select **Send To**, and select a delivery method (e-mail, CD, etc.).



4.6 Playback Data

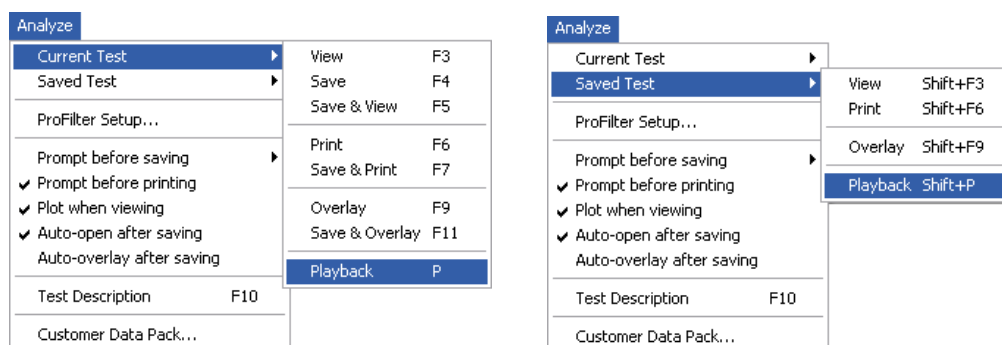
The **Playback** command enables you to replay recorded data (current test) or a stored test (saved data). Use this feature to review a previously run test with any display file and show customers how their engine or vehicle performed on the dynamometer.

During playback, data displays as accurately as possible compared to that of the actual test. How close the playback data represents the live test depends on how frequently the live test data was recorded and how the live test data varied between recordings. The playback function performs linear interpolation of the data between the recorded data points. It is important to understand that this may distort the perception of the test if the data acquisition rate was too slow to capture the full test information.

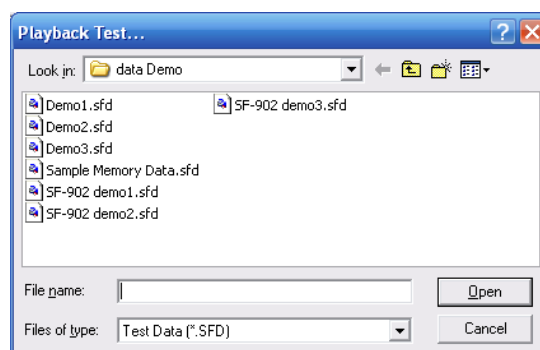
4.6.1 Playing Back Test Data

To select a test for playback, from the **WinDyn** main menu, select **Analyze>>Current Test>>Playback**, click the **Playback Current Test** toolbar button, or press **P** for the keyboard shortcut.

Or, select **Analyze>>Saved Test>>Playback**, click the **Playback Saved Test** toolbar button, or press **SHIFT+P** for the keyboard shortcut.



If you selected **Saved Test**, the **Playback Test** dialog box appears.



If an active screen group exists, WinDyn will perform the playback operations with the active screens. If no screens are open, you will be prompted to open one. Otherwise, select a test in the list and click **Open**.

4.6.2 Playback Data Menu

When a test is loaded for playback, a floating toolbar appears with buttons used for controlling the data playback. Informational text below the buttons indicates the Repeat Play and Playback Speed status.



Figure 4-3. Playback Controls toolbar

An additional menu item called Playback appears on the **WinDyn** main menu.



Figure 4-4. Playback menu item

The Playback menu contains all the controls for the playback function (the playback controls are only available after a test file is selected).

NOTE: The **Playback** feature can be used to compare data from different saved tests. For X-Y plots, the data is not erased unless **Erase Real-time Plot** is selected. After playing back a test, data from another test can be loaded and then played back over the existing X-Y plot. Other methods for comparing saved tests are to use the **Reference Plot Display** or **Plot Test Data** function of the stored data viewer.

4.6.3 Playback Functions

The Playback functions can be performed on the data file. After a saved test is loaded for playback, the **Playback Controls** floating toolbar appears. The buttons are shortcuts to the WinDyn menu system. Informational text appears indicating the **Repeat Play** and **Playback Speed** status.

Rewind



Performs several functions depending on what the playback system is currently performing:

- **Stopped:** Instantly rewinds to the beginning of data
- **Paused:** Play – reverse, speed x 1
- **Play – Reverse, any speed:** Doubles reverse speed up to 8X
- **Play – Forward, speed x 1/8:** Play – reverse, speed x 1/8
- **Play – Forward, speed x 1/4 or more:** Halves forward speed

Reverse



Always set the system to play in reverse at normal (x1) speed. Play will continue from the end of the data (if recently loaded, rewound, or fast forwarded) or from the current position (if recently stopped, paused, or if playing in any direction and speed).

Stop



Stops the data from playing. The current data position is not altered.

Play



Always sets the system to play forward at normal (x 1) speed. Play will continue from the beginning of the data (if recently loaded, rewound, or fast forwarded) or from the current position (if recently stopped, paused, or if playing in any direction and speed).

Fast Forward



Performs several functions depending on what the playback system is currently performing:

- **Stopped:** Instantly fast forwards to the end of data
- **Paused:** Play – forward, speed x 1
- **Play – Forward, any speed:** Doubles forward speed up to 8X
- **Play – Reverse, speed x 1/8:** Play – forward, speed x 1/8
- **Play – Reverse, speed x 1/4 or more:** Halves reverse speed

Pause



Pauses the system. The current data position is not altered. This operation is ignored if the playback system is stopped.

Exit



Exits the playback mode and returns the system to Run mode. The playback floating toolbar is removed.

Repeat Play



Toggles the current status of the repeat play mode. If the repeat play mode is on, the playback of data continues to repeat every time it reaches the end of the data. If the repeat play mode is off, the data file plays back once and then stops. Text next to the Repeat Play button indicates the current status of this operation. A check mark appears next to this menu item if Repeat Play is on.

Playback Speed

This text indicates the current rate at which the data displays. The rate is from 1/8 to 8. For example, if the data file contains 80 seconds of data, playing the data at 8X plays the data back in only 10 seconds. Use the Fast Forward or Rewind operations to change the playback speeds.

4.7 ProFilter

The ProFilter feature enhances acceleration test data for engine and chassis dynamometers. When you turn ProFilter on, your “accel” test data is automatically saved at even-increment engine speed points. You can select the desired rpm increment (50 rpm, 100 rpm, etc.). ProFilter can automatically smooth your test data to improve repeatability between tests, and you can select the desired amount of data smoothing (0%–100%).

Using ProFilter is easy and completely automatic. Save the test data to the computer hard drive and ProFilter does the rest, displaying data exactly the way you want to see it.

To use ProFilter, the test profile must be edited to record data at 100 lines per second (see “ProFilter Setup” on page 4-15). In some systems a test profile can also set the parameters for the ProFilter setup.

ProFilter can be run on test files that were already saved if the test was recorded at 100 data lines per second.

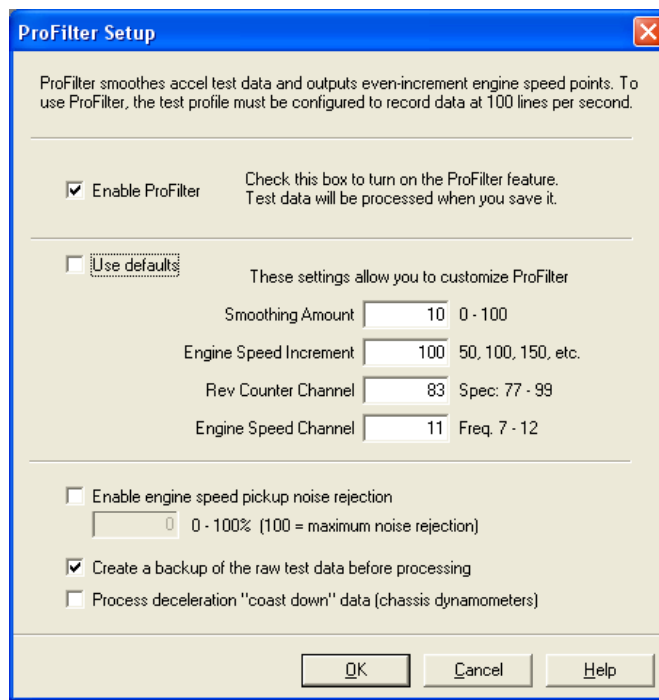
4.7.1 Testing Requirements

ProFilter is designed for acceleration type testing, with test data recorded on a time-interval basis at a minimum rate of 100 Hz (100 data lines per second). Your tests should be designed to record data at 100 Hz, with a steadily increasing engine speed (rpm) throughout the duration of the test. For WinDyn versions 2.2 and prior, indicate a test data record rate of 100 lines per second in the test profile editor by entering 0 in the data recording time interval test step.

In addition to standard acceleration testing, ProFilter can also process acceleration tests that have a “coast down” deceleration portion at the end of the test (typically used on chassis dynamometers for measuring parasitic losses). In this case, your tests should be designed to coast down to an engine speed value that is below the start test engine speed; otherwise, ProFilter will ignore the deceleration portion of your data.

4.7.2 ProFilter Setup

To access the ProFilter setup, from the **WinDyn** main menu select **Analyze>>ProFilter Setup** or from the **Stored** main menu, select **File>>ProFilter Setup**.



- **Enable ProFilter:** Select this option to turn ProFilter on. When ProFilter is on, test data is processed when you save it to the computer.
- **Use defaults:** Select this option to use the default ProFilter settings designed by SuperFlow to achieve optimum performance from your dynamometer. SuperFlow recommends using the default ProFilter settings for the majority of your testing.
 - **Smoothing Amount:** Type an amount in the text box. Valid values are 0 through 100. A value of 0 means no smoothing; a value of 100 means maximum smoothing. The default value for engine dynamometers is 40. The default value for chassis dynamometers is 10.
 - **Engine Speed Increment:** In the text box, type an increment value for your test data desired engine speed rpm (1/min). Valid values are 1 through 999, though typical values are usually a multiple of 50 (100 rpm, 250 rpm, etc.). The default value is 100.
 - **Rev Counter Channel:** Specifies how to convert from speed-Hz to speed-rpm. This channel is always one of the available specification channels (77 through 99) and is typically named **Cts/Rv** on engine dynamometers and **SparkP** on chassis dynamometers. The default channel for engine dynamometers is 87. The default channel for chassis dynamometers is 83. This value must be correct for ProFilter to function properly.
 - **Engine Speed Channel:** Measures dynamometer or engine speed in Hertz. This channel is always one of the available frequency channels (7 through 12) and is typically named **DynSpd** on engine dynamometers and **EngFrq** on chassis dynamometers. The default channel for engine dynamometers is 10. The default channel for chassis dynamometers is 11. This value must be correct for ProFilter to function properly.

- **Enable engine speed noise rejection:** Select this option to remove noise from the measured engine speed channel. ProFilter noise rejection is designed to remove noise generated by missing or extra pulses from speed pickup sensors. The suggested default value is 20%.
- **Create a backup of the raw test data before processing:** Select this option to save a copy of the raw test data before it is processed using ProFilter. The raw test data file has a numeric extension (for example, *.000, *.001, etc.) and the ProFilter file is saved with the same name and an .sfd extension.
- **Process deceleration “coast down” data:** Select this option for ProFilter to process acceleration test data that contains a “coast-down” deceleration portion at the end of the test. When using this option, your tests should be designed to coast down to an engine speed value that is below the start test engine speed.

When using this option, SuperFlow recommends setting the ProFilter “Smoothing Amount” to 10 or below. Note that when this option is *not* selected, ProFilter ignores all deceleration data.

4.8 System Log

WinDyn provides a system log feature that maintains a permanent record of important test system activity over days, weeks, or months.

The system log records information to help you answer questions such as, “Who was operating the Test System at a particular time and date?”, “When was the Test System last calibrated?” and “What was the exact sequence of events that led to a limits out-of-bounds condition during testing?” This information can be useful for troubleshooting system problems.

Each log entry records the entry type (ID), the time and date (Received), the network node that generated the message (From), and the actual message (Log Entry).

The WinDyn System Log editor is used to view and manage WinDyn system logs, including the log currently in use by the test system (the active log). With the editor you can create and archive as many log files as needed; however, only one of these logs can be active at a time and is always named **ActiveLog**. If the ActiveLog file does not exist on your computer, WinDyn will automatically create it for you.

System Log Main Menu

To view the active system log, from the **WinDyn** main menu select **View>>System Log**. Note that the log file name is **ActiveLog.sf1**.

The screenshot shows the WinDyn System Log window with the title bar "WinDyn System Log - [ActiveLog - 'N:\Temp\ActiveLog.sf1']". The window contains a table of log entries and a tutorial overlay at the bottom.

ID	Received	Log Entry	From
02/16/2007	12:05:15	Connection established to remote system	CSTestCell
02/16/2007	12:04:14	Received file <C:\windyn32\XConsole\data\XConsole\Birciar\122006\02122007\data2.sfp>	CSTestCell
02/16/2007	12:04:02	Low Alarm trip on "OilPrs" at 12:04:02:33am on FSetting: 5.0, actual -0.0 psig	CSTestCell
02/16/2007	12:04:02	Limits enabled12:04:02:32am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:03:58	Autozero, all channels12:03:58.40am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:03:48	Limits file "SF902.lmt" installed12:03:48.28am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:03:42	Limits disabled12:03:41.98am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:02:49	Limits enabled12:02:49.41am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:02:33	Limits disabled12:02:32.91am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:55	Test profile stopped at 12:01:55:73am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:50	System filter set to 612:01:50:56am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:49	Test data, all data erased12:01:49:62am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:49	Test profile Acce902 started at 12:01:49:51am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:25	Received file <C:\windyn32\XConsole\data\XConsole\Birciar\122006\02122007\data1.sfp>	CSTestCell
02/16/2007	12:01:24	EMERGENCY STOP112:01:24:63am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:05	Limits enabled12:01:04.99am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:01:05	Limits file "SF902.lmt" installed12:01:04.98am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:00:23	Control file "sf902.ccp" installed12:00:23.51am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:00:23	Calibration file "SF902.CAL" installed12:00:23.39am on Fri Feb 16,2007.	CSTestCell
02/16/2007	12:00:20	Configuration file "SF902.CFA" installed12:00:20.43am on Fri Feb 16,2007.	CSTestCell
02/16/2007	11:59:48	Connection established to remote system	CSTestCell

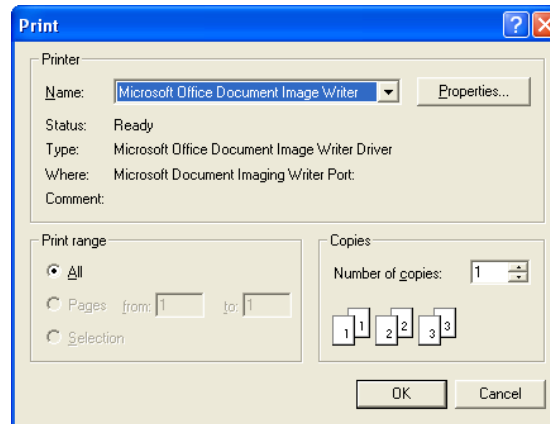
At the bottom of the window, there is a "Tutorial Steps" overlay with the following text:

Welcome!
This tutorial explains how to manage your WinDyn system log using the system log editor.
To begin the tutorial, click the "Next >>" button located to the left.

Below the tutorial, there are tabs for "Description", "Tip of the day", and "Tutorial". The "Tutorial" tab is selected. At the bottom of the window, there is a status bar showing "File: ACTIVELOG", "Total: 21", "INS", and "NUM".

Printing the System Log

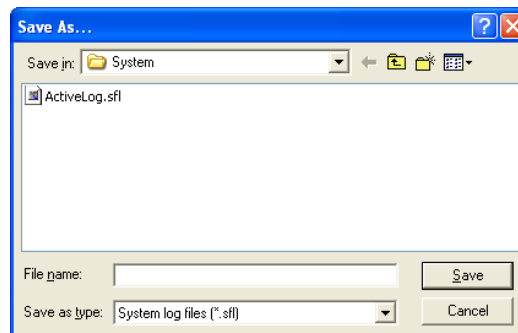
To print the active system log, from the **System Log** menu select **File>>Print**.



In the **Print** dialog box, click **OK** or make selections as needed and then click **OK**.

Saving the System Log

To save a “snapshot” of the active system log for archival purposes, from the **System Log** menu select **File>>Save As**.



Type a new name in the **File name** text box and click **Save**.

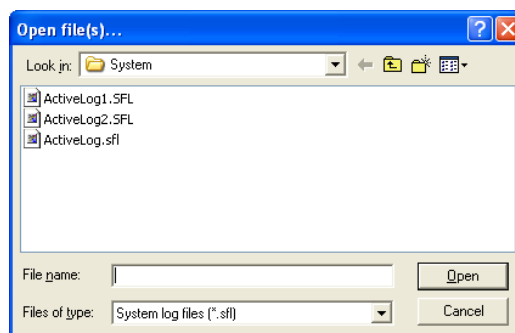
Creating a New System Log

To create a new empty log and make it active, from the **System Log** menu select **File>>New**. When the new log appears, select **File>>Activate, Save, Exit** to make the new log active and return to the WinDyn main data screens.



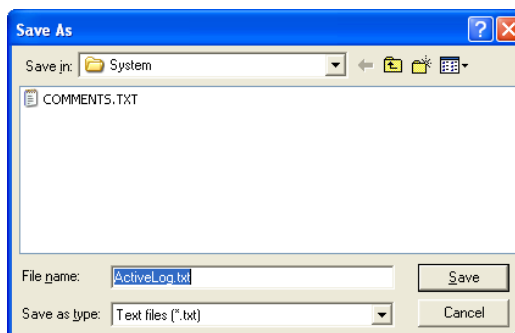
IMPORTANT: SuperFlow recommends creating a new log periodically to clear out old entries. The old files can be archived and retained for future reference.

When you open another system log, note that the previous active log is automatically backed up with a numeric suffix, such as **ActiveLog1.sfl**.



Exporting the System Log

Using the export feature, you can save the active system log as a text file to use with other programs (such as any text editor). From the **System Log** menu select **File>>Export as text**.



In the **Save As** dialog box, click the **Save** button.

Returning to WinDyn from the System Log

To return to the WinDyn current data screens, from the **System Log** menu select **File>>Exit**.

4.9 Password-protected Features

The WinDyn administrator can limit individual access to specific WinDyn features.

4.9.1 System Menu

Log on

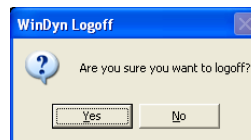
Select this menu item to log on to WinDyn and access assigned privileges. If a prior user is still logged on, the system automatically logs off the prior user and modifies the access privileges according to the new user.



When logging on, users must enter their assigned log on identification and password.

Log off

Select this menu item to log off the WinDyn system.



When a user logs off, WinDyn features are reset to the WinDyn default access.

Change Password

Users can select this menu item to change their own password (they must be logged on at the time).

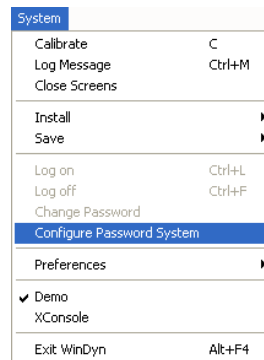


A dialog box appears containing two editable text fields labeled New Password and Verify Password. The new password must be entered into both of the password fields and must be the same.

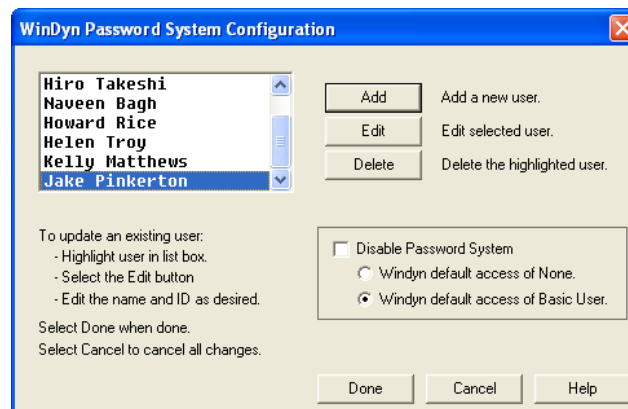
Configure Password System

A user account contains the user name, login identification, password, and access privileges.

1. Select **System>>Configure Password System** to enable or disable the password system, select the WinDyn default access, and manage user accounts.

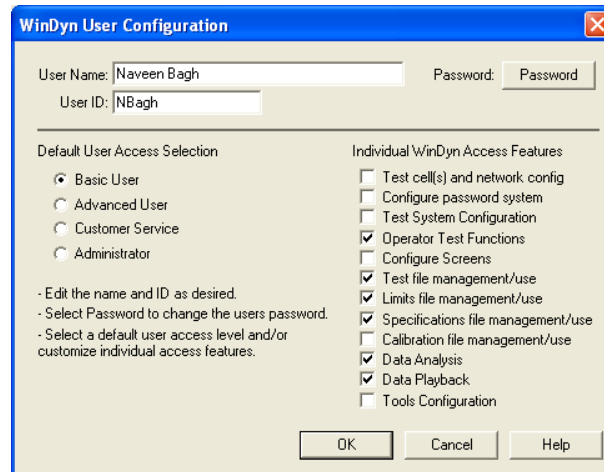


2. The **WinDyn Password System Configuration** dialog box appears.



3. The drop-down list contains all the login accounts indicated by user name.
 - Click the **Add**, **Edit**, or **Delete** buttons to the right of the list to modify user information and access.
 - At the bottom right, click **Done** to apply changes, **Cancel** to exit the dialog box without applying changes, or **Help** to access the online Help.
4. Make sure the **Disable Password System** option is cleared when adding, editing, or deleting users or assigning user access.
 - Select **WinDyn default access of None** to disable all access privileges. This forces all users to log on to access their user privileges.
 - Select **WinDyn default access of Basic User** to enable the basic access privileges when no user is logged on. Users must log on to gain additional access privileges beyond the basic level.

5. To add a new user, click **Add**. The **WinDyn User Configuration** dialog box appears.



The **WinDyn User Configuration** dialog box is shown. It has a blue title bar with the text "WinDyn User Configuration" and a close button. The main area is divided into two columns. The left column contains "User Name:" with the text "Naveen Bagh", "User ID:" with the text "NBagh", and a "Password:" button. Below this is the "Default User Access Selection" section with four radio buttons: "Basic User" (selected), "Advanced User", "Customer Service", and "Administrator". Below the radio buttons are three bullet points: "Edit the name and ID as desired.", "Select Password to change the users password.", and "Select a default user access level and/or customize individual access features." The right column is titled "Individual WinDyn Access Features" and contains a list of checkboxes: "Test cell(s) and network config", "Configure password system", "Test System Configuration", "Operator Test Functions" (checked), "Configure Screens", "Test file management/use" (checked), "Limits file management/use" (checked), "Specifications file management/use", "Calibration file management/use", "Data Analysis" (checked), "Data Playback" (checked), and "Tools Configuration". At the bottom are three buttons: "OK", "Cancel", and "Help".

6. Type the new **User Name** and **User ID** in the text boxes.
- The user name should contain the a form of the user's name.
 - The User ID is an abbreviated form of the user name for logging on to WinDyn.
7. In the **Default User Access Selection** area, select a user access level on the left.
- When you select an option in this area, the rights that level are automatically selected in the **Individual WinDyn Access Features** area on the right.
 - You may also manually select or clear options for this user.
8. Click the **Password** button. The **Change WinDyn Password** dialog box appears.



The **Change WinDyn Password** dialog box is shown. It has a blue title bar with the text "Change WinDyn Password" and a close button. The main area contains the text "Enter your new password and verify that password." Below this are two text boxes: "New Password:" and "Verify Password:". Below the text boxes is the text "Both password entries must match." At the bottom are two buttons: "OK" and "Cancel".

9. Type the password in the **New Password** and **Verify Password** text boxes.
10. Click **OK**.

4.9.2 Individual WinDyn Access Features

The WinDyn menu items and other functions are grouped into categories called the Individual WinDyn Access Features. The grouped features can contain one to several related WinDyn operations. The WinDyn menu items are listed below.



To see the access feature group functions and menus for each feature group, refer to the WinDyn online Help.

- Test cells and network config
- Configure password system
- Test system configuration
- Operator test functions
- Configure screens
- Test file management/use
- Limits file management/use
- Specifications file management/use
- Calibration file management/use
- Data analysis
- Excel
- Data playback
- Tools configuration

CHAPTER 5

STORED DATA VIEWER

IN THIS CHAPTER

- **Introduction**
 - Features
 - Speed Tips
- **Using the Stored Data Viewer**
- **Viewing Test Data**
- **Test Description**
- **Printing Test Data**
- **Plotting Test Data**
- **Comparing Test Data**
- **Exporting Test Data**
- **Averaging Test Data**
- **Post Processing Test Data**



5.1 Introduction

View, print, and plot current and saved test data in the Stored Data Viewer. Current data is stored in the data acquisition system's memory (the dyno's memory). Saved data is stored on the computer's hard drive or other selected location.

NOTE: *It is sometimes helpful to view data while it is still recorded in the test system in order to determine if the data is worth saving to disk. However, in most cases, data is saved with every test.*

You may set configure up to ten channel groups (pages) to view, print, or plot data. Each channel group can display up to nine different data channels. Configure which channel groups and data channels display using the WinDyn **channel order** which is part of the WinDyn test group.



For more information, refer to section 5.3.3, "Channel Order," on page 5-9.

5.1.1 Features

With the Stored Data Viewer, users can:

- View and graphically plot current and saved data on the computer monitor.
- Print current and saved data in numeric format or as a graphical plot.
- Save the data with a user-selected file name or with the default data file name as defined in the Auto-Increment Filenames dialog box. The default file name automatically increments numerically each time a data file is saved.
- Easily change which channels are displayed or plotted by changing the channel order. The Save button permanently saves any channel order changes to the data file only. The channel order defined in the test group is used for the next test.
- Average multiple tests together into a single data file. The averaged data may then be displayed, plotted, and printed as any other test data.
- Column average a single test over a specific range (for example, 4500–5500 rpm). Also view minimum or maximum data values for that range. All three can be printed with the test data.
- Perform a limited number of post-process operations on data files (such as filtering measured channels to reduce noise). The post-process feature creates a new data file identical to the original data file with the selected options added.
- Convert a SuperFlow data file (*.sfd) to a Comma-Separated Value (*.csv) data file to easily import into most spreadsheet programs (for example, Microsoft® Office® Excel) for analysis.
- Export a plot to a metafile, bitmap, or JPG image or a text/data file.

NOTE: *Metafile is a rarely used advanced feature. Metafiles are used to maintain an identical image display regardless of the device the image displays on (screen, printer, etc.)*

- View data as it is recorded in the dyno (line by line) using the Auto data refresh option.
- Enter custom test notes (comments) that are saved with test data in an .sfd file.
- Create a customer diskette with the viewer program and selected data files to give to a customer to view later.
- Play back a stored data test and review a previously run test on a WinDyn data display.

5.1.2 Speed Tips

Right-click in either the data window or the plot window to display a pop-up menu for the most common commands.

Double-click inside the test data window to display the **Channel Order** dialog box (if a data file is not open, the **File Open** dialog box appears instead).

5.2 Using the Stored Data Viewer

5.2.1 Main Menu













The second line of the Stored Data display is the main menu with operational categories. Select each item to see the drop-down menu features. The gray menu items are only available in the proper program context.

- **File:** Contains typical file viewing, saving, closing, and printing functions; commands to some of the special features; and a Preferences command to define certain software settings.
- **View:** Turn display elements on and off and switch between the various areas of WinDyn.
- **Tools:** Provides direct access to other programs which are frequently used with WinDyn. Also use to edit the list of programs displayed on this menu.
- **Help:** Provides context-sensitive Help information for all WinDyn programs. It includes several links to topics of interest on SuperFlow's Web site.

NOTE: The **Help>>About WinDyn** menu item includes the option to view and print a detailed version report that lists all components of WinDyn with their version number and date stamp. When contacting SuperFlow Customer Service, you may be asked for this information for better assistance.

5.2.2 Toolbar

A toolbar resides below the Stored Data Viewer main menu. SuperFlow highly recommends using the tool bar for the most common computer commands because many of the buttons provide direct access to common functions without going through the menus. Position the mouse pointer over an item on the toolbar, and a caption appears with a description of the button function. The gray selections are only available in the proper program context.

	View Current Test	Displays the test data which is currently stored in the dyno system's memory.
	View Saved Test	Displays the test data saved on the computer's hard drive or other memory media.
	Save & View Current Test	Saves the test data currently stored in the dyno system's memory to the computer's hard drive or other memory and then displays it.
	Playback	Starts a playback of the currently displayed data. This feature is available only when a full version of WinDyn is installed on the computer.
	Print	Prints the currently displayed data.
	Plot	Plots the currently displayed data.
	Column Averages	Displays the column average, minimum data, or maximum data.
	Channel Order	Displays the Channel Order dialog box.
	Test Description	Displays the Test Description editor.
	Number buttons	When numbers 1 through 10 are selected, the data screens change from the current screen to the number of the screen selected. You can also use keyboard keys 1 through 10 (for screen 10, press the 0 key) to change display screens.
	Current Data	Displays the WinDyn real-time data screen.
	Database	Displays the database library if enabled.

5.2.3 Status Bar

The status bar at the bottom of the display shows critical information about the test data:

- The number of lines recorded in the data file. In ProFiltered data, this is the number of lines after the post processing. In non-ProFiltered tests, this is the number of lines recorded in the test.
- The test execution date (for example, **Tested on: 4/14/2005 at 13:29**). This date information is a permanent record of when the test was started (meaning, when the first data line was recorded) and cannot be changed. The **Tested on** date also appears on the first page of all data printouts.
- The configuration file (CFA) that was active in the system at the time of the test.

5.2.4 Preferred Settings

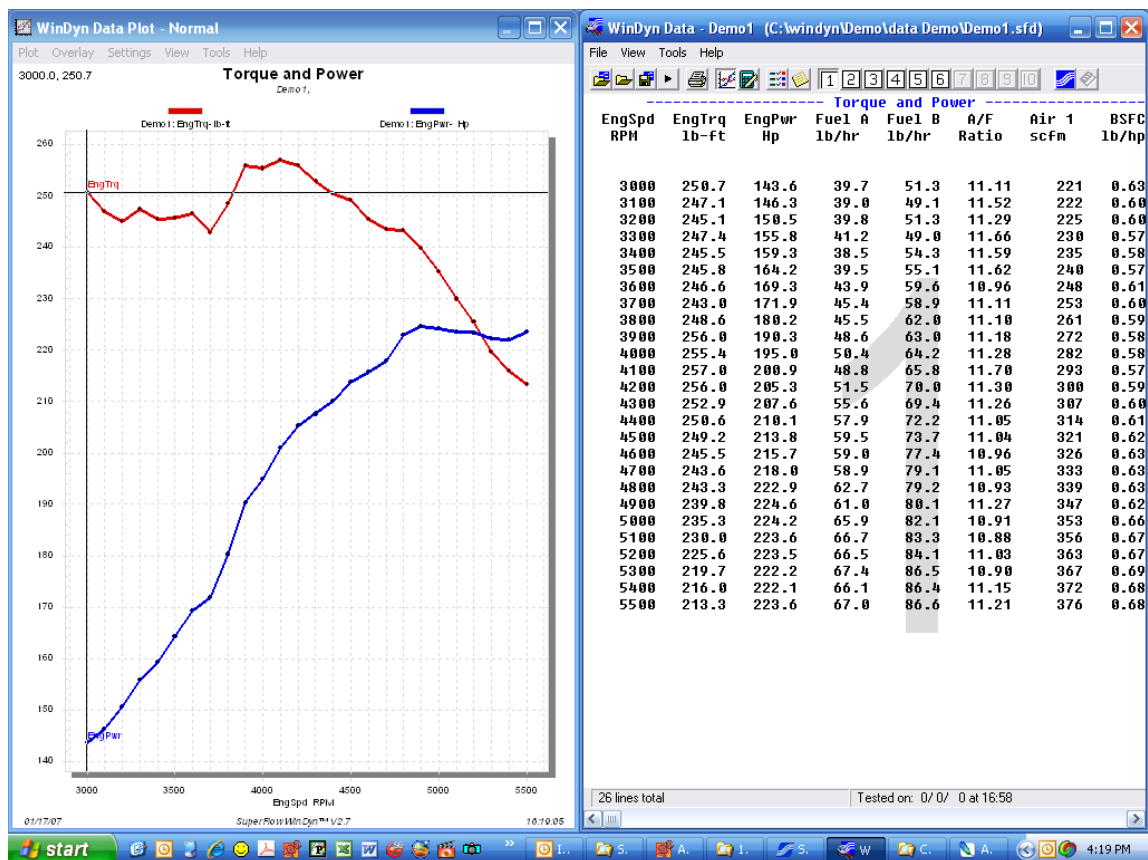
The user can set several individual preferences.

Display

Select **View** to display a drop-down menu. Use this menu to display or hide the **Status Bar** and the **Tool Bar**. Select each item. A check mark to the left means the item will display automatically. When the check mark disappears, the item will no longer display on the main window.

Viewing Plot and Data Side by Side

To quickly view both the tabular data and the plot side by side, from the **Plot** menu select **View>>Tile Vertical** which arranges the two windows on the screen. Or press **CTRL+I** to display and tile both the tabular and the plot window.



Stored Viewer Preferences

Selections are available for setting prompts for automatic action. From the **Stored Data Viewer** menu, select **File>>Preferences** to see the options.

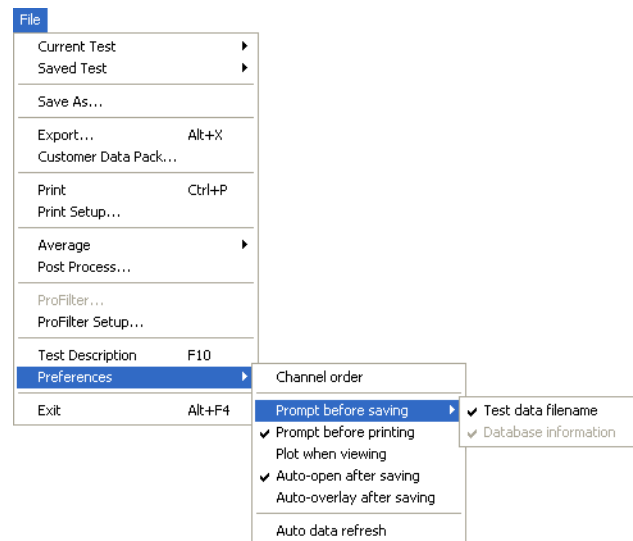


Figure 5-1. Stored Data Viewer Preferences Menu

- **Channel order:** Displays the Channel Order dialog box where you can make changes (see section 5.3.3, “Channel Order,” on page 5-9).
- **Prompt before saving:**
 - **Test data filename:** Prompts for a file name when saving current data using WinDyn functions other than an autotest. If this menu item is not checked, the system uses the default file name as defined in the Auto-Increment Filenames dialog box.
 - **Database information:** Opens the database library New Record Entry dialog box. The Database Manager must be enabled for this feature to be available.
- **Prompt before printing:** Opens the Print Setup dialog box so you can modify what data prints. Otherwise, printing begins immediately based on the settings last used.
- **Plot when viewing:** Lets you open a plot when the data viewer is opened. Otherwise, the data screen displays. (A plot can be opened from the data screen.)
- **Auto-open after saving:** Opens the data viewer with the data that was last saved in an autotest from the operators console or from the remote handheld controller. This feature has no effect when saving test data from WinDyn.
- **Auto-overlay after saving:** Automatically overlays new saved test data on a displayed plot. This feature has no effect when overlaying test data from WinDyn.
- **Auto data refresh:** Allows you to view current test data on the Stored Data Viewer display as it is being recorded in the test system.

5.3 Viewing Test Data

5.3.1 Viewing Data after Testing

When a test is completed, the test data resides in the test system memory (current test) or is saved to a disk or CD (saved test). Use the Stored Data Viewer to view both.

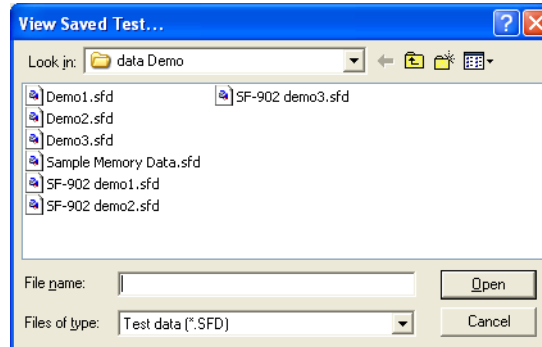
The **Analyze** drop-down menu on the WinDyn main menu contains several options to automatically perform sequences of viewing, saving, plotting, or printing operations. Keyboard shortcuts are also assigned to those sequences.

To view the current test, from the **WinDyn** main menu select **Analyze>>Current Test>>View**, click the **View Current Test** toolbar button, or press **F3** for the keyboard shortcut. The test results display in tabular format.

EngSpd RPM	EngTrq lb-ft	EngPwr Hp	Fuel A lb/hr	Fuel B lb/hr	A/F Ratio	Air 1 scfm	BSFC lb/hph	VoIEff %
3000	250.3	143.6	42.1	54.9	10.73	227	0.676	94.9
3100	249.3	147.2	40.6	52.4	11.23	228	0.632	92.1
3200	248.7	151.8	39.3	49.9	11.88	231	0.588	90.6
3300	247.0	155.9	41.4	57.0	10.86	233	0.631	88.6
3400	242.9	157.6	42.7	55.3	11.03	236	0.622	87.0
3500	244.4	163.8	42.5	55.2	11.35	242	0.596	86.7
3600	247.9	170.0	46.6	61.5	10.52	249	0.636	86.4
3700	246.8	174.4	47.0	59.8	11.00	257	0.612	86.9
3800	246.6	178.6	48.2	59.5	11.24	264	0.603	87.2
3900	242.4	180.5	48.6	62.9	11.23	273	0.618	87.9
4000	246.2	187.8	48.0	64.8	11.35	280	0.601	87.6
4100	252.9	197.6	52.0	67.1	11.13	290	0.603	88.5
4200	256.2	205.1	52.5	71.8	11.14	302	0.606	90.2
4300	255.7	209.5	54.5	70.0	11.39	310	0.594	90.3
4400	253.1	212.5	58.9	68.2	11.42	317	0.598	90.3
4500	250.7	215.0	57.5	74.7	11.24	325	0.615	90.4
4600	248.4	218.3	59.3	74.9	11.22	329	0.615	89.6
4700	244.4	218.8	59.2	81.5	10.96	337	0.643	89.8
4800	241.6	221.0	63.1	81.1	10.87	342	0.652	89.3
4900	238.5	223.3	65.0	79.8	10.94	346	0.648	88.4
5000	234.7	223.5	67.2	80.3	10.92	352	0.660	88.1
5100	231.6	225.2	66.2	85.7	10.79	358	0.675	88.0
5200	223.7	222.0	65.3	84.8	11.01	361	0.676	87.0
5300	220.6	222.7	68.1	87.7	10.80	368	0.700	86.9
5400	214.5	220.7	67.0	86.7	11.11	373	0.696	86.5
5500	213.1	223.5	68.9	88.7	11.01	379	0.705	86.3

NOTE: If no data is stored in the test system or if no test system is connected to the computer running WinDyn, the **Current Test...** selections are unavailable (gray).

To view the saved test, select **Analyze>>Saved Test>>View**. The **View Saved Test** dialog box opens.



Select a test data file and click **Open**. The test results display in tabular format.

5.3.2 Viewing Data during Testing

Use the auto-refresh option to view current test data on the computer as it is being recorded in the test system. From the **Stored Data Viewer** menu, select **File>>Preferences>>Auto data refresh**. To turn it off, select the same menu option again. A dialog box appears each time stating that the Auto Data Refresh option is on or off.

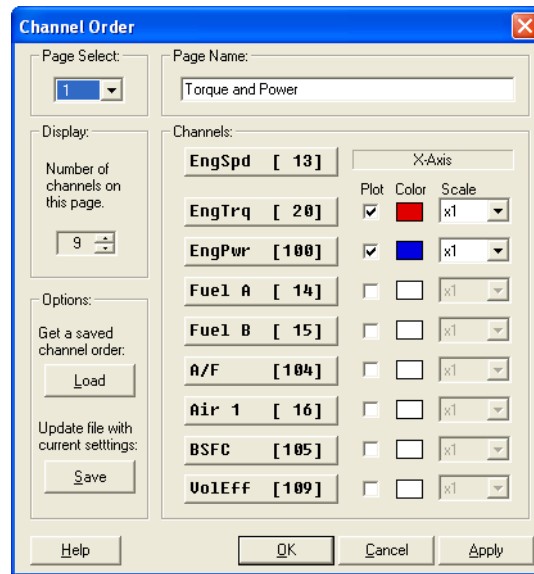
NOTE: The Auto Data Refresh works most efficiently when **no** WinDyn current data display screens are active.

5.3.3 Channel Order

The **channel order** determines the display order of the data channels for analysis, printing, and plotting. For example, you may want Speed in Column 1, Torque in Column 2, Power in Column 3, and so on. You can configure up to ten pages of column designs and select up to nine channels on each page.

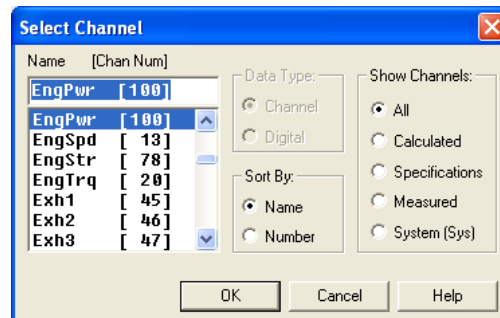
The channel order is specifically assigned to a test group. Each test group has a channel order that becomes the default for data files saved while that test group is active and becomes imbedded in the data file when it is saved. You can change the channel order for a saved data file while viewing the data.

To access the **Channel Order** dialog box, from the **Stored Data Viewer** menu, select **File>>Preferences>>Channel Order**, click the **Channel Order** toolbar button, or double-click anywhere in the data screen.



Use the Channel Order dialog box to select which channels will display *and* plot when viewing WinDyn data. The channel order can be changed in a viewed test as desired for a particular application.

- **Page Select:** To modify a stored data page, select the desired page using the drop-down list. Ten pages are available.
- **Page Name:** Each page can have a unique name which displays on the headings of the WinDyn **Stored Data** and **Plot** view screens and on the data and plot prints.
- **Display:** Selects the number of data channels that will display on the page. Select a number using the **UP/DOWN** arrows or type a number in the text box.
- **Channels:** For each channel on the page, select the channel to display by clicking a channel button. The **Select Channel** dialog box appears. Use the slide bar or **UP/DOWN** arrows to scroll through the list and select the desired channel. The first channel at the top of the list is always the X-axis (the axis across the bottom) on the graphs.



NOTE: A shortcut for finding a desired channel is to enter the first letter of the channel name in the dialog box. The channel will then appear in the list.

- **Plot:** To plot a particular channel, select the associated check box. The first channel at the top of the list is always the X-axis. The channels selected will be on the left or right Y-axis depending on the settings in the Plot preferences.
- **Color:** A wide range of colors can be selected for the plot lines. Click the **Color** box to display the dialog box with selections.
- **Scale:** To plot a channel multiplied by a scale factor, select the desired scale factor in the Scale drop-down list for that channel. The indicated Y-axis scale equals the actual value times the scale factor. For example, if the scale factor for engine speed is 0.01 and the real speed range is 0-10000 rpm, engine speed will be plotted with a Y-axis scale of 0-100.
- **Save:** The Save button permanently saves any channel order change to the currently viewed data file or to the active test group if viewing *current data* (data currently recorded in the remote).
- **Load:** Click the **Load** button to retrieve a saved channel order from a data file (*.sfd) or a test group (*.tgp) so the channel order can be matched. This way you do not need to enter all the channel order information manually. The loaded channel order can then be saved with the current test group file.

5.3.4 Closing the Viewer

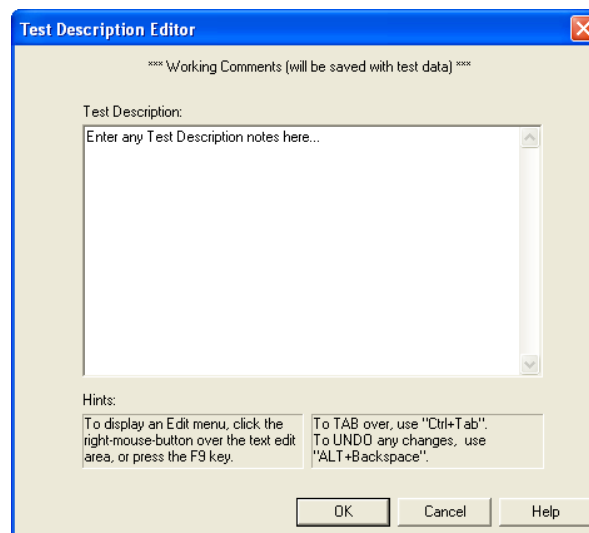
To return to the WinDyn Current Data window (if running):

- **Leave the Stored Data Viewer open:** From the **Stored Data Viewer** menu, select **View>>Current Data**.
- **Terminate the Stored Data Viewer:** From the **Stored Data Viewer** menu, select **File>>Exit**, press **ALT+F4** for the keyboard shortcut, or click the **X** in the top right corner.

5.4 Test Description

Use the **Test Description** feature to attach notes to each test you run. These notes can include details on the test device, the owner's contact information, reasons for testing the device, results of the test, etc. The information is saved with the stored test data files (*.sfd). Test comments can be a maximum of 5,280 characters. The test description can be printed as part of the report header on the data printout.

To open the **Test Description Editor**, from the **Stored Data Viewer** menu, select **Analyze>>Test Description**, click the **Test Description** toolbar button, or press **F10** for the keyboard shortcut.



Type notes (comments) in the **Test Description** text box.

Right-click anywhere in the **Test Description** area to access the Edit menu. Use this menu and the following shortcuts to edit the text.

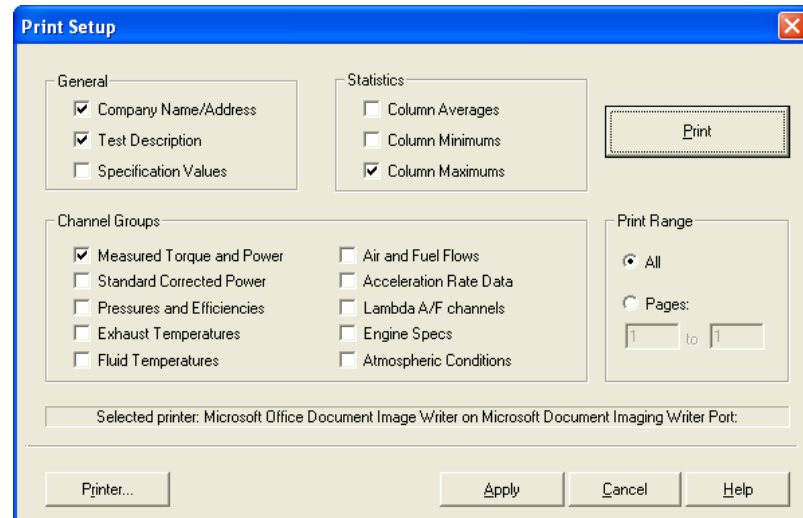
Table 5-1. Test Description Editor Shortcut Keys

Shortcut Key	Description
CTRL+TAB	Tab over one tab setting
CTRL+LEFT/RIGHT ARROW	Move to the next/previous word
SHIFT+LEFT/RIGHT ARROW	Select/highlight text
CTRL+X (SHIFT+DELETE)	Cut selected text to clipboard
CTRL+C (CTRL+INSERT)	Copy selected text to clipboard
CTRL+V (SHIFT+INSERT)	Paste text from clipboard
DELETE	Delete selected text
CTRL+Z (ALT+BACKSPACE)	Undo last edit
HOME	Move cursor to beginning of line
END	Move cursor to end of line
CTRL+HOME	Move cursor to beginning of test description comments
CTRL+END	Move cursor to end of test description comments

5.5 Printing Test Data

WinDyn prints test data in a contemporary style with headers at the top and bottom of each page. The customer's company name, address, and logo can be printed on *each* page. The first page always contains the specific test information (file name, configuration used, date file was saved). All pages are integrated with as many data lines as will fit on the page. Bold text and various font styles are used to produce a professional output.

To display the **Print Setup** dialog box, from the **Stored Data Viewer** main menu, select **File>>Print Setup**. Make selections and click **Apply** to enable new settings without printing. Click the **Print** button to send data to the printer.



To print tabular data, from the **Stored Data Viewer** main menu, select **File>>Print**, click the **Print** button, or press **CTRL+P** on the keyboard. If the **Prompt before print** menu item is not checked, printing begins immediately based on the settings last used. If the **Prompt before print** menu item is checked, the **Print Setup** dialog box appears.

- **General:**
 - **Company Name/Address:** Displays at the top of each page the information entered in the Test Report Headings dialog box on the WinDyn main menu.
 - **Test Description:** Displays on the first page the information entered into the Test Description dialog box. This information can include details on the test device, the owner's contact information, reasons for testing the device, test results, and so on. The number of lines allowed is a function of everything else that is printed on the first page. The fewer optional features printed (e.g., specifications) the more test description lines that will print. The maximum number of test description lines that will ever print is 15.
 - **Specification Values:** Displays on the first page the information entered in the specification channels that are defined in the configuration.
- **Statistics:**
 - **Column Averages, Column Minimums, or Column Maximums:** The printout displays on the last page the values calculated for each column selected. You can set a range for the values with the Column Averaging feature.
- **Channel Groups:** The printout displays all of the channel groups selected.
- **Print Range:**
 - **All:** Prints all pages for *each* channel group selected.
 - **Pages:** Prints a specific page or range of pages within each channel group.

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"Corrected Performance" from test XConsole Demo 1.sfd

Test Information:

File name: XConsole Demo 1.sfd (KROYPRO.cfa)
Data page: Corrected Performance - 20 lines total
Tested on: Jun 27, 2002

Test Description:

*** PROFILTER
*** PROCESSED DATA
*** Created on: 12/03/02
*** Created from: XConsole Demo 1

XConsole Demo 1, Data at 100/second, NASCAR V-8

Specifications:

Cts/Rv 60, Elnert 2.60 lbs/ft², EngBor 4.138 inches, EngCyc 4 Cycle, EngCyl 8 Number,
EngRat 1.000 Ratio, EngStr 4.000 inches, FuelSG 0.728 Coeff., MaxSpd 9,000 RPM, SparkP 0.5 Pul/Rv,
Start 4,000 RPM, StepTm 16.0 second, StopAt 7,100 RPM, StpSiz 250 RPM

EngSpd RPM	STPTrq Cib-ft	STPPwr CHp	STPCor Factor	Oil P psig	CrkVac in.Hg	AirVol cfm	BSFC lb/hph	Fuel P psig
4,100**	534.4	417.2	1.112	56.0	-10.6	510.6	0.482	0.0
4,200	538.1	430.3	1.112	56.2	-10.6	522.5	0.470	0.0
4,300	541.3	443.2	1.112	56.6	-10.6	535.1	0.468	0.0
4,400	546.0	457.5	1.112	56.9	-10.6	551.4	0.468	0.0
4,500	548.7	470.2	1.112	57.1	-10.6	566.1	0.453	0.0
4,600	557.5	488.3	1.112	57.6	-10.5	587.4	0.448	0.0
4,700	563.7	504.5	1.112	58.0	-10.4	607.3	0.444	0.0
4,800	567.4	518.6	1.112	58.4	-10.5	625.8	0.432	0.0
4,900	569.1	531.0	1.112	58.9	-10.5	642.4	0.425	0.0
5,000	568.8	541.5	1.112	59.5	-10.5	659.2	0.433	0.0
5,100	570.0	553.5	1.112	60.0	-10.4	674.7	0.435	0.0
5,200	573.5	567.8	1.112	60.6	-10.5	696.0	0.440	0.0
5,300	573.8	579.0	1.112	61.1	-10.5	715.1	0.450	0.0
5,400	570.7	586.8	1.112	61.7	-10.4	733.5	0.459	0.1
5,500	572.5	599.6	1.112	62.3	-10.5	748.7	0.458	0.0
5,600	571.8	609.7	1.112	63.1	-10.5	765.4	0.458	0.0
5,700	571.1	619.8	1.112	63.8	-10.4	779.7	0.461	0.0
5,800	569.9	629.3	1.112	64.7	-10.4	797.0	0.465	0.0
5,900	567.7	637.7	1.112	65.4	-10.4	809.5	0.470	0.0
6,000**	563.9	644.2	1.112	66.1	-10.4	821.7	0.471	0.0
Avg**								
5,050	562.0	541.5	1.112	60.2	-10.5	667.5	0.455	0.0
Max**								
6,000	573.8	644.2	1.112	66.1	0.0	821.7	0.482	0.1

5.6 Plotting Test Data

Use WinDyn graphical plots to easily and quickly view both current and saved test data in a graphical format. You can overlay up to 10 different tests on one plot and configure up to 10 pages of test data, each with its own plot setup. A sample plot is shown in Figure 5-2.

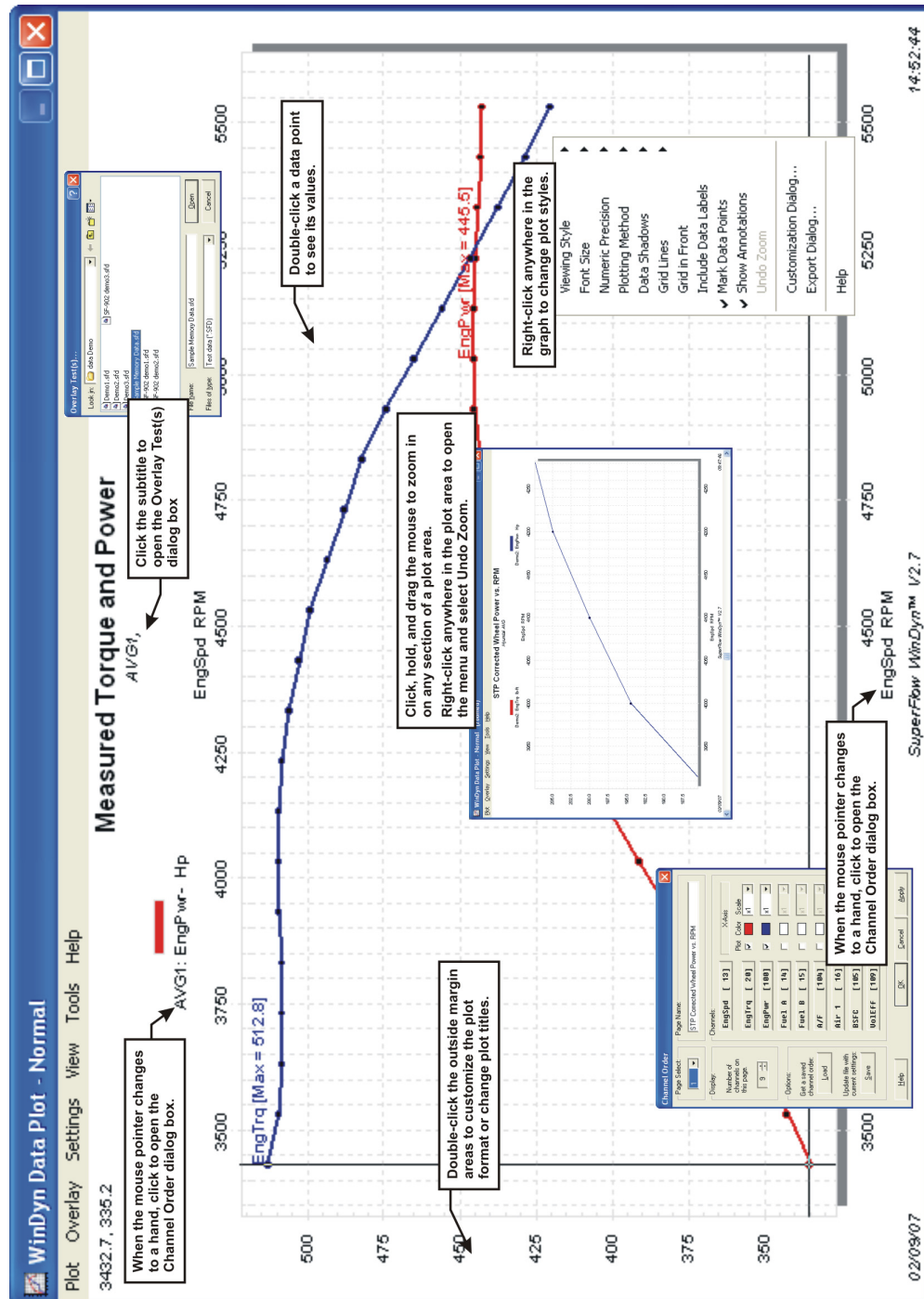


Figure 5-2. STP Corrected Wheel Power vs. RPM

5.6.1 Plot Main Menu

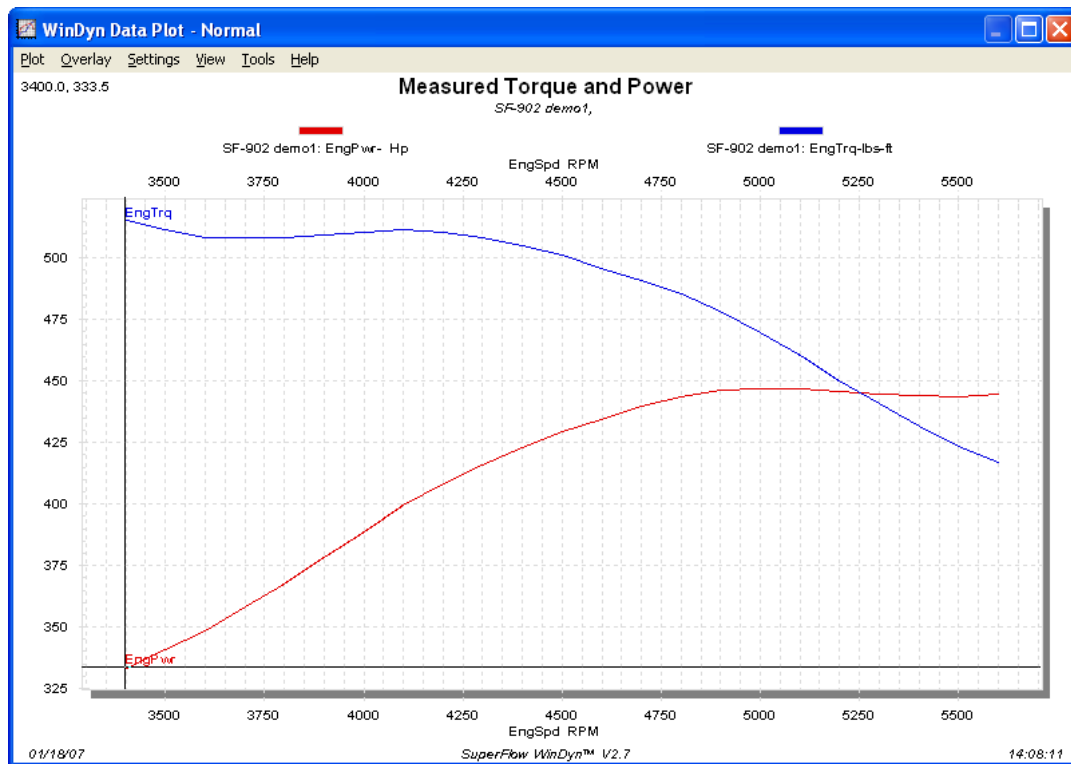
The Plot menu provides operational categories. Select a menu item to see the drop-down menu items. The gray selections are only available in the proper program context.

- **Plot:** Contains typical file viewing, saving, closing, and printing functions. It also contains commands to some of the special features and a preferences command to define certain software settings.
- **Overlay:** Overlay up to 10 data files in one window.
- **Settings:** Used as a shortcut to many of the more commonly used items located in the Plot Settings dialog box.
- **View:** Turn display elements on and off and switch between the various areas of WinDyn.
- **Tools:** Provides direct access to other programs frequently used with WinDyn and allows users to edit the list of programs displayed on this menu.
- **Help:** Provides context-sensitive Help information for all WinDyn programs and includes several links to interesting topics on the SuperFlow Web site.

5.6.2 Plotting a Test

To plot the displayed data, from the **Stored Data Viewer** menu, select **View>>Plot**, click the **Plot** toolbar button, or right-click anywhere on the data screen and select **Plot** from the menu.

A plot window appears and the data channels selected in the active channel order are automatically plotted.



To select a different page group, press the number keys 0 through 9 (0 is group 10). The channels displayed are set by the channel order in the active test group.

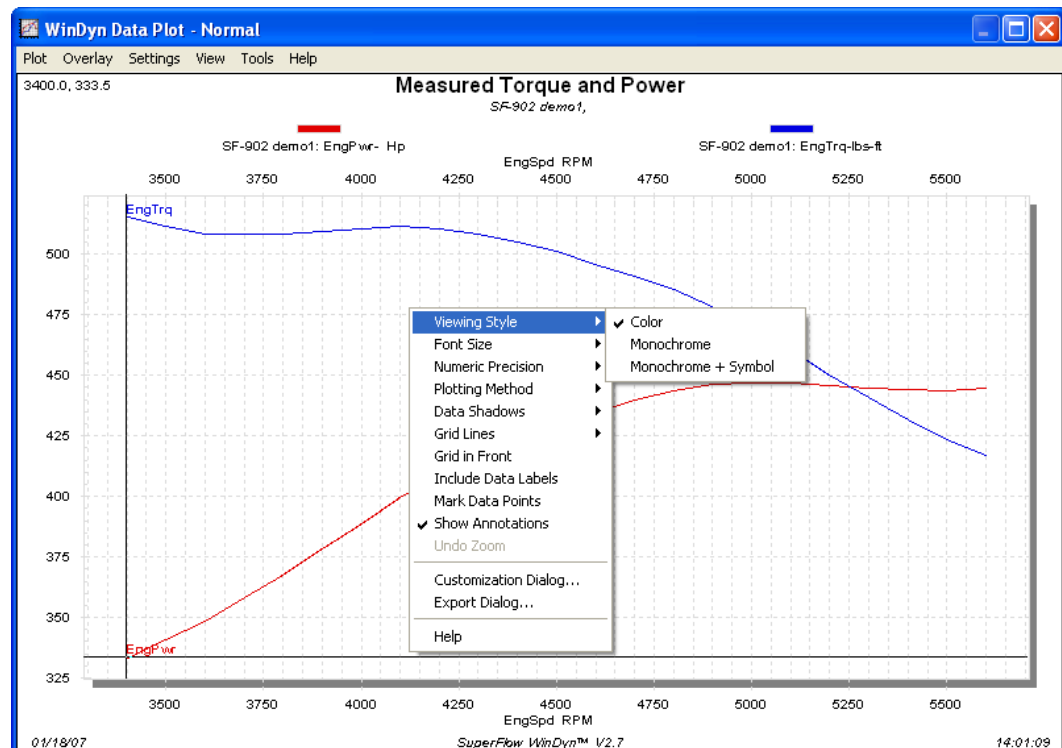
5.6.3 Printing a Plot

To print the current plot, select **Plot>>Print**. If the resulting printout is not satisfactory, select **Plot>>Preferences>>Settings** or **Plot>>Preferences>>Customization** and adjust the plot settings in the dialog boxes.

Monochrome Printing Options

In situations where a color print is not available or desired, you can select monochrome (black and white) print settings to differentiate the plot lines.

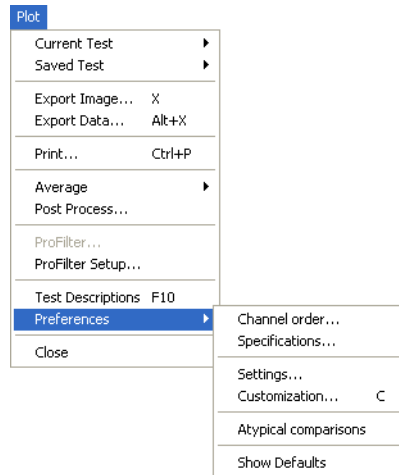
- Select **Settings>>Line Style>>Default** to put the plot in the dot/dash mode to define the channels or tests.
- Select **Settings>>Color Mode>>Color is Test**.
 - Then right-click the plot grid and select **Viewing Style>>Monochrome + Symbol**. Each test is then be identified by a unique symbol. Each channel is identified by the channel name written directly on the plot (the annotations).



- Select **Settings>>Line Style>>Thin** if the symbols are difficult to see when using medium thickness.

5.6.4 Plot Preferences

To change plot options, from the **Plot** menu select **Plot>>Preferences**.



Clicking **Apply** or **OK** changes the display settings, but they will revert to the saved channel order if the plot is closed, then reopened. To make the changes permanent, click the **Save** button, and the changes are saved with the data file. This does not apply when viewing current data.

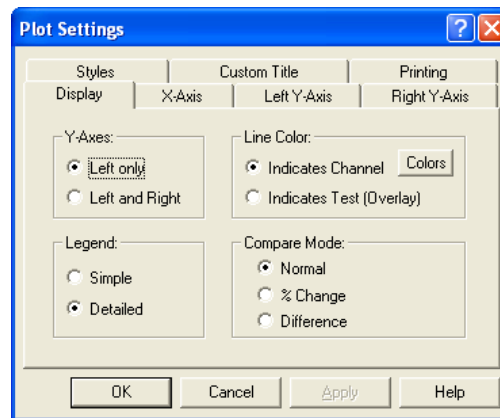
- **Channel Order:** Opens the Channel Order dialog box where you select the new channels to plot using the channel buttons and plot check boxes. Then click the **Apply**, **OK**, or **Save** button (see section 5.3.3).

NOTE: Place the mouse pointer on any of the test names at the top of the plot window for a shortcut to the Channel Order dialog box. The mouse pointer turns into a hand when placed over the test names.

- **Specifications:** Display (on the plot) selected specification channel values that were in effect during the test.
- **Settings:** Configure the general plot display settings to the user's specific choices.
- **Customization:** Adjust the appearance of the displayed plot.
- **Atypical Comparisons:** Facilitates comparing test data that was recorded using different configurations or channel orders. See section 5.7.2, "Atypical Comparisons," on page 5-34 for details.
- **Show Defaults:** If the menu item is checked, the plot display resets to the factory default settings.

5.6.5 Plot Settings

From the **Plot** menu select **Plot>>Preferences>>Settings**. The **Plot Settings** dialog box appears.



Click the tabs to configure different aspects of the WinDyn plots. The **Settings** menu on the Plot menu provides a shortcut to many of the more commonly used items located here.

Once these settings are set, they will remain in that mode until they are changed again.

NOTE: Double-click the X-axis or Y-axis channel name on the plot to display the Plot Settings dialog box. The mouse pointer changes to a hand when it is over an axis.

Display Tab

- **Y-Axes:** The default setting displays the Y-Axes on the **Left only**. To use a second Y-Axis, select the **Left and Right** option and click **OK**.

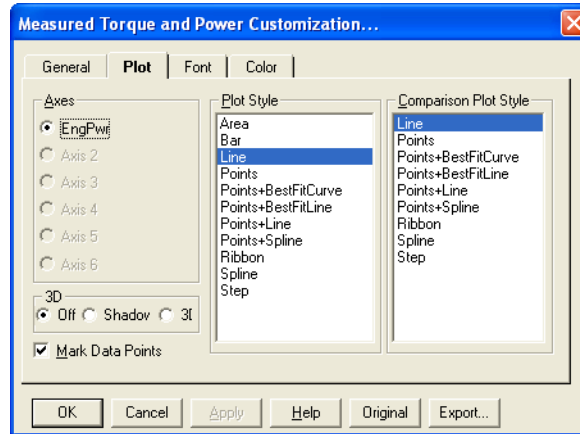
When plotting data using both a left and right Y-axis, channels are assigned to either the left or right Y-axis in the following manner: Think of the plot check boxes in the Channel Order dialog box as being ordered from the top to the bottom. The first half of the channels selected for this page will be plotted with respect to the left Y-axis, and the remaining half selected will be plotted with respect to the right Y-axis. If an odd number of channels are selected, the greater number will always appear on the left Y-axis.

Using a left and right axis has two primary purposes:

- You can graphically compare channels that have very different values (differ by some order of magnitude).
- Using the **Compare Mode**, you may plot data against the left Y-axis using one particular plot style (such as Best Curve Fit), and then plot the same data against the right Y-axis using a different plot style (such as Cubic Spline).

To modify the comparison plot styles, first ensure the compared channels are selected in the channel order. If only one channel is to be compared against itself, select it twice. On the **Plot** settings main menu, check the **Enable Dual Y-Axes** menu item. Then select **Plot>>Preferences>>Customization** and click the **Plot** tab.

The **Plot Style** list is for the left Y-axis, and the **Comparison Plot Style** list is for the right Y-axis.



- **Legend:** Configures the appearance of the channel description legends, which display at the top of the plot window.
 - **Simple:** Displays only the test name and line color (or style) indicator.
 - **Detailed:** (default) Every channel displayed on the plot will have a complete legend entry to include the test name, channel name, and channel units (for example: **DEMO0001: EngPwr – hp**).

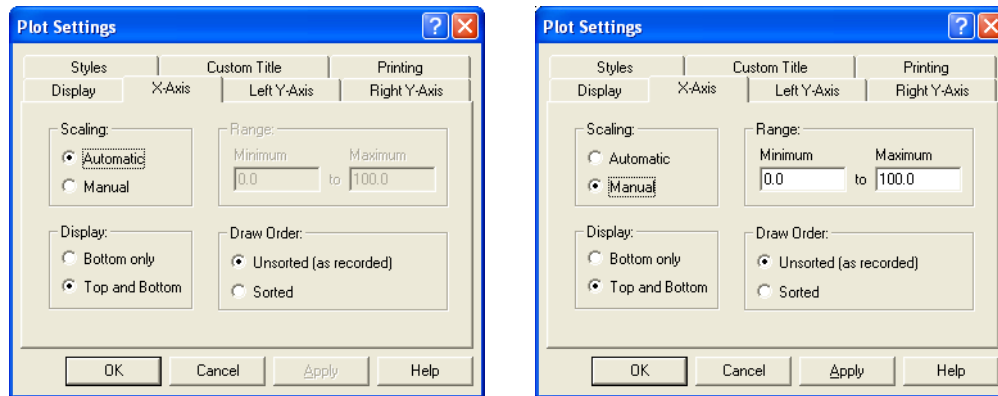
NOTE: When plotting several channels, the legend can become crowded and hard to read. Use the Simple option when this occurs.

- **Line Color:** Configures how the plot uses line color (and line style) to distinguish between different channels (default) and different tests (overlays).
 - **Indicates Channel:** Line **color** is the same for each channel (for example, all EngTrq channels are red); line **style** (for example, solid, dashed, dot) indicates the test (overlay).
 - **Indicates Test (Overlay):** Line **style** is the same for each channel (for example, all EngTrq channels are dashed); line **color** (for example, red, blue) indicates the test (overlay). The **F12** key is a shortcut to switch modes.
- **Compare Mode:** Graphically compare test runs normally, by **%-Change** or by **Difference**. **Normal** is the default setting.



See sections section 5.7.3, “Plot Percent Change,” on page 5-35 and section 5.7.4, “Plot Difference,” on page 5-35 for details on this feature.

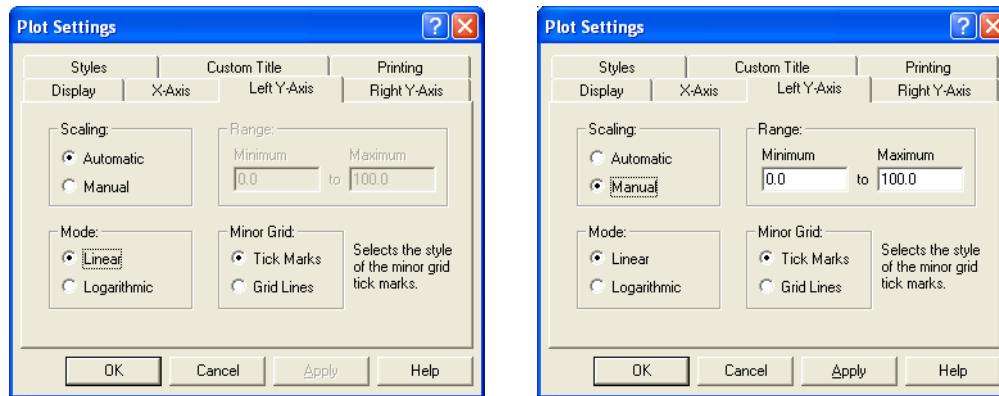
X-Axis Tab



- **Scaling:** This information determines how the plot is scaled for the X-axis.
 - **Automatic:** (default) Plot is automatically scaled, fitting the plot window to the channel with the greatest range for this axis. The manual range values (Minimum and Maximum) are not available.
 - **Manual:** Select to activate the **Range** area.
- **Range:** Type a specific **Minimum** and **Maximum** range for this axis.
- **Display:**
 - **Bottom only:** (default) A single X-axis displays at the bottom of the plot.
 - **Top and Bottom:** In addition to the bottom X-axis, a duplicate X-axis displays at the top of the plot.
- **Draw Order:** Controls in what order the plot lines will be drawn from data point to data point (meaning, connect the dots).
 - **Unsorted (as recorded):** (default) Line is drawn from point to point in the order the data was recorded.
 - **Sorted:** Line is drawn from point to point in order from the minimum X-axis data value to the maximum X-axis data value.

NOTE: For large data sets (≥ 200 data lines), the plotting time increases significantly when the data is sorted.

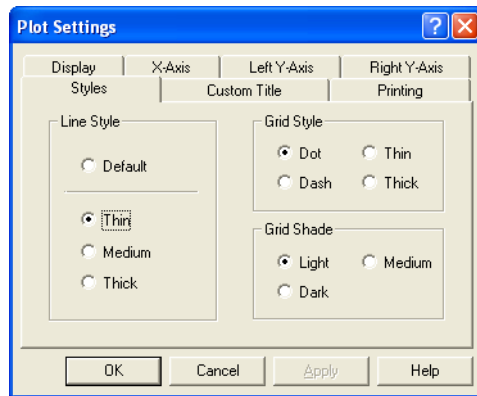
Left Y-Axis and Right Y-Axis Tabs



- **Scaling:** This information determines how the plot is scaled for this axis.
 - **Automatic:** (default) Plot is automatically scaled, fitting the plot window to the channel with the greatest range for this axis. The manual range values (Minimum and Maximum) are not available.
 - **Manual:** Select to activate the **Range** area.
- **Range:** Type a specific **Minimum** and **Maximum** range for this axis.
- **Mode:** Controls the scaling mode used for the Y-axis.
 - **Linear:** Default mode.
 - **Logarithmic:** May be useful for data sets with a very large Y-axis range.
- **Minor Grid** (left Y-axis) or **Major/Minor Grid** (right Y-axis): Controls the grid markings for the Y-Axis.
 - **Tick Marks:** (default setting) Displays small tick marks along the edge of the Y-axis.
 - **Grid lines:** Displays lines across the entire plot.

NOTE: Grid lines must be enabled for this option to take effect. To enable grid lines, right-click over the plot area to access the pop-up menu and select **Grid Lines>>Both X and Y Axes**.

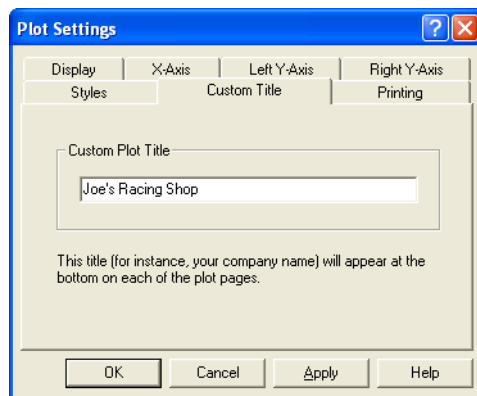
Styles Tab



The following settings affect printing more than the screen images.

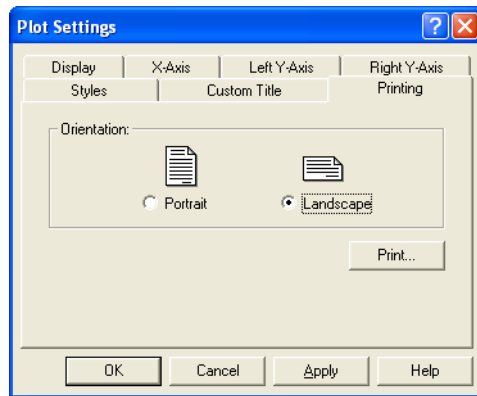
- **Line Style:** Select the line thickness for the test plots. Once the desired line thickness is set, WinDyn will remember it until it is changed.
 - **Default:** A very thin line; the style (solid, dot, dash, etc.) indicates either test or channel.
 - **Thin, Medium, or Thick:** Creates a solid line (regardless of test or channel) of the indicated thickness. The default line style (new installs) is Medium.
- **Grid Style and Grid Shade:** Determines how the plot grid appears on all plots. This is useful if the grid does not appear properly on the plot printouts. Both line styles (dot, thin, dash, thick) and shading (light, medium, dark) can be adjusted.

Custom Title Tab



Type information (such as your company name) in the **Custom Plot Title** text box. The text will display at the bottom of each WinDyn plot. Text entered here will display on all plots until changed.

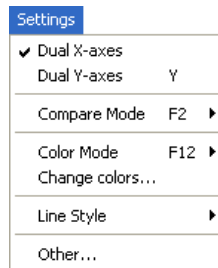
Printing Tab



Select the desired plot print orientation. Click the **Print** button to send the currently displayed plot to the printer. The selected orientation is saved until it is changed. Landscape is the default.

5.6.5.1 Plot Settings Menu

A faster way to access all the plot setting commands is to select the **Settings** menu from the **Plot** menu. Two keyboard shortcuts are also available to quickly cycle through the options. Press **F2** to cycle through **Compare Mode** options; press **F12** to cycle through **Color Mode**.



5.6.6 Plot Customization

To access a pop-up customization menu (Figure 5-3), right-click anywhere on the plot area.

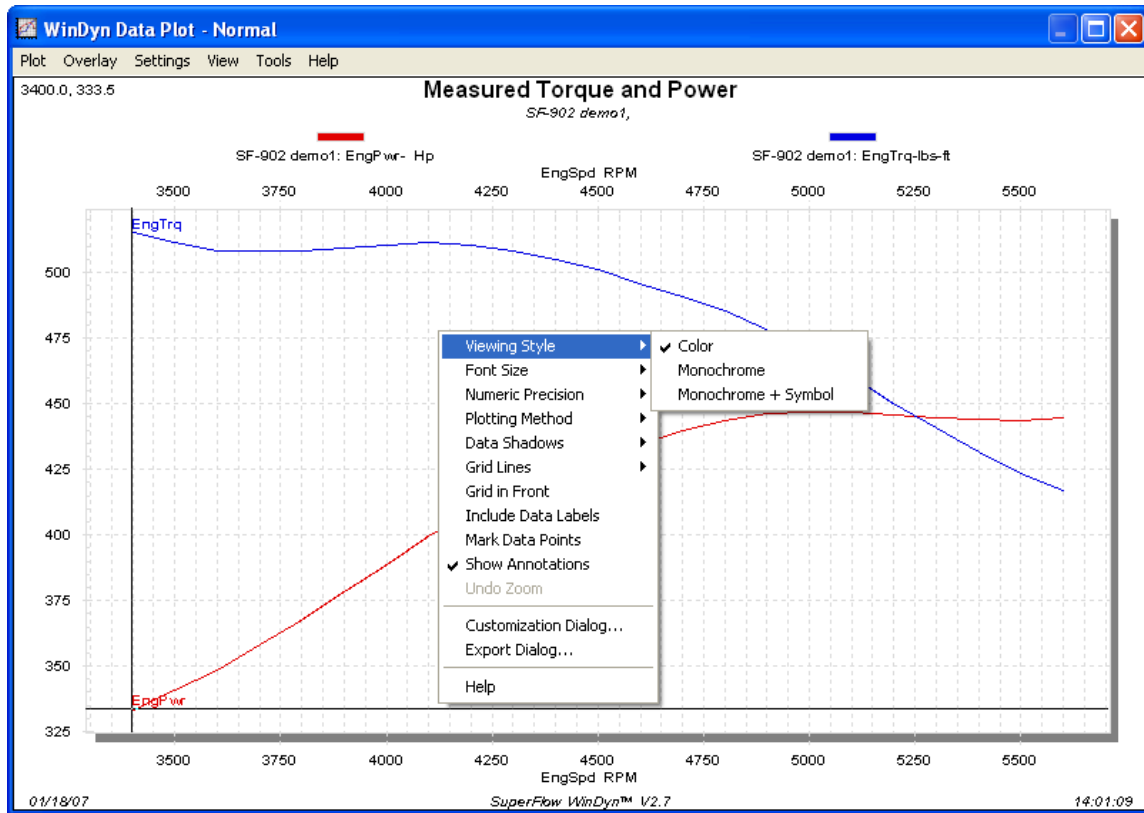


Figure 5-3. Pop-up Customization Menu

Some of the same menu selections from the primary menu can be accessed here. Other special menus include:

- **Include Data Labels:** Tags each data point on the plot with the value.
- **Undo Zoom:** Restores a zoom plot back to the default setting.
- **Customization Dialog** and **Export Dialog:** Provides shortcuts to these two dialog boxes.

5.6.6.1 Original and Custom Parameters

The Plot window stores two sets of parameters. The original set is programmed by SuperFlow and cannot be modified by the user. The custom set can be adjusted using the Customization dialog box. Clicking the **Original** button resets the plot to the default factory settings. To toggle between original and custom sets of parameters, close the **Customization** dialog box and press the **T** key.

NOTE: The Customization dialog box cannot be used to toggle between the original and custom set of parameters. This is because pressing the OK button creates a new custom set of parameters.

To access the **Customization** dialog box, select one of four methods:

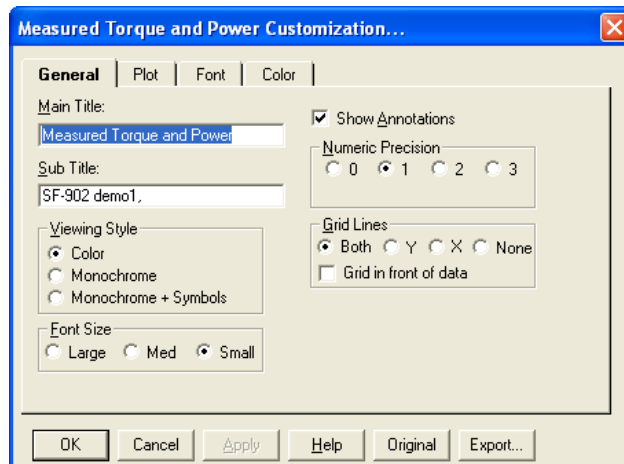
- From the **Plot** menu select **Plot>>Preferences>>Customization**
- Press the **C** key
- Press the **SPACEBAR**
- Double-click outside the actual plot area

When the dialog box opens, the parameters shown reflect the current state of the plot.

When the user makes adjustments and clicks **OK**, the custom set of parameters controlling the object are updated.

The **Apply** button is similar to the **OK** button but does not close the Customization dialog box. You can make continuous changes and switch to other tabs without closing and reopening the dialog box.

General Tab

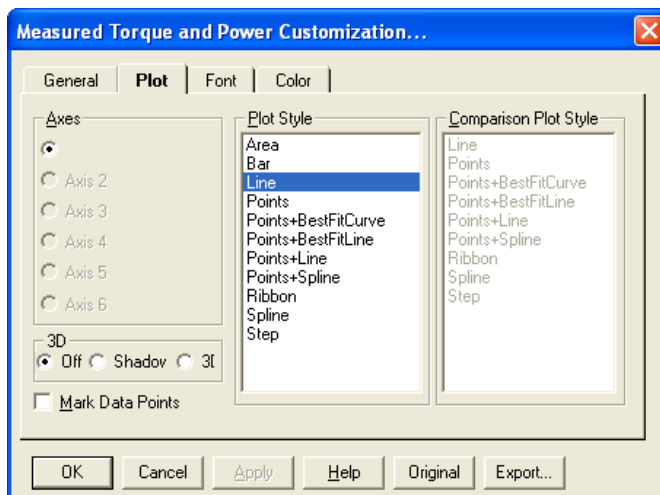


- **Main Title/Sub Title:** Type, edit, or delete information in the **Main Title** and **Sub Title** text boxes. This information displays at the top of plot window. By default, the main title is generated by the Test Group Channel Order page name while the subtitle is generated by the test file name.
- **Viewing Style:** The graph supports three viewing styles: **Color**, **Monochrome**, and **Monochrome + Symbols**. The default is Color. Use Monochrome + Symbols to quickly adjust the image to best suit printing on a monochrome printer. If including fewer than four subsets in a graph, the Monochrome setting is usually the best choice. If including four or more subsets in the graph, using Monochrome + Symbols helps distinguish the different subsets.

- **Font Size:** The graph supports three font sizes: **Large**, **Medium**, and **Small**. The default is Medium. Depending on the size of the graph, the user can select the font size that is most readable. When printing the graph, a medium or small font size is suggested. In some cases, the graph may automatically reduce the font size to produce a higher quality image.
- **Show Annotations:** If the graph contains annotations, select this option to allow you to remove or add the annotations from/to the image. This option is selected by default.
- **Numeric Precision:** When placing data labels onto the graph or when exporting the graph using the Export dialog box, the number of decimal positions can be between 0 and 3. The default is **1**.
- **Grid Lines:** The graph can contain vertical grid lines, horizontal grid lines, both vertical and horizontal grid lines, or no grid lines. The default is **Both**.

If the **Grid in front of data** is selected, the graph's grid is placed in front of the data graphics. Otherwise, the data graphics are drawn on top of the graph's grid. This option is cleared by default.

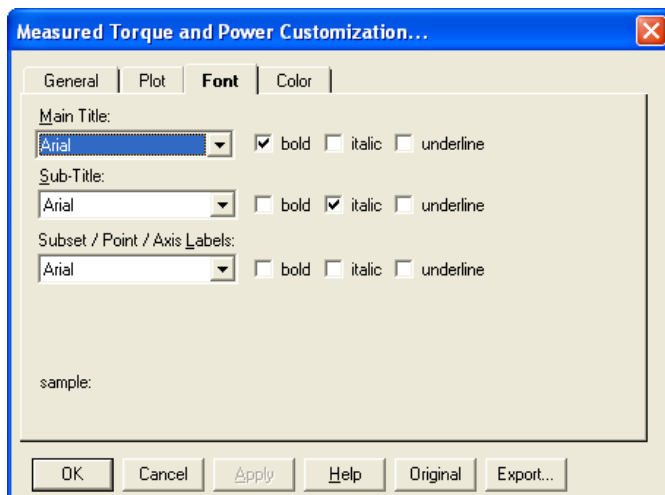
Plot Tab



Select a style in the **Plot Style** list. If the style can be set for a secondary comparison plot style, it displays in the **Comparison Plot Style** list. The default setting is **Line**.

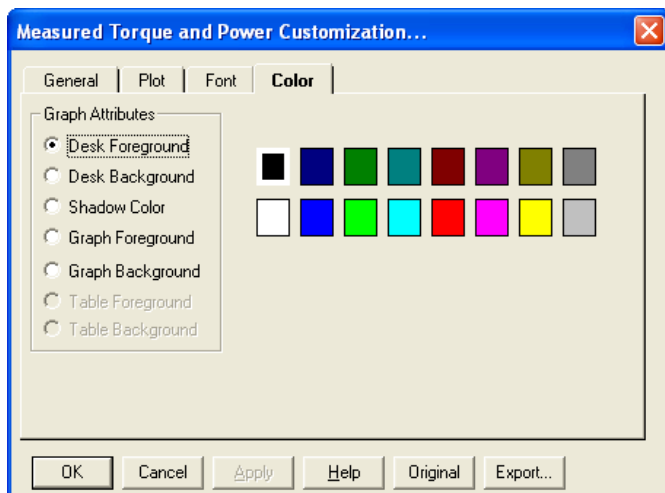
- **3D:** Depending upon the plot style, this option draws shadows behind bars, points, and the area of a graph. The shadow is always black. The default setting is **Off**.
- **Mark Data Points:** Displays markers for each individual data point on the graph. The default setting is selected.

Font Tab



The graph only supports True Type fonts because they are scalable. Users can select fonts in the **Main Title**, **Sub-Title**, and **Subset/Point/Axis Labels** drop-down lists. The default setting is **Arial**. The **Main Title** is **bold** and the **Sub-Title** is **italic**.

Color



The graph supports two sets of color parameters: a monochrome set and a color set. Depending upon the viewing style, the **Color** tab customizes the appropriate set.

To adjust colors, select an attribute in the **Graph Attributes** area. The corresponding color for that attribute highlights in the color selection grid to the right.

Click an alternate color, or use the keyboard **ARROW KEYS** to move to adjacent colors. Click **OK** to update the new color selections.

- **Desk Foreground:** The color used when placing text onto the desk foreground; includes the main title, subtitle, subset labels, grid numbers, and axis labels. The default is black.
- **Desk Background:** The color that surrounds the bounding rectangle of the graph's grid. The default is white.
- **Shadow Color:** The rectangle that makes up the graph's grid displays shadows at the bottom and right edges. To remove the shadows, select the same color as the desk background. The default is dark gray.
- **Graph Foreground:** The color used for the outline rectangle of the grid and for the grid lines. The default is dark gray.
- **Graph Background:** The color used as the background color of the graph's grid. The default is white.
- **Table Foreground/Background:** Select colors if plotting a table.

5.6.7 Zooming in on Plots

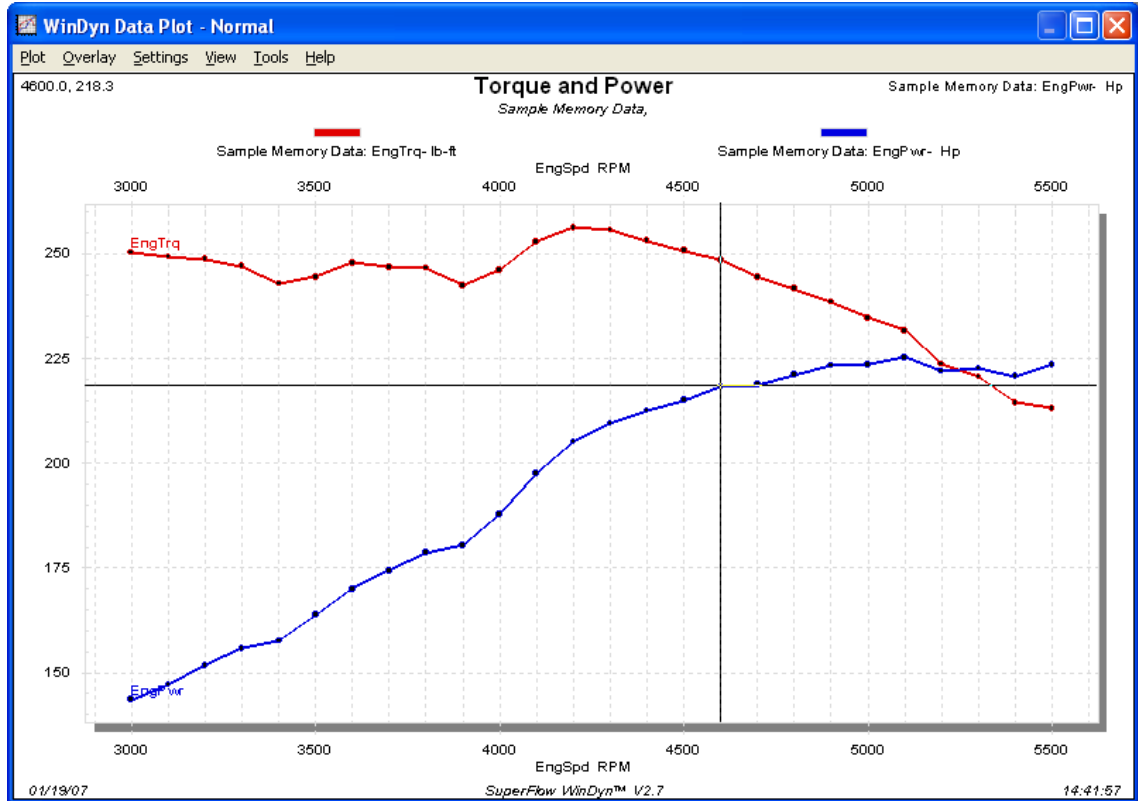
To zoom in on a specific area of the plot, click anywhere in the plot and drag the mouse. The mouse pointer changes to a magnifying glass. Position the box (which appears when dragging) over the area of interest and drag. The plot zooms in to the area you selected. After zooming in, you may toggle the zoom in and out by selecting **View>>Zoom** on the Plot menu or pressing **ALT+Z**. If a plot is currently in a zoom view, the word **(Zoomed)** displays in the title bar at the very top of the plot window.

NOTE: Each of the available plot pages maintains its own zoom view as the pages are switched and until the Stored Data Viewer is closed. If the plot is closed and reopened (without closing Stored Data Viewer) the zoom view will remain. If you view a current data plot in zoom view and save a modified channel order to the test group, subsequent plots when opened with that test group active will display the same zoom view.

5.6.8 Using the Plot Data Cursor

The plot window has a single data cursor which you can use to identify the test data file, channel, and value of any data point displayed on the plot. From the **Plot** menu select **View>>Cursor** to display the cursor. To mark the actual data points, display the **Plot** pop-up menu by right-clicking in the plot area and selecting **Mark Data Points**. Notice the mouse pointer changes to a hand when hovering over a data point.

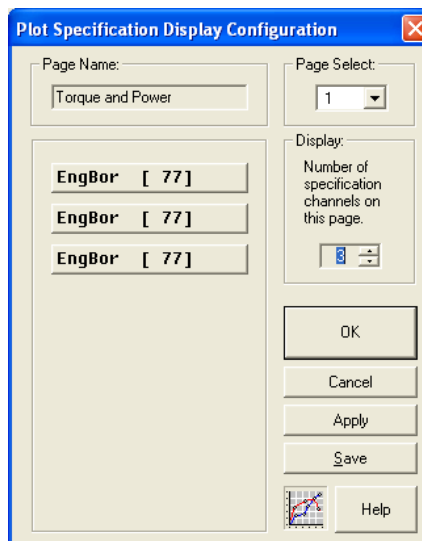
Now activate the data cursor by clicking a data point; this positions the data cursor cross hairs on that point. Two cursor position indicators display. The upper left-hand corner shows the data point (x, y) value (that is, both horizontal and vertical plot values); the upper right-hand corner identifies the test data file and channel. The keyboard **LEFT/RIGHT ARROW** keys move the cursor from point to point; the **UP/DOWN ARROW** keys move the cursor from channel to channel.



Double-click any point in the plot area to see the value for that point displayed next to the point.

5.6.9 Displaying Specification Values

Use this feature to display (on the plot) the specification channel values that were in effect during the test, such as the Engine Bore and Stroke. From the **Plot** menu select **Plot>>Preferences>>Specifications**. The **Plot Specification Display Configuration** dialog box appears.

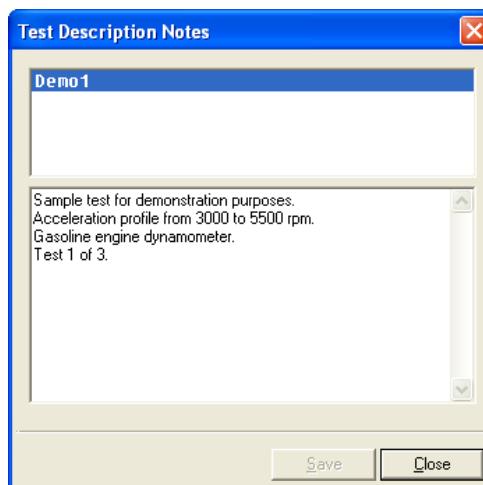


Select which specification channels will display on each of the available plot pages. You may select different specification channels on each page.

- **Page Select:** Type or select a page number in the drop-down list.
- **Page Name:** Title of the data page (for example, **Torque and Power**). You cannot edit the page name using this dialog box.
- **Display:** Selects the number of specification channels to display on the currently selected page. Select the channels to display by clicking a channel button to the left of the Display area.
- **Buttons:** Click **Save** to permanently save any changes to the data file you are currently viewing (or to the currently active test group if viewing the data currently recorded in the test system). If you make changes and click **OK** or **Apply**, the changes will be lost.

5.6.10 Viewing Test Notes

To view and change the test description for each test overlaid in the plot window, from the **Plot** menu select **Plot>>Test Descriptions** or press **F10**. The **Test Description Notes** dialog box appears. In the upper pane, select a test to view its associated test description notes.



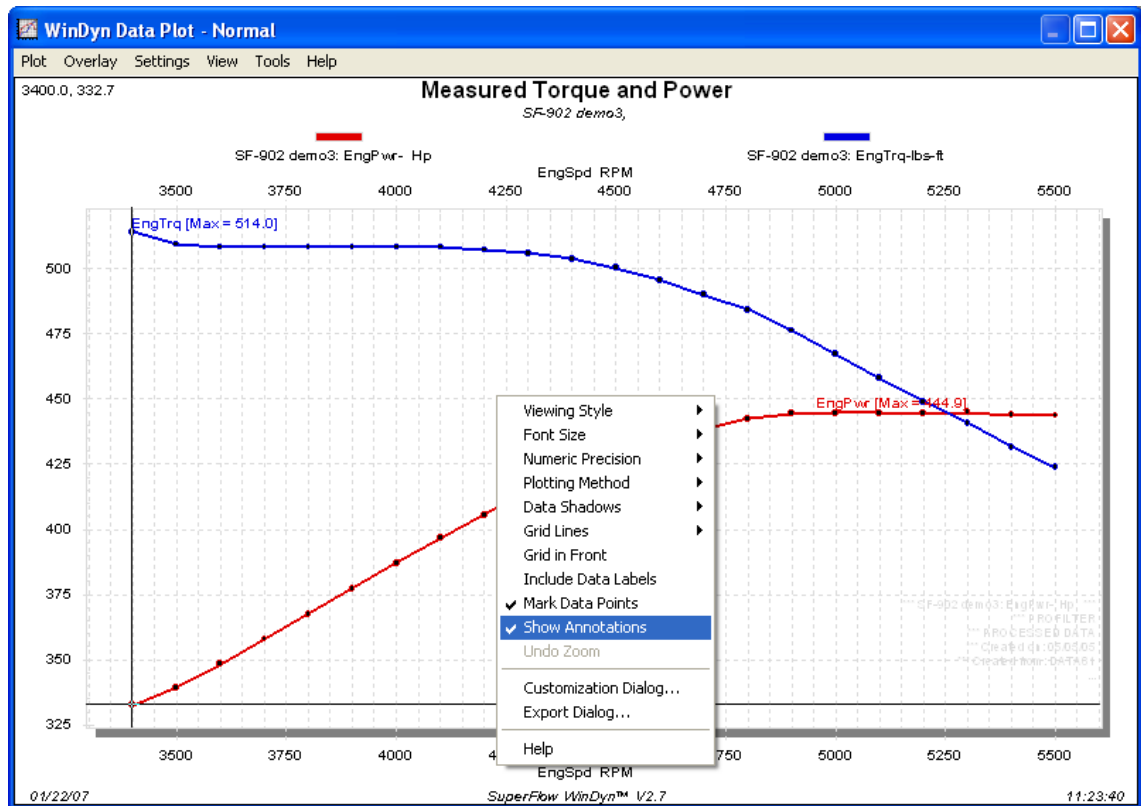
The lower pane displays editable notes. When a change is made to the notes, the **Save** button activates; click **Save** to keep changes.

Test notes can also be viewed directly on the plot. From the plot menu, click **View>>Test Description** to see the first 125 characters entered in the Test Notes (sometimes a little less depending on the actual characters) in the lower right corner of the plot.

NOTE: The **View>>Cursor** option must be enabled for the **Test Description** option to be available.

5.6.11 Viewing Channel Maximums

Test data plots support the option to display the maximum value of each channel graphed. The maximum value is written directly on the plot next to the channel's annotation name, for example, **EngTrq (Max = 514.0)**. To enable this new feature, from the **Plot** menu select **View>>Maximums** or press the **M** key. You must also select **Show Annotations** (right-click the plot to select the menu item).



Note that only one maximum per channel graphed displays; in the case of multiple overlays, the maximum value displayed is from the test with the highest value of all tests plotted. Therefore, you can quickly determine the highest channel value from a group of tests by overlaying the group.

Also note that the magnitude of each channel is the determining factor with regard to calculating the maximum. For example, -11.1 in.hg. will always be considered larger than -9.1 in.hg. Use the **M** keyboard shortcut to quickly toggle this feature on or off.

5.6.12 Plot Mouse and Keyboard Commands

Depending upon the program context, some of the following user interface features may not be accessible.

Mouse Commands

- Right-click to open a pop-up menu.
- Double-click a data point to show the data point value. If the cursor view is checked on the Plot menu, click the data point once.
- Click any of the test names at the top of the plot window (when the mouse pointer turns into a hand) to display the Channel Order dialog box.
- Click any of the X-axis or Y-axis channel names (when the mouse pointer turns into a hand) to display the Plot Settings dialog box.
- Double-click in the plot margins outside the plot area to display the Customization dialog box.
- Double-click the plot window inside the lot area to display the X, Y values for that point in the plot.
- Click the plot file name list (below the main plot title) to display the Overlay Test(s) dialog box.

Keyboard Commands

Not all keyboard commands are shown in this list.

Table 5-2. Plot Keyboard Shortcuts

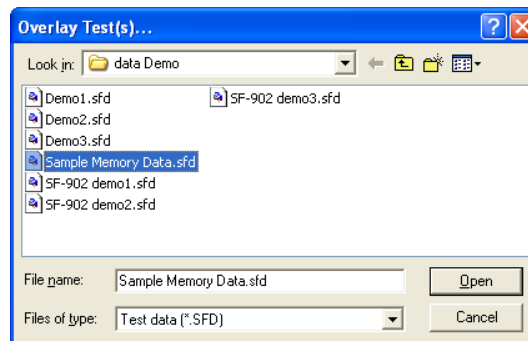
SPACEBAR	Displays the Customization dialog box
ARROWS	Move the mouse pointer on the graph
F2	Compare mode
F10	Displays the Test Description Notes dialog box
F12	Toggles the color mode between Color is Test and Color is Channel
D	Displays the Export dialog box for data
M	Toggles the channel maximum displayed values
P	Displays the Printing dialog box
Q	Displays a pop-up menu for viewing options
S	Toggles between monochrome and color styles
T	Toggles between custom and original parameters
X	Displays the Export dialog box to export text or data to a graphic file
Y	Toggles between Left Only and Left and Right Y axes
Z	Undo Zoom
ALT+Z	Toggles between Zoom and Undo Zoom

5.7 Comparing Test Data

WinDyn provides several methods for comparing test data on a plot. You can compare data directly on an overlay or by difference (either direct or by percentage) and can also export and compare data numerically.

5.7.1 Overlaying Tests

To overlay tests for graphical comparisons, from the **Plot** menu select **Overlay>>Open**. The **Overlay Test(s)** dialog box appears.



Select a file and click **Open**. You may select up to nine overlays (for a total of ten tests plotted at one time).

NOTE: To select more than one data file at a time, hold down the **CTRL** key and click the tests using the mouse.

- To temporarily remove a test from the plot, select **Overlay>><test name>** to remove the check mark. Click the same command again to re-plot the test.
- To toggle *all* the overlay tests on or off, select **Overlay>>Toggle All**.
- To clear the list of recently opened overlaid files from the Overlay menu, select **Overlay>>Clear All**.

5.7.2 Atypical Comparisons

Use this advanced feature to compare test data that was recorded using different configurations or channel orders. From the **Plot** menu, select **Plot>>Preferences>>Atypical comparisons**.

When the Atypical comparisons menu item is checked, the channel order from each test determines which channels are actually plotted. When the menu item is not checked, the channel order from the reference (main) test determines the channels plotted for all tests.

This feature could be used, for example, to effectively compare engine dyno data with that from a chassis dyno data. It is also useful if comparing SF-901 data files to new SF-902 dyno files.

5.7.3 Plot Percent Change

NOTE: When using % change or Difference comparison modes, WinDyn compares tests on a direct data line by data line basis using the channel on the X-axis as the reference.

WinDyn does not compensate for tests that start at different reference values or tests with different data record rates. Therefore, to effectively use these comparison modes, the test profiles must be structured so each run starts at the same point, and each must use the same data record rate.

Test data acquired using ProFilter will always compare correctly.

The standard method of comparing tests (normal overlay) is to display the actual values recorded during the test. In this mode the plot window title bar reads **WinDyn Data Plot – Normal**. This indicates the display is in the **Normal** comparison mode.

From the plot menu, select **Settings>>Compare Mode>>% Change** or press **F2** to switch modes. The first run is now plotted as a straight line at 0.0; this is the **reference** test. The second run is plotted in percent-change from the reference. Now the left Y-axis units are in percent (+/-) and the plot window title bar reads **WinDyn Data Plot – %Change**.

This mode can easily gauge the magnitude and direction of deviation between successive runs. If the two runs had provided identical data, two flat lines would display on top of each other at 0.0%.

5.7.4 Plot Difference

The Difference comparison mode is very similar to the **%-Change** mode. The only difference is that the results appear as a straight mathematical subtraction instead of as percent-change. From the Plot menu, if you select **Settings>>Compare mode>>Difference** or press the **F2** key again, the plot will toggle to the **Difference** comparison mode.

Now the Y-axis units are in the measured units for the displayed channel, and the plot window title bar reads **WinDyn Data Plot – Difference**. The first run is plotted as a straight line at 0.0; this is the **reference** test. The second run is plotted as a difference in value from the reference.

TIP: Then using these comparison modes, you can use the plot cursor to view the exact difference value for any data point, regardless of the active comparison mode.

5.7.5 Numerically Comparing Tests

WinDyn has the ability to numerically compare data from different tests in side-by-side columns. This feature is based on the plot's ability to export numbers for each of the test data points plotted. For instance, to numerically compare torque between three runs, each of the torque curves must be plotted as an overlay.



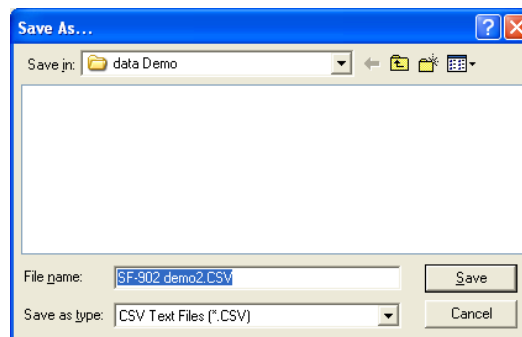
See section 5.8.3, "Exporting Plot Data," on page 5-38.

5.8 Exporting Data

5.8.1 Exporting Data to a CSV File

You can use the Export option to convert a SuperFlow data file (*.sfd) to a Comma-Separated Value (*.csv) data file that easily imports into most spreadsheet programs (such as Microsoft Excel) for analysis.

1. To export a SuperFlow data file, first open the desired data file.
2. From the **Stored Data Viewer** main menu, select **File>>Export...** The **Save As** dialog box appears.



3. Type a name in the **File Name** text box and click **Save**. The CSV file is then created and saved on disk. CSV files cannot be viewed with the WinDyn Stored Data Viewer.

Only the data channels selected in the **Test Group Channel Order** are exported to the CSV file. All 10 pages in the channel order are exported – not just the one displayed. Data channels that are recorded and saved in the file but not selected in the channel order are **not** exported.

ProExport

ProExport™ provides a number of advanced services related to exporting WinDyn test data. These data export services are not provided with the basic WinDyn software package. This product is intended for use by engine and vehicle testers who routinely work with test data in spreadsheet format (e.g., Microsoft Excel).

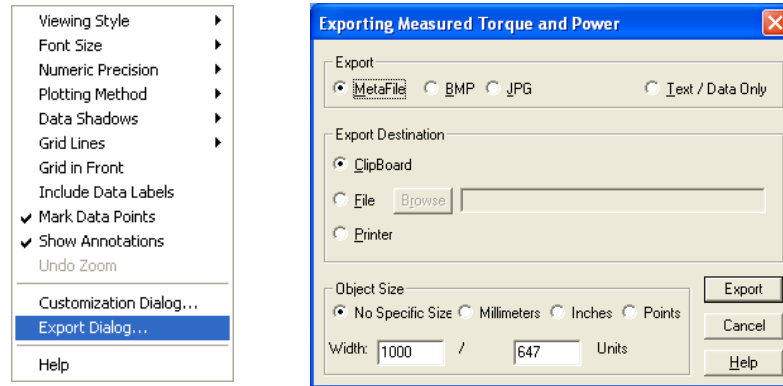


Visit the SuperFlow Web site at **www.superflow.com** for a 30-day trial download, or contact SuperFlow Customer Service to order.

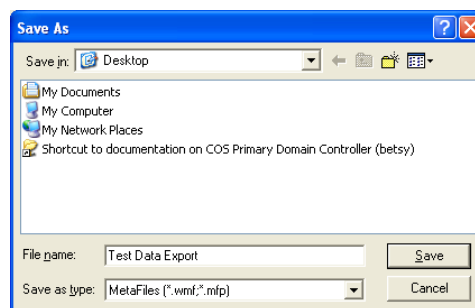
5.8.2 Exporting a Plot as a Graphic File

To export a plot as an image:

1. From the **Plot** menu, select **Plot>>Export Image** or right-click inside the plot area and select **Export** dialog box.
2. The **Exporting [Plot Name]** dialog box appears.



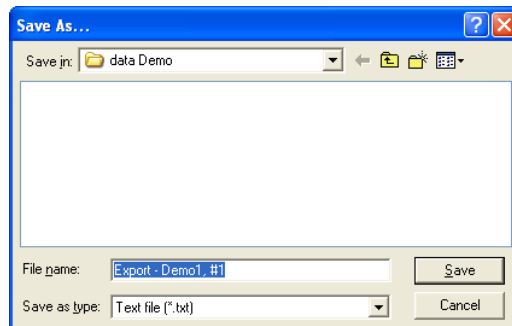
3. Select the type of export format:
 - **Metafile:** Clipboard, file, and printer
 - **Bitmap:** Clipboard and file
 - **JPEG:** Clipboard, file, and printer
 - **Text/Data Only:** Clipboard and file. When exporting the plot as Text/Data Only, click the **Export** button to launch the Text/Data Export dialog box. See section 5.8.2 on page 5-37 for details.
4. Select the **Export Destination:**
 - **Clipboard:** Exports the file to the Windows clipboard
 - **File:** If exporting to a file, you must enter a target file name.
 - Click the **Browse** button to open the **Save As** dialog box.
 - **Printer:** Exports the file directly to the printer.



- Type a target name in the **File name** text box and click **Save**.
 - The directory path and file name then display in the box next to the Browse button.
 - **Printer:** Exports the file directly to the printer.
5. If available, select the **Object Size** of the image to export.
 6. Click the **Export (Print...)** button.

5.8.3 Exporting Plot Data

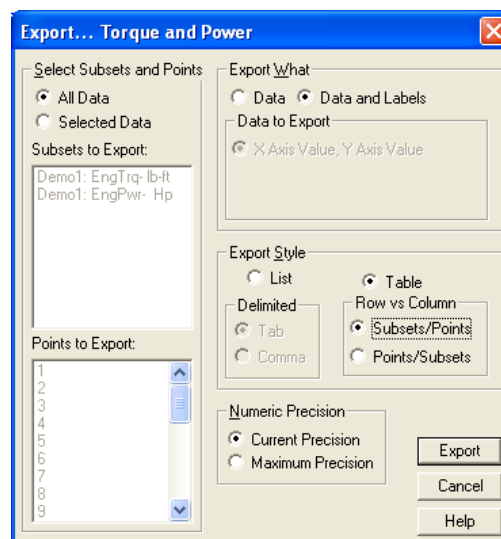
After the desired curves are plotted, from the **Plot** menu select **Plot>>Export Data...** The **Save As** dialog box appears.



The export results will save to a text file in the current test data directory.

If the display is in %-Change or Difference mode when the data is exported, the numbers in the text file will be the %-Change or Difference numbers. The reference test channel will be zero, as expected. If you had exported the previous comparison data when the plot was in Normal comparison mode, the data columns would basically be the actual values.

Use the default name is provided, or change the name and click **Save**. The **Export [Plot Name]** dialog box appears.

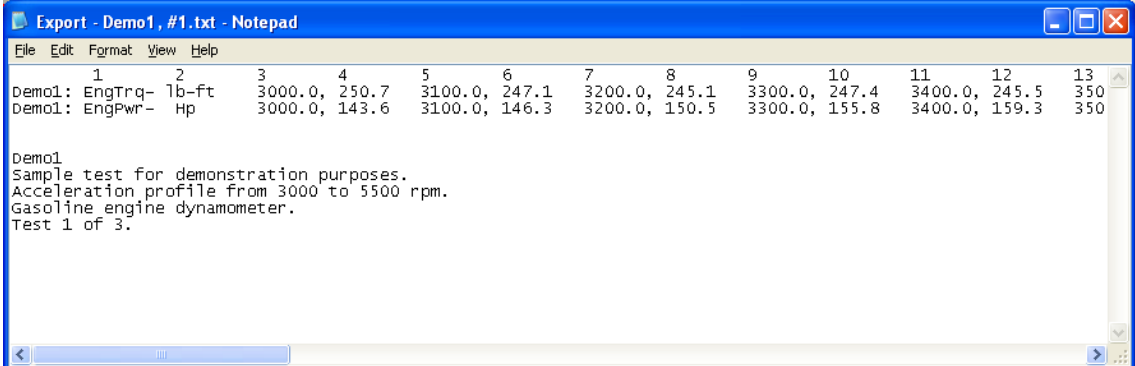


Configure how the exported data will be formatted. Note that all defaults in this dialog box display.

- **Select Subsets and Points:** If you select the **Selected Data** option, the **Subsets to Export** and **Points to Export** lists activate where you select what to export in each list.
- **Export What:** The data can be exported with or without subset and point labels.
- **Data to Export:** Not implemented.
- **Export Style:** The information can be exported in two formats. When you select a style, the area pertaining to that style activates with two options to select from.
 - **List:** Exports the information one record per line. In the **Delimited** area, select whether to separate the data fields by tabs or commas.
 - **Table:** Exports the information in a grid fashion. In the **Row vs Column** area, select either a subset by point (**Subsets/Points**) or point by subset (**Subsets/Points**) style.
- **Export Precision:** The numeric precision of the data can be the current precision state of the object or 7 decimal positions (the maximum precision stored by the object).

For best results, in the **Export Style** area, select **Table** to activate the **Row vs Column** area, then select **Subsets/Points** to set each row to be a data point and each column to be a curve (subset). Then click **Export**.

The data now appears for comparison (exported in Difference mode). Note that the test description notes for each run are included with the export data. If desired, the data columns can easily be imported into Microsoft Excel for further processing (use the **Delimited** import mode in Excel).



	1	2	3	4	5	6	7	8	9	10	11	12	13
Demo1: EngTrq-	1b-ft	3000.0,	250.7	3100.0,	247.1	3200.0,	245.1	3300.0,	247.4	3400.0,	245.5	350	
Demo1: EngPwr-	Hp	3000.0,	143.6	3100.0,	146.3	3200.0,	150.5	3300.0,	155.8	3400.0,	159.3	350	

Demo1
Sample test for demonstration purposes.
Acceleration profile from 3000 to 5500 rpm.
Gasoline engine dynamometer.
Test 1 of 3.

In addition to a table of columns, many other ways are available to format the exported data for comparison. Experiment with the settings in the **Export** dialog box to see the results.

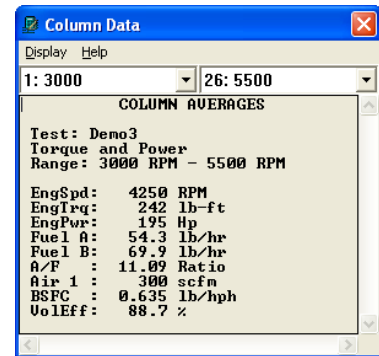
5.9 Averaging Test Data

Averaging tests is the best way to get the most accurate and repeatable data. Data can be averaged by columns in one test, or multiple tests can be averaged together.

5.9.1 Averaging Test Data by Columns

From the **Stored Data Viewer** menu, select **File>>Average>>Columns**. The **Column Data** dialog box appears displaying the column averages, minimums, or maximums for a particular data range. The information shown is for the currently displayed page of test data; switch to any of the available test data pages to view the Column Data information for that particular page.

Select the **Display** menu at the top of the dialog box and select **Minimums** or **Maximums** to display different column data. To print column data on the data report, select **File>>Print Setup** and in the **Statistics** area, select the column type to print.



NOTE: You can copy the information in the Column Data dialog box and paste it into the Test Description notes or other text documents.

Data Range

The data range the calculations are derived from appear in the two drop-down lists at the top of the Column Data dialog box.

- The left drop-down list is the lower start range, and the right drop-down list is the upper end range.
- Column 1 (the left column) of the data sheet is always the reference data and is shown in the drop-down lists.

Click the arrows in the lists to select the start and end range values. The number to the left of the data reference is the line number.

Statistics Maintain Range Mode

The Column Data (statistics) dialog box has a menu option called **Maintain Range**. To toggle this mode on or off, in the Column Data dialog box, select **Display>>Maintain range**. If the menu item is checked, the option is active. When Maintain Range is on or off, WinDyn remembers the setting until changed.

The Maintain Range mode controls whether this dialog box will keep the same averaging range when viewing successive files with the Stored Data Viewer.

Example:

Assume you have two acceleration tests each from 3000–5500 rpm. Open the first test in the Stored Data Viewer, then average the data columns from 4000–4500 rpm. Then open the second data file.

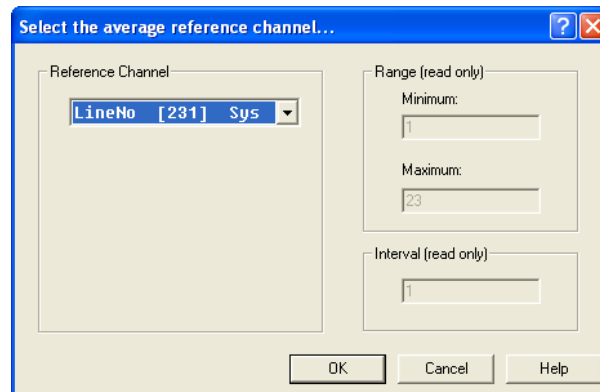
If Maintain Range is checked, when you open the second data file, the average range is still 4000–4500 rpm. If Maintain Range is not checked, the average range reverts to the full-range default (3000–5500 rpm, in this case) when you open the second data file.

5.9.2 Averaging Data from Multiple Tests

The data from multiple tests can be mathematically averaged into a single data file that can be displayed, plotted, and printed as any other data file.

To average test data, from the **Stored Data Viewer** menu, select **File>>Average>>Tests**. You may average together up to 10 files. To select more than one channel at a time, hold down the **SHIFT** key and drag the mouse, or hold down the **CTRL** key and select the files using the mouse or the **SPACEBAR**.

Select the files to average and click **Open**. The **Select the average reference channel...** dialog box appears.



IMPORTANT: It is important to average only those tests with a common X-axis range, (i.e. number of data points). Averaging files of varying lengths will result in averaged files with erroneous data.

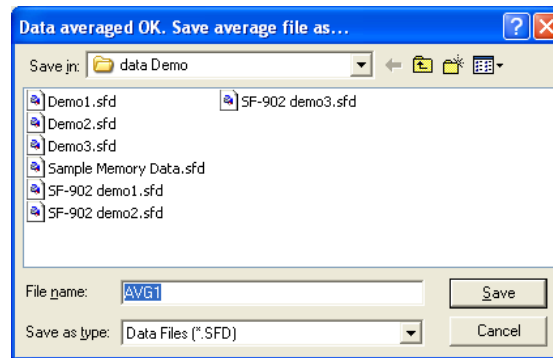
Reference Channel

A reference channel is required when averaging multiple data files. The reference channel allows WinDyn to automatically compensate for tests that start and end at different engine speed points. For example, if two tests are averaged – the first starting at 4000 rpm and the second starting at 4100 rpm – WinDyn will automatically compensate for this difference during averaging.

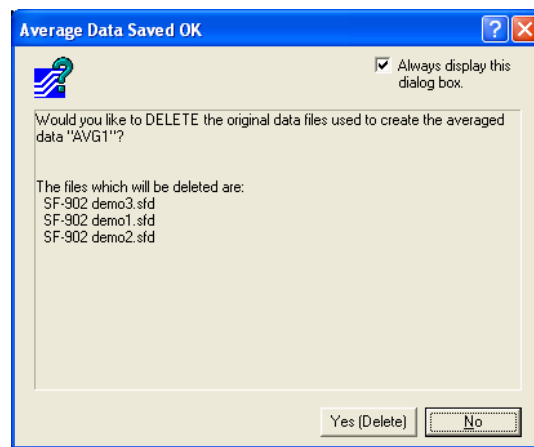
When the test data being averaged has even-increment engine speed points (such as ProFilter data), the reference channel should be the Engine Speed (rpm) channel. However, when the test data being averaged does not have even-increment engine speed points, the reference channel should be the Line Number (LineNo) system channel.

After you select a reference channel, WinDyn remembers it until it is changed.

1. Select a valid reference channel and click **OK** to quickly average the data. The **Data averaged OK. Save average file as...** dialog box appears.



2. Accept the default name, or type a different name in the **File name** text box.
3. Click **Save** to save the averaged data to disk. The **Average Data Saved OK** dialog box appears asking if you would like to delete the original data files used to create the averaged data file and lists the files that will be deleted.



4. Click **No** to keep your files. If you know you will never use the original data files and want to permanently remove them from your computer disk, click **Yes (Delete)**.



CAUTION: Once the original files are deleted, they cannot be recovered.

NOTE: You can select to never display this dialog box so no files are ever deleted. In the top right corner, clear the **Always display this dialog box** check box, or from the **Stored Data Viewer** menu select **File>>Average>>Prompt to delete files** and make sure the menu item is not checked.

The averaging reference channel never gets averaged. However, all other channels do, so this can affect the way the averaged data will appear if an averaged channel is used for the X-axis and the two plots that were averaged did not contain an equal number of data points.

WinDyn uses the averaging reference channel to properly align the data files before averaging. This allows you to properly average tests referenced to, for instance, rpm or mph.

Table 5-3. Averaged Test Example

Test1	Test2
3300	3500
3400	3600
3500	3700

WinDyn will shift the data in Test2 down, then average across all data points. The lines that do not share a common range are thrown out.

NOTE: For a channel to be used as the averaging reference channel, the values **must** evenly increment throughout the entire test (100-rpm increments, for example). That is why the Line Number channel always works, since the even increment value is always 1.

However, when Line Number is the reference channel, the data is already aligned according to WinDyn's calculations (even though this may not be the case in reality).

Example:

Two back-to-back tests are performed on a chassis dyno.

- In the first test, the operator accelerates and records data from 40 mph to 90 mph.
- The second test does the same, only from 45 mph to 95 mph.

Although each power curve appears very similar and the number of recorded data points may be the same, the reference channel Line Number will not make an accurate alignment of the data for averaging.

The offset in the above example will be minute, but it is still there. Thus, it is very important to note that when averaging multiple tests, the test data aligns accurately. In the above example, WinDyn will skip the “shift” part of the averaging function and start averaging across the data points (line 1 vs. line 1, line 2 vs. line 2, etc.). Therefore, the data collected at 40 mph will be averaged with the data collected in the second test at 45 mph, and so on.

SuperFlow test file averaging has always worked this way, even prior to WinDyn. Thus, it is very important to keep test data well-aligned for the file-averaging feature to generate the most accurate results. Using the ProFilter feature greatly enhances the ability to line up test data on an even-increment channel such as Engine Speed (rpm).

Adding to the Database

If the Test Database Manager menu item is checked, a dialog box appears asking if this file is to be added to the WinDyn database. Click **Yes**.

Test Description

Information on the Averaged Data file (including the files the averaged file was created from) is automatically added to the Test Description Notes of the averaged file. To view the Test Description Notes, from the **Stored Data Viewer** menu, select **File>>Test Description** or press **F10**. To edit the notes, type the information in the text box and click **OK** to save changes.

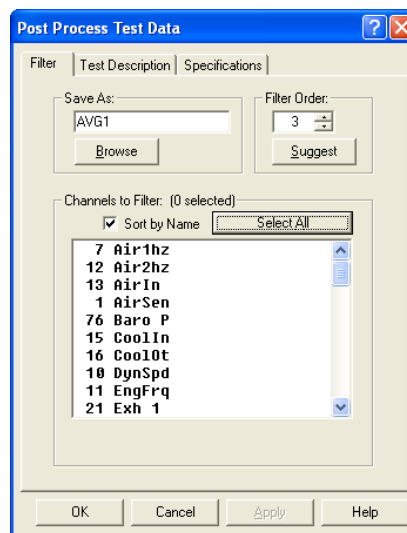
5.10 Post Processing Test Data

WinDyn allows a limited number of post-processing operations on data files:

- Add filtering to measured data
- Change specification channel values and recompute test data

The Post Processing feature creates a new data file identical to the original data file except for the options that were changed. The new data file is an actual SFD file, which means it can be displayed, printed, plotted, overlaid without another file, averaged, or used in any other operation allowed on SuperFlow data files.

From the **Stored Data Viewer** menu, select **File>>Post Process**. The **Post Process Test Data** dialog box appears.



Filter Tab

The Filter operation smooths any measured data channel. The actual filter used is a “moving window average.” Select the filter order (the amount of smoothing):

- **Save As:** Type a new data file name in the text box or accept the default name. Click the **Browse** button to select a different directory other than the default, or select (and overwrite) an existing SFD file. WinDyn remembers the name and increments the suffix number until the name is changed.
- **Filter Order:** Use the **UP/DOWN ARROWS** arrows to select a filter order (a higher number means more smoothing). Click the **Suggest** button to let the system determine the best filter order for this data. Note that the filter order maximum range is dependent upon the data.
- **Channels to Filter:** Select (highlight) the measured channels to filter. To select more than one channel at a time, hold down the **SHIFT** key and drag the mouse, or hold down the **CTRL** key and select the files using the mouse or the **SPACEBAR**.
- **Sort by Name:** Select to display the available channels in a different order.
- **Select All:** Click to change all measured channels.

After making the changes, click the **OK** button to create the new data file. The new data file automatically displays. The original data file still exists and is not modified in any way.



WARNING: Only measured channels can be filtered. Since each calculated channel may reference several measured channels, the noise present may be the result of more than one channel.

For example, if the system under test calculates Engine Power (EngPwr) using the standard formula $\text{EngPwr} = \text{EngSpd} * \text{EngTrq} / \text{Constant}$, then the Engine Speed (EngSpd) and Engine Torque (EngTrq) measured channels will each contribute some noise to the resultant Engine Power.

Since Engine Power in this example is a calculated channel (it is not directly measured), it cannot be filtered directly. Therefore, to effectively filter Engine Power, both Engine Speed and Engine Torque may need filtering. Also note that if Engine Speed is filtered and is used as the X-axis for your plots (a common scenario), the plot appearance may change dramatically.

Test Description Tab

Click the **Test Description** tab to enter notes about the new data file created with changed filter values.

Specifications Tab

Click the **Specifications** tab to change specification channel values and recompute test data. The post processing feature creates a new data file identical to the original data file except for the options you select. The new data file is an actual .sfd file, which means you can display and plot the data, overlay the data on a plot, average the data, and so on.

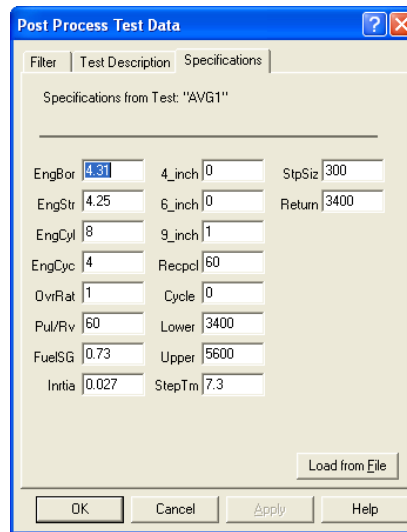
5.10.1 Updating Specification Values

The specifications (Bore, Stroke, etc.) that were in effect during a test are stored as part of the test data file. These specifications are used to calculate various important values (such as Corrected Power, Displacement, etc.). Once a data file is saved, the specification values stored in the data file cannot be changed. Using the Post Process feature, however, you can create a *new* data file (based on the original) with new specification values.

Specification values are changed for a two reasons: If a series of tests are run with incorrect specification value(s), you can fix the error and get the true data without re-running the tests. Changing specification values also allows you to see the effect on data using various correction factors.

1. To update the value for any specification channel, first open the desired data file.
2. From the **Stored Data Viewer** main menu, select **File>>Post Process**. The **Post Process Test Data** dialog box appears.
3. In the **Save As** text box, type name for the new data file in the text box or accept the default name. Click the **Browse** button to select a different directory other than the default, or select (and overwrite) an existing SFD file. WinDyn remembers the name and increments the suffix number until the name is changed.

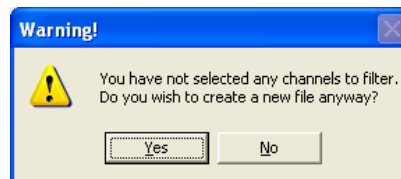
- Click the **Specifications** tab. The saved value for each specification channel displays (these are the values that were in effect when the test was run).



- Type in a new value in the text box for any defined specification.
- Click the **Load from File** button if you want to update all the displayed specification values with the values stored in a previously created specification file (.cst file).

NOTE: Click the *Test Description* tab to enter notes about the new data file created with changed specification values.

- After updating the specifications, click the **OK** button to create the new data file. If filtering was not changed, an error message appears stating you have not selected any new channels to filter and asking if you wish to create a new file anyway.



- Click **Yes** if no filtering is desired. The new data file automatically displays. The original data file still exists and is not modified in any way.

CHAPTER 6

WINDYN SAFETY LIMITS

IN THIS CHAPTER

- **Introduction**
 - Applications
 - Functions and Features
 - Limit Response Actions
 - Operator Limits Monitoring
- **Limits Editor**
 - Main Menu
- **Limits Channel List**
 - Symbol Definitions
 - Column Definitions
 - List Operations
 - Quick Edit Mode
 - Color Settings
- **Channel Properties**
- **Alarms and Warnings**
- **Information Pane**
- **Limits Application Examples**



6.1 Introduction

Programmed tests may provide a false sense of comfort. Because the operator is not directly in control of the test, a tendency may arise to pay less attention to the test. Never forget that an engine (particularly a high-performance engine) can always develop a problem with possible disastrous effects on the engine or test system. Even during automated tests, the operator should continuously monitor all operating parameters and be ready to intervene in case of trouble.

WinDyn provides a Limits safety system that can take over most of the monitoring tasks. Even then, SuperFlow recommends always paying attention to the test because some error conditions are not measurable by the system (for example, a small leak in a high-pressure fuel line will cause a fine fuel spray which is not detectable by the test system but could quickly result in a catastrophic fire).

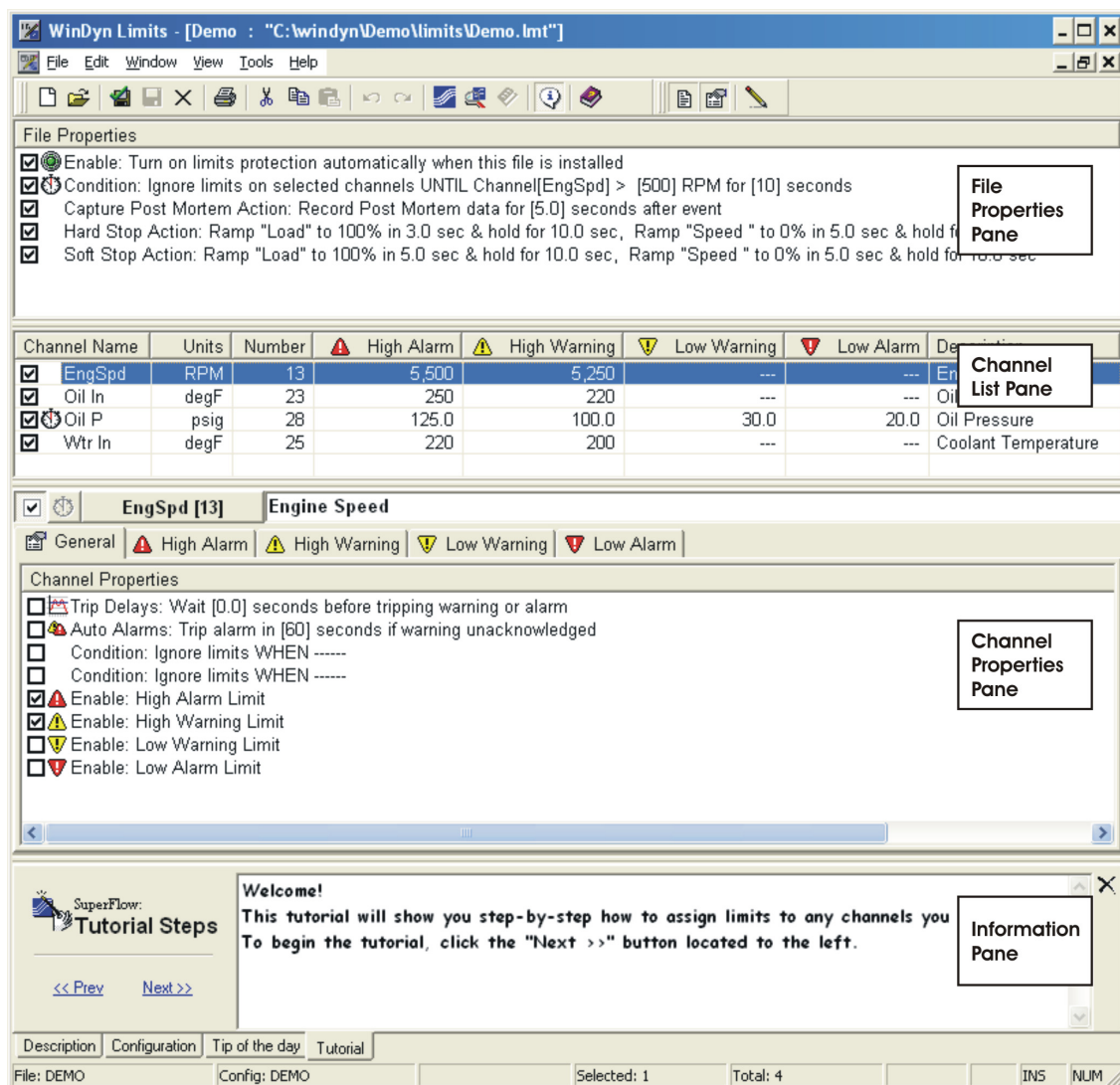


Figure 6-1. WinDyn Limits Editor

WinDyn Limits provide automatic warning and shutdown actions that are initiated when any channel value reaches its assigned limit. The WinDyn Limits editor assigns the channel limits as well as the warning and shutdown actions. Limits are created in the editor and saved on the computer as *.lmt files.

6.1.1 Applications

WinDyn Limits is most effective on engine dynamometers for both long-duration endurance testing and short-duration performance acceleration testing. Limits allow the operator to concentrate on the test itself rather than divide attention between the test and the engine condition. In long-duration testing, WinDyn Limits allow the operator to be distracted and even take a short break without having to stop the test.



IMPORTANT: With Limits in place, SuperFlow still does not recommend leaving a running engine unattended for any length of time).

WinDyn Limits can also be used on chassis dynamometers for monitoring engine and dyno conditions. In most cases, however, the operator of a vehicle should maintain complete control of the vehicle. Therefore Limits are seldom used.

6.1.2 Functions and Features

WinDyn Limits provide:

- User-configured operating parameters for any:
 - Measured *or* calculated channel
 - Digital channel
- Four levels of limit protection per channel (two warnings and two alarms)
- Fixed or dynamic limit trip values (entered or real-time)
- Master-level conditional limits based on user-definable conditions
- Channel-level conditional limits based on user-definable conditions
- Integrated high-speed post-mortem data capture and failure analysis
- An integrated system event log to permanently record limit events
- Trip delays to avoid false limit trips on noisy channels
- Auto alarm during unattended tests to advance the Limits state to the next level
- Custom test profile scripting in response to the limit event
- Audible operator alarm sounded through the computer sound system

6.1.3 Limit Response Actions

- **Hard stop:** Ramps the system controllers to the specified set point. In custom mode, executes a specified test profile. Turns off the ignition and fuel pump when using the XConsole engine controls.
- **Soft stop:** Ramps the system controllers to the specified set point. In custom mode, executes a specified test profile. Does not affect ignition or fuel pump controls.
- **Stop Autotest:** Immediately terminates the execution of any autotest in progress.
- **Pause Autotest:** Immediately suspends the execution of any autotest in progress.
- **Stop recording:** Immediately terminates any automatic data recording in progress.
- **Capture Post Mortem:** Immediately saves a snapshot of the high-speed post-mortem data buffer. The post-mortem data is automatically saved to the WinDyn master node test data folder.
- **Record message:** Immediately records the limit trip information as two lines in the current test data set.
- **Log message:** Immediately logs the limit trip information as an entry in the WinDyn system event log.
- **Set Program Flag:** Sets one of the generic programmable flags used to notify other processes of a limit event.
- **Audible alarm:** Sounds an audible alarm through the computer's sound system.

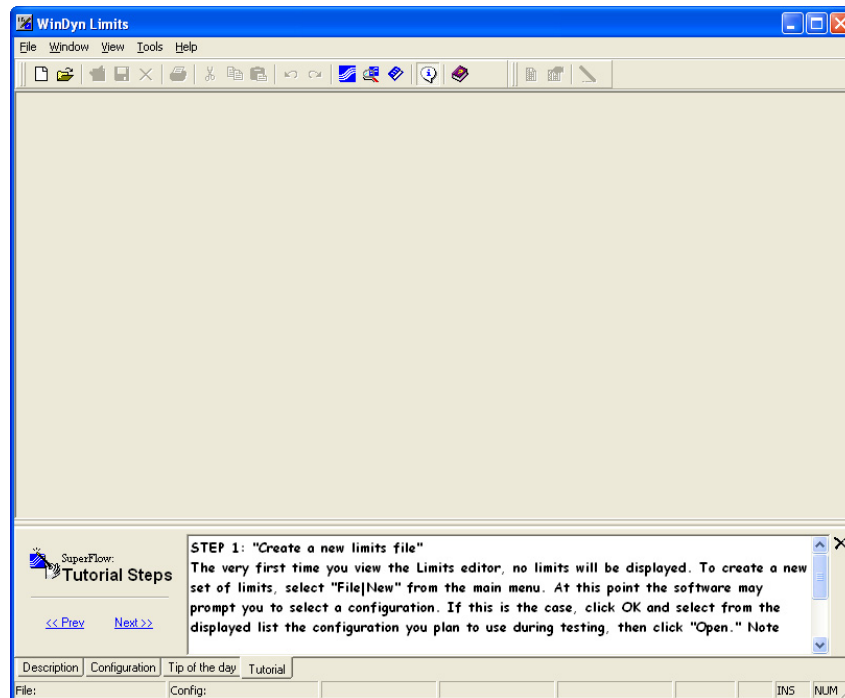
6.1.4 Operator Limits Monitoring

All limit events immediately display in real time on the computer monitor and the operator control display.

- Current limits protection status can always be visible.
- Limits on/off control commands are easily accessed.

6.1.5 Limits Editor

To view the Limits Editor, from the **WinDyn** main menu, select **Design>>Safety Limits**. The **WinDyn Limits [Name: path]** window appears.



The Limits Editor is a standard Windows-based file editor. Multiple files may be opened and edited during a single editing session. The editor supports most Windows-based word processing features including:

- Undo and redo commands
- Cut, copy, and paste commands
- Drag-and-drop capability
- Context-sensitive pop-up menus

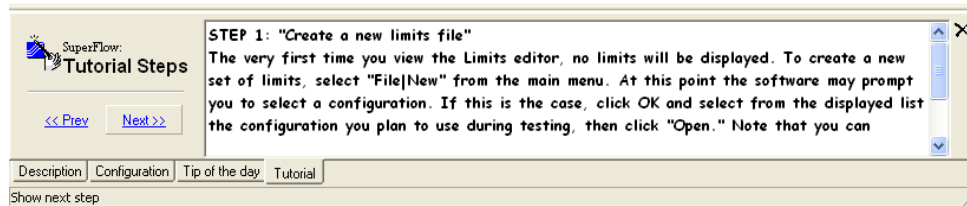
The editor menu bar contains operational commands or menus (**File, Edit, Window, View, Tools, Help**). Select any of the menu choices to see a list of commands. The gray choices are only available when the WinDyn program is ready to accept information from the command.

- A toolbar located below the menu bar provides quick access to specific commands in the editor, saving time and effort when performing most of the Limits Editor common commands.
- Click the toolbar buttons to perform the commands without navigating through the usual hierarchy of menus and commands.
- Position the mouse arrow over any item on the toolbar to display a caption describing the button's purpose. To display or clear the status bar or toolbar, select them in the View menu. A check mark next to the menu item indicates the display is turned on. Select the menu item again to remove the check mark and turn off the display.

Tutorial

The Limits Editor provides a built-in tutorial designed to help you understand and use the basic Limits Editor features. The tutorial steps through the process to build a simple Limits file.

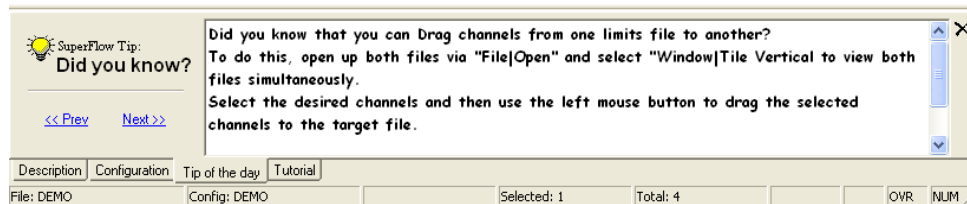
To view the tutorial, from the **WinDyn Limits** menu select **Help>>Tutorial**. The **Tutorial Steps** window appears in the pane at the bottom of the window.



Click **<< Prev** and **Next >>** to navigate back and forth through the tutorial.

Tip of the Day

The Limits Editor features Tip-of-the-Day notices to help with some of the basic features of the system. Each day, a new tip automatically displays. To view today's tip, select **Help>>Tip of the day**. The tip appears in the pane at the bottom of the window.

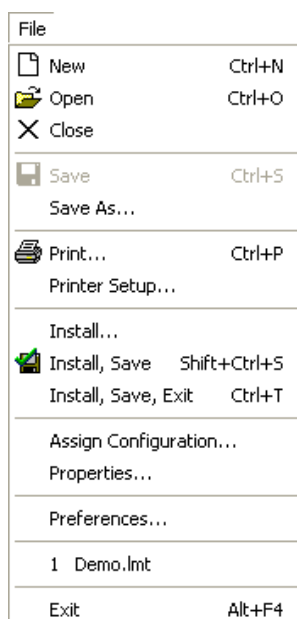


Click the **<< Prev** and **Next >>** links to navigate back and forth through the Tip topics.

6.1.6 Limits Editor Main Menu

File Menu

The File menu contains file-management commands including viewing, saving, closing, and printing commands.

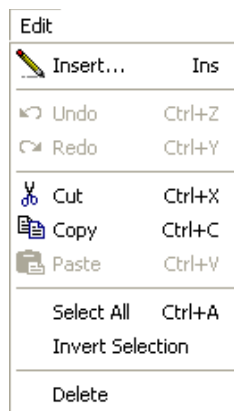


- **New:** Opens a new file.
- **Open:** Opens an existing file.
- **Close:** Closes the file. If the file was not previously saved, a dialog box appears prompting whether to save the file.
- **Save:** Saves the file under the current name. If no file name exists, a dialog box appears prompting you to enter a name.
- **Save As...:** A dialog box appears prompting you to enter a name to save the file to.
- **Print:** Prints the file.
- **Printer Setup:** Displays the Printer Setup dialog box.
- **Install:** Select any file from the disk and install it into the test system. Use this command to install a file that is different than the one currently being worked on.
- **Install, Save:** Save changes to the file currently being worked on. The changes are saved to the file and then installed into the test system. Use this command to easily test the result of the changes without closing the file.
- **Install, Save, Exit:** Saves any changes in the file you are currently working on, then automatically installs the file into the test system. The feature then quits the editor program. Use this command to make changes and quickly exit the editor while automatically saving your changes.
- **Assign Configuration:** Assigns a different WinDyn System Configuration file to the file you are working with. Use this command to make a file compatible with the selected WinDyn system configuration.

- **Properties:** Displays general information about the file you are currently working with including size, location, time, and date last modified. Use this command to view the general properties of the file you are working with or to change the author and company names that display when the file is printed.
- **Preferences:** Customize the editor application to suit your needs. Select the display configuration viewed on the screen when the Limits Editor is initially opened.
- **Exit:** Exits the program and returns to the main WinDyn screen.

Edit Menu

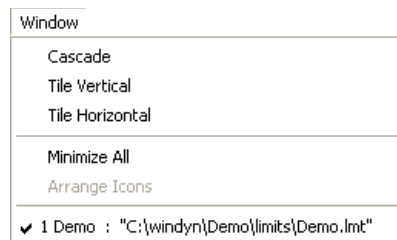
The Edit menu contains file-edit functions including cut, copy, paste, undo, and redo commands.



- **Insert:** Inserts a new item into the working list.
- **Undo:** Cancels the most recent operation. Use this command to back up when you want to undo a change.
- **Redo:** Performs the last undo operation. Use to reverse the last operation you canceled using undo.
- **Cut:** Cuts the selected text and places it in the Windows clipboard.
- **Copy:** Copies the item currently selected to the Windows clipboard.
- **Paste:** Pastes the contents of the Windows clipboard into your file. After you cut or copy an item, paste the contents of the Windows clipboard to the selected location.
- **Select All:** Selects all of the available items within the currently active window. Use when you are going to make the same change to all items.
- **Invert Selection:** Toggles the current selection for all items. Easily select cleared items or clear selected items.
- **Delete:** Deletes the selected item. Use when you want to permanently remove one or more items.

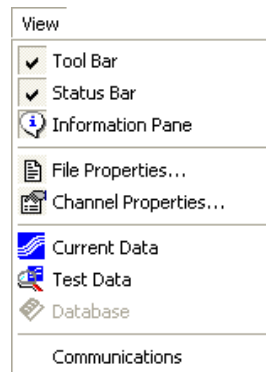
Window Menu

The Window menu lists all of the currently open files and provides commands to switch between and arrange open files.



View Menu

The View menu contains a list of displays that may be activated or turned off. Use this menu to also switch between the various areas of WinDyn.



Tools

The Tools menu provides direct access to other programs which are frequently used with WinDyn. Programs may be added or removed from this list to accommodate specific needs.

Help

The Help menu provides context-sensitive Help for all WinDyn programs. It includes several links to topics of interest on the SuperFlow Web site.

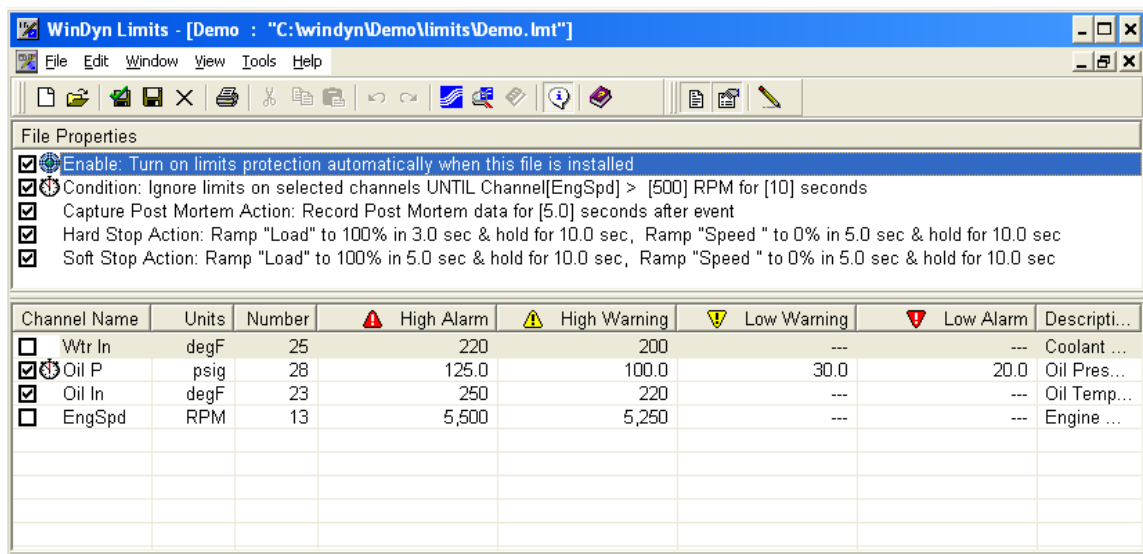
6.2 Limits Channel List

This section list the selected channels monitored by the Limits program.

6.2.1 Symbol Definitions

A check mark next to the channel name indicates limits protection for the channel is active. You can turn off limits protection for any channel while retaining all its limit settings by clearing the check box next to the channel name. You may also right-click the channel name and select **Enabled**. A stopwatch next to the channel name indicates that the channel is associated with the file properties conditional statement.

To view the current conditional statement, from the WinDyn Limits menu select **File>>File Properties**. The **File Properties** area displays a description of the conditional statement.



You will see these symbols used throughout the WinDyn system:

- **Red triangle:** Indicates a limits-high alarm
- **Yellow triangle:** Indicates a limits-high warning
- **Upside-down yellow triangle:** Indicates a limits-low warning
- **Upside-down red triangle:** Indicates a limits-low alarm

6.2.2 Column Definitions

- **Channel Name:** The channel name which limits are applied is protected and cannot be changed. The channel name protected by limits is defined in the associated configuration file. A check mark next to the channel name indicates limits are enabled for the channel. A stop watch next to the channel name indicates limits are conditional for the channel. The channel's conditional setting is set in the Channel Properties conditional statement.
- **Units:** The units of the channel protected by limits. The units are defined in the associated configuration file.
- **Number:** The number of the channel protected by limits.
- **High Alarm:** The channel's high-alarm limit trip value. You can enter this value, or it can be a real-time channel or memory value. A dashed line (---) indicates the trip point is disabled.
- **High Warning:** The channel's High Warning limit trip value. You can enter this value, or it can be a real-time channel or memory value. A dashed line (---) indicates the trip point is disabled.
- **Low Warning:** The channel's Low Warning limit trip value. You can enter this value, or it can be a real-time channel or memory value. A dashed line (---) indicates the trip point is disabled.
- **Low Alarm:** The channel's Low Alarm limit trip value. You can enter this value, or it can be a real-time channel or memory value. A dashed line (---) indicates the trip point is disabled.
- **Description:** A description of the channel's limit definition. You can edit the channel description.

6.2.3 List Operations

NOTE: To display a speed menu of available commands, click the right mouse button anywhere in the limits list.

- **Selecting a list item:** To select a list item, click the desired row.
- **Selecting multiple list items:** To select more than one item in the list, press the **CTRL** key while clicking the items you want.
- **Sorting the list:** To sort the list by any column heading, click the column heading that contains the information you want to sort. Click the same column heading again to reverse the sort order.

6.2.4 Quick-Edit Mode

When editing limit trip values, use the **ENTER** key to move to the next input field. To move through limit trip value fields:

1. Select a channel in the limits list.
2. Press **ENTER** to move to the first limit level for the selected channel.
3. If needed, enter a new value.
4. Press **ENTER** to continue moving through the remaining fields. The cursor will automatically move to the next channel in the list when you have cycled through all four limit levels of each channel.

6.2.5 Column Settings

This section explains how to edit the information displayed in the limits list columns.

- **Channel Enable:** A check mark indicate the on or off status of each channel in the limits list.
- **Channel Condition:** The channel condition symbol is used to toggle the condition symbol next to each selected channel in the limits list.
- **Channel Selection:** Use the **Channel Selection** to change the channel for the selected channels in the limits list.
- **Channel Description:** Use the **Channel Description** area to edit the description of each selected channel in the limits list.

6.3 Channel Properties

To view the limits channel properties, from the **WinDyn Limits** menu, select **View>>Channel Properties**.

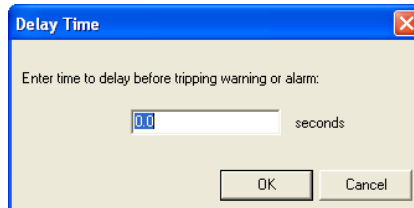


Several tabs display providing access to the various options available for each channel. The **General** tab displays the following properties:

Trip Delays

This property configures the trip delay time for the currently selected channels in the limits list. Use this feature to avoid false limit trips on noisy channels. Note that the trip delay time is shared between all four limit levels.

To modify the setting, double-click the statement. The **Delay Time** dialog box appears. Type the desired time the channel value must be in the limit zone before tripping a warning or alarm.



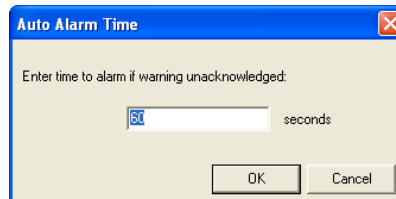
NOTE: In addition to setting the Trip Delay time and selecting the statement's check box, you must depress the Trip Delay button for each limit level to delay.

Auto Alarms

If the warning is not acknowledged within the amount of time set in the database, it progresses immediately to an alarm state.

This property configures the auto alarm time for the currently selected channels in the limits list. Note that the auto alarm time is shared between both warning limit levels.

To modify the setting, double-click the statement. The **Auto Alarm Time** dialog box appears. Type the desired time to automatically trip an alarm if the already tripped warning goes unacknowledged by the operator.



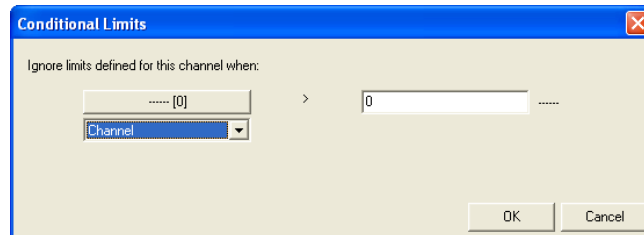
Use this feature for additional safety during unattended tests. In addition to setting the auto alarm time and selecting the statement's check box, you must depress the Auto Alarm button for each warning limit level to be auto-alarm enabled.

Ignore limits WHEN...

This property configures the channel level conditional feature for the selected channels in the limits list. Note that the condition is shared between all four limit levels.

All limits for the associated channels are disabled *whenever* the conditional statement is true. Whenever the condition becomes false, all four limit levels become re-enabled. To permanently disable the condition and enable all associated limits, clear the conditional statement's check box.

To modify the conditional statement, double-click the statement. The **Conditional Limits** dialog box appears. Set the controls to create the desired conditional statement.



Note that you can press the **ENTER** key to cycle through the available controls. An example conditional statement might be:

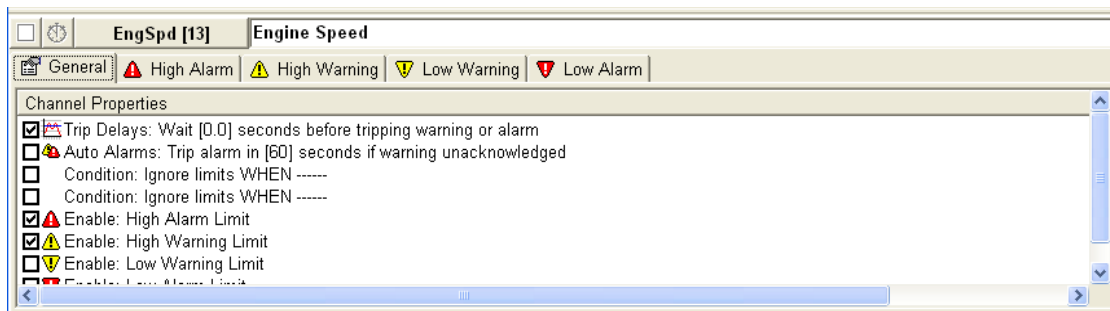
For channel OilP:

“Condition: Ignore limits WHEN Channel [EngSpd] < [500] inHg”

Use this feature to enable limits only under certain conditions (for example, full throttle).

Enable Limit

This property enables or disables the associated limit level for the selected channels in the limits list. To enable a particular limit level (warning or alarm), set its associated check box. To disable a level, clear its associated check box.



Use this feature to enable or disable any of the four limit levels.

6.4 Alarms and Warnings

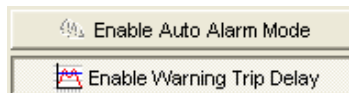
The Limits program has four levels of protection: Low Alarm, Low Warning, High Warning, and High Alarm. Click the tabs above the Channel Properties area to display their settings. Each level has identical options.

6.4.1 Trip Delay Enable

The **Enable Warning Trip Delay** button enables or disables the trip delay mode for the associated limit levels for each selected channel in the limits list. To enable or disable the trip delay mode, select **Trip Delays** in the **Channel Properties** area. Then click an alarm or warning tab and click **Enable Warning Trip Delay**.



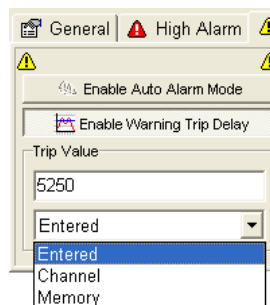
When the Enable Warning Trip Delay button is down and highlighted, the mode is on.



When the button is up and not highlighted, the mode is off.

6.4.2 Trip Value

The trip value sets the value at which a limit will trip.



Click the **Trip Value** drop-down list to select one of the following types:

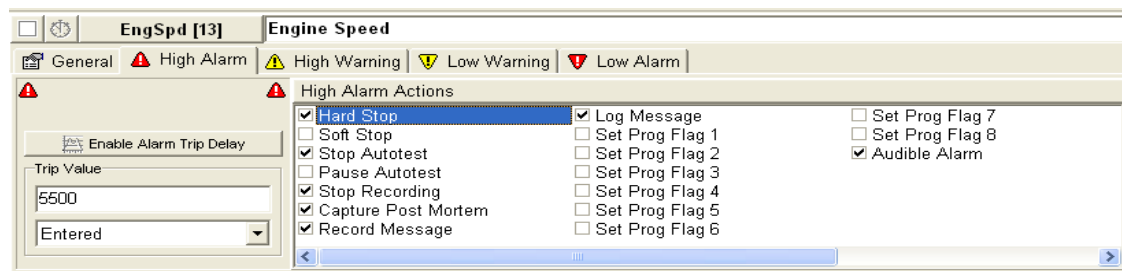
- **Entered:** Type a static value in the **Trip Value** text box. The trip value will stay constant for the duration of the test. Use this type for simple limits.
- **Channel:** A real-time channel value. The trip value can fluctuate throughout the duration of the test. Use this type for dynamic limits.
- **Memory:** A real-time programmable memory value. The trip value can fluctuate throughout the duration of the test. Use this type for custom dynamic limits.

6.4.3 Actions

This section explains the available limits actions. To enable any action, set its associated check box. To disable, clear its associated check box.


6.4.3.1 Hard Stop

In default mode, Hard Stop ramps the system controller to the specified set point. In custom mode, Hard Stop executes a specified test profile. To edit the action's modes and settings, double-click the **Hard Stop** option in the alarm or warning actions area.



Use this action to command load and throttle to the desired set points in response to a limit event. At the start of the action, Hard Stop turns off the ignition and fuel pump if the system uses engine controls. The action then ramps the system controllers to the specified set point and holds for a specified time.

NOTE: Some test systems will not set or clear predefined engine controls (such as ignition) in response to a hard stop.

 To set the hard stop properties, see "Hard Stop Properties" on page 6-22.

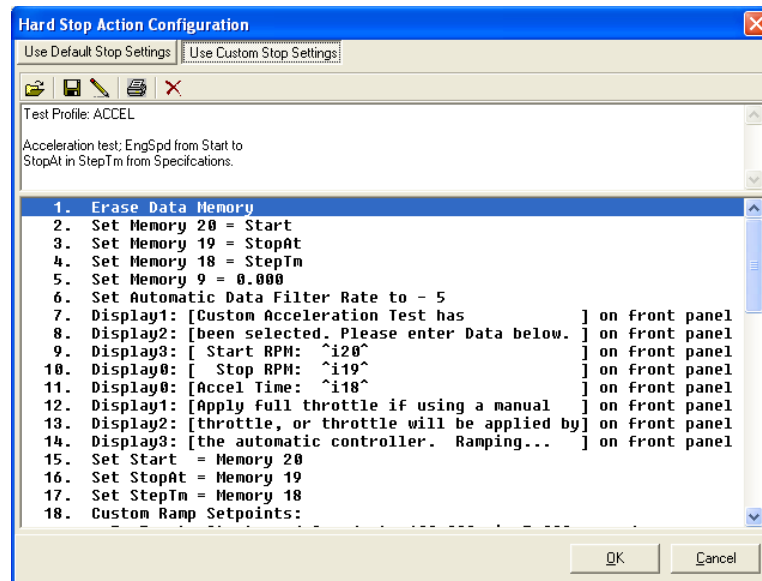
Custom Stop Settings Tab

Use this tab to configure the *custom* stop action settings. This property allows you to retrieve and perform any test profile in response to a tripped limit.

To create the test profile, from the **WinDyn** main menu, select **Design>>Test Profile**.

To modify the custom stop-section setting:

- Double-click the statement.
- Click **Use Custom Stop Settings**.
- In the displayed dialog box, click **Open** and select the desired test profile.

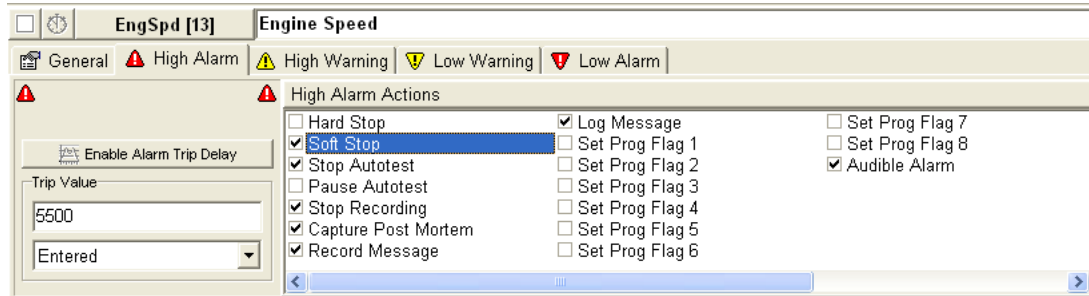


- Click **OK** to save your settings.

Use this property to set the control system's response to a hard- or soft-stop-limit action.

6.4.3.2 Soft Stop

In default mode, Soft Stop ramps the system controller to the specified set point. In custom mode, Soft Stop executes a specified test profile. To edit the action's modes and settings, double-click the **Soft Stop** option in the alarm or warning actions area.



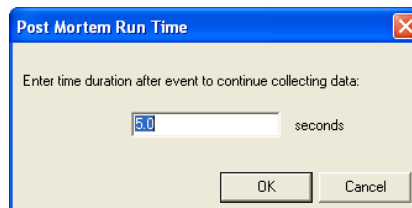
Use this action to command load and throttle to the desired set points in response to a limit event. The action ramps the system controllers to the specified set point, holds for a specified time, then returns to the initial state the system was in before the test was started.

NOTE: A soft stop will not turn off the ignition and fuel pump if the system uses engine controls.

The Soft Stop action is configured the same way as a Hard Stop.

6.4.4 Alarm and Warning Actions

- **Stop Autotest:** Immediately terminates the execution of any autotest in progress. Use this action to shut down the autotest in progress.
- **Pause Autotest:** Immediately suspends the execution of any autotest in progress. Use this action to suspend autotest execution until the limit is analyzed.
- **Stop Recording:** Immediately terminates any automatic data recording in progress. Use this feature to hold off recording test data while a limit is tripped.
- **Capture Post Mortem:** Saves a snapshot of the high-speed, post-mortem data buffer after the time specified in the Post Mortem Run Time database passes. The post-mortem data is automatically saved to the WinDyn master node test data folder. To edit the action's settings, double-click **Capture Post Mortem**. The **Post Mortem Run Time** dialog box appears.



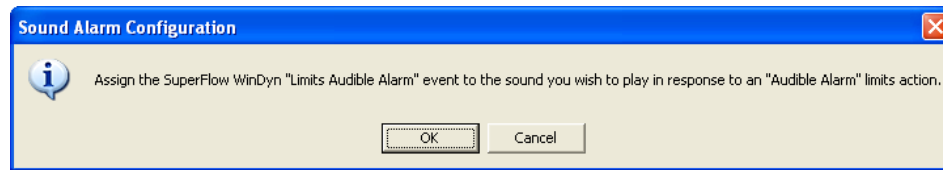
Use this action in conjunction with the Stored Data Viewer to closely analyze the test conditions before and after the limit trip event.

- **Record Message:** Immediately records the limit trip information as two lines in the current test data set. Use this action to integrate limits trip information with your test data.

- **Log Message:** Immediately logs the limit trip information as an entry in the WinDyn system event log. Use this action to save a permanent record of limits trip information, especially during unattended testing.
- **Set Prog Flag:** Sets one of the generic programmable flags used to notify other processes of a limit event. Use this action as a logic condition in the test profile to affect test profile execution.

NOTE: Program flags are accessed in the test profile using the **When Limit Flag** step type.

- **Audible Alarm:** Sounds an audible alarm through the WinDyn computer's sound system. To edit the action's settings, double-click **Audible Alarm**. The **Sound Alarm Configuration** dialog box appears.

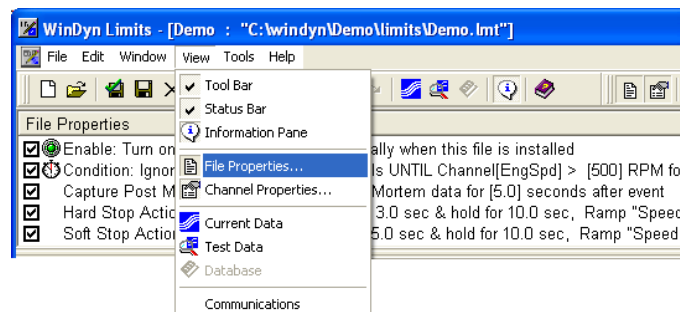


Use this action to alert the operator to a limit condition.

NOTE: The computer must have a sound card installed to effectively use this feature.

6.4.5 File Properties

This section explains the limits file properties. To view the Limits file properties, from the Limits menu select **View>>File Properties**.



Turn Limits Protection on Automatically

Use this property to automatically turn on limits protection new limit settings are programmed into the test system. Select this property's check box to automatically enable limits protection when the limits file is installed into the test system. If the check box is cleared, you must manually turn on limits protection before running your test. Go to the WinDyn System toolbar to manually turn on limits protection.

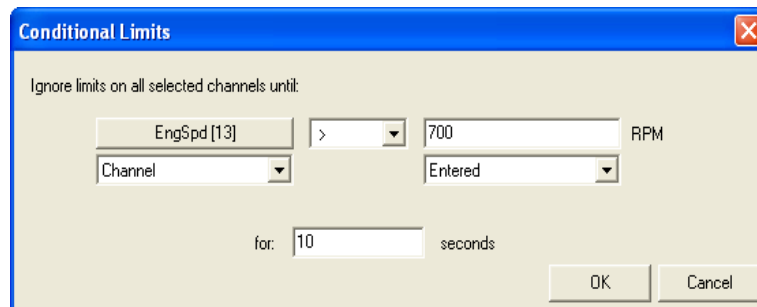


Ignore Limits on Selected Channels UNTIL...

This property configures the master-level conditional feature, which allows you to enable or disable selected limits based on a single specified condition. All limits in the limits list that show the condition symbol are disabled until the conditional statement is met.

During a test, if the conditional statement is changed to false, the process will reset and all associated limits will be disabled until the condition statement is again true. To permanently disable the condition and enable all associated limits, clear the **Condition** check box.

To change the conditional statement, double-click the statement. The **Conditional Limits** dialog box appears. Set the controls to create the conditional statement you want. Press **ENTER** to cycle through the available controls.



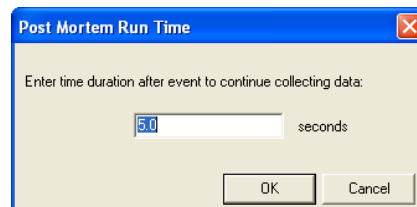
Example Conditional Statement:

“Condition: Ignore limits on selected channels UNTIL EngSpd > 700 RPM for 10 seconds”

This conditional statement delays any specified limits from activating until the readings from the engine or vehicle being tested has stabilized.

Capture Post Mortem Action

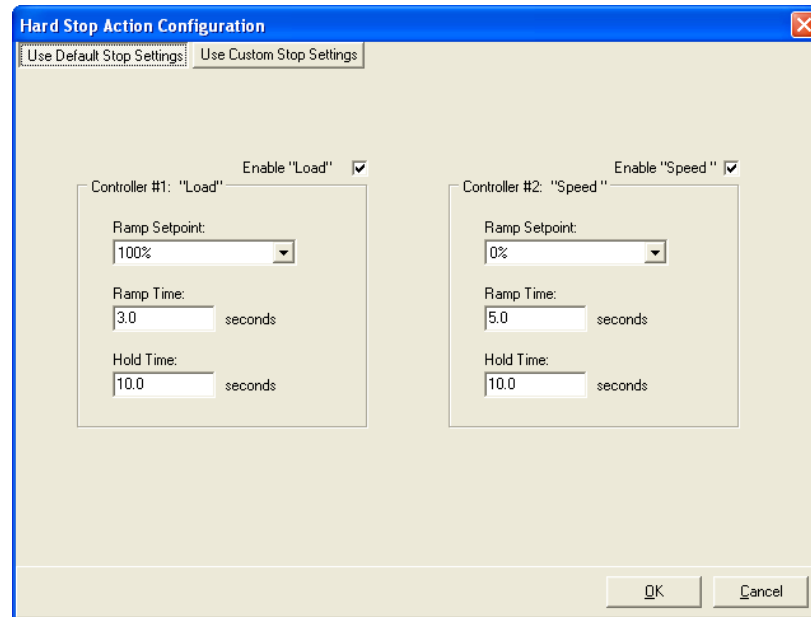
This property configures the high-speed post-mortem data capture feature. To modify this property, double-click the statement. The **Post Mortem Run Time** dialog box appears.



In the dialog box, type the duration time to collect data. Use this property to adjust the time to collect post-mortem data after a failure event.

Hard Stop Properties

To configure the Hard Stop action, in the **File Properties** area, double-click **Hard Stop Action**. The **Hard Stop Action Configuration** dialog box appears.



Use Default Stop Settings Tab

Use this tab to configure the *default* stop-action settings:

- Double-click the statement.
- Click **Use Default Stop Settings**.
- In the displayed dialog box, select the desired ramp set point value for each controller displayed.
- Type the desired **Ramp Setpoint** and **Hold** times. The ramp time is the time needed to reach the specified ramp set point. The hold time is the time needed to maintain the ramp set point after the ramp set point is reached.
- Click **OK** to save your settings.

Use this property to set the control system's response to a hard- or soft-stop-limit action.

Soft Stop Properties

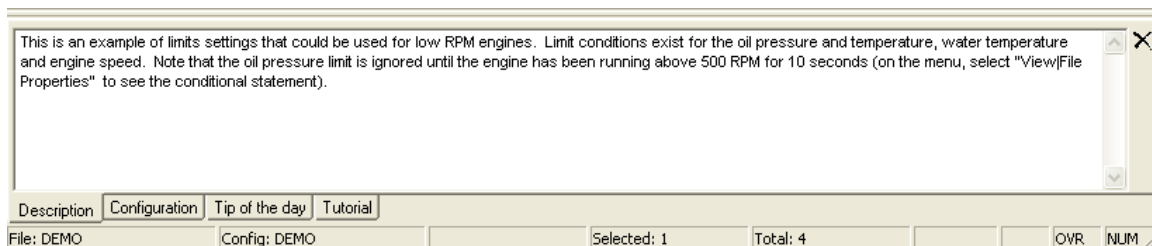


To configure the default soft stop settings, refer to Section 6.4.3.2, "Soft Stop," on page 6-19.

6.5 Information Pane

Description Tab

This tab provides a built-in description notes area. Type information that describes the file. To view the description, from the **Limits** menu select **View>>Information Pane** and click the **Description** tab (usually the default).



The description displays on printouts and appears when browsing for files to easily locate them. After editing the file description, select **File>>Save** from the main menu to save the changes.

Configuration Tab

This is a built-in configuration viewer designed to display all the channels in the associated configuration. To view the configuration, from the **Limits** menu select **View>>Information Pane** from the main menu and click the **Configuration** tab.


Name	Units	Number	Type	Description
A/F	Ratio	104	Calculation	(Air 1)*4.578/FulA+B
Air 1	scfm	16	Measured	
Air 2	scfm	17	Measured	
Air1+2	scfm	63	Calculation	Air 1+Air 2
AirCor		119	Calculation	(BaroP-VapPrs)/29.92*520/(460+AirT mp)
AirDen	Assign	120	Calculation	0.0763*AirCor
AirTmp	Select All	21	Measured	
AirVol	Print All	111	Calculation	Air 1/AirCor
AvgExT	Open	64	Calculation	(Exh1+Exh2+Exh3+Exh4+Exh5+Exh6+Exh7+Exh8)/8
AvPsSp		129	Calculation	(EngStr*2/12)*EngSpd
BaroP		29	Measured	
BMEP	psi	121	Calculation	EngTrq/Displ.*EngCyc/2*75.4
BSAC	lb/hph	106	Calculation	(Air 1)*4.578/EngPwr
BSFC	lb/hph	105	Calculation	FulA+B/EngPwr
Day		234	System	Day of month
DayWk		235	System	Day of week
Displ	In^3	126	Calculation	(EngBor/2)^2*3.1416*EngStr*EngCyl
DsFrTq	lb-ft	108	Calculation	[(EngSpd*EngStr/6)T131]*Displ
EngBor	inches	77	Specification	
EngCyc	cycles	82	Specification	
EngCyl	number	79	Specification	
EngPwr	Hp	100	Calculation	EngTrq*EngSpd/5252.113
EngSpd	RPM	13	Measured	
EngStr	inches	78	Specification	

Description Configuration Tip of the day Tutorial

Print displayed configuration channel information

Click the column headers at the top of each column to sort the configuration channels by that column. Right-click in the configuration area to display a pop-up menu of available options.

Tip of the Day Tab

 Refer to “Tip of the Day” on page 6-7.

Tutorial Tab

 Refer to “Tutorial” on page 6-7.

6.6 Limits Application Examples

This section provides examples of WinDyn Limits Safety system applications.


6.6.1 Basic Examples

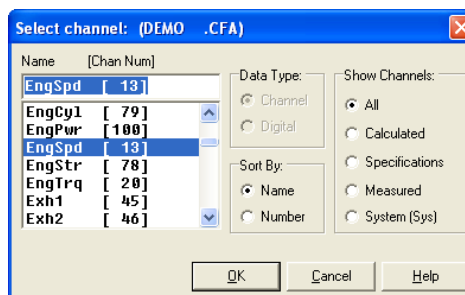
Engine Speed Limit

To set a limit to protect the engine from an over-speed condition, we’ll set both a high warning and high alarm on the engine speed channel (**EngSpd**).

For example, if the engine has a maximum safe speed of 6000 rpm, we can set a high warning at 5800 rpm and a high alarm at 6000 rpm. This will warn the operator as the engine exceeds 5800 rpm and automatically shut down the engine above 6000 rpm.

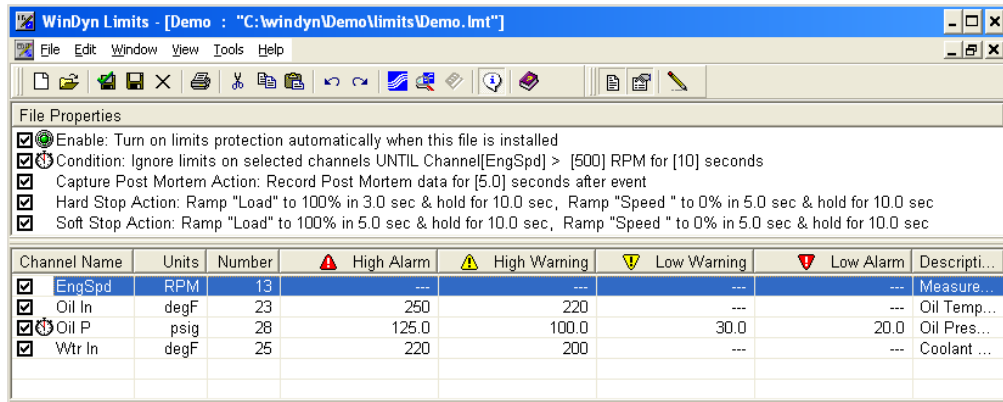
To set a limit on engine speed:

1. From the **Limits** menu, select **Edit>>Insert** or click the **Insert Channel**  toolbar button. The **Select channel: [Filename]** dialog box appears.

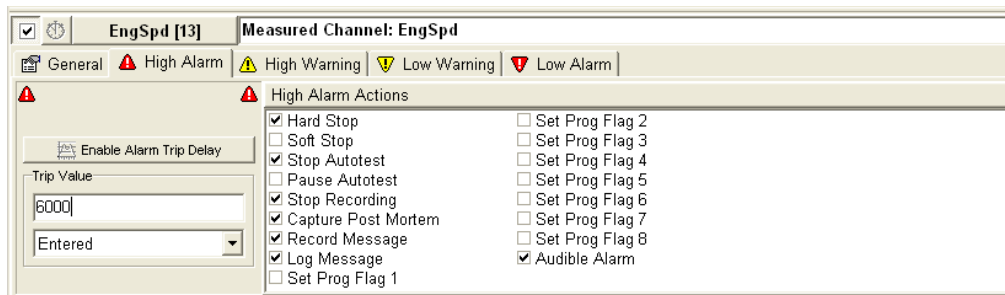


2. Select **EngSpd**.

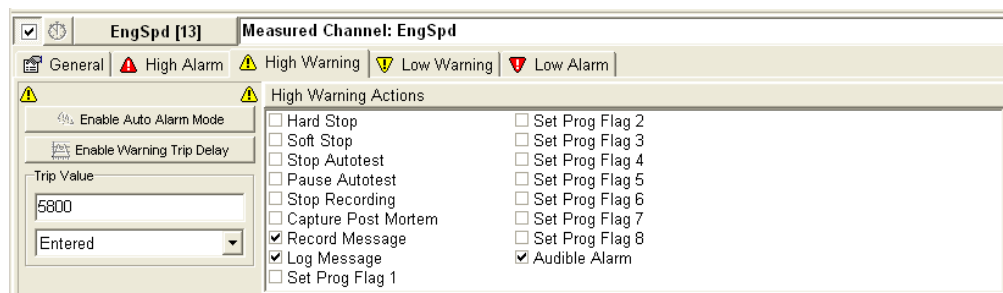
3. Click **OK** to add it to the limits list.



4. Press **ENTER** to open **Channel Properties**; type **6000** for the **High Alarm** trip value.



5. Press **ENTER** to move to the next tab; type **5800** for the **High Warning** trip value.



6. From the **Limits** menu, select **File>>Install, Save** to program the limits into the Test System.
7. With these settings, a High Alarm limit trip will command a hard stop action; this commands the system to apply full load. Depending upon your particular test system, the hard stop will also turn off the ignition and fuel supply.

Coolant Temperature Limit

To set a limit to protect the test engine from coolant over-temperature, we'll set both a high warning and high alarm for coolant outlet temperature (**CoolOt**).

For example, if the normal engine operating temperature is 190° F, we can set the high warning point at 205° F and the high alarm point at 215° F. This will warn the operator whenever the temperature is over 205° F and shut down the engine if the temperature exceeds 215° F.

To set a limit on coolant temperature:

1. Insert channel **CoolOt** into the limits list.
2. Press **ENTER** to open **Channel Properties**; type **215** for the **High Alarm** trip value.
3. Press **ENTER** to move to the next tab; type **205** for the **High Warning** trip value.
4. From the **Limits** menu, select **File>>Install, Save** to program the limits into the test system.

Oil Pressure Limit

To set a limit to protect the engine in case of low oil pressure, we'll set a low warning, a low alarm, and a condition to deactivate the limit when the engine is switched off.

For example, if the normal minimum hot oil pressure is 25 psi at idle, we can set a low warning at 22 psi and a low alarm at 20 psi. We will also set a global condition to allow the system to ignore the oil pressure until the engine is started and running normally. This will warn the operator if the oil pressure drops to 22 psi and shut down the engine if the oil pressure drops below 20 psi. By using an appropriate delay condition, we will not see a warning when the engine is shut off or restarted.

The delay will have two parts: an "ignore limit until" portion and a delay time to continue ignoring the limit for some time after the ignore condition is no longer true.

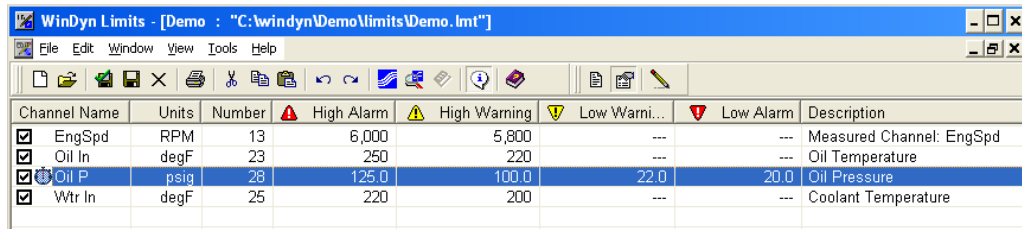
For this example, we choose to ignore limits until engine speed indicates the engine is running and then continue ignoring the limit until the oil pressure gauge has time to reach a correct minimum value.

If our engine cranks at 300 rpm and idles at 800 rpm, we can assume it's started if engine speed is greater than 500 rpm. If the oil pressure takes 5 seconds to reach 25 psi in the slowest case (oil cold), this is an acceptable delay value.

To set a limit on oil pressure:

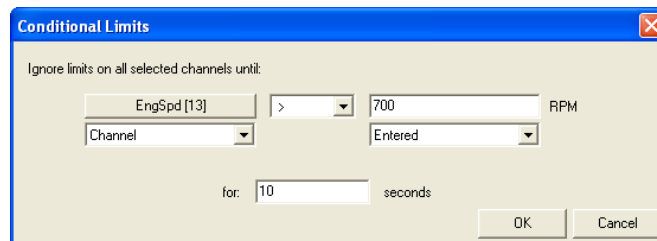
1. Insert channel **Oil P** into the limits list.
2. Press **ENTER** to open **Channel Properties**.
3. Press **ENTER** two more times to move to the Low Warning tab; type **22** for the **Low Warning** trip value.
4. Press **ENTER** again; type **20** for the **Low Alarm** trip value.
5. Click the stopwatch symbol to activate the **Ignore** condition for this channel.

6. From the **Limits** menu, select **View>>File Properties** to display the **Ignore** condition.



Channel Name	Units	Number	High Alarm	High Warning	Low Warni...	Low Alarm	Description
EngSpd	RPM	13	6,000	5,800	---	---	Measured Channel: EngSpd
Oil In	degF	23	250	220	---	---	Oil Temperature
Oil P	psig	28	125.0	100.0	22.0	20.0	Oil Pressure
Wtr In	degF	25	220	200	---	---	Coolant Temperature

7. Double-click the **Condition** line to edit the condition; click the channel button and select **EngSpd** from the list.



Conditional Limits

Ignore limits on all selected channels until:

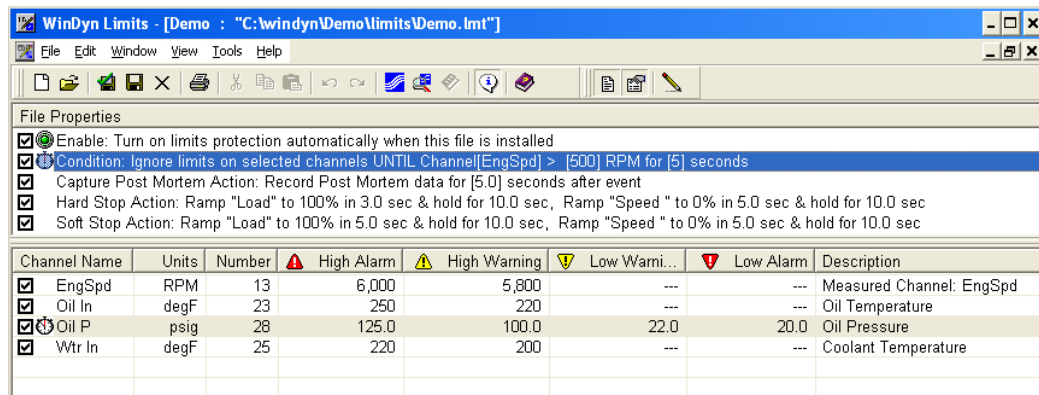
EngSpd [13] > 700 RPM

Channel: [] Entered: []

for: 10 seconds

OK Cancel

8. Type **500** in the **RPM** text box.
9. Type **5** in the **for ___ seconds** text box and click **OK**. The condition should now read **Ignore limits on selected channels until Channel [EngSpd] > [500] rpm for [5] seconds**. The stopwatch symbol should appear next to the Oil P channel in the limits list indicating we applied the Ignore condition to the Oil P limit.



Channel Name	Units	Number	High Alarm	High Warning	Low Warni...	Low Alarm	Description
EngSpd	RPM	13	6,000	5,800	---	---	Measured Channel: EngSpd
Oil In	degF	23	250	220	---	---	Oil Temperature
Oil P	psig	28	125.0	100.0	22.0	20.0	Oil Pressure
Wtr In	degF	25	220	200	---	---	Coolant Temperature

File Properties

- ☒ Enable: Turn on limits protection automatically when this file is installed
- ☒ Condition: Ignore limits on selected channels UNTIL Channel[EngSpd] > [500] RPM for [5] seconds
- ☒ Capture Post Mortem Action: Record Post Mortem data for [5.0] seconds after event
- ☒ Hard Stop Action: Ramp "Load" to 100% in 3.0 sec & hold for 10.0 sec, Ramp "Speed" to 0% in 5.0 sec & hold for 10.0 sec
- ☒ Soft Stop Action: Ramp "Load" to 100% in 5.0 sec & hold for 10.0 sec, Ramp "Speed" to 0% in 5.0 sec & hold for 10.0 sec

When we start the engine, the limit will ignore oil pressure for 5 seconds after engine speed exceeds 500 rpm, then enables to give a warning or alarm. When the engine is turned off, the channel ignores oil pressure once engine speed drops below 500 rpm. Some adjustment of the engine speed and delay values may be necessary to eliminate false warnings or trips in normal operation.

10. Click **OK** to save your changes.
11. From the **Limits** menu, select **File>>Install, Save** to program the limits into the test system.

6.6.2 Advanced Examples

This section details advanced applications of the WinDyn Limits System.



CAUTION: This feature requires a complete understanding of the Configuration Editor and the Limits Editor.

Mapped Oil Pressure Limit

This limit is similar in many respects to the simple oil pressure limit, but it will follow a mapped oil pressure with engine speed. This allows the oil pressure trip point to vary during the test with respect to engine speed.

Take the following example of engine speeds and minimum oil pressures:

Example:

Engine Speed (rpm)	Oil Pressure (psi)
0	0
500	10
1000	15
2000	25
3000	35
4000	45
5000	55
6000	60
7000	65
8000	70

We will create a calculated channel to determine minimum oil pressure for any rpm in the range we defined above. This calculated channel will reference an interpolation table with the above values.

- Enter the values in an interpolation channel and call this channel **OilP_T** for Oil Pressure Table.
- A calculated channel is used for the speed-based oil pressure reading warning values; we call this **Oil W**.
- Another calculated channel is used for the speed-based oil pressure alarm (shutdown) values; call this **Oil A**.
- The **EngSpd** channel is assumed to be channel **125**.

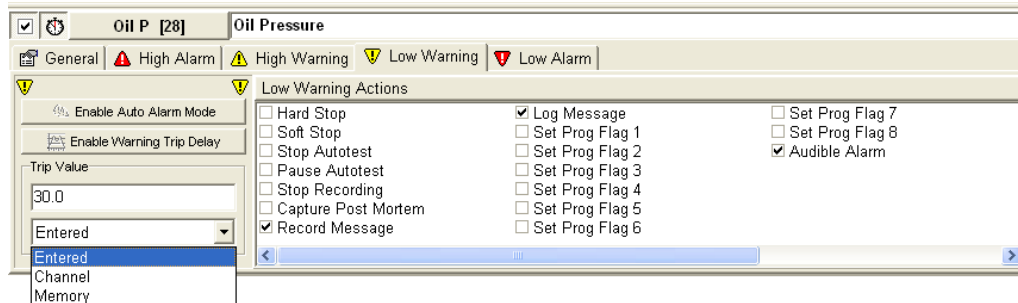
From the **WinDyn** main menu, select **Design>>System Configuration**.

1. Retrieve the configuration file to use.
2. Determine which interpolation table and calculated channels are available. Press **CTRL+Z** to show all defined channels. Interpolation tables are in channels 130 to 139. Channels 100 to 129 are calculated channels, but any unused measured channel (13 to 76) can be converted to a calculated channel.
3. Press **E** for edit, and type the channel number for the interpolation table.
4. Press **ENTER** to accept a variable interval table.
5. Type the values in the table above: **X** values are engine speed; **Y** values are oil pressure; press **ENTER** to move to the next field.
6. Press **ESC** when the last pair of numbers is entered.
7. Press **ENTER** to accept **Yes** when asked if the above data is what you want.
8. Press **ENTER** to accept **No** when asked to print the screen.
9. Type the number for the calculated channel.
10. Type **Oil W** for the channel name and press **ENTER**.
11. Type **psi** for the channel units and press **ENTER**.
12. Type **C125T139+2** and press **ENTER** to direct this channel to input channel **125** to interpolation channel **139** and return the interpolated oil pressure value **+ 2 psi**.
13. Type **0** for the maximum value and press **ENTER**; type **0** for the minimum value and press **ENTER**.
14. Verify the entries are correct and press **ENTER** twice to accept entries and decline a printout.
15. Type the number for the second calculated channel and press **ENTER**.
16. Type **Oil A** for the channel name and press **ENTER**.
17. Type **psi** for the channel units and press **ENTER**.
18. Type **C125T139** and press **ENTER** to direct this channel to input channel **125** to interpolation channel **139** and return the interpolated oil pressure value.
19. Type **0** for the maximum value and press **ENTER**; type **0** for the minimum value and press **ENTER**.
20. Verify the entries are correct and press **ENTER** twice to accept entries and decline a printout.
21. Press **ESC** to return to the main menu, and press **K** to keep the file; click the highlighted name highlighted to keep the same configuration file name; click **Yes** to accept overwriting/ updating the old configuration file with the new changes.
22. Press **Q** to **Quit** and **Y** for **Yes**, you really want to quit.
23. From the **WinDyn** main menu, select **System>>Install>>System Configuration** and install the configuration file just modified.

This completes the entry of the speed-dependent oil pressure channel we will use. The remainder is identical to the basic oil pressure limit example.

Open the **Limits** file and follow these steps to complete the variable limit on oil pressure:

1. Insert channel **Oil P** into the limits list.
2. Press **ENTER** to open **Channel Properties**.
3. Press **ENTER** two more times to move to the **Low Warning** tab; click the drop-down arrow next to **Entered** and select **Channel**. Click the channel button above this area and select **Oil W**. This selects the Oil Warning calculation for the Low Warning trip value.



4. Press **ENTER** again; click the drop-down arrow next to **Entered** and select **Channel**; click the channel button above this area and select **Oil A**. This selects the Oil Alarm calculation for the Low Alarm trip value.
5. Click the stopwatch symbol to activate the **Ignore** condition for this channel.
6. From the **Limits** menu, select **View>>File Properties** to display the Ignore condition.
7. Double-click the **Condition** line to edit the condition; click the channel button and select **EngSpd** from the list.
8. Type **500** as a minimum rpm for a running engine in the **RPM** text box.
9. Type **5** in the **for ___ seconds** text box and click **OK**. The condition should now read **Ignore limits on selected channels until Channel [EngSpd] > [500] rpm for [5] seconds**. The channel properties area should display the stopwatch symbol in color, indicating we applied the Ignore condition to the Oil P limit. When we start the engine, the limit will ignore oil pressure for 5 seconds after engine speed exceeds 500 rpm, then enables to give a warning or alarm. When the engine is turned off, the channel ignores oil pressure once engine speed drops below 500 rpm.
10. From the **Limits** menu, select **File>>Install, Save** to program the limits into the test system.
11. Some adjustment of the engine speed and delay values may be necessary to eliminate false warnings or trips in normal operation.

CHAPTER 7

CONFIGURATION UTILITY

IN THIS CHAPTER

- **Configuration Files**
- **Configuration Utility**
 - Viewing a Configuration File
 - Viewing All Defined Channels
 - Viewing Calculation Dependencies
 - Viewing a Configuration Summary
 - Viewing Remote Screen Definitions
 - Viewing Other Definitions
- **Customizing the Configuration Display**
 - Sorting Displayed Channels
 - Showing Units for Displayed Channels
 - Showing Channel Names in Calculations
- **Searching the Configuration**
 - Searching Calculations for a Particular Channel
 - Searching Calculations for Undefined Channels
 - Searching Calculations for Self References
- **Printing Configuration Information**



7.1 Configuration Files

The configuration file is the master file for all SuperFlow data acquisition systems that utilize the WinDyn™ program. This configuration is created and modified using the System Configuration editor accessed through WinDyn. The configuration file specifies in detail all of the channels the system is capable of measuring and sets the various programmable channels available to the user which can be configured to suit a wide range of specific testing requirements.

The configuration file exists in two formats: *.cfd and *.cfa. The CFD file is the editing format. The CFA file is the absolute compiled version of the CFD file and is the actual file installed in the data acquisition system.

The configuration file is the master system file because most of the other file types used by SuperFlow Technologies Group data acquisition systems (Limits, Test Profiles, etc.) are valid only with the configuration file they are associated with.

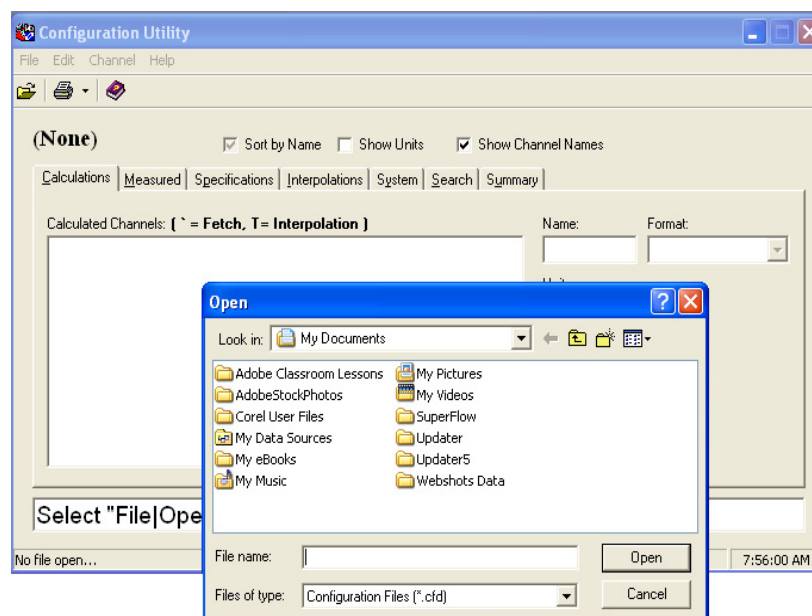
7.2 Configuration Utility



The Configuration Utility (DEFTool) can display one SuperFlow configuration file at a time in a read-only format. However, you can run multiple copies of the program simultaneously to compare different configuration files. Users can view configuration information in a clear, easy-to-read format, but they cannot change the configuration using this tool. For instance, the Configuration Utility is useful for quickly viewing the formulas used to calculate important channels such as corrected power and torque, or to see how a sensor input channel is formatted.

Viewing a Configuration File

1. From any **WinDyn** menu, select **Tools>>View System Configurations**.



2. When the **Configuration Utility** opens, select **File>>Open** or press **CTRL+O**.

3. The **Open** dialog box appears. Select a configuration file and click **Open**.
 - The first time the program starts, it opens to the **My Documents** folder. After a file is selected, the Configuration Utility “remembers” that location.
 - The Configuration Utility program can retrieve a file from any memory media, i.e., hard drive, flash drive, CD, etc. You can browse to alternative locations.

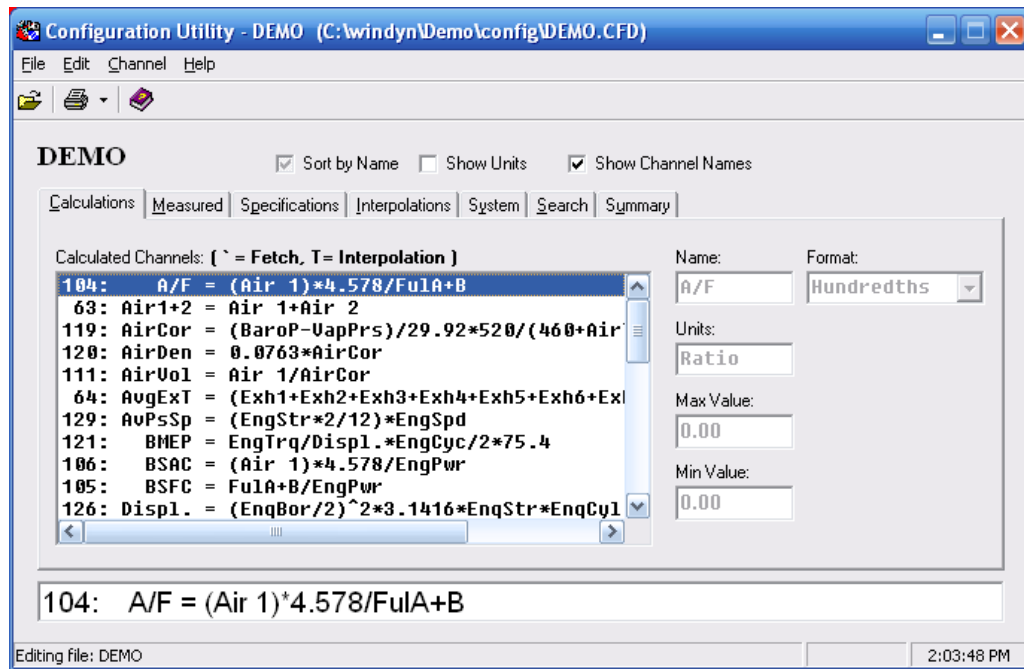



Figure 7-1. Configuration Utility

Each of the tabs displays a different channel type. Search and Summary are special-purpose tabs and are not channel types.

- **Calculations:** Shows all calculated channels as a group, using channel names or channel numbers (EngSpd*EngTrq/5252).
- **Measured:** Name, format, default value, filter rate, and other relevant information for sensor input channels (thermocouples, voltages, frequencies).
- **Specifications:** Default values for specification (constants) channels.
- **Interpolations:** Shows the complete table definition.
- **System:** Shows the channel definition for the system channels (time, date, etc.).
- **Search:** Search for and display how a particular channel is used in calculated channels (see “Searching the Configuration” on page 7-8). The Configuration Utility can also search for undefined channels used in calculations and self references.
- **Summary:** A configuration file summary including version number, control type, and heading information.

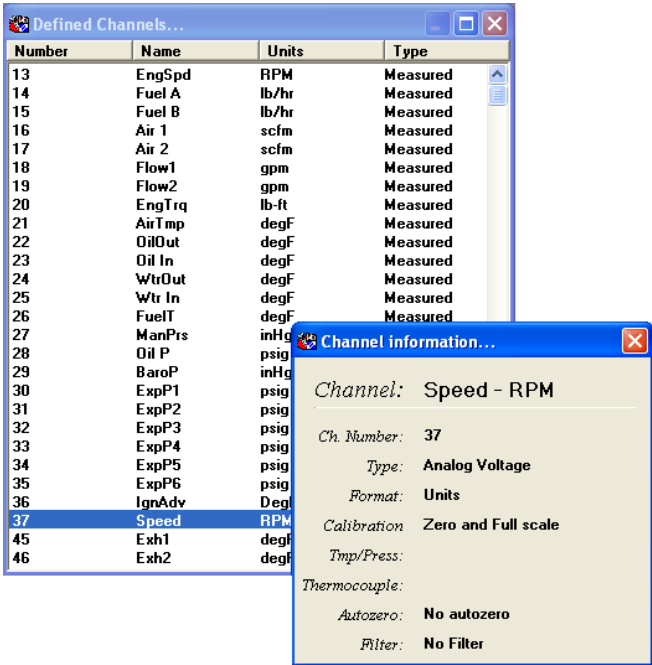
For instance, click the **Specifications** tab to view all the defined specifications in the currently opened configuration (undefined channels are not displayed). From the displayed list of specification channels, select one to view the information associated with the channel. All of the other channel type tabs work in a similar manner.

Note that many channel tabs have options to sort, show units, and display channel names or numbers.

 Refer to “Customizing the Configuration Display” on page 7-7.

Viewing All Defined Channels

From the **Configuration Utility** menu, select **Channel>>Show All** or press **CTRL+Z** to display the **Defined Channels** window.

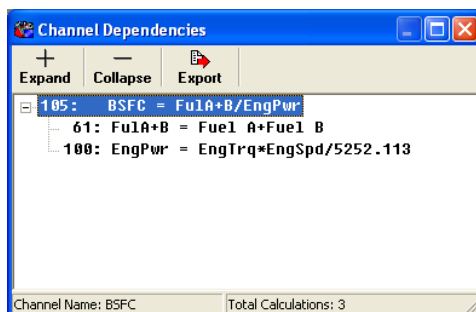


Click the header buttons at the top of the window to sort the display by channel number, name, units, or type. Double-click the same header button to sort the list in descending (versus ascending) order. Double-click any channel in the Defined Channels window to display a secondary window with detailed information about the channel selected.

NOTE: You do not have to close the Defined Channels window to continue using the main DEFTool window. Click anywhere on the main DEFTool window to send the Defined Channels window to the background.

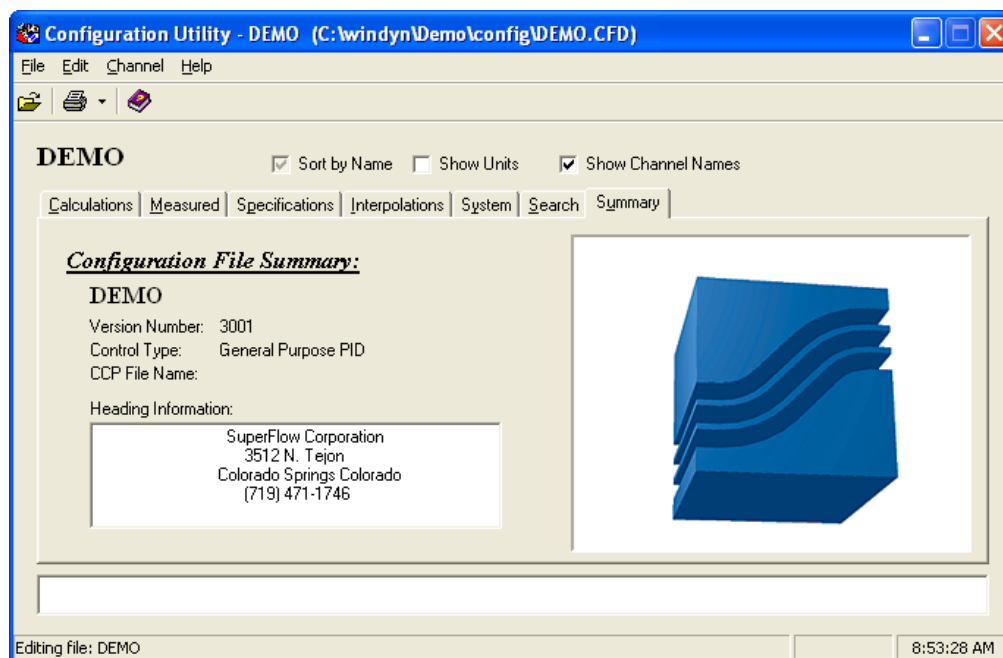
Viewing Calculation Dependencies

The Configuration Utility can display all channels and calculations required for any calculated channel (also known as the “dependency chain”). Use this feature to view the relationships between calculations in a configuration file. To view the dependencies for a calculated channel, select a calculation, then from the **Configuration Utility** menu, select **Channel>>Show Dependencies**.



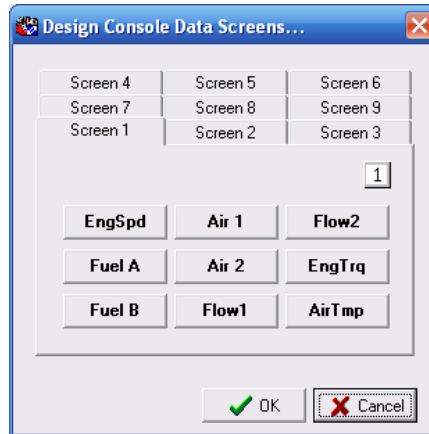
Viewing a Configuration Summary

Click the **Summary** tab on the **Configuration Utility** to view a summary of the currently opened configurations.



Viewing Remote Screen Definitions

From the **Configuration Utility** menu, select **Edit>>Console Data Screens**.



The channels displayed in the Design Console Data Screens dialog box will appear on the Remote Data Acquisition screens (for example, the hand-held or operators console).

The Configuration Utility shows how those nine screens are configured, meaning, what channels are on each screen.

7.3 Customizing the Configuration Display

Sorting Displayed Channels

In the **Configuration Utility** dialog box, select the **Sort by Name** check box above the row of tabs to reorder the displayed channels.

- **No check mark:** Sort channels by number.
- **Gray check mark:** Sort channels by name (ascending order)
- **Black check mark:** Sort channels by name (descending order)

Repeatedly click the **Sort by Name** check box to cycle through the various sort settings.

Showing Units for Displayed Channels

In the **Configuration Utility** dialog box, select the **Show Units** check box to show/hide the units associated with each displayed channel. Note that this option has no effect when viewing certain channel types (such as calculations or Interpolation tables).

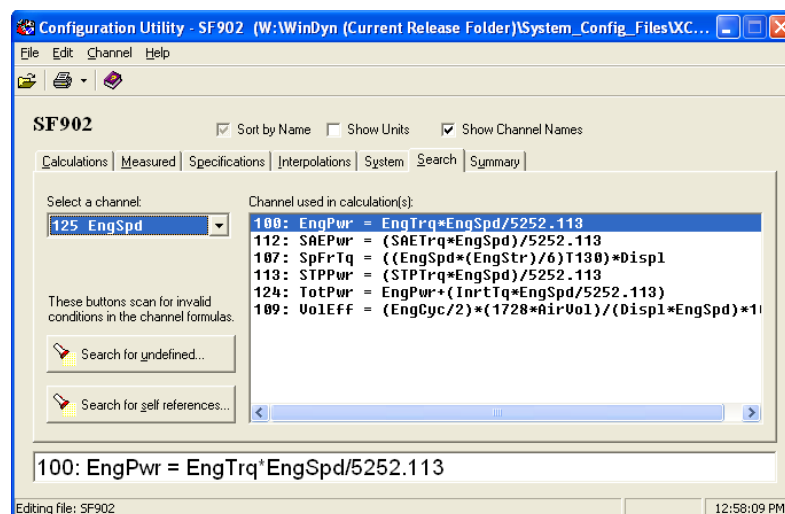
Showing Channel Names in Calculations

In the **Configuration Utility** dialog box, select the **Show Channel Names** check box to view the displayed calculations using either channel numbers (when the option is cleared) or channel names (when the option is selected). This affects the displayed calculations on both the Calculations tab and the Search tab.

7.4 Searching the Configuration

Searching Calculations for a Particular Channel

The Configuration Utility can search for and display all calculated channels that reference a particular channel, for instance, a search for all the calculations that use Engine Speed (EngSpd).



To search the currently displayed configuration, first click the **Search** tab. Click the down arrow in the **Select a channel** drop-down list and select a channel. A list of all the calculations that use the selected channel will appear in the list on the right. If the channel selected is not used in any calculations, the box on the right displays **(not referenced)**.

Searching Calculations for Undefined Channels

The Configuration Utility can search for any undefined channels used in calculations. This feature verifies that no invalid or missing channels are referenced by any calculations.

To search the currently displayed configuration for undefined channels, click the **Search** tab. Then click the **Search for undefined...** button. If any of the calculations reference one or more undefined channels, a list of the undefined channels displays. Otherwise, a **File OK** dialog box appears indicating no undefined channels were found.

Searching Calculations for Self References

The Configuration Utility can search for self references in calculated channels. Self references indicate a poorly designed configuration file that will lock up the sensor box if used. Click the **Search** tab, then click **Search for self references**. All calculated channels are scanned to see if any calculation references to itself are in its dependency chain. If not, a **File OK** dialog box appears indicating no self references were found.

7.4.1 Printing Configuration Information

The Configuration Utility can print a list of all the defined channels in the currently opened configuration. The printout includes the formula for each calculated channel. To print the channel listing, from the **Configuration Utility** menu, select **File>>Print** and select **Channels**, **Tables**, or **All**, click the **Print Channels** toolbar button, or press **CTRL+P**.

CHAPTER 8

WINDYN COMMUNICATIONS

IN THIS CHAPTER

- **Overview**
- **Communication Requirements**
 - Configuring WinDyn Communications
- **Installing Hardware Components**
 - Installing the Network Card
 - Installing Network Cable
- **NetBEUI Communications**
 - Windows XP and Vista
 - Windows 95/98/2000/NT
- **Connecting Multiple WinDyn Computers**
- **Communication Troubleshooting**



8.1 Overview

WComNet is a program that provides communication between WinDyn™ and SuperFlow test systems using Network Basic Input/Output System (NetBIOS) network communication protocols. WComNet must be running and configured correctly to allow WinDyn to communicate with a SuperFlow data acquisition test system.

When the WinDyn program starts, WComNet automatically launches. The SuperFlow WComNet icon displays in the lower-right corner of the Microsoft® Windows® system tray (near the clock). A green colored dot in the corner of the icon indicates WinDyn is communicating with a system. A red X across the icon indicates no communication.

- If WinDyn connects with the data acquisition system, no further effort is required.
- If WinDyn does not connect with the data acquisition system, or if you are connecting multiple WinDyn computers on a network, the information contained in this chapter can help users understand WComNet and isolate the problem.

8.2 Communication Requirements

WinDyn communicates over a Local Area Network (LAN) configuration.

Computer Hardware

As part of the WinDyn computer requirements, a Network Interface Card (NIC) must be installed in the computer. Note that some computers have the network interface hardware built into the main computer board. The NIC has a standard network connection—usually an RJ-45 female jack to accommodate a Cat-5 cable. Some older NICs may also have a BNC male connector to accommodate a coaxial (COAX) cable.

NOTE: All SuperFlow systems built after January 2004 only accommodate a Cat-5 network cable. Some older SuperFlow systems may have both Cat-5 and COAX options. A few very early systems have only COAX.

Depending on which type is used, a Cat-5 or COAX cable is required to connect the computer to the SuperFlow data acquisition system. If necessary, a LAN router or workgroup hub can be used with the system.

Computer Software

As part of the WinDyn software requirements, a Windows NetBIOS protocol must be installed. SuperFlow uses NetBIOS Extended User Interface (NetBEUI).



For a list of hardware and software requirements, refer to section 1.1.1, “Computer Requirements,” on page 1-3 or visit the SuperFlow Web site at www.superflow.com.



IMPORTANT: The NetBEUI protocol allows SuperFlow system data to continuously broadcast over a LAN or Wide Area Network (WAN). This can compromise the overall performance of a large network by seeming to “slow down” normal traffic on the network. This effect should be considered when setting up a SuperFlow data acquisition system.

8.2.1 Configuring WinDyn Communications

Generally, when a WinDyn computer is connected to a network, one or more SuperFlow test systems are available on the same network. Before the computer can communicate with a specific SuperFlow test system, WComNet must be directed to that test system using NetBIOS names.



IMPORTANT: These names must be defined even with only one computer and one test system.

- The data acquisition system name (usually referred to as a **node**) is set at the SuperFlow factory or by a service engineer. Some systems may have more than one node.
- WComNet is configured with a group name and a unique name.
 - The group name (SuperFlowNet) is shared by all SuperFlow data acquisition and computer systems on the same network. The group name is the same for all SuperFlow systems and is never changed.
 - Each computer on the network running WinDyn must have a unique name that identifies it. These names can be any combination of characters and numbers.

By default, WinDyn assigns the unique name **WinDynPC** upon installation on a computer. As long as this is the only computer on a LAN running WinDyn, it can remain as installed. If multiple computers all running WinDyn are connected on the network each must be assigned a unique name to prevent conflicts between computers.



See section 8.5, “Connecting Multiple WinDyn Computers.”

When connecting a SuperFlow data acquisition system to your “house” network or if multiple data acquisition systems of the same type are connected to a single LAN, provisions must be made to prevent communication conflicts (for example, all SF-902 engine dynamometers are given the same node name at the factory – typically **XConsole**). If multiple SF-902 dynamometers are located in a facility and connected to the same house network, perform one of the two following options:

- Install a second NIC on the computer. Use one for the SuperFlow system and the other for the house network.
 - Disable NetBEUI in the Network Properties on the NIC used for the house network.
 - Disable TCP/IP on the NIC used with the SuperFlow system.

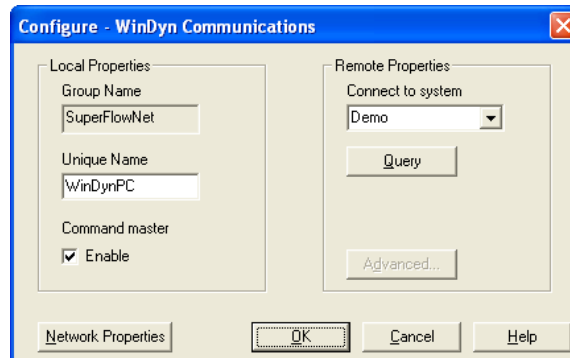
This allows the computer itself to be used on the network but isolates the SuperFlow system from the house network. The only downside is users cannot view the system data on remote computers.

- Assign a different node name to each system, for example, if you have two test cells, one could have the node name **Cell1** and the other **Cell2**. The advantage of this option is users can view real-time data from each test cell on a remote connected computer running WinDyn. Only SuperFlow Customer Service technicians can change or direct the change of node names.

NOTE: Node names that start with an asterisk (*) are not allowed; also, names should not start with the characters **IBM**.

To access the WinDyn communication configuration, from the main **WinDyn** menu, select **View>>Communications**, or click the **WComNet** icon in the system tray (where the Windows clock displays).

The **Configure – WinDyn Communications** dialog box appears.



The **Local Properties** area contains the values that configure the computer.

- The **Group Name (SuperFlowNet)** is fixed and cannot be changed
- The **Unique Name** distinguishes the computer from other WinDyn computers on the network. **WinDynPC** is the default name assigned upon installation. Type any name within the limits of the provided space.
- **Command master** specifies which computer will serve as the command master for the test system. When two or more WinDyn computers are monitoring the same test system, only one computer should be allowed to send commands to the test system to avoid conflicts.

The **Remote Properties** area groups the controls used to query the network and specify which test system the computer is connected to.

- Click the **Query** button to query the network for all devices with the same Group Name (SuperFlowNet). When powered on, any device with this name will respond and activate (turn from gray to black) the **Advanced** button.
- Once queried, the name of any SuperFlow data acquisition connected to the network and powered on displays in the **Connect to system** drop-down list. From this list, select a dynamometer system to connect to and click **OK**. WinDyn then connects to that system.
 - If the **Advanced** button does not activate indicating a system was detected, a problem exists in the network setup, or the dynamometer system is not turned on.
 - If the **Advanced** button does activate, click it to view the individual system nodes connected to the computer in the **Devices on SuperFlow Net** drop-down list.

To view details of a particular device, select it and click the **Details** button.

The **Op System** button accesses the low-level operating system software of a test system. This access is password-protected; only SuperFlow service technicians use it.

8.3 Installing Hardware Components

NOTE: *The following instructions are necessarily vague because of the variability in computer hardware and software in the computer industry.*

Fundamental Requirements

- The computer and the data acquisition sensor box must be properly connected to each other using a 10Base-T (Cat-5) Ethernet cable; 10Base-2 (COAX cable) is also available in some older systems.
- The computer must be running Microsoft Windows.



See the computer requirements in section 1.1.1 on page 1-3 or visit www.superflow.com for the most current list.

These instructions assume the use of 10Base-T (Cat-5) cable and Windows XP. The WComNet programs in earlier versions of WinDyn (pre-version 2.2) use a different format and may not match these instructions.

8.3.1 Installing the Network Card

If the computer did not come with a network adapter, install an appropriate Network Interface Card (NIC). Follow the instructions that came with the network card for installation. We suggest using a 10/100 MBPS PCI network interface card that is 10Base-T compatible (RJ-45).

NOTE: *For certain older systems, the EtherNet communication port on the SuperFlow CPU mother board may not have an RJ-45 connection. For these systems, a BNC connection is required and the NIC must have a BNC port or EtherNet hub with a BNC port.*

8.3.2 Installing Network Cable

Cat-5

The SuperFlow Data Acquisition system (sensor box) is typically shipped for use with a 10Base-T (Cat-5) cable. Connect a Cat-5 cable of suitable length to the **Computer Network** connector on the sensor box. Connect the other end of the cable to the Local Area Network (LAN) port on the computer or to a network workgroup hub.



SuperFlow sensor box processor boards (with the exception of early revision 1942 and 2242 boards) have two 10Base-T RJ-45 connectors – one for MDI (Medium Dependent Interface) and one for MDIX (Medium Dependent Interface - crossed). This provides an easy way to connect either a straight (MDI) or crossover (MDIX) Cat-5 cable or use a network hub without having to search for the right cable. If communication cannot be established, switch the cable from one port to the other and try again. An activity Light-Emitting Diode (LED) on the processor card will flash to indicate the correct connection.

- 2620 processor cards: LAN ports are labeled **J32** and **J33**
- 1942 processor cards: Ports are **J6** and **J7**
- 2242 cards: Ports are **J18** and **J19**

Networks using 10Base-T cabling are typically connected using a star topology, with a hub at the center of the star. Each device is then connected to the hub using a length of Cat-5 cable. This cable is terminated so all of the pins on one end connect to the corresponding pins at the other end. Cables terminated in this manner are known as MDI cables.



Figure 8-1. Star Network Layout

If the network consists of only two devices (for example, a sensor box and a computer), you can eliminate the hub from the network by connecting the devices together using a single Cat-5 cable. In these situations, the Cat-5 cable normally should be the crossover type where two wires are switched (crossed over) at the ends. Cables terminated in this manner are referred to as MDIX. However, since the SuperFlow systems have both MDI and MDIX ports on the CPU circuit board, the type of cable does not matter.

Coax Network Cabling

The 1942 and 2242 processor boards also have a BNC (coaxial) network port. These boards can be configured for either Cat-5 or BNC coax cables. Early 1942 boards (Rev B) have only BNC ports.

1. There are two jumpers on the boards that determine which communication port type is used. These jumpers are labeled JP10 and JP13 on the 1942 and JP16 and JP17 on the 2242.

- TBase-T position is for Cat-5
- Tbase-2 position is for Coaxial

Ensure the jumpers are in the correct position.

2. Connect a suitable length of coaxial cable from the P1 bulkhead BNC connector of the sensor box to the network card installed in your computer or in a network workgroup hub. Place a T adapter and a grounded 50-ohm terminator on the cable.

The 50-ohm terminator should have a grounding wire to connect the ground lug to the screw that secures the network card or any grounding point on the computer mainframe.

3. Make sure the processor circuit board inside the sensor box also has a T and a terminator connected to a short length of coaxial cable also connected to the P1 bulkhead connector.

NOTE: Each end of the cable must have a T and a terminator, or you will experience unreliable communications.



Coaxial Cable Connectors

If changing from Tbase-2 (coax) to Tbase-T (Cat-5):

1. Remove the BNC cables and connectors.
2. Switch the jumpers JP10 and JP13 to the Tbase-2 position.
3. Connect a short Cat-5 cable from the RJ-45 connector on the sensor box panel bulkhead to the appropriate connector on the processor card.
4. Connect a suitable length of Cat-5 cable from the P3 RJ-45 connector to the LAN port on the computer or network hub.

8.4 NetBEUI Communications

WinDyn requires the NetBEUI network communications protocol to be installed in any computer used with the SuperFlow New Generation Electronics (NGE) Data Acquisition System. Installing NetBEUI allows WinDyn to “see” the data broadcast by the system.

To check if NetBEUI is installed:

- Open the **Network Properties** dialog box for the Local Area Network adapter used with the SuperFlow system.
- On the **General** tab, notice whether NetBEUI is listed and has a check mark. If no check appears, click the box to put one there. If NetBEUI is not listed, follow the procedure below.

8.4.1 Windows XP and Vista

The NetBEUI protocol normally installs automatically when WinDyn is installed on a Microsoft Windows XP or Vista computer. However, in some situations NetBEUI fails to install in the normal process. When this happens, NetBEUI must be independently installed using a special program available on the WinDyn CD.



IMPORTANT: Do not attempt to install NetBEUI from the **Windows Network Properties** dialog box. This process is not compatible with WinDyn and will corrupt WComNet. If this was done, the protocol must be un-installed and the **NETNBF.INF** file deleted from the **Windows\Inf** folder before proceeding with the following procedure.

If WinDyn fails to install NetBEUI, you can run the installation program independently.

To do this:

1. Close all programs that are running.
2. Insert the **WinDyn** installation CD in the computer.
3. Click the **Browse CD** button at the top of the displayed window.
4. Locate the **NetBEUI** folder and open it.
5. Double-click the **INSTBEUI.EXE** program icon. A window briefly appears signifying the installation executed.
6. Remove the CD and restart the computer.



If NetBEUI still fails to install, contact SuperFlow Customer Service for assistance.

8.4.2 Windows 95/98/2000/NT

For earlier versions of Windows (and WinDyn version 2.1 and earlier), you must manually install and configure the NetBEUI protocol.

1. Start the computer. Click **Start** and select **Start>>Settings>>Control Panel**.
2. Double-click the **Network** icon. If NetBEUI is not listed:
 - Click **Add**
 - Click **Protocol**
 - Select **Microsoft** in the **Manufacturers** list
 - Select **NetBEUI** in the **Network Protocols** list
 - Click **OK** and follow the on-screen instructions

If more than one protocol is listed:

- Select **NetBEUI**
- Click **Properties**
- Click the **Advanced** tab
- In the lower-left corner, select **Set this protocol to be the default protocol**
- Click **OK**, then click **OK** in the **Network** dialog box

NOTE: Restart the computer for the network property changes to take effect.

8.5 Connecting Multiple WinDyn Computers

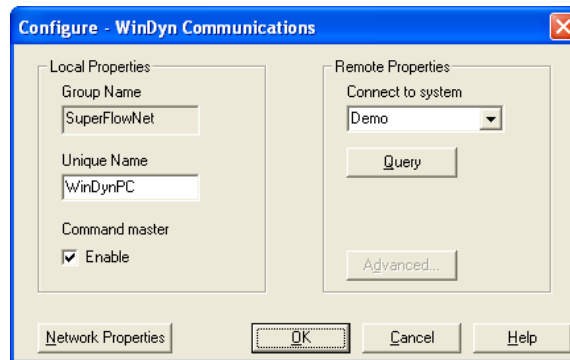
WinDyn Command Master Logic

The primary purpose of the command master WinDyn computer is to be the only computer receiving automatically saved data files from the remote system.

For each SuperFlow New Generation Electronics (NGE) system, only one command master can be connected at any time. The command master is the only computer allowed to perform certain operations on a system. This is useful for reducing any confusion that may occur if several WinDyn computers are connected to a single system such as not being able to find data files and whether configuration files were installed and from which computer.

In general, the WinDyn system located nearest to the dynamometer system should be the command master for that system.

1. To set the command master names, from the main **WinDyn** menu, select **View>> Communications**, or click the **WComNet** icon in the system tray (where the Windows clock displays). The **Configure – WinDyn Communications** dialog box appears.



2. In the **Local Properties** area, select the **Command master** option to specify which computer will serve as the command master for the test system.

Command Master Functionality

Only the command master can:

- Broadcast the time to the remote systems.
- Automatically save a file from the remote system including auto data files and post mortem files.
- Install files to the remote system.
- Respond to a request for a list of files that can be installed to the remote system.
- Respond to a request for access to a function, i.e., password function validation.
- Start, stop, pause, or resume a test.
- Record or erase data lines or comment lines.
- Calibrate or zero channels.

When a new configuration file is installed into the remote system, the configuration file synchronizes with the configuration file of all non-command master WinDyn computers connected to the remote system.

Items Specifically Affected by Command Master Status

If not a command master, the following menu items are disabled in WinDyn:

- **System>>Calibrate**
- **System>>Install>>System Configuration**
- **System>>Install>>Specifications**
- **System>>Install>>Test Profile**
- **System>>Install>>Limits Profile**
- **System>>Install>>Set of Files**
- **System>>Install>>System Calibration**
- **System>>Install>>Control Parameters**
- **System>>Install>>Hardware Configuration**
- **System>>Save>>Post Mortem Data**

If not a command master, the following toolbar items are disabled in WinDyn:

- Test toolbar
 - Start Test
 - Stop Test
 - Pause Test
 - Resume Test
 - Manual Record
- System toolbar
 - Calibrate
- Advanced toolbar
 - Calibrate

- If not a command master, the following Control Panel items are disabled in WinDyn:
 - Start autotest
 - Stop autotest
 - Pause autotest
 - Resume autotest
 - Record data
 - Record comment
 - Erase data
 - Erase last line

Known Deficiencies

None of the limits functionality is affected by the status of the command master except for some methods of installing the limits file:

- Turning limits on/off
- Resetting limits
- Acknowledging limits
- Viewing system messages
- Receiving Limits-generated post mortem files

Some file installations still perform when not the command master:

- Test groups
- Limits editor
- Specifications editor when manually setting individual channels

8.6 Communication Troubleshooting

If WinDyn does not communicate, check the LAN activity light on the Central Processing Unit (CPU) circuit board inside the sensor box to make sure it flickers (a flickering light indicates a good cable connection).

Activity light does not flicker	<p>Several possible causes:</p> <ul style="list-style-type: none">• Wrong LAN port used. Turn the system power off and swap the Cat-5 cable between the LAN connectors on the CPU circuit board.• Defective or disconnected Local Area Network (LAN) cable.• Defective network adapter or Network Interface Card (NIC) in computer.• Conflict with router or hub if used. Remove the router or local network connections to verify.• Defective communication circuit in sensor box.
Activity light flickers	<p>Several possible causes:</p> <ul style="list-style-type: none">• Check your network configuration settings and verify that NetBEUI is installed (see section 8.4, "NetBEUI Communications," on page 8-9).• For Windows 95/98/2000/ME, verify that NetBEUI is set as the default protocol.• Check for other protocols and adapters assigned to the NIC. Generally, normal house or Internet protocols (TCP/IP) do not cause conflicts but may. Dial-up adapters frequently can cause communication conflicts.• Check to make sure the computer was not set up to use as both an Internet and dyno computer (sometimes Internet security programs and firewalls can cause communication conflicts).

CHAPTER 9

DATABASE MANAGER

IN THIS CHAPTER

- **Introduction**
- **Database Navigation**
- **Test Sequence**
 - Adding Existing Records to the Database
 - Modifying a Database Record
- **Database Reporting**
 - Concise Reports
 - Column Reports
- **Searching the Database**
- **Sorting the Database**
 - Database Field Descriptions



9.1 Introduction

The WinDyn™ DataLib program is an application designed to help users manage and archive stored data files.

Whenever test data is stored to disk, information about the test can be stored in a database table. The user can then review all saved test records and even search for specific records based on the owner's name, device ID number, work order, etc.

The DataLib program works together with the WinDyn and Stored programs. The Database Manager menu item must be checked on the System Preferences menu. From the **WinDyn** main menu, select **System>>Preferences>>Test Database Manager**. If the Test Database Manager menu item is not checked, select this menu sequence again.

To open the database, from the **WinDyn** main menu, select **View>>Database** or click the **Database** toolbar button.

WinDyn Database - Demo1 (C:\windyn\Demo\data Demo\Demo1)

File Record Database View Help

Last Name Telephone

First Name Contact

Address 1

Address 2

City Country

State Postal Code

Searchable fields are labeled using this color





Owner Test Device Miscellaneous Test Description Test Information Picture Grid

9.2 Database Navigation




The database maintains a cursor (pointer) to a record in the database table. This is the current record. To move the cursor to another record, click the **First**, **Previous**, **Next**, or **Last** buttons on the WinDyn Database toolbar.







Navigation Buttons

- | | | |
|---|--------------|---|
|  | First | Move database cursor to first record |
|  | Prior | Move database cursor to previous record |
|  | Next | Move database cursor to next record |
|  | Last | Move database cursor to last record |

Database Edit Buttons

- | | | |
|---|---------------|--|
|  | Edit | Modify the current database record |
|  | Save | Save changes made to the current database record |
|  | Cancel | Abandon changes made to the current record |

Miscellaneous Buttons

- | | | |
|---|---------------------|---|
|  | Search | Search the database |
|  | Report | Create and print a report |
|  | Current Data | Make the record the current record |
|  | Test Data | Display test data associated with a database record |

On the **Grid** page, you can move the cursor by pressing the **PAGE UP/PAGE DOWN** and **UP/DOWN ARROW** keyboard buttons. The current record highlights.

Viewing Data Associated with a Database Record

To view the test data associated with a particular database record, from the **WinDyn Database** menu select **View>>Test Data** or click the **Test Data** toolbar button. The Stored Data Viewer feature activates and the data file automatically displays.

Returning to WinDyn Current Data Screens

To view current data, from the **WinDyn Database** menu select **View>>Current Data** or click the **Current Data** toolbar button. This moves the current data screen to the desktop and makes it the active window.

Returning to WinDyn Stored Data Viewer

To view stored data, from the **WinDyn Database** menu select **View>>Test Data** or click the **Test Data** toolbar button. The Stored Data Viewer moves to the desktop and becomes the active window.

9.3 Using the Database

9.3.1 Database Field Descriptions

Field labels in red are searchable.

WinDyn Database - SF-902 demo3 (C:\windyn\Demo\data Demo\SF-902 demo3)

File Record Database View Help

Last Name: MCMILLEN Telephone: 303.221.6559
 First Name: Joe Contact: John Smith
 Address 1: 5411 Main Street
 Address 2: Suite 3A
 City: Denver Country: USA
 State: CO Postal Code: 80221

Searchable fields are labeled using **this color**

Owner Test Device Miscellaneous Test Description Test Information Picture Grid

Owner Tab

This page contains information about the owner of the system under test.

- **Last Name:** The owner's last name (searchable)
- **First Name:** The owner's first name
- **Address 1:** First address line
- **Address 2:** Second address line, such as suite, building, or route number
- **City:** City where the owner resides
- **State:** State where the owner resides
- **Telephone:** Owner's telephone number (include area cod)
- **Contact:** If the owner is a business, this field could be used for the customer contact name
- **Country:** Country where the owner resides
- **Postal Code:** Postal code for the owner's address

Test Device Tab

This page contains information about the system under test. The system may be an engine only, engine/transmission, or an entire vehicle. Type information in all applicable fields. Any fields not pertinent to the system under test may be left blank or filled with N/A for Not Applicable.

Vehicle		Engine		Drive Train	
Veh Make	FORD	Eng Make	FORD	Axle Ratio	4.11
Veh Model	F-150	Eng Model	460	Axles	1
Year	2006	Type	V-8	Tire Type	Rad
VIN	VDAVFB2DM100162	Eng Ser no	DZ3879S47	Tire Size	P150x14
ID no	Unit 12	Perf Spec	0T-1234	Tire Tread	M+S
Weight	2300	Transmission		Searchable fields are labeled using this color	
Mileage	89456	Make	Ford		
		Model	C-6		
		Trns Type	3-speed auto		

Vehicle

- **Veh Make:** Vehicle manufacturer (searchable)
- **Veh Model:** Vehicle model (searchable)
- **Year:** Year of vehicle manufacture
- **VIN:** Vehicle identification number (searchable)
- **ID no:** Owner's vehicle identification number
- **Weight:** Vehicle weight
- **Mileage:** Vehicle mileage

Engine

- **Eng Make:** Engine manufacturer (searchable)
- **Eng Model:** Engine model (searchable)
- **Type:** Engine type
- **Eng Ser no:** Engine serial number
- **Perf Spec:** Performance specification number

Transmission

- **Make:** Transmission manufacturer
- **Model:** Transmission model
- **Trns Type:** Transmission type

Drive Train

These entries typically are used for chassis dynamometers.

- **Axle Ratio:** Drive axle ratio
- **Axes:** Number of drive axles
- **Tire Type:** Type of tire on drive rolls
- **Tire Size:** Size of tire on drive rolls
- **Tire Tread:** Type of tire tread on drive rolls

Miscellaneous Tab

This page contains fields for miscellaneous data about the unit under test. Type information in all applicable fields. Any fields not pertinent to the system under test may left blank or filled with N/A for Not Applicable.

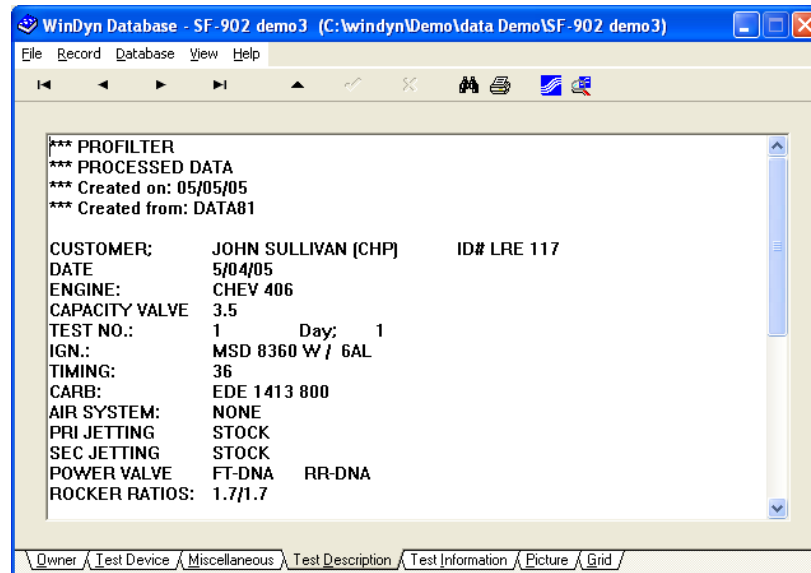
Accessories	2	Spark Plug ID	CHAMP N11Y
Combustion System	DI	Catalytic Converter	Yes
Intake System	Turbo	O2 Sensor	Bosch LMS11
Air Filter	Fram CA360	O2 Location	Exh Manifold
Governor	Woodward	Exhaust Description	Dual, headers
Fuel Type	Exxon 97	Thermostat	180 degF
Fuel Supply	EFI	Coolant	Zerex 50/50
ECU ID	Ford	Lubricant	Mobil
Eprom ID	050696	Oil Cooler	Yes

- **Accessories:** Number of accessories such as water pump, alternator, etc.
- **Combustion System:** Type of combustion, for example, direct or indirect injection
- **Intake System:** Intake system type, for example, Turbo charged, Naturally aspirated, etc.
- **Air Filter:** Type of air filter
- **Governor:** Governor ID for diesel engines
- **Fuel Type:** Type of fuel used during test
- **Fuel Supply:** Fuel supply type, for example, Carb, Electronic Fuel Injector, Throttle body fuel injector
- **ECU ID:** Control module identification
- **Eprom ID:** Control module Erasable Programmable Read-Only Memory (EPROM) ID number
- **Spark Plug ID:** Type of spark plug used during test

- **Catalytic Converter:** Indicates if the test system has a catalytic converter
- **O2 Sensor:** Type of oxygen sensor
- **O2 Location:** Location of oxygen sensor
- **Exhaust Description:** Type of exhaust system
- **Thermostat:** Type of thermostat installed
- **Coolant:** Type of coolant used
- **Lubricant:** Type of oil used
- **Oil Cooler:** Indicate use of oil cooler

Test Description Tab

Use this tab to enter comments that may be applicable to this test. Up to 5,280 characters may be entered. In edit mode, the white region can be used as a simple text editor.



The text entered in this area is identical to the text entered in the Notes area of the Test Setup dialog box or in the Test Description notepad. These notes are embedded in the data file.

Test Information Tab

This page contains information about the particular test. The following fields are underlined on the screen and are filled in automatically: Date, Time, Data Name, Data Filename, Serial number, Cfa Filename, and Test Filename (obtained from the currently loaded test group).

WinDyn Database - SF-902 demo3 (C:\windyn\Demo\data Demo\SF-902 demo3)

File Record Database View Help

Work Order R056789 Data Name SF-902 demo3

Date 5/11/2006 Time 08:59

Dyno Location Dyno Cell3 Test Description Slow acceleration

Dyno Operator John Smith Test Type 100-rpm ramp

System ID SF-902 Test Serial No 5

Cfa Filename SF901A

Test Filename Test0001

Test Filespec C:\windyn\Demo\data Demo\SF-902 demo3

Searchable fields are labeled using this color

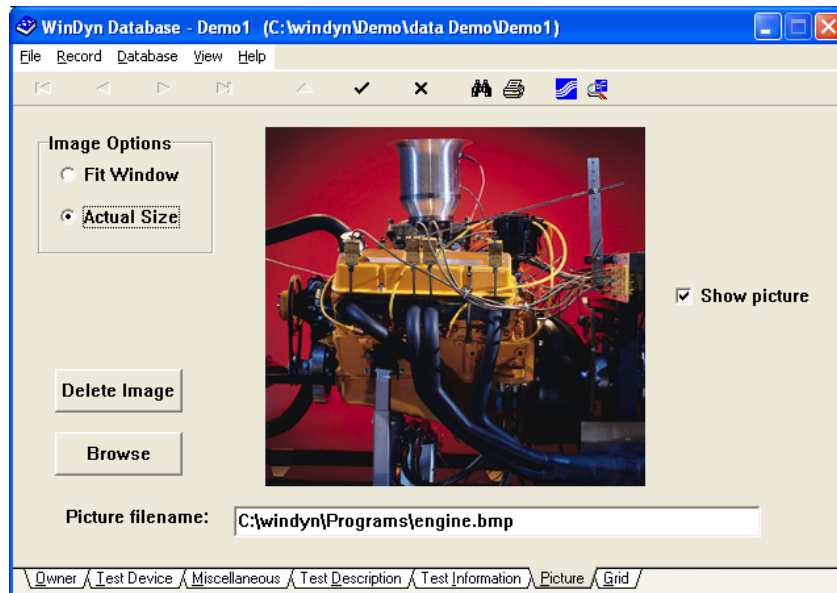
Owner Test Device Miscellaneous Test Description Test Information Picture Grid

- **Work Order:** The customer's repair order number
- **Date:** The date the record was added to the database
- **Dyno Location:** Location of the dyno
- **Dyno Operator:** Name of the dyno operator
- **System ID:** Dyno system type
- **Cfa Filename:** System configuration file name
- **Test Filename:** Test file name used to perform the system test taken from the name and path entered in the Test Setup dialog box
- **Test Filespec:** Data file name including system path
- **Data Name:** Name of the saved data file without path information
- **Time:** The time the record was added to the database
- **Test Description:** A short test description
- **Test Type:** The type of test used to record data
- **Test Serial No:** Serial number of the test in database

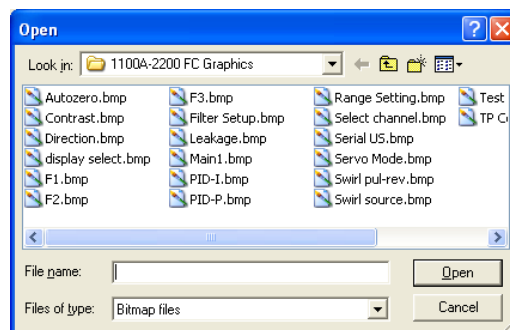
Picture Tab

Use this tab to include a picture with the test record.

- **Image Options:** Select how to display the image as actual size or scale it to fit the display window.
- **Show picture:** Select this option to display images in the window. If you use many large bitmap images with your database records, the process of scrolling through the database records may become slow. Clearing this check box will speed up the process.



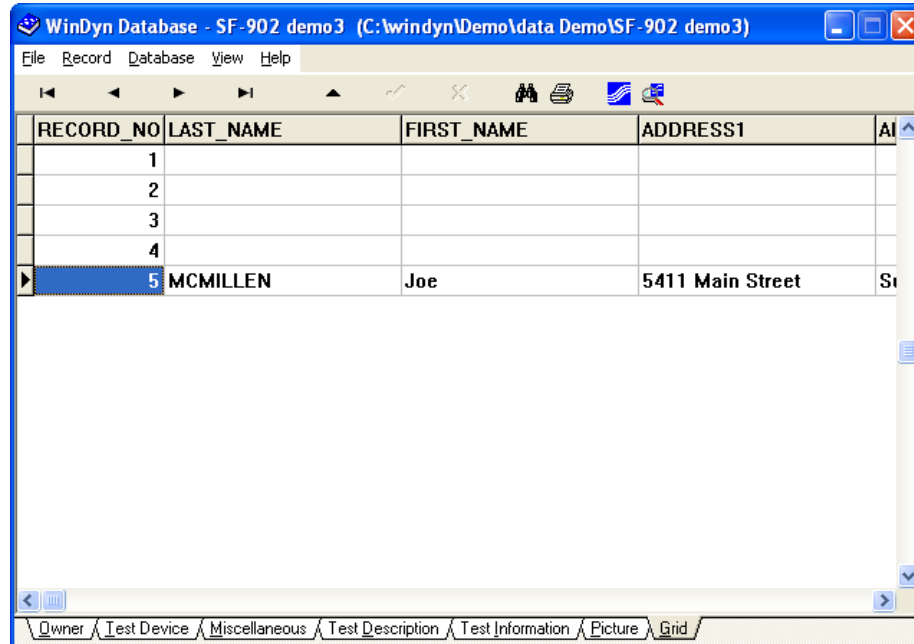
- **Delete Image:** In edit mode, click this button to delete the image from the database record.
- **Browse:** In edit mode, clicking this button opens a dialog box where you can select a bitmap file to include with the database record.



- **Picture filename:** Type the path and file name of the bitmap file in the text box.
- **Searchable fields:** No fields on this page are searchable.

Grid Tab

This page provides a comprehensive view of the records in the database and is a convenient way to look for a specific record. Once you find the desired record, click any of the tabs to view data for the current record.



The screenshot shows a window titled "WinDyn Database - SF-902 demo3 (C:\windyn\Demo\data Demo\SF-902 demo3)". The window has a menu bar with "File", "Record", "Database", "View", and "Help". Below the menu bar is a toolbar with various icons. The main area is a table with the following columns: "RECORD_NO", "LAST_NAME", "FIRST_NAME", "ADDRESS1", and "ADDRESS2". The table contains five rows of data. The fifth row is selected, showing "5" in the first column, "MCMILLEN" in the second, "Joe" in the third, "5411 Main Street" in the fourth, and "St" in the fifth. At the bottom of the window is a tab bar with the following tabs: "Owner", "Test Device", "Miscellaneous", "Test Description", "Test Information", "Picture", and "Grid". The "Grid" tab is currently selected.

RECORD_NO	LAST_NAME	FIRST_NAME	ADDRESS1	ADDRESS2
1				
2				
3				
4				
5	MCMILLEN	Joe	5411 Main Street	St

No fields on this tab are searchable.

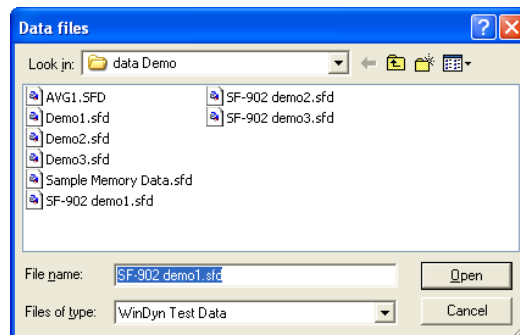
9.3.2 Adding New Data Files

Every time a data file is saved to disk, a new record is added to the database. This makes it convenient to quickly make multiple runs and add them to the database automatically.

Before saving test data, make sure the information displayed in the DataLib program is current. This information can be edited later if necessary.

9.3.3 Adding Existing Data Files to the Database

1. From the **WinDyn Database** menu, select **File>>Add Test**. The **Data files** dialog box appears.



2. Select a file in the list and click **Open**.
3. Update information in the edit fields as required.
4. After making all changes, save the record. Click the **Save** button or select **Record>>Save**.

9.3.4 Modifying a Database Record

1. Select the record as the current record.
2. From the **WinDyn Database** menu, select **Record>>Edit** or click the **Edit** toolbar button.

3. Make changes to the record.
4. Click the **Save** button or select **Record>>Save**.

9.3.5 Deleting a Record from the Database

1. Select the record to delete.
2. From the **WinDyn Database** menu, select **Record>>Delete**. Or click the **Grid** tab, select the record, and press the **DELETE** key on the keyboard.
3. A **Notice** dialog box appears asking whether to delete the current record. Click **Yes**.
4. A prompt appears to delete the corresponding data file. Click **Yes** or **No**.

9.4 Database Reporting

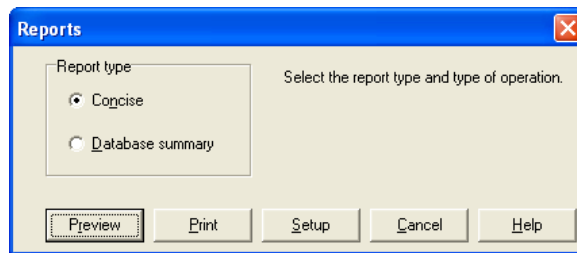
The DataLib program can create and print concise and summary reports.

9.4.1 Concise Reports

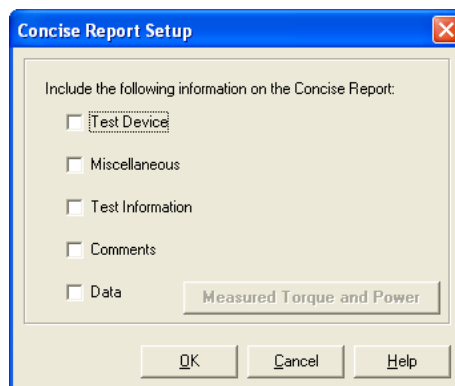
A concise report is a short, two-page report containing the information entered into the database. You can also select which page of test data to include with the report.

To configure a Concise Report:

1. From the **WinDyn Database** menu, select **File>>Report**. The **Reports** dialog box appears.

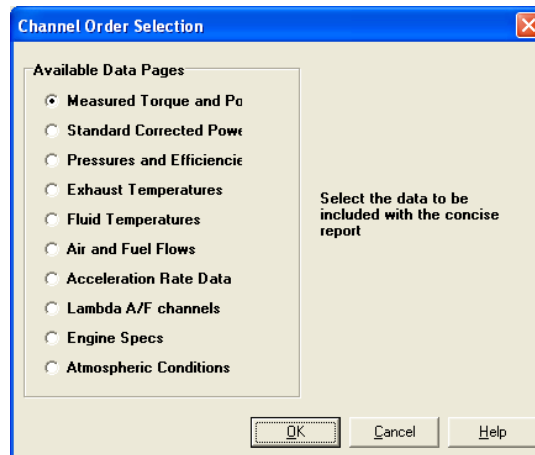


2. Select the **Concise** option.
3. Click the **Setup** button. The **Concise Report Setup** dialog box appears.



4. Select each option (check box) for the data to include in the report. You may select more than one option.

5. The button to the right of the Data check box displays the name of the channel order page to include in the report. To change the page, click this button. The **Channel Order Selection** dialog box appears.



6. Only one page can be printed with each report. Select the data page in the **Available Data Pages** list and click **OK**.
7. Click **OK** in the **Concise Report Setup** dialog box. The report is now configured and ready to view or print.
8. Click the **Preview** button to see what the report will look like before printing it, or click the **Print** button to print the report immediately. You can also print the report from the preview window.

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Data-Measured Torque and Power

EngSpd RPM	EngPwr Hp	EngTrq lbs-ft	A/F Ratio	Full+2 lbs/hr	Airl+2 SCFM	BSAC lb/hph	BSFC lb/hph	Voleff %
3400	332.7	514.0	0.0	171.9	0	0.00	0.517	0.0
3500	339.5	509.4	0.0	173.9	0	0.00	0.512	0.0
3600	348.4	508.2	0.0	177.3	0	0.00	0.509	0.0
3700	358.1	508.2	0.0	181.5	0	0.00	0.507	0.0
3800	367.7	508.2	0.0	184.7	0	0.00	0.502	0.0
3900	377.4	508.2	0.0	188.5	0	0.00	0.499	0.0
4000	387.1	508.2	0.0	193.0	0	0.00	0.499	0.0
4100	396.8	508.2	0.0	198.6	0	0.00	0.501	0.0
4200	405.5	507.1	0.0	204.6	0	0.00	0.504	0.0
4300	414.2	506.0	0.0	210.3	0	0.00	0.508	0.0
4400	422.0	503.7	0.0	214.1	0	0.00	0.507	0.0
4500	428.6	500.3	0.0	217.5	0	0.00	0.508	0.0
4600	434.1	495.7	0.0	221.6	0	0.00	0.510	0.0
4700	438.5	490.0	0.0	225.2	0	0.00	0.514	0.0
4800	442.6	484.3	0.0	229.3	0	0.00	0.518	0.0
4900	444.3	476.3	0.0	233.2	0	0.00	0.525	0.0
5000	444.7	467.1	0.0	236.5	0	0.00	0.532	0.0
5100	444.7	458.0	0.0	238.8	0	0.00	0.537	0.0
5200	444.4	448.0	0.0	238.5	0	0.00	0.530	0.0

Page 1 of 1

- After printing, press the **Cancel** button to close the **Reports** dialog box.

9.4.2 Column Reports

A column report is a summary report that contains a record for each record in the database. Each record contains ownership and contact information as well as the serial number and test name.

To generate a column report:

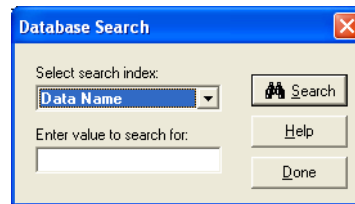
- From the **WinDyn Database** menu, select **File>>Report**. The **Reports** dialog box appears.
- Select the **Database summary** option button.
- Click the **Preview** button to see what the report will look like before printing it, or click the **Print** button to print the report immediately. You can also print the report from the preview window.
- After printing, press the **Cancel** button to close the **Reports** dialog box.

9.5 Searching the Database

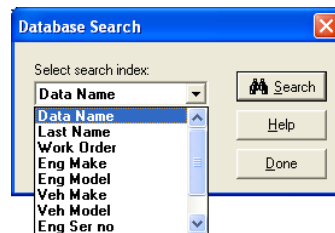
To help find a particular record, the DataLib program includes a search function. You can search the database for a particular record based on the owner's last name, repair order number, engine make, engine serial number, vehicle make, vehicle model, and vehicle ID number.

NOTE: Notice on the tabbed pages some field headings are colored red. These are the searchable fields.

1. From the **WinDyn Database** menu, select **Database>>Search** or click the **Search** button (binoculars). The **Database Search** dialog box appears.



2. In the **Select search index** drop-down list, select the search criteria.



3. In the **Enter value to search for** text box, type the specific name or information.
4. Click the **Search** button. A dialog box displays stating an exact match been found or an exact match does not exist and the currently displayed record is the closest match found in the database. If an exact match was not found, you can use the navigator buttons to move through the database to find the record.
5. When you are finished searching the database, click the **Done** button to close the dialog box.

9.6 Sorting the Database

The database records can be sorted based on the same fields used for searching the database. To sort the records in the database, follow the instructions for searching the database. Using the Grid tab to view the sorted records makes it easy to find the record.

CHAPTER 10

SOFTWARE ARCHITECTURE

IN THIS CHAPTER

- **Introduction**
 - File Extension Reference
- **Executable Components**
- **Non-executable Components**
- **System Configuration File Structure**
 - File Relationships



10.1 Introduction

The SuperFlow WinDyn™ software system comprises executable components (programs) and non-executable components (files).

10.1.1 File Extension Reference

General Use File Types

- .BMP:** Bitmap image
- .CHM:** HTML-based help documentation
- .CNT:** Windows-based Help table of contents
- .CSV:** Comma-Separated Value spreadsheet
- .DAT:** Data (custom plot settings)
- .DBF:** dBASE database table
- .HLP:** Windows-based Help documentation
- .MDX:** dBASE database index
- .TXT:** Text information

Configuration File Types

- .BTP:** Backup test profile
- .CAL:** Calibration
- .CCP:** Control parameters
- .CDF:** Screen group (current data display)
- .CFA:** System configuration (compiled)
- .CFD:** System configuration (editable)
- .CST:** Specifications
- .HDW:** Hardware configuration
- .LMT:** Limits profile
- .PRG:** NGE program file (flash memory application)
- .SCA:** Switch configuration (editable)
- .SCF:** Switch configuration (compiled)
- .SET:** Set of files
- .SFD:** Test data
- .SFL:** System log
- .SFP:** Post-mortem data
- .TGP:** Test group
- .TPF:** Test profile
- .WDP:** WinDyn preferences

System File Types

- .DLL:** Dynamic Link Library (shared code)
- .EXE:** Executable (application)
- .USR:** Password system settings

10.2 Executable Components

The WinDyn™ software system is composed of several software executable files.

WinDyn.exe



WinDyn is the engine and chassis dynamometer software package developed by SuperFlow Technologies Group.

Using WinDyn, tests can be designed and configured to meet individual needs and a SuperFlow system can:

- Acquire and display real-time test data
- Intelligently manage test data
- Display, print, and plot data based on your requirements
- Generate custom reports

WComNet.exe



WComNet is a program that provides communication between SuperFlow computer programs and SuperFlow test systems using Network Basic Input/Output System (NetBIOS) network communication protocols. WComNet must be loaded before any other SuperFlow computer program can communicate with SuperFlow test systems. WComNet launches automatically with WinDyn. The WComNet icon appears in the system tray (where the Windows clock displays).

SFLIB32.DLL



This is a Windows Dynamic Link Library (DLL) that contains a library of routines written by SuperFlow to facilitate data handling and communication to and from dynamometer data acquisition systems. The function of this library is to provide a set of routines that define a common interface to real-time and stored data for application-level programs. With this DLL, an application program can perform such operations as obtain the current value of a data channel and its name and units, record data lines, send and receive files, read stored data from disk files, and calibrate channels.

Stored.exe



Stored.exe is a program for viewing, printing, and plotting tabular stored data (either from the data acquisition memory or from disk).

DataLib.exe



DataLib.exe is a database program used for managing and archiving stored test data.

Editors



Editors are required to configure the various functions of the data acquisition/control system. Examples include channel configuration, limits, autotest, real-time displays, and profiles. Note that real-time screens are edited using WinDyn itself.

SFBrowse.exe



A file browser tool (called SuperFlow Explorer) allows users to view and manage test data files directly.

ProFilter.exe



ProFilter enhances acceleration test data analysis for both engine and chassis dynamometers.

DefTool1.exe

The Configuration Utility (DEFTool) can display and print SuperFlow configuration files in a read-only format. Users can view configuration information in a clear, easy-to-read format but cannot make changes to the configuration using this tool. The Configuration Utility is useful for quickly viewing the formulas used to calculate important channels or to see how measured channels are formatted.

SFEditCal.exe

The Calibration Viewer allows users to view and print WinDyn calibration (*.cal) files. The sensor calibration data for a SuperFlow dynamometer is saved in a WinDyn calibration file. This viewer displays the coefficients and offsets for each calibrated channel.

Custom Applications

Custom applications can be written using the SFLIB32.DLL to provide the user with data in a unique way. Given the appropriate header file and documentation, a programmer could write an application to access the data acquisition system as required.

DataPackBuilder.exe

The Customer Data Pack feature creates a single data pack file to give customers. The data pack contains customer data files and the WinDyn Data Viewer program to view, graph, and print test data.

SFEditLog.exe

The WinDyn System Log editor is used to view and manage WinDyn system logs, including the log currently in use by the test system (the active log). Use the editor to create and archive as many log files as needed. The system log feature a permanent record of important test system activity over days, weeks, or months.

SFVersionReport.exe

The SF Version Report provides a list of all programs, features, and editors in WinDyn and the version, size, file type, data modified, path, and description of each.

Terminal.exe

This program allows SuperFlow technicians to access internal programming and functions to perform low-level configurations and diagnostics.

TestSetup.exe

Use the Test Setup feature to view and edit the most common WinDyn test preferences from a single location.

10.3 Non-executable Components

Several non-executable files are required for the operation of WinDyn. These are user-configured files utilized by the WinDyn software system. The WinDyn program automatically handles the interaction between itself and the executable commands which process each of these files.

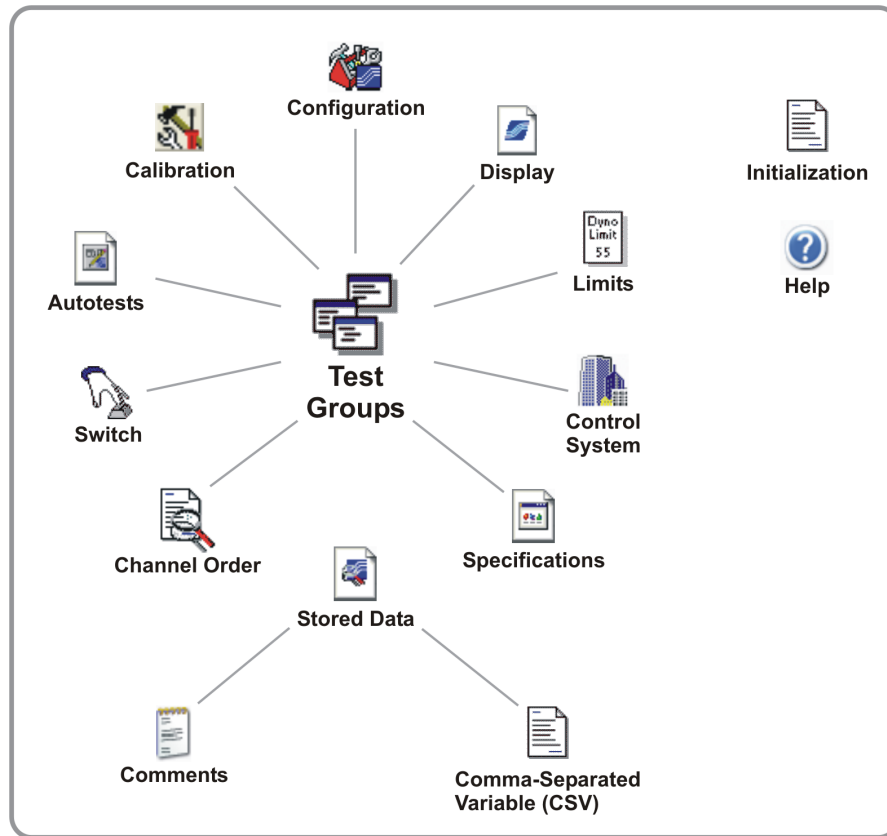


Figure 10-1. Non-executable Files

AutoTest



Autotest files have a .tpf extension. They are located in the Test folder. These files contain system automation scripts to facilitate testing. Autotest files are edited using an Autotest editor. Once edited and are then loaded into the data acquisition/control system for processing.

Calibration



Calibration files have a .cal extension. They are located in the Config folder. These files contain information generated from calibrating the data acquisition system.

Comments



A comments file with the name COMMENTS.TXT exists in the WinDyn System directory. This is an ASCII text file which is intended to contain any user comments stored with the stored data file. The maximum size of this file is 5280 characters. The text contained in this file is test notes entered by the operator.

Configuration

System configuration files have a .cfa and .cfd extension. They are located in the Config folder. These files are edited using DEF.EXE, the old DOS editor originally written for the SF-740 system. These files contain information which describes the various data channels such as name, display units, channel type, etc. The file also sets the control channels and defines the handheld or console display screens. The compiled versions of these files are loaded into the dynamometer systems directly and also into the communications interface programs for the systems. A configuration file is required for data display, test and limits editing, etc.

Control System

Control system files have a .ccp extension. They are located in the Config folder. They store the Proportional, Integral, and Derivative (PID) values used in automatic control of the dyno and throttle. These files configure the control system in most systems including setting controller phase and control system gains. Control files must be loaded into the control system for processing.

CSV

WinDyn exports test data in the industry standard Comma-Separated Value (CSV) format. Files in this format can be easily viewed using Microsoft® Excel and other spreadsheet or analysis software.

Display

Display files have a .cdf extension. They are located in the Config folder. These files format how the current data screens will appear on the computer monitor. Display files are edited using the screen editor in WinDyn.

Hardware

Hardware files have a .hdw extension and are not intended for the customer to edit. They are located in the Config folder. The hardware file is used to customize the dynamometer at the factory for the specific application and configure the dynamometer system to:

- Customize the Liquid Crystal Display (LCD) layout to display any system channel in any display position.
- Map the sensor channels connected to your system.
- Set the engine function outputs (ignition, starter, fuel on/off, auxiliary) for a relay enclosure or an engine control panel.
- Map the location of each controller module to its physical location on the controller Printed Circuit Board (PCB); applicable only on some systems.
- Map data channels to Data Acquisition and Control (DAC) outputs. The outputs can be scaled as required.
- Enable or disable additional system options.

Help

Help files in Windows have a .hlp extension and are available for all SuperFlow executable programs.

Limits

Limits files have an .lmt extension. They are located in the Limits folder. A Limit file is programmed to monitor selected channels for safety conditions. If a limit parameter is met, the file will initiate a programmed action. This action ranges from a simple operator notification to an engine shutdown. These files are edited using a Limits File Editor. Once edited, limits files are loaded into the data acquisition system for processing.

Set

Set files have a .set extension and are intended for customer use and are located in the Config folder. Use Set files to override the LCD configurations defined in the HDW file and also assemble sets of specifications files, test profile files, and Limits files to download into the dynamometer system when these files are imbedded into the system flash memory.

Specification

Specification files have a .cst extension. They are located in the Config folder and are used to set the values for important test parameters such as engine bore and stroke. A specification file can enter all the specifications for a specific application simultaneously.

Stored Data

Stored data files have an .sfd extension and are located in the Data folder. These files contain recorded data and copies of the configuration CFA format and the COMMENTS.TXT file.

Switch

Switch files are found in two forms: editable (SCA) and compiled (SCF). They are located in the Config folder. These files configure the digital switch/relay/input system on systems with relay enclosures. Switch files are edited using the DOS editor SWED.exe. Once edited, switch files must be loaded into the data acquisition/control system for processing.

Test Group

Test group files have a .tgp extension and facilitate loading other configuration files. They are located in the Config folder. These files are edited using the WinDyn Test Group Editor. The user can specify configuration, display, autotest, limits, calibration, control, specifications, and switch files which can be loaded whenever the test group file is loaded. The test group file also sets the channel order for viewing and plotting the recorded data.

Test Preferences

Test preferences files have a .wdp extension. Operators can view and adjust the most common WinDyn test preferences from a single location using the new Test Setup dialog box. Available preferences include test notes, specifications, test data name/location, print preferences, etc. Test preferences can be memorized and retrieved later for similar test scenarios.

10.4 System Configuration File Structure

The configuration file is the master file for all SuperFlow data acquisition systems that utilize the WinDyn™ program. This configuration is created and modified using the System Configuration editor accessed through WinDyn. The configuration file specifies in detail all of the channels the system is capable of measuring and sets the various programmable channels available to the user which can be configured to suit a wide range of specific testing requirements.

The configuration file exists in two formats: *.cfd and *.cfa. The CFD file is the editing format. The CFA file is the absolute compiled version of the CFD file and is the actual file installed in the data acquisition system.

The configuration file is the master system file because most of the other file types used by SuperFlow Technologies Group data acquisition systems (Limits, Test Profiles, etc.) are valid only with the configuration file they are associated with. The configuration file is always designed and installed in the dyno first. Then the other system files, which were designed around that particular configuration file, may be installed to configure the dyno to meet specific testing requirements.



See Section 10.3, "Non-executable Components," on page 10-6 for a description of these files.

10.4.1 File Relationships

The foundation of the overall configuration is that all the system files are based on the configuration file (CFA). It is important to note that changes to the CFA can affect one or more of the other system files in such a way that false measurements or inaccurate controls will result. Figure 10-2. shows these files and their relationship with the Configuration file.

The system files are created and based on a configuration file. In some cases they are installed into the system to overwrite the default values set in the configuration file. The following describes the relationship and what could happen when a configuration file is changed but not the system files. This occurs after installing an unmodified system file after a new configuration file.

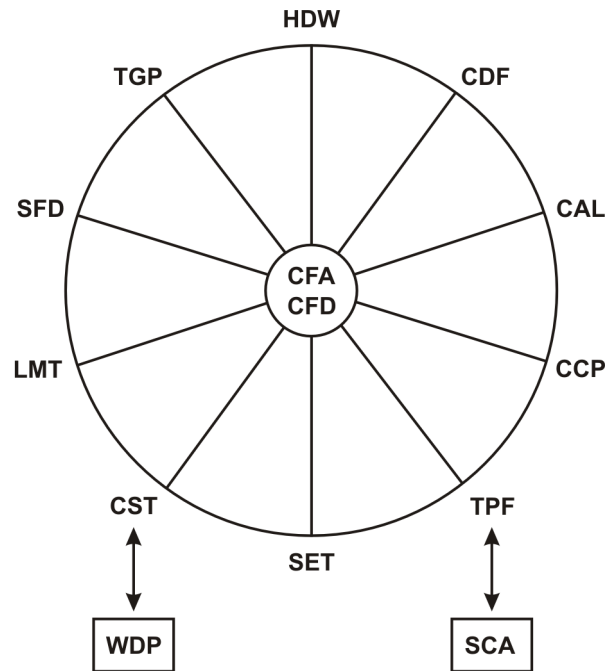


Figure 10-2. WinDyn Configuration Structure

- **AutoTest (TPF):** Autotest profiles contain commands to run an automatic test sequence. Command steps can refer to defined channels. Changing channel definitions can result in undesired reactions in the test vehicle or engine.
- **Calibration files (CAL):** Measured channels have coefficient values determined by the configuration. The coefficients are altered by the calibration process and stored in the calibration file. Changing the channel configuration can result in different coefficient values requiring a new calibration file to be saved, or false readings may occur.
- **Control files (CCP):** The PID values are assigned to a channel in the configuration file and stored in the control file. Changing the controlled channel's structure in the configuration file can result in mismatched PID values and unpredictable control of the engine or vehicle.
- **Hardware Files (HDW):** Hardware files map the electronic signals in the data acquisition circuitry to the channels defined in the configuration file. Changing the channel definitions can result in mismatched signals.
- **Limit Files (LMT):** Limit files specify which channels are monitored for safety parameters. Changing the channel definitions can result in erroneous Limits actions.

- **Screen Group files (CDF):** The computer real-time displays are built on the channel definitions in the configuration file. Changing a channel definition is reflected in the displays.
- **Set of Files (SET):** Set files are used to assemble sets of specifications files, test profile files, and limits files to download into the dynamometer system. If one or more of these files are modified, they must be re-saved in the Set file. A Set file is also used to select which channels appear on the sensor box LCD display. Changing the channel definition affects the display.
- **Specification files (CST):** The values in a specification files are based on the channel definitions in the configuration file and can be altered and stored. Changing the channel definition for these channels can result in erroneous calculations.
- **Stored Data File (SFD):** Data files contain the data recorded in the data acquisition system and saved to the computer. The recorded data is formatted according to the channel definition in the configuration file. After the file is saved, the channel definition and values cannot be changed.
- **Test Group (TGP):** A test group file installs a selected group of other files (Display, Autotest, Limits, etc.) into the data acquisition system. If one or more of those files are deleted or renamed, the test group is unable to install, and an error message appears. If channel definitions are changed in the configuration file (CFA/CFD), those changes will reflect in the channel order defined in the test group.
- **Switch Files (SCA):** A switch file is independent of the configuration file and therefore has no association with it. However, switch functions can be controlled in a test profile (TPF).
- **WinDyn Preferences Files (WDP):** A preference file is independent of the configuration file and therefore has no association with it. However, specification values can be memorized in the file so the same relationship exists as with CST files.

CHAPTER 11

CONFIGURATION EDITOR

IN THIS CHAPTER

- **Introduction**
- **Channel Types**
 - Measured Channels
 - Calculated Channels
 - Specification Channels
 - Interpolation Tables
 - System Channels
- **Designing Configurations**
 - Configuring Measured Sensor Channels
 - Configuring Specification Channels
 - Configuring Calculated Channels
 - Configuring Interpolation Tables
 - Saving and Exiting



11.1 Introduction

The Configuration (DEF) Editor is used to define the functions of WinDyn. Once defined, the configuration is stored in a *.cfa file on the computer hard drive and uploaded to the Data Acquisition system. Most systems are pre-configured to customer specifications at the factory. However, this editor can be used for custom configurations.



WARNING: Use of the Configuration editor requires a thorough knowledge of the system. Improper editing of the Configuration file could result in system failure.

From the editor, the three basic elements of the WinDyn configuration file are defined:

- Channel definition (name, units, format, filtering, etc.)
- Control channels (closed-loop control for load, throttle, or flow)
- Display channels on the operator's console or remote handheld controller

The SuperFlow test system is completely configured by the WinDyn software. After WinDyn is installed, a system configuration is installed. The configuration files appropriate for this system type are then installed in the main system directories. These files can be the standard default files for that system type or custom files developed for a specific application.



IMPORTANT: The system configuration files are essential to the operation of the system, and most of the other files (such as display files, test files, limits files, etc.) are linked to specific configuration files. Any changes to channel definitions within a configuration file can impact functionality of other WinDyn user files.



Refer to Chapter 10, "Software Architecture" for more details on the relationship between configuration and user files.

For specific measurements, some customers may wish to use different units than the ones defined in the default configurations. For example, metric configurations systematically use kilowatt (kW) for power, but you may wish to use horsepower (hp) instead while keeping all other metric units.

In that case, the standard configuration file that most closely fits the requirements will be selected and then modified where desired, using the channel Configuration Editor.



For detailed explanations of the standard channel definitions, refer to section 10.4, "System Configuration File Structure" on page 10-8.

Chapter 9 in the product operators manual contains the specific definitions for the default configuration of your product (CycleDyn, AutoDyn, SF902, etc.)

Engine, vehicle, and test setup data is usually stored in specification channels 77-99. Specification channels can be modified and saved with the Specifications editor in WinDyn. Therefore, it is unnecessary to have multiple configuration files just to change specifications.

11.2 Channel Types

The first and most important element of Configuration file configuration is channel definition because it ultimately determines all other functions of WinDyn. All information in WinDyn is carried by channels defined in the Configuration File Editor.

The WinDyn system uses five types of channels:

- **Measured Sensor Channels:** Receive data from sensors
- **Calculated Channels:** Perform calculations using inputs from other channels
- **Specifications:** Also known as constants, specification channels are set values associated with a particular engine, vehicle, or test
- **Interpolation Tables:** Store nonlinear values for calibration and calculation purposes
- **System Channels:** Contain timers and system memories

11.2.1 Measured Channels

Measured sensor channels are used to display inputs from the various sensors such as torque, speed, temperatures, pressures, etc. and are limited to the number of sensors supplied with the system. Measured channels are defined in channels 1 to 76.

NOTE: *Measured channels may be converted to calculated channels if more calculations are needed.*

Sensor Types

Four types of measured data channels are available in the WinDyn system for sensor inputs:

- Strain gauge (load cells)
- Frequency
- Analog voltage
- Thermocouple

Any of these channels may be used for any display function, in a calculated channel, as a control channel, or in a test profile.

- Strain gauge channels accept the differential voltage output signal from a strain gauge or load cell.
- Frequency channels can read any sensor device that provides a magnetic (mag) or Transistor-Transistor Logic (TTL) output. These channels are typically used for fuel, air, and fluid flow meters. Six frequency channels are available directly on the data acquisition, but others can be added with a frequency-to-voltage converter on an analog voltage expansion panel.
- Analog voltage channels may be used to measure any sensor device outputting analog voltage. These inputs are most commonly used for pressure transducers or other auxiliary devices. There are 10 channels located directly on the data acquisition system. Others are available on expansion panels (pressure and voltage).
- Thermocouple channels can be configured for several different types of thermocouples (K, J, T, or E) and can be read in either Fahrenheit or Celsius degrees.

The Thermocouple/analog voltage channels are designated in four blocks of 16 channels each which accept inputs through expansion panels (thermocouple, pressure, or analog voltage). The input panels may be mixed in any combination of four panels totaling 64 input channels. Each individual 16-channel group (13-29, 29-44, 45-60 and 61-76) must be either analog voltage or thermocouple. Thermocouples cannot be mixed in the same 16-channel group with analog voltages or with different type thermocouples.

Filters

Measured channels have filters applied to the raw data. Table 11-1 shows the filter choices, their corresponding corner frequencies, and the recommended applications.

Table 11-1. Data Filter Rates

Filter Value	Frequency	Recommended for...
Auto	Variable	Changing conditions*
0	No filter	Not recommended
1	20hz/50 ms	2000 rpm/sec acceleration tests
2	10hz/100 ms	1000 rpm/sec acceleration tests
3	5hz/200 ms	600 rpm/sec acceleration tests step changes during step tests
4	2.5hz/400 ms	300 rpm/sec acceleration tests
5	1.25hz/800 ms	100 rpm/sec acceleration tests (system default setting for most sensors) or for sensors with a slow response time
6	0.625hz/1600 ms	Steady-state tests wait time during step tests
7	0.3125hz/3200 ms	Steady-state tests wait time during step tests (system default setting for weather sensors) or for sensors with readings that do not typically change

* Automatic filtering is selected on individual data channels when building a configuration file. The filter applied to these data channels is determined by the system filter setting. The system filter is set during an autotest (see section 13.7.3.2, "Adjust Data Filter" on page 13-32).

The standard filter rate settings for the various types of inputs are:

- Torque, engine speed, and vehicle speed – automatic
- Thermocouples – 5
- Air and fuel turbines – automatic
- Wideband O2 sensors – 5
- Air temperature, humidity, and barometric pressure – 7

11.2.2 Specification Channels

Specification channels set the specifications of the dynamometer testing system or the unit under test. These are usually values that commonly change from engine to engine, vehicle to vehicle, or from test to test, such as engine bore (EngBor), vehicle weight (VehWht), or test start speed (Start).

The values entered into the configuration file are typically default values. Specifications can easily be changed through WinDyn and the values saved in a file specific for the engine or vehicle.

11.2.3 Calculated Channels

The calculated channel is one of the most powerful features of the WinDyn software. Sensor data, specifications, interpolation tables, calculations, or any direct constant value can be combined into a mathematical calculation to produce real-time data that displays and records along with the rest of the test data.

Each configuration file has at least 30 calculated channels. Channels 100 through 129 are dedicated calculated channels. Additionally, any measured channel may be configured as a calculated channel to create more than 30, although it is not recommended to create them in channel blocks used for installed measured channels.

For instance, if a thermocouple module is installed in channels 13–28, do not make channel 25 a calculated channel. If the thermocouple module was not installed, any or all of channels 13–28 could be used for additional calculated channels. Any calculated channel may easily be modified using the configuration editor.

A number of operators (both standard mathematical operators and some special functions) are available when entering or modifying the formula for any calculated channel. These operators are listed in Table 11-2. In the examples, an expression such as C13 implies channel number 13.

Table 11-2. Configuration Mathematical Operators

Operator	Function	Description	Example
+	Add	Adds two expressions.	C13+C20
-	Subtract	Subtracts two expressions.	C13-C20
*	Multiply	Multiplies two expressions.	C13*C20
/	Divide	Divides two expressions.	C13/C20
()	Precedence	Forces operator precedence.	C100*(C13+C20)
^	Exponent	Exponential expression. The exponential value is preceded by the “^” character. Square roots are notated as “^0.5”	(C13+C20)^2
Abs	Absolute Value	Returns the absolute value of an expression so it always reads positive. The abs operator is listed immediately after the expression to be operated upon.	C2abs (C13+C20)abs
&	Round	Rounds expression to the nearest 10th, 100th, etc.	(C13+C20)&10
F	Fetch	Retrieves immediate raw channel value and uses in a calculation. Does not apply with NGE systems.	(F13+F20)
Tn	Interpolate	Interpolate expression through table n.	(C13+C20)T130

Table 11-2. Configuration Mathematical Operators

Operator	Function	Description	Example
TEST	Compare	Compare two expressions (see “Test (Compare) Operator” on page 11-7).	C13C20TEST=3.14
sin	Sine	Returns the sine of expression.	(C13+C20)sin
asin	ArcSine	Returns the arcsine of expression.	(C13+C20)asin
cos	Cosine	Returns the cosine of expression.	(C13+C20)cos
acos	ArcCosine	Returns the arccosine of expression.	(C13+C20)acos
tan	Tangent	Returns the tangent of expression.	(C13+C20)tan

The output of each calculated channel is the result of a mathematical formula.

Example:

On an engine dynamometer: if channel #125 is engine speed and channel 121 is engine torque, the following formula would output engine horsepower:

C125*C121/5252.113

where speed is multiplied by torque and the result is divided by the constant 5252.113.



IMPORTANT: The formula in each SuperFlow calculated channel is always evaluated from left to right. The normal rules of mathematical precedence (e.g., multiplication before addition) do not apply. Parentheses can be used to force a desired precedence. Be very careful, or a calculation will not function as expected if the precedence is not set correctly for WinDyn to read it.

11.2.3.1 Test (Compare) Operator

The **Test** command compares the value of two channels using the compare operators (<, =, >). If the compare operation is **True**, then the value returned is the value of the first channel listed; if **False**, then the value returned is an immediate value listed in the expression.

Example 1:

In the following expression, if the measured values of the two channels listed are equal in value, the result is the value of the first channel (C13).

If the measured values of the two channels are not equal, the result is the immediate value 3.14:

C13C14TEST=3.14

Example 2:

Assume channels #45 and #46 are both exhaust gas thermocouples connected to the same exhaust port.

The following expression uses one calculated channel to return only the thermocouple with the highest reading:

(C45C46TEST>0)+(C46C45TEST>0)

NOTE: *Do not add any spaces between the characters.*

11.2.3.2 Fetch (F) Operator

The Fetch command was used in older SuperFlow systems to retrieve the raw data from the measured channel it is associated with and apply a calculation to it. This function is not used in the current SuperFlow NGE Data Acquisition systems.

11.2.4 Interpolation Tables

Interpolation tables are used to linearize a sensor or perform calculations from a set of arbitrary data. By using this process, it is possible to linearize the output from measured data sensors and to otherwise utilize data that is in a nonlinear format. This is a very powerful tool for improving the test system accuracy.

Interpolation tables can also be used for calculating correction factors that are based on a single sensor reading.

11.2.5 System Channels

System channels are predefined by the data acquisition system and cannot be renamed or modified in any way. Examples of system channels are Time of Day, Test Time, and Line Number. System channels may be referenced in calculated channels or displayed on the WinDyn real-time data and stored data screens.

System channels supply important information to WinDyn. Table 11-3 lists the system channels and their functions. System channels can be read and displayed in the same manner as other channels and can be used in calculated channels. System channels cannot be used for closed-loop control.

Though users cannot change the actual definition of the system channels, they can assign values test profile steps for the system memories. Memory locations can be used to store values for calculation, display, control, or other purposes.

Table 11-3. System Channels

Channel Number	Name	Description
200	Time-H	Displays the current hour from the system clock*
201	Time-M	Displays the current minute from the system clock
202	Time-S	Displays the current second from the system clock
203	SecDay	Displays the number of seconds since midnight
204	TsTime	Displays the number of seconds of an autotest. Resets to zero when an autotest starts
205	RnTime	Display total number of seconds since data acquisition system was first turned on.
206	Fuel-M	Not used in current SuperFlow systems
207	SetPt1	Displays the command value to controller #1 (typically the absorber load on dynamometers and the motors on a flowbench)
208	SetPt2	Displays the command value to controller #2 (typically the throttle on dynamometers)
209	SpcGv1	Not used in current SuperFlow systems
210–218	Timer1 through Timer9	Used by the autotest to monitor timing functions. The timers are not user accessible. See the Test Profile editor for details
219	SpcGv2	Not used in current SuperFlow systems
220–230	Memry0 through Memry10	Used in the data acquisition system to input specific readings unique to each system (see chapter 9 in the product operators's manual for the use of these channels in that particular system)
231	LineNo	Displays the number of recorded data lines in the system memory
232	Year	Displays the current year from the system clock
233	Month	Displays the current month from the system clock
234	Day	Displays the current year from the system clock
235	Day of the week	Displays the current day of the week from the system clock

* WinDyn will synchronize the computer clock with the clock in the data acquisition system. The system time/date channels (200-203 & 232-235) are linked to the computer clock when WinDyn connects with the system.

11.3 Designing a Configuration File

WinDyn software was designed so you can create your own instrumentation system. You can select the units for data display, calculations, specifications used for calculations, and the resolution of the readouts using the Configuration Editor feature.

NOTES:

- In the Configuration Editor, specifications are referred to as the channel definition and are also known as “constants” in channels 77–99.
- To view currently defined channels, press **CTRL+Z** while anywhere in the editor.
- If changing an existing channel to one of a different type (such as a thermocouple channel to an analog voltage channel), the existing channel definition must be cleared using the Clear Channel function from the channel edit menu.
- Six characters each are allowed for both the channel name and the units so the names will fit onto the various screen displays and printouts. Neither the name nor the units has any effect on the displayed or recorded sensor data.

The data definition software creates two different files. The CFD file is the actual working file that is used as data is entered and modified. The CFA file is an absolute file that is compiled from the CFD file. This file is more compact and is the memory image file used by the data acquisition system to process data.

From the **WinDyn** main menu, select **Design>>System Configuration**. The **Def Editor** appears.

TIP: If the editor shows a blank blue screen, press **ALT+ENTER**.

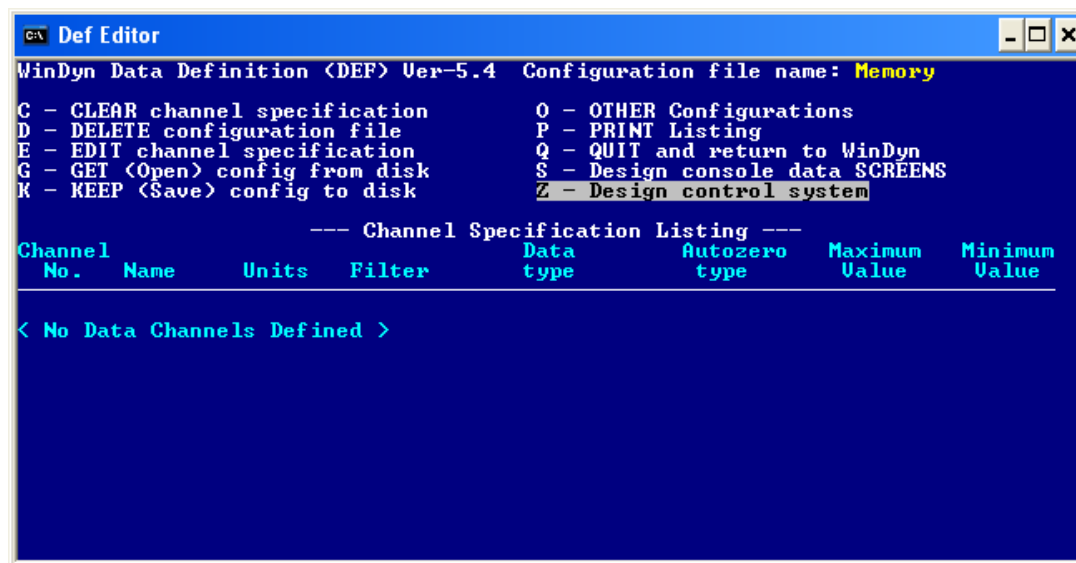


Figure 11-1. Configuration Editor

Press **G** or select **G – GET <Open> config from disk** (use the mouse or the UP/DOWN ARROWS to make selections). A list of available configuration files appear. In most cases, it is easiest to start with an existing configuration file and modify it.

Type the name of the desired file or click the file name in the box. The name appears in the upper right corner of the screen, and the defined channels appear at the bottom of the screen.

Before proceeding further, it is best to save the file with a different name to create a backup copy. Select **K – KEEP <Save> config to disk**. Type a unique name and press the **ENTER** key to create a new file. Press any key to confirm the CFA was created. A copy of the original configuration file is now stored on the computer. The name should appear in the upper right corner of the screen with the .cfd (for configuration) file-name extension.

The original file is intact in memory, and the new file is now the working copy. If you are making changes to use with the system, save the changes using the original file name. The backup is the file with the new name. If you are only learning how to use the editor, use the new name to save the file so the original file is left intact.

Table 11-4. Configuration Editor Menu

Shortcut Key	Function	Description
C	CLEAR channel specification	Deletes a single channel or a range of multiple channels
D	DELETE configuration file	Not used in current SuperFlow systems
E	EDIT channel specification	Selects a channel for modifying
G	GET <Open> config from disk	Opens a CFD file from the designated WinDyn folder on the computer
K	KEEP <Save> config to disk	Saves the CFD file to the designated folder and creates the CFA file
O	OTHER configurations	Not used in current SuperFlow systems
P	PRINT listing	Prints a list of the defined channels. Not recommended to use this. Use the Configuration utility in the WinDyn Tools menu to print the CFD file
Q	QUIT and return to Windyn	Exits the editor
S	Design console data SCREENS	Selects the channels to be displayed on the console or handheld controller
Z	Design control system	Selects the servo control channels

NOTE: Because this is a DOS-based editor, the computer mouse does not function well in the editor. Instead make selections by entering the first one or two letters of the desired entry or by using the UP/DOWN ARROW keys to highlight the selection. Press the **ENTER** key to advance the selection.

11.3.1 Defining Data Channels

Each channel has a number. Use these numbers for the calculation formulas and other features of the program. Whenever you forget the number or the name, press **CTRL+Z** to display a list of the defined channels. Press **CTRL+Z** twice, and a list of the system channels appears. This includes the timers and the controller set point information. Pressing CTRL+Z again returns you to the first listing of channels. To exit these listings, press any key.

Select **E – EDIT Channel Specification** (do not confuse with specification channels). The **Data Definition Channel Edit Screen** appears for selecting a data channel, which you may then edit as needed.

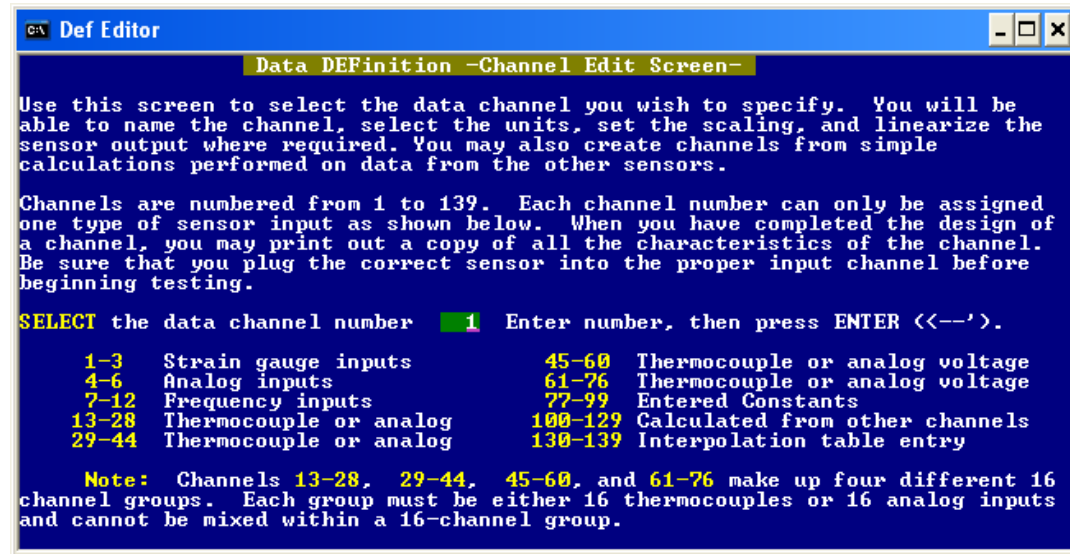


Figure 11-2. Edit Channel Specification

The SuperFlow Data Acquisition systems contains 139 user-defined channels and 36 system channels.

Table 11-5. Channel Definitions

Channel Number	Channel Type	Input Type	Description
1	Analog voltage	0-4.096 Volts DC	Typically used for an air temperature sensor
1-3	Strain gauge (load cell)	Low-level differential voltages	Used for torque sensors
4-5	Analog voltage	0-10 Volts DC	Typically used for auxiliary devices such as O2 sensors or throttle position sensors
1	Analog voltage	0-4.096 Volts DC	Typically used for an air humidity sensor
7-12	Frequency	TTL or MAG (channel 11 mag only)	Used for dyno speed, airflow, liquid flow, or other frequency output devices
13-70	Analog voltage or thermocouple	Thermocouple or voltage	Expansion channels for pressure, temperature or voltage modules (can be converted to calculated channel if desired)
71-76	Analog voltage	0-4.096 volts DC	Dedicated inputs such as Baro, Battery voltage, Servo valve position, CycleDyn wheel base position, etc. (can be converted to calculated channel if desired)
77-99	Specifications (constants)	Internal entry	See "Specification Channels" on page 11-6
100-129	Calculated	Internal formula	See "Calculated Channels" on page 11-6
130-139	Interpolation tables	Internal entry	See "Interpolation Tables" on page 11-8
200-235	System	N/A	See "System Channels" on page 11-8

11.3.1.1 Configuring Measured Sensor Channels

Measured sensor channels are used to display the inputs from the various sensors such as torque, speed, temperatures, pressures, etc. The number of valid channels is limited to the actual number of sensors supplied with the system. Some extra channels may be defined that appear on the display screens and printouts but are not supported by sensor hardware. You can delete these channels from the configuration files you use or choose not to include the extra channels on the screens and printouts.

1. Type the desired channel number on the screen and press the **ENTER** key on the keyboard to open the **Channel Edit** dialog box. The **Data Definition Channel Edit Screen** appears.

TIP: Press **CTRL-Z** to display a list of all the defined channels. Press **ESC** to return to the previous screen

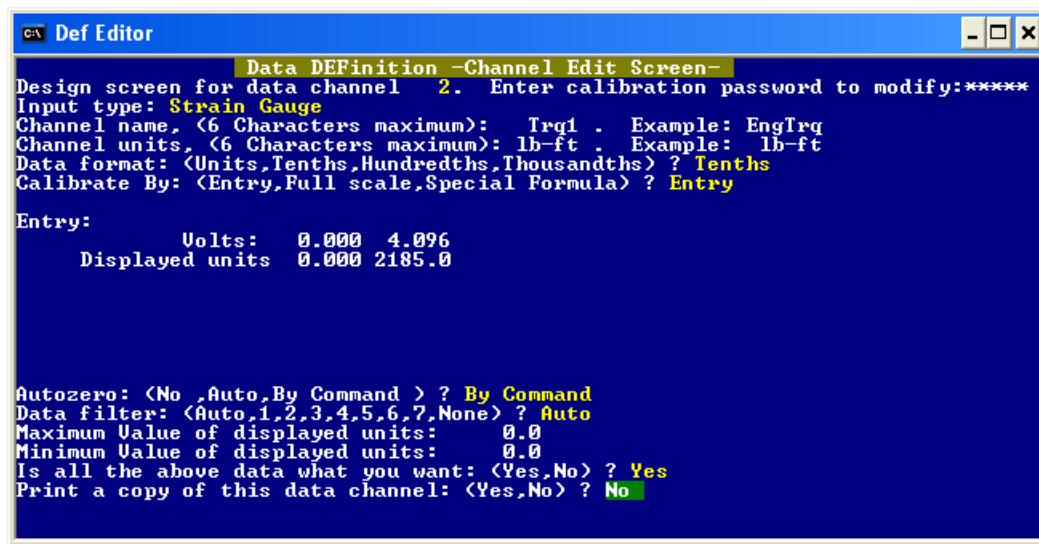


Figure 11-3. Data Channel Definition

Information on the type of channel displays here. The example shown is an input for an analog voltage from a strain gauge on the dynamometer power absorption unit.

If modifying an existing channel, or if accessing the fixed entry type channels 1 through 12, the prompt will go directly to the channel name. When creating a new channel number 13 to 76, the screen prompts for the channel type. Two options are available:

- Thermocouple
 - Analog Voltage
2. Type **A** for Analog or **T** for Thermocouple. If one channel in a 16-channel group (13–28, 29–44, 45–60, 61–77) is set for thermocouple or analog voltage, all channels within that 16-channel group will automatically be set to the same channel type. The exception is any measured channel within a group can be converted to a calculated channel.
 3. Type the name of the channel. The channel name characters are limited to six alphanumeric so the name will fit onto the various screen displays and printouts. Press **ENTER**.

4. The next entry field is for the channel units.
 - **Analog Voltage channels:** Type the units of the channel in the desired notation convention (for example: rpm, voltsDC, psi). Up to six alphanumeric characters are allowed. The typed units do not affect the channel reading or calculation, but the units of measurement for the sensor should match the calibration. This entry is for labeling purposes only. Press **ENTER**.
 - **Thermocouple channels:** Select the desired units by typing the first letter of the temperature format (F for Fahrenheit or C for Celsius). Fahrenheit is the default. Selecting Special Formula will convert the channel to a calculated channel.
5. Press **ENTER** to advance to the Data Format entry field.
 - **Strain Gauge, Frequency, and Analog Voltage channels:** Enter the data format. This entry specifies how many, if any, significant digits display after the units place in the data display. Units selects displays of only whole numbers above 0. Tenths displays one place to the right of the decimal (X.x), hundredths two places to the right (X.xx) of the decimal, thousandths three places right of the decimal (X.xxx). You only need to type the first one or two letters of the word for the program to recognize your choice. Press **ENTER**.
 - **Thermocouple channels:** Type the letter of the thermocouple type (K, J, T, or E). The thermocouple type must match this entry to get the correct readings and display the correct units format. All channels within the 16-channel block must be of the same type thermocouple. However, additional expansion panels can be of different types.
6. Press **ENTER** to advance to the calibration method (strain gauge, frequency, and analog channels only). Three methods are available: **Entry**, **Full Scale**, and **Special Formula**.
 - **By Entry Calibration:** calibrates the sensor between one corresponding sensor input/ displayed value and a second corresponding input/ displayed value. This method is used when the sensor may not “fit” the exact values entered and needs to be calibrated using a known external source (load cells fit this category). Most sensors can be calibrated by entry. One advantage to using this method over the full-scale method is that you can “see” the input values.

NOTE: The torque circuitry on SuperFlow system is scaled at 4.096 VDC for full scale. On many pressure transducer and flow channels, you can enter the actual calibration units from the sensor. You must enter the correct scaling for calibration to get the correct results.

Example:

A 150-psi pressure transducer has a maximum output of 5 volts DC (based on a 5-VDC excitation voltage). Therefore, the calibration entry for this channel will be:

Volts	0.000	5.000
Displayed Units	0.000	150.00

Where 0 volts in = 0 psi displayed and 5 volts in = 150 psi displayed.

- **Full Scale** calibrates the sensor by taking the specified sensor output value at 0 volts and at full scale to linearize the sensor output between the two values. This method is useful with very linear sensors. If a sensor has a known non-linearity, it may be better to use entry calibration or use a calculated channel and an interpolation table.
- **Special Formula** converts the channel into a calculated channel. This function is used to create additional calculated channels when needed and when unused measured channels are available. The equation entry parameters are the same as described for calculated data channels (see “Configuring Calculated Channels” on page 11-19).

Type the values and use the **ENTER** key to step through the choices.

TIP: *If changing a pressure channel to read out in different units, take the full-scale rating for the transducer and convert to the desired units of measurement. Type that value in the full-scale displayed units column. Remember: doing this will affect the calibration coefficient for that channel requiring which requires consideration.*



For details on the coefficients, see Appendix A, “WinDyn Calibration Files.”

7. After the calibration method is completed, the program moves to the autozero selection (Strain Gauge, Frequency, and Analog channels only).

Autozeroing allows for setting the displayed value of the channel at zero with no signal (or a reference signal) applied to the sensor. Some sensors, such as a pressure transducer or load cell, needs to be referenced at local atmospheric conditions. Other sensors, such as a Wideband O2 sensor do not need to be zeroed. Three choices are available: **No**, **Auto**, and **By Command**.

- **No** autozero specifies that the channel cannot be zeroed. The No autozero method is more commonly used to prevent zeroing of absolute output devices that should not be autozeroed. Examples of such devices are barometric pressure sensors and fuel specific gravity sensors. Such sensors always output a reading and are never in a zero output condition.
- Autozero **By Command** allows the sensor to be autozeroed manually by the operator from the PC or the Handheld Controller. This is the most common autozero setting for control channel type sensors. For information on performing this function, see the WinDyn command functions reference.
- The **Auto** selection is not implemented in current SuperFlow systems.



For more information on Calibration and Autozeroing, see Appendix A, “WinDyn Calibration Files.”

Select the desired setting by entering the first letter and press the **ENTER** key.

8. Enter the data filter rate. Seven choices are available. Entering one of the five values fixes the data filter rate of the sensor. Entering **None** prevents data filtering. Entering **Auto** allows WinDyn or the handheld controller to specify data filtering. Select the desired data filtration by entering the number or first letter (see Table 11-1 on page 11-5) and press the **ENTER** key again.
9. The minimum value and maximum value units do not need to be set unless the channel is to be used as a control channel. These channels are used for closed-loop control on the dyno load, engine throttle, or flowbench airflow. If the channel is used for this purpose, set the values to minimum and maximum values of the control range. Otherwise, leave these values set at zero.

Example:

If dyno speed is used to control the load and the maximum rated speed of the dynamometer is 10,000 rpm, set the minimum value to 0 and the maximum value to 10,000.



See section 11.3.3, “Designing the Control System” on page 11-27 for information on configuring the control channels.

10. For the line that reads **Is all the above data what you want?** review the channel configuration, press **Y** for **Yes**, and press the **ENTER** key. Selecting **No** will return the operation to the top of the menu and the process will start over.

11. A copy of the channel configuration can be sent to the local printer if desired. However, you can get a printout of the channel definition using the Configuration Utility program (see Chapter 7, "Configuration Utility"). For **Print a copy**, select **No** and press the **ENTER** key.
12. Now you return to the initial channel number selection menu. Type another channel number or press **ESC** to return to the main menu.

11.3.1.2 Configuring Specification Channels

Specification channels are user-defined channels that hold discreet values entered for a test engine or vehicle. The values do not change as measured data channel values do. The operator can change the value of specification data channels from the **WinDyn Test Setup** dialog box, the operator interface device (handheld controller or console), or in an autotest.

Common uses for specification channels include values such as bore and stroke, spark pulses/revolution, or fuel-specific gravity. More complex uses of the specification channels include test parameters for acceleration ramp tests.

Example:

In an engine dynamometer system

Channel 77 = Engine Bore

Channel 78 = Engine Stroke

Channel 79 = Number of Cylinders

The formula in channel 126 (Disp) will take these specification values and calculate the engine displacement. Therefore, by changing the specification channel values in the **Test Setup** dialog box for each engine, the displacement value is automatically calculated so you do not need to change the configuration file. (Refer to section 3.3, "WinDyn Test Setup" on page 3-9.)

Example:

In an engine dynamometer system standard acceleration test:

Channel 95 = Start

Channel 96 = StopAt

Channel 97 = StpTim

Channel 98 = StpSiz

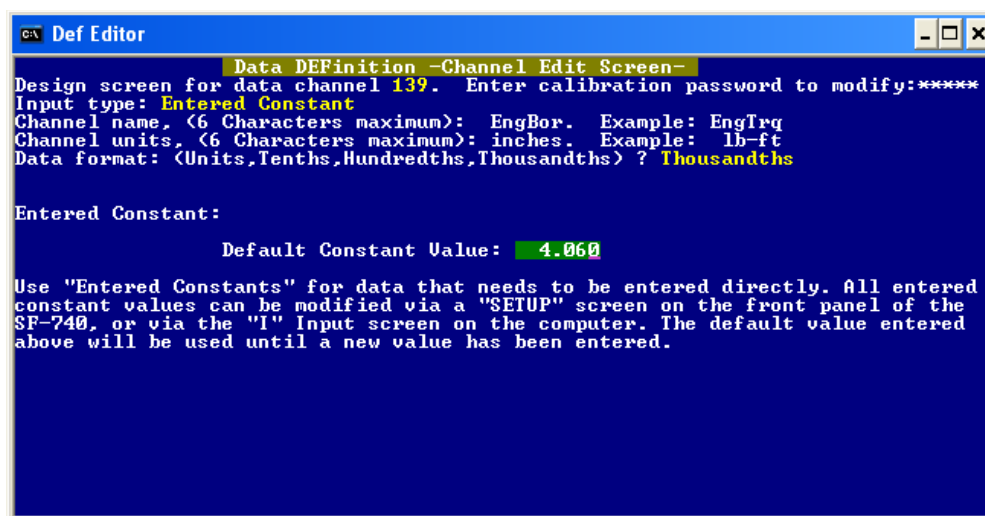
In a test profile, a mathematical function will subtract the value in channel 95 (starting rpm) from the value in channel 96 (ending rpm) and divide the result by the value in channel 98 (rate or rpm per second). The result of this calculation will be the time period in seconds for the acceleration ramp which is automatically entered into channel 97 (test time) by the test.

Since the ramp time is a calculated value, changing the specification channels adjusts the ramp to meet a new acceleration time without actually having to rewrite the test profile. For more information on this and other applications, see Chapter 13, "Test Editor."

Engine, vehicle, and test setup data is stored in specification channels 77 through 99. The values entered in the configuration file are the **default** specification channel values. The actual specification values being used by the system are entered in the WinDyn **Test Setup** dialog box before a test is run.

1. From the editor main menu, select **E – EDIT Channel Specification** and type the desired channel number on the **Channel Select** screen.

TIP: Press **CTRL+Z** to display a list of all the defined channels. Press **ESC** to return to the previous screen.



The example shown is channel **77**, commonly used for engine bore diameter on engine dynos. This value and other specifications on the engine is used to calculate important information such as its displacement, piston speed, volumetric efficiency, Brake Mean Effective Pressure (BMEP), etc.

2. Type the name of the channel. The channel name characters are limited to six so the name will fit onto the various screen displays and printouts. Press **ENTER**.
3. Type the units of the channel in the desired notation convention (for example: rpm, voltsDC, psi). Up to six alphanumeric characters are allowed. The typed units do not affect the channel reading or calculation, but the units of measurement for the sensor should match the calibration. This entry is for labeling purposes only. Press **ENTER**.
4. Enter the data format. This entry specifies how many, if any, significant digits display after the units place in the data display. Units selects displays of only whole numbers above 0. Tenths displays one place to the right of the decimal (X.x), hundredths two places to the right (X.xx) of the decimal, thousandths three places right of the decimal (X.xxx). You only need to type the first one or two letters of the word for the program to recognize your choice. Press **ENTER**.
5. A default constant (specification) value entry box appears. By entering the appropriate specification value, WinDyn can calculate other important information that uses this value. The value entered here is only a default setting.



It is important to check the specifications before running each test to make sure they agree with the engine or vehicle being tested. Use the WinDyn **Test Setup** feature to modify the specification channels with the correct values and activate them for the test. See section 3.3, "WinDyn Test Setup" on page 3-9.

- For the line that reads **Is all the above data what you want?** review the channel configuration, press **Y** for **Yes**, and press the **ENTER** key. Selecting **No** will return the operation to the top of the menu, and the process will start over.
- A copy of the channel configuration can be sent to the local printer if desired. However, you can get a printout of the channel definition using the Configuration Utility program (see Chapter 7, "Configuration Utility"). For **Print a copy**, select **No** and press the **ENTER** key.

TIP: Specification files can be assigned to test groups, thereby setting all the specification channel values when the test group is loaded. Therefore, you do **not** need to create multiple configuration files to set different values for the specification channels; instead, use a single configuration file and multiple test groups, with each test group using the same configuration and a different specification file.

11.3.1.3 Configuring Calculated Channels

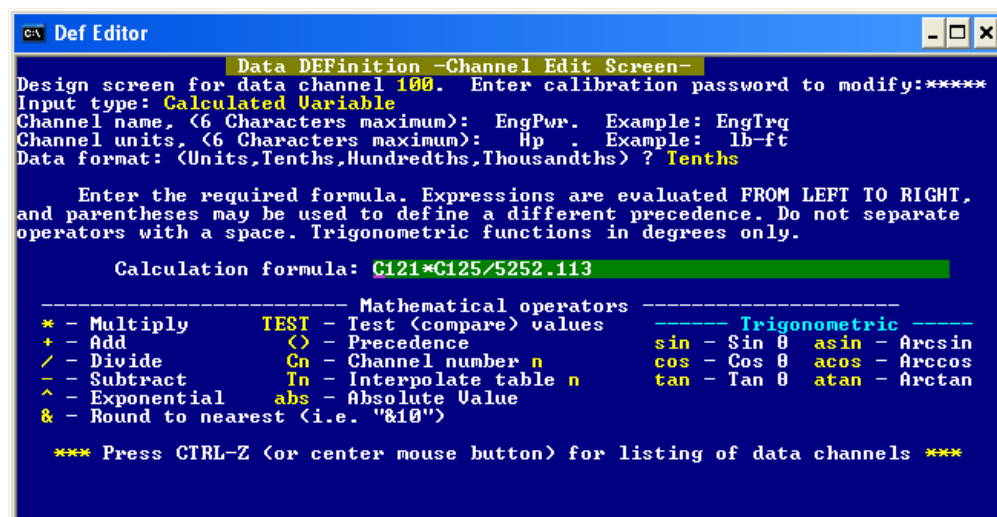
Calculated channels are one of the most powerful features of the WinDyn software. Calculated data channels are used to perform mathematical operations using other data channels. You can combine input from any sensor, specification channel, and interpolation table into any kind of mathematical calculation to produce real-time data that will display and record along with the rest of the test results.

The value of a calculated channel is the value of the function at a given time. Any channel with a numerical value may be used as a constant or variable in a mathematical operation.

Channels 100 through 129 are designated as calculated channels. Additional calculated channels may be added using channels 1 through 76 if they are not utilized for sensor inputs.

- From the editor main menu, select **E – EDIT Channel Specification** and type the desired channel number on the **Channel Number Select** screen.

TIP: Press **CTRL+Z** to display a list of all the defined channels. Press **ESC** to return to the previous screen.



The example shown is channel **100**, commonly used for measured horsepower or BHP on both engine and chassis dynos.

- Type the name of the channel. The channel name characters are limited to six so the name will fit onto the various screen displays and printouts. Press **ENTER**.

3. Type the units of the channel in the desired notation convention (for example: rpm, voltsDC, psi). Up to 6 alphanumeric characters are allowed. The typed units do not affect the channel reading or calculation but the units of measurement for the sensor should match the calibration. This entry is for labeling purposes only. Press **Enter**.
4. Enter the data format. This entry specifies how many, if any, significant digits display after the units place in the data display. Units selects displays of only whole numbers above 0. Tenths displays one place to the right of the decimal (X.x), hundredths two places to the right (X.xx) of the decimal, thousandths three places right of the decimal (X.xxx). You only need to type the first one or two letters of the word for the program to recognize your choice. Press **Enter**.
5. Next, the formula entry box appears. Below the calculation formula is a list of the mathematical operations that can be performed in an equation. The equation must fit within the green box; therefore, it can only use that many characters. For a long or complex formula, use two calculation channels so the first channel is called by the second channel.

Example:

C121*C125/5252.113

The formula indicates channel 121 (Engine Torque) multiplied by channel 125 (Engine Speed) and divided by 5252.113. This is the formula for horsepower (in Imperial units). A different formula is required for kilowatts or other power units.

It is very important to use the parentheses symbols () to designate the order of precedence in the calculations. Any calculations inside the parentheses will be completed before any of the calculations outside the parentheses. Use multiple levels of nested parentheses if required.

The exponential function uses the ^ symbol followed by a number. Use any power required. For example, a square root would require a ^ followed by 0.5. It is necessary to always precede a decimal point with a numeral or a zero when entering it into a formula. For trigonometric functions, the angle must be entered in degrees and fractions of a degree. Trigonometric functions must be entered *after* the channel or value they apply to, as in **(C100*2)sin**.

One special feature is the ability to call an interpolation table. These tables are located in channels 130 through 139 (section 11.2.4, "Interpolation Tables" on page 11-8). Interpolation tables are called by placing the letter T between the part of the formula calling the table and the table number, as in **C6T137**.

NOTE: Use the Configuration Utility program to view additional calculated formulas to see how the operations are performed. Good examples are typically channel 101 for correction factors and channel 120 for humidity.

6. Press **ENTER** to advance the editor to the next entry. The minimum value and maximum value units do not need to be set unless the channel is used as a control channel. These channels are used for closed-loop control on the dyno load, engine throttle, or flowbench airflow. If the channel is used for this purpose, set the values to minimum and maximum values of the control range. Otherwise, leave these values set at zero.

Example:

If engine power is used to control the load and the maximum rated power of the dynamometer is 1000 hp, set the minimum value to 0 and the maximum value to 1000.



See section 11.3.3, "Designing the Control System" on page 11-27 for information on configuring the control channels.

7. For the line that reads **Is all the above data what you want?** review the channel configuration, press **Y** for **Yes**, and press the **ENTER** key. Selecting **No** will return the operation to the top of the menu, and the process will start over.
8. A copy of the channel configuration can be sent to the local printer if desired. However, you can get a printout of the channel definition using the Configuration Utility program (see Chapter 7, “Configuration Utility”). For **Print a copy**, select **No** and press the **ENTER** key.

11.3.1.4 Configuring Interpolation Tables

Interpolation channels are tables that determine values from devices with nonlinear signal output. Such devices include flow turbines (air and fluid). Before they are integrated into a system, flow turbines are manually tested to determine flow rates for given signal output. The resulting table of output signal vs. flow values is entered into an interpolation table when defining an interpolated channel. An interpolation channel “holds” the table of values. Interpolation channels cannot be used alone. They are used with data channels and calculated channels to interpolate the raw input signal from a data channel through the interpolation table.

Example:

Channel 138, an interpolation channel, is configured with the frequency-to-gallons/hour calibration values for a gasoline flow turbine. Channel 8, a frequency channel, is configured to measure the flow turbine frequency output. To derive the gallons per hour (gph) flow values from the flow turbine frequency, a calculated channel is configured as:

C8T138

The calculated channel will read the frequency from channel 8 and convert it to gallons per hour through the interpolation table, channel 138.

Another use of interpolation channels is to define input-output correspondence for complex mathematical functions. Equations can be solved for two values – input and output – and the data entered into the table. This is useful when a complex mathematical operation such as an integral, derivative, or differential function is to be performed on an input signal.

The interpolation tables are located in channels 130 through 139.

1. From the Editor main menu, press **E** to open the **Data Definition Channel Edit Screen**. Type the channel number in the selection box and press the **ENTER** key to open the interpolation table. A menu appears with a choice between **fixed interval** and **variable interval** numbers.

TIP: Press **CTRL+Z** to display a list of all the defined channels. Press **ESC** to return to the previous screen.

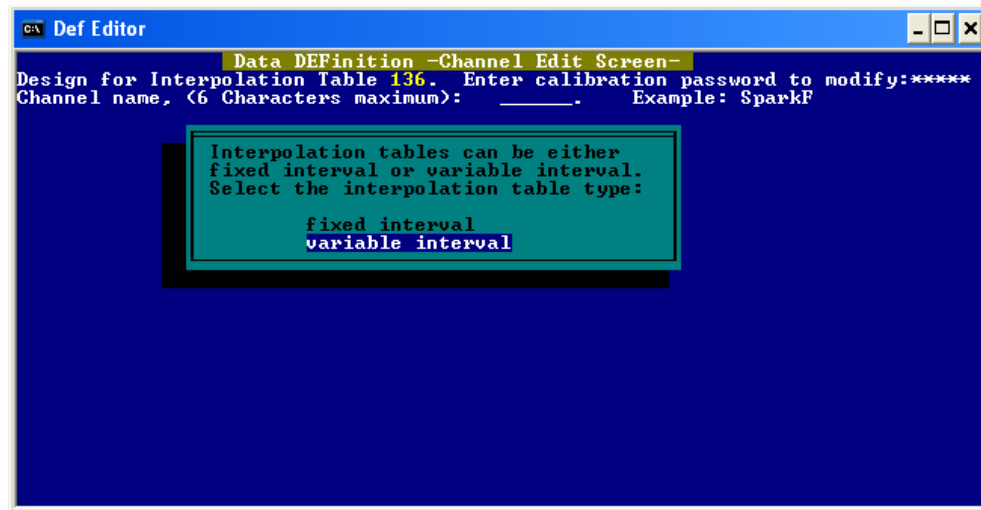
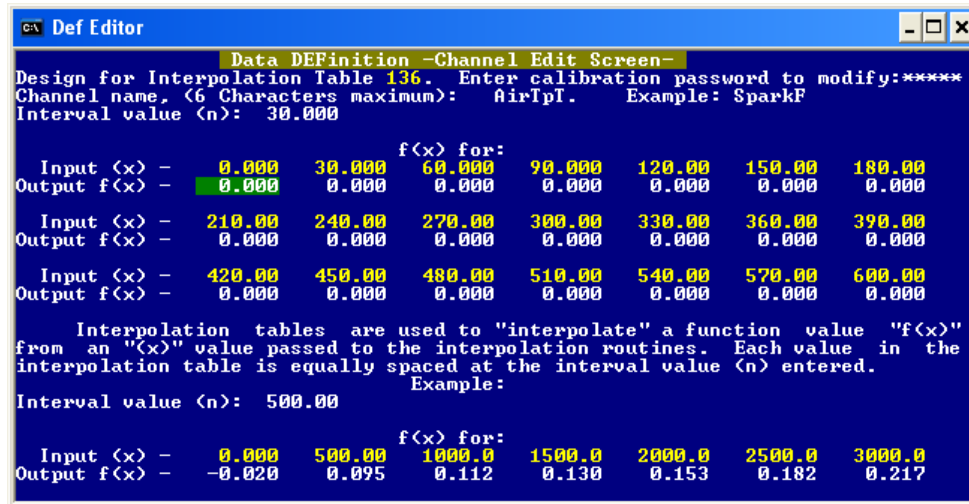


Figure 11-4. Interpolation Table Interval

Fixed interval tables use an operator-defined interval to determine the sample input (x) values that corresponding output (F(x)) values will be assigned to. The operator can use **variable interval** tables to assign any sample input value (x) for a corresponding output (F(x)) value. In most cases, the choice of fixed or variable type **interpolation table** is based on the interpolation data provided with the sensor to be interpolated. For example, most flow meters are provided with variable interval interpolation data.

2. Use the LEFT/RIGHT ARROW keys to select **fixed** or **variable** and press **ENTER**. The interval displayed is the information entered in the table.

3. Press **ENTER** twice to view the entire chart.



The example shown is channel **136** from an engine dyno configuration. In all SuperFlow default configuration for all systems, this is the **AirTpT Air Temperature** table.

With the chart displayed, you can see the general principle involved in an interpolation table. The upper line is for the input data. This is the data that arrives from a calculated or sensor channel. The lower line is the output data. This is the data output by this channel as a result of the input. The advantage of this concept is that it allows you to enter data for nonlinear sensors or numeric information. Enter all the data points that are available, and the table then calculates the appropriate points that would fall in between. This feature is used to linearize a sensor or perform calculations from a set of arbitrary data.

4. Type the name of the channel. Up to six alphanumeric characters are allowed. The name should reflect the source data channel or should indicate the use of the table (for example, the last T in AirTpT indicates it is a table). This way the channel will not be confused with other data channels. The interpolation channels have no readings that can be displayed.
5. Press **ENTER**.
6. To build an interpolation table, select the intervals for the input values. It is limited to 21 entries. Type all the values, pressing **ENTER** after each. The editor will advance through the table from top to bottom, then left to right. The values can be edited by using the arrow keys on the computer keyboard to highlight the desired table entry value.
 - If you select a **Fixed interval**, the screen prompts to enter the input value (x) value. The software will start at zero and calculate upward 21 incremental values of the specified interval.
 - If you select **Variable**, type the values for each of increments whether they are evenly spaced or not. The screen displays the table of values and highlights the first F(x) value.
7. Type the output values that correspond with the input values. A typical example might be to enter the flow rate in gallons per minute for a turbine on the lower line while entering frequency for the input on the upper line.
8. After all 21 fields are complete, a line appears on the screen asking, **Is all the above data what you want?** Review the channel configuration, press **Y** for **Yes**, and press the **ENTER** key. Selecting **No** will return the operation to the top of the menu, and the process will start over.

9. A copy of the channel configuration can be sent to the local printer if desired. However, you can get a printout of the channel definition using the Configuration Utility program (see Chapter 7, "Configuration Utility"). For **Print a copy**, select **No** and press the **ENTER** key.
10. Write a calculation formula that uses the signal from the sensor channel and calls the interpolation table number to obtain the final result.

To see how this is written, look at the calculated channel 74 for AirInT. It calls the interpolation table 136 to display Air Temperature as a function of the voltage from the sensor.

By using this process, it is possible to linearize sensors and otherwise utilize data that is in a nonlinear format. This is a powerful tool for improving the accuracy of the test system.

11.3.2 Designing Console Data Screens

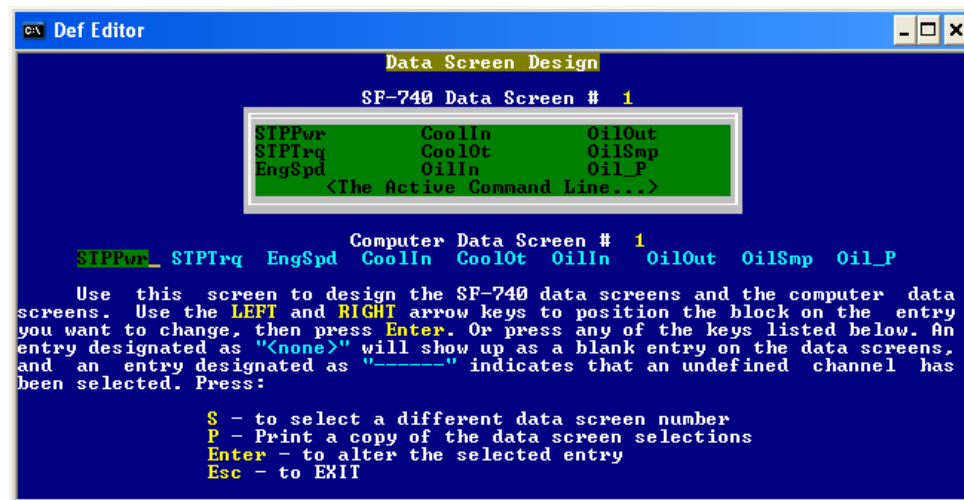
Console and handheld controller screens display the defined data channels. The main display (right-hand) screen on the SF-902/XConsole or the single display on a remote handheld controller displays selected data channels. The display channels can be grouped onto nine separate screens for convenience.



IMPORTANT: Channels must be defined in the configuration file before data screens can be designed.

Access the screens by pressing a numeric key (1-9) on the control panel or handheld numeric keypad.

1. To configure or edit the screens, from the **Configuration editor** main menu, select **S-Design Stored Data Screens**. The editor defaults to designing screen #1. The representation of the screen appears at the top of the edit screen. Nine channels of data may be displayed.



The example shown is from a standard SF-902 engine dynamometer system.

NOTE: The XConsole and the standard SF-1853 wired handheld controller are configured differently. See below for the differences.

2. Use the LEFT and RIGHT arrow keys to position the cursor on the entry you want to change, then press **ENTER**. Or press any of the keys listed on the menu below the channel display. An entry designated as **<none>** appears as a blank entry on the data screens, and an entry designated as **---** indicates an undefined channel was selected.
3. Type the channel number to display and press **ENTER**.

***TIP:** Press **CTRL+Z** for the complete channel list.*
4. The channel name appears on the mock display screen and the position selected in the nine horizontal display selectors.
5. Repeat until all necessary channels are defined.
6. To change to a different screen, press the **S** key. Then type the desired screen number (1-9) and press **ENTER** (9 screens are available with 9 display channels each for a total of 81 displayed channels).
 - Press **P** to print a copy of the screen definition.
 - Press **ESC** to return to the Configuration Editor main menu.

SF-902, XConsole, and Wireless Handheld Screens

The screen design (Figure 11-5) of the XConsole, SF-902, and wireless handheld is set for screens 1 through 5 to display nine channels while screens 6 through 9 show 18 channels. A typical screen could be configured as:

EngSpd 0			
EngTrq -26.0			
EngPwr 0.0			
EngSpd	0 RPM	Fuel IM	0.0 lb/hr
EngTrq	-26.0 lb-ft	A/F 1	4.03 Ratio
EngPwr	0.0 Hp	A/F 2	4.02 Ratio
Oil P	0.3 psia	A/F 3	4.02 Ratio
Oil In	78 degF	A/F 4	4.02 Ratio
Oil Out	87 degF	A/F 5	4.02 Ratio
Cool In	74 degF	A/F 6	4.02 Ratio
Cool Out	100 degF	A/F 7	4.02 Ratio
Fuel P	0.1 psia	A/F 8	4.02 Ratio
Start Test	Pause Test	Stop Test	Setup

Figure 11-5. XConsole Data Screen

The editor defines the screens as:

Table 11-6. Screen Functions

Screen Number	Function
S = 1	Designs screen 1 on the display console and the top three lines and left-hand column for screen 6 on the display console.
S = 2	Designs the right-hand column of screen 6 on the display console.
S = 3	Designs screen 2 on the display console and the top three lines and left-hand column for screen 7 on the display console.
S = 4	Designs the right-hand column of screen 7 on the display console.
S = 5	Designs screen 3 on the display console and the top three lines and left-hand column for screen 8 on the display console.
S = 6	Designs the right-hand column of screen 8 on the display console.
S = 7	Designs screen 4 on the display console and the top three lines and left-hand column for screen 9 on the display console.
S = 8	Designs the right-hand column of screen 9 on the display console.
S = 9	Designs screen 5 on the display console.

Handheld Controller

The screen design (Figure 11-6) of the SF-1853 wired remote handheld controller has 9 screens with 9 channels on each screen. The configuration editor defines the screens as numbered (S=1 designs screen 1, S=2 designs screen 2, and so on).



Figure 11-6. Handheld Data Screen

NOTE: The screen design of the wireless handheld controller is defined the same way as the XConsole.

11.3.3 Designing the Control System

Control channels are data channels that can function as closed-loop feedback channels where the SuperFlow control system can servo (adjust) a control device such as control on a dynamometer or a throttle actuator to produce a desired value such as 4,000 rpm or 100 lb-ft of torque. The system uses the control channel to “see” the current value (for example, the engine rpm) and compares it to the desired value. The control system continues to servo (up or down depending on whether the current value is higher or lower than the desired value) until the current reading matches the desired value. This process of “read current value, compare to desired value, and adjust” continues until the control system is placed in manual mode.

The combination of a controller controlling to a specific channel is called a mode. Five control channels are available to use by up to two controlled devices such as dynamometer load and throttle controllers. This allows you to define five different control modes to for closed-loop control. In other words, you could use one or both controllers to execute closed-loop control on up to five possible channels. The exception is on XConsole-based systems where only the first two control modes are available on the controller panel.

Once defined, channels are assigned to the two controllers in the Configuration editor. At least one control channel must be assigned to each channel if desiring closed-loop control. If several control channels are assigned to each controller (for example, speed and torque for each channel), then multiple modes are available for each controller.



IMPORTANT: Channels must be defined in the configuration file prior to designing the control system.

A control channel can be any channel defined in the configuration; however, measured channels work best because direct values input of the system calculating a value before sending it to the control system. Still, using calculated channels or even specification channels is permissible and does not create any serious problems. In all cases, the channel output must be a strong, reliable signal or the control will be erratic and unstable.

The most common control channels in SuperFlow dynamometer systems are the torque channels (channels 2 and 3) and the absorber speed channel (channel 10). Flowbenches use test pressure and flow as control channels. On engine dynamometers, calculated channels (121 for engine torque and 125 for engine rpm) are used for engine torque and engine speed because of the possible inclusion of a transmission or gearbox in the system requiring a ratio applied to the measured channels. Chassis dynamometers use roll speed as the control because it is a measured channel (channel 10) and a reliable signal for controlling to.

TIP: *If two controllers are available (such as throttle and load), the engine can be controlled in closed-loop fashion by servoing the throttle to one control channel and the absorber load to another to produce the desired results. **Both controllers cannot be adjusted to the channel at the same time.***

It is not necessary to define all five control channels in the configuration file. At a minimum, one channel must be defined if requiring closed-loop control. Engine dynamometers typically use two control channels—one for torque and one for speed. Some engine dynamometers have two controllers as well (dyno load and engine throttle). Chassis dynamometers frequently use only one controller (load) but two control channels—roll speed one-roll torque. Flowbenches will have one controller for the motors with two control modes—test pressure and flow rate. Towing dynamometers have a fixed control system with vehicle speed and torque as the control modes.

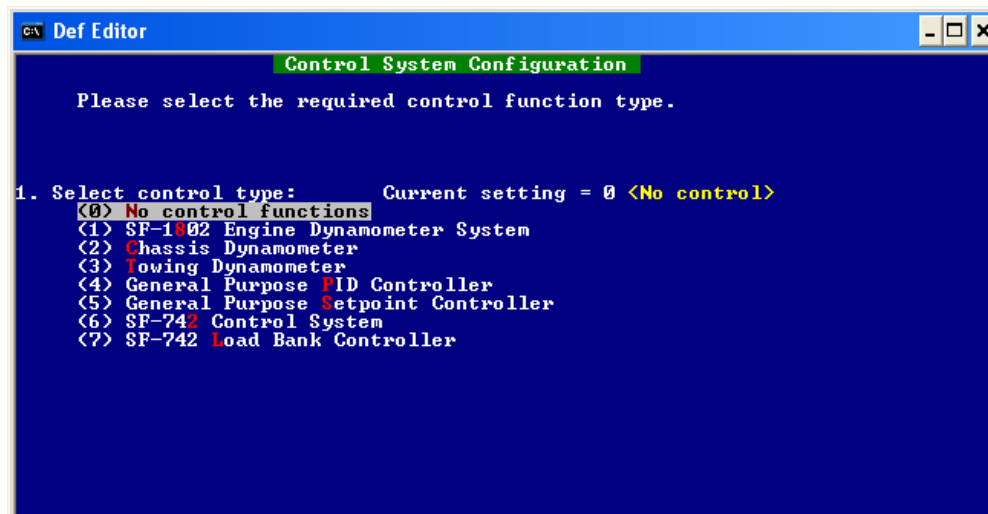
In all systems, control requirements vary considerably with test requirements.



IMPORTANT: In all SuperFlow systems, controller #1 is the load controller for the dynamometer.

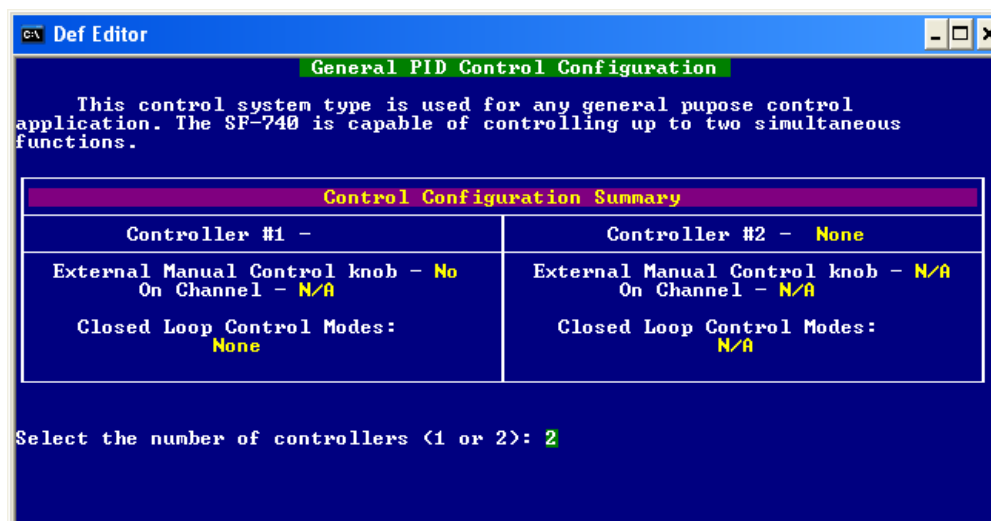
Setting Up the Control System

1. From the **Configuration Editor** main menu, select **Z – Design control system**. Press **ENTER**.
2. The **Control System Configuration** screen appears.

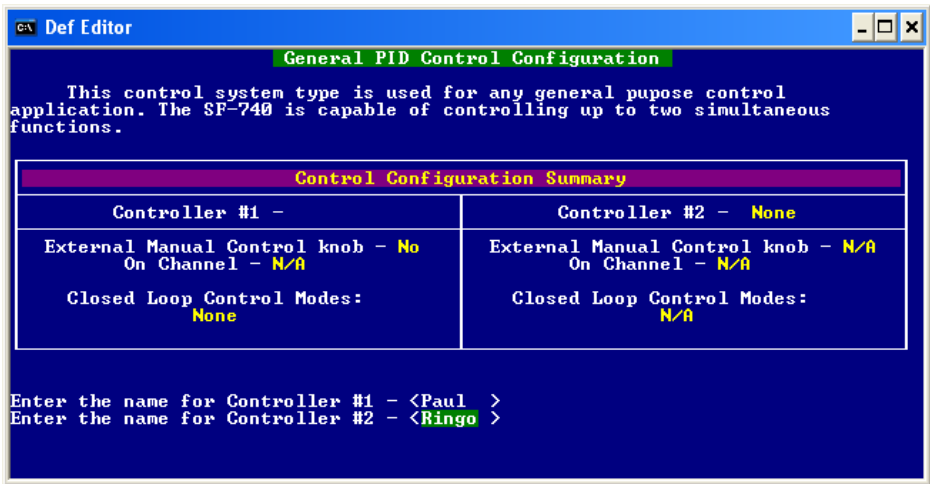


For all SuperFlow systems after 2003, use the **General Purpose PID Controller** type with the exception of the towing dynamometers. This procedure details the general-purpose type. Refer to the *Towing Dynamometer Operator Manual* for details on configuring the mode for these.

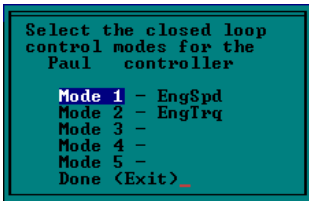
3. Use the arrow keys to select **(4) General Purpose PID Controller** and press **ENTER**.
4. A message appears asking if the control type is correct. Type **Y** for **Yes**. The **General PID Control Configuration** screen appears.



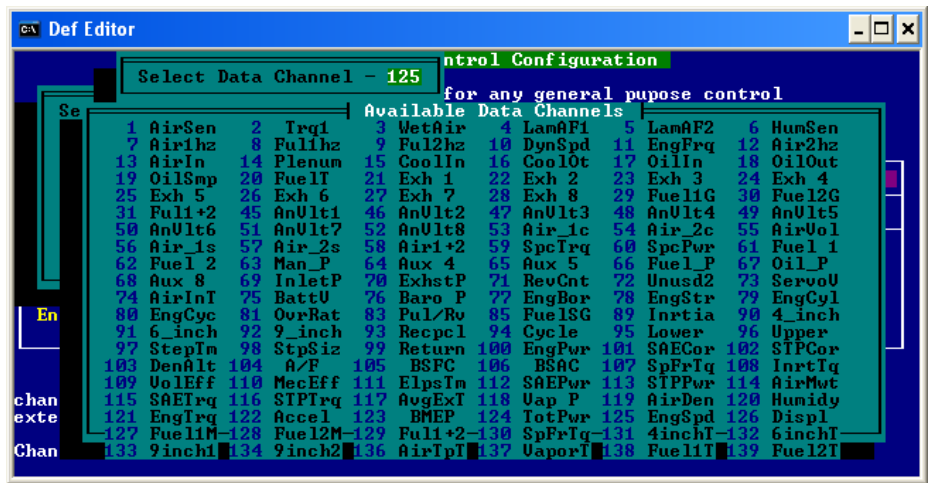
5. Type the number of controllers available on the system. The engine dynamometer system will have one or two depending on whether an electric throttle option is present. Chassis dynamometers and flowbenches in most cases will have only one controller. Press **ENTER**.



6. Type a name for the controllers. This name will display on the console controller panel and on the remote handheld control screen. The names are limited to six characters so they will fit onto the various screen displays. Common names are **Load** or **Dyno** for controller #1 and **Engine** or **Thrctl** for controller #2.
7. Press **ENTER**.
8. The next entries are for designating a channel for external control knobs. This feature is not supported on current SuperFlow systems. Type **0** for both controllers and press **ENTER**.



9. Use the arrow keys to select the control mode number. Always start at the top with number one. The XConsole system only uses the first two modes. Press **ENTER** to select the mode channel.



NOTE: Only channels defined in the current configuration can be used as control channels.

10. Select a channel by typing the channel number in the green box. Press **ENTER**.
11. After the controller setup is complete, use the arrow keys to select **Done** and press **ENTER**.
12. Repeat the above process for the second controller if applicable.
13. The screen prompts to confirm if the configuration is correct. Selecting **No** reenters the controller setup screen; select **Yes** to continue. Press **ENTER**.

11.3.4 Saving and Exiting

1. To save the configuration file and exit the editor, first press the **ESC** key to return to the main menu. Then press **K** to **KEEP <Save>** the configuration on disk. The name of the file that was originally opened will display in the green box. Press **ENTER** to use this name, or type a new name.
 - If you are making changes to the configuration used in your system, save the file under the existing name so the file association with the other user files remain intact.



Refer to Chapter 10, “Software Architecture” for more details on the relationship between configuration and user files.

- If this is a new configuration or if you are only experimenting, save the file under a different name than what is used for the installed file. It is best to keep the name under eight characters.
2. If saving over an existing file, a prompt will appear stating the file already exists and asks whether to overwrite the file. Use the arrow keys to select **Yes** or **No** and press **ENTER**.
 - If **No**, the editor will return to the previous screen so you can enter a different name.
 - If **Yes**, the editor will check the file for errors and save it if none are found. If the editor detects errors, a message displays. You must go back into the editor and locate and fix the error.
 3. A screen appears stating a CFA file was created. Press any key to continue and return to the editor main screen.
 4. Use the arrow keys to select **QUIT and return to WinDyn**. Press **ENTER**.
 5. Select **Yes** to exit the editor.

11.3.5 Installing Configuration Files

After making changes to the configuration file, you must load it into the Data Acquisition System to activate the changes. If you save a new configuration file and do not install it, the changes will not take effect.

1. To load a configuration file, from the **WinDyn** main menu, select **System>>Install>>System Configuration**.
2. Select the name of the configuration file (CFA) to load. Click **Open**.

NOTE: WinDyn will display only the configuration files (*.cfa) located in the path directories specified for **Configuration files**. See **System>>Preferences>>System File Paths** on the main menu.

If a display screen group was open, it will close and the WinDyn screen will go blank. The status bar at the bottom of the WinDyn screen will show the name of the installed configuration.



WARNING: If the units of measurement for a sensor channel was changed, the calibration coefficient was also changed. Installing a test group (*.tgp) or a calibration file (*.cal) without considering this will result in the channel displaying the readings in the same format as before the changes were made, regardless of how the configuration file is defined. To remedy this, a new calibration file must be saved with the new coefficients for this channel before installing a test group or calibration. Saving a new calibration file in this way will also default the calibration in all other calibrated channels—particularly the torque and barometric pressure channels. These channels should be recalibrated after the new configuration is installed and a new calibration file saved.

3. Install a calibration file by selecting from the **WinDyn** main menu **System>>Install>>Sensor Calibration**. Select a *.CAL file and click **Open**. In most situations the calibration file will have the same name as the configuration file.
4. Install a test group by selecting from the **WinDyn** main menu **System>>Install>>Test Group**. Select the desired test group (*.tgp) name and click **Open**.
5. The system is now ready for operation with the new changes in place.

11.4 Metric Configurations

Metric configurations are nothing more than a configuration file with the channels defined for metric values. Sensor channels can be designed to display metric values from the sensor input. Thermocouple channels can be set for Celsius readings, specification channels can be defaulted to metric units, calculated channels can have metric formulas, and interpolation tables are metric as well. The only channels that cannot be changed are the system channels, but these can be converted to metric in a calculated channel.

CHAPTER 12

DISPLAY EDITOR

IN THIS CHAPTER

- Custom Tools
- Using the Current Data Screens
- Designing Panel Meters
- Designing Bar Graphs
- Designing X-Y Graphs
- Designing Strip Charts
- Status Indicator
- Switches
- Status Indicator with Switches
- Background Images
- X-Y Reference Plots



12.1 Introduction

A screen group configures real-time current data displays on the computer monitor. Each screen group consists of one or more screens; each screen consists of one or more instruments.

WinDyn allows you to design 10 Current Data screens for each particular screen group. You may create as many setups as desired. A good plan is to create a basic setup for many tests, then customize the basic setup for each individual engine type and resave each new screen design under a new file name.

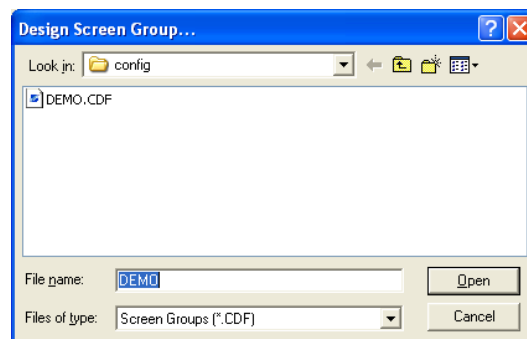
It is feasible to have different screen groups for each application or each type of test. This allows you to scale all the screen graphs appropriately for the application.

12.2 Designing Test Screens

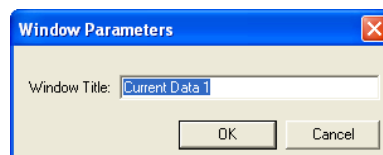
1. From the **WinDyn** main menu, select **Design>>Screen Group**, press **CTRL+T**, or click the **Design Screen Group** toolbar button .


NOTE: If a screen group is active, selecting one of these options will open the current active screen group for editing. If one is not open, the **Design Screen Group** dialog box appears.

- If opening an existing screen group, the **Design Screen Group** dialog box appears.

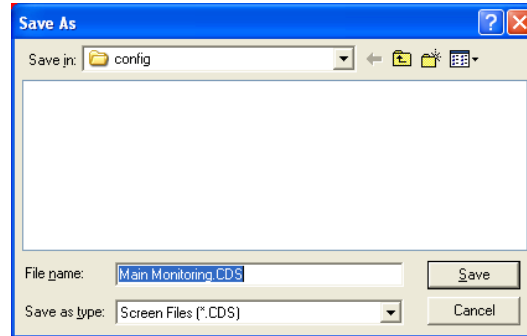


- Select a screen group and click **Open**.
- If creating a new screen group, the **Window Parameters** dialog box appears.



- Type a **Window Title** and click **OK**.
2. A current data display window now appears on the screen. Notice on the toolbar that most of the number buttons are up, while one button is depressed. The depressed button is the screen you are viewing. Click the other buttons to view the additional screens. A gray number indicates an undefined screen. 

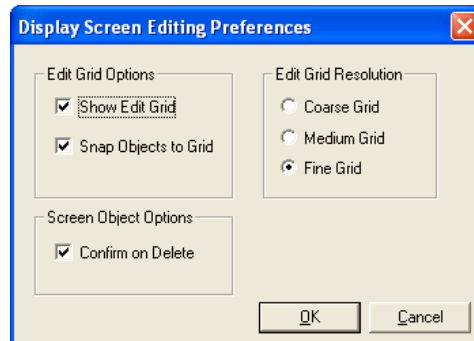
- When redesigning the screens, save a backup of the original. From the **Display Editor** menu, select **Screen>>Save As**.



- When the dialog box appears, highlight the text in the **File name** text box and type a new title.
- Click **Save**.
 - Notice the name of the new display file in the lower right corner of the screen. You can now modify this file and save it without affecting the original design. This is the same procedure you will use to design special screens for each of the different types of tests and engines.
 - If making a change to your current screens, keep this one as the backup, and save the changes with the original name.

12.2.1 Screen Editing Mode Preferences

From the **Display Editor** menu select **File>>Preferences**. The **Display Screen Editing Preferences** dialog box appears.



Use this menu to select edit grid and screen object options and the edit grid resolution:

- Show Edit Grid:** Select to see the grid when modifying screen displays. The visible grid appears as horizontal and vertical lines onscreen but not on the printed page.
- Snap Objects to Grid:** The grid attracts objects to it. As you size, move, or drag objects, they snap to the closest line on the grid.
- Confirm on Delete:** Select if you want a confirmation dialog box to appear when deleting objects during screen designs.
- Edit Grid Resolution:** Select the grid line thickness (**Fine Grid** is recommended).

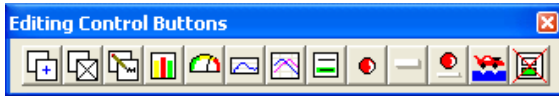
Click **OK**.

12.2.2 Selecting Objects for a Screen Design

Whether you begin with a new screen design or add objects to an existing screen design, a wide variety of choices are available.

12.2.2.1 Editing Control Buttons Toolbar

When you open a screen or screen group, a floating toolbar appears.

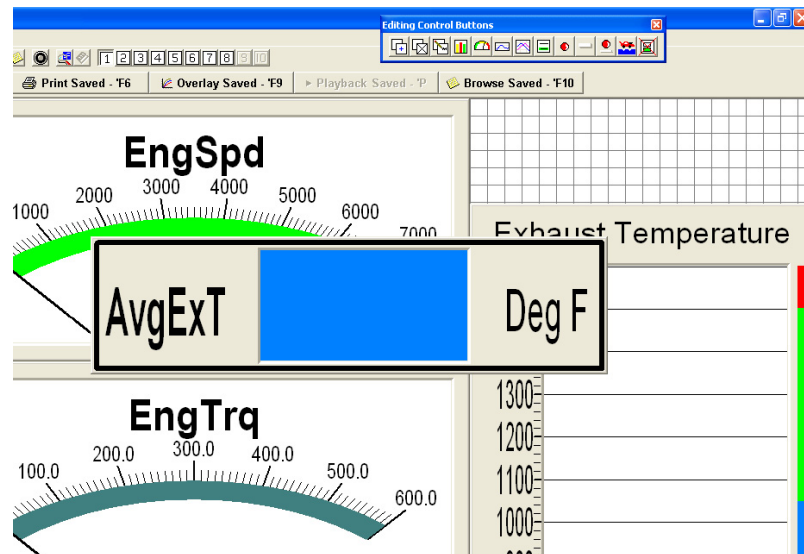


	Add New Screen		Strip Chart		Switch
	Delete Screen		X-Y Graph		Status Indicator with Switch
	Edit Screen Properties		Digital Display		Background Image
	Bar Graph		Status Indicator		Delete Instrument
	Analog Meter				

12.2.3 Resizing Objects

To resize existing objects on the screen, click an object to select and outline the object.

Place your mouse pointer at a corner or edge, and when the pointer changes to a double arrow, drag the corner to resize the meter. You can also drag the object over other existing display items.



When you release the mouse button, the object snaps to the nearest grid lines which make it easier to line up all the objects. If you wish to overlap objects in an unusual way, select **File>> Preferences**, and in the **Edit Grid Options** area, clear the **Snap Objects to Grid** option. If you later turn the snap-to-grid option on, the object you did not snap to the grid line does not change unless you reselect it.

By sizing objects in this way, you can make any object any size within the size of the entire screen. It is even possible to position the object on top of another object. If you do this, be careful with the sequence because the object selected last is always on top when the screen is opened again.

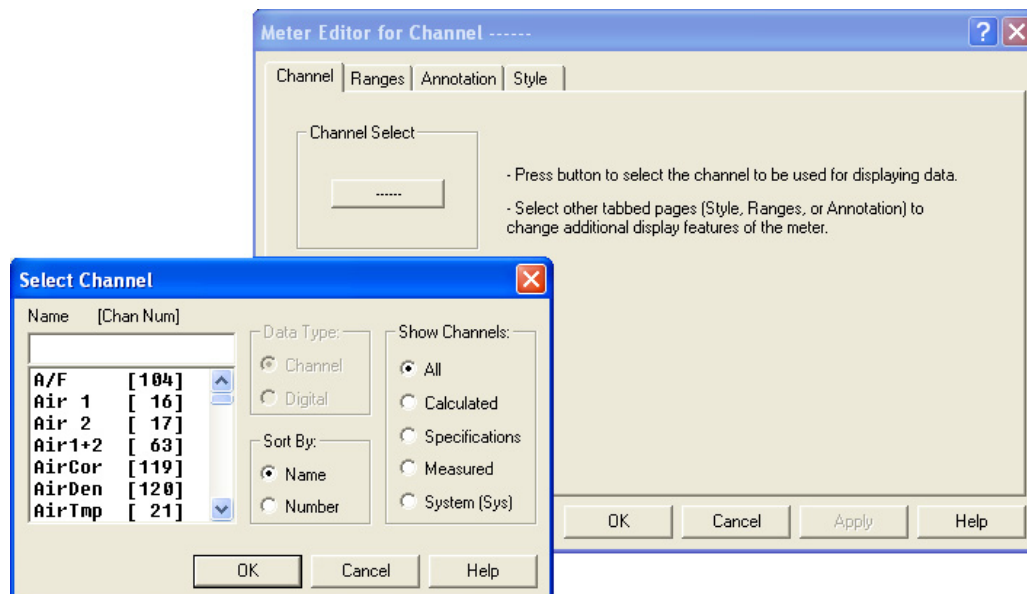
Always completely size and design the object to be on the bottom before designing and positioning the second object on top. If you inadvertently move one object behind the other, slide the overlaid object out of the way and then drag the object beneath it back onto the screen. Then reposition the objects and continue.

12.2.4 Selecting Channels

You can select the channel for each display object.


NOTE: The number of channels, channel name, and channel color items can only be changed while in **Edit mode**.

1. From the **Display Editor** menu select **Edit>>Properties**, or right-click the object and select **Properties**.
2. The **[Object Name] Editor for Channel** dialog box appears.
3. Click the **Channel** tab.



4. Click the button in the **Channel Select** area.

Use the scroll bar to view all the channels currently available for display objects. These channels are determined by the configuration file for the test system. The configuration file contains all of the sensor inputs, specifications, and the calculated channels.

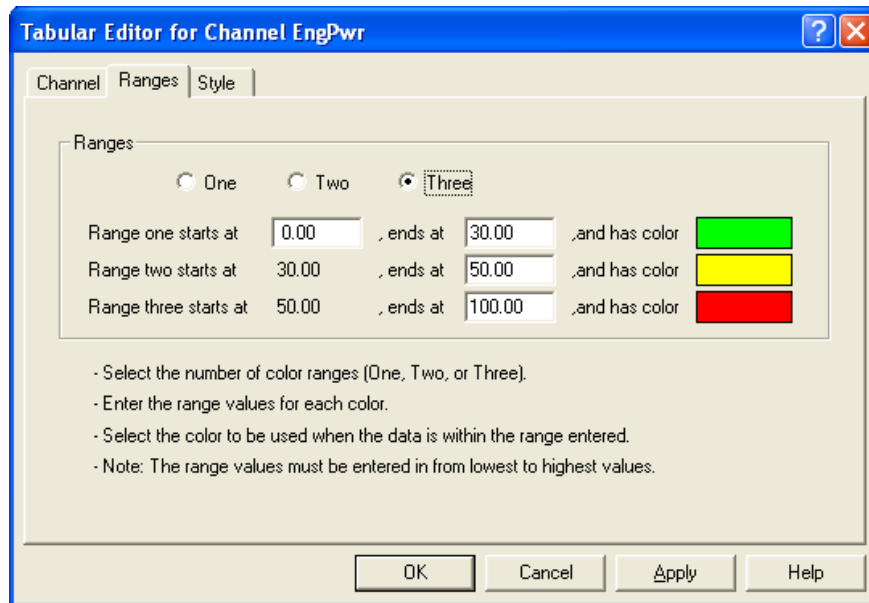
 Refer to Chapter 7, “Configuration Utility” for more information about the Configuration file.

5. When the dialog box appears, select a channel for your object and click **OK**.

12.2.5 Selecting Color Ranges

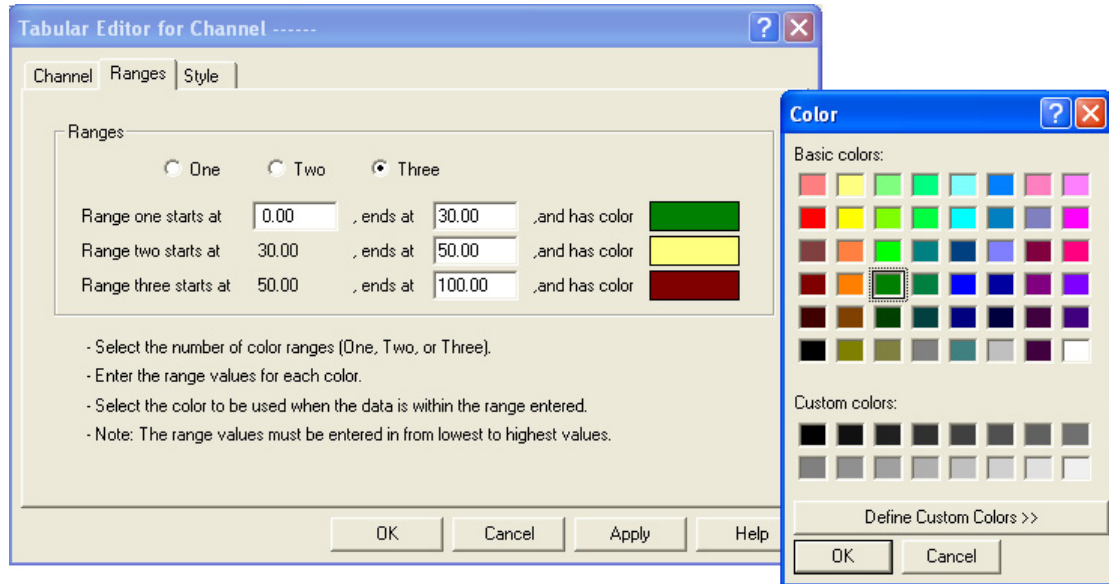
You can select default or custom colors for your display screens.

1. From the **Display Editor** menu select **Edit>>Properties**, or right-click the object and select **Properties**.
1. The **Tabular Editor for [Channel Name]** dialog box appears.
2. Click the **Ranges** tab.



3. Select **One**, **Two**, or **Three** color ranges. For this example, select 3.
4. Now enter the lowest expected range for this data item (usually 0) and the highest expected value. Enter the lowest value in the left text box in line 1 (Range one starts at...) and the highest value in the text box in line 3 (Range three ends at...).
5. Select the intermediate color change points by entering them in the remaining two text boxes (in this example, the text boxes with values of 30.00 and 50.00).

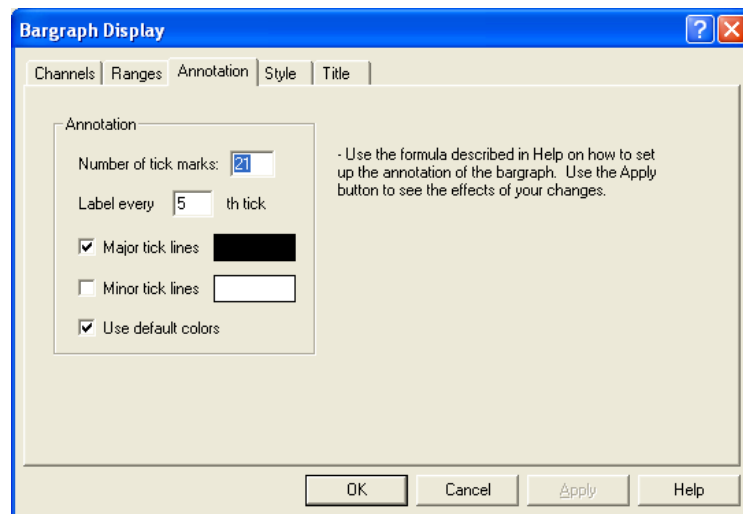
- Click the color bar next to each item. When the **Color** menu appears, select or define colors for each application.



- Click **OK**. Repeat the color choice for each of the other two bars. When one range is selected, only one value entry is required or possible.

12.2.6 Selecting Annotations

Select how many tick marks to display vertically on a display object and which of those to label. The actual label values depend upon the minimum and maximum range values entered on the **Ranges** tab.



Example:

Assume you want to create a bar graph to display water temperature from 0 to 300 degrees, a label every 50 degrees, and a tick mark for each 10 degrees. Determine how many tick marks are needed using the following formula:

$$\text{Number of tick marks} = ((\text{Max range} - \text{Min range}) / \text{interval}) + 1$$

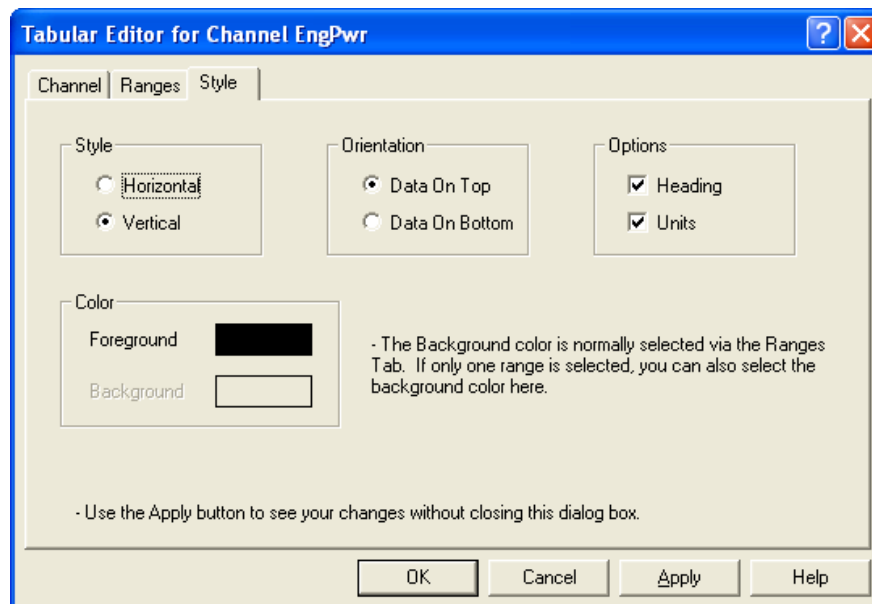
In this case, $((300 \text{ degrees} - 0 \text{ degrees}) / 10 \text{ degrees}) + 1 = 31$ tick marks. Now divide the label interval by the tick mark interval to determine which tick marks to label. In the example case, $50 / 10 = 5$. Therefore, enter **31** in the **Number of tick marks** text box, type **5** in the **Label every __th tick** text box.

By selecting the **Major tick lines** check box, you can add grid lines on the bar graph which correspond to the labeled tick marks. Selecting the **Minor tick lines** check box adds grid lines to the bar graph which correspond to the unlabeled tick marks

12.2.7 Selecting Object Styles

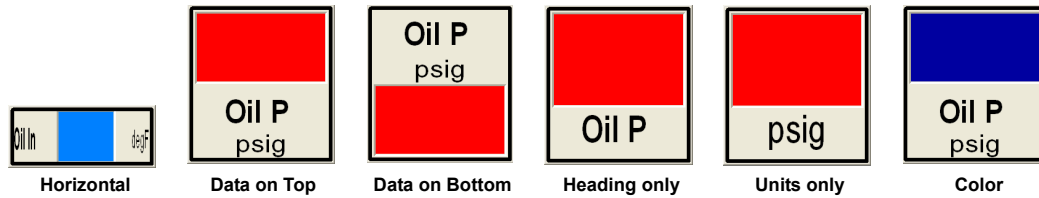
You can select how each object will display.

1. From the **Display Editor** menu select **Edit>>Properties**, or right-click the object and select **Properties**.
2. The **Tabular Editor for [Channel Name]** dialog box appears.




3. Click the **Styles** tab.

- **Style:** If you select **Horizontal**, the **Orientation** options are unavailable because the data displays on the left and right.



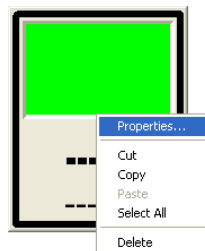
- **Orientation:** If you select **Vertical** in the **Style** area, in the **Orientation** area select whether to display data on the top or bottom.
- **Color:** If only one range is selected on the Ranges tab, you can set the **Foreground** and **Background** color in this area. Otherwise, the Background area is gray (unavailable). You can also use the Range tab to set colors.

 See section 12.2.5, "Selecting Color Ranges," on page 12-7.

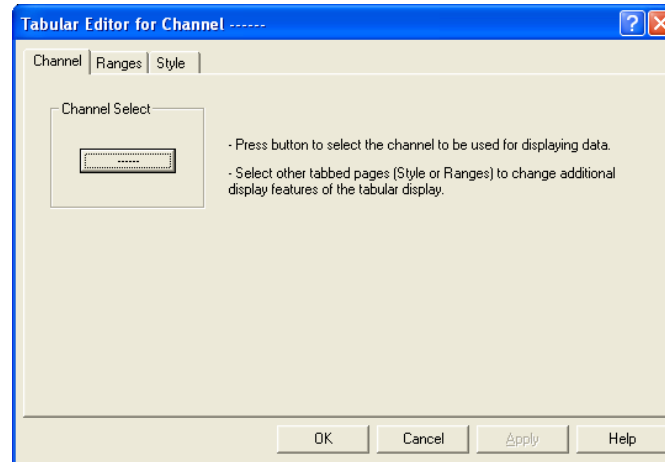
12.2.8 Digital Display Configuration

Each WinDyn Tabular display object lets you monitor the digital value of a single channel *during testing*.

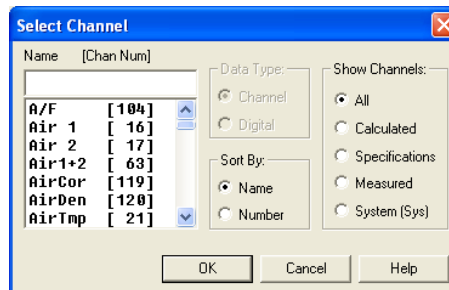
1. On the **Editing Control Buttons** toolbar, click the **Digital Display** button (sixth from the right) to create a new digital display item (a tabular object).
2. Select the new object and size it; then use the mouse to drag the object to any place on the screen (move the floating toolbar out of the way if necessary).
3. Right-click the object and select **Properties**. The Tabular Editor opens. This is where you select the data to display in the object, color ranges for the object as the display value changes, and various horizontal and vertical styles.




NOTE: No changes appear in the object until you click **Apply** or **OK** on the Tabular Editor dialog box.



4. Click the button in the **Channel Select** area to open the **Select Channel** dialog box.



Use the scroll bar to view all the channels currently available for display objects. These channels are determined by the configuration file for the test system. The configuration file contains all of the sensor inputs, specifications, and the calculated channels.

 Refer to Chapter 7, "Configuration Utility" for more information about the Configuration file.

5. Select a channel for your display object and click **OK**.
6. Click the **Ranges** tab, select the color ranges for this object, and click **OK** (see section 12.2.5, "Selecting Color Ranges," on page 12-7).
7. Click the **Style** tab. Try selecting various style options and click the **Apply** button to see the effect of each (see section 12.2.7, "Selecting Object Styles," on page 12-9).
8. Click **OK** to complete the design. The new display object appears on the screen with the correct title and color changes.
9. Resize the object and move it any place on the screen as desired.
10. To remove this object, press the **DELETE** key. The **Delete Instrument(s)** dialog box appears asking you to confirm the deletion.



IMPORTANT: Be careful not to continue pressing the **DELETE** button multiple times because additional objects will be deleted from the screen. Once an object is deleted, it cannot be recovered.

12.2.9 Designing Analog Meters

Use the WinDyn Meter display object to monitor the value of a channel on an analog meter.

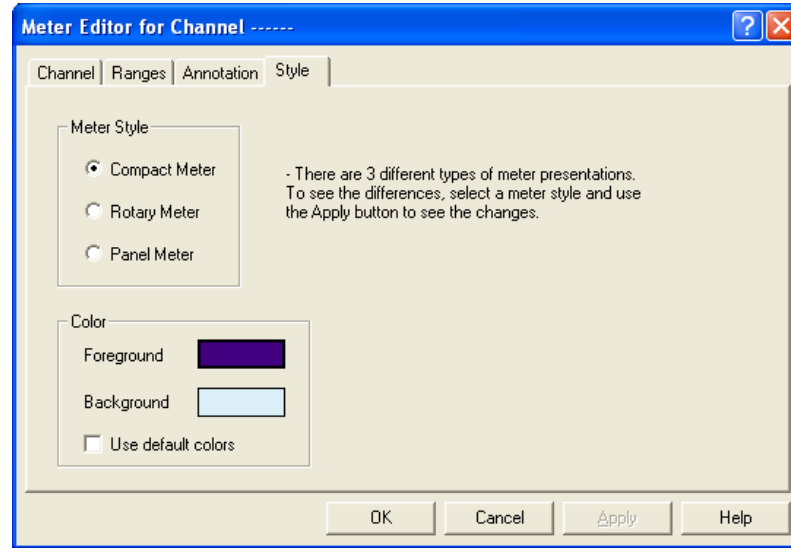
1. On the **Editing Control Buttons** toolbar, click the **Analog Meter** button (fifth from the left). A new panel meter appears. Each tab contains four buttons:
 - **OK:** Applies the changes made to the bar graph and exits the Meter Editor dialog box.
 - **Cancel:** Exits the dialog box without applying changes.
 - **Apply:** Immediately applies the changes made to the panel meter but keeps the dialog box open so you can see the effects of your changes without closing the Meter Editor dialog box.
 - **Help:** Opens the online documentation files.

NOTE: Clicking **Cancel** will not remove changes that were applied using the **Apply** button.

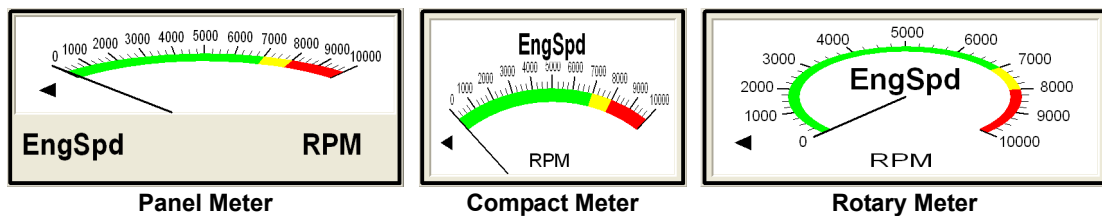
2. Click the corner of the panel meter and drag the corner to increase the size.
3. Right-click the panel meter and select **Properties**. The **Meter Editor** dialog box opens.
4. Click the button in the **Channel Select** area. When the dialog box appears, select a channel for your meter and click **OK** (see section 12.2.4, "Selecting Channels," on page 12-6).
5. Click the **Ranges** tab, select the color ranges for this meter, and click **OK** (see section 12.2.5, "Selecting Color Ranges," on page 12-7).
6. Click the **Annotation** tab. Annotation determines the positioning of the numbers and the increments for the panel meter (see section 12.2.6, "Selecting Annotations," on page 12-8).
 - **Number of tick marks:** Look at the total numeric range you selected from the start point to the end point for the meter. It is desirable to divide the tick marks in even increments between these points. For example, if the range is 1,000, you may choose 51 to 101 tick marks. SuperFlow generally recommends choices between 41 to 81 tick marks for making the most attractive meter. Use the lower number if the meter is smaller. If the full-scale range is 1,000, indicate 51 tick marks. This choice will provide 50 increments plus zero.
 - **Label every ___th tick:** Select a number that will add between 4 and 10 labels. For example, for 51 tick marks, select **Label every 5th tick** for 11 labels total.

NOTE: Always end with a **1** to make the end of the panel even.

7. Click the **Style** tab.



8. In the **Meter Style** area, select how you want the meter to appear.



- Consider if the increments make sense for the display. Also determine if too few or too many numbers appear. Note the color changes. Are they appropriate for the requirements?
 - A digital display of the actual numeric value appears in the space beneath the meter. You cannot see this display until the meter is used.
 - Note the arrow to the right or left of the meter. This arrow indicates the current value is either below or above the range of the display meter.
9. In the **Color** area, If only one range is selected on the Ranges tab, you can set the **Foreground** and **Background** color in this area. Otherwise, the Background area is gray (unavailable). To customize colors, first clear the **Use default colors** option, and then click each box to select the color. You can also use the Range tab to set colors.



See section 12.2.5, "Selecting Color Ranges," on page 12-7.

10. Click **OK** to review the finished panel meter.

Reposition and resize this meter to fit into the display, or press **DELETE** to remove it.

The units and titles of these meters are determined by the configuration file. You must use the Configuration File Editor to change them.



Refer to Chapter 7, "Configuration Utility" for more information about the configuration file.

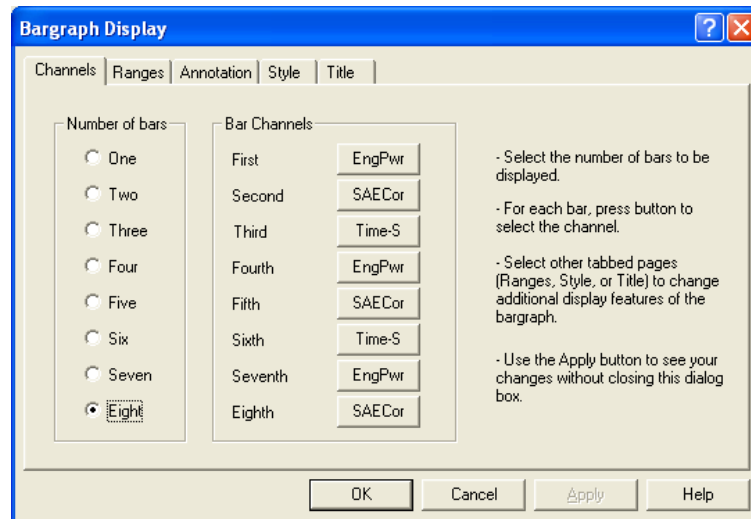
12.2.10 Designing Bar Graphs

To design a bar graph, on the **Editing Control Buttons** toolbar, click the **Bar Graph** button (fourth from the left). A new bar graph appears. Select the new graph and size it; then use the mouse to drag the object to a desired place on the screen. Each WinDyn bar graph display object allows you to graphically monitor the value of up to eight separate channels during testing.

Right-click the graph and select **Properties**. The **Bargraph Display** dialog box appears. Each tab contains four buttons:

- **OK:** Applies the changes made to the bar graph and exits the Bargraph Display dialog box.
- **Cancel:** Exits the dialog box without applying changes.
- **Apply:** Immediately applies the changes made to the bar graph but keeps the dialog box open so you can see the effects of your changes without closing the Bargraph Display dialog box.
- **Help:** Opens the online documentation files.

NOTE: Clicking **Cancel** does not remove changes that were applied using the **Apply** button.



Channels Tab

- **Number of bars:** Select the number of channels to display on the bar graph.
- **Bar Channels:** To select the channels to display on the bar graph, click the corresponding button to display the **Select Channel** dialog box. Scroll up and down the channels to select the first item to appear in the bar graph. Because all the items in the bar graph will have the same scale, you normally will use the bar graph only for channels which are similar. The most common use is for temperatures.

Ranges Tab

Select the number of color ranges (see section 12.2.5, “Selecting Color Ranges,” on page 12-7).

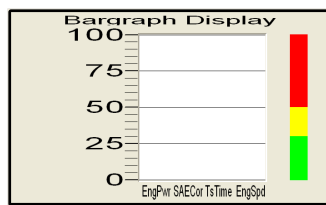
Annotation Tab

Select how many tick marks to display vertically on the bar graph and which of those to label. The actual label values depend upon the minimum and maximum range values entered on the **Ranges** tab (see section 12.2.6, “Selecting Annotations,” on page 12-8).

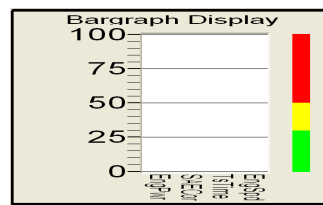
Style Tab

The bar graph has different sizing limitations unique for the label orientations, types, and annotation selected. If you select **Horizontal**, the **Orientation** options are unavailable because the data displays on the left and right.

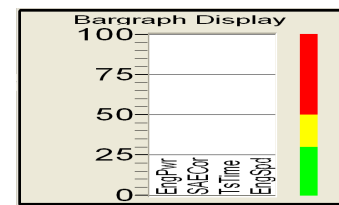
- **Label Orientation:**



Horizontal Labels



Vertical Labels



Labels Below Graph

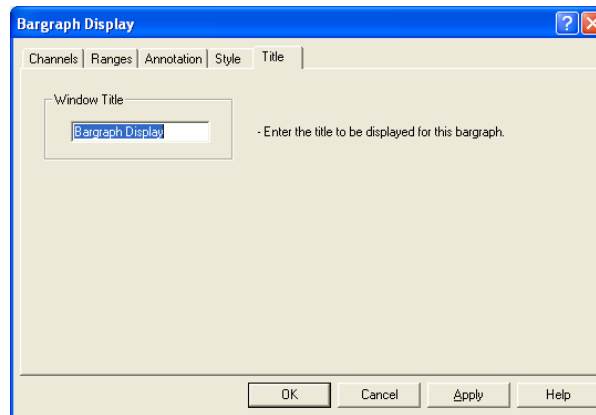
- **Horizontal Labels:** Displays the channel names horizontally
- **Vertical Labels:** When you select this option, the **Vertical Label Type** area activates.
Labels Below Graph: Displays the channel names from top to bottom starting below the graphing area.
Labels in Graph: Displays the channel names displayed from bottom to top starting in the lower portion of the graphing area.
- **Color:** If only one range is selected on the Ranges tab, you can set the **Foreground** and **Background** color in this area. Otherwise, the Background area is gray (unavailable). To customize colors, first clear the **Use default colors** option, and then click each box to select the color. You can also use the Range tab to set colors.



See section 12.2.5, “Selecting Color Ranges,” on page 12-7.

Title Tab

Type a name for the bar graph in the **Window Title** text box.



Click **Apply** to view the final design.


If the design is not quite what you want, modify the design and click **OK** when finished.

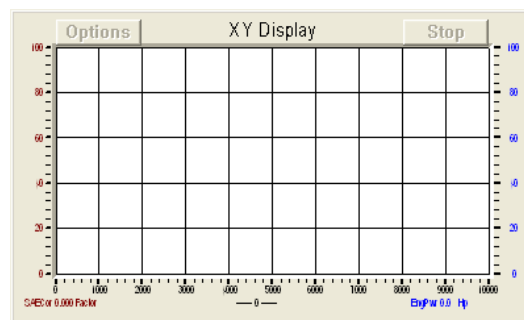
Now resize and position the bar graph anywhere on the screen. You can also delete the item by pressing the **DELETE** key.

12.2.11 Designing X-Y Graphs

Use the WinDyn XY display object to plot the value of up to four channels *during testing*. The X-axis of the plot may be any channel you select such as Engine Speed or Time.

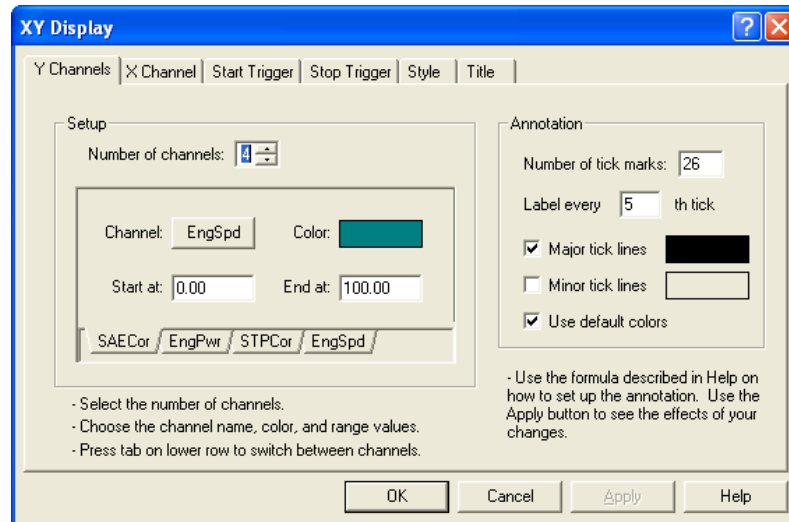
1. On the **Editing Control Buttons** toolbar, click the **X-Y Graph** button (seventh from the left). A new X-Y graph appears. Notice that the **Options** and **Start/Stop** buttons in the upper left and right corner of the X-Y graph are not functional during the design phase, but you can use them during testing.

 Refer to section 12.3, "X-Y Reference Plots," on page 12-28 for more information.



2. Drag the corner of the graph to expand it.

3. Right-click the graph and select **Properties**. The **XY Display** dialog box appears.

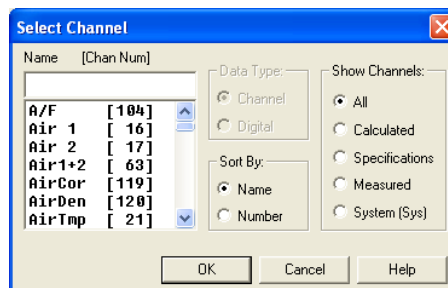


Each tab contains four buttons:

- **OK:** Applies the changes made to the bar graph and exits the X-Y Display dialog box.
- **Cancel:** Exits the dialog box without applying changes.
- **Apply:** Immediately applies the changes made to the bar graph but keeps the dialog box open so you can see the effects of your changes without closing the Bargraph Display dialog box.
- **Help:** Opens the online documentation files.

NOTE: Clicking **Cancel** does not remove changes that were applied using the **Apply** button.

4. In the **Setup** area, type or select **4** in the **Number of Channels** drop-down list.
- Click the tabs at the bottom of this area to edit the information for each channel that will appear on the X-Y graph. Click the **Channel** button to open the **Select Channel** dialog box.



- Select a channel and click **OK**.
- Then select the **Channel**, **Color**, and **Start at/End at** display range for each channel.

- Use the **Annotation** area to select how many tick marks to display on the Y axis and which of those to label. The actual label values will depend upon the minimum and maximum range values entered in the **Setup** area.

 See section 12.2.6, "Selecting Annotations," on page 12-8.

Some experimentation or calculations may be required to determine a combination that fits multiple channels while still providing even increments useful for a readout. Select from 21 to 81 minor tick marks with major increments typically every 5 to 10 tick marks.

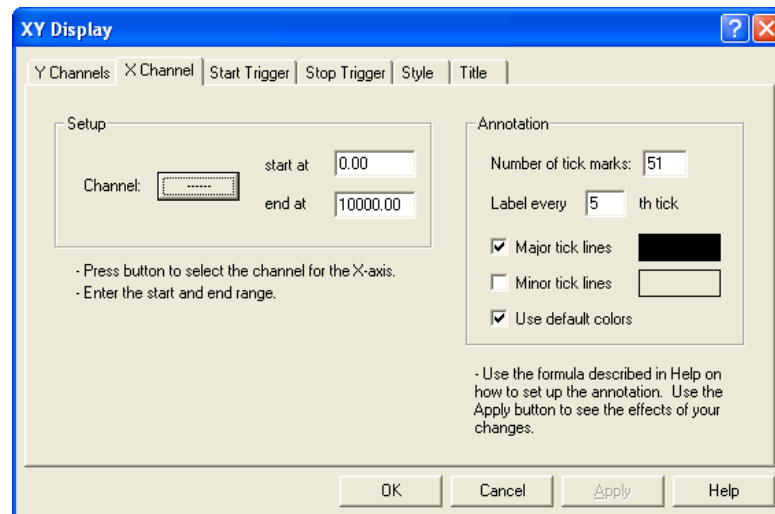
- **Major tick lines:** Adds grid lines on the plot which correspond to the labeled tick marks on the Y axis.
- **Minor tick lines:** Adds grid lines to the plot which correspond to the unlabeled tick marks.

NOTE: Since up to four channels being plotted, the annotation used may look okay for some channels but not necessarily all.

For example, using the annotation of 26 tick marks and label every 5th tick from the **Annotation** example above, suppose one of the other channels was coolant temperature with a range from 50 to 260 degrees F.

In this case, values of 92, 134, 176, and 218 degrees F would appear on the Y axis. A simple way to change these values so they are divisible by 10 would be to change the lower range from 50 to 60 degrees F. In this case, Y-axis values of 100, 140, 180, and 200 would appear.

- Click the **X Channel** tab.



- In the **Setup** area, click the **Channel** button to select the channel to use for the X-axis.
 - The **Select Channel** dialog box appears.
 - Select a channel and click **OK**.
 - Then type the **start at** and **end at** ranges in the text boxes.
- Use the **Annotation** area to select how many tick marks to display on the X-axis and which of those to label. The actual label values will depend upon the **start at** and **end at** values entered in the **Setup** area (see step 5).

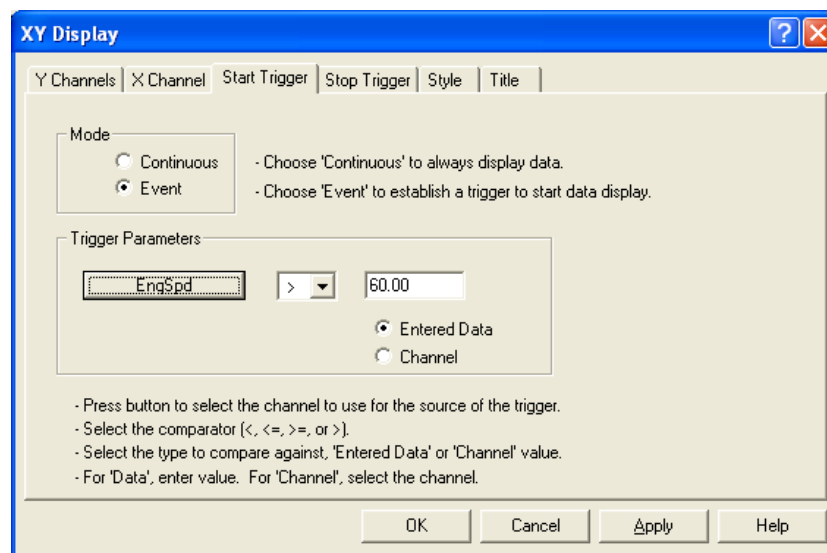
9. Click the **Start Trigger** and **Stop Trigger** tabs to begin and end the graphing. Once the graph is triggered, it continues to record data until it reaches the stop trigger condition. If no stop trigger condition is met, it continues to graph data indefinitely whether you are running a test or not. You can start or stop the trigger based on any item contained in the configuration file.

It is common to use Memory 9 (channel 229) as a trigger and set it in a test profile. Only values of 1 or 0 are to be used for digital comparisons. These digital values may be set by an autotest or external condition depending upon your system.

Example:

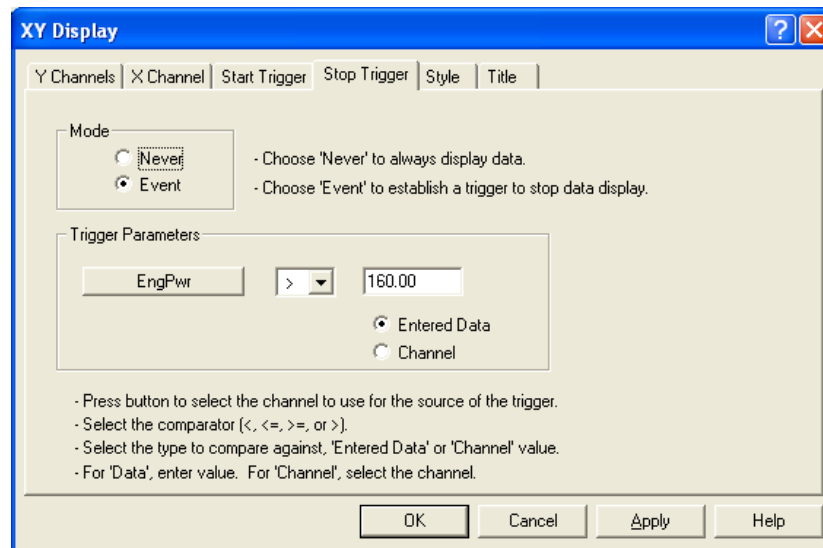
An acceleration test sets Memory 9 to **1** at the start of the run and **0** at the end.

10. Click the **Start Trigger** tab. In the **Mode** area, select **Event** (select **Continuous** for the graph to run all the time).



11. To stop or start the graph, type a value for the data or select a channel. For example, power could be graphed on the chart whenever the speed channel on a chassis dyno exceeds 60 mph and stops at 160 mph. In the **Trigger Parameters** area, click the button and select **EngSpd**.
12. In the drop-down list next to the **EngSpd** button, select the greater than (>) symbol.
13. The selected channel may be compared to an entered data value or another data channel.
- To compare to a data value, select **Entered Data** and type **60** in the text box above it.
 - To compare to another data channel, click the **Channel** option button and click the accompanying channel button to open the **Select Channel** dialog box.

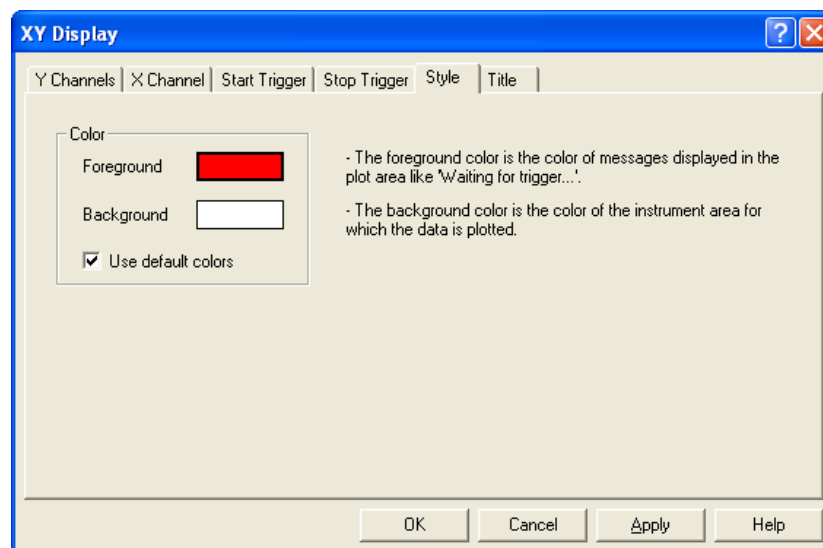
- Click the **Stop Trigger** tab.



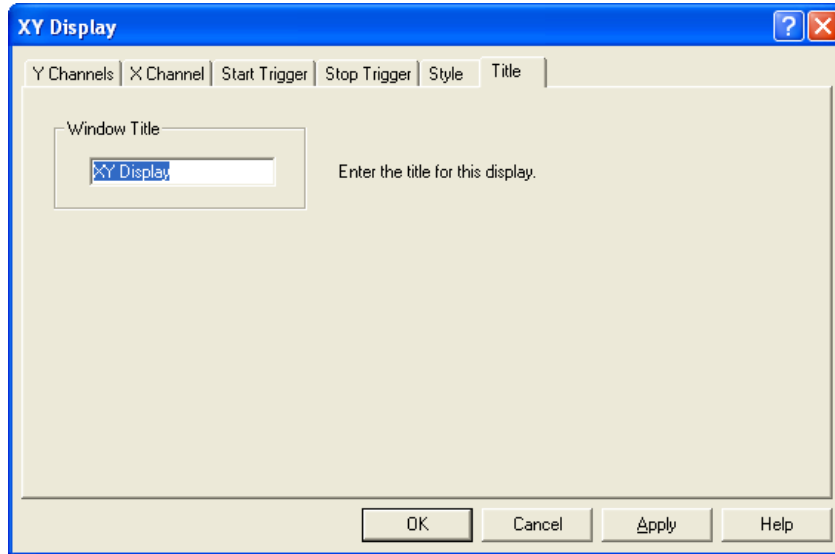
- In the **Mode** area, select **Event**.
- In the **Trigger Parameters** area, click the button and select **EngSpd**.
- In the drop-down list next to the **EngSpd** button, select the greater than (>) symbol.
- Select **Entered Data** and type **160** in the text box above it.

NOTE: Make sure you set the graph to display when speed first exceeds 60 mph and to continue to record until the speed exceeds 160 mph.

- Click the **Style** tab. Select new colors or use the default colors.



20. Click the **Title** tab. Type a name for the X-Y graph in the **Window Title** text box.



21. Click **OK**. This completes the X-Y graph design.
22. Now resize and reposition the graph as desired. To make additional changes, right-click the graph to return to the design menu.

You can trigger the graph for a test and then stop it manually. Use the **Print Screen** utility provided with WinDyn to print the graph even if you did not store the data.

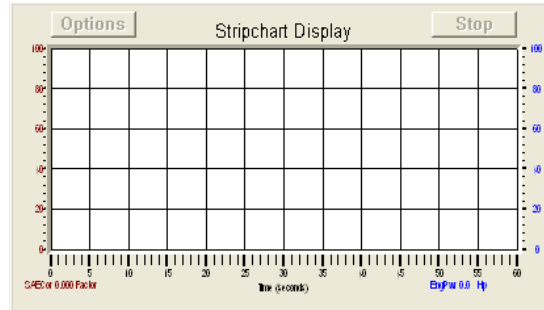


For additional information on display design, see section 5.5, "Printing Test Data," on page 5-13.

To save the screen, from the **WinDyn** main menu select **Screens>>Save As** or press **CTRL+S**. Type a name in the **Save As** dialog box and click **Save**.

12.2.12 Designing Strip Charts

Use the WinDyn Strip Chart display object to plot the value of up to four channels *during testing*. The X-axis of the plot is always Time (in hours, minutes, or seconds). Strip charts are designed to display a graphical history of a function over time.



For directions on designing and configuring strip charts, follow the steps in section 12.2.11, “Designing X-Y Graphs,” on page 12-16.

NOTE: The strip chart configuration does not have an **X Channel** tab and instead has a **Timebase** tab that is not part of the X-Y display configuration.

In the **Range** area, type the time base range in the text box and select **Seconds**, **Minutes**, or **Hours**.

Use the **Annotation** area to select how many tick marks to display on the Y axis and which of those to label. The actual label values will depend upon the minimum and maximum range values entered in the **Setup** area.



See section 12.2.6, “Selecting Annotations,” on page 12-8.

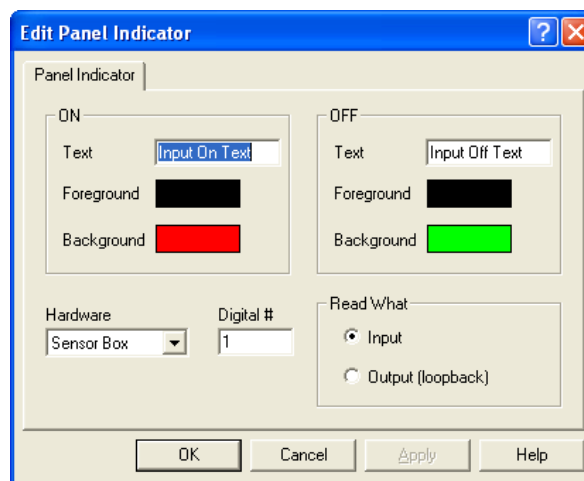
12.2.13 Status Indicator

A status indicator display object allows you to monitor the **ON/OFF** status of a system control function. Examples of control functions are the status of the roll lock on an AutoDyn, the engine ignition on or off, Safety Limits on or off, manual or servo control mode, the status of a relay in an SF-1843 relay box, or the status of a relay box digital input.

On the **Editing Control Buttons** toolbar, click the **Status Indicator** button (fifth from the right). The **Input Off Text** panel appears.



Right-click the panel and select **Properties**. The **Edit Panel Indicator** dialog box appears.



Use this dialog box to configure the run-time characteristics for digital panel indicator displays. Digital panels are typically used to display various system status conditions (ON/OFF).

ON/OFF

- **Text:** Type the text to display when the digital input or relay is set to the applicable state.
- **Foreground/Background:** Click the accompanying rectangles to select a color to display when the digital input or relay is set to the applicable state.

Hardware

- Select the hardware type in the drop-down list. The options available are the digital inputs and outputs in the sensor box, software relays, or the relay network (available only with the SF-1843 relay enclosure).

Digital#

- Type the number of the digital input or relay to associate with this panel indicator.

Read What

- **Input:** Select if this panel indicator is to display the state of a digital input.
- **Output (loopback):** Select if this panel indicator is to display the state of a relay.

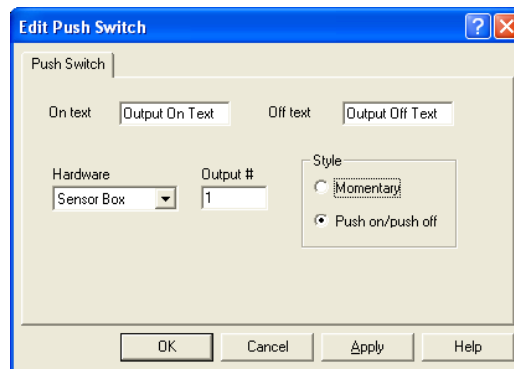
12.2.14 Switches

An on-screen push-button switch is used to turn on and off various system functions. These functions can be software switches (start/stop an autotest, limits on/off, record data), engine controls (ignition, starter, fuel), chassis dynamometer controls (roll lock), or relays in an SF-1853 relay box. The objects can be an on/off toggle or a momentary contact switch.

On the **Editing Control Buttons** toolbar, click the **Switch** button (fourth from the right). The **Output Off Text** panel appears.



Right-click the panel and select **Properties**. The **Edit Push Switch** dialog box appears.



- **On text:** Type the text to display when the digital relay is set to 1, the **ON** state. The button appears depressed in the ON state.
- **Off text:** Type the text to display when the digital relay is set to 0, the **OFF** state. The button appears raised in the OFF state.
- **Hardware:** Select the hardware type in the drop-down list. The options available are software switches, the eight on-board digital outputs in the **sensor box**, or the 32 relays in the **relay network** (available only with the SF-1843 relay enclosure).
- **Output #:** Type the relay number to associate with this switch.
- **Style:** Select the type of switch:
 - **Momentary:** Select this option if the switch is to turn a relay on only while it is depressed (such as a starter switch).
 - **Push on/push off:** Select if the switch is to turn a relay on and leave it on once it is depressed (such as an ignition switch). Depressing the switch a second time turns it off.

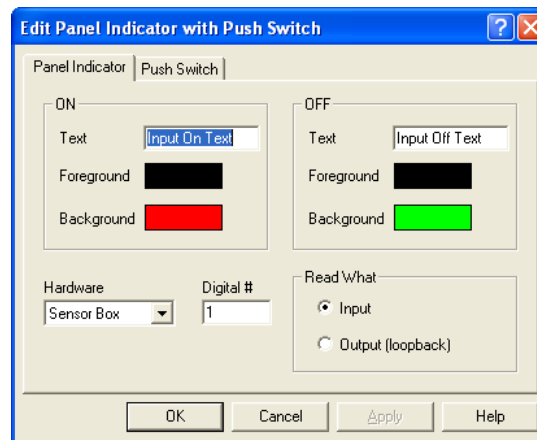
12.2.15 Status Indicator with Switches

These display objects are a combination of a status indicator and a switch. They can be used to display the status of a relay or digital input and to control a relay. The status indicator and switch on the display object does not have to be associated with the same function.

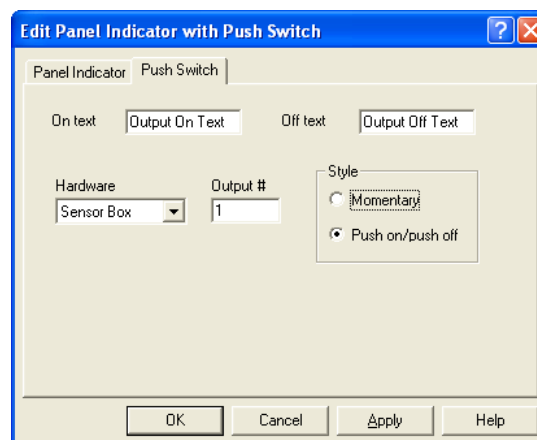
On the **Editing Control Buttons** toolbar, click the **Status Indicator with Switch** button (fourth from the right). The **Input/Output Off Text** panel appears.



Use this dialog box to configure the run-time characteristics for combination digital panel indicators with push switches.

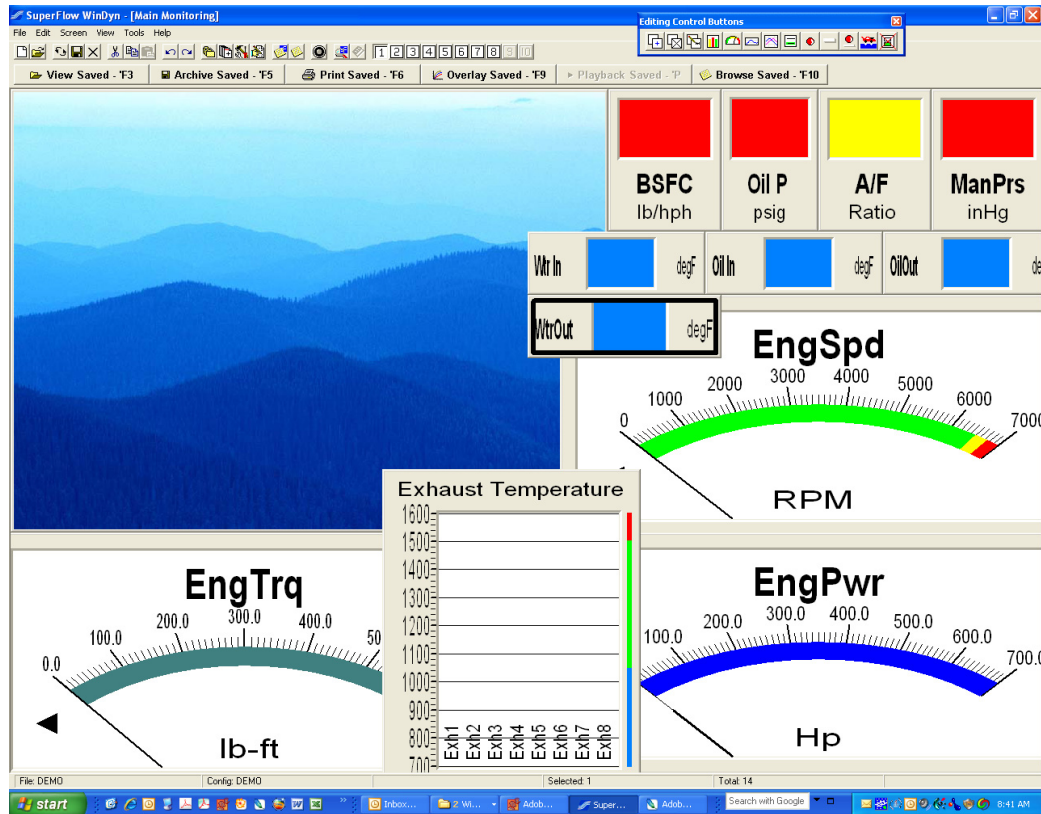


The two tabs in the Edit Panel Indicator with Push Switch dialog box are identical to those in section 12.2.13, “Status Indicator” and section 12.2.14, “Switches.”



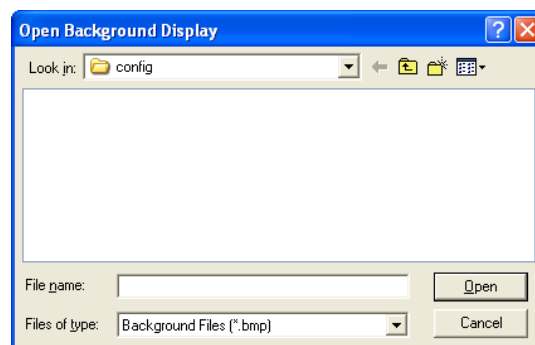
12.2.16 Background Images

Use the WinDyn Background Image object to display any bitmap (BMP) file as a screen background. More than one bitmap can be used per screen. Overlapping other display objects with a background bitmap always results in the display objects appearing on top of the bitmap. The following illustration shows several objects overlapping the mountain bitmap image.



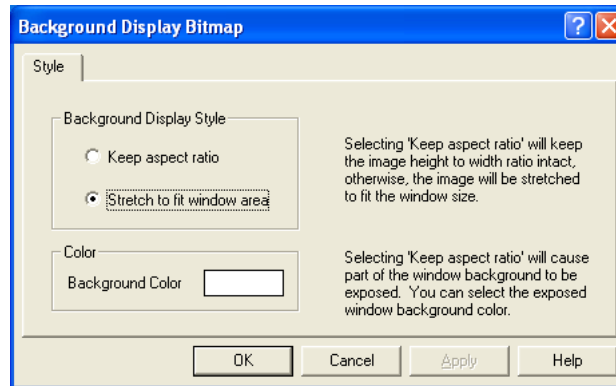
NOTE: You can open bitmap files in the Microsoft Windows Paint program (provided as a Windows accessory) to enhance existing or create new bitmaps.

On the **Editing Control Buttons** toolbar, click the **Background Image** button (second from the right). The **Open Background Display** dialog box appears.



Select a file and click **Open**.

To edit the bitmap, right-click the image and select **Properties**. The **Background Display Bitmap** dialog box appears.



Background Display Style

- **Keep aspect ratio:** Keeps the image height-to-width ratio intact.
- **Stretch to fit window area:** Stretches the image to fit into the current window.

Color

Bitmap files with many colors (photos) display better in the higher color modes. If your high-color bitmap displays have bands or incorrect color representations, try changing the color palette display properties in Windows to High color or True color mode. If the color palette is set to 256 colors, Windows uses the first 256 colors that it finds in the image and then try to match the remaining colors to those 256 colors. This causes color banding and mismatches in the high-color displays.

Use the **Background Color** box to select the run-time characteristics for the background bitmap.

12.3 X-Y Reference Plots

Use the Reference Plots feature available for WinDyn X-Y real-time plots to display up to two reference plots (that is, previous tests) on the same display that shows your current test as it is running.

Reference plots are useful for quick, visual test comparisons and for displaying minimum/maximum tolerance conditions. For example, in Figure 12-1, the data plotted has a noticeable dip in the torque and power from about 3950 to 4050 rpm when compared to the reference plot.

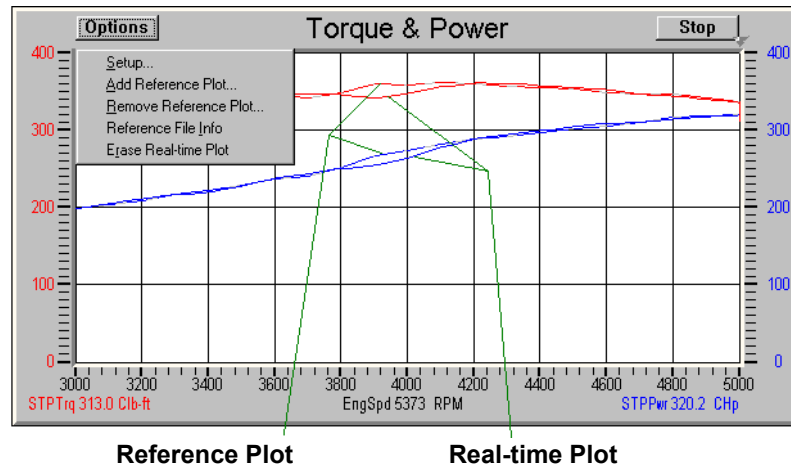


Figure 12-1. Torque and Power Reference Plot

1. Click the **Options** button in the top left corner to open the menu.
 - **Setup:** Opens the **XY Display Configuration** dialog box.
 - **Add Reference Plot:** When the dialog box appears, select the data file (*.sfd) to display as a reference. Up to two reference files may be displayed.
 - For each reference file, the channels displayed are always the same as the channels selected to display real-time data. Each channel is drawn in the same color as its corresponding real-time channel.
 - The first reference file is drawn with dashed lines, the second reference file is drawn with dotted lines, and the real-time channels are drawn with solid lines.

NOTE: The configuration file (*.CFA) assigned to the reference files (stored data files) must match the configuration file currently installed.

- **Remove Reference Plot:** Removes a reference file from the X-Y plot. Files are removed in the reverse order in which they were added.
- **Reference File Info:** Shows which reference files are currently in use.
- **Erase Real-time Plot:** Erases all the real-time data plotted. Reference plots are not erased by this operation.

2. Click the **Stop (Start)** button in the top right corner.
 - Clicking this button when it is labeled **Stop** stops the X-Y display from plotting any additional data.
 - Clicking this button when it is labeled **Start** returns the X-Y display to plotting data if trigger conditions are met.



See also the **Start Trigger** and **Stop Trigger** headings in section 12.2.11, “Designing X-Y Graphs,” on page 12-16.

TEST EDITOR

IN THIS CHAPTER

- **Developing Test Profiles**
- **Test Profile Functions**
- **Considerations for Developing Test Profiles**
 - Configuration Alignment
 - Sensors and Controllers
 - Channel Monitoring
 - Set of Files
- **Data Management**
- **Operator Interaction**
- **Using the Test Editor**
 - Opening a Test Profile
 - Saving Test Profiles
 - Toolbar
 - Menu Bar
 - Test Description and Control
 - Test Profile Command Entry/Editing
 - Information Pane
- **Test Profile Commands**
 - Test Documentation
 - Controller Actions
 - Data Recording
 - Operator Display
 - Safety Limits
 - Switch Actions
 - Test Branches
 - Test Values
 - Optional Events
- **Example Test Profile**



13.1 Developing Test Profiles

A **test profile** is a user-defined series of commands that automatically performs test system functions. The test profile is written with the WinDyn Test Profile Editor. Writing a test profile is similar in method but less complex than writing a program in C or Basic computer language. In some cases, the test profile automates functions an operator would normally perform such as recording data or command load and throttle. In other cases, the test profile performs functions an operator cannot perform such as simultaneously comparing multiple data and calculated channels against limits tables and taking appropriate actions when a limit is exceeded.

The test profile itself is a file stored on the computer hard drive. Multiple test profiles can be created and stored for use as required. To use a test profile, the operator loads the test profile from the computer into the SuperFlow data acquisition system and then executes the test profile. The system “reads” the test profile and carries out the commands it contains.

Internally, test profiles perform many functions similar to advanced programming languages. The test profile language can command program flow control, data, temporary data, variable data and memories, timer functions, variable statements, and counter functions.

13.1.1 Writing the Test Profile

Individuals who are familiar with computer programming will find the methods presented here familiar. The Test Profile Editor features menus which contain all the test profile commands. This eases the learning process by limiting the need to memorize a command language. In almost all cases, the Test Profile Editor enters commands into the test profile script after the programmer selects from a menu. This minimizes the chance of syntax errors.

When planning test profiles, it is important to remember that the test profile language was developed to account for the wide variety of test equipment and conditions encountered by a diverse group of SuperFlow customers. The potential functions of the test profile can easily exceed the function of your hardware or testing requirements. It is important to clarify your testing requirements. Test profile development is complex and requires a thorough understanding of the control and data requirements, the system capabilities, and the test profile language.

13.1.2 Editor Interface

The WinDyn Test Profile editor interface is the test profile programming environment. The editor interface is a module of the WinDyn program on the computer. All writing and editing of test profiles is done within this environment, and all programming tools, functions, and information are available in this environment. The test commands are selected from a menu and inserted into the script. Test commands cannot be typed.

13.1.3 File Size

The maximum number of allowed test steps is not a fixed number, but instead depends on the overall composition of the test profile in question. The size limit on Test Profile TPF files is 65,535 bytes. This equates to nearly 2000 steps in practice. Most test profiles are rarely more than a few hundred steps, and the editor will not allow the programmer to save a test that is too large. The editor also has features for reducing step duplication and making use of multiple TPF files for running a single test.

13.2 Test Profile Functions

In general, test profiles perform four types of actions: Device control, Data control, Display control, and Program branching. The test profile combines these functions to control data values using device control or to control a device with information from a data channel. Each of the action groups has many subtypes and multiple functions which are combined into a single test profile.

13.2.1 Device Control

Device control is separated into two types:

Open/Closed Loop

Water brake servo valves, eddy current (EC) controllers, and throttle actuators are generally controlled by a test profile in open-loop or closed-loop modes.

Open loop is essentially a position mode, but the position is based on the controller output, not the device it is controlling.

Example:

An electric throttle actuator is mechanically linked to the throttle body on the engine. Unless the linkage is precisely adjusted, the full range throw on the actuator will not correspond to the throw on the throttle body. If the controller is set to 50% (half the full scale output), the actuator will be midway of its full travel, but the throttle body will not be.

Closed loop is when a measured or calculated variable such as engine rpm, power, or throttle position is employed by a device control function to manipulate throttle or load to maintain an assigned value.

Example:

A throttle controller in closed-loop mode could employ a throttle position sensor to feed information to WinDyn on the throttle body position. In this case the desired 50% setting would correspond to the actual measured throttle body position—not just actuator travel. The actuator would then be controlled based on the information fed back to WinDyn from the throttle position sensor. In this way the loop between throttle control signal, actual resulting throttle position, and subsequent adjustment is closed.

Not all devices can or should be controlled in closed-loop mode.

On/Off

The test profile can control many types of peripheral devices that have only two states: on or off. These can be “on-board” devices such as those associated with an engine control panel on an engine dynamometer (ignition, starter, fuel pump) or the roll functions on a chassis dynamometer (roll lock, wheelbase adjust). A test profile can also control the relays in a SuperFlow SF-1843 relay enclosure for test cell support equipment (lights, fans, pumps).

13.2.2 Data Control

While running, a test profile can record data from all the channels defined in the system configuration and store it in a temporary data buffer. Data recording can be based on time or on an event such as changes in a sensor reading. This can be as basic as automatically recording a line of data once every second or more advanced such as recording one line of data with every 10 degrees of temperature change.

At any point in the test, data can be cleared from the buffer so all new data is fresh. Also, at any time in the test you can transfer data from the buffer to WinDyn where it is saved in a data file for later retrieval.

Data can control the flow and the function of the test itself using counters, timers, if/when conditional statements, display messaging, and more. Advanced data control functions can combine both data control and device control.

Examples:

- A data control function combined with device control uses a counter to record the number of times a value reaches a certain limit within a specific period of time and takes a responsive action such as engine shutdown or turning on a cooling fan.
 - When incrementing a calculated data value such as power in 40-hp steps of the throttle every 10 seconds, in this case WinDyn samples torque and speed data to calculate power, then monitors a timer and modulates the throttle actuator to reach the 40-hp step.
-

Specification and memory channels can play an important role in a test profile. Specification channels are part of the system configuration and are user defined as to name, purpose, and default value. They can be set or changed in a test profile by direct input or through operator interaction.

Up to 100 memory locations are available in the SuperFlow data acquisition system (0-99). Some have specific uses within the system, but others are available for use in a test profile as status indicators to establish a complex set point or as placeholders. They can also be used as mathematical scratch pads.

13.2.3 Display Control

A test profile can make use of the console, handheld, and computer displays in an automated test. Using display control commands, the console or handheld can display the values in selected data channels, provide the operator with instructions, and prompt the operator to make a selection. If desired, the computer monitor can display an alert or informative message requiring an acknowledgement from the operator.

13.2.4 Program Branching

A test profile can be made up of a primary routine and a group of subroutines. You can use GOTO, CALL, and IF/WHEN statements to help structure a profile to perform the desired tasks. Program branching allows a single subroutine to be used multiple times in a single test. A CALL EXTERNAL feature is available to allow multiple individual test profiles to use a common routine contained in a separate profile. Labeling the subroutines makes tracking the test profile flow easy, and non-operative comment lines help the programmer describe what is happening.

13.3 Considerations for Developing Test Profiles

The autotest language was intended to cover a wide variety of testing conditions. No single test would use all the features of the test profile. In fact, one of the most significant limitations on the test profile is the system *configuration*. Before creating an autotest, the programmer must have a clear understanding of the system and what the test profile will control. It is possible to write a test that is incompatible with or exceeds the capabilities of the system.

The following is a partial list of some considerations the programmer must know prior to writing a test profile and its general impact on the test profile. These considerations directly affect the operator's primary tasks: device control and data acquisition. This information will aid in planning a well-organized test profile.

The listed considerations are intended as a general reference and may not cover all possible applications and situations.

13.3.1 Configuration Assignment

One of the most important considerations for developing the test profile is the configuration file, which defines the channel assignments. When programmed, a test profile is "assigned" to a configuration file (*.CFA). However, the profile can run with any CFA file installed in the system. The channels used in the test profile must match in both the CFA file used for programming and the one installed in the system, or problems will result. The test profile cannot control or respond to an undefined channel. Therefore, it is always best to use the same CFA file for both programming and operation.

13.3.2 Sensors and Controllers

Sensors affect the type and nature of actions a test profile can perform. In most cases, the technical issues of compatibility and electrical characteristics are handled in the Configuration (CFA). A small number of considerations remain for test profile development.

Of particular concern is sensor resolution. A sensor with a wide range will have less resolution than a sensor with a narrow range. Test profile commands and Limit action levels can easily exceed the resolution of a wide-range sensor. In most cases this is not a safety problem but a data reliability question. For example, a wide-range temperature sensor tasked with triggering an action that is specified at 0.1°F may trigger within $\pm 1^\circ\text{F}$ of the desired point.

The same type of problem can be encountered with controlled devices. The test profile can command far greater resolution than a control valve or a throttle actuator is capable of delivering. For example, a 0.1% step in throttle or valve control may not be precisely repeatable, but a 5% step would produce repeatable results.

13.3.3 Channel Monitoring

Some channels often perform important warning functions. These can be low oil pressure, low fuel, high temperatures, and inadequate voltages or frequencies. Such functions can be used to trip limit action independent of the test profile or used to trigger events in the test profile.

Data channels can be monitored with IF/WHEN statements which, when tripped, can trigger events within a test profile. Functions performed by channel monitoring can range from a progression to a subroutine in the test, to alerting the operator, to a full system shutdown. Channel-triggered test profile actions can activate a wide variety of valid test profile functions.

Another function of channel monitoring is to trigger from a safety limit action. When used in conjunction with a test profile, a “flag” in a **Safety Limits** file can initiate a sequence of events when values in selected channels exceed or fall below a “window.” To implement this function, a **when limit flag** and **goto** or **call** function is set up in the test profile. The limit action itself cannot perform these functions. The limit action only sets a flag for the test profile to read.

Example:

To identify concurrent events surrounding the oil temperature changes, use a high- and low-trip value in a **Safety Limits** file to define acceptable engine oil temperature and set a flag if it exceeds these values. The test profile recognizes the flag and initializes a subroutine to respond to the limit action.



For more information, refer to “Test Profile Commands” on page 13-20 and “Optional Events” on page 13-51 and Chapter 6, “WinDyn Safety Limits.”

13.3.4 Set of Files

Test Profiles are activated in the system in two ways. One is by installing the test profile directly from the computer using the **WinDyn System>>Install>>Test Profile** menu or selecting the test from the **Select Test** menu on an SF-1853 wired handheld controller. When installed, begin the test by pressing the **Start Test** button on the console or handheld controller.

Another way to activate test profile is with a **SET** file which contains a selection of test profile selected from those programmed and saved on the WinDyn computer. The set file is then installed into the system memory where it resides even when power is turned off. Activate the test using the **Select Test** button on the console or handheld and begin by pressing the **Start Test** button.

At this point the WinDyn computer is not needed to run a test because the profiles are embedded in the system. However, WinDyn is needed to view the real-time data and to store and retrieve recorded data.

The main purpose of using Set files is to allow the interaction between individual test profiles with the CALL EXTERNAL command. When “called,” the test will jump to the requested profile, perform the actions in that test, and return to the primary test when completed. This feature allows multiple tests to use a single routine and lets the operator run a test independently; other tests may also use it.

Another purpose of Set files is to allow the use of tables in test profiles.



See section 13.7.2.1, “Command a Controller Action,” on page 13-25 for more information on using tables. Refer to Chapter 14, “WinDyn Set File Editor” for more information on Set files.

13.4 Data Management

When data is recorded in a test, it is stored temporarily in battery-backed, Random Access Memory (RAM) on the Data Acquisition system Central Processing Unit (CPU). If desired, at the end of the test you can save data to a SuperFlow Data file (*.SFD) on the WinDyn computer or to a network server. For this to happen properly, consider the following issues.

13.4.1 Disk Space

Ensure a minimum of 1 Megabyte (MB) is available on the computer hard drive or server before testing begins. If less than 1 MB is available, the system could run out of disk space before all recorded data is saved, resulting in possible data loss or the WinDyn system locking up.

13.4.2 Data Space

Also consider the rate and amount of data recording in the test profile. The data buffers (RAM) in the system can only hold a set amount of data lines (the actual number is system dependent). If data is recorded at a rapid rate, the data buffers can fill very quickly. The data recording rate should be the minimum necessary for your testing needs. This minimizes burden on the system, offers the greatest guarantee of data integrity, and uses the minimum amount of disk space.

If you know beforehand that this will happen, you can program the test profile to save data to the hard drive, clear the buffers, and start recording again. However, this does slow the system, potentially causing data loss if the system misses some critical data during this time.

13.4.3 Data File Names

There are three ways to save recorded data and name a WinDyn data file:

- **From WinDyn:** After data is recorded in the system memory, to save it to the computer, click **Analyze>>Current Data>>Save** on the main WinDyn menu. A prompt appears to enter a file name and select the file path. This can be done even when an autotest is running.
- **Automatically in a Test Profile:** An "Auto Increment File Name" feature in WinDyn allows the operator to pre-designate the file name and folder location where the data will be saved. A test profile command directs the system to autosave the data which is then saved according to the pre-designation. The Auto Increment feature in WinDyn tags the name with a number and will not overwrite an existing file.
- **Specific name in a Test Profile:** A test profile can be programmed to save data with a specific name. It will be saved in the folder pre-designated in the Test Setup and will overwrite an existing file with the same name. This feature is useful in long duration endurance or cyclical tests to safeguard against data loss in the event of a power loss or system failure. As data accumulates in the buffer, it saves to the computer at the end of a cycle or at some point in the test. As long as the data buffer is not erased, the next time data is saved, it will replace the saved file with a new one containing the existing data with the new data. *It is important to remember to use WinDyn to re-save the saved data to a different name before starting a new test.* Otherwise, the freshly cleared buffer in the new test will overwrite the existing file on the computer, and data from the previous test will be lost.

TIP: *Save the data with a specific name at the end of minor cycles, then auto save at the end of a major cycle or when the test is complete.*

13.4.4 Printing

In many cases, it is not necessary or desirable to save all recorded data to disk. In such cases, preserve disk space by using the print data command during the test.

13.5 Operator Interaction

Many actions in the test profile can be performed with or without operator interaction. If desired, a test can be completely automatic. However, in most situations some intervention by an operator is preferred.

In general, four areas of operator interaction are available:

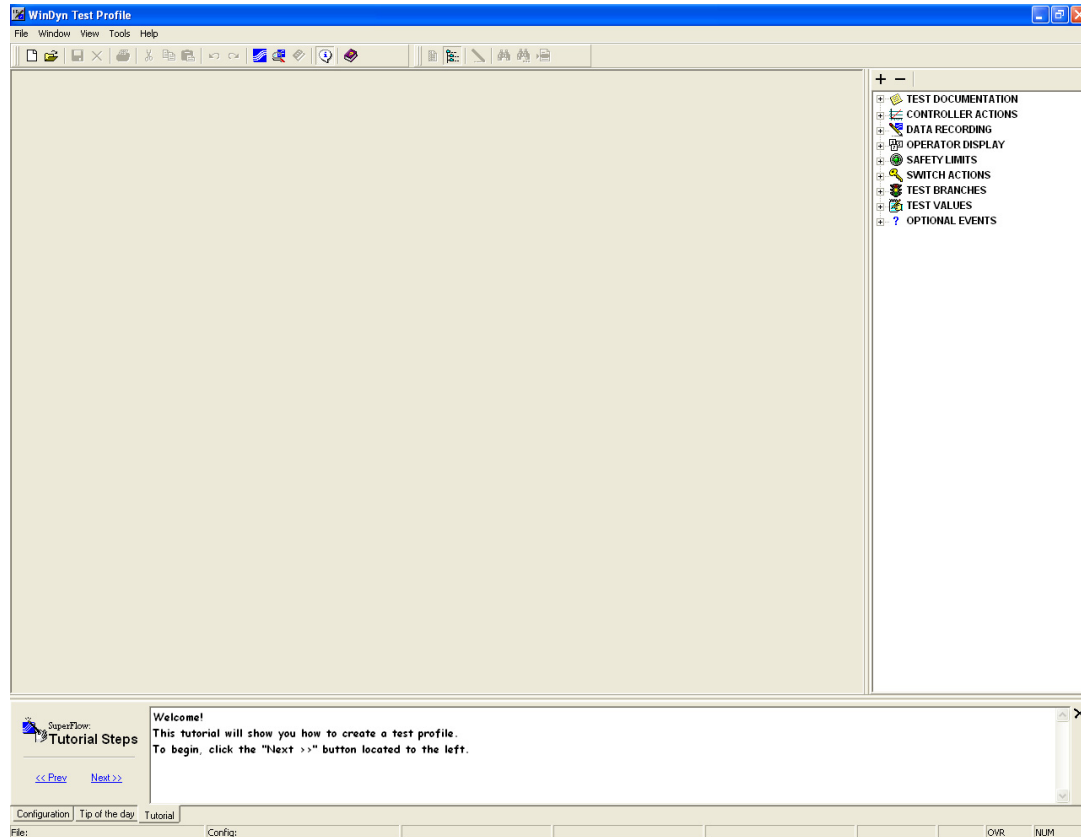
- **Operator Data Input:** Most often, data input is used to provide test parameters or variables in an automated fashion. Data can be input numerically into memory locations or in specification channels (also called constants) by direct input in the test profile using assigned buttons on the console or handheld controller. Test parameters can also be pre-set prior to running a test using controls on the console or with the WinDyn **Test Setup** dialog box.
- **Controller and Set Point Values:** Many test functions are designed with user-definable specification channels for acceleration ramp times or ramp start and stop points. The values can be set prior to starting the test; or the test can prompt the operator to enter the values as required from the console or handheld controller.
- **Test Flow Control:** Flow control can be done by branching commands which are operator controlled. In many circumstances, a condition encountered during testing may require one of several actions. For example, when an engine is being tested against a set of specifications and the engine fails to meet one specification during the test, a branching routine could prompt the operator to stop the test or continue further testing.

Pause/stop interaction is similar to branch action. The pause or stop function is used to temporarily halt or stop the execution of the test profile.

- **Operator Displays:** Operator displays are the most visible type of operator interaction. Two devices are available for data display: the computer monitor and the console or handheld controller. These devices can be used to display any of the 10 WinDyn current data screens on the computer, the 9 data screens on the console or handheld controller, operator alerts, and custom messages. The programmer should consider what information to display in the test profile, how to display it, and on what device it will be shown.

13.6 Using the Test Editor

From the **WinDyn** main menu, select **Design>>Test Profile**. The **WinDyn Test Profile** editor appears as a blank screen.



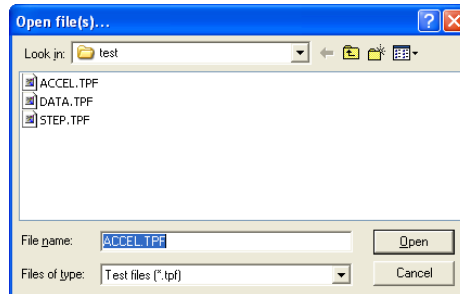
The Test Profile Editor is a standard Windows-based file editor. Multiple files may be opened and edited during a single editing session. The editor supports most Windows-based word processing features including:

- Undo and redo commands
- Cut, copy, and paste commands
- Drag-and-drop capability
- Hot keys
- Search engine
- Context-sensitive pop-up menus
- Full screen or window mode viewing

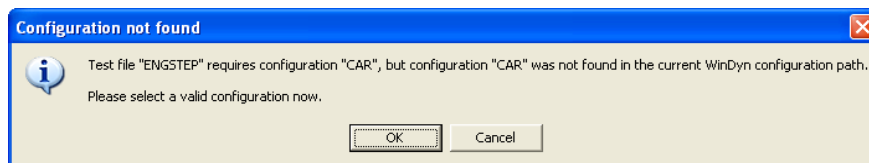
13.6.1 Opening a Test Profile

To create a new test profile, from the **Test Profile** menu select **File>>New**.

To open an existing test profile, from the **Test Profile** menu select **File>>Open**. The **Open file(s)** dialog box appears. Select a file and click **Open**.



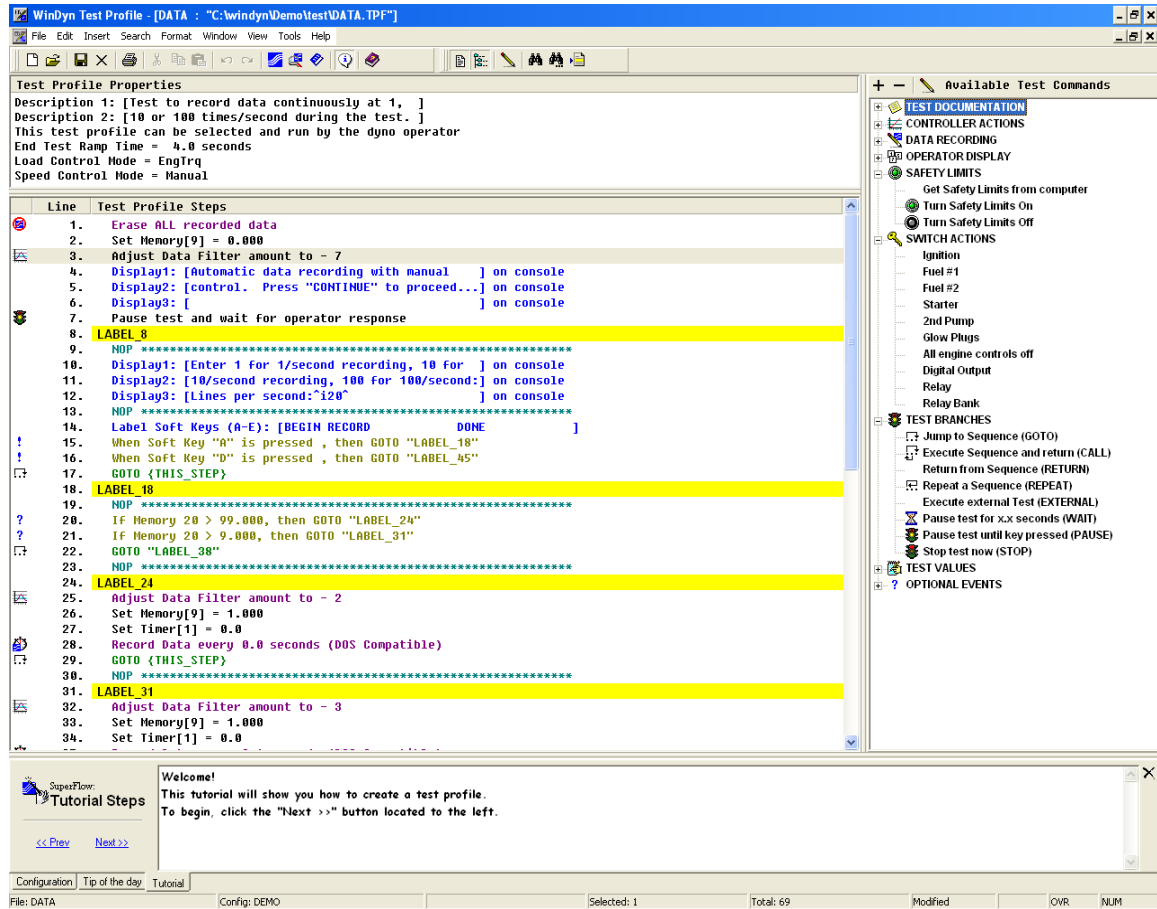
If a **Configuration not found** dialog box appears with an error message, click **OK** and find the correct file in the directory (see section 13.3.1, “Configuration Assignment,” on page 13-6).



Test Profile Editor Display Screen

The WinDyn Test Profile editor display window is divided into six sections:

- The top section contains the title bar that displays the name of the current test, the menu bar, and the toolbar. Use the menu and toolbar selections to modify the test description and control configuration and to print the test. To hide the tool bar, select **View>>Tool Bar**. The menu bar always remains visible.
- The top pane displays the test profile properties (select **View>>Test Properties** to display). An area for a description of the test is provided here along with some particular information about the test.
- The large central section of the screen displays the test script (or “commands”). A limited number of test lines can display at one time on the editor screen.
- The right pane displays an outline of all the available commands organized into functional categories. To hide this pane, select **View>>Available Commands**.
- The Information pane at the bottom provides a tutorial, tip of the day, or a configuration file channel list. Click the tabs for each option. To hide this pane, select **View>>Information Pane**.
- At the very bottom of the display is a status bar with the file name, the assigned configuration, the current selected step, and the total number of steps in the test. To hide the status bar, select **View>>Status Bar**.



13.6.2 Saving Test Profiles

To save a test profile using the same name, From the **WinDyn Test Profile** menu, select **File>>Save** and click the **Save** toolbar button. The existing file will be retained as a backup with a BTP extension, and the new file will be saved. Only one backup file is maintained.

Select **File>>Save As** to save the test profile with a different name. In the **Save As** dialog box, type a **File name** and click **Save**. If the file exists, select **Yes** to overwrite it or **No** if you wish to review editing or use a different name. If an existing file is replaced, a backup is created.

TIP: To restore a backup file, use Windows Explorer or My Computer to locate the file and rename it with a TPF extension.

13.6.3 Toolbar

The toolbar located below the menu bar is of standard Microsoft® Windows® design. It provides quick access to specific commands in the editor, saving time and effort when performing most of the Test Profile Editor common commands.

Position the mouse pointer over the toolbar icon to display a caption of its function. Click the buttons to perform the commands without navigating through the usual hierarchy of menus and commands. Many of the shortcut tools coincide with the menu functions described below.

13.6.4 Menu Bar

The editor menu bar contains operational commands or menus (**File, Edit, Insert, Search, Format, Window, View, Tools, Help**). Select any of the menu choices to see a list of commands. The gray choices are only available when the program is able to accept information from the command.

A check mark next to a menu item indicates that option is turned on. Select the menu item again to remove the check mark and turn off the option.

File

The File menu contains standard Windows file-management commands including opening, saving, closing, and printing. The following is a description of the commands unique to the test editor.

- Export as text...

This command will convert the test profile script to a plain text format and save it to a TXT file. This allows the information in the test profile to be used with word processing programs and imported into reports or other documents.

- Validate Set File

A Set file can contain multiple test profile, some of which may be used from within other test profiles with the **CALL EXTERNAL** command. This validation feature will check the SET file and verify that all test profiles are present to properly run the tests.

- Check Hardware compatibility

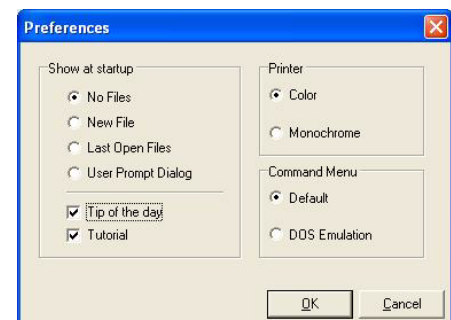
The test profile editor is used with several different SuperFlow data acquisition system types. Not all of the commands available in the editor are compatible with each individual system. This hardware compatibility feature will check the test profile and display a message indicating which type of system the test will work with. The profile must be changed if it is not compatible with the system in use.

- Assign Configuration...

This command assigns a different WinDyn System Configuration file to the test profile currently open. Use this command to make a file compatible with the selected WinDyn System Configuration.

- Preferences...

Most of the preferences are self explanatory. However, the **Command Menu** is unique. It has two options: Default and DOS Emulation. When the Default setting is selected, the editor displays all the available commands in the menu, even those not compatible with older systems. When the DOS Emulator setting is selected, the editor will only display those commands that were used with the previous DOS-based editor. This makes it easier for a programmer working with a 2242 or 1942 based system to know which commands can be used.



Edit

The commands in this menu are basic Windows and self explanatory.

Insert

- **Step:** This option displays the floating **Select Command to Insert** bar. See section 13.6.6, "Test Profile Command Entry/Editing," on page 13-17.
- **Test Sequence...:** This option displays a dialog box for selecting a test profile TPF file. Selecting a file will insert the entire script of that profile into the open profile at the highlighted location.

Search

- **Find...:** Conduct a text search for a particular word or phrase.
- **Find Next:** Search for the next occurrence of a word or phrase.
- **Go To...:** Displays a list of the labels in the test profile. Click a label name to advance to that position in the script.



Format

When selected, the editor shows these options:

- **Show Colors:** Displays certain types of command lines highlighted in color.
- **Show Styles:** Shows certain types of command lines in special character fonts.
- **Use Indentation:** Indents the text under each label for easy viewing.
- **Highlight Labels:** Highlights the labels with a yellow background.
- **Mark New Commands:** Highlights the command lines new to the DOS version with a gray background.
- **Show Step Images:** Displays an image along the left border that identifies certain command lines with a unique icon.
- **Show Line Numbers:** Displays the line number to the left of each command line.



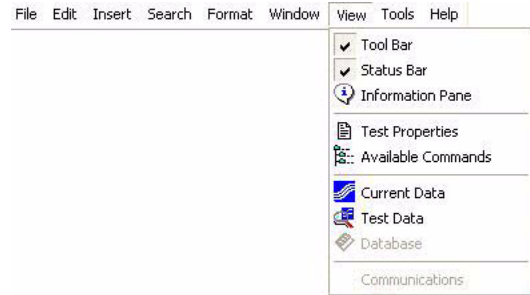
Window

The commands in this menu are basic Windows and self explanatory.

View

When selected, the editor displays the following:

- **Tool Bar:** Along the top of the window.
- **Status Bar:** Along the bottom of the window.
- **Information Pane:** At the bottom of the window.
- **Test Properties:** At the top of the window.
- **Available Commands:** On the right side of the window.
- **Current Data:** The WinDyn real-time data screen displays, and the test editor moves to the background.
- **Test Data:** The WinDyn current data screen along with any data recorded in the data buffers display, and the test editor moves to the background.
- **Database:** If enabled, the WinDyn database displays and the test editor moves to the background.
- **Communications:** If WinDyn is running and connected to a system, the communications dialog box displays, and the test editor moves to the background.



Tools

This menu provides direct access to frequently used WinDyn functions or other programs outside of WinDyn on the computer. The list can be edited as needed.

Help

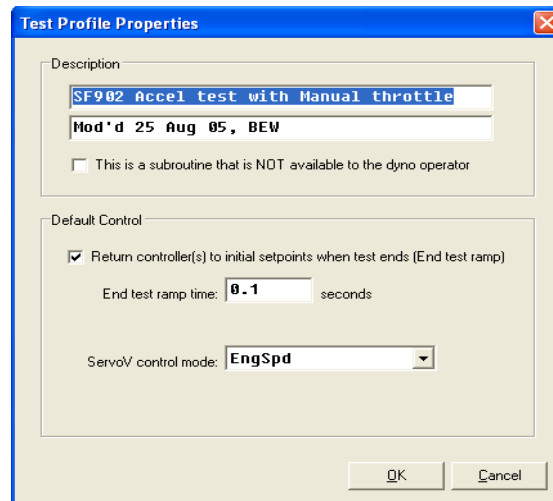
The Help menu provides context-sensitive help for the test editor. It also includes version information and links to interesting topics on SuperFlow's Web site.

13.6.5 Test Description and Control

The first step in creating or editing a test is to establish a description and control configuration.

1. Open an existing or create a new test profile.
2. Select **View>>Test Properties** or click the test properties icon (📄) on the toolbar to display the **Test Profile Properties** pane if it is not already there.

3. Double-click inside the **Test Profile Properties** area (the top pane of the window). A dialog box appears.



The following options are available

- Type the test description in the **Description** text boxes. Text is limited to the space available in each box.
- Selecting **This is a subroutine that is NOT available to the dyno operator** hides the test name from the selection menu on the operator's console or remote handheld when the test profile is embedded in a Set file. The file is always visible in the computer folder even with this option selected.



For more information on Set files, refer to section 13.3.4, "Set of Files," on page 13-7 and Chapter 14, "WinDyn Set File Editor."

- **Return controller(s) to initial setpoints at test end (End Test ramp):** If this is checked, each controller is returned to its pre-test control mode and ramped to its "pre-test" set points in the configured "End test ramp time." This is the normal default mode of operation. If this box is not checked, then the controllers are left in their current state—the mode and set point values are left unchanged as the test ends. This is required for Motoring dyno applications.

This setting also affects how the system responds when a test is ended through the "Stop" button on the console or the handheld controller. If the box is checked and the Stop button is pressed while a test is running, the controllers return to their pretest mode, and the set points immediately return to their pre-test settings—there is no end test ramp. If this box is not checked, then pressing the stop button basically ends the test but leaves the controllers in their current mode and set points.

- **End test ramp time:** The time the system will take to return the controllers to their pre-test set points at the normal end of a test. Set this value to 5.0 seconds unless you have specific goals.
- **Load control mode:** The default mode of the controller #1 for the test. Manual, engine speed or vehicle speed are the most common choices.
- **Speed control mode:** The default mode of the controller #2 for the test. Manual, engine speed or engine torque are the most common choices. This option is generally not enabled on chassis dynamometers or engine dynamometers without electronic throttle control because the operator manually controls the throttle.

13.6.6 Test Profile Command Entry/Editing


The second step in creating or editing a test profile is to add test steps, or commands, to the script in the main window. There are two methods of adding a command line to the script.

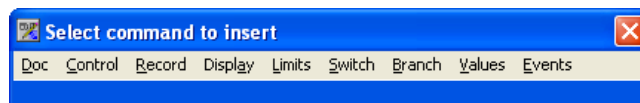
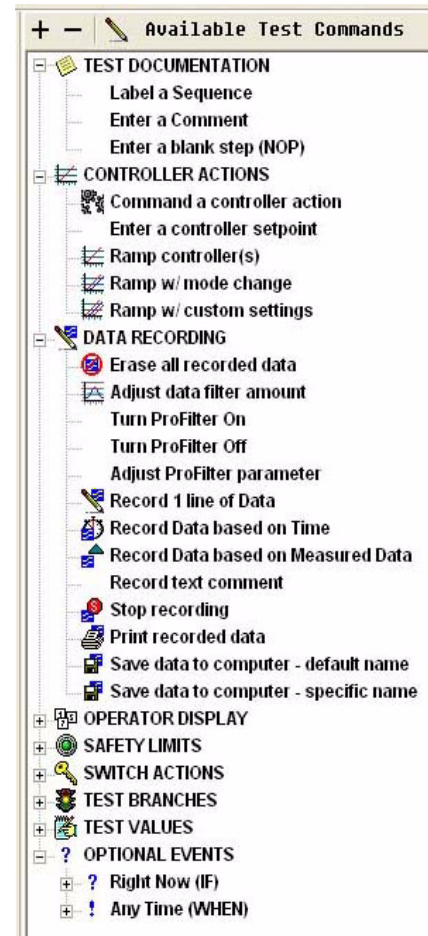
Drag and Drop

The right-hand pane (shown at right) displays the list of available test commands (select **View>>Available Commands** if it is not visible). At start-up the category lists will be collapsed. Click the plus (+) symbol to the left of the category to expand it. The available commands in that category will then be visible.

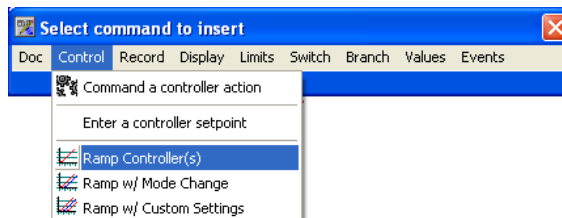
To add the command to the script, position the mouse cursor over the command, hold down the left mouse button, move the cursor to the place in the test script where you want the command, and let go the mouse button. This is called “Drag and Drop”.

Insert

1. Use the mouse pointer or keyboard keys to highlight the line just after where a new step will be added.
2. Press the **INSERT** key and click the **Insert Command** button (the pencil),  or right-click a line and select **Insert**. The floating **Select command to insert** menu bar appears.



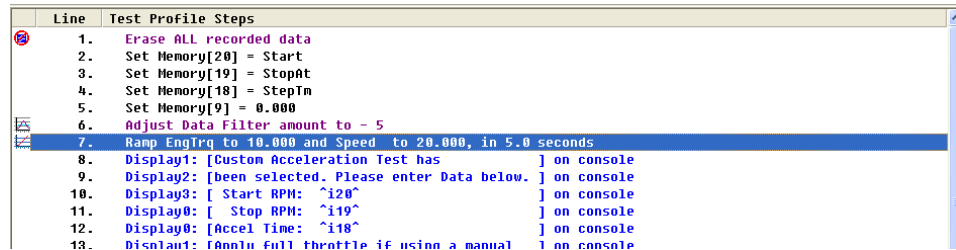
3. The menu bar accesses all available test profile commands. Select a command from the drop-down menu.



4. A dialog box appears where you can add the information for the new command.



5. In the bottom right of the dialog box, click **Accept** to add the new line.



Editing a Line

1. Use the mouse pointer or keyboard keys to highlight the line to edit.
2. Right-click the line and select **Edit**, or double-click the line. A dialog box appears where you can change the information for the new command.
3. In the bottom right of the dialog box, click **Accept** to add the changed line.



Before developing a test profile, read and understand “Test Profile Commands” on page 13-20.

Test Profile Editor Keyboard Functions

The PAGE UP, PAGE DOWN, END, HOME, and arrow keys can be used within the Test Profile editor. Use the DELETE and INSERT keys to remove or add lines, respectively. The ESC key ends the current operation.

13.6.7 Information Pane

When enabled, the information pane displays at the bottom of the Test Profile window. To display it, select **View>>Information Pane** on the main menu. A check mark in front of the item indicates the option is on.

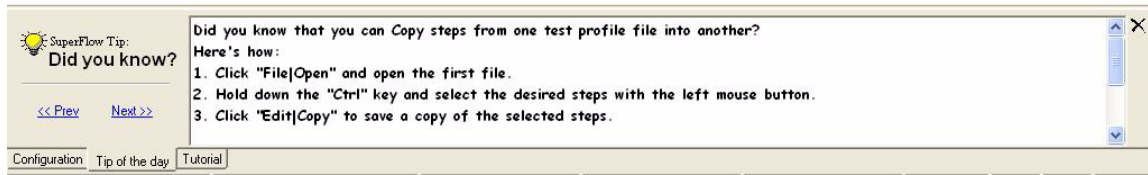
The information pane has four options it can display. Click the tab at the bottom of the pane to select the desired display.

Configuration

This shows a list of the defined channels in the assigned configuration with the name, units, channel number, channel type, the formula in calculated channels, and a description of system channels.

Tip of the Day

The Test Profile Editor features Tip-of-the-Day notices to help with some of the basic features of the system. Each day, a new tip automatically displays. To view today's tip, select **Help>>Tip of the day**. The tip appears in the pane at the bottom of the window.



Click the **<< Prev** and **Next >>** links to navigate back and forth through the Tip topics.

Tutorial

The Test Profile Editor provides a built-in tutorial designed to help users understand and use the editor's basic features. The tutorial steps through the process to build a simple Test Profile. To view the tutorial, select **Help>>Tutorial**. The **Tutorial Steps** window appears in the pane at the bottom of the window.

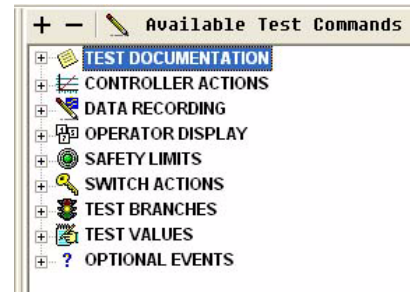


Click **<< Prev** and **Next >>** to navigate back and forth through the tutorial.

13.7 Test Profile Commands

The test functions are implemented by the commands in the advanced test profile language. The advanced test profile language is not unlike simple computer programming languages such as *Basic*. All forms of automated device control and data control in the WinDyn system are implemented by means of the test profile commands.

Test Profile commands are divided according to types of functions they perform:



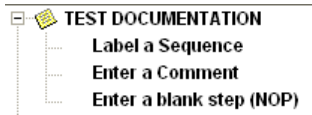
- **Test Documentation:** Add labels and comments to a test profile.
- **Controller Actions:** Used to change the open/closed loop controllers (typically absorber load or throttle position) from one set point (manual position, speed, or a torque value) to another.
- **Data Recording:** Commands for recording data in the system memory, saving data to a file on the computer or network, setting filters on designated channels, adjusting ProFilter™ parameters, and printing recorded data.
- **Operator Display:** Perform a variety of functions including showing data and prompting the operators for a response on the console or handheld display, displaying alerts on the computer monitor, designating a particular console or WinDyn display screen, and managing event functions.
- **Safety Limits:** Retrieve (load) pre-programmed safety limit values from WinDyn or system memory and turn them on or off.
- **Switch Actions:** On/off commands associated with test system switches such as ignition, starter, fuel, control relays, etc.
- **Test Branches:** Controls program flow. Branching commands are used to navigate directly through subroutines and external test routines; and to initiate specific test functions.
- **Test Values:** Control a variety of data and control functions including specification values, timer resets, counters, and memory values.
- **Optional Events:** Conditional statements to navigate through subroutines or initiate specific test functions. Some commands operate in tandem with all other test profile commands.

The function types and their respective commands are described below.



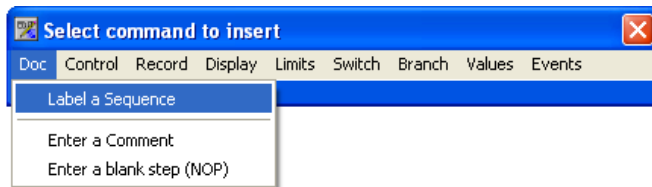
For information on using the command language, see section 13.1.1, "Writing the Test Profile," on page 13-3.

13.7.1 Test Documentation



Test documentation steps are used to help the programmer construct the test profile and make it easier for readers to follow the programmer's intentions. The system ignores these steps when executing the test.

13.7.1.1 Label a Sequence



A label identifies the start of a sequence of test steps or subroutine. Certain other command types (GoTo, Call) use the label to "jump" (transfer test execution) to the location in the test profile where the label is. Labels are also used to segregate and identify sections within the test profile script.

Labels should be as descriptive as possible to make the test profile intentions clear.

Label lines are included in the total file size, but the system ignores them when executing the test so processing time is not consumed.

Reserved Labels

In addition to user-defined labels, the test profile system provides a number of useful reserved labels which allow the test profile author to perform commonly used jumps without entering a specific user-defined label. This makes test profile scripts faster to write and easier to read and maintain.

For instance, if the goal is to wait at a test profile line until a soft key is pressed, the statement GOTO {THIS_STEP} would do just that. THIS_STEP is a reserved label the system understands without the test profile author explicitly creating a separate label step.

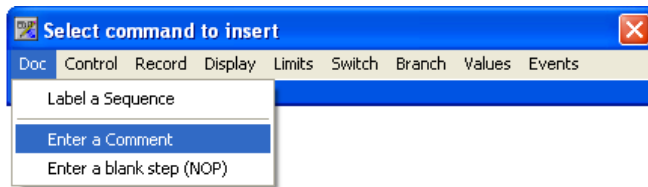
The test profile author has the option to enter a reserved label from any test command type that supports jumping to a label. This includes the GOTO, CALL, IF, and WHEN commands. Keyboard and mouse shortcuts allow the test profile author to easily enter the desired reserved label.

Reserved labels are always shown within curly brackets { }. This easily differentiates reserved labels from user-defined labels within the test profile.

The available reserved labels are:

- **TEST_START:** Test execution goes to the first line in the test profile.
- **TEST_END:** Test execution goes to the last line in the test profile, effectively ending the test.
- **THIS_STEP:** Test execution stops at the current line and waits for a command that allows it to continue (commonly a WHEN statement inserted prior to the current step).
- **NEXT_STEP:** Test execution proceeds to the next step in the test profile.
- **PREVIOUS_STEP:** Test execution repeats the previous step (commonly used with an IF statement on the previous step).

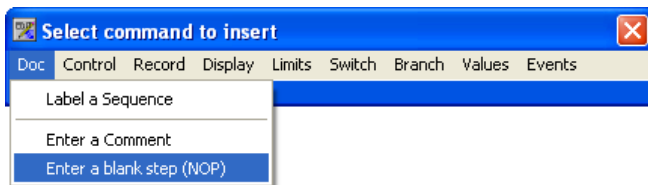
13.7.1.2 Enter a Comment



Comment lines are used to explain something about the test profile or document changes to a profile. Comment lines can be any desired text up to 40 characters long per line and can be inserted at any location in the test script. They do not “word wrap,” so you must confine the text to the space provided. However, any number of comment lines can be placed with the test script.

Comment lines are included in the total file size, but the system ignores them when executing the test so processing time is not consumed.

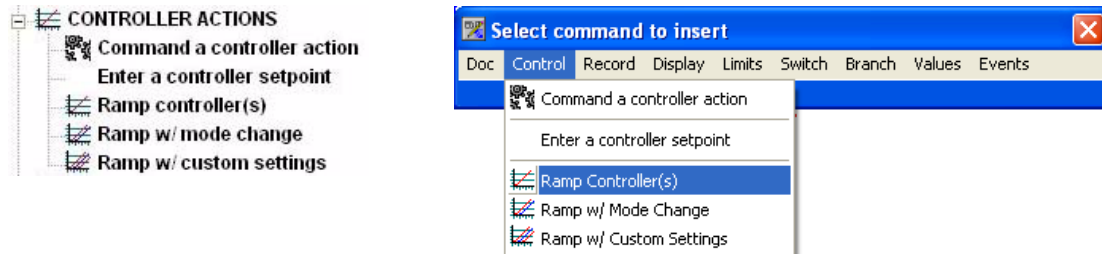
13.7.1.3 Enter a Blank Step (NOP)



NOP stands for **No Operation**. This a placeholder step, often used in place of a label to visually group related steps together or to separate steps from others.

NOP lines are included in the total file size, but the system ignores them when executing the test so processing time is not consumed.

13.7.2 Controller Actions



The controller action type commands affect the test system's controllers, for example, the *load* and *throttle* controllers on an engine dyno).

- The **Controller Action** command can instruct a controller to do almost anything you need a controller to do.
- The **Ramp** and **Set point** commands are older type commands used on WinDyn systems prior to version 2.3. The Controller Action command works in a similar manner but is more flexible and powerful.



CAUTION: It is important to remember that the data or constant channel value can be used to set a controller to a meaningless value such as dyno water pressure or oil temperature. This is not the intended use of the function and can cause unpredictable results.

Ramp commands cause the controllers to smoothly change the position of an actuator or its controlled variable—for example, torque or engine speed—from the present set point to a new set point in a specified time period. Some systems have both a throttle controller and a load controller. Others may have only one controller, such as a chassis dynamometer.

The most common use of the controller action is to perform acceleration tests in which the rate of acceleration and the starting and ending speed of the test are fixed. The following shows a very simple example of an acceleration ramp.

```

35.  Controller[ServoV]: EngSpd = 4000.0 in 0.1 seconds!
36.  Display1: [ Increase to WOT..... ] on console
37.  Display2: [ Stabilizing Speed at ^C95^ RPM. ] on console
38.  Display3: [ Press Accel (D) key to begin test. ] on console
39.  Label Soft Keys (A-E): [Acceleration ready.... Accel ]
40.  When Soft Key "D" is pressed , then GOTO "BEGIN RAMP PORTION"
41.  GOTO {THIS_STEP}
42.  BEGIN RAMP PORTION
43.  Controller[ServoV]: EngSpd = 8000.0 in 16.0 seconds

```

In this application, two ramps are used to control the engine between a lower speed and an upper speed at a fixed acceleration with a specific throttle position (100% is most common). It is assumed the throttle is operated manually, so only a load controller is used.

The first ramp is designed to set the load controller setpoint at the lower speed and wait for the operator to respond. This action is needed to set the starting speed for the acceleration ramp. The ramp time for the first ramp is not critical because the engine is still at idle and will not be affected by a load set point higher than the actual engine speed.

The display lines provide the prompts for the operator to increase the throttle to 100% and to push the **D** button on the control panel to begin the acceleration. The test pauses at this point and waits for the operator to respond.

When the **Accel** button is pressed, the test proceeds to the second ramp which lets the engine accelerate from the lower (ramp start) speed to the higher speed (ramp end) at 250 rpm per second (4000 rpm ramp divided by 16 seconds equals 250 rpm per second).

The acceleration rate is a function of the time setting for the second ramp. The faster the ramp executes, the greater the acceleration rate. The slower the ramp executes, the slower the acceleration. The rpm range of the test (the start and end speed) and acceleration rate at which the second ramp takes place (set by the duration [time] of the ramp) are fixed. The range and acceleration rate cannot be changed without editing the test.

However, **Specification** channels can be used to set the test variables (start speed, end speed, and acceleration rate). A math function within the test profile calculates the ramp time. This permits the operator to change the test start and end points and the test range without actually modifying the test profile. These specification channels are usually included in the standard configuration files provided by SuperFlow.

Several methods are available for the operator to pre-set the test parameters in the specially defined specification channels: by using either the WinDyn Test Setup feature, console knobs and buttons, or buttons on the handheld controller to set the variables before a test is started. The test profile itself can prompt the operator to enter values into the specification channels.

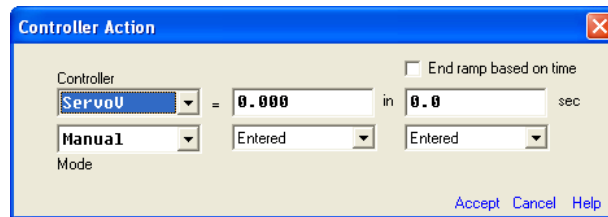


Refer to Chapter 7, "Configuration Utility" in this Users Guide and Chapter 9 in the product operators manual for detailed information on specification channels and how they are used.

NOTES:

- **Data channel and constant (specification) channel values for the controller set points cause the system to ramp the controlled value to the value of the data or constant (specification) channel at the moment the test profile line is executed. The controller set point does not continuously change even though the data or constant (specification) channel may be changing.**
 - **In all ramp commands, the *ramp controller to <value>* statements give sample controlled values for the controller. What the controller controls depends on the system configuration as defined in the configuration file (CFA). In some cases, such as chassis dynamometers, only a load controller is used. Chassis dynamometers rely on the operator to apply throttle manually. In most engine-control applications, however, the dyno (absorber) is controller #1 and the engine (throttle) is controller # 2. Thus, all ramp commands could be shown with engine speed as the #1 controller and throttle position as the #2 controller.**
 - **All user-entered variables are shown within < > symbols to differentiate them from the display text accompanying the commands. When entering data values or other information into command entry fields, do not type the < > symbols because this invalidates the command.**
-

13.7.2.1 Command a Controller Action



Syntax

<Controller> <mode> = <value> in <time> seconds]

<Controller>: One of two possible controllers as defined in the system configuration.

<mode>: The desired control mode for the specified controller as defined in the configuration.

<value>: Controller set point. The value in the selected source at the time the test profile command is executed is used for the controller setpoint. Choose from the following:

- **Entered**: Any positive number entered by the test profile author.
- **Channel**: Any defined channel in the system configuration.
- **Specification**: Any specification channel defined in the system configuration. Usually it would be one designated for this purpose.
- **Counter**: There are 9 counters available in the system that would have a value set prior to the controller actions.
- **Timer**: There are 9 timers in the system that run continuously during the test. They can only be reset to zero.
- **Memory**: These are value holders in the system that are used for various purposes, Generally, memories 11 through 30 are available for use in test profiles.
- **Table**: See "Table Support" on page 13-26.
- **Math**: The present value retained from an earlier command is adjusted through a mathematical formula.
- **Unchanged**: Present value is held steady for the specified amount of time.

<Time>: This sets the ramp time for the controller to change from the starting point to the ending point. The valid range is 0.1 to 2100 seconds. As with the controller set point, it uses the value in the selected source at the time the command is executed.

End Ramp Based on Time

When using the Controller Action command, by default the system is guaranteed to reach the specified ramp upper set point, even if this requires extending the ramp time beyond that time specified. To override the default behavior, check the **End ramp based on time** box; this will force the system to end the ramp at the specified time even if the ramp upper set point was not reached in that time.

It is crucial to do this when using the Controller Action as a "Set point" command; otherwise, the test will hold at that step waiting to "see" the value it needs to proceed.

Use

Controller Action is a powerful, flexible command that can be used to generate any desired controller behavior including (but not limited) to: ramps, set points, steps, racetrack simulations, non-constant acceleration testing, bumpless mode switching, etc. Using a controller action command, you can create constant acceleration ramps where the time to the next step is typically 2 to 1,800 seconds, or effect an immediate change in the set point.

The Controller Action command obsoletes the older-style ramp commands that were used in previous versions of WinDyn (Ramp, Override Ramp, and Custom Ramp) and the older style Set Setpoint command. The older style commands are still available to support existing test profiles; however, SuperFlow recommends writing all future test profiles for new systems using the Controller Action command exclusively.

To effectively use the Controller Action command, you must understand two very important actions it supports:

- **Command Grouping**

A single Controller Action command can affect only one of the available controllers in a system. If you want to command an action to affect multiple controllers simultaneously (for example, ramp load and throttle together in a specified amount of time), group two or more Controller Action commands together directly adjacent to one another with no other test profile commands in between. Furthermore, the adjacent commands must refer to different controllers or they will be interpreted as separate commands.

When two or more Controller Action commands are adjacent in a test profile, they are interpreted as a single command, and each of the specified controller actions are executed simultaneously. The duration of the overall command is determined by the Controller Action command that specifies the longest time period.

- **Mode Persistence**

The Controller Action command requires the test profile author to specify which control mode will be in effect for the duration of the command. With mode persistence, once a control mode is specified through a Controller Action command, that mode remains in effect even after the Controller Action command completes execution.

Mode persistence is different than the older style Override Ramp command which invoked the new controller modes only for the duration of the command. With the Override Ramp command, the control mode reverts to the default setting in the Test Profile properties.

Essentially, Mode Persistence means the Controller Action command permanently overrides the default control modes specified in the test profile properties.

Set Point Command

To create fast step ramps or simply place a set point value into the controller, enter a fixed time of 0.1 seconds for the ramp time. This essentially makes the action an immediate set point change. However, make certain to check the **End ramp based on time** box. Otherwise, the test will hold at that step waiting to “see” the commanded set point value before it will proceed to the next step.

13.7.2.2 Table Support

The Controller Action command includes support for specifying controller behavior through a pre-defined table of values. For instance, using the table support feature, an entire racetrack (which may consist of hundreds of separate ramps) can be simulated using a single test profile command.

A table is a basic Comma-Separated Value (CSV) text file containing any number of rows. The first column in each row must specify a ramp time. The second column contains the value for controller #1 (the load controller). If the system is configured for controller #2 (typically throttle), its value is in the third column.

TIP: Any table of values in a Microsoft Excel spreadsheet can be easily saved in CSV format.

Table 13-1. Example Test Profile Table *

Time (seconds)	Controller #1 (load)	Controller #2 (throttle)
20	6000	50
20	8500	100
15	8000	100
20	8500	100
20	7500	75
15	8500	100

* Column headings in the table are not necessary

The test profile author may create any number of tables and reference different tables during a single test profile execution. Tables are loaded into a WinDyn Set file which is then installed in the test system. Note that the test profile can only access tables that are resident in the currently installed Set file.



For more information about Set files, refer to Chapter 14, "WinDyn Set File Editor."

<Controller>: One of two possible controllers as defined in the system configuration.

<Mode>: The desired control mode for the specified controller as defined in the configuration.

<Table>: The file that contains the desired table of values. The file is selected from a directory on the computer, but the same file must be in the installed Set file.

<Start>: Determines the first row of the table to execute.

<Stop>: Determines the last row of the table to execute.

<time>: Specifies the time (in seconds) the controllers will ramp to the first entry in the table. Once the table executes, the value in the first column determines the ramp time.

NOTES:

Be aware of several important considerations:

- The Start and Stop values can be one of the following: Entered, Channel, Specification, Counter, Timer, or Memory (same concept as a standard controller action). Both values must use the same format. Use a different channel, specification, counter, timer, or memory for the start and stop values.
- If two controllers are used, two controller actions using the same table must be adjacent to each other in the test profile.
- It is not necessary to execute an entire table. Using the start and stop offsets, the test profile author can run any portion of any available table. Execution begins at the table row specified by Start and ends at the table row specified by Stop.
- If a value of 0 is read for the Stop offset, the test profile is directed to execute all rows beyond Start regardless of the actual number of rows. This feature allows you to modify a table without forcing a change in the test profile as well.

13.7.2.3 Enter a Controller Set Point

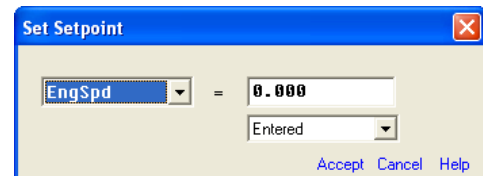
Syntax

Set <controller> Set Point = <value>

<controller>: One of two possible controllers

<value>: Can be any one of the following:

- **Entered value:** Any positive number. Sets the controller to the entered value
- **Channel:** Sets the controller set point to the value of a data channel at the time the command is executed
- **Specification:** Sets the controller set point to the value of a specification channel.
- **Math function:** Defines the value of the controller set point by mathematical operation.
- **Counter:** Sets the controller set point to the value of a specified counter at the time the command is executed.
- **Timer:** Sets the controller set point to the value of the specified timer at the time the command is executed.
- **Memory:** Sets the controller set point to the value of the specified memory at the time the line is executed.



13.7.2.4 Ramp Controller

The normal ramp uses the default control mode setting in the test profile properties.

Syntax

Controller #1 <value>, Controller #2 <value> in <time> seconds

<value>: Any positive number that is applicable to the current control configuration.

<time>: Ramp time in seconds; valid range: 0.1 to 2100

If only one controller is defined in the system configuration, then only controller #1 will display.

Use

The entered variables are the values each controller will ramp to. If the default control mode for controller #1 was set to engine speed, the controller #1 value would be a specified engine speed as in the example above. In manual mode, controller #2 might be a percentage of throttle actuator travel, for example 50%.

If the controller #1 value was set to 4000 rpm, controller #2 to 100%, and the time to 10, the control system would ramp the engine speed and torque values smoothly from the current settings to the new setting settings in 10 seconds.

The normal ramp command is based on the modes set by the configuration section. These modes are used as the default and are automatically inserted into the command line as it is created. The available control options are defined by the channel Configuration (DEF) program.

13.7.2.5 Ramp with Mode Change

The mode change command is a normal ramp command with the ability to override the default control mode set in the test profile properties.

Syntax (Mode Change ramp setup)

Linear ramp set points:

Controller to <Value>, <Mode> in <time> seconds

<Value>: Any valid value for the controlled quantity

<Mode>: Selection as defined in the system configuration

<time>: Ramp time in seconds; valid range: 0.1 to 2100

If only one controller is defined in the system configuration, then only controller #1 will display.

Use

With this command, the control modes for the ramp can be temporarily changed. The system easily switches to the changed modes as soon as the test profile reads the line and stays in the changed mode until the ramp is completed. At that time the test profile defaults to the normal mode, so successive mode change commands are required for continued operation in modes other than default control mode.

13.7.2.6 Ramp with Custom Settings

The custom ramp commands offer more flexibility than the normal ramp or mode change ramp when selecting controller set points.



Syntax

Ramp Controller #1 to **<value>** and Controller #2 to **<value>** in **<time>** seconds.

<value>: can be any of the following:

- **Entered:** Any positive number sets the controller set point to the entered value.
- **Channel:** Sets the controller set point to value of a data channel at the time the command is executed.
- **Specification:** Sets the controller set point to the value of a specification channel at the time the command is executed.
- **Unchanged:** The controller set point remains the same as it was at the time the command is executed.

<time>: Ramp time from 0.1 to 2100 seconds. Value can be entered or derived from a channel or specification.

If only one controller is defined in the system configuration, then only controller #1 will display.

Use

The “ramp to” controller set points can be an entered value, data channel, specification channel, or may remain unchanged when only changing one of two variables.

Entered values are fixed numeric values that are valid for the controlled quantity in question. Immediate values are fixed set points exactly like the set points entered in the normal ramp and mode change ramp.



See “Ramp Controller” on page 13-29 for more information on immediate values.

Unchanged values for the custom ramp controller settings cause the control system to hold the controlled value at its present value. Often the no-change value is used for one controller, and an immediate value is used for the other controller and for ramp time. This allows one controller to be isolated from the other during a ramp.

Data **channel** and **specification** values for the controller set points cause the system to ramp the controlled value to the value of the data or specification channel at the moment the test profile line executes. The controller set point does not continuously change even though the data or specification channel value may be changing.

Example:

The most common use of the custom ramp is to conduct acceleration tests where the rate of acceleration and the starting and ending speed of the test are not fixed.

In this application, two ramps are used to control the engine between a lower speed and an upper speed at a fixed acceleration with a specific throttle setting (100% is most common).

- The first ramp is constructed to set the engine at the lower speed and 100% throttle. Ramp time for the first ramp is not critical because the ramp controls the engine to the starting throttle and speed configuration. Often the first ramp time can be set to 2 seconds and the engine commanded to the starting speed with a set point command. The first ramp is still needed to ramp to the desired ramp start throttle position (100% in this case).
- The second ramp controls the engine from the lower (ramp start) speed and 100% throttle to the higher speed and 100% throttle at a specified acceleration. The acceleration rate is a function of the time setting for the second ramp. The faster the ramp is executed, the greater the acceleration rate. The slower the ramp is executed, the slower the acceleration.

This function could be carried out using normal ramps, but the speed range of the test (the start and end speed) and acceleration at which the second ramp takes place (set by the ramp duration/time) are fixed.

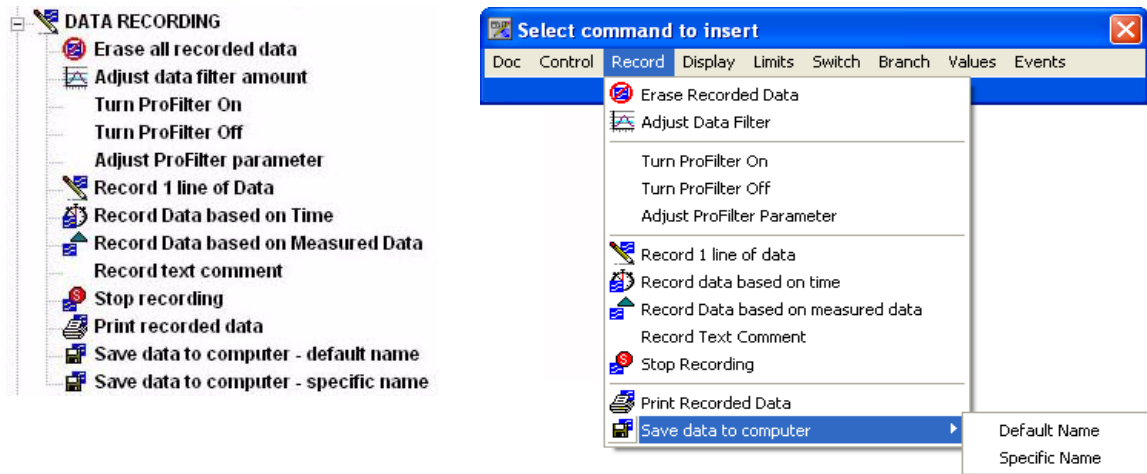
The test range and acceleration rate in rpm/sec cannot be changed without editing the test. Custom ramps let the test use specification channels for the start speed and end speed. The operator can define and edit specification channels from the handheld controller or from WinDyn. This way the operator can change the test start and end points and test range without modifying the test profile.

Similarly, the second ramp can use a specification channel (time in seconds) defined by the output of a calculated channel (range in speed divided by specified acceleration in rpm/seconds) to calculate the time necessary to produce a specified acceleration over the specified test range.

So the operator can specify an acceleration rate, the calculated channel uses a user-defined constant (specification) channel to reach the acceleration value. The user enters this value at the front panel.

13.7.3 Data Recording

A test profile can automatically clear the data buffers of the Data Acquisition System (erase data), record data one line at a time, and record data based on time or a change in a data channel. A test can also adjust the ProFilter settings, adjust the data filter settings, place a comment into the data stream, and automatically print the data.



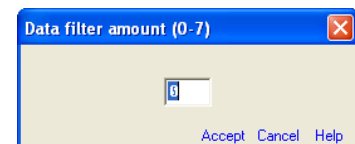
13.7.3.1 Erase All Recorded Data

This command deletes all data stored in the test system's data storage area. Once deleted, it cannot be retrieved.

This command does not affect data stored on the computer hard disk. It is generally recommended to erase data at the beginning of new test. Otherwise, the data storage area would continue to increase in size until the memory was completely filled. When the memory is filled, no new data can be stored.


13.7.3.2 Adjust Data Filter

This command sets the filter amount for all data channels that are configured with a filter setting of auto. Channels with a fixed filter are not affected. Valid values are 0 to 7. Zero turns off data filtering. Values 1-7 apply data filtering to all data channels, with 7 being the maximum filter amount.



NOTES:

- This command overrides the filter rate that may be previously set in the system.
- It is best to have a low filter rate when performing fast acceleration ramps while data is being recorded and a higher filter rate for steady state testing.

 For more information on data filters, see "Filter Tab" on page 5-44.

13.7.3.3 Turn ProFilter On

This command activates the ProFilter system. ProFilter is typically used to extrapolate high-speed recorded data and provide results with even-increment rpm points.

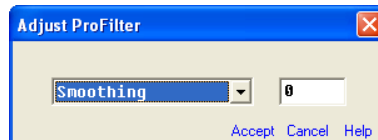
NOTE: To use ProFilter, the test data record method must be time-based and set to record at 100 data lines per second.

13.7.3.4 Turn ProFilter Off

Deactivates the ProFilter system.

13.7.3.5 Adjust ProFilter Parameter

This command adjusts the ProFilter parameters.




Syntax

Adjust ProFilter <parameter> = <value>

<parameter> = <value>: Can be the following:

- **Smoothing = (0-100%):** The amount of data smoothing
- **Increment = (0-999):** The even-increment speed interval for the resultant data
- **Counter Channel = (77-99):** The “counts per revolution” specification channel number
- **Speed Channel = (7-12):** The speed pickup frequency channel number

 For more information on ProFilter, see section 4.7, “ProFilter,” on page 4-14.

13.7.3.6 Record 1 Line of Data

This command records 1 line of test data. The current values of all defined channels are stored in RAM memory on the data acquisition CPU circuit card. Another line of data will be added to the data buffer each time this command is executed. The recorded data will remain in the buffers until erased or cleared.



IMPORTANT: Data must be saved to the computer hard drive to be permanent.

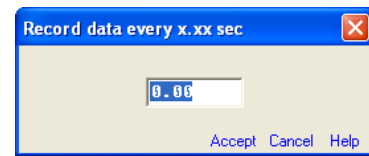
13.7.3.7 Time-Interval Recording

This command instructs the test system to record data at the specified time interval. Data recording continues until data recording is turned off, the memory becomes full, or the test stops.

Syntax

Record data every **<x.xx>** seconds

- Enter 1.00 to record 1 data line per second (or increments of 1 up to 655 seconds)
- Enter 0.10 to record 10 data lines per second
- Enter 0.05 to record 20 data lines per second
- Enter 0.01 to record 100 data lines per second



NOTE: Data record rates slower than 1 line every 10.92 minutes are not supported by the hardware.

13.7.3.8 Time-Interval Recording (DOS Compatible)

This command instructs the test system to record data at the specified time interval. Data recording continues until data recording is turned off, the memory becomes full, or the test stops.

This DOS-compatible command is supported on all SuperFlow products running any version of WinDyn (using either the DOS test editor or the Windows test editor) and must be used on older 1942 or 2242 based systems (where the tests were originally written with the DOS editor).

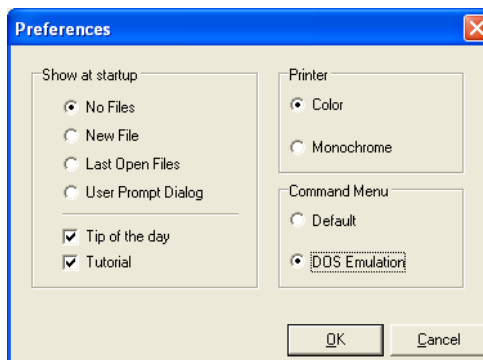
Syntax

Record data every **<x.xx>** seconds (DOS compatible)

<x.x> Valid values are

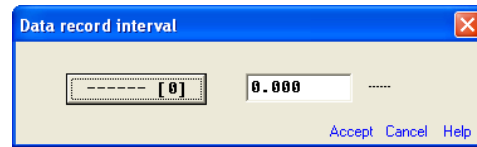
- 0.0 to record 100 data lines per second
- 0.1 to record 10 data lines per second
- 1 to 326 seconds (data record rates slower than 1 line every 5.46 minutes are not supported by 2242 or 1942 based systems the hardware)

This command is accessible only from the DOS Emulation command menu. To activate, from the **WinDyn Test Profile** menu, select **File>>Preferences**. In the **Command Menu** area, select **DOS Emulator** and click **OK**. Select **Insert** to display the floating menu bar, and select **Record** to display the command list. This option is not available in the Available Test Commands list.



13.7.3.9 Record Based On Measured Data

Data can be recorded as a function of data channel change. For example, you could have the system record 1 data line for every 100 rpm change of the Engine Speed channel.



Syntax

Record a data line for every **<x>** change of **<channel>**

<x> Can be any valid numeric value for the selected interval channel.

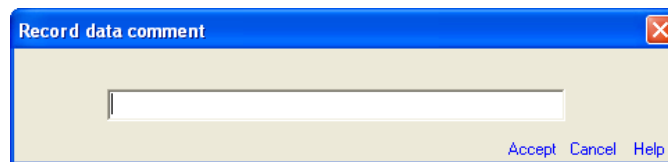
<channel> Can be any data channel.



IMPORTANT: Data will most likely *not* fall exactly on the desired excursions, and extremely fast rates of change for the data channel can corrupt the recorded data.

13.7.3.10 Record Text Comment

This command will allow the test author to embed a text comment into the recorded test data. Use to document test data lines of interest. The comment will appear in the data stream at the point where the comment was executed. Up to 40 characters can be written.



13.7.3.11 Stop Data Recording

This command stops any form of automatic data recording previously activated in the test profile. If data recording was already off, it has no effect.

13.7.3.12 Print Recorded Data

This command prints the test data currently recorded in the test system. Format is determined by the current WinDyn print settings.

13.7.3.13 Save Data to Computer – Default Name

This command saves the currently recorded test data to a file on the WinDyn computer hard drive.

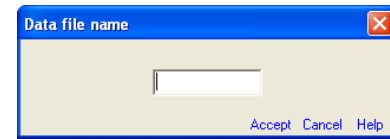
The file name used is the auto-increment file named specified by the WinDyn **Test Setup** or the **Auto-Increment File Name** dialog box. The file name increments numerically each time data is saved. For example, Chevy1, Chevy2, etc.

13.7.3.14 Save Data To Computer – Specific Name

This command saves the currently recorded test data to a file on the WinDyn computer hard drive. The file name used is specified in the test profile command.

Syntax

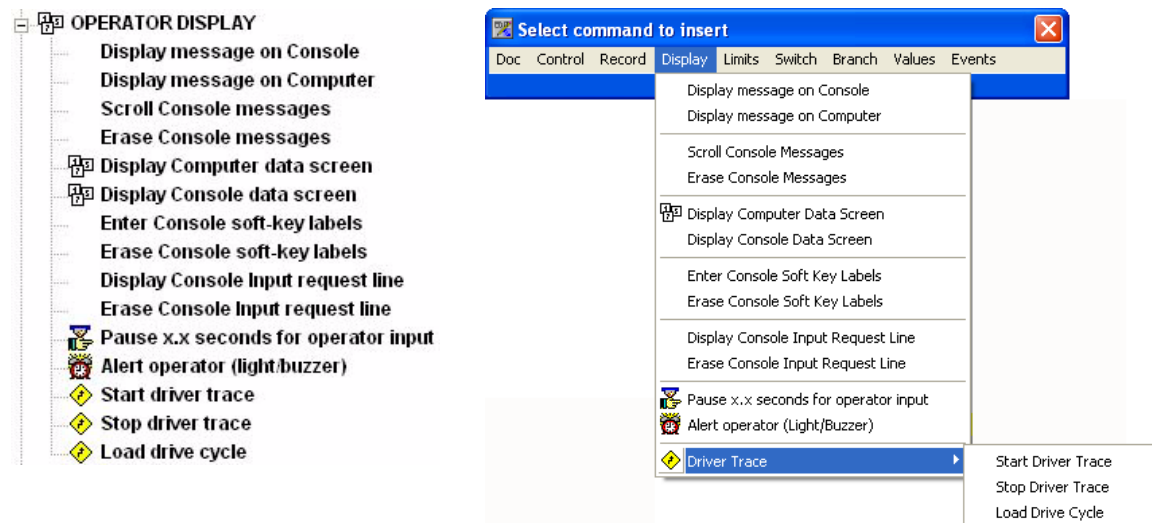
Save recorded data to file [] on computer



See “Data File Names” on page 13-8 for more information on this feature.

13.7.4 Operator Display

NOTE: All user-entered variables are shown within < > symbols to differentiate them from the display text accompanying the commands. When entering data values or other information into command entry fields, do not type the < > symbols because this invalidates the command.



13.7.4.1 Display Message on Console

The display commands show operator-defined information on the left-hand console or handheld controller display, depending on the system. The following conditions apply:

- Three lines of display information can be shown on the handheld. Each line may have up to 40 characters.
- The # entry selects the display line on the handheld (numbered vertically from the top down) on which the message will display. If 0 is selected, the lines will appear according to first-in, first-out control of the three-line current data area that appears on the handheld.

Syntax

Display# [Message] on the console:

- The # entry is the desired display line number. Valid values are 0, 1, 2, 3.
- The message entry within the [] defines the message to display. Up to 40 characters may be used.

Displaying Real-Time Values

You can display the real-time value of a data or memory channel within the text of a message, with continuously updated values. This lets the operator monitor the value of a channel during test profile execution.

The following special-character sequence instructs the system to display a real-time channel value:

^C#.p^

- The **^** symbols surround the special command string to be replaced at run time with the appropriate system information.
- The **C** tells the system to display a channel value (use **M** to display a memory value. Valid memory numbers are 0–60).
- The **#** is the channel (or memory) number. For example, **^C100^** instructs the system to display the value of channel **#100**.
- The **.p** is an optional precision specifier (0–4), for example, **^C100.2^** instructs the system to display channel **#100** to **2** decimal points of precision. If you do not enter a **.p** specifier, the default precision for the channel (defined in the system configuration) is automatically used.

Example:

To continuously show the engine torque (channel #121) on the second line of the display, the complete test profile message command would look like:

Display2: [Engine torque = ^c121^ lb-ft.] on front panel

TIP: When editing the message string, use keyboard shortcuts **CTRL+C** and **CTRL+M** to quickly enter a **^C#.p^** type command.

Setting Real-time Values

You can input the value of specification or memory channels within the text of a message. This lets the operator input specification/memory values during test profile execution.

The following special-character sequence instructs the system to input a specification value:

^S#.p^

- The **^** symbols surround the special command string to be replaced at run time with the appropriate system information.
- The **S** tells the system to input a value into a defined **Specification** channel (channels 77–99). (use **I** to input a memory value. Valid memory numbers are 0–60).
- The **#** is the specification channel (or memory) number. For example, **^S77^** instructs the system to prompt the operator to input a value into specification channel **#77**.
- The **.p** is an optional precision specifier (0–4), for example, **^S77.3^** instructs the system to let the operator enter the specification value with up to 3 decimal points of precision. If you do not enter a **.p** specifier, the default precision for the channel (defined in the system configuration) is automatically used.

Example:

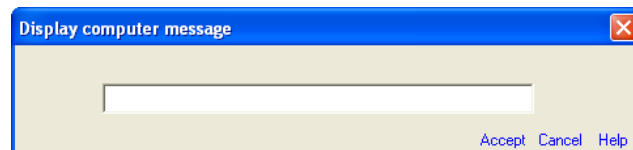
To let the operator specify the end rpm for a test (specification #83) on the second line of the handheld controller display, the complete test profile message command would look like:

Display2: [StopAt = ^S83^ RPM] on front panel.

TIP: When editing the message string, use keyboard shortcuts **CTRL+S** and **CTRL+I** to quickly enter a ^S#.p^ type command.

13.7.4.2 Display Message on Computer

This command will display a text message on the WinDyn computer monitor. Up to 40 characters can be used. A common use of this feature is to alert the operator. A response is required from the operator to clear the message.



13.7.4.3 Scroll Console Messages

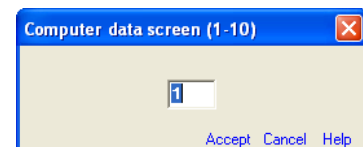
Commands the display messages on the console or handheld controller to “roll up” on the display, for example, the text on the third line would be placed in the second line, and so forth. The original first line is removed. This is used in conjunction with labeling consecutive console messages with #0 (zero). A **Wait** (see “Pause Test for x.x Seconds (WAIT)” on page 13-46) command can be used between the message command lines to allow time for the operator to read the message. Note that doing this will not allow the test to proceed until all the messages have been displayed (unless a provision is in place to bypass that section).

13.7.4.4 Erase Console Messages

This command will clear all front-panel messages. The message area on the console remains blank until a new message command is received. On the handheld controller, the display will revert to the real-time data screen.

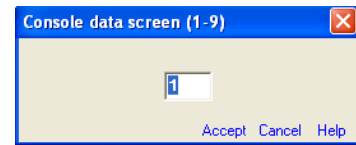
13.7.4.5 Display Computer Data Screen

This commands WinDyn to display one of the 10 available real-time data screens (on the computer monitor). To see the screen, WinDyn must be in current data display mode. The data screen remains until the operator or the test profile commands a different screen.



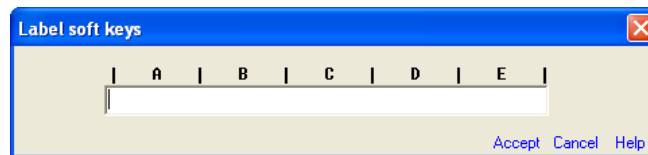
13.7.4.6 Display Console Data Screen

This commands the system to display one of the nine available real-time data screens on the console and handheld controller which may be in any mode when the commanded screen appears. The new data screen remains on the display device until a the operator or test profile commands a different screen. The final data screen remains on the display device after the test ends.



13.7.4.7 Enter Console Soft Key Labels

This command assigns text labels to the A-E keys located on the bottom row of the handheld controller or below the right-hand console display.



Each label is limited to a maximum of 8 characters and should be positioned so it appears directly below its associated key letter when the test is run. Insert blanks using the keyboard SPACE BAR. The keys function only if a **WHEN Soft Key Is Pressed** function is active and the system is monitoring that particular key. Labeling alone does not define a soft key function; it only defines the text below the key.

This feature can also be used for a “4th” display line.

13.7.4.8 Erase Soft Key Labels

This command erases all soft key labels on the system console and handheld controller.

13.7.4.9 Display Console Input Request Line

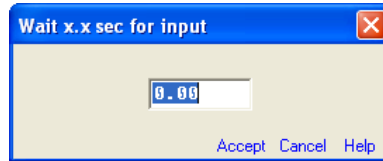
Displays the command line that appears on the bottom (8th) row of the handheld controller. This line is generally the engine and rollset controls on a dynamometer. In the default mode with no soft key labels, the control command line may remain visible which may not be preferred for all tests. The Erase Console Input Request Line (see below) clears this line. This command puts it back.

13.7.4.10 Erase Console Input Request Line

This hides the command line that appears on the bottom (8th) row of the handheld controller. In the default mode with no soft key labels, the control command line may remain visible which may not be preferred for all tests.

13.7.4.11 Pause x.x for Operator Input

This commands the system to wait (pause) for the number of seconds entered in this dialog box or until the operator presses the **Continue** button. The test continues when the wait time expires.



TIP: The test profile can be configured to prompt for an operator response through the **Enter Soft Key Labels**, **When Soft Key is Pressed**, and **GOTO This Step** commands. After these commands are executed, the test normally waits indefinitely for a response. Use **Pause x.x For Operator Input** instead of **GOTO This Step** to allow test execution to continue if a response is not received in the specified amount of time.

13.7.4.12 Alert Operator

This command is not implemented at this time. It is intended to notify the operator of alert conditions with a light or buzzer.

13.7.4.13 Start Driver Trace

Driver Trace is an optional software product available from SuperFlow Technologies Group (visit www.superflow.com).

This commands the Driver Trace window to start running (i.e., scrolling) the currently displayed drive cycle. If the driver trace application is not open, it will open automatically with the most recently used drive cycle.



IMPORTANT: The following command sequence should always be separated by a 1.0-second delay:

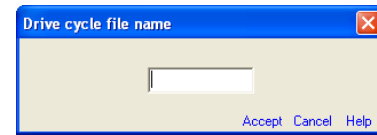
1. Load Drive Cycle
2. WAIT for 1.0 seconds
3. Start Driver Trace

13.7.4.14 Stop Driver Trace

This command stops the Driver Trace test and closes the window.

13.7.4.15 Load Drive Cycle

This commands the Driver Trace window to display the specified drive cycle. If the driver trace application is not running, it opens the most recently run trace automatically.

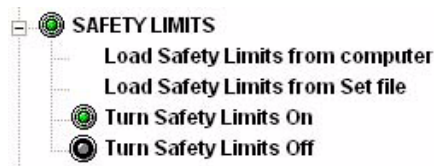


IMPORTANT:

- The specified Drive Cycle Definition file must be located in the active WinDyn\Test folder and must have a .csv extension.
- FILE_NAME] specifies the name of the Drive Cycle Definition file (maximum of 8 characters, no spaces allowed). Do not enter a file extension.

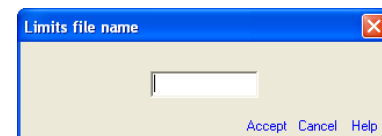
13.7.5 Safety Limits

Limits determine how the system will respond to channels going above or below a specified value.



13.7.5.1 Load Safety Limits from Computer

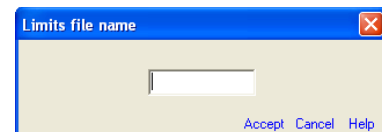
This command retrieves a safety limits file from the WinDyn\Limits directly on the computer hard disk to use. The file name is limited to 8 characters maximum. After the file is loaded, safety limits must be turned ON using a separate command unless the limits file is configured to turn on automatically.



IMPORTANT: It is best to wait several seconds for the computer to access the disk before turning on the new safety limits.

13.7.5.2 Load Safety Limits from Set File

This command retrieves a safety limits file from the currently installed Set file. The file name is limited to 8 characters maximum. After the file is loaded, safety limits must be turned ON using a separate command unless the limits file is configured to turn on automatically.



13.7.5.3 Turn Safety Limits ON

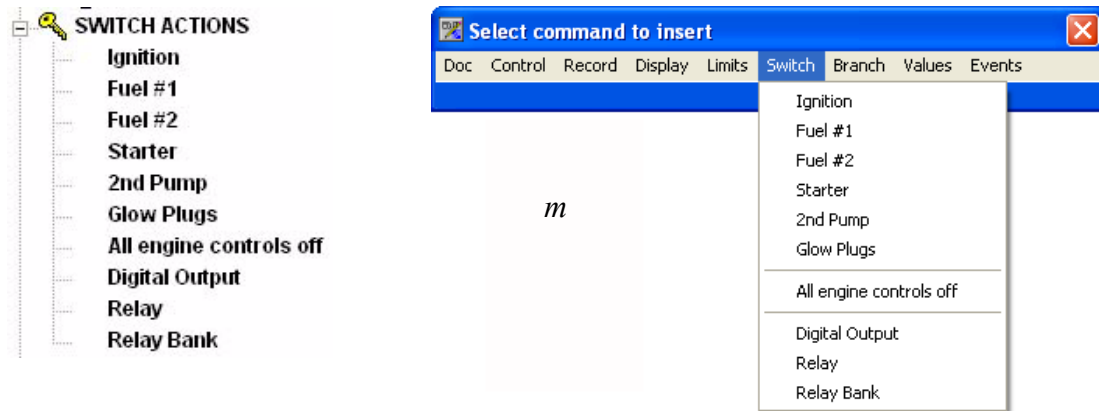
Activate the currently installed Safety Limits system to trip any out-of-bound conditions.

13.7.5.4 Turn Safety Limits OFF

Deactivate the Safety Limits system.

13.7.6 Switch Actions

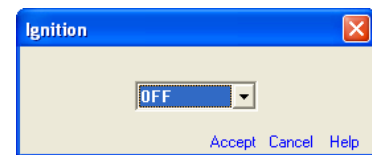
These commands are associated with test system switches including engine control, digital outputs, and relays.



13.7.6.1 Turn Engine Control On/Off

Examples of engine controls include ignition, starter, fuel pump, etc. The actual signal for the engine controls are passed through the on-board digital outputs which is configured in the Hardware file. The typical Hardware file settings for the digital outputs on an engine dyno are:

- **Starter:** Digital Output 1
- **Fuel #2:** Digital Output 2 (normally used as the auxiliary or fan control)
- **Fuel #1:** Digital Output 3
- **Ignition:** Digital Output 4



WARNING: When using an Engine Control function in a test profile, the programmer must be aware of the implications and possibilities if safeguards are not implemented. For example, if an engine is running and the **Starter On** command is executed, the starter **WILL** engage. It is up to the programmer to ensure that this does not happen.

When used with an Engine Control Panel (ECP) installed on the sensor box, the engine control commands are “hard wired” through software to control the functions on the ECP.

To use an engine control command with a relay box, the hardware file must have the digital outputs configured as **On Board**. Then you must link the relay to the engine control command in a switch file using a system function command (for example, **R1=E4**, where **Relay 1** is used for ignition and **E4** is digital output 4).

13.7.6.2 All Engine Controls Off

This command turns off all engine controls. It will have no effect if the control was already off.

13.7.6.3 Digital Output

The NGE sensor box provides eight digital output signals that can be used in a variety of ways. On engine dynamometers, four outputs are used for engine functions (ignition, starter, fuel pump, and auxiliary). On chassis dynamometers, digital outputs are used to control system functions (roll lock, wheel clamp, wheelbase adjusting motors, electric starting motors, etc.) Digital outputs can also be user-selected and assigned to control other functions in a dynamometer test cell such as lights, fans, water systems, emergency stop systems, and so on.



These signals can be controlled by test profile commands. The typical use of digital outputs on SuperFlow systems is shown in the table below.

Table 13-2. Typical System Digital Outputs

Output Number	Engine*	AutoDyn	CycleDyn
1	Starter	Not used	Not used
2	Auxiliary	Pump On/Off	Starter
3	Fuel Pump	WB Reverse	Clamp Open
4	Ignition	Roll Lock	Clamp Closed
5	Not used	WB Forward	WB Shorter
6	Not used	Diff Lock On/Off	WB Longer
7	Not used	Not used	Blower
8	Not used	Not used	Not used

* When using a sensor box mounted engine control panel.



WARNING: When using a Digital Output function in a test profile, the programmer must be aware of the implications and possibilities if safeguards are not implemented. For example, if an engine is running and the digital output controlling the starter is commanded to turn on, the starter **WILL** engage. On AutoDyn and CycleDyn systems, precautions are built into the electronic circuitry to disable the roll lock, wheel clamp, and other system functions while the rolls are turning. But this will not stop the system from executing these commands when the vehicle is stationary. For example, if in a CycleDyn test the wheel clamp is commanded to open while the roll is spinning, the clamp will remain closed until the roll stops; then it will immediately open. It is up to the test profile programmer to ensure that these things do not happen.

13.7.6.4 Relay

The SuperFlow SF-1843 relay enclosure provides 32 independent, user-configured relays. By wiring these relays, users can assign them to control system functions (lights, fans, pumps, valves, emergency stop systems, etc.) and command them in a test profile.



13.7.6.5 Relay Bank

The 32 relays in the SuperFlow SF-1843 relay enclosure can be controlled in groups with one command.

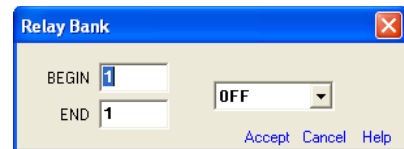
Syntax

Turn Relay [x] through Relay [y] <ON/OFF>

[x] specifies the first relay in the group

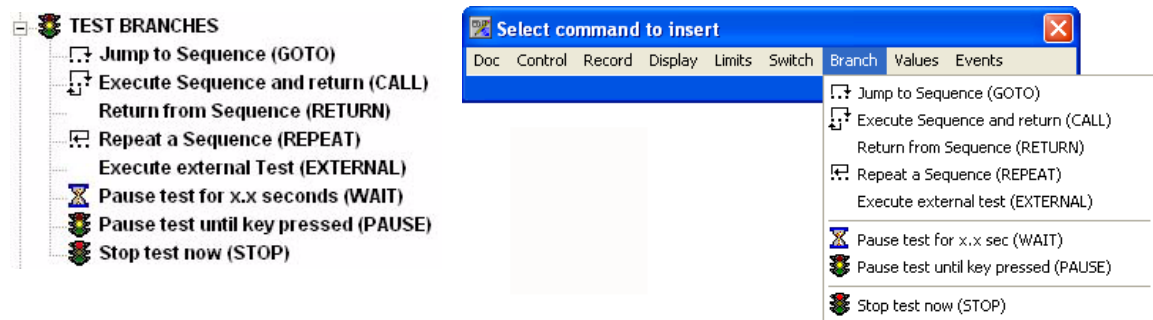
[y] specifies the relay after the last one in the desired group

<ON/OFF> specifies the desired relay state (ON or OFF)



13.7.7 Test Branches

Branch commands are associated with test execution and subroutines. A subroutine is a sequence of test steps that can be invoked from within many different locations in the main script. This allows the test profile author to build a multi-function test and lets a single subroutine be used several times in the same test.



NOTE: All user-entered variables are shown within < > symbols to differentiate them from the display text accompanying the commands. When entering data values or other information into command entry fields, do not type the < > symbols because this invalidates the command.

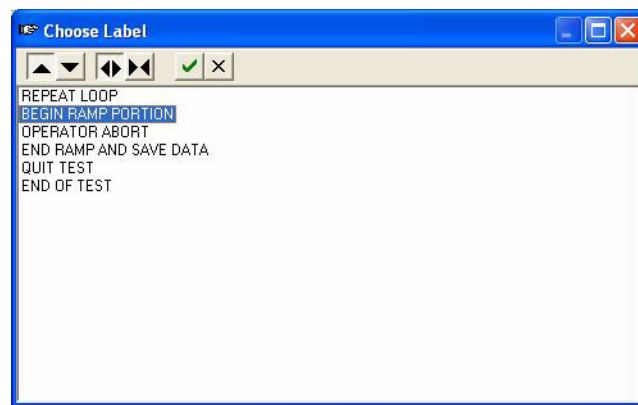
13.7.7.1 Jump To Sequence (GOTO)

The GOTO command transfers the test profile execution to the specified location in the test profile or to the next command line located immediately after a <label>.



To make the selection, click the options available in the dialog box or use the shortcut keys. When the command is executed, the test will “jump” to that location and continue from there. The available options are:

- **CTRL+S:** Beginning of the test
- **CTRL+E:** End of test – the test will effectively end.
- **CTRL+T:** Go to this step – the test will hold at this step and wait for a new command (commonly used in conjunction with **When Soft Key is Pressed**) commands.
- **CTRL+M:** Go to the next step.
- **CTRL+F:** Go to the previous step – the test will move back to the previous step and execute that command. Commonly used with **If/Then** commands in a loop.
- **CTRL+L:** Select a label in the test – the test will “jump” to the next command line immediately after the label. This option will display a list of the labels used in the test profile. Use one of the following methods to select the label:
 - Double-click the desired label on the list.
 - Highlight the desired label and click the green check mark.
 - Highlight the label and press **ENTER**.



TIP: The list of labels can be sorted alphabetically or chronologically.

13.7.7.2 Execute Sequence and Return (CALL)

A CALL command transfers the test profile execution to the selected location or to the step located immediately after a **<label>**. After that, when a RETURN command is encountered, the test will return to the step immediately following where the CALL statement was invoked.

Several layers of CALL and RETURN may be built into the test profile.

Use the **CALL TEST SEQUENCE** dialog box to call a series of commands. The keyboard shortcuts are the same as the GOTO LABEL shortcuts.

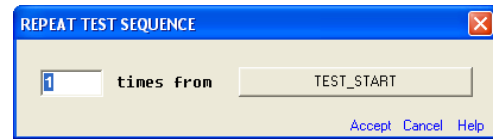


13.7.7.3 Return From Sequence (RETURN)

The RETURN command accompanies a CALL command. Test execution is transferred to the step immediately following the most recent CALL command.

13.7.7.4 Repeat A Sequence (REPEAT)

The REPEAT command executes a test sequence a specified number of times. This command is useful in reducing the size of a test profile by reducing repeated syntax.



Syntax

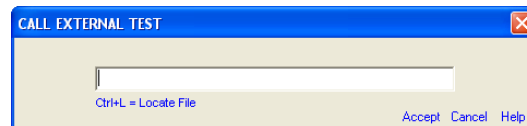
REPEAT <x> times from step <label>

<x> is any positive number.

<label> is the same; keyboard shortcuts are the same as the GOTO LABEL and CALL.

13.7.7.5 Execute External Test (EXTERNAL)

This command transfers test execution to a separate test profile that is included in the installed Set file. When executed, the test will invoke and run the called test. The test returns to the original test at the called location when the external test completes.



Click the available option, or use the shortcut key to display a list of test profiles stored in an appropriate folder on the computer and select the desired file. This same test profile must also be included in the installed Set file for this feature to function properly.

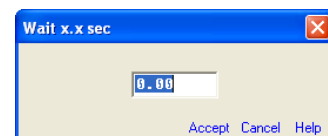
With this command, the test profile author can create test profiles that can be used with several primary tests, reducing the need to duplicate the same subroutine in multiple primary tests. Any number of test profiles can share a called test sequence. This feature also allows a test profile to be used in a primary test and also be available for the operator to run independently.



IMPORTANT: During test execution, the Call External Test command can only access test profiles that are included in the currently installed Set file.

13.7.7.6 Pause Test for x.x Seconds (WAIT)

The WAIT command will pause the test for the specified amount of time. Data recording and WHEN conditional commands will continue to be active during the wait time.



13.7.7.7 Pause Test Until Key Pressed (PAUSE)

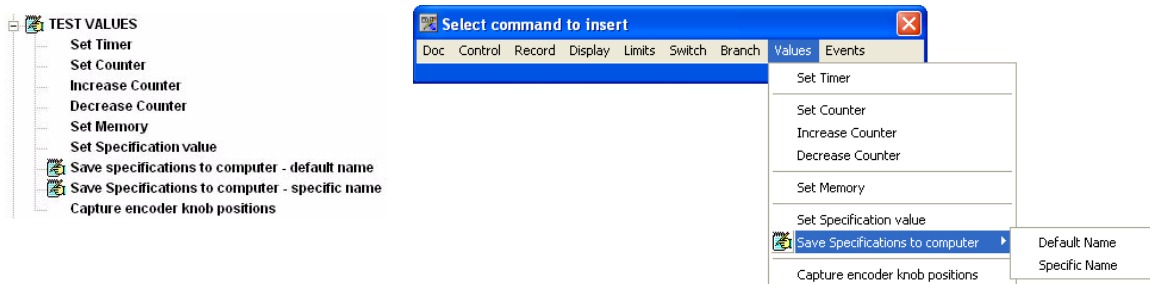
This command pauses the test execution until the **Continue** button on the console/handheld is pressed. While paused, the controller set points remain at the point present immediately preceding the pause command. All other test activity is stopped until the test resumes.

13.7.7.8 Stop Test Now (STOP)

This command immediately ends test profile execution. Controllers are ramped down based on the End Test ramp time specified in test profile properties.

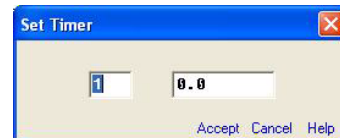
13.7.8 Test Values

NOTE: All user-entered variables are shown within < > symbols to differentiate them from the display text accompanying the commands. When entering data values or other information into command entry fields, do not type the < > symbols because this invalidates the command.



13.7.8.1 Set Timer

The SuperFlow data acquisition system has nine timers. Each timer starts at zero (0) when a primary test is started and *increments* with time. The timer value is recorded as its own channel and can be used as part of a calculated channel or an input to conditional IF/WHEN commands.



This command initializes a test profile timer to any desired value between 0 and 6500.

NOTE: The highest value a time can reach is 6,500 seconds. At that time it automatically resets to zero and starts over.

Timers 0–9 correspond with system channels 210–218. All have a resolution of 0.1 seconds with the exception of Timer #2 which has a resolution of 0.01 seconds.

Syntax

Set Timer [n] = <x.x>

[n] specifies the timer (0–9)

<x.x> specifies the timer value (0–6,500)

13.7.8.2 Set Counter

The data acquisition system includes nine counters that can be used to “count” events as they occur such as the number of cycles. Other uses include setting a step or stage of a test. All counters are set to zero (0) when the primary test is started,



When set, a counter will remain at its set value until specifically changed by another test profile command (see below). Test profile counters can be used in conditional IF/WHEN statements within the test profile.

Syntax

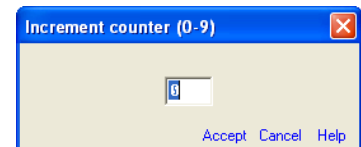
Set Counter [n] = <xxxx>

[n] specifies the counter (0-9)

<xxxx> specifies the value (0-65,000)

13.7.8.3 Increase Counter

Use to add 1 to the current value of a counter (see above). It is often used in conjunction with IF/WHEN commands to count events such as the number of times a value exceeds or falls below a specified level or to count cycles in a test.



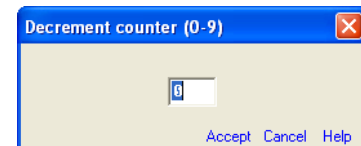
Syntax

Increment Counter [n]

[n] specifies which counter to increment (0-9)

13.7.8.4 Decrease Counter

Use to subtract 1 from the current value of a counter (see above). Often used in conjunction with IF/WHEN commands to count events such as the number of times a value exceeds or falls below a specified level or to count down from a preset value.



Syntax

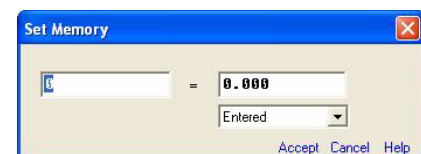
Decrement Counter [n]

[n] specifies which counter to decrement (0-9).

13.7.8.5 Set Memory

Up to 100 memory locations are available in the SuperFlow data acquisition system (0-99). Memory locations 0-10 correspond with system channels 210-220 and have specific uses within the system. Some locations above 30 also have specific uses. Therefore, test profiles should only use memory locations 11 through 29.

Memory location is a very flexible feature in a test profile with many possible uses including status indicators, complex set points, mathematical scratch pads, etc.



Syntax

Set Memory [n] = <value>

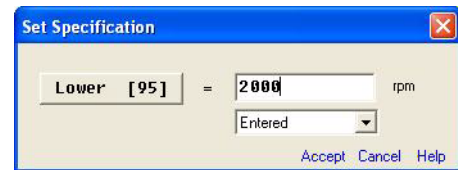
[n] specifies the test profile memory (0–99)

<value>: Can be any one of the following:

- **Entered value:** Any positive number
- **Channel:** Value of a data channel at the time the line is executed
- **Specification:** Value of a specification at the time the line is executed
- **Math function:** Value is determined by a mathematical formula
- **Counter <counter #>:** Value of a counter at the time the command is executed
- **Timer <timer #>:** Value of a timer at the time the line is executed
- **Memory <memory #>:** Value of memory at the time the line is executed

13.7.8.6 Set Specification

Specification channels are user defined in the system configuration (CFA) with a name, unit, and a default value. They are generally used for predetermined functions in the data acquisition. Some uses for specification channel in test profiles are start speed, stop speed, step time, and step number.



Specifications are often used to hold a preset value and are used for set point or time control. During a test, specifications can copy the value of calculated channels, timers, or counters at a given moment which may then be used in IF/WHEN statements. Specifications are also useful when performing mathematical operations on or with other channels.

- If a specification value is changed during a test, the last value entered displays in that channel throughout the entire recorded data file.
- The last entered specification values are retained at the conclusion of the test.

This command sets the value of a specification channel.

Syntax

Set <specification> = <value>

<specification> specifies the specification channel

<value>: Can be any one of the following:

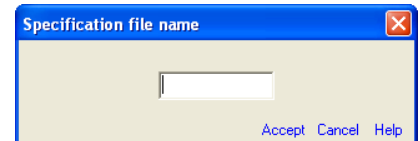
- **Entered value:** any positive number
- **Channel:** Copies the value of a data channel at the time the line is executed
- **Specification:** Copies the value of a specification channel at the time the line is executed
- **Math function:** Value is determined by a mathematical formula
- **Counter:** Copies the value of a counter at the time the command is executed
- **Timer:** Copies the value of a timer at the time the line is executed
- **Memory:** Copies the value of a memory at the time the line is executed

13.7.8.7 Save Specifications to Computer – Default Name

This command saves the current value of all specification channels to an auto-incremented file on the computer in the appropriate WinDyn Config folder. The name portion of the file is specified by the WinDyn **Test Setup** or **Auto Test Saves Data** file name setting. The numeric portion of the file is determined automatically based on the number assigned to the previous file saved. A new file is always created. Existing files are never overwritten. The file will have a .CST extension.

13.7.8.8 Save Specifications to Computer– Specific Name

This command saves the current value of all specification channels to a file on the computer in the appropriate WinDyn config folder. The test profile author enters the file name in the dialog box.



- A file is created if it doesn't exist.
- Existing files with the same name are overwritten.
- The name must have no more than 8 letters; no spaces are allowed nor characters other than a dash or underscore.
- Do not enter a file extension. A .CST extension is automatically added to the name.

13.7.8.9 Capture Encoder Knob Positions

When a test profile starts from the XConsole or a wireless controller, the *Upper*, *Lower*, and *Return* console knob settings are saved to predefined specification channels. After the test is started, changing these knob settings has no effect on the system.

When executed, this command will “capture” the settings of these knobs and update the values in those channels with the current settings. The following is a definition of the predefined specification channels used in conjunction with the console knobs:

Channel Number	Name on Console	Function
95	Lower	Normally used as the start test speed.
96	Upper	Normally used as the end test speed
99	Return	Normally used as the speed the engine is returned to at the end of a test cycle.

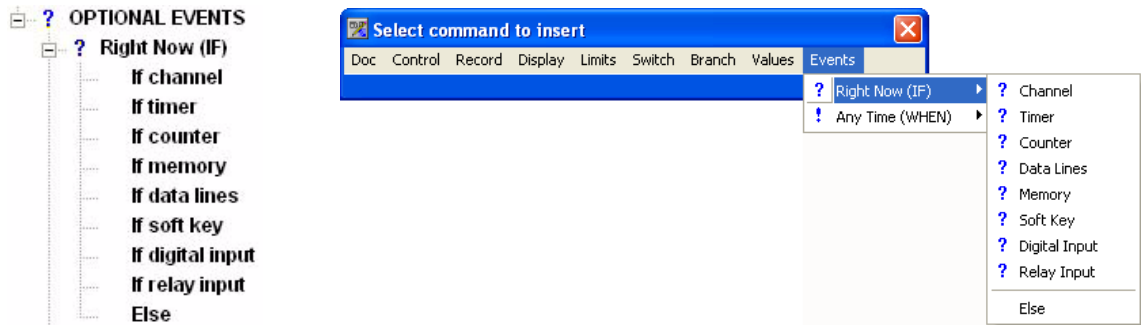
This command is useful in test profiles that have a “repeat test” option. When placed in a suitable point in the profile, it lets the operator change the test parameters between runs without having to stop the test and start over.

13.7.9 Optional Events

These are IF/WHEN conditional statements that will monitor data channels or system functions for a specific condition and perform the commanded action if/when that condition is met.

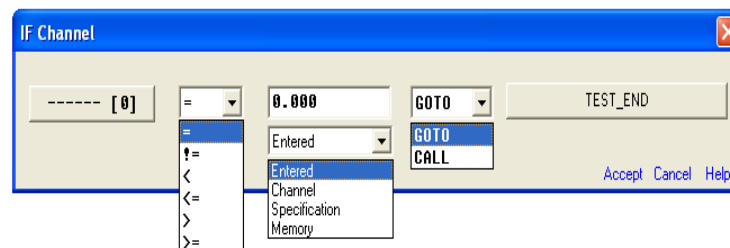


13.7.9.1 Right Now (IF)



An IF statement checks for the prescribed condition only at the exact time when the line is read within the test profile progression. If the condition is true at that point (and that point *only*), the commanded action will take place. Otherwise, the test passes over the IF command line and continues following the script.

All IF commands use the following basic syntax:



<Condition>:

- = equal to
- != not equal to
- < less than
- <= less than or equal
- > greater than
- >= greater than or equal

<Value>:

- **Entered:** Any valid numeric value
- **Channel:** Any currently defined data channel
- **Specification:** Any currently defined specification channel
- **Memory:** Any memory location within the system (0-99)

<Action>:

- **GOTO:** Causes the test to branch and continue executing from a specific test location
- **CALL:** Causes the test to execute a subroutine and then return to the line immediately following the IF statement when a RETURN command is executed

<Label>: Any valid label within the test profile

IF Channel

This command checks the current value of a data channel and performs the specified action only if the condition is True.

Syntax

IF Channel **<Channel>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

<Channel> can be any valid channel defined in the current configuration.

IF Timer

This command checks the current value of a timer (1-9) and performs the specified action only if the condition is True. This is very useful for cycle times and timer loops.

Use the equal condition with caution. Because the timer must exactly match the specified value when the IF command executes, the test could literally bypass the command without acting on it. It is best to use a *less than or equal* (\leq) or *greater than or equal* (\geq) condition when monitoring timers.

Syntax

IF Timer **<X>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

<x> specifies the system timer (1-9).

IF Counter

This command checks the current value of a counter (1-9) and performs the specified action only if the condition is True. Useful for counting the number of times a test has gone through a cycle or for setting step numbers.

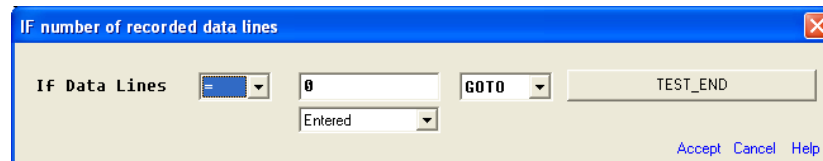
Syntax

IF Counter **<X>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

<x> specifies the system (0-9).

IF Data Lines

Have the test profile perform an action when a specified number of data lines is recorded (useful for long duration tests when the data buffers could fill up).



Syntax

IF Number of Data Lines, **<Condition>**, **<Value>**, **<Action>** **<Label>**

IF Memory

Have the test profile perform an action if the specified condition in the memory location is True. Generally, a memory value is set somewhere else in the test.

Syntax

IF Memory **<X>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

<x> specifies the memory location (0-99).

IF Soft Key

Have the test profile perform an action if the specific soft key is pressed when the IF command executes. Because the soft key must be pressed (held down) as the test profile executes the IF command, it could easily bypass the command without acting on it. A WHEN command is usually preferable.

Syntax

IF Soft Key **<X>** is pressed, **<Action>** **<Label>**

< x >: Specifies the console/handheld soft key (A-E)

IF Digital Input

The NGE sensor box provides six independent, user-configured inputs. A typical use for these inputs is connected to an external switch which is used to trigger an action in a test profile. This command causes the test profile to perform an action if the specified condition or state of the digital input is True (useful for an external device or switch to trigger an action).

Syntax

IF Digital Input **<X>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

< x > specifies the onboard digital input (1-8)

IF Relay Input

The SuperFlow SF-1843 relay enclosure provides 64 independent, user-configured digital inputs. A typical use for these inputs is connected to an external switch which is used to trigger an action in a test profile. This command causes the test profile to perform an action if the specified condition or state of an input on the external relay net is True (useful for having an external device or switch trigger an action).

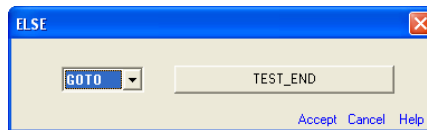
Syntax

IF Relay Input <X>, <Condition>, <Value>, <Action> <Label>

< x > specifies the relay-net relay input (1–64)

ELSE

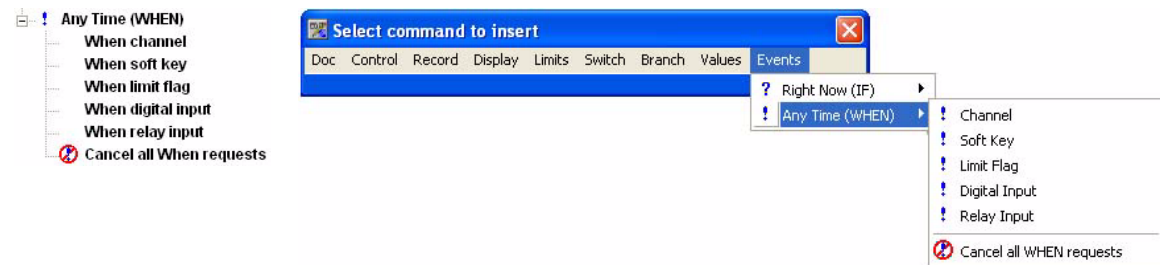
All ELSE commands *must* be immediately preceded in the test profile by an IF command (meaning, an ELSE command must always be paired with an IF command). ELSE commands the test profile to perform an action *only if the associated IF statement evaluates to false*.



Syntax

ELSE <Action> <Label>

13.7.9.2 Any Time (WHEN)

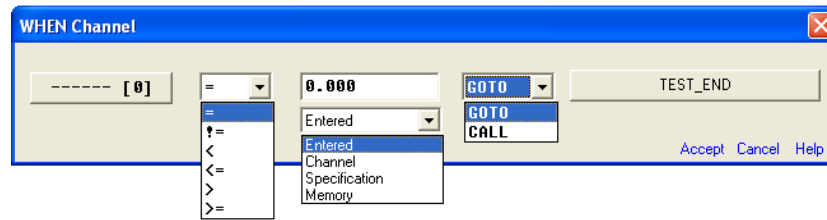


WHEN type commands make a request to the test system to monitor for a specified condition. Conditions always evaluate to either True or False. As soon as a WHEN request is made, the test system begins monitoring the specified condition to see if it is True. This monitoring takes place continuously, while the test profile proceeds to execute subsequent commands. As soon as the specified condition becomes true, the associated action specified in the WHEN command is then invoked.

Once a particular WHEN statement becomes true, and the associated action is executed, the WHEN request then returns to monitoring for the condition. The WHEN request must be explicitly canceled if you wish for the system to discontinue monitoring for the same condition.

Multiple WHEN requests can be active simultaneously. For all WHEN commands, the condition is monitored for True/False at all times during execution of the test profile.

All WHEN commands use the following basic syntax for conditions and values:



<Condition>:

- = equal to
- != not equal to
- < less than
- <= less than or equal
- > greater than
- >= greater than or equal

<Value>:

- **Entered:** Any valid numeric value
- **Channel:** Any currently defined data channel
- **Specification:** Any currently defined specification channel
- **Memory:** Any memory location within the system (0-99)

<Action>:

- **GOTO:** Causes the test to branch and continue executing from a specific test location
- **CALL:** Causes the test to execute a subroutine and then return to the line immediately following the IF statement when a RETURN command is executed

<Label>: Any valid label within the test profile

WHEN Channel

Have the test profile perform an action *any time* the specified condition is True (useful for having the test react when the value in a data channel reaches the specified value).

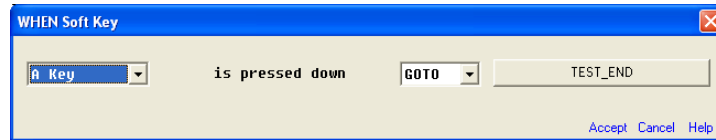
Syntax

When Data Channel **<Channel>**, **<Condition>**, **<Value>**, **<Action>** **<Label>**

< Channel> can be any valid channel defined in the current configuration.

WHEN Soft Key

Have the test profile perform an action *any time* the specified soft key is pressed (useful for having the operator select the path a test profile will take). Commonly followed by a **GOTO this step** command so the test will pause at that point and wait for the operator to press a button.



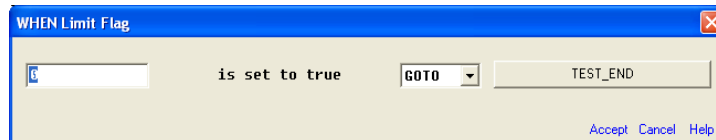
Syntax

When soft key **<X>** is pressed, **<Action> <Label>**

<X> specifies the console/handheld soft key (A – E)

WHEN Limit Flag

The WinDyn Safety Limits system can be configured to set limit flags based on channel limit conditions. Therefore, limit flags are a mechanism to allow the test profile to perform conditional actions based on what the Safety Limits system is doing. This command causes the test profile to perform an action *any time* the specified condition is True.



Syntax

When Limit Flag **<X>** is set, **<Action> <Label>**

<X> specifies the limit flag (1–8)

WHEN Digital Input

The NGE sensor box provides six independent, user-configured inputs. A typical use for these inputs is connected to an external switch which is used to trigger an action in a test profile. This command causes the test profile to perform an action *any time* the specified condition or state of the digital put is True (useful for having an external device or switch trigger an action).

Syntax

When Digital Input **<X>**, **<Condition>**, **<Value>**, **<Action> <Label>**

< X > specifies the onboard digital input (1–8)

WHEN Relay Input

The SuperFlow SF-1843 relay enclosure provides 64 independent, user-configured digital inputs. A typical use for these inputs is connected to an external switch which is used to trigger an action in a test profile. This command causes the test profile to perform an action *any time* the specified condition or state of relay input is True.

Syntax

WHEN Relay Input <X>, <Condition>, <Value>, <Action> <Label>

< X > specifies the relay net input (1-64)

Cancel All WHEN Requests

This command cancels all currently active WHEN commands. It is frequently used to prevent unanticipated branching when multiple menu levels of labeled soft keys (A-E) are used for operator interaction in an autotest or when conditional statements are no longer desired.

Example:

An operator is prompted to select one of the functions displayed at the A, C, and E keys. After one of those actions is performed, a new WHEN SOFT KEY command calls new subroutines that respond to the A, C, and E keys. A **Cancel WHEN Request** statement must be used prior to the second WHEN statement to prevent the test from inadvertently jumping to the wrong place.

The most common use is to cancel a WHEN Limit Flag function. In many cases, limit flags are set to perform functions such as recording data when the limit in question is triggered (flagged).

Since limits can be flagged only once, the WHEN statement that calls the limit flag action must be removed from the queue if the limit is to function again.



See section 13.7.9.2, "Any Time (WHEN)," on page 13-54.

If the Cancel WHEN command is not used, the WHEN Limit Flag function will not execute the next time the limit flag is set. In some cases this is not critical, but in cases where a limit flag function warns the operator with a display message that oil temperature is high or water pressure is low, failure to reset the WHEN queue and reactivate the limits function could result in an apparent failure of the limits system if it was not properly reset after triggering a limits flag.

This situation is usually not a concern in a limit action that shuts down a test and kills the engine because further execution of the test is halted at that time.

A Cancel WHEN Requests command might be run as part of a subroutine that is called if a WHEN Limit Flag function is executed. In this case, the limit trips and sets a flag, a WHEN limit flag statement calls a subroutine, an appropriate action is taken, and, after that action is completed (if it is not a system shutdown), in the next line, the Cancel WHEN Request command resets the limit in question.

This section shows a typical example of a test profile.

Actual test profiles shipped with the test system are regularly improved or expanded and may differ from the example shown.

Example Code

Test Name - IACCELUS.TPF CFA Name - USADWB1E.CFA Test Steps - 51

Test Profile: Accel902

Test Profile Steps:

- ```

1. ***
2. *** SF902 Accel test Version 1.02 ***
3. *** WinDyn 2.4 ***
4. *** ***
5. Erase ALL recorded data
6. Set Memory[9] = 0.000
7. *** Calculate set point overshoot limit ***
8. *** Use memory 21 ***
9. Set Memory[21] = Upper
10. Set Memory[21] = Memory[21] * 1.500
11. *** Calculate accel rate, for StepTm ***
12. Set Memory[19] = Upper
13. Set Memory[19] = Memory[19] - Lower
14. Set Memory[19] = Memory[19] ÷ StpSiz
15. Set StepTm = Memory[19]
16. *** Reciprocal calculation: ***
17. Set Recpcl = 1.000
18. Set Recpcl = Recpcl ÷ OvrRat
19. Set Recpcl = Recpcl * Pul/Rv
20. Cancel all WHEN requests
21. Erase Soft Key labels
22. Erase ALL console messages
23. REPEAT LOOP
24. Controller: EngSpd = Lower in 0.1 seconds!
25. Display1: [Increase to WOT.....] on console
26. Display2: [Stabilizing Speed at ^C95^ RPM.] on console
27. Display3: [Press Accel (D) key to begin test.] on console
28. Label Soft Keys (A-E): [Acceleration ready.... Accel Quit]
29. Turn ProFilter ON
30. Adjust Data Filter amount to - 6
31. When Soft Key "E" is pressed, then GOTO "QUIT TEST"
32. When Soft Key "D" is pressed, then GOTO "BEGIN RAMP PORTION"

```





## CHAPTER 14

# WINDYN SET FILE EDITOR

### IN THIS CHAPTER

- **Introduction**
- **Set Editor Main Window**
- **LCD Display Configuration**
  - Description Block
  - NGE Set Editor
  - Sending the Set File to the NGE System
- **Specification Files**
- **Test Profiles**
- **Limit Files**
- **Tables**
- **Reports**



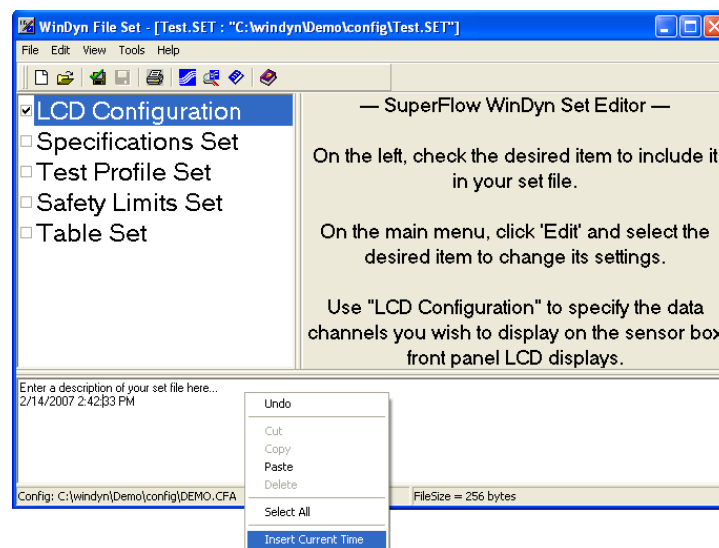


## 14.1 Introduction

The Set file is used to customize the data acquisition and control box for your specific application. The Set file is stored inside the dynamometer electronics, so a computer is not required to access the contents of the Set file after it is uploaded to the New Generation Electronics (NGE) system. With the Set file you can configure your dynamometer system to:

- Customize the Liquid Crystal Display (LCD) layout to display any system channel in any display position
- Collect a group of files to include in the Set file:
  - Test profiles
  - Specification files (constants)
  - Limit files
  - Table files

To open the Set File Editor, from the **WinDyn** main menu, select **Design>>Set of Files**. The **WinDyn File Set [Name/Path]** dialog box appears.



Five areas are editable:

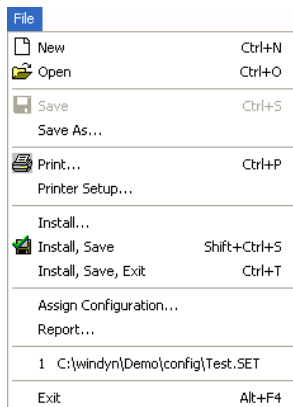
- **Description:** Edits the string of text that describes the Set file contents.
- **LCD Display Setup:** Map NGE system channels to the LCD displays
- **Specifications Set:** Collects a group of specification (.cst) files but does not edit the contents of individual specifications files.
- **Test Profile Set:** Collects a group of TPF files but does not edit the contents of individual TPF files.
- **Safety Limits Set:** Collects a group of safety limit files for the test system to use but does not edit the contents.
- **Table Set:** Collects a group of tables for the test profile system to use but does not edit the contents.

The Set Editor can generate a report listing its contents.

The main window is an overview of the Set file contents and an entry point to editing the various portions of the Set file. Double-click any item in the list in the left pane to edit that portion of the file.

## 14.1.1 Set File Menu Commands

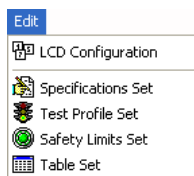
### File



Use the File menu to create new or open existing Set files; save, print, or install a Set file; assign a configuration to the file; and exit the Set File Editor.

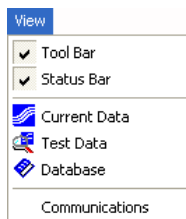
All WinDyn files must be associated with a configuration (CFA) in order for the files to work properly. In a Set file, the LCD configuration requires the association so it can display the appropriate channel.

### Edit



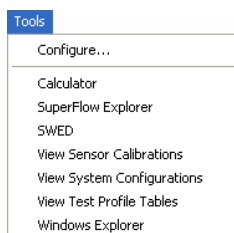
Use the Edit menu to open an LCD configuration or specifications, test profile, safety limits, or table set to modify.

### View



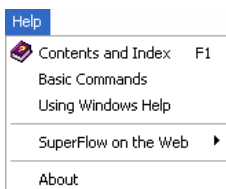
Use the View menu to select the toolbars and status bars to display in WinDyn, select the WinDyn current data, test data, or database, and configure WinDyn communications.

### Tools



The Tools menu provides quick access from WinDyn to other programs on the computer (see section 4.4, "Tools Editor," on page 4-7 for more information).

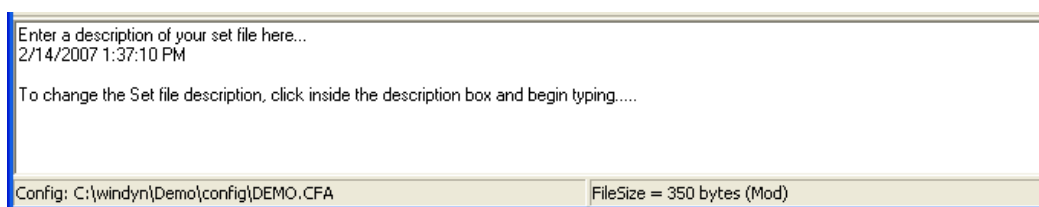
## Help



Use the online Help menu to answer questions and find more information on particular topics relating to WinDyn and the Set File Editor. Select the Help menu item, or press the **F1** key.

### 14.1.2 Description Block

The description block is a text description of the Set file contents. The description can be up to 8 lines by 40 characters. You may change the description at any time by editing the text in the text box in the bottom pane.



When you create a new file, the current date and time are automatically inserted into the description as plain text. You may or edit or delete the date and time like any other text and can also insert the current date and time by right-clicking the text box and using the pop-up menu.

To change the Set file description, click inside the description box and begin typing.

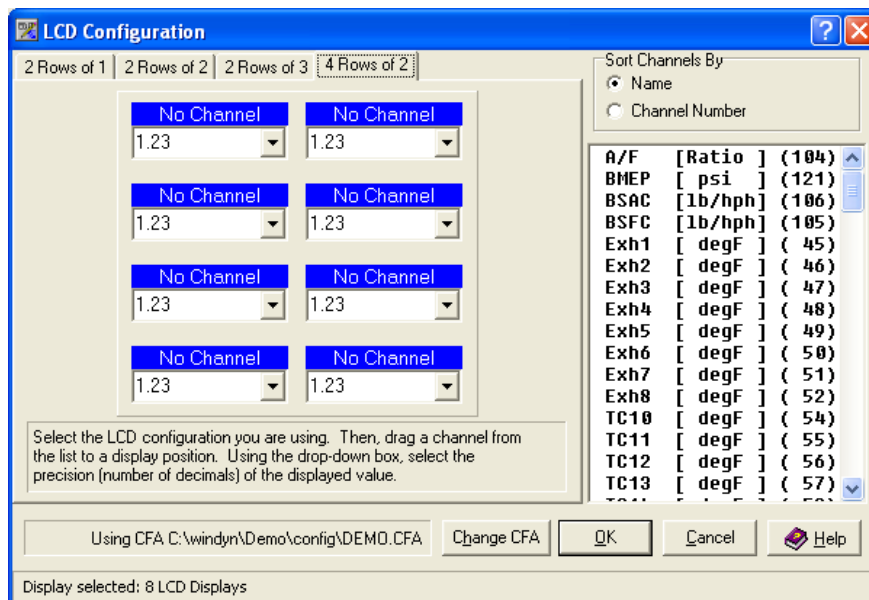
### 14.1.3 Sending the Set File to the NGE System

The Set file must be uploaded to the NGE system before it can be useful. From the **WinDyn** main menu, select **System>>Install>>Set of Files**.

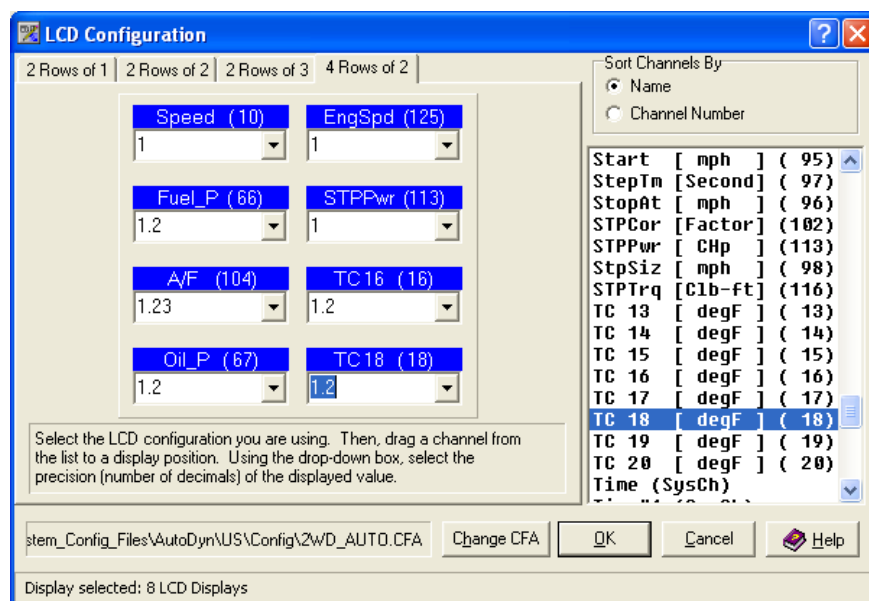


## 14.2 LCD Configuration

Use the LCD Configuration dialog box to map NGE system channels to the LCD displays.



Click the tab that contains the LCD configuration present on your equipment. Then select a channel and use the mouse to drag it from the list on the right to a display position. Using the drop-down boxes, select the precision of the displayed value (number of digits after the decimal point) for each channel.



The channels displayed in the list can be sorted by channel **Name** or **Channel Number**. Selecting the option displays the list with the proper sorting.

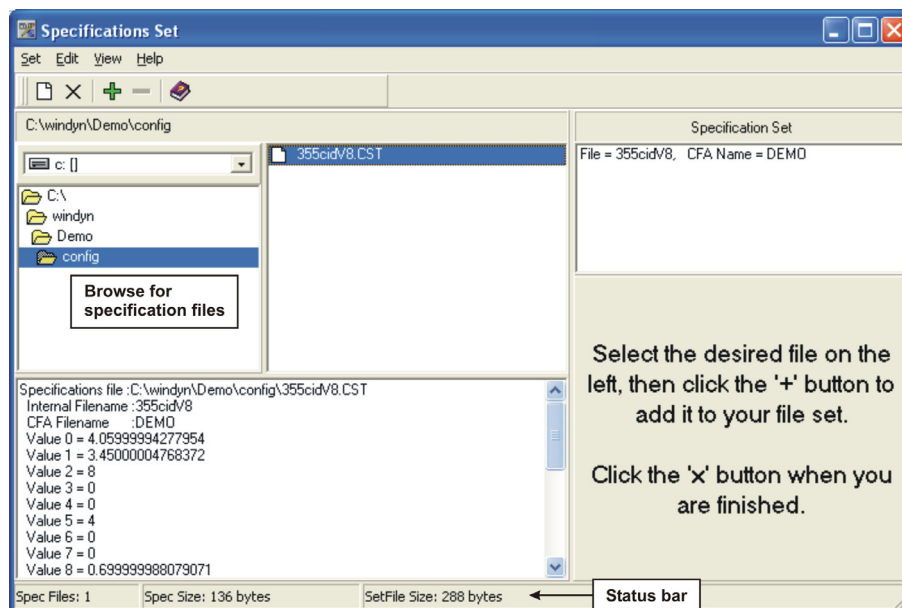
Note that the channel names are not contained in the Set file. These names are embedded in the CFA file. The CFA file must be specified before the channel names can display. If you have not specified a CFA file, a prompt appears when you try to access the LCD configuration screen.

You can change the current CFA file by clicking the **Change CFA** button at the bottom of the LCD configuration dialog box or by selecting **File>>Open** from the Set File menu. The CFA file name is stored in the set file, so you only need to specify a CFA once.

When you are finished configuring the LCDs, click the **OK** button.

## 14.3 Specification Files

The Specifications File Set Editor assembles a group of specifications (.cst) files for the NGE system to use.



In the left pane of the editor window, browse for specification files on the computer or network. The middle pane displays specification files that can be included in the set, and the right pane shows the contents of the specification set. The window under the file list displays the contents of the currently selected specification file.

Navigate to the location or folder that contains the specification files to include in the set. When you select a folder containing specification files, the files appear in the middle pane. To include a file in the set, do one of the following:

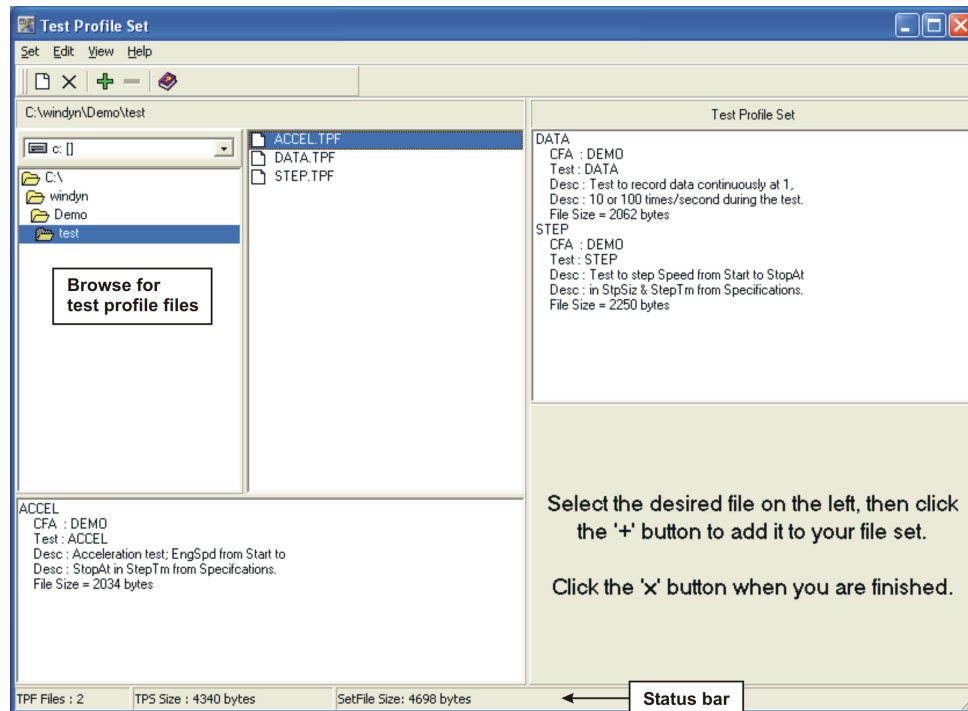
- Select file names from the middle pane and drag the files to the right pane, or click the **Add (+)** button on the toolbar.
- Double-click a file name in the center pane.
- Drag a specification (\*.cst) file from any Windows Explorer folder into the right pane.

To remove specification files from the set, select the files to remove and click the **Remove (-)** button on the toolbar, or right-click the file and select **Delete from set** in the pop-up menu.

The editor panes can be resized for better viewing. Use the mouse to drag the bar between the panes to resize.

## 14.4 Test Profiles

Use the Test Profile Set Editor to assemble a group of test profile (TPF) files for the NGE system to use.



In the left pane of the editor window, browse for TPF files on the computer or network. The middle pane displays TPF files that can be included in the set, and the right pane shows the contents of the TPF file contents. The window under the file list displays the contents of the currently selected TPF file.

Navigate to the folder that contains the TPF files to include in the set. When you select a folder containing TPF files, the files appear in the middle pane. To include a file in the set, do one of the following:

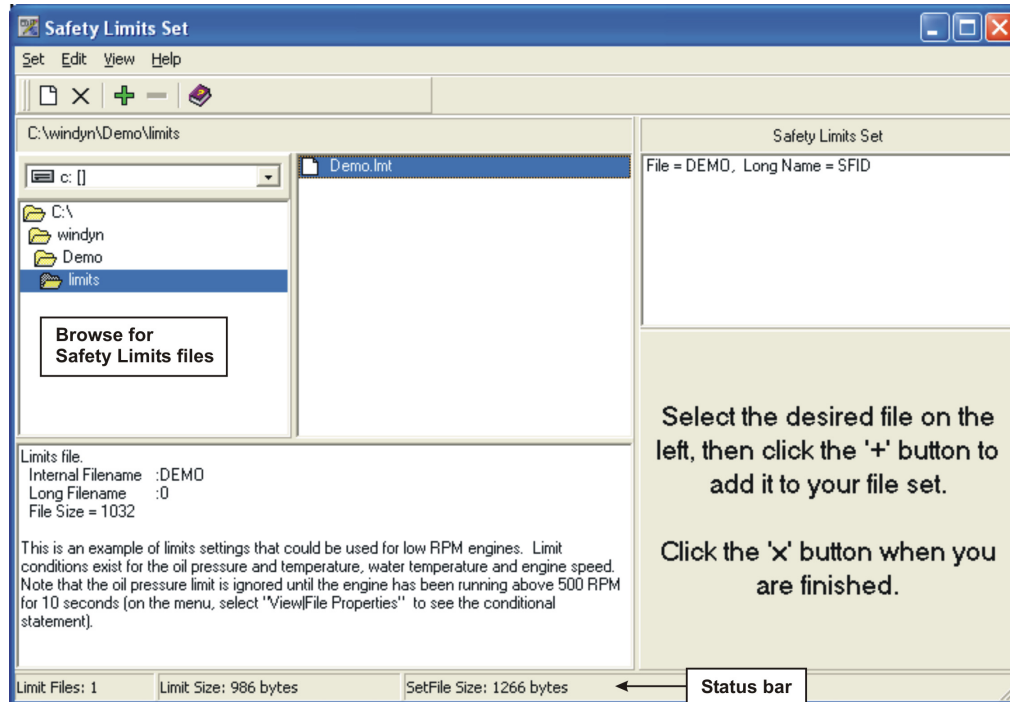
- Select file names from the middle pane and drag the files to the right pane, or click the **Add (+)** button on the toolbar.
- Double-click a file name in the center pane.
- Drag a TPF file from any Windows Explorer folder into the right pane.

To remove TPF files from the set, select the files to remove and click the **Remove (-)** button on the toolbar, or right-click the file and select **Delete from set** in the pop-up menu.

The editor panes can be resized for better viewing. Drag the bar between the panes to resize.

## 14.5 Limit Files

Use the Limits File Set Editor to assemble a group of Limits (LMT) files for the NGE system to use.



In the left pane of the editor window, browse for Limits files on the computer or network. The middle pane displays Limits files that can be included in the set, and the right pane shows the contents of the Limits file contents. The window under the file list displays the contents of the currently selected Limits file.

Navigate to the folder that contains the Limits files to include in the set. When you select a folder containing Limits files, the files appear in the middle pane. To include a file in the set, do one of the following:

- Select file names from the middle pane and drag the files to the right pane, or click the **Add (+)** button on the toolbar.
- Double-click a file name in the center pane.
- Drag a Limits file from any Windows Explorer folder into the right pane.

To remove Limits files from the set, select the files to remove and click the **Remove (-)** button on the toolbar, or right-click the file and select **Delete from set** in the pop-up menu.

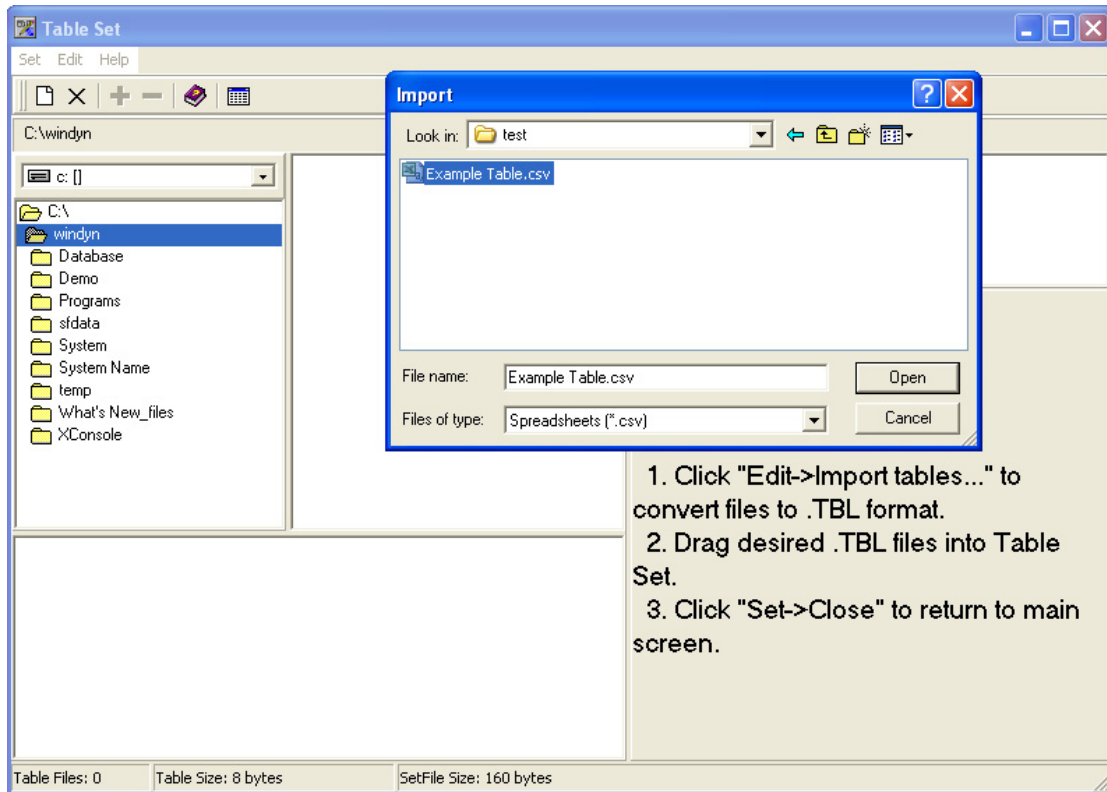
The editor panes can be resized for better viewing. Drag the bar between the panes to resize.

## 14.6 Tables

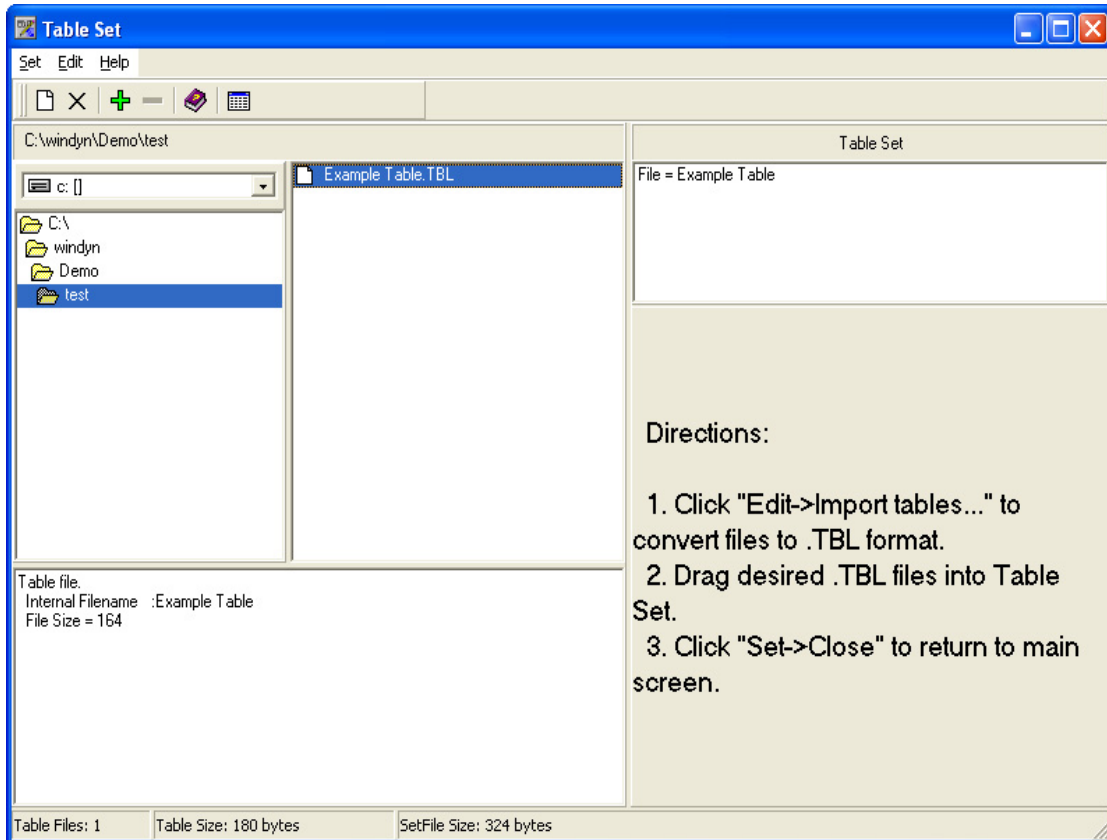
Use the Table Set Editor to assemble a group of table (TBL) files for the test profile system to use.

The Set editor works with table files. You can import spreadsheet (Commas-Separated Values – CSV) or text (TXT) files to create table (TBL) files.

From the **Set File Editor** main menu, select **Edit>>Table Set**. To import a table, in the **Table Set** dialog box select **Edit>>Import tables**.



Select the desired tables in the **Import** dialog box and click **Open**. The new table files display in the file list window.



Tables you import must be ASCII text files, saved as either .csv or .txt and should have five columns each separated by commas. The first column contains the time in seconds. The next four columns contain the controller set point values for the available controllers in the order that the controllers are defined in the configuration file. The following example shows the correct file format for a .csv or .txt table to import:

```
1.2,1000,250,0,0
2.3,2000,300,0,0
1.5,3000,350,0,0
```

Browse for table files in the left pane of the editor window. The middle pane shows table files that can be included in the set, and the right pane shows the table file contents. The window under the file list displays the contents of the currently selected table.

In the left pane, navigate to the folder that contains the table files to include in the set. When you are at a folder that contains TBL files, the files appear in the middle pane. To include a file in the set, do one of the following:

- Select file names from the middle pane and drag the files to the right pane, or click the **Add (+)** button on the toolbar.
- Double-click a file name in the center pane.
- Drag a table file from any Windows Explorer folder into the right pane.

To remove table files from the set, select the files to remove and click the **Remove (-)** button on the toolbar, or right-click the file and select **Delete from set** in the pop-up menu.

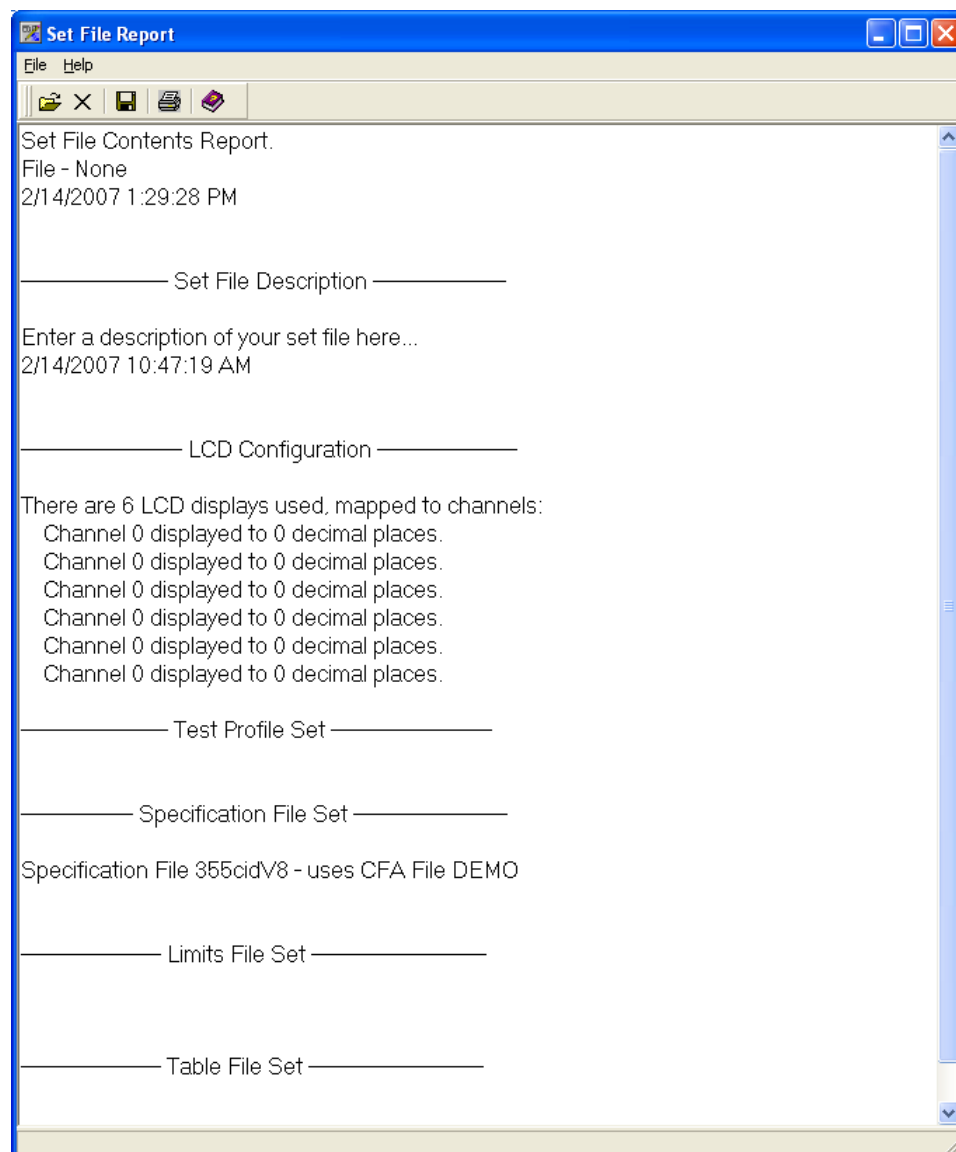
The editor panes can be resized for better viewing. Drag the bar between the panes to resize.

## 14.7 Reports

You can generate reports on the set file contents. These can be used for system documentation or help with setting up the system. Reports can be saved to disk or printed. Saved reports can be retrieved from disk for later viewing. They are in plain ASCII format, so they can be viewed as any text file using Notepad or a similar editor, or sent to someone else using e-mail.

### System Config Report

To generate a report listing the contents of a set file, From the **Set File Editor** main menu select **File>>Report**. This report contains a summary of the set file that can be saved as a text file or printed.



CHAPTER 15

# SWITCH FILE EDITOR

## IN THIS CHAPTER

- **Introduction**

- SWED Menu Command
- Switch Equation Syntax
- Creating Switch Files
- Switch Functions
- Editing Existing Switch Files
- Help Files







## 15.1 Introduction

The Switch Editor (SWED) program is a software utility run from the computer that configures the front panel switches for SuperFlow Data Acquisition systems.

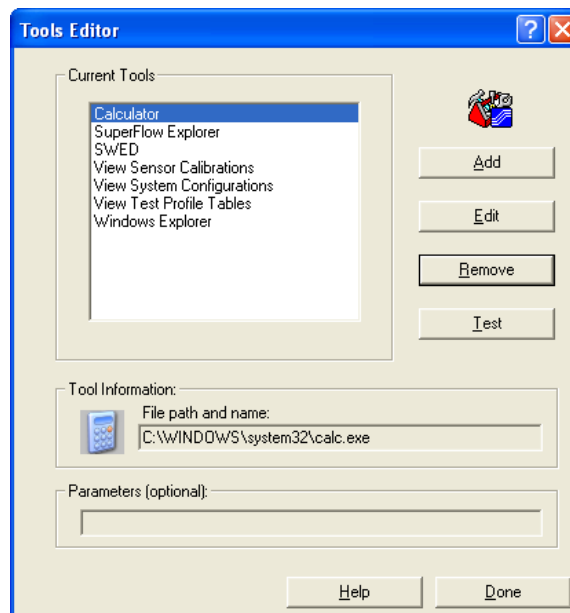
In most cases, it is unnecessary to use this utility because the keys are programmed at the factory to the user's specifications. The SWED program requires a knowledge of Boolean operators and is highly technical. This section covers:

- SWED commands grouped by menu
- Creating switch files
- Editing existing switch files



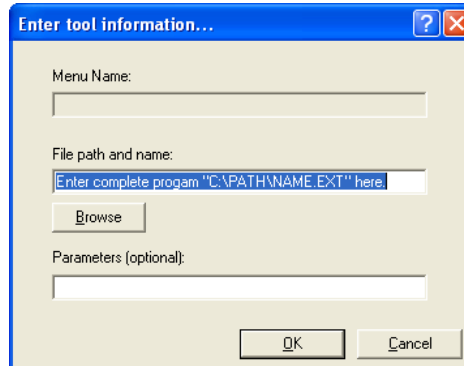
**WARNING: Only qualified persons should to modify the SWED file. If you do not thoroughly understand Boolean operators and the SWED software utility, do NOT attempt to perform the steps described in this section. Changing this information could make your system unstable, inoperable, or cycle into an unstoppable mode.**

1. To access the **Switch Configuration Editor**, from the **WinDyn** main menu, select **Tools>>Configure**. The **Tools Editor** dialog box appears.

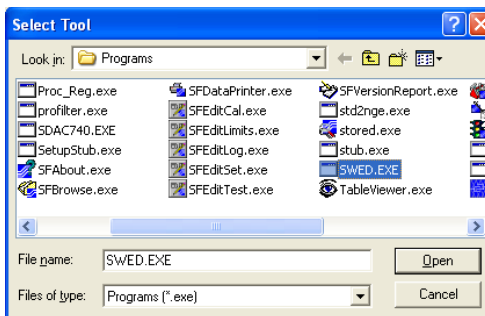


2. Click **Add**.

The **Enter tool information** dialog box appears.



3. Click the **Browse** button to find the program to add. The **Select tool** dialog box appears.



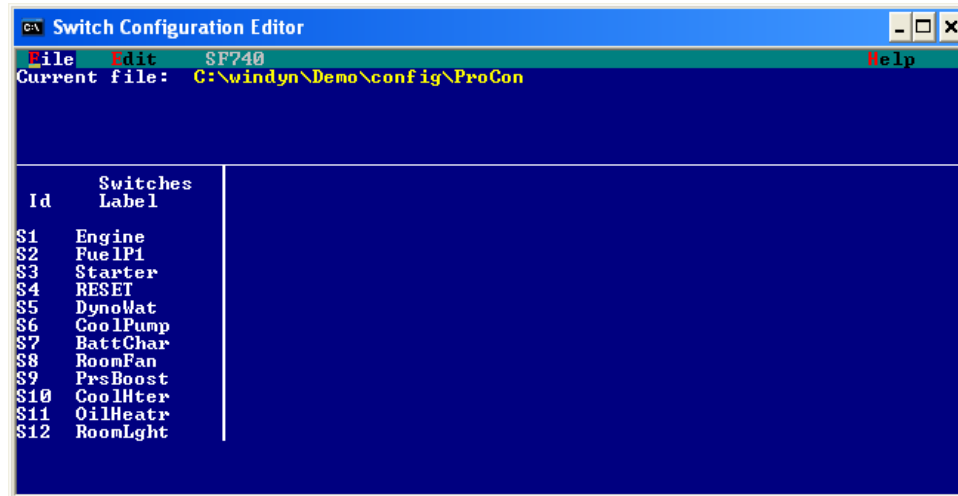
4. In the **Programs** directory, select **SWED.EXE** and click **Open**.
5. The tool and menu path appear in the **Enter tool information** dialog box. Click **OK**.
6. In the **Tools Editor** dialog box, note that **SWED** appears in the **Current Tools** list. Click **Done**.

## Opening SWED Files

1. To open the **Switch Configuration Editor**, from the **WinDyn** main menu, select **Tools>>SWED**.

**NOTE:** Do not use the mouse to operate the switch editor. Use the **UP/DOWN ARROWS** on the keyboard or press the shortcut keys highlighted in red on each menu. Then press **ENTER**.

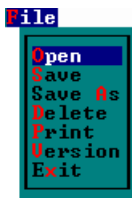
2. To open a Switch Editor file, select **File>>Open**.
3. Select the file in the list and press **ENTER**. The file appears in the Switch Configuration Editor.



4. To maximize the Switch Configuration Editor screen, press **ALT+ENTER**. To minimize the screen, press **ALT+ENTER** again.

## 15.1.1 SWED Menu Commands

### File Menu

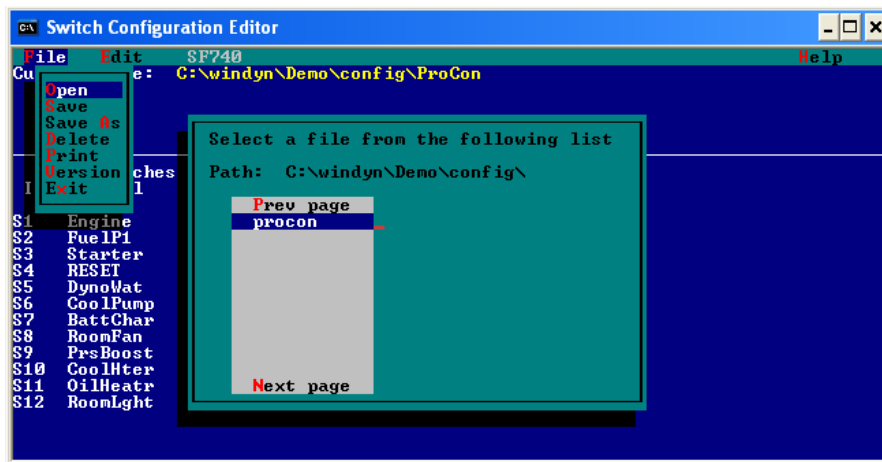


Use the File menu to perform basic file-management commands.

- **Open:** Select a switch file for editing. This file must exist in the current path (the path defined by the System File Paths configuration in WinDyn).

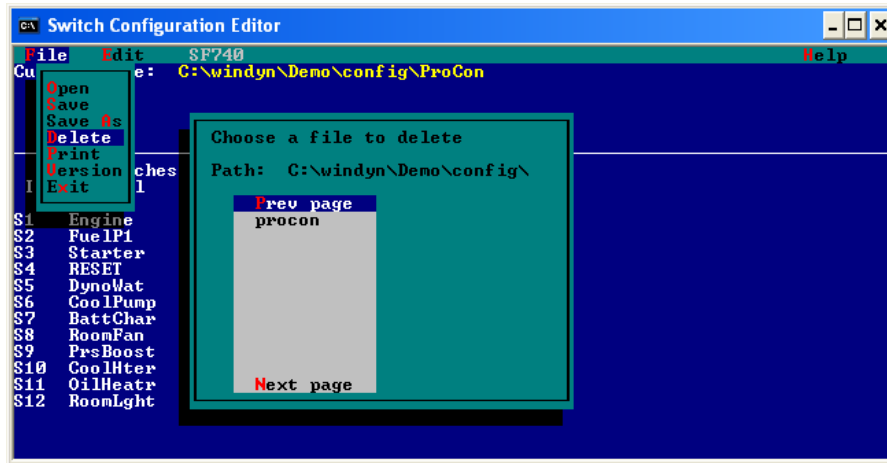


For more information on specifying system file paths, see Figure 2.4.6, “System File Paths,” on page 2-19.

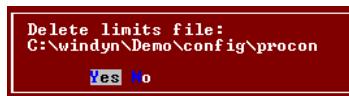


- **Save:** Saves the current switch file.
- **Save As:** Saves the current switch file under a new, user-specified name. The file is stored in the current path.

- **Delete:** Selecting this command opens a window that displays all of the switch files in the current subdirectory. Select a file or group of files and press **ENTER**.



A **Delete [file name] file** confirmation window appears. Select **Yes** or **No** and press **ENTER**.



- **Print:** Selecting this command sends the current switch file to be sent to the printer connected to LPT1.
- **Version:** Select to view version information about the current file loaded.
- **Exit:** Exits the SWED program.

## SF740 Menu

This menu does not apply to the current WinDyn system.

## Edit Menu



Use the Edit menu to make changes to the current file loaded.

- **Switches:** Edit the switch definitions
- **System Functions:** Edit up to 10 lines of system function equations.
- **Emergency stop:** Edit up to 10 lines of equations to be implemented when **emergency stop** is asserted.
- **Shutdown One:** Edit up to 10 lines of equations to be implemented when **shutdown 1** is asserted.
- **Shutdown Two:** Edit up to 10 lines of equations to be implemented when **shutdown 2** is asserted.
- **Shutdown Three:** Edit up to 10 lines of equations to be implemented when **shutdown 3** is asserted.
- **Shutdown Four:** Edit up to 10 lines of equations to be implemented when **shutdown 4** is asserted.
- **Reset:** Edit up to 10 lines of equations to be implemented when a **reset** is asserted
- **Messages 1-12 and 13-24:** The operator can define 24 different messages that can be called in switch equations, system functions, emergency stop equations and shutdown equations.

## 15.1.2 Switch Equation Syntax

The switches are configured by Boolean equations that assign the switch parameters and define the hardware relays that the switch performs its function through as well as associated display and system functions. The equations must be valid Boolean expressions. Ten equation lines are provided for each switch function. Refer to Tables 15-1 and 15-2 for the operators and operands used in the Switch Editor equations.

When writing Boolean equations for the SWED program, you must follow five rules of syntax:

1. All logical functions must be complete equations. Writing **RI** will not make relay one *true*. RI must be set equal to the Boolean true function as defined in the operator table:

**RI (relay one)=IM1(immediate number lor the true on condition)**

2. Each equation must end with a semicolon.
3. When multiple items are triggered by the same Boolean conditions, they must be delimited by the comma character ( , ).
4. The last line of every equation must be **end**;
5. True (on) or False (off) designations for operands are made by adding the single quote (') following the operand in the equation. When present, the quote designates the operand to be false or equal to zero.

A discussion of the fine points of Boolean logic is beyond the scope of this manual. SuperFlow highly recommends a thorough review of the operator and operand tables and examples.

**Table 15-1. Valid Operators**

| Operator | Function               |
|----------|------------------------|
| +        | or n                   |
| *        | and n                  |
| ! or '   | not n                  |
| ()       | left/right separator n |
| =        | left item delimiter    |
| ,        | left item delimiter    |
| ;        | equation terminator    |
| ' '      | spaces ignored         |

Each equation must be terminated by a semicolon. The last entry in an equation list must be **end**; as shown in the examples below.

---

### Examples:

r1, s1=s1!; end;

l1=(s1\*s2)+(s1\*s3!); end;

---



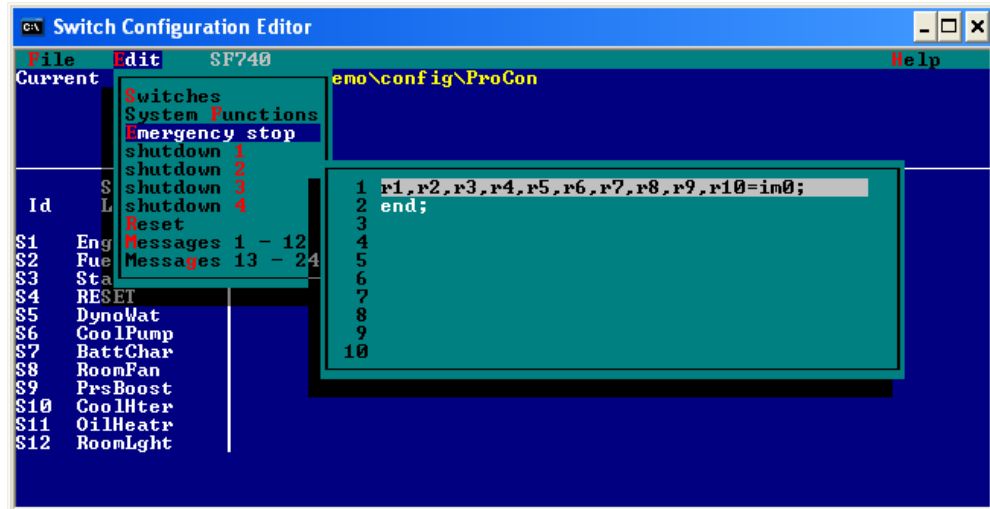
### Table 15-2. Operand Descriptions

| <b>Operand</b> | <b>Description</b>                                                                                                                                                                                            |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>rn</b>      | relay n    n = 1 – 32                                                                                                                                                                                         |
| <b>ln</b>      | led    n    n = 1 – 12 (n corresponds to switch number n)                                                                                                                                                     |
| <b>sn</b>      | state n    n = 1 – 32                                                                                                                                                                                         |
| <b>in</b>      | input n    n = 1 – 64                                                                                                                                                                                         |
| <b>en</b>      | engine control n<br>n = 1 ignition                                 n = 2 fuel system #1<br>n = 3 fuel system #2                      n = 4 starter<br>n = 5 2 pump (fuel system)              n = 6 glow plug |
| <b>imn</b>     | Immediate number n = 0 or n = 1 (can also use #n)                                                                                                                                                             |
| <b>reset</b>   | request system reset (same as F0)                                                                                                                                                                             |
| <b>sd1</b>     | request system shutdown (same as F1)                                                                                                                                                                          |
| <b>sd2</b>     | request system shutdown (same as F2)                                                                                                                                                                          |
| <b>sd3</b>     | request system shutdown (same as F3)                                                                                                                                                                          |
| <b>sd4</b>     | request system shutdown (same as F4)                                                                                                                                                                          |
| <b>escmd</b>   | request emergency stop command (same as F5)                                                                                                                                                                   |
| <b>esflag</b>  | emergency stop flag                                                                                                                                                                                           |
| <b>fn</b>      | system function n (n = 1 – 80)                                                                                                                                                                                |
| <b>blink</b>   | blink flag; when “anded” with an led, causes led to flash                                                                                                                                                     |
| <b>dmm</b>     | display message n on front panel                                                                                                                                                                              |
| <b>pmm</b>     | print message n                                                                                                                                                                                               |
| <b>amn</b>     | display message n on annunciator                                                                                                                                                                              |
| <b>end</b>     | marks end of equation list                                                                                                                                                                                    |

True (on) or False (off) designations for operands are made by the addition of the single quote ( ' ) following the operand in the equation. When present, the quote designates the operand to be false or equal to zero.

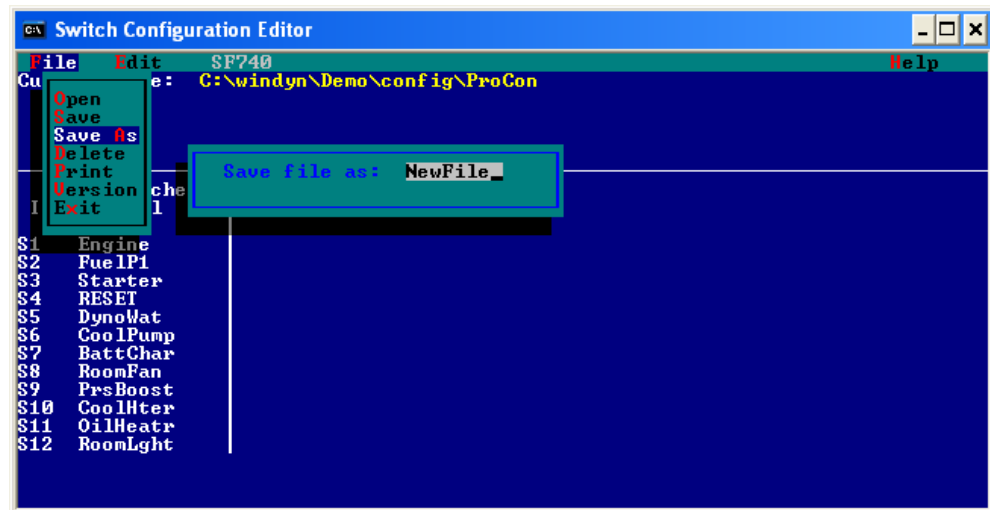
### 15.1.3 Creating Switch Files

To create a new switch file, from the **Switch Configuration Editor**, select **File>>Open** and select a file to edit.



Then select **Edit** and begin editing the switch configurations.

After editing all configurations, select **File>>Save As** and enter a new file name.



## 15.1.4 Switch Functions

The three most common switch functions are toggle or on/off switches, momentary switches, and toggle switches with timers.

### 15.1.4.1 Toggle Switches

Toggle switches perform a function each time the key is pressed. The function can be the same every time, or it can change with successive presses of the switch.

The simplest toggle switches perform on/off functions and are the most common type of switch used in SF-742 applications. Each time the switch is pressed it performs a function and reconfigures itself to perform the opposite function on the next key press, for example, ignition power on/off switches, fan on/off, Water supply on/off, etc.

The SWED file programmer must be aware that the switch must not only perform a function (such as switch the fan on), but immediately afterward redefine its Boolean operator to perform the opposite function when the switch is closed again (such as switch the fan off).

### 15.1.4.2 Toggle Switches with Timers

Toggle switches with timers are identical to regular toggle switches with the addition of delay timers for the Boolean functions. The switch is configured to execute a function a specified number of seconds after it is pressed (close) or released (open), or both. Toggle switches with timers usually perform two-part functions where a first function is established when the switch is pressed (close) and a second function follows X number of seconds afterward.

Toggle and timer functions can also be assigned to the switch release (open) action of the switch. The SuperFlow series 10 fuel systems use timer functions to bypass fuel turbines at a fuel supply on command. This action keeps air bubbles out of the flow turbines at startup. Once the fuel flows for about 5 seconds, the timer delayed function (solenoid valve) directs the flow through the flow turbine.

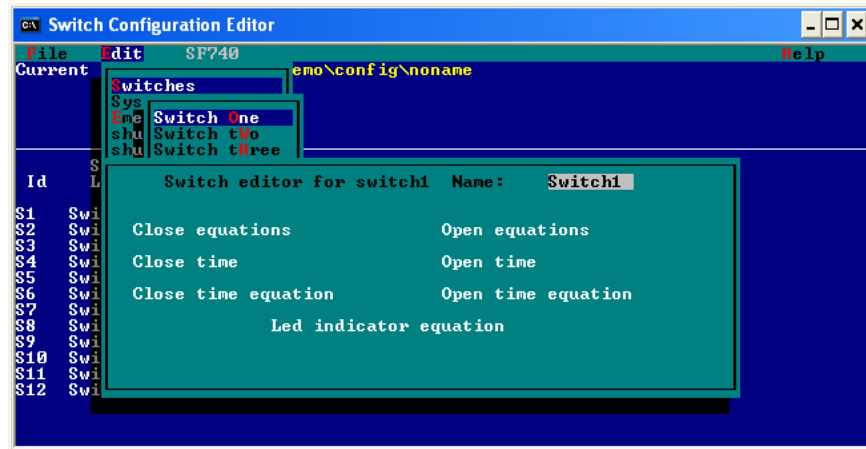
### LEDs and Display Messages

An Light-Emitting Diode (LED) on/off and display message function can be associated with each switch close or open function. LED functions turn on/off the LED above a given switch and in some cases can flash the LED. Message functions post messages on the third line of the SF-742 display.

Message and LED operations are generally conditional upon a key press (close) or a key release (open). For example, a message of **...ignition ON...** and an LED on function would be associated with the ignition switch close function. It is important to remember that the ignition switch must be configured to change its function to the opposite function on every key press. Thus, you would need to configure the message and LED functions to change as the key function reverses.

1. To create a toggle switch or a toggle switch with a timer, open the **Switch Configuration Editor**.
2. Select **Edit>>Switches**.
3. Select the desired switch. The 12 configurable switches on the SF-742 front panel are numbered left to right, top to bottom, by row. The upper left switch is #1, the middle row right is #8, and the lower right is #12. When a switch is selected, the configuration screen displays. The first field highlighted is **Switch Name**.

4. Type a switch name and press **ENTER**.



5. **Close Equation** highlights. The close equation entry screen displays. 10 equation lines are available. The close equation line defines the function of the switch when it is depressed (closed).
6. Enter a valid Boolean equation for the close function. Tables 15-1 on page 15-9 and 15-2 on page 15-10 show the operators and the operands used in the Switch Editor equations. Examples of an on/off toggle close function are shown below (assume sw1 was selected as the switch and relay one is water on/off).

---



---

**Example:**

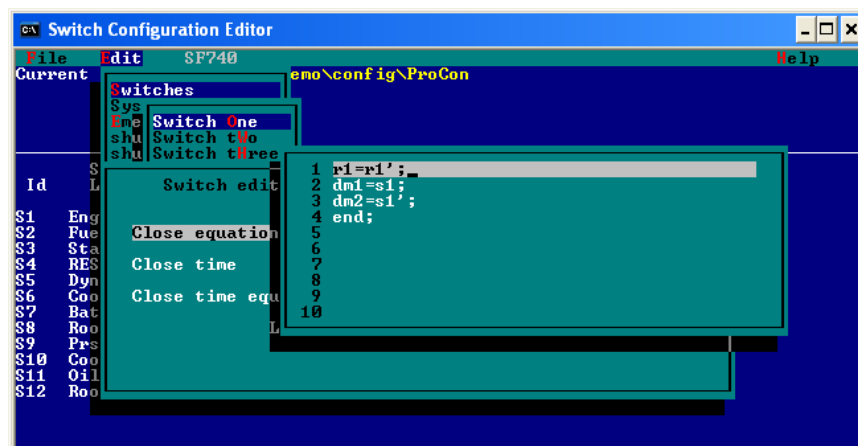
Close equation syntax for sw#1:

```
r1=r1';
dm1=r1;
dm2=r1';
end;
```

---



---



- Line 1 commands the switch to implement the opposite of the current state of relay 1. If relay one is on, turn it off, if it is off, turn it on.

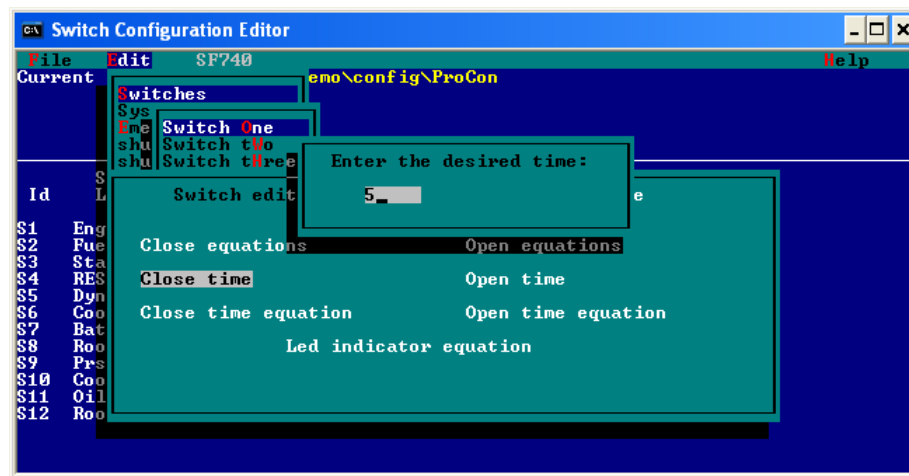
- Line 2 tells the switch to display message 1 when r1 is on and line 3 tells the switch to display message 2 when r1 is off. Messages are defined under the Messages 1–12 and Messages 12–24 options under the edit menu of the SWED editor.

---

**NOTE:** LED commands (In) work in the same manner.

---

- Line 4 is a required end statement and a semicolon. Every equation list must terminate with an **end;** statement.
- When the equation is completed, press **ENTER**.
  - Open equation** highlights. Use the keyboard **ARROWS** to select **Close time**.
  - Press **ENTER** and the close time entry field appears. The close time is used in conjunction with the close time equation field to perform a function X number of seconds after the user presses the switch. This function is used to control bypass valves in fuel systems which require a few moments of air purging before running fuel through flow turbines.
  - If using the **Close time** function, type the close time in seconds.



- Press **ENTER**. The **Open time** function highlights. The open timer function is similar to the close time function, except it performs a function X number of seconds after the switch closes. The open time function usually has no use in toggle switches.
- Use the keyboard arrows to select the **Close time equation**. This function is identical in application to the close function, except the actions defined take place after the switch is closed after a delay defined in the close time field. Enter the equations to be implemented after the switch close. Press **ENTER**.

---

**NOTE:** The two switch message fields—open message and close message—should not be used. Messages are called by number in switch equations using the DMn operand.

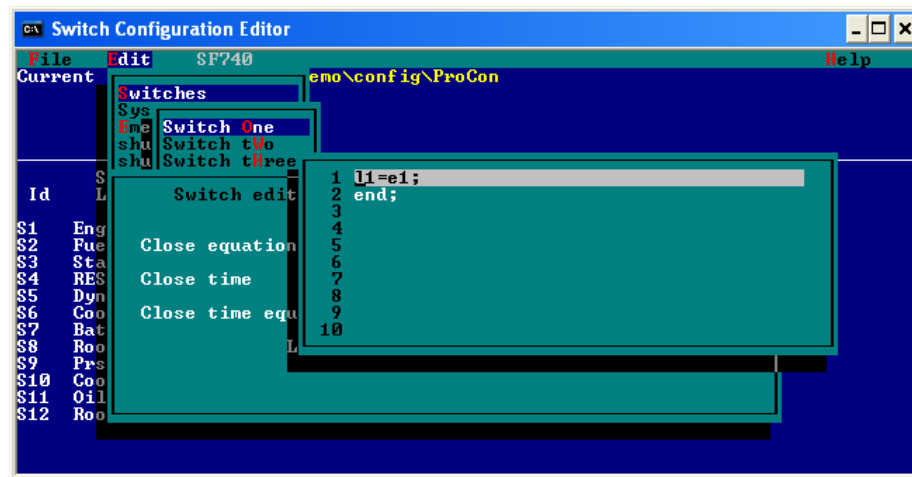
---



See Tables 15-1 on page 15-9 and 15-2 on page 15-10 for syntax information on the DMn message call operand. The messages should be defined in the Message 1–12 and Message 12–24 menu item under the SWED Edit menu.

---

13. Use the arrows to select **LED indicator equation**. Press **ENTER** to open the LED indicator equation entry screen.



The LED equations follow the same conventions as the open/close switch function equations, except only LED relevant functions can be called. In essence, all LED equations are conditional Boolean operations. An LED turns on or off in response to certain input (in) or relay status conditions (Rn ' or Rn). Recalling the earlier example of switch #1, the close equation of the sw#1 on/off toggle is:

```
rl=rl';
dml=rl; 3. dm2=rl'; 4. end;
```

A suitable LED equation would turn led! (above sw#1) on when R! is closed (on), and turn the LED off when Rl is off (open):

```
l1=r1; 2.l1'=r1'; 3. End;
```

14. After entering the equation, press **ENTER**.
15. The switch is now defined. Repeat the process for every on/off toggle switch.
16. At this point, edit another switch, or save the file. If necessary, back out of each menu level by pressing the **ESC** key. Select **File>>Save As** to save the file.



**IMPORTANT:** A SWED file must be loaded from the SF-740 menu of the SWED editor before it is active.

### 15.1.4.3 Momentary Switches

Momentary switches perform functions only as long as they are held closed. When the switch is released (open), the function is canceled. The only procedural difference between momentary and on/off switches is that momentary switches use the **close** (key press) function to initiate an action and the **open** (key release) function to cancel the action.

The best and most common momentary switch example is a starter function. The starter should halt when the starter key is released. Thus, the switch close function would call the starter action, and the switch open function would cancel the action.

An example for switch#2 using the engine control function operand E4 (starter) is shown below. It is assumed that the editor is open and switch two is selected for editing.



See Tables 15-1 on page 15-9 and 15-2 on page 15-10 for operator and operand functions.

---

---

**Example:****Close Equations**

```
E4=ImI;
Dm3=ImI
end;
```

---

---

Line 1 sets the value of the E4 operand function (starter) to the boolean value (immediate number) 1, which is the logical value for true or **on**. Line two performs the same function on the display message (Dm3), setting it to **on**.

---

---

**Example:****Open Equations**

```
E4=ImO;
Dm3=ImO
end;
```

---

---

The open equations, which trigger when the switch is released, perform the opposite functions of the close equations. Line 1 sets the value of the E4 operand function (starter) to the Boolean value (immediate number) 0 which is the logical value for false or **off**. Line two performs the same function on the display message (Dm3), setting it to **off**.

LED functions could be incorporated easily into this scheme.

---

---

**Example:****LED Equations**

```
L2=E4;
L2'=E4';
end;
```

---

---

In this case, LED2 illuminates (L2) when E4 (the starter function) is true or **on**. LED2 turns off (L2') when E4 is false or **off** (E4'). Note the use of the single quote character ( , ) for the Boolean false/not operator.

### LEDs and Display Messages

An LED on/off and display message function can be associated with each switch close or open function. LED functions turn the LED above a given switch on or off and in some cases can flash the LED. Message functions post messages on the third line of the SF-742 display. Message and LED operations are generally conditional upon a key press (close) or a key release (open), for example, a message of **...Ignition On...** and an **LED on** function would be associated with the ignition switch close function.

Messages are commanded in the switch equation lists, and LED equations are commanded in the LED equation entry field in the Switch Edit screen that appears after selecting a switch to edit in the SWED program.

## Input Function Triggers

In some cases relay actions, messages, and LED functions can be triggered by true/false inputs from the SF-1843 relay network. The in function listed in Table 15-2 on page 15-10 is used for this purpose. These functions are usable only in the system function equations under the Edit menu of the Switch Editor. Do not attempt to use the in functions in the LED, Message or Switch close/open equations. Input functions are constantly monitored and are not a function of a switch press.

Common applications of input function triggers include controlling fuel supply solenoids to test cells or calling an emergency stop if a fire extinguishing system activates.

In the following example, assume a SF-742 system is installed with an SF-1843 relay system. Input line 1 is configured to be high or true if the system water supply differential pressure switch trips at a low pressure. Input 2 is configured to read high if a pump breaker trips and the pump stops. Display message #5 is defined as ...**Low Sys Water Pres...**

---

### Example:

#### System Function equations

```
ems=I1+I2;
```

```
Dm5=I1+I2;
```

```
end;
```

---

Line one calls an emergency stop (ems) when the I1 or I2 line reads high; in either case, the pump pressure was low or the pump stopped and the ems will trigger. Line two calls the low water pressure message to indicate the fault.

To use an existing switch file as a template for similar files, open the file, make changes, and save the file using a different name (the original file is left unchanged) by selecting **File>>Save As**.

## 15.1.5 Editing Existing Switch Files

To edit an existing file, select **File>>Open** and then select the name of the file to edit.



For more information, see "Opening SWED Files" on page 15-5.

---

Edit the switch entries as described above, and save the file saved to disk by selecting **File>>Save**.

---

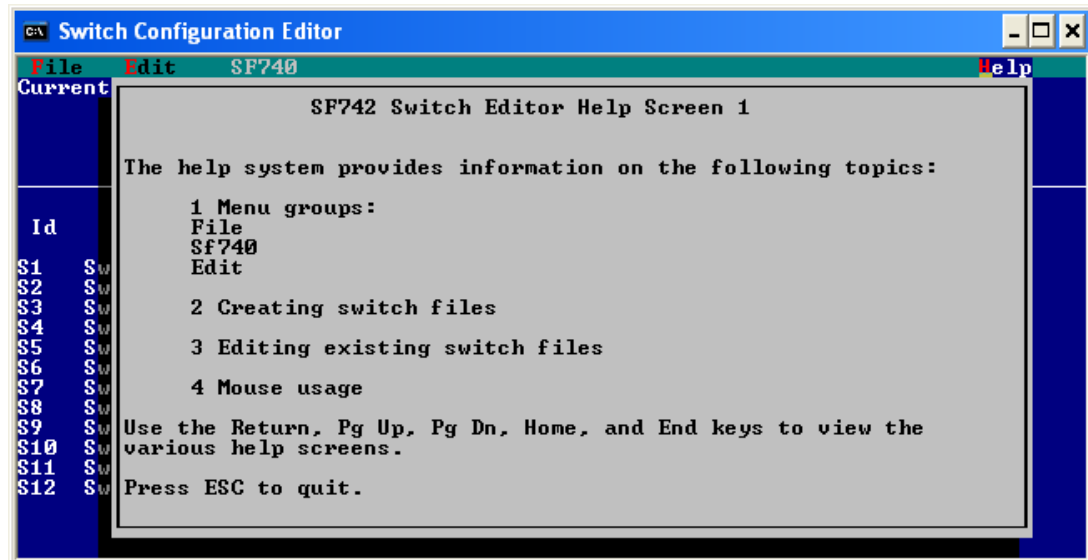
**NOTE:** An existing switch file can be used as a template for similar files. Open the file, make changes, and save the file using a different name (the original file is left unchanged) by selecting **File>>Save As**.

---



## 15.1.6 Help Files

To access the Switch Editor online Help, use the **ARROW** keys to select the **Help** menu and press **ENTER**. The **SF742 Switch Editor Help Screen 1** appears.



Use the keyboard pagination keys to browse the online Help screens.



All of the information contained in the online Help screens can be found section 15.1, “Introduction” in this chapter. The online Help feature makes it easy to access the information while working on the computer.

**NOTE:** Do not use the **SF740** online Help information under *Menu groups* or the **Mouse usage** information. It is not applicable.

APPENDIX A

# WINDYN CALIBRATION FILES

IN THIS APPENDIX

- **Calibration (.cal) Files**
  - Creating the Calibration File
  - Using the Calibration File
  - Corrupt Calibration Files
- **Changing Calibration Coefficients**
- **Calibration Viewer**





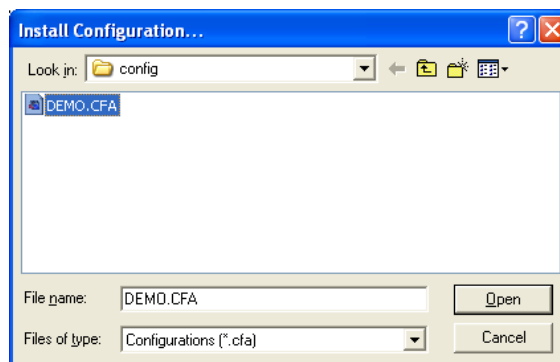
## A.1 Calibration (.cal) Files

The SuperFlow WinDyn dynamometer software system uses a variety of files for daily operation. One of the file types that requires complete understanding is the calibration file. This file has a three-letter extension of .cal and normally resides in the **C:\WinDyn\DynoType\Config** folder on your hard drive. The dyno type may be CycleDyn, AutoDyn, XConsole, SF-902, etc.

This file may be included in your test groups as part of the file list to load into the sensor system during WinDyn startup. It is a good idea to include the calibration file, since its purpose is to calibrate and zero your measurement sensors on the dyno system by sending the proper coefficient and offset to the sensor system for each measured channel (such as torque or barometric pressure).

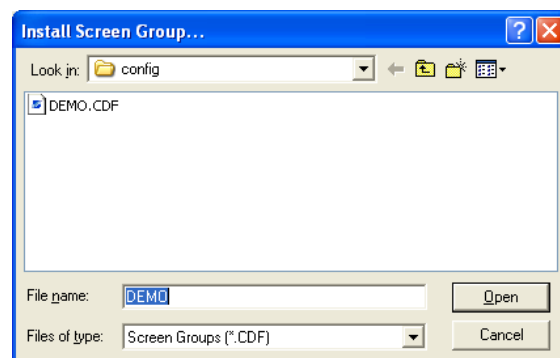
### A.1.1 Creating the Calibration File

To create a calibration file, first load the desired configuration file (.cfa) into the sensor system by selecting **System>>Install>>System Configuration** on the WinDyn menu. The **Install Configuration** dialog box appears.



Select a configuration file in the list and click **Open**.

It is best to view a screen image, so install a screen group by selecting **System>>Install>>Screen Group**. The **Install Screen Group** dialog box appears. Select a file to install and click **Open**.

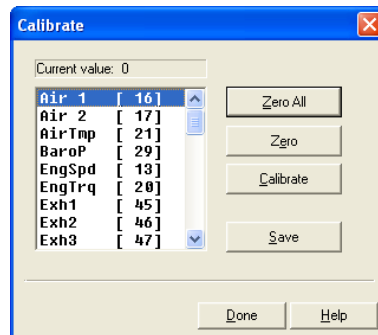


Installing the configuration file sends sensor system default coefficients and offsets for each measured channel. For instance, the barometric pressure channel (channel 76, BaroP) typically has

a coefficient of 8.2288 inHg per volt and an offset of zero; therefore, if you view the BaroP channel, a value of 30.03 inHg may display. This indicates the sensor is sending an output of 3.64937 VDC. WinDyn then takes that voltage and multiplies it by the coefficient value, adds any offset, then displays the desired value on the screen.

If the value displayed is inaccurate, calibration is required. This can be done in many ways on any measured channel, but this section focuses on the method using the WinDyn software.

To access the calibration menu, press the **C** key on the keyboard or select **System>>Calibrate** from the menu. The **Calibrate** dialog box appears.

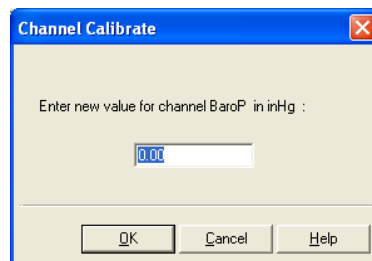


Select the channel to calibrate.

### Example:

Using the BaroP channel, suppose the actual barometric pressure is 29.94 instead of the 30.03 displayed on the screen using the coefficient from the configuration (.cfa) file.

1. To change the displayed value, select the **BaroP** channel in the list and click the **Calibrate** button. The **Channel Calibrate** dialog box appears.



2. Type the correct value in the text box and click **OK**.
3. At this point, the system will calculate a new coefficient for the channel. Although the transducer voltage remained the same (3.64937 VDC), the system will calculate a new coefficient of 8.2041 inHg per volt which will produce the desired resultant display of 29.94 inHg.

You can continue to calibrate all sensor channels using the same method described above. For each channel calibrated, a new coefficient is produced and stored in memory in the sensor box.

Offsets are generated for any channel that requires zeroing. Such channels are typically pressure channels or the strain gauge (torque) channel on the sensor system. Other channels may use offsets as well. Offsets are created when a channel is zeroed. For instance, if the TRQ1 channel is

reading a value other than zero after installation of the configuration (.cfa) file, that channel would require zeroing before your torque measurement system would produce an accurate result.

You can zero channels using the dialog box for calibrating a channel.

---

---

**Example:**

Using **TRQ1** as an example, suppose it displays a value of 20 lbs-ft in its quiescent state (no load applied).

To set that value to zero, use the **Calibrate** dialog box to select the TRQ1 channel, then click the **Zero** button.

---

---

After calibrating your sensors and zeroing any necessary channels, save the calibration file by clicking the **Save** button in the **Calibration** dialog box.

A calibration (.cal) file is saved using the configuration file name. For instance, if the configuration (.cfa) file name is SF902.cfa, a corresponding calibration (.cal) file named SF902.cal is saved. If one already exists, a dialog box appears with a message asking to overwrite the existing file with the new one. The new file will contain new coefficients for any channels you calibrated along with any new zero offsets.

## A.1.2 Using the Calibration File

Since the calibration file contains correct coefficients and offsets for your sensors, it is commonly used to calibrate your sensor system automatically.

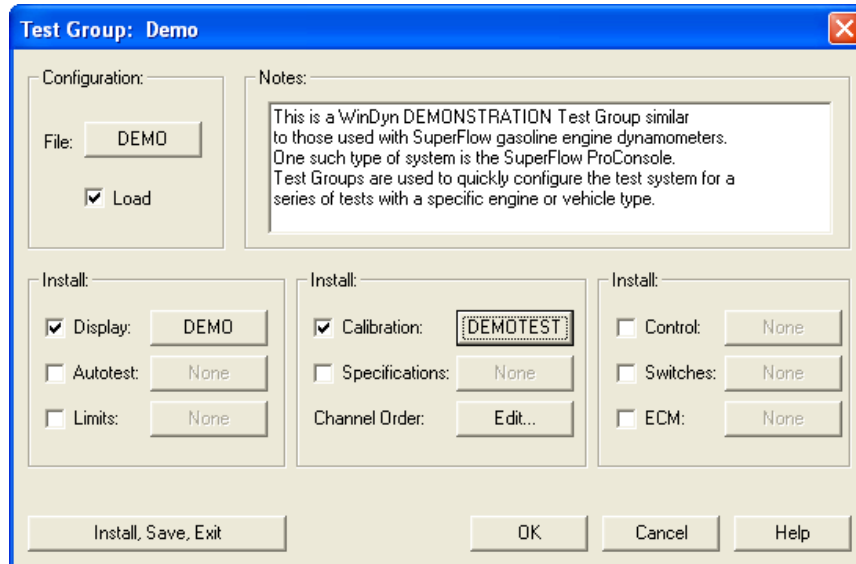


**IMPORTANT:** If the calibration file becomes corrupted or if you have multiple configuration files and calibration files on your computer system, problems can arise. It is imperative that you keep an accurate log of which calibration file is correct for your system.

---

After loading your configuration (.cfa) file using the **System>>Install>>System Configuration** menu, load your calibration (.cal) file using the **System>>Install>>System Calibration** menu. Be sure to select the proper calibration (.cal) file to go with your configuration (.cfa) file.

Another method is to include the calibration (.cal) file in your test groups. Add the file to any test group using the **Design>>Test Group>>Open** dialog box. To do this, open any test group and place a check mark in the **Calibration** dialog box. Then select the calibration (.cal) file by selecting the check box next to each option and then clicking the button. Then install and save the test group.



Using test groups is a common way to load calibration files. However, beware that any time you create a new test group, it is important to consider which configuration file to load and the appropriate calibration file to also load. Problems often arise on systems with multiple test groups containing the incorrect calibration files. Loading an incorrect calibration file or none at all can result in erroneous test data.

### A.1.3 Corrupt Calibration Files

It is best to delete corrupt calibration files from your computer using Microsoft® Windows® Explorer. If you delete a corrupt file that is loaded by a test group, the test group will no longer load. You must remove the check mark next to the option in the **Design>>Test Group>>Calibration** dialog box until you create a new calibration file. Then add the new calibration (.cal) file back to your test group.

If you suspect your calibration file is in error and you are loading it through your test group, do not continue to load the test group until you correct the calibration file. Go through the steps to create a calibration file, then add it back into your test groups.



If you have any questions or need further support, contact SuperFlow Customer Service or send an e-mail to [service@superflow.com](mailto:service@superflow.com).

## A.2 Changing Calibration Coefficients

---

A calibration file (CAL) contains coefficient values for the channels defined in the configuration file (CFA/CFD) as calibrated channels. The coefficients are determined by the default values set in the channel configuration or by the values entered during a calibration procedure. If the channel configuration is changed to affect a new displayed value, a new calibration coefficient must also be generated to support the changes. The coefficient is generated by installing the new configuration file (CFA) into the system or by calibrating the channel. Then a new calibration file (CAL) must be generated and saved, replacing the old file which now does not match the channel configuration.

If an old calibration file is installed after the new configuration file, it will overwrite the new coefficient with the old one, thereby resetting the channel to the way it was prior to the change. If the channel name and units were changed, they will show those changes, but the displayed values will not match the input signal.

To properly reset the system with a change in a channel configuration:

1. Install the new configuration file (CFA). Do not install any other file—especially a calibration file (CAL) or test group file (TGP).
2. To see the WinDyn displays, open a screen file (CDF) if desired.
3. Calibrate the torque channel (and the Baro channel if atmospheric correction factors are used). Perform a calibration on the channel that was changed unless the default values in the channel are acceptable.
4. Save a new calibration file.

The system is now safely reconfigured.

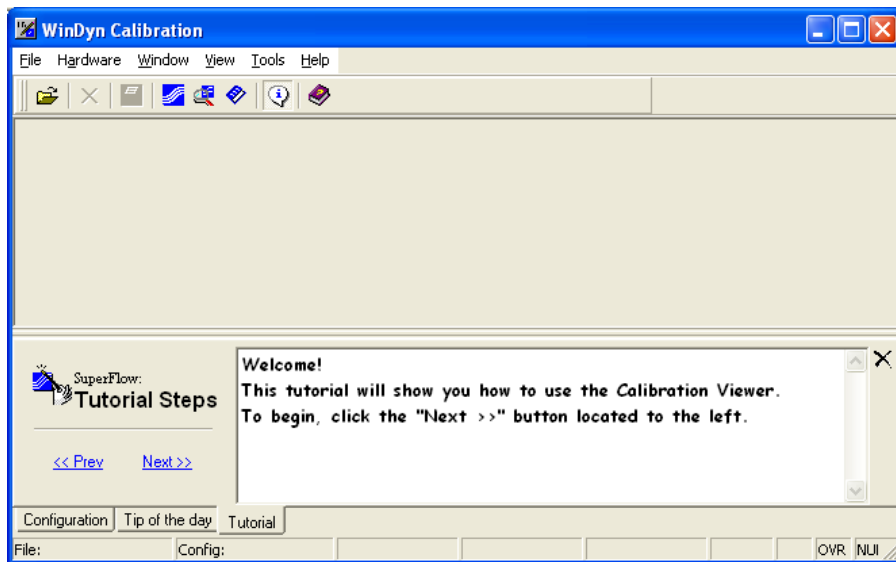


## A.3 Calibration Viewer

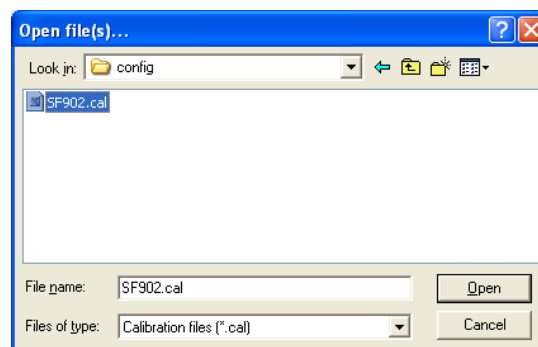
Use the Calibration Viewer to view and print WinDyn calibration files to keep in a log. This can be useful for documentation and tracking any drift trends in the sensors or changes in the channel definitions.

The sensor calibration data for your dynamometer is saved in a WinDyn calibration file. The calibration file is the same name as your system configuration and has a .cal extension, for example, MCDyno.cal).

1. To open the Calibration Viewer, from the main **WinDyn** menu, select **Tools>>View Sensor Calibration**. The **WinDyn Calibration** dialog box appears. The Tutorial Steps area at the bottom provides steps for the basic operation.

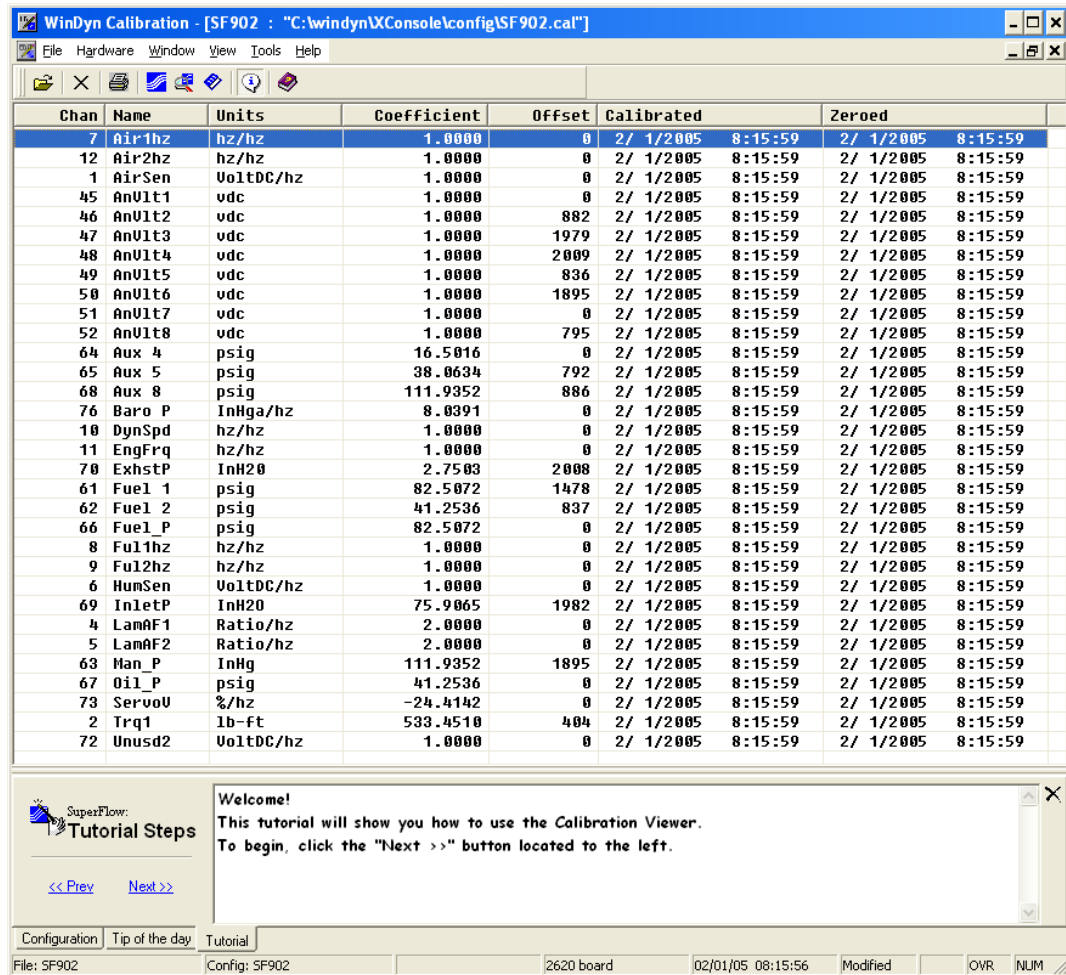


2. Select **File>>Open**, click the **Open** toolbar button, or press **CTRL+O**. The **Open file(s)** dialog box appears.



3. Select a file in the list and click **Open**.

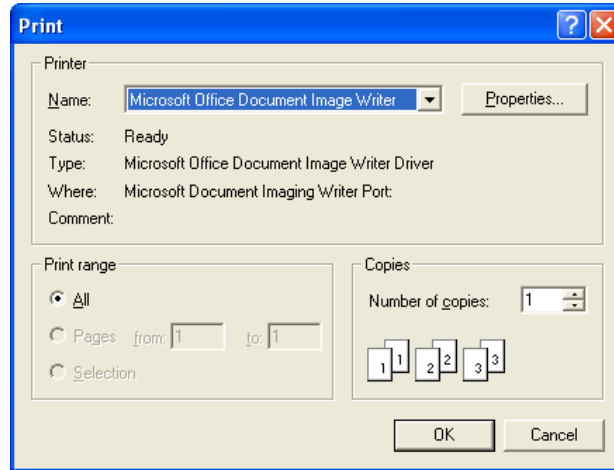
4. The **WinDyn Calibration [file name]** dialog box appears.



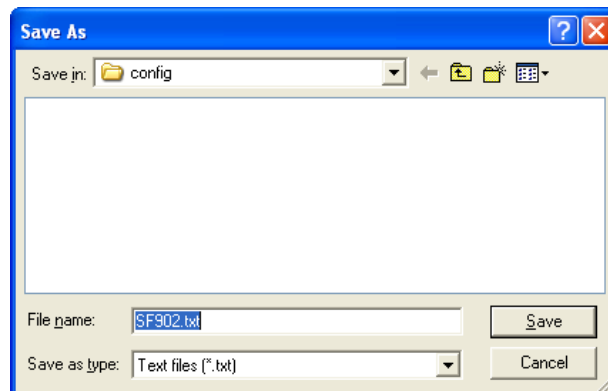
5. This information can be viewed, sorted and printed, but not edited. To sort the data, click the column name to sort all the information by that column.

- **Chan:** The channel number as defined in the configuration file.
- **Name:** The channel name as defined in the configuration file.
- **Units:** The units of measurements as defined in the configuration file.
- **Coefficient:** The value generated by the calibration procedure. This value multiplied by the input signal value results in the displayed value for that channel. The coefficient value will change only when the channel is calibrated.
- **Offset:** The value generated by the system when a channel is autozeroed. This value is in engineering units and has no direct relationship to the format units of the channel. The offset value will change each time the channel is autozeroed.
- **Calibrated/ Zeroed:** The date and time the calibration was saved to the computer.

- To print the sensor calibration information, select **File>>Print**, click the **Print** toolbar button, or press **CTRL+P**. The Print dialog box appears.



- Select your print options and click **OK**.
- To export the calibration data as a text file, select **File>>Export as text**. The **Save As** dialog box appears.



- Type a name in the **File name** text box and click **Save**.
- To return to the WinDyn main menu, select **File>>Exit** or click the **X** in the top right corner of the Calibration Viewer.

## APPENDIX B

# QUICK-REFERENCE AND HOW-TO GUIDE

### IN THIS APPENDIX

- **WinDyn Keyboard Shortcuts**
- **Test Description Keyboard Commands**
- **Graph Shortcut Keys**
- **How to ...**
  - Set Up WinDyn to Run a Test
  - Modify a WinDyn Calculated Channel
  - Completely Remove WinDyn from a Computer
  - Change the Default Channel Order
  - Change the Handheld and Console Displays





## B.1 WinDyn Keyboard Shortcuts

Table B-1. WinDyn Keyboard Shortcuts

| Key             | Purpose                                       |
|-----------------|-----------------------------------------------|
| <b>F1</b>       | Display online WinDyn Help                    |
| <b>F2</b>       | Install test group                            |
| <b>SHIFT+F2</b> | Open design test group                        |
| <b>F3</b>       | View current test                             |
| <b>SHFT+F3</b>  | View saved test                               |
| <b>F4</b>       | Save current test                             |
| <b>ALT+F4</b>   | Exit WinDyn                                   |
| <b>F5</b>       | Save and view current test                    |
| <b>F6</b>       | Print current test                            |
| <b>SHFT+F6</b>  | Print saved test                              |
| <b>F7</b>       | Save and print current test                   |
| <b>F8</b>       | Save, view, and print current test            |
| <b>F9</b>       | Save and overlay current test                 |
| <b>SHFT+F9</b>  | Select saved tests to overlay                 |
| <b>F10</b>      | Edit test description notes (test comments)   |
| <b>F11</b>      | Arrange data window and plot window           |
| <b>F12</b>      | Display WinDyn control panel                  |
| <b>1</b>        | Display current data screen 1                 |
| <b>2</b>        | Display current data screen 2                 |
| <b>3</b>        | Display current data screen 3                 |
| <b>4</b>        | Display current data screen 4                 |
| <b>5</b>        | Display current data screen 5                 |
| <b>6</b>        | Display current data screen 6                 |
| <b>7</b>        | Display current data screen 7                 |
| <b>8</b>        | Display current data screen 8                 |
| <b>9</b>        | Display current data screen 9                 |
| <b>0</b>        | Display current data screen 10                |
| <b>A</b>        | Specify auto-increment file names             |
| <b>C</b>        | Calibrate or auto-zero channels               |
| <b>F</b>        | Specify System file paths                     |
| <b>P</b>        | Playback test                                 |
| <b>S</b>        | View specifications                           |
| <b>CTRL+F</b>   | Log off the WinDyn password security system   |
| <b>CTRL+L</b>   | Log on to the WinDyn password security system |

## B.2 Test Description Keyboard Commands

In addition to the Edit menu (accessed by right-clicking the mouse over the text edit area), the following keyboard commands are available when editing the test description comments:

**Table B-2. Test Description Shortcut Keys**

| Key                           | Function                             |
|-------------------------------|--------------------------------------|
| <b>CTRL+TAB</b>               | Tab over one tab width               |
| <b>CTRL+RIGHT/LEFT ARROW</b>  | Move to next word                    |
| <b>SHIFT+RIGHT/LEFT ARROW</b> | Select/deselect text                 |
| <b>CTRL+X (SHIFT+DELETE)</b>  | Cut selected text to clipboard       |
| <b>CTRL+C (CTRL+INSERT)</b>   | Copy selected text to clipboard      |
| <b>CTRL+V (SHIFT+INSERT)</b>  | Paste text from clipboard            |
| <b>DELETE</b>                 | Delete selected text                 |
| <b>CTRL+Z (ALT+BACKSPACE)</b> | Undo last edit                       |
| <b>HOME</b>                   | Move cursor to beginning of line     |
| <b>END</b>                    | Move cursor to end of line           |
| <b>CTRL+HOME</b>              | Move cursor to beginning of comments |
| <b>CTRL+TAB</b>               | Tab over one tab width               |

## B.3 Graph Shortcut Keys

Not all keyboard commands are shown:

**Table B-3. Plot and Graph Shortcut Keys**

| Key             | Function                                                                        |
|-----------------|---------------------------------------------------------------------------------|
| <b>SPACEBAR</b> | Displays the Customization dialog box                                           |
| <b>D</b>        | Displays the Text/Data Export dialog box                                        |
| <b>P</b>        | Displays the Print dialog box                                                   |
| <b>F-10</b>     | Displays the Test Description notes                                             |
| <b>F-12</b>     | Toggles the color mode between <b>color is test</b> and <b>color is channel</b> |
| <b>M</b>        | Toggles the channel maximum displayed values                                    |
| <b>Q</b>        | Displays the pop-up menu                                                        |
| <b>T</b>        | Toggles between custom and original parameters                                  |
| <b>Y</b>        | Toggles between <b>Left Only</b> and <b>Left and Right</b> Y axes               |
| <b>S</b>        | Toggles between monochrome and color styles                                     |
| <b>X</b>        | Displays the Export dialog box                                                  |
| <b>Z</b>        | Undo Zoom                                                                       |
| <b>ALT+Z</b>    | Toggles between Zoom and Unzoom states                                          |
| <b>ARROWS</b>   | Moves cursor on the graph                                                       |



## B.4 How to ...

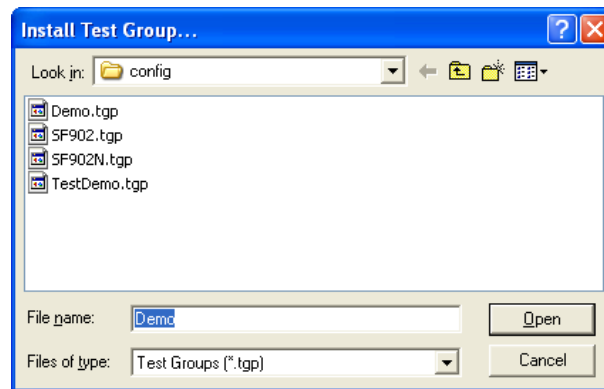
---

### B.4.1 Set Up WinDyn to Run a Test

This section describes the WinDyn steps necessary to properly configure the system for testing, from loading a test group to autozeroing the remote test system's sensors. It may not be necessary to perform each of these steps before running every single test, but the WinDyn operator should be aware of all the steps in order to ensure accurate test results. This section assumes the dynamometer was already successfully calibrated.

#### Load a Test Group

1. From the **WinDyn** main menu, select **System>>Install>>Test Group**, click the **Install Test Group** button, or press **F2** to load a test group. The **Install Test Group** dialog box appears.



2. Select a test group in the list.
3. Click **Open**. The selected test group will load.

## Prepare WinDyn

1. From the **WinDyn** main menu select **Design>>Test Setup**, click the **Test Setup** toolbar button, or press the **S** key.
2. Select the test data file path where WinDyn will store all test data files.

The WinDyn Test Setup dialog box is shown with the following configuration:

- Test Data Name:** DATA
- Start At:** 1
- Test Data Location:** C:\windyn\Demo\data Demo
- Buttons:** Activate - F2, Cancel - Esc, Recall - F3, Memorize - F4, Refresh - F5
- Logos:** SuperFlow TECHNOLOGIES GROUP
- Tabs:** Specifications, Data Printouts, Data Analysis
- Table:**

| Num | Name   | Value | Units  | Description |
|-----|--------|-------|--------|-------------|
| 77  | EngBor | 0.000 | inches |             |
| 78  | EngStr | 0.000 | inches |             |
| 79  | EngCyl | 0     | number |             |
| 82  | EngCyc | 0     | cycles |             |
| 85  | FuelSG | 0.000 | ratio  |             |
| 89  | VapPrs | 0.00  | InHg   |             |
| 90  | Start  | 0     | RPM    |             |
| 91  | StopAt | 0     | RPM    |             |
| 92  | StepTm | 0     | Second |             |
| 93  | StpSiz | 0     | RPM    |             |
| 97  | IntLng | 0     | inches |             |
| 99  | StrTst | 0     | second |             |
- Test Notes - F12:** Enter any Test Description notes here...
- Status Bar:** Test group: Demo, Last data: , Date: 01/03/2007

## Set the Test Data File Name

The **Test Data Name** is the file name WinDyn will use when creating test data files.

1. Verify the name in the **File Name** text box is correct. Type a new name if desired.  

The last character should not be a number. WinDyn will add numbers at the end of this name each time data is saved to disk starting with the number in the Start At drop-down list. Each subsequent file that is saved will increment to the next number. With this method, each data file will have the same name and a unique test number. WinDyn will never overwrite an existing data file. If a file exists in the selected folder with the same file name and number, WinDyn will skip to the next available number.
2. Click **OK** to save changes.

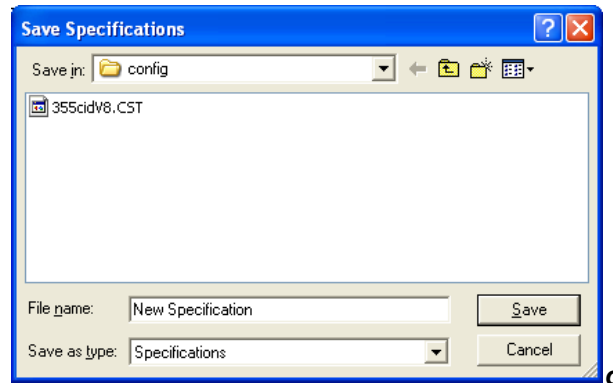
## Check the Test Data File Path

3. Verify that the path in the top **Data Path** text box is correct. Type a new path if desired.
4. If the new path does not exist, WinDyn will automatically create it. Use the drop-down list to select a previously used location or click the **Browse** button to search for it.

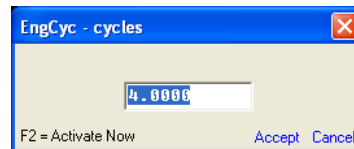
## Check the Test Specification Values

Specification values can be modified and saved as a group (file) and stored in a separate specifications file (CST) for easy retrieval.

1. To save a file, place the mouse pointer in the **Specifications** area, right-click, and select **Save**. The **Save Specifications** dialog box appears.



2. Type a new name in the **File name** text box and click **Save**.
3. To edit a specifications file, place the mouse pointer in the **Specifications** area, right-click, and select **Edit**. The **[Specification Name]** dialog box appears.

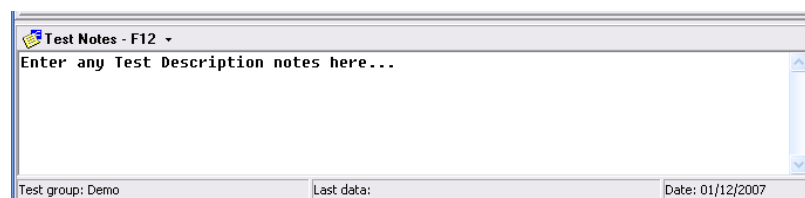


4. Type the information in the text box and click **Accept** in the bottom right corner.

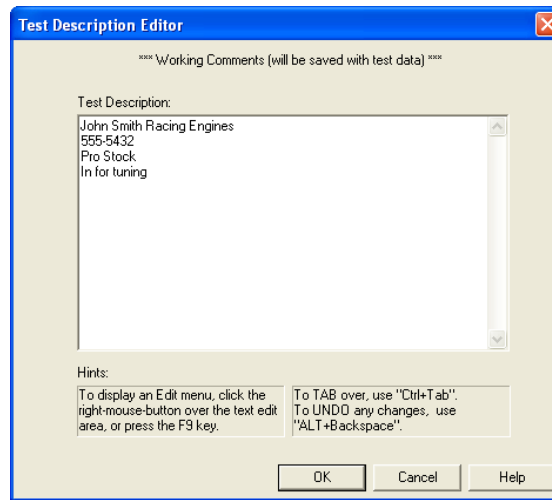
Specifications can also be saved by memorizing a WinDyn Preferences file (WDP) in the Test Setup dialog box and retrieving it later.

## Check the Test Notes

Use the **Test Notes** area (referred to as Test Description in previous versions of WinDyn) in the Test Setup dialog box to attach notes for each test. These notes can include details on the test device, owner contact information, reasons for testing the device, test results, and so on. The information is saved with the stored test data (\*.sfd) files. Test notes can contain a maximum of 5,280 characters and be printed as part of the report header on the data printout.

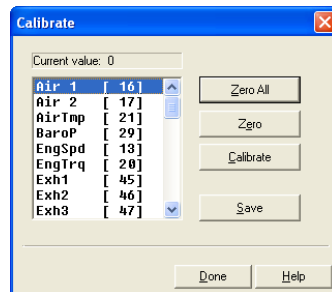


Once the data is stored, additional information may be added to the file later by pressing the F10 key and using the Stored Data Viewer program (for more information, see section 5.6.10, "Viewing Test Notes," on page 5-31).

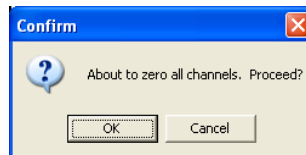


## Autozero Sensors

1. To autozero the test system's sensors, verify that the engine or vehicle is *not* running.
2. From the **WinDyn** main menu select **System>>Calibrate**.



3. Click the **Zero All** button. A dialog box appears confirming you are zeroing all channels.



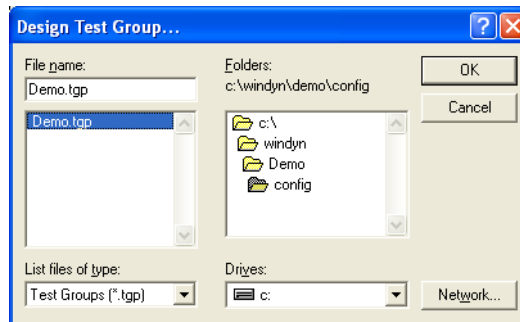
4. Click **Yes** to confirm. This autozeros all the appropriate channels in the list at the left of the Zero All button.
  5. When the autozero process is complete, click **Done** to close the **Calibrate** dialog box.
- WinDyn is now set up and ready to run a test.

## B.4.2 Change the Default Channel Order

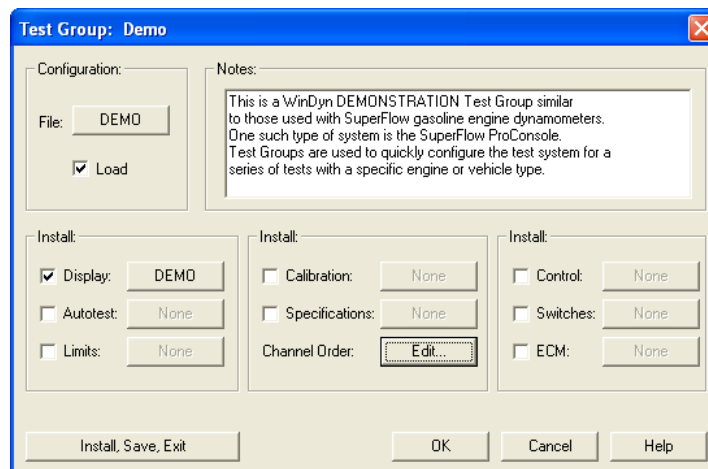
The **channel order** determines the display order of the data channels for analysis, printing, and plotting. For example, you may want Speed in Column 1, Torque in Column 2, Power in Column 3, and so on. You can configure up to ten pages of column designs and select up to nine channels on each page.

The channel order is specifically assigned to a test group. Each test group has a channel order that becomes the default for data files saved while that test group is active and becomes imbedded in the data file when it is saved. You can change the channel order for a saved data file while viewing the data.

1. To access the **Channel Order** dialog box and change the default order, open a test group for editing. Select **Design>>Test Group>>Open**.



2. Select a TGP file in the list and click **OK**. The Test Group [Name] dialog box appears.

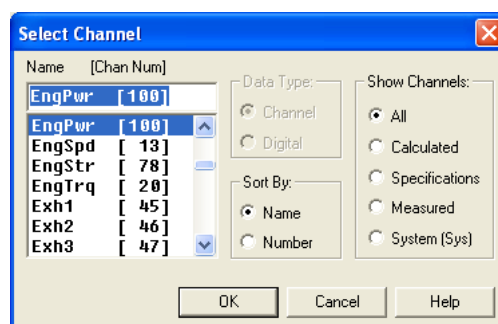


3. In the **Install** area, click the **Edit** button next to **Channel Order** (in the middle of the dialog box).



Use the Channel Order dialog box to select which channels will display *and* plot when viewing WinDyn data.

- **Page Select:** To modify a stored data page, select the desired page using the drop-down list. Ten pages are available.
- **Page Name:** Each page can have a unique name which displays on the headings of the WinDyn **Stored Data** and **Plot** view screens and on the data and plot prints.
- **Display:** Selects the number of data channels that will display on the page. Select a number using the **UP/DOWN** arrows or type a number in the text box.
- **Channels:** For each channel on the page, select the channel to display by clicking a channel button. The **Select Channel** dialog box appears. Use the slide bar or **UP/DOWN** arrows to scroll through the list and select the desired channel. The first channel at the top of the list is always the X-axis (the axis across the bottom) on the graphs.



**NOTE:** A shortcut for finding a desired channel is to enter the first letter of the channel name in the dialog box. The channels beginning with that letter will then appear in the list.

- **Plot:** To plot a particular channel, select the associated check box. The first channel at the top of the list is always the X-axis. The channels selected will be on the left or right Y-axis depending on the settings in the Plot preferences.

- **Color:** A wide range of colors can be selected for the plot lines. Click the **Color** box to display the dialog box with selections.
- **Scale:** To plot a channel multiplied by a scale factor, select the desired scale factor in the Scale drop-down list for that channel. The indicated Y-axis scale equals the actual value times the scale factor. For example, if the scale factor for engine speed is 0.01 and the real speed range is 0-10000 rpm, engine speed will be plotted with a Y-axis scale of 0-100.
- **Save:** In the Editor, the Save button is unavailable (gray).
- **Load:** Click the **Load** button to retrieve a saved channel order from a data file (\*.sfd) or another test group (\*.tgp) so the channel order can be matched. This way you do not need to enter all the channel order information manually. The loaded channel order can then be saved with the current test group file.

### B.4.3 Modify a WinDyn Calculated Channel

This procedure describes the steps necessary to modify the mathematical formula associated with a WinDyn calculated channel.

#### View a Calculated Channel

1. If you only want to view a calculated channel (to see how WinDyn is calculating data) and you do not need to make any changes to the channel, use the Configuration Utility provided with WinDyn. From the **WinDyn** main menu, select **Tools>>View System Configuration**.
2. When the Configuration Utility appears, press **F2** to display a list of available configuration files.
3. Click the desired configuration file and then click **Open**.
4. Scroll to the desired channel and select it.
5. The formula for the calculated channel displays.



For more information on calculated channels, refer to Chapter 11, "Configuration Editor."

---

#### Set the Configuration File Path

1. Verify the path where the Configuration Editor will search for files. The standard folder where configuration files are stored is C:\WinDyn\XXXX\Config where XXXX is typically the dyno product name (XConsole, MCDyno, etc.).
2. From the **WinDyn** main menu, select **Design>>System Setup>>File Paths**.
3. Verify the path in the **Configuration path** dialog box points to the directory of the configuration file to modify. Type a new path if desired.
4. Click **OK** to exit and save changes if any were made.

Note that the DOS-based Configuration Editor has a limitation on the file path length. This means the editor cannot see configuration files if the file path string (displayed in the Configuration path text box) contains more than **30** characters. Therefore, configuration files must reside in a directory with a file path name fewer than **31** characters before you can edit the configuration file.

## Display the Configuration Editor

From the **WinDyn** main menu, select **Design>>System Configuration**. The DOS-based Configuration Editor (WinDyn Data Definition) appears, displaying the editor's main menu screen.

## Open (Retrieve) a Configuration

1. Press the **G** key on the keyboard. A list of available configurations display.
2. Type the name of the desired configuration (for example, **SF902**).
3. Press **ENTER**. A listing of the channels in the configuration you selected displayed (in yellow).

## Determine a Calculated Channel Number

1. To find the channel number of the calculated channel to edit, press **CTRL+Z** on the keyboard to view the **Current Defined Channels** window which displays a list of all the defined channels in the configuration file you are currently editing.
2. Find the channel name of interest and its associated channel number in the list.
3. Press the **ESC** (Escape) key to exit.

## Edit the Calculated Channel

1. Press **E** to access the **Channel Edit** dialog box.
2. Type the channel number for the calculated channel to edit and press **ENTER**.
3. Press the **ENTER** key three more times to view the calculated channel's formula.
4. Type the desired modifications to the formula.
5. Press the **ENTER** key five more times to return to the **Channel Edit** dialog box.
6. Press the **ESC** (Escape) key to return to the main menu.

## Save (Keep) Modifications

1. To save the changes, press **K** and **ENTER**.
2. A dialog box appears with a message asking whether to overwrite the existing file; press **Y** for yes. The **Compile** window appears. If any errors are found in the formula you modified, they will display here.
3. Repeat the preceding edit steps to fix any errors. Once the Compile window shows no errors, press any key to return to the main menu.

## Exit the Configuration Editor

1. To exit the Configuration Editor, press **Q**. A dialog box appears with the message **Quit?**
2. Press **Y** to return to the WinDyn main window.



## Reinstall the Modified Configuration

1. To reinstall the modified configuration, select **System>>Install>>System Configuration**.
2. A window appears with a list of configurations. Click the configuration you just modified.
3. Click **OK**; this loads the modified configuration and activates your changes. If a current data screen was active, it will close when the configuration file is loaded.

The calculated channel is now modified and active. If desired, you may now run a Current Data display screen that shows the channel to verify that the new calculation is correct.



**IMPORTANT:** When installing a configuration file, the calibration information is lost and must be restored by loading the proper calibration file into the system. Select **System>>Install>>Sensor Calibration** and select the desired file.

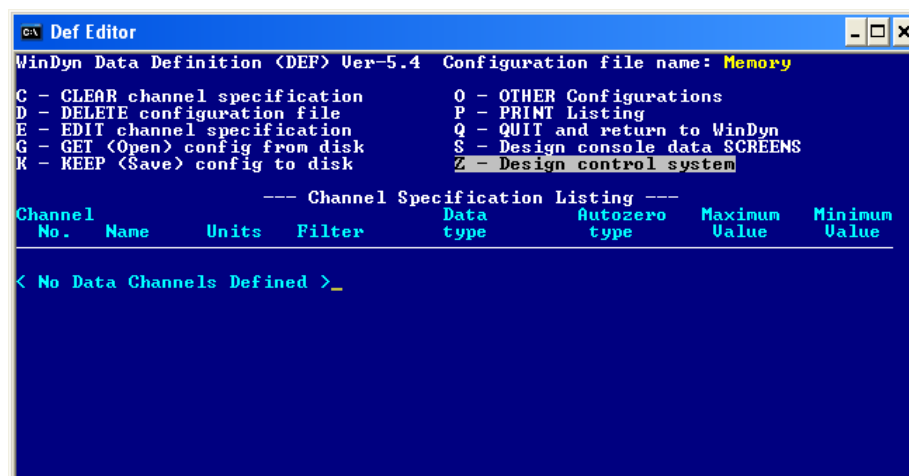
## B.4.4 Change the Handheld and Console Displays

This section describes how to change your handheld screens.

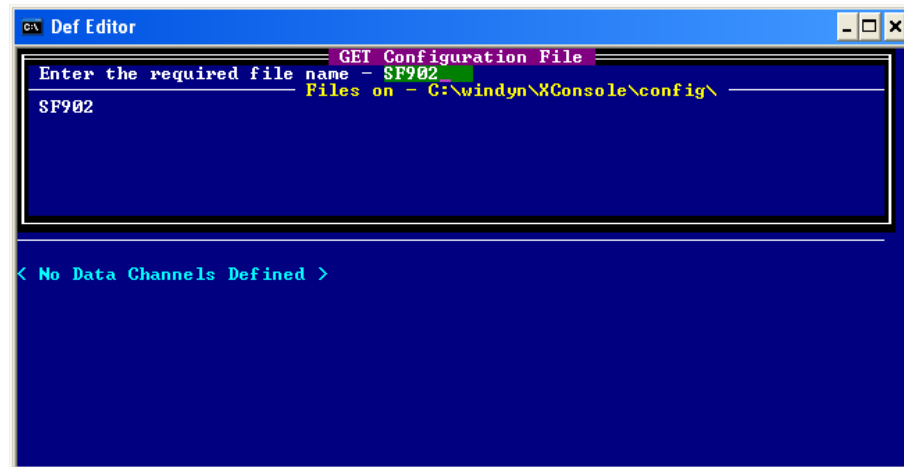


If you have problems or questions, contact SuperFlow Technical Support before proceeding.

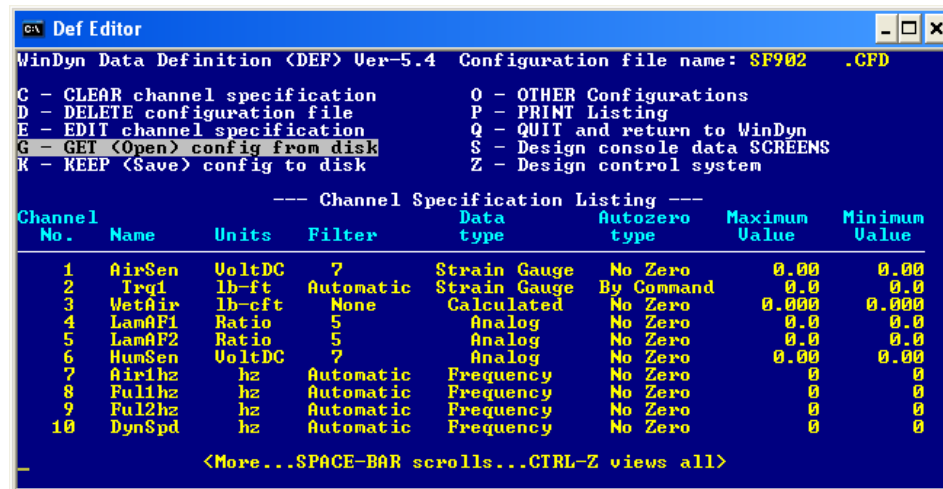
1. From the **WinDyn** main menu, select **Design>>System Configuration**. The **Configuration** main screen appears.



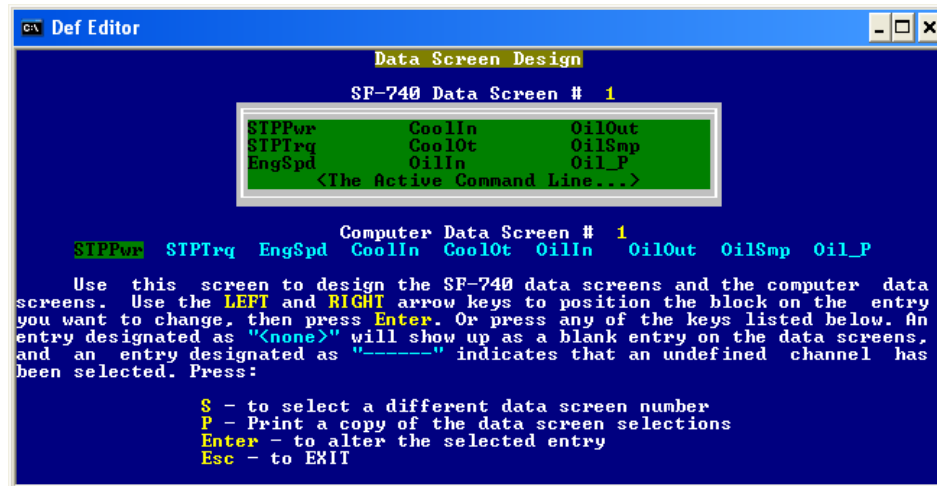
2. Press the **G** key to **Get (OPEN) config from disk**. A new screen appears.



3. In the **Enter the required file name –** area, type a name, for example **SF902**.
4. Press **ENTER**. The **SF902** configuration screen appears.



5. Press the **S** key for **Design console data SCREENS**.



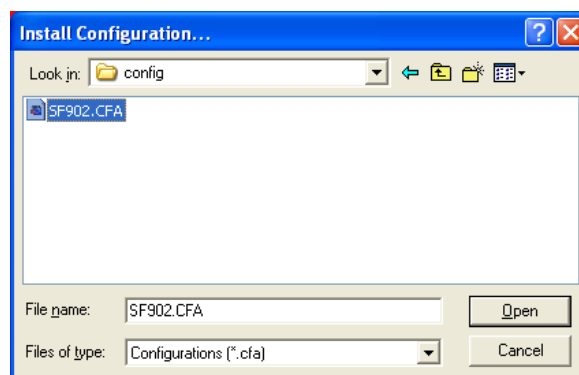
- Follow the screen directions above to make changes.

---

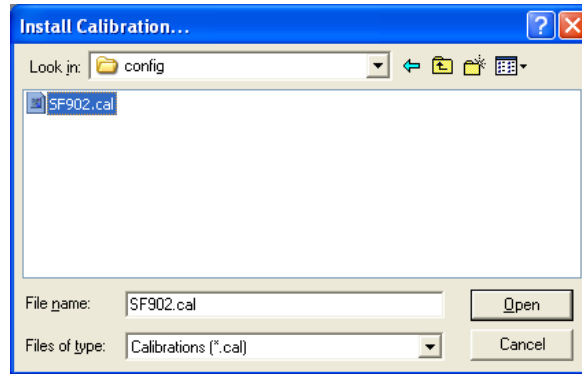
**NOTE:** CTRL+Z displays all channel information.

---

- After making all changes, press the **ESC** key on the computer.
- Press the **K** key to keep (save) the configuration.
- Save changes with the same name. A message appears asking if you want overwrite the existing file.
- Select **Yes** (press the letter **Y**). A message appears stating the compilation is finished.
- Press any key to continue. Press any key again to return to the first screen.
- Press the **Q** key to quit and return to WinDyn.
- A screen appears asking if you are sure you want to quit.
- Select **Yes** (press the letter **Y**).
- To load the CFA file, from the **WinDyn** main menu, select **System>>Install>>System Configuration**.



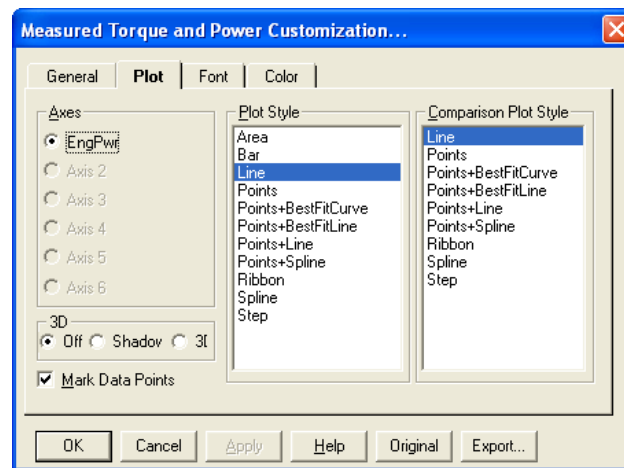
- In the **Install Configuration** dialog box, select the modified file and click **Open**.
- From the **WinDyn** main menu, select **System>>Install>>Sensor Calibration**.



18. In the **Install Calibration** dialog box, select the file with the same name as the configuration and click **Open**.
19. Then load the test group (TGP) file by pressing **F2** on the keyboard. Select SF902.tgp and press **OK**.

## B.4.5 Customize the Plot View

From the **Plot** menu select **Plot>>Preferences>>Customization**. The **[plot name] Customization** dialog box appears.



Click the **General** tab. The **Plot Style** list is for the left Y-axis, and the **Comparison Plot Style** list is for the right Y-axis.

- **Legend:** Configures the appearance of the channel description legends, which display at the top of the plot window.
  - **Simple:** Displays only the test name and line color (or style) indicator.
  - **Detailed:** (default) Every channel displayed on the plot will have a complete legend entry to include the test name, channel name, and channel units (for example: **DEMO0001: EngPwr – hp**).

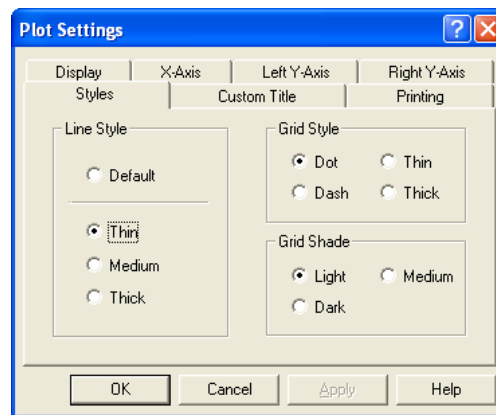
**NOTE:** When plotting several channels, the legend can become crowded and hard to read. Use the Simple option when this occurs.

- **Line Color:** Configures how the plot uses line color (and line style) to distinguish between different channels (default) and different tests (overlays).
  - **Indicates Channel:** Line **color** is the same for each channel (for example, all EngTrq channels are red); line **style** (for example, solid, dashed, dot) indicates the test (overlay).
  - **Indicates Test (Overlay):** Line **style** is the same for each channel (for example, all EngTrq channels are dashed); line **color** (for example, red, blue) indicates the test (overlay). The **F12** key is a shortcut to switch modes.
- **Compare Mode:** Graphically compare test runs normally, by **%-Change** or by **Difference**. **Normal** is the default setting.



See sections section 5.7.3, “Plot Percent Change,” on page 5-35 and section 5.7.4, “Plot Difference,” on page 5-35 for details on this feature.

From the **Plot** menu select **Plot>>Preferences>>Settings**. The **Plot Settings** dialog box appears.



Click the **Styles** tab. The following settings affect printing more than the screen images.

- **Line Style:** Select the line thickness for the test plots. Once the desired line thickness is set, WinDyn will remember it until it is changed.
  - **Default:** A very thin line; the style (solid, dot, dash, etc.) indicates either test or channel.
  - **Thin, Medium, or Thick:** Creates a solid line (regardless of test or channel) of the indicated thickness. The default line style (new installs) is Medium.
- **Grid Style and Grid Shade:** Determines how the plot grid appears on all plots. This is useful if the grid does not appear properly on the plot printouts. Both line styles (dot, thin, dash, thick) and shading (light, medium, dark) can be adjusted.

## B.4.6 Completely Remove WinDyn from a Computer

This section describes how to completely remove WinDyn from a computer.

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**NOTE:** *This procedure is not necessary when upgrading to a newer version of WinDyn.*

---

### Save Existing Test Group Files and Data Files

Use Windows Explorer or My Computer to copy the **WinDyn\XXXX** folder and all subfolders to a temporary directory (where XXXX is the product name). This saves all existing test groups, configurations, screens, specifications, calibrations, controls, switch configurations, AutoTests, limits, and data files for later use if you reinstall WinDyn. If using the WinDyn Database Manager, also copy the WinDyn\Database folder.

### Close all Running Applications

Before continuing, be sure to close all software applications that are currently running.

### Run the Uninstall Program

1. Access the **Control Panel** on your computer (the procedure depends upon your Windows configuration). On some computers you may need to click **Start**, then select **Programs>> SuperFlow WinDyn** to access an uninstall program.
2. Click **Add or Remove Programs**.
3. A dialog box appears with a list of currently installed programs. You first must uninstall all SuperFlow WinDyn system configurations.
4. Select SuperFlow WinDyn and click the Change/Remove button.
5. A dialog box appears asking if you are sure you want to remove WinDyn and all its components. Click **Yes**.

### Delete the WinDyn Folder

1. Use Windows Explorer to delete the WinDyn folder (and all subfolders) from the hard drive.
2. Answer **Yes** to all prompts.
3. Restart your computer.



If you need to remove all trace files from your computer, contact SuperFlow Customer Service to order the WinDynClean32.exe program.

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APPENDIX C

# TROUBLESHOOTING AND ERROR CODES

## IN THIS APPENDIX

- **Troubleshooting Guide**
  - WinDyn
  - Stored Data Viewer
  - Errors Involving the Customer Data Pack Program
  - Errors Involving the Configuration Utility Program
  - Errors Involving the WinDyn Database Manager
- **Troubleshooting Procedures**







# C.1 Troubleshooting Guide

Table C-1. WinDyn

| Problem                                                                                                                                                                                                                  | Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error message when installing WinDyn: "Error occurred during move data process - 132".                                                                                                                                   | Possible problem with copying files from the disk (corrupt disk).                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Error message: "Valid SuperFlow system not found."                                                                                                                                                                       | A SuperFlow system configuration has not been installed in the computer.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| WinDyn installs but does not operate properly                                                                                                                                                                            | WinDyn may not have full administrator privileges. WinDyn must be installed and run with full access to the registry to properly operate.                                                                                                                                                                                                                                                                                                                                                               |
| Windyn cannot find Test Group [Null] for _Autoloading Path Path:H                                                                                                                                                        | Problem is with the autoload path name. Select <b>System&gt;&gt;Preferences&gt;&gt;Auto-Install Test Group</b> and correct the error.                                                                                                                                                                                                                                                                                                                                                                   |
| WinDyn will not communicate with the sensor box                                                                                                                                                                          | Several causes for this problem: <ul style="list-style-type: none"> <li>• Defective or disconnected Local Area Network (LAN) cable</li> <li>• Conflict with router or hub on local network (Remove router or local network connections)</li> <li>• WComNet not configured properly (see section C.2.1 below or Chapter 8, "WinDyn Communications")</li> <li>• Defective network adapter or Network Interface Card (NIC) in computer</li> <li>• Defective communication circuit in sensor box</li> </ul> |
| The operator or user is editing an X-Y display and the contents of the properties window are not contained within the window. User has changed the Windows display properties resolution to all settings with no effect. | Could be resources. Close all other running programs. Check video drivers.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| On a 1942/2060, the console or handheld shows the data, but WinDyn does not – except for temperatures. WinDyn will display RTD from the thermocouples but not pressure, torque, speed, or even Baro.                     | The Single In-line Memory Module (SIMM) board is loose in the socket.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| WinDyn screens are displaying ***** on some or most of the channels (which indicates an out-of-range condition), but the handheld or console are correctly displaying data.                                              | Possibly bad Network Interface Card (NIC) in the computer or a bad network driver in the sensor box.                                                                                                                                                                                                                                                                                                                                                                                                    |

Table C-1. WinDyn

| Problem                                                                                                                                                                                               | Solution                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error message: "Log File error, File Corrupt (Checksum failed)"                                                                                                                                       | System Log file is corrupt (View System Log). Close WinDyn and delete the <b>ActiveLog.sfl</b> file in the <b>C:\Windyn\System</b> folder. WinDyn will create a new one when the program is restarted.<br><br>Refer to section 4.8, "System Log," on page 4-16 for more information on the System Log.                                          |
| Error Message: "Unable to save data to C:\WinDyn\..... [rest of data file path]"<br><br>"Error reading data from remote" Stored will not view Current Data as well. A similar error message is shown. | Could be a communications issue. Check network devices and settings. Remove routers or network hubs and test again. Problem occurs specifically when large data files are recorded and attempts to save or view the data to WinDyn result in this error.                                                                                        |
| Error message when saving from an autotest, the console, or the handheld: "File not found."                                                                                                           | Could happen if the file path and name is too long or if invalid characters are in the file path/name.                                                                                                                                                                                                                                          |
| Error message: Invalid SuperFlowNetName entry in registry.                                                                                                                                            | WComLink detected a configuration error. Re-install WinDyn.                                                                                                                                                                                                                                                                                     |
| Error message when starting WinDyn: "Application MUTEX already exists."                                                                                                                               | The WComLink communications program is already running on the computer and WinDyn is trying to start it again. Restart the computer to clear it.                                                                                                                                                                                                |
| Error message when starting WinDyn: "Error 123 resetting password file."                                                                                                                              | Indicates the computer has restricted access controls in place. In order to run properly, WinDyn requires full administrator rights to the Registry and system INI files.                                                                                                                                                                       |
| Error message when opening a test group: "Unable to Load Configuration File - Error Code: 1"                                                                                                          | The test group being opened has the installation of a configuration file enabled. If the computer running WinDyn is not set as a command master, the configuration file cannot be installed. Open the <b>WComNet</b> communications dialog box and select the <b>Command Master</b> option.                                                     |
| If/when opening the Configuration Editor, the blank blue screen appears.                                                                                                                              | The editor normally appears as a full-screen DOS window. A problem exists with Windows XP that causes the editor malfunction at times. To remedy this situation, press <b>ALT+ENTER</b> to reduce the window and allow the editor to function.<br><br>In some cases the problem exists in the video card. A different card may fix the problem. |

**Table C-2. Stored Data Viewer**

| Problem                                                                                 | Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Message on trying to plot a data file: error in Stored.exe / "Floating Point Overflow". | <p>Typical sources of this kind of problem:</p> <ul style="list-style-type: none"> <li>• The configuration in effect has invalid calculations or settings.</li> <li>• Data is being recorded with a malfunctioning or off sensor or data is being recorded when engine is not running, etc.</li> <li>• One way to track down what's generating the overflow is to clear the channel order for the page in question, then turn on one channel at a time until you get the error.</li> </ul> |
| The cursor on the plot screen does not appear but is checked on the View menu.          | Reset customization. Could be a separate program sharing a DLL. Make sure the cursor is enabled and clicking on a data point.                                                                                                                                                                                                                                                                                                                                                              |
| Program will not print to a printer other than the default printer                      | The Stored Data Viewer program does not have the ability to print to any printer other than the one designated as the default printer in the Windows Control Panel Settings for Printers and Faxes. To print to a network printer, select it as the default.                                                                                                                                                                                                                               |

**Table C-3. Errors Involving the Customer Data Pack Program**

| Problem                                                                                                           | Solution                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| When trying to install the Customer Data Pack into a computer an error message appears saying WinDyn is detected. | A computer with WinDyn installed already has all the Stored Data Viewer services and therefore does not need a Data Pack. In this case just copy the SFD data files from the Data Pack disk to the computer or open them directly using WinDyn. |

**Table C-4. Errors Involving the Configuration Utility Program**

| Problem                        | Solution                                                                                        |
|--------------------------------|-------------------------------------------------------------------------------------------------|
| Error 5 reading comments file. | Comments.txt in Windyn\System folder is missing or corrupt. Create a new txt file with Notepad. |

**Table C-5. Errors Involving the WinDyn Database Manager**

| Problem                                            | Solution                                                                                            |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| General error                                      | Re-index and Pack table will clear. The error appears most often after conducting several searches. |
| Access to table disabled because of previous error | Corrupted database file. Delete database files and re-install WinDyn. All data is lost.             |

## C.2 Troubleshooting Procedures

---

### C.2.1 No WinDyn Communication

1. Click **OK** on any messages displayed and return to the WinDyn main window. No real-time displays will be viewed.
2. From the main **WinDyn** menu, select **View>>Communications**, or click the **WComNet** icon in the system tray (where the Windows clock displays). The **Configure – WinDyn Communications** dialog box appears.
3. Click the **Query** button to query the network. The **Advanced** button activates indicating a system was detected.
  - If not, check the Cat-5 cable to make sure it is connected to the **Computer Network** port on the sensor box.
  - Then check the **LAN (D20)** activity light on the circuit board inside the sensor box to make sure it is flickering. If not, turn the system off and swap the Cat5 cables between the LAN connectors on the board.
  - Turn the system back on and try the query again.
4. If the Advanced button activates, click the **Connect to system** drop-down list and select the dynamometer system name shown in the list.
5. Click **OK**.
6. Install a test group

# ACRONYMS & ABBREVIATIONS





---

## **4WD**

Four-Wheel Drive

## **A**

### **acfm**

actual cubic feet per minute

### **ADC**

Analog-to-Digital Converter

### **ATX**

Advanced Technology Extended

### **AWD**

All-Wheel Drive

## **B**

### **BDC**

Bottom Dead Center

### **BMEP**

Brake Mean Effective Pressure

### **BPS**

bits per second

### **BSAC**

Brake Specific Air Consumption

### **BSFC**

Brake Specific Fuel Consumption

### **BTDC**

Before Top Dead Center (TDC)

### **BTU**

British Thermal Unit

## **C**

### **C**

Celsius

### **Cat5**

Category 5

### **cfm**

cubic feet per minute

### **CID**

Cubic Inch Displacement

### **cm**

centimeter (cm)

### **cmH<sub>2</sub>O**

centimeter of water

### **CPU**

Central Processing Unit

### **CSV**

Comma-Separated Value

## **D**

### **D**

diameter

### **DAC**

- Data Acquisition and Control
- Digital-to-Analog Converter

### **DACS**

Data Acquisition Control System

### **DBMS**

Database Management System

### **DLL**

Data Link Library



---

## **DPDT**

Double-Pole, Double-Throw

## **DRAM**

Dynamic Random Access Memory

## **E**

### **EC**

eddy current

### **ECE**

Economic Commission for Europe

### **e.g.**

for example

### **EMS**

Emergency Stop

### **EPROM**

Erasable Programmable Read-Only Memory

### **etc.**

and so on

## **F**

### **F**

Fahrenheit

### **fax**

facsimile

### **ft-lb**

foot-pound

### **ft<sup>3</sup>/sec**

cubic feet per second (also cfs and ft<sup>3</sup>/s)

## **G**

### **GB**

gigabyte

### **GPF**

General Protection Fault

### **gpm**

gallons per minute

### **GUI**

Graphical User Interface

## **H**

### **H<sub>2</sub>O**

Water (Hydrogen/Oxygen)

### **hp**

horsepower

### **HTML**

HyperText Markup Language

## **I**

### **icfm**

inlet cubic feet per minute

### **ID**

identification or identifier

### **IDE**

Integrated Drive Electronics

### **i.e.**

that is; meaning

### **IIS**

Internet Information Server

### **inH<sub>2</sub>O**

inches of water

---

**in/Hg)**

inches of mercury

**ISA**

Industry Standard Architecture

**K****KB**

kilobyte

**KBps**

kilobytes per second

**KHz**

kilohertz

**km**

kilometer

**kPa**

Kilo Pascal

**kW**

kilowatt

**L****LAN**

Local Area Network

**lb-ft**

pound-foot

**LCD**

Liquid Crystal Display

**L/D ratio**

Length-to-diameter ratio

**LED**

Light-Emitting Diode

**l/s**

liters per second

**lpm**

liters per minute

**M****m**

meter

**m<sup>3</sup>/sec**

cubic meters per second

**mag/TTL**

magnetic/Transistor-Transistor Logic

**MB**

megabytes

**Mbps**

megabits per second

**MDI-X**

Medium Dependent Interface-X (crossed)

**MDX**

Multi-channel Data Exchange

**MHz**

megahertz

**mm**

millimeter

**m/s**

milliliters per second

**N****N-m**

Newton-meter

---

**NetBEUI**

NetBIOS Extended User Interface

**NetBIOS**

Network Basic Input/Output System

**NGE**

New Generation Electronics

**NIC**

Network Interface Card

**O****O.D.**

Outside Diameter

**OEM**

Original Equipment Manufacturer

**P****Pa**

Pascal

**PC**

personal computer

**PCB**

Printed Circuit Boards

**PCI**

Peripheral Component Interconnect

**PDF**

Portable Document Format

**PID**

Proportional, Integral, and Derivative

**psi**

pounds per square inch

**R****RAM**

Random Access Memory

**RJ-45**

Registered Jack-45

**ROM**

Read-Only Memory

**rpm**

revolutions per minute.

**S****SAE**

Society of Automotive Engineers

**SIMM**

Single In-line Memory Module

**SRAM**

Static Random-Access Memory

**SWED**

SWitch EDitor

**T****TCP/IP**

Transmission Control Protocol/Internet Protocol

**TDC**

Top Dead Center

**TPF**

Test Profile (also referred to as an autotest)

**TPS**

Throttle Position Sensor

**TTL**

Transistor-Transistor Logic

---

# U

## UI

User Interface

## USB

Universal Serial Bus

## UPS

Uninterruptible Power Supply

# V

## VAC

Volts Alternating Current

## VDC

Volts Direct Current

## VFD

Vacuum Fluorescent Display

# W

## WAN

Wide Area Network

## WYSIWYG

What You See Is What You Get



# GLOSSARY





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# Num/Sym

## 10-Base-TX Ethernet Converter

The TC3105 UTP-to-Fiber Optic Converter replaces or extends 10Base-T segments with multimode (850/1300nm) or single mode (1300/1550nm) fiber-optic cable and is frequently used to link Ethernet switches or workstations. Typical applications include extending full duplex LAN segments up to 80km or connecting two Ethernet segments through fiber optic cable.

## A

### acfm

actual cubic feet per minute (*see* “cfm” on page 5)

### acceleration

In physics or physical science, acceleration (a) is defined as the rate of change (or derivative with respect to time) of velocity. It is thus a vector quantity with dimension length/time.

### accuracy

A measurement that is referenced to a known standard.

### ADC

An Analog-to-Digital Converter (abbreviated ADC, A/D or A to D) is an electronic circuit that converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (DAC).

*See also:* “DAC” on page 6.

### ATX

Advanced Technology Extended (ATX) refers to a computer-industry standard for a type of power supply.

### auto-install

Install a file automatically on a specific condition (for example, install a test group upon launching WinDyn).

### autotest

A scripted procedure or sequence of steps instructing the SuperFlow dynamometer to perform various commands. Usually executed and controlled automatically by the test system. Also known as a *test profile*.

### average

The sum of a data set divided by the number of items in the set (also known as *Mean*).

### AWD

Four-Wheel Drive (4WD, 4x4, four by four) and All-Wheel Drive (AWD) is a four-wheeled vehicle with a drivetrain that allows all four wheels to receive power from the engine simultaneously.

## B

### BDC

Bottom Dead Center (BDC) is the position of a piston where it is closest to the crankshaft.

*See also:* “BTDC” on page 4 and “TDC” on page 14.

### bell housing

The bell housing is part of the transmission system on a gasoline (also known as petrol) or diesel powered vehicle. It is bolted to the engine block and contains the flywheel and torque converter or clutch of the transmission. A starter motor is usually mounted on the bell housing using a ring gear on the flywheel.

### best fit line

The closest straight line fit to a given set of data points. Calculated from a least-squares approximation of the data set.



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## BMEP

The Mean Effective Pressure (MEP) is an estimate of the pressure exerted into the combustion chamber of an internal combustion engine. Brake MEP (BMEP) denotes dynamometer testing.

It is calculated by taking the torque exerted by the engine over one revolution for a two-stroke engine and two revolutions for a four-stroke engine and dividing it by its displacement.

BMEP is a useful comparison tool between different engines and is a good indicator of engine performance. It is important to remember that the values produced by the formula are for theoretical analysis only and do not reflect the actual pressures inside an individual combustion chamber.

## BSAC

Brake-Specific Air Consumption (BSAC) is an efficiency rating showing the amount of air consumed in pounds per horsepower hour.

## BSFC

Brake-Specific Fuel Consumption (BSFC) is an efficiency rating showing the amount of fuel consumed in pounds per horsepower hour.

## BTDC

Before Top Dead Center. Top Dead Center (TDC) is the datum point from which engine timing measurements are made. For example, ignition system timing is normally specified as degrees Before Top Dead Center (BTDC), although a very few small and fast-burning engines require a spark just After Top Dead Center (ATDC) such as the Nissan MA engine with hemispherical combustion chambers or hydrogen engines.

*See also:* “BDC” on page 3 and “TDC” on page 14.

## BTU

A British Thermal Unit (BTU) is a unit used to measure quantity of heat, defined as the quantity of energy necessary to raise the temperature of 1 lb. of water 1° Fahrenheit.

# C

## calibration

Calibration refers to the process of determining the relation between the output (or response) of a measuring instrument and the value of the input quantity or attribute—a measurement standard. In non-specialized use, calibration is often regarded as including the process of adjusting the output or indication on a measurement instrument to agree with the value of the applied standard within a specified accuracy.

## CAN

A Controller Area Network (CAN) is a broadcast, differential serial bus standard for connecting Electronic Control Units (ECUs). Specifically designed to be robust in electromagnetically noisy environments such as automotive, but is now used in industrial environments that may be subject to noise.

*See also:* “LAN” on page 9 and “WAN” on page 16.

## Cat-5

Category 5 Unshielded Twisted Pair (UTP) cabling used for connecting computer networks.

## Celsius (C)

Celsius: Of or relating to a temperature scale that registers the freezing point of water as 0° and the boiling point as 100° under normal atmospheric pressure.

*See also:* “F (Fahrenheit)” on page 7.

## CFA/CFD configuration file

WinDyn software configuration file. The .cfa file is the binary file that is sent to the data acquisition for use; the .cfd file is the editable (non-compiled) file.

*See also:* “configuration file” on page 5 and “DEFTool” on page 6.

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## cfm

When manufacturers list performance for blowers and compressors, it is stated as “Capacity” in cfm (cubic feet per minute). This refers to the volume of air at the inlet to the unit; therefore, it is often referred to as inlet cfm (icfm) or actual cfm (acfm). The terms cfm, acfm, and icfm are used interchangeably and mean basically the same thing.

## channel order

Defines which data channels (out of all available channels) WinDyn will display and plot when viewing stored test data.

## chassis dynamometer

A test system which uses a set of rolls (that are driven by the wheels of a vehicle under test), connected to a type of power absorber capable of controlling the load applied to the rolls.

These dyno’s do not account for power losses in the drivetrain such as the gearbox, transmission, or differential, etc.

*See also:* “dynamometer” on page 7 and “engine dynamometer” on page 7.

## CID

Cubic Inch Displacement. Engine displacement is defined as the total volume of air/fuel mixture an engine can draw in during one complete engine cycle; it is normally stated in cubic centimeters, liters or cubic inches. In a piston engine, this is the volume that is swept as the pistons are moved from Top Dead Center (TDC) to Bottom Dead Center (BDC).

## cm

A centimeter (cm) is a unit of length equal to one hundredth of a meter, the current International System of Units (SI) base unit of length.

*See also:* “m (meter)” on page 10 and “mm” on page 11.

## cmH<sub>2</sub>O

A centimeter of water or cmH<sub>2</sub>O is used to determine pressures during mechanical ventilation.

It is defined as the pressure exerted by a column of water of 1 cm in height at 4 °C (temperature of maximum density) at the standard acceleration of gravity.

1 cmH<sub>2</sub>O = 98.0638 pascals

*See also:* “H<sub>2</sub>O” on page 8, “inH<sub>2</sub>O” on page 9, and “Pascal” on page 12.

## Column Averages

A WinDyn window that shows the column averages, minimums, or maximums for a particular data range. The information shown is for the currently displayed page of test data. The values can be printed by selecting the appropriate item in the Print Setup dialog box.

## configuration file

The configuration file is the master file for all SuperFlow data acquisition systems which utilize the WinDyn™ program.

The configuration file exists in two formats: \*.CFD and \*.CFA. The CFD format is the editing format used as data is entered and modified. The CFA format is the “absolute” compiled version of the CFD format and is the actual file installed in the data acquisition system.

*See also:* “CFA/CFD configuration file” on page 4.

## Control

Configures the Proportional, Integral, and Derivative (PID) closed-loop control system for SuperFlow data acquisition systems. The file extension is .ccp.

*See also:* “PID” on page 12.

## conversion factor

A number used to convert units to a different reference of units such as converting inches to feet, feet to miles, or hours to seconds.

## correction factor

A number used to arithmetically correct data to a recognized and defined standard.

---

## CPU

The Central Processing Unit (CPU) is the component in a digital computer that interprets computer program instructions and processes data. Sometimes referred to as the processor or central processor, the CPU is where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor.

## CSV

The Comma-Separated Value (CSV) file is a common file format that stores tabular data (like in a Microsoft® Excel® spreadsheet). The format is old, dating back to the days of mainframe computing. For this reason, CSV files are common on all computer platforms. For more information, refer to Microsoft online Help.

## current test

Test data currently recorded in the data acquisition system's memory. Data is temporary and is erased when a new test is started or when power is turned off.

*See also:* "saved test" on page 13.

# D

## D (diameter)

In geometry, a diameter (D) of a circle is any straight line segment that passes through the center and whose endpoints are on the circular boundary, or, in more modern usage, the length of such a line segment.

## DAC

- **Data Acquisition and Control:** Gathering and analyzing information, making a decision based upon that analysis, and then acting accordingly (*See also:* "DACs" on page 6).

- **Digital-to-Analog Converter:** In electronics, a DAC is a device for converting a digital (usually binary) code to an analog signal (current, voltage or electric charge). Digital-to-analog converters are interfaces between the abstract digital world and analog real life.

The reverse operation is performed by an analog-to-digital converter (ADC).

*See also:* "ADC" on page 3.

## DACS

A Data Acquisition Control System is a network of sensors and actuators governed by a controlling application. On SuperFlow systems, this application is often referred to as the "sensor box."

## decibel (dB)

A dimensionless, logarithmic unit of measurement used for expressing ratios. Decibels are useful for measurements in acoustics, physics, electronics, and other disciplines. A decibel is one tenth of a bel (B).

## DEF

A SuperFlow WinDyn™ configuration (channel DEFinition).

## DEFTool

The SuperFlow WinDyn Configuration Utility program used to view the CFD file.

*See also:* "CFA/CFD configuration file" on page 4.

## DIN

Deutsches Institut für Normung (DIN; in English, the German Institute for Standardization) is the German national organization for standardization.

DIN and mini-DIN connectors, as well as DIN rails, are several examples of older DIN standards used around the world today.

## displacement

A change of position.

*See also:* "CID" on page 5 and "velocity" on page 16.

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## display file

A WinDyn file that configures real-time current data displays on the computer monitor. Each display consists of one or more screens; each screen consists of one or more instruments.

*See also:* “screen group” on page 13.

## DPDT/DPST

Double-Pole, Double-Throw (DPDT) or Double-Pole, Single-Throw (DPST) describes a switch or relay that can throw or make electrical contact with two separate stationary contacts.

## DRAM

Dynamic Random Access Memory (DRAM) is a type of memory used in most computers.

*See also:* “EPROM” on page 7, “RAM” on page 12, “ROM” on page 13, and “SRAM” on page 14.

## dynamometer

A dynamometer (dyno) is a machine used to measure torque and rotational speed (rpm) from which power produced by an engine, motor, or other rotating prime mover can be calculated.

*See also:* “chassis dynamometer” on page 5 and “engine dynamometer” on page 7.

# E

## EC (eddy current)

An eddy current is caused by a moving magnetic field intersecting a conductor or vice-versa.

## ECE

The Economic Commission for Europe (ECE) was established to encourage economic cooperation among its member States.

## EMS

Emergency Stop (EMS) is a SuperFlow feature that disables an engine from running.

## engine dynamometer

An engine dynamometer measures power and torque directly from the engine's crankshaft (or flywheel), when the engine is removed from the vehicle.

*See also:* “dynamometer” on page 7 and “chassis dynamometer” on page 5.

## EPROM

An Erasable Programmable Read-Only Memory (EPROM) is a type of nonvolatile computer memory chip that retains its data when its power supply is switched off. It is an array of floating gate transistors individually programmed by an electronic device that supplies higher voltages than those normally used in electronic circuits.

*See also:* “DRAM” on page 7, “RAM” on page 12 and “ROM” on page 13, and “SRAM” on page 14.

## Ethernet

Ethernet is a large and diverse family of frame-based computer networking technologies for Local Area Networks (LANs). It defines a number of wiring and signaling standards for the physical layer, two means of network access at the Media Access Control (MAC)/Data Link Layer, and a common addressing format.

*See also:* “LAN” on page 9.

# F

## F (Fahrenheit)

Fahrenheit (measured in degrees) is a temperature scale where the freezing point of water is 32 degrees Fahrenheit (32°F) and the boiling point is 212 degrees, placing the boiling and freezing points of water exactly 180 degrees apart. Negative 40 degrees Fahrenheit (-40 °F) is equal to negative 40 degrees Celsius (-40 °C).

*See also:* “calibration” on page 4.

## force

In physics, force is an influence that may cause a body to accelerate. Force may be experienced as a lift, a push, or a pull and has a magnitude and a direction. The actual acceleration of the body is determined by the vector sum of all forces acting on it (known as net force or resultant force). In an extended body, it may also cause rotation or deformation of the body. Rotational effects and deformation are determined respectively by the torques and stresses that the forces create.

*See also:* “torque” on page 15, and “work” on page 16.

## ft-lb

The foot-pound force ( $\text{ft}\cdot\text{lb}_f$ ) is an English unit of work or energy (frequently abbreviated to foot-pounds). Foot-pound force is the name given as the unit of measure for “kinetic energy” equation.

When using torque setting for a torque wrench, such as a specification for tightening a fastener, use the engineering units of ft-lb.

*See also:* “torque” on page 15 and “lb-ft” on page 10.

## ft<sup>3</sup>/sec

A cubic feet per second (also cfs and  $\text{ft}^3/\text{s}$ ) is an Imperial unit/U.S. customary unit volumetric flow rate, which is equivalent to a volume of 1 cubic foot flowing every second.

# G

## gpm

gallons per minute

## group name

Network name used to designate several devices on the network as part of a common group. Each device that shares the common name is part of the same group.

*See also:* “node name” on page 11.

# H

## H<sub>2</sub>O

Water (Hydrogen and Oxygen)

Freezing point 0°C (32°F); boiling point 100°C (212°F); specific gravity (4°C) 1.0000; weight per gallon (15°C) 8.338 pounds (3.782 kilograms).

## hardware

Hardware is the general term that is used to describe physical artifacts of a technology.

It can be equipment such as fasteners, keys, locks, hinges, latches, corners, handles, wire, chains, plumbing supplies, tools, utensils, cutlery and machine parts.

In the computer industry, hardware refers to computer equipment such as Central Processing Units (CPUs), disks, disk drives, display screens, keyboards, printers, boards, and chips.

*See also:* “software” on page 14.

## Help file

Instructions and other information accessed on a computer. The file extension is .hlp.

Many programs come with the instruction manual or a portion of the manual integrated into the program. To access online documentation in most programs using Microsoft Windows®, press the **F1** function key.

## hill simulation

A special autotest used to simulate hill conditions while driving on a flat test track. Typically used in towing dynamometer applications.

## hp

The horsepower (hp) is a non-metric unit of power listing the maximum rate of power application of internal-combustion engines.

The English horsepower is defined in terms of ft-pound force.

1 watt (W) = ~ 44.253 728 96 ft·lbf/min

1 horsepower (hp) (Imperial mechanical) = 33000 ft·lbf/min = 550 ft·lbf/s

*See also:* “lb-ft” on page 10.

---

# I

## icfm

inlet cubic feet per minute

*See also:* “cfm” on page 5.

## IDE

An Integrated Drive Electronics (IDE) interface is an interface for mass storage devices in which the controller is integrated into the disk or CD-ROM drive.

## inertia

The property of matter which requires a force to be exerted upon it to change either its position or motion.

## inH<sub>2</sub>O

Inches of water is a unit of measurement for pressure. It is expressed as the pressure required to displace a quantity of liquid in a fixed or given area, i.e., a tube or manometer.

*See also:* “H<sub>2</sub>O” on page 8 and “inH<sub>2</sub>O” on page 9.

## in/Hg

Inches of mercury (inHg, in/Hg, or Hg) is a unit for pressure. It is defined as the pressure exerted by a column of mercury of 1 inch in height at 32 °F (0 °C) at the standard acceleration of gravity.

1 inHg = 3,386.389 pascals at 0°C

*See also:* “calibration” on page 4 and “Pascal” on page 12.

## install

Load a file into the test system to use.

## install, save, exit

Install a file into the test system, save changes, and exit the current program editor.

## instrument

A virtual measurement device (such as an analog meter or bar graph) that displays on the computer monitor and shows data in real-time. Also called a *screen object*.

# ISA

Industry Standard Architecture (ISA) was a computer bus standard for IBM®-compatible computers

# K

## km

A kilometer (km) is a unit of length that is equal to 1,000 meters, the current International System of Units (SI) base unit of length.

## kPa

Kilo Pascal is a unit of pressure: 1 kPa is approximately the pressure exerted by a 10-g mass resting on a 1-cm<sup>2</sup> area. 101.3 kPa = 1 atm. There are 1000 pascals in 1 kilo pascal.

*See also:* “Pascal” on page 12.

## kW

A kilowatt (kW) is a unit of power equal to 1,000 watts. A watt (W) is the International System of Units (SI) derived unit of power, equal to one joule per second. One joule is the work done or energy required to exert a force of one newton for a distance of one meter.

*See also:* “N-m” on page 11 and “newton” on page 11.

# L

## LAN

A Local Area Network (LAN) is a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings and connect workstations and computers. However, one LAN can be connected to other LANs over any distance through telephone lines and radio waves. A system of LANs connected in this way is called a Wide-Area Network (WAN).

*See also:* “Ethernet” on page 7, “NetBEUI” on page 11, “NetBIOS” on page 11, “CAN” on page 4, and “WAN” on page 16.



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## lb-ft

When torque is generated by an engine *and* absorbed and measured by SuperFlow dynamometer systems, the engineering units are in lb-ft (pound-feet).

*See also:* “force” on page 8, “ft-lb” on page 8, and “N-m” on page 11.

## LCD

A Liquid Crystal Display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.

## L/D ratio

**Length-to-diameter (L/D) ratio** is a frequently used engineering relationship.

In aerodynamics, the **lift-to-drag (L/D) ratio** is the amount of lift generated by a wing, compared to the drag it creates by moving through the air.

Both concepts can be applied when referring to lift-to-valve-diameter ratio.

## LED

A Light-Emitting Diode (LED) is a semiconductor device that emits incoherent narrow-spectrum light when electrically biased in the forward direction.

## l/s

Liters per second is a type of flow measurement used to quantify bulk fluid or gas movement.

## Limits or Safety Limits

A WinDyn program that monitors selected channels and reacts to trip values on those channels.

## linearize

To associate a non-linear function (such as temperature) with a measured linear parameter (such as voltage).

## lpm

Liters per minute is a type of flow measurement used to quantify bulk fluid or gas movement.

# M

## m (meter)

The meter (m) is a measure of length. It is the basic unit of length in the metric system and in the International System of Units (SI) used around the world for general and scientific purposes. This is approximately the distance from floor to hip on the average barefoot man.

*See also:* “cm” on page 5 and “mm” on page 11.

## m<sup>3</sup>/sec

A cubic meter per second (m<sup>3</sup>/sec, m<sup>3</sup> s<sup>-1</sup>, m<sup>3</sup>/s) is a derived International System of Units (SI) unit of flow rate equal to that of a cube with sides of one meter (1000 mm; 39.37 in) in length exchanged or moving each second. It is popularly used for water flow, especially in rivers and streams, and fractions for Heating, Ventilation, Air Conditioning (HVAC) values measuring air flow.

## mag/TTL

The term magnetic/Transistor-Transistor Logic (mag/TTL) refers to a low-level signal typical of magnetic sensors. The TTL signal is optimum 0–5 VDC. Mag and TTL are two different types of low-level signals.

## margin of error

A specific index that is beyond or less than the minimum acceptable number.

## MDI-X

Medium Dependent Interface-X (crossed): crossover 10Base-Tx Ethernet interface connector.

## MDX

Multi-channel Data Exchange: normal 10Base-Tx Ethernet interface connector.

## mean

The sum of a data set divided by the number of items in the set (also known as *average*).

## micron or micrometer (μm)

One millionth of a meter

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## mm

A millimeter (mm) is one thousandth of a meter, the International System of Units (SI) base unit of length.

*See also:* “cm” on page 5, “m (meter)” on page 10, and “micron or micrometer (mm)” on page 10.

## m/s

Milliliters per second is a type of flow measurement used to quantify bulk fluid or gas movement.

# N

## N-m

A Newton-meter (N-m) is a compound unit of torque corresponding to the torque from a force of one newton applied over a distance arm of one meter.

(A newton is the amount of force required to accelerate a body with a mass of one kilogram at a rate of one meter per second squared).

*See also:* “lb-ft” on page 10.

## NetBEUI

Pronounced *net-boo'-ee*, NetBIOS Extended User Interface (NetBEUI) is an enhanced version of the NetBios protocol used by Microsoft Windows networking.

It is a non-routable protocol, which means computers not located on the same network segment or subnet cannot communicate.

*See also:* “Ethernet” on page 7, “LAN” on page 9, and “NetBIOS” on page 11.

## NetBIOS

Network Basic Input/Output System. An application-programming interface used to implement data exchange between computer nodes usually connected through a Local Area Network (LAN).

*See also:* “Ethernet” on page 7, “LAN” on page 9, and “NetBEUI” on page 11.

## newton

A newton (N) is the amount of force required to accelerate a mass of one kilogram (Kg) at a rate of one meter per second squared.

$$1 \text{ N} = 1 \text{ Kg X m/s}^2$$

*See also:* “N-m” on page 11 and “Pascal” on page 12.

## NGE

New Generation Electronics: a SuperFlow data acquisition and control system for dynamometers.

*See also:* “chassis dynamometer” on page 5, “dynamometer” on page 7, and “engine dynamometer” on page 7.

## NIC

Network Interface Card. Provides the required hardware support for network communications. Typically inserted into one of the computer card slots or CCA1ptop slots.

## node name

Network name of an individual device.

*See also:* “group name” on page 8.

# O

## O.D.

Outside Diameter

## OEM

Original Equipment Manufacturer

## ohm

The ohm (symbol:  $\Omega$ ) is the SI unit of electrical impedance or, in the direct current case, electrical resistance.

## overlay

Graphically compare two or more sets of test data.



---

# P

## Pascal

The Pascal (Pa) is the International System of Units (SI) derived unit of pressure or stress. It is equivalent to one newton per square meter.

*See also:* “newton” on page 11.

## PCB

In electronics, Printed Circuit Boards (PCBs) are used to mechanically support and electrically connect electronic components using conductive pathways, or traces, etched from copper sheets laminated onto a non-conductive substrate.

Alternative names are printed wiring board (PWB), etched wiring board, and switchboard. After populating the board with electronic components, a printed circuit assembly (PCA) is formed.

## PCI

The Peripheral Component Interconnect, or PCI Standard, specifies a computer bus for attaching peripheral devices to a computer motherboard. These devices can take any of the following forms:

- An *integrated circuit* fitted onto the motherboard itself, called a *planar device* in the PCI specification.
- An *expansion card* that fits in sockets.

The PCI bus is common in modern computers, where it has displaced ISA and VESA Local Bus as the standard expansion bus, but it also appears in many other computer types. The bus will eventually be succeeded by PCI Express, which is standard in most new computers and other technologies.

## percentage of error

The theoretical value minus the actual value divided by the actual value times 100.

## PID

A Proportional, Integral, and Derivative (PID) controller is a common feedback loop component in industrial control systems.

*See also:* “Control” on page 5.

## probable error

A term that can be defined with mathematics and is directly related to the number of samples taken.

## psi

The pound-force per square inch (lbf/in<sup>2</sup>) is a unit of pressure based on avoirdupois units. In casual English language use, it is rendered as “pounds per square inch” (psi) with little distinction between “mass” and “force.”

# R

## RAM

Random Access Memory (RAM) is a type of volatile computer memory in the form of integrated circuits that can be accessed randomly in any order. RAM is the most common type of memory found in computers and other devices such as printers.

*See also:* “DRAM” on page 7, “EPROM” on page 7, “ROM” on page 13, and “SRAM” on page 14.

## receive

Retrieve (download) a file from the test system and save it to a computer disk.

## real-time data

Data displayed as it occurs.

## repeatability

A test that readily duplicates another test under the same conditions.

## RJ-45

Registered Jack-45. An eight-wire connector used in networking) when Cat-5 (Category 5) Unshielded Twisted Pair (UTP) cables are used.

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## ROM

Read-Only Memory (ROM) is prerecorded nonvolatile computer memory. Once data is written onto a ROM chip, it cannot be removed and can only be read.

Unlike RAM, ROM retains its contents even when the computer is turned off.

*See also:* “DRAM” on page 7, “EPROM” on page 7, “RAM” on page 12, and “SRAM” on page 14.

## rpm

Revolutions per minute (rpm) is a unit of frequency commonly used to measure rotational speed – particularly in the case of rotation around a fixed axis. It represents the number of full rotations an object makes in one minute.

# S

## SAE

SAE International is the Society of Automotive Engineers (SAE), a professional organization for mobility engineering professionals in aerospace, automotive, and the commercial vehicle industries. The Society is a standards development organization for engineering powered vehicles of all kinds, including cars, trucks, boats, aircraft, and others.

## saved test

Test data saved in a file on a computer disk.

*See also:* “current test” on page 6.

## screen

One of the available windows in a single WinDyn screen group.

## screen group

A WinDyn file that configures real-time current data displays on the computer monitor. Each screen group consists of one to ten screens; each screen consists of one or more instruments. Screen groups have a CDF extension.

## screen object

A virtual measurement indicator (for example, meter, bar graph, strip chart, etc.) located on a WinDyn screen. Also called an instrument.

## serial port

In computing, a serial port is a serial communication physical interface through which information transfers in or out one bit at a time (contrast parallel port).

While such interfaces as Ethernet, FireWire, and USB all send data as a serial stream, the term “serial port” usually identifies hardware more or less compliant to the RS-232 standard, intended to interface with a modem or with a similar communication device.

For the most part, the USB interface has replaced the serial port.

*See also:* “USB” on page 15.

## servo

A servomechanism, usually shortened to servo, is a power-driven mechanism that automatically controls the performance of a machine.

## set point

A value to which a controller attempts to maintain.

## SIMM

Single In-line Memory Module is a small circuit board that can hold a group of memory chips. Typically, SIMMs hold up to eight (MacIntosh) or nine (PC) RAM chips. SIMMs are measured in bytes rather than bits.

*See also:* “DRAM” on page 7, “EPROM” on page 7, “RAM” on page 12, “ROM” on page 13, and “SRAM” on page 14.

---

## software

Software (or a software program) enables a computer to perform specific tasks, as opposed to the physical components of the system (hardware). This includes application software such as a word processor, which enables a user to perform a task, and system software, such as an operating system, which enables other software to run properly by interfacing with hardware and with other software or custom software made to user specifications.

*See also:* “hardware” on page 8.

## specification

- Specifications (also known as constants) are set values associated with a particular engine, vehicle, or test. For example, engine bore and stroke are parameters associated with an engine and are used to calculate other values. Another example are Lower and Upper speeds used in an automated test. A specification file is used to enter all the specifications simultaneously. Specification files have a .cst extension.
- A technical description of the construction or requirements for a product or device. In general, specifications are in the form of written descriptions, drawings, prints, commercial designations, industry standards, and other descriptive references.

## SRAM

Static Random-Access Memory (SRAM) is a type of memory that is faster and more reliable than the more common DRAM (Dynamic RAM). The term static is derived from the fact that it doesn't need to be refreshed like DRAM.

*See also:* “DRAM” on page 7, “EPROM” on page 7, “RAM” on page 12, and “ROM” on page 13.

## SWED

The SWitch EDitor (SWED) file configures the front panel switches for SuperFlow data acquisition systems that include a relay box.

## switch configuration

Specifies the function of a system's switches, relays, and digital input/output (I/O). Switch files have .sca (editable) and .scf (compiled) file name extensions. The program that defines a switch configuration is called SWED.

# T

## TCP/IP

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. It can also be used as a communications protocol in a private network (either an intranet or an extranet).

## TDC

Top Dead Center (TDC) is the position of a piston where it is furthest from the crankshaft.

*See also:* “BDC” on page 3 and “BTDC” on page 4.

## test averaging

WinDyn can mathematically average the data from multiple tests into a single data file. The averaged data may then be displayed, plotted, and printed like any other data file.

## test data

The recorded information from an AutoTest saved to memory or a computer disk.

## test description

User notes describing a test and saved with the test data.

## test group

Comprises a set of system files including a configuration, screen group, channel order, etc. Used to quickly configure the system for a specific application or series of tests. Test group files have a .tgp extension.

## test system

A test system normally consists of a data acquisition and control system, a dynamometer, and a number of sensors. The test system is responsible for controlling and measuring the vehicle or engine under test.

---

## thermocouple

A thermocouple is a sensor for measuring temperature. It consists of two dissimilar metals, joined together at one end. When the junction of the two metals is heated or cooled, a voltage is produced that can be correlated to the temperature. Thermocouple alloys are commonly available as wire.

## torque

A twisting force, expressed in pounds-feet (lbs-ft). In physics, torque (or often called a moment) can informally be thought of as “rotational force” or “angular force” which causes a change in rotational motion.

*See also:* “force” on page 8 and “work” on page 16.

## towing dynamometer

A trailer- type test system towed behind a vehicle. The dynamometer installed in the trailer loads the engine by applying a measured pulling force to the draw bar of the vehicle. The draw bar pull is often programmed as a hill simulation while driving on a flat test track.

## TPF

Test Profile. Also referred to as an autotest.

## TPS

A Throttle Position Sensor (TPS) is a sensor used to monitor the position of the throttle in an internal combustion engine. The sensor is usually located on the butterfly spindle so it can directly monitor the position of the butterfly throttle valve.

The sensor is usually a potentiometer and therefore provides a variable resistance dependent upon the position of the butterfly valve (and hence throttle position).

## TTL

Transistor-Transistor Logic (TTL) is a class of digital circuits built from Bipolar Junction Transistors (BJTs) and resistors. It is called transistor-transistor logic because both the logic gating function (e.g., AND) and the amplifying function are performed by transistors.

# U

## μm (micron or micrometer)

One millionth of a meter

## undefined channel

A configuration channel that has not been assigned a purpose. Initially, all configuration channels are “undefined.” Deleting any channel from a configuration causes it to become undefined.

## unique name

A network name that uniquely identifies a device on the network.

*See also:* “node name” on page 11.

## USB

Universal Serial Bus (USB) is an external bus standard that supports data transfer rates of 12 Mbps. A single USB can be used to connect up to 127 peripheral devices such as mice, modems, and keyboards. USB also supports plug-and-play installation and hot plugging.

*See also:* “serial port” on page 13.

## UPS

Uninterruptible Power Supply. A UPS (sometimes called a battery backup) is a device which maintains a continuous supply of electric power to connected equipment by supplying power from a separate source when utility power is not available

# V

## VDC/VAC

VDC is a three-letter abbreviation with multiple meanings; the most common is Volts (V) of continuous current (Direct Current – DC). VAC stands for Volts of Alternating Current.

---

## **velocity**

The velocity of an object is its speed in a particular direction. Velocity can also be defined as rate of change of displacement or just as the rate of displacement. It is a vector physical quantity with dimension  $LT^{-1}$ .

*See also:* “displacement” on page 6.

## **VFD**

A Vacuum Fluorescent Display (VFD) is a type of display used primarily on consumer-electronics equipment such as video cassette recorders and microwave ovens. Unlike Liquid Crystal Displays (LCDs), a VFD emits a very bright light with clear contrast and can easily support display elements of various colors.

# **W**

## **WAN**

A Wide Area Network (WAN) is used to connect Local Area Networks (LANs) and other types of networks together so users and computers in one location can communicate with users and computers in other locations.

*See also:* “LAN” on page 9 and “CAN” on page 4.

## **WinDyn™**

SuperFlow Technologies Group’s dynamometer software package.

## **work**

Work is the quantity of energy transferred from one system to another. In a typical measurement system, work is gauged in joules. The rate at which work is performed is power.

*See also:* “force” on page 8 and “torque” on page 15.



# Index

## Symbols

10Base-T  
network cable, 8-7

## A

Acceleration test data  
ProFilter, 4-14

Access features  
individual, 4-23

Acquiring data/disk space  
test profile data management, 13-8

Actions  
alarms and warnings, 6-17, 6-19  
controller, 13-23, 13-25

Activating  
test setup selections, 3-16

Adding  
background images, 12-26  
customer files to data pack, 4-10  
existing data files to database, 9-13  
files to database, 5-43  
new data files to database, 9-12  
picture to test record, 9-11  
users to password system, 4-22

Adjusting  
data filter  
record command, 13-32  
ProFilter  
record command, 13-33

Advanced examples  
Limits application, 6-28

Alarms  
actions, 6-19  
audible, 6-20  
auto, 6-14  
protection levels, 6-16

Alert Operator  
display command, 13-40

All channels  
zeroing, 4-5

Analog meters  
designing, 12-12

Analyze menu  
functions, 2-13

Analyzing data, 2-17, 3-20

Annotations  
selecting, 12-8

Applications  
WinDyn limits, 6-4

Assigning user passwords, 4-22

Attaching test description notes, 3-16, 5-12

Atypical comparisons  
comparing test data, 5-34

Audible alarm  
limits action, 6-20

Auto alarms  
channel properties, 6-14

Auto-incrementing file names, 2-20, 3-11

Autoloading test groups  
system preferences, 4-3

Automatic limits protection, 6-20

Autotest  
defined, 2-3

Autozeroing sensors, 4-4, B-9

Averaging test data  
by columns, 5-40  
from multiple tests, 5-41

## B

Background images  
adding, 12-26

Backing up files, 2-21

Backups  
screen group file, 1-7

Bar graphs  
designing, 12-14

Basic examples  
Limits application, 6-24

Bitmaps  
adding background image, 12-26

Boolean equations  
switches, 15-9

Branches  
test profile commands, 13-44

Buttons  
database navigation, 9-4  
Display Editor, 12-5  
playback, 4-13  
Stored Data Viewer, 5-5  
test setup, 3-10  
toolbars, 2-15

---

## C

### Cables

- coax network, 8-8
- installing WComNet network, 8-6
- MDI/MDIX, 8-7

### Calculated channels

- configuring, 11-19
- determining numbers, B-13
- editing, B-13
- function, 11-6
- modifying, B-12
- saving changes, B-13
- test
  - (compare) operator, 11-7
  - Fetch (F) operator, 11-8

### Calculation dependencies

- viewing, 7-6

### Calculations

- Configuration Utility, 7-4
- searching for channels, 7-8
- showing channel names, 7-7

### Calibrating

- channels, 4-4
- sensors, 4-4

### Calibration

- coefficients
  - changing, A-7
  - defined, 2-3
- files
  - corrupt, A-6
  - creating, A-3
  - function, A-3
  - saving, 4-6
  - using, A-5

### CALL

- branch command, 13-45

### CALL EXTERNAL TEST

- branch command, 13-46

### Cancel all WHEN requests, 13-57

### Capture post-mortem action

- limits action, 6-21

### Cat-5 WComNet cable, 8-6

### Changing

- calibration coefficients, A-7
- default channel order, B-10
- handheld and console displays, B-14
- user passwords, 4-22

### Channels

- calculated, 11-6, 11-19
  - determining, B-13
  - editing, B-13
  - modifying, B-12
  - saving changes, B-13
- calibrating, 4-4
- changing specifications, 5-45

### data

- defining, 11-12
- default order
  - changing, B-10
- filtering, 5-44
- ignore limits, 6-21
- interpolation tables, 11-8
- list
  - limits monitoring, 6-11
- maximums
  - viewing, 5-32
- measured, 11-4
  - sensors, 11-14
- names
  - showing calculations, 7-7
- order
  - defined, 2-3
  - determining, 3-6
  - Stored Data Viewer, 5-9
- properties
  - auto alarms, 6-14
  - enable limit, 6-15
  - ignore limits when, 6-15
  - safety limits, 6-13
  - trip delays, 6-14
- reference, 5-41
- searching calculations, 7-8
- selecting, 12-6
- specification, 11-6, 11-17
- system, 11-8
- types
  - configuring, 11-4
- viewing all defined, 7-5
- zeroing, 4-5
  - sensors, 3-19

### Charts

- strip, 12-22
- X-Y graphs, 12-16

### Checking test

- data file path, B-7
- notes, B-8
- specification values, B-8

### Closing Stored Data Viewer, 5-11

### Coax network cabling, 8-8

### Code

- test profile example, 13-58

### Coefficients

- calibration, 2-3
- changing calibration, A-7

### Color

- plots, 5-28
- ranges
  - selecting, 12-7

### Columns

- averaging test data, 5-40
- definitions
  - limits channels, 6-12



- 
- Columns (*continued*)
    - limit lists, 6-13
    - reports
      - WinDyn database, 9-16
  - Command master
    - functionality, 8-12
    - items affected, 8-12
    - known deficiencies, 8-13
    - purpose, 8-11
    - setting, 8-11
  - Commands
    - branches, 13-44
    - CALL, 13-45
    - CALL EXTERNAL TEST, 13-46
    - controller action, 13-25
    - display, 13-36
    - entry
      - test profile, 13-17
    - GOTO, 13-44
    - grouping
      - controller action, 13-26
    - limits, 13-41
    - PAUSE, 13-47
    - plot mouse and keyboard, 5-33
    - record, 13-32
    - REPEAT, 13-46
    - RETURN, 13-46
    - STOP, 13-47
    - switch, 13-42
    - Switch Editor, 15-6
    - test
      - profile, 13-20
    - values, 13-47
    - WAIT, 13-46
  - Comments
    - database field descriptions, 9-9
    - recording, 13-35
  - Communication
    - configuring WComNet, 8-3
    - connecting to a house network, 8-4
    - NetBEUI, 2-11, 8-9
    - WinDyn
      - troubleshooting, C-6
  - Company header and logo
    - test data display, 3-14
  - Compare mode
    - plot setting, 5-19
  - Comparing
    - test data, 5-34
      - atypical comparisons, 5-34
      - numerically, 5-35
      - overlying tests, 5-34
    - plot
      - difference, 5-35
      - percent change, 5-35
  - Compatibility
    - SuperFlow Explorer, 3-25
  - Components
    - executable, 10-4
    - non-executable, 10-6
    - WComNet, 8-6
  - Computers
    - connecting multiple, 8-11
    - display message, 13-38
    - requirements, 1-3
    - WinDyn settings, 2-11
  - Concise reports
    - WinDyn database, 9-14
  - Configuration
    - assignment in test profiles, 13-13
    - changes
      - saving, 11-30
    - display
      - customizing, 7-7
    - editor
      - purpose, 11-3
    - file path
      - setting, B-12
    - files
      - backing up, 2-21
      - designing, 11-10
      - extensions, 10-3
      - file relationships, 10-9
      - function, 2-3
      - installing, 11-31
    - information
      - viewing, 7-3
    - Limits information pane, 6-23
    - metric, 11-31
    - modified
      - reinstalling, B-14
    - opening, B-13
    - summary
      - viewing, 7-6
  - Configuration Editor
    - displaying, B-13
    - exiting, B-13
  - Configuration Utility
    - customizing configuration display, 7-7
    - printing channels, 7-8
    - purpose, 7-3
    - searching configuration, 7-8
    - troubleshooting, C-5
  - Configuring
    - calculated channels, 11-6, 11-19
    - channel types, 11-4
    - column report, 9-16
    - concise report, 9-14
    - digital relay switches, 12-24
    - dynamometer
      - test groups, 3-3



- 
- Configuring (*continued*)
    - interpolation tables, 11-21
    - measured sensor channels, 11-14
    - meters, 12-12
    - password system, 4-21
    - plot settings, 5-19
    - specification channels, 11-17
    - status indicator, 12-23
      - with switches, 12-25
    - strip charts, 12-22
    - tabular display, 12-10
    - test
      - description, 13-15
      - system, 8-4
    - tools, 4-7
    - WComNet communications, 8-3
    - WinDyn, 8-9
      - system, 2-9
      - users, 4-22
    - X-Y graphs, 12-16
  - Connecting multiple WinDyn computers, 8-11
  - Considerations
    - test profiles, 13-6
  - Console
    - display
      - changing, B-14
    - display message, 13-36
    - enter soft key labels, 13-39
    - erase
      - message, 13-38
      - soft key labels, 13-39
    - input request line
      - displaying, 13-39
      - erasing, 13-39
    - scroll message, 13-38
  - Console data screens
    - designing, 11-24
  - Constants
    - specification channels, 3-17
  - Control
    - commands
      - custom settings, 13-30
      - enter set point, 13-28
      - ramp with mode change, 13-29
    - device, 13-4
    - parameters
      - function, 2-3
    - system
      - designing, 11-27
      - setting up, 11-28
  - Control Panel
    - WinDyn, 4-6
  - Controller actions
    - command, 13-25
    - command grouping, 13-26
    - defined, 13-26
    - end ramp based on time, 13-25
    - mode persistence, 13-26
    - purpose, 13-23
    - table support, 13-26
  - Controller ramp, 13-29
  - Coolant temperature limit
    - Limits basic example, 6-26
  - Corrupt files
    - calibration, A-6
  - Counters
    - decreasing, 13-48
    - increasing, 13-48
    - setting, 13-48
    - test profiles
      - as used in IF command, 13-52
  - Creating
    - calibration files, A-3
    - switch files, 15-11
    - system log, 4-19
  - CSV files
    - exporting test data, 5-36
  - Current
    - data
      - defined, 2-3
    - test
      - playback data, 4-11
  - Custom
    - hard stop settings, 6-18
    - parameters
      - plot, 5-26
    - settings
      - ramp command, 13-30
    - titles
      - plot settings, 5-23
  - Customer
    - data pack
      - data files, 4-9
      - troubleshooting, C-5
    - files
      - adding to data pack, 4-10
  - Customizing
    - configuration display, 7-7
    - plots, 5-25
      - view, B-17
    - tools, 4-7
- ## D
- Data
    - acquisition, 13-8
      - activating setup, 3-16
      - calibrating and zeroing sensors, 4-4
    - analysis, 3-20
      - plotting test data, 3-15
      - system preferences, 2-17
    - averaging
      - multiple tests, 5-41
      - test columns, 5-40

- 
- Data (*continued*)
    - channels
      - defining, 11-12
      - smoothing, 5-44
      - test profiles
        - as used in WHEN command, 13-55
      - test profiles as used in
        - IF command, 13-52
    - current, 2-3
    - cursor
      - plot, 5-29
    - displays
      - operator interaction, 13-9
    - erasing, 13-32
    - exporting, 5-36
      - plot data, 5-38
    - file path
      - checking, B-7
    - files
      - adding to WinDyn database, 9-13
      - backing up, 2-21
      - customer data pack, 4-9
      - playback functions, 4-13
    - filters
      - adjusting, 13-32
      - measured channels, 11-4
    - in test profiles, 13-5
    - lines
      - record, 13-33
    - location
      - test data, 3-12
    - management
      - SuperFlow Explorer, 3-21
      - test profiles, 13-8
    - menu
      - playback, 4-12
    - pack
      - troubleshooting, C-5
    - play back test data, 4-11
    - post processing tests, 5-44
    - range
      - averaging test data by columns, 5-40
    - recorded
      - printing, 13-35
    - recording
      - monitoring number of lines in a
        - test profile, 13-53
    - saved, 2-3
    - screen
      - displaying
        - computer, 13-38
        - console, 13-39
    - screens
      - designing, 11-24
      - handheld controller, 11-26
    - tests, 5-34
      - plotting, 5-15
      - printing, 5-13
      - setting file name, B-7
      - viewing test data, 5-8
  - Data Acquisition and Display package
    - computer requirements, 1-3
  - Database
    - adding files, 5-43
    - deleting records, 9-14
    - field descriptions, 9-6
      - add picture, 9-11
      - drivetrain, 9-8
      - engine, 9-7
      - grid, 9-12
      - miscellaneous, 9-8
      - owner, 9-6
    - test
      - description, 9-9
      - device, 9-7
      - information, 9-10
      - transmission, 9-7
      - vehicle, 9-7
    - navigating, 9-4
    - reports, 9-14
    - searching, 9-17
    - sorting, 9-17
    - using WinDyn Database Manager, 9-6
  - Database Manager
    - troubleshooting, C-5
    - viewing record data, 9-5
  - Data-interval recording
    - record commands, 13-35
  - DataLib
    - WinDyn Database Manager, 9-3
  - Decrease counter
    - values command, 13-48
  - Default
    - access
      - password, 4-21
    - channel order
      - changing, B-10
    - stop
      - hard stop settings, 6-22
  - Definitions
    - limits
      - channel columns, 6-12
      - symbols, 6-11
    - remote screen, 7-7
  - DEFTool
    - Configuration Utility, 7-3
  - Delays
    - trip, 6-14
  - Deleting
    - record from WinDyn database, 9-14
    - users from password system, 4-21

- 
- Dependencies calculation, 7-6
  - Description
    - block
      - Set File Editor, 14-5
    - Limits information pane, 6-23
    - operands, 15-10
    - test profile, 13-15
  - Design menu
    - functions, 2-12
  - Designing
    - analog meters, 12-12
    - bar graphs, 12-14
    - console data screens, 11-24
    - control system, 11-27
    - screen objects, 12-5
    - SF-902, XConsole, and wireless
      - handheld screens, 11-25
    - strip charts, 12-22
    - test
      - groups, 3-4
      - screens, 12-3
    - X-Y graphs, 12-16
  - Determining
    - calculated channel number, B-13
    - operator interaction in test profiles, 13-9
  - Developing test profiles, 13-3
    - considerations, 13-6
  - Device control
    - test profile function, 13-4
  - Difference
    - plot, 5-35
  - Digital input
    - relays, 12-23
    - test profiles
      - as used in IF command, 13-53
      - as used in WHEN command, 13-56
  - Digital output
    - switch commands, 13-42, 13-43
  - Digital relay switches
    - configuring, 12-24
  - Disabling password system, 4-21
  - Disk space
    - acquiring, 13-8
    - computer requirements, 1-5
    - printing, 13-9
  - Display
    - messages
      - switches, 15-16
      - toggle switches with timers, 15-12
    - properties
      - computer, 2-11
      - WinDyn, 2-11
  - Display commands
    - alert operator, 13-40
    - display
      - computer data screen, 13-38
      - console data screen, 13-39
      - console input request line, 13-39
      - message on computer, 13-38
      - message on console, 13-36
  - Driver Trace
    - load drive cycle, 13-41
  - enter soft key labels
    - on console, 13-39
  - erase
    - console input request line, 13-39
    - console message, 13-38
    - soft key labels on console, 13-39
  - pause for operator input, 13-40
  - scroll console message, 13-38
  - start Driver Trace, 13-40
  - stop Driver Trace, 13-40
  - WinDyn Test profile, 13-36
- Display screens
    - selecting
      - annotations, 12-8
      - channels, 12-6
      - color ranges, 12-7
      - object styles, 12-9
      - objects, 12-5
  - Displayed channels
    - sorting and showing units, 7-7
  - Displaying
    - Configuration Editor, B-13
    - hidden files, 3-25
    - plot specification values, 5-30
    - real-time values
      - message on console, 13-37
    - WinDyn Control Panel, 4-6
  - Displays
    - changing handheld and console, B-14
    - data, 13-9
    - order
      - data channels, 5-9
    - Stored Data Viewer preferences, 5-6
    - Switch Editor full screen, 1-8
    - tabular, 12-10
    - use in test profiles, 13-5
  - DOS compatible
    - timer interval recording, 13-34
  - DOS editor
    - erratic mouse behavior, 1-8
  - Driver Trace
    - load drive cycle, 13-41
    - starting, 13-40
    - stopping, 13-40
  - Drivetrain
    - database field descriptions, 9-8
  - Dynamometers
    - configuring
      - test groups, 3-3
    - safety limits, 6-4

---

## E

- Edit menu
  - Switch Editor commands, 15-8
  - WinDyn Limits Editor, 6-9
- Editing
  - calculated channels, B-13
  - limit trip values
    - Quick-Edit mode, 6-12
  - screen mode preferences, 12-4
  - specifications, 3-17
  - test profile, 13-17
  - user password, 4-21
- Editing Control
  - toolbar buttons, 12-5
- Editor interface
  - test profiles, 13-3
- Else
  - test profiles as used in IF command, 13-54
- Enable limit
  - channel properties, 6-15
- Enabling password system, 4-21
- End ramp
  - based on time, 13-25
- Engine
  - controls
    - turn all off, 13-43
    - turn on/off, 13-42
  - database field descriptions, 9-7
  - speed limit
    - Limits basic example, 6-24
- Enhancing acceleration, 4-14
- Equations
  - switch syntax, 15-9
- Erase data
  - record command, 13-32
- Example
  - test profile, 13-58
- Executable components
  - software architecture, 10-4
- Exiting
  - Configuration Editor, B-13
  - Configuration screen, 11-30
- Explorer
  - SuperFlow, 3-21
- Exporting
  - data, 5-36
    - to CSV file, 5-36
  - multiple files
    - using ProExport, 5-36
  - plot
    - as graphic file, 5-37
    - data, 5-38
  - system log, 4-19
  - test data
    - using ProExport, 5-36
  - test profile text, 13-13

- Extensions
  - file name, 10-3

## F

- Features
  - added since WinDyn 2.3, 1-6
  - password protection, 4-20
  - Stored Data Viewer, 5-3
  - SuperFlow Explorer, 3-23
  - upgrading from older WinDyn version, 1-5
  - WinDyn
    - limits, 6-4
    - new features, 1-3
- Field descriptions
  - WinDyn database, 9-6
- File
  - directory
    - WinDyn setting, 2-11
  - extension reference
    - software architecture, 10-3
  - menu
    - Switch Editor commands, 15-6
    - WinDyn Limits Editor, 6-8
  - names
    - auto-incrementing, 2-20, 3-11
  - path
    - checking, B-7
  - properties
    - limits, 6-20
  - relationships
    - configuration file, 10-9
  - structure
    - WinDyn system, 10-8
- Files
  - backing up, 2-21
  - calibration, A-3
  - configuration, 2-3, 7-3
    - viewing, 7-3
  - corrupt calibration, A-6
  - installing specifications, 3-18
  - switch
    - creating, 15-11
- Filters
  - in measured data, 11-4
  - smoothing measured data channels, 5-44
- Fixed interval
  - interpolation tables, 11-22
- Fonts
  - plots, 5-28
- Full-screen display
  - Switch Editor, 1-8
- Function keys
  - SWED, 15-3
- Functions
  - switch, 15-12
  - test profile, 13-4

---

## G

Generating Set file reports, 14-12

Get safety limits

from computer, 13-41

GOTO

branch command, 13-44

Graphic files

exporting test data, 5-37

Graphs

bar, 12-14

shortcut keys, B-5

X-Y, 12-16

Grid

database field descriptions, 9-12

Group names

SuperFlowNet, 8-4

Grouping command, 13-26

Groups

screen, 2-3

test, 2-3

## H

Handheld

controller

data screens, 11-26

zeroing sensors, 3-20

display

changing, B-14

Hard stop

action settings, 6-17

Hardware

compatibility in test profiles, 13-13

installing components, 8-6

Headings

test reports, 2-16

Help menu

functions, 2-14

WinDyn Limits Editor, 6-10

Hidden files

SuperFlow Explorer, 3-25

How to

change

handheld and console displays, B-14

the default channel order, B-10

customize the plot view, B-17

modify a WinDyn calculated channel, B-12

remove WinDyn from computer, B-19

set up WinDyn to run a test, B-6

## I

IF (right now)

test profile use, 13-51

Ignore limits

channel properties, 6-15

selected channels, 6-21

Images

adding background, 12-26

Increase counter

values command, 13-48

Indicators

status, 12-23

with switches, 12-25

Individual access features

WinDyn, 4-23

Information

pane

Limits, 6-23

test profile, 13-18

ReadMe notes, 1-3

Input

digital, 12-23

function triggers

switches, 15-17

Installation

release notes, 1-5

Installing

configuration files, 11-31

specification files, 3-18

test groups, 3-4

WComNet

hardware components, 8-6

network card and cable, 8-6

WinDyn, 2-4

Instrumentation

designing configuration files, 11-10

Interaction operator, 13-9

Interface editor, 13-3

Interpolation tables

configuring, 11-21

fixed and variable intervals, 11-22

function, 2-3, 11-8

Interpolations

Configuration Utility, 7-4

## K

Keyboard

commands

plot, 5-33

test description, B-4

functions

Test Profile editor, 13-18

shortcuts

graphs, B-5

WinDyn, B-3

Known

deficiencies

command master, 8-13

issues

Switch Editor screen display, 1-8

WinDyn software, 1-8

---

## L

- LAN adapter
  - configuring WinDyn 1.x, 8-9
- LAN, connecting WinDyn to a house network, 8-4
- LCD configuration
  - purpose, 14-6
- LED messages
  - switches, 15-16
- LEDs
  - and display messages, 15-12
  - toggle switches with timers, 15-12
- Left Y-axis and right Y-axis
  - plot settings, 5-22
- Legend
  - customizing plot, B-17
  - plot appearance, 5-20, B-17
- Limit flag
  - test profiles
    - as used in WHEN command, 13-56
- Limits
  - actions, 6-17
  - alarms and warnings, 6-16
  - application examples, 6-24
  - channels
    - column definitions, 6-12
    - list
      - operations, 6-12
      - WinDyn safety limits, 6-11
    - properties, 6-13
  - commands
    - get safety limits from computer, 13-41
    - WinDyn Test profile, 13-41
  - configuration, 6-23
  - custom hard stop settings, 6-18
  - description notes, 6-23
  - enable, 6-15
  - file properties, 6-20
  - hard stop
    - action settings, 6-17
    - settings, 6-22
  - ignore
    - on selected channels, 6-21
    - when, 6-15
  - information pane, 6-23
  - lists
    - column settings, 6-13
  - operator, 6-5
  - profile
    - function, 2-3
  - protection
    - turn on automatically, 6-20
  - response actions
    - defined, 6-5
  - safety, 6-3
  - soft stop action settings, 6-19

- symbol definitions, 6-11
- tip of the day, 6-24
- trip
  - delay enable, 6-16
  - values, 6-16
    - Quick-Edit mode, 6-12
- turn on and off, 13-41
- tutorial, 6-24

- Limits Editor
  - description, 6-6
  - main menu, 6-8
  - tutorial, 6-7, 13-19
- Limits File Set Editor
  - purpose, 14-9
- Line style
  - customizing plot, B-18
- Lists
  - limits channels, 6-12
- Load drive cycle
  - display command, 13-41
- Loading test groups, B-6
- Locations
  - test data, 3-12

## M

- Main menus
  - Stored Data Viewer, 5-4
  - WinDyn, 2-12
    - Database Manager, 9-4
    - Display Editor, 12-5
    - Limits Editor, 6-8
- Maintaining range mode statistics, 5-40
- Manager
  - test database, 2-18
- Managing
  - data, 3-21
  - test profile data, 13-8
  - WinDyn database, 9-3
- Mapped oil pressure limit
  - Limits advanced example, 6-28
- Mathematical operators
  - calculated channels, 11-6
  - square root, 11-6
- Maximums
  - plot channel, 5-32
- MDI/MDIX network cabling
  - 10Base-T, 8-7
- Measured
  - channels
    - function, 11-4
  - sensor channels
    - configuring, 11-14
- Memory
  - setting, 13-48
  - use of in test profiles, 13-5

- Memory channels
  - test profiles
    - as used in IF command, 13-53
- Menu bar
  - test profile editor, 13-13
- Menu commands
  - Switch Editor, 15-6
- Menus
  - customizing tools, 4-7
  - Limits, 6-8
  - Playback data, 4-12
  - plot, 5-16
    - customization, 5-25
    - settings, 5-24
  - SF740, 15-8
  - Stored Data Viewer, 5-4
  - SWED Edit menu, 15-8
  - SWED File menu, 15-6
  - system log, 4-17
  - test setup, 3-10
  - WinDyn, 2-12
- Messages
  - display on
    - computer, 13-38
    - console, 13-36
  - erase console, 13-38
  - scroll console, 13-38
- Meters
  - analog, 12-12
- Metric configurations
  - defined, 11-31
- Microsoft Windows
  - NetBEUI
    - installation, 8-9
    - protocol, 8-9
  - Vista
    - installing
      - system configuration, 2-9
      - WinDyn, 2-4
- Minimum computer requirements, 1-4
- Miscellaneous database field descriptions, 9-8
- Mode
  - change ramp
    - control command, 13-29
  - persistence
    - controller action, 13-26
- Modifying
  - SF-742 function keys, 15-3
  - WinDyn database records, 9-13
- Momentary switches
  - function, 15-15
- Monitoring
  - limits channels, 6-11
  - operator limits, 6-5
- Monochrome
  - plot print option, 5-17

- Mouse
  - commands
    - plot, 5-33
  - issue
    - erratic behavior in DOS editor, 1-8
- Multiple
  - computers
    - connecting WinDyn, 8-11
  - tests
    - averaging data, 5-41
  - views
    - SuperFlow Explorer, 3-25

## N

- Navigating
  - Stored Data Viewer, 5-4
  - WinDyn, 2-12
    - database, 9-4
    - Display Editor, 12-5
    - Test Editor, 13-10
- NetBEUI
  - communications, 8-9
  - network communication protocol, 2-11
- NetBEUI, connecting to a house network, 8-4
- Network
  - cable
    - coax, 8-8
    - MDI/MDIX, 8-7
  - NIC requirements, 8-3
  - setting names, 8-4
  - WComNet
    - communications, 8-3
    - installing cable and card, 8-6
- New
  - data files
    - adding to WinDyn database, 9-12
  - features
    - since WinDyn version 2.3, 1-6
    - upgrading from older WinDyn version, 1-5
    - WinDyn, 1-3
- NGE Set Editor
  - Set files, 14-3
- NGE system
  - sending Set files, 14-5
- NIC computer requirement, 8-3
- No WinDyn communication
  - troubleshooting procedure, C-6
- Non-executable components
  - software architecture, 10-6
- Notes
  - attaching test description, 5-12
  - entering, 5-45
  - Limits information pane, 6-23
  - release, 1-5
  - test description, 5-31, 5-43
  - WinDyn upgrade, 1-7



---

Numerically compare tests  
side-by-side columns, 5-35

## O

Objects  
selecting screen design, 12-5  
sizing, 12-5

Oil pressure limit  
Limits basic example, 6-26  
mapped  
advanced example, 6-28

On/off device control, 13-4

Open/closed-loop device control, 13-4

Opening  
configurations, B-13  
ReadMe notes, 1-3  
Set File Editor, 14-3  
Switch Editor files, 15-5  
Test Profile editor, 13-10

Operands  
descriptions, 15-10

Operator input  
pausing for, 13-40

Operators  
console  
zeroing sensors, 3-20  
Fetch, 11-8  
input  
test profiles, 13-9  
interaction  
data displays, 13-9  
test profiles, 13-9  
limits  
monitoring, 6-5  
test (compare), 11-7  
valid syntax, 15-9

Original parameters plot, 5-26

Output  
digital, 13-43  
relays, 12-24

Overlaying tests  
comparing test data, 5-34

Owner  
database field descriptions, 9-6

## P

Parameters  
control, 2-3  
plots  
original and custom, 5-26

Password  
protection  
system preferences, 2-18  
system  
adding new users, 4-22  
enabling or disabling, 4-21

Password-protected features  
special features  
password protection, 4-20

Passwords  
assigning and changing, 4-22  
default access, 4-21  
editing users, 4-21

PAUSE  
branch command, 13-47

Pause/stop  
test profile action, 13-9

Pausing for operator input, 13-40

Percent change  
plot, 5-35

Pertinent information  
before starting WinDyn, 1-3

Pictures  
adding to test record, 9-11

Playback  
data menu, 4-12  
functions, 4-13  
test data, 4-11

Plot view  
customizing, B-17

Plots  
channel maximums  
viewing, 5-32  
color, 5-28  
customizing, 5-25  
data  
exporting, 5-38  
viewing side by side, 5-6  
data cursor  
using, 5-29  
difference  
comparing test data, 5-35  
displaying specification values, 5-30  
fonts, 5-28  
main menu, 5-16  
mouse and keyboard commands, 5-33  
original and custom parameters, 5-26  
percent change  
comparing test data, 5-35  
preferences  
setting, 5-18  
printing, 5-17, 5-24  
reference, 12-28  
settings  
compare mode, 5-19  
configuring, 5-19  
custom titles, 5-23  
left Y-axis and right Y-axis, 5-22  
menu, 5-24  
styles, 5-23  
X-axis, 5-21  
Y-axes, 5-19



- 
- Plots (*continued*)
    - shortcuts
      - keyboard, 5-33
    - styles, 5-27
    - viewing test notes, 5-31
    - zooming in, 5-29
  - Plotting
    - test data, 3-15, 5-15
    - tests, 5-16
    - WinDyn data, 3-7
  - Post processing
    - test data, 5-44
    - updating specification values, 5-45
  - Post-mortem action
    - capturing, 6-21
  - Preferences
    - auto-incrementing file names, 2-20
    - autoloading test groups, 4-3
    - data analysis, 2-17
    - password protection, 2-18
    - plot, 5-18
    - screen editing mode, 12-4
    - Stored Data Viewer, 5-7
    - system file paths, 2-19
    - test
      - Database Manager, 2-18
      - profiles, 13-13
      - report headings, 2-16
    - toolbars, 2-15
    - WinDyn system, 2-15
  - Preferred settings
    - Stored Data Viewer, 5-6
  - Preparing WinDyn test setup, B-7
  - Prerequisites
    - test setup, 3-26
  - Pressure limit
    - oil
      - basic example, 6-26
  - Print recorded data
    - record command, 13-35
  - Printer requirements, 1-5
  - Printing
    - configuration information, 7-8
    - disk space, 13-9
    - plots, 5-17, 5-24
    - system log, 4-18
    - test data, 3-13, 5-13
  - ProExport
    - advanced exporting services, 5-36
  - Profile limits, 2-3
  - ProFilter
    - adjusting, 13-33
    - purpose, 4-14
    - setup, 4-15
    - turning on and off, 13-33
  - Program branching
    - use in test profiles, 13-5
  - Programmed tests
    - safety limits, 6-3
  - Properties
    - hard stop, 6-22
    - limits files, 6-20
  - Protection
    - levels
      - alarms and warnings, 6-16
    - limits
      - turn on automatically, 6-20
- ## Q
- Quick-Edit mode
    - editing limit trip values, 6-12
- ## R
- Ramp
    - controller
      - control command, 13-29
      - end ramp based on time, 13-25
      - with mode changes, 13-29
  - Range
    - data, 5-40
  - ReadMe notes
    - WinDyn, 1-3
  - Real-time values
    - displaying, 13-37
  - Recommended computer requirements, 1-4
  - Record
    - commands
      - adjust
        - data filter, 13-32
        - ProFilter, 13-33
      - data interval recording, 13-35
      - erase data, 13-32
      - print recorded data, 13-35
      - record
        - comment, 13-35
        - data line, 13-33
        - stop data recording, 13-35
        - test profile commands, 13-32
        - time interval recording, 13-34
        - DOS compatible, 13-34
    - comment
      - record command, 13-35
    - data line
      - record command, 13-33
  - Recorded data
    - printing, 13-35
  - Recording
    - stop data, 13-35
    - time interval, 13-34
    - DOS compatible, 13-34
  - Records
    - deleting from WinDyn database, 9-14
    - modifying, 9-13

---

- Reference channel
  - multiple tests, 5-41
- Reference plots
  - X-Y, 12-28
- References
  - file extension, 10-3
- Reinstalling modified configuration, B-14
- Relay
  - bank
    - switch command, 13-44
  - digital input, 12-23
  - switch command, 13-44
- Relay box
  - test profiles
    - as used in WHEN command, 13-57
- Relay box inputs
  - test profiles
    - as used in IF command, 13-54
- Release notes
  - WinDyn, 1-5
- Remote screen definitions
  - viewing, 7-7
- Removing WinDyn from computer, B-19
- Renaming test groups, 3-5
- REPEAT
  - branch command, 13-46
- Reports
  - generating Set file contents, 14-12
  - WinDyn database, 9-14
- Requirements
  - Profilter, 4-14
  - WComNet, 8-6
  - WinDyn, 1-3
- Resizing objects, 12-5
- Response actions
  - limit, 6-5
- Retrieving configurations, B-13
- RETURN
  - branch command, 13-46
- Returning to
  - Stored Data Viewer, 9-5
  - WinDyn
    - from system log, 4-19
- Right Y-axis and left Y-axis
  - plot settings, 5-22

## S

- Safety limits
  - get from computer, 13-41
  - turn on and off, 13-41
  - WinDyn, 6-3
- Saved
  - data
    - defined, 2-3
  - test
    - playback data, 4-11

- Saving
  - calculated channel changes, B-13
  - calibration, 4-6
  - configuration changes, 11-30
  - specifications, 3-18
  - system log, 4-18
  - test
    - groups, 3-5
    - profiles, 13-12
- Screen groups
  - defined, 2-3, 12-3
  - file backups, 1-7
- Screens
  - designing, 12-3
  - Display Editor design objects, 12-5
  - editing preferences, 12-4
  - handheld controller, 11-26
  - selecting
    - annotations, 12-8
    - channels, 12-6
    - color ranges, 12-7
    - design objects, 12-5
    - object styles, 12-9
- Searching
  - Configuration Utility, 7-8
  - WinDyn database, 9-17
- Selecting
  - display screen
    - annotations, 12-8
    - channels, 12-6
    - color ranges, 12-7
    - objects, 12-5
  - LAN adapter, 8-9
  - limit channel lists, 6-12
  - object display styles, 12-9
- Self references
  - searching calculations, 7-8
- Sending Set files to NGE system, 14-5
- Sensor types
  - data channels, 11-4
- Sensors
  - autozeroing, B-9
  - calibrating and zeroing, 4-4
  - measured sensor, 11-14
  - zeroing, 3-19
- Set File Editor
  - description block, 14-5
  - LCD configuration, 14-6
- Set files
  - generating reports, 14-12
  - Limits File Set Editor, 14-9
  - NGE Set Editor, 14-3
  - purpose, 14-3
  - sending to NGE system, 14-5
  - Specifications Set Editor, 14-7
  - Table Set Editor, 14-10
  - Test Profile Set Editor, 14-8
  - validation in test profiles, 13-13

- 
- Set points
    - entering, 13-28
  - Setting
    - command master, 8-11
    - configuration file path, B-12
    - plot preferences, 5-18
    - real-time values
      - message on console, 13-37
    - system preferences, 2-15
    - test data file name, B-7
  - Setting up
    - control system, 11-28
    - ProFilter, 4-15
    - tests, 3-9, 3-26
      - data printouts, 3-13
    - WinDyn to run a test, B-6
  - Settings
    - computer, 2-11
    - custom ramp, 13-30
    - default hard stop, 6-22
    - limits
      - hard stop, 6-18
        - action, 6-17
      - list columns, 6-13
      - soft stop action, 6-19
    - plot, 5-19
  - SF740 menu
    - Switch Editor commands, 15-8
  - SF-742
    - Switch Editor, 15-3
  - SF-902 screens
    - designing, 11-25
  - Shortcuts
    - graphs, B-5
    - keyboard, 5-33, B-3
    - plot, 5-33
    - test description, B-4
  - Showing
    - channel names in calculations, 7-7
    - units for displayed channels, 7-7
  - Single channel
    - zeroing, 4-5
  - Sizing objects, 12-5
  - Soft key
    - labels
      - entering, 13-39
      - erasing, 13-39
    - test profiles
      - as used in IF command, 13-53
      - as used in WHEN command, 13-56
  - Soft stop
    - action settings, 6-19
  - Software
    - ProExport, 5-36
  - Sorting
    - Configuration Utility displayed channels, 7-7
    - limit channel lists, 6-12
    - WinDyn database, 9-17
  - Specifications
    - changing channel values, 5-45
    - channels
      - configuring, 11-17
      - function, 11-6
      - use of in test profiles, 13-5
    - Configuration Utility, 7-4
    - defined, 2-3
    - editing channels, 3-17
    - installing files, 3-18
    - saving, 3-18
      - default name, 13-50
      - specific name, 13-50
    - setting, 13-49
    - values
      - displaying plot, 5-30
      - updating, 5-45
  - Specifications Set Editor
    - purpose, 14-7
  - Speed limit
    - engine
      - basic example, 6-24
  - Speed tips
    - Stored Data Viewer, 5-4
  - Spreadsheets
    - exporting data
      - ProExport, 5-36
  - Square Root
    - in a calculated channel, 11-6
  - Star topology
    - network cable connections, 8-7
  - Start Driver Trace
    - display command, 13-40
  - Statistics maintain range mode
    - column data, 5-40
  - Status bar
    - function, 2-3
    - purpose, 2-14
    - Stored Data Viewer, 5-5
  - Status indicator
    - configuring, 12-23
    - with switches, 12-25
  - STOP
    - branch command, 13-47
  - Stop
    - data recording
      - record command, 13-35
    - Driver Trace
      - display command, 13-40
  - Stored Data Viewer
    - averaging test data, 5-40
    - channel order, 5-9
    - closing, 5-11
    - comparing test data, 5-34
    - exporting data, 5-36

---

## Stored Data Viewer (*continued*)

- main menu, 5-4
- Plot main menu, 5-16
- plotting test data, 5-15
- post processing test data, 5-44
- printing test data, 5-13
- purpose and features, 5-3
- returning from WinDyn Database Manager, 9-5
- setting preferences, 5-7
- speed tips, 5-4
- status bar, 5-5
- test description, 5-12
- toolbar, 5-5
- troubleshooting, C-5
- viewing
  - plot data
    - side by side, 5-6
  - test data, 5-8

## Strip charts

- designing, 12-22

## Structure

- WinDyn, 10-8

## Styles

- object
  - selecting, 12-9
- plot, 5-27
- settings, 5-23

## Summary

- configuration, 7-6

## SuperFlow Explorer

- compatibility, 3-25
- description, 3-21
- test data, 3-24
- unique features, 3-23

## SuperFlowNet

- group name, 8-4

## SWED

- See* Switch Editor

## Switch commands

- digital output, 13-43
- engine controls
  - turn all off, 13-43
  - turn on/off, 13-42
- relay, 13-44
  - bank, 13-44
- test profiles, 13-42

## Switch Editor

- adding program to Tools menu, 15-3
- defined, 15-3
- full-screen display, 1-8
- menus, 15-6
- opening files, 15-5

## Switch files

- creating, 15-11

## Switches

- configuring, 12-24
- digital relay, 12-25
- equation syntax, 15-9
- functions, 15-12
- input function triggers, 15-17
- LED and display messages, 15-16
- momentary, 15-15
- toggle, 15-12
  - with timers, 15-12

## Symbol definitions

- limits, 6-11

## Syntax

- Boolean switch equations, 15-9

## System

- channels
  - Configuration Utility, 7-4
  - function, 11-8
- configuration
  - configuration editor, 11-3
  - installing, 2-9
  - WinDyn file structure, 10-8
- file
  - paths
    - preferences, 2-19
  - types
    - extensions, 10-3

- menu
  - functions, 2-12
- preferences
  - setting, 2-15

## System Config report

- generating from Set File Editor, 14-12

## System log

- creating, 4-19
- exporting, 4-19
- main menu, 4-17
- printing, 4-18
- returning to WinDyn, 4-19
- saving, 4-18
- test system activity, 4-16

## Systems

- control
  - designing, 11-27
  - setting up, 11-28

## T

## Table Set Editor

- purpose, 14-10

## Table support

- controller action, 13-26

## Tables

- interpolation, 2-3, 11-8, 11-21

## Tabular display

- configuring, 12-10

---

- Taskbar properties
  - computer, 2-11
- Temperature limit coolant
  - basic example, 6-26
- Terminology
  - WinDyn, 2-3
- Test
  - description
    - keyboard commands, B-4
  - groups
    - loading, B-6
  - notes
    - checking, B-8
  - profiles
    - saving, 13-12
- Test Editor
  - navigating, 13-10
- Test profile
  - assign configuration, 13-13
  - branching
    - use of, 13-5
  - check hardware compatibility, 13-13
  - commands, 13-20
    - entry/editing, 13-17
  - considerations, 13-6
  - counters
    - IF command, 13-52
  - data channels
    - IF command, 13-52
    - WHEN command, 13-55
  - data control, 13-5
  - data management, 13-8
  - description and control, 13-15
  - developing, 13-3
  - digital input
    - as used in WHEN command, 13-56
    - IF command, 13-53
  - DOS emulation, 13-13
  - else
    - IF command, 13-54
  - example code, 13-58
  - exporting as text, 13-13
  - functions, 13-4
  - IF (right now) command, 13-51
  - information pane, 13-18
  - limit flag
    - as used in WHEN command, 13-56
  - memory
    - IF command, 13-53
  - memory locations
    - use of, 13-5
  - monitoring data line recording, 13-53
  - operator interaction, 13-9
  - Preferences, 13-13
  - relay input
    - as used in WHEN command, 13-57
    - IF command, 13-54
  - set set-point command, 13-26
  - setting real-time values, 13-37
  - soft key
    - as used in WHEN command, 13-56
  - soft keys
    - IF command, 13-53
  - specification channels
    - use of, 13-5
  - timers
    - IF command, 13-52
  - validate set file, 13-13
  - WHEN (Any Time) event command, 13-54
- Test Profile editor
  - keyboard functions, 13-18
  - opening, 13-10
- Test Profile Set Editor
  - purpose, 14-8
- Testing
  - channel order, 3-6
  - requirement
    - ProFilter, 4-14
- Tests
  - (compare) operator
    - calculated channels, 11-7
  - adding to database, 5-43
  - checking test data path, B-7
  - comparing numerically, 5-35
  - data
    - analyzing, 3-20
    - attaching test notes, 3-16
    - atypical comparisons, 5-34
    - auto-increment file names, 3-11
    - averaging, 5-40
      - from multiple tests, 5-41
    - comparing, 5-34
    - customer data pack, 4-9
    - displaying company header and logo, 3-14
    - exporting
      - as graphic file, 5-37
      - to CSV file, 5-36
    - location, 3-12
    - multiple views, 3-25
    - playback, 4-11
      - functions, 4-13
    - plotting, 3-15, 5-15
    - post processing, 5-44
    - printing, 5-13
    - printouts, 3-13
    - ProFilter, 4-14
    - SuperFlow Explorer, 3-24
    - viewing
      - after testing, 5-8
      - during testing, 5-9
- Database Manager
  - system preferences, 2-18

---

## Tests (*continued*)

- description, 5-45
  - averaged data file, 5-43
  - database field descriptions, 9-9
  - Stored Data Viewer, 5-12
  - test profile, 13-15
- device
  - database field descriptions, 9-7
- Fetch (F) operator
  - calculated channels, 11-8
- groups
  - autoloading, 4-3
  - calibration files, A-3
  - corrupt calibration files, A-6
  - defined, 2-3
  - installing, 3-4
  - saving and renaming, 3-5
  - WinDyn tool, 3-3
- information
  - database field descriptions, 9-10
- notes
  - attaching, 3-16
  - viewing, 5-31
- overlying, 5-34
- pause
  - branch command, 13-47
- plotting, 5-16
- preparing WinDyn, B-7
- profiles
  - defined, 2-3
- records
  - adding picture, 9-11
- reports
  - headings, 2-16
- screens
  - designing, 12-3
- setting file name, B-7
- setup, 3-26
  - activating selections, 3-16
  - menu, 3-10
  - WinDyn, 3-9, B-6
- specification values
  - checking, B-8
- system
  - configuring, 8-4
- system activity
  - system log, 4-16
- Tick marks
  - selecting, 12-8
- Time interval recording
  - record command, 13-34
  - DOS compatible, 13-34
- Timers
  - setting, 13-47
  - test profiles
    - as used in IF command, 13-52
  - toggle switches, 15-12

## Tip of the Day

- Limits information pane, 6-24

## Titles

- custom, 5-23

## Toggle switches

- function, 15-12
- with timers
  - function, 15-12
  - LEDs and display messages, 15-12

## Tool menu

- functions, 2-14

## Toolbars

- buttons, 2-15
- Display Editor, 12-5
- Stored Data Viewer, 5-5
- test profile editor, 13-13
- test setup, 3-10
- WinDyn database, 9-4

## Tools

- customizing, 4-7
- menu
  - WinDyn Limits Editor, 6-10
  - WinDyn system, 3-3

## Tools Editor

- adding
  - programs, 4-7
  - Switch Editor, 15-3

## Transmission

- database field descriptions, 9-7

## Triggers

- input function, 15-17

## Trip

- delays
  - channel properties, 6-14
  - enable alarms and warnings, 6-16
- value
  - alarms and warnings, 6-16

## Troubleshooting

- Configuration Utility, C-5
- customer data pack, C-5
- procedures, C-6
- Stored Data Viewer, C-5
- WinDyn
  - Database Manager, C-5
  - system, C-3

## Turn off

- all engine controls
  - switch command, 13-43

## Turn on/off

- engine control
  - switch command, 13-42
- ProFilter
  - test profile, 13-33
- safety limits
  - limits command, 13-41

---

## Tutorial

- accessing, 1-3
- Limits Editor, 6-7, 13-19
- Limits information pane, 6-24

## U

### Uninstalling

- WinDyn from computer, B-19

### Updating specification values, 5-45

### Upgrade notes

- WinDyn, 1-7

### Upgrading

- WinDyn new features, 1-5

### User passwords

- assigning and changing, 4-22

### Using

- calibration file, A-5
- plot data cursor, 5-29
- Stored Data Viewer, 5-4
- WinDyn Database Manager, 9-6

## V

### Valid operators

- switch equations, 15-9

### Validate set file, 13-13

### Values

- test profile commands, 13-47

### Values commands

- decreasing counter, 13-48
- increasing counter, 13-48
- save specifications
  - default name, 13-50
  - specific name, 13-50
- set
  - counter, 13-48
  - memory, 13-48
  - specifications, 13-49
  - timer, 13-47

### Variable interval

- interpolation table, 11-22

### Vehicle

- field descriptions, 9-7

### View menu

- functions, 2-13
- WinDyn Limits Editor, 6-10

### Viewing

- all defined channels, 7-5
- calculation dependencies, 7-6
- channel maximums, 5-32
- configuration
  - files, 7-3
  - information, 7-3
  - summary, 7-6
- database record data, 9-5
- Limits information pane, 6-23
- plots

### color, 5-28

### customizing, B-17

### fonts, 5-28

### styles, 5-27

### test notes, 5-31

### zooming, 5-29

### remote screen definitions, 7-7

### test data, 5-8

### Views

- multiple, 3-25

### Vista NetBEUI installation, 8-9

## W

### WAIT

- branch command, 13-46

### Warnings

- actions, 6-19
- and shutdown actions
  - WinDyn limits, 6-3
- protection levels, 6-16

### WComNet

- configuring WinDyn, 8-9
- defined, 2-3, 8-3
- installing hardware components, 8-6
- NetBEUI communication, 8-9

### What's new

- WinDyn 2.7 features, 1-6
- WinDyn 2.8 features, 1-7

### WHEN (Any Time)

- Cancel all WHEN requests, 13-57

### WHEN commands

- as used in test profiles, 13-54

### Window menu

- WinDyn Limits Editor, 6-10

### Windows

- NetBEUI
  - installation, 8-9
  - protocol, 8-9

### Vista

- installing
  - system configuration, 2-9
- WinDyn, 2-4

### WinDyn

- accessing tutorial, 1-3
- adding users
  - to password system, 4-22
- before starting, 1-3
- command master logic, 8-11
- computer
  - requirements, 1-3
  - settings, 2-11
- configuring, 8-9
- connecting multiple computers, 8-11
- Control Panel
  - displaying, 4-6
- data
  - plotting, 3-7



---

## WinDyn (*continued*)

- database
  - adding
    - existing data files, 9-13
    - new data files, 9-12
  - field descriptions, 9-6
  - searching, 9-17
  - sorting, 9-17
- Database Manager
  - using, 9-6
- DataLib, 9-3
- display properties, 2-11
- executable components, 10-4
- file extension reference, 10-3
- graph shortcuts, B-5
- important terms, 2-3
- individual access features, 4-23
- installing, 2-4
- keyboard shortcuts, B-3
- known issues, 1-8
- limit response actions, 6-5
- limits
  - features and functions, 6-4
- Main menu, 2-12
- new features, 1-3
- non-executable components, 10-6
- password system, 4-21
- pertinent information before starting, 1-3
- release notes, 1-5
- removing from computer, B-19
- safety limits, 6-3
  - channel properties, 6-13
- setting up tests, B-6
- status bar, 2-14
- system preferences, 2-15
- test description
  - keyboard commands, B-4
- Test Profile editor, 13-3
- Test Setup feature, 3-9
- troubleshooting, C-3
  - no communication, C-6
- uninstalling, B-19
- upgrade notes, 1-7
- users
  - deleting from password system, 4-21
- zeroing sensors, 3-19

## WinDyn 2.7

- new features, 1-6

## WinDyn 2.8

- new features, 1-7

## WinDyn Database Manager

- troubleshooting, C-5

## WinDyn Limits Editor

- Edit menu, 6-9
- File menu, 6-8
- Help menu, 6-10
- main menu, 6-8
- Tools menu, 6-10
- View menu, 6-10
- Window menu, 6-10

## WinDyn Test Editor

- navigating, 13-10

## Wireless handheld screens

- designing, 11-25

## Writing test profiles, 13-3

## X

### X-axis

- plot setting, 5-21

### XConsole screens

- designing, 11-25

### X-Y

- graphs
  - designing, 12-16
- reference plots, 12-28

## Y

### Y-axis

- plot settings, 5-19

## Z

### Zeroing

- all channels, 4-5
- sensors, 4-4
  - from WinDyn, 3-19
  - operators console or remote handheld controller, 3-20
- single channel, 4-5

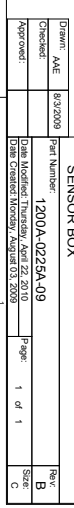
### Zooming

- on plots, 5-29





| REVISION HISTORY |                      |         |      |
|------------------|----------------------|---------|------|
| REV              | DESCRIPTION          | DATE    | NAME |
| A                | INITIAL DESIGN       | 8/3/09  | AAE  |
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