SuperFlow
DYNAMOMETERS & FLOWBENCHES
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AD30-2WD CHASSIS DYNO CONFIGURATION FILE DESCRIPTION

Original Instructions

www.SuperFlow.com

AutoDyn-30-2WD Chassis Dyno Configuration File Description

Trademark Notices

Please keep this manual for future reference.

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

⚠ WARNING

Services performed beyond preventive maintenance by personnel other than SuperFlow Service Technicians on any SuperFlow products during the warranty period may void the warranty.

IMPORTANT

When available, please include the model number and serial number of the product in any correspondence.

Table of Contents

1.0 Configuration File Description 1
1.1 Overview 1
1.2 WinDyn Configuration File Editor 1
1.3 Channel Types 2
1.4 Channel Functions 3
1.4.1 Sensor Channels 3
1.4.2 Specification Channels 8
1.4.3 Equations 12
1.4.4 Interpolation Tables 20
1.4.5 System Channels 27

1.0 Configuration File Description

1.1 Overview

The Configuration file is used to define the functions of WinDyn™ and the Next Generation Electronics (NGE) Data Acquisition System. The channel functions, control functions, and the console display are all set in the Configuration file. Once established, the file is stored on the computer hard drive and downloaded to the Data Acquisition System (memory). The Configuration file defines the basic elements of WinDyn and is required for proper operation.

Refer to WinDyn Users Guide for more information on the configuration file and how to modify it.

1.2 WinDyn Configuration File Editor

WinDyn Configuration File Editor is a simple and powerful built-in editor. The editor can be used to edit the system configuration (config) file discussed in this manual. To edit the system config file, simply open the editor's program window by navigating to **DESIGN > SYSTEM CONFIGURATION** within WinDyn as illustrated in Figure 1.1. To open the system config file in the editor, click on the **FOLDER** icon or select **FILE > OPEN** and navigate to the directory where the config file is located.

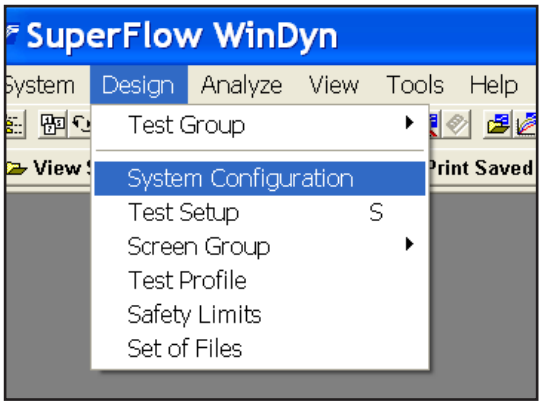

Figure 1.1: Accessing Editor

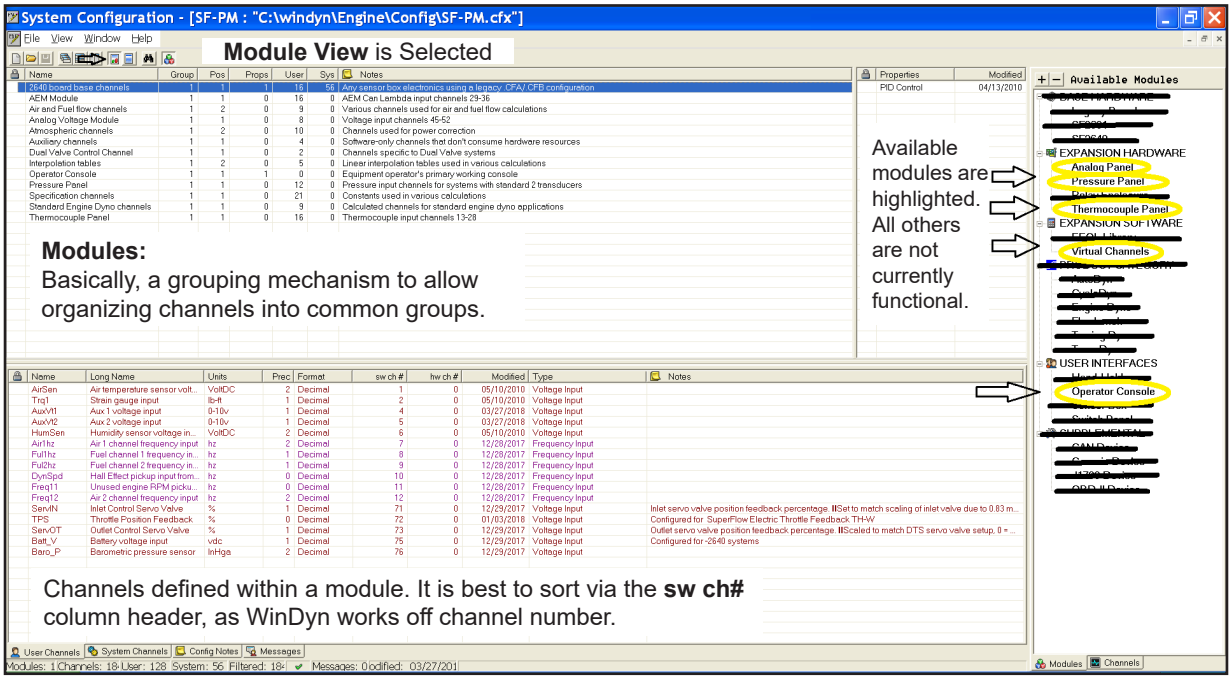

Figure 1.2: Editor Window

1.0 Configuration File Description

1.3 Channel Types

Five general channel types are available in the WinDyn system:

- **Sensor Channels:** Receive data from sensors
- **Equations:** Perform calculations using inputs from other channels
- **Specifications:** Store constants associated with a particular engine, vehicle, or test
- **Interpolation Tables:** Store nonlinear functions for calibration and calculation purposes
- **System Channels:** Contain timers and system memories

The editor identifies channel types by the following colors.

Gray	=	System	**Maroon**	=	Voltage Inputs
Blue	=	Equations	**Purple**	=	Frequency Inputs
Green	=	Specifications	**Red**	=	Thermocouple Inputs
Pink	=	Interpolation Tables			

1.0 Configuration File Description

1.4 Channel Functions

The channels listed in this section are in the standard default configuration file for the dynamometer system. Actual configurations may vary based on the product and the customer application. Gaps in the numbering are undefined channels or are sensor channels used as calculated channels.

1.4.1 Sensor Channels

Sensor channels 1 through 76 input measured data and convert it to a reading. In some cases the reading is a direct reflection of the input, such as volts in to volts out. In other cases the input is converted to a different value, such as volts in to air/fuel (A/F) ratio out or frequency to rpm. Temperature channel values are determined by the type of thermocouple used.

Filters

The default system filter on 2640 boards is 6. All measured channels in released configs are set to system filter except AirSen(ch1), HumSen(ch6), and BaroP(ch76). Those channels are set to 7. System filters are controlled via commands in a test profile or via menu selection in NetDyn.

Filter Rates

1	=	20Hz corner	5	=	1.25Hz corner
2	=	10Hz corner	6	=	0.625Hz corner
3	=	5Hz corner	7	=	0.3125Hz corner
4	=	2.5Hz corner			

Channel Types

Four types of measured data channels are available in the SuperFlow Data Acquisition system for sensor inputs:

- **Frequency channels** can read any sensor device (0-15 KHz) 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.

IMPORTANT

- **The channel name and unit of measurement for each channel shown in the channel definition tables is the default configuration as set by SuperFlow. The user can alter the actual name and unit of measurement through the configuration editor.**
- **The unit of measurement used in Equation channels is based on the formula in the channel definition. The unit of measurement for Specification channels is based on how it is used within the system. Changing the format for the unit of measurement does not change how the channel functions.**
- **The full range value of each sensor channel is based upon the normal range of the sensor used in that channel and by the defined unit of measurement. The default full-scale range value in the system can be overwritten by a current value calibration of the channel.**

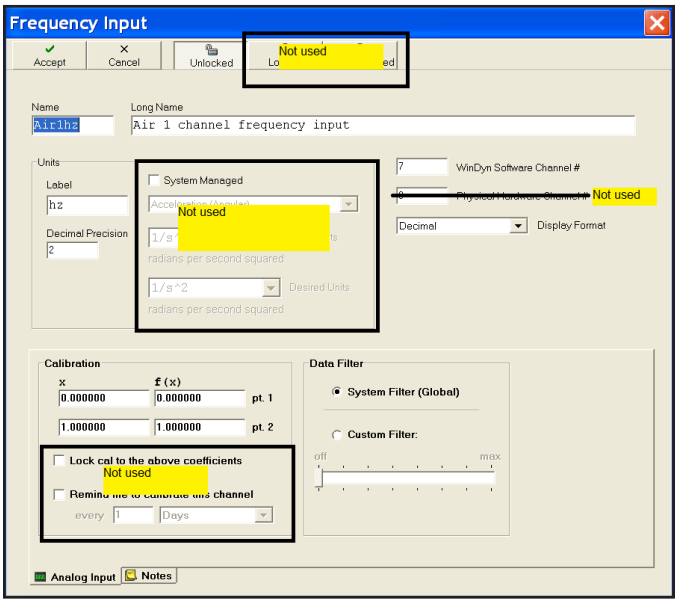

Figure 1.3: Config Frequency Channel Window

1.0 Configuration File Description

- **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.

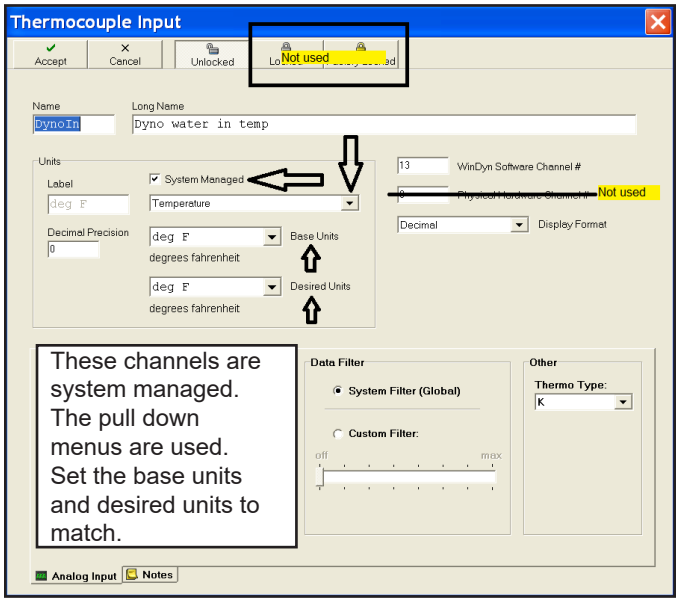

Figure 1.4: Config Thermocouple Channel Window

- **Analog voltage channels** may be used to measure any sensor device outputting analog voltage (typically 0-10 VDC). These inputs are most commonly used for pressure transducers or other auxiliary devices. Ten channels are located directly on the data acquisition system. Others are available on expansion panels (pressure and voltage).

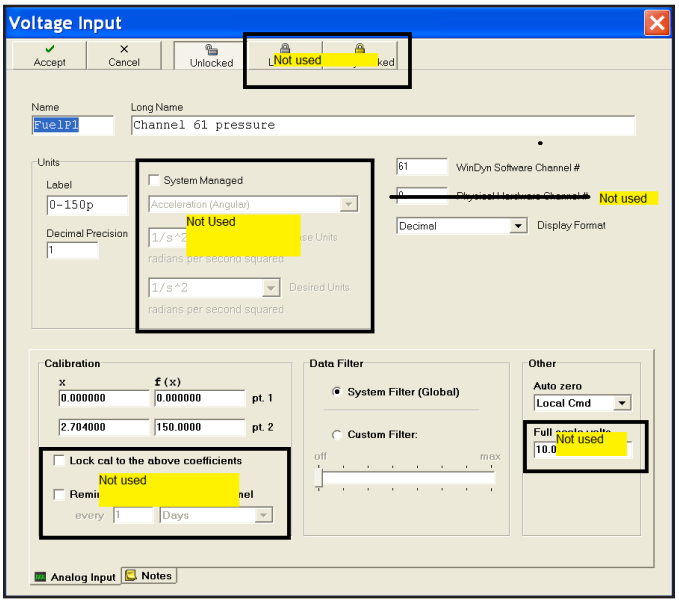

Figure 1.5: Config Voltage (Pressure) Channel Window

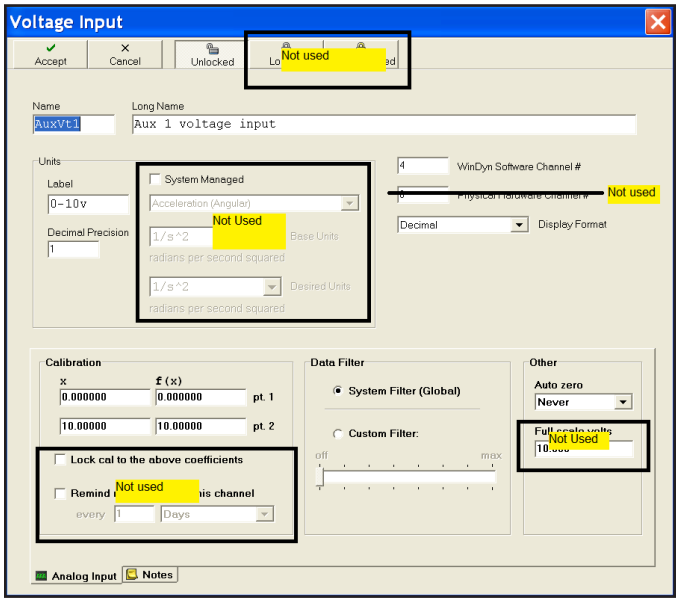

Figure 1.6: Config Voltage Channel Window

Any of these channels may be used for any display function, in a equation channel, as a control channel, or in a test profile.

1.0 Configuration File Description

Table 1-2. Sensor Channels

Channel
1 - AirSen
Channel 1 is used to measure the voltage from the ambient air temperature sensor. This channel is used in channel 74 in conjunction with lookup table 136 to produce temperature units in degrees F for use in horsepower correction formulas. Calibrate this channel before doing humidity.
2 - Trq1
Channel 2 is used to measure the torque from the strain gauge mounted to the eddy current absorber. This channel should be calibrated by the end user. Low level offset should be adjusted to provide maximum range for the end user and vehicle types. If using in a bi-directional mode, the cal coefficient must produce a positive TRQ1 value for Track Road Load (TRL) to function. The coefficient will be changed through calibration. The channel is set up for zeroing by command.
4 – LamVt1
Channel 4 is used for auxiliary voltage input 1. It uses a 0–10 VDC input signal. Used for Wideband O2 inputs. The channel is not zeroed by command.
5 - LamVt2
Channel 5 is used for auxiliary voltage input 2. It uses a 0-10 VDC input signal. Used for Wideband O2 inputs. The channel is not zeroed by command.
6 - HumSen
Channel 6 is the input for the humidity sensor used to measure the humidity of the air. It is used in channel 120 to produce humidity units in % relative humidity for use in vapor pressure computations which are used in horsepower correction formulas. This channel has a coefficient of 1.000, no autozero, and is filtered at 7. Changing the values for this channel is not recommended. Changing the coefficient alters the values displayed by channel 120.
7 - Freq_1
Channel 7 is typically used to measure the frequency from an air turbine. Labeled Air 1 (Red Lemo), the coefficient for this channel is 1.000, with a maximum input frequency of 15,000 hz. Changing the coefficient alters the values displayed.
8 - Freq_2
Channel 8 is typically used to measure the frequency from a fuel turbine. Labeled Fuel 1 on interconnect AMP panel, the coefficient for this channel is 1.000, with a maximum input frequency of 15,000 hz. Changing the coefficient alters the values displayed.
9 - RolFrq
Channel 9 is used to measure the frequency from the roll speed sensor. Jumpered via R85 to R79 on -2640 board; couples raw roll frequency to use for Calculated RPM method. Allows Pro Filter to work properly on Calculated RPM method. The coefficient for this channel is 1.000, with a maximum input frequency of 15,000 hz. Changing the coefficient alters the values displayed.
10 - Speed
Channel 10 is used to measure the frequency from a Hall Effect pickup and 60 tooth gear. It is used by channel 125 to calculate engine speed. Changing the coefficient alters the values displayed and severely alters the dynamometer calibration. Changing the values for this channel is not recommended. Uses 11.227 for 29.94 inch AD-30 rollset.

1.0 Configuration File Description

Table 1-2. Sensor Channels

Channel
11 - EngFrq
Channel 11 is defined as an auxiliary frequency channel. It is used for external RPM input from the vehicle using the Green Lemo on interconnect panel. It can accommodate multiple input types: Inductive, Coil, Optical. The coefficient for this channel is 1.000, with a maximum input frequency of 15,000 hz. Changing the coefficient alters the values displayed.
12 - Freq12
Channel 12 is defined as an auxiliary frequency channel. Input is labeled Tach/Freq on Yellow Lemo connector. The coefficient for this channel is 1.000, with a maximum input frequency of 15,000 hz. Changing the coefficient alters the values displayed.
45 - BoostP
Channel 45 is setup as Pressure Input 1 to measure the voltage from the Boost Pressure sensor. The channel uses a 0–10 VDC input. It may be recalibrated if required through the calibration menu or through changes in the Configuration Editor program. The channel is set for zeroing by command.
46 - Pres2
Channel 46 is setup as Pressure Input 2 to measure the voltage from a sensor. The channel uses a 0–10 VDC input. It may be recalibrated if required through the calibration menu or through changes in the Configuration Editor program. The channel is set for zeroing by command.
47 to 50 - Analog Voltages - AnVt47 through AnVt50
Channels 47 through 50 are used for measuring DC voltage inputs. They are currently defined for 0–10 VDC inputs. Each channel may be recalibrated if required through the calibration menu or through changes in the Configuration Editor program. These channels are set to not zero by command.
51 - OilTmp
Channel 51 is setup to measure the voltage from the oil temperature dipstick probe. The channel uses a 0–10 VDC input. It may be recalibrated if required through the calibration menu or through changes in the Configuration Editor program. The channel is set to not zero by command.
52 - Batt_V
Channel 52 is setup to measure the voltage from the battery voltage input. The channel uses a 0–20 VDC input. It may be recalibrated if required through the calibration menu or through changes in the Configuration Editor program. The channel is set to not zero by command.
71 - AbsSen
Channel 71 is used to measure the voltage from the absorber temperature sensor and is used for absorber temperature calculation. The channel is set to not zero by command and is filtered at 7. Changing the values for this channel is not recommended. Changing the coefficient alters the values displayed.
76 - BaroP
Channel 76 is used to measure the uncorrected or station barometric pressure. The barometric pressure transducer is located on the circuit board installed in the sensor box. SuperFlow recommends calibrating the barometric pressure sensor with an accurate barometric pressure measurement device. The channel is set to not zero by command and is filtered at 7. The default coefficient for the channel should be 8.0391. This channel is used for horsepower correction formulas and must use station pressure, not relative pressure.

1.0 Configuration File Description

1.4.2 Specification Channels

Channels 77 through 99 are all specifications or constants. The values shown here are defaults, and may be changed as necessary by the end user.

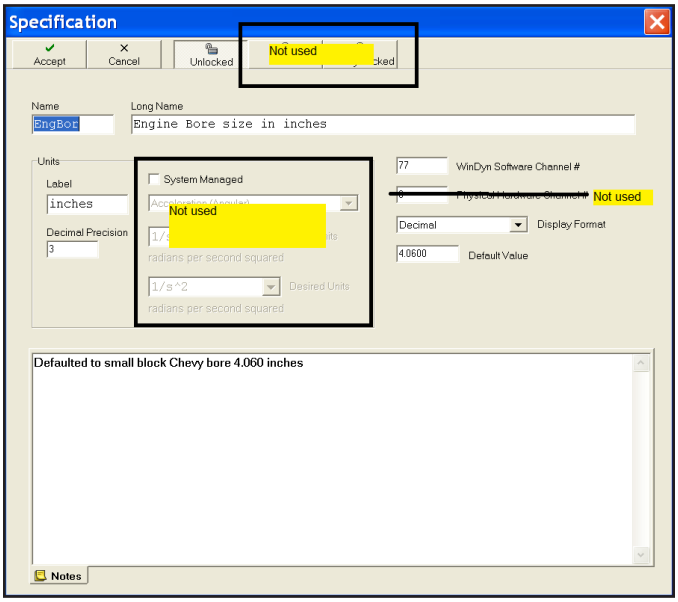

Figure 1.7: Config Specification Channel Window

Table 1-3. Specification Channels

Channel	Default Value
77 - K_Fact	**0.0700**
Channel 77 is an Engine Power channel for entering the K_Factor for drivetrain losses. This value specifies what percentage of the total drivetrain losses on a vehicle are Torque Dependent vs. Speed Dependent. This is an operator specified "correction" channel to produce proper engine power results. During a coast down, the dyno measures all of the speed dependent losses, but only a fraction of the torque dependent losses. The torque that is going through the vehicle drivetrain during coast down is much less than it was during the acceleration run. By entering the proper value, the system can more accurately derive what the drive train losses were during acceleration by slightly altering what it measured during a coast down test. Typical values for manual transmission vehicles are 0.07 - 0.09. Automatic equipped vehicles may require values as high as 0.30. The default value is 0.07.	
78 - Corfac	**1.1000**
Channel 78 is for entering the operator input correction factor. Channel 78 is used for comparison to other dynamometer systems and equation channels 58 - DJWhTq and 114 - DJWhPw use this factor. The channel is defaulted to a 10% (default value 1.10) correction factor.	
79 - Pwr_50	**15**
Channel 79 is a Track Road Load (TRL) channel for target power at 50mph. Channel 79 is defaulted to 15 horsepower. This can be altered by the user if they have values obtained from the vehicle manufacturer or EPA testing.	
80 - WhlInr	**125**
Channel 80 is the inertia value for wheels. Channel 80 is defaulted to 125lbs for 2WD systems. Suggest using 40 for motorcycles, 60 for quads or Razors, 125 for cars, and 200 for trucks for 2WD systems. Suggest using 0 for AWD systems. You can use 0 for 2wd systems, but will show significantly lower power numbers (up to 10%) when doing acceleration type tests.	

1.0 Configuration File Description

Table 1-3. Specification Channels

Channel	Default Value
81 - Stoich	**14.700**
Channel 81 is used to input the Stoichiometric ratio. Typical values for channel 81: pump gas = 14.7, E10 = 14.13, E85 = 9.86, Methanol = 6.5. The channels default value is 14.7 (pump gas).	
82 - K_SE	**0**
Channel 82 is a TRL channel used to enter an Inertia Simulation Error K-factor. Defined as a correction factor in TRL as an integration of the error between the commanded "Target" torque (TGTtrq) and measured "Actual" torque (ACTtrq): SEtrq = (ACTtrq-TGTtrq)*Kfactor. Defaulted to use 0 on Eddy current systems. Setting it to 0 will disable the Simulation Error correction to the TRL setpoint command. THIS MUST BE IN CHANNEL 82!!!!	
83 - Pul_Rv	**1.000**
Channel 83 is used to enter the number of pulses per revolution specification channel for the ignition pickup. Typically, use 0.5 or 1.0 as the setting. Default is 1.0 for wasted spark ignitions.	
84 - TirDia	**24.000**
Channel 84 is used to enter the tire diameter in inches. The channel is used in calculated RPM method and ground torque equation. Default value is 24.	
85 - IgnPck	**0.000**
Channel 85 is used as an ignition pickup selection switch. Default is 0, enter a one (1) when using Green Lemo ignition tach signal input.	
86 - OpTPck	**0.000**
Channel 86 is used as an optical tach pickup selection switch. Default is 0, enter a one (1) when using Green Lemo optical tach signal input.	
87 - CalPck	**1.0000**
Channel 87 is used as a selector switch for the calculated engine speed method. Use a "1" when using roll speed signal input to compute engine RPM. Default is set to "1"	
88 - CoeffA	**13.610**
Channel 88 is a TRL channel used to set the A Coefficient - AvPF, Av, or Af. Set to use Imperial units in FORCE mode. See Track Road Load instructions. Customer must derive values for cars and trucks. Default value Af is for a mid-size sedan, 13.61. THIS MUST BE IN CHANNEL 88!!!!	
89 – CoeffB	**0.0800**
Channel 89 is a TRL channel used to set the B Coefficient - BvPF, Bv, or Bf. Set to use Imperial units in FORCE mode. See Track Road Load instructions. Customer must derive values for cars and trucks. Default value Bf is for a mid-size sedan, 0.080. THIS MUST BE IN CHANNEL 89!!!!	
90 - CoeffC	**0.0200**
Channel 90 is a TRL channel used to set the C Coefficient - CvPF, Cv, or Cf. Set to use Imperial units in FORCE mode. See Track Road Load instructions. Customer must derive values for cars and trucks. Default value Cf is for a mid-size sedan, 0.020. THIS MUST BE IN CHANNEL 90!!!!	

1.0 Configuration File Description

Table 1-3. Specification Channels

Channel	Default Value
91 - Weight	**3700.0**
Channel 91 is a TRL channel used to enter Equivalent Vehicle Test Weight in pounds. Set to use Imperial units in FORCE mode. See Track Road Load setup instructions. Default value is 3700lbs for a mid-size sedan. THIS MUST BE IN CHANNEL 91!!!!.	
92 - TRLHP	**-1.000**
Channel 92 is a TRL channel used as a Track Road Load Power selector. If the entered TRLHP value is set to any negative value, then the A, B, and C coefficients are used in FORCE mode. This is the DEFAULT mode. If the TRLHP value is set to a positive non-zero value, then the A, B, and C coefficients are considered to be "Power Fractions" as defined by the EPA- IM240 specifications §85.2226(a)(2)(i)(D). This will be called POWER FRACTION mode. If the entered TRLHP value is set to zero, then the A, B, and C coefficients are the raw power coefficients of the polynomial. This will be called RAW POWER mode. THIS MUST BE IN CHANNEL 92!!!!	
93 - Recpcl	**1.000**
Channel 93 is a reciprocal value used by the ProFilter feature to properly calculate engine speed increments when in ratio mode. This value is controlled by the test profile. This channel is used when setting up the ProFilter rev counter channel. The user should not alter it.	
94 - RPMRat	**1.000**
Channel 94 is used to calculate engine RPM when using an optical tach on a revolving device that is at a non 1:1 ratio to engine revolutions. If you are using the optical tach on the rear wheel, then this would represent the overall ratio, which would be primary ratio * transmission ratio * final drive ratio = overall ratio. Default value is 1:1	
95 - Start	**40.00**
Channel 95 is for entering the starting value in MPH to use for automated test profiles. Typically used in Accel and Step tests. It may be changed from the test setup dialog.	
96 - StopAt	**100.0**
Channel 96 is for entering the ending value in MPH to use for automated test profiles. Typically used in Accel and Step tests. It may be changed from the test setup dialog.	
97 - StepTm	**20.00**
Channel 97 is used to enter the step time increment in seconds for the step type automated tests. It may be changed from the test setup dialog.	
NOTE: If running an Accel test, this value will be automatically calculated. The operator does not need to enter this value. If running a STEP test, the operator will need to enter this value.	
98 - StpSiz	**10.00**
Channel 98 is used to enter the requested step size or ramp increment in MPH for step type automated test profiles. It may be changed from the test setup dialog.	

1.0 Configuration File Description

Table 1-3. Specification Channels

Channel	Default Value
99 - Metric	**0.000**
Channel 99 is used as a Metric/English force units selector switch. As of this writing, the METRIC function does not appear to work. The EIS will not compute properly when the vehicle weight is entered in kilogram units. The math appears to compute using the value as if it were in pounds units. So, by default, 0.000 is used to select Imperial units. THIS MUST BE IN CHANNEL 99!!!! The values for this channel are as follows: --->0 or 100 = If an AC motor and EC are both tied to the system, use 0 to select Imperial units and the AC motor. Use 100 to select Imperial units and the Eddy Current. --->1 or 101 = If an AC motor and EC are both tied to the system, use 1 to select metric units and the AC motor. Use 101 to select metric units and the Eddy Current. If there is no AC motor, only an Eddy Current, then either 0 or 100, or 1 or 101, will work to engage the eddy current unit. The A, B, C coefficients and inertia value can be entered in either Imperial or metric units. If channel 99 is set to zero or 100 then these coefficients are in Imperial units: Af = lbs(force), Bf = lbs/mph, and Cf = lbs/mph2. If channel 99 is set to 1 or 101, then the force coefficients are entered in metric units: Af = N(Newtons) Bf = N/kph, and Cf = N/kph2. See Track Road Load setup instructions.	

1.0 Configuration File Description

1.4.3 Equations

The Equation channel is one of the most powerful features of the WinDyn software. Sensor data, specifications, interpolation tables, other equations, 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. Channels 100 through 129 are dedicated equation channels. Additionally, any unused measured channel may be configured as an equation channel, although SuperFlow does not recommend creating 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 an equation channel. However, if the thermocouple module was not installed, any or all of channels 13–28 could be used for additional equation channels. Any predefined equation channel may easily be modified using the configuration editor supplied with WinDyn.

The configuration editor can utilize any of the **E**xtended **Eq**uation **L**anguage (EEQL (.CFA) (pronounced 'equal')) variables shown on the following page when creating equations.

```
//-------------------------------------------------------------------------------
//
//
//
//
// EQUATION TERMS:
// 1. SAE corrected wheelpower
// 2. Measured CoastDown Losses: speed dependent losses + load dependent
//    losses (based on load during coastdown)
// 3. SAECor: SAE correcton factor
// 4. (InrPwr+DynLos+AbsPwr): power thru drivetrain during accel
// 5. lerp(Speed,CstDwn): power thru drivetrain during coastdown
// 6. K Factor: Additional load dependent losses not measured during coastdown
//
//-------------------------------------------------------------------------------
return(
     SAECor*(InrPwr+DynLos+AbsPwr)  //SAE corrected wheelpower
   + lerp(Speed,CstDwn)             //Measured CoastDown Losses
   + (SAECor*(InrPwr+DynLos+AbsPwr) //see 'terms' #4 above
   - lerp(Speed,CstDwn))            //see 'terms' #5 above
   * K_Fact                         //K Factor
);
```

Figure 1.9: Example Equation

Figure 1.9 above shows an example of a lengthy equation with extensive comment lines. Comments may be placed on their own lines in equations, or after a function. Comments are identified by the use of the double back slashes: //

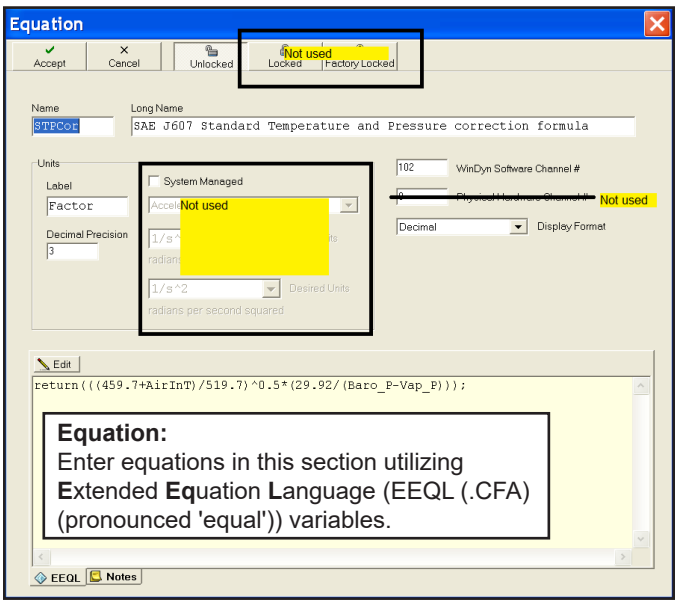

Figure 1.8: Edit Equation Channel Window

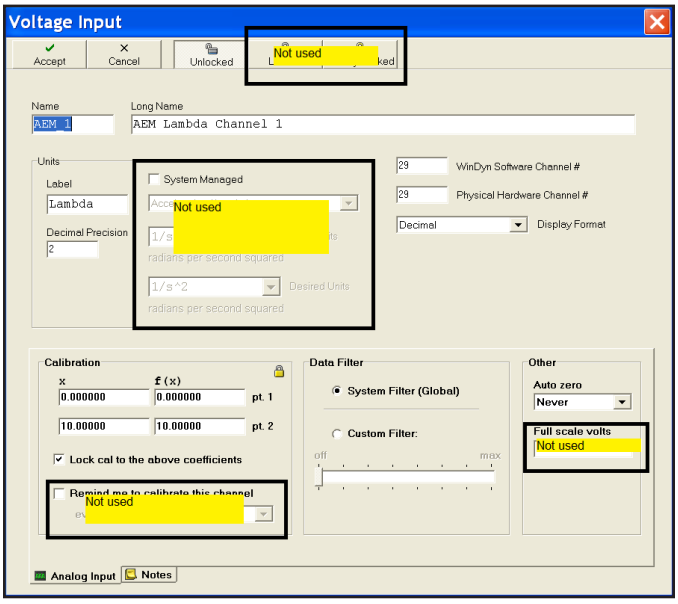

Figure 1.10: CAN Channel,
AEM Channels 29-36, Edit Equation Window

1.0 Configuration File Description

EEQL (.CFA)

(pronounced 'equal')

Extended Equation Language

Lexical Elements supported by .CFA files

PUNCTUATION

Token	Function	Description	Example
//	Comment	Specify comment text	sin(0) //compute trig sine
()	Precedence	Override default precedence	1+2*3 = 7 (1+2)*3 = 9
()	Function input	Specify function input expression	abs(A+B) (A+B)^2
;	Statement terminator	Specify end of a statement	return(A+B);
,	Argument delimiter	Separate multiple function arguments	round(1.5,0)

ARITHMETIC OPERATORS (BINARY)

Token	Function	Description	Example	Result
+	Add	Adds two expressions	1+1	2
-	Subtract	Subtracts two expressions	1-1	0
*	Multiply	Multiplies two expressions	1*1	1
/	Divide	Divides two expressions	1/1	1
^	Exponentiate	Exponentiates expression	2^3	8

ARITHMETIC FUNCTIONS

Token	Function	Description	Example	Result
ABS	Absolute value	Absolute value of expression	abs(0-1)	1
LERP	Interpolate	Linear interpolation of expression	lerp(A,Table1)	Run A thru table
ROUND	Round	Round expression to position n (0,1,2,etc.) Rounds up at >= 5, rounds down at < 5.	round(123.55,1)	123.6

TRIGONOMETRIC FUNCTIONS - Angles in degrees only

Token	Function	Description	Example	Result
SIN	Sin	Trigonometric sine of expression	sin(90)	1
COS	Cosine	Trigonometric cosine of expression	cos(90)	0
TAN	Tangent	Trigonometric tangent of expression	tan(45)	1
ASIN	Arcsine	Trigonometric arcsine of expression	asin(1)	90
ACOS	Arccosine	Trigonometric arccosine of expression	acos(0)	90
ATAN	Arctangent	Trigonometric arctangent of expression	atan(1)	45

FLOW CONTROL

Operator	Function	Description	Example
RETURN	Return expression	End program and return expression	return(EngSpd*EngTrq/HPD);

MISCELLANEOUS FUNCTIONS

Token	Function	Description	Example	Result
RAW	Raw channel value	Value of channel (raw ADC units)	raw(EngTrq)	ADC of EngTrq

CONSTANTS

Token	Function	Description	Value
PI	pi	Value of pi to 15 digits of precision	3.14159265358979
HPD	hp divisor	Divisor for horsepower calculation	5252.11312203255
TRUE	true	boolean true	1
FALSE	false	boolean false	0
ON	on	boolean on	1
OFF	off	boolean off	0

NUMERICAL VALUES

Token	Function	Description	Examples
1	Number	A valid number (no decimal point)	1 12 123 1234 12345
1.0	Number	A valid number (with decimal point)	0.01 0.1 1.0 10.0 123.123
1.0E+1	Number	A valid number (scientific notation)	1e1 1E+1 1.0e-1 6.022E+23
0x7F	Number	A valid number (hexadecimal)	0x7F 0X7FFF 0xABCD 0X1234ABCD

IDENTIFIERS - Only letters, numbers, and underscores allowed. First char can't be a number.

Token	Function	Description	Examples
x	Identifier	A valid indentifier	x tmp EngSpd AirT4
x1	Identifier	A valid indentifier	x1 tmp1 tmp2 tmp23
_1	Identifier	A valid indentifier	_x _1 NO_COMM tmp_23

1.0 Configuration File Description

The formula as it is in the configuration is shown next to the channel name in Table 1-4.

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
3 - TrqAbs	**lb-ftA**	**return(abs(Trq1));**
Channel 3 is for calculating the absolute value of strain gauge torque. It allows bi-directional operation of the system.		
20 - SpeedC	**mph**	**return(RolFrq*0.0891);**
Channel 20 is a calculated speed channel for more low speed resolution. Uses 1/11.227 = 0.0891 for AD-30 coefficient.		
21 - Rv_mph	**ratio**	**return(EngSpd/Speed);**
Channel 21 provides a ratio between engine RPM and wheel speed.		
22 - Oil_T	**deg F**	**return(lerp(OilTmp,AirTpT));**
Channel 22 is the equation to compute oil temp from sensor input.		
23 - LamAF1	**ratio**	**return(Lambd1*Stoich);**
Channel 23 is for calculating air fuel ratio from wideband O2 input. Set for Daytona WEGO wideband O2, AFR = Lambda*Stoich		
24 - LamAF2	**ratio**	**return(Lambd2*Stoich);**
Channel 24 is for calculating air fuel ratio from wideband O2 input. Set for Daytona WEGO wideband O2, AFR = Lambda*Stoich		
53 - MAP	**kPa**	**return((Baro_P*3.386388)+(BoostP*6.894757));**
Channel 53 is a conversion channel to create Manifold Absolute Pressure.		
54 - WatGrn	**grains**	**return((7000*(18.02/28.85)) * (SatVap/((Baro_P*0.4911)-SatVap)) * (Humidy/100));**
Channel 54 is used to calculate water grains at current relative humidity and barometric pressure.		
55 - ADR	**ratio**	**return((AirDen/0.0763) * 100);**
Channel 55 is used to calculate air density ratio. Ratio of current air density to standard sea level conditions, 60 deg F, dry air, 29.92 inHg baroP.		
56 - InVald	**null**	**return(0);**
Channel 56 is a place holder channel for control functions. Used as a second control channel. The third control channel will be TRLTRQ for Track Road Load simulation.		
57 - SatVap	**psi**	**return((lerp(AirInT,VaporT)* 0.4911));**
Channel 57 calculates saturation vapor pressure in psi. Recommend using this channel as an intermediary rather than combined with the water grains calc.		
58 - DJWhTq	**Clb-ft**	**return(DJWhPw*5252.113/EngSpd);**
Channel 58 is an "operator" corrected wheel torque value derived from channel 114 - DJWhPw. Uses the SAE J-1349 atmospheric correction applied to wheel power. Then multiplies by an additional "operator" selected multiplier. Defaulted to 1.10 or 10%.		

1.0 Configuration File Description

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
59 - OptRPM	**RPM**	**return((EngFrq*OpTPck)*60);**
Channel 59 calculates optical tach RPM. It is used for computing ratios in the Eng_Spd test profile.		
60 - LoadP	**%**	**return(Mem2/40.96);**
Channel 60 is the load percentage feedback from TDebug mem2 channel. Must turn ON TDebug Mem95 function for it to work. Mem95 = 2 for normal PID values, use 1 if looking for Track Road Load values. Mem95 can be set via test profile commands.		
61 - EngTrq	**lbs-ft**	**return((EngPwr*HPD/EngSpd));**
Channel 61 calculates the uncorrected estimated engine torque.		
62 - EngPwr	**hp**	**return((WhlPwr+EsDTLs)*Mem1);**
Channel 62 calculates an estimate for uncorrected engine power by taking the measured wheel power and adding in an estimate of drive train losses during the acceleration part of the test. Those losses consist of the measured losses and a K_Fact adjustment. Added Mem1 multiplier to turn this channel ON/OFF. If Mem1 = 1, channel is ON. If Mem1 = 0, channel is OFF.		
63 - CEngTq	**Clb-ft**	**return((CEngPw*HPD/EngSpd));**
Channel 63 calculates corrected engine torque based on corrected engine power and measured engine speed. By default, this channel uses the SAE J-1349 correction formula.		
64 - CEngPw	**Chp**	**return(((SAECor*WhlPwr+C_DLos+(SAECor*WhlPwr-C_DLos)*K_Fact))*Mem1);**
Channel 64 calculates corrected engine power by correcting the wheel power numbers for atmospheric conditions. Coast down losses are not corrected as they are very weakly affected by air density changes. Very little of the measured coast down losses are aerodynamic (losses from air windage around rotating components). By default, this channels uses the SAE J-1349 correction formula. Added Mem1 multiplier to turn this channel ON/OFF. If Mem1 = 1, channel is ON. If Mem1 = 0, channel is OFF.		
65 - PwrDif	**%**	**return((1-(WhlPwr/EngPwr))*100);**
Channel 65 calculates the percentage difference between measured wheel power and estimated engine power. Result is in percentage units.		
66 - EsDTLs	**hp**	**return(C_DLos+(WhlPwr-C_DLos)*K_Fact);**
Channel 66 estimates what the drivetrain losses were during the acceleration run. It is based on measured wheel power during the acceleration run as well as measured coast down loss power. The K-Factor is used to compensate for the torque dependent losses that are not completely measured during the coast down when the torque through the drivetrain of the vehicle is much less than what went through the drivetain during the acceleration run. The K_Fact channel is used to "adjust" the final EngPwr value.		
67 - C_DLos	**hp**	**return(lerp(speed,CstDnT));**
Channel 67 calculates the coast down power loss for use in printouts. It extracts data from the CstDnT table that is populated during a coast down function.		

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
68 - MeasCD	**HP**	**return(InrPwr+DynLos+AbsPwr);**
Channel 68 calculates drivetrain power losses during coast down. It uses using the vehicle wheel inertia value (WhlInr) that was set during the test. It is important to have a relatively accurate wheel inertia value to make this calculation more accurate. If you do not know what to use for a car, use 125. This channel is then curve fit and placed into table 139. It is later used to generate an estimate of engine power. Low level setting must be changed from 122 to 68 to match this channel number.		
72 - Lambd1	**ratio**	**return((LamVt1*0.136)+0.680);**
Channel 72 calculates the Lambda value from wideband O2 input one. Set for Daytona WEGO wideband O2. Lambda = (VDC*0.136)+0.680.		
73 - Lambd2	**ratio**	**return((LamVt2*0.136)+0.680);**
Channel 73 calculates the Lambda value from wideband O2 input two. Set for Daytona WEGO wideband O2. Lambda = (VDC*0.136)+0.680.		
74 - AirInT	**deg F**	**return(lerp(AirSen,AirTpT));**
Channel 74 displays the air inlet temperature from the thermistor used for ambient air temperature measurement. The thermistor is located inside the humidity probe. The voltage is measured by Channel 1, then retrieves the temperature for that voltage from the channel 136 interpolation table. The air temperature data is used to determine power correction factors and air density.		
75 - AbsTmp	**deg F**	**return(lerp(AbsSen,AirTpT));**
Channel 75 displays the temperature at the eddy current absorber. Temperatures above 300 degrees F should be cause for concern.		
100 - WhlPwr	**hp**	**return(InrPwr+DynLos+AbsPwr);**
Channel 100 is used to calculate wheel power from inertia power plus dyno losses plus absorber power from the strain gauge. No atmospheric correction is applied.		
NOTE: The correction factors listed below are the default formulas provided by SuperFlow. WinDyn is capable of generating performance data corrected to any standard. All that is required is to change the name and formula in one of these channels. The channel names of the referenced channels (xxxPwr and xxxTrq) should also be changed to reflect the proper correction standard.		
101 - SAECor	**factor**	**return(((459.7+AirInT)/536.7)^0.5*(29.23/ (Baro_P-Vap_P)));**
Channel 101 is used to calculate the Society of Automotive Engineers (SAE) J1349 power correction factor. It combines the ambient air temperature from channel 74 and the barometric pressure from channel 76 with the vapor pressure of the moisture of the air from channel 118. The ^0.5 value indicates a square root function. This factor estimates what the measured torque and power would be at 77° Fahrenheit *[25°C]* and 29.23 inches of mercury *[99 kPa]* air pressure. The SAE correction factor is used by channel 115, SAE Torque, to correct the wheel torque in channel 121.		

1.0 Configuration File Description

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
102 - STPCor	**factor**	**return(((459.7+AirInT)/519.7^0.5*(29.92/Baro_P-Vap_P)));**
Channel 102 is used to calculate the Standard Temperature and Pressure (STP) J607 power correction factor. It uses the ambient air temperature from channel 74, the barometric pressure from channel 76, and the vapor pressure from channel 118 to calculate a power correction factor. This factor estimates what the measured torque and power would be at 60° Fahrenheit and 29.92 inches of mercury barometric pressure *[15.5°C and 101.3 kPa]*. Channel 102 is used by channel 116, STP Torque, to correct the wheel torque in channel 121.		
103 - Bf	**coeff**	**return(lerp(VehNum,Bf_Tbl));**
Channel 103 is used to calculate the Bf force coefficient based off the PWR@50mph value entered in channel 79. A vehicle # (type) is determined by the lookup table and then a value is computed by the equation.		
104 - VehNum	**#**	**return(lerp(Pwr_50,VehTbl));**
Channel 104 is used to determine the vehicle type # based off the PWR@50mph value entered in channel 79. A vehicle # (type) is determined by the lookup table and then a value is computed by the equation.		
105 - DynLos	**hp**	**return((lerp(Speed,DynLsT))*AirDen/0.0763);**
Channel 105 uses roll speed to look up a loss value (in hp) from the embedded system tables. That value is then slightly modified by any changes in air density.		
106 - Af	**coeff**	**return((0.0425*(VehNum^3))-(0.8321*(VehNum^2))+(6.0267*(VehNum))-0.6188);**
Channel 106 is used to calculate the Af force coefficient based off the PWR@50mph value entered in channel 79. A vehicle # (type) is determined by the lookup table and then a value is computed by the equation.		
107 - Cf	**coeff**	**return((0.00007*(VehNum^3))-(0.0011*(VehNum^2))+(0.0056*VehNum)+0.013);**
Channel 107 is used to calculate the Cf force coefficient based off the PWR@50mph value entered in channel 79. A vehicle # (type) is determined by the lookup table and then a value is computed by the equation.		
108 - InrPwr	**hp**	**return((Mem4+WhlInr)*Accel*Speed/375);**
Channel 108 is used to calculate an inertia power value from the accelerative forces applied to the total roll set and rear wheel inertia mass. Uses MEM4 for rollset inertia.		
109 - DstncF	**feet**	**return(Mem5*5280);**
Channel 109 converts the distance in miles from system channel Mem5 to feet.		
110 - DstncM	**miles**	**return(Mem5);**
Channel 110 displays the reported distance in miles from system channel Mem5.		
111 - ElpsTm	**seconds**	**return(Timer2);**
Channel 111 uses timer 2, channel 211, to measure elapsed time in seconds during a test profile. It allows decimal precision adjustments, if desired. It is defaulted to hundredths of a second precision.		
112 - SAEPwr	**Chp**	**return(WhlPwr*SAECor);**
Channel 112 takes the measured wheel power from channel 100 and multiplies by the J-1349 atmospheric correction factor to provide a corrected wheel power value.		

1.0 Configuration File Description

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
113 - STPPwr	**Chp**	**return(WhlPwr*STPCor);**
Channel 113 takes the measured wheel power from channel 100 and multiplies by the J-607 atmospheric correction factor to provide a corrected wheel power value.		
114 - DJWhPw	**Chp**	**return(SAEPwr*Corfac);**
Channel 114 an "operator" corrected wheel power channel that uses the SAE J-1349 atmospheric correction applied to wheel power and then multiplies by an additional "operator" selected multiplier. Defaulted to 1.10 or 10%.		
115 - SAETrq	**Clb-ft**	**return(SAEPwr*5252.113/EngSpd);**
Channel 115 derives an atmospherically corrected wheel torque value from the SAEPwr channel. Uses the J-1349 correction factor.		
116 - STPTrq	**Clb-ft**	**return(STPPwr*5252.113/EngSpd);**
Channel 116 derives an atmospherically corrected wheel torque value from the STPPwr channel. Uses the J-607 correction factor.		
117 - DenAlt	**Feet**	**return(148300*(460+AirInT-17.34782*Baro_P+6.582028*Vap_P)/ (4.956534*(460+AirInT)-17.34782*Baro_P+6.582028*Vap_P));**
Channel 117 produces a value in estimated density altitude used by engine tuners.		
118 - Vap P	**InHg**	**return((lerp(AirInT,VaporT) * Humidy/100);**
Channel 118 calculates the vapor pressure in the air under the current test conditions. Interpolation table 137 contains the vapor pressure for 100% relative humidity at different air temperatures. The formula provides the vapor pressure from the table for the air temperature measured in channel 74 (Air Temp). That number is multiplied by channel 120, the percent relative humidity to obtain the actual vapor pressure. In channels 101 and 102, the vapor pressure is subtracted from the barometric pressure to determine the net barometric pressure to be used in the power correction factors. Vapor pressure is the true measure of water vapor content of the air. Relative humidity cannot be used directly because it varies with air temperature.		
119 - AirDen	**lb/cft**	**return(0.0763 * BaroP/29.92 * 520/(460+AirInT));**
Channel 119 is used to calculate the air density under the test conditions. Air density is measured in pounds per cubic feet of air. The constant 0.0763 is the lbs/cubic foot of air at sea level. Channel 119 uses the barometric pressure from channel 76 and the air temperature from channel 74 to calculate the actual air density under test conditions.		
120 - Humidy	**%**	**return(((HumSen-0.655)/2.54*100)/(1.093-(0.0012*AirInT)));**
Channel 120 takes the humidity sensor voltage input from channel 6 and combines it with the air temperature to determine the percent relative humidity of the air during the test. This data is then used by channel 118 to determine the vapor pressure in the air for power correction.		
121 - WhlTrq	**lbs-ft**	**return(WhlPwr*5252.113/EngSpd);**
Channel 121 derives an uncorrected wheel torque value in lbs-ft from engine RPM.		

1.0 Configuration File Description

Table 1-4. Equation Channels

Channel	Units Of Measurement	Formula
122 - Accel	**g**	**return(Mem0/21.937);**
Channel 122 derives the rate of acceleration in G units. Low level channel Mem0 produces an accel value in MPH/Sec, which is then converted into G units here.		
123 - RolRPM	**RPM**	**return(Speed*5280/60/29.94/3.1416*12);**
Channel 123 is used to calculate roll revolutions per minute. Uses 29.94" for AD-30 roll diameter.		
124 - TRLTRQ	**lb-ft**	**return(Trq1);**
Channel 124 is the channel Electrical Inertia Simulation (EIS) Road Load Controls to -- sum of load cells when there is an AC motor and an Eddy Current strain gauge together. Must produce a positive value using a positive cal coefficient from the TRQ1 channel for TRL to work properly. THIS MUST BE IN CHANNEL 124!!!!		
125 - EngSpd	**RPM**	**return((IgnPck*EngFrq/Pul_Rv*60)+(((OpTPck*OptRPM)+(CalPck*RolFrq))*RPMRat));**
Channel 125 derives engine speed from various inputs. Specification channels are used as switches to turn on/off portions of the equation, so only one signal source is used at any one time. Requires a jumper from channel 10 input to channel 9 for calculated method to work. Typically, on a 2640 board, the jumper is between R79-R85. The hardware file must be set for proper signal level, MAG or TTL. New systems use a Hall Effect, so use TTL.		
126 - AbsPwr	**hp**	**return(TrqAbs*RolRPM/5252.113);**
Channel 126 is used to calculate the absorber power in horsepower. It uses channel 3 - TrqAbs for 2WD AutoDyn systems instead of TRQ1 channel.		
128 - GrndTq	**lbs-ft**	**return(WhlPwr*5252.113/RolRPM/29.94*TirDia);**
Channel 128 is used to calculate torque applied to the ground. Derived from uncorrected wheel power channel, and reflects true torque at the ground as affected by gear ratio and tire diameter. Must have a reasonably close tire diameter input to be accurate.		

1.0 Configuration File Description

1.4.4 Interpolation Tables

Interpolation tables store non-linear functions for calibration and calculation purposes. They are typically used as calibration tables for air turbines, parasitic inertia tables for chassis dyno rolls, and correction factor tables. This feature is used to linearize a sensor or basically perform calculations from a set of arbitrary data. Tables can be defined with fixed interval or variable interval input values. The interpolation tables are located in channels 130 through 139.

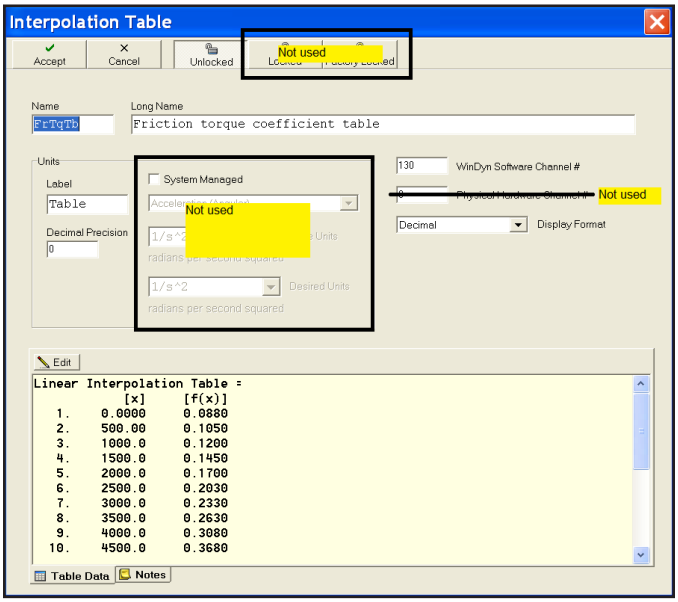

Figure 1.11: Edit Interpolation Channel Window

Interpolation Channel 130 - VehTbl

Channel 130 is an interpolation vehicle number look-up table used to compute Af, Bf, and Cf values based on vehicle Pwr@50mph. Operator enters in the Pwr@50mph value and the table selects the vehicle number, 1-15. Used in the Track Road Load simulation. The Input(x) is in HP units. The Output f(x) column, is a vehicle number used in the equations.

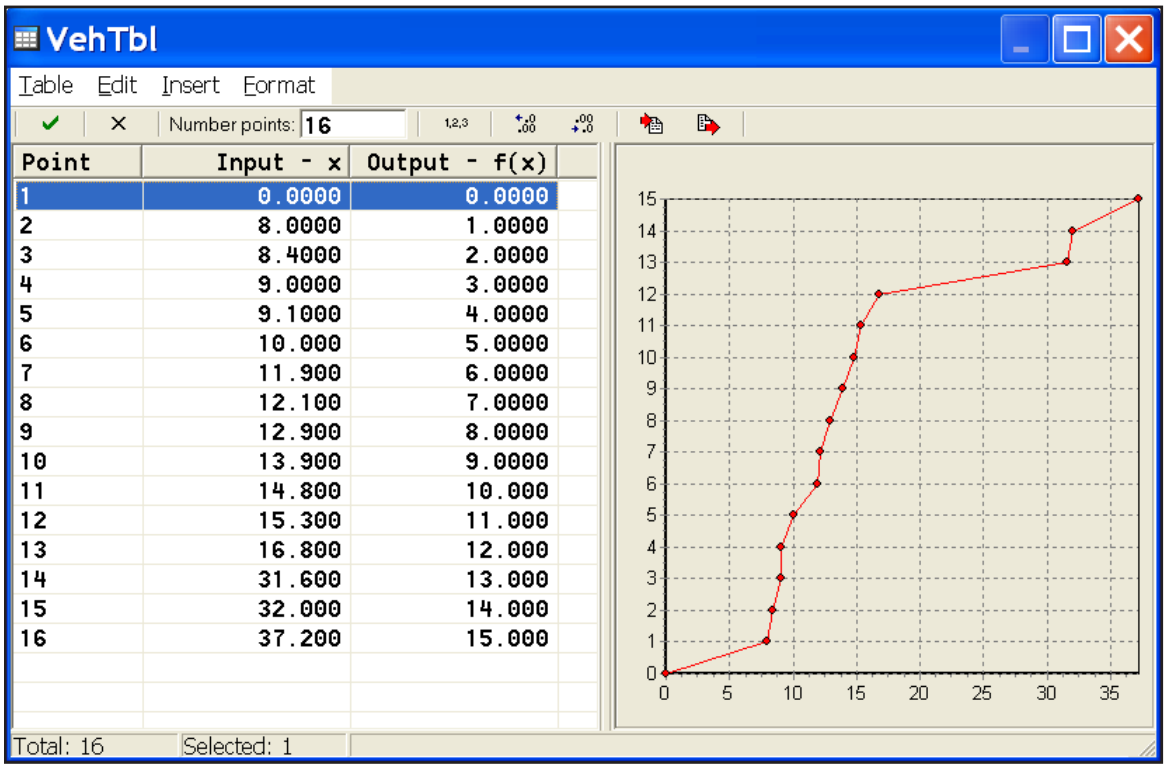

Figure 1.12: Channel 130 Values

NOTE:

The values are typical and come from EPA testing.

1.0 Configuration File Description

Interpolation Channel 132 - DynLsT

Channel 132 is a dyno loss interpolation look-up table in power units. It uses POWER values. This table is used for TRLTRQ calcs and the DynLos channel. The input is in MPH units. The output is in HP units. User must enter correct values in the table from the SuperFlow calibration sheet for their dyno. Typically, this is done by SF at time of dyno production

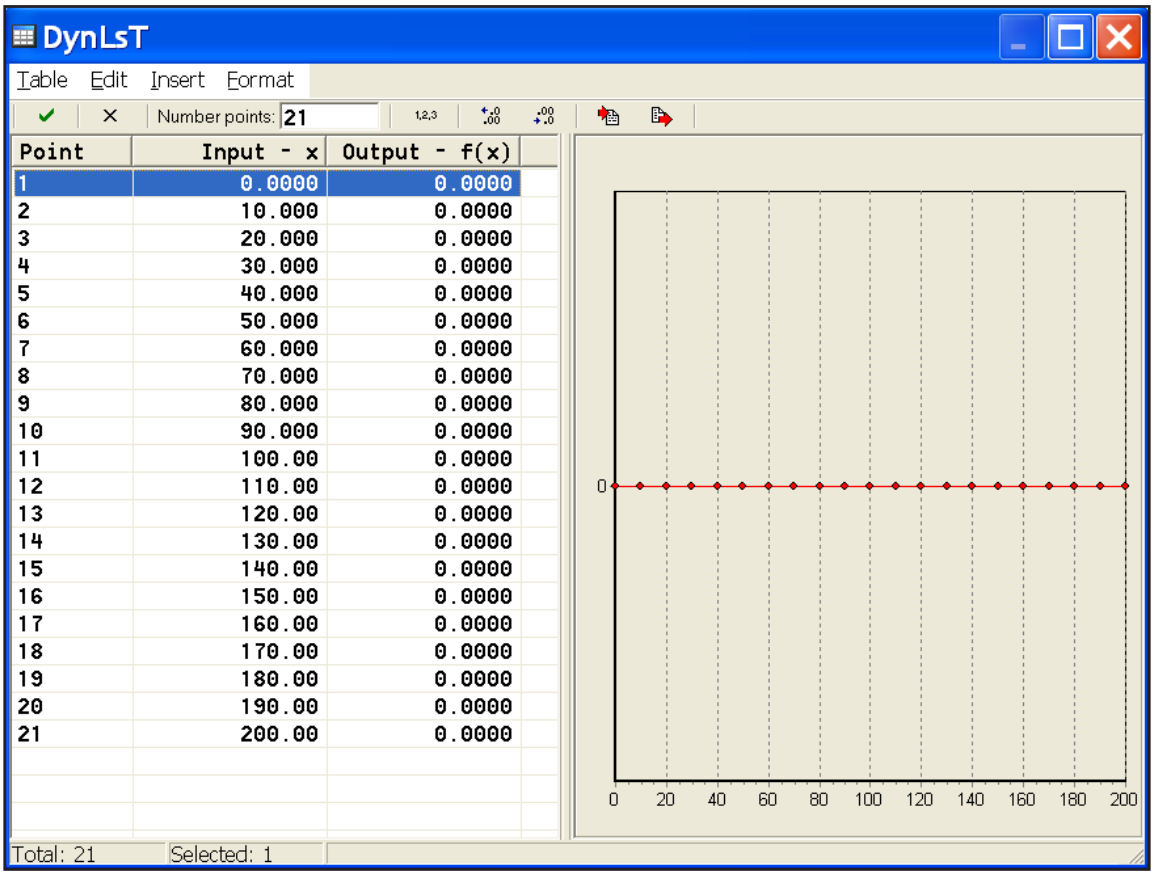

Figure 1.13: Channel 132 Values

1.0 Configuration File Description

Interpolation Channel 133 - Bf_Tbl

Channel 133 is an interpolation look-up table containing values used to compute Track Road Load simulation Bf values based on vehicle Pwr@50mph. Operator enters in the Pwr@50mph. A table selects the vehicle number, 1-15, which is then applied here to compute the appropriate Bf value.

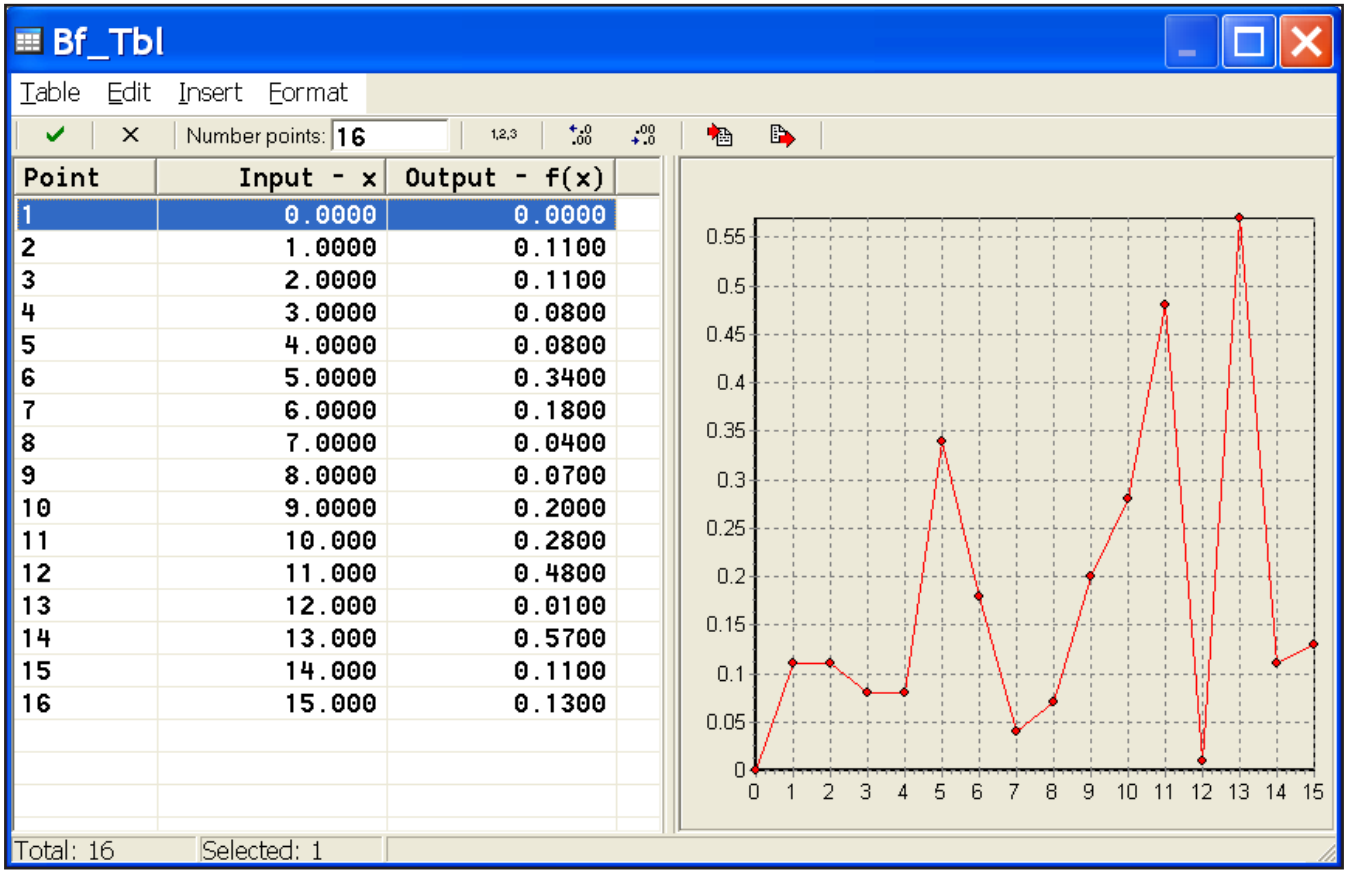

Figure 1.14: Channel 133 Values

NOTE:

The output values are typical and come from EPA testing.

1.0 Configuration File Description

Interpolation Channel 136 - AirTpT

Channel 136 is an interpolation look-up table to convert the voltage from the air temperature sensor in channel 1 into actual temperature for channel 74.

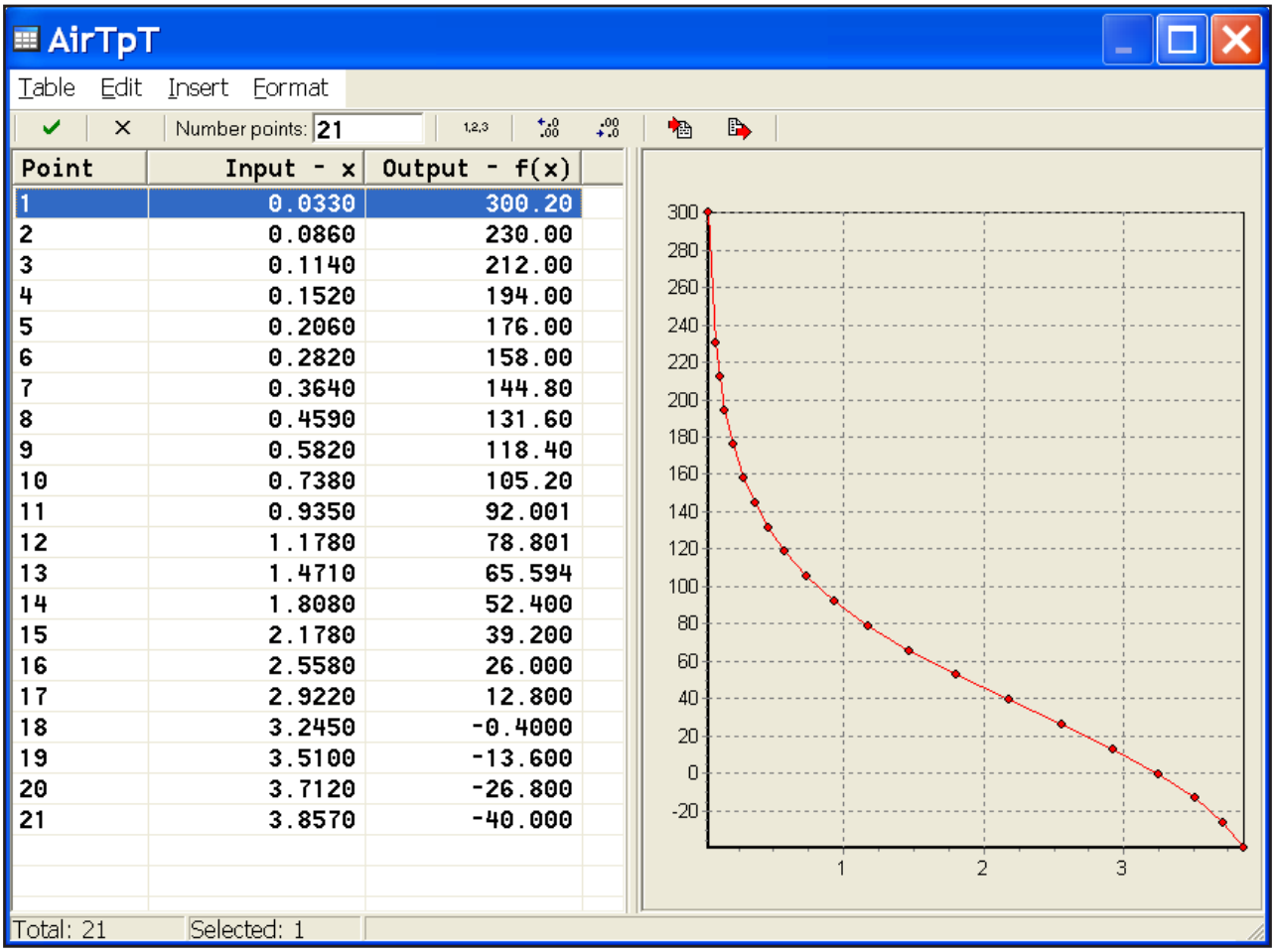

Figure 1.15: Channel 136 Values

1.0 Configuration File Description

Interpolation Channel 137 - VaporT

Channel 137 is an interpolation look-up table to determine the vapor pressure at 100% relative humidity (saturation vapor pressure) for the dry bulb temperature. The input is in temperature units in deg. F. The output is in vapor pressure units, inHg. This table is used in channel 118.

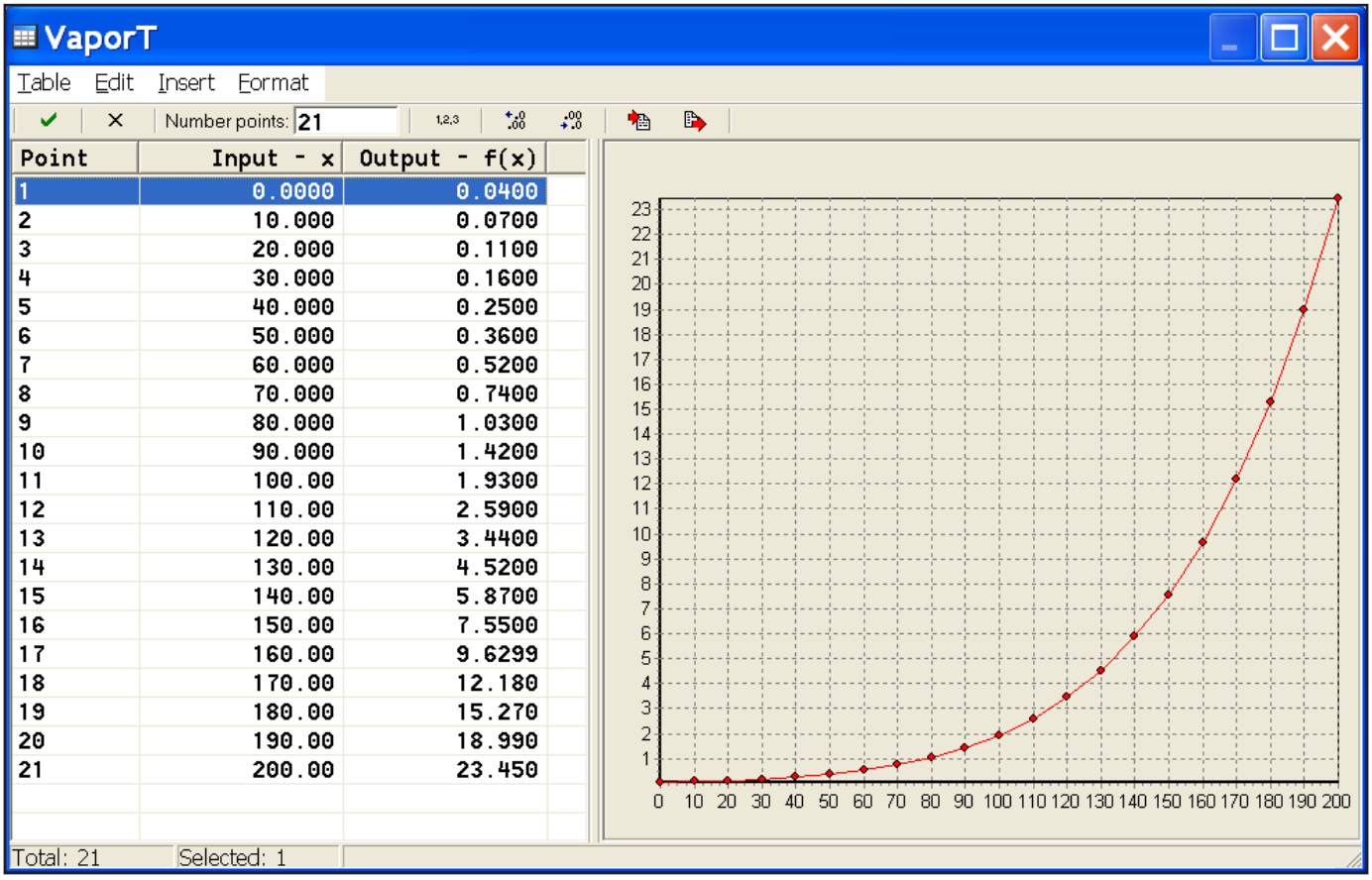

Figure 1.16: Channel 137 Values

1.0 Configuration File Description

Interpolation Channel 138 - AbsTab

Channel 138 is an interpolation look-up table to determine the absorber temperature. It is a curve fit table for the absorber temp sensor.

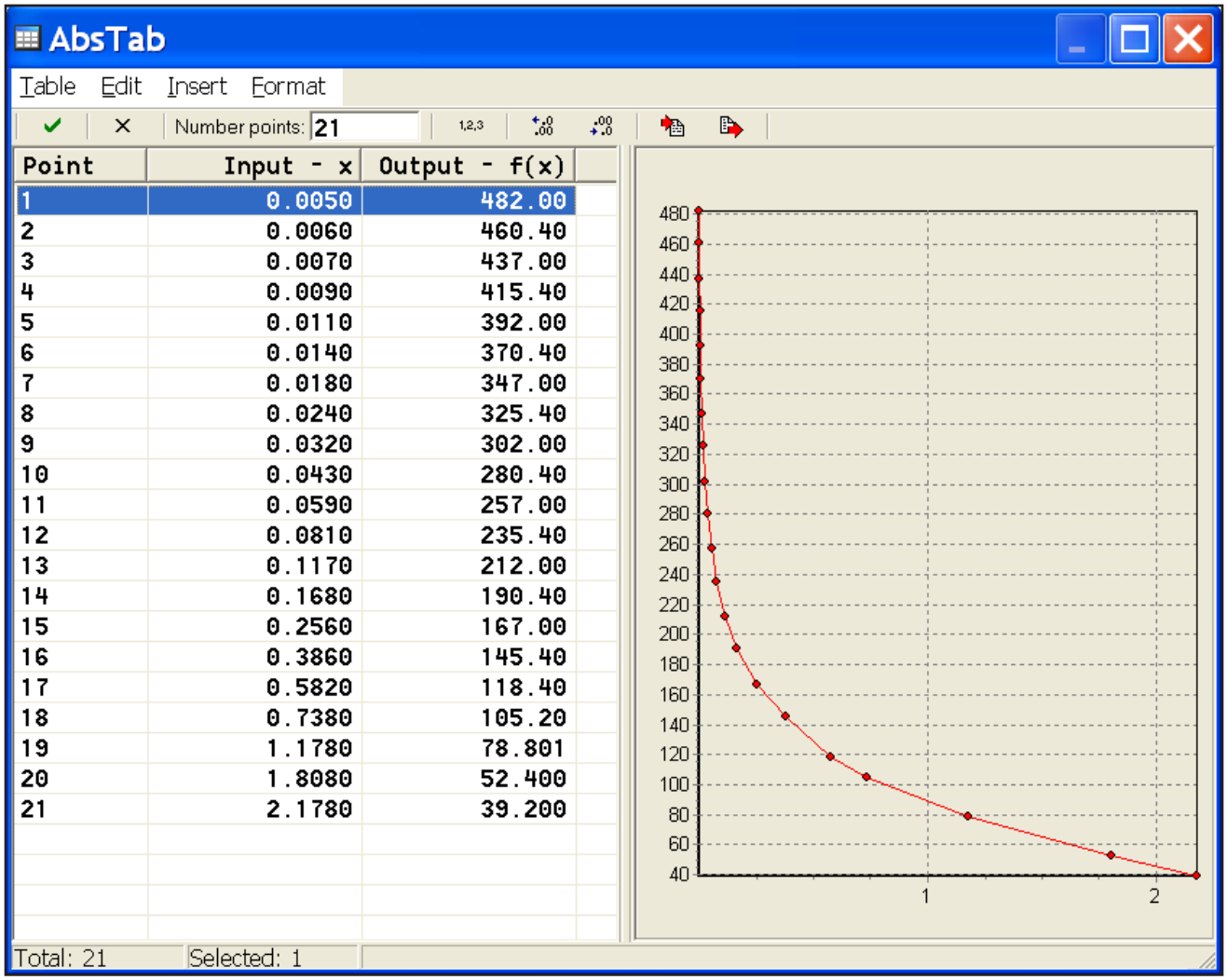

Figure 1.17: Channel 138 Values

1.0 Configuration File Description

Interpolation Channel 139 - CstDnT

Channel 139 is an interpolation look-up table which contains the power absorbed by the vehicle during a coast down. The values are curve fit from coast down data to smooth out irregularities in the data that may occur at the beginning of the test. The dyno and the vehicle will often times experience a torsional vibration that may take a second or two to become damped when the clutch is suddenly pushed in. This data is only used in the engine power calculations. The data is derived from the MeasCD channel, which is in Hp units.

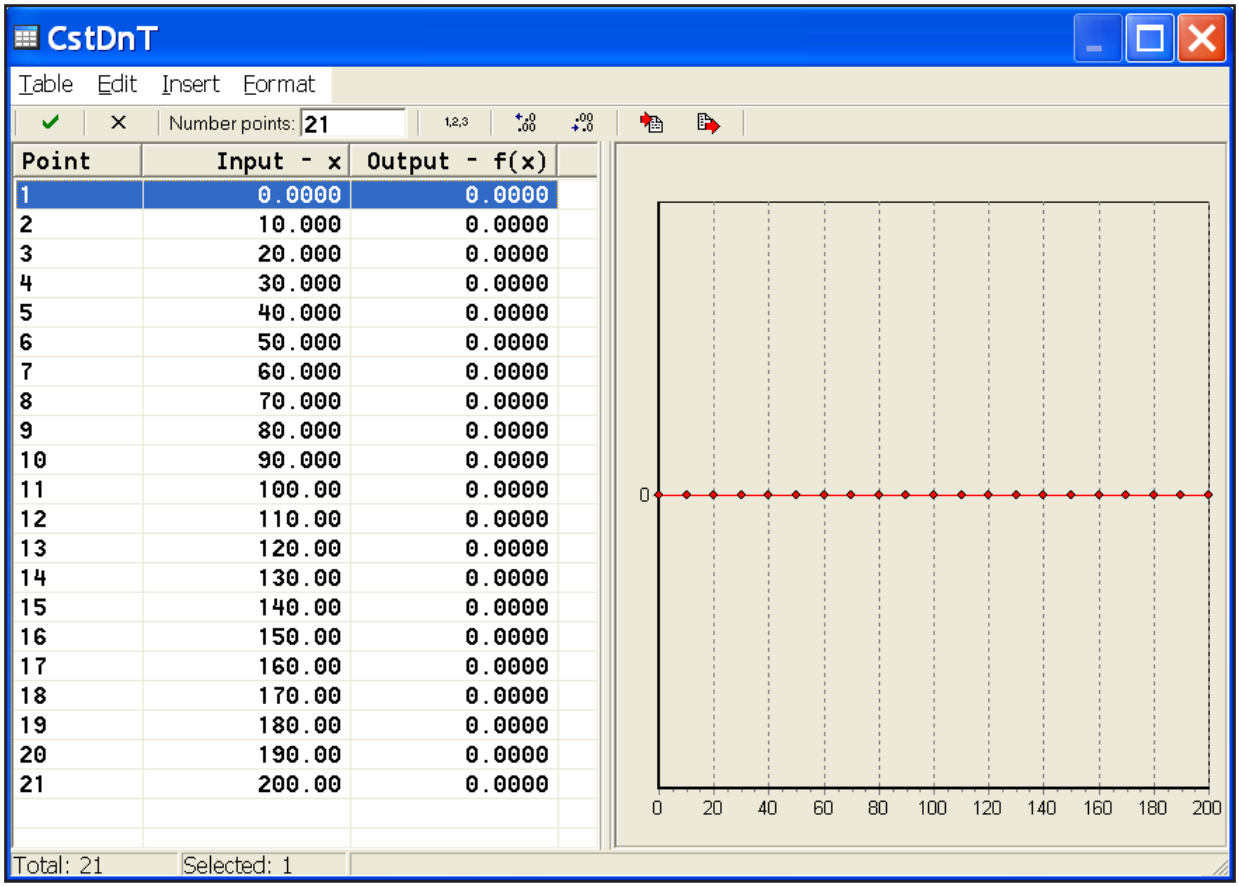

Figure 1.18: Channel 139 Values

NOTE:

The input is in MPH units. The output is automatically populated when a coastdown is performed. However, the data will not show up in the .cfx file. It is stored in system memory in the sensor box until the sensor box is powered OFF.

1.0 Configuration File Description

1.4.5 System Channels

System channels are pre-programmed channels that supply important information to WinDyn. The following descriptions lists the system channels and their functions. System Channels can be read and displayed in the same manner as data channels and can be used as operators in calculated channels. System channels cannot be modified or used for closed loop control.

Table 1-5. System Channels

Channel	Name	Description
200	**Time_H**	Displays the current hour from the system clock* (see note below)
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**	Not used.
205	**RnTime**	Not used.
207	**SetPt1**	Channel 207 is the load set point used by the absorber control system. A value in this channel indicates the control set point being used. The value changes depending upon the control channel being used. If control is manual, then the value represents a percentage of load from 0-100%. If the control is to vehicle speed, then the value indicates mph control point from 0–225 mph. If the control is to TRLTRQ, then the value represents a Track Road Load Torque.
208	**SetPt2**	Channel 208 is the throttle set point used by the optional electronic throttle control system. A value is this channel indicates the control set point being used. The value changes depending upon the control channel being used. If control is manual, then the value represents a percentage of throttle from 0-100%. If the control is to engine speed, then the value indicates an rpm control point from 0-20,000 rpm. This channel is not typically used on chassis dynamometers.
210	**Timer1**	Channel 210 is a system timer channel. This channel is typically used in test profiles to indicate the total time a test is running. It uses tenths precision.
211	**Timer2**	Channel 211 is a system timer channel. This channel is typically used in test profiles to indicate ramp time or the time during which the data is collected during a test. It uses thousandths precision.
212–218	**Timer3 to Timer9**	Used by the autotest to monitor timing functions. The timers are not user accessible. See the Test Profile editor in the WinDyn Users Guide for details
219	**SpcGv2**	Not used in current SuperFlow systems
220	**Memry0**	Channel 220 is acceleration in mph/second. It is used by Channel 122 to calculate acceleration.
221–222**	**Memry1 & Memry2**	Memory 1 (channel 221) used in test profiles to turn ON/OFF the engine power equations. Memory 2 (channel 222) is used when TDEbug is turned ON.
223	**Memry3**	Channel 223 is used to hold the total number of data lines recorded.

* 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.

1.0 Configuration File Description

Channel	Name	Description
224	**Memry4**	Contains chassis dyno system inertia value in Lbs. units.
225	**Memry5**	Display miles traveled on chassis dyno systems. May be reset via TPF commands.
226–227**	**Memry6 to Memry7**	Used when TDEBug, MEM95 is turned ON.
228**	**Memry8**	Used when TDEBug, MEM95 is turned ON.
229**	**Memry9**	Used when TDEBug, MEM95 is turned ON.
230	**Memr10**	Channel 230 used to hold the total number of data lines recorded.
231	**LineNo**	Channel 231 is a system channel which indicates the line number of the data line recorded in a test data file (.sfd). It can also be used when recording raw data at 100 times per second as a 1/100th second timer channel.
232	**Year**	This channel specifies the year when a data line is recorded in a test. This information is a permanent record of the test execution date and cannot be changed.
233	**Month**	This channel specifies the month when a data line is recorded in a test. This information is a permanent record of the test execution date and cannot be changed.
234	**Day**	This channel specifies the date when a data line is recorded in a test. This information is a permanent record of the test execution date and cannot be changed.
235	**DayWk**	This channel specifies the day of the week when a data line is recorded in a test. This information is a permanent record of the test execution date and cannot be changed. Day of week (0-7 = Sun-Sat)

** Memory 2, 6, 7, 8, and 9 have special functions due to MEM95=2 in TPF's. They report PID information about the control system.

NOTE: On some systems, channels 140-171 may be defined as thermocouple inputs or CAN channel inputs. They will have hard coded definitions which cannot be modified by the end user.