SuperFlow
DYNAMOMETERS & FLOWBENCHES
A Division of Power Test, Inc.

Operator Manual

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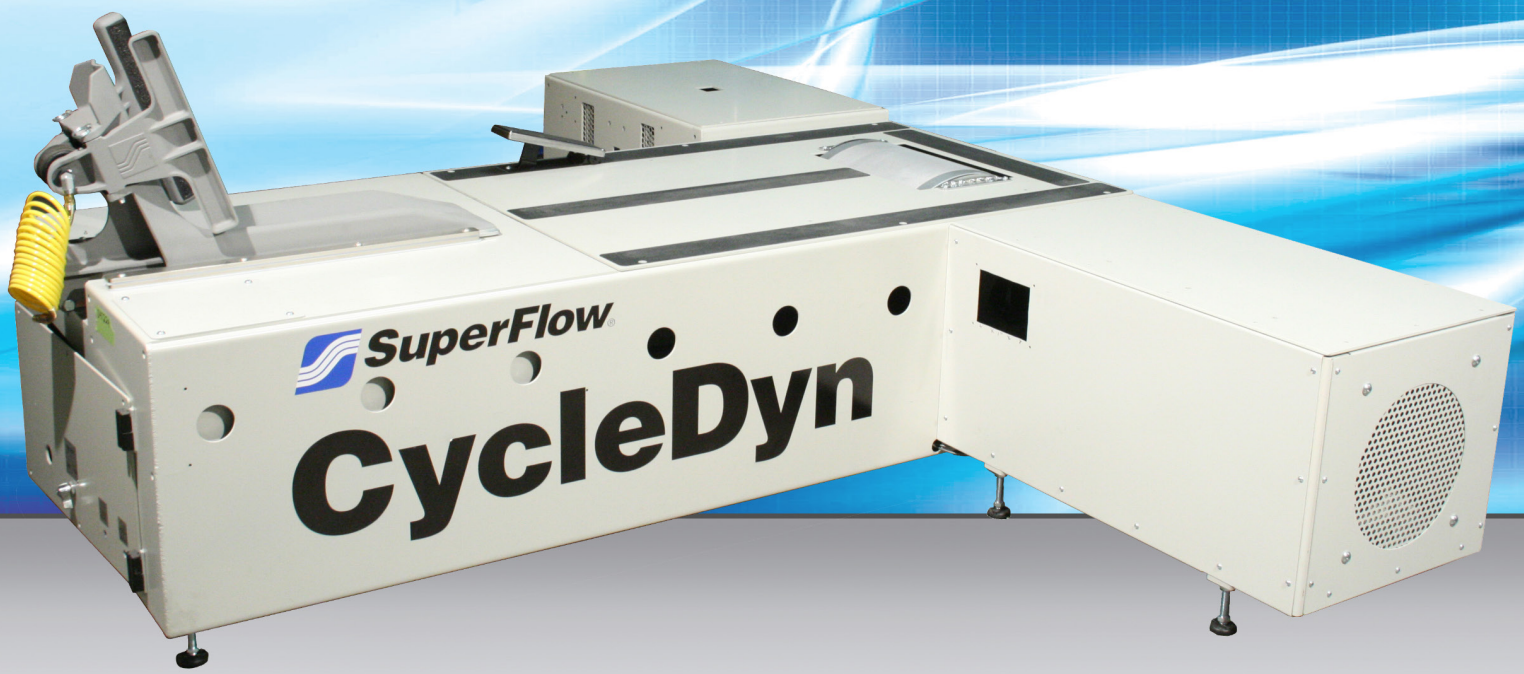
CycleDyn - AC



Original Instructions

www.PowerTestDyno.com

CHASSIS DYNAMOMETER

SuperFlow®
DYNAMOMETERS & FLOWBENCHES
A Division of Power Test, Inc.

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.

Introduction

Welcome

Thank you purchasing the SuperFlowAC Motoring Chassis Dynamometer Option. This is a quality product designed and manufactured to give years of dependable service. If you have any questions or comments, please call the SuperFlow Technologies Customer Service Department in Sussex, Wisconsin at 1-262-252-4301.

Product Features

Features of the AC Motoring Chassis Dynamometer include:

- Feature
- Feature
- Feature
- Feature
- Feature

About This Manual

This operator manual provides user information regarding basic component functions and operational procedures. *It is your responsibility* to become completely familiar with the information in this manual. Any person instructed to carry out installation, maintenance, or repair of the equipment must read and understand this manual and in particular the technical safety instructions.

SuperFlow Technologies Group is not responsible for any personal or property damage resulting from negligent actions by the user of this product.

How to Use This Manual

This manual is provided as a reference to explain the setup and operation of the AC Motoring Chassis Dynamometer and contains the following information:

- **Safety**

  General safety and operating safety, including warnings regarding non-observance of safety instructions.

- **Overview**

  Describes features and lists specifications.

- **Packaging and Handling**

  Describes how the unit was packagedand what parts to expect

- **Installation**

  Describes installation and how to prepare for operation.

- **Operation**

  Describes the basic operation principles and procedures.

- **Maintenance, Calibration & Troubleshooting**

  Covers general, daily, and periodical maintenance; calibration; and basic troubleshooting procedures.

- **Parts Lists**

  Replacement parts list.

- **Drawings**

  Includes general drawings.

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 specified 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).

SuperFlow Acceptance Certificate

Agreement made _____ __, ____ between SuperFlow Technologies Group and
Date

_____ (hereinafter called receiver) located
Company Name

at:

_____
Company Location (address)

_____

_____

_____

Receiver acknowledges and agrees that SuperFlow has supplied, installed and conducted training to its satisfaction on the SuperFlow equipment listed below:

Contract Components

Component Description	Component Serial No.

If any of the above components were never ordered and therefore never received, then indicate **Never Ordered** in place of that component's serial number.

Remarks: _____

By: _____

SAFETY

IN THIS CHAPTER

- **Safety Warnings**
  - **Dangers Due to Non-observance of Safety Instructions**
- **Room Requirements**
- **General Safety Procedures**
- **Noise Levels**
- **Carbon Monoxide Warnings**

1.1 Safety Warnings

WARNING: To ensure safe operation, this equipment must only be operated according to the instructions in the *SuperFlow Dynamometer Operator's Manual*. It is also essential that this equipment is installed, maintained, and operated according to local safety requirements.

Any person instructed to carry out installation, maintenance or repair of the equipment must read and understand the SuperFlow *Operator's Manual* and in particular the technical safety instructions. Any users of this equipment must operate only the controls of the equipment. Only qualified personnel should remove exterior panels and service equipment.

1.1.1 Dangers Due to Non-observance of Safety Instructions

- Hearing damage due to high noise level
- Electrical shock
- Exposure to rotating parts

1.2 Room Requirements

Follow all local construction codes when building a test cell.

- Install a Carbon Monoxide (CO) detector in the test cell.
- Provide fire extinguishers that are rated for gasoline and oils.
- Provide adequate lighting in the test cell and at the operators console.
- Provide a switch outside the test cell to turn off the ventilation fans and water pumps.
- Provide a means outside the test cell to shut off the fuel supply.

1.3 General Safety Procedures

CAUTION: Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around Printed Circuit Boards (PCBs).
- Do not touch the components or conductors on a PCB with your hands or with conductive devices.

CAUTION: To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Always follow basic safety precautions when using this product to reduce risk of injury or damage to equipment.

- Only authorized personnel trained in the operation of the dynamometer should have access to the equipment.
- Read and understand all instructions in the operator's manual.
- Use only the proper electrical sources as prescribed in the installation guide. Ensure circuit breakers are easily accessible and have the proper rating.
- Observe all warnings and instructions marked on the product.
- Provide fire extinguishers that are rated for electrical and oils.
- Provide adequate lighting in the test cell and at the operators console.
- Always wear proper protective clothing and eye/ear protection.
- Refer all service questions to qualified personnel.
- Do not remove any safety guards while the machine is in operation and be sure the safety guards are correctly mounted before operating the device.
- Disconnect the external power switch before opening any panel on the device.
- Replace the power cable if it is damaged.
- Keep the air inlet grids free of dust or dirt.
- Keep loose material away from the inlet and exhaust ducts.
- Do not store flammable materials in the vicinity of the equipment.
- Keep all personnel, flammable items, and sensitive objects away from any rotating object that can throw debris radially outward

1.4 Noise Levels

SuperFlow Technologies Group always recommends ear protection when operating the _____.

Warning Signs of Hazardous Noise[1]

- You must raise your voice to be heard.
- You cannot hear someone two feet away from you.
- Speech around you sounds muffled or dull after leaving a noise area.
- You have pain or ringing on your ears (tinnitus) after exposure to noise.

Hazardous Noise

Both the amount of noise and the duration of exposure determine the amount of damage to hearing. Noise levels are measured in decibels (dB). The higher the decibel level, the louder the noise.

For sound levels of 85 decibels (dB) or above, use hearing protection. Please follow all safety standards when operating this or any equipment.

1. Information in this section was adapted from "Noise and Hearing Loss," American Speech-Language-Hearing Association, 1997–2007, **http://www.asha.org/public/hearing/disorders/noise.htm**, February 2007.

1.5 Carbon Monoxide Warnings

When operating fuel-generated equipment in enclosed areas, take the following precautions to protect you and your employees against carbon monoxide exposure.

What is carbon monoxide?[1]

Carbon monoxide (CO) is a poisonous, colorless, odorless, and tasteless gas. Although it has no detectable odor, CO is often mixed with other gases that do have an odor; therefore, you can inhale carbon monoxide right along with gases you can smell and not even know that CO is present.

CO is a common industrial hazard resulting from the incomplete burning of natural gas and any other material containing carbon such as gasoline, kerosene, oil, propane, coal, or wood. One of the most common sources of exposure in the workplace is the internal combustion engine.

How does CO harm you?

Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen. Large amounts of CO can overtake you in minutes without warning—causing you to lose consciousness and suffocate.

Besides tightness across the chest, initial symptoms of CO poisoning may include headache, fatigue, dizziness, drowsiness, or nausea. Sudden chest pain may occur in people with angina. During prolonged or high exposures, symptoms may worsen and include vomiting, confusion, and collapse in addition to loss of consciousness and muscle weakness. Symptoms vary widely from person to person. CO poisoning may occur sooner in those most susceptible: young children, elderly people, people with lung or heart disease, people at high altitudes, or those who already have elevated CO blood levels such as smokers. CO poisoning poses a special risk to fetuses.

Acute poisoning may result in permanent damage to the parts of your body.

How can employers help prevent CO poisoning?

To reduce the chances of CO poisoning in your workplace:

- Install an effective ventilation system that will remove CO from work areas.
- Maintain equipment and appliances that can produce CO to ensure they are in good working order, promote their safe operation, and reduce CO formation.
- Consider switching from gasoline-powered equipment to equipment powered by electricity, batteries, or compressed air if it can be used safely.
- Prohibit the use of gasoline-powered engines or tools in poorly ventilated areas.
- Provide personal CO monitors with audible alarms if potential exposure to CO exists.
- Test air regularly in areas where CO may be present, including confined spaces.
- Install CO monitors with audible alarms.

1. Information in this section was adapted from the “OSHA Fact Sheet,” U.S. Department of Labor, Occupational Safety and Health Administration, 2002, **http://www.osha.gov/OshDoc/data_General_Facts/carbonmonoxide-factsheet.pdf**, February 2007.

- Use a full-face piece, pressure-demand, Self-Contained Breathing Apparatus (SCBA) certified by the National Institute for Occupational Safety and Health (NIOSH) or a combination full-face piece, pressure demand supplied-air respirator with auxiliary self-contained air supply in areas with high CO concentrations (those immediately dangerous to life and health atmospheres).
- Use respirators with appropriate canisters for short periods under certain circumstances where CO levels are not exceedingly high.
- Educate workers about the sources and conditions that may result in CO poisoning as well as the symptoms and control of CO exposure.
- In addition, if your employees are working in confined spaces where the presence of CO is suspected, you must ensure that workers test for oxygen sufficiency before entering.

What can employees do to help prevent CO poisoning?

To reduce the chances of CO poisoning in the workplace, employees should:

- Report any situation to your employer that might cause CO to accumulate.
- Be alert to ventilation problems—especially in enclosed areas where gases of burning fuels may be released.
- Report promptly complaints of dizziness, drowsiness, or nausea.
- Avoid overexertion if you suspect CO poisoning, and leave the contaminated area.
- Tell your doctor that you may have been exposed to CO if you get sick.
- Avoid the use of gas-powered engines, such as those in powered washers as well as heaters and forklifts, while working in enclosed spaces.

What are the OSHA standards for CO exposure?

The OSHA PEL is 50 parts per million (ppm). OSHA standards prohibit worker exposure to more than 50 parts of the gas per million parts of air averaged during an 8-hour time period.

For more information on carbon monoxide, visit the OSHA Web site at **http://www.osha.gov**.

AC MOTORING DYNAMOMETER

IN THIS CHAPTER

- Introduction
- Specifications
- Packaging and Handling
- Installation
- Preliminary Checks and Calibration
- Operation
- Maintenance

2.1 Introduction

Figure 2-1. CycleDyn AC Motoring Dynamometer with EC Absorber Option

A dynamometer, or "dyno" for short, is a device used to measure the torque and horsepower output of an engine. On a chassis dynamometer, torque is produced by applying a force or load on the vehicle tires as they rotate. Horsepower is calculated by simultaneously measuring the torque along with the rotational speed of the dynamometer.

The SuperFlow CycleDyn is a motorcycle chassis dynamometer designed to test motorcycles, go-karts, ATVs (quads), and similar vehicles within a safe, controlled environment. Testing on a dynamometer reduces road testing liability, improves measurement accuracy, and enhances productivity. Typical applications include:

- Research and Development (R&D)
- Performance testing and tuning
- Diagnostics
- Durability and quality control
- Fuel consumption and emissions testing
- Education
- Vehicle certification

CAUTION: This equipment generates, uses, and can radiate radio frequency energy. If not installed according to the *CycleDyn Operator Manual*, this equipment may cause interference to radio communications. The equipment was designed to provide reasonable protection against such interference when operated in a commercial environment. Operating this equipment in a residential area is likely to cause interference, and the user will be required to correct the interference at the user's own expense.

A dynamometer can also be used to determine the power required to “drive” an engine or vehicle. In that case, a motoring or driving dynamometer is used. A dynamometer that is designed to only be driven by the machine under test (MUT) is called an absorption or passive dynamometer. These are typically water brake or eddy current systems. A dynamometer that can either drive or absorb is called a universal or active dynamometer. Universal dynamometers can not only absorb the power of the MUT but can also drive the MUT for measuring friction, drive train losses and other factors.

Figure 2-2. AC Motor Module

The SuperFlow motoring dynamometer uses an AC electric motor with a specialized type of adjustable-speed drive. This setup classifies the system as a “universal” dynamometer where it can operate:

- As a generator that is driven by the MUT and applies a load as commanded by the system controller. In this mode the dyno functions as a typical water brake or eddy current system. However, the power “absorbed” by the AC motor must be transferred to a resistive load (load bank) or other outlet. In some systems, regenerative control units can transfer power from the unit under test to the electric utility where owner of the dynamometer can receive payment (or credit) from the utility for the returned power.
- As a motor that spins the dynamometer roll in controlled conditions, and therefore can “drive” the MUT at a desired speed or torque setpoint.

A motoring dynamometer provides the features of a brake dynamometer system, but can also can measure the frictional losses in an engine and allow testing of very small power small outputs. On chassis dynamometers it can duplicate speeds and loads that are experienced when operating a vehicle traveling downhill or on/off throttle operations. Many tests can even be run without the test vehicle’s engine running.

In addition to being used to determine the torque or power characteristics of a machine under test, motoring dynamometers are employed in a number of other roles. In standard emissions testing cycles such as those defined by the US Environmental Protection Agency (US EPA), dynamometers are used to provide simulated road loading of either the engine (using an engine dynamometer) or the full power train (using a chassis dynamometer). The hardware and software system can then “motor” the test vehicle to perform emissions drive cycles and inertia simulations, evaluate frictional losses, map Engine Control Units (ECUs) and numerous other engineering-grade test procedures. Using the AC Motoring option, you can test brakes, drivetrains, and other chassis components.

In fact, beyond simple power and torque measurements, motoring dynamometers can be used as part of a test bed for a variety of engine development activities such as the calibration of engine management controllers or detailed investigations into combustion behavior.

2.2 Specifications

NOTE: *These specifications are for a standard 75hp model and may vary based on the actual motor used. Refer to the documentation provided with the individual units for precise information.*

- **Dynamometer Power Rating**
  - Inertia only: 500 hp *[370 kW]*
  - AC Motor: contingent on power rating of AC Motor
  - Continuous with Eddy Current option: 300 hp @ 80 mph *[220 kW @ 130 Kph]*
- **Inertia Simulation**
  - 50 – 1,250 lbs *[22.7 – 568.2 kg]*
- **Load Bank Breaking Power**
  - 58,000 Watts continuous
- **Torque Measurement**
  - In-line rotary torque transducer
- **Power Requirements (motor drive)**
  - 480 VAC, 200 Amps, 3Ph, 50 or 60 hz
- **Dimensions (standard model only)**
  - AC Motor module: 35 L x 23 W x 21 H inches *[89 x 58 x 54 cm]*
  - AC Motor Drive: 17 W x 17 D x 36 H inches *[43 x 43 x 110 cm]*
  - AC Load Bank: 30 W x 18 D x 40 H *[76 x 46 x 102 cm]*
- **Weights**
  - AC Motor Module: 1200 lbs *[545 kg]*
  - AC Motor Drive: 170 lbs *[77 kg]*
  - AC Load Bank: 250 lbs *[114 kg]*
- **Shipping weights and dimensions**
  - AC Motor module: 1400 lbs / 60 x 35 x 28 inches *[635 kg / 152 x 89 x 71 cm]*
  - AC Drive Unit: 175 lbs / 39 x 17 x 24 inches *[80 kg / 99 x 43 x 61 cm]*
  - AC Load Bank: 250 lbs / 36 x 22 x 46 inches *[115 kg / 92 x 56 x 117 cm]*

2.3 Packaging and Handling

The components of a CycleDyn dynamometer are shipped on wooden pallets or in crates. It is shrinkwrapped and covered by a fitted cardboard box secured by plastic or metal straps.

CAUTION: The dynamometer modules may have UNEVEN weight distributions.

2.3.1 Lifting and Handling Instructions

If possible, leave the dynamometer and auxiliary modules on the shipping pallets until ready for installation.

Lift point (both sides)

Place hooks on a lifting chain or strap into the openings at each end of the AC Motor module. Lift the module carefully and place it into position. You can make the final adjustment of the module position by hand.

Once off the pallet, use a forklift or pallet jack to move the frames or modules. Make sure the forks are completely across the frame and extend out the opposite side. Always use blocks under the frame edges when removing the forklift or pallet jack.

Use an overhead hoist to lower the dynamometer frame and modules to their final position on the floor. Never push the frame off the forklift, pallet jack, or blocks.

WARNING: Failure to use the lift points indicated or improperly using a hoist or forklift may result in damage or severe personal injury.

TIP: *An alternative method for moving the dynamometer and modules is to use a heavy-duty strap under the frame and lift them with a forklift or hoist. When the dynamometer is in position, slide the strap out from under the frame.*

2.3.2 Packaging

Use the list below as a general checklist when the system arrives. The list describes a standard 75HP AC Motor option. Individual systems may vary; this list is for a standard system and does not include options. Check the order acknowledgement for the exact listing for the particular system.

- ❑ AC Motor module
- ❑ 4-foot calibration arm
- ❑ Calibration support arm with turnbuckle link
- ❑ Motor Drive Unit
- ❑ Regenerative Load Bank
- ❑ Shaft coupler with in-line torque transducer
- ❑ Six each ½-13 x 1-½ bolts to connect the AC Motor module to the main dynamometer frame
- ❑ Cable, Sensor Box to AC Motor Drive (1200A-0270)
- ❑ Cable, Sensor Box to AC Motor Drive (1200A-0271)

2.4 Installation

IMPORTANT: This section covers only the installation of an AC Motor module on a dynamometer. Refer the regular system operator's manual for details on the installation of the dynamometer itself and the Eddy Current option if applicable. Read the unpacking and inspection instructions in it's entirety before installing the dynamometer or any accessories.

The installation involves both mechanical connections and electrical connections.

- The AC Motor module attaches to the roll shaft on the dynamometer chassis but can also be coupled to an eddy current module to provide even greater testing capability.
- The motor drive unit connects to the AC motor, the resistive load bank (if applicable), and to the data acquisition system (sensor box).

Consider where the dynamometer will be located. The floor must be level and able to support the weight of the dynamometer, all add-on options, and the vehicle under test including the operator. Allow access space on all sides of the dynamometer.

Inspect all crates and boxes for external damage. Be sure to check underneath the crate for possible forklift damage. Report any damage to the shipping company and SuperFlow Customer Service.

Unpack the equipment and take inventory of all the provided parts. Contact SuperFlow Customer Service if there are any questions.

2.4.1 Mechanical Connections

Detailed information for this section is pending.

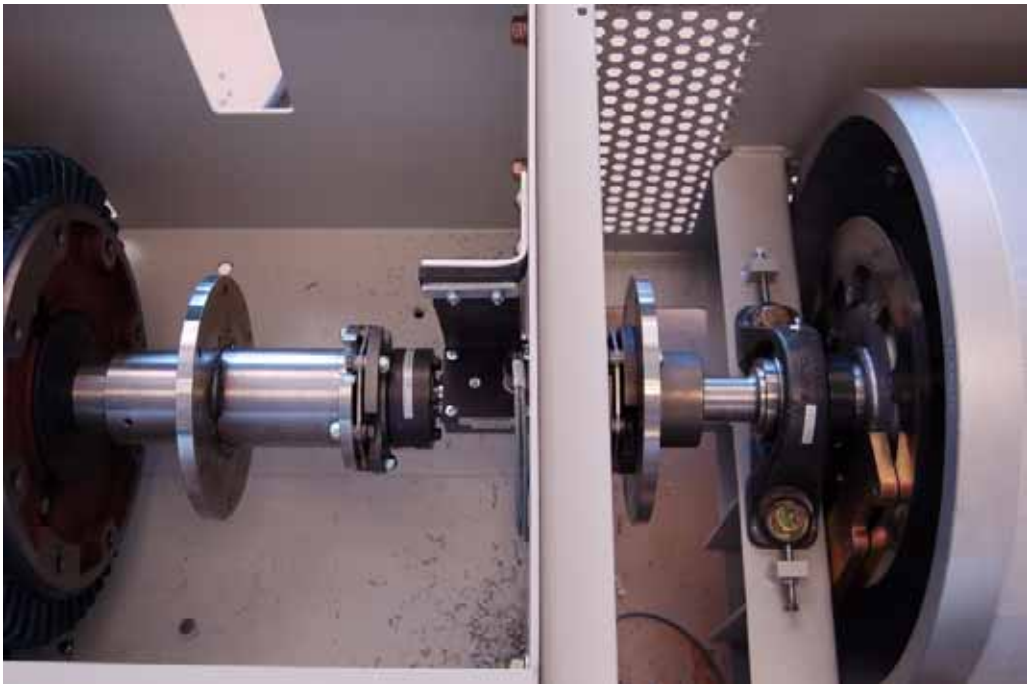
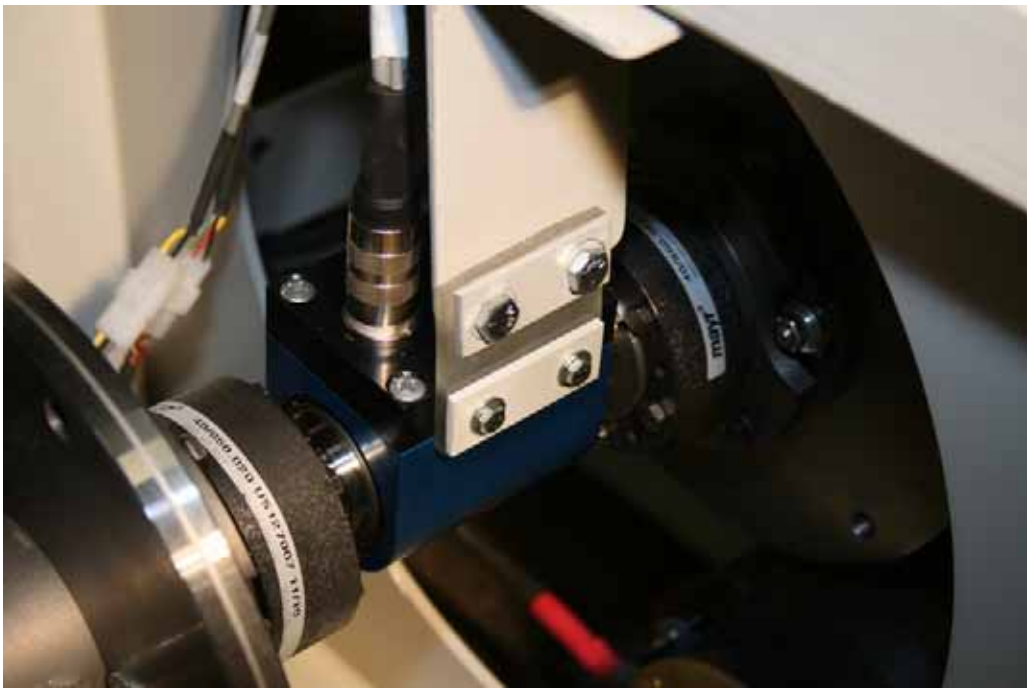


Figure 2-3. AC Motor Coupling - Overview

1. Attach the AC Motor cube to the side of the main CycleDyn chassis ensuring the cube is level.
2. Insert the shaft keys and slide the couplers on the shafts.
3. Place the keys and couplers on the in-line torque/speed transducer
4. Mount the transducer assembly on the bracket in the AC Motor cube. Be certain to mount the nylon cushions on both sides of the bracket.



5. Bolt the couplers together.
6. Verify the coupler and transducer run-out is less than 0.020". Adjust if necessary.

2.4.2 Electrical Connections

NOTE: *This procedure assumes the use of a ABB model ACS800 Motor Drive but it can be applicable for other makes and models. Only basic instructions are provided with references to the manufacturers installation guide for specific details or information. If a manual was not included with the AC Motor assembly, check the manufacturers website for a download version or contact SuperFlow Customer Service with the make and model number of the motor drive.*

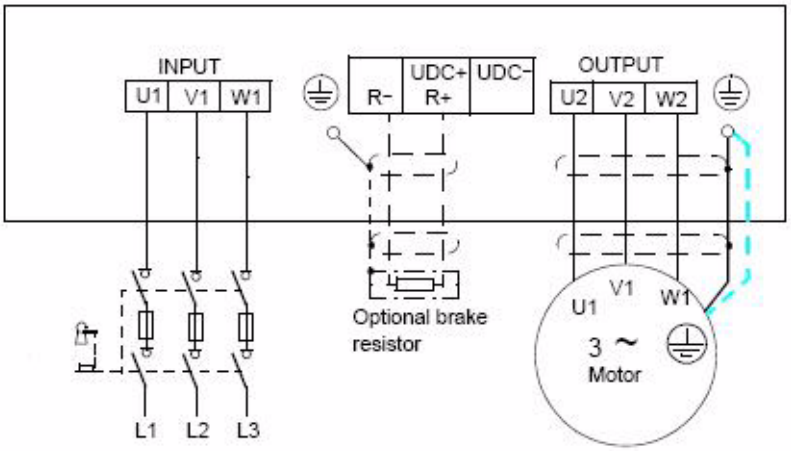
1. Mount the primary Motor Drive unit to a suitable wall or other support structure according to the instructions in the manufacturers installation guide.
   - The drive unit should be no further than 25 feet *[7.5 meters]* from the SuperFlow sensor box for the control cables to reach. Custom length cables can be obtained from SuperFlow if necessary.
   - Maintain free space around the unit to enable cooling air flow and service access. Follow the manufacturers recommendations or allow a minimum of 12 inches *[300 mm]* on all sides.
   - When installed in a closed cabinet, ensure adequate cooling through the enclosure.

Figure 2-4. ABB model ACS800

IMPORTANT: The installation of high voltage electrical equipment must always be made according to applicable local laws and regulations. All electrical work must only be performed by a qualified electrician. Always follow standard safety precautions. SuperFlow Technologies Group or it's affiliates do not assume any liability whatsoever for any installation which breaches local laws and/or regulations, or for any work done by un-qualified personnel. Furthermore, if the recommendations provided in this procedure or in the manufacturers installation guidelines are not followed, the drive may experience problems that the warranty does not cover.

2. Install a hand-operated disconnecting device (switch) between the AC power source and the motor drive. The disconnecting device must conform to the applicable safety regulations and be of a type that can be locked to the open position for installation and maintenance work.
3. Follow the procedures and precautions for installing the motor drive as outlined in the manufacturers guidelines or manual. With any installation, always consider the following recommendations.
   - Ensure the electrical power source has thermal overload and short-circuit protection. Follow the manufacturers guidelines or use a suitable 200 Amp breaker in the power circuit.
   - Select the cable size according to local regulations based upon the rated drive load current. 600 VAC cable is normally accepted for up to 500 VAC.
   - Ensure a common ground between the motor drive, motor, resistive load bank, and source power.
   - Shielded symmetrical motor cable is recommended. However, shielded cable is not necessary when continuous conduit is used.
   - It is recommended that the power cable, motor cables, and load bank cables be installed in separate conduits or cable trays. High voltage cables should never be run alongside control cables or low-voltage wiring.

4. Motor Drive Power Cable Connections:
   - Make sure the motor drive is disconnected from the main power source during installation.
   - Remove the cover on the motor controller frame to access the entry holes for the cables. Open the holes if necessary.
   - Route the power cables through the access holes and connect them as specified in the manufacturers installation guide or as shown below. Remember there are also control cables that will pass through the panel.



Power Input	U1 = Red	V1 = White	W1 = Black
Load Bank	R- = Black	R+ = White	
Motor	U2 = Red	V2 = White	W2 = Black

Figure 2-5. Motor Controller Power Connections

   - Cover the terminals if provided with an insulated or plastic shroud.

5. Connect the power cables to the AC motor as specified in the manufacturers installation guide or a shown below.

T1 = Red	T2 = White	T3 = Black

NOTE: *Reverse the wires on T2 and T3 to change motor rotation direction.*

6. Connect the power cables to the resistive load bank as specified in the manufacturers installation guide or as below.
   - Terminals are typically located at the bottom of the load bank. The wire polarity is not important. Connect the ground wire to the load bank case.

2.4.3 Cooling Fan Motor

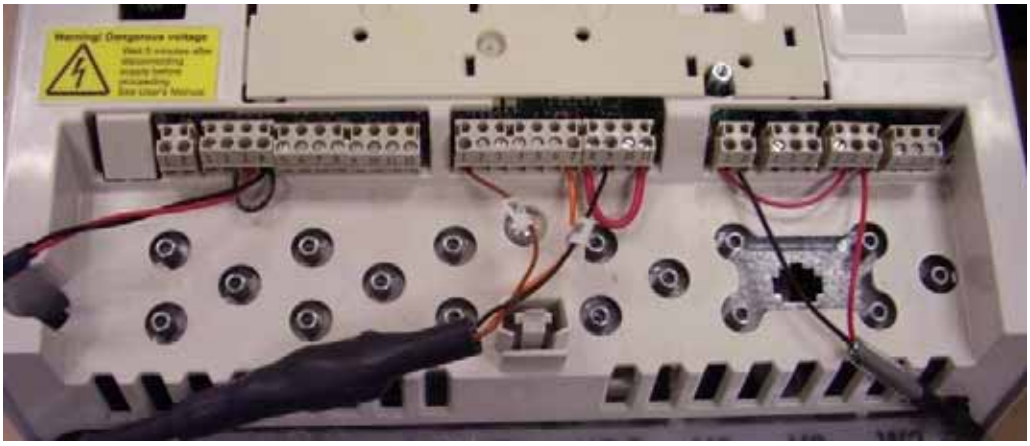
The optional cooling fan motor is attached to the end of the AC motor on the dynamometer. The motor will generally have it's own motor controller which can be programmed to run independently or triggered from the primary drive. This procedure assumes the cooling motor will be set to run whenever the primary motor is on.

1. Connect the power cables for the motor controller to an appropriate source. The motors are usually 240V, single phase so power can be "tapped" off two legs of the 3-phase power to the primary controller as shown below or power can be from an independent source. Ensure a common ground between the two motor controllers.

2. Using the operator's manual for the motor drive, program as follows:
   - Set for remote or external trigger.
   - Set motor drive frequency or run speed to 40% (this reduces the noise from the motor but still provides adequate cooling).
   - Set the mode of operation as an exhaust fan (if applicable).
   - Set to run for a minimum of 30 seconds after the remote signal is turned off.
3. Connect a cable to the remote control input on the cooling fan motor drive. The other end of the cable is covered in the next section.

2.4.4 Control Cable Connections

There are two control cables that connect between the motor controller and the data acquisition sensor box system interconnect panel. A third control cable goes to the cooling fan motor drive.



1200A-0270 Control Cable | **1200A-0271 Switching Cable** | **Fan Motor Switching Cable**

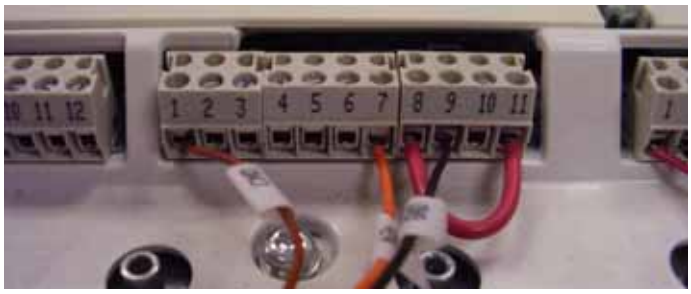
Figure 2-6. Motor Drive Control Connections

1. The 1200A-0270 cable carries the 0-10V variable control voltage from the data acquisition system to the motor drive. On the ABB drive it connects to the speed reference input as shown below. The jumper between terminals 2 and 4 tie the reference grounds together. Refer to the manufacturers installation guide for detailed information.

Terminal #	Wire Color	Function
X21-2	Black	Ground
X21-3	Red	Signal +
X21-4	Black	Signal -

Figure 2-7. 1200A-0270 Motor Drive Cable Connections

2. The 1200A-0271 cable carries the switching signal from the data acquisition system to the motor drive. This signal turn the motor on and off as needed. Refer to the manufacturers installation guide for detailed information.

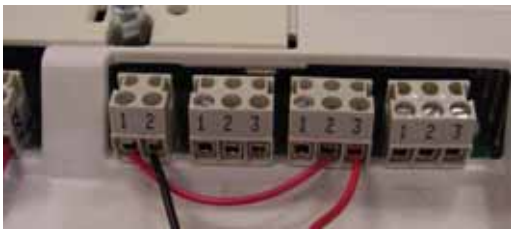


Terminal #	Wire Color	Function
X22-1	Brown	Start/Stop Command
X22-7	Orange	+24Vdc
X22-8	Red	+24Vdc
X22-9	Black	Ground
X22-11	Red	Start Interlock (0 = Stop)

Figure 2-8. 1200A-0271 Motor Drive Cable Connections

The jumper between terminal 8 and 11 is an safety interlock. If desired, this can be connected to a normally closed external switch that can be used to disable the motor from running if the the switch is open.

3. Connect any two-wire cable between the primary motor drive and the fan motor drive as shown below or as per the manufacturers installation guide. The primary drive provides a programmable relay output than turns on the fan motor when the main drive is on.



Pin #	Wire Color	Function
X23-1	Red	+24Vdc
X23-2	Black	Ground
X26-2	Red	Relay 2 Input
X26-3	Red	Relay 2 Output

Figure 2-9. Motor Drive Fan Motor Switching Connection

The jumper between terminals X23-1 and X26-2 is to connect +24Vdc to the relay control.

2.4.5 Sensor Box Connections

Connect the 1200A-0270, 1200A-0271, and main dynamometer cables to the data acquisition sensor box as shown below. All other connections on the sensor box should be made according to the primary system operator's manual.

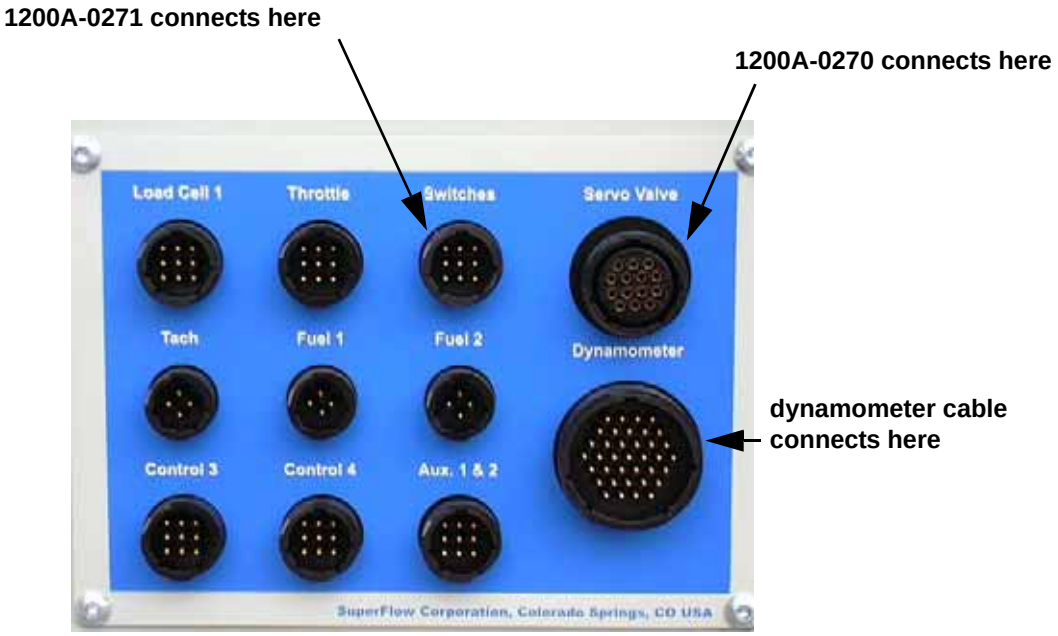


Figure 2-10. Sensor Box Interconnect Panel

2.5 Preliminary Checks and Calibration

The AC motor and controller were setup by SuperFlow prior to shipping with all the required parameters programmed in the controller. If the controller or motor has been replaced or repaired, the programming may have to be performed again. Contact SuperFlow Customer Service for the necessary information and procedures.

CAUTION: Operation of the AC Motor and dynamometer can sometimes be very loud. Always wear proper ear protection.

2.5.1 Motor Rotation Direction

1. Double check all connections ensuring they are correct and that terminal screws are tight.
2. Turn on the AC power source to the motor drive. The display on the motor drive may become active and the cooling fan may come on but the motor should not start moving.
3. Turn on the motor controller power switch if applicable. ABB controllers typically do not have a power switch.
4. Turn on the power to the SuperFlow data acquisition sensor box.

NOTE: *The following procedure assumes an ABB ACS800 motor controller. Refer to the manufacturers operation manual for other makes and models.*

5. Select the desired language if prompted on the ABB drive. This procedure assumes English.
6. The next step is to verify the motor is turning in the correct direction.
   - Place the controller in “Local” by pressing the Local/Remote button until “L” is displayed on the status display.
   - Make sure the motor and dynamometer roll is clear of any obstruction.
   - Press the ACT button to display the status row.
   - Press the REF button to access manual control.
   - Press the up arrow button to increase the speed reference by a small amount. Press the green start button. The motor will make a high pitched sound and start turning. Press the red stop button to stop the motor.
   - If the motor turns in the wrong direction interchange the red and white wires to the motor at the controller connections.

     CAUTION: Wait 5 minutes after switching motor power off before touching any wires.

   - Recheck the motor rotation direction.
   - Stop the motor and place the controller in “Remote” mode.

2.5.2 Motor Identification (ID)

In order for the system to work properly and smoothly, the motor and controller must be synchronized together or “mated”. This is done through a process using the local mode on the controller panel. The Motor ID is done by SuperFlow prior to shipping but it can be done on site as a test or motor operation check.

1. Remove the coupling between the AC Motor and dynamometer roll. The motor ID should be done without any load on the motor.
2. Power the ABB drive.
3. Press the **Loc** Button.
4. Press the **Para** Button.
5. Navigate to the **99 -10** parameter using the up and down buttons.
6. Change 99-10 to **Standard**.
7. Press the Green Go Button.
8. The drive will perform the identification process which will take a few minutes.
9. After it finishes the drive will display **ID Done**.
10. Press the **Rem** Button to place the drive in remote mode.

2.5.3 Remote Control Test

From the dyno handheld set the controller to speed mode by pressing the **blue arrow** button then the **Modes** (J) button. Press the A or B buttons to select speed and press **Done**. Set the ABB controller to remote by pressing the Rem button. Increase the load control to 10 and the motor should start turning. Decrease the load control to 0 and the motor should stop turning. Switch the motor off from WinDyn.

2.5.4 Torque Calibration

Any load (positive or negative) applied by the AC Motor is measured by an in-line torque sensor mounted on the roll-to-motor drive shaft. This torque is used in the total power calculations for a vehicle under test on the dynamometer.

Calibration information on the Interface in-line torque transducer is used to generate a coefficient that converts the voltage output to torque. This coefficient is entered into the system configuration file and should be accurate for all applications. However, the torque readings can be verified if desired using the following procedure.

Further detailed information for this section is pending.

2.5.5 Inertia and Parasitic Loss Calibration

Every chassis dynamometer has a built-in inertia factor and parasitic losses.

- The inertia is the equivalent vehicle weight of the rotating components of the dynamometer and is used in the calculations to determine the required force needed to accelerate those components. This force is accounted for in the total power calculations for a vehicle under test. Inertia factor are referenced in pounds (lbs).
- The dynamometer internal parasitic losses, typically bearing friction and aerodynamic drag, are measured, stored, and accurately accounted for in the power calculations for the vehicle under test. Parasitic losses are referenced in foot / pounds (ft / lbs).

Verification of the inertia factor and parasitic loss curve should conducted at a frequency set by the requirements of the testing being done, or as necessary following service to the dynamometer.

2.5.5.1 Inertia Calibration

This process determines the inertia of the system and will set the value into Memory 4, Dyno Inertia. The value in this memory is automatically used as the inertia factor in the power calculations.

This procedure is performed without a vehicle on the dynamometer.

From the dyno handheld press **Configure** (the I button) then **Calibrate** (B). Select the "**Inertia**" option.

The settings have been defaulted for best use, but may be changed if desired. The warm up routine should be done if the AC motor has not been used in more than 10 minutes. Once the **OK** button is pressed the process will begin automatically. Observe the inertia value displayed after each cycle. It should only vary by one or two points. Ten cycles will be performed, but the process may be terminated early by pressing the DONE option. The EXIT option will abort the process.

2.5.5.2 Parasitic Loss Calibration

This routine will spin the roll up to the maximum speed as set in the dynamometer low-level configuration, then sequentially step down in 10 mph increments down to 0 mph. At each step the speed will stabilize and the system will collect data. This process takes about 10 minutes.

After completion of this calibration, the loss values are embedded into flash memory and used in all power calculations.

From the dyno handheld press **Configure** (the I button) then **Calibrate** (B). Select the "**Inertia**" option.

The settings are fixed and cannot be changed. The warm up routine should be done if the AC motor has not been used in more than 10 minutes. Once the **OK** button is pressed the process will begin automatically. Pressing the EXIT button will abort the process.

2.5.5.3 Coastdown Test

Detailed information for this section is pending.

2.6 Operation

Detailed information for this section is pending

NOTE: *The EC cube and AC Motoring cube may not be controlled concurrently. While the EC cube can remain attached to the AC Motor cube, the data acquisition and control system cannot control both at the same time. Software is provided to control one or the other.*

2.7 Maintenance

Detailed information for this section is pending

CAUTION: Stop the drive and wait for the motor to stop before turning off power to the drive or opening a contactor between the output of the drive and the motor.