HVAC Controls–Laboratory

Model 8635-C

SureFlow™ Room Pressure Controller

Operation and Service Manual

P/N 1980274, Revision E
April 2006

TSI®

Model 8635-C

SUREFLOW™
Room Pressure Controller

Operation and Service Manual

April 2006
P/N 1980274 Rev.E

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CONTENTS

How to Use This Manual

The SUREFLOW Operation and Service Manual is divided into two parts. Part one describes how the SUREFLOW unit functions and how to interface with the device. This section should be read by users, facilities staff, and anyone who requires a basic understanding of how the SUREFLOW operates.

Part two describes the technical aspects of the product which includes operation, calibration, configuration, maintenance, and troubleshooting. Part two should be read by personnel programming or maintaining the unit. TSI recommends thoroughly reading this manual before changing any software items.

NOTE: This operation and service manual assumes proper SUREFLOW installation. Refer to the Installation Instructions to determine if the SUREFLOW has been properly installed.

PART ONE

User Basics

Reading product manuals should not be a difficult and time-consuming process. This section provides a brief but thorough overview of the SUREFLOW product by maximizing information with minimal reading. These few pages explain the purpose (The Instrument), and the operation (Useful User Information, Digital Interface Module, Alarms) of the unit. Technical product information is available in Part Two of the manual. The manual focuses on laboratory spaces, but the product information is accurate for any room pressure application.

The Instrument

SUREFLOW measures and reports "room pressure". Proper room pressure can control airborne contaminants that can adversely affect experiments, workers in the laboratory, and people in the laboratory vicinity. For example, laboratories with fume hoods need negative room pressure (air flowing into the room), to minimize exposure to people outside the laboratory. The fume hood is the first level of containment, and the laboratory itself is the second level of containment.

Room pressure, or pressure differential, is created when one space (hallway) is at a different pressure than an adjoining space (laboratory). When a pressure differential is created between two spaces, air is forced to flow from the higher-pressure space to the lower pressure space. The direction of air flow is one component of proper room pressure. The second component of room pressure is the speed or how fast is the air moving between the two spaces. The SUREFLOW provides both pieces of information by measuring whether the air is flowing into or out of a laboratory, and the speed of the air.

Negative room pressure is present when air flows from a hallway into the laboratory. If air flows from the laboratory into the hallway the room is under positive pressure. Figure 1 gives a graphic example of positive and negative room pressure.

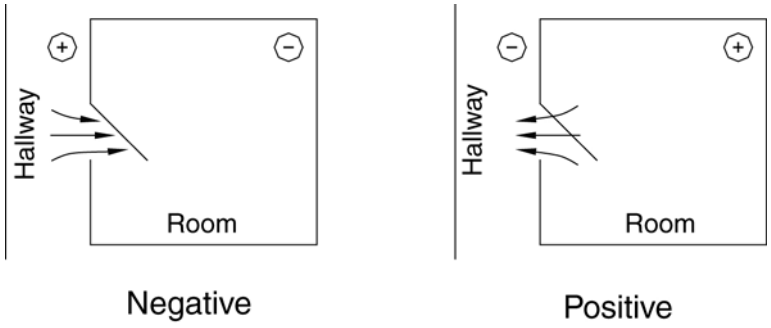

Figure 1: Room Pressure

An example of negative pressure is a bathroom with an exhaust fan. When the fan is turned on, air is exhausted out of the bathroom creating a slight negative pressure when compared to the hallway. This pressure differential forces air to flow from the hallway into the bathroom.

The SUREFLOW device informs the laboratory users when the laboratory is under proper pressure, and provides alarms when the room pressure is inadequate. If the room pressure is in the safe range, a green light is on. If the pressure is inadequate, a red alarm light and audible alarm turn on.

The SUREFLOW consists of two pieces: a pressure sensor and a Digital Interface Module (DIM). The pressure sensor is mounted above the doorway entrance to the laboratory. Usually the DIM is mounted close to the entrance to the laboratory. The pressure sensor continuously measures the room pressure and provides room pressure information to the DIM. The DIM continuously reports the room pressure and activates the alarms when necessary. SUREFLOW is a continuous measuring system providing instant information on the room pressure.

Useful User Information

The DIM has a green light and red light to indicate room pressure status. The green light is on when the room has proper room pressure. The red light comes on when an alarm condition exists.

Sliding the door panel to the right reveals a digital display and keypad (Figure 2). The display shows detailed information about room pressure, alarms, etc. The keypad allows you to test the device, put the device into emergency mode, and program or change the device parameters.

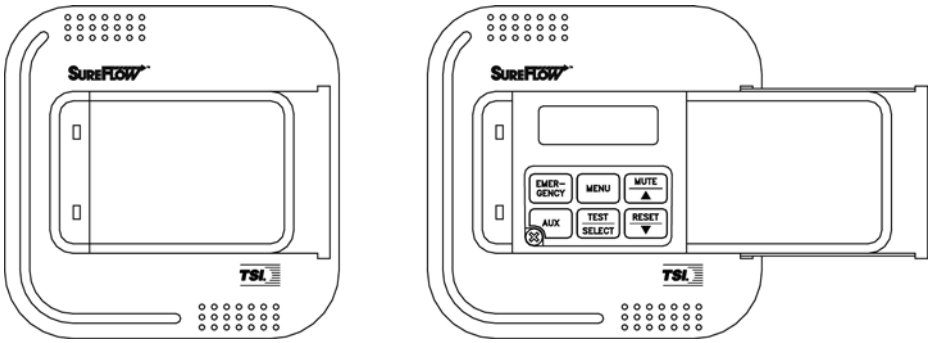

Figure 2: Digital Interface Module (DIM)

SUREFLOW has two levels of user information:

1. SUREFLOW has a red light and green light to provide continuous information on room pressure status.

2. SUREFLOW has a hidden operator panel providing detailed room status information, self-testing capabilities, and access to the software programming functions.

NOTE: The unit provides continuous room pressure status through the red and green light. The operator panel is normally closed unless further information on room pressure status is needed, or software programming is required.

Operator Panel

The DIM in Figure 3 shows the location of the digital display, keypad and lights. An explanation of the operator panel follows the figure.

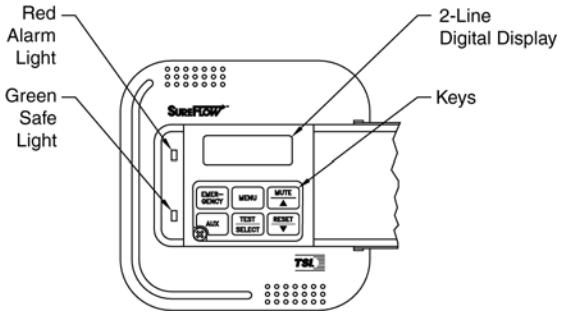

Figure 3: SUREFLOW Operator Panel - Open

Green/Red light

The green light is on when all the conditions for proper room pressure are adequate. This light indicates the laboratory is operating safely. If any of the room pressure conditions cannot be satisfied the green light turns off, and the red alarm light turns on.

Operator Panel

A cover hides the operator panel. Sliding the door panel to the right exposes the operator panel (Figure 2).

Digital Display

The alphanumeric digital display is a two line display that indicates actual room pressure (positive or negative), alarm status, menu options, and error messages. In normal operation (green light is on), the display continuously scrolls information about room pressure, and other variables programmed; flow, air changes per hour, etc. The variables that scroll depend on the options installed.

As an example, if an alarm condition occurs, the variable that normally scrolls

STANDARD		STANDARD
NORMAL	will change to read	ALARM = *

* will state type of alarm; low pressure, high pressure, flow

NOTE: When switch input (pins 11 & 12) is closed, the word standard is replaced with remote on display.

When programming the unit, the display will change and now show menus, menu items, and current value of the item, depending on the specific programming function being performed.

Keypad

The keypad has six keys. The gray keys with black letters are user information keys. In normal operation these keys are active. Additionally, the red emergency key is active. The gray keys with blue characters are used to program the unit. A thorough description of each key is given below.

User Keys - Gray with Black Letters

The four keys with black letters provide you information without changing the operation or the function of the unit.

TEST Key

The **TEST** key initiates an instrument self-test. Pressing the **TEST** key activates a scrolling sequence on the display that shows the product model number, software version, and all set point and alarm values. The unit then performs a self test that tests the display, indicator lights, audible alarm, and internal electronics to ensure they are operating properly. If a problem with the unit exists, DATA ERROR will be displayed. You should have qualified personal determine the problem with the unit.

RESET Key

The **RESET** key performs three functions. 1) Resets the alarm light, alarm contacts, and audible alarm when in a latched or non automatic reset mode. The room pressure must be in the safe or normal range before the **RESET** key will operate. 2) Resets the emergency function after the emergency key has been pressed (see **EMERGENCY** key). 3) Clears any displayed error messages.

MUTE Key

The **MUTE** key temporarily silences the audible alarm. The time the alarm is temporarily silenced is programmable by you (see MUTE TIMEOUT). When the mute period ends, the audible alarm turns back on if the alarm condition is still present.

NOTE: You can program the audible alarm to be permanently turned off (see AUDIBLE ALM).

AUX Key

The **AUX** key is active only in specialty applications and is not used on the standard SUREFLOW. If the **AUX** key is used, a separate manual supplement will explain the **AUX** key function.

Programming Keys - Gray with Blue Characters

The four keys with blue print are used to program or configure the unit to fit a particular application.

WARNING: Pressing these keys will change how the unit functions, so please thoroughly review the manual before changing menu items.

MENU Key

The **MENU** key performs three functions. 1) Provides access to the menus when in the normal operating mode. 2) When the unit is being programmed, the **MENU** key acts as an escape key to remove you from an item or menu, without saving data. 3) Returns the unit to the normal operating mode. The **MENU** key is further described in the **Software Programming** section of this manual.

SELECT Key

The **SELECT** key performs three functions. 1) Provides access to specific menus. 2) Provides access to menu items. 3) Saves data. Pressing the key when finished with a menu item will save the data, and exit you out of the menu item.

▲/▼ Keys

The ▲/▼ keys are used to scroll through the menus, menu items, and through the range of item values that can be selected. Depending on the item type the values may be numerical, specific properties (on / off), or a bar graph.

Emergency Key - Red with Black Letters

EMERGENCY Key

The red **EMERGENCY** key puts the controller into emergency mode. If the room is under negative room pressure control, the emergency mode will maximize the negative pressure. Conversely, if the room is under positive room pressure control the emergency mode will maximize the positive pressure.

Pressing the **EMERGENCY** key will cause the display to flash "EMERGENCY", the red alarm light to flash on and off, and the audible alarm to beep intermittently. To return to control mode press the **EMERGENCY** key or the **RESET** key.

Alarms

SUREFLOW has visual (red light) and audible alarms to inform you of changing conditions. The alarm levels (set points) are determined by administrative personnel, Industrial Hygienists, or the facilities group depending on the organization.

The alarms, audible and visual, will activate whenever the preset alarm level is reached. Depending on the SUREFLOW items installed, programmed alarms will activate when room pressure is low or inadequate, when room pressure is high or too great, or when the supply or exhaust air flow is insufficient. When the laboratory is operating safely, no alarms will sound.

Example: The low alarm is preset to activate when the room pressure reaches -0.001 inches H_2O. When the room pressure drops below -0.001 inches H_2O (gets closer to zero), the audible and visual alarms activate. The alarms turn off (when set to unlatched) when the unit returns to the safe range which is defined as negative pressure greater than -0.001 inches H_2O.

Visual Alarm Operation

The red light on the front of the unit indicates an alarm condition. The red light is on for all alarm conditions, low alarms, high alarms, and emergency. The light is on continuously in a low or high alarm condition, and flashes in an emergency condition.

Audible Alarm Operation- EMERGENCY key

When the **EMERGENCY** key is pressed, the audible alarm beeps intermittently until the **EMERGENCY** or **RESET** key is pressed terminating the emergency alarm. The emergency alarm cannot be silenced by pressing the **MUTE** key.

Audible Alarms - All Except Emergency

The audible alarm is continuously on in all low and high alarm conditions. The audible alarm can be temporarily silenced by pressing the **MUTE** key. The alarm will be silent for a period of time (see MUTE TIMEOUT to program time period). When the time out period ends, the audible alarm turns back on if the alarm condition is still present.

You can program the audible alarm to be permanently turned off (see AUDIBLE ALM). The red alarm light will still turn on in alarm conditions when audible alarm is turned off.

The audible and visual alarms can be programmed to either automatically turn off when the unit returns to the safe range or to stay in alarm until the **RESET** key is pressed (See ALARM RESET).

Before Calling TSI

This manual should answer most questions and resolve most problems you may encounter. If you need assistance or further explanation, contact your local TSI representative or TSI. TSI is committed to providing high quality products backed by outstanding service.

Please have the following information available prior to contacting your authorized TSI Manufacturer's Representative or TSI:

- Model number of unit* 8635-C- ____
- Software revision level*
- Facility where unit is installed

* First two items that scroll when **TEST** key is pressed

Due to the different SUREFLOW models available, the above information is needed to accurately answer your questions.

For the name of your local TSI representative or to talk to TSI service personnel, please call TSI at:

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PART TWO

Technical Section

The SUREFLOW is ready to use after being properly installed. The pressure sensor is factory calibrated prior to shipping, and should not need adjustment. The Digital Interface Module (DIM) is programmed with a default configuration that can be easily modified to fit your application.

The Technical section is separated into five parts that cover all aspects of the unit. Each section is written as independently as possible to minimize flipping back and forth through the manual for an answer.

The **Software Programming** section explains the programming keys on the DIM. In addition, the programming sequence is described, which is the same regardless of the menu item being changed. At the end of this section is an example of how to program the DIM.

The **Menu and Menu Item** section lists all of the software items available to program and change. The items are grouped by menu which means all set points are in one menu, alarm items in another, etc. The menu items and all related information is listed in table format and includes programming name, description of menu of item, range of programmable values, and how the unit shipped from the factory (default values).

The **Calibration** section describes the required technique to compare the pressure sensor reading to a thermal anemometer, and how to adjust the zero and span to obtain an accurate calibration. This section also describes how to zero a TSI flow station transducer.

The **Maintenance and Repair Part** section covers all routine maintenance of equipment, along with a list of repair parts.

The **Troubleshooting** section is split into two areas: Mechanical operation of the unit and system performance. Many external variables will affect how the unit functions so it is critical to first determine if the unit is having mechanical problems - i.e. no display on unit, remote alarms don't function, dampers don't modulate, etc. If problems still exist, look for performance problems (i.e. doesn't seem to read correctly, display fluctuates, etc.). The first step is to determine that the system is mechanically operating correctly, followed by modifying the configuration to eliminate the performance problems.

Software Programming

Programming the SUREFLOW is quick and easy if the programming keys are understood, and the proper keystroke procedure is followed. The programming keys are defined first, followed by the required keystroke procedure. At the end of this section is a programming example.

NOTE: The unit is always operating while programming unit (except when checking the control outputs). When a menu item value is changed, the new value takes effect *immediately* after saving the change.

NOTE: This section covers programming the instrument through the keypad and display. If programming through RS-485 communications, use the host computer's procedure. The changes take place immediately upon saving data in the instrument.

Programming Keys

The four keys with blue characters (refer to Figure 4) are used to program or configure the unit to fit your particular application. Programming the instrument will change how the unit functions, so thoroughly review the items to be changed.

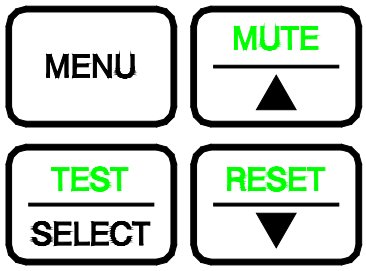


Figure 4. Programming Keys

MENU Key

The **MENU** key has three functions.

1. The **MENU** key is used to gain access to the menus when the unit is in the normal operating mode. Pressing the key once will exit the normal operating mode and enter the programming mode. When the **MENU** key is first pressed, the first two menus are listed.

2. When the unit is being programmed, the **MENU** key acts like an escape key.
   - When scrolling through the main menu, pressing the **MENU** key will return the unit to standard operating mode.
   - When scrolling through the items on a menu, pressing the **MENU** key will return you to the list of menus.
   - When changing data in a menu item, pressing the **MENU** key will escape out of the item without saving changes.

3. When programming is complete, pressing the **MENU** key will return the unit to normal operating mode.

SELECT Key

The **SELECT** key has three functions.

1. The **SELECT** key is used to gain access to specific menus. To access a menu, scroll through the menus (using arrow keys) and place the flashing cursor on the desired menu. Press the **SELECT** key to select the menu. The first line on the display will now be the selected menu, and the second line will show the first menu item.

2. The **SELECT** key is used to gain access to specific menu items. To access a menu item scroll through the menu items until item appears. Press the **SELECT** key and the menu item will now appear on the first line of the display, and the second line will show the item value.

3. Pressing the **SELECT** key when finished changing an item will save the data, and exit back to the menu items. An audible tone (3 beeps) and visual display ("saving data") gives confirmation data is being saved.

▲/▼ Keys

The ▲/▼ keys are used to scroll through the menus, menu items, and through the range of item values that can be selected. Depending on the menu item selected the value may be numerical, specific property (on / off), or a bar graph.

NOTE: When programming a menu item, continuously pressing the arrow key will scroll through the values faster than if arrow key is pressed and released.

Keystroke Procedure

The keystroke operation is consistent for all menus. The sequence of keystrokes to follow is the same regardless of the menu item being changed.

1. Press the **MENU** key to access the main menu.

2. Use the ▲/▼ keys to scroll through the menu choices. The blinking cursor needs to be on the first letter of the menu you want to access.

3. Press the **SELECT** key to access chosen menu.

4. The menu selected is now displayed on line one, and the first menu item is displayed on line 2. Use the ▲/▼ keys to scroll through the menu items. Scroll through the menu items until desired item is displayed.

   NOTE: If "Enter Code" is flashing the access code must be entered before you can enter the menu. Access codes are found in Appendix C. Appendix C may have been removed from the manual for security reasons.

5. Press the **SELECT** key to access chosen item. The top line of display shows menu item selected, while the second line shows current item value.

6. Use the ▲/▼ keys to change item value.

7. Save the new value by pressing the **SELECT** key (pressing the **MENU** key will exit out of menu function without saving data).

8. Press the **MENU** key to exit current menu, and return to main menu.

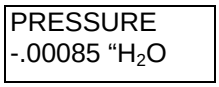
9. Press the **MENU** key again to return to normal instrument operation.

If more than one item is to be changed, skip steps 8 and 9 until all changes are complete. If more items in the same menu are to be changed, scroll to them after saving the data (step 7). If other menus need to be accessed, press the **MENU** key once to access list of menus. The instrument is now at step 2 of the keystroke sequence.

Programming Example

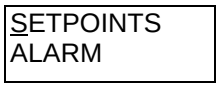
The following example demonstrates the keystroke sequence explained above. In this example the high alarm set point will be changed from -0.002 inches H_2O to -0.003 inches H_2O.

❶ Unit is in normal operation scrolling room pressure, flows, etc. Pressure is shown in this case:



❷ Press the **MENU** key to gain access to the menus.

The first 2 menu choices are displayed.



❸ Press the ▼ key once. Blinking cursor should be on A of Alarm. Press the **SELECT** key to access the ALARM menu.

NOTE: Blinking cursor must be on A in Alarm.

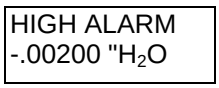
Line 1 shows menu selected.
Line 2 shows first menu item.

❹ Press the ▼ key until HIGH ALARM is shown on display.

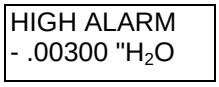
Menu selected
Item name

❺ Press the **SELECT** key to access the positive low alarm set point. The item name (HIGH ALARM) will now be displayed on line 1, and the item's current value will be displayed on line 2.

Item Name
Current Value



❻ Press the ▲ key to change the high alarm set point to - 0.003 inches H_2O.



❼ Press the **SELECT** key to save the new negative low alarm set point.

Three short beeps will sound indicating that the data is being saved.

HIGH ALARM
Saving Data

Immediately after the data is saved, the SUREFLOW will return to the menu level displaying the menu title on the top line of the display and the menu item on the bottom line
(goes to step 3).

ALARM
HIGH ALARM

WARNING: If the **MENU** key was pressed instead of the **SELECT** key, the new data would not have been saved, and the SUREFLOW would have escaped back to the menu level shown in step 3.

❽ Press the **MENU** key once to return to the menu level:

ALARM
CONFIGURE

❾ Press the **MENU** key a second time to return to the normal operating level:

Unit is now back in normal operation

PRESSURE
-.00085 "H_2O

Menu and Menu Items

The SUREFLOW is a very versatile device which can be configured to meet your specific application. This section describes all of the menu items available to program and change (except diagnostics menu). Changing any item is accomplished by using the keypad, or if communications are installed through the RS-485 Communications port. If you are unfamiliar with the keystroke procedure please see **Programming Software** for a detailed explanation. This section provides the following information:

- Complete list of menu and all menu items.
- Gives the menu or programming name.
- Defines each menu item's function; what it does, how it does it, etc.
- Gives the range of values that can be programmed.
- Gives default item value (how it shipped from factory).

The menus covered in this section are divided into groups of related items to ease programming. As an example all set points are in one menu, alarm information in another, etc. The manual follows the menus as programmed in the controller. The menu items are always grouped by menu and then listed in menu item order, not alphabetical order. Figure 5 shows a chart of all the Model 8635-C controller menu items.

SETPOINTS	**ALARM**	**CONFIGURE**	**CALIBRATION**
SETPOINT	LOW ALARM	DISPLAY AVG	SENSOR ZERO
REM SETPOINT	HIGH ALARM	UNITS	SENSOR SPAN
VENT MIN SET	REM LOW ALM	EXH DCT AREA	EXH FLO ZERO
TEMP MIN SET	REM HIGH ALM	SUP DCT AREA	SUP FLO ZERO
TEMP LOW	MIN SUP ALM	FLO STA TYPE	ELEVATION
TEMP HIGH	ALARM RESET	TOP VELOCITY	ACCESS CODE
ACCESS CODE	AUDIBLE ALM	ROOM VOLUME	
	ALARM DELAY	ACCESS CODE	
	DOOR DELAY		
	MUTE TIMEOUT		
	ACCESS CODE		

CONTROL	**INTERFACE**	**DIAGNOSTICS** *
SPEED	NET PROTOCOL	CONTROL SUP
SENSITIVITY	NET ADDRESS	CONTROL EXH
CONTROL SIG	ACCESS CODE	SENSOR INPUT
OUTPUT MODE		SENSOR STAT
KC VALUE		SWITCH INPUT
TI VALUE		EXH FLOW IN
TD VALUE		SUP FLOW IN
ACCESS CODE		TEMP INPUT
		LOW ALM REL
		HIGH ALM REL
		ACCESS CODE

***** Menu item description located in Troubleshooting section

Figure 5: Menu Items - Model 8635-C Controller

SETPOINTS MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
PRESSURE SET POINT	SETPOINT	The SETPOINT item sets the pressure control set point. The SUREFLOW controller will maintain the room pressure, negative or positive, under normal operating conditions. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is open, or the RS 485 communications sends a command.	0 to -0.19500 "H_2O or 0 to +0.19500 "H_2O	-0.00100" H_2O
REMOTE OR ALTERNATE PRESSURE SET POINT	REM SETPOINT	The REM SETPOINT item sets an alternate control set point. The SUREFLOW controller will maintain the room pressure at the alternate set point when this item is enabled. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is closed, or the RS 485 communications sends a command. **NOTE**: The REM SETPOINT also enables the DOOR DELAY, and disables the ALARM DELAY.	0 to -0.19500 "H_2O or 0 to +0.19500 "H_2O	0
VENTILATION SUPPLY FLOW SETPOINT	VENT MIN SET	The VENT MIN SET item sets the ventilation supply flow set point (CFM). This item provides supply air flow adequate to meet the ventilation requirement, by preventing the supply flow from going below a preset minimum CFM. The controller will not allow the supply air damper to be closed further than the VENT MIN SET set point. If room pressure is not maintained, at minimum supply flow, the general exhaust damper modulates open until pressure set point is reached. A TSI flow station is required to make the flow measurement and enable this function. The flow station and control damper must be mounted in the supply duct for this item to function properly.	0, pressure based flow stations 400–2832 ft/min (2.0–14.4 m/s) x duct area in square feet (ft^2): square meters (m^2). Linear based flow stations 0 to TOP VELOCITY times the duct area in square feet (ft^2): square meters (m^2).	0

SETPOINTS MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
TEMPERATURE SUPPLY FLOW SET POINT	TEMP MIN SET	The TEMP MIN SET item sets the temperature supply flow set point (CFM). This item provides supply air flow adequate to meet the temperature requirements by preventing the supply flow from going below a preset minimum CFM. The controller will not allow the supply air damper to be closed further than the TEMP MIN SET set point. If room pressure is not maintained at minimum temperature flow, the general exhaust damper modulates open until pressure set point is reached. A TSI flow station is required to make the flow measurement and enable this function. The flow station and control damper must be mounted in the supply duct for this item to function properly.	0, pressure based flow station 400–2832 ft/min (2.0–14.4 m/s) x duct area. The duct area in square feet (ft^2): square meters (m^2). Linear based flow stations 0 to TOP VELOCITY times the duct area in square feet (ft^2): square meters (m^2).	0
TEMPERATURE COOLING	TEMP LOW	The TEMP LOW item determines when the supply air changes from ventilation control mode (VENT MIN SET) to temperature cooling mode (TEMP MIN SET). The lower the voltage the larger the span between ventilation mode and temperature mode. When the thermostat signal drops below the TEMP FLOW setpoint, the TEMP MIN SET is the supply air minimum (VENT MIN SET is not in use). **NOTE**: The thermostat is connected to the temp input (pins 23 & 24). The 0-5 or 0-10 VDC thermostat signal is constantly monitored by the DIM and is compared to the TEMP LOW set point.	Off, 0-10 VDC.	Off

SETPOINTS MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
TEMPERATURE HEATING	TEMP HIGH	The TEMP HIGH determines when the supply air changes from ventilation control mode (VENT MIN SET) to temperature heating mode (TEMP MIN SET). The higher the voltage the larger the span between ventilation mode and temperature mode. When the thermostat signal is greater than the TEMP HIGH setpoint, the TEMP MIN SET is the supply air minimum (VENT MIN SET is not in use). When TEMP HIGH is off, the supply air is always in ventilation mode. **NOTE**: The thermostat is connected to the temp input (pins 23 & 24). The 0-5 VDC or 10 VDC thermostat signal is constantly monitored by the DIM and is compared to the TEMP HIGH set point.	Off, 0-10 VDC	Off
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	OFF
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or MENU key to exit out of the menu.		

ALARM MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
LOW PRESSURE ALARM	LOW ALARM	The LOW ALARM item sets the low pressure alarm set point. A low alarm condition is defined as when of the room pressure falls below or goes in the opposite direction of the LOW ALARM set point. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is open, or the RS 485 communications sends a command.	OFF, 0 to -0.19500 "H_2O 0 to +0.19500 "H_2O	OFF
HIGH PRESSURE ALARM	HIGH ALARM	The HIGH ALARM item sets the high pressure alarm set point. A high alarm condition is defined as when of the room pressure rises above the HIGH ALARM set point. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is open, or the RS 485 communications sends a command.	OFF, 0 to -0.19500 "H_2O 0 to +0.19500 "H_2O	OFF
REMOTE OR SECOND LOW ALARM	REM LOW ALM	The REM LOW ALM item sets a remote or second low pressure alarm set point. A remote low alarm condition is defined as when the room pressure falls below or goes in the opposite direction of the REM LOW ALM set point. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is closed, or the RS 485 communications sends a command.	OFF, 0 to -0.19500 "H_2O 0 to +0.19500 "H_2O	OFF
REMOTE OR SECOND HIGH ALARM	REM HIGH ALM	The REM HIGH ALM item sets a remote or second high pressure alarm set point. A high alarm condition is defined as when the room pressure rises above the REM HIGH ALM set point. This item is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is closed, or the RS 485 communications sends a command.	OFF, 0 to -0.19500 "H_2O 0 to +0.19500 "H_2O	OFF

ALARM MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
MINIMUM SUPPLY FLOW ALARM	MIN SUP ALM	The MIN SUP ALM item sets the supply duct's flow alarm set point. A minimum flow alarm is defined as when the supply duct flow is less than the MIN SUP ALM set point. **NOTE**: Supply air duct size SUP DCT AREA (configure menu) must be entered before MIN SUP ALM can be accessed.	OFF, pressure based flow stations 0 to 2832 ft/MIN (2.0–14.4 m^2) times the supply duct area in square feet (ft^2): square meters (m^2). Linear based flow stations 0 to TOP VELOCITY times the supply duct area in square feet (ft^2): square meters (m^2).	OFF
ALARM RESET	ALARM RESET	The ALARM RESET item selects how the alarms terminate after the unit returns to control set point (pressure or flow). UNLATCHED (alarm follow) automatically resets the alarms when the unit reaches control set point. LATCHED requires the staff to press the **RESET** key after the unit returns to control set point. The ALARM RESET affects the audible alarm, visual alarm, and relay output, which means all are latched or unlatched.	LATCHED OR UNLATCHED	UNLATCHED
AUDIBLE ALARM	AUDIBLE ALM	The AUDIBLE ALM item selects whether the audible alarm is turned ON or OFF. Selecting ON requires the staff to press the **MUTE** key to silence the audible alarm. Selecting OFF permanently mutes all audible alarms, except when the **EMERGENCY** key is pressed.	ON or OFF	ON
ALARM DELAY	ALARM DELAY	The ALARM DELAY determines the length of time the alarm is delayed after an alarm condition has been detected. This delay affects the visual alarm, audible alarm, and relay outputs. An ALARM DELAY prevents nuisance alarms from people entering and leaving the laboratory. The ALARM DELAY is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is open, or the RS 485 communications sends a command.	20–600 SECONDS	20 SECONDS

ALARM MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
DOOR DELAY	DOOR DELAY	The DOOR DELAY item is an alarm delay used when the door will be open for an extended period of time. The DOOR DELAY is usually set for a longer period of time than the ALARM DELAY. This delay affects the visual alarm, audible alarm, and relay outputs. The DOOR DELAY prevents nuisance alarms from people leaving the doors open to move equipment into or out of the laboratory, or when a large group will be entering or leaving the laboratory. The DOOR DELAY is enabled when the SWITCH INPUT contact closure, pins 11 and 12, is closed, or the RS 485 communications sends a command. **NOTE**: When the switch input is closed, the remote set point and remote alarms are activated, and the standard setpoint alarms, and alarm delay are turned off. Set the REMOTE SETPOINT and remote alarms equal to the standard SETPOINT and alarms if the same pressure control is required.	20–600 SECONDS	20 SECONDS
MUTE TIMEOUT	MUTE TIMEOUT	The MUTE TIMEOUT determines the length of time the audible alarm is silenced after the **MUTE** key is pressed. This delay temporarily mutes the audible alarm. **NOTE**: If the DIM is in alarm when MUTE TIMEOUT expires, the audible alarm turns on. When the pressure returns to the safe range, the MUTE TIMEOUT is canceled. If the room goes back into an alarm condition, the **MUTE** key must be pressed again to mute the audible alarm.	5 to 30 MINUTES	5 MINUTES
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	OFF
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or MENU key to exit out of the menu.		

ALARM CONSTRAINTS

There are a number of constraints built into the software that prevent users from programming conflicting alarm information. These are as follows:

1. Remote alarms. The remote alarms are only active when the switch input (pins 11 and 12) is closed, which activates the remote or second set point. When the remote or second set point are active, the standard alarms are turned off.

2. The SUREFLOW is programmed not to allow the pressure alarms to be programmed within 20 ft/min (0.00028 " H_2O at 0.001 "H_2O) of the control set point.

   Example: The control SETPOINT is set at -0.001 "H_2O. The LOW ALARM set point cannot be set higher than -0.00072 "H_2O. Conversely, if your control SETPOINT is set at -0.001 "H_2O, the HIGH ALARM set point cannot be set lower than -0.00128 "H_2O.

3. The minimum flow alarms must be programmed to be at least 50 CFM less than the minimum flow set point.

4. The alarms, both standard and remote, can be programmed for positive or negative pressure. However, both the low and high alarm must be set either positive or negative. The DIM does not allow one positive alarm and one negative alarm.

5. Alarms do not terminate until the pressure or flow exceeds the alarm set point. The alarm set point must be slightly exceeded before alarm will terminate.

6. The ALARM RESET item selects how the alarms will terminate when controller returns to the safe range. The pressure and flow alarms all terminate the same; they are either latched or unlatched. If unlatched is selected the alarms automatically turn off when the value slightly exceeds the control set point. If latched is selected the alarms will not terminate until the controller returns to set point and the **RESET** key is pressed.

7. There is a programmable ALARM DELAY (and optional DOOR DELAY) that determines how long to delay before activating the alarms. This delay affects all pressure and flow alarms.

8. The MUTE TIMEOUT item temporarily turns the audible alarm off for all pressure and flow alarms.

9. The display can only show one alarm message. Therefore, the controller has an alarm priority system, with the highest priority alarm being displayed. If multiple alarms exist, the lower priority alarms will not display until after the highest priority alarm has been eliminated. The alarm priority is as follows:

   Pressure sensor - low alarm
   Pressure sensor - high alarm
   Flow station - minimum supply flow
   Data error

10. The low and high alarms are absolute values. The chart below shows how the values must be programmed in order to operate correctly.

-0.2 inches H_2O (maximum negative)			0			+0.2 inches H_2O (maximum positive)
High Negative Alarm	Negative Set point	Low Negative Alarm	Zero	Low Positive Alarm	Positive Set point	High Positive Alarm

The value of each set point or alarm is unimportant (except for small dead band) in graph above. It is important to understand that the negative (positive) low alarm must be between zero (0) pressure and the negative (positive) set point, and that the high alarm is a greater negative (positive) value than set point.

CONFIGURE MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
DISPLAY AVERAGE	DISPLAY AVG	The DISPLAY AVG item selects the display's averaging period. The display averaging period is the length of time the room pressure has been averaged before being displayed. The DISPLAY AVG item value may be set between 0.75 and 40 seconds. The higher the averaging value, the more stable the display.	0.75, 1, 2, 3, 5, 10, 20 or 40 seconds	20 seconds
UNITS	UNITS	The UNITS item selects the unit of measure that the controller displays all values (except calibration span). These units display for all menu items set points, alarms, flows, etc.	FT/MIN, m/s, "H_2O Pa, mm H_2O	"H_2O
EXHAUST DUCT AREA	EXH DCT AREA	The EXH DCT AREA item is used to input the exhaust duct size. The duct size is needed to compute the flow out of the room. This item requires a flow station to be mounted in the exhaust duct. When a duct area is programmed, the display will automatically scroll the actual exhaust flow as part of the display sequence. If a zero value is entered, the exhaust flow value will not scroll on the display. If the DIM displays English units, area must be entered in square feet. If metric units are displayed area must be entered in square meters.	0–10 square feet (0–0.9500 square meters) The DIM does not compute area. The area must be first calculated and then entered into the unit.	0
SUPPLY DUCT AREA	SUP DCT AREA	The SUP DCT AREA item is used to input the supply duct size. The duct size is needed to compute the air flowing into the room. This item requires a flow station to be mounted in the supply duct. When a duct area is programmed, the display will automatically scroll the actual supply flow as part of the display scroll sequence. If a zero value is entered the supply flow value will not scroll on the display. If the DIM displays English units area must be entered in square feet. If metric units are displayed area must be entered in square meters.	0–10 square feet 0–0.9500 square meters The DIM does not compute area. The area must be first calculated and then entered into the unit.	0

CONFIGURE MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
FLOW STATION TYPE	FLO STA TYPE	The FLO STA TYPE item is used to select the input signal for the flow station. PRESSURE is selected when TSI flow stations with pressure transducers are installed. LINEAR is selected when a linear output flow station is installed (0-5 VDC): Typically a thermal anemometer based flow station.	PRESSURE or LINEAR	PRESSURE
MAXIMUM FLOW STATION VELOCITY	TOP VELOCITY	The TOP VELOCITY item is used to input the maximum velocity of a linear flow station outputs. A TOP VELOCITY must be input for linear flow station to operate. **NOTE**: Supply and exhaust flow stations must be the same velocity range. **NOTE**: This item is disabled if a pressure based flow station is installed.	0–5,000 FT/MIN (0–25.4 m/s)	0
ROOM VOLUME	ROOM VOLUME	The ROOM VOLUME item is used to input the volume of the room. The room volume is required to calculate air changes per hour. Entering a value for the volume will add the air changes per hour value to the display's scrolling sequence. If a zero value is entered the air changes per hour will not scroll on the display. If the DIM displays English units, area must be entered in cubic feet. If metric units are displayed area must be entered in cubic meters. The air changes per hour is calculated using the ROOM VOLUME and the input from the supply air flow station. If no flow station is installed, a zero value should be entered.	0–20,000 cubic feet (0–550 cubic meters) The DIM does not compute volume. The volume must be first calculated and then entered into the unit.	0

CONFIGURE MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	OFF
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or **MENU** key to exit out of the menu.		

CALIBRATION MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
SENSOR ZERO	SENSOR ZERO	The SENSOR ZERO item is used to calibrate the SUREFLOW pressure sensor. A sensor zero should be established prior to adjusting the sensor span (see **Calibration** section following menu item section).	NONE	Unit is factory calibrated. No initial adjustment should be necessary.
SENSOR SPAN	SENSOR SPAN	The SENSOR SPAN item is used to match or calibrate the SUREFLOW velocity sensors to the average room pressure velocity as measured by a portable air velocity meter. A sensor zero should be established prior to adjusting the sensor span (see **Calibration** section following menu item listing).	NONE	Unit is factory calibrated. No initial adjustment should be necessary.
EXHAUST FLOW ZERO	EXH FLO ZERO	The EXH FLO ZERO item is used to establish the flow station zero flow point. A zero or no flow point needs to be established prior to using the flow measurement output (see **Calibration** section following menu item listing). All pressure based flow stations need to have an EXH FLO ZERO established on initial set up. Linear flow stations with a 1-5 VDC output also need to have an EXH FLO ZERO established. Linear flow stations with a 0-5 VDC output do not need an EXH FLO ZERO.	NONE	
SUPPLY FLOW ZERO	SUP FLO ZERO	The SUP FLO ZERO item is used to establish the flow station zero flow point. A zero or no flow point needs to be established prior to using the flow measurement output (see **Calibration** section following menu item listing). All pressure based flow stations need to have a SUP FLO ZERO established on initial set up. Linear flow stations with a 1-5 VDC output also need to have a SUP FLO ZERO established. Linear flow sup stations with a 0-5 VDC output do not need a SUP FLO ZERO.	NONE	

CALIBRATION MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
ELEVATION	ELEVATION	The ELEVATION item is used to enter the elevation of the building above sea level. This item has a range of 0-10,000 feet in 1,000 foot increments. The pressure value needs to be corrected due to changes in air density at different elevations.	0–10,000 feet above sea level	0
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	ON
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or **MENU** key to exit out of the menu.		

CONTROL MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
SPEED	SPEED	The SPEED item is used to select the control output speed. When this item is selected, a bar graph is shown on the display. There are 10 bars, each one representing 10% of speed. Starting from the right side (+ sign), 10 bars displayed indicates maximum speed. This is the fastest the controller will operate. 1 bar is the slowest the control output will move. The more bars shown, the faster the control output.	1 to 10 bars	5 bars
SENSITIVITY	SENSITIVITY	The SENSITIVITY item is used to select the integral dead band. The integral dead band determines when the controller uses integral control (slow control), and when the controller enters PID control (fast control). When this item is selected, a bar graph will be shown on the display. There are 10 bars each representing ±10 ft/min. Starting from the right side (+ sign), 10 bars displayed indicates no dead band so the controller will always be in PID control mode. The less bars displayed, the larger the integral dead band. For example, with 8 bars displayed and an operating set point of 100 ft/min, the integral dead band is between 80 and 120 ft/min. When the measured room pressure velocity is within this range, integral or slow control is used. However, when the room pressure velocity falls below 80 ft/min or rises above 120 ft/min, PID control is enabled until the unit returns within the dead band. The SENSITIVITY item has a unique feature that when zero bars are displayed, the unit never goes into PID control. The control output is a slow control signal. **WARNING:** When SENSITIVITY is set for 10 bars, the system is always in PID control, which will probably cause an unstable system. It is recommended that the SENSITIVITY be set at 9 bars or less.	0 to 10 bars	5 bars

CONTROL MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
CONTROL SIGNAL	CONTROL SIG	The CONTROL SIG item determines the control signal's output direction. As an example; if the control system closes the exhaust damper instead of opening the damper, this option will reverse the control signal to now open the damper. **NOTE**: Changing the CONTROL SIG changes both the supply and exhaust damper directions. If only one damper needs to change direction, change the jumper on the actuator instead of changing the CONTROL SIG.	Direct or Reverse	Direct
VARIABLE FREQUENCY DRIVE CONTROL OUTPUT	OUTPUT MODE	The OUTPUT MODE item switches the supply and exhaust control outputs from 0–10 VDC to 0–20 mA. When TSI damper/actuators are installed 0–10 VDC must be selected. The output mode is set to 0–20 mA when VFD applications require a 4–20 mA control signal.	0–10 VDC or 0–20 mA	0–10 VDC
Kc VALUE Ti VALUE Td VALUE	Kc VALUE Ti VALUE Td VALUE	**WARNING:** The Kc VALUE, Ti VALUE, and Td VALUE items provides you with the ability to manually change the PID control loop variables. **DO NOT CHANGE THESE VALUES UNLESS YOU HAVE A THROUGH UNDERSTANDING OF PID CONTROL LOOPS. CONTACT TSI FOR ASSISTANCE PRIOR TO CHANGING ANY VALUES.** Contact TSI for assistance in determining your control problem and for instructions on how to change a value. Incorrectly changing a value will result in poor or non existent control. Suggestion: Before changing Kc, Ti, or Td, change the speed or adjust the sensitivity to try to eliminate the problem.	Kc = 0–1000 Ti = 0–1000 Td = 0–1000 The range of values is very large. Poor control will occur if values are more than twice or less than 1/2 the default value	Kc = 100 Ti = 200 Td = 25

CONTROL MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
		The Kc VALUE item is used to read and change the gain control coefficient. When this item is entered, a value for Kc is indicated on the display. If the SUREFLOW is not controlling correctly, the Kc gain control coefficient may need adjusting. Decreasing Kc will slow the control system down, which will increase stability. Increasing Kc will increase the control system which may cause system instability. The Ti VALUE item is used to read and change the integral control coefficient. When this item is entered, a value for Ti is indicated on the display. If the SUREFLOW is not controlling correctly, the unit may have an inappropriate integral control coefficient. Increasing Ti will slow the control system which will increase stability. Decreasing Ti will increase the control system which may cause system instability.		
	Kc VALUE Ti VALUE Td VALUE *(Continued)*	The Td VALUE item is used to read and change the derivative control coefficient. When this item is entered, a value for Td is indicated on the display. If the SUREFLOW is not controlling correctly, the unit may have an inappropriate derivative control coefficient. **WARNING**: Setting Kc or Ti to zero turns the control output signal off causing the unit to act like a monitor.		
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	OFF
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or **MENU** key to exit out of the menu.		

INTERFACE MENU

MENU ITEM	SOFTWARE NAME	ITEM DESCRIPTION	ITEM RANGE	DEFAULT VALUE
NETWORK PROTOCOL	NET PROTOCOL	The NET PROTOCOL item selects the communications protocol used to interface with the building management system.	MODBUS or CIMETRICS	MODBUS
NETWORK ADDRESS	NET ADDRESS	The NET ADDRESS item is used to select the main network address of the individual room pressure device. Each unit on the network must have its own unique address. The values range from 1-247. If RS-485 communications are being used, then a unique NET ADDRESS must be entered into the unit. There is no priority between the RS-485 and keypad. The most recent signal by either RS-485 or keypad will initiate a change. RS-485 communications allows you access to all menu items except calibration items. The RS-485 network can initiate a change at any time.	1-247	1
ACCESS CODE	ACCESS CODE	The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.	ON or OFF	OFF
	END OF MENU	The END OF MENU item informs you that the end of a menu has been reached. You can either scroll back up the menu to make changes, or press the **SELECT** or **MENU** key to exit out of the menu.		

Calibration

The calibration section explains how to calibrate the SUREFLOW pressure sensor, including setting the proper elevation, and how to zero a flow station.

NOTE: The SUREFLOW pressure sensor is factory calibrated and normally does not need to be adjusted. However, inaccurate readings may be detected if pressure sensor is not installed correctly, or problems with the sensor exist. First check that the sensor is installed correctly (usually only a problem on initial set up). Second, go into DIAGNOSTICS menu, SENSOR STAT item. If NORMAL is displayed, calibration can be adjusted. If an error code is displayed, eliminate error code and then verify pressure sensor needs adjustment.

All pressure transducer based flow stations and 1–5 VDC linear flow stations must be zeroed upon initial system set up. Linear 0–5 VDC flow stations do not require a zero flow to be established.

Adjusting the SUREFLOW calibration may be required to eliminate errors due to convection currents, HVAC configuration, or equipment used to make the measurement. TSI recommends always taking the comparison measurement in the exact same location (i.e., under the door, middle of door, edge of door, etc.). A thermal air velocity meter is needed to make the comparison measurement. Normally the velocity is checked at the crack under the doorway, or the door is opened 1" to allow alignment of the air velocity probe making the measurement. If the crack under the door is not large enough, use the 1" open door technique.

Calibrating pressure sensor - primary sensor or second sensor

Enter calibration menu (see **Software Programming** if not familiar with key stroke procedure). Access code is turned on so enter proper access code. All menu items described below are found in CALIBRATION menu.

Elevation

The ELEVATION item eliminates pressure sensor error due to elevation of building. (See ELEVATION item in **Menu and Menu items** section for further information).
Enter the ELEVATION menu item. Scroll through the elevation list and select the one closest to the building's elevation.
Press the **SELECT** key to save the data and exit back to the calibration menu.

Sensor zero

Slide open pressure sensor door and tape over 1/2 inch sensor orifice (see Figure 6). Make sure pressure sensor orifice is taped over. Sensor is located about 3/4" into housing.
Select SENSOR ZERO item.
Press **SELECT** key. Sensor zero procedure, which takes 120 seconds, is automatic.
Press **SELECT** key to save the data.
Remove tape from sensor orifice and close pressure sensor door.

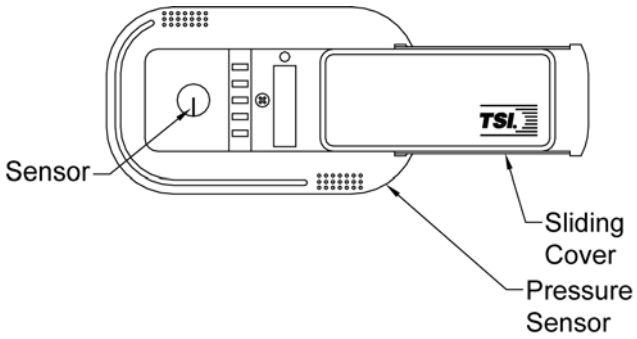


Figure 6: Pressure sensor door slid open

Sensor span

NOTE: Always take a sensor zero prior to adjusting the sensor span. A smoke test and a comparison measurement by an air velocity meter are required to calibrate the pressure sensor. The air velocity meter only gives a velocity reading, so a smoke test must be performed to determine pressure direction.

WARNING: The span can only be adjusted in the same pressure direction. Adjusting span cannot cross zero pressure. Example: If unit displays +0.0001 and actual pressure is -0.0001 do not make any adjustments. Manually change the air balance, close or open dampers, or open door slightly to get both unit and actual pressure to read in same direction (both read positive or negative). This problem can only occur at very low pressures so slightly changing the balance should eliminate the problem.

Perform a smoke test to determine pressure direction.
Select SENSOR SPAN item.
Position thermal air velocity meter in door opening to obtain velocity reading. Press ▲/▼ keys until pressure direction (+/-) and sensor span match thermal air velocity meter, and smoke test.
Press **SELECT** key to save sensor span.
Exit menu, calibration is complete.

Flow station pressure transducer zero

NOTE: Not required for linear flow stations with 0-5 VDC output.

Pressure based flow station

Disconnect tubing between pressure transducer and flow station.
Enter calibration menu. Access code is required.
Select EXH FLO ZERO to take exhaust flow zero.
or
Select SUP FLO ZERO to take supply flow zero.
Press **SELECT** key. Flow zero procedure, which takes 10 seconds, is automatic.
Press **SELECT** key to save data.
Connect tubing between pressure transducer and flow station.

Linear flow station 1-5 VDC output

Remove flow station from duct, or cutoff flow in duct. Flow station must have no flow going past the sensor.
Enter calibration menu. Access code is required.
Select EXH FLO ZERO to take exhaust flow zero.
or
Select SUP FLO ZERO to take supply flow zero.

Press **SELECT** key. Flow zero procedure, which takes 10 seconds, is automatic.
Press **SELECT** key to save data.
Install flow station back in duct.

Maintenance and Repair Parts

The Model 8635 SUREFLOW Room Pressure Controller requires minimal maintenance. Periodic inspection of system components as well as an occasional pressure sensor cleaning are all that are needed to insure that the Model 8635 is operating properly.

System Component Inspection

It is recommended that the pressure sensor be periodically inspected for accumulation of contaminants. The frequency of these inspections is dependent upon the quality of the air being drawn across the sensor. Quite simply, if the air is dirty, the sensors will require more frequent inspection and cleaning.

Visually inspect the pressure sensor by sliding open the sensor housing door (Figure 7). The air flow orifice should be free of obstructions. The small ceramic coated sensors protruding from the orifice wall should be white and free of accumulated debris.

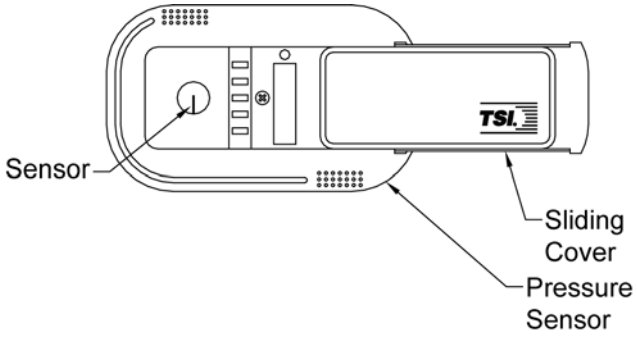


Figure 7: Pressure sensor door slid open

Periodically inspect the other system components for proper performance and physical signs of excessive wear.

Pressure Sensor Cleaning

Accumulations of dust or dirt can be removed with a dry soft-bristled brush (such as an artist's brush). If necessary, water, alcohol, acetone, or trichlorethane may be used as a solvent to remove other contaminants.
Use extreme care when cleaning the velocity sensors. The ceramic sensor may break if excessive pressure is applied, if sensor is scraped to remove contaminants, or if the cleaning apparatus abruptly impacts the sensor.

WARNING: If you are using a liquid to clean the sensor, turn off power to the Model 8635.

Do **not** use compressed air to clean the velocity sensors.

Do **not** attempt to scrape contaminants from the velocity sensors. The velocity sensors are quite durable; however, scraping may cause mechanical damage and

possibly break the sensor. Mechanical damage due to scraping voids the pressure sensor warranty.

Replacement Parts

All components of the room pressure controller are field replaceable. Contact TSI HVAC Control Products at (800) 874-2811 (U.S. and Canada) or (001 651) 490-2811 (other countries) or your nearest TSI Manufacturer's Representative for replacement part pricing and delivery.

Part Number	Description
800224	Model 8635 Pressure Controller
800326	Pressure Sensor
800248	Sensor Cable
800414	Transformer Cable
800420	Transformer
800199	Controller Output Cable
800360	Electric Actuator
800119	Electric to Pneumatic Interface
800116	Pneumatic Actuator

Troubleshooting Section

The SUREFLOW Room Pressure Controller is designed to be trouble free. However, installation problems or interaction with other HVAC components may cause system problems. The SUREFLOW system is easy to trouble shoot if an organized approach to evaluate the system is taken. Troubleshooting is broken down into hardware and software problems. Hardware problems deal with the physical installation of the device. Hardware problems include wiring problems, incorrectly installed equipment, and add-ons or non TSI equipment. Software problems include control problems, configuration problems, or interaction problems with the HVAC system.

The hardware test described in this section determines that all TSI mechanical components are functioning correctly. The hardware test requires the diagnostics menu items to be accessed. If you are unfamiliar with the SUREFLOW menus, see **Software Programming** for keystroke procedure. Troubleshooting the majority of problems is usually quick if the hardware test is followed.

Software and hardware problems are covered in the troubleshooting chart. Pick the problem that most closely resembles your problem and review the possible symptoms and corrective action. Software or system performance problems can and are affected by the supply air system, exhaust air system, or physical configuration of the room. Separating TSI system problems from the HVAC system can sometimes be difficult. TSI recommends confirming all hardware is operating correctly before troubleshooting software problems.

Hardware Test

Three tests need to be performed in order to determine all hardware is functioning correctly. The test are broken down into:

Confirming wiring is correct.

Confirming physical installation is correct.

Verifying mechanical components.

Confirming wiring is correct

The most common problem with installed hardware equipment is incorrect wiring. This problem usually exists on initial installation, or when modifications to the system take place. The wiring should be very closely checked to verify it exactly matches the wiring diagram. The TSI cables are all color coded to ensure proper wiring. A wiring diagram is located in Appendix B of this manual. Wiring associated with non TSI components should be closely checked for correct installation. If non TSI components are installed, consider disconnecting them for testing purposes.

Confirming physical installation is correct

All of the hardware components need to be installed properly. Review the installation instructions and verify components are installed properly at the correct location. This is easily done when the wiring is checked.

Verifying mechanical components

Verifying all TSI components are operating correctly requires following a simple procedure. The fastest procedure to confirm all equipment is operating is to first test the DIM, and then go into the diagnostic menu to test each component.

NOTE: These tests require power to the units, so if unit has no power, refer to hardware troubleshooting chart to eliminate power problem.

TEST - DIM

Press **TEST** key to verify Digital Interface Module (DIM) electronics are functioning correctly. At the end of the self test, the display will show SELF TEST - PASSED if all DIM electronics are good. If unit displays DATA ERROR at the end of the test, the electronics may be corrupted. Check all software items to determine cause of DATA ERROR.

If SELF TEST - PASSED is displayed proceed to test individual components. Enter **Diagnostics Menu** and check the following:

Control output - supply.
Control output - exhaust.
Sensor input.
Sensor status.
Exhaust flow station.
Supply flow station.
Temperature input.

NOTE: Skip any test that does not have option installed.

These diagnostic menu items are explained in detail in the next section (**Diagnostics Menu**) of the manual, so their function is not reviewed here. If the SUREFLOW system passes each of the tests, the mechanical piece parts are all functioning correctly.

TEST - Control output - supply

Enter CONTROL SUP menu item in diagnostics menu. A number between 0% OPEN and 100% OPEN will be displayed. Press the ▲/▼ keys until either 0% OPEN or 100% OPEN shows on the display. Note the position of the supply air control damper. If display reads 0% OPEN, press the ▲ key until 100% OPEN is shown on display. If display reads 100% OPEN, press ▼ key until 0% OPEN is shown on display. Note the position of the supply air damper. The damper should have rotated either 45 or 90 degrees depending on actuator installed. If not see hardware section *Control system is not controlling*.

TEST - Control output - exhaust

Enter CONTROL EXH menu item in diagnostics menu. A number between 0% OPEN and 100% OPEN will be displayed. Press the ▲/▼ keys until either 0% OPEN or 100% OPEN shows on the display. Note the position of the general exhaust control damper. If display reads 0% OPEN, press the ▲ key until 100% OPEN is shown on display. If display read 100% OPEN, press ▼ key until 0 is shown on display. Note the position of the general exhaust damper. The damper should have rotated either 45 or 90 degrees depending on actuator installed. If not see hardware section *Control system is not controlling*.

TEST - Sensor input

Enter SENSOR INPUT menu item in diagnostics menu. A voltage between 0 and 10 volts DC will be displayed. It is not important what the exact voltage is to pass this test. Tape over the pressure sensor (slide pressure sensor door open) and voltage should read approximately 5 volts (zero pressure). Remove tape and blow on sensor. Displayed value should change. If voltage changes, the unit passes. If voltage doesn't change, proceed to TEST - Sensor status.

TEST - Sensor status

Enter SENSOR STAT menu item in diagnostics menu. If NORMAL is displayed, the unit passes test. If an error message is displayed, go to diagnostics menu section of the manual, SENSOR STAT menu item for explanation of error message.

TEST - Exhaust flow station

Enter EXH FLOW IN menu item in diagnostics menu. A voltage between 0 and 5 volts DC will be displayed. The exact voltage displayed is not important as long as the voltage varies as flow changes. Zero volts equals no flow while 5 volts is maximum flow. The signal is linear, so a correlation between flow and voltage can be established.

TEST - Supply flow station

Enter SUP FLOW IN menu item in diagnostics menu. A voltage between 0 and 5 volts DC will be displayed. The exact voltage displayed is not important as long as the voltage varies as flow changes. Zero volts equals no flow while 5 volts is maximum flow. The signal is linear, so a correlation between flow and voltage can be established.

TEST - Thermostat input

Enter TEMP INPUT menu item in diagnostics menu. A voltage between 0 and 10 volts DC will be displayed. The exact voltage displayed is not important as long as the voltage changes when thermostat changes. Zero volts equals maximum cooling while 10 volts (5 volts if 0–5 VDC thermostat) equals maximum heating.

If unit passed all tests, the mechanical components are physically working. If problems still exist, go to troubleshooting chart for additional information, on both hardware and software symptoms.

Diagnostics Menu

The items in the diagnostic menu aid in identifying problems the staff may encounter. The items in this menu temporarily change the function by pressing the ▲/▼ keys. No permanent change occurs with these menu items. Items are exited by pressing the **MENU** key. When an item is exited the SUREFLOW returns to its normal state.

Supply Air Control Output

Menu item - CONTROL SUP

The CONTROL SUP item is used to change the control output signal to the supply air actuator/damper (or motor speed drive). When this item is entered, a number will be shown on the display indicating the last control output value. The range of values displayed is 0% OPEN–100% OPEN. Pressing the ▲/▼ keys change the count on the display. Pressing the ▲ key should increase the displayed value, while pressing the ▼ key will decrease the displayed value. The supply control device should change (modulate) as the number changes. Depending on the jumper location on the actuator, 0% OPEN or 100% OPEN is full open on damper. Conversely, 100% OPEN or 0% OPEN will be full closed. A count of 50% OPEN should position the damper approximately 1/2 open. On units controlling variable frequency drives, fan speed should increase or decrease as numbers change.

WARNING: The CONTROL SUP function overrides the pressure control signal. Adequate room pressure will NOT be maintained while in this item.

Exhaust Air Control Output

Menu item - CONTROL EXH

The CONTROL EXH item is used to change the control output signal to the exhaust supply air actuator/damper (or motor speed drive). When this item is entered, a number will be shown on the display indicating the last control output value. The range of values displayed is 0% OPEN–100% OPEN. Pressing the ▲/▼ keys change the count on the

display. Pressing the ▲ key should increase the displayed value, while pressing the ▼ key will decrease the displayed value. The exhaust control device should change (modulate) as the number changes. Depending on the jumper location on the actuator, 0% OPEN or 100% OPEN is full open on damper. Conversely, 100% OPEN or 0% OPEN will be full closed. A count of 50% OPEN should position the damper approximately 1/2 open. On units controlling variable frequency drives, fan speed should increase or decrease as numbers change.

WARNING: The CONTROL EXH function overrides the pressure control signal. Adequate room pressure will NOT be maintained while in this item.

Sensor Input

Menu item - SENSOR INPUT

The SENSOR INPUT item is used to verify that the DIM or controller electronics is receiving a signal from the sensor. When this item is entered, a voltage will be indicated on the display. The exact voltage displayed is relatively unimportant. It is more important that the voltage is changing which indicates the sensor is working correctly.

0 volts represents a negative pressure of -0.2 inches H_2O.
5 volts represents 0 pressure
10 volts represents a positive pressure of +0.2 inches H_2O.

Sensor Communications

Menu Item - SENSOR STAT

The SENSOR STAT item verifies that the RS-485 communications between the pressure sensor and DIM is working correctly. Sensor error messages do not display on DIM except when SENSOR STAT item is selected. The item will display NORMAL if communications are established correctly. If problems exist, one of four error messages will display:

COMM ERROR - DIM cannot communicate with sensor. Check all wiring and the pressure sensor address. Address must be 1.

SENS ERROR - Problem with sensor bridge. Physical damage to pressure sensor or sensor circuitry. Unit is not field repairable. Send to TSI for repair.

CAL ERROR - Calibration data lost. Sensor must be returned to TSI to be calibrated.

DATA ERROR - Problem with EEPROM, field calibration, or analog output calibration lost. Check all data programmed and confirm unit is function correctly.

Switch Input

Menu Item - SWITCH INPUT

The SWITCH INPUT item reads the input of the SWITCH IN contact pins 11 and 12. When this item is entered, the display will indicate either open or closed. If the display indicates open, the DIM is in SETPOINT and ALARM DELAY mode. If the display indicates closed, the DIM is in REM SETPOINT and DOOR DELAY mode.

SWITCH INPUT changes both pressure set point and alarm delay when closed. If the same set point or alarm delay is required, set both set points or alarm delay to same value.

Exhaust Flow Input

Menu Item - EXH FLOW IN

The EXH FLOW IN item is used to read the input from the exhaust flow station. When this item is entered, a voltage will be indicated on the display. The exact voltage displayed is relatively unimportant. It is more important that the voltage is changing which indicates the flow station is working correctly.

0 volts displayed equals zero flow.

5 volts displayed equals 2832 ft/min x duct area $(ft)^2$ - pressure based flow station.

5 volts displayed equals TOP VELOCITY x duct area (ft^2). (See Configure Menu, TOP VELOCITY item) - linear based flow station.

Supply Flow Input

Menu Item - SUP FLOW IN

The SUP FLOW IN item is used to read the input from the supply flow station. When this item is entered, a voltage will be indicated on the display. The exact voltage displayed is relatively unimportant. It is more important that the voltage is changing which indicates the flow station is working correctly.

0 volts displayed equals zero flow.

5 volts displayed equals 2832 ft/min x duct area $(ft)^2$ - pressure based flow station.

5 volts displayed equals TOP VELOCITY x duct area (ft^2). (See Configure Menu, TOP VELOCITY item) - linear based flow station.

Temperature Input

Menu Item - TEMP INPUT

The TEMP INPUT item is used to read the input from the thermostat. When this item is entered, a voltage will be indicated on the display. The exact voltage displayed is relatively unimportant. It is more important that the voltage is changing which indicates the thermostat is working correctly. The output range that can be read is 0-10 VDC. Zero volts correlates to maximum cooling, while 10 volts (5 volts on 0-5 V thermostats) correlates to maximum heating.

Low Alarm Relay

Menu Item - LOW ALM REL

The LOW ALM REL item is used to change the state of the low alarm relay. When this item is entered, the display will indicate either OPEN or CLOSED. The ▲/▼ keys are used to toggle the state of the relay. The ▲ key is used to OPEN the alarm contact. The ▼ key is used to CLOSE the alarm contact. When the contact is closed, the LOW ALM REL should be in an alarm condition.

High Alarm Relay

Menu Item - HIGH ALM REL

The HIGH ALM REL item is used to change the state of the high alarm relay. When this item is entered, the display will indicate either OPEN or CLOSED. The ▲/▼ keys are used to toggle the state of the relay. The ▲ key is used to OPEN the alarm contact. The ▼ key is used to CLOSE the alarm contact. When the contact is closed, the HIGH ALM REL should be in an alarm condition.

Access Code

Menu Item - ACCESS CODE

The ACCESS CODE item selects whether an access code (pass code) is required to enter the menu. The ACCESS CODE item prevents unauthorized access to a menu. If the ACCESS CODE is ON, a code is required before the menu can be entered. Conversely, if the ACCESS CODE is OFF, no code is required to enter the menu.

Troubleshooting Chart

Symptom	Possible Cause	Corrective Action
Display is blank.	Fuse is blown.	Measure voltage at pins 1 and 2 on DIM. The voltage should nominally be; 24–40 VDC when using TSI electric actuators 24–30 VAC when using TSI pneumatic actuators 24–30 VAC when using motor speed drives. If correct voltage is measured, internal DIM fuse is probably blown. Unplug 14-pin connector from DIM for 2 minutes. The internal fuse will automatically reset. Plug unit back in and check display. If display is still blank, check all wiring, etc. If no problems are found, replace DIM. If approximately 5 volts is measured, the fuse in the electric actuator or E/P is blown. Disconnect power to the electric actuator or E/P for two minutes to reset fuse. Disconnecting power requires either shutting off circuit breaker or disconnecting the wires on pins 1 and 2 on the electric actuator or E/P. If zero volts are measured, see *No power to DIM*.
	No power to DIM.	Verify circuit breaker is on. Verify transformer primary measures 110 VAC. Verify transformer secondary measures 24–30 VAC. Verify electric actuator or E/P interface is receiving 24–30 volts between pins 1 and 2. Verify 24–40 VDC is found between pins 3 and 4 of the electric actuator. Verify 24–30 VAC between pins 3 and 4 of the E/P interface. Verify voltage on pins 1 and 2 of DIM is 24–30 VAC for pneumatic systems and VFDs, or 24–40 VDC on electric actuators.
	DIM is defective.	If proper voltage is found between pins 1 and 2 of the DIM, all wiring has been checked, fuses have been reset, and screen is still blank, the DIM is probably defective. Replace DIM.
Control system is not controlling.	Incorrect wiring.	Verify correct wiring (see wiring diagrams, Appendix B). DIM must be wired exactly as shown.
	Supply and exhaust control wiring reversed.	Verify supply control wiring (pins 17 and 18) goes to supply damper and exhaust control wiring (pins 9 and 10) goes to general exhaust damper.

Symptom	Possible Cause	Corrective Action
Control system is not controlling. *(continued)*	No control output signal.	Go into DIAGNOSTICS menu, CONTROL SUP or CONTROL EXH item. A number between 0% OPEN and 100% OPEN will be displayed. Pressing the ▲ key increases the number. Pressing the ▼ key decreases the number. Measure the DC voltage between pins 17 and 18 on the controller. Change the CONTROL value by about 40% OPEN. The voltage output should change approximately 4 volts. Change the CONTROL value to 50% OPEN. The voltage should read approximately 5 VDC. If no change occurs, disconnect control wires on pins 17 ad 18 and repeat test. If DIM still fails to change voltage output, DIM is probably defective.
	Bad actuator or E/P (damper doesn't move).	Go into DIAGNOSTICS menu, CONTROL SUP or CONTROL EXH item. A number between 0% OPEN and 100% OPEN will be displayed. Pressing the ▲ key increases the number. Pressing the ▼ key decreases the number. Change the CONTROL value to read 0% OPEN or 100% OPEN. Note damper position. Press an arrow key to change 0% OPEN to 1000% OPEN or 100% OPEN to 0% OPEN. Note position of damper. Damper should have rotated 45 or 90 degrees depending on actuator system installed. If damper rotated 45 or 90 degrees, actuator is installed and operating correctly. If damper did not rotate, check that: • Jumper is installed correctly on actuator or E/P. (Appendix B) • Damper is not physically stuck (screws, etc.). • Wiring is correct between actuators and controller. Check that voltage varies between 0 and 10 volts on pins 5 and 6 on electric actuator or E/P (see *No control output signal*). • Electric actuator is not over torqued. The electric actuator has current limiting protection. If damper is physically stuck or actuator is over current, the actuator will shut down. To restart either kill power to actuator or move damper in opposite direction it was trying to rotate (CONTROL SUP or CONTROL EXH menu item).
	Defective variable frequency drive (VFD).	Perform test described in *Control system is not controlling*. If CONTROL OUT is functioning, verify wiring to VFD by confirming CONTROL OUT voltage changes at VFD. If voltage changes, a problem with VFD exists. See VFD manual for further troubleshooting.
	Damper rotating opposite direction.	If damper is full open when it should be closed or full closed when it should be open, go into CONTROL menu CONTROL SIG menu item. Change direct to reverse or reverse to direct to change control output direction. The control sig changes the direction of both the supply and exhaust damper. If only 1 damper rotates incorrectly, change the jumper on the E/P or electric actuator.

Symptom	Possible Cause	Corrective Action
Control system is not controlling *(continued*)	Damper is full open or full closed, won't move.	Actuator jumper is missing or loose. Verify jumper is installed correctly. Control wires are loose. Check wires and verify control output is working (see *no control output signal).* If control output test passes, verify damper is rotating correct direction (see *damper rotating opposite direction).* If damper is rotating correctly and set point cannot be reached, DIM will fully rotate damper to get as close to set point as possible. Air balance needs to be adjusted.
Sensor does not calibrate.	Sensor communications not working.	Check SENSOR STAT item in diagnostics menu. If NORMAL is displayed, sensor is okay. If COMM ERROR is displayed, check wiring, pressure sensor address, and that DIP switch 1 & 2 are ON (Figure 8).
	Incorrect pressure sensor address.	Pressure sensor must have address of 1. Check pressure sensor DIP switches 5 & 6 and verify address 1 is correct (7-12 must be OFF).
Pressure sensor red LED is blinking (Figure 8).	Problem with sensor (slow uniform blink).	Check SENSOR STAT and confirm NORMAL is displayed. If ERROR is displayed, correct error.
	Communication (fast burst of non-uniform blinking).	Unit is communicating with DIM. This is normal.
	Red LED is constantly on.	This is normal when no problems exist or when no communication is occurring.
DIM always displays 0.200 inches H_2O.	Incorrect pressure sensor output.	Pressure sensor must be set for 0–10 volt output, not 4–20 mA. Check pressure sensor DIP switch 3 and make sure it is OFF (see Figure 8).

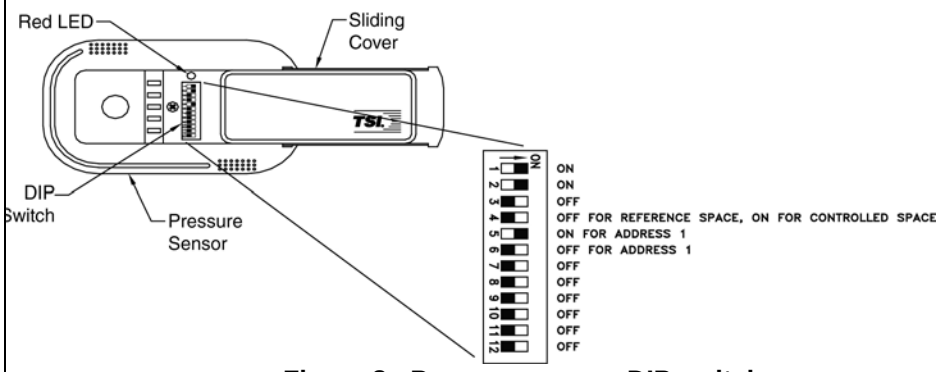


Figure 8: Pressure sensor DIP switch

Symptom	Possible Cause	Corrective Action
DIM does not respond to RS-485 communications.	Network protocol is incorrect.	Go into INTERFACE menu, NET PROTOCOL item. The protocol must match host system. Select correct interface.
	Incorrect network address.	The network address at the building automation system and at the DIM must match. The network address must be unique for each DIM.
	Incompatible software.	Data sent to DIM may be in form that the SUREFLOW cannot recognize.
DIM displays opposite pressure signal.	Sensor direction is incorrect.	Pressure sensor must have DIP switch correctly set for proper sign display. Verify DIP switch 4 is ON when sensor is mounted in the laboratory (controlled space), and OFF when sensor is mounted in corridor (reference space). See Figure 8.
Alarm relays don't work.	Alarms are turned off.	Press **TEST** key. The individual alarm set points will display. If all alarm set points are zero, alarm relay is not active, so relay will not be required to change state.
	Incorrect wiring.	Check the wiring from SUREFLOW relay's output to the device that is connected to the relays.
	Relay may be defective.	Disconnect the wiring from relay contact pins 13 and 14 for low alarm relay and pins 25 and 26 for high alarm relay. Go into DIAGNOSTICS menu, LOW ALM REL or HIGH ALM REL. Connect an ohmmeter to relay terminals to verify contact open and closes. Press the ▲/▼ key to manually trip the relay. If relay responds (contact opens and closes), the device connected is incompatible or defective. If relay doesn't respond, relay is defective (may be caused by incompatible device). Replace DIM.
"DATA ERROR" flashing on display.	DIM was hit by electrical disturbance.	All data may be lost or changed. Review all configuration parameters. DATA ERROR is removed by pressing the **RESET** key.
Actuator hunting. Display indicates steady pressure.	Control system is unstable.	Go into CONTROL menu, SPEED item. Turn speed down until hunting is eliminated. If speed is too slow review CONTROL menu items and adjust accordingly to eliminate hunting.
Displayed pressure wildly fluctuating.	Control system is unstable.	Go into CONTROL menu SPEED item, turn speed down until fluctuation is eliminated. If speed is too slow, review CONTROL menu items and adjust accordingly until performance is adequate.
	Exhaust system unstable.	Turn DIM to emergency. If pressure stabilizes, this is not the problem. Verify reference pressure is not fluctuating.
	Supply or exhaust air is affecting the sensor.	Check location of supply air diffusers and exhaust grilles. They should be as far from pressure sensor as is realistic, 6 feet preferred, 2½ feet minimum. Supply diffuser terminal throw velocity must be less than 10 ft/min at the sensor. Relocate supply or exhaust as needed.

Appendix A

Specifications

Room Pressure Module

Display

Range	-0.20000 to +0.20000 inches H_2O
Resolution	5% of reading
Display Update	0.5 sec

Inputs

Switch in	SPST (N.O.) Switch. Closing switch initiates condition.
Flow in	0–5 VDC

Outputs

Low Alarm Range	-0.19500 to +0.19500 inches H_2O
High Alarm Range	-0.19500 to +0.19500 inches H_2O
Alarm Contacts	SPST (N.O.) Max current 5A, max voltage 150 VDC, 250 VAC. Maximum switch load 10 mA, 5 VDC. Contacts close in alarm condition.
RS-485	Yes
Operating Temperature	32 to 120°F
Input Power	24 VAC, 5 watts max
Dimensions	4.9 in. × 4.9 in. × 1.35 in.
Weight	0.7 lb.

Pressure Sensor

Temperature Compensation Range	55 to 95°F
Power Dissipation	0.16 watts at 0 inches H_2O, 0.20 watts at 0.00088 inches H_2O
Dimensions (DxH)	5.58 in. × 3.34 in. × 1.94 in.
Weight	0.2 lb.

Damper/Actuator

Types of Actuators	Electric or pneumatic
Input Power	Electric: 24 VAC, 7.5 watts max. Pneumatic: 24 VAC, 3 watts max.
Time for 90° Rotation	Electric: 1.5 seconds Pneumatic: 5 seconds

Appendix B

Network Communications

Network communications are available on the Model 8635. The Model 8635 can communicate with a building management system through Modbus or LonWorks protocols. Please refer to the appropriate section below for more detailed information.

Modbus Communications

Modbus communications are installed in all Model 8635 laboratory room pressure controllers and monitors. This document provides the technical information needed to communicate between the host DDC system and the Model 8635 units. This document assumes the programmer is familiar with Modbus protocol. Further technical assistance is available from TSI if your question is related to TSI interfacing to a DDC system. If you need further information regarding Modbus programming in general, please contact:

Modicon Incorporated
One High Street
North Andover, MA 01845
Phone (800) 468-5342

The Modbus protocol utilizes the RTU format for data transfer and Error Checking. Check the Modicon Modbus Protocol Reference Guide (PI-Mbus-300) for more information on CRC generation and message structures.

The messages are sent at 9600 baud with 1 start bit, 8 data bits, and 2 stop bits. Do ***not*** use the parity bit. The system is set up as a master slave network. The TSI units act as slaves and respond to messages when there correct address is polled.

Blocks of data can be written or read from each device. Using a block format will speed up the time for the data transfer. The size of the blocks is limited to 20 bytes. This means the maximum message length that can be transferred is 20 bytes. The typical response time of the device is around 0.05 seconds with a maximum of 0.1 seconds.

Unique to TSI
The list of variable addresses shown below skips some numbers in the sequence due to internal Model 8635 functions. This information is not useful to the DDC system and is therefore deleted. Skipping numbers in the sequence will not cause any communication problems.

All variables are outputted in English units: ft/min, CFM, or inches H_2O. The room pressure control setpoints and alarms are stored in ft/min. The DDC system must convert the value to inches of water if that is desired. The equation is given below.

$$\text{Pressure in Inches } H_2O = 6.2*10^{-8}*(\text{Velocity in ft/min}/.836)^2$$

RAM Variables

RAM variables use the Modbus command **04 Read Input Registers.** RAM variables are read only variables that correspond to what is shown on the Digital Interface Module (DIM) display. TSI offers a number of different models, so if a feature is not available on a unit, the variable is set to 0.

Variable Name	Variable Address	Information Provided to Master System	Integer DDC system receives
Velocity	0	Velocity of room pressure	Displayed in feet per minute.
Pressure	1	Room pressure	Displayed in inches H_2O. Host DDC system must divide value by 100,000 to report pressure correctly.
General Exhaust Flow Rate	2	Flow (CFM) measured by the general exhaust duct flow station	Displayed in CFM.
ACPH	3	Calculated room air changes	Host DDC must divide by 10 to get number per hour.
Supply Flow Rate	4	Flow (CFM) measured by the supply duct flow station	Displayed in CFM.
Setpoint	7	Active control setpoint	Displayed in feet per minute.
Status Index	8	Status of SUREFLOW device	0 Normal 1 Low Alarm 2 High Alarm 3 Min Exh Alm 4 Min Sup Alm 7 Data Error 8 Emergency
Control Mode	9	Control mode device is in	0 Main 1 Remote
Exhaust Control Output	11	Control output value	0 - 100 will be displayed.
Supply Control Output	13	Control output value	0 - 100 will be displayed.

EXAMPLE of **04 Read Input Registers** function format.
This example read variable addresses 0 and 1 (Velocity and Pressure from 8635-C).

QUERY		**RESPONSE**	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	04	Function	04
Starting Address Hi	00	Byte Count	04
Starting Address Lo	00	Data Hi Addr0	00
No. Of Points Hi	00	Data Lo Addr0	64 (100 ft/min)
No. Of Points Lo	02	Data Hi Addr1	00
Error Check (CRC)	--	Data Lo Addr1	59 (.00089" H_2O)
		Error Check (CRC)	--

XRAM Variables

These variables can be read using Modbus command **03 Read Holding Registers**. They can be written to using Modbus command **16 Preset Multiple Regs**. Many of these variables are the same "menu items" that are configured from the SUREFLOW keypad. The calibration and control items are not accessible from the DDC system. This is for safety reasons, since each room is individually setup for maximum performance. TSI offers a number of different models, so if a feature is not available on a unit, the variable is set to 0.

Variable Name	Variable Address	Input Provided to Master System	Integer DDC system receives
Software Version (read only)	0	Current software version	1.00 = 100
Control Device (read only)	1	SUREFLOW Model	5 8635-M 6 8635-C
Emergency Mode	2	Emergency Mode Control	0 Leave emergency mode 1 Enter emergency mode Value will return a 2 when read
Setpoint	3	Pressure control setpoint	Displayed in feet per minute.
Remote Setpoint	4	Remote pressure control setpoint	Displayed in feet per minute.
Minimum Ventilation Supply Flow Setpoint	5	Minimum supply flow control setpoint in normal mode.	Displayed in CFM.
Minimum Temperature Supply Flow Setpoint	6	Minimum supply flow control setpoint in temperature mode.	Displayed in CFM.
Low Alarm	7	Low pressure alarm setpoint	Displayed in feet per minute.
High Alarm	8	High pressure alarm setpoint	Displayed in feet per minute.
Remote Low Alarm	9	Remote mode low pressure alarm setpoint	Displayed in feet per minute.
Remote High Alarm	10	Remote mode high pressure alarm setpoint	Displayed in feet per minute.
Min Supply Alarm	12	Minimum supply flow alarm	Displayed in CFM.

EXAMPLE of **16 (10 Hex) Preset Multiple Regs** function format:
This example changes the remote setpoint to 100 ft/min.

QUERY		**RESPONSE**	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	10	Function	10
Starting Address Hi	00	Starting Address Hi	00
Starting Address Lo	04	Starting Address Lo	04
No. Of Registers Hi	00	No. of Registers Hi	00
No. Of Registers Lo	01	No. of Registers Lo	01
Data Value (High)	00	Error Check (CRC)	--
Data Value (Low)	64		
Error Check (CRC)	--		

Example of **03 Read Holding Registers** function format:
This example reads the minimum ventilation setpoint and the minimum temperature setpoint.

QUERY		**RESPONSE**	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	03	Function	03
Starting Address Hi	00	Byte Count	04
Starting Address Lo	05	Data Hi	03
No. Of Registers Hi	00	Data Lo	8E (1000 CFM)
No. Of Registers Lo	02	Data Hi	04
Error Check (CRC)	--	Data Lo	B0 (1200 CFM)
		Error Check (CRC)	

Appendix C

Wiring Information

Back Panel Wiring

PIN #	DIM Input / Output / Communication	Description
1, 2	Input	24 VAC to power Digital Interface Module (DIM) and sensor. **NOTE**: 24 VAC becomes polarized when connected to DIM.
3, 4	Output	24 VAC power for Pressure Sensor
5, 6	Input	0–10 VDC pressure sensor signal
7, 8	Communications	RS-485 communications between DIM and pressure sensor
9, 10	Output	0–10 VDC general exhaust control signal
11, 12	Input	Non powered switch input - When input is closed these software items are enabled: REMOTE LOW ALARM, REMOTE HIGH ALARM, and DOOR DELAY.
13, 14	Output	Low alarm relay - N.O., closes in low alarm condition. - See menu items LOW ALARM REMOTE LOW ALARM
15, 16	Communications	RS-485 communications between DIM and host building automation system.
17, 18	Output	0–10 VDC supply air control signal
19, 20	Input	0–5 VDC flow station signal - exhaust duct.
21, 22	Input	0–5 VDC flow station signal - supply duct.
23, 24	Input	0–5 VDC, 0–10 VDC thermostat input signal
25, 26	Output	High alarm relay - N.O., closes in high alarm condition. - See menu items HIGH ALARM, REMOTE HIGH ALARM

WARNING: The wiring diagram shows polarity on many pairs of pins: +/-, H / N, A / B. Damage to the DIM may occur if polarity is not observed.

Jumper Wiring Information - Damper systems

The Model 8635 SUREFLOW Room Pressure Controller modulates electric or pneumatic actuated dampers mounted in the exhaust and supply ducts. The TSI damper / actuators are shipped configured (jumper installed) to be mounted in the exhaust duct (normally open on pneumatic). If the damper is mounted in the supply duct, the supply actuator will need the jumper changed. The menu item CONTROL SIG (CONTROL menu) reverses both control outputs, so if only 1 damper rotates incorrectly the jumper must be changed.

WARNING: A jumper must be installed for the actuator to operate.

Table B1. Jumper Wiring Configurations

Electric Actuator P/N 800360

Damper Location	Jumper Location
Supply Air	No Jumper
Exhaust Air	9–10 (reverse)

Pneumatic Actuator P/N 800119

Damper Location	Jumper Position	Damper Type*
Supply Air	9–10 (reverse)	Normally Open (N.O.)
Supply Air	8–9 (direct)	Normally Closed (N.C.)
Exhaust Air	8–9 (direct)	Normally Open (N.O.)
Exhaust Air	9–10 (reverse)	Normally Closed (N.C.)

*Damper position when pressure is lost. TSI ships Normally Open dampers unless otherwise specified.

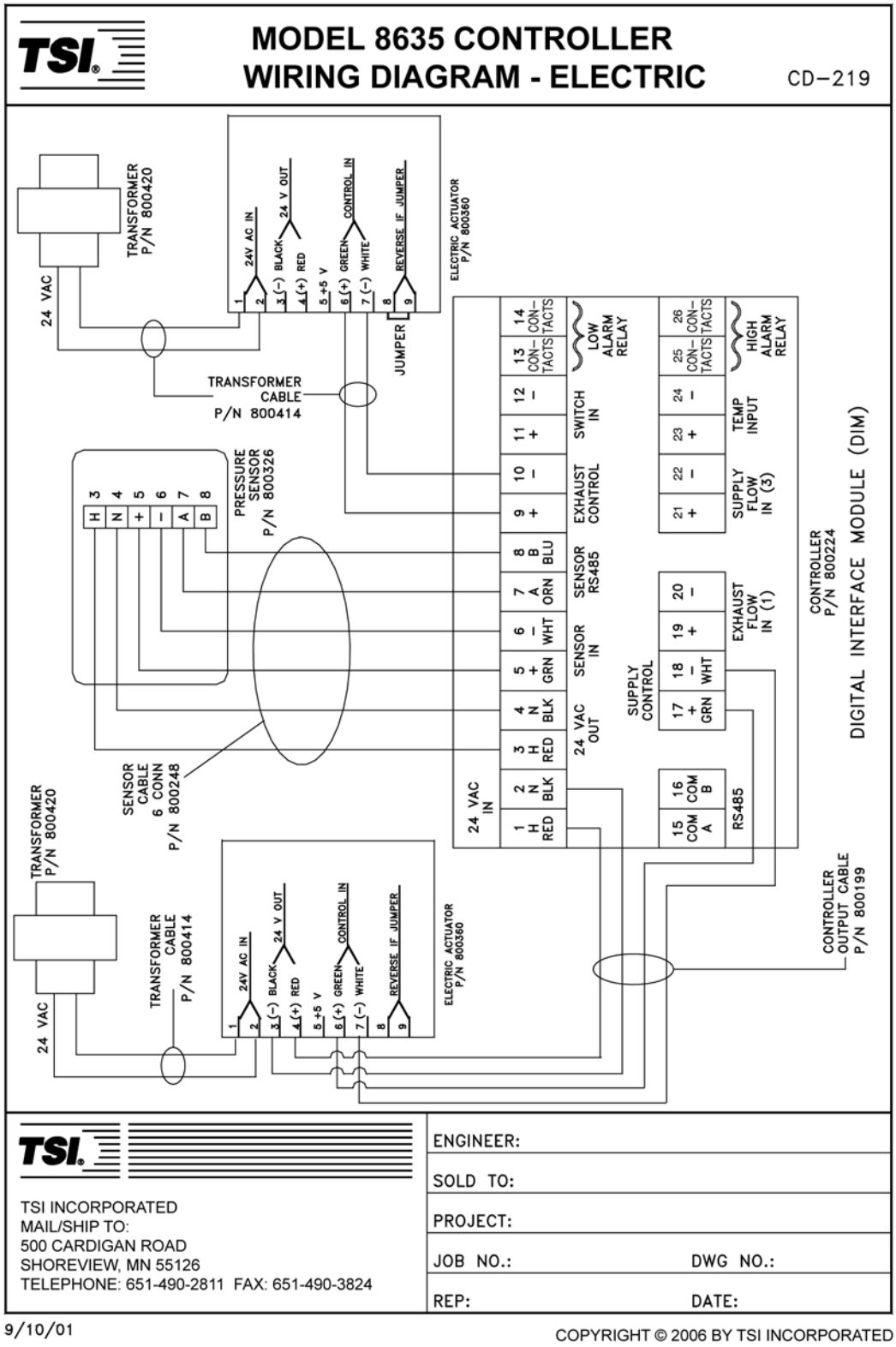


Figure 10: Wiring Diagram - Damper System with Electric Actuator

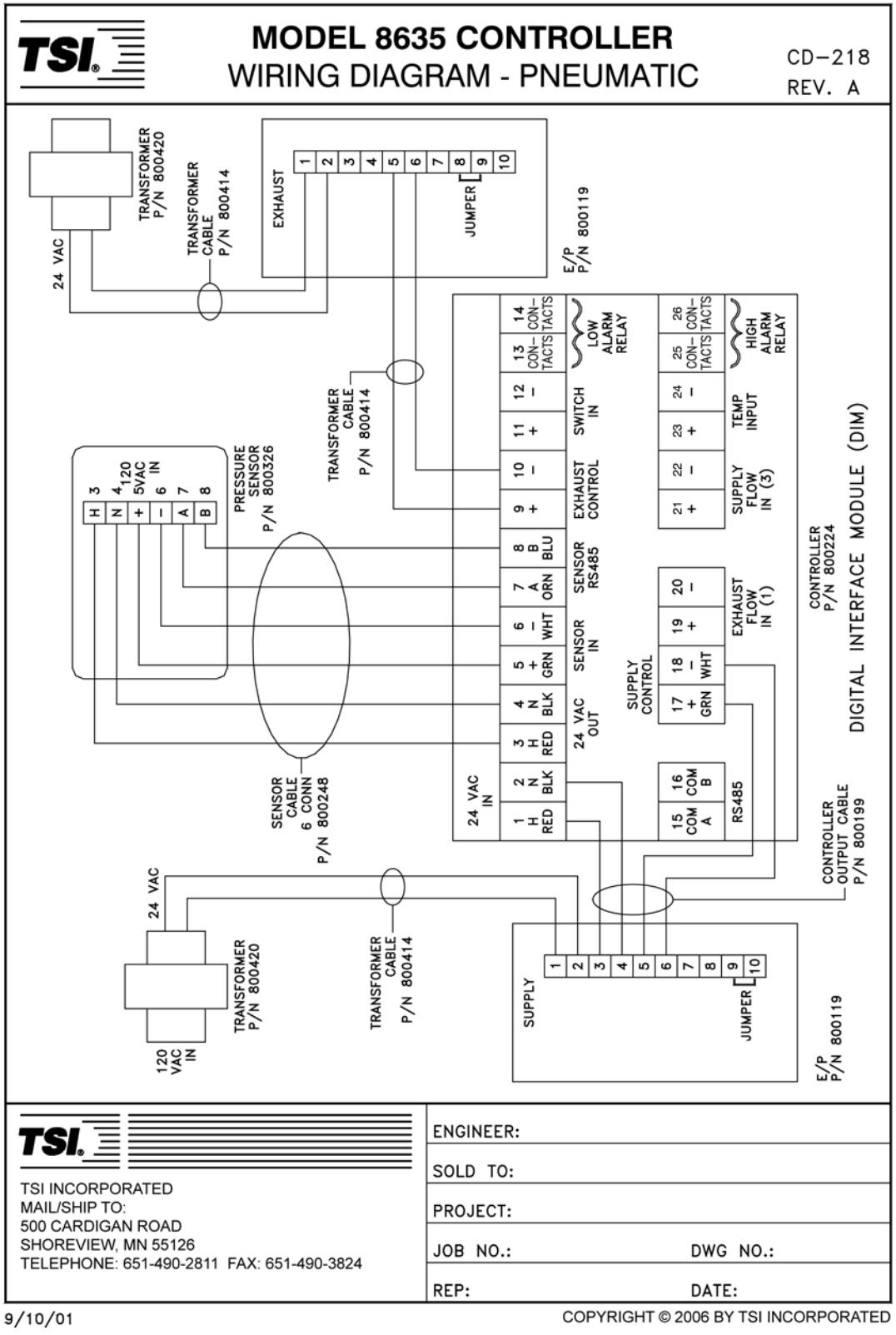


Figure 11: Wiring Diagram - Damper System with Pneumatic Actuator

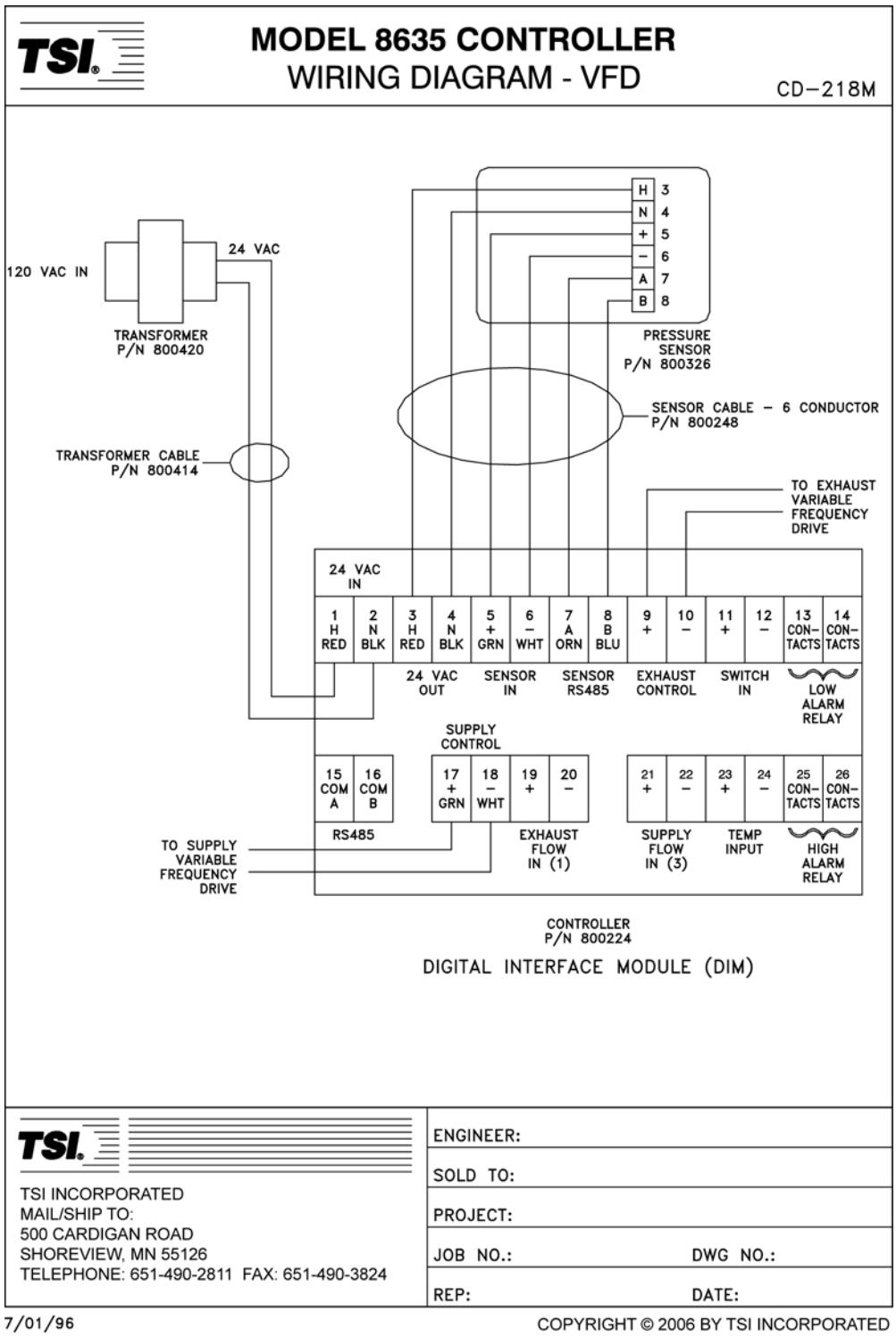


Figure 12: Wiring Diagram - VFD Systems

Appendix D

Access Codes

These are the access codes to the different menus of the SUREFLOW. When an access code is required, pressing the following key sequence will provide access to the required menu.

Key #	Setpoints	Alarm	Configure	Calibration	Control
1	EMERGENCY	TEST	EMERGENCY	AUX	MENU
2	MUTE	TEST	MENU	MENU	MUTE
3	MUTE	MUTE	AUX	MUTE	RESET
4	MENU	EMERGENCY	MENU	MENU	EMERGENCY
5	AUX	MENU	MENU	AUX	AUX

	Interface	Diagnostics
1	TEST	TEST
2	EMERGENCY	MUTE
3	AUX	AUX
4	MUTE	AUX
5	MENU	MENU

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