Manual Supplement

Model Number: 8650-CNPY

Product/System Title: Canopy Hood Flow Controller (CFM Measurement) with LON

Contents of this manual supplement include:

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IMPORTANT INFORMATION

The Model 8650-CNPY is a substantially different product than a fume hood controller (Model 8650). This model measures and controls flow (CFM) in applications where face velocity cannot be measured. In a typical laboratory application this device would be used to control canopy hoods, snorkel exhaust, or other specialty exhaust.

The unit functions almost identically to the Model 8650 Face Velocity Controller. The major difference is that flow (CFM) is being measured instead of face velocity. The standard Model 8650 Users Guide can be used with the Model 8650-CNPY if all references to velocity are changed to flow. As an example changing the flow set point in the set point menu, follows the exact procedure as changing a velocity set point, just substitute flow in the sentences where velocity appears.

Note: The Model 8650-CNPY does not have an external Emergency Mode input.

In the manual there are a number of areas where references to velocity do not relate to flow. These are found in;

Calibration - Sensor zero and span have been deleted.

Control - Autotune has been deleted.

Maintenance - There is no velocity sensor to clean.

Troubleshooting - All areas dealing with velocity measurements in fume hoods.

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Application Drawing

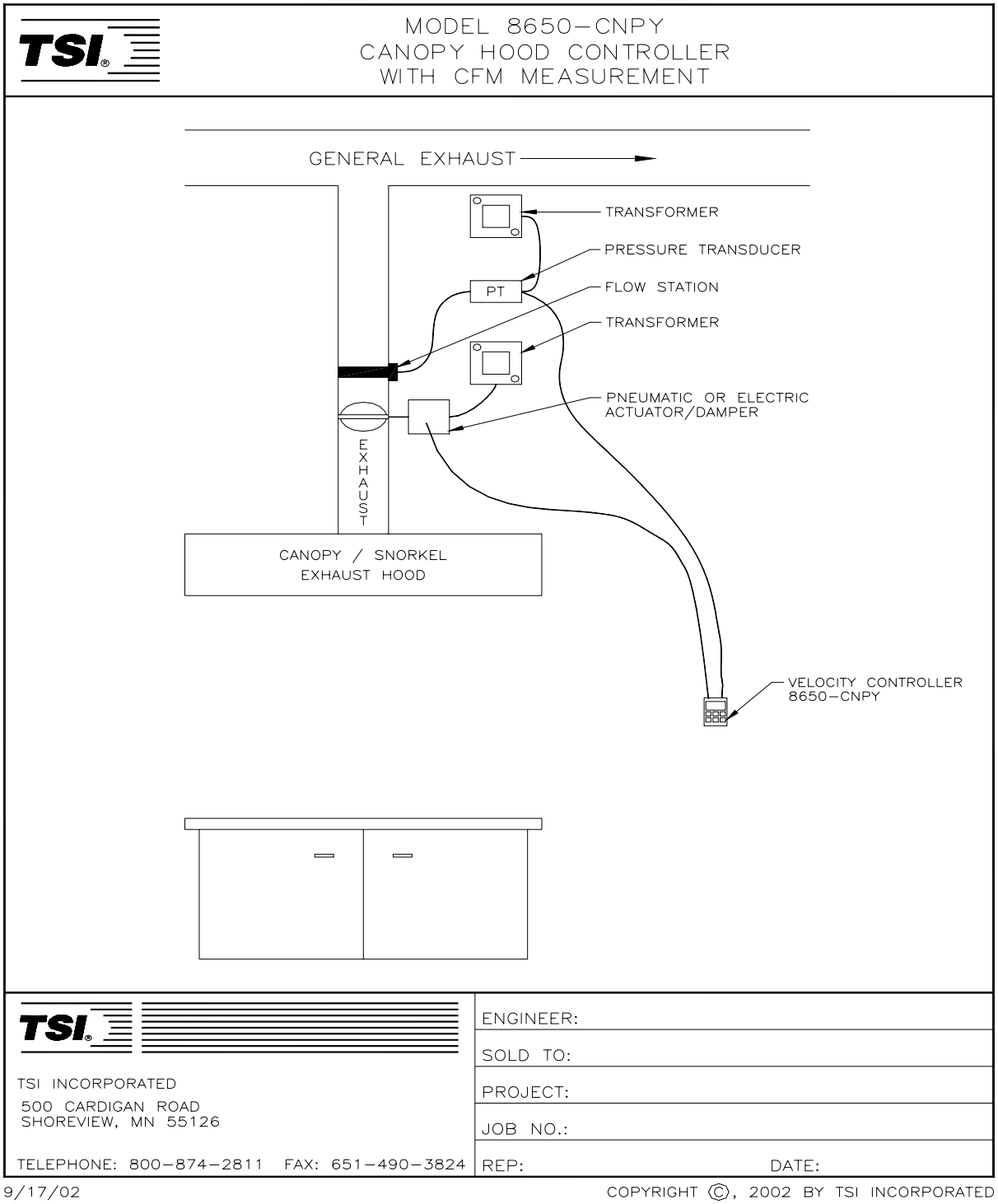

Figure 1: Model 8650-CNPY Application Drawing

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Sequence of Operation

The Model 8650-CNPY uses a flow station in the exhaust duct of a canopy hood (or other exhaust) to measure the air volume in the duct. The flow station measures the duct flow (CFM or l/s) and sends a flow signal to the controller, which compares the flow set point to the actual flow. The controller then sends a signal to the actuator or VFD to open a damper if the actual flow is too low or close a damper if flow is too high. If flow is at set point the actuator or VFD maintain position.

The sequence of control operation and theory of operation (except velocity measurement section) is the same as for a face velocity controller except flow is the control variable instead of face velocity. All set points, alarms, etc. that are listed in the manual as velocity have been modified to display in flow. When using the Users Guide remember to insert flow wherever velocity is printed except in rare cases (see **Deleted Software Items**).

NOTES: When changing flow set point, setback, no flow alarm, low alarm, or high alarm the CFM increments are 10 CFM.

The alarm deadband is a minimum of 50 CFM. In other words if the flow set point is 500 CFM the low alarm can be no greater than 450 CFM and the high alarm can be no less than 550 CFM.

The maximum flow is 10,000 CFM (14,150 l/s).

The Model 8650-CNPY features alarm relays and RS-485 communications to communicate with a building management system. Modbus Communications and N2 Communications are installed on the Model 8650-CNPY fume hood controllers. This document provides the technical information needed to communicate between the host DDC system and the Model 8650 units. This document assumes the programmer is familiar with either Modbus or N2 protocol. Further technical assistance is available from TSI if your question is related to TSI interfacing to a DDC system. If you need further assistance regarding either Modbus or N2 protocol please contact Modicon Incorporated (for Modbus assistance) or Johnson Controls (for N2 assistance).

LON Works communication is available when an optional LON Works board is included.

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Menu and Menu Items

The SUREFLOW is a very versatile device that can be configured to meet your specific application. This section lists all of the menu items available to program and change. 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** of the Model 8650 Operation and Service Manual for a detailed explanation. This section provides the following information:

0 Complete list of menus and all menu items.
1 Gives the menu or programming name.
2 Defines the function of new menu item's; what it does, how it does it, etc.
   i. Gives the range of values that can be programmed.
   ii. 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 2, below, shows a chart of the Model 8650-CNPY controller menu items. The new menu items are shown in **bold**.

SETPOINTS

SET POINT
SET BACK
LOW ALARM
HIGH ALARM
MIN DAMPER
MAX DAMPER
ACCESS CODE

CONFIGURE

DISPLAY AVG
UNITS
ALARM RESET
OUTPUT SIG
AUD DISABLE
NET PROTOCOL*
NET ADDRESS*
DUCT AREA
FLO STA TYPE
TOP VELOCITY
ACCESS CODE

CALIBRATION

PRESSURE ZERO
LOW SETP
HIGH SETP
LOW CAL
HIGH CAL
RESET CAL
ACCESS CODE

CONTROL

SENSITIVITY
SPEED
CONTROL SIG
Kc VALUE
Ti VALUE
ACCESS CODE

DIAGNOSTICS

CONTROL OUT
ANALOG OUT
LOW RELAY
HIGH RELAY
ACCESS CODE

***** LON Menu Item will replace the NET ADDRESS menu item for 8650-CNPY Canopy Hood Controllers that include an optional Lon Works board. The Menu Item NET ADDRESS will be deleted as menu options on 8650-CNPY Canopy Hood Controllers that include the optional Lon Works board.

Figure 2: Menu items - Model 8650-CNPY Fume Hood Controller

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Deleted / Changed Items

The following items have been deleted from the Model 8650-CNPY menu:

SENSOR ZERO
SENSOR SPAN
SETBACK IN
EMERGENCY IN
SENSOR INPUT

The following items have been changed**.**

The **alarm delay is 20 seconds** versus 5 seconds.
Ti = 100 was 110
The **caution light** goes off when within **20%** of set point not 10%.
The **Emergency Input** (back panel) now is the **Setback Input** (setback input is used for flow). Label on back of unit has not been changed.

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Description of New Software Items

The Model 8650-CNPY has new software items that allow the units to be calibrated and configured for each application. The new software items are located in various menus as shown in the attached Menu Structure drawing.

Item	Description
DUCT AREA	The **DUCT AREA** item is used to program the cross sectional area of the duct where the flow station is mounted. Since the flow station and pressure transducer are used to measure duct velocity, the **DUCT AREA** is necessary to calculate the duct airflow.

WARNING:
If the proper **DUCT AREA** is not programmed into the Model 8650-CNPY, the flow measurement will be incorrect. Thus, all the other information that uses the flow measurement, such as low and high flow alarms, will also be incorrect.

When this item is entered, the display will indicate a value in square feet (**sq. ft**) or square meters (**sq. m**). The displayed value ranges from 0.050 to 9.999 SQ. FT. The unit is sent out with a factory default of 0.500 **sq. ft**.

FLO STA TYPE — The **FLO STA TYPE** item is used to program the type of air flow sensor being used. **PRESSURE** is selected when TSI flow stations with pressure transducers are installed. **LINEAR** is selected when a linear output flow station, typically thermal anemometer based, is installed. The default value is **PRESSURE**.

TOP VELOCITY — The **TOP VELOCITY** item is used to input the maximum velocity of a linear flow station output. A **TOP VELOCITY** must be input for the linear flow station to operate. This item is disabled if a pressure-based flow station is installed. The range is 0 – 5000 FT/MIN (0 – 25.4 m/s). The default value is 0 FT/MIN.

PRESSRE ZERO

The **PRESSRE ZERO** item is used to calibrate the zero in the pressure transducer. When this item is entered by pressing the **SELECT** key, the display will instruct the user to Remove Pressure Tap then press **SELECT** key.

After the pressure taps are removed and the **SELECT** key has been pressed, the display will go through a 10 second countdown of the calibration followed by the standard Saving data message and three beeps indicating the pressure zero calibration is complete. The unit then automatically exits back out to the item level.

LOW SETP

The **LOW SETP** item is used to set the damper position for low flow calibration. Pressing the ▲ arrow key will increase the displayed value, pressing the ▼ arrow key will decrease the displayed value When this item is entered by pressing the **SELECT** key, the display will indicate the low flow calibration damper position. The damper position can range between 0 and 255. The default value of **LOW SETP** is 255.

HIGH SETP

The **HIGH SETP** item is used to set the damper position for low flow calibration. Pressing the ▲ arrow key will increase the displayed value, pressing the ▼ arrow key will decrease the displayed value When this item is entered by pressing the **SELECT** key, the display will indicate the low flow calibration damper position. The damper position can range between 0 and 255. The default value of **HIGH SETP** is 0.

LOW CAL

The **LOW CAL** menu items display the currently measured flow rate and the calibrated value for that flow. The damper will move to the **LOW SETP** damper position for the low calibration. The calibrated supply flow can be adjusted using the ▲/▼ keys to make it match a reference measurement. Pressing the SELECT key will save the new calibration data.

HIGH CAL

The **HIGH CAL** menu items display the currently measured flow rate and the calibrated value for that flow. The damper will move to the **HIGH SETP** damper position for the low calibration. The calibrated supply flow can be adjusted using the ▲/▼ keys to make it match a reference measurement. Pressing the SELECT key will save the new calibration data.

RESET CAL

The **RESET CAL** menu item zeroes out the calibration adjustments for the flow. When this menu item is entered, the 8650-CNPY will prompt the user to verify that they want to do this. Press the SELECT key to reset the calibrations, and the MENU key to reject it.

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MODBUS Communications

Modbus communications are installed in all Model 8650-CNPY fume hood face velocity controllers. This document provides the technical information needed to communicate between the host DDC system and the Model 8650-CNPY units. This document assumes the programmer is familiar with Modbus protocol. Further technical assistance is available from TSI if you 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 (508) 794-0800

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 8650-CNPY 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, and CFM. If the DDC system is to display different units, the DDC system needs to make the conversion.

MODBUS Communications (continued)

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.** These variables are the same "menu items" that are configured from the PRESSURA 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
Flow Rate	0	Current Flow	Displayed in CFM.
Status Index	1	Status of SUREFLOW Device	0 Normal 1 Setback 2 Low Alarm 4 High Alarm 8 Sensor Error 10 Data Error 12 Emergency
Emergency Mode	2	Put unit in or out of emergency	Write only variable 0 will take unit out of emergency 1 will put unit into emergency
Setback Mode	3	Put unit in or out of setback	Write only variable 0 will take unit out of emergency 1 will put unit into emergency
Main Setpoint	4	Main Control Setpoint	Displayed in CFM.
Setback Setpoint	5	Setback Control Setpoint	Displayed in CFM.
Low Alarm	6	Low Flow Alarm Setpoint	Displayed in CFM.
High Alarm	7	High Flow Alarm Setpoint	Displayed in CFM.
Units	10	Units of device	0 CFM 1 l/s

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N2 Variable Map

NPT	NPA	*UNITS	DESCRIPTION	
AI	1	CFM, l/s	Current Flow	
AI	2	CFM, l/s	Current Flow Setpoint	
AI	3	#	Control Output	
BI	1		Setback Mode	0=Normal 1=Setback
BI	2		Low Flow Alarm	0=Normal 1=Low Alarm
BI	3		High Flow Alarm	0=Normal 1=High Alarm
BI	4		Data Error	0=Normal 1=Data Error
BI	5		Emergency Mode	0=Normal 1=Emergency
AO	1	CFM, l/s	Main Flow Setpoint	
AO	2	CFM, l/s	Setback Flow Setpoint	
AO	3	CFM, l/s	Low Alarm Setpoint	
AO	4	CFM, l/s	High Alarm Setpoint	
AO	5	#	Units	0=English 1=Metric

* Units will correspond with choice in UNITS variable (AO#5). Flow rates will either be CFM or l/s, based on whether UNITS variable is set for an English or Metric type.

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Description of Variables

NPT - Network Point Type
Variables are defined as analog inputs, binary inputs, and analog outputs. Analog inputs are current control parameters and items that the controller is measuring. Binary inputs represent controller states. Analog outputs are the programmable setpoints for the face velocity controller. These setpoints can be changed through the keypad or by over-writing the current setpoint.

NPA - Network Point Address
Address of the desired point.

Change of Status (COS) - Face Velocity Analog Input
The 8650-CNPY has the ability to change control setpoints locally. The alarm setpoints need to be based on the controller's control setpoint (AI #2). The unit can be changed from Normal Mode to Setback Mode. For example the setpoint could go from 1000 CFM to 600 CFM when the Setback key is pressed. If the COS alarm setpoints are not changed to accommodate, you could get low alarm or low warning messages when the unit is working correctly. If these alarm points are set outside of the setback and main velocity setpoint values, incorrect alarm messages can be prevented.

Override Analog Input Command
Analog Input values can be set using the override command. These values will be reset to the correct items when the Override is released. There is not a time-out on the override command.

Override Binary Input Command
Overriding a 1 to the Setback or Emergency binary inputs enables the respective mode. To return the controller to normal mode from setback mode, press the Setback key on the controller, toggle the setback contact input, or release the override. To release controller from emergency state, override a 0 to the Emergency input or press either the emergency or reset key. Releasing the override will return the controller to the state it was in previous to the emergency, either Normal or Setback.

The alarm and data error variables can be overridden, but this will not affect the controller. Overriding the low alarm variable will result in a change of status, but will not put the controller into low alarm mode. The local alarm modes can only be controlled locally. Only override these variables for diagnostic purposes, and release them for normal operation.

Binary Inputs, Data Error
Data Error indicates when some of the data stored on the device has been corrupted. The calibration and setpoint values should be checked on the controller.

Override Analog Output Command
The analog output variables can be overridden to change their values. The overridden value will be checked for validity. If invalid, the override command will be ignored, and the value will not change. The override flag will not be set when the value is ignored. The override command will be cleared when the variable is reset in the menus. The variable will not reset with the release command.

Supported Commands

Command	Response
Request Device ID	Returns 0x10
Synchronize Time Command	Acknowledged. There is no internal clock to synchronize.
Poll without/With Ack Message	Any change of status is returned
Read Analog Input Command	Variable value
Read Binary Input Command	Variable value
Read Analog Output Command	Variable Value
Write Analog Input	Acknowledge
Write Binary Input	Acknowledge
Write Analog Output	Acknowledge
Override Analog Input Command	Acknowledge
Override Binary Input Command	Acknowledge
Override Analog Output Command	Acknowledge
Override Release Request	Acknowledge
Identify Device Type Command	Returns 0x10H

LON Works Canopy Controller Object Details

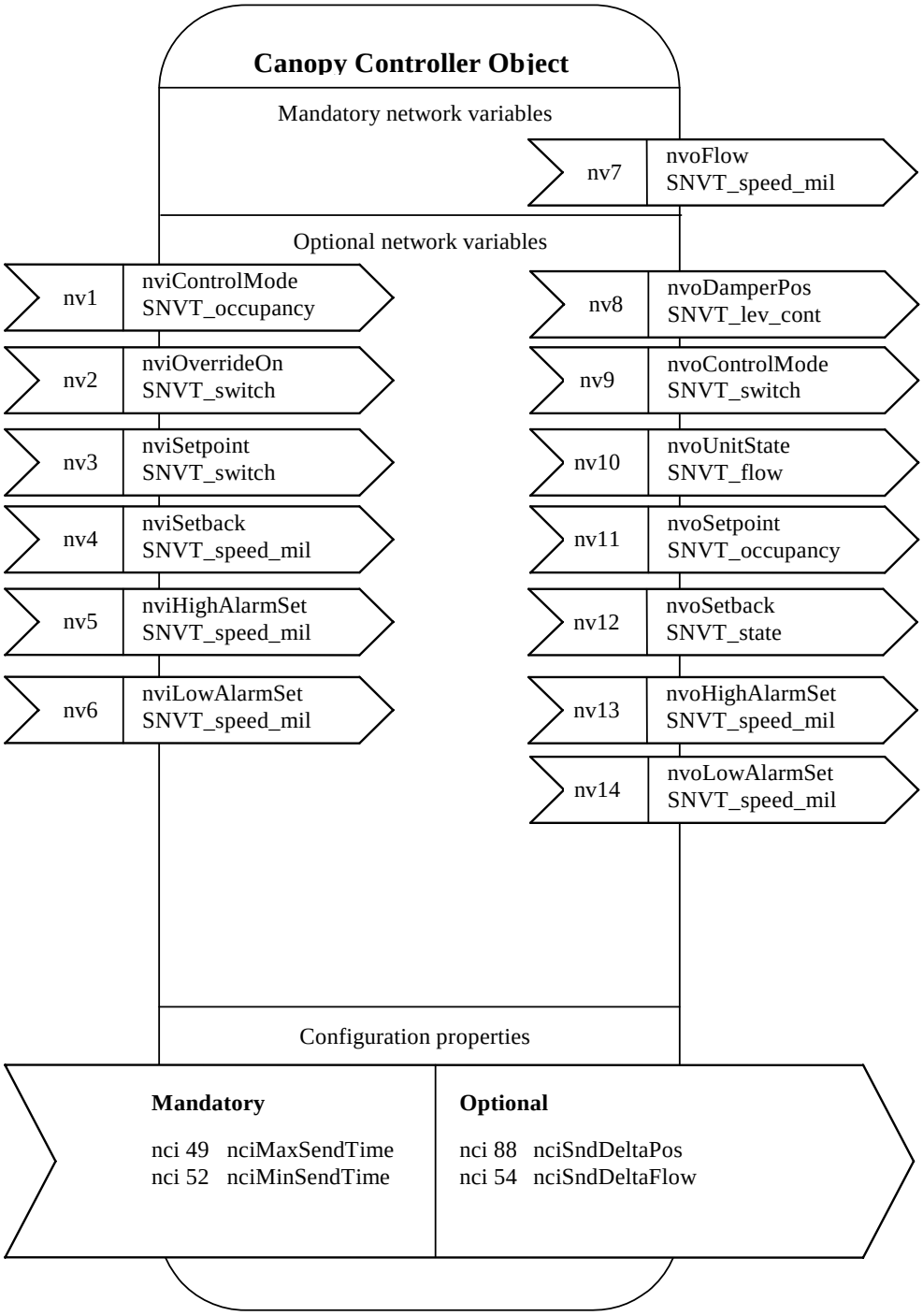

Figure 3: Canopy Controller Object Details

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LON Works Canopy Controller Unit State Definition

nvo UnitState	
Bit	Description
0	0 = Occupied 1 = Unoccupied
1	Low Alarm
2	High Alarm
3	Sensor Error
4	Data Error
5	Emergency Mode
6	Override

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Wiring Information

PIN #	Input / Output / Communication	Description
	J1 Terminal Strip	
1, 2	Input	24 VAC to power Digital Interface Module (DIM). **NOTE**: 24 VAC becomes polarized when connected to DIM.
3, 4	Communications	LonWorks communications to building management system (optional)
5, 6	Output	0-10 VDC exhaust airflow control signal. 10 VDC = open (N.O. damper) - See menu item CONTROL SIG.
7, 8	Output	Low alarm relay – N.O., closes in Low Alarm condition
9, 10	Output	High alarm relay – N.O., closes in High Alarm condition
	J5 Terminal Strip	
1, 2	Communications	RS-485 communications; DIM to building management system (Modbus or N2)
3, 4	Input	0-5 VDC flow station signal – Fume hood exhaust flow
5, 6	Input	Non powered switch input. - See menu item SETBACK. Setback Mode initiate by contact closure.
7, 8	Output	0–10 VDC or 4-20 mA, face velocity signal output - See menu item OUTPUT SIG

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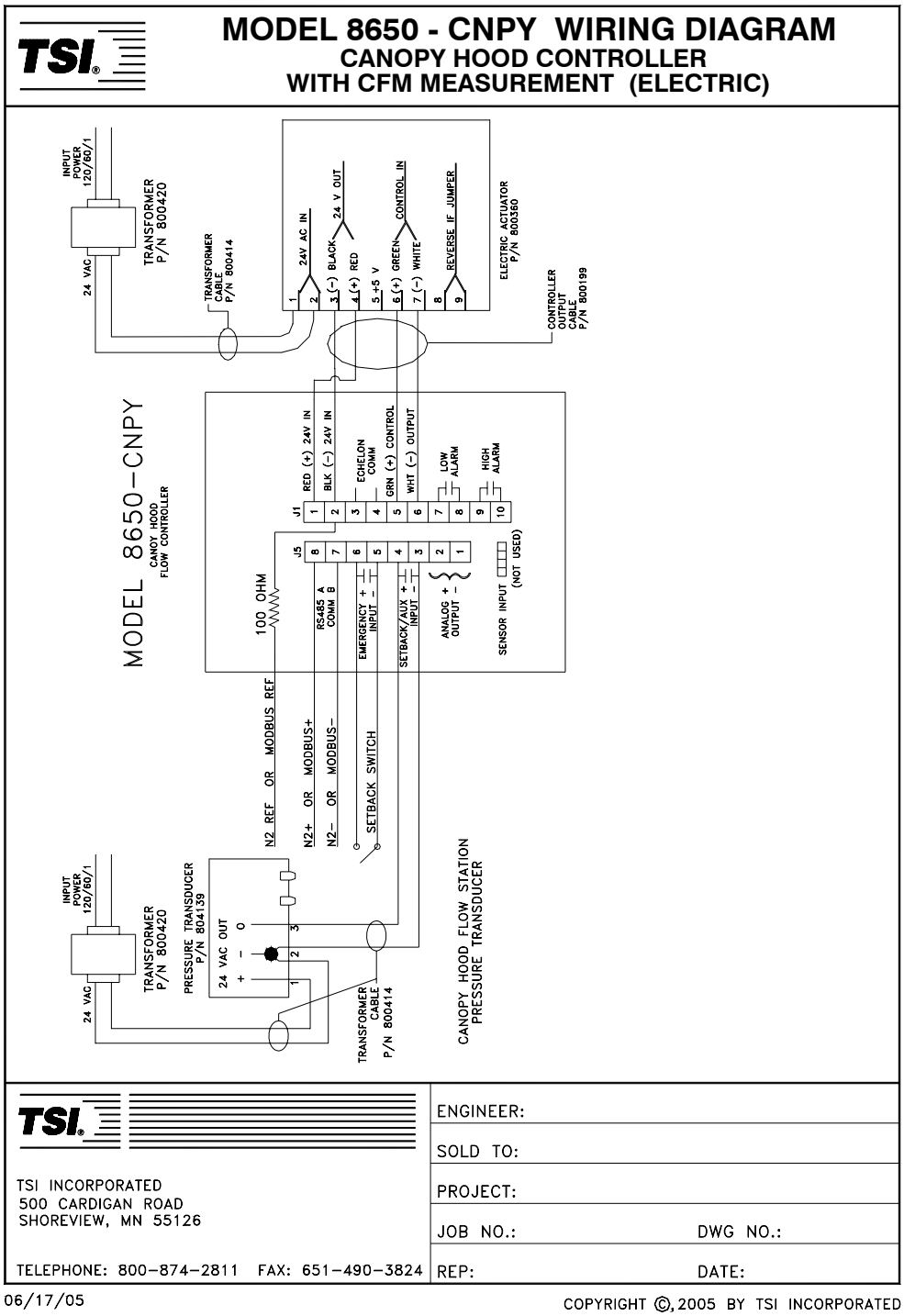
Wiring Diagrams



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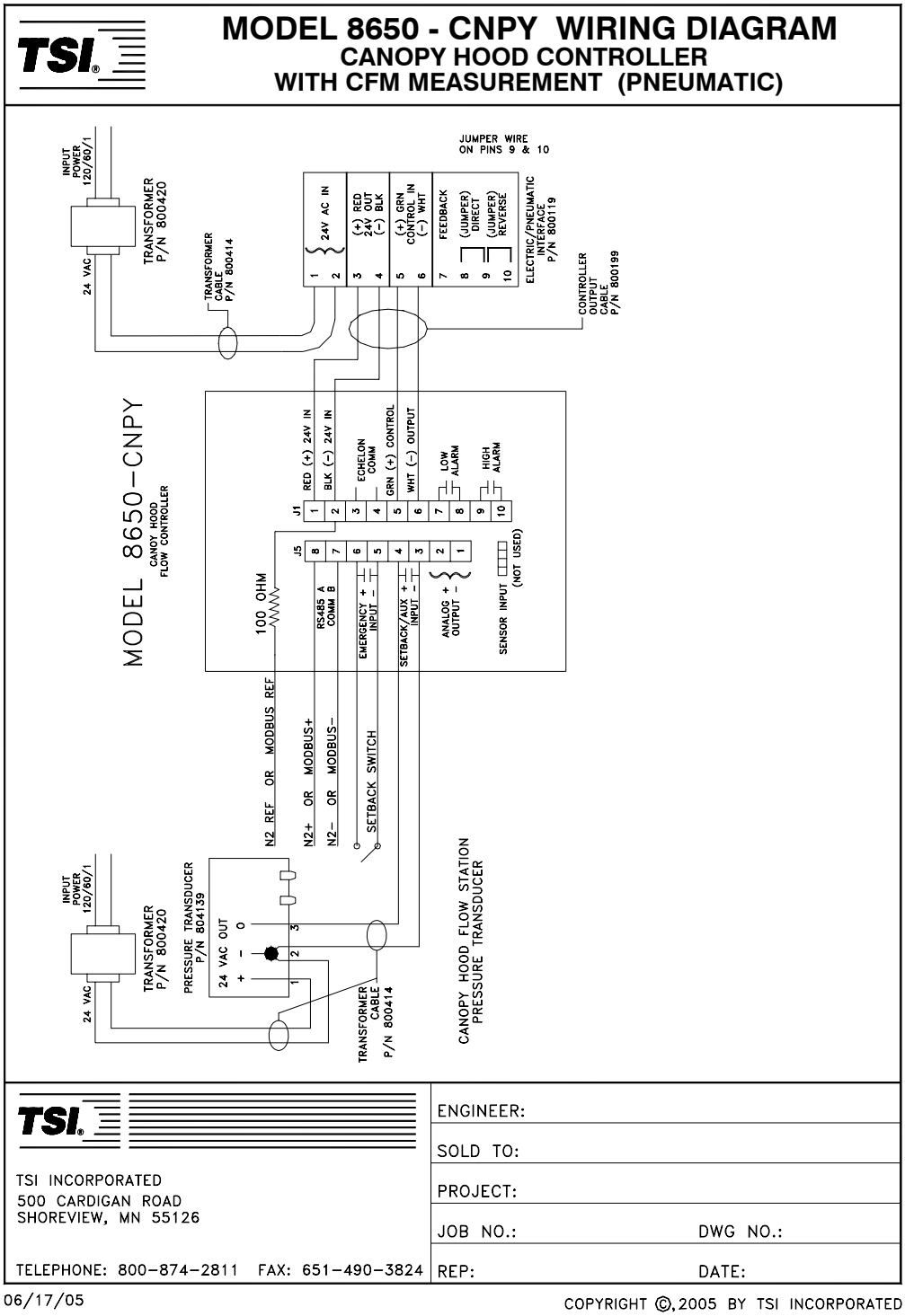
Wiring Diagrams (continued)



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