TSI® MODEL 8635-C, 8635-M SUREFLOW™ 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 8685 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:

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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.

Pressure in Inches H_2O = $6.2*10^{-8}*$(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.

8635-C, 8635-M Laboratory Room Pressure Controller

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
*Control Output	13	Control output value	0 to 255 will be displayed.

***NOTE**: Only available on 8635-C.

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

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 <u>read</u> using Modbus™ command **03 Read Holding Registers**. They can be <u>written</u> 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.

8635-C, 8635-M Variable List

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.
Top Velocity	13	Maximum Velocity out of linear based flow station	Displayed in feet per minute.
Averaging Index	15	Display averaging period	0 .75 sec. 4 5 Sec. 1 1 Sec. 5 10 Sec. 2 2 Sec. 6 20 Sec. 3 3 Sec. 7 40 Sec.
Units Value	16	Current pressure units displayed	0 Feet per minute 1 meters per second 2 inches of H_2O 3 Pascal 4 millimeters H_2O
Alarm Mode	17	Latched or unlatched alarms	0 Unlatched 1 Latched
Audible Alarm	18	Audible alarm indication	0 OFF 1 On
Alarm Delay	19	Time delay before audible alarm sounds	Host DDC system must divide value by 10 to report alarm delay correctly.
Mute Delay	20	Length of time alarm is muted when mute key is pressed	Host DDC system must divide value by 600 to report alarm delay correctly.
Output Mode	22	Analog output signal	0 4 to 20 mA 1 0 to 10 Volt
Elevation	23	Elevation above sea level	0-10,000 feet. Displayed in 1,000 feet increments.
Exhaust Duct Area*	24	Duct area in square feet of general exhaust flow station	Host DDC system must divide value by 1,000 to report duct area correctly.

Variable Name	Variable Address	Input Provided to Master System	Integer DDC system receives
Room Volume	25	Room volume in cubic feet (needed for ACPH calculation)	Displayed in Cubic Feet
Supply Duct Area	26	Supply duct area in square feet	Host DDC system must divide value by 1,000 to report supply duct area correctly.
Flow Station Type	27	Type of flow station being utilized by controller	0 Pressure Based 1 Linear
ACPH Flow channel	28	Set ACPH flow calculation	0 Exhaust 1 Supply,
Program Control Mode	29	Changes room pressure control mode	0 Main 1 Remote
Control Action*	32	Control output signal direction	0 Reverse 1 Direct
Network Protocol	36	Network Protocol for RS-485 Communications	0 Modbus 1 Cimetrics
Network Address	37	Communication address of device	Range is 1 to 247
Set Code Enable*	48	Setpoint menu access code enable	0 Off 1 On
Alarm Code Enable	48	Alarm menu access code enable	0 Off 1 On
Conf Code Enable	50	Configure menu access code enable	0 Off 1 On
Cal Code Enable	51	Calibration menu access code enable	0 Off 1 On
Control Code Enable*	52	Control menu access code enable	1 On 0 Off
Interface Code Enable	53	Interface menu access code enable	0 Off 1 On
Diagnostic Code Enable	54	Diagnostic menu access code enable	0 Off 1 On
Door Delay	62	Time delay before audible alarm sounds when unit is in remote mode	Host DDC system must divide value by 10 to report alarm delay correctly.
Temp Low*	63	Low limit to switch into temperature mode	Voltage signal from thermostat. Host DDC system must divide by 10 to report correctly
Temp High*	64	High limit to switch into temperature mode	Voltage signal from thermostat. Host DDC system must divide by 10 to report correctly

*Not used on 8635-M Laboratory Room Monitor

EXAMPLE of **16 (10 Hex) Preset Multiple Regs** function format
This example changes the remote set point 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)	--

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