

TSI Model 8635-ST SUREFLOW™ Modbus® Communications

Application Note LC-135

Modbus communications are installed in all Model 8635-ST laboratory room pressure controllers. This document provides the technical information needed to communicate between the host DDC system and the Model 8635-ST 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 their 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-ST 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.



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 |
|----------------------|------------------|---------------------------------------|---|
| Pressure | 1 | Duct Pressure | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Setpoint | 7 | Active control setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Status Index | 8 | Status of SUREFLOW device | 0 Normal 1 Low Alarm 2 High Alarm 7 Data Error 8 Emergency |
| Control Mode | 9 | Control mode device is in | 0 Main 1 Remote |
| Control Output Value | 12 | Control output value | 0 - 255 will be displayed. |

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

QUERY

| | |
|---------------------|-------|
| Field Name | (Hex) |
| Slave Address | 01 |
| Function | 04 |
| Starting Address Hi | 00 |
| Starting Address Lo | 00 |
| No. Of Points Hi | 00 |
| No. Of Points Lo | 01 |
| Error Check (CRC) | -- |

RESPONSE

| | |
|---------------|-----------------------------|
| Field Name | (Hex) |
| Slave Address | 01 |
| Function | 04 |
| Byte Count | 04 |
| Data Hi Addr0 | 00 |
| Data Lo Addr0 | 64 (1.00 "H ₂ O) |

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 |
| 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 | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Remote Setpoint | 4 | Remote pressure control setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Low Alarm | 7 | Low pressure alarm setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| High Alarm | 8 | High pressure alarm setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |

| Variable Name | Variable Address | Input Provided to Master System | Integer DDC system receives |
|----------------------|-------------------------|---|---|
| Remote Low Alarm | 9 | Remote mode low pressure alarm setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Remote High Alarm | 10 | Remote mode high pressure alarm setpoint | If standard units: Host DDC system must divide value by 100 to get inches H ₂ O. If metric units: Value will be displayed in Pascals. |
| Min Setpoint | 11 | Minimum damper position or VFD drive, set as a percentage | If control action = Direct: Value will be 0-255, where 0 = 100% of Max, and 255 = 0% of Max If control action = Reverse: Value will be 0-255, where 0 = 0% of Max, and 255 = 100% of Max |
| 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 | 2 inches H ₂ O 3 Pascals |
| 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 (in seconds). |
| 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 (in minutes). |
| Program Control Mode | 29 | Changes room pressure control mode | 0 Main 1 Remote |

EXAMPLE of 16 (10 Hex) Preset Multiple Regs function format:

This example changes the remote set point to 0.5 in H₂O.

QUERY

| Field Name | (Hex) |
|---------------------|-------|
| Slave Address | 01 |
| Function | 10 |
| Starting Address Hi | 00 |
| Starting Address Lo | 04 |
| No. Of Registers Hi | 00 |
| No. Of Registers Lo | 01 |
| Data Value (High) | 00 |
| Data Value (Low) | 32 |
| Error Check (CRC) | -- |

RESPONSE

| Field Name | (Hex) |
|---------------------|-------|
| Slave Address | 01 |
| Function | 10 |
| Starting Address Hi | 00 |
| Starting Address Lo | 04 |
| No. of Registers Hi | 00 |
| No. of Registers Lo | 01 |
| Error Check (CRC) | -- |

Example of 03 Read Holding Registers function format:

This example reads the minimum setpoint.

QUERY

| Field Name | (Hex) |
|---------------------|-------|
| Slave Address | 01 |
| Function | 03 |
| Starting Address Hi | 00 |
| Starting Address Lo | 0B |
| No. Of Registers Hi | 00 |
| No. Of Registers Lo | 01 |
| Error Check (CRC) | -- |

RESPONSE

| Field Name | (Hex) |
|-------------------|----------|
| Slave Address | 01 |
| Function | 03 |
| Byte Count | 02 |
| Data Hi | 00 |
| Data Lo | 14 (20%) |
| Error Check (CRC) | -- |

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