FLUID COMPONENTS INTERNATIONAL LLC

PROFIBUS DP Manual

ST80 / ST80L
Thermal Mass Flow Meter

PROFIBUS PROCESS FIELD BUS

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1. GENERAL

Introduction

PROFIBUS DP (decentralized peripherals) is a high-speed version of PROFIBUS that is designed specifically for communication between automation systems and decentralized field devices. With the ST80/ST80L PROFIBUS DP option board, the flow meter functions as a PROFIBUS Profile 3.02 compliant slave that is addressable by either a Class 1 master (cyclic operation) or a Class 2 master (acyclic operation). With the profile-specific configuration the flow meter operates as a drop-in replacement for any "Mass Flow Meter with Totalizer" device in a PROFIBUS network. With its manufacturer-specific configuration a Class 2 master can operate the ST80/ST80L over the PROFIBUS network using the flow meter's full range of setup, control, and diagnostic features.

ST80/ST80L PROFIBUS DP option board has an RS-485 differential serial interface with selectable bit rates up to 12 Mbits/sec.

This manual describes the ST80/ST80L PROFIBUS DP option features, configuration, and operation.

PROFIBUS Technology, OSI Reference Model

The OSI reference model for the PROFIBUS DP is shown in Figure 1 below. The relevant layers as they pertain to ST80/ST80L are listed below.

- **Application** – Application support is provided for DP protocols DPV0 for cyclical communication and DPV1 for acyclical communication.
- **Data Link** – The Field bus Data Link (FDL) uses a master-slave paradigm combined with token passing (hybrid access method) to arbitrate bus ownership among masters. Data is in the form of packets (telegrams) all with a particular start delimiter (defines type) and an end delimiter.
- **Physical** – The physical connection is an RS-485 differential serial interface that runs at speeds from 9.6 kbits/sec to 12 Mbits/sec.

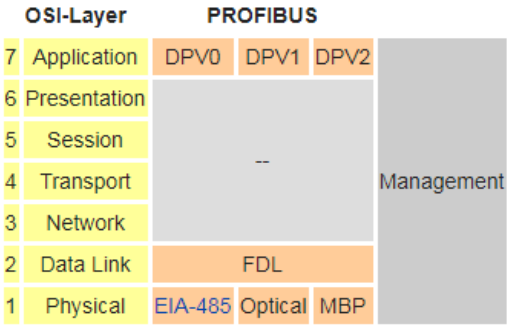

Figure 1 – PROFIBUS OSI Layers

Definitions

Physical Block: This block describes the necessary parameters and functions of the device or the device hardware itself.

Function Blocks: These blocks describe the functions of the device executing within the automation system. An example of a function block is the Flow Transducer Analog Input block.

Transducer Block: This block contains device parameters that define the connection to the process. The ST80/ST80L has two transducer block types. The Process Data transducer block includes parameters for flow, temperature, and FCI Totalizer. The Service transducer block is used for service-related functions including instrument information, instrument set up, troubleshooting, self-test, and calibration.

Analog Input (AI) Blocks: These blocks receive the ST80/ST80L process data variables from the Process Data transducer block and make the process data of the ST80/ST80L available to other function blocks at the output. The AI blocks are a subset of Function blocks.

Totalizer Blocks: The TOTALIZER block integrates (accumulates) the rate (i.e. flow rate) to the corresponding integral. The ST80/ST80L offers two ways of providing the Totalize output of the flow rate; the internal *FCI Totalizer*, or the PROFIBUS *Profile Totalizer* function block. These two totalizer choices represent manufacturer-specific and profile-specific PROFIBUS configurations, respectively.

GSD Files: The General Station Description (GSD) file is an electronic device data sheet or device data base file that identifies the PROFIBUS device. All PROFIBUS devices (Class 1/Class 2 masters and slaves) have their own GSD files.

FCI Configuration Software: A Windows-based application that is supplied with the instrument for accessing ST80/ST80L functions and features. The application, also simply referred to as the "configurator," is typically used for basic instrument setup and configuration, as well as provide access to advance functions. The FCI configurator interfaces through the ST80/ST80L USB service port.

Technical Characteristics

Physical Characteristics (PROFIBUS DP Channel)

- Data transmission rate: 9.6 kbits/second to 12 Mbits/second
- Bus connection: Polarized; Line A (Negative/Green); Line B (Positive/Red)
- I/O Interface: RS-485, differential serial I/O

Profile 3 Characteristics

- PROFIBUS DP Version 3.02
- Instrument profile: Mass Flow Meter with Totalizer (Profile Ident_Number 0x9740)
- Function Blocks:
  - 1 Physical Block
  - 3 Process Data Transducer Blocks
    - Flow Transducer Block
    - Temperature Transducer Block
    - FCI Totalizer Transducer Block
  - 5 Service Transducer Blocks
    - Instrument Information Service Transducer Block
    - Instrument Setup Service Transducer Block
    - Troubleshooting Service Transducer Block
    - Self-Test Service Transducer Block
    - Calibration Information Service Transducer Block
  - 4 Analog Input Blocks
    - Flow Transducer Analog Input Block
    - Temperature Transducer Analog Input Block
    - FCI Totalizer Analog Input Block
    - Profile Totalizer Analog Input Block

2. INSTALLATION

General

For details on ST80/ST80L mounting/mounting options and general wiring, refer to the main manual **06EN003490**.

Electrical Wiring

The ST80/ST80L PROFIBUS DP connections are made on a small, plug-in terminal board that mounts on top of the PROFIBUS DP controller board as shown in Figure 2 and Figure 3 below. The PROFIBUS DP controller board (installed at the factory) mounts on top of the main board. The terminal board's 4-position TB1 connector accepts 26–16 AWG (0.14 mm^2–1.5 mm^2) PROFIBUS wiring.

Note: The PROFIBUS DP PROFIBUS connections supersede that provided by the J8 connector on the main board for PROFIBUS PA.

Follow these steps to wire the PROFIBUS DP option.

1. Open the flow meter's blind lid to access the wiring terminal blocks.
2. Route the PROFIBUS DP cable, incoming and outgoing, through enclosure ports as shown in Figure 2 below. FCI recommends Belden PROFIBUS DP cable part number 3079A or equivalent. When wiring the enclosure, follow the assembly instructions for the type cable fittings used such as conduit hubs, cable glands, etc. Allow an adequate length of wire inside the enclosure for a service loop.

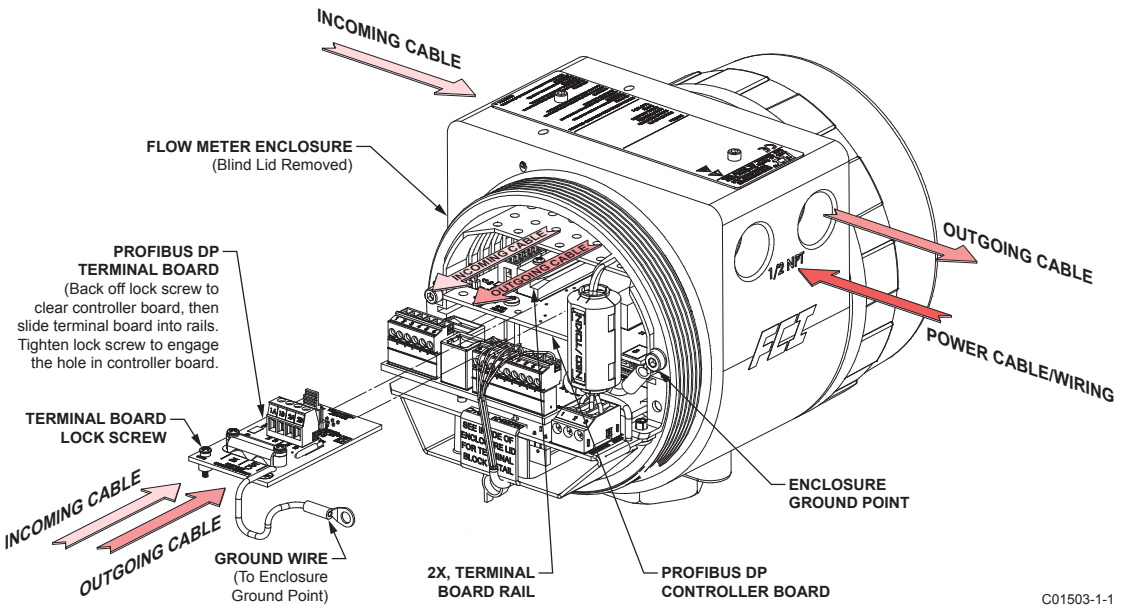

Figure 2 – ST80/ST80L PROFIBUS DP SUGGESTED CABLE ROUTING

3. Using a PROFIBUS cable stripping tool, strip the cable ends as shown in "Cable Stripping Dimensions" in Figure 3. Those experienced with working with cables can opt to use a knife or wire cutter to remove the insulation.
4. Remove the terminal board ground wire. Loosen the lock screw just enough to clear the hole in the controller board, then pull the terminal board out from the rails on the PROFIBUS DP controller board.
5. Remove the cable clamp from the terminal board (remove 2 ea. Phillips screws and split lockwasher). Connect the PROFIBUS DP wires to the appropriate TB1 terminals. Connect the "IN" cable green and red leads to the TB1 terminals marked 1A and 1B respectively. Connect the "OUT" cable green and red leads to the TB1 terminals marked 2A and 2B respectively.
6. Reinstall the cable clamp. Place the cable's shield braid underneath the clamp before tightening.
7. The terminal board has two jumper fields, JH1 and JH2, each with a .100" jumper shunt (with easy-grip pull tab), for configuring bus termination. If the flow meter is to be at the end of a bus segment, **enable** termination by moving the JH1/JH2 jumper shunts to the J3 and J4 positions. If the flow meter is not at the end of a bus segment, **disable** termination by moving the JH1/JH2 jumper shunts to the J1 and J2 positions.

8. Back off the terminal board lock screw so that screw tip is flush with the standoff underneath.
9. Slide the terminal board into the controller board rails. Push the board all the way in until the board's pin socket connector fully engages the controller board's pin header. Observe that the outside edge of the terminal board is flush with the outside edge of the controller board when the terminal board is fully inserted.
10. Lock the terminal board in place by tightening its lock screw. The lock screw, when fully extended, engages the hole in the controller board, thus locking the terminal board in place.

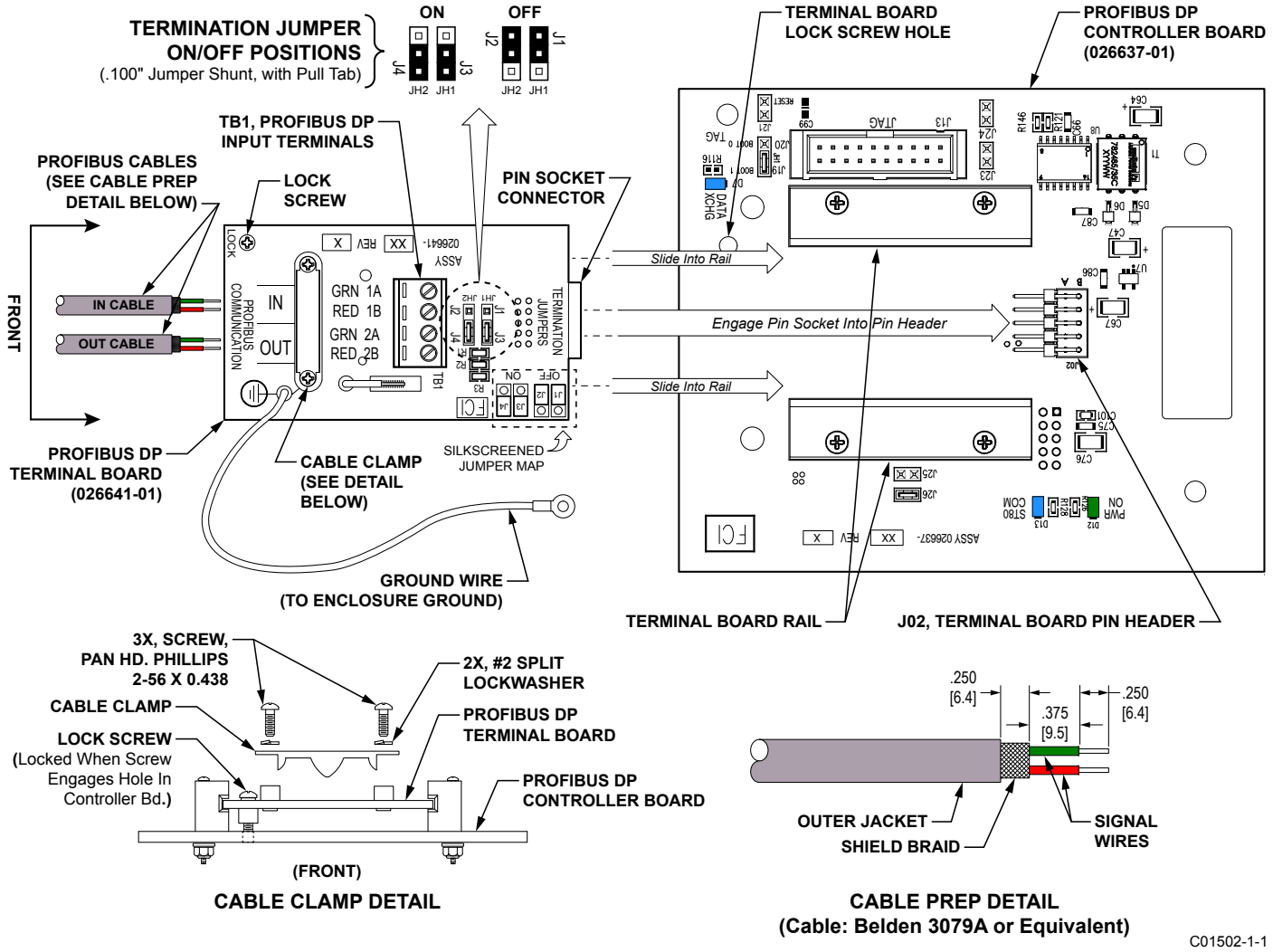

Figure 3 – ST80/ST80L PROFIBUS DP Wiring and Jumper Configuration

Topology and Network Configuration

The PROFIBUS DP uses a chain topology in which field devices are connected to the trunk/network segment via an in/out cabling arrangement. The network segment is terminated at each end with a switchable/jumper-selectable terminating resistor, which is typically integrated into the connector or the device itself. Additional segments can be added via repeaters. Note the following when wiring a PROFIBUS DP network.

- The maximum number of slaves per segment is **32**
- The maximum total number of slaves is **126**

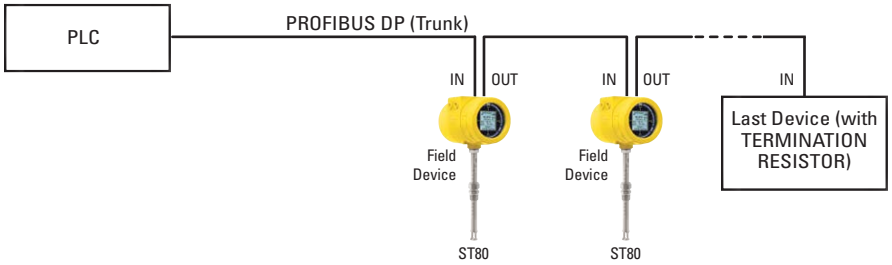

Figure 4 – Example PROFIBUS DP System

The network segment's maximum length depends on the configured speed as summarized in Table 1 below.

Table 1 – Communication Rate vs. Maximum Segment Length

Transmission Rate in kbit/sec	9.6	19.2	93.75	187.5	500	1500	12000
Max. Segment Length	1200 m	1200 m	1200 m	1000 m	400 m	200 m	100 m

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3. OPERATION

Configuration

Note: If the ST80/ST80L was ordered from the factory as a PROFIBUS DP device, the factory will have configured the instrument accordingly with no further instrument configuration required.

Configure the flow meter for PROFIBUS DP operation using the supplied ST80/ST80L Configuration software (normally done at the factory).

ST80/ST80L Configuration Software Setup

Use the ST80/ST80L Configuration software to verify that the flow meter is set up for PROFIBUS DP operation. Refer to the ST80/ST80L Configuration Software manual **06EN003491** for details on the use of the application. As shown in Figure 5 below, select the **Output** tab of the menu tree's **Configuration** branch and check that **Profibus DP** is shown in the *Digital Output Selection* field. Select **Profibus DP** from the *Digital Bus* pull down list as required.

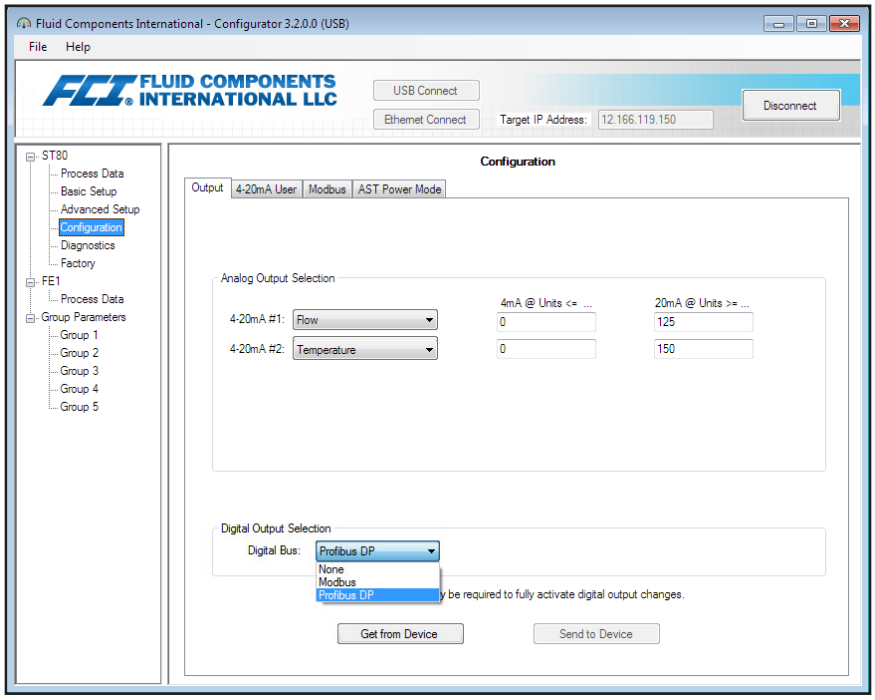


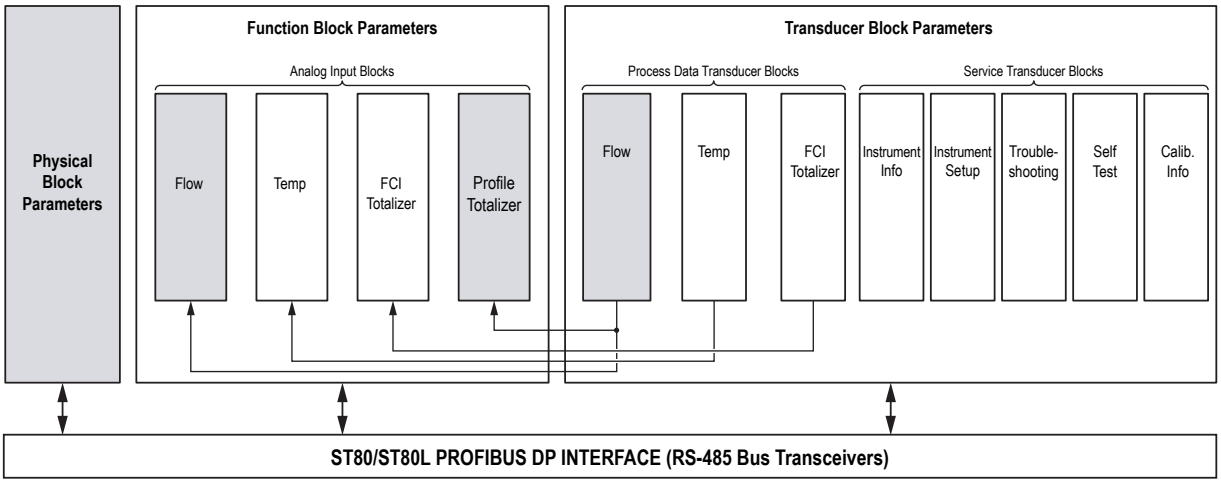
Figure 5 – ST80/ST80L Configuration Software Output Tab with Profibus DP Selected (Configuration)

PROFIBUS DP Profile 3 Operation

PROFIBUS profiles are used to set up a PROFIBUS device for use in a particular application. The v3.02 PROFIBUS specification defines a set of rules under which various devices communicate over the PROFIBUS network. Profile parameters are grouped into three major data block categories: Physical Block, Transducer Block, and Function Block. Combinations of these blocks and sub-blocks provide for two PROFIBUS configuration modes:

- **Profile-specific** – Nine kinds of Profile-specific configurations are defined which allow for interchangeability among different manufacturers of like devices. If a particular device uses a profile-specific configuration, it can be easily replaced with a similar device from another manufacturer via the replacement device's profile-specific configuration. For the ST80/ST80L the relevant Profile-specific configuration is for a "Mass Flow Meter with Totalizer" with Ident_Number 0x9740. Use the GSD file PA039740.GSD to operate the ST80/ST80L in the profile-specific configuration. For a profile-specific application, the available module blocks are the Physical block, Flow analog input function block, Profile Totalizer analog input block, and the Flow process data transducer block.
- **Manufacturer-specific** – The various parameter extensions found within these blocks form the basis of the manufacturer-specific PROFIBUS configuration, which allows use of all the flow meter's features over the PROFIBUS. Use the GSD file 0080111A.GSD to operate the ST80/ST80L in the manufacturer-specific configuration. For a manufacturer-specific application, all module blocks are available.

The ST80/ST80L PROFIBUS functional blocks are shown in Figure 6 below.



Notes: Shaded blocks = Blocks for **Profile-specific configuration** *Mass Flow Meter with Totalizer* (PA039740.GSD)
All blocks are available for **Manufacturer-specific configuration** (0080111A.GSD)

C01505-1-1

Figure 6 – ST80/ST80L PROFIBUS Profile Functional Blocks

Cyclic Data Description

The ST80 Series is a PROFIBUS slave that transmits cyclic data (INPUT) to a Class 1 master as prescribed in the PROFIBUS DPV0 protocol. For flow and totalizer the data type 101 floating point data structure is used. Shown below are the variables transmitted in the Profile-specific data output.

Flow – Data Type 101, 5 bytes input

Flow (Floating Point) 4 bytes	**Status** 1 byte

Totalizer – Data Type 101, 5 bytes input

Totalizer (Floating Point) 4 bytes	**Status** 1 byte

Acyclic Data Description

The ST80 Series supports acyclic data operation, which is typically done with a Class 2 master, as prescribed in the PROFIBUS DPV1 protocol. The Class 2 master accesses the slave device when it is granted time on the bus via a token that is passed on by the other bus master(s). Using a manufacturer-specific profile, the Class 2 master reads/configures the ST80/ST80L in-between the slices of time that the (other) Class 1 master is receiving cyclical data from slave devices over the PROFIBUS.

LED Status Indicators

LEDs are provided on the PROFIBUS DP board to show power and PROFIBUS data exchange/communication status. These Status LEDs, however, are visible only when the instrument's blind lid is removed. Refer to "Hardware Troubleshooting" on page 46 for details on the LED indicators.

Commissioning

Set the parameters and configure the ST80/ST80L through either:

- The Class 2 master and a bus interface configuration tool (e.g., Thorsis isPlorer, Siemens TIA Portal).
- FDT (Field Device Tool) software that works in concert with the supplied ST80/ST80L DTM file to set up, communicate, and adjust the settings of the ST80/ST80L via a graphical user interface. PACTware™ is one example of FDT software.

Load the appropriate ST80/ST80L GSD file into the process control system and save it in the desired sub-directory:

- Manufacturer-specific GSD file – 0080111A.GSD
- Profile-specific GSD file – PA039740.GSD

A Class 2 master typically is used to configure/setup a slave on the network. A Class 1 master can also perform setup functions, but it requires that the network be stopped (offline) for the Class 1 master to make changes to a slave.

Setting the Slave Address

The PROFIBUS DP-equipped ST80/ST80L is set to a slave address of 126 by default. Using a bus interface configuration tool such as Thorsis' isPlorer Fieldbus Browser or Siemens' TIA Portal, set the slave address to some value <126 as appropriate for your installation (i.e., use a non-conflicting address). In the example screen below, Thorsis' isPlorer is used to set the slave address to "80." Follow the instructions for your bus configuration tool of choice to set the flow meter's PROFIBUS DP slave address.

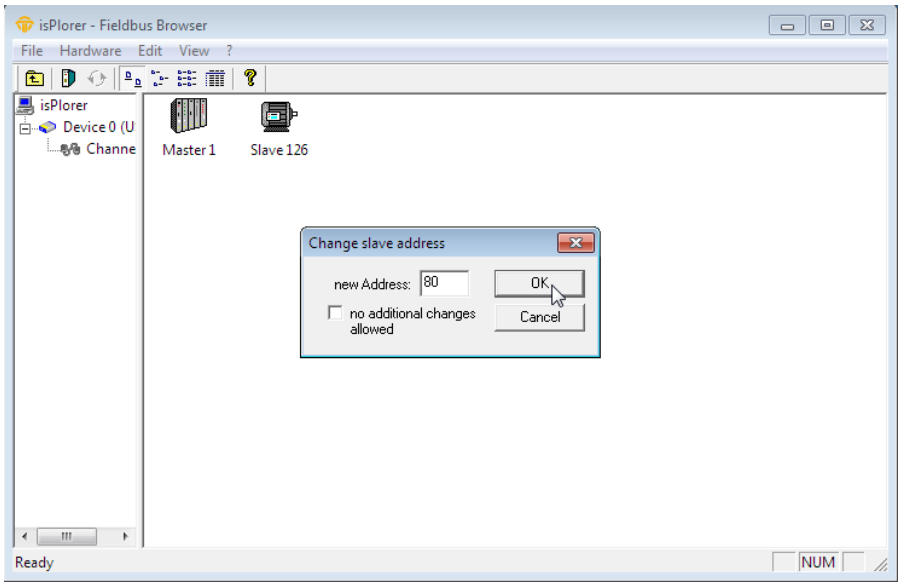


Figure 7 – Setting Slave Address Using Thorsis isPlorer

Parameterization

The parameterization process lets the user choose the variables that are transmitted in the cyclic telegram as well as the order in which they are transmitted.

The exact set of variables for parameterization depends on the selected PROFIBUS configuration.

For Profile-specific (factory default configuration):

- Flow (mass flow)
- Profile Totalizer

For Manufacturer-specific:

- Flow (mass flow, velocity flow, volumetric flow)
- Profile Totalizer
- Temperature
- FCI Totalizer

Shown below is an example slave configuration screen that is used to set up the input/output modules for the Profile-specific configuration.

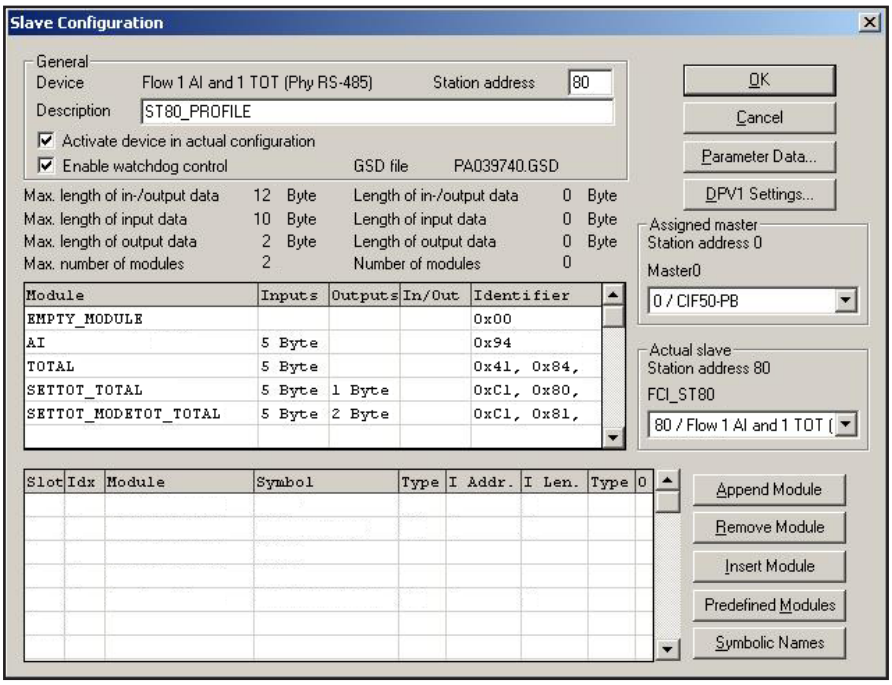


Figure 8 – Example PROFIBUS Slave Configuration Screen, Modules Not Assigned (Profile-Specific)

The available modules are shown in the middle portion of the slave configuration window. Click on a module in the middle portion to select it. Then place that module in the bottom portion of the window by clicking the appropriate button:

Append Module – Places the selected module at the bottom of the list.

Insert Module – Places the selected module at the top of the list.

Remove Module – Removes the selected module (at bottom portion of window) from the list.

Figure 9 below is an example slave configuration screen showing the module assignment.

Note: The module sequence is currently fixed with no option to reorder. Set the Profile-specific modules in the order shown in Figure 9.

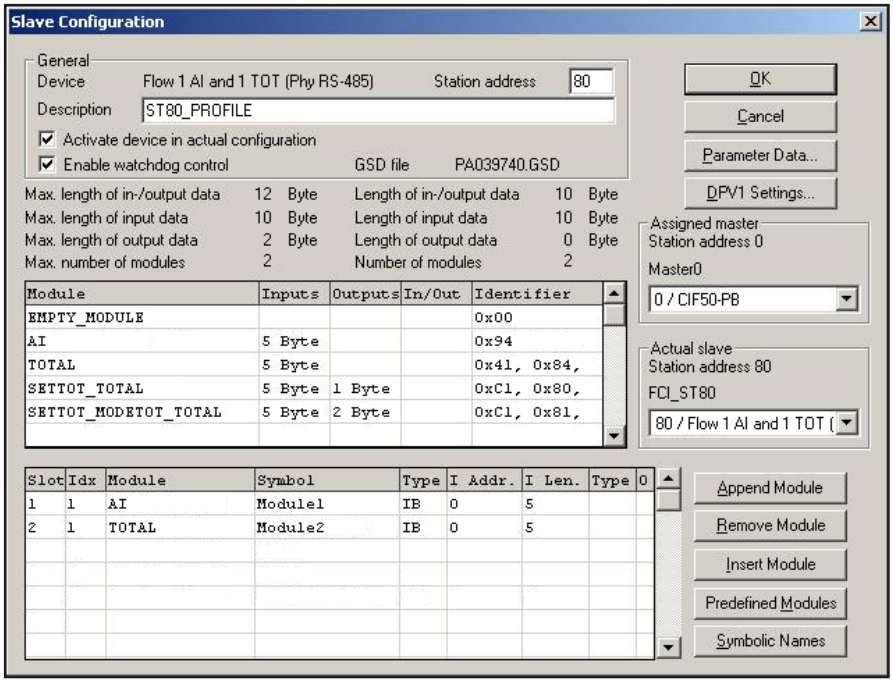


Figure 9 – Example PROFIBUS Slave Configuration Screen, Modules Assigned (Profile-Specific)

The figures below show example slave configuration screens for the Manufacturer-specific profile.

Note: The module sequence is currently fixed with no option to reorder. Set the Manufacturer-specific modules in the order shown in Figure 11.

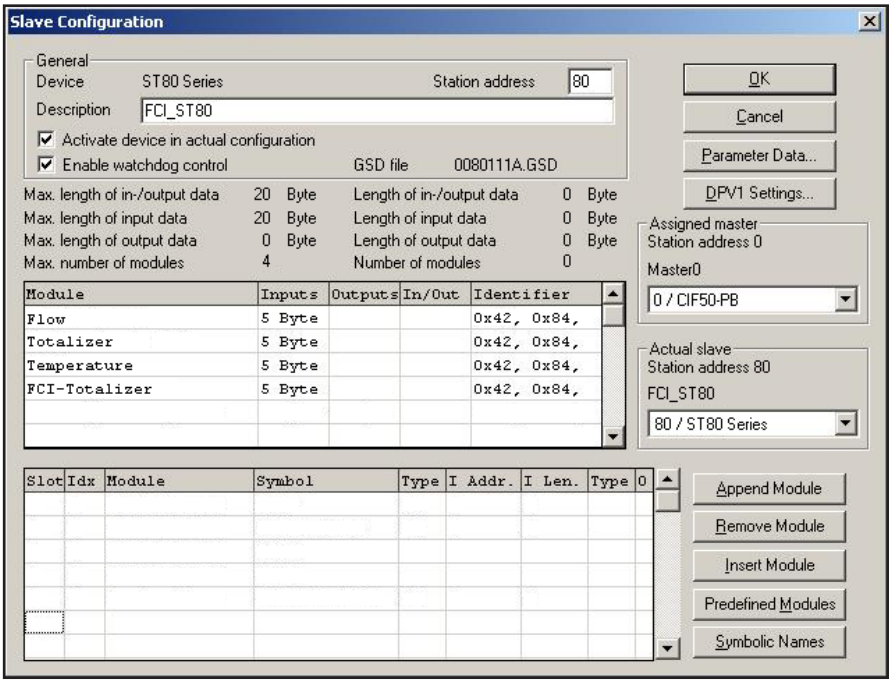


Figure 10 – Example PROFIBUS Slave Configuration Screen, Modules Not Assigned (Manufacturer-Specific)

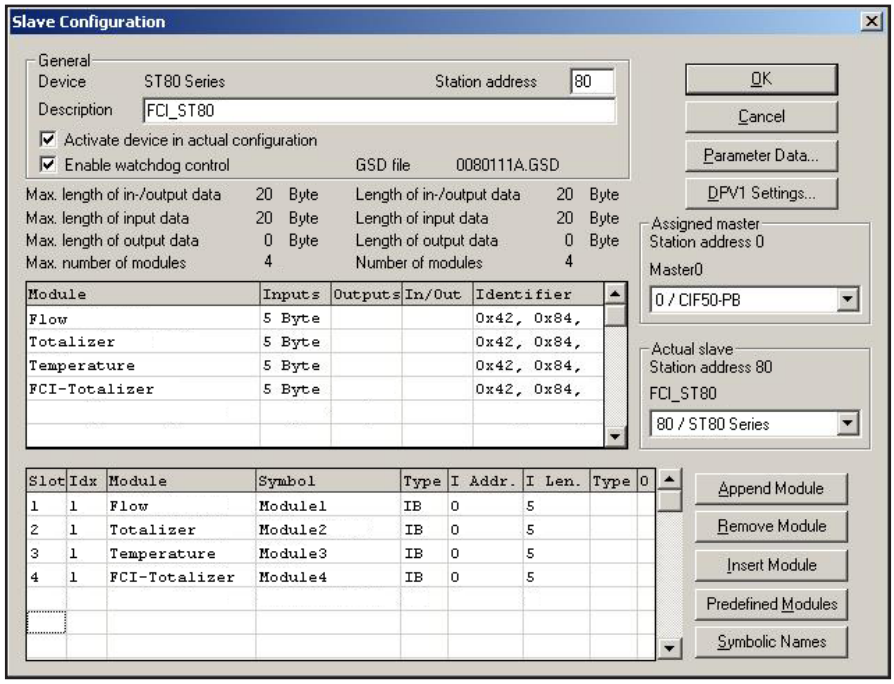


Figure 11 – Example PROFIBUS Slave Configuration Screen, Modules Assigned (Manufacturer-Specific)

Bus Configuration

Before connecting the master/PROFIBUS interface to the network, it is important for the bus to be properly configured to ensure reliable communication between master and slave(s). The ideal bus timings to use depend on the transmission (baud) rate used, the number of network nodes, and the requirements of the node device(s). There are tools (software) and formulas available that can be used to determine the required bus parameters. As a starting point use the bus parameters shown in the example screen below pending evaluation of the system by an experienced PROFIBUS network engineer/technician.

The PROFIBUS bus timing parameters are summarized below.

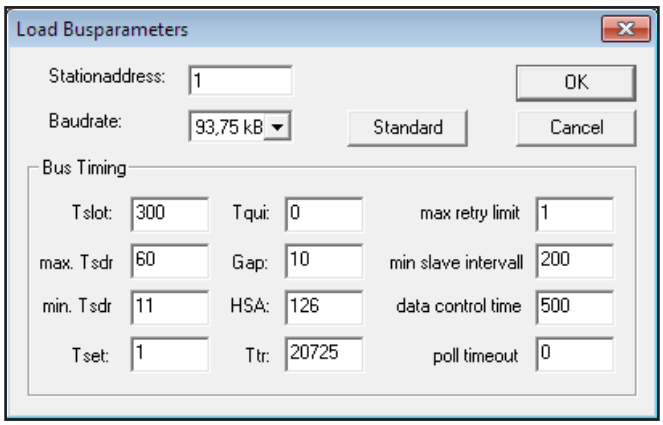


Figure 12 – Example Bus Parameters Configuration Screens

T_{syn} = The synchronization time is the time during which each station must receive at least one idle state before it can accept the start of a request (specified as 33 Tbit).

T_{id1} = After receipt of the last character of a telegram, the initiator must wait this amount of time until it can send the next telegram. This time must be at least the time Tsyn plus a safety factor (especially important when high transmission rates are used).

Tsdr = The time that a slave requires to respond. Minimum and maximum times are specified in the PROFIBUS specification.

min. Tsdr = The minimum time a slave must wait before it can respond.

max.Tsdr = The maximum time after which a slave must respond.

poll timeout = Applicable only to DPV1 Class 2 master-to-master communication, the maximum time the requester may take to fetch the response.

The table below summarizes the precise times in T_{Bit} (bit time = 1/transfer rate).

Table 2 – Transmission Rate vs. Minimum & Maximum Tsdr

Transmission Rate in kbit/sec	9.6	19.2	93.75	187.5	500	1500	12000
min. Tsdr in T_{Bit}	11	11	11	11	11	11	11
max. Tsdr in T_{Bit}	60	60	60	60	100	150	800

Totalizer Setup, Configuration, and Operation

The ST80/ST80L PROFIBUS DP offers two ways of getting the totalized value of the flow for Volumetric and Mass flow.

- Profile Totalizer – Externally calculated totalizer for use with Profile-specific PROFIBUS configuration only.
- FCI Totalizer – Internal/built-in totalizer for use with Manufacturer-specific PROFIBUS configuration only.

Note: The normal factory default PROFIBUS DP configuration is Profile-specific (Mass Flow Meter with Totalizer). However, the ST80/ST80L is delivered in the Manufacturer-specific PROFIBUS configuration if specified by the customer order.

As shipped from the factory, the totalizer is stopped from counting. See below for totalizer setup details.

Only one of these totalizers is to be active in the system. If one type totalizer is used, make sure the other one is off or deactivated.

Turning ON/OFF the FCI Totalizer – Using the PC-based configuration software, select the **Basic Setup** branch on the menu tree on the window's left side. Select the **Totalizer** tab.

- Turn ON/Enable – Tick the *Totalizer Enabled* checkbox. If not already ticked, tick the *Show Totalizer Value* checkbox.
- Turn OFF/Disable – Untick the *Totalizer Enabled* checkbox.

Turning ON/OFF the Profile Totalizer – Use a Fieldbus browser such as Thorsis' isPlorer or the supplied DTM to modify the Profile Totalizer AI block's SET_TOT parameter (Slot 4, Index 29) as follows:

- Turn ON/Enable – Write 0x00 to the SET_TOT parameter (Slot 4, Index 29). With the DTM, select the Profile Totalizer AI Block and select TOTALIZE from the *Set Totalizer* field's pulldown menu.

Note: Turning the Profile Totalizer ON starts the totalizer count.

- Turn OFF/Disable – Write 0x01 to the SET_TOT parameter (SIot 4, Index 29). With the DTM, select the Profile Totalizer AI Block and select RESET from the *Set Totalizer* field's pulldown menu.

Profile Totalizer, Quick Start

The Profile Totalizer is controlled via the Profile Totalizer AI block. Refer to "Profile Totalizer Analog Input Block" on page 26 for details. See also "DTM Introduction, Installation, and Operation" on page 27 and "Figure 20 – Example Profile Totalizer Analog Input Function Block FDT/DTM Screen" on page 35.

1. Set totalizer units via the UNIT_TOT parameter (Slot 4, Index 27). Enter the PROFIBUS code for the desired units as listed in "Table 23 – ST80/ST80L PROFIBUS Engineering Unit Codes" on page 47. With the DTM, select the Profile Totalizer AI block and select the appropriate units from the *Unit Total* field's pulldown menu. Click **Apply** when done (PACTware FDT). Note that the selected units must correspond to the flow specified in the Flow transducer block.
2. Set the totalizer to POS_ONLY totalization by writing 0x01 to the MODE_TOT parameter (Slot 4, Index 30). With the DTM, select the Profile Totalizer AI block and select POS_ONLY from the *Mode Totalizer* field's pulldown menu.

3. Choose the totalizer fail-safe mode by writing the appropriate value to the FAIL_TOT parameter (Slot 4, Index 31):
   - Value 0x00: RUN – Continue totalizing even if the input channel has a BAD status.
   - Value 0x01: HOLD – Totalizing stops on occurrence of BAD status.
   - Value 0x02: MEMORY – Continue totalizing using the last GOOD value before the BAD status occurrence.

   With the DTM, select the Profile Totalizer AI block and select the desired fail-safe mode from the *Fail Totalizer* field's pulldown menu. Click **Apply** when done (PACTware FDT).
4. If required, set the totalizer preset value by writing the preset value to the PRESET_TOT parameter (Slot 4, Index 32). With the DTM, select the Profile Totalizer AI block and enter the desired preset value in the *Preset Totalizer* data entry box. The PRESET_TOT parameter specifies the value from which the totalizer starts when in the PRESET mode.
5. Set the totalizer operating mode by writing the appropriate value to the SET_TOT parameter (Slot 4, Index 29):
   - Value 0x00: TOTALIZE – Starts the totalizer.
   - Value 0x01: RESET – Stops the totalizer and sets it to zero. (Also turns OFF the Profile totalizer.)
   - Value 0x02: PRESET – Totalizer starts from the customer-entered value in the PRESET_TOT parameter.

   With the DTM, select the Profile Totalizer AI block and select the desired operating mode from the *Set Totalizer* field's pulldown menu. Click **Apply** when done (PACTware FDT).

FCI Totalizer, Quick Start

Use the FCI Totalizer AI block to configure the internal totalizer. Use the FCI Totalizer transducer block for basic control (e.g., turn the totalizer ON/OFF). Refer to "FCI Totalizer Transducer Block Parameters (Manufacturer-Specific)" on page 18, and "FCI Totalizer Transducer Block Configuration" on page 26. See also "DTM Introduction, Installation, and Operation" on page 27, plus "Figure 21 – Example FCI Totalizer Analog Input Function Block FDT/DTM Screen" on page 36 and "Figure 17 – Example FCI Totalizer Transducer Block FDT/DTM Screen" on page 34.

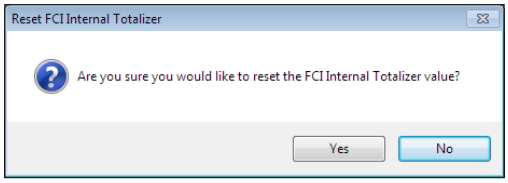
1. Set instrument write protection to UNPROTECTED by writing 0x01 to the WRITE_PROTECT_MODE parameter (Slot 10, Index 28) in the Instrument Information service transducer block.

   With the DTM, select the Instrument Information service transducer block. Verify that the window's *Write Protect Mode* field shows "Protected." Click **Toggle Write Protect Mode**. Observe that the *Write Protect Mode* field shows "Un-Protected."

   Note: Make sure that write protection is OFF ("Un-Protected") to allow any changes to the FCI totalizer via PROFIBUS. When done, turn write protection back ON ("Protected" or write 0x00 to WRITE_PROTECT_MODE parameter).
2. Verify the FCI totalizer units by reading the TOTALIZER_UNITS_CODE parameter (Slot 9, Index 27) in the FCI Totalizer transducer block. If needed, use the Flow transducer block to change the totalizer units via the VOLUME_FLOW_UNITS or MASS_FLOW_UNITS parameters. Enter the PROFIBUS code for the desired units as listed in "Table 23 – ST80/ST80L PROFIBUS Engineering Unit Codes" on page 47.

   With the DTM, select the FCI Totalizer Transducer Block and check the units shown in the *Totalizer Unit* field's box. Change the units as needed by selecting the Flow Transducer Block and using the *Flow Units* pull-down menu.
3. **FCI Totalizer Start/Stop**: Write the appropriate value to the FCI Totalizer transducer block TOTALIZER_STATE parameter (Slot 9, Index 24):
   - Value 0x01: START – Starts the FCI totalizer. If previously stopped, the totalizer value resumes from the last stopped count.
   - Value 0x00: STOP – Stops the FCI totalizer. The totalizer count is saved the moment the totalizer is stopped.

   With the DTM, select the FCI Totalizer transducer block and select the desired action from the *Totalizer State* pulldown menu: **Totalizer Off** or **Totalizer On**. Click **Apply** when done.
4. **FCI Totalizer Reset**: Reset the FCI totalizer to zero by writing any value (0x*nn*) to the FCI Totalizer transducer block TOTALIZER_RESET parameter (Slot 9, Index 26). With the DTM, select the FCI Totalizer transducer block and click the the **Totalizer Reset** button. Observe that a dialog similar to the below (PACTware FDT) is shown.



   Click **Yes** to reset the FCI totalizer count to zero.

System Blocks Description

A PROFIBUS profile is made up of 3 major functional blocks:

- Physical Block
- Transducer Block
- Function Block

The ST80/ST80L parameters that make up each of these blocks are summarized below. Use the FDT/DTM software to easily view/change any of the PROFIBUS block parameter values using the application's graphical interface. See "DTM Introduction, Installation, and Operation" on page 27.

Physical Block Parameters (Profile-Specific and Manufacturer-Specific)

This block contains hardware-specific flow meter/field device information and basic diagnosis information as well as provide for some device controls.

Table 3 – Physical Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	SOFTWARE_VERSION	0	24	VISIBLE STRING	24	R
9	HARDWARE_REVISION	0	25	VISIBLE STRING	16	R
10	DEVICE_MAN_ID	0	26	UNSIGNED 16	2	R
11	DEVICE_ID	0	27	VISIBLE STRING	16	R
12	DEVICE_SER_NUM	0	28	VISIBLE STRING	16	R
13	DIAGNOSIS	0	29	OCTETSTRING	4	R
14	DIAGNOSIS_EXTENSION[1]	0	30	OCTETSTRING	6	R
15	DIAGNOSIS_MASK	0	31	OCTETSTRING	4	R
16	DIAGNOSIS_MASK_ EXTENSION[1]	0	32	OCTETSTRING	6	R
17	DEVICE_CERTIFICATION	0	33	VISIBLE STRING	32	R
18	WRITE_LOCKING	0	34	UNSIGNED 16	2	RW
19	FACTORY_RESET	0	35	UNSIGNED 16	2	RW
20	DESCRIPTOR	0	36	OCTETSTRING	32	RW
21	DEVICE_MESSAGE	0	37	OCTETSTRING	32	RW
22	DEVICE_INSTAL_DATE	0	38	OCTETSTRING	16	RW
23	NOT USED	0	39	UNSIGNED 8	1	—
24	IDENT_NUMBER_SELECTOR	0	40	UNSIGNED 8	1	RW
25	HW_WRITE_PROTECTION	0	41	UNSIGNED 8	1	R
26	FEATURE	0	42	DS-68	8	R
27	COND_STATUS_DIAG	0	43	UNSIGNED 8	1	RW
28	DIAG_EVENT_SWITCH (N/A)	0	44	DIAG_EVENT_SWITCH		RW

Notes: 1. Parameter not implemented in ST80/ST80L.

Transducer Blocks Description

The ST80/ST80L Transducer blocks are of two types.

- **Process Data Transducer Blocks** – Each process variable that the ST80/ST80L can measure: flow, temperature, and FCI totalizer, is represented by a process data transducer block.
- **Service Transducer Blocks** – These five blocks provide instrument information/status for service functions which include diagnostics, troubleshooting, and calibration.

Flow Transducer Block Parameters (Profile-Specific and Manufacturer-Specific)

There are three possible flow types, mass flow, velocity flow, and volumetric flow, of which only one can be active at a time. The active flow type is the only one that has valid data in that structure of the block. This block provides the input to the Profile Totalizer AI block as well as the Flow Transducer AI block, which makes up the *Mass Flow Meter with Totalizer* profile-specific configuration.

Table 4 – Flow Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	CALIBR_FACTOR[1]	6	24	FLOAT	4	RW
9	LOW_FLOW_CUTOFF[1]	6	25	FLOAT	4	RW
10	MEASUREMENT_MODE[1]	6	26	UNSIGNED 8	1	RW
11	FLOW_DIRECTION[1]	6	27	UNSIGNED 8	1	RW
12-14	NOT USED	6	28-30	—	—	—
15	NOMINAL_SIZE[2]	6	31	FLOAT	4	RW
16	NOMINAL_SIZE_UNITS[2]	6	32	UNSIGNED 16	2	RW
17	VOLUME_FLOW	6	33	101 (DS-33)	5	R
18	VOLUME_FLOW_UNITS	6	34	UNSIGNED 16	2	RW
19	VOLUME_FLOW_LO_LIMIT	6	35	FLOAT	4	R
20	VOLUME_FLOW_HI_LIMIT	6	36	FLOAT	4	R
21	MASS_FLOW	6	37	101 (DS-33)	5	R
22	MASS_FLOW_UNITS	6	38	UNSIGNED 16	2	RW
23	MASS_FLOW_LO_LIMIT	6	39	FLOAT	4	R
24	MASS_FLOW_HI_LIMIT	6	40	FLOAT	4	R
25-42	NOT USED	6	41-58	—	—	—
43-52	RESERVED BY PI	6	59-68	—	—	—
53	VELOCITY_FLOW	6	69	101 (DS-33)	5	R
54	VELOCITY_UNITS	6	70	UNSIGNED 16	2	RW
55	VELOCITY_LO_LIMIT	6	71	FLOAT	4	RW
56	VELOCITY_HI_LIMIT	6	72	FLOAT	4	RW
57	DEVICE_VARIABLE_CODE[3]	6	73	UNSIGNED 8	1	R

Notes: 1. The following parameters are in the block for compatibility with the flow profile but perform no real function since the method of measurement used by the ST80/ST80L does not use them: CALIBR_FACTOR, LOW_FLOW_CUTOFF, MEASUREMENT_MODE, and FLOW_DIRECTION.

2. The NOMINAL_SIZE and the NOMINAL_SIZE_UNITS parameters are used for Volume flow and Mass flow. These parameters are associated with the pipe dimensions and units. NOMINAL_SIZE is the diameter of the pipe.

3. DEVICE_VARIABLE_CODE: 0 = Volumetric flow, 1 = *Not Used*, 2 = Mass flow, 3 = Mass (Totalizer), 4 = Velocity flow, and 5 = *Not Used*.

Temperature Transducer Block Parameters (Manufacturer-Specific)

The ST80/ST80L uses RTDs to measure flow, with the reference RTD also measuring process temperature. This block provides the measured temperature.

Table 5 – Temperature Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	PRIMARY_VALUE[1]	7	24	DS-33 (101)	5	R
9	PRIMARY_VALUE_UNIT	7	25	UNSIGNED 16	2	RW
10	SECONDARY_VALUE_1[1]	7	26	DS-33 (101)	5	R
11	NOT USED	7	27	—	—	—
12	SENSOR_MEAS_TYPE	7	28	UNSIGNED 8	1	RW
13	INPUT_RANGE	7	29	UNSIGNED 8	1	RW
14	LIN_TYPE	7	30	UNSIGNED 8	1	RW
15 - 18	NOT USED	7	31 - 34	—	—	
19	BIAS_1	7	35	FLOAT	4	RW
20	NOT USED	7	36	—	—	—
21	UPPER_SENSOR_LIMIT[2]	7	37	FLOAT	4	R
22	LOWER_SENSOR_ LIMIT[2]	7	38	FLOAT	4	R
23	NOT USED	7	39	—	—	—
24	INPUT_FAULT_GEN (N/A)[3]	7	40	UNSIGNED 8	1	R
25	INPUT_FAULT_1 (N/A)	7	41	UNSIGNED 8	1	R
26 - 32	NOT USED	7	42 - 48	—	—	—
33 - 35	Reserved by PI	7	49 - 51	—	—	—
36	SENSOR_CONNECTION (N/A)[3]	7	52	UNSIGNED 8	1	RW
37	COMP_WIRE1 (N/A)[3]	7	53	FLOAT	4	RW

Notes: 1. Primary and Secondary values are the same.

2. These parameter values are from the ST80/ST80L CALMax and CALMin.

3. These parameters are not applicable to the ST80/ST80L.

FCI Totalizer Transducer Block Parameters (Manufacturer-Specific)

The FCI Totalizer Transducer block is part of the ST80/ST80L's built-in totalizer function. The built-in totalizer is intended for a manufacturer-specific configuration as opposed to the profile-specific *Profile Totalizer* AI block. FCI recommends the use of the built-in totalizer function due to its faster update capability (i.e., no software calculation required). This block provides the input to the FCI Totalizer Analog Input block.

Table 6 – FCI Totalizer Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	TOTALIZER_STATE	9	24	UNSIGNED 8	1	RW
9	TOTALIZER_VALUE	9	25	FLOAT	4	R
10	TOTALIZER_RESET	9	26	UNSIGNED 8	1	W
11	TOTALIZER_UNITS_CODE	9	27	UNSIGNED 8	1	R

Instrument Information Service Transducer Block Parameters (Manufacturer-Specific)

The Instrument Information Service Transducer Block provides access to the ST80/ST80L configuration and setup parameters so that some configuration can be done from the control room through PROFIBUS. Use this block to adjust the pipe size dimensions, restore factory settings, change flow type (Volumetric, Mass Flow, and Velocity), set write protect, read various instrument status, and save the current calibration group.

Table 7 – Instrument Information Service Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	FLOW_TYPE	10	24	UNSIGNED 8	1	RW
10	PLENUM_SIZE_VALUE1	10	26	FLOAT	4	RW
11	PLENUM_SIZE_VALUE2	10	27	FLOAT	4	RW
17	PLENUM_UNITS	10	33	UNSIGNED 8	1	RW
12	WRITE_PROTECT_MODE	10	28	UNSIGNED 8	1	RW
13	FACTORY_RESTORE	10	29	UNSIGNED 8	1	W
14	DEVICE_CO	10	30	STRING 10	10	R
15	DEVICE_SERIAL_NUM	10	31	STRING 10	10	R
16	DEVICE_SOFTWARE_VERSION	10	32	STRING 4	4	R
18	SYSTEM_MODE_STATUS	10	34	UNSIGNED 8	1	RW
19	OPERATING_MODE_STATUS	10	35	UNSIGNED 8	1	RW
20	INSTRUMENT_REVISION (N/A)	10	36	STRING 4	4	R
21	INSTRUMENT_HARDWARE_REVISION	10	37	UNSIGNED 8	1	R
22	CORE_SOFTWARE_VERSION	10	38	UNSIGNED 8	1	R
23	INTERFACE_BOARD_TYPE (N/A)	10	39	UNSIGNED 8	1	R
24	HMI_SOFTWARE_VERSION (N/A)	10	40	STRING 6	6	R
25	SD_CARD_STATUS (N/A)	10	41	UNSIGNED 8	1	R
26	SAVE_CURRENT_GROUP	10	42	UNSIGNED 8	1	RW

Instrument Setup Service Transducer Block Parameters (Manufacturer-Specific)

The Instrument Setup Service Transducer Block is a manufacturer-specific block that allows certain ST80/ST80L setup parameters for the currently active calibration group (1-5) to be read/adjusted. Identify the active calibration group via the ACTIVE_CAL_GROUP_NAME parameter.

Note: Before accessing this block, write any value to the READBLOCK parameter to force a refresh of block data.

Table 8 – Instrument Setup Service Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	K_FACTOR_1	13	24	FLOAT		RW
9	K_FACTOR_2	13	25	FLOAT		RW
10	K_FACTOR_3	13	26	FLOAT		RW
11	K_FACTOR_4	13	27	FLOAT		RW
12	DATE_TIME	13	28	STRING 8	8	RW
13	CMINFLOW(LRV)	13	29	FLOAT		RW
14	CMAXFLOW(URV)	13	30	FLOAT		RW
15	TEMPERATURE_UNITS	13	31	UNSIGNED 8	1	RW
16	CUSTOMER_TEMPERATURE_MIN	13	32	FLOAT		RW
17	CUSTOMER_TEMPERATURE_MAX	13	33	FLOAT		RW
18	CMIN_PRES (N/A)	13	34	FLOAT		RW
19	CMAX_PRES (N/A)	13	35	FLOAT		RW
22	PRESSURE_CONVERSION_CONSTANT	13	38	FLOAT		RW
23	PROCESS_DATA	13	39	PARAM_ENTRY_5	5	RW
24	ACTIVE_CAL_GROUP_NAME	13	40	STRING 20	20	RW
25	READBLOCK	13	41	UNSIGNED 8	1	W

Troubleshooting Service Transducer Block Parameters (Manufacturer-Specific)

The Troubleshooting Service Transducer Block is a manufacturer-specific block that provides ST80/ST80L parameters for troubleshooting purposes. Reset functions are also included in this block.

Note: Before accessing this block, write any value to the READBLOCK parameter to force a refresh of block data.

Table 9 – Troubleshooting Service Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	INDIVIDUAL_FE_SELECTION	15	24	PARAM_ENTRY 16		RW
9	FE PHYSICAL SLOT SELECTION (N/A)	15	25	PARAM_ENTRY 16	2	RW
10	HMI_CONTROL	15	26	UNSIGNED 8	1	RW
11	CONFIG_CHANGE_STATUS	15	27	UNSIGNED 16	2	RW
12	CONFIG_INFORMATION	15	28	UNSIGNED 16	2	R
14	CONFIGURATION_STATUS	15	30	STRING 6	6	R
15	DENSITY	15	31	FLOAT	4	RW
16	EXTENDED_CORE_DIAGNOSTIC_STATUS	15	32	UNSIGNED 32	4	R
17	FE_PROCESS_DATA (0-2)[1]	15	33	PARAM_ENTRY_2[2]	16	R
18	CORE_ENG_UNITS(FLOW_TEMP_PRESS)	15	34	PARAM_ENTRY_3[3]	4	RW
19	SOFT_RESET	15	35	—		W
22	RESET_CALIBRATION_TO_FACTORY[4]	15	38	UNSIGNED 8	1	W
23	HEATER_1	15	39	UNSIGNED 8	1	RW
24	READBLOCK	15	40	UNSIGNED 8	1	W

Notes: 1. Raw FE1 Process Data

2. PARAM_ENTRY_2 (16 bytes): FLOW (Double, 8 bytes); Temperature (Float, 4 bytes)

3. PARAM_ENTRY_3 (4 bytes): Unit codes for Flow, Temperature, and Totalizer.

4. Specify Group No. (1-5) that you want to revert to factory values.

Self-Test Service Transducer Block Parameters

The Self-Test Service Transducer Block is a manufacturer-specific block that provides access to the ST80/ST80L Internal Delta-R Resistor (idR) Check feature.

Note: Before accessing this block, write any value to the READBLOCK parameter to force a refresh of block data.

Table 10 – Self-Test Service Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	START_END_IDR_TEST	16	24	6 FLOATS, UNSIGNED 3	9	RW
9	FE A/B SELF-CHECK_START_DELAY[1]	16	25	NOT SUPPORTED[1]		W
10	SCHED_DELTA_R_SELF_CHECK_FE1	16	26	UNSIGNED 32		W
—	SCHED_A/B_SELF_CHECK_0[1]	—	—	NOT SUPPORTED[1]		W
—	SCHED_A/B_SELF_CHECK_1[1]	—	—	NOT SUPPORTED[1]		W
12	SELF TEST EXP_LOW_IDR	16	28	FLOAT		R
13	SELF TEST EXP_MID_IDR	16	29	FLOAT		R
14	SELF TEST EXP_HIGH_IDR	16	30	FLOAT		R
14	READBLOCK	16	31	UNSIGNED 8	1	W

Note: 1. Unsupported ST80 Series parameter.

Calibration Information Service Transducer Block Parameters (Manufacturer-Specific)

The Calibration Information Service Transducer Block is a manufacturer-specific block that provides access to the ST80/ST80L calibration data.

Note: Before accessing this block, write any value to the READBLOCK parameter to force a refresh of block data.

Table 11 – Calibration Information Service Transducer Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
8	CAL_FLOW_MIN_SFPS	12	24	FLOAT	4	R
9	CAL_FLOW_MAX_SFPS	12	25	FLOAT	4	R
10	CAL_PRESSURE_MIN_PSIG	12	26	FLOAT	4	R
11	CAL_PRESSURE_MAX_PSIG	12	27	FLOAT	4	R
12	CAL_TEMPERATURE_MIN_F	12	28	FLOAT	4	R
13	CAL_TEMPERATURE_MAX_F	12	29	FLOAT	4	R
14	FLOW_MIN_IN_CUSTOMER_UNITS	12	30	FLOAT	4	R
15	FLOW_MAX_IN_CUSTOMER_UNITS	12	31	FLOAT	4	R
16	PIPE_DUCT_SIZE_ENG_UNITS	12	32	UNSIGNED 8	1	R
17	MIN_FLOW_ACTIVE_CAL_ENG_UNITS	12	33	UNSIGNED 8	1	R
18	MAX_FLOW_ACTIVE_CAL_ENG_UNITS	12	34	UNSIGNED 8	1	R
19	PRESSURE_CONVERSION_CONSTANT	12	35	UNSIGNED 8	1	R
20	CALIBRATION_GROUP_PARAMETERS	12	36	UNSIGNED 8	1	W
21	ACTIVE_CALIBRATION_NUMBER	12	37	UNSIGNED 8	1	R
22	dRMin	12	38	FLOAT	4	R
23	dRMax	12	39	FLOAT	4	R
24	Std_Density	12	40	FLOAT	4	R
25	REFR	12	41	FLOAT	4	R
26	TCSLP0	12	42	FLOAT	4	R
27	TCSLP2	12	43	FLOAT	4	R
28	READBLOCK	12	44	UNSIGNED 8	1	W

Function Blocks Description

For the ST80/ST80L, the following Analog Input (AI) blocks make up the PROFIBUS Function blocks (a fifth AI block, pressure, is not available to the ST80/ST80L).

- Flow Transducer Analog Input Block
- Temperature Transducer Analog Input Block
- FCI Totalizer Analog Input Block
- Profile Totalizer Analog Input Block

Flow Transducer Analog Input (AI) Function Block (Profile-Specific and Manufacturer-Specific)

The Flow AI block is the instrument's primary parameter. This block gets its input from the Flow Transducer block.

Table 12 – Flow Transducer Analog Input (AI) Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
10	OUT (FLOW)	1	26	DS-33 (101)	5	R
11	PV_SCALE	1	27	FLOAT	8	RW
12	OUT_SCALE	1	28	DS-36	11	RW
13	LIN_TYPE	1	29	UNSIGNED 8	1	RW
14	CHANNEL	1	30	UNSIGNED 16	2	RW
16	PV_FTIME	1	32	FLOAT	4	RW
17	FSAFE_TYPE	1	33	UNSIGNED 8	1	RW
18	FSAFE_VALUE	1	34	FLOAT	4	RW
19	ALARM_HYS	1	35	FLOAT	4	RW
21	HI_HI_LIM	1	37	FLOAT	4	RW
23	HI_LIM	1	39	FLOAT	4	RW
25	LO_LIM	1	41	FLOAT	4	RW
27	LO_LO_LIM	1	43	FLOAT	4	RW
30	HI_HI_ALM	1	46	DS-39	16	R
31	HI_ALM	1	47	DS-39	16	R
32	LO_ALM	1	48	DS-39	16	R
33	LO_LO_ALM	1	49	DS-39	16	R
34	SIMULATE	1	50	DS-50	6	RW
35	OUT_UNIT_TEXT	1	51	STRING 16	16	RW

Temperature Transducer Analog Input (AI) Function Block (Manufacturer-Specific)

The Temperature AI block is the instrument's secondary parameter. This block gets its input from the Temperature Transducer block.

Table 13 – Temperature Transducer Analog Input (AI) Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
10	OUT (TEMP)	3	26	DS-33 (101)	5	R
11	PV_SCALE	2	27	FLOAT	8	RW
12	OUT_SCALE	2	28	DS-36	11	RW
13	LIN_TYPE	2	29	UNSIGNED 8	1	RW
14	CHANNEL	2	30	UNSIGNED 16	2	RW
16	PV_FTIME	2	32	FLOAT	4	RW
17	FSAFE_TYPE	2	33	UNSIGNED 8	1	RW
18	FSAFE_VALUE	2	34	FLOAT	4	RW
19	ALARM_HYS	2	35	FLOAT	4	RW
21	HI_HI_LIM	2	37	FLOAT	4	RW
23	HI_LIM	2	39	FLOAT	4	RW
25	LO_LIM	2	41	FLOAT	4	RW
27	LO_LO_LIM	2	43	FLOAT	4	RW
30	HI_HI_ALM	2	46	DS-39	16	R
31	HI_ALM	2	47	DS-39	16	R
32	LO_ALM	2	48	DS-39	16	R
33	LO_LO_ALM	2	49	DS-39	16	R
34	SIMULATE	2	50	DS-50	6	RW
35	OUT_UNIT_TEXT	2	51	STRING 16	16	RW

FCI Totalizer Analog Input (AI) Function Block (Manufacturer-Specific)

The FCI Totalizer AI block provides the instrument's internal totalizer function, which is intended for use in a manufacturer-specific profile. This block gets its input from the FCI Totalizer Transducer block.

Table 14 – FCI Totalizer Analog Input (AI) Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
10	OUT (FCI INTERNAL TOTALIZER VALUE)	5	26	DS-33 (101)	5	R
11	PV_SCALE	5	27	FLOAT	8	RW
12	OUT_SCALE	5	28	DS-36	11	RW
13	LIN_TYPE	5	29	UNSIGNED 8	1	RW
14	CHANNEL	5	30	UNSIGNED 16	2	RW
16	PV_FTIME	5	32	FLOAT	4	RW
17	FSAFE_TYPE	5	33	UNSIGNED 8	1	RW
18	FSAFE_VALUE	5	34	FLOAT	4	RW
19	ALARM_HYS	5	35	FLOAT	4	RW
21	HI_HI_LIM	5	37	FLOAT	4	RW
23	HI_LIM	5	39	FLOAT	4	RW
25	LO_LIM	5	41	FLOAT	4	RW
27	LO_LO_LIM	5	43	FLOAT	4	RW
30	HI_HI_ALM	5	46	DS-39	16	R
31	HI_ALM	5	47	DS-39	16	R
32	LO_ALM	5	48	DS-39	16	R
33	LO_LO_ALM	5	49	DS-39	16	R
34	SIMULATE	5	50	DS-50	6	RW
35	OUT_UNIT_TEXT	5	51	STRING 16	16	RW

Profile Totalizer Analog Input (AI) Function Block (Profile-Specific)

The Profile Totalizer AI block provides the profile-specific totalizer function. This block gets its input from the Flow Transducer block, which forms the basis of the externally calculated (software) totalizer.

Table 15 – Profile Totalizer Analog Input (AI) Block Parameters

REL. INDEX	PARAMETER	SLOT	INDEX	DATA TYPE (LENGTH)	SIZE	READ/WRITE
10	TOTAL	4	26	DS-33 (101)	5	RW
11	UNIT_TOT	4	27	UNSIGNED 16	2	RW
12	CHANNEL	4	28	UNSIGNED 16	2	RW
13	SET_TOT	4	29	UNSIGNED 8	1	RW
14	MODE_TOT	4	30	UNSIGNED 8	1	RW
15	FAIL_TOT	4	31	UNSIGNED 8	1	RW
16	PRESET_TOT	4	32	FLOAT	4	RW
17	ALARM_HYS	4	33	FLOAT	4	RW
18	HI_HI_LIM	4	34	FLOAT	4	RW
19	HI_LIM	4	35	FLOAT	4	RW
20	LO_LIM	4	36	FLOAT	4	RW
21	LO_LO_LIM	4	37	FLOAT	4	RW
22	HI_HI_ALM	4	38	DS-39	16	R
23	HI_ALM	4	39	DS-39	16	R
24	LO_ALM	4	40	DS-39	16	R
25	LO_LO_ALM	4	41	DS-39	16	R

Configuring Process Parameters in the Transducer Block Modules

The *Flow* transducer block, the *Temperature* transducer block, and the *FCI Totalizer* transducer block have a number of configurable process-related parameters. These parameters include *pipe size* under the NOMINAL_SIZE parameter; three flow engineering unit types, and the ability to start and stop the ST80/ST80L internal FCI Totalizer. All of the parameters listed below are easily addressed using the FDT/DTM described in "DTM Introduction, Installation, and Operation" on page 27.

Flow Transducer Block Configuration

Pipe Settings: Enter the pipe diameter value using the NOMINAL_SIZE (slot 6, index 31) parameter in the Flow transducer block. Enter pipe size engineering units using the NOMINAL_SIZE_UNITS (slot 6, index 32) parameter.

Flow Units Settings: There are 3 possible flow types (Volumetric, Mass, and Velocity) and each has in own engineering units parameter. Only one flow type is active at a time. For volumetric units use VOLUME_FLOW_UNITS, for mass flow units use MASS_FLOW_UNITS, and for velocity flow use VELOCITY_UNITS.

FCI Totalizer Transducer Block Configuration

See "FCI Totalizer, Quick Start" on page 14 for details.

Configuring the Analog Input Block Modules

The Analog Input (AI) blocks make the process variables available to the PROFIBUS protocol application layer. AI blocks are used to configure and set the way that the process data is presented. An AI block gets its input from a corresponding process data transducer block. AI blocks are also used to set process alarms. The AI block configurable parameters are identified by a RW definition in the AI block table's Read/Write column.

Note: Some of the settable parameters require putting the AI block in an *Out of Service* (OOS) mode. To set the AI block in the OOS mode load the value of 0x80 into the TARGET_MODE parameter (one of the common block parameters not shown in this manual's parameter lists). To set the AI block to the AUTO mode load the value of 0x08 into the TARGET_MODE parameter.

Profile Totalizer Analog Input Block

When using the Profile Totalizer function block confirm that the instrument flow is set for volumetric or mass flow. Listed below are the parameters that can be used to manipulate the operation of the Profile Totalizer.

SET_TOT	Value 0x00: Sets the Profile Totalizer to run in "normal" TOTALIZE mode. Value 0x01: Resets the TOTALIZER. Value 0x02: Preset mode: Profile Totalizer starts from a count value specified in the PRESET_TOT parameter.
MODE_TOT	*Controls the behavior of the totalization:* Value 0x00: BALANCED behavior. Value 0x01: POS_ONLY totalization. Value 0x02: NEG_ONLY totalization. Value 0x03: HOLD or stop behavior.
FAIL_TOT	*Sets the fail-safe mode:* Value 0x0: RUN – Continue totalizing even if the input channel has a BAD status. Value 0x1: HOLD – Totalization stops when the input channel has a BAD status. Value 0x2: MEMORY – Continue totalizing using last GOOD value when status is BAD.
PRESET_TOT	*Holds the value of the preset to be used by the PRESET mode.*

The DTM provides easy access to this block. See "Figure 20 – Example Profile Totalizer Analog Input Function Block FDT/DTM Screen" on page 35. See "Profile Totalizer, Quick Start" on page 13 for more information.

DTM Introduction, Installation, and Operation

Introduction

The ST80/ST80L comes with a DTM (Device Type Manager) that is similar in function to a device driver. The DTM software describes to a host application how the FCI hardware works. The host application in this case is a frame application called an FDT (Field Device Tool). The FDT/frame follows a set of rules (the FDT group's open standard) that allow consistent graphical displays of information that is independent of the device type (e.g., sensor, actuator, remote I/O, drives, etc.) and independent of the communication protocol (e.g., HART, PROFIBUS, Foundation Fieldbus, etc.). For the ST80/ST80L, the FDT/DTM serves to set up/configure the instrument's PROFIBUS DP functionality.

There are several FDT applications available. Use the FDT of your choice to conveniently view and change the various PROFIBUS function block parameters. This manual shows the use of PACTware 4.1. Other FDT applications operate similarly.

Listed below are the components needed to make a desktop or laptop PC operate as a PROFIBUS Class 2 master that can communicate to the ST80/ST80L PROFIBUS slave:

- PROFIBUS USB interface (Thorsis isPro USBx12 or equivalent)
- D-SUB bus connector (Phoenix Contact, SUBCON-PLUS-PROFIB/SC2 - 2708232)
- PROFIBUS DP cable, length as required (Belden part number 3079A or equivalent)
- FDT/frame application (PACTware 4.1 or equivalent)
- FCI ST80/ST80L DTM (FCI 09EN000252)

Installation

- Install the PROFIBUS USB interface software per the manufacturer's instructions/installer software.
- Install the FDT application following the instructions in the manufacturer's installer software.
- Install the FCI DTM following the instructions in the installer software.

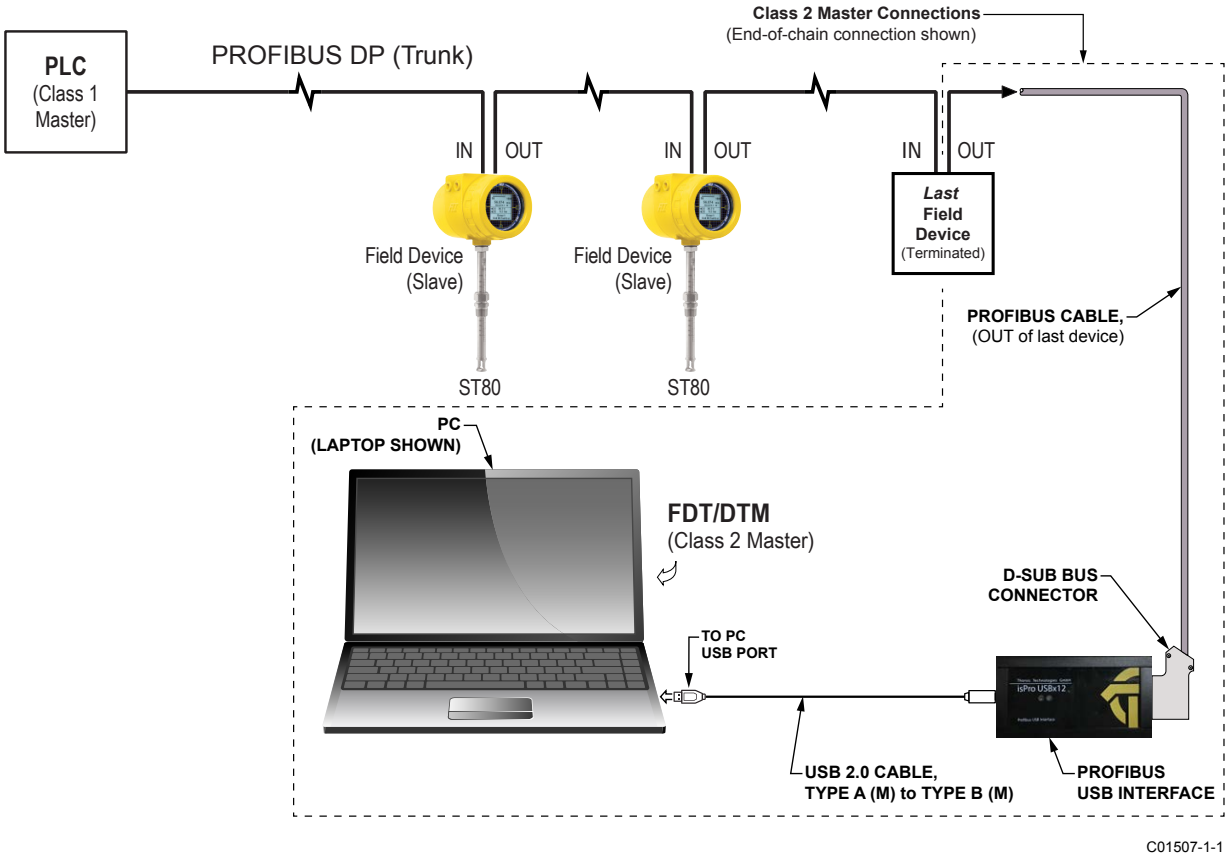


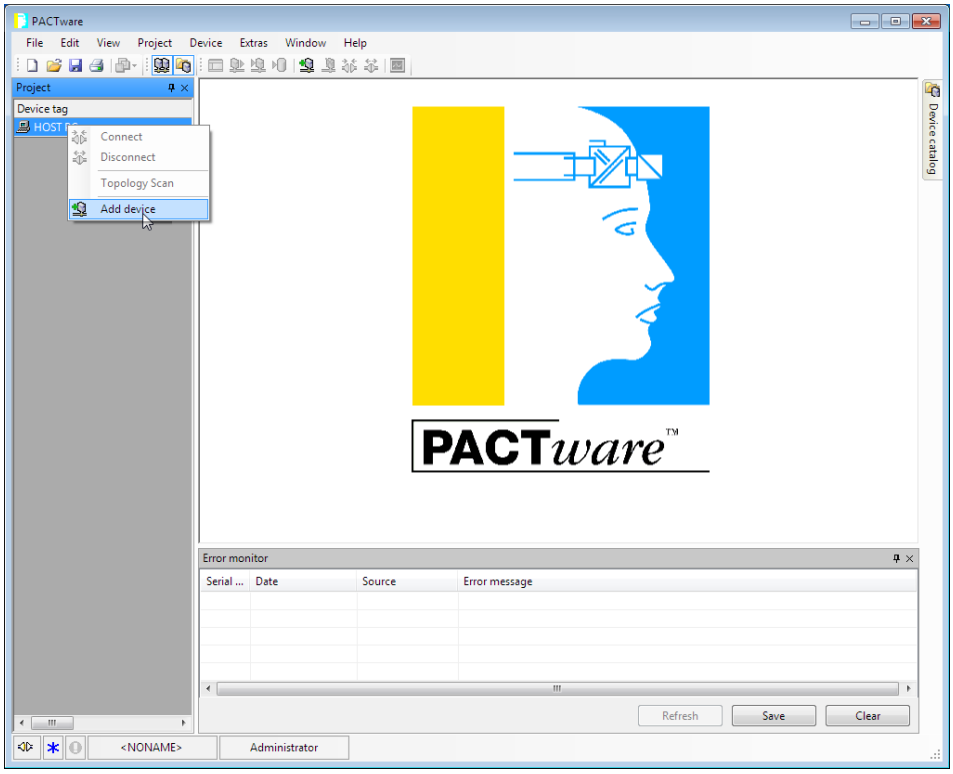
Figure 13 – Example Class 2 Master Connection, Last Device on Network

Once all of the above are installed, make the computer/PROFIBUS connections as shown in "Figure 13 – Example Class 2 Master Connection, Last Device on Network" on page 27. The figure shows an example connection to the last device on the network. However, the Class 2 master connection can be made at any point within the chain (observe polarity In/Out). If the Class 2 master connection is being made to an ST80/ST80L, see "Electrical Wiring" on page 3 for connection details.

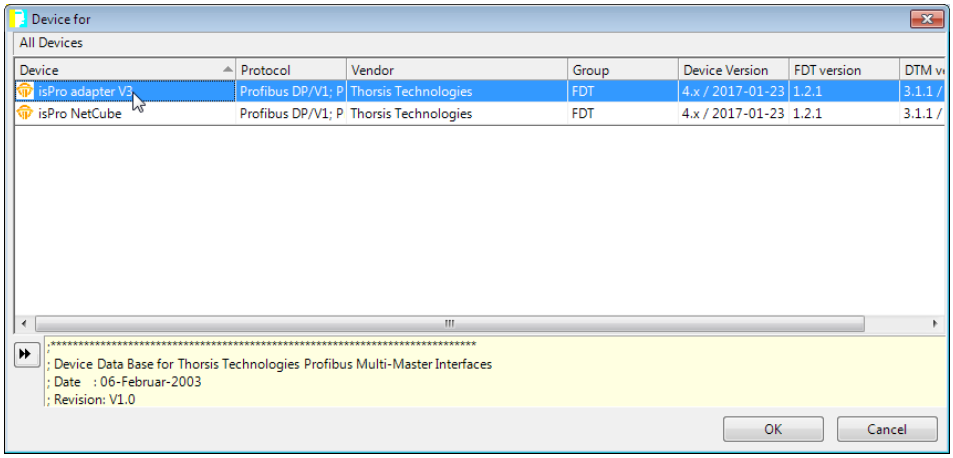
Operation

The FDT used for the below examples is PACTware 4.1 v4.1.0.52. Adapt the instructions for use with another type FDT application. The instructions assume that all connections are made and that the PROFIBUS USB interface and FCI DTM are properly installed, and proper bus parameters (i.e., transmission rate, bus timings, etc.) and slave address set. These instructions also assume a first-time connection to the ST80 flow meter. (Configuration details are saved when calling up a saved PACTware project.)

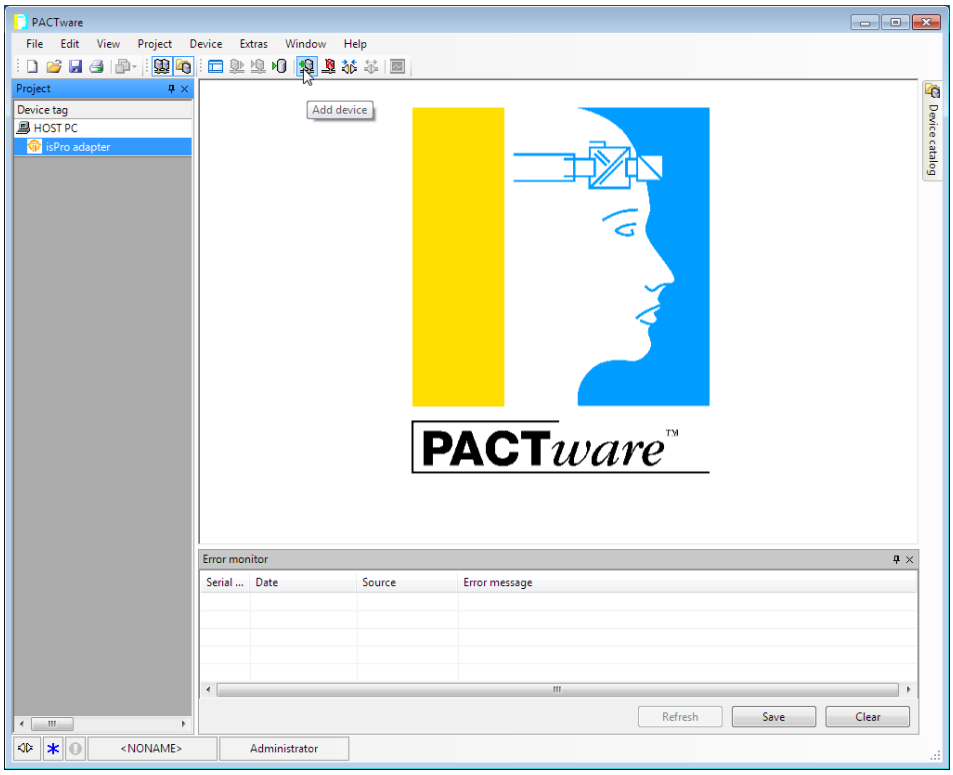
1. Start the PACTware application. Note the **Project** window at the left side of the application. This is an independently movable window that is docked (pinned) at this window position by default. In the *Project* window, right click on HOST PC and select **Add device**.



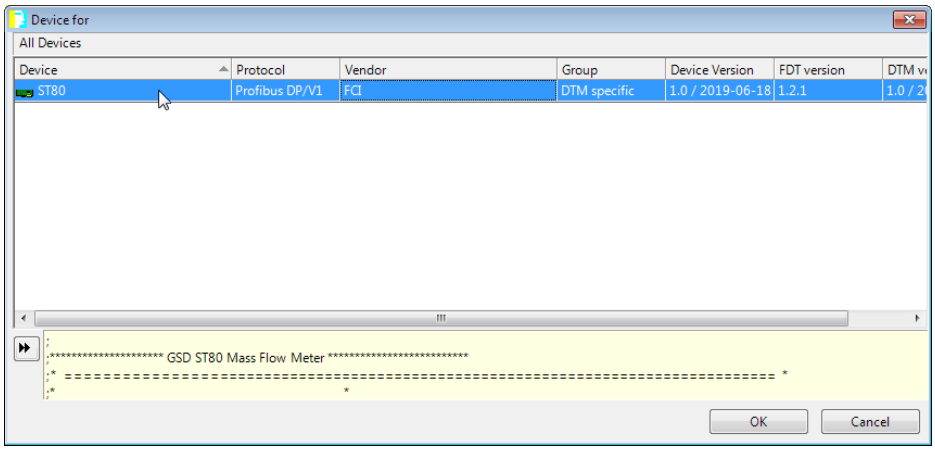
2. Observe that the **Device for** window appears. Select the appropriate PROFIBUS USB adapter, *isPro adapter V3*, then click **OK** (or double click *isPro adapter V3*).



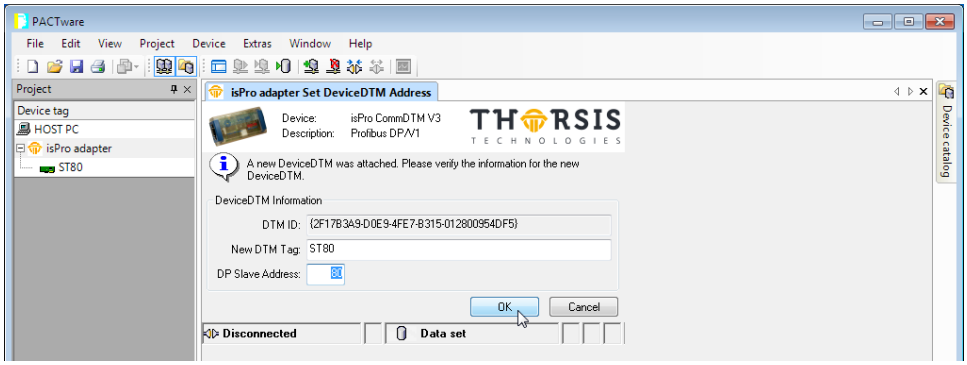
3. Verify that *isPro adapter* now appears under HOST PC in the **Project** window. Click *isPro adapter* and then click the **Add device** icon on the toolbar (alternatively, right click *isPro adapter* and select **Add device**).



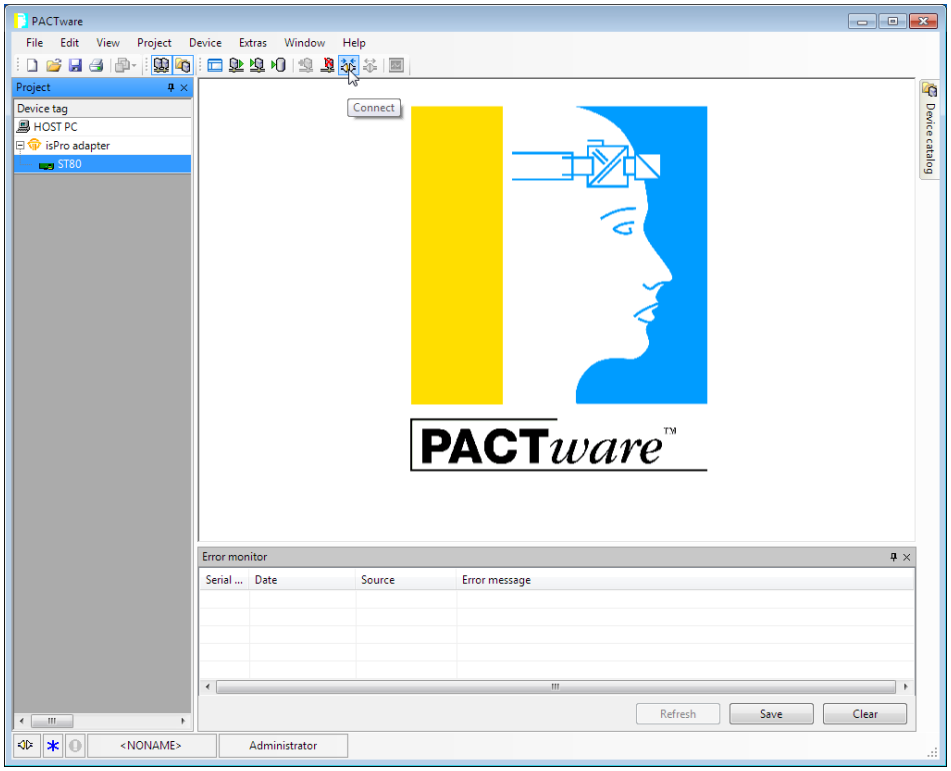
4. Observe that the **Device for** window appears. Select *ST80*, then click **OK** (or double click *ST80*).



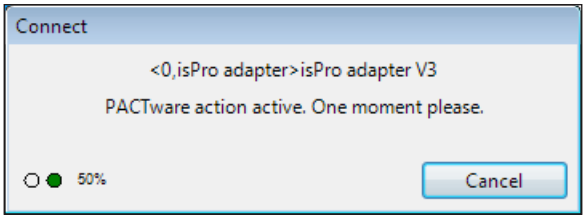
5. Observe that the **isPro adapter Set DeviceDTM Address** screen appears. Enter the slave address that was set beforehand (see "Setting the Slave Address" on page 9) in the DP Slave Address data box. For this example enter "80" to match the previously set slave address and then click **OK**.



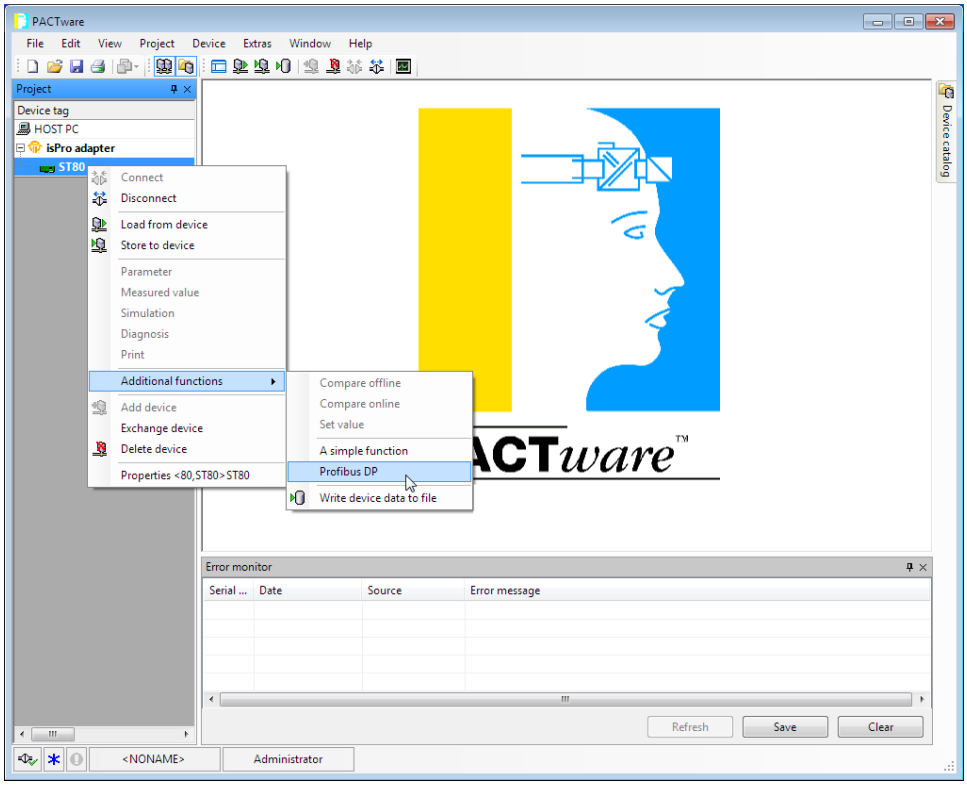
6. Verify that *ST80* now appears under *isPro adapter* in the **Project** window. Click *ST80* and then click the **Connect** icon on the toolbar (alternatively, right click *ST80* and select **Connect**).



7. Observe that the Connect dialog appears showing the connection-in-progress.



8. In the **Project** window, right click *ST80* and select *Additional functions* ▸ *Profibus DP*.

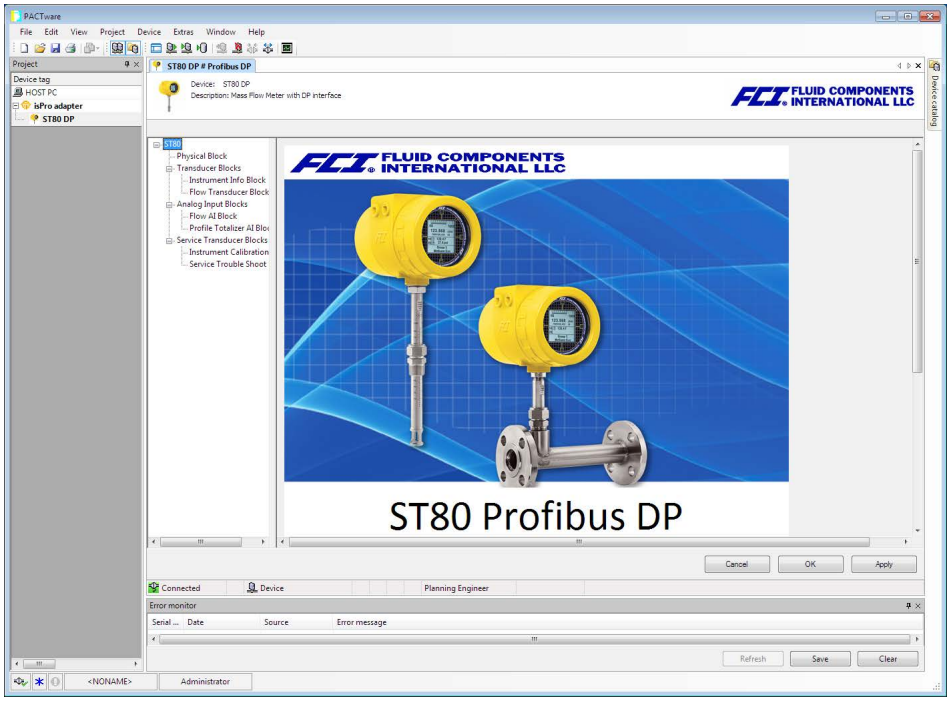


9. Observe that the PACTware application now shows the DTM window showing the ST80 Profibus DP splash screen. Resize the application window as needed to more easily see the information on the screen. At the left of the PACTware application window is a tree view showing all of the available PROFIBUS functional modules within the major block groups:

   - Physical Block
   - Transducer Blocks
   - Analog Input Blocks (Function Blocks)
   - Service Transducer Blocks

   Click the plus sign ⊞ to show all the branches (functional modules) in the tree.

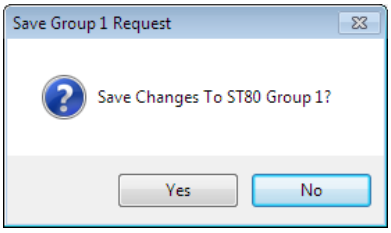
   Note: The actual modules shown under the major block groups depends on the selected profile: Manufacturer-specific or Profile-specific. Fewer modules are shown for a Profile-specific configuration, which is shown in the Physical block DTM screen as **Profile ID: 0x9740** in the *Indent Number Optons:* field. **Manufacturer ID: 0x111A** indicates that the Manufacturer-specific profile is selected.



10. Click on a functional block to see all the associated parameters in the DTM window. Use the vertical/horizontal scroll bars to see all the data. The parameter values are shown in text boxes, pull down lists, check boxes, etc. If necessary, make a parameter change using the appropriate Windows data entry method (e.g., tick the box, enter the number, etc.) then click **Apply** or **OK**.

    Note: Write Protect must be OFF to make an instrument level change. Access the Service Transducer block and click the **Toggle Write Protect Mode** button to change the write protect mode status from *Protected* to *Un-Protected*. Also note that some displayed parameter values are read-only, with the actual parameter effecting the change residing in another block. An example of this is the write protect status shown in the Physical block, and the write protect control in the Service Transducer block.

Making Changes Permanent – After making parameter change(s), make the change(s) permanent by saving to the calibration group currently in effect. Do this by clicking **Save GroupX** in the Physical block window's *Save Configuration* field. The save button automatically shows the current calibration group (typically Group1). Observe that the **Save Group Request** dialog box appears, asking to confirm the save:



Click **Yes**. Change the write protect mode back to *Protected* when done.

The figures below show example FDT/DTM screens for the ST80/ST80L functional PROFIBUS blocks (manufacturer-specific profile selected).

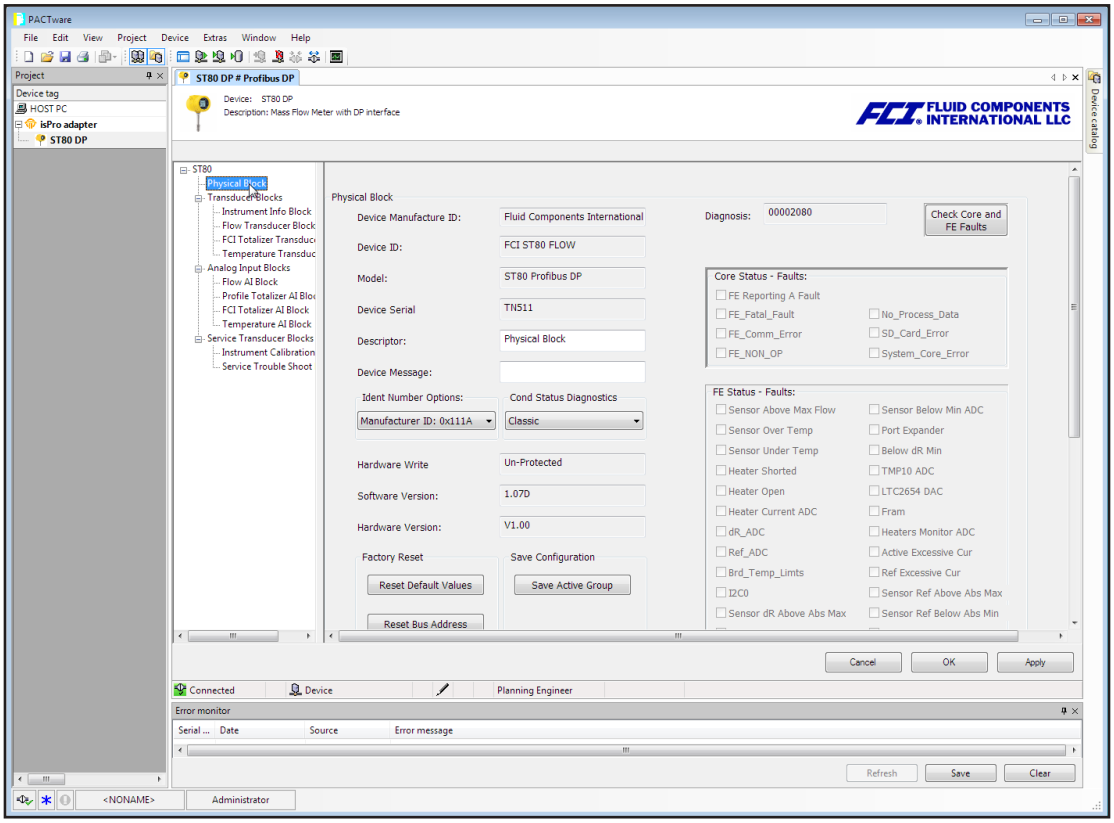


Figure 14 – Example Physical Block FDT/DTM Screen

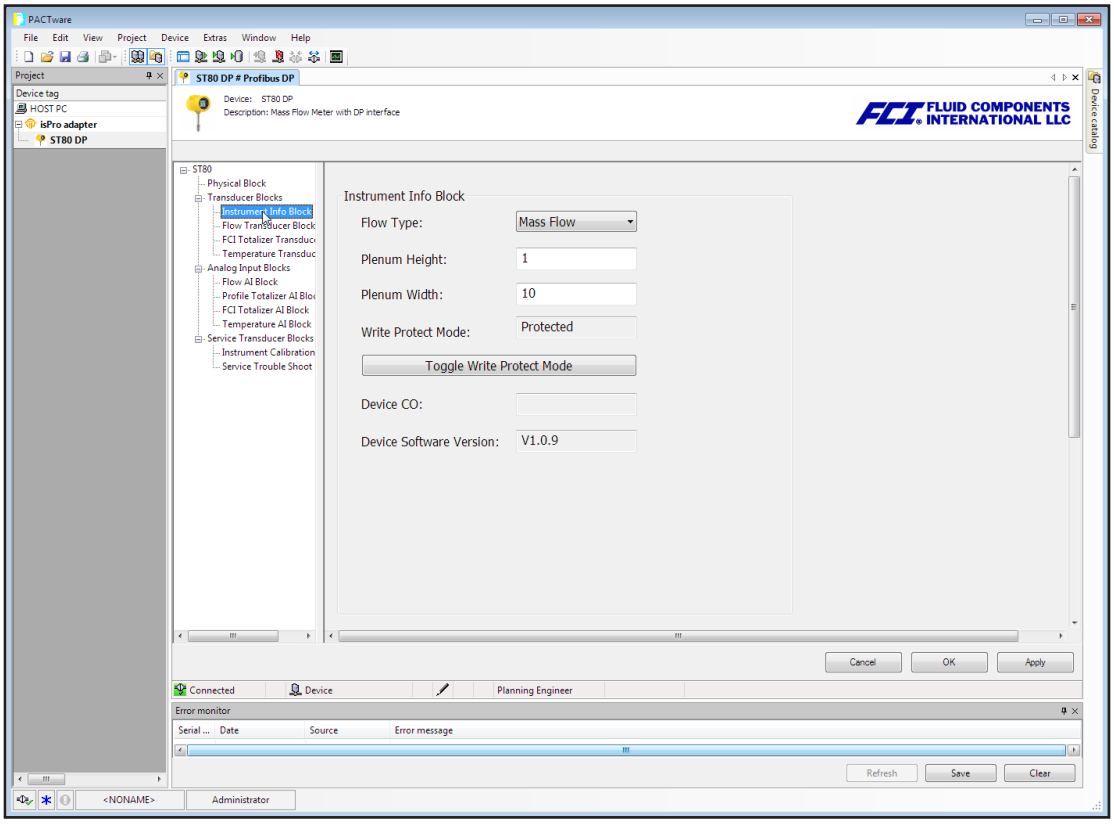


Figure 15 – Example Instrument Info Service Transducer Block FDT/DTM Screen

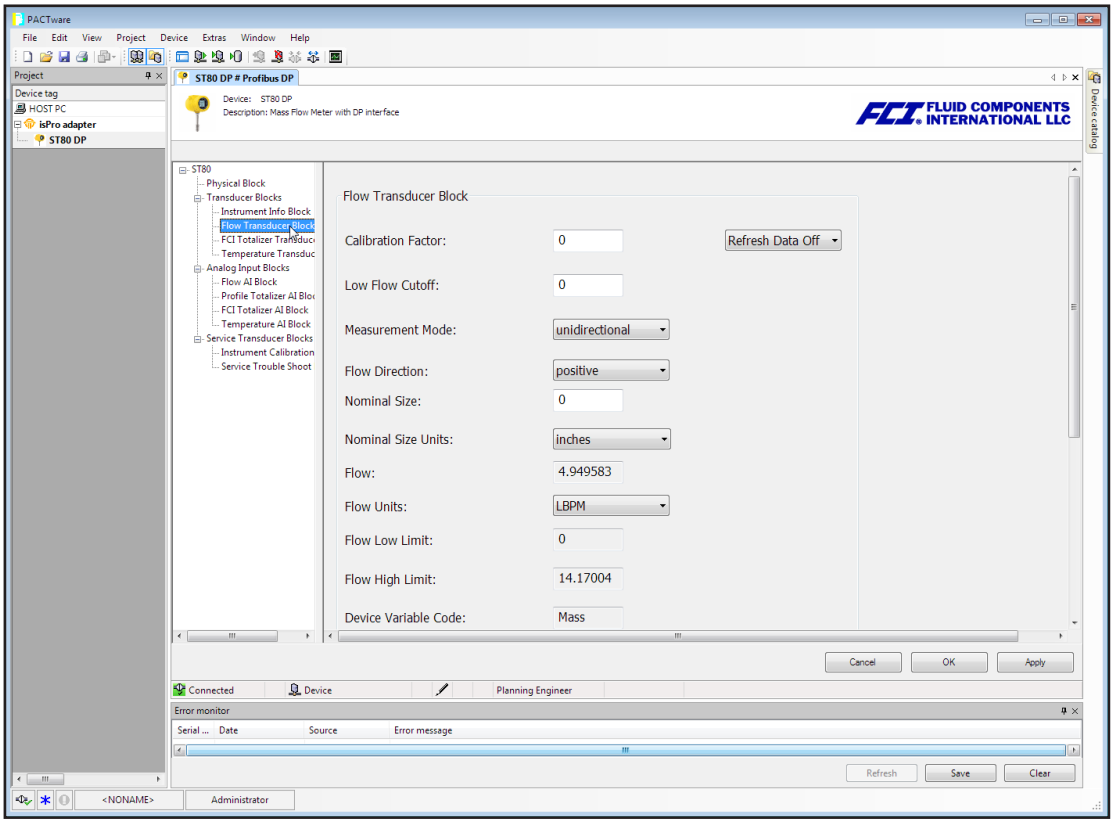


Figure 16 – Example Flow Transducer Block FDT/DTM Screen

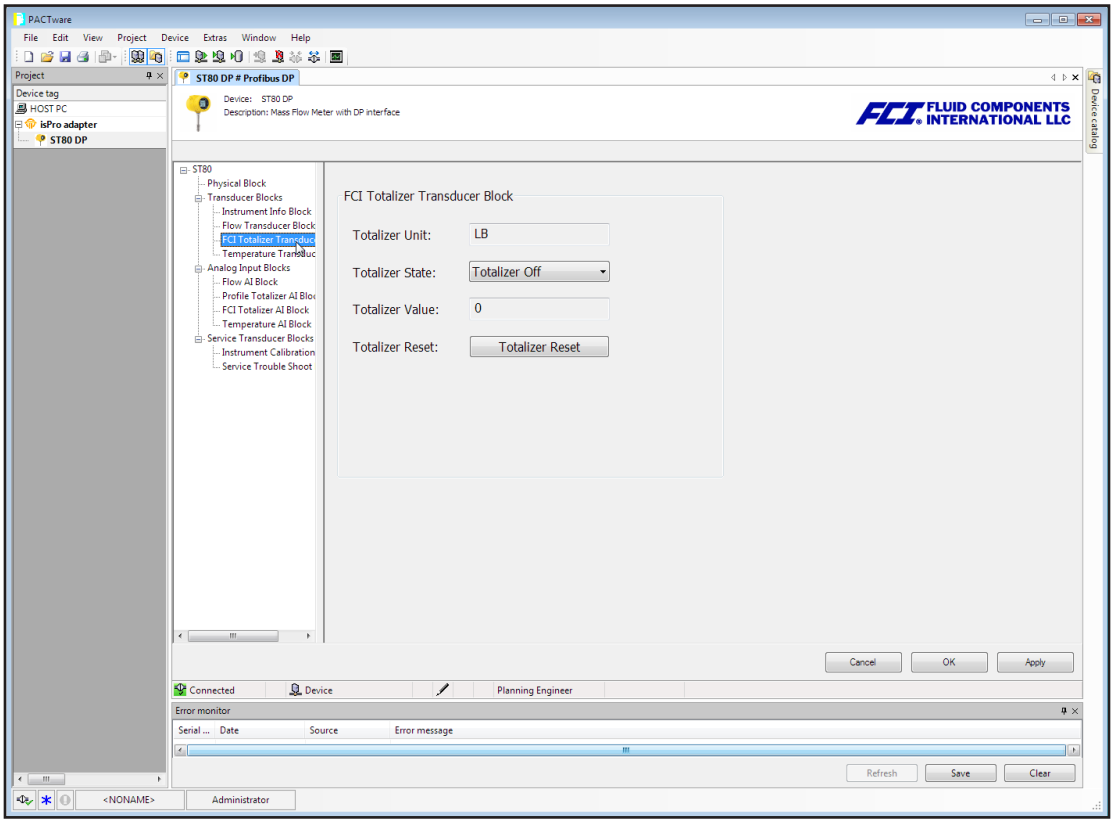


Figure 17 – Example FCI Totalizer Transducer Block FDT/DTM Screen

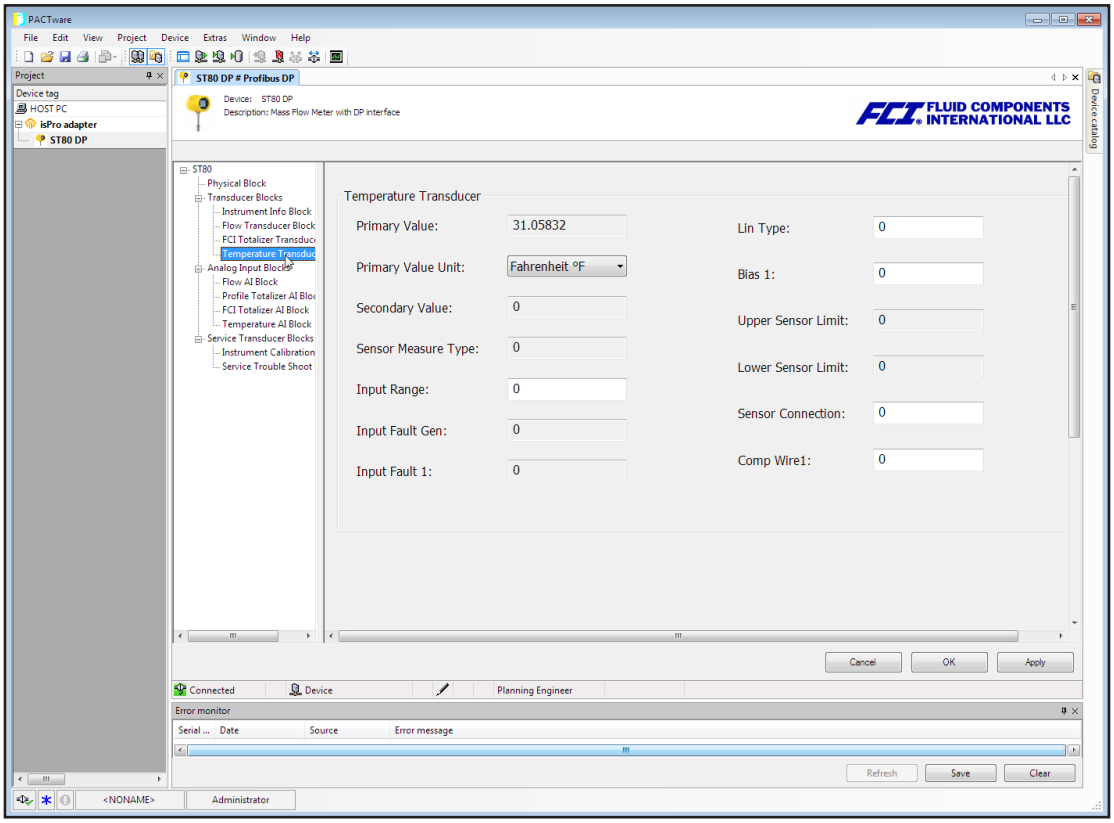


Figure 18 – Example Temperature Transducer Block FDT/DTM Screen

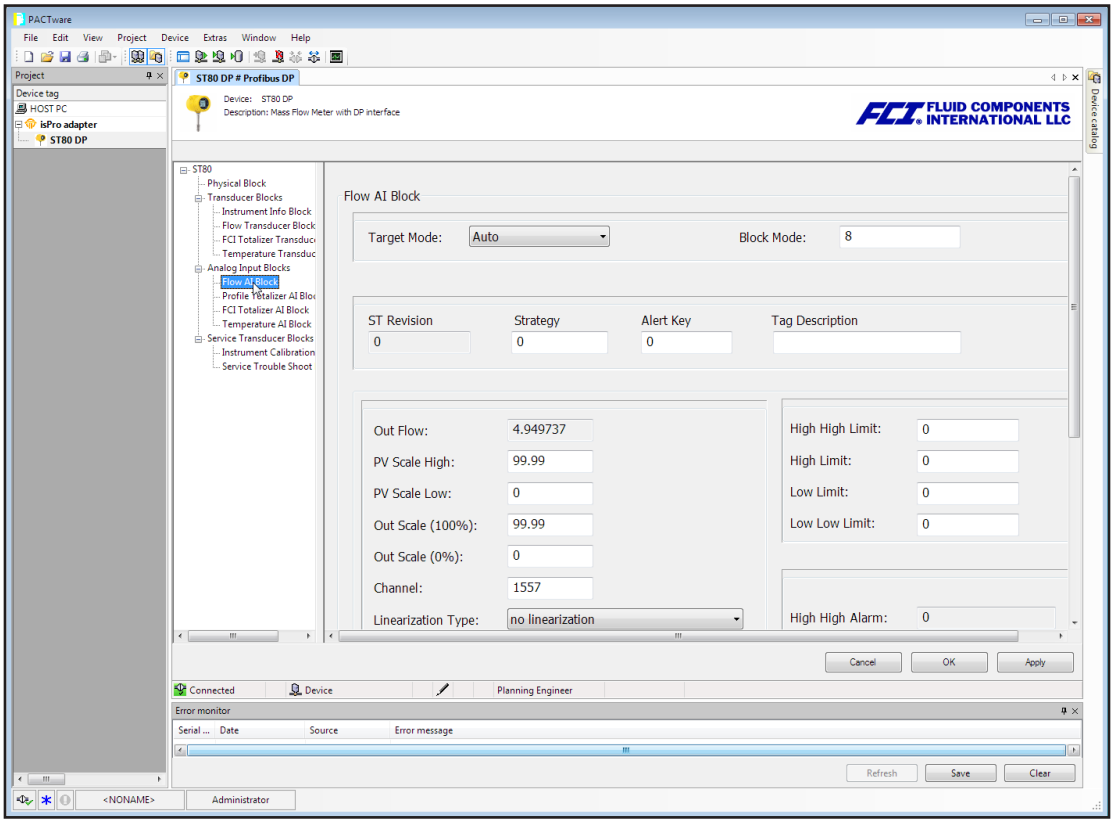


Figure 19 – Example Flow Analog Input Function Block FDT/DTM Screen

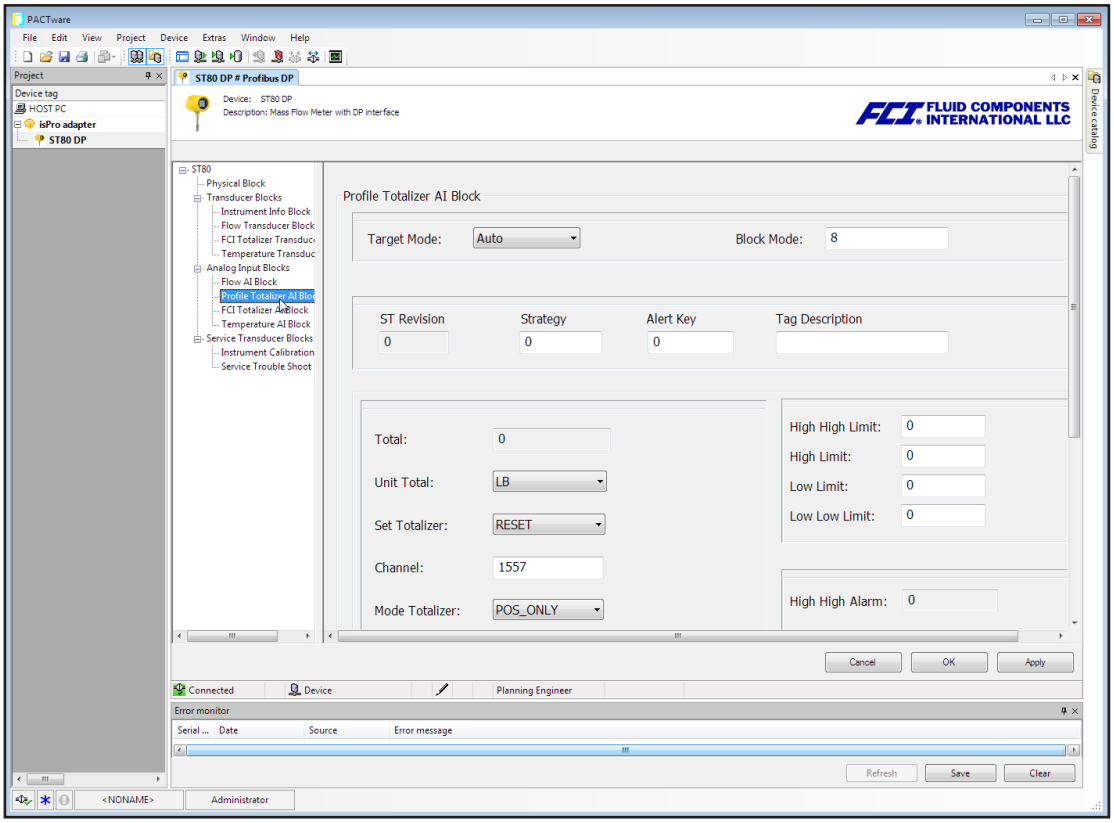


Figure 20 – Example Profile Totalizer Analog Input Function Block FDT/DTM Screen

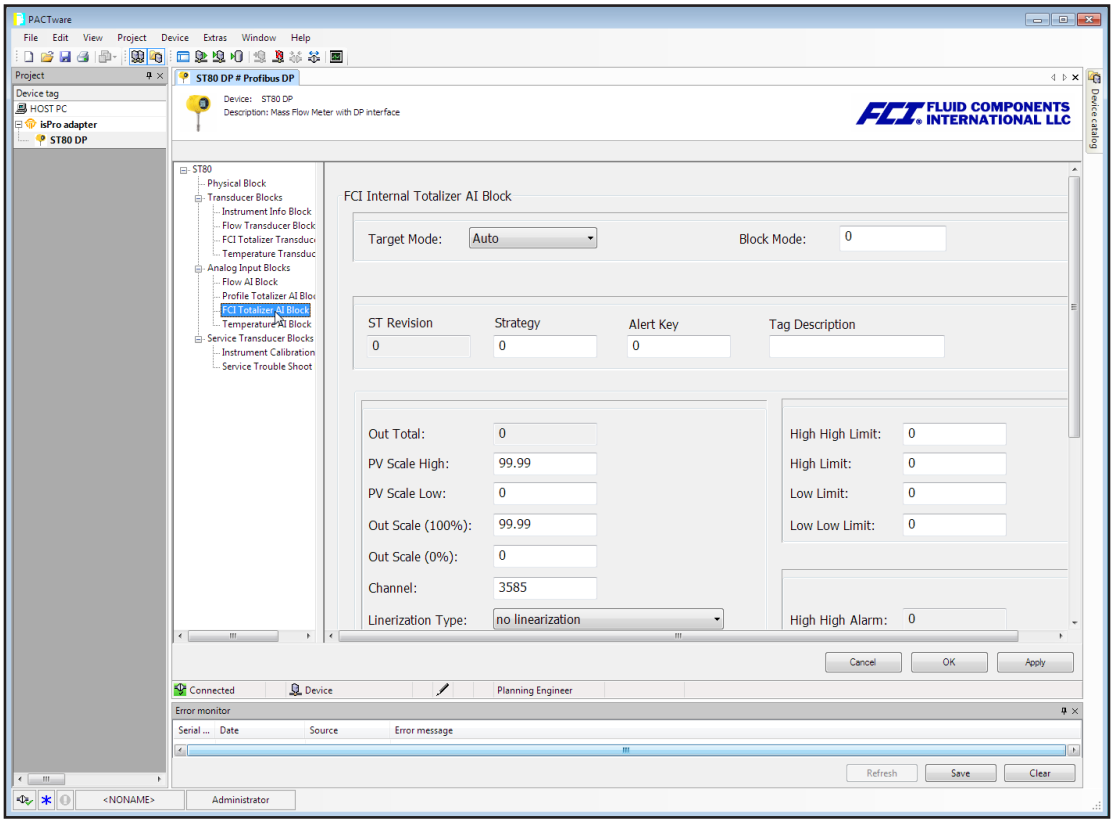


Figure 21 – Example FCI Totalizer Analog Input Function Block FDT/DTM Screen

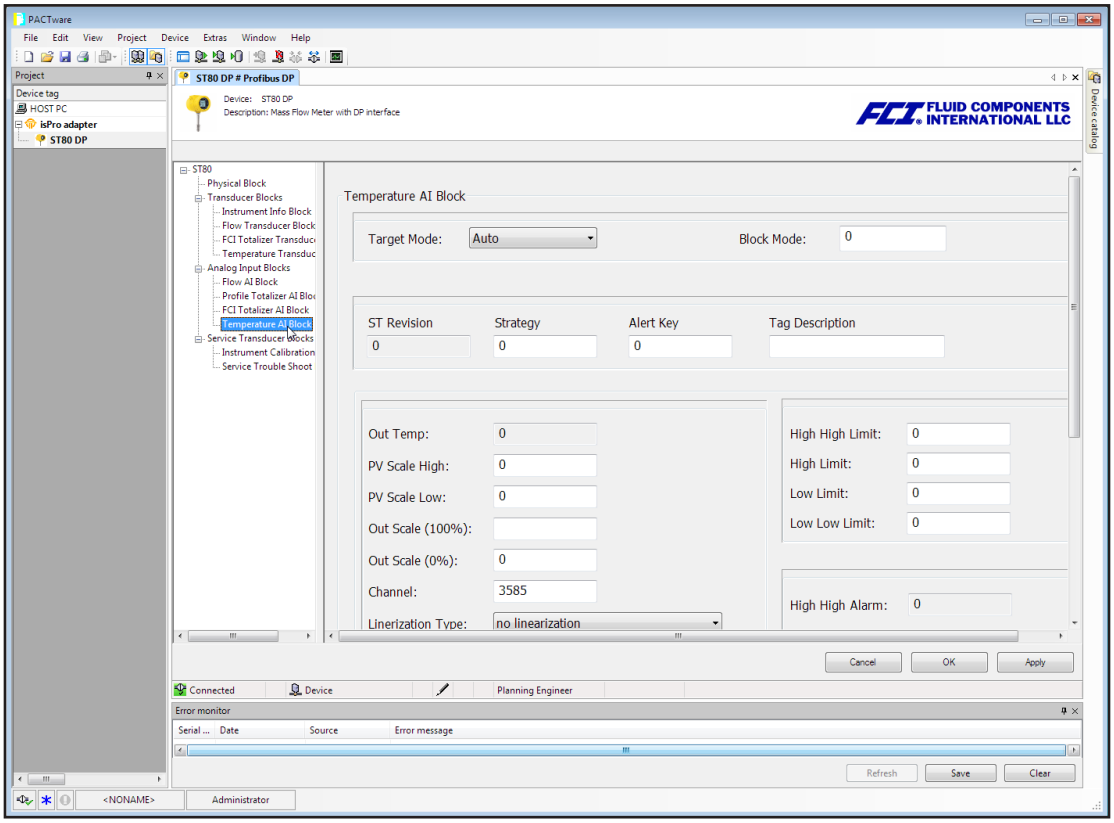


Figure 22 – Example Temperature Analog Input Function Block FDT/DTM Screen

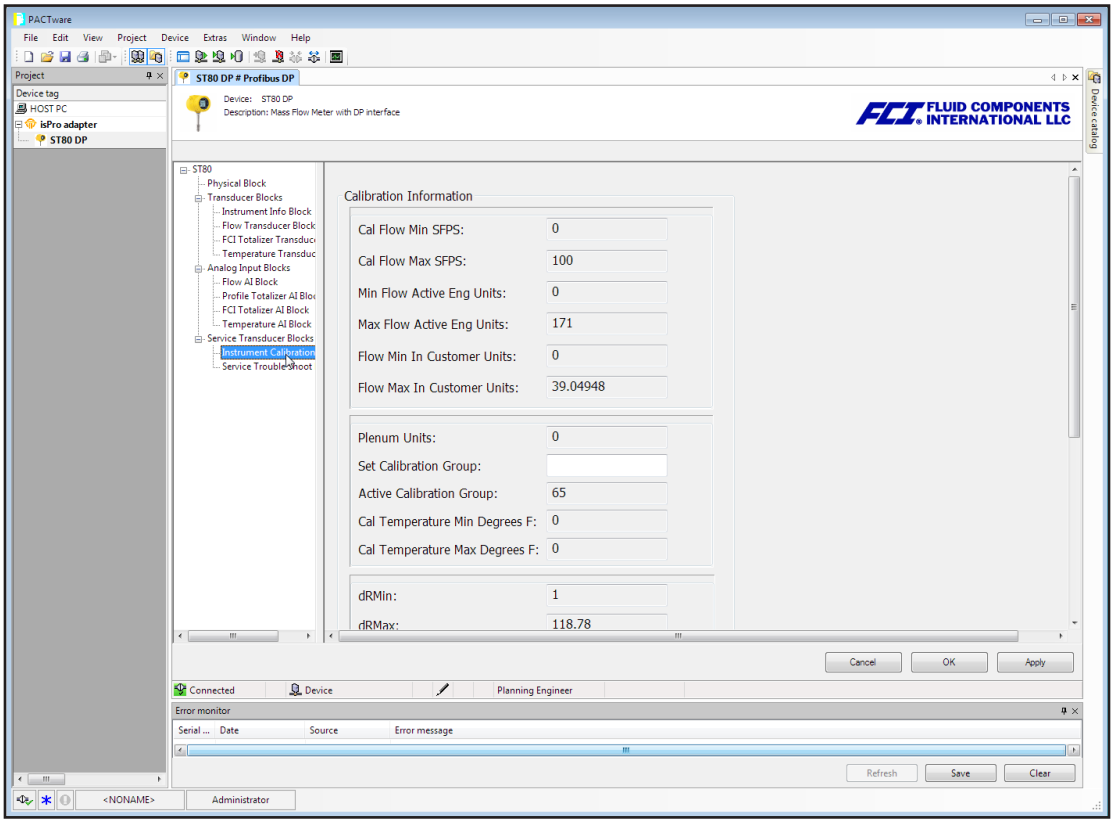


Figure 23 – Example Calibration Info Service Transducer Block FDT/DTM Screen

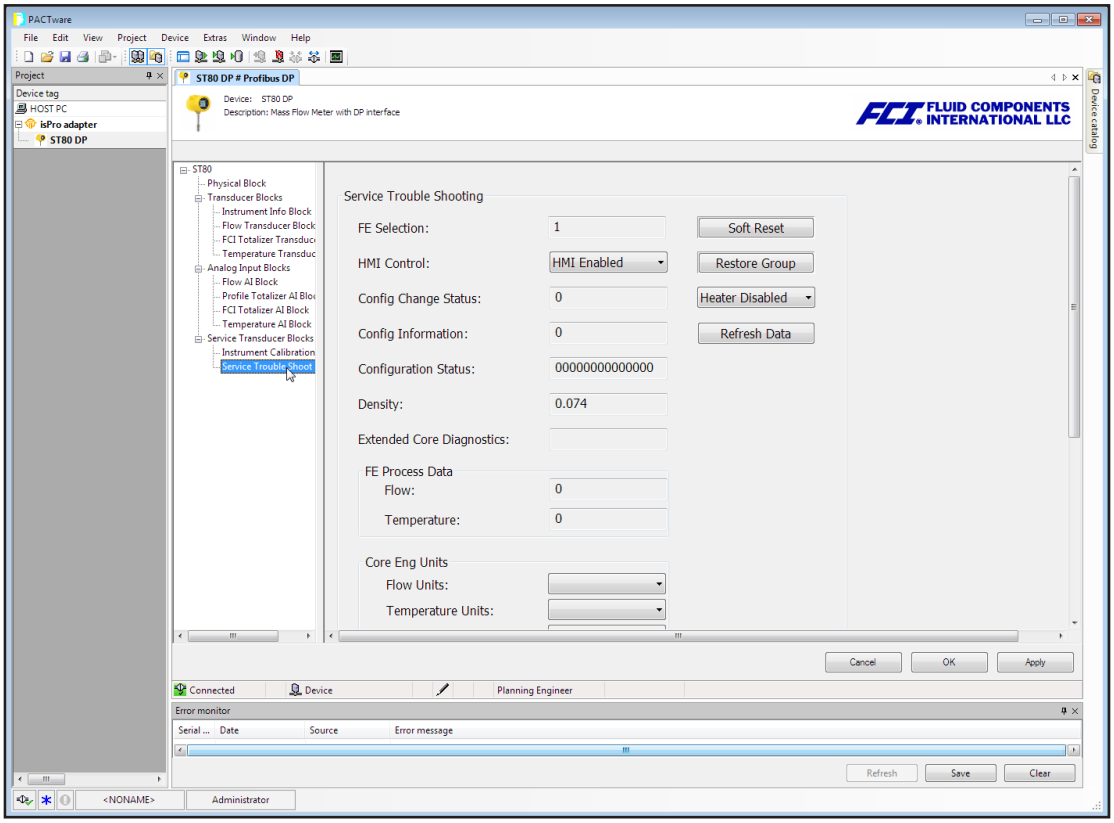


Figure 24 – Example Troubleshooting Service Transducer Block FDT/DTM Screen

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4. DIAGNOSTICS/TROUBLESHOOTING

The ST80/ST80L PROFIBUS DP has both *Classic* and *Condensed* diagnostic functionality, which is selectable via the Physical block COND_STATUS_DIAG parameter (Slot 0, Index 43). See "Table 3 – Physical Block Parameters" on page 15 for the Physical block parameter listing. The PROFIBUS PA v3.02 specification defines the *Condensed* format status codes, which are based on the NAMUR Recommendation NE 107 document. The instrument defaults to the *Classic* diagnosis mode to ensure compatibility with legacy masters.

The ST80/ST80L provides two levels of diagnostic information. See Figure 27 below. The first level diagnostics are included in the slave's cyclic response to the master. Additional diagnostic messages, accessible by a Class 2 master, provide more detailed information about the warning or fault at the instrument (Core) level or FE (Flow Element) level.

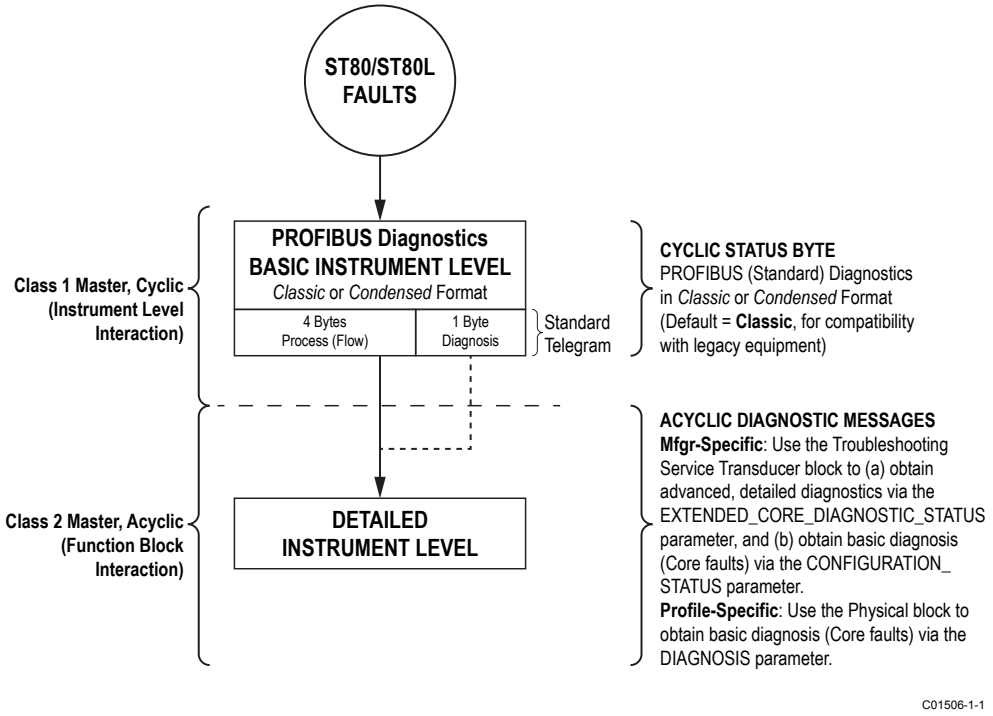

Figure 25 – PROFIBUS Faults/Diagnostics Levels

- **Basic Instrument Level/Cyclic Status Byte** – In addition to the process data, the slave's cyclic response (the standard telegram to the Class 1 master) includes a basic status byte, which is summarized in the Status Byte Coding columns in Table 17 below. Depending on the Physical block's COND_STATUS_DIAG parameter, the diagnostic parameter format is either *Classic* (COND_STATUS_DIAG = 0) or *Condensed* (COND_STATUS_DIAG = 1). The basic instrument level faults are given in four bytes as summarized in Table 16 below. The bits within these bytes are mapped to a specific PROFIBUS diagnosis mnemonic and a particular status (Classic or Condensed style).
- **Detailed Instrument Level/Acyclic Diagnostic Messages** – *Manufacturer-specific profile*: Advanced/detailed diagnostics are obtained by reading the Troubleshooting Service Transducer block parameter EXTENDED_CORE_DIAGNOSTIC_STATUS. The Class 2 master can also use this block to read the basic diagnosis (Core faults) by reading the CONFIGURATION_STATUS parameter.

  Profile-specific: The Class 2 master can obtain basic diagnosis (Core faults) via the Physical block's DIAGNOSIS parameter.

  The detailed instrument level faults provided by the Troubleshooting Service Transducer block parameter EXTENDED_CORE_DIAGNOSTIC_STATUS are summarized in Table 18 below.

For any interactions between the instrument level or function blocks, the FDT/DTM software provides a graphical user interface (GUI) to issue commands and receive data in human readable form over the PROFIBUS. See "DTM Introduction, Installation, and Operation" on page 27 for details.

Table 16 – ST80/ST80L PROFIBUS Basic Instrument Level Diagnosis Bytes[1]

	OCTET-BIT	FAULT NAME	FAULT DESCRIPTION	FAULT TYPE[2]	HEX BIT MAP
Byte 0, FE Faults	0-0	FE_01_FAULT	FE1 is reporting a fault or an error	Fatal/Non-Fatal	0x00000001
	0-1	FE_02_FAULT	FE2 is reporting a fault or an error (ST100A)	Fatal/Non-Fatal	0x00000002
	0-2 to 0-7	FCI Reserved (Not Used)			0x00000004 to 0x00000080
Byte 1, FE Faults	1-0 to 1-7	FCI Reserved (Not Used)			0x00000100 to 0x00008000
Byte 2, Core/FE Faults	2-0	PD_FATAL_FAULT	At least one FE has a fatal error or fault	Fatal	0x00010000
	2-1	PD_COMM_ERROR	At least one FE has a communication problem	Non-Fatal	0x00020000
	2-2	PD_NON_OP	At least one FE was non-operational (self-test)	Non-Fatal	0x00040000
	2-3	PD_SYSTEM_ERROR	System (Core) error		0x00080000
	2-4	FCI Reserved (Not Used)			0x00100000
	2-5	PD_NO_PD_UPDATE	All FEs reported a fatal error	Fatal	0x00200000
	2-6	PD_SD_CARD_ERROR	SD Card error	Non-Fatal	0x00400000
	2-7	FCI Reserved (Not Used)			0x00800000
Byte 3, Process Variable Alarms	3-0 to 3-1	FCI Reserved (Not Used)			0x01000000 to 0x02000000
	3-2	Process Alarm #1	—	—	0x04000000
	3-3	Process Alarm #2	—	—	0x08000000
	3-4	Process Alarm #3	—	—	0x10000000
	3-5	Process Alarm #4	—	—	0x20000000
	3-6	Process Alarm #5	—	—	0x40000000
	3-7	Process Alarm #6	—	—	0x80000000

Notes: 1. This table is extended in the table on the next page ("Table 17 – ST80/ST80L PROFIBUS Basic Instrument Level Diagnosis Bytes with Classic and Condensed Status").

2. The Fatal/Non-Fatal designation is programmable via the Configurator software's **Core Faults** tab (*Factory* branch menu tree – requires entry of appropriate level password).

Table 17 – ST80/ST80L PROFIBUS Basic Instrument Level Diagnosis Bytes with Classic and Condensed Status

OCTET-BIT	FAULT NAME	Classic: Physical Block Diagnosis Mnemonic[1]	Classic: Status[2]	Classic: Status Byte Coding								Condensed: Physical Block Diagnosis Mnemonic[3]	Condensed: Status[4]	Condensed: Status Byte Coding							
				Quality		Quality Substatus				Limits				Quality		Quality Substatus				Limits	
0-0	FE_01_FAULT	DIA_HW_ELECTR	UNCERTAIN (3):ALL	0	1	0	0	0	0	x	x	DIA_MAINTENANCE_ ALARM	OUT OF SPECIFICATION (S)	0	1	0	0	1	0	1	1
0-1	FE_02_FAULT	DIA_HW_ELECTR	UNCERTAIN (3):ALL	0	1	0	0	0	0	x	x	DIA_MAINTENANCE_ ALARM	OUT OF SPECIFICATION (S)	0	1	0	0	1	0	1	1
0-2 to 0-7	FCI Reserved (Not Used)																				
1-0 to 1-7	FCI Reserved (Not Used)																				
2-0	PD_FATAL_FAULT	DIA_HW_ELECTR	BAD (4):ALL	0	0	0	1	0	0	x	x	DIA_MAINTENANCE_ ALARM	FAILURE (F)	0	0	1	0	0	1	x	x
2-1	PD_COMM_ERROR	DIA_MAINTENANCE										DIA_MAINTENANCE									
2-2	PD_NON_OP	DIA_MEASUREMENT	UNCERTAIN (9):0,2,4	0	1	1	0	0	1	x	x	DIA_FUNCTION_ CHECK	CHECK (C)	0	0	1	1	1	1	x	x
2-3	PD_SYSTEM_ERROR	DIA_HW_ELECTR	BAD ALL	0	0	0	1	0	0	x	x	DIA_MAINTENANCE_ ALARM	FAILURE (F)	0	0	1	0	0	1	x	x
2-4	FCI Reserved (Not Used)																				
2-5	PD_NO_PD_UPDATE	DIA_MEASUREMENT	BAD (6):0,1,2,3,4,5	0	0	0	1	0	0	x	x	DIA_MAINTENANCE_ ALARM	FAILURE (F)	0	0	1	0	0	1	x	x
2-6	PD_SD_CARD_ERROR	DIA_MAINTENANCE	GOOD	1	0	1	0	0	1	x	x	DIA_MAINTENANCE	GOOD (G)	1	0	1	0	0	1	x	x
2-7	FCI Reserved (Not Used)																				
3-0 to 3-1	FCI Reserved (Not Used)																				
3-2	Process Alarm #1	General (non-specific) Process Alarm(s) shown on the front panel display and the configuration software's Process Data screen only (via virtual LED alarm/fault indicators).																			
3-3	Process Alarm #2																				
3-4	Process Alarm #3																				
3-5	Process Alarm #4																				
3-6	Process Alarm #5																				
3-7	Process Alarm #6																				

Notes: 1. See "Table 19 – DIAGNOSIS Mnemonics, Classic Mode" on page 43 for the list of Classic diagnostics mnemonics.

2. See "Classic Format" on page 44 for an explanation of the Classic mode *Status* column.

3. See "Table 20 – DIAGNOSIS Mnemonics, Condensed Mode" on page 43 for the list of Condensed diagnostics mnemonics.

4. See "Condensed Format" on page 44 for an explanation of the Condensed mode *Status* column.

Table 18 – ST80/ST80L PROFIBUS Detailed Instrument Level Diagnosis Bytes

	OCTET-BIT	FAULT NAME	FAULT DESCRIPTION	FAULT TYPE[1]	HEX BIT MAP
Byte 0	0-0	Not Used	—	—	0x00000001
	0-1	Not Used	—	—	0x00000002
	0-2	HTR_CURR_ADC_OVER_RANGE_FAULT	The heater current analog-to-digital converter shows saturation at its input.	Fatal	0x00000004
	0-3	Not Used	—	—	0x00000008
	0-4	Not Used	—	—	0x00000010
	0-5	Not Used	—	—	0x00000020
	0-6	SENSOR_ABOVE_MAX_FLOW_FAULT	Process flow is above the maximum limit.	Fatal	0x00000040
	0-7	SENSOR_OVER_TEMP_FAULT	Process temperature is above the maximum limit.	Fatal	0x00000080
Byte 1	1-0	SENSOR_UNDER_TEMP_FAULT	Process temperature is below the minimum limit.	Fatal	0x00000100
	1-1	HEATER_SHORTED_FAULT	The heater is shorted or its value is below the normal operating value.	Fatal	0x00000200
	1-2	HEATER_OPEN_FAULT	The heater is open or its value is above the normal operating value.	Fatal	0x00000400
	1-3	HTR_CURR_ADC_FAULT	The heater current analog-to-digital converter (ADC) fails to respond.	Non-Fatal	0x00000800
	1-4	dR_ADC_FAULT	The Delta-R ADC fails to respond.	Fatal	0x00001000
	1-5	REF_ADC_FAULT	The Reference-R ADC converter fails to respond.	Fatal	0x00002000
	1-6	BRD_TEMP_LIMITS_FAULT	Temperature inside the unit is outside the limits (above or below the operating limits).	Fatal	0x00004000
	1-7	I2C0_FAULT	The Inter-Integrated Circuit (I^2C) channel 0 bus fails to communicate.	Fatal	0x00008000
Byte 2	2-0	SENSOR_BELOW_MIN_ADC_FAULT	The Reference-R ADC's count number is below the minimum.	Fatal	0x00010000
	2-1	Not Used	—	—	0x00020000
	2-2	PORT_EXPANDER_FAULT	The port expansion integrated chip fails to respond.	Non-Fatal	0x00040000
	2-3	BELOW_dR_MIN_FAULT	Delta-R value is below minimum limit.	Fatal	0x00080000
	2-4	TMP100_ADC_FAULT	The ADC for monitoring the temperature inside the unit fails to respond.	Non-Fatal	0x00100000
	2-5	LTC2654_DAC_FAULT	The digital-to-analog converter fails to respond.	Non-Fatal	0x00200000
	2-6	FE_FRAM_FAULT	The FRAM of the Flow Element fails to respond.	Non-Fatal	0x00400000
	2-7	Not Used	—	—	0x00800000
Byte 3	3-0	HTRS_MON_ADC_FAULT	The ADC for monitoring heater's conditions fails to respond.	Non-Fatal	0x01000000
	3-1	ACT_EXC_CURR_FAULT	The Active excitation current Integrated Circuit (IC) fails.	Non-Fatal	0x02000000
	3-2	REF_EXC_CURR_FAULT	The Reference excitation current Integrated Circuit (IC) fails.	Non-Fatal	0x04000000
	3-4	SENSOR_REFR_ABOVE_ABS_MAX	Reference-R value is above operating limit.	Fatal	0x08000000
	3-4	SENSOR_REFR_BELOW_ABS_MIN	Reference-R value is below operating limit.	Non-Fatal	0x10000000
	3-5	SENSOR_DR_ABOVE_ABS_MAX	Delta-R value is above operating limit.	Non-Fatal	0x20000000
	3-6	SENSOR_DR_BELOW_ABS_MIN	Delta-R value is below operating limit.	Fatal	0x40000000
	3-7	FE_AUTO_CHECK	The unit is performing a (diagnostic) test.	Fatal	0x80000000

Notes: 1. The Fatal/Non-Fatal designation is programmable via the Configurator software's **FE Faults** tab (*Factory* branch menu tree – requires entry of appropriate level password).

Diagnosis Mnemonics

The format of Physical block parameter DIAGNOSIS (slot 0, index 29) is set by Physical block parameter COND_STATUS_DIAG (slot 0, index 43):

- 0 = Classic
- 1 = Condensed

The 4 bytes that make up the DIAGNOSIS parameter form the diagnosis mnemonic that is triggered by the occurrence of a diagnostic event. The diagnosis mnemonics for both Classic and Condensed modes are summarized in the tables below.

Table 19 – DIAGNOSIS Mnemonics, Classic Mode

Classic DIAGNOSIS Mnemonic	Description
DIA_HW_ELECTR	Hardware failure of the electronics.
DIA_HW_MECH	Hardware failure, mechanical.
DIA_TEMP_MOTOR	Motor temperature too high.
DIA_TEMP_ELECTR	Electronic temperature too high.
DIA_MEM_CHKSUM	Memory error.
DIA_MEASUREMENT	Failure in measurement.
DIA_NOT_INIT	Device not initialized (no self calibration).
DIA_INIT_ERR	Self calibration failed.
DIA_ZERO_ERR	Zero point error (limit position).
DIA_SUPPLY	Power supply failed (electrical, pneumatic).
DIA_CONF_INVAL	Configuration not valid.
DIA_WARMSTART	Warm start detected (cleared after 10 seconds).
DIA_COLDSTART	Cold start detected (cleared after 10 seconds).
DIA_MAINTENANCE	Maintenance required.
DIA_CHARACT	Characterization invalid.

Table 20 – DIAGNOSIS Mnemonics, Condensed Mode

Classic DIAGNOSIS Mnemonic	Description
DIA_MAINTENANCE	Maintenance required.
DIA_MAINTENANCE_ALARM	Failure of the device or armature.
DIA_MAINTENANCE_DEMANDED	Maintenance demanded.
DIA_FUNCTION_CHECK	Device is in function check mode, or in simulation, or under local control; i.e., maintenance.
DIA_INV_PRO_COND	The process conditions do not allow to return valid values. Set if a value has the quality: UNCERTAIN – Process related, no maintenance, or BAD – Process related, no maintenance.

Status, Basic Instrument Level Diagnosis Bytes

Depending on the diagnosis configuration set by Physical block parameter COND_STATUS_DIAG, the indicated Status is either Classic or Condensed.

Classic Format

In the PROFIBUS Basic Instrument Level Diagnosis Bytes table, the **Classic** Status column describes the basic condition of applicable process variables. In case no relevant diagnosis information is available, or existing diagnosis information disappears, the status will be set to GOOD.

Status information shown is in two parts, a Condition code and Process Variable code(s). These codes are summarized in the table below.

Table 21 – Classic Status

Condition Code

Code	*Condition*
0	GOOD – OK
1	GOOD – maintenance required
2	GOOD – maintenance demanded
3	UNCERTAIN – maintenance demanded
4	BAD – maintenance alarm
5	UNCERTAIN – process related, no maintenance required
6	BAD – process related, no maintenance
7	BAD – function check/local override
8	GOOD – function check
9	UNCERTAIN – self-test

Process Variable Code

Code	*Process Variable*
0	Volumetric Flow
1	Volume (Totalizer)
2	Mass Flow
3	Mass (Totalizer)
4	Velocity Flow
5	Temperature

Example:

UNCERTAIN (5)0,2,4 – The condition is "UNCERTAIN – process related, no maintenance required" for process variables volumetric flow, mass flow, and velocity flow.

Condensed Format

In the PROFIBUS Basic Instrument Level Diagnosis Bytes table, the **Condensed** Status column shows the status condition, which is based on the NAMUR NE 107 standard. NE 107 provides a way to convey status/diagnostics/alerts via a consistent use of terminology (text), icons, and colors, which prescribes how this type of information appears in the FDT/DTM graphical user interface (GUI) display.

The table below summarizes the Condensed status conditions as set forth by the PROFIBUS PA Profile for Process Control Devices v3.02 and the NAMUR NE 107 standard.

Table 22 – Condensed Status

Text ▸	Failure (F)	Out Of Specification (S)	Maintenance Required (M)	Check Function (C)	Good (G)
Icon, Color ▸					
Icon, Monochrome ▸					
Color ▸					

Using the ST80/ST80L PROFIBUS DP Service Transducer Block

The service transducer blocks provide instrument information/status for service functions which include diagnostics, troubleshooting, and calibration. A quick summary of relevant parameters are listed below.

Configuration Parameters (Instrument Information Service Transducer Block – see page 18)

FLOW_TYPE:	Use this parameter to set the instrument to one of three flow types: • Velocity Flow = 0x04 • Mass Flow = 0x02 • Volumetric Flow = 0x00
PLENUM_SIZE_VALUE1:	For **duct** (rectangular) applications only: Enter duct width value for this parameter. For **round** applications only: Enter diameter value for this parameter.
PLENUM_SIZE_VALUE2:	For **duct** (rectangular) applications only: Enter duct height value for this parameter. For **round** applications only: Enter "0" for this parameter.
WRITE_PROTECT_MODE:	Use this parameter to inhibit service port (USB or Ethernet) access, other than PROFIBUS DP, to the setup parameters. • Inhibit Service Port Access = 0x01 • Do Not Inhibit Service Port Access = 0x00
FACTORY_RESTORE:	Use this parameter to restore original factory-set calibration values to the current calibration group: • Factory Restore = 0x01

Information Parameters (Instrument Information Service Transducer Block – see page 18)

DEVICE_CO:	This read-only parameter presents the Customer Order number assigned to the instrument.
DEVICE_SERIAL_NUM:	This read-only parameter presents the instrument's serial number.
DEVICE_SOFTWARE_ VERSION:	This read-only parameter presents the instrument's software version.
SYSTEM_MODE_STATUS:	This R/W parameter indicates the following. • Instrument in service/diagnostic mode = 0x01 • Instrument in normal operation mode = 0x02

Troubleshooting Parameters (Troubleshooting Service Transducer Block – see page 20)

EXTENDED_CORE_DIAG-NOSTIC_STATUS	Use this parameter to read the four bytes of diagnosis information that make up the advanced, detailed diagnostic faults (mix of CORE and FE faults). See "Table 18 – ST80/ST80L PROFIBUS Detailed Instrument Level Diagnosis Bytes" on page 42.
FE_PROCESS_DATA (0-2):	To identify any sensor issues, use this parameter to read sensor process data (flow and temperature).
HEATER_1	Use this R/W parameter to turn ON/OFF the sensor heater: • Heater OFF = 0x01 • Heater ON = 0x00

Hardware Troubleshooting

To aid in troubleshooting, the PROFIBUS DP board is provided with LEDs to show power ON status, communication status with the main board's UART interface, and communication status between the instrument and a Class 1 master. Remove the instrument's blind lid to see the LEDs, which are shown in Figure 28 below.

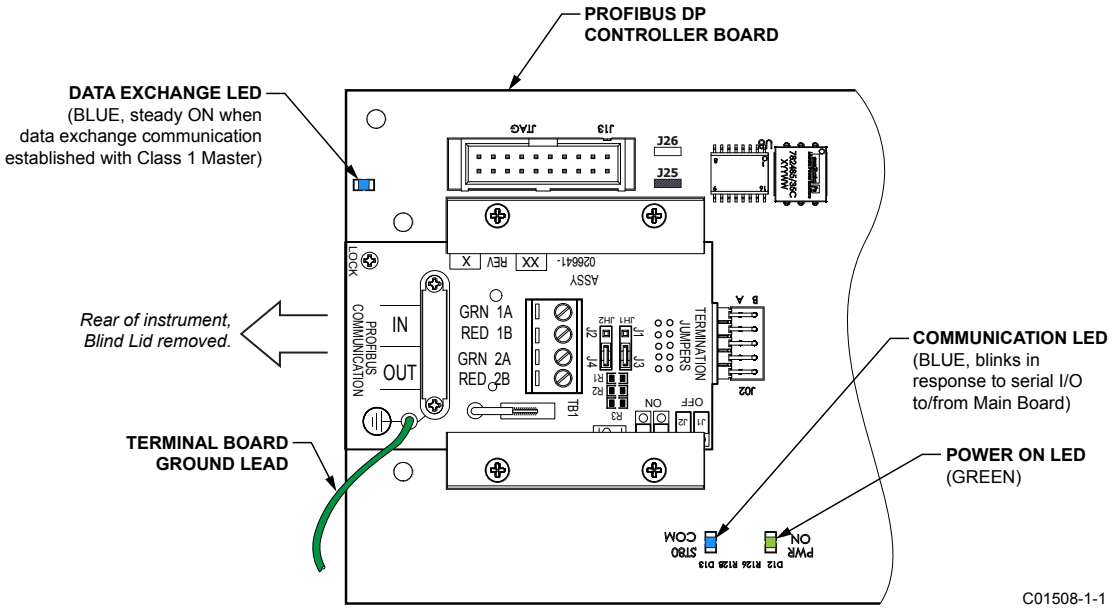

Figure 26 – PROFIBUS DP Board Status LEDs

APPENDIX A – CODES AND TABLES

Table 23 – ST80/ST80L PROFIBUS Engineering Unit Codes

Units Type	Description	PROFIBUS Codes (Dec / Hex)
TEMPERATURE	Degrees Celsius	1001 / 03E9
	Degrees Fahrenheit	1002 / 03EA
VOLUMETRIC	SCFS (Standard Cubic Feet per Second)	1604 / 0644
	SCFM (Standard Cubic Feet per Minute)	1360 / 0550
	SCFH (Standard Cubic Feet per Hour)	1361 / 0551
	SCFD (Standard Cubic Feet per Day)	1605 / 0645
	NCMS (Normal Cubic Meters per Second)	1588 / 0634
	NCMM (Normal Cubic Meters per Minute)	1589 / 0635
	NCMH (Normal Cubic Meters per Hour)	1590 / 0636
	NCMD (Normal Cubic Meters per Day)	1591 / 0637
	NLPS (Normal Litters per Second)	1592 / 0638
	NLPM (Normal Litters per Minute)	1593 / 0639
	NLPH (Normal Litters per Hour)	1594 / 063A
	NLPD (Normal Litters per Day)	1595 / 063B
MASS FLOW	LBPS (Pounds per Second)	1330 / 0532
	LBPM (Pounds per Minute)	1331 / 0533
	LBPH (Pounds per Hour)	1332 / 0534
	LBPD (Pounds per Day)	1333 / 0535
	KGPS (Kilograms per Second)	1322 / 052A
	KGPM (Kilograms per Minute)	1323 / 052B
	KGPH (Kilograms per Hour)	1324 / 052C
	KGPD (Kilograms per Day)	1325 / 052D
	TNPS (Metric Tonnes Per Second)	1326 / 052E
	TNPM (Metric Tonnes Per Minute)	1327 / 052F
	TNPH (Metric Tonnes Per Hour)	1328 / 0530
	TNPD (Metric Tonnes Per Day)	1329 / 0531
VELOCITY FLOW	SFPS (Standard Feet per Second)	1532 / 05FC
	SFPM (Standard Feet per Minute)	1533 / 05FD
	SFPH (Standard Feet per Hour)	1534 / 05FE
	SFPD (Standard Feet per Day)	1535 / 05FF
	NMPS (Normal Meters per Second)	1536 / 0600
	NMPM (Normal Meters per Minute)	1537 / 0601
	NMPH (Normal Meters per Hour)	1538 / 0602
	NMPD (Normal Meters per Day)	1539 / 0603
TOTALIZER	SCF (Standard Cubic Feet)	1053 / 041D
	NCM (Normal Cubic Meters)	1573 / 0601
	NL (Normal Liters)	1574 / 0626
	LB (Pounds)	1094 / 0446
	KG (Kilograms)	1088 / 0440
	TN (Metric Tonnes)	1092 / 0444
PLENUM/PIPE/ DUCT SIZE	In (inches)	1019 / 03FB
	mm (millimeters)	1013 / 03F5

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APPENDIX B – APPROVAL INFORMATION

EU Information

FLUID COMPONENTS INTERNATIONAL LLC

Statement of Continued Compliance for the ST80 with Profibus DP

This document for the ST80 with Profibus DP model is an amendment to the EU Declaration of Conformity for the ST80 Series, document 23EN000041.

Directive 2014/34/EU ATEX

Compliance to the ATEX directive 2014/34/EU is maintained, but only with an increased T-rating (T3 or above). The T6 to T4 ratings stated in the certificate are not allowed. See FCI document 07EN000465 for temperature test results.

Testing was performed at the worst case ambient temperature of 60°C for ST80 with and without Profibus DP. The results for the sample without Profibus DP confirm the original results obtained by FM Approvals:

T4/T135°C for -40°C < $T_{ambient}$ < +60°C

However, for the sample with Profibus DP, a component in the power supply rose to a temperature of 78°C. At an ambient of 60°C, plus an added 5°C margin required by the standard, the temperature of the entire system is 78°C + 60°C + 5°C = 143°C, which is 8°C above the T4's 135°C maximum rating. Therefore, the T-rating for ST80 with Profibus DP models to maintain valid ATEX compliance must be T3 or above.

T3/T200°C for -40°C < $T_{ambient}$ < +60°C
T2/T300°C for -40°C < $T_{ambient}$ < +60°C
T1/T450°C for -40°C < $T_{ambient}$ < +60°C

Directive 2014/30/EU Electromagnetic Compatibility (EMC)

Retesting was performed with positive results at TUV SUD, San Diego, CA, for all tests per IEC/EN 61000-6-2 and IEC/EN 61000-6-4 except as listed. The following were not performed as the electronics changes are not affected by these tests: IEC/EN 61000-4-2, IEC/EN 61000-4-5, IEC/EN 61000-4-8 and IEC/EN 61000-4-11.

Directive 2014/35/EU Low Voltage (LVD)

The Profibus DP electronics are low power and are on the secondary circuit. Compliance is maintained.

Directive 2014/68/EU Pressure Equipment (PED)

PED is not affected by the addition of Profibus DP. Compliance is maintained.

Directive 2011/65/EU RoHS 2

The ST80 with Profibus DP will be built in the same fashion as the standard ST80. Compliance is maintained.

Issued at San Marcos, California USA
July 2019

Manuel Liong Jr
2019.07.09 15:02:10
-07'00'

Manuel Liong, Qualifications Engineer

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Doc no. 23EN000045A

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APPENDIX C – CUSTOMER SERVICE

FCI provides full in-house technical support. Additional technical representation is also provided by FCI field representatives.

By Mail

Fluid Components International LLC

1755 La Costa Meadows Dr.

San Marcos, CA 92078-5115 USA

Attn: Customer Service Department

By Phone

Contact the area FCI regional representative. If a field representative is unable to be contacted or if a situation is unable to be resolved, contact the FCI Customer Service Department toll free at 1 (800) 854-1993.

By Fax

To describe problems in a graphical or pictorial manner, send a fax including a phone or fax number to the regional representative. Again, FCI is available by facsimile if all possibilities have been exhausted with the authorized factory representative. Our fax number is 1 (760) 736-6250; it is available 7 days a week, 24 hours a day.

By Email

FCI Customer Service can be contacted by email at: techsupport@fluidcomponents.com.

Describe the problem in detail making sure a telephone number and best time to be contacted is stated in the email.

International Support

For product information or product support outside the contiguous United States, Alaska, or Hawaii, contact your country's FCI International Representative or the one nearest to you.

After Hours Support

For product information visit FCI at www.fluidcomponents.com. For product support call 1 (800) 854-1993 and follow the prerecorded instructions.

Point of Contact

The point of contact for service, or return of equipment to FCI is your authorized FCI sales/service office. To locate the office nearest you, go to www.fluidcomponents.com.

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