FLUID COMPONENTS INTERNATIONAL LLC

HART Operation Manual

ST100 Series
Thermal Mass Flow Meter

HART® COMMUNICATION PROTOCOL

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Introduction

This manual describes the ST100 HART protocol 7.3 features, its operation and configuration. The ST100 can provide up to 4 different process variables. It provides Flow, Temperature, Flow Totalizer, and Pressure, as outputs. The flow output can be selected as Volumetric, Mass or Velocity units. The ST102 and ST112 can support up to two flow sensors and provides the average flow of the two sensors in a single output.

This documents is written to be used with all members of the ST100 product family configured with the HART 7.3 communication Protocol.

The HART output is provided through an extension card that is fully integrated into the ST100 instrument.

Definition

Universal HART Commands

A collection of commands that must be supported by all HART compatible devices. The Universal Command Specification establishes the minimum Application layer support required of all HART devices. The Application layer defines the commands, responses, data types and status reporting supported by the Protocol.

Common Practice HART Commands

A collection of commands applicable to a wide range of devices. These commands shall be supported by devices whenever possible. The HART Common Practice Commands enhances interoperability by providing additional standardized, device-independent commands.

Device Specific Commands

Commands defined by the manufacturer according to the need of the Field device. The manufacturer of the Field device controls these commands. The FCI ST100 family of products has 20 manufacturer specific commands.

EDDL/DD Files

Text files interpreted by the host system. The EDDL file is a file that tells the host what functionality the device (ST100) has, and how the functionality is invoked. The EDDL also tells the host to do common maintenance functions such as calibration, configuration check status of individual sensors, change engineering units, etc.

FCI Configurator

A PC software tool that gives access to the ST100 functions and features. It facilitates basic instrument setup and configuration, as well as advance functions. The FCI configurator can interface through the ST100 USB Service port or the Ethernet Service port.

Installation

General

For details on the general mounting, placement of sensor head and mounting options see the Basic User Manual, 06EN003400.

Electrical Wiring

Access the wiring terminal block by removing the rear electrical connection cover. This cover can be locked closed by the cover locking screw. Release the cover locking screw and remove the cover.

Cable access to wiring connections is obtained through one of the four conduit outlets, see Figure 6 below.

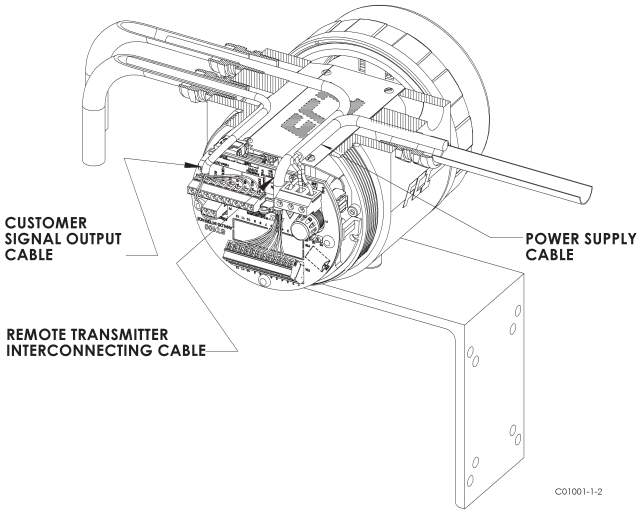


Figure 6 - Instrument Wiring

The HART connections for the ST100 are located in the back panel. The connector for the HART is P1A; the pins are labeled “CH1” and “RTN 1/2”. The ST100 HART connections are non- polarized, but polarity needs to be observed for other manufacturer’s devices. Connect the HART bus cable as noted below. See Appendix A for Channel 1 HART Connections on instruments shippped before April 2012.

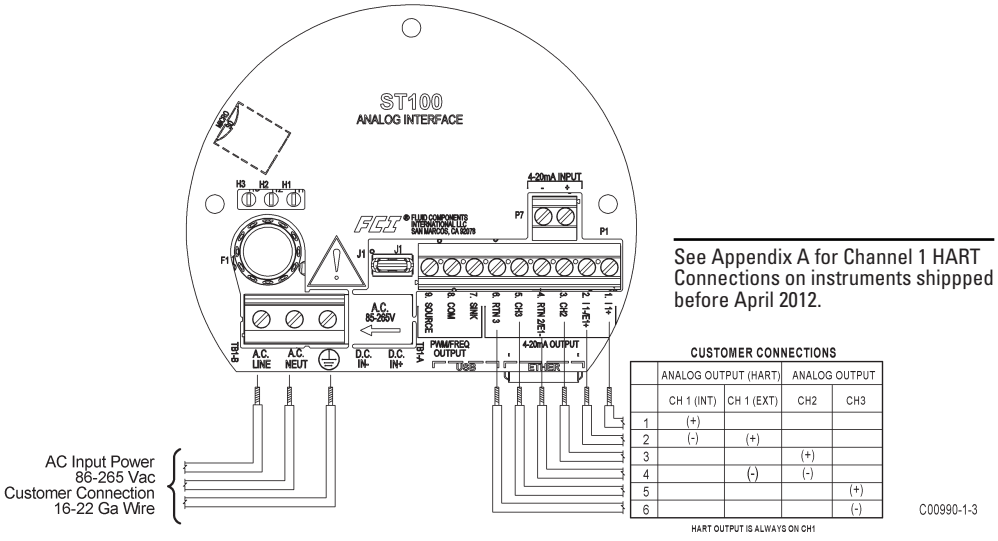


Figure 1 - HART Output Wiring Table

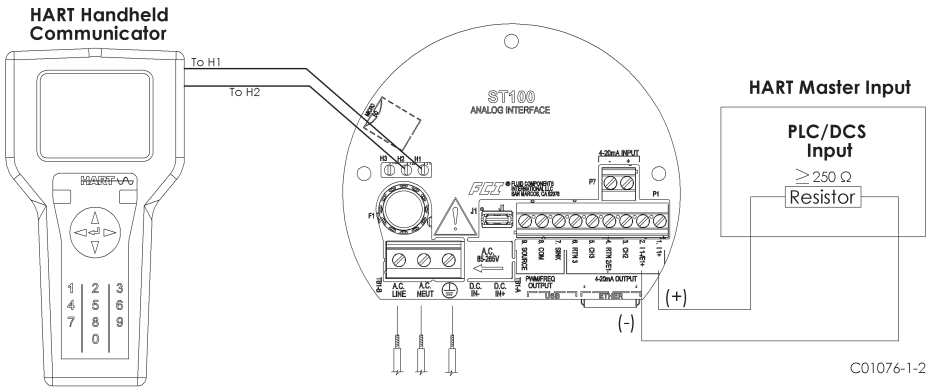


Figure 2 - Detail Internal Power Supply connection for Non-Network

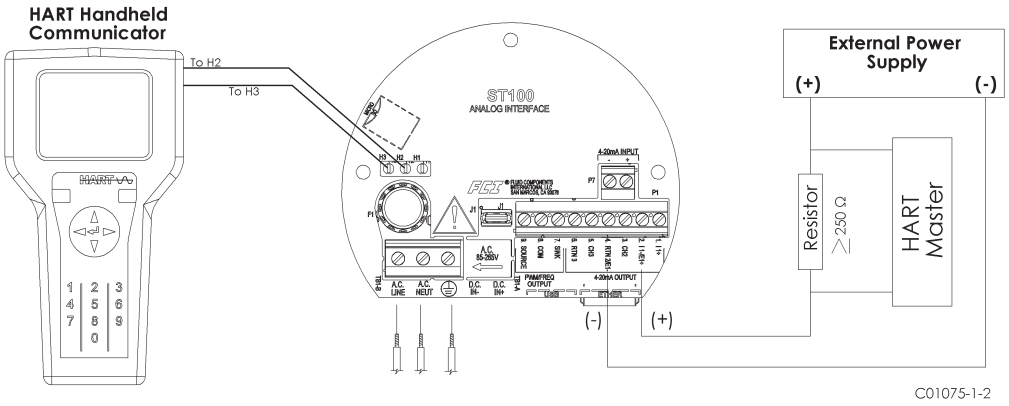


Figure 3 - Detail External Power Supply connection for Non-Network

Topology and Network Configuration

The ST100 supports Multidrop topology. In multidrop operation, the devices exchange data and measured values only via the HART protocol/HART Network. In Network configuration the analog current signal serves just to energize the two-wire devices, providing a current of 4 mA per instrument.

In multidrop mode, up to 15 field devices are connected in parallel to a single wire pair or segment (Figure 4). The host distinguishes the field devices by their preset addresses that range from 1 to 255. The factory preset address is 0.

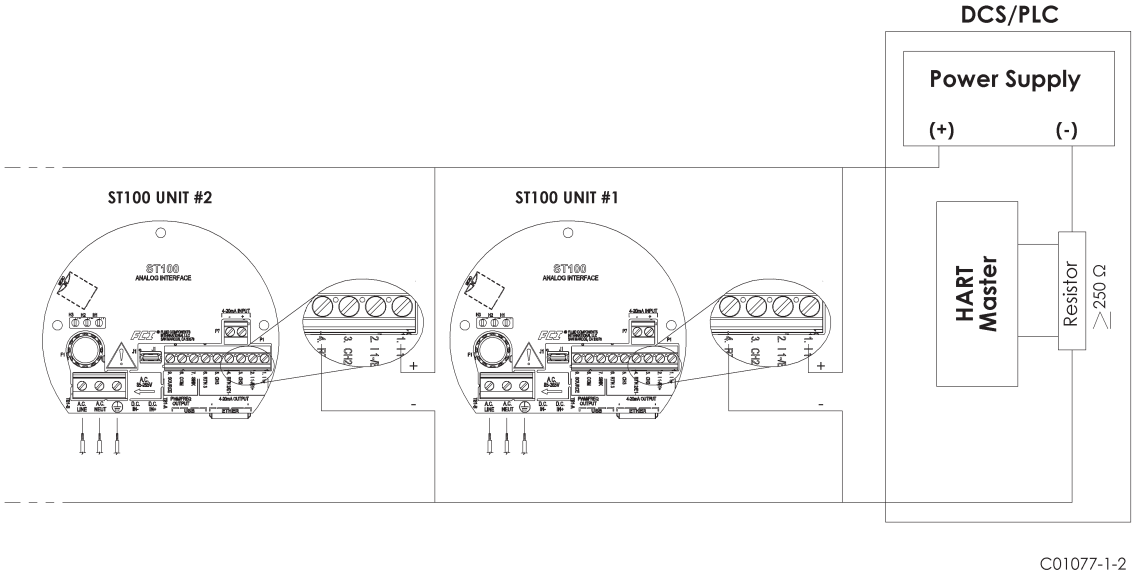


Figure 4 - Multidrop Mode with HART Transmitters

Operation

Functional Description

The primary function of the HART protocol is to present the instruments process data through its process data commands. Command 1, command 3 and command 9.

The ST100 does not implement the HART Burst mode. A HART master that supports HART 7.0 and higher is required. A HART communicator that supports HART 7.0 and higher is required (e.g., Emerson 475 Communicator.)

Process Data Operation

Even though HART 7.0 is compatible with older versions of the HART protocol, the ST100 HART implementation and commands 1 and 3 are still supported, they contain the Flow Variable only, for the full set of Dynamic variables it is recommended that the HART master use command 9 to request process data of dynamic variables and status.

ST100 HART Process Data Organization

It is important to briefly review how the ST100 Process data is organized under the HART command 9. For Details on Command 9 see the HART Specification "Universal Commands Specification" HCF_SPEC-127, Revision 7.1.

Not all the variables described in this section are available in all configurations of the ST100 flow meter. For example not all configurations have Process Pressure, and instruments that output Mass Flow or Volumetric flow, the Flow Totalizer may be turned on or off.

The following are the ST100 process variables that are provided through HART command 9.

There are 3 flow classes or types, and these are "Exclusively OR" meaning that only one class of flow is active at a time.

PROCESS VARIABLE	SLOT #	HART VARIABLE CODE DESCRIPTION	DEVICE VARIABLE CODE	DEVICE VARIABLE CLASSIFICATION
VOLUMETRIC FLOW *	0	PRIMARY VARIABLE	0	66
MASS FLOW *	2	PRIMARY VARIABLE	2	72
VELOCITY FLOW *	4	PRIMARY VARIABLE	4	67
VOLUME (TOTALIZER)	1	SECONDARY VARIABLE	1	68
MASS (TOTALIZER)	3	SECONDARY VARIABLE	3	71
TEMPERATURE	5	TERTIARY VARIABLE	5	64
PRESSURE	6	QUATERNARY VARIABLE	6	65

* Implies an "Exclusive OR" Releationship

Under the "Device Variable Status" parameter, for each process variable, only the four most significant bits are used.

The two most significant bits contain

"Process Data Status": 11 = good
01 = Poor Accuracy
10 = manual/fixed
00 = bad

The two bits after the two most significant contain

"Limit Status": 11 = constant
01 = low limited
10 = high limited
00 = not limited

Device variable status example: 1100XXXX.X, variable values indicated in positions represented by an 'X' can be ignored.

Device Description Files

EDDL Files

TThe ST100 EDDL files are support files that provide an extended description of each object in the Virtual Field Device (VFD), and provide information needed for a control system or host to understand the meaning of the data in the VFD including the human interface. The EDDL file can be thought as a "driver" for the device.

FCI provides two types of files; first the standard EDDL files located in the folder A67F0101, and the Emerson 375 and 475 files located in the folder DDP.

A67F0101Folder:

0101.fm8

A67F0101.ddl

DDP Folder:

00A67F0101.hdd

00A67F0101.hhd

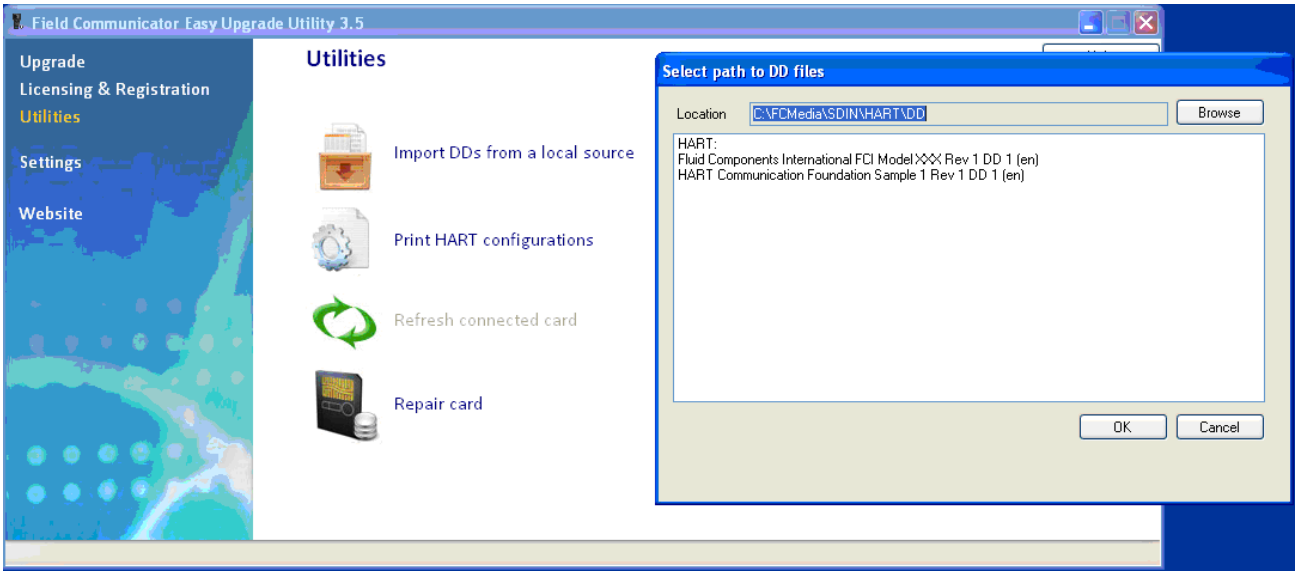
0101.fm8

A67F0101.ddl

Loading the DD Files to the 475 Field Communicator

In order to load the DDPs into the Field Communicator the "Easy Upgrade Utility from EMERSON must be used. Below is the procedure for how to load DD files into the 475-Field communicator.

Open Field Communicator Easy Upgrade Utility program and click Utilities on the left hand menu; select Import DDs from local source. The following window should pop up:



Select the FCI files and press "OK".

Service Data Operation

The Service Data functions are organized into 3 areas:

1. ST100 Basic Setup
2. ST100 Configuration
3. ST100 Factory Calibration Limits

The service information is presented here as seen through the 475 HART communicator, with FCI's EDDL files loaded. The same information seen by the 475 is shown in the DCS when the ST100 HART EDDL files are loaded.

ST100 Basic Setup

The Basic Setup function includes the ability to review and change the engineering units of the process variables, review and change the Plenum or pipe size, enable or disable the Totalizer, review and change device information, reset the operation of the ST100 to the factory settings, enable or disable the write protect, and PV Setup.

Engineering Units Information

Factory Reset

WARNING

The factory Reset command re-loads the configuration and calibration parameters that were loaded into the instrument during the original cal and setup. Any changes made to the configuration of calibration parameters will be lost when the Factory Reset command is executed.

ST100 Configuration

The configuration functions facilitate the setup of the individual 4 - 20 mA current output channels.

ST100 Calibration Limits (example)

The ST100 Calibration Limits function provide you with the ability to review the limits that have been set for each of the following process parameters: Flow, Temperature, and Pressure.

Setting the ST100 for the HART Protocol Operation

Note: If the ST100 was ordered as a 4-20 mA analog current output or a HART device, the factory will have configured the instrument for HART operation, and it should not be necessary to do any instrument configuration.

The ST100 PC Configurator tool is used to select the communication protocol with instrument power ON. In normal operating conditions, connect the PC with the configurator software to the ST100 USB port using FCI's cable (P/N 022646).

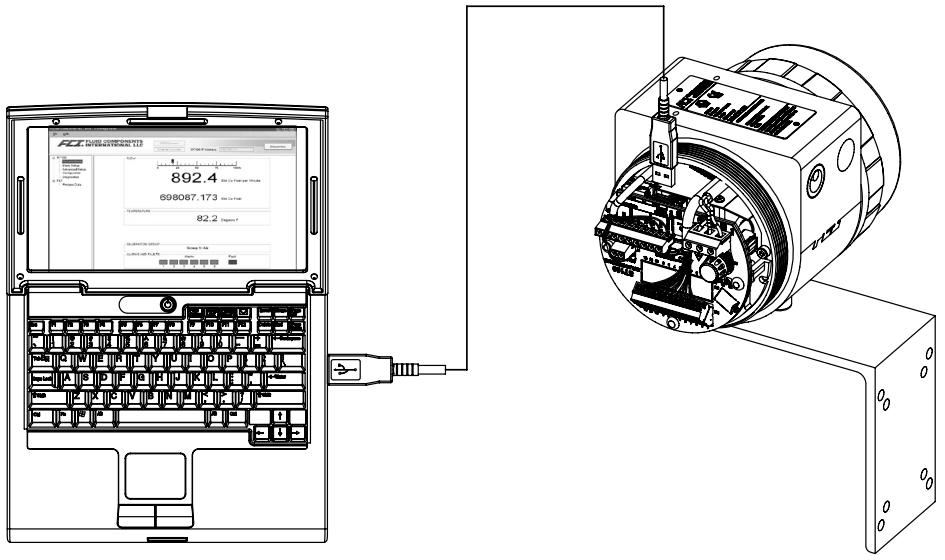


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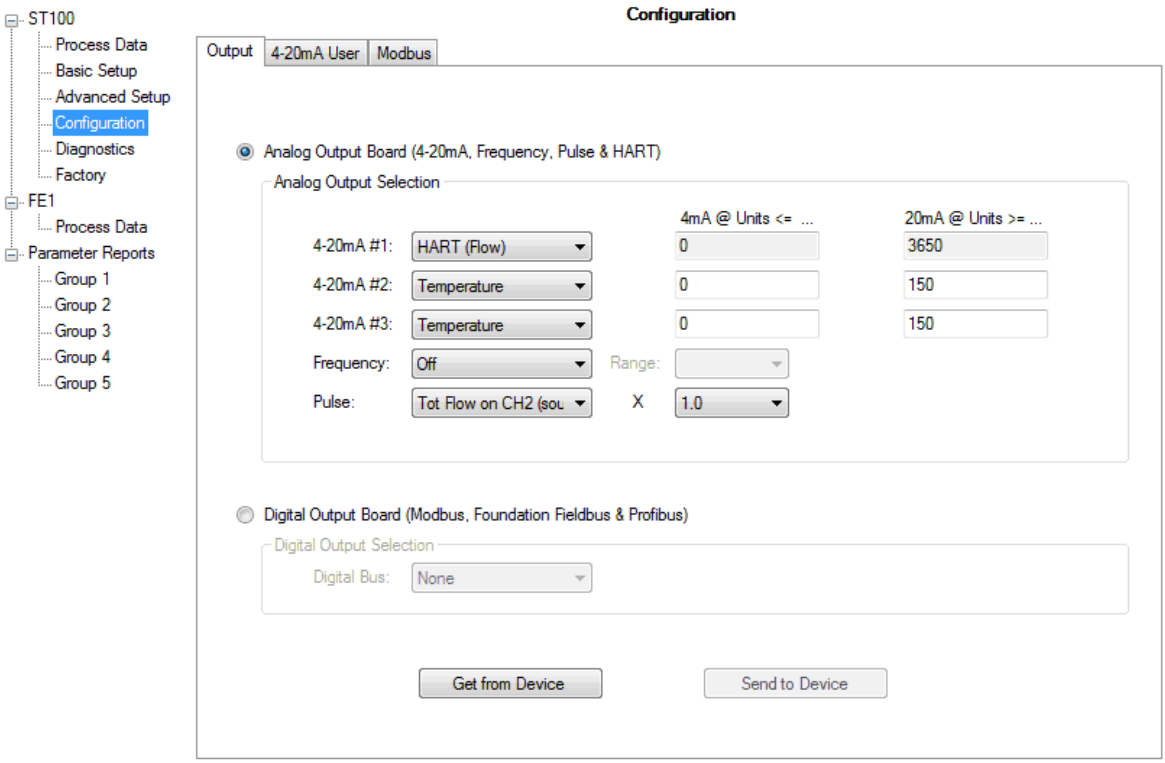
Figure 5 - Communication via the USB Port

To configure the ST100 for HART open the ST100 Configurator  . From the tree menu, on the left side select "Configuration", and then select the "Output" tab. In the Output tab select "Analog Output Board" and then select "4-20mA channel #1 as HART". Verify the 4-20mA range values meet the process requirements. Then press the "Send to Device" button to download the setting to the ST100 instrument.



ST100 HART Command List

The ST100 HART commands are divided into three classes.

- Universal Commands
- Common Practice Commands
- Device Specific Commands

ST100 HART Universal Commands

The ST100 HART supports Universal Commands 0 through 22. Commands 4 and 5 are reserved under Universal Command Specification Rev. 7.1 (HCF_SPEC-127, Revision 7.1) and not implemented in this specification. There is no HART command 10.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
0	READ UNIQUE IDENTIFIER -	
	"254"	"254" UNSIGNED-8
	EXPANDED DEVICE TYPE	EXPAND DEV TYPE ENUM (2 BYTE)
	MINIMUM PREAMBLES - REQUEST	MIN # PREAMBLES UNSIGNED-8
	HART PROTOCOL MAJOR REV	HART PROTOCOL REV. UNSIGNED-8
	DEVICE REVISION LEVEL	DEV. REV LEVEL UNSIGNED-8
	DEVICE SOFTWARE REVISION LEVEL	SOFTWARE REV. LEVEL UNSIGNED-8
	ELECTRONICS REVISION LEVEL (HARDWARE)	ELECTRONICS REV. LEVEL UNSIGNED-8
	PHYSICAL SIGNALING CODE CODE 0 = BELL 202 CURRENT	STAK SOFT. REV ENUM (1 BYTE)
	FLAGS CODE 01 = MULTI SENSOR	FLAGS ENUM (1 BYTE)
	DEVICE ID	DEV. ID NUMB. UNSIGNED-24
	MINIMUM PREAMBLES - RESPONSE	UNSIGNED-8
	MAXIMUM # OF VARIBLES	MAX # VARIABLES UNSIGNED-8
	CONFIGURATION CHANGE COUNTER	CONFIG CHANGE COUNT UNSIGNED-16
	EXTENDED FIELD DEVICE STATUS	UNSIGNED-8
	MANUFACTURER ID CODE FCI CODE = 166 DEC (00A6)	ENUM (2 BYTES)
	PRIVATE LABEL DIST. CODE	ENUM (2 BYTES)
	DEVICE PROFILE CODE	ENUM (2 BYTES)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
1	READ PV VARIABLE (FLOW UNITS, & FLOW VALUE)	PV UNITS CODE CHAR (1 BYTE) PV VALUE FLOAT (4 BYTE)
2	READ PV CURRENT AND % RANGE	PV I VALUE (mA) FLOAT (4 BYTE) % PV VALUE FLOAT (4 BYTE)
3	READ PV CURRENT OUT & ALL DYNAMIC VARIABLES FLOW UNITS FLOW VALUE	PV I VALUE (mA) FLOAT (4 BYTE) PV UNITS CODE CHAR (1 BYTE) PV VALUE (4 BYTE)
6	WRITE NODE ID (WRITE POLLING ADDRESS)	POLLING ADDRS CHAR (1 BYTES) LOOP CUR MODE CHAR (1 BYTES)
7	READ LOOP CONFIGURATION	POLLING ADDRS CHAR (1 BYTES) LOOP CUR MODE CHAR (1 BYTES)
8	READ DYNAMIC VARIABLE CLASSIFICATIONS	ENUM (4 BYTES)
9	READ DEVICE VARIABLES WITH STATUS (UP TO 8 SLOTS) EXTENDED FIELD DEVICE STATUS SLOT X DEV. VARIABLE CODE SLOT X DEV. VARIABLE CLASS SLOT X UNITS COD SLOT X DEV. VARIABLE VALUE SLOT X DEV. VARIABLE STATUS	 BITMAP UNSIGNED-8 (1 BYTE) ENUM (1 BYTE) ENUM (1 BYTE) FLOAT (4 BYTE) BITS (1 BYTE)
9	SLOT X DATA TIME STAMP (BYTES 65 - 68)	UNSIGNED-8 (4 BYTES)
11	READ UNIQUE IDENTIFIER ASSOCIATED W/TAG NOTE: SAME AS COMMAND "0" (SEE COMMAND "0")	UNIQ. ID (TAG) BITSTRING (12 BYTES)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
12	READ USER MESSAGE	DEV. ID NUMB. BITSTRING (12 BYTES)
13	READ TAG	TAG ASCII BIT STRING (6 BYTES)
	READ DESCRIPTOR	DESCRIPTOR ASCII BIT STRING (12 BYTES)
	READ DATE CODE	DATE ASCII BIT STRING (5 BYTES)
14	READ PV SENSOR INFO SENSOR SERIAL NUMBER	SENSOR S/N UNSIGNED-24
	LIMITS UNITS CODE - PV	LIMITS UNITS CODES ENUM (1BYTE)
	UPPER SENSOR LIMIT - PV	UPPER SENSOR LIMIT FLOAT (4 BYTES)
	LOWER SENSOR LIMIT - PV	LOWER SENS LIMITS FLOAT (4 BYTES)
	MIN SPAN - PV	MIN SPAN FLOAT (4 BYTES)
15	READ OUTPUT INFORMATION ALARM SELECT CODE	ALRM SEL. CODE ENUM (1BYTE)
	TRANSFER FUNCTION CODE	TRN. FUNC. CODE CHAR (1BYTE)
	FLOW RANGE UNITS CODE	RNG UNITS CODE CHAR (1BYTE)
	FLOW UPPER-RANGE VAL	UP RANG VALUE FLOAT (4 BYTES)
	FLOW LOWER-RANGE VAL	LO RANG VALUE FLOAT (4 BYTES)
	FLOW DAMPING VALUE	DAMPING VALUE FLOAT (4 BYTES)
	WRITE PROTECT CODE	W PROTECT CODE ENUM (1BYTE)
	RESERVED (SET TO 250)	RESERVED ENUM (1BYTE)
16	READ FINAL ASSEMBLY NUMBER ASSEMBLY NUMBER	ASSEMB. # UNSIGNED-24
17	WRITE MESSAGE MESSAGE	BITSTRING (24 BYTES)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
18	WRITE TAG, DESCRIPTOR, DATE TAG DESCRIPTOR DATE	 TAG BITSTRING (6 BYTES) DESCRIPTOR BITSTRING (12 BYTES) DATE CHAR (3 BYTES)
19	WRITE FINAL ASSEMBLY NUMBER ASSEMBLY NUMBER	 ASSEMB. # UNSIGNED-24
20	READ LONG TAG LONG TAG	 LONG TAG BITSTRING (32 BYTES)
21	READ UNIQUE INDENTIFIER ASSOCIATED WITH LONG TAG UNIQUE IDENTIFIER	UNIQ. ID BITSTRING (32 BYTES)
22	WRITE LONG TAG LONG TAG	 LONG TAG BITSTRING (32 BYTES)

ST100 HART Common Practice Commands

The ST100 HART supports Common Practice commands 35, 38, 40, 42, 44, 45, 46, 48, 50, and 51.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
35	WRITE PV RANGE VALUES	
		RNG UNITS CODE UNSIGNED-8
	UPPER RANGE VALUE	UPPER-RNG VAL FLOAT (4 BYTES)
	LOWER RANGE VALUE	LOWER-RANGE VALUE FLOAT (4 BYTES)
38	RESET "CONFIGURATION CHANGE" FLAG	RESET CONFIG. CHANGE. FLAG UNSIGNED-8
40	ENTER/EXIT FIXED CURRENT MODE (IN mA) Value =0 means exit fixed current mode	I MODE SELECT FLOAT (4 BYTES)
42	PERFORM DEVICE RESET	RESET INSTRUM. UNSIGNED-8
44	WRITE PV UNITS	PV UNITS CODE ENUM (1BYTE)
45	TRIM DAC ZERO - MEASURED CURRENT CHAN #1 IN (mA)	TRIM_DAC_ZERO FLOAT (4 BYTES)
46	TRIM DAC GAIN - MEASURED CURRENT CHAN #1 IN (mA)	TRIM_DAC_GAIN FLOAT (4 BYTES)
48	READ ADDITIONAL DEVICE STATUS	25 BYTES
	DEVICE-SPECIFIC STATUS	6 BYTES
	EXTENDED DEVICE STATUS	1 BYTE
	DEVICE OPERATING MODE	1 BYTE
	STANDARIZED STATUS 0	1 BYTE
	STANDARIZED STATUS 1	1 BYTE
	ANALOG CHAN SATURATED	1 BYTE
	STANDARIZED STATUS 2	1 BYTE

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
48	STANDARIZED STATUS 3	1 BYTE
	ANALOG CHAN FIXED	1 BYTE
	DEVICE SPECIFIC STATUS	11 BYTES
50	READ DYNAMIC VARIABLE ASSIGNMENTS	
	PRIMARY DEVICE VARIABLE	1 BYTE
	SECONDARY DEVICE VARIABLE	N/A
	TERTIARY DEVICE VARIABLE	N/A
	QUATERNARY DEVICE VARIABLE	N/A
51	WRITE DYNAMIC VARIABLE ASSIGNMENTS	1 BYTE
	PRIMARY DEVICE VARIABLE	1 BYTE
	SECONDARY DEVICE VARIABLE	N/A
	TERTIARY DEVICE VARIABLE	N/A
	QUATERNARY DEVICE VARIABLE	N/A

ST100 HART Device Specific Commands

The ST100 HART supports 20 Device Specific commands.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
137	READ TOTALIZER VALUE	READ TOTALIZER FLOAT (4BYTES)
138	READ TOTALIZER STATE	READ TOT STATE UNSIGNED-8
139	WRITE TOTALIZER STATE	READ TOT STATE UNSIGNED-8
140	READ DEVICE INFORMATION	
	DEVICE CO	DEVICE CO ASCII BITSTRING (10 BYTES)
	DEVICE SERIAL NUMBER	DEVICE S/N ASCII BITSTRING (10 BYTES)
	DEVICE SOFTWARE VER	DEV SOFTW VER ASCII BITSTRING (4 BYTE)
159	WRITE FACTORY RESTORE	FACT_RESTORE ENUM (1 BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
145	READ CUSTOMER ENGINEERING UNITS	
	FLOW UNITS CODE	FLOW CODE UNSIGNED-8
	TEMPERATURE UNITS CODE	TEMP CODE UNSIGNED-8
	TOTALIZER UNITS CODE	TOTAL CODE UNSIGNED-8
	PRESSURE UNITS CODE	PRESS CODE UNSIGNED-8
146	WRITE CUSTOMER ENGINEERING UNITS	
	FLOW UNITS CODE	FLOW CODE UNSIGNED-8
	TEMPERATURE UNITS CODE	TEMP CODE UNSIGNED-8
	TOTALIZER UNITS CODE	TOTAL CODE UNSIGNED-8
	PRESSURE UNITS CODE (optional)	PRESS CODE UNSIGNED-8
148	READ PLENUM INFORMATION (PIPE SIZE)	
	PLENUM HEIGHT VALUE	PIPE_HEIGHT FLOAT (4BYTES)
	PLENUM WIDTH (DIAM) VALUE	PIPE_WIDTH FLOAT (4BYTES)
	PLENUM UNITS CODE	PIPE_CODE UNSIGNED-8
149	WRITE PLENUM INFORMATION (PIPE SIZE)	
	PLENUM HEIGHT VALUE	PIPE_HEIGHT FLOAT (4BYTES)
	PLENUM WIDTH (DIAM) VALUE	PIPE_WIDTH FLOAT (4BYTES)
	PLENUM UNITS CODE	PIPE_CODE UNSIGNED-8
150	WRITE "WRITE PROTECT" MODE	WRITE_PROT UNSIGNED-8

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
160	WRITE (4-20mA) OUTPUT CHANNEL #1 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ1
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF1
		UNSIGNED-16
	CHANNEL #1 OUT VARIABLE	CHA_1_PRO_VAR
		UNSIGNED-8
161	READ (4-20mA) OUTPUT CHANNEL #1 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ1
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF1
		UNSIGNED-16
	CHANNEL #1 OUT VARIABLE	CHA_1_PRO_VAR
		UNSIGNED-8
163	WRITE (4-20mA) OUTPUT CHANNEL #2 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ2
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF2
		UNSIGNED-16
	CHANNEL #2 OUT VARIABLE	CHA_2_PRO_VAR
		UNSIGNED-8
164	READ (4-20mA) OUTPUT CHANNEL #2 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ2
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF2
		UNSIGNED-16
	CHANNEL #2 OUT VARIABLE	CHA_2_PRO_VAR
		UNSIGNED-8
166	WRITE (4-20mA) OUTPUT CHANNEL #3 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ3
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF3
		UNSIGNED-16
	CHANNEL #3 OUT VARIABLE	CHA_3_PRO_VAR
		UNSIGNED-8
167	READ (4-20mA) OUTPUT CHANNEL #3 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ3
		UNSIGNED-16
	D/A SETTING FOR 20mA OUT	OUTF3
		UNSIGNED-16
	CHANNEL #3 OUT VARIABLE	CHA_3_PRO_VAR
		UNSIGNED-8

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
170	READ BANK #1 OF SENSOR VARIABLES	
	FLOW VALUE -SENSOR #1	FLOW1_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#1	TEMP1_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#1	PRESS1_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #2	FLOW2_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#2	TEMP2_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#2	PRESS2_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #3	FLOW3_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#3	TEMP3_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#3	PRESS3_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #4	FLOW4_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#4	TEMP4_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#4	PRESS4_VAL
		FLOAT (4BYTES)
151	READ CAL FLOW LIMITS	
	FLOW LOWER LIMIT	FLOW_LO_LIM
		FLOAT (4BYTES)
	FLOW UPPER LIMIT	FLOW_UP_LIM
		FLOAT (4BYTES)
154	READ CAL TEMP. LIMITS	
	TEMPERATURE LOWER LIMITS	TEMP_LO_LIM
		FLOAT (4BYTES)
	TEMPERATURE UPPER LIMITS	TEMP_UP_LIM
		FLOAT (4BYTES)
157	READ CAL PRESS. LIMITS	
	PRESSURE LOWER LIMIT	PRESS_LO_LIM
		FLOAT (4BYTES)
	PRESSURE UPPER LIMIT	PRESS_UP_LIM
		FLOAT (4BYTES)

Description of Write Commands

COMMANDS	VALUE	DESCRIPTION
6	Zero for pooling add., loop current mode 1	Zero= default address Loop current- 1=enable, 0=disable
17	24 bytes	Write any message to the device
18	21 bytes	0-5 bytes=Tag 6-17=Descriptor 18-20=date
19	3 bytes	Write final assembly number to the device
22	32 bytes	Write 32-byte long tag
35	9 bytes	0=upper & lower range values unit code 1-4=upper range value 5-8=lower range value
40	4 bytes	The device is placed in fixed current mode with the loop current set to the value received
42		Reset the device before slave time out
44	1 byte	Select the units in which the primary variable & its range will be returned
45	4 bytes	Trim the zero or lower end point value of the loop current exactly to its minimum
46	4 bytes	Trim the gain or upper end point value of the loop current exactly to its maximum
51	4 bytes	Assigns device variables to the PV, SV, TV and QV
139	1 byte	0=disable totalizer 1=enable totalizer
146	4 bytes	Write customer engineering units for Flow, Temperature, Totalizer and Pressure
149	9 bytes	0-3= Plenum height value 4-7= Plenum width value 8= Plenum unit code
150	1 byte	0= Disable write protect 1= Enable write protect
159	1 byte	Write factory restore
160	5 bytes	0-1= DAC settings for 4mA 2-3= DAC settings for 20mA 4= Channel #1 out variable
161	5 bytes	0-1= DAC settings for 4mA 2-3= DAC settings for 20mA 4= Channel #2 out variable
162	5 bytes	0-1= DAC settings for 4mA 2-3= DAC settings for 20mA 4= Channel #3 out variable

ST100 HART DTM

The ST100 product of family supports FDT-DTM Functionality through the HART Protocol 7.3. Fluid Components International provides DTM files for the ST100 HART device. This chapter describes the following:

- What is FDT-DTM Technology
- How it works with ST100 HART device
- Examples/Screenshots for ST100 HART DTM

What is FDT-DTM Technology?

Field devices have gained intelligence along with the spread of digital communication. As the number of intelligent devices increases, the more complicated settings and adjustments needed to use the advance functions in such devices. FDT (Field Device Tool) is a software architecture that lets field devices be set and adjusted in an open framework independent of a specific host system. FDT standardizes the communication and configuration interface between all field devices and host systems. FDT provides a common environment for accessing the device's most sophisticated features.

DTM stands for Device Type Manager, which at its core is a device driver. There are two DTM categories.

1. Device DTMs which connect to the field device configuration components

2. Communication DTMs which connect to the software communication components.

The DTM provides a unified structure for accessing device parameters, configuring and operating the devices, and diagnosing problems. DTMs can range from a simple Graphical User Interface for setting device parameters to a highly sophisticated application capable of performing complex real-time calculations for diagnosis and maintenance purposes.

How it works with the ST100 HART device?

The relationship between the FDT frame application and DTM is similar to that between the Windows Office application and Printer driver. A dedicated printer driver is provided for each printer and a standard interface is available in each printer driver. The Office applications can print data on any printer via this standard interface. In FDT, a DTM driver specific to a field device is provided and a standard interface is available in this driver. FDT frame applications such as the engineering system and asset management system can use the field devices via the FDT interface.

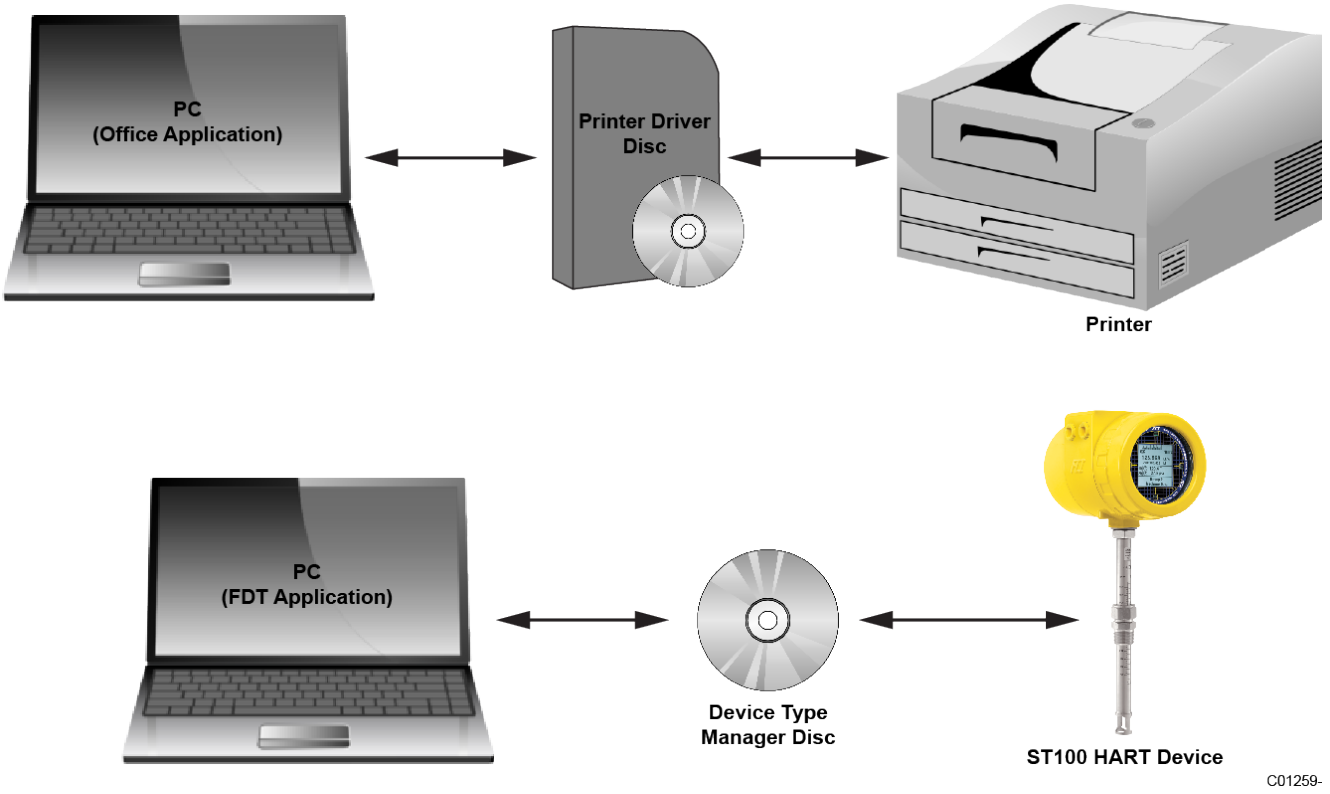


Figure 6 - Device Driver/FDT Device Manager Example

ST100 HART DTM Installation and Setup examples

In the installation process, there are three basic software components required: 1) FDT frame software such as PACTware, 2) an executable DTM file from the manufacturer (FCI) and 3) Comm_DTM for HART protocol communication.

Install device DTM prior to PACTWare and Comm_DTM components. Once device DTM is downloaded successfully run it on the PC. After that download and install Comm_DTM onto the system.

Below figure shows the basic setup requirements for ST100 HART DTM.

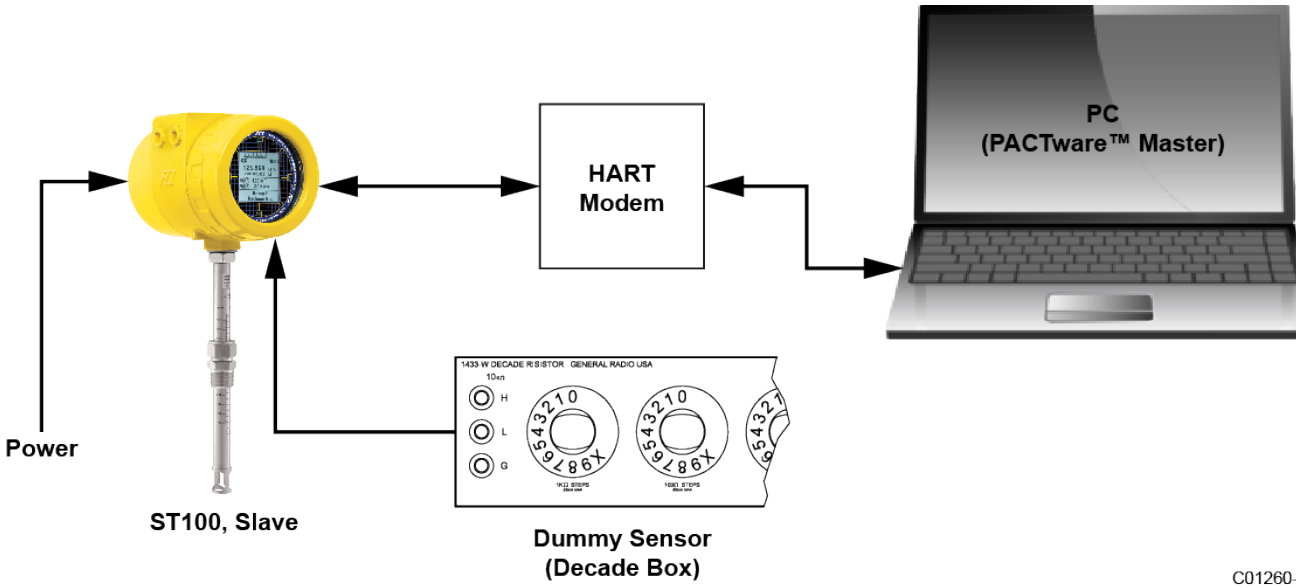
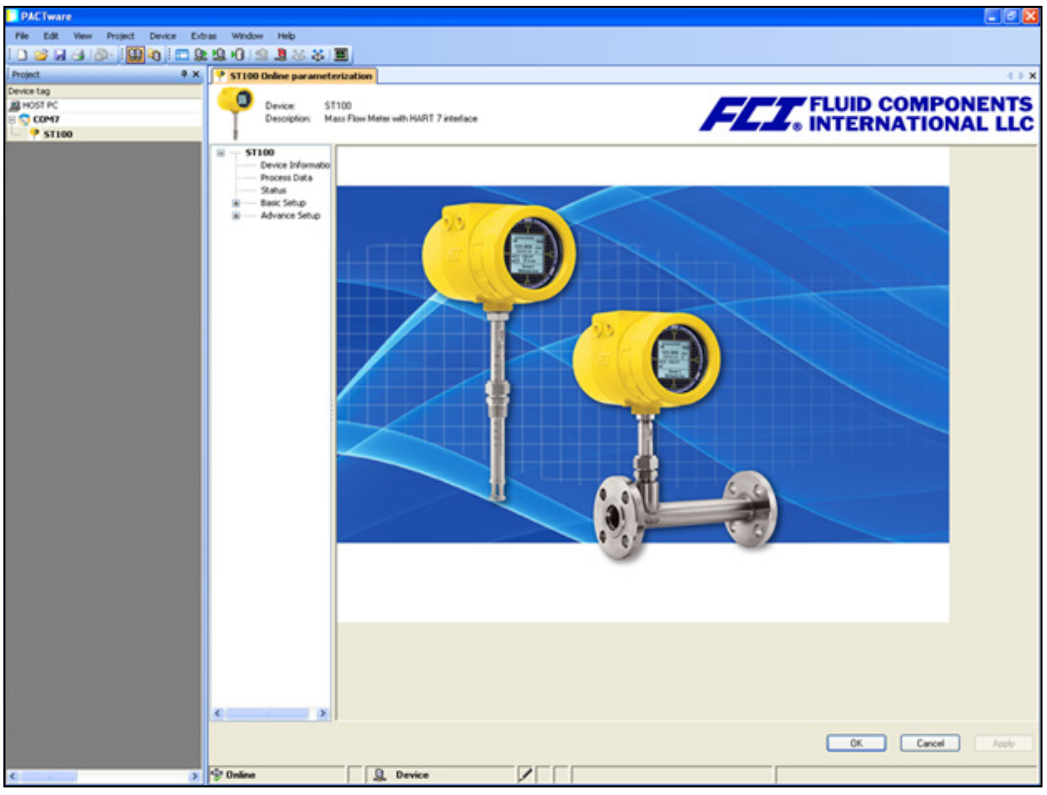
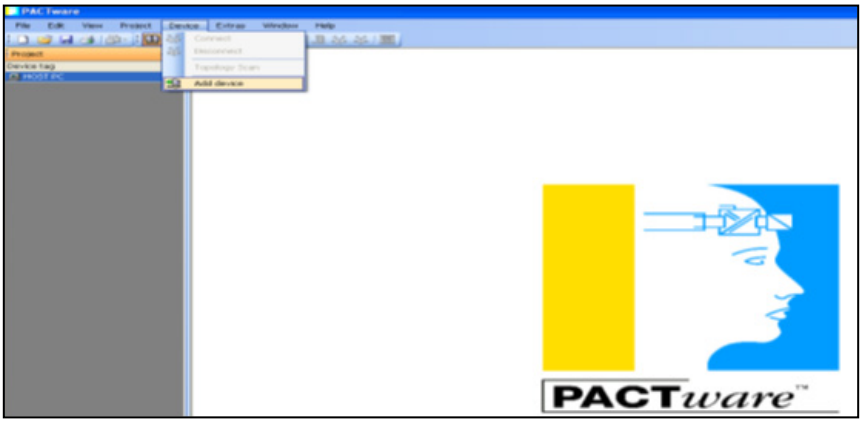


Figure 7 - Basic Setup Requirements, ST100 HART DTM

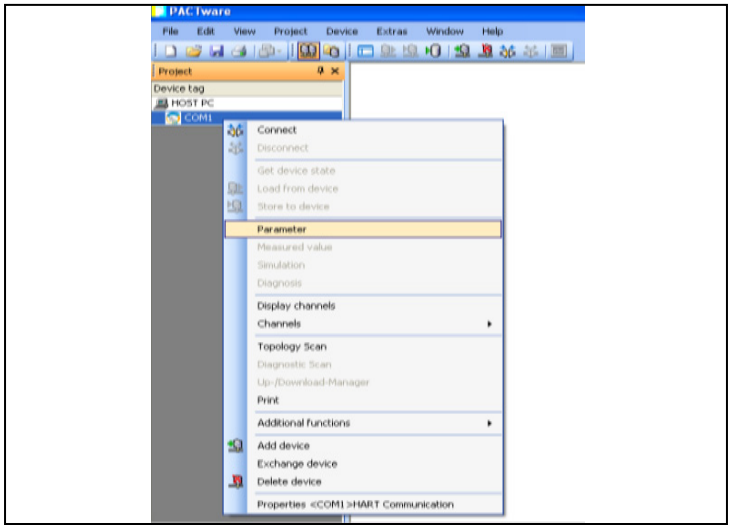
Once all three software components are downloaded and installed, the ST100 HART DTM should appear through the PACTware™ application as shown in the figure below.

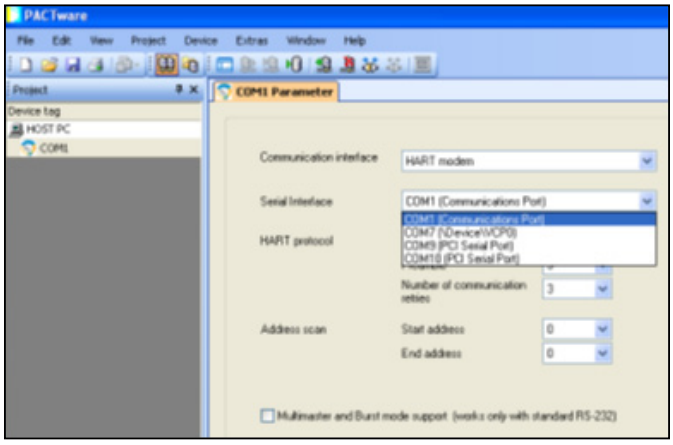


Now invoke PACTware program. Select device from the menu and click on “Add Device” tab.

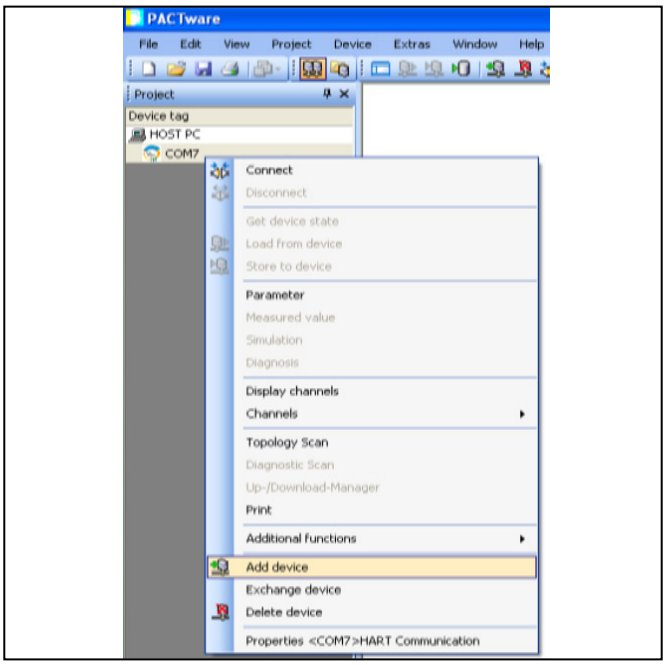


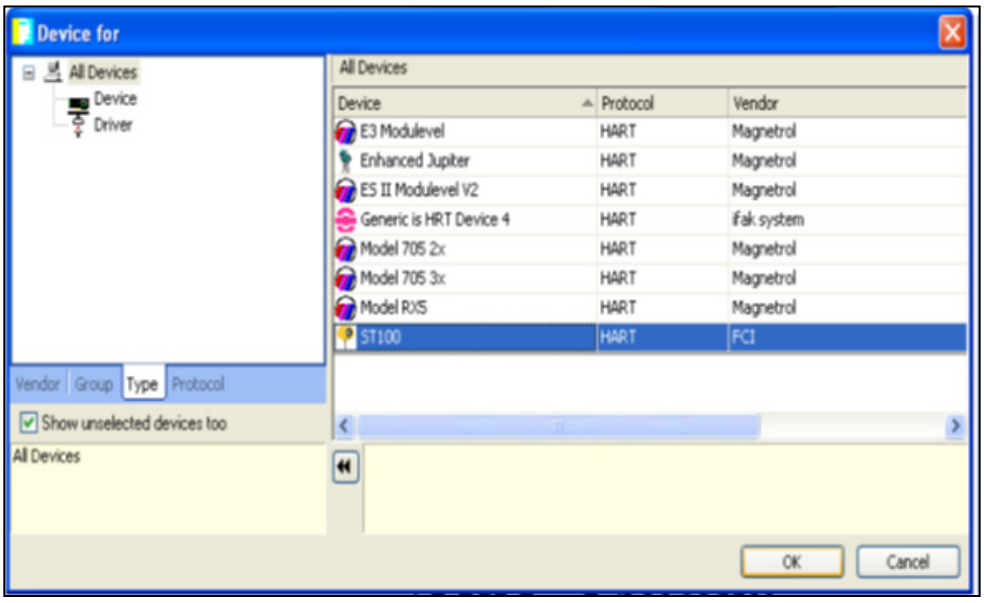
Right click on the device and select “Parameter”, change correct COM port for HART modem.



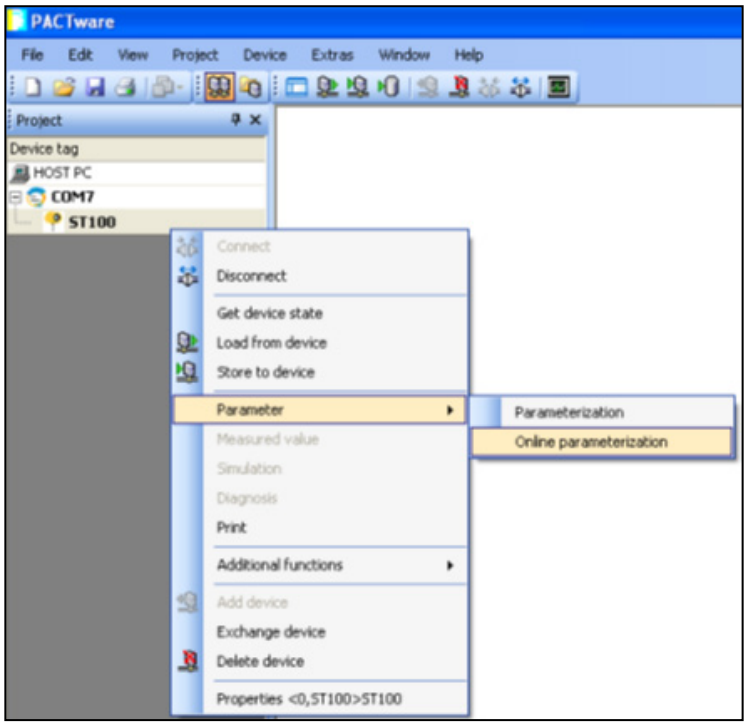


Right click on the device and add “Device DTM” from the list.





Right click on the device and click on the “Connect”. Select “Online parameterization” pull-down menu command to check the communication between ST100 HART DTM and ST100 Field Device.

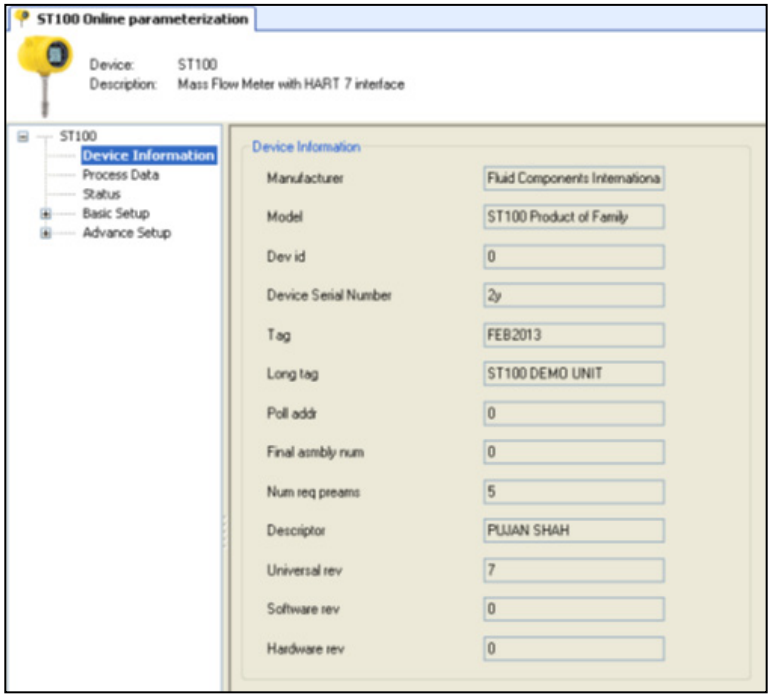


Once you are done with the previous steps, ST100 device will be detected through PACTware program.

How to get the information through ST100 HART DTM device

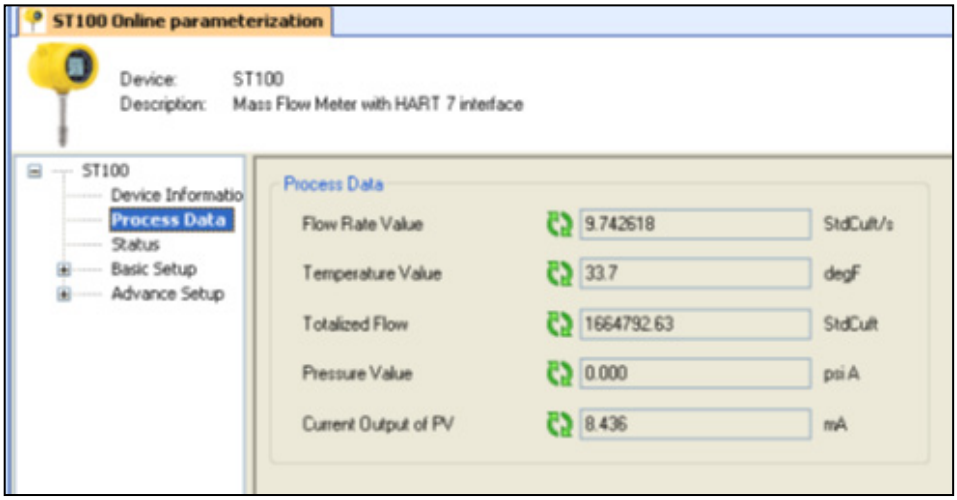
Device Information

ST100 HART DTM contains “Device Information” tab wich has all the basic information of the instrument such as manufacturer, model, device ID, serial number, tag, poll address and so on.



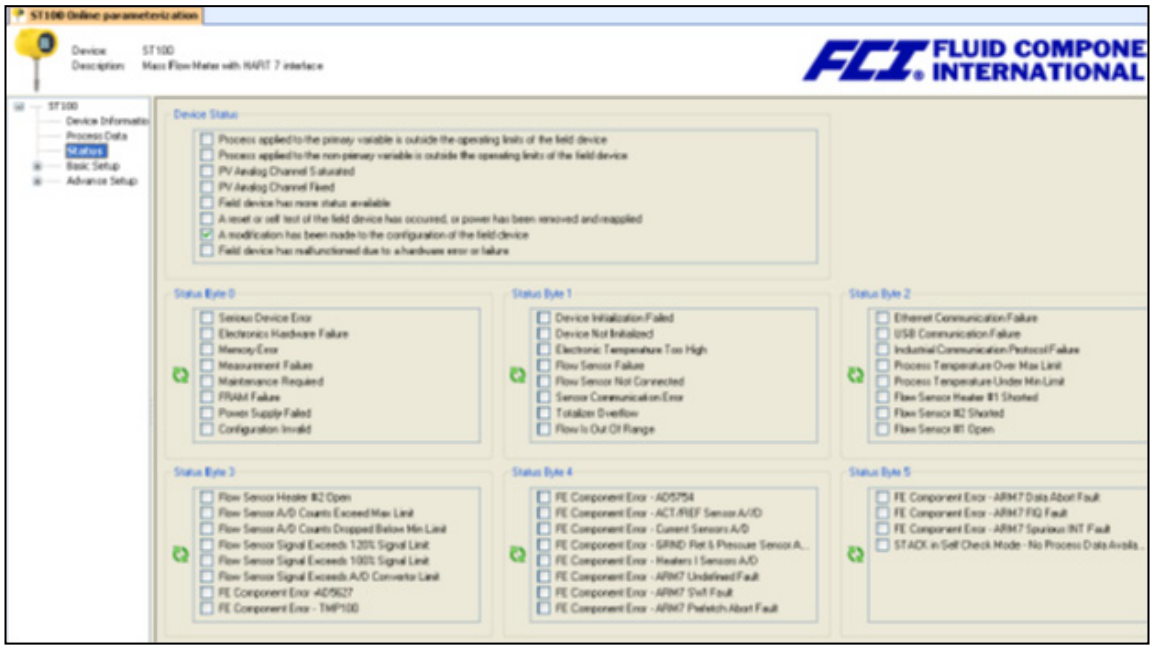
Process Data

ST100 HART DTM file shows all process data variables on a single screen with the value and engineering units. This tab also shows current output value for the primary variable. The figure below shows example data for Flow Value, Temperature Value, Totalizer Value and Pressure Value.



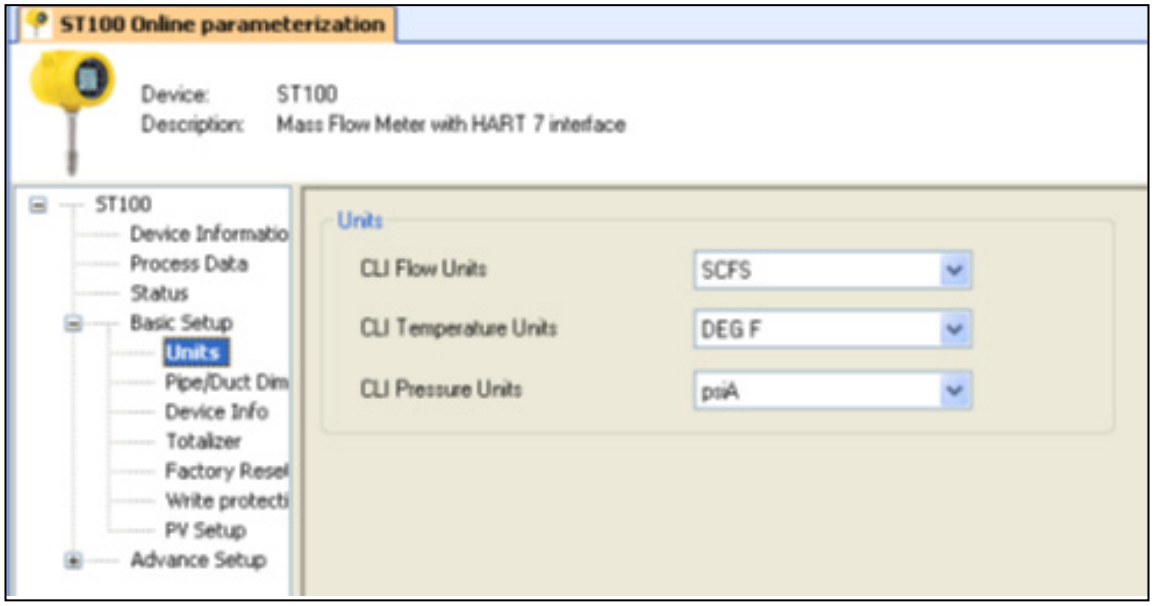
Staus

ST100 Status tab has all the possible fault/error for the core as well as for the ST100 meter front end (FE). This tab lets the customer or technician diagnose/troubleshoot meter issues.



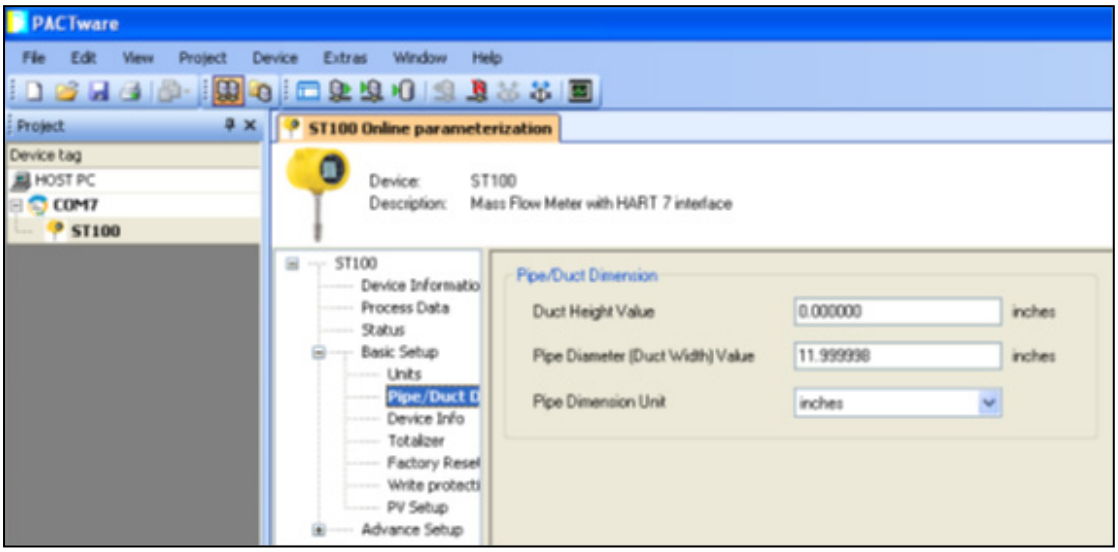
Basic Setup

Basic Setup has various ST100 settings including Units, Plenum, and Totalizer, Factory Reset, Write Protection and PV Setup. Use this tab to select engineering units for Flow, Temperature and Pressure variables.



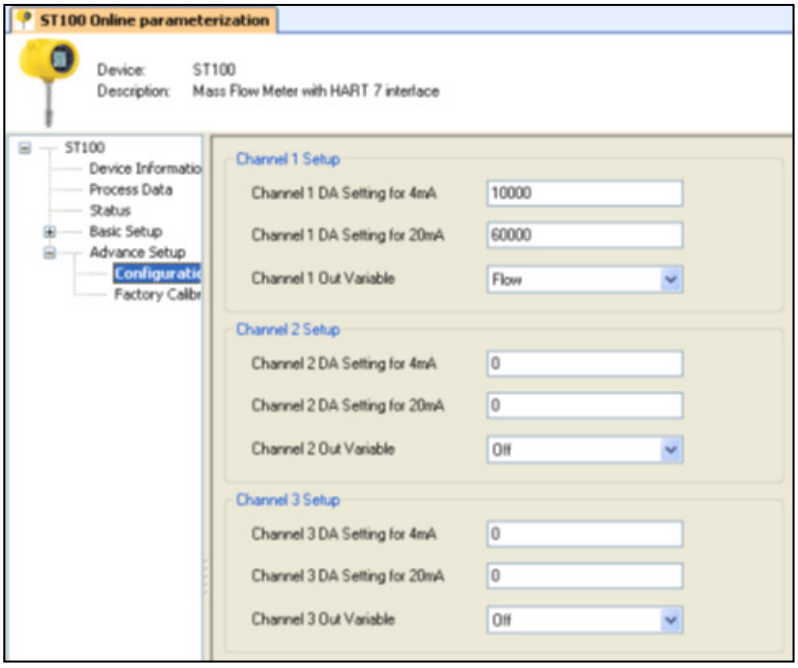
Pipe/Duct Dimension

Use this tab to specify the height, width and/or diameter for the pipe/duct. Specify dimension units as inches or millimeters.



Advance Setup

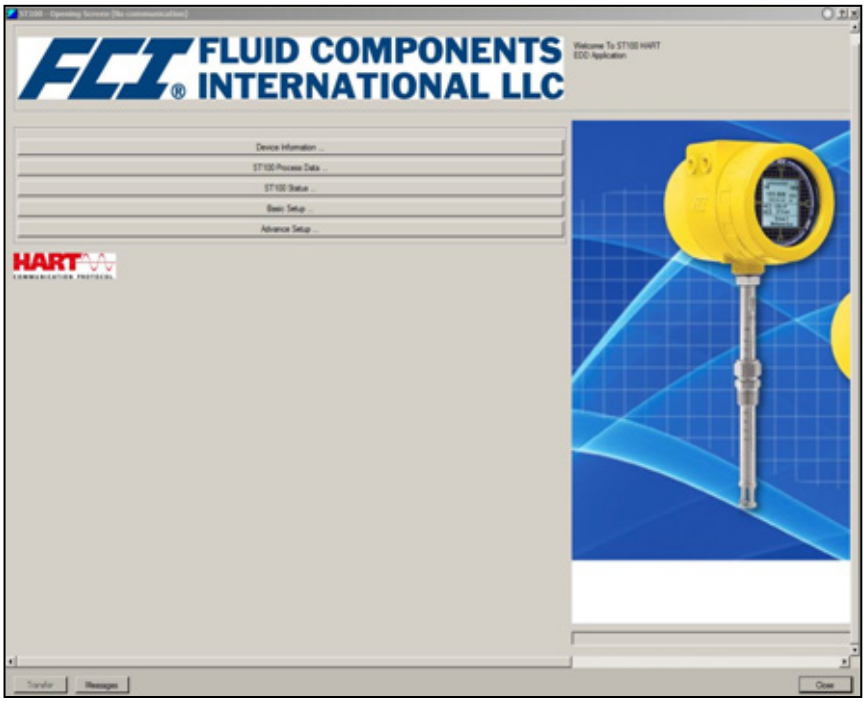
Use this tab to change DAC values (per user requirements) and select an output variable (Flow, Temperature or Pressure) for any of the three channels.



ST100 HART PDM

The ST100 product of family supports PDM (Process Device Manager) functionality through the HART Protocol 7.3. Fluid Components International provides PDM files for the ST100 HART device.

Shown below are example screenshots for the ST100 HART_PDM.

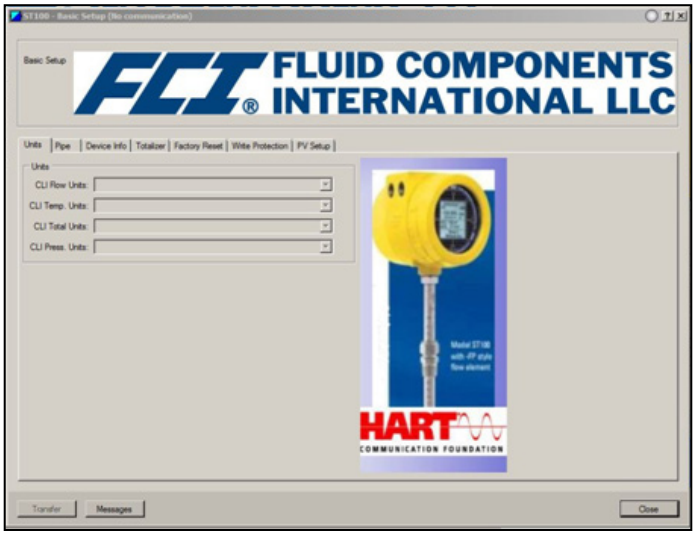


Opening Screen

Device Information Screen

Process Data Screen

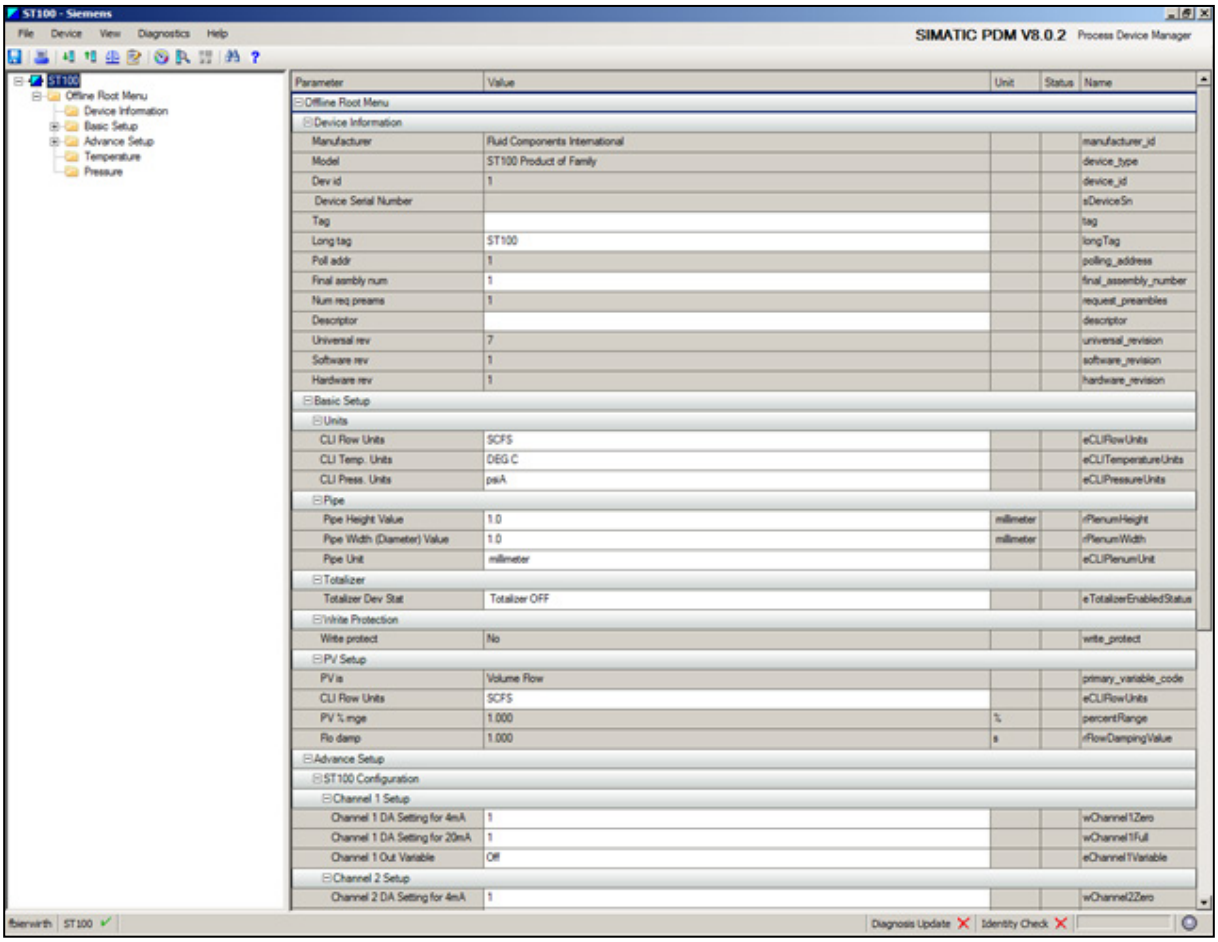
Diagnostic Screen



Basic Setup Screen

Basic Screen - Pipe/Duct Information

Advance Setup Screens



Live Data from ST100 HART Device Through PDM

HART Diagnostics

Device Status

Bit 0 ("Primary Variable Out of Limits") refers to the selected PV Dynamic Variable. This does not set bit 7, "Device Malfunction".

Bit 1 ("Non-Primary Variable Out of Limits") refers to the device variables Temperature and Pressure out of limits. This does not set bit 7, "Device Malfunction".

Bit 4 ("More Status Available" is set whenever a failure reported by a Command 48 status bit being set.

Extended Device Status

The Field Device cannot predict, in advance, when the maintenance will be required. This status byte is set to 1 (Maintenance Required) when a sensor break is detected.

Additional Device Status (Command #48)

Command #48 returns 25 bytes of data, with the following status information for status bytes 0 through 5. The remaining status bytes are reserved for future use.

Listed below are definitions for status bytes 0 through 5.

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	Serious Device Error	Hardware	4
1	Electronics Hardware Failure	Hardware	4
2	Memory Error	Hardware	4
3	Measurement Failure	Hardware	4, 7
4	Maintenance Required	Hardware	4
5	FRAM Failure	Hardware	4
6	Power Supply Failure	Hardware	4
7	Configuration Invalid	Hardware	4

Status Byte 0

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	Device Initialization Failed	Hardware	4
1	Device Not Initialized	Hardware	4
2	Electronic Temperature Too High	Hardware	4
3	Flow Sensor Failure	Hardware	4, 7
4	Flow Sensor Not Connected	Hardware	4,7
5	Sensor Communication Failure	Hardware	4
6	Totalizer Overflow	Hardware	4
7	Flow Is Out Of Range	Hardware	4

Status Byte 1

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	Ethernet Communication Failure	Hardware	4
1	USB Communications Failure	Hardware	4
2	Industrial Communication Protocol Fail	Hardware	4
3	Procees Temperature Over Max Limit	Hardware	4
4	Process Temperature Under Min Limit	Hardware	4
5	Flow Sensor Heater #1 Shorted	Hardware	4
6	Flow Sensor # 2 Shorted	Hardware	4
7	Flow Sensor #1 Open	Hardware	4

Status Byte 2

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	Flow Sensor Heater #2 Open	Hardware	4
1	Flow Sensor A/D Counts Exceed Max Limit	Hardware	4
2	Flow Sensor A/D Counts Under Min Limit	Hardware	4
3	Flow Sensor Signal Exceeds 120% Limit	Hardware	4
4	Flow Sensor Signal Exceeds 100% Signal	Hardware	4
5	Flow Sensor Signal Exceeds A/D Limit	Hardware	4
6	FE Component Error – AD56 27	Hardware	4
7	FE Component Error – TMP100	Hardware	4

Status Byte 3

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	FE Component Error – AD5754	Hardware	4
1	FE Component Error – ACT/REF Sensor A/D	Hardware	4
2	FE Component Error – Current Sensors A/D	Hardware	4
3	FE Component Error – GRND Ret & Pressure Sensor A/D	Hardware	4
4	FE Component Error – Heaters I Sensors A/D	Hardware	4
5	FE Component Error ARM7 Undefined Fault	Hardware	4
6	FE Component Error ARM7 SWI Fault	Hardware	4
7	FE Component Error ARM7 Prefetch Abort Faule	Hardware	4

Status Byte 4

BIT	MEANING	CLASS	DEVICE STATUS BITS SET
0	FE Component Error – ARM7 Data Abort Fault	Hardware	4
1	FE Component Error ARM7 FIQ Fault	Hardware	4
2	FE Component Error – ARM Spurious INT Fault	Hardware	4
3	STACK in Self Check Mode No Process Data Available		
4	Reserved		
5	Reserved		
6	Reserved		
7	Reserved		

Status Byte 5

"Not used" bits are always set to 0. The bits may be set as errors are detected. But these errors are not reported from "continuous background self-testing", but rather through "observation" of various conditions during normal operation. That is, no actual "self testing" is being "continuously" performed. But as errors are detected during normal operation, these will be reported.

Technical Characteristics

Manufacture ID:	0XA67F
Output Signal:	4 to 20 mA signal via a FSK modem/ HI311 HART PC Interface
Data transmission rate:	1200Hz
Signal coding:	Bell 202 Current (Physical layer)
Supported communication:	Publisher, Subscriber
HART Commands:	Universal Commands Common Practice Commands Manufacturer Specification Commands
Certification:	Hart Communication Foundation Registered
Register Features:	Alarms and Events Relays Muti-bit Alert Reporting Field Diagnostics

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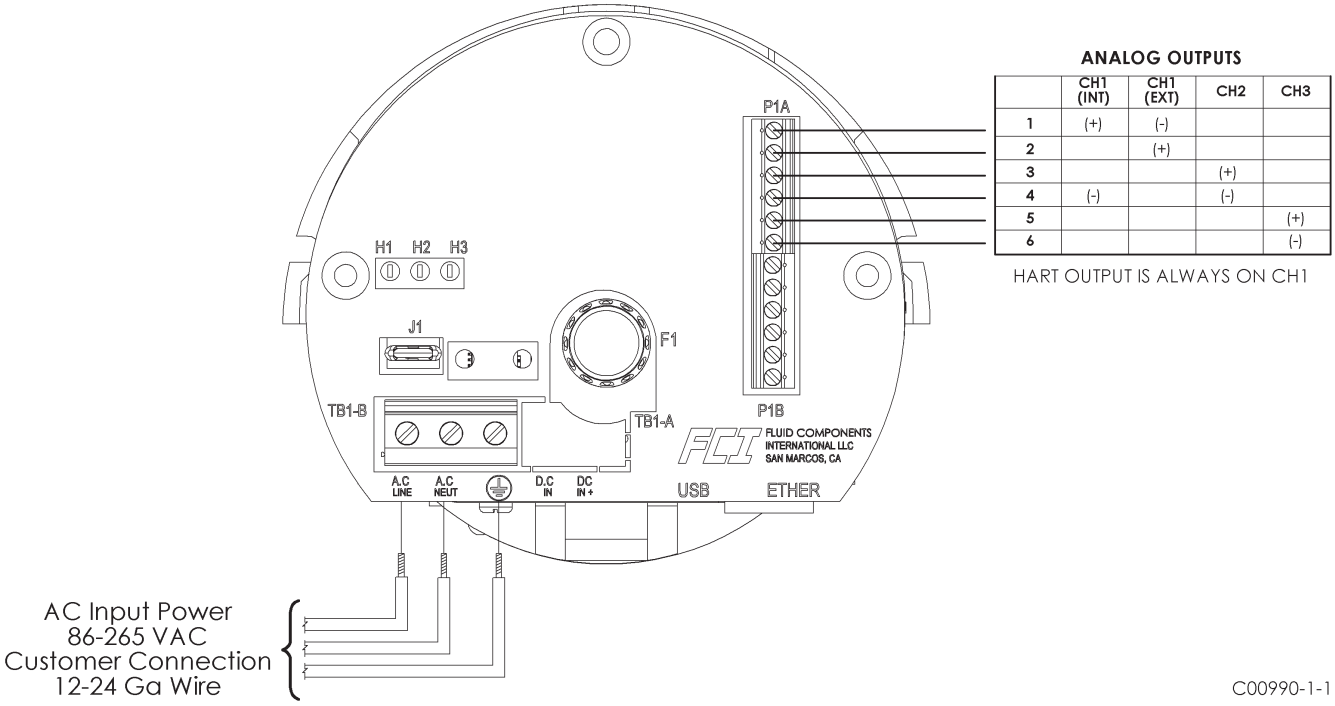
Appendix A – Drawings



Channel 1 HART Connection
Before April 2012

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Appendix B – Customer Service / Technical Support

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 E-Mail

FCI Customer Service can be contacted by e-mail at: techsupport@fluidcomponents.com.

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

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, please go to www.fluidcomponents.com.

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FCI World Headquarters
1755 La Costa Meadows Drive | San Marcos, California 92078 USA | Phone: 760-744-6950 Toll Free (US): 800-854-1993 Fax: 760-736-6250

FCI Europe
Persephonestraat 3-01 | 5047 TT Tilburg, The Netherlands | Phone: 31-13-5159989 Fax: 31-13-5799036

FCI Measurement and Control Technology (Beijing) Co., LTD | www.fluidcomponents.cn
Room 107, Xianfeng Building II, No.7 Kaituo Road, Shangdi IT Industry Base, Haidian District | Beijing 100085, P. R. China
Phone: 86-10-82782381 Fax: 86-10-58851152