FoxThermal
Precision Mass Flow Measurement
An ONICON Brand

HART Communication Manual

FOR

MODEL FT3

THERMAL MASS FLOW METER & TEMPERATURE TRANSMITTER

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104984, Revision B

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 Scope

The Fox Thermal Instruments' Model FT3 transmitter complies with HART Protocol Revision 7.1. This document specifies all the device-specific features and documents HART Protocol implementation details (e.g., the Engineering Unit Codes supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART-capable Host Applications.

1.2 Purpose

This specification is designed to compliment the FT3 Instruction Manual by providing a complete description of this Field Device from a HART Communication perspective.

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands and performance requirements) used during development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

1.3 References

HART Smart Communications Protocol Specification. HCF_SPEC-12. Available from the HCF.

FT3 Installation Manual, Document 104488.

2. DEVICE IDENTIFICATION

Manufacturer Name:	Fox Thermal Instruments	**Model Name(s):**	FT3
Manufacture ID Code:	24635 (603b hex)	**Device Type Code:**	57583 (EOEF Hex)
HART Protocol Revision	7.1	**Device Revision:**	1
Number of Device Variables	None		
Physical Layers Supported	FSK		
Physical Device Category	Transmitter, DC-isolated Bus Device		

3. PRODUCT OVERVIEW

The FT3 HART communication option board provides a 4-20mA flow output signal and can be monitored and configured using a HART master device or a hand-held communicator.

4. PRODUCT INTERFACES

4.1 Flow Sensor

The FT3 is shipped with a sensor probe connected and calibrated to customer specifications. Refer to the FT3 Instruction Manual for details.

4.2 Process Flow Rate 4-20mA Analog Output

The 4-20mA output of the FT3 HART option board represents the process flow rate measurement, linearized and scaled according to the configured range of the instrument. This output corresponds to the Primary Variable. HART Communication is supported on this loop.

4.3 Local Controls and Display Interface

The FT3 has an optional 2 line by 16 character LCD display, a four key interface and an infra-red keypad that can be operated through the enclosure window. A USB interface is available for configuring the meter using a PC.

4.4 HART Option Board Indicators

LED indicator LP1 cycles on and off to indicate that the HART option board is operating.

LED indicator LP2 blinks when HART signals are received and LP3 blinks when HART signals are transmitted.
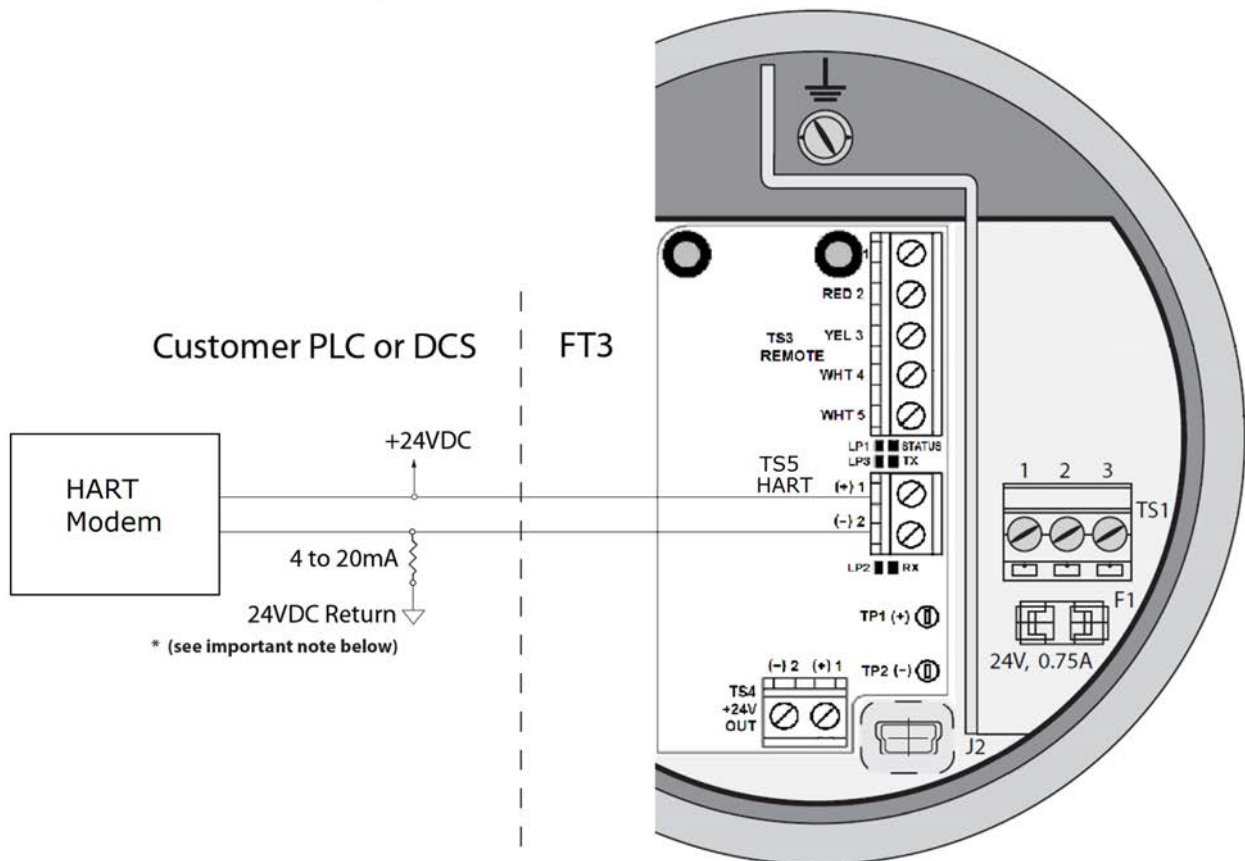
5. HART OPTION BOARD WIRING

The HART option board is accessed by removing the rear cover of the FT3 enclosure.

Note: The 4-20mA flow output available on the FT3 terminal block TS2 cannot be used for HART communication.

5.1 HART 4-20mA Output Wiring: Customer-Supplied Power Source

The 4-20mA current loop and HART modem connections are made on terminal block TS5 pin 1 (+) and pin 2(-). Terminal block TS5 is located on the HART communication option board of the FT3.

Important Note
The load resistor on the Fox Flow Meter 4 to 20mA signal is typically 250 ohms and is located in or at the customers PLC or DCS. A 250 ohm resistor in the 4 to 20mA line will result in a 1 to 5VDC signal to the PLC or DCS. Some PLC/DCS equipment has the load resistor built in to the unit; please refer to the PLC/DCS technical manual. **Do not exceed a 600 ohm load on the Fox Flow Meter 4 to 20mA signal.**

5.2 HART 4-20mA Output Wiring: Handheld Communicator

The 4-20mA current loop connections are made on terminal block TS5 pin 1 (+) and pin 2(-). Terminal block TS5 is located on the HART communication option board of the FT3.
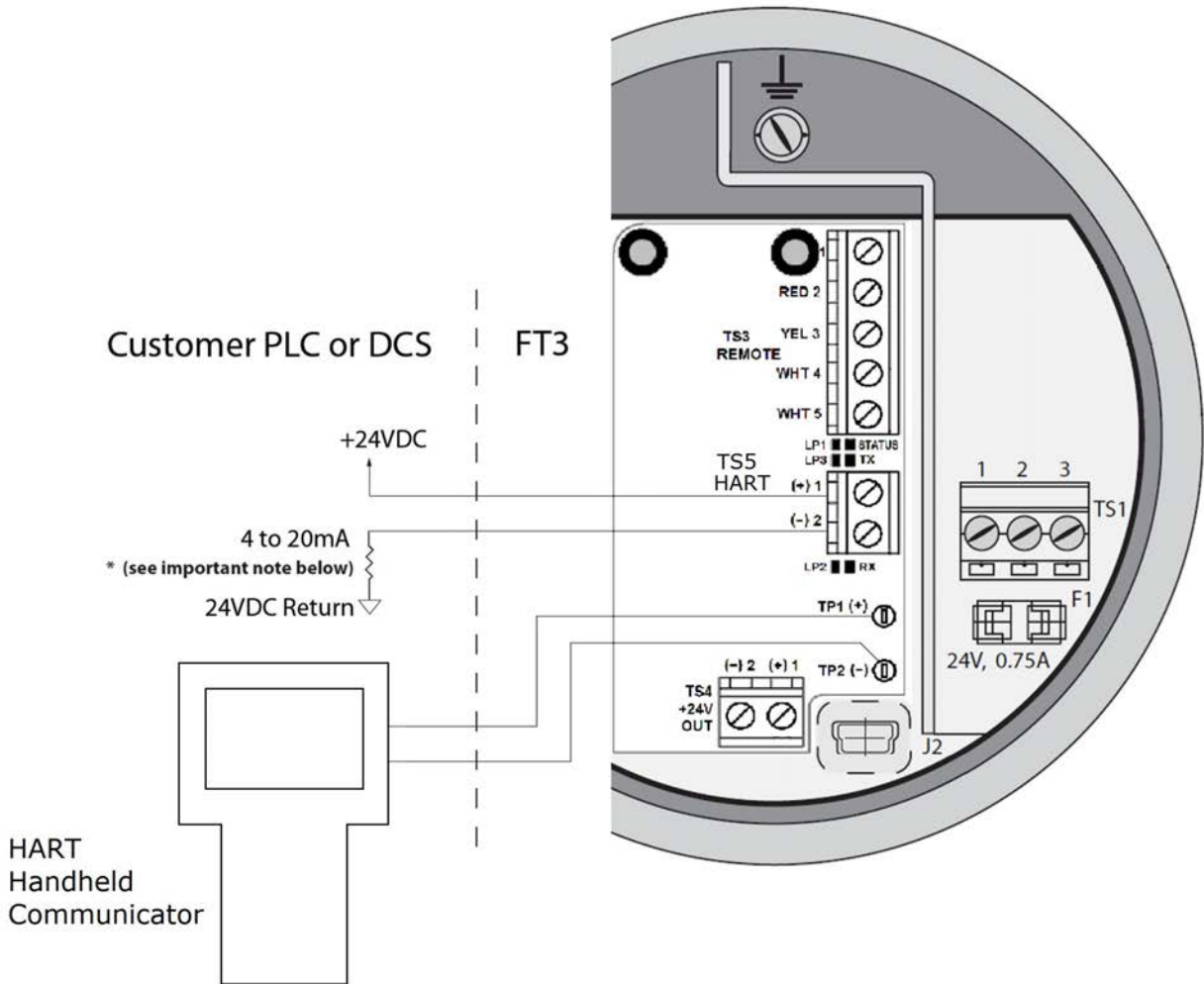
A hand-held HART communicator can be connected to test points TP1 (+) and TP2 (-) with clip leads or to terminal block TS5 pin 1 (+) and pin 2 (-) with wires. These test points and terminal block pins are connected together on the HART option board.

Important Note
The load resistor on the Fox Flow Meter 4 to 20mA signal is typically 250 ohms and is located in or at the customers PLC or DCS. A 250 ohm resistor in the 4 to 20mA line will result in a 1 to 5VDC signal to the PLC or DCS. Some PLC/DCS equipment has the load resistor built in to the unit; please refer to the PLC/DCS technical manual. **Do not exceed a 600 ohm load on the Fox Flow Meter 4 to 20mA signal.**

HART 4-20mA Output Wiring: Loop Power Provided by FT3

The 4-20mA current loop and HART modem connections are made on terminal block TS5 pin 1 (+) and pin 2 (-). Terminal block TS5 is located on the HART communication option board of the FT3.

Isolated 24 volt output power is available on terminal block TS4 pins 1 (+) and 2 (-) of the HART option board. This output can be used to power the 4-20mA loop if an external supply is not available.
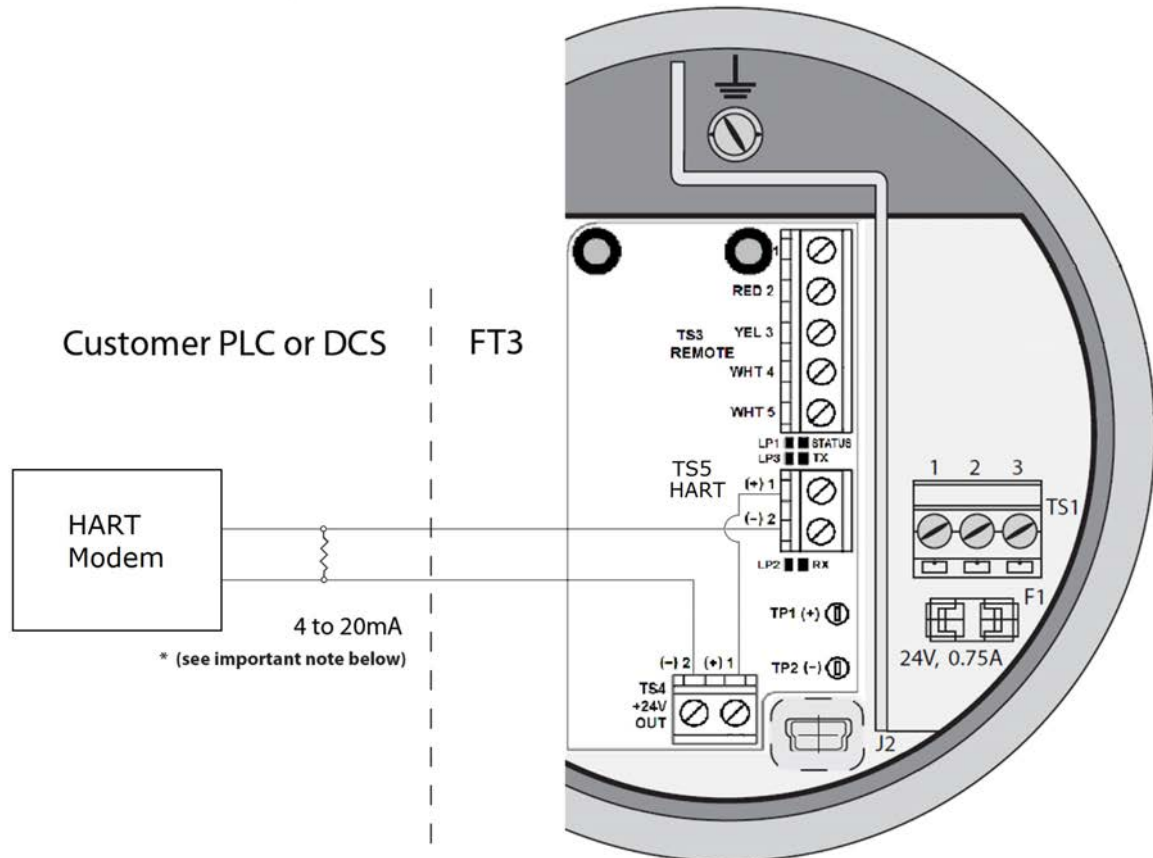

Important Note
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6. FT3 HART COMMUNICATION SETUP

HART communication must be selected in the FT3 Serial Communication menu for HART communication to operate. When this communication parameter is changed, power to the FT3 must be cycled for it to take effect.

7. DEVICE VARIABLES

This device does not expose any Device Variables.

8. DYNAMIC VARIABLES

Four Dynamic Variables are implemented.

	Meaning	Units
PV	Flow Rate	In Selected Units
SV	Total	In Selected Units
TV	Temperature	In Selected Units
QV	Elapsed Time	In Hours

9. STATUS INFORMATION

9.1 Device Status

Bit 4 ("More Status Available") is set when any failure is detected. Command #48 provides additional detail.

9.2 Extended Device Status

This bit is set if a sensor error is detected. "Device Variable Alert" is set if the PV is out of limit.

9.3 Additional Device Status (Command #48)

Command #48 returns 2 Device-Specific Status bytes of data, with the following status information:

These bits are set when an alarm or error condition is present. The bit automatically clears when the condition returns to its normal state.

Byte	Bit	Meaning	Class
0	0	Power Up Indication	Status
	1	High Flow Limit Alarm	Alarm
	2	Low Flow Limit Alarm	Alarm
	3	High Temperature Limit Alarm	Alarm
	4	Low Temperature Limit Alarm	Alarm
	5	Sensor out of range	Error
	6	Velocity out of range	Error
	7	Check Parameter Settings	Error
1	0	In Simulation Mode	Alarm
	1	Frequency output out of range	Alarm
	2	CH 1 4-20mA out of range	Alarm
	3	CH 2 4-20mA out of range	Alarm
	4	Busy	Alarm
	5	Bridge shutdown	Error
	6	CRC database error	Error
	7	Error with Total	Error

10. COMMON-PRACTICE COMMANDS

10.1 Supported Commands

The following common-practice commands are implemented:

34   Write Damping Value

35   Write Range Values

36   Set PV Upper Range Values

37   Set PV Lower Range Values

38   Reset "Configuration Changed" Flag

40   Enter/Exit Fixed Current Mode

44   Write PV Units

45   Trim Loop Minimum

46   Trim Loop Maximum

48   Read Additional Device Status (Command #48 returns 2 bytes of data)

59   Write Number of Response Preambles

10.2 Burst Mode

This device does not support Burst Mode.

10.3 Catch Device Variable

This device does not support Catch Device Variable.

11. DEVICE-SPECIFIC COMMANDS

No Device-Specific commands are implemented.

11.1 Modes

Fixed current mode is implemented, using Command 40. This mode is cleared by power loss or reset.

11.2 Damping

Damping is standard, affecting only the PV and the loop current signal.

ANNEX A.   CAPABILITY CHECKLIST

Manufacturer, model	Fox Thermal Instruments, FT3
Device type	Transmitter
HART revision	7.1
Device Description available	No
Number and type of sensors	1
Number and type of actuators	0
Number and type of host side signals	1: 4-20mA analog
Number of Device Variables	0
Number of Dynamic Variables	4
Mappable Dynamic Variables	No
Number of common-practice commands	17
Number of device-specific commands	0
Bits of additional device status	8
Alternative operating modes	No
Burst mode	No
Write-protection	Yes

ANNEX B.   REVISION HISTORY

Rev A to Rev B: Rebranded with new logo, new web address, shortened the company name to Fox Thermal (removed "Instruments"). Changed font styling according to branding style sheet. Changed all instances of "4 to 20mA" to "4-20mA".