



600/700 Series HART



# 600/700 Series HART

## Instruction Manual

HART Device Specification for Models:  
640S, 760S, 780S, and 780S-UHP  
Thermal Mass Flow Meters



Part Number: IM600/700 HART, Rev. V1  
May 2013



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# Warnings and Cautions



**Warning!** Agency approval for hazardous location installations varies between flow meter models. Consult the flow meter nameplate for specific flow meter approvals before any hazardous location installation.

**Warning!** Hot tapping must be performed by a trained professional. U.S. regulations often require a hot tap permit. The manufacturer of the hot tap equipment and/or the contractor performing the hot tap is responsible for providing proof of such a permit.

**Warning!** All wiring procedures must be performed with the power off.

**Warning!** To avoid potential electric shock, follow National Electric Code safety practices or your local code when wiring this unit to a power source and to peripheral devices. Failure to do so could result in injury or death. All AC power connections must be in accordance with published CE directives.

**Warning!** Do not power the flow meter with the sensor remote (if applicable) wires disconnected. This could cause over-heating of the sensors and/or damage to the electronics.

**Warning!** Before attempting any flow meter repair, verify that the line is de-pressurized.

**Warning!** Always remove main power before disassembling any part of the mass flow meter.



**Caution!** Before making adjustments to the device, verify the flow meter is not actively monitoring or reporting to any master control system. Adjustments to the electronics will cause direct changes to flow control settings.

**Caution!** All flow meter connections, isolation valves and fittings for hot tapping must have the same or higher pressure rating as the main pipeline.

**Caution!** Changing the length of cables or interchanging sensors or sensor wiring will affect the accuracy of the flow meter. You cannot add or subtract wire length without returning the meter to the factory for re-calibration.

**Caution!** When using toxic or corrosive gases, purge the line with inert gas for a minimum of four hours at full gas flow before installing the meter.

**Caution!** The AC wire insulation temperature rating must meet or exceed 80°C (176°F).

**Caution!** Printed circuit boards are sensitive to electrostatic discharge. To avoid damaging the board, follow these precautions to minimize the risk of damage:

- before handling the assembly, discharge your body by touching a grounded, metal object
- handle all cards by their edges unless otherwise required
- when possible, use grounded electrostatic discharge wrist straps when handling sensitive components

## Note and Safety Information

We use caution and warning statements throughout this book to draw your attention to important information.



### Warning!

This statement appears with information that is important to protect people and equipment from damage. Pay very close attention to all warnings that apply to your application.



### Caution!

This statement appears with information that is important for protecting your equipment and performance. Read and follow all cautions that apply to your application.

## Receipt of System Components

When receiving a Sierra mass flow meter, carefully check the outside packing carton for damage incurred in shipment. If the carton is damaged, notify the local carrier and submit a report to the factory or distributor. Remove the packing slip and check that all ordered components are present. Make sure any spare parts or accessories are not discarded with the packing material. Do not return any equipment to the factory without first contacting Sierra Customer Service.

## Technical Assistance

If you encounter a problem with your flow meter, review the configuration information for each step of the installation, operation, and setup procedures. Verify that your settings and adjustments are consistent with factory recommendations. Installation and troubleshooting information can be found in the [SteelMass™ 640S](#) and [FlatTrak™ 780S \(includes 780S-UHP and 760S\)](#) Series product manuals.

If the problem persists after following the troubleshooting procedures outlined in the 640S or 780S product manuals, contact Sierra Instruments by fax or by E-mail (see inside front cover). For urgent phone support you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. PST. In Europe, contact Sierra Instruments Europe at +31 20 6145810. In the Asia-Pacific region, contact Sierra Instruments Asia at +86-21-58798521. When contacting Technical Support, make sure to include this information:

- The flow range, serial number, and Sierra order number (all marked on the meter nameplate)
- The software version (visible at start up)
- The problem you are encountering and any corrective action taken
- Application information (gas, pressure, temperature and piping configuration)


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# Chapter 1: Introduction

This document describes the function and operation of the optional HART interface for the Sierra Instruments flow meter. The 600/700 Series HART provides different process variables: Instantaneous Flow, Totalized Flow, User Full Scale, and K-Factor. Instantaneous flow can be selected as Velocity, or Mass units. The Totalizer output provides totalized mass flow. The K-factor provides a Flow Correction Factor for Velocity and Mass Flow.

This document specifies all the variables for a HART configured 640S, 760S, 780S, and 780S-UHP. The HART signal output is provided through an extension protocol that is fully integrated into the 640S, 760S, 780S, and 780S-UHP models.

	<p><b>Note</b> In this manual 600/700 Series HART refers to product models 640S, 760S, 780S, and 780S-UHP.</p>
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## HART Commands

The 600/700 Series HART meter supports the HART Universal and Device specific commands.

### 640S/780S SIP Configurator

The SIP software gives access to the 600/700 Series HART functions and features. It can be used to configure the basic flow meter setup, and advance functions. The SIP Software configurator interfaces through the 600/700 Series HART RS-232 Serial port and a PC USB RS-232 port.

### Device Variables and Dynamic Variables

Through the Dynamic Variable Assignment the Device Variables are mapped to the four Dynamic Variables: Primary (PV), Secondary (SV), Tertiary (TV) and Quaternary (QV). The assignment is performed using Common Practice Command 50.

### Device Variables Classification

The Device Variable Classification is determined by the process measurement type and will determine the Engineering Unit that is supported. The tables below show the Device Variable Classes and the related Engineering Units supported by the Sierra Instruments 600/700 Series HART.

Device Variable			
Velocity	HART Variable Menu Units List		Actual Flow Meter Measurement
<b>Device Variable Classification Code 67</b>	Code	Description	
	20	ft/s	(SFPS), Standard feet per second
	21	m/s	(SMPS), Standard meters per second (NMPS), Normal meters per second
	116	ft/min	(SFPM), Standard feet per minute
	120	m/hr	(SMPH), Standard meters per hour (NMPH), Normal meters per hour
Volumetric Flow	HART Variable Menu Units List		Actual Flow Meter Measurement
<b>Device Variable Classification Code 66</b>	Code	Description	
	15	CuFt/min	(SCFM), Standard Cubic feet per minute
	17	l/min	(SLPM), Standard Liters per minute (NLPM), Normal Liters per minute
	19	CuMtr/hr	(Sm3/h), Standard Cubic meter per hour

			(Nm <sup>3</sup> /h), Normal Cubic meter per hour
	24	l/s	(SLPS), Standard Liters per second (NLPS), Normal Liters per second
	26	CuFt/s	(SCFS), Standard Cubic feet per second
	28	CuMtr/s	(Sm <sup>3</sup> /S), Standard Cubic meters per second (Nm <sup>3</sup> /S), Normal Cubic meters per second
	130	CuFt/hr	(SCFH), Standard Cubic feet per hour
	131	CuMtr/min	(Sm <sup>3</sup> /m), Standard Cubic meters per minute (Nm <sup>3</sup> /m), Normal Cubic meters per minute
	138	l/hr	(SLPH), Standard Liters per hour/ (NLPH), Normal Liters per hour
<b>Mass Flow</b>	<b>HART Variable Menu Units List</b>		<b>Actual Flow Meter Measurement</b>
<b>Device Variable Classification Code 72</b>	<b>Code</b>	<b>Description</b>	
	73	kg/s	(Kg/s), kilograms per second
	74	kg/min	(kg/m), kilograms per minute
	75	kg/hr	(kg/hr), kilograms per hour
	76	kg/day	(kg/d), kilograms per day
	80	lb/s	(lb/s), pounds per second
	81	lb/min	(lb/m), pounds per minute
	82	lb/hr	(lb/hr), pounds per hour
	83	lb/day	(lb/day), pounds per day
<b>Volume Flow Totalizer</b>	<b>HART Variable Menu Units List</b>		<b>Actual Flow Meter Measurement</b>
<b>Device Variable Classification Code 68</b>	<b>Code</b>	<b>Description</b>	
	41	l	(SL), Standard Liter/(NL), Normal Liter
	43	CuMtr	(SM <sup>3</sup> ), Standard Cubic meters/ (NM <sup>3</sup> ), Normal Cubic meters
	112	CuFt	(SCF), Standard Cubic feet/ (NCF), Normal Cubic feet
<b>Mass Flow Totalizer</b>	<b>HART Variable Menu Units List</b>		<b>Actual Flow Meter Measurement</b>
<b>Device Variable Classification Code 71</b>	<b>Code</b>	<b>Description</b>	
	60	g	(g), Grams
	61	kg	(kg), Kilograms
	63	lb	(lb), Pounds

### Device Variables Classification

Process Variable	Slot#	HART Variable Code Description	Device Variable Code	Device Variable Classification
Velocity Flow	0	Primary Variable	0	67
Volumetric Flow	0	Primary Variable	0	66
Mass Flow	0	Primary Variable	0	72
Volume Flow Totalizer	1	Secondary Variable	1	68
Mass Flow Totalizer	1	Secondary Variable	1	71
Flow User Full Scale	2	Tertiary Variable	2	67
Flow User Full Scale	2	Tertiary Variable	2	66
Flow K-Factor	3	Quaternary	3	83

**Primary Variable** is mapped to Velocity, Volumetric, Mass Flow, depending on the selection of Primary Variable units.

**Secondary Variable** is mapped to standard or normalized Volume Totalizer or Mass Totalizer Flow, depending on which value is mapped to Secondary Variable.

**Tertiary Variable** is mapped to standard or normalized Flow User Full Scale for Velocity, Volumetric, and Mass Flow, depending on the selection of Primary Variable units.

**Quaternary Variable** is mapped standard or normalized to K-factor for Velocity, Volumetric, and Mass Flow.

**640S/780S Common Practice HART Commands**  
**640S/780S Command List**

Command Number and Function	Data In Command	Data In Reply and Size
1 Read Pv	Read Variable Flow Value, and Flow Units	Byte 0 PV unit code Byte 1-4 Primary variable
2 Read Current & Percentage Of Range	Read Primary Variable	Byte 0-3 current (mA) Byte 4-7 % of range
3 Read Current & Four Variables	Flow Totalizer User Full Scale K-Factor	Byte 0-3 Current Byte 4 PV unit code Byte 5-8 PV Byte 9 SV unit Code Byte 10-13 SV Byte 14 TV unit Code Byte 15-18 TV Byte 19 FV unit Code Byte 20-23 FV
12 Read Message	None	Byte 0-23 message
13 Read Tag Descriptor, Date	None	Byte 0-5 Tag A Byte 18-20 date D
14 Read PV Sensor	Flow Value	Byte 4-7 Upper sensor limit Byte 8-11 Lower sensor limit Byte 12-15 Minimum span
15 Read PV Output Information	Flow Value	Byte 2 Range values unit code Byte 3-6 Upper range value Byte 7-10 Lower range value
16 Read Final Assembly Number	None	Byte 0-2 final assembly number
38 Reset Configuration Changed Flag	None	None
42 Master Reset	None	None
48 Read Additional Transmitter Status	None	Byte 0-1 = status Byte 2 = com status
50 Read Dynamic Variable Assignments	Flow for PV Totalizer for SV U/F for TV K-Factor for FV	Byte 0 Device Variable Code for PV Byte 1 Device Variable Code for SV Byte 2 Device Variable Code for TV Byte 3 Device Variable Code for TV
148 Read Device Variable Upper Range	User Full Scale for TV	Byte 1-4 Upper Range data



## Drawings

See drawings below for Analog output and HART Connection.

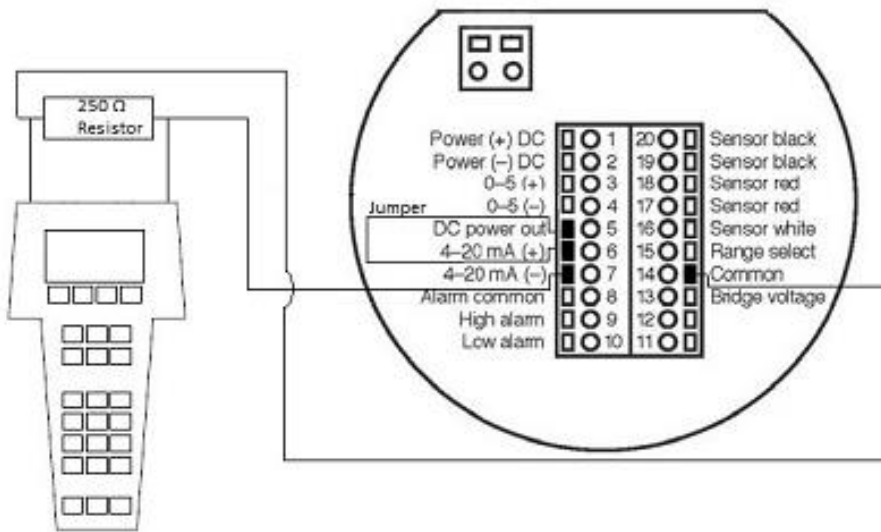


Figure 1 Point to point with Non-Isolated 4-20 mA loop

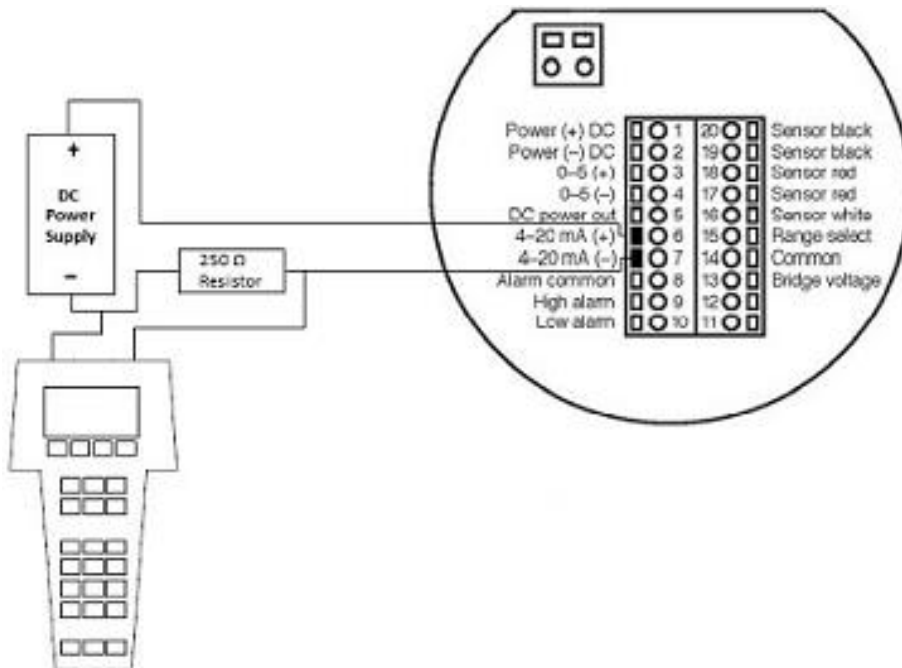


Figure 2 Point to point with Isolated 4-20 mA loop

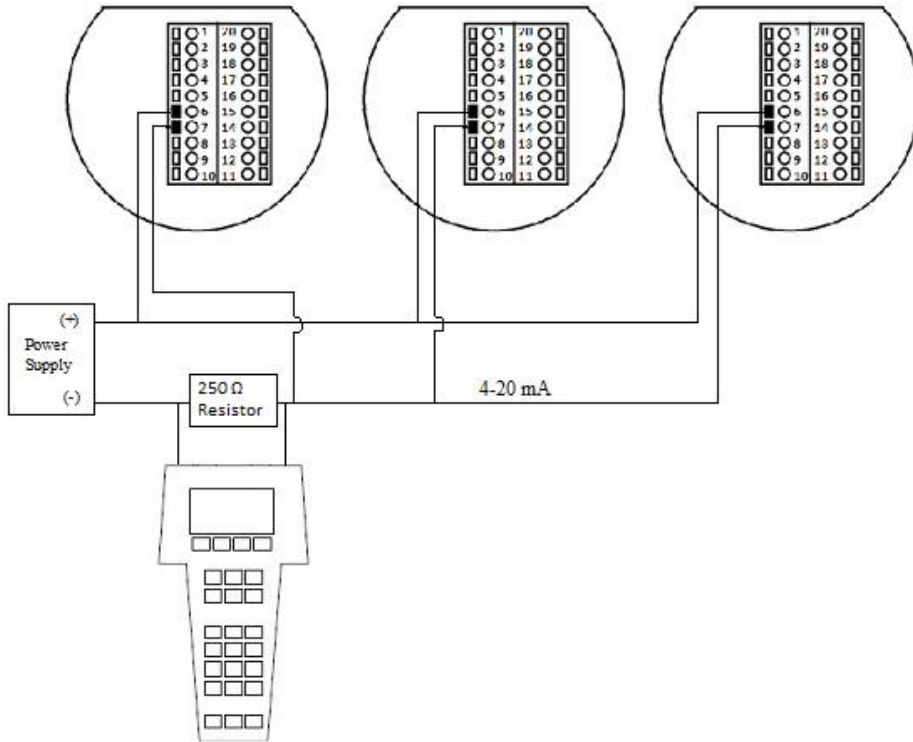


Figure 3 Multi-drop, digital signal only, 4-20mA must be set to a fixed 4 mA (Consult factory).