

CamCor™ Coriolis Flow Meter

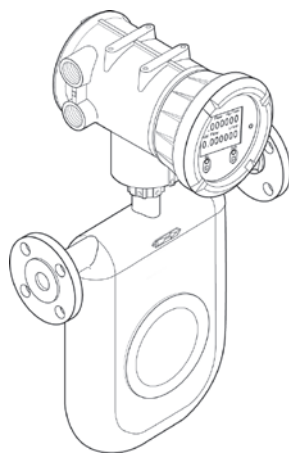
Hardware User Manual

CT Series Models: CC00A, CC001, CC003, CC006, CC010, CC015, CC025, CC040, CC050, CC080, CC100, CC150, CC15H, CC200, CC20H, and CC250

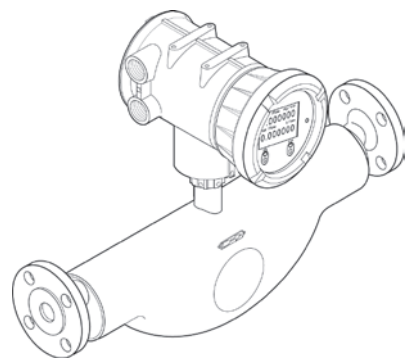
PRO Series Models: CP006, CP010, CP015, CP025, CP040, CP050

Transmitter Model: PA0K

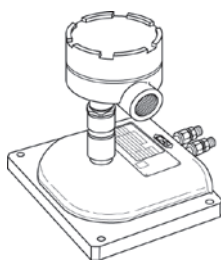
Every CamCor product is fabricated, tested, and inspected under stringent quality control before it leaves the factory. Please review the information and instructions in this manual before placing your CamCor flow meter into service and store the document in an easy-to-access location for quick reference.



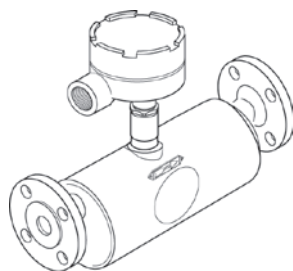
CT Series
CC006 to CC080



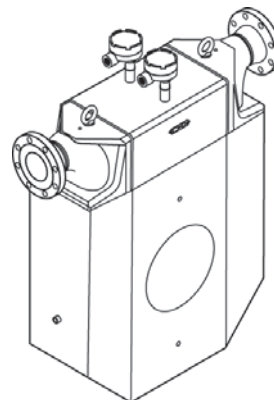
PRO Series
CP006 to CP050



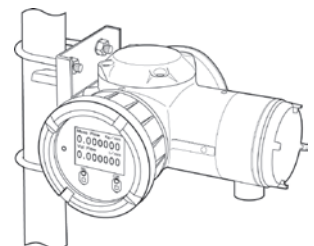
CT Series
CC00A, CC001



CT Series
CC003



CT Series
CC100 to CC250



Separately-mounted
transmitter (PA0K)

IMPORTANT SAFETY INFORMATION

Terms Used in this Manual



WARNING: This symbol identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

CAUTION Caution statements indicate actions or procedures which, if not performed correctly, may lead to personal injury or incorrect function of the instrument or connected equipment.

Important Important statements indicate actions or procedures which may affect instrument operation or may lead to an instrument response which is not planned.

Symbols Marked on Equipment



Attention! Refer to manual



Protective (earth) ground

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Section 1—General Information

GENERAL DESCRIPTION

CamCor meters—high-performance models (CT Series) and low-cost, general-purpose models (PRO Series)— are Coriolis flow meters capable of directly measuring mass flows at a high degree of accuracy. Equipped integrally or separately from the sensor unit is a highly-sophisticated transmitter featuring a self-diagnosis feature, a large display, and field reconfiguration capability via a touch panel or digital communications.

SERIAL TAG INFORMATION

The CamCor meter is comprised of a sensor and a transmitter. Product codes and major ratings will appear on each component. Upon receipt of your order, verify that the product(s) you receive comply with your order specifications.

Note When you make inquiries, include the product name, model number, serial number, and other pertinent information.

Sensor

As shown in [Figure 1.1](#), the serial tag on the CT Series CC006 to CC080 sensor body is located on the front. Tag placement may vary depending on sensor type.

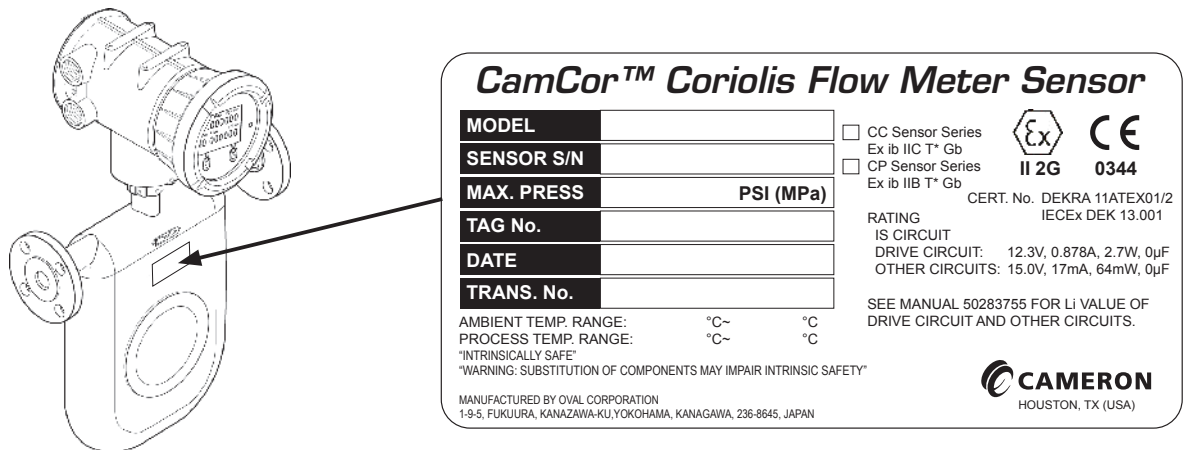


Figure 1.1—Sensor tag location and sample serial tag

Transmitter

As shown [Figure 1.2](#), the serial tag is located on the side of transmitter. Tag content will vary depending upon the certification standard selected when you placed your order.

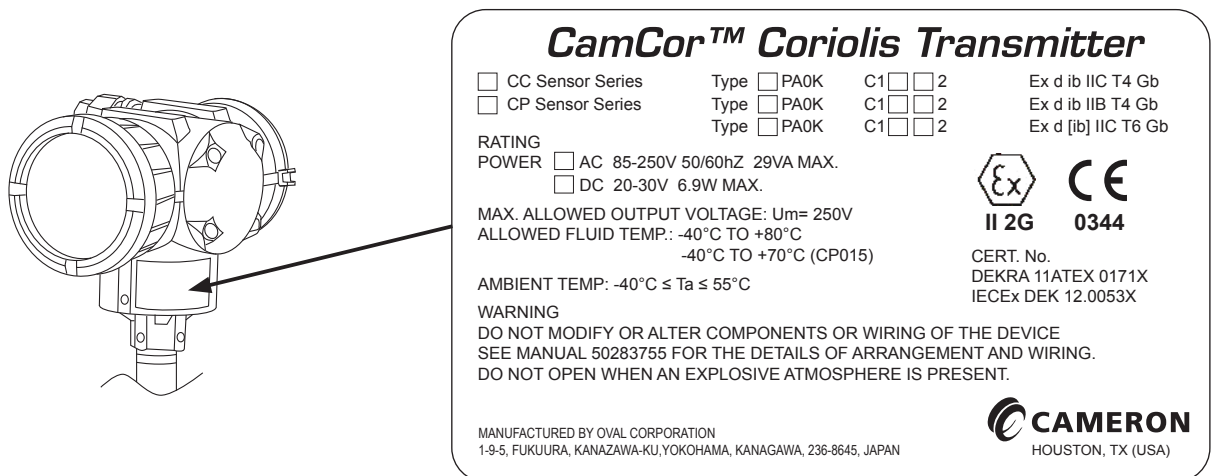


Figure 1.2—Transmitter tag location and sample serial tag

OPERATING CONDITIONS

In order to maintain the design metering accuracy and long service life, it is essential that the ratings, such as the flow rate, pressure, and temperature, be held within the specified limits. These operating conditions are stated in [Section 3—Specifications and Performance \(U.S. Customary Units\)](#), [page 15](#) of this manual and in the product code section of the CamCor CT Series and PRO Series General Specifications. Before placing the meter into service, consider the following:

- If the process fluid is corrosive, meter materials must be compatible.
- Cleanse the interior of flow tube thoroughly after measuring fluids that deposit solids. A flow tube with solid deposits can affect the meter accuracy.
- To change operating conditions, consult the factory.
- Some non-homogeneous gas-mixed flows are not measurable. Consult the factory for technical assistance in such applications.

INSTALLATION LOCATION

To ensure accurate and consistent measurement, the Coriolis flow meter should be installed in a location where pipeline oscillation will not exceed 0.3G.

POWERING UP THE METER AFTER INSTALLATION

To ensure stable measuring conditions, allow a 20-minute warm-up period after installing. “WARM UP 20” will appear and count down to zero after powering on the device. The number indicates remaining warm-up time in minutes.

STORAGE

If this product is to be stored for long periods of time before installation, take the following precautions:

1. Store your product in the manufacturer’s original packing used for shipping if possible.
2. Storage location should conform to the following requirements:
 - Free from rain and water
 - Free from vibration and impact shock
 - At room temperature with minimal temperature and humidity variation

RETURNING EQUIPMENT

If the meter must be returned to Cameron for any reason, follow these steps to ensure the most efficient processing:

1. Clean the unit, flush out the tubes, and pack the sensor unit carefully. Provide complete information about the process fluid. Inadequate information will delay handling of the meter.
2. Fill in the forms on [page 111](#) and [page 112](#). Provide complete information about the material being returned, including
 - model number
 - serial number
 - reason for return
 - return address
 - full documentation of the process fluid type
3. Pack the equipment carefully, using the original packaging if possible.
4. Return the complete flow meter, including the separate electronics unit, with all circuit boards and associated parts.

Important **Remove the conduit connections and all other parts not originally shipped with the meter (i.e. wiring connections).**

Important **Completely remove foreign materials from the inner walls of the sensor unit. Because the sensor unit cannot be disassembled, Cameron will not be able to remove buildup inside the tubes and service your meter.**

Section 2—Setup

Before moving the device to its intended location, perform the following tasks in a safe area.

EXAMINING THE DEVICE

Upon receipt, visually inspect the sensor and transmitter for any sign of damage that may have occurred during trASMEt.

Important **If damage is observed, contact CAMERON for further instructions.**

TRANSPORTATION

1. Transport the product to the installation site using the original manufacturer's packing whenever possible.
2. Avoid impact shocks, rain and water during transportation.

POWER TEST



WARNING: Before attempting any wiring, ensure that all power is disconnected. Failure to disconnect main service power to the device can cause severe personal injury, death, or substantial property damage. Before reapplying power, ensure that all wiring connections are secure and connected properly.

Ensure that the device is receiving power using the following steps:

1. Wire power to the device using the detailed instructions provided in [Power and Output Signal Connections \(Integrally- and Separately-mounted Transmitter Models\)](#), page 55.
2. To confirm that power is connected properly, turn on the device and verify that the backlight and green LED light up.
3. Power down the unit.

BAUD RATE FOR OPTIONAL COMMUNICATIONS

CamCor meters with optional communications are shipped ready to be wired. Communication wiring must be custom-er-provided. See [Line Wiring of Optional Communications](#), page 58 for wire sizes and additional information.

Using the Default Baud Rate

A CamCor meter purchased with the Modbus communication option is shipped with the baud rate set to 9600. To use the device with this baud rate,

1. Ensure that power to the unit is turned off.



WARNING: Failure to turn off power to the device can cause severe personal injury, death, or substantial property damage. Before reapplying power, ensure that all wiring connections are secure and connected properly.

2. Remove terminal cover B as follows:

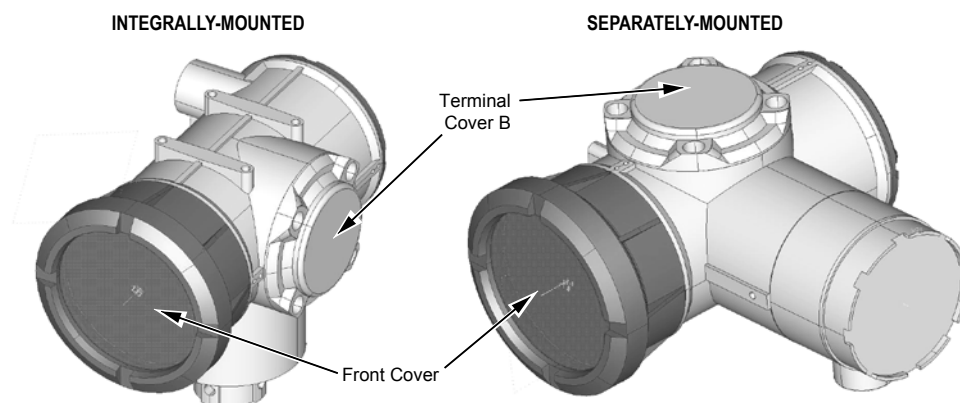


Figure 2.1—Terminal cover B location on integrally-mounted and separately-mounted transmitter

- a. Locate terminal cover B (Figure 2.1) and unscrew and remove the four M8 hex bolts. Set bolts aside for reassembly.

- b. Insert a flathead screwdriver between terminal cover B and the device body and gently pry off the terminal cover (Figure 2.2, page 10), being careful not to damage the socket and spigot joint.

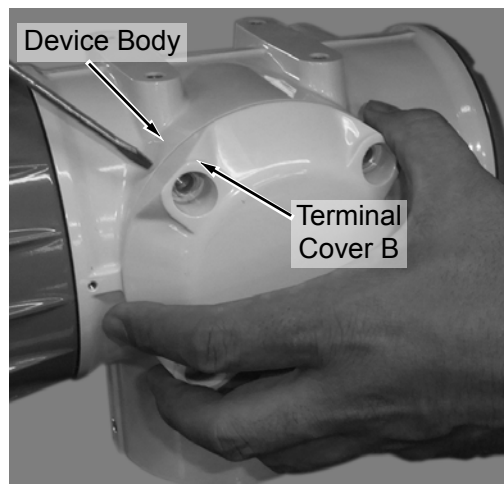


Figure 2.2—Terminal cover B being separated from device body

- c. Lift terminal cover B off to expose the black plastic cap (Figure 2.3).

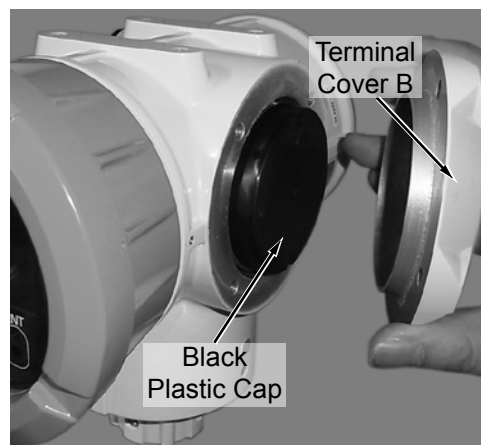


Figure 2.3—Black plastic cap located underneath Terminal cover B

- d. Unscrew and remove the two M3×10mm screws holding the black plastic cap in place (Figure 2.4). Set screws aside for reassembly.

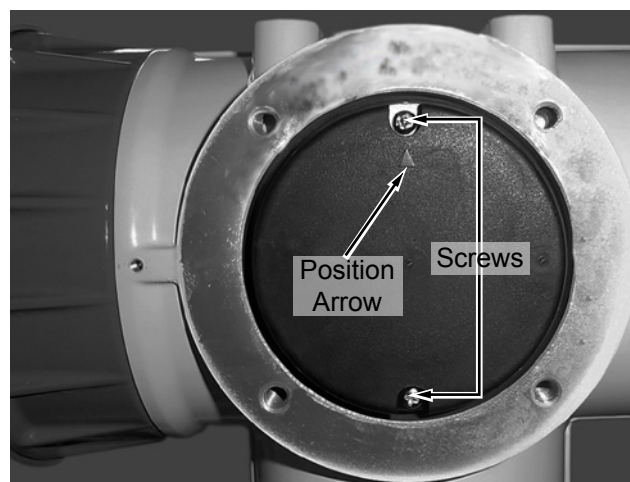


Figure 2.4—Black plastic cap, detail view

3. Lift off the black plastic cap to expose the maintenance board (Figure 2.5). Take care not to lose the spacers between the circuit boards.

CAUTION The screws holding the plastic cap in place also secure two shock-absorbing spacers positioned between the maintenance board and the blind board underneath it (Figure 2.5). To avoid damage to the circuit boards, ensure that the spacers are in place before reinstalling the black plastic cap.

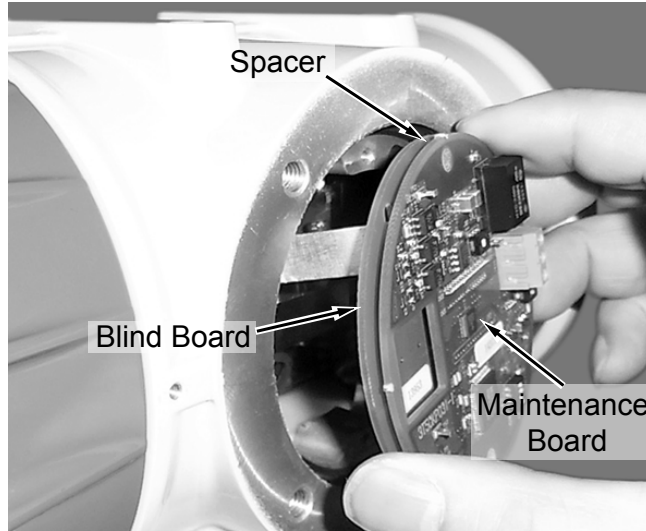


Figure 2.5—Maintenance and blind boards, showing location of shock-absorbing spacer (1 of 2)

4. To retain the spacers in the proper position, insert the screws from the black plastic cap into the screw holes on the Maintenance/Blind board assembly. Do not lift the board assembly from the enclosure.

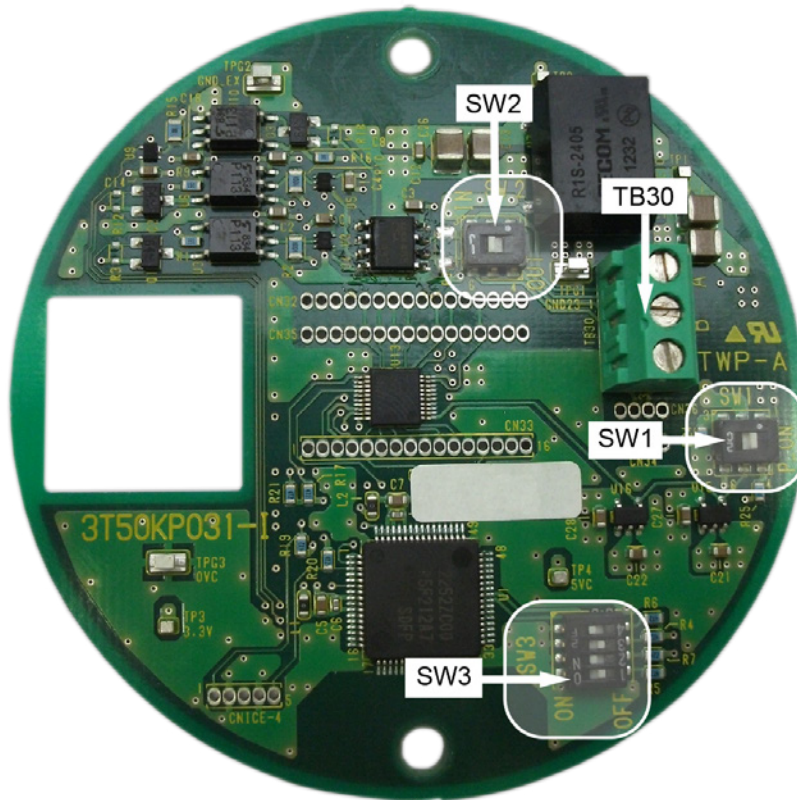


Figure 2.6—Maintenance board, showing switch and terminal block positions

5. Verify that SW1 (Figure 2.6), which provides power to the maintenance board, is in the “P_ON” position.

6. Check the position of SW2 (Figure 2.6, page 11) and wire the cable as described below:
 - If the switch is in the “IN” (default) position, wire the cable to the I/O board using the procedures described in [Line Wiring of Optional Communications, page 58](#).
 - If the switch is in the “OUT” position, wire the cable to the TB30 terminal block located on the Maintenance board.
7. Turn on power to the device.
8. Send a test message to the slave device using Modbus or HART communications. If using Modbus communications, you must first connect to the slave device. See [Setting Modbus Slave Addresses, page 12](#) for detailed procedures.
9. Once communications are verified, turn off power to the device.
10. Replace the black plastic cap, ensuring that the position arrow is pointing up (Figure 2.4, page 10) and secure with the fasteners removed in Step 2d.
11. Replace terminal cover B and secure them with the fasteners removed in Step 2a.

Changing the Baud Rate

The baud rate is adjustable using Switch 3 (SW3) on the Maintenance board located in the transmitter body. To change the baud rate,

1. Turn off power to the device and access the Maintenance board using Steps 1 through 3 of “Using the Default Baud Rate.”
2. Locate SW3 on the Maintenance board (Figure 2.6, page 11) and change the SW3-1 and SW3-2 positions (Figure 2.7) to set the desired baud rate. See the [Baud Rate Switch Settings](#) table below for switch positions.

Note Switches 3-3 (SW3-3) and 3-4 (SW3-4) are not required for Modbus communications.

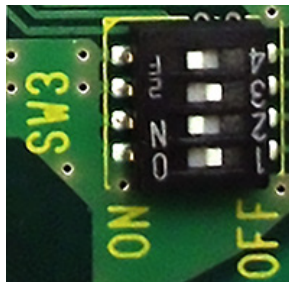


Figure 2.7—Closeup of SW3, showing the baud rate set to 38400

BAUD RATE SWITCH SETTINGS

Baud Rate	SW3-1 Setting	SW3-2 Setting
9600	Off	Off
19200	On	Off
38400	Off	On
Do Not Set	On	On

3. Follow Steps 7 through 11 of [Using the Default Baud Rate](#) procedure above.

SETTING MODBUS SLAVE ADDRESSES

Slave addresses can range from 1 to 255. Slave Address “0” broadcasts messages to all slave devices and is only available for Modbus Function Code 16. If the broadcast message contains valid data, the device is updated and no response is sent to the host system.

If you do not know the slave address of a device to be connected to the CamCor meter, you can set/reset it using the following procedure:

WARNING Do not use this query while more than one slave is connected. In a multipoint drop connection setup, all connected slaves share the same address; therefore, resetting the slave address will assign the same address to all slave devices.

1. Establish a point-to-point connection between the slave device and the CamCor meter.
2. Send the following message to the slave device using hexadecimal:
 - Broadcast Slave Address: 0 (broadcast message)
 - Function Code: 16 (write command)
 - Register: 167 (slave address register)
 - Write Quantity: 1
 - Slave Address to Be Set: 1 to 255
3. Verify communications with the slave device by sending the following message:
 - Slave Address established above: 1 to 255
 - Register: 167 (slave address register)
 - Function Code: 3 (read command)
 - Write Quantity: 1

You should receive a valid response if communications have been successfully established. If you do not, repeat Steps 2 and 3.

Note Record slave addresses in a secure location. If you lose a slave address, repeat this procedure to reset it.

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Section 3—Specifications and Performance (U.S. Customary Units)

This section presents specifications in U.S. Customary units. For specifications in metric units, see [Appendix A—CamCor Specifications \(Metric Units\)](#), page A-1.

CT SERIES SENSOR GENERAL SPECIFICATIONS

Low-Flow Models (CC00A, CC001 and CC003)

Item		Description		
Model		CC00A	CC001	CC003
Nominal size		1/4"		10 mm, 1/2", DN15
Materials	Wetted parts ¹	SUS316L		SUS316L, Alloy C22
	Housing	SUS304		
	O-rings	Fluoro-elastomer (standard Viton [®]), PTFE (option)		—
Process connection		1/4-18 FNPT		ASME 100, 300, 600, 900 ² RF; DIN PN 10, 16, 25, 40 RF ³ , IDF Ferrule ⁴ , Threaded
Applicable fluid		Liquid and gas		
Density range		0 to 2.0 g/mL		
Temperature range		-328°F to 392°F ⁶		
Tube withstand @ 100°F		—		Wetted parts materials: SUS316L maximum 1440 psig; Alloy C22 maximum 2185 psig (depending on flange rating)
Maximum operating pressure @ 100°F	Liquid	2176 psi		
	Gas	142 psig		
Sensor housing withstand ⁵		—		1044 psig
Flow direction		Bi-directional		
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications , page 113 for details.)		
Dust-tight, waterproof configuration		IP66/67		

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel. It represents 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- Refer to "Explosion-proof Specifications" on page 11 for details. In case of non-explosion-proof type, the maximum measurement temperature is 266°F. However, the product must be used within the maximum ambient temperature of 113°F. Higher temperature limits can be achieved with the high-temperature models.

- * Only available with separately-mounted transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).
- * For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

Standard Models (CC006 through CC080)

Item		Description						
Model		CC006	CC010	CC015	CC025	CC040	CC050	CC080
Nominal size		10 mm, 1/2", DN15	15 mm, 1/2", DN15	25 mm, 1", DN25	40 mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80	
Materials	Wetted parts ¹	SUS316L, Alloy C22						
	Housing	SUS304						
Process connection		ASME 150, 300, 600, 900 ² RF; DIN PN 10, 16, 25, 40 RF ³ ; IDF Ferrule ⁴ ; Threaded						
Applicable fluids		Liquid and gas						
Density range		0 to 2.0 g/mL						
Temperature range		-328°F to 392°F ⁶						
Tube withstand @ 100°F		SUS316L: 1520 psig; Alloy C22: 2276 psig						
Maximum operating pressure		Depends on flange rating						
Sensor housing withstand ⁵		551 psig	435 psig	319 psig	232 psig	261 psig	203 psig	
Flow direction		Bi-directional						
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications , page 113 for details.)						
Dust-tight, waterproof configuration		IP66/67						

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel. It represents 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- Refer to [Section 10—Explosion-proof Specifications](#), page 113 for details. In case of non-explosion-proof type, the maximum measurement temperature is 266°F. However, the product must be used within the maximum ambient temperature of 113°F. Higher temperature limits can be achieved with the high-temperature models.

- * Available with either integrally-mounted or separately-mounted transmitter.
- * For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

High-Flow Models (CC100 through CC250)

Item		Description				
Model		CC100	CC150	CC15H	CC200	CC20H CC250
Nominal size		100 mm, 4", DN100	150 mm, 6", DN150		200 mm, 8", DN200 250 mm, 10", DN250	
Materials	Wetted parts ^①	SUS316L				
	Housing	SUS304				
Process connection ^②		ASME 150, 300, 600 RF; DIN PN 10, 16, 25, 40 RF				
Applicable fluids		Liquid				
Density range		0.3 to 2.0 g/mL				
Viscosity range		Maximum 10000 cP				
Temperature range		-328°F to 392°F ^③				
Tube withstand @ 100°F		1924 psig		1551 psig		1300 psig
Maximum operating pressure		Depends on flange rating				
Flow direction		Bidirectional				
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)				
Dust-tight, waterproof configuration		IP66/67				

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- Models CC20H and CC250 available only up to ASME Class 300 flanges.
- Refer to [Section 10—Explosion-proof Specifications, page 113](#) for details. When flowing non-combustible product, the maximum media temperature is 266°F. However, the maximum ambient temperature is 113°F. Higher temperature limits can be achieved with the high-temperature models. For products conforming to the high-pressure gas safety regulations, consult Cameron.

High-Pressure Models (CC010 and CC015)

Item		Description	
Model		CC010	CC015
Materials	Wetted parts	Flow Tube: Alloy C22; Manifold: Alloy C22 equivalent (CX2MW)	
	Housing	SUS304	
Process connection		3/8-18 FNPT	3/4-14 FNPT
Applicable fluid		Liquid and gas	
Density range		0.3 to 2.0 g/mL	
Temperature range		Integrally-mounted: -4°F to 194°F; Separately-mounted: -328°F to 392°F	
Maximum operating pressure @ 68°F		5221 psig	6237 psig
Sensor housing withstand ^①		435 psig	319 psig
Flow direction		Bidirectional	
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)	
Dust-tight, waterproof configuration		IP66/67	

- This pressure does not represent the rated test pressure of a pressure vessel. It represents 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test. For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

High-Temperature Models (CC025 through CC150)

Item		Description				
Model		CC025	CC040	CC050	CC080	CC100 CC150
Nominal size		25 mm, 1", DN25	40 mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80	100 mm, 4", DN100 150 mm, 6", DN150
Materials	Wetted parts ^①	SUS316L		SUS316L, Alloy C22	SUS316L	
	Housing	SUS304				
Process connection		1" to 3": ASME 150, 300, 600, 900 ^④ RF; DIN PN 10, 16, 25, 40 RF 4" and 6" : ASME 150, 300, 600 RF; DIN PN 10, 16, 25, 40 RF				
Applicable fluids		Liquid				
Density range		0.3 to 2.0 g/mL				
Temperature range ^②		-40°F to 662°F				
Tube withstand @ 100°F		SUS316L: 1520 psig; Alloy C22 (Model CC080 only): 2276 psig			1924 psig	
Maximum operating pressure		Dependent on flange rating				
Sensor housing withstand ^③		232 psig	261 psig	203 psig	—	
Flow direction		Bidirectional				
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)				
Dust-tight, waterproof configuration		IP66/67				

Optional Heat Tracer Specifications (Available for Models CC025 through CC080) ^⑤

Applicable fluids	Hot water, saturated steam, overheated steam
Heat retention fluid maximum output pressure	142 psig
Joint port for heat retention fluid	10 mm stainless tubing
Recommended joint	Standard stainless steel ferrule-type compression fitting for 10 mm tubing

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- Allowable ambient temperature permitted for the sensor unit is up to 122°F.
- This pressure does not represent the rated test pressure of a pressure vessel. It represents 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- ASME 900 flanges are only available in Alloy C22 material.
- Heat trace should only be used for heating the meter. Do not use for cooling of flowing media.
 - * For products conforming to the high-pressure gas safety regulations, consult Cameron.
 - * Only available with separately-located transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).

Low-Temperature Models (CC025 through CC250)

Item		Description									
Model		CC025	CC040	CC050	CC080	CC100	CC150	CC15H	CC200	CC20H	CC250
Nominal size		25 mm, 1", DN25	40 mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80	100 mm, 4", DN100	150 mm, 6", DN150		200 mm, 8", DN200		250 mm, 10", DN250
Materials	Wetted parts ①	SUS316L, Alloy C22				SUS316L					
	Housing	SUS304									
Process connection		ASME 150, 300, 600, 900 ③ RF; DIN PN 10, 16, 25, 40 RF ②; IDF Ferrule ④			ASME 150, 300, 600 RF; DIN PN 10, 16, 25, 40 RF ②			ASME 150, 300 RF; DIN PN 10, 16, 25, 40 RF ②			
Applicable fluids		Liquid and gas				Liquid					
Density range		0.3 to 2.0 g/mL									
Temperature range		-328°F to 122°F									
Tube withstand @ 100°F		1520 psig			1924 psig		1551 psig		1300 psig		
Maximum operating pressure		Dependent on flange rating									
Sensor housing withstand ⑤		232 psig	261 psig	203 psig	—						
Flow direction		Bi-directional									
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)									
Dust-tight, waterproof configuration		IP66/67									

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- DIN flanges are only available for meter material SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel. It represents 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.

* Only available with separately-mounted transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).
 * For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

PRO SERIES SENSOR GENERAL SPECIFICATIONS

Item		Description					
Model		CP006	CP010	CP015	CP025	CP040	CP050
Nominal size (in.)		1/2	1/2	1/2	1	1-1/2	2
Materials	Wetted parts	SUS316L					
	Housing	SUS304					
Process connection		ASME 150, 300, 600 RF; IDF Ferrule; Threaded (CP006, CP010 and CP015 only)					
Applicable fluid		Liquid					
Density range		0.3 to 2.0 g/mL					
Temperature range ①		-40°F to 257°F ②					
Maximum operating pressure		Dependent on process connection					
Flow direction		Bidirectional					
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)					
Dust-tight, waterproof configuration		IP66/67					

- Refer to [Section 10—Explosion-proof Specifications, page 113](#). In case of non-explosion-proof model, up to 257°F is permitted. However, the product must be used within the maximum ambient temperature of 113°F.
- Cleaning in place (CIP) is permitted within the temperature range.

TRANSMITTER GENERAL SPECIFICATIONS

Item	Description	
Model	PA0K	
Power supply	CSA: 85 to 264 VAC, 50/60 Hz or 20 to 30 VDC (Safety rated 100 to 240 VAC, 50/60 Hz) ATEX: 100 to 240 VAC, 50/60 Hz, or 20 to 30 VDC	
Power consumption	CSA: Maximum 15 W; ATEX: 250 V	
Ambient temperature	-40°F to 131°F 1	
Transmission length (separately-mounted)	Maximum 200 m (interconnect cable used) 2	
Applicable EU directive	EMC Directive: 2004/108/EC; ATEX Directive: 94/9/EC	
Applicable EN standards	EMC—EN 55011: 1998/A1, 1999/A2, 2002 Group 1, Class B; EN 61000-6-2: 2001; EN 61326-1: 2006 ATEX—EN 60079-0: 2012; EN 60079-1: 2007; EN 60079-11: 2012 IECEX—IEC 60079-0: 2011; IEC 60079-1: 2007-04; IEC 60079-11: 2011	
Explosion-proof configuration	CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)	
Dust-tight, waterproof configuration	IP66/67	
Transmitter configuration	Integral or separately-mounted	
Finish	Paint type: Baked enamel; Paint color: Light gray (RAL7035)	
Display	LCD display provided (128×64 dots), backlit (white, orange) ; Two infrared light sensors; Two LEDs (green and red)	
Weight (approximate)	Integrally-mounted model, 7.94 lb; Separately-mounted model, 11.02 lb	
Communication interface 5	HART (Standard)	Protocol Version 7, Bell 202 3
	Modbus (Optional)	RS-485: Baud rate: 9600, 19200, 38400; RTU; Response time: 25 to 50 ms
Damping (default)	Flow rate, 0.8 sec.; Density, 4.0 sec.; Temperature, 2.5 sec.	
Low-flow cutoff (default)	Less than 0.6% of maximum service flow rate	
Pulse output	Open drain (equivalent to open collector)—10 V to 30 V, 50 mADC, ON resistance ≤0.6 Ω OR Voltage—1.5 V maximum (low level) to 13 V minimum (high level), output impedance: 2.2 kΩ; Frequency output range: 0 to 10000 Hz (Maximum: 11000 Hz)	
Analog output	4 to 20 mADC (maximum load: 600 Ω); Select two outputs from instant flow rate (mass or volume) temperature, and density.	
Status output	Open drain (equivalent to open collector)—30 V maximum, 50 mADC, ON resistance ≤0.6 Ω; Select one from error (default) 4 , flow direction, high/low alarm, or drive output alarm.	
Status input	Contact-closure (Form "a" contact)—Close: 200 Ω maximum, Open: 100 kΩ minimum; Select one output from remote zero, total reset, 0% signal lock, or function off (default).	

- Below -4°F, the display loses its visibility due to weakened contrast. Both the display and infrared sensor may exhibit slow responses below -4°F.
- If the sensor-to-transmitter communications cable length exceeds 200 m, consult Cameron.
- HART communications are available only across the Analog Output 1.
- The status output can also be configured to activate when meter zeroing is in process.
- Electrical noise filtering components are installed in connections between power source, output, communications, and chassis.

CT SERIES SENSOR GENERAL PERFORMANCE

Flow Rate

Meter type	Model	Size (in.)	Guaranteed minimum rate (lb/min)	Minimum setting rate (lb/min)	Maximum service rate (lb/min)	Maximum allowable rate (lb/min)	Uncertainty ⑤		Repeatability ⑤		Zero stability (lb/min)	Analog output uncertainty				
							Liquids	Gases	Liquids	Gases						
Low-flow	CC00A	1/4	0.00088	0.0044	0.088	0.132	±0.2% of reading (±ZS) ⑤	±0.5% of reading (±ZS)	±0.05% of reading (±1/2 ZS)	±0.25% of reading (±1/2 ZS)	0.000013	Uncertainty ±0.1% of full scale				
	CC001		0.0033	0.0165	0.33	0.496					0.000005					
	CC003	1/2	0.026 (0.033) ①	0.13	2.65	5.29 (6.61) ①					0.000066					
	CC006	1/2	0.132	0.66	13.23	26.46					0.00066					
	CC010	1/2	0.44	2.2	44.09	88.18					0.0022					
	CC015	1/2	1.32	6.61	132	265					0.0066					
Standard and Low-temperature	CC025	1	3.97	19.8	397	794	±0.1% of reading ②	±0.05% of reading ③	±0.05% of reading ③	±0.25% of reading (±1/2 ZS)	0.0198	Uncertainty ±0.1% of full scale				
	CC040	1-1/2	14.33	71.7	1433	2866					0.071					
	CC050	2									0.22					
	CC080	3	44.09	220	4409	8818					0.0066					
	CC100	4	126	628	12566	25133					0.628					
	CC150	6									1.286					
	CC15H	6									257		1286	25721	51441	2.572
	CC200	8														0.0198
	CC20H	8	514	2572	51441	102883					0.071					
	CC250	10									0.22					
High-pressure	CC010	3/8	0.88	4.41	30.86	61.73	±0.2% of reading (±ZS) ⑤	±0.5% of reading (±ZS)	±0.1% of reading (±1/2 ZS)	±0.25% of reading (±1/2 ZS)	0.0077	Uncertainty ±0.1% of full scale				
	CC015	3/4	2.87	14.33	93.7	187					0.0234					
High-temperature	CC025	1	3.97	19.8	397	794	±0.1% of reading (±ZS)	—	±0.05% of reading (±1/2 ZS)	—	0.0396	Uncertainty ±0.1% of full scale				
	CC040	1-1/2	14.33	71.7	1433	2866					0.143					
	CC050	2									0.441					
	CC080	3	44.09	220	4409	8818					0.441					
	CC100	4	126	628	12566	25133					1.257					
CC150	6	1.257														

- When a maximum allowable range 6.61 lb/min is adopted, the minimum flow rate is 0.033 lb/min.
- ±ZS is applied for flow rates below 5% (2.5% for Model CC003) of the maximum service rate (within the guaranteed flow range).
- ±1/2 ZS is applied for flow rates below 5% (2.5% for Model CC003) of the maximum service rate (within the guaranteed flow range).
- If an uncertainty of ±0.1% of reading is required, consult Cameron.
- Above maximum service flow rate, the uncertainty is ±0.3% of reading (±ZS).
 - If you request volume flow measurement for the purpose of fiscal transactions or weights and measurements transactions, contact Cameron.
 - In gas measurement, the maximum permissible flow velocity varies with the type of gas and some may be beyond the bounds of measurement. If so, contact Cameron.
 - ZS = Zero stability error (During testing, zero stability and current flow rate should be read in the same measurement unit.)

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Current flow rate}} \times 100\%$$

Volumetric Flow Rate ①

Model	Units	Guaranteed minimum rate	Minimum setting rate	Maximum service rate	Maximum allowable
CC00A	gal/hr	0.006	0.032	0.635	0.952
CC001	gal/hr	0.023	0.119	2.38	3.57
CC003	gal/hr	0.19	0.952	19.04	38.07
CC006	gal/min	0.016	0.08	1.58	3.17
CC010	gal/min	0.053	0.264	5.28	10.6
CC015	gal/min	0.159	0.793	11.5	31.7
CC025	gal/min	0.476	2.38	47.6	95.2
CC040	gal/min	1.72	8.59	172	344
CC050	gal/min				
CC080	bbbl/hr	7.55	37.8	755	1511
CC100	bbbl/hr	21.5	108	2153	4306
CC150	bbbl/hr				
CC15H	bbbl/hr	44.1	220	4407	8813
CC200	bbbl/hr				
CC20H	bbbl/hr	88.1	441	8813	17627
CC250	bbbl/hr				
CC010*	gal/min	0.106	0.529	3.7	7.4
CC015*	gal/min	0.344	1.719	11.2	22.5

* High-pressure models

- Calculations based on water (specific gravity of 1) at 59°F (mass = 62.37 lb/ft³). Actual flow ranges vary with media density. To determine the flow range for your fluid, divide the values above by the fluid's specific gravity.

Density (Liquids)

Meter type	Model	Size (in.)	Metering range	Uncertainty	Analog output uncertainty
Low-flow	CC00A	1/4	0.3 to 2g/mL	±0.0005 g/mL	Uncertainty ±0.1% of full scale
	CC001				
	CC003	1/2			
	CC006	1/2			
	CC010	1/2			
	CC015	1/2			
Standard and Low-temperature	CC025	1	0.3 to 2g/mL	±0.0005 g/mL	Uncertainty ±0.1% of full scale
	CC040	1-1/2			
	CC050	2			
	CC080	3			
	CC100	4			
	CC150	6			
	CC15H	6			
	CC200	8			
	CC20H	8			
	CC250	10			
High-pressure	CC010	3/8	0.3 to 2 g/mL	±0.004 g/mL	Uncertainty ±0.1% of full scale
	CC015	3/4			
High-temperature	CC025	1	0.3 to 2g/mL	±0.003g/mL	Uncertainty ±0.1% of full scale
	CC040	1-1/2			
	CC050	2			
	CC080	3			
	CC100	4			
CC150	6				

PRO SERIES SENSOR GENERAL PERFORMANCE

Mass Flow Rate

Item		Description					
Model		CP006	CP010	CP015	CP025	CP040	CP050
Flow rate	Guaranteed minimum rate (lb/min)	0.88	2.82	7.05	21.2	70.5	70.5
	Minimum setting rate (lb/min)	2.2	7.05	17.6	52.9	176	176
	Maximum service rate (lb/min)	22	70.5	176	529	1764	1764
	Maximum allowable rate (lb/min)	44.1	141	353	1058	3527	3527
	Uncertainty	±0.2% of reading (± zero stability)					
	Repeatability	±0.1% of reading (± 1/2 zero stability)					
	Zero stability (lb/min)	0.0033	0.011	0.026	0.079	0.265	0.265
Density (Liquid)	Metering range	0.3 to 2 g/mL					
	Uncertainty	±0.003 g/mL					
Analog output uncertainty		±0.1% of full scale					

During testing, zero stability and flow rate during the test should read in the same measurement unit.

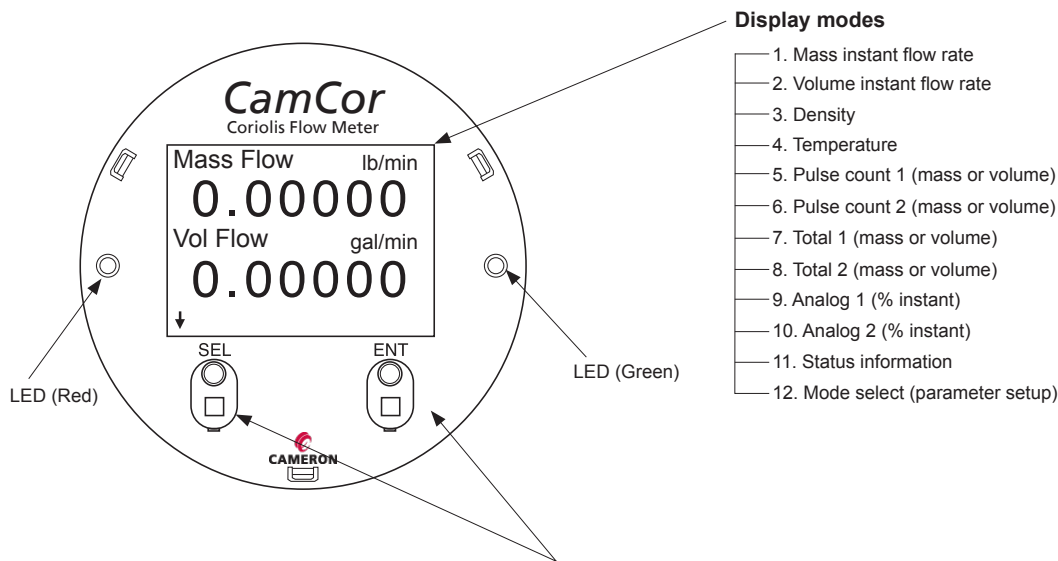
$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Current flow rate}} \times 100\%$$

Volumetric Flow Rate ①

Item		Description					
Model		CP006	CP010	CP015	CP025	CP040	CP050
	Guaranteed minimum rate (gal/min)	0.106	0.338	0.846	2.54	8.46	8.46
	Minimum setting rate (gal/min)	0.264	0.846	2.12	6.35	21.2	21.2
	Maximum service rate (gal/min)	2.64	8.46	21.2	63.5	212	212
	Maximum allowable rate (gal/min)	5.29	16.9	42.3	127	423	423

1. Calculations based on water (specific gravity of 1) at 59°F (mass = 62.37 lb/ft³). Actual flow ranges vary with media density. To determine the flow range for your fluid, divide the values above by the fluid's specific gravity.

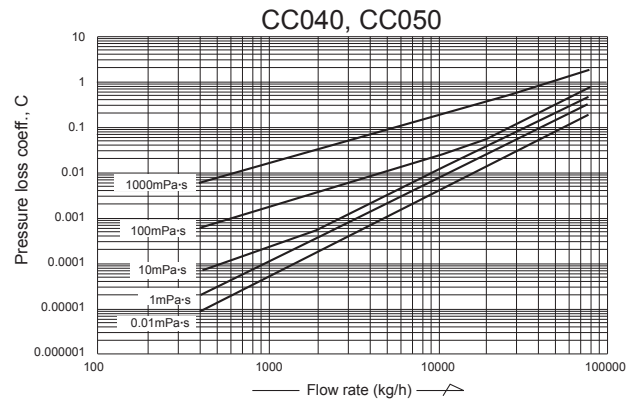
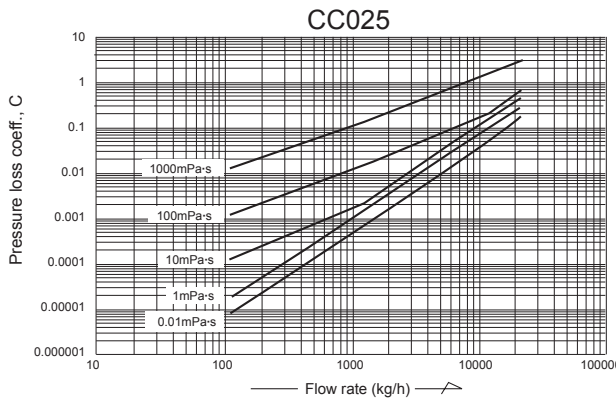
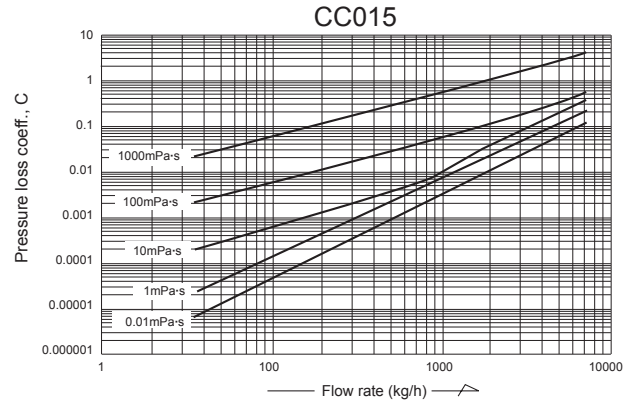
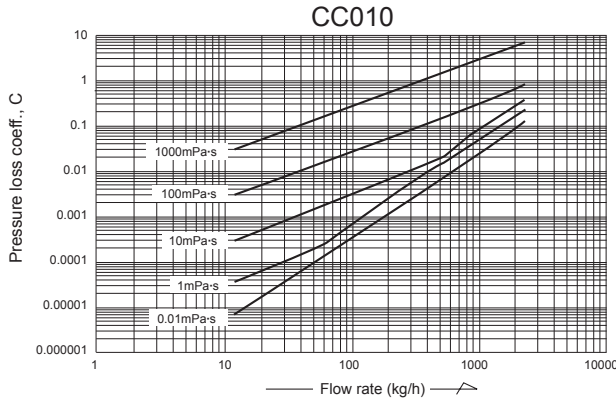
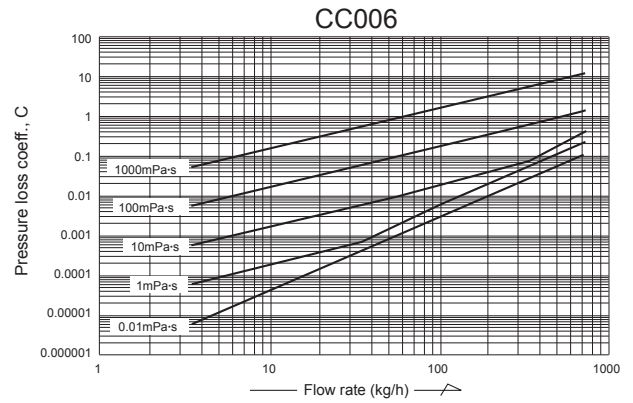
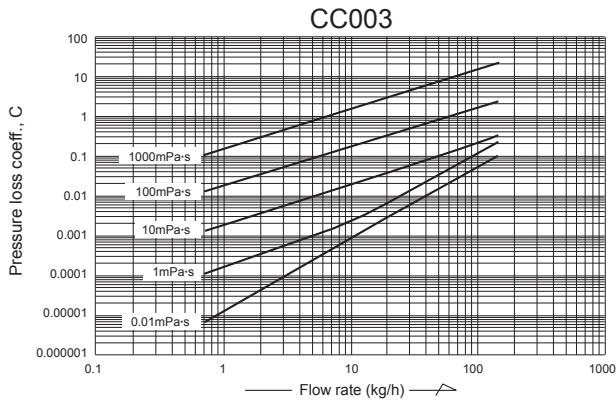
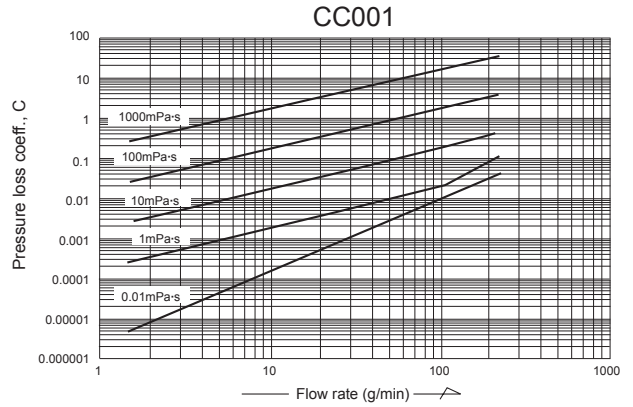
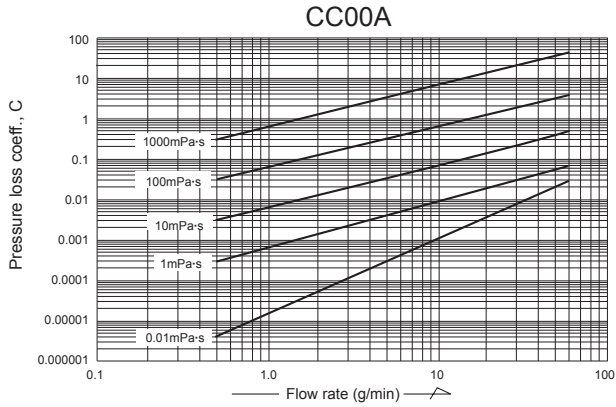
DISPLAY

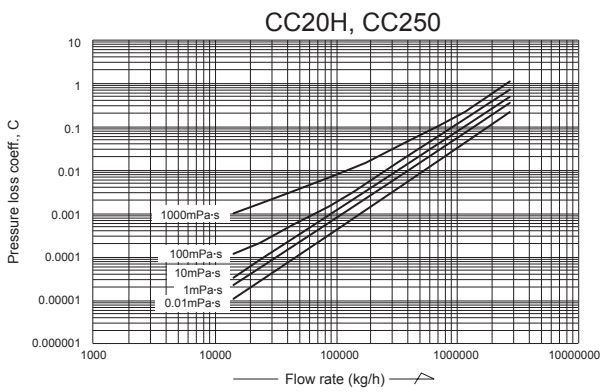
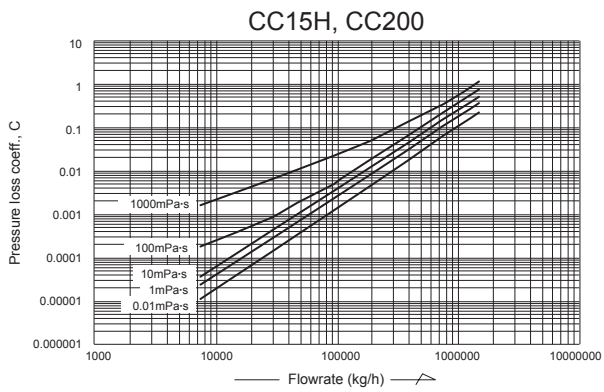
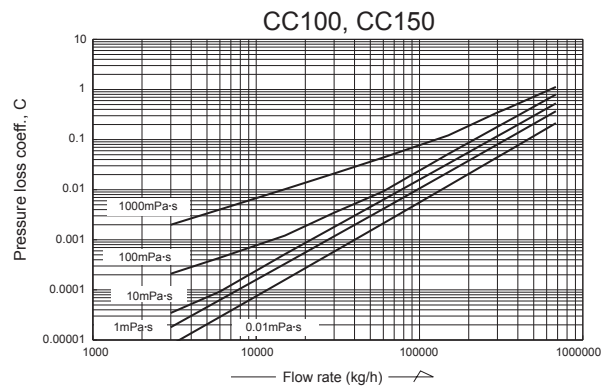
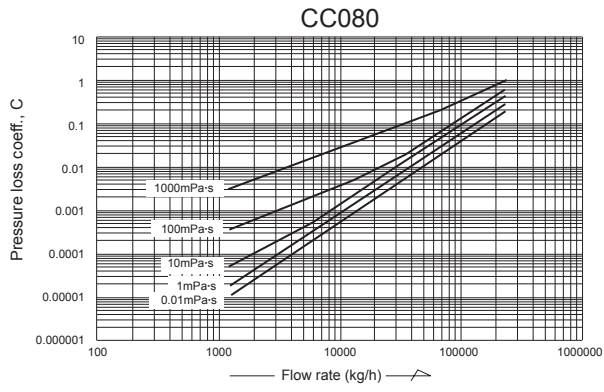


- LCD backlight available in white and orange. Color changes according to the status of flow meter.
- In most cases, the backlight shuts off automatically if the optical sensor does not respond within a user-defined duration.

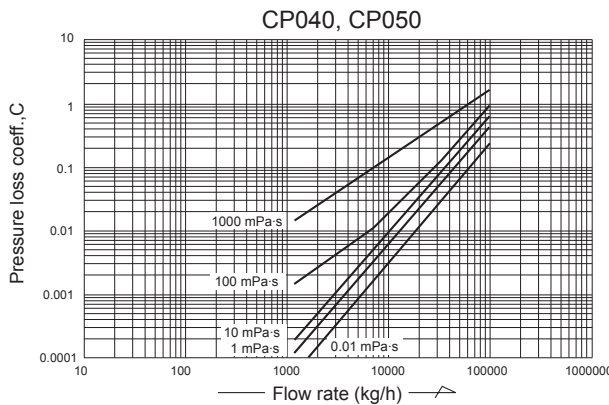
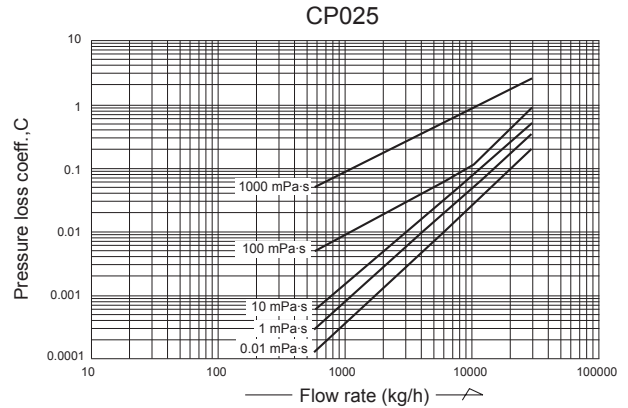
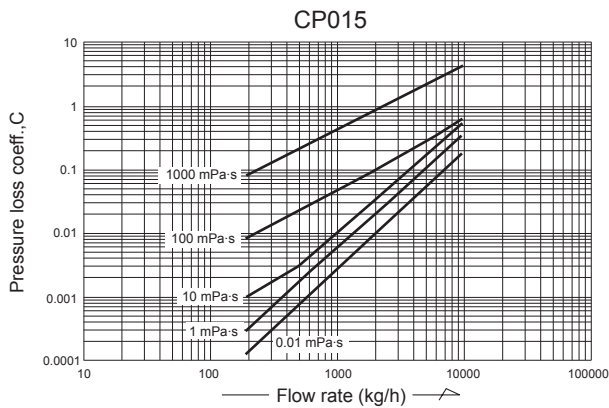
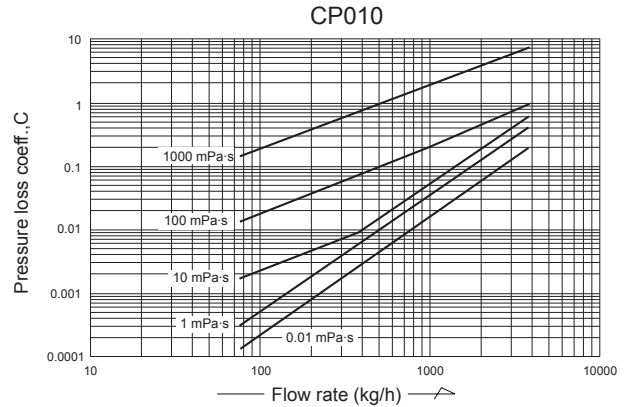
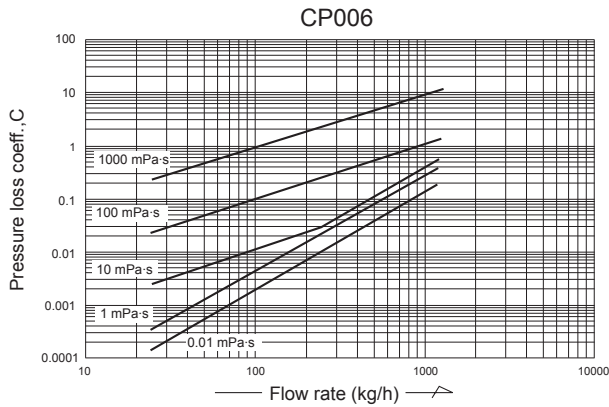
To select the mode, touch and hold your finger over the front glass where the infrared optical sensor appears.

CT SERIES PRESSURE LOSS CURVES





PRO SERIES PRESSURE LOSS CURVES



Determining Pressure Loss

Find the pressure loss factor “C” for a given parameter from its flow rate (kg/h or g/min) and viscosity (mPa·s), then divide “C” by specific gravity “d” (“1” for water) as shown in the following formula:

$$\Delta P = \frac{C}{d} \text{ (MPa)}$$

*For high viscosity liquids not shown in these graphs, calculate the pressure loss using the following form

$$\Delta P_2 = C \times \frac{\mu_2}{\mu_1} \times \frac{1}{d}$$

- where ΔP_2 = Pressure loss of high viscosity liquid (MPa)
- μ_1 = Maximum viscosity shown in the graph (mPa·s)
- μ_2 = Viscosity of high-viscosity liquid (mPa·s)
- d = Specific gravity of high-viscosity liquid (“1” for water)
- C = Pressure loss factor

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Section 4—Product Dimensions (U.S. Customary Units)

This section presents product dimensions in U.S. Customary units (inches). For specifications in metric units, see [Appendix B—Product Dimensions \(Metric Units\)](#).

CT Series CC00A and CC001 Sensor with Separately-mounted Transmitter (Threaded)

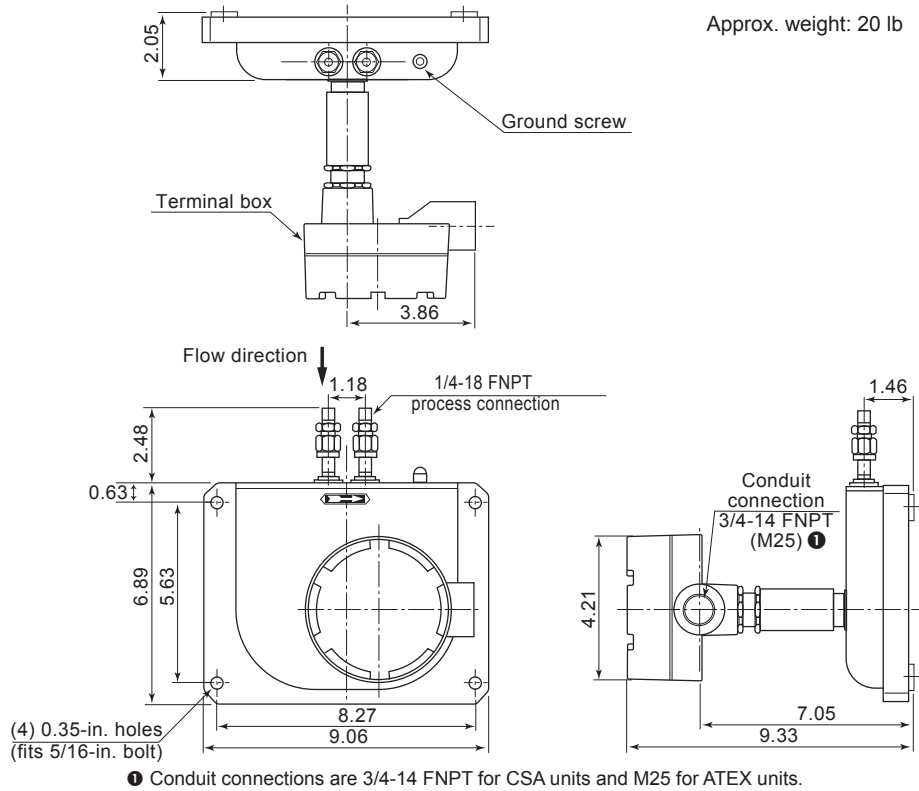
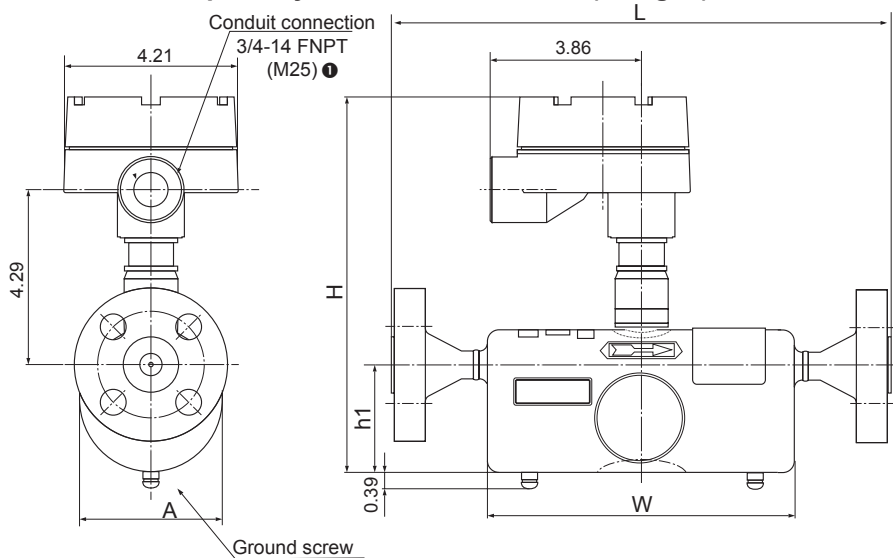


Figure 4.1—Outline dimensions of CT Series sensor units CC00A and CC001 (inches)

CT Series CC003 Sensor with Separately-mounted Transmitter (Flanged)

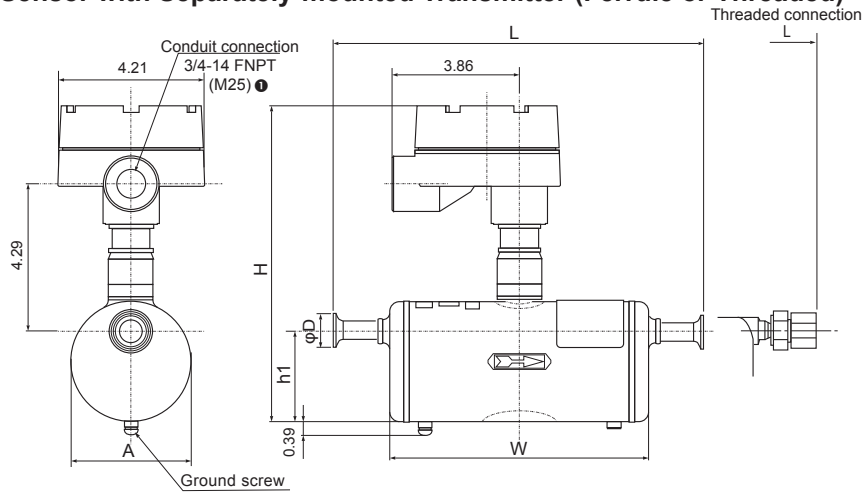


Model	Nominal size (in.)	ASME				Nominal size (DN)	DIN		H (in.)	h1 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
		150	300	600	900 ②		PN 10, 16	PN 25, 40					
CC003	1/2	11.9	12.2	12.7	13.3	15	10.8	11.1	9.06	2.64	3.51	7.56	11

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. ASME 900 flanges are only available with Alloy C22 material.
- This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
- DIN flanges are only available for meter material SUS316L.

Figure 4.2—Outline dimensions of CT Series flanged sensor unit CC003 with separately-mounted transmitter (inches)

CT Series CC003 Sensor with Separately-mounted Transmitter (Ferrule or Threaded)

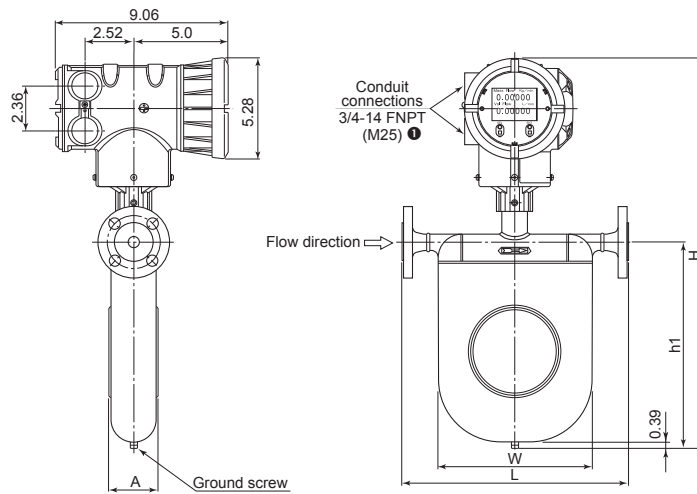


Model	Ferrule		L (in.)	H (in.)	h1 (in.)	A (in.)	W (in.)	D (in.)	Approx. Weight (lb)	Model	Threaded Connection	L (in.)	Approx. Weight (lb)
	Nominal size	Connection 2											
CC003	10	Ferrule 10A	10.49	9.06	2.64	3.51	7.56	1.34	9.92	CC003	1/2-14 FNPT	13.1	9.92

- Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
- Process connection: A = mm

Figure 4.3—Outline dimensions of CT Series ferrule/threaded sensor unit CC003 with separately-mounted transmitter (inches)

CT Series CC006 through CC080 Sensor with Integral Transmitter (Flanged)

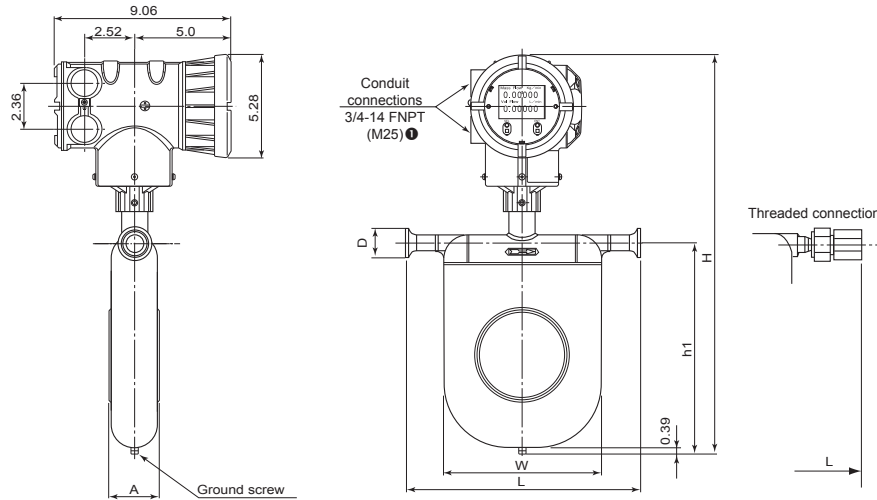


Model	Nominal size (in.)	ASME				Nominal size (DN)	DIN		H (in.)	h1 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
		150	300	600	900 2		PN 10, 16	PN 25, 40					
		L (in.)					L						
CC006	1/2	10.6	10.9	11.4	12.1	15	9.49	9.72	16.7	7.09	2.09	5.83	15.4
CC010		11.1	11.5	11.9	12.6		10.1	10.3	18.2	8.58		6.42	17.2
CC015		12.8	13.1	13.7	14.3		11.8	12	20.2	10.6		2.56	8.07
CC025	1	16.2	16.7	17.2	18.1	25	14.8	15	22.8	13	3.27	10.3	29.3
CC040	1-1/2	21.5	22	22.6	23.7	40	20	20.2	28	17.8	4.76	15.2	50.7
CC050	2	21.7	22.2	22.9	25.2	50	20.2	20.4					50.7
CC080	3	27.5	28.2	29	30.6	80	25.9	26.6					34.6

- Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 - This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
 - DIN flanges are only available for meter material SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.

Figure 4.4—Outline dimensions of CT Series flanged sensor units CC006 through CC080 with integral transmitter (inches)

CT Series CC006 through CC080 Sensor with Integral Transmitter (Ferrule or Threaded)



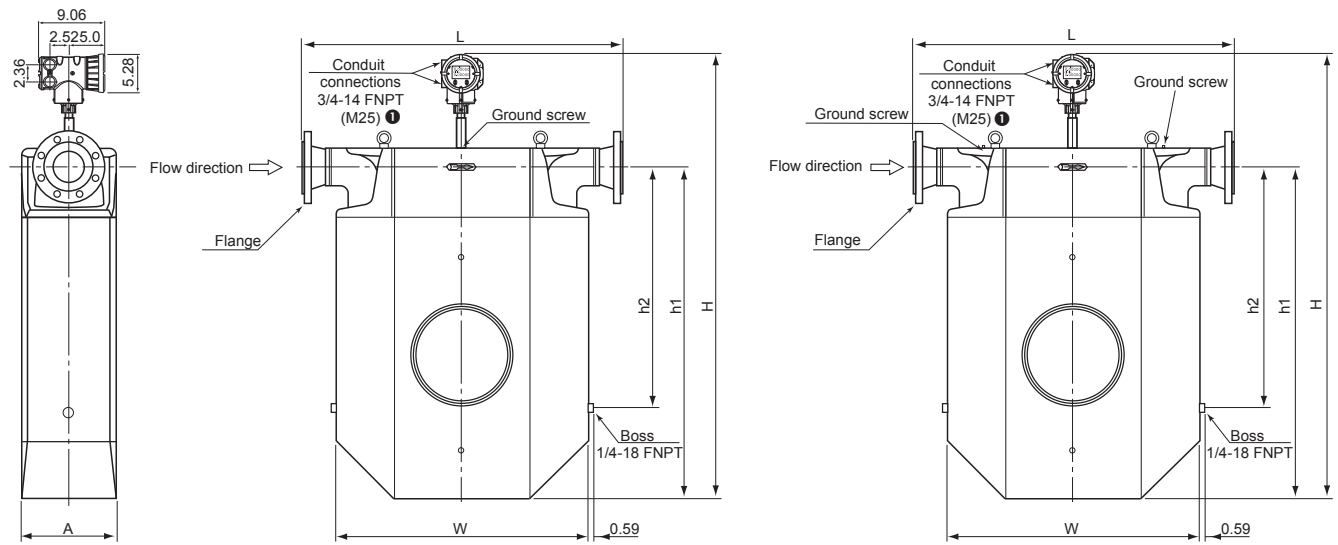
Model	Ferrule		L (in.)	H (in.)	h1 (in.)	A (in.)	W (in.)	D (in.)	Approx. Weight (lb)
	Nominal size	Connection ②							
CC006	10	Ferrule 10A	9.11	17.1	7.09	2.09	5.83	1.34	12.6
CC010	15	Ferrule 15A	10.1	18.2	8.58				6.42
CC015		Ferrule 15A	11.4	20.2	10.6	2.56	8.07		15.7
CC025	25	Ferrule 25 (ISO), IDF 1S	14.6	22.8	13	3.27	10.3	1.99	23.6
CC040	40	Ferrule 38 (ISO), IDF 1.5S	19.4	28	17.8	4.76	15.2	2.52	41.9
CC050	50	Ferrule 51 (ISO), IDF 2S							
CC080	80	Ferrule 76.1 (ISO), IDF 3S	25.9	34.6	23.7	6.85	20.1		3.58

Model	Threaded Connection	L (in.)	Approx. Weight (lb)
CC006	1/2-14 FNPT	11.7	12.6
CC010		12.3	13.9
CC015	3/4-14 FNPT	15	15.7

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: A = mm, S (sanitary) = in.

Figure 4.5—Outline dimensions of CT Series ferrule/threaded sensor units CC006 through CC080 with integral transmitter (inches)

CT Series CC100 through CC250 Sensor with Integral Transmitter (Flanged)



① Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.

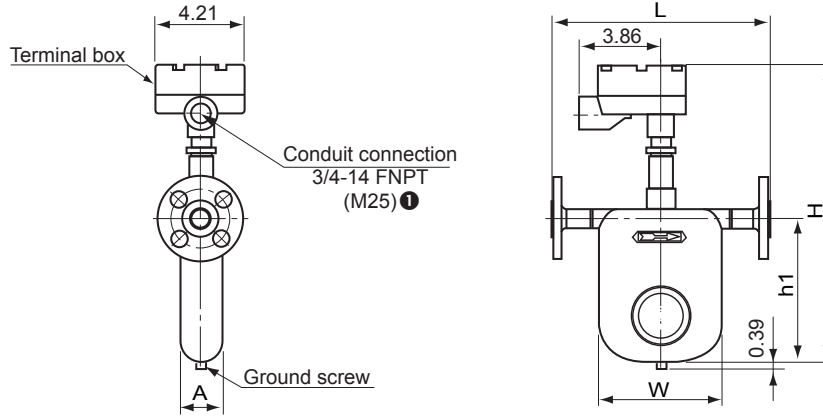
CC100, CC150

CC15H through CC250

Model	Flange		L (in.)	H (in.)	h1 (in.)	h2 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
	Nominal size	Flange rating							
CC100	4"	ASME 150	40.1	55.2	40	26	11.8	31.9	509
		ASME 300	40.8						
		ASME 600	42.6						
	DN100	PN 10, 16	38.1						
		PN 25, 40	39.1						
CC150	6"	ASME 150	51.9	55.2	40	26	11.8	31.9	542
		ASME 300	52.7						
		ASME 600	54.6						
	DN150	PN 10, 16	49.2						
		PN 25, 40	50.8						
CC15H	6"	ASME 150	42.8	63.1	46.9	33.5	12.6	31.9	683
		ASME 300	43.6						
		ASME 600	45.6						
	DN150	PN 10, 16	40.1						
		PN 25, 40	41.7						
CC200	8"	ASME 150	55.8	63.1	46.9	33.5	12.6	31.9	750
		ASME 300	56.6						
		ASME 600	58.8						
	DN200	PN 10, 16	52.7						
		PN 25, 40	54.1						
CC20H	8"	ASME 150	55.8	72	54.7	37.8	16.5	43.7	1345
		ASME 300	56.6						
	DN200	PN 10, 16	52.7						
		PN 25	54.1						
		PN 40	54.7						
CC250	10"	ASME 150	69.8	72	54.7	37.5	16.5	43.7	1433
		ASME 300	71.1						
	DN250	PN 10	67.1						
		PN 16	67.3						
		PN 25	68.7						
		PN 40	70						

Figure 4.6—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with integral transmitter (inches)

CT Series CC006 through CC080 Sensor with Separately-mounted Transmitter (Flanged)

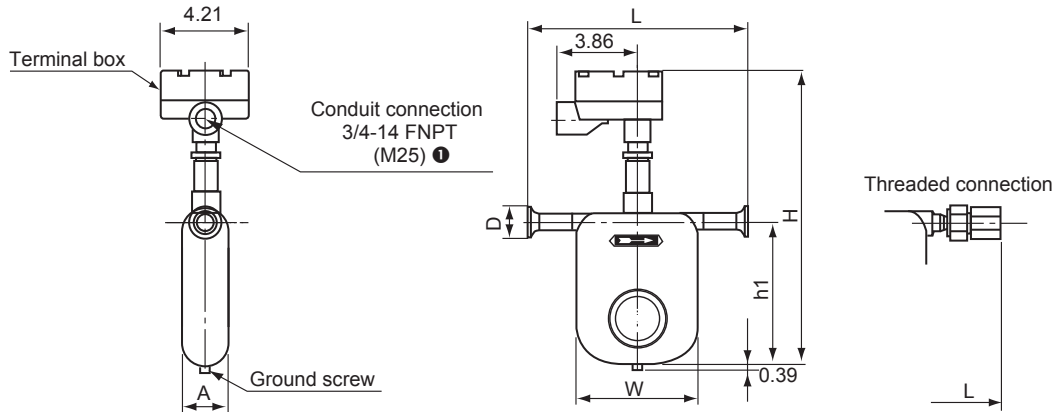


Model	ASME					DIN			H (in.)	h1 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
	Nominal size (in.)	150	300	600	900 ②	Nominal size (DN)	PN 10, 16	PN 25, 40					
		L (in.)					L						
CC006	1/2	10.6	10.9	11.4	12.1	15	9.49	9.72	14.5	7.09	2.09	5.83	8.8
CC010	1/2	11.1	11.5	11.9	12.6	15	10	10.3	16	8.58		6.42	10.4
CC015	1/2	12.8	13.1	13.7	14.3	15	11.8	12	18	10.6		8.07	12.3
CC025	1	16.2	16.7	17.2	18.1	25	14.8	15	21	13	3.27	10.3	23
CC040	1-1/2	21.5	22	22.6	23.7	40	20	20.2	25.7	17.8	4.76	15.2	44.1
CC050	2	21.7	22.2	22.9	25.2	50	20.2	20.4					
CC080	3	27.5	28.2	29	30.6	80	26	26.6	32.4	23.7	6.85	20.1	119

- Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 - This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
 - DIN flanges are only available for meter material SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.

Figure 4.7—Outline dimensions of CT Series flanged sensor unit CC006 through CC080 with separately-mounted transmitter (inches)

CT Series CC006 through CC080 Sensor with Separately-mounted Transmitter (Ferrule or Threaded)



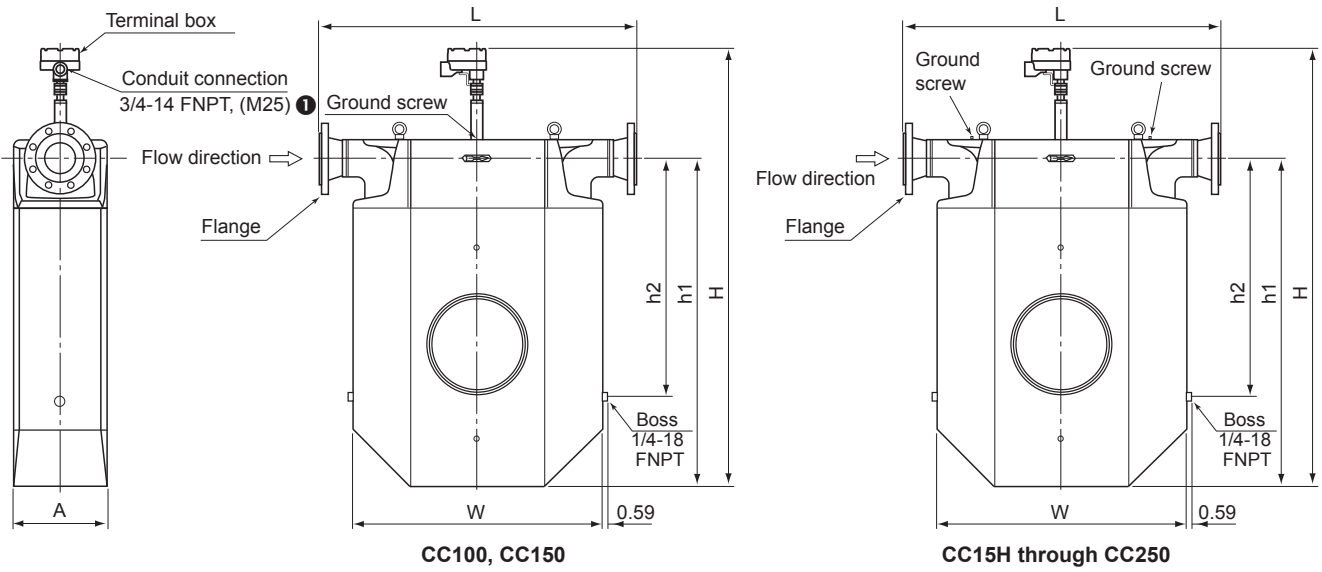
Model	Ferrule		L (in.)	H (in.)	h1 (in.)	A (in.)	W (in.)	D (in.)	Approx. Weight (lb)
	Nominal size	Connection ②							
CC006	10	Ferrule 10A	9.11	14.5	7.09	2.09	5.83	1.34	6.2
CC010	15	Ferrule 15A	10.1	16	8.58		6.42		7.5
CC015	15	Ferrule 15A	11.4	18	10.6	2.56	8.07		9.3
CC025	25	Ferrule 25 (ISO), IDF 1S	14.6	20.6	13	3.27	10.3	1.99	17.2
CC040	40	Ferrule 38 (ISO), IDF 1.5S	19.4	25.7	17.8	4.76	15.2	2.52	35.3
CC050	50	Ferrule 51 (ISO), IDF 2S							
CC080	80	Ferrule 76.1 (ISO), IDF 3S	25.9	32.4	23.7	6.85	20.1	3.58	105.8

Model	Threaded Connection	L	Approx. Weight (lb)
CC006	1/2-14 FNPT	11.7	6.2
CC010	1/2-14 FNPT	12.3	7.5
CC015	3/4-14 FNPT	15	9.3

- Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
- Process connection: A = mm, S (sanitary) = in.

Figure 4.8—Outline dimensions of CT Series ferrule/threaded sensor units CC006 through CC080 with separately-mounted transmitter (inches)

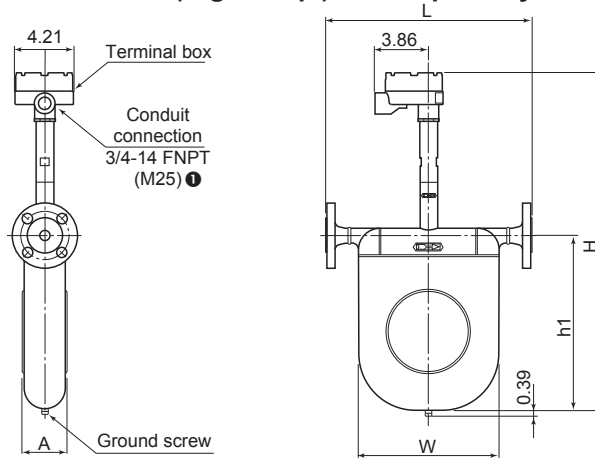
CT Series CC100 through CC250 Sensor with Separately-mounted Transmitter (Flanged)



Model	Flange		L (in.)	H (in.)	h1 (in.)	h2 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
	Nominal size	Flange rating							
CC100	4"	ASME 150	40.1	53.3	40	26	11.8	31.9	509
		ASME 300	40.8						
		ASME 600	42.6						
	DN100	PN 10, 16	38.1						
		PN 25, 40	39.1						
CC150	6"	ASME 150	51.2	53.3	40	26	11.8	31.9	542
		ASME 300	52.7						
		ASME 600	54.6						
	DN150	PN 10, 16	49.2						
		PN 25, 40	50.8						
CC15H	6"	ASME 150	42.8	61.2	46.9	33.5	12.6	31.9	683
		ASME 300	43.6						
		ASME 600	45.6						
	DN150	PN 10, 16	40.1						
		PN 25, 40	41.7						
CC200	8"	ASME 150	55.8	61.2	46.9	33.5	12.6	31.9	750
		ASME 300	56.6						
		ASME 600	58.8						
	DN200	PN 10, 16	52.7						
		PN 25	54.1						
		PN 40	54.7						
CC20H	8"	ASME 150	55.8	70.1	54.7	37.8	16.5	43.7	1345
		ASME 300	56.6						
	DN200	PN 10, 16	52.7						
		PN 25	54.1						
		PN 40	54.7						
CC250	10"	ASME 150	69.8	70.1	54.7	37.8	16.5	43.7	1433
		ASME 300	71.1						
	DN250	PN 10	67.1						
		PN 16	67.3						
		PN 25	68.7						
		PN 40	70						

Figure 4.9—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with separately-mounted transmitter (inches)

CT Series CC025 through CC080 Sensor (High-temp.) with Separately-mounted Transmitter (Flanged)

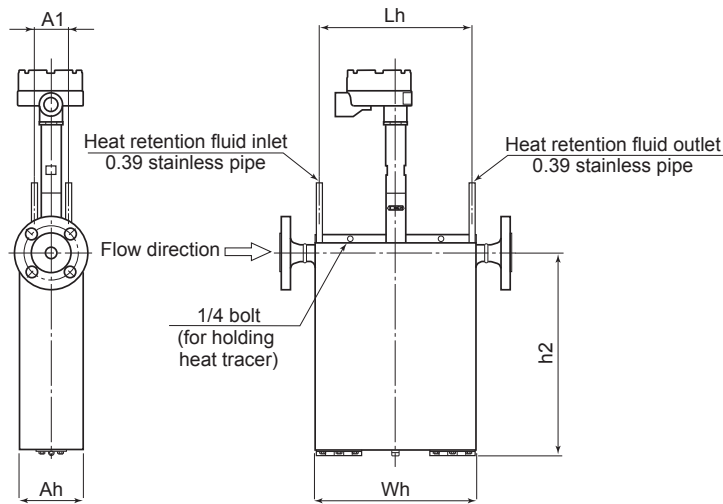


Model	ASME					DIN			H (in.)	h1 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
	Nominal size (in.)	150	300	600	900 ②	Nominal size (DN)	PN 10, 16	PN 25, 40					
		L (in.)					L						
CC025	1	16.2	16.7	17.2	—	25	14.8	15	25.1	12.3	3.27	10.3	24
CC040	1-1/2	21.5	22	22.6	—	40	20	20.2	30.2	17.8	4.76	15.2	44.8
CC050	2	21.7	22.2	22.9	—	50	20.2	20.4					45.6
CC080	3	27.5	28.2	29	30.6	80	25.9	26.6	37.8	23.7	6.85	20.1	119

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. ASME 900 flanges are only available with Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.

Figure 4.10—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with separately-mounted transmitter (inches)

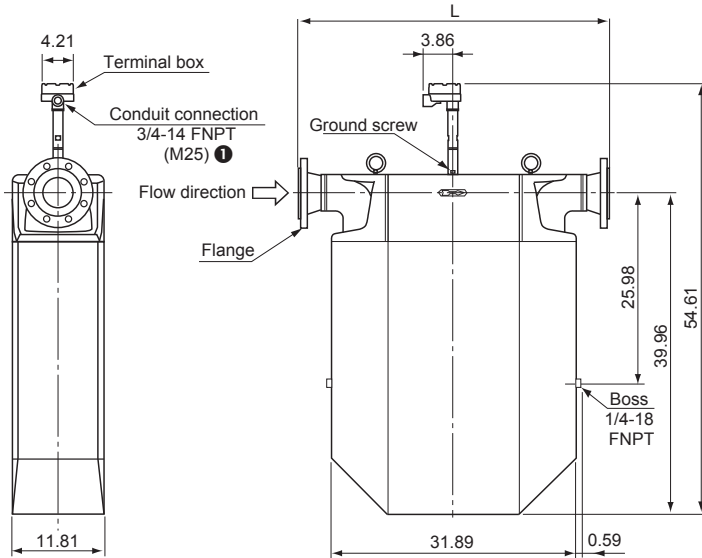
CT Series CC025 through CC080 Sensor with Heat Tracer and Separately-mounted Transmitter (Flanged)



Model	Nominal size (in.)	Heat Tracer Model Compatibility	Lh (in.)	h2 (in.)	Ah (in.)	A1 (in.)	Wh (in.)	Approx. Weight (lb)
CC025	1	HT1-025A	10	13.4	4.17	2.2	10.6	37.3
CC040	1-1/2	HT1-040A	14.8	18.3	5.67	2.76	15.4	70.1
CC050	2							71
CC080	3	HT1-080A	19.7	24.1	7.8	4.33	21.5	166

Figure 4.11—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with heat tracer and separately-mounted transmitter (inches)

CT Series CC100 and CC150 Sensor (High-temperature) with Separately-mounted Transmitter (Flanged)

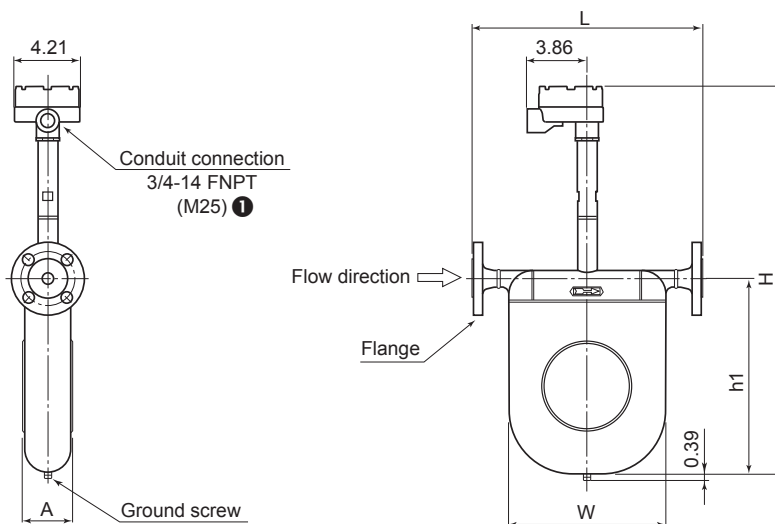


Model	Flange		L (in.)	Approx. Weight (lb)
	Nominal size	Flange rating ②		
CC100	4"	ASME 150	40.1	522
		ASME 300	40.8	540
		ASME 600	42.6	562
	DN100	PN 10, 16	38.1	509
		PN 25, 40	39.1	531
CC150	6"	ASME 150	51.9	547
		ASME 300	52.7	584
		ASME 600	54.6	644
	DN150	PN 10, 16	49.2	542
		PN 25, 40	50.8	584

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. For specifications of other flange ratings, see the approval drawing (or delivery specification).

Figure 4.12—Outline dimensions of CT Series flanged sensor units CC100 and CC150 with separately-mounted transmitter (inches)

CT Series CC025 through CC080 Sensor (Low-temp.) with Separately-mounted Transmitter (Flanged)

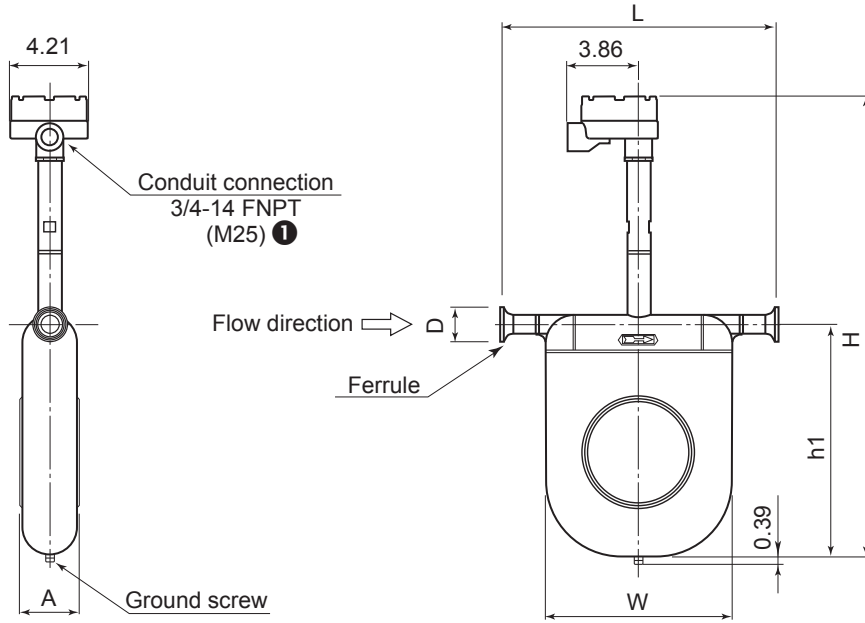


Model	Nominal size (in.)	ASME				DIN			H (in.)	h1 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
		150	300	600	900 ②	Nominal size (DN)	PN 10, 16	PN 25, 40					
		L (in.)					L						
CC025	1	16.2	9.53	17.2	18.1	25	14.8	15	26	13	3.27	10.3	24
CC040	1-1/2	21.5	22	22.6	23.7	40	20	20.2	31.1	17.8	4.76	15.2	44.8
CC050	2	21.7	22.2	22.9	25.2	50	20.2	20.4					
CC080	3	27.5	28.2	29	30.6	80	25.9	26.6	37.8	23.7	6.85	20.1	119

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 2. ASME 900 flanges are only available with Alloy C22 material.
- This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
 - DIN flanges are only available for meter material SUS316L.

Figure 4.13—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with separately-mounted transmitter (inches)

CT Series CC025 through CC080 Sensor (Low-temp.) with Separately-mounted Transmitter (Ferrule)

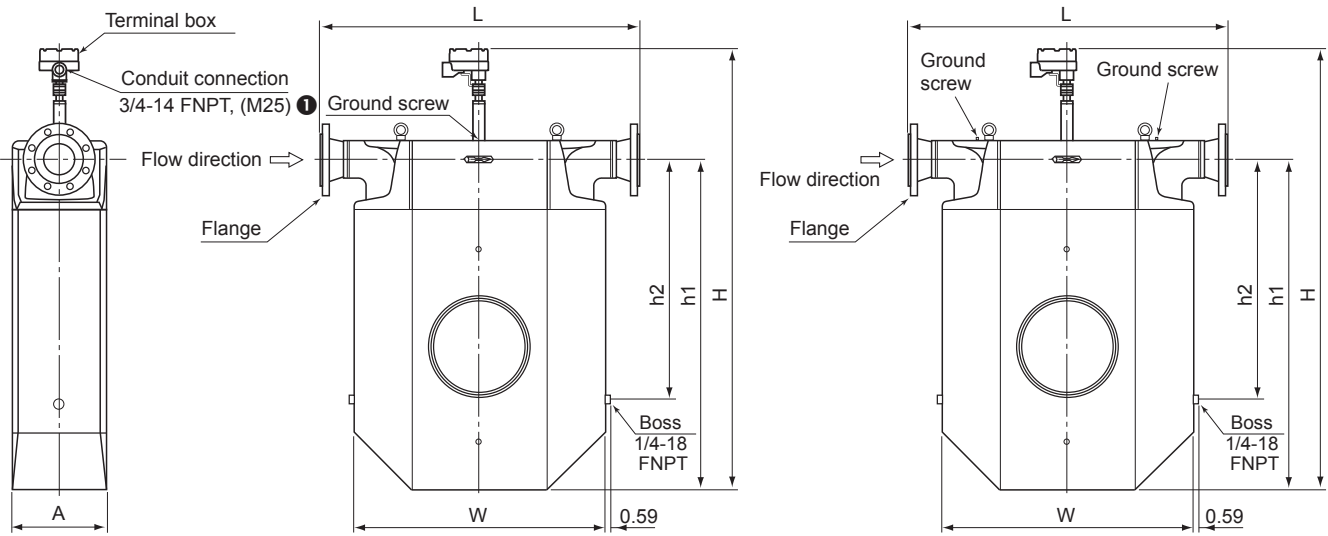


Model	Ferrule		L (in.)	H (in.)	h1 (in.)	A (in.)	W (in.)	D (in.)	Approx. weight (lb)
	Nominal size	Connection 2							
CC025	25	Ferrule 25 (ISO), IDF 1S	14.6	26	13	3.27	10.3	1.99	18.3
CC040	40	Ferrule 38 (ISO), IDF 1.5S	19.4	31.1	17.8	4.76	15.2		37.5
CC050	50	Ferrule 51 (ISO), IDF 2S						2.52	
CC080	80	Ferrule 76.1 (ISO), IDF 3S	25.9	37.8	23.7	6.85	20.1	3.58	105.8

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: S = in.

Figure 4.14—Outline dimensions of CT Series ferrule sensor units CC025 through CC080 with separately-mounted transmitter (inches)

CT Series CC100 through CC250 Sensor (Low-temp.) with Separately-mounted Transmitter (Flanged)



① Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.

CC100, CC150

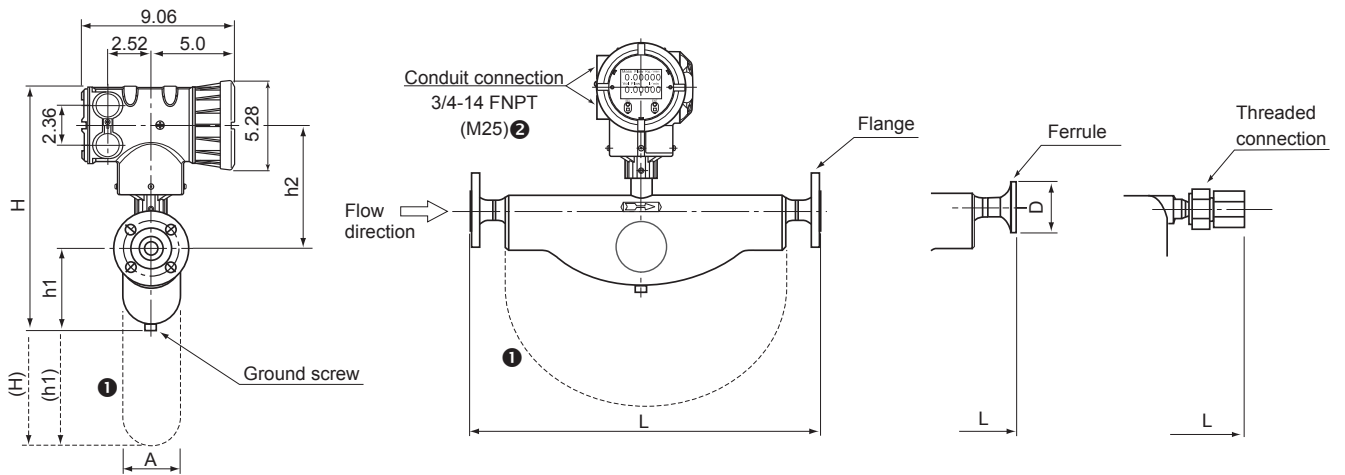
CC15H through CC250

Model	Flange		L (in.)	H (in.)	h1 (in.)	h2 (in.)	A (in.)	W (in.)	Approx. Weight (lb)
	Nominal size	Flange rating ②							
CC100	4"	ASME 150	40.1	54.6	40	26	11.8	31.9	509
		ASME 300	40.8						
		ASME 600	42.6						
	DN100	PN 10, 16	38.1						
PN 25, 40		39.1							
CC150	6"	ASME 150	51.2	54.6	40	26	11.8	31.9	542
		ASME 300	52.7						
		ASME 600	54.6						
	DN150	PN 10, 16	49.2						
PN 25, 40		50.8							
CC15H	6"	ASME 150	42.8	62.5	46.9	33.5	12.6	31.9	683
		ASME 300	43.6						
		ASME 600	45.6						
	DN150	PN 10, 16	40.1						
PN 25, 40		41.7							
CC200	8"	ASME 150	55.8	62.5	46.9	33.5	12.6	31.9	750
		ASME 300	56.6						
		ASME 600	58.8						
	DN200	PN 10, 16	52.7						
		PN 25	54.1						
PN 40	54.7								
CC20H	8"	ASME 150	55.8	71.4	54.7	37.8	16.5	43.7	1345
		ASME 300	56.6						
		PN 10, 16	52.7						
	DN200	PN 25	54.1						
		PN 40	54.7						
CC250	10"	ASME 150	69.8	71.4	54.7	37.8	16.5	43.7	1433
		ASME 300	71.1						
	DN250	PN 10	67.1						
		PN 16	67.3						
		PN 25	68.7						
PN 40	70								

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. For specifications of other flange ratings, see the approval drawing (or delivery specification).

Figure 4.15—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with separately-mounted transmitter (inches)

PRO Series CP006 through CP050 Sensor with Integral Transmitter* (Flanged, Ferrule, or Threaded)



Model	Nominal size (in.)	ASME			H	h1	h2	A	Approx. Weight (lb)
		150	300	600					
CP006	1/2	14.5	14.9	15.4	13.5	3.7	7.56	2.32	16.1
CP010	1/2	16	16.3	16.8	13.4	3.7	7.44	2.32	16.8
CP015	1/2	20.2	20.5	21	17	6.61	8.11	3.58	25.6
CP025	1	23.7	24.1	24.6	16.8	6.89	7.64	3.58	31.3
CP040	1-1/2	26	26.5	27.1	22.8	12.7	7.76	4.92	72.3
CP050	2	26.1	26.6	27.4	22.8	12.7	7.76	4.92	73.2

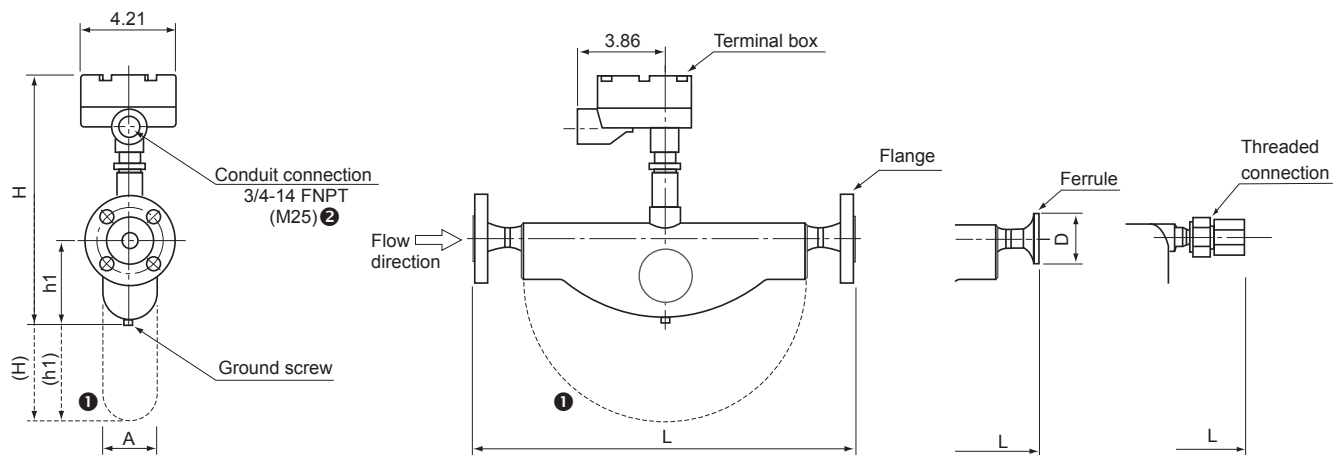
Model	Ferrule			Approx. Weight (lb)
	Connection ③	L	D	
CP006	10A	13.1	1.34	11.5
CP010	15A	15	1.34	13.4
CP015	15A	18.7	1.34	21.8
CP025	25 (ISO), IDF 1S	22	1.99	24.5
CP040	38 (ISO), IDF 1.5S	23.9	1.99	64.6
CP050	51 (ISO), IDF 2S	23.9	2.52	64.6

Model	Threaded		Approx. Weight (lb)
	Connection	L (in.)	
CP006	1/2-14 FNPT	15.7	11.5
CP010	1/2-14 FNPT	17.2	13.4
CP015	3/4-14 FNPT	22.4	21.8

1. Dotted lines show the envelope of models CP040 and CP050.
 2. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 3. Process connection: A = mm, S (sanitary) = in.
- * Pressure-tight packing assembly only provided for explosion-proof models.
See Section 10—Explosion-proof Specifications, page 113 for details.

Figure 4.16—Outline dimensions of PRO Series flanged/ferrule sensor units CP006 through CP050 with integral transmitter (inches)

PRO Series CP006 through CP050 Sensor with Separately-mounted Transmitter (Flanged, Ferrule, or Threaded)



Model	Nominal size (in.)	ASME			H	h1	A	Approx. Weight (lb)
		150	300	600				
CP006	1/2	14.53	14.9	15.4	11.9	3.7	2.32	10.4
CP010	1/2	16	16.3	16.8	11.7	6.22	2.32	11
CP015	1/2	20.2	20.5	21	15.7	6.61	3.58	19.8
CP025	1	23.7	24.1	24.6	15.1	6.89	3.58	25.6
CP040	1-1/2	26	26.5	27.1	21.1	12.7	4.92	66.6
CP050	2	26.1	26.6	27.4	21.1	12.7	4.92	67.5

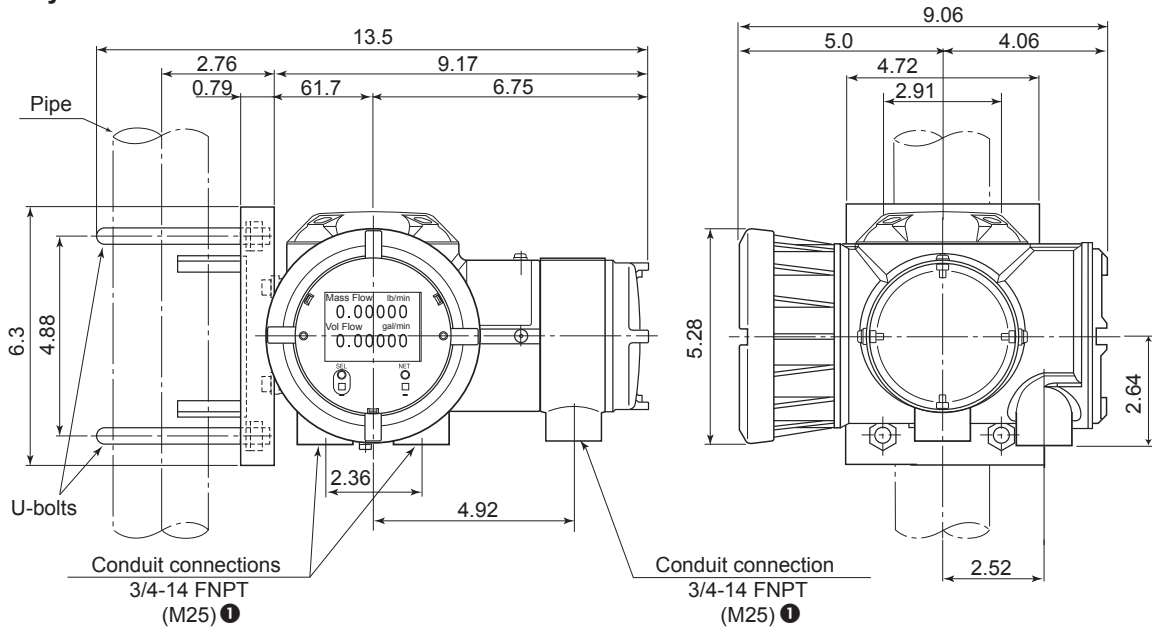
Model	Ferrule			
	Connection ③	L	D	Approx. Weight (lb)
CP006	10A	13.1	1.34	5.73
CP010	15A	15	1.34	7.72
CP015	15A	18.7	1.34	16.1
CP025	25 (ISO), IDF 1S	22	1.99	18.7
CP040	38 (ISO), IDF 1.5S	23.9	1.99	58.9
CP050	51 (ISO), IDF 2S	23.9	2.52	58.9

Model	Threaded		
	Connection	L (in.)	Approx. Weight (lb)
CP006	1/2-14 FNPT	15.7	5.73
CP010	1/2-14 FNPT	17.2	7.72
CP015	3/4-14 FNPT	22.4	16.1

1. Dotted lines show the envelope of models CP040 and CP050.
2. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
3. Process connection: A = mm, S (sanitary) = in.

Figure 4.17—Outline dimensions of PRO Series flanged sensor units CP006 through CP050 with separately-mounted transmitter (inches)

Separately-mounted Transmitter



① Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.

Pipe mounting hardware (U-bolts) are furnished as standard accessories. The pipe must be provided by the customer.

Figure 4.18—Outline dimensions (in inches) of separately-mounted transmitter (inches)

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Section 5—Installation

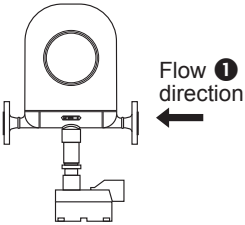
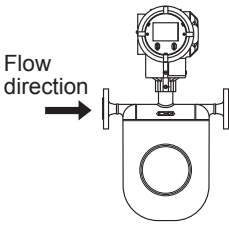
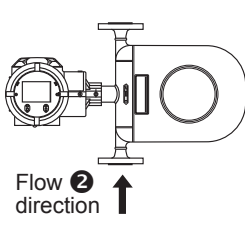
INSTALLATION GUIDELINES

- Select a location easy to access for inspection and maintenance.
- Avoid a location subject to
 - excessive temperature variation and vibration
 - direct exposure to the sun (Provide a sunshade or similar protection to keep the meter out of exposure to direct sunlight if necessary.)
 - immersion in water
 - corrosive gases
 - dust and mist
- Keep the device at least one meter away from sources of electromagnetic induction, such as large transformers and motors.
- To ensure consistent and accurate measurement, adhere to all instructions in this section of the manual.
- Install where pipeline oscillation is held below 0.3G to ensure consistent and accurate measurement. External vibration (including pulsation), particularly with the same frequency as the drive frequency of the measuring pipe, may affect the measurement. Contact Cameron regarding the drive frequency of each model.
- Locate the control valve downstream of the flow meter. Where cavitation is likely to occur, install the flow meter at least five meters away.

CT SERIES METER PHYSICAL ORIENTATION

The sensor may be installed either in a horizontal run or vertical run. The following physical orientations are suggested, depending on the type of process fluid. For example, [Figure 5.1](#), No. 2 shows the typical orientation for liquids. If the conduit connection points up, make provisions for sealing off or keeping rainwater and other moisture from entering the meter. Physical orientation must be specified at the time of order.

CT Series CC003 through CC250 Meters

	Horizontal run		Vertical run
	No.1	No.2	No.3
Orientation			
Fluids	<ul style="list-style-type: none"> •Gases •Slurries 	<ul style="list-style-type: none"> •Liquids 	<ul style="list-style-type: none"> •Slurries (requiring cleaning) •Liquids •Gases

1. For installation orientation in No. 1, Cameron recommends the separately-mounted transmitter. If the integral transmitter is preferred, contact Cameron.
2. The measuring tube of the CC003 is in double-loop configuration without self-draining feature.

Figure 5.1—Physical orientation examples for horizontal and vertical runs

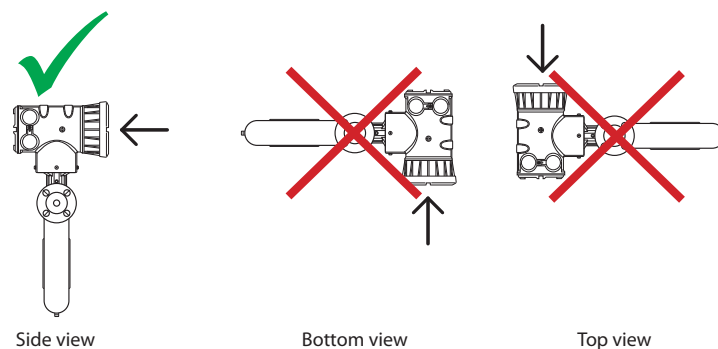


Figure 5.2—Transmitter orientation is correct if its display face is not in the horizontal plane.

For the orientation a of separately-mounted transmitter, see [Installing the Separately-mounted Transmitter](#), page 50.

CT Series CC00A and CC001 Meters

The instrument can be installed either on a bench or a wall. The following physical orientation is suggested. (When wall mounting, secure the instrument with bolts using the mounting holes on the sensor unit.)

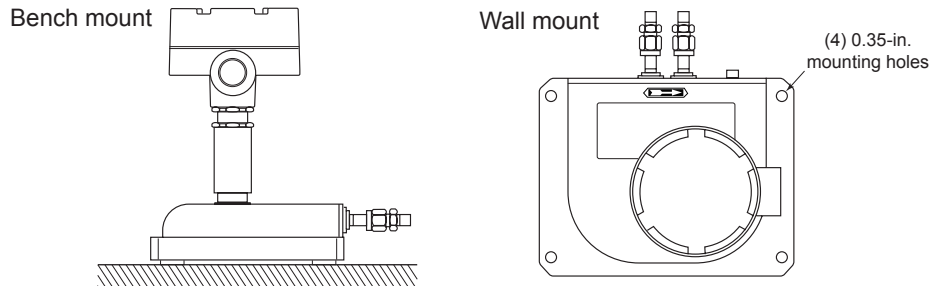


Figure 5.3—Bench or wall mounts

PRO SERIES METER PHYSICAL ORIENTATION

The flow meter may be installed either in a horizontal line or a vertical line. Where cleaning is required or air bubble entrapment is likely, we suggest installation in a vertical run. If a conduit connection points up, take necessary measures to prevent rain and water from entering the meter.

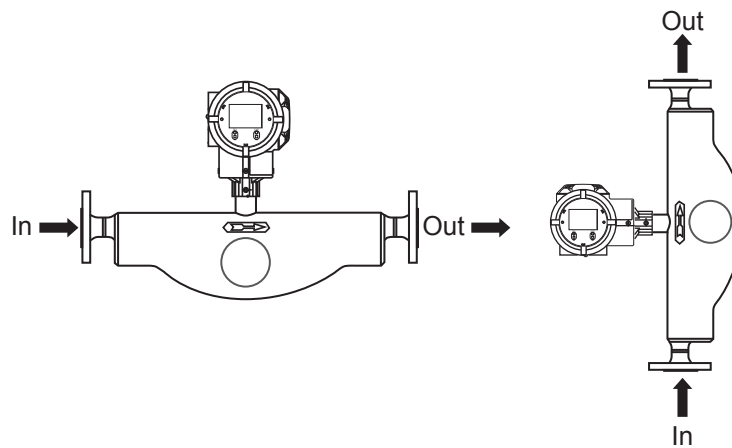


Figure 5.4—Horizontal and vertical run installations

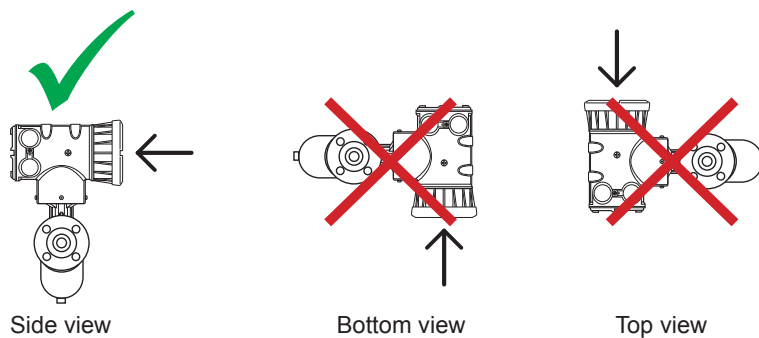


Figure 5.5—Transmitter orientation is correct if its display face is not in the horizontal plane.

For the orientation of a separately-mounted transmitter, see [Installing the Separately-mounted Transmitter, page 50](#).

INSTALLATION LOCATION

Air bubbles in the flow tube can result in a loss of meter accuracy. To minimize this risk,

- Never locate the sensor at the highest point in the piping system.
- In a vertical piping system, never directly discharge the metered fluid from the piping system without the provision of a valve or similar controlling device.

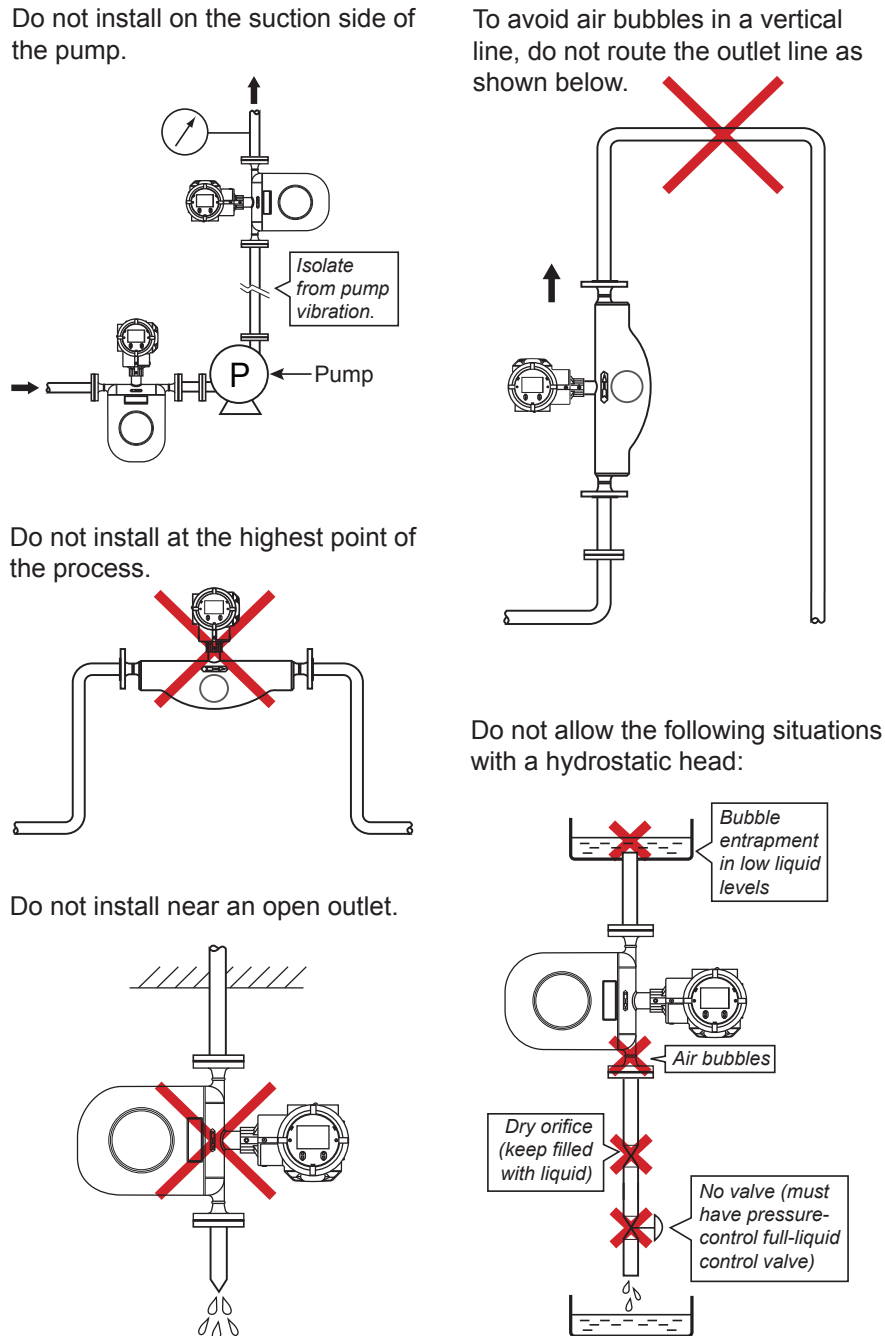


Figure 5.6—Common installation errors for CT and PRO Series meters

INSTALLATION GUIDELINES

Standard Piping Conditions

- A Coriolis mass flow meter is unaffected by the flow pattern of process fluid. Therefore, no flow straightener is required. Use a concentric reducer or tapered pipe to connect to piping of a different diameter.
- Locate the meter sufficiently away from sources of vibration and pulsations.
- For use in zeroing, a valve that can shut off the process flow completely should be provided downstream of the meter. (Provide another upstream of the meter as necessary.)
- Avoid pipe stress on the sensor.

Standard Piping Conditions

While the CT Series meter is referenced in the installation examples below, the same applies to PRO Series meters.

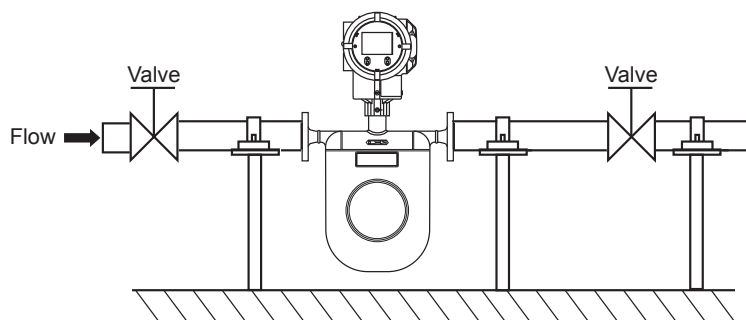


Figure 5.7—Standard piping conditions for CT Series and PRO Series meters

CAUTION With the exception of CT models CC00A and CC001, which are typically bench- or wall-mounted, CamCor meters are designed for flange mounting and should be supported by the pipeline. Piping supports should not be placed under the sensor body but should be installed upstream and downstream of the meter.

Influence of Vibration and Pulsation

Generally, Coriolis mass flow meters can best perform in measurements with least pipeline vibration and pulsation. In applications where vibration and pulsation are not negligible, the following considerations must be taken into account:

- Locate the meter away from the sources of vibration and pulsation.
- Provide attenuators, such as flexible tubes and chambers.
- Close shutoff valves upstream and downstream of the meter at process flow shutdown to prevent erratic signal generation at shutoff. Take precautions to prevent pressure inside the meter from exceeding the maximum allowable pressure rating of the meter.
- If meters of the same type are to be installed in a pipeline, allow adequate space between them (at least five times the face-to-face dimension of the meter is recommended).

Prevention of Cavitation (Gas Flash Off)

Cavitation can cause a loss in Coriolis meter measurement accuracy. To prevent cavitation, maintain line pressure upstream and downstream of the meter. Avoid piping arrangements that open the line to the atmosphere immediately downstream of the meter. Particular care must be taken in low pressure applications and with high vapor pressure liquids, such as NGLs (natural gas liquids).

It is recommended the back pressure immediately downstream of the meter be kept above the value calculated by the formula below:

$$P_d = 2\Delta P + 1.25P_v$$

where P_d : Downstream pressure (PSIA)

ΔP : Pressure drop across meter (PSID)

P_v : Vapor pressure of the process fluid (PSIA)

Calculation based on API Manual of Petroleum Measurement Standards, Chapter 5.6, Section 6.3.2.

Prevention of Excessive Flows

CAUTION Exceeding the meter's maximum flow rate will not significantly reduce the meter's long term durability. Bear in mind, however, that the output will be clamped at 110% of the allowable full-scale flow rate.

Prevention of Gas Mixed (Slug) Flows

Slug flows (gases exist in the process liquid) are generally not measurable at a high degree of accuracy. It also causes erratic pulse generation at shutdown of the flow.

This transmitter is capable of detecting gas mixed flows. On finding the result of densitometer measurement exceeding 0.3 to 2 g/mL (default), the meter interprets it as a slug flow and reduces the instant flow rate to zero, interrupting the flow output.

If it is desired to make a gas flow measurement, disable the gas mixed flow detection function (see [Assigning the Slug Flow Alarm to a Status Output, page 107](#)).

Keeping the Sensor Filled with Process Liquid

CAUTION The sensor must be filled with the process fluid during measurement. A partially filled meter results in large errors particularly at zeroing.

Note When CC100 or CC150 is installed in a horizontal line, it is difficult to wash away air bubbles in the flow tube at flow rates below 10% of the maximum service flow rate (water used as the metered fluid). In such cases, run the fluid at a flow rate greater than 10% of the maximum service flow rate, then adjust to the required rate. Even with the flow rate greater than 10% of the maximum service flow rate, it will take approximately 40 seconds to completely fill the flow tube from its empty state (with water used as the metered fluid).

CAUTION Expansion of the process fluid due to freezing may damage the measured pipe. Ensure that process fluid does not freeze.

Bypass Loop

To facilitate maintenance and servicing, it is good practice to provide a bypass loop as shown below:

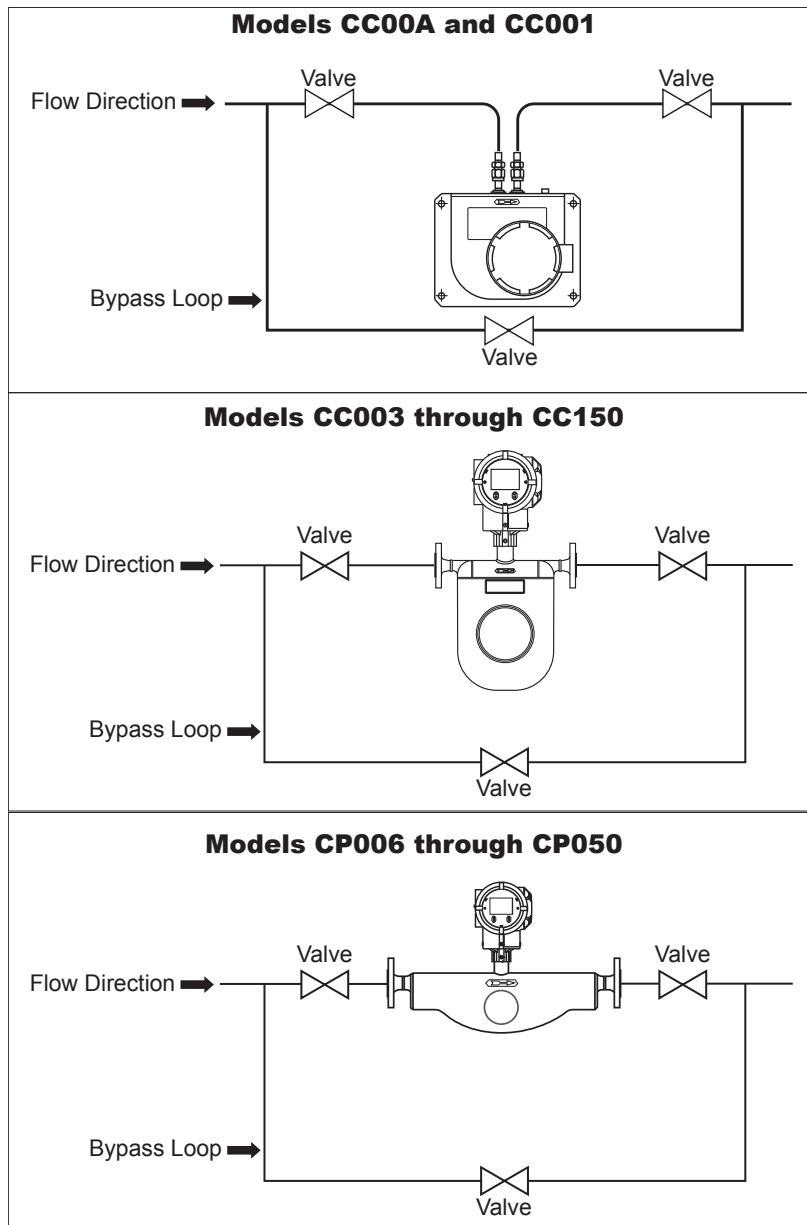


Figure 5.8—Bypass loop installations for CT Series and PRO Series meters

INSTALLATION

Flange Meters

- In order to avoid strains on sensor flanges, be sure to correct the flange face-to-face dimension, tilt and concentric alignment of pipes immediately before and after the sensor.
- Ensure the flow direction in the pipe matches the direction of the arrow on the front of the flow direction plate.
- Align the sensor flange O.D. with the flange O.D. of the pipeline, install gaskets, and tighten hex bolts evenly.

CAUTION Remove the factory-installed protective seals on the sensor flanges before installing the meter.

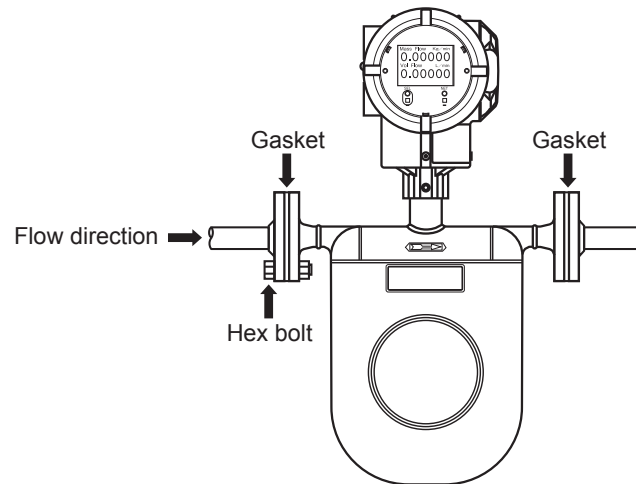
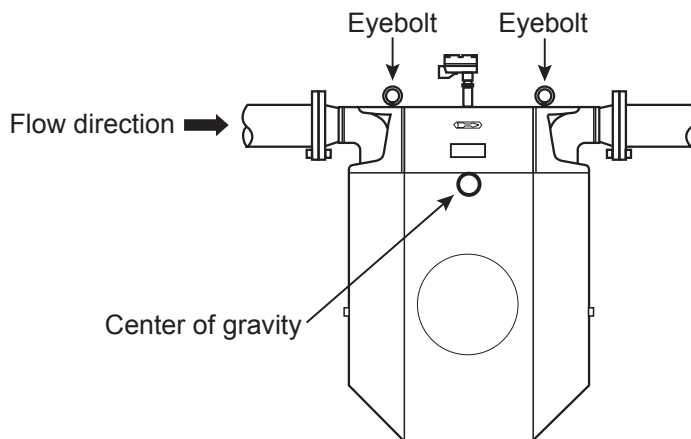


Figure 5.9—Flange meter



CAUTION

Because of the potential risk to personnel and equipment due to the weight of Models CC150 through CC250 (500 lb or greater), we recommend that installation be performed only by qualified personnel experienced in sling work and crane operation. Note that center of gravity is shown to facilitate installation in a vertical run.

The eyebolts shown in this diagram may be removed after installation in the piping assembly. If the eyebolts are retained, they should be tightened periodically to counteract loosening caused by vibration.

Figure 5.10—Location of the meter's center of gravity

Sanitary Fittings

The sanitary fitting uses clamp connections and G3447 stainless steel sanitary tubes as piping material. Install according to the procedure below.

1. Weld the companion sleeves furnished to the piping. Pay attention to the perpendicularity of the ferrule end face and the difference in height at the weld.
2. Insert the gasket between the sensor and ferrule, aligning it with the groove in the ferrule-end face, and tighten with the clamp.

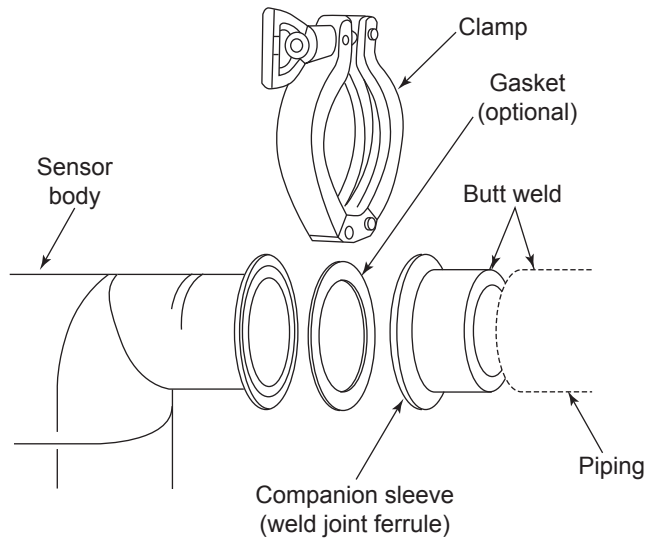


Figure 5.11—Sanitary fittings

CT Series CC00A and CC001 Threaded Meters

Install a threaded fitting (1/4-14 FNPT) onto the piping, fit an O-ring between the end of piping and the gland of sensor unit, then tighten them firmly.

CAUTION Avoid damaging the gland flat and the protrusion of flow inlet (outlet). Do not overtighten the nut. Overtightening it can damage the gland flat.

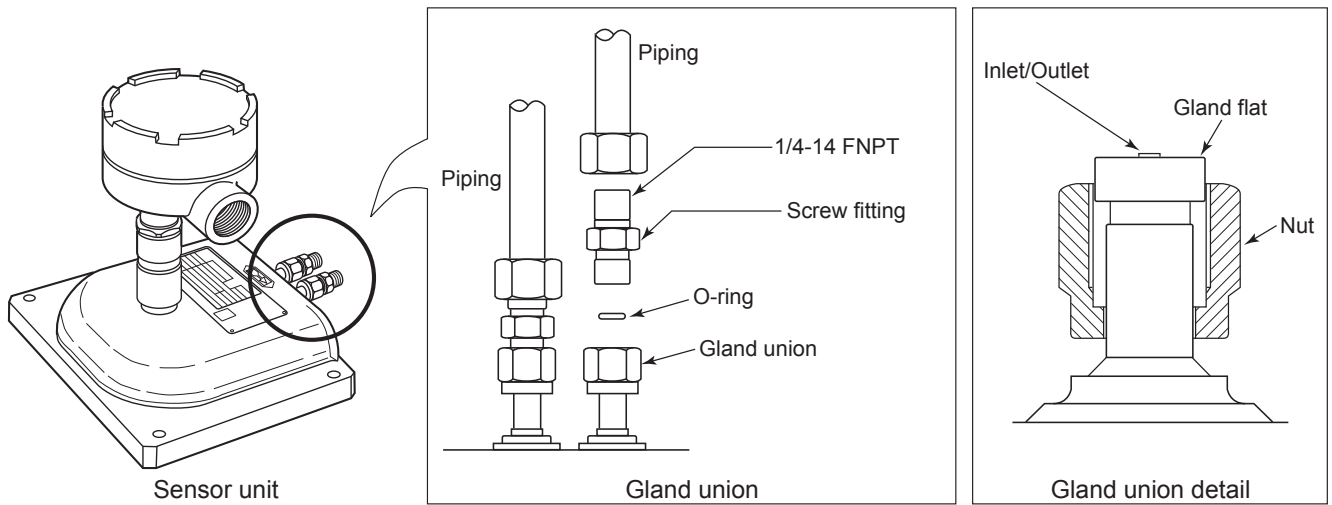


Figure 5.12—Threaded connections for CT Series CC00A and CC001 meters

CT Series CC003 to CC015 Threaded Meters

Insert an O-ring between the probe and union fitting and tighten.

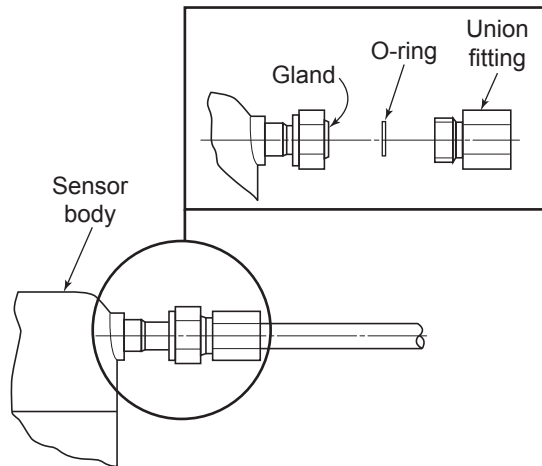


Figure 5.13—Threaded connections for CT Series CC003 through CC015 meters

INSTALLING PIPE SUPPORTS

If pipeline oscillation is significant, or flow rates are low, consider the following precautions:

- Provide pipe supports in the range shown below preferably with hold-down clamps arranged symmetrically upstream and downstream of the sensor.
- Clamp the pipeline securely without using rubber bushings or similar cushioning material intended for the absorption of shock and vibration.
- While the clamps supporting upstream and downstream piping, pedestal, floor, etc. that hold individual supporting members must be rigid/sturdy enough to bear their weight, it is more important to secure and maintain the rigidity of the entire structure. Changes in the spring elements inside the area marked with dotted lines in [Figure 5.15, page 47](#), can cause zero shifts, especially in large installations. These changes may result from exposure to thermal stress, line pressure, shocks, aging, and other contributing factors.

CAUTION Support the pipeline with hold-down clamps; never hold down the sensor unit.

CT Series Pipe Supports

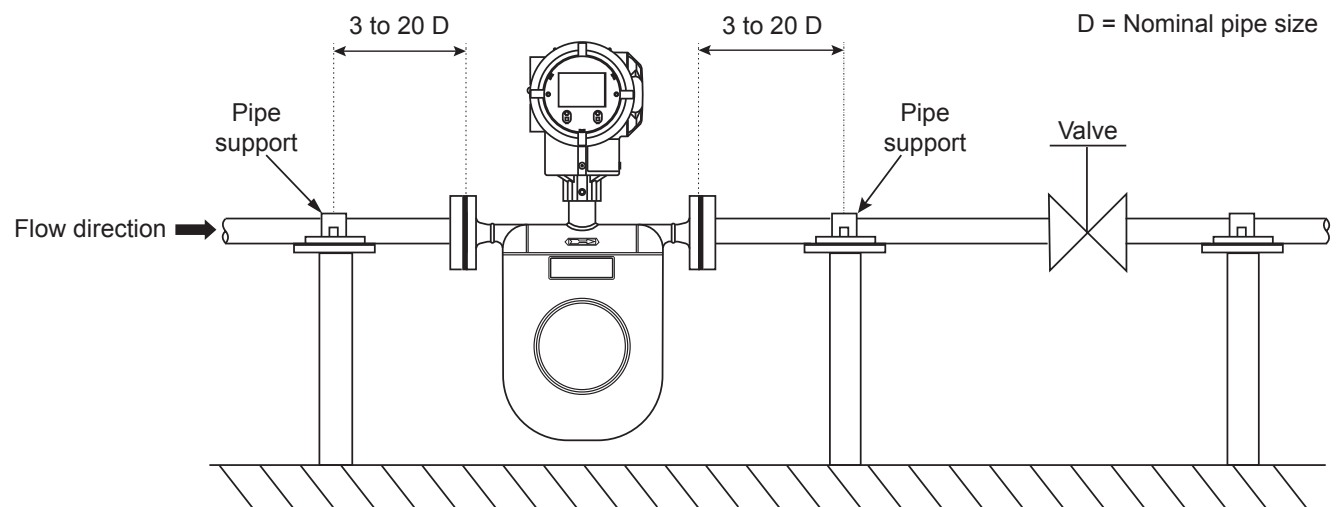


Figure 5.14—Pipe supports for CT Series CC003 through CC080 meters

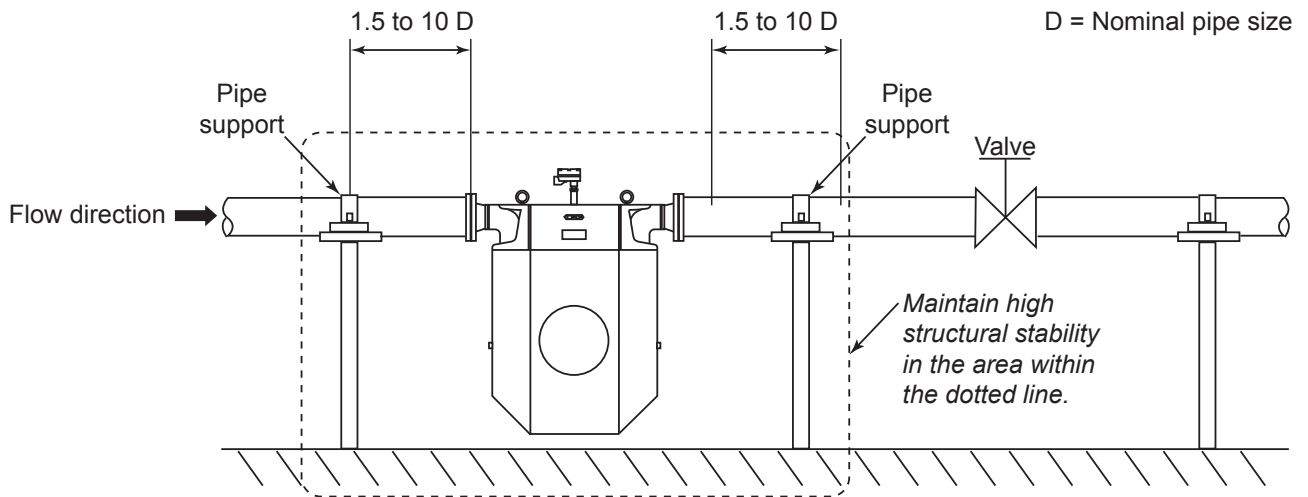


Figure 5.15—Pipe supports for CT Series CC100 and CC150 meters

PRO Series Pipe Supports

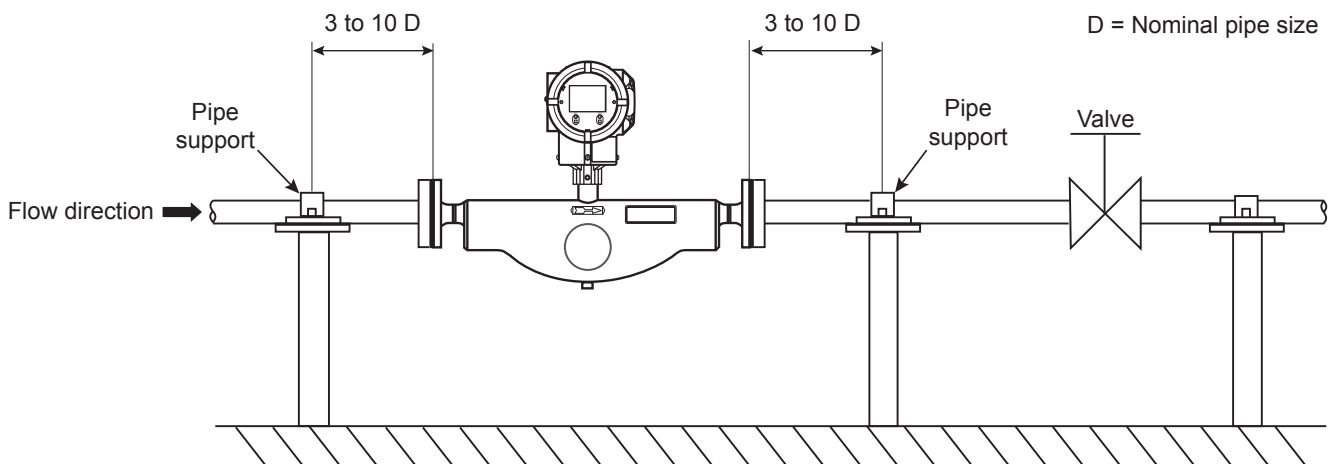


Figure 5.16—Pipe supports for PRO Series meters

HEAT AND COLD RETENTION

When the fluid to be measured requires temperature retention at low or high temperature, use the following techniques to keep the sensor unit at high or low temperature:

- When installing heat retaining or cold retaining material on the sensor unit, apply heat retention or cold retention to only the main body. As the fluid passes through the sensor case, heat retention or cold retention on the mounting tube and terminal box has no effect. In the case of high- and low-temperature explosion-proof types, do not install heat retaining or cold retaining material within a distance of 0.79 in. from the mounting tube so that the terminal box is protected against heat (or cold) (see [Figure 5.18, page 48](#)).
- For easy maintenance, a simplified heat retaining system is recommended on the sensor unit.
- When covering the heat insulating material with an outer sheath for heat retention or cold retention, if the natural frequency of the outer sheath is close to the frequency of the tube oscillating in the sensor unit (140 to 170 Hz for most meter models), it may affect measurement. The frequency band for CC100 through CC250 meters is 70 to 100 Hz.
- Pay careful attention to the maximum permissible temperature when steam trace is applied. Trace temperature should be the same as that of the metered fluid (see [CT Series Sensor General Specifications, page 15](#) and [PRO Series Sensor General Specifications, page 17](#)).
- If you plan to spirally wind copper tubing or similar around the sensor unit, secure the copper tubing with pipe retainers shown in [Figures Figure 5.17, page 48](#) through [Figure 5.20, page 49](#) and spot weld the copper tubing to the sensor unit.
- Use of heat tracer is recommended for CT Series models CC025, CC040, CC050, and CC080.

Note Vibrating copper tubing caused by the flow meter in operation can produce zero shifts. Increase the number of fixed points to reduce vibration.

To minimize transmission of oscillation to the sensor, the spirally wound copper tubing should start and end at the manifold of flanged sensor housing.

Sudden temperature change may damage the performance of the flow meter. Keep the temperature change of the fluid within $\pm 53.6^{\circ}\text{F}/\text{min.}$ for both heating and cooling.

CAUTION Do not use electric heaters which could produce noise. If ambient temperature around the transmitter is expected to exceed 131°F , a separately-mounted transmitter is recommended.

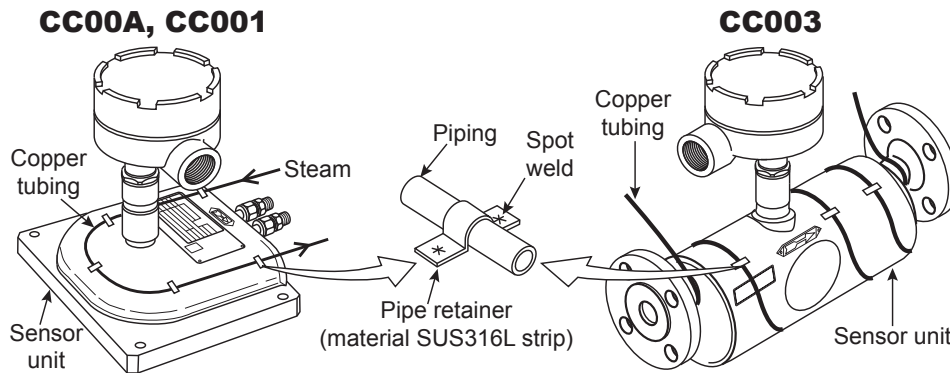


Figure 5.17—Heat and cold retention via copper tubing and pipe retainers (CT Series CC00A, CC001, and CC003 meters)

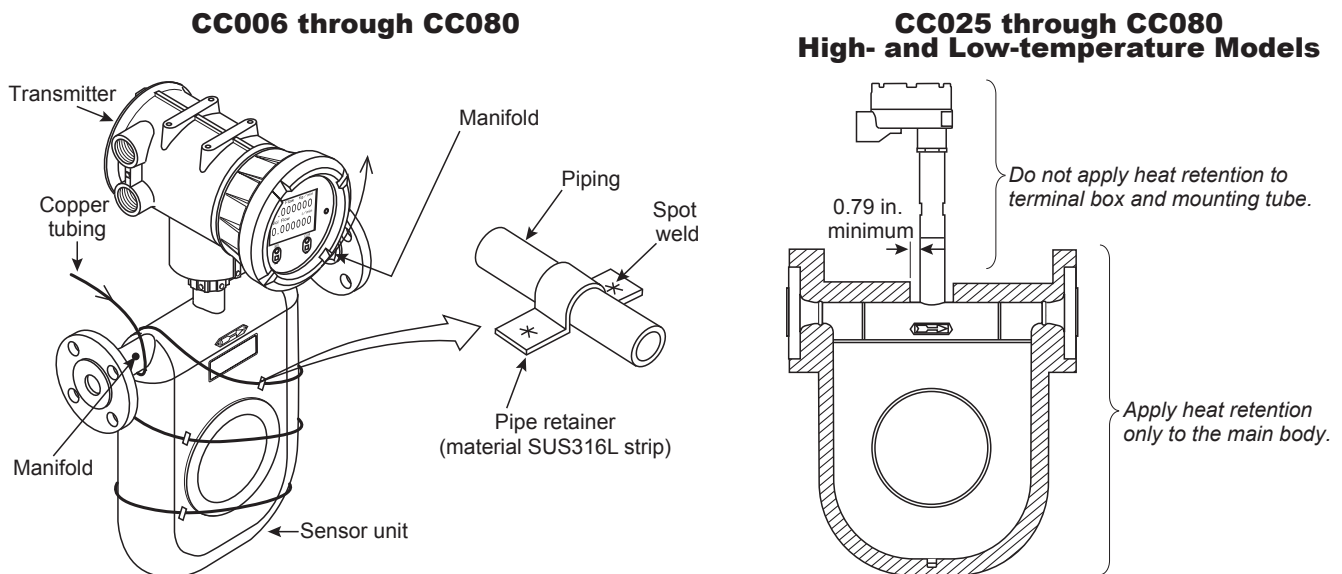


Figure 5.18—Heat and cold retention via copper tubing and pipe retainers (CT Series CC006 to CC080 meters)

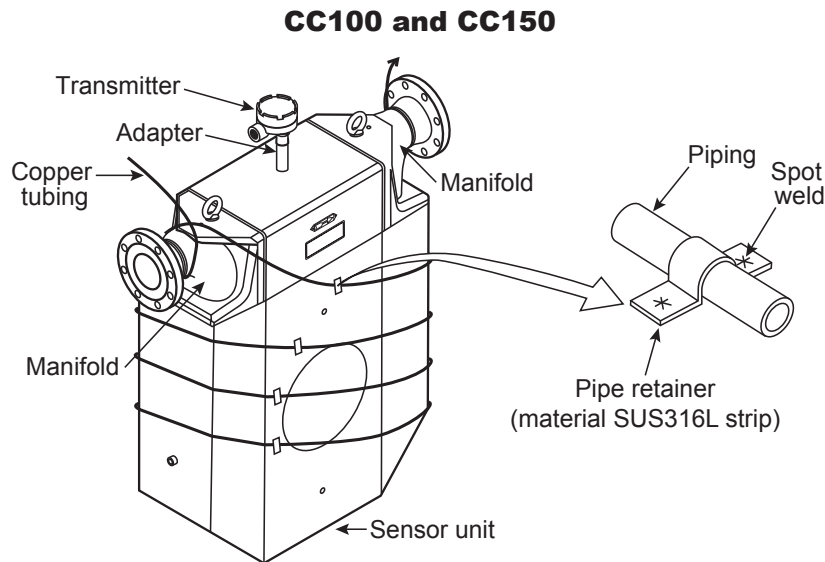


Figure 5.19—Heat and cold retention via copper tubing and pipe retainers (CT Series CC100 to CC250 meters)

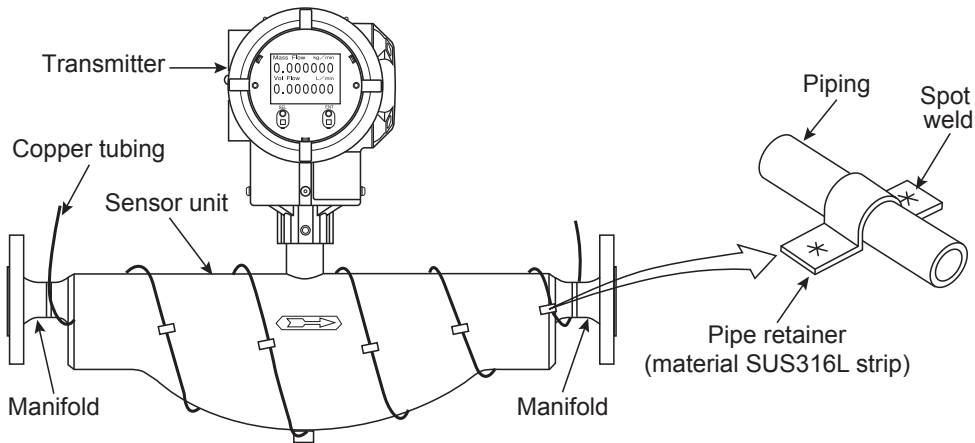


Figure 5.20—Heat and cold retention via copper tubing and pipe retainers (PRO Series meters)

PRESSURE RELIEF BOSS

The CT Series high-pressure service meter has a boss (1/4-18 FNPT) for housing a customer-provided pressure relief device. A pressure-relief device is designed to release internal pressure from the housing in the event that an internal tube ruptures due to pressure build-up or erosion (Figure 5.21, page 50). Because the maximum pressure the sensor housing can withstand is lower than that of the tube, the sensor housing can be damaged if a tube ruptures and no pressure relief device is installed, depending on the process conditions.

A hex socket-head plug (1/4 in.) is screwed into the female taper pipe thread (1/4-18 FNPT) of the boss.

WARNING Do not remove the hex socket unless installing a pressure-relief device. The housing of the sensor unit is filled with an inert gas which protects internal electronics from damaging moisture.

Installing a Pressure Relief Device

To prevent moisture from entering the sensor during the installation of a pressure relief device, avoid installing a pressure-relief device in a very humid environment. Also, be prepared to remove the socket plug and install the device in the opening quickly to prevent the escape of gas from the housing.

Contact Cameron for help with specific questions regarding the installation of a pressure relief device.

**CC010 and CC015
High-pressure Models**

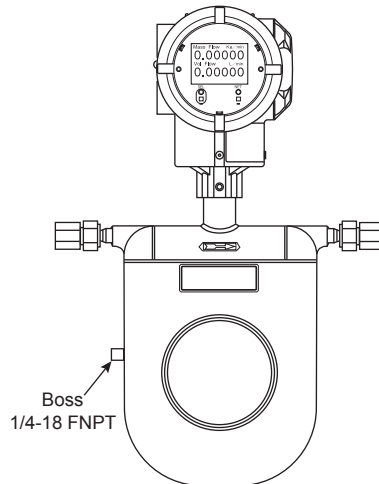


Figure 5.21—A boss for installing a pressure relief device

INSTALLING THE SEPARATELY-MOUNTED TRANSMITTER

- The maximum transmission cable length varies with the sensor unit type: locate the transmitter within this range.
- Secure the transmitter to a customer-provided horizontal or vertical 2-in. steel pipe using the U-bolts furnished with the transmitter.

CAUTION Do not install in locations that are difficult to access for maintenance and servicing or in locations that are prone to excessive temperature changes, vibration or immersion in water.

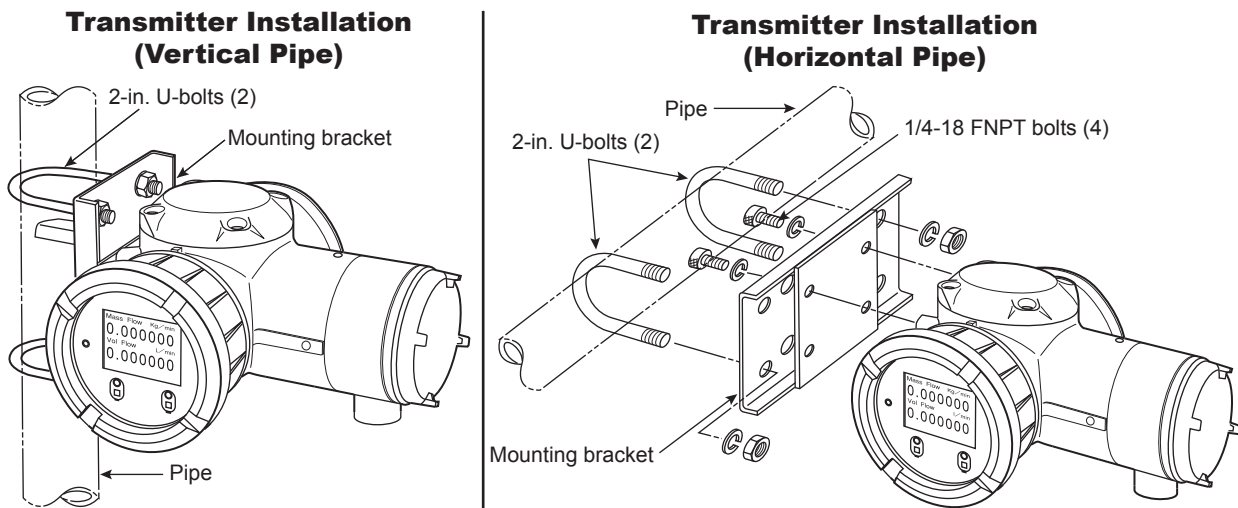


Figure 5.22—U-bolts, mounting brackets and bolts are standard accessories supplied with each transmitter.

CHANGING THE TRANSMITTER ORIENTATION

Conduit and cable connections may be affected by a change in transmitter orientation. For best results, change the transmitter orientation before determining conduit and cable requirements.

To change transmitter orientation, follow the steps below:



WARNING: Turn off power before you start working.

1. Work on a level plane with the transmitter up and the sensor secured so that loosening set screws will not cause the transmitter to separate from the sensor.
2. Using a hex wrench, loosen the set screws in the transmitter adapter. See [Figure 5.23](#) (5/16-18 FNPT hex socket head screws at four places).



WARNING: Never loosen the hex socket head screws located on the transmitter body. Loosen the set screws in the transmitter adapter only to allow rotation of the transmitter. Do not remove the set screws or attempt to separate the transmitter from the sensor unit.

3. Rotate the transmitter to the desired position and secure it with set screws (four places).

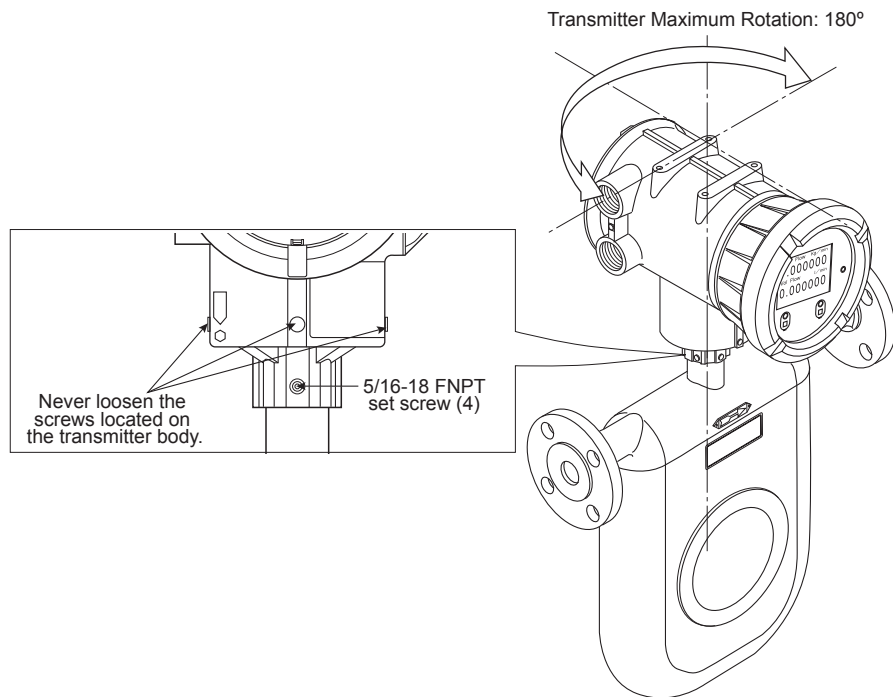


Figure 5.23—Changing the transmitter orientation

CAUTION The transmitter may be rotated over an 180° arc as shown in [Figure 5.23](#). Rotating the transmitter beyond 180° will twist the harness from the sensor unit, damaging the equipment.

4. Connect conduit and wiring.
5. Verify that the flow meter operates properly.

CHANGING THE TRANSMITTER DISPLAY ORIENTATION

The transmitter display may be rotated 360° in steps of 90° within the housing.



WARNING: Before changing the display orientation, turn off power and discharge static electricity.

CAUTION When tightening the display lid, tighten securely using a flat tool or similar instrument. Insufficient tightening can affect gas-tightness and sensitivity of the display's optical switch.

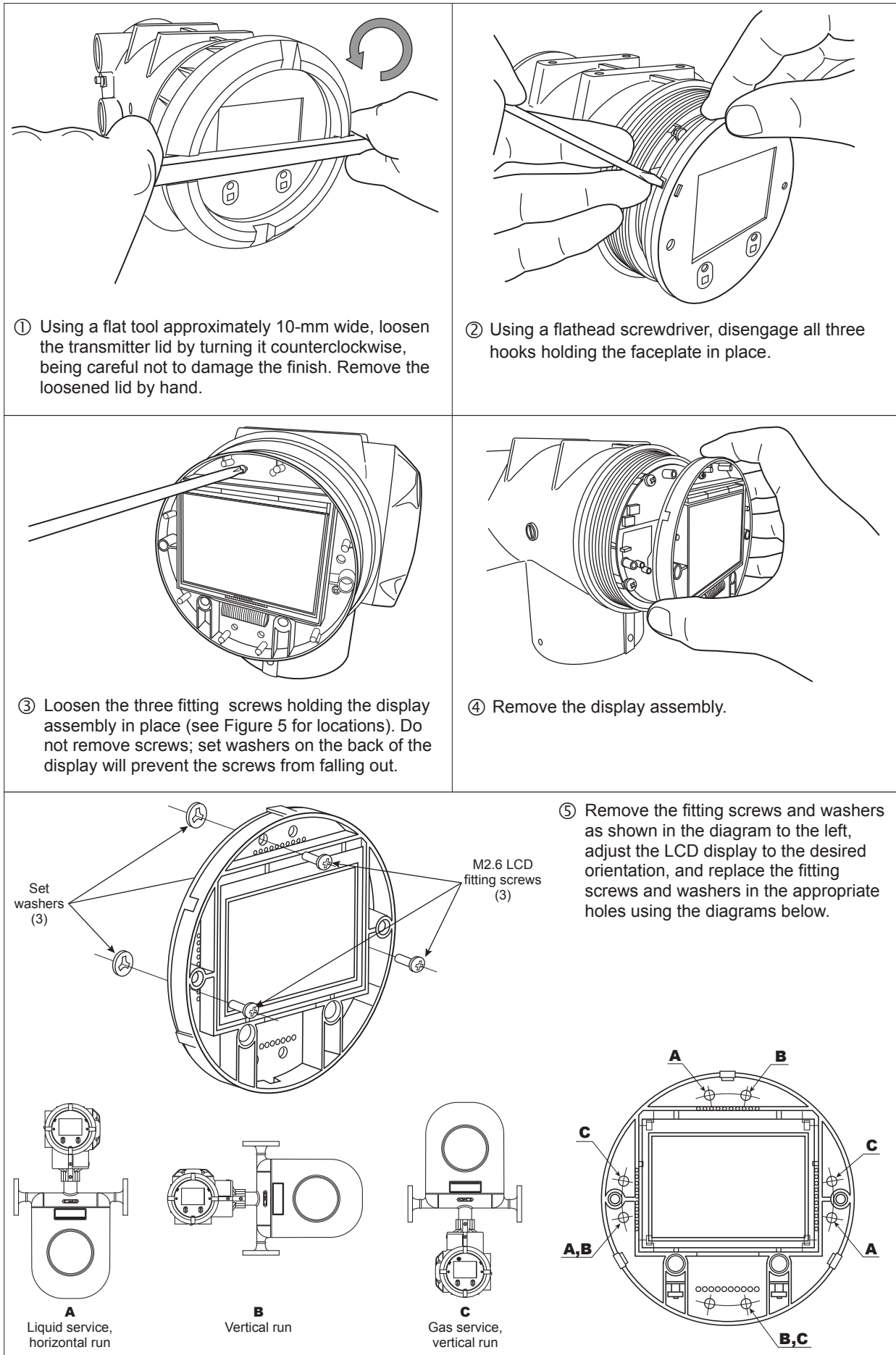


Figure 5.24—Procedure for changing the transmitter display orientation (Part 1 of 2)

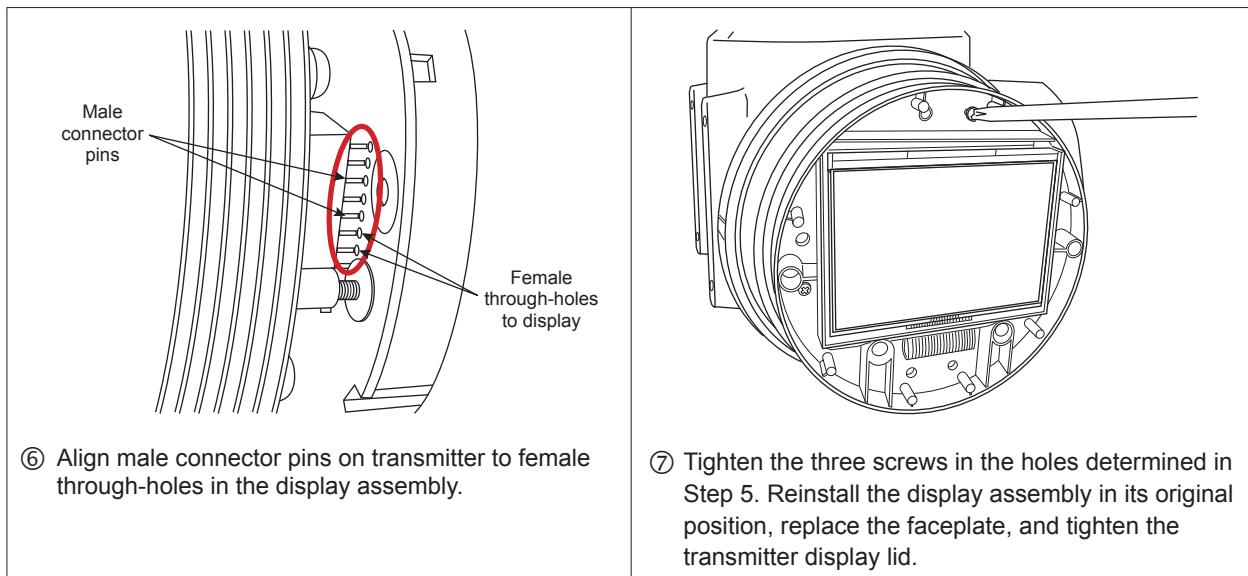


Figure 5.25—Procedure for changing the transmitter display orientation (Part 2 of 2)

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Section 6—Wiring Instructions

WIRING CONNECTIONS

Power and Output Signal Connections (Integrally- and Separately-mounted Transmitter Models)

Terminals for wiring connections are found at the back of transmitter housing. Remove the cover and make wiring connections as follows:

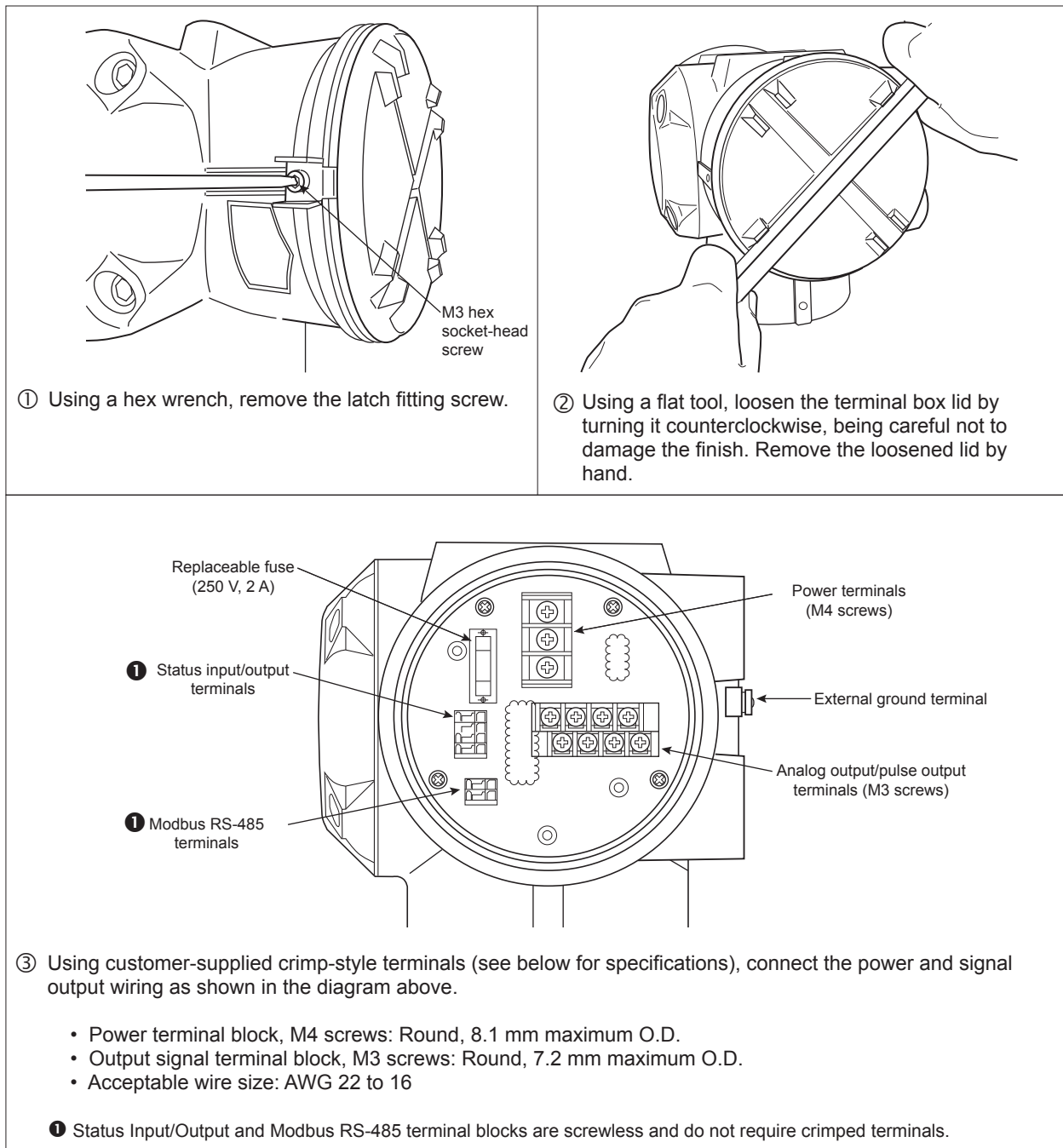


Figure 6.1—Wiring procedure for power and output signal connections

Connections between the Separately-mounted Transmitter and Sensor Models

Terminals for wiring connections with the sensor unit are found on the side of the transmitter housing. Remove the cover and make the wiring connections as follows:

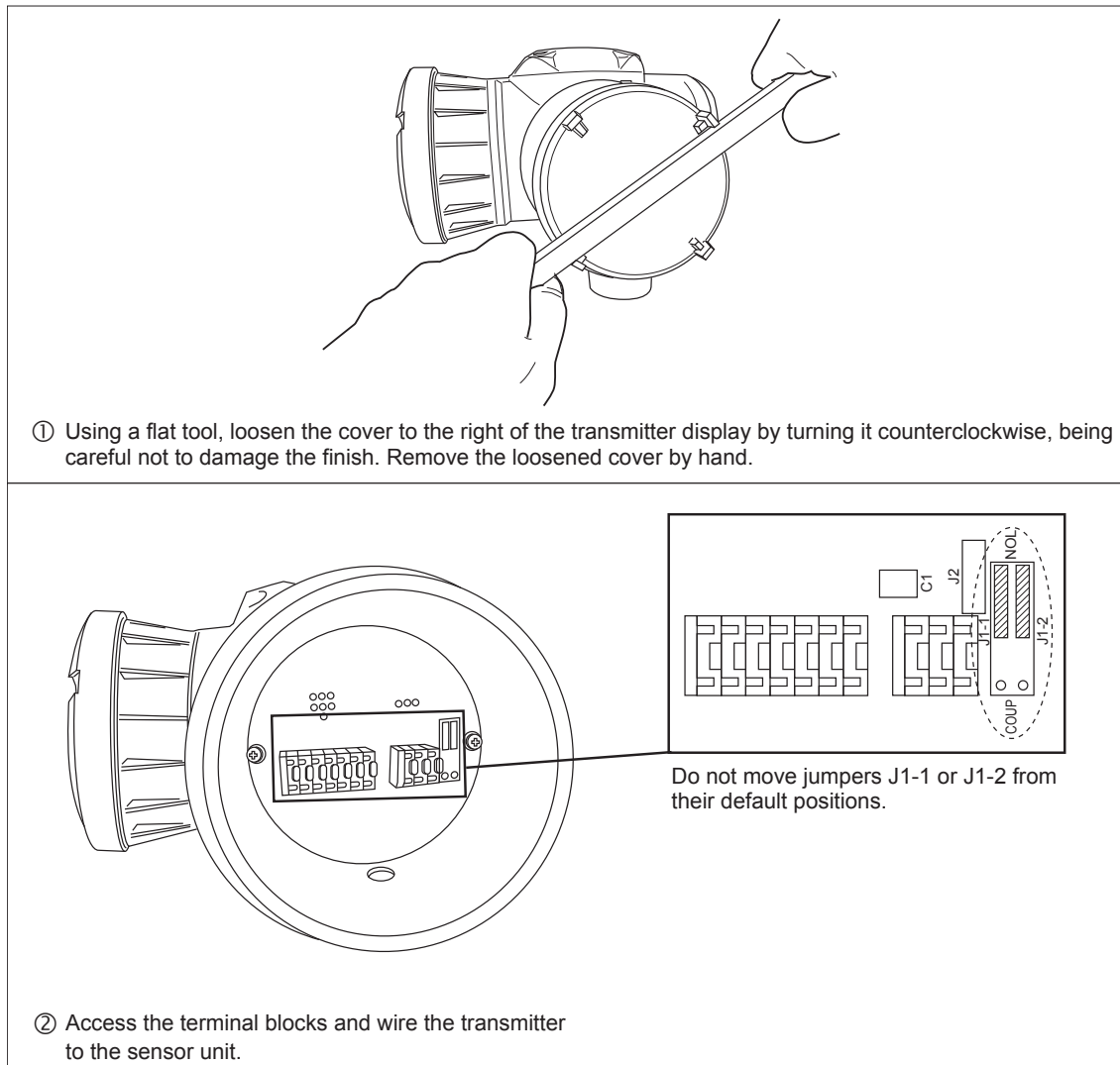


Figure 6.2—Wiring procedure for separately-mounted transmitter to sensor unit

POWER SUPPLY LINES AND GROUND TERMINAL

Power source primary lines are connected to terminals L (+) and N (-). (Over-voltage Category II, Pollution Degree 2). Connect an earth ground only to “GND” on the terminal block or to the external ground terminal (shown in Figure 6.3).

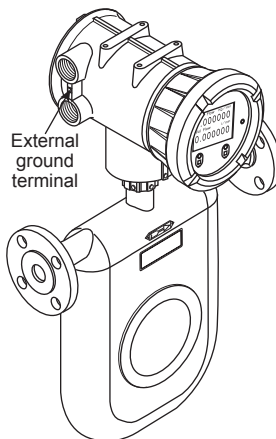


Figure 6.3—Location of external ground terminal on CT Series sensor with integrally-mounted transmitter

CAUTION Supply voltage must be within the range shown on the product nameplate attached to the housing.

ANALOG OUTPUT WIRING

When connecting an analog output (4 to 20 mA) to a receiving instrument, Analog Output 1 has terminals A1 (+) and A1 (-). Analog Output 2 has terminals A2 (+) and A2 (-). The maximum load resistance is 600Ω. For analog output setup instructions, see [Analog Output Function, page 101](#).

PULSE OUTPUT WIRING

When connecting a pulse output to a receiving instrument, Pulse Output 1 has terminals P1 (+) and P1 (-) and Pulse Output 2 has terminals P2 (+) and P2 (-). If you choose voltage pulse signal, the signal transmission length has restrictions on output frequency, as follows:

Output Frequency	Maximum Transmission Length ¹
10 kHz	10 m
1 kHz	100 m
100 Hz	1000 m

1. Values are based on AWG 18 wire.

To change from voltage pulse output to open collector pulse output, or vice versa, remove the front lid and select the appropriate jumper positions at the right of the display, as shown in [Figure 6.4](#) below:

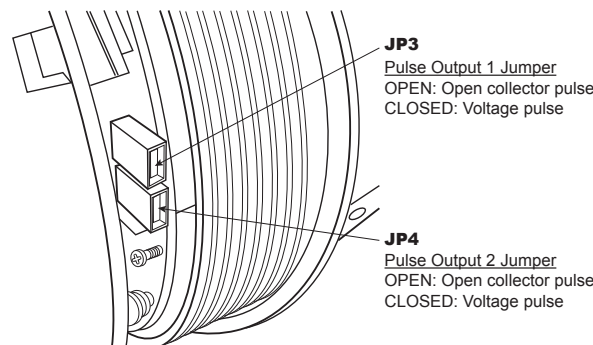


Figure 6.4—Jumper positions for switching between voltage pulse and open collector pulse

For pulse output setup instructions, see [Pulse Output Function, page 97](#).

STATUS OUTPUT WIRING

Status output appears across terminals S.O. (+) and S.O. (-). For status output setup instructions, see [Status Output Function, page 102](#).

CAUTION

Pulse Outputs 1 and 2 and Status Outputs common to this product are not isolated. Therefore, when connecting an external device to each output terminal, connecting a load (resistance) to the minus side will result in no correct output being obtained. Refer to the following figures for correct and incorrect wiring of an external device.

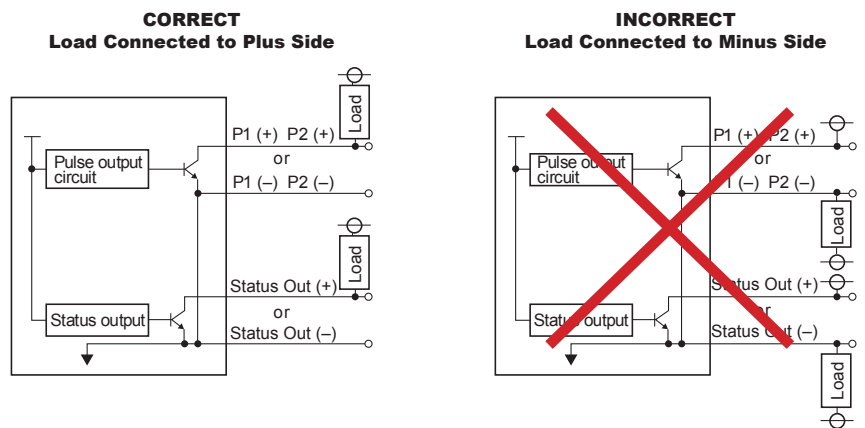


Figure 6.5—Correct and incorrect load resistance connection

STATUS INPUT WIRING

Status input appears across terminals S.I. (+) and S.I. (-). For status output setup instructions, see [Status Input Function](#), page 104.

LINE WIRING OF OPTIONAL COMMUNICATIONS

To wire optional Modbus communications, use terminals I/O (+) and I/O (-). Please refer to the CamCor Modbus Protocol Manual for configuration details.

CAUTION HART (Bell 202) communications protocol does not use these terminals. Instead, HART communications are wired to A1 (+) and A1(-) terminals.

Recommended Cable

Item	Label	Minimum Recommended Cable Specifications			
		Rating Voltage/ Allowable Current (at 86°F)	Cross-section	Solderless Terminals	Maximum Operating Temperature
Power	L (+)	300V, 2A	14 to 16 AWG	R-type, 0.32 in. Size: M4	140°F ²
	N (-)				
	GND				
Signal	A1 (+)	100V, 0.1A	14 to 18 AWG ¹	R-type, 0.28 in. Size: M3	
	A1 (-)				
	A2 (+)				
	A2 (-)				
	P1 (+)				
	P1 (-)				
	P2 (+)			N/A (screwless terminal)	
	P2 (-)				
	S.I. (+)				
	S.I. (-)				
	S.O. (+)				
S.O. (-)					
Communication	I/O (+)	18 AWG			
	I/O (-)				
External Ground	N/A	600V, 40A	12 AWG	Direct wiring or solder-less terminal (R-type, 8.1 mm)	

1. Select the cable size to be used with the number of signals.
2. If the ambient temperature is 113°F or higher, use a cable resistant to 158°F or higher.

Recommended Cable for Modbus Communications

For Modbus communications, use a 0.75 mm² twisted-pair cable with a maximum cable length of 1200 m, depending on operation environment.

Applicable Rubber Packing Size by Wire Gauge and Number of Conductors

Use shielded cables and refer to the following table for applicable rubber packing size(s):

Cable Packing Gum I.D.	Recommended Wire Size		
	14 AWG	16 AWG	18 AWG
10.1 to 11.0	2	3, 4	6, 7
11.1 to 12.0	3, 4	5	8
12.1 to 13.0	5	6	10, 12
13.1 to 14.0	6	7, 8	—

TERMINAL IDENTIFICATION OF SEPARATELY-MOUNTED TRANSMITTER

Item	Terminal Name	Terminal Number	Terminal Color	Description	
Sensor unit-to-transmitter interconnect cable (200 m maximum) ¹	TB20	1AB	BRN	Flow tube drive output	
		2AB	RED		
		3AB	BLK	BRN/RED, GRN/WHT, BLU/GRY, PUR/ORG/YEL shielded cables, bundled	
	TB21	1AB	PUR		Temperature input (inner)
		2AB	ORG		Temperature input (outer)
		3AB	YEL		Temperature input
		4AB	BLU		
		5AB	GRY		Right-position pick-off sensor input
		6AB	WHT		
		7AB	GRN		Left-position pick-off sensor input

1. Maximum cable length for PRO Series is 5 meters.

WIRING DIAGRAM

Transmitter Power and Output Signal Wiring

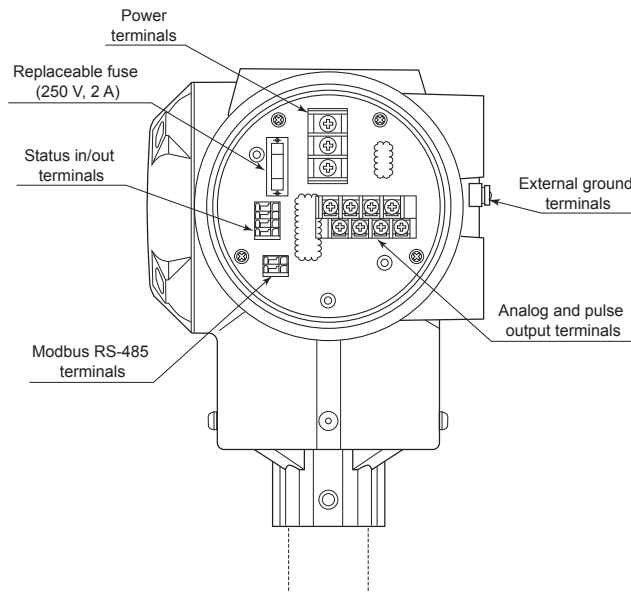


Figure 6.6—Transmitter terminal blocks

Transmitter Identification and Description

Item	Label	Description	Remarks
Signal	A1 (+)	Analog Output 1 (4 to 20 mA)	Maximum load resistance is 600Ω for Analog Outputs 1 and 2. Maximum pulse output (voltage/open drain) transmission length: • 10 m @ 10 kHz • 100 m @ 1 kHz • 1 km @ 100 Hz Minimum conductor size: 18 AWG
	A1 (-)		
	A2 (+)	Analog Output 2 (4 to 20 mA)	
	A2 (-)		
	P1 (+)	Pulse Output 1 (voltage/open drain)	
	P1 (-)		
	P2 (+)	Pulse Output 2 (voltage/open drain)	
	P2 (-)		
	SI (+)	Status Input (contact)	
	SI (-)		
SO (+)	Status Output (open drain)		
SO (-)			
I/O (+)	Expanded Input/Output (Modbus communication, etc.)	For Modbus communications: • Maximum transmission length: 1200 m • Minimum conductor size: 18 AWG	
I/O (-)			
Power	L (+)	Power (with DC power: +)	—
	GND	Earth Ground	
	N (-)	Power (with DC power: -)	

Conduct earth grounding work at the external ground terminal or “GND” on the power terminal block shown in [Figure 6.6](#) (Grade D grounding work).

CAUTION Connect a fuse with a maximum 2 A rating when supplying power to the transmitter.

Separately-mounted Transmitter and Sensor Unit Wiring

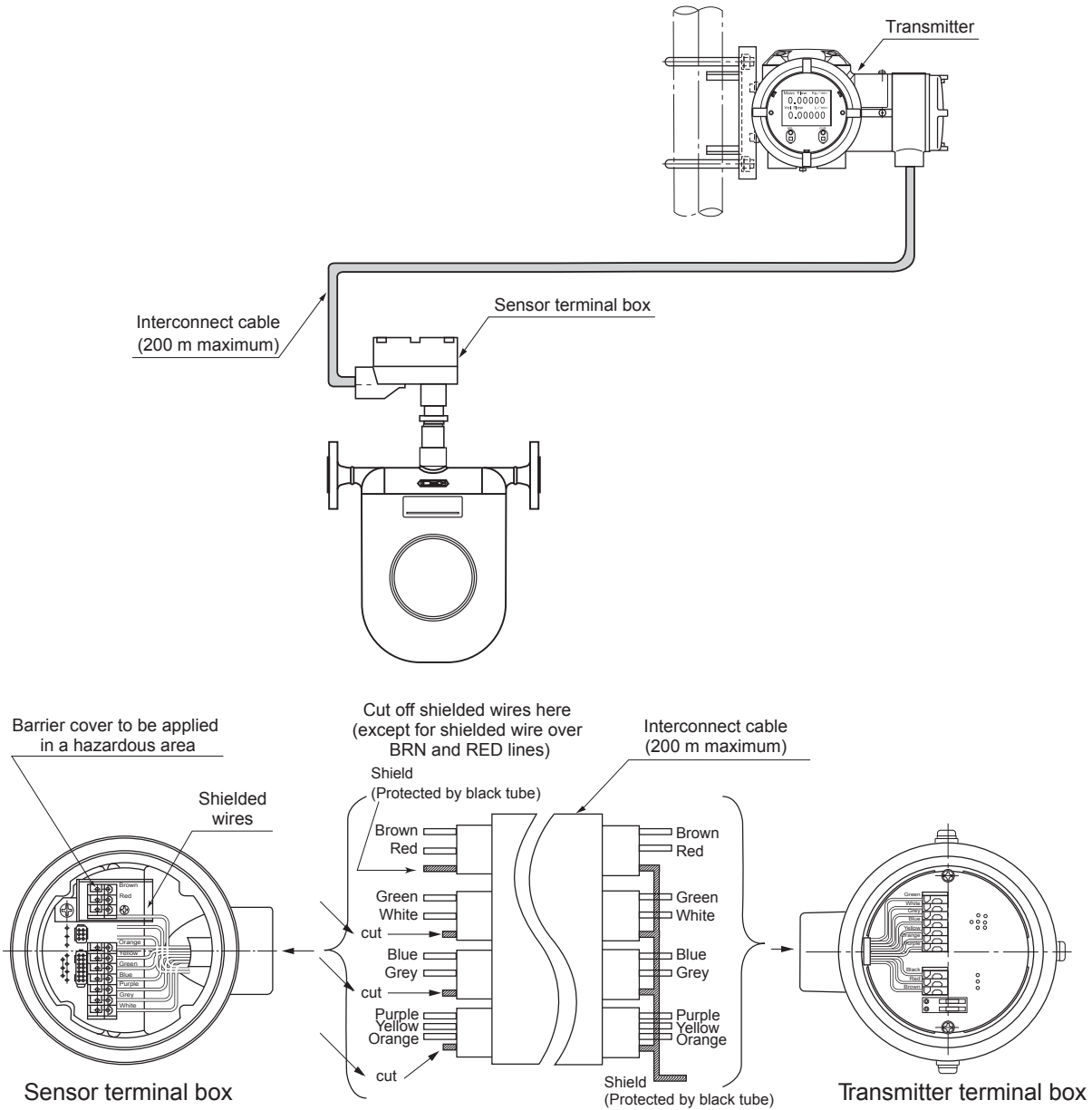


Figure 6.7—Sensor and transmitter terminal box wiring (per Wiring Diagram 20140217)

Use dedicated interconnect cable and prepare shielded wire as follows:

Transmitter End

1. Bundle shielded wires colored in BRN/RED, GRN/WHT, BLU/GRY and PUR/YEL/ORG and cover the wires with a black tube.
2. Connect only one wire to the terminal box (BLK), taking care to avoid potential contact with the housing or conductive parts.

Sensor End

1. Cover the BRN/RED shielded wire with a black tube and connect it to the terminal box, taking care to avoid potential contact with the housing or conductive parts.
2. Clip all shielded wires (except BRN/RED). Use of a crimp pin terminal is not necessary.

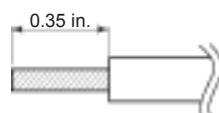


Figure 6.8—Recommended Cable End Treatment

Section 7—Operation

FLUSHING THE PIPING ASSEMBLY

If scale and sludge are expected in the piping assembly, particularly in a new piping assembly, flush the assembly before installing the sensor unit.

CONFIRMING THE SENSOR UNIT IS CORRECTLY INSTALLED

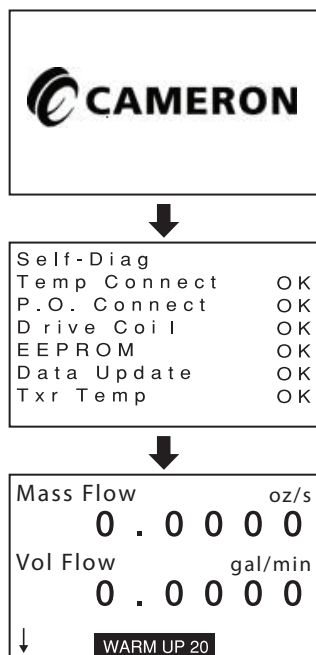
To ensure the safety of personnel and equipment, verify that all bolts are tight and that all gaskets are securely installed before placing the unit into operation. Verify the flow direction at the same time.

CONDUCTING A LEAK CHECK

To check for any connection leaks, completely fill the sensor tube with process fluid and check for leaks from connections.

SUPPLYING THE POWER

After wiring and leak checks are conducted, supply power. The transmitter LCD should show the following information:



1. Corporate logo appears.

2. Self-diagnostics begin. If nothing unusual is found, “OK” appears to the right of each item. If “NG” appears, a check of item is required. Refer to the “Transmitter Check” section of this manual, correct the condition and turn on the power again.

3. The variable view screen appears and measurement begins.

Figure 7.1—Power-up menu

MEASUREMENT LINE STARTUP

Start the pump, open valves, etc. to allow the process fluid to flow.

WARM-UP

To ensure stability of measuring conditions, allow approximately 20 minutes for warm up. After starting the unit, the message “Warm Up XX” will appear at the bottom of the LCD, as shown in [Figure 7.1](#). “XX” represents the remaining warm-up time in minutes.

ZEROING PROCEDURE

When the warm-up period expires, shut off the downstream valve. Adjust readings to zero using the procedure described in [Zeroing Function, page 91](#), then initiate measurement.

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Section 8—Incorporated Functions

DISPLAY

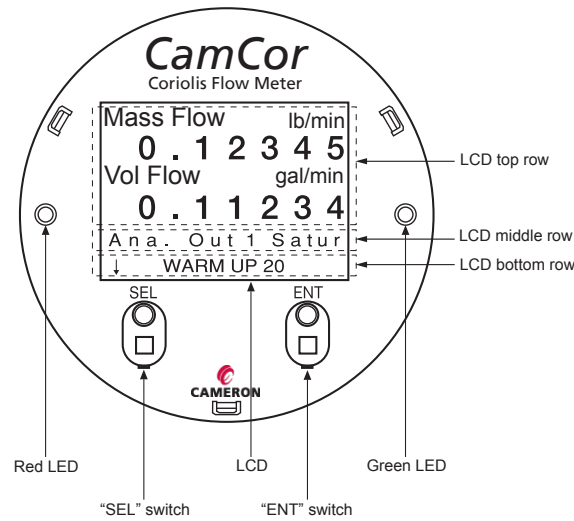


Figure 8.1—Transmitter display

LCD Top Row

Measurements are displayed on the top row. Other variables can be configured with switches. For example, [Figure 8.1](#) shows instant mass flow rate and instant volume rate. For more information about displaying variables, see [Viewing Variables, page 65](#).

LCD Bottom Row

The bottom row shows the display scroll direction, action buttons (in configuration mode), and a running hours status indicator (when appropriate). The arrow at the bottom left indicates the direction in which the variables are displayed (an arrow pointing down indicates a forward direction; an arrow pointing up indicates a reverse direction). For information about configuring variable display direction, see [Viewing Variables, page 65](#).

A blinking black circle to the right of the arrow indicates that the number of running hours has exceeded 100,000. See [Status Messages, page 110](#) to learn how to address this issue.

Red and Green LEDs

Similar to the messages that appear on the LCD, these lights indicate the status of the flow meter. During normal operations, the red LED stays off, while the green LED remains on. A red LED that is on or a green LED that is off indicates erratic behavior. For assistance with troubleshooting, see [Error Messages, page 109](#) and [Status Messages, page 110](#).

SEL and ENT Switches

These infrared switches respond when a finger is held to the glass in front of the switch. The menus in the following sections will introduce functions associated with two switches: SEL and ENT. SEL functions are categorized by SEL1 and SEL3 descriptors that appear in the LCD, and the user activates each menu by touching and holding a finger over the sensor to initiate configuration, and then removing the finger after a specified number of cycles to select a menu (a cycle is characterized by the highlighting and unhighlighting of an “S” character on the LCD). Therefore, removing the finger after a single highlight activates the SEL1 menu, but the user must hold a finger over the sensor for a count of three highlights to activate the SEL3 menu. Detailed operating instructions are provided in [Switch Operation, page 64](#).

In low light conditions, consider holding a light-colored object in front of the sensor to improve reflection of the infrared beam if touching the glass with a finger does not produce a response. Sensitivity of the infrared switches can also be adjusted if required. Contact Cameron technical support for details.

Switch Operation

The transmitter has two infrared switches: SEL and ENT. Operation of these switches is described below. For information about parameter configuration and other functions, see the respective manual sections.

ENT Operation

This switch is used for scrolling the display, the cursor, etc. In the following example, ENT is covered to switch the variable view screens.

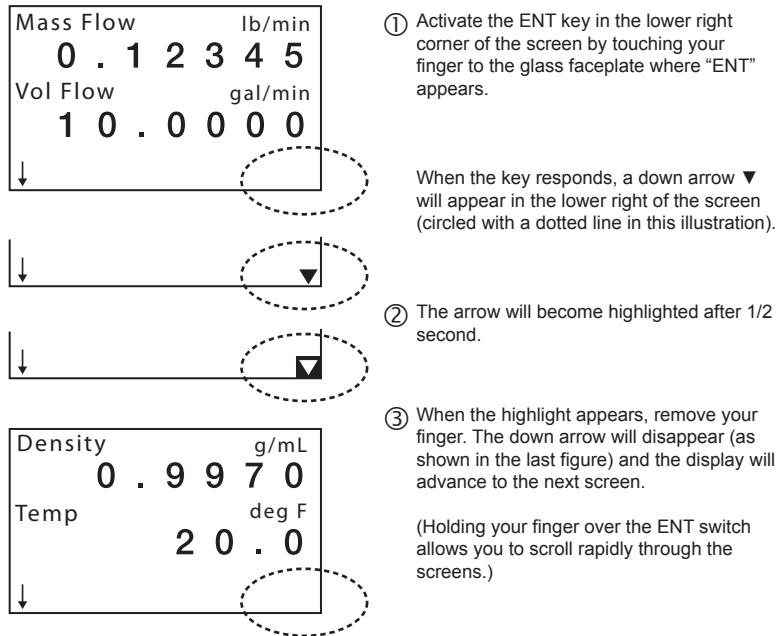


Figure 8.2—ENT operation

SEL Operation

This switch is used to reverse variable display direction, adjust variable values, select parameters, etc. In the following example, SEL is used to switch the variable display direction.

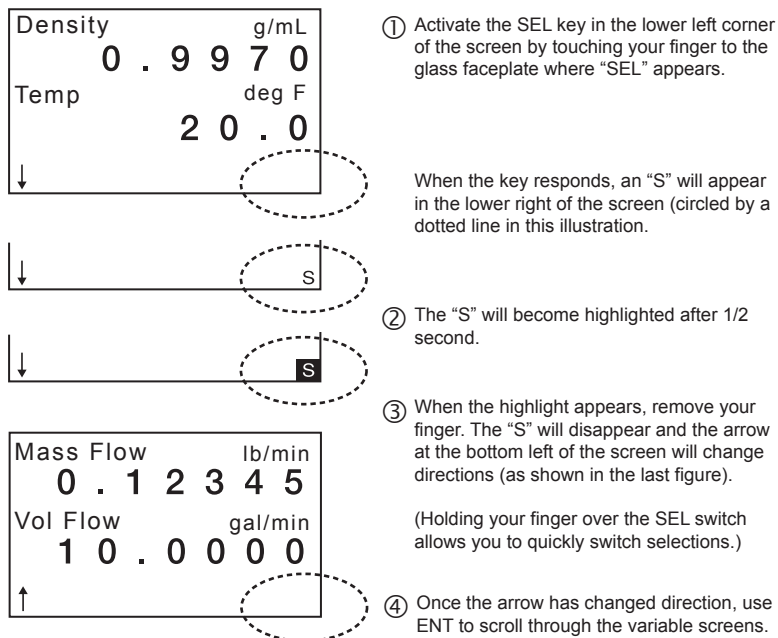


Figure 8.3—SEL operation

SEL3 Operation

The SEL3 operation is used to finalize and activate a numeric value that has been changed. In the following example, the SEL3 operation is used to switch to the *Mode Select* menu screen.

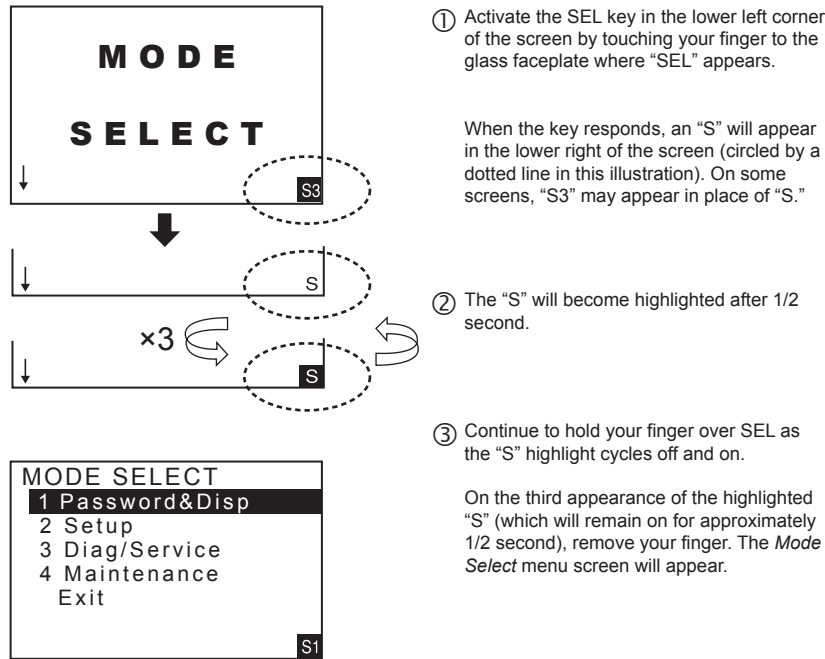


Figure 8.4—SEL3 operation

Viewing Variables

The figure below shows a flow diagram of the CT series sensor default settings and describes the various elements of the display screens. The screen changes each time the SEL switch is touched. Touch the SEL switch repeatedly until the desired screen appears.

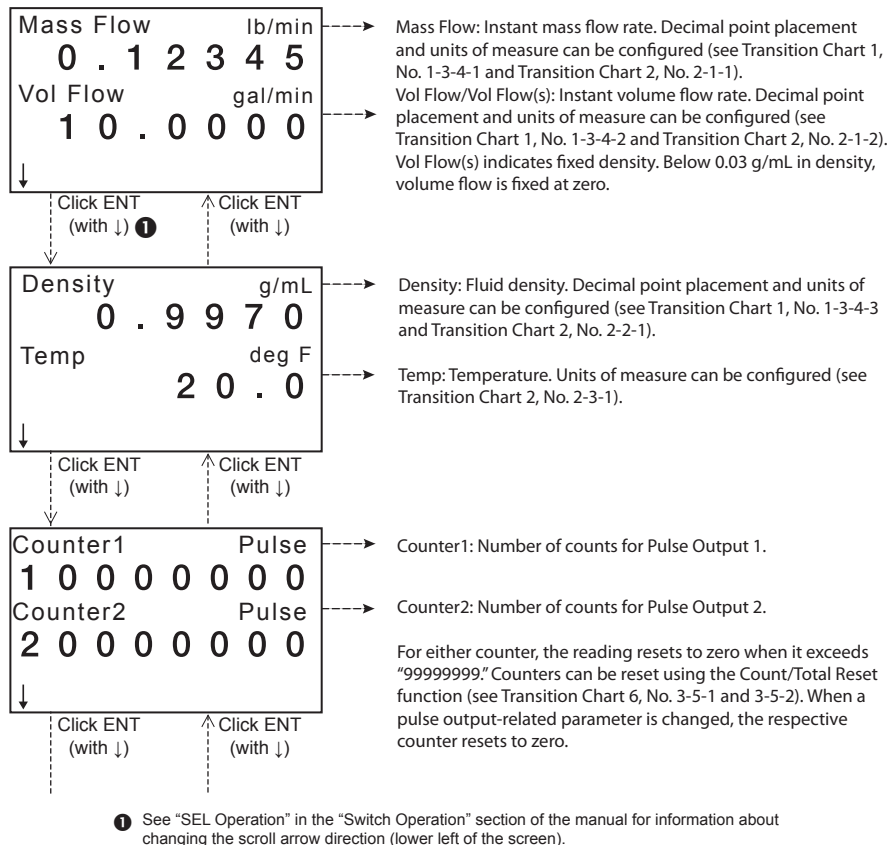


Figure 8.5—Variable screens (continued in Figure 8.6, page 66)

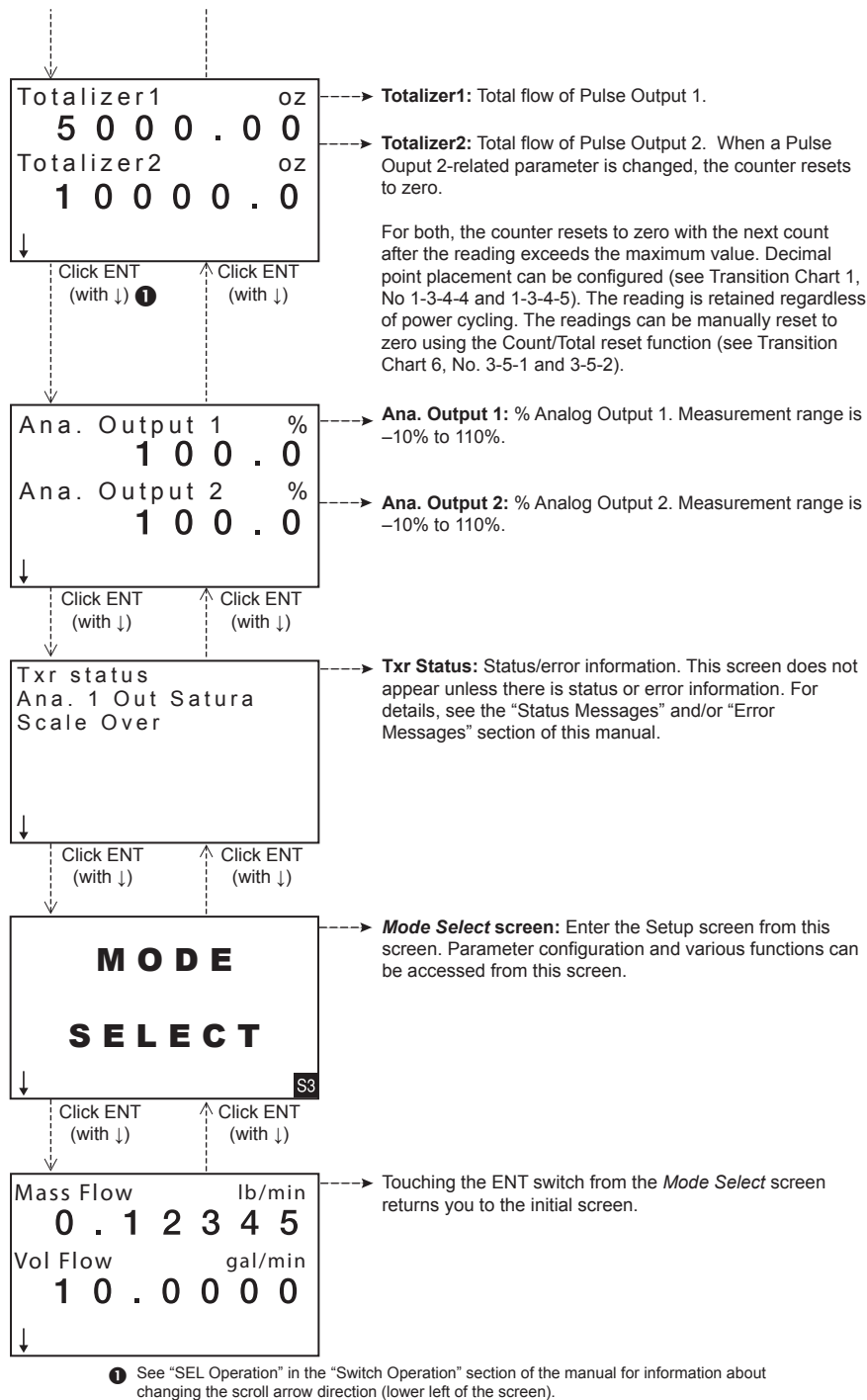


Figure 8.6—Variable screens (continued from Figure 8.5, page 65)

Changing the Variable View

Individual variables can be displayed or hidden and their display priority can be changed. For details, see [Configuring the Variable View, page 96](#).

Additionally, the display font size can be changed. In the default setting (shown in [Figure 8.5, page 65](#) and [Figure 8.6](#)), two variables appear on one screen. Selecting the standard font enables three items to be displayed on one screen. For details about changing the display font size, see [Transition Chart 1, page 68](#), No. 1-3-3.

VIEWING PARAMETERS AND DESCRIPTION

Many parameters and functions are incorporated into the transmitter. For more information about individual parameters, see [Transition Chart 1, page 68](#) through [Transition Chart 6, page 78](#).

Viewing the Setup Menu

To reconfigure parameters, etc., access the *Mode Select* menu screen using the following procedure:

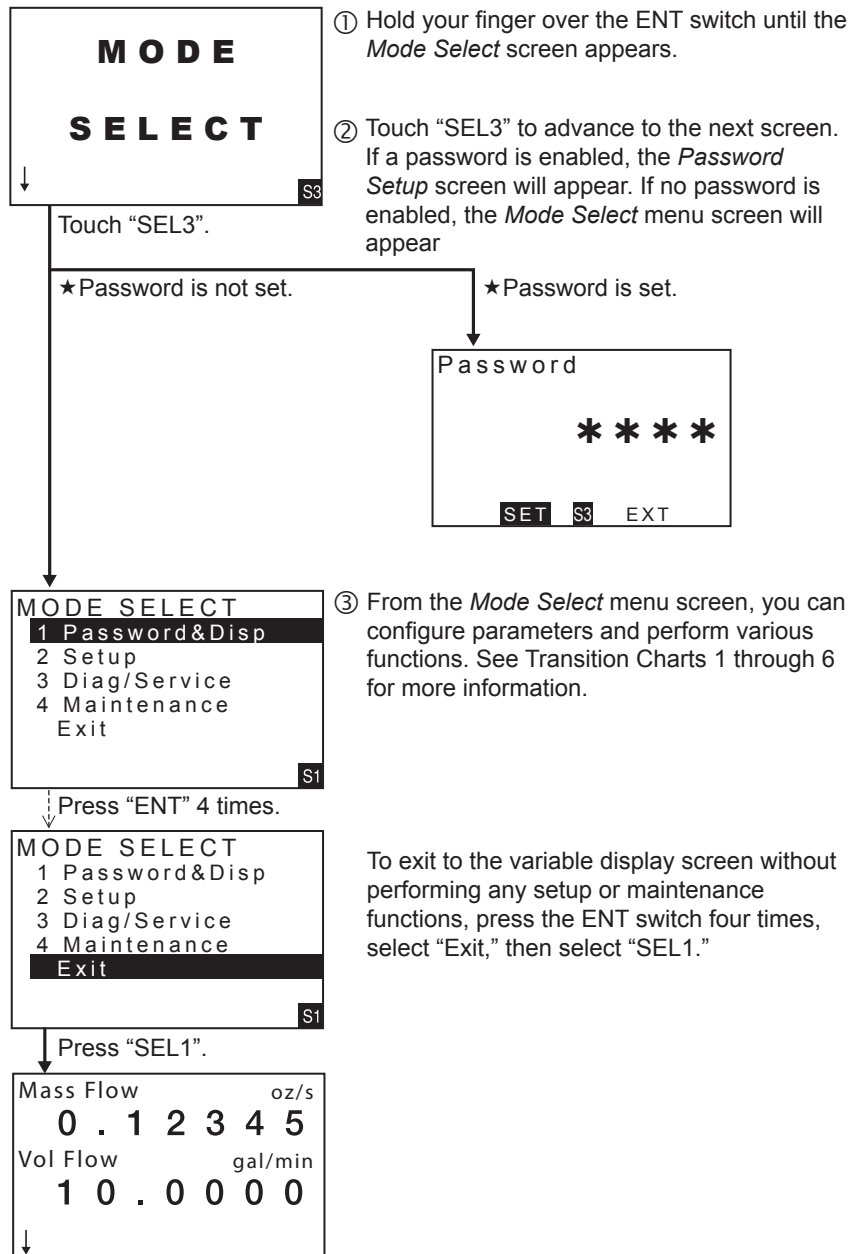
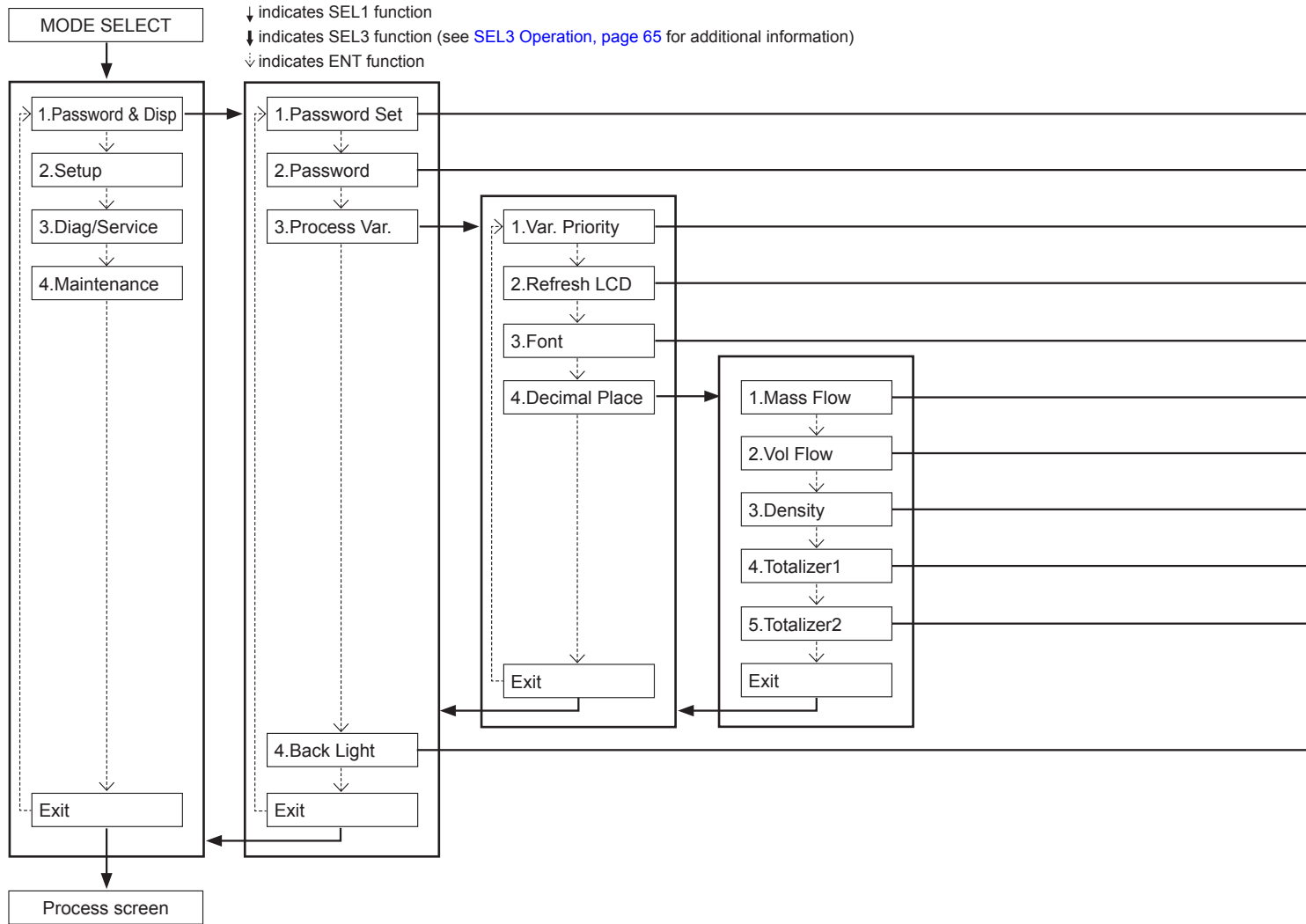


Figure 8.7—Setup menu procedure

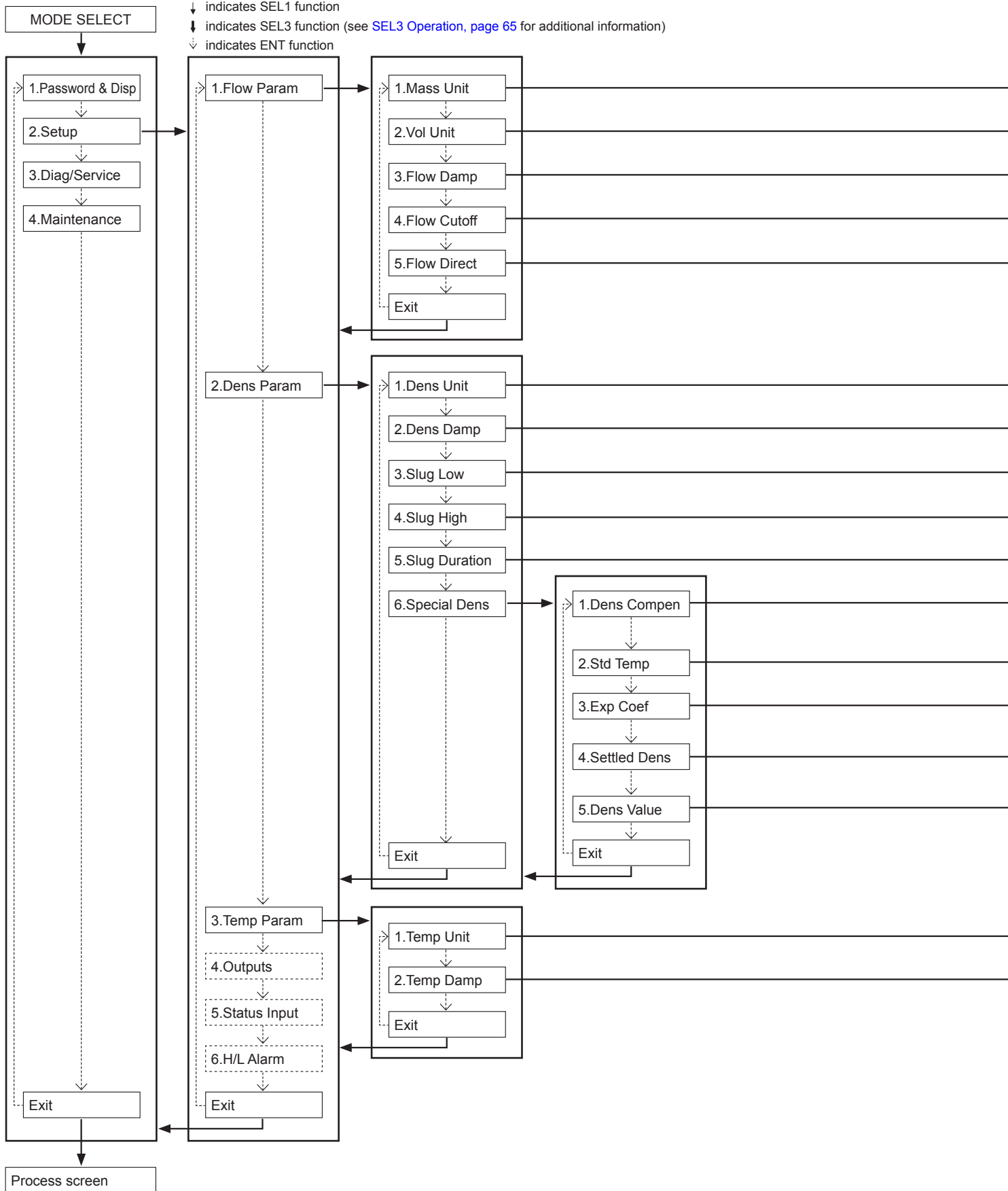
Note If no command is received from the *Mode Status* menu screen within five minutes, you will be returned to the variable display screen.

TRANSITION CHART 1



No.	Item	Description	Procedure Location	Default
1-1	Password Set	Select password active/inactive. When "ON" is selected, you must enter a password before you can enter setup mode from the <i>Mode Select</i> menu screen to prevent any unauthorized password changes.	Password Function, page 82	Off
1-2	Password	Set a password. To validate the setting, the password setting in No. 1-1 must be turned "ON." CAUTION: If password is forgotten, there is no way to change parameters.		9999
1-3-1	Variable Priority	Select run indicator display/hide and priority of variables view.	Configuring the Variable View, page 96	
1-3-2	Refresh LCD	Change LCD display refresh rate (ms). Select from: 100 ms, 200 ms, 500 ms, 1000 ms, or 2000 ms. We recommend selecting a slower rate if the reading is difficult to read because the display advances too quickly. Select a faster rate for prompt readout.	Password Function, page 82	500 ms
1-3-3	Font	Changes LCD font size. Select from : Double Angle (larger font/two variables per screen) or Normal (smaller font/three variables per screen).		Double
1-3-4-1	Mass Flow	Change displayed instant mass flow rate decimal point position to match the instant mass rate used. Select from: Auto [automatic (from 0 to 5 decimal places)]; Integer (no fractions); or 1, 2, 3 or 4 decimal places.		Auto
1-3-4-2	Vol Flow	Change displayed instant volume flow rate decimal point position to match the instant mass rate used. Select from: Auto (automatic); Integer (no fractions); or 1, 2, 3 or 4 decimal places.		Auto
1-3-4-3	Density	Change displayed density decimal point position to match the viscosity used. Select from: Auto (automatic); Integer (no fractions); or 1, 2, 3 or 4 decimal places.		4th decimal
1-3-4-4	Totalizer1	Change displayed total flow 1 decimal point position to match the total flow 1 used. Select from: Auto (automatic); Integer (no fractions); or 1, 2, 3 or 4 decimal places.		Auto
1-3-4-5	Totalizer2	Change displayed total flow 2 decimal point position to match the total flow 2 used. Select from: Auto (automatic); Integer (no fractions); or 1, 2, 3 or 4 decimal places.	Auto	
1-4	Backlight	Select backlight mode. Select from: Sleep 5 min (on for 5 minutes, then off); Sleep 10 min (on for 10 minutes, then off); Sleep 20 min (on for 20 minutes, then off); or Sleep 30 min (on for 30 minutes, then off) Note: When meter operation is erratic, the backlight remains on or blinks.	Password Function, page 82	Sleep 20 min

TRANSITION CHART 2

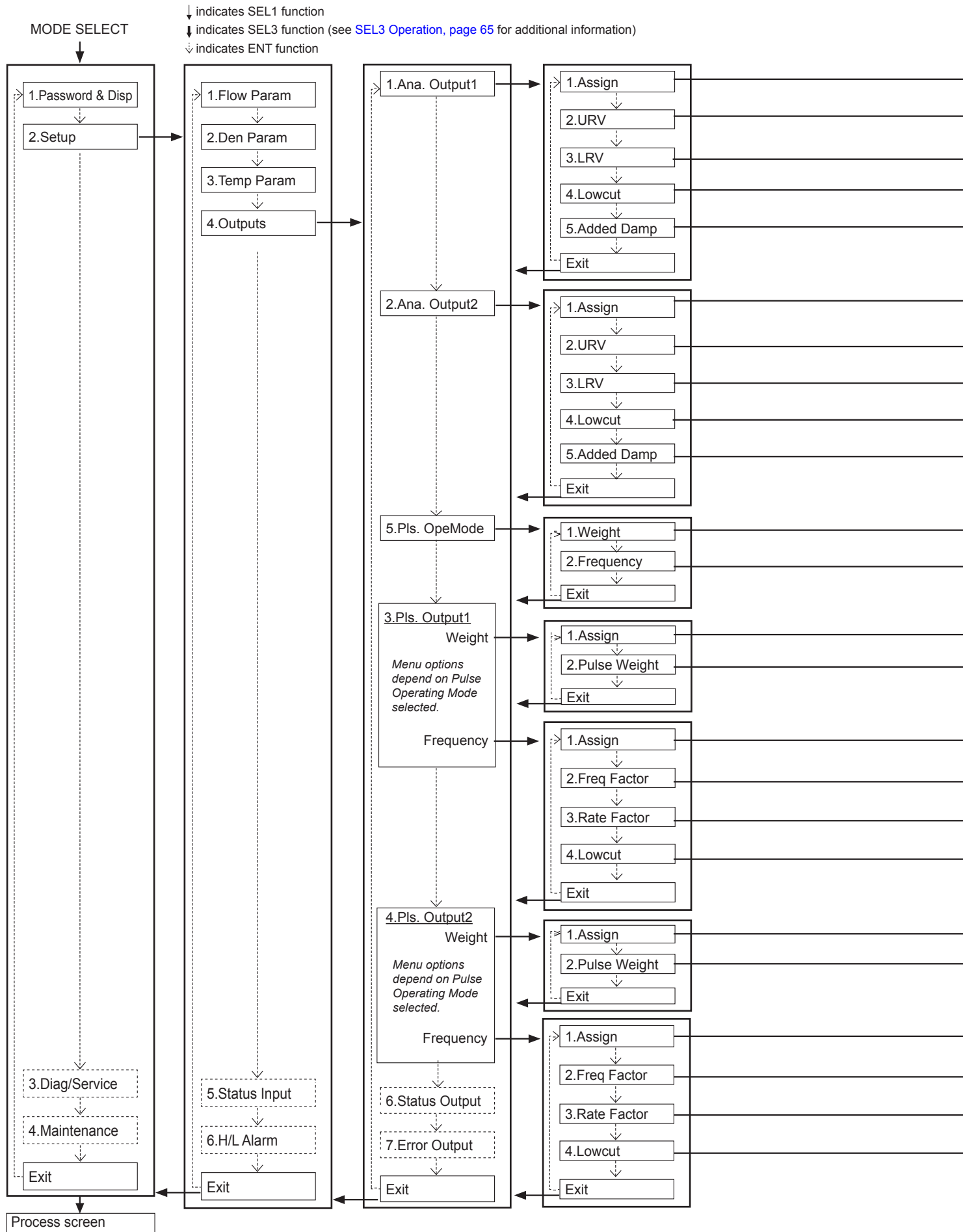


No.	Item	Description	Procedure Location	Default
2-1-1	Mass Unit	Select instant mass flow rate unit. Flow rate-related views and settings use the selected unit of measure.	Selecting a Parameter, page 81	kg/min
2-1-2	Vol Unit	Select instant volume flow rate unit. Flow rate-related views and settings use the selected unit of measure.		L/min
2-1-3	Flow Damp	Change instant flow rate damping factor (sec). If flow rate fluctuates greatly, select a larger damping factor. Select a smaller damping factor (0 to 200 sec) if fast response is desired.	Entering Parameter Values, page 80	0.8
2-1-4	Flow Cutoff	Change instant mass rate cutoff (%). Within the range where [-cutoff rate<instant mass rate<cutoff rate], the instant rate is clamped at zero with respect to the cutoff rate multiplied by the maximum allowable instant mass rate+cutoff rate. If flow rate fluctuates greatly, select a larger value. For smaller flow measurements, select a smaller value (0% to 10%).		0.3
2-1-5	Flow Direct	Change flow direction. Select from: Forward (+ when fluid flows in the sensor's flow direction; - when fluid flows opposite the sensor's flow direction) or Reverse (- when fluid flows in the sensor's flow direction; + when fluid flows opposite the sensor's flow direction)	Selecting a Parameter, page 81	Forward

2-2-1	Dens Unit	Select density unit. Density-related views and settings use the selected unit of measure.	Selecting a Parameter, page 81	g/mL
2-2-2	Dens Damp	Change density damping factor (sec). If density fluctuates greatly, select a larger value. For fast response, select a smaller value.	Entering Parameter Values, page 80	4.0
2-2-3	Slug Low	Set lower limit density (low-end in normal density) for slug flow detection. Set a value smaller than expected flow density.		0
2-2-4	Slug High	Set higher limit density (high-end in normal density) for slug flow detection. Set a value larger than expected flow density.		10
2-2-5	Slug Duration	Set the slug flow detection duration. During the preset duration, if a measured density falls below the lower limit density (No. 2-2-3) or exceeds the higher limit density (No. 2-2-4), it is identified as slug flow to indicate an alarm.		0
2-2-6-1	Dens Compen	Enable/disable reference temperature conversion function on density; On (reference temperature function is enabled based on the following formula and the obtained density value is used in the view and output, etc. Density after temperature conversion=Measured density+{reference temperature conversion factor [No. 2-2-6-3] × (fluid temperature – reference temperature [No. 2-2-6-2])}	Selecting a Parameter, page 81	Off
2-2-6-2	Std Temp	Change the reference temperature (°C) of the reference temperature conversion function. The setting is valid when the reference temperature conversion function (No. 2-2-6-1) is active.	Entering Parameter Values, page 80	20.00
2-2-6-3	Exp Coef	Change the reference temperature conversion factor in the reference temperature conversion function. The setting is valid when the reference temperature conversion function (No. 2-2-6-1) is active.		0.00024
2-2-6-4	Settled Dens	Enable/disable the fixed density function. Select from: Off (fixed density function inactive); On (regardless of measured density, the fixed density (No. 2-2-6-5) is used to display measurement and output, etc. ("Vol Flow" on display changes to "Vol Flow(s)" to avoid confusion with true density volume output.)	Selecting a Parameter, page 81	Off
2-2-6-5	Dens Value	Change fixed density (g/mL) of fixed density function. The setting is valid when fixed density function (No. 2-2-6-4) is active.	Entering Parameter Values, page 80	1.0000

2-3-1	Temp Unit	Select unit of measure for temperature. Temperature-related views and settings use the selected unit of measure.	Selecting a Parameter, page 81	°C
2-3-2	Temp Damp	Change temperature damping factor (sec). If temperature fluctuates greatly, select a larger value. For fast response, select a smaller value.	Entering Parameter Values, page 80	4.0

TRANSITION CHART 3



No.	Item	Description	Procedure Location	Default
2-4-1-1	Assign	Change Analog Output 1 assignment (see Analog Output Function, page 101). If assignment is changed, reconfigure upper limit (No. 2-4-1-2), lower limit (No. 2-4-1-3), low cutoff (No. 2-4-1-4) and damping factor (No. 2-4-1-5) for optimum settings.	Selecting a Parameter, page 81	Volume Flow
2-4-1-2	URV	Change Analog Output 1 upper limit. A 20-mA output will be produced when the value is set. A value smaller than the lower limit (No. 2-4-1-3) or a value larger than the maximum allowable range are not acceptable.	Entering Parameter Values, page 80	180.00
2-4-1-3	LRV	Change Analog Output 1 lower limit. A 4-mA output will be produced when the value is set. A value smaller than the upper limit (No. 2-4-1-2) or a value larger than the maximum allowable range are not acceptable.		0.00000
2-4-1-4	Lowcut	Change Analog Output 1 low cutoff (%). When the low-flow cutoff is greater than the proportion of the analog output where the upper limit (No. 2-4-1-2) is set at 100% and the lower limit (No. 2-4-1-3) is set at 0%, the analog output is clamped at 4 mA.		0.0
2-4-1-5	Added Damp	Change Analog Output 1 damping factor (sec). If Analog Output 1 fluctuates greatly, select a larger value. For a fast response, select a lower value.		0.0

2-4-2-1	Assign	Change Analog Output 2 assignment (see Analog Output Function, page 101). If assignment is changed, reconfigure upper limit (No. 2-4-2-2), lower limit (No. 2-4-2-3), low cutoff (No. 2-4-2-4) and damping factor (No. 2-4-2-5) for optimum settings.	Selecting a Parameter, page 81	Density
2-4-2-2	URV	Change Analog Output 2 upper limit. A 20-mA output will be produced when the value is set. A value smaller than the lower limit (No. 2-4-2-3) or a value larger than the maximum allowable range are not acceptable.	Entering Parameter Values, page 80	180.00
2-4-2-3	LRV	Change Analog Output 2 lower limit. A 4-mA output will be produced when the value is set. A value smaller than the upper limit (No. 2-4-2-2) or a value larger than the maximum allowable range are not acceptable.		0.00000
2-4-2-4	Lowcut	Change Analog Output 2 low cutoff (%). When the low-flow cutoff is greater than the proportion of the analog output where the upper limit (No. 2-4-2-2) is set at 100% and the lower limit (No. 2-4-2-3) is set at 0%, the analog output is clamped at 4 mA.		0.0
2-4-2-5	Added Damp	Change Analog Output 2 damping factor (sec). If Analog Output 2 fluctuates greatly, select a larger value. For a fast response, select a lower value.		0.0

2-4-5-1	Weight	Change the Pulse Operating Mode to Weighted pulse output.	Selecting a Parameter, page 81	Weight
2-4-5-2	Frequency	Change the Pulse Operating Mode to Frequency pulse output.		

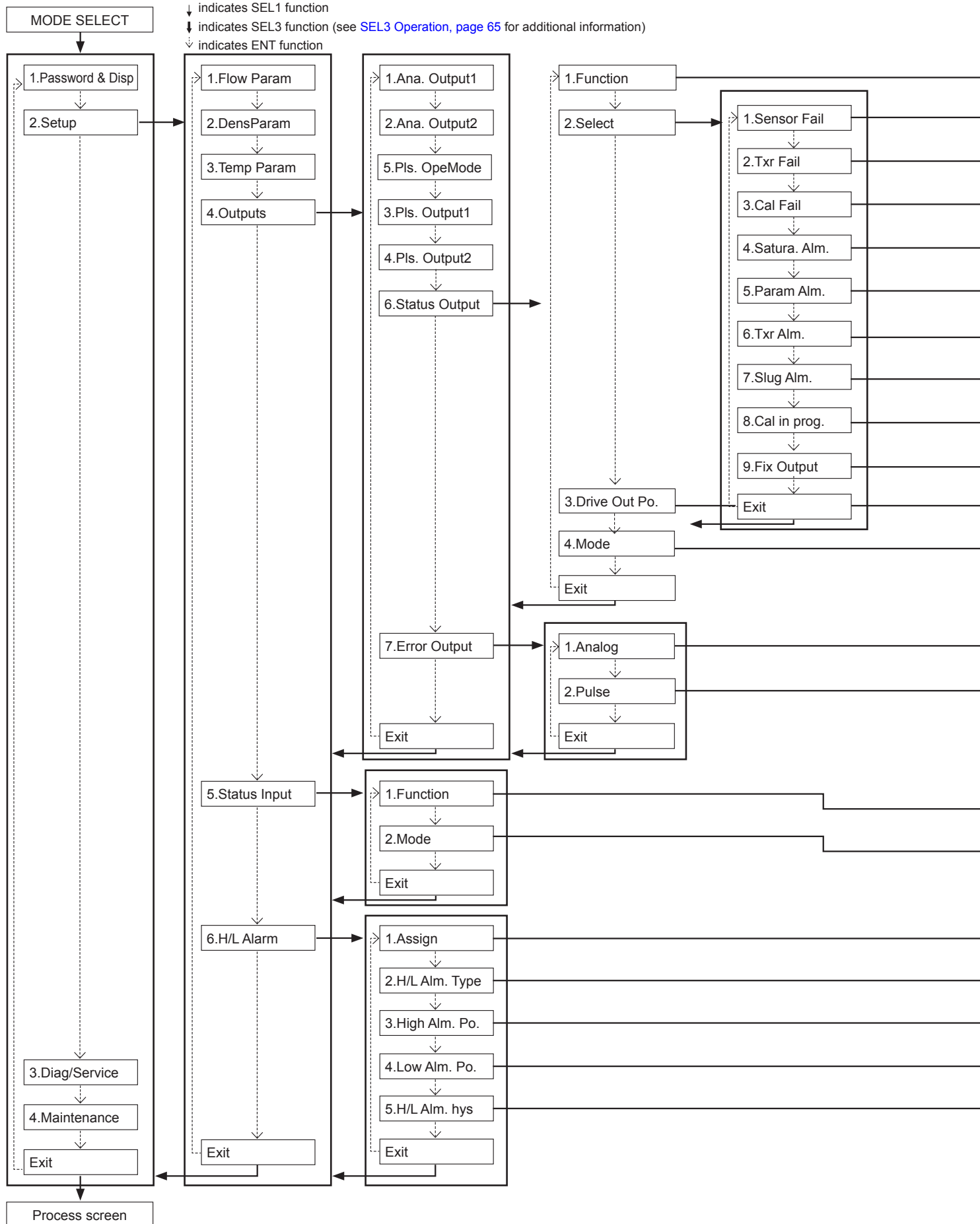
2-4-3-1	Assign	Change Pulse Output 1 assignment (see Pulse Output Function, page 97). If assignment is changed, reconfigure pulse weight (No. 2-4-3-2) for optimum settings.	Selecting a Parameter, page 81	Volume Flow
2-4-3-2	Pulse Weight	Change the flow rate per unit of output pulse of Pulse Output 1.	Entering Parameter Values, page 80	1000.0

2-4-3-1	Assign	Change Pulse Output 1 assignment (see Pulse Output Function, page 97). If assignment is changed, reconfigure frequency at full scale (No. 2-4-3-2), full-scale flow rate (No. 2-4-3-3) and low cutoff (No. 2-4-3-4) for optimum settings.	Selecting a Parameter, page 81	Volume Flow
2-4-3-2	Freq Factor	Change the maximum frequency of Pulse Output 1. An output is produced at the frequency (duty 50%) set at full scale (No. 2-4-3-3). Configure this setting to match the measuring frequency range of the instrument used for pulse output measurement.	Entering Parameter Values, page 80	1000.0
2-4-3-3	Rate Factor	Change Pulse Output 1 full-scale flow rate. An output is produced at the maximum frequency (No. 2-4-3-2) when the preset flow rate is reached.		180.000
2-4-3-4	Lowcut	Change Pulse Output 1 low cutoff (%). When the proportion of the flow rate falls below the low cutoff where the full-scale flow rate (No. 2-4-3-3) is set at 100%, the pulse output is clamped at 0.0.		0.0

2-4-4-1	Assign	Change Pulse Output 2 assignment (see Pulse Output Function, page 97). If assignment is changed, reconfigure pulse weight (No. 2-4-4-2) for optimum settings.	Selecting a Parameter, page 81	Volume Flow
2-4-4-2	Pulse Weight	Change the flow rate per unit of output pulse of Pulse Output 2.	Entering Parameter Values, page 80	1000.0

2-4-4-1	Assign	Change Pulse Output 2 assignment (see Pulse Output Function, page 97). If assignment is changed, reconfigure frequency at full scale (No. 2-4-4-2), full-scale flow rate (No. 2-4-4-3) and low cutoff (No. 2-4-4-4) for optimum settings.	Selecting a Parameter, page 81	Volume Flow
2-4-4-2	Freq Factor	Change the maximum frequency of Pulse Output 2. An output is produced at the frequency (duty 50%) set at full scale (No. 2-4-4-3). Configure this setting to match the measuring frequency range of the instrument used for pulse output measurement.	Entering Parameter Values, page 80	1000.0
2-4-4-3	Rate Factor	Change Pulse Output 2 full-scale flow rate. An output is produced at the maximum frequency (No. 2-4-4-2) when the preset flow rate is reached.		180.000
2-4-4-4	Lowcut	Change Pulse Output 2 low cutoff (%). When the proportion of the flow rate falls below the low cutoff where the full-scale flow rate (No. 2-4-4-3) is set at 100%, the pulse output is clamped at 0.0.		0.0

TRANSITION CHART 4



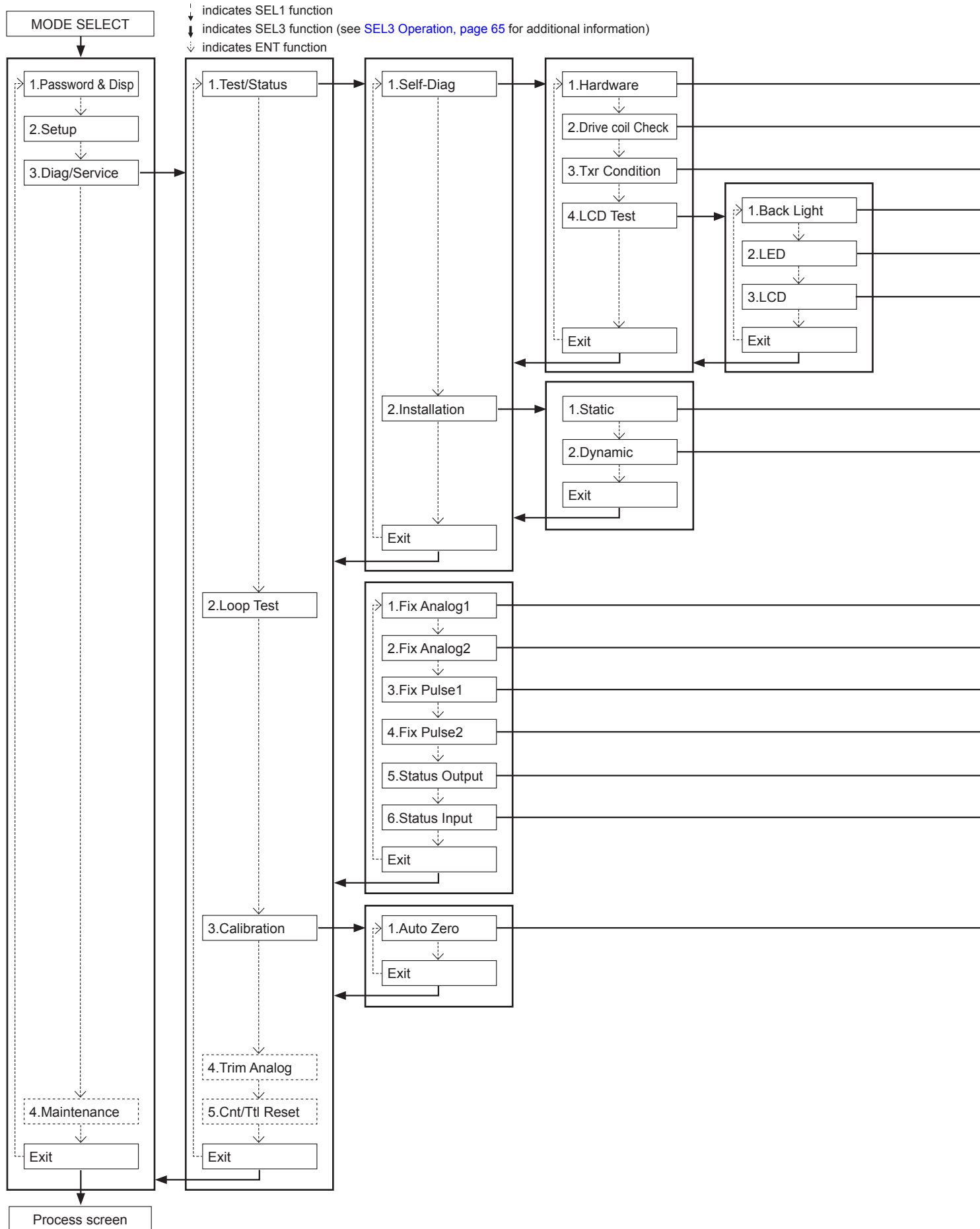
No.	Item	Description	Procedure Location	Default
2-4-5-1	Function	Change Status Output assignment. See Status Output Function, page 102 for more information.	Selecting a Parameter, page 81	No Function
2-4-5-2-1	Sensor Fail	Select Off (no assignment to status output) or On (Sensor Fail state assigned to status output). No output will appear unless Out is selected. For information about sensor fail, see Error Messages, page 109 .		Off
2-4-5-2-2	Txr Fail	Select Off (no assignment to status output) or On (Transmitter Fail state assigned to status output). No output will appear unless Out is selected. For information about transmitter fail, see Error Messages, page 109 .		Off
2-4-5-2-3	Cal Fail	Select Off (no assignment to status output) or On (Calibration Fail state assigned to status output). No output will appear unless Out is selected. For information about calibration fail, see Error Messages, page 109 .		Off
2-4-5-2-4	Satura. Alm.	Select Off (no assignment to status output) or On (Saturated Alarm state assigned to status output). No output will appear unless Out is selected. For information about saturation alarms, see Error Messages, page 109 .		Off
2-4-5-2-5	Param Alm.	Select Off (no assignment to status output) or On (Parameter Alarm state assigned to status output). No output will appear unless Out is selected. For information about parameter alarms, see Error Messages, page 109 .		Off
2-4-5-2-6	Txr Alm.	Select Off (no assignment to status output) or On (Transmitter Alarm state assigned to status output). No output will appear unless Out is selected. For information about transmitter alarms, see Error Messages, page 109 .		Off
2-4-5-2-7	Slug Alm.	Select Off (no assignment to status output) or On (Slug Alarm state assigned to status output). No output will appear unless Out is selected. For information about slug alarms, see Error Messages, page 109 .		Off
2-4-5-2-8	Cal in prog.	Select Off (no assignment to status output) or On (Calibration in Progress state assigned to status output). No output will appear unless Out is selected. For information about calibration in progress, see Error Messages, page 109 .		Off
2-4-5-2-9	Fix Output	Select Off (no assignment to status output) or On (Fix Output state assigned to status output). No output will appear unless Out is selected. For information about fix output, see Error Messages, page 109 .		Off
2-4-5-3	Drive Out Po.	Configure the threshold value of a drive output.	100	
2-4-5-4	Mode	Select N.C. (When the status output condition is met, the status output is deactivated.) or N.O. (When the status output condition is met, the status output is enabled.)	N.C.	

2-4-6-1	Analog	Select analog output pattern when an alarm condition occurs (sensor failure, transmitter failure or parameter alarm). Select from Downscale (produces 2.4 mA), Zero (produces 4 mA), Hold (produces an analog value as though it is an error) or Upscale (produces 21.6 mA).	Selecting a Parameter, page 81	Downscale
2-4-6-2	Pulse	Select pulse output pattern in an error (sensor failure, transmitter failure or parameter alarm). Select from Zero (stops pulse output), Hold (produces a pulse output value as though it is an error) or Upscale (produces an 11-kHz output).		Zero

2-5-1	Function	Change the status input assignment. See Status Input Function, page 104 for more information.	Selecting a Parameter, page 81	No Function
2-5-2	Mode	Select status input operating condition. Select from Closed Active (The status input is closed and action begins.) or Open Active (The status input is open and action begins.).		Closed Active

2-6-1	Assign	Change H/L Alarm assignment. See High/Low Alarm Function, page 105 for more information. To validate this setting, a high-low alarm must be selected for the status output assignment.	Selecting a Parameter, page 81	Mass Flow
2-6-2	H/L Alm. Type	Select H/L alarm type. Select from High Alarm (high alarm is active), Low Alarm (low alarm is active) or H/L Alarm (High and low alarms are active).		High Alarm
2-6-3	High Alm. Po.	Change the High Alarm setting. Any value exceeding this setting triggers the high alarm. When the value falls below this setting by H/L alarm hysteresis (No. 2-6-5), the high alarm condition is reset. A smaller value than the low alarm (No. 2-6-4) is not acceptable.	Entering Parameter Values, page 80	0.0
2-6-4	Low Alm. Po.	Change the Low Alarm setting. Any value below this setting triggers the low alarm. When the value falls below this setting by H/L alarm hysteresis (No. 2-6-5), the low alarm condition is reset. A higher value than the high alarm (No. 2-6-3) is not acceptable.		0.0
2-6-5	H/L Alm. Hys.	Change the High/Low Alarm Hysteresis setting. Choose a larger value to mediate repetitive false alarms (rapid switching on and off). For		0

TRANSITION CHART 5



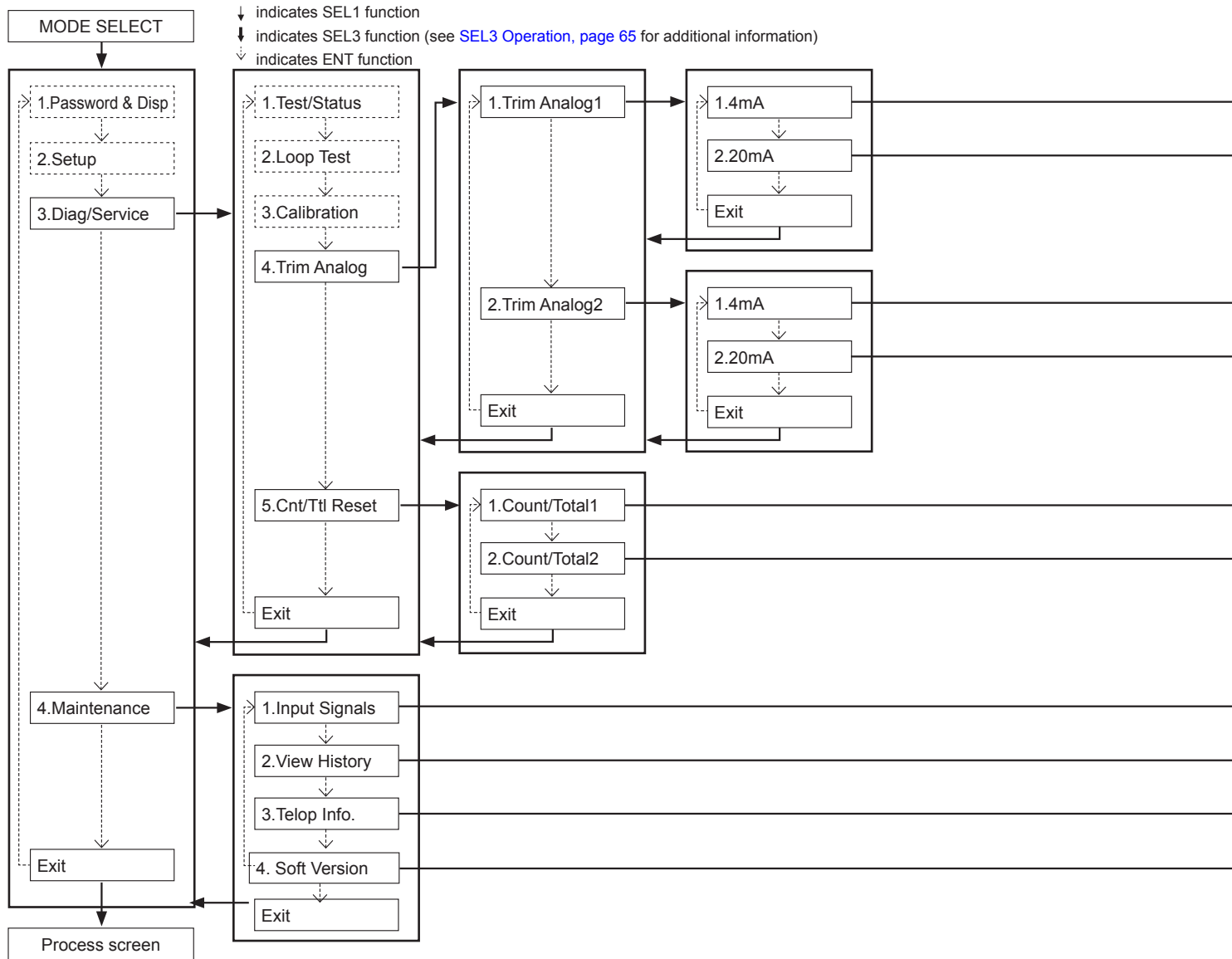
No.	Item	Description	Procedure Location	Default
3-1-1-1	Hardware	Run a probe check to identify potential issues. CAUTION: Under certain circumstances, this check may stop outputs.	Probe Check, page 83	—
3-1-1-2	Drive Coil Check	Run a check for an "open" in the drive coil. CAUTION: Under certain circumstances, this check may stop outputs.	Drive Coil Check, page 84	—
3-1-1-3	Txr Condition	Run a check for potential transmitter issues.	Transmitter Check, page 85	—
3-1-1-4-1	Back Light	Test the backlight for potential issues (LCD will remain blank during testing). The performance test lasts 18 seconds, cycles through White Background Lit (3 sec), Orange Background lit (3 sec) and Backlight unlit (3 sec) twice and automatically terminates. Normal LCD illumination is restored upon test completion.	Entering Parameter Values, page 80	—
3-1-1-4-2	LED	Test LED for potential issues (LCD will remain blank during testing). The performance test lasts 18 seconds alternates 6 times between red LED lit (1.5 sec) and green LED lit (1.5 sec). Normal LCD illumination is restored upon test completion.		—
3-1-1-4-3	LCD	Test LCD for possible issues by turning all LCD dots off and on. During the test, the LCDs are switched in and out. The performance test lasts 12 seconds and twice alternates between all dots lit (3 sec) and all dots unlit (3 sec). Normal LCD illumination is restored upon test completion.		—

3-1-2-1	Static	Run a stability check on the sensor signal at zero flow.	Pipeline Vibration Check (at Zero Flow), page 86	—
3-1-2-2	Dynamic	Run a stability check on the sensor signal while fluid is flowing.	Pipeline Oscillation Check (at Normal Flow), page 87	—

3-2-1	Fix Analog1	Produces a simulated output of Analog Output 1 to test cable fault and associated equipment performance.	Analog Output Function, page 101	—
3-2-2	Fix Analog2	Produces a simulated output of Analog Output 2 to test cable fault and associated equipment performance.		—
3-2-3	Fix Pulse1	Produces a simulated output of Pulse Output 1 to test cable fault and associated equipment performance.	Pulse Output Function, page 97	—
3-2-4	Fix Pulse2	Produces a simulated output of Pulse Output 2 to test cable fault and associated equipment performance.		—
3-2-5	Status Output	Produces a simulated output of Status Output to test cable fault and associated equipment performance.	Status Output Function, page 102	—
3-2-6	Status Input	Monitor status input to test cable fault and associated equipment performance.	Status Input Function, page 104	—

3-3-1	Auto Zero	Zeros the meter readings. Before zeroing, ensure that flow is at zero.	Zeroing Function, page 91	—
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TRANSITION CHART 6



No.	Item	Description	Procedure Location	Default
3-4-1-1	4mA	Trim Analog Output 1 (4 mA). This setting is factory-calibrated and does not normally require further adjustment.	Analog Trim Function, page 94	—
3-4-1-2	20mA	Trim Analog Output 1 (20 mA). This setting is factory-calibrated and does not normally require further adjustment.		—

3-4-2-1	4mA	Trim Analog Output 2 (4 mA). This setting is factory-calibrated and does not normally require further adjustment.	Analog Trim Function, page 94	—
3-4-2-2	20mA	Trim Analog Output 2 (20 mA). This setting is factory-calibrated and does not normally require further adjustment.		—

3-5-1	Count/Total1	Reset Counter 1 and Totalizer 1 to zero.	Reset Function, page 95	—
3-5-2	Count/Total2	Reset Counter 2 and Totalizer 2 to zero.		—

4-1	Input Signals	This screen is used for maintenance.	view only	—
4-2	View History	Displays the transmitter's running hours. This setting can be switched to calendar view. Note: The internal clock is maintenance-oriented; therefore, no updating occurs if power to the transmitter is interrupted.		—
4-3	Telop Info.	Enable/disable the running hours warning (blinking black circle ● in the lower left of the LCD). Select from: Off (● stays off regardless of elapsed hours) or On (● blinks after 100,000 running hours).	Selecting a Parameter, page 81	On
4-4	Soft Version	Displays the software version and the checksum value.	view only	—

ENTERING PARAMETER VALUES

The procedure to enter numerical parameter data is described below. In the example, the temperature damping factor is modified from “4.0” to “4.2.” Other parameters are configured in the same manner.

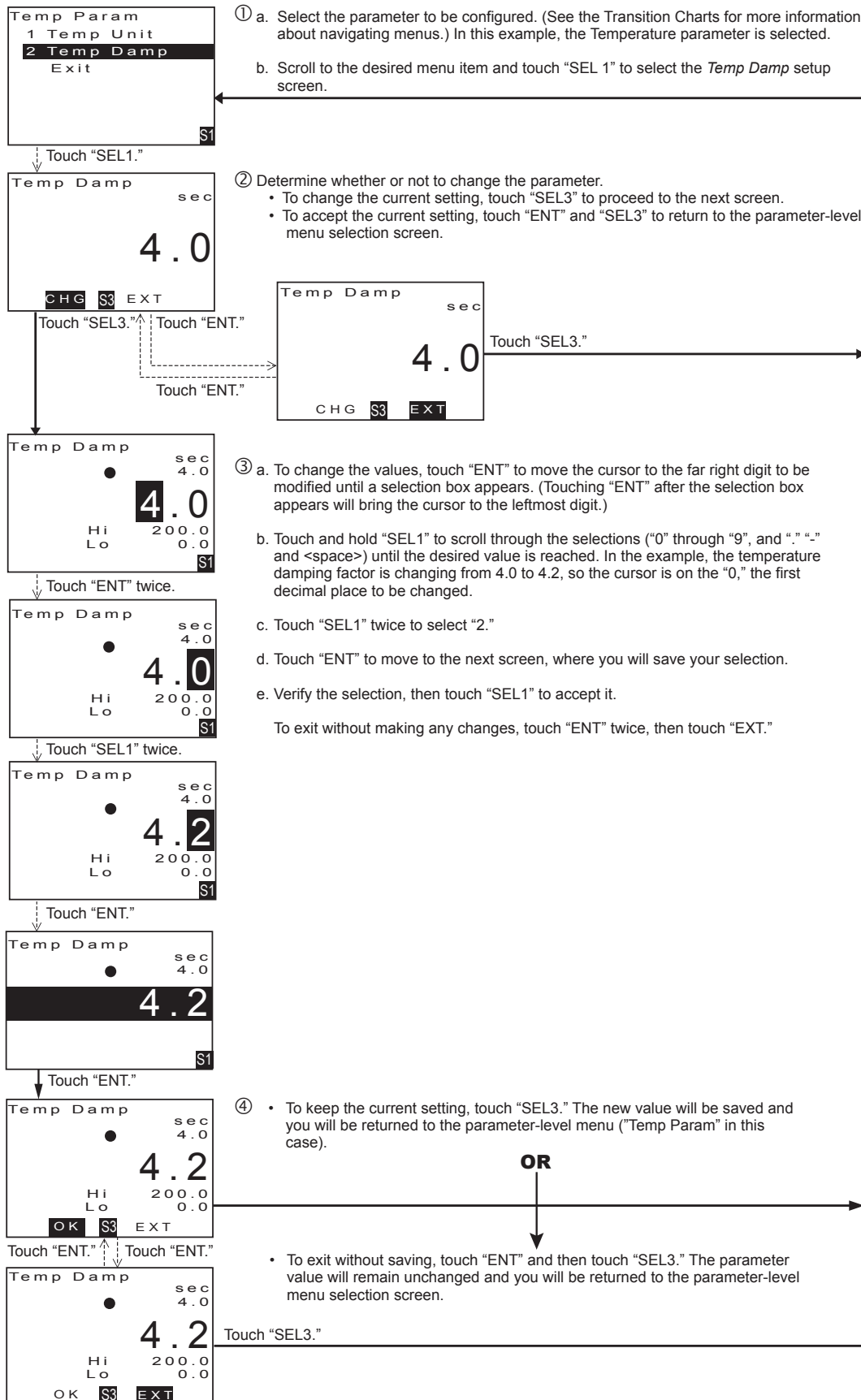


Figure 8.8—Procedure: Change Temperature Damping Factor

SELECTING A PARAMETER

The procedure to configure a parameter by selecting a different parameter menu item is described below. In the example, the temperature unit setting is changed from “deg C” to “Kelvin.” Other parameters are selected in the same manner.

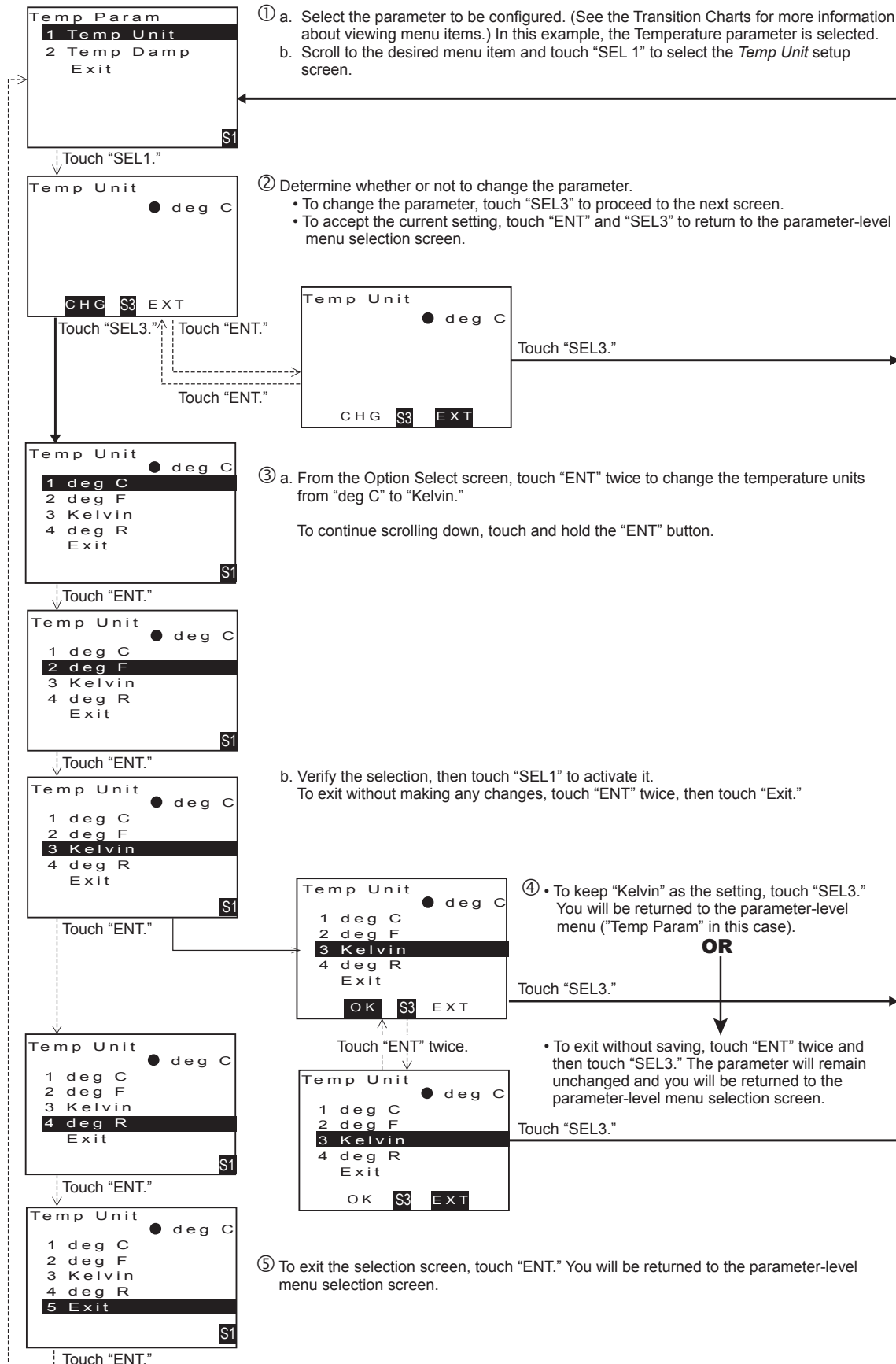


Figure 8.9—Procedure: Selecting a New Temperature Unit

PASSWORD FUNCTION

To safeguard transmitter signals and readings against unauthorized parameter modification, you can configure the transmitter to request entering a password before bringing up the configuration screen.

Enabling the Password Function

To enable the password function, perform the following tasks:

1. From the *Password Function Setting* screen (Transition Chart 1, No. 1-1), select “On” to enable the password function.
2. Enter a 4-number password.

Once these steps are completed, the password must be entered to access the configuration screens.

CAUTION Select a password that is easy for you to remember, but is not easy for others to guess. If you forget the password, you will be unable to access the configuration menus. If you forget your password, contact Cameron. To facilitate technical assistance, please provide the transmitter serial number.

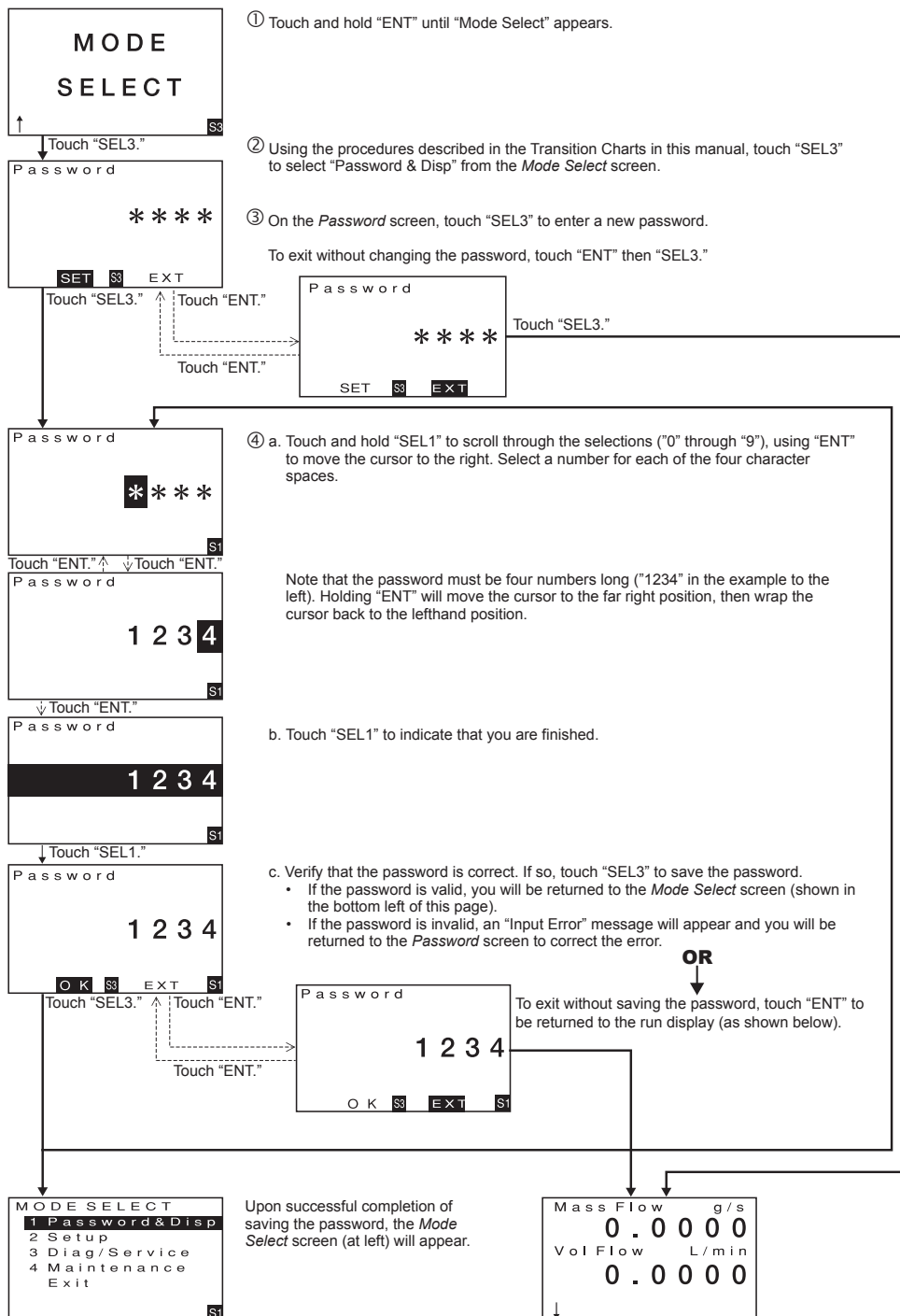


Figure 8.10—Procedure: Configuring a Password

SELF DIAGNOSTICS

Comprehensive self diagnostic capabilities are incorporated in this transmitter. During maintenance and inspection, the following tests and checks can aid in troubleshooting fault conditions and identifying issues that could impair meter performance.

Probe Check

A diagnostic test can be conducted to determine whether the transmitter is free from any problem in the probe circuitry.

If an error is detected upon diagnosis, there is a possibility that it presents a risk to maintaining accurate measurement. You will be prompted to follow the instructions given when “NG” appears.

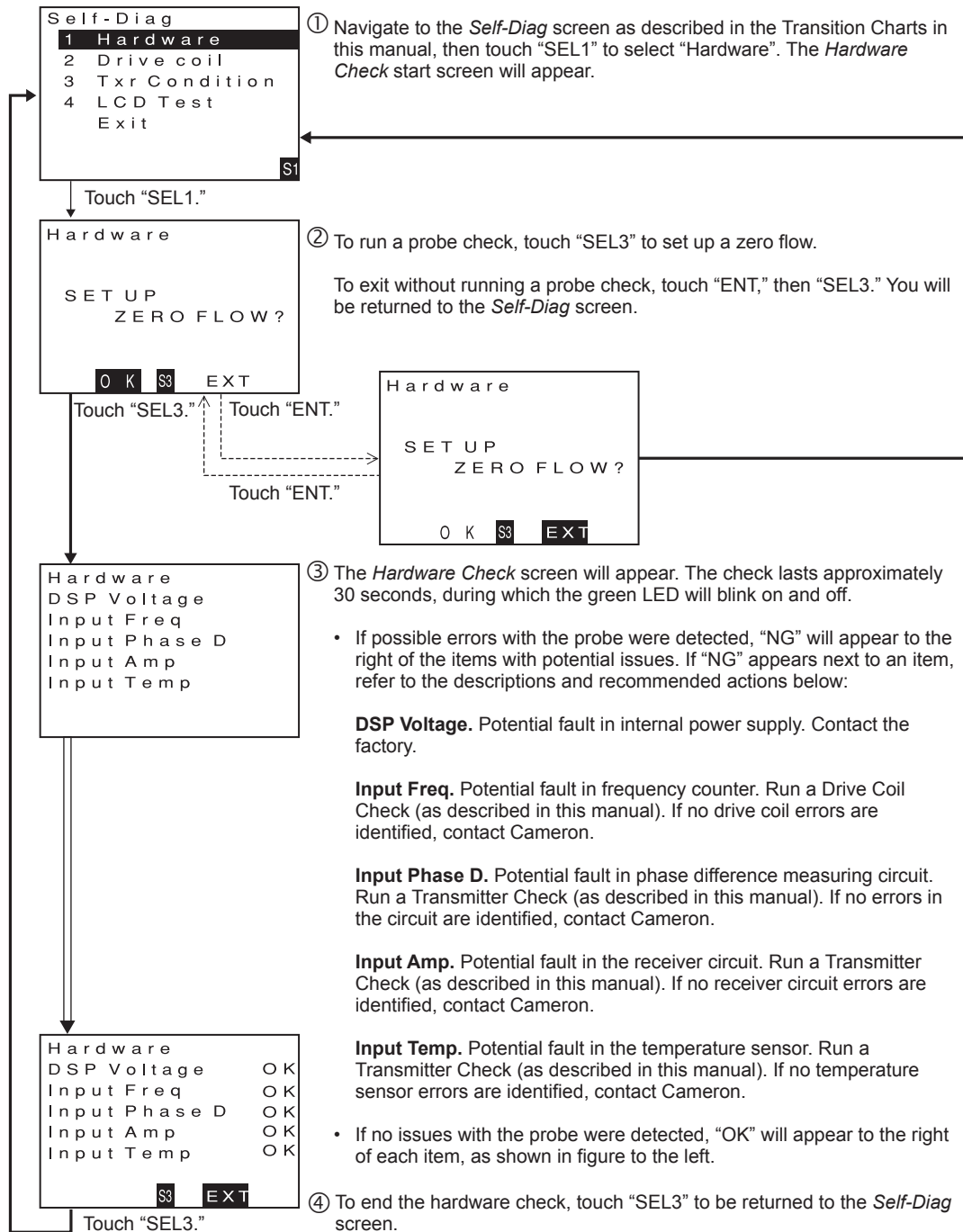


Figure 8.11—Procedure: Running a Probe Check

Drive Coil Check

A diagnostic test can be conducted to see if the drive coil is free from any problem. If an error is detected upon diagnosis, there is a possibility that it presents a risk to maintaining accurate measurement. You are prompted to follow the instructions given below:

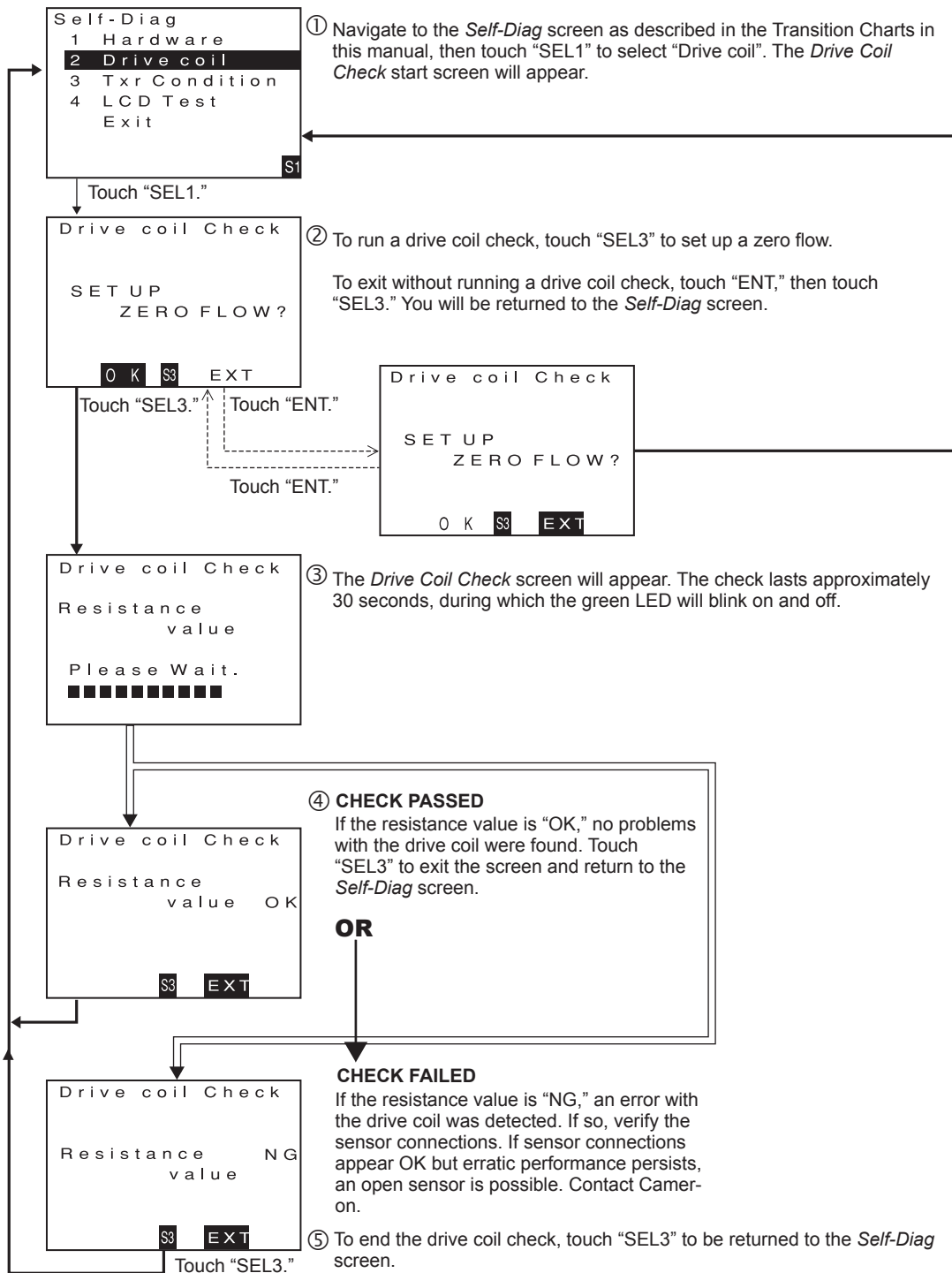


Figure 8.12—Procedure: Drive Coil Check

Transmitter Check

A diagnostic test can be conducted to see if the transmitter is free from any problem. If an error is detected upon diagnosis, there is a possibility that it presents a risk to maintaining accurate measurement. You are prompted to follow the instructions given below:

Note While the check is in progress, flow metering is disabled with the flow rate at zero.

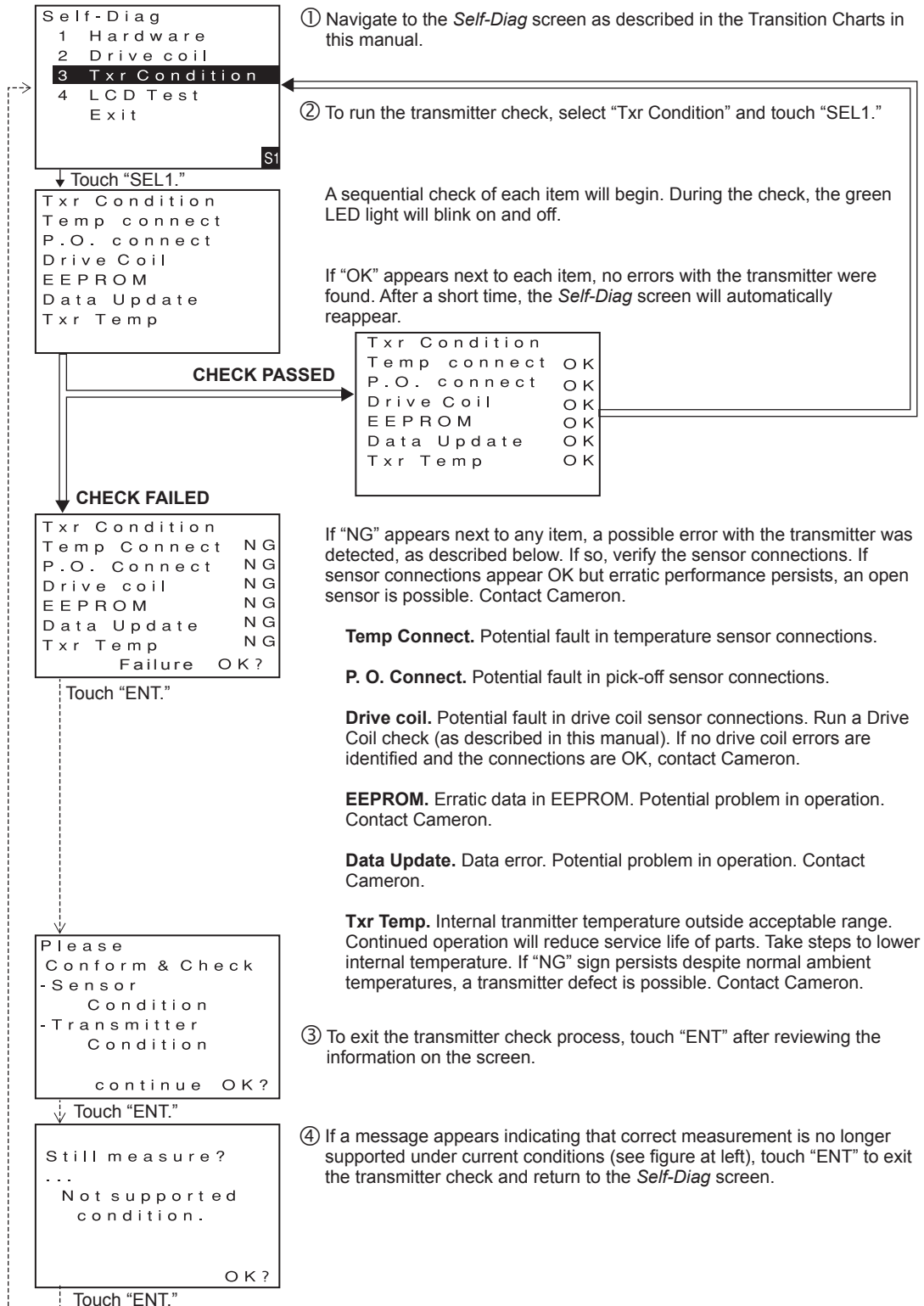


Figure 8.13—Procedure: Transmitter Check

Pipeline Vibration Check (at Zero Flow)

This check diagnoses your flow measurement installation to determine whether it is free from external disturbances and noises resulting from pipeline vibration or other factors. To be successful in obtaining accurate results, run the test at zero flow. Upon completion of the check, diagnostic results will be indicated and you will be prompted to follow the instructions given.

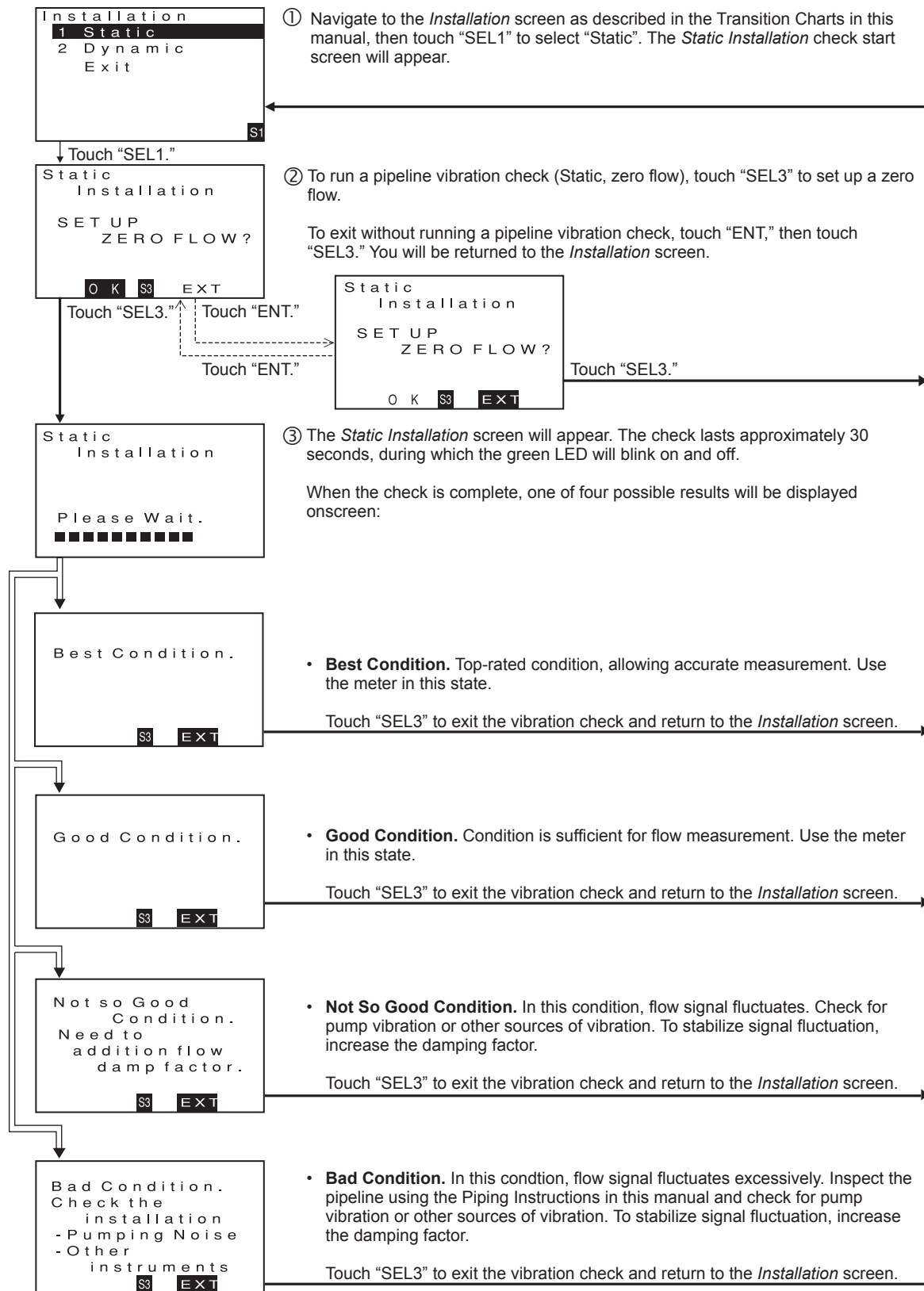


Figure 8.14—Procedure: Pipeline Vibration Check

Pipeline Oscillation Check (at Normal Flow)

This check diagnoses your flow measurement installation at normal flow to determine whether it is free from external disturbances and noises resulting from pipeline vibration or other factors. Upon completion of the check, diagnostic results will be indicated and you will be prompted to follow the instructions given.

Note During the process of diagnosis, analog output and pulse output operations are suspended.

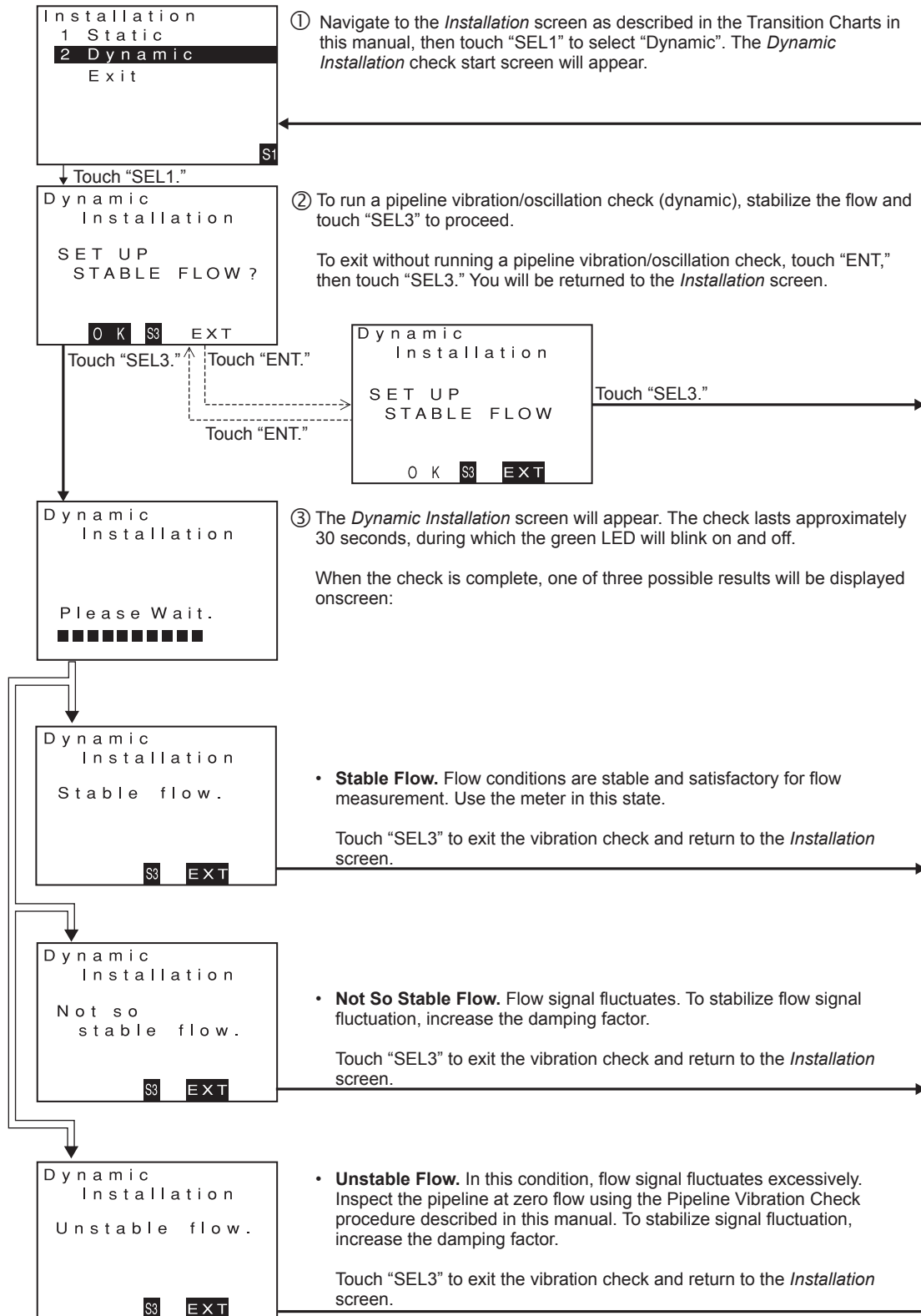


Figure 8.15—Procedure: Pipeline Oscillation Check

SIMULATED SIGNAL INPUT/OUTPUT FUNCTIONS

The transmitter features simulated output and input monitor functions, which can be used for running a loop check after installation and for diagnosing erratic flow signals.

Analog Output

An analog output simulation can be configured at any current magnitude. In the example below, Analog Output 1 is configured to loop test a 12-mA output. All simulated analog outputs are configured as shown in the example.

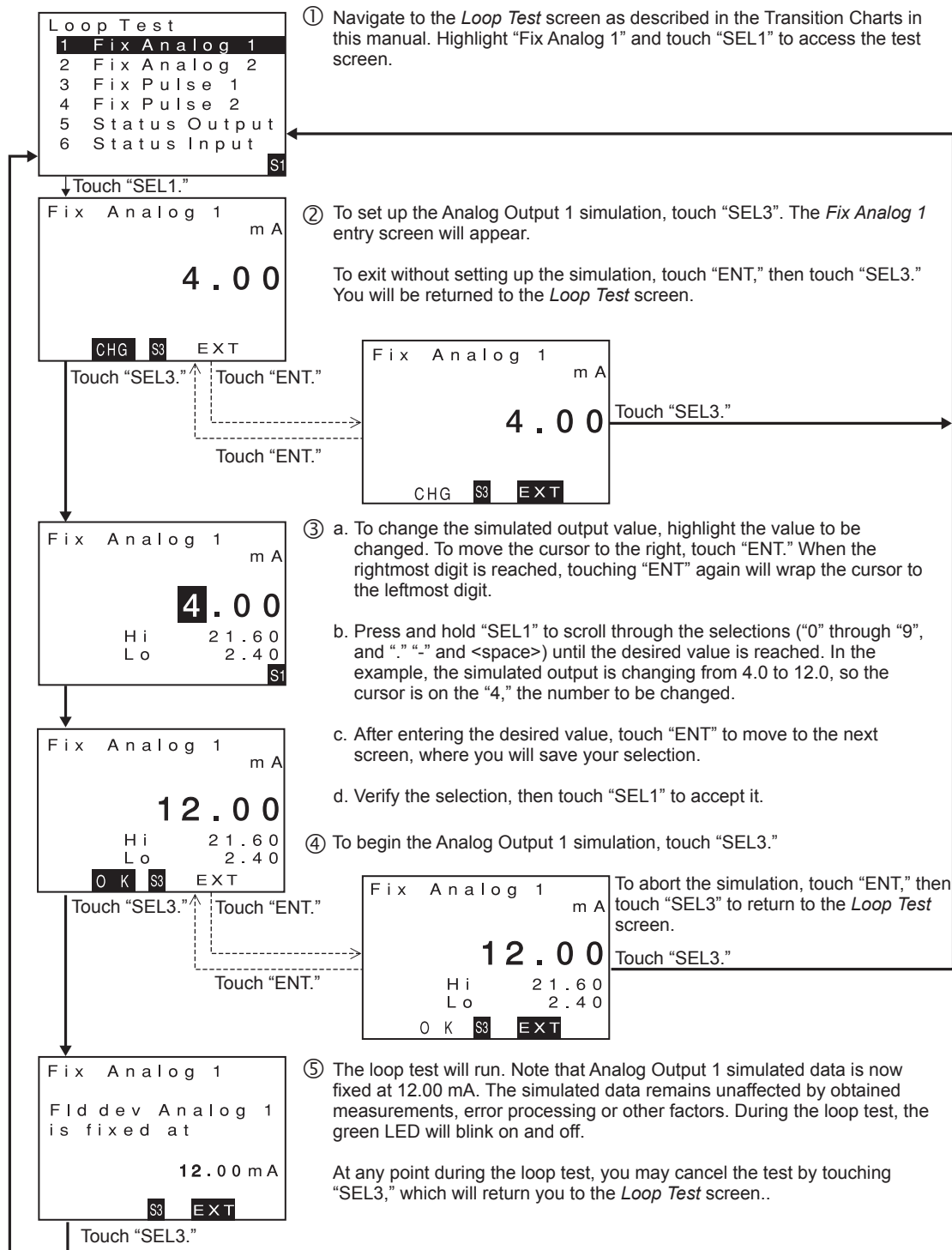


Figure 8.16—Procedure: Configure an Analog Output Loop Test

Pulse Output

A pulse output simulation can be configured at any frequency desired. In the example below, Pulse Output 1 is configured to loop test a 2100-Hz output. All simulated pulse outputs are configured as shown in the example.

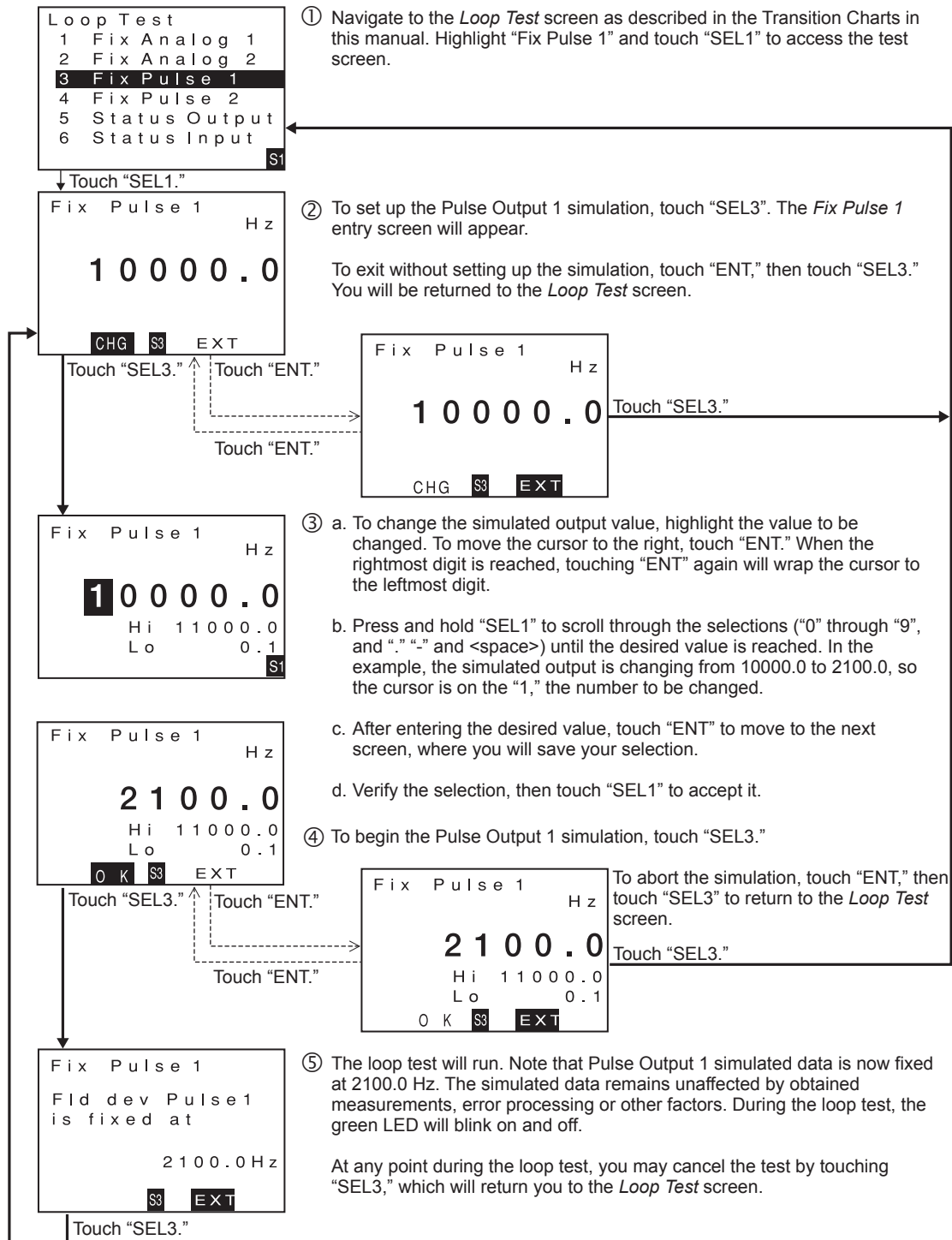


Figure 8.17—Procedure: Configure a Pulse Output Loop Test

Status Output

A status output can be configured at any level desired. In the example below, the status output is configured to loop test the “On” setting. All simulated status outputs are configured as shown in the example.

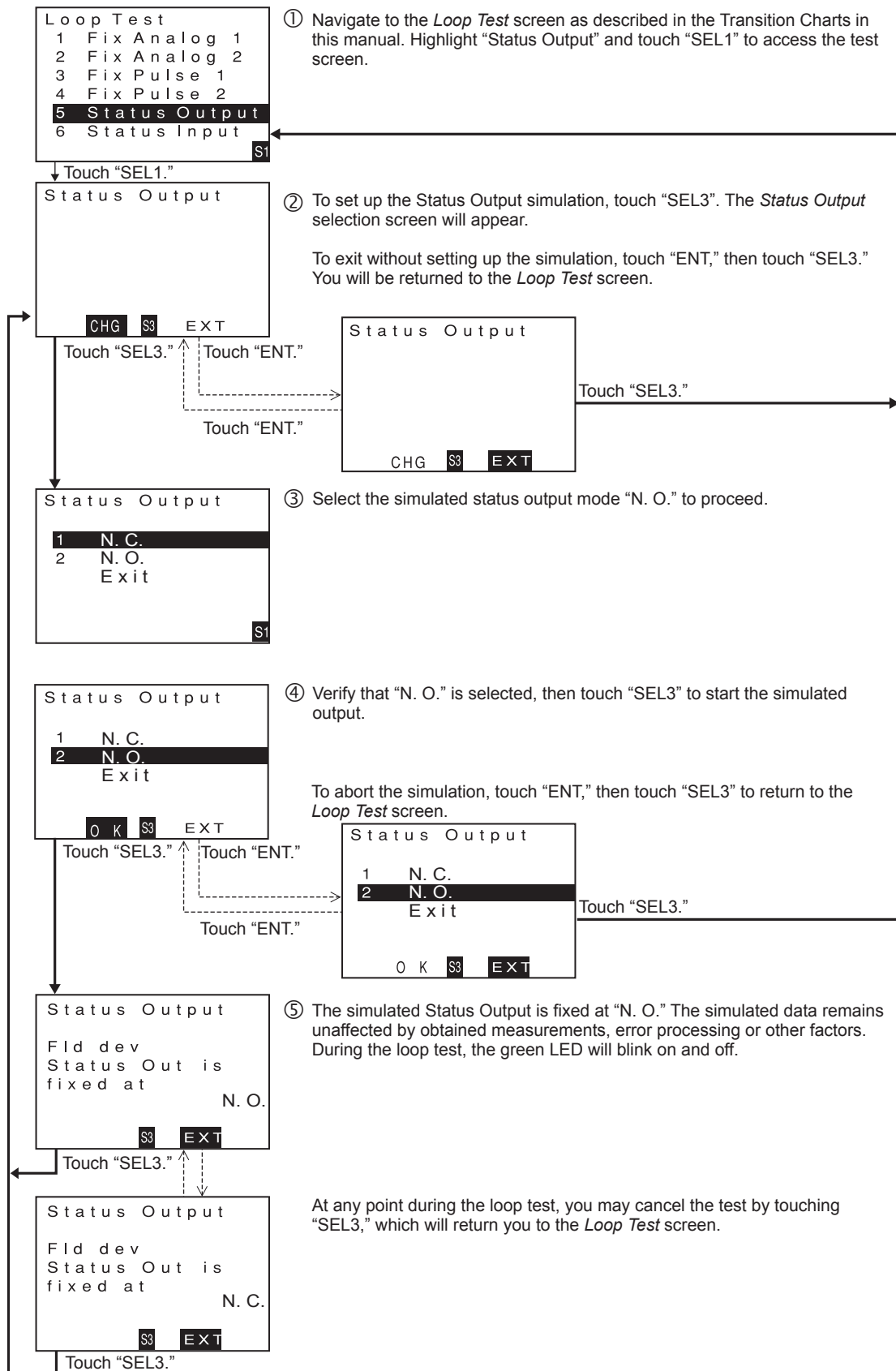


Figure 8.18—Procedure: Status Output Loop Test

Status Input

A simulated status input can be configured to monitor the status input signal, as described in the example below:

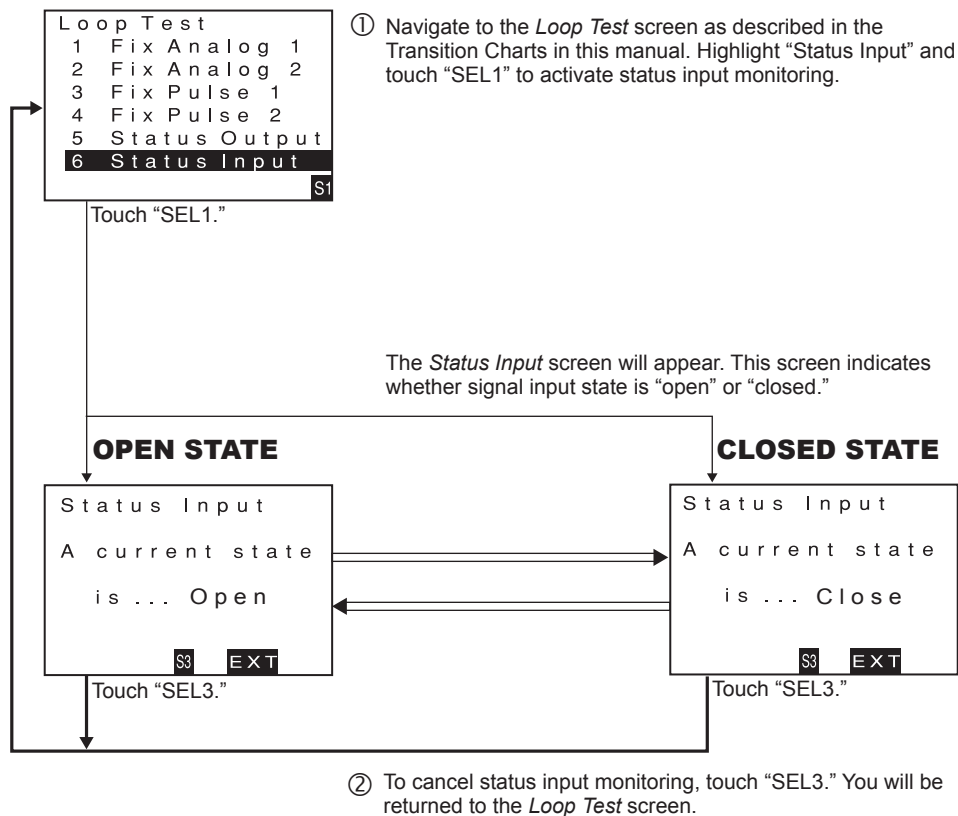


Figure 8.19—Procedure: Status Input Monitoring

ZEROING FUNCTION

This feature detects errors in zeroing and reduces offset flow rate drift to minimum. At the stage of installation and in cases where flow conditions significantly change, zeroing is an essential part of the routines required for maintaining accurate and consistent measurement. During the zeroing, fill the sensor unit completely with the fluid the temperature of which is within $\pm 50^{\circ}\text{F}$ ($\pm 10^{\circ}\text{C}$) from the temperature at which it operates.

CAUTION:

1. Fluid (liquid or gas) must completely fill the sensor unit and be absolutely at zero flow.
2. Accurate zeroing cannot be achieved unless fluid flow is completely halted.
3. Ensure that the shutoff valve has no leaks.

There are three methods of performing zero adjustment: via LCD switches, via status input, and via communication. Each method has the same results, so choose the one best suited to your task.

Zeroing via LCD Display Switches

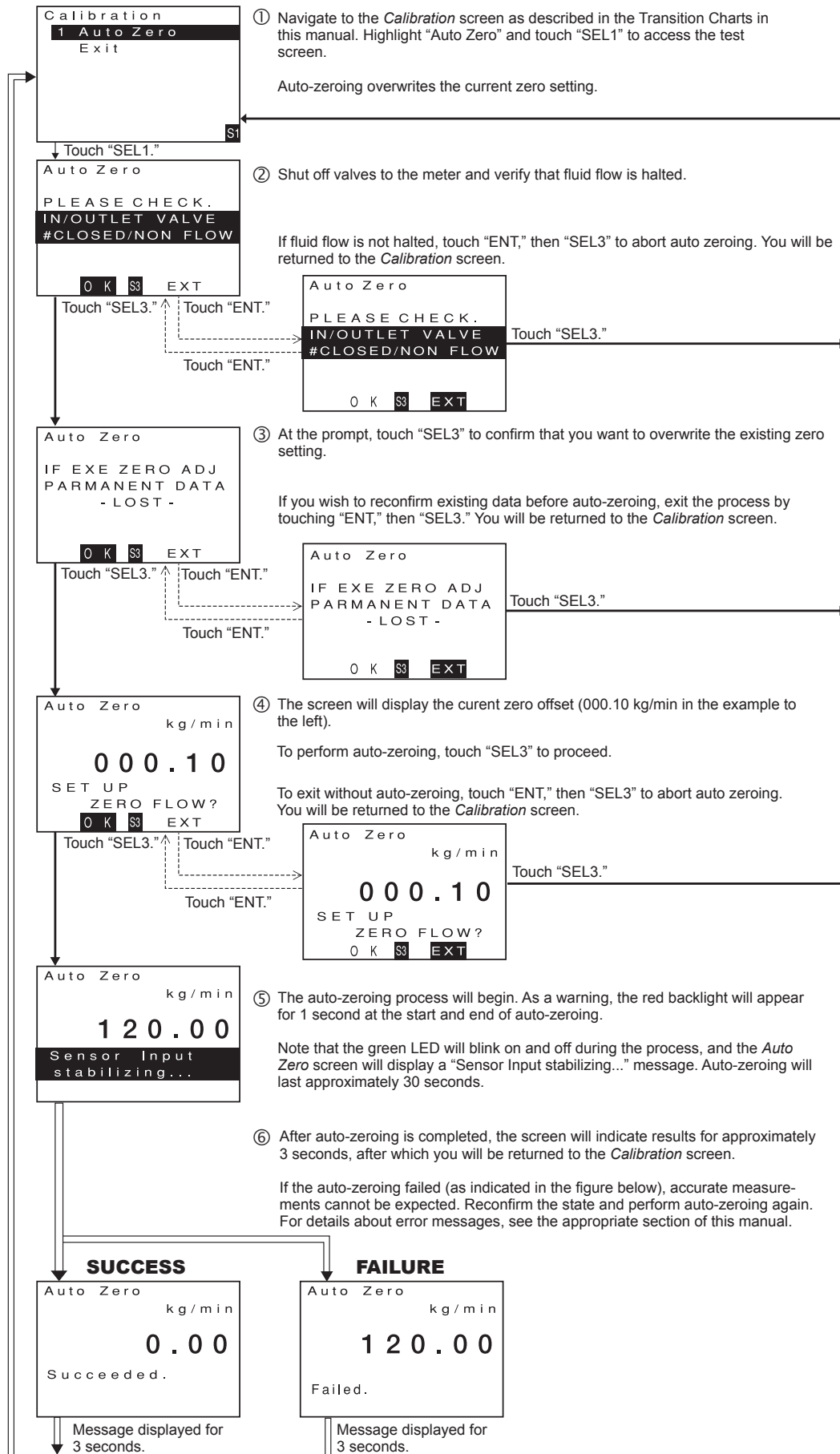


Figure 8.20—Procedure: Zero Adjustment

Zeroing via Status Input Signal

You can perform the zeroing with status input signal. Follow the procedure given below for preparation and operation:

1. Assign status input to zeroing as follows:
 - a. Set status input function to “Auto Zero.” For setup details, see [Status Input Function, page 104](#) and [Transition Chart 4, page 74](#), No. 2-5-1.
 - b. Set input mode of status input. For setup details, see [Status Input Function, page 104](#) and [Transition Chart 4, page 74](#), No. 2-5-2.
2. Assign zeroing in progress to status output as described below. This step is optional; however, by completing the settings that follow, you can monitor the zeroing status with status output.
 - a. Set status output function assignment to “Error Status.”
 - b. Set status output adjustment item to “N. O.”
 - c. Set working output of status output. For setup details, see [Status Input Function, page 104](#) and [Transition Chart 4, page 74](#), No. 2-4-5-1, No. 2-4-5-2-8 and No. 2-4-5-3.
3. During the zeroing, fill the sensor unit completely with the fluid the temperature of which is within $\pm 10^{\circ}\text{C}$ from the temperature at which it operates.

CAUTION

1. Fluid (liquid or gas) must completely fill the sensor unit and be absolutely at zero flow.
2. Accurate zeroing cannot be achieved unless fluid flow is completely halted.
3. Ensure that the shutoff valves, etc. have no leaks.

4. Set the status input to Open or Closed for 0.3 sec or longer. When the input is detected, the zeroing process starts and this process lasts in about 30 seconds.

In the event zeroing has failed, you cannot expect accurate measurement. Upon completion of zeroing, do not forget to run a check for possible errors.

Zeroing via EZ-Link Communication

Zeroing can be performed via communication using EZ-Link software. For more information, see the EZ-Link Instruction Manual.

ANALOG TRIM FUNCTION

The transmitter is provided with two factory-calibrated analog outputs that should require no further adjustment. However, if it is absolutely necessary to readjust, follow the instructions outlined below.

Before making adjustments, connect the instruments needed to measure the analog output level. In the following example, the procedure to trim Analog Output 1 from “4.1 mA” to “4.0 mA) is described. All analog trim functions are performed similarly.

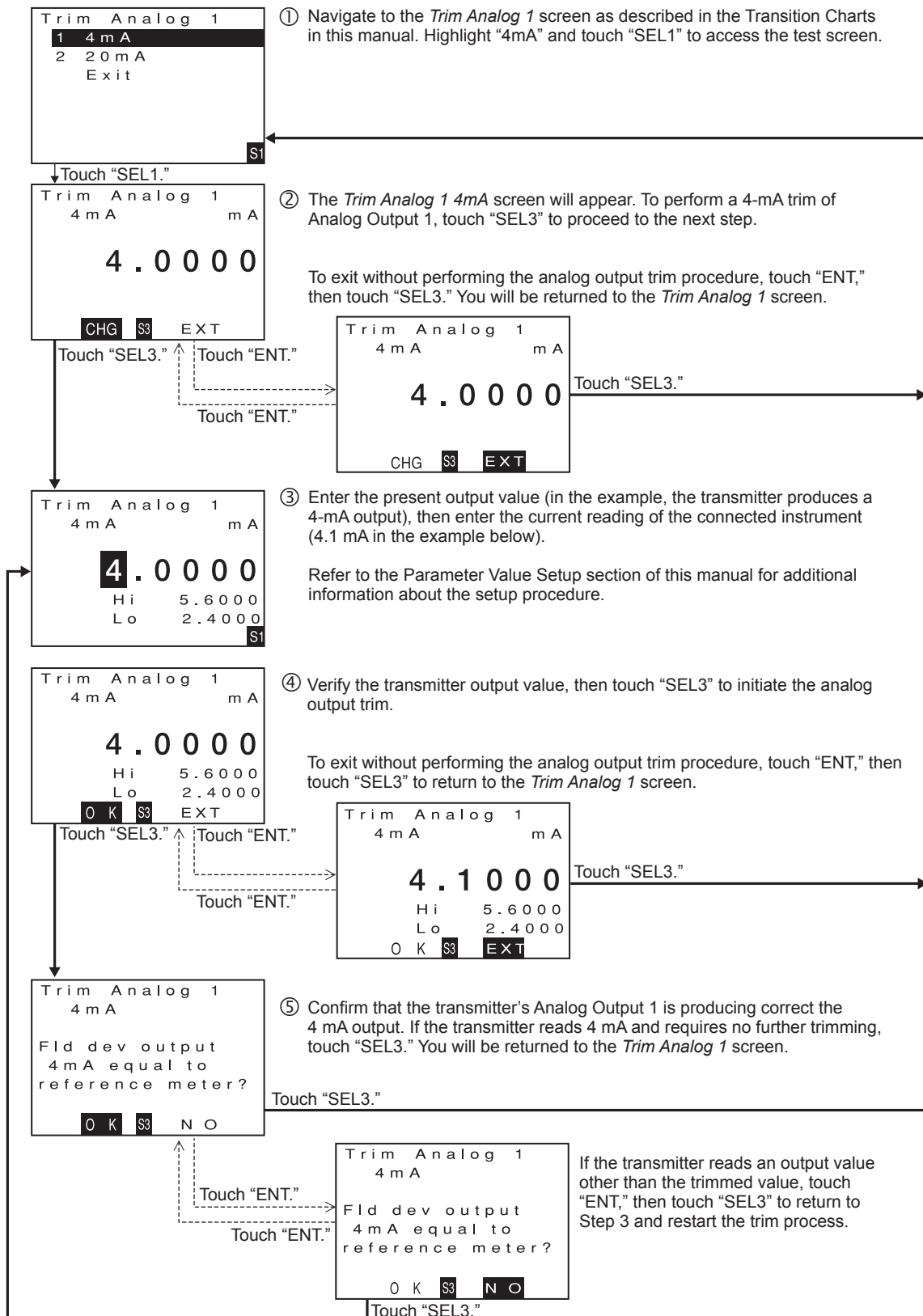


Figure 8.21—Procedure: Analog Trim

RESET FUNCTION

The transmitter is provided with two pulse outputs, two counters and two totalizers, which work in sync with the pulse output. To reset a counter and its associated totalizer, follow the procedure outlined below. Because the totalizer counts pulses from the counter, you cannot reset the counter and totalizer independently.

The example below describes the procedure to reset Counter/Totalizer 1 to zero. The same procedure applies to Counter/Totalizer 2.

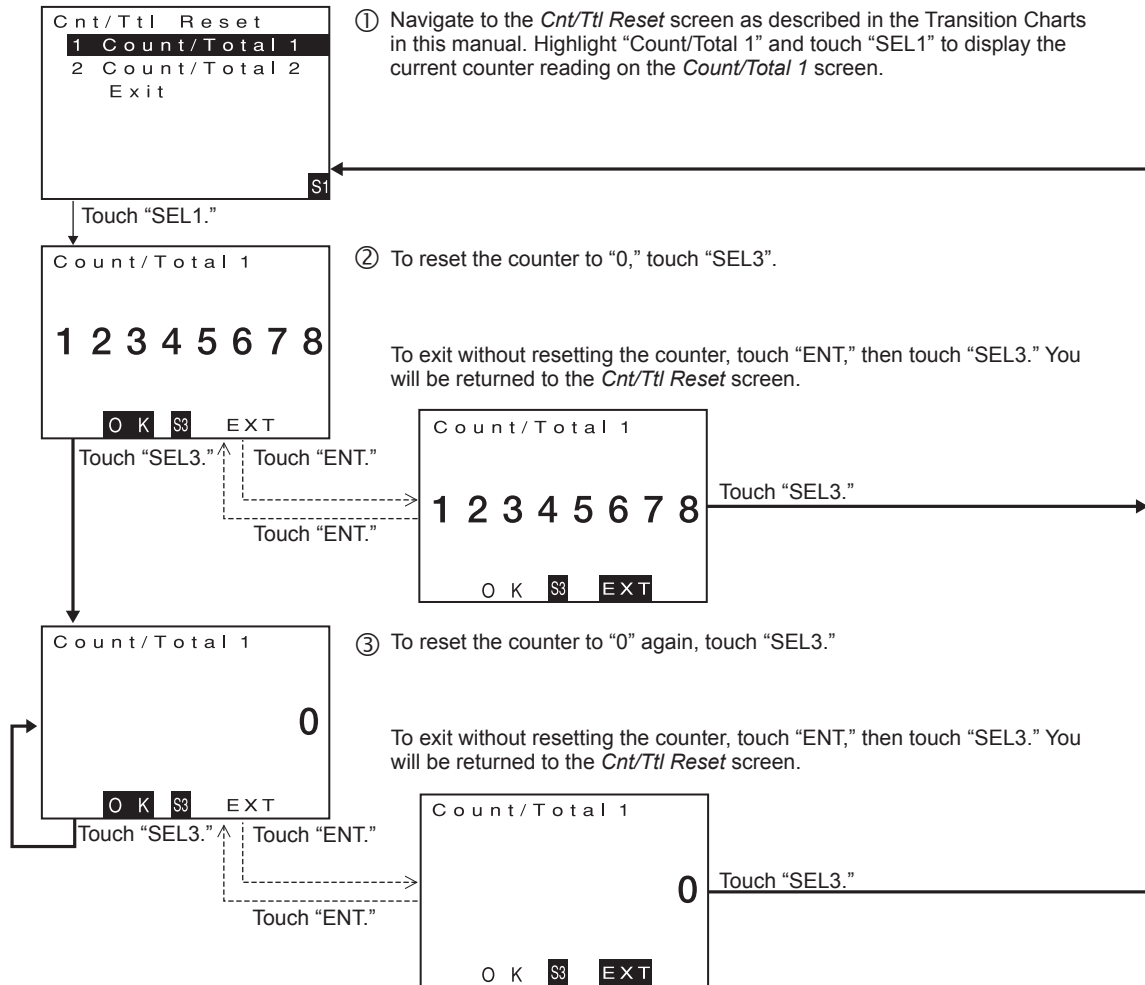


Figure 8.22—Procedure: Reset Counter/Totalizer

CONFIGURING THE VARIABLE VIEW

To configure variables to display (or hide) and to set the display priority of the variables, follow the procedure below:

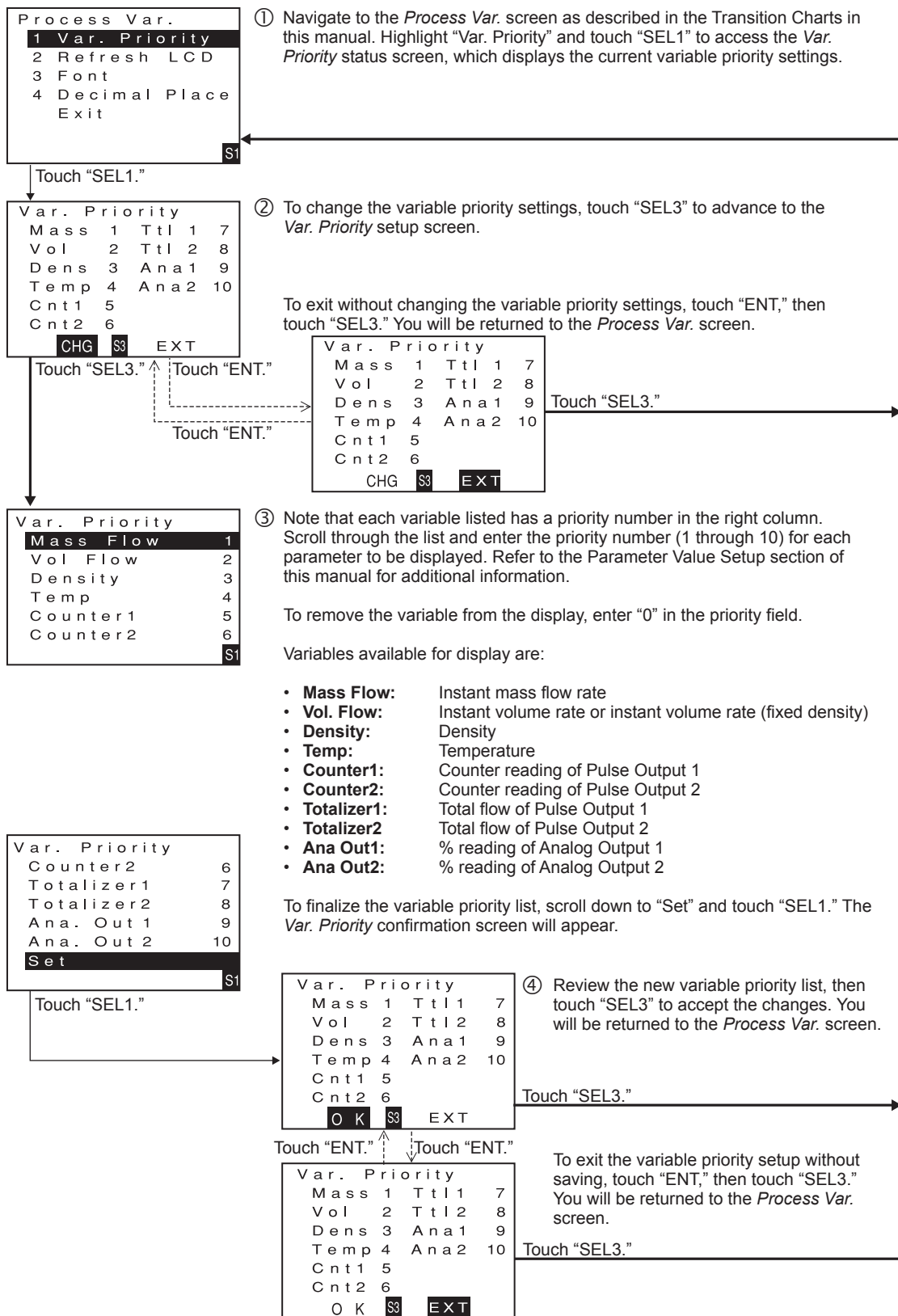


Figure 8.23—Procedure: Configure Variable View

PULSE OUTPUT FUNCTION

The transmitter is provided with two pulse outputs which can be configured as independent outputs. Features include two pulse output operating modes, a double-pulse output created by allowing two pulses out of phase by 90 or 180 degrees, and a bidirectional pulse output linked with status output signal, enabling the operator to determine the direction of flow. Refer to the following topics for description of these features.

Note When the pulse output assignment, weight, full-scale flow rate, or frequency at full scale is modified, the Counter/Totalizer will be reset.

Pulse Output Operating Modes

1. Select from the following two available pulse output operating modes:
 - **Weight:** Pulses are output according to the number of configured pulses per unit of flow
 - **Frequency:** Pulses are output at a specific frequency according to the configured frequency factor, rate factor, and low cutoff rate.

After selecting the operating mode, follow the operating-mode specific instructions below.

Pulse Output 1 (Weight)

To use Pulse Output 1 in Weight (Scaling) Mode, configure as follows. For bidirectional pulse output or double-pulse output, configure the parameters as follows.

1. Set the Pulse Output 1 assignment (see [Transition Chart 3, page 72](#), No. 2-4-3-1) and select the flow type from the following:
 - **Mass Flow:** Mass flow
 - **Volume Flow:** Volumetric flow
2. Select the weight (scaling) factor (0 to 999999) for Pulse Output 1 (see [Transition Chart 3, page 72](#), No. 2-4-3-2).

Pulse Output 1 (Frequency)

To use Pulse Output 1 in Frequency Mode, configure as follows. For bidirectional pulse output or double-pulse output, configure the parameters as follows.

1. Set the Pulse Output 1 assignment (see [Transition Chart 3, page 72](#), No. 2-4-3-1) and select the flow type from the following:
 - **Mass Flow:** Mass flow
 - **Volume Flow:** Volumetric flow
2. Select the frequency factor of Pulse Output 1 (see [Transition Chart 3, page 72](#), No. 2-4-3-2). This is the maximum pulse frequency output by the device under normal operating conditions, generated when the flow rate configured in Step 3 is measured, and should match the measurable range of the device detecting the transmitter's pulse output. Acceptable setting range is 0.1 Hz to 10000 Hz.
3. Select the rate factor of Pulse Output 1 (see [Transition Chart 3, page 72](#), No. 2-4-3-3), which determines the maximum flow rate under normal operating conditions. An output at the frequency established in Step 2 will be generated when the preset flow rate is reached.
4. Select the low-flow cutoff of Pulse Output 1 (see [Transition Chart 3, page 72](#), No. 2-4-3-4). The output will clamped at "0" when the proportion of flow rate is smaller than the low-flow cutoff value when the flow rate established in Step 2 reaches 100%. Acceptable setting range is 0.0% to 10.0%.
5. Select the pulse output error state (see [Transition Chart 4, page 74](#), No. 2-4-6-2) from the following options:
 - **Zero:** Pulse output is halted.
 - **Hold:** Last good pulse output before the error is kept.
 - **Upscale:** 11 kHz output (see [Error Messages, page 109](#) for more information)

Pulse Output 2 (Weight)

To use Pulse Output 2 in Weight (Scaling) Mode, configure as follows. For bidirectional pulse output, configure the parameters per the procedure. For double-pulse output, set only the Pulse Output 2 assignment (see [Double-Pulse Output, page 100](#) for more information). The weight (scaling) factor will use by Pulse Output 1 (Weight) settings.

1. Set the Pulse Output 2 assignment (see [Transition Chart 3, page 72](#), No. 2-4-4-1) and select the flow type from the following:
 - **Mass Flow:** Mass flow
 - **Volume Flow:** Volumetric flow
 - **Double pulse 90:** Double pulse output 90°
 - **Double pulse 180:** Double pulse output 180°
 - **Double pulse -90:** Double pulse output -90°

Steps 2 and 3 below use a procedure similar to Pulse Output 1 (Weight) configuration. See [Pulse Output 1 \(Weight\), page 97](#) for more information.

2. Select the weight (scaling) factor of Pulse Output 2 (see [Transition Chart 3, page 72](#), No. 2-4-4-2).

Pulse Output 2 (Frequency)

To use Pulse Output 2 in Frequency Mode, configure as follows. For bidirectional pulse output, configure the parameters as follows. For double-pulse output, set only the Pulse Output 2 assignment (see [Double-Pulse Output, page 100](#) for more information). All other parameters will use Pulse Output 1 (Frequency) settings.

1. Set the Pulse Output 2 assignment (see [Transition Chart 3, page 72](#), No. 2-4-4-1) and select the flow type from the following:
 - **Mass Flow:** Mass flow
 - **Volume Flow:** Volumetric flow
 - **Double pulse 90:** Double pulse output 90°
 - **Double pulse 180:** Double pulse output 180°
 - **Double pulse -90:** Double pulse output -90°

Steps 2 through 4 below use a procedure similar to Pulse Output 1 (Frequency) configuration. See [Pulse Output 1 \(Frequency\), page 97](#) for more information.

2. Select the frequency factor of Pulse Output 2 (see [Transition Chart 3, page 72](#), No. 2-4-4-2).
3. Select the rate factor of Pulse Output 2 (see [Transition Chart 3, page 72](#), No. 2-4-4-3).
4. Select the low-flow cutoff of Pulse Output 2 (see [Transition Chart 3, page 72](#), No. 2-4-4-4).
5. Select the pulse output error state (see [Transition Chart 4, page 74](#), No. 2-4-6-2).

Bidirectional Pulse Output

By allowing the status output signal to provide flow direction information, the transmitter distinguishes between pulse outputs in forward and reverse flow and counts pulses independently. Therefore, the instrument measuring circuit must be able to distinguish flow direction. To use this function, you need to set up the following, as well as configuring [Pulse Output 1 \(Weight\)](#), page 97 or [Pulse Output 1 \(Frequency\)](#), page 97 and [Pulse Output 2 \(Weight\)](#), page 98 or [Pulse Output 2 \(Frequency\)](#), page 98.

1. Select “Bi Direction” as the status output function assignment (see [Transition Chart 4](#), page 74, No. 2-4-5-1).
2. Select one of the following for the status output active mode (see [Transition Chart 4](#), page 74, No. 2-4-5-3):
 - N.C.: Output is Closed in the forward fluid flow.
 - N.O.: Output is Open in the forward fluid flow.

In the example below, the following settings and assignments were made:

- **Status output function assignment:** Bi Direction
- **Pulse Output 1 active mode:** N.C.
- **Pulse Output 1 assignment:** Mass Flow
- **Pulse Output 1 frequency factor:** 1000 Hz
- **Pulse Output 1 rate factor:** 100.0 kg/min
- **Pulse Output 1 low-flow cutoff:** 10.0 %

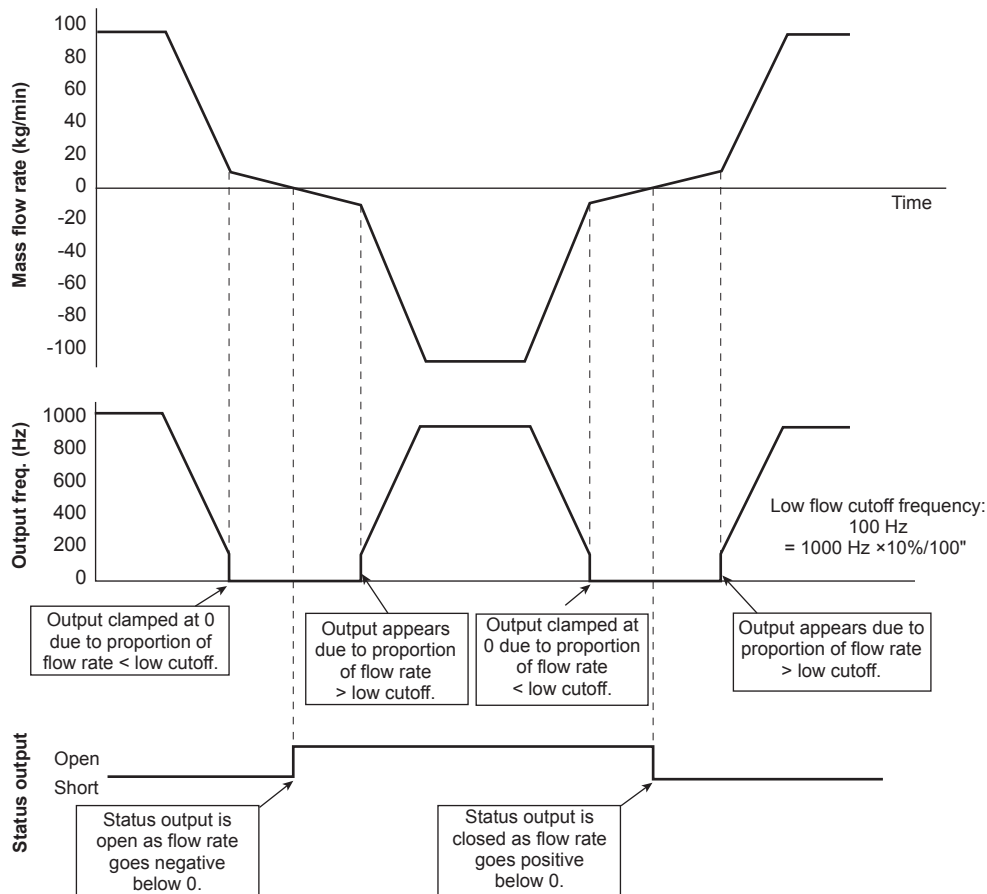


Figure 8.24—Bidirectional pulse output

Double-Pulse Output

The double-pulse output function allows you configure Pulse Output 2 to synchronize with Pulse Output 1. Therefore, Pulse Output 1’s operating mode will also apply to Pulse Output 2. (See [Pulse Output Function](#), page 97 for more information.) To enable this function, configure one of the following as the Pulse Output 2 (Weight) or Pulse Output 2 (Frequency) assignment:

- **Double pulse 90:** Double-pulse output 90°. Pulse Output 2 lags Pulse Output 1 by 90° (1/4 of the period) when it is activated. The maximum lag is 1 msec, above which is a lag within 1/4 of the period.
- **Double pulse 180:** Double-pulse output 180°. Pulse Output 2 is activated and the polarity of the Pulse Output 1 wave form is inverted.
- **Double pulse -90:** Double-pulse output -90°. When active, Pulse Output 1 lags Pulse Output 2 by 90° (1/4 of the period). The maximum lag is 1 msec, above which is a lag within 1/4 of the period.

The following diagram illustrates the behavior of the pulse outputs as related to settings above:

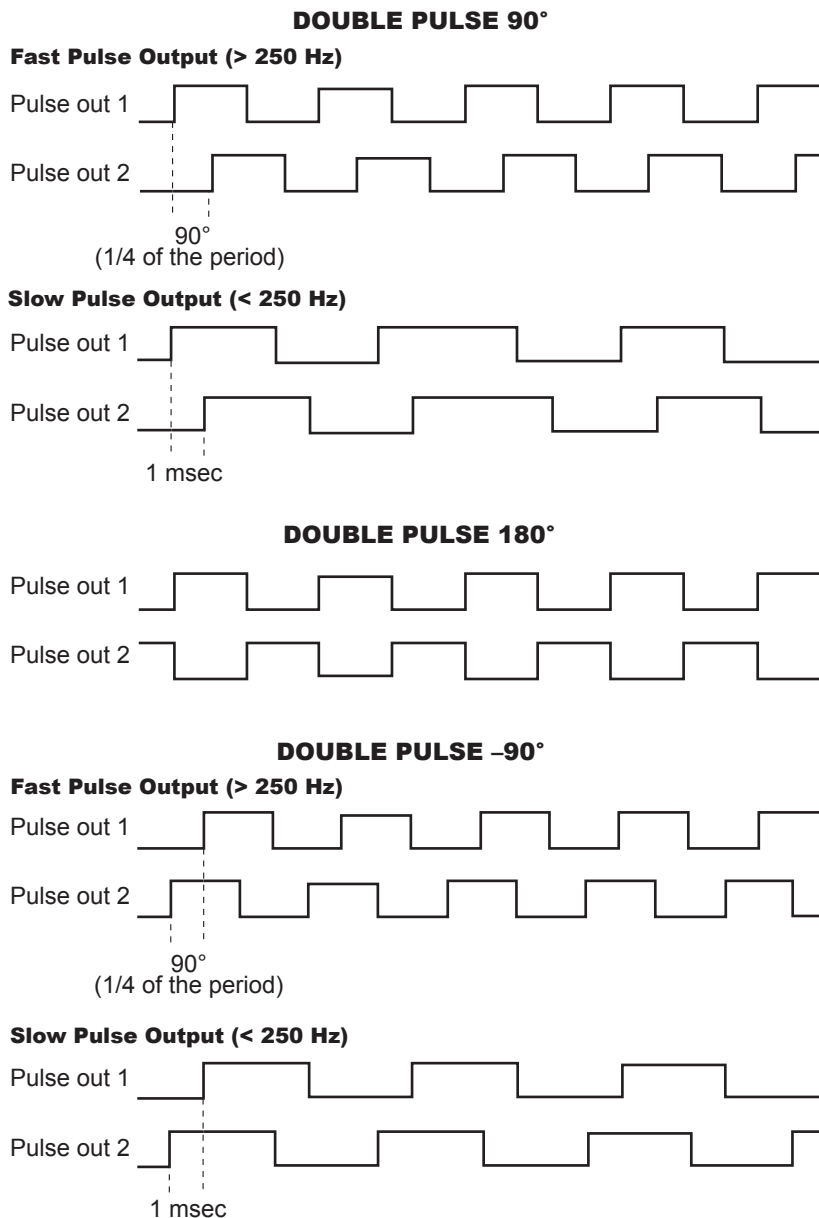


Figure 8.25—Double-pulse output

ANALOG OUTPUT FUNCTION

The transmitter is equipped with two analog outputs that can be assigned to mass flow, volume flow, temperature, density and drive output.

Configuring an Analog Output

Use the following procedure to configure the parameters for your application:

1. Select the measurement type (output assignment) (see Transition Chart 3, No. 2-4-1-1 and No. 2-4-2-1) from the following options:
 - **Mass Flow:** Instant mass flow rate
 - **Vol Flow:** Instant volume flow rate
 - **Density:** Density
 - **Temp:** Temperature
 - **Drive Output:** Drive output
2. After making an output assignment, reconfigure upper limit, lower limit, low-flow cutoff and damping factor:
 - a. **Upper limit value (URV)** (see Transition Chart 3, page 72, No. 2-4-1-2 and No. 2-4-2-2): A 4-mA output is produced when the preset value is reached. Values cannot be set outside the maximum range (see table below) or be smaller than the lower limit value.
 - b. **Lower limit value (LRV)** (see Transition Chart 3, page 72, No. 2-4-1-3 and No. 2-4-2-3): A 20-mA output is produced when the preset value is reached. Values cannot be set outside the maximum range (see table below) or be larger than the upper limit value.
 - c. **Low-flow cutoff** (see Transition Chart 3, page 72, No. 2-4-1-4 and No. 2-4-2-4): When the low-flow cutoff value is larger than the proportion of analog output (where the upper limit is set to 100% and the lower limit is set to 0%), the analog output becomes 4 mA. Available setting range is from 0% to 10%.
 - d. **Damping factor** (see Transition Chart 3, page 72, No. 2-4-1-5 and No. 2-4-2-5): Select a larger value when analog output fluctuates greatly; select a smaller value when a fast response is desired. Available setting range is from 0 to 200 seconds.

Maximum Range by Output Assignment

Output Assignment	Maximum Range
Instant mass flow rate	Maximum allowable range to maximum allowable range
Instant volume flow rate	Maximum allowable range/0.3 to maximum allowable range/0.3
Temperature	Sensor maximum temperature
Density	0.0 to 0.5

3. Select the output error state of the analog output (see Transition Chart 5, page 76, No. 2-4-6-1).
 - **Downscale:** 2.4 mA output
 - **Zero:** 4 mA output
 - **Hold:** Output immediately before an error
 - **Upscale:** 21.6 mA output

For details of outputs in an error, see [Error Messages, page 109](#).

CAUTION When measurement-related unit set up at Assign is modified, the upper and lower limit values will be converted automatically to the measures to read in the unit selected.

STATUS OUTPUT FUNCTION

One output chosen from status information, flow direction, or an alarm state can be assigned to the status output.

Status Output (Error Status)

Assigning status information to the status output allows the flow meter status to be output. Below are the user-assignable flow meter-related items that can be configured individually. For details about output messages, see [Error Messages, page 109](#) and [Status Messages, page 110](#).

- **Sensor Failure:** Sensor error
- **Txr Failure:** Transmitter warning
- **Calibration Failure:** Calibration error
- **Saturated Alarm:** Output error
- **Parameter Alarm:** Parameter alarm
- **Transmitter Alarm:** Transmitter alarm
- **Slug Alarm:** Slug flow alarm
- **Cal in Progress:** Calibration in progress
- **Fix Output:** Simulated output being produced

Configuring an “Error Status” Output

1. Select “Error Status” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).
2. Select the desired output type(s) from the list above and enable or disable them. See [Transition Chart 4, page 74](#), No. 2-4-5-2-1 through No. 2-4-5-2-9.
3. Configure the active output (see [Transition Chart 4, page 74](#), No. 2-4-5-3). The following outputs become available based on the selections made above:
 - **N.C.:** Output is Closed when the preset state is reached.
 - **N.O.:** Output is Open when the preset state is reached.

When the settings above take effect, the functions are ready for use.

Bidirectional Flow Direction Output

Assigning bidirectional output to the status output allows the flow direction to be output. Pulse output is normally used to indicate forward flow direction. Using bi-direction output enables a pulse output to indicate reverse flow direction. For more information, see [Bidirectional Pulse Output, page 99](#).

Configuring Bidirectional Flow Direction Output

1. Select “Bi Direction” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).
2. Configure the active output (see [Transition Chart 4, page 74](#), No. 2-4-5-3). The following outputs become available based on the selections made above:
 - **N.C.:** Output is Closed when the preset state is reached.
 - **N.O.:** Output is Open when the preset state is reached.

When the settings above take effect, the functions are ready for use.

H/L Alarm Output

Assigning the high/low alarm output to the status output allows a high/low alarm error to be output. Below are the available parameters that can be configured as high/low alarm outputs:

- **Mass Flow:** Instant mass flow rate
- **Vol Flow:** Instant volume flow rate
- **Dens:** Density
- **Temp:** Temperature
- **Counter 1:** Counter 1
- **Counter 2:** Counter 2

Configuring a High/Low Alarm Output

1. Select “H/L Alarm” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).
2. Configure the active output (see [Transition Chart 4, page 74](#), No. 2-4-5-3). The following outputs become available based on the selections made above:
 - **N.C.:** Output is Closed when the preset state is reached.
 - **N.O.:** Output is Open when the preset state is reached.

When the settings above take effect, the functions are ready for use.

Drive Output Alarm (for Maintenance Purposes)

Assigning the drive output alarm to the status output allows an alarm to be activated when the drive output exceeds the user-established threshold.

Configuring a Drive Output Alarm

1. Select “Drive O Alm.” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).
2. Enter the threshold to indicate at what percentage of the drive output the alarm should be activated. The default is 100%. See [Transition Chart 4, page 74](#), No. 2-4-5-3 for more information.
3. Configure the active output (see [Transition Chart 4, page 74](#), No. 2-4-5-3). The following outputs become available based on the selections made above:
 - **N.C.:** Output is Closed when the preset state is reached.
 - **N.O.:** Output is Open when the preset state is reached.

When the settings above take effect, this function is enabled.

No Function/Assignment

When “no function” is selected as the status output function assignment, the following status output appears:

- **N.C.:** Output is always Closed.
- **N.O.:** Output is always Open.

Configuring a No Function Output

To configure a “No Function” output, select “No Function” as the status output function assignment. (See [Transition Chart 4, page 74](#), No. 2-4-5-1).

STATUS INPUT FUNCTION

One output from fixed pulse/analog output (0%), zeroing, totalizer 1 and totalizer 2 reset, totalizer 1 reset or totalizer 2 reset can be assigned to the status input.

0% Fixed Pulse/Analog Output

Assigning the 0% fixed pulse/analog output generates a 0 Hz pulse output and a 0 mA analog output when an input arrives across the status input terminals. Stopping an input across status input terminals cancels the fixed output.

Configuring a 0% Fixed Pulse/Analog Output

1. Select “0% Sig Lock” as the status input function assignment (see [Transition Chart 4, page 74](#), No. 2-5-1).
2. Configure the input mode for the status input (see [Transition Chart 4, page 74](#), No. 2-5-2). With the setting activated, the following input modes become enabled:
 - **Closed Active:** Function is activated when status input terminals are closed for a minimum of 0.3 seconds.
 - **Open Active:** Function is activated when status input terminals remain open for a minimum of 0.3 seconds.

When the settings above take effect, the functions are ready for use.

Zero Adjustment (Auto Zero)

Assigning zero adjustment initiates an automatic zero, which reduces the offset flow rate drift to minimum, when an input arrives across the status input terminals. For more information, see [Zeroing Function, page 91](#).

Configuring a Zero Adjustment

1. Select “Auto Zero” as the status input function assignment (see [Transition Chart 4, page 74](#), No. 2-5-1).
2. Configure the input mode for the status input (see [Transition Chart 4, page 74](#), No. 2-5-2). With the setting activated, the following input modes become enabled:
 - **Closed Active:** Function is activated when status input terminals are closed for a minimum of 0.3 seconds.
 - **Open Active:** Function is activated when status input terminals remain open for a minimum of 0.3 seconds.

When the settings above take effect, the functions are ready for use.

Totalizer 1 and Totalizer 2 Reset

The transmitter is equipped with counters (Counters 1 and 2) and totalizers (Totalizers 1 and 2) that work in synchronization with the pulse output function. Assigning the Totalizer 1 and Totalizer 2 reset causes all counters and totalizers to be reset to “0” when an input arrives across the status input terminals. Counter 1/Totalizer 1 respond to Pulse Output 1 and Counter 2/Totalizer 2 respond to Pulse Output 2. For more information, see [Reset Function, page 95](#).

Configuring the Totalizer 1 and Totalizer 2 Reset

1. Select “Reset C/T 1-2” as the status input function assignment (see [Transition Chart 4, page 74](#), No. 2-5-1).
2. Configure the input mode for the status input (see [Transition Chart 4, page 74](#), No. 2-5-2). With the setting activated, the following input modes become enabled:
 - **Closed Active:** Function is activated when status input terminals are closed for a minimum of 0.3 seconds.
 - **Open Active:** Function is activated when status input terminals remain open for a minimum of 0.3 seconds.

When the settings above take effect, the functions are ready for use.

Totalizer 1 Reset

The transmitter is equipped with counters (Counters 1 and 2) and totalizers (Totalizers 1 and 2) that work in synchronization with the pulse output function. Assigning the Totalizer 1 reset causes Counter 1 and Totalizer 1 to be reset to “0” when an input arrives across the status input terminals. Counter 1/Totalizer 1 respond to Pulse Output 1 and Counter 2/Totalizer 2 respond to Pulse Output 2. For more information, see [Reset Function, page 95](#).

Configuring the Totalizer 1 Reset

1. Select “Reset C/T 1” as the status input function assignment (see [Transition Chart 4, page 74](#), No. 2-5-1).
2. Configure the input mode for the status input (see [Transition Chart 4, page 74](#), No. 2-5-2). With the setting activated, the following input modes become enabled:
 - **Closed Active:** Function is activated when status input terminals are closed for a minimum of 0.3 seconds.
 - **Open Active:** Function is activated when status input terminals remain open for a minimum of 0.3 seconds.

When the settings above take effect, the functions are ready for use.

Totalizer 2 Reset

The transmitter is equipped with counters (Counters 1 and 2) and totalizers (Totalizers 1 and 2) that work in synchronization with the pulse output function. Assigning the Totalizer 2 reset causes Counter 2 and Totalizer 2 to be reset to “0” when an input arrives across the status input terminals. Counter 1/Totalizer 1 respond to Pulse Output 1 and Counter 2/Totalizer 2 respond to Pulse Output 2. For more information, see [Reset Function, page 95](#).

Configuring the Totalizer 2 Reset

1. Select “Reset C/T 2” as the status input function assignment (see [Transition Chart 4, page 74](#) No. 2-5-1).
2. Configure the input mode for the status input (see [Transition Chart 4, page 74](#), No. 2-5-2). With the setting activated, the following input modes become enabled:
 - **Closed Active:** Function is activated when status input terminals are closed for a minimum of 0.3 seconds.
 - **Open Active:** Function is activated when status input terminals remain open for a minimum of 0.3 seconds.

When the settings above take effect, the functions are ready for use.

HIGH/LOW ALARM FUNCTION

Assigning high/low alarms provides the operator with a snapshot of the installation conditions (flow rate, temperature, density and total flow). When the preset alarm conditions are met, the high/low alarm function signals the event with an alarm message, as well as a status output signal.

Configuring a High/Low Alarm

1. Select “H/L Alarm” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).

Note The “H/L Alarm” setting must be selected, even in cases of high alarm only or low alarm only.

2. Configure the status output mode (see [Status Output Function, page 102](#)) as “active output” (see [Transition Chart 4, page 74](#), No. 2-4-5-3). The following outputs become available based on the selections made above:
 - **On Active:** Output is Closed when the preset state is reached.
 - **Off Active:** Output is Open when the preset state is reached.
3. Assign the H/L alarm values (see [Transition Chart 4, page 74](#), No. 2-6-1) from the following options:
 - **Mass Flow:** Instant mass flow rate
 - **Vol Flow:** Instant volume flow rate
 - **Dens:** Density
 - **Temp:** Temperature
 - **Counter 1:** Counter 1
 - **Counter 2:** Counter 2

4. Select “H/L Alarm Type” (see [Transition Chart 4, page 74](#), No. 2-6-2) from the following options:
 - **High Alarm:** Validate only the high alarm.
 - **Low Alarm:** Validate only the low alarm.
 - **H/L Alarm:** Validate the high alarm and the low alarm.
5. Set the alarm value based on the alarm type selected in Step 5.
 - Set the high alarm value (see [Transition Chart 4, page 74](#), No. 2-6-3). If the input exceeds the established value, the high alarm will be activated.

Note If “Low Alarm” is selected in Step 5, the high alarm value is not required.

- Set the low alarm value (see [Transition Chart 4, page 74](#), No. 2-6-4). If the input drops below the established value, the low alarm will be activated.

Note If “High Alarm” is selected in Step 5, the low alarm value is not required.

- Set the high/low alarm hysteresis value (see [Transition Chart 4, page 74](#), No. 2-6-5). This setting determines the “dead” or “immunity” zone following an alarm. Select a larger value for measurements that fluctuate greatly. Select a smaller value for rapid recovery from an alarmed condition.

High/Low Alarm Example

- **Status output assignment (Function):** H/L Alarm
- **Active output of status output (Mode):** Off Active
- **H/L alarm value assignment (Assign):** Mass Flow
- **Alarm type selection (H/L Alm. Type):** H/L Alarm
- **High alarm value setting (High Alm. Po.):** 900 kg/min
- **Low alarm value setting (Low Alm. Po.):** 200 kg/min
- **High/low alarm hysteresis value (H/L Alm. hys):** 100 kg/min

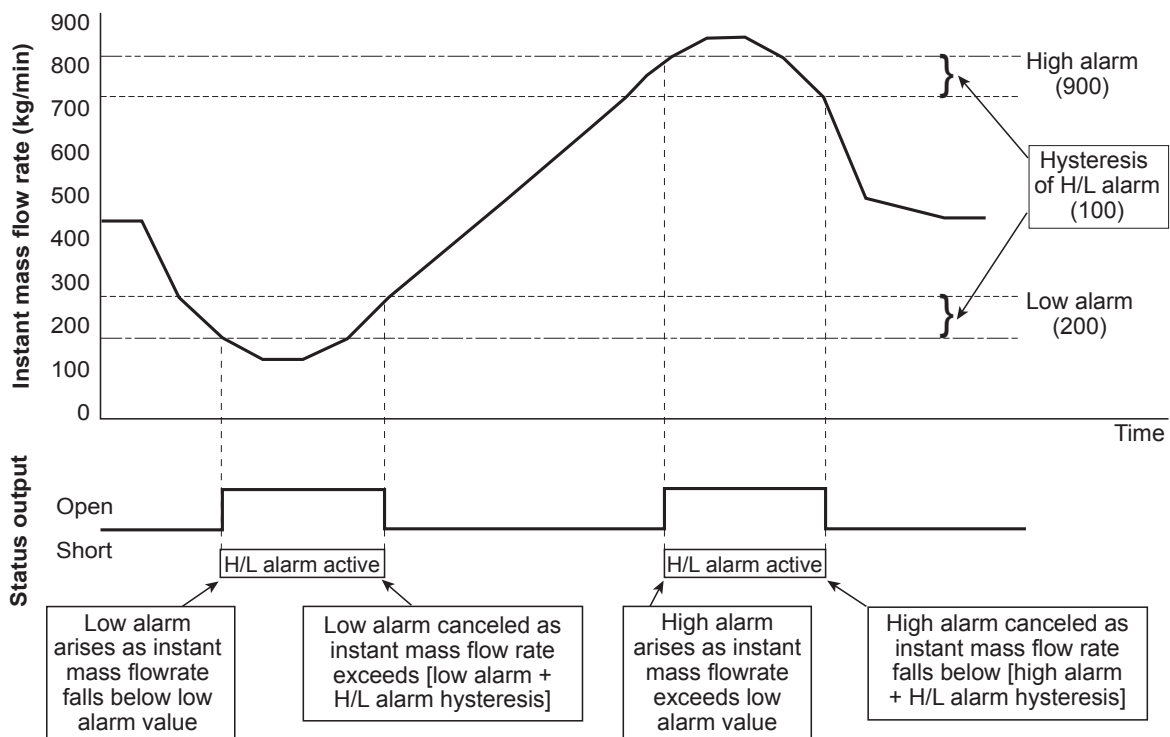


Figure 8.26—High/low alarm graph

GAS MIXED FLOW (SLUG FLOW) ALARM FUNCTION

The Gas Mixed Flow Alarm Function, or “Slug Flow Alarm,” makes it possible to accurately measure flow, even when large amounts of gas are mixed with the process fluid. The Slug Flow Alarm detects gases entrapped in the fluid, returns a slug flow alarm, clamps the flow signal at “0” and produces a status output of the alarm event.

Configuring a Slug Flow Alarm

1. Set the slug flow lower limit density (see [Transition Chart 2, page 70](#), No. 2-2-3). When the device detects a density lower than the established limit, the sensor interprets the reading as slug flow and analysis begins. Set a value smaller than the expected flow density.
2. Set the slug flow higher limit density (see [Transition Chart 2, page 70](#), No. 2-2-4). When the device detects a density higher than the established limit, the sensor interprets the reading as an error and analysis begins. Set a value greater than the expected flow density.
3. Set the slug flow duration (see [Transition Chart 2, page 70](#), No. 2-2-5), which is the time required for the sensor to identify flow outside the slug flow high/low limit and to issue a slug flow alarm (in seconds). The most recent measured value is returned until the user-established slug flow duration expires. Upon expiration of the slug flow duration, the flow rate will be reported as “0.”

Assigning the Slug Flow Alarm to a Status Output

To assign the slug flow alarm to the status output function, configure the status output as follows. For more information, see [Status Output Function, page 102](#).

1. Set “Error Status” as the status output function assignment (see [Transition Chart 4, page 74](#), No. 2-4-5-1).
2. Set the slug flow error selection to “On” (see [Transition Chart 4, page 74](#), No. 2-4-5-2-7).
3. Set the active output to “Off Active” or “On Active.” See [Transition Chart 4, page 74](#), No. 2-4-5-3 for more information.

Slug Flow Alarm Example

- **Slug flow lower limit density:** 0.5 g/mL
- **Slug flow higher limit density:** 2.0 g/mL
- **Slug flow duration:** 10 sec.

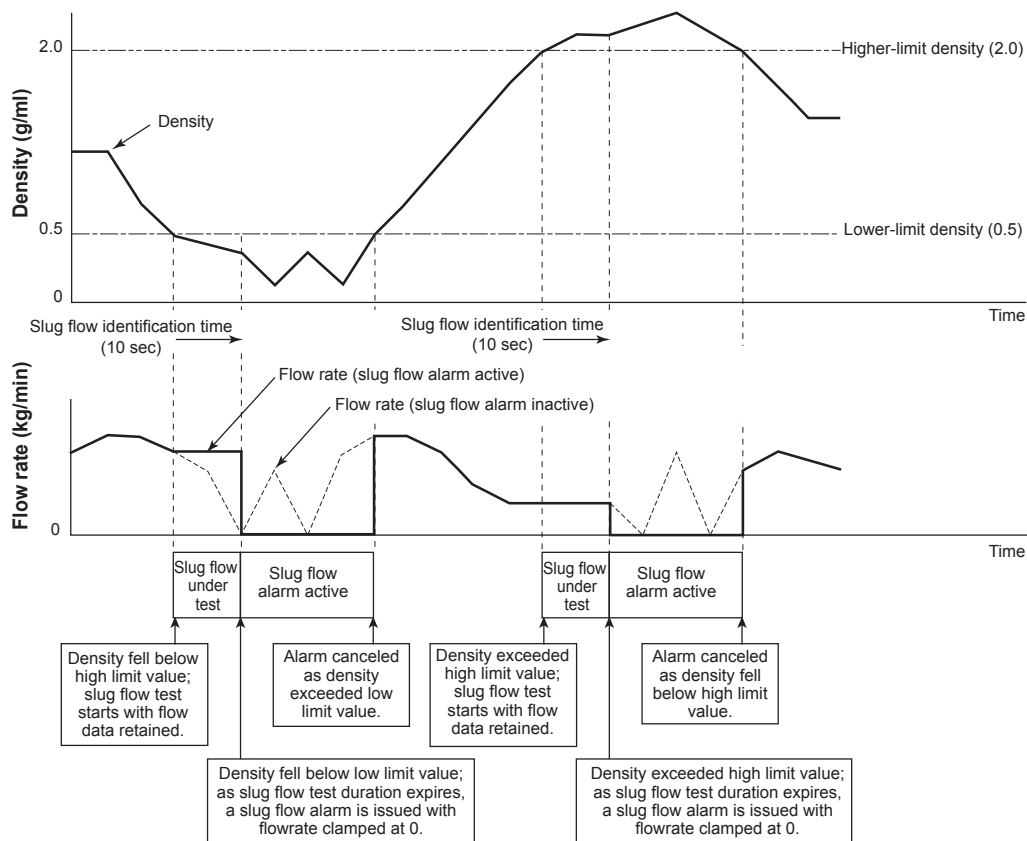


Figure 8.27—Slug flow alarm graph

UNITS SETUP LIST

Measurement Type	No.	Acceptable Setup Units	LCD Readout
Instant mass flow rate	M-1	g/sec	g/s
	M-2	g/min	g/min
	M-3	g/hr	g/h
	M-4	kg/sec	kg/s
	M-5	kg/min	kg/min
	M-6	kg/hr	kg/h
	M-7	kg/day	kg/d
	M-8	MetTon/min	Mt/min
	M-9	MetTon/hr	Mt/h
	M-10	MetTon/day	Mt/d
	M-11	lb/sec	lb/s
	M-12	lb/min	lb/min
	M-13	lb/hr	lb/h
	M-14	lb/day	lb/d
	M-15	ShTon/min	St/min
	M-16	ShTon/hr	St/h
	M-17	ShTon/day	St/d
Instant volume flow rate	V-1	ml/sec	mL/s
	V-2	ml/min	mL/min
	V-3	ml/hr	mL/h
	V-4	liter/sec	L/s
	V-5	liter/min	L/min
	V-6	liter/hr	L/h
	V-7	liter/day	L/d
	V-8	m ³ /sec	Cm/s
	V-9	m ³ /min	Cm/min
	V-10	m ³ /hr	Cm/h
	V-11	m ³ /day	Cm/d
	V-12	gal/sec	ga/s
	V-13	gal/min	ga/min
	V-14	ImpGal/min	Ig/min
	V-15	ImpGal/hr	Ig/h
	V-16	ImpGal/day	Ig/d
	V-17	ft ³ /sec	Cf/s
	V-18	ft ³ /min	Cf/min
	V-19	ft ³ /hr	Cf/h
	V-20	bbl/sec	bl/s
	V-21	bbl/min	bl/min
	V-22	bbl/hr	bl/h
	V-23	bbl/day	bl/d
Density	D-1	SGU	SGU
	D-2	g/ml	g/mL
	D-3	g/cm ³	g/cc
	D-4	kg/l	kg/L
	D-5	kg/m ³	kg/Cum
	D-6	lb/gal	lb/gal
	D-7	lb/ft ³	lb/Cf
Temperature	T-1	°C	deg C
	T-2	°F	deg F
	T-3	Kelvin	Kelvin
	T-4	°R	deg R

Section 9—Maintenance

If an error occurs, an error message will appear at the bottom of LCD display. The sections below will help to identify the cause of the error and to troubleshoot the issue. If the problem persists, or if you have any question, contact Cameron.

ERROR MESSAGES

Error Type	Status Message	Description	Action	Error Indicators			Error Output								
				Red LED	Green LED	Back-light ①	Ana. Out 1	Ana. Out 2	Pulse Out 1	Pulse Out 2	Status Out				
Saturated Alarm	Ana. Out 1 Satur	Analog Output 1-2 out of range (~10% to 110%); failure to produce proper output	Adjust measurement to fall within lower limit to upper limit of analog output or modify setting. ⑥	Blink	On	Off	21.6 mA	—	—	—	Per status select ⑦				
	AO2 Range Error						—								
	—	21.6 mA													
	PO2 Range Error	2.4 mA													
Ana. Out 2 Satur															
Pls. Out 1 Satur	Pulse Output 1-2 exceeds 11kHz; instant flow rate selected exceeds full-scale flow rate of pulse output; failure to produce proper output	Lower instant flow rate or increase full-scale flow rate. ⑤	On	Off	Orange ④	Per error output setting ⑥	Per error output setting ⑤	Per error output setting ⑤	11 KHz	—					
Pls. Out 2 Satur									—	11 KHz					
Drive Out Of Range	Drive frequency out of normal range; possible fault in drive coil connections; failure to make proper measurement	Run self-diagnostics on drive coil connections; see Drive Coil Check, page 84 .							On	Off	Orange ④	Per error output setting ⑥	Per error output setting ⑤	Per error output setting ⑤	Per status select ⑦
Scale Over	Mass flow rate exceeds 110% of maximum allowable range; possible failure to make proper measurement	Use within the maximum allowable range.													
Temp Out Of Range	Temperature out of normal range; fault in temperature sensor; failure to make proper measurement	Run self-diagnostics on temperature sensor connections; see Transmitter Check, page 85 .													
Density Outside	Density out of normal range (0 to 5 g/mL); bubble entrapment possible; failure to make proper measurement	Check for bubble entrapment.													
P.O. Sig Err	Pickoff signal voltage out of normal range; possible fault in pickoff sensor; failure to make proper measurement	Run self-diagnostics on pickoff coil connections; see Transmitter Check, page 85 .													
Temp Connect Err	Possible fault in temperature sensor wiring connections	Check temperature sensor connections.													
P.O. Connect Err	Possible fault in pickoff sensor wiring connections	Check pickoff coil connections.													
Drive Coil Error	Possible fault in drive coil wiring connections	Check drive coil connections; run self-diagnostics on drive coil connections; see Drive Coil Check, page 84 .													
Transmitter Failure	EEPROM Err	Error in parameters; inactive operation	Contact Cameron.	Blink ②	Off	Orange ④	2.4 mA	Stopped	Off						
	Data Update Err	Fault in internal data or transmitter	Contact Cameron.	On	Off	Orange ④	Per error output setting ③ ⑥	Per error output setting ③ ⑤	Per status select ⑦						
Parameter Alarm	Ana. 1 Set Alm.	Parameter setting of Analog Output 1-2 in one of the following conditions: <ul style="list-style-type: none"> Upper limit < lower limit Upper or lower limit > maximum acceptable setting 	Verify parameters and reconfigure to acceptable values. ⑥	Blink	On	Off	Per error output setting ⑥	Per error output setting ⑤	Per status select ⑦						
	Ana. 2 Set Alm.									<ul style="list-style-type: none"> Upper or lower limit < maximum acceptable setting 					
	H/L Po.Set Alm.	H/L alarm parameter setting comes under any of the following conditions <ul style="list-style-type: none"> High alarm < Low alarm High alarm or low alarm > maximum acceptable setting High alarm or low alarm < maximum acceptable setting 	Verify parameters and reconfigure to acceptable values; see High/Low Alarm Function, page 105 .												
Calibration Failure	Auto Zero Fail	Auto zero offset is out of normal range.	Allow fluid flow to return to a steady state and retry zeroing; see Zeroing Function, page 91 .	Blink	Off	Off	—	—	Per status select ⑦						
Slug Flow Alarm	Slug Flow	Alarm remain active for a preset duration (slug flow check) upon detection of gas entrapment	Air entrapment in the fluid is a possibility. Verify the fluid and line for conditions.	Blink	On	Off	Only flow output clamped	Clamped	Per status select ⑦						
		After expiration of slug flow alarm, check slug flow duration					Flow output clamped at "0"	Stopped							
Transmitter Alarm	Txr Temp Alm.	Transmitter's internal temperature is above 80°C	Lower ambient temperature to prevent shortening of component life.	Blink	On	Off	Continued	Continued	Per status select ⑦						
	Switch Alm.	Possible faulty operating switches	Contact Cameron.	Blink	On	Off	Continued	Continued							

- If the backlight is set to sleep mode, the white backlight will still illuminate after switch operation even if the operation is stopped.
- During a parameter error alarm, the LED blinks faster (intervals of 100 ms) than is normal for other alarms (intervals of 250 ms).
- Transmitter outputs may become erratic in the event of transmitter failure.
- The orange backlight remains on for 5 minutes after an alarm, or for the sleep duration of the backlight. After this time, the orange backlight will blink on and off.
- See [Pulse Output Function, page 97](#) for more information.
- See [Analog Output Function, page 101](#) for more information.
- See [Status Output Function, page 102](#) for more information.

STATUS MESSAGES

Error Type	Status Message	Description	Error Indicators			Error Output				
			Red LED	Green LED	Back-light ①	Ana. Out 1	Ana. Out 2	Pulse Out 1	Pulse Out 2	Status Out
Fixed Output	Ana. Out 1 Fix	Analog Output 1 is fixed. ②	Off	Blink	Off	Fixed output	—	—	—	—
	Ana. Out 2 Fix	Analog Output 2 is fixed. ②				—	Fixed output			
	Pls. Out 1 Fix	Pulse Output 1 is fixed. ②				—	—	Fixed output	—	
	Pls. Out 2 Fix	Pulse output 2 is fixed. ②				—	—	—	Fixed output	
	Status Out Fix	Status output is fixed. ②				—	—	—	Fixed output	
	0% Sig Lock	0% signal lock is active while there is a signal input. ②				Clamped at 4 mA	Stopped	—		
Calibration in Progress	Cal. in Progress	Auto zero in progress.	Off	Blink	Off ③	—	—	—	—	
H/L Alarm	H/L Alm. Trig.	H/L alarm was triggered and is active; see High/Low Alarm Function, page 105 .	Off	Blink	Off	—	—	—	—	
Test	Self diag	Self diagnostics in progress.	Off	Blink	Off	0%	Stopped	—	—	
	Installation	Pipeline vibration check in progress.	Off	Blink	Off	0%	Stopped	—	—	
	Maintenance Test	Maintenance in progress.	Off	Blink	Off	—	—	—	—	
Transmitter Operation	Key Protect	A key operation was attempted with key protect active. Reconfigure to allow key operation.	Off	On	Off	—	—	—	—	
	Transmitter Operating Time Over (*•• blinks at lower left of LCD)	When the run hours exceed 100,000 hours, component failure or degradation could occur. Transmitter replacement recommended. See Transition Chart 6, page 78 , No. 4-3 for details about cancelling indicator.	Off	On	Off	—	—	—	—	
	WARMUP 20	Warmup in progress. Warmup indicator appears when meter is powered on and counts down 1 minute at a time until count reaches "0."	Off	On	Off	—	—	—	—	
	Powr OK ? ④	A short duration power cycling has occurred more than once, indicating possible poor power supply condition. Check power supply condition.	Off	On	Off	—	—	—	—	

1. If the backlight is set to sleep mode, the white backlight will still illuminate after switch operation even if the operation is stopped.
2. Regardless of the alarm state, simulated output remains available. Certain errors can disable the output.
3. The orange indicator light will blink at operation startup and shutdown, but the backlight will remain off during startup, shutdown, and testing.
4. Operations can be continued if this message appears. The message automatically disappears after 20 minutes.

REPLACEMENT PARTS

When ordering replacement parts, please provide the following information:

- Flow meter model number
- Part name
- Product number
- Quantity

The following parts are available for order as replacement parts:

- Interconnect cable (Teflon or PVC)
- Transmitter parts
 - O-ring between front display lid and body
 - O-ring between rear terminal box lid and body
 - O-ring between adapter and body (integral transmitter only)
 - O-ring on sensor unit (integral transmitter only)
 - Sheet packing between side lid and body
- O-ring between terminal box and lid (separate transmitter only)
- Cable gland (rubber seal and O-ring)

Replacing Transmitter and Terminal Parts

O-rings and gaskets are used as sealing components and have a limited service life. Although exact service life is dependent on the operating environment, periodic replacement is recommended every 5 to 8 years after delivery.

Important **Inspect O-rings and gaskets whenever instrument is opened or disassembled. Replace any deteriorated parts. Also, periodically re-torque corresponding parts to ensure instrument soundness.**

SAFETY STATEMENT ON RETURNED GOODS

Cameron is committed to creating a safe work environment for our employees. Prior to returning your Coriolis flow meter for repair or other service, fax or email a copy of a completed Safety Statement. Cameron will respond with a Return Authorization (RMA) to track the meter back to our facility. When you ship the meter to Cameron, include a copy of the RMA and this Safety Statement in the shipment.

If the RMA or the Safety Statement is not included with the returned meter, or if we find it difficult to ensure safety, we may decline to accept and process the returned equipment at our discretion.

Important **If residual metered fluid may be present in the housing, consult the factory before returning the device.**

CAMERON CAMCOR™ CORIOLIS FLOW METER

Model		
Serial No.		
Process Fluid Names	List all chemicals and process fluids in contact with the equipment.	
Health and Safety Hazards	If an MSDS ❶ is available, include it with this form.	
Precautions (First aid)	If an MSDS ❶ is available, include it with this form.	

1. MSDS stands for Material Safety Data Sheet. It informs us of the physical and chemical properties of materials and how to handle them.

Date:

Company Name			
Address			
Phone No.		Fax No.	
Job Title		Email	
Signature by			
Reason for return			
Remarks			

REPAIR REQUEST SHEET

Company name			
Address			
Contact			
Return (shipping)			
Reason for return (type of order)	<input type="checkbox"/> Repair <input type="checkbox"/> Calibration <input type="checkbox"/> Replacement Return <input type="checkbox"/> Other _____		
Delivery date		Installation date	
Date of failure			
Descriptions of nonconformance (failure)			

IMPORTANT Unless the statements below are fully documented, returned equipment will not be processed.

Model			
Serial number			
Fluid name			
Fluid density			
Fluid temperature			
Line pressure			
Specification modification	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Full-scale flow rate			
Pulse output	<input type="checkbox"/> Mass <input type="checkbox"/> Volume (fixed) <input type="checkbox"/> Volume <input type="checkbox"/> Pulse unit: _____ <input type="checkbox"/> O.C. <input type="checkbox"/> Voltage		
Pulse output	<input type="checkbox"/> Mass <input type="checkbox"/> Volume (fixed) <input type="checkbox"/> Volume <input type="checkbox"/> Pulse unit: _____		
Analog output	<input type="checkbox"/> Mass <input type="checkbox"/> Volume (fixed) <input type="checkbox"/> Temperature <input type="checkbox"/> Density _____ to _____		
Analog output	<input type="checkbox"/> Mass <input type="checkbox"/> Volume (fixed) <input type="checkbox"/> Temperature <input type="checkbox"/> Density _____ to _____		
Sensor conditions	<input type="checkbox"/> Tubes empty (no obstacles)		
	<input type="checkbox"/> Sensor empty (no obstacles)		
	<input type="checkbox"/> Tubes clogged/contaminated		
Cleaning material used for sensor unit			

IMPORTANT If sensor tubes leak, ensure that no process fluids remain in the housing. To provide a safe working environment for our employees and engineers, this form must be filled in completely and accurately. Unless accurate and precise information about the process fluids is given, returned equipment will NOT be processed. Include your instructions and conditions accurately and in detail.

Section 10—Explosion-proof Specifications

CSA (CT SERIES)

Integral Type

- Transmitter ratings: Class I, Zone 1, Ex d ib IIB T4 Gb
Class I, Zone 1, AEx d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: -40°F to 131°F
- Fluid temperature: -40°F to 176°F
- Sensor ratings: Class I, Zone 1, Ex ib IIB T4 Gb
Class I, Zone 1, AEx ib IIB T4 Gb
- Sensor to be connected: CC006 through CC250
- Communication: HART, Modbus

Separate Type

- Transmitter ratings: Class I, Zone 1, Ex d [ib] IIB T6 Gb
Class I, Zone 1, AEx d [ib] IIB T6 Gb
- Transmitter ambient temperature: -40°F to 131°F
- Sensor ratings: Class I, Zone 1, Ex ib IIC T1, T2, T3, T4, T5 Gb
Class I, Zone 1, AEx ib IIC T1, T2, T3, T4, T5 Gb
- Communication: HART, Modbus

Meter Combinations (US Customary Units)

Model	Meter Temperature Category			Transmitter		Hazardous Location Temperature Class			
	Model Code 7	Description	Nominal Media Temp (°F)	Model Code 12	Mounting Type	Model Code 18	Description	Media Temp (°F)	Ambient Temp (°F)
CC00A and CC001	2	Standard B	266° to 392°	2	Separate	3	Class T3	-40° to 302°	-40° to 140°
CC003	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
CC006 through CC015	1	Standard A	-40° to 266°	1	Integral	4	Class T4	-40° to 176°	-40° to 140°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
CC025 through CC080	1	Standard A	-40° to 266°	1	Integral	4	Class T4	-40° to 176°	-40° to 140°
	1	Standard A	-40° to 266°	2	Separate	3	Class T3	-40° to 302°	-40° to 140°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
	3	High Temp	392° to 662°	2	Separate	1	Class T1	-4° to 662°	-4° to 122°
CC100 through CC150	4	Low Temp	-328° to 122°	2	Separate	5	Class T5	-328° to 122°	-4° to 122°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
	3	High Temp	392° to 662°	2	Separate	1	Class T1	-4° to 662°	-4° to 122°
CC15H through CC250	4	Low Temp	-328° to 122°	2	Separate	5	Class T5	-328° to 122°	-4° to 122°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
	4	Low Temp	-328° to 122°	2	Separate	5	Class T5	-328° to 122°	-4° to 122°

Temperature Category describes the nominal temperature rating of the meter, with no consideration for hazardous area certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

Temperature Class describes "T" codes, which define temperature limitations that apply if the meter is installed in a hazardous area, per the CSA certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

If a meter will be used in a process with temperature lower than -22°F, Charpy impact testing is required.

Meter Combinations (Metric Units)

Model	Meter Temperature Category			Transmitter		Hazardous Location Temperature Class			
	Model Code 7	Description	Nominal Media Temp (°C)	Model Code 12	Mounting Type	Model Code 18	Description	Media Temp (°C)	Ambient Temp (°C)
CC00A and CC001	2	Standard B	130° to 200°	2	Separate	3	Class T3	-40° to 150°	-40° to 60°
CC003	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
CC006 through CC015	1	Standard A	-40° to 130°	1	Integral	4	Class T4	-40° to 80°	-40° to 60°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
CC025 through CC080	1	Standard A	-40° to 130°	1	Integral	4	Class T4	-40° to 80°	-40° to 60°
	1	Standard A	-40° to 130°	2	Separate	3	Class T3	-40° to 150°	-40° to 60°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
	3	High Temp	200° to 350°	2	Separate	1	Class T1	-20° to 350°	-20° to +50°
CC100 through CC150	4	Low Temp	-200° to 50°	2	Separate	5	Class T5	-200° to 50°	-20° to +50°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
	3	High Temp	Under 350°	2	Separate	1	Class T1	-20° to 350°	-20° to +50°
CC15H through CC250	4	Low Temp	-200° to 50°	2	Separate	5	Class T5	-200° to 50°	-20° to +50°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
	4	Low Temp	-200° to 50°	2	Separate	5	Class T5	-200° to 50°	-20° to +50°

Temperature Category describes the nominal temperature rating of the meter with no consideration for hazardous area certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

Temperature Class describes "T" codes or temperature limitations that apply if the meter is installed in a hazardous area, per the CSA certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

If a meter will be used in a process with temperature lower than -30°C, Charpy impact testing is required.

CSA (PRO SERIES)

Integral type

- Transmitter ratings: Class I, Zone 1, Ex d ib IIB T4 Gb
Class I, Zone 1, AEx d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: -40°F to 131°F (-40°C to 55°C)
- Fluid temperature: -40°F to 158°F (-40°C to 70°C) for CP015
-40°F to 176°F (-40°C to 80°C) other than CP015
- Sensor ratings: Class I, Zone 1, Ex ib IIB T4 Gb
Class I, Zone 1, AEx ib IIB T4 Gb
- Sensor to be connected: CP006 through CP050
- Communication: HART, Modbus

Separate type

- Transmitter ratings: Class I, Zone 1, Ex d [ib] IIB T6 Gb
Class I, Zone 1, AEx d [ib] IIB T6 Gb
- Transmitter ambient temperature: -40°F to 131°F (-40°C to 55°C)
- Fluid temperature:
Temp. Class 3: -40°F to 257°F (40°C to 125°C) All models
Temp. Class 4: -40°F to 158°F (-40°C to 70°C) for CP015
-40°F to 176°F (-40°C to 80°C) Other than CP015
- Sensor ratings: Class I, Zone 1, Ex ib IIB T3, T4 Gb
Class I, Zone 1, AEx ib IIB T3, T4 Gb
- Sensor to be connected: CP006 to CP050
- Sensor ambient temperature: -40°F to 140°F (-40°C to 60°C)
- Communication: HART, Modbus

ATEX/IECEx (CT SERIES)

Integral type

- Transmitter ratings: Zones 1 and 2
II 2G Ex d ib IIC T4 Gb
- Transmitter and sensor ambient temperature: -40°F to 131°F (-40°C to 55°C)
- Fluid temperature: -40°F to 176°F (-40°C to 80°C)
- Sensor ratings: Zones 1 and 2
II 2G Ex ib IIC T4 Gb
- Sensor to be connected: CC006 through CC250
- Communication: HART, Modbus

Separate type

- Transmitter rating: II 2G Ex d [ib] IIC T6 Gb
- Transmitter ambient temperature: -40°F to 131°F (-40°C to 55°C)
- Sensor ratings: II 2G Ex ib IIC T1, T2, T3, T4, T5
- Communication: HART, Modbus

Meter combinations (US Customary Units)

Model	Meter Temperature Category			Transmitter		Hazardous Location Temperature Class			
	Model Code 7	Description	Nominal Media Temp (°F)	Model Code 12	Mounting Type	Model Code 18	Description	Media Temp (°F)	Ambient Temp (°F)
CC00A and CC001	2	Standard B	266° to 392°	2	Separate	3	Class T3	-40° to 302°	-40° to 140°
CC003	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
CC006 through CC015	1	Standard A	-40° to 266°	1	Integral	4	Class T4	-40° to 176°	-40° to 140°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
CC025 through CC080	1	Standard A	-40° to 266°	1	Integral	4	Class T4	-40° to 176°	-40° to 140°
	1	Standard A	-40° to 266°	2	Separate	3	Class T3	-40° to 302°	-40° to 140°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
	3	High Temp	392° to 662°	2	Separate	1	Class T1	-4° to 662°	-4° to 122°
CC100 through CC150	4	Low Temp	-328° to 122°	2	Separate	5	Class T5	-328° to 122°	-4° to 122°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°
	3	High Temp	392° to 662°	2	Separate	1	Class T1	-4° to 662°	-4° to 122°
CC15H through CC250	4	Low Temp	-328° to 122°	2	Separate	5	Class T5	-328° to 122°	-4° to 122°
	2	Standard B	266° to 392°	2	Separate	2	Class T2	-40° to 392°	-40° to 140°

Temperature Category describes the nominal temperature rating of the meter, with no consideration for hazardous area certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

Temperature Class describes "T" codes, which define temperature limitations that apply if the meter is installed in a hazardous area, per the CSA certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

If a meter will be used in a process with temperature lower than -22°F, Charpy impact testing is required.

Meter combinations (Metric Units)

Model	Meter Temperature Category			Transmitter		Hazardous Location Temperature Class			
	Model Code 7	Description	Nominal Media Temp (°C)	Model Code 12	Mounting Type	Model Code 18	Description	Media Temp (°C)	Ambient Temp (°C)
CC00A and CC001	2	Standard B	130° to 200°	2	Separate	3	Class T3	-40° to 150°	-40° to 60°
CC003	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
CC006 through CC015	1	Standard A	-40° to 130°	1	Integral	4	Class T4	-40° to 80°	-40° to 60°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
CC025 through CC080	1	Standard A	-40° to 130°	1	Integral	4	Class T4	-40° to 80°	-40° to 60°
	1	Standard A	-40° to 130°	2	Separate	3	Class T3	-40° to 150°	-40° to 60°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
	3	High Temp	200° to 350°	2	Separate	1	Class T1	-20° to 350°	-20° to +50°
CC100 through CC150	4	Low Temp	-200° to 50°	2	Separate	5	Class T5	-200° to 50°	-20° to +50°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°
	3	High Temp	Under 350°	2	Separate	1	Class T1	-20° to 350°	-20° to +50°
CC15H through CC250	4	Low Temp	-200° to 50°	2	Separate	5	Class T5	-200° to 50°	-20° to +50°
	2	Standard B	130° to 200°	2	Separate	2	Class T2	-40° to 200°	-40° to 60°

Temperature Category describes the nominal temperature rating of the meter with no consideration for hazardous area certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

Temperature Class describes "T" codes or temperature limitations that apply if the meter is installed in a hazardous area, per the CSA certification. See the CT Series General Specification, Doc. No. 50284154, Appendix B, for product code selections.

If a meter will be used in a process with temperature lower than -30°C, Charpy impact testing is required.

ATEX/IECEX (PRO SERIES)

Integral type

- Transmitter ratings: II 2G Ex d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: –40°F to 131°F (–40°C to 55°C)
- Fluid temperature: –40°F to 158°F (–40°C to 70°C) for CP015
–40°F to 176°F (–40°C to 80°C) Other than CP015
- Sensor ratings: II 2G Ex ib IIB T4 Gb
- Sensor to be connected: CP006 to CP050
- Communication: HART, Modbus

Separate type

- Transmitter ratings: II 2G Ex d [ib] IIC T6 Gb
- Transmitter ambient temperature: –40°F to 131°F (–40°C to 55°C)
- Fluid temperature:
Temp. Class 3: –40°F to 257°F (40°C to 125°C) All models
Temp. Class 4: –40°F to 158°F (–40°C to 70°C) for CP015
–40°F to 176°F (–40°C to 80°C) Other than CP015
- Sensor ratings: II 2G Ex ib IIB T3, T4
- Sensor to be connected: CP006 to CP050
- Sensor ambient temperature: –40°F to 140°F (–40°C to 60°C)
- Communication: HART, Modbus

CONDITIONS FOR HAZARDOUS AREA USE

Conditions for the safe use of explosion-proof equipment include the following:

Transmitter (Model PA0K)

- The threaded (glass) display cover, threaded (blind) terminal cover, and spigot joint side lid, which provide the explosion-proof integrity, must not be altered.
- The fastening screw for the side lid shall be “A-50.”
- The transmitter shall be used only in the position specified in the instruction manual.
- Threaded electrical conduit shall complete engage 8 threads at a minimum.
- Electric capacitance of the label shall be 1nF maximum to avoid charging of static electricity. Use a wet cloth to clean the label.
- The transmitter is permanently connected equipment, Pollution Degree 2.
- Line and neutral pole connections supplying power at the installation site must be protected by NRTL certified or listed fuses for Canada and US rated 2A max, installed outside the equipment and acceptable to the authorities where equipment is sold.
- Wiring providing power to the unit must be NRTL certified or listed for Canada and US –type Field Wiring suitable for temperatures above 75°C and size AWG 14-16.
- The user-replaceable mains fuse found within the equipment must be NRTL certified or listed for Canada and US acceptable to the authorities where the equipment is sold.
- Units installed with conduit runs must have conduit seals installed at the enclosure.
- Units installed with other than conduit runs and conduit seals, must be fitted with certified or listed cable glands evaluated to ASME/UL Standard 2225 for use in “Class I, Zone 1, AEx d IIB” or better suitable for the ambient temperature range.
- Remove adapter before installing stopping plug in the conduit entry.
- Terminal cover fasteners (M6 x 1 - 6g) are class A-50 or better.
- There are no other replaceable parts other than the mains fuse.
- If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.

Transmitter Handling

To maintain the explosion-proof integrity of the CamCor transmitter enclosure, adhere to the following guidelines:

- The threaded covers of the flameproof enclosure are the critical parts in maintaining the explosion-proof integrity. Exercise care to ensure that the threads are not damaged and do not contain debris. If damage or debris is detected, contact the Cameron service center nearest you.
- The side lid (bonded surface of spigot joint) of the flameproof enclosure is a critical part in maintaining the explosion-proof integrity. Do not open this lid. If it is accidentally opened during maintenance, exercise care to avoid damaging it and protect it from debris. Tightening screws of strength class A-50 are used on the side lid. If it appears these screws are missing or have been replaced, contact the Cameron service center nearest you.

Cable Glands

Use only cable glands that conform to the following requirements:

- Explosion-proof code: Exd CU
- Protection class: IP66 min.
- Nominal size: 3/4-14 FNPT for CSA units; M25 for ATEX units

Insulation Performance

The following part of the transmitter is subject to insulation:

- IS circuit terminals (separate detector board: TB20, TB21) - Enclosure
Withstand voltage condition: 500VAC, leak current: 3 to 5mA

Due to the built-in noise eliminator between the transmitter power source terminals (TB1's L and N) and output terminals (TB2, TB3 and TB4), and the enclosure respectively, complete insulation is not provided. Withstand voltage tests should be conducted at voltages of AC 200V or DC 250V and leak current of 3 to 5 mA.

Earth Ground Terminal

1. Using green or green/yellow 10 AWG wire, ground the device at the power source's GND terminal block or any of the external grounding terminals. A minimum of D-class grounding is recommended.
2. If external wiring is used, ensure that the grounding wire is connected with the earth terminal cover and plain washer as shown in [Figure 10.1](#).

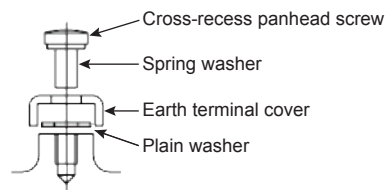


Figure 10.1—Earth ground terminal

Interconnect Cable (for Use with Separately-mounted Transmitters)

A genuine CamCor interconnect cable is used to connect the sensor to a separately-mounted transmitter. Use of other cables may violate the explosion-proof integrity of the device. Use installation methods that minimize the potential for interference from other electrical cabling nearby.

Meter Inspection and Maintenance

Perform inspection and maintenance according to the following items. Also, make sure to check and inspect the flow meter while de-energizing without hazardous gas in the surrounding area.

Check item	Description	Check
General	Is the CamCor interconnect cable in use and properly installed to prevent electrical interference with power lines?	
	Is the interconnect cable coating damaged or peeling?	
	Is the interconnect cable properly connected to both terminals?	
	If the transmitter is separately mounted, is the terminal lid cover properly installed?	
	Are the transmitter bolts and hex socket set screws properly tightened?	
Grounding	Is the meter properly grounded?	
	Is the screw for the grounding terminal loose?	
	Are the grounding wires deteriorated?	
Sensor	Drive circuit resistance: Resistance range: 50 to 5kΩ *1 Pick-off circuit resistance: Resistance range: 60 to 600Ω *1 Temp. sensor circuit resistance: $(100 + 0.385 \times \text{Temperature}) \Omega$ *2 *1: Actual values may vary due to sensor size, sensor type and fluid temp *2: This measurement is possible only with the separately-mounted transmitter. If measured at the transmitter, the resistance of the interconnect cable must be added.	
Transmitter	Are the display lid, terminal lid, or side lid connections loose?	
	Is the cable gland properly installed and tightened?	
	Is the enclosure or glass deformed or cracked?	

Grease on Bonded Surfaces

Periodically inspect the threaded display and terminal covers—as well as the terminal box cover of separately mounted transmitters—for damage, debris and proper lubrication. Replenish silicone grease as required.

Appendix A—CamCor Specifications (Metric Units)

This section presents specifications in metric units. For specifications in U.S. Customary units, see [Section 3—Specifications and Performance \(U.S. Customary Units\)](#), page 15.

CT SERIES SENSOR GENERAL SPECIFICATIONS

Low-Flow Models (CC00A, CC001 and CC003)

Item		Description		
Model		CC00A	CC001	CC003
Nominal size		1/4"		10mm, 1/2", DN15
Materials	Wetted parts ^①	SUS316L		SUS316L, Alloy C22
	Housing	SUS304		
	O-rings	Fluoro-elastomer (standard Viton [®]), PTFE (option)		—
Process connection		1/4-18 FNPT		ASME 100, 300, 600, 900 ^② RF; DIN PN 10, 16, 25, 40 RF ^③ ; IDF Ferrule ^④ , Threaded
Applicable fluid		Liquid and gas		
Density range		0 to 2.0 g/mL		
Temperature range		-200°C to 200°C ^⑤		
Tube withstand @ 37.8°C		—		Wetted parts materials: SUS316L maximum 10 MPa; Alloy C22 maximum 15 MPa (depending on flange rating)
Maximum operating pressure @ 37.8°C	Liquid	15 MPa		
	Gas	0.98 MPa		
Sensor housing withstand ^⑥		—		7.2 MPa
Flow direction		Bi-directional		
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications , page 113 for details.)		
Dust-tight, waterproof configuration		IP66/67		

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- Refer to [Section 10—Explosion-proof Specifications](#), page 113 for details. In case of non-explosion-proof type, the maximum measurement temperature is 130°C. However, the product must be used within the maximum ambient temperature of 45°C. Higher temperature limits can be achieved with the high-temperature models.

* Only available with separately-mounted transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).

* For products conforming to the high pressure gas safety regulations and CE marking, consult Cameron.

Standard Models (CC006 through CC080)

Item		Description						
Model		CC006	CC010	CC015	CC025	CC040	CC050	CC080
Nominal size		10 mm, 1/2", DN15	15 mm, 1/2", DN15		25 mm, 1", DN25	40 mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80
Materials	Wetted parts ^①	SUS316L, Alloy C22						
	Housing	SUS304						
Process connection		ASME 150, 300, 600, 900 ^② RF; DIN PN 10, 16, 25, 40 RF ^③ ; IDF Ferrule ^④ ; Threaded						
Applicable fluids		Liquid and gas						
Density range		0 to 2.0 g/mL						
Temperature range		-200°C to 200°C ^⑤						
Tube withstand @ 37.8°C		10.5 MPa						
Maximum operating pressure		Depends on flange rating						
Sensor housing withstand ^⑥		3.8 MPa	3.0 MPa	2.2 MPa	1.6 MPa	1.8 MPa	1.4 MPa	
Flow direction		Bi-directional						
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications , page 113 for details.)						
Dust-tight, waterproof configuration		IP66/67						

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- Refer to [Section 10—Explosion-proof Specifications](#), page 113 for details. In case of non-explosion-proof type, the maximum measurement temperature is 130°C. However, the product must be used within the maximum ambient temperature of 45°C. Higher temperature limits can be achieved with the high-temperature models.

* For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

High-Flow Models (CC100 through CC250)

Item		Description				
Model		CC100	CC150	CC15H	CC200	CC20H CC250
Nominal size		100 mm, 4", DN100	150 mm, 6", DN150		200 mm, 8", DN200 250 mm, 10", DN250	
Materials	Wetted parts ①	SUS316L				
	Housing	SUS304				
Process connection		ASME 150, 300, 600 RF; DIN PN 10, 16, 25, 40 RF ②				
Applicable fluids		Liquid				
Density range		0.3 to 2.0 g/mL				
Viscosity range		Maximum 10000 mPa·s				
Temperature range		-200°C to 200°C ③				
Tube withstand @ 37.8°C		13.3 MPa	10.7 MPa		9.0 MPa	
Maximum operating pressure		Dependent on flange rating				
Flow direction		Bi-directional				
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)				
Dust-tight, waterproof configuration		IP66/67				

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME flanged process connections for Models CC20H and CC250 are limited to ASME classes 150 and 300.
- Refer to [Section 10—Explosion-proof Specifications, page 113](#) for details. In case of non-explosion-proof type, the maximum measurement temperature is 130°C. However, the product must be used within the maximum ambient temperature of 45°C. Higher temperature limits can be achieved with the high-temperature models.

High-Pressure Models (CC010 and CC015)

Item		Description	
Model		CC010	CC015
Materials	Wetted parts	Flow tube: Alloy C22; Manifold: Alloy C22 equivalent (CX2MW)	
	Housing	SUS304	
Process connection		3/8-18 FNPT	3/4-14 FNPT
Applicable fluid		Liquid and gas	
Density range		0.3 to 2.0 g/mL	
Temperature range		Integrally-mounted: -20°C to 90°C; Separately-mounted: -200°C to 200°C	
Maximum operating pressure @ 20°C		36 MPa	43 MPa
Sensor housing withstand ①		3.0 MPa	2.2 MPa
Flow direction		Bidirectional	
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)	
Dust-tight, waterproof configuration		IP66/67	

- This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
* For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

High-Temperature Models (CC025 to CC150)

Item		Description				
Model		CC025	CC040	CC050	CC080	CC100 CC150
Nominal size		25 mm, 1", DN25	40mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80	100 mm, 4", DN100 150 mm, 6", DN150
Materials	Wetted parts ①	SUS316L			SUS316L, Alloy C22	SUS316L
	Housing	SUS304				
Process connection		1" to 3": ASME 150, 300, 600, 900 ② RF; DIN PN 10, 16, 25, 40 RF 4" and 6": ASME 150, 300, 600 RF; DIN PN10, 16, 25, 40 RF				
Applicable fluids		Liquid				
Density range		0.3 to 2.0 g/mL				
Temperature range ③		-40°C to 350°C				
Tube withstand @ 37.8°C		10.5 MPa			13.3 MPa	
Maximum operating pressure		Dependent on flange rating				
Sensor housing withstand ④		1.6 MPa	1.8 MPa	1.4 MPa	—	
Flow direction		Bi-directional				
Explosion-proof configuration		CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)				
Dust-tight, waterproof configuration		IP66/67				

Optional Heat Tracer Specifications (Available for Models CC025 through CC080) ④

Applicable fluids	Hot water, saturated steam, overheated steam
Heat retention fluid maximum output pressure	0.98 MPa
Joint port for heat retention fluid	10 mm stainless tubing
Recommended joint	Standard stainless steel ferrule-type compression fitting for 10mm tubing

- When SUS316L is selected as the wetted parts material, the flange material will be dual-rated SUS316/SUS316L.
- ASME 900 flanges are only available in Alloy C22 material.
- Allowable ambient temperature permitted for the sensor unit is up to 50°C.
- This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
- Heat trace should only be used for heating the meter. Do not use for cooling of flowing media.
* For products conforming to the high-pressure gas safety regulations, consult Cameron.
* Only available with separately-mounted transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).

Low-Temperature Models (CC025 through CC250)

Item	Description									
Model	CC025	CC040	CC050	CC080	CC100	CC150	CC15H	CC200	CC20H	CC250
Nominal size	25 mm, 1", DN25	40 mm, 1-1/2", DN40	50 mm, 2", DN50	80 mm, 3", DN80	100 mm, 4", DN100	150 mm, 6", DN150		200 mm, 8", DN200		250 mm, 10", DN250
Materials	Wetted parts ①					SUS316L, Alloy C22				
	Housing					SUS304				
Process connection	ASME 150, 300, 600, 900 ② RF; DIN PN 10, 16, 25, 40 RF ③; IDF Ferrule ④				ASME 150, 300, 600 RF; DIN PN 10, 16, 25, 40 RF ③			ASME 150, 300, RF; DIN PN 10, 16, 25, 40 RF ③		
Applicable fluids	Liquid and gas					Liquid				
Density range	0.3 to 2.0 g/mL									
Temperature range	-200°C to 50°C (separately-mounted only)									
Tube withstand @ 37.8°C	10.5 MPa			13.3 MPa		10.7 MPa		9.0 MPa		
Maximum operating pressure	Dependent on flange rating									
Sensor housing withstand ⑤	1.6 MPa	1.8 MPa	1.4 MPa	—						
Flow direction	Bidirectional									
Explosion-proof configuration	CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)									
Dust-tight, waterproof configuration	IP66/67									

- When the SUS316L is selected as wetted parts material, the flange material will be SUS316.
- ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.
- For application with foods, this product does not comply with CE marking.
- This pressure does not represent the rated test pressure of a pressure vessel, but 1/4 of the factory-tested breakdown pressure or the data obtained from FEA analysis, whichever is lower. Distorted enclosures do not constitute a failure of the test.
 - Only available with separately-mounted transmitter and interconnect cable (ordered separately; 10-meter minimum, available in 5-meter increments thereafter).
 - For products conforming to the high-pressure gas safety regulations and CE marking, consult Cameron.

PRO SERIES SENSOR GENERAL SPECIFICATIONS

Item	Description					
Model	CP006	CP010	CP015	CP025	CP040	CP050
Nominal size (mm)	10	15	15	25	40	50
Materials	Wetted parts					
	SUS316L					
Materials	Housing					
	SUS304					
Process connection	ASME 150, 300, 600RF, IDF Ferrule; Threaded (CP006, CP010 and CP015 only)					
Applicable fluid	Liquid					
Density range	0.3 to 2.0 g/mL					
Temperature range ①	-40°C to 125°C ②					
Maximum operating pressure	Dependent on process connection					
Flow direction	Bidirectional					
Explosion-proof configuration	CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)					
Dust-tight, waterproof configuration	IP66/67					

- Refer to [Section 10—Explosion-proof Specifications, page 113](#). In case of non-explosion-proof model, up to 125°C is permitted. However, the product must be used within the maximum ambient temperature of 45°C.
- Cleaning in place (CIP) is permitted within the temperature range.

TRANSMITTER GENERAL SPECIFICATIONS

Item	Description
Model	PA0K
Power supply	CSA: 85 to 264 VAC, 50/60 Hz or 20 to 30 VDC (Safety rated 100 to 240 VAC, 50/60 Hz) ATEX: 100 to 240 VAC, 50/60 Hz, or 20 to 30 VDC
Power consumption	CSA: Maximum 15 W; ATEX: 250 V
Ambient temperature	-40°C to 55°C 1
Transmission length (separately-mounted)	Maximum 200 m (dedicated cable used) 2
Applicable EU directive	EMC Directive: 2004/108/EC; ATEX Directive: 94/9/EC
Applicable EN standards	EMC—EN 55011: 1998/A1, 1999/A2, 2002 Group 1, Class B; EN 61000-6-2: 2001; EN 061326-1: 2006 ATEX—EN 60079-0: 2012; EN 60079-1: 2007; EN 60079-11: 2012 IECEX—IEC 60079-0: 2011; IEC 60079-1: 2007-04; IEC 60079-11: 2011
Explosion-proof configuration	CSA, ATEX, and IECEx (Refer to Section 10—Explosion-proof Specifications, page 113 for details.)
Dust-tight, waterproof configuration	IP66/67
Transmitter configuration	Integral or separately-mounted
Finish	Paint type: Baked enamel; Paint color: Light gray (RAL7035)
Display	LCD display provided (128×64 dots), backlit (white, orange); Two infrared light sensors; Two LEDs (green and red)
Weight (approximate)	Integrally-mounted model, 3.6 kg; Separately-mounted model, 5.0 kg
Communication interface 5	HART (Standard) Protocol Version 7, Bell 202 3
	Modbus (Optional) RS-485 Modbus protocol; Baud rate: 9600, 19200, 38400; RTU; Response time: 25 to 50 ms
Damping (default)	Flow rate, 0.8 sec.; Density, 4.0 sec.; Temperature, 2.5 sec.
Low-flow cutoff (default)	Less than 0.6% of maximum service flow rate
Pulse output	Select one: Open drain (equivalent to open collector)—10V to 30V, 50 mADC, ON resistance $\leq 0.6 \Omega$ or Voltage—1.5 V maximum (low level) to 13 V minimum (high level), Output impedance: 2.2 k Ω ; Frequency output range—0 to 10000 Hz (Maximum: 11000 Hz)
Analog output	4 to 20 mADC (maximum load: 600 Ω); Select two outputs from instant flowrate (mass or volume) temperature, and density.
Status output	Open drain (equivalent to open collector)—30 V maximum, 50 mADC, ON resistance $\leq 0.6 \Omega$; Select one from error (default) 4 , flow direction, high/low alarm, or drive output alarm.
Status input	Contact-closure (Form "a" contact)—Close: 200 Ω maximum, Open: 100 k Ω minimum; Select one output from remote zero, total reset, 0% signal lock, or function off (default).

- Below -20°C, the display loses its visibility due to weakened contrast. Both the display and infrared sensor may exhibit slow responses below -20°C.
- If the signal transmission length for a separately-mounted transmitter exceeds 200 m, consult Cameron.
- Of the two analog output systems, only analog output 1 is available for HART communication.
- The status output can also be configured to activate when meter zeroing is in process.
- Electrical noise filtering components are installed in connections between power source, output, communications, and chassis.

CT SERIES SENSOR GENERAL PERFORMANCE

Flow Rate

Meter type	Model	Size (in.)	Guaranteed minimum rate (kg/h)	Minimum setting rate (kg/h)	Maximum service rate (kg/h)	Maximum allowable rate (kg/h)	Uncertainty ⑤		Repeatability ⑤		Zero stability (kg/h)	Analog output uncertainty
							Liquids	Gases	Liquids	Gases		
Low-flow	CC00A	1/4	0.024	0.12	2.4	3.6	±0.2% of reading (±ZS) ⑤	±0.5% of reading (±ZS)	±0.05% of reading (±1/2 ZS)	±0.25% of reading (±1/2 ZS)	0.00036	±0.1% of full scale
	CC001		0.09	0.45	9	13.5					0.00135	
	CC003	1/2	0.72 (0.9) ①	3.6	72	144 (180) ①					0.0018	
	CC006	1/2	3.6	18	360	720					0.018	
	CC010	1/2	12	60	1200	2400					0.06	
	CC015	1/2	36	180	3600	7200					0.18	
Standard and Low-temperature	CC025	1	108	540	10800	21600	±0.1% of reading ②	±0.05% of reading ③	±0.05% of reading (±1/2 ZS)	±0.25% of reading (±1/2 ZS)	0.54	±0.1% of full scale
	CC040	1-1/2	390	1950	39000	78000					1.95	
	CC050	2										
	CC080	3	1200	6000	120000	240000					6	
	CC100	4	3420	17100	342000	684000					17.1	
	CC150	6										
	CC15H	6										
	CC200	8										
	CC20H	8	7000	35000	700000	1400000					35	
	CC250	10	14000	70000	1400000	2800000					70	
High-pressure	CC010	3/8	24	120	840	1680	±0.2% of reading (±ZS) ⑤	±0.5% of reading (±ZS)	±0.1% of reading (±1/2 ZS)	±0.25% of reading (±1/2 ZS)	0.21	±0.1% of full scale
	CC015	3/4	78	390	2550	5100					0.636	
High-temperature	CC025	1	108	540	10800	21600	±0.1% of reading (±ZS) ④	—	±0.05% of reading (±1/2 ZS)	—	1.08	±0.1% of full scale
	CC040	1-1/2	390	1950	39000	78000					3.9	
	CC050	2										
	CC080	3	1200	6000	120000	240000					12	
	CC100	4	3420	17100	342000	684000					34.2	
CC150	6											

- When a maximum allowable range 180 kg/h is adopted, the minimum flow rate is 0.9 kg/h.
- ±ZS is applied for flow rates below 5% (2.5% for Model CC003) of the maximum service rate (within the guaranteed flow range).
- ±1/2 ZS is applied for flow rates below 5% (2.5% for Model CC003) of the maximum service rate (within the guaranteed flow range).
- If an uncertainty of ±0.1% of reading is required, consult Cameron.
- Above maximum service flow rate, the uncertainty is ±0.3% of reading (±ZS).
 - If you request volume flow measurement for the purpose of fiscal transactions or weights and measurements transactions, contact Cameron.
 - In gas measurement, the maximum permissible flow velocity varies with the type of gas and some may be beyond the bounds of measurement. If so, contact Cameron.
 - ZS = Zero stability error (During testing, zero stability and current flow rate should be read in the same measurement unit).

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Current flow rate}} \times 100\%$$

Volumetric Flow Rate ①

Model	Units	Guaranteed minimum rate	Minimum setting rate	Maximum service rate	Maximum allowable
CC00A	gal/hr	0.024	0.12	2.4	3.6
CC001	gal/hr	0.09	0.45	9.01	13.5
CC003	gal/hr	0.721	3.6	72.1	144
CC006	gal/min	0.06	0.3	6.01	12
CC010	gal/min	0.2	1	20	40
CC015	gal/min	0.601	3	60	120
CC025	gal/min	1.8	9.01	180	360
CC040	gal/min	6.51	32.5	651	1301
CC050	gal/min				
CC080	bb/hr	1.2	6.01	120	240
CC100	bb/hr	3.42	17.1	342	685
CC150	bb/hr				
CC15H	bb/hr	7.01	35	701	1401
CC200	bb/hr				
CC20H	bb/hr	14	70	1401	2802
CC250	bb/hr				
CC010*	gal/min	0.4	2	14	28
CC015*	gal/min	1.3	6.51	42.5	85.1

* High-pressure models

- Calculations based on water (specific gravity of 1) at 15°C (mass = 999.13 kg/ml3). Actual flow ranges vary with media density. To determine the flow range for your fluid, divide the values above by the fluid's specific gravity.

Density (Liquids)

Meter type	Model	Size (in.)	Metering range	Uncertainty	Analog output uncertainty
Low-flow	CC00A	1/4	0.3 to 2g/mL	±0.0005 g/mL	±0.1% of full scale
	CC001				
	CC003	1/2			
	CC006	1/2			
	CC010	1/2			
	CC015	1/2			
Standard and Low-temperature	CC025	1	0.3 to 2g/mL	±0.0005 g/mL	±0.1% of full scale
	CC040	1-1/2			
	CC050	2			
	CC080	3			
	CC100	4			
	CC150	6			
	CC15H	6			
	CC200	8			
High-pressure	CC010	3/8	0.3 to 2 g/mL	±0.004 g/mL	±0.1% of full scale
	CC015	3/4			
High-temperature	CC025	1	0.3 to 2g/mL	±0.003g/mL	±0.1% of full scale
	CC040	1-1/2			
	CC050	2			
	CC080	3			
	CC100	4			
	CC150	6			

PRO SERIES SENSOR GENERAL PERFORMANCE

Mass Flow Rate

Item		Description					
Model		CP006	CP010	CP015	CP025	CP040	CP050
Flow rate	Guaranteed minimum rate (kg/h)	24	76.8	192	576	1920	1920
	Minimum setting rate (kg/h)	60	192	480	1440	4800	4800
	Maximum service rate (kg/h)	600	1920	4800	14400	48000	48000
	Maximum allowable rate (kg/h)	1200	3840	9600	28800	96000	96000
	Uncertainty	±0.2% of reading (± zero stability)					
	Repeatability	±0.1% of reading (± 1/2 zero stability)					
Density (Liquid)	Zero stability (kg/h)	0.09	0.288	0.72	2.16	7.2	
	Metering range	0.3 to 2 g/mL					
Uncertainty		±0.003 g/mL					
Analog output uncertainty		±0.1% of full scale					

Zero stability and flow rate during the test should read in the same measurement unit.

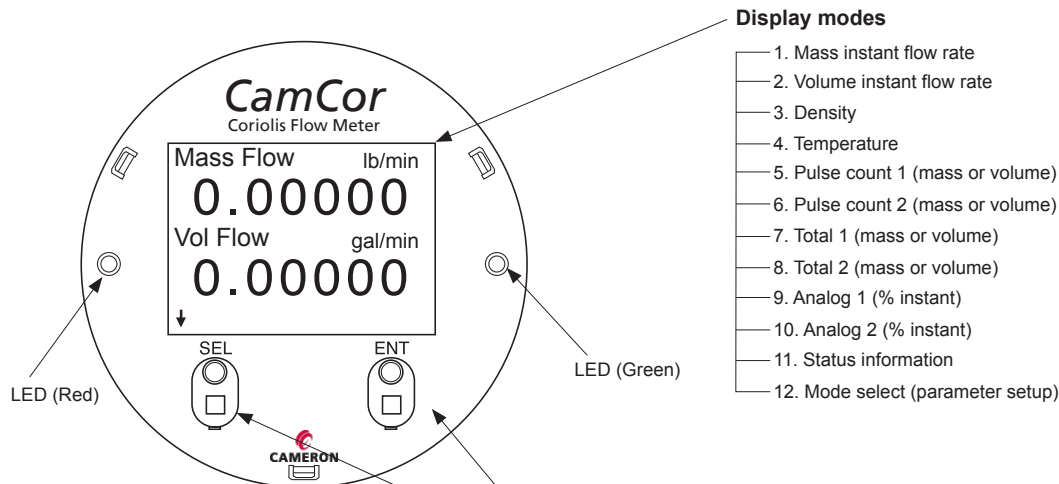
$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Current flow rate}} \times 100\%$$

Volumetric Flow Rate ①

Item		Description					
Model		CP006	CP010	CP015	CP025	CP040	CP050
Guaranteed minimum rate (l/min)		0.400	1.28	3.20	9.61	32.0	32.0
Minimum setting rate (l/min)		1.00	3.20	8.00	24.0	80.1	80.1
Maximum service rate (l/min)		10.0	32.0	80.0	240	801	801
Maximum allowable rate (l/min)		20.0	64.1	160	480	1601	1601

- Calculations based on water (specific gravity of 1) at 15°C (mass = 999.13 kg/m³). Actual flow ranges vary with media density. To determine the flow range for your fluid, divide the values above by the fluid's specific gravity.

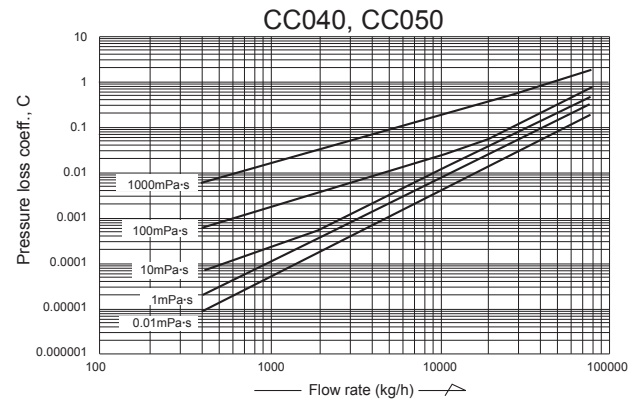
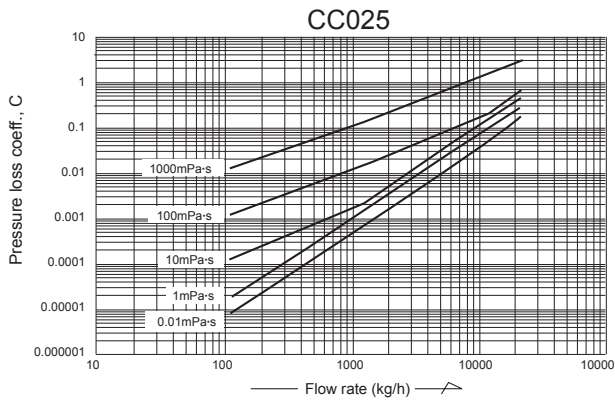
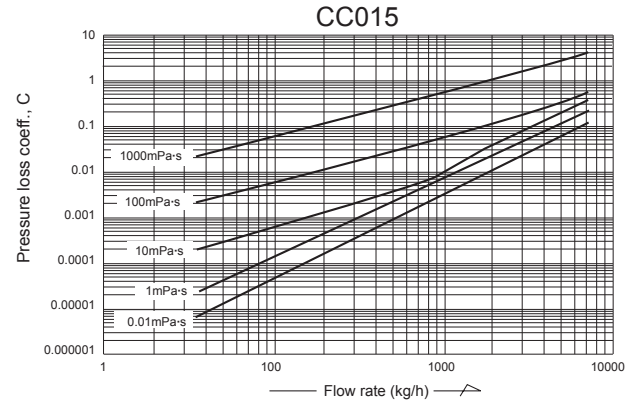
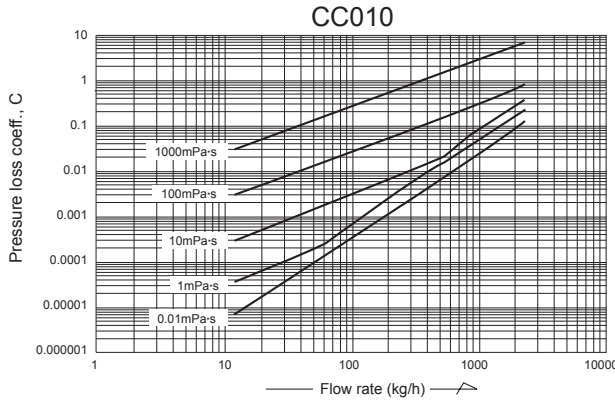
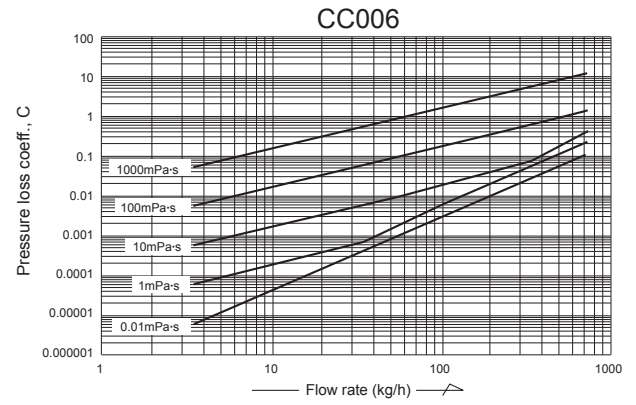
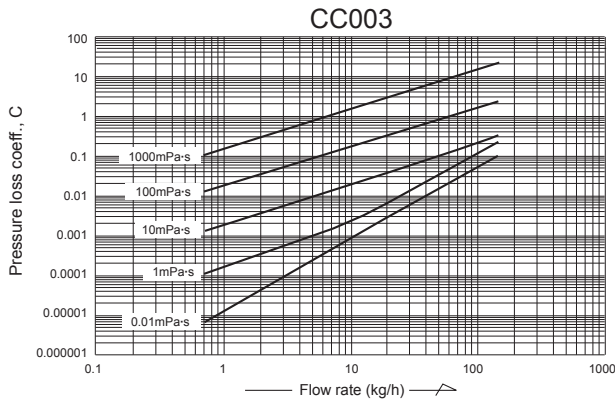
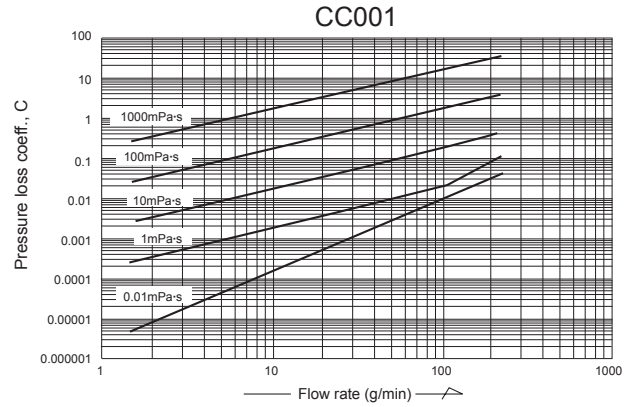
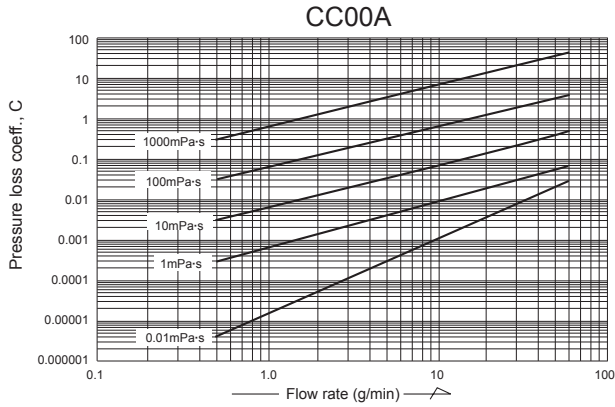
DISPLAY

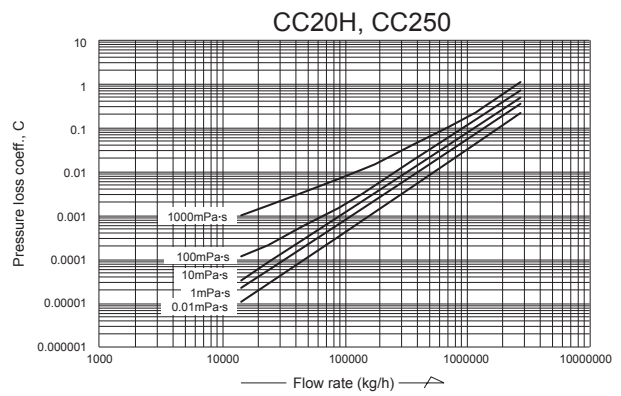
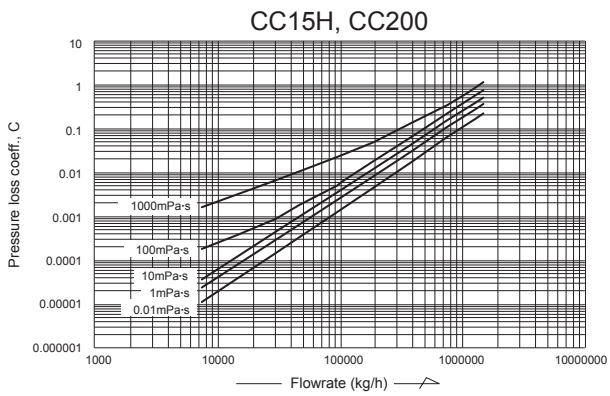
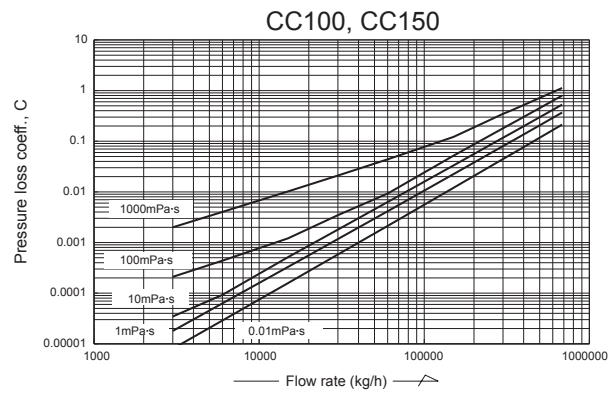
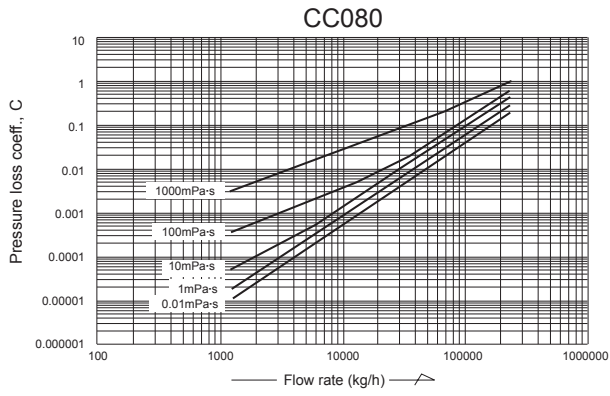


- LCD backlight available in white and orange. Color changes according to the status of flow meter.
- In most cases, the backlight shuts off automatically if the optical sensor does not respond within a user-defined duration.

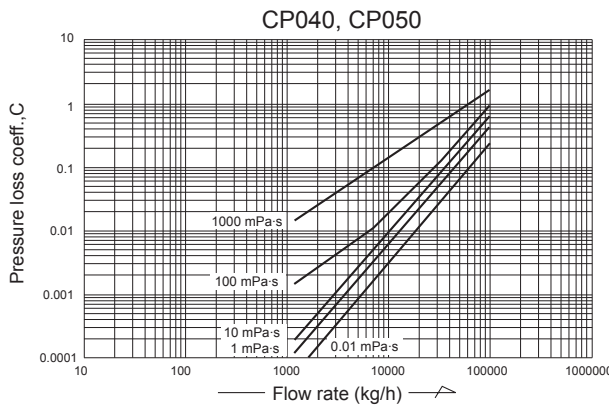
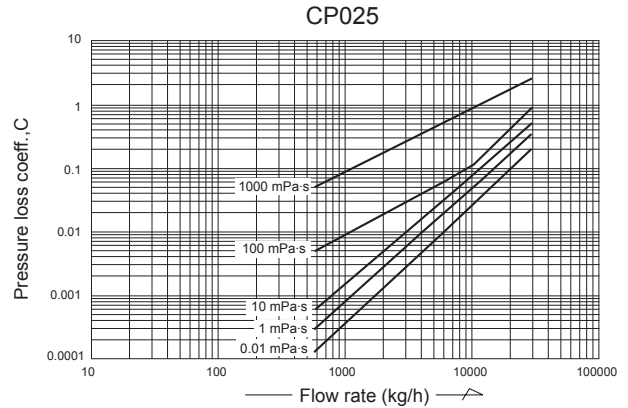
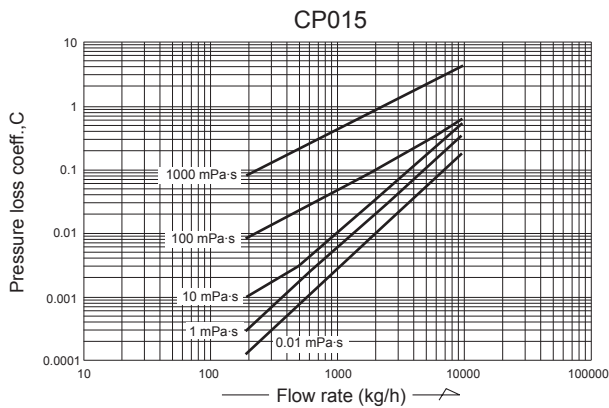
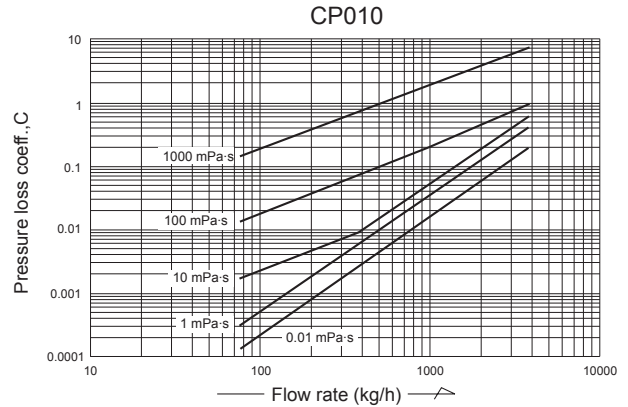
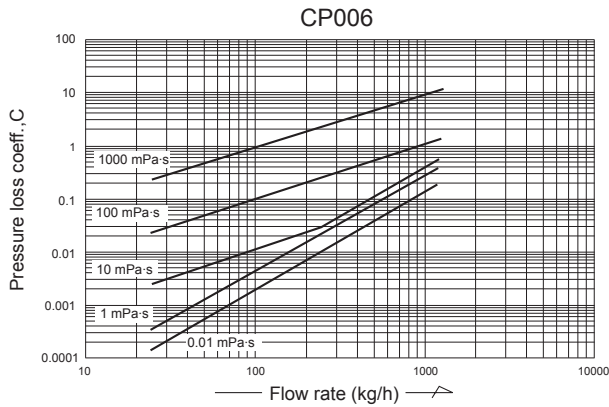
To select the mode, touch and hold your finger over the front glass where the infrared optical sensor appears.

CT SERIES PRESSURE LOSS CURVES





PRO SERIES PRESSURE LOSS CURVES



Determining Pressure Loss

Find the pressure loss factor “C” for a given parameter from its flow rate (kg/h or g/min) and viscosity (mPa·s), then divide “C” by specific gravity “d” (“1” for water) as shown in the following formula:

$$\Delta P = \frac{C}{d} \text{ (MPa)}$$

*For high viscosity liquids not shown in these graphs, calculate the pressure loss using the following formula:

$$\Delta P_2 = C \times \frac{\mu_2}{\mu_1} \times \frac{1}{d}$$

- where ΔP_2 = Pressure loss of high viscosity liquid (MPa)
- μ_1 = Maximum viscosity shown in the graph (mPa·s)
- μ_2 = Viscosity of high-viscosity liquid (mPa·s)
- d = Specific gravity of high-viscosity liquid (“1” for water)
- C = Pressure loss factor

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Appendix B—Product Dimensions (Metric Units)

This section presents product dimensions in metric units (millimeters). For specifications in U.S. customary units, see [Section 4—Product Dimensions \(U.S. Customary Units\)](#).

CT Series CC00A and CC001 Sensor with Separately-mounted Transmitter (Threaded)

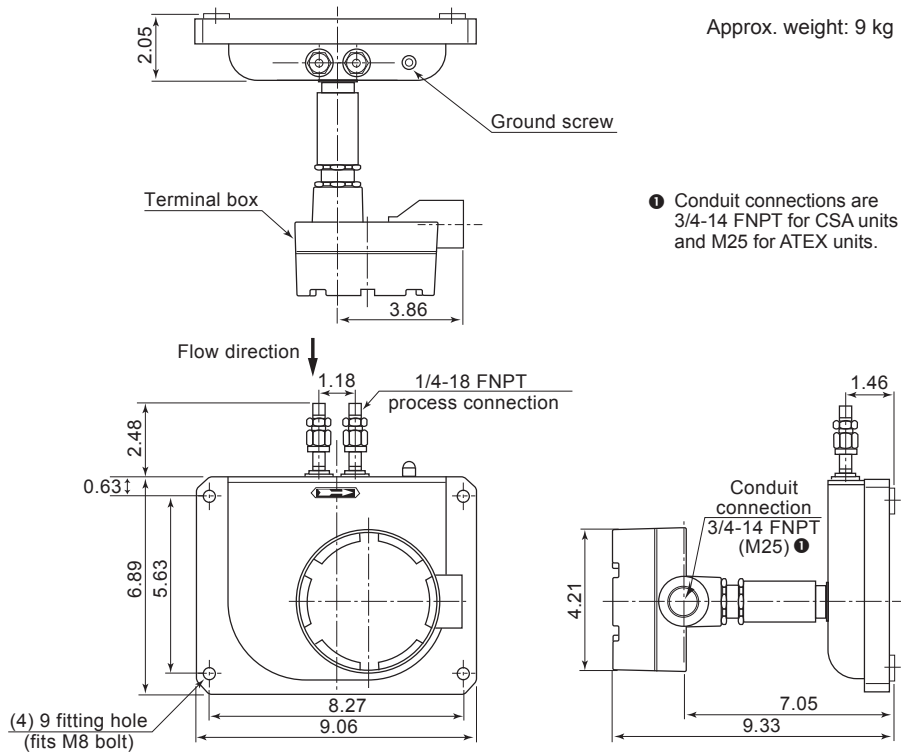
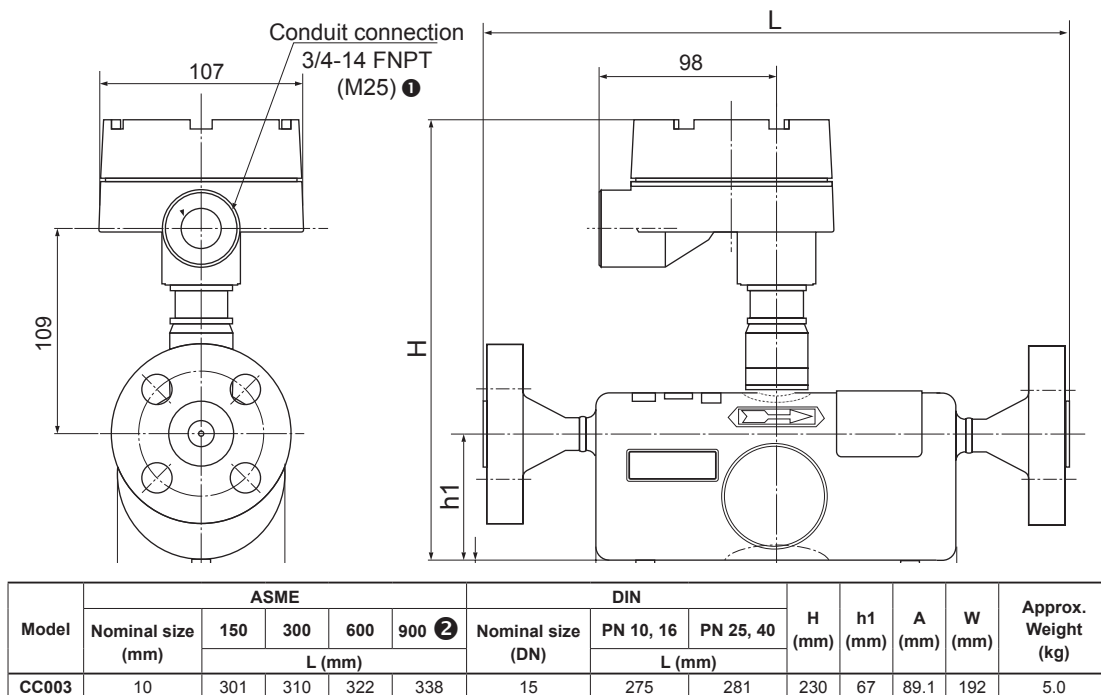


Figure B.1—Outline dimensions of CT Series sensor units CC00A and CC001 (millimeters)

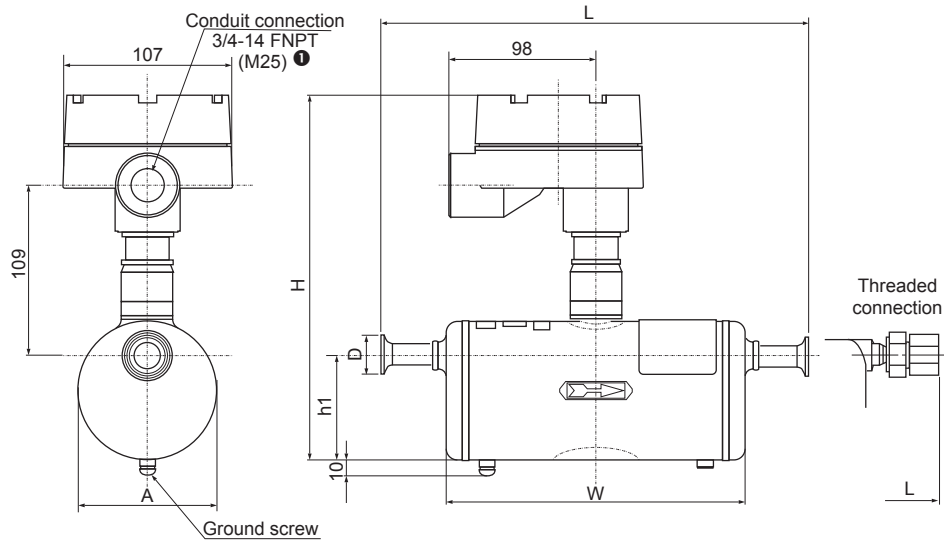
CT Series CC003 Sensor with Separately-mounted Transmitter (Flanged)



1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. ASME 900 flanges are only available in Alloy C22 material.
- This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
- DIN flanges are only available for meter material SUS316L.

Figure B.2—Outline dimensions of CT Series flanged sensor unit CC003 with separately-mounted transmitter (millimeters)

CT Series CC003 Sensor with Separately-mounted Transmitter (Ferrule or Threaded)



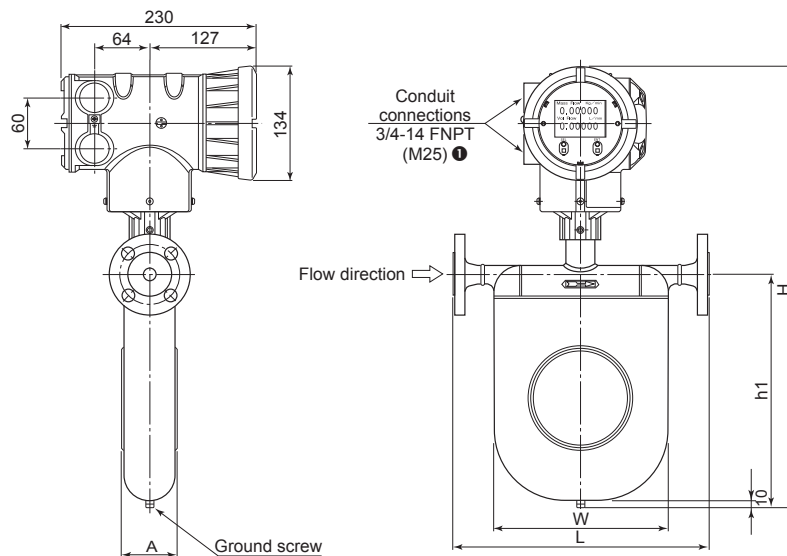
Model	Ferrule		L (mm)	H (mm)	h1 (mm)	A (mm)	W (mm)	D (mm)	Approx. Weight (kg)
	Nominal size	Connection ②							
CC003	10	Ferrule 10A	265	230	67	89.1	192	34	4.5

Model	Threaded Connection	L (mm)	Approx. Weight (kg)
CC003	1/2-14 FNPT	332	4.5

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: A = mm

Figure B.3—Outline dimensions of CT Series ferrule/threaded sensor unit CC003 with separately-mounted transmitter (millimeters)

CT Series CC006 through CC080 Sensor with Integral Transmitter (Flanged)

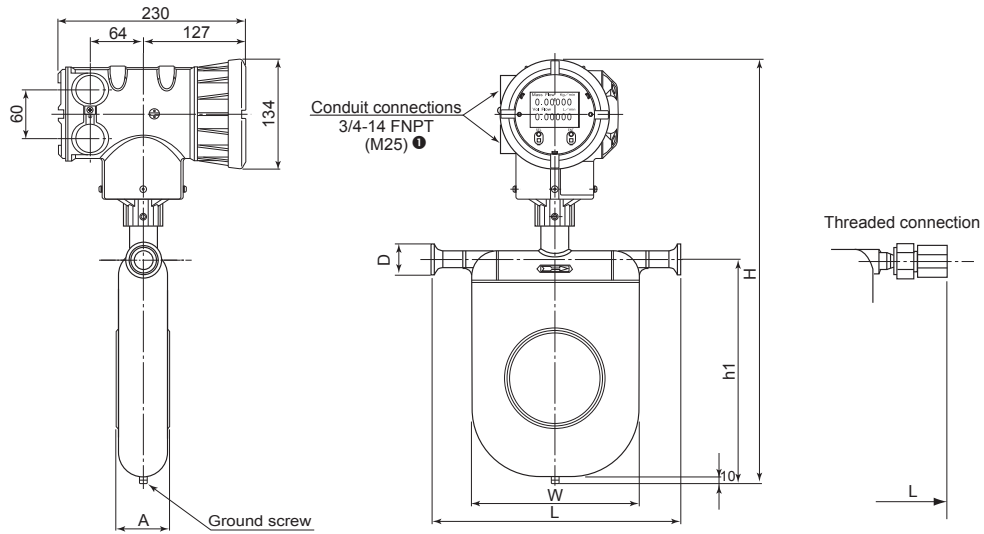


Model	Nominal size (mm)	ASME				Nominal size (DN)	DIN		H (mm)	h1 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
		150	300	600	900 ②		PN 10, 16	PN 25, 40					
		L (mm)					L (mm)						
CC006	10	268	277	289	306	15	241	247	424	180	53	148	7
CC010	15	282	291	303	320	15	256	261	462	218	53	163	7.8
CC015		325	334	347	363	15	299	305	512	268	65	205	8.8
CC025	25	411	424	437	460	25	376	380	580	329	83	262	13.3
CC040	40	547	560	575	603	40	507	513	710	452	121	385	23
CC050	50	550	563	582	641	50	513	519					
CC080	60	699	717	737	777	80	659	675	880	602	174	510	57

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. ASME 900 flanges are only available in Alloy C22 material.
 - This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
 - DIN flanges are only available for meter material SUS316L.

Figure B.4—Outline dimensions of CT Series flanged sensor units CC006 through CC080 with integral transmitter (millimeters)

CT Series CC006 through CC080 Sensor with Integral Transmitter (Ferrule or Threaded)



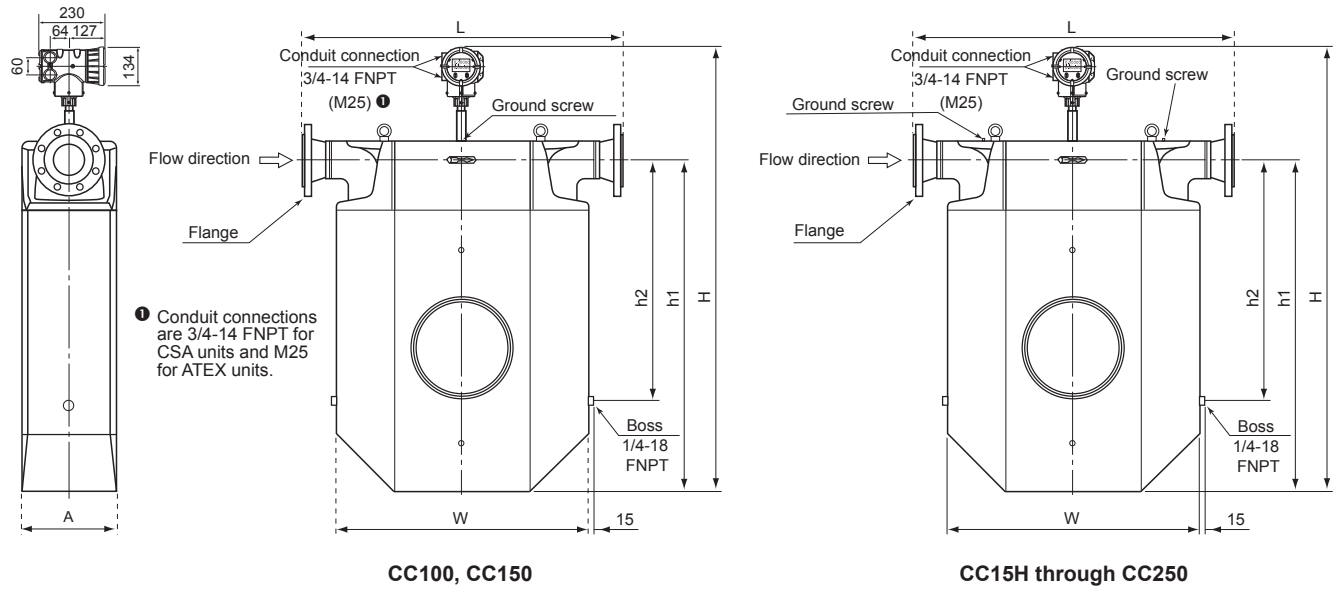
Model	Ferrule		L (mm)	H (mm)	h1 (mm)	A (mm)	W (mm)	D (mm)	Approx. Weight (kg)
	Nominal size	Connection ②							
CC006	10	Ferrule 10A	231.5	434	180	53	148	34	5.7
CC010	15	Ferrule 15A	256	462	218	65	163		6.3
CC015			289	512	268		205		7.1
CC025	25	Ferrule 25 (ISO), IDF 1S	370	580	329	83	262	50.5	10.7
CC040	40	Ferrule 38 (ISO), IDF 1.5S	493	710	452	121	385		19
CC050	50	Ferrule 51 (ISO), IDF 2S						64	
CC080	80	Ferrule 76.1 (ISO), IDF 3S	658.5	880	602	174	510	91	51

Model	Threaded Connection	L (mm)	Approx. Weight (kg)
CC006	1/2-14 FNPT	296	5.7
CC010		312	6.3
CC015	3/4-14 FNPT	382	7.1

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: A = mm, S (sanitary) = in.

Figure B.5—Outline dimensions of CT Series ferrule/threaded sensor units CC006 through CC080 with integral transmitter (millimeters)

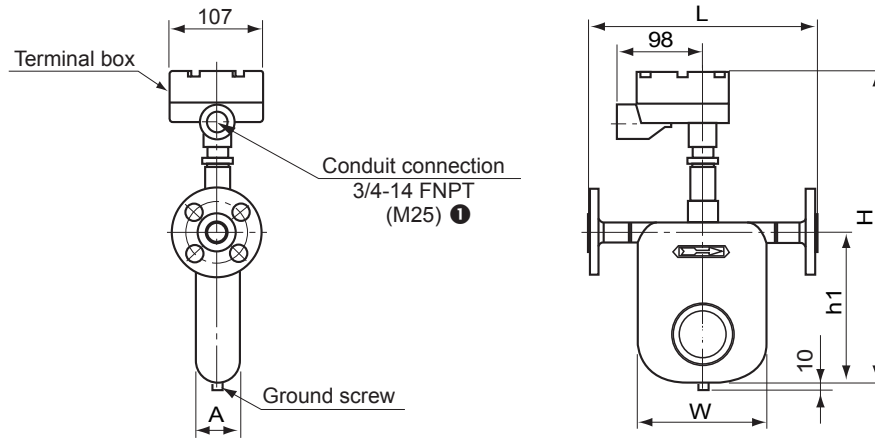
CT Series CC100 through CC250 Sensor with Integral Transmitter (Flanged)



Model	Flange		L (mm)	H (mm)	h1 (mm)	h2 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
	Nominal size	Flange rating							
CC100	4"	ASME 150	1018	1403	1015	660	300	810	231
		ASME 300	1036						
		ASME 600	1082						
	DN100	PN 10, 16	968						
		PN 25, 40	994						
CC150	6"	ASME 150	1318	1403	1015	660	300	810	246
		ASME 300	1338						
		ASME 600	1388						
	DN150	PN 10, 16	1250						
		PN 25, 40	1290						
CC15H	6"	ASME 150	1087	1604	1190	851	320	810	310
		ASME 300	1107						
		ASME 600	1157						
	DN150	PN 10, 16	1019						
		PN 25, 40	1059						
CC200	8"	ASME 150	1418	1604	1190	851	320	810	340
		ASME 300	1438						
		ASME 600	1494						
	DN200	PN 10, 16	1338						
		PN 25	1374						
		PN 40	1390						
CC20H	8"	ASME 150	1418	1830	1390	960	420	1110	610
		ASME 300	1438						
		PN 10, 16	1338						
	DN200	PN 25	1374						
		PN 40	1390						
CC250	10"	ASME 150	1773	1830	1390	960	420	1110	650
		ASME 300	1805						
	DN250	PN 10	1705						
		PN 16	1709						
		PN 25	1745						
		PN 40	1779						

Figure B.6—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with integral transmitter (millimeters)

CT Series CC006 through CC080 Sensor with Separately-mounted Transmitter (Flanged)

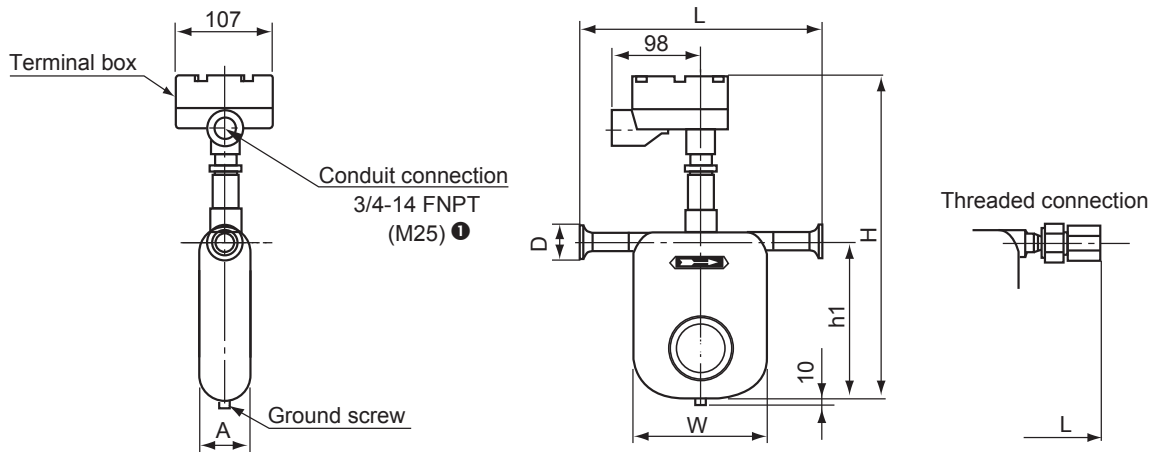


Model	ASME					DIN			H (mm)	h1 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
	Nominal size (mm)	150	300	600	900 ②	Nominal size (DN)	PN 10, 16	PN 25, 40					
		L (mm)					L (mm)						
CC006	10	268	277	289	306	15	241	247	368	180	53	148	4.0
CC010	15	282	291	303	320	15	256	261	406	218	53	163	4.7
CC015		325	334	347	363	15	299	305	456	268	65	205	5.6
CC025	25	411	424	437	460	25	376	380	524	329	83	262	10.4
CC040	40	547	560	575	603	40	507	513	654	452	121	385	20
CC050	2	550	563	582	641	50	513	519					
CC080	3	699	717	737	777	80	659	675					

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 2. ASME 900 flanges are only available in Alloy C22 material.
- This table only applies to meter material SUS316L. For information about material Alloy C22, please consult Cameron.
 - DIN flanges are only available for meter material SUS316L.

Figure B.7—Outline dimensions of CT Series flanged sensor unit CC006 through CC080 with separately-mounted transmitter (millimeters)

CT Series CC006 through CC080 Sensor with Separately-mounted Transmitter (Ferrule or Threaded)



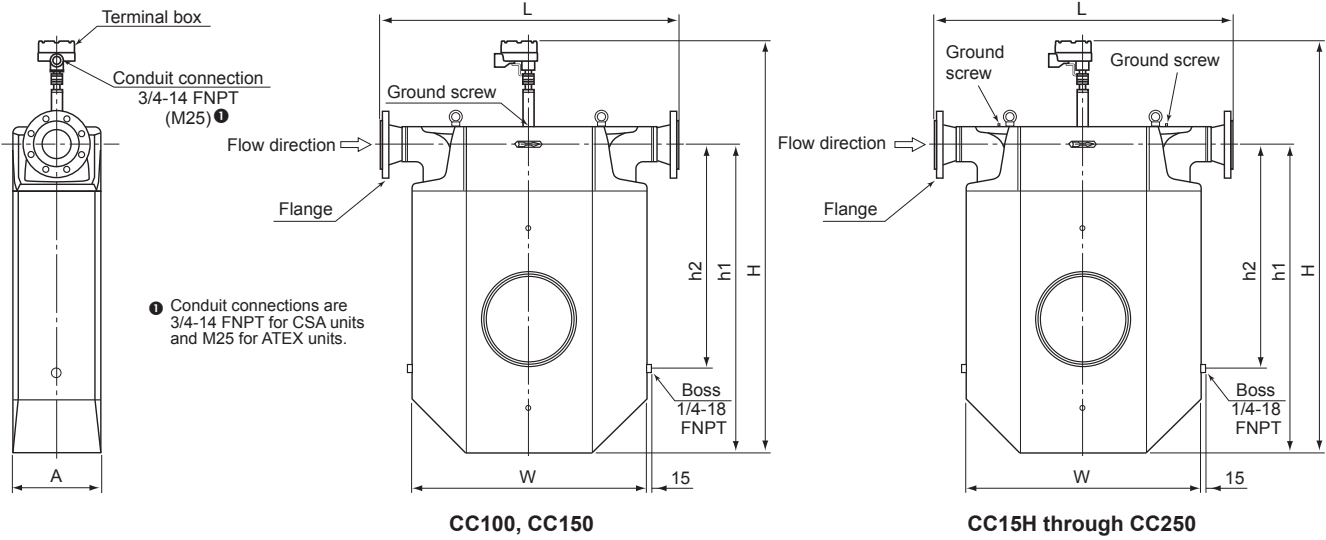
Model	Ferrule		L (mm)	H (mm)	h1 (mm)	A (mm)	W (mm)	D (mm)	Approx. Weight (kg)
	Nominal size	Connection ②							
CC006	10	Ferrule 10A	231.5	368	180	53	148	34	2.8
CC010	15	Ferrule 15A	256	406	218		163		3.4
CC015	15	Ferrule 15A	289	456	268	65	205		4.2
CC025	25	Ferrule 25 (ISO), IDF 1S	370	524	329	83	262	50.5	7.8
CC040	40	Ferrule 38 (ISO), IDF 1.5S	493	654	452	121	385	64	16
CC050	50	Ferrule 51 (ISO), IDF 2S							
CC080	80	Ferrule 76.1 (ISO), IDF 3S	658.5	824	602	174	510		91

Model	Threaded Connection	L (mm)	Approx. Weight (kg)
CC006	1/2-14 FNPT	296	2.8
CC010		312	3.4
CC015	3/4-14 FNPT	382	4.2

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: A = mm, S (sanitary) = in.

Figure B.8—Outline dimensions of CT Series ferrule/threaded sensor units CC006 through CC080 with separately-mounted transmitter (millimeters)

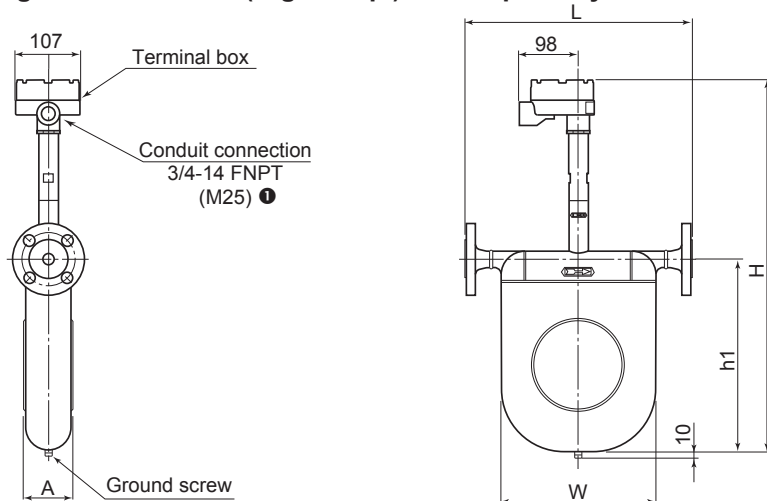
CT Series CC100 through CC250 Sensor with Separately-mounted Transmitter (Flanged)



Model	Flange		L (mm)	H (mm)	h1 (mm)	h2 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
	Nominal size	Flange rating							
CC100	4"	ASME 150	1018	1353	1015	660	300	810	231
		ASME 300	1036						
		ASME 600	1082						
	DN100	PN 10, 16	968						
PN 25, 40		994							
CC150	6"	ASME 150	1318	1353	1015	660	300	810	246
		ASME 300	1338						
		ASME 600	1388						
	DN150	PN 10, 16	1250						
		PN 25, 40	1290						
CC15H	6"	ASME 150	1087	1554	1190	851	320	810	310
		ASME 300	1107						
		ASME 600	1157						
	DN150	PN 10, 16	1019						
		PN 25, 40	1059						
CC200	8"	ASME 150	1418	1554	1190	851	320	810	340
		ASME 300	1438						
		ASME 600	1494						
	DN200	PN 10, 16	1338						
		PN 25	1374						
PN 40	1390								
CC20H	8"	ASME 150	1418	1780	1390	960	420	1110	610
		ASME 300	1438						
	DN200	PN 10, 16	1338						
		PN 25	1374						
		PN 40	1390						
CC250	10"	ASME 150	1773	1780	1390	960	420	1110	650
		ASME 300	1805						
	DN250	PN 10	1705						
		PN 16	1709						
		PN 25	1745						
		PN 40	1779						

Figure B.9—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with separately-mounted transmitter (millimeters)

CT Series CC025 through CC080 Sensor (High-temp.) with Separately-mounted Transmitter (Flanged)

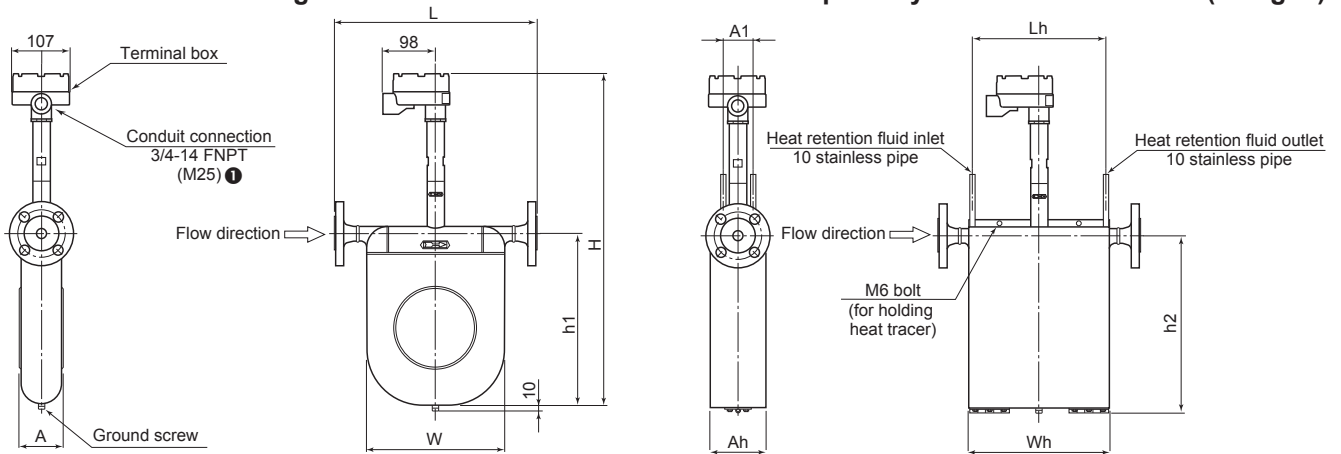


Model	ASME					DIN			H (mm)	h1 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
	Nominal size (mm)	150	300	600	900 ②	Nominal size (DN)	PN 10, 16	PN 25, 40					
		L (mm)					L (mm)						
CC025	25	411	424	437	N/A	25	376	380	638	329	83	262	10.9
CC040	40	547	560	575	N/A	40	507	513	768	452	121	385	20.3
CC050	50	550	563	582	N/A	50	513	519					20.7
CC080	80	699	717	737	777	80	659	675	960	602	174	510	54.1

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 2. ASME 900 flanges are only available in Alloy C22 material.
- DIN flanges are only available for meter material SUS316L.

Figure B.10—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with separately-mounted transmitter (millimeters)

CT Series CC025 through CC080 Sensor with Heat Tracer and Separately-mounted Transmitter (Flanged)



① Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.

Model	Nominal size (mm)	Heat Tracer Model Compatibility	Lh (mm)	h2 (mm)	Ah (mm)	A1 (mm)	Wh (mm)	Approx. Weight (kg)
CC025	25	HT1-025A	254	340	106	56	268	16.9
CC040	40	HT1-040A	376	464	144	70	390	31.8
CC050	50	HT1-040A	376	464	144	70	390	32.2
CC080	80	HT1-080A	501	612	198	110	545	75.1

Figure B.11—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with heat tracer and separately-mounted transmitter (millimeters)

CT Series CC100 and CC150 Sensor (High-temperature) with Separately-mounted Transmitter (Flanged)

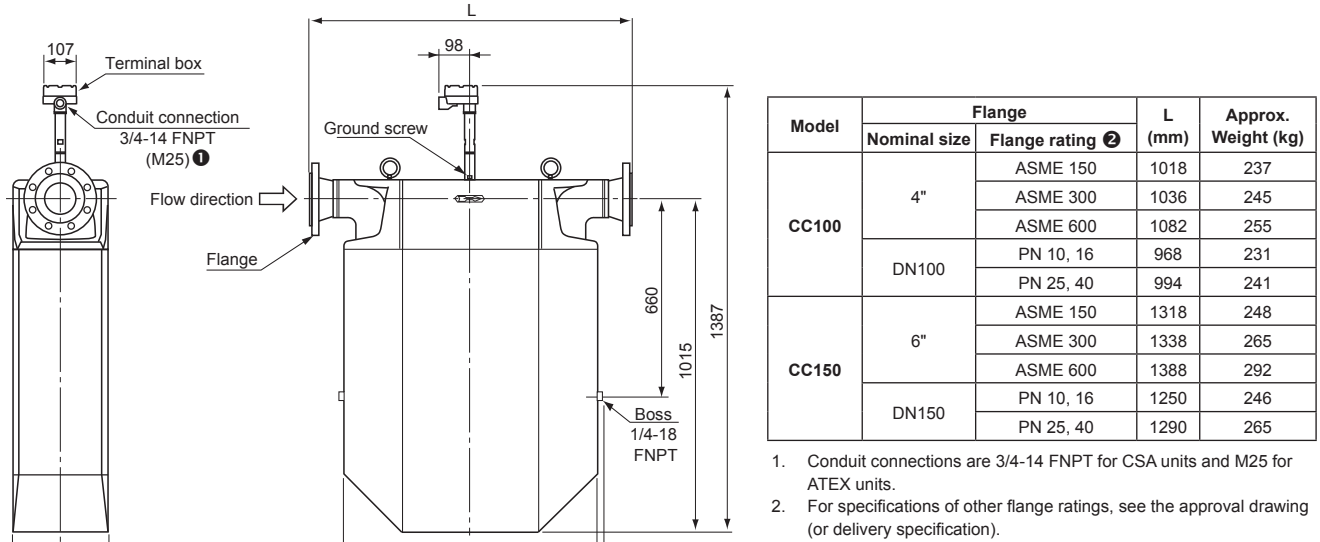


Figure B.12—Outline dimensions of CT Series flanged sensor units CC100 and CC150 with separately-mounted transmitter (millimeters)

CT Series CC025 through CC080 Sensor (Low-temp.) with Separately-mounted Transmitter (Flanged)

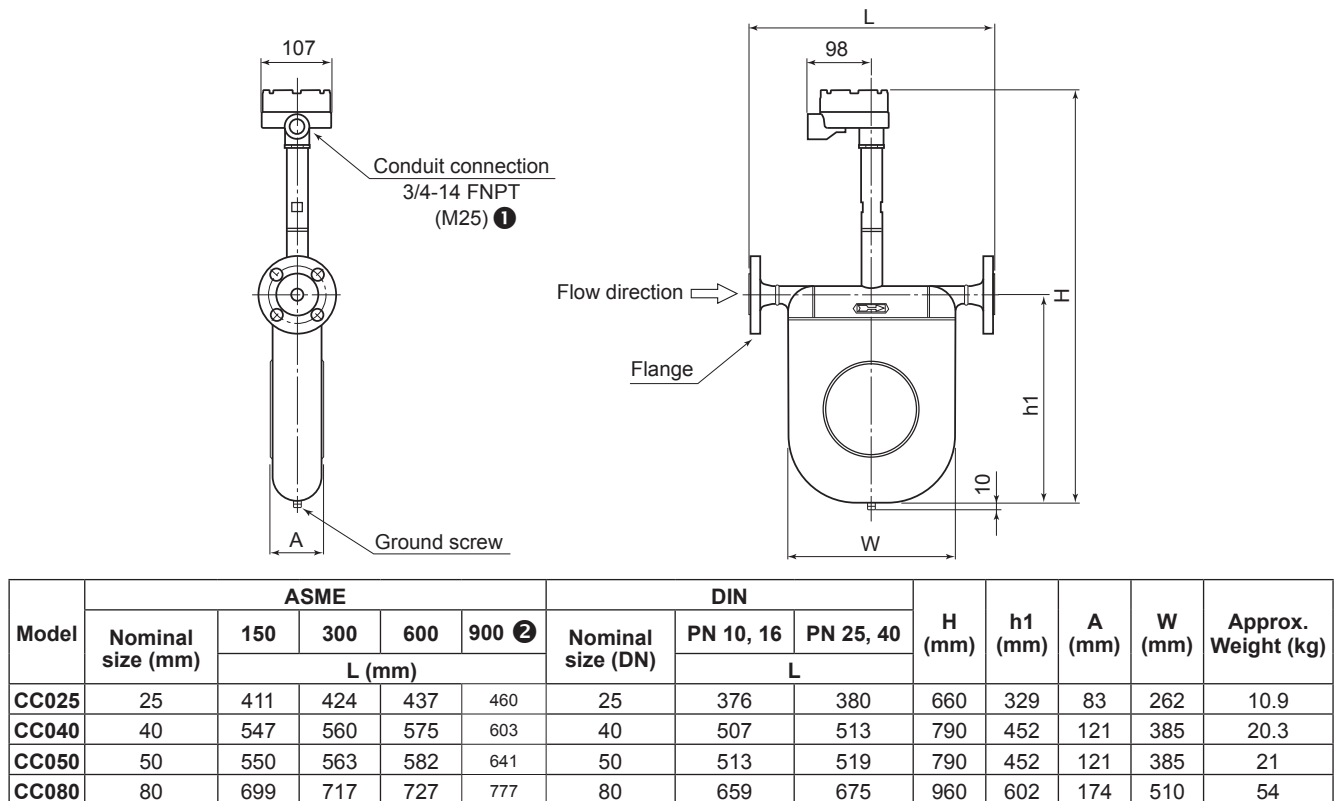
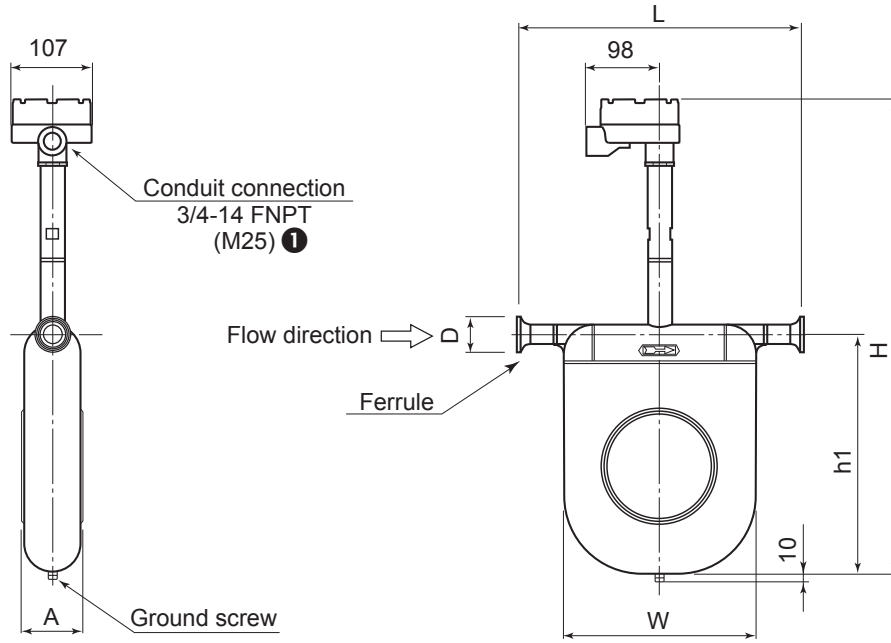


Figure B.13—Outline dimensions of CT Series flanged sensor units CC025 through CC080 with separately-mounted transmitter (millimeters)

CT Series CC025 through CC080 Sensor (Low-temp.) with Separately-mounted Transmitter (Ferrule)

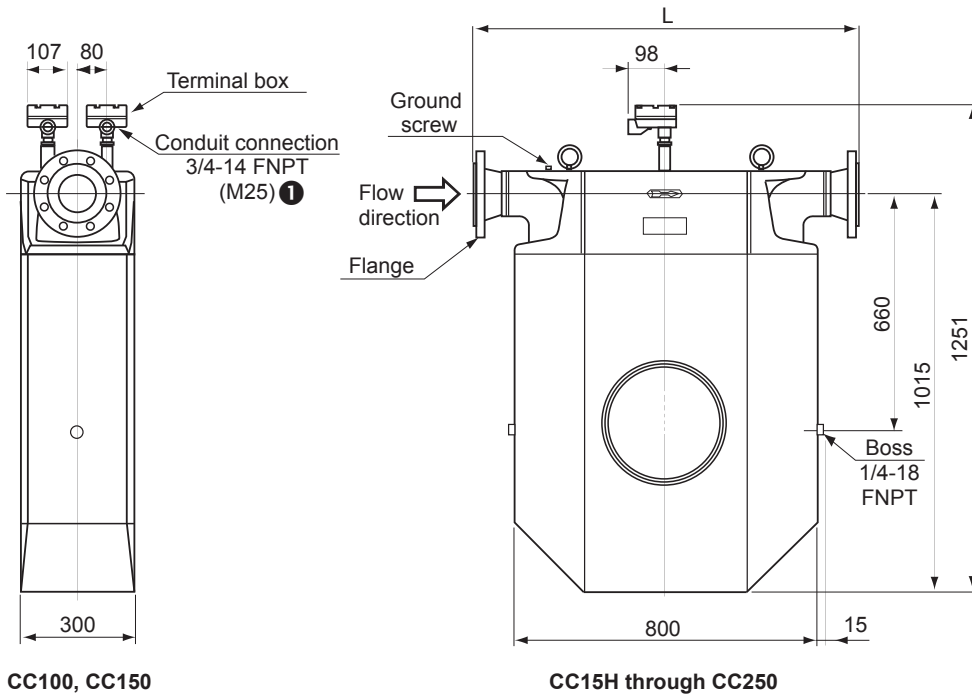


Model	Ferrule		L (mm)	H (mm)	h1 (mm)	A (mm)	W (mm)	D (mm)	Approx. weight (kg)
	Nominal size	Connection ²							
CC025	25	Ferrule 25 (ISO), IDF 1S	370	660	329	83	262	50.5	8.3
CC040	40	Ferrule 38 (ISO), IDF 1.5S	493	790	452	121	385	50.5	17
CC050	50	Ferrule 51 (ISO), IDF 2S	493	790	452	121	385	64	17
CC080	80	Ferrule 76.1 (ISO), IDF 3S	658.5	960	602	174	510	91	48

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
2. Process connection: S = in.

Figure B.14—Outline dimensions of CT Series ferrule sensor units CC025 through CC080 with separately-mounted transmitter (millimeters)

CT Series CC100 through CC250 Sensor (Low-temp.) with Separately-mounted Transmitter (Flanged)



CC100, CC150

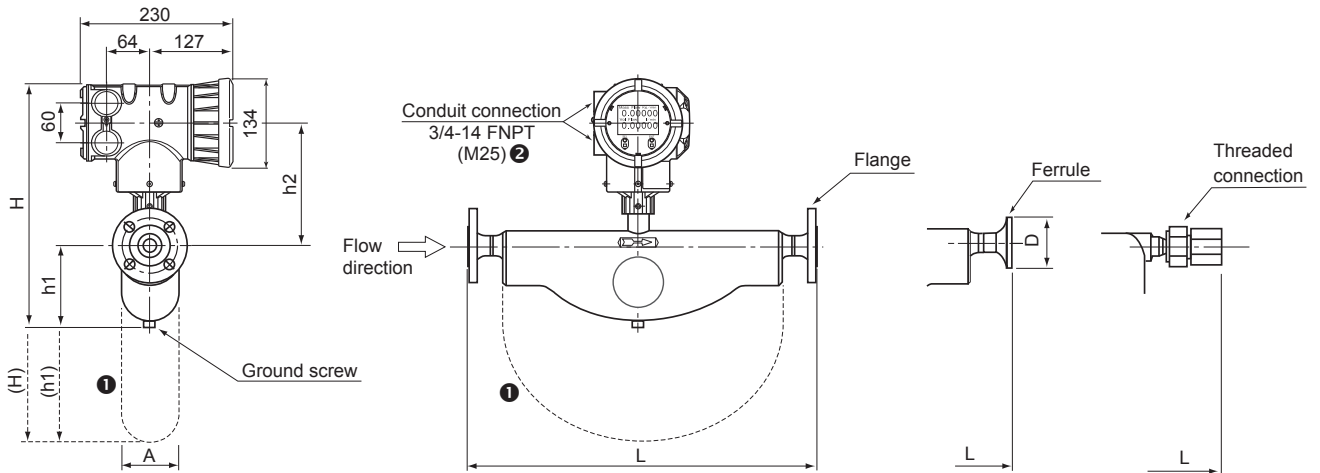
CC15H through CC250

Model	Flange		L (mm)	H (mm)	h1 (mm)	h2 (mm)	A (mm)	W (mm)	Approx. Weight (kg)
	Nominal size	Flange rating 2							
CC100	4"	ASME 150	1018	1387	1015	660	300	810	231
		ASME 300	1036						
		ASME 600	1082						
	DN100	PN 10, 16	968						
		PN 25, 40	994						
CC150	6"	ASME 150	1318	1387	1015	660	300	810	246
		ASME 300	1338						
		ASME 600	1388						
	DN150	PN 10, 16	1250						
		PN 25, 40	1290						
CC15H	6"	ASME 150	1087	1588	1190	851	320	810	310
		ASME 300	1107						
		ASME 600	1157						
	DN150	PN 10, 16	1019						
		PN 25, 40	1059						
CC200	8"	ASME 150	1418	1588	1190	851	320	810	340
		ASME 300	1438						
		ASME 600	1494						
	DN200	PN 10, 16	1338						
		PN 25	1374						
	PN 40	1390							
CC20H	8"	ASME 150	1418	1814	1390	960	420	1110	610
		ASME 300	1438						
		PN 10, 16	1338						
	DN200	PN 25	1374						
		PN 40	1390						
CC250	10"	ASME 150	1773	1814	1390	960	420	1110	650
		ASME 300	1805						
	DN250	PN 10	1705						
		PN 16	1709						
		PN 25	1745						
	PN 40	1779							

1. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 2. For specifications of other flange ratings, see the approval drawing (or delivery specification).

Figure B.15—Outline dimensions of CT Series flanged sensor units CC100 through CC250 with separately-mounted transmitter (millimeters)

PRO Series CP006 through CP050 Sensor with Integral Transmitter* (Flanged, Ferrule, or Threaded)



Model	Nominal size (mm)	ASME			H	h1	h2	A	Approx. Weight (kg)
		150	300	600					
		L							
CP006	10	369	378	390.5	344	94	192	59	7.3
CP010	15	406	415	427.5	341	94	189	59	7.6
CP015	15	512	521	533.5	432	168	206	91	11.6
CP025	25	601	613	626	426	175	194	91	14.2
CP040	40	660	673	688.5	578	323	197	125	32.8
CP050	50	663	676	695	578	323	197	125	33.2

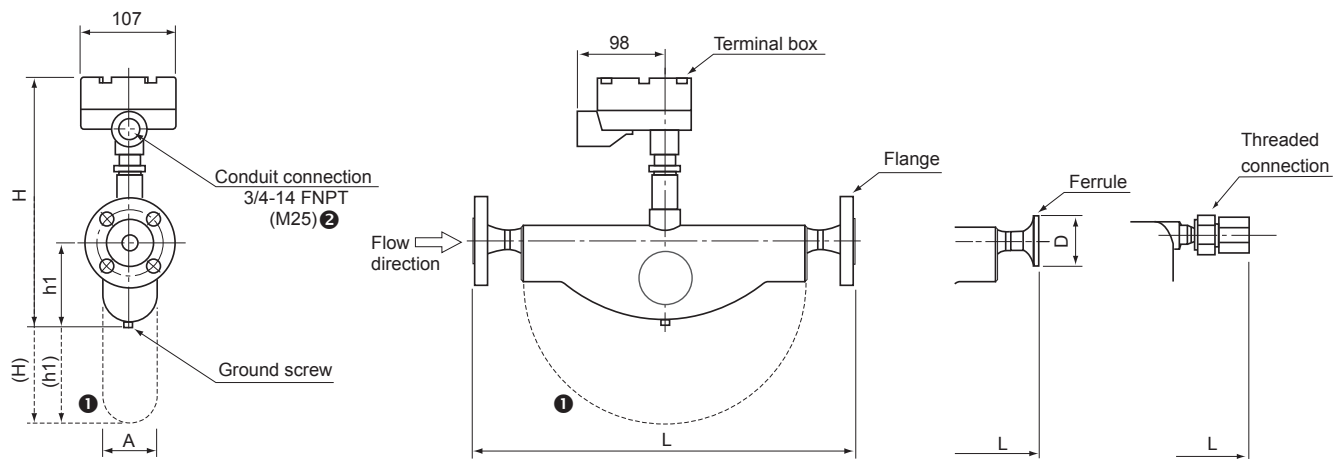
Model	Ferrule			
	Connection ③	L	D	Approx. Weight (kg)
CP006	10A	333	34	5.2
CP010	15A	380	34	6.1
CP015	15A	476	34	9.9
CP025	25 (ISO), IDF 1S	559	50.5	11.1
CP040	38 (ISO), IDF 1.5S	606	50.5	29.3
CP050	51 (ISO), IDF 2S		64	

Model	Threaded		
	Threaded Connection	L (mm)	Approx. Weight (kg)
CP006	1/2-14 FNPT	399	5.2
CP010	1/2-14 FNPT	435.5	6.1
CP015	3/4-14 FNPT	588	9.9

1. Dotted lines show the envelope of models CP040 and CP050.
 2. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
 3. Process connection: A = mm, S (sanitary) = in.
- * Pressure-tight packing assembly only provided for explosion-proof models. See [Section 10—Explosion-proof Specifications, page 113](#), for details.

Figure B.16—Outline dimensions of PRO Series flanged/ferrule sensor units CP006 through CP050 with integral transmitter (millimeters)

PRO Series CP006 through CP050 Sensor with Separately-mounted Transmitter (Flanged, Ferrule, or Threaded)



Model	Nominal size (mm)	ASME			H	h1	A	Approx. Weight (kg)
		150	300	600				
CP006	10	369	378	390.5	301	94	59	4.7
CP010	15	406	415	427.5	298	158	59	5.0
CP015	15	512	521	533.5	389	168	91	9.0
CP025	25	601	613	626	384	175	91	11.6
CP040	40	660	673	688.5	535	323	125	30.2
CP050	50	663	676	695	535	323	125	30.6

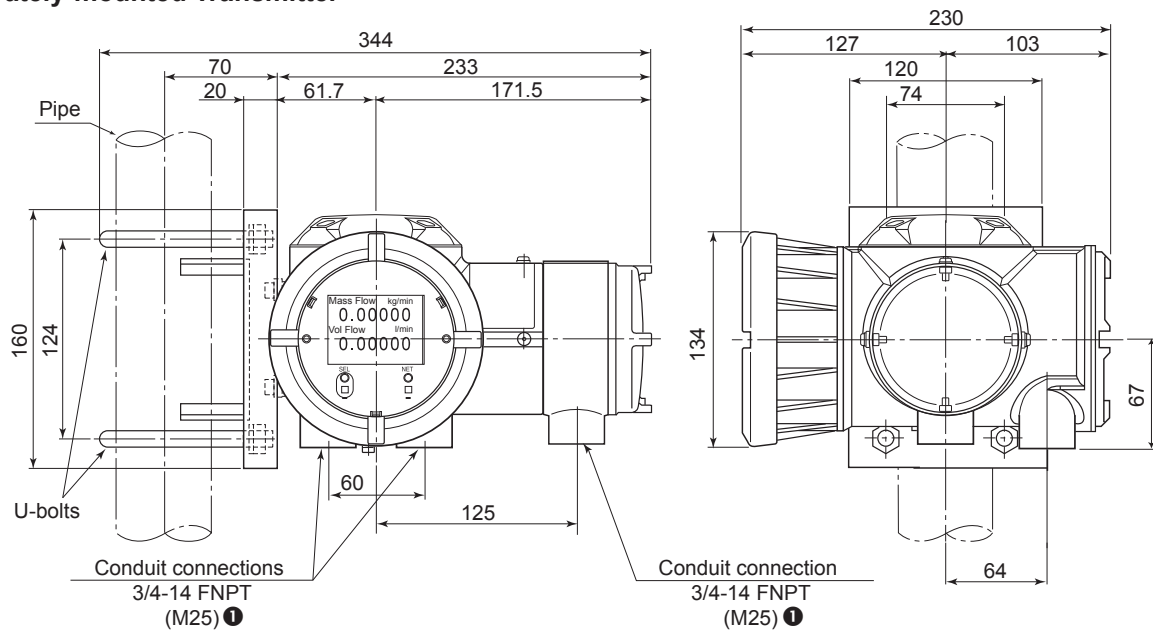
Model	Ferrule			
	Connection ③	L	D	Approx. Weight (kg)
CP006	10A	333	34	2.6
CP010	15A	380	34	3.5
CP015	15A	476	34	7.3
CP025	25 (ISO), IDF 1S	559	50.5	8.5
CP040	38 (ISO), IDF 1.5S	606	50.5	26.7
CP050	51 (ISO), IDF 2S	606	64	26.7

Model	Threaded		
	Threaded Connection	L (mm)	Approx. Weight (kg)
CP006	1/2-14 FNPT	399	2.6
CP010	1/2-14 FNPT	435.5	3.5
CP015	3/4-14 FNPT	588	7.3

1. Dotted lines show the envelope of models CP040 and CP050.
2. Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.
3. Process connection: A = mm, S (sanitary) = in.

Figure B.17—Outline dimensions of PRO Series flanged sensor units CP006 through CP050 with separately-mounted transmitter (millimeters)

Separately-mounted Transmitter



① Conduit connections are 3/4-14 FNPT for CSA units and M25 for ATEX units.

Pipe mounting hardware (U-bolts) are furnished as standard accessories. The pipe must be provided by the customer.

Figure B.18—Outline dimensions of separately-mounted transmitter (millimeters)

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