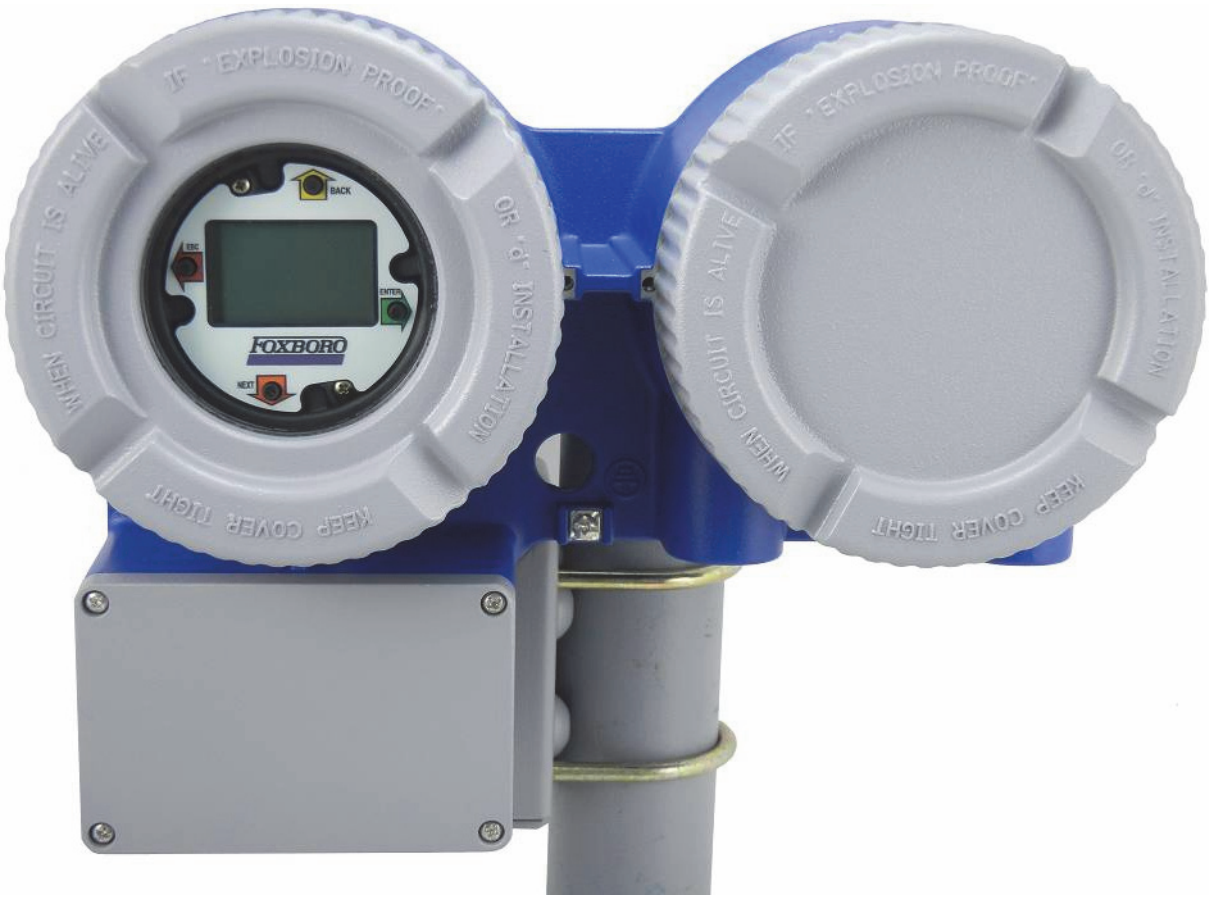
Instruction

MI 019-142
March 2016

Model NOCT60A Net Oil Coriolis Transmitter



Foxboro®

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1. Introduction

Overview

The NOCT60A Net Oil Coriolis Transmitter, when used with a Foxboro® CFS flowtube, integrates Foxboro-patented digital Coriolis technology with Realflo® industry-leading flow computation software and PLC-style logic to provide a complete solution for liquid net oil measurement.

The transmitter provides frequency, scaled pulse, 4 to 20 mA current, alarm, and contact outputs. It also supports nonvolatile totalization of the output. Modbus communication protocol allows full intelligent digital communications using a Modbus communication interface.

You can configure the transmitter functions via the pushbuttons on the transmitter's LCD indicator, or via the PC-based CFT51 Configurator. The flow computer functions are configured with Realflo PC software. If you have a PC that is equipped with both the CFT51 Configurator and the Realflo software, a Launch CFT51 button on the Realflo toolbar allows you to launch the CFT51 Configurator from within Realflo.

Logic Programming

The NOCT60A can be configured to run logic programs created using either the Telepace® Studio or SCADAPack® IEC 61131-3 Workbench software, as specified in the model code.

The default configuration, model code selection -P, permits ladder diagrams (LDs) created using Telepace Studio to be downloaded and run on the NOCT60A. The NOCT60A includes a license to run the Telepace Studio software (IDE), so no additional licensing is required.

If the NOCT60A is ordered with model code -Q, it is delivered with a firmware configuration to run IEC 61131-3 logic programs. The IEC 61131-3 development environment (IDE) required to create these logic programs is the SCADAPack Workbench. The SCADAPack Workbench is included on the NOCT60A DVD; however, this requires purchase of a license to run the IDE software. If needed, this license can be purchased by ordering Foxboro Auxiliary Specification SPW-L.

A NOCT60A can be converted in the field to run logic programs with the alternate development environment. In this case, a firmware and software change is required, and the flow computer application must be re-loaded. All configurations, flow history, and logic programs must be saved prior to loading the alternate firmware. Telepace ladder logic firmware may be loaded or upgraded using the Firmware Loader application, or Telepace Studio Software. IEC 61131-3 logic firmware may be loaded or upgraded using the Firmware Loader application, or the SCADAPack Configurator application. All of these are included on the NOCT60A Software and Documentation disk.

Refer to the product manuals and software help files on the NOCT60A Software and Documentation disk for additional details on logic programming, upgrading firmware, and upgrading/re-loading the flow computer application.

Reference Documents

In addition to this instruction, there is other user documentation supporting the NOCT60A Transmitter, as listed in Table 1.

Table 1. Reference Documents

Document Number	Document Description
DP 019-366	Dimensional Print – CFS10 Style B Flowtubes (1/8 inch)
DP 019-182	Dimensional Print – CFS10 Style B Flowtubes (1/4 through 2 inch)
DP 019-183	Dimensional Print – CFS20 Style B Flowtubes (1-1/2 and 3 inch)
DP 019-186	Dimensional Print – CFS25 Flowtubes
DP 019-376	Dimensional Print – CFT51 and NOCT60A Transmitters
MI 019-120	Instruction – CFS10 and CFS20 Mass Flowtubes
MI 019-125	Instruction – CFS25 Mass Flowtubes
MI 019-140	Instruction – CFT51 Transmitter
MI 019-141	Instruction – CFT51 and NOCT60A Safety Connection Diagrams (FM, CSA)
MI 019-179	Flow Products Safety Information (ATEX, IECEx)
MI-019-276	Advanced DTM Library – Operation Using Modbus Communication Protocol
PL 008-752	Parts List – CFT51 and NOCT60A Transmitters
PL 008-733	Parts List – CFS10 Style B Flowtubes
PL 008-735	Parts List – CFS20 Style B Flowtubes
Realflo® Reference Manual	
Realflo® User Manual	
Firmware Loader Manual	

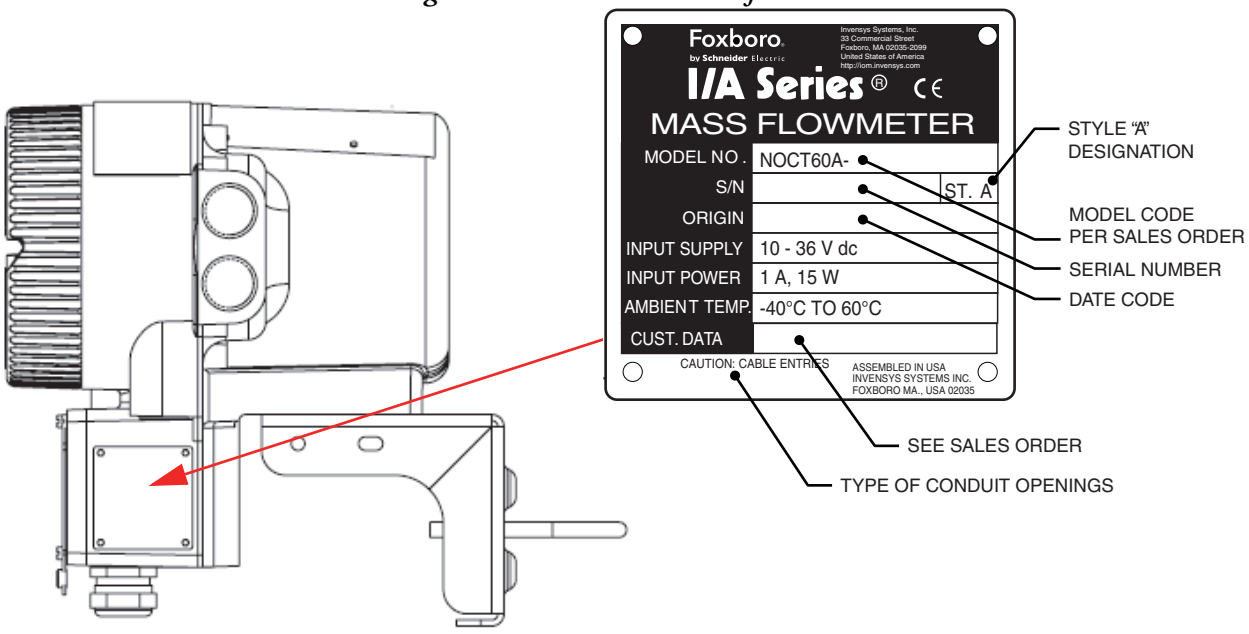
Additional Documentation

Detailed documentation for the Telepace® Studio and SCADAPack® IEC 61131-3 Workbench software is available in the help files that accompany the software.

Transmitter Identification

A data plate fastened to the side of the housing provides the model number and other information as shown in Figure 1. Some of this information is also available in the configuration software of the transmitter.

Figure 1. Transmitter Identification



Standard Specifications

Refer to Chapter 3, "Wiring" for additional specifications regarding the individual inputs/outputs and communication ports.

Table 2. Standard Specifications

Item	Specification
Ambient Temperature Normal Operating Condition Limits	–40 and +60°C (–40 and +140°F) (a)
Relative Humidity Limits	5 and 100% (with transmitter covers installed)
Vibration Limits	5 m/s^2 (0.5 "g") from 5 to 500 Hz
Power Supply	10 to 36 Vdc 10 W typical; 15 W maximum 3 A startup current
Flow Computer Electronics	1.75 W maximum LAN disable power reduction is 850mW (b) Low power mode power reduction is 150mW (b) 375 mA fuse
Terminations	Screw terminations Solid or stranded wire; 24 to 12 AWG/ 0.5 to 2.5 mm^2
Non-Volatile RAM	CMOS RAM with lithium battery retains contents for 2 years with no power
Clock	±1 minute/month at 25°C +1/-3 minutes/month 0 to 50°C

a. At temperatures between -40 and -20° C, the display may fade or be blank; however, the device is still operational.

b. Refer to the user documentation for Telepace Studio and SCADAPack Workbench for details about LAN disable power reduction and low power mode.

Modbus Specifications (Coriolis)

Item	Possible Configurations	As Shipped Configuration
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400 (a)	38400 (b)
Format	None, Odd, Even	None
Device Address	1 through 247	247
Byte Order	0123, 2301, 1032, 3210	2301

a. This is the baud rate for communication between the Coriolis transmitter electronics and the flow computer electronics. Although other settings may appear to be available, a baud rate of 38400 is required for proper functioning.

b. The NOCT60A is shipped with a 38400 baud rate; however, if you reset the Coriolis electronics, the baud rate will default to 9600 baud. Use the CFT51 Configurator or the buttons on the LCD display to change the baud rate to 38400.

Electromagnetic Compatibility (EMC) Specifications

The NOCT60A Transmitter complies with the international and European Union standards listed in Table 3.

Table 3. International and European Union Standards

Parameter	IEC Standard	EN Standard
Radiated RFI Immunity	10 V per IEC 61000-4-3	10 V per EN 61000-4-3
Conducted RFI Immunity	10 V per IEC 61000-4-6	10 V per EN 61000-4-6
RFI Radiated and Conducted Emissions	Per CISPR 11, Class A	Per EN 55011, Class A
ESD Immunity	6 kV contact discharge per IEC 61000-4-2	6 kV contact discharge per IEC 61000-4-2
Electrical Fast Transients/Burst Immunity: Power	2 kV per IEC 61000-4-4	2 kV per EN 61000-4-4
Electrical Fast Transients/Burst Immunity: I/Os	1 kV per IEC 61000-4-4	1 kV per EN 61000-4-4
Surge Immunity: Power	2 kV per IEC 61000-4-5	2 kV per IEC 61000-4-5
Surge Immunity: I/Os	1 kV per IEC 61000-4-5	1 kV per IEC 61000-4-5
Power Dips and Interruptions	Per IEC 61000-4-11	Per EN 61000-4-11

Electrical Safety Specifications

These transmitters have been designed to meet the electrical safety descriptions listed in the table below. For detailed information, or status of testing laboratory approvals/certifications, contact Global Customer Support.

Types of Protection and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX, II 2 (1) G Ex d [ia IIB Ga] IIC T6 Gb	Flameproof enclosure with Intrinsic safe sensor outputs. Temperature Class T6. Ta = -40°C to +60°C.	ADA
ATEX, II 2 (3) G Ex d [ic IIB Gc] IIC T6 Gb	Flameproof enclosure with Energy Limited or intrinsic safe zone 2 sensor outputs. Temperature Class T6. Ta = -40°C to +60°C.	ADN (a)
ATEX, II 3 (1) G Ex nA [ia IIB Ga] IIC T4 Gc	Non-sparking enclosure with Intrinsic safe sensor Temperature Class T4. Ta = -40°C to +60°C.	ANA
ATEX, II 3 G Ex nA IIC T4 Gc	Non-sparking Temperature Class T4. Ta = -40°C to +60°C	ANN (a)
CSA/CSAus XP Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1; AIS Class I, Division 1, Groups A, B, C, and D; Ex d IIC [ia] IIB; AEx d IIC [ia] IIB	Explosionproof and Flameproof enclosure with intrinsically safe outputs Temperature Class T6. Ta = -40°C to +60°C Temperature Class T4. Ta = -40°C to +60°C	CDA
CSA/CSAus XP Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1; ANI Class I, Division 2, Groups A, B, C, and D; Ex d [nL] IIC; AEx d [nC] IIC	Explosionproof and Flameproof enclosure with Non-Incendive outputs Temperature Class T6. Ta = -40°C to +60°C Temperature Class T4. Ta = -40°C to +60°C	CDN (a)
CSA/CSAus NI Class I, Division 2, Groups A, B, C, and D; also intrinsically safe for AIS Class I, Division 1, Groups A, B, C, and D; AEx nA IIC [ia] IIB; Ex nA IIC [ia] IIB	Non-incendive enclosure with intrinsically safe outputs Temperature Class T4. Ta = -40°C to +60°C	CNA
CSA/CSAus NI Class I, Division 2, Groups A, B, C, and D; also nonincendive for ANI Class I, Division 2, Groups A, B, C, and D; AEx nA [nL] IIC; Ex nA [nC] IIC	Non-incendive and Non-sparking Temperature Class T4. Ta = -40°C to +60°C	CNN (a)

Types of Protection and Area Classification	Application Conditions	Electrical Safety Design Code
IECEx, Ex d [ia IIB Ga] IIC T6 Gb	Flameproof enclosure with Intrinsic safe sensor outputs. Temperature Class T6 Ta = -40°C to +60°C	EDA
IECEx, Ex d [ic IIB Gc] IIC T6 Gb	Flameproof enclosure with Energy Limited or intrinsic safe zone 2 sensor outputs Temperature Class T6. Ta = -40°C to +60°C	EDN (a)
IECEx, Ex nA [ia IIB Ga] IIC T4 Gc	Non-sparking enclosure with Intrinsic safe sensor. Temperature Class T4 Ta = -40°C to +60°C	ENA
IECEx, Ex nA IIC T4 Gc	Non-sparking Temperature Class T4. Ta = -40°C to +60°C	ENN (a)
No Certifications	Not Applicable	ZZZ

a. Not available with CFS25 flowtubes.

Electrical Safety Warnings

⚠ WARNING

Do not open while circuits are live.
Do not open when energized or when an explosive atmosphere may be present.
Substitution of components may impair intrinsic safety or Division 2 approvals.

For Explosionproof Certifications

⚠ WARNING

Keep cover tight while circuits are live unless area is known to be nonhazardous.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

The flowtube junction box contains more than 10% aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken to prevent impact and friction when installing or using the junction box in a Zone 0 installation.

⚠ CAUTION

The NOCT60A transmitter is to be used only with a Foxboro CFS flowtube in accordance with the safety drawings in MI 019-141 and MI 019-179.

Before You Begin

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

Verify that all installation and setup procedures have been completed.
Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death or serious injury.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future reference.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to help prevent accidental equipment damage.

Acceptable Use

The NOCT60A controller is intended for use in monitoring and controlling non-critical equipment only. It is not intended for safety-critical applications.

⚠ WARNING

UNACCEPTABLE USE

Do not use the NOCT60A controller as an integral part of a safety system. These devices are not safety products.

Failure to follow these instructions can result in death or serious injury.

⚠ CAUTION

EQUIPMENT OPERATION HAZARD

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

For safe and proper operating results, use only Schneider Electric software or approved software with Schneider Electric hardware products.

Failure to follow these instructions can result in minor or moderate injury.

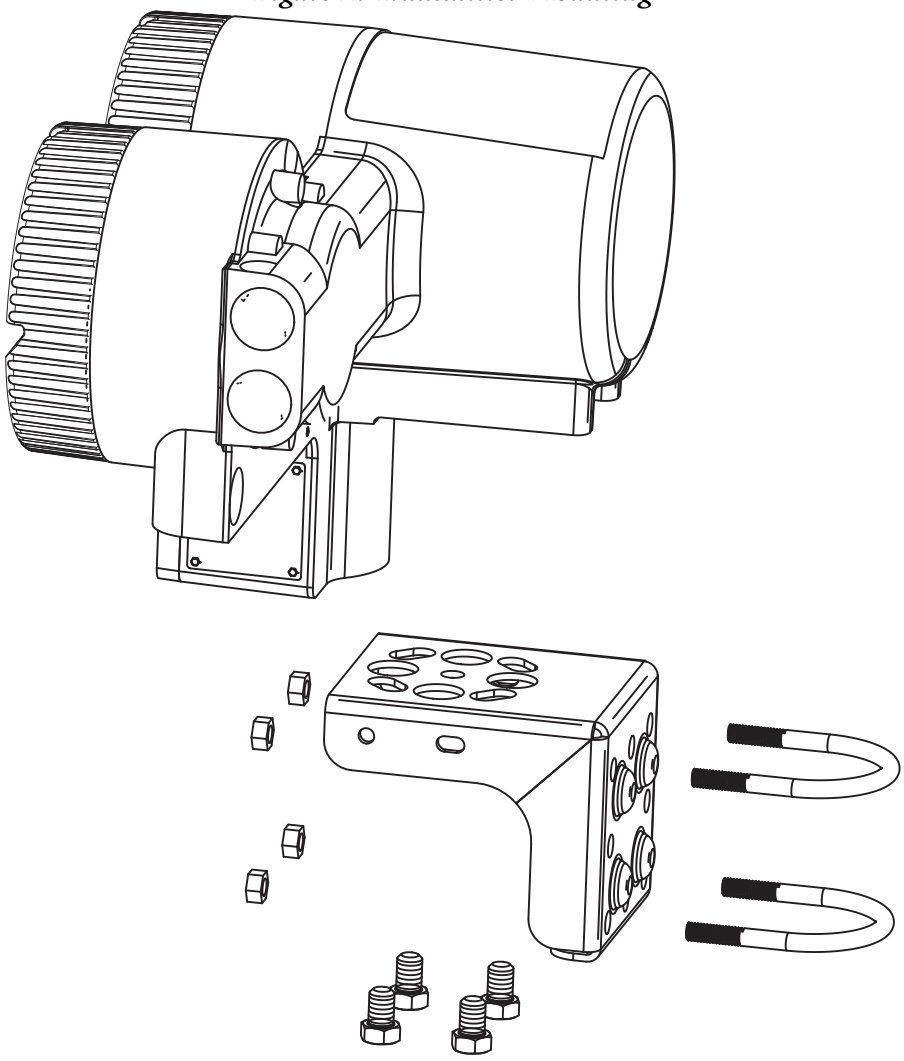
NOCT60A Configuration Steps

1. Install the NOCT60A. See Chapter 2, “Mounting” for details on mounting the hardware. See Chapter 3, “Wiring” for details on connecting the power supply and sensors.
2. Use the CFT51 Configurator to set up the transmitter. Refer to MI 019-140 for details.
3. Use the Realflo software to configure the flow computer. Refer to the Realflo User Manual and Realflo Reference Manual for details.

2. Mounting

Four 0.437-20 UNS threaded holes are provided on the surface of the enclosure on which a carbon steel mounting bracket or optional stainless steel (SS) mounting bracket can be attached. The other surface of the bracket allows for mounting to a surface, or to a nominal DN50 (2 inch) vertical or horizontal pipe. An optional bracket is available for mounting to a DN80 (3 inch) vertical or horizontal pipe. See Figure 2.

Figure 2. Transmitter Mounting



⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the device before removing power.

HAZARD OF ELECTRIC SHOCK

Remove power from the device before mounting it.

Failure to follow these instructions can result in death or serious injury.

NOTICE

CONFIGURATION DATA LOSS

Device configuration information can be lost if the onboard RAM back-up battery goes flat, is disconnected, if the device is damaged, or if there has been a firmware upgrade. Verify the voltage of the onboard RAM back-up battery before installing the device in the field.

Failure to follow these instructions can result in loss of data.

NOTICE

UNEXPECTED EQUIPMENT OPERATION

Do not install the device in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the device.

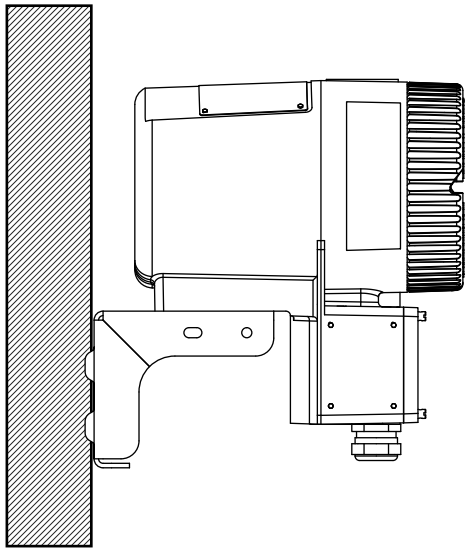
Failure to follow these instructions can result in equipment damage.

Positioning the Housing

The housing can be positioned at almost any angle in a horizontal plane by loosening the bracket bolt and turning the housing with respect to the mounting bracket. See Figure 2.

The NOCT60A transmitter can be mounted to a wall as displayed in Figure 3.

Figure 3. Wall Mounting



The transmitter can be mounted horizontally or vertically to a pipe. Some common mounting configurations are shown in Figures 4, 5, 6, and 7.

Figure 4. Vertical Pipe Mounting - Orientation 1

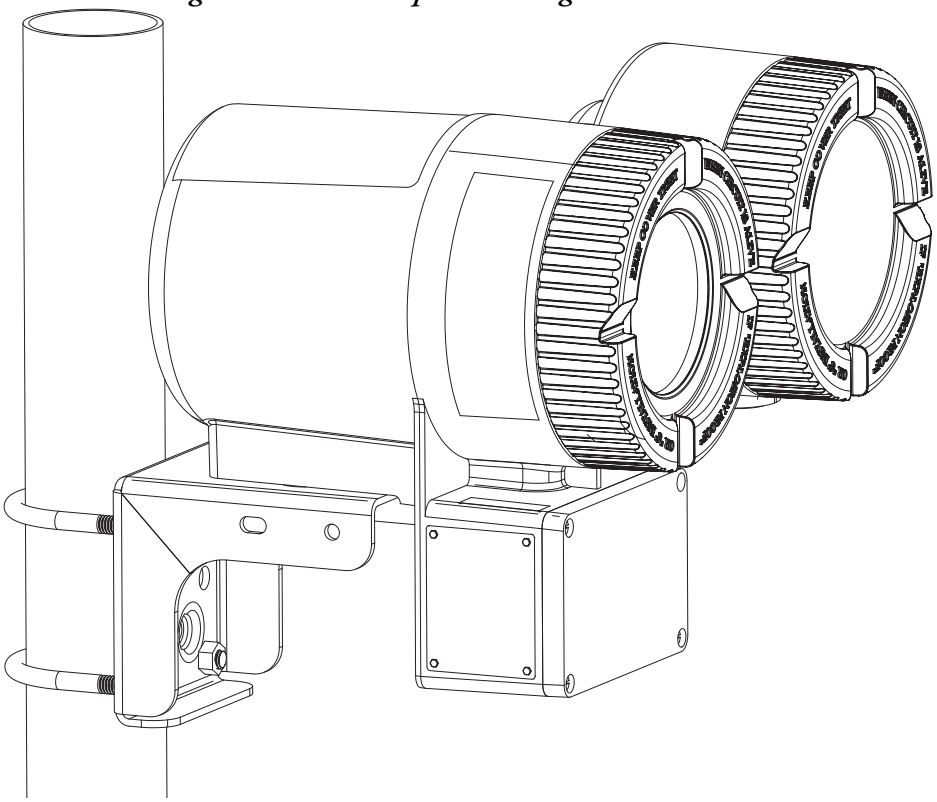


Figure 5. Vertical Pipe Mounting - Orientation 2

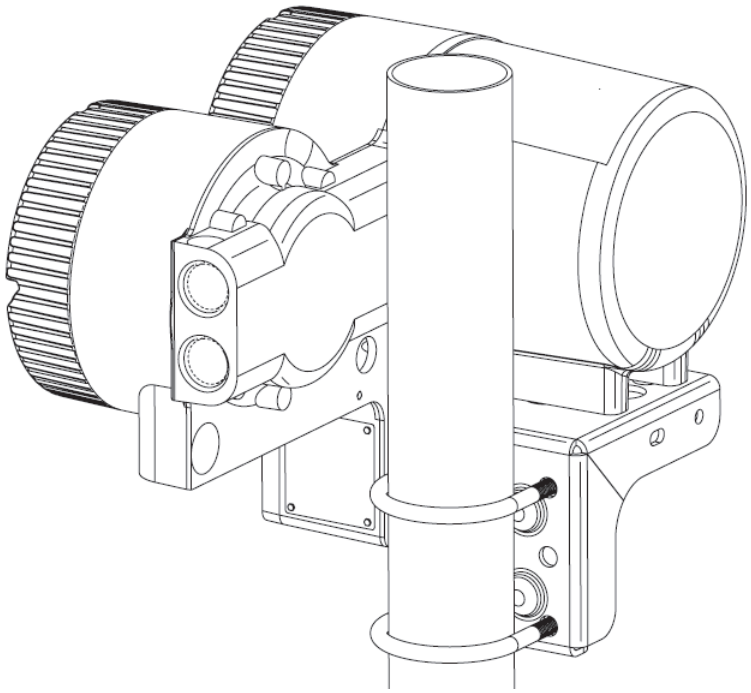


Figure 6. Vertical Pipe Mounting - Orientation 3

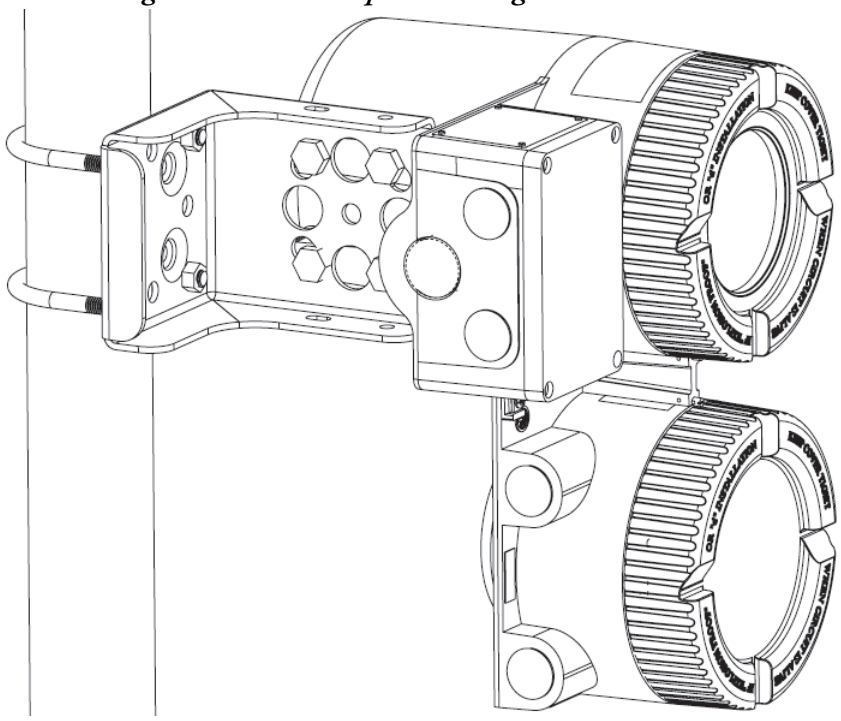
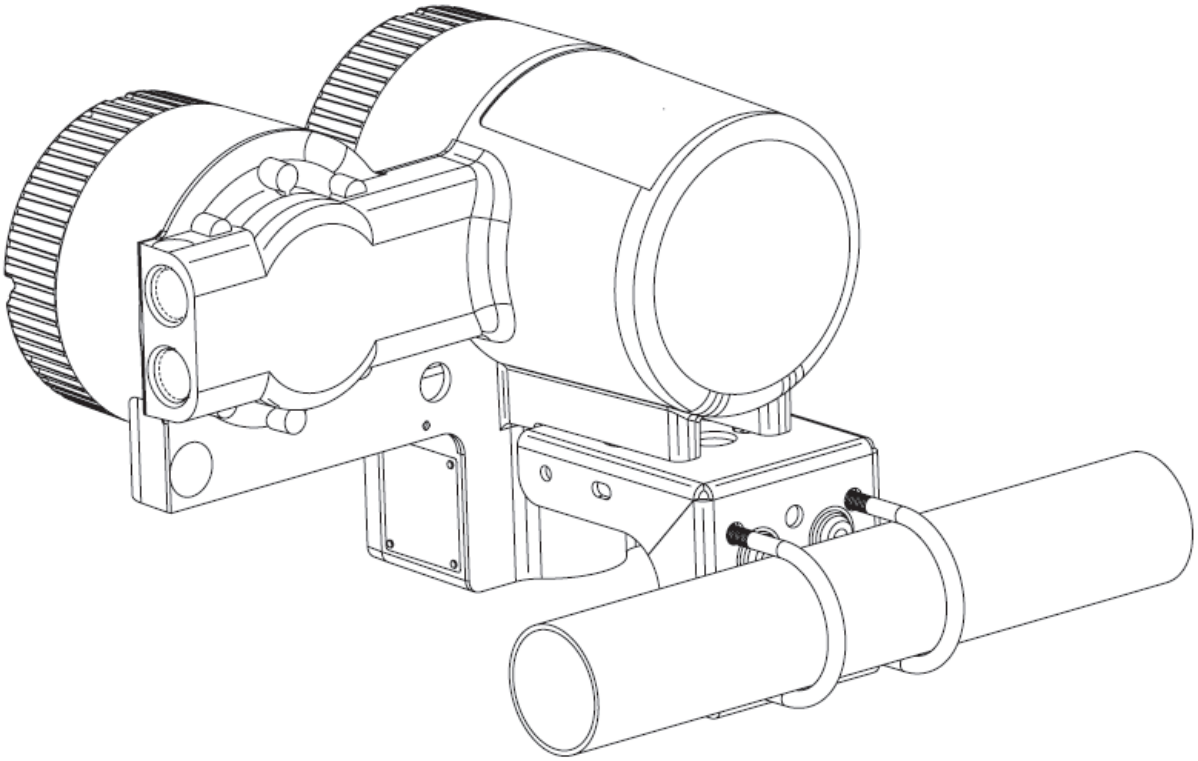


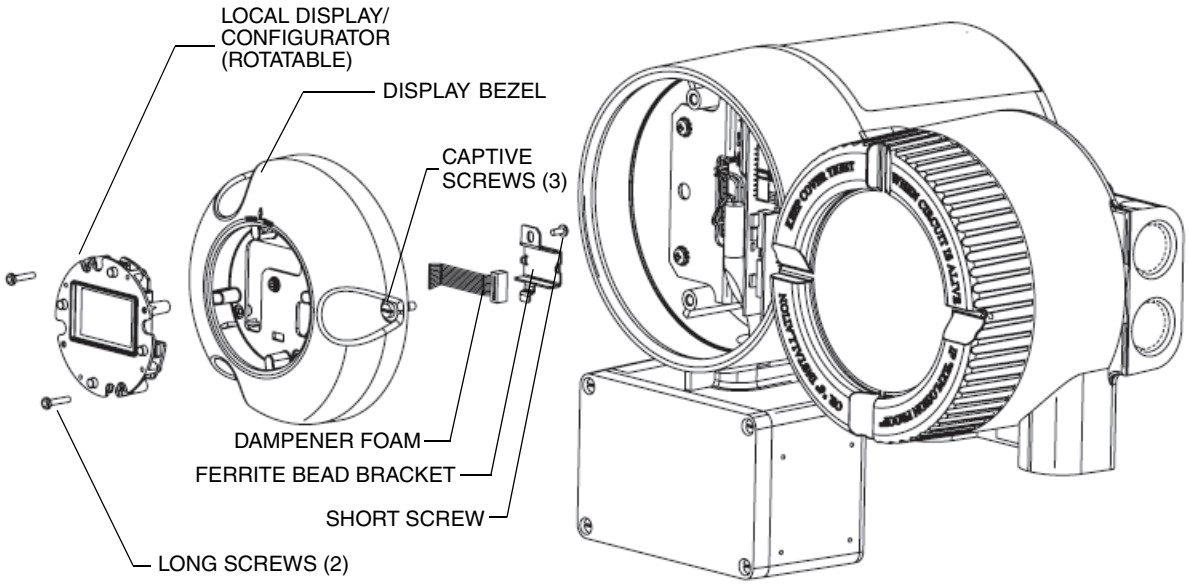
Figure 7. Horizontal Pipe Mounting



Rotating the Display

The Display/Configurator can be rotated in 90 degree increments within the display bezel. The display bezel does not rotate, and must always be mounted in the housing in the orientation shown in Figure 8.

Figure 8. Display Orientation



To rotate the display to the desired orientation:

1. Remove the display assembly by loosening the captive screws.
2. Remove the short screw that retains the ferrite bead bracket and the dampener foam to the back of the molding. Be careful that you save the screw in a safe place for reassembly.
3. Remove the Local Display/Configurator from the Display Bezel by removing the long screws that retain the assembly to the front of the molding.
4. Rotate the Local Display/Configurator to the desired orientation with the display assembly molding and feed the cable of the Local Display/Configurator through the corresponding opening in the molding.
5. Secure the Local Display/Configurator to the bezel using the long screws.
6. Place the dampener foam and the bracket over the ferrite bead on the cable and secure the Local Display/Configurator to the Display Bezel using the short screw.
7. Place the reassembled display assembly in line with the required orientation as shown.
8. Secure the assembly to the housing using the captive screws.

NOTE

The display bezel is not rotatable. The bezel must always be aligned with the housing as shown in Figure 8 to retain the jumper configurations on the electronics module.

Cover Locks

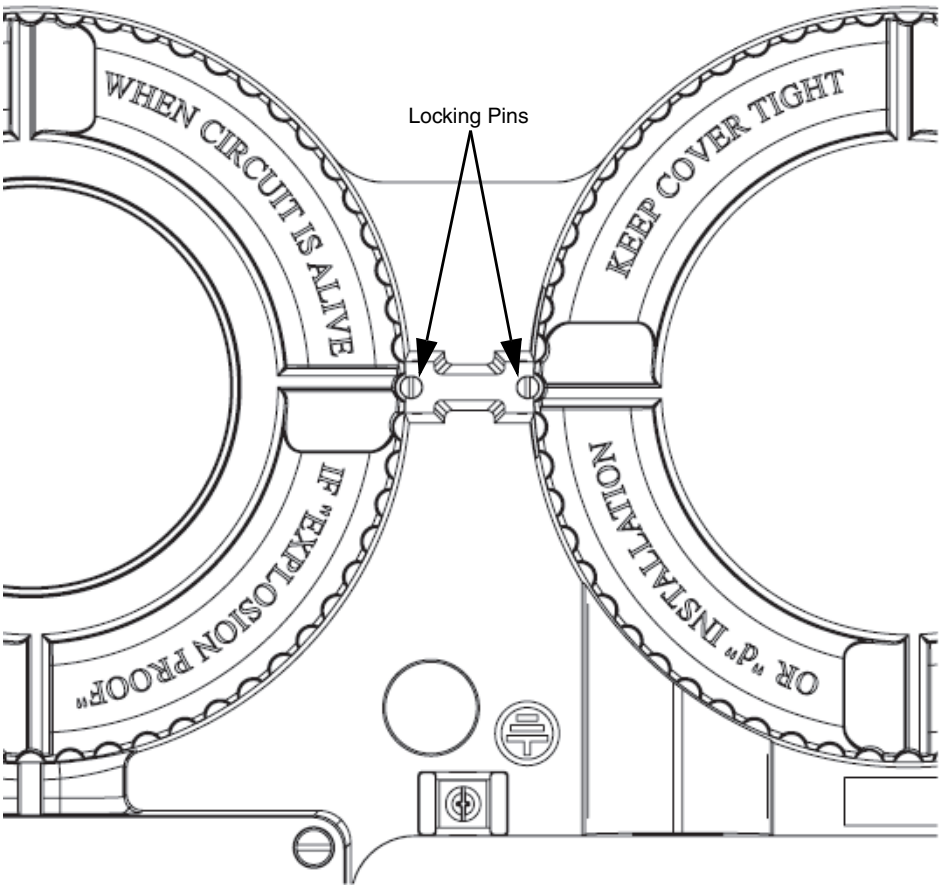
Two lock and seal mechanisms are available with the NOCT60A. Certain locking mechanisms are required for specific applications.

- For all model codes, locking pins are provided for the round electronic housing covers (Figure 9). This cover locking mechanism is required for all agency flameproof applications.
- For the Tamperproof Sealing (-S) model code selection, locking pins are provided with an additional seal wire and crimp seal for the round electronic housing covers (Figure 10). Additional locking mechanisms are provided for the transmitter junction box (Figure 17) and flowtube junction box (CFS10 and CFS20 flowtubes only, Figure 18).

Locking Pins

To lock the two round transmitter housing covers, unscrew each locking pin until approximately 6 mm (0.25 in) engages the groove on the cover. Note that the two round transmitter housing covers must be locked for all agency (ATEX, CSA, IECEx) flameproof certifications.

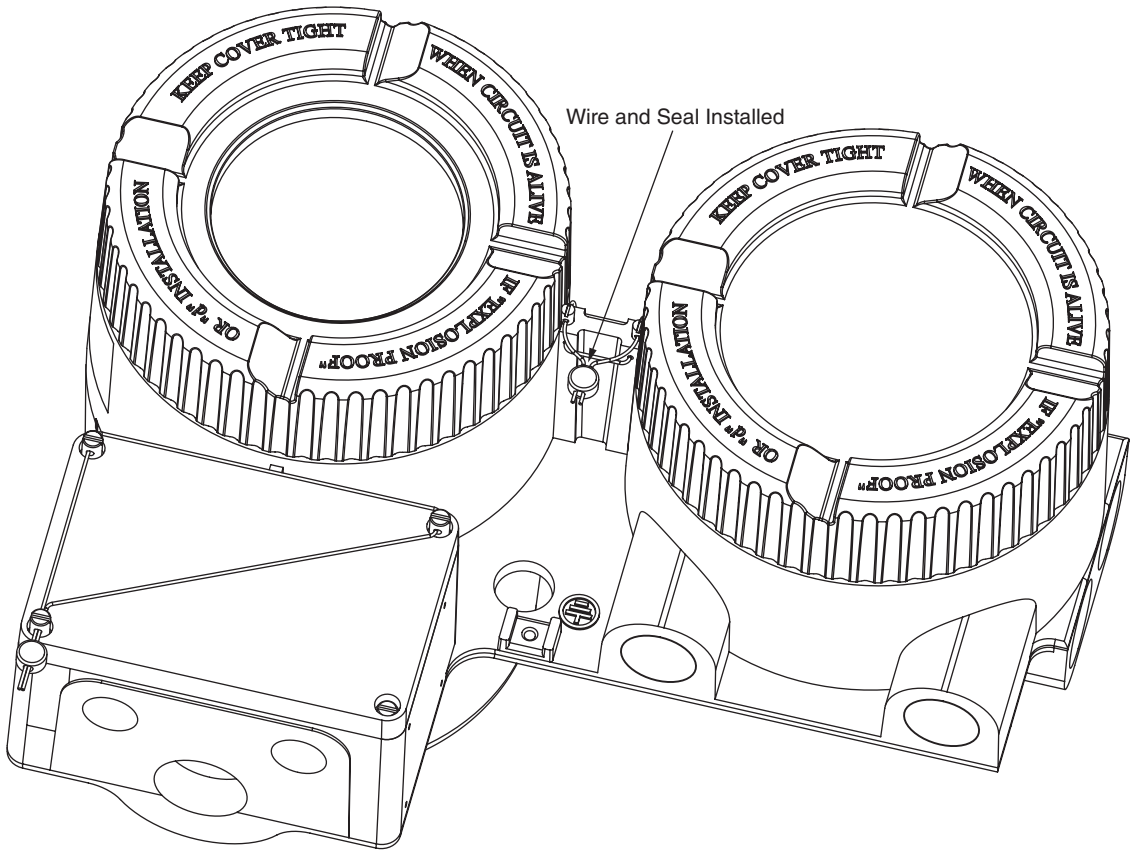
Figure 9. Cover Locking Pins



Wire Seals

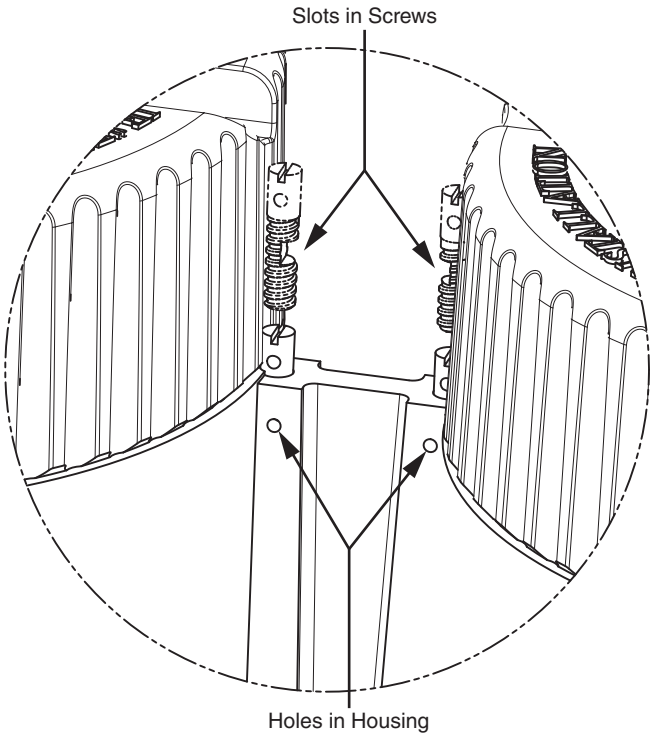
For the Tamperproof Sealing (-S) model code selection, perform the following steps to lock and seal the transmitter housing covers (Figure 10), the transmitter junction box (Figure 17), and flowtube junction box (CFS10 and CFS20 flowtubes only, Figure 18):

Figure 10. Cover Locks for Tamperproof Sealing (-S) Model Code Selection



1. Lock and seal the round transmitter housing covers:
   a. Install the cover lock screws so that the slots in the screws align with the holes in the housing. The screws will stick out approximately ¼ inch. See Figure 11.

Figure 11. Aligning Cover Lock Screws with Housing



b. Insert one end of the seal wire through each of the two holes in the housing and corresponding slots in the locking screws. Pull both ends of the wire until it contacts the housing. See Figure 12 and Figure 13.

Figure 12. Inserting the Wire in the Holes in the Housing

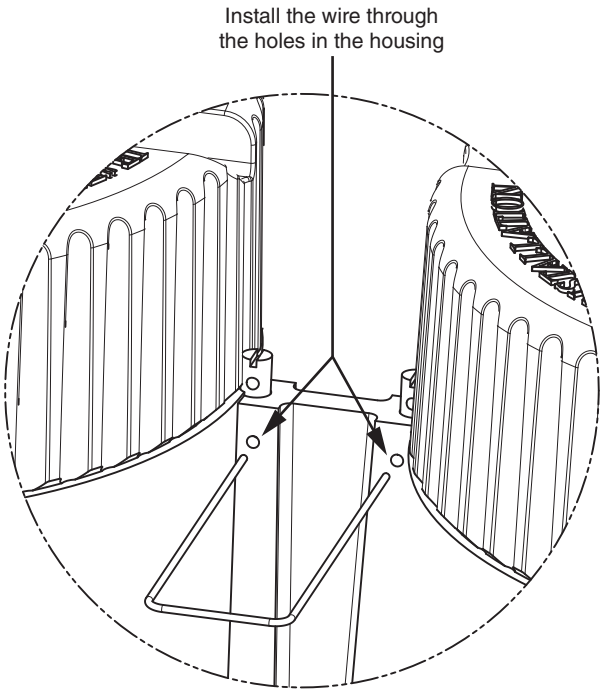
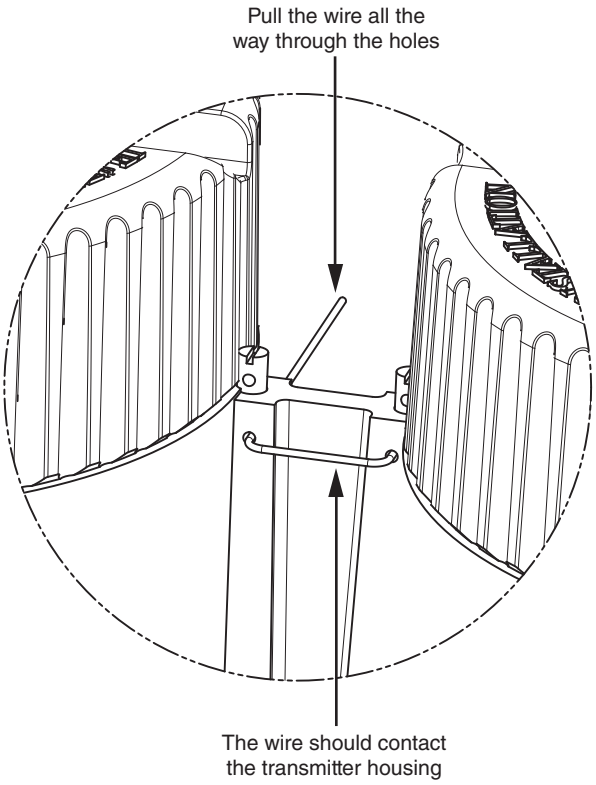
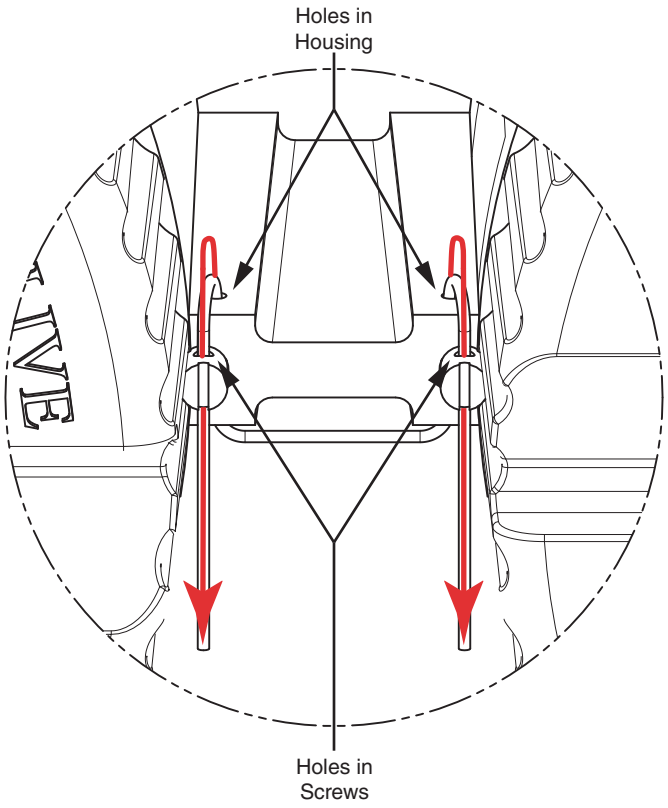


Figure 13. Pulling the Wire Through the Housing



c. Insert one end of the seal wire through each of the two holes in the locking screws and pull both ends of the wire until snug. See Figure 14.

Figure 14. Pulling the Wire Through the Housing Screws



d. Insert both ends of the seal wire through the hole in the seal. Slide the seal up on the wires until the seal is close to the housing, and crimp the seal on the wires to secure them. See Figure 15 and Figure 16.

Figure 15. Inserting Both Ends of the Wire Through the Seal

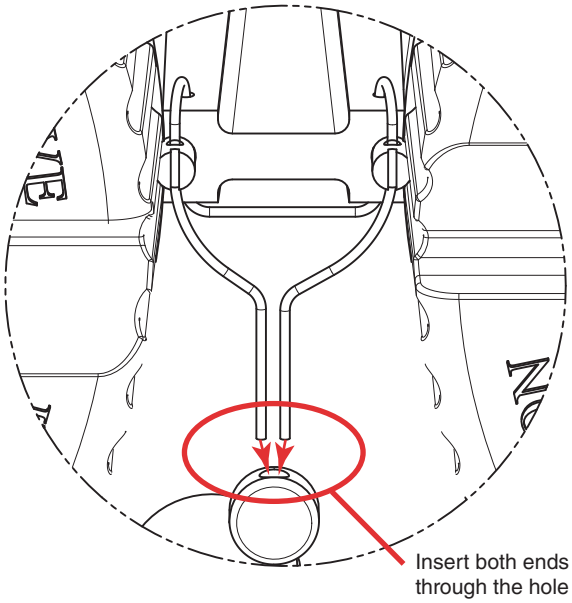
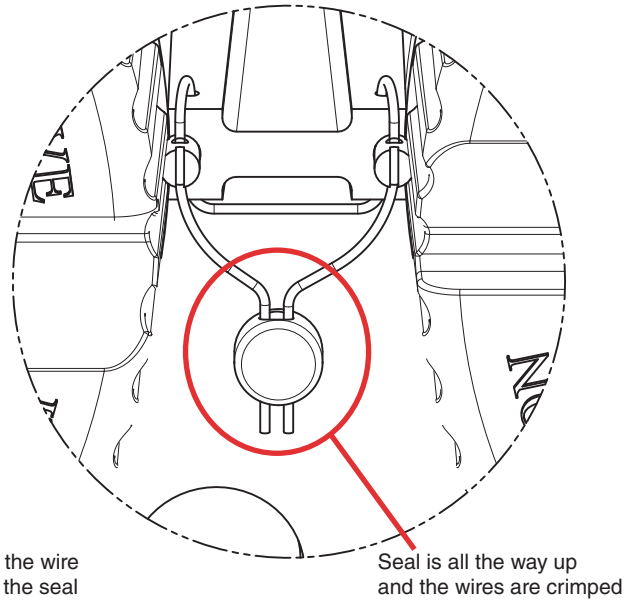
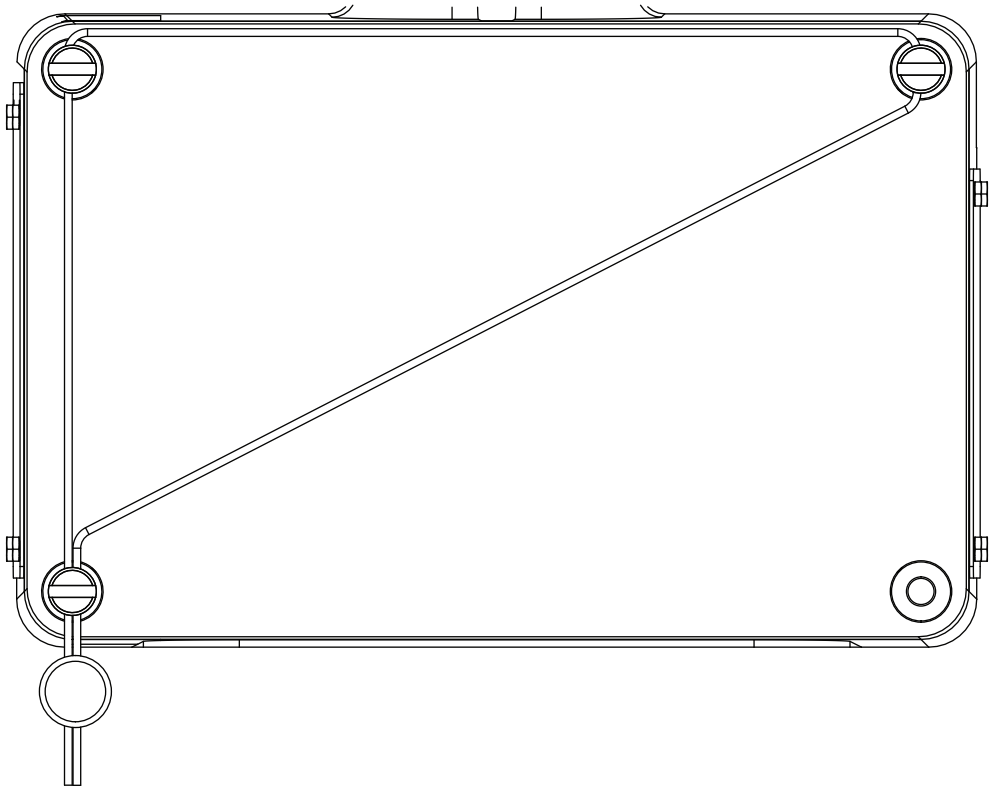


Figure 16. Positioning the Seal and Crimping the Wire



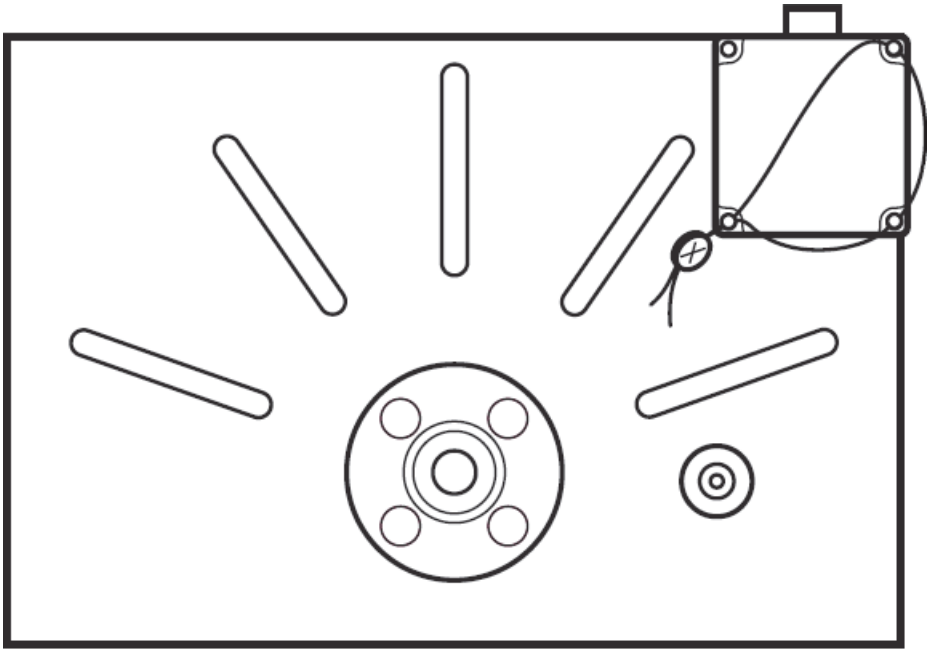
2. Lock the transmitter junction box (Figure 17):
   a. Slide one end of the seal wire through the holes in the three elongated cover screws as shown.
   b. Slide the other end of the wire through the bottom screw as shown, making sure that both ends of the wire pass through the hole in the screw.
   c. Slide the seal onto both wire ends and crimp the seal as shown.

Figure 17. Transmitter Junction Block - Cover Locks



3. Lock the flowtube junction box (CFS10 and CFS20 flowtubes only; Figure 18):
   a. Slide one end of the seal wire through the holes in the three elongated cover screws as shown.
   b. Slide the other end of the wire through the bottom screw as shown, making sure that both ends of the wire pass through the hole in the screw. This is important to ensure that each screw cannot be removed by independent sequential loosening of the screws.
   c. Slide the seal onto both wire ends and crimp the seal as shown.

Figure 18. Flowtube Junction Box



NOTE

For additional information on cover locks for flowtube models CFS10 and CFS20, refer to MI 019-120.

3. Wiring

The installation and wiring of your transmitter must conform to local code requirements.

See Figure 19 for an overview of relevant wiring locations.

See Figure 20 for an overview of transmitter wiring with a CFS10 or CFS20 flowtube; see Figure 21 for an overview of transmitter wiring with a CFS25 flowtube.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the device before removing power.

HAZARD OF ELECTRIC SHOCK

Remove power from the device before removing the device cover.
Remove power from the device before servicing.

Failure to follow these instructions can result in death or serious injury.

NOTICE

CONFIGURATION DATA LOSS

Device configuration information can be lost if the onboard RAM back-up battery goes flat, is disconnected, if the device is damaged, or if there has been a firmware upgrade. Verify the voltage of the onboard RAM back-up battery before installing the device in the field.

Failure to follow these instructions can result in loss of data.

NOTICE

UNEXPECTED EQUIPMENT OPERATION

Do not install the device in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the device.

Failure to follow these instructions can result in equipment damage.

Figure 19. NOCT60A Wiring Locations

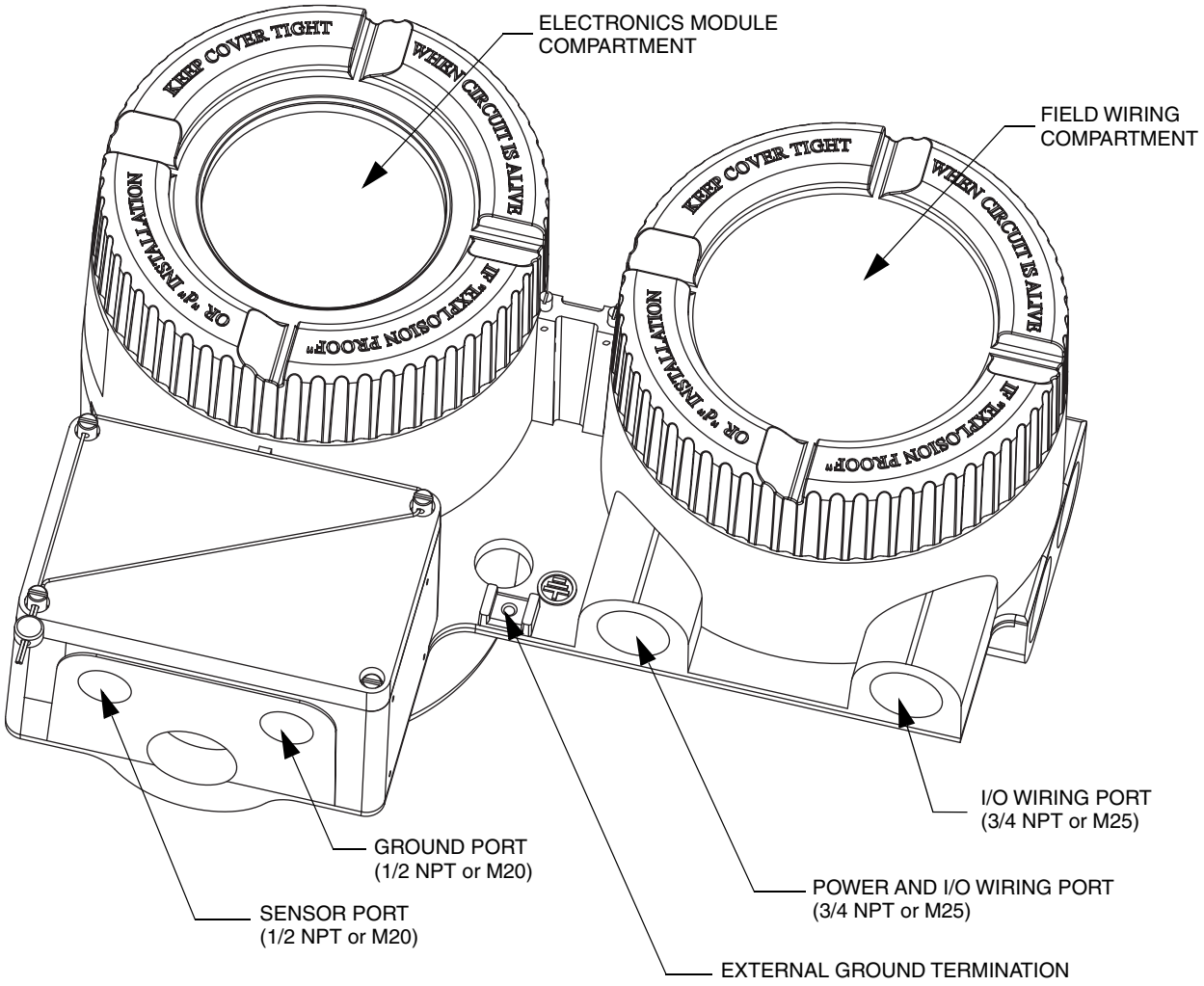
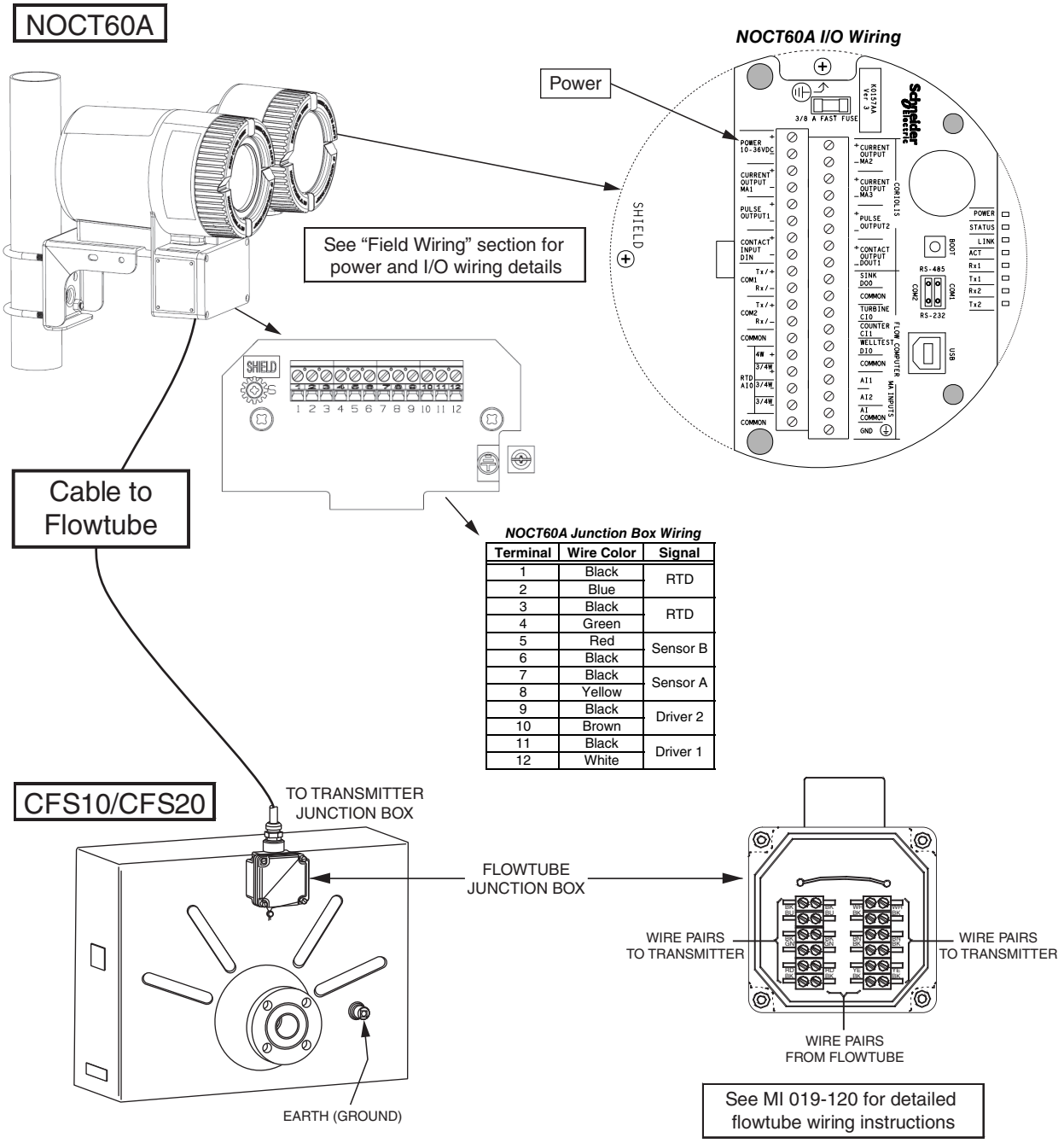
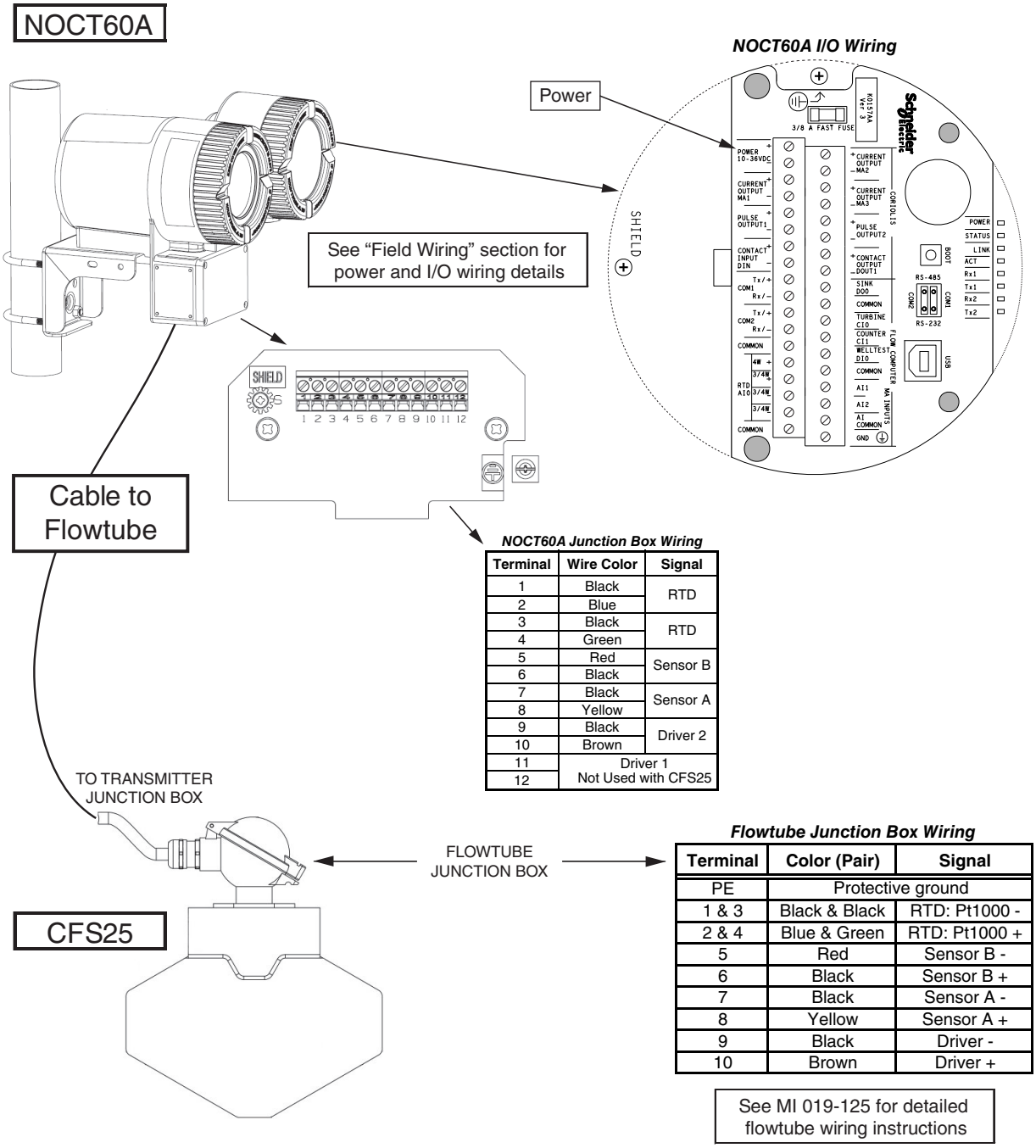


Figure 20. Overview of Transmitter Wiring with a CFS10 or CFS20 Flowtube



Terminal	Wire Color	Signal
1	Black	RTD
2	Blue	
3	Black	RTD
4	Green	
5	Red	Sensor B
6	Black	
7	Black	Sensor A
8	Yellow	
9	Black	Driver 2
10	Brown	
11	Black	Driver 1
12	White	

Figure 21. Overview of Transmitter Wiring with a CFS25 Flowtube



NOCT60A Junction Box Wiring

Terminal	Wire Color	Signal
1	Black	RTD
2	Blue	
3	Black	RTD
4	Green	
5	Red	Sensor B
6	Black	
7	Black	Sensor A
8	Yellow	
9	Black	Driver 2
10	Brown	
11	Driver 1 Not Used with CFS25	
12		

Flowtube Junction Box Wiring

Terminal	Color (Pair)	Signal
PE	Protective ground	
1 & 3	Black & Black	RTD: Pt1000 -
2 & 4	Blue & Green	RTD: Pt1000 +
5	Red	Sensor B -
6	Black	Sensor B +
7	Black	Sensor A -
8	Yellow	Sensor A +
9	Black	Driver -
10	Brown	Driver +

See MI 019-125 for detailed flowtube wiring instructions

Field Wiring

To access the transmitter field terminals, remove the field wiring compartment cover by turning it counterclockwise. The field wiring compartment cover is the one closest to the conduit openings.

When replacing the cover, tighten it until the cover meets the housing metal-to-metal.

⚠ WARNING

In hazardous locations, do **not** remove cover while circuits are live.

⚠ CAUTION

Field wiring must be rated for 77°C or higher.

Field Wiring Compartment

There are three boards in the NOCT60A field wiring compartment. See Figure 22.

- The termination board is the board closest to the front of the compartment. Field wring connects to this board. The termination board also provides a user-replaceable battery, a boot button, and a USB connector.
- The controller board is located in the middle. Ethernet LAN field wiring connects to this board. Indicator LEDs are located on this board.
- The base board is located furthest from the user. A shield connection to chassis ground is provided on this board.

Table 4. LED Indicators

Indicator Label	Description
POWER	Indicates that power is applied to the POWER input and that the fuse is not blown.
STATUS	See “Status LED” section.
LINK	LAN indicators. See “Ethernet Communication” section.
ACT	
Rx1	Serial communication indicators. See “Serial Communication” section.
Tx1	
Rx2	
Tx2	

Figure 22. Inside the Field Wiring Compartment

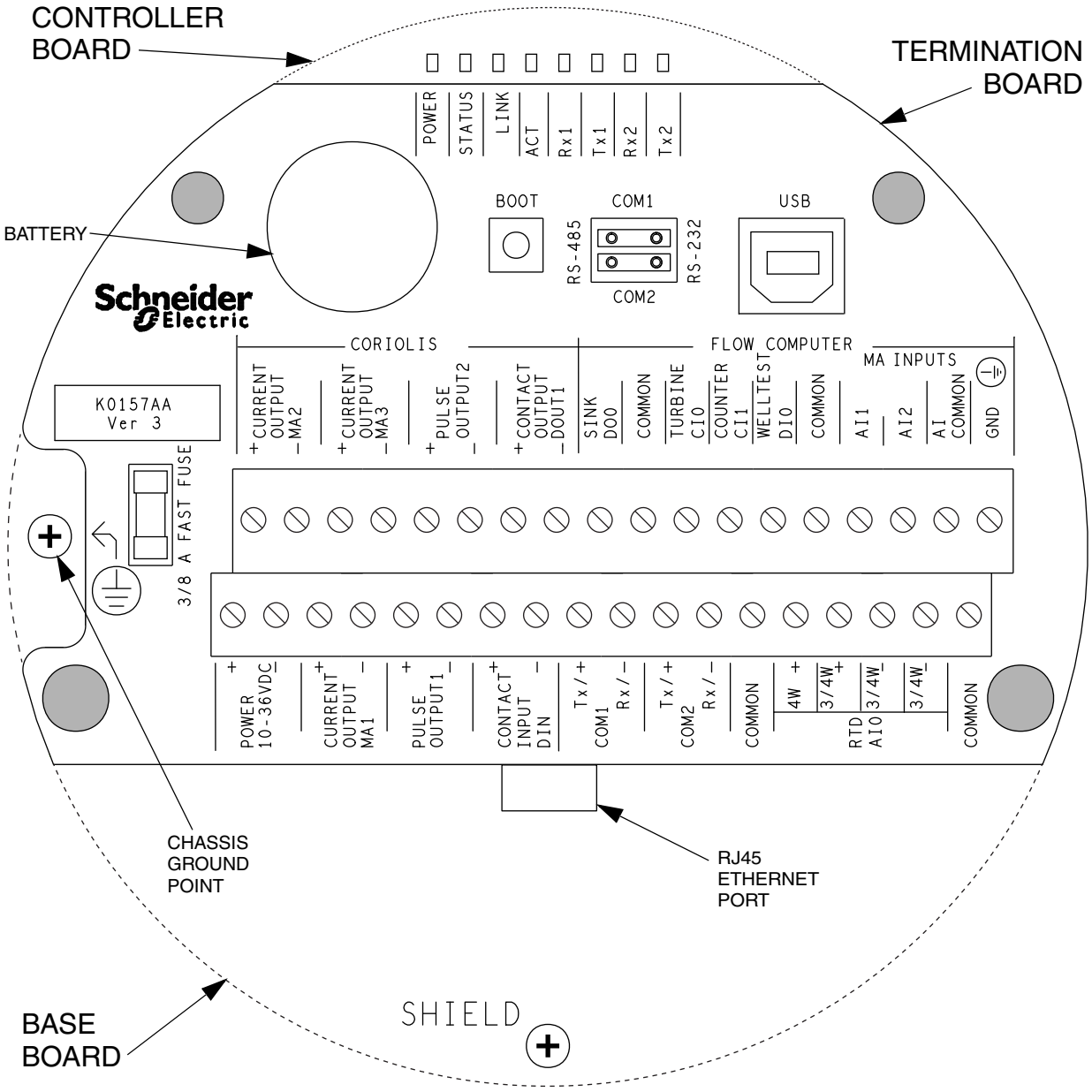


Table 5. Inside the Field Wiring Compartment

Feature/Terminal Name	Description
LED indicators	LED indicators located on the controller board. The labels for the indicators are on the termination board. See Table 4.
Battery	Lithium battery that powers the CMOS memory and real-time clock when input power is absent. See “Replacing the Battery” section.
BOOT button	See “Operating Modes” section.
RS-485, RS-232 (COM1 and COM2 switches)	See “Serial Communication” section.
USB connector	USB port (type B) for connection to external PC for Realflo configuration software and other programming tools. See “USB Port” section.
3/8 A FUSE	A 0.375 A fuse that helps to protect the power supply. See “Replacing the Fuse” section.
POWER 10-36VDC (+ and -)	See “Transmitter Power Wiring” section.
CURRENT OUTPUT MA1 (+ and -) CURRENT OUTPUT MA2 (+ and -) CURRENT OUTPUT MA3 (+ and -)	See “Current Outputs MA1, MA2, and MA3” section.
PULSE OUTPUT1 (+ and -) PULSE OUTPUT2 (+ and -)	See “Pulse Outputs 1 and 2” section.
CONTACT INPUT DIN (+ and -)	See “Contact Input (DIN)” section.
CONTACT OUTPUT DOUT1 (+ and -)	See “Contact Output (DOUT1)” section.
COM1 Tx/+, RX/- COM2 Tx/+, RX/- COMMON (a)	See “Serial Communication” section.
SINK DO0 COMMON (a)	See “Digital Output (SINK DO0)” section.
TURBINE CI0	See “Turbine Meter Counter Input” section.
COUNTER CI1	See “Digital Counter Input” section.
WELL TEST DI0	See “Well Test Digital Input (DI0)” section.
COMMON (a)	The electrical common terminal below the WELL TEST DIO terminal is shared by the serial communication ports, counter/digital inputs, analog outputs, and input power.
RTD AI0 4W+, 3/4W+, 3/4W-, 3/4W- COMMON	See “RTD Input” section.
AI1, AI2 MA INPUTS AI COMMON (a)	Current (MA) inputs. See “Current (Analog) Inputs” section.
GND	Flow computer ground, connected to chassis ground.
(chassis ground)	Chassis ground point, on the left side of the compartment. The notch near the fuse on the termination board provides access to the chassis ground point.
SHIELD (chassis ground)	Located on the base board, this shield attachment point is connected to chassis ground.
Ethernet port	The Ethernet port is mounted at the edge of the controller board, just below the CONTACT INPUT terminals on the termination board. See “Ethernet Communication” section.

a. The field termination circuitry is electrically isolated from the housing for voltages up to 550 Vac. Terminal board connections labeled COMMON are tied together and connected to the negative (-) terminal of the POWER input.

Transmitter Power Wiring

Power Supply

The NOCT60A is powered by a 10 to 36 Vdc input power source. Input power is applied to the POWER+ and POWER- terminals on the termination board.

Refer to the Specifications section of this manual for the minimum and maximum operating voltages and input power requirements. When the input voltage is below the minimum recommended voltage, the NOCT60A turns off.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

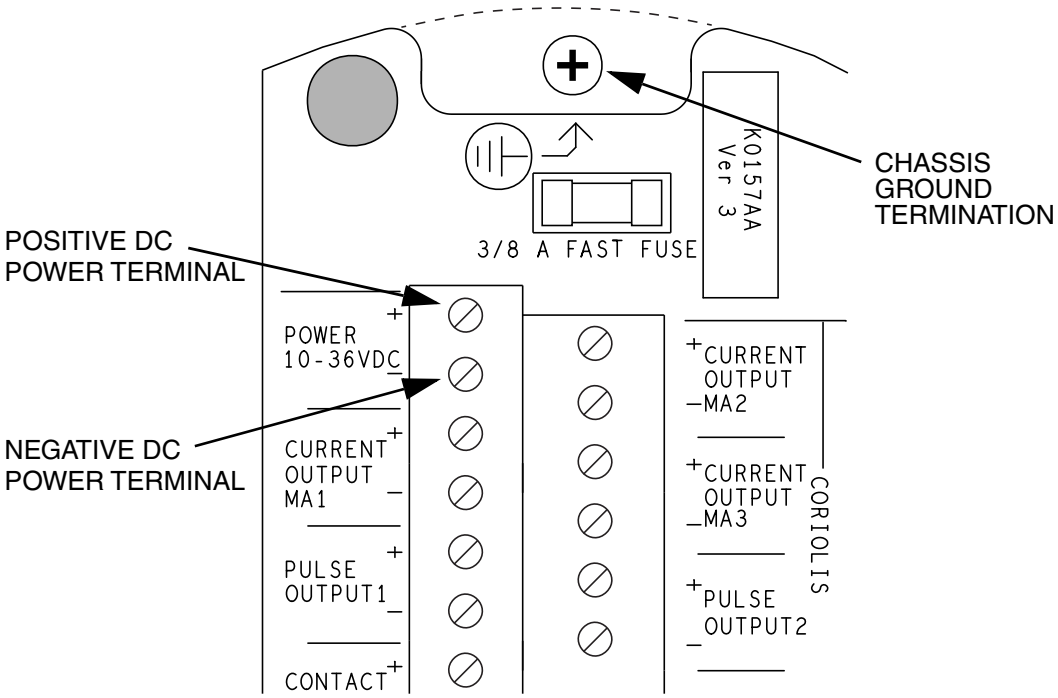
Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) power supplies are required on the power input and I/O points. Power supplies with 100...240 Vac inputs that comply with safety standard IEC/EN 60950 generally have SELV outputs. Check with the manufacturer or the agency certification listing to confirm that they have SELV outputs.

The input power supply must be a filtered dc supply.

Failure to follow these instructions can result in death or serious injury.

Connect the power wiring to the field wiring terminal board. Use shielded wire. Connect the shield on both ends.

Figure 23. Transmitter dc Power Connection Terminals



System Grounding

Ground the system by connecting the system power supply common, to the chassis or panel ground. The negative (-) side of the dc power input terminal as well as the I/O point terminals labeled GND are connected to chassis ground.

Input/Output Wiring - Coriolis Terminations Group

The NOCT60A supports multiple I/O options, both isolated and non-isolated, which require external power sources.

Outputs in the Coriolis group of terminations must be externally powered by nominal 24 Vdc.

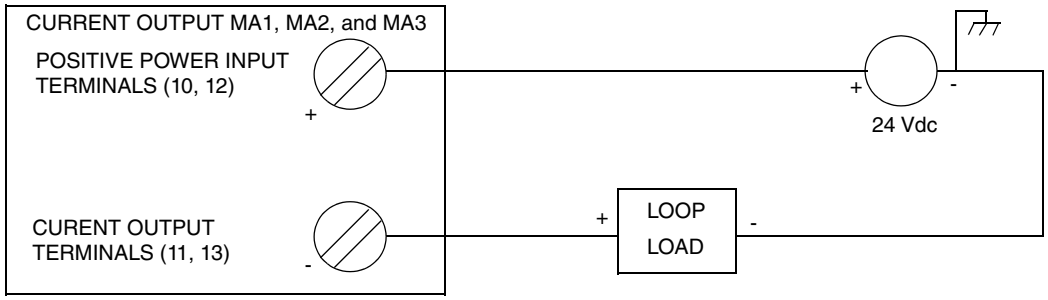
— NOTE

If only one power source is available, the + terminals of multiple I/Os can be connected together. In this case, the I/Os are no longer isolated from one another.

Refer to Figure 22 for a diagram of the termination board layout.

Current Outputs MA1, MA2, and MA3

Figure 24. Current Output Wiring (MA1, MA2, and MA3)



The loop load resistor can be a value from 0 to 683 Ω.To determine your loop load resistance, add the series resistance of each component in the loop, excluding the transmitter.

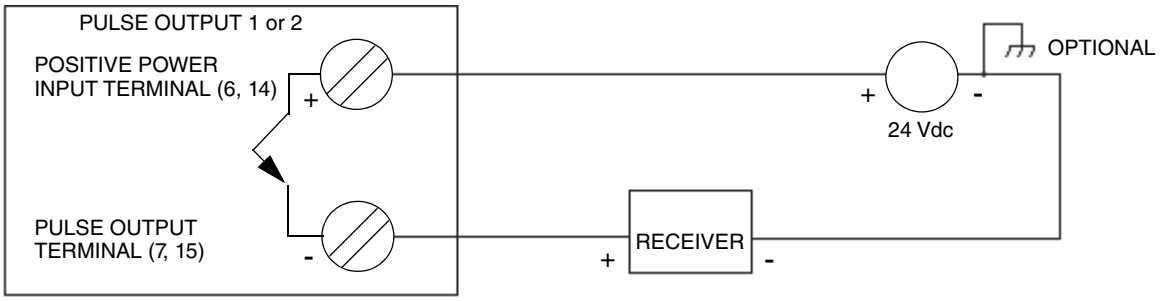
Table 6. Current Output Specifications

Item	Specification
Supply Voltage	24 Vdc ±10% (external power supply)
Load	0 to 683 Ω
Current	22 mA maximum, 3.8 mA minimum

Pulse Outputs 1 and 2

The pulse output (Pulse Output 1 and Pulse Output 2) signal is typically used with a receiver such as an external totalizer or control system. The pulse output is a high side switch or sourcing output. If the receiver requires a sourcing input and is internally current limited, it can be connected as shown in Figure 25.

Figure 25. Pulse Output with a Sourcing Input Receiver (with Internal Current Limiting, Pulse Output 1 or Pulse Output 2)

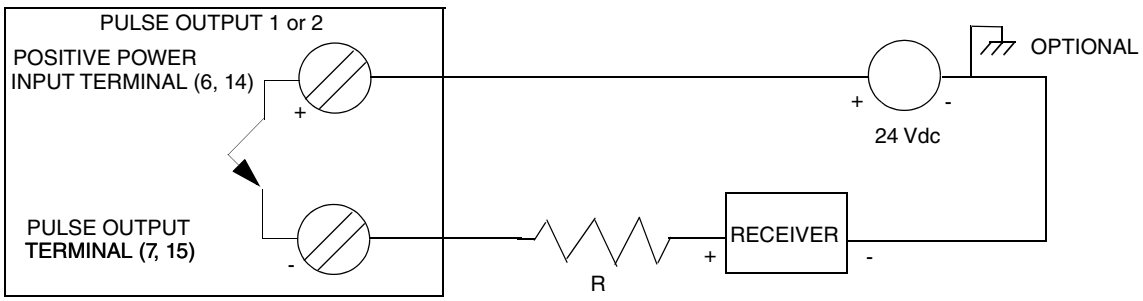


For receivers requiring a sourcing input but without internal current limiting, a resistor is required to limit the current to that specified by the receiver as shown in Figure 26. The pulse output current is limited to 80 mA maximum.

For example:

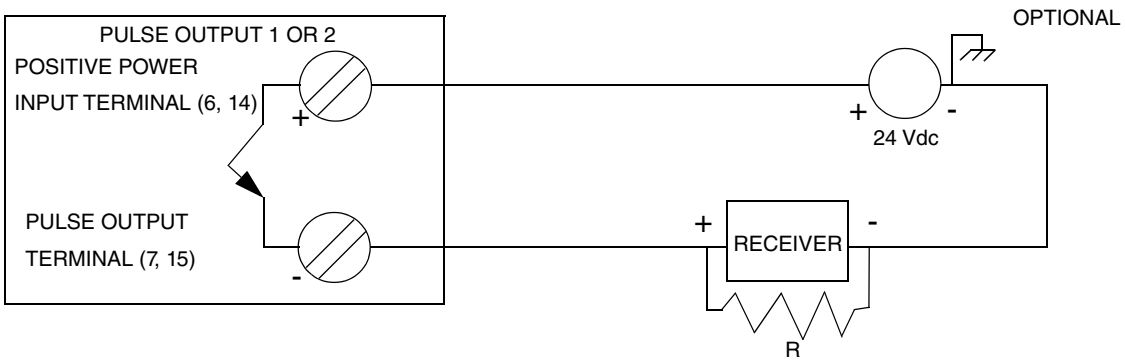
V = 24 Vdc
I = 80 mA
R ≥ 300 Ohms

Figure 26. Pulse Output with a Sourcing Input Receiver (without Internal Current Limiting, Pulse Output 1 or Pulse Output 2)



If the receiver requires a current sinking input (such as a contact closure or transistor switch), a resistor is required across the receiver terminals as shown in Figure 27. The resistor should be sized to limit the on-state current in the pulse output to 80 mA maximum.

Figure 27. Pulse Output with a Receiver Requiring a Sinking Input (Pulse Output 1 or Pulse Output 2)



Because of the internal bias currents produced by some receivers requiring sinking inputs, a resistor divider may be necessary to ensure that the low input threshold requirement of the receiver is met. This configuration is shown in Figure 28. R1 and R2 must limit the pulse output on-state current to 80 mA maximum.

Figure 28. Pulse Output with a Sinking Input Receiver Using a Divider Network (Pulse Output 1 or Pulse Output 2)

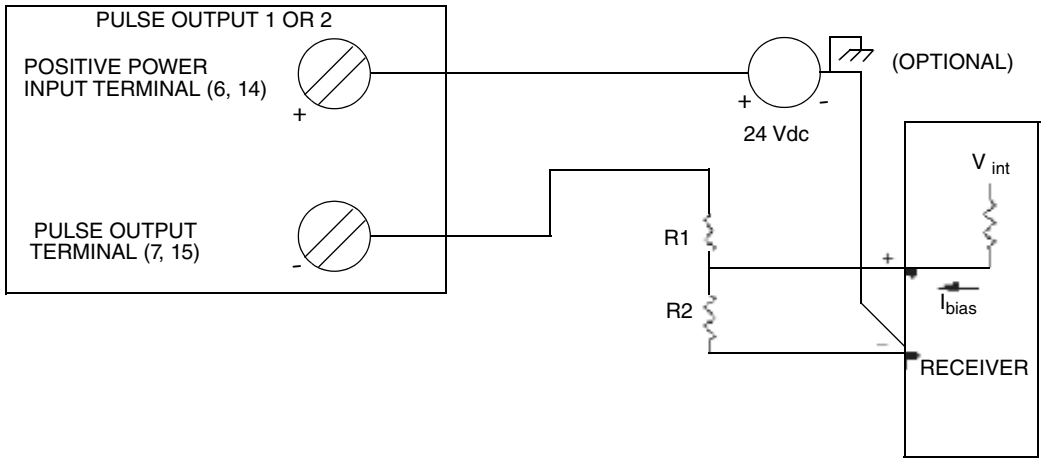
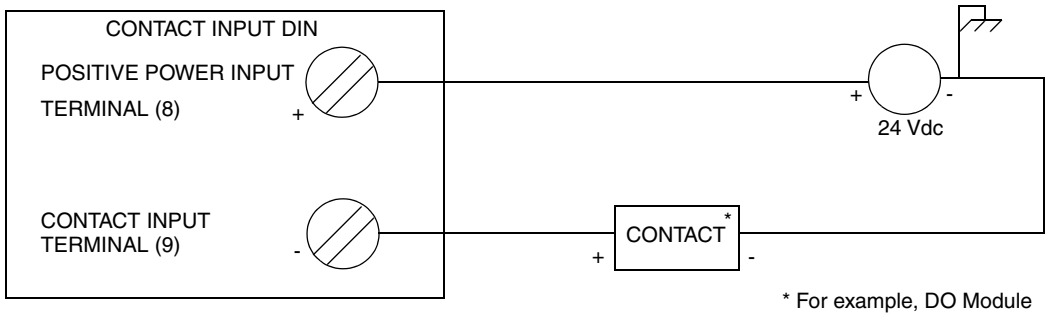


Table 7. Pulse Output Specifications

Item	Specification
Supply Voltage	24 Vdc ±10% (External Power Supply)
Current	80 mA maximum

Contact Input (DIN)

Figure 29. Contact Input Wiring (DIN)



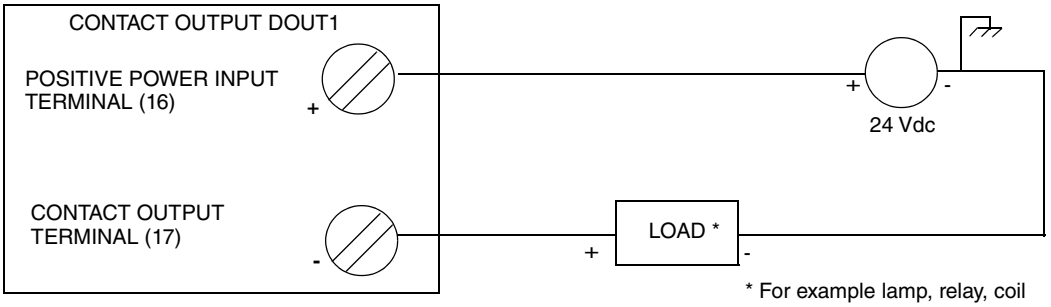
The voltage requirement for Discrete Input (DIN) is 24 Vdc ±10%. The load requirement is limited to producing a maximum current of 100 mA.

Table 8. Contact Input Specifications

Item	Specification
Supply Voltage	24 Vdc ±10% (External Power Supply)
Current	15 mA minimum

Contact Output (DOUT1)

Figure 30. Contact Output Wiring (DOUT1)



The voltage requirement for Discrete Output is 24 Vdc ±10%. The load requirement is limited to producing a maximum current of 100 mA.

Table 9. Contact Output Specifications

Item	Specification
Supply Voltage	24 Vdc ±10% (External Power Supply)
Current	100 mA maximum

Input/Output Wiring - Flow Computer Terminations Group

Serial Communication

The NOCT60A has one internal and two external serial communication ports which support RS-232 and RS-485 communication. The external serial ports are labeled COM1 and COM2. The internal serial port is connected to the Coriolis electronics.

Table 10. Serial Communication Port Specifications

Item	Specification
Quantity	Two, external, DIP switch selectable RS-232 or RS-485 One, internal, RS-485 Modbus to Coriolis electronics
Connector	Terminal block
RS-232	TxD and RxD implemented. RS-232 compatible serial port (0-5V)
RS-485	2-wire half duplex. 5100 Ω bias resistors
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	none, even, or odd
Word Length	7 or 8 bits
Stop Bits	1 or 2 bits
Isolation	None
Cable Length	RS-232: maximum 3m (10 ft) RS-485: maximum 1200 m (4000 ft)
Protocol	TeleBUS (compatible with Modbus RTU and Modbus ASCII)
Protocol Modes	Slave Master Master/slave Store and forward

Serial Communication Options

The following table shows the serial and protocol communication parameters supported by COM1 and COM2. These parameters are set from Telepace®, IEC 61131-3 or from an application program running in the NOCT60A. Default values are set when a Cold Boot or Service Boot is performed on the NOCT60A.

Parameter	Default	Other Supported Values
Baud Rate	9600	300, 600, 1200, 2400, 4800, 19200, 38400, 57600, 115200
Duplex	Half duplex	N/A
Parity	None	Odd, Even
Data Bits	8 bits	7 bits
Stop Bits	1 bit	N/A
Receive Flow Control	ModbusRTU	None
Transmit Flow Control	None	Ignore CTS
Station	1	2 to 65534
Protocol	Modbus RTU	None, Modbus ASCII, DF1, DNP
Addressing Mode	Standard	Extended

RS232 Operation

The serial mode switch on the termination board configures the external ports for RS-232 or RS-485 mode. Ports can be individually configured.

Three connections are needed for RS-232 operation.

Function	Description
SERIAL COM	This pin is connected to the system ground.
Rx (input)	The NOCT60A receives data on this pin. The level is SPACE on standby and MARK for received data. The LED is lit for a MARK level.
Tx (output)	The NOCT60A transmits data on this pin. The level is SPACE on standby and MARK for transmitted data. The LED is lit for a MARK level.

A MARK level is a voltage of +3 Vdc or greater. A SPACE level is a voltage of -3 Vdc or lower.

The serial port transmitters generate RS-232 compatible 5 Vdc levels. Cables should be limited to a maximum of 3 m (10 ft.).

⚠ WARNING

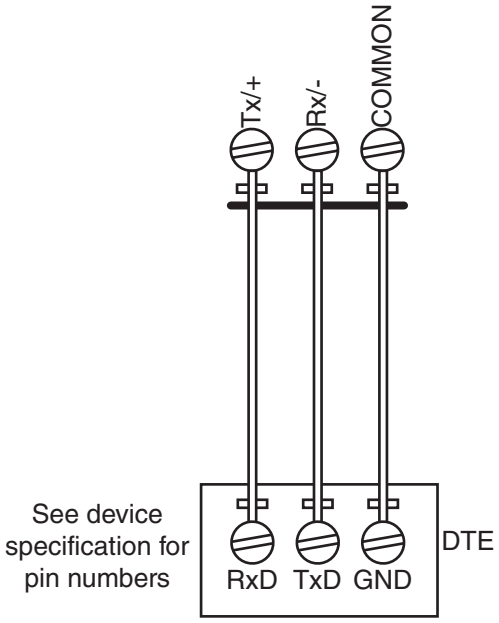
HAZARD OF ELECTRIC SHOCK

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

RS-232 wiring uses shielded cable. The shield should be connected to chassis ground at one point. Failure to properly shield the cable may result in the installation not complying with FCC or DOC radio interference regulations.

Figure 31. RS-232 Wiring Example



RS485 Operation

The serial mode switch on the termination board configures the external ports for RS-232 or RS-485 mode. Ports can be individually configured.

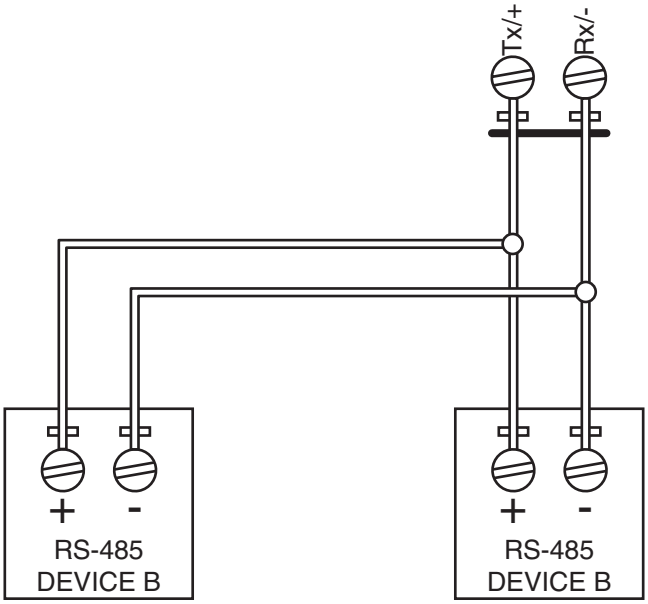
Three connections are needed for RS-485 operation.

Function	Description
SERIAL COM	This pin is connected to the system ground.
+ (input/output)	Connect the positive side of the differential pair to this pin.
- (input/output)	Connect the negative side of the differential pair to this pin.

RS-485 mode transmits and receives differential voltages. The RS-485 specification allows a maximum of 32 devices connected on a single RS-485 network. The specification for RS-485 recommends that the cable length should not exceed a maximum of 1200 m (4000 ft.)

The signal grounds of the RS-485 devices in the network are not connected together but instead are referenced to their respective incoming electrical grounds. The grounds of the RS-485 devices on the network are wired to be within several volts of each other.

Figure 32. RS-485 Wiring Example



RS-485 Bias Resistors

The RS-485 receiver inputs on the NOCT60A are biased so that that received data is driven to a valid state (space) when there are no active drivers on the network. The value of these bias resistors is 5100 Ω from Ground to the - inputs and 5100 Ω from +5 Vdc to the + inputs.

RS-485 Termination Resistors

Termination resistors are required in long networks operating at the highest baud rates. Networks as long 1200 m (4000 ft.) operating at 9600 baud will function without termination resistors. Terminations should only be considered if the baud rate is higher.

When termination resistors are required, they are installed on the first and last station on the RS-485 wire pair. Other stations should not have termination resistors.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

Modbus Wiring

It may be necessary to install an optional termination resistor to reduce signal reflections on long cable length interconnections. It may also be necessary to reverse the Modbus signal wires for some Modbus masters to keep the proper D0 and D1 signalling convention.

— NOTE

Follow Modbus wiring guidelines and requirements as documented at www.modbus.org.

The maximum length of signal wires for Modbus communication over RS-485 is 1000 m (3280 ft), running 26 AWG and 150 ohm terminator resistor. Use twisted shielded wire and connect the shield on both ends.

For systems with a common connection, use dual twisted shielded wire: one twisted pair for D0 and D1, and the other twisted pair shorted together on both ends for the common connection.

Digital Output (SINK DO0)

The NOCT60A board has one digital output. The output is provided using a sinking output circuit.

Table 11. Digital Output Specifications

Item	Specification
Type	Sinking low side switch
Load	250mA maximum
Voltage	36Vdc max.
Isolation	None

Two connections are needed for the output.

Function	Description
SINK DO0	Connection to negative side of load
COMMON	Common (return) terminal

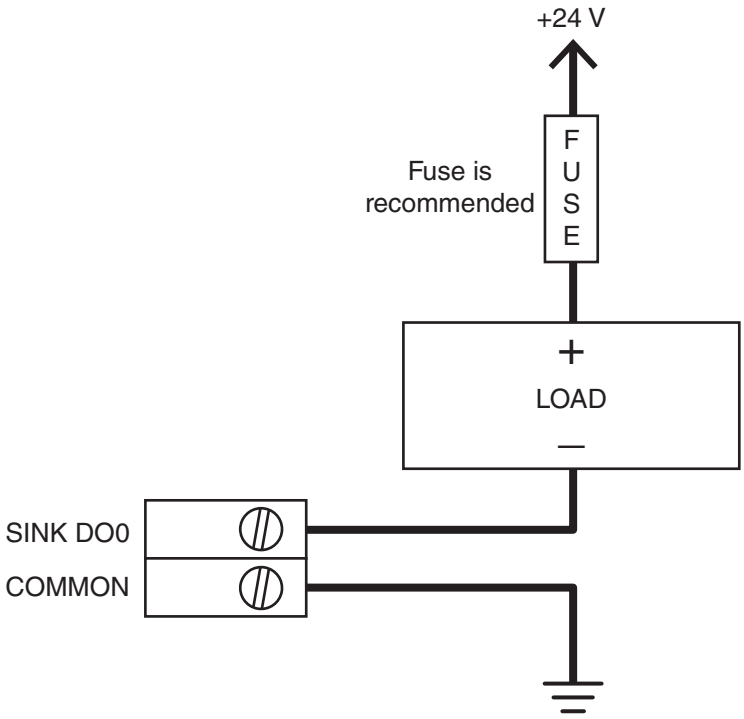
NOTICE

UNEXPECTED EQUIPMENT OPERATION

External lightning protection is required if the device being controlled is outside the physical area (cubicle or building) in which the NOCT60A is located.

Failure to follow these instructions can result in equipment damage.

Figure 33. Digital Output Wiring



Writing the Digital Output

Refer to the appropriate software manual for information on using the NOCT60A Digital Output in application programs.

- For Telepace applications, use the **NOCT60 Controller I/O** register assignment to write the output.
- For IEC 61131-3 applications, use the **noct60** I/O device to write the output.
- For C applications, use the **ioWriteNoct60Outputs** function.

Counter Inputs

The NOCT60A has two counter inputs.

- Turbine Counter Input is designed for millivolt level turbine meters.
- Digital Counter Input is a digital input for use with 12 to 24 V signals.

NOTICE

UNEXPECTED EQUIPMENT OPERATION

- Do not exceed the maximum voltage specified for each counter input.
- When wiring counter inputs:
  - Confirm that the connection to the counter input does not exceed the ratings for the input. See the Specifications section for details.
  - Confirm that the polarity of the connection is correct with the two positive terminals wired together and the two negative terminals wired together.
  - Counter input signals must be shielded using Belden 9322 or equivalent, when the unit is operating in an electrically noisy environment or to meet the requirements of EN61000-6-2.

Failure to follow these instructions can result in equipment damage.

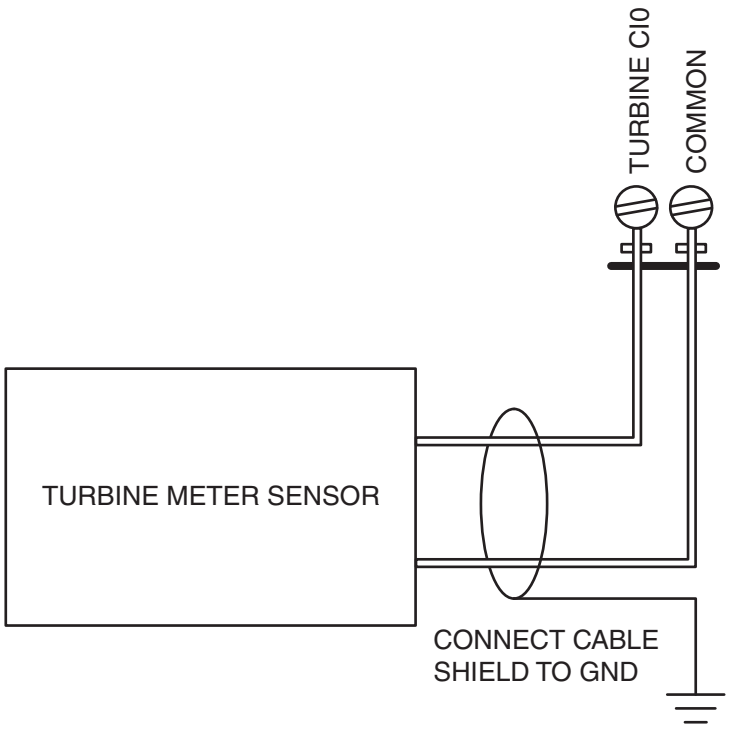
Turbine Meter Counter Input

The NOCT60A allows for the direct connection of a turbine meter sensor. This sensor produces millivolt outputs and an additional pre-amplifier is not required to be connected to a NOCT60A. The turbine meter inputs should be used in low noise environments with shielded cabling.

Table 12. Turbine Meter Input Specifications

Item	Specification
Type	For use with turbine meter magnetic pickups.
Sensitivity	Minimum input 30mVp-p at 5-50Hz Minimum input 150mVp-p at 150Hz Minimum input 650mVp-p at 5kHz Minimum input 750mVp-p at 10kHz Maximum input 4Vp-p
Maximum cable length	3m maximum
Isolation	None

Figure 34. Turbine Meter Counter Input Wiring



Digital Counter Input

The digital counter input counts transitions of 12 to 24 Vdc signals.

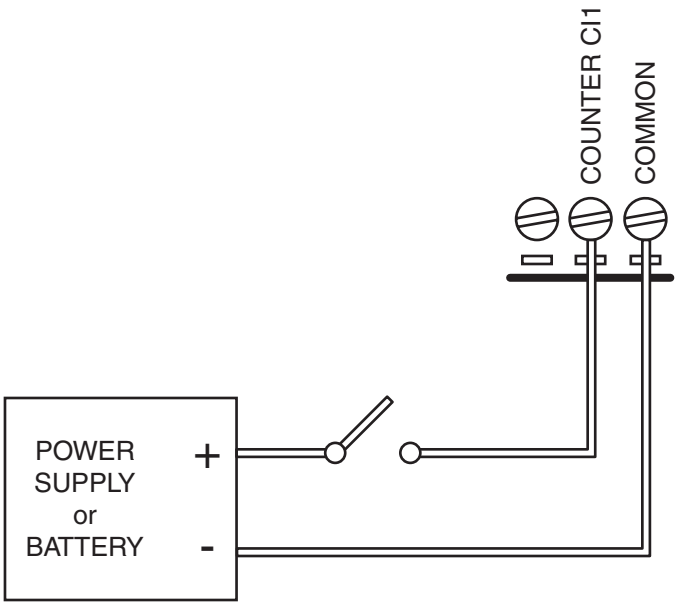
Table 13. Digital Counter Input Specifications

Item	Specification
Operation range	12 to 24 Vdc nominal, 36 Vdc max.
Turn on voltage	8 Vdc (minimum turn on voltage)
Turn off voltage	4 Vdc (maximum turn off voltage)
dc Input Current	0.35 mA to 0.45 mA at 12 Vdc 0.75 mA to 0.85 mA at 24 Vdc
Frequency Range	5 KHz
Isolation	None

Two connections are needed for the input.

Function	Description
COUNTER CI1	Counter input terminal
COMMON	Common (return) terminal

Figure 35. Digital Counter Input Wiring



Reading Counter Inputs

Refer to the appropriate software manual for information on using the NOCT60A Counter Inputs in application programs.

- For Telepace applications, use the **NOCT60 Controller I/O** register assignment to read the counters.
- For IEC 61131-3 applications, use the **noct60** I/O device to read the board counters.
- For C applications, use the **ioReadNoct60Inputs** function.

Well Test Digital Input (DI0)

The well test input senses the state of a digital signal.

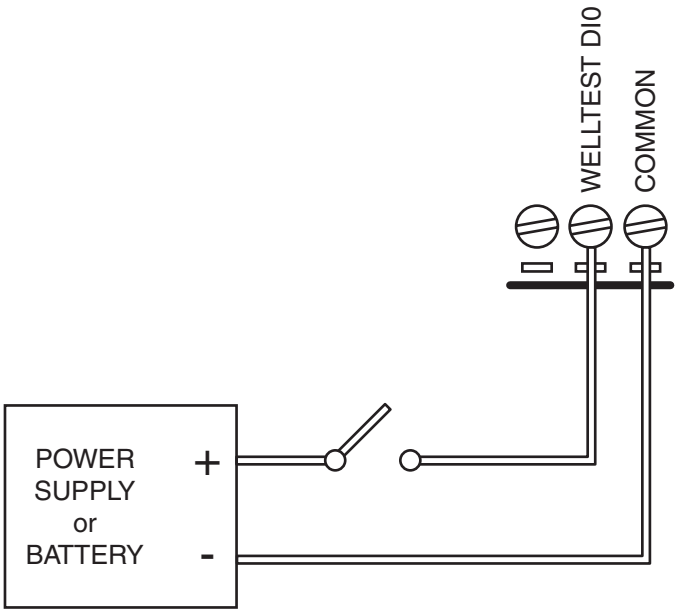
Table 14. Well Test Input Specifications

Item	Specification
Operation range	12 to 24 Vdc nominal, 36 Vdc max.
Turn on voltage	8 Vdc (minimum turn on voltage)
Turn off voltage	4 Vdc (maximum turn off voltage)
dc Input Current	0.35 mA to 0.45 mA at 12 Vdc 0.75 mA to 0.85 mA at 24 Vdc
Isolation	None

Two connections are needed for the input.

Function	Description
WELLTEST DI0	Well test input
COMMON	Common (return) terminal

Figure 36. Well Test Input Wiring



NOTICE

UNEXPECTED EQUIPMENT OPERATION

When wiring digital inputs:

- Confirm that the connection to the digital input does not exceed the ratings for the digital input. See the Specifications section for details.
- Confirm that the polarity of the connection is correct.

Failure to follow these instructions can result in equipment damage.

Refer to the appropriate software manual for information on using the NOCT60A Digital Inputs in application programs.

- For Telepace applications, use the **NOCT60 Controller I/O** register assignment to read the inputs.
- For IEC 61131-3 applications, use the **noct60** I/O device to read the inputs.
- For C applications, use the **ioReadNoct60Inputs** function.

Analog Inputs

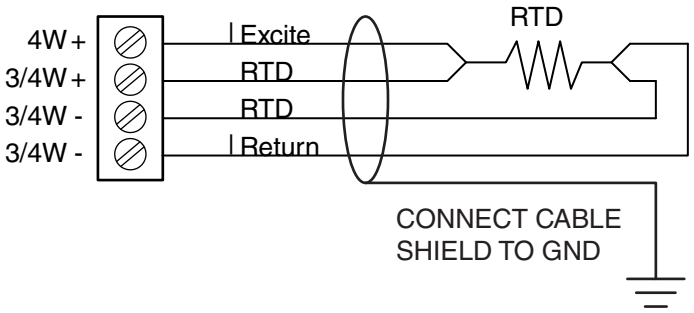
The flow computer electronics provide three external analog inputs and three internal inputs.

RTD Input

The RTD input measures temperature from three- or four-wire RTDs. Four-wire measurement techniques are more accurate and consume less power.

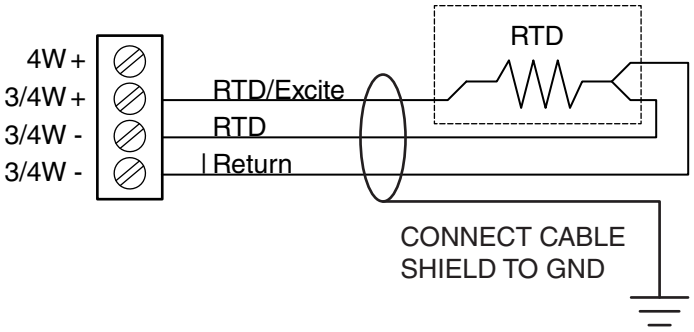
When using four-wire RTDs, the four wires are connected as shown below. The 4W+ and 3/4W- terminals supply the excitation current to the RTD. The 3/4W+ and 3/4W- terminals return the sensed voltage. Although the circuitry and measurement technique can compensate for wiring resistance, you should minimize the lead resistance as much as possible.

Figure 37. Four-Wire RTD Connection



When using three-wire RTDs, the three wires are connected as shown below. The 3/4W+ and 3/4W- terminals supply the excitation current to the RTD. The 3/4W+ and 3/4W- terminals return the sensed voltage. The 4W+ terminal is not used. The wiring resistance is monitored and compensated. In three-wire installations, the three wires must be of the same length and type for this compensation to be accurately performed.

Figure 38. Three-Wire RTD Connection



A dc supply powers the isolated RTD input circuits. The NOCT60A sources this voltage. A range of voltages can be tolerated.

Table 15. RTD Input Specifications

Item	Specification
Type	100 Ω platinum 0.385 Ω/°C ASTM E 1137/E 1137M-04 ITS-90 3 and 4 wire, auto detection and compensation.
Resistance Range	18.5 to 329.6 Ω
Temperature Range	-200 to +650°C -328 to +1202°F
Accuracy, 4-Wire Operation, -40 to +70°C (-40 to +158°F)	+/-0.3°C for process temperatures -100 to +200°C (+/-0.54°F for process temperatures -148 to +392°F)
Accuracy, 3-Wire Operation, -40 to +70°C (-40 to +158°F)	+/-0.5°C for process temperatures -100 to +200°C (+/-0.90°F for process temperatures -148 to +392°F)
Response Time	300 ms
Converter type	24 bit delta-sigma
Excitation Current	Pulsed, 0.8mA
Wiring resistance	100 Ω max., in each line

Refer to the appropriate software manual for information on using the NOCT60A Analog Inputs in application programs.

- For Telepace applications, use the **NOCT60 Controller I/O** register assignment to read the inputs.
- For IEC 61131-3 applications, use the **noct60** I/O device to read the inputs.
- For C applications, use the **ioReadNoct60Inputs** function.

Current (Analog) Inputs

The two current mA inputs measure current signals, typically from 4 to 20 mA transmitters. Currents from 0 to 22 mA can be measured. The two inputs share a common return.

Table 16. Current Input Specifications

Item	Specification
Input Resistance	250 Ω max. burden
Accuracy	±0.1% of full scale at 25°C (77°F) ±0.2% over temperature range
Converter type	24 bit delta-sigma
Isolation	None
Range	0 to 25mA

The analog inputs support loop powered and self-powered transmitters. Loop powered transmitters are two terminal devices that connect between a power supply and the analog input. The loop current continues from the power supply, through the transmitter and to ground through a 100 Ω resistor built into the input circuit. Self-powered transmitters have three terminals typically labelled power in, signal out and common. Self-powered transmitters can have a current or voltage output. The power in connects to a power supply, the signal out terminal connects to an MA INPUTS terminal (AI1 or AI2), and the common connects to AI COMMON.

The transmitter is powered from a power supply supplied by the user.

NOTICE

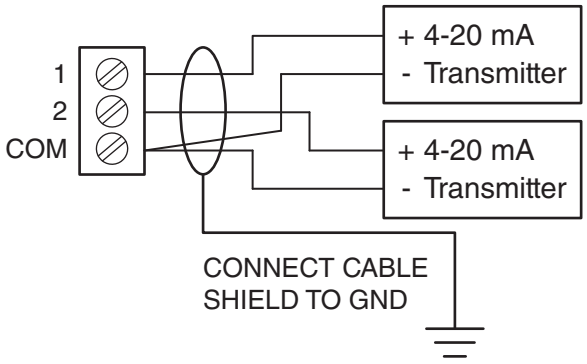
UNEXPECTED EQUIPMENT OPERATION

- If a transducer or transmitter connected to an analog channel is placed outside of the building or structure where the NOCT60A is installed, there is an increased possibility of extremely severe power surges caused by lightning. In these cases, additional surge protection must be supplied by the user.
- Analog input signals must be shielded using Belden 9322 or equivalent, when the unit is operating in an electrically noisy environment or to meet the requirements of EN61000-6-2.

Failure to follow these instructions can result in equipment damage.

Connect the inputs as shown below. Use twisted-pair cabling.

Figure 39. Current Input Wiring



Refer to the appropriate software manual for information on using the NOCT60A Analog Inputs in application programs.

- For Telepace applications, use the **NOCT60 Controller I/O** register assignment to read the inputs.
- For IEC 61131-3 applications, use the **noct60** I/O device to read the inputs.
- For C applications, use the **ioReadNoct60Inputs** function.

Input Voltage (Internal Analog Input)

The input voltage internal analog input provides useful information about the power input to the NOCT60A flow computer controller, such as if a battery back-up system is functioning correctly. The reading returned from this input is typically in the range from 11000 to 30000, representing the input supply in millivolts (mV). The input supply voltage resolution is 100 millivolts.

Table 17. Input Voltage Specifications

Item	Specification
Internal Power Input Voltage Monitor Specification	40V full scale, accuracy 0.5% FS

- For Telepace applications, use the **Controller Input Voltage** register assignment to read the input voltage in millivolts.
- For IEC 61131-3 applications, use the **ainvolt** I/O connection to read the input voltage in millivolts.

Controller Board Temperature (Internal Analog Input)

The ambient temperature internal analog input measures the temperature at the controller circuit board. It is useful for measuring the operating environment of the controller and returns an integer value in the range -40 to +75 °C (-40 to +167 °F.) The temperature reading represents temperatures in the range -40 to +75 °C(-40 to +167 °F.) Temperatures outside this range cannot be measured.

Table 18. Internal Temperature Monitor Specifications

Item	Specification
Measurement range	-40°C to +75°C -40°F to +167°F
Accuracy	±5°C ±9°F

- For Telepace applications, use the **Controller Board Temperature** register assignment to read the ambient temperature in °C and °F.
- For IEC 61131-3 applications, use the **aintemp** I/O connection to read the ambient temperature in °C and °F.

Controller RAM Battery Voltage (Internal Analog Input)

The lithium battery internal analog input measures the voltage of the battery that maintains the non-volatile RAM in the controller. The reading returned from this input is in the range from 0 to 5000 representing the battery voltage in mV. It is useful in determining if the battery needs replacement. The 3.6 Vdc lithium battery will return a typical value of 3500 to 3700. A reading less than 3000 (3.0 Vdc) indicates that the lithium battery requires replacement.

Table 19. Battery Voltage Monitor Specifications

Item	Specification
Internal Onboard Lithium Battery Voltage Monitor Specification	4 V full scale, 100 mV resolution
Measurement range	0 to 5000 mV
Accuracy	±100 mV

- For Telepace applications, use the **Controller RAM Battery Voltage** register assignment to read the lithium battery voltage.
- For IEC 61131-3 applications, use the **ainbatt** I/O connection to read the lithium battery voltage.

Ethernet Communication

The NOCT60A has one 10/100Base-T Ethernet port. This is a single communications channel running at 10/100 Mb/s over unshielded, twisted-pair cabling, using differential signaling. It supports both half-duplex and full-duplex operation. The interface supports auto-negotiation for both the speed and half/ full-duplex mode selection.

Table 20. LAN/Ethernet Communication Specifications

Item	Specification
Terminations	RJ45 modular connector
Speed	10BaseT (twisted pair) 10/100M bits per second
Max Server Connections	20
Protocols Supported	Modbus/TCP Modbus RTU in UDP Modbus ASCII in UDP DNP in TCP DNP in UDP FTP
Visual indicators (LEDs)	Serial 1 RXD Serial 1 TXD Serial 2 RXD Serial 2 TXD LAN Activity LAN Link Status Power

TCP/IP Settings

The following table shows the TCP/IP parameters supported by the LAN port. These parameters are set from the IEC 61131-3 or from an application program running in the NOCT60A. Default values are set when a Cold Boot is performed on the NOCT60A.

Parameter	Default	Other Supported Values
IP Address	0.0.0.0	In the format 255.255.255.255
Subnet Mask	255.255.0.0	In the format 255.255.255.255
Gateway	0.0.0.0	In the format 255.255.255.255

The **IP Address** is the address of the NOCT60A. The IP address is statically assigned. Contact your network administrator to obtain an IP address.

The **Subnet Mask** determines the subnet on which the NOCT60A is located. The subnet mask is statically assigned. Contact your network administrator to obtain the subnet mask.

The **Gateway** determines how your NOCT60A communicates with devices outside its subnet. Enter the IP address of the gateway. The gateway is statically assigned. Contact your network administrator to obtain the gateway IP address.

Modbus/TCP Settings

The following table shows the Modbus/TCP parameters supported by the LAN port. These parameters are set from the IEC 61131-3 or from an application program running in the NOCT60A. Default values are set when a Cold Boot or Service Boot is performed (see “Boot Modes” on page 64).

Parameter	Default	Other Supported Values
Master Idle Timeout	10 seconds	Any value in seconds
Server Receive Timeout	10 seconds	Any value in seconds
Maximum Server Connections	20	1 to 20
TCP Port	502	1 to 65535
Modbus Addressing Type	Standard	Standard or Extended
Modbus Station Address	1	1 to 65534
Store and Forward Messaging	Disabled	Enabled and Disabled

The **Master Idle Timeout** parameter sets when connections to a slave controller are closed. Setting this value to zero disables the timeout; the connection will be closed only when your program closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are sent in that time. This allows the slave device to free unused connections.

The **Server Receive Timeout** parameter sets when connections from a remote device are closed. Setting this value to zero disables the timeout; the connection will be closed only when the remote device closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are received in that time. This allows the NOCT60A to free unused connections.

The **Maximum Server Connections** parameter sets the number of incoming (server) connections that the NOCT60A will allow. Incoming (server) connections are used when a remote device creates a connection to this NOCT60A. Outgoing connections are used when this NOCT60A creates a connection to a remote device (e.g. using a masterip function block from a Telepace or IEC 61131-3 program). Setting this value to the maximum allows the server to use all

connections for incoming connections. Setting the value below the maximum limits the number of incoming connections from remote devices. This reserves the remaining connections for use by the NOCT60A for outgoing connections.

The **TCP Port** parameter sets the port used by the Modbus/TCP protocol. This should be set to 502. This is the well-known port number for Modbus/TCP. Modbus/TCP devices use 502 by default, and on many devices the value cannot be changed. It is suggested that you change this value only if this port is used by another service on your network. Consult your network administrator to obtain a port if you are not using the default.

The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices.

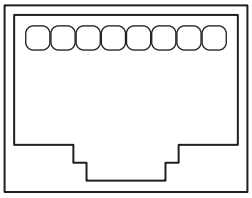
The **Station** parameter sets the station number of the NOCT60A. The valid range is 1 to 255 if standard addressing is used and 1 to 65534 if extended addressing is used.

The **Store and Forward Messaging** parameter controls forwarding of messages on the Ethernet port. If this option is enabled, messages will be forwarded according to the settings in the store and forward routing table.

RJ45 Modular Connector for Ethernet

The NOCT60A can be connected directly to a wall jack or hub using standard RJ45 Category 5 patch cables. The following diagram shows the pin connections for the RJ45 modular connector.

Figure 40. RJ45 Modular Jack



NOTICE

UNEXPECTED EQUIPMENT OPERATION

The IEEE 802.3 10 BASE-T specification requires that 10 BASE-T and 100 BASE-T devices support UTP 100-120 unshielded twisted pair cables of up to at least 100 m (325 ft.) in length.

This requirement does not factor in losses due to connectors, patch panels, punch-down blocks, or other cable management hardware, which introduce additional loss.

For each connector or other intrusive cable management device in the total link, subtract 12 m (39 ft.) from the total allowable link length.

Failure to follow these instructions can result in equipment damage.

10/100Base-T has a maximum run of 100 m (350 ft.) but the actual limit is based on signal loss and the noise in the environment. This may limit the practical distance to less than 100 m (350 ft). The Ethernet cables should not be run in parallel with power or any cables that generate noise.

USB Port

The NOCT60A has one USB 2.0 compliant peripheral port, supporting both low speed (1.5 Mb/s) and full speed (12 Mb/s). The port allows communication with the Realflo flow computer software by connecting to a USB host, such as a personal computer.

Table 21. USB Specifications

Item	Specification
Type	USB peripheral port Type "B" connector USB 2.0 compliant
Low Speed	1.5 Mb/s
Full Speed	12 Mb/s

⚠ WARNING

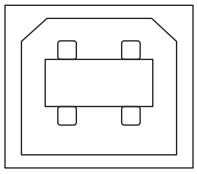
EXPLOSION RISK

Use the USB port only when performing product configuration, data retrieval, maintenance, or troubleshooting on transmitters installed in non-hazardous applications, or in locations that are known to be in a non-hazardous state.

Failure to follow these instructions can result in death or serious injury.

The peripheral port uses a USB type “B” connector. The NOCT60A does not draw significant power from the host over the USB peripheral port.

Figure 41. USB Type “B” Connector



Transmitter Wiring Connections from the Flowtube

Connect the wiring from the flowtube to the transmitter per Figure 42 and Table 22. Distance between the flowtube and transmitter can be up to 305 m (1000 ft) with CFS10 or CFS20 flowtubes; up to 30 m (100 ft) with CFS25 flowtubes.

Connect the "dressed" end of the factory-supplied cable to the transmitter terminals. To facilitate wire identification, ensure that the proper wire pairs remain twisted, as the black wires are not common.

Figure 42. Transmitter Junction Box

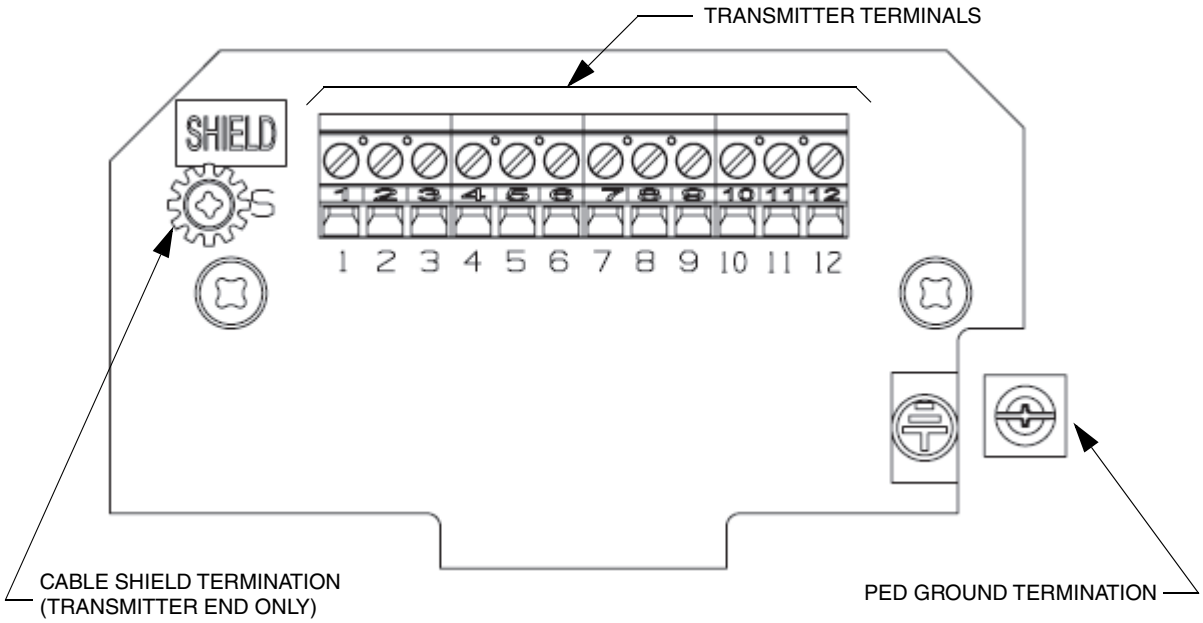


Table 22. Transmitter Junction Box Wiring

Terminal	Wire Color	Signal
1	Black	RTD
2	Blue	
3	Black	RTD
4	Green	
5	Red	Sensor B
6	Black	
7	Black	Sensor A
8	Yellow	
9	Black	Driver 2
10	Brown	
11 (a)	Black	Driver 1 (CFS10 and CFS20 only)
12 (a)	White	

a. For CFS25 flowtubes, terminals 11 and 12 are not used.

Write Protect Jumper

The write protection jumper is located on the printed wiring board in the electronics module compartment. See Figure 44. Placing the jumper in the "enabled" position engages the write protection feature. When write protection is enabled, the transmitter configuration cannot be changed, and grand totalizers cannot be reset. (Batch totalizers, however, can still be changed.)

NOTE

The jumper must be kept in the "disabled" (factory default) position for Realflo® software to enable pressure compensation in the transmitter. However, enabling write protection does not interfere with pressure compensation if pressure compensation is already enabled in the transmitter.

If write protection is enabled, the display reads `WPROT/LOCKED` when there is an attempt to enter Quick Start or Setup mode, or to reset the totals.

NOTE

A change in the write protect jumper position takes effect immediately.

Figure 43. Write Protect Jumper Location

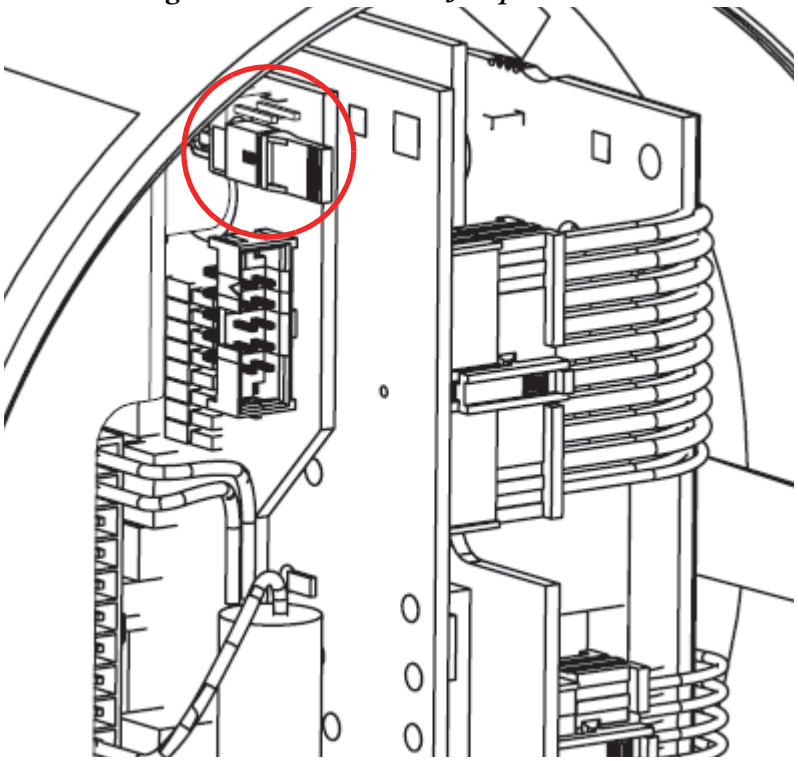
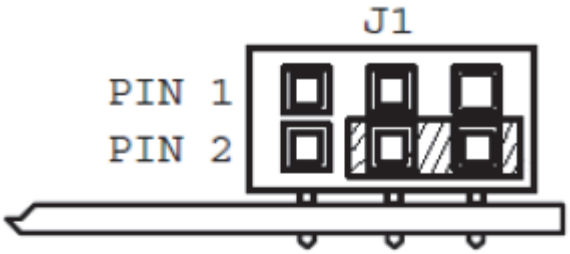
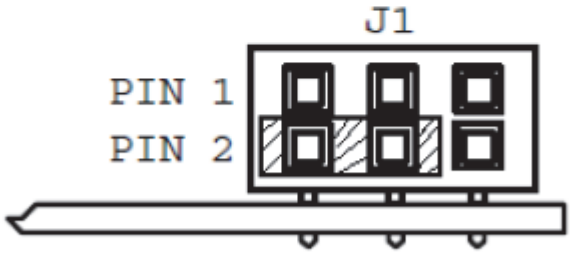


Figure 44. Write Protect Jumper



WRITE PROTECT DISABLED



WRITE PROTECT ENABLED

4. Operation

This section focuses on the operation of the flow computer portion of the NOCT60A.

- For all details of Coriolis transmitter configuration, refer to the “Using the Local Display,” “Quick Start,” “Setup,” and “Operation with Modbus Protocol” chapters of the Master Instruction for the CFT51 transmitter (MI 019-140).
- For details of flow computer configuration, refer to the Realflo and SCADAPack user documentation.

Operating Modes

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment monitored and controlled by the device before it is restarted.

Failure to follow these instructions can result in death or serious injury.

NOTICE

LOSS OF DATA AND APPLICATIONS

Performing a Cold Boot or Factory Boot returns the NOCT60A flow computer controller configuration parameters to their default settings, deletes logs and files in the file system, and erases Telepace logic, IEC-61131-3 logic, and C++ applications. This information must be reloaded into the controller for normal operation.

Before performing a Cold Boot or Factory Boot, save a copy of the controller configuration, logic and C++ applications, logs, files, and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in loss of data.

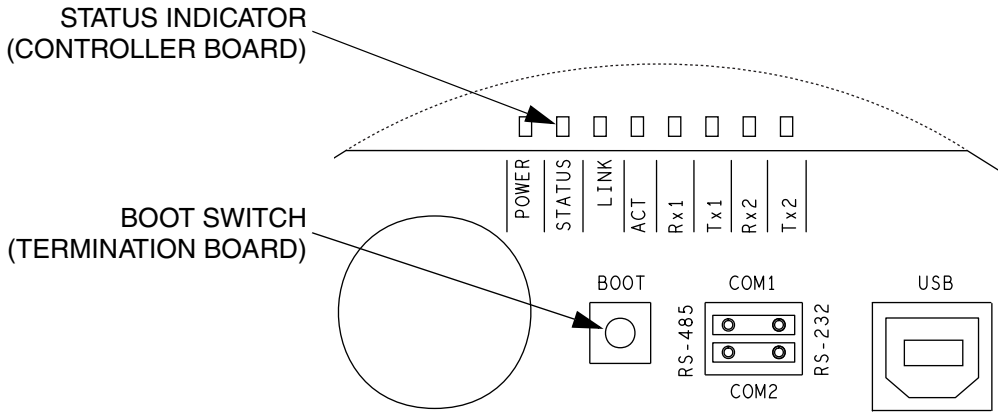
A NOCT60A may start up in RUN, SERVICE, COLD BOOT, FACTORY BOOT, or REENTRY BOOT modes.

- Startup in the RUN mode automatically executes Ladder Logic and C/C++ programs in the flow computer memory.
- Startup in the SERVICE mode stops the programs to allow reprogramming and initialization.
- Startup in the COLD BOOT mode initializes the flow computer and erases application programs.
- Startup in FACTORY boot reformats the Flash file system, initializes the flow computer and erases application programs.
- REENTRY boot is performed as part of the firmware download process.

Each boot mode is determined by the amount of time that the BOOT switch is depressed when power is applied or a board reset occurs.

The boot does not take place until the BOOT switch is released. Thus, it is possible to cancel the boot by removing power before releasing the BOOT switch.

Figure 45. Boot Switch and STATUS Indicator



Boot Modes

RUN Mode

The RUN mode is the normal operating mode of the flow computer. No action is required to select RUN mode. When power is applied to the flow computer:

- The user defined serial communication parameters for COM ports are used.
- If a Telepace Ladder Logic or IEC 61131-3 application program is loaded in RAM, it is executed.
- C application programs are executed.
- If there is no application program in RAM and there is an application program in flash ROM, then the flash ROM program will be executed.
- The lock settings and password are used.

SERVICE Mode

Use SERVICE mode during application programming and maintenance work. When a NOCT60A starts in SERVICE mode:

- The default serial communication parameters are used (see "Serial Communication" section for a description of the default parameters).
- The Telepace Ladder Logic or IEC 61131-3 program is stopped.
- The C program is stopped.
- Application programs are retained in non-volatile memory.
- The lock settings and password are used.

Select SERVICE mode by performing a SERVICE BOOT as follows:

1. Remove power from the flow computer.
2. Hold down the BOOT button.
3. Apply power to the flow computer.
4. Continue holding the BOOT button until the STATUS indicator illuminates.
5. Release the BOOT button.

If the BOOT button is released before the STATUS indicator illuminates, the NOCT60A will start in RUN mode.

COLD BOOT Mode

Use COLD BOOT mode after installing new firmware. When a NOCT60A starts in COLD BOOT mode:

- The default serial and Ethernet communication parameters are used (see "Serial Communication" and "Ethernet Communication" sections for a description of the default parameters).
- The Telepace Ladder Logic, IEC 61131-3 logic programs are erased.
- C programs are erased. This includes the Realflo flow computer application.
- The registers in the I/O database or I/O Connection are initialized to their default values.
- The Register Assignment is erased.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the flow computer before removing power.

Failure to follow these instructions can result in death or serious injury.

NOTICE

DATA LOSS

Starting the NOCT60A flow computer controller in Cold Boot mode returns the flow computer controller configuration parameters to their default settings and erases applications created in SCADAPack Workbench as well as Telepace programs and Realflo configurations. This information must be reloaded into the controller for correct NOCT60A operation.

Before starting the NOCT60A in Cold Boot mode, save a copy of the flow computer controller configuration information, user-created applications, logs, and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in loss of files related to configuration and data collection.

Select COLD BOOT mode by performing a COLD BOOT as follows:

1. Remove power from the NOCT60A.
2. Hold down the BOOT button.
3. Apply power to the NOCT60A.
4. Continue holding the BOOT button for 25 seconds until the STATUS indicator begins flashing continuously.
5. Release the BOOT button.

   If the BOOT button is released before the STATUS indicator begins to flash, the NOCT60A starts in SERVICE mode.
6. Reload the flow computer configuration and user-created applications from backup.

FACTORY BOOT Mode

Use the FACTORY BOOT mode to reformat the flash file system and initialize the NOCT60A to factory default settings. When the flow computer starts in FACTORY BOOT mode:

- The default serial and ethernet communication parameters are used (see “Serial Communication” and “Ethernet Communication”).
- The Telepace Ladder Logic or IEC 61131-3 and C Tools programs are erased.
- The C program is erased.
- The registers in the I/O database or I/O Connection are initialized to their default values.
- The Register Assignment is erased.
- The flow computer is unlocked.
- The flash file system is reformatted.

Select FACTORY BOOT mode by performing a FACTORY BOOT as follows:

1. Remove power from the NOCT60A.
2. Hold down the BOOT button.
3. Apply power to the NOCT60A.
4. Continue holding the BOOT button for longer than 30 seconds until the STATUS indicator illuminates steadily.
5. Release the BOOT button.

The FACTORY boot takes approximately 60 seconds to complete. During this time, the flow computer may appear unresponsive while the file system is being formatted. The STATUS indicator remains on until the FACTORY boot has completed.

Low RAM Battery Voltage Effect

If the lithium RAM battery is detected at 1.0 Vdc or less (or if it is absent) when a RUN_BOOT or SERVICE_BOOT is performed, a modified version of the RUN_BOOT or SERVICE_BOOT occurs.

The special initialization with low voltage battery includes the following:

- The registers in the I/O database or I/O connection are initialized to their default values.
- Ladder logic applications saved in RAM are erased.
- Ladder Logic programs, including DNP configurations and register assignments, saved to flash memory will be restarted on a Run boot.
- IEC 61131-3 applications are erased.
- The DNP configuration is erased.
- The communication parameters for serial ports and LAN port are set to default values when a Service boot is performed, and are returned to user defined values when a Run boot is performed.
- C applications are stopped during a Service boot and restarted fresh with the execution state set to first run during a Run boot condition. This enables C applications to re-initialize any “dynamic NVRAM” allocation that is required when the application starts.
- Data Log and Data Log to File functions return either “Invalid ID or has not been created” or “Invalid logging mode” errors.

Boot Mode Effects

The table below summarizes the effects of the various boot modes.

Table 23. Boot Mode Effects

Action	Run Boot	Service Boot	Cold Boot	Factory Boot	Re-entry Boot
IP Address set to default			Yes	Yes	
Serial settings set to default		Yes	Yes	Yes	
Lock settings set to default			Yes	Yes	
S&F settings set to default		Yes	Yes	Yes	
Friendly IP Table set to default		Yes	Yes	Yes	
BOOT set to default			Yes	Yes	
Register assignment erased			Yes	Yes	
Database initialized			Yes	Yes	IEC 61131-3: Yes Telepace: Yes, if upgrading from firmware before 1.40
Logic application erased			Yes	Yes	IEC 61131-3: Yes Telepace: Yes, if upgrading from firmware before 1.40
C/C++ Applications Erased			Yes	Yes	
Application files are erased			Yes	Yes	
Flash File System reformatted				Yes	
C/C++ Applications started	Yes				
Logic application started	Yes				
Communication settings on active interface retained					Yes
Settings saved to non-volatile memory			Yes	Yes	Yes
Ladder logic in flash is erased			Yes	Yes	
Protocols are set to defaults		Yes	Yes	Yes	

Reduced Power Mode

The NOCT60A is capable of lower power operation when in Reduced Power Mode. The flow computer enters this mode under control of the application program. During Reduced Power Mode, the following happens:

- The CPU runs at 12 MHz.
- The POWER indicator blinks once per second to indicate this mode.

The NOCT60A exits from Reduced Power Mode under the following conditions:

- In a Telepace application, the user changes the corresponding register associated with the CNFG Power Mode register assignment.

  Refer to the Telepace manual for more information on the CNFG Power Mode register assignment.
- In an IEC 61131-3 application, the setpmode or getpmode is used.

  Refer to the IEC 61131-3 manual for more information about these functions.
- In a C application, the user calls the SetPowerMode or GetPowerMode function. Refer to the NOCT60A C Tools manual.

Status LED

The STATUS indicator signifies a run-time condition in the flow computer. The STATUS indicator blinks when a condition exists, and turns off when the conditions are cleared.

The STATUS indicator blinks codes in a binary sequence:

Table 24. Status LED Codes

Sequence	Controller Status Code
Off	0 = Normal
1 Short, 1 Long	Register Assignment Checksum Invalid

The status LED also indicates a boot-time condition. See “Operating Modes” for more information.

Register Assignment Checksum Invalid

This status code this indicates that the register assignment is not valid. To correct this, initialize the register assignment from the Realflo or Telepace Studio software.

Troubleshooting

Refer to the “Troubleshooting” chapter of MI 019-140 for transmitter error codes and faults.

For software issues, refer to the appropriate user guides.

5. Maintenance

The NOCT60A requires little maintenance. The Power LED indicates the status of the 5 Vdc supply. If the LED is off, the onboard fuse may require replacing. If the program is lost during power outages, the lithium battery may require replacement.

The analog input circuitry is calibrated at the factory and does not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage.

If the flow computer controller is not functioning correctly, contact Global Customer Support for information on returning the NOCT60A for repair.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the device before removing power.

HAZARD OF ELECTRIC SHOCK

- Remove power from the device before removing the device cover.
- Remove power from the device before servicing.

Failure to follow these instructions can result in death or serious injury.

Replacing the Fuse

A single 0.375 Amp fast-blow fuse helps to protect the power supply. The fuse is mounted on the termination board.

Investigate and correct the cause of the fuse failure before replacement. Common causes of blown fuses are short circuits and excessive input voltages.

⚠ WARNING

EXPLOSION RISK

Before replacing the fuse, verify that the area is non-hazardous and disconnect power.

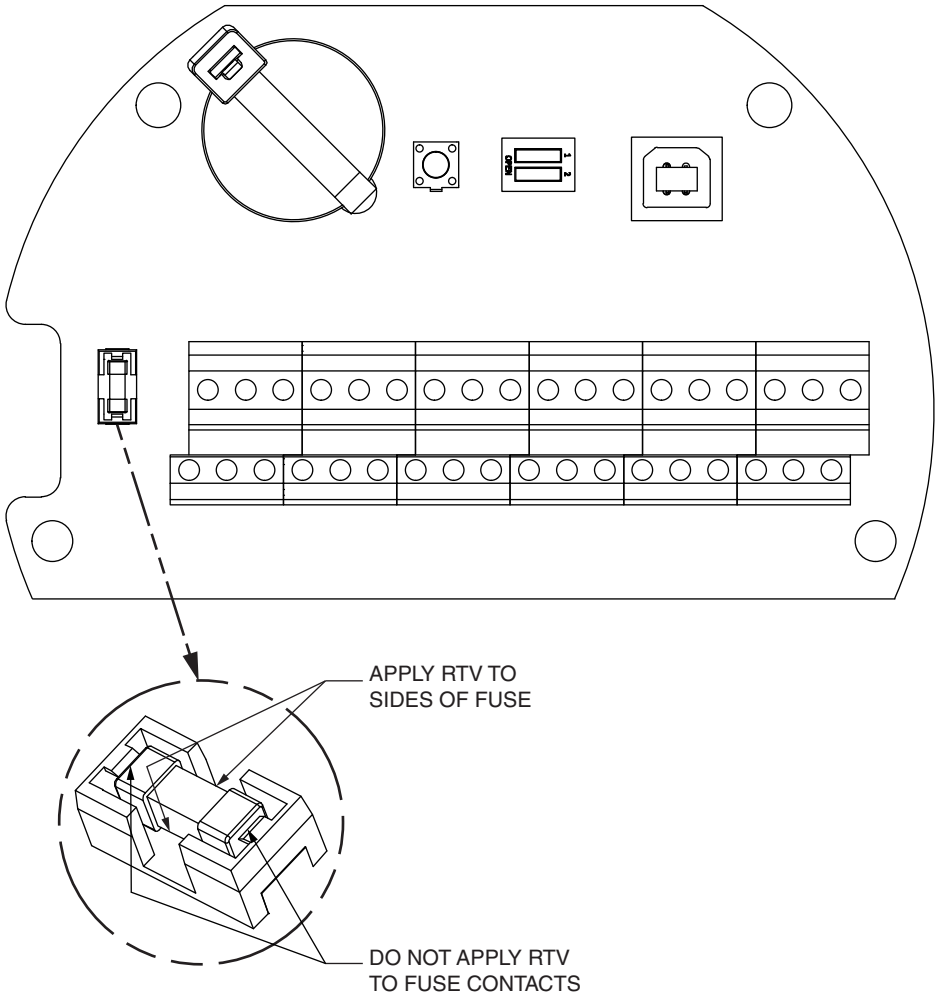
UNEXPECTED EQUIPMENT OPERATION

- Evaluate the operational state of the equipment monitored and controlled by the device before removing power.
- Replace the fuse with a fuse of the same rating. Under no circumstances should a fuse be bypassed or replaced with a fuse of a higher rating.

Failure to follow these instructions can result in death or serious injury.

1. Remove the fuse from the fuse holder.
2. Clean off old RTV sealant from the board.
3. Insert a replacement 0.375 Amp fast-blow fuse into the fuse holder.
4. Secure the fuse to the holder using RTV adhesive sealant (MG Chemicals TSE397C-333ML) as shown in Figure 46.

Figure 46. Replacing the Fuse



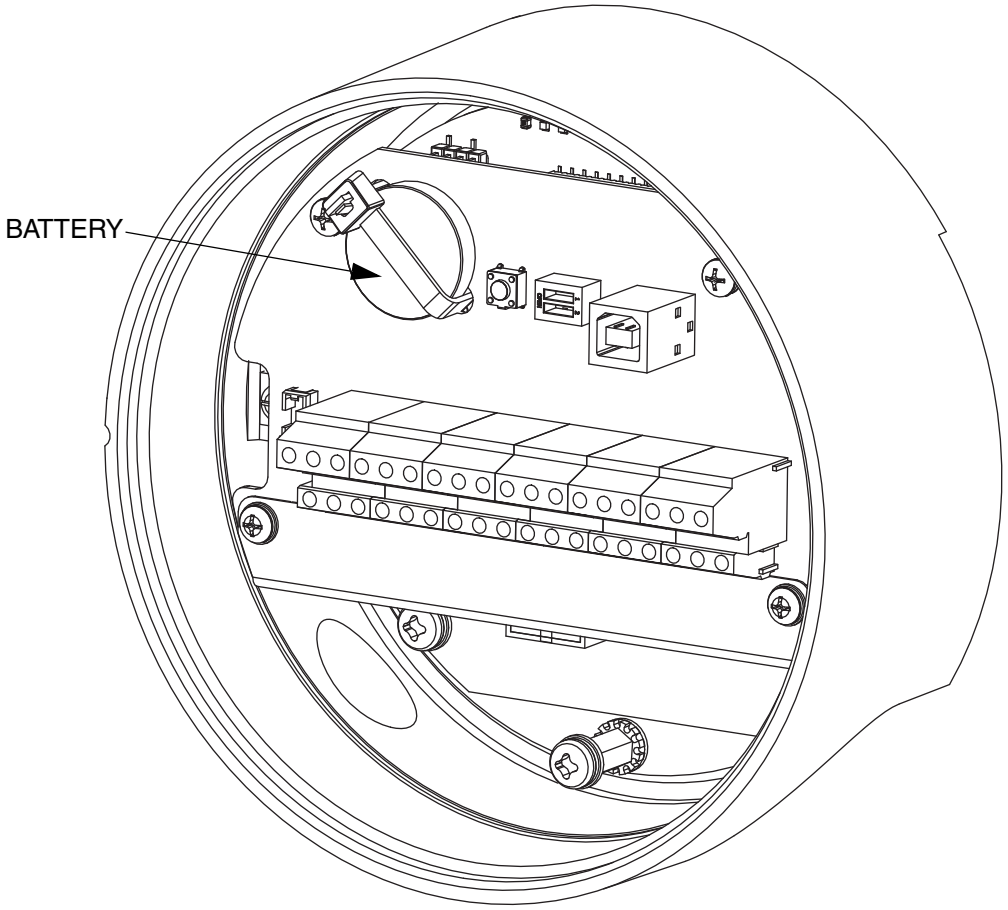
Replacing the Battery

A small lithium battery powers the CMOS memory and real-time clock when input power is removed. The voltage of a functioning battery should be greater than 3.0 V. An application program can monitor this voltage. Refer to the programming manual for details.

The shelf life of the battery is 10 years. The battery is rated to maintain the real-time clock and RAM data for two years with the power off. Accidental shorting or extreme temperatures may damage the battery.

The battery is plugged into the circuit board and held in place with a tie-wrap. It must be replaced with an identical battery available as Foxboro part number K0157AH.

Figure 47. Lithium Battery



NOTICE

CONFIGURATION DATA LOSS

Device configuration information can be lost if the onboard RAM back-up battery goes flat, is disconnected, if the device is damaged, or if there has been a firmware upgrade. Verify the voltage of the onboard RAM back-up battery before installing the device in the field.

UNEXPECTED EQUIPMENT OPERATION

- Treat battery with care.
- Follow the manufacturer's instructions concerning battery storage, use and disposal.
- Keep the battery clean and free from contaminants or other materials that could short the terminals.
- Connect the new battery using the correct polarity.
- Replace battery with a new unit of the same chemistry, capacity and make.
- Observe the manufacturer's instructions regarding disposal of batteries. Considerable energy remains in the battery.

Failure to follow these instructions can result in equipment damage.

1. Save the program running in the NOCT60A, if applicable.
2. Disconnect power from the NOCT60A.
3. Remove the field wiring compartment cover.

   The battery is located on the left side of the circuit board. It is fastened in place at the factory with a reusable tie-wrap.
4. Open the tie wrap and remove the battery by gently lifting it straight up from the circuit board. The battery has two pins that mate with two sockets on the circuit board.
5. Replace the battery, ensuring correct polarity.
6. Close the tie wrap around the battery.
7. Cold boot the flow computer controller. Refer to section COLD BOOT Mode for the Cold Boot procedure.

   If a cold boot is not done, the behavior of the flow computer controller is unpredictable.
8. Reload/reprogram the flow computer configuration and reset the real-time clock (RTC). See “Reloading the Flow Computer Configuration” for details.

Reloading the Flow Computer Configuration

1. Connect a USB or serial cable from your PC to the NOCT60A.
2. Run the Realflo software.

   If Realflo opens in Maintenance Mode, click "Switch to Expert Mode."
3. From the File menu, select **Open**. Select the Realflo configuration file for this NOCT60A unit.
4. From the Configuration menu, select **Replace flow computer**.
5. Select **Flow Computer with Enron Modbus** and click **Next**.
6. The "Set Time" step is displayed when the flow computer configuration is loaded. Set the real-time clock by selecting either **Yes, set to PC time** or **Yes, set to this time**, and click **Next**.
7. The "Write Flow Computer Configuration" step is displayed.
   a. Select **Yes** and click **Next**.
   b. Select **All Configuration** and click **Next**.
   c. Follow the onscreen instructions.
8. The "Select Alarm and Event Logs" step is displayed. Click **Finish**.
9. Verify that the flow computer is operating and measuring flow.

Replacing the Electronics Module

Kits are available to replace the electronics module. The replacement procedure requires static protection materials (such as a wrist strap with wire to ground) and Phillips-head screwdrivers. Refer to MI 019-140 for part numbers and installation instructions for the Electronics Module Replacement Kit.

After replacing the electronics module, use the PC-based CFT51 Configurator or the pushbuttons on the transmitter's LCD indicator to change the baud rate to 38400.

Replacing the Flow Computer Module

The following kits are available to replace the flow computer module.

Part No.	NOCT60A Flow Computer Module Kit
K0157AF	Configured for Telepace Ladder Logic Programming
K0157AG	Configured for IEC61131-3 Logic Programming

Preparing for Installation

Reference Documents

Refer to the following documents for additional information:

MI 019-120	I/A Series® Mass Flowtubes Models CFS10 and CFS20 Installation, Startup, Troubleshooting and Maintenance
MI 019-125	I/A Series® Mass Flowtubes Model CFS25 Installation, Startup, Troubleshooting and Maintenance
MI 019-140	Digital Coriolis Mass Flow Transmitter Model CFT51 with HART® or Modbus® Communication Protocol

Required Tools

Make sure you have the following materials on hand:

- Phillips-head screwdriver
- Static protection materials, such as a wrist static strap with wire to ground.

Safety Considerations

Please observe the following safety considerations when removing and replacing the flow computer module.

⚠ DANGER

Explosion Hazards:

Do not disconnect equipment when a flammable or combustible atmosphere is present unless power has been switched off.

To prevent possible explosions and injury to personnel, ensure that wiring meets applicable safety codes.

For nonintrinsically safe installations, to prevent a potential explosion in a Division 1 or Zone 1 hazardous area, de-energize transmitters before you remove threaded housing covers. Failure to comply with this warning could result in an explosion resulting in severe injury or death.

⚠ WARNING

Before replacing parts, turn the power off.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

This product contains components that have critical safety characteristics. **Do not** substitute components. Replace components only with identical factory-supplied components. Component substitution may impair the electrical safety of this equipment and its suitability for use in hazardous locations.

NOTICE

Components in your transmitter, including the replacement flow computer module, are ESD sensitive and thus are susceptible to damage resulting from electrostatic discharge.

The replacement flow computer module is shipped in a protective antistatic plastic bag. **Do not remove it from this bag until it is ready to be installed**. This minimizes the possibility of damage due to accidental electrostatic discharge.

Be sure that you are grounded via a conductive wrist strap or by standing on an ESD mat when performing maintenance in the electronics compartment, field wiring compartment, or junction box, or if the housing is removed.

Procedure

1. Before replacing the flow computer module, use the CFT51 Configurator to upload the configuration to a file on a computer for downloading after the replacement module is installed.
2. Take the unit offline.
3. Disconnect power from the unit.
4. Use proper static electricity protection such as a static strap or conductive shoes according to local standards.

5. Unscrew and remove the front windowed cover.

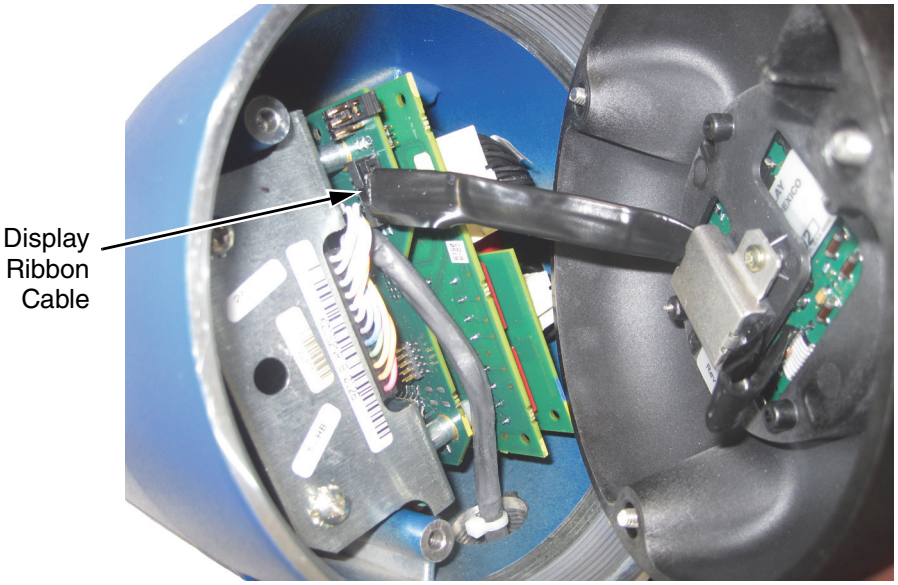
Figure 48. Removing the Front Windowed Cover

6. Remove the display bezel assembly by loosening the three screws all the way. The screws are captive and will not fall out.

Figure 49. Loosening the Display Bezel Screws

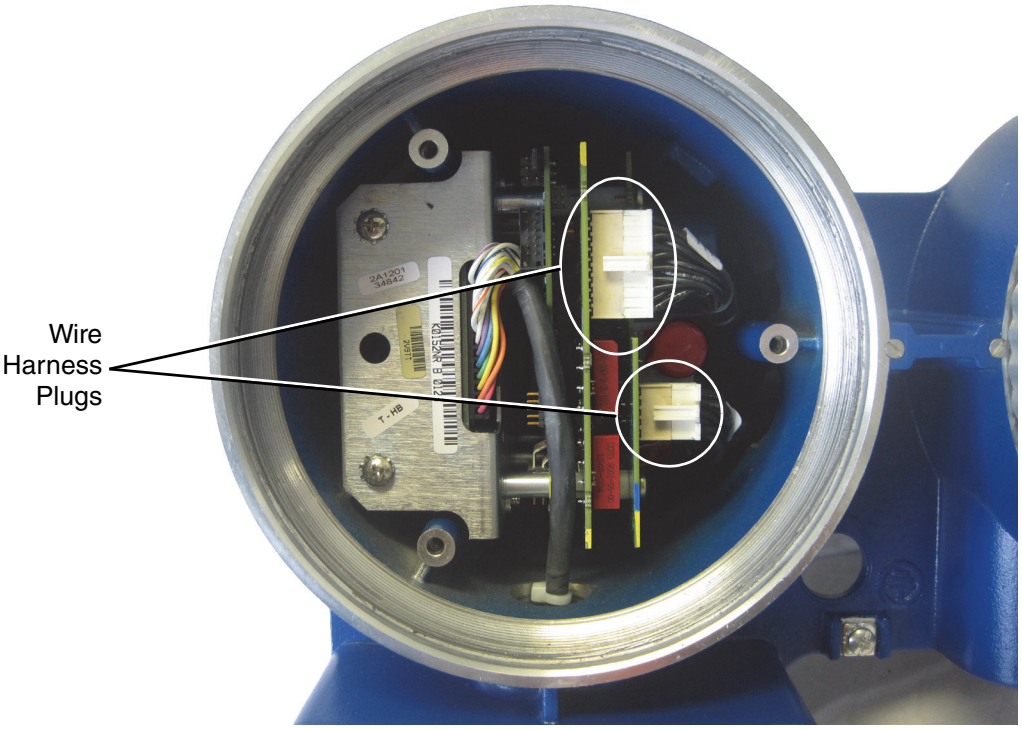
7. Once you have loosened the screws, remove the display bezel assembly and disconnect the display ribbon cable from the electronics board.

Figure 50. Disconnecting the Display Ribbon Cable



8. Disconnect the two wire harness plugs from the electronics module as shown in the diagram.

Figure 51. Disconnecting the Wire Harness Plugs



9. Unscrew and remove the cover from the field connections compartment.
10. In the field connections compartment, disconnect all power wires, I/O wires, and shield wires.
11. Remove the cable shield standoff and hardware. See Figure 57 and Figure 58.
12. Remove the module board grounding screws and washers (two sets) at the bottom of the module. See Figure 56.
13. Remove the two long module board screws at the top of the module. See Figure 55.
14. Gently begin to remove the flow computer module while guiding the I/O and power cables that you disconnected in Step 8 down into the electronics compartment.
15. When the wire harness plugs that you disconnected in Step 8 reach the opening between the compartments as shown in Figure 52, there will be enough slack to disconnect the cables from the bottom of the flow computer module as shown in Figure 53.

Figure 52. Guiding the I/O and Power Cables Downwards

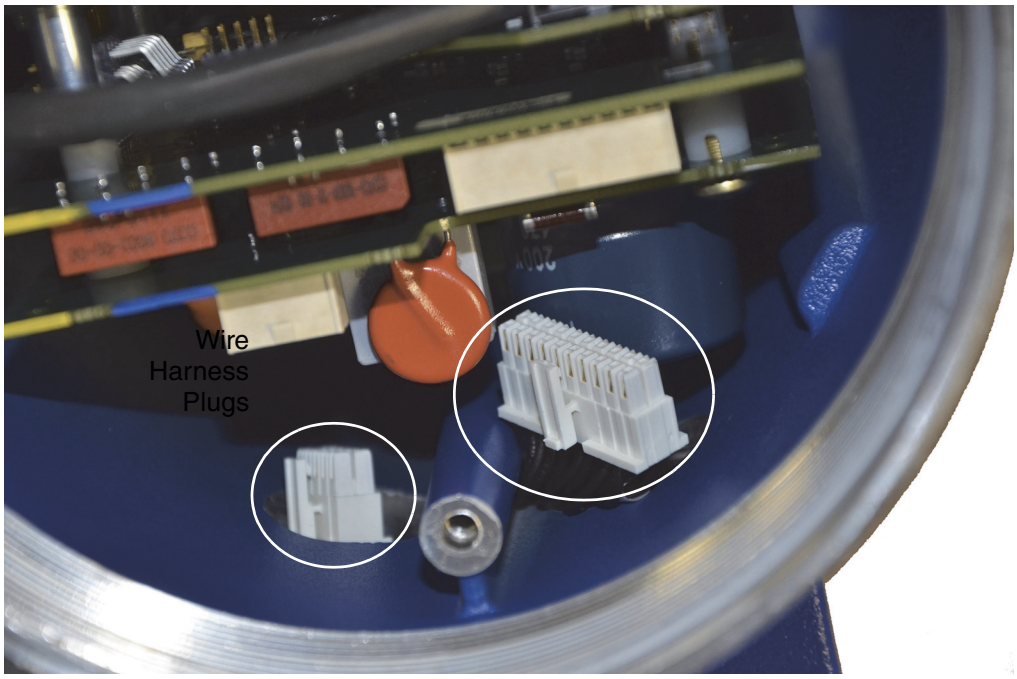
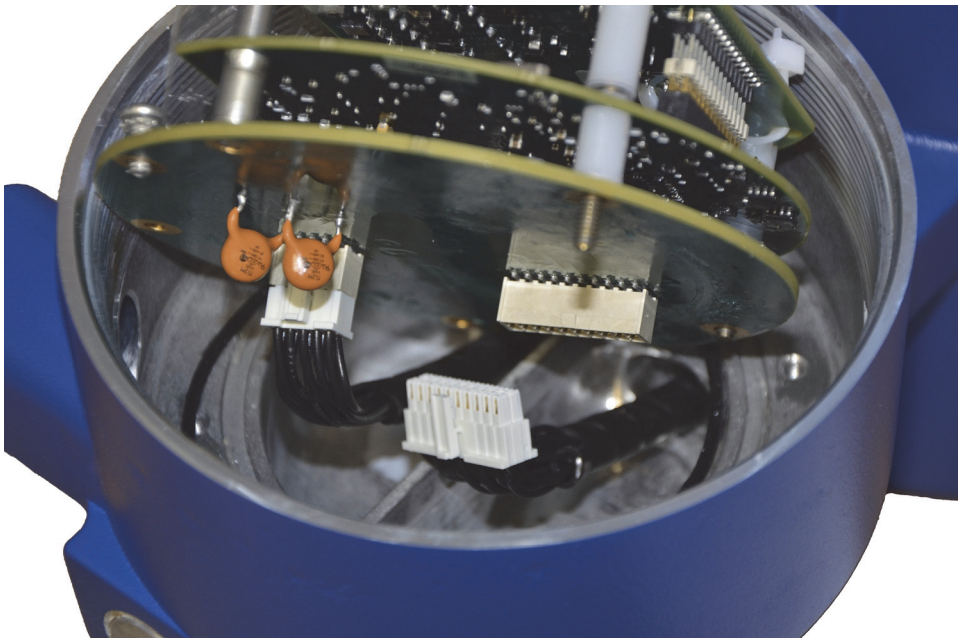
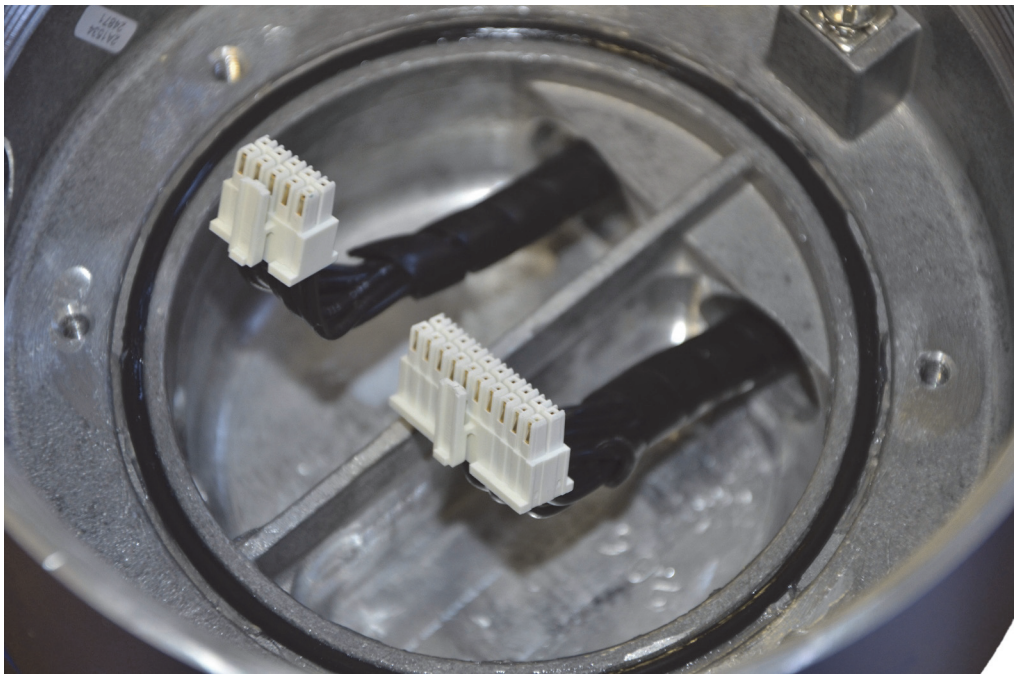


Figure 53. Disconnecting the I/O and Power Cables



16. Make sure the o-ring is in the groove at the bottom of the compartment. If it is not, gently push it back into the groove.

Figure 54. Re-seating the O-Ring



17. Connect the I/O cable and power cable to the bottom of the replacement flow computer module. See Figure 53.

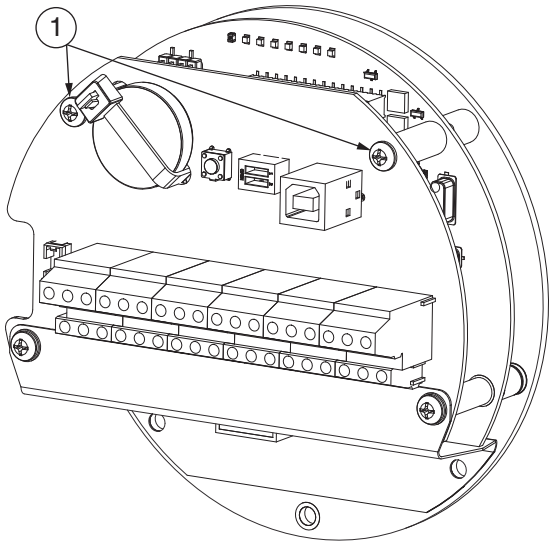
18. Begin to place the flow computer module into position at the bottom of the housing while carefully sliding the I/O and power cables back up into the electronics compartment until the wire harness plugs are at the top of the electronics module. See Figure 52.

NOTICE

Do not allow the cables to become pinched between the housing and the module. Pinching the cable can damage the electronics.

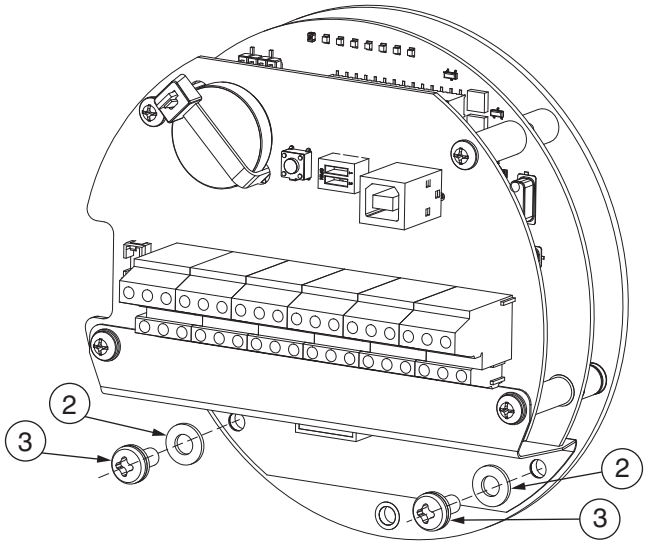
19. Using the two long screws (item 1), loosely secure the module to the housing in two places as shown.

Figure 55. Securing the Module with Long Screws



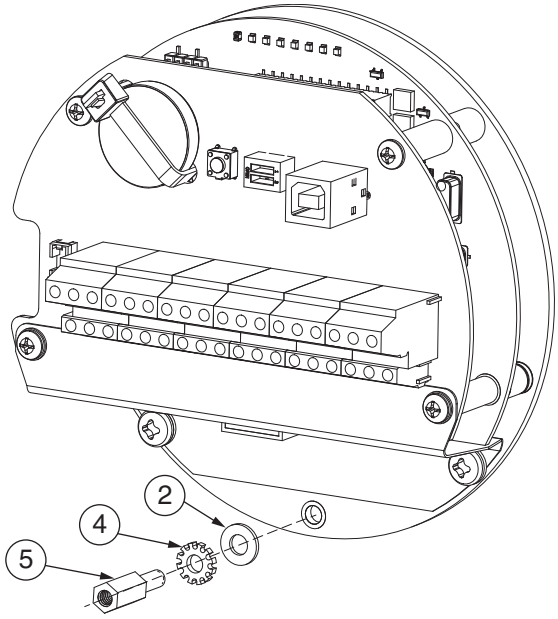
20. Using flat washers (item 2) and sems screws (item 3), loosely secure the module to the housing in two places as shown.

Figure 56. Securing the Module to the Housing



21. Using a flat washer (item 2), a toothed washer (item 4), and the standoff (item 5), loosely secure the module board to the housing in the location shown.

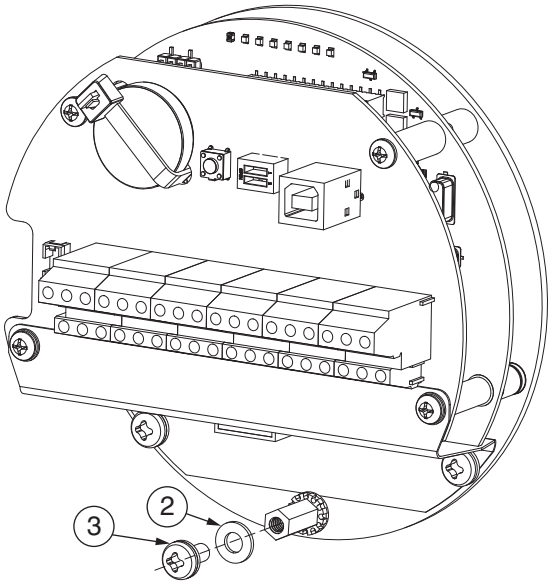
Figure 57. Securing the Board to the Housing



22. Torque the long screws (item 1) to 2 to 4 in/lb. Torque the two sems screws (item 3) and the standoff (item 5) to 11 in/lb.

23. Install the flat washer (item 2) and sems screw (item 3). Reconnect the cable shield to the standoff (item 5), if applicable. Torque to 7 in/lb, with or without the cable shield.

Figure 58. Securing the Standoff



24. Reconnect the two wire harness plugs shown in Figure 51.
25. Reconnect the display ribbon cable shown in Figure 50.
26. Reposition the display, making sure that the top of the display bezel is positioned at the top of the transmitter housing, and tighten the three screws shown in Figure 49. Torque the three screws to 11 in/lb.
27. Put the windowed cover back on the electronics compartment. Tighten the cover until it lays flat against the metal housing.
28. Put the field wiring compartment cover back on. Tighten the cover until it lays flat against the metal housing.

The flow computer module has now been replaced, and the transmitter is ready to be placed back into service.

Returning the Transmitter to Service

After replacing the flow computer module, apply power to the device and configure it for your application.

If you used the Realflo Configurator to backup/upload the configuration file from the original module prior to replacement, reconnect the configurator and download the configuration file into the replacement module. If a configuration backup file was not uploaded, you will need to use the configurator to manually enter the settings required for your application.

You will also need to program the flowtube information into the transmitter. The information is stamped on the flowtube data label. Flow rate measurement will not be correct if the information is not programmed into the transmitter properly. Perform the procedures in the "Quick Start" chapter of MI 019-140 to program the flowtube information into the transmitter.

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