IS Sensor Module Instruction Sheet

SignalFire Model: MC1D1-3BIS-1-M-N

The SignalFire Intrinsically Safe interface has the following features:

- Powers two 4-20mA/1-5V sensor interfaces at 18.0VDC
- One analog input channel can support a HART loop with up-to 4 devices
- Two counter/frequency inputs, up to 2kHz. Open drain or pulse input supported
- Reports state of dry contact inputs, open/closed.
- Two 32Bit count totalizer
- Low power operation from an intrinsically safe high capacity lithium primary battery pack.
- Optional LCD can display sensor readings and status information locally
- Sends data to a SignalFire Buffered Modbus Gateway
- Settable (rotary switch) check-in period
- Settable (rotary switch) network address
- Settable (DIP switch) Modbus ID

Specifications

Enclosure Size:	4.5” tall x 6.0” wide x 4.0” deep
Power Supply:	IS Lithium battery pack, 3.0VDC to 3.7VDC, 160mA max. SignalFire Part Number 810-0008-02
Temperature Range:	-40ºC to +60 ºC
Radio Frequency:	902-928MHz ISM Band, FHSS radio.
Compliance:	Certified for use in Class I, Division 1 groups C and D. EXi [EXi] FCC/IC Certified.

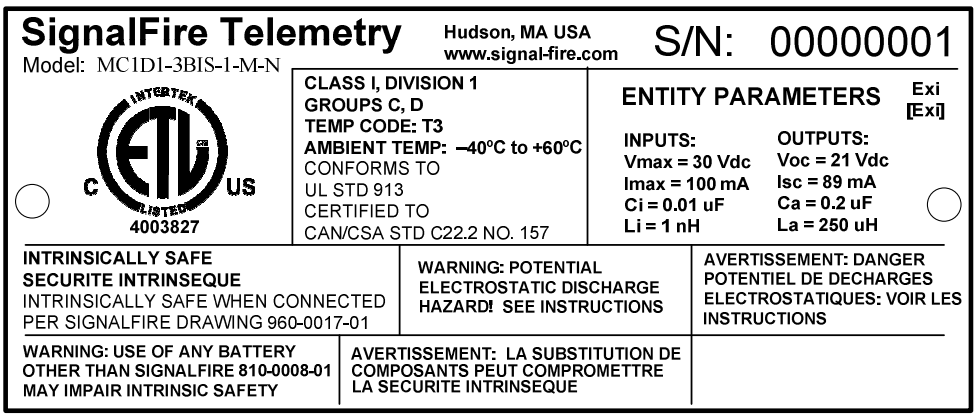
WARNING: *Use of this equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment.*

WARNING: *The use of any parts not supplied by the manufacturer violates the safety rating of the equipment*

The associated apparatus provides intrinsically safe outputs
L'appareil associé fournit des sorties à sécurité intrinsèque

Refer to control drawing 960-0017-01 for requirements when used in a Class I Division 1 area.

The following marking must be visible when the product is installed:



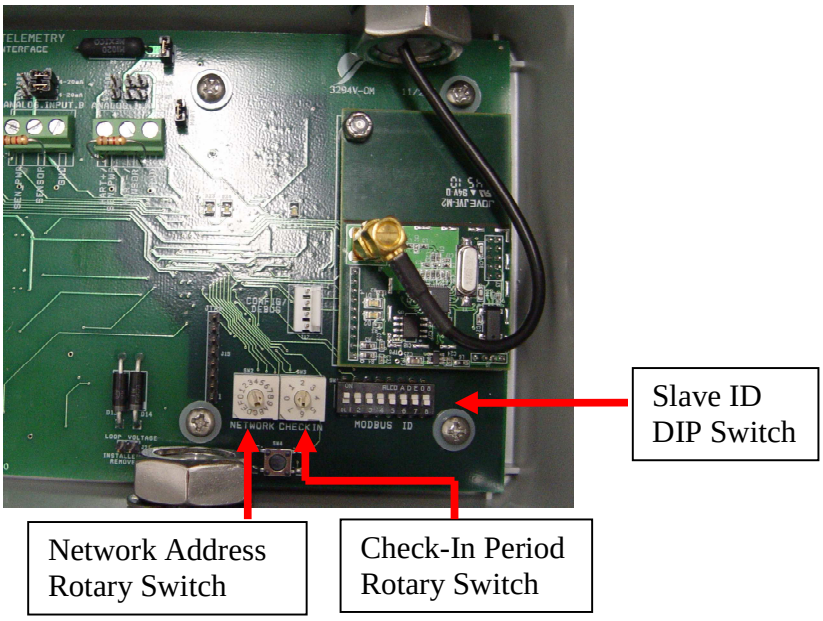
Section 1: Setup

⚠ ***WARNING:*** *Perform the steps in section 1 setup in a safe location only.*

The nodes need to be set up for correct operation before being fielded. The configurable items are:

- Network Selection
- Check-in Period Selection
- Modbus Slave ID Setting

The network and check-in period are set via a rotary switch. The Modbus slave ID is set using the DIP switch.



Network Setting

The network address can be used to create multiple networks using multiple gateways (that are in close proximity with one another). The network address can be selected using the 16 position rotary switch as detailed above.

The network setting must be the same on all units in the network including the gateway.

System Check-In Period

The check-in period is set using the 8 position rotary switch. The switch settings are a shown in the following table:

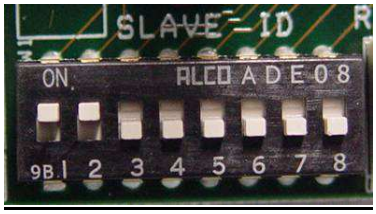
Switch Setting	Check-In Period
0	1 min
1	2 min
2	4.5 min
3	10 min
4	30 min
5	1 hr
6	5 sec
7	15 sec

The default setting is 2 for a check-in period of 4.5 minutes.

Note: Settings 6 and 7 should only be used for testing as they will result in a short battery life.

Modbus Slave ID

The Modbus Slave ID is set using the DIP switch. The DIP switch takes an 8-bit binary input which is converted into a slave ID from 1 to 255. In the picture below switch 1 and 2 are on which is 00000011 and results in a slave ID of 3. The least significant bit (LSB) is on the left and is labeled 1 under the row of switches.

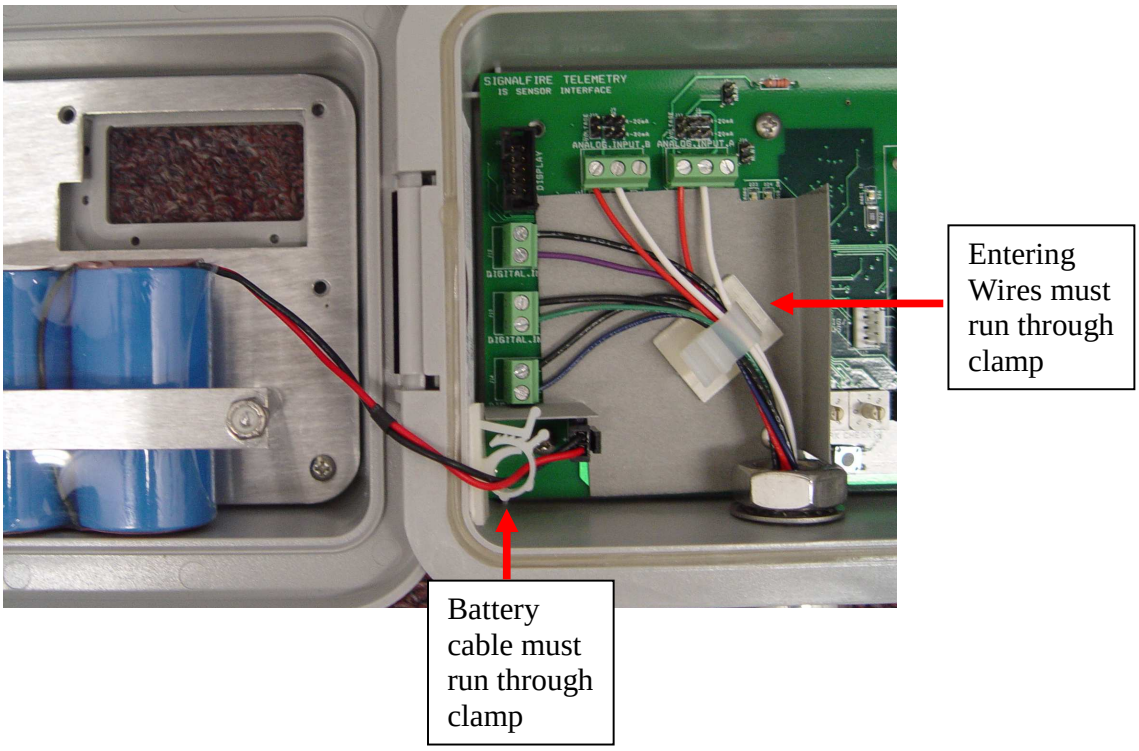


Section 2: Sensor Connections

Wiring Requirements

To ensure intrinsic safety is maintained it is required that the installer follow these guidelines when connecting sensors to the SignalFire device. See picture for proper wire routing example.

- All wires entering the enclosure must be run through the cable hold-down clamp.
- The battery wire much be routed through the battery cable hold-down clamp.
- Installer must ensure that the battery cable cannot come into contact with any of the wires exiting the enclosure.
- Strip the wires so that there is a minimum exposed un-insulated wire when inserted into the screw terminals.
- All wiring should be neat and orderly.
- All wiring must remain within the shielded area of the board.

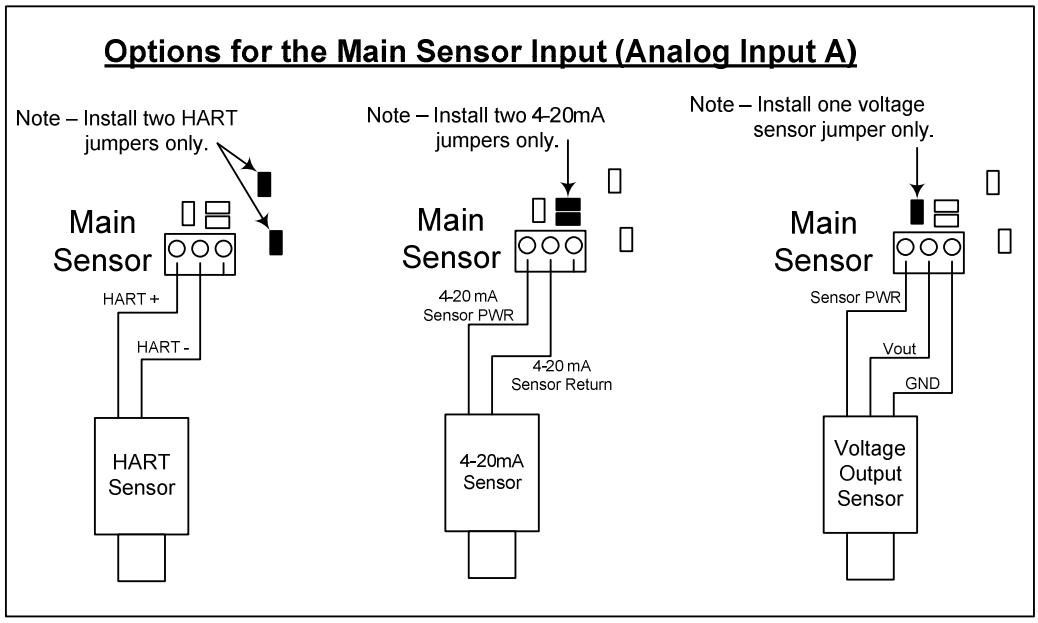


Main Sensor Connection

The main sensor channel can be configured for three types of sensors, HART, 4-20mA, or 1-5V.

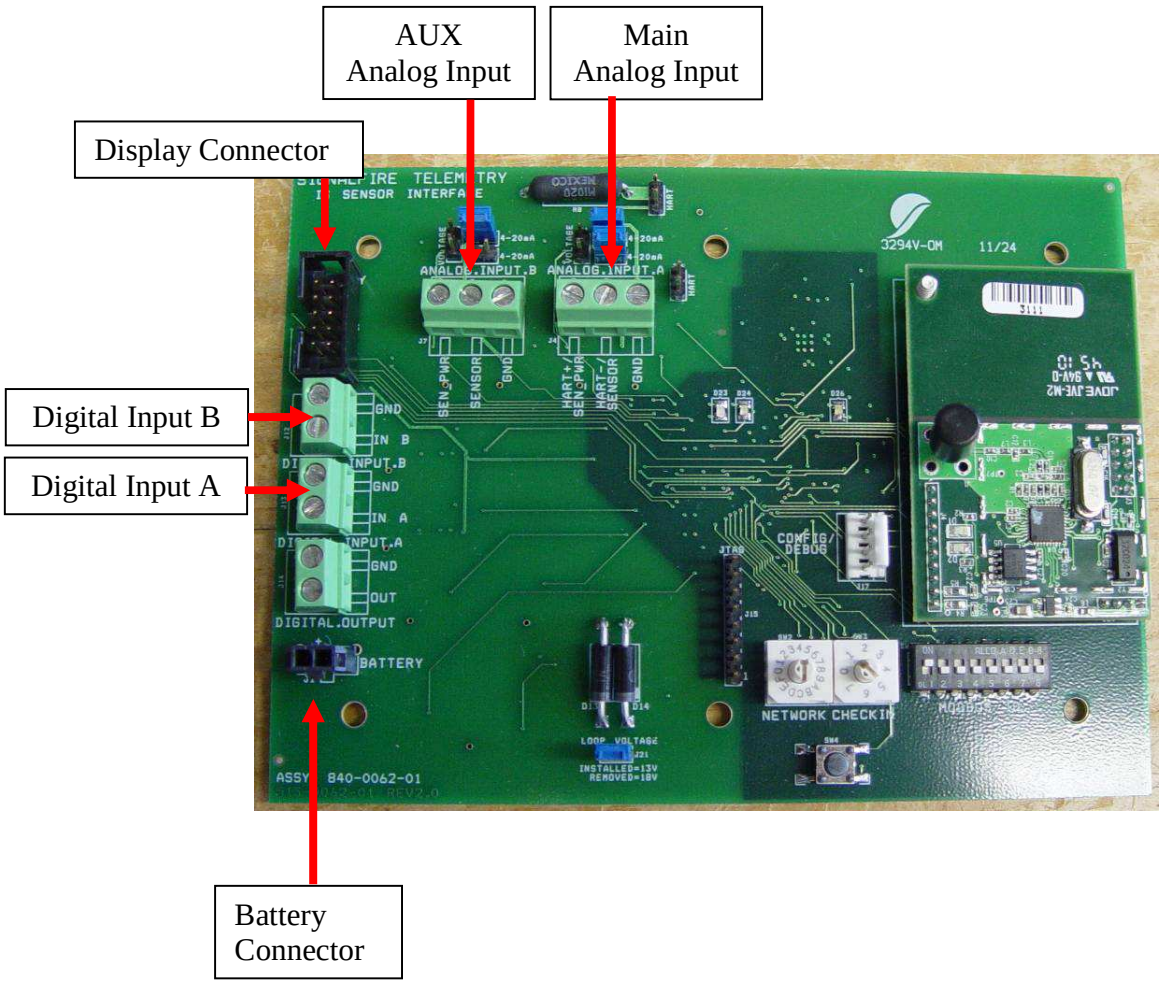
When configured for HART operation up-to 4 sensors can be connected on the HART current loop. The sensors must be pre-configured for multi-drop mode and ID's 1-4 are supported.

When configured for 4-20mA, or 1-5V operation, only a single sensor may be connected to the input channel.



The system will supply either 18 Volts (voltage jumper not installed) to the sensors or 12V (voltage jumper installed) for 2 seconds and measure the resultant current/voltage.

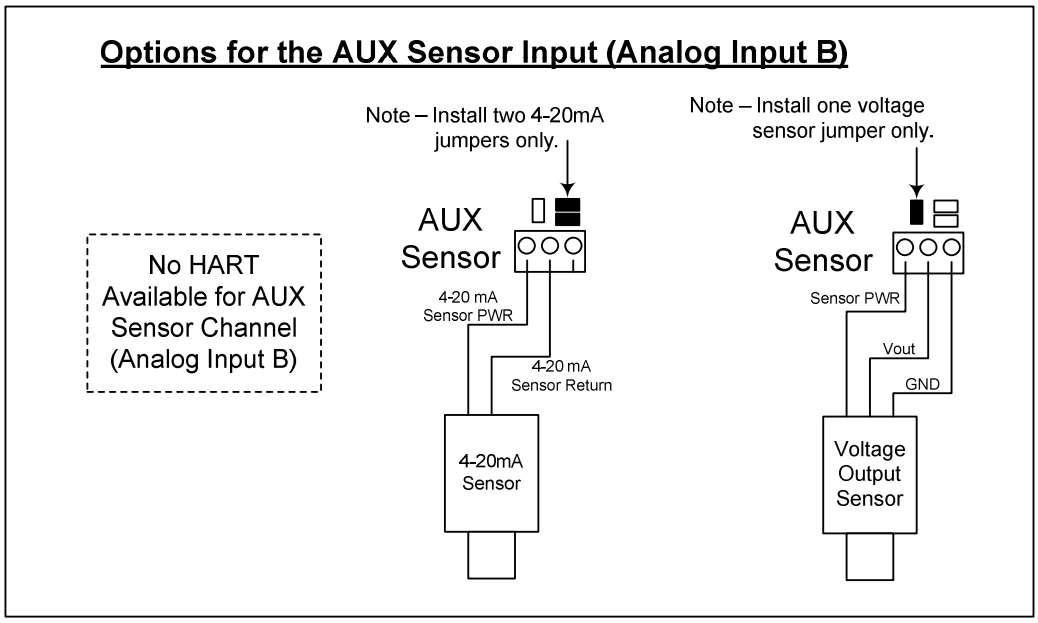
Selecting a loop voltage of 12V will result in longer battery life; however some sensors require higher voltage. The loop voltage selection will set the voltage on both the Main Sensor and Aux Sensor channels.



Connector and jumper locations

Aux Sensor Connection

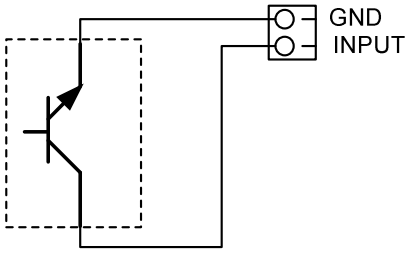
The aux sensor channel can be configured for either, 4-20mA, or 1-5V inputs.



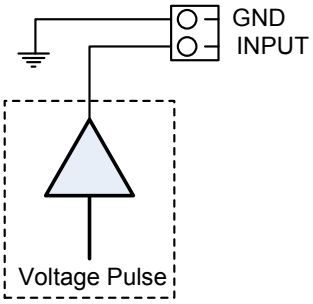
Counter / Frequency / Digital Inputs

Each counter input may be either open collector type (sinking ground), dry contact inputs, or voltage pulse type. The inputs can count up to 2000 Hz.

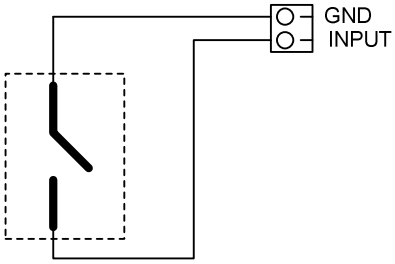
The digital outputs may be connected to the board as shown in the following diagrams:



Open Collector Connection



Voltage Pulse Connection



Dry Contact Connection

The count accumulates and the current count is stored into non-volatile memory every two hours. If the system is reset the counts will revert to the last stored value from non-volatile memory.

The system also reports the state of the contact closure input at the time of check-in.

Section 3: Remote Modbus Register Mapping

The MC1D1-3BIS-1-M-N sends data to a SignalFire Telemetry buffered Modbus gateway. The data that is sent to the gateway shows up at the gateway in registers when it can then be read by a Modbus RTU. Consequently, the node needs to have a unique (to the network it is in) Modbus slave ID which the gateway will use to store its unique data. The ID is set via the DIP switch on the board.

Modbus Registers

Every check-in period, the sensors are read and data is sent to the gateway. The gateway will save the data under the set Modbus ID in 16-bit registers. The register map for this system is:

Analog and Digital Input Registers

Register Number	Register Address (offset)	Description
43001	3000	A/D Counts Loop A
43002	3001	Loop A current in µA
43003	3002	Loop A voltage in mV
43004	3003	Custom Scaling of Loop A (32bit Float High Word)
43005	3004	Custom Scaling of Loop A (32bit Float Low Word)
43006	3005	A/D Counts Loop B
43007	3006	Loop B current in µA
43008	3007	Loop B voltage in mV
43009	3008	Custom Scaling of Loop B (32bit Float High Word)
43010	3009	Custom Scaling of Loop B (32bit Float Low Word)
43011-43012	3010-3011	32-bit Hardware counter, 1004=high word (two registers)
43013	3012	Digital Input state (1=closed, 0=open)
43014	3013	Average frequency over the last check-in period times 10
43015	3014	Frequency over 2 seconds at check-in time times 10
43016	3015	Ave. counts per minute over the check-in period times 10
43017-43018	3016-3017	32-bit Hardware counter, 1004=high word (two registers)
43019	3018	Digital Input state (1=closed, 0=open)
43020	3019	Average frequency over the last check-in period times 10
43021	3020	Frequency over 2 seconds at check-in time times 10
43022	3021	Ave. counts per minute over the check-in period times 10

HART Registers

Register Number	Register Address (offset)	Description
44001	4000	HART ID 1: Manufacturer's ID Code/Device Type (ID=MSB, Device=LSB)
44002	4001	HART ID 1: Device ID Number (ID high bite = MSB, ID mid byte = LSB)
44003	4002	HART ID 1: Device ID Number, HART Status (ID low byte=MSB, Status=LSB)
44004	4003	HART ID 1: PV & SV Units Code (PV=MSB, SV=LSB)
44005	4004	HART ID 1: TV & QV Units Code (TV=MSB, QV=LSB)
44006-44007	4005-4006	HART ID 1: Primary Variable (PV) (two registers) (float)
44008-44009	4007-4008	HART ID 1: Secondary Variable (SV) (two registers) (float)
44010-44011	4009-4010	HART ID 1: Tertiary Variable (TV) (two registers) (float)
44012-44013	4011-4012	HART ID 1: Quaternary Variable (QV) (two registers) (float)
44014	4013	HART ID 2: Manufacturer's ID Code/Device Type (ID=MSB, Device=LSB)
44015	4014	HART ID 2: Device ID Number (ID high bite = MSB, ID mid byte = LSB)
44016	4015	HART ID 2: Device ID Number, HART Status (ID low byte=MSB, Status=LSB)
44017	4016	HART ID 2: PV & SV Units Code (PV=MSB, SV=LSB)
44018	4017	HART ID 2: TV & QV Units Code (TV=MSB, QV=LSB)
44019-44020	4018-4019	HART ID 2: Primary Variable (PV) (two registers) (float)
44021-44022	4020-4021	HART ID 2: Secondary Variable (SV) (two registers) (float)
44023-44024	4022-4023	HART ID 2: Tertiary Variable (TV) (two registers) (float)
44025-44026	4024-4025	HART ID 2: Quaternary Variable (QV) (two registers) (float)
44027	4026	HART ID 3: Manufacturer's ID Code/Device Type (ID=MSB, Device=LSB)
44028	4027	HART ID 3: Device ID Number (ID high bite = MSB, ID mid byte = LSB)
44029	4028	HART ID 3: Device ID Number, HART Status (ID low byte=MSB, Status=LSB)
44030	4029	HART ID 3: PV & SV Units Code (PV=MSB, SV=LSB)
44031	4030	HART ID 3: TV & QV Units Code (TV=MSB, QV=LSB)
44032-44033	4031-4032	HART ID 3: Primary Variable (PV) (two registers) (float)
44034-44035	4033-4034	HART ID 3: Secondary Variable (SV) (two registers) (float)
44036-44037	4035-4036	HART ID 3: Tertiary Variable (TV) (two registers) (float)
44038-44039	4037-4038	HART ID 3: Quaternary Variable (QV) (two registers) (float)
44040	4039	HART ID 4: Manufacturer's ID Code/Device Type (ID=MSB, Device=LSB)
44041	4040	HART ID 4: Device ID Number (ID high bite = MSB, ID mid byte = LSB)
44042	4041	HART ID 4: Device ID Number, HART Status (ID high byte=MSB, Status=LSB)
44043	4042	HART ID 4: PV & SV Units Code (PV=MSB, SV=LSB)
44044	4043	HART ID 4: TV & QV Units Code (TV=MSB, QV=LSB)
44045-44046	4044-4445	HART ID 4: Primary Variable (PV) (two registers) (float)
44047-44048	4046-4047	HART ID 4: Secondary Variable (SV) (two registers) (float)
44049-44050	4048-4049	HART ID 4: Tertiary Variable (TV) (two registers) (float)
44051-44052	4050-4051	HART ID 4: Quaternary Variable (QV) (two registers) (float)

Status Registers

Register Number[1]	Register Address (offset)	Description
49988	9987 or 65524	Major revision number for the mainboard
49989	9988 or 65525	Minor revision number for the mainboard
49990	9989 or 65526	Major revision number for the radio
49991	9990 or 65527	Minor revision number for the radio
49992	9991 or 65528	High 16 bits of SFTS node address
49993	9992 or 65529	Low 16 bits of SFTS node address (the radio ID)
49994	9993 or 65530	Slave ID readback
49995	9994 or 65531	Received signal strength of last packet from the slave
49996	9995 or 65532	Battery voltage of the Modbus client, in millivolts
49997	9996 or 65533	Minutes until this slave will time out, unless new data is received
49998	9997 or 65534	Number of registers cached for this slave device
49999	9998 or 65535	Remote device type (?? for IS Sensor Node)

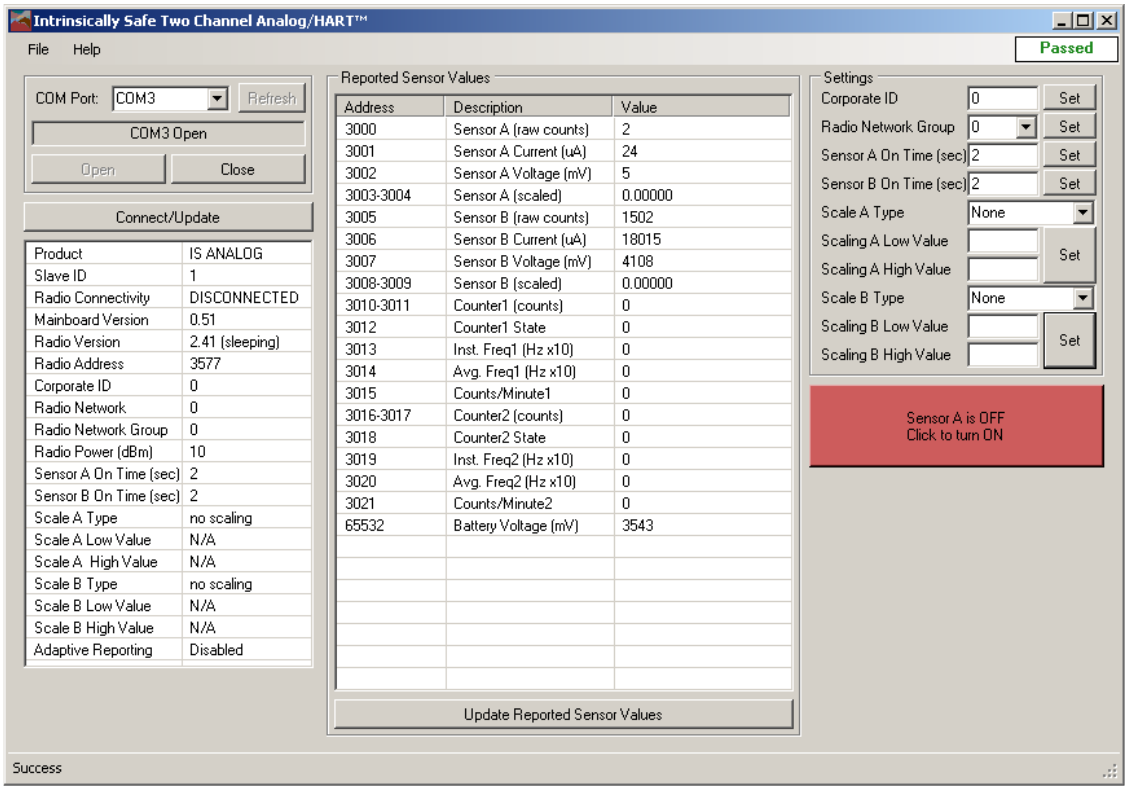
[1]The status registers are only available from the 49988-49999 address range if the Gateway is running firmware 7.52 or higher.

Section 4: Debug and Advanced Configuration

***WARNING:** Only connect to the debug port in a safe area!*

Debug and configuration information is available if a connection is made via the debug port on the main board. A RS232 converter cable (available from SignalFire) must be used for this interface.

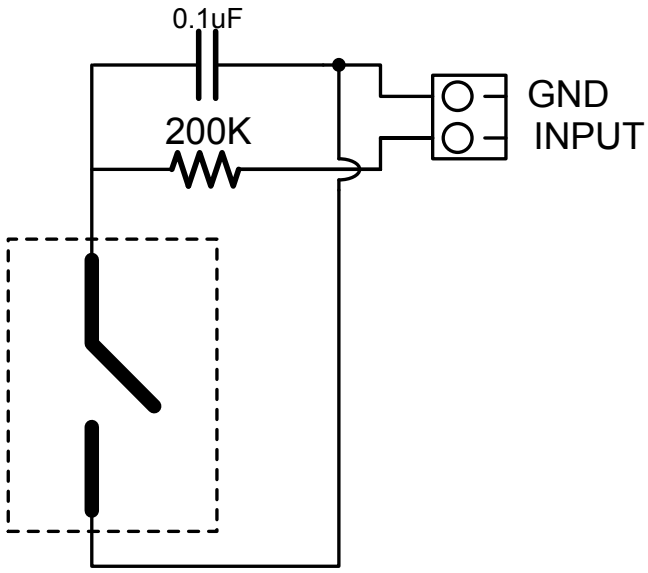
To begin configuration, open SFToolkit, and select "Class 1 Division 1 Two Channel Analog/HART". Alternatively, you can choose Auto-Detect on the COM port that the C1D1 unit is connected to. The configuration window below will open up. Select the correct COM port and click "Connect/Update" to view all the settings.



Appendix

Counting Dry Contact Inputs:

Generally a dry contact input will be used for input state reporting only, however if the count totalizer for a dry contact input is needed it may be necessary to add an external filter to prevent false counts due to contact bounce.
Adding a 200K resistor and a 0.1uF capacitor as shown below will filter contact bounce and allow for accurate dry contact closure counting up to 20Hz.



Optional External Filter for Dry Contact Closure Counting

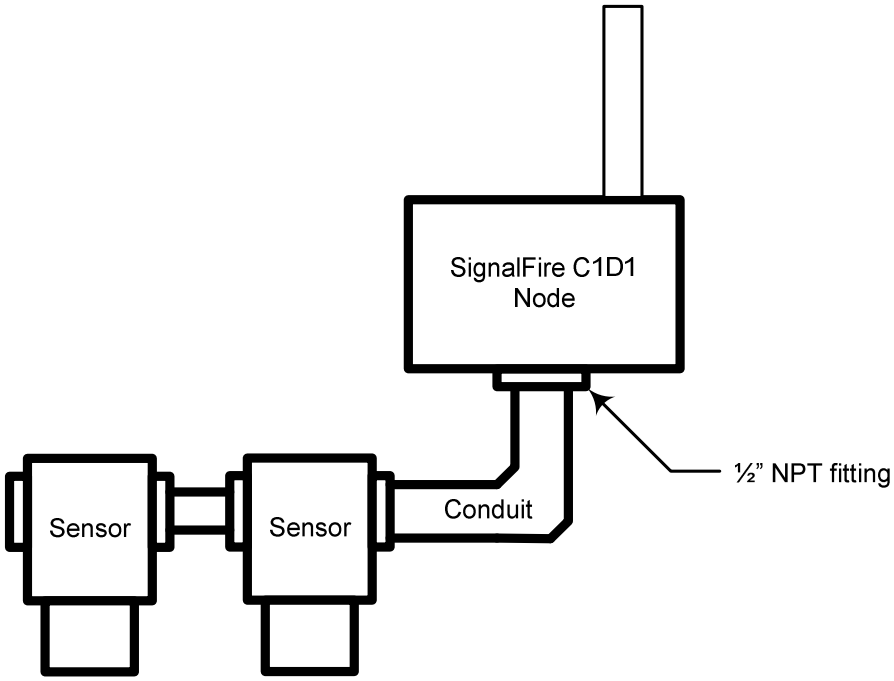
Mounting

The unit comes with a ½" female NPT fitting mounted to the bottom of the enclosure. There are two means of mounting the unit:

- Direct Mount to Sensor with Shot Conduit
- Remote Mount with Conduit to Sensor

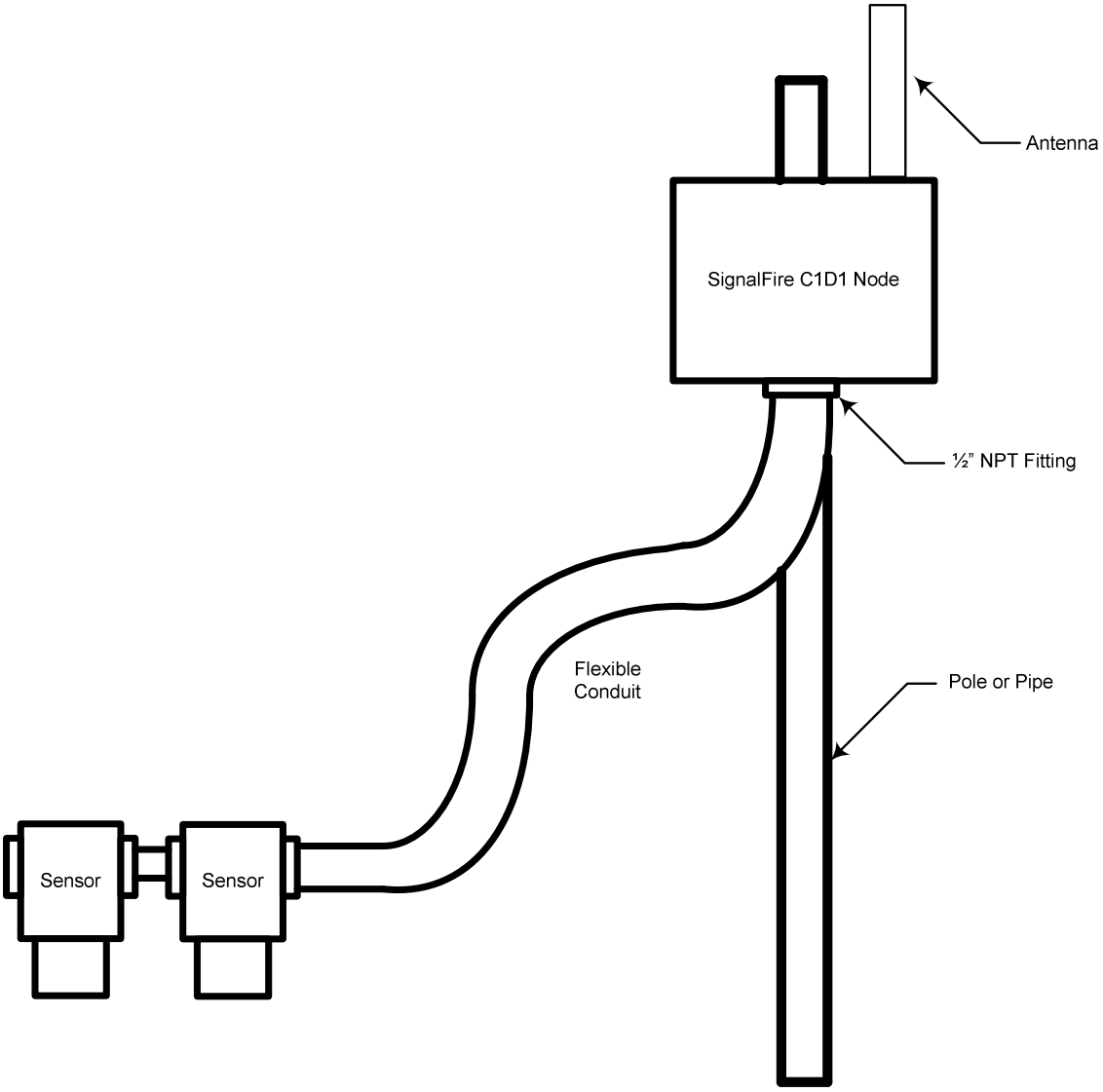
Direct Mount to Sensor with Short Conduit

This mounting method uses a short conduit run from the sensor and the unit is held in place by the conduit.



Remote Mount with Conduit to Sensor

This mounting method uses flexible conduit to mount the SignalFire unit a short distance from the sensor. The SignalFire unit may be mounted to a pole using pipe clamps that bolt to the rear of the bracket mounted to the enclosure.



Battery Replacement

Battery Packs can be changed in with the node in place.

1. Open the cover from the enclosure.
2. Unplug the battery from the PCB, by depressing the locking clip on the connector.
3. Remove the two nuts, battery hold down bar, and old battery.
4. Install new battery pack and secure with battery hold down bar and nuts.
5. Connect the battery to the main PCB battery connector.
6. Close the cover of the enclosure.

⚠***WARNING:*** *Use of any battery other than the SignalFire part number 810-0008-02 will impair the protection provided by the equipment.*

Cleaning Instructions

The outside of the enclosure may be cleaned with water and a mild soap with a damp cloth as needed. High pressure washing is not recommended.

⚠***WARNING:*** *Electrostatic Discharge Hazard! Care must be taken to avoid the potential of creating a change on the enclosure or antenna. Do not wipe with a dry cloth. Do not brush against the enclosure with clothing or gloves.*

Technical Support Contact Information

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