

Addendum

HART® Communication with the
X3301 Multispectrum IR Flame Detector



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AUTOMATIC

HART Communication with the X3301 Multispectrum IR Flame Detector



Digital communication with the X3301 allows the operator to monitor the status of the detector, determine factory settings, adjust field settings, and initiate field tests. This addendum provides guidance for establishing HART communication, and describes the HART menu structure when using the X3301 with a HART Handheld Communicator, a PC, or other process interface device that supports Device Description Language (DD).

NOTE

A minimum level of understanding with regard to the operation and navigation of the HART Communicator is required. Refer to the instruction manual supplied with the HART Communicator for basic operating instructions.

INTERCONNECTING THE HART COMMUNICATOR WITH THE DETECTOR

Point-to-Point Mode

The HART Communicator can connect to the X3301 at any wiring termination point in the analog output signal loop. Connect the HART Communicator in parallel with the X3301 analog signal or load resistor. The HART connections are non-polarized.

IMPORTANT WIRING NOTE

The HART Communicator does not measure loop current directly, but instead reads a voltage signal across a resistance (250 ohms) in the loop. The recommended connection point is across the input impedance of the signal receiver (PLC), which is a nominal 250 ohms. See Figures 1 to 4. If testing/programming on a bench, a 250 ohm load resistor must be used. See Figure 5.

Switch on the HART Communicator. If a device is found, the HART Communicator displays the Main menu. If no device is found, check the connections and verify the presence of a minimum of 250 ohms load resistance in series in the loop.

9	mA +	19	mA -	29	SPARE
8	mA + REF	18	mA - REF	28	SPARE
7	COM FIRE	17	COM FIRE	27	COM AUX
6	NO FIRE	16	NO FIRE	26	NO AUX
5	NC FIRE	15	NC FIRE	25	NC AUX
4	COM FAULT	14	COM FAULT	24	NOT USED
3	NO FAULT	13	NO FAULT	23	NOT USED
2	+Vin	12	+Vin	22	MAN O _i
1	-Vin	11	-Vin	21	-Vin

E2061

Figure 1—X3301 HART Wiring Terminal Identification

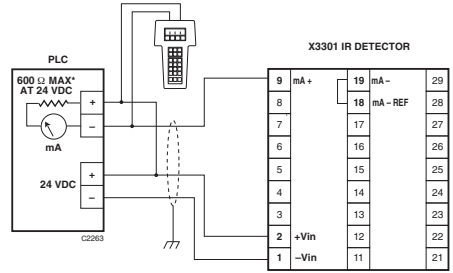


Figure 4—X3301 Detector Wired for Non-Isolated 0 to 20 mA Current Output (Sinking)

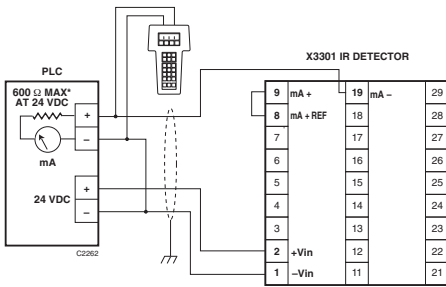


Figure 2—X3301 Detector Wired for Non-Isolated 0 to 20 mA Current Output (Sourcing)

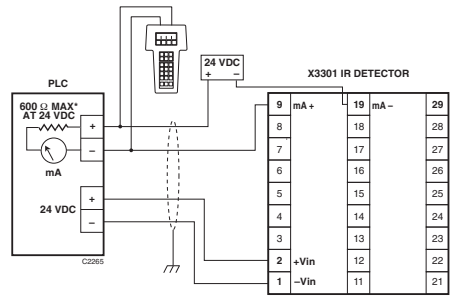


Figure 5—X3301 Detector Wired for Isolated 0 to 20 mA Current Output (Sinking)

*Nominal input impedance of PLC = 250 ohms.
Maximum loop impedance including input impedance of PLC = 600 ohms.

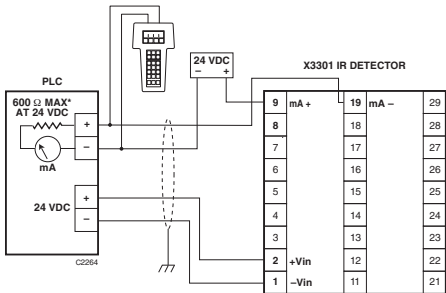


Figure 3—X3301 Detector Wired for Isolated 0 to 20 mA Current Output (Sourcing)

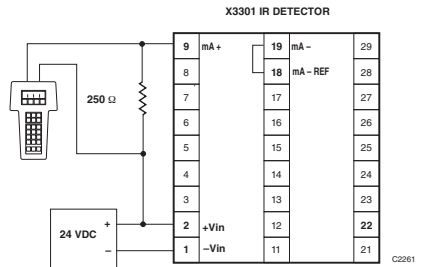


Figure 6—Wiring the X3301 for Benchtop Testing/Programming Using HART Protocol

Multidrop Mode

Optical flame detectors are life safety devices and require the 0-20 mA loop for transmitting important detector status data. They should not be used in conjunction with multidrop mode. If multidrop mode is a requirement, the alarm and fault relay contacts must be connected directly to the safety system or fire panel for signalling purposes.

NOTE

RS-485 Modbus communication is not available on HART equipped models.

NOTE

This addendum covers HART wiring only. Refer to the device instruction manual for NFPA-72 compliant releasing wiring diagrams.

HART DEVICE DESCRIPTION LANGUAGE

The HART protocol incorporates a concept called the Device Description Language (DD) that enables all suppliers of HART instruments to define and document their products in a single consistent format. This format is readable by handheld communicators, PCs and other process interface devices that support DD. DD enables full interoperability of devices, regardless of manufacturer, allowing full functionality from any HART device.

In the event that your Communicator does not establish communications with the X3301, ensure that the appropriate DDs for the X3301 have been programmed into your Communicator. To review the DDs programmed into your HART Communicator:

1. From the Main menu, access the Offline menu.
2. From the Offline menu, select "New Configuration" to access the list of device descriptions programmed into the HART Communicator.
3. Select "Det-Tronics" and review the list of models to determine if the X3301 DDs are installed in your Communicator.

If the X3301 DDs have not been programmed into the Memory Module, you must use the generic interface built into your HART Communicator.

The HART Communication Foundation manages a library of Manufacturer Device Descriptions, which are distributed to programming sites for inclusion in master devices. A complete listing of the HCF DD Library is available for download in

manufacturer and device type sequence at en.hartcomm.org.

DETECTOR WIRING

Refer to the X3301 instruction manual (form number 95-8527 or 95-8704) for complete instructions regarding detector installation and wiring. However, note that the device power consumption specifications for the HART model are different than the standard model.

Power Consumption Specifications of X3301 Detector with HART Communication

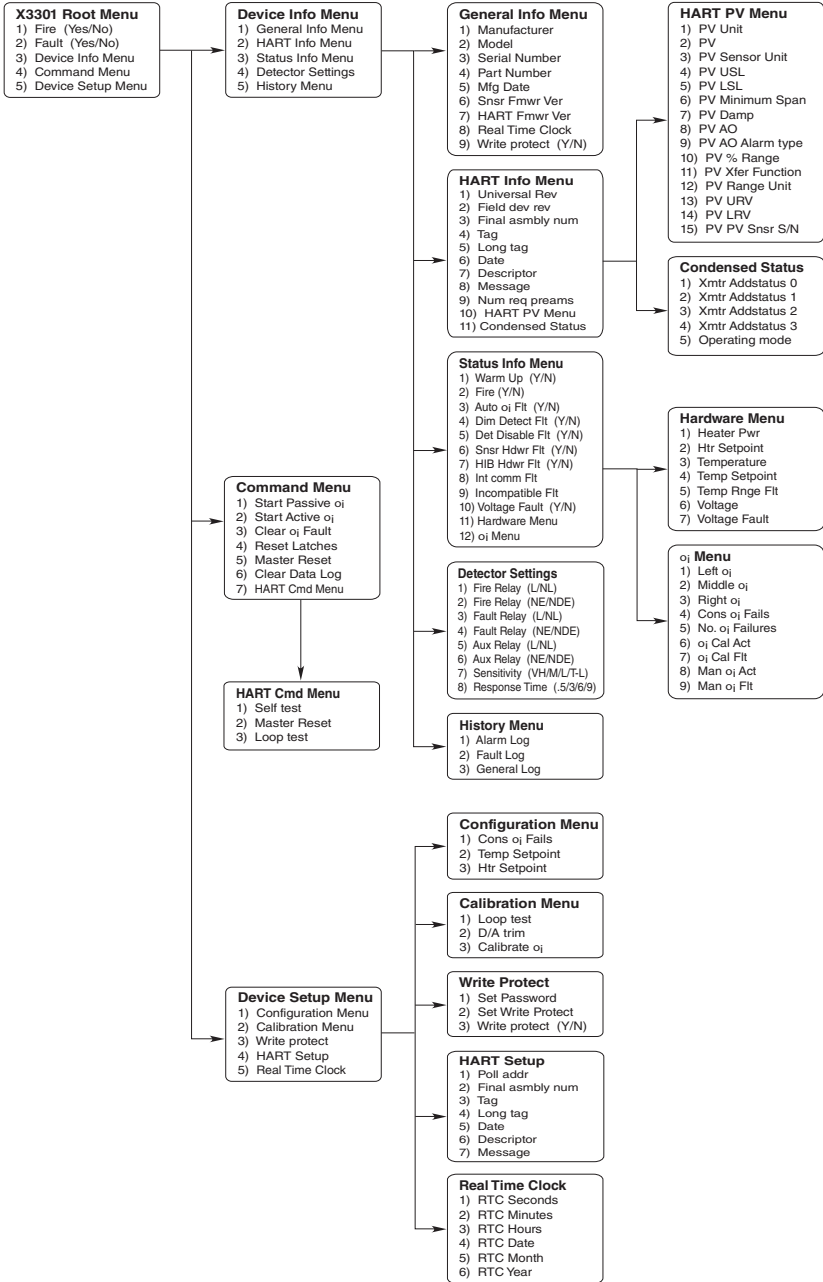
Without heater: 4.7 watts at 24 Vdc nominal;
6.1 watts at 24 Vdc in alarm;
5.5 watts at 30 Vdc nominal;
7.4 watts at 30 Vdc in alarm.
Heater only: 8 watts maximum.
Total power: 17 watts at 30 Vdc with EOL resistor installed and heater on maximum.

EOL resistor must be ceramic, wirewound type, rated 5 watts minimum, with actual power dissipation not to exceed 1.5 watts.

HIB Hdwr Flt

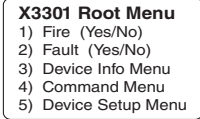
When a HART field communicator is first connected to the detector, a "HIB Hdwr Flt" message may be displayed. If this message is displayed, set the Real Time Clock (RTC) using the HART field communicator as detailed in the Real Time Clock section of this manual. See Marketing Bulletin 78-1026 for further information.

HART MENU STRUCTURE



X3301 ROOT MENU

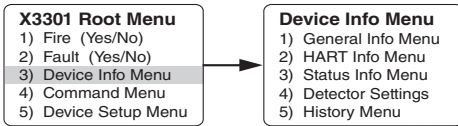
When HART communication is established, the first menu displayed is the X3301 Root menu:



- 1) Fire (Yes/No)** Indicates “Y” if the device is in a fire alarm status — analog output is at 20 mA, fire alarm relay is actuated, and LED is red.
- 2) Fault (Yes/No)** Indicates “Y” if a fault condition exists. Go to “Device Info” and select “Status Info” to determine the nature of the fault.
- 3) Device Info Menu** Provides access to manufacturer and HART information, current device status, factory settings, and history logs.
- 4) Command Menu** This menu allows the operator to initiate a manual o₁ test and to perform various reset/clear functions.
- 5) Device Setup Menu** This menu allows various setup, configuration, and calibration functions.

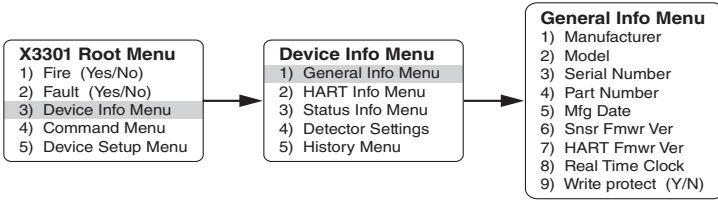
DEVICE INFO MENU

This menu allows access to a variety of “read-only” information.



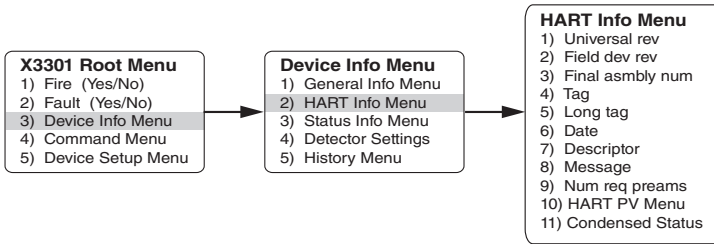
- 1) General Info Menu** Factory information.
- 2) HART Info Menu** HART Specific Variables.
- 3) Status Info Menu** Current operating status and/or diagnostic information.
- 4) Detector Settings** Factory settings relating to relay operation, detector sensitivity, and response.
- 5) History Menu** Display log files: Alarm, Fault, General.

GENERAL INFO MENU



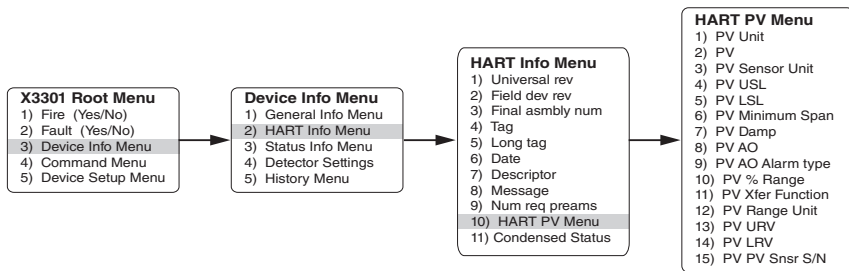
- | | |
|-------------------------------|---|
| 1) Manufacturer | Det-Tronics. |
| 2) Model | X3301. |
| 3) Serial Number | Serial number of device. |
| 4) Part Number | Manufacturer's part number for this device. |
| 5) Mfg Date | Date of manufacture shown as XX/XX/XX (month/day/year). |
| 6) Snsr Fmwr Ver | Firmware revision level of sensor module. |
| 7) HART Fmwr Ver | Firmware revision level of HART Interface Board (HIB). |
| 8) Real Time Clock | Current time and date settings of real time clock. |
| 9) Write protect (Y/N) | This indicates whether variables can be written to the device or whether commands that cause actions to be performed in the device can or cannot occur. |

HART INFO MENU



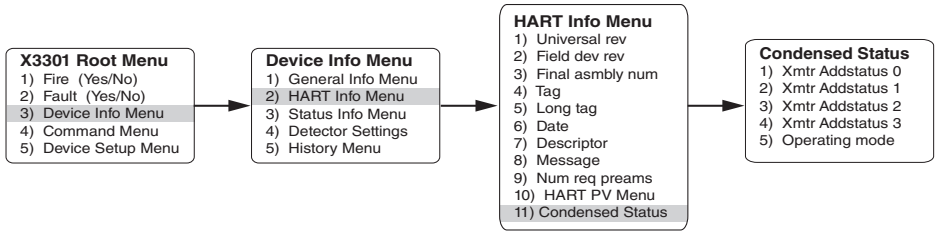
- | | |
|-----------------------------|---|
| 1) Universal rev | HART universal revision. |
| 2) Field dev rev | HART field device revision. |
| 3) Final asmbly num | A number that is used for identification purposes and is associated with the overall field device. |
| 4) Tag | Text that is associated with the field device installation. This text can be used by the operator in any way. Max of eight character input. |
| 5) Long tag | Text that is associated with the field device installation. This text can be used by the operator in any way. Max of 32 character input. |
| 6) Date | Any date chosen by the operator to be used for any purpose. XX/XX/XXXX (month/day/year). |
| 7) Descriptor | Text associated with the field device that can be used by the operator in any way. |
| 8) Message | Text associated with the field device that can be used by the operator in any way. |
| 9) Num req preams | HART specific synchronization messages. |
| 10) HART PV Menu | Display HART specific primary variable (PV) items. |
| 11) Condensed Status | Device status condensed for HART handheld display. |

HART PV MENU



1) PV Unit	Not implemented for X3301.
2) PV	Not implemented for X3301.
3) PV Sensor Unit	Not implemented for X3301.
4) PV USL	Not implemented for X3301.
5) PV LSL	Not implemented for X3301.
6) PV Minimum Span	Not implemented for X3301.
7) PV Damp	Not implemented for X3301.
8) PV AO	Analog Output. The value that tracks the Digital Value representation, under normal operating modes.
9) PV AO Alarm type	Not implemented for X3301.
10) PV % Range	Percent of Range. The variable that tracks the Digital Value representation with respect to the range defined by the Lower Range Value and Upper Range Value, for normal operating modes. The units of this variable are always in percent.
11) PV Xfer Function	Not implemented for X3301.
12) PV Range Unit	Not implemented for X3301.
13) PV URV	Not implemented for X3301.
14) PV LRV	Not implemented for X3301.
15) PV PV Snshr S/N	Not implemented for X3301.

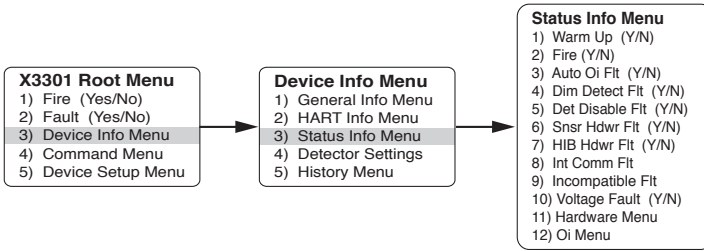
CONDENSED STATUS



- 1) Xmtr Addstatus 0** Fire Alarm
o) Cal Active
Manual o) Active
Warm-up
- 2) Xmtr Addstatus 1** Spare
- 3) Xmtr Addstatus 2** Fault
Auto o) Fault
Manual o) Fault
o) Cal Fault
Dim Detect Fault (Diminished detection fault)
Detect Disable Flt (Detection disabled fault)
Temp Out of Range
Volt Out of Range (Operating voltage out of range)
- 4) Xmtr Addstatus 3** Snsr HW Fault (Sensor hardware fault)
HART HW Fault (HART hardware fault)
Intern Comm Fault (Modbus communication fault)
Incompatible Fault
- 5) Operating mode** Fault
Fire Alarm

STATUS INFO MENU

This menu (read-only) shows extensive status information about the detector.



1) Warm Up (Y/N)

Device is in the power-up time delay (warm-up) mode.

2) Fire (Y/N)

Indicates “Y” if the device is in a fire alarm status — analog output is at 20 mA, fire alarm relay is actuated, and LED is red.

3) Auto oi Flt (Y/N)

Automatic oi Fault. Check viewing windows and oi reflector plate for cleanliness.

4) Dim Detect Flt (Y/N)

Diminished Detection Fault. Excessive background IR radiation. Eliminate IR interference and/or re-aim/orient detector.

5) Det Disable Flt (Y/N)

Flame detector function has been disabled. Check viewing windows for cleanliness and/or presence of excessive background IR signal.

6) Snsr Hdwr Flt (Y/N)

Sensor hardware fault.

7) HIB Hdwr Flt (Y/N)

HART Interface Board hardware fault.

8) Int Comm Flt

Internal communication fault.

9) Incompatible Flt

Sensor module firmware version is not compatible with HART Interface Board.

10) Voltage Fault (Y/N)

Detector operating voltage is out of tolerance.

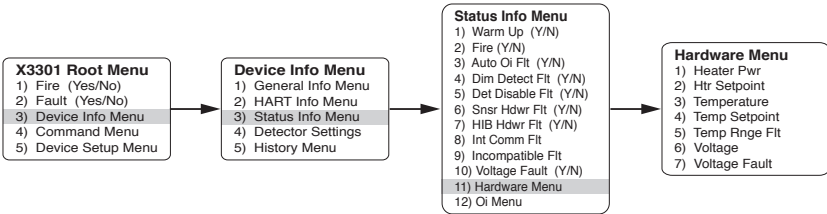
11) Hardware Menu

Refer to sub-menu.

12) oi Menu

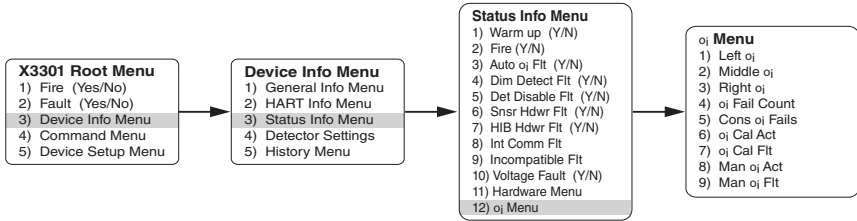
Refer to sub-menu.

HARDWARE MENU



- 1) Heater Pwr** Actual heater power (0-100%). Heater prevents condensation and icing on the detector optics.
- 2) Htr Setpoint** Maximum amount of heater power allowed (in percent of full power).
- 3) Temperature** Actual internal temperature of detector.
- 4) Temp Setpoint** Internal target temperature that the heater will attempt to maintain (in degrees C).
- 5) Temp Rnge Fit** Detector integral temperature out of range — Operating range: -40°F to $+167^{\circ}\text{F}$ (-40°C to $+75^{\circ}\text{C}$).
- 6) Voltage** Actual detector supply voltage must be 18 to 30 Vdc.
- 7) Voltage Fault** Supply voltage is out of range. Operating voltage must be 18 to 30 Vdc.

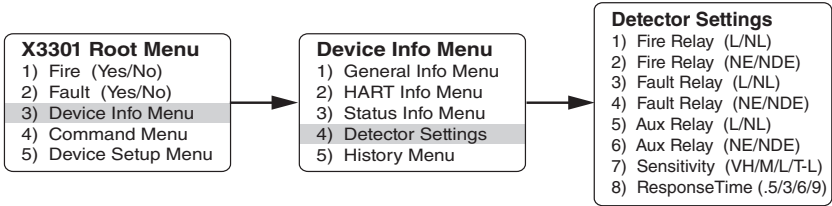
Oj MENU



- 1) **Left oj** Percentage of calibrated oj test signal returned by the left sensor. Reading should be 90-100%. If reading is below 90%, go to "Device Setup," select "Calibration," and perform oj Calibration.
- 2) **Middle oj** Percentage of calibrated oj test signal returned by the middle sensor. Reading should be 90-100%. If reading is below 90%, go to "Device Setup," select "Calibration," and perform oj Calibration.
- 3) **Right oj** Percentage of calibrated oj test signal returned by the right sensor. Reading should be 90-100%. If reading is below 90%, go to "Device Setup," select "Calibration," and perform oj Calibration.
- 4) **oj Fail Count** Number of consecutive oj failures counted (one passed oj test resets the counter).
- 5) **Cons oj Fails** Set (allowable) number of consecutive oj failures to produce a fault.
- 6) **oj Cal Act** oj calibration is in progress.
- 7) **oj Cal Fit** An oj calibration fault has occurred.
- 8) **Man oj Act** A manual oj test is in progress.
- 9) **Man oj Fit** The detector has failed the last manual oj test.

DETECTOR SETTINGS

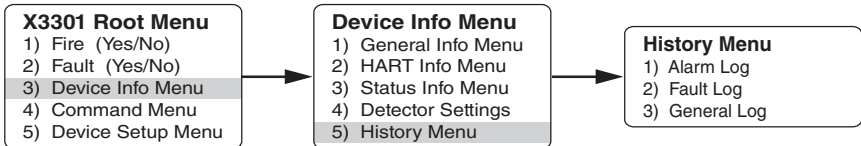
This menu shows factory settings relating to relay operation, detector sensitivity, and response.



- 1) Fire Relay (L/NL)** Fire relay contacts, latching (L), or non-latching (NL).
- 2) Fire Relay (NE/NDE)** Fire relay coil, normally energized (NE), or normally de-energized (NDE).
- 3) Fault Relay (L/NL)** Fault relay contacts, latching (L), or non-latching (NL).
- 4) Fault Relay (NE/NDE)** Fault relay coil, normally energized (NE), or normally de-energized (NDE).
- 5) Aux Relay (L/NL)** Auxiliary relay contacts, latching (L), or non-latching (NL).
- 6) Aux Relay (NE/NDE)** Auxiliary relay coil, normally energized (NE), or normally de-energized (NDE).
- 7) Sensitivity (VH/M/L/T-L)** Detector sensitivity setting: Very high, Medium, Low, or T-Low.
- 8) Response Time (.5/3/6/9)** Fire alarm processing time in seconds.

HISTORY MENU

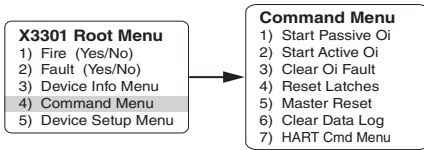
This menu provides historical information about the detector. Up to 32 events in each of the three categories will be kept in non-volatile memory. When the log is full, the oldest event will be overwritten. The most recent event will be displayed first.



- 1) Alarm Log** Scroll through 32 Alarm Logs with time, date, and temperature stamp.
- 2) Fault Log** Scroll through 32 Fault Logs with time, date, and temperature stamp.
- 3) General Log** Scroll through 32 General Logs with time, date, and temperature stamp.

COMMAND MENU

The Command Menu allows the operator to initiate a manual oi test and also to perform various reset/clear functions.



1) Start Passive oi

A passive oi test command checks the cleanliness of the detector's optical surfaces. This confirms the ability of the detector to respond correctly to an IR signal. Fire and fault relays as well as 0–20 mA current loop output are unaffected by this test. A red LED signals a successful test and a yellow LED signals a failed test. The event log will indicate either "Man oi Pass" or "Man oi Flt."

2) Start Active oi



An active oi test generates an actual Fire Alarm Output. All fire response equipment must be bypassed/disabled prior to testing to prevent unwanted output actuation.

An active oi test performs an oi test with all detector outputs fully operational. Fire and fault relays as well as the 0-20 mA loop are "live."

If the test is successful:

- Fire relay = Alarm
- Fault relay = no fault
- Current output is 20 mA
- LED turns red
- General log indicates "Man oi Pass"
- Alarm log indicates "Fire Alarm"

If the test is unsuccessful:

- Fire relay = No Alarm
- Fault relay = Fault
- Current output is 2 mA
- LED turns yellow
- Fault log indicates "Man oi Flt"

3) Clear oi Fault

If the cause of the fault has not been corrected, subsequent oi faults will occur.

4) Reset Latches

Latching relays are reset and LED turns green.

5) Master Reset

This function re-initializes the microprocessor, resets the operating software, and initiates a hardware reset for both the sensor and the HART interface. Latched relays are reset.

6) Clear Data Log

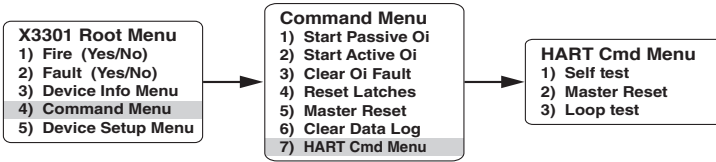
This function resets the HART data log history. To view the logs, go to "Device Info Menu" and select "History Menu."

7) HART Cmd Menu

This menu performs various diagnostic and/or service functions.

HART CMD MENU

The HART Cmd (Command) Menu allows the operator to perform diagnostic and service functions as follows:



1) Self test

Internal tests are performed and any detected problems are reported in "Status Info." If successful, indication will be "Self Test Pass."

2) Master Reset

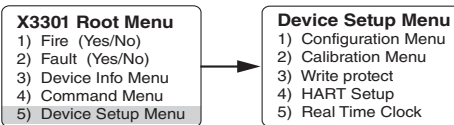
This function re-initializes the microprocessor, resets the operating software, and initiates a hardware reset for both the sensor and the HART interface. Latched relays are reset.

3) Loop test

This test allows the operator to manually set the analog signal output at 1, 2, 3, or between 4 and 20 mA in increments of 2 (4, 6, 8, etc.).

DEVICE SETUP MENU

This menu allows various setup, configuration, and calibration functions. When Write Protect is off, these menus allow the operator to reconfigure or write new variables to the device.



1) Configuration Menu

2) Calibration Menu

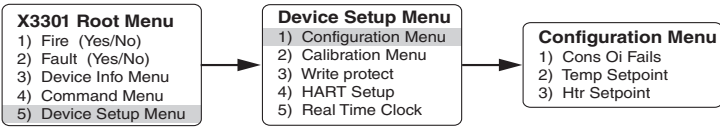
3) Write protect

4) HART Setup

5) Real Time Clock

Refer to the appropriate sub-menus for details.

CONFIGURATION MENU



1) Cons oi Fails

This option allows the operator to select the number of consecutive oi failures before an oi fault will be generated. Selectable range is 1-1000.

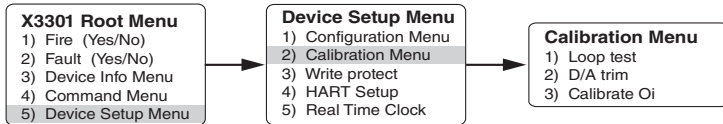
2) Temp Setpoint

This option allows the operator to select the temperature at which the optics heater begins operating.

3) Htr Setpoint

This option allows the operator to select the maximum amount of heater power allowed, in percent of full power. (0% = heater shut off.)

CALIBRATION MENU



1) Loop test

This test allows the operator to manually set the analog signal output at 1, 2, 3, or between 4 and 20 mA in increments of 2 (4, 6, 8, etc.).

2) D/A trim

This function allows adjustment of the 0-20 mA span factor.

NOTE

Trim in increments of 0.1 mA resolution only.

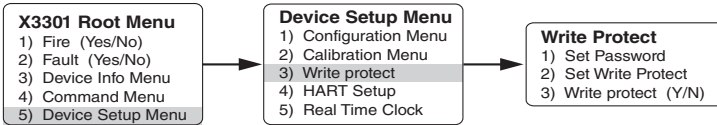
3) Calibrate oi

This procedure calibrates the oi test signal for all three IR sensors.

1. Bypass/disable all Alarm outputs connected to the detector.
2. Thoroughly clean the sensor and oi reflector for each of the three sensors. Check each of the three oi source openings for contaminants and clean as needed.
3. Cover the detector with the provided cover.
4. Initiate oi Calibration. The detector performs the calibration automatically and notifies the operator upon completion. The procedure takes approximately two minutes.
5. Upon completion of oi calibration, remove the cover and return all alarm outputs to service.

WRITE PROTECT

This function enables the operator to enable/disable password and write protection capability, as well as to enter or change a password. The device is provided from the factory with Write Protect off. With Write Protect on, the use of a password is required to enable writing to the device.



1) Set Password

The password is used to validate the command to enable or disable writes in the device. (The factory default password is: 1*****. Once the password has been changed, the default password is no longer valid.)



Always record the new password. If the password is forgotten, the device must be returned to the factory for re-programming.

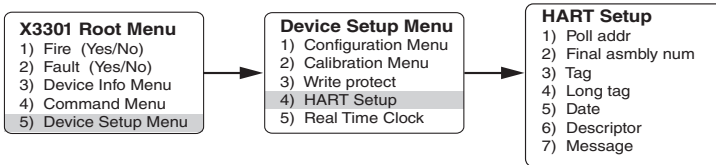
2) Set Write Protect

With Write Protect "On," variables cannot be written to the device and commands that cause actions to be performed in the device cannot occur.

3) Write protect (Y/N) This indicates whether or not Write Protect is enabled.

HART SETUP

This menu allows editing of the following functions:



1) Poll addr

Address used by the host device to identify a field device. Note that if it is set to an address other than "0," the Detector will output 1 mA.

2) Final assembly num

A number that is used for identification purposes and is associated with the overall field device.

3) Tag

Text that is associated with the field device installation. This text can be used by the operator in any way. Max of eight character input.

4) Long tag

Text that is associated with the field device installation. This text can be used by the operator in any way. Max of 32 character input.

5) Date

Any date chosen by the operator to be used for any purpose. XX/XX/XXXX (month/day/year).

6) Descriptor

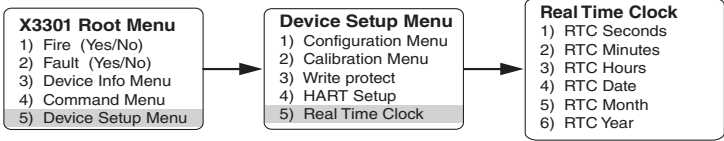
Text associated with the field device that can be used by the operator in any way.

7) Message

Text associated with the field device that can be used by the operator in any way.

REAL TIME CLOCK

To set the real time clock, enter the current time and date information into the appropriate fields.



- 1) **RTC Seconds** 0 to 59
- 2) **RTC Minutes** 0 to 59
- 3) **RTC Hours** 0 to 23
- 4) **RTC Date** 1 to 31
- 5) **RTC Month** 1 to 12
- 6) **RTC Year** 0 to 99



95-8577



FlexSonic® Acoustic
Leak Detector



X3301 Multispectrum
IR Flame Detector



PointWatch Eclipse® IR
Combustible Gas Detector



FlexVu® Universal Display
with GT3000 Toxic Gas Detector



Eagle Quantum Premier®
Safety System

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Det-Tronics manufacturing system is certified to ISO 9001—
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