Addendum
HART® Communication with the X3302 Multispectrum IR Flame Detector
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Digital communication with the X3302 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 X3302 with a HART Handheld Communicator, a PC, or other process interface device that supports DDL.

**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 X3302 at any wiring termination point in the analog output signal loop. Connect the HART communicator in parallel with the X3302 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.
*Nominal input impedance of PLC = 250 ohms.
Maximum loop impedance including input impedance of PLC = 600 ohms.
Multidrop Mode

Optical flame detectors are life safety devices and require the 4-20 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
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 (DDL) 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 DDL. DDL 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 X3302, ensure that the appropriate DDLs for the X3302 have been programmed into your Communicator. To review the DDLs 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 X3302 DDLs are installed in your Communicator.

If the X3302 DDLs 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 http://www.hartcomm2.org/hart_protocol/protocol/dd_library_main.html.

DETECTOR WIRING

Refer to the X3302 instruction manual (form number 95-8576) 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 X3302 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.
X3302 ROOT MENU
When HART communication is established, the first menu displayed is the X3302 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 test and also 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.

### GENERAL INFO MENU

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1) Manufacturer</strong></td>
<td>Det-Tronics.</td>
</tr>
<tr>
<td><strong>2) Model</strong></td>
<td>X3302.</td>
</tr>
<tr>
<td><strong>3) Serial Number</strong></td>
<td>Serial number of device.</td>
</tr>
<tr>
<td><strong>4) Part Number</strong></td>
<td>Manufacturer’s part number for this device.</td>
</tr>
<tr>
<td><strong>5) Manufacture Date</strong></td>
<td>Date of manufacture shown as XX/XX/XX (month/day/year).</td>
</tr>
<tr>
<td><strong>6) Sensor Firmware</strong></td>
<td>Firmware revision level of sensor module.</td>
</tr>
<tr>
<td><strong>7) HART Firmware</strong></td>
<td>Firmware revision level of HART Interface Board (HIB).</td>
</tr>
<tr>
<td><strong>8) Real Time Clock</strong></td>
<td>Current time and date settings of real time clock.</td>
</tr>
<tr>
<td><strong>9) Write Protect (Y/N)</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
HART INFO MENU

1) Universal rev  
HART universal revision.

2) Fld 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.

5) Date  
Any date chosen by the operator to be used for any purpose.

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.

8) Num req preams  
HART specific synchronization messages.

9) HART PV Menu  
Display HART specific primary variable (PV) items.

10) Condensed Status  
Device status condensed for HART handheld display.
1) PV Unit
   Not implemented for X3302.

2) PV
   Not implemented for X3302.

3) PV Sensor Unit
   Not implemented for X3302.

4) PV USL
   Not implemented for X3302.

5) PV LSL
   Not implemented for X3302.

6) PV Minimum Span
   Not implemented for X3302.

7) PV Damp
   Not implemented for X3302.

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 X3302.

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 X3302.

12) PV Range Unit
    Not implemented for X3302.

13) PV URV
    Not implemented for X3302.

14) PV LRV
    Not implemented for X3302.

15) PV Snsr S/N
    Not implemented for X3302.
CONDENSED STATUS

1) Xmtr Addstatus 0
   Fire Alarm
   oi Cal Active
   Manual oi Active
   Warmup

2) Xmtr Addstatus 1
   Spare

3) Xmtr Addstatus 2
   Fault
   Auto oi Fault
   Manual oi Fault
   oi Cal Fault
   Dim Detect Fault (Dimensioned 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 HWFault (HART hardware fault)
   Intern Comm Fault (Modbus communication fault)
   Incompatible Fault

5) Operating Mode
   Fault
   Fire Alarm
   Normal

6) Operating Mode 2
   Spare
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) Automatic oį Fault (Y/N)  
Automatic oį Fault. Check viewing windows and oį reflector plate for cleanliness.

4) Diminish. Detect. Flt (Y/N)  
Diminished Detection Fault. Excessive background IR radiation. Eliminate IR interference and/or re-aim/orient detector.

5) Detect. Disable Flt (Y/N)  
Flame detector function has been disabled. Check viewing windows for cleanliness and/or presence of excessive background IR signal.

6) Sensor Hdwr Fault (Y/N)  
Sensor hardware fault.

7) HIB Hardware Fault (Y/N)  
HART Interface Board hardware fault.

8) Internal Com. Flt  
Internal communication fault.

9) Incompatible Fault  
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) oį Menu  
Refer to sub-menu.
1) **Heater Power**  
Actual heater power (0 to 100%). Heater prevents condensation and icing on the detector optics.

2) **Heater 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 Range Fault**  
Detector integral temperature out of range — Operating range: –40°F to +167°F (–40°C to +75°C).

6) **Voltage**  
Actual detector supply voltage (must be 18 to 30 Vdc).

7) **Voltage Fault (Y/N)**  
Supply voltage is out of range. Operating voltage must be 18 to 30 Vdc.
1) Left $\text{o}_i$

Percentage of calibrated $\text{o}_i$ test signal returned by the left sensor. Reading should be 90 to 100 percent. If reading is below 90 percent, go to “Device Setup”, select “Calibration”, and perform $\text{o}_i$ Calibration.

2) Middle $\text{o}_i$

Percentage of calibrated $\text{o}_i$ test signal returned by the middle sensor. Reading should be 90 to 100 percent. If reading is below 90 percent, go to “Device Setup”, select “Calibration”, and perform $\text{o}_i$ Calibration.

3) Right $\text{o}_i$

Percentage of calibrated $\text{o}_i$ test signal returned by the right sensor. Reading should be 90 to 100 percent. If reading is below 90 percent, go to “Device Setup”, select “Calibration”, and perform $\text{o}_i$ Calibration.

4) $\text{o}_i$ Fail Count

Number of consecutive $\text{o}_i$ failures counted (one passed $\text{o}_i$ test resets the counter).

5) Consecutive $\text{o}_i$ Fails

Set (allowable) number of consecutive $\text{o}_i$ failures to produce a fault.

6) $\text{o}_i$ Calibrate Active (Y/N)

$\text{o}_i$ calibration is in progress.

7) $\text{o}_i$ Calibrate Fault (Y/N)

An $\text{o}_i$ calibration fault has occurred.

8) Manual $\text{o}_i$ Active (Y/N)

A manual $\text{o}_i$ test is in progress.

9) Manual $\text{o}_i$ Fault (Y/N)

The detector has failed the last manual $\text{o}_i$ 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  
   Detector sensitivity setting: Very high, High, Medium, or Low.

8) Response Time  
   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 4 to 20 mA current loop output are unaffected by this test. A red LED signals a successful test, and an amber LED signals a failed test. The event log will indicate either “Man **oi** Pass” or “Man **oi** Flt”.

2) **Start Active oi**

**CAUTION**

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 4-20 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”.

If the test is unsuccessful:

- Fire relay = No Alarm.
- Fault relay = Fault.
- Current output is 2 mA.
- LED turns amber.
- 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 Command Menu**

This menu performs various diagnostic and/or service functions.
HART COMMAND MENU
The HART 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”.

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 (4 to 20 mA) to a fixed user defined value.

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.
1) Consecutive oï Fails

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

2) Temp Setpoint

Internal target temperature that the heater will attempt to maintain (in degrees C).

3) Heater 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 (4 to 20 mA) to a fixed user defined value.

2) D/A trim

This function allows adjustment of the 4 to 20 mA span factor.

3) Calibrate oï

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

1. Bypass/disable all Alarm outputs connected to the detector.

2. Thoroughly clean the sensor and oï reflector for each of the three sensors. Check each of the three oï source openings for contaminants and clean as needed.

3. Cover the detector with the provided cover.

4. Initiate oï Calibration. The detector performs the calibration automatically and notifies the operator upon completion. The procedure takes approximately two minutes.

5. Upon completion of oï 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.)

**CAUTION**
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.

2) Final Assembly No.
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.

4) Date
Any date chosen by the operator to be used for any purpose.

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

6) 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.