Honeywell

HART® 7.x Field Device Specification for Honeywell ST 800 Smart Pressure Transmitters

Document Number: 34-ST-00-119

Revision: 1.0

January 2013

Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Scope

The Honeywell Smart Pressure Transmitter, ST 800, device complies with HART Protocol Revision 7.x . This document specifies all the device specific features and gives HART Protocol implementation details. The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

1.2 Purpose

This specification is designed to complement other documentation by providing a complete, unambiguous description of this Field Device from a HART Communication perspective.

1.3 Who should use this document?

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

1.4 Abbreviations and definitions

Table 1 Abbreviations and Definitions

ADC	Analog to Digital Converter
DAC	Digital to Analog Converter
EEPROM	Electrically-Erasable Programmable Read-Only Memory
ROM	Read-Only Memory
PV	Primary Variable
SV	Secondary Variable
TV	Tertiary Variable
MSG	Model Selection Guide
Float	An IEEE 754 single precision floating point value (4 bytes)

Packed	A string consisting of 6-bit alpha-numeric characters that are a subset of the ASCII character set. This allows four characters to be packed into three bytes.
Unsigned-nn	An unsigned integer where nn indicates the number of bits in this integer. Multi-byte integers are transmitted MSB-LSB.
Enum	It can be assigned any of the enumerators as a value

1.5   References

HART Field Communications Protocol Specification. HCF_SPEC-12, Revision 7.4, dated 29 June 2012.

Honeywell ST 800 Series HART_DE Option User_s Manual Rev C-, Document under review.

2.   Device Identification

Table 2 Device Identification

Manufacturer Name:	Honeywell	Model Name(s):	ST 800
Manufacture ID Code:	23 (17 Hex)	Device Type Code:	32 (20 Hex)
HART Protocol Revision	7.x	Device Revision:	1
Number of Device Variables	3		
Physical Layers Supported	FSK		
Physical Device Category	Transmitter, Non-DC-isolated Bus Device		

The Honeywell ST 800 is designed to meet hazardous area approvals. Refer to the ST 800 Transmitter User manual on the available methods of protections for use in hazardous locations.

3.   Product Overview

3.1 Transmitter

The ST 800 Pressure Transmitter comes in a variety of models for measurement applications involving one of these basic types of pressure:

- • Differential Pressure
- • Gauge Pressure
- • Absolute Pressure

The transmitter measures the process pressure and transmits an output signal proportional to the measured variable over a 4 to 20 milliampere, two-wire loop. Its major components are electronics housing and a meter body as shown in **Figure 1** for a typical differential pressure model transmitter.

The ST 800 can transmit its output in either an analog 4 to 20 milliampere format or a digital DE protocol format for direct digital communications with our TPS system, Allen-Bradley PLCs and other control systems. Besides the process variable (PV) output, the transmitter also provides its meter body temperature as a secondary variable and the Static Pressure as a tertiary variable, which are both available as read-only parameters through the MC Toolkit when the transmitter is in its analog mode.

A configuration tool (Honeywell MCToolkit) is connected to the loop wiring of the ST 800 transmitter for direct communication with the transmitter. The handheld device communicates with the transmitter via the HART interface.

Note that multiple mounting configurations are possible and are fully described in the ST 800 Transmitter User Manual.

Figure 1 Typical Communication Interface

3.2 Communicator Purpose

The communicator allows the user to adjust transmitter values, or diagnose potential problems from a remote location such as the control room. The communicator can be used to:

- Configure: Define and enter the transmitter's operating parameters.
- Monitor: Read the input pressure to the transmitter in engineering units and the transmitter's output in mA or percent.
- Display: Retrieve and display data from the transmitter or the communicator's memory.
- Change Mode of Operation: Select configuration for multi-drop mode (digital) or loop current enabled (analog) operation.
- Check current output: Use the transmitter to supply the output current desired for verifying analog loop operation, troubleshooting, or calibrating other components in the analog loop.
- Troubleshoot: Check status of transmitter operation and display diagnostic messages to identify transmitter, communication, or operator error problems.
- Product Interfaces
- Process Interface

4. Product Interfaces

4.1 Process Interface

4.1.1 Sensor Input Channel

The primary variable is the pressure measured by the pressure sensor. Pressure Sensors are housed in the meter body of the transmitter. The transmitter is piped to the process where the pressure is to be measured using a mechanical connection. Please refer to the User Manual for details on mounting and piping the transmitter to the process.

An additional internal sensor measures the meter body temperature that is provided to the user as the secondary variable and Static Pressure is available as the tertiary variable.

4.1.2 Process Connections

Table 3 Process Connections

Transmitter Type	Process Connection
Differential Pressure	• Process heads with ¼ -inch NPT female connection. • Flange adapters and manifolds with 1/2-inch female connection are optional. • Models with pseudo flange on one side include 2- or 3-inch ANSI class 150 flange.
Gauge Pressure	• Process head with ½ -inch NPT female connection. • In-line ½ -inch NPT female connection (STGxxL). • In-line ½ inch NPT male • 9/16 AMINCO • DIN 19213 • Process heads with ¼ -inch NPT female connection (STG8x4). • Flange adapters and manifolds with 1/2-inch female connections are optional (STG8x4). • 2-inch Sanitary Tri-Clamp (STGxxT) • Flush mount in 1-inch weld sleeve, with O-ring and locking bolt (STGxxP).
Absolute Pressure	• Process head with ½ -inch NPT female connection. (STAx22, x40). • In-line ½ inch NPT Female • In-line ½ inch NPT male • 9/16 AMINCO • DIN 19213

Flange Mounted Liquid Level	• Small flange ½ -inch, 1-, 1 ½ - and 2-inch (STFxxT)
	• 2, 3- or 4-inch flange with flush or 2-, 4- or 6-inch extended diaphragm (See Table 14) on high pressure side.*
	• DN 50, 80, or 100 PN 40 flange with flush or 2, 4 or 6 inch extended diaphragm (See Table 14) on High Pressure Side*.
Remote Diaphragm Seals	See Model Selection Guide for description of available Flanged, Threaded, Chemical Tee, Saddle, and Sanitary process connections.

* Reference side has standard differential pressure process head.

The transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range shown in figure.

4.2   Host Interface

The transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range shown in **Figure 2**.
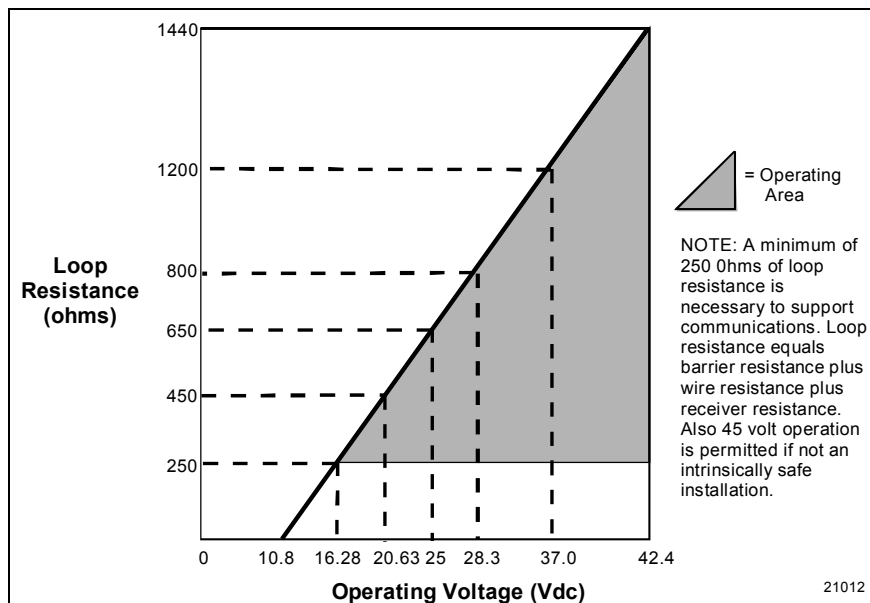
Figure 2 Transmitter Operating Ranges

Loop wiring is connected to the transmitter by simply attaching the positive (+) and negative (–) loop wires to the positive (+) and negative (–) terminals on the Transmitter terminal block in the Electronics Housing shown earlier in figure.
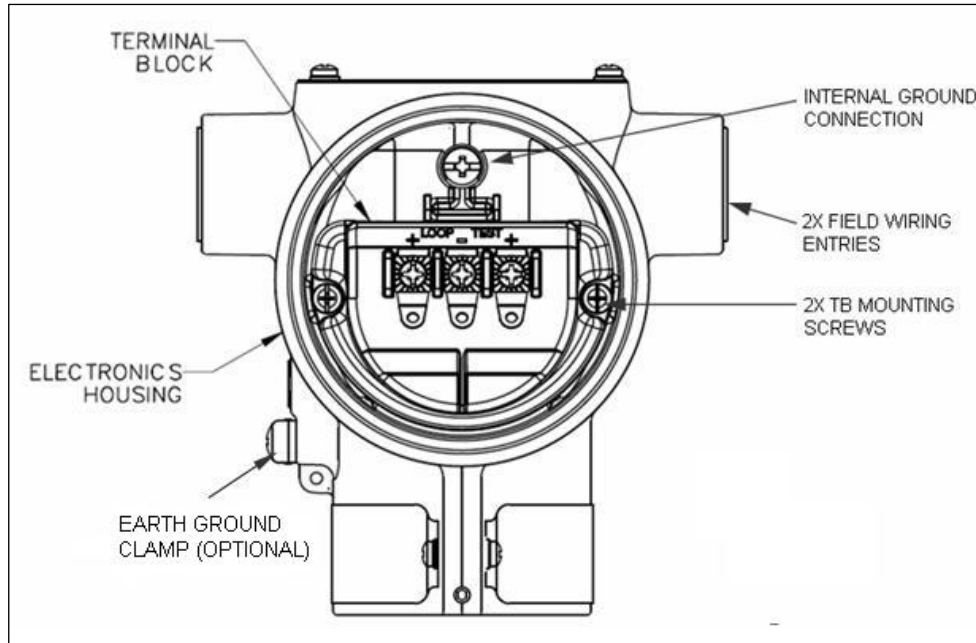
Figure 3 Transmitter 3-Screw Terminal Board and Grounding Screw

As shown in **Figure 3**, each Transmitter has an internal terminal to connect it to earth ground. Optionally, a ground terminal can be added to the outside of the Electronics Housing. While it is not necessary to ground the Transmitter for proper operation, doing so tends to minimize the possible effects of noise on the output signal and provides additional protection against lightning and static discharge. Optional lightning protection can be ordered for Transmitters that will be installed in areas highly susceptible to lightning strikes. When the optional lightning protection is installed in the Transmitter, the terminal block will be red.

Table 4 Analog Output Values

	Direction		Values (% of range)	Values (mA or V)
Linear over-range*	Classic	Down	-1.25 % ± 0.1 %	3.8 to 4.0 mA 0.95 to 1.0 V
		Up	105.0 % ± 0.1 %	20.0 to 20.8 mA 5.0 to 5.2 V
	NAMUR	Down	-1.25 % to ± 0.1 %	3.8 to 4.0 mA 0.95 to 1.0 V
		Up	103.125 % ± 0.1 %	20.0 to 20.5 mA 5.0 to 5.125 V
Device malfunction indication	Down: less than		- 1.25 %	3.58 mA
	Up: greater than		+ 105 %	21 mA
Maximum current				21.8 mA
Multi-Drop current draw				4.0 mA
Lift-off voltage **				10.8 V

* Honeywell will offer the ST 800 HART transmitter with NAMUR compliant analog outputs, in addition to the "Classic" levels traditionally featured in the product.

** For the Lightning protection option, add 1 Volt (internal added 50 Ohm impedance).

4.3 Local Interfaces, Jumpers and Switches

The ST 800 three-button option provides a user interface and operation without the use of the MC Toolkit. Figure shows the location of the three-button option and the labels for each button.
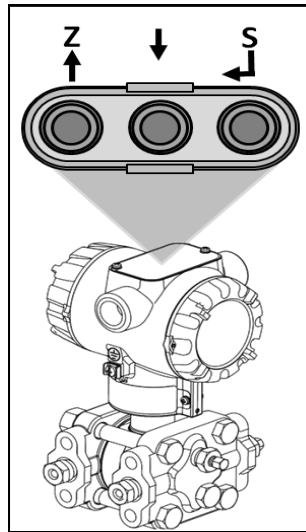
Figure 4 Three-Button Option

The functions of the three buttons are:

- **Enter** (**S↵**)
    - Enter the top level main menu from the normal PV display mode
    - Select a target to go down to the next menu level, up to the previous level or exit back to the PV display mode
    - Accept the current value of an entered parameter
- **Down** (↓)
    - Advance to the next configured screen when in the normal PV display mode
    - Scroll down to the next item in a menu
    - Advance through a list of parameters for configuration
    - Advance through numerical values or alpha characters for data entry
- **Up** (**Z**↑**)**
    - Go back to the previous configured screen when in the normal PV display mode
    - Scroll up to the previous item in a menu
    - Go back through a list of parameters for configuration
    - Go back through numerical values or alpha characters for data entry
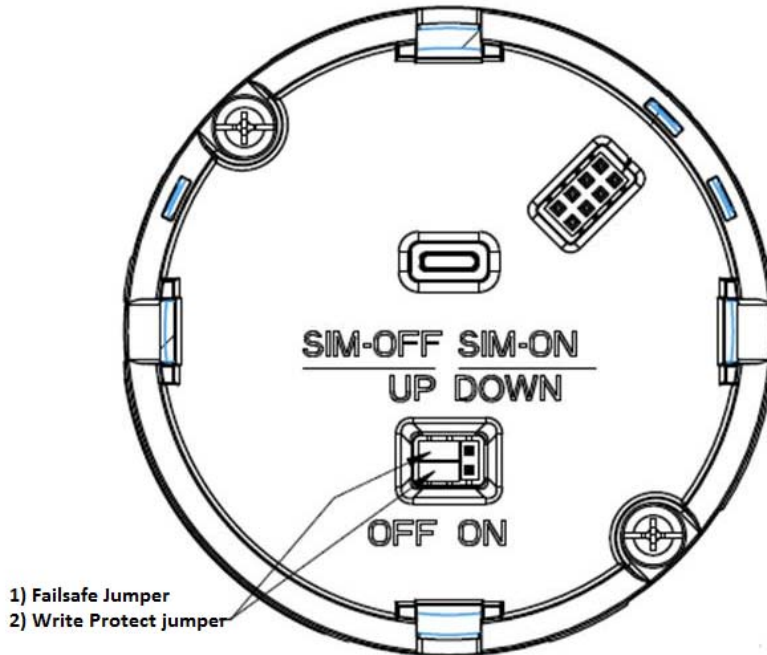
Figure 5 Locating the Failsafe Jumper

4.3.1 Device Malfunction

The direction of indication of a detected malfunction by the analog current output is user-selectable to up or down, by means of a two-position jumper inside the instrument. ST 800 transmitters are shipped with a default failsafe direction of upscale. This means that the transmitter's output will be driven upscale (maximum output) when the transmitter detects a critical status.

4.3.2 Write Protection

The ST 800 transmitters have a transmitter security option, also known as a "write protect option," which is jumper-selectable. The jumper, located on the transmitter's printed wiring assembly (PWA), can be positioned to allow read and write access or read only access to the transmitter's configuration database. When the jumper is in the read only position, the transmitter's configuration and calibration data can only be read / viewed. The factory-default jumper positions are for read and write access. The figure above shows the location of the write protect jumper on the PWA. The Write Protect hardware Jumper is placed behind the Display PWA. For accessing the hardware write protect jumper, the Display PWA needs to be removed. Also a Software write protect is available. Refer Common Practice command 175 &command 176. When the Device is in Hardware write protect (Jumper) then the software write protect functionality is inoperative.

4.4 Meter Display Options

The ST 800 Pressure Transmitter offers two display options: Basic and Advanced; see Table 55.

Basic Display	- Suitable for basic process needs 360° rotation in 90° Increments 2 lines, 16 characters - Standard units-of-measurement: Pa, KPa, MPa, KGcm2, TORR, ATM, inH2O, mH2O, bar, mbar, inHg, FTH2O, mmH2O, MMHG, and PSI - Diagnostic messaging - Square root indication & Out-of-range indication - Supports optional 3-Button configuration
Advanced Display	360° rotation in 90° increments - Three (3) configurable screen formats with configurable rotation timing - Large process variable (PV) - Small PV with bar graph - Small PV with trend (1-24 hours, configurable) - Eight (8) screens 3-30 seconds rotation timing - Standard and custom engineering units - Diagnostic alerts and diagnostic messaging - Multiple language support: - EN, FR, GE, RU, SP - EN, CH (Kanji), IT (future release) - Square root and out-of-range indication - Supports 3-button configuration, transmitter messaging, and maintenance mode indications

Table 5 Available Display Characteristics

5. Device Variables

The Device variables are the same as the Dynamic variables used.

6. Dynamic Variables

Three Dynamic Variables are implemented.

Process Variable	Meaning	Units
PV	Pressure	InH2O, psi, Pa, inH2O @ 4degC, InHg, bar, kPa, mmH2O @ 4degC, ftH2O, mbar, torr, inH2O @ 60degF, mmH2O, g/Sqcm, atm, mmHg, Kg./Sqcm, Mpa
SV	Meter Body Temperature	degC, degF, Rankine, Kelvin
TV	Static Pressure	Psi

Table 6 List of Dynamic Variables

The HART units' code for inH2O@60degF is 145 as well as 240.

7. Status Information

7.1 Field Device Status

Many of the flags in the device status are further described by critical, non-critical, and informative flags in the additional status bytes described in section 0.

Table 7 Field Device Status

Bit	Name	Use
7	Device Malfunction	This flag is set to "1" when any critical failure is detected. When a "Device Malfunction" is indicated, the "More Status Available" status flag is always asserted and further information is available in the manufacturer specific status bytes. The designation for critical status, and Honeywell's unique status bytes are described in section 0.
6	Configuration Changed	Set when any parameter in the device configuration is changed. The flag will be reset when command 38 is received.
5	Cold Start	Set when power is first applied. The flag will also be set when the device is reset.
4	More Status Available	Set whenever any failure is detected. Command #48 gives further detail. (See section 0).
3	Loop Current Fixed	Set when the device is placed in fixed current mode (command 40).
2	Loop Current Saturated	Set if the primary variable is out of range. The measurement limits differ between the "classic" and "NAMUR" output options. This event does *not* set bit 7 ("Field Device Malfunction").
1	Non-Primary Variable Out Of Limits	Set if the temperature calculated from the internal meter body temperature sensor is too high (greater than 125 degC for most transmitters). When this status is asserted, the "More Status Available" flag is also set, and the specific failure is indicated as "Sensor Over Temp" in the manufacturer specific status (see section 0).
0	Primary Variable Out of Limits	Set if the pressure is greater than twice the Upper Range Limit (URL) of the device. When this status is asserted, the "More Status Available" flag is also set, and the specific failure is indicated as "Meter Body Overload" in the manufacturer specific status (see section 0).

7.2 Extended Device Status

The Extended Device Status byte has the following flags:

Bit	Description	Use in Device
0	Maintenance Required	Not Used
1	Device Variable Alert	Set when a critical or non-critical error (except "In Fixed Output Current Mode") associated with the PV has been detected (see section 0).
2-7	Undefined	

Table 8 Extended Device Status

Command #48 – Additional Field Device Status

Command #48 returns 8 bytes of data. The first 3 bytes contain device specific status as shown below. The Extended Device Status byte (byte 6) will be returned as defined above in section 7.2. All other bytes are unused, and will be returned as 0. The three detailed status bytes are divided by category of status: critical error and non-critical error.

Table 9 Additional Field Device Status

Status Type	Bit	Command 48 Status
Critical status (Byte 1)	7	Unused
	6	Unused
	5	Sensor Comm Timeout
	4	Meter Body Critical Failure
	3	Electronic Module Diag Failure
	2	Config Data Corrupt
	1	Meter Body NVM Corrupt
	0	Electronic Module DAC Failure
Non critical status (Byte 2)	7	No DAC Compensation
	6	No Factory Calibration
	5	PV Out of Range
	4	Fixed Current Mode
	3	Sensor Over Temperature
	2	Meter Body Excess Correct
	1	Electronic Module Comm Failure
	0	Display Failure

Non critical status 2 (Byte 3)	7	Low Supply Voltage
	6	No DAC Calibration
	5	Tamper Alarm
	4	Meter Body Unreliable Comm
	3	Loop current noise
	2	AO Out of Range
	1	URV Set Error - Span Config Button
	0	LRV Set Error - Zero Config Button

All critical faults will be indicated to the user with bits 4 and 7 set in the Field Device Status byte of the response.

Some faults are cleared when the error condition is resolved, while All Critical Status faults require the device be power cycled.

8. Universal Commands

The transmitter supports version 7.x of the HART protocol, thus each universal command is as specified in that standard. The following universal commands are provided by the device:

Number	Name	Notes
0	Read Unique Identifier	Returns unique identification for the device
1	Read Primary Variable	Returns PV value and its unit
2	Read Loop Current and Percent of Range	Returns AO value and % range
3	Read Dynamic Variables and Loop Current	Returns PV and SV values and corresponding unit values along with AO value
6	Write Polling Address	Changes device's polling address and loop current mode.
7	Read Loop Configuration	Returns polling address and loop current mode status.
8	Read Dynamic Variable Classifications	Returns dynamic variable classification.
9	Read Device Variables with Status	Returns dynamic variables PV, SV & TV with status.
11	Read Unique Identifier Associated With Tag	Same response as command 0
12	Read Message	Returns 24 bytes of packed ASCII data
13	Read Tag, Descriptor, Date	Returns tag, descriptor (packed ASCII format) and date from the device
14	Read Primary Variable Transducer Information	Returns transducer limits and span
15	Read Device Information	Returns burnout settings, PV unit value, LRV, URV, damping value and write protect code
16	Read Final Assembly Number	Returns final assembly number
17	Write Message	Write 24 bytes of packed ASCII data.
18	Write Tag, Descriptor, Date	Writes tag, descriptor (packed ASCII format) and date to the device
19	Write Final Assembly Number	Writes final assembly number to the device
20	Read Long Tag	Returns 32-byte Long Tag.
21	Read Unique Identifier	Returns unique identifier associated with

Number	Name	Notes
		Long Tag.
22	Write Long Tag	Writes Long Tag
38	Reset Configuration Changed Flag	Resets the configuration change flag
48	Read Additional Device Status	See section 11.2 for details.

Table 10 Universal Commands

9. Common-Practice Commands

9.1 Supported Common Practice Commands

The following common-practice commands are implemented:

Number	Name	Notes
33	Read Device Variables	Will return Device Variable 0 = PV (Pressure), Device Variable 1 = SV (Meter body Temperature) and Device Variable 2= TV (Static Pressure) when requested.
34	Write PV Damping Value	Accepts damping values between 0 and 32 seconds.
35	Write PV Range Values	Write PV LRV/URV values
36	Set PV Upper Range Value	Set current PV as URV. Adjusts the span accordingly. Some ST800 models support accurate operation in both the forward and reverse directions. Consult the Model Selection Guide for models that are compound characterized.
37	Set PV Lower Range Value	Set current PV as LRV. Adjusts the span accordingly.
40	Enter/Exit Fixed Current Mode	Sets loop current to a fixed value.
42	Perform Device Reset	Resets the device
43	Set Primary Variable Zero	Sets present PV to zero
44	Write Primary Variable Units	Write PV units value
45	Trim Loop Current Zero	Trims loop current to 4mA
46	Trim Loop Current Gain	Trims loop current to 20mA
47	Write PV Transfer Function	Writes Transfer Function as Linear and Square root.
53	Write Device Variable Units	Writes Device Variable Units
71	Lock Device	This command locks a device preventing any changes being made from a local panel or from another master.
76	Read Lock Device status	This command reads the current state of lock device.

Table 11 Common Practice Commands

9.2 Burst Mode
This Field Device does not support Catch Device Variable.

9.3 Catch Device Variable
This Field Device does not support Catch Device Variable.

10. Device-Specific Commands

The following device-specific commands are implemented:

Number	Name	Notes
130	Write Upper Sensor Trim Point (Correct URV)	It trims the PV to URV.
131	Write Lower Sensor Trim Point (Correct LRV)	It trims the PV to LRV.
133	Reset Corrects	It resets all the user correct operations performed .
134	Read transmitter specifics	13 digit Meter-body bar code and display information
138	Read Primary Variable Sensor Information	Reads LRV and URV
139	Read model number – Key Number and Table I	Reads 7 byte Key number, and Table I information. For factory use.
140	Read model number - Table II	Reads Table II information. For factory use.
141	Read model number - Table III	Reads Table III information. For factory use.
142	Read time in service, service life remaining, percent time in stress	It reads Time in Service , Service life and % life in stress.
144	Read last time and date for correct URV, correct LRV and zero trim.	Reads Calibration records.
145	Read filter selection	Reads filter parameters.
146	Write filter selection	Write filter parameters.
148	Read power fail counter and its timestamp	The power fail count and Time stamp are read.
149	Read Electronics Temperature and upper tracking parameters value	Electronics Temperature maximum tracking parameters.
150	Read Electronics Temperature lower tracking parameters value	Electronics Temperature minimum tracking

		parameters.
151	Read differential PV UP tracking parameters	Reads PV maximum tracking.
152	Read Meter Body Temperature upper tracking parameters	Reads Meter Body Temperature tracking (maximum)
153	Read Meter Body Temperature lower tracking parameters	Reads Meter Body Temperature tracking (minumum)
154	Read Static Pressure and its tracking parameters	Reads Static Pressure tracking
155	Read current and min operating voltage and its timestamp	Reads operating voltage and minimum Time stamp.
156	Reset min terminal voltage and its time stamp	It resets the Operating Voltage records.
157	Read M360 core temperature up tracking parameters	Reads M360 temp up tracking.
158	Read M360 core temperature down tracking parameters	Reads M360 temp down tracking.
159	Read AVDD max and time stamp	Read AVDD records and Time stamp.
160	Read AVDD min and time stamp	Read AVDD records and Time stamp.
161	Read sensor install date and time in service	Reads sensor installed date.
162	Read MB stress monitor and MB service life	Reads MB Stress and service life.
163	Write install date to sensor	Writes Sensor install date. One time writable.
164	Read Model Number –Table IV	Reads Table IV information. For factory use.
165	Read Previous time and date for correct URV, correct LRV, zero trim	Reads Calibration records.
166	Read current time and date for correct URV,	Reads Calibration records.

	correct LRV, zero trim	
167	Read current, last and previous reset correct Time & Date	Reads Calibration records for Reset corrects.
168	Read differential PV Down tracking parameters	Reads PV down tracking.
175	Read/Lock Write Protect Configuration	Soft Write protection
176	Write/Change Write Protect Password	Changes the write Protect Password.
177	Read Database ID	Reads Database ID for the requested config history code
178	Read last 5 Configuration history	Enables to view the last 5 configuration history.
185	Read low flow cutoff mode	Reads Method selected for Low Flow cut-off.
186	Read sensor time in service	Reads Sensor time in Service.
187	Read f/w revision	It reads Communication board firmware rev. number.
202	Write Screen configuration I	Writes Screen Configuration I for display
203	Write Screen configuration II	Writes Screen Configuration II for display
204	Write Screen configuration III	Writes Screen Configuration III for display
205	Write Screen configuration IV	Writes Screen Configuration IV for display
206	Read Screen configuration I	Reads Screen Configuration I for display
207	Read Screen configuration II	Reads Screen Configuration II for display
208	Read Screen configuration III	Reads Screen Configuration III for display

209	Read Screen configuration IV	Reads Screen Configuration IV for display
210	Write Display Common Configuration	Writes Displays common features like Rotation time and Contrast.
211	Read Display Common Setup	Reads the display set-up.
212	Read Display Firmware Version	Reads Display Firmware Version.
220	Read additional status	It reads the Device status in Detail.
221	Set Date/Time for calibration	Before Calibration it is compulsory to enter the Time and Date.
222	Sensor f/w read	Reads Sensor Firmware version
223	Read flow value	Read the % flow value.
225	Low flow cutoff method selection	Selects the method for Low flow cutoff.
226	Read user breakpoint	It reads the user break point for method 1 selected.
227	Write user breakpoint in % flow	It writes the user break point for method 1 selected.
228	Read the state of "Available for maintenance" flag	Reads the status of "Available for Maintenance" Flag
229	Enable "Available for maintenance" message	Enables the flag.
230	Read the Tamper configuration	Reads the tamper configuration
231	Write tamper configuration	Writes the tamper configuration.
232	Reset recorded tamper attempts	It resets the Tamper attempts recorded.

Table 12 Device Specific Commands

10.1 Device Specific Commands

Each device specific command is detailed below. Only the supported response codes are listed for a command.

Command #130: Correct Input to URV

This command performs a calibration trim for the sensor. The calibration pressure applied to the transmitter is received with this command and the transmitter trims the sensor calibration so that its output equals this value.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
6	Error	Transmitter specific command error
7	Error	In Write Protect Mode
9	Error	Applied Process too High
10	Error	Applied process too low
32	Error	Busy

Command #131: Correct input at LRV

This command performs a calibration trim for the sensor. The calibration pressure applied to the transmitter is received with this command and the PV is calibrated to the applied URV input.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
6	Error	Transmitter specific command error
7	Error	In Write Protect Mode
9	Error	Applied Process too High
10	Error	Applied process too low
32	Error	Busy

Command #133: Reset Corrects

This command removes the calibration and returns the performance to factory calibration. This function is useful as a diagnostic tool to get an indication of characterization performance, as well as the PV is calibrated to the applied LRV input.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error
7	Error	In Write Protect Mode
32	Error	Busy

Command #134: Read Transmitter Specifics

The command reads the 13 digit Meter-body bar code and display information.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	Device type
1-13	ASCII	Meter-body bar code
14	Enum	meter connected flag 00: Not Connected 01: Connected
15	Enum	meter type 01: Advanced display 02: Basic display

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #138: Read Primary Variable Sensor Information

This command reads the PV related information for sensor.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	Sensor Limits/Min Span Units
1-4	IEEE Float	Upper Range Limit
5-9	IEEE Float	Lower Range Limit

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #139: Read Model Number – Key Number, Table I

This command reads the 7 byte key number and 20 byte Table 1 information.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-6	Enum	key number
7-27	Enum	Table 1 information

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #140: Read Model Number – Table II

This command reads Model number Table II information.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-19	Enum	Table II information

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #141: Read Model Number –Table III

This command reads Model number Table III information.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-19	Enum	Table III information

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #142: Read time in service, percent time in stress, service life remaining

This command reads time in service, percent time in stress, service life remaining for the transmitter.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Enum	Time in Service
4-7	Float	Percent Time in stress
8-11	Enum	Service Life remaining

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #143: Read Alternate filter selection parameter

This command reads Alternate filter selection parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	SF (sync filter) value and can be in the range of 0 to 255.
1	Enum	AF (averaging filter) value and can be in the range of 0 to 255.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #144: Read last Time & Date for correct URV, correct LRV, zero trim

This command reads Last Time and Dates for correct URV, correct LRV and zero trim.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Enum	last correct URV time (DD 1 MM 1 YY 1 HR 1 MIN 1)
5-9	Enum	last correct LRV time (DD 1 MM 1 YY 1 HR 1 MIN 1)
10-14	Enum	last zero trim time (DD 1 MM 1 YY 1 HR 1 MIN 1)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #147: Write alternate filter selection parameter

This command writes Alternate filter selection parameters.

Request Data Bytes

Byte	Format	Description
0	Enum	SF (sync filter) value and can be in the range of 0 to 255.
1	Enum	AF (averaging filter) value and can be in the range of 0 to 255.

Response Data Bytes

Byte	Format	Description
0	Enum	Byte 1 is the AF (averaging filter) value and can be in the range of 0 to 255.
1	Enum	Byte 0 is the SF (sync filter) value and can be in the range of 0 to 255.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied

Command #148: Read power fail counter and its timestamp

This command reads the power fail counter and its time stamp.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-1	Enum	Power fail count
2-5	Enum	Time stamp

Command-Specific Response Codes

Code	Class	Description

Code	Class	Description
0	Success	No Command-Specific Errors

Command #149: Read ET and electronics temperature tracking values.

This command reads electronics temperature and electronics temperature tracking values.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	ET value
4-7	Float	ET max limit
8-11	Float	max value
12-15	Float	max time counter
16-19	Float	max time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #150: Read ET lower tracking parameters

This command reads ET lower tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	ET min limit
4-7	Float	min value
8-11	Float	min time counter

12-15	Float	min time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #151: Read differential PV UP tracking parameters

This command reads differential PV UP tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	PV max
4-7	Float	PV up accumulator
7-11	Float	PV up time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #152: Read MBT upper tracking parameters

This command reads MBT upper tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	MBT max
4-7	Float	MBT max accumulator
8-11	Float	MBT max time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #153: Read MBT lower tracking parameters

This command reads MBT lower tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	MBT min
4-7	Float	MBT min accumulator
8-11	Float	MBT min time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #154: Read SP and its tracking parameters

This command reads SP and its tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	SP max
4-7	Float	SP max accumulator
8-11	Float	SP max time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #155: Read current, minimum operating voltage and its timestamp

This command reads current, minimum operating voltage and its timestamp.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Vloop current value(4),
4-7	Float	VLOOP min value(4),
8-11	Float	Vloop min time stamp(4)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #156: Reset min terminal voltage and its time stamp

This command Resets min terminal voltage and its time stamp.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description

Code	Class	Description
0	Success	No Command-Specific Errors
32	Error	Busy

Command #157: Read M360 core temperature up tracking parameters

This command reads the M360 (Sensor's Microprocessor) core temperature up tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	M360 core temp max
4-7	Float	max accumulator
7-11	Float	max time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #158: Read M360 core temperature down tracking parameters

This command reads the M360 core temperature down tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	M360 core temp min
4-7	Float	min accumulator
7-11	Float	min time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #159: Read AVDD max and time stamp

This command reads the AVDD max and time stamp.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	AVDD max
4-7	Float	max time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #160: Read AVDD min and time stamp

This command reads the AVDD min and time stamp.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	AVDD min
4-7	Float	min time stamp

Command-Specific Response Codes

Code	Class	Description

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #161: Read sensor install date

This command reads the sensor install date.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Enum	install date

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #162: Read MB stress monitor and MB service life

This command reads the MB stress monitor and MB service life.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	MB stress monitor
4-7	Float	service life

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #163: Write install date to sensor

This command write install date to sensor.

Request Data Bytes

Byte	Format	Description
0	Enum	Date
1	Enum	Month
2	Enum	Year

Response Data Bytes

Byte	Format	Description
0	Enum	Date
1	Enum	Month
2	Enum	Year
3-4	Enum	Minutes

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too few data bytes received
7	Error	In write protect mode
16	Error	Access Restricted
32	Error	Busy

Command #164: Read Model Number –Table IV

This command reads the 20 byte Model Number –Table IV

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-19	Enum	Model Number –Table IV Information

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #165: Read Previous Time & Date for correct URV, correct LRV, zero trim

This command reads Previous Time and Dates for correct URV, correct LRV and zero trim.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Enum	Previous correct URV time (DD 1 MM 1 YY 1 HR 1 MIN 1)
5-9	Enum	Previous correct LRV time (DD 1 MM 1 YY 1 HR 1 MIN 1)
10-14	Enum	Previous zero trim time (DD 1 MM 1 YY 1 HR 1 MIN 1)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #166: Read current Time & Date for correct URV, correct LRV, zero trim

This command reads Current Time and Dates for correct URV, correct LRV and zero trim.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Enum	Current correct URV time (DD 1 MM 1 YY 1 HR 1 MIN 1)
5-9	Enum	Current correct LRV time (DD 1 MM 1 YY 1 HR 1 MIN 1)

| 10-14 | Enum | Current zero trim time (DD 1 MM 1 YY 1 HR 1 MIN 1) |

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #167: Read current, last and previous reset correct Time & Date

This command reads the current, last and previous reset correct T&D

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-4	Enum	Read current reset correct T&D(DD 1 MM 1 YY 1 HR 1 MIN 1)
5-9	Enum	Read last reset correct T&D(DD 1 MM 1 YY 1 HR 1 MIN 1)
10-14	Enum	Read previous reset correct T&D(DD 1 MM 1 YY 1 HR 1 MIN 1)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #168: Read differential PV Down tracking parameters

This command reads the differential PV Down tracking parameters.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description

0-3	Float	DP min
4-7	Float	DP min accumulator
8-11	Float	DP min time stamp

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #175: Read/Lock Write Protect Configuration

This command Read/Lock Write Protect Configuration.

Request Data Bytes

Byte	Format	Description
0	Enum	0x01 - Enable WP 0x02 - Read WP status

Response Data Bytes

Byte	Format	Description
0	Enum	0x00 - Disabled 0x01 - Enabled

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #176: Write/Change Write Protect Password

This command Write/Change Write Protect Password.

Request Data Bytes

Byte	Format	Description

0	Enum	Unlock(0x00) / Change(0x03)
1-4	ASCII	Password

Response Data Bytes

Byte	Format	Description
0	Enum	Unlock(0x00) / Change(0x03)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #177: Read Database ID

This command provides a Database ID for the requested configuration history code.

Request Data Bytes

Byte	Format	Description
0	Enum	01:-(This is request byte to read latest parameter)
		02:- (This is request byte to read second last parameter written)
		03:- (This is request byte to read third last parameter written)
		04:- (This is request byte to read forth last parameter written)
		05:- (This is request byte to read fifth last parameter written)

Response Data Bytes

Byte	Format	Description
0	Enum	Database ID of the parameter for which we have made request
		When no record is present, database ID returned will be 0xFF.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received

Command #178: Read Configuration history

This command provides a history of the last 5 Configuration changes.

Request Data Bytes

Byte	Format	Description
0	Enum	01:-(This is request byte to read latest parameter)
		02:- (This is request byte to read second last parameter written)
		03:- (This is request byte to read third last parameter written)
		04:- (This is request byte to read forth last parameter written)
		05:- (This is request byte to read fifth last parameter written)

Response Data Bytes

Byte	Format	Description
0	Enum	Database ID of the parameter for which we have made request
		When no record is present, database ID returned will be 0xFF.
1-33	Enum	Value of the parameter for which we have made request
		We will get number of byte= size of parameter
		Eg, If PV unit is of size 2 byte so we will get 2 byte rest 3-33 bytes will be garbage.
		Rest bytes will be garbage data
		When no record is present, it will return 32 garbage bytes.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received

Command #185: Read low flow cutoff mode

This command reads low flow cutoff mode

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description

0	Enum	0x00 – Methad 1
		0x01 – Method 2

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #186: Read sensor time in service

This command reads the Sensor Time in Service.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Sensor Time in Service

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #187: Read HART-DE board firmware revision

This command reads the HART-DE board firmware revision.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-7	ASCII	

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Code	Class	Description
32	Error	Busy

Command #202: Write Display Screen configuration I

This command Write Screen Configuration I.

Request Data Bytes

Byte	Format	Description
0	Enum	Screen Selection screen 1:-Hex 3E screen 2:-Hex 3F screen 3:-Hex 40 screen 4:-Hex 41 screen 5:-Hex 42 screen 6:-Hex 43 screen 7:-Hex 44 screen 8:-Hex 45
1	Enum	Screen Format None- 00 PV - 01 PV & Bar Graph - 02 PV & Trend - 03
2	Enum	Identifies which of the process variables in the publish message is displayed in the view – parameter index
3-4	Enum	Unit Code (Refer Table 11.1)
5	Enum	Number of digits to display after the decimal point.
6	Enum	PV Processing. 0 – NONE 1 – CONVERT EU. 2 – LINEAR 3 – SQRT
7	Trend duration	Duration of a trend screen in hours. Valid range 1 – 24

Response Data Bytes

Byte	Format	Description

0	Enum	Screen Selection screen 1:-Hex 3E screen 2:-Hex 3F screen 3:-Hex 40 screen 4:-Hex 41 screen 5:-Hex 42 screen 6:-Hex 43 screen 7:-Hex 44 screen 8:-Hex 45	
1	Enum	Screen Format None- 00 PV - 01 PV & Bar Graph - 02 PV & Trend - 03	
2	Enum	Identifies which of the process variables in the publish message is displayed in the view – parameter index	
3-4	Enum	Unit Code (Refer Table 11.1)	
5	Enum	Number of digits to display after the decimal point.	
6	Enum	PV Processing. 0 – NONE 1 – CONVERT EU. 2 – LINEAR 3 – SQRT	
7	Trend duration	Duration of a trend screen in hours. Valid range 1 – 24	

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #203: Write Display View configuration II

This command Write Screen Configuration II.

Request Data Bytes

Byte	Format	Description
0	Enum	View OID
1-4	Float	fCustomEuHi
5-8	Float	fCustomEuLo
10-13	Float	fLowLimit (Trend, Bar chart)
14-17	Float	fHighLimit (Trend, Bar chart)

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-4	Float	fCustomEuHi
5-8	Float	fCustomEuLo
10-13	Float	fLowLimit (Trend, Bar chart)
14-17	Float	fHighLimit (Trend, Bar chart)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #204: Write View configuration III

This command Write Screen Configuration III.

Request Data Bytes

Byte	Format	Description
0	Enum	View OID

1-18	Float	CustomUnits

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-18	Enum	CustomUnits

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #205: Write Display View configuration IV

This command Write Screen Configuration IV.

Request Data Bytes

Byte	Format	Description
0	Enum	View OID
1-32	Enum	CustomTag

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-32	Enum	CustomTag

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error

Code	Class	Description
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #206: Read Display View configuration I

This command reads view configuration I.

Request Data Bytes

Byte	Format	Description
0	Enum	Screen Selection screen 1:-Hex 3E screen 2:-Hex 3F screen 3:-Hex 40 screen 4:-Hex 41 screen 5:-Hex 42 screen 6:-Hex 43 screen 7:-Hex 44 screen 8:-Hex 45

Response Data Bytes

Byte	Format	Description
0	Enum	Screen Selection screen 1:-Hex 3E screen 2:-Hex 3F screen 3:-Hex 40 screen 4:-Hex 41 screen 5:-Hex 42 screen 6:-Hex 43 screen 7:-Hex 44 screen 8:-Hex 45
1	Enum	Screen Format None- 00 PV - 01 PV & Bar Graph - 02 PV & Trend - 03
2	Enum	Identifies which of the process variables in the publish message is displayed in the view – parameter index
3-4	Enum	Unit Code (Refer Table 11.1)

5	Enum	Number of digits to display after the decimal point.
6	Enum	PV Processing. 0 – NONE 1 – CONVERT EU. 2 – LINEAR 3 – SQRT
7	Trend duration	Duration of a trend screen in hours. Valid range 1 – 24

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received

Command #207: Read Display View configuration II

This command reads the View configuration II

Request Data Bytes

Byte	Format	Description
0	Enum	Screen Number

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-4	Float	fCustom Eu Hi
5-8	Float	fCustom Eu Low
10-13	Float	fLow Limit (Trend, Bar chart)
14-17	Float	fHigh Limit (Trend, Bar chart)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received

Command #208: Read Display View configuration III

This command reads the View configuration III

Request Data Bytes

Byte	Format	Description
0	Enum	Screen number

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-18	Enum	Custom Units

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received

Command #209: Read Display View configuration IV

This command reads the View configuration IV.

Request Data Bytes

Byte	Format	Description
0	Enum	Screen Number

Response Data Bytes

Byte	Format	Description
0	Enum	View OID
1-32	Enum	Custom Tag

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received

Command #210: Write Display General configuration

This command Writes the General Display Configuration

Request Data Bytes

Byte	Format	Description
0	Enum	Language: English—0 French—1 German—2 Spanish—3 Itaian—4 Russian—5 Chinese—6 Japanese—7
1	Enum	Rotation Time(3 to 30 Seconds.)
2-5	ASCII	Password
6	Enum	Display Contrast(0-9)

Response Data Bytes

Byte	Format	Description
0	Enum	Language: English—0 French—1 German—2 Spanish—3 Itaian—4 Russian—5 Chinese—6 Japanese—7
1	Enum	Rotation Time(3 to 30 Seconds.)
2-5	ASCII	Password
6	Enum	Display Contrast(0-9)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received
6	Error	Transmitter specific command error
7	Error	Transmitter In Write Protect Mode

Code	Class	Description
16	Error	Access Denied
32	Error	Busy

Command #211: Read Display General configuration

This command reads the Display General Configuration.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	Language: English—0 French—1 German—2 Spanish—3 Itaian—4 Russian—5 Chinese—6 Japanese—7
1	Enum	Rotation Time(3 to 30 Seconds.)
2-5	ASCII	Password
6	Enum	Display Contrast(0-9)

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #212: Read Display Firmware Version

This command reads the Display Firmware Version.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-7	Enum	Display Firmware revision

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
6	Error	Transmitter specific command error

Command #220: Read additional status

This command reads the additional Status.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-8	Enum	Refer table 11.3

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #221: Set Date/Time for calibration

This command Set Date/Time for calibration.

Request Data Bytes

Byte	Format	Description

| 0-4 | Enum | DD 1 MM 1 YY 1 HR 1 MIN 1 |

Response Data Bytes

Byte	Format	Description
0-4	Enum	DD 1 MM 1 YY 1 HR 1 MIN 1

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
32	Error	Busy

Command #222: Read sensor firmware version number

This command reads the sensor Firmware revision number.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-7	Enum	Sensor Firmware revision

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #223: Read flow value for square-root functionality

This command reads the 4 byte float value for the flow calculation when the device is configured for square root mode.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Flow value

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #225: Low flow cutoff method selection

This command helps in selecting the method for Low Flow Cutoff.

Request Data Bytes

Byte	Format	Description
0	Enum	0x00 - Method 1 0x01 - Method 2

Response Data Bytes

Byte	Format	Description
0	Enum	0x00 - Method 1 0x01 - Method 2

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #226: Read user breakpoint in % flow for low flow cutoff

This command reads the user breakpoint in % flow for low flow cut-off.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0-3	Float	Flow value in %.

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #227: Write user breakpoint in % flow for low flow cutoff

This command Writes user breakpoint in % flow for low flow cutoff.

Request Data Bytes

Byte	Format	Description
0-3	Float	User configured breakpoint in % flow for low cut off feature

Response Data Bytes

Byte	Format	Description
0-3	Float	User configured breakpoint in % flow for low cut off feature

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
32	Error	Busy

Command #228: Read maintenance flag

This command reads the maintenance flag.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	0x00 – "Check with operator" 0x01 – "Available for maintenance"

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #229: Write maintenance flag

This command writes Maintenance Flag.

Request Data Bytes

Byte	Format	Description
0	Enum	0x00 – "Check with operator" 0x01 – "Available for maintenance"

Response Data Bytes

Byte	Format	Description
0	Enum	0x00 – "Check with operator" 0x01 – "Available for maintenance"

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received

Command #230: Read tamper alarm settings

This command reads tamper alarm settings.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
0	Enum	Tamper mode(0x00 – Disable/ 0x01 – Enable),
1	Enum	Tamper latency in seconds(range 0 - 60 seconds),
2	Enum	Maximum allowable Tamper Attempts (Min 1 / Max 10),
3	Enum	Tamper attempts recorded so far

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors

Command #231: Write Tamper alarm settings

This command writes Tamper alarm settings.

Request Data Bytes

Byte	Format	Description
0	Enum	Tamper mode(0x00 – Disable/ 0x01 – Enable),
1	Enum	Tamper latency in seconds(range 0 - 60 seconds),
2	Enum	Maximum allowable Tamper Attempts (Min 1 / Max 10),

Response Data Bytes

Byte	Format	Description
0	Enum	Tamper mode(0x00 – Disable/ 0x01 – Enable),
1	Enum	Tamper latency in seconds(range 0 - 60 seconds),
2	Enum	Maximum allowable Tamper Attempts (Min 1 / Max 10),
3	Enum	Tamper attempts recorded so far

Command-Specific Response Codes

Code	Class	Description

Code	Class	Description
0	Success	No Command-Specific Errors
2	Error	Invalid Selection
5	Error	Too Few Data Bytes Received
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

Command #232: Reset executed attempts counter

This command resets the tamper attempt count.

Request Data Bytes

Byte	Format	Description
None		

Response Data Bytes

Byte	Format	Description
None		

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
7	Error	Transmitter In Write Protect Mode
16	Error	Access Denied
32	Error	Busy

11.   Tables

11.1 Unit Codes

	Unit	HART Code
0	Custom	0
1	Inch of Water (68 Deg. F)	1
2	Inch of Mercury (0 Deg. C)	2
3	Feet of Water (68 Deg. F)	3
4	Millimeter of Water (68 Deg. F)	4
5	Millimeter of Mercury (0 Deg. C)	5
6	PSI	6
7	Bar	7
8	Millibar	8
9	gram-force/cm2	9
10	Kgf/cm2	10
11	Pascals	11
12	Kilopascal	12
13	Torr	13
14	Atmosphere	14
15	Mega-pascal	237
16	Inch of Water (39.2 Deg. F)	238
17	Millimeters of Water (4 Deg. C)	239
18	Inch of Water (60 Deg. F)	145
19	Degrees Celsius	32
20	Degrees Fahrenheit	33
21	Degrees Rankin	34
22	Kelvin	35

	Unit	HART Code
23	Gallons per Minute	16
24	Gallons per Hour	136
25	Liters per Minute	17
26	Liters per Hour	138
27	Percent	57

Table 13 Unit Codes supported

11.2 Unit Conversion

Pressure Units

Internally, the transmitter uses inches H_2O at 39.2 degF (4 degC) for the pressure variable. Conversions to the other supported units are made using the following equations:

"To" unit	Formula
inH$_2$O 68 degF	$P_{inH2O68F} = 1.00177 * P_{inH2O39F}$
inHg 0 degC	$P_{inH2O0C} = 0.073555 * P_{inH2O39F}$
ftH$_2$O 68 degF	$P_{ftH2O68F} = 0.083483 * P_{inH2O39F}$
mmH$_2$O 68 degF	$P_{mmH2O68F} = 25.445313 * P_{inH2O39F}$
mmHg 0 degC	$P_{mmH2O0C} = 1.868286 * P_{inH2O39F}$
Psi	$P_{psi} = 0.036126 * P_{inH2O39F}$
Bars	$P_{bar} = 0.002491 * P_{inH2O39F}$
Mbar	$P_{mbar} = 2.490845 * P_{inH2O39F}$
g/cm^2	$P_{gcm2} = 2.539917 * P_{inH2O39F}$
kg/cm^2	$P_{kgcm2} = 0.00254 * P_{inH2O39F}$
Pascals	$P_P = 249.082031 * P_{inH2O39F}$
kilopascals	$P_{KP} = 0.249081 * P_{inH2O39F}$
Torr	$P_P = 1.868286 * P_{inH2O39F}$
Atm	$P_{atm} = 0.002458 * P_{inH2O39F}$
megapascals	$P_{MP} = 0.000249 * P_{inH2O39F}$
inH$_2$O 4 degC	$P_{inH2O4C} = 1.0 * P_{inH2O39F}$
mmH$_2$O 4 degC	$P_{mmH2O4C} = 25.399902 * P_{inH2O39F}$
inH$_2$O 60 degF	$P_{inH2O60F} = 1.000976 * P_{inH2O39F}$

Table 14 Common Unit Conversions

Temperature Units

Internally, the transmitter uses degrees Celsius for the sensor temperature variable. Conversions to the other supported units are made using the following equations:

"To" unit	Formula
Farenheit	$T_F = (T_C * 1.8) + 32$
Rankine	$T_K = T_C + 273.15$
Kelvin	$T_R = (T_C + 273.15) * 1.8$

Table 15 Temperature Units

11.3 Command 220 details

Type	Bit	Command 220 bit status
DAC Failure (HART/DE) (BYTE1)	7	SPI Failure
	6	Packet Error
	5	Over Current Status
	4	Under Current Status
	3	Temp Above 140C
	2	Temp Above 100C
	1	Unused
	0	Unused
Communication (HART/DE) (BYTE2)	7	Unused
	6	Unused
	5	Unused
	4	Unused
	3	Brownout Status
	2	Program Flow Failure
	1	ROM Failure
	0	RAM Failure
Display (HART/DE) (BYTE3)	7	Unused
	6	Unused
	5	Unused
	4	Unused
	3	Unused
	2	Display Config Data Corrupt
	1	Display Comm Timeout
	0	Unused
DAC Info (HART/DE) (BYTE4)	7	Unused
	6	Unused
	5	Unused
	4	Unused
	3	Unused
	2	Unused
	1	Low Transmitter supply
	0	Control Word Write Fault

Sensor (BYTE5)	7	Program Flow Failure
	6	ROM Failure
	5	RAM Failure
	4	Suspect Input
	3	PV/SV/TV Bad
	2	Char Table CRC Fault
	1	Meter Body Failure
	0	Low sensor supply
Sensor (BYTE6)	7	Sensor RAM Database Fault
	6	PV Out of Range
	5	TV Bad
	4	SV Bad
	3	PV Bad
	2	Charact Calc Error
	1	Excess Span Correction
	0	Excess Zero Correction
Database Integrity (BYTE7)	7	Unused
	6	Display Common Config DB corrupt
	5	Display View Config DB corrupt
	4	Adv Diag DB corrupt
	3	Config Change DB corrupt
	2	General Config DB corrupt
	1	Vital Config DB corrupt
	0	Common DB corrupt
Display Integrity (BYTE8)	7	Display View8 corrupt
	6	Display View7 corrupt
	5	Display View6 corrupt
	4	Display View5 corrupt
	3	Display View4 corrupt
	2	Display View3 corrupt
	1	Display View2 corrupt
	0	Display View1 corrupt

Table 16 Command 220 details

12.   Performance

12.1 Sampling Rates

Typical sampling rates are shown in the following table.

Primary pressure sensor sample	50 per second
Internal (meter-body) sensor sample (MB Temp)	1.67 per second
PV digital value calculation	50 per second
SV digital value calculation	1.67 per sec
Analog output update	50 per second

Table 17 Sampling Rates

12.2 Power-Up

On power up, the transmitter initializes the data in RAM and the HART communication links and starts the task scheduler to sample the input.

The device will not respond to HART commands during the Power Up sequence.

Fixed-current mode is cancelled by power loss or software reset (command 42, for instance).

Typical Startup Time = 1-2 sec

In very short succession after power is applied to the transmitter, the device will set its output to the user-selected burnout level, then briefly transition to 50% (12 mA nominal), and then begin publishing the primary variable.

12.3 Device Reset

Command 42 ("Perform Device Reset") causes the device to reset its microprocessor. The resulting restart is similar to the normal power up sequence. (See section 0). The only difference is if the primary variable is valid at the start of the reset sequence. If so, it will be maintained until initialization is performed, and then a new calculation will be placed on the analog output channel.

12.4 Self Test

The transmitter keeps performing continuous self tests in the background. The device does support Command 237 "Self Test".

12.5 Command Response Times

Minimum	15.1778ms
Typical	67ms
Maximum	180.5778ms

Table 18 Response Times

12.6 Busy and Delayed-Response

1) BUSY (32) response code implementation:

BUSY Response code is implemented for the commands, where NVM writing is involved. Each time when the NVM write command comes, first it is checked if the device is busy in writing NVM in background, when some configuration is done from display OR long string parameters like tag/date/descriptor, Long tag, Message from previous HART command, in the background task.

a. If device is busy in writing long string parameters then the device issues RC-32 to the HART command and completes the NVM write activity in hand in the command itself using its response time of 250ms. As device sends RC-32 to the HART command, the host is expected to send the same command again until it gets a success response code or till the limited number of retries as decided by host in case of BUSY RC.

b. If the NVM write background task is in progress for the parameters configured from display, the device sends BUSY RC to the host, and keeps on sending BUSY RC's to the next coming HART commands until it finishes this background task of NVM write.

For any IPC command if the Comm PWA is unable to respond in 240mSec as it may have not received response from sensor/display, for the first time it sends BUSY response so that host can retry, then if again the Comm PWA is unable to respond in 240mSec then it sends a Device specific error (RC=0x06) to HART host.

Delayed-response is not used.

12.7 Long Messages

The largest data field used is in the response to Commands 20 and 22: 32 bytes of long tag and Command 17: 24 bytes containing the packed ASCII message data.

12.8 Non-Volatile Memory

EEPROM is used to hold the device's configuration parameters. New data is written to this memory 20 seconds after the execution of a write command. When data is downloaded to the device, power to the transmitter should not be interrupted until the data is copied to the non volatile memory.

12.9 Modes
Fixed current mode is implemented, using Command 40. This mode is cleared by power loss or reset. When the device is in fixed current mode, the analog output will not track the input.

12.10 Write Protection
Write-protection is provided, selected by an external jumper as well as a software write protect (command 175 and 176) .When the jumper is present, all commands are available.

11.11 Damping
The damping is available from 0 to 32 seconds in HART.

Annex A.   Capability Checklist

Manufacturer, model and revision	Honeywell Intl (23)., ST 800, rev.1
Device type	1 (Transmitter)
HART revision	7.x
Device Description available?	Yes
Number and type of sensors	3(three internal)
Number and type of actuators	0
Number and type of host side signals	1: 4 - 20mA analog
Number of Device Variables	3
Number of Dynamic Variables	3
Map able Dynamic Variables?	No
Number of common-practice commands	15
Number of device-specific commands	63
Bits of additional device status	24
Alternative operating modes?	No
Burst mode?	No
Capture Device Variables?	No
Write-protection?	Yes

Table 19 Capability checklist

Annex B.   Default Configuration

Parameter	Default value
Sensor Type	Differential Pressure
Lower Range Value	0
Upper Range Value	depends on the model (400 inH$_2$O@4C for a 400" DP, for example)
PV Units	Inches of H$_2$O @ 4 deg C
SV Units	Degrees Celsius
TV Units	PSI
Damping time constant	0.5 seconds
Fault-indication jumper	Up-scale
Write-protect jumper	Installed (write disabled)
Number of response preambles	7
Polling Address	0
Loop Current	Enable
Output mode	Analog

Table 20 Default Configuration

Annex C.   Revision History

Document Revision	Date	Device Revision	DD Revision	Description
0.1	1st August 12	1	7	Preliminary version - for HART 7.x device.
0.2	27th August 12	1	9	Modified after review from Team.
0.3	6th September 12	1	9	Modified after Review and Testing from Team members.

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

(TAC) **hfs-tac-support@honeywell.com**

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Phone: + 80012026455 or +44 (0)1202645583
FAX: +44 (0) 1344 655554
Email: (Sales) **sc-cp-apps-salespa62@honeywell.com**
or
(TAC) **hfs-tac-support@honeywell.com**

NORTH AMERICA

Honeywell Process Solutions,
Phone: 1-800-423-9883
Or 1-800-343-0228
Email: (Sales) **ask-ssc@honeywell.com** or
(TAC) **hfs-tac-support@honeywell.com**

SOUTH AMERICA

Honeywell do Brazil & Cia
Phone: +(55-11) 7266-1900
FAX: +(55-11) 7266-1905
Email: (Sales) **ask-ssc@honeywell.com** or
(TAC) **hfs-tac-support@honeywell.com**

Specifications are subject to change without notice.

Honeywell

Honeywell Process Solutions
1860 West Rose Garden Lane   34-ST-00-119 Rev.1
Phoenix, Arizona 85027   January 2013
www.honeywellprocess.com   ©2013 Honeywell International Inc.