HART® Field Device Specification:

Amphenol (Maryland) PCH Sensor Revision 1

Document 93064, rev. 1

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Effective June 16, 2017, Amphenol Corporation purchased the Wilcoxon Research brand and the Meggitt (Maryland), Inc. business in its entirety. Our new d.b.a. and brand is Wilcoxon Sensing Technologies. Our new legal name is Amphenol (Maryland), Inc. The Meggitt email address is set for temporary use. Notification of new email addresses will be provided shortly.

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Table of Contents

1. Introduction

Scope

The Wilcoxon, model PCH series sensor, revision 1 complies with HART Protocol Revision 7.5. This document specifies all the device specific features and documents HART Protocol implementation details (e.g., the Engineering Unit Codes supported). 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.

Purpose

This specification is designed to complement other documentation (e.g., the *Installation Manual*) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective

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.

References

HART Smart Communications Protocol Specification. HCF_SPEC-12. Available from the HCF.

2. Device Identification

Manufacturer Name:	Wilcoxon	**Model Name(s):**	PCH420V-M12, PCH420V-R6
Manufacture ID Code:	24,744 (0x60A8)	**Device Type Code:**	58,092(0xE2EC)
HART Protocol Revision	7.5	**Device Revision:**	1
Number of Device Variables	4		
Physical Layers Supported	Bell202		
Physical Device Category	Sensor, Vibration, Velocity		

The model name and serial number are engraved on the case of the sensor.

3. Product Overview

The PCH series sensor is a loop powered vibration sensor with HART® interface. The sensor is a piezo-electric accelerometer or velocity sensor (two hardware versions). The 4-20mA output is proportional to the level of vibration measured at its mounting base. The sensor can transmit several banded vibration values and its own internal temperature via HART®**.** Configuration and local calibration are performed through the digital communication interface.

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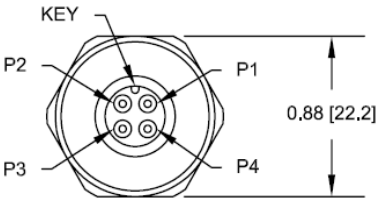
4. Product Interfaces

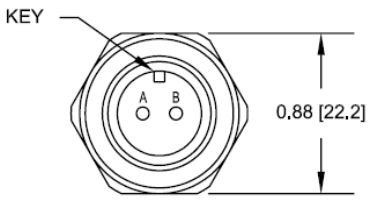
The PCH420 series is a loop powered industrial vibration sensor contained with-in a stainless-steel case that includes an external connector.

Connections



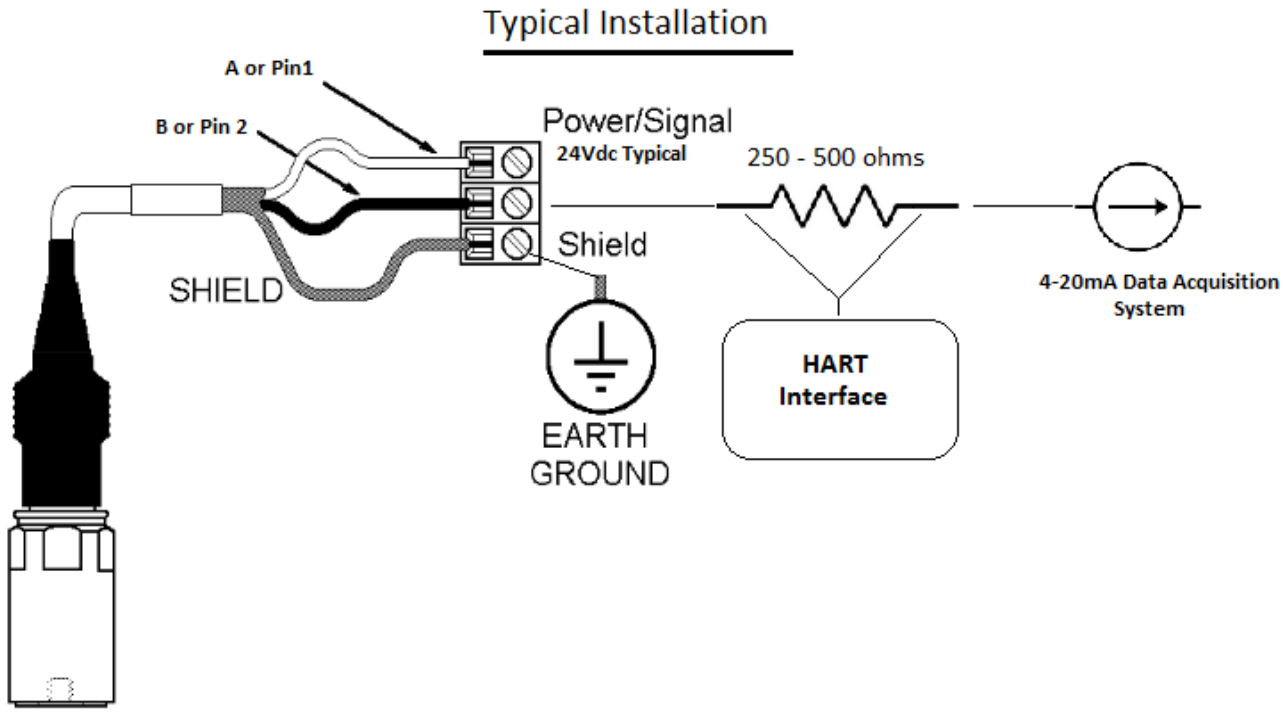
M12 connector

Function	Connector pin
loop positive	1
loop negative	2
N/C	3
N/C	4
ground	shell



MIL-C-5015

Function	Connector pin
loop positive	A
loop negative	B
ground	shell



5. DEVICE VARAIBELS

This Field Device does not expose any Device Variables. Device variables are mapped to Dynamic variables and are not configurable.

6. Dynamic Variables

Four Dynamic Variables are implemented

	Meaning	Units		
PV	Band1, velocity	in/s[114], m/s[21], mm/s[240]	Fixed to DV0	Fixed to analog output
SV	Band2, velocity	in/s[114], m/s[21], mm/s[240]	Fixed to DV1	
TV	Band3, velocity	in/s[114], m/s[21], mm/s[240]	Fixed to DV2	
QV	Internal Electronic Temperature	degC[32], degF[33],K[35], R[34]	Fixed to DV3	

7. Status Information

7.1. Bit 4 (”More Status Available) is set for the following conditions

7.1.1. NV memory SPI communication error
7.1.2. NV memory CRC error
7.1.3. Signal processing compute time flag –Device status bit D7, device malfunction
7.1.4. DAC SPI communication error –Device status bit D7, device malfunction
7.1.5. DAC fault input indicate error –Device status bit D7, device malfunction
7.1.6. DAC fault register indicate error –Device status bit D7, device malfunction

7.2. Additional Device Status (command #48)

7.2.1. Hardware Failure Memory defect SPI error – Standard Status0 Register 8, bit 1
7.2.2. Hardware Failure Memory defect CRC error - Standard Status 0 Register 8,bit 1

7.2.3. AD5421 SPI Fault -Standard Status 0, Register8, bit 6
-Device Specific Status1; Register1, bit7
7.2.4. AD5421 PEC fault -Standard Status 0, Register8, bit 7
-Device Specific Status1; Register1, bit7
7.2.5. AD5421 loop, current over fault -Standard Status 0, Register8, bit 7
-Device Specific Status1; Register1, bit5
7.2.6. AD5421 loop, current under fault -Standard Status 0, Register8, bit 7
-Device Specific Status1; Register1, bit
7.2.7. AD5421 Temperature fault -Standard Status 0, Register8, bit 7
-Device Specific Status1; Register1, bit3
7.2.8. DAC SPI Fault -Standard Status 0, Register8, bit 7
-Device Specific Status1; Register1, bit2
7.2.9. AD5421 loop under 6V fault -Standard Status 0, Register8, bit 1
7.2.10. DAC_FaultPin -Standard Status 0, Register8, bit 0
7.2.11. HF_Fatal_Error -Device Specific Status 0, Register0, 0xAA
7.2.12. SF_DSP_TIMEOUT_COUNT -Device Specific Status 1, Register2
7.2.13. SF_Not_Calibrated -Device Specific Status 0, Register0, 0x55

8. Universal Commands

This device supports all universal HART commands.

0 Read Unique Identifier
1 Read Primary Variable
2 Read Loop Current and Percent of range

3 Read Dynamic Variables and Loop Current
Command #3 returns PV, SV, TV and Qv for a total of 24 bytes.

6 Write Polling Address
7 Read the Loop Configuration
8 Read Dynamic Variable Classifications
9 Read Device Variables with Status
11 Read the Unique Identifier Associated With Tag
12 Read Message
13 Read Tag, Descriptor, Date
14 Read the Primary Variable Transducer Information
15 Read the Device Information
16 Read the Final Assembly Number
17 Write Message
18 Write Tag, Descriptor, Date
19 Write Final Assembly Number
20 Read the Long Tag
21 Read the Unique Identifier Associated With Long Tag
22 Write Long Tag
38 Reset Configuration Change Flag
48 Read Additional Device Status

9. Common-Practice Commands

The following common-practice commands are supported

33 Read Device Variables
34 Write Primary Damping Value
35 Write Primary Variable Range Values
36 Set Primary Variable Upper Range Value
37 Set Primary Variable Lower Range Value
40 Enter Exit Fixed current Mode
42 Perform Device Reset
44 Write Primary Variable Units
45 Trim Loop Current Zero
46 Trim Loop Current Gain
50 Read Dynamic Variable Assignments
53 Write Device Variable Units
54 Read Device Variable Information
59 Write Number of Response Preambles
71 Lock a Device
76 Read Lock Device State
78 Read Aggregated Commands
79 Write Device a Variable
89 Set Real-Time Clock
90 Read Real-Time Clock
95 Read Device Communication Statistics
100 Write Primary Variable Alarm Code
103 Write Burst Period
104 Write Burst Trigger
105 Read Burst Mode Configuration
107 Write Burst Device Variables
108 Write Burst Mode Command Number
109 Burst Mode Control
512 Read Country code
513 Write country code

10. Non –public Device-Specific Commands –

Contact Factory for details

11. Device specific commands

<table>
<tr><td colspan="2">Command #128: “Read DV configuration”</td><td>Status:</td><td>Open</td></tr>
<tr><td></td><td colspan="2">Description</td><td>Ref.</td></tr>
<tr><td>1</td><td colspan="2">Device specific command #128 shall be implemented with the following data.

Request Data Bytes:
<table>
<tr><th>Byte</th><th>Format</th><th>Description</th></tr>
<tr><td>0</td><td>Unsigned-8</td><td>Device Variable code (only DV0-DV2 allowed)</td></tr>
</table>
Response Data Bytes:
<table>
<tr><th>Byte</th><th>Format</th><th>Description</th></tr>
<tr><td>0</td><td>Unsigned-8</td><td>Device Variable code</td></tr>
<tr><td>1-4</td><td>Float</td><td>Lower Frequency Limit(Hz)</td></tr>
<tr><td>5-8</td><td>Float</td><td>Upper Frequency Limit (Hz)</td></tr>
<tr><td>9</td><td>Enum</td><td>Detector type
0 = RMS
1 = Peak
2 = TruePeak
3 = Max
4 = Min</td></tr>
<tr><td>10</td><td>Enum</td><td>Filter type
0 = Bandpass
1 = Lowpass
2 = Highpass
3 = None</td></tr>
<tr><td>11-14</td><td>Float</td><td>True Peak Hold Time (sec)</td></tr>
</table>
Command-Specific Response Codes
<table>
<tr><th>Code</th><th>Class</th><th>Description</th></tr>
<tr><td>0</td><td>Success</td><td>No Command-Specific Errors</td></tr>
<tr><td>2</td><td>Error</td><td>Invalid selection</td></tr>
<tr><td>11</td><td>Error</td><td>Invalid Device Variable Code</td></tr>
</table></td><td></td></tr>
<tr><td>2</td><td colspan="2">The command shall return the current DV configuration. This command is only valid for DV0 – DV2.</td><td></td></tr>
<tr><td>3</td><td colspan="2">The parameter shall be available after a reboot of the device.</td><td></td></tr>
</table>

<table>
<tr><td></td><td>Command #129: “Write DV configuration”</td><td>Status:</td><td>Open</td></tr>
<tr><td></td><td>Description</td><td></td><td>Ref.</td></tr>
<tr><td>1</td><td colspan="3">Device specific command #129 shall be implemented with the following data.

Request Data Bytes:
<table>
<tr><th>Byte</th><th>Format</th><th>Description</th></tr>
<tr><td>0</td><td>Unsigned-8</td><td>Device Variable code (only DV0-DV2 allowed)</td></tr>
<tr><td>1-4</td><td>Float</td><td>Lower Frequency Limit (Hz)
Valid range: 2-1800</td></tr>
<tr><td>5-8</td><td>Float</td><td>Upper Frequency Limit (Hz)
Valid range: 2-1800</td></tr>
<tr><td>9</td><td>Enum</td><td>Detector type
0 = RMS (=default value)
1 = Peak
2 = TruePeak
The following enumerations are only selectable if the magic pattern is attached:
3 = Max
4 = Min</td></tr>
<tr><td>10</td><td>Enum</td><td>Filter type
0 = Bandpass (=default value)
1 = Lowpass
2 = Highpass
3 = None</td></tr>
<tr><td>11-14</td><td>Float</td><td>True Peak Hold Time (sec)
Valid range: 0.0 – 86400 (1 day)</td></tr>
<tr><td>15-18</td><td>Unsigned-32</td><td>0x77BB77BB (magic pattern / password)</td></tr>
</table>
Response Data Bytes:
<table>
<tr><th>Byte</th><th>Format</th><th>Description</th></tr>
<tr><td>0</td><td>Unsigned-8</td><td>Device Variable code</td></tr>
<tr><td>1-4</td><td>Float</td><td>Start frequency (Hz)</td></tr>
<tr><td>5-8</td><td>Float</td><td>Stop frequency (Hz)</td></tr>
<tr><td>9</td><td>Enum</td><td>Detector type
0 = RMS
1 = Peak
2 = TruePeak
3 = Max
4 = Min</td></tr>
<tr><td>10-13</td><td>Float</td><td>True Peak Hold Time (sec)</td></tr>
</table>
Command-Specific Response Codes
<table>
<tr><th>Code</th><th>Class</th><th>Description</th></tr>
<tr><td>0</td><td>Success</td><td>No Command-Specific Errors</td></tr>
<tr><td>2</td><td>Error</td><td>Invalid Selection</td></tr>
<tr><td>11</td><td>Error</td><td>Invalid Device Variable Code</td></tr>
</table></td><td></td></tr>
<tr><td>2</td><td colspan="3">With the command it shall be possible to write the DV configuration. This command is only valid for DV0 – DV2.</td><td></td></tr>
</table>

3	When this command is received the HART Stack shall be call the function: - void DSP_updateUserParameters(int band, float start_freq, float stop_freq, int detector_type, int filter_type, float meas_time); This function shall update the parameters of the signal processing. New parameters become active only after the processing block has finished its first conversion (250mS). Before this happens, the DAC output and DVs should be 'fixed' at the last value and held until new values are available (250mS).	
4	The parameter shall be available after a reboot of the device.	

	Command #130: "Reset user configuration"	*Status:*	*Open*
	Description		*Ref.*
1	Device specific command #130 shall be implemented with the following data. Request Data Bytes: Byte | Format | Description 0-3 | Unsigned-32 | 0x77BB77BB (magic pattern / password) Response Data Bytes: Byte | Format | Description 0-3 | Unsigned-32 | 0xAA55AA55 4-7 | Unsigned-32 | 0xAA55AA55 8-11 | Unsigned-32 | 0xAA55AA55 12-15 | Unsigned-32 | 0xAA55AA55 16-19 | Unsigned-32 | 0xAA55AA55 Command-Specific Response Codes Code | Class | Description 0 | Success | No Command-Specific Errors 64 | Error | Command Not Implemented	
2	The command shall reset some NV memory data to default values. The default values are hard-coded in the firmware. The selection of the supported default values shall be listed in the document HART data dictionary /9/.	
3	After the device has answered the command, a complete device reset shall be performed.	

12. Unit Conversion

12.1. Temperature (degree C)

12.1.1. F = engineering value *1.8 +32
12.1.2. K = engineering value +273.1
12.1.3. R = engineering value *1.8 +491.67

12.2. Velocity (inch per second)

12.2.1. m/s = engineering value * 0.0254
12.2.2. mm/s = engineering value *25.4

13. Performance

13.1. Power-up

Power up is less than 5 seconds. Analog 4-20 output is stable in less than 10 seconds. This device has no special requirements for the reset and power-down process.

13.2. Command Response Times

Minimum	-15ms
Typical	-25mS
Maximum	-75mS

13.3. Channel update time period

Typical	-250mS

13.4. Non-Volatile Memory

The devices configuration parameters are stored in EEPROM. New data is written to this memory immediately on execution of a write command.

13.5. Modes

Fixed current mode, using command 40 is cleared by power loss or a reset command 42.

13.6. Damping

Command 34 Damping is standard and affects only the PV and the loop signal. Additional damping is available using device specific command 129, parameter “detector time constant”. This damping affects PV, SV and TV and can be changed per channel.

13.7. Specification sheet – Vibration transmitters with HART protocal

Part number – 99249

ANNEX A. Capability Checklist

N/A

ANNEX B. DEFAULT CONFIGURATION

All Modes

Damping = 1 second
Alarm code = High Alarm
QV = degree C [32]

PV (DV0), SV (DV1), TV (DV2)
Lower Frequency Limit = 2 Hz
Upper Frequency Limit = 1500 Hz
Filter Type= 2

PV (DV0)
PV lower range = calibrated at the factory
Detector Type= 1
Filter Detect Time= 0.75

SV (DV1), TV (DV2)
Detector Type= 0
Filter Detect Time= 1

Velocity

Device Variable code = inch per second [114]
PV upper range 20mA = 1g

ANNEX C. REVISION HISTORY

Rev 1- PCH Release
Rev 1.01- Re-branded document