AWT420
Universal 4-wire, dual-input transmitter

HART connection/configuration
and reference tables

Measurement made easy

—
**Universal 4-wire,
dual-input transmitter**

Introduction

This Communication Supplement provides
procedures specifically related to the HART® option
for the AWT420 transmitter. Refer to the AWT420
Operating instructions (OI/AWT420-EN) for general
information on installation, operation and
maintenance.

For more information

Further publications for the AWT420 transmitter are
available for free download from www.abb.com/
measurement (links and reference numbers for the
transmitter publications are shown below) or by
scanning this code:

Contents

1   Health & Safety

Document symbols

Symbols that appear in this document are explained below:

⚠ DANGER

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠ WARNING

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠ CAUTION

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word '**NOTICE**' indicates potential material damage.

Note
'**Note**' indicates useful or important information about the product.

Safety precautions

Be sure to read, understand and follow the instructions contained within this manual before and during use of the equipment. Failure to do so could result in bodily harm or damage to the equipment.

⚠ WARNING

Bodily injury
Installation, operation, maintenance and servicing must be performed:
- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations

Potential safety hazards

AWT420 transmitter – electrical

⚠ WARNING

Bodily injury
To ensure safe use when operating this equipment, the following points must be observed:
- Up to 240 V AC may be present. Be sure to isolate the supply before removing the terminal cover.

Safety advice concerning the use of the equipment described in this manual or any relevant Material Safety Data Sheets (where applicable) can be obtained from the Company, together with servicing and spares information.

Safety standards

This product has been designed to satisfy the requirements of IEC61010-1:2010 3rd edition 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500, NIST and OSHA.

…1   Health & Safety

Product symbols

Symbols that may appear on this product are shown below:

Protective earth (ground) terminal.

Functional earth (ground) terminal.

Alternating current supply only.

Direct current supply only.

This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and/or death. The user should reference this instruction manual for operation and/or safety information.

This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.

The equipment is protected through double insulation.

Recycle separately from general waste under the WEEE directive.

Product recycling and disposal (Europe only)

ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible. The European Waste Electrical and Electronic Equipment (WEEE) Directive that initially came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment. In conformity with European local and national regulations, electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.

NOTICE

For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

End-of-life battery disposal
The transmitter contains a small lithium battery (located on the processor/display board) that must be removed and disposed of responsibly in accordance with local environmental regulations.

Information on ROHS Directive 2011/65/EU (RoHS II)

ABB, Industrial Automation, Measurement & Analytics, UK, fully supports the objectives of the ROHS II directive. All in-scope products placed on the market by IAMA UK on and following the 22nd of July 2017 and without any specific exemption, will be compliant to the ROHS II directive, 2011/65/EU.

2   Cyber security

This product is designed to be connected to and to communicate information and data via a digital communication interface. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be). You shall establish and maintain any appropriate measures (such as but not limited to the application of authentication measures etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Communication protocol specific
The HART protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

3   Overview

The AWT420 HART® option provides either a 4-20mA analog signal (conventional analog), a 4-20mA analog signal with superimposed digital signal (HART point to point analog), or a polled digital signal (HART multi-drop). Using HART communications, many functions normally requiring the use of the local user-interface can be accessed remotely using HART communication devices.

The AWT420 is a universal dual-input transmitter that uses ABB's AWT400 range of advanced digital or analog sensors to monitor the key parameters in municipal and industrial water/wastewater treatment.

Supported analog sensors:
• pH
• 2-electrode conductivity
• 4-electrode conductivity
• 7998 turbidity sensors

Supported digital sensors:
• pH/Redox (ORP)
• Dissolved oxygen
• Turbidity/suspended solids

Information from the sensor is sent to the transmitter via a sensor interface board. The process reading is displayed on the main page and can be displayed as a graph in the Chart View.

Diagnostic messages inform the user of the system status and can be logged for review. The system status can also be assessed remotely using the optional HART communications.

Up to 2 analog or digital sensors can be connected to the AWT420 transmitter using either ABB's EZLink technology or analog sensors. Installation and commissioning is simplified with plug-and-play digital sensor connections and automatic sensor recognition and set-up.

The HART analog output of this device corresponds to the primary variable (pH, Redox/ORP, conductivity, concentration, turbidity, suspended solids or dissolved oxygen), outputting 4 mA at the lower range value and 20 mA at the upper range value.

The ABB AWT420 transmitter complies with HART Protocol Revision 7.0.

...3   Overview

Abbreviations and Definitions

Module	Description
2-electrode	2-Electrode conductivity module
4-electrode	4-Electrode conductivity module
Pt100	100 Ω Platinum temperature sensor
Pt1000	1000 Ω Platinum temperature sensor
3k Balco	3000 Ω Balco alloy temperature sensor
ORP	Oxidation-Reduction Potential
DDL	Device Description Language
HART	Highway Addressable Remote Transducer
HHT	Hand Held Terminal
TSS	Turbidity Suspended Solids
RDO	Dissolved Oxygen

Reference documents

Document ID	Title
DS/AWT420-EN	AWT420 transmitter datasheet
OI/AWT420-EN	AWT420 transmitter operating instruction
CI/AWT420-EN	AWT420 transmitter commissioning instruction
COM/AWT420/HART-FDS-EN	AWT420 transmitter HART Field Device specification

HART manufacturing ID and device type

All HART products contain unique identifiers that specify the product manufacturer and device type. In accordance with this requirement, the ABB Manufacture ID is 26 (1A hexadecimal) and the device type code for AWT420 is 1A 35 hexadecimal.

Engineering units and dynamic variables

pH/Redox (ORP)

	Measurement	Units
PV (Sensor 1 – pH)	pHRedox/ORP	pH mV
SV (Sensor 1 – pH)	Temperature	°C °F
TV (Sensor 2 – pH)	pHRedox/ORP	pH mV
QV (Sensor 2 – pH)	Temperature	°C °F

Conductivity (2-electrode/4-electrode)

	Measurement	Units
PV (Sensor 1 – Conductivity)	Conductivity Concentration Resistivity	µS/cm mS/cm % ppb ppm µg/l mg/l MΩ.cm
SV (Sensor 1 – Temperature)	Temperature	°C °F
TV (Sensor 2 – Conductivity)	Conductivity Concentration Resistivity	µS/cm mS/cm % ppb ppm µg/l mg/l MΩ.cm
QV (Sensor 2 – Temperature)	Temperature	°C °F

Turbidity/Total suspended solids

	Measurement	Units
PV (Sensor 1 – TSS)	Turbidity Suspended solids	NTU FNU mg/l ppm
SV (Sensor 1 – TSS)	N/A Turbidity	NTU FNU
TV (Sensor 2 – TSS)	Turbidity Suspended solids	NTU FNU mg/l ppm
QV (Sensor 2 – TSS)	N/A Turbidity	NTU FNU

Dissolved oxygen/Saturation

	Measurement	Units
PV (Sensor 1 – RDO)	Dissolved Oxygen % Saturation	ppm %
SV (Sensor 1 – RDO)	Temperature	°C °F
TV (Sensor 2 – RDO)	Dissolved Oxygen % Saturation	ppm %
QV (Sensor 2 – RDO)	Temperature	°C °F

Unit codes

pH/Redox (ORP)

Unit code	Description	Measurement type
59	pH	pH
36	mV	Redox/ORP

Conductivity (2-electrode/4-electrode)

Unit code	Description	Measurement type
66	mS/cm	Conductivity
67	µS/cm	Conductivity
173	MΩ-cm	Resistivity
57	%	Concentration
139	ppm	Concentration
169	ppb	Concentration
170	mg/l	Concentration
146	µg/l	Concentration

Turbidity/Total suspended solids

Unit code	Description	Measurement type
171	FTU	Turbidity
172	NTU	Turbidity
139	ppm	Total suspended solids
170	mg/l	Total suspended solids

Dissolved oxygen/Saturation

Unit code	Description	Measurement type
139	ppm	Dissolved oxygen
170	mg/l	Dissolved oxygen
57	%	Saturation

Temperature

Unit code	Description	Measurement type
32	Degrees Celsius	Temperature
33	Degrees Fahrenheit	Temperature

4   Transmitter functionality and operator interface controls

Host interface

The 2-wire 4 to 20 mA current loop is connected via terminals 4 and 5 on the HART communications module, and can be tested via terminals 1 and 2.

Output from the transmitter representing the PV measurement linearized and scaled according to the engineering range set on the instrument.

Analog output

	Value
Below lower range	3.8 mA
Above upper range	20.5 mA
Maximum current	22.0 mA
Multi-drop current draw	4.0 mA

5   Installation

This section provides installation instructions specific to the AWT420 HART functionality.

⚠ **WARNING**

Do not run wiring in conduit or open trays where power or heavy electrical equipment could physically or electrically interfere with the signal wiring. Use twisted, shielded pairs for cabling to ensure best performance.
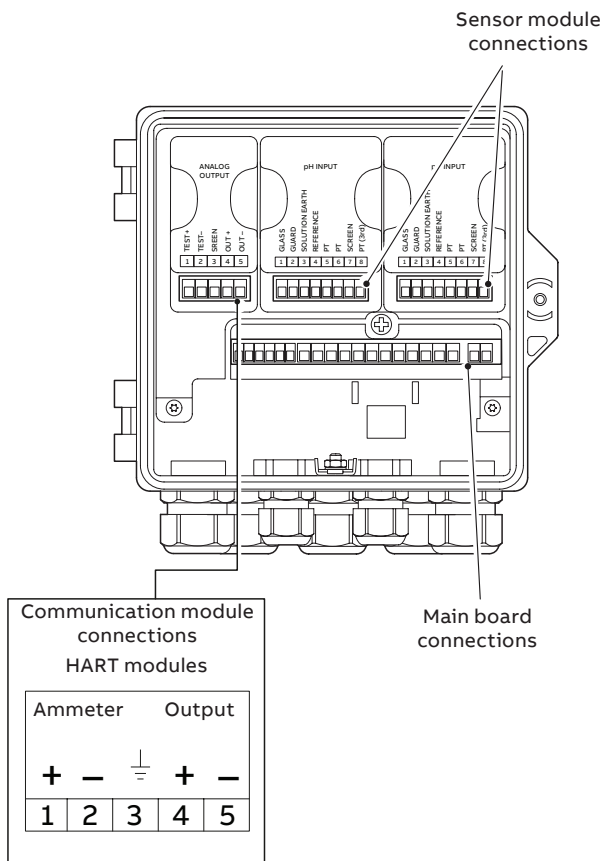

Figure 1   Module/main board connections

...5   Installation

HART point-to-point analog signal and power wiring (loop current mode enabled)

Make connections to the HART communication module as shown in Figure 2.

Load resistance must include any meters external to the AWT420 transmitter, the wiring and the system input.
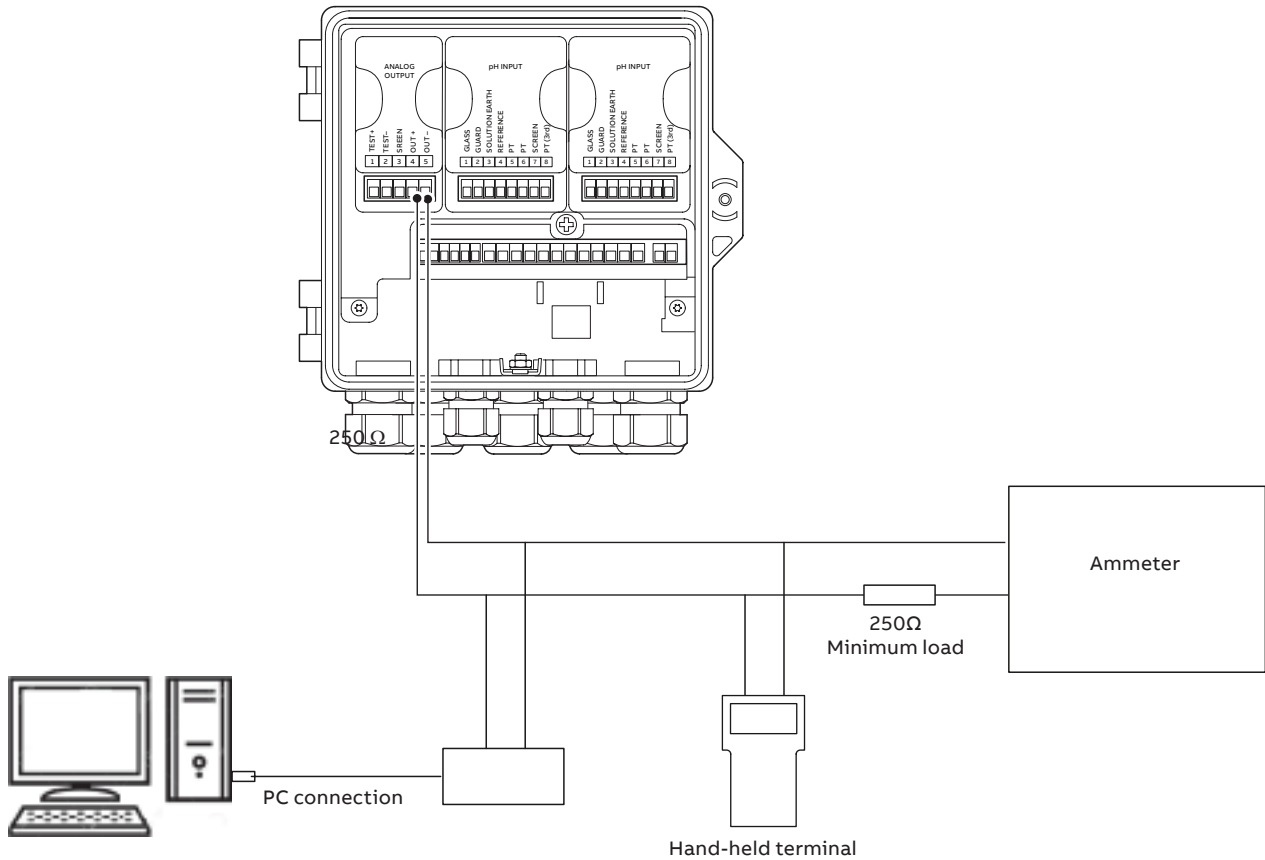

Figure 2   HART point-to-point analog signal and power wiring

Multi-drop mode (digital) signal and power wiring (loop current mode enabled)

Refer to Figure 3 for a typical wiring configuration for multi-drop installations. In the multi-drop mode of operation, the analog 4 to 20 mA is not used. Instead the transmitter draws a constant 4 mA of current to maintain operation. The maximum number of transmitters connected in this mode is 63.

In the multi-drop mode, the process variable signal of each transmitter on the signal bus is digitally polled. The primary communication device sequentially polls each transmitter output on the bus. Each transmitter has its own unique address that is assigned during configuration. The address (1 to 63) allows the primary communication device to distinguish between transmitters on the bus. Each transmitter on the bus is wired from the primary communication device to the positive (+) and negative (–) output terminals of the AWT420 HART communications module. Connect all transmitters on the bus in parallel.

The load resistance must include the system input resistance and the resistance of the wire. Analog meters or measurement devices should not be connected to the bus since the transmitters on the bus are not delivering an analog process variable
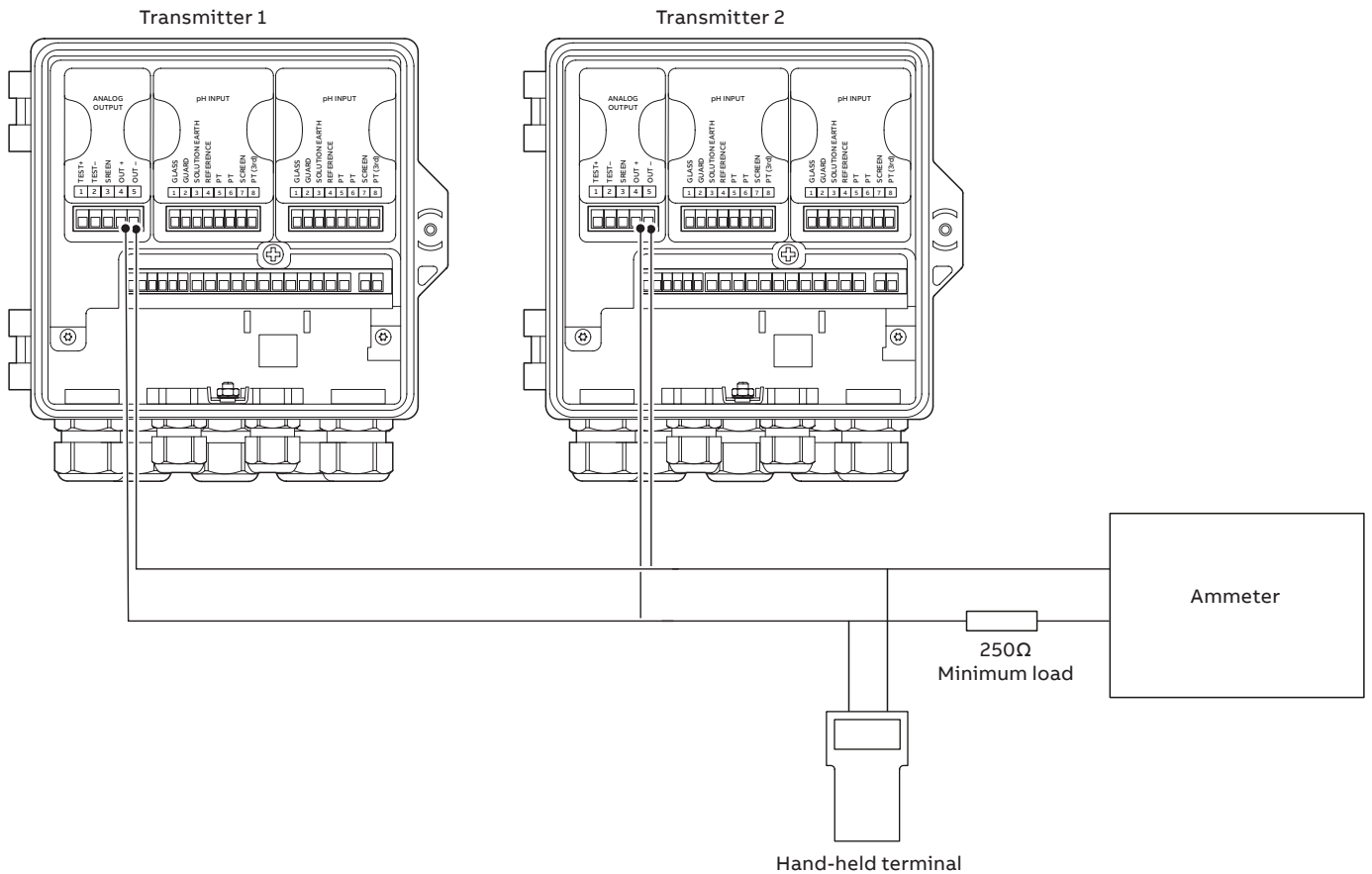

Figure 3   Digital mode wiring diagram

Appendix A – HART commands

Introduction

This appendix contains descriptions of the HART commands available through the HART universal, common practice and device specific command sets.

Device-specific command details such as data bytes and response codes are described in the AWT420 HART field device specification (COM/AWT420/HART-FDS-EN)

Supported HART commands

The following HART Commands are supported on the AWT420.

Universal HART commands

Command	Description	
0	Read Unique Identifier	
1	Read Primary Variable	
2	Read Loop Current and Percent of Range	
3	Read Dynamic Variables And Loop Current	PV, SV, TV and QV
6	Write Polling Address	
7	Read Loop Configuration	
8	Read Dynamic Variable Classification	
9	Read Device Variable Classification	
11	Read Unique Identifier	
12	Read Message	
13	Read Tag Descriptor Date	
14	Read Primary Variable Transducer Information	
15	Read Primary Variable Output Information	
16	Read Final Assembly Number	
17	Write Message	
18	Write Tag Descriptor Date	
19	Write Final Assembly Number	
20	Read Long Tag	
21	Read Unique Id Associated With Long Tag	
22	Write Long Tag	
38	Reset Configuration Changed Flag	
48	Read Additional Device Status	

Table 1   Universal HART commands

Common practice HART commands

Command	Description
33	Read Device Variables
35	Write PV Range Values
40	Enter/Exit Fixed Current Mode
41	Perform Self-Test
42	Perform Device Reset
44	Write PV 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
55	Write Device Variable Damping Value
59	Write Number of Response Preambles
71	Lock Device
73	Find Device
76	Read Lock Device State
523	Read Condensed Status Map
526	Write Status Simulation Mode
527	Write Simulate Status Bit

Table 2   Common practice HART commands

Device-specific HART commands: general

Command	Description
132	Read Device Setup Parameters
133	Write Device Setup Parameters
134	Read Device Info
135	Read Analog Signal Status
136	Read Analog Signal List
137	Read Analog Output 1 Configuration
138	Write Analog Output 1 Configuration
139	Read Analog Output 2 Configuration
140	Write Analog Output 2 Configuration
141	Read Process Alarm 1 Configuration
142	Write Process Alarm 1 Configuration
143	Read Process Alarm 2 Configuration
144	Write Process Alarm 2 Configuration
145	Read Process Alarm 3 Configuration
146	Write Process Alarm 3 Configuration
147	Read Process Alarm 4 Configuration
148	Write Process Alarm 4 Configuration
149	Read Process Alarm 5 Configuration
150	Write Process Alarm 5 Configuration
151	Read Process Alarm 6 Configuration
152	Write Process Alarm 6 Configuration
153	Read Process Alarm 7 Configuration
154	Write Process Alarm 7 Configuration
155	Read Process Alarm 8 Configuration
156	Write Process Alarm 8 Configuration
157	Read Digital Input/Output Configuration
158	Write Digital Input/Output Configuration
159	Read Relay 1 Configuration
160	Write Relay 1 Configuration
161	Read Relay 3 Configuration
162	Write Relay 2 Configuration
163	Read Relay 3 Configuration
164	Write Relay 3 Configuration
165	Read Relay 4 Configuration
166	Write Relay 4 Configuration
167	Read Data Logging
168	Write Data Logging
169	Read Language
170	Write Language
171	Read Operator Template
172	Write Operator Template
173	Read Chart View Setup
174	Write Chart View Setup
175	Read View/Log Enable Setup
176	Write View/Log Enable Setup
177	Read Date and Time Setup
178	Write Date and Time Setup
179	Read Custom Daylight Savings Configuration
180	Write Custom Daylight Savings Configuration

Command	Description
181	Read Sensor1 Information
182	Read Sensor2 Information
183	Read Cleaning 1 Information
184	Write Cleaning 1 Information
185	Read Cleaning 2 Information
186	Write Cleaning 2 Information
187	Write Write-Protection Status
188	Read Diagnostics Block 1
189	Read Diagnostics Block 2
190	Write Diagnostics Block 1 Masking
191	Write Diagnostics Block 2 Masking
192	Write Diagnostics Block 1 Simulation
193	Write Diagnostics Block 2 Simulation
194	Read Diagnostics Block 1 Masking
195	Read Diagnostics Block 2 Masking
196	Read Diagnostics Block 1 Simulation
197	Read Diagnostics Block 2 Simulation
198	Read Current Date And Time
199	Write Current Date And Time
200	Read Clean 1 Date And Time
201	Write Clean 1 Date And Time
202	Read Clean 2 Date And Time
203	Write Clean 2 Date And Time
204	Read Diagnostic Simulation Status
205	Write Diagnostic Simulation Status
206	Read Alarm Current Option
207	Write Alarm Current Option
208	Read Operator Control Enable
209	Write Operator Control Enable
210	Read S1 Control Action
211	Write S1 Control Action
212	Read S2 Control Action
213	Write S2 Control Action
214	Read S1 Direct Control Setup
215	Write S1 Direct Control Setup
216	Read S2 Direct Control Setup
217	Write S2 Direct Control Setup
218	Read S1 Reverse Control Setup
219	Write S1 Reverse Control Setup
220	Read S2 Reverse Control Setup
221	Write S2 Reverse Control Setup
222	Read S1 Dual Control Setup
223	Write S1 Dual Control Setup
224	Read S2 Dual Control Setup
225	Write S2 Dual Control Setup
226	Read S1 Control Configuration
227	Write S1 Control Configuration
228	Read S2 Control Configuration
229	Write S2 Control Configuration
230	Read S1 Control Manual Output

Table 3 Device-specific HART commands: general
(continued overleaf)

…Appendix A – HART commands

…Supported HART commands

…Device-specific HART commands: general

Command	Description
231	Write S1 Control Manual Output
232	Read S2 Control Manual Output
233	Read S2 Control Manual Output
234	Read Control Output Signals
235	Read pH Configuration
236	Write pH Configuration
237	Read 2-Electrode Conductivity Configuration
238	Write 2-Electrode Conductivity Configuration
239	Read 4-Electrode Conductivity Configuration
240	Write 4-Electrode Conductivity Configuration
241	Read RDO Configuration
242	Write RDO Configuration
243	Read TSS Configuration
244	Write TSS Configuration
245	Read Turbidity Configuration
246	Write Turbidity Configuration
247	Read Sensor Module Tag
248	Write Sensor Module Tag
249	Read Custom Curve Table
250	Write Custom Curve Table
251	Reset Sensor Configuration
252	Read Calculation Configuration
253	Write Calculation Configuration

Table 3   Device-specific HART commands: general (continued)

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