AWT210

HART® 2-wire transmitter

Measurement made easy

—
AWT210
2-Wire transmitter

Introduction

This Communication Supplement provides procedures specifically related to the AWT210 HART® 2-wire transmitter. Refer to the AWT210 Operating Instruction (OI/AWT210) for general information on installation, operation and maintenance.

For more information

Further publications for the AWT210 transmitter are available for free download from:
www.abb.com/measurement
or by scanning this code:

Search for or click on:	
AWT210 transmitter – Data Sheet	DS/AWT210
AWT210 transmitter – Commissioning Instruction	CI/AWT210
AWT210 transmitter – Operating Instruction	OI/AWT210
AWT210 transmitter – HART FDS Communications Supplement	COM/AWT210/HART/FDS

Contents

Sales Service Software

1 Health & safety

Document symbols

Symbols that appear in this document are explained below:

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

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

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 national and local regulations

Potential safety hazards

AWT210 transmitter – electrical

⚠ WARNING

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.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- 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.

This equipment complies with the requirements of CEI/IEC 61010-1:2010 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500 and Occupational Safety & Health Administration. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

...1 Health & Safety

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.

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.

Product symbols

Symbols that may appear on this product are shown below:

Risk of electric shock.

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.

Protective earth (ground) terminal.

Functional earth (ground) terminal.

Direct current supply only.

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.

Recycle separately from general waste under the WEEE directive.

2 Overview

The AWT210 HART® transmitter provides either a 4 to 20 mA analog signal (conventional analog), a 4 to 20 mA analog signal with superimposed digital signal (HART point to point analog), or a polled digital signal (HART multidrop). Using HART communications, many functions normally requiring the use of the local user interface can be accessed remotely using HART communication devices.

Four variants of AWT210 are available for use with pH, ORP, pIon, and conductivity sensors.

The device has four dynamic variables. The device does not have any device variables.

The analog output of this device corresponds to the primary variable (pH, ORP, pIon, Ion concentration, conductivity, or concentration), outputting 4 mA at the lower range value and 20 mA at the upper range value.

Supported sensors:

- pH
- 2-electrode conductivity
- 4-electrode conductivity
- toroidal conductivity

The ABB AWT210 analyzer complies with HART Protocol revision 7.0.

Abbreviations and definitions

Table 1 Abbreviations and definitions

Module	Description
TE Module	2-electrode conductivity module
EC Module	4-electrode conductivity module
TC Module	Toroidal 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

Reference documents

Table 2 Reference documents

Document ID	Title
DS/AWT210	AWT210 transmitter Data Sheet
OI/AWT210	AWT210 transmitter Operating Instruction
CI/AWT210	AWT210 transmitter Commissioning Instruction
COM/AWT210/HART-FDS	AWT210 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 AWT210 is 34 (22 hexadecimal).

Engineering units and dynamic variables

Table 3 Dynamic variables

	pH (pH)		Conductivity (TE, EC, TC)	
	Measurement	**Units**	**Measurement**	**Units**
PV	pH ORP pION Ion Conc.	pH mV %, ppb, ppm, µg/L mg/L	Conductivity concentration	µS/cm, mS/cm % ppb ppm µg/L mg/L
SV	Temperature	°C, °F	Temperature	°C °F
TV	Reference impedance	kΩ	Compensated conductivity	µS/cm
QV	Input voltage	mV	Uncompensated conductivity	µS/cm

Table 4 Unit codes

Unit	Unit code	Unit type/dynamic variable classification	Unit type code
Deg C	32	Temperature	64
Deg F	33	Temperature	64
uS/Cm	67	Conductivity/Volumetric conductance	87
mS/Cm	66	Conductivity/Volumetric conductance	87
mV	36	EMF	83
pH	59	Analytical	81
Kilo Ohm	163	Electric resistance	85
%	57	Concentration	90
ppm	139	Concentration	90
ppb	169	Concentration	90
ug/l	146	Concentration	90
mg/l	240	Concentration	90

3 Transmitter functionality and operator interface controls

Process interface

Sensor input channels

The sensor module provides 8 terminals marked 1 to 8, 1 to 4 for Process Variable (detailed in commissioning instructions) and 5 to 8 for temperature sensor (up to 3 wire RTD + shield). Operating ranges correspond to the capabilities of each sensor type.

Host interface

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

Output from the transmitter representing the PV measurement linearized and scaled according to the engineering range set on the instrument. PV /*+\% is displayed on the **Signals View** page.

Table 5 Analog output

	Value
Below Lower Range	3.8 mA
Above Upper Range	20.5 mA
Device malfunction indication	
Maximum current	22.0 mA
Multi-drop current draw	3.6 mA
Lift-off voltage	12 V

Local interfaces, jumpers and switches

Local controls and displays

- The device has a 75 × 65 mm (3.00 × 2.55 in) monochromatic dot matrix LCD display and four push buttons

Internal jumpers and switches

- The device has two internal switches, situated on the top right side of the HART Communication Module – see Figure 1.
- SW1: Reset to Defaults
  - If the device is powered up with SW1 in the **ON** position, it returns device setup to default factory settings. If powered up with SW1 in the **OFF** position, the device retains previously saved user settings[1].
- SW2: Write Protection
  - If SW2 is in the **ON** position, HW write protect shows as enabled, and the user is unable to make changes to setup or send Write commands via HART. With SW2 in **OFF** position, the user is able to make changes/send commands providing they are in a sufficient access level and **Software Write Protect** has not been enabled.

1 Reset to defaults is not performed if **SW2 Write Protection** is **ON**

4 Installation

This section provides installation instructions specific to the AWT210 HART functionality.

⚠ WARNING

- For general mechanical, electrical and hazardous location installation requirements, refer to the AWT210 Operating Instructions (OI/AWT210).
- The signal/power terminals accept wire sizes 0.14 mm² (26 AWG) to 1.5 mm²(14 AWG).
- Wiring should not be run in conduit or open trays where power or heavy electrical equipment could physically or electrically interfere with the signal wiring. Twisted, shielded pairs should be used for cabling to ensure best performance. Reverse polarity protection, built into the transmitter, protects it against accidental reversal of the field wiring connections.

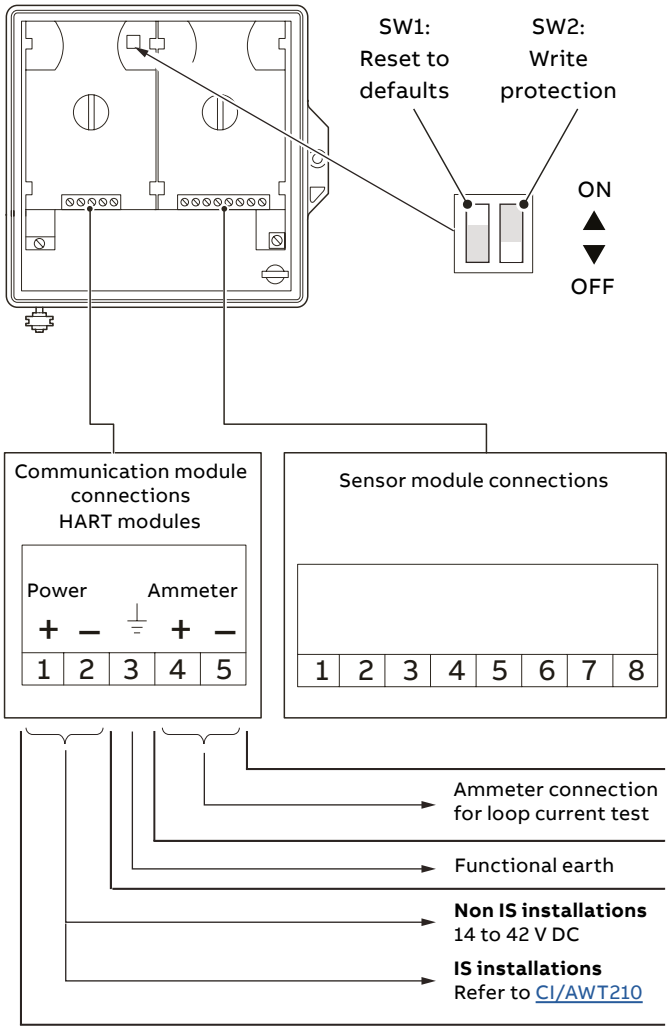

Figure 1 HART communication module connection overview

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.
Do not connect secondary communication device directly across the power supply.

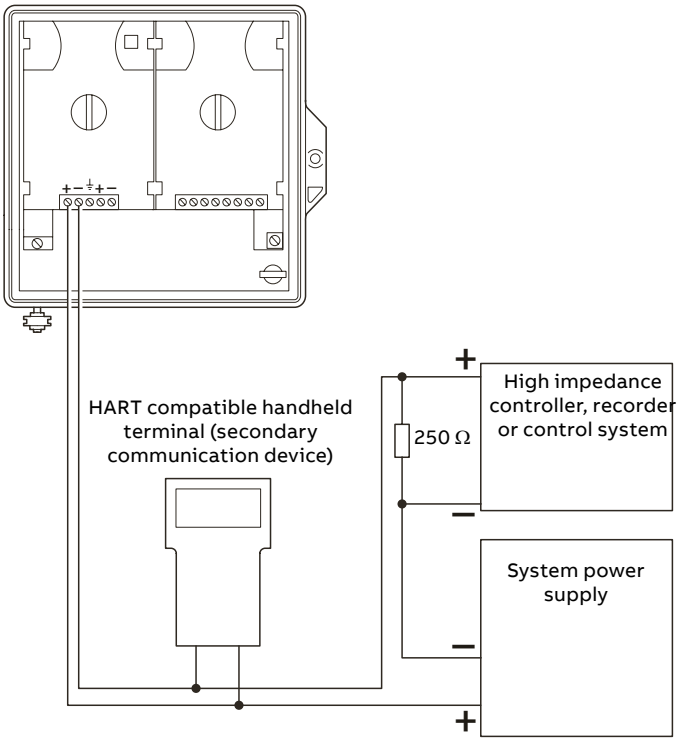

Figure 2 Analog mode wiring diagram

The signal wiring supplies all power to the transmitter.

The power supply limits are 14.0 to 42.0 V DC
(14 to 30 V DC for agency-certified installation).

The minimum supply voltage is determined by the loop resistance (R) as follows:

- minimum supply = 14.0 (volt) + 0.022 (amps) × R (ohms)

Load resistance must include any meters external to the AWT210 transmitter, the wiring and the system input.

NOTICE

The equation for minimum supply voltage is based on a maximum output current of 20 mA. In some cases such as fail high or process variable over range condition, the output current limits to 21.5 mA. To support these cases, use 0.0215 instead of 0.020.

A secondary communication device can be connected anywhere there is access to the signal wires as long as it is not connected directly across the power supply.

NOTICE

Only one secondary device can communicate on the loop at any given time.

...4 Installation

Multidrop mode (digital) signal and power wiring (loop current mode disabled)

Refer to Figure 3 for a typical wiring configuration for multidrop installations. In the multi-drop mode of operation, the analog 4 to 20 mA is not used. Instead, the transmitter draws a constant 3.6 mA of current to maintain operation.

- Do not connect secondary communication device directly across the power supply.
- Add 1 V DC to all minimum supply voltage values if using the TEST connections.
- The maximum number of transmitters is 63.

NOTICE

The equation for minimum supply voltage is based on a maximum output current of 4 mA. In some cases, other transmitters may use a multidrop minimum current of greater than 4 mA. Consult the vendor product instruction for multidrop current values for other equipment on the bus.

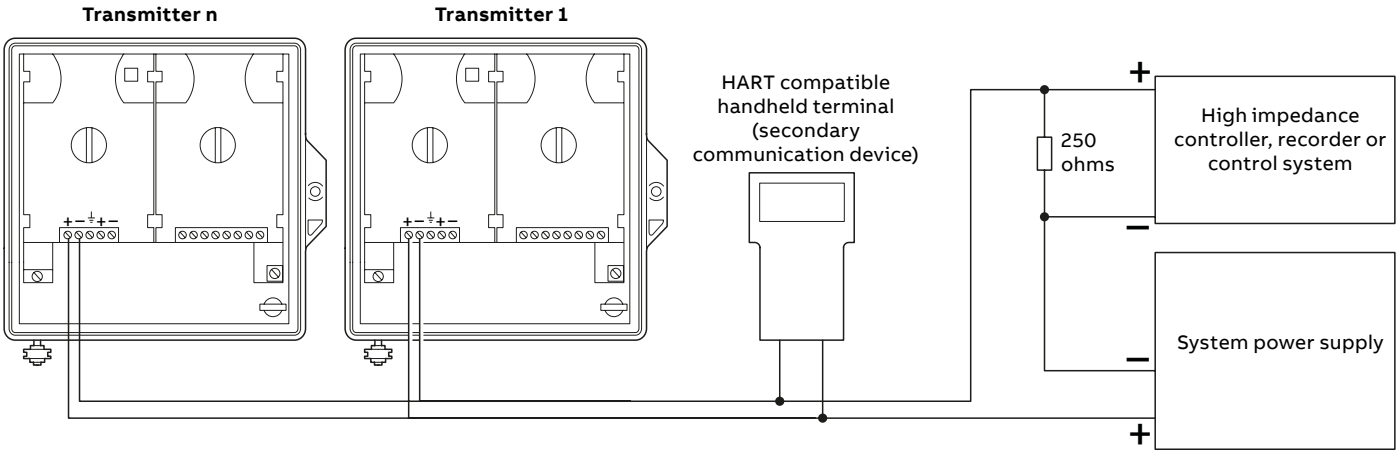

Figure 3 Digital mode wiring diagram

In the multidrop 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..15) 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 (-) POWER (SIGNAL) terminals of the AWT210. Connect all transmitters on the bus in parallel.

The minimum power supply voltage required for the loop is typically determined by:

- minimum voltage supply = 14 V + (0.004 A × R)
- minimum current supply = 0.004 A × T

Where:

- R is the load resistance in ohms, and
- T is the number of transmitters on the bus

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.

A secondary communication device can be connected anywhere there is access to the signal wires, as long as it is not connected directly across the power supply.

NOTICE

Only one secondary device can communicate on the loop at any given time.

Sensor wiring and grounding

Refer to the AWT210 Operating Instructions (OI/AWT210) for sensor wiring and grounding instructions.

5 Appendix

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 AWT210 HART field device specification (COM/AWT210/HART-FDS)

Supported HART commands

The following HART commands are supported on the AWT210.

Table 6 Universal HART commands

Command	Description	
3	Read Dynamic Variables And Loop Current	PV,SV,TV and QV14[1]
14	Read Primary Variable Transducer Information	

Table 7 Common practice HART commands

Command	Description	
34	Write PV Damping Value	*
35	Write PV Range Values	*
36	Set PV Upper Range Value	*
37	Set PV Lower Range Value	*
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	*
48	Read Additional Device Status	
59	Write Number of Response Preambles	*
71	Lock Device	*
76	Read Lock Device State	

*Requires HART login (Command 168) to Advanced level or higher if HART login is enabled via Configuration -> Advanced-> Device Setup -> Security -> HART Login -> Enabled

Table 8 Device-specific HART commands: general

Command	Description	
122	Login to Service Level	
123	Read Board Object	*
124	Write Object	*
125	Read Memory	*
126	Write Memory	*
128	Reset Software Write Protection	
129	Read Revision	
130	Write Current Alarm Selection	
131	Read Write Protection	
132	Write Software Write Protection	
134	Recognize Temperature Compensation Type	
135	Reset to Factory Default	
136	Write Temperature Compensation Type	
137	Read Front End Board Data	
138	Write Manual Temperature Setpoint	
139	Write Reference Temperature	
140	Read PV and Temperature Calibration Slope and Offset	
141	Write PV Calibration Slope and Offset	
142	Write Temperature Calibration Slope and Offset	
143	Log Out HART Service Code	
168	HART Login with Password[2]	
200	Read Diagnosis Masking	
201	Write Diagnosis Masking	
202	Read Diagnosis Simulation	
203	Write Diagnosis Simulation	
210	Write HART Version	
243	Write Sensor Diagnostic Option	
249	Write Temperature Unit	
250	Read Conductivity Units Mode	
251	Write Conductivity Units Mode	
253	Read Condensed Status Mapping Array	

*Requires HART Login to Service Level (Command 122)

1 AWT does not support device variables, only dynamic variables. Hence, Command 9 returns a response code of 14 (Dynamic Variables returned for Device Variables) as required by the HART specification. However, this return value is seen as an error by Simatic PDC software. This response code may be turned off in the device by enabling PDM compatibility at the following menu: Device Setup > PDM Compatibility > Enable.

2 HART commands that write to the device can be protected with access control. This is similar to the access control within the device that has **Read Only, Calibrate, Advanced** and **Service** levels. Access control for HART can be enabled at the following menu:
Device Setup > Security Setup > HART Logging > Password Protected.
If this option is enabled, the user will have to log in with the appropriate access level password before sending write commands to the device. Please see details of command 168 in the HART Field Device Specification document for AWT210.

…5 Appendix

…Supported HART commands

Device-specific HART commands: 2-electrode conductivity (TE)

Table 9 Device-specific HART commands: 2-electrode conductivity (TE)

Command	Description
144	Write Measurement Type
145	Write Cell Constant
146	Read Concentration Configuration
147	Write Concentration Display Text
148	Read Temperature Sensor and Compensation Configuration
149	Write Automatic Temperature Compensation Option
150	Write Temperature Compensation Coefficient
151	Write Temperature Compensation Pure H_2O Option
152	Read Temperature Compensation Curve
153	Write Temperature Compensation Curve
154	Read Concentration Curve
155	Write Concentration Curve
156	Reset PV and Temperature Calibration
157	Read Stable Value for edit during 1 point PV Calibration
158	Read Calibration Mode and Status
159	Write Calibration Mode and Status
160	Write Calibration Value
161	Read Calibration Progress and Error Status
162	Read Factory Calibration Parameters
163	Write Factory Calibration Parameters
164	Read Factory Calibration Slope and Offset
252	Read PV Sensor Config

Device-specific HART commands: Toroidal conductivity (TC)

Table 10 Device-specific HART commands: Toroidal conductivity (TC)

Command	Description
165	Read PV Sensor Configuration
166	Write Measurement Type
167	Read Concentration Configuration
169	Write Concentration Display Text
170	Read Temperature Sensor and Compensation Configuration
171	Write Automatic Temperature Compensation Option
172	Write Temperature Compensation Coefficient
173	Read Temperature Compensation Curve Part 1
174	Read Temperature Compensation Curve Part 2
175	Read Temperature Compensation Curve Part 3
176	Read Temperature Compensation Curve Part 4
177	Reset PV and Temperature Calibration
178	Read Stable PV for edit during 1 point PV Calibration
179	Read Calibration Mode and Status
180	Write Calibration Mode and Status
181	Write Calibration Value
182	Read Calibration Progress and Error
183	Read Factory Calibration Parameters
184	Write Factory Calibration Parameters
185	Read Factory Calibration Slope and Offset
253	Write Concentration Solution

Device-specific HART commands: 4-electrode conductivity (EC)

Table 11 Device-specific HART commands: 4-electrode conductivity (EC)

Command	Description
186	Read PV Sensor Configuration
187	Write Measurement Type
188	Write Sensor Group
189	Read Concentration Configuration
190	Write Concentration Solution
191	Write Concentration Text Display
192	Read Temperature Sensor and Compensation Configuration
193	Write Automatic Temperature Compensation Option
194	Write Temperature Compensation Coefficient
195	Read Temperature Compensation Curve Part 1
196	Read Temperature Compensation Curve Part 2
197	Read Temperature Compensation Curve Part 3
198	Read Temperature Compensation Curve Part 4
199	Reset PV and Temperature Calibration
204	Read Stable PV for edit during 1 point PV Calibration
205	Read Calibration Mode and Status
206	Write Calibration Mode and Status
207	Write Calibration Value
208	Read Calibration Progress and Error
209	Read Factory Calibration Parameters
211	Write Factory Calibration Parameters
212	Read Factory Calibration Slope and Offset

Device-specific HART commands: pH

Table 12 Device-specific HART commands: pH

Command	Description
213	Read PV Sensor Configuration
214	Write Measurement Type
215	Write pH Sensor Type
216	Write Reference Impedance Limit
217	Write Isopotential pH and Asymmetric Potential
218	Read ION Concentration Configuration
219	Write ION Concentration Configuration
220	Read Temperature Sensor and Compensation Configuration
221	Write pH Solution Coefficient Value
222	Write millivolt Solution Coefficient Value
223	Read Primary Variable Transfer Function Curve Part 1
224	Write Primary Variable Transfer Function Curve Part 1
225	Read Two Point Manual Calibration Parameters
226	Write Two Point Manual Calibration Parameters
227	Reset PV and Temperature Calibration
228	Read the Stable PV for edit during 1 point PV Calibration
229	Read PV Calibration Slope and Offset Alarm Limits
230	Write PV Calibration Slope and Offset Alarm Limits
231	Read Auto-Buffer Calibration Parameters
232	Write Standard Buffer Type
233	Write Buffer 1 and Buffer 2 Values
234	Read Calibration Mode and Status
235	Write Calibration Mode and Status
236	Read Temperature Compensated Buffer Value
237	Write Calibration Value
238	Read Calibration Progress and Error
239	Read User Defined Buffer Table 1 Temperature and pH
240	Write User Defined Buffer Table 1 Temperature and pH
241	Read User Defined Buffer Table 2 Temperature and pH
242	Write User Defined Buffer Table 2 Temperature and pH
244	Read Factory Calibration Parameters
245	Write Factory Calibration Parameters
246	Read Factory Calibration Slope and Offset
247	Write Linearity/Function Generator
248	Read Linearity/Function Generator

Acknowledgements

- HART is a registered trademark of the FieldComm Group.

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/measurement

COM/AWT210/HART-EN Rev. C 02.2023