Honeywell

APT2000 Series
2-Wire Contacting Conductivity Transmitters User Manual

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Revision 1 – 01/00

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Safety Precautions

Be sure to read and observe the following requirements!

Warning

The APT2000CC-0(H)-00 Transmitter is approved for operation in safe areas and hazardous locations DIV 2 (USA/Canada only).
Before connecting the Transmitter to a power supply unit, make sure that this is not capable of outputting more than 40 Vdc (safe areas) / 30 Vdc (DIV 2).

Warning

The APT 2000CC-0(H)-IS Transmitter is approved for operation in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe).
Before connecting the Transmitter to a power supply unit, make sure that this is an associated apparatus.

Warning

The measuring inputs of the APT 2000PH-0(H)-IS Transmitter may be led into Zone 0 (Europe).
However, be sure to observe the national regulations concerning Zone 0 applications.
The Transmitter itself is not approved for operation in Zone 0!

Whenever it is likely that the protection has been impaired, the instrument shall be made inoperative and secured against unintended operation.
The protection is likely to be impaired if, for example:

- ❏ the instrument shows visible damage
- ❏ the instrument fails to perform the intended measurements
- ❏ after prolonged storage at temperatures above 70 ˚C
- ❏ after severe transport stresses

Before recommissioning the instrument, a professional routine test must be performed. This test should be carried out at our factory.

The instrument shall not be used in a manner not specified by this manual.

Information on this Instruction Manual

ITALICS are used for texts which appear in the Transmitter display.

Bold print is used to represent keys, e.g. **CAL**.

CAL

Keys for which the functions are explained are frequently shown in the left-hand column.

Note

Notes provide important information that should be strictly followed when using the unit.

Warning

Warning means that the instructions given must always be followed for your own safety. Failure to follow these instructions may result in injuries.

Mode Codes

After pressing **CAL** or **CONF** you can enter one of the following codes to access the designated mode:

CONF

CONF, 0000: Error info
CONF, 1200: Configuration
CONF, 5555: Current source

CAL

CAL, 0000: Cal info (cell calibration factor)
CAL, 1015: Temp probe adjustment
CAL, 1100: Calibration mode
CAL, 2222: Test mode

Contents

1 Assembly

Package Contents and Unpacking

Unpack the instrument carefully and check the shipment for transport damage and completeness.
The package contains:

– Front unit of APT2000CC Transmitter

– Lower case

– Short instruction sheet

– This instruction manual

– HART description
(only for Model APT2000CC-H-..)

– Bag containing:

① 2 plastic plugs
② 5 hexagon nuts
③ 3 Pg cable glands
④ 1 Pg rubber reducer
⑤ 1 Pg plugs
⑥ 4 set screws
⑦ 1 hinge pin
⑧ 3 cable ties
⑨ 3 filler plugs
⑩ 3 sealing rings
⑪ 1 metal plate for conduit
⑫ 1 jumper

Assembly

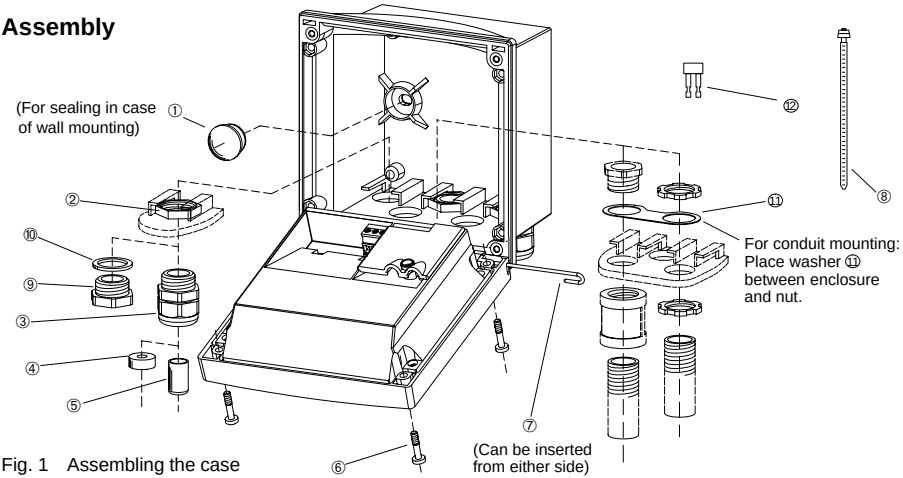


Fig. 1 Assembling the case

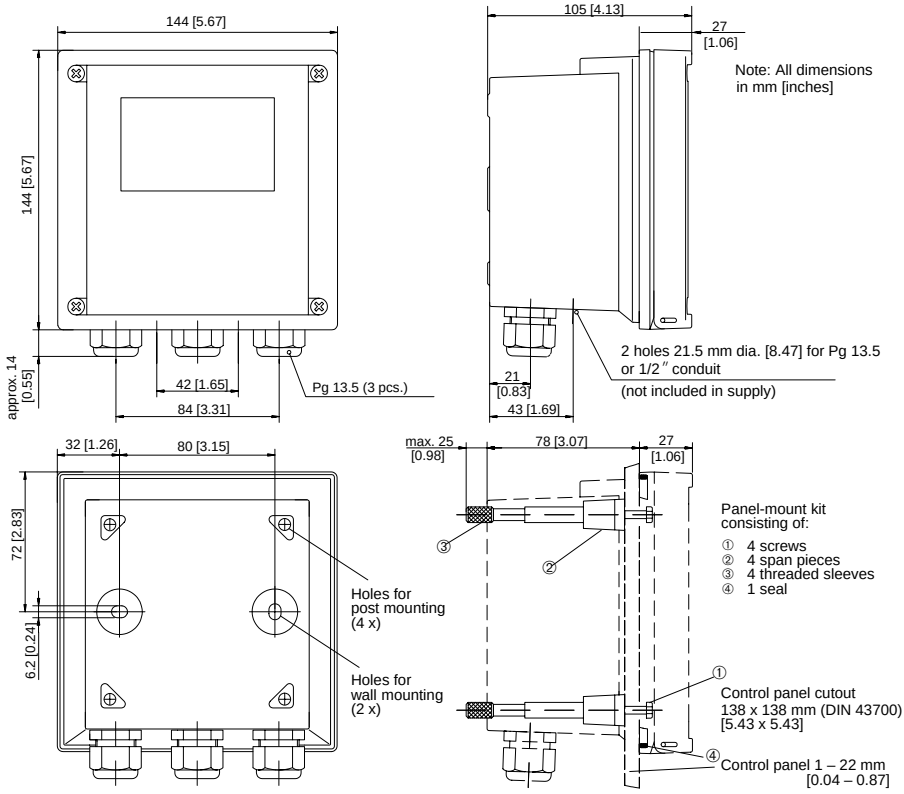


Fig. 2 Dimension drawing for Transmitter, mounting diagram and P/N 51205990-001 panel-mount kit

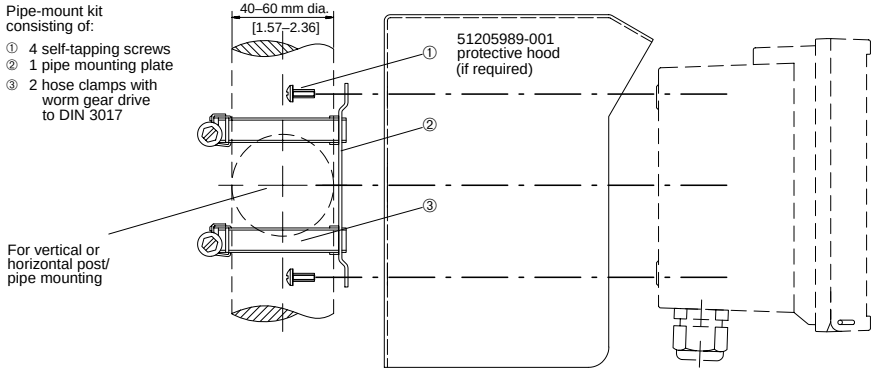


Fig. 3 P/N 51205988-001 pipe-mount kit

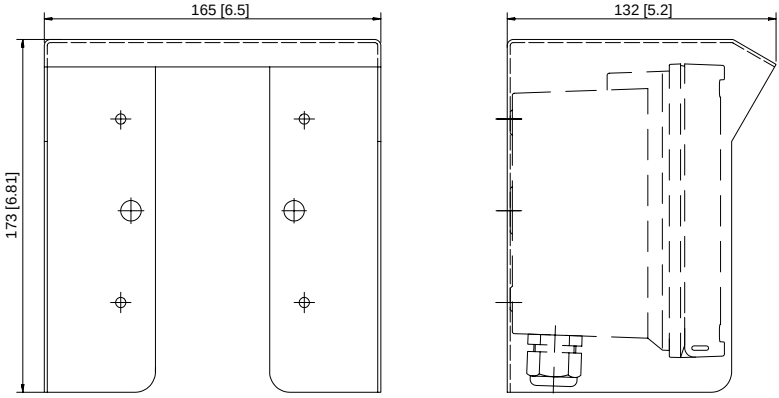
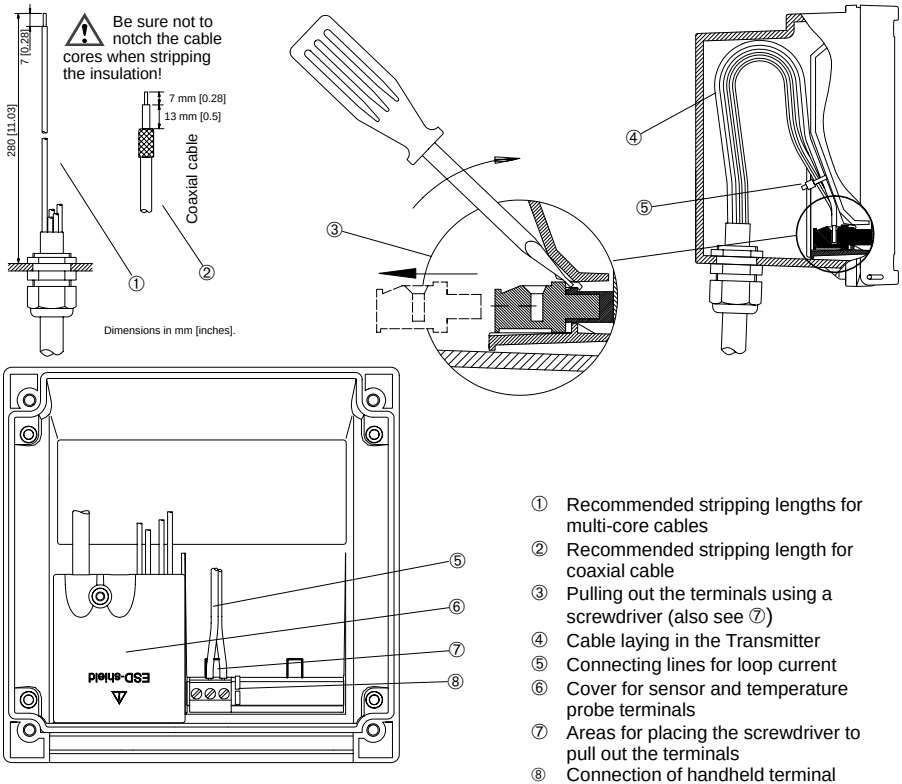


Fig. 4 P/N 51205989-001 protective hood for wall and pipe mounting



① Recommended stripping lengths for multi-core cables
② Recommended stripping length for coaxial cable
③ Pulling out the terminals using a screwdriver (also see ⑦)
④ Cable laying in the Transmitter
⑤ Connecting lines for loop current
⑥ Cover for sensor and temperature probe terminals
⑦ Areas for placing the screwdriver to pull out the terminals
⑧ Connection of handheld terminal

Fig. 5 Installation information

2 Installation, Connection and Commissioning

Proper Use

The APT2000CC Transmitter is used for conductivity and temperature measurement in biotechnology, food processing, pharmaceutical and chemical industry, waste-water treatment, as well as for monitoring ultrapure water. It can be either field-mounted or fixed into a control panel.

Warning

The APT2000CC-0(H)-00 Transmitter is approved for operation in safe areas and hazardous locations DIV 2 (USA/Canada only) Before connecting the Transmitter to a power supply unit, make sure that this is not capable of outputting more than 40 Vdc (safe areas) / 30 Vdc (DIV 2).

Warning

The APT2000CC-0(H)-IS Transmitter is approved for operation in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe).
Before connecting the Transmitter to a power supply unit, make sure that this is an associated apparatus.

Warning

The measuring inputs of the APT 2000PH-0(H)-IS Transmitter may be led into Zone 0 (Europe). However, be sure to observe the national regulations concerning Zone 0 applications.
The Transmitter itself is not approved for operation in Zone 0!

Overview of the Conductivity Transmitter

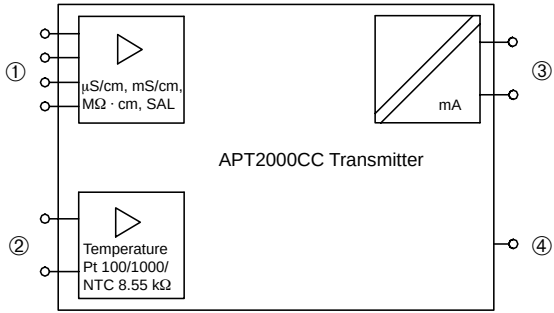


Fig. 6 System functions of APT2000CC Transmitter

① Input for 2-electrode cond. sensor
② Input for temperature probe
③ Current loop 4 – 20 mA,
transports power to and output signal from the transmitter,
with APT2000CC-H-.. Transmitter also for HART® communication
④ Equipotential bonding (only with APT2000CC-0(H)-IS Transmitter for meeting CENELEC/ATEX requirements – not required by FM/CSA)

Terminal Assignment

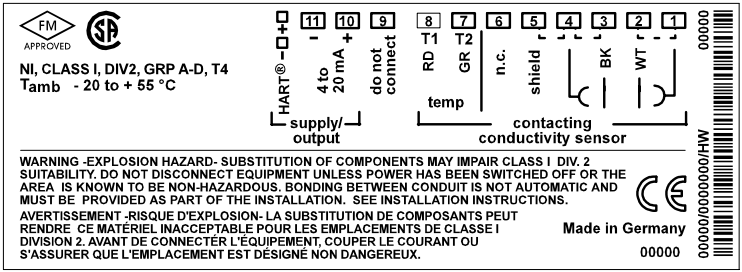


Fig. 7 Terminal assignment of APT2000CC-0(H)-00 Transmitter
NI, Class 1, Div 2, Group A – D, T4

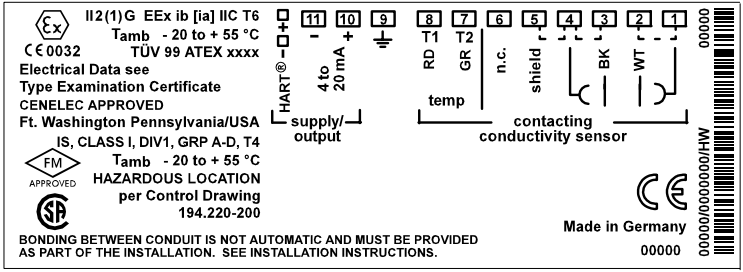


Fig. 8 Terminal assignment of APT2000CC-0(H)-IS Transmitter
IS, Class I, Div 1, Group A – D, T4
II 2(1) G EEx ib [ia] IIC T6

Installation and Commissioning

Warning

Installation and commissioning of the Transmitter may only be carried out in accordance with this instruction manual and per applicable local and national codes. Be sure to observe the technical specifications and input ratings.

Warning

Before connecting the APT2000CC-0(H)-00 Transmitter to a power supply unit, make sure that this is not capable of outputting more than 40 Vdc (safe areas) / 30 Vdc (DIV 2).

Warning

Before connecting the APT2000CC-0(H)-IS Transmitter to a power supply unit, make sure that this is an associated apparatus (for input ratings refer to the Control Drawing or the annex of the EC Type Examination Certificate).

Warning

Do not use alternating current or mains power supply!

Warning

When commissioning, a complete configuration must be carried out.

For easier installation, the terminal strips are of a plug-in design. The terminals are suitable for single wires and flexible leads up to 2.5 mm^2 (AWG 14) (see Pg. 9).
See Pg. 14 for a connection example.

Typical Wiring

Conductivity measurement with Honeywell 2-electrode cells

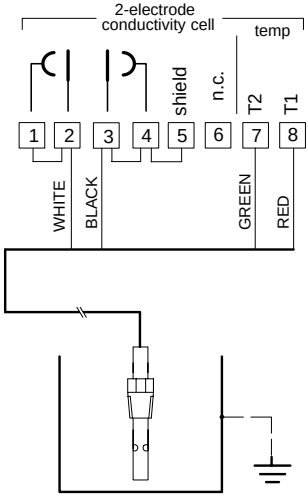


Fig. 9 Conductivity measurement with Honeywell 2-electrode cells

3 Operation

User Interface

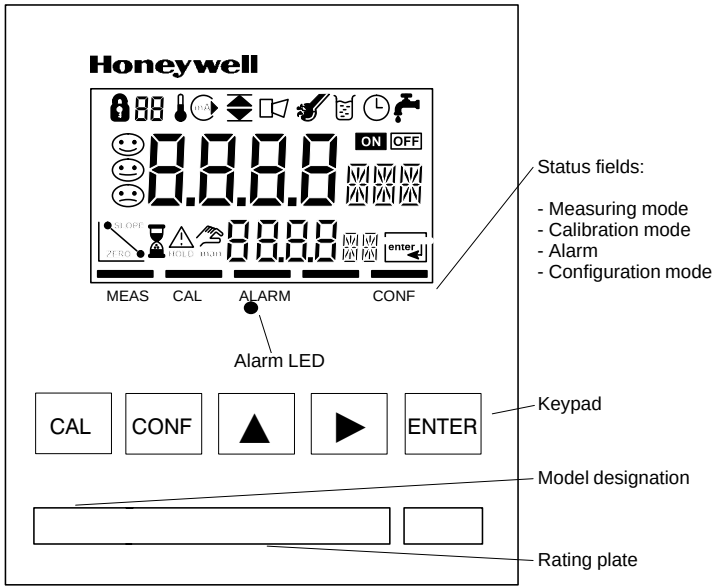


Fig. 10 Front view of Transmitter

Display

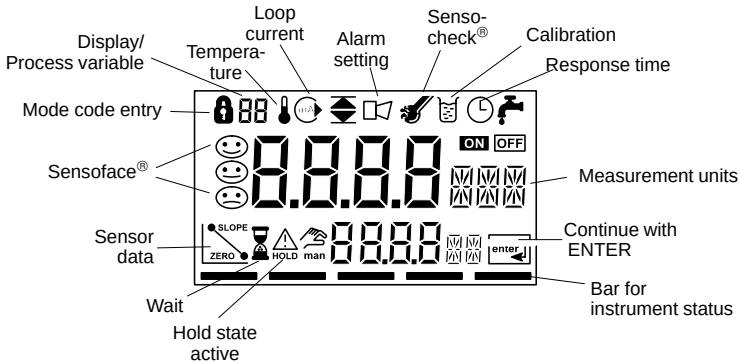


Fig. 11 Display of Transmitter

Keypad

CAL — Start, end calibration

CONF — Start, end configuration

▶ — Select digit position (selected position flashes)

▲ — Change digit

ENTER — Prompt in display: continue in program sequence, Configuration: Confirm entries, next configuration step, Measuring mode: Display loop current

CAL → ENTER — Cal info, display cell calibration factor (see Pg. 24)

CONF → ENTER — Error info, display last output error message (see Pg. 24)

▲ + ▶ — Start GainCheck® manual instrument self-test (see Pg. 17)

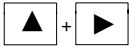
Safety Functions

Sensoface® sensor monitoring

Sensoface® provides information on the sensor condition. A sad "Smiley" indicates that there is a Sensocheck® message. **Sensocheck**® alerts for significant sensor polarization or excessive cable capacitance caused by an unsuitable cable or a cable that is too long. Sensocheck® can be switched off. With Sensocheck® switched off, no friendly Smiley appears.

For more detailed information, see chapter "Diagnostic, Maintenance and Cleaning" (Pg. 25).

GainCheck® manual instrument self-test



Simultaneously pressing ▲ and ▶ starts the manual instrument self-test.

A display test is carried out, the software version is displayed and the memory and measured value transmission are checked.

Automatic instrument self-test

The automatic unit self-test checks the memory and the measured-value transmission. It runs automatically in the background at fixed intervals.

Outputs

Current loop (4 to 20 mA)

The current loop transports power to and output signals from the Transmitter. The current is controlled by the process variable selected in the configuration. The current characteristic can be configured as linear or logarithmic curve for conductivity and resistivity.
The current beginning and end can be set to represent any desired value.
If LIN (linear characteristic) is chosen, the minimum span is 5% of the selected process variable / measurement range. If LOG (logarithmic characteristic) is chosen, the minimum span is one decade within the chosen range.
To check connected peripherals (e.g. limit switches, controllers), the loop current can be manually specified (see Pg. 27).

HART® communication

The APT2000CC-H-.. Transmitter can be remote controlled via HART® communication. It can be configured using a handheld terminal or from the control room. Measured values, messages and device identification can be downloaded at any time. This allows easy integration also in fully automatic process sequences.

For more detailed information, refer to the HART® Command Specification.

Alarm

During an error message the alarm LED flashes. Alarm response time is permanently set to 10 sec.

Error messages can also be signaled with a 22 mA signal via the loop current (see Configuration, Pg. 20).

Configuration

The instrument arrives from the factory configured and ready to operate as a conductivity transmitter. This section provides detailed procedures for changing operation values for specific applications.

Activate with **CONF**
change parameter with ▲ and ▶,
confirm/continue with **ENTER**,
end with **CONF.**

Mode code “1200”

During configuration the Transmitter is in the Hold state, the loop current is frozen.

When the configuration mode is exited, the Transmitter remains in the Hold state for safety reasons. This prevents undesirable reactions of the connected peripherals (e.g. limit switches, controllers) due to incorrect settings. The measured value and *Hold* are displayed alternately. Now you can check whether the measured value is plausible and specifically end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Hold state is ended.

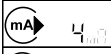
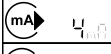
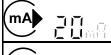
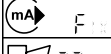
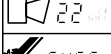
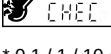
Note

The configuration parameters are checked during the input. In the case of an incorrect input “ERR” is displayed for 3 sec. The parameters cannot be stored with **ENTER** until the input has been repeated.

Configuration parameters

Before attempting any changes refer to the parameter setup list shown below. This table presents the possible options and the factory settings.

Picto-graph	Parameter	Choices	Factory setting
SF	Sensor factor (nominal values)	0.01 (for 0 – 99 µS/cm) 0.10 (for 0 – 1999 µS/cm) 1.00 (for 0 – 99 mS/cm) 10.0 (for 0 – 99.9 mS/cm)	**1.00**
00	Process variable / meas. range Selected process variable and measuring range control loop current and measured values. Complete configuration required after change.	o.ooo µS / oo.oo µS / ooo.o µS / oooo µS o.ooo mS / oo.oo mS / ooo.o mS o.ooo MΩ / oo.oo MΩ / ooo.o MΩ o.ooo SAL	**ooo.o mS**
	Temperature display	°C °F	**°C**
	Temperature probe	Pt 100 / Pt 1000 / NTC 8.55 kΩ	**NTC**

	Temperature compensation (not with SAL)	OFF LIN NLF (natural waters) -01- FCT (ultrapure water, NaCl traces) -02- FCT (ultrapure water, HCl traces) -03- FCT (ultrapure water, NH_3 traces)	**OFF**
	Temperature coefficient (only with tc LIN)	xx.xx %/K	**02.00 %/K**
	Current characteristic (not with SAL)	LIN LOG	**LIN**
	Current beginning (0 / 4 mA) (only with LIN)	µS / mS / MΩ / SAL	**000.0 mS**
	Current end (20 mA) (only with LIN)	µS / mS / MΩ / SAL	**100.0 mS**
	Current beginning (0 / 4 mA) (only with LOG)	µS / mS / MΩ *	**0.1 mS**
	Current end (20 mA) (only with LOG)	µS / mS / MΩ *	**100 mS**
	Hold state	Last: Last current value Fix: Current specified	**Last**
	Hold value (only with Fix)	xx.xx mA	**21.00 mA**
	22 mA signal for error message	ON / OFF	**OFF**
	Sensocheck®	ON / OFF	**OFF**

* 0.1 / 1 / 10 /100 / 1000 µS / mS / MΩ

Configuration is circular. To stop, press **CONF**.

Calibration

The conductivity value is determined by multiplication of the cell constant with the measured conductance. The cell constant consists of the sensor factor (SF) multiplied by the cell calibration factor (CF). The sensor factor is the nominal value for the definite sensor type. It is set in the configuration mode (see Pg. 19). The cell calibration factor (factory setting 1.0) is changed in the calibration mode. If the cell calibration factor of the sensor in use is known, it can be entered directly. Furthermore, the cell calibration factor can be determined with a known calibration solution under consideration of the temperature.

Note

The cell calibration factor will not be reset by a new selection of the sensor factor in the configuration mode.

CAL

Activate with **CAL**, confirm/continue with **ENTER**, abort with **CAL → ENTER**

HOLD

During calibration the Transmitter is in the Hold state. The loop current is frozen.

When the calibration mode is exited, the Transmitter remains in the Hold state for safety reasons. This prevents undesirable reactions of the connected peripherals (e.g. limit switches, controllers) due to incorrect settings. The measured value and *Hold* are displayed alternately. Now you can check whether the measured value is plausible and specifically end the Hold state with **ENTER** or repeat calibration with **CAL.** If you end the Hold state, the Transmitter will return to measuring mode after a relax time of 20 sec (for measured value stabilization).

Calibration by input of cell calibration factor (CF) (CAL 1100)

Note

Make sure that the sensor factor has been set in the configuration mode (see Pg. 19).

CAL

Activate calibration by pressing the **CAL** key.
Using the ▲ , ▶ keys enter mode code *"1100"* and then press **ENTER**.

Using the ▲ , ▶ keys enter the calibration factor. The lower display shows the conductivity value.

A change in the calibration factor also changes the conductivity value.

When there has not been an entry for approx. 6 sec, conductivity and temperature are displayed alternately.

ENTER

Press **ENTER** to confirm the calibration factor.

The Transmitter remains in the Hold state. You can end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Calibration with calibration solution (CAL 1100)

Note

Make sure that the sensor factor has been set in the configuration mode (see Pg. 19).

Note

Be sure to use known calibration solutions and the respective temperature-corrected table values (see Calibration Solutions, Pg. 36).

CAL

Activate calibration by pressing the **CAL** key.
Using the ▲ , ▶ keys enter mode code *"1100"* and then press **ENTER**.

Immerse the conductivity cell in the calibration solution.

After approx. 6 sec the lower display alternately shows the conductivity and temperature values. Read the conductivity value corresponding to the displayed temperature from the table of the used calibration solution (for tables see Pg. 36).

Using the ▲ , ▶ keys change the calibration factor until the display shows the conductivity value from the table.

Make sure that the temperature is stable during the calibration procedure.

ENTER

Press **ENTER** to confirm the calibration factor.

The Transmitter remains in the Hold state. You can end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Adjustment of temperature probe (CAL 1015)

Note

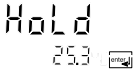
Incorrectly set parameters may go unnoticed, yet change the measurement properties.
Temperature probe adjustment is particularly useful when using Pt 100 temperature probes. For NTC temperature probes, an adjustment is not required.

Activate calibration by pressing the **CAL** key.
Using the ▲ , ▶ keys enter mode code *"1015"* and then press **ENTER**.

Measure the temperature of the process medium using an external thermometer.

Using the ▲ , ▶ keys enter the determined temperature value in the main display. If you take over the temperature value shown in the lower display, the correction is without effect.

Press **ENTER** to confirm the temperature value.



The Transmitter remains in the Hold state. You can end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Measurement

Measuring mode

In the measuring mode the main display shows the configured process variable and the lower display the temperature.

Cal info

With **CAL** and mode code *"0000"* you can activate the cal info. Cal info shows the current calibration data for approx. 20 sec. The 20 sec can be reduced by pressing **ENTER**. During cal info the Transmitter is not in Hold state.

Error info

With **CONF** and mode code *"0000"* you can activate the error info. Error info shows the most recent error message for approx. 20 sec. After that the message will be deleted. The 20 sec can be reduced by pressing **ENTER**. During error info the Transmitter is not in Hold state.

Hold state

The Transmitter will enter the Hold state under the following conditions:

For calibration:	Mode code *1015* Mode code *1100* Mode code *2222*
configuration:	Mode code *1200* Mode code *5555*

The loop current is frozen at *Last* or *Fix* (configuration Pg. 20).
If the calibration or configuration mode is exited, the Transmitter remains in the Hold state for safety reasons. This prevents undesirable reactions of the connected peripherals (e.g. limit switches, controllers) due to incorrect settings. The measured value and *Hold* are displayed alternately. Now you can check whether the measured value is plausible and specifically end the Hold state with **ENTER**.
The loop current will remain frozen for another 20 sec (relax time). This ensures that the Transmitter can adjust to the new measured value. After that, the Transmitter returns to measuring mode.

Note  During error conditions the Hold state will not be active.

4 Diagnostics, Maintenance and Cleaning

Sensoface®, Sensocheck®

Sensoface® provides information on the sensor condition. A sad "Smiley" indicates that there is a Sensocheck® message.

Sensocheck® alerts for significant sensor polarization or excessive cable capacitance caused by an unsuitable cable or a cable that is too long. Sensocheck® can be switched off. With Sensocheck® switched off, no friendly Smiley appears.

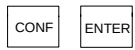
Error Messages

When one of the following error messages is output, the Transmitter can no longer correctly determine the process variable or output it via the loop current.

During an error message the alarm LED flashes. The alarm response time is permanently set to 10 sec.

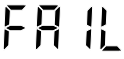
Error messages can also be signaled with a 22 mA signal via the loop current (see Configuration, Pg. 20).

Error info



With **CONF** and mode code *"0000"* you can activate the error info. Error info shows the most recent error message for approx. 20 sec. After that the message will be deleted. The 20 sec can be reduced by pressing **ENTER**. During error info the Transmitter is not in Hold state.

Error number	Display (flashing)	Problem	Possible causes
Err 01		Conductivity cell	- Wrong cell factor - Conductivity ≥ 1000 mS/cm - SAL > 45 ‰ - Cell connection or cable defective
Err 02		Conductivity cell	- Unsuitable cell
Err 03		Temperature probe	- Outside temp range - Outside temp range for TC - Outside temp range for SAL
Err 21		Loop current	- Meas. value below configured current beginning - Wrong configuration for current beginning (see Pg. 20)

Error number	Display (flashing)	Problem	Possible causes
Err 22		Loop current	- Meas. value above configured current end - Wrong configuration for current end (see Pg. 20)
Err 23		Loop current	- Configured current span too small (Difference between current beginning and end)
Err 33		Sensocheck®	- Wrong conductivity cell - Conductivity cell defective - Connection cable or screw cap defective - Connection terminals or screw cap dirty
Err 98		System error	- Configuration or calibration data defective; completely reconfigure and recalibrate the instrument - Measured value transmission defective - Memory error in Transmitter program (PROM defective)
Err 99		Factory settings	- EEPROM or RAM defective - Error in factory settings This error message normally should not occur, as the data are protected from loss by multiple safety functions. Should this error message nevertheless occur, there is no remedy. The Transmitter must be repaired and recalibrated at the factory.

Diagnostics Functions

Cal info

Pressing **CAL** and entering mode code *"0000"* is going to activate the cal info. Cal info shows the current calibration data for approx. 20 sec. During cal info the Transmitter is not in Hold state.

Test mode

Pressing **CAL** and entering mode code *"2222"* is going to activate the test mode. In the test mode you can check the measuring equipment with a resistor. Sensoface® is disabled. The resistor is connected instead of the conductivity cell. The equivalent resistance value is shown in the main display in kΩ. With a resistance value > 2 MΩ the display reads "*OPEn"*. Pressing **ENTER** ends the test mode. The Transmitter goes to Hold state.

Error info

Pressing **CONF** and entering mode code *"0000"* is going to activate the error info. Error info shows the most recent error message for approx. 20 sec. After that the message will be deleted. During error info the instrument is not in Hold state.

Display loop current

Pressing **ENTER** in measuring mode displays the loop current for a few seconds.

Current source

To check the connected peripherals (e.g. limit switches, controllers), the loop current can be manually specified.

Warning

In the current source mode the loop current no longer follows the measured value! It is manually specified.
Therefore, it must be ensured that the connected devices (control room, controllers, indicators) do not interpret the current value as a measured value!

Pressing **CONF** and entering mode code "5555" is going to activate the current source mode. Specify the loop current using ▶, ▲ and **ENTER**. The actually flowing loop current is shown in the lower display.
Pressing **CONF** exits the current source mode again.

GainCheck® manual instrument self-test

The manual instrument self-test is started by simultaneously pressing ▲ and ▶.

A display test is carried out, the software version is displayed and the memory and measured-value transmission checked.

Automatic self-test

The automatic unit self-test checks the memory and the measured-value transmission. It runs automatically in the background at fixed intervals.

Maintenance and Cleaning

Maintenance

The Transmitter contains no user repairable components. If problems persist even after reviewing section 4, please contact the factory.

Cleaning

To remove dust, dirt and spots, the external surfaces of the Transmitter may be wiped with a damp, lint-free cloth. A mild household cleaner may also be used if necessary.

5 Appendix

Product Line

Units

	Ref. No.
Conductivity Transmitter for application in safe areas or hazardous locations DIV 2 (USA/Canada only)	APT2000CC-0-00
Conductivity IS Transmitter for application in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe).	APT2000CC-0-IS
Conductivity Transmitter with HART® communication for application in safe areas or hazardous locations DIV 2 (USA/Canada only)	APT2000CC-H-00
Conductivity IS Transmitter with HART® communication, for application in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe)	APT2000CC-H-IS

Mounting Accessories

	Ref. No.
Pipe-mount kit	51205988-001
Panel-mount kit	51205990-001
Protective hood	51205989-001

Further Accessories

	Ref. No.
HART® test socket, integrated in Pg cable gland (for APT2000CC-H-.. Transmitter only)	51205991-001

Specifications

APT2000CC-0(H)-00 Transmitter

Cond input	Input for 2-electrode cells
Display range	0.2 µS·c to 1000 mS·c
Accuracy**	< 1 % of meas. value + 0.4 µS·c
Process variable/range (display resolution 3 1/2 digits)	0.000 to 9.999 µS/cm 00.00 to 99.99 µS/cm 000.0 to 999.9 µS/cm 0000 to 9999 µS/cm 0.000 to 9.999 mS/cm 00.00 to 99.99 mS/cm 000.0 to 999.9 mS/cm 0.000 to 9.999 MΩ/cm 00.00 to 99.99 MΩ/cm 000.0 to 999.9 MΩ/cm
Salinity	0.0 to 45.0 ‰ (0 to 35 °C)
Sensor monitoring	Sensocheck®: polarization detection and monitoring of cable capacitance (can be switched off)
Sensor standardization*	– Entry of cell calibration factor with display of conductivity and temperature – Temperature probe adjustment
Perm. calibration factors	0.000 to 9.999 cm^{-1}
Temperature input	Pt 100 / Pt 1000 / NTC 8.55 kΩ
Ranges	– NTC –10.0 to +130.0 °C +14 to +266 °F – Pt –20.0 to +150.0 °C –4 to 302 °F
Resolution	0.1 °C / 1 °F
Accuracy	< 0.5 K***

APT2000CC-0(H)-IS Transmitter

Cond input	Input for 2-electrode cells
Display range	0.2 µS·c to 1000 mS·c
Accuracy**	< 1 % of meas. value + 0.4 µS·c
Process variable/range (display resolution 3 1/2 digits)	0.000 to 9.999 µS/cm 00.00 to 99.99 µS/cm 000.0 to 999.9 µS/cm 0000 to 9999 µS/cm 0.000 to 9.999 mS/cm 00.00 to 99.99 mS/cm 000.0 to 999.9 mS/cm 0.000 to 9.999 MΩ/cm 00.00 to 99.99 MΩ/cm 000.0 to 999.9 MΩ/cm
Salinity	0.0 to 45.0 ‰ (0 to 35 °C)
Sensor monitoring	Sensocheck®: polarization detection and monitoring of cable capacitance (can be switched off)
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Resolution	0.1 °C / 1 °F
Accuracy	< 0.5 K***

APT2000CC-0(H)-00 Transmitter

Temperature compensation* (Ref. temp 25 °C)	LIN	00.00 to 19.99 %/K
	NLF	Natural waters to EN 27888 (0 to 36 °C)
	-01-	Ultrapure water with NaCl traces (0 to 120 °C)
	-02-	Ultrapure water with HCl traces (0 to 120 °C)
	-03-	Ultrapure water with NH_3 traces (0 to 120 °C)
Display	LC display, alarm LED	
Loop current	4 to 20 mA, floating 22 mA for error message* supply voltage 14 to 30 V	
Characteristic*	Linear or logarithmic	
Current error	< 0.3 % of current value + 0.05 mA	
Start/End of scale*	As desired within ranges for µS, mS, MΩ, SAL	
Min. span	LIN	5 % of selected range
	LOG	1 decade
Current source	3.8 mA to 22.00 mA	
HART® communication (HART transmitter only)	Digital communication via FSK modulation of loop current, reading of device identification, measured values, status and messages reading and writing of parameters	
Explosion protection	USA/Canada: NI, Class I, Div 2, Group A – D, T4	
Data retention	> 10 years (EEPROM)	

APT2000CC-0(H)-IS Transmitter

Temperature compensation* (Ref. temp 25 °C)	LIN	00.00 to 19.99 %/K
	NLF	Natural waters to EN 27888 (0 to 36 °C)
	-01-	Ultrapure water with NaCl traces (0 to 120 °C)
	-02-	Ultrapure water with HCl traces (0 to 120 °C)
	-03-	Ultrapure water with NH_3 traces (0 to 120 °C)
Display	LC display, alarm LED	
Loop current EEx ib IIC	4 to 20 mA, floating 22 mA for error message* supply voltage 14 to 30 V, I_{max} = 100 mA, P_{max} = 0.8 W	
Characteristic*	Linear or logarithmic	
Current error	< 0.3 % of current value + 0.05 mA	
Start/End of scale*	As desired within ranges for µS, mS, MΩ, SAL	
Min. span	LIN	5 % of selected range
	LOG	1 decade
Current source	3.8 mA to 22.00 mA	
HART® communication (HART transmitter only)	Digital communication via FSK modulation of loop current, reading of device identification, measured values, status and messages reading and writing of parameters	
Explosion protection	USA/Canada: IS, Class I, Div 1, Group A – D, T4 Europe: II 2G EEx ib [ia] IIC T6	
Data retention	> 10 years (EEPROM)	

APT2000CC-0(H)-00 Transmitter

RFI suppression	To EN 50 081-1 and EN 50 081-2
Immunity to interference	To EN 50 082-1 and EN 50 082-2
Temperature	Operating/ambient temp –20 to +55 °C Transport and storage temp –20 to +70 °C
Enclosure	Material: thermoplastic polyester, reinforced (polybutylene terephthalate) Protection: IP 65 (USA/Canada: indoor use only) Color: bluish gray RAL 7031
Cable glands	3 breakthroughs for Pg 13.5 2 breakthroughs for NPT 1/2 “ or Rigid Metallic Conduit
Dimensions	See Dimension drawings, Pg. 7 ff
Weight	Approx. 1 kg

* user defined ** ± 1 count
*** with Pt 100 < 1K, with NTC > 100 °C < 1 K

APT2000CC-0(H)-IS Transmitter

RFI suppression	To EN 50 081-1 and EN 50 081-2
Immunity to interference	To EN 50 082-1 and EN 50 082-2
Temperature	Operating/ambient temp T6: -20 to +40 °C T4: -20 to +55 °C Transport and storage temp –20 to +70 °C
Enclosure	Material: thermoplastic polyester, reinforced (polybutylene terephthalate) Protection: IP 65 (USA/Canada: indoor use only) Color: bluish gray RAL 7031
Cable glands	3 breakthroughs for Pg 13.5 2 breakthroughs for NPT 1/2 “ or Rigid Metallic Conduit
Dimensions	See Dimension drawings, Pg. 7 ff
Weight	Approx. 1 kg

* user defined ** ± 1 count
*** with Pt 100 < 1K, with NTC > 100 °C < 1 K

Type Examination Certificate

Translation

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment or Protective System intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

TÜV 99 ATEX 1500

(4) Equipment or Protective System: Analytical process transmitter Typ APT2000CC-*-IS

(5) Manufacturer: Honeywell Inc.

(6) Address: USA - Fort Washington PA 19034, 1100 Virginia Drive

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV Certification Body N° 0032 in accordance with Article 9 of the Council Directive 94/9/EC of March 23, 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report N° 99/PX25990.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014:1997 **EN 50 020:1994**

(10) If the sign "X" is placed after the certification number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment or protective system.

(12) The marking of the equipment or protective system shall include the following:

II 2 (1) G EEx ib [ia] IIC T6

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover

Hannover, 1999-11-17

Head of the Certification Body

This certificate may only be reproduced without any change, schedule included. Excerpts or changes shall be allowed by the TÜV Hannover/Sachsen-Anhalt e.V.

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(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 99 ATEX 1500**

(15) Description of equipment or protective system

The Analytical process transmitter Typ APT2000CC-*-IS is used for the recognition and processing of electrochemical quantities.

The maximum permissible ambient temperature is 55°C.

Electrical data

Current loop ....in type of protection "Intrinsic Safety" EEx ib IIC
(terminals 10, 11)
only for the connection to a certified intrinsically safe circuit with the following maximum values:

U_i = 30 V
I_i = 100 mA
P_i = 0.8 W
effective internal capacitance C_i = 20 nF
effective internal inductance L_i = 0.2 mH

Conductivity measuring loop .....in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 1, 2, 3, 4, 5)
Maximum values:

U_O = 10 V
I_O = 145 mA
P_O = 145 mW
R_i = 34.5 Ω
Characteristic: linear
effective internal capacitance C_i = 5 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 3 µF
max. permissible external inductance L_o = 1 mH

Temperature measuring loop ....in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 7, 8)
Maximum values:

U_O = 5 V
I_O = 3.5 mA
P_O = 5 mW
R_i = 1590 Ω
Characteristic: linear
effective internal capacitance C = 250 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 100 µF
max. permissible external inductance L_o = 1 H

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EP (Terminal 9) — for the connection to the equipotential bonding system

The current loop is safely separated from the conductivity measuring loop and the temperature measuring loop up to a voltage of 60 V. The conductivity measuring loop and the temperature measuring loop are galvanically connected.

(16) Test documents are listed in the test report No. 99/PX25990.

(17) Special condition for safe use

none.

(18) Essential Health and Safety Requirements

no additional ones

EA 02 · 1.98 1.000.000

Calibration Solutions

Potassium Chloride Solutions
Electrical Conductivity in mS/cm

Temperature [°C]	Concentration 0.01 mol/l	0.1 mol/l	1 mol/l
0	0.776	7.15	65.41
5	0.896	8.22	74.14
10	1.020	9.33	83.19
15	1.147	10.48	92.52
16	1.173	10.72	94.41
17	1.199	10.95	96.31
18	1.225	11.19	98.22
19	1.251	11.43	100.14
20	1.278	11.67	102.07
21	1.305	11.91	104.00
22	1.332	12.15	105.94
23	1.359	12.39	107.89
24	1.386	12.64	109.84
25	1.413	12.88	111.80
26	1.441	13.13	113.77
27	1.468	13.37	115.74
28	1.496	13.62	
29	1.524	13.87	
30	1.552	14.12	
31	1.581	14.37	
32	1.609	14.62	
33	1.638	14.88	
34	1.667	15.13	
35	1.696	15.39	
36		15.64	

Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen .... Volume 2, Part. Volume 6

Sodium Chloride Solutions
Electrical Conductivity in mS/cm

Temperature [°C]	Concentration saturated*	0.1 mol/l**	0.01 mol/l**
0	134.5	5.786	0.631
1	138.6	5.965	0.651
2	142.7	6.145	0.671
3	146.9	6.327	0.692
4	151.2	6.510	0.712
5	155.5	6.695	0.733
6	159.9	6.881	0.754
7	164.3	7.068	0.775
8	168.8	7.257	0.796
9	173.4	7.447	0.818
10	177.9	7.638	0.839
11	182.6	7.831	0.861
12	187.2	8.025	0.883
13	191.9	8.221	0.905
14	196.7	8.418	0.927
15	201.5	8.617	0.950
16	206.3	8.816	0.972
17	211.2	9.018	0.995
18	216.1	9.221	1.018
19	221.0	9.425	1.041
20	226.0	9.631	1.064
21	231.0	9.838	1.087
22	236.1	10.047	1.111
23	241.1	10.258	1.135
24	246.2	10.469	1.159
25	251.3	10.683	1.183
26	256.5	10.898	1.207
27	261.6	11.114	1.232
28	266.9	11.332	1.256
29	272.1	11.552	1.281
30	277.4	11.773	1.306
31	282.7	11.995	1.331
32	288.0	12.220	1.357
33	293.3	12.445	1.382
34	298.7	12.673	1.408
35	304.1	12.902	1.434
36	309.5	13.132	1.460

Data source: * K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen .... Volume 2, Part. Volume 6
** Test solutions calculated according to IEC 746-3

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