Honeywell

APT2000 Series
2-Wire pH Transmitters
User Manual

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MU1I-6245
Revision 1 – 09/00

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Safety Precautions

Be sure to read and observe the following requirements!

Warning

The APT2000PH-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 2000PH-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 Transmitter shall be made inoperative and secured against unintended operation.
The protection is likely to be impaired if, for example:

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

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

The Transmitter 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

With **CONF**/**CAL** and input of a mode code you can activate one of the following modes:

CONF

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

CAL

CAL, 0000: Cal info
CAL, 1001: Nominal zero adjustment
CAL, 1015: Temperature probe adjustment
CAL, 1100: Calibration
CAL, 2222: Test mode (display electrode potential)

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 APT2000PH Transmitter

– Lower case

– Short instruction sheet

– This instruction manual

– HART Command Specification
(only for Model APT2000PH-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

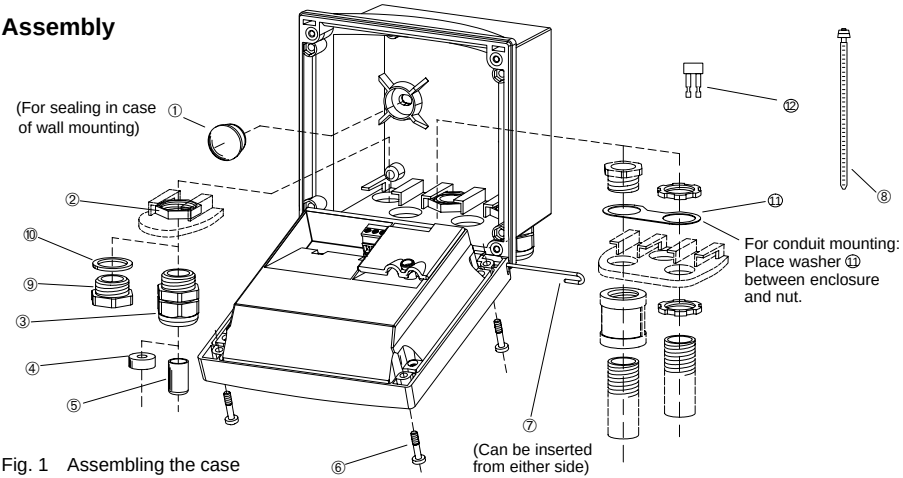


Fig. 1 Assembling the case

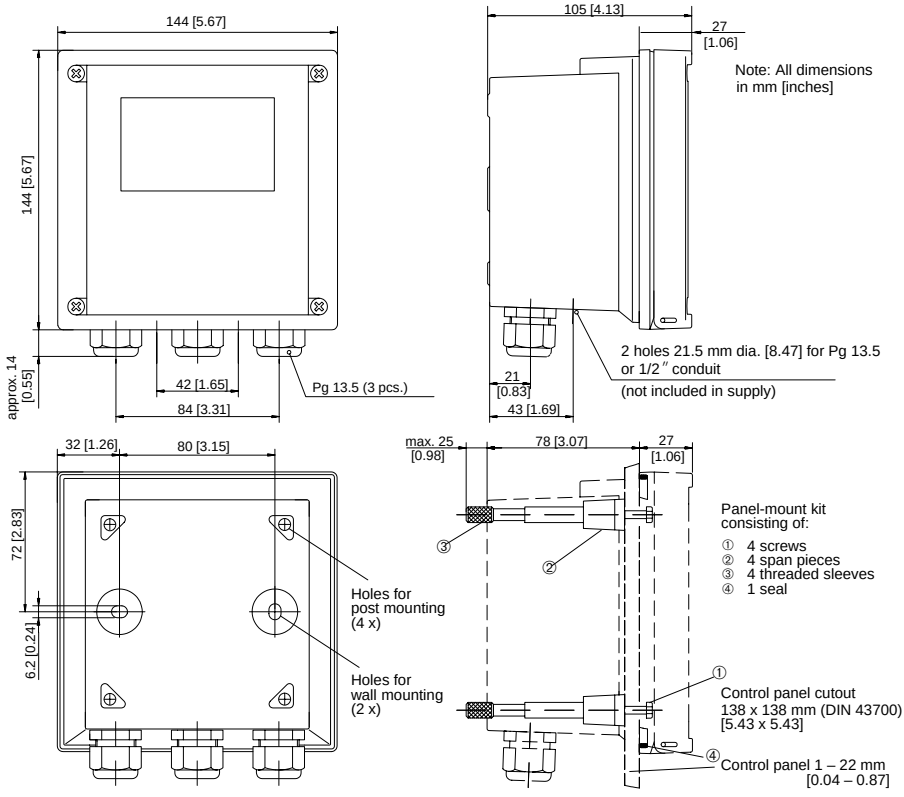


Fig. 2 Dimension drawing for Transmitter, mounting diagram and P/N 51205990-001 panel-mount kit

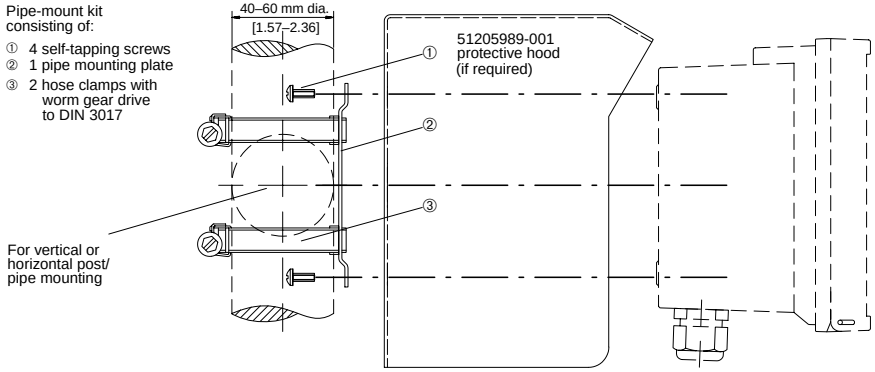


Fig. 3 P/N 51205988-001 pipe-mount kit

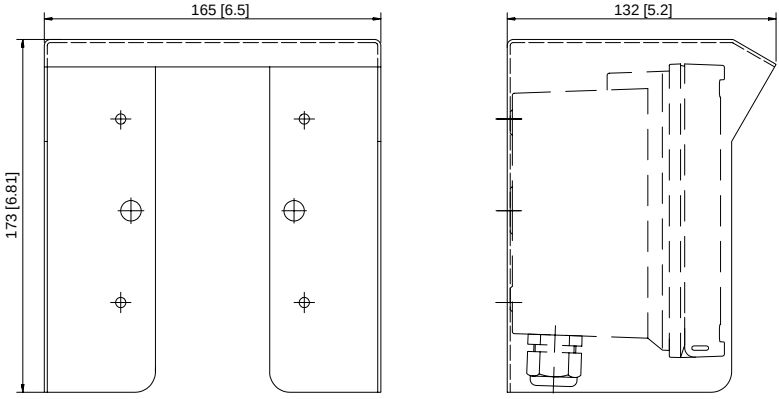
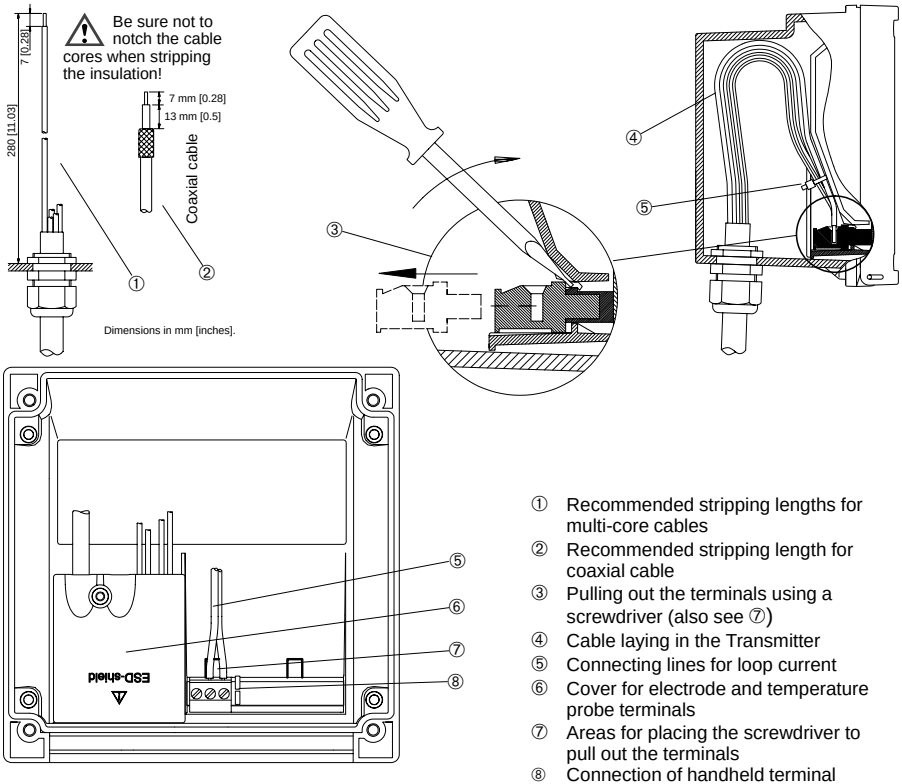


Fig. 4 P/N 51205989-001 protective hood for wall and pipe mounting



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 electrode 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 APT2000PH Transmitter is used for pH and temperature measurement in industry, the environment, food processing and waste-water field. It can be either field-mounted or fixed into a control panel.

Warning

The APT2000PH-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 APT2000PH-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 pH/ORP Transmitter

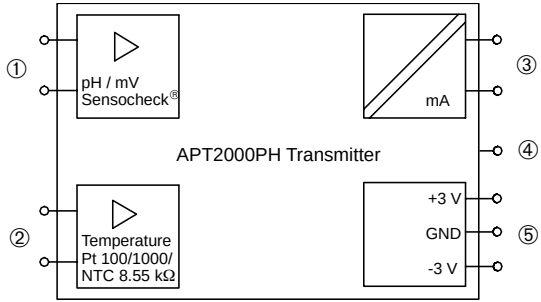


Fig. 6 System functions of APT2000PH Transmitter

① Inputs for pH electrodes (Durafet® / glass and reference electrode)
② Input for temperature probe
③ Current loop 4 – 20 mA, either for pH or mV, transports power to and output signal from the Transmitter,
with APT2000PH-H-.. Transmitter also for HART® communication
④ Equipotential bonding (only with APT2000PH-0(H)-IS Transmitter) (also see Pg. 51)
⑤ Power supply for Durafet® adapter

Terminal Assignment

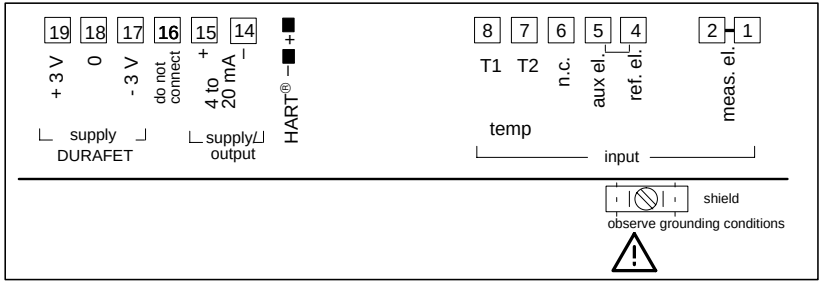


Fig. 7 Terminal assignment of APT2000PH-H-00 Transmitter
Class 1, Div 2, Group A, B, C, D, T4

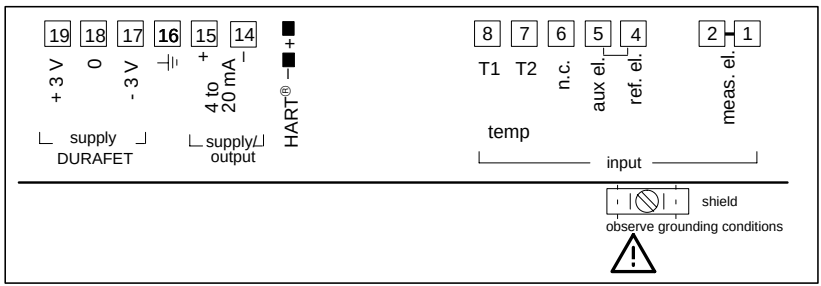


Fig. 8 Terminal assignment of APT2000PH-H-IS Transmitter
IS, Class I, Div 1, Group A, B, C, D, T4
II 2(1) G EEx ib [ia] IIC T6

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 APT2000PH-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 APT2000PH-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 and following for connection examples.

Warning

Do not use cable clamp (shield) for reference electrode connection when auxiliary electrode (solution ground) is in use.

Wiring Diagrams (pH)

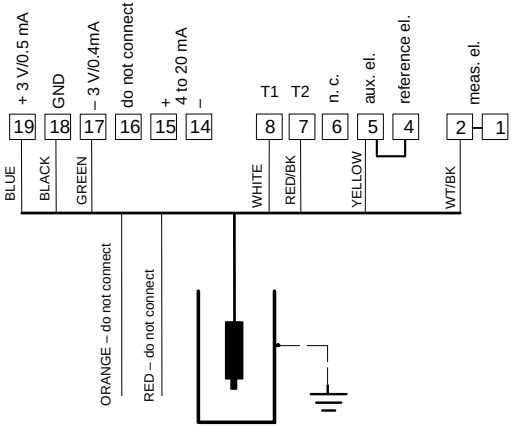


Fig. 9 pH measurement with Durafet® combination electrode, with integrated temperature measurement (without Sensocheck®)

Note

ORANGE and RED wires are not typically connected. These should be clipped and electrically sealed to avoid possible contact with other conductors.

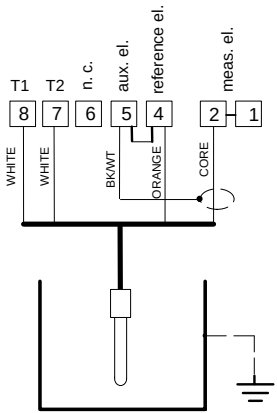


Fig. 10 pH measurement with Meredian® combination electrode,
with integrated temperature measurement and Sensocheck® for the glass electrode

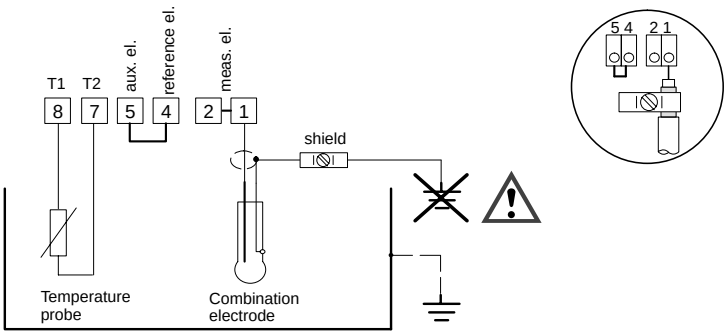


Fig. 11 pH measurement with other manufacturer's combination electrode, with separate temperature measurement and Sensocheck® for the glass electrode

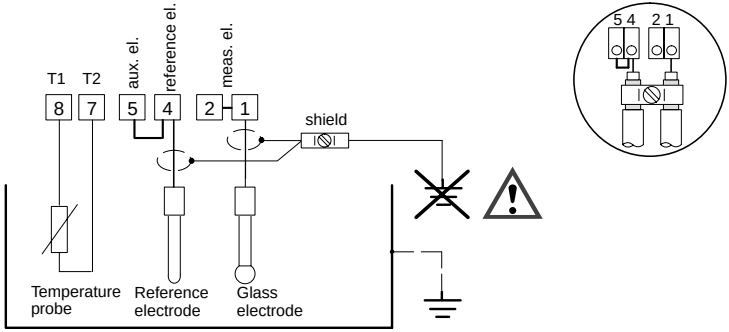


Fig. 12 pH measurement with separate glass and reference electrode, with separate temperature measurement and Sensocheck® for the glass electrode

Wiring Diagrams (ORP)

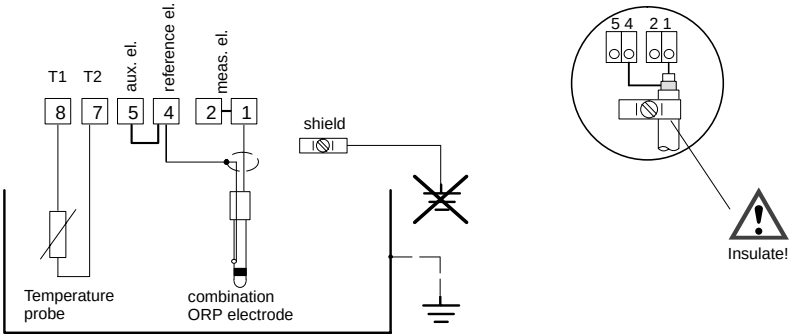


Fig. 13 ORP measurement with separate combination ORP electrode and temperature probe

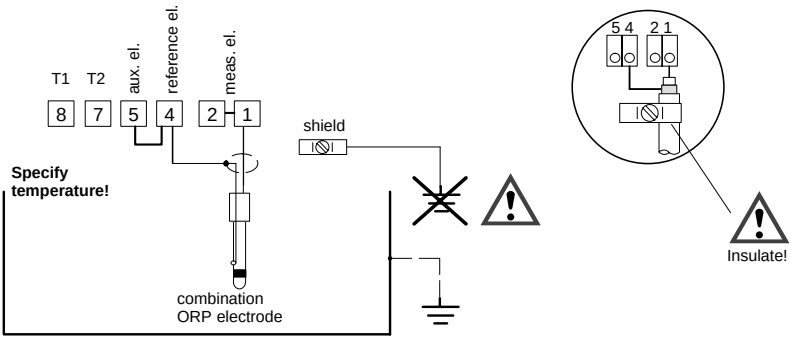


Fig. 14 ORP measurement with combination ORP electrode without temperature probe

3 Operation

User Interface

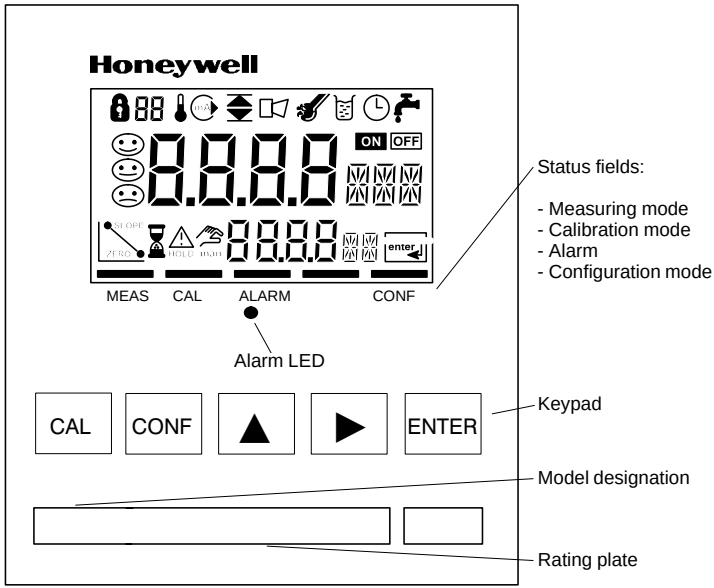


Fig. 15 Front view of Transmitter

Display

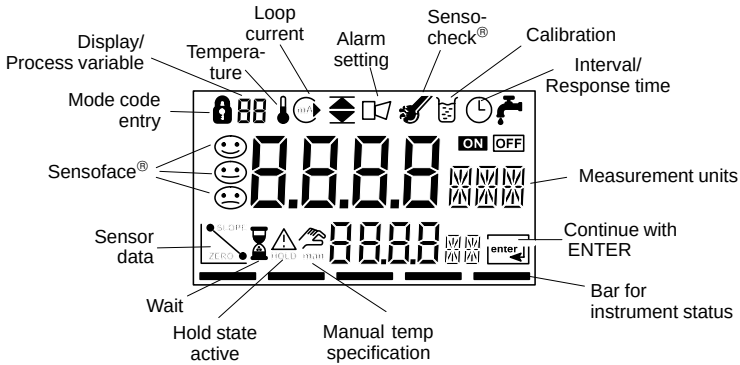


Fig. 16 Transmitter display

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 output current

CAL → ENTER — Cal info, display asymmetry potential (zero) and slope (see Pg. 31)

CONF → ENTER — Error info, display last output error message (see Pg. 31)

▲ + ▶ — Start GainCheck® manual unit self-test (see Pg. 20)

Safety Functions

Sensoface® electrode monitoring

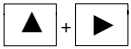
Sensoface® provides information on the electrode state. The asymmetry potential, slope and response time during calibration are evaluated. **Sensocheck**® continuously monitors the glass and reference electrode.

Note

When measuring with a Durafet® electrode, Sensocheck® is not active.

For more detailed information, see chapter “Diagnostic, Maintenance and Cleaning” (Pg. 32).

GainCheck® manual self-test



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

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

Outputs

Loop current

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 beginning and end can be set to any desired value.
To check connected peripherals (e.g. limit switches, controllers), the loop current can be manually specified (see Pg. 36).

HART communication

The APT2000PH-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. 23).

Configuration

Here the basic settings of the Transmitter are carried out. Symbols show which parameter is being configured.

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

Mode code *"1200"*

During configuration 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.

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
	Process variable (when changed, complete configuration required)	pH 0.00 to 14.00 ORP -1,500 to +1,500 mV	**pH**
	Electrode type	Durafet (FEt EL) Glass (GLAS EL)	**FEt EL**
	Temperature display / detection	Auto °C / °F automatic detection man °C / °F manual specification	**Auto °C**
	Temperature probe	Pt 100 / Pt 1000 / NTC 8.55 kΩ	**NTC**
mA	Current beginning, current end	4 mA, 0 to 14 pH, 20 mA, 0 to 14 pH	**4 mA, 0 pH** **20 mA, 14 pH**
mA	Hold state	Last: Last loop current Fix: Specified loop current	**Last**
	22 mA signal for error message	On / OFF	**OFF**
	Sensocheck® (sensor diagnostics) (not for Durafet®)	On / OFF	**OFF**
	Calibration mode: Automatic with Calimatic®	BUF –00– Knick techn. buffers BUF –01– Mettler Toledo techn. buffers BUF –02– Merck/Riedel de Haën BUF –03– Ciba (94) BUF –04– NIST technical buffers BUF –05– NIST standard buffers BUF –06– HACH	**BUF –04–**
	Manual	MAN Manual buffer entry DAT Data entry of premeasured values	
	Calibration timer interval	xxxx hours	**0000 (OFF)**

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

Calibration

Adjustment of nominal zero
CAL 1001

When measuring with a Durafet® electrode, the nominal zero point must be adjusted each time a new electrode is connected. This is important if you want to obtain reliable Sensoface® messages.

The Sensoface® messages issued during all further calibrations are based on this basic calibration.

CAL

Activate calibration by pressing the **CAL** key.
Using the ▲ , ▶ keys enter mode code *"1001"* and then press **ENTER**.

Place the electrode in a pH 7.00 buffer.
Using the ▲ , ▶ keys enter the correct pH value in the range pH 6.50 to 7.50 for the actual temperature (see buffer chart).

ENTER

Press **ENTER** to confirm.

Note

If the zero offset of the electrode is too large (more than ±200 mV), the CAL ERR error message will be generated. In that case the electrode cannot be calibrated.

Stability check:
measured mV value is displayed

Note

The stability check can be aborted with **CAL**. However, accuracy of the calibration will be compromised.

At the end of the adjustment the slope and asymmetry potential (based on 25 °C) of the electrode are displayed. These are not the calibrated values of the electrode! These must still be determined using a complete 2-point calibration (CAL 1100).

ENTER

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

Note

After having adjusted the nominal zero point, be sure to calibrate the electrode following one of the procedures as described on the next pages.

Electrode standardization (CAL 1100)

You can conduct either a one- or a two-point calibration. The calibration can be carried out with the Calimatic® automatic buffer recognition, with manual buffer input or by entering pre-measured electrode data (selected in Conf mode).

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

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

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).

Automatic calibration with Calimatic® BUF and automatic calibration temp detection
(if selected in Conf mode)

Note

The Transmitter can only operate properly when the buffer solutions used correspond to the configured buffer set. Other buffer solutions, even those with the same nominal values, may demonstrate a different temperature behavior. This leads to measurement errors.

CAL

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

CAL 1

Remove the electrode and temperature probe and immerse them in the first buffer solution; it does not matter which buffer solution is taken first.

ENTER

Start calibration with **ENTER**.

While the hour glass flashes, the electrode and temperature probe remain in the first buffer solution.

Note

The response time of electrode and temperature probe is considerably reduced if the electrode is first moved about in the buffer solution and then held still. Stirring provides stable values faster.

Buffer recognition

7.00 pH

Nominal buffer value is displayed

0 mV

Stability check:
measured mV value is displayed

Note

The stability check can be aborted with **CAL**. However, accuracy of the calibration will be compromised.

CAL 2

Calibration with the first buffer is completed. Remove the electrode and temperature probe from the first buffer solution and rinse off both thoroughly.

- ❏ If you would like to carry out a one-point calibration, end the calibration now with **CAL**. The Transmitter then shows the newly determined asymmetry potential in the lower display and the old slope in the main display.
- ❏ If you would like to carry out a two-point calibration, immerse the electrode and the temperature probe in the second buffer solution. Now start the calibration again with **ENTER**. The calibration process runs again as for the first buffer.

At the end of calibration the slope and asymmetry potential (based on 25 °C) of the electrode are displayed. Calibration is ended with **ENTER**. The Transmitter remains in the Hold state. You can now reinstall the electrode and temperature probe and end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Manual calibration MAN
with automatic calibration temp detection
(if selected in Conf mode)

For calibration with manual buffer specification, you must enter the pH value of the buffer solution used in the Transmitter **for the actual temperature**.
This enables calibration with any desired buffer solution.

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

Remove the electrode and temperature probe and immerse them in the first buffer solution; it does not matter which buffer solution is taken first. Confirm with **ENTER**.

Set the pH value of your buffer solution for the actual temperature with ▲ and ▶. Start calibration with **ENTER**.

Note

The response time of electrode and temperature probe is considerably reduced if the electrode is first moved about in the buffer solution and then held still.

Stability check: measured mV value is displayed.

Note

The stability check can be aborted with **CAL**. However, the calibration accuracy will be compromised.

Calibration with the first buffer is completed. Remove the electrode and temperature probe from the first buffer solution and rinse off both thoroughly.

- ❏ If you would like to carry out a one-point calibration, press **CAL** to end the calibration now. The Transmitter then shows the newly determined asymmetry potential (zero point) in the main display and the old slope in the lower display.
- ❏ If you would like to carry out a two-point calibration, immerse the electrode in the second buffer solution. Enter the pH value of the second buffer solution as has been done with the first buffer. Now start the calibration again with **ENTER**. The calibration process runs again as for the first buffer.

At the end of calibration the slope and asymmetry potential (based on 25 °C) of the electrode are displayed. Press **ENTER** to end calibration. The Transmitter remains in the Hold state. You can now reinstall the electrode and temperature probe and end the Hold state with **ENTER**. After 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Data entry of premeasured electrodes DAT
(if selected in Conf mode)

You can directly enter the slope and asymmetry potential of an electrode. The values must be known, e.g. determined beforehand in the laboratory.

CAL — Activate calibration with **CAL**

 Mode code *"1100"*

 Enter asymmetry potential, confirm with **ENTER**

 Enter slope, confirm with **ENTER**

 At the end of calibration the slope and asymmetry potential (based on 25 °C) of the electrode are displayed. Press **ENTER** to end calibration. The Transmitter remains in the Hold state. You can now reinstall the electrode and the temperature probe and end the Hold state with **ENTER**. After a relax time of 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Convert slope [%] to slope [mV/pH] at 25 °C

%	78	80	82	84	86	88	90	92	94	96	98	**100**	102
mV/pH	46.2	47.4	48.5	49.7	50.9	52.1	53.3	54.5	55.6	56.8	58.0	**59.2**	60.4

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.

CAL

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.

ENTER

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 upper display shows the configured process variable (pH or mV) 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.

Manual temperature specification

The  indicator signals that the temperature will be manually specified. The measuring temperature can be set in the configuration, the calibration temperature in calibration.

Hold state

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

For calibration:	Mode code *1001*
	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. 23). 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.

4 Diagnostics, Maintenance and Cleaning

Sensoface®, Sensocheck®

Note

Sensocheck® can only be applied with a glass electrode. When a Durafet® electrode is used, Sensocheck® is not active.

Sensoface® provides information on the electrode state. The slope, asymmetry potential and response time during calibration are evaluated. **Sensocheck®** continuously monitors the glass and reference electrode. With Sensocheck® turned off no ☺ appears.

Three Smileys provide information on wear and required maintenance. However, the unit can still determine the measured variable and output it via the loop current.

Note

The worsening of a Sensoface® criterion leads to the devaluation ☺ or ☹ of the Sensoface® indicator.

An improvement ☺ of the Sensoface® indicator can only take place after calibration or removal of an electrode defect. ☺ is only displayed when Sensocheck® has been activated.

Note

The condition for accurate information is proper calibration.

Sensoface® displays during calibration		
Display	Problem	Status
	Electrode response time	☺ The electrode adjusts slowly. You should consider replacing it. It may be possible to achieve an improvement by cleaning or, in the case of an electrode stored dry, by “watering”. ☹ The electrode adjusts very slowly to the measured value. Correct measurement is no longer ensured. The electrode should be replaced.
	Asymmetry potential and slope	☺ Asymmetry potential (zero point) and slope of the electrode are still okay, however the electrode should be replaced soon. ☹ Asymmetry potential (zero point) and/or slope of the electrode have reached values which no longer ensure proper calibration. It is advisable to replace the electrode.

Sensoface® displays during measurement		
Display	Problem	Status
	Calibration timer	Over 80 % of the calibration interval has already past. The calibration interval has been exceeded.
	Electrode defect	Check the electrode and its connections (also see error messages 33 and 34).

Error Messages

When one of the following error messages is output, the unit can no longer correctly determine the measured 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.

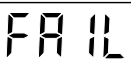
During alarm condition the unit does not switch into Hold state. The current loop will remain active and still represents the currently displayed reading. If 22 mA function is configured (see page 23), error messages will also be indicated with a 22 mA signal.

Error info

CONF ENTER

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. The 20 sec can be reduced by pressing **ENTER**. During error info the unit is not in Hold state.

Error number	Display (flashing)	Problem	Possible causes
Err 01		pH electrode	- Electrode defective - Too little electrolyte in electrode - Electrode not connected - Break in electrode cable - Incorrect electrode connected - Measured pH value less than 0 or greater than +14
Err 02		ORP electrode	- Electrode defective - Electrode not connected - Break in electrode cable - Measured electrode voltage less than –1500 mV or greater than +1500 mV

Error number	Display (flashing)	Problem	Possible causes
Err 03		Temperature probe	- Incorrect temperature probe connected or configured - Open or short circuit in temperature probe - Measured temperature less than –20 °C or greater than +150 °C (NTC: +130 °C)
Err 21		Loop current	- Measured value below configured current beginning - Check configuration current beginning (see Pg. 23)
Err 22		Loop current	- Measured value above configured current end - Check configuration current end (see Pg. 23)
Err 23		Loop current	- Configured current span too large or too small (Difference between current beginning and end)
Err 33		Glass electrode	- Glass electrode defective - Connection cable or electrode cap defective - Connection terminals or electrode cap dirty
Err 34		Reference electrode	- Reference electrode defective - Connection cable or electrode cap defective - Connection terminals or electrode cap dirty - Jumper between terminal 4 and 5 missing (see wiring diagrams on Pg. 14 and the following)
Err 98		System error	- Configuration or calibration data defective; completely reconfigure and recalibrate the unit - Measured value transmission defective - Memory error in unit 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.

Calibration Error Messages

(only during calibration)

Display	Problem	Possible causes
	Asymmetry potential (zero) out of range (±60 mV)	- Electrode “worn out” - Buffer solutions contaminated - Buffer does not belong to configured buffer set - Temperature probe not immersed in buffer solution (for automatic temperature compensation) - Wrong buffer temperature set (for manual temperature specification) - No zero point adjustment performed for electrode with nominal zero point < pH 6 or > pH 8
	Electrode slope out of range (80 – 103 %)	- Electrode “worn out” - Buffer solutions contaminated - Buffer does not belong to configured buffer set - Temperature probe not immersed in buffer solution (for automatic temperature compensation) - Wrong buffer temperature set (for manual temperature specification) - Electrode used has different nominal slope
	Problems during recognition of the buffer solution	- Same or similar buffer solution was used for both calibration steps - Buffer solution used does not belong to buffer set currently configured in the unit - During manual calibration the buffer solutions were not used in the specified order - Buffer solutions contaminated - Electrode defective - Electrode not connected - Electrode cable defective - Wrong buffer temperature set (for manual temperature specification)
	Calibration was canceled after approx. 2 minutes, because the electrode drift was too large.	- Electrode defective or dirty - No electrolyte in the electrode - Electrode cable insufficiently shielded or defective - Strong electric fields influence the measurement - Major temperature fluctuation of the buffer solution - No buffer solution or extremely diluted

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.

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. The 20 sec can be reduced by pressing **ENTER**. During error info the Transmitter is not in Hold state.

Display electrode potential

During electrode maintenance it is useful to directly indicate the electrode potential. This allows, for example, to check electrode response after cleaning.

Pressing **CAL** and entering mode code *"2222"* will display the electrode potential. The Transmitter is 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 function 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 function. Specify the loop current using ▶, ▲ and **ENTER**. The present loop current is shown in the lower display. Pressing **CONF** exits the current source function again.

GainCheck® manual unit self-test

To start press ▲ and ▶ simultaneously.

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

Automatic unit 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 APT2000PH 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 unit may be wiped with a damp, lint-free cloth. A mild household cleaner may also be used if necessary.

5 Annex

Product Line

Units

	Ref. No.
pH/ORP Transmitter for application in safe areas or hazardous locations DIV 2 (USA/Canada only)	APT2000PH-0-00
pH/ORP IS Transmitter for application in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe)	APT2000PH-0-IS
pH/ORP Transmitter with HART® communication for application in safe areas or hazardous locations DIV 2 (USA/Canada only)	APT2000PH-H-00
pH/ORP IS Transmitter with HART® communication, for application in hazardous locations DIV 1 (USA/Canada) / Zone 1 (Europe)	APT2000PH-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 APT2000PH-H-.. Transmitter only)	51205991-001

Specifications

APT2000PH-0(H)-00 Transmitter

pH/mV input		
Ranges	pH value mV value	0.00 to +14.00 -1500 to +1500 mV
Glass	Input resistance Input current (20 °C)**	$> 0.5 \cdot 10^{12}\ \Omega$ $< 2 \cdot 10^{-12}$ A
Reference	Input resistance Input current (20 °C)**	$> 1 \cdot 10^{10}\ \Omega$ $< 1 \cdot 10^{-10}$ A
Max. cable length	Glass electrode	20 m
Accuracy (± 1 count)	pH < 0.02 mV < 1 mV	TC: 0.0021 pH/K TC: 0.1 mV/K
Electrode monitoring	Sensocheck®: Monitoring of glass and reference electrode (can be switched off)	
Alarm limits	Determination during calibration	
Electrode standardization*	– Calimatic® automatic calibration with the buffer sets: -01- Knick technical buffers (correspond to Mettler Toledo techn. buffers) 2.00/4.01/7.00/9.21 -02- Merck/Riedel de Haën 2.00/4.00/7.00/9.00/12.00 -03- Ciba (94) 2.06/4.00/7.00/10.00 -04- Techn. buffers NIST 1.68/4.00/7.00/10.01/12.46 -05- Standard buffers NIST 4.006/6.865/9.180 -06- HACH 4.00/7.00/10.18	

APT2000PH-0(H)-IS Transmitter

pH/mV input EEx ia IIC		
Ranges	pH value mV value	0.00 to +14.00 -1500 to +1500 mV
Glass	Input resistance Input current (20 °C)**	$> 0.5 \cdot 10^{12}\ \Omega$ $< 2 \cdot 10^{-12}$ A
Reference	Input resistance Input current (20 °C)**	$> 1 \cdot 10^{10}\ \Omega$ $< 1 \cdot 10^{-10}$ A
Max. cable length	Glass electrode	20 m
Accuracy (± 1 count)	pH < 0.02 mV < 1 mV	TC: 0.0021 pH/K TC: 0.1 mV/K
Electrode monitoring	Sensocheck®: Monitoring of glass and reference electrode (can be switched off)	
Alarm limits	Determination during calibration	
Electrode standardization*	– Calimatic® automatic calibration with the buffer sets: -01- Knick technical buffers (correspond to Mettler Toledo techn. buffers) 2.00/4.01/7.00/9.21 -02- Merck/Riedel de Haën 2.00/4.00/7.00/9.00/12.00 -03- Ciba (94) 2.06/4.00/7.00/10.00 -04- Techn. buffers NIST 1.68/4.00/7.00/10.01/12.46 -05- Standard buffers NIST 4.006/6.865/9.180 -06- HACH 4.00/7.00/10.18	

APT2000PH-0(H)-00 Transmitter

	– Manual entry of individual buffer values (MAN) – Data entry for pre-measured electrodes (DAT)
Calibration timer	0 to 9999 h
Calibration ranges	Asymmetry potential ± 60 mV Slope 80 to 103 % Display message when range is exceeded (Sensoface®)
Nominal zero	Valid range ± 200 mV Valid pH range pH 6.5 to 7.5 (without automatic temperature correction)
Temp 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*** ± 1 count
Temp compensation	automatic with Pt 100 / Pt 1000 / NTC 8.55 kΩ or manual
Display	LC display, alarm LED
Loop current	4 to 20 mA, floating 22 mA for error message* supply voltage 12 to 30 V
Current error	< 0.3 % of current value ± 50 µA
Current source	3.80 mA to 22.00 mA

APT2000PH-0(H)-IS Transmitter

	– Manual entry of individual buffer values (MAN) – Data entry for pre-measured electrodes (DAT)
Calibration timer	0 to 9999 h
Calibration ranges	Asymmetry potential ± 60 mV Slope 80 to 103 % Display message when range is exceeded (Sensoface®)
Nominal zero	Valid range ± 200 mV Valid pH range pH 6.5 to 7.5 (without automatic temperature correction)
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Resolution	0.1 °C / 1 °F
Accuracy	< 0.5 K*** ± 1 count
Temp compensation	automatic with Pt 100 / Pt 1000 / NTC 8.55 kΩ or manual
Display	LC display, alarm LED
Loop current EEx ib IIC	4 to 20 mA, floating 22 mA for error message* supply voltage 12 to 30 V I_{max} = 100 mA, P_{max} = 0.8 W
Current error	< 0.3 % of current value ± 50 µA
Current source	3.80 mA to 22.00 mA

APT2000PH-0(H)-00 Transmitter

Start/end of scale*	configurable within pH or mV ranges	
Spans*	pH value mV value	2.00 to 14.00 200 to 3000 mV
HART® communication (HART transmitter only)	digital communication via FSK modulation of loop current, point-to-point connection, reading of device identification, measured values, status and messages reading and writing of parameters	
Power supply output	for Durafet cap adapter +3 V / 0.5 mA -3 V / 0.4 mA	
Explosion protection	USA/Canada: Class I, Div 2, Group A, B, C, D, T4	
Data retention	> 10 years (EEPROM)	
RFI suppression	to EN 50081-1 and EN 50081-2	
Immunity to interference	to EN 50082-1 and EN 50082-2	
Temperature	Operating/ambient temp -20 to +55 °C Transport and storage temp -20 to +70 °C	

APT2000PH-0(H)-IS Transmitter

Start/end of scale*	configurable within pH or mV ranges	
Spans*	pH value mV value	2.00 to 14.00 200 to 3000 mV
HART® communication (HART transmitter only)	digital communication via FSK modulation of loop current, point-to-point connection, reading of device identification, measured values, status and messages reading and writing of parameters	
Power supply output	for Durafet cap adapter +3 V / 0.5 mA -3 V / 0.4 mA	
Explosion protection	USA/Canada: IS, Class I, Div 1, Group A, B, C, D, T4 Europe: II 2(1)G EEx ib [ia] IIC T6 CE 0032 TÜV 99 ATEX 1448	
Data retention	> 10 years (EEPROM)	
RFI suppression	to EN 50081-1 and EN 50081-2	
Immunity to interference	to EN 50082-1 and EN 50082-2	
Temperature	Operating/ambient temp -20 to +55 °C Transport and storage temp -20 to +70 °C	

APT2000PH-0(H)-00 Transmitter

Enclosure	Material: thermoplastic polyester, reinforced (polybutylene terephthalate) Protection: IP 65, NEMA 4X 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 ** doubles every 10 K
*** Pt 100: 1K

APT2000PH-0(H)-IS Transmitter

Enclosure	Material: thermoplastic polyester, reinforced (polybutylene terephthalate) Protection: IP 65, NEMA 4X 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 ** doubles every 10 K
*** Pt 100: 1K

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 1448

(4) Equipment or Protective System: **Analytical process transmitter type APT2000 PH-*-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/PX12992.

(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, 1999-06-23

Head of the Certification Body

(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 99 ATEX 1448**

(15) Description of equipment or protective system

The analytical process transmitter type APT2000 PH-*-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 14, 15) 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

pH-measuring loop ..... in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 1/2, 4, 5) Maximum values:
U_o = 10 V
I_o = 12 mA
P_o = 15 mW
R_i = 450 Ω
Characteristic: linear
effective internal capacitance C_i = 50 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 3 µF
max. permissible external inductance L_o = 200 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 mA
P_O = 4 mW
R_i = 1900 Ω
Characteristic: linear
effective internal capacitance C_i = 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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Schedule EC-type examination certificate N° TÜV 99 ATEX 1448

DF-output.....in type of protection "Intrinsic Safety" EEx ia IIC
(terminals 17, 18, 19) Maximum values:
U_o= 10 V
I_o = 14 mA
P_o= 35 mW
R_i= 712 Ω
Characteristic: linear
effective internal capacitance C_i = 25 nF
The effective internal inductance is negligibly small.

max. permissible external capacitance C_o = 3 µF
max. permissible external inductance L_o = 150 mH

EP for the connection to the equipotential bonding system
(Terminal 16)

The current loop is safely separated from the measuring loops and the DF-output up to a voltage of 60 V. The pH-measuring loop, the temperature measuring loop and the DF-output are galvanically connected.

(16) Test documents are listed in the test report No. 99/PX12992.

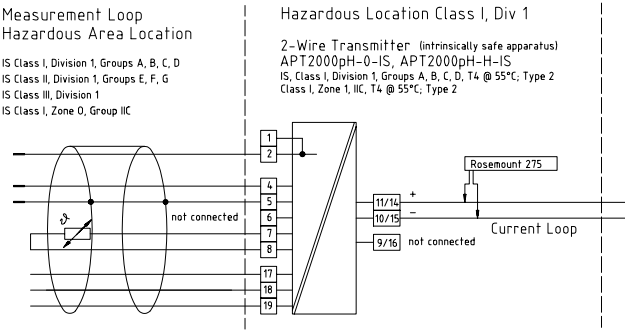
(17) Special condition for safe use

none.

(18) Essential Health and Safety Requirements

no additional ones

Control / Installation drawing



pH-Measuring Loop

Entity Parameters: Terminals 1, 2, 4, 5, and 6
V_t, U_0 = 10 V; I_t, I_0 = 10 mA; P_{max}, P_0 = 25 mW
Class I, Division 1, Groups A & B Class I, Zone 1, IIC
C_a, C_0 = 3 µF; L_a, L_0 = 330 mH
Class I & II, Division 1, Groups C & E Class I, Zone 1, IIB
C_a, C_0 = 9 µF; L_a, L_0 = 1 H
Class I, II, III Division 1, Groups D, F & G Class I, Zone 1, IIA
C_a, C_0 = 24 µF; L_a, L_0 = 1 H

Temp-Measuring Loop

Entity Parameters: Terminals 7 and 8
V_{oc}, U_0 = 5 V; I_{sc}, I_0 = 3 mA; P_{max}, P_0 = 4 mW
Class I, Division 1, Groups A & B Class I, Zone 1, IIC
C_a, C_0 = 2000 µF; L_a, L_0 = 1 H
Class I & II, Division 1, Groups C & E Class I, Zone 1, IIB
C_a, C_0 = 6000 µF; L_a, L_0 = 1 H
Class I, II, III Division 1, Groups D, F & G Class I, Zone 1, IIA
C_a, C_0 = 16000 µF; L_a, L_0 = 1 H

DF-Supply

Entity Parameters: Terminals 17, 18 and 19
V_{oc}, U_0 = 10 V; I_{sc}, I_0 = 14 mA; P_{max}, P_0 = 35 mW
Class I, Division 1, Groups A & B Class I, Zone 1, IIC
C_a, C_0 = 3 µF; L_a, L_0 = 170 mH
Class I & II, Division 1, Groups C & E Class I, Zone 1, IIB
C_a, C_0 = 9 µF; L_a, L_0 = 620 mH
Class I, II, III Division 1, Groups D, F & G Class I, Zone 1, IIA
C_a, C_0 = 24 µF; L_a, L_0 = 1 H

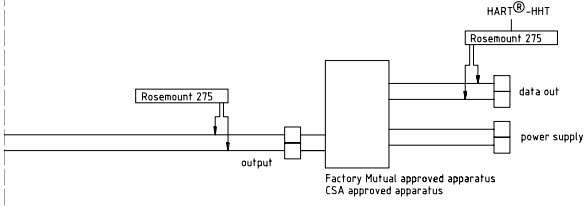
Entity Parameters: Terminals 10/15 and 11/14
V_{max}, U_i = 30 V C_i = 32.4 nF
I_{max}, I_i = 100 mA L_i = 240 µH
P_{max}, P_i = 0.8 W

Entity Parameters: Terminals 1, 2, 4, 5, 6, 7, 8, 17, 18 and 19
V_t, U_0 = 10 V; I_t, I_0 = 27 mA; P_t, P_0 = 66 mW
Class I, Division 1, Groups A & B Class I, Zone 1, IIC
C_a, C_0 = 3 µF; L_a, L_0 = 50 mH
Class I & II, Division 1, Group C Class I, Zone 1, IIB
C_a, C_0 = 9 µF; L_a, L_0 = 180 mH
Class I, II, III Division 1, Group D Class I, Zone 1, IIA
C_a, C_0 = 24 µF; L_a, L_0 = 400 mH

Non-Hazardous Location

Transmitter Power Supply

(associated apparatus)



NOTES :

1: V_{max} , U_i > V_{oc} , V_t , or U_o I_{max} , I_i > I_{sc} , I_t , or I_o P_{max} > P_o

$C_i + C_{cable} < C_a$ or C_o $L_i + L_{cable} < L_a$ or L_o

2: Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70) and ANSI/ISA RP12.6 in US, Canadian Electric Code (Can3-M421) in Canada.

3: Associated apparatus must be FMRC and CSA Approved and must be used in an FMRC and CSA Approved configuration. Use of the Rosemount Model 275 Communicator in Zones is not an FMRC Approved configuration. The control drawing for the associated apparatus must be followed when installing this equipment.

4: Control equipment connected to the associated apparatus must not use or generate more than 250 V.

5: The intrinsically safe equipment connecting to 1, 2, 4, 5, 6 and 7, 8 must be FMRC and CSA Approved or be simple apparatus (a device which will neither generate nor store more than 1.2 V, 0.1 A, 25 mW or 20 mJ). The intrinsically safe equipment connecting to 17, 18 and 19 must be FMRC and CSA Approved.

6: No revisions to drawing without prior FMRC and CSA Approval.

7: Use of the Rosemount Model 275 Communicator is FM Approved for Division use only, see note 3. When using the Rosemount Model 275 Communicator in the loop between the associated apparatus and the APT2000pH-H-IS 2-Wire Transmitter, the maximum loop inductance must be less than the marked La of the associated apparatus to account for the Isc from the Model 275 Communicator. Refer to the Rosemount Installation Drawing 00275-0081 to determine the allowable loop inductance.

8: The Rosemount Model 275 Communicator is not approved by CSA for use in the entity concept. For CSA application the Rosemount Model 275 Communicator must only be used on the non-hazardous side of the barrier/transmitter power supply.

Version **Honeywell**

Buffer Charts

-01- Knick technical buffers
(correspond to Mettler-Toledo technical buffers)

°C	pH			
0	2.03	4.01	7.12	9.52
5	2.02	4.01	7.09	9.45
10	2.01	4.00	7.06	9.38
15	2.00	4.00	7.04	9.32
20	2.00	4.00	7.02	9.26
25	**2.00**	**4.01**	**7.00**	**9.21**
30	1.99	4.01	6.99	9.16
35	1.99	4.02	6.98	9.11
40	1.98	4.03	6.97	9.06
45	1.98	4.04	6.97	9.03
50	1.98	4.06	6.97	8.99
55	1.98	4.08	6.98	8.96
60	1.98	4.10	6.98	8.93
65	1.99	4.13	6.99	8.90
70	1.99	4.16	7.00	8.88
75	2.00	4.19	7.02	8.85
80	2.00	4.22	7.04	8.83
85	2.00	4.26	7.06	8.81
90	2.00	4.30	7.09	8.79
95	2.00	4.35	7.12	8.77

-02- Merck-Titrisole, Riedel Fixanale

°C	pH				
0	2.01	4.05	7.13	9.24	12.58
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33
55	2.00	4.00	6.95	8.76	11.19
60	2.00	4.00	6.96	8.73	11.04
65	2.00	4.00	6.96	8.72	10.97
70	2.01	4.00	6.96	8.70	10.90
75	2.01	4.00	6.96	8.68	10.80
80	2.01	4.00	6.97	8.66	10.70
85	2.01	4.00	6.98	8.65	10.59
90	2.01	4.00	7.00	8.64	10.48
95	2.01	4.00	7.02	8.64	10.37

-03- Ciba (94) buffers
Nominal values: 2.06, 4.00, 7.00, 10.00

°C	pH			
0	2.04	4.00	7.10	10.30
5	2.09	4.02	7.08	10.21
10	2.07	4.00	7.05	10.14
15	2.08	4.00	7.02	10.06
20	2.09	4.01	6.98	9.99
25	2.08	4.02	6.98	9.95
30	2.06	4.00	6.96	9.89
35	2.06	4.01	6.95	9.85
40	2.07	4.02	6.94	9.81
45	2.06	4.03	6.93	9.77
50	2.06	4.04	6.93	9.73
55	2.05	4.05	6.91	9.68
60	2.08	4.10	6.93	9.66
65	2.07*	4.10*	6.92*	9.61*
70	2.07	4.11	6.92	9.57
75	2.04*	4.13*	6.92*	9.54*
80	2.02	4.15	6.93	9.52
85	2.03*	4.17*	6.95*	9.47*
90	2.04	4.20	6.97	9.43
95	2.05*	4.22*	6.99*	9.38*

* extrapolated

-04- NIST technical buffers

°C	pH				
0	1.67	4.00	7.11_5	10.32	13.42
5	1.67	4.00	7.08_5	10.25	13.21
10	1.67	4.00	7.06	10.18	13.01
15	1.67	4.00	7.04	10.12	12.80
20	1.67_5	4.00	7.01_5	10.06	12.64
25	**1.68**	**4.00_5**	**7.00**	**10.01**	**12.46**
30	1.68	4.01_5	6.98_5	9.97	12.30
35	1.69	4.02_5	6.98	9.93	12.13
40	1.69	4.03	6.97_5	9.89	11.99
45	1.70	4.04_5	6.97_5	9.86	11.84
50	1.70_5	4.06	6.97	9.83	11.71
55	1.71_5	4.07_5	6.97	9.83*	11.57
60	1.72	4.08_5	6.97	9.83*	11.45
65	1.73	4.10	6.98	9.83*	11.45*
70	1.74	4.13	6.99	9.83*	11.45*
75	1.75	4.14	7.01	9.83*	11.45*
80	1.76_5	4.16	7.03	9.83*	11.45*
85	1.78	4.18	7.05	9.83*	11.45*
90	1.79	4.21	7.08	9.83*	11.45*
95	1.80_5	4.23	7.11	9.83*	11.45*

* values complemented

-05- NIST standard-buffers

°C	pH		
0	4.010	6.984	9.464
5	4.004	6.951	9.395
10	4.000	6.923	9.332
15	3.999	6.900	9.276
20	4.001	6.881	9.225
25	**4.006**	**6.865**	**9.180**
30	4.012	6.853	9.139
35	4.021	6.844	9.102
40	4.031	6.838	9.068
45	4.043	6.834	9.038
50	4.057	6.833	9.011
55	4.071	6.834	8.985
60	4.087	6.836	8.962
65	4.109	6.841	8.942
70	4.126	6.845	8.921
75	4.145	6.852	8.903
80	4.164	6.859	8.885
85	4.185	6.868	8.868
90	4.205	6.877	8.850
95	4.227	6.886	8.833

-06- HACH buffers

Nominal values: 4.00, 7.00, 10.18

°C	pH		
0	4.00	7.14	10.30
5	4.00	7.10	10.23
10	4.00	7.04	10.11
15	4.00	7.04	10.11
20	4.00	7.02	10.05
25	4.01	7.00	10.00
30	4.01	6.99	9.96
35	4.02	6.98	9.92
40	4.03	6.98	9.88
45	4.05	6.98	9.85
50	4.06	6.98	9.82
55	4.07	6.98	9.79
60	4.09	6.99	9.76
65	4.09*)	6.99*)	9.76*)
70	4.09*)	6.99*)	9.76*)
75	4.09*)	6.99*)	9.76*)
80	4.09*)	6.99*)	9.76*)
85	4.09*)	6.99*)	9.76*)
90	4.09*)	6.99*)	9.76*)
95	4.09*)	6.99*)	9.76*)

* values complemented

Buffer values up to 60 °C as specified by Bergmann & Beving Process AB.

Glossary

Asymmetry potential (zero point)
The voltage which a pH electrode gives off at a pH of 7. The asymmetry potential is different for every electrode and changes with age and wear.

Buffer set
Contains selected buffer solutions which can be used for automatic calibration with the Calimatic® feature. The buffer set must be selected prior to calibration.

Buffer solution
Solution with an exactly defined pH value for calibrating a pH meter.

Calibration
Adjustment of the pH meter to the current electrode characteristics. The asymmetry potential (zero point) and slope are adjusted. Either a one-or two-point calibration can be carried out. With one-point calibration only the asymmetry potential is adjusted.

Calibration buffer set
See Buffer set.

Calimatic®
Automatic buffer recognition. Before the first calibration, the buffer set used must be activated once. The patented Calimatic® then automatically recognizes the buffer solution used during calibration.

Cap adapter
Adapter integrated in the protective cap of the Durafet® electrode. Here, the signal of the pH-sensitive FET is converted to a voltage corresponding to the signal of a glass electrode. This voltage is led to the pH input of the Transmitter and is processed further as usual. The adapter is directly supplied from the Transmitter.

Combination electrode
Combination of glass and reference electrode in one body.

Durafet®
Durafet® combination pH/ORP electrodes consist of an ISFET measuring electrode, a reference electrode and a temperature sensor. A cap adapter provides a pH signal similar to a glass electrode to allow connection to any conventional pH meter.

Electrode slope
Is indicated in % of the theoretical slope (59.2 mV/pH at 25 °C). The electrode slope is different for every electrode and changes with age and wear.

Electrode zero point
See Asymmetry potential.

Equipotential bonding
Connection to ground to protect against electrostatic discharge within intrinsically safe installations (necessary only for meeting CENELEC/ATEX requirements – not required by FM/CSA).

GainCheck®
Unit self-test which runs automatically in the background at fixed intervals. The memory and measured-value transmission are checked. You can also start the GainCheck® manually (see Pg. 20). Then a display test is also conducted and the software version displayed.

HART®
Highway **A**ddressable **R**emote **T**ransducer, digital communication via FSK modulation of the loop current

Meredian®
Meredian® combination pH/ORP electrodes consist of a glass or metallic measuring electrode, a reference electrode and a temperature probe. They include a permanent reference junction and gel fill for maintenance-free operation.

Mode code
Preset four-digit number to select certain modes.

One-point calibration
Calibration with which only the electrode asymmetry potential (zero point) is taken into consideration. The previous slope value is retained. Only one buffer solution is required for a one-point calibration.

pH electrode system
A pH electrode system consist of a glass and a reference electrode. If they are combined in one body, they are referred to as a combination electrode.

Response time
Time from the start of a calibration step to the stabilization of the electrode potential.

Sensocheck®
Sensocheck® continuously monitors the glass and reference electrodes. The resulting information is indicated by the Sensoface® indicators.
Sensocheck® can be switched off.

Sensoface®
Sensoface® provides information on the status of the electrode. The zero point, slope and response time are evaluated. In addition, the Sensocheck® information is indicated.

Slope	See Electrode slope.	**Zero point**	See Asymmetry potential.
Two-point calibration	Calibration with which the electrode asymmetry potential (zero point) and slope are determined. Two buffer solutions are required for two-point calibration.	**Zero point adjustment**	Basic adjustment of the Durafet® electrode to ensure reliable Sensoface® information.

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