pH and Conductivity

USER MANUAL

of firmware version 1.10

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1 TECHNICAL DATA

1.1 Specifications

- **Supported sensor**:

pH sensor	up to 14.000 pH measure range
Conductivity sensor	from 0.1 uS up to 1000 mS measure range with various cell constants K. Recommend cell constant K in particular measured range due to the best accuracy: K = 0.01 cm^{-1} (measured range from 0.1 uS to 30 uS) K = 0.1 cm^{-1} (measured range from 0.1 uS to 3000 uS) K = 1 cm^{-1} (measured range from 1 uS to 15 mS) K = 2 cm^{-1} (measured range from 1 uS to 100 mS) K = 10 cm^{-1} (measured range from 10 uS to 1000 mS)
Temperature sensor	NTC 10k Thermistor (R25 = 10kΩ ± 2% by 25 °C, B25/100: 3474 ± 2.5%) for temperature compensation.

- **Measurement range**:

pH sensor:	0.000 pH - 14.000 pH
Conductivity sensor:	0.1 uS - 1000.0 mS
Temperature sensor:	-80 °C - +80 °C
Battery:	0.000 V - 4.800 V

- **Resolution**:

pH sensor:	approx. 0.004 pH (Accuracy of the resolution depends on calibration
Conductivity sensor:	0.1 uS from 0.1 uS to 2500 uS by K = 1 cm^{-1}. From 2500 uS the value of resolution grows up geometrical by K = 1 cm^{-1}. Approx. 0.2 uS by 4000 uS, approx. 0.5 uS by 7000 uS. (Accuracy of the resolution depends on calibration and cell constant K)
Temperature sensor:	0.1 °C
Battery:	0.016 V

- **Accuracy**:

pH sensor:	± 0.010 pH
Conductivity sensor:	± 2 % (Accuracy depends on calibration and cell constant K)
Temperature sensor:	± 0.5 °C
Battery:	± 1 %

- **Power**:

3.6 Battery 2400mAh (5 Years operating with one calibration)
(4 Years operating with more calibrations and common use)
Up to 4 mA by measure.
45 uA by sleep mode.

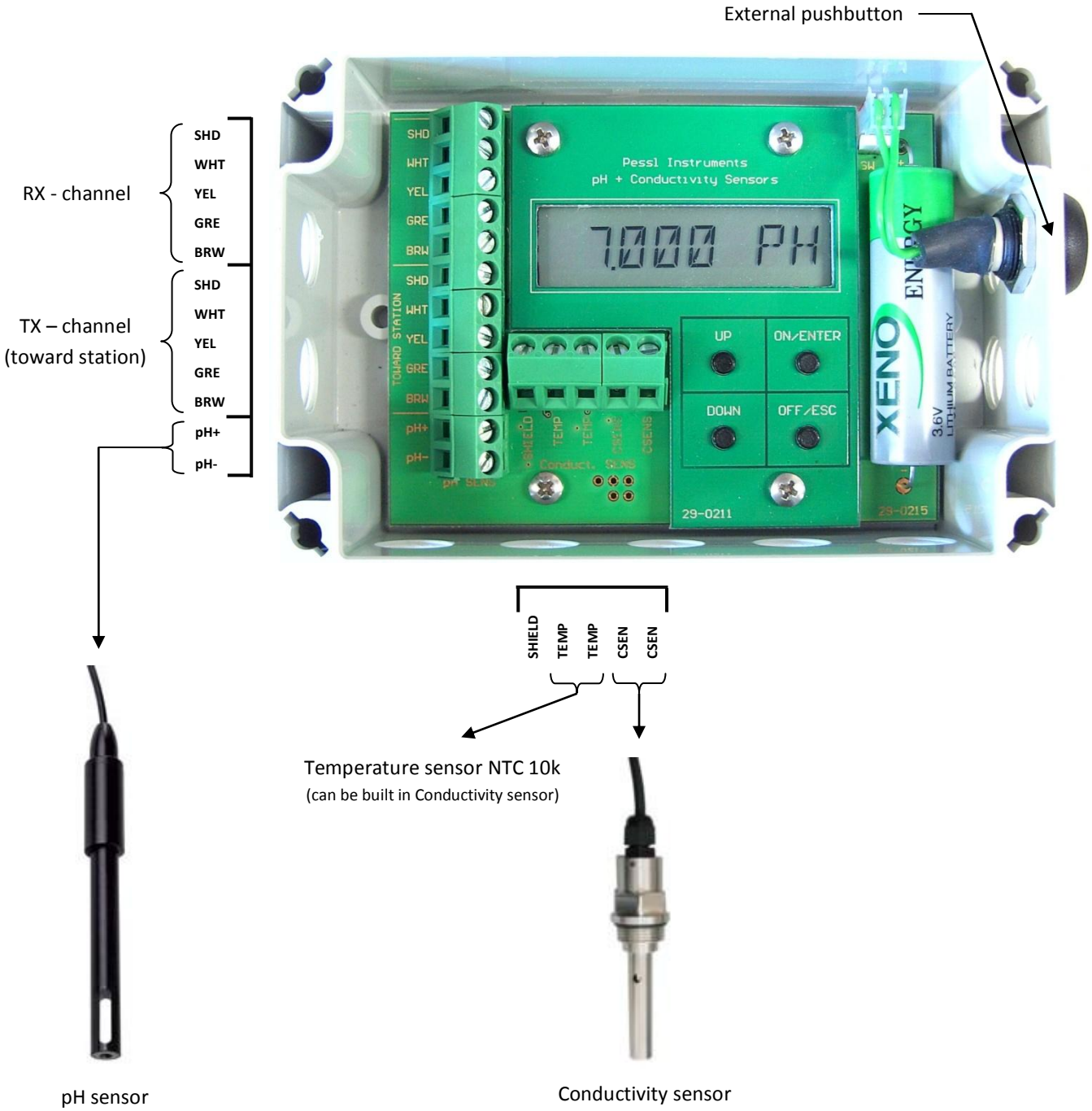
- **Operating temperature**:

-15 °C - +80 °C

- **Data Output/Input**:

Protocol 1.0 of Pessl Intruments (through RS-485).

1.2 Connection Schema



2 CALIBRATION MENU

- Calibration menu starting: "**ON**" Pushbutton.

  `CAL. MENU` - Introduction display

  or:

  `NO CAL` - The hardware is not calibrated of production. Calibration main menu is not available. Contact the producer!

- Item switching in calibration menu: "**UP**" and "**DOWN**" Pushbuttons.

  1. `PH CAL.` - pH sensor calibration
  2. `C CAL.` - Conductivity sensor calibration
  3. `PH MEAS.` - pH sensor measure
  4. `C MEAS.` - Conductivity sensor measure
  5. `T MEAS.` - Temperature sensor measure
  6. `BAT MEAS.` - Battery voltage measure
  7. `SETTINGS` - Settings
  8. `FW VER.` - Current firmware version

- Menu item choosing: "**ENTER**" Pushbutton.
- Turn off the calibration menu: "**OFF**" Pushbutton or automatic after **10 seconds**.

2.1 pH Calibration

- pH sensor calibration starting (1. Item of the calibration menu): "**ON**" Pushbutton.

  Ph calibration mode realizes 2 calibrations with 2 various calibration solutions:

  1. calibration:

  `1.PH SOL.` - Introduction display of 1. calibration solution (approx. 1 sec.)

  after that:

  `1.000 PH` to `12.450 PH` - Calibration solution choosing with "**ENTER**" pushbutton. Solution switching with "**UP**" and "**DOWN**" pushbuttons. List of all support calibration solutions of pH in chapter 4.1.

  after choice:

  `- WAIT...` - Calibration (can take the time from 90 seconds to approx. 4 min)

  `-` or `□` or `□` - Characters mean stable measured value, increase or decrease of current measured value during the calibration.

ABORT	- Calibration is possible to abort with "**ESC**" pushbutton during calibration measure.

successful calibration:

DONE	- Then the calibration is necessary to confirm with "**ENTER**" pushbutton.

after confirmation 2. Calibration begins:

2. calibration:

2.PH SOL.	- Introduction display of 2. calibration solution (approx. 1 sec.)

after that:

1.000 PH to 12.450 PH	- Calibration solution choosing with "**ENTER**" pushbutton. Solution switching with "**UP**" and "**DOWN**" pushbuttons. List of all support calibration solutions of pH in chapter 4.1.
7.000*PH	- This character " * " means warning of already used calibration solution after 1. calibration.

after choice:

- WAIT...	- Calibration (can take the time from 90 sec. to approx. 4 min.)
- or □ or □	- Characters mean stable measured value, increase or decrease of current measured value during the calibration.
ABORT	- Calibration is possible to abort with "**ESC**" pushbutton during calibration measure.

successful calibration:

DONE	- Then the calibration is necessary to confirm with "**ENTER**" pushbutton.

after confirmation the calculation begins:

Final calculations of calibration values:

CALC...OK	- Displayed text, when the calculation is done (approx. 1 sec.).
END OF C.	- After the calculation comes automatically the end of the pH calculation (approx. 1 sec.) and return to the calibration main menu.

Cancel the pH calibration after 1. Calibration (if the calibration measure is not in progress):

CANC. Y/N	- Calibration is possible to cancel with "**ESC**" pushbutton. > Yes = "**ON**" pushbutton (pH calibration canceled and returned to the calibration main menu) > No = "**ESC**" pushbutton (pH calibration continues).

2.2 Conductivity Calibration

- Conductivity sensor calibration starting (2. Item of the calibration menu): "**ON**" Pushbutton.

Conductivity calibration mode realizes only 1 calibration with 1 chosen calibration solution:

1. calibration:

`COND. SOL.` - Introduction display (approx. 1 sec.)

after that:

`25.0 uS` to `111.80 mS` - Calibrations solution choosing with "**ENTER**" pushbutton. Solution switching with "**UP**" and "**DOWN**" pushbuttons. List of all support calibration solutions of conductivity in chapter 4.2.

after choice:

`- WAIT...` - Calibration (can take the time from 30 seconds to approx. 3 min)

`-` or `□` or `□` - Characters mean stable measured value, increase or decrease of current measured value during the calibration.

`ABORT` - Abort the calibration with "**ESC**" pushbutton during calibration measure.

unsuccessful calibration:

`T ERROR` - When the temperature sensor in not connected. To repeat the calibration measure push "**ENTER**" button.

`C ERROR` - When the conductivity sensor is not connected. To repeat the calibration measure push "**ENTER**" button.

or successful calibration:

`DONE` - Then the calibration is necessary to confirm with "**ENTER**" pushbutton.

after confirmation the calculation begins:

Final calculations of calibration value:

`CALC...OK` - Displayed text, when the calculation is done (approx. 1 sec.).

`END OF C.` - After the calculation comes automatically the end of the pH calculation (approx. 1 sec.) and return to the calibration main menu.

Cancel the conductivity calibration after the calibration (if the calibration measure is not in progress):

`CANC. Y/N` - Calibration is possible to cancel with "**ESC**" pushbutton.
- > Yes = "**ON**" pushbutton (pH calibration canceled and returned to the calibration main menu)
- > No = "**ESC**" pushbutton (pH calibration continues).

2.3 pH Sensor Measure

- pH sensor measure starting (3. Item of the calibration menu): "**ON**" Pushbutton.

  3 possible situations:

  1. situation:

  `MEASURE` - Displayed text, when the measure is in progress (approx. 1.5 sec.)

  after measure:

  `7.000 PH` - Displayed measured pH value in range 0.000 to 14.000 pH (f. e. 7.000 pH)

  or

  `NO VALUE` - Immeasurable value.

  or 2. situation:

  `NO CAL` - The pH sensor is not calibrated. It is not possible to measure.

  or 3. situation:

  `SENS OFF` - The pH sensor measure circuit is turned off. It is not possible to measure.

- pH sensor measure repeat: "**ENTER**" Pushbutton.
- Close the pH sensor measure: "**ESC**" Pushbutton or automatic after **15 seconds** (then is turned off the menu)

2.4 Conductivity Sensor Measure

- Conductivity sensor measure starting (4. Item of the calibration menu): "**ON**" Pushbutton.

  3 possible situations:

  1. situation:

  `MEASURE` - Displayed text, when the measure is in progress (approx. 1.5 sec.)

  After measure:

  `1413.0 uS` - Displayed measured conductivity value in range 0.1 uS to 999.9 mH (f. e. 1413.0 uS)

  or

  `OUT OF R` - Out of range!

  or 2. situation:

  `NO CAL` - The conductivity sensor is not calibrated. It is not possible to measure.

  or 3. situation:

  `SENS OFF` - The conductivity sensor measure circuit is turned off. It is not possible to measure.

- Conductivity sensor measure repeat: "**ENTER**" Pushbutton.
- Close the conductivity sensor measure: "**ESC**" Pushbutton or automatic after **15 seconds** (then is turned off the menu)

2.5 Temperature Sensor Measure

- Temperature sensor measure starting (5. Item of the calibration menu): "**ON**" Pushbutton.

  2 possible situations:

  1. situation:

  `MEASURE` - Displayed text, when the measure is in progress (approx. 0.3 sec.)

  After measure:

  `25.5 °C` - Displayed measured temperature value in range -80.0 °C to 80.0 °C (f. e. 25.5°C)

  or

  `NO VALUE` - No connected temperature sensor!

  or 2. situation:

  `SENS OFF` - The temperature sensor measure circuit is turned off. It is not possible to measure.

- Temperature sensor measure repeat: "**ENTER**" Pushbutton.
- Close the conductivity sensor measure: "**ESC**" Pushbutton or automatic after **15 seconds** (then is turned off the menu)

2.6 Battery Measure

- Battery measure starting (6. Item of the calibration menu): "**ON**" Pushbutton.

  `MEASURE` - Displayed text, when the measure is in progress (approx. 0.3 sec.)

  After measure:

  `3632 mV` - Displayed measured battery value in range from the lowest measured battery voltage to 4080 mV. (f. e. 3632 mV). The full battery has 3600 to 3700 mV as standard.

  or

  `<3.400 mV` - The battery voltage is lower than displayed value. Min. battery voltage by which is possible the battery to measure. (Event of too low battery.)

- Battery measure repeat: "**ENTER**" Pushbutton.
- Close the battery measure: "**ESC**" Pushbutton or automatic after **10 seconds** (then is turned off the menu)

2.7 Settings

- Submenu of settings starting (7. Item of the calibration menu): "**ON**" Pushbutton.
- Item switching in settings submenu: "**UP**" and "**DOWN**" Pushbuttons.

4 settings submenu items:

1. item (Enable setting of pH sensor measure circuit):

`PH ON`	- Enables the pH sensor measure.
`PH OFF`	- Disables the pH sensor measure (When the pH sensor is not used!).

2. item (Enable setting of conductivity sensor measure circuit):

`C ON`	- Enables the conductivity sensor measure.
`C OFF`	- Disables the conductivity sensor measure (When the conductivity sensor is not used!).

3. item (Enable setting and type of temperature sensor measure circuit):

`T NTC10K`	- Enables the temperature sensor NTC 10k Thermistor.
`T OFF`	- Disables the temperature sensor measure (When the temperature sensor is not used!).

4. item (Temperature offset):

`T-O 0.0`	- Current temperature offset (f.e. 0.0 °C). Setup of temperature offset by pushing the "**ENTER**" Pushbutton. The offset setting is important due to temperature difference between various temperature sensors. After temperature offset change is **recommended** new conductivity calibration!
`T-O* 0.8`	- Change the temperature offset with "**U**P" and "**DOWN**" pushbuttons. With "**ENTER**" pushbutton is necessarily to confirm the new offset value.

- Change the settings: "**ENTER**" Pushbutton.
- Close the settings: "**ESC**" Pushbutton or automatic after **10 seconds** (then is turned off the menu)

2.8 Firmware Version

- Firmware version information starting (8. Item of the calibration menu): "**ON**" Pushbutton.
- Information about current firmware version, producer and year of production.

`V. 1.00` - Displayed text of current firmware version (approx. 2 sec.).

then

`PESSL INSTRUMENTS 2011` - Displayed text of producer and year of production.

- Close the information about firmware version: "**ESC**" Pushbutton or automatic after **12 seconds**.

2.9 Events

- Various possible events :

BAT LOW	- When the battery has value lower than approx. 3.4 V. There is no possible to execute any calibration.
SLEEP	- The PC-Board goes into SLEEP mode after 60 seconds waiting on any pushed button (only during the calibration).
CONTINUE	- Return from SLEEP mode and continue in calibration.
NO CAL	- The sensor is not calibrated. It is not possible to measure.
SENS OFF	- The sensor measure circuit is turned off. It is not possible to measure.

3 EXTERNAL PUSHBUTTON

- External pushbutton measures all calibrated and enabled sensors (ph, conductivity, temperature sensor and battery).
- Item choosing with external pushbutton.
- Turning off automatic after **15 seconds** or switching over the last item (over battery result).

MEASURE	- Displayed text, when the measure is in progress (approx. up to 2 sec.)

After measure follow the result of pH sensor, when the sensor is enabled:

PH SEN.	- Introduction display of pH sensor measure (approx. 0.6 sec.)

After that:

7.000 PH	- Displayed measured pH value in range 0.000 to 14.000 pH (f. e. 7.000 pH)

or:

NO VALUE	- Immeasurable value.

or:

NO CAL	- The pH sensor is not calibrated. It is not possible to measure.

The result of conductivity sensor follows, when the sensor is enabled:

C SEN.	- Introduction display of conductivity sensor measure (approx. 0.6 sec.)

After that:

1413.0 uS

- Displayed measured conductivity value in range 0.1 uS to 999.9 mH (f. e. 1413.0 uS)

or:

`OUT OF R` - Out of range!

or:

`NO CAL` - The conductivity sensor is not calibrated. It is not possible to measure.

The result of temperature sensor follows, when the sensor is enabled:

`TEMP` - Introduction display of temperature sensor measure (approx. 0.6 sec.)

After that:

`25.5 °C` - Displayed measured temperature value in range -80.0 °C to 80.0 °C (f. e. 25.5°C)

The battery result follows:

`BATTERY` - Introduction display of battery measure (approx. 0.6 sec.)

After that:

`3632 mV` - Displayed measured battery value in range from the lowest measured battery voltage to 4080 mV. (f. e. 3632 mV). The full battery has 3600 to 3700 mV as standard.

or:

`<3.400 mV` - The battery voltage is lower than displayed value. Min. battery voltage by which is possible the battery to measure. (Event of too low battery.)

4 RECOMMENDED CALIBRATION SOLUTIONS

4.1 Supported pH Calibration Solutions

- 1.000 pH
- 1.090 pH
- 1.679 pH
- 2.000 pH
- 3.000 pH
- 3.776 pH
- 4.000 pH
- 4.010 pH
- 4.650 pH
- 5.000 pH
- 6.000 pH
- 6.865 pH
- 7.000 pH
- 7.413 pH
- 8.000 pH
- 9.000 pH
- 9.180 pH
- 9.230 pH
- 10.000 pH
- 10.012 pH
- 11.000 pH
- 12.000 pH
- 12.450 pH

4.2 Supported Conductivity Calibration Solutions

- 25.0 uS
- 84.0 uS
- 146.9 uS
- 180.0 uS
- 1000.0 uS
- 1015.0 uS
- 1413.0 uS
- 1990.0 uS
- 5000.0 uS
- 12.85 mS
- 12.88 mS
- 18.0 mS
- 80.0 mS
- 111.3 mS
- 111.8 mS

5 USER MANUAL CHANGES

USER MANUAL REVISION	PCB FIRMWARE VERSION	CHANGES
Rev001	**1.0X**	- First release of user manual.
Rev002	**1.10**	- Changed temperature system from Pt100 to NTC 10k Thermistor.