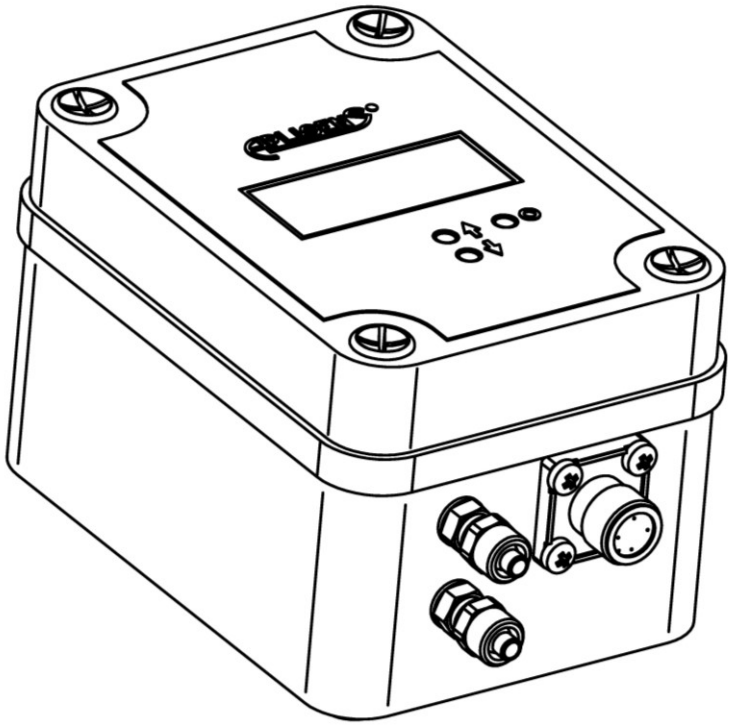
EN.IO.APREGN
SEPTEMBER 2020
Revision 02.A.002

USER'S MANUAL

SMART DIFFERENTIAL PRESSURE TRANSMITTER
for low ranges

APRE-2000GN



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Symbols used

Symbol	Description
	Warning to proceed strictly in accordance with the information contained in the documentation in order to ensure the safety and full functionality of the device.
	Information particularly useful during installation and operation of the device.
	Information on disposal of used equipment.

BASIC REQUIREMENTS AND SAFE USE

The manufacturer will not be liable for damage resulting from incorrect installation, failure to maintain suitable technical condition of the device, or use of the device other than for its intended purpose.

Installation should be carried out by qualified staff having the required authorizations to install electrical and I&C equipment. The installer is responsible for performing the installation in accordance with manual as well as with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.

In systems with I&C equipment, in case of leakage, there is a danger to staff due to the medium under pressure. All safety and protection requirements must be observed during installation, operation and inspections.

If a malfunction occurs, the device should be disconnected and handed over to the manufacturer for repair.

In order to minimize the risk of malfunction and associated risks to staff, the device is not to be installed or used in particularly unfavourable conditions, where the following hazards occur:

- possible mechanical impacts, excessive shocks and vibration;
- excessive temperature fluctuation;
- water vapour condensation, dusting, icing.

Changes made to the manufacturing of products may be introduced before the paper version of the manual is updated. The up-to-date manuals are available on the manufacturer's website: www.aplisens.com.

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1. INTRODUCTION

1.1. Purpose of the document

The subject of manual is smart differential pressure transmitters **APRE-2000GN** in standard version. The manual contains data, tips and general recommendations for safe installation and operation of the transmitters, as well as troubleshooting in case of possible failure.

1.2. Trademarks

HART® is a registered trademark of FieldComm Group.
Windows® – is a registered trademark of Microsoft Corporation.
Google Play® – is a service registered and managed by Google® Inc

1.3. Definitions and abbreviations

Table 1. Definitions and abbreviations.

Item no.	Abbr.	Meaning
1	**LRV**	"Lower Range Value" – the value of the set range expressed in physical units corresponding to the current of 4.000 mA, i.e. 0% of the output setpoint. The set range cannot exceed the set range limits. The minimum width of the set range **|(URV-LRV)|** is limited to 10 % of the base range **(URL-LRL)**.
2	**URV**	"Upper Range Value" — the value of the set range expressed in physical units corresponding to the current of 20.000mA, i.e. 100% of the output setpoint. The set range cannot exceed the set range limits. The minimum width of the set range**(URV-LRV)|** is limited to 10 % of the base range **(URL-LRL)**.
3	**LRL LSL**	"Lower Range Limit" or "Lower Sensor Limit" – lower limit of set range expressed in physical units. Value **(URL-LRL)** or **(USL-LSL)** is referred to as the base transmitter range.
4	**URL USL**	"Upper Range Limit" or "Upper Sensor Limit" – upper limit of set range expressed in physical units. Value **(URL-LRL)** or **(USL-LSL)** is referred to as the base transmitter range.
5	**LPL**	"Lower Processing Limit" – lower limit of digital processing of measured value. The transmitter processes a digital measurement up to 50 % of the base range width below the lower limit of set range LRL (LSL). After reaching the LPL and when below this value up to LSAL, the transmitter freezes the refreshing of digital value of the measurement. In this situation, message "UndEr" will be displayed on the display and diagnostic alarm mode will be activated depending on the settings I_AL < 3.650 mA or I_AL > 21.500 mA. Additionally, collective status PV_OUT_OF LIMITS and status PV_LOW_LIMITED in the Transducer Block will be set, which can be read out in the diagnostic tab via HART communication.
6	**UPL**	"Upper Processing Limit" – upper limit of digital processing of measured value. The transmitter processes a digital measurement up to 50% of the base range width above the upper limit of set range **URL (USL).** After reaching the **UPL** and when above this value up to **USAL**, the transmitter freezes the refreshing of digital value of the measurement. In this situation, message "OvEr" will be displayed on the display and diagnostic alarm mode will be activated depending on the settings I_AL< 3.650 mA or I_AL > 21.500 mA. Additionally, collective status PV_OUT_OF LIMITS and status PV_HIGH_LIMITED in the Transducer Block will be set, which can be read out in the diagnostic tab via HART communication.
7	**LSAL**	"Lower Saturation Limit" – lower limit of the A/D transmitter processing range. The lower limit of the A/D transmitter saturation is on the pressure/differential pressure scale below the **LPL** point and is associated with the minimum pressure, at which the analogue-digital pressure measurement transmitter reaches the lower limit of the processing capacity. The exact determination of this pressure is not possible, however usually the pressure does not exceed the pressure corresponding to 200 % of the base range width **(URL-LRL)** below the lower limit of the digital processing of measured **LPL** value. After reaching **LSAL** and when below this value, error number E0256 will be displayed and the diagnostic alarm mode will be activated depending on the settings I_AL < 3.650 mA or I_AL > 21.500 mA. Additionally, collective status SENSOR_FAULT, PV_OUT_OF LIMITS, status NOREF+ERR@AIN1_AD7794 in the Sensor Block and PV_LOW_LIMITED in the Transducer Block will be set, which can be read out in the diagnostic tab via HART communication.

8	**USAL**	"Upper Saturation Limit" – upper limit of the A/D transmitter processing range. The upper limit saturation point of A/D transmitter is on the pressure/differential pressure scale above the **UPL** point and is associated with the maximum pressure at which the analogue-digital pressure measurement transmitter reaches the upper limit of the processing capacity. The exact determination of this pressure is not possible, however usually the pressure does not exceed the pressure corresponding to 200% of the base range width **(URL-LRL)** above the upper limit of the digital processing of measured **UPL** value. After reaching **USAL** and when above this value, error number E0256 will be displayed and the diagnostic alarm mode will be activated depending on the settings I_AL < 3.650 mA or I_AL > 21.500 mA. Additionally, collective status SENSOR_FAULT, PV_OUT_OF LIMITS, status NOREF+ERR@AIN1_AD7794 in the Sensor Block and PV_HIGH_LIMITED in the Transducer Block will be set, which can be read out in the diagnostic tab via HART communication.
9	**AL_L**	Low current alarm (I < 3.650 mA).
10	**AL_H**	High current alarm (I > 21.500 mA).
11	**I_AL**	The alarm current set by the transmitter controller in the current loop.

1.4. Transmitter set range

The figure below shows the transmitter set range and limits related to allowable set range, digital processing range and saturation limits of A/D pressure measurement transducer. As standard, values of 4 mA/20 mA currents are assigned to LRV/URV points. In order to obtain reverse characteristics, it is possible to reverse the assignment so that the LRV/URV points are assigned to 20 mA/4 mA currents.

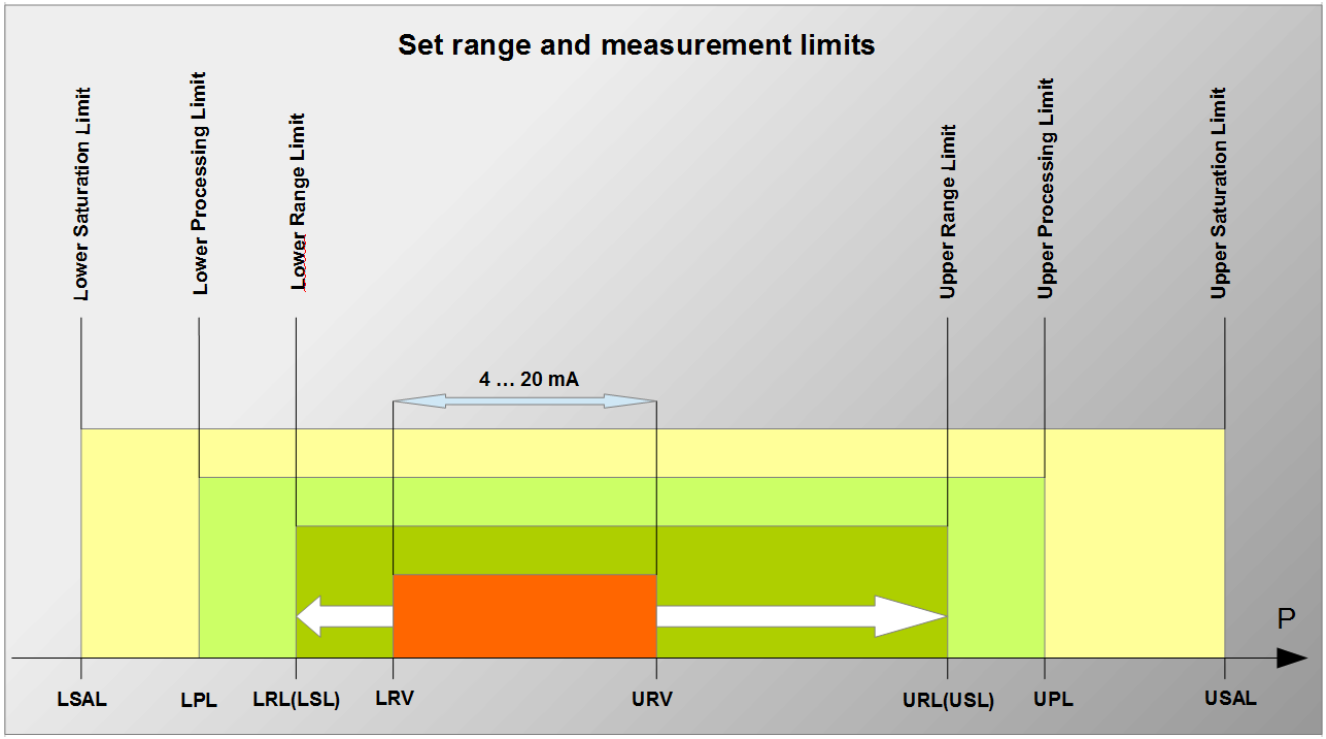


Figure 1. Set range and measurement limits.

2. SAFETY

- The installation and start-up of the device and any activities related to operation shall be carried out after thorough examination of the contents of user's manual and the instructions related thereto;
- installation and maintenance should be carried out by qualified staff having the required authorizations to install electrical and measuring devices;
- the device shall be used according to its intended purpose in line with the permissible parameters specified on the nameplate (➔ Transmitter identification);
- the protecting elements used by the manufacturer to ensure transmitter safety may be less effective if the device is operated in a manner not consistent with its intended purpose;

- before installing or disassembling the device, it is absolutely necessary to disconnect it from the power source;
- no repairs or alterations to the transmitter electronic system are permitted. Assessment of damages and possible repair may only be performed by the manufacturer or authorized representative;
- do not use instruments if damaged. In case of malfunction, the device must be put out of operation.

3. TRANSPORT AND STORAGE

3.1. Delivery check

After receiving the delivery of the equipment, it is necessary to:

- make sure that the packaging and its contents were not damaged during transport;
- check the completeness and correctness of the received order, and make sure no parts are missing.

3.2. Transport

Transport of transmitters shall be carried out with the use of covered means of transport, in original packages. The packaging shall be protected against movement and direct impact of atmospheric factors.

3.3. Storage

Transmitters shall be stored in a factory packaging, in a room, without vapours and aggressive substances, protected against mechanical impact.

Allowable range of storage temperature:
-25 … 70 °C (-13 ... 158 °F).

4. GUARANTEE

General terms and conditions of guarantee are available on the manufacturer's website:
www.aplisens.com/ogolne_warunki_gwarancji

The guarantee shall be repealed if the device is used against its intended use, failure to comply with user's manual or interference with the structure of the device.

5. IDENTIFICATION

5.1. Manufacturer's address

APLISENS S.A.
03-192 Warsaw
Morelowa 7 St.
Poland

5.2. Transmitter identification

Each transmitter **APRE-2000GN** is equipped with a nameplate showing the following data.

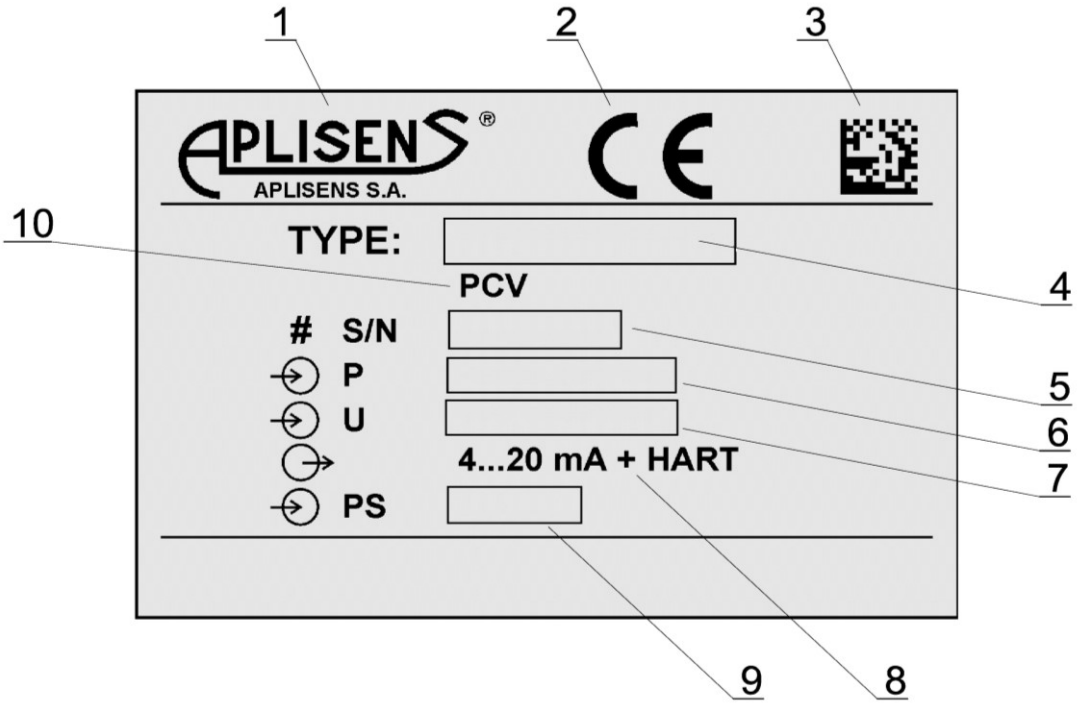


Figure 2. **APRE-2000GN** transmitter nameplate.

1. Logo and name of manufacturer.
2. CE mark.
3. Product code.
4. Transmitter type.
5. Transmitter serial number.
6. Base measuring range.
7. Supply voltage values.
8. Output signal.
9. Maximum static pressure.
10. Type of process connector.

5.3. CE mark, declaration of conformity

The device has been designed to meet the highest safety standards, has been tested and has left the factory in a condition that is safe for operation. The device complies with the applicable standards and regulations listed in the EU Declaration of Conformity and has CE marking on nameplate.

6. CONSTRUCTION

The basic transmitter assemblies are: housing, processing unit (with pressure sensor and electronic unit), in which the pressure signal is converted into an electric signal and transformed into a unified output signal.

6.1. Transmitter housing and dimensions

The **APRE-2000GN** transmitter housing is made of polycarbonate – PC or ABS and consists of a housing body and a transparent cover to ensure the readability of the LCD display.
The housing body is equipped with pressure connections for plastic tubes Ø6x1 and electrical connection.
On the inner side surface of the housing body there is an anti-interference filter unit electrically connected to the processing unit and to the base of the electrical connection of the transmitter.

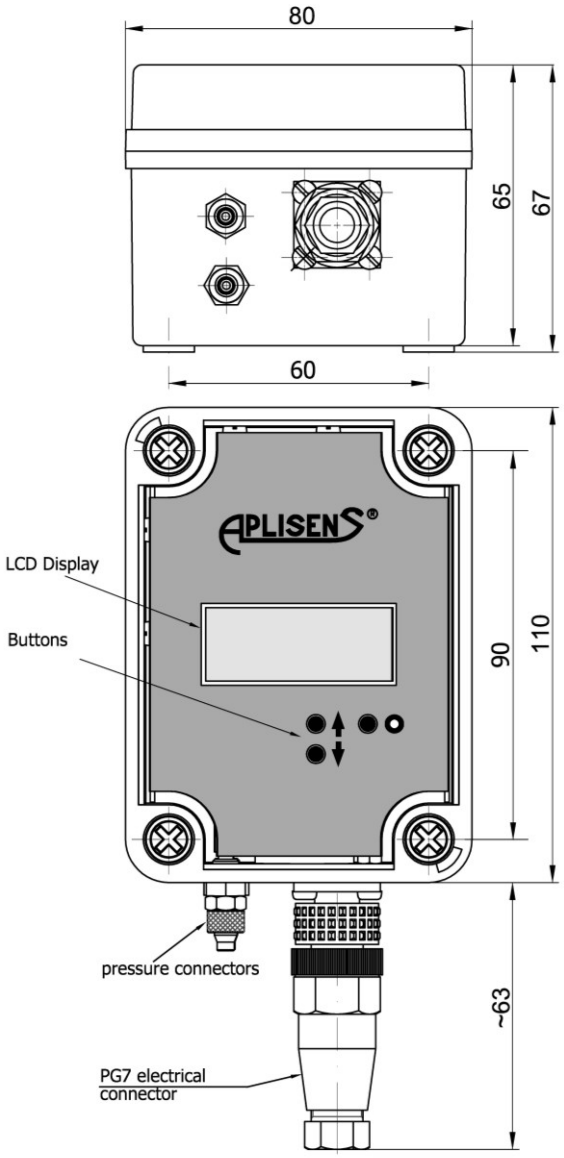


Figure 3. **APRE-2000GN** differential pressure transmitter – dimensions.

7. INSTALLATION

7.1. General recommendations

It is recommended that in case of a gaseous medium, the transmitters should be installed above the measuring point so that condensate may flow to the point from which the measured pressure is collected. The configuration of impulse tubes and valve connection system should be selected taking into account the measurement conditions.
Differential pressure transmitters for gases APRE-2000GN should be obligatorily installed vertically.

7.2. Installation and pressure connection

The **APRE-2000GN** transmitters can be mounted on a wall or on a control panel.
The installation method is shown in Fig. 4.
The transmitter is fitted with connectors which fit to a Ø6x1 elastic impulse tube.
In case of significant level differences between the transmitter location and the pulse point, a ‘’floating’’ effect of the measurement may occur when the temperature difference of the impulse tubes changes. This effect can be reduced by leading the impulse tubes side by side.
When assembling transmitter mounting accessories, information about connecting pressure elements such as: reductive, nests, valves, reducer clamps, signal tubes – offered by APLISENS – may be helpful. Data on this subject are contained in catalogue.

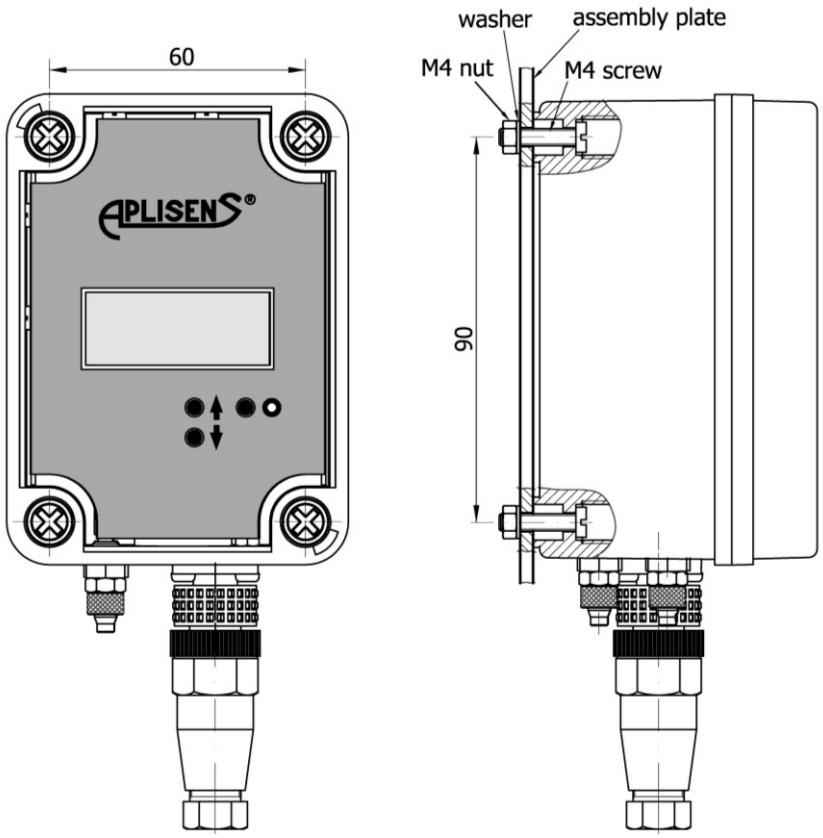


Figure 4. **APRE-2000GN** differential pressure transmitter – mounting method.

8. ELECTRICAL CONNECTION

8.1. Electrical connection of transmitter

All connection and installation operations shall be performed with disconnected supply voltage and disconnected input signal.

Failure to provide proper connection of the transmitter may result in danger.

Connect the differential pressure transmitter **APRE-2000GN** according to fig. 5.

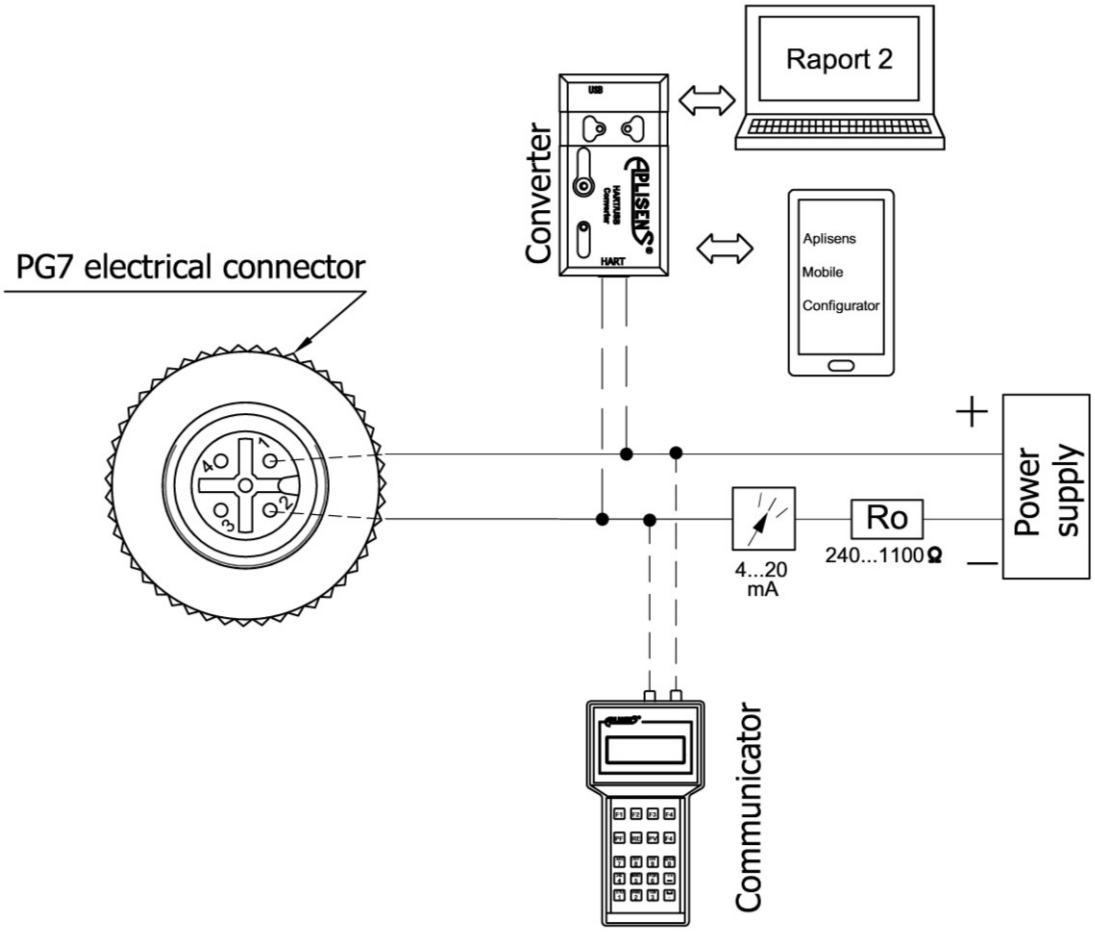


Figure 5. Connection of the **APRE-2000GN** transmitter and communicator or modem.

Communicator or modem electrical connections.

In order to enable communication by connecting a communicator, modem or converter to the transmitter's terminals, make sure that the resistance Ro seen from the transmitter's terminals towards the power supply source lies within the range of 240≤Ro≤1100 Ω. If necessary, an additional resistor can be installed in the line. The communicator or modem connection must be in accordance with Fig.5.

8.2. Transmitter power supply

8.2.1. Transmitter supply voltage

Power cables may be live.
There is a risk of electric shock.

Table 2. Permissible transmitter supply voltages.

Version	Minimum supply voltage	Maximum supply voltage
Standard	10 V DC	55 V DC

8.2.2. Resistance load in power supply line

The power line resistance, power source resistance and other additional serial resistances increase the voltage drops between the power source and the transmitter terminals. The maximum transmitter current under normal operation conditions is 20.500 mA but during high alarm the value of current I_max is 22.000 mA.
The maximum resistance value in the power circuit (along with the power cables resistance) is defined by the formula:

$$R_{L\_MAX}\ [\Omega] \leq= \frac{(U-10)[V]}{0{,}022[A]}$$

where:
U – voltage of 4…20 mA current loop power supply unit in [V];
R_{L_MAX} – maximum power supply line resistance in [Ω].

8.2.3. Shielding, equipotential bonding

When using a cable in the screen, connect the screen on one side at the transmitter's power supply point.

9. OPERATION

9.1. Local LCD display

The LCD has three primary information fields identified in the figure below as LCD1, LCD2, LCD3.

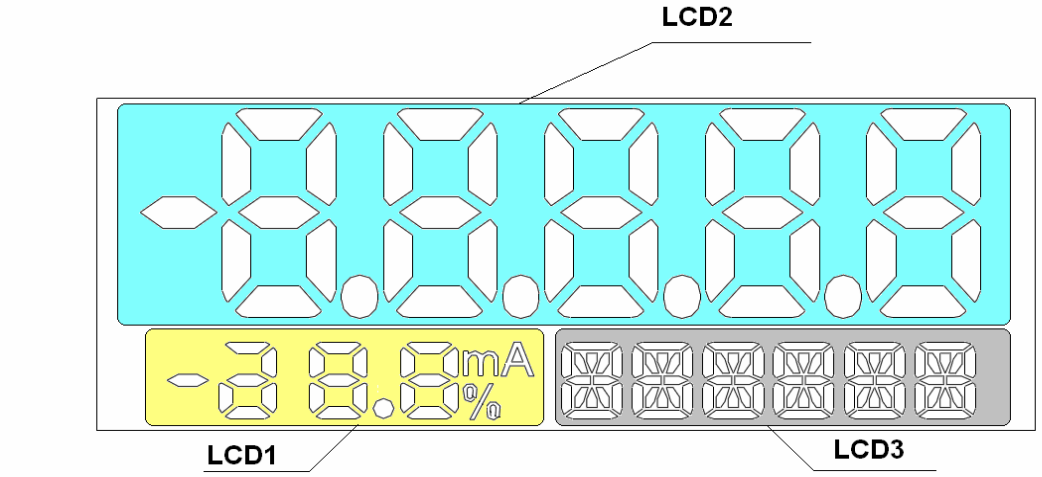


Figure 6. Display information fields.

LCD1 field:
[mA] - value (milliamperes) of process current in line 4...20 mA, proportional to the measured pressure.

[%] - value (percentage) of the setpoint $U(t)$ of current controller in current loop 4...20 mA. This value is the ratio of the process current $Ip(t)$ to the current range width according to the following formula:

$$\%U(t) = \frac{Ip(t)-4\,[mA]}{16\,[mA]} * 100[\%]$$

LCD2 field:

The LCD2 field is used mainly to display floating point decimal values in a unit displayed on LCD3. In some cases, other messages may be displayed:

- **ERROR** in case of some operating errors or failure diagnosed in the transmitter, error/failure number **Exxxx** will appear on LCD2, the **ERROR** message will be displayed on LCD3. The image will blink to attract the operator's attention. The transmitter will set the current output to alarm status depending on the configuration I_AL < 3.650 mA or I_AL > 21.500 mA.
  In order to identify the cause, please refer to the chapter **"Troubleshooting"** placed in Technical Information;
- **undEr** the message will appear when 50% of the base range below the lower limit range of the set LRL (LSL) is exceeded. After reaching the LPL and when below this value up to LSAL, the transmitter freezes the refreshing of digital value of the measurement. In this situation, message "UndEr" will be displayed. The image will blink to attract the operator's attention. The diagnostic alarm mode will be enabled depending on the settings I_AL < 3.650 mA or I_AL > 21.500 mA. Additionally, common status PV_OUT_OF LIMITS and status PV_LOW_LIMITED in the Sensor Block will be set, which can be read out in the diagnostic tab via HART communication;
- **ouEr** the message will appear when 50 % of the base range below the lower limit range of the set URL (USL) is exceeded. After reaching the UPL and when above this value up to USAL, the transmitter freezes the refreshing of digital value of the measurement. In this situation, the

message “ovEr” will be displayed. The image will blink to attract the operator’s attention. The diagnostic alarm mode will be enabled depending on the settings I_AL < 3.650 mA or I_AL > 21.500 mA. Additionally, common status PV_OUT_OF LIMITS and status PV_HIGH_LIMITED in the Sensor Block will be set, which can be read out via HART communication;

– ● ● ● ● when the set position of comma (point) on LCD2 does not allow for the correct display of the process variable, four dots ● ● ● ● will appear on LCD. The image will blink to attract the operator’s attention. In this situation, change the decimal point position in the local setpoint change MENU or via HART communications.

LCD3 field:

Abbreviations of physical units of pressures and levels and their description:

INH2O	inches of water column with temperature of 0°C.
INHG	inches of mercury column with temperature of 0°C.
FTH2O	feet of water column with temperature of 20°C (68°F).
MMH2O	millimeters of water column with temperature of 20°C (68°F).
MMHG	millimeters of mercury column with temperature of 0°C.
PSI	pounds per square inch.
BAR	bars.
MBAR	millibars.
GSQCM	grams per square centimeter.
KGSQCM	kilograms per square centimeter.
PA	pascals.
KPA	kilopascals.
TORR	torrs.
ATM	atmosphere.
MH2O4	metres of water column with temperature of 4°C.
MPA	megapascals.
INH2O4	inches of water column with temperature of 4°C.
MMH2O4	millimeters of water column with temperature of 4°C.
NOUNIT	the shortcut displayed when a unit not implemented in the transmitter is configured via HART communication.

Abbreviations of temperature measurement point name:

SENS °C temperature of pressure/differential pressure sensor measurement structure in degrees Celsius.

CPU °C temperature of the main CPU structure in degrees Celsius.

Abbreviations displayed during configuration via local MENU and their descriptions:

<-BACK	return to one level above in local MENU.
EXIT	going out of the local MENU.
UNIT	pressure and level unit selection menu.
SENS_T	option of measuring the temperature of pressure/differential pressure sensor measurement structure.
CPU_T	option of measuring the main CPU structure temperature.
DAMPIN	menu of selecting damping time constant of process variable.
TRANSF	menu of selecting the current output linearization function.
%SQRT	menu of selecting the deadband percentage of the root characteristics of the current output linearization.
PVZERO	pressure transmitter resetting menu and option.
SETURV	URV setting menu (upper pressure of the set range).
SETLRV	LRV setting menu (lower pressure of the set range).
BYPRES	option of setting the range according to pressure.
BYVALU	option of setting the set range by entering a value.
RESET	transmitter hot restart software menu.
LCD1VR	menu for selection of the type of measurement displayed on LCD1.

LCD2VR	menu for selection of the type of measurement displayed on LCD2.
LCD2DP	menu for selecting position of comma / decimal point.
FACTOR	return to factory values menu.
RECALL	option of return to factory settings. Factory pressure/differential pressure calibrations, zero setpoints of pressure and current will be restored.
LINEAR	option of linear function of current output setpoint linearization.
SQRT	option of root function of current output setpoint linearization.
SPECIA	option of the user's special characteristics of current output setpoint linearization.
SQUARE	option of square function of current output setpoint linearization.
CURREN	option of selecting the display of set current on LCD1.
PERCEN	option of selecting the display of set percentage on LCD1.
PRESS	option of selecting the display of pressure/differential pressure on LCD1.
USER	option of selecting user's units and scaling to be displayed on LCD1.
MID_WP	MID mode setting menu. In this mode, the option of changing the setpoints related to the transmitter metrology is disabled. Exceeding of LRV and URV limits results in displaying the undEr or ouEr message, blinking of the display and setting of the process output to the current alarm mode depending on the configuration I_AL<3.650 mA or I_AL>21.500 mA.
ON	MID mode activation option.
OFF	MID mode deactivation option.
X.XXXX	option of selecting position of comma / decimal point.
XX.XXX	option of selecting position of comma / decimal point.
XXX.XX	option of selecting position of comma / decimal point.
XXXX.X	option of selecting position of comma / decimal point.
XXXXX.	option of selecting position of comma / decimal point.
0 [S]	option of selecting damping time constant.
2 [S]	option of selecting damping time constant.
5 [S]	option of selecting damping time constant.
10 [S]	option of selecting damping time constant.
30 [S]	option of selecting damping time constant.
60 [S]	option of selecting damping time constant. The 60-second damping constant is only available from the local keypad; the configuration via HART in Revision 5 does not allow a damping value greater than 30 seconds. Other damping values are possible to be set via HART communication.
0.0%	option of selecting root characteristics deadband point.
0.2%	option of selecting root characteristics deadband point.
0.4%	option of selecting root characteristics deadband point.
0.6%	option of selecting root characteristics deadband point.
0.8%	option of selecting root characteristics deadband point.
1.0 %	option of selecting root characteristics deadband point.
	other deadband values are possible to be set via HART communication.
DONE	message about the acceptance and implementation of the set-point change.

Abbreviations of local configuration errors and description of abbreviations:

ER_L07	message displayed on LCD3. It is displayed if a user tries to change the setpoint in the transmitter protected against entry (change of setpoints).
ER_L09	message displayed on LCD3. It is displayed if: – a user tries to change the set range by set pressure which is not within the allowable upper URL pressure. – A user tries to reset pressure when the pressure exceeds the allowable upper limit.
ER_L10	message displayed on LCD3. It is displayed if: – a user tries to change the set range by set pressure which is not within the allowable lower LRL pressure. – A user tries to reset pressure when the pressure exceeds the allowable lower limit.
ER_L14	message displayed on LCD3. It is displayed if: – the adopted URV value through the set pressure or entry of a value cannot be accepted because it causes a reduction of the set pressure range set below the allowable limit.
ER_L16	message displayed on LCD3. It is displayed if: – a user tried to perform an operation that is disabled or unavailable. It may be caused by: – attempting to access the local setpoint change MENU when the access to the local MENU is disabled; – attempting to reset pressure in the absolute pressure measurement transducer.

WG_L14 the message will appear if the assumed LRV value through the set pressure or entry of a value causes a decrease of the current set range. Entry of LRV automatically results in the transmitter's attempt to set URV in such a way that the current width of the set range is maintained. If this is not possible due to exceeded URL, the transmitter automatically adopts the URV = URL and a new LRV. Since the set range width and URV deviate from previous values, a message is displayed.

ASCII characters displayed on LCD3 in user's unit:

- using HART communication, the user can configure its own 6-character unit displayed on LCD3. It is possible to display ASCII characters from the range (32 ... 96 dec) or (20 … 60 hex), i.e.:

!"#$%&'()*+,-./0123456789:;<>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`

9.2. Local buttons

Local buttons are used to enable the configuration mode of some transmitter parameters and to navigate through MENU and accept MENU options. The MENU can be accessed by pressing and holding any of the buttons for at least 4 seconds. After this time, the LCD3 field of the local display will show an **EXIT** message. This signals entering into the MENU navigation mode.

9.3. Local configuration of setpoint

APRE-2000GN transmitter enables local configuration of some of the most common setpoints via local buttons and local LCD display.

9.4. Navigation in local setpoints MENU

The MENU can be accessed by pressing and holding any of the buttons for at least 4 seconds. After this time, the LCD3 field of the local display will show an **EXIT** message. This signals entering into the local configuration MENU. By pressing the buttons with arrows [↑] [↓] for at least 1 second you can move up or down MENU.

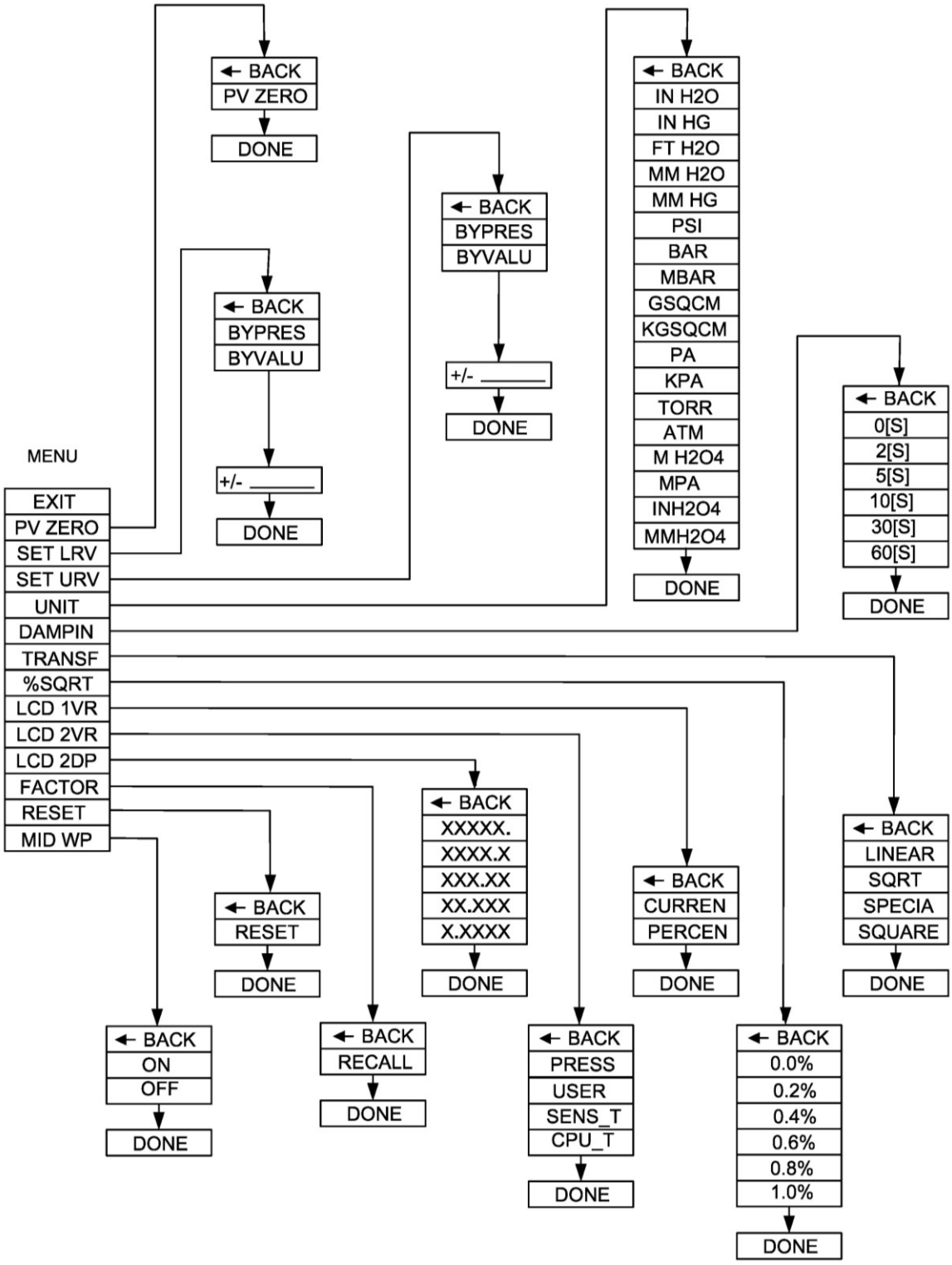
9.5. Acceptance of local setpoints

The key marked with symbol [●] is used to accept the selection. The acceptance of setpoint change is confirmed by a **DONE** message displayed on LCD3. After changing the setpoint, the transmitter leaves the local configuration change MENU. If no selection is made in the MENU mode, after 2 minutes the transmitter automatically returns to display of standard messages. The MENU can also be left by selecting and accepting the **EXIT** option.

9.6. Structure of local setpoints MENU

Press and hold any of 3 buttons for 4 seconds.

When navigating in the area of the active local MENU, holding the button required to trigger the action is minimum 1 second. Continuous pressing of the ↑ or ↓ button results in scrolling of the MENU positions every 1 second. If the local MENU remains inactive for more than 2 minutes, after this time the transmitter will automatically leave the local MENU and will display the process variable.


MENU
EXIT
PV ZERO
SET LRV
SET URV
UNIT
DAMPIN
TRANSF
%SQRT
LCD 1VR
LCD 2VR
LCD 2DP
FACTOR
RESET
MID WP
BACK
PV ZERO
DONE
BACK
BYPRES
BYVALU
+/- _____
DONE
BACK
BYPRES
BYVALU
+/- _____
DONE
BACK
IN H2O
IN HG
FT H2O
MM H2O
MM HG
PSI
BAR
MBAR
GSQCM
KGSQCM
PA
KPA
TORR
ATM
M H2O4
MPA
INH2O4
MMH2O4
DONE
BACK
0[S]
2[S]
5[S]
10[S]
30[S]
60[S]
DONE
BACK
ON
OFF
DONE
BACK
RESET
DONE
BACK
RECALL
DONE
BACK
XXXXX.
XXXX.X
XXX.XX
XX.XXX
X.XXXX
DONE
BACK
PRESS
USER
SENS_T
CPU_T
DONE
BACK
CURREN
PERCEN
DONE
BACK
0.0%
0.2%
0.4%
0.6%
0.8%
1.0%
DONE
BACK
LINEAR
SQRT
SPECIA
SQUARE
DONE

9.7. Remote configuration of setpoints (HART 5/HART 7)

The transmitter allows to read out and configure the parameters via HART communication using 4...20 mA loop as a physical layer for FSK BELL 202 modulation.

9.7.1. Compatible devices

The following devices may be used to communicate with the transmitter:

- Aplisens S.A. KAP-03, KAP-03Ex communicator (HART 5 only);
- communicators from other companies, including those using DDL and DTM libraries;
- PC computers equipped with HART modem (e.g. HART/USB converter by Aplisens S.A.) with Windows7 or Windows10 operating system with installed Raport 2;
- PC computers equipped with HART modem using software from other companies, accepting DDL and DTM libraries;
- smartphones with Android system, using a converter providing wireless communication (e.g. HART/USB converter by Aplisens S.A.) using Aplisens Mobile Configurator. The software is available on Google Play under the link: https://play.google.com/store/apps/details?id=com.aplisens.mobile.amc

9.7.2. Compatible configuration software

- Raport 2 Aplisens under control of Windows 7 or Windows 10;
- Aplisens Mobile Configurator under control of the Android system;
- every software from other companies accepting DDL and DTM libraries.

10. START-UP

As standard, the transmitter is adjusted to a set range equal to the base range, unless a specific set range is provided in the order. The base range and the basic unit of the transmitter can be read out from its nameplate (➔Transmitter identification).

Use the transmitter within the allowable pressure limits. Risk of injury due to component breakage after exceeding the maximum permitted operating pressure.

10.1. Alarm configuration

Transmitter **APRE-2000GN** has a developed internal diagnostics, which monitors the work of electronic circuits, process and environmental parameters. Diagnosed dangerous states or malfunctions of the internal transmitter systems result in setting the alarm current depending on the configuration I_AL < 3.650 mA or I_AL > 21.500 mA. The user has an option of enabling/disabling of the current alarms. Current alarms are disabled by default.
The figure below shows the normal operation ranges of the transmitter process output and the ranges of saturation and alarm currents

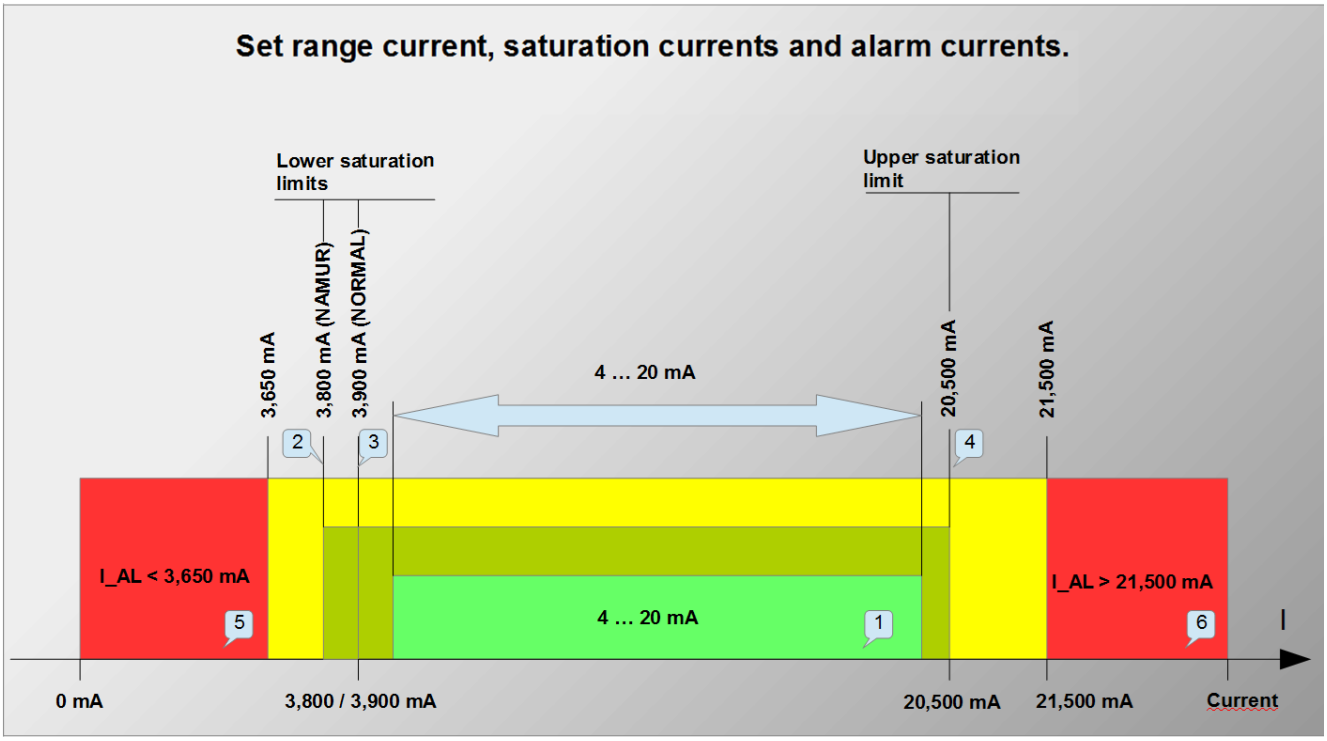


Figure 7. Set range current, saturation currents, alarm currents.

1 – Set 4...20 mA current area is corresponding to setpoint 0…100% of the process output.
2 – Lower saturation current of 3.800 mA for NAMUR mode.
3 – Lower saturation current of 3.900 mA for NORMAL mode.
4 – Upper saturation current of 20.500 mA for NAMUR and NORMAL mode.
5 – Alarm current area AL_L < 3.650 mA for internal diagnostic alarms.
6 – Alarm current area AL_H > 21,500 mA for internal diagnostic alarms.

The transmitter diagnostics continually tests the environmental parameters:

- temperature of the pressure measurement structure sensor;
- temperature of the ADC transducer converting the electric signal from the pressure sensor to the digital value of measurement;
- temperature of the CPU structure (transmitter's main microcontroller). If alarms from 2, 3 and 4 process variable (temperatures) are enabled, when the transmitter operating temperature limits are exceeded, the diagnostics will trigger an alarm depending on the settings AL_L < 3.650 mA or AL_H > 21.500 mA. Temperature return to permissible range of the transmitter operation will result in deactivation of the diagnostic alarm mode and return to normal operation.

The transmitter diagnostics continually tests the pressure process parameters

- if the pressure/differential pressure value increases to the upper limit of ADC measurement converting transducer, reaching the USAL point, the diagnostics will trigger an alarm depending on the configuration AL_L < 3.650 mA or AL_H > 21.500 mA. The return of the pressure/differential pressure below the USAL point will result in deactivating the alarm and returning the transmitter to its normal operation;
- if the pressure/differential pressure value decreases to the lower limit of ADC measurement transducer converting, reaching the LSAL point, the diagnostics will trigger an alarm depending on the configuration AL_L < 3.650 mA or AL_H > 21.500 mA. The return of the pressure/differential pressure above the LSAL point will result in deactivating the alarm and returning the transmitter to its normal operation.

The transmitter diagnostics continually tests electric parameters and software resources of transmitter:

- if the inner diagnostics detects the malfunctioning or failure of the transmitter which are not critical with regard of integrity of hardware and software, the transmitter software will activate alarm depending on the configuration AL_L < 3.650 mA or AL_L > 21.500 mA. The diagnostic alarm condition will continue until the failure or damage is resolved. Error/failure number **Exxxx** will appear on LCD2; the **ERROR** message will be displayed on LCD3. The image will blink to attract the operator's attention;
- if the internal diagnostics detects malfunctioning or failure of the transmitter which are critical from the point of view of integrity of hardware and software, such as the hardware error of RAM, FLASH, SVS, CPU logs, mathematical computation error, or if there is a difference exceeding 1% between the set process current and the current measured in the line, the transmitter will immediately stop operation and activate the critical diagnostic alarm mode. The transmitter display will be switched off. HART communication with the transmitter will not be possible. In the critical diagnostic alarm mode, the additional protection of the transmitter will lower the current in the loop 4...20 mA. In such a case, alarm current I_AL is much lower than 3.650 mA, amounting about 0.150 mA. The transmitter will remain in the critical alarm status for approx. 10 seconds, then it will attempt to restart. When the internal diagnostics detects no hardware errors after restart, the transmitter will return to normal operation.

10.2. Configuration of operating mode

Before starting the work, the transmitter must be configured. The configuration should cover the following basic parameters:

- basic unit of transmitter;
- processing characteristics;
- the beginning of the set LRV range;
- the end of the set URV range;
- damping time constant;
- NORMAL/NAMUR analogue output operation mode;
- analog output operation mode in alarm status (AL_L/AL_H);
- alarm mode for indicating environmental events and defects;
- transmitter tag (TAG / LONG_TAG);

- LCD display configuration parameters;
- setting of the settings change lock password.

10.3. Correction of impact of transmitter mounting position on site – pressure reset

Once the transmitter is mounted in a target location, it must be reset. This operation will eliminate the possible influence of the mounting position on the indication of pressure/differential pressure. In order to do so:

- in the case of relative pressure transmitter without pressure supplied (vented), perform the pressure reset operation using the local MENU or HART communication;
- in the case of a differential pressure transmitter, at compensated pressures on the L and H supply, perform the pressure reset operation by means of local MENU or HART communication;
- in case of absolute pressure transmitter the resetting is only possible with an absolute pressure calibration device. Otherwise an attempt to reset the transmitter will display an error.

Once the transmitter parameters have been entered and it has been reset at the workstation, it is required to:

- **secure the device against the possibility of making changes in the local setpoint change MENU;**
- **set your own password different from default password of "00000000". The new password may consist of any combination of 8 hexadecimal characters 0...9, A…F. Store the password in a safe place. If the password is lost, its restoration or resetting to factory settings may only be performed by the manufacturer;**
- **activate the setpoint change lock to secure the transmitter against accidental, unintentional change of parameters.**

Pressure reset can be done via local setpoint change MENU or HART communication. The remaining operations described in this section may only be performed using HART communication.

11. MAINTENANCE

11.1. Periodic inspections

Periodic inspections shall be carried out in accordance with applicable standards. During the inspection, the condition of the pressure (absence of loosened elements and leaks) and electrical (check of connections reliability and condition of gaskets and glands) connectors. Check the processing characteristics by performing the operations specific for the CALIBRATION and possibly CONFIGURATION procedure.

11.2. Non-periodic inspections

If the transmitter at the installation site has been exposed to mechanical damage, pressure overload, hydraulic pulses, overvoltage or incorrect operation of the transmitter is detected, the device should be inspected. Check the electrical functionality of the transmitter and the processing characteristics.

If there is no signal in the transmission line or its value is improper, check the supply line, connection status on terminal blocks, connectors, etc. Check if the supply voltage and load resistance are correct.

11.3. Cleaning / washing

To remove impurities from the external surfaces of the transmitter wipe it with a cloth dampened in water.

11.4. Spare parts

Parts of the transmitter that may be worn or damaged and thus replaced: pressure connections (stubs), connector.

11.5. Repair

Faulty or non-operational transmitter shall be provided to the manufacturer.

11.6. Returns

In the following cases, the transmitter should be returned directly to the manufacturer:

- need for repair;
- need for factory calibration;
- replacement of improperly selected/shipped transmitter.

12. SCRAPPING, DISPOSAL

Worn or damaged devices shall be scrapped in accordance with WEEE Directive (2012/19/EU) on waste electrical and electronic equipment or returned to the manufacturer.

13. HISTORY OF REVISIONS

Revision No.	Document revision	Description of changes
-	02.A.002/2020.09	New document edition. Prepared by DBFD.