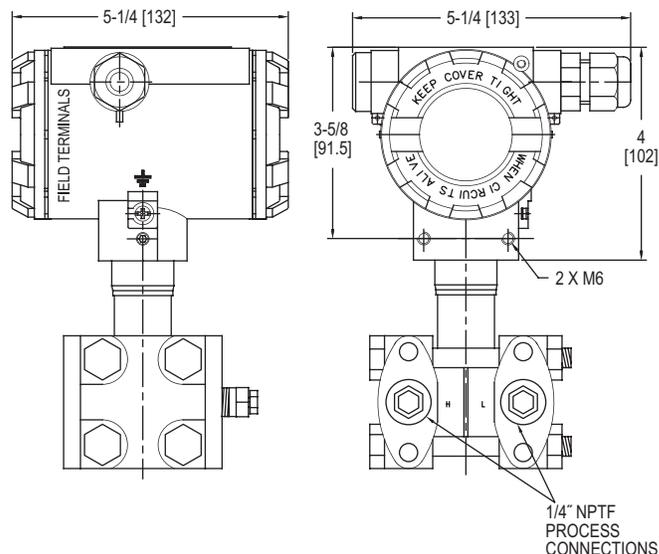




## Series 3500 Smart Differential Pressure Transmitter

### Specifications - Installation and Operating Instructions



The **Series 3500 Smart Differential Pressure Transmitter** is a microprocessor-based high performance transmitter, which has flexible pressure calibration, push button configuration, and programmable using HART® Communication. The Series 3500 is capable of being configured for differential pressure or level applications with the zero and span buttons. A field calibrator is not required for configuration. The transmitter software compensates for thermal effects, improving performance. EEPROM stores configuration settings and stores sensor correction coefficients in the event of shutdowns or power loss. The rangeability allows the smart transmitter to be configured to fit any application.

#### FEATURES/BENEFITS

- High accuracy ( $\pm 0.075\%$  FS)
- Rangeability (up to 25:1)
- Completely Configurable using zero/span buttons (no calibrator required)
- Fail-mode process function
- Automatic ambient temperature compensation

#### APPLICATIONS

- Flow measurement
- Level monitoring
- Filter or pump differential pressure
- Critical process monitoring

#### SPECIFICATIONS

**Service:** Compatible gases, steam, liquids or vapors.  
**Wetted Materials:** 316L SS and fluoroelastomer.  
**Accuracy:**  $\pm 0.075\%$  FS (@ 20°C).  
**Rangeability:** Up to 25:1 turn down.  
**Stability:**  $\leq 0.075\%$  FSO/3 years.  
**Temperature Limits:** -40 to 185°F (-40 to 120°C) ambient.  
**Thermal Effect:**  $< \pm 0.05\%$  span/10°C.  
**Power Requirements:** 10 to 55 VDC.  
**Output Signal:** 4 to 20 mA.  
**Response Time:** 16 to 480 ms (programmable).  
**Damping Time:** 0 to 60 seconds.  
**Loop Resistance:** Operation: 0 to 1500  $\Omega$ ; HART® communication: min. 240  $\Omega$ , max. 1100  $\Omega$ .  
**Electrical Connection:** Packing gland M20x1.5, two 1/2" female NPT conduit, screw terminal.  
**Process Connections:** 1/4" female NPT.  
**Enclosure Rating:** NEMA 4X IP66/IP67.  
**Agency Approvals:** CE.

#### Explanation of Symbols:

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.

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## BASIC REQUIREMENTS AND SAFE USE

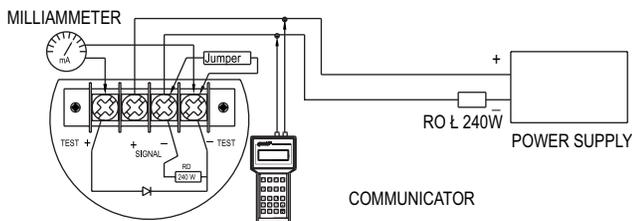


- The manufacturer will not be liable for damage resulting from incorrect installation, failure to maintain the device in a suitably functional condition, or use of the device other than for its intended purpose.
- Installation should be carried out by qualified personnel having the necessary authorization to install electrical and pressure measuring devices. The installer is responsible for performing the installation in accordance with these instructions and with the electromagnetic compatibility and safety regulations and standards applicable to the type of installation.
- The device should be configured appropriately for the purpose for which it is to be used. Incorrect configuration may cause erroneous functioning, leading to damage to the device or an accident.
- All safety and protection requirements must be observed during installation, operation and inspections.
- If a device is not functioning correctly, disconnect it and send it for repair to Dwyer Instruments, Inc..

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



- Possibility of mechanical impacts, excessive shocks and vibration
- Excessive temperature fluctuation
- Condensation of water vapor, dust, icing



TO MEASURE THE CURRENT IN THE TRANSMITTER WITHOUT DISCONNECTING THE SIGNALLING CIRCUIT, CONNECT A MILLIAMMETER TO TRANSMITTER TERMINALS TEST+, TEST-.

Figure 1



The transmitter is equipped in additional communication resistor RD = 240 Ω. During normal operation terminals <SIGNAL → and <TEST → are shorted. RD resistor is used when communicating with the transmitter locally (from its terminals) and Ro < 240 Ω. Terminals <SIGNAL → and <TEST → must be opened.

## 4. Power supply and exploitation of transmitters.

- In the event that transmitters come in contact with structural metal parts or pipes which are connected to the equipotential bonding system, transmitters do not require to be earthed.
- Transmitters should be supplied from DC electrical source with voltage max.45 V from transformer feeders or other devices which have at least a strengthened isolation among primary and secondary windings, with a maximum voltage of 250 V. The duty of power supply installation with above mentioned requirements rests on user.
- Transmitter sensor diaphragm should not be subject to damage during installation and operation of the unit. The diaphragm is made from 1.4404/1.4435 (316L) or Hastelloy thin foil and cannot come in contact with incompatible media.
- Due to the casing material being a light alloy with large aluminum content, the unit should be installed in a location where there is a low possibility for the casing to be impacted.
- Within the transmitter casing are two holes for installation of M20x1.5 or 1/2" NPT cable glands.
- Normally transmitters are delivered without installed glands but with blank plugs (corks) in the second hole.
- It is necessary to apply a shielded cable or unshielded cable with round cross section and non-moisture absorbing elastomer insulation.
- During service a check must be made of the covers and cable glands to ensure they are securely fastened. The casing and supply line must be inspected for physical damage, and the transmitter label for legibility. The diaphragms should also be periodically checked for signs of damage. During maintenance it is recommended that the threads of the covers be lubricated with Vaseline or similar substance. Due to the possibility of sensor damage, the ambient temperature should not be allowed to exceed 176°F.

## III. FEATURES, INSTALLATION AND MAINTENANCE OF TRANSMITTERS

### 1. Introduction

- This Manual is intended for users of Series 3500 smart pressure transmitters, containing the data and guidelines necessary to understand the functions of the transmitters and how to operate them. It includes essential recommendations concerning installation and use, as well as emergency procedures. The parameters and information specified for transmitters identified here as series 3500 apply to all variations differing by type of process terminals. Information on the transmitter sizes and the method of installation apply to all versions of transmitters.

### 2. Applications and Main Features

- The Series 3500 smart pressure transmitters are designed to measure gauge pressure, vacuum pressure and absolute pressure of gases, vapors and liquids (including corrosive substances).
- The transmitters may be fitted with a range of types of process connectors, which enables them to be used in a variety of conditions such as thick or highly reactive media, high and low temperatures, etc.
- Series 3500 transmitters generate a 4 to 20 mA output signal and a digital HART signal in a two-wire system (current loop).



### 3. Identifying Marks Ordering Procedure

- Every transmitter carries a rating plate containing at least the following information: CE mark, manufacturer name, transmitter type, serial number, pressure range, maximum pressure, output signal, and power supply voltage.

### 4. Technical Data

- Series 3500 Common parameters
  - Series 3500 Electrical parameters

Versions of the transmitter	Power supply
Normal	10 - 55 VDC
Intrinsically Safe (Exi)	10.5 - 28 VDC
Explosion proof (Exd)	10.5 - 55 VDC

Output signal: 4 to 20mA + HART rev.5.1

Communication with the transmitter to check its configuration parameters is carried out via HART transmission protocol and signal of 4 to 20mA. For this purpose: KAP-03, KAP-03Ex communicator, HART/RS232 converter or HART/USB/Bluetooth Converter or another converter, PC computer and Raport 2 program can be used.

Resistance for communication (HART):  
min 240 Ω

Load resistance:

$$R_o[\Omega] = \frac{U_{sup}[V] - 10 V^{**}}{0.0225 A}$$

The maximum length of the connection cable:  
4,921 ft (1500 m)

Value of the minimum supply voltage transmitters in standard version should be calculated from:

$$U_{supply \text{ min.}} = 12^{**} + 0.0225 \cdot R_o [V]$$

R<sub>o</sub> [Ω] is a total resistance of the measuring line (current loop)

(\* ) For other versions of transmitters insert lower supply voltage specified in the table above.



- 4.1.2. Series 3500 Construction materials  
316L SS or Hastelloy C276  
Sensing module:  
316L SS  
Liquid filling the interior the sensing module  
Silicone oil, chemically inactive liquid for measurement of oxygen uses.  
Connectors:  
316L SS
- 4.1.3. Enclosure ingress protection  
IP 66/67 according to EN 60529  
IP 65 according to EN 60529 with PD connector
- 4.1.4. Response time on pressure stroke

In response to the pressure stroke measured by the transmitter - full change (100%) of the transmitter output current is carried out over a period of one to a maximum of two values of processing time. The value of transmitter response time can be set in the Raport 2 program using the slider on the tab Specific parameters -> Configuration.

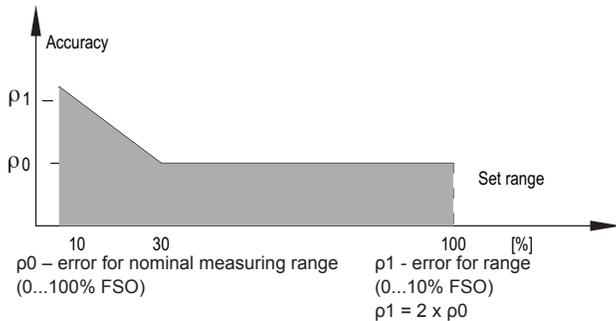


Figure 2

- 4.2. Permitted environmental conditions  
Operating temperature range: -40° to 185°F (-40° to 85°C)  
Medium temperature range: -40° to 248°F (-40° to 120°C) –  
for direct measurement, over 248°F (120°C) measurement with a  
transmission tube or diaphragm seal  
Thermal compensation range: -13° to 176°F (-25° to 80°C)  
Relative humidity: max 98% with condensation

## 5. Construction

- 5.1. Electronic system. Principle of measurement  
The electrical signal from the sensor, which is proportional to the pressure, is sent to a digital analog input and converted to a digital signal. The digital signal is then transmitted via optoelectronic galvanic isolation to the conditioning module. The main plate microcontroller reads measured values and, using internal algorithms, calculates the exact value of pressure and temperature. The calculated value of the process variable is displayed on the integrated LCD screen, which can be configured as needed. The digital value of the measured pressure signal is converted to an analog 4 to 20 mA signal. A built-in modem BELL 202 and HART rev5.1 communication stack enables communication with the transmitter via a converter HART/RS232 attached to a PC and software, or via communicator. The electrical output of transmitter is equipped with a suppression filter and surge protective elements. The Series 3500 transmitters monitor the work of their hardware resources to determine the correctness of calculations. In the event of an error the 3500 will display an error message on the LCD and expose an alarm current to the current loop. Sensor electronics are galvanically isolated from the measuring line. This galvanic isolation reduces susceptibility of measurement to interference.
- 5.2. Enclosure of transmitters  
Enclosures of Series 3500 transmitters are made of die-cast aluminum alloy or stainless steel and consist of a body and two screwed covers (display and electrical connection), one of which is equipped with a glass window. The enclosure provides two holes on the cable entries with thread M20x1.5 or 1/2 NPT (the unused hole is sealed with stopper). The housing consists of two chambers separated by an electrical culvert. Housing is equipped with both internal and external grounding terminals. The basic units of transmitter are: the sensor module which converts the pressure signal into an electrical signal, and the main electronic circuit board which transforms this signal into a unified output signal.

- 5.3. Main electronics plate with display  
Main plate electronics with display is placed in the casing of polycarbonate. It is placed in the larger chamber where it is possible to change the display position by 345° with 15° increments to required position (see Figure 5). In the second chamber is a connecting board with protective devices and the EMC filter.
- 5.4. Measuring head  
The measuring head is a measuring unit equipped with a silicon diaphragm sensor. The sensor is placed in a silicone oil-filled space enclosed, on one side of the culvert with the leads insulated in glass on the other side of the separating diaphragm which separates the sensor from the medium. Measuring heads are equipped with process connectors. This transmitter in standard version (economic) is equipped in the process connectors adjusted to elastic pipes ø6x1, and in industrial versions in adapters.

## 6. Place of Installation

- 6.1. General recommendations
- 6.1.1. The smart differential pressure transmitter can be installed both indoors and outdoors. It is recommended that transmitters intended for outdoor use be placed in a box or under cover.
- 6.1.2. The place of installation should be chosen in such a way as to allow access to the device and to protect it from mechanical damage. In planning the installation of the transmitter and configuration of the impulse lines, attention should be paid to the following requirements:
- The impulse lines should be as short as possible, with a sufficiently large cross-section, and free of sharp bends, in order to prevent blockages
  - Where the medium is a gas, the transmitters should be installed above the measuring point, so that condensation flows down towards the site of the pressure measurement; where the medium is a liquid or where a protective liquid is used, the transmitters should be installed below the place where the pressure measurement is taken
  - The impulse lines should be inclined at a gradient of at least 10 cm/m
  - The levels of filling liquid in the impulse lines should be equal or kept constant difference
  - The configuration of the impulse lines and the valve connection system should be chosen with regard to the measurement conditions and to requirements such as the need to reset the transmitters in position and the need for access to the impulse lines during water or gas removal and flushing
- 6.1.3. Where there is a risk of damage to the transmitter through impact (which can result in extreme cases with the transmitter being separated from the connecting pipework thus permitting leakage of medium), appropriate means of protection should be applied for obvious safety reasons and to avoid the possibility of sparking caused by being struck. If the transmitter cannot be suitably protected then an alternative mounting location should be sought.
- 6.1.4. Attention should also be paid to possible installation faults which may lead to measurement errors, such as connections which are not tight, sediment blockage in lines which are too narrow, gas bubbles in a liquid line or liquid column in a gas line etc.
- 6.2. Low Ambient Temperature  
When the solidification point of the liquid whose pressure is being measured is higher than the ambient temperature, steps should be taken to protect the measurement apparatus from freezing effects such as medium expansion. This is particularly important in the case open-air installations. Protection is obtained by filling the impulse lines with a mixture of ethylene glycol and water, or another liquid whose solidification point does not exceed the ambient temperature. Thermal insulation can protect the transmitter casing and lines only from brief exposure to low temperatures. Where the temperature is very low, the transmitter and impulse lines should be heated.
- 6.3. High Medium Temperature  
The Series 3500 transmitters may be used to measure media with temperatures of up to 240°F. To protect the sensing module from temperatures higher than 248°F, long impulse lines are used to disperse the heat and to lower the temperature of the sensing module.



#### 6.4. Mechanical Vibration shocks. Corrosive Media

- 6.4.1. Transmitters should correctly work with vibrations with amplitudes to 1.6 mm and accelerations to 4g. If strong vibrations are carried via the pressure line and disturb measurement, use elastic pulse lines or transmitters with a remote diaphragm seal.
- 6.4.2. Transmitters should not be installed in places where the diaphragm, made of 316L SS, would be subject to corrosion by the medium being measured. If possible, transmitters with diaphragms made of Hastelloy C276 should be used.



### 7. Installation and Mechanical Connections

The Series 3500 transmitters can operate in any position. When installed on an object with a high-temperature medium, it is advantageous to mount the transmitter in a horizontal position or downwards, in such a way that the transmitter is kept away from the rising hot air. For the small measurement ranges, the reading can be affected by the transmitter position, and by the impulse lines configuration, or the way in which they are filled with liquid. This error can be corrected using the zero-setting function.



#### 7.1. Series 3500 Installation and connections

- 7.1.1. The Series 3500 transmitters can be mounted directly on the rigid impulse lines.
- There are adapters for standard DIN50, (DIN40, DIN25, Clamp2", Clamp1.5", Clamp1") type connections provided for readouts carried out in aseptic conditions using transmitters with CM30x2 connection.
- There are gaskets provided for every transmitter with P, CM30x2, CG1, CG1/2 and GP type connections. The gasket material is selected based on the pressure value, temperature and the type of the medium.
- 7.1.2. Tighten the transmitter in the socket with a torque suitable for the type of the gasket used and the pressure measured.
- 7.1.3. The Series 3500 transmitter can be installed using a universal "AL" holder allowing to mount the transmitter in any position on the support or a horizontal or vertical pipe Ø35... Ø65 (Figure 16).

### 8. Electrical Connection

#### 8.1. General recommendations

- 8.1.1. It is recommended that twisted pair cabling be used for the signal lines. If the transmitter and signal line are subject to a large amount of electromagnetic interference, then shield pair cable should be used. The signal wires should not run alongside network power supply cables or near to large electrically-powered devices. The devices used together with the transmitters should be resistant to electromagnetic interference from the transmission line in accordance with compatibility requirements. It is also beneficial to use anti-interference filters on the primary side of the transformers, the power supplies used for the transmitters and apparatus used in conjunction with them.
- 8.1.2. Moisture inside transmitter casing can cause its damage. When the isolation of the wires in the cable gland is ineffective (for example, when single wires are used) the opening of the gland should be carefully sealed with an elastic sealing compound to obtain IP66 protection. It is useful to form the segment of the signal wire leading to the cable gland into a protective loop to prevent condensation from running down in the direction of the gland.

#### 8.2. Electrical connections for Series 3500

The Series 3500 transmitters are to be connected as shown in Figure 3a – 3d. In Series 3500 transmitters, a 240 Ω resistor is permanently fitted in series in the transmitter's current circuit and blocked up with jumper between <SIGNAL →> and <TEST →> as shown in Figure 3a and 3b. When the resistance in the current loop is lower than 240 Ω it is necessary to jumper disassemble to HART communication.

#### 8.3. Protection from excess voltage

- 8.3.1. The transmitters may be in danger from excess voltage caused by connection faults or atmospheric electrical discharge. Protection from excess voltage between the wires of the transmission line is provided by TVS diodes installed in all types of transmitter.
- 8.3.2. In order to protect against excess voltage between the transmission line and the casing or earth (not prevented by the diodes connected between the transmission wires), additional protection is provided in the form of plasma surge arresters. Also external protective devices may be used. When the transmission lines are long, it is advantageous to use one protective device near the transmitter (or inside it), and another near entry points to other devices used in conjunction with it.

#### 8.4. Earthing

The transmitters are fitted with internal and external earth terminals.

### 9. Setting and Regulation

Series 3500 transmitters are factory calibrated to the range stated in the order or to the basic range.



After installation, the transmitter's zero-point may move and require adjustment. This applies particularly in cases where the measurement range is small, where the impulse lines are filled with a separating liquid or where Series 3500 transmitters are used with remote diaphragm seals.

#### 9.1. Transmitter Range, Basic Range. Definitions

- 9.1.1. The maximum range of differential pressure, which the transmitter can measure, is called the "basic range." The width of the basic range is the difference between the upper and lower limits of the basic range.
- The internal characteristic conversion curve for the basic range is coded in the transmitter's memory. This is the reference curve used when making any adjustments which affect the transmitter's output signal.
- 9.1.2. When the transmitter is in use the term "set range" is used. The set range is the range whose lower end-point corresponds to an output current of 4mA and whose upper end-point corresponds to a current of 20mA (or 20mA and 4mA respectively when the conversion curve is inverted). The set range may cover the whole of the basic range or only a part of it. The width of the set range is the difference between its upper and lower end-points.

#### 9.2. Configuration and Calibration

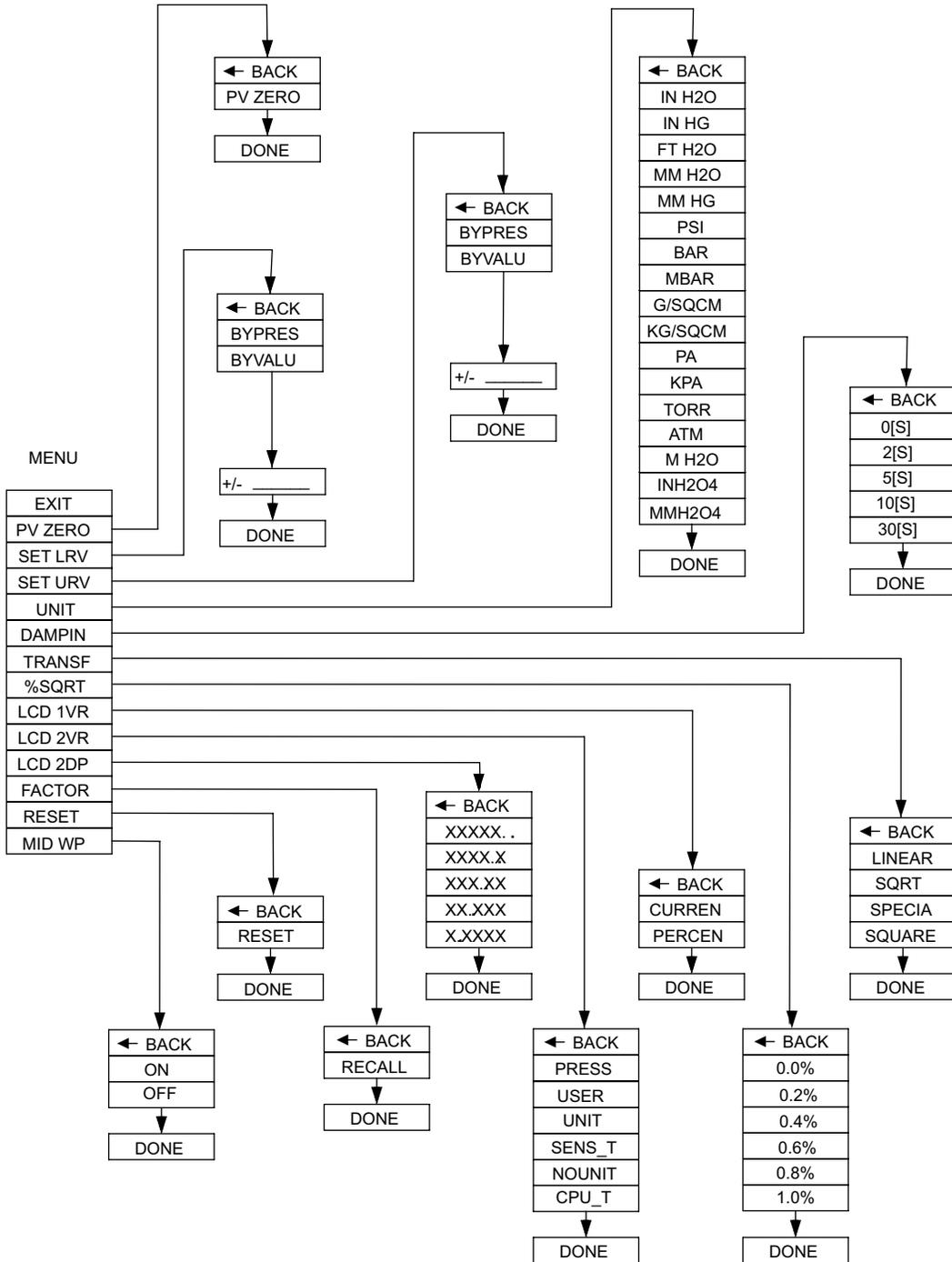
- 9.2.1. The transmitter has features which enable metrological and identification parameters to be set and altered. The configurable metrological parameters affecting the transmitter's output current include the following:
- Unit in which the measured pressure is expressed on the display
  - Upper end-point of the set range
  - Lower end-point of the set range
  - Time constant
  - Type of characteristic curve: linear or radical
- Parameters of an informational nature which cannot be altered include the following:
- Upper limit of the basic range
  - Lower limit of the basic range
  - Minimum range
- 9.2.2. Other identification parameters, not affecting the output signal, include: device address, device type code, factory identification code, factory device code, number of preambles (3-20), UCS, TSD, program version, electronics version, flags, serial number, label tag, description tag, date tag, message, record number, sensing module number. The process of setting the parameters is called "Configuration".
- 9.2.3. It is possible to carry out a "pressure zeroing" procedure, for example to compensate for measurement deviation caused by a change in position during the transmitter installation. The transmitter may also be calibrated, by taking readings with the input pressure controlled using a standard device. These process and zero-point adjustments are called "Calibration".
- 9.2.4. Configuration and Calibration of the transmitter are carried out using certain HART communicators or a PC with HART/RS232 converter. There is "INTERVAL LINEARIZATION" software supplied to enable the input of 21-point nonlinear functional characteristics to the transmitter. Information on the HART/RS232 converter can be found on the HART/RS232/01 Converter information sheet.

#### 9.2.5. TRANSMITTER CONFIGURATION WITH USING ITS BUTTONS AND LOCAL MENU

##### 9.2.5.1. Local menu - structure. Local configuration of transmitters.

If the option of local configuration is active, the operator can change the transmitter set using the buttons below the display. To gain access to these buttons the operator must unscrew the cover. The display position can also be adjusted with the cover removed (Figure 5). To enter changes at the local set mode, press one of the buttons and hold it for about 4 seconds. If after pressing the button the display reads the message ERR\_L16, local configuration of the transmitter is switched off. In order to switch on local configuration it is necessary to use KAP-03 calibrator or a PC with HART communication protocol. The buttons are labeled with symbols: [↑] [↓] [■] After pressing any of the buttons for 4 seconds the display will read "EXIT". Once here, the operator can use the [↑] button to move up in the menu tree, or use the [↓] button to move down in the menu tree. In order to confirm a menu item

or advance in the menu tree the [ENTER] must be pressed for 1 second. If no buttons are pressed within 2 minutes the unit will automatically time out and return to the main display. The menu tree is shown below.



Descriptions:		
Local Menu	Submenu	Notice
EXIT		Return from the local Menu to the normal operation of the transmitter
PVZERO		Pressure zeroing
SETLRV	BYPRES BYVALU  +/- _____	Set across set pressure Set across inscribing of value (after approval at display the current value will appear before the passage in edit mode) Select and confirm sign introduced parameter. Introduce in sequence, digit after digit, 5 digital numbers with point or without point. After confirmation the last 5 digit of the parameter transmitter will confirm the party of command by the "DONE" announcement or the proper number of error will notify. The parameter will be written down in units "UNIT"
SETURV		Set the upper range value by the done pressure
UNIT	IN_H2O IN_HG  FT_H2O MM_H2O MM_HG MBAR G/SQCM KG/SQCM  KPA TORR ATM M_H2O MPA INH2O4 MMH2O4	Menu process variable units inches of water at a temperature of 68° Fahrenheit inches of mercury at a temperature of 68° Fahrenheit Foot of water a temperature of 68° Fahrenheit mm of water at a temperature of 68° Fahrenheit mm of mercury at 0°C millibar grams per square centimetres kilogram per square centimetres, technical atmosphere kilopascal tor (mm Hg) physical atmosphere meter of water at 4°C Megapascal inch of water at a temperature of 4°C mm of water at 4°C
DAMPIN		set of the solid temporary suppression of the process variable
TRANSF	LINEAR SQRT SPECIA SQUARE	set of the current output form linear square root user's special square
%SQRT		Square root characteristic cut-of point setting
LCD1VR	CURREN  PERCEN	Assigning a process variable to LCD1 On LCD1 will displayed current value in current loop in [mA] The percent value output signal will displayed on LCD1- controlling in%
LCD2VR	PRESS USER  SENS_T  CPU_T	Assigning a process variable to LCD2 The pressure value will displayed on LCD2 The user's units will be displayed on LCD2. Scaling of the user range and record of the user units can be made using a computer or communicator, see → HART command No. 244.245. The current temperature of pressure sensor will displayed on LCD2 The current temperature of the transmitter CPU will displayed on LCD2 - in °C
LCD2DP		Set the decimal point position on LCD2. In a situation where the value provided to display on the display LCD2 cannot be displayed properly due to the position of the decimal point, this is indicated by displaying the four flashing dots ••••. In this case, you must enter to the local menu setting and move the decimal point respectively to the right.
FACTOR		Back to factory settings (removing of current and pressure calibrations)
RESET		Reboot your transmitter
MID_WP	ON OFF	Blocking records / change the parameters associated with transmitter metrology Switch on blocking Switch of blocking

#### 9.2.5.2. Local Menu, error reports.

During command entry, an error code may be displayed indicating an invalid command. A shortened list of error codes is shown below.

Type	Description
ERR_L07	[in_write_protected_mode] Error will display when attempting to change settings in local menu with write protection enabled. In order to make changes to the settings the transmitter must be equipped with local menu option as well as having write protection disabled. It is possible to modify write protection using the KAP-03 communicator or a PC with HART communication software using library EDDL. • default setting: Local Menu service: switched on Write Protection: switched off
ERR_L09	[applied_process_too_high] Error will display when process pressure exceeds the upper range end.
ERR_L10	[applied_process_too_low] Error will display when process pressure is below the lower range end.
ERR_L14	[span_too_small] Error will display when attempting to set the upper and lower range ends too close together.
ERR_L16	[access_restricted] Error will display when the user attempts to access the local configuration menu when it is switched off. To switch on local configuration menu it is necessary to use KAP-03 communicator or a PC with HART communication software using library EDDL. Warning! ERR_L16 error code may also be displayed due to a zeroing attempt of an absolute transmitter.
WNG_L14	[WARNING! New Lower Range Value Pushed !] Error will display when upper range end will cause the lower range end to be changed.

#### 9.2.3. View local LCD display

Changes of the display options in the local MENU are possible using configuration buttons, using a communicator, or using PC software. If it is necessary the display can be switched. A HART communicator or PC software is required to switch off the display.

There 3 main displays are visible:

- Secondary Display (Lower Left) - the current or percentage output display. Depending on configuration the current value in the 4-20mA loop or the current percentage output will be displayed.
- This section of the LCD can display any of the following depending on configuration. This section can display the measured pressure value, the calibrated pressure value based on user selected units, the process variable units, user units, pressure sensor/CPU temperature, the MENU announcement and information, or the warning announcement display. When the measured pressure value or calibrated pressure value are displayed, a "-" sign can be displayed indicating a negative value. The decimal position can be set through the local MENU or remotely using a communicator. The 3500 makes it possible to set up custom units. In order to do this it is necessary to use a communicator or PC software. Simply write the corresponding low value and high value of the range and enter a unit name. When using a custom unit the re-scale value will be visible on the display.
- This section acts as an information display. During normal operation base units or user units will be displayed here. In the event of an error in operation this section will display an error code. In manual mode the local menu displays configuration options. It also displays errors related to the implementation of commands in the local menu.

Display backlighting - Local display is equipped in backlight. Figure 5 shows how to change the display position by rotation.

Warning!

Exceeding the high limit or the low limit of the specified operating range by 50% will result in LCD2 displaying "o v E r" or "u n d E r" respectively.

After configuration it is important to protect the transducers using command HART [247]. During operation, the transmitter should be protected prior to entries. This prevents accidental or intentional changes to configurational data. The protection function is accessible in KAP03 communicator, "Raport 2" software, as well as, in applying DD or DMT programs libraries.



#### 9.2.4. Remote configuration

Remote configuration is possible with KAP-03 communicator or PC software. Measuring circuit should be in accordance with the

Figure 3a.

9.3. Alarms



Alarms signal exceeding the specified operating range of the transmitter, or improper function of some of its components. The menu of the series 3500 contains the following alarms: HART modem error, ADC error (error of A/D converter), EEPROM error, error of the oscillator, DS33 error (check the correctness of floating point calculations). Errors are signaled by exposing the current loop to an alarm current (3.6mA for low alarm, 22mA for high alarm), and displaying an error code on the LCD. For example, if the specified operating range is exceeded by 50% the code E0256 will be displayed and the current loop will have a current of 22mA. Alarm current in the current loop can be set using the Raport 2 configuration program.

10. Inspections and Spare Parts

10.1. Periodic service

Periodic inspections should be made in accordance with the regulations to which the user is subject. During inspection, the pressure connectors should be checked for loose connections and leaks, the electrical connectors should be checked with regard to tightness and the state of the gaskets, cable glands, and the diaphragm seals should be checked for tarnishing and corrosion. Check the characteristic conversion curve by following the procedures for "Calibration" and, where appropriate, "Configuration".

10.2. Other services



If the transmitters are installed in a location where they may be exposed to mechanical damage, excess pressure, hydraulic impulses or excess voltage, or the diaphragm may be in danger from sedimentation, crystallization or erosion, inspections should be carried out as required.

Where it is found that the signal in the transmission line is absent or its value is incorrect, a check should be made on the line and its terminal connections. Check whether the values of the supply voltage and load resistance are correct. If a communicator is connected to the power supply line of the transmitter, a fault in the line may be indicated by the message "No response" or "Check connection".

If the line is in order, check the operation of the transmitter.

10.3. Cleaning the Diaphragm Seal, Overloading Damage

10.3.1. Sediment and dirt which have formed on the diaphragm in the course of operation must not be removed by mechanical means, as this may damage both the diaphragm and the transmitter itself.

The only permitted method is the dissolving of sediment.

10.3.2. Sometimes transmitters malfunction due to damage caused by overloading, e.g. in case of:

- Application of excessive pressure
- Freezing or solidification of the medium
- Action of a hard object, such as a screwdriver, on the diaphragm



Usually in such cases the symptoms are such that the output current falls below 4mA or rises above 20mA, and the transmitter fails to respond to input pressure.

10.4. Spare parts



Parts of the transmitter which may be subject to wear or damage and require replacement: cover gasket.

Other listed parts, may be replaced only by Dwyer Instruments or by a firm authorized by Dwyer Instruments.

11. Packing, Storage and Transport



The transmitters should be packed singly or in sets, in such a way as to protect them from damage during transportation.

The transmitters should be stored in multiple packs under cover, in a place free of vapors and reactive substances, with temperature and humidity not exceed the limits specified in Section 4.2 for Series 3500

Transmitters with uncovered diaphragm or seal connectors, stored without packaging, should have covers to prevent damage to the diaphragm.

During transportation, the transmitters should be packed and secured so as to prevent them from shifting.

Any means of transport may be used, provided direct atmospheric effects are eliminated.

12. Figures

Communicator or converter electrical connections to transmitter measuring lines.



For successful communication with transmitter the resistance in measuring loop, behind connected device to communication, should be higher than 240Ω.

If necessary install the additional resistor in the line. The connection diagrams for the communicator or converter are shown in the figures. When increasing resistance in the measuring loop it is important to note that the resistance should be added in series with the loop not at the transmitter terminals.

Connection of the Series 3500 transmitter

If it is necessary to enable communication with the transmitter, a communicator or converter can also be connected. Optional connection configurations to communication devices are shown in the figures. When connecting a distant transmitter to the control cabinet, the resistance  $R_0$  must be checked to make sure it does not exceed the range 240-1100Ω. If necessary, an additional resistance can be integrated into the line. Connect the communicator or converter as shown in Figure 3a.

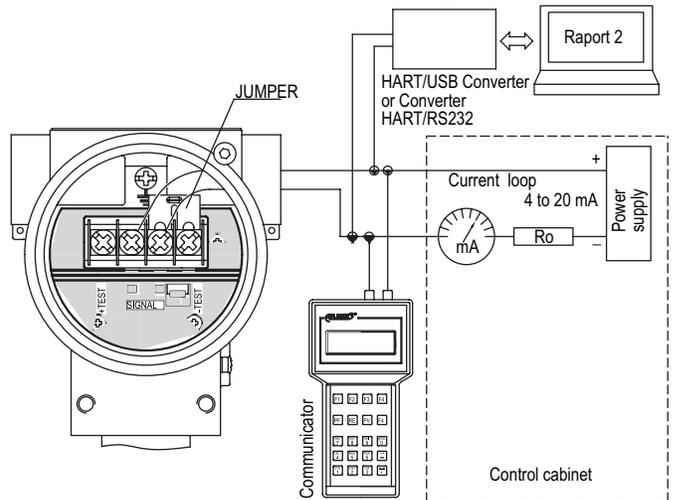
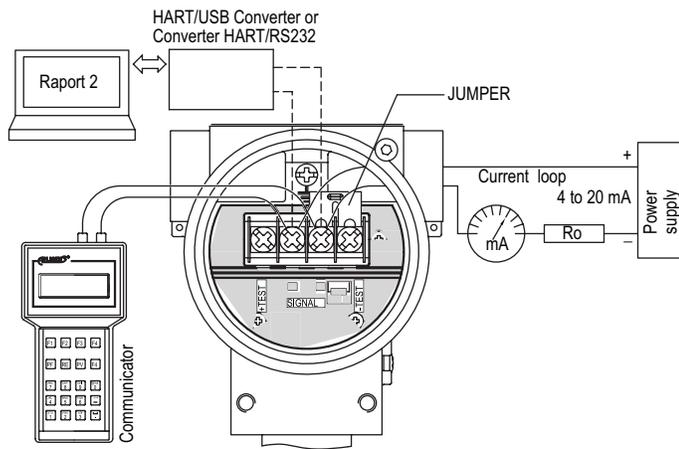


Figure 3a: The link of transmitter and communicator or converter to current line by the control cabinet throughout (in case of the resistance in current loop is higher than 240Ω)

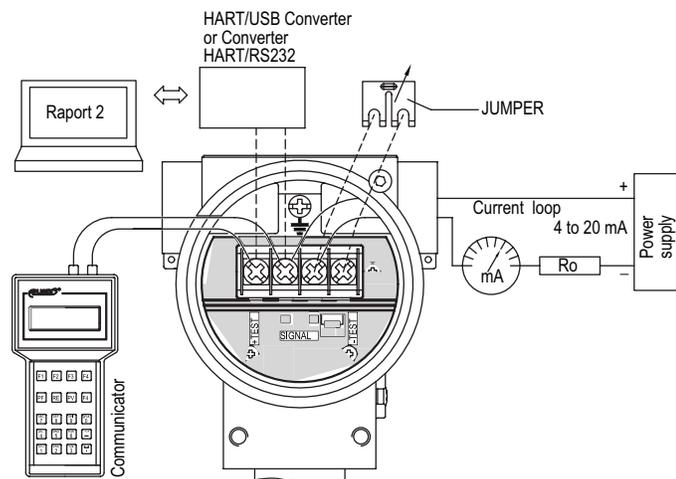
Communicator or converter connection to the transmitter's terminals

In order to enable local communication by connecting a communicator or converter to the transmitter's terminals, make sure that the resistance  $R_0$  from the transmitter's terminals to the power supply source lies within the range of 240-1100 Ω. If so, connect the communicator or converter to the terminals <+> <-> as shown in Figure 3.



Rys. 2b

Figure 3b: The link of transmitter and communicator or converter to <SIGNAL+> <SIGNAL-> transmitter terminals in case of the resistance in current loop is higher than 240Ω



Rys. 2c

Figure 3c: The link of transmitter and communicator or converter to <SIGNAL+> <TEST+> transmitter terminals in case of the resistance in current loop is smaller than 240Ω

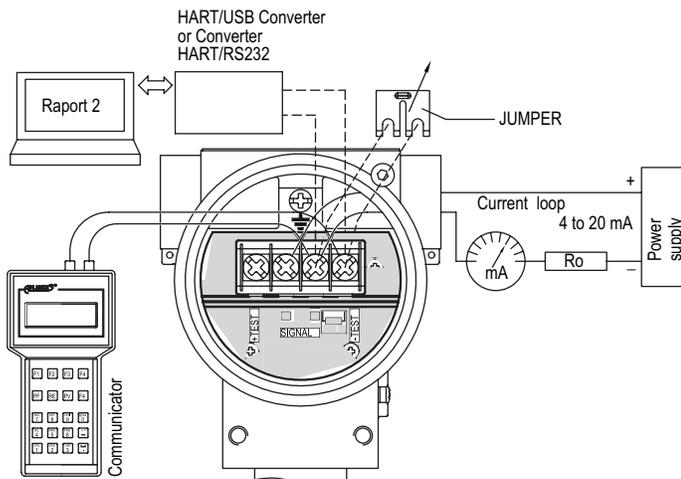
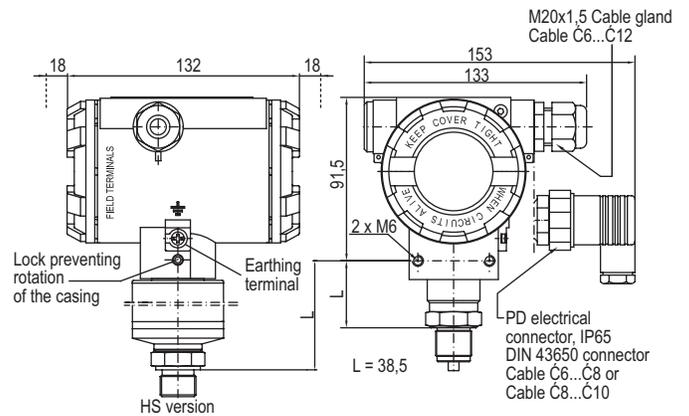


Figure 3d: The link of transmitter and communicator or converter to <SIGNAL+> <SIGNAL-> transmitter terminals in case of the resistance in current loop is smaller than 240Ω

⚠ If  $R_o$  in current loop is lower than 240Ω is necessary to connect 240Ω resistor to current loop by remove jumper from <SIGNAL-> and <TEST-> terminals. After communication jumper should came back at its place.



Rys.3.

Figure 4: Series 3400 shown in picture

3450 WITH 150 PITCH

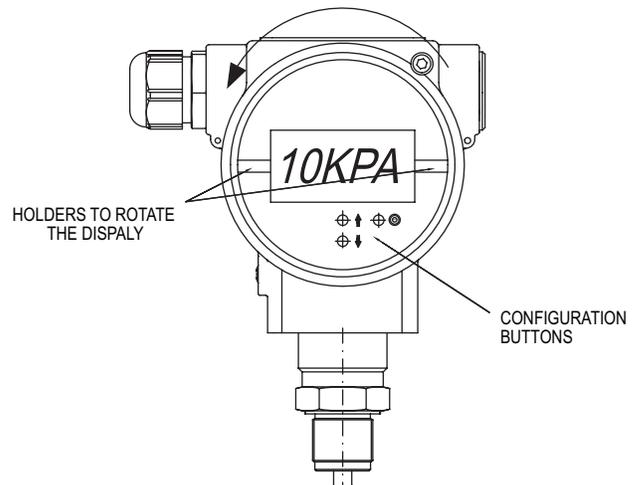


Figure 5: Series 3400 shown in picture

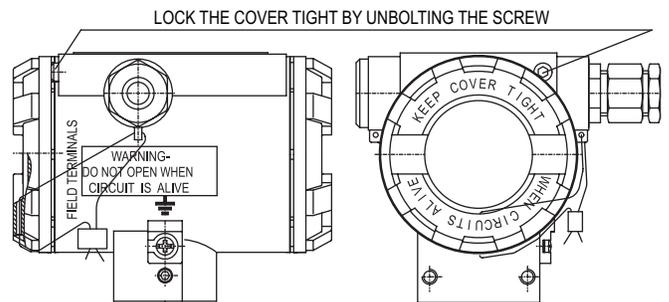


Figure 6: How to lead the casing of Series 3500 transmitters