

DIFFERENTIAL PRESSURE TRANSMITTER

ESA PT-1 SERIES

FEATURES

GENERAL

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- Power supply 110 or 220 Vac \pm 10% 50/60Hz
- Absorption 6 W (in max. output current conditions, 20 mA, max. display luminosity)
- Maximum absolute pressure 1 bar
- Rated differential pressure 100 mbar
- Max. overload diff. pressure 750 mbar
- Accuracy out of rated downscale value 100 mbar:
 - \pm 0.1% \pm 1 digit in the range from 0.0 to 10.0 mbar
 - \pm 0.25% \pm 1 digit in the range from 10.0 to 25.0 mbar
 - \pm 1% \pm 1 digit in the range from 25.0 to 100.0 mbar
- Read out resolution which can be set in tenths, hundredths, thousandths of mbar
- Automatic compensation of flow rate values at working temperature
- Serial digital communication standard interface RS 485
- Working temperature 0 \div 70 °C
(Max. compensation temperature for compensation: 60°C)
- Dimensions 165 x 140 x 65 mm
- Mounting position vertical
- Protection degree IP 43
- Mass ~ 1050 gr

DISPLAY SECTION

- Lower display: 7-segment digit display, height 0.5"
Colour: bright red
- Upper display: 8-segment alphanumeric, height 0.2"
5x7 point matrix. Colour: red
- Luminosity: adjustable from 13% to 100%

INPUT SECTION (No. 2 DISHOMOGENEOUS INPUTS)

- Differential pressure sensor 0 \div 100 mbar
copper pipe union \varnothing 6x4 (0 \div 300 mbar on request)
- Temperature probe: optoinsulated thermocouple with standard "J" type calibration curb (0 \div 760 °C / 32 \div 1400 °F)
with compensation for cold junction



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OUTPUT SECTION

- 0 \div 20 mA optoinsulated (RL max 250 Ω)
- 4 \div 20 mA optoinsulated (RL max 250 Ω)
- possibility of center scale (12 mA) with null input signal

APPLICATIONS

- Air/gas differential pressure indicator
- Temperature (°C), pressure (mbar), flow rate (Nm³/h), transmitted current signal (mA) indicator
- Current signal transmitter (0 \div 20 mA, 4 \div 20 mA) proportional to pressure or capacity
- Flow meter with fluid temperature compensation
- Resettable fluid flow rate totalizer

DESCRIPTION

ESA PT-1 is a displaying, transmitter and field-totalizing instrument, a microprocessor-operated transducer-receiver of positive or negative differential pressures and a transmitter of current signals that can be sent through a double-wire connection to other remote devices such as electronic flow rate regulators, electronic pressure switches, flow indicators, flow rate totalizers, recorders, and so on.

ESA PT-1 can be driven from any measuring device (set flange, annubar, absolute pressure intake) that produces a differential pressure comprised between 0 and 100 mbar, mounted on the pipe of the fluid that is meant to be checked.

The sensor of the differential pressure is the main input in order to measure the flow rate; the temperature probe allows for the automatic compensation of the flow rate values at the working temperature of the fluid.

ESA PT-1 transmits the results of all measuring to a remote instrument both by means of a current signal through a double-wire cable (4÷20 mA) and on a standard RS 485 serial line.

When the instrument is working in the steady state mode, the upper (8-figure alphanumeric) display shows the name of the physical quantity which is being examined whereas the lower (4-figure numeric) display shows the value of that quantity.

The following quantities may be displayed:

- | | |
|-------------------------------------|----------------------|
| • Instant flow rate | (Nm ³ /h) |
| • Temperature | (°C) |
| • Totalized flow rate | (Nm ³) |
| • Differential or absolute pressure | (mbar) |
| • Transmitted equivalent current | (mA) |

The upper display also shows the value of the flow rate. In case of power cut the value of totalization is stored in the non volatile memory. Every 120 seconds a cycle of storage of the value of totalization is completed. If ESA PT-1 is turned off before the end of this cycle the value which has been stored does not change.

ESA PT-1 may be programmed to suit the needs of any user. When programming it, it is possible to directly set the parameters which may be set by the user. For instance it is possible:

- to select the quantity (differential pressure or flow rate) associated with the current signal;
- to set the values of pressure and flow rate associated with the maximum (20 mA) and minimum (4 or 0 mA) value of the transmitted current signal;
- to select the type of current output (4÷20 mA, 0÷20 mA).

The instrument can work in four different modes:

- | | |
|--------------------|---------------------|
| • Automatic mode | (AUTOMODE) |
| • Programming mode | (PROGRAM.) |
| • Setting mode | (PROT. PRG.) |
| • Calibration mode | (CALIBRAT.) |

For further information please consult the specific paragraphs.

KEYBOARD DESCRIPTION

There are 2 groups of keys:

- 1) Increase (\uparrow) and Decrease (\downarrow)
- 2) **F** function key.

The main functions of these keys are shown in the following table; a more detailed description of each function is to be found on the page shown on the right.

OPERATION	MODE	DESCRIPTION	PAGE
\uparrow o \downarrow	Automode	Displays scanning of pressure, transmitted signal, capacity, temperature	4
F	Automode	Displays flow rate totalization	4
\uparrow F	Automode	Sets the programming mode	5
\uparrow o \downarrow	Program. & Prot. prg	Displays scanning of parameters to be programmed	5, 6
		When the values of parameters are being changed, changes the displayed	5
F	Program. & Prot. prg	Enables the possibility of entering changes	5
		When the change is made, stores the current value	5
\uparrow F	Program. & Prot. prg	Goes back to Automode	5
		When the values of the parameters are being changed, exits without storing	5
F \downarrow	Program.	Opens the programming mode of the protected parameters	7

DESCRIPTION OF DISPLAY SECTION

There are two groups of displaying elements:

1) UPPER ALPHANUMERIC DISPLAY

In automatic mode, it displays the name of the physical quantity measured by the instrument or, by pressing the F key, the value of the total flow rate (Nm³); in programming mode and programming mode of the protected parameters it displays the name of the current parameter.

2) 7-ELEMENT 4-DIGIT DISPLAY

In automatic mode, it displays the physical quantity measured by the instrument, whereas in the programming and programming of protected parameters modes, it displays the value of the parameter whose name is shown on the upper display.

STARTING UP

During the starting up, the instrument displays "ESA -PT" and, after a few moments, it displays the software version installed displaying the phrase "rel. se" on the upper display and the number of the release on the lower one.

The message "dataerr." may appear on the upper display if the instrument realizes that some parameters which were previously programmed in the non volatile memory have not been properly stored: in this case please contact ESA-PYRONICS.

AUTOMATIC MODE (AUTOMODE)

After the starting up, if no errors were made while storing data, the instrument automatically enters the displaying phase.

By pressing the \uparrow or \downarrow keys, the different displaying functions of the steady state mode are made available which permit to show the values of the physical quantities measured by the instrument on the lower display, for instance flow rate, temperature, pressure, transmitted signal in mA.

A physical default quantity may be chosen, which must be selected (see parameter **default**, on page 7). If the user decides to display the temperature when the default quantity is the flow rate, after a few seconds the instrument will no longer display the temperature but the flow rate. To return to temperature again, press the \uparrow or \downarrow keys.

OPERATION	LOWER DISPLAY	UPPER DISPLAY	DESCRIPTION
Power supply	8888	ESA Pt	— —
None	r.888	Release	Instrument software release
\uparrow o \downarrow	8888	Flow	Displays flow rate (Nm ³ /h)
\uparrow o \downarrow	8888	Temper.	Displays temperature (°C)
\uparrow o \downarrow	8888	Pressure	Displays applied pressure (mbar)
\uparrow o \downarrow	8888	Current	Dispalys transmitted current (mA)
F	8888	88888888	Displays total flow rate (Nm ³)

DISPLAY OF TOTALIZER

The instrument assesses the fluid consumption on the basis of the instant flow rate values taken one after the other. By pressing the **F** key the total flow rate is displayed on the upper screen. At the same time the message "Totl." also appears on the lower display. After a few moments (the time may be programmed by means of the parameter **T. showt.**, see on page 8) either the message on the upper display automatically disappears or it disappears after pressing the **F** key. The maximum value which can be expressed is **99999999** Nm³. In order to reset the totalizer do as follows:

- while the total flow rate is displayed on the screen (that is while

the message "totL." is displayed on the lower display) press the \uparrow and \downarrow keys simultaneously; the instrument shows the current functioning mode displaying the message "Tot. clr?" on the upper display and "YES" on the lower one;

- while the message "Tot.clr?" is being displayed, press the **F** key to confirm you want to reset the totalizer, otherwise press the \uparrow or \downarrow key to renounce.

If you press the **F** key, the totalizer is reset and the message "donE" appears on the lower display.

PROGRAMMING MODE (PROGRAM.)

USER PARAMETERS PROGRAMMING

During this stage all the instrument's working parameters can be set.

The instruments are factory-set based on the system's specifications or the client's requirements.

To access to the displaying and programming mode of the parameters which can be set by the user, press the \uparrow and **F** keys simultaneously. The instrument shows the current functioning mode displaying "**Program.**" on the upper display for a few seconds; then the compensation value of the zero pressure is automatically shown (parameter **ZeroPres.**, see on page 6).

To leave the programming mode and go back to the steady state mode press the \uparrow and **F** keys simultaneously again; "**Automode**" is be displayed for a couple of seconds showing you are leaving the programming mode.

When you need to change some parameters do as follows:

- select the parameter you want to change by pressing the \uparrow and \downarrow keys which permit to go up and down the list of the parameters available. At that moment a string of 8 digits identifying the type of parameter is shown on the upper display, whereas its value is shown on the lower display;
- press the **F** key to enable the parameter to be changed: the message on the upper display starts blinking;
- by pressing the \uparrow and \downarrow keys, set the new value. At this stage the value you have just changed has not been stored yet, therefore you can avoid storing it if you realize you made a mistake by leaving the programming mode and pressing the \uparrow and **F** keys simultaneously;
- press the **F** key to store the new value. If the changed value has been correctly stored the message "**done**" appears on the lower display for a few seconds;
- if you need to change another parameter select it, otherwise leave the programming mode by pressing the \uparrow and **F** keys simultaneously.

LIST OF THE PARAMETERS WHICH CAN BE SET BY THE USER

PARAMETER	UPPER DISPLAY	MIN. VALUE	MAX. VALUE
Compensation of the zero pressure	ZeroPres	OFF	ON
Flow rate of reference at 0 °C (in Nm ³ /h)	Flowref	0	6553
Pressure of reference (in mbar)	Pressref	0	300
Temperature of reference (in °C)	Temp.ref	0	700
Downscale pressure (in mbar)	Prs.Init.	-300	300
Quantity associated with current output 4÷20 mA	4-20 sou	FLOW	PRES
Type of current signals	out type	0.0	12.0
Enabling/disabling of totalizer resetting	tot.res	OFF	ON

N.B.: the blinking point, on the upper display, shows the modification phase of a previously programmed value.

- **ZeroPres.:** corrects zero pressure through keystroke; this parameter allows for automatic resetting of the differential pressure reading; it is meant to field-compensate the changes of zero reading in the medium-long run. Before starting, **make sure ESA PT-1 has been working for 15 minutes at least** (otherwise lower display shows **ERR2**); the tube of the input pressure signal must be disconnected.
This function is not displayed if resetting through keystroke is not possible, that is when the parameter **res.sou** is set either on **OFF** or **Ext** (see on page 8);
- **Flowref:** sets the flow rate for the calculation of the measuring tools; together with **Pressref** and **Temp.ref** (see above and on side), this parameter is necessary in order to assess the instant, total flow rate.
Furthermore, if the **4-20 sou** parameter equals **FLou** (see on side), the value of **Flowref** is also the value of reference for the current output downscale (20 mA);
- **Pressref:** sets the differential pressure for the calculation of the measuring tools. Together with **Flowref** and **Temp.ref** (see above and on side), this parameter is necessary in order to assess the instant, total flow rate.
Furthermore, if the **4-20 sou** parameter equals **PrES** (see on side), the value of **Pressref** is also the value of reference for the current output downscale (20 mA);
- **Temp.ref:** sets the temperature of reference at which the calculation of the measuring tools was made. Together with **Flowref** and **Pressref**, this parameter is necessary in order to assess the instant, total flow rate;
- **Prs.Init:** sets the pressure value corresponding at downscale to the signal current 0÷20 mA. This parameter also adjusts the pressure of reference to some pressures other than 0 but having 0 flow rate;
- **4-20 sou:** selects the type of proportionality of the current signal; there may be 2 values:
 - **PrES**, signal proportional to pressure;
 - **FLou**, signal proportional to flow rate;
- **out type:** selects the output current scale. There are 3 possibilities:
 - **0.0**, current signal from 0 to 20 mA;
 - **4.0**, current signal from 4 to 20 mA;
 - **12.0**, current signal from 4 to 20 mA with zero corresponding to 12 mA (to be used only with proportionality to pressure);
- **tot.res:** enables/disables totalizer resetting (see on page 4):
 - **ON**, resetting of totalizer enabled;
 - **OFF**, resetting of totalizer disabled.

SETTING OF PROTECTED PARAMETERS (PROT. PRG MODE)

To enter the displaying and programming mode of the protected parameters press the \uparrow and **F** keys simultaneously while the instrument is in automatic mode.

The instrument shows the current functioning mode by displaying "**Program.**" on the upper display for a few seconds.

While "**Program.**" is being displayed, by pressing the **F** and \downarrow keys simultaneously you are asked the password to enter the protected menus. "**Password**" appears on the upper display. Now the user can use the \uparrow and \downarrow keys to select a figure or letter on the display with the blinking point. After selecting one, press the **F** key to store another one on the next display. When the 4-digit password is completed on the lower display, press the **F** key again.

If the password is correct, you enter the corresponding menu. The password to enter the programming menu of the protected parameters is "**-AE-**". If the password you have inserted is correct, the sentence "**Prot.prg**" appears for a few seconds. If you do not know the password or if you want to go back to the programming mode, press the **F** and \downarrow keys simultaneously.

To leave the programming mode for protected parameters and go back to the steady state mode press the \uparrow and **F** keys simultaneously again. The word "**Automode**" appears on the display for a few seconds. To change any parameter, follow the procedure described on page 5.

LIST OF PROTECTED PARAMETERS

PARAMETER	UPPER DISPLAY	MIN. VALUE	MAX. VALUE
Filtering on pressure values	P filter	2	20
Physical quantity of displayed as default	default	-	-
Accuracy of pressure displaying	P resltn	.0	.000
Enabling of the compensation of zero pressure	res. sou	OFF	ALL
Minimum pressure for enabling of reading	P thresh	0.00	5.00
Time of totalizer displaying (seconds)	t.showt.	1	65
Adjustment of display luminosity	brightns	7	1
Pressure of reference at 0 °C (mbar)	Press.0C	-	-
Increase in the center scale of flow rate (Nm ³ /h)	Flow inc	0	6553
Pressure of ref. at 0 °C considering the increase of downscale flow rate (in mbar)	Prs.0inc	-	-

- **P filter**: sets the filtering function of the pressure signal. The higher this parameter, the smaller the influence of small, instant changes of the pressure value on the pressure value displayed. Should a high value be set, the pressure value displayed could change rapidly.
- **default**: defines the physical quantity to be displayed as default. It means that by selectioning a different physical quantity, after some 60 seconds, the instrument automatically displays the quantity selected as default. Possibilities available:
 - **PrES**: pressure is displayed as default;
 - **Flou**: flow rate is displayed as default;
 - **Curr**: current is displayed as default;
 - **TenP**: current is displayed as default;
 - **rAnd**: the last quantity to be selected by the user through the γ and β keys is displayed.
- **P resltn**: defines the way the pressure is to be displayed; here are the possibilities:
 - **.0**: pressure expressed in tenths of mbar;
 - **.00**: pressure expressed in hundredths of mbar;
 - **.000**: pressure expressed in thousandths of mbar.

- **res. sou:** selects the type of event enabled to perform the compensation of zero pressure (see parameter ZeroPres, on page 6). Here are the possibilities:
 - **OFF:** the storage of the compensation value of zero pressure is not possible;
 - **Butt:** the storage of the compensation value of zero pressure is possible only through the **F** key, within the programming menu;
 - **Ext:** the storage of the compensation value of zero pressure is possible only through external logical signal (some 5 seconds after the zeroing, after it has been pressed for 10 seconds at least);
 - **ALL:** the storage of the compensation value of zero pressure is possible both through the **F** key from within the programming menu and the external logical signal.
- **P thresh:** sets the minimum value of the input differential pressure (mbar); pressure measuring is not possible below that value; in this case 0.0 mbar is the value taken into consideration.
- **t.showt.:** sets the displaying time (seconds) of the total consumption value (see on page 4).
- **brightns:** sets the index of luminosity of the displays. 1 is the maximum value which corresponds to the maximum power absorption of the instrument.
- **Press.0C:** displays the pressure value of reference calculated by the instrument at 0 °C. This parameter may not be changed by the user.
- **Flow inc:** sets the value of flow rate to be added to the flow rate of reference (indicated by the parameter **Flowref**, see on page 5).
- **Prs.0inc:** displays the pressure of reference calculated by the instrument for 0 °C, taking a potential increase in the flow rate value of reference into account (indicated by the previous parameter). This parameter may not be changed by the user, because it is calculated automatically by the instrument.

REMOTE CONTROL FOR PRESSURE RESETTING

The calibration of the zero pressure is possible through a remote signal. This signal must go on for 10 seconds at least, afterwards, 5 more seconds should elapse to store the compensation value of zero pressure. During this 15 second-operation the message **ext.zero** appears on the upper display. **This operation must be performed only when the differential pressure of the instrument is null** at a temperature as similar as possible to the one set for the calibration of the ambient temperature sensor. If the remote function of resetting is not enabled (parameter **res. sou**, see above) the remote zero signal does not work.

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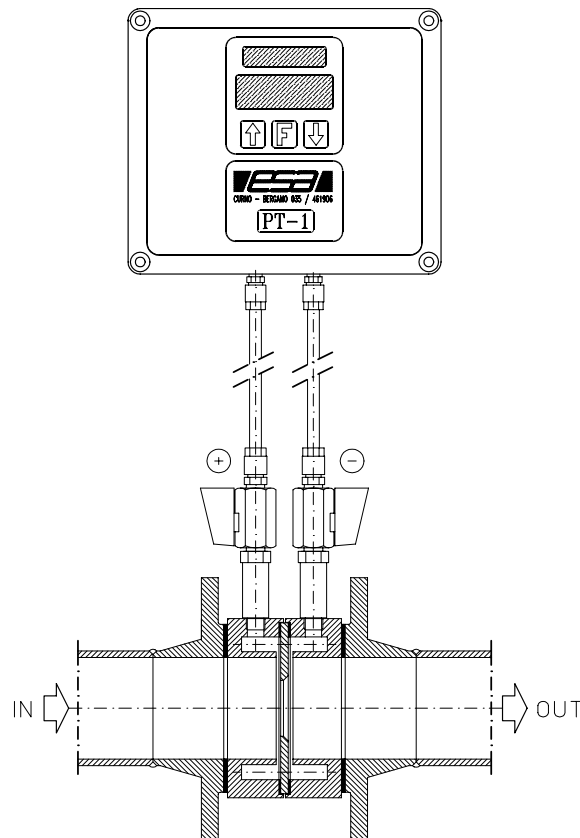
CALIBRATION OF THE INSTRUMENT (CALIBRAT. MODE)

The calibration of ESA PT-1 is factory-made. Hence, this stage is not available to the user, since a wrong operation could disable the

instrument. For specific requirements or information, please contact ESA-PYRONICS.

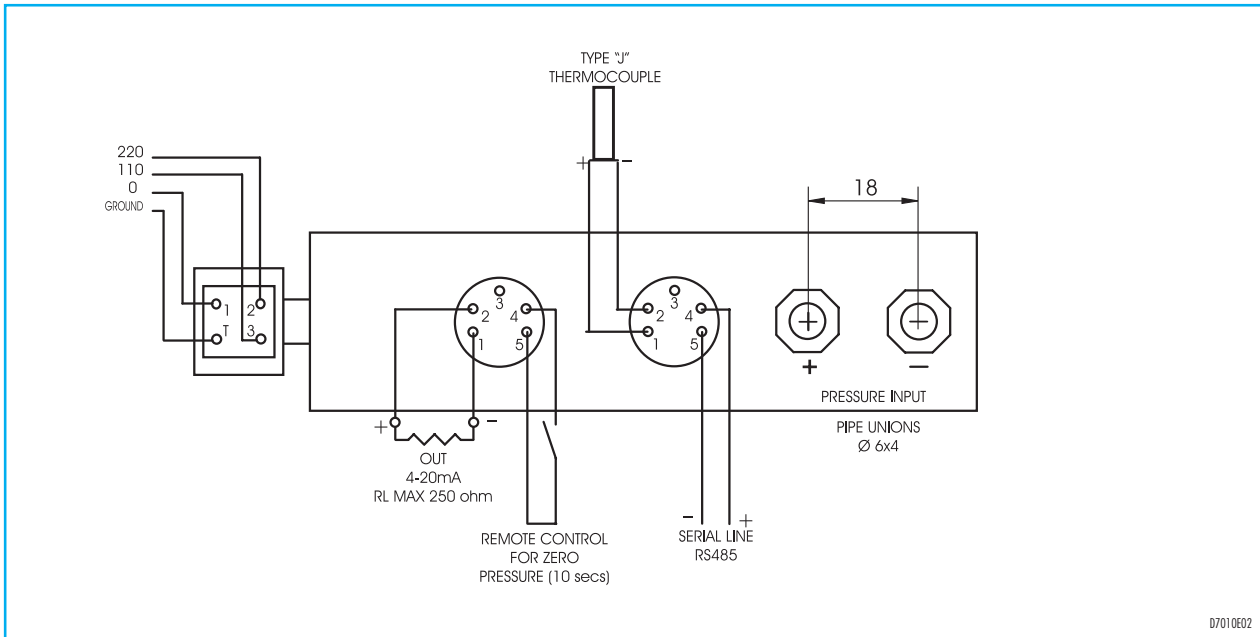
INSTALLATION

1. Place ESA PT-1 in places where thermal excursions are within the permitted limits, avoid accommodating it close to intense electrical and/or magnetic fields, in places exposed to vibration or in conditions where it might be exposed to irradiated heat, or come in contact with fuels, liquids, solvents, or corrosive gases.
2. The device should be mounted vertically. The special mounting holes are on the back cover. A diagram of the electrical connections is also located inside the back cover.
3. The pneumatic connections for the pressure input signals (+/-) can be carried out with copper pipes (6x4 mm), avoiding long and U shaped courses. It is advisable to install the device in a high position far from pressure intakes (calibrated flange, anubar, etc.), otherwise steam traps must be duly installed.
4. The connections for the transmission of the mA signal from ESA PT-1 to the remote unit must be made with a shielded double-wire cable, 2x1 mm² in section, taking care that the shielding is grounded from one end only. The connection for the output signal transmission is made through the five-pole connector, which is also used for the serial transmission.
5. The connection of the compensation thermocouple is made as shown drawing "Connections".
6. The power supply line is connected to the four-pole connector, where there are two different terminals for the 110 or 220V supplies



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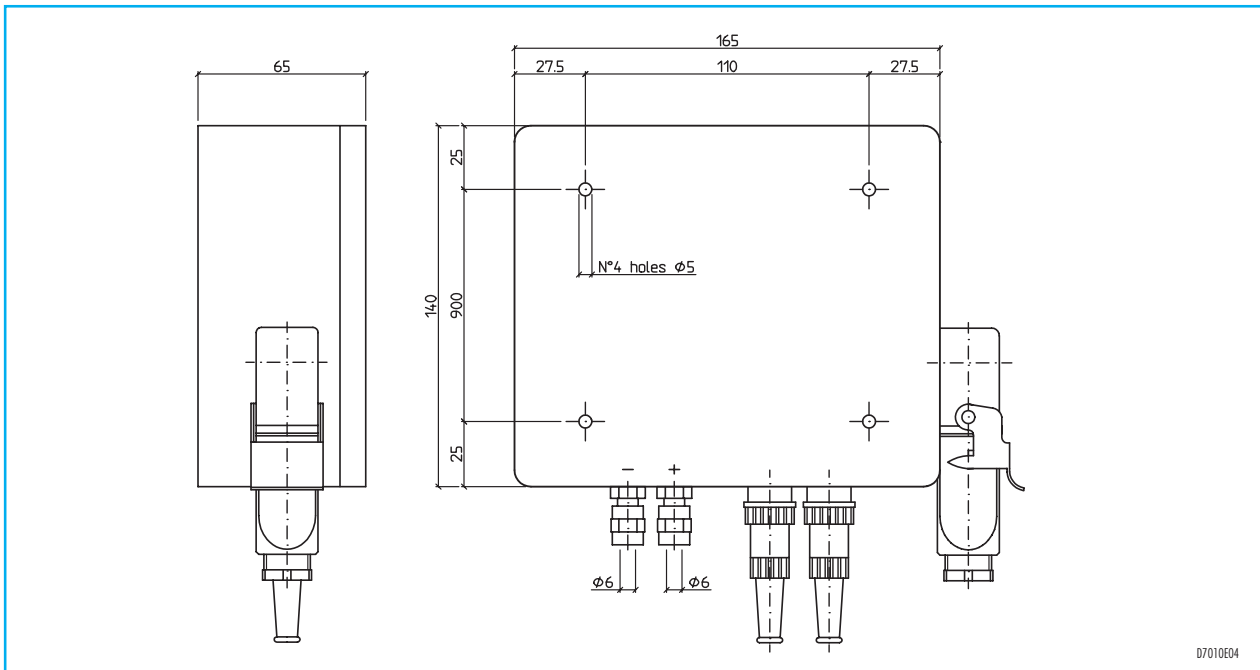
CONNECTIONS



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IMPORTANT: THE CONNECTIONS FOR THE TRANSMISSION OF THE mA SIGNAL BETWEEN ESA PT-1 AND THE REMOTE INSTRUMENT MUST BE MADE WITH A SHIELDED DOUBLE-WIRE CABLE (2x1 mm² IN SECTION), WITH THE SHIELDING ONLY GROUNDED FROM ONE END.

DIMENSIONS



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