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Sensors and Controls, llc.

User Manual
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Universal Panel Meter
with Analog 4-20mA Output

Accepts 10 Different Thermocouple Inputs, RTD's and other Sensors

1/8 DIN Meter Size

Thermocouple Inputs Include

Type C: Tungsten Rhenium extreme high temperatures

Type: K, J, T, E, and N Popular base metal designs

Type: R, S, and B Platinum Rhodium designs

Type L: European/German variant for type J with differet EMF output specifications

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4 Red LED digits, 7-Segment, 0.56" (14.2 mm) Digit Height, 5 Brightness Levels

Universal Power Supply for Global Ultilization 18-265V AC/DC

The information contained in this document is believed to be correct, but Evosensors accepts no liability for any errors it contains, and reserves the right to alter specifications without notice. **Table of Contents**

1.1 1/8 DIN Universal panel meter for Temperature, Process, Voltage and Resistance

Electrical measurements

Universal digital panel meter in $^1/_8$ DIN size for panel mount, and a wide range of applications. Accepts AC and DC voltage signals from mV up to 600 V and currents up to 5 A (AC measures in True RMS), process signals (mA and Vdc) with excitation voltage included, thermocouples K, J, E, N, L, R, S, B, T and C, resistive temperature probes (Pt100, Pt500, Pt1000, Ni100, Ni200, Ni1000, PTC and NTC), resistances, potentiometers and frequency. Scalable reading with 4 digits up to 9999 / -1999 with configurable decimal point. Two independent alarms, configurable as maximum or minimum, with hysteresis and setpoint.

Optional 1 or 2 relay outputs, 4/20 mA isolated analog output, and Modbus RTU isolated serial communications.

Front protection IP65. Connections with plug-in screw terminals.

Instrument designed for industrial use, highly flexible, allows for integration in multiple applications, reduced cost, excellent quality and optional customization available.

- **'Fast access'** menu at front key UP (5) configurable for fast access to alarm setpoints *(see section 1.20).*
- **'Eco'** mode reduces power consumption *(see section 1.23).*
- Simplified scaling configuration *(see section 1.21)* .
- Function **'external control'** to activate with a contact a predefined function (second scaling, decimal point, reading "hold", "tare," memory of maximum or minimum) *(see section 1.24)* .
- 5 configurable brightness levels *(see section 1.29.7)* .

1.2 Front View

Alarm 2   Alarm 1

Logo

Units

Key 'LE'   Key 'UP'   Key 'SQ'
'Fast access'   'Configuration menu'
(see section 1.29.4)   *(see section 1.29)*

1.3 Rear view

Option 2   Option 1

1 2 3 4 5   8 9 0

Signal   Power
(see section 1.5)   *(see section 1.4)*
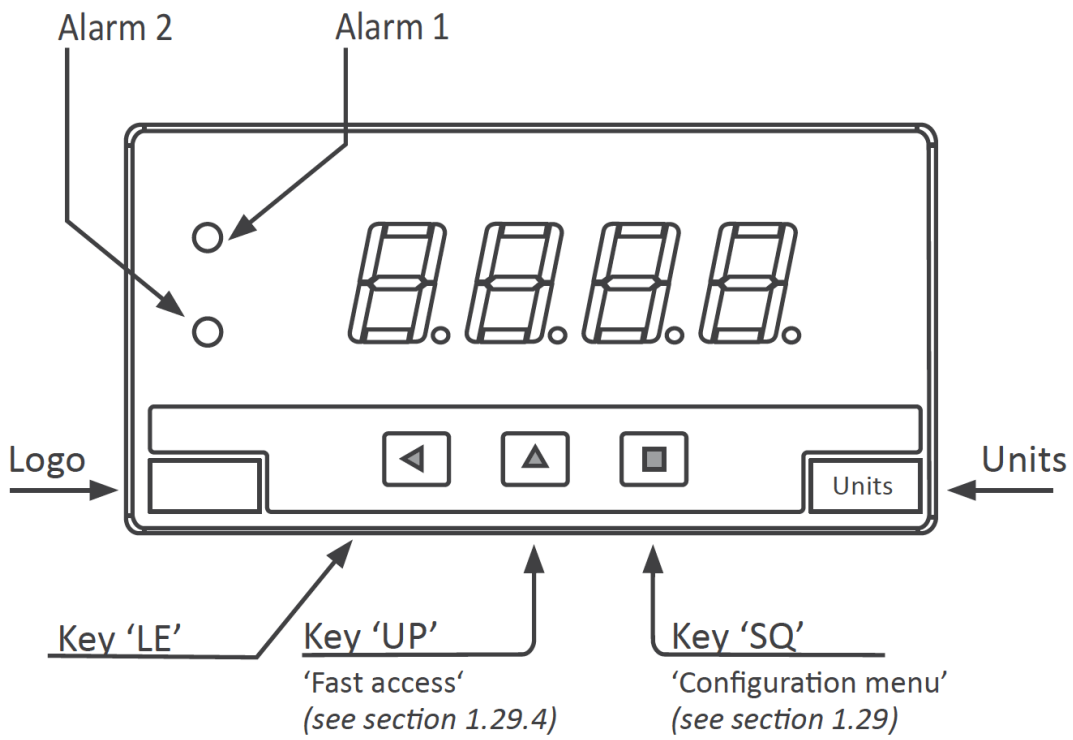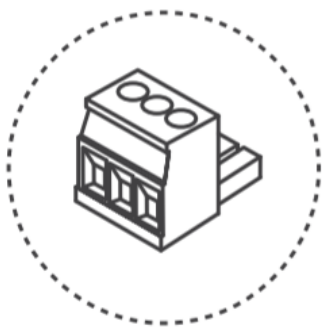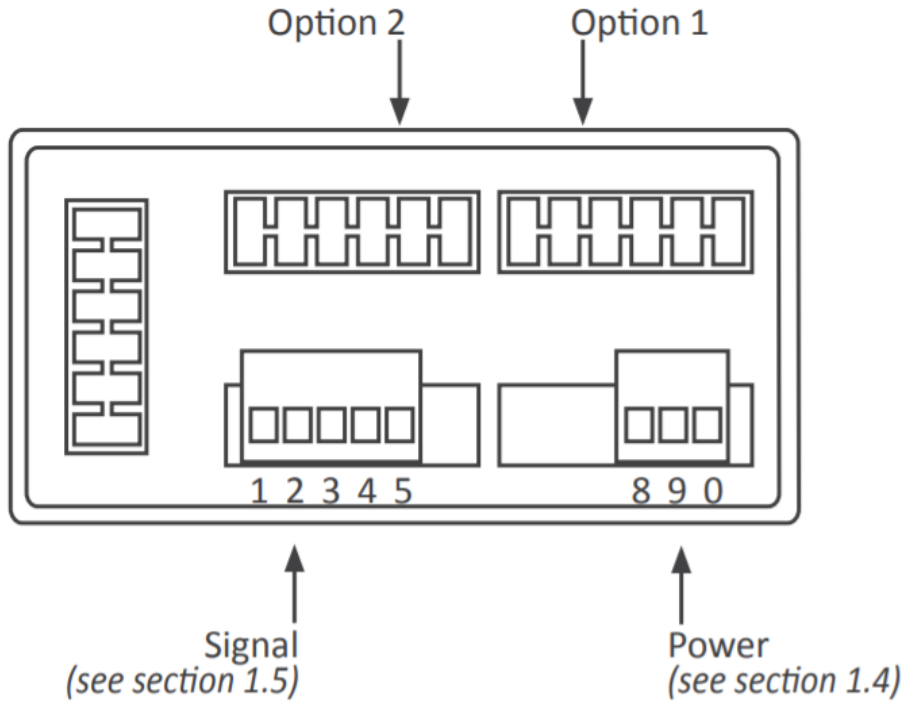
Detail of the plug-in screw terminals provided with the instrument. The instrument is provided with all terminals needed, both male and female.

1.4 Power connections

Power 18 to 265 Vac/dc
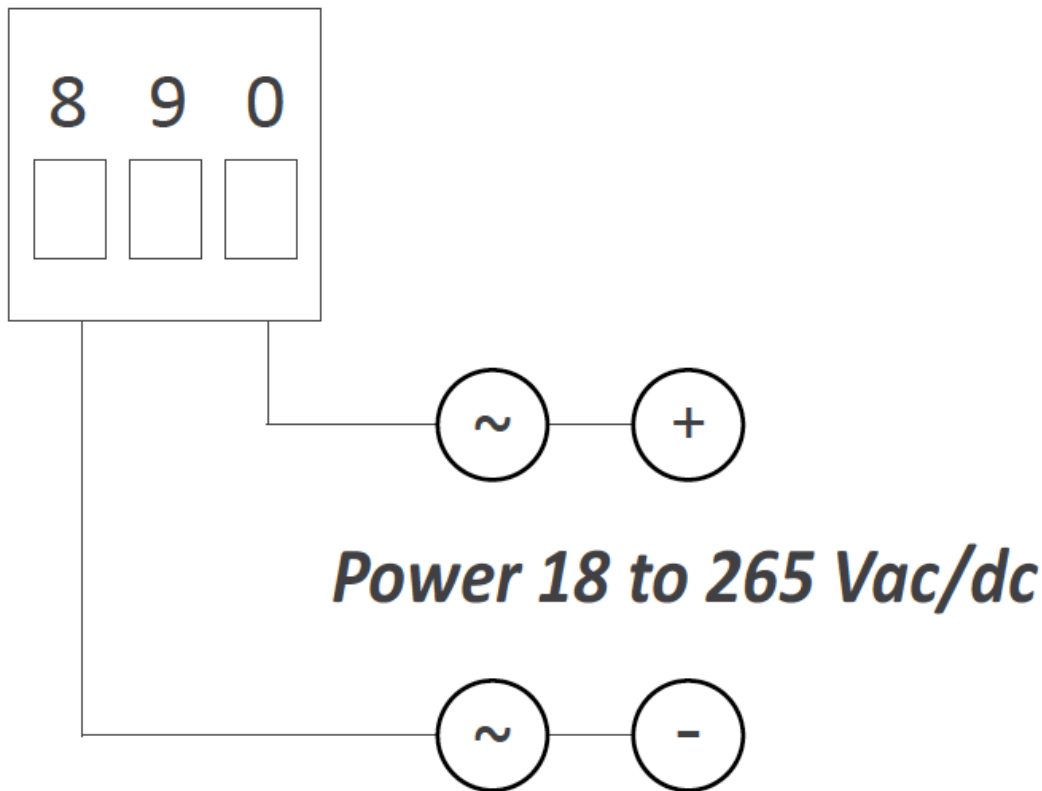
Earth connection - The instrument does not need earth connection for correct operation nor for compliance with security regulations. Terminal 9 is not connected to any internal circuit and is provided only as a safe place for earth wire.

Fuse - As requested by security regulation 61010-1, add a protection fuse to the power to act as disconnection element, easily accessible to the operator and identified as a protection device.

250 mA time-lag for power voltage > 50 Vac/dc
400 mA time-lag for power voltage < 50 Vac/dc

1.5 Signal connections

Signals up to 600 V and 200 V (AC and DC) must be connected at terminals 1 and 4. Signals for 5 A current (AC and DC) must be connected at terminals 3 and 4. All other signals must be connected between terminals 2 and 4. Terminal 5 is a 'multifunction' terminal, configurable with one of the following functions:

- +15 Vdc excitation voltage (Vexc) for process signals
- +5 Vdc excitation for potentiometer signals
- connection for the Pt100 third wire compensation
- external contact 'EK' function

To select the terminal 5 function, select the position of internal jumper 'T' *(see section 1.9)* .

Terminal	Function	Description
multifunc.	{	Vexc, Pt100 3 wire, Pot+, 'EK' external control
Common	{	neutral, 0 V, common
5 A	{	~5 Aac, ±5 Adc
Signal	{	~Vac, ±Vdc, resistance, mA, pot, thermocouple+, Pt+, Ni+, PTC+, NTC+
HV signal	{	~600 Vac, ~200 Vac ±600 Vdc, ±200 Vdc
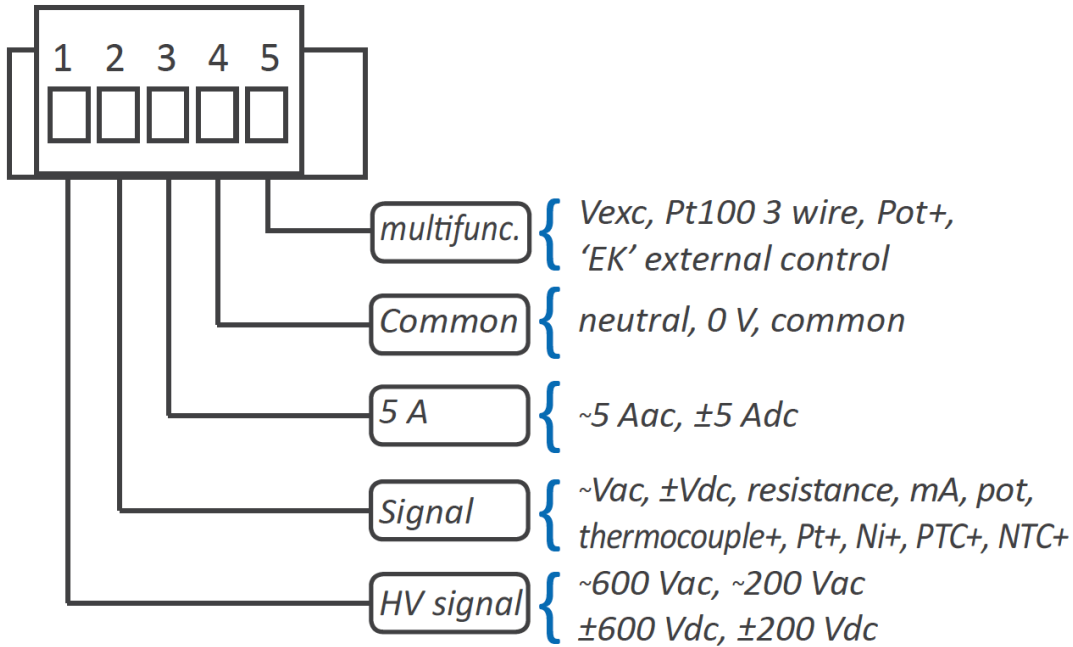
1.6 Mechanical dimensions in mm (in)

48 (1.89)

96 (3.78)

16 (0.63) 75 (2.95) 8 (0.31)

Units

Panel cut-out

44 (1.74)

92 (3.63)
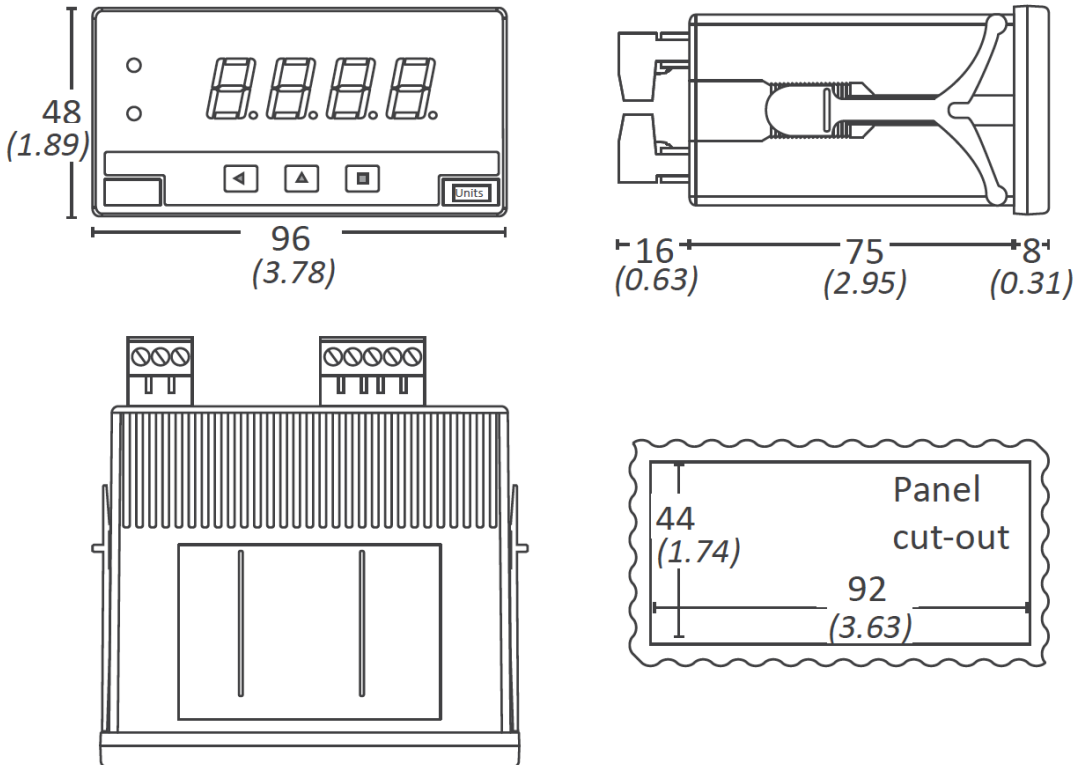
1.7 Installation and start-up

1. Open the instrument as indicated at section 1.26 and access the internal board.
2. Select jumpers 'S' for the signal range required *(see section 1.9)* .

3. Select jumper 'T' to assign to multifunction terminal 5 the required functionality *(see section 1.9)* .
4. Close the instrument as indicated at section 1.26.
5. Connect the input signal and the power supply as indicated at sections *1.4* and *1.5* .
6. Enter the *'configuration menu'* to configure the instrument (scaling, alarms, ...) *(see section 1.29)* .

1.8 Technical specifications

Digits	
number of digits	4
led	7 segments led
color	red
height	14mm

Reading	
max. reading	9999
min. reading	-1999
decimal point	configurable X.X.X.X
readings	3 readings / second
display refresh	3 refresh / second
step response	300 mSec. (0 % to 99 % signal)
overrange	reading flashes at '9999'
underrange	reading flashes at '-1999'

Accepted input signal	
AC voltages and currents	600 Vac, 200 Vac, 20 Vac, 2 Vac 200 mVac, 60 mVac, 5 Aac, 20 mAac *(see section 1.10)*
DC voltages and currents	±600 Vdc, ±200 Vdc, ±20 Vdc, ±2 Vdc ±200 mVdc, ±60 mVdc, ±5 Adc, ±20 mAdc *(see section 1.11)*
thermocouples	K, J, E, N, L, R, S, B, T y C *(see section 1.12)*
temperature 'Pt'	Pt100 (2 and 3 wires with automatic compensation up to 30 R), Pt500, Pt1000 *(see section 1.13)*
temperature 'Ni'	Ni100, Ni200, Ni1000 *(see section 1.13)*
temperature 'NTC'	*(see section 1.14)*
temperature 'PTC'	*(see section 1.15)*
process	4/20 mA, 0/10 Vdc (active and passive) *(see section 1.16)*
Measuring Frequency	*frequency up to 100 Hz (see section 1.17)*

resistances	ranges of 5 K and 50 K *(see section 1.18)*
potentiometers	nominal value 500 Ohm up to 20 KOhm *(see section 1.18)*
Accuracy at 25ºC **Thermal drift**	*see following sections for each signal* 150 ppm/º
Excitation voltage	+15 Vdc (max. 30 mA) for process signals +5 Vdc for potentiometers (at terminal 5, see sections *1.5* and *1.16*)

Power supply	
power 'U' isolation	18 to 265 Vac/dc 1500 Veff. *isolation tested for 60 sec.*
consumption (without 'Eco')	<1.5 W meter only <2.5 W meter with options
consumption (with 'Eco')	<0.3 W meter only <1.5 W meter with options

Functions included		**Section**
Fast access	to alarm setpoints, maximum and minimum	1.20
External Control	second scaling decimal point 0, 1, 2 or 3 'hold' reading 'tare' function memory of maximal memory of minimum	1.24
'ECO' mode	reduced consumption	1.23
Alarms	setpoint hysteresis set as max or min type	1.29.3
Offset reading	add a fixed number of counts to reading	1.22
Display filter	recursive 'steps'	1.29.7
Simplified scaling		1.21
Memory	max and min memory	1.29.4
Password	blocks configuration	1.29.7
Display brightness	5 levels	1.29.7

Table 1 - Functions included

Configuration	3 front push buttons
Front protection	IP65, NEMA13
Output options	relay, analog, serial *(see section 2)*
Mechanical	
mounting	panel
connections	plug-in screw termnials
housing material	ABS, polycarbonate (V0)

weight	<150 grams
front size	96 x 48 mm (1/8 DIN)
panel cut-out	92 x 44 mm
deep	91 mm (including terminals)
Temperature	
operation	from 0 to +50ºC (32 to 122ºF)
storage	from -20 to +70ºC (-4 to 150ºF)
'warm-up' time	15 minutes

1.9 Internal jumpers

Internal jumpers 'S' are associated to the signal range. The position of internal jumper 'T' assigns the function of the multifunction terminal 5. At 'T'ble 2' see a list of signal ranges and associated jumper 'S' and 'T'. At Table 3 see the position for jumper 'T' associated to each function of the multifunction terminal 5. To access the internal jumpers, open the housing as explained at section 1.26. For additional information on each signal range see the following sections:

- Ranges for AC voltages and currents, see *section 1.10*
- Ranges for DC voltages and currents, see *section 1.11*
- Ranges for thermocouples, see *section 1.12*
- Ranges for Pt and Ni probes, see *section 1.13*
- Ranges for NTC probes, see *section 1.14*
- Ranges for PTC probes, see *section 1.15*
- Ranges for process signals, see *section 1.16*
- Ranges for frequency signals, see *section 1.17*
- Ranges for resistance measures, see *section 1.188*
- Ranges for potentiometer measures, see *section 1.199*

Displays

Jumpers 'T' for terminal 5
function selection

Jumpers 'S' for signal
range selection

K
J
I
H
G
F
E
D
C
B
A

1
2
3
4
5
6

Input signal terminals
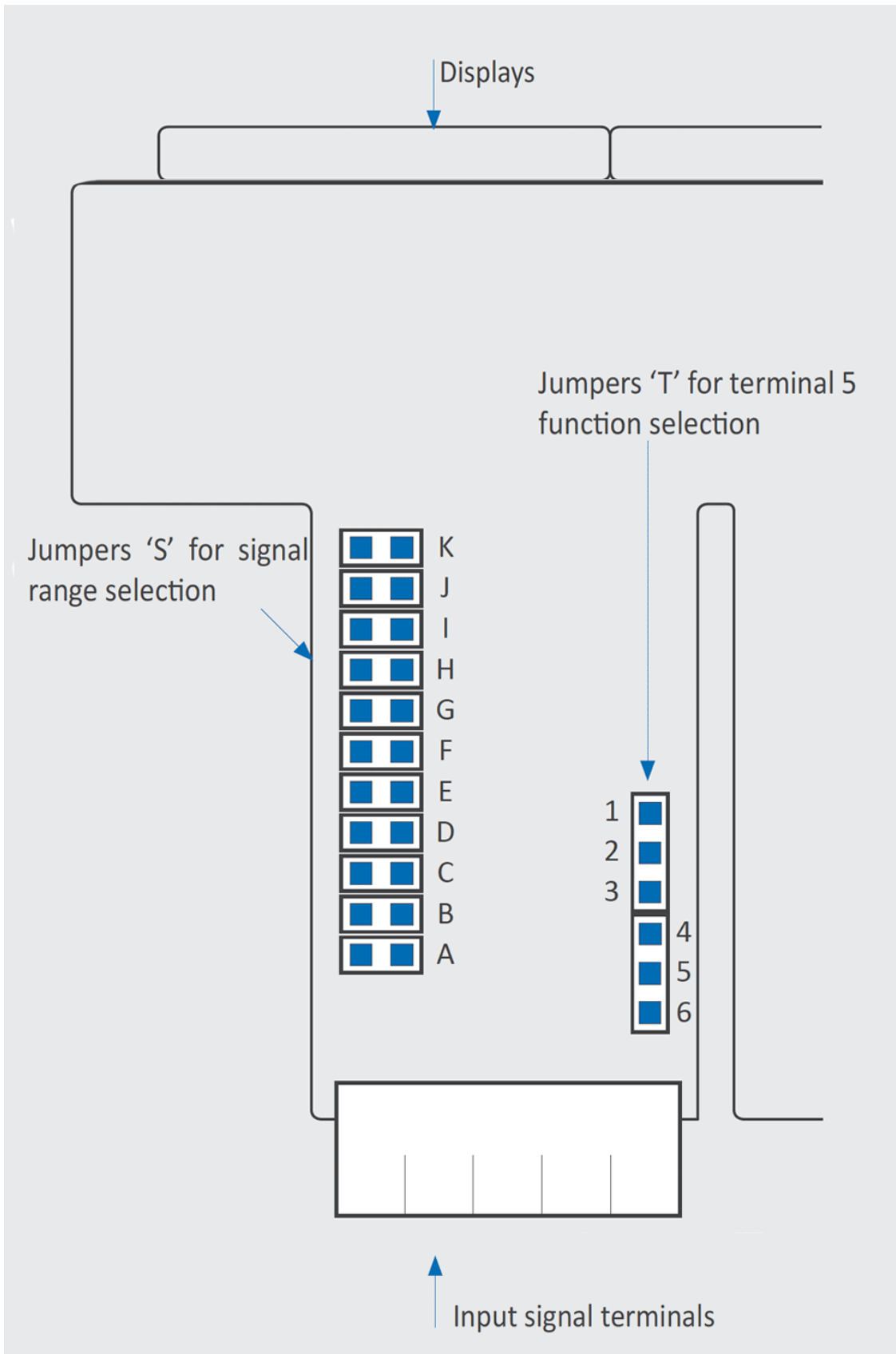
Jumpers not used can be stored for future use by placing them at the 'no contact' positions indicated below.

Jumpers stored at 'no contact' position

K
J
I
H
G
F

Only the 3 positions indicated are safe to store jumpers.
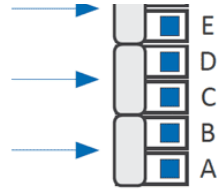
Range	Jumpers 'S'	Jumper 'T'
AC voltages and currents		
~600 Vac	*G I*	
~200 Vac	*I*	
~20 Vac	*A I*	
~2 Vac	*B I*	
~200 mVac	*C I*	*4-5*
~60 mVac	*E I*	
~5 Aac	*I*	
~20 Vac	*D I*	
DC voltages and currents		
±600 Vdc	*G*	
±200 Vdc	*---*	
±20 Vdc	*A*	
±2 Vdc	*B*	
±200 mVdc	*C*	*4-5*
±60 mVdc	*E*	
±5 Adc	*---*	
±20 mAdc	*D*	
Process		
4/20 mA	*D*	*1-2 **
0/10 Vdc	*A*	
* jumper 1-2 to activate Vexc. Select 4-5 to activate function 'EK'		
Resistances		
0 to 5 K	*F H K*	*4-5*
0 to 50 K	*F K*	
Thermocouples		
Tc.K		

Tc.J	E	
Tc.E		
Tc.N		
Tc.L		4.5
Tc.R	E J	
Tc.S		
Tc.T		
Tc.C	E	
Tc.B	E J	
Pt and Ni probes		
Pt100 (3 wire)	*F H J*	*5-6*
Pt100 (2 wire)	*F H*	
Pt500	*F*	
Pt1000	*F*	4-5
Ni100	*F H*	
Ni200	*F H*	
Ni1000	*F*	
NTC probes		
NTC	*F K*	*4-5*
PTC probes		
KTY 121	*F*	
KTY 210, 220	*F H K*	*4-5*
Potentiometers		
0/100%	*A*	*2-3*

Table 2 - Jumpers 'S' and 'T' and signal ranges

Jumpers 'T'	Active function at terminal 5
1 2	*Vexc (excitation voltage +15 Vdc) for process*
2 3	*Potentiometer excitation (+5 Vdc)*
4 5	*External control ('EK' function)*
5 6	*Pt100 third wire*

Table 3 - Jumpers 'T' and function at multifunction terminal 5

1.10 Measuring AC voltages and AC currents

- *AC signal ranges*
  The instrument accepts the measure of AC voltages and currents, with ranges from 60 mVac up to 600 Vac, covering from shunt signals to typical power line voltages of 48 Vac, 115 Vac, 230 Vac and even 380 Vac. Both phase - to - neutral and phase - to - phase measures are accepted. AC currents signals of up to 5 Aac are accepted, and it has a range of 20 mAac.

- *'True RMS' measure*
  AC measure are TrueRMS. The instrument assigns a 'dead band' around 0, with a configurable value between 0 and 100. Value is empirical, and by default is set to 20. The 'dead band' can be configured at the 'Configuration menu' *(see section 1.29.7)* .

- *Scaling*
  The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable decimal point to any position. The *'second scaling'* function can also be used *(see section 1.25)* .

- *Maximum oversignal*
  'Maximum oversignal' is the maximum signal accepted by the instrument. Higher signal values may cause instrument damage. Lower values are non destructive but may be out of accuracy specifications.

- *Response times*
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.

- *Terminal 5 'multifunction' - External control* Terminal 5 remains configured as 'EK' external control function. See *section 1.9* for a list of available functions.

- *Start-up, connections and jumpers* For instrument start-up follow the steps listed at section *1.7* . Signal connections are indicated at section *1.5* . Location for internal jumpers is indicated at section *1.9* .

| Vac ranges (Veff.)	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% FS)	Max. oversignal	Connection (terminals)	Z_{in}
~600 Vac	600		G I			800 Vac	1(~) 4(~)	12 M
~200 Vac	200.0		I			800 Vac		12 M
~20 Vac	20.0	from 9999 to -1999	A I	4-5	<0.30% (up to 150 Hz)	150 Vac		1 M
~2 Vac	2.000		B I			100 Vac		100 K
~200 mVac	200.0		C I			30 Vac	2(~) 4(~)	10 K
~60 mVac	60.0		E I			3 Vac		1 M

Table 4 - Measuring ranges in Vac

Aac ranges	Scale by	Scalable	Jumper 'S' (see	Jumper 'T' (see	Accuracy	Max.	Connection	Z_{in}

(Veff.)	default		section 1.9)	section 1.9)	(% FS)	oversignal	(terminals)	
~5 Aac	5.00	from 9999 to -1999	/	4-5	<0.50% (up to 150 Hz)	7 Aac (max. 7sec.)	3(~) 4(~)	20 mOhm
~20 mAac	20.00		D /			25 mAac	2(~) 4(~)	4.7 R

Table 5 - Measuring ranges in Aac

See below a list of typical connections:
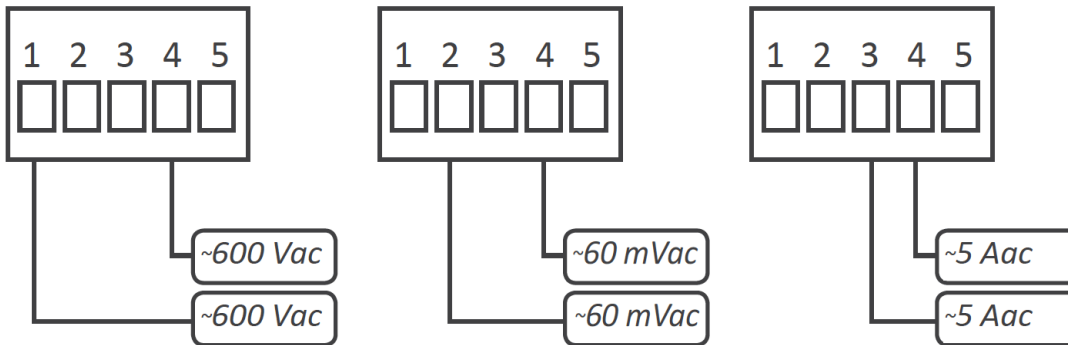
Applications	
... with shunts ...	measure of AC currents through a current shunt of 60 mV, 100 mV or 150 mV and scaled reading
... with X/5, X/1 current transformers ...	measure of AC currents through a X/5 or X/1 current transformer and scaled reading
... direct measure ...	direct measure of currents up to 5 Aac
... with power line voltages ...	measure of voltages over power lines phase and neutral, of 230 Vac, 115 Vac, ...
... with power voltages ...	measure of phase to phase lines on power lines 380 Vac, 230 Vac, ...
... with AC voltages	measure of AC voltages in panels using 24 Vac, 48 Vac, ...

Table 6 - Applications with measure of AC signals

1.11 Measuring DC voltages and DC currents

- **Measuring DC signal ranges**
  The instrument accepts the measure of DC voltages and currents, with ranges from 60 mVdc up to 600 Vdc, covering applications with current shunts, tachometric dynamos, batteries, process, etc. DC currents signals of up to 5 Adc are accepted, and it has a range of 20 mAdc.
- **Bipolar ranges**
  All signal ranges are bipolar, and the instrument can measure both the positive and the negative signal.

- **Scaling**
  The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable decimal point to any position. The 'second scaling' function can also be used (see section 1.25).
- **Maximum oversignal**
  'Maximum oversignal' is the maximum signal accepted by the instrument. Higher signal values may cause instrument damage. Lower values are non destructive but may be out of accuracy specifications.
- **Response times**
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.
- **Terminal 5 'multifunction' - External control**
  Terminal 5 remains configured as 'EK' external control function. See section 1.9 for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

| Vdc ranges	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% FS)	Max. oversignal	Connection (terminals)	Z_{in}
±600 Vac	600	from 9999 to -1999	G	4-5	<0.20%	800 Vdc	1(+) 4(-)	12 M
±200 Vdc	200.0		---			800 Vdc		12 M
±20 Vdc	20.00		A			150 Vdc	2(+) 4(-)	1 M
±2 Vdc	2.000		B			100 Vdc		100 K
±200 mVdc	200.0		C			30 Vdc		10 K
±60 mVdc	60.0		E		<0.25%	3 Vdc		1 M

Table 7 - Measuring ranges in Vdc

Adc ranges (Veff.)	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% FS)	Max. oversignal	Connection (terminals)	Z_{in}
±5 Adc	±5.00	from 9999 to -1999	---	4-5	<0.25%	7 Adc (max. 7sec.)	3(+) 4(-)	20 mOhm
±20								

mAdc	±20.00		D		<0.15%	25 mAdc	2(+) 4(-)	4.7 R

Table 8 - Measuring ranges in Adc

See below a list of typical connections:
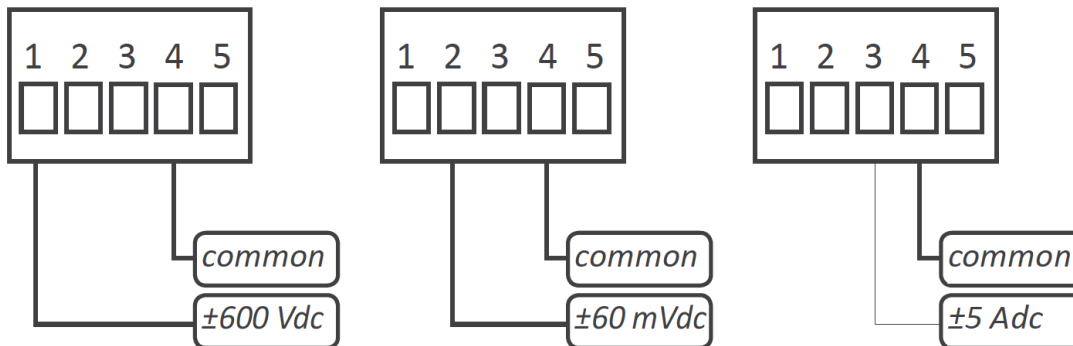
Applications	
... with shunts ...	measure of DC currents through a current shunt of 60 mV, 100 mV or 150 mV and scaled reading
... direct measure ...	direct measure of currents up to 5 Adc and voltages up to 400 Vdc
... with batteries ...	measure of the battery voltage at 12 Vdc and 24 Vdc
... with tachometric dynamos ...	read the speed in RPM from a tachometric dynamo voltage signal
... with speed variators ...	measure the voltage signal from the variator, proportional to the RPM speed of the motor

Table 9 - Applications with DC Signals

1.12 Measuring thermocouples

- **Thermocouples accepted**
  The instrument accepts direct connection of thermocouples type K, J, E, N, L, R, S, B, T and C.
- **Temperature ranges and total error**
  Temperature ranges and total error for each type of thermocouple are indicated on *'Table 10'* below.
- **Cold junction compensation**
  The thermocouple cold junction is automatically compensated by the instrument. The automatic compensation can be disabled from the configuration menu.
- **Resolution and units**
  The instrument resolution when measuring thermocouples is 1º. Reading can be configured in ºC (degrees Celsius) or ºF (degrees Fahrenheit).
- **Sensor break detection**
  In case of sensor break, the instrument will show *'h.ovr'* or *'h.udr' (see Table 17)* depending on the broken cable.
- **Compensated cable**
  To correctly measure a thermocouple signal, always use compensated cable, of the thermocouple used, to connect the instrument and the thermocouple.

- **Response times**
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.
- **Terminal 5 'multifunction' - External control**
  Terminal 5 remains configured as 'EK' external control function. See section *1.9* for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section *1.7*. Signal connections are indicated at section *1.5*. Location for internal jumpers is indicated at section *1.9*.

See below connections for thermocouple:
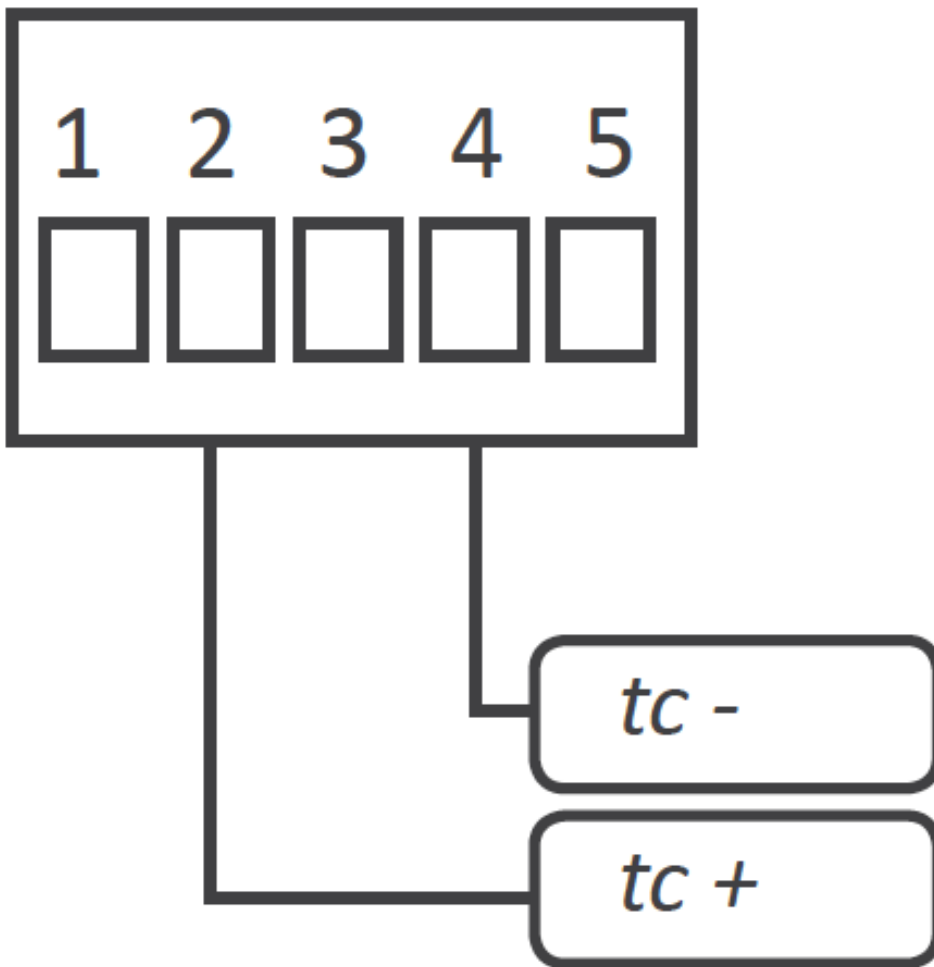
Thermocouple	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range in ºC (in ºF)	Connection (terminals)	Total error (cold junction included)

Thermocouple K			-100 / 1350ºC (-148 / 2462ºF)		
Thermocouple J	E		-100 / 1200ºC (-148 / 2192ºF)		
Thermocouple E			-100 / 1000ºC (-148 / 1832ºF)		<3º
Thermocouple N		4-5	-100 / 1300ºC (-148 / 2372ºF)		
Thermocouple L			-100 / 900ºC (-148 / 1652ºF)	2(tc +) 4(tc -)	
Thermocouple R			0 / 1768ºC (32 / 3214ºF)		
Thermocouple S	E J		0 / 1768ºC (32 / 3214ºF)		
Thermocouple T			-100 / 400ºC (-148 / 752ºF)		
Thermocouple C	E		0 / 2300ºC (32 / 4172ºF)		<5º
Thermocouple B	E J		700 / 1820ºC (1292 / 3308ºF)		

Table 10 - Temperature ranges for thermocouples

1.13 Measuring with Pt and Ni probes

- **Accepted Pt and Ni probes**
  The instrument accepts connection of Pt100, Pt500 and Pt1000 temperature probes, and also Ni100, Ni200 and Ni1000 temperature probes. Temperature ranges for each type of probe are indicated on *'Table 11'* below.
- **Pt100 with 2 and 3 wires**
  The instrument accepts connection for 2 and 3 wire Pt100 probes. For 3 wire Pt100 probes, configure internal jumper 'T' at position 5-6 *(see section 1.9)*. For 2 wire Pt100 probes,

configure internal jumper 'T' at position 4-5. Compensation of the wire resistance for 2 wire probes can be manually configured with the parameter *'Offset reading' ('oFFS') (see section 1.22)* which allows to configure a fixed number of counts to be added to the reading.

- **Resolution and units**
  The temperature resolution using Pt and Ni temperature probes is configurable to 1º or 0.1º. Reading can be configured in ºC (degrees Celsius) or ºF (degrees Fahrenheit).
- **Sensor break detection**
  In case of sensor break, the instrument will show *h.ovr* or *'h.udr' (see Table 17)* depending on the broken cable.
- **Alpha temperature coefficient**
  The instrument accepts Pt probes (Pt100, Pt500, Pt1000) with *'Alpha'* parameter of *'0.0385'* and *'0.0390' (see section 1.29.7)*. This parameter is associated to the specific model of probe installed.
- **Terminal 5 'multifunction' - 'Pt100 3 wire' or 'External control'**
  To configure for 3 wire Pt100 probes, set internal jumper 'T' at position 5-6 *(see section 1.9)*. Terminal 5 will be assigned to the connection of the third wire of the Pt100 probe, for automatic wire resistance compensation purposes, up to 30 R. To configure for 2 wire Pt100 probes, set internal jumper 'T' at position 4-5 *(see section 1.9)*. Terminal 5 will be configured as 'EK' external control function. See section *1.9* for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section *1.7*. Signal connections are indicated at section *1.5*. Location for internal jumpers is indicated at section *1.9*.

See below a list of typical connections:
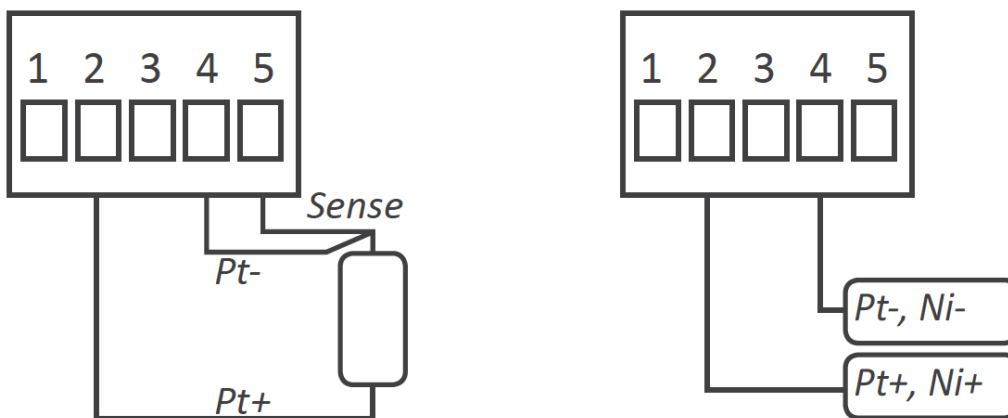
Sensor	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range in ºC (in ºF)	Total error	Connection (terminals)	Current at sensor
Pt100 3 wires	F H J	5-6	-200 / 700ºC (-328 / 1292ºF)		2 (Pt+) 4 (Pt-) 5 (sense)	<900 uA
Pt100 2			-200 / 700ºC			

wires	F H		(-328 / 1292ºF)			
Pt500	F		-150 / 630ºC (-238 / 1166ºF)			< 90 uA
Pt1000	F	4-5	-190 / 630ºC (-310 / 1166ºF)	<1º	2 (Pt+, Ni+) 4 (Pt-, Ni-)	< 90 uA
Ni100	F H		-60 / 180ºC (-76 / 356ºF)			< 900 uA
Ni200	F H		-60 / 120ºC (-76 / 248ºF)			< 900 uA
Ni1000	F		-60 / 180ºC (-76 / 356ºF)			< 90 uA
Table 11 - Ranges of temperature for Pt and Ni probes						

1.14 Measuring with NTC probes

- **Accepted NTC probes**
  The NTC probe is a temperature variable resistor with a temperature - resistance curve defined by two parameters called 'R25' and 'beta'. By default, the instrument is configured for a standard NTC with 'R25' of 10K and 'beta' of 3500. The measured temperature ranges from -60ºC to 150ºC. Different NTC probes can be used, by configuring the instrument for different values of 'R25' and 'beta'. The instrument measures resistance from 100 R up to 1 MOhm. Use 'Table 12' to write down values for your NTC.
- **Parameters 'R$_{25}$' and 'Beta'**
  The instrument accepts values of 'beta' between 2500 and 5500, and values of R25 between 1.0 K and 200.0 K
- **Resolution and units**
  The temperature resolution using NTC temperature probes is configurable to 1º or 0.1º. Reading can be configured in ºC (degrees Celsius) or ºF (degrees Fahrenheit).
- **Sensor break detection**
  In case of sensor break, the instrument will show *'h.ovr'* or *'h.udr' (see Table 17)* depending on the broken cable.
- **Terminal 5 'multifunction' - External control**
  Terminal 5 remains configured as 'EK' external control function. See section *1.9* for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section *1.7*. Signal connections are indicated at section *1.5*. Location for internal jumpers is indicated at section *1.9*.

See below connections for NTC probe:
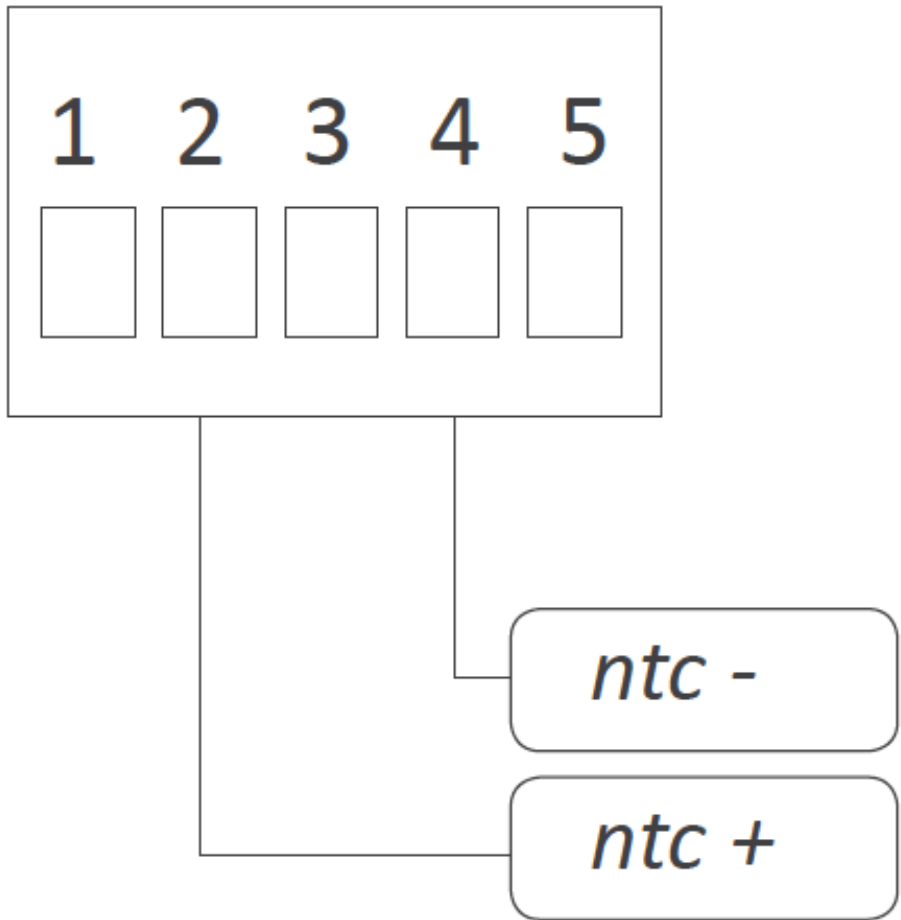
Range of Measure	NTC probe		
	Temp.	R25	Beta
100R			
1 MOhm			

Table 12 - Data from NTC datasheet

NTC 'R$_{25}$' (configurable) *	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range of measure	Accuracy (% of reading)	Connection (terminals)	Beta (configurable)
10K	*F K*	*4-5*	*From -60 ºC to 150ºC*	*<1.5% of reading*	*2 (NTC +) 4 (NTC -)*	*3500*

*Table 13 - *'Beta' is configurable from 2000 to 5500. 'R25' is configurable from 1.0 K up to 200.0 K.*

1.15 Measuring with PTC probes

- **Accepted PTC probes**
  The instrument accepts direct connection of PTC probes. Accepted PTC probes are listed at *'Table 14'*.
- **Resolution and units**
  The temperature resolution using PTC temperature probes is configurable to 1º or 0.1º.
  Reading can be configured in ºC (degrees Celsius) or ºF (degrees Fahrenheit).
- **Sensor break detection**
  In case of sensor break, the instrument will show *'h.ovr'* or *'h.udr' (see Table 17)* depending on the broken cable.
- **Terminal 5 'multifunction' - External control**
  Terminal 5 remains configured as 'EK' external control function. See section *1.9* for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section *1.7*. Signal connections are indicated at section *1.5*. Location for internal jumpers is indicated at section *1.9*.

See below connections for PTC probe:
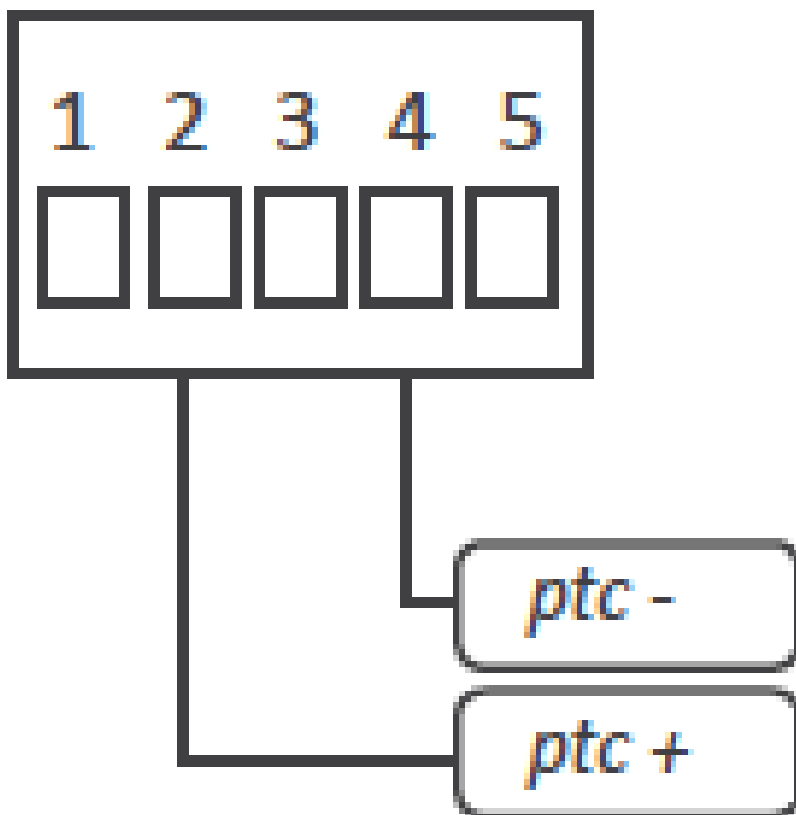
Family	Sensor	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range in ºC (in ºF)	Total Error
KTY 121	KTY81-121 KTY82-121	F			
KTY 210	KTY81-210 KTY82-210	FHK	4-5	-55 / 150ºC (-67 / 302ºF)	<1º
KTY 220	KTY81-220 KTY82-220	FHK			
Table 14 - Ranges of temperature for PTC probes					

1.16 Process measures

- **Measuring process signals**
  The instrument accepts the measure of process signals in 4/20 mA and 0/10 Vdc. The instrument provides excitation voltage to power up transducers.
- **Scaling**
  The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable decimal point to any position. The 'second scaling' function can also be used (see section 1.25).
- **Maximum oversignal**
  'Maximum oversignal' is the maximum signal accepted by the in- strument. Higher signal values may cause instrument damage. Low- er values are non destructive but may be out of accuracy specifica- tions.
- **Response times**
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.
- **Terminal 5 'multifunction' - 'Vexc' or 'External control'**
  To configure the +15 Vdc excitation voltage at terminal 5, set internal jumper 'T' at position 1-2 (see section 1.9). Transducers with a consumption of up to 30 mA can be powered from this terminal.

  To configure the 'EK' external contact function at terminal 5, set internal jumper 'T' at position 4-5 (see section 1.9). See section 1.9 for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

  See below a list of typical connections :

1 2 3 4 5

+15 Vdc (mA+)

signal (mA-)

1 2 3 4 5

+15 Vdc

common

+Vdc

1 2 3 4 5

mA -

mA +

1 2 3 4 5

common

+Vdc

Ranges of Measure		Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (%FS)	Max. oversignal	Connection (terminals)	Z in
4 /20 mA	passive (needs Vexc.)	0/100.0	de 9999 a - 1999	D	1-2	<0.15%	25 mA	2 (signal) 5 (Vexc)	4.7 Ohm
	active				4-5			2 (mA+) 4 (mA-)	
0 /10 Vdc	passive (needs Vexc.)			A	1-2	<0.20%	25 Vdc	2 (+Vdc) 4 (comm.) 5 (Vexc)	1 M
	active				4-5			2 (+Vdc) 4 (comm.)	

Table 15 - Ranges of measure for process signals

1.17 Measuring frequency

- **How the instrument measures frequency**
  The instrument measures frequency from an AC voltage (Vac) or AC current (Aac) signal.
  The instrument detects each '0' crossing of the signal, either '0 Vac' or '0 Aac'. All available Vac and Aac signal ranges are accepted as frequency input signal.

- **How to configure the instrument to measure frequency**
  To measure frequency from a Vac signal, select the internal jumpers for the desired AC voltage range (see section 1.9), connect the signal for the selected voltage range (see section 1.10), and configure the instrument to measure frequency (see section 1.29.1). The same applies to measure frequency from Aac signals. See example at section below.
- **Scaling**
  The default resolution is 0.1 Hz. The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable decimal point to any position. The 'second scaling' function can also be used (see section 1.25).
- **Maximum and minimum signal**
  Frequency signals below 15 Hz are measured as '0'. Frequency signals higher than 100 Hz are out of accuracy. Signals higher than 1000 Hz will read 'display overflow' 'd.oVr' error.
- **Example**
  To measure the 50 Hz frequency from a 230 Vac power line, select jumpers 'GI' for 600 Vac signal range (see section 1.9), connect signal to terminals '1' and '4' (see section 1.10), and configure 'frequency' at the input signal configuration menu (see section 1.29.1).

Ranges of measure	Scale by default	Scalable	AC Signal *(see section 1.9)*	Jumper 'T'	Response time	Accuracy (% reading)
15 to 100Hz	0/100.0	from 9999 to -1999	select Vac or Aac range	4-5	70mSec.	<0.15% of reading
Table 16 - Ranges of measure for frequency						

1.18 Measures of resistance

- **Measuring resistive signals**
  The instrument accepts the measure of resistances and provides two ranges of measure from 0 to 5 K and from 0 to 50 K.
- **Compensating the resistance of the signal wire**
  Resistances are measured with 2 wires system. To compensate for the possible error introduced by the resistance of the signal wires, the instrument allows to configure a fixed number of counts to be added to the reading, both in positive or negative. This is done with the parameter 'Offset reading' ('oFFS') (see section 1.22).
- **Scaling**
  The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable decimal point to any position. The 'second scaling' function can also be used (see section 1.25).
- **Response times**
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.
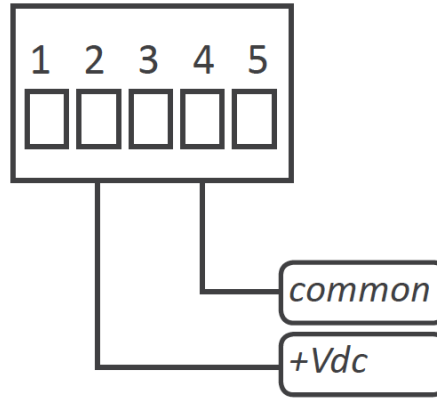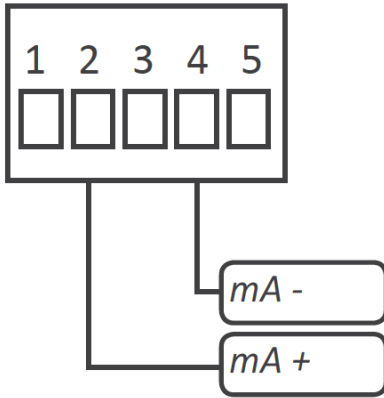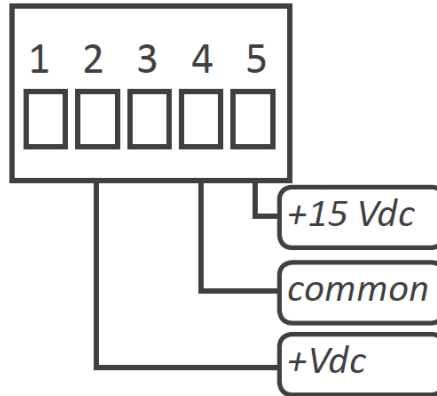- **Terminal 5 'multifunction' - External control**
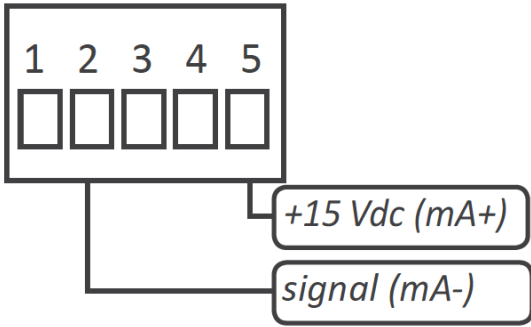 Terminal 5 remains configured as 'EK' external control function. See section 1.9 for a list of available functions.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.
  See below connections for resistance measures :

```
┌─────────────────────────┐
│  1   2   3   4   5       │
│  □   □   □   □   □       │
│                          │
└──┬───────────┬───────────┘
   │           │
   │        ┌──┴──────────┐
   │        │   res -      │
   │        └─────────────┘
   │    ┌─────────────────┐
   └────┤   res +          │
        └─────────────────┘
```

Ranges of measure	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% of reading)
0 to 5 K	5.000	from 9999 to -1999	F H K	4-5	<1.5% of reading
0 to 5 K	50.00		F K		
Table 15 - Ranges of measure for resistances					

1.19 Measures of potentiometers

- **Measuring potentiometers**
  The instrument accepts the measure of 3 wire potentiometers, with a single default range of 0 /100 % of the potentiometer span.
- **Scaling**
  The instrument allows to scale the reading to 4 digits (9999 / -1999) with configurable .
- **Response times**
  The response time to a signal step is 300 mSeconds, independent of the signal range selected.

- **Terminal 5 'multifunction' - 'Vexc'**
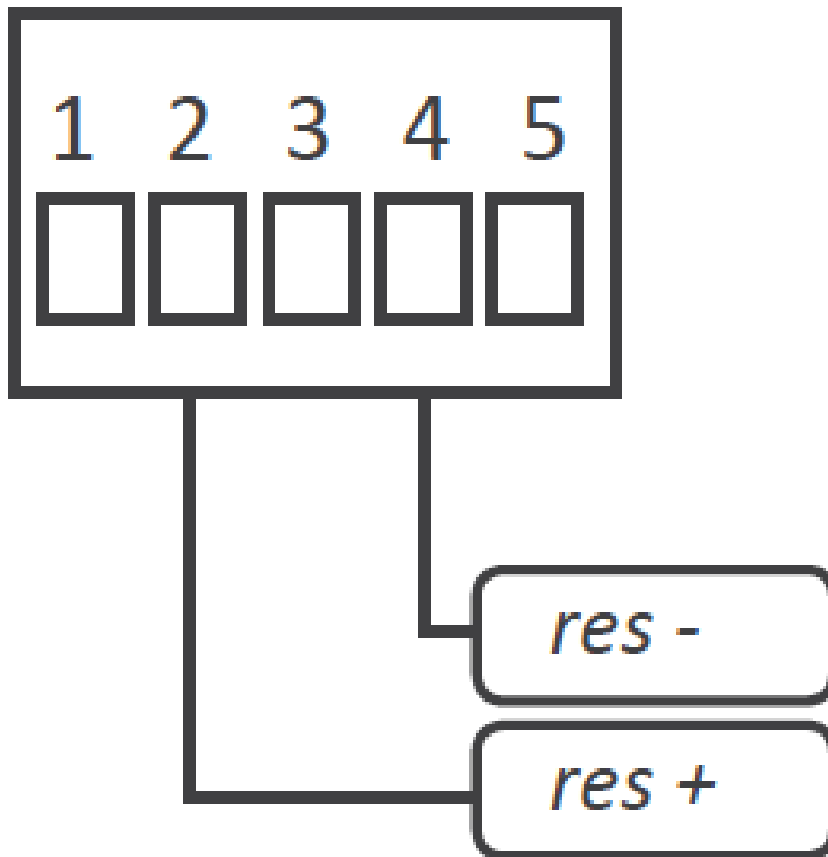 To measure potentiometer signals, set internal jumper 'T' at position 2-3 (see section 1.9).
  Terminal 5 will be assigned to a +5 Vdc excitation voltage for the potentiometer.
- **Start-up, connections and jumpers**
  For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.
  See below connections for measure of potentiometers :
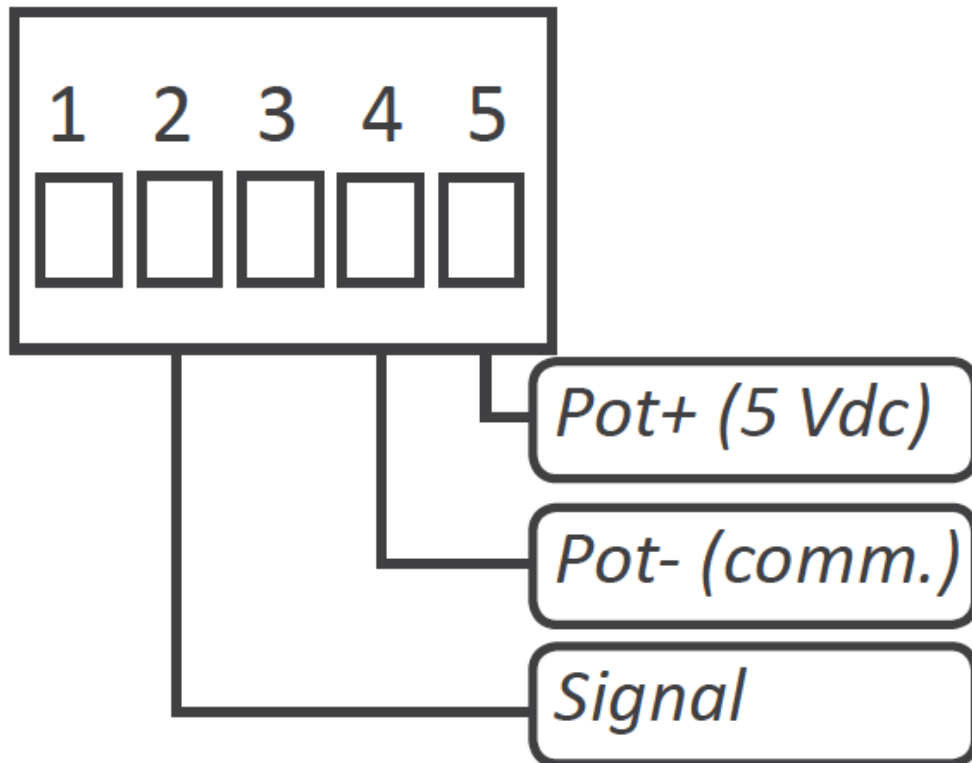
Nominal pot. value	Ranges of measure	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% FS)
from 500 R up to 20 K	0 to 100 %	0/100.0	from 9999 to -1999	A	2-3	<0.5%
Table 16 - Ranges of measure for potentiometers						

1.20 'Fast access' menu

The 'fast access' menu allows to configure the front key 'UP' (' 5 ') as a direct access to the alarm 1 and / or alarm 2 setpoint values, and / or the memory of maximum and minimum reading. The objective is to provide the operator with a fast and direct access to alarm setpoints, without accessing the standard configuration menu.

Access to 'fast access' menu is still allowed even with active 'password' function, allowing the

operator to modify the alarm setpoints, while still blocking any other change on the configuration.

The 'fast access' menu is configurable, and it allows to assign to the front key none, one, several or all of the available functions. In case of configuring access only to alarm 1, when pushing front key 'UP' (' 5 '), the display directly access the setpoint value of alarm 1 (same for alarm 2)

To configure the 'fast access' menu see section 1.29.4.

1.21 Scaling

The instrument can scale the reading to any value between 9999 and -1999 and configure the decimal point position, for all signal ranges except temperature ranges (thermocouples, Ni and Pt sensors, NTC and PTC sensors) are not scalable. The scaling configuration is a simplified two steps process:

1. configure at the 'Display Low' ('d.Lo') parameter the reading value associated to the low signal range
2. configure at the 'Display High' ('d.Hi') parameter the reading value for the high signal range

Some examples are explained below:

- for AC voltage and current ranges, for example 0/400 Vac, configure at 'd.Lo' the reading for a signal of 0 Vac. Configure at 'd.Hi' the reading for a signal of 400 Vac.
- for DC voltage and current ranges, for example ±400 Vdc, configure at 'd.Lo' the reading for a signal of 0 Vdc. Configure at 'd.Hi' the reading for a signal of 400 Vdc.
- for process ranges, for example 4/20 mA, configure at 'd.Lo' the reading for a signal of 4 mA. Configure at 'd.Hi' the reading for a signal of 20 mA.
- for potentiometer ranges, configure at 'd.Lo' the reading for a signal of 0% (0 R). Configure at 'd.Hi' the reading for a signal of 100% (nominal of the potentiometer).

To configure the scaling see section 1.29.2.

1.22 Offset reading

The 'Offset reading' ('oFFS') parameter allows a number of counts to be added to the reading. This is specially useful to manually compensate for resistance errors due to wire resistance, when measuring with 2 wires Ni and Pt probes, and resistances. Applies to all signal ranges. See configuration menu at 'Tools' \ 'oFFS' (see section 1.29.7).

1.23 'Eco' mode

The 'Eco' mode reduces the consumption of the instrument to a level of 0.3 W. The 'Eco' mode turns off the display, while the right decimal point remains flashing gently on and off, showing that the instrument is running on the background.

Display will turn on when an alarm activates, or when the operator touches any of the front keys. If no alarms are active, and there is no interaction from the operator, the instrument will turn off the display. The waiting time before display turn off is configurable from 5 to 255 seconds.

To configure the 'Eco' mode see the configuration menu at 'Tools' \ 'Eco' (see section 1.29.7).

1.24 External control

The 'external control' function allows to activate, by closing a free potential contact, one of the following configurable functions:

- activation of the second scaling
- change the active decimal point
- 'hold' the reading
- 'tare' function
- visualize de memory of maximum (or minimum)

To configure the 'EK' external contact function, set internal jumper 'T' at position 4-5 (see section 1.9). The 'EK' external control function is not compatible with function 'Vexc' (excitation voltage), the measure of 3 wire Pt100, and the measure of potentiometers.

To assign a function to the 'external control' see the configuration menu at 'External control' (see section 1.29.6).

The function associated to the 'EK' external control activates when short-circuiting terminal 5 and terminal 4.

> ⚠ *Risk of electric shock. The 'EK' external control function shares terminal 4 with the common of the input signal connection. When measuring dangerous voltages <u>AND</u> using 'EK' external control contact, apply the appropriate protections to isolate the operator from dangerous voltages.*

1.25 Second scaling

The instrument provides a 'second scaling', independent and additional to the standard scaling explained at section 1.21. Control of the scaling to be applied, with a free potential contact called 'External control'. To configure the 'second scaling' :

1. configure the internal jumper 'T' to activate the 'EK' external control function (see section 1.9).
2. associate the external control to the 'second scaling' function, at the configuration menu 'ScL. 2' set the value 'EXt.c' ('External control') (see section 1.29.6)
3. configure the scaling at the configuration menu 'Tools' \ 'ScL.2' (see section 1.29.7).
4. apply connections to the external control

1.26 To open the instrument

To open the housing and access the internal circuits, use a flat screwdriver to unlock clips 'D', 'C', 'B' and 'A', in this order. Remove the front filter. Let the inside of the instrument slide out of the housing.

To reinsert the instrument make sure that all modules are correctly connected to the pins on the display module. Place all the set into the housing, assuring that the modules correctly fit into the internal guiding slides of the housing. Once introduced, place again the front filter at cover 'X', and

then insert clips 'A', 'B', 'C' and 'D', in this order.

See section 3 for a detailed description on how to open and close the housing.

Optional modules

Front filter

Display

Opt.1

Opt.2

Opt.1

Motherboard

Housing
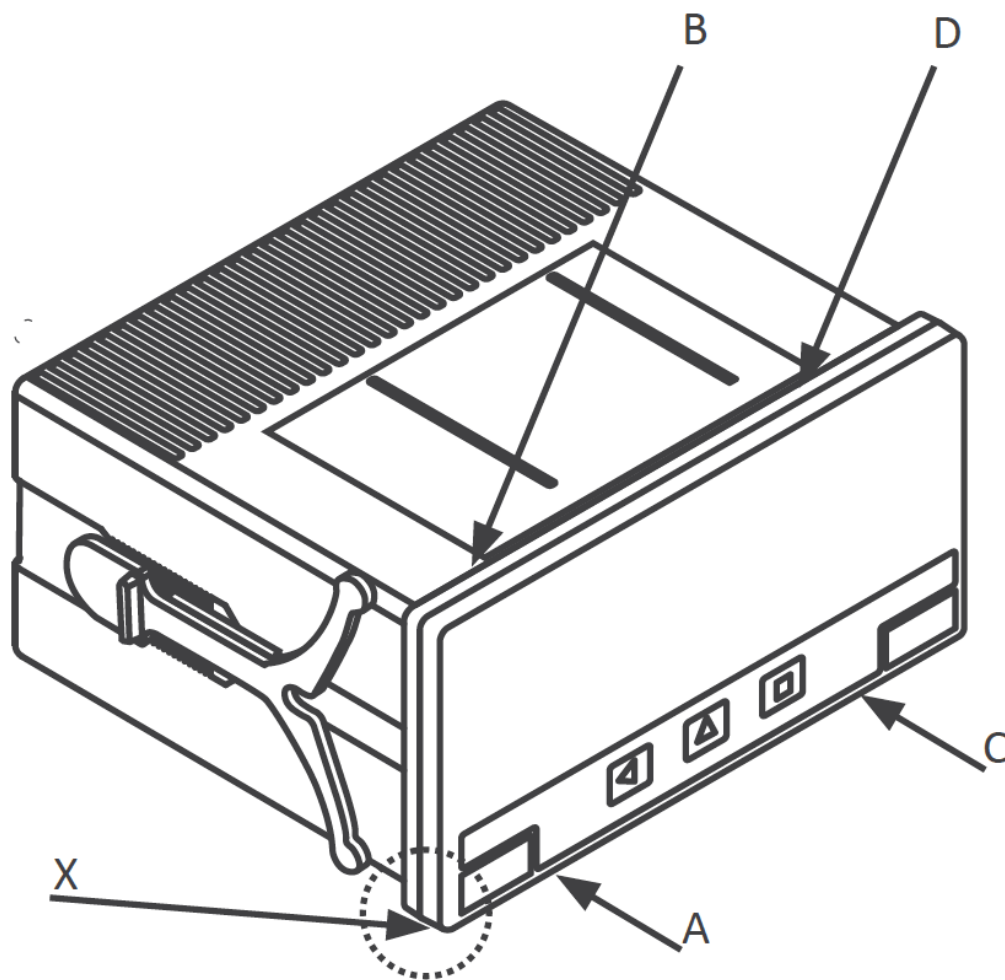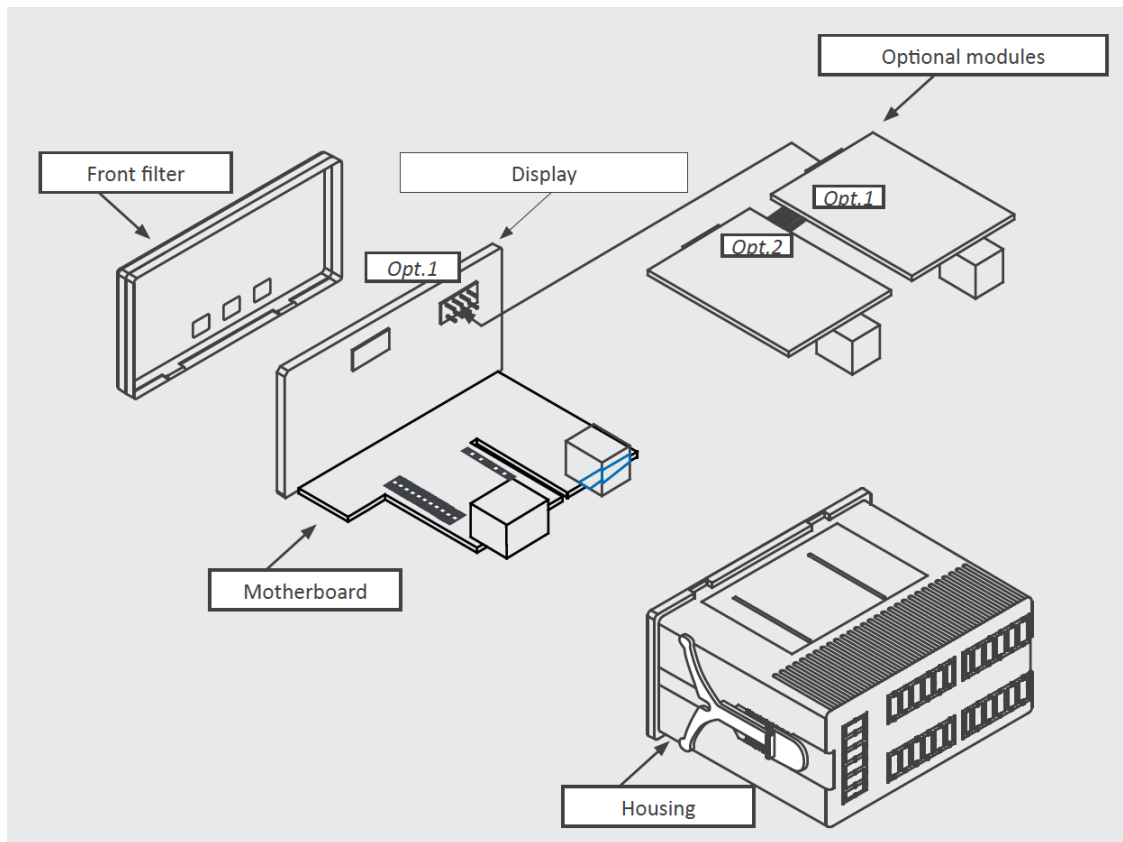
1.27 How to operate the menus

The instrument has two menus accessible to the user:

'Configuration menu' (key SQ) ( )

'Fast access' menu (key UP) ( )

Configuration menu

The 'configuration menu' modifies the configuration parameters to adapt the instrument to the application needs. To access the 'configuration menu' press for 1 second the SQ (<) key. This access can be blocked by activating the **'Password' ('PASS')** function. While operating the 'configuration menu', the alarm status is 'hold' to the status they had before accessing the menu, and the output and control modules remain in 'error' state. When leaving the 'configuration menu', the instrument applies a system reset, followed by a brief disconnection of the alarms and the output and control modules. Functionality is then recovered.

For a detailed explanation on the 'configuration menu' see section 1.30, and for a full view of the 'configuration menu' structure see section 1.30.

'Fast access' menu

The 'fast access' menu is an operator configurable menu, providing fast and direct access to the most usual functions of the instrument with a single key pad stroke. Press key UP (5) to access this menu.

See section 1.20 for a list of functions eligible for 'fast access' in this instrument. The **'Password'**

('PASS') function does not block access to this menu. Accessing and modifying parameters in the 'fast access' menu does not interfere with the normal functionality of the instrument, and it does not generate any system reset when validating the changes.

Front key pad description

Key SQ (<) - press the SQ (<) key for 1 second to access the 'configuration menu'. Inside the menu, the SQ (<) key functions as a 'ENTER' key. It selects and accesses the menu option currently displayed. At menus with numerical value entries, it validates the number displayed.

Key UP (5) - the UP (5) key gives access to the 'fast access' menu. Inside the menus, it moves vertically through the different menu options. At menus with numerical value entries, it modifies the digit selected by increasing its value to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Key LE (3) - inside the menus, the LE (3) key functions as the 'ESCAPE' key. It leaves the selected menu, and eventually, will leave the whole menu. When leaving the 'configuration menu' with the LE (3) key, the changed parameters are activated. At menus with numerical value entries, the LE (3) key allows to select the active digit. To modify the value of the selected digit use the UP (5) key.

Menu 'rollback'

After 30 seconds without interaction from the operator, the instrument will rollback and leave the 'configuration menu' or the 'fast access' menu. All changes will be discarded.
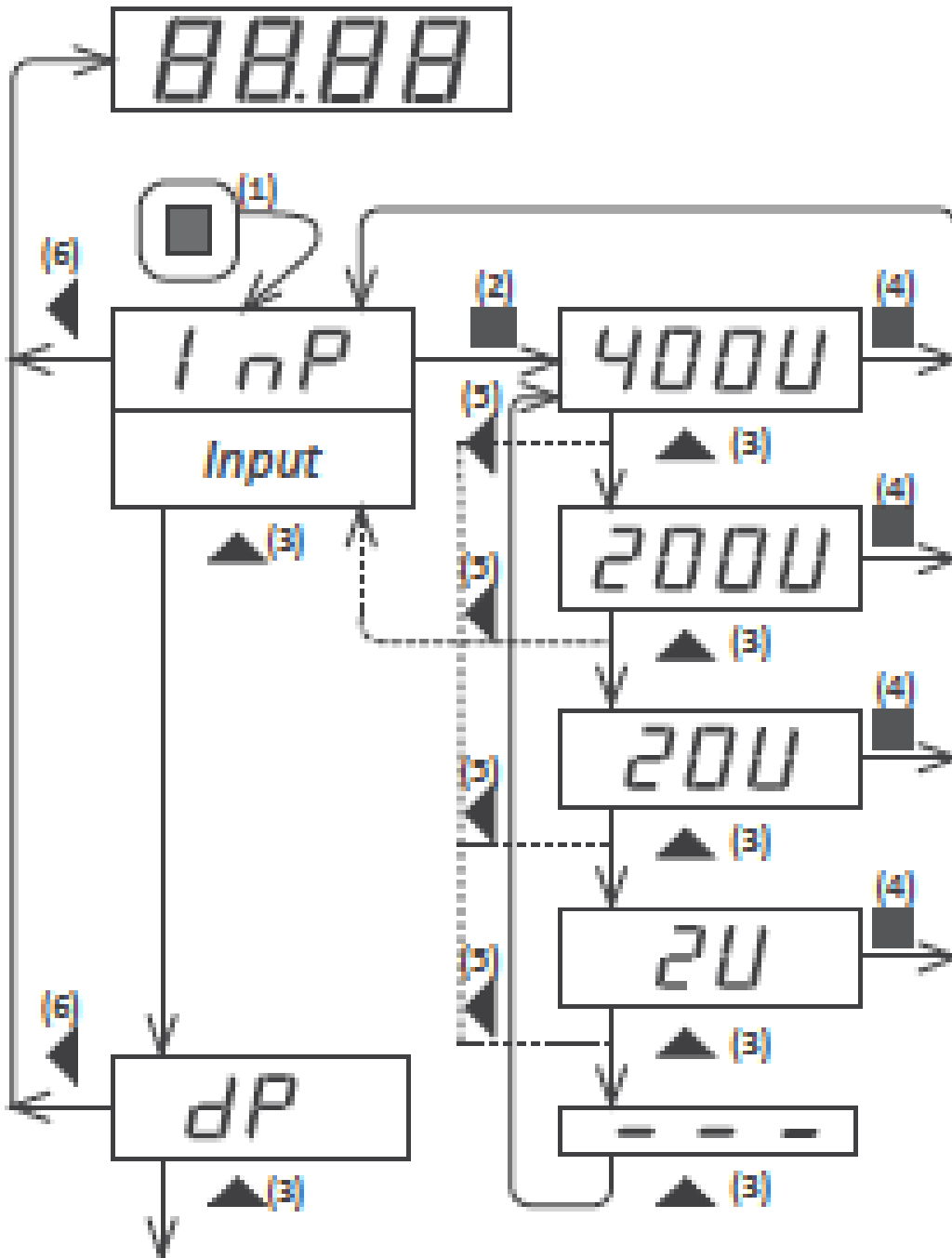
Example of operation inside the 'configuration menu'.

1. The SQ (<) key enters into the 'configuration menu'.
2. The SQ (<) key enters into the **'InP'** option menu.
3. The UP (5) key moves through the menu options.
4. The SQ (<) key selects the desired range and returns to the **'InP'** menu.
5. The LE (3) key leaves the actual menu level and moves to the previous menu level.
6. The LE (3) key leaves the 'configuration menu'. Changes are applied and saved at this moment.

1.28 Messages and errors

The error messages are shown on display in flash mode.

Messages and errors
'h.udr' Hardware underrange (**'h.udr'**) / overrange (**'h.ovr'**). 'h.oVr' Input signal is lower / higher than the minimum / maximum signal the instrument can detect.
'd.udr' display underrange (**'d.udr'**) / overrange (**'d.ovr'**). The 'd.oVr' instrument already displays the minimum / maximum value possible (9999 / -1999).
'Err.0'* at the **'scaling'** (**'ScAL'**) menu entry, the defined slope is higher than '5000' (slope almost vertical). Entered values are dismissed and default values are activated.
'Err.1' incorrect password.
Table 17 - Messages and error codes

1.29 Configuration menu

InP Input	**Ac** AC signals	**600U**	600 Vac range
		200U	200 Vac range
		20U	20 Vac range
		2U	2 Vac range
		0.2U	200 mVac range
		60ΠU	60 mVac shunt range
		5A	5 Aac range
		20ΠA	20 mAac range
		- - - -	

dc DC signals	**600U**	±600 Vdc range
	200U	±200 Vdc range
	20U	±20 Vdc range
	2U	±2 Vdc range
	0.2U	±200 mVdc range
	60ΠU	±60 mVdc shunt range
	5A	±5 Adc range
	20ΠA	±20 mAdc range
	- - - -	

Proc	**420**	4/20 mA range

Process	`010` — 0/10 Vdc range

`tc` Thermocouples	`tc F`	thermocouple K
	`tc J`	thermocouple J
	`tc E`	thermocouple E
	`tc n`	thermocouple N
	`tc L`	thermocouple L
	`tc r`	thermocouple R
	`tc S`	thermocouple S
	`tc b`	thermocouple B
	`tc t`	thermocouple T
	`tc c`	thermocouple C
	`- - - -`	

1.29.1 Input signal ranges

Access the **'Input'** (**'InP'**) menu to select the input signal range. For a correct reading, the internal jumper 'T' (see section 1.9) must also be selected accordingly.

The instrument offers the following signal ranges :

- **'AC signals' ('Ac')** - select a range between 600 Vac, 200 Vac, 20 Vac, 2 Vac, 200 mVac, 60 mVac, 5 Aac and 20 mAac. The AC measure ranges provide 'True RMS' reading.
- **'DC signals' ('dc')** - select a range between ±600 Vdc, ±200 Vdc, ±20 Vdc, ±2 Vdc, ±200 mVdc, ±60 mVdc, ±5 Adc and ±20 mAdc. Dc measures are bipolar.
- **'Process' ('Proc')** - select 4/20 mA or 0/10 Vdc. The instrument provides excitation voltage to power up transducers at terminal 5. To configure the excitation voltage, see section 1.16.
- **'Thermocouples' ('tc')** - select the thermocouple type between K, J, E, N, L, R, S, B, T and C. The instrument automatically compensates for the thermocouple cold junction.
- **'RTD probes' ('rtd')** - the **'rtd'** menu offers temperature resistive probes type Pt (platinum) and Ni (Nickel). Select the type of probe from the available options Pt100 3 wire, Pt100 2

wire, Pt500, Pt1000, Ni100, Ni200 and Ni1000. For measures with 2 wires, a manual compensation for the wire resistance error is available using parameter 'Offset reading' ('oFFS') (see section 1.22).

- **'NTC probes' ('ntc')** - select the **'ntc'** menu to configure the input for NTC probes. To correctly configure the measure for NTC, two parameters need to be defined : first the resistance of the NTC probe at 25º (**'r.25')** and parameter 'beta' (**'bEtA**). The instrument accepts beta values between 2000 and 5500. For more information on NTC measures see section 1.14.

- **'PTC probes' ('Ptc')** - select the 'ptc' menu to configure the input for PTC probes. Select K121 for PTC probes from the KTY-121 family (KTY81-121 and KTY82-121). Select K220 for PTC probes from the KTY-210 family (KTY81-210 and KTY82-210) and KTY-220 (KTY81-220 and KTY82-220). For more information on PTC probes see section 1.15.

rtd RTD probes	**Pt.2H**	Pt100 a 2 hilos
	Pt.3H	Pt100 a 3 hilos
	P.500	pt500
	P.1t	Pt1000
	n.100	Ni100
	n.200	Ni200
	n.1t	Ni1000
	- - - -	

ntc NTC probes	**r.25**	**8.8.8.8.**	res. at 25º
	bEtA	**8.8.8.8.**	beta

Ptc PTC probes	**t 121**	KTY 121 family
	t220	KTY 210 and 220 family

rES Resistance	**5t**	range 0 to 5 K
	50t	range 0 to 50 K

Pot Potentiometer

FrE9 Frequency

- - - -

ScAL Scaling	**dP** Decimal point	**8.8.8.8.**
	d.Lo Display Low	**8888**
	d.hI Display High	**8888**

- **'Resistance' ('rES')** - select 5 K for a measuring range from 0 to 5 KOhms or select 50 K for a measuring range of 0 to 50 KOhms. For a manual compensation for the error introduced by the signal wires, see parameter 'Offset reading' ('oFFS') (see section 1.22).
- **'Potentiometer' ('Pot')** - potentiometer measure has a single range, valid for any potentiometer with nominal value between 500 R and 20 K.
- **'Frequency' ('FrEq')** - frequency measure has no selectable ranges. The instrument reads frequency up to 100 Hz, within accuracy specifications. For more information on frequency measuring see section 1.17.

1.29.2 Scaling

Scale the reading at the **'Scaling' ('ScAL')** menu. Temperature ranges (thermocouples, Pt and Ni probes, NTC and PTC probes) have direct temperature indication and are not scalable.

To configure the scaling, enter the **'Decimal point' ('dP')** parameter and select the desired position for the decimal point, using key 'LE' (3).

Then configure at the **'Display Low' ('d.Lo')** parameter the reading value associated to the low signal range and configure at the **'Display High' ('d.Hi')** parameter the reading value for the high signal range. For more information see section 1.21.

1.29.3 Alarms

The instrument has 2 independent and configurable alarms.

Control the independent activation of relays A1 installed (optionally) at slots 1 and 2 (see section 2.1) from menu entries **'Alarm 1' ('ALr1')** and **'Alarm 2' ('ALr2')** . Alarms control also the activation of front leds '1' and '2' located as indicated at section 1.2.

To configure the alarms, enter at the alarm menu (**'ALr1'** , or **'ALr2')** and configure the following parameters:

- at the 'Alarm type' ('TypE') parameter select alarm as as a maximum type alarm ('MAX') or a minimum type alarm ('MIn'). The maximum type alarm (or minimum type) activates when the display value is higher (or lower) than the setpoint value.
- at the 'Setpoint' ('SEt') parameter enter the value for the alarm activation point. This parameter is eligible for configuration through the 'Fast access' menu (see section 1.20).
- configure the hysteresis value at 'Hysteresis' ('hySt') . The hysteresis applies to the deactivation process of the alarm. The alarm deactivates when the reading has passed the setpoint value plus the hysteresis value. Hysteresis helps to avoid repetitive switching of the alarm relays, due to fluctuating input signals around the setpoint.

ALr2 — Alarm 2
→ **tYPE** — Alarm type
→ **NAH**
→ **NIn**

SEt — Setpoint
→ **8888**

hYSt — Hystereses
→ **8888**

- - - -

t.uP — Key UP (fast access)
→ **SEt.1** — Setpoint 1
→ **on/oFF**

SEt.2 — Setpoint 2
→ **on/oFF**

NAH — Memory of maximum
→ **on/oFF**

NIn — Memory of minimum
→ **on/oFF**

tArE — Tare function

- - - -

EHt.c — External control
→ **oFF** — Disabled

NAH — Memory of maximum

NIn — Memory of minimum

hoLd
Display hold

tArE
Tare function

dP.0
Decimal point 0

dP.1
Decimal point 1

dP.2
Decimal point 2

dP.3
Decimal point 3

ScL.2
Second scaling

- - - -

1.29.4 Fast access

The key 'UP' (5) at the front of the instrument gives access to a list of functions configurable by the operator. See section 1.27 for an explanation on how to operate the 'fast access' menu.

The **'Key UP (Fast access)' ('K.uP')** menu allows user to select which functions will be accessible when pressing the front key 'UP' (5). Select 'on' to activate each function.

- the **'Setpoint 1' ('ALr1')** function allows user to visualize and modify the setpoint value of alarm 1.
- the **'Setpoint 2' ('ALr2')** function allows user to visualize and modify the setpoint value of alarm 2.
- the **'Memory of maximum' ('MAX')** or **'Memory of minimum' ('MIn')** allows user to visualize the memory of maximum and minimum reading. The memory resets when the instrument restarts (power off-on cycle, or when leaving the configuration menu with a change to be applied).
- the **'Tare function' ('tArE')** allows user to visualize the actual tare value.

1.29.5 Super fast access

If only a single function is selected for the 'fast access' menu, pressing the the 'UP' (5) key will shortly display the function name and then automatically jump to the function value.

1.29.6 External control

An external on / off control can be connected to the rear of the instrument. The operator can then control the activation of a configured function based on the state of this control. Function remains activated while the external contact is closed, and will deactivate when contact is open. To configure the function associated to the external control, enter the menu **'External control' ('EXt. c')** .

- select **'Disabled' ('oFF')** to have no function associated.
- select parameter **'Memory of maximum' ('MAX')** to visualize on display the memory of maximum reading.
- select parameter **'Memory of minimum' ('MIn')** to visualize on display the memory of minimum reading.
- select parameter **'Display hold' ('hoLd')** to maintain the actual reading 'on hold'. Open the external contact to free the reading
- select **'Tare function' ('tArE')** to activate a tare to the signal. The actual signal will read '0'. The calibration is not changed.

Parameters **'Memory of maximum' ('MAX')** , **'Memory of minimum' ('Min')** and **'Display hold' ('hoLd')** show on display a value which is not the actual measured input signal, therefore the values for this parameters will be shown in flash mode, indicating that the actual value is not the actual input value.

tooL	out.1	oFF
Tools	Option 1	disabled

rELE
relay

420
analog output

the parameter '420' gives access to the calibration menu for the analog output. See section 2.2 for more information.

r.485
Modbus RTU

- - - - -

StEP	1
Steps	2
	5
	10
	20
	50

- - - - -
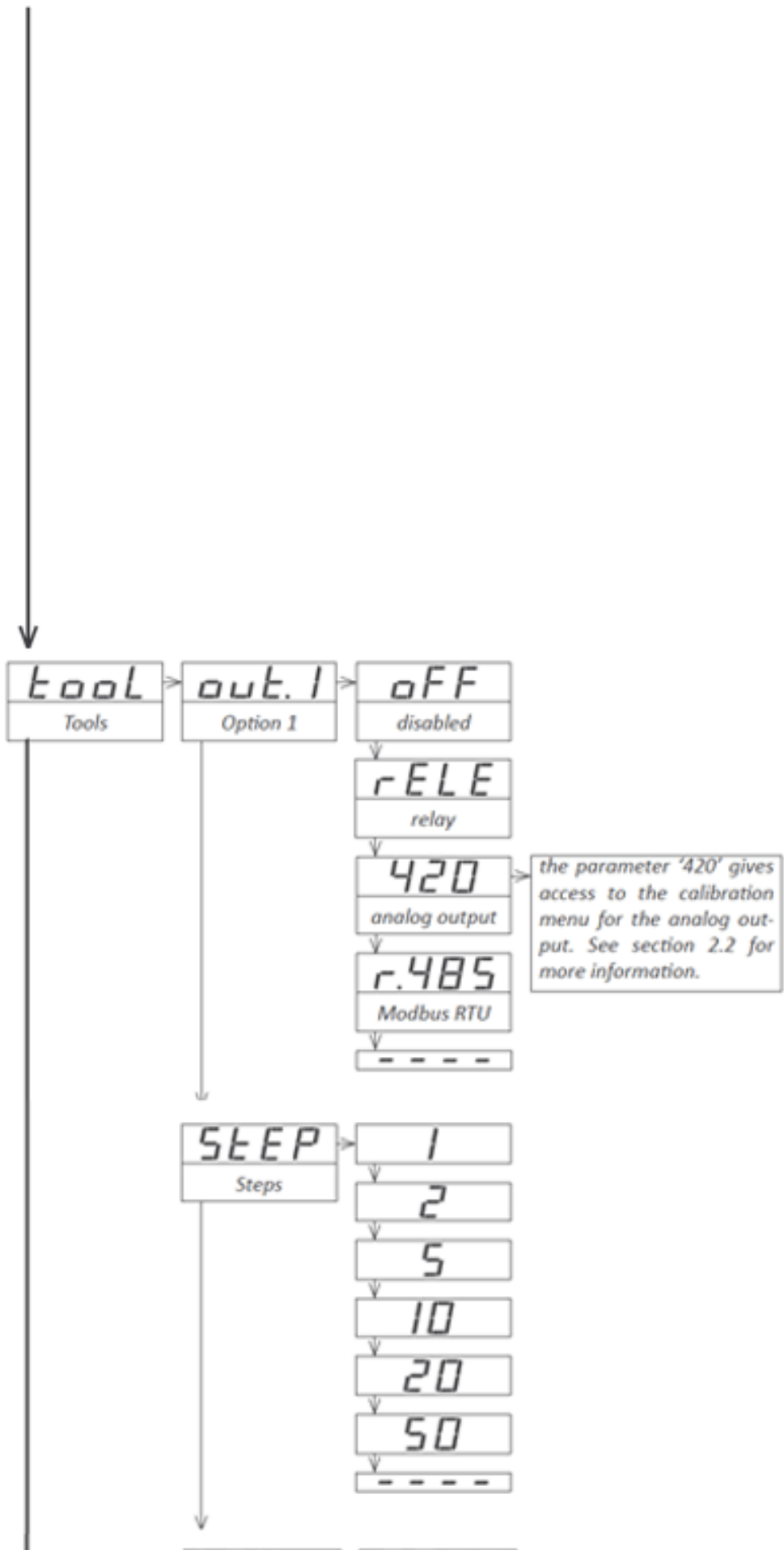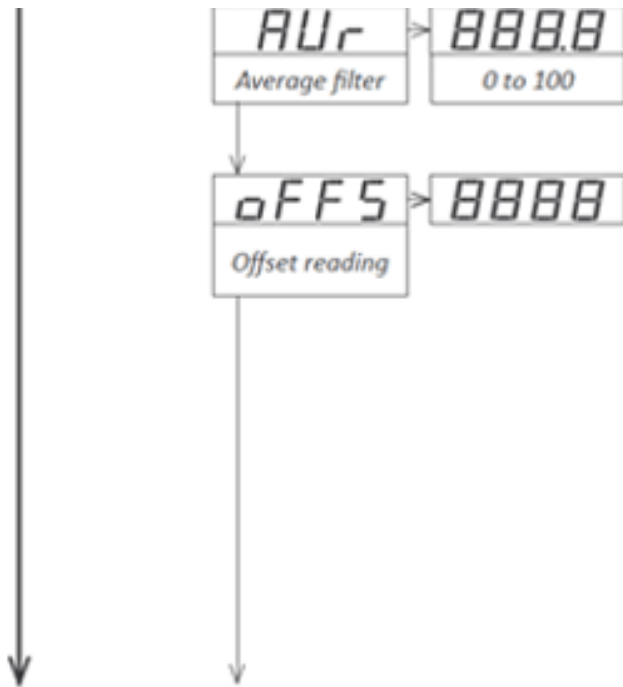
- select parameter **'Decimal point 0' ('dP.0')** to remove the decimal point on display.
- select parameter **'Decimal point 1' ('dP.1')** to activate the decimal point at position XXX.X
- select parameter **'Decimal point 2' ('dP.2')** to activate the decimal point at position XX.XX
- select parameter **'Decimal point 3' ('dP.3')** to activate the decimal point at position X.XXX

Parameters **'Decimal point 0' ('dP.0')** and similar **'dP.1'** and>, **'dP.2'** and **'dP.3'** control which decimal point is on. When the external contact closes, the decimal point selected lights on and the decimal point that was activated before will power off. When the external contact opens, the previous decimal point powers on again while removing the new decimal point. Display does not show in flash mode when decimal point functions are activated.

- select parameter **'Second scaling' ('ScL.2')** to activate the second scaling configured at menu **'Tools' ('TooL')** \ **'Second scaling'** . The activation of the 'Second scaling' function is accepted for all signal input ranges based on AC input signals, DC input signals, process and resistances. Display does not show in flash mode when second scaling function is activated. For more information on the 'Second scaling' seer section 1.25

1.29.7 Menu 'Tools'

The **'Tools' ('tooL')** menu contains multiple configuration options of the instrument.

- select at the **'Option 1' ('out.1')** parameter the module type installed at the 'Opt.1' (see section 2) slot. Select **'relay' ('rELE')** for the relay output module 'A1'. Select **'analog output' ('420')** for the analog output module 'M1'. Select **'Modbus RTU' ('r.485')** for the Modbus RTU serial output module 'S1'.

Note : the parameter **'420'** gives access to the calibration menu for the analog output module. See section 2.2 for more information about this menu and the calibration.

- the **'Steps' ('StEP')** parameter allows to configure a defined minimum step change on the reading. Reading will change in steps of 1, 2, 5, 10, 20 or 50 counts.

- the **'Average filter' ('AVr')** function allows to reduce reading oscillations due to noisy signals, by applying a recursive filter on the reading values. The strength of the recursive filter is a value configurable between '0' and '100'. Value '0' means 'filter disabled'. Filter strength increases with the value. Increasing the filter strength, increases the response time of the instrument.
- the **'Offset reading' ('oFFS')** parameter allows to configure a fixed number of counts to be added to the reading. Accepts values from -500 to 500. This function allows to compensate for the possible error introduced by the resistance of the signal wires when measuring Pt probes, Ni probes or resistances. For more information see section 1.22

1.30 Full configuration menu

InP *Input*	**Ac** *AC signals*	**600U**	600 Vac range
		200U	200 Vac range
		20U	20 Vac range
		2U	2 Vac range
		0.2U	200 mVac range
		60mU	60 mVac shunt range
		5A	5 Aac range
		20mA	20 mAac range
		- - - -	
	dc *DC signals*	**600U**	±600 Vdc range
		200U	±200 Vdc range
		20U	±20 Vdc range
		2U	±2 Vdc range
		0.2U	±200 mVdc range
		60mU	±60 mVdc range
		5A	±5 Adc range
		20mA	±20 mAdc range
		- - - -	
	Proc *Process*	**420**	4/20 mA range

`0 10`		0/10 Vdc range

`tc`
Thermocouples

`tc t`	thermocouple K
`tc J`	thermocouple J
`tc E`	thermocouple E
`tc n`	thermocouple N
`tc L`	thermocouple L
`tc r`	thermocouple R
`tc S`	thermocouple S
`tc b`	thermocouple B
`tc t`	thermocouple T
`tc c`	thermocouple C
`- - - -`	

rtd — RTD probes	**Pt.2H**		Pt100 a 2 wires
	Pt.3H		Pt100 a 3 wires
	P.500		Pt500
	P.1t		Pt1000
	n.100		Ni100
	n.200		Ni200
	n.1t		Ni1000
	- - - -		

ntc — NTC probes	**r.25**	**8.8.8.8.**	res. at 25º
	bEtA	**8.8.8.8.**	beta

Ptc — PTC probes	**t 121**	KTY 121 family
	t 220	KTY 210 and 220 families

rES — Resistance	**5t**	range 0 to 5 K
	50t	range 0 to 50 K

Pot — Potentiometer

- - - -

ScAL — Scaling	**dP** — Decimal point	**8.8.8.8.**
	d.Lo — Display Low	**8888**
	d.hI — Display High	**8888**

```
- - - -
```

ALr1 → **tYPE** → **MAH**
Alarm 1 *Alarm type* ↓
                          MIn

SEt → **8888**
Setpoint

hYSt → **8888**
Hysteresis

```
- - - -
```

```
   ↓
┌─────────┐   ┌─────────┐   ┌─────────┐
│  ALr2   │→  │  tYPE   │→  │  NAH    │
├─────────┤   ├─────────┤   └─────────┘
│ Alarm 2 │   │ Alarm type│       ↓
└─────────┘   └─────────┘   ┌─────────┐
   │               │        │  NIn    │
   │               ↓        └─────────┘
   │          ┌─────────┐   ┌─────────┐
   │          │  SEt    │→  │  8888   │
   │          ├─────────┤   └─────────┘
   │          │ Setpoint │
   │          └─────────┘
   │               ↓
   │          ┌─────────┐   ┌─────────┐
   │          │  hYSt   │→  │  8888   │
   │          ├─────────┤   └─────────┘
   │          │ Hysteresis│
   │          └─────────┘
   │               ↓
   │          ┌─────────┐
   │          │ - - - - │
   │          └─────────┘
   ↓
┌─────────┐   ┌─────────┐   ┌─────────┐
│  t.uP   │→  │  SEt.1  │→  │ on/oFF  │
├─────────┤   ├─────────┤   └─────────┘
│ Key UP  │   │ Setpoint 1│
│(fast access)│└─────────┘
└─────────┘        ↓
   │          ┌─────────┐   ┌─────────┐
   │          │  SEt.2  │→  │ on/oFF  │
   │          ├─────────┤   └─────────┘
   │          │ Setpoint 2│
   │          └─────────┘
   │               ↓
   │          ┌─────────┐   ┌─────────┐
   │          │  NAH    │→  │ on/oFF  │
   │          ├─────────┤   └─────────┘
   │          │ Memory of│
   │          │ maximum  │
   │          └─────────┘
   │               ↓
   │          ┌─────────┐   ┌─────────┐
   │          │  NIn    │→  │ on/oFF  │
   │          ├─────────┤   └─────────┘
   │          │ Memory of│
   │          │ minimum  │
   │          └─────────┘
   │               ↓
   │          ┌─────────┐   ┌─────────┐
   │          │  tArE   │→  │ on/oFF  │
   │          ├─────────┤   └─────────┘
   │          │Tare function│
   │          └─────────┘
   │               ↓
   │          ┌─────────┐
   │          │ - - - - │
   │          └─────────┘
   ↓
┌─────────┐   ┌─────────┐
│  EHt.c  │→  │  oFF    │
├─────────┤   ├─────────┤
│External control│ Disabled │
└─────────┘   └─────────┘
   │               ↓
```

```
┌─────────────┐
│    ПAH      │
│  Memory of  │
│   maximum   │
└─────────────┘
       ↓
┌─────────────┐
│    ПI n     │
│  Memory of  │
│   minimum   │
└─────────────┘
       ↓
┌─────────────┐
│    hoLd     │
│Display hold │
└─────────────┘
       ↓
┌─────────────┐
│    tArE     │
│Tare function│
└─────────────┘
       ↓
┌─────────────┐
│    dP.0     │
│Decimal point 0│
└─────────────┘
       ↓
┌─────────────┐
│    dP.1     │
│Decimal point 1│
└─────────────┘
       ↓
┌─────────────┐
│    dP.2     │
│Decimal point 2│
└─────────────┘
       ↓
┌─────────────┐
│    dP.3     │
│Decimal point 3│
└─────────────┘
       ↓
┌─────────────┐
│   ScL.2     │
│Second scaling│
└─────────────┘
       ↓
┌─────────────┐
│  - - - -    │
└─────────────┘
```

```
┌─────────┐   ┌─────────┐   ┌─────────┐
│  tooL   │→ │  out.1  │→ │   oFF   │
│  Tools  │   │ Option 1│   │ disabled│
└─────────┘   └─────────┘   └─────────┘
                                 ↓
                            ┌─────────┐
                            │  rELE   │
                            │  relay  │
                            └─────────┘
                                 ↓
                            ┌─────────┐      ┌──────────────────────┐
                            │   420   │→    │ the parameter '420' gives │
                            │analog   │      │ access to the calibration │
                            │ output  │      │ menu for the analog out-  │
                            └─────────┘      │ put. See section 2.2 for  │
                            ┌─────────┐      │ more information.          │
                            │  r.485  │      └──────────────────────┘
                            │Modbus RTU│
                            └─────────┘
                                 ↓
                            ┌─────────┐
                            │ - - - - │
                            └─────────┘
```

```
┌─────────┐   ┌─────────┐
│  StEP   │→ │    1    │
│  Steps  │   └─────────┘
└─────────┘        ↓
              ┌─────────┐
              │    2    │
              └─────────┘
                   ↓
              ┌─────────┐
              │    5    │
              └─────────┘
                   ↓
              ┌─────────┐
              │   10    │
              └─────────┘
                   ↓
              ┌─────────┐
              │   20    │
              └─────────┘
                   ↓
              ┌─────────┐
              │   50    │
              └─────────┘
                   ↓
              ┌─────────┐
              │ - - - - │
              └─────────┘
```

```
┌─────────┐   ┌─────────┐
│   AUr   │→ │  888.8  │
│Average  │   │ 0 to 100│
│ filter  │   └─────────┘
└─────────┘
     ↓
┌─────────┐   ┌─────────┐
│  oFFS   │→ │  8888   │
│ Offset  │   └─────────┘
│ reading │
└─────────┘
     ↓
┌─────────┐   ┌─────────┐   ┌──────────┐
│  ScL.2  │→ │   dP    │→ │ 8.8.8.8. │
│ Second  │   │Decimal  │   └──────────┘
│ scaling │   │  point  │
└─────────┘   └─────────┘
                   ↓
              ┌─────────┐   ┌──────────┐
              │  d.Lo   │→ │   8888   │
              │Display  │   └──────────┘
              │   Low   │
              └─────────┘
```

d.hI

Display High

`- - - -`

Eco

'Eco' mode

→ **on** → `8888`

5 to 255 seconds

oFF

t.rES

Temperature resolution

1°   1º resolution

0.1°   0.1º resolution

dEG

Degrees

°c   degrees Celsius

°F   degrees Fahrenheit

ALPh Alpha	**385**	Alpha 385
	390	Alpha 390

cJc Cold junction	**on**	Thermocouple cold junction compensation 'on' or 'off'
	oFF	

d.bnd 'AC deadband'	**8888**	Deadband fo AC signals

LIGh Brightness	**LIG1**	Minimum
	LIG2	
	LIG3	Standard
	LIG4	
	LIG5	Maximum

UEr Version	**HHHH**

PASS Password	**on**	**8888**
	oFF	

FAct Factory reset	**no**
	YES

- - - -

out.1 Option 1 configuration* (*value selected	**420** Analog output	**d.Lo** Display Low	**8888**
		d.hI	**8888**

Display High

```
r.485  >  Addr  >  8888
Modbus RTU   Address 1 to 247
              |
              v
            bAud  >  9.6
            Speed Kbps
                     4.8
              |
              v
            bitS  >  8n1
            Format
                      8E1
                      8o1
                      8n2
              |
              v
            - - - -
```

- - - -

1.31 Precautions on installation

Risk of electrical shock. Instrument terminals can be connected to dangerous voltage.

Instrument protected with double isolation. No earth connection required.

Instrument conforms to CE rules and regulations.

This instrument has been designed and verified conforming to the 61010-1 CE Security Regulation, for industrial applications. Installation of this instrument must be performed by qualified personnel only. This manual contains the appropriate information for the installation. Using the instrument in ways not specified by the manufacturer may lead to a reduction of the specified protection level. Disconnect the instrument from power before starting any maintenance and / or installation action.

The instrument does not have a general switch and will start operation as soon as power is connected. The instrument does not have protection fuse, the fuse must be added during installation.

The instrument is designed to be panel mounted. An appropriate ventilation of the instrument must be assured. Do not expose the instrument to excess of humidity. Maintain clean by using a humid rag and do NOT use abrasive products such as alcohols, solvents, etc. General recommendations for electrical installations apply, and for proper functionality we recommend : if possible, install the instrument far from electrical noise or magnetic field generators such as power relays, electrical motors, speed variators, ... If possible, do not install along the same conduits power cables (power, motor controllers, electrovalves, ...) together with signal and/or control cables. Before proceeding to the power connection, verify that the voltage level available matches the power levels indicated in the label on the instrument. In case of fire, disconnect the instrument from the power line, fire alarm according to local rules, disconnect the air conditioning, attack fire with carbonic snow, never with water.

According to directive 2012/19/EU, electronic equipment must be recycled in a selective and controlled way at the end of its useful life.

1.32 Factory configuration

Range	600 Vac
Scaling and decimal point	0/600 Vac = 0/600
Alarms 1	
Type	alarm as maximum
Setpoint	1000
Hysteresis	0 counts
External control	off
Fast access	all off
Tools	
Option.1	off (retains last configuration value)
Step	1
Average	0
Offset reading	0
Second scaling	0/600
'Eco' mode	off
Temperature resolution	1º
Degrees	ºC
Alpha	385

cJc	on
AC deadband	20
Brightness	3
Password	off
Option 1 configuration	
Option analog output	0/100.0=4/20 mA
Option serial Modbus RTU	9600 bps, address 1, format 8n1
Jumpers 'S'	selected for 600 Vac
Jumper 'T'	selected for 'EK' external control function

2. Output and control modules

2.1 Modules A1 and A2 (relay output)

The A1 (and A2) modules offer 1 relay output to be installed at slot Opt.1 (module A2 at Opt.2). The relay installed at Opt.1 is controlled by alarm 1, and is configured from the **'Alarm 1' ('Alr1')** menu explained at section 1.29.3. The relay installed at Opt.2 is controlled by alarm 2, and is configured from the **'Alarm 2' ('Alr2')** explained at section 1.29.3. Relay with 3 contacts (Common, Normally closed, Normally open) accepting voltages up to 250V @8A.

The A1 and A2 modules can be ordered installed in to a Series C instrument or standalone for later installation, as they do not require soldering or special configuration..
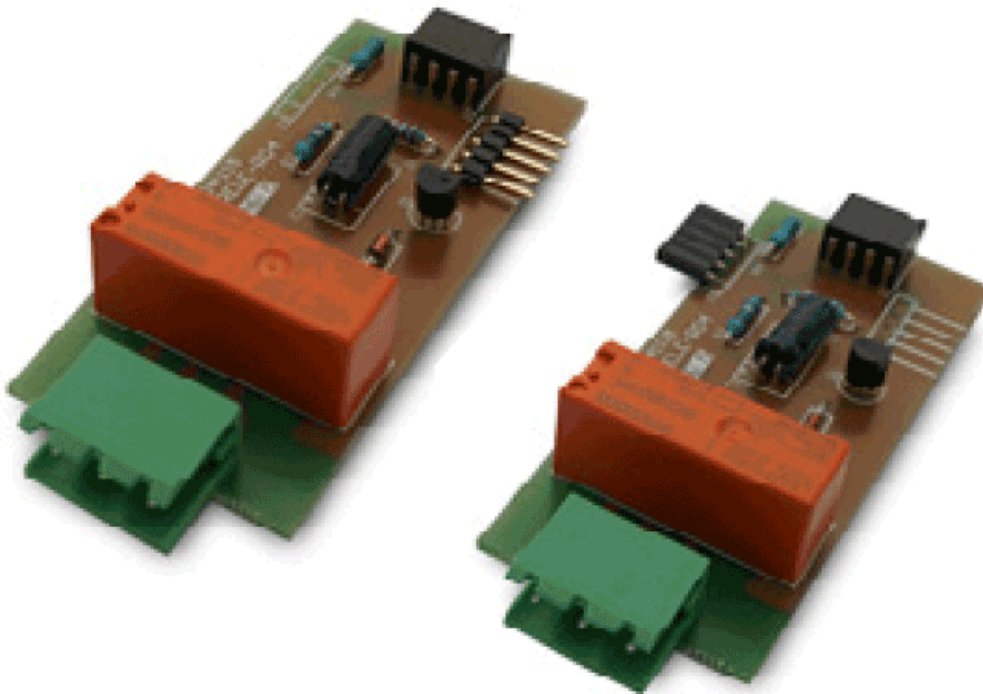
Type of relay	3 contact relay (NC, NO, common)
Current maximum	8 A per relay (resistive load)
Voltage maximum	250 Vac continuous
when switching power lines, with overvoltage category 3, maximum switching voltage is 150Veff to comply with CE safety requirements.	
Isolation	3500 Veff
Type of terminal	plug-in screw terminal, pitch 5.08 mm
Slots allowed	Opt.1 for A1 module
	Opt.2 for A2 module
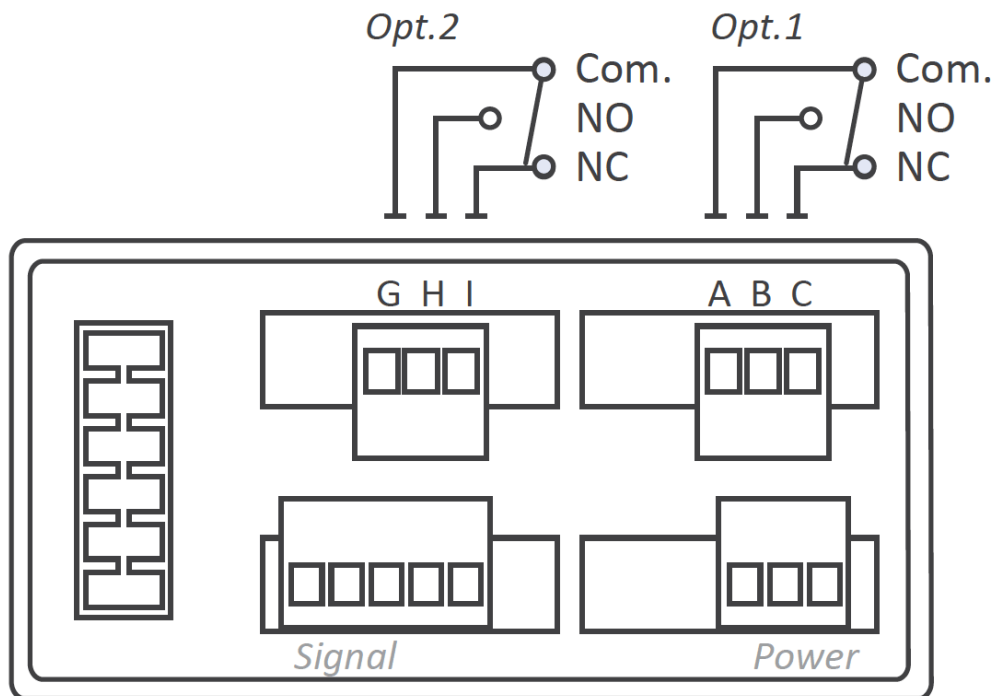
Terminal A, G — Common
Terminal B, H — NO - Normally open
Terminal C, I — NC - Normally closed

2.2 Module M1 (analog output)

The M1 module offers 1 analog output at 4/20 mA, isolated, to be installed at slot Opt1.

The 4/20 mA output signal is fully scalable, both with positive and negative slopes, and is proportional to the reading of the instrument. The mA output can be connected to work in active loop (the module provides the power of the loop) or passive mode (the power of the loop is not provided by the instrument)

Connections

For an active 4/20 mA loop, connect terminal A ('Vexc +15 Vdc') as current output and terminal B ('Signal in mA') as return of current. For a passive 4/20 mA loop, connect terminal B ('signal in mA') as current output and terminal C ('GND') as return of current.
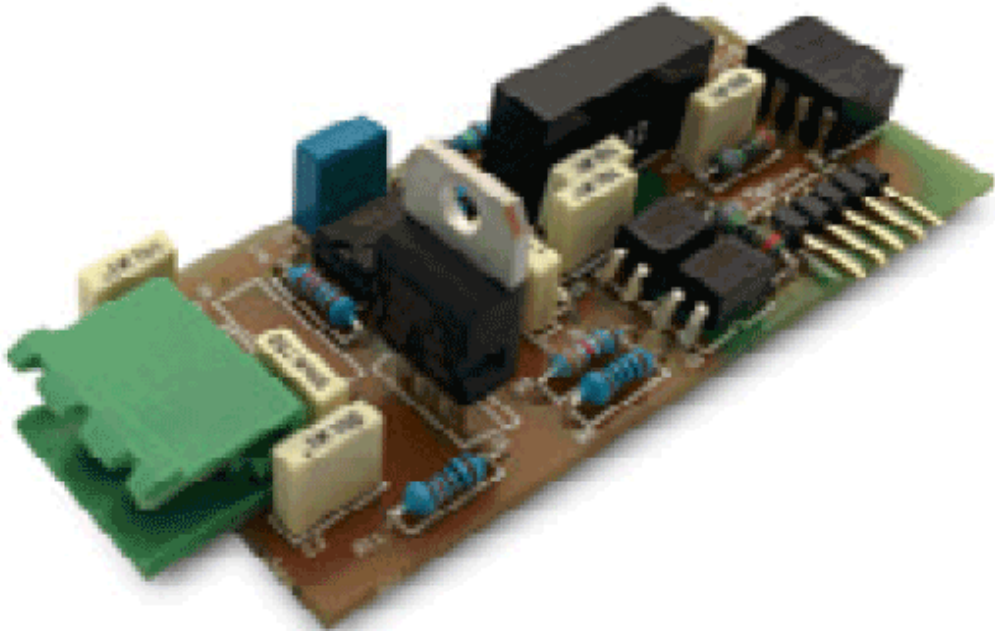
Output signal	4/20 mA (active and passive)
Active output	connect terminal A (+15 Vdc) and B (mA)RL<350 R
Passive output	connect terminal C (GND) and B (mA)RL< 700 R
Accuracy	<0.5% FS
Response time	<100 mSeg. + meter response time
Isolation	1000 Vdc
Slots allowed	Opt.1
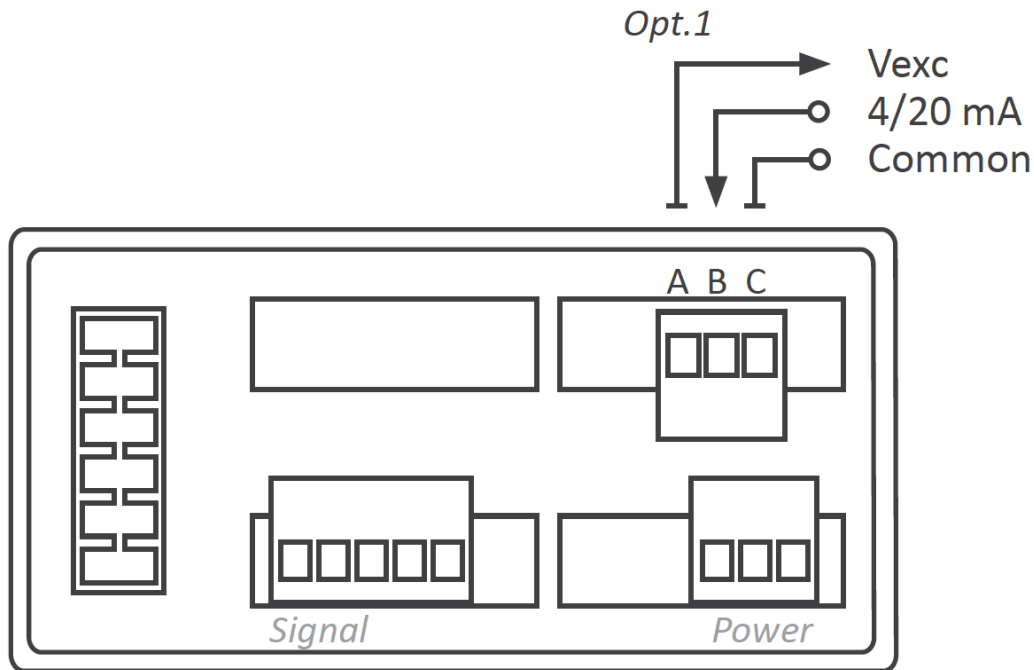
Terminal A	Vexc +15 Vdc
Terminal B	Signal in mA
Terminal C	Common

Installing, calibrating and configuring a M1 module

If the M1 module has been acquired installed in the instrument, then the module has been factory calibrated. In this case you can jump directly to point 7 below.

If the M1 module has been acquired separately and installation is needed, follow the next steps :

1. Access the instrument and install the M1 module at slot Opt.1 (see section 1.26).
2. From the 'Configuration menu' go to 'tool' \ 'out.1' and select value '420' (see section 1.29.7) to inform the instrument that there is a M1 analog output module installed.

From this point you will need the calibration sheet provided together with the module M1. This sheet shows the values for parameters 'cAL.y / 4mA' and 'cAL.y / 20mA'.

3. When selecting '420' the instrument shows 'cAL.n'. ('Do not calibrate'). Press 'UP' (5) to read 'cAL.y' ('Calibrate').
4. When selecting 'cAL.y' ('Calibrate') select '4 mA'. Display shows a number. Introduce the value of the 'cAL.y / 4mA' indicated at the calibration sheet provided together with the M1 module. Increase the numerical value with key 'UP' (5) and reduce the value with key 'LE' (3). Validate the value with key 'SQ' (<). See below an image of the configuration menu.
5. Repeat with the '20 mA' parameter, and update with the value 'cAL.y / 20mA' indicated at the calibration sheet. Validate with key 'SQ' (<), and press key 'LE' (3) several times to exit the 'Configuration menu'.
6. The instrument will reboot when exiting the menu. The analog output is calibrated.
   Note : if you do not have the calibration sheet which was shipped together with the M1 module, you can use a miliammeter to measure the mA at the output loop. Then access

parameters 'cAL.y / 4mA' and 'cAL.y / 20mA' and adjust the calibration value by checking the miliammeter value.

At this point the module is installed and calibrated. Now configure the reading associated to the output signal 4 mA and 20 mA.

7. Configure the reading associated to the 4 mA output signal and the reading associated to the 20 mA output signal, at the configuration menu 'out.1' \ '420' (see section 1.29.8).
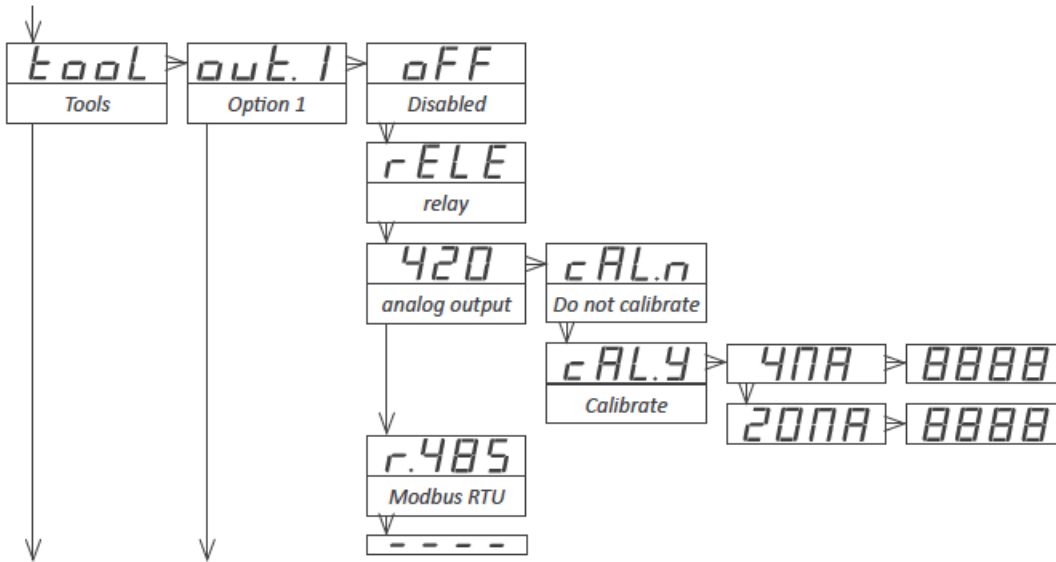
2.3 Module S1 (Modbus RTU)

The S1 module offers 1 Modbus RTU serial output, isolated, to be installed at slot Opt1.

Configuration is done from the front keypad, through the configuration menu. The instrument must be informed that there is a Modbus RTU module at slot.1 and this is done at the configuration menu 'Tool' \ 'out.1' (see section 1.29.7). Then configure the bus parameters at the configuration menu 'out.1' \ 'r485' (see section 1.29.8).

The S1 module can be ordered installed in to a Series C instrument or standalone for later installation, as it does not require soldering or special configuration.
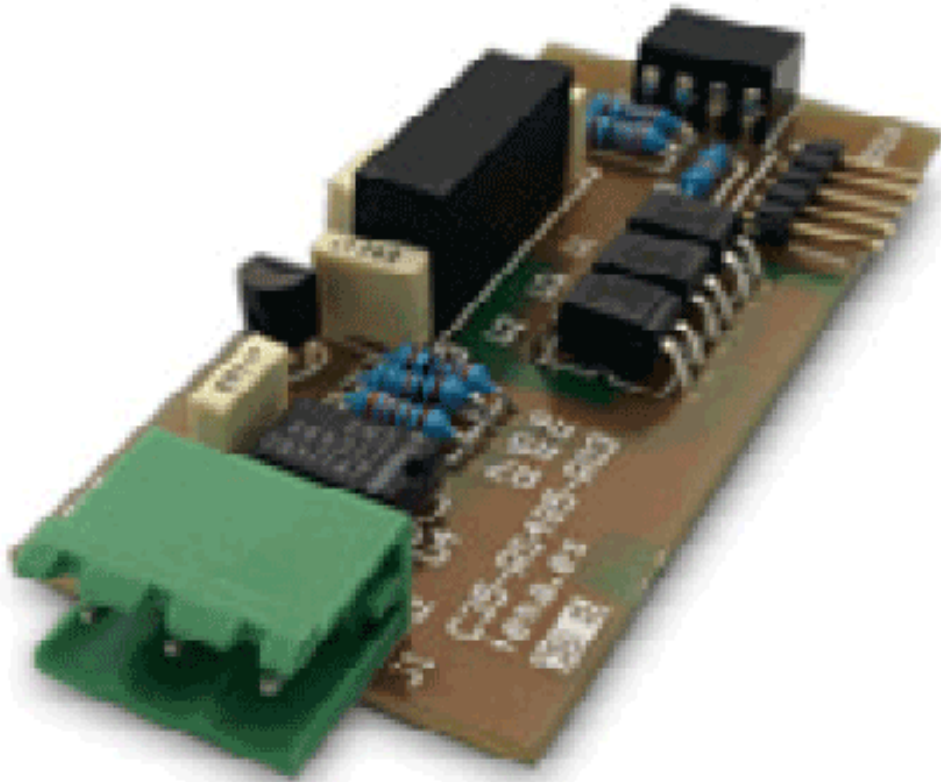
Protocol	Modbus RTU	
Bus type	RS-485, configurable for 9.600 or 4800 bps	
Addresses	1 to 247	
Formats	configurable 8n1, 8e1, 8o1, 8n2	
Function code	4	read register
Registers	0	reading value (16 bits)
	1	number of decimals (16 bits)
Errors	0	function not supported
	1	register not accessible
Isolation	1000 Vdc	
Slots allowed	Opt.1	

Opt.1

B
A
GND

B A G

Signal

Power
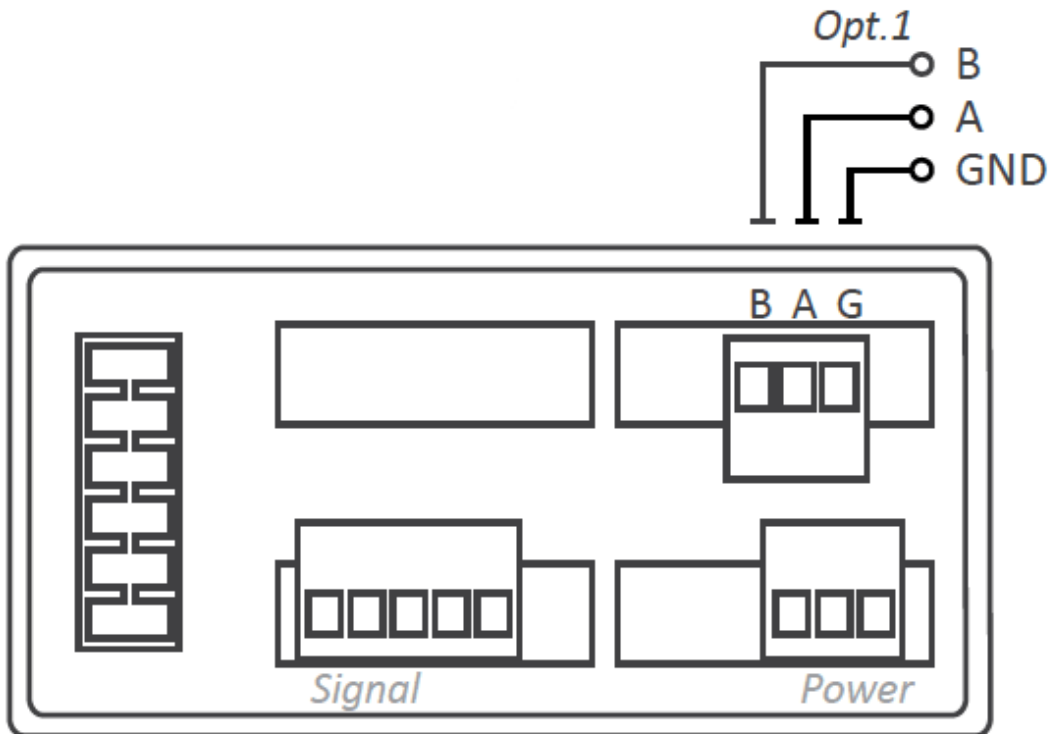
Terminal B   B
Terminal A   A
Terminal G   GND

3. How to open and close

3.1 How to open the housing

A. Locate the clips

Locate the 4 clips (A B C D). Clips are covered by the front filter.

Clips can be seen when looking from the rear of the instrument, just below the front filter.

A.1
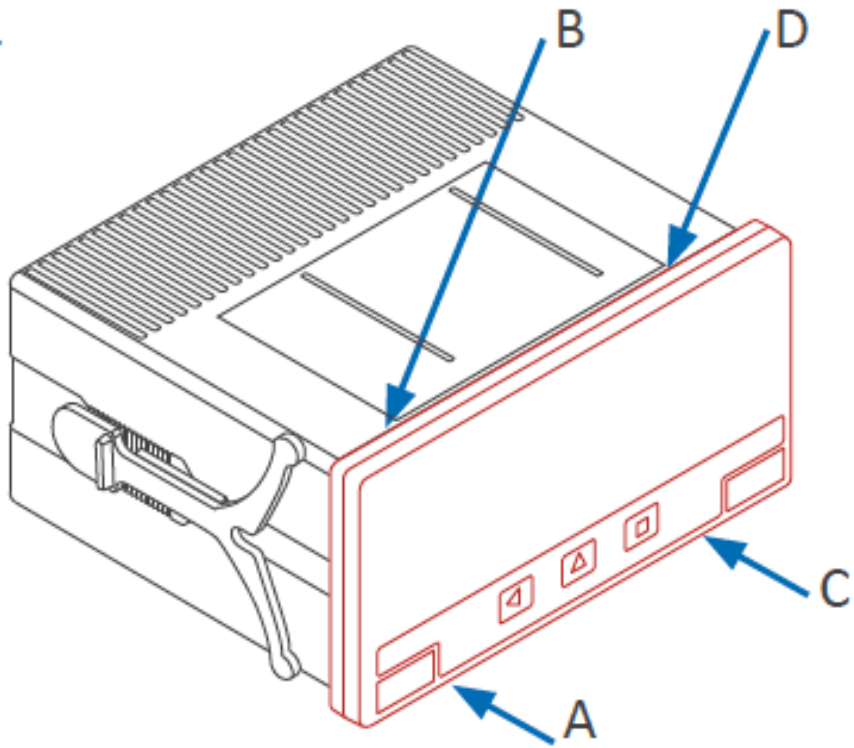
A.2
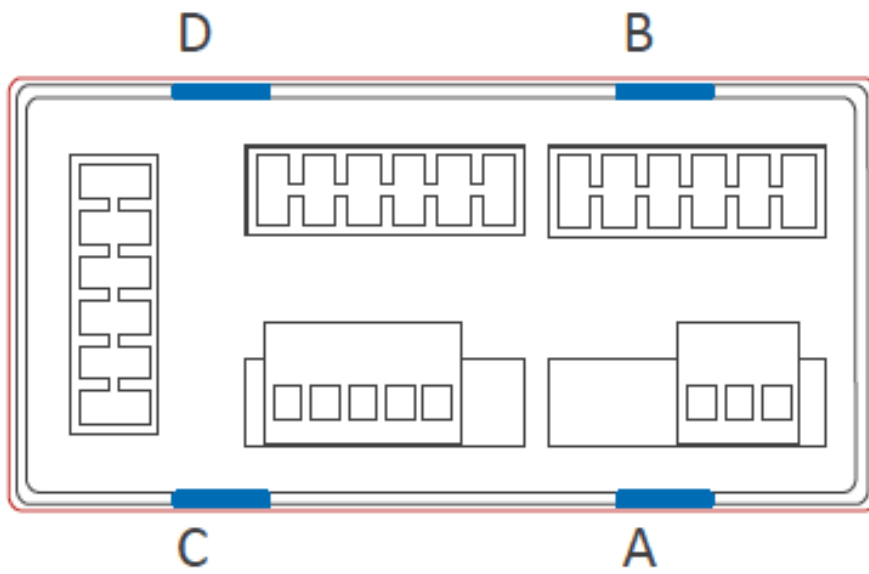
A.3
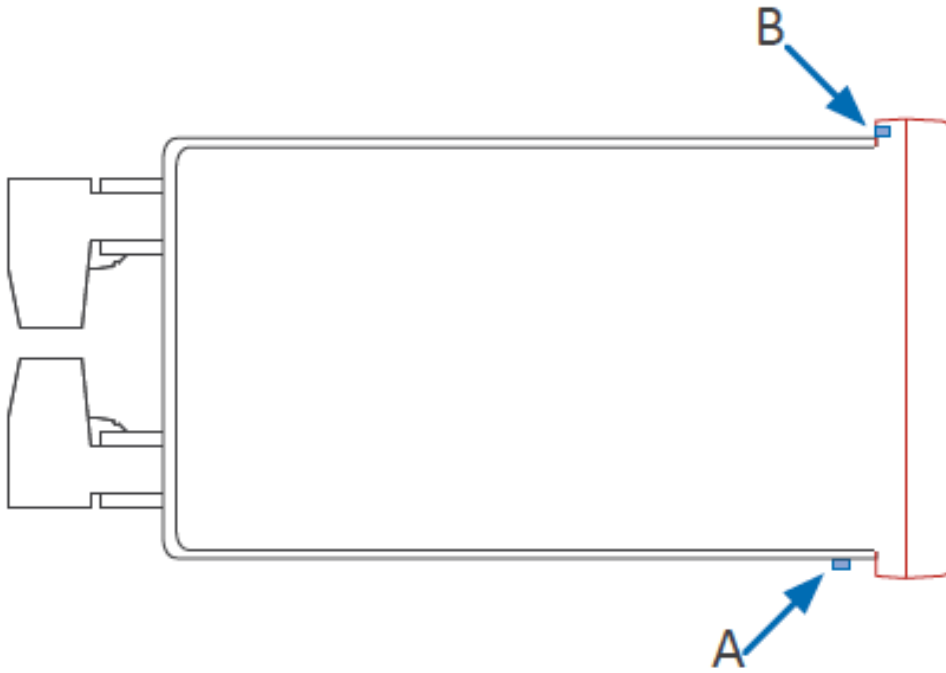
B. How to unclip one clip

Place a flat screw driver at the first clip. Insert firmly until the end of the clip space, and then turn gently the screwdriver clockwise approx. 45º (while still pushing against the clip). The front filter will 'move up' and unclip itself. Clip is unclipped when the front filter corner moves slightly to the front.

B.1
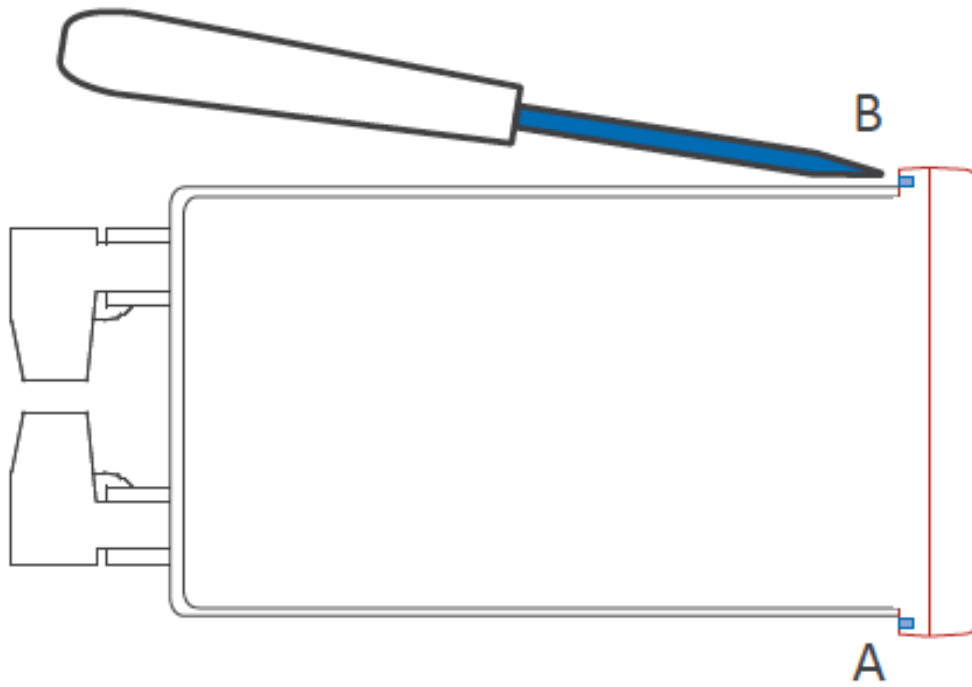
B.2
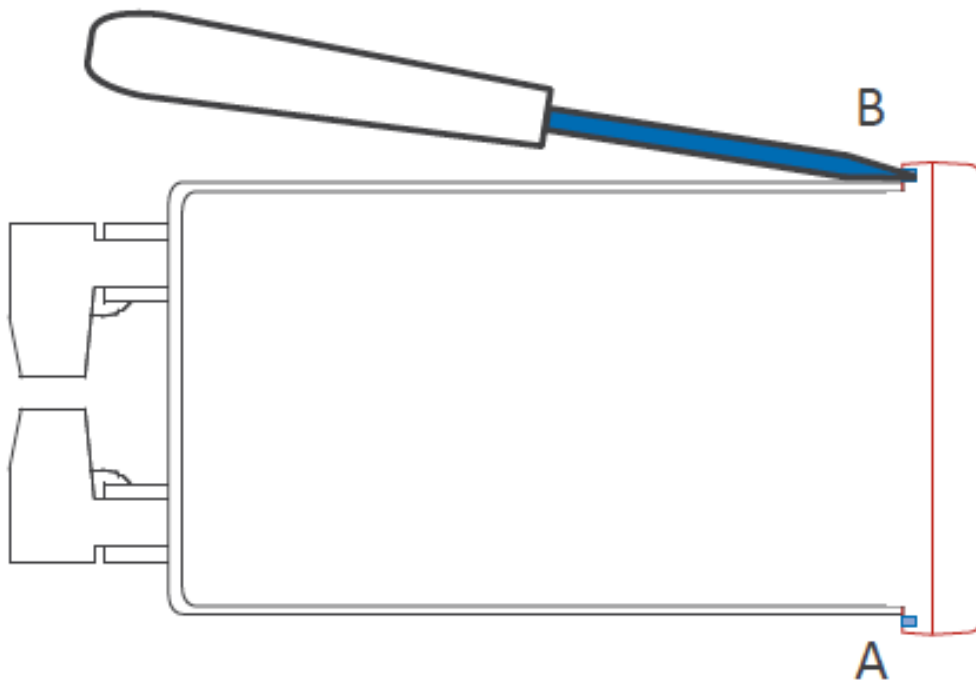
B.3 Screw driver placed   Screw driver turned
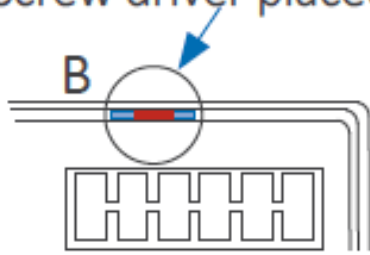
B   B
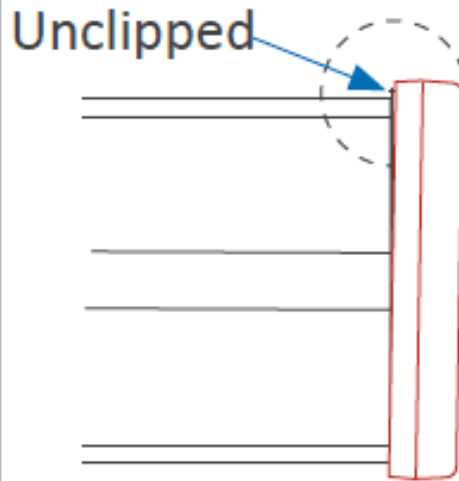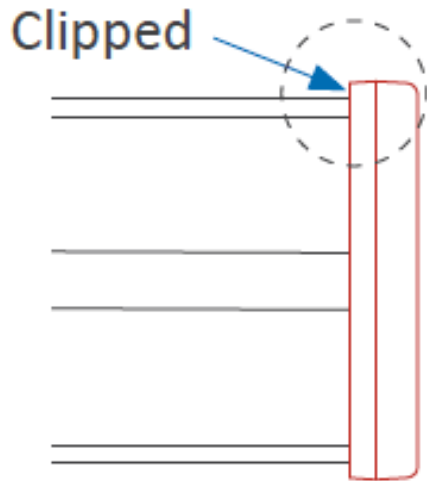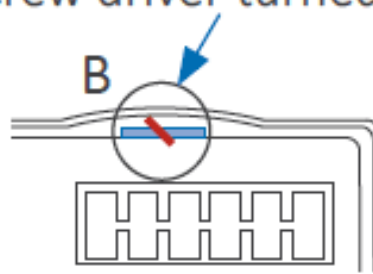
Clipped   Unclipped

C. Repeat with all clips

Repeat for remaining 3 clips. All 4 clips are now unclipped.

Front filter is slightly moved to the front on each corner. It can now be removed by hand.

C.1
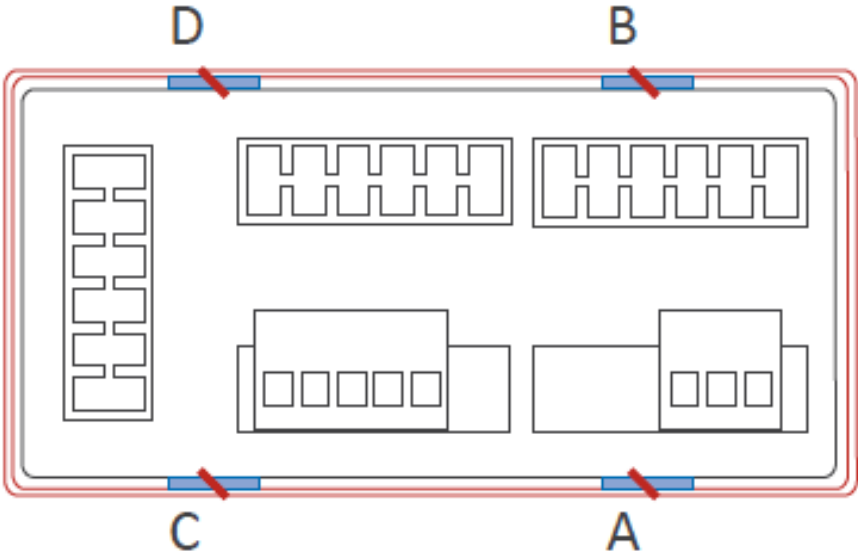
C.2
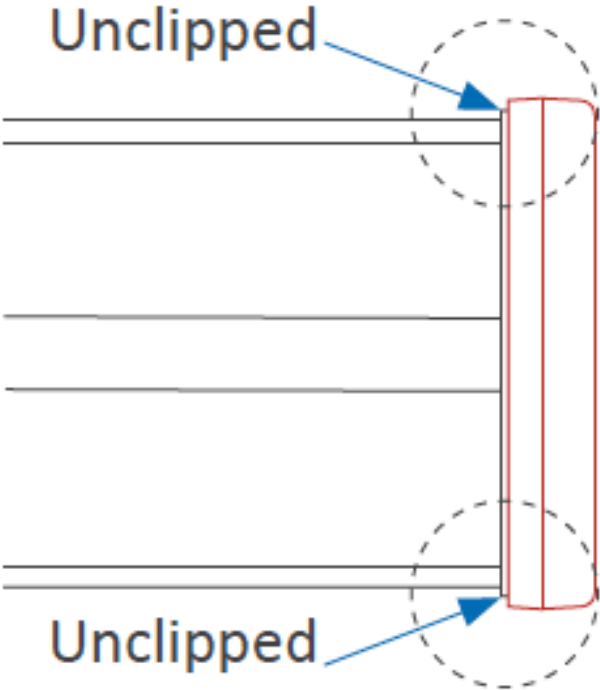
C.3
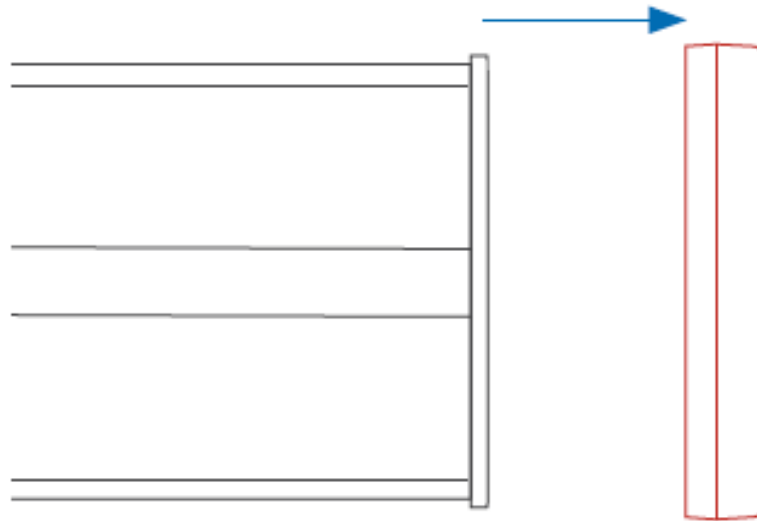
3.2 How to close the housing

A. Locate the clips

Locate the 4 clips (A B C D) at the housing (image A.1) and the 4 matting clips at the filter (image A.2). With the instrument inside the housing, face the front filter against the housing (do not clip yet). Do not press the rear terminals with your hand, as the instrument would force the filter outwards.

A.1

A.2

Front filter
Internal View
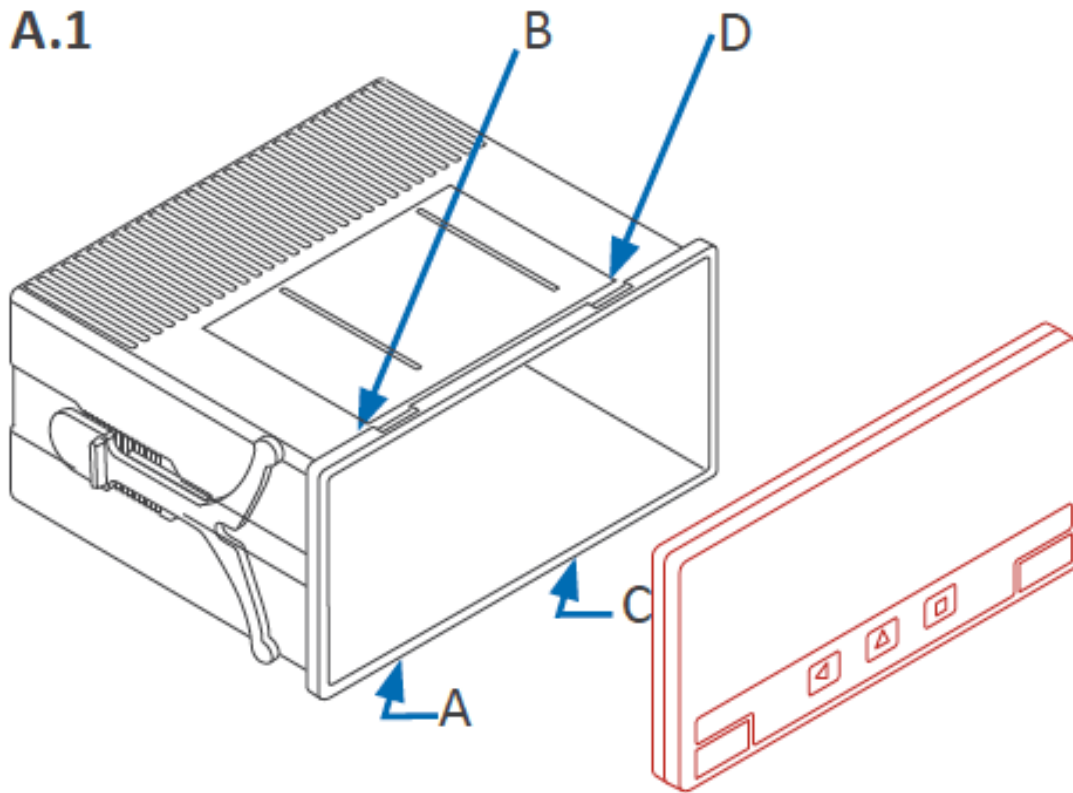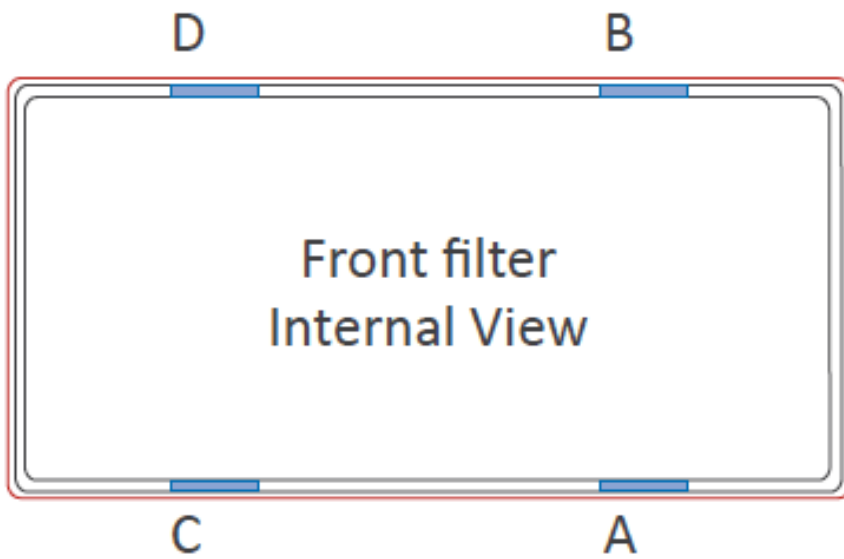
A.3
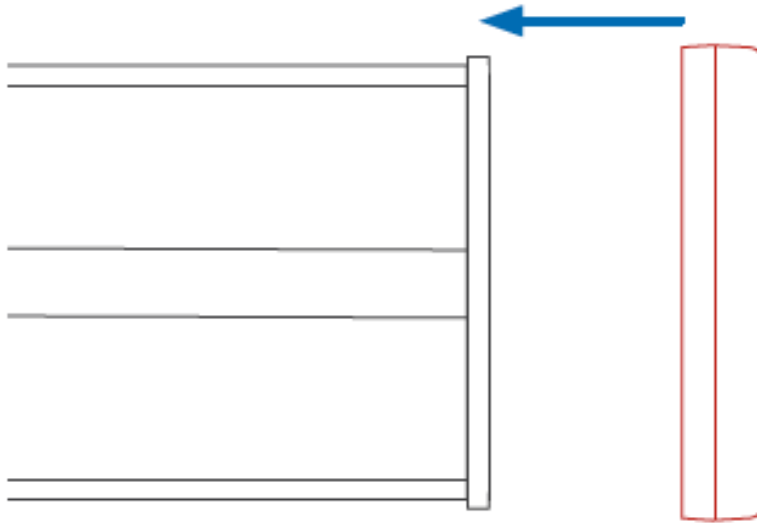
B. Fit corner 'X' and clip 'A'

Fully insert corner 'X' into the housing. See at image B.2 that the filter is not yet clipped : only corner 'X' is completely fitted. Corner 'Y' can be also fitted or not fitted (it is not important). With corner X fitted and firmly pressed (it must remain fitted), press clip 'A' and it will clip (you will hear a clear 'snap').
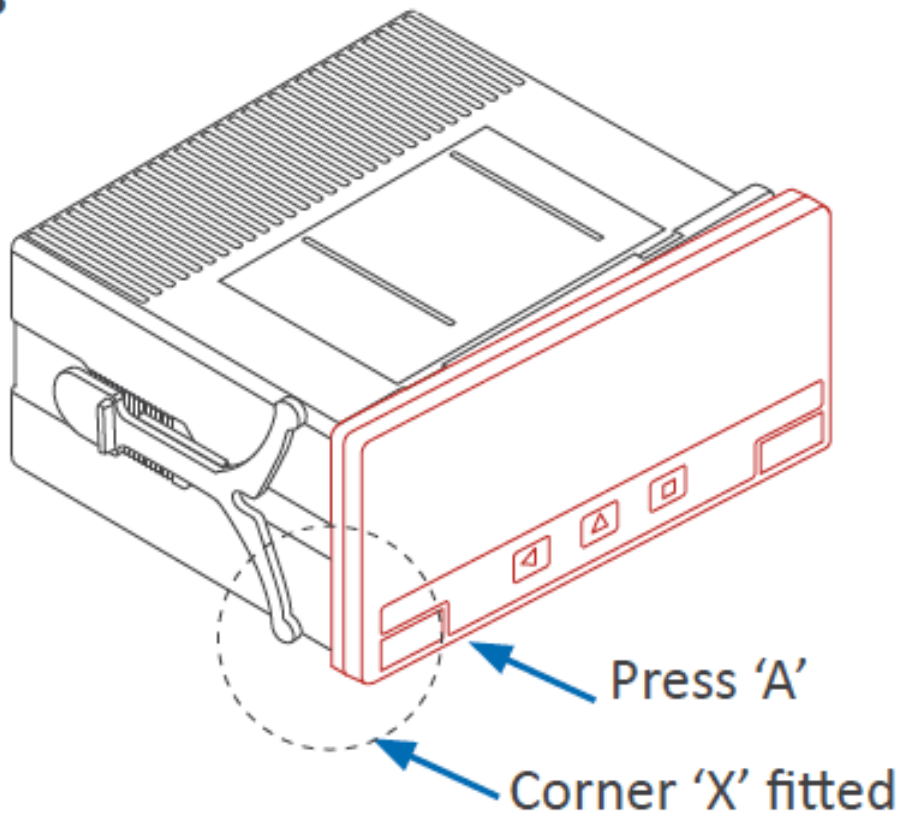
B.1

'X'

B.2

Corner 'Y' can be
fitted or not fitted

Corner 'X' fitted

B.3

Press 'A'

Corner 'X' fitted
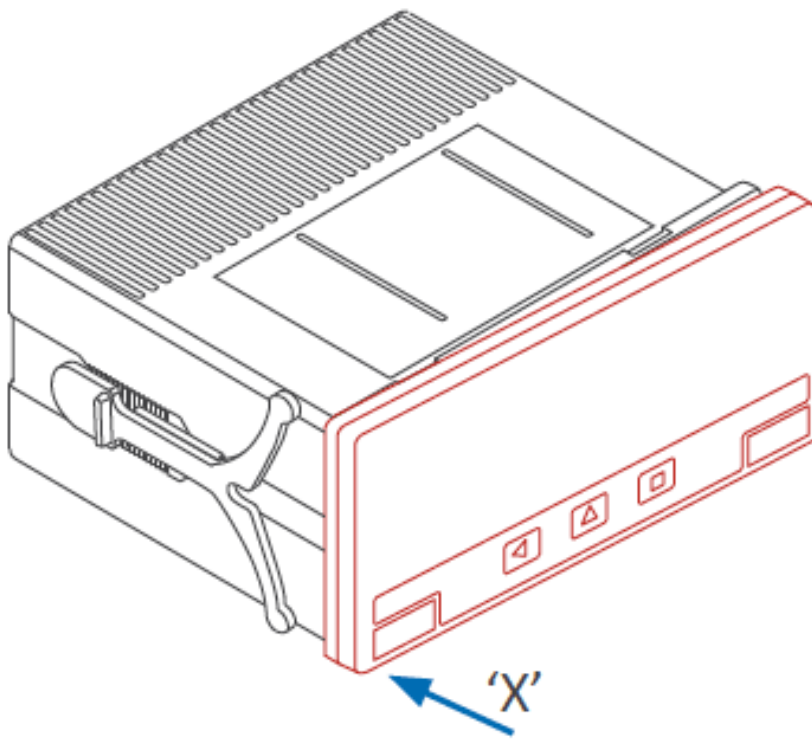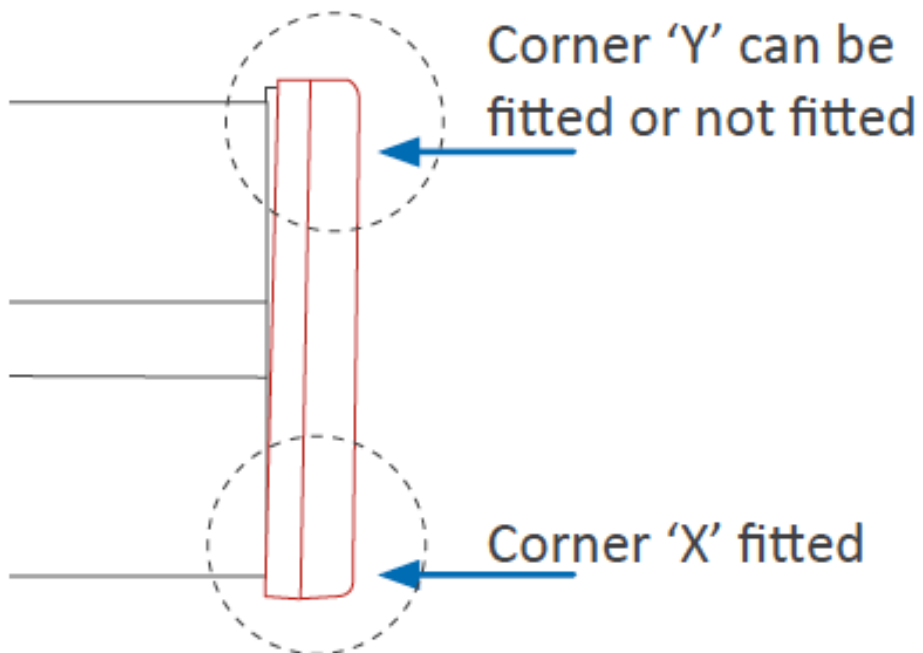
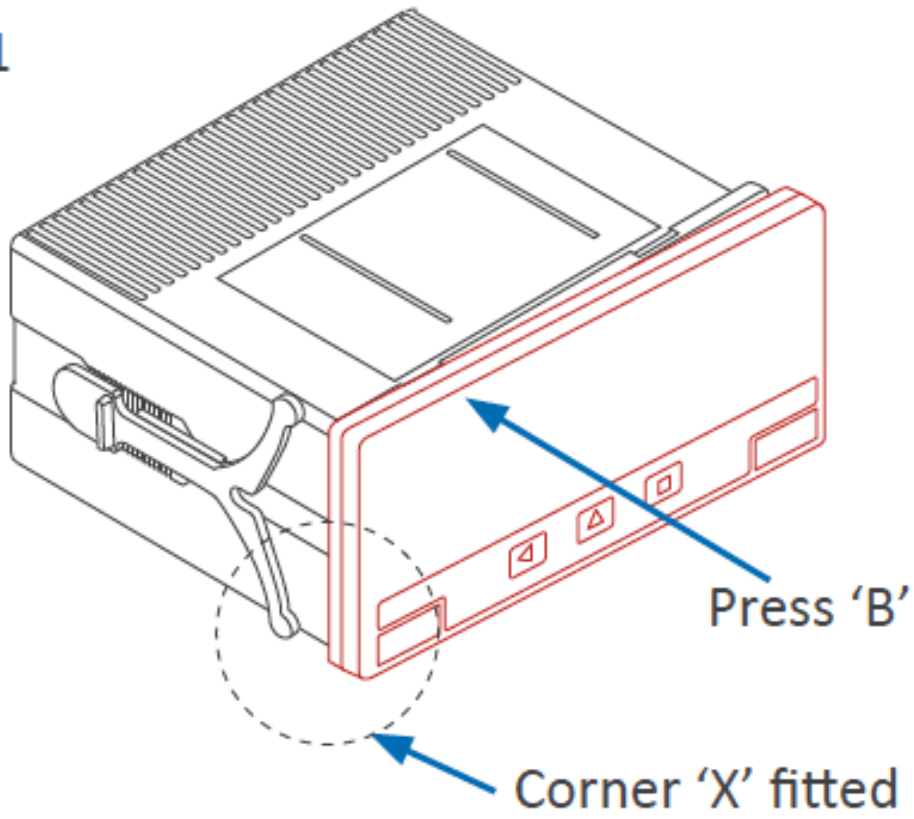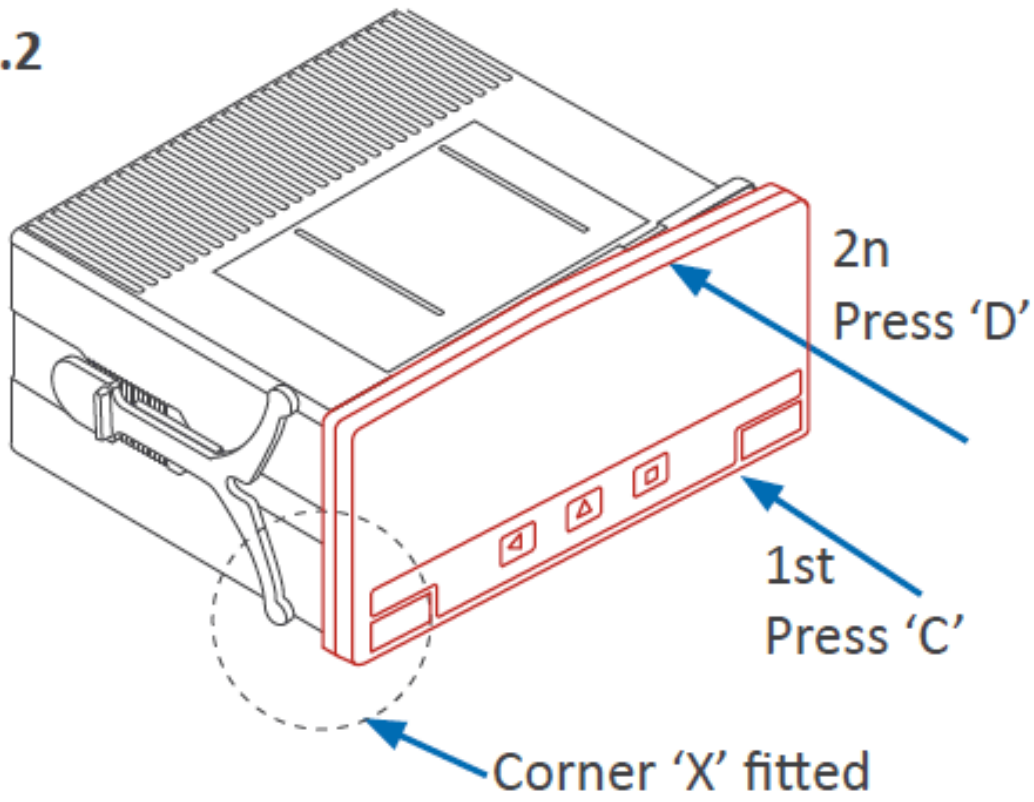## C. Clip remaining clips 'B', 'C' & 'D'

Still press firmly corner 'X' until all four clips are clipped. You can release your finger from clip 'A' as clip 'A' will not unclip once it is clipped. Press on clip 'B' until it clips (you will hear a clear 'snap'). Then press on clips 'C' and 'D' (you will hear a clear 'snap' on each case).
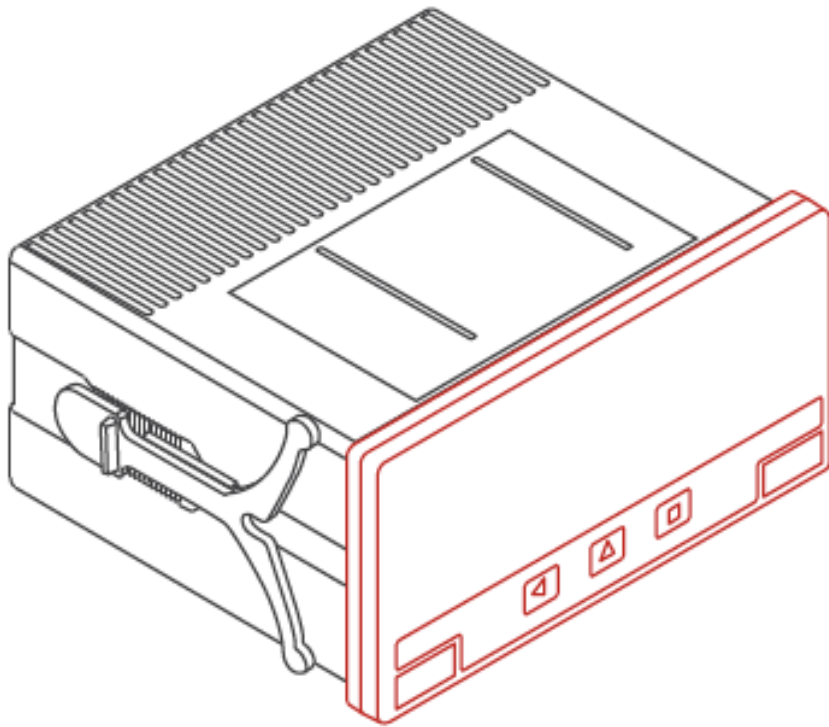
C.1

Press 'B'

Corner 'X' fitted

C.2

2n
Press 'D'

1st
Press 'C'

Corner 'X' fitted

C.3

The information contained in this document is believed to be correct, but Evosensors accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.