



Ω OMEGA™ **User's Guide**



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DP20
Economical Multisignal Meter
for Process, Temperatures and Electrical signals



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2. Model and serial number of the product, and
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1. Economical multisignal meter DP20

1/8 DIN Economical Multisignal panel meter for Process, Temperature and Electrical measurements

Economical multisignal 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.

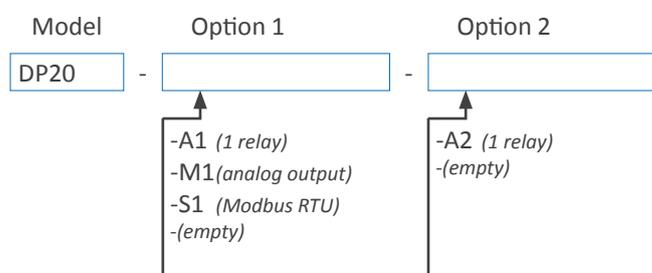
Optional 1 or 2 relay outputs, 4/20 mA isolated analog output, and Modbus RTU isolated serial communications.

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 (▲) 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).

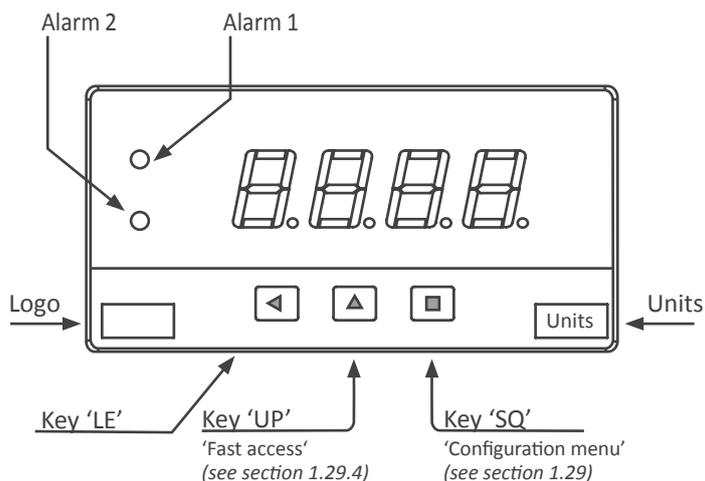
1.1 How to order



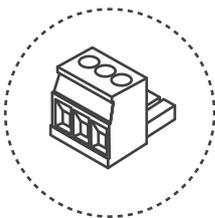
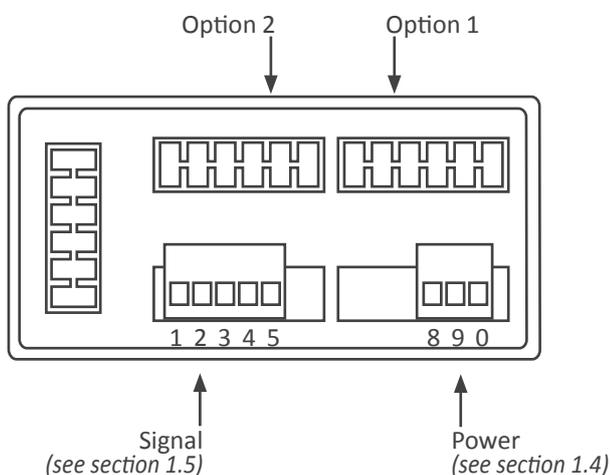
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1.2 Front view



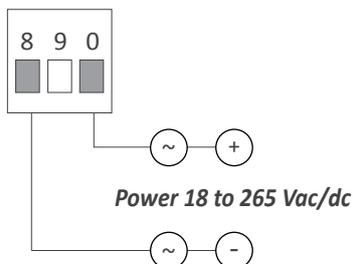
1.3 Rear view



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

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

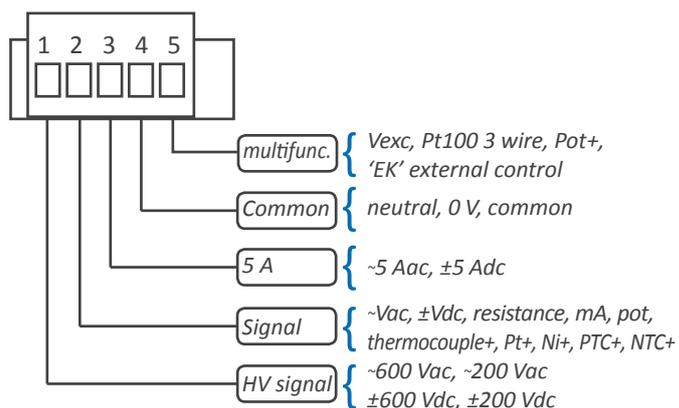
400 mA time-lag for power voltage < 50 Vac/dc

1.5 Signal connections

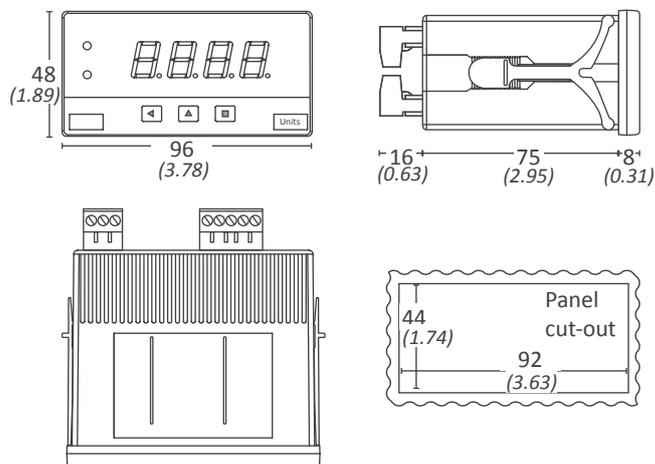
Signals up to 600 V and 200 V (AC and DC) must be connected at terminals 1 and 4. Signals for 5 A current (AC and DC) must be connected at terminals 3 and 4. All other signals must be connected between terminals 2 and 4. Terminal 5 is a 'multifunction' terminal, configurable with one of the following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



1.6 Mechanical dimensions in mm (in)



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	14 mm
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 γ 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)
<i>Measuring Frequency</i>	<i>frequency up to 100 Hz</i> (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 25 °C	<i>see following sections for each signal</i>
Thermal drift	150 ppm/°
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'	18 to 265 Vac/dc
isolation	1500 Veff. <i>isolation tested for 60 sec.</i>
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

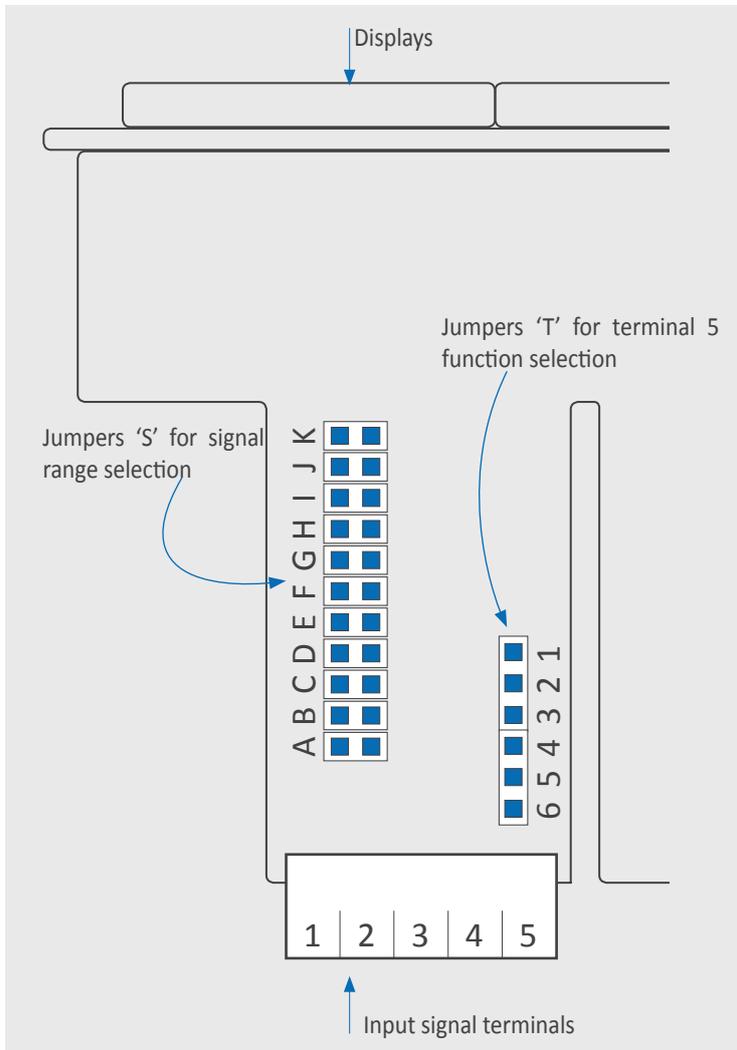
<i>Functions included</i>		Section
<i>Fast access</i>	<i>to alarm setpoints, maximum and minimum</i>	1.20
<i>External control</i>	<i>second scaling decimal point 0, 1, 2 or 3 'hold' reading 'tare' function" memory of maximal memory of minimum</i>	1.24
<i>'Eco' mode</i>	<i>reduced consumption</i>	1.23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

Configuration	3 front push buttons
Front protection	IP65, NEMA13
Output options	relay, analog, serial (see section 2)
Mechanical	
mounting	panel
connections	plug-in screw terminals
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 +50 °C (32 to 122 °F)
storage	from -20 to +70 °C (-4 to 150 °F)
'warm-up' time	15 minutes

1.9 Internal jumpers

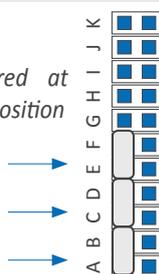
Internal jumpers 'S' are associated to the signal range. The position of internal jumper 'T' assigns the function of the multifunction terminal 5. At 'Table 2' see a list of signal ranges and associated jumper 'S' and 'T'. At Table 3 see the position for jumper 'T' associated to each function of the 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



Jumpers not used can be stored for future use by placing them at the 'no contact' positions indicated below. Only the 3 positions indicated are safe to store jumpers.

Jumpers stored at 'no contact' position



Range	Jumpers 'S'	Jumper 'T'
AC voltages and currents		
~600 Vac	G & I	4-5
~200 Vac	I	
~20 Vac	A & I	
~2 Vac	B & I	
~200 mVac	C & I	
~60 mVac	E & I	
~5 Aac	I	
~20 mAac	D & I	
DC voltages and currents		
±600 Vdc	G	4-5
±200 Vdc	---	
±20 Vdc	A	
±2 Vdc	B	
±200 mVdc	C	
±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	

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

Range	Jumpers 'S'	Jumper 'T'
Thermocouples		
Tc. K	E	4-5
Tc. J		
Tc. E		
Tc. N		
Tc. L		
Tc. R	E & J	4-5
Tc. S		
Tc. T	E	4-5
Tc. C		
Tc. B	E & J	
Pt and Ni probes		
Pt100 (3 wire)	F & H & J	5-6
Pt100 (2 wire)	F & H	4-5
Pt500	F	
Pt1000	F	
Ni100	F & H	
Ni200	F & H	
Ni1000	F	
NTC probes		
NTC	F & K	4-5
PTC probes		
KTY 121	F	4-5
KTY 210, 220	F & H & K	
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

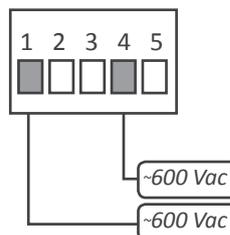
Terminal 5 remains configured as ‘EK’ external control function. See section 1.9 for a list of available functions.

• Start-up, connections and jumpers

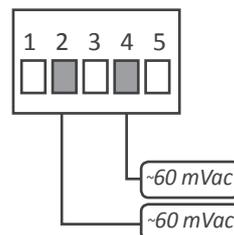
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

See below a list of typical connections :

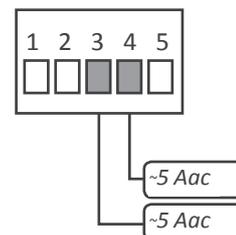
- 600 Vac
- 200 Vac



- 20 Vac to 60 mVac
- 20 mAac



- 5 Aac

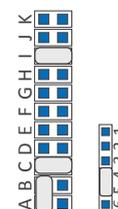


Applications	
... with shunts ...	measure of AC currents through a current shunt of 60 mV, 100 mV or 150 mV and scaled reading
... with X/5, X/1 current transformers ...	measure of AC currents through a X/5 or X/1 current transformer and scaled reading
... direct measure ...	direct measure of currents 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 5 - Applications with measure of AC signals

Example for jumper selection for ~200mVac

Jumpers ‘S’ placed on jumpers C & I.
 Jumper ‘T’ between 4-5 for EK external control function.
 Jumper not used placed between A-B of non-use.



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	from 9999 to -1999	G I	4-5	<0.30 % (up to 150 Hz)	800 Vac	1(-) 4(-)	12 M
~200 Vac	200.0		I			800 Vac		12 M
~20 Vac	20.00		A I			150 Vac	2(-) 4(-)	1 M
~2 Vac	2.000		B I			100 Vac		100 K
~200 mVac	200.0		C I			30 Vac		10 K
~60 mVac	60.0		E I			3 Vac		1 M

Table 4 - Measuring ranges in Vac

Aac 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 Aac	5.00	from 9999 to -1999	I	4-5	<0.50% (up to 150 Hz)	7 Aac (max. 7 sec.)	3(-) 4(-)	20 mOhm
~20 mAac	20.00		D I			25 mAac	2(-) 4(-)	4.7 R

Table 6 - Measuring ranges in Aac

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

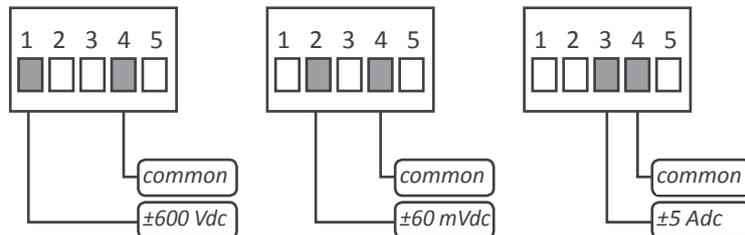
Terminal 5 remains configured as 'EK' external control function. See section 1.9 for a list of available functions.

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.

See below a list of typical connections :

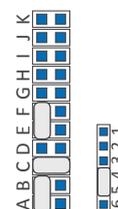
- ± 600 Vdc
- ± 200 Vdc
- ± 20 Vdc to ± 60 mVdc
- ± 5 Adc
- ± 20 mAdc



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

Example for jumper selection for ± 200 mVdc
 Jumpers 'S' placed on jumpers C.
 Jumper 'T' between 4-5 for EK external control function.
 Jumper not used placed between A-B and E-F of non-use.



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 Vdc	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	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 Aac (max. 7 sec.)	3(+) 4(-)	20 mOhm
± 20 mAdc	± 20.00		D		<0.15 %	25 mAdc	2(+) 4(-)	4.7 R

Table 8 - Measuring ranges in Adc

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 1°. Reading can be configured in °C (degrees Celsius) or °F (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.

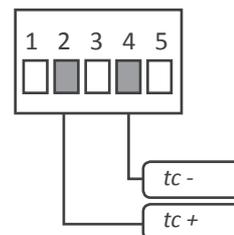
• Terminal 5 'multifunction' - External control

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 :



Example for jumper selection for Thermocouple N
Jumpers 'S' placed on jumpers E.
Jumper 'T' between 4-5 for EK external control function.
Jumper not used placed between A-B and C-D of non-use.

Thermocouple	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range in °C (in °F)	Connection (terminals)	Total error (cold junction included)	
Thermocouple K	E	4-5	-100 / 1350 °C (-148 / 2462 °F)	2 (tc +) 4 (tc -)	<3 °C	
Thermocouple J			-100 / 1200 °C (-148 / 2192 °F)			
Thermocouple E			-100 / 1000 °C (-148 / 1832 °F)			
Thermocouple N			-100 / 1300 °C (-148 / 2372 °F)			
Thermocouple L			-100 / 900 °C (-148 / 1652 °F)			
Thermocouple R			0 / 1768 °C (32 / 3214 °F)			
Thermocouple S	E J		0 / 1768 °C (32 / 3214 °F)			
Thermocouple T			-100 / 400 °C (-148 / 752 °F)			
Thermocouple C	E		0 / 2300 °C (32 / 4172 °F)			<5 °C
Thermocouple B	E J		700 / 1820 °C (1292 / 3308 °F)			

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 1° or 0.1°. Reading can be configured in °C (degrees Celsius) or °F (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.

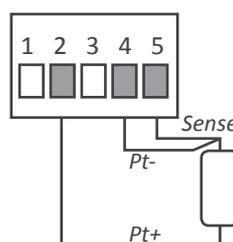
To configure for 2 wire Pt100 probes, set internal jumper 'T' at position 4-5 (see section 1.9). Terminal 5 will be configured as 'EK' external control function. See section 1.9 for a list of available functions.

Start-up, connections and jumpers

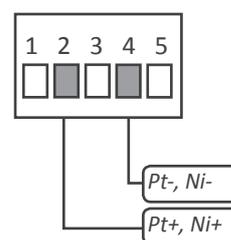
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

See below a list of typical connections :

Pt100 3 wires

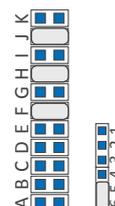


other probes 2 wires



Example for jumper selection for PT100 3 wire

Jumpers 'S' placed on jumpers F & H & J
Jumper 'T' between 5-6 for PT100 3rd wire.



Sensor	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Range in °C (in °F)	Total error	Connection (terminals)	Current at sensor	
Pt100 3 wires	F H J	5-6	-200 / 700 °C (-328 / 1292 °F)	<1°C	2 (Pt+) 4 (Pt -) 5 (sense)	< 900 uA	
Pt100 2 wires	F H	4-5	-200 / 700 °C (-328 / 1292 °F)		2 (Pt+, Ni+) 4 (Pt -, Ni-)	< 900 uA	
Pt500	F		-150 / 630 °C (-238 / 1166 °F)				< 90 uA
Pt1000	F		-190 / 630 °C (-310 / 1166 °F)				< 90 uA
Ni100	F H		-60 / 180 °C (-76 / 356 °F)				< 900 uA
Ni200	F H		-60 / 120 °C (-76 / 248 °F)				< 900 uA
Ni1000	F		-60 / 180 °C (-76 / 356 °F)				< 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 -60 °C to 150°C.

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 'R₂₅' 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 1° or 0.1°. Reading can be configured in °C (degrees Celsius) or °F (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.

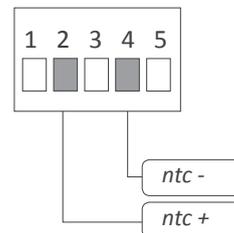
Terminal 5 'multifunction' - External control

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 :

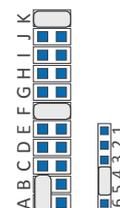


Example for jumper selection for NTC

Jumpers 'S' placed on jumpers F & K.

Jumper 'T' between 4-5 for EK external control function.

Jumper not used placed between A-B of non-use.



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°C to 150°C	<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.

Range of measure	NTC probe		
	Temp.	R25	Beta
100 R			
1 MOhm			

Table 12 - Data from NTC datasheet

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 1° or 0.1°. Reading can be configured in °C (degrees Celsius) or °F (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.

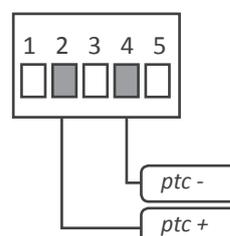
Terminal 5 'multifunction' - External control

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 °C (in °F)	Total error
KTY 121	KTY81-121 KTY82-121	F	4-5	-55 / 150 °C (-67 / 302 °F)	<1°C
KTY 210	KTY81-210 KTY82-210	FHK			
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 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' - '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.

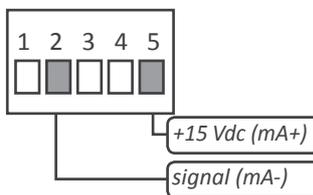
To configure the 'EK' external contact function at terminal 5, set internal jumper 'T' at position 4-5 (see section 1.9). See section 1.9 for a list of available functions.

Start-up, connections and jumpers

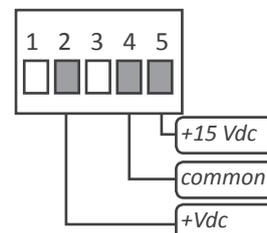
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

See below a list of typical connections :

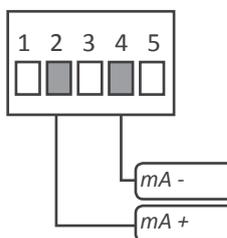
signal 4/20 mA passive



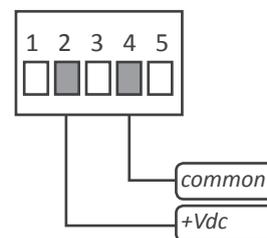
signal 0/10 Vdc passive



signal 4/20 mA active



signal 0/10 Vdc active



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 '0Vac' or '0Aac'. 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 'G1' 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.

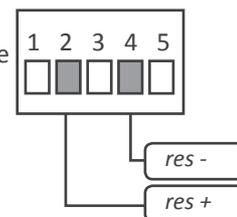
• Terminal 5 'multifunction' - External control

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 :

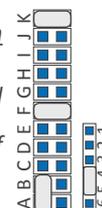


Ranges of measure	Scale by default	Scalable	Jumper 'S' (see section 1.9)	Jumper 'T' (see section 1.9)	Accuracy (% of reading)
0 to 5 K	5.000	from 9999 to -1999	F H K	4-5	<1.5% of reading
0 to 50 K	50.00		F K		

Table 15 - Ranges of measure for resistances

Example for jumper selection for 0/50 KOhm

Jumpers 'S' placed on jumpers F & K
 Jumper 'T' between 4-5 for EK external control function.
 Jumper not used placed between A-B of non-use.



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'

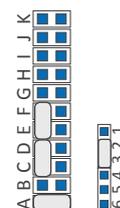
To measure potentiometer signals, set internal jumper 'T' at position 2-3 (see section 1.9). Terminal 5 will be assigned to a +5 Vdc excitation voltage for the potentiometer.

• Start-up, connections and jumpers

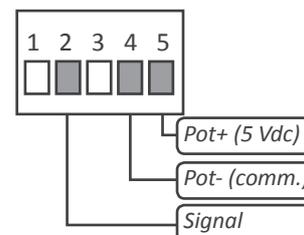
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

Example for jumper selection for Potentiometer

Jumpers 'S' placed on jumper A.
 Jumper 'T' between 2-3 for 5 Vdc for Pot+.
 Jumper not used placed between C-D and E-F of non-use.



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' ('▲') 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' ('▲'), 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 AND using 'EK' external control contact, apply the appropriate protections to isolate the operator from dangerous voltages.

1.25 Second scaling

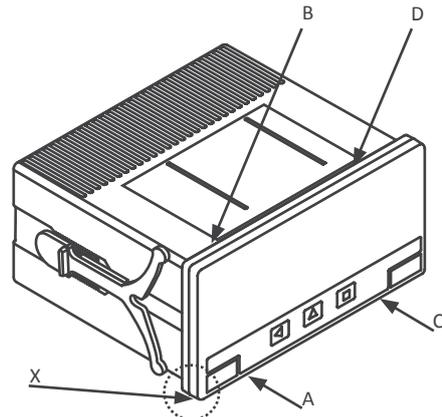
The instrument provides a *'second scaling'*, independent and additional to the standard scaling explained at section 1.21. Control of the scaling to be applied, with a free potential contact called *'External control'*. To configure the *'second scaling'* :

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 and install in a panel

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.



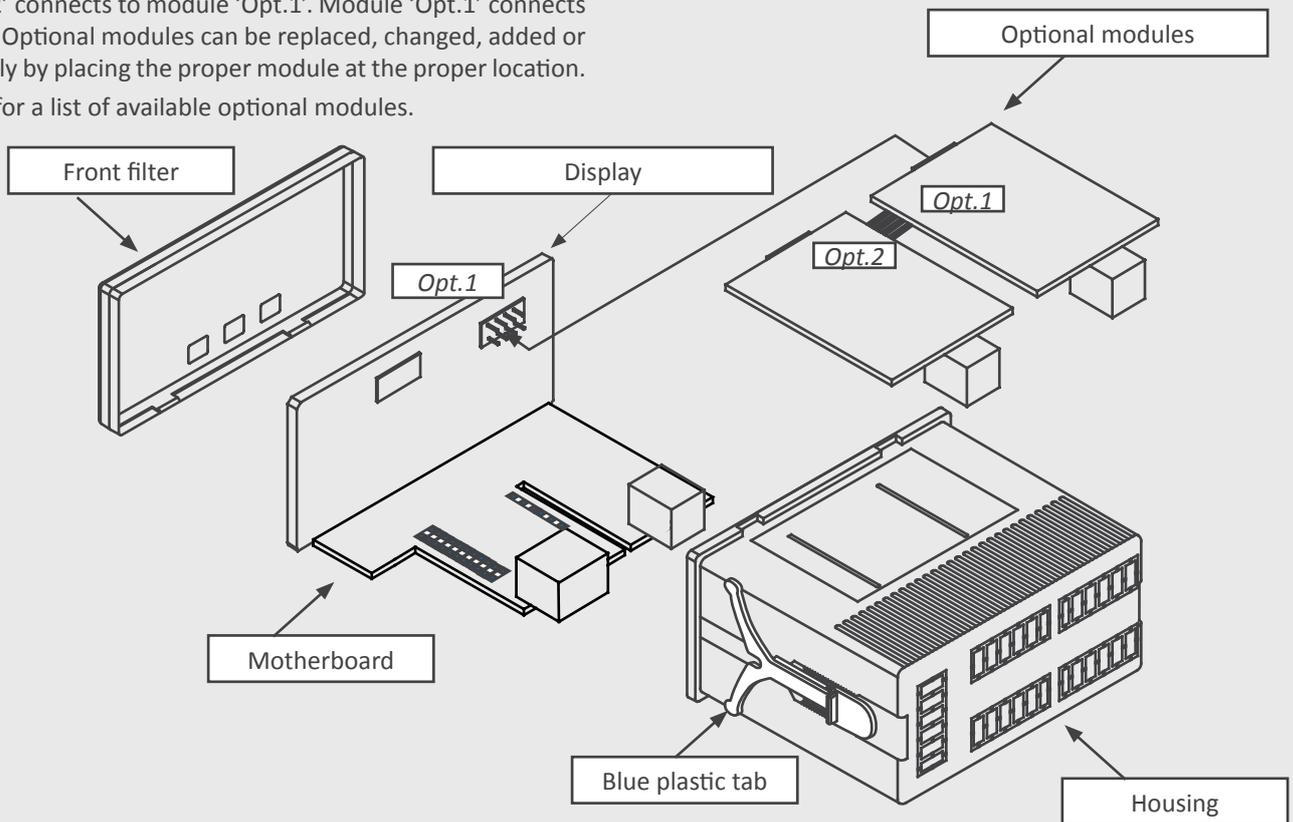
Observe precautions for handling ESD (electrostatic discharge) sensitive devices



* Risk of electric shock. Removing the front cover will grant access to the internal circuits. Disconnect the power and the input signal to prevent electric shock to the operator. Operation must be performed by qualified personnel only.

The internal structure of the instrument is shown in the graphic below.

Module 'Opt.2' connects to module 'Opt.1'. Module 'Opt.1' connects to the display. Optional modules can be replaced, changed, added or removed simply by placing the proper module at the proper location. See section 2 for a list of available optional modules.

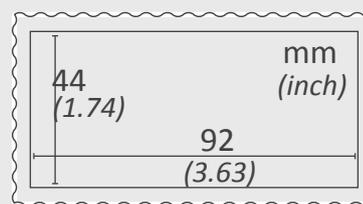


How to Install in a panel

1. Remove the 2 blue plastic tabs from each side of the unit.
2. After setting jumpers per manual (described in this manual) and housing is firmly closed, insert instrument from the front of panel into panel cut out.
3. Re-attach the 2 blue plastic tabs by sliding each one into the track opening on each side and push until the tabs grab onto the notches until snug onto the back of panel.

If needed use a flat screw driver to push the tabs strongly like in the image (A).

To uninstall the instrument, just place the screw driver and turn it between the box and the tab to ungrab the tabs (B).



Panel cut-out



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 (▲) 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

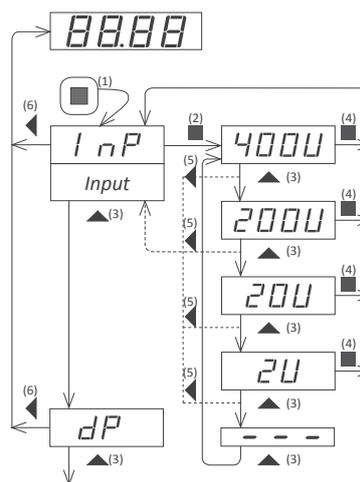
Key SQ (■) - press the SQ (■) key for 1 second to access the 'configuration menu'. Inside the menu, the SQ (■) key functions as a 'ENTER' key. It selects and accesses the menu option currently displayed. At menus with numerical value entries, it validates the number displayed.

Key UP (▲) - the UP (▲) 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 (◀) - inside the menus, the LE (◀) 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 (◀) key, the changed parameters are activated. At menus with numerical value entries, the LE (◀) key allows to select the active digit. To modify the value of the selected digit use the UP (▲) 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 (▲) key moves through the menu options.
4. The SQ (■) key selects the desired range and returns to the 'InP' menu.
5. The LE (◀) key leaves the actual menu level and moves to the previous menu level.
6. The LE (◀) key leaves the 'configuration menu'. Changes are applied and saved at this moment.

Note : example menu indicated above is for information purposes only, and may not match with the actual menu entries of the instrument.

1.28 Messages and errors

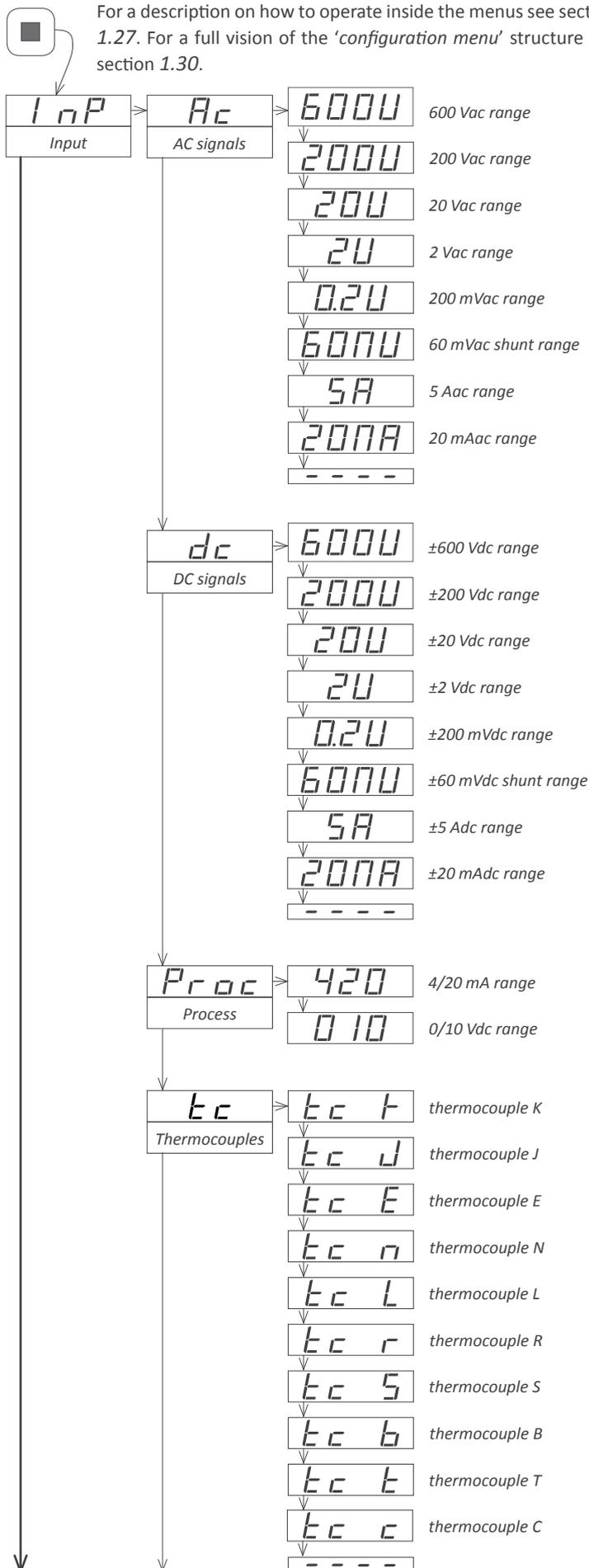
The error messages are shown on display in flash mode.

Messages and errors	
'h.udr' 'h.ovr'	Hardware underrange ('h.udr') / overrange ('h.ovr'). Input signal is lower / higher than the minimum / maximum signal the instrument can detect.
'd.udr' 'd.ovr'	display underrange ('d.udr') / overrange ('d.ovr'). The 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

Press 'SQ' (■) for 1 second to access the 'configuration menu'. For a description on how to operate inside the menus see section 1.27. For a full vision of the 'configuration menu' structure see section 1.30.



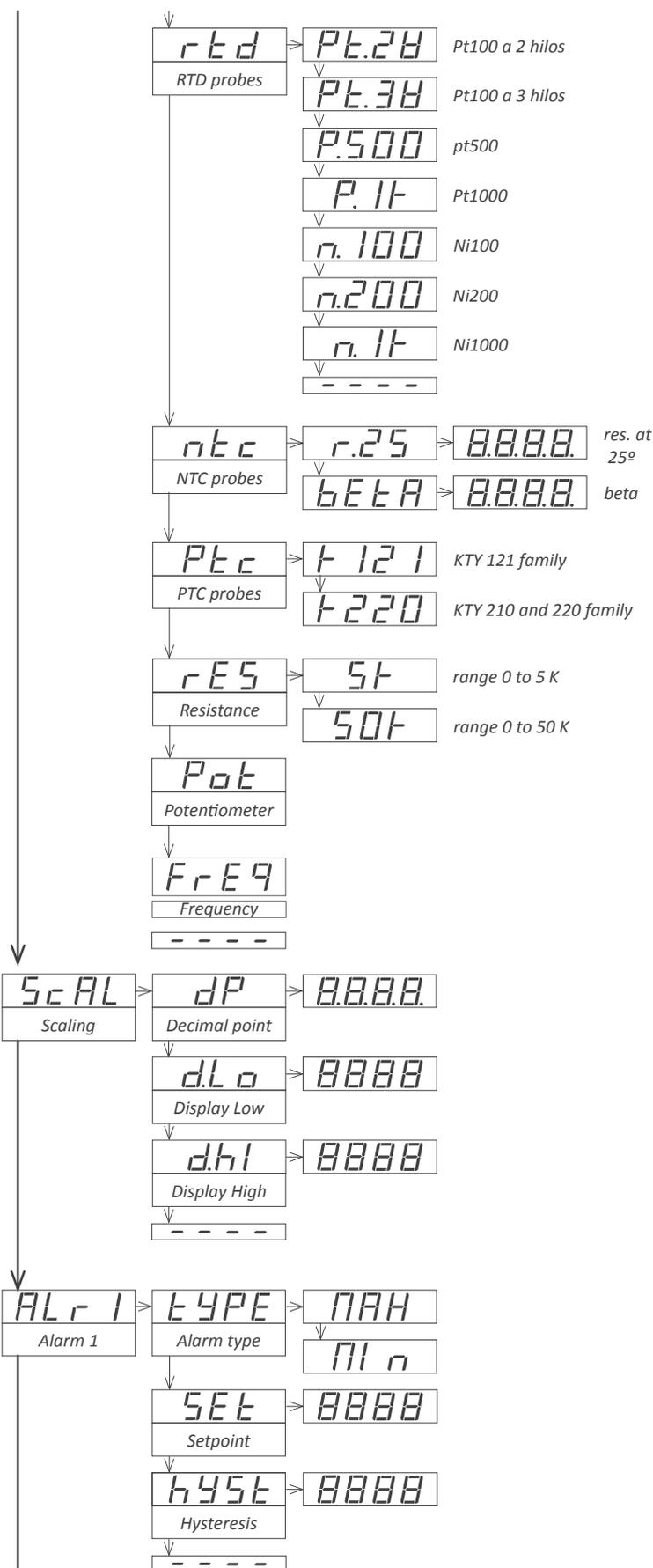
1.29.1 Input signal ranges

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 mAac. 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 25° ('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.

1.29 Configuration menu (cont.)



- **'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'** (◀).

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.H')** parameter the reading value for the high signal range. For more information see section 1.21.

1.29.3 Alarms

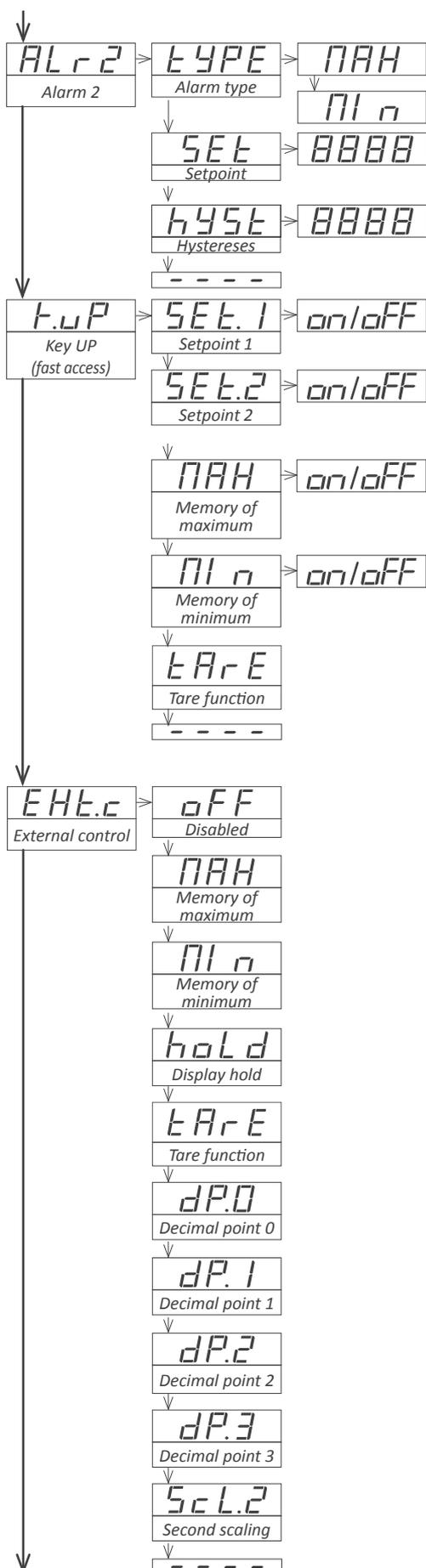
The instrument has 2 independent and configurable alarms.

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.

1.29 Configuration menu (cont.)



1.29.4 Fast access

The key 'UP' (▲) 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' (▲). 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' (▲) key will shortly display the function name and then automatically jump to the function value.

1.29.6 External control

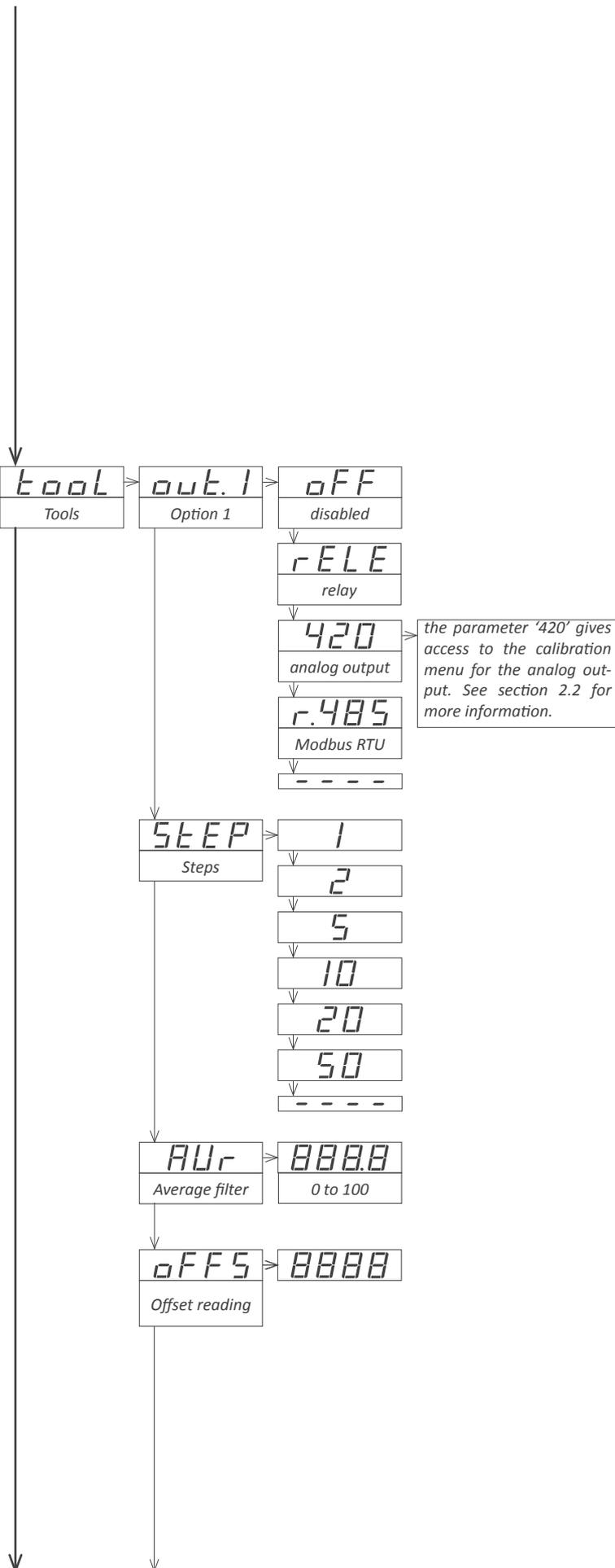
An external on / off control can be connected to the rear of the instrument. The operator can then control the activation of a configured function based on the state of this control. Function remains activated while the external contact is closed, and will deactivate when contact is open. To configure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

- 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

1.29 Configuration menu (cont.)



- 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', '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' see 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'.

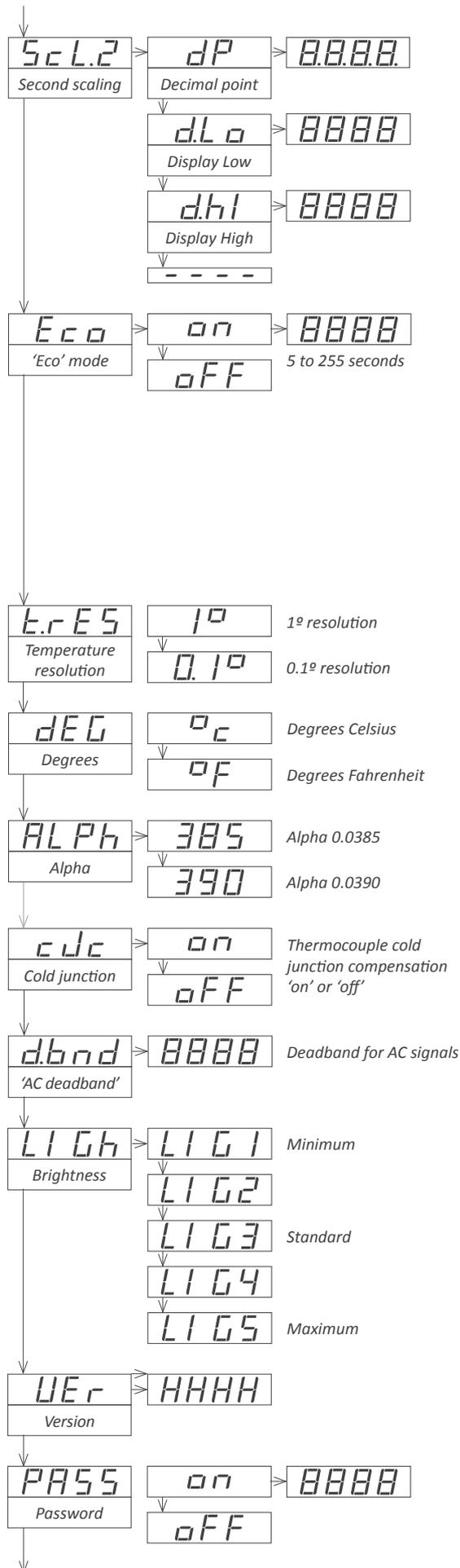
Note : the parameter '420' gives access to the calibration menu for the analog output module. See section 2.2 for more information about this menu and the calibration.

- 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

1.29 Configuration menu (cont.)



- the 'second scaling' (SCL.2) function allows to configure the reading associated to the 'second scaling', which can be activated by controlling a contact at the 'external control'. For more information on the 'second scaling' function see section 1.25.

- the 'Eco mode' ('Eco') is a function to reduce consumption of the instrument, by powering off the display when display is not needed. For consumption data in 'Eco' mode see section 1.8. For more information in 'Eco' mode see section 1.23. The operation of the 'Eco' mode is explained below :

- the waiting time until display is powered off display is configurable from 5 to 255 seconds.

- after the configured time is over, without interaction from the operator, the display powers off the reading. It will not power off if the instrument is into 'configuration menu' or in 'fast access' menu or there is an active alarm.

- the instrument will power on the display when an alarm activates (either alarm 1 or 2) and will remain on if alarm remains active.

- the instrument will power on the display if the operator press any front key.

- at the 'Temperature resolution' ('t.RES') menu select the resolution to 1° or 0.1°. This resolution applies to temperature probes Pt100, Pt500, Pt100, Ni100, Ni200, Ni1000, PTC and NTC. For thermocouple probes resolution is fixed to 1°.

- at the 'Degrees' ('dEG') menu select the temperature values to be read in °C (degrees Celsius) or in °F (degrees Fahrenheit).

- at the 'Alpha' ('ALPH') menu select the value for the alpha parameter to '0.0385' or '0.0390'. This parameter affects to Pt probes (Pt100, Pt500, Pt1000) and it depends on the probe.

- at the 'Cold junction' ('cJc') menu select 'on' to activate the thermocouple cold junction compensation. Select 'off' to deactivate.

- the 'AC deadband' ('d.bnd') parameter applies only to AC measuring ranges. The True RMS measures deal with a considerable noise when signal is near to 0. This parameter allows to set a value between 0 and 100 (by default is 20) to empirically set the signal level at which reading will be forced to 0, when signal is below that level.

- at the 'Brightness' ('LIGH') menu select between 5 levels of brightness intensity for the display. It adapts the instrument to environments with higher or lower brightness is needed or to adapt the intensity to other meters in the area.

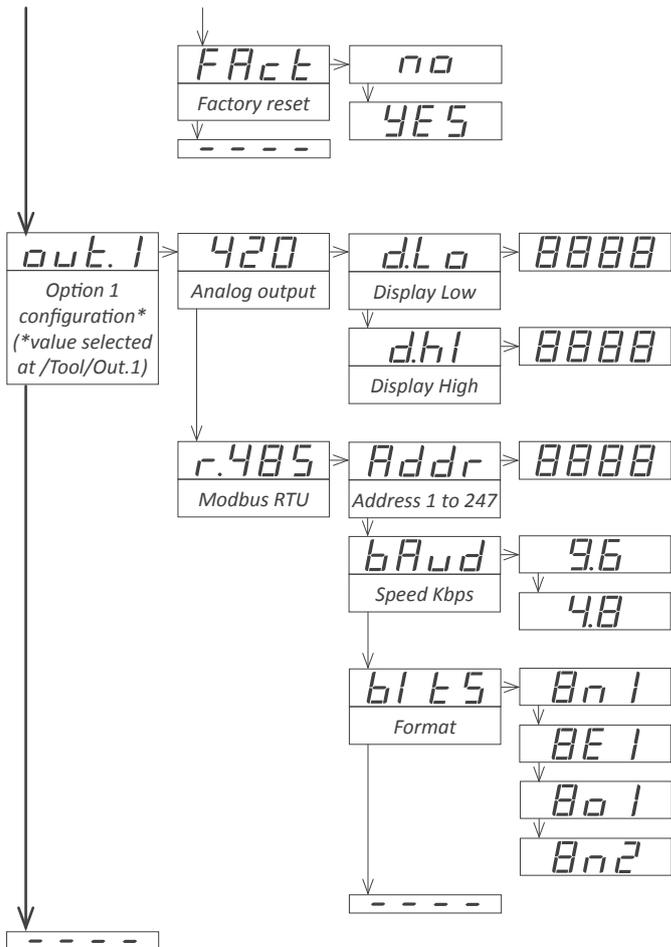
- the 'Version' ('VEr') menu informs about the firmware version installed on the instrument.

- at the 'Password' ('PASS') menu select a 4 digit code to block access to the 'configuration menu'. Use the 'Password' function to prevent modifications on the instrument configuration. To activate the 'Password' select 'on' and enter the numerical code.

The code will be requested when trying to access the 'configuration menu'. The 'fast access' menu is not blocked by the 'Password'.

- At the 'Factory reset' ('FACT') menu, select 'yes' to load the

1.29 Configuration menu (cont.)



default factory configuration for the instrument. See section 1.32 for a list of values at default factory configuration.

1.29.8 Configuring the options

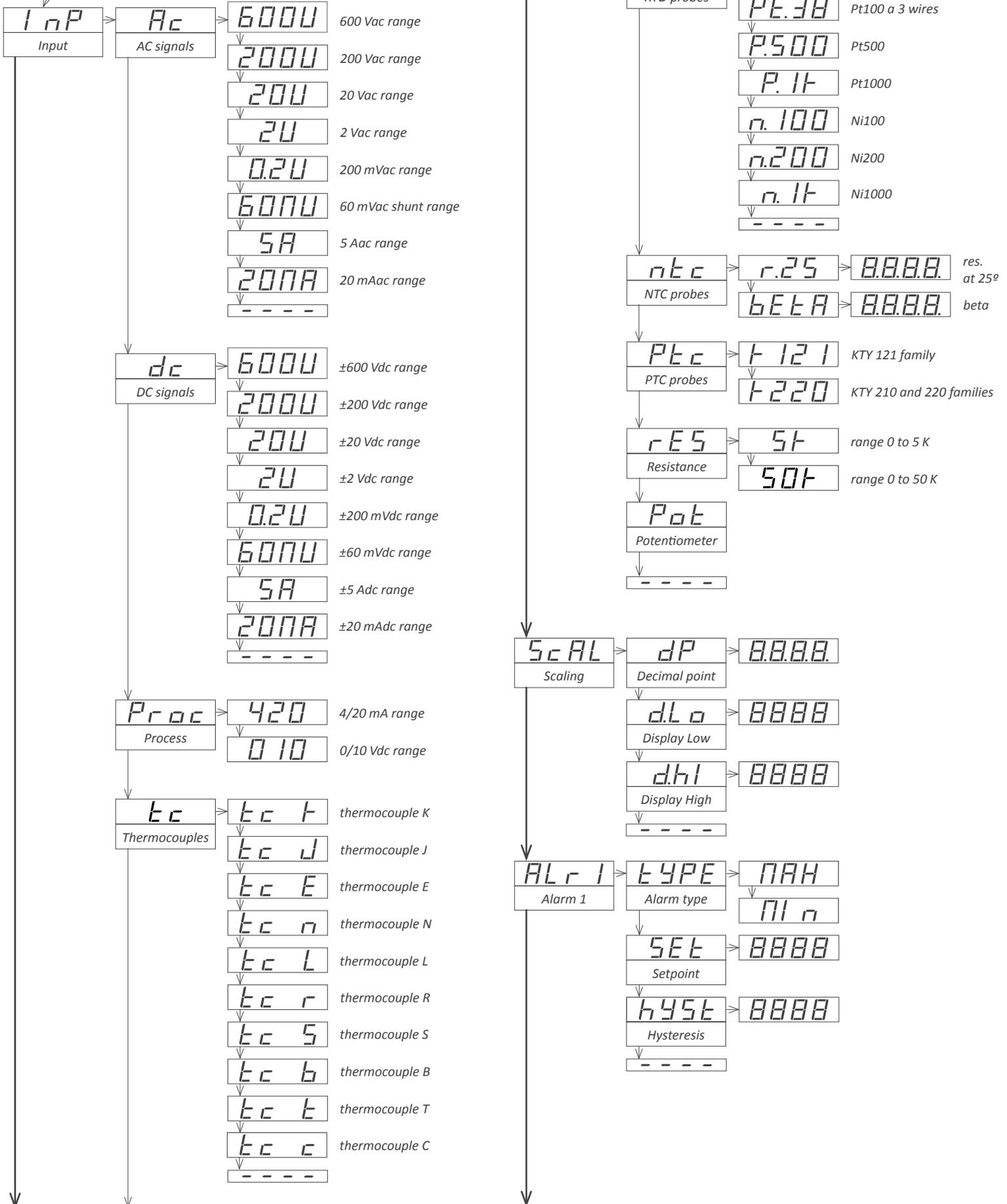
At the 'Option 1 configuration' ('out.1') configure the module installed at slot Opt.1. This menu varies depending on the module installed (relay, analog output or serial output). The type of module installed is indicated at the menu 'Tools' / 'out.1'.

- 'Analog output' ('420') : select 'analog output' ('420') at 'Tools' / 'out.1' / '420', to have the analog output configuration at this menu entry. Introduce the reading value associated to 4 mA (Display Low ('d.Lo')) and the reading value associated to 20 mA (Display High ('d.Hi'))
- 'Modbus RTU' ('r.485') : select 'Modbus RTU' ('r.485') at 'Tools' / 'out.1' / 'r.485', to have the serial output configuration at this menu entry. Configure the address for the instrument (parameter 'Address 1 to 247' ('Addr')), the bus speed (parameter 'Speed kbps' ('bAud')) configurable to 9.600 bps or 4.800 bps, and the bus format (parameter 'Format' ('bitS')) configurable at 8n1, 8E1, 8o1 or 8n2.

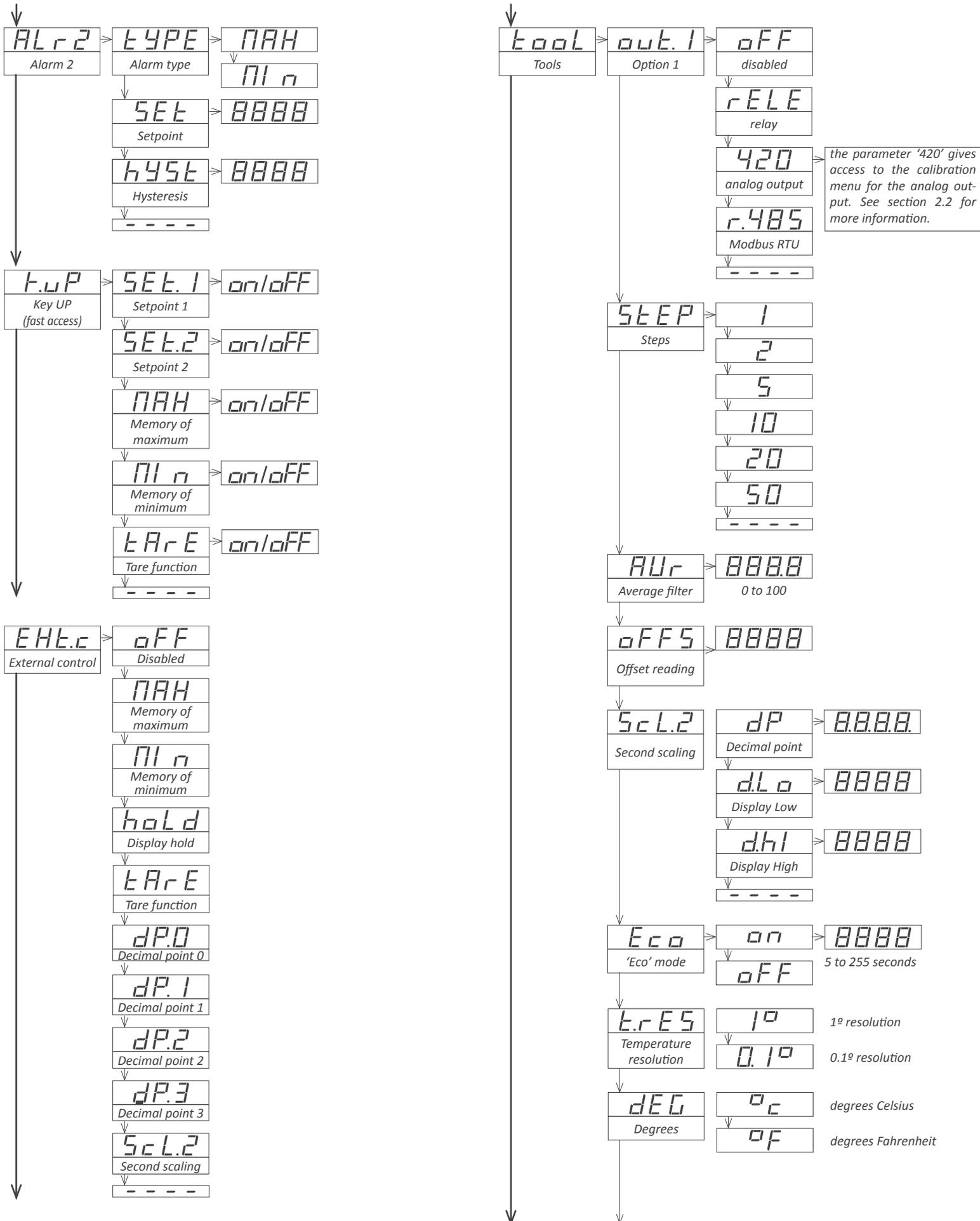
The slot at Opt.2 allows only for a relay module, and configuration is done through the menu entry 'Alarm 2' ('ALr2').

1.30 Full configuration menu

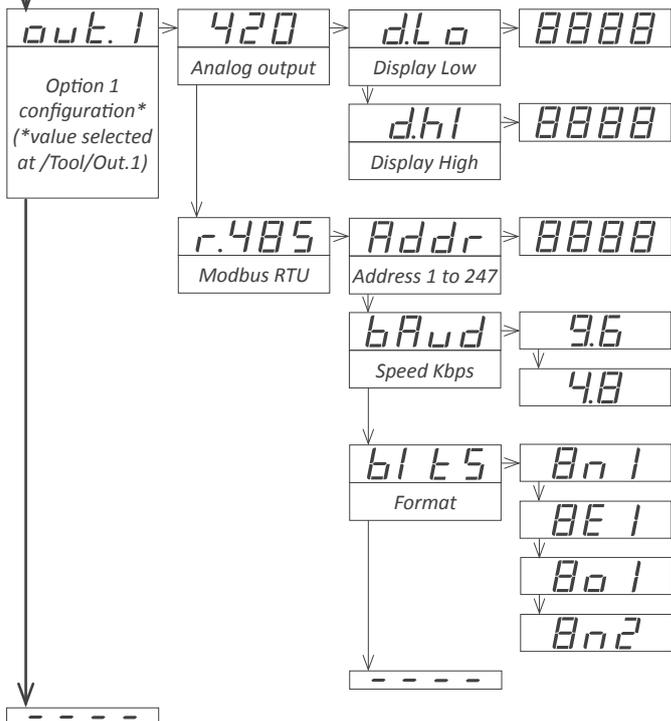
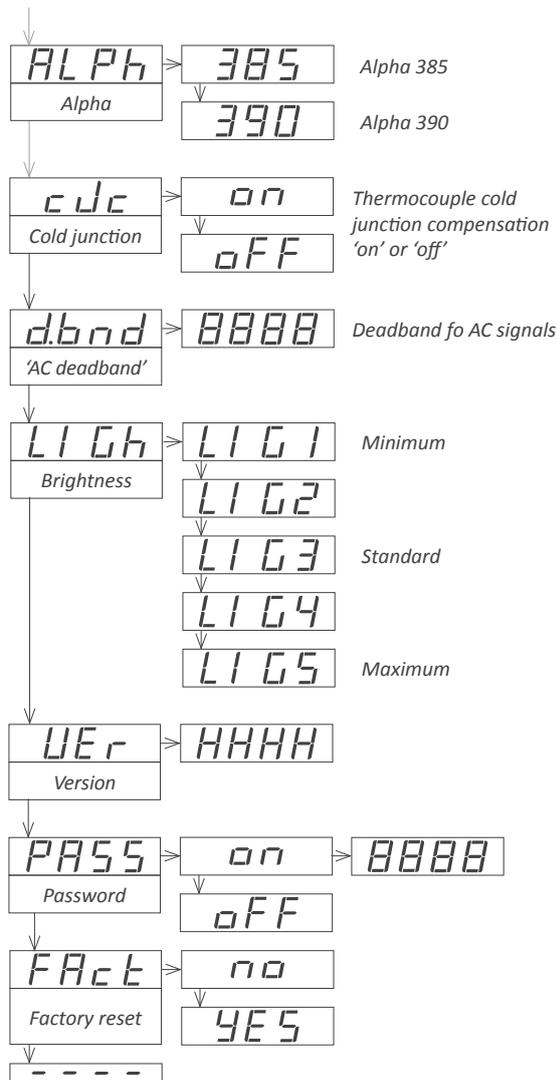
Press 'SQ' (■) for 1 second to access the 'Configuration menu'. See section 1.29 for a description of each menu entry.



1.30 Full configuration menu (cont.)



1.30 Full configuration menu (cont.)



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.



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

Note: The AC powered units cannot be shipped to Canada.

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.

1.32 Factory configuration

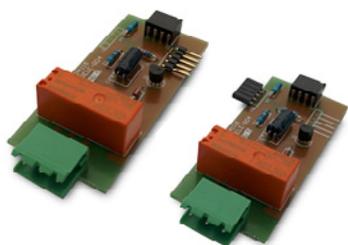
Range	600 Vac
Scaling and decimal point	0/600 Vac = 0/600
Alarms 1	
Type	alarm as maximum
Setpoint	1000
Hysteresis	0 counts
Alarm 2	
Type	alarm as maximum
Setpoint	1000
Hysteresis	0 counts
External control	off
Fast access	all off
Tools	
Option.1	off (retains last configuration value)
Step	1
Average	0
Offset reading	0
Second scaling	0/600
'Eco' mode	off
Temperature resolution	1°
Degrees	°C
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

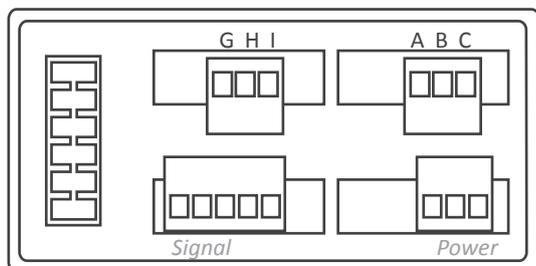
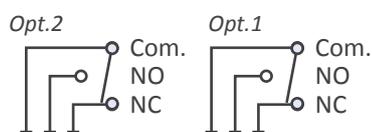
2.1 Modules A1 and A2 (relay output)

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 <i>when switching power lines, with overvoltage category 3, maximum switching voltage is 150Veff to comply with CE safety requirements.</i>
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)

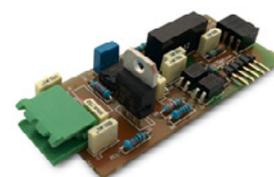
The M1 module offers 1 analog output at 4/20 mA, isolated, to be installed at slot Opt1.

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)

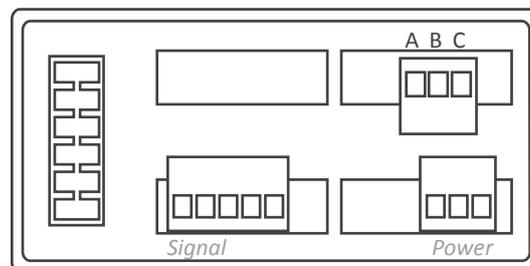
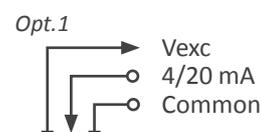
Connections

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) $R_L < 350 R$
Passive output	connect terminal C (GND) and B (mA) $R_L < 700 R$
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

2.3 Module S1 (Modbus RTU)

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' (▲) 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' (▲) and reduce the value with key 'LE' (◀). 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' (◀) 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 milliammeter 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 milliammeter 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).

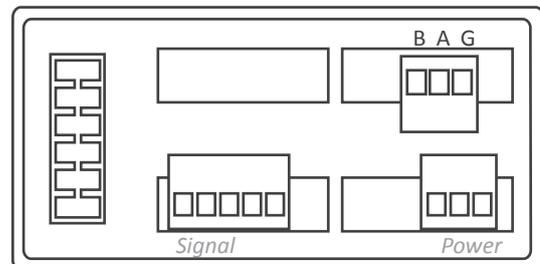
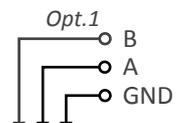
The S1 module offers 1 Modbus RTU serial output, isolated, to be installed at slot Opt1.

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).

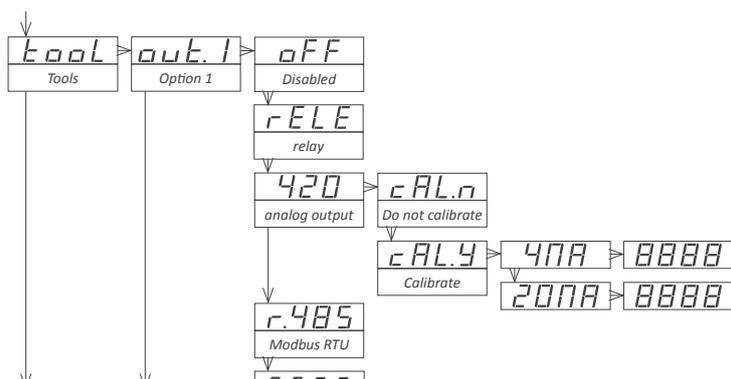
The S1 module can be ordered installed in to a Series C instrument or standalone for later installation, as it does not require soldering or special configuration.



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



Terminal B B
Terminal A A
Terminal G GND



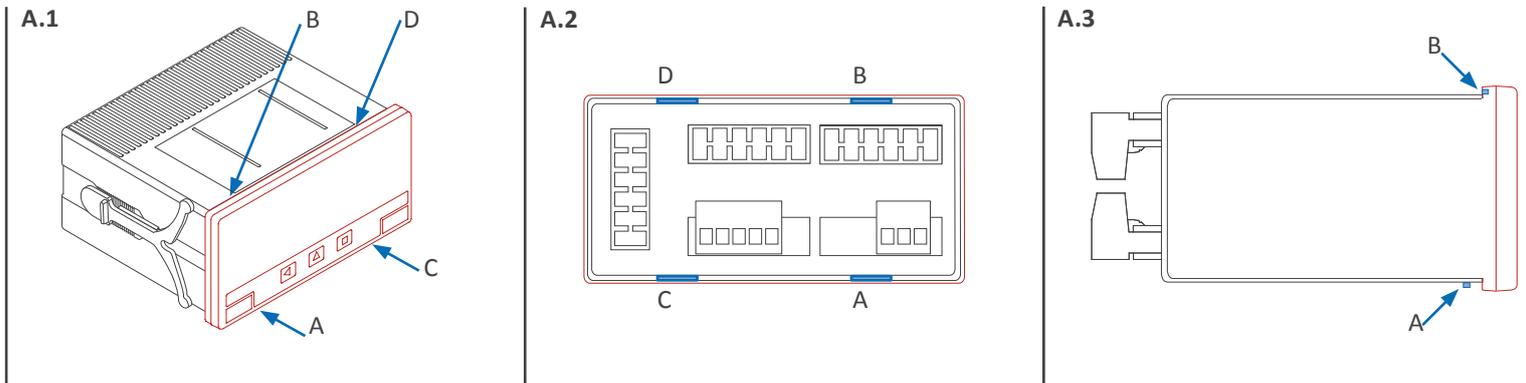
3. How to open and close

3.1 How to open the housing

A. Locate the clips

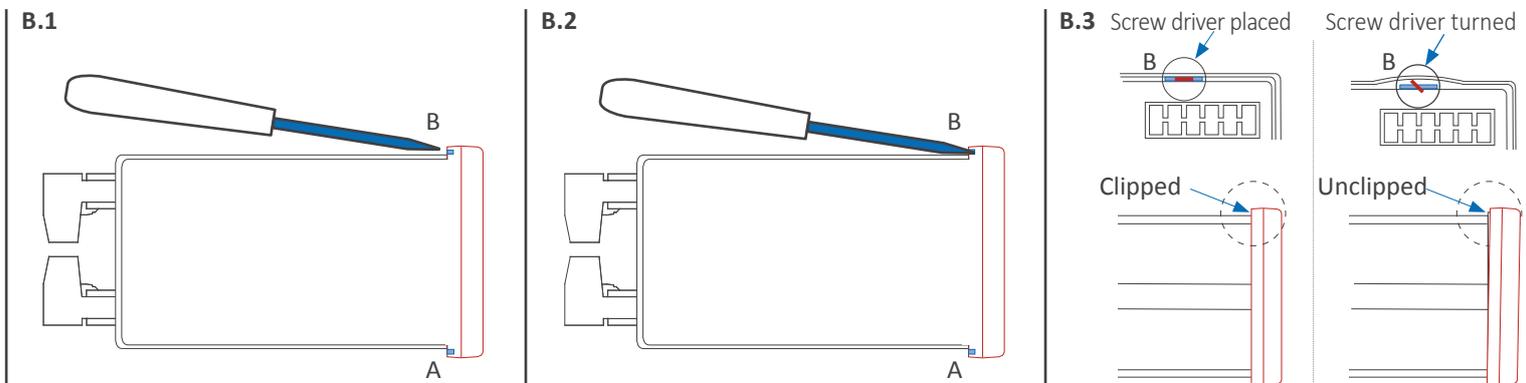
Locate the 4 clips (A B C D). Clips are covered by the front filter.

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



B. How to unclip one clip

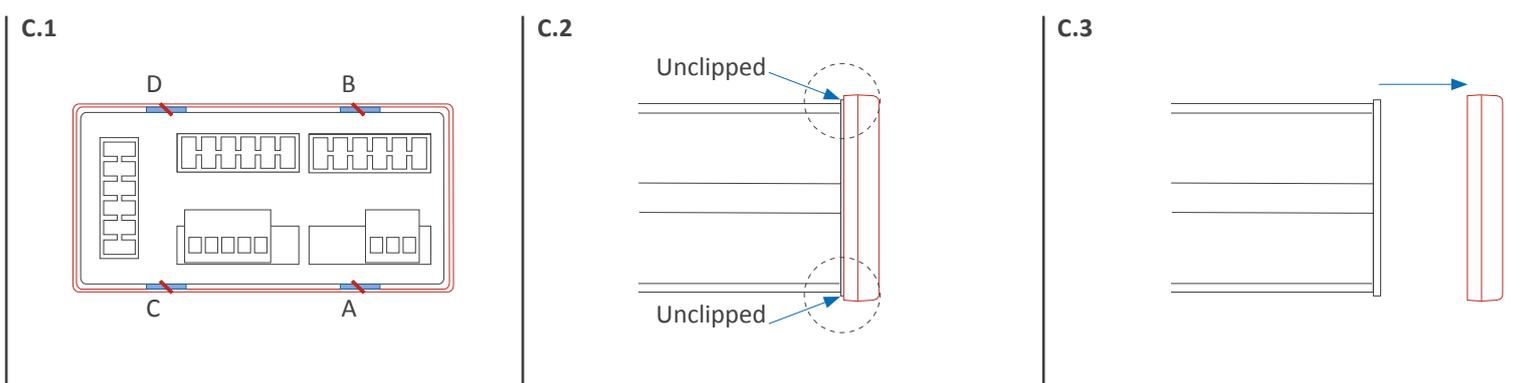
Place a flat screw driver at the first clip. Insert firmly until the end of the clip space, and then turn gently the screwdriver clockwise approx. 45° (while still pushing against the clip). The front filter will 'move up' and unclip itself. Clip is unclipped when the front filter corner moves slightly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



C. Repeat with all clips

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

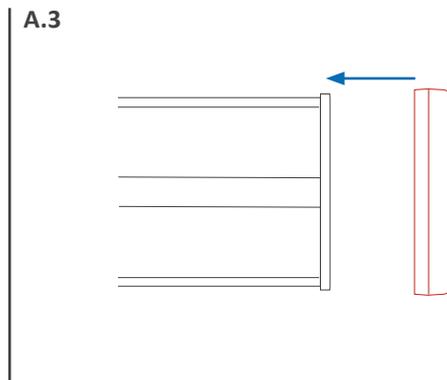
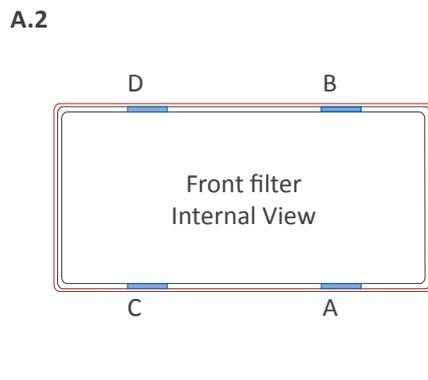
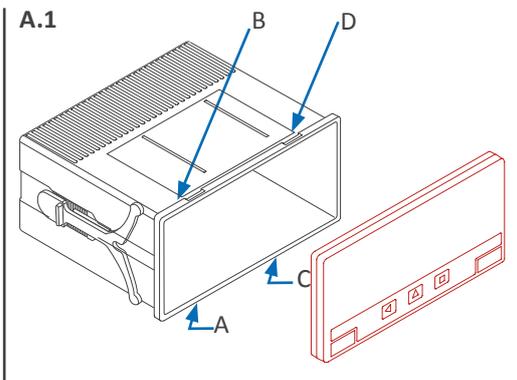
Front filter is slightly moved to the front on each corner. It can now be removed by hand.



3.2 How to close the housing

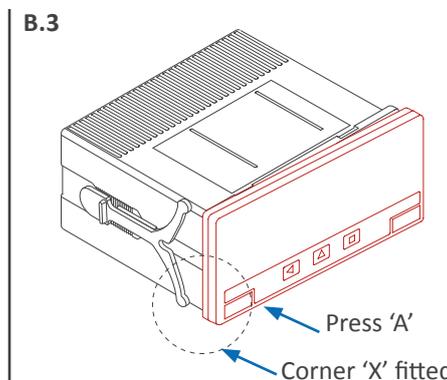
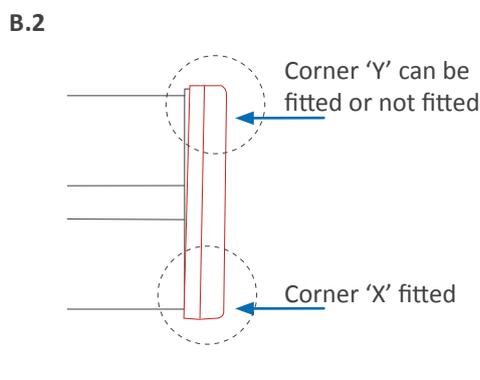
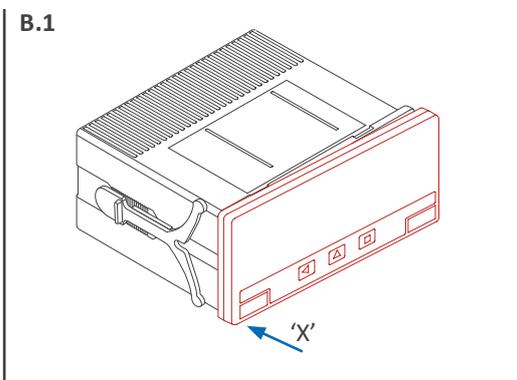
A. Locate the clips

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.



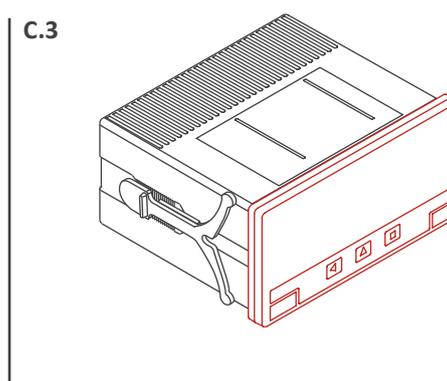
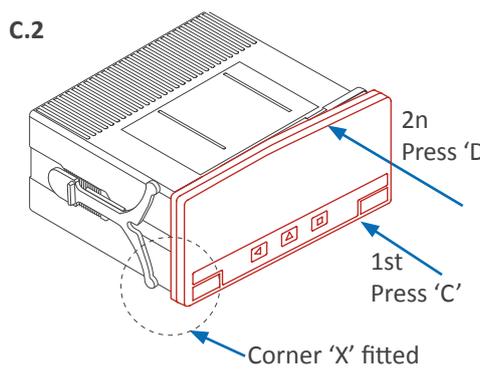
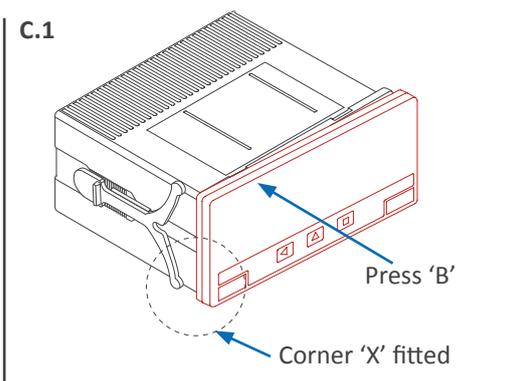
B. Fit corner 'X' and clip 'A'

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').



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).



4. How to install a DP20-C-M1 module

4.1 Characteristics

Modules 'M1' provide 4/20 mA analog output signal, to be installed on slot 'Opt.1' on DP20 instruments. Installing a 'M1' module is fast, with the only help of a flat screw driver to unlock the housing clips and a minimum configuration explained in this document. The 'M1' module provides 4/20 mA signal, isolated, proportional to the instrument reading, scalable both with positive or negative slope, and can be connected to generate active or passive loops.

Material included with the reference DP20-C-M1 (Board DP20 Output)

1x Module 'M1'	1x Data for precision improvement
	1x Female screw clamp for connexion

! Before proceeding to install the module, remove all terminal connections from power lines, input signal and controls.

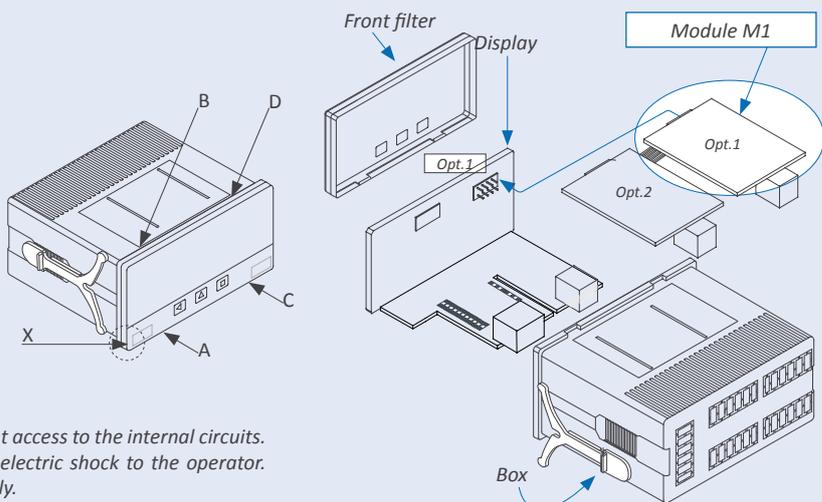
4.2 How to install the module

1. Open the housing (see section 4.3)
2. If a module exists on slot 'Opt.1', take it out
3. Install module 'M1' at slot 'Opt.1' and then the instrument
4. Close the housing (see section 4.3)
5. Configure module 'M1' and scale it (see section 4.6)

4.3 How to open the instrument for M1

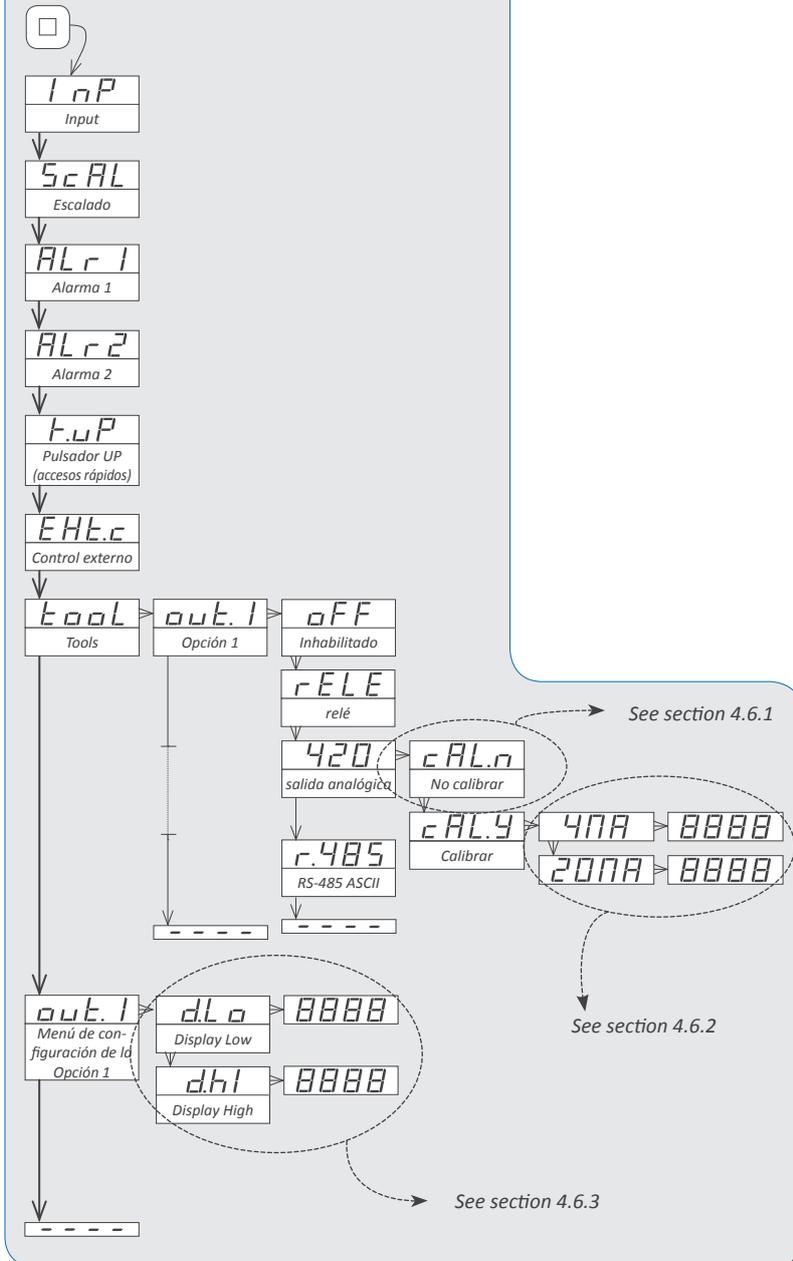
To open the housing and access the internal circuits, use a flat screwdriver to unlock clips 'D', 'C', 'B' and 'A', in this order. Remove the front filter. Let the inside of the instrument slide out of the housing.

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.



! Risk of electric shock. Removing the front cover will grant access to the internal circuits. Disconnect the power and the input signal to prevent electric shock to the operator. Operation must be performed by qualified personnel only.

4.4 Configuration menu

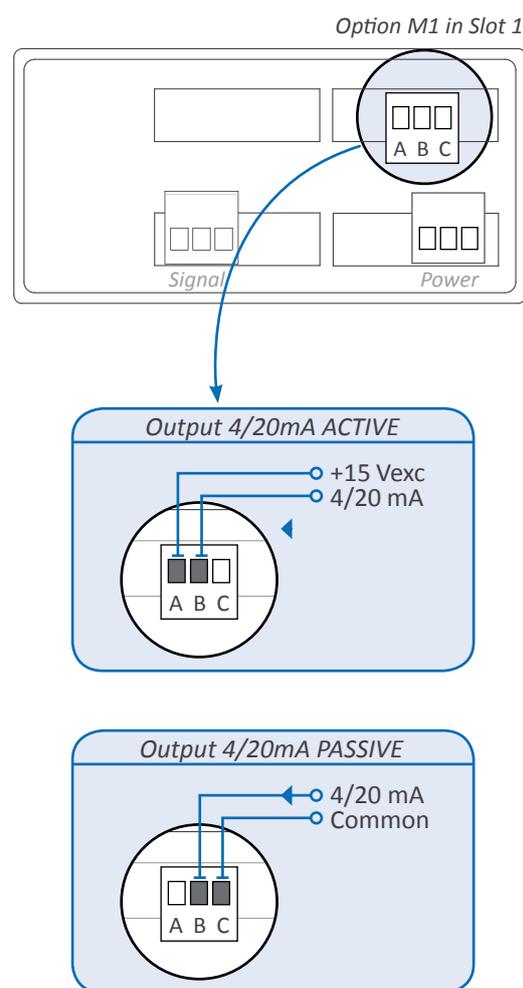


4.5 Connections

Indicated below are the connections for a 4/20 mA signal loop generated from a module 'M1'.

To generate an active 4/20 mA loop, connect terminal 'A' as the output current, and terminal 'B' as the input current.

To generate a passive 4/20 mA loop (the loop is powered from an external power supply), connect terminal 'C' as the output current, and terminal 'B' as the input current.



4.6 Configuration for module 'M1' and scaling

Once installed, the instrument must be informed that such module is installed at Slot 'Opt.1' and configure the adjust for the analog output 4/20mA

To do it, go to parameter 'Tool' → 'out.1' and select value '420'. Validate 'cAL.n' and leave the menu saving. A step-by-step process is indicated below :

4.6.1 Activate de module M1

- enter the configuration menu pressing key 'SQ' (■). Meter shows 'InP'
- press key 'UP' (▲) several times until parameter 'Tool' is displayed
- press key 'SQ' (■) to enter the 'Tool' menu, message 'out.1' is displayed
- press key 'SQ' (■) to enter the 'out.1' menu, message 'oFF' is displayed
- press key 'UP' (▲) until value '420' is displayed
- press key 'SQ' (■) to enter the '420', message 'cAL.n' is displayed
- press key 'SQ' (■) to validate 'cAL.n', then 'out.1' appears again
- press key 'LE' (◀) several times to leave the configuration menu saving new parameters
- when leaving the menu the instrument restarts to apply the new changes, and shows the new parameters configuration. Now analog output is activated and functional.

4.6.2 Introduce the data for precision improvement for the output

Parameters by default are :

'cAL.y' → '4mA' = 100
 'cAL.y' → '20mA' = 900

Correct the values 100 and 900 with the values supplied in the sheet attached to the module "Data for precision improvement" for the analog output 4/20mA

- press key 'SQ' (■) to enter the menu
- press key 'UP' (▲) until reach parameter 'Tool'
- press key 'SQ' (■) 3 times to enter to 'Tool' → 'out.1' → '420' → 'cAL.n'
- press key 'UP' (▲) until reach parameter 'cAL.y'
- press key 'SQ' (■) to enter 'cAL.y', it shows '4mA'
- press key 'SQ' (■) to enter '4mA' and modify the parameter 100 for the value supplied (value in our sample is XXX).
- enter the menu '20mA' and modify the parameter 900 for the value supplied (value ZZZ in our sample)
- press key 'LE' (◀) several times to go out the menu configuration saving new parameters

Data for precision improvement for M1
 Module M1 - Analog output 4/20 mA

Parameter	Value
'cAL.y' → '4mA'	X X X
'cAL.y' → '20mA'	Z Z Z

4042r00

The entered 'cALy' values are not reseted if the "factory default" function is activated. Once entered, the data remains in the memory.

4.6.3 Configure the Output 4/20mA with the desired adjust according to the indication of the meter

Analog output is scaled with respect to the indication, with a scale 0/1000=4/20mA. To modify this scale, in the menu 'out.1' → 'dLo' and 'dhl', which can be modified to scale the analog output:

- d.Lo = 0000 indication for 4 mA. Modify according to the required setting.
- d.hl = 1000 indication for 20 mA. Modify according to the required setting.

Note : if you do not have the sheet 'Data for precision improvement' supplied with the module, but you do have a miliammeter to measure the mA generated by the loop, you can still access parameters 'cAL.y' → '4mA' and 'cAL.y' → '20mA' and readjust the value manually by checking the generated signal in your miliammeter.

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