



Series C . C40-D

OEM
APPLICATIONS
YOUR METER !

Multisignal panel meter

PANEL METERS. OEM APPLICATIONS

Multisignal digital panel meter, configurable to work as AC and DC voltmeter (up to 600 Vac / dc), AC and DC ammeter (up to 5 Aac / dc), accepts process signals (mA, Vdc), thermocouples, resistive temperature probes (Pt, Ni, PTC and NTC), resistances, potentiometers and frequency. Configurable. Standard 96 x 48 mm size (1/8 DIN). Scalable reading with 4 digits (9999 / -1999). 'Fast access' function to alarm setpoints, 'external control' to activate predefined functions, 'Eco' mode for low consumption, selectable dual scaling, 5 levels of configurable brightness. Single universal power supply 18 to 265 Vac/dc. Optional modules for output and control (relays, analog output, Modbus RTU). Recommended for OEM applications.

www.fema.es

Tel. (+34) 93.729.6004 info@fema.es

1. Panel meter C40-D

Multisignal 96 x 48 mm panel meter, for OEM applications

Multisignal digital panel meter in 96 x 48 mm size (1/8 DIN), for OEM 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.

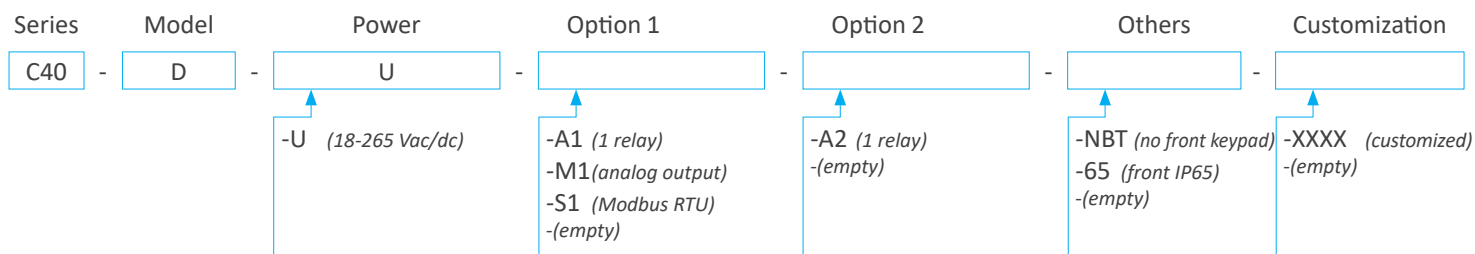
Optional 1 or 2 relay outputs, 4/20 mA isolated analog output, and Modbus RTU isolated serial communications.

Front protection IP50, with optional 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).

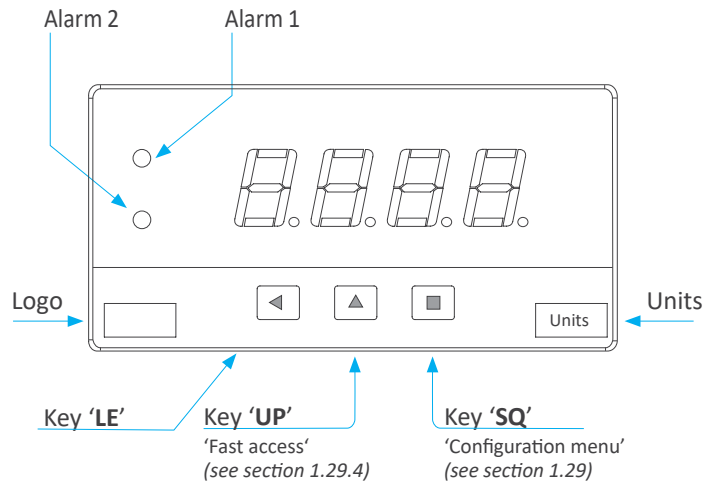
1.1 How to order



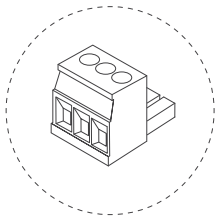
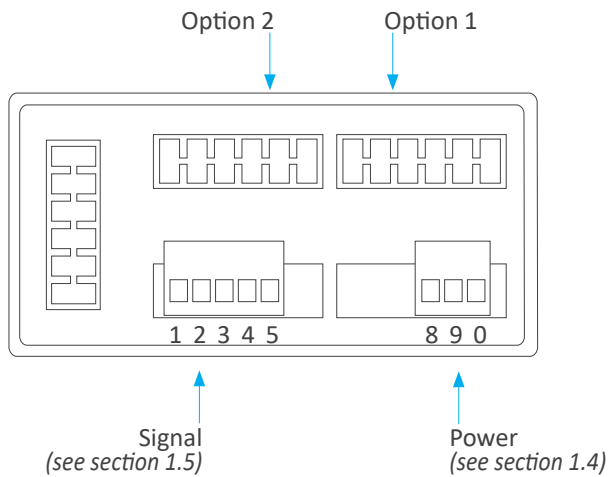
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1.2 Front view



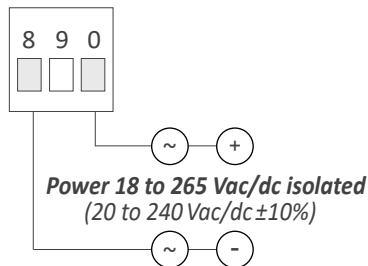
1.3 Rear view



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 - This instrument has not internal fuse. Conforming to security regulation 61010-1, add a protection fuse to the power line to act as disconnection element, easily accessible to the operator and identified as a protection device.

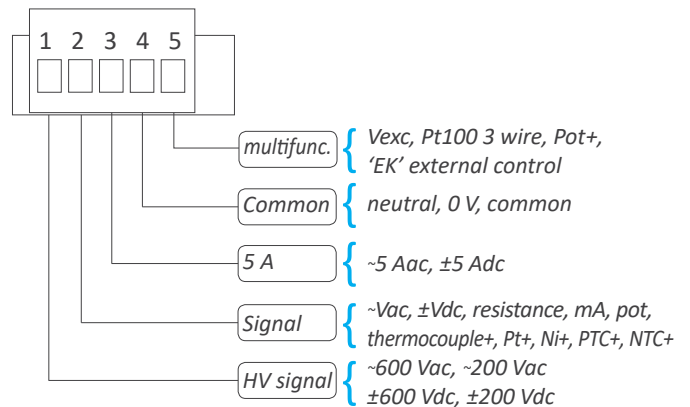
250 mA time-lag for power voltage > 50 Vac/dc
400 mA time-lag for power voltage < 50 Vac/dc

1.5 Signal connections

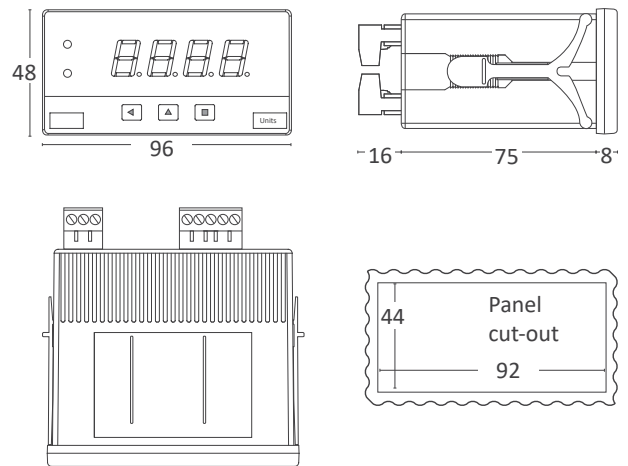
Signals up to 600 V and 200 V (AC and DC) must be connected at terminals 1 and 4. Signals for 5 A current (AC and DC) must be connected at terminals 3 and 4. All other signals must be connected between terminals 2 and 4. Terminal 5 is a 'multifunction' terminal, configurable with one of the following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



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 signals | |
| 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) |
| frequency | up to 100 Hz (see section 1.17) |
| resistances | ranges of 5 KOhm and 50 KOhm (see section 1.18) |
| potentiometers | nominal value 500 Ohm up to 20 KOhm (see section 1.19) |
| Accuracy at 25 °C | see following sections for each signal |
| 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 isolated (20 to 240 Vac/dc ±10%) |
| AC power | 45 to 65 Hz, overvoltage category 2 |
| isolation | 1500 Veff. isolation tested for 60 sec. |
| consumption (without 'Eco') | <1.5 W meter only <3.0 W meter with options |
| consumption (with 'Eco') | <0.3 W meter only <1.5 W meter with options |
| Power wires | 1 mm ² to 2.5 mm ² (AWG17 to AWG14) |

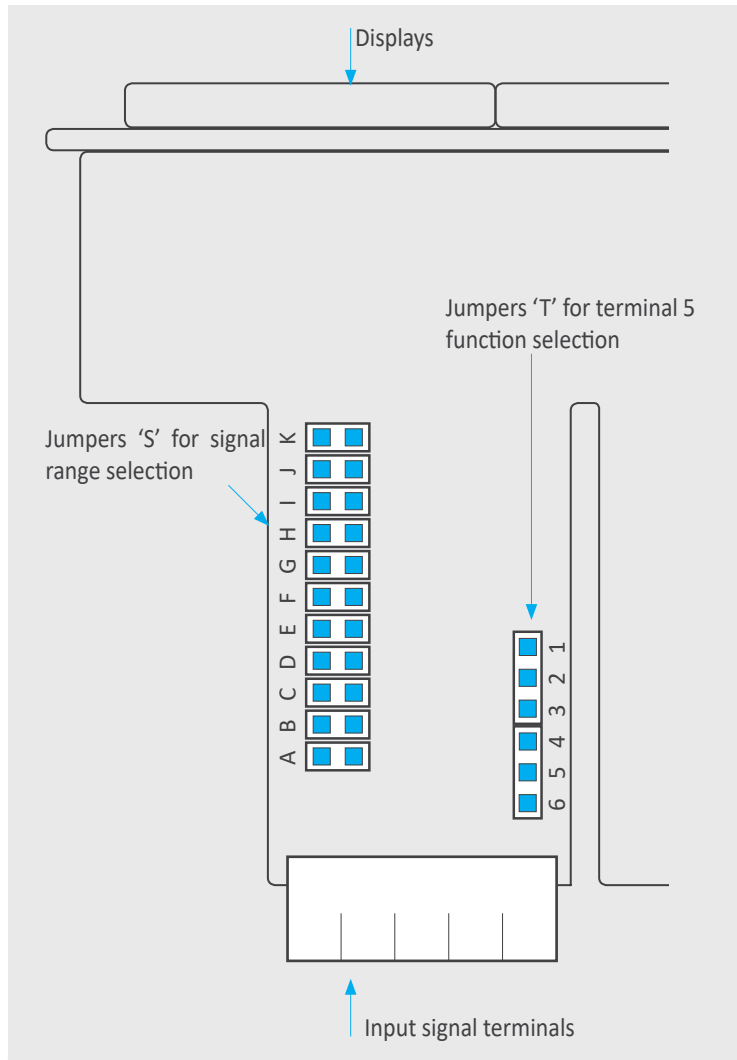
| Functions included | | Section |
|------------------------------|---|----------------|
| Fast access | to alarm setpoints, maximum and minimum | 1.20 |
| External control | second scaling decimal point 0, 1, 2 or 3 'hold' reading tare function memory of maximum memory of minimum | 1.24 |
| 'Eco' mode | reduced consumption | 1.23 |
| Alarms | setpoint hysteresis set as max or min type | 1.29.3 |
| Offset reading | subtract 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 | IP50 standard IP65 optional (see section 3.2) |
| 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 |
| storage | from -20 to +70 °C |
| 'warm-up' time | 15 minutes |
| relative humidity | 0 % to 95 % non-condensing humidity |

1.9 Internal jumpers

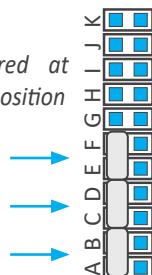
Internal jumpers 'S' are associated to the signal range. The position of internal jumper 'T' assigns the function of the multifunction terminal 5. At 'Table 2' see a list of signal ranges and associated jumper 'S' and 'T'. At 'Table 3' see the position for jumper 'T' associated to each function of the 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 1.18
- Ranges for potentiometer measures, see section 1.19



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 mAadc | 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 KOhm | F H K | 4-5 |
| 0 to 50 KOhm | 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 | | |
| Tc. S | E J | 4-5 |
| Tc. T | | |
| Tc. C | E | 4-5 |
| 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 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

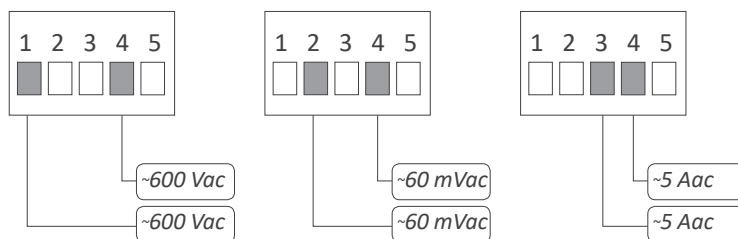
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

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 6 - Applications with measure of AC signals

| 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 MOhm |
| ~200 Vac | 200.0 | | I | | | 800 Vac | | 12 MOhm |
| ~20 Vac | 20.00 | | A I | | | 150 Vac | 2(-) 4(-) | 1 MOhm |
| ~2 Vac | 2.000 | | B I | | | 100 Vac | | 100 KOhm |
| ~200 mVac | 200.0 | | C I | | | 30 Vac | | 10 KOhm |
| ~60 mVac | 60.0 | | E I | | | 3 Vac | | 1 MOhm |

Table 4 - Measuring ranges in Vac. *See section 1.34 for category of measure.

| 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 Ohm |

Table 5 - 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 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**

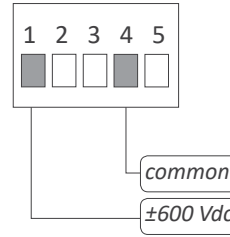
Terminal 5 remains configured as 'EK' external control function. See section 1.9 for a list of available functions.

• **Start-up, connections and jumpers**

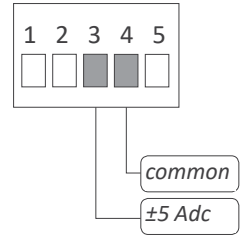
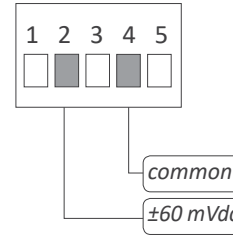
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

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 600 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

| 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 MOhm |
| ±200 Vdc | 200.0 | | --- | | | 800 Vdc | | 12 MOhm |
| ±20 Vdc | 20.00 | | A | | | 150 Vdc | 2(+) 4(-) | 1 MOhm |
| ±2 Vdc | 2.000 | | B | | | 100 Vdc | | 100 KOhm |
| ±200 mVdc | 200.0 | | C | | | 30 Vdc | | 10 KOhm |
| ±60 mVdc | 60.0 | | E | | 3 Vdc | <0.25 % | 1 MOhm | |

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(-) | 20mOhm |
| ±20 mAdc | ±20.00 | | D | | <0.15 % | 25 mAdc | 2(+) 4(-) | 4.7 Ohm |

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 section 1.28) 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.

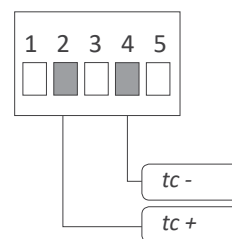
- **Terminal 5 'multifunction' - External control**

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.

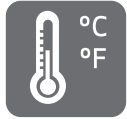
See below connections for thermocouple :



| Thermocouple | Jumper 'S' (see section 1.9) | Jumper 'T' (see section 1.9) | Range in °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 | E J | 4-5 | 0 / 1768 °C (32 / 3214 °F) | | | 2 (tc +) 4 (tc -) | <5 °C | | |
| Thermocouple S | | | 0 / 1768 °C (32 / 3214 °F) | | | | | | |
| Thermocouple T | | | -100 / 400 °C (-148 / 752 °F) | | | | | | |
| Thermocouple C | E | | 0 / 2300 °C (32 / 4172 °F) | | | | | 2 (tc +) 4 (tc -) | <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 section 1.28) 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.

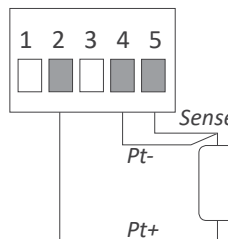
To configure for 2 wire Pt100 probes, set internal jumper 'T' at position 4-5 (see section 1.9). Terminal 5 will be configured as 'EK' external control function. See section 1.9 for a list of available functions.

• **Start-up, connections and jumpers**

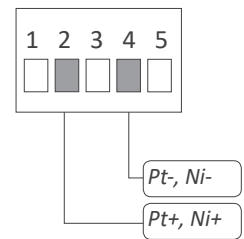
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

See below a list of typical connections :

• **Pt100 3 wires**



• **other probes 2 wires**



| 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 10KOhm 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 Ohm 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 KOhm and 200.0 KOhm

• **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 section 1.28) depending on the broken cable.

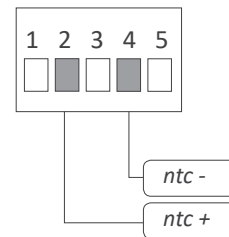
• **Terminal 5 'multifunction' - External control**

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 :



| 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) |
|---|---------------------------------|---------------------------------|--------------------------|----------------------------|---------------------------|-------------------------|
| 10KOhm | 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 Ohm | | | |
| 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 section 1.28) depending on the broken cable.

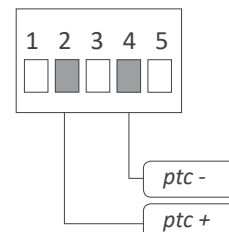
• **Terminal 5 'multifunction' - External control**

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.

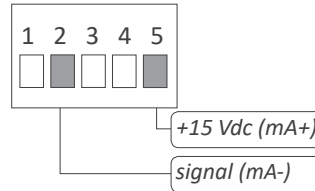
To configure the 'EK' external contact function at terminal 5, set internal jumper 'T' at position 4-5 (see section 1.9). See section 1.9 for a list of available functions.

• **Start-up, connections and jumpers**

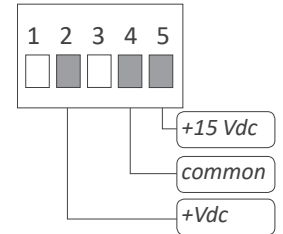
For instrument start-up follow the steps listed at section 1.7. Signal connections are indicated at section 1.5. Location for internal jumpers is indicated at section 1.9.

See below a list of typical connections :

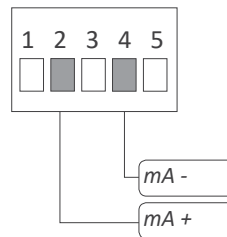
• **signal 4/20 mA passive**



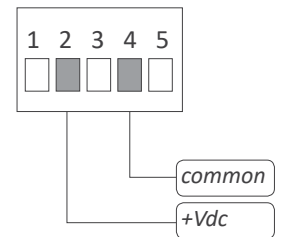
• **signal 0/10 Vdc passive**



• **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 MOhm |
| | 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.

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

Table 16 - Ranges of measure for frequency

• **Example**

To measure the 50Hz frequency from a 230Vac power line, select jumpers 'GI' for 600Vac 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).

1.18 Measuring resistances



• **Measuring resistive signals**

The instrument accepts the measure of resistances and provides two ranges of measure from 0 to 5 KOhm and from 0 to 50 KOhm.

• **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.

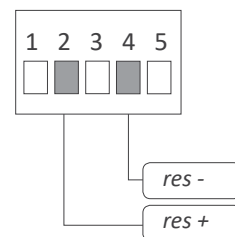
• **Terminal 5 'multifunction' - External control**

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 KOhm | 5.000 | from 9999 to -1999 | F H K | 4-5 | <1.5% of reading |
| 0 to 50 KOhm | 50.00 | | F K | | |

Table 17 - Ranges of measure for resistances

1.19 Measuring 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.

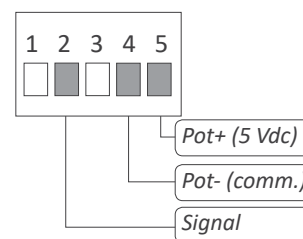
• **Terminal 5 'multifunction' - 'Vexc'**

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 Ohm up to 20 KOhm | 0 to 100 % | 0/100.0 | from 9999 to -1999 | A | 2-3 | <0.5% |

Table 18 - 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 0/600 Vac, configure at '**d.Lo**' the reading for a signal of 0 Vac. Configure at '**d.Hi**' the reading for a signal of 600 Vac.
- for DC voltage and current ranges, for example ± 600 Vdc, configure at '**d.Lo**' the reading for a signal of 0 Vdc. Configure at '**d.Hi**' the reading for a signal of 600 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 Ohm). 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 subtracted from 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

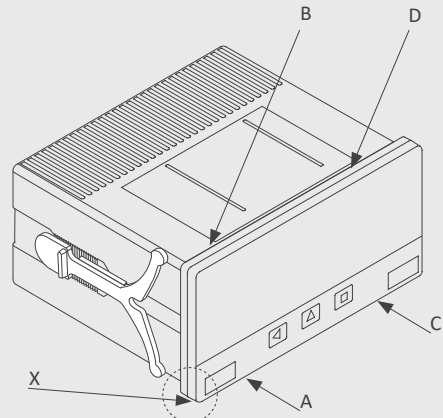
The instrument provides a '*second scaling*', independent and additional to the standard scaling explained at section 1.21. Control of the scaling to be applied, with a free potential contact called '*External control*'. To configure the '*second scaling*' :

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

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 input signal to prevent electric shock to the operator. Operation must be performed by qualified personnel only.

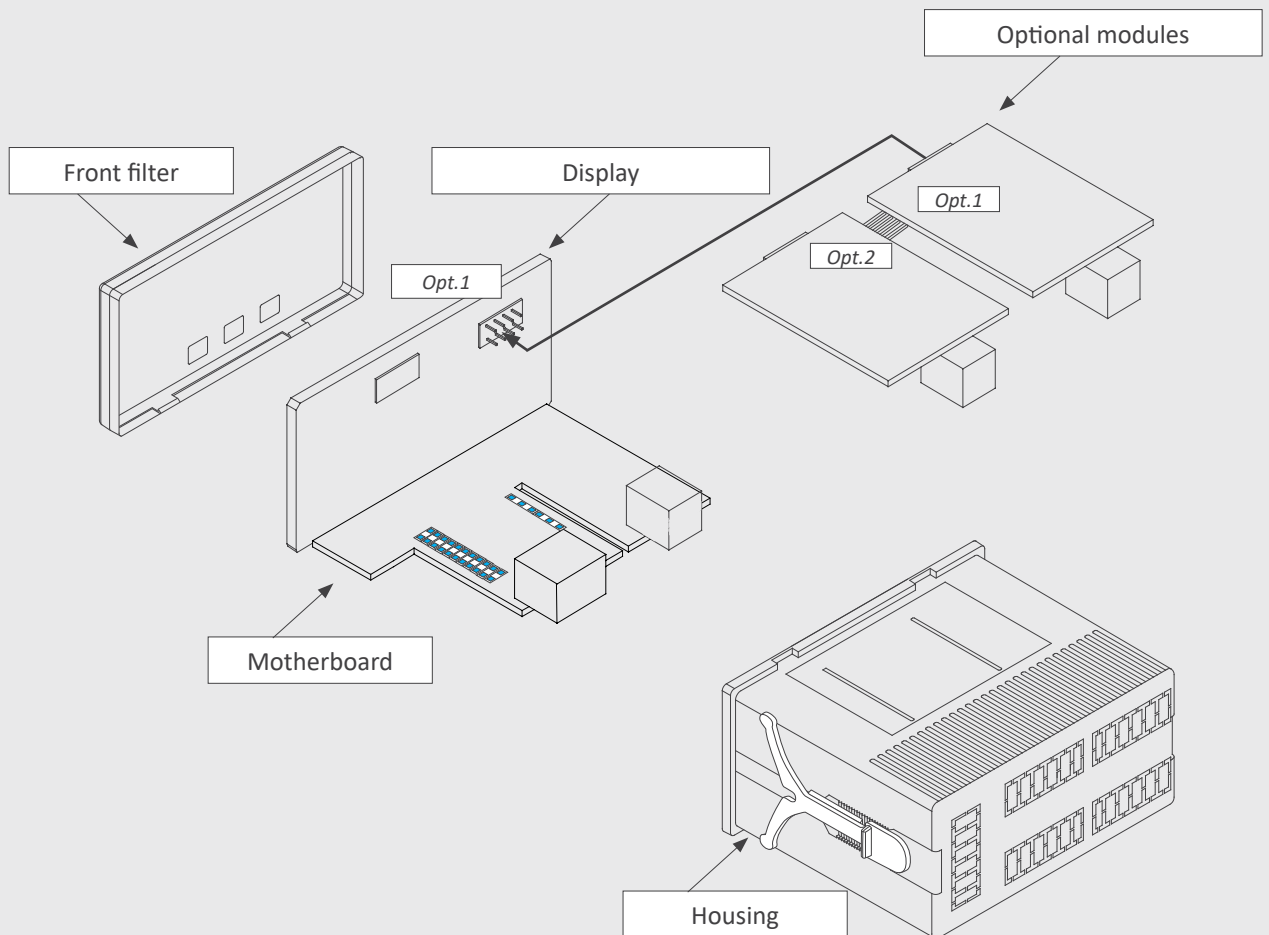


Observe precautions for handling ESD (electrostatic discharge) sensitive devices

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.



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

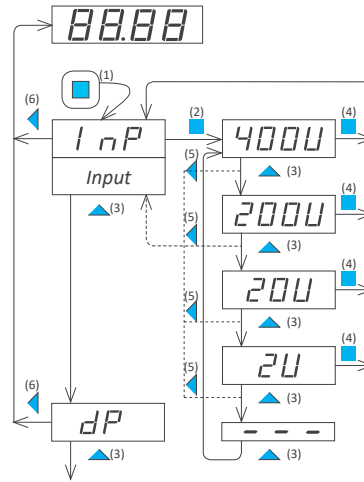
Key 'SQ' (■) - press the 'SQ' (■) key for 1 second to access the 'configuration menu'. Inside the menu, the 'SQ' (■) key functions as a 'ENTER' key. It selects and accesses the menu option currently displayed. At menus with numerical value entries, it validates the number displayed.

Key 'UP' (▲) - the 'UP' (▲) key gives access to the 'fast access' menu. Inside the menu, 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. The negative signs '-' and '-1' are located at the MSD (most significant digit) only.

Key 'LE' (◀) - inside the menu, 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.



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

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.

1.28 Messages and errors

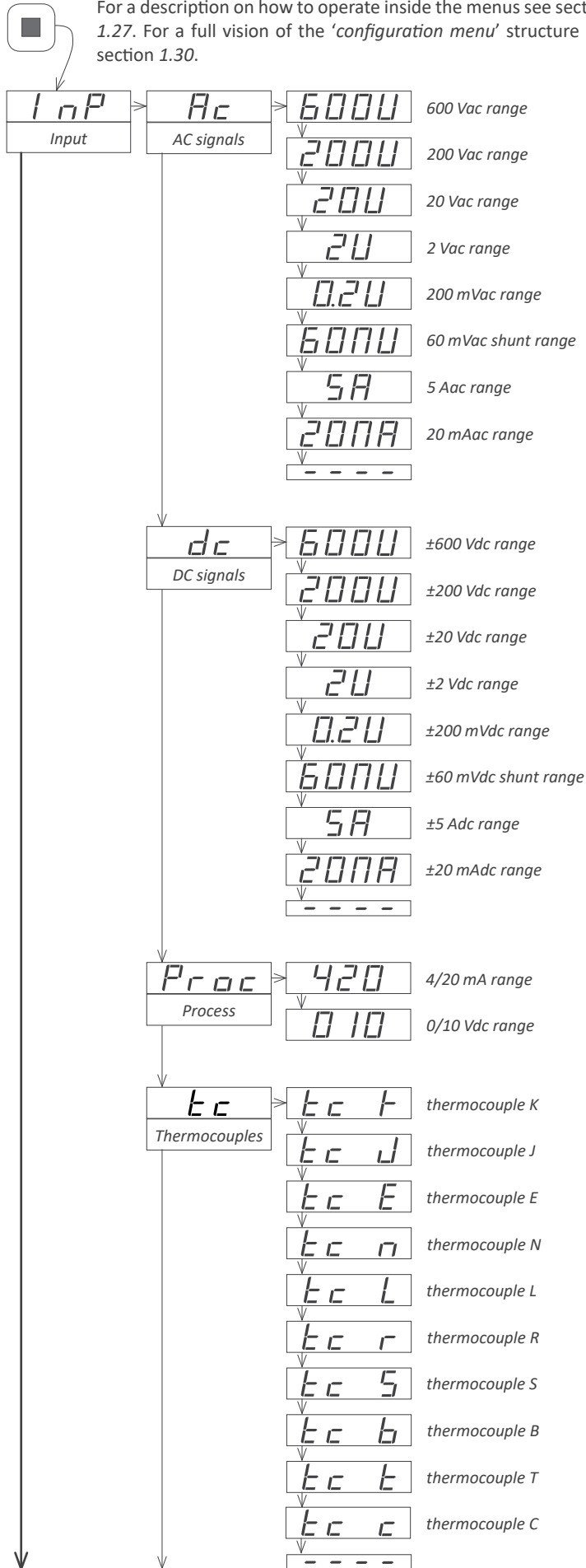
The error messages are shown on display in flash mode.

| 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.1' | incorrect password. |

Table 19 - 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.



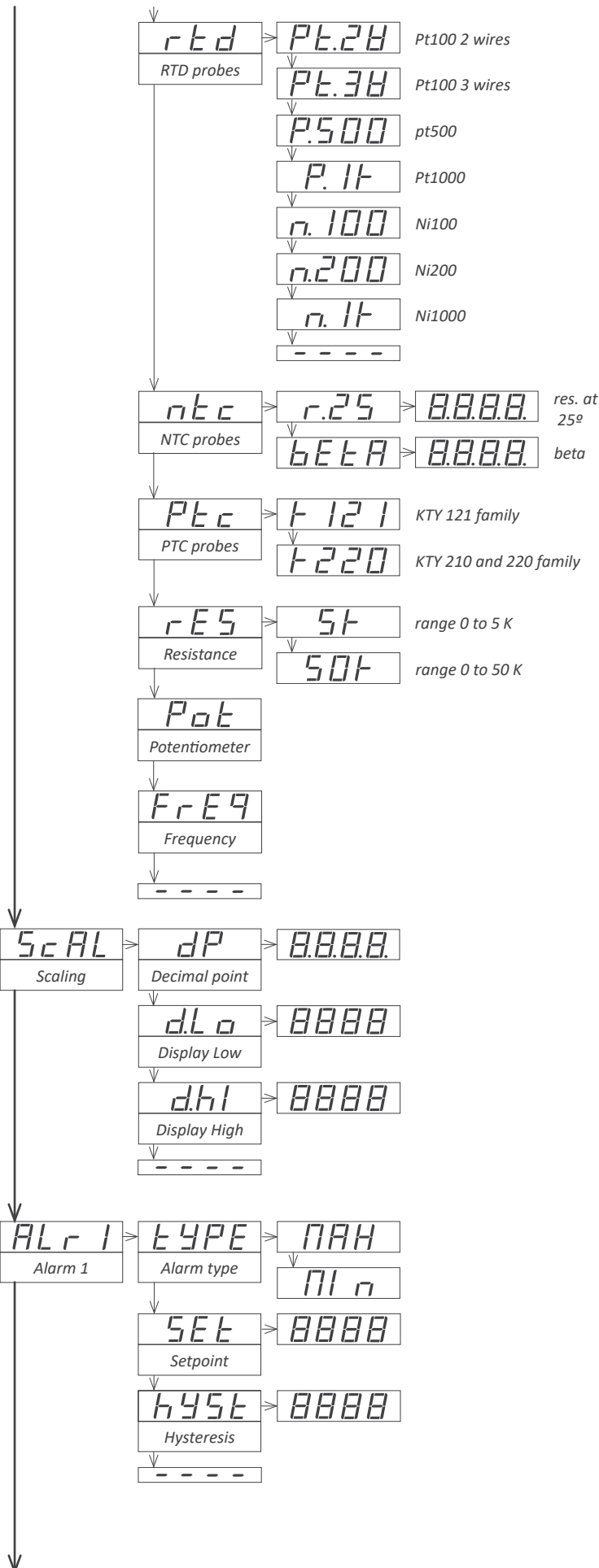
1.29.1 Input signal ranges

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 measurement 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 25° ('r.25') and parameter 'beta' ('bEtA'). The instrument accepts beta values between 2000 and 5500, and values of R25 between 1.0 K and 200.0 K. 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 Ohm and 20 KOhm.
- **'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.Hi')** parameter the reading value for the high signal range. For more information see section 1.21.

1.29.3 Alarms

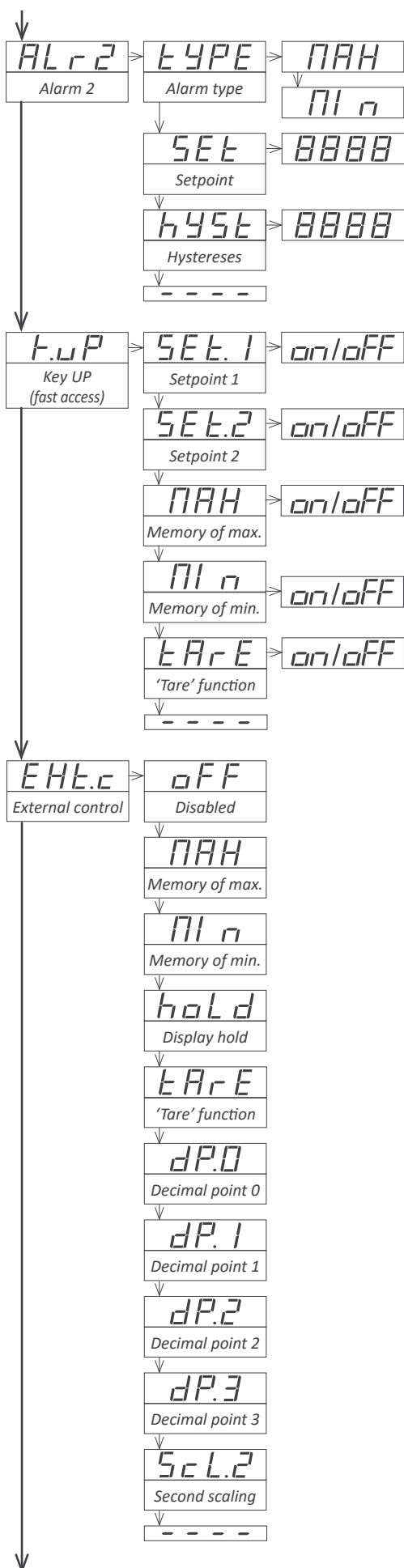
The instrument has 2 independent and configurable alarms.

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 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 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 to visualize and modify the setpoint value of alarm 1.
- the 'Setpoint 2' ('ALr2') function allows to visualize and modify the setpoint value of alarm 2.
- the 'Memory of maximum' ('MAX') or 'Memory of minimum' ('Min') allows 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 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

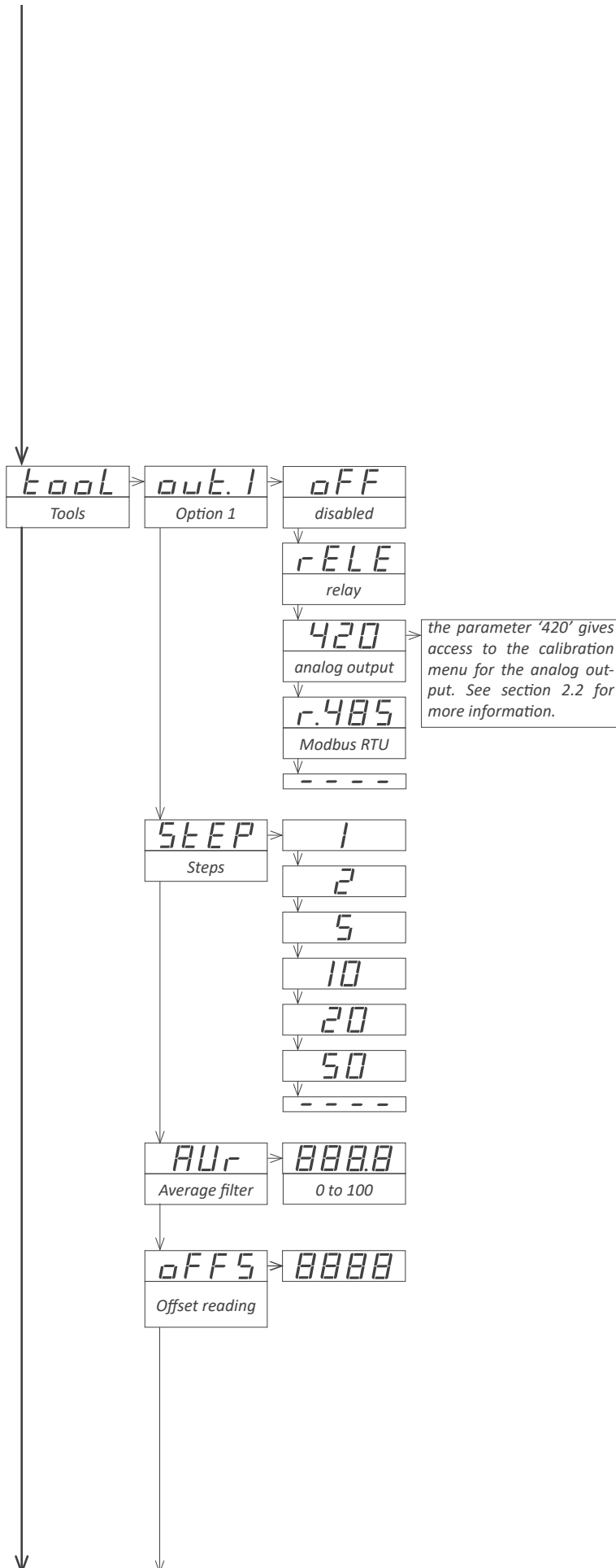
An external on / off control can be connected to the rear of the instrument. The operator can then control the activation of a configured function based on the state of this control. Function remains activated while the external contact is closed, and will deactivate when contact is open. To configure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

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 'Tare function' ('tArE') to activate a tare to the signal. The actual signal will read '0'. The calibration is not changed.
- 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

1.29 Configuration menu (cont.)



- 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', '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'

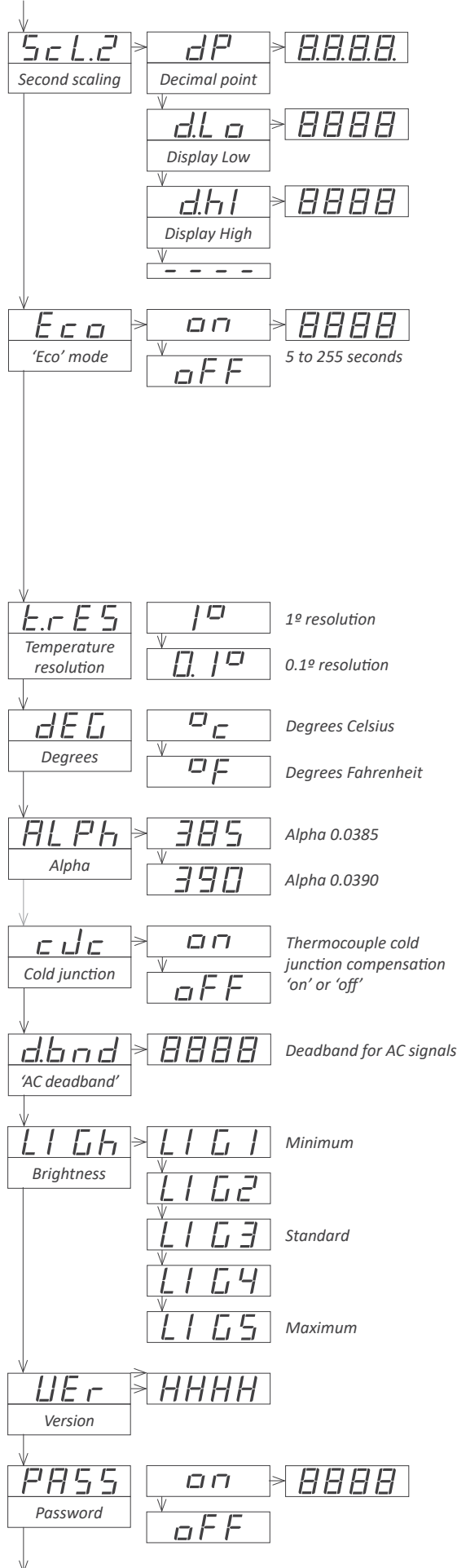
The 'Tools' ('tool') menu contains multiple configuration options of the instrument.

- 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 subtracted from 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.

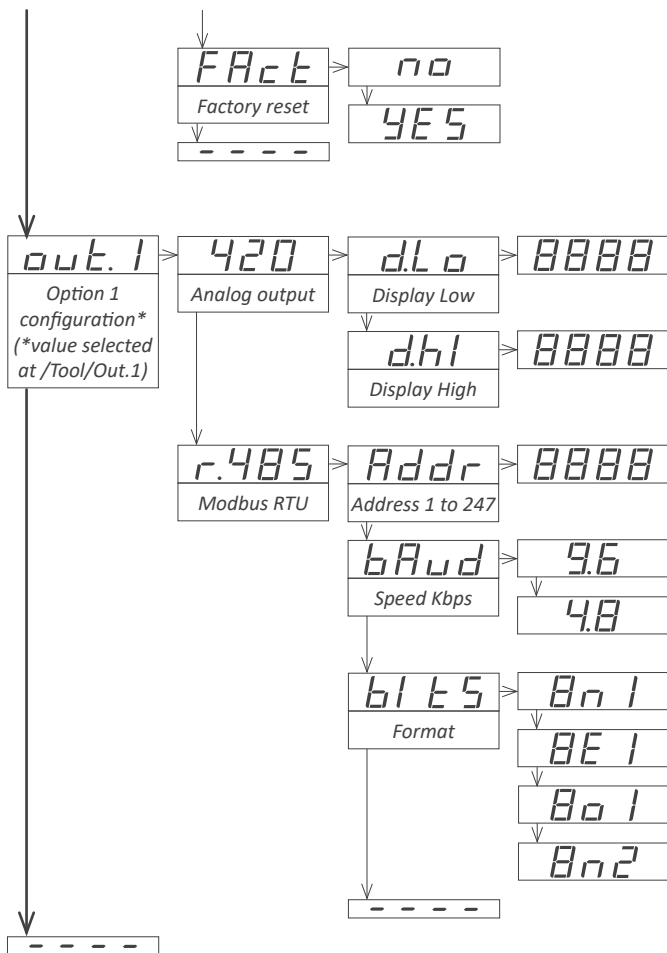
- at the 'Brightness' ('LIGH') menu select between 5 levels of brightness intensity for the display. It adapts the instrument to environments with higher or lower brightness is needed or to adapt the intensity to other meters in the area.

- 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'.

1.29 Configuration menu (cont.)



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

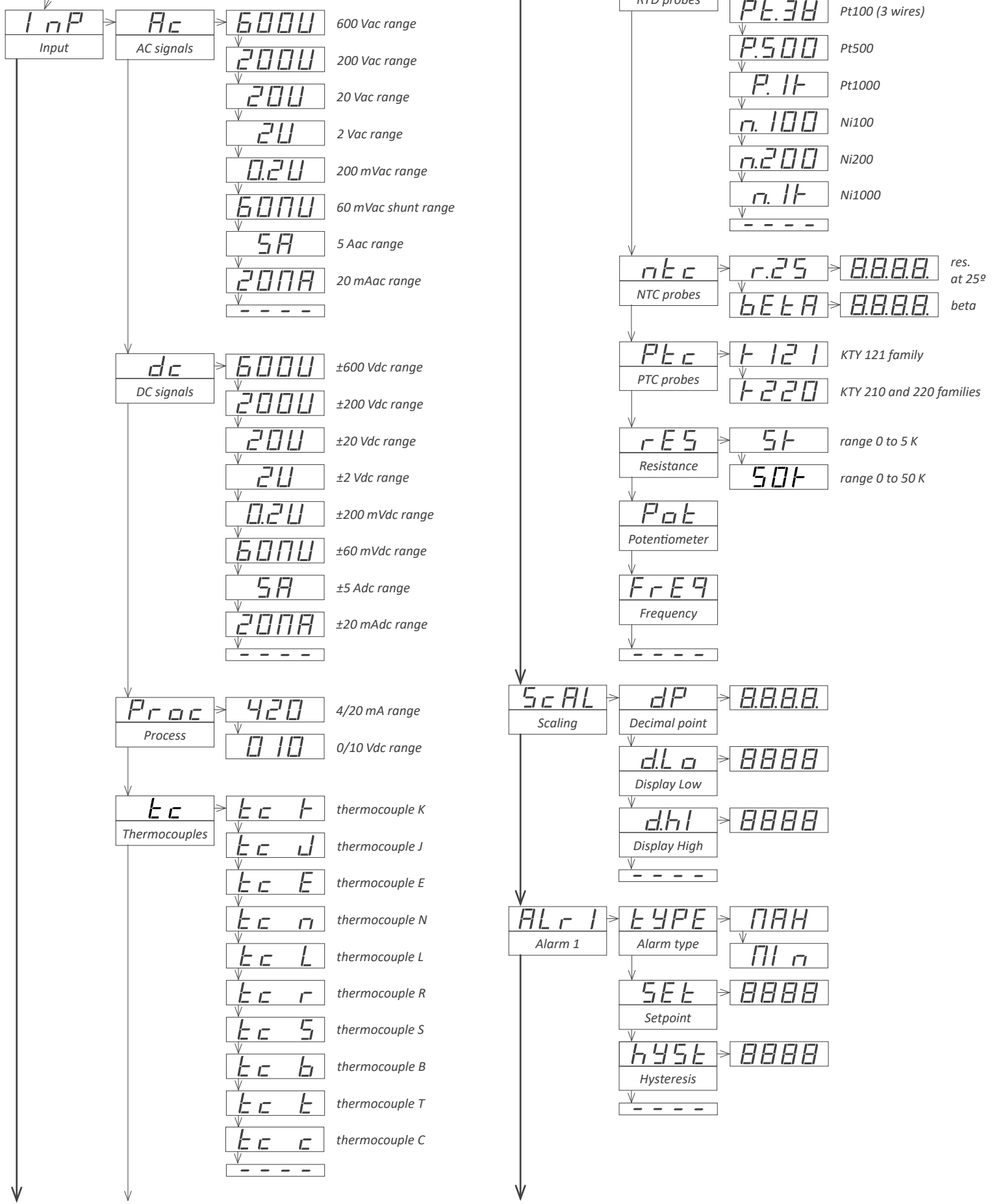
At the 'Option 1 configuration' ('out.1') configure the module installed at slot Opt.1. This menu varies depending on the module installed (relay, analog output or serial output). The type of module installed is indicated at the menu 'Tools' / 'out.1'.

- '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.

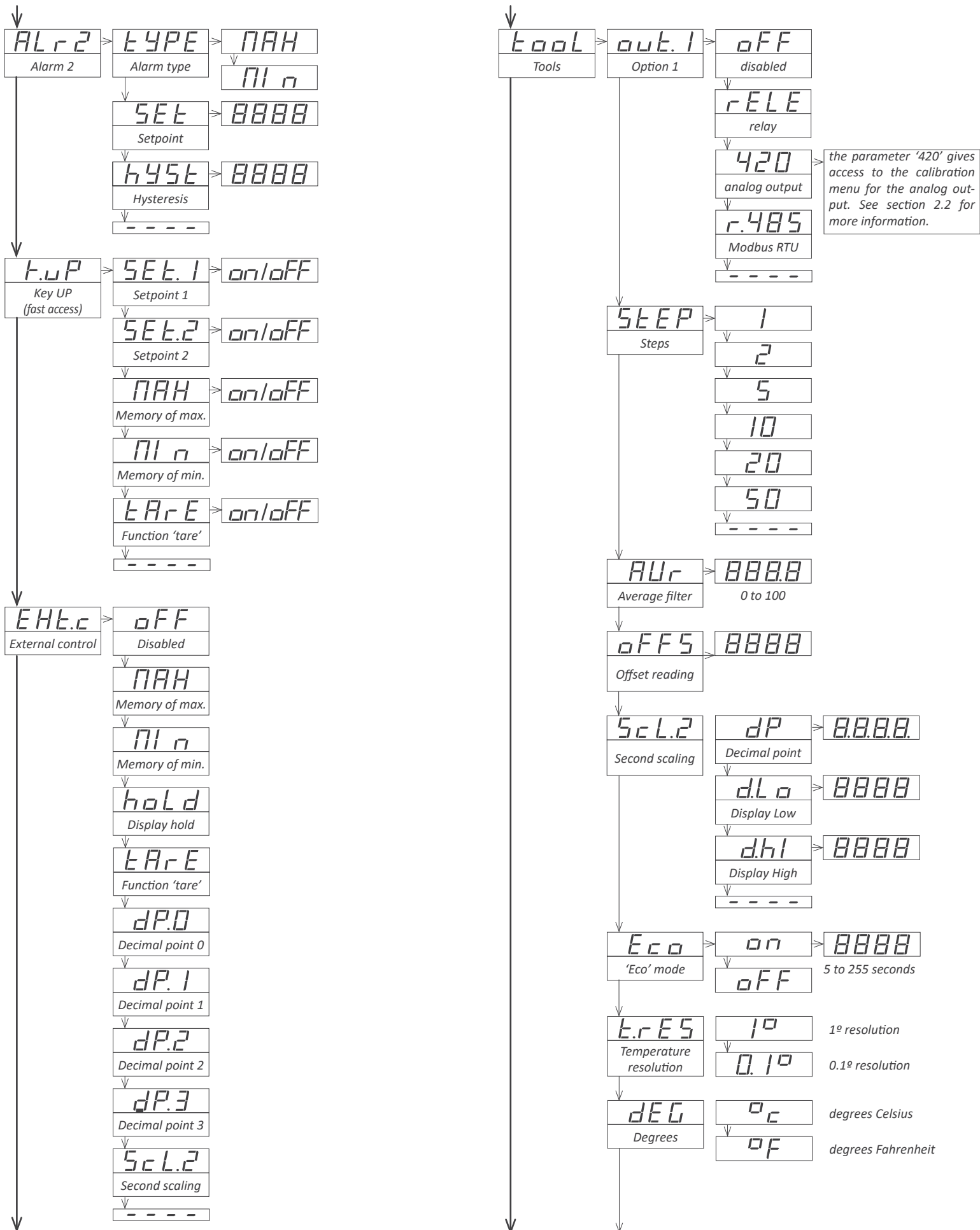
The slot at Opt.2 allows only for a relay module, and configuration is done through the menu entry 'Alarm 2' ('ALr2').

1.30 Full configuration menu

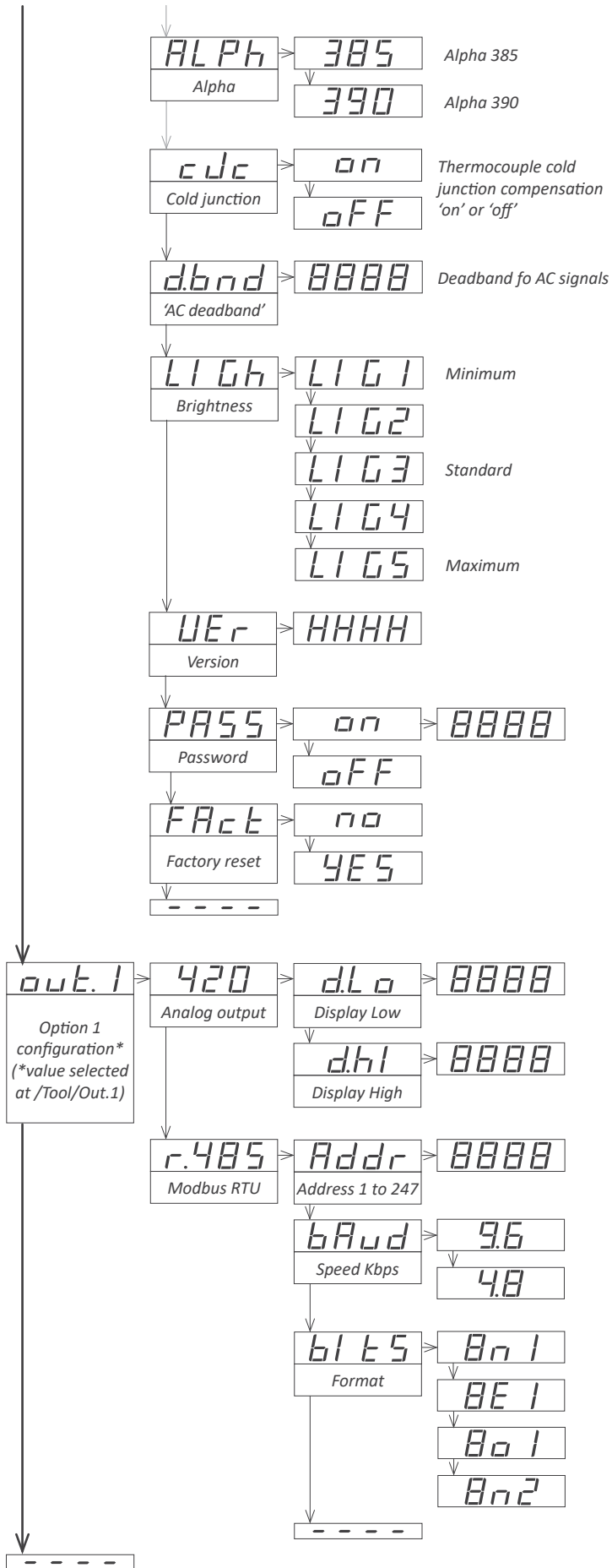
Press 'SQ' (■) for 1 second to access the 'Configuration menu'. See section 1.29 for a description of each menu entry.



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.

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 |

1.33 Warranty

This instrument is warranted against all manufacturing defects for a period of 24 months, as requested by the European legislation. This warranty does not apply in case of misuse or accident, and the scope of the warranty is limited to repair of the instrument, not being the manufacturer responsible for additional damages or additional costs. Within the warranty period and after examination by the manufacturer, the unit will be repaired or substituted when found to be defective.

Extended warranty available at www.fema.es/docs/4153_Warranty1_en.pdf

1.34 CE declaration of conformity

Manufacturer FEMA ELECTRÓNICA, S.A.
 Altimira 14 - Pol. Ind. Santiga
 E08210 - Barberà del Vallès
 BARCELONA - SPAIN
www.fema.es - info@fema.es

Products C40-D

The manufacturer declares that the instruments indicated comply with the directives and rules indicated below.

Electromagnetic compatibility directive 2014/30/EU

Low voltage directive 2014/35/EU

ROHS directive 2011/65/EU

WEEE directive 2012/19/EU

Security rules EN-61010-1

Instrument Fixed, Permanently connected
 Pollution degree 1 and 2 (without condensation)
 Isolation Double
 Category CAT-III up to 300V
 CAT-II up to 600V (only with 'Pollution degree 1')

Electromagnetic compatibility rules EN-61326-1

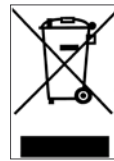
EM environment Industrial

CISPR 11 Instrument Class A & Class B Group 1

For a detailed declaration see document www.fema.es/docs/4152_CE-Declaration_C40-D_en.pdf

Barberà del Vallès, January 2017

Xavier Juncà - Product Manager



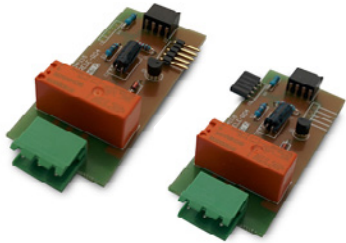
According to directive 2012/19/EU, electronic equipment must be recycled in a selective and controlled way at the end of its useful life.

2. Output and control modules

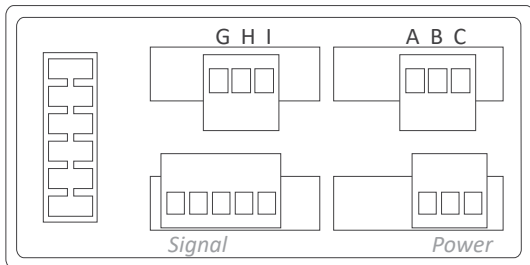
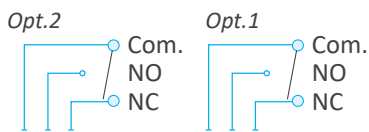
2.1 Modules A1 and A2 (relay output)

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)

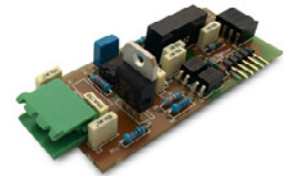
The M1 module offers 1 analog output at 4/20 mA, isolated, to be installed at slot Opt1.

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)

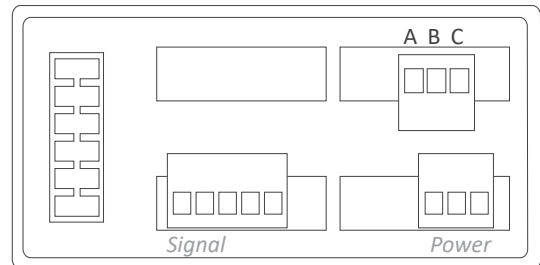
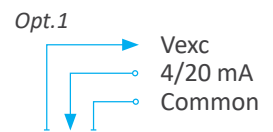
Connections

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) $R_L < 350 \text{ Ohm}$ |
| Passive output | connect terminal C (GND) and B (mA) $R_L < 700 \text{ Ohm}$ |
| 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.

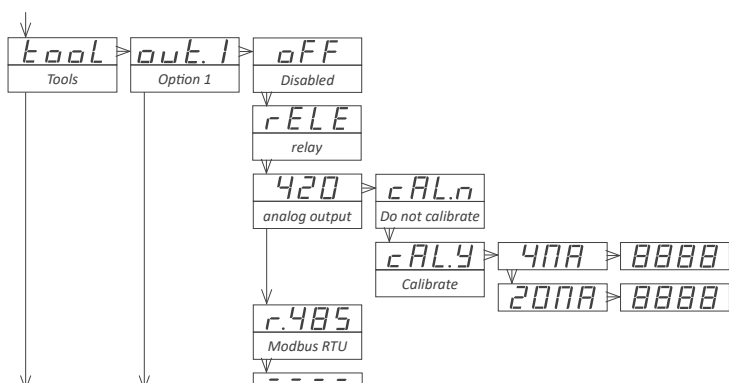
From this point you will need the calibration sheet provided together with the module M1. This sheet shows the values for parameters 'cAL.y/4mA' and 'cAL.y/20mA'.

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 attached to the M1 module at manufacturing time, 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).



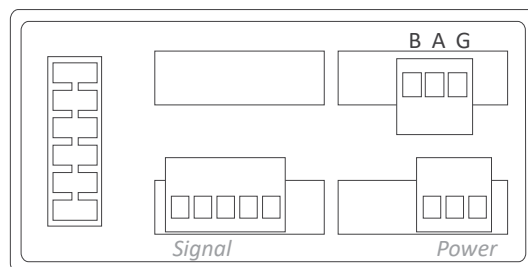
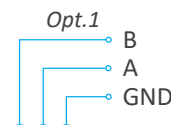
The S1 module offers 1 Modbus RTU serial output, isolated, to be installed at slot Opt1.

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 |
| Fan-out | maximum 32 devices per segment |
| Slots allowed | Opt.1 |



Terminal B B
Terminal A A
Terminal G GND

3. Other options

3.1 Option NBT

Instruments without front keypad. To configure the instrument, remove the meter from the panel and remove the front filter. Internal press buttons for configuration are accessible. Optionally, request the instrument preconfigured from factory.



3.2 Option 65

O-ring for IP65 front protection



3.3 Option 'customized'

Instruments can be adapted to your needs :

- improved technical specifications
- custom configurations
- special functions
- ...



4. Accessories

4.1 Adapter DRA-M

Adapter for DIN rail mount, for Series C



4.4 WME wall housing

Wall mount housing. Together with the KIP protector, offers a full IP65 protection. For Series C of panel meters.



4.2 Adapter KA96

Adapter 96 x 96 mm for 96 x 48 mm instruments.



4.5 THM benchtop housing

Benchtop housing for Series C and of panel meters. Handle with three selectable positions. Power connector with manual switch and fuse holder.



4.3 Protector KIP

Removable front cover for additional mechanical and IP65 front protection.



4.6 Set of units (included)

Set of labels 'Vdc', 'Vac', 'Adc', 'Aac', 'mVdc', 'mVac', 'mAdc', 'mAac', '%', '°C', '°F', 'ph', 'm', 'cm', 'mm', 'bar', 'psi', 'Pa', 'N', 'Ω', 'kΩ', 'W', 'kW', 'MW', 'kV', 'kA', 'm/min', 'rpm', 'l'

(1 set included with each instrument)

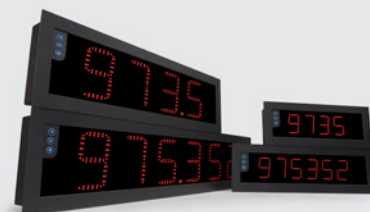
| | | |
|------|------|-------|
| Vdc | Vac | Adc |
| Aac | mVdc | mVac |
| mAdc | mAac | % |
| °C | °F | ph |
| m | cm | mm |
| bar | psi | Pa |
| N | Ω | kΩ |
| W | kW | MW |
| kV | kA | m/min |
| rpm | l | |



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