1 YEAR WARRANTY

CE

RoHS

OMEGA™

# User's Guide

**Shop online at omega.com**

e-mail: info@omega.com

For latest product manuals:
www.omegamanual.info


# DPS20 Series
## Panel Meter for Load cell signals
### 6-Digit, 1/8 DIN Panel Mount

**www.omega.com   info@omega.com**

## Servicing North America:

| | |
|---|---|
| **U.S.A. Headquarters:** | Omega Engineering, Inc.<br>Toll-Free: 1-800-826-6342 (USA & Canada only)<br>Customer Service: 1-800-622-2378 (USA & Canada only)<br>Engineering Service: 1-800-872-9436 (USA & Canada only)<br>Tel: (203) 359-1660     Fax: (203) 359-7700<br>e-mail: info@omega.com |

**For Other Locations Visit omega.com/worldwide**

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **61 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **five (5) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY / DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

# 1. Panel meter DPS20

## Panel meter for load cells, size 96 x 48 mm (1/8 DIN)

Digital panel meter, with 96 x 48 mm (1/8 DIN) size and 6 digits with 14 mm digit height, for load cell signals. Provides excitation voltage configurable to +5 Vdc or +10 Vdc to power up to 8 standard 350 Ohms cells. Scalable reading from 999999 to -199999 with configurable decimal point.

Tare function, with configurable controls, and 'auto-tare' function for automatic tare correction when weight is removed from the cell. Three working modes with different acquisition speeds and noise rejection to 50 and 60 Hz.

Output and control options with 1, 2 and 3 relays, isolated analog outputs, Modbus RTU communications, transistor outputs, SSR control outputs, RS-485 ASCII and RS-232.

Independent alarms configurable as maximum or minimum, with activation at setpoint or when reading is stable, with 1 or 2 setpoints per alarm, hysteresis, independent activation and deactivation delays, configurable inverted activation of the relay and configurable locked alarms *(see section 1.12.8)*.

Front protection IP65. Connections by plug-in screw terminals. For industrial applications.

Functions included :

- tare accessible from frontal key or rear contact *(see section 1.11)*
- automatic 'auto-tare' function *(see section 1.12.4)*
- access to gross weight value and tare value *(see section 1.9.5)*
- function '**On Power Up**' for automatic activation of functions at start-up *(see section 1.12.14)*
- scale factor for easy modification of reading units *(see section 1.12.5)*
- 'stock units' function to count units *(see section 1.12.6)*
- access to the measured signal value (in mV), excitation current provided (in mA) and real excitation voltage *(see section 1.12.13)*
- configurable '**Fast access**' menu (key 'UP' (▲)) with access to selected functions *(see section 1.12.13)*

Multiple display filters, memory for maximum and minimum, password, 5 configurable brightness levels.

## 1.1 How to use this manual

If this is the first time you are configuring this instrument, below are the steps to follow to install and configure the instrument. Read all the manual sections in order to have a full and clear view of the characteristics of the instrument. Do not forget to read the installation precautions at section *1.19*.

1. Power and signal connections
   - connect the power *(see section 1.8)*
   - connect the signal *(see section 1.8)*
   - read recommendations to connect the 'sense' *(see section 1.8.1)* and for load cell ground connections *(see section 1.8.2)*
2. Initial setup *(see section 1.12.2)*
   - theoretical configuration of the cell (obtain the load cell data : sensitivity, load and excitation) and configure the instrument
   - apply the empirical configuration of the cell (apply the high and low 'field correction')
   - assign the 'system zero'
3. Advanced configuration (optional) *(see section 1.12.7)*
   - tare configuration, see sections *1.11* and *1.12.4*
   - function 'stock units' *(see section 1.12.6)*
   - scale factor *(see section 1.12.5)*
   - acquisition modes *(see section 1.9.1)*
4. Configure the alarms (optional) *(see section 1.12.8)*
5. Display filters (optional) *(see section 1.12.10)*
6. Configure operator controls (optional)
   - configure the rear control *(see section 1.12.11)*
   - configure the front key 'LE' (◄ )*(see section 1.12.12)*
   - configure the fast access (key 'UP' (▲)) *(see section 1.12.13)*
7. Configure other functions (optional)
   - configure the 'on power up' function *(see section 1.12.14)*
   - configure the password and brightness level *(see section 1.12.17)*
8. Configure the output and control options: analog (AO) or serial (RTU, S4, S2) *(see section 1.12.18)*

## 1.2 Index



## 1.3 How to order

| Model No. | Description |
|---|---|
| DPS20-HV | 1/8 DIN panel meter with 85/265Vac/dc power supply |
| DPS20-HV-AO | 1/8 DIN panel meter with 85/265Vac/dc power supply with 1 analog output |
| DPS20-HV-R1 | 1/8 DIN panel meter with 85/265Vac/dc power supply with 1 relay output |
| DPS20-HV-R1-AO | 1/8 DIN panel meter with 85/265Vac/dc power supply with 1 relay output and 1 analog output |
| DPS20-HV-R1-R1 | 1/8 DIN panel meter with 85/265Vac/dc power supply with 2 relay output |
| DPS20-HV-R1-R1-AO | 1/8 DIN panel meter with 85/265Vac/dc power supply with 2 relay output and 1 analog output |
| DPS20-HV-R1-R1-R1 | 1/8 DIN panel meter with 85/265Vac/dc power supply with 3 relay output |
| DPS20-HV-RTU | 1/8 DIN panel meter with 85/265Vac/dc power supply with 1 Modbus RTU output |
| DPS20-HV-R1-R1-RTU | 1/8 DIN panel meter with 85/265Vac/dc power supply with 2 relay output and 1 Modbus RTU output |
| DPS20-LV | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply |
| DPS20-LV-AO | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 1 analog output |
| DPS20-LV-R1 | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 1 relay output |
| DPS20-LV-R1-AO | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 1 relay output and 1 analog output |
| DPS20-LV-R1-R1 | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 2 relay output |
| DPS20-LV-R1-R1-AO | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 2 relay output and 1 analog output |
| DPS20-LV-R1-R1-R1 | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 3 relay output |
| DPS20-LV-RTU | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 1 Modbus RTU output |
| DPS20-LV-R1-R1-RTU | 1/8 DIN panel meter with 11/60Vdc and 24/48Vac power supply with 2 relay output and 1 Modbus RTU output |
| Comes complete with operator’s manual. The AC powered units can not be shipped to Canada. | |

## 1.4 Material included

The shipment includes :

- 1 instrument DPS20
- 1 pack of orange power terminals
- 1 pack of green signal terminals
- 1 user's manual
- 1 set of units label (see *Figure 1*)

If the instrument mounts output and control options *(see section 2)*, the shipment also includes:

- 1 pack of green signal terminals for each output and control option installed

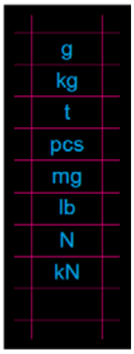
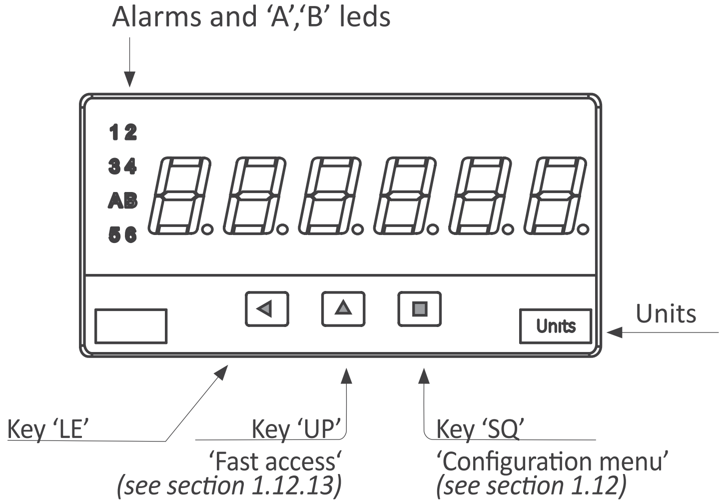



*Figure 1 - Set of units label*

## 1.6 Front view




Front leds 'A' and 'B' show the active function *(see Table 1)*. See section *1.9.5* for a definition on gross weight, net weight and tare. The manual activation of the 'tare' activates a fast flash on led 'B'.

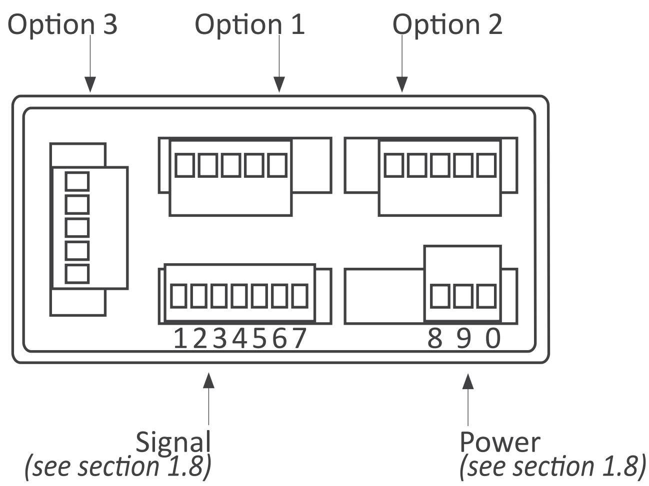
| *Reading* | *A* | *B* |
|---|---|---|
| *Gross weight* | *on* | *off* |
| *Actual tare value* | *off* | *on* |
| *'tare' function activated* | *off* | *fast flash* |
| *Net weight* | *off* | *off* |
| *Units ('stock units')* | *on* | *on* |

*Table 1 - Meaning for the front leds 'A' and 'B'*

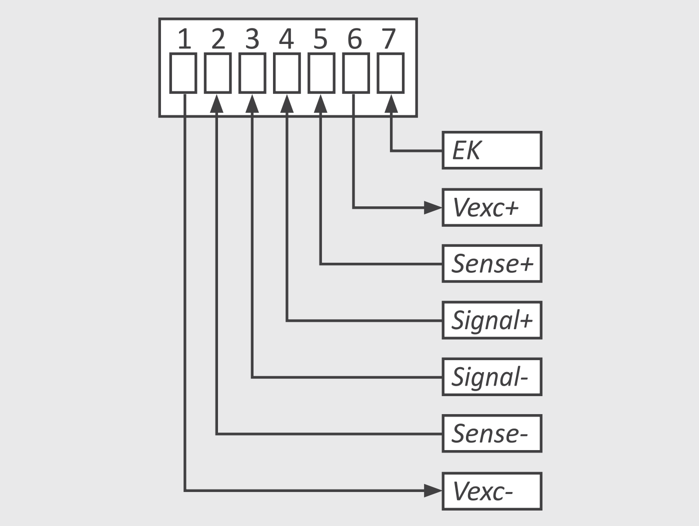
## 1.5 Additional information

You can find more information at www.omega.com website.

## 1.7 Rear view



## 1.8 Signal and power connections




| | | |
|---|---|---|
| *7* | EK | 'on / off' rear control *(short circuit to 'Vexc-')* |
| *6* | Vexc+ | Excitation voltage + |
| *5* | Sense+ | Excitation voltage sense + |
| *4* | Signal+ | Signal + |
| *3* | Signal- | Signal - |
| *2* | Sense- | Excitation voltage sense - |
| *1* | Vexc- | Excitation voltage - |

*Figure 2 - Signal connections*

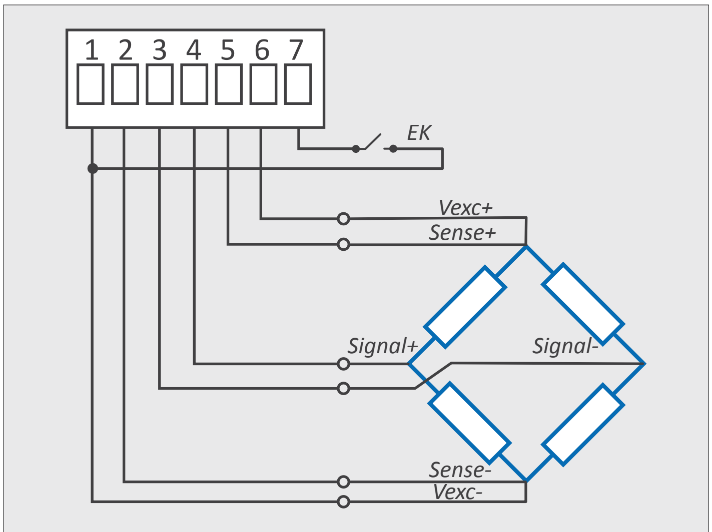
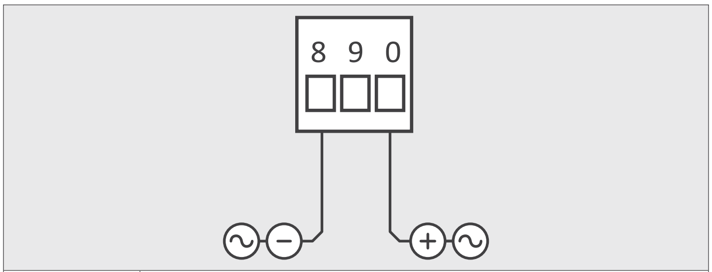



*Figure 4 - Example for connections with 1 load cell.*

The 'sense' terminals must be always connected. If you do not use the 'sense', shortcircuit with 'Vexc' terminals *(see section 1.8.1)*.




| | |
|---|---|
| 8 | Neutral AC / Negative DC |
| 9 | Not connected |
| 0 | Phase AC / Positive DC |

*Figure 3 - Power connections*

*Fuse : to comply with the security regulation 61010-1, add to the power line a protection fuse acting as a disconnection element, easily accessible to the operator and identified as a protection device.*

- *Power 'H' 250 mA time-lag fuse*
- *Power 'L' 400 mA time-lag fuse*

### 1.8.1 Connecting the 'sense'

Measuring with load cells requires a stable and accurate excitation voltage. Connecting the '*sense+*' and '*sense-*' terminals to the load cell, provides the instrument with an accurate value of the excitation voltage received by the cell. Deviations and errors from the standard excitation value are automatically compensated by the instrument, increasing the accuracy and reliability of the measure.

If you do not wish to use the '*sense*', place a shortcircuit between terminals '*sense+*' and '*Vexc+*', and between terminals '*sense-*' and '*Vexc-*'.

For applications with multiple cells (2, 3, 4 cells or more) connect the '*sense*' wires to the 'electrical middle point' of the power wires of all the cells *(see section 1.16.4)*.

### 1.8.2 Connecting the cell to the ground

Measuring with load cells requires an electrically clean installation. When connecting the ground to the cell system, assure that :

- the cell connection to ground is performed in such a way that the current to ground DOES NOT flow through the cell.

### 1.8.3 Real cases

See section *1.16* for different examples on how to connect the load cell and configure the instrument.

## 1.9 Technical specifications

| | |
|---|---|
| **Digits** | |
| number of digits | 6 |
| led | 7 segments |
| color | red or green |
| digit height | 14 mm |
| **Reading** | |
| max. reading | 999999 |
| min. reading | -199999 |
| decimal point | configurable X.X.X.X.X.X |
| overrange | flash reading |
| underrange | flash reading |
| **Load cells** | |
| type of cells | 1 mV/V, 2 mV/V, 3 mV/V and others |
| excitation voltage | configurable 5 Vdc or 10 Vdc |
| max. excitation current | 140 mA |
| Vexc. protection | against shortcircuit (see error at section *1.15*) |
| max. terminals voltage | 30 Vdc |
| number of cells* | 1 to 8 load cells (power 5 Vdc)<br>1 to 4 load cells (power 10 Vdc) |

**(values calculated for standard 350 Ohms load cells. For cells with different impedance, the number is limited by the 140 mA available current)*

| | |
|---|---|
| **Measure** | |
| signal ranges | *(see section 1.9.2)* |
| accuracy at 25 ºC | *(see section 1.9.2)* |
| thermal stability | 50 ppm/º |
| input impedance | 20 MOhm |
| acquisitions / second | see *Table 2* |

*(and refresh for alarms, analog outputs and bus)*

| | |
|---|---|
| display refresh | see *Table 2* |
| step response | see *Table 2*<br>*0 % to 99 % signal* |
| signal terminals | plug-in screw terminals (pitch 3.81 mm) |
| **Power** | |
| power 'HV' | 85 to 265 Vac/dc |
| power 'LV' | 11 to 60 Vdc and 24/48 Vac |
| isolation* | 2500 Veff with power 'HV' |
| **(60 seconds)* | 1500 Veff with power 'LV' |
| consumption | <1.5 W only meter<br><4.0 W meter with options |
| power terminals | plug-in screw terminals (pitch 5.08 mm) |
| wire section | 1 to 2.5 mm2 (AWG17 to AWG14) |
| **Configuration** | front keypad with 3 keys |
| **Front protection** | IP65 |
| **Output and control options** | relay, analog, communications, ...<br>*(see section 2)* |
| **Mechanical** | |
| mounting | panel |
| connections | plug-in screw terminal |
| housing | ABS, polycarbonate (V0) |
| weight | <150 gr. |
| front size | 96 x 48 mm (1/8 DIN) |
| panel cut-out | 92 x 44 mm |
| depth | 91 mm (including terminals) |
| **Temperature** | |
| operation | 0 to +50 ºC |
| storage | 20 to +70 ºC |
| warm-up time | 15 minutes |

### 1.9.1 Acquisition modes

The instrument works by default with a fast acquisition mode of 16 acquisitions per second, with a noise rejection optimized for 50 and 60 Hz frequencies. Two additional faster acquisition modes are available, optimized for noise rejection to a single specific frequency of 50 Hz or 60 Hz.

To optimize the noise rejection only to 50 Hz and / or increase the acquisition speed to 50 acquisitions per second, configure the '**Mode**' ('**ModE**') parameter to '**50.hZ**' value. This selection increases the speed to 50 acquisitions per second and increases the noise rejection to 50 Hz, although it reduces the noise rejection to 60 Hz. Configure the parameter value to '**60.hZ**' to increase to 60 acquisitions per second and maximum rejection to 60 Hz noise, reducing the noise rejection for 50 Hz.

To configure the mode see section *1.12.7*.

| | *Acquisitions / sec.* | *Display refresh* | *Step response* |
|---|---|---|---|
| ***Mode standard*** | *16 acq. / sec.* | *16 refresh / sec.* | *63 mSec.* |
| ***Mode 50 Hz*** | *50 acq. / sec.* | *16 refresh / sec.* | *20 mSec.* |
| ***Mode 60 Hz*** | *60 acq. / sec.* | *16 refresh / sec.* | *17 mSec.* |

*Table 2 - Technical data for the configured acquisition mode*

# 1.9 Technical data (cont.)

## 1.9.2 Signal ranges

The instrument works with 6 internal signal ranges and the active range is automatically selected when the instrument is started. The selection depends on the value of the two parameters : '**Sensitivity**' ('**MV.V**') and '**Excitation voltage**' ('**V.EXc**') *(see section 1.12.2)*

*Example : with a sensitivity configuration of 2.0000 mV/V and a configured excitation voltage of 10 Vdc, the instrument selects the 20 mV input signal range, by calculating 2 mV/V x 10 Vdc = 20 mV.*

The internal signal ranges available are shown below at *Table 3*.

| *Signal ranges* | *Accuracy* | *Max. input signal* |
|---|---|---|
| *0/100 mVdc* | *0.05% FS* | *30 V* |
| *0/30 mVdc* | *0.05% FS* | |
| *0/20 mVdc* | *0.05% FS* | |
| *0/15 mVdc* | *0.05% FS* | |
| *0/10 mVdc* | *0.05% FS* | |
| *0/5 mVdc* | *0.05% FS* | |

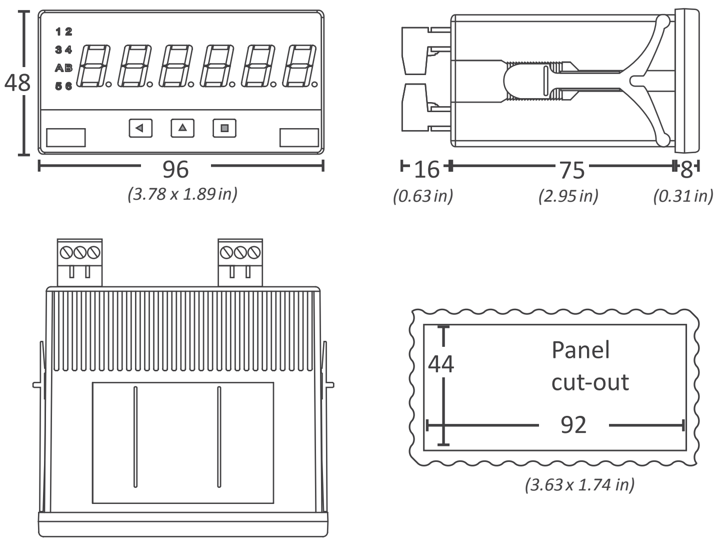
*Table 3 - Input signal ranges*

## 1.9.3 Number and type of cells accepted

The instrument accepts connection for up to 8 standard 350 Ohms load cells. With a configured excitation voltage of 10 Vdc connect from 1 to 4 load cells. With a configured excitation voltage of 5 Vdc connect from 1 to 8 load cells. For load cells with different impedance, calculate the current consumption for each cell, and the total must not exceed the maximum current the instrument can provide.

In case of problems with the power or the signal provided by the load cells, the instrument provides three functions for troubleshooting purposes. These functions allow to access the signal input value (in mV), the excitation voltage value at the 'sense' terminals (in Vdc) and the current provided to the cells (in mA). The operator can use this values to identify the cause of the problem. See section *1.12.13* for more information on how to access this values in real time.

## 1.9.4 Mechanical dimensions (mm *(in)*)




## 1.9.5 Gross weight, net and tare

The instrument shows the value for the net weight, and can be configured to switch reading to gross weight and the actual value of the tare. The relation between them is :

- Net weight = gross weight - tare

Operator can access these values by configuring the fast access menu (key 'UP ( ▲ )) *(see section 1.12.13).*

Reading the gross weight or tare values activate the front leds 'A' and 'B' *(see section 1.6)*.

## 1.10 Included functions

| *Included functions* | | *Section* |
|---|---|---|
| *Function tare* | *yes* | *1.11* |
| *Auto-tare* | *automatic zero tare* | *1.12.4* |
| *Maximum tare* | *to prevent undesired tare activations* | *1.12.7* |
| *Scale factor* | *change the reading scale* | *1.12.5*<br>*1.12.7* |
| *Stock of units* | *counts units instead of weight* | *1.12.6* |
| *Modes* | *high rejection to 50 Hz and 60 Hz* | *1.9.1* |
| *Alarms* | *standard*<br>*stability alarms*<br>*double setpoint*<br>*activation delays*<br>*deactivation delays*<br>*hysteresis*<br>*inverted relay*<br>*locked deactivation* | *1.12.8* |
| *Display filters* | *fixed digits*<br>*recursive*<br>*'steps'*<br>*left zeros* | *1.12.10* |
| *Rear controls* | *activate functions from rear terminal* | *1.12.11* |
| *Front key 'LE' (◀)* | *activate functions from key 'LE' (◀)* | *1.12.12* |
| *Fast access (key 'UP' (▲))* | *fast access to parameters from front key 'UP' (▲)* | *1.12.13* |
| *On power up* | *activate functions at power up* | *1.12.14* |
| *Memory* | *maximum and minimum* | *1.12.13* |
| *Password* | *blocks access to configuration menu* | *1.12.17* |
| *Troubleshooting functions* | *values for input signal, excitation voltage and excitation current* | *1.9.3*<br>*1.12.13* |
| *Display brightness* | *5 levels* | *1.12.17* |

*Table 4 - Functions included*

## 1.11 'Tare' functions included

Activate the tare function to force the instrument to take the actual signal as a '0' weight. The tare function does not modify the internal calibration of the cell, and can be activated as many times as needed. The tare function is typically used to set a '0' reading when a fixed weight has been added to the load cell.

*Example : a truck enters a loading area and is placed on a weighing system. The instrument indicates that the weight of the truck is 2.500 Kg. A tare is applied to the instrument, and now the reading is 0 Kg. The truck enters the loading area and when it leaves, it is placed on the weighing system again. Now the reading is 1.550 Kg. This is the weight of the material loaded on the truck. When the truck leaves the weighing system the instrument reads -2.500 Kg. Activate a tare again to force a reading of 0 Kg or wait for a new truck.*

The instrument accepts different ways to activate the tare function:

- from the rear terminal, shortcircuit the 'EK' terminal against the 'Vexc-' terminal. Previously, configure the 'EK' terminal with the tare function *(see section 1.12.11).*
- from the front keypad, press the front key 'LE' (◀). Previously, configure the 'LE' (◀) key with the tare function *(see section 1.12.12).*
- automatically when the instrument starts. Previously, configure the 'on power up' function with the tare function *(see section 1.12.14).*
- automatically with the 'auto-tare' function. The inherent mechanical characteristics of a load cell makes the 'zero weight' signal a non constant value. This can be detected by placing and removing the same weight from a load cell, several times. When the weight is removed, the reading is not always '0', but a random value close and around '0'. The 'auto-tare' function automates the activation of the 'tare' when the reading of the instrument is stable and close to '0' *(see section 1.12.14).*

To avoid accidental tares, the instrument provides the '**Max. Tare**' ('**MAX.t**') parameter. The activation of the 'tare' function, either manual or automatic, is not applied if the reading is higher than the value defined in this parameter *(see section 1.12.7).*

The actual tare value can be accessed from the front key 'UP' (▲) activating the 'Tare' function at the 'Key UP' menu *(see section 1.12.15)*. A reset to the tare value can be applied also from this same menu.

# 1.12 Configuration

## 1.12.1 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 it 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 the following sections, and for a full view of the '*configuration menu*' see section *1.13*.

### *'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 *1.12.15* for a list of selectable functions for the '*fast access*' menu 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.

### Operating with the front keypad inside the menus

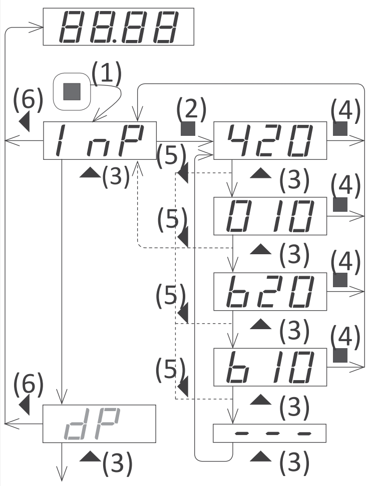
**Key 'SQ'** (■) - press the 'SQ' (■) key for 1 second to access the '*configuration menu*'. Inside the menu, the 'SQ' (■) key acts as an '*ENTER*'. It enters into the menu option selected, and when entering a numerical value, it validates the number.

**Key 'UP'** (▲) - press the 'UP' (▲) key to access the '*fast access*' menu. Inside the menu,the 'UP' (▲) key sequentially moves through the available parameters and menu entries. When entering a numerical value, it modifies the digit selected by increasing its value to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

**Key 'LE'** (◄) - press the 'LE' (◄) key to activate the configured special functions associated to this key. Inside the menu, the 'LE' (▲) acts as an 'ESCAPE'. It leaves the selected menu level and eventually, by leaving all menu levels, it leaves from the configuration menu. Then changes are applied and the instrument is back to normal function. When entering a numerical value, it selects the active digit, and the value is then modified by key 'UP' (▲).

### '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 (■) key enters into the 'configuration menu'.
2. The (■) key enters into the '**InP**' menu.
3. The (▲) key moves through the menu options.
4. The (■) key selects the desired range and returns to the '**InP**' menu.
5. The (◄) key leaves the actual level and moves to the previous menu level.
6. The (◄) key leaves the 'configuration menu'. Changes are applied and saved at this moment.

*Figure 5 - Example of operation inside the 'configuration menu' (menu entries are given as example, and may not be the exactly the same as the instrument menu entries).*

## 1.12.2 Initial set-up

Before starting to configure the instrument, identify the parameters of the load cell, at the manufacturers datasheet *(see Table 5)*. If the parameters are not know, leave the instrument with the default values.

| *Load cell parameters* | *Default values* |
|---|---|
| *Sensitivity* | *2 mV/V* |
| *Nominal weight* | *1000 Kilos* |
| *Excitation voltage* | *10 Vdc* |

*Table 5 - Parameters of the load cell*

For an accurate measure, the instrument needs to correctly configure its parameters for the particular load cell connected. The configuration procedure has a first theoretical step and a second empirical step. The third and final step will set the 'system zero' of the instrument.

**Theoretical configuration of the load cell**

The theoretical parameters are configured at the '**Parameters of the cell**' ('**cELL**') menu.

- at the '**Decimal point**' ('**dP**') parameter, place the decimal point according to the resolution you want to see.
- at the '**Nominal weight**' ('**LoAd**') parameter introduce the nominal weight of the load cell. The value is entered with the resolution configured in the parameter above.
- at the '**Sensitivity**' ('**MV.V**') parameter, introduce the value of the cell sensitivity.
- at the '**Excitation voltage**' ('**V.EXc**') parameter, select 5 or 10 Vdc. (The 'LAb' value enables the laboratory mode, for direct measure from a millivolt generator instead of a load cell *(see section 1.16.5))*.

*Example : load cell with 1.95 mV/V sensitivity and a nominal value of 5 Kg and power 5 Vdc. To read in grams with a decimal point, configure the theoretical parameters as indicated below :*

*Decimal point : XXXXX.X*
*Sensitivity : 1.95 mV/V*
*Nominal weight : 5000.0*
*Excitation voltage : 5 Vdc*

When the theoretical values are configured, leave the configuration menu. Apply a '**system zero'**. Force a tare, and place different weights to check if the reading is correct. If it is not correct, apply the empirical configuration and again the '**system zero**'.

**Empirical configuration of the load cell**

The second part of the load cell configuration is an empirical process of field correction. The instrument will detect and correct the individual deviations of this particular load cell.

For the empirical configuration you will need access to two weights : a low weight, as small as possible (it can be the cell without weight) and a high weight as close as possible to the nominal weight of the cell.

In each case the meter will be informed of the real weight applied to the cell in order to correct and compensate for the measured deviations at the signal. Both corrections are need (high and low) for a correct configuration of the load cell.

- low weight correction : place the load cell without weight or with the smallest weight possible, and access the '**Low weight correction**' ('**F.Lo**') menu. Press key SQ ('■'), introduce the value of the weight and press again SQ ('■'). The instrument will flash shortly and return to the menu entry '**Low weight correction**' ('**F.Lo**').
- high weight correction : place the load cell with a weight closest to nominal and access the '**High weight correction**' ('**F.hI**') menu. Press key SQ ('■'), introduce the value of the weight and press again SQ ('■'). The instrument will flash shortly and return to the menu entry '**High weight correction**' ('**F.hI**').

Once both corrections are applied, leave the configuration menu. Force a tare, and place different weights to check that the reading is correct. As a last step, assign the 'system zero' if you want to access gross weight and net values.

**Assign the 'system zero'**

This is a necessary and important step for a correct measurement with a load cell.

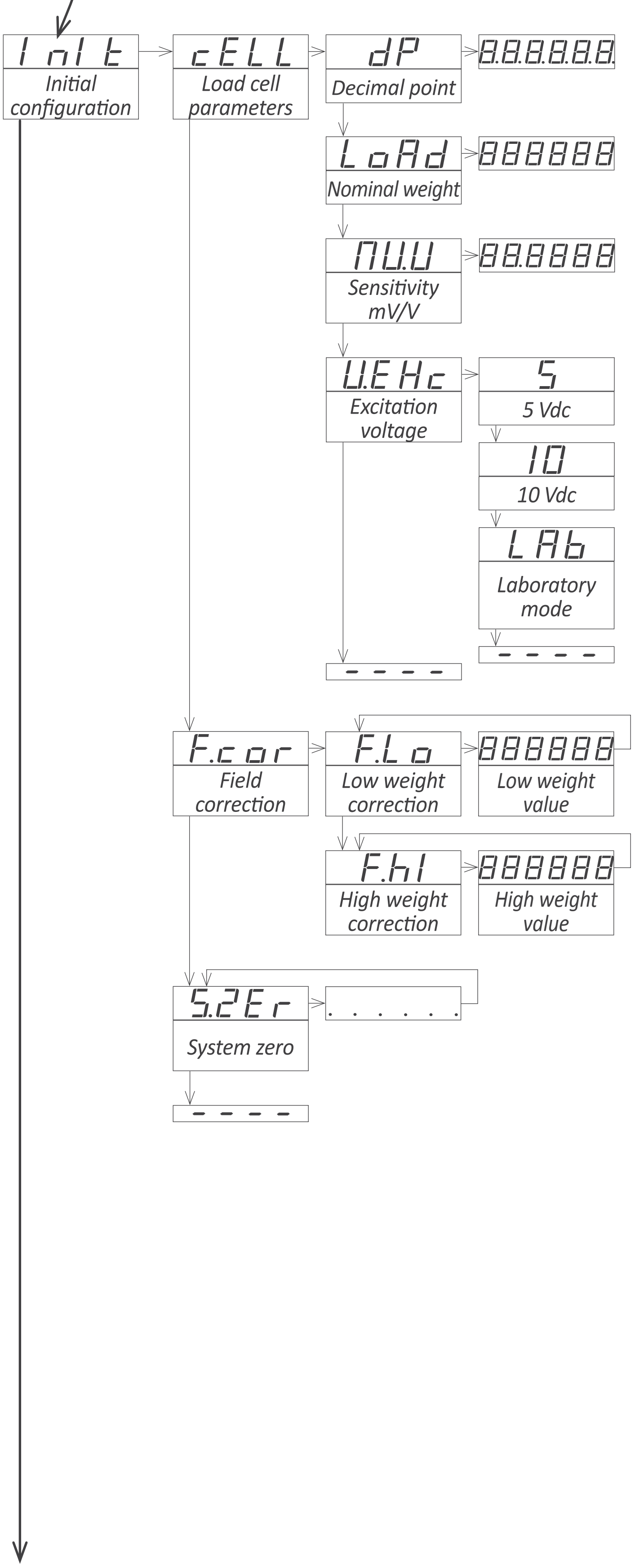
- assign the 'system zero' : place the load cell without weight or with the weight that will be considered as 'zero' and access the '**System zero**' ('**S.ZEr**') parameter. Press key SQ ('■'). The instrument will flash shortly and return to the menu entry '**System zero**' ('**S.ZEr**').

⚠ The empirical configuration of the load cell recalculates and updates the theoretical sensitivity value ('**Sensitivity mV/V**' ('**MV.V**') parameter). Manual modifications of this parameter will modify the configuration of the cell. To prevent accidental modification consider the activation of the '**password**' function *(see section 1.12.17)*.

⚠ Once the load cell has been correctly configured, and the reading of the instrument is correct, it is not necessary to access again this part of the configuration menu. If you need to scale the reading to different units, use the '**Scale factor**' ('**ScL.F**) parameters at the 'Advanced configuration' menu *(see section 1.12.7)*.

## 1.12.3 Initial setup menu

Press 'SQ' (■) for 1 second to access the '*configuration menu*'. For a description on how to operate inside the menus see section *1.12.1*. For a full vision of the '*configuration menu*' structure see section *1.13*.




At the initial set up of the instrument, first configure the theoretical part of the load cell at the '**Load cell parameters'** ('**cELL**') menu and later configure the empirical part of the load cell at the '**Field correction**' ('**F.cor**') menu. See section *1.12.2* for additional information.

- at the '**Decimal point**' ('**dP**') parameter, select the decimal point position. Move the decimal point with key 'LE' (◀). The position defined will be used for all reading parameters.

  *Example : to read in 'Kg' with tenths of kilograms, place the decimal point at 'XXXXX.X' and the reading will be always be shown with 1 decimal.*

  *Changing the position of the decimal point will only light a different decimal point led, but will not modify or re-scale the measure of the instrument.*
- at the '**Sensitivity mV/V**' ('**MV.V**') parameter, configure the value for the load cell sensitivity. Accepts any value between 0.0001 and 99.9999 mV/V. Default value is 2.0000 mV/V.
- at the '**Nominal weight**' ('**LoAd**') parameter, configure the nominal weight of the load cell. accepts any value between 0 and 999999. The decimal point will be shown in the position configured at the '**Decimal point**' ('**dP**') parameter. Default value is 1000.

  *Example : for a 5 Kg cell, configure a value of 5000 to read in grams.*
- at the '**Excitation voltage**' ('**V.Exc**') parameter, configure the voltage to power the load cell. Select '5 Vdc' or '10 Vdc'. Default value is 10 Vdc. Select 'LAb' for a millivolt meter mode in laboratory *(see section 1.16.5).*

The '**Field correction**' ('**F.cor**') menu includes the functions for the empirical configuration of the load cell. See section *1.12.2* for additional information on each function.

- at the '**Low weight correction**' ('**F.Lo**') parameter, introduce the real value of the actual weight at the cell. Use the lowest weight possible, close to 0. Press key SQ ('■') to start the correction process.
- at the '**High weight correction**' ('**F.hI**') introduce the real value of the actual weight at the cell. Use the lowest weight possible, close to nominal weight of the cell. Press key SQ ('■') to start the correction process.

The '**System zero**' ('**S.ZEr**') entry assigns the actual weight to the 'system zero' of the instrument. See section *1.12.2* for additional information.

## 1.12.4 Function 'auto-tare'

The 'auto-tare' function automatically activates the 'tare' when the weight is removed from the load cell. The 'auto-tare' configuration has three parameters :

- Activation value : the 'auto-tare' function activates when reading is lower than the defined value.
- Stability band: reading must be stable, and its fluctuation must be lower than the number of counts defined in this parameter.
- Stability time : reading must be within the stability band for the time defined in this parameter.

When these three parameters are met (the system is 'without weight' and the reading is 'stable') the 'auto-tare' function automatically activates the 'tare'.

*Example : weighing system with reading from 0.0 to 2500.0 Kg. When weight is removed from the system, there is always a variable remnant value : 2.2 Kg, 3.1 Kg, -0,7 Kg, ... This remnant value is associated to the specific imperfections of each load cell. Also this remnant value takes some time to stabilize, approximately 1 second. A manual tare can be applied each time the load cell is unloaded in order to correct this error. The 'auto-tare' function will correct it automatically without operator intervention, configuring the following parameters.*

- *activation value = 5.0*
- *stability = 1.0*
- *stability time = 2 seconds*

*When reading is lower than '5.0', the 'auto-tare' system activates, and it will analyze the stability of the signal. When reading does not change more than ±1.0 counts for a time of 2 seconds, the tare will automatically activate.*

The 'auto-tare' function is affected by the '**Maximum tare**' ('**MAX.t**') parameter. The instrument will not accept the activation of the tare when reading is higher than the '**Maximum tare**' ('**MAX.t**') value.

## 1.12.5 Scale factor

The '**Scale factor**' ('**ScL.F**') configures a fixed multiplier to apply to the reading.

*Example: a weighing system is configured to read in Kg, but the system is going to be shipped to an area where measure must be in pounds. The relation between kilograms and pounds is: 1 Kg=2,20462 pounds. Within the scale factor, configure the multiplier to 220462 and the divider to 100000. The instrument is now configured to read in 'pounds'.*

## 1.12.6 Function 'stock'

The '**Stock units**' ('**Stck**') function is provided to count large quantities of small units, in situations such as stock inventory, reception of goods, etc. The operator must configure the number of 'units' assigned to a weight. The instrument will measure the weight but will show the number of 'units'.

To configure the '**Stock units**' function, weight a known number of units. Then introduce the number of units, either from the configuration menu ('Advanced configuration'\'Stock units') or from the fast access menu (key 'UP' (▲)).

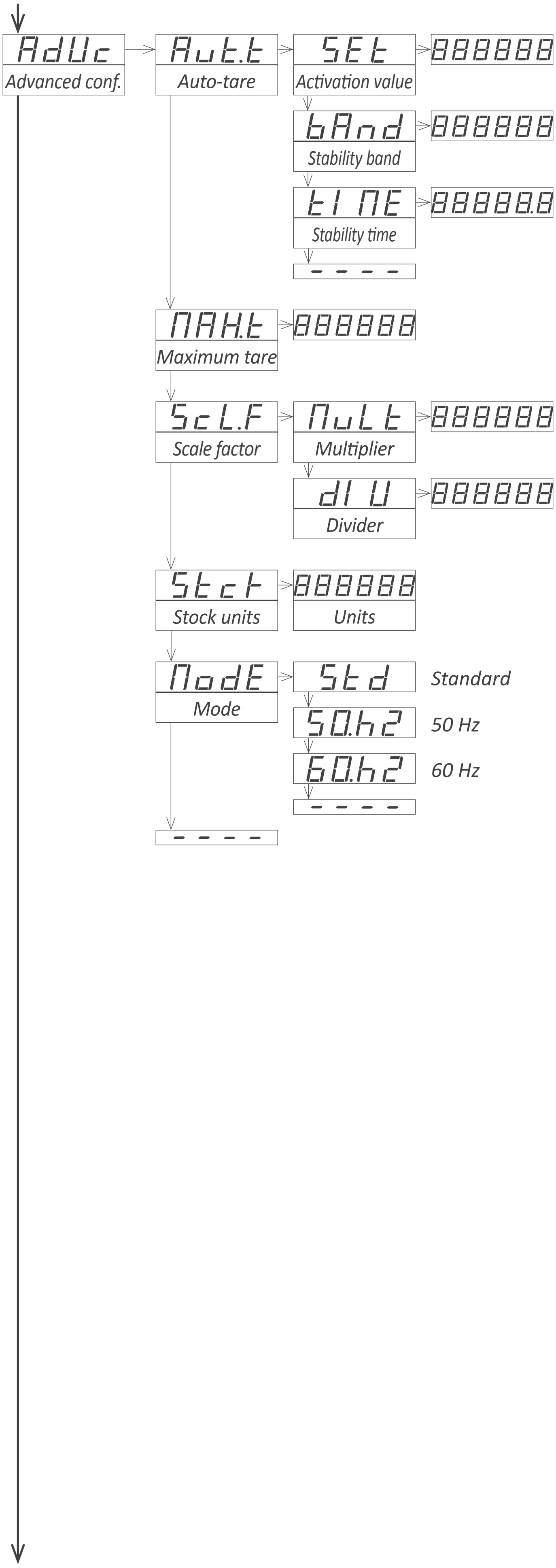
*Example from the configuration menu : place 50 units on the load cell, and check that the instrument is weighing correctly. Enter the configuration menu, and at the 'Stock units' ('Stck') parameter, within the 'Advanced configuration', introduce '50' as the number of units. Save the value (key 'SQ' (■)) and leave the configuration menu (key 'LE' (◀) two times). The instrument restart and reads 50 units. Add more units and observe that the reading increases proportionally to the number of units.*

*Example from the front key 'UP' (▲) : configure the function 'Stock units' to be accessible from the front key 'UP' (▲)' (fast access menu) (see section 1.12.13) and leave the configuration menu. Place 50 units on the load cell, and check that the instrument is weighing correctly. Access the parameter 'Stock units' through the front key 'UP' (▲), and configure the number of units actually on the load cell (50 units). Save the value (key 'SQ' (■)) and leave the fast access menu (key 'LE' (◀)). The instrument reads 50 units. Add more units and observe that the reading increases proportionally to the number of units*

In both cases, setting a value to the '**Stock units**' ('**Stck**') parameter assigns the value to the actual weight. The actual value of units ('**Stock units**' ('**Stck**') parameter) can be assigned to the actual weight by pressing front key 'LE' (◀) *(see section 1.12.12)* and/or activating the rear terminal 'EK' *(see section 1.12.11)*.

Assign the value '0' to the '**Stock units**' ('**Stck**') parameter to disable this function and return to normal reading of weight.

## 1.12.7 Advanced configuration menu




At the '**Auto-tare**' ('**Aut.t**') menu configure the activation value and stability values to control the automatic activation of the tare, when weight is removed from the cell. See section *1.12.4* for additional information.

- at the '**Activation value**' ('**SEt**') parameter, configure the working limits for the 'auto-tare'. The 'auto-tare' only activates for lower values of reading. Accepts any value between 0 and 999999. Default value is 1000.
- at the '**Stability band**' ('**bAnd**') parameter, configure the number of counts allowed to consider a signal 'stable'. The 'auto-tare' only activates if the reading fluctuates within this band of counts. Accepts any value between 0 and 999999. Default value is 10.
- at the '**Stability time**' ('**tIME**') parameter, configure the minimum time, in tenths of second, for the signal to be within the stability band to consider it 'stable'. Accepts any value between '0.0' and '99999.9'. Default value is '0.0'.

Value 0 at the stability band and/or 0.0 at the stability time, disable the 'auto-tare' function.

The tare is automatically activated when reading is lower than the activation value, and the fluctuation of the reading is lower than the counts defined at the 'stability band' for the time defined at the 'stability time'.

At the '**Maximum tare**' ('**MAX.t**') parameter, configure the maximum value of reading to allow for a tare to be applied. See section *1.12.4* for additional information. Accepts any value between 0 and 999999. Default value is 999999.

At the '**Scale factor**' ('**ScL.F**') parameter, configure the value for the multiplier and the divider. See section *1.12.5* for additional information. Accepts any value between 0 and 999999. Default value is 1.

At the '**Stock units**' ('**Stck**') parameter, configure the number of units for the actual weight. See section *1.12.6* for additional information. Accepts any value between 0 and 999999. Default value is 0 (function disabled).

At the '**Mode**' ('**ModE**') parameter, configure the acquisition mode. See section *1.9.1* for additional information. Default value is '**Standard**' ('**Std**').

## 1.12.8 Alarms

The instrument manages 3 independent internal alarms, each one controlling the activation of an optional relay, transistor or SSR control output. These outputs are optional *(see section 2)* and are installed at the free slots of the instrument *(see section 1.18)*.

The instrument has three front leds that reflect the state of the three internal alarms, identified as '1', '2' and '3'.

- **Configurable parameters**

  Each alarm has several configuration parameters, starting with the usual setpoint, hysteresis and maximum (alarm active when reading is higher than setpoint) or minimum (alarm active when reading is lower than minimum) alarm types *(see Figure 6)*.

- **Activation and deactivation delays**

  Each alarm can configure independent activation and deactivation delays. These delays affect the alarm as a whole, and the delay will affect the front led and the associated relay.

- **Stability activation**

  The stability activation delays the alarm activation until the reading is stable *(see Figure 7)*.

  *Application : the filling of a tank with liquid is controlled with a load cell. Upon reaching 5000 liters, the alarm 1 activates to stop the filling pump. After the pump has stopped, the liquid is still moving inside the tank, and this movement is reflected in weight and reading oscillations. Alarm 2 is configured as 'stability alarm' and activates when the liquid inside the tank is at rest. At this moment, the tank can be removed safely.*

- **Second setpoint**

  Configuring a second setpoint creates 'windowed alarms'. The windowed alarm controls with a single relay output if the reading is inside or outside the values defined *(see Figure 8)*.

- **Inverted relay**

  Activate the 'inverted relay' function to invert the activation logic of the associated relay.

- **'Locked alarms'**

  Activate the 'locked alarms' function to force the operator to interact with the instrument when an alarm has activated. Once activated, the alarm will remain locked at active state, even if the reading returns to a value below setpoint, until the operator manually unlocks the alarms by pressing the front key 'LE' ( ◀ ).

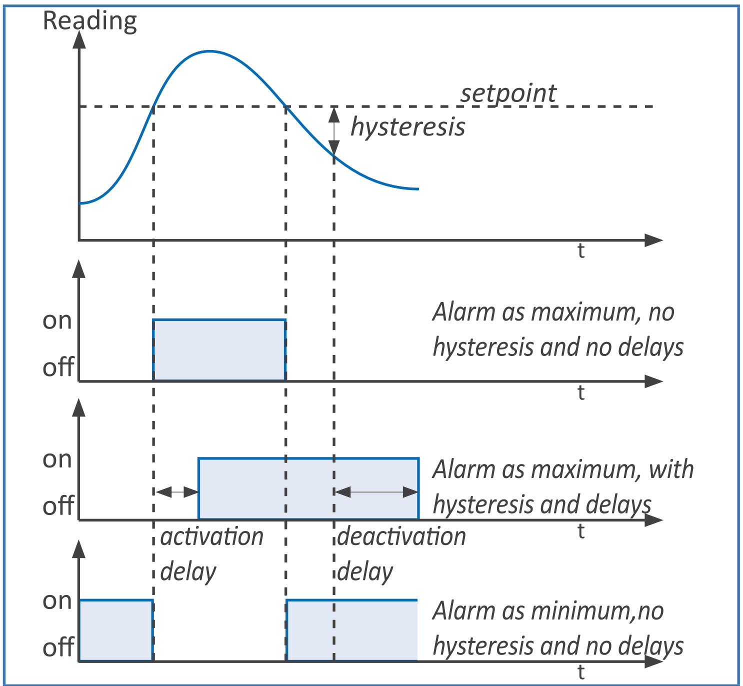



*Figure 6 - Examples of alarms with 1 setpoint*

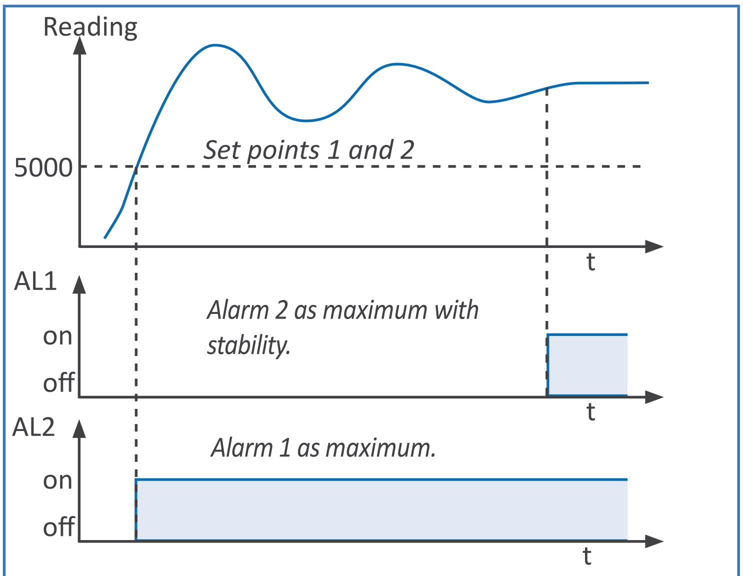



*Figure 7 - Example of alarm with stability*

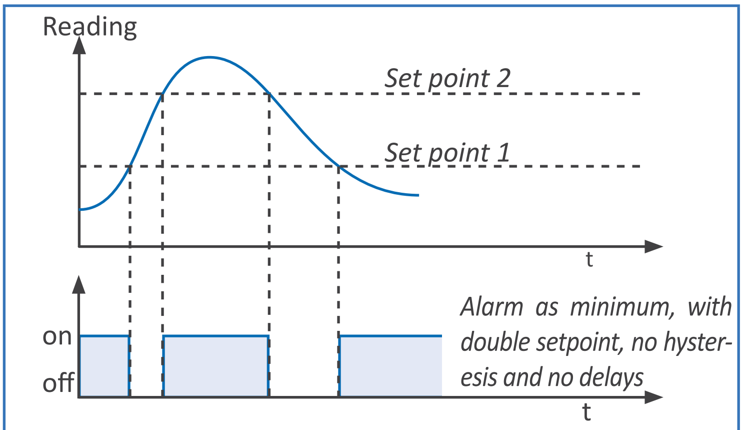
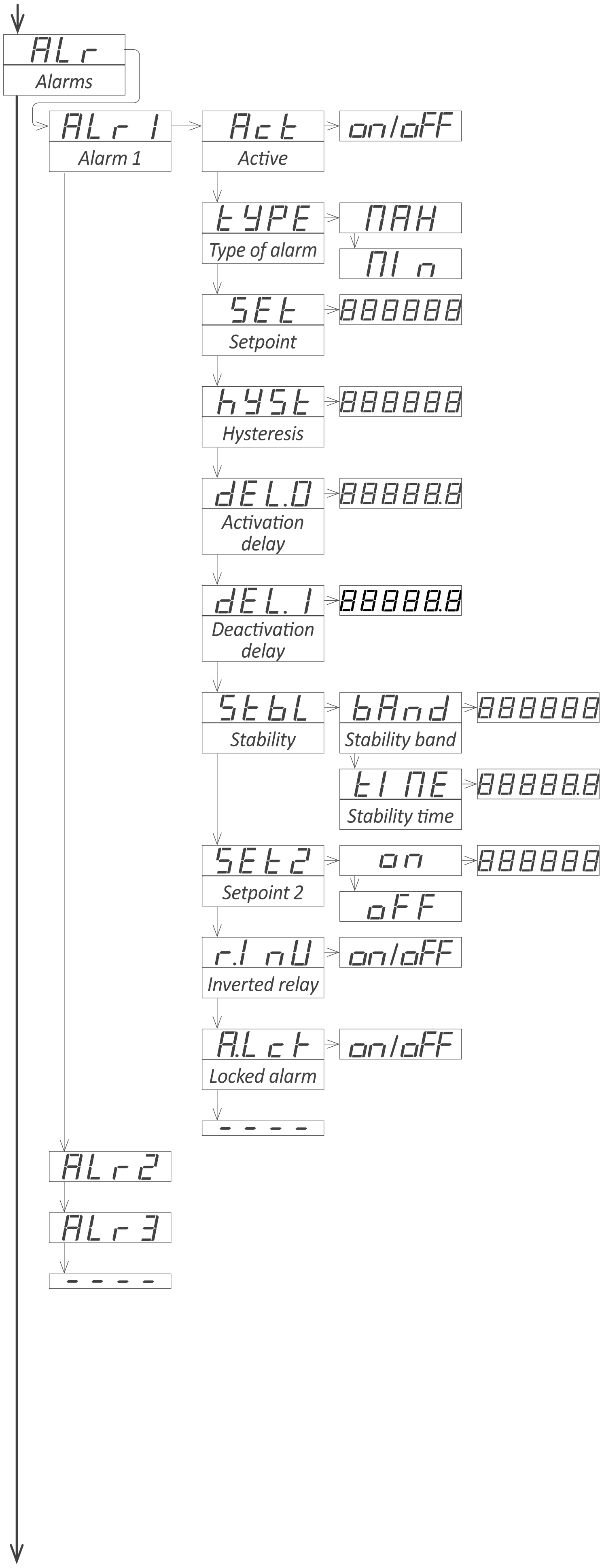



*Figure 8 - Example of alarm with double setpoint*

## 1.12.9 Alarm configuration




Alarms 1, 2 and 3 are configured from menu '**ALr1**', '**ALr2**' or '**ALr3**'. See section *1.12.8* for additional information.

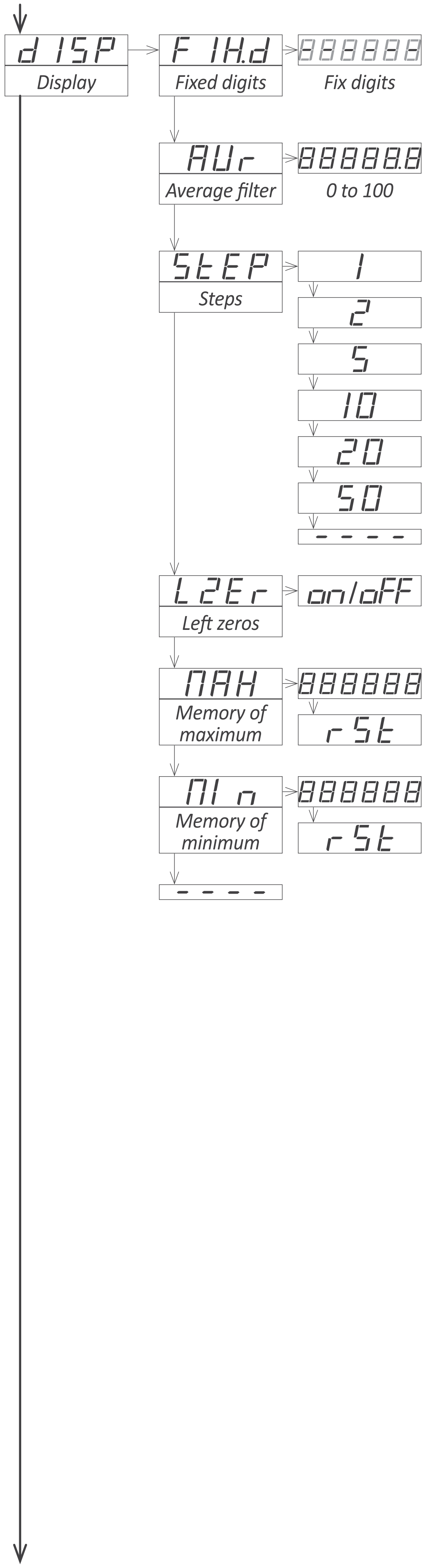
- at the '**Active**' ('**Act**') parameter select '**on**'
- at the '**Type of alarm**' ('**TypE**') parameter, select '**MAX**' for maximum alarm (activates when reading is higher than setpoint), or '**MIn**' for minimum alarm (activates when reading is lower than setpoint).
- at the '**Setpoint**' ('**SEt**') parameter, configure the alarm activation point. Value accessible through the '*fast access*' menu *(see section 1.12.13).*
- at the '**Hysteresis**' ('**hySt**') parameter, select the hysteresis value. Hysteresis applies to the alarm deactivation. Alarm deactivates once the reading is beyond the setpoint plus the hysteresis value. Hysteresis prevents relay switching in case of signal fluctuations close to the setpoint value.
- at the '**Activation delay**' ('**dEL.0**') parameter, configure the delay to apply before the alarm is activated. Delay starts to count once the setpoint is reached. Value from 0.0 to 99.9 seconds.
- at the '**Deactivation delay**' ('**dEL.1**') parameter, configure the delay to apply before the alarm is deactivated. Delay starts to count once the setpoint is reached plus the hysteresis value. Value from 0.0 to 99.9 seconds.
- at the '**Stability**' ('**StbL**') parameter, configure the conditions to detect stability at the signal and activate the alarm. Value '0' at 'stability band' or at 'stability time' deactivate the stability control of the alarm.
  - at the '**Stability band**' ('**bAnd**') parameter, configure the number of counts that the reading can change and still be considered stable. Values from 0 to 999999. Default is 10.
  - at the '**Stability time**' ('**tIME**') parameter, configure the time, in tenths of second, that the reading must be within the 'stability band' to be considered stable. Values from 0.0 to 99999.9. Default is 0.0.
- to work with 'windowed alarmas' configure '**Setpoint 2**' ('**SEt2**') to '**on**' and configure the value for the second setpoint. The second setpoint must always be higher than the first setpoint.
- at the '**Inverted relay**' ('**r.Inv**') parameter, configure '**on**' to invert the activation of the relay. Relay is inactive when alarm is active, and relay is active when alarm is inactive.
- at the '**Locked alarm**' ('**A.Lck**') parameter, configure '**on**' to block the automatic alarm deactivation. Alarm deactivation must be performed manually, by pressing the front key 'LE' ( ◀ ) *(see section 1.12.12)* or rear control *(see section 1.12.11).*

## 1.12.10 Display filters

The instrument provides several functions to act upon the reading in order to increase stability, reduce noise and adapt to particular needs. These functions are grouped under the '**Display**' ('**dISP**') menu and are explained below :

- the '**Fixed digits**' ('**FIX.d**') function allows to fix each digit to a fixed value. Typically, one or more right digits are fixed to '0'. Fix digits starting from the right. Value '-' indicates that the digit is not fixed.
- the '**Average filter**' ('**AVr**') applies a recursive filter upon the reading values, in order to reduce oscillations due to noisy signals. Configure the filter strength between '0' and '100'. The filter is stronger with higher values. Increasing the strength of the filter slows the reading. Value '0' disables the filter.
- the '**Steps**' ('**StEP**') function configures the reading to be done in steps of 1, 2, 5, 10, 20 or 50 counts.

  *Example: configure a step of 20 and the reading will change in steps of 20 counts ('1420', '1440', '1460', ...).*
- the '**Left zero**' ('**LZEr**') function lights all zeros to the left.
- the '**Memory of maximum**' ('**MAX**') displays the maximum reading stored on memory. To reset this memory, select the '**rSt**' input. The value can be accessed through the 'fast access' menu at front key 'UP' ( ▲ ) *(see section 1.12.13).*
- the '**Memory of minimum**' ('**MIn**') displays the minimum reading stored on memory. To reset this memory, select the '**rSt**' input. The value can be accessed through the 'fast access' menu at front key 'UP' ( ▲ ) *(see section 1.12.13).*

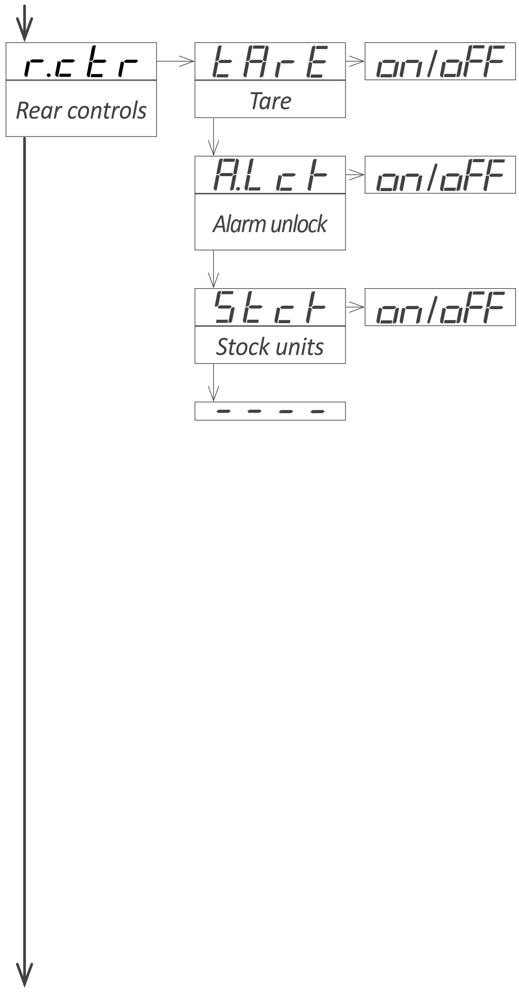


## 1.12.11 Rear controls

The instrument provides a digital 'on/off' input at the rear terminals, referenced as '**EK**' *(see section 1.8)*. Assign functions to this terminal and activate these functions with a short circuit between terminal '**EK**' and terminal '**Vexc-**'. Functions available are explained below :

- the '**Tare**' ('**tArE**') function applies a tare.
- the '**Alarm unlock**' ('**A.LcK**') function unlocks all alarms that are locked due to the 'Locked alarms' function *(see section 1.12.8).*
- the '**Stock units**' ('**Stck**') function assigns the actual weight to the number of units defined at the 'stock units' parameter *(see section 1.12.6).*

In case of multiple functions enabled, the activation is performed sequentially in the same order as the configuration menu (first is the tare, then the alarm unlock, etc).

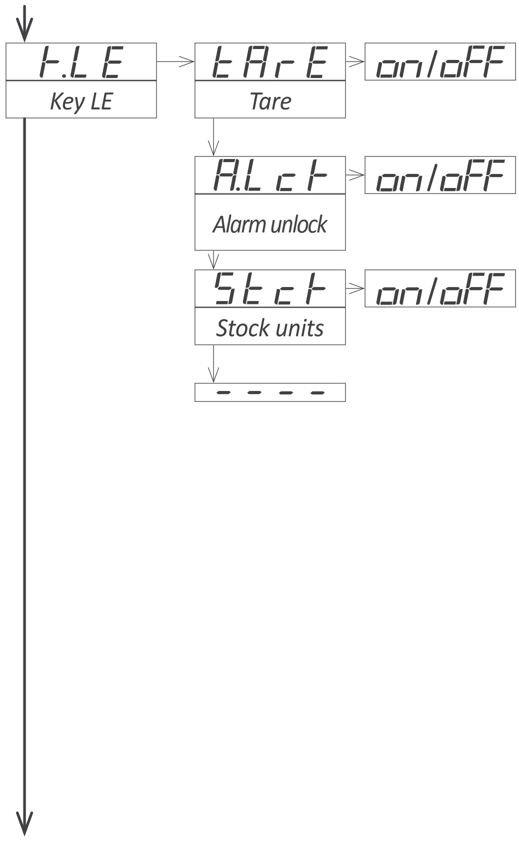



## 1.12.12 Front key 'LE' ( ◀ )

The front key 'LE' ( ◀ ) can be configured to activate a set of functions. Functions available are explained below :

- the '**Tare**' ('**tArE**') function applies a tare.
- the '**Alarm unlock**' ('**A.LcK**') function unlocks all alarms that are locked due to the 'Locked alarms' function *(see section 1.12.8).*
- the '**Stock units**' ('**Stck**') function assigns the actual weight to the number of units defined at the 'stock units' parameter *(see section 1.12.6).*

In case of multiple functions enabled, the activation is performed sequentially in the same order as the configuration menu (first is the tare, then the alarm unlock, etc).



## 1.12.13 Fast access

The '*fast access*' is an operator configurable menu. When configured, the operator can access the most usual functions with a single press of the front key 'UP' (▲). Functions available are listed below :

- access to alarm setpoints from the front key 'UP' (▲) allows to read and modify the actual setpoint values
- access to the 'stock units' parameter from the front key 'UP' (▲) allows to read and modify the actual 'stock value' parameter. See section *1.12.6* for additional information about the 'stock units' function.
- values for 'gross weight' and 'tare' are accessible from the front key 'UP' (▲) *(see section 1.9.5).* To reset the tare value visualize the value and press key 'UP' (▲). When message 'rSt' appears, press key 'SQ' (■). The instrument returns to visualize the 'tare' value. Press key 'LE' (◀) to leave the menu.
- functions 'signal mV', 'exc. voltage' and 'exc. current' five access to values for the input signal measured in mV, the excitation voltage measured in Vdc between terminals '*sense+*' and '*sense-*', and the excitation current measured in mA provided from the instrument to the load cell

  These three functions act as an integrated voltmeter and ammeter, to be used for troubleshooting purposes, as they give information on the real signals received and provided to the load cell.
- access to maximum and minimum memories from the front key 'UP' (▲) allows to visualize the values. To reset the maximum or minimum value, visualize the value, and press key 'UP' (▲). When message 'rSt' appears, press key 'SQ' (■). The instrument returns to visualize the actual memory value. Press key 'LE' (◀) to leave the menu

The '*fast access*' menu is not affected by the password function, allowing to have a locked access to the general configuration menu, while still some functions are accessible to the operator through the '*fast access*' menu.

• **Super fast access**

If only one function is configured at the '*fast access*' menu, pressing the front key 'UP' (▲) will shortly read the name of the function and then automatically show into the value.

## 1.12.14 'On power up' function

The '**On power up**' ('**on.Pu**') menu allows to define a series of functions to activate when the instrument restarts after a power loss.

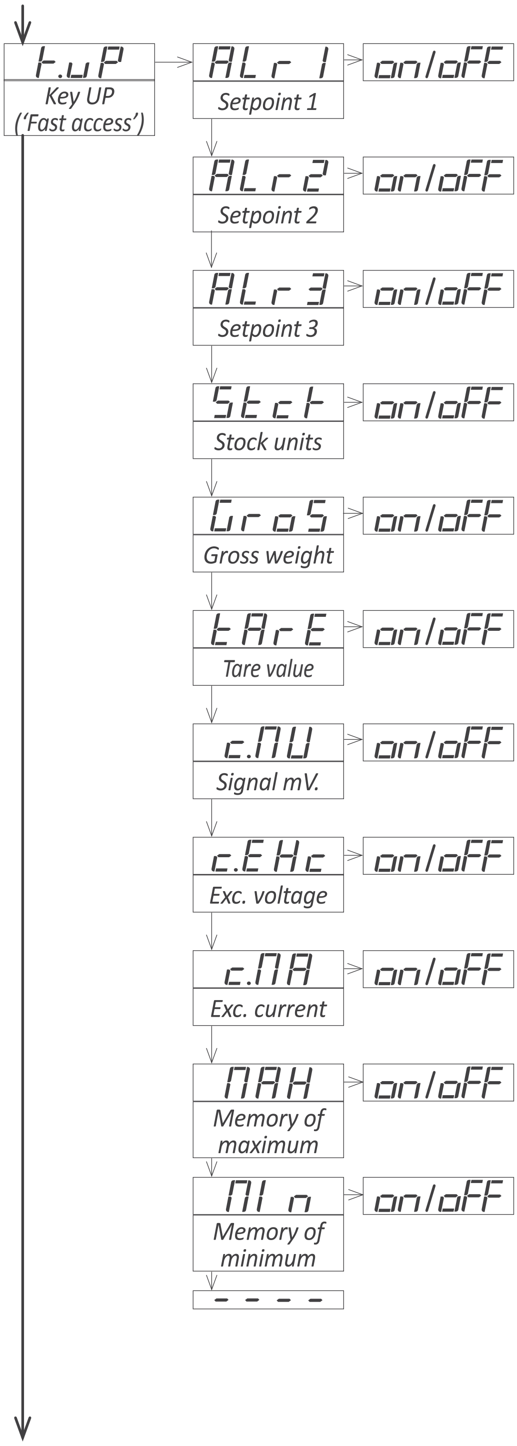
Functions available are a delay on the activation of measure and control functions, and a tare function.

These functions will activate only after a restart due to power-loss, they will not apply after a restart due to changes in configuration.

Delay the measure and control functions gives time to slow system elements to start completely before the instrument begins to acquire signal and control the outputs.

While on delay mode, the instrument shows all decimal points lightened and flashing, all alarms are deactivated, and there is no signal acquisition or communications control. When the delay time is over, the instrument starts its normal functioning.

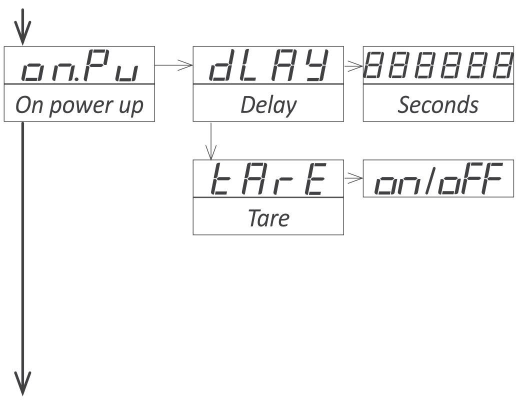
## 1.12.15 'Fast access' configuration menu




At the '**Key UP ('fast access')**' ('**K.uP**') menu configure which functions and parameters will be accessible through the 'fast access' menu. Select 'on' to activate each function. See section *1.12.13* for additional information.

- the '**Setpoint 1**' ('**ALr1**') function allows to visualize and modify the setpoint for alarm 1.
- the '**Setpoint 2**' ('**ALr2**') function allows to visualize and modify the setpoint for alarm 2.
- the '**Setpoint 3**' ('**ALr3**') function allows to visualize and modify the setpoint for alarm 3.
- the '**Stock units**' ('**Stck**') function allows to visualize and modify the quantity of units defined at the 'stock units' parameter *(see section 1.12.6)*.
- the '**Gross weight**' ('**GroS**') function allows to visualize the gross weight.
- the '**Tare value**' ('**tArE**') function allows to visualize the actual tare value.
- the '**Signal mV**' ('**c.MV**') function allows to visualize the actual value of the input signal, without scaling. Value is offered in mV.
- the '**Exc. voltage**' ('**c.EXc**') function allows to visualize the actual value of the excitation voltage, measured between terminals '*sense+*' and '*sense-*'. Value is offered in Vdc.
- the '**Exc. current**' ('**c.MA**') function allows to visualize the actual value of the current provided by the instrument to the load cell. Value is offered in mA.
- the '**Memory of maximum**' ('**MAX**') or '**Memory of minimum**' ('**MIn**') allows to visualize and/or reset the actual value of the maximum and minimum memory.

## 1.12.16 'On power up' configuration




The '**On power up**' ('**on.Pu**') menu assigns functions to apply when the instrument restarts after a power loss. See section *1.12.14* for additional information.

- at the '**Delay**' ('**dLAy**') parameter configure the time the instrument waits before starting normal operation. Value between 0 and 200 seconds.
- at the '**tare**' ('**tArE**') parameter configure to '**on**' to activate a tare every time the instrument restarts after a power loss.

## 1.12.17 Tools

The '**Tools**' ('**tooL**') menu groups functions with a variety of uses.

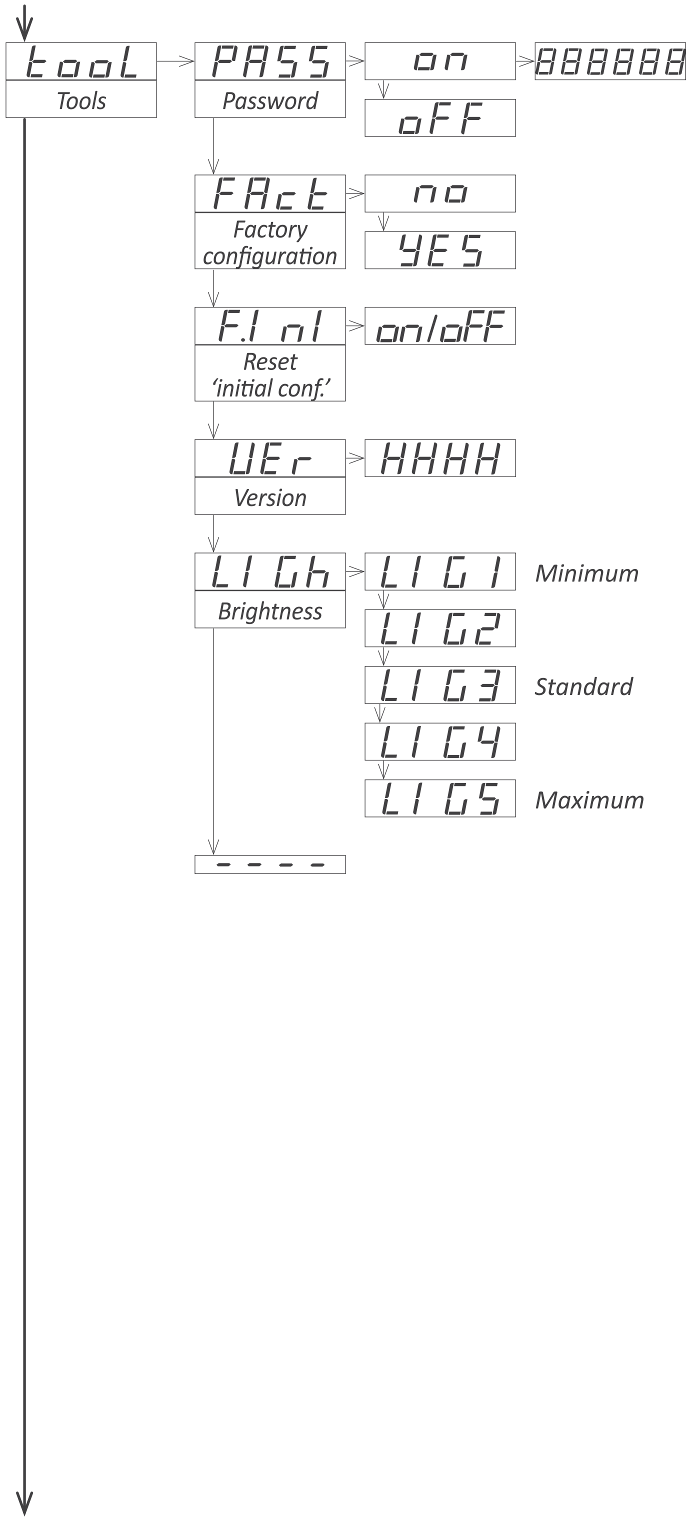
- at the '**Password**' ('**PASS**') function define a 6 digit code to block access to the 'configuration menu'. Activate the password to prevent access to the instrument configuration by non authorized personnel. To activate the '**Password**' function select '**on**' and enter the code.

  The numerical code is asked when accessing the 'configuration menu' (key'SQ' (■)). Functions configured to be accessible through the 'fast access' menu are not '**Password**' blocked.

- at the '**Factory configuration**' ('**FAct**') select '**yes**' to activate the default factory configuration (see section *1.14* for a list of default parameters). The cell configuration parameters ('**Initial conf.**' ('**Init**') menu) are not affected by this reset if the '**Reset 'initial conf.**'' ('**F.InI**') parameter is '**off**'.
- at the '**Reset 'initial conf**'' ('**F.InI**') parameter select '**on**' to include the cell configuration parameters when activating the default factory configuration.

> ⚠ The factory reset applied to the 'initial configuration' parameters affects the cell configuration parameters. For a correct reading, a new cell configuration must be applied, as indicated in section *1.12.2*.

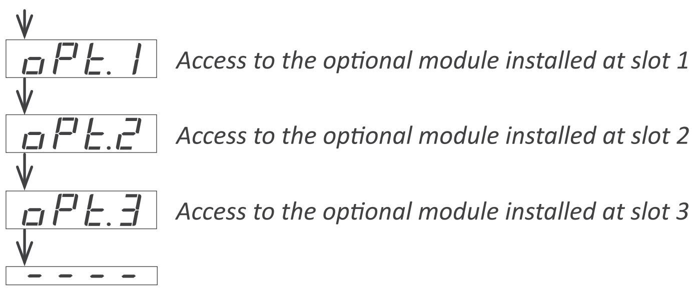
- the '**Version**' ('**VEr**') parameter informs about the firmware version loaded on the instrument.
- At the '**Brightness**' ('**LIGh**') parameter select the intensity of the display brightness. Five levels available. With this function the instrument brightness can be adapted to match the brightness of nearby instruments.




## 1.12.18 Access to options configurations menu

The 'OPt.1', 'OPt.2' and 'OPt.3' menu entries give access to the configuration menus for the optional modules installed at Opt.1, Opt.2 and Opt.3 slots.

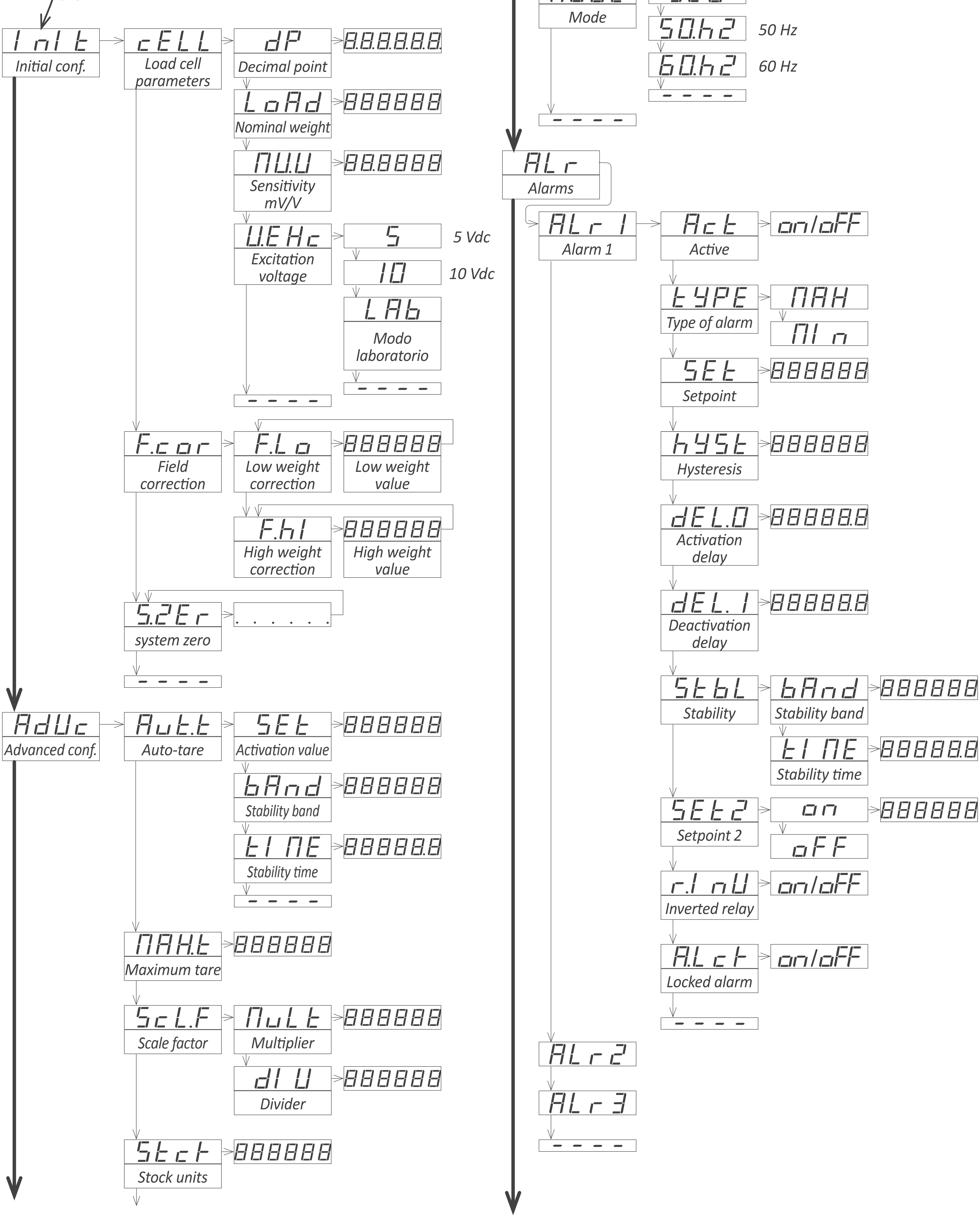
See section *2* for a list of the different modules available that can be installed on each slot. The configuration menu for each module is described at the User's Manual of each module.

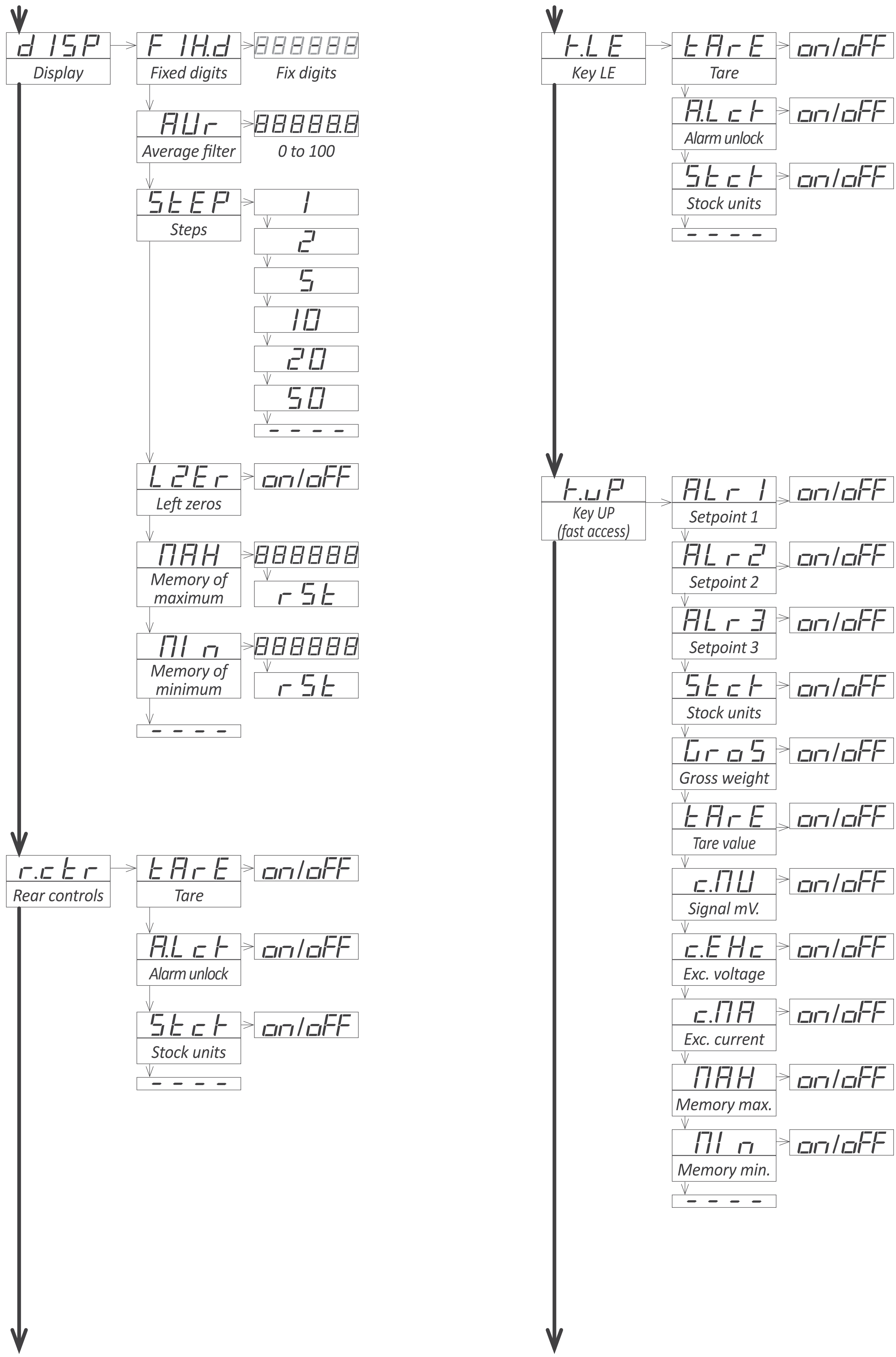


This page blank

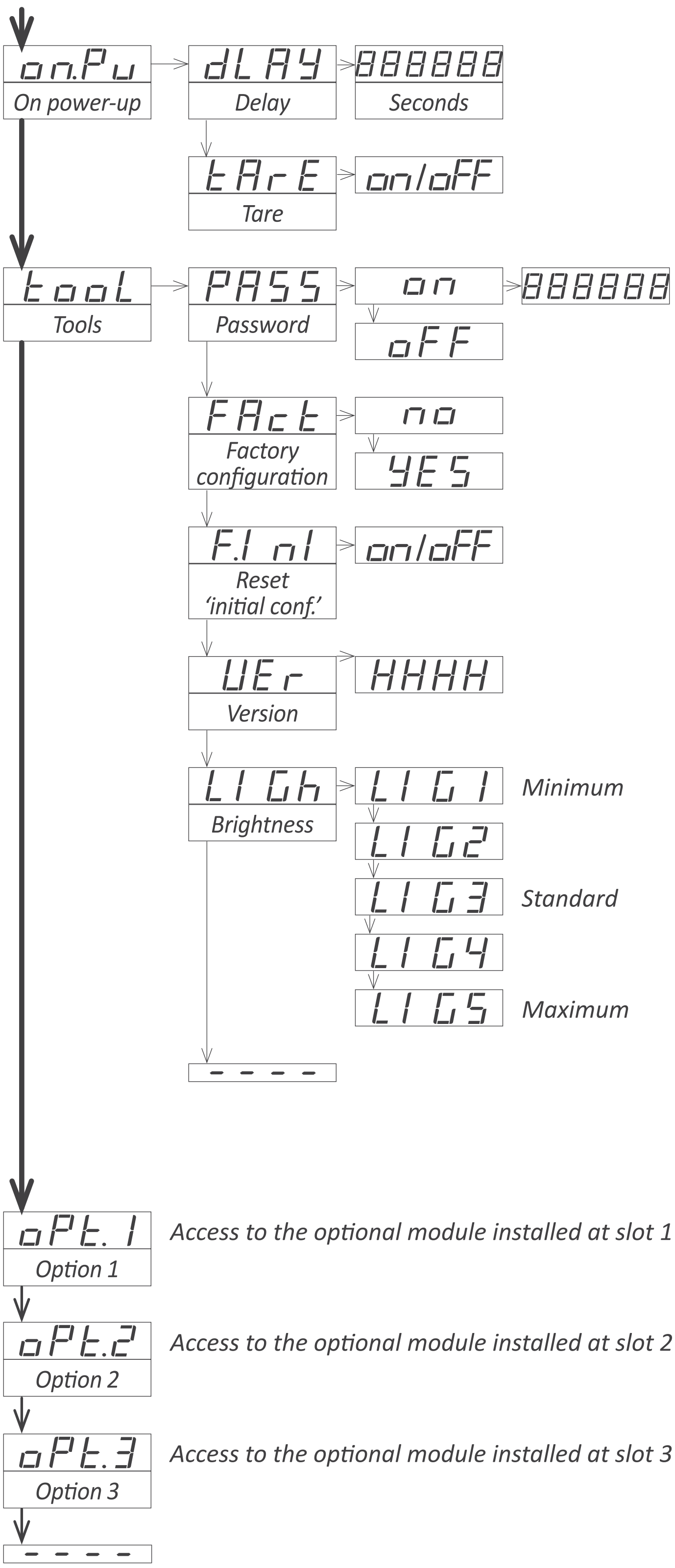
## 1.13 Full configuration menu

Press 'SQ' (■) for 1 second to access the '*configuration menu*'.




dISP
Display
FIHd
Fixed digits
888888
Fix digits
AUr
Average filter
888888
0 to 100
StEP
Steps
1
2
5
10
20
50
----
L2Er
Left zeros
on/oFF
MAH
Memory of maximum
888888
rSt
MIn
Memory of minimum
888888
rSt
----
r.ctr
Rear controls
tArE
Tare
on/oFF
A.Lck
Alarm unlock
on/oFF
Stck
Stock units
on/oFF
----
k.LE
Key LE
tArE
Tare
on/oFF
A.Lck
Alarm unlock
on/oFF
Stck
Stock units
on/oFF
----
k.uP
Key UP (fast access)
ALr1
Setpoint 1
on/oFF
ALr2
Setpoint 2
on/oFF
ALr3
Setpoint 3
on/oFF
Stck
Stock units
on/oFF
GroS
Gross weight
on/oFF
tArE
Tare value
on/oFF
c.MU
Signal mV.
on/oFF
c.EHc
Exc. voltage
on/oFF
c.MA
Exc. current
on/oFF
MAH
Memory max.
on/oFF
MIn
Memory min.
on/oFF
----

## 1.14 Full configuration menu (cont)



## 1.14 Factory configuration

| | |
|---|---|
| Initial configuration ('**InIt**') | |
| Load cell parameters ('**cELL**') | |
| Decimal point ('**dP**') | without (XXXXXX) |
| Sensitivity mV/C ('**MV.V**') | 2.0000 |
| Nominal weight('**LoAd**') | 200000 |
| Excitation voltage ('**V.Exc**') | 10 Vdc ('**10**') |
| Advanced configuration ('**AdVc**') | |
| Auto-tare ('**Aut.t**') | |
| Activation value('**SEt**') | 10 |
| Stability band ('**bAnd**') | 0 (disabled) |
| Stability time ('**tIME**') | 0.0 (disabled) |
| Maximum tare ('**MAX.t**') | 999999 |
| Scale factor ('**ScL.F**') | |
| Multiplier ('**MuLt**') | 1 |
| Divider('**dIV**') | 1 |
| Stock units ('**Stck**') | 0 (disabled) |
| Mode ('**ModE**') | standard ('**Std**') |
| Alarms 1,2 and 3 ('**ALr.1**', '**ALr.2**', '**ALr.3**') | |
| Active ('**Act**') | off (disabled) |
| Type ('**tYPE**') | maximum ('**MAX**') |
| Setpoint ('**SEt**') | 1000 |
| Hysteresis ('**hYSt**') | 0 counts |
| Activation delay ('**dEL.0**') | 0.0 seconds |
| Deactivation delay ('**dEL.1**') | 0.0 seconds |
| Stability ('**StbL**') | |
| Stability band ('**bAnd**') | 10 counts |
| Stability time ('**tIME**') | 0.0 (disabled) |
| Setpoint 2 ('**SEt.2**') | off (disabled) |
| Inverted relay ('**r.InV**') | off |
| Locked alarms ('**A.LcK**') | off |
| Display ('**dISP**') | |
| Fixed digits ('**FIX.d**') | no fixed digits ('**------**') |
| Average filter('**AVr**') | 0 (disabled) |
| Steps ('**StEP**') | 1 |
| Left zeros ('**LZEr**') | off |
| Memory of maximum ('**MAX**') | -199999 |
| Memory of minimum ('**MIn**') | 999999 |
| Rear controls ('**r.ctr**') | all 'off' |
| Key LE ('**K.LE**') | |
| Tare | on |
| Alarm unlock | off |
| Stock units | off |
| Key UP ('**K.uP**') | all 'off' |
| On power up | |
| Delay | 0 |
| Tare | off |
| Tools | |
| Password ('**PASS**') | off |
| Reset 'initial conf.'('**F.Ini**') | off |
| Brightness ('**LIGh**') | 3 |

## 1.15 Messages and errors

Error messages are informed flashing on display.

| ***Messages and errors*** | |
|---|---|
| *'d.udr'* *'d.oVr'* | display underrange ('**d.udr**') / overrange ('**d.ovr**'). The display is already reading the minimum / maximum value possible (-199999 / 999999). |
| *'Err.0'* | incorrect scaling (vertical slope) |
| *'Err.1'* | incorrect password. |
| *'Err.2'* | when accessing an '**oPt.X**' menu entry, there is no recognize module installed. |
| *'Err.6'* | in 'stock units' mode, weight value is 0 and can not be assigned to a quantity of units. |
| *'Err.8'* | over current at the excitation voltage. |
| *'----'* | requested reading is not accessible (reading of units with the 'stock units' mode disabled). |

*Table 6 - Messages and error codes*

# 1.16 Practical cases

## 1.16.1 Normal case

Case for 1 load cell, powered from the instrument, with power 10 Vdc, nominal weight 100 Kg and 2 mV/V sensibility.

- Connect the load cell to the instrument *(see section 1.8).*
- Configure the 'theoretical configuration of the load cell' *(see section 1.12.2).*
- Apply the 'empirical configuration of the load cell' *(see section 1.12.2).*
- Configure the 'system zero' *(see section 1.12.2).*

Depending on the specifications of your load cell, you may need to apply a 'tare' each time that the weight is removed from the load cell. See at section *1.11* the different options available to activate the 'tare' function.

## 1.16.2 Load cell with external power

Case for 1 load cell, with external power.

- Connect the load cell normally, and **do not** connect 'Vexc+'. Connect 'Sense+' and 'Sense-' to the load cell. 'Vexc-' must be connected to 'Sense-'. See *Figure 9.*
- Configure the 'theoretical configuration of the load cell' *(see section 1.12.2).* The value assigned to Vexc does not affect the measure.
- Apply the 'empirical configuration of the load cell' *(see section 1.12.2).*
- Configure the 'system zero' *(see section 1.12.2).*

Depending on the specifications of your load cell, you may need to apply a 'tare' each time that the weight is removed from the load cell. See at section *1.11* the different options available to activate the 'tare' function.

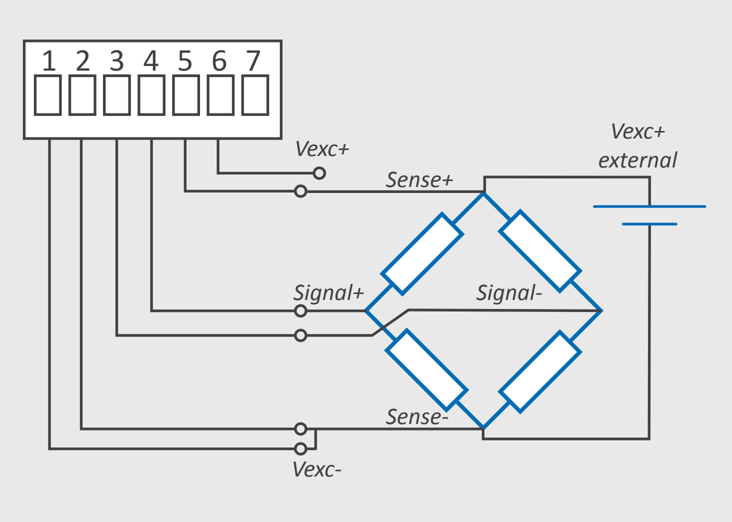



*Figure 9 - Connections for external power*

## 1.16.3 Connections with a junction box

> ⚠ A 'junction box' for load cells has internal electronics that can modify the 'signal / weight' relation provided to the instrument. Check the manufacturer documentation of the junction box.

Case for 4 load cells connected to a 'junction box'. It is assumed that the 'junction box' is used as a simple 'connections box'. All 4 load cells are the same type of load cell, with nominal weight of 100 Kg and 2 mV/V sensibility.

- Connect the 4 load cells to the 'junction box'. Connect the instrument to the 'junction box' using 4 or 6 wires, as indicated in the 'junction box' documentation. If 4 wires 'junction box' is used, see section *1.8.1* to connect the 'sense' wires not used ('sense' wires must connected).
- Configure the 'theoretical configuration of the load cell' *(see section 1.12.2).* Take note that the sensitivity of the system remains the same (2 mV/V) and the nominal weight of the system is the addition of the nominal weight of each cell (4 x 100 Kg = 400 Kg)
- Apply the 'empirical configuration of the load cell' *(see section 1.12.2).*
- Configure the 'system zero' *(see section 1.12.2).*

Depending on the specifications of your load cell, you may need to apply a 'tare' each time that the weight is removed from the load cell. See at section *1.11* the different options available to activate the 'tare' function..

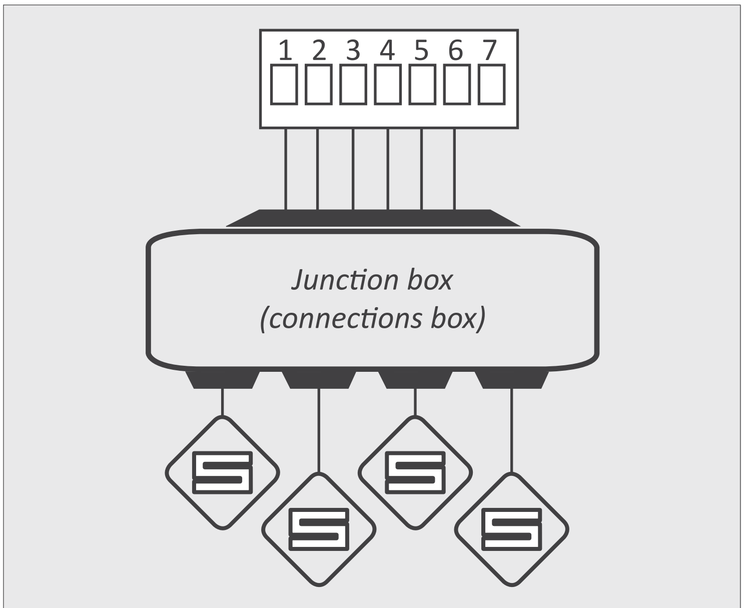



*Figure 10 - Example for 4 load cells connection through a 'junction box' or 'connections box'.*

# 1.16 Practical cases (cont.)

## 1.16.4 Connections with 3 or 4 load cells

Using 3 load cells is the optimal way to distribute the weight on a plane, although it is common to work with 4 load cells, in applications with tanks, hoppers and similar.

When working with multiple load cells, the optimal connection is the one that makes the wires of the cell converge in the same central area, so that all the cells are at the same 'electrical distance' from the meter.

Use the same type load cell (for example, load cells with nominal load of 100 Kg and sensitivity of 2 mV/V) and connect the wires to the central area as indicated below. Configure the instrument as indicates in this manual, assuming that :

- the sensitivity of the system remains the same (2 mV/V)
- the nominal weight of the system is the addition of the nominal weight of each cell (3 x 100 Kg = 300 Kg for 3 cells or 4 x 100 Kg = 400 Kg for 4 cells)
- the 'sense' wires are carried to the central zone together with the Vexc wires, but are not propagated to each individual cell. If you do not want to use the 'sense' wires, see section *1.8.1*.

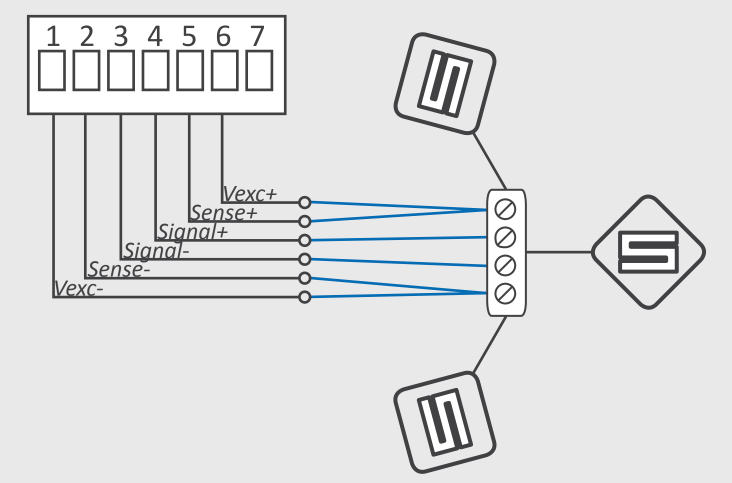



*Figure 11 - Connection example with 3 load cells.*

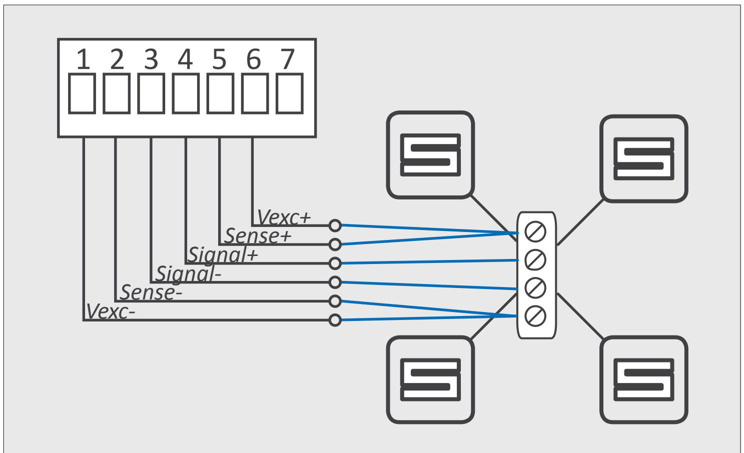



*Figure 12 - Connection example with 4 load cells.*

## 1.16.5 Measuring mV at the laboratory

If you wish to configure the instrument to measure a millivolt generated signal at the laboratory, there is a special configuration to apply. Different from the load cell, the millivolt generator is not a differential system, and does not need excitation voltage.

- Connect the instrument to the millivolt meter *(see Figure 13)*. Add 2 resistances of 10 KOhm to connect the 'Vexc' terminals to the common of the signal generator.
- Inside the 'configuration menu', select the 'Vexc' parameter to 'Lab' *(see section 1.12.2)*. This value deactivates the ratiometric measurement and activates the direct millivolt measurement.
- At the additional parameters at the 'theoretical configuration of the load cell' *(see section 1.12.2)* assign the desired reading and the mV/V parameter. Note that values of 1 mV/V, 2 mV/V and 3 mV/V will activate a full scale range of 10 mV, 20 mV and 30 mV respectively.
- **Do not** apply the 'empirical configuration of the load cell' *(see section 1.12.2).* Applying this characterization to the signal generator will only generate a reduction in the measurement accuracy.
- Configure the 'system zero' *(see section 1.12.2).* This step is needed for a correct mV measurement. Generate 0 mV and 'assign the system zero'.

⚠ To reduce leak currents that can affect the laboratory measurement:

1. if the millivolt generator is powered from the mains network, use an isolator transformer to power the generator
2. if the instrument is powered from the mains network, use a separate isolator transformer to power the instrument

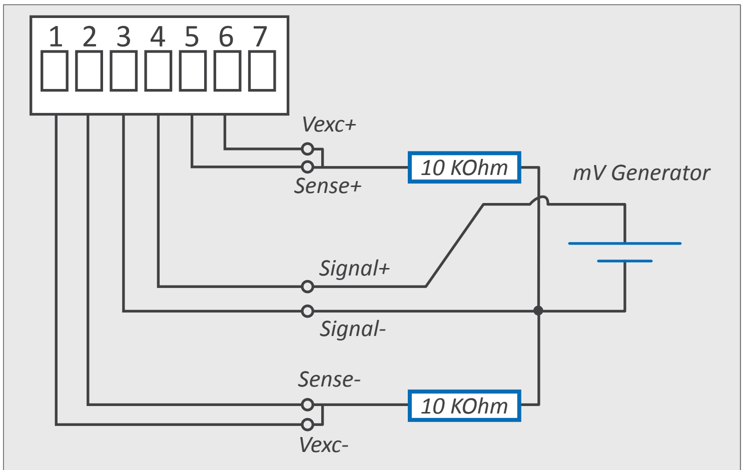
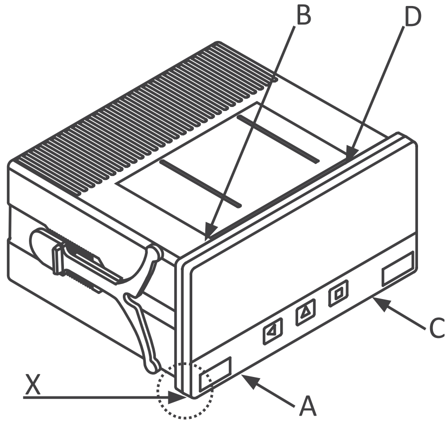



*Figure 13 - Connections for 'laboratory' mode*

## 1.17 To access 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 corner 'X', and then insert clips 'A', 'B', 'C' and 'D', in this order.




*Observe precautions for handling ESD (electrostatic discharge) sensitive devices*

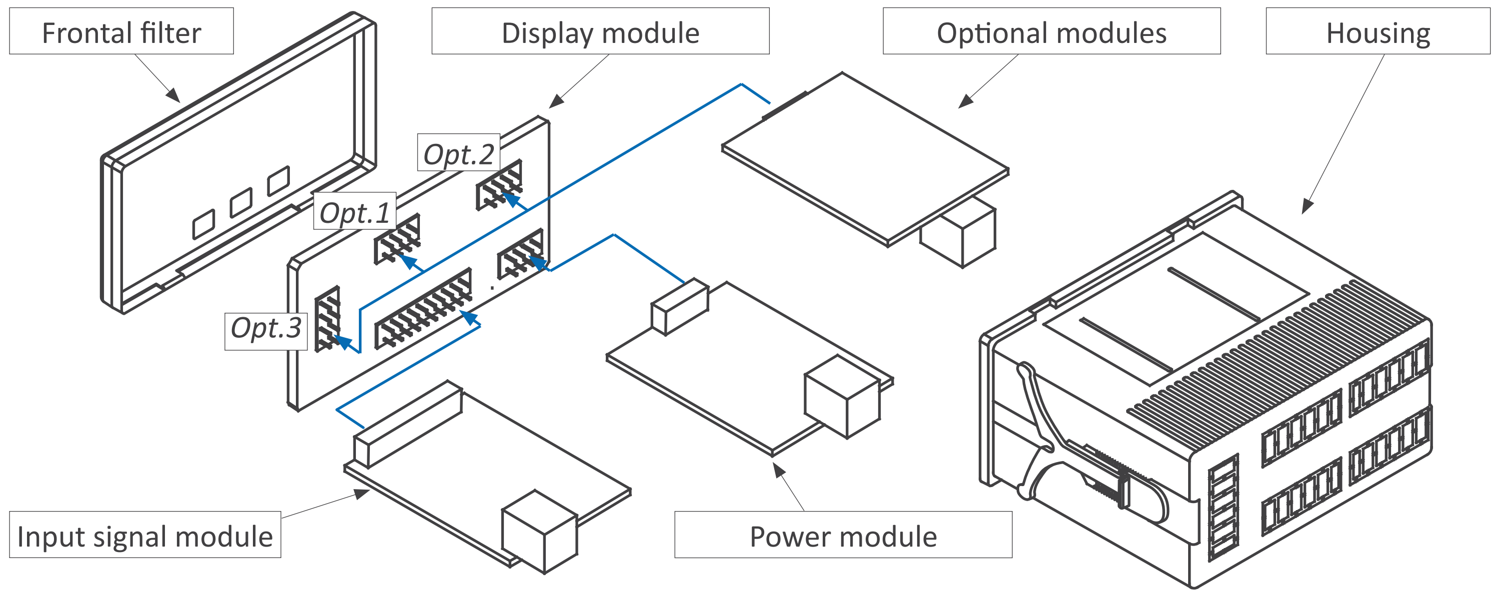
*Risk of electric shock. Removing the front cover will grant access to the internal circuits. Disconnect the input signal to prevent electric shock to the operator. Operation must be performed by qualified personnel only.*

## 1.18 Modular architecture

Series M panel meter are designed based on a modular architecture. This modularity allows to replacement, change or add any of the internal modules conforming the instrument.

Below is a graphical explanation of the location of each module.

See section *2* for a list of optional modules available.

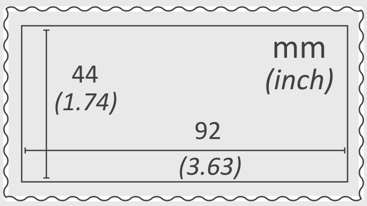



**How to Install in a panel**

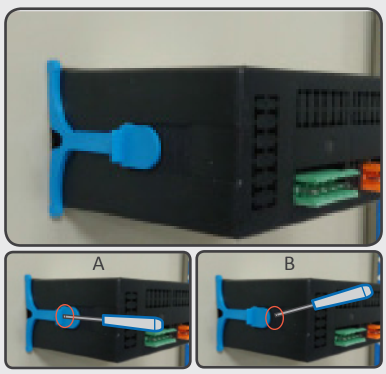
1. Remove the 2 blue plastic tabs from each side of the unit.
2. Insert instrument from the front of panel into panel cut out.
3. Re-attach the 2 blue plastic tabs by sliding each one into the track opening on each side and push until the tabs grab onto the notches until snug onto the back of panel.

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



## 1.19 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.

## 1.20 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.

## 1.21 CE declaration of conformity

Product DPS20 Series

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

Electromagnetic compatibility directive 2014/30/EU
Low voltage directive 2014/65/EU
Directive ROHS 2011/65/EU

**Security rules EN-61010-1**

| | |
|---|---|
| Instrument | Fixed<br>Permanently connected |
| Degree of pollution 1 and 2 (without condensation) | |
| Isolation | Double |

**Electromagnetic compatibility rules EN-61326-1**

| | | |
|---|---|---|
| EM environment | | Industrial |
| ***Immunity levels*** | | |
| EN-61000-4-2 | By contact ±4 KV | Criteria B |
| | By air ±8 KV | Criteria B |
| EN-61000-4-3<br>**use shielded cable for signal and power lines to assure compliance with the rule.* | | Criteria A |
| EN-61000-4-4 | On AC power lines: ±2 KV | Criteria B |
| | On DC power lines: ±2 KV | Criteria B |
| | On signal lines : ±1 KV | Criteria B |
| EN-61000-4-5 | Between AC power lines ±1 KV | Criteria A |
| | Between DC power lines DC ±0.5 KV | Criteria A |
| EN-61000-4-6<br>**maintain signal and control lines below 3 meter length to assure compliance with the rule.* | | Criteria A |
| EN-61000-4-8 | 30 A/m a 50/60 Hz | Criteria A |
| EN-61000-4-11 | 0 % 1 cycle | Criteria A |
| | 40 % 10 cycles | Criteria A |
| | 70 % 25 cycles | Criteria B |
| | 0 % 250 cycles | Criteria B |
| ***Emission levels*** | | |
| CISPR 11 | Instrument Class A, Group 1 | Criteria A |

*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 Módules R1, T1 and SSR

The R1, T1 and SSR modules provides 1 relay output, 1 transistor output or 1 SSR drive output, to install in DPS20 digital panel meters, up to a maximum of 3 modules in a single meter.

Configuration is performed from the frontal keypad of the meter, by setting the parameters at the alarms configuration menu ('ALr.1', 'ALr.2' or 'ALr.3' depending on the position the module is installed). The menu allows to configure the setpoint, hysteresis, independent activation and deactivation delays, and a second setpoint to create alarm windows.

Modules R1, T1 and SSR are isolated against all other instrument circuits, and isolated between them.

Modules R1, T1 and SSR can be ordered pre-installed into a DPS20 digital panel meter, or standalone for delayed installation, as they do not require soldering or special configuration.

| | |
|---|---|
| Option | R1 |
| Output type | relay |
| Relay type | 3 contact relay (NC, NO, common) |
| Maximum current | 8 A (resistive load) |
| Maximum voltage | 250 Vac continuous |
| Isolation | 3500 Veff |
| Type of terminal | plug-in screw terminal pitch 5.08 mm |
| Installation allowed at | 'Opt.1', 'Opt.2', ' Opt.3' |
| Option | T1 |
| Output type | transistor |
| Maximum voltage | 35 Vdc |
| Maximum current | 50 mA |
| Isolation | 3500 Veff |
| Type of terminal | plug-in screw terminal pitch 5.08 mm |
| Installation allowed at | 'Opt.1', 'Opt.2', ' Opt.3' |
| Option | SSR |
| Output type | to control a SSR relay |
| Output voltage | +15 Vdc |
| Maximum current | 45 mA |
| Isolation | 1000 Vdc |
| Type of terminal | plug-in screw terminal pitch 5.08 mm |
| Installation allowed at | 'Opt.1', 'Opt.2', ' Opt.3' |

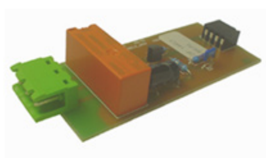
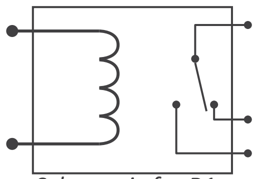
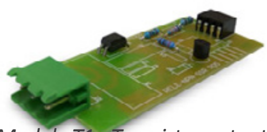
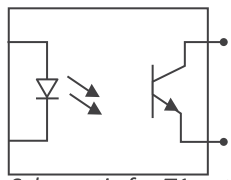
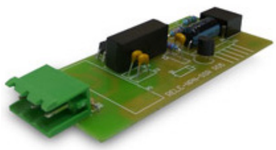
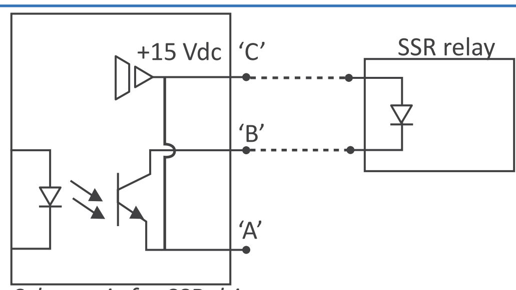
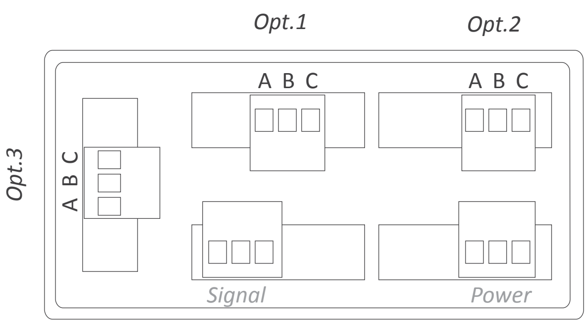
| *Module* | *Output schematics and connections* |
|---|---|
|  *Module R1 - Relay output* |   *Schematic for R1 output* |
|  *Module T1 - Transistor output* |   *Schematic for T1 output* |
|  *Module SSR - SSR drive output* |   *Schematic for SSR drive output* |

*Table 7 - Connections*




**Rear view DPS20**

## 2.2 Module AO

Module AO provides 1 analog output configurable as 4/20 mA or 0/10 Vdc, to install in DPS20 digital panel meters.

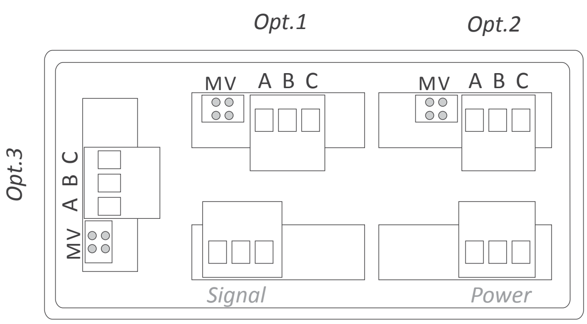
Configuration is performed from the frontal keypad of the meter, by setting the parameters at the options configuration menu ('Opt.1', 'Opt.2' or 'Opt.3' depending on the position the module is installed).

The output signal is proportional to the instrument reading, and it can be fully scaled with direct (positive) or inverted (negative) slopes. The mA output can be configured as an active loop (the instrument provides the excitation for the loop ) or as a passive loop (the loop is externally powered).

⚠ A maximum of 1 analog output module can be installed in a single instrument. The analog output is isolated from all other circuits.

Modules AO can be ordered pre-installed into a DPS20 digital panel meter, or standalone for delayed installation, as they do not require soldering or special configuration.

| **Option** | **AO** |
|---|---|
| Output type | analog output |
| Output signals | 4/20 mA active<br>4/20 mA passive<br>0/10 Vdc |
| Max. signal output | 22 mA, 10.5 Vdc |
| Min. signal output | 0 mA, -50 mVdc |
| Scaling | related to the instruments reading<br>direct or inverse slope |
| Vexc (terminal A) | +13.8 Vdc ± 0.4 Vdc (max. 25 mA)<br>protected against short circuit |
| Load impedances | ≤350 Ohms (in 4/20 mA active)<br>≤800 Ohms (in 4/20 mA passive) *(with a 24 Vdc external Vexc) (maximum 27 Vdc between terminals 'B' and 'C')*<br>≥10 KOhms (in 0/10 Vdc) |
| Accuracy (at 25 ºC) | <0.1 % FS |
| Thermal stability | 60 ppm/ºC in mA mode<br>50 ppm/ºC in Vdc mode |
| Step response | <75 mSeconds + meter step response (0% to 99% signal) |
| Isolation | 1000 Vdc |
| Warm-up | 15 minutes |
| Type of terminal | plug-in screw terminal<br>pitch 5.08 mm |
| Installation allowed at | 'Opt.1', 'Opt.2', 'Opt.3' |




**Rear view DPS20**

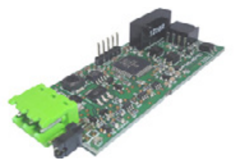
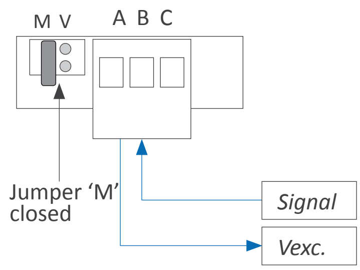
| *Module* | *Connections* | |
|---|---|---|
|  *Module AO - Analog output* | Terminal A<br>Terminal B<br>Terminal C<br>Jumper M<br>Jumper V | Vexc<br>Signal (mA or Vdc)<br>GND<br>closed for 'mA'<br>closed for 'Vdc' |

*Table 8 - Connection terminals*

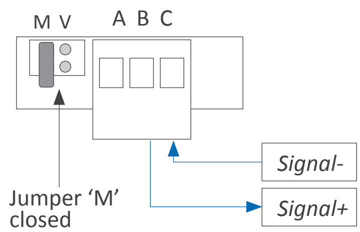
**Output 4/20 mA active**

*The current loop is powered from the 'AO' module*




**Output 4/20 mA passive**

*The current loop is powered from an external equipment*




**Output 0/10 Vdc**

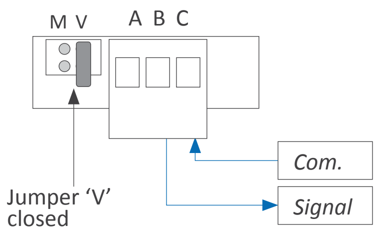



*Table 9 - Connections for each output mode*

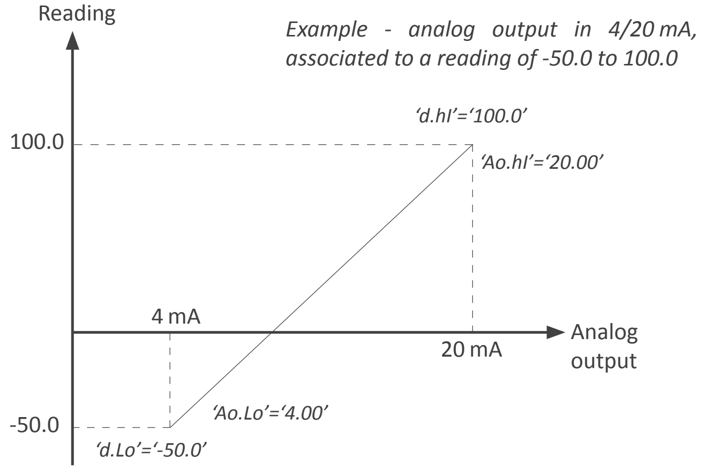
## 2.2.1 Configuration menu

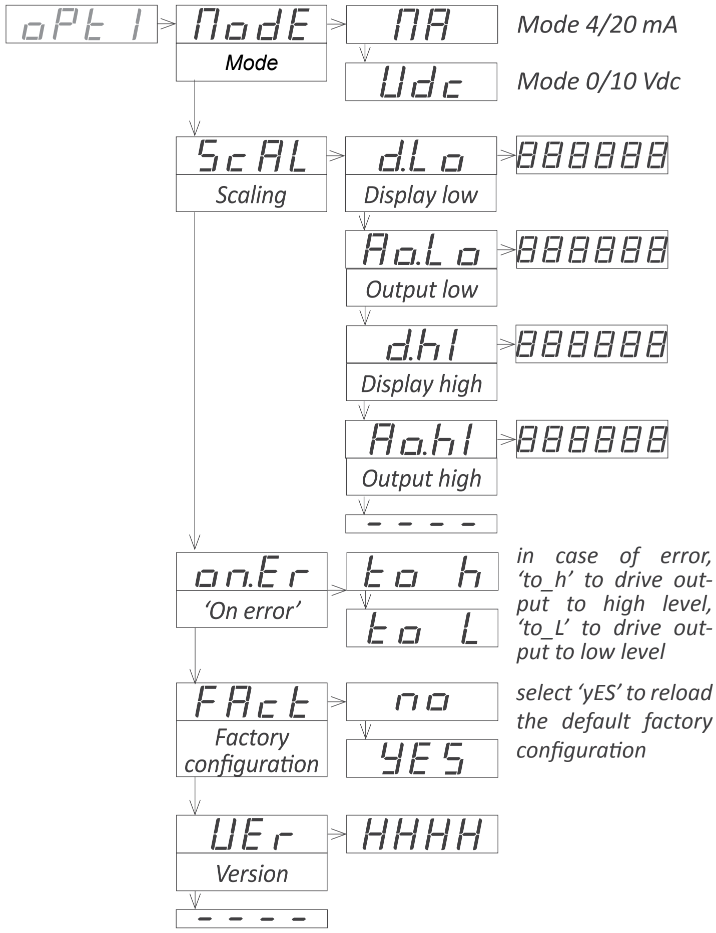
Configure at menu 'Mode' ('ModE') the output signal range to '4/20 mA' ('mA') or '0/10 Vdc' ('Vdc'). Position for jumpers 'V' and 'M' must be according to the range selected.

At menu 'Scaling' ('ScAL') configure the values that define the two points ('high' and 'low') of the 'signal-reading' slope:

- the lower slope point, defined by 'Display low' ('d.Lo') and 'Output low' ('Ao.Lo')
- the higher slope point, defined by 'Display high' ('d.hI') and 'Output high' ('Ao.hI')

Analog output values are shown with 'XX.XX' format, acceptable values are '0.00' to '10.00' Vdc for voltage, and '0.00' to '20.00' mA for current.




## 2.2.2 Error codes

'Er.34' output signal configured to value lower than 0 Vdc or 0 mA

'Er.35' output signal configured to a value higher than 10 Vdc or 20 mA

'Er.36' configured slope points are not acceptable, such as : 'd.Hi'='d.Lo'

'Ao.Hi'='Ao.Lo'

('Ao.Hi'-'Ao.Lo')>('d.Hi'-'d.Lo')

## 2.2.3 Factory configuration

| | |
|---|---|
| Mode | 'mA' |
| Scaling | |
| Display Low | 0 |
| Output Low | 4.00 [mA] |
| Display High | 9999 |
| Output High | 20.00 [mA] |
| On error | to high level('to_h')' |

## 2.3 Module RTU

Module RTU provides 1 Modbus RTU communications port, to install in DPS20 digital panel meters. Enables protocol function '4' ('*Read Input Registers*') to access the instrument registers (reading value, alarm status, memory of maximum and minimum, setpoint values, ...).

Protocol configuration is performed from the frontal keypad of the meter, by setting the parameters at the options configuration menu ('Opt.1', 'Opt.2' or 'Opt.3' depending on the position the module is installed).

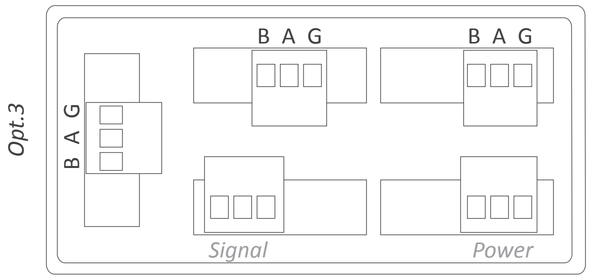
Up to a maximum of 3 RTU modules can be installed in a single instrument, all modules isolated between them and isolated from all other circuits.

Modules RTU can be ordered pre-installed into a DPS20 digital panel meter, or standalone for delayed installation, as they do not require soldering or special configuration.

| **Option** | **RTU** | |
|---|---|---|
| Output type | Modbus RTU communication port | |
| Function implemented | 4 (Read_Input_Registers) | |
| Addresses | 01 to 247 | |
| Exception codes | see section | |
| Registers | see section 1.9.3 | |
| Bus | RS-485 | |
| speed | 57.6 Kbps to 600 bps | |
| Data format | 8n1 (standard), 8o1, 8n2, 8e1 | |
| bus terminator | not included | |
| Isolation | 1000 Vdc | |
| Configuration | 3 button front keypad | |
| Temperature | operation from 0 to 50 ºC | |
| | storage from -20 to +70 ºC | |
| Factory configuration | 'Address | 1' |
| | 'Speed | 19.2 Kbps' |
| | 'Format | 8n1' |
| | 'Decimal point | Auto' |
| Installation allowed at | 'Opt.1', 'Opt.2', 'Opt.3' | |

| *Module* | *Connections* | |
|---|---|---|
|  *Module RTU - Modbus RTU* | *Terminal B* | *B signal from RS-485 bus* |
| | *Terminal A* | *A signal from RS-485 bus* |
| | *Terminal G* | *GND* |

*Table 11 - Connection terminals*



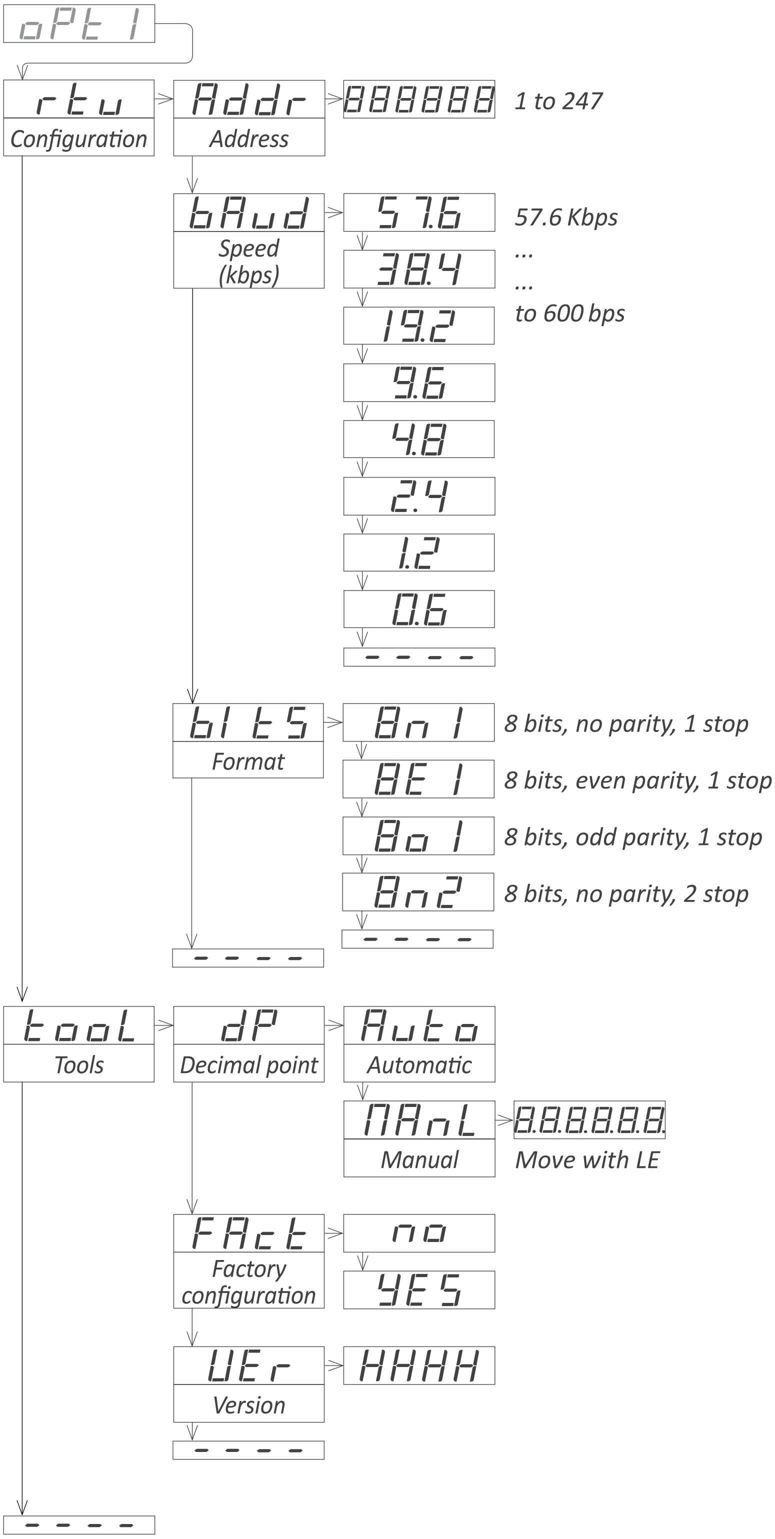

**Rear view DPS20**

### 2.3.1 Accessible registers

| *Register* | *Name* | *Description* | *Size* | *Refresh* | *Value : Series M* | *Value : Series K and S* |
|---|---|---|---|---|---|---|
| *0* | *DISPLAY1_L* | *Display value* | *16 bits* | *same as display* | *999999 to -199999* | *9999 to -1999* |
| *1* | *DISPLAY1_H* | | *16 bits* | | | |
| *2* | *DECIMALS1* | *Decimals on display* | *16 bits* | | *0 to 6* | *0 to 4* |
| *3* | *MAXMEM_L* | *Memory of maxi-mum* | *16 bits* | *every 30 seconds* | *999999 to -199999* | *9999 to -1999* |
| *4* | *MAXMEM_H* | | *16 bits* | | | |
| *5* | *MINMEM_L* | *Memory of mini-mum* | *16 bits* | | *999999 to -199999* | *9999 to -1999* |
| *6* | *MINMEM_H* | | *16 bits* | | | |
| *7* | *SETPOINT1_L* | *Setpoint 1 value* | *16 bits* | *every 2 seconds* | *999999 to -199999* | *9999 to -1999* |
| *8* | *SETPOINT1_H* | | *16 bits* | | | |
| *9* | *SETPOINT2_L* | *Setpoint 2 value* | *16 bits* | | *999999 to -199999* | *9999 to -1999* |
| *10* | *SETPOINT2_H* | | *16 bits* | | | |
| *11* | *SETPOINT3_L* | *Setpoint 3 value* | *16 bits* | | *999999 to -199999* | *9999 to -1999** |
| *12* | *SETPOINT3_H* | | *16 bits* | | | |
| *13* | *STATUS* | *Alarm status Instrument status* | *16 bits* | *same as display* | *bit 0...7 alarm status bit 8...16 instrument status* | |
| *14 a 16* | *Reserved* | *Reserved* | *16 x 3 bits* | | *Not accessible* | *Not accessible* |

*Table 10 - Registers accessible via MODBUS-RTU.*
*All registers codified as binary numbers. Negative values are codified in two's complement.*

## 2.3.2 Configuration menu




Configure at menu '**Configuration**' ('**rtu**'), the address value between '1' and '247' at parameter '**Address**' ('**Addr**'), bus speed in kbps at parameter '**Speed**' ('**bAud**') and data format at parameter '**Format**' ('**bItS**').

Special tools are grouped inside the '**Tools**' ('**TooL**') menu.

- the '**Decimal point**' ('**dP**') menu is provided for compatibility with ancient hardware that does not support decimal point retransmission. By default, select '**Automatic**' ('**Auto**'). If your instrument does nos transmit the decimal point position, select '**Manual**' ('**MAnL**') and fix the position of the decimal point manually.
- at the '**Factory reset**' ('**FAct**') menu, select '**yes**' to load the default factory configuration for the instrument.

the '**Version**' ('**VEr**') menu informs of the current firmware version installed in the module.

## 2.3.3 Exception codes

The Modbus RTU protocol defines the following scenarios when a 'Master' is sending a frame to a 'Slave':

- the 'Slave' device receives the frame correctly and replies with the requested data
- the 'Slave' devices detects a CRC error, parity error, or other. and discards the frame without generating a reply frame. The 'Master' will detect a 'TIMEOUT' condition due to the absence of reply.
- the 'Slave' device receives the frame correctly, but replies with an 'EXCEPTION_CODE' as it can not process the function or register requested.

The 'EXCEPTION_CODES' configured in the RTU module are :

| *Exception code* | *Name* | *Description* |
|---|---|---|
| *0* | ILLEGAL_FUNCTION | *Requested function is not supported* |
| *1* | ILLEGAL_DATA_ADDRESS | *Requested register is not supported* |

*Table 12 - Exception codes*

## 2.3.4 Description for Modbus RTU registers

**Register R0 and R1 (DISPLAY1_L and DISPLAY1_H)**

Contains the display value of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example R0=FBF1 (hex) and R1=0009 (hex)*
*Register value = 0009 FBF1 (hex)*
*Reading value = 654321*

**Register R2 (DECIMALS1)**

Contains the number of decimals of the display, codified in a single register of 16 bits. Possible values are from 0 to 6.

*Example R2=0002 (hex)*
*Number of decimals = 2 = 6543.21*

**Register R3 and R4 (MAXMEM_L and MAXMEM_H)**

Contains the memory of maximum reading of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example - same example as in R0 and R1 but accessing to R3 and R4.*

**Register R5 and R6 (MINMEM_L and MINMEM_H)**

Contains the memory of minimum reading of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example - same example as in R0 and R1 but accessing to R5 and R6.*

**Register R7 and R8 (SETPOINT1_L and SETPOINT1_H)**

Contains the setpoint value of alarm 1, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example - same example as in R0 and R1 but accessing to R7 and R8.*

**Register R9 and R10 (SETPOINT2_L and SETPOINT2_H)**

Contains the setpoint value of alarm 2, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example - same example as in R0 and R1 but accessing to R9 and R10.*

**Register R11 and R12 (SETPOINT3_L and SETPOINT3_H)**

Contains the setpoint value of alarm 3, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

*Example - same example as in R0 and R1 but accessing to R11 and R12.*

**Register R13 (STATUS)**

Information bit-by-bit, for the alarm status (on / off) and instrument status. See below for a description.

Bit 0 Alarm 1 status (0 = inactive, 1 = active)
Bit 1 Alarm 2 status (0 = inactive, 1 = active)
Bit 2 Alarm 3 status (0 = inactive, 1 = active)
Bit 3 a 7 Reserved
Bit 8 Display overrange
Bit 9 Display underrange
Bit 10 Lost communication with the main processor
Bit 11 to 15 Reserved

**Registers R14, R15 and R16**

Reserved

## 2.4 Module S4

Module S4 provides 1 RS-485 ASCII communications port, to install in DPS20 digital panel meters. ASCII protocol with '*master*' - '*slave*' architecture. Addressable up to 31 modules. Frames codified in representable ASCII characters (codes 32 to 255), directly visible using 'hyperterminal' or similar programs.

Instrument registers are accessible through the RS-485 ASCII port (reading value, alarm status, memory of maximum and minimum, setpoint values, ...).

Protocol configuration is performed from the frontal keypad of the meter, by setting the parameters at the options configuration menu ('Opt.1', 'Opt.2' or 'Opt.3' depending on the position the module is installed).

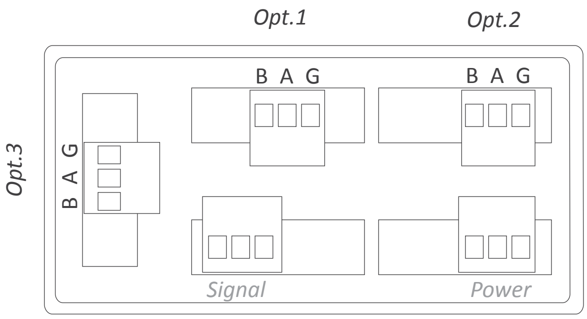
Up to a maximum of 3 S4 modules can be installed in a single instrument, all modules isolated between them and isolated from all other circuits.

Modules S4 can be ordered pre-installed into a DPS20 digital panel meter, or standalone for delayed installation, as they do not require soldering or special configuration.

| **Option** | **S4** |
|---|---|
| Output type | RS-485 ASCII communication port |
| Bus | RS-485 |
| Speed | 57.6 Kbps to 600 bps |
| Data format | 8n1 (standard), 8o1, 8n2, 8e1 |
| Protocol | ASCII |
| Architecture | 'master - slave' |
| Addresses | 01 to 31 |
| 'Broadcast' address | 128 |
| Registers | see section 2.4.1 |
| Isolation | 1000 Vdc |
| Configuration | 3 button front keypad |
| Temperature | operation from 0 to 50 ºC |
| | storage from -20 to +70 ºC |
| Installation allowed at | 'Opt.1', 'Opt.2', 'Opt.3' |

| *Module* | *Connections* | |
|---|---|---|
|  *Module S4 - RS-485 ASCII* | *Terminal B* | *B signal from RS-485 bus* |
| | *Terminal A* | *A signal from RS-485 bus* |
| | *Terminal G* | *GND* |

*Table 13 - Connection terminals*




**Rear view DPS20**

### 2.4.1 Accessible registers

Display values (DISPLAY1, MAXMEM, MINMEM, AL1, AL2, AL3) are codified with a minimum of 6 digits (left zeros are added if necessary), polarity and decimal point.

| *Register* | *Name* | *Description* |
|---|---|---|
| *0* | *DISPLAY1* | *Display1 value* |
| *1* | *MAXMEM* | *Memory of maximum* |
| *2* | *MINMEM* | *Memory of minimum* |
| *3* | *AL1* | *Setpoint 1 value* |
| *4* | *AL2* | *Setpoint 2 value* |
| *5* | *AL3* | *Setpoint 3 value* |
| *6* | *STATUS* | *Alarm status* |

*Table 14 - Accessible registers for ASCII protocol.*

Register 0 - DISPLAY1
Contains the display value of the instrument, in ASCII code, including polarity (positive / negative) and decimal point.

Example 1 R0='+' '0' '6' '5' '4' '3' '.' '2'
Display value = 6543.2

Example 2 R0='-' '0' '0' '0' '4' '.' '5' '2'
Display value = -4.52

Register 1 - MAXMEM
Contains the value for memory of maximum, in ASCII code, including polarity (positive / negative) and decimal point.

Register 2 - MINMEM
Contains the value for memory of minimum, in ASCII code, including polarity (positive / negative) and decimal point.

Register 3 - AL1
Contains the value for alarm 1 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

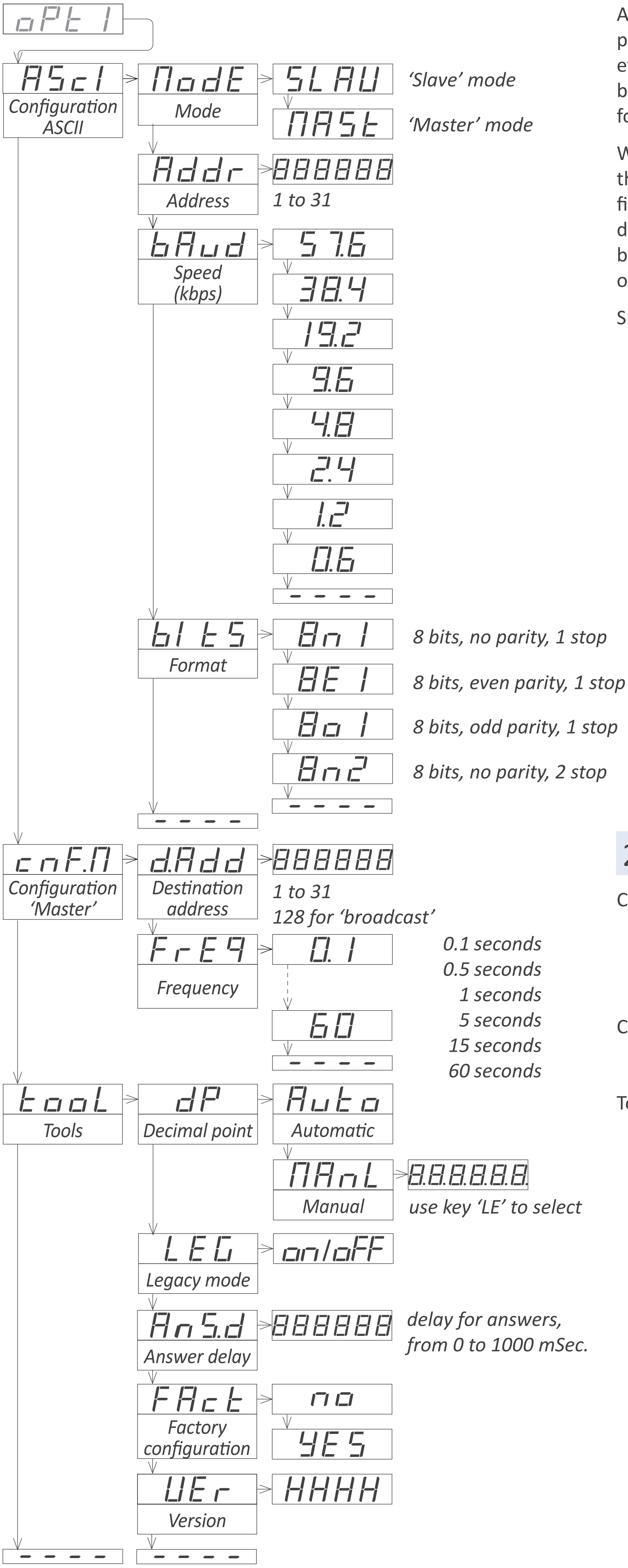
Register 4 - AL2
Contains the value for alarm 2 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

Register 5 - AL3
Contains the value for alarm 3 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

Register 6 - STATUS
Contains the alarm status (on/off).

| | |
|---|---|
| Bit 0 | Alarm 1 status (0 = inactive, 1 = active) |
| Bit 1 | Alarm 2 status (0 = inactive, 1 = active) |
| Bit 2 | Alarm 3 status (0 = inactive, 1 = active) |
| Bit 3 to 15 | Reserved |

## 2.4.2 Configuration menu




At menu 'Configuration ASCII' ('AScI'), configure the instrument at parameter 'Mode' ('ModE') to work as 'slave' or 'master', at parameter 'Address' ('Addr') set the address value from '1' to '31', set the bus speed in kbps at parameter 'Speed' ('bAud') and set the data format at parameter 'Format' ('bItS').

When working as 'master', the instrument continuously transmits the display value data frame. The local module address is '0'. Configure at menu 'Configuration Master' ('cnF.M') the 'Destination address' ('d.Add') parameter from '1' to '31' or use value '128' for a broadcast message. At parameter 'Frequency' ('FrEq') select the how often the frame with the reading value will be transmitted.

Special tools are grouped inside the 'Tools' ('TooL') menu.

- the 'Decimal point' ('dP') menu is provided for compatibility with ancient hardware that does not support decimal point retransmission. By default, select 'Automatic' ('Auto'). If your instrument does nos transmit the decimal point position, select 'Manual' ('MAnL') and fix the position of the decimal point manually.
- the 'Legacy mode' ('LEG') parameter is provided to maintain compatibility with instruments with older communication protocols. Select 'on' to activate this mode.
- the 'Answer delay' ('AnS.d') parameter applies only to 'Slave' mode. The local module delays the answer frame. Configure for applications where the 'Master' needs additional time to switch between 'transmit' and 'receive' modes. Enter a numeric value between '0' and '1000' mSeconds.
- at the 'Factory reset' ('FAct') menu, select 'yes' to load the default factory configuration for the instrument.

the 'Version' ('VEr') menu informs of the current firmware version installed in the module.

## 2.4.3 Factory configuration

| | |
|---|---|
| Configuration ASCII | |
| Mode | Slave |
| Address | 1 |
| Speed ('bAud') | 19.2 Kbps |
| Format ('bItS') | 8n1 |
| Configuration 'Master' | |
| Destination address | 31 |
| Frequency | 0.5 seconds |
| Tools | |
| Decimal point | Auto |
| Legacy | Off |
| Answer delay | 0 mSeconds |

## 2.4.4 Frame types

The ASCII protocol defines the following frames:

• Frame 'read' ('**RD**'). Id code 36. Request data frame. The requested register is indicated into the 'REG' byte ('Header' section).

• Frame 'answer' ('**ANS**'). Id code 37. Response frame to a request data frame. The requested register is indicated into the 'REG' byte' ('Header' section). Data of the requested register is indicated into data bytes 'D0' to 'Dn' ('Data' section).

• Frame 'error' ('**ERR**'). Id code 38. Response frame to a request data frame. Indicates that an error has occurred. Error code is codified into the 'REG' byte ('Header' section).

• Frame 'ping' ('**PING**'). Id code 32. Used to confirm the existence of the remote instrument.

• Frame 'pong' ('**PONG**'). Id code 33. Response to a 'ping' frame. It confirms the existence of the remote instrument.

## 2.4.5 Frame structure

| Header | | | | | | | | Data | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | D0 | D1 | ... | Dn | CRC | ETX |
| 2 | x | 32 | x | x | x | 32 | n+1 | [data] | | | | x | 3 |
| *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *...* | *n+7* | *n+8* | *n+9* |

Protocol frames have a structure made of 'Header', 'Data' and 'Trail'.

**Section 'Header'**

Contains the start byte ('STX'), the frame identifier ('ID'), the origin address ('FROM') and the destination address ('TO'), the register id ('REG') and the length ('LONG') of the 'Data' section.

**Section 'Data'**

Contains data for the requested register ('REG').

**Section 'Trail'**

Contains the 'CRC' code and the end of frame byte ('ETX').

**'Real value' and 'Frame value'**

To use representable ASCII values, the real values are codified before being sent into the frame. The following definitions apply :

- 'real value' is the value of the field without codification
- 'frame value' is the value of the field, codified

| *Field* | *Description* | *Size* | *Position* | *Real value* | *Frame value* |
|---|---|---|---|---|---|
| *STX* | *Start of frame* | *1 byte* | *0* | *does not apply* | *2* |
| *ID* | *Frame type* | *1 byte* | *1* | *(see section 2.4.4)* | *real_value* |
| *RSV* | *Reserved* | *1 byte* | *2* | *0* | *32* |
| *FROM* | *Origin address* | *1 byte* | *3* | *0 ('Master') / 1 to 31 ('Slave')* | *32 + real_value* |
| *TO* | *Destination address* | *1 byte* | *4* | *0 ('Master') / 1 to 31 ('Slave')<br>128 ('broadcast')* | *32 + real_value* |
| *REG* | *Register identification* | *1 byte* | *5* | *(see section 2.4.1)* | *32 + real_value* |
| *RSV* | *Reserved* | *1 byte* | *6* | *0* | *32* |
| *LONG* | *Length of 'Data' section* | *1 byte* | *7* | *n (between 0 and 32)* | *32 + real_value* |
| *D0 ... Dn* | *Data* | *n bytes* | *8 to n+7* | *number 0 to 9<br>decimal point<br>polarity (+/-)* | *ASCII code of the number (48 to 57)<br>ASCII code of decimal point (46)<br>ASCII code of '+' (43)<br>ASCII code of '-' (45)* |
| *CRC* | *CRC calculation* | *1 byte* | *n+8* | *does not apply* | *(see section 1.19)* |
| *ETX* | *End of frame* | *1 byte* | *n+9* | *does not apply* | *3* |

*Table 15 - Description of the bytes for the ASCII frame*

## 2.4.6 Error codes

Frames 'ERR' contain within the 'REG' field, the error code. Available error codes are :

| | |
|---|---|
| error 1 | unknown register |
| error 2 | display overrange |
| error 3 | display underrange |
| error 4 | CRC error |
| error 5 | internal error |

## 2.4.7 Frame examples

### Frames 'RD' (36) and 'ANS' (37)

*Example - 'Master' (address '0') requests the value of register '0' (display value) to the 'Slave' at address '28' ('RD' frame) and the 'Slave' replies to the 'Master' with a reply frame ('ANS' frame) containing the requested data (765.43).*

**Instruments with 4 digits also send reading values formatted with 6 digits : value -321.5 is transmitted as -00321.5*

| Header | | | | | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | CRC | ETX |
| 2 | 36 | 32 | 32 | 60 | 32 | 32 | 32 | 58 | 3 |
| Start | RD | --- | 0 | 28 | 0 | --- | 0 | CRC | Stop |

| Header | | | | | | | | Data | | | | | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC | ETX |
| 2 | 37 | 32 | 60 | 32 | 32 | 32 | 40 | 43 | 48 | 55 | 54 | 53 | 46 | 52 | 51 | 15 | 3 |
| Start | ANS | --- | 28 | 0 | 0 | --- | 8 | +0765.43 | | | | | | | | CRC | Stop |

### Frames 'ERR' (38)

*Example - 'Slave' at address '11' replies to the 'Master' (address '0') with an error frame ('ERR' frame) indicating that the requested register number is unknown ('UNKNOWN_REGISTER', error code '1'). The error code is codified into the 'REG' byte. For a list of error code see section 2.4.6.*

| Header | | | | | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | CRC | ETX |
| 2 | 38 | 32 | 43 | 32 | 33 | 32 | 32 | 46 | 3 |
| Start | ERR | --- | 11 | 0 | 1 | --- | 0 | CRC | Stop |

### Frames 'PING' (32) and 'PONG' (33)

*Example - 'Master' (address '0') requests confirmation of existence to the 'Slave' at addrress '22' ('PING' frame) and the 'Slave' replies to the 'Master' with a 'PONG' frame.*

| Header | | | | | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | CRC | ETX |
| 2 | 32 | 32 | 32 | 54 | 32 | 32 | 32 | 52 | 3 |
| Start | Ping | --- | 0 | 22 | 0 | --- | 0 | CRC | Stop |

| Header | | | | | | | | Trail | |
|---|---|---|---|---|---|---|---|---|---|
| STX | ID | RSV | FROM | TO | REG | RSV | LONG | CRC | ETX |
| 2 | 33 | 32 | 54 | 32 | 32 | 32 | 32 | 53 | 3 |
| Start | Pong | --- | 22 | 0 | 0 | --- | 0 | CRC | Stop |

## 2.4.8 CRC calculation

The 'frame value' for the CRC byte is calculated applying a XOR function to the 'frame value' (see section 2.4.5) of all bytes in sections 'Header' and 'Data', from byte '0' ('STX') to the last data byte ('Dn').

• if the calculated CRC value is lower than '32', it is normalized by applying the 'one's complement' function .

CRC0=STX ^ ID ^ RSV ^ FROM ^ TO ^ REG ^ RSV ^ LONG ^ D0 ^...^ Dn

- if (CRC0<32) -> CRC=!CRC0 (one's complement function)
- if (CRC0>31) -> CRC=CRC0

```
//example of CRC calculation in C language
int8 Calculate_CRC(int8 CRC_Position)
{
 int8 i,CRC=0;
  for(i=0;c<CRC_Position;c++)
  {
     crc=crc ^ frame[i];
  }
 if(crc<32) CRC=~CRC;
 return(CRC);
}
```

## 2.5 Module S2

Module S2 provides 1 RS-232 ASCII communications port, to install in DPS20 digital panel meters. Protocol specifications are the same as with module S4 (see section 2.4), with only difference that the physical bus is RS-232 instead of RS-485.

S2 modules allow for point-to-point communication over RS-232 and also allow for multinode communication over RS-232 using a 'Daisy-Chain' type of connection.

Terminals RX1 and TX1 are for connection to the RS-232 bus. Terminals RX2 and TX2 are for RS-232 multinode connection. Frames received on RX1 with destination address different than the local instrument's address, will be retransmitted over the TX2 terminal. In a similar way, frames received from RX2 with destination address other than the local address, will be retransmitted over TX1 terminal.

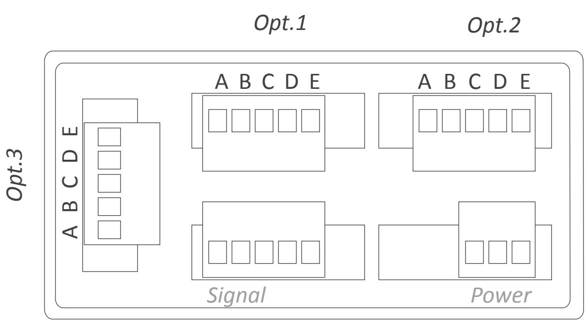
Up to a maximum of 3 S4 modules can be installed in a single instrument, all modules isolated between them and isolated from all other circuits.

Modules S2 can be ordered pre-installed into a DPS20 digital panel meter, or standalone for delayed installation, as they do not require soldering or special configuration.

| **Option** | **S2** |
|---|---|
| Output type | RS-232 ASCII communication port |
| Bus | RS-232 |
| Speed | 57.6 Kbps to 600 bps |
| Data format | 8n1 (standard), 8o1, 8n2, 8e1 |
| Protocol | ASCII |
| Architecture | 'master - slave' |
| Addresses | 01 to 31 |
| 'Broadcast' address | 128 |
| Registers | see section 2.4.1 |
| Isolation | 1000 Vdc |
| Configuration | 3 button front keypad |
| Temperature | operation from 0 to 50 ºC |
| | storage from -20 to +70 ºC |
| Installation allowed at | 'Opt.1', 'Opt.2', 'Opt.3' |

| *Module* | *Connections* | |
|---|---|---|
|  | *Terminal A* | *Tx2* |
| | *Terminal B* | *Rx2* |
| | *Terminal C* | *Tx1* |
| | *Terminal D* | *Rx1* |
| *Module S2 - RS-232 ASCII* | *Terminal E* | *GND* |

*Table 16 - Connection terminals*




**Rear view DPS20**

This page blank

# 3. How to open and close

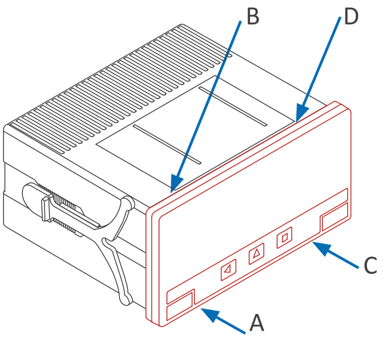
## 3.1 How to open the housing

### A. Locate the clips

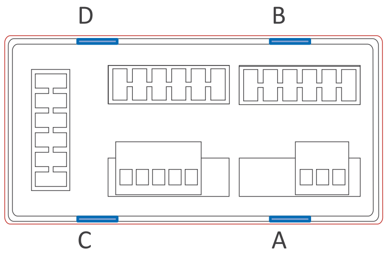
Locate the 4 clips (A B C D). Clips are covered by the front filter.

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

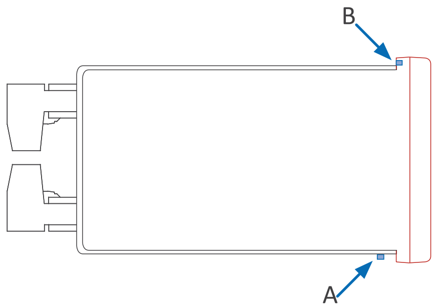
**A.1**




**A.2**



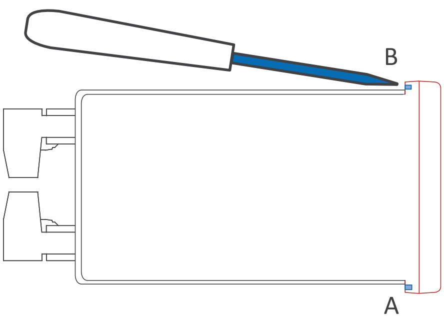

**A.3**



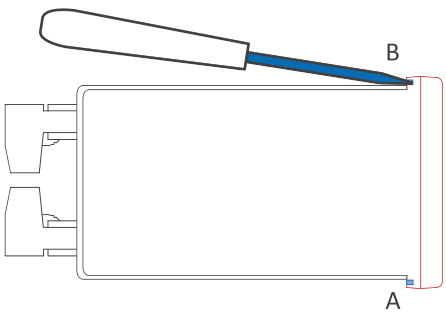

### B. How to unclip one clip

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

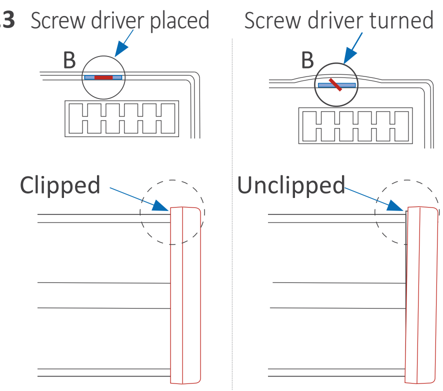
**B.1**




**B.2**




**B.3**

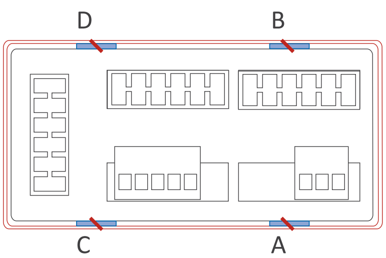



### C. Repeat with all clips

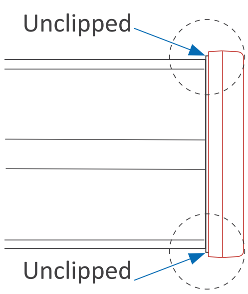
Repeat for remaining 3 clips. All 4 clips are now unclipped.

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

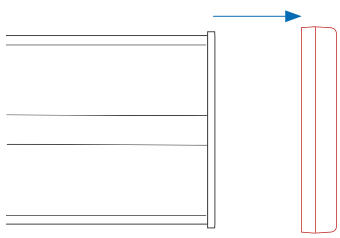
**C.1**




**C.2**




**C.3**

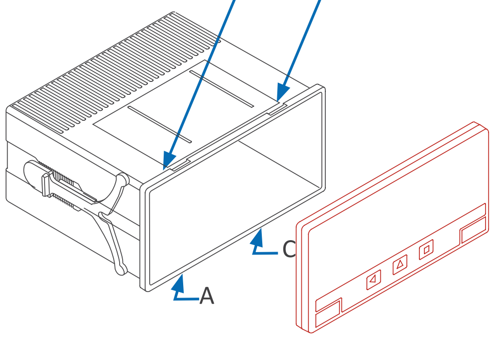


## 3.2 How to close the housing

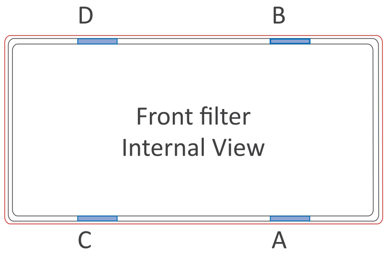
### A. Locate the clips

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

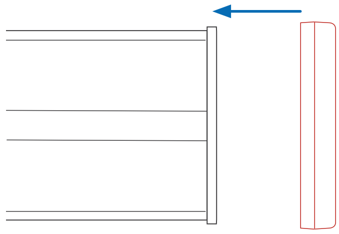
**A.1**




**A.2**



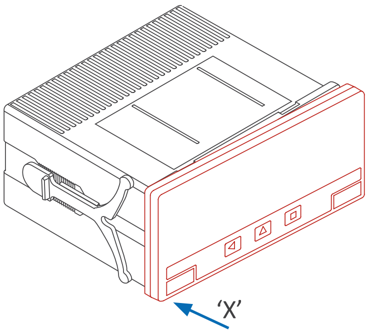

**A.3**



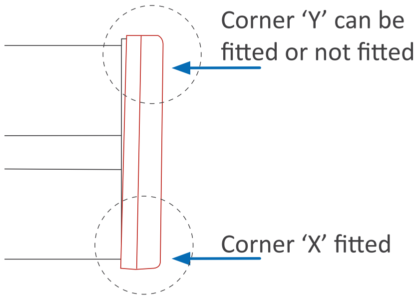
### B. Fit corner 'X' and clip 'A'

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

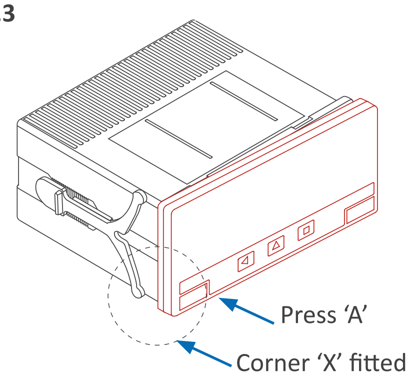
**B.1**




**B.2**



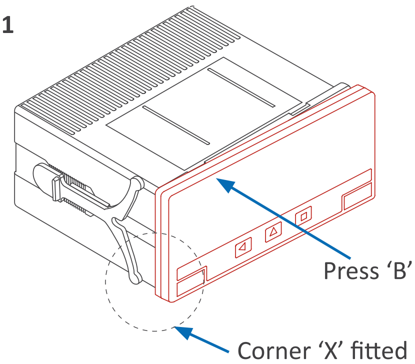

**B.3**



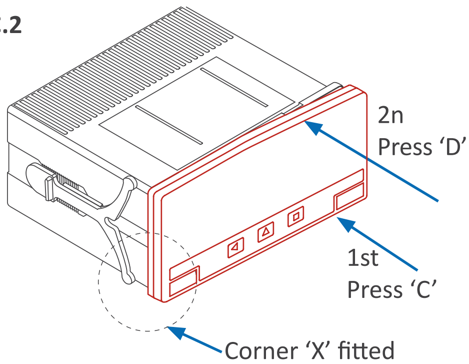

### C. Clip remaining clips 'B', 'C' & 'D'

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

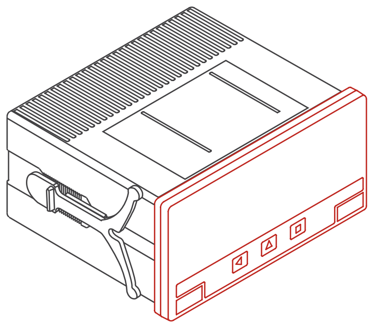
**C.1**




**C.2**




**C.3**



M5760/2003