YEAR 2000 COMPLIANT

User's Guide

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DP31 SERIES

Dual Input Meter

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page

1 - GENERAL REMARKS

1.1 IDENTIFICATION

To order (specity model number)	
Model number	**Description**
DP31	**1/8 DIN Digital panel indicator**

Ordering Example: DP31-CR-24V: DP31 meter with 24Vac/Vdc power, 4 relay outputs, 2 contact inputs, RS-485 communications.

Display and Power options

Ordering Suffix	Description
-GN	Green display
-24V	24 Vac/Vdc power
-48V	48 Vac/Vdc power

Output options

Ordering Suffix	Description
-R	4 relays
-AR	4 relays, 2 contact inputs analog output
-CR	4 relays, 2 contact inputs RS-485 communications

1.2 EU CONFORMITY

The DP31 complies with European Directives concerning:

- Electromagnetic compatibility 89/336/CEE
- Low voltage supplies (LVD): 73/23/CEE amended by EEC Directive 93/68 – Applicable standard – EN 61010-1 dated April 1993

1.2.1 Operating conditions

- Operating temperature: -5 to +55°C
- Storage temperature: -20 to +70°C
- Ambient relative humidity: 10 to 90% non-condensing.
- Power supply: 85 to 264 Vac - 50/60 Hz - 10 VA
  24/48 Vac ± 10% - 50/60 Hz - 10VA
  24/48 Vdc ± 10% - 10 VA
- Installation category (overload): II
- Pollution level: II as defined in IEC 664
- Display panel sealing: IP65.

1.2.2. Meaning of symbols used in documentation and on labels on connectors

Operating ground terminal	~ Alternating current
Safety ground terminal	**Caution**: Refer to accompanying documentation

2 - PHYSICAL INSTALLATION

2.1 SPACE REQUIRED – CUTTING THE DISPLAY PANEL HOLES

- Format: 1.89” x 3.78” (48 x 96 mm) in accordance with DIN 43760
- Overall depth behind flange: 4.53” (115 mm).
- Weight: 11.3 oz (320 g).

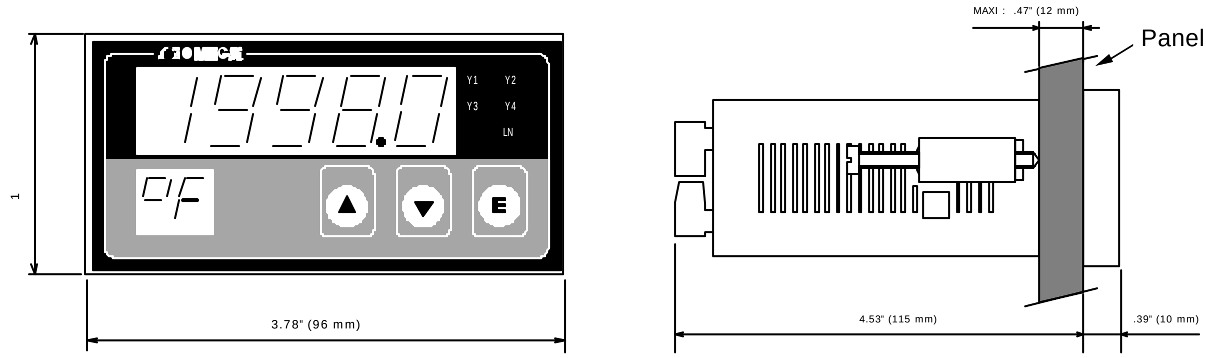


FIGURE 1 (lengths in inches [mm]

Display panel holes

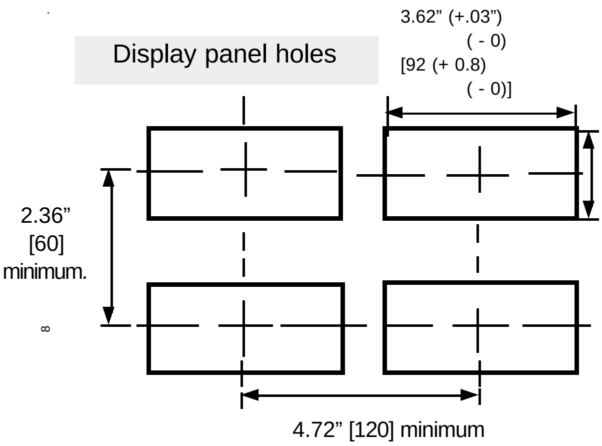


FIGURE 2

Mounting brackets

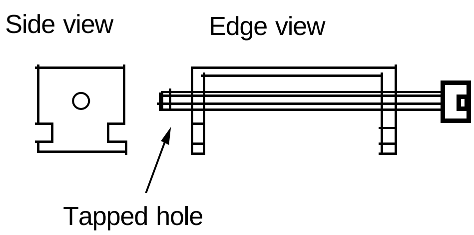


FIGURE 3

2.2 FITTING THE EQUIPMENT

The DP31 is fixed by means of two mounting brackets (figures 1 & 3). To fix the unit:

- Insert a screw into each bracket.
- Slide the apparatus into the hole in the panel.
- Insert a bracket at each fixing point located on the sides of the casing.
- Position each bracket in the rear of its fixing on the terminal strip side.
- Tighten the screws until the apparatus is secure. Do not over-tighten.

3 - INSTALLATION AND CONNECTION

3.1 GENERAL ADVICE

† The precautions described below must be taken when connecting the meter, in order for the equipment to comply with the European directives concerning:

- Electromagnetic compatibility: 89/336 CEE
- Low voltage supply safety rules: LVD 73/23 CEE amended by EEC Directive 93/68.

If the DP31 is used other than as specified, then the protection provided by the equipment may be compromised.

3.2 INSTALLATION RECOMMENDATIONS

Avoid placing the meter near:

- High power or relay cut-off or transforming devices.
- Thyristor power units, motors, etc.

As a rule, the instrument panel should be located in a separate part of the cabinet from power and relay controls.

Avoid placing the meter above equipment giving off heat.
If the temperature inside the cabinet exceeds 55°C, install a filtered air ventilation system.

3.3 WIRING RECOMMENDATIONS

3.3.1 Power supply connection

The DP31 is designed to be permanently connected to the AC power supply. Consequently, the user should provide a switch or similar means of shutting off the power which should be located in the cabinet near the unit.

It is also advisable to fit an identifiable safety fuse near the meter: rating 250 mA 230 Vac.

Where several units are to be fitted in the same cabinet, power connections should be as direct as possible: use a star pattern for wiring in order to avoid daisy-chaining from one unit to another.

Do not power the unit with the same line used for powering contactors or relay coils.

If the power supply network suffers from disturbances (in particular due to high power switching via contactors or thyristor regulators), the instrument section should be run on an isolating transformer with a grounded screen.

3.3.2 Grounding

The grounding terminals on all units must be linked together in a star at a single point (the facility's metal earth ground) by means of a conductor of equal section to that of the power cables. In order to avoid interference due to the common mode, it is vital to ensure that the grounds of all equipment linked to the unit's inputs and outputs are all at equal potential.

3.3.3 Connecting the inputs and outputs

The wires connected to the measurement inputs and outputs (analog, digital communication) must be physically separated from power cables and cables used for relays or contactor coils, along their entire length.

Use wiring gutters or separate or divided wiring ducts.
Any one cable must only carry signals of exactly the same type.
Use sheathed cables with stranded wire for connections.

† The protective sheathing MUST be grounded via a single point, preferably on the earth ground terminal side of the indicator.

3.4 CONNECTION

The DP31 has two detachable terminal strips (1 & 2) connected to the base card. Two additional terminal strips (3 & 4) are present on the -R, -AR, and -CR models. The screw terminals have a clamping capacity of 2.5 mm².

3.4.1 Selecting transmitter and measuring bridge power supplies

On terminal 7 there is a power supply available for:

- Energizing transmitters. The supply is 24 V at a maximum of 30 mA ; or
- A measuring bridge which may be energized between 4.5 and 10.2 V at a maximum of 30 mA.

If the measurement input requires the use of one of these power supplies, it must be selected prior to connection. To perform this operation:

- Remove terminal strip 2
- Set the diverter switch on the base card as shown in figure 4.

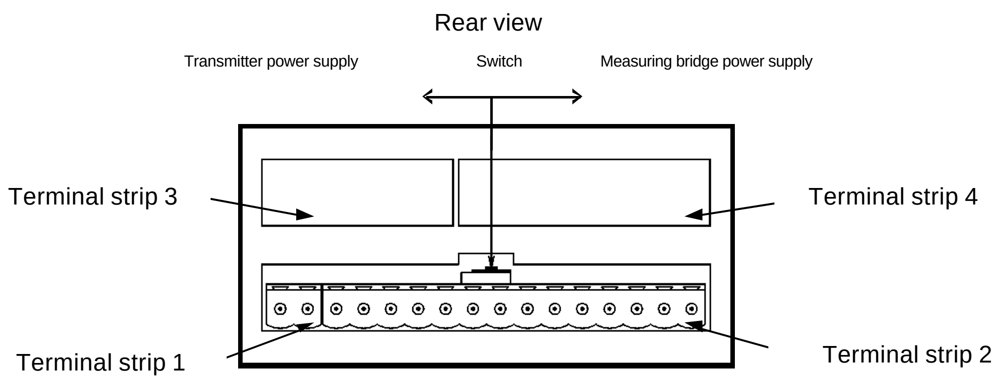


FIGURE 4

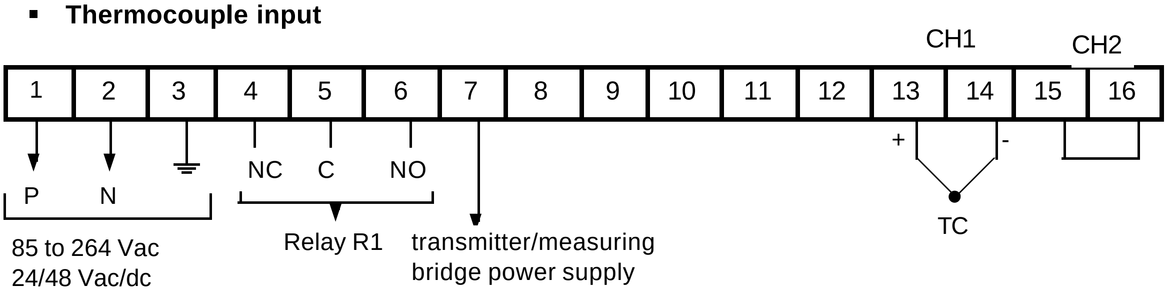
3.4.2 Connecting terminal strips 1 & 2 on the base card

Terminal strip 1 (terminals 1 & 2): meter power supply.

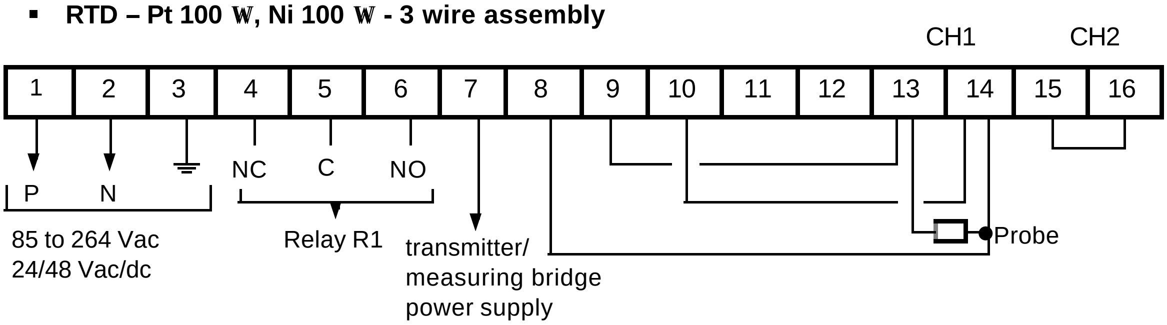
Terminal strip 2 (terminals 3 – 16): alarm relays R1; power supply for transmitter/measuring bridge, measurement input (connections vary according to input type).

3.4.2.1 Single temperature measurement (input CH1)

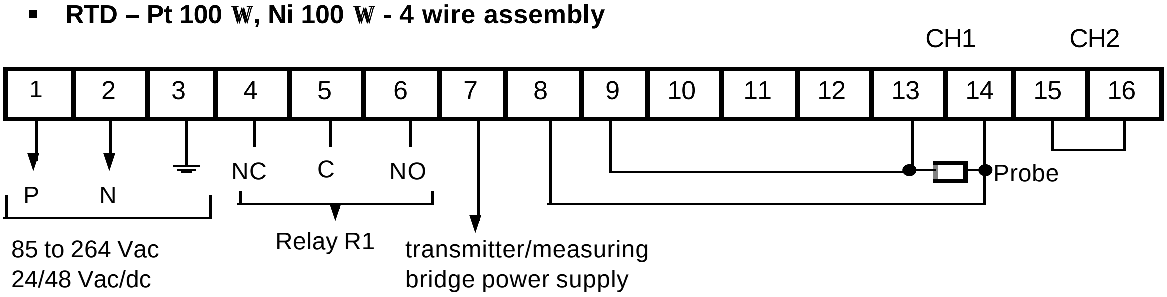
- **Thermocouple input**



- **RTD – Pt 100 W, Ni 100 W - 3 wire assembly**



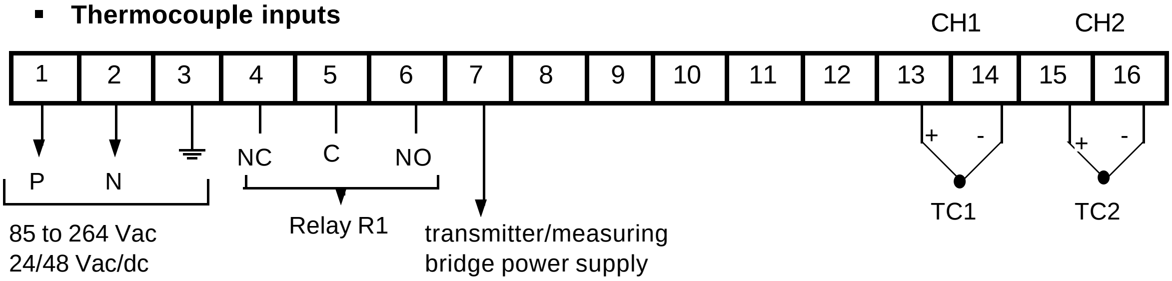
- **RTD – Pt 100 W, Ni 100 W - 4 wire assembly**



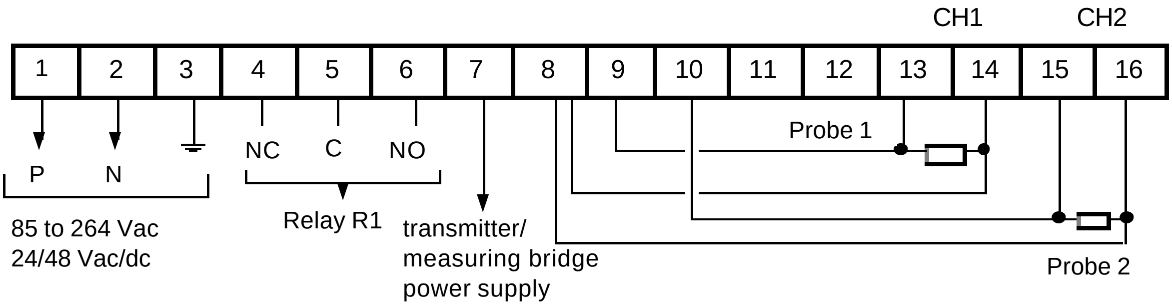
3.4.2.2 Differential temperature measurement (CH1 – CH2)

> † The sensors and the configuration of the two inputs must be identical

- **Thermocouple inputs**

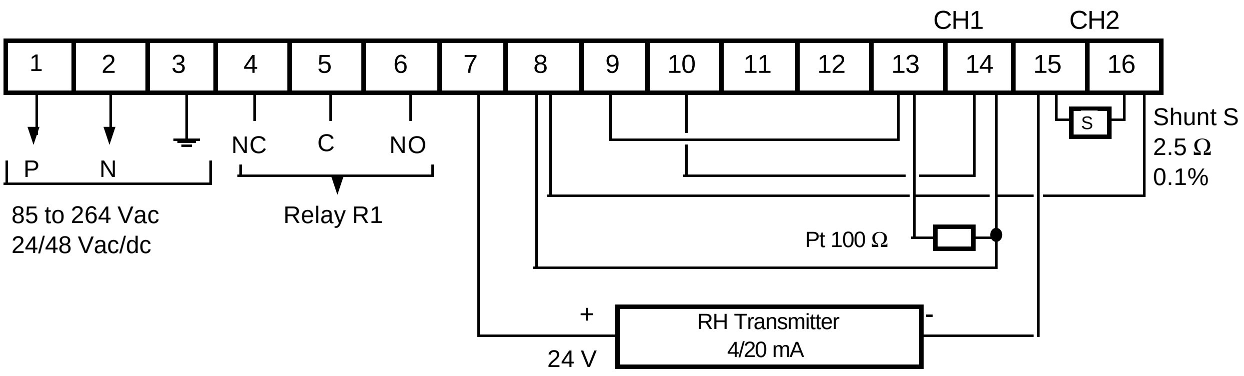


- **RTD – Pt 100 W, Ni 100 W - 4 wire assembly only**

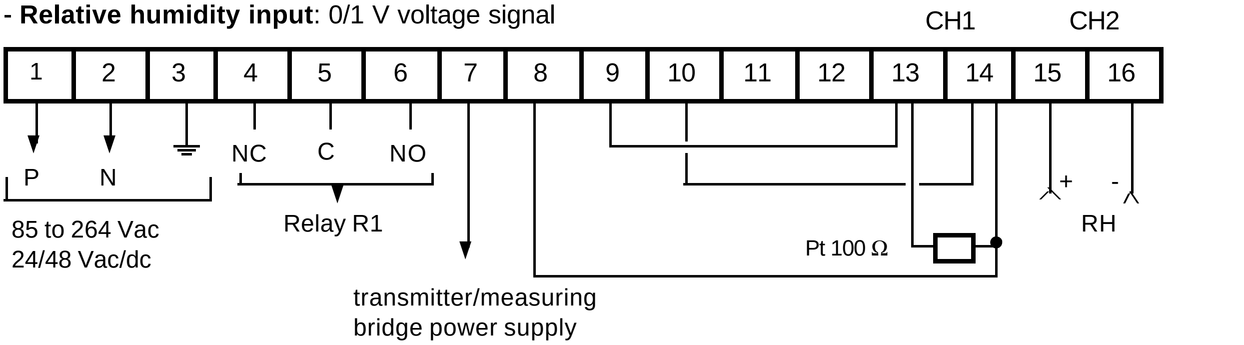


3.4.2.3 Temperature (input CH1) and relative humidity (input CH2)

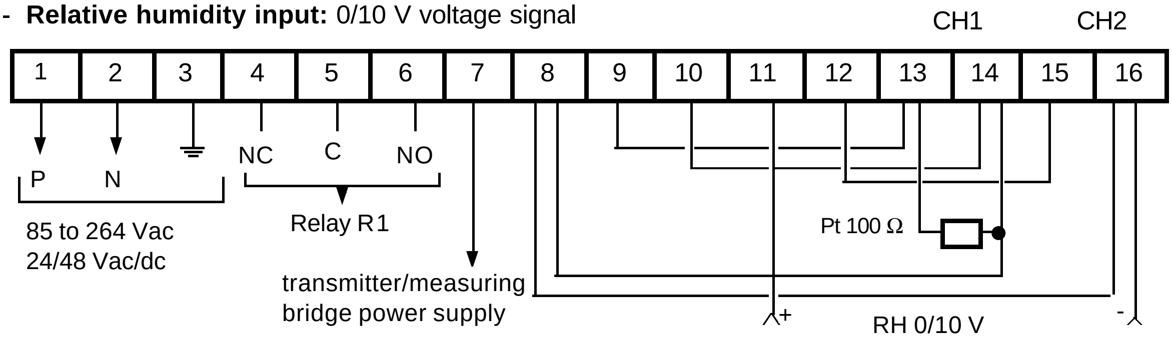
- **Temperature input:** RTD probe – Pt 100 Ω - 3 wire assembly
- **Relative humidity input:** 4/20 mA current signal supplied by a two-wire transmitter powered by the DP31



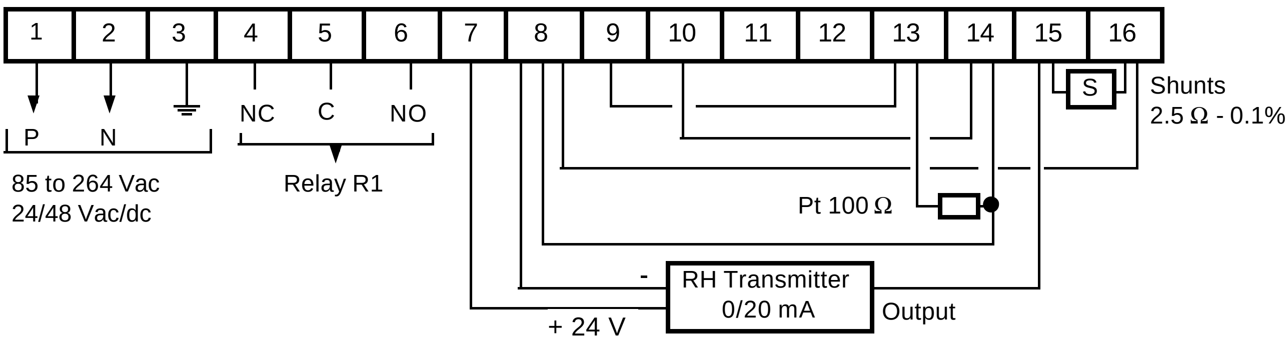
- **Temperature input: RTD probe** – Pt 100 Ω - 3 wire assembly
- **Relative humidity input**: 0/1 V voltage signal



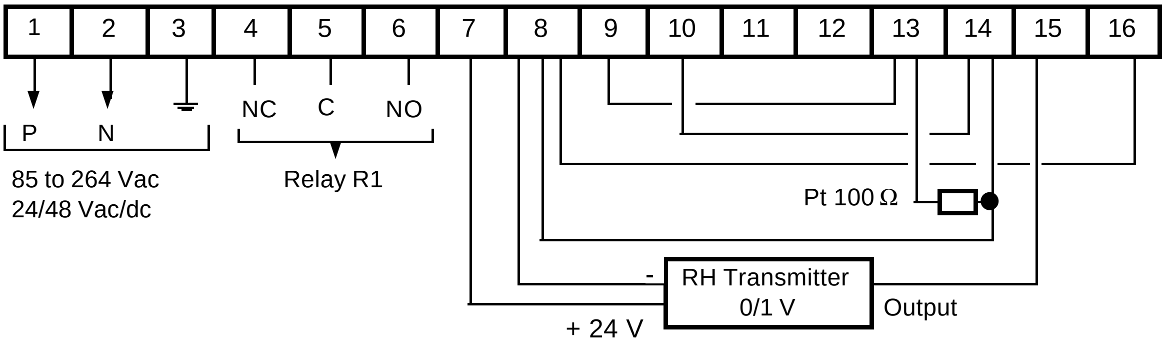
- **Temperature input**: RTD probe – Pt 100 Ω - 3 wire assembly
- **Relative humidity input:** 0/10 V voltage signal



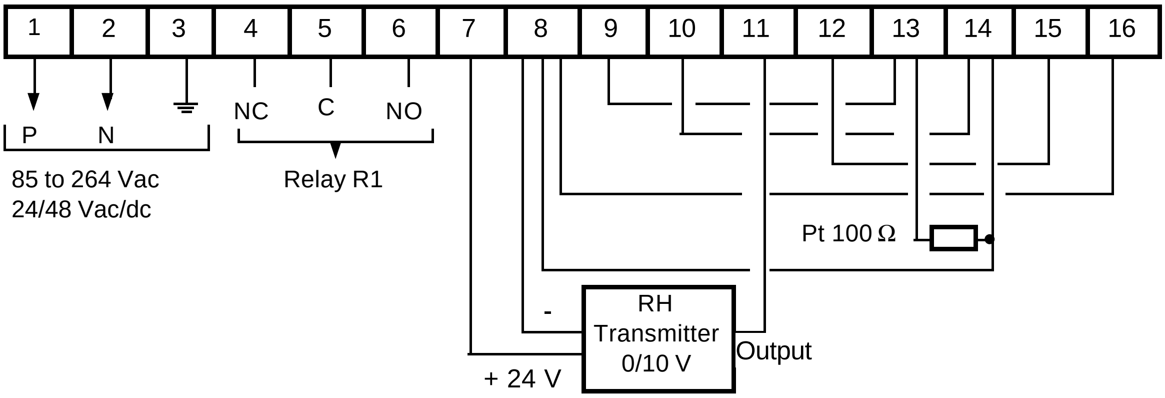
- **Temperature input:** RTD probe – Pt 100 Ω - 3 wire assembly
- **Relative humidity input:** 0-20 mA current signal provided by 3 wire transmitter powered by the DP31



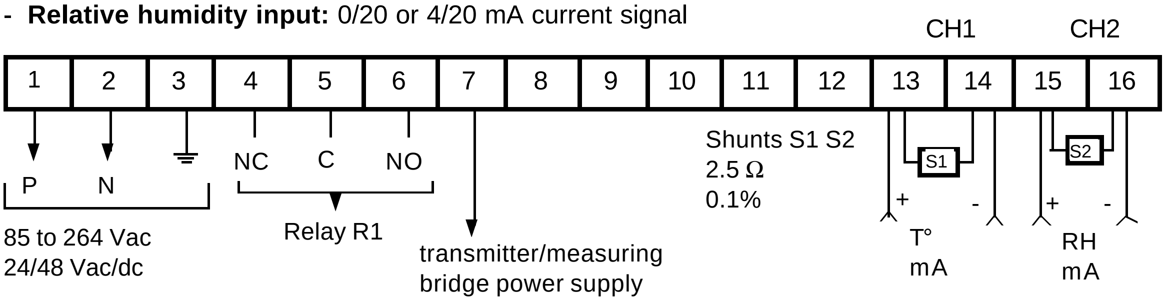
- **Temperature input:** RTD probe – Pt 100 Ω - 3 wire assembly
- **Relative humidity input:** 0-1 V voltage signal provided by 3 wire transmitter powered by the DP31



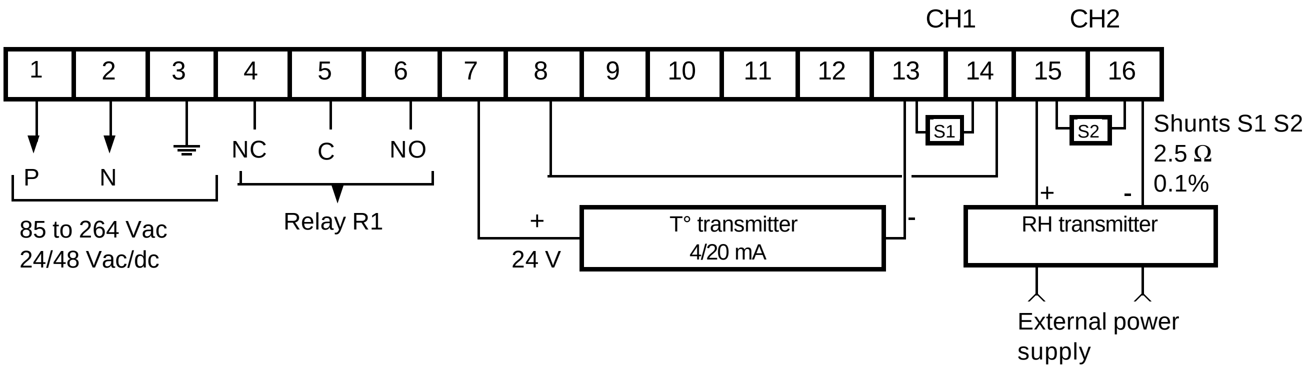
- **Temperature input:** RTD probe – Pt 100 Ω - 3 wire assembly
- **Relative humidity input:** 0-10 V voltage signal provided by 3 wire transmitter powered by the DP31



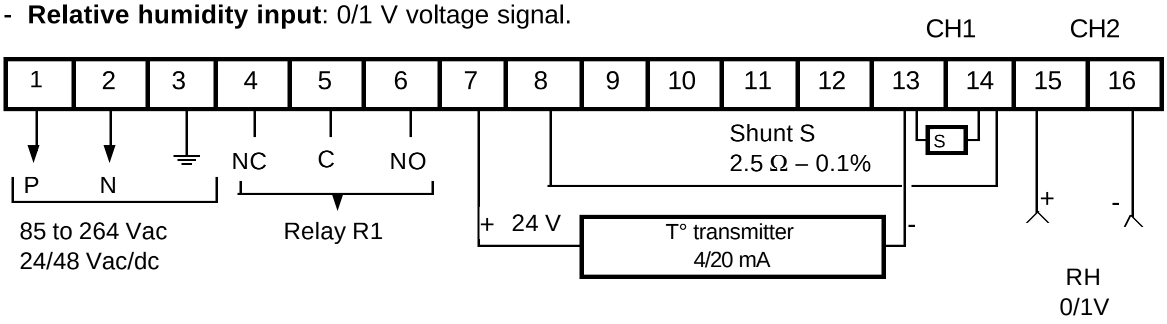
- **Temperature input:** 0/20 or 4/20 mA current signal
- **Relative humidity input:** 0/20 or 4/20 mA current signal



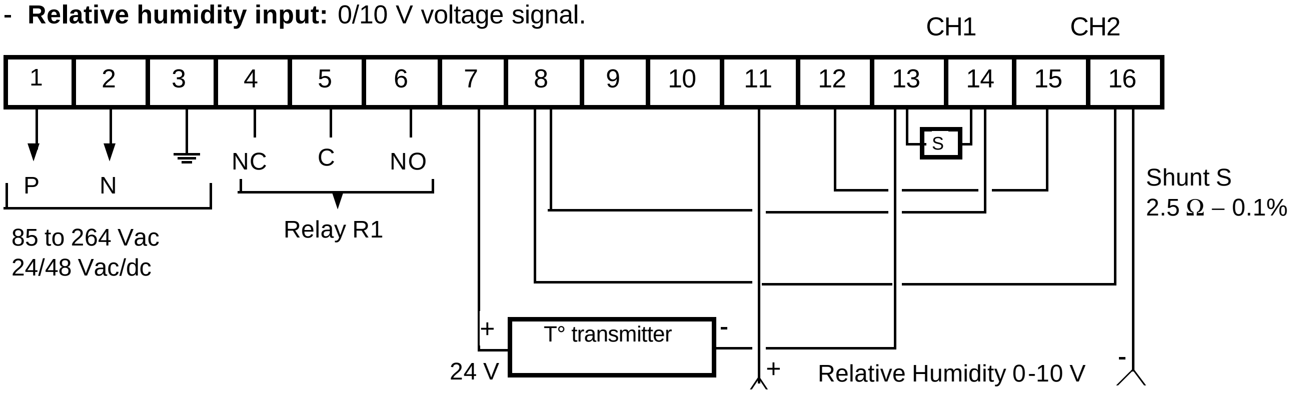
- **Temperature input:** 4/20 mA current signal provided by 2 wire transmitter powered by the DP31.
- **Relative humidity input:** 0/20 or 4/20 mA current signal provided by independently powered 4 wire transmitter.



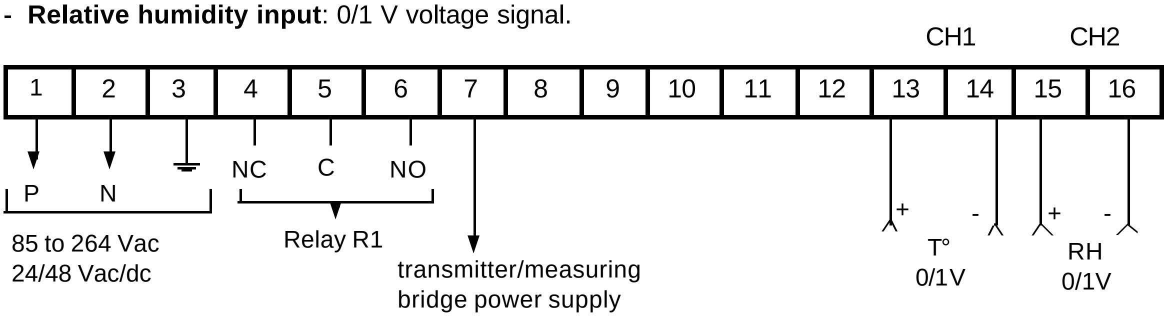
- **Temperature input:** 4/20 mA current signal provided by 2 wire transmitter powered by the DP31.
- **Relative humidity input**: 0/1 V voltage signal.



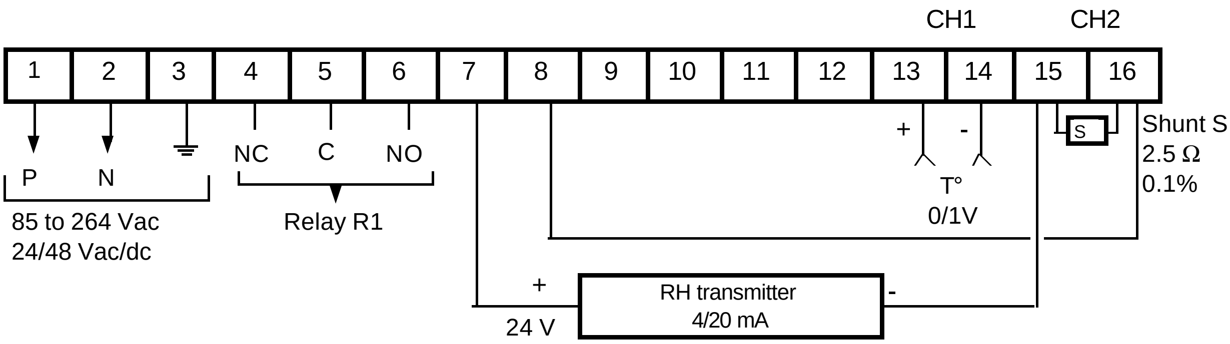
- **Temperature input:** 4/20 mA current signal provided by 2 wire transmitter powered by the DP31.
- **Relative humidity input:** 0/10 V voltage signal.



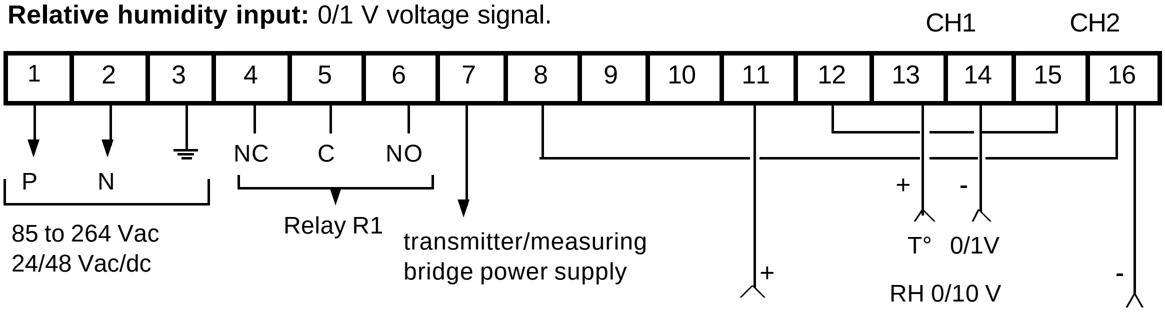
- **Temperature input:** 0/1 V voltage signal.
- **Relative humidity input**: 0/1 V voltage signal.



- **Temperature input:** 0/1 V voltage signal
- **Relative humidity input**: 4/20 mA current signal provided by 2 wire transmitter powered by the DP31.

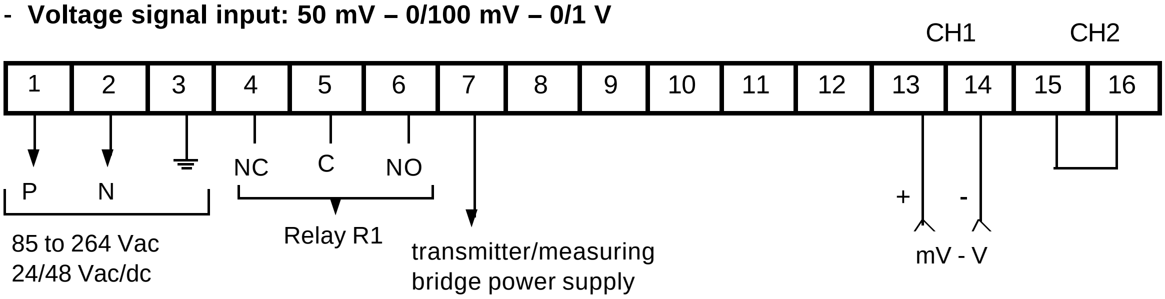


- **Temperature input:** 0/1 V voltage signal.
- **Relative humidity input:** 0/1 V voltage signal.

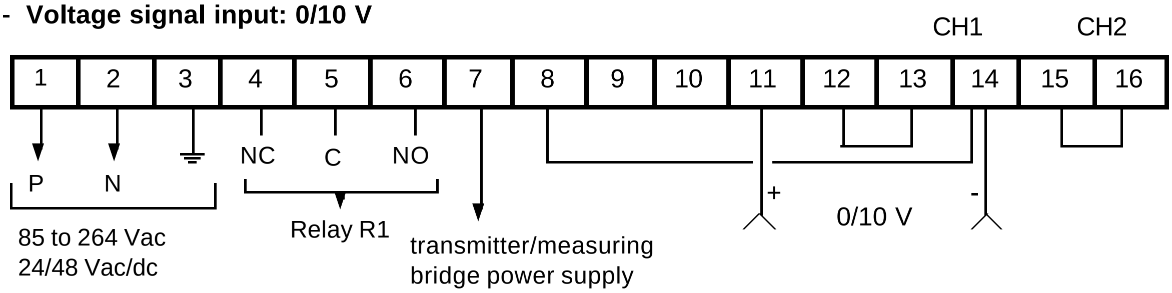


3.4.2.4 Single voltage or current input signal measurements (input CH1)

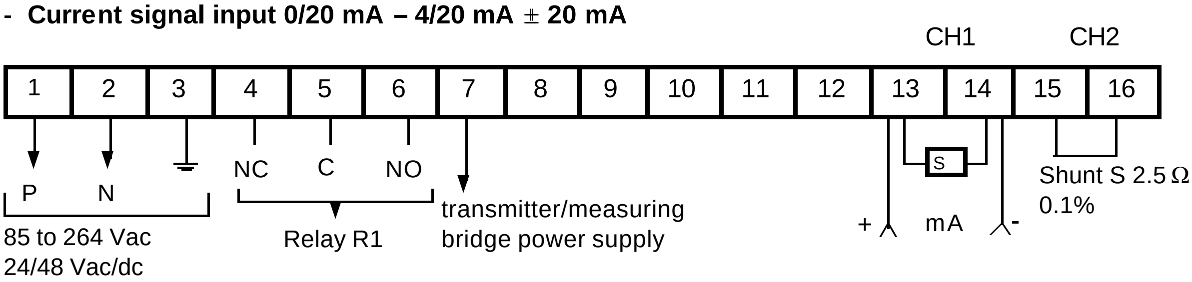
- **Voltage signal input: 50 mV – 0/100 mV – 0/1 V**



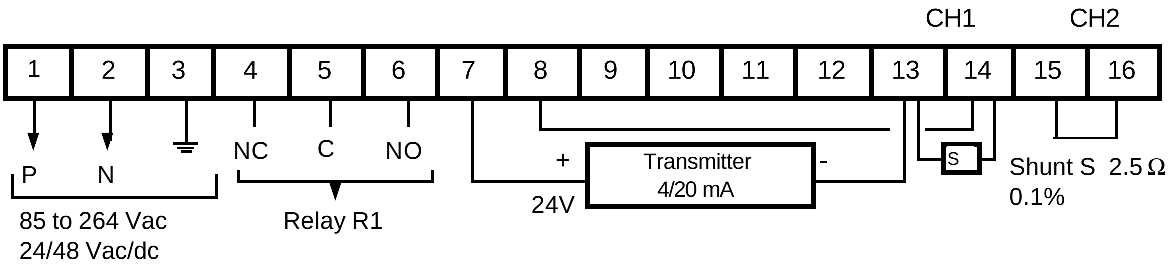
- **Voltage signal input: 0/10 V**



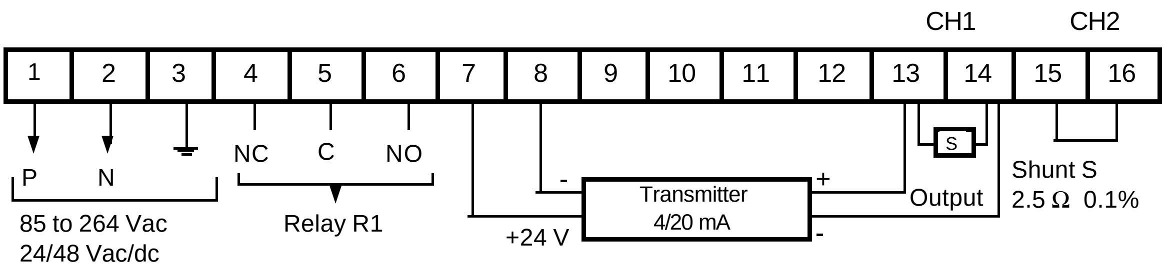
- **Current signal input 0/20 mA – 4/20 mA ± 20 mA**



- **Current signal input: 4/20 mA provided by 2 wire transmitter powered by the DP31**



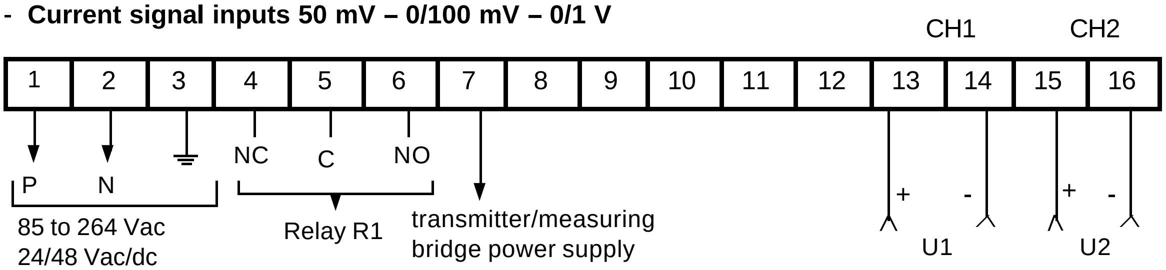
- **Current signal input: 4/20 mA provided by 4 wire transmitter powered by the DP31**



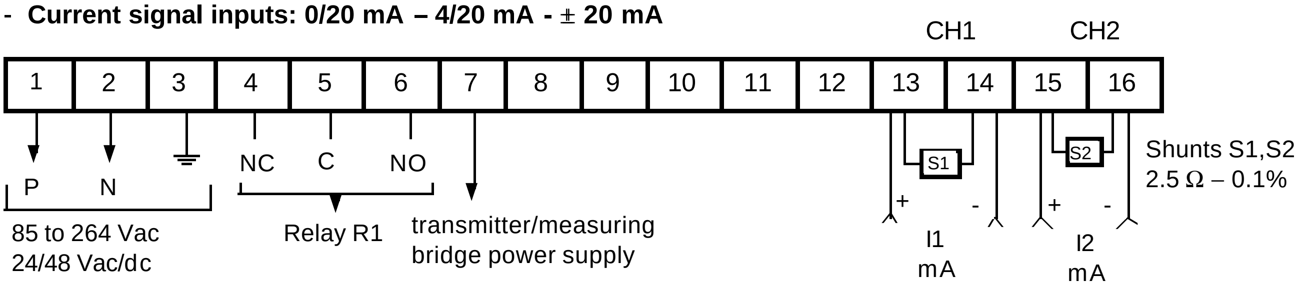
3.4.2.5 Differential measurement (channel 1 – channel 2) of voltage and current input signals

† Signal types, ratings and the configuration of the two inputs must be identical

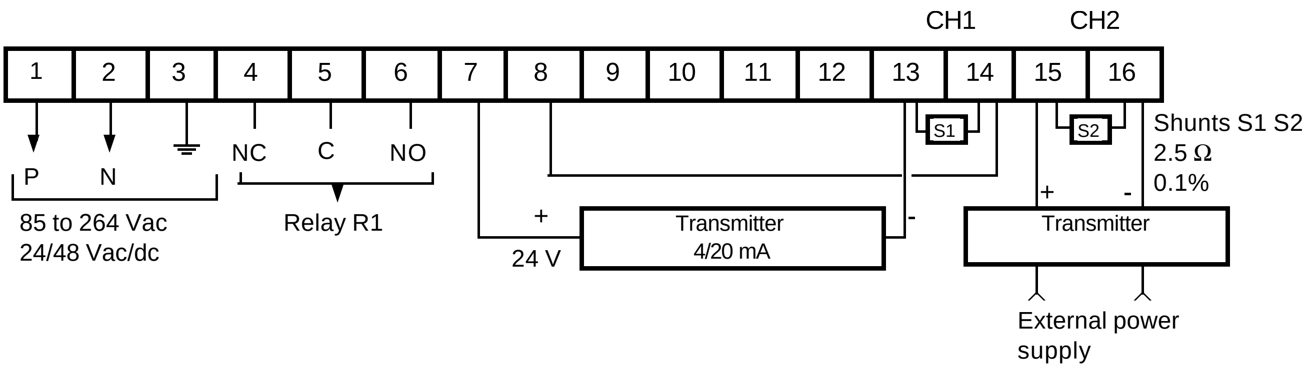
- **Current signal inputs 50 mV – 0/100 mV – 0/1 V**



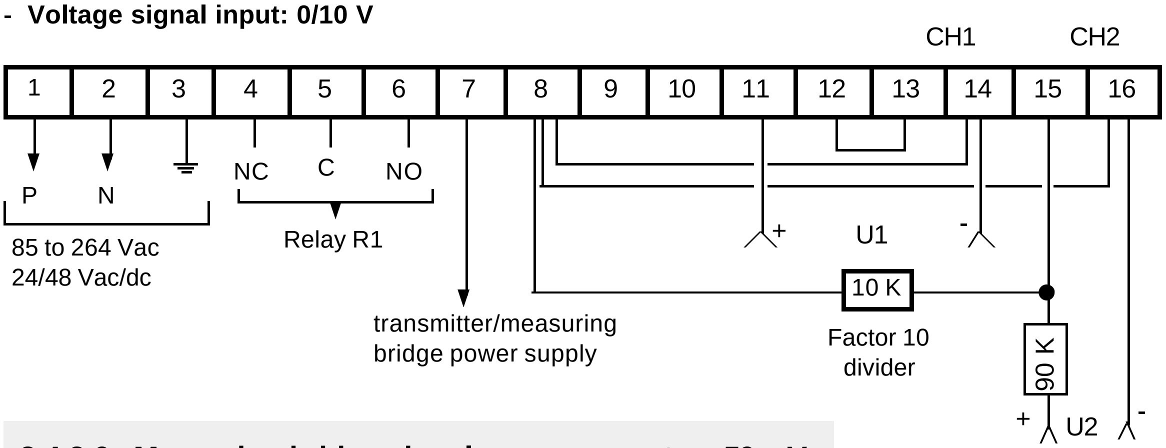
- **Current signal inputs: 0/20 mA – 4/20 mA - ± 20 mA**



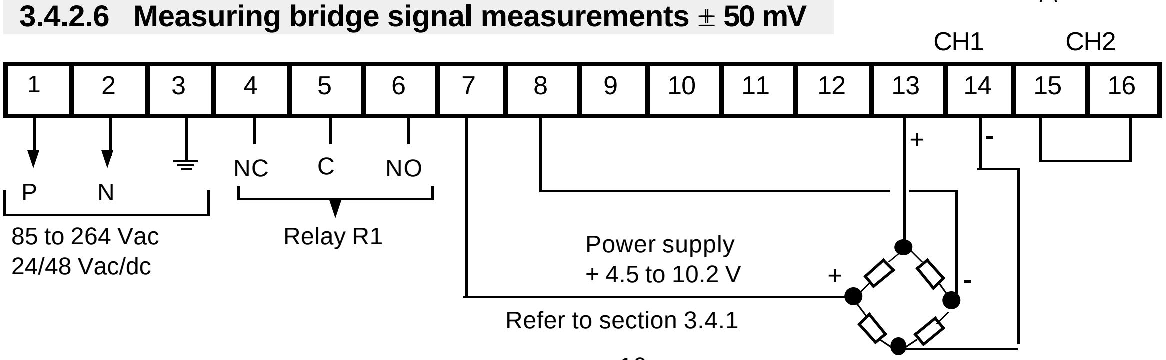
- **Current signal inputs: : 0/20 mA – 4/20 mA provided by transmitters, one of which is 2-wire powered by the DP31**



- **Voltage signal input: 0/10 V**

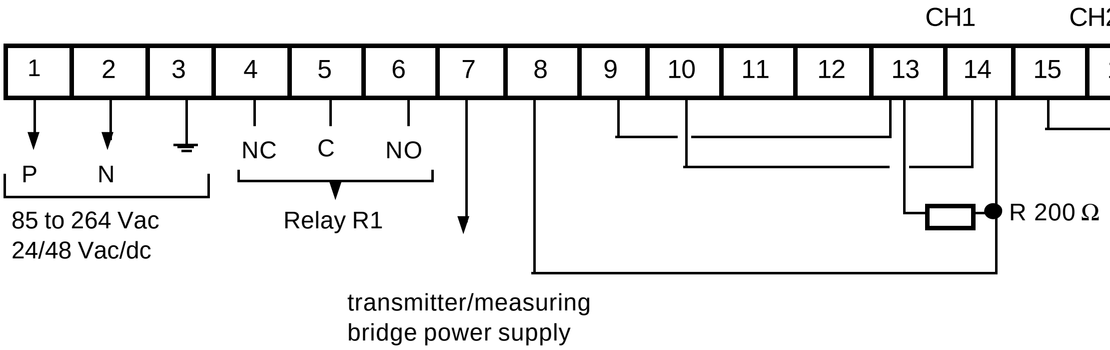


3.4.2.6 Measuring bridge signal measurements ± 50 mV

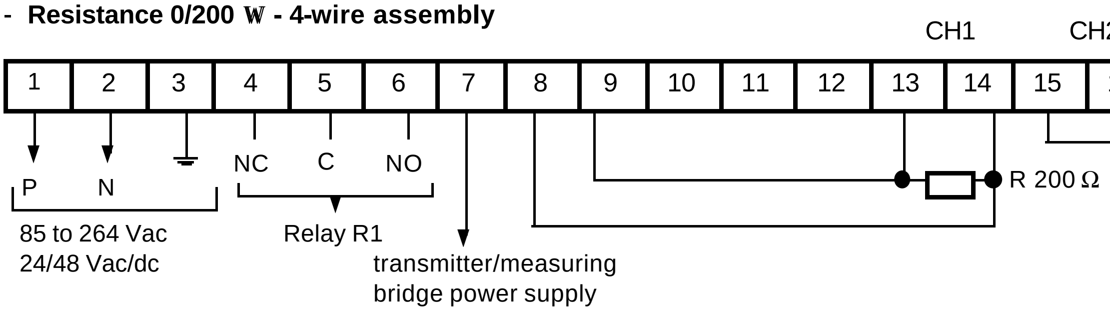


3.4.2.7 Resistance signal measurements

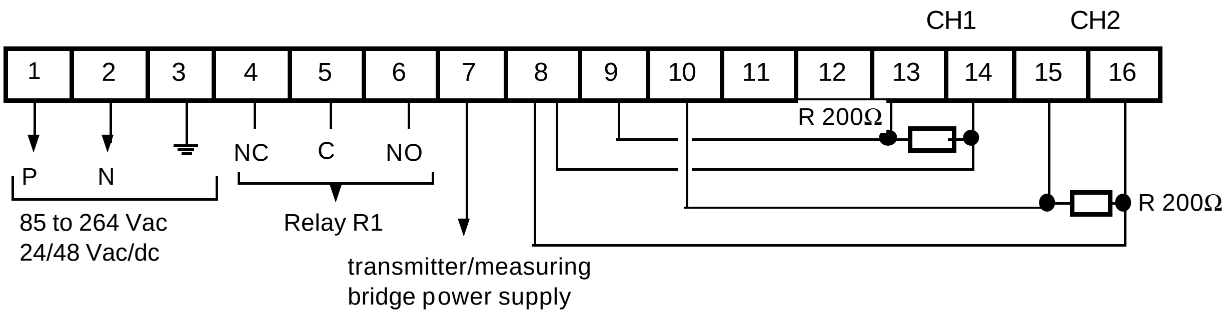
- **Resistance 0/200 W - 3-wire assembly**



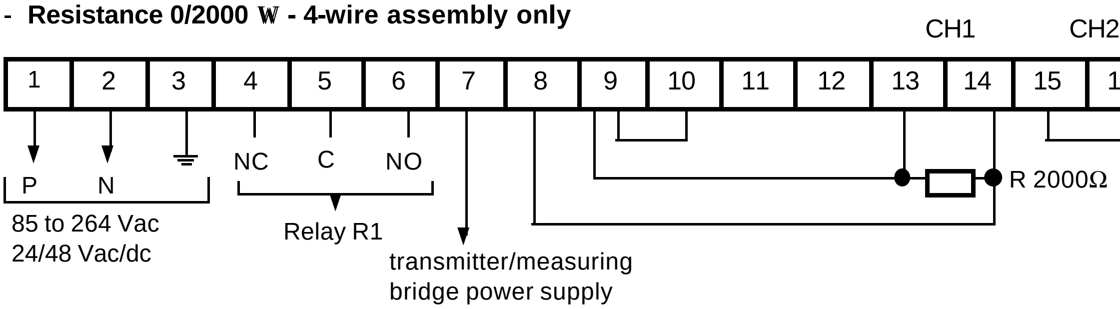
- **Resistance 0/200 W - 4-wire assembly**



- **Resistance 0/200 W -Differential measurement (Ch1-Ch2) 4-wire assembly only**



- **Resistance 0/2000 W - 4-wire assembly only**

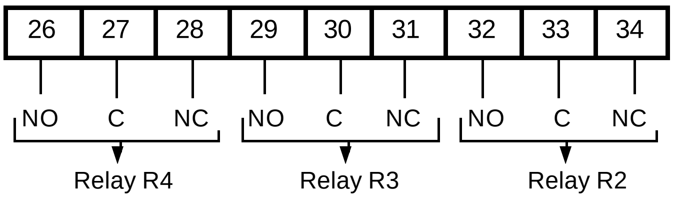


3.4.3 Connecting the additional terminal strips on the -R, -AR, -CR models

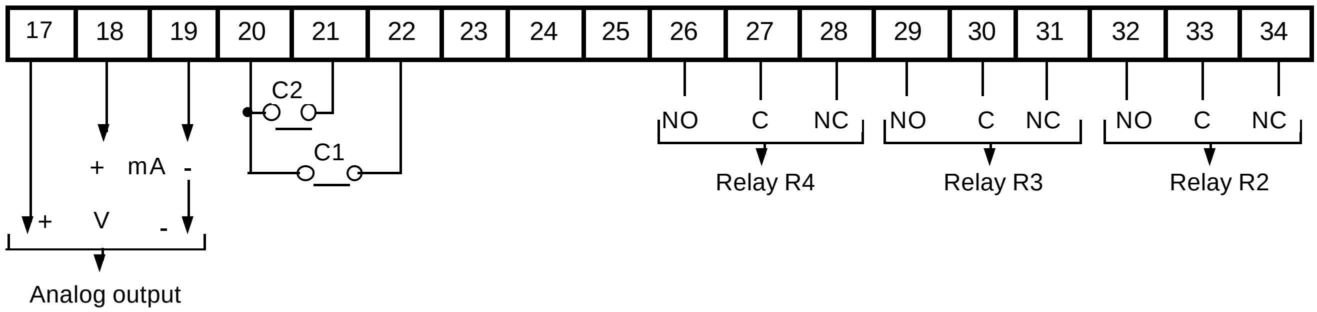
Connections vary depending on the model.

Terminal strip 3 (terminals 17 to 25): analog output, contact inputs C1 & C2, digital link RS-485.
Terminal strip 4 (terminals 26 to 34): alarm relays R2-R3-R4.

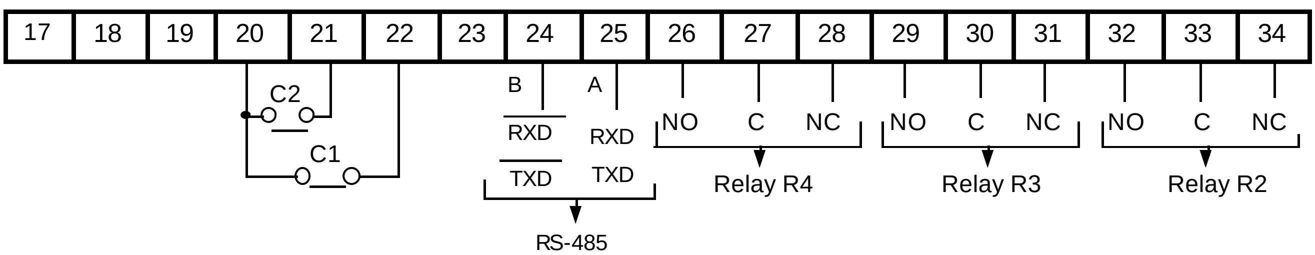
- Model DP31-R: 4 alarm relays



- Model DP31-AR: 2 contact inputs + 4 alarm relays + analog output



- Model DP31-CR: 2 contact inputs + 4 alarm relays + RS-485 digital link



4 - USER DIALOGUE

4.1 INSTRUMENT FACE LAYOUT

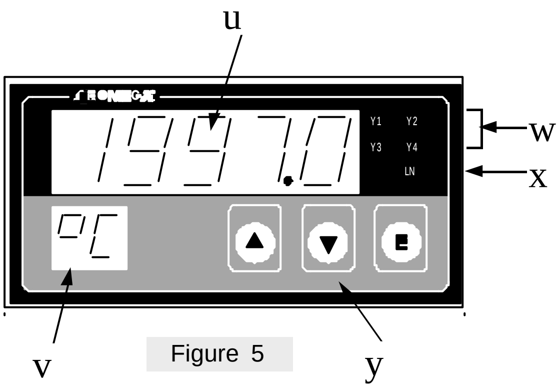


Figure 5

u 5 digit display comprising seven 14 mm-high segments, for displaying:
- Single (channel 1), differential (channel 1 – channel 2) and alternating relative humidity/temperature measurements.
- Alarm thresholds, menus and configuration parameters.
- Display limits: -19999 to 99999 units.

v Two digit display comprising seven 9 mm-high segments, for displaying:
- Measurement units.
- Menu and configuration parameters.

w Four red LED's (Y1, Y2, Y3 & Y4) indicating that the respective thresholds have been exceeded (lit during alarm status and latching).

x One red LED LN indicating the use of the digital link: it flashes during reception of messages.

y Keypad with 3-dual function keys:

E : - select parameters to be displayed
- confirm configuration or parameter adjustment.

▲ - Scroll through menu or parameters
- Increase number value

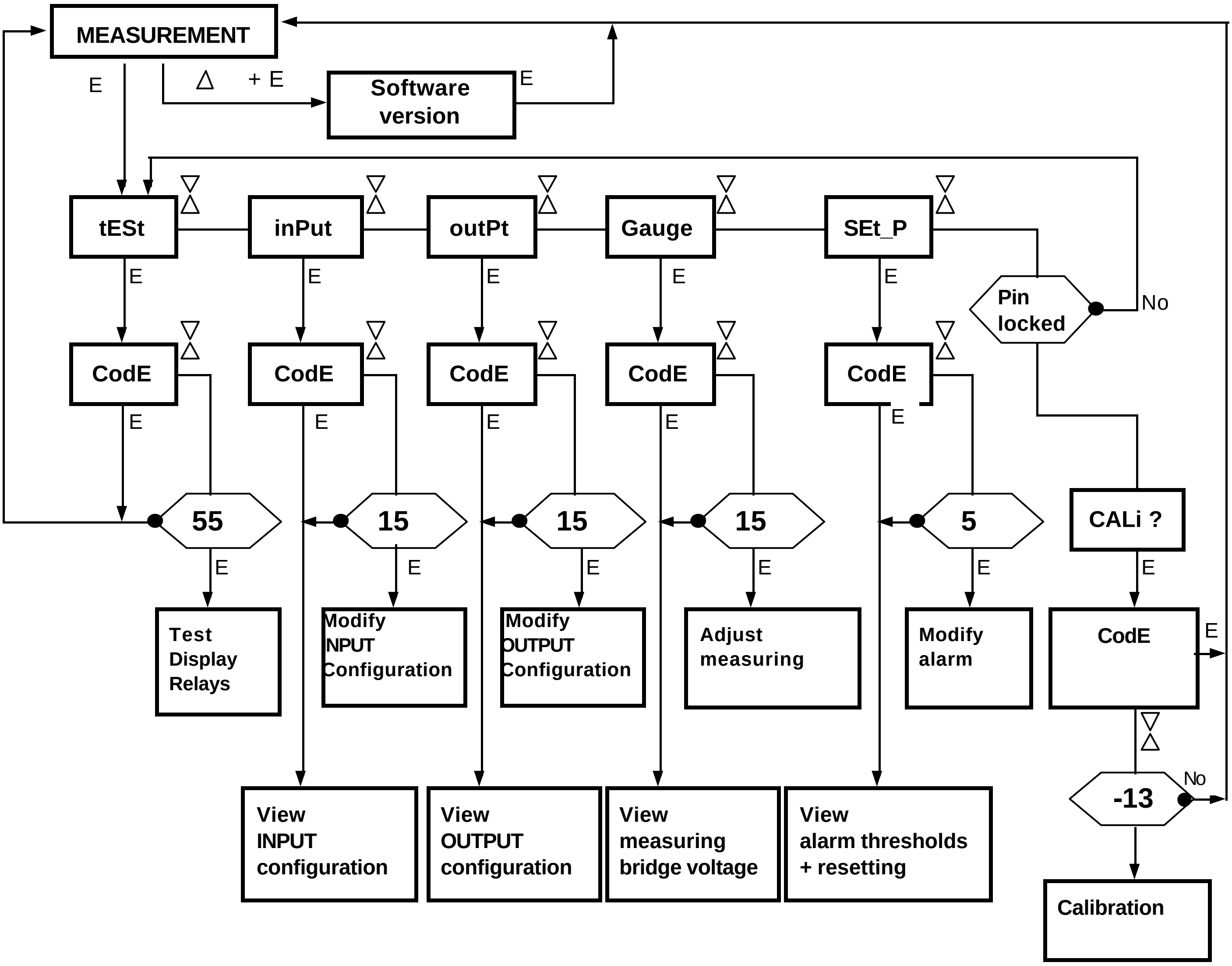
▼ - Scroll back through menu or parameters
- Decrease number value

To increase or decrease a number, keys p and q are dual action:
- One press to change by one unit.
- Sustained pressure to change rapidly.

4.2 DIALOG PRINCIPLE

User dialog is structured in menus with different levels of accessibility:
- **Normal use**, accessed directly, allows measurements, parameters and alarm thresholds to be viewed but not changed. Latched alarms may also be reset.
- **Set**, which is accessed by entering code (5), allows alarm thresholds to be modified.
- **Configure,** which is accessed by entering code (15), allows the DP31 unit to be configured for a specific application.
- **Automatic calibration** of the input/outputs is accessed by entering code (-13) and closing the calibration pin (see section 7.1).
- **Test**, which is accessed by entering code (55), allows the user to test the display and relays.

4.3 ACCESS TO CONFIGURATION MENUS



† During the view phases, the measurement is displayed automatically 9 seconds after the last key is pressed.

¡ **SOFTWARE VERSION**

With the measurement on-screen, depress and hold p, then press E; the version number **PA02 UE** will be displayed e.g.:

5 - CONFIGURATION

The DP31 unit may be configured to suit the characteristics and requirements of a given application by the choice and definition of the input and output parameters. The configuration process is structured around menus (input-output) consisting of several successive stages described in the various flowcharts.

† - Modifying the configuration is only possible by entering code 15. Otherwise, it is only possible to view the existing configuration.

- For safety reasons, the configuration modification procedure may not be exited until all phases of the menu to be modified have been run through and confirmed.

- Certain parameters and flowchart steps will not be displayed during the procedure; this is due to either:

  . The absence of certain functions (input contacts, analog output, etc.), depending on the DP31 model;
  . A previously confirmed choice in the menu concerning certain parameters and functions.

5.1 CONFIGURING MEASUREMENT INPUTS

The DP31 unit has two means of reading data which allows the following measurements to be made:

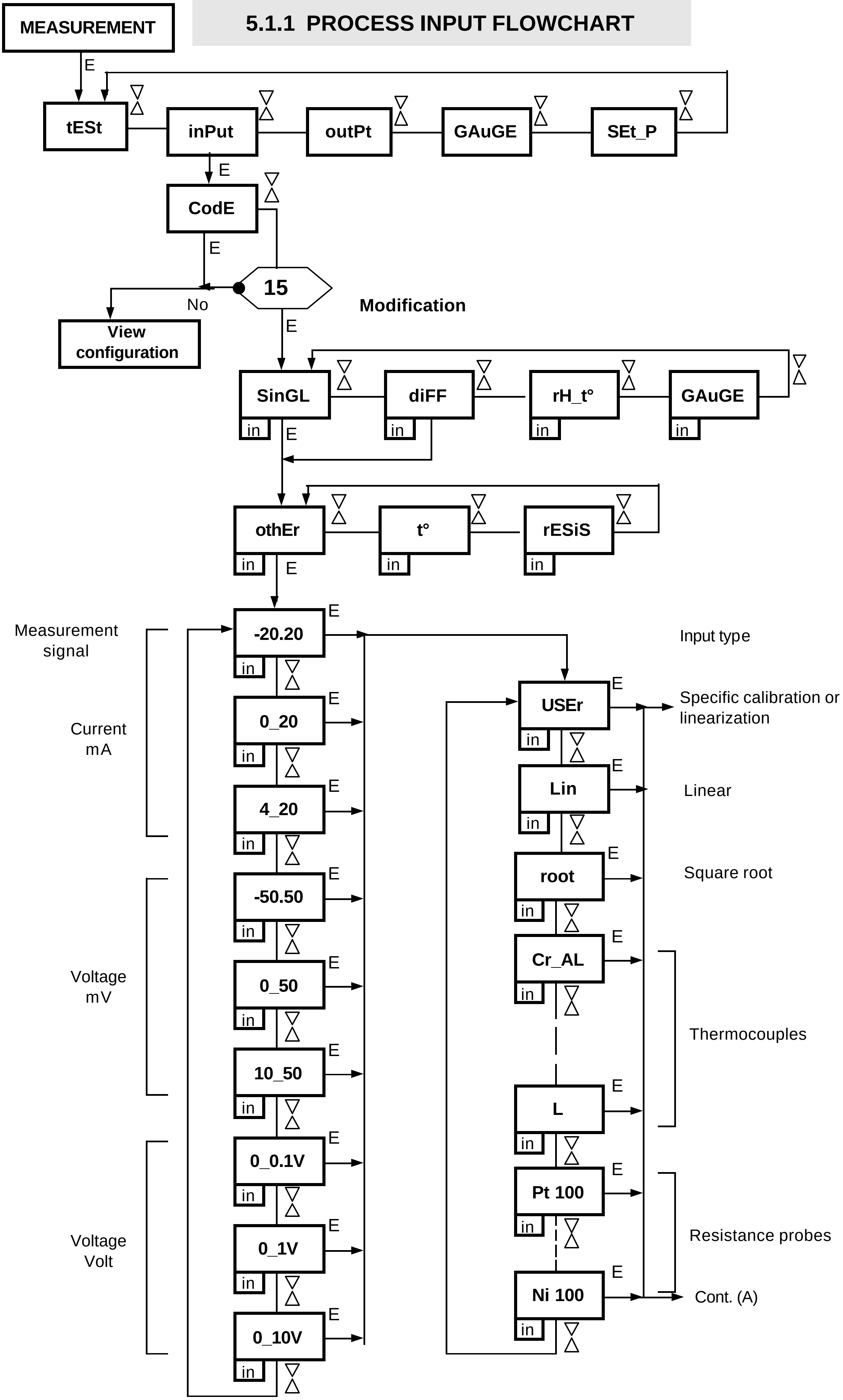
- A single process variable, which reading must be made via channel 1: SinGL input mode.

- Differential measurement (channel 1 – channel 2) of a process variable: diFF input mode. In this case, both channels must be fitted with identical sensors or types of input signal. The chosen configuration is automatically assigned to both channels.

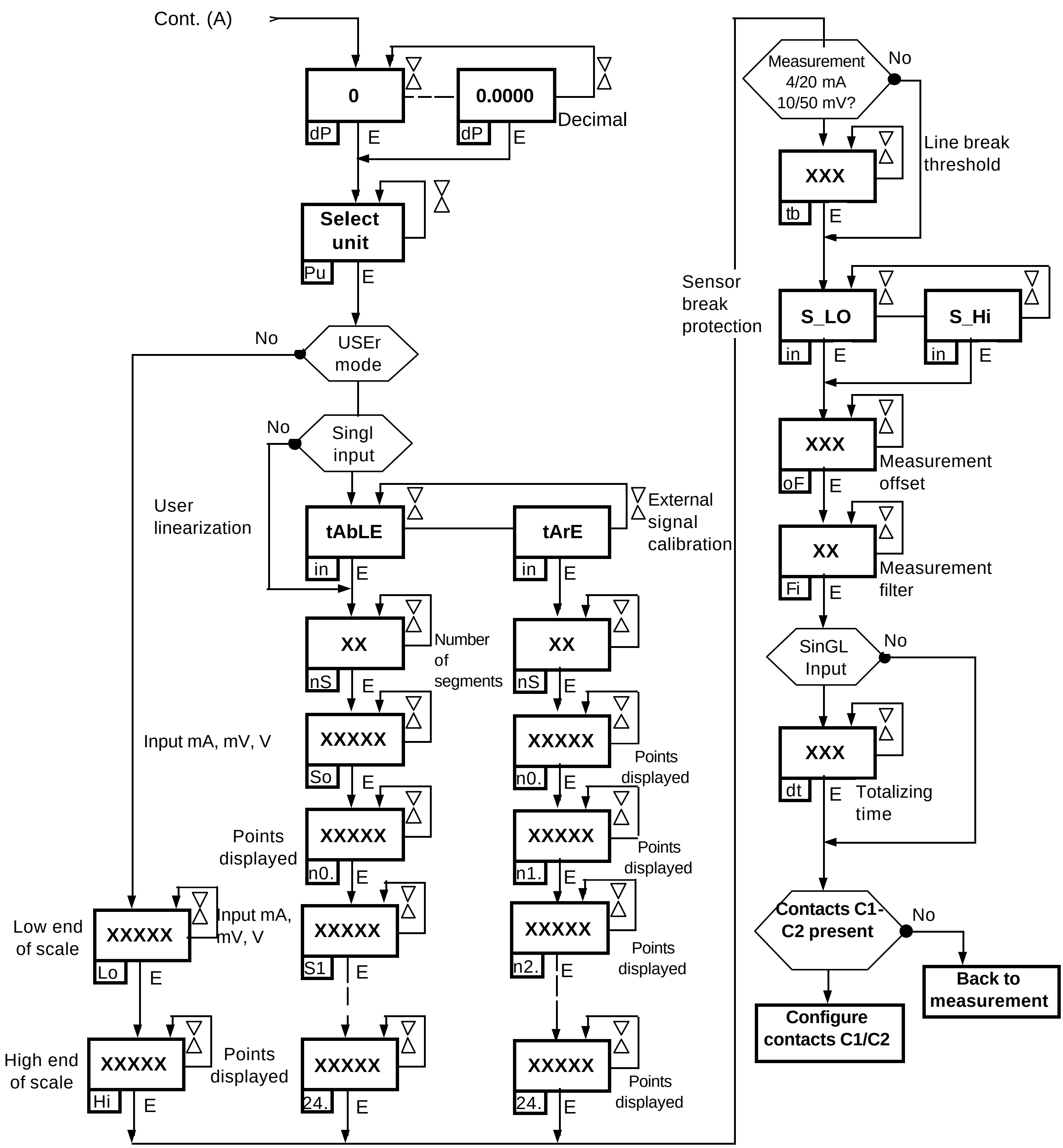
- Two distinct process variables: temperature (channel 1), and relative humidity (channel 2).

† Follow one of the five flowcharts describing the configuration procedure, depending on the sensor type or input signal, and the process variable to be measured. To access the configuration procedure, select the input menu and enter code 15.

5.1.1 PROCESS INPUT FLOWCHART



PROCESS INPUT (Cont.)



CONFIGURING THE PROCESS INPUT: voltage and current signals

- **STEP 1 :** **Select type of measurement: parameter [in]**
  - ✍ **SinGL** : single (on channel 1)
  - ✍ **diFF** : differential (channel 1 – channel 2)

- **STEP 2 :** **Select input type [othEr]**

- **STEP 3 :** **Select measurement signal: parameter [in]**

  . Current mA : ± 20, 0/20, 4/20
  . Voltage mV : ± 50, 0/50, 10/50
  . Voltage V : 0/0,1, 0/1, 0/10

- **STEP 4 :** **Select input or sensor type: parameter [in]**

- **USEr** : specific linearization of the input signal in up to 25 stages, or calibration function for a real input signal – max. 25 points.

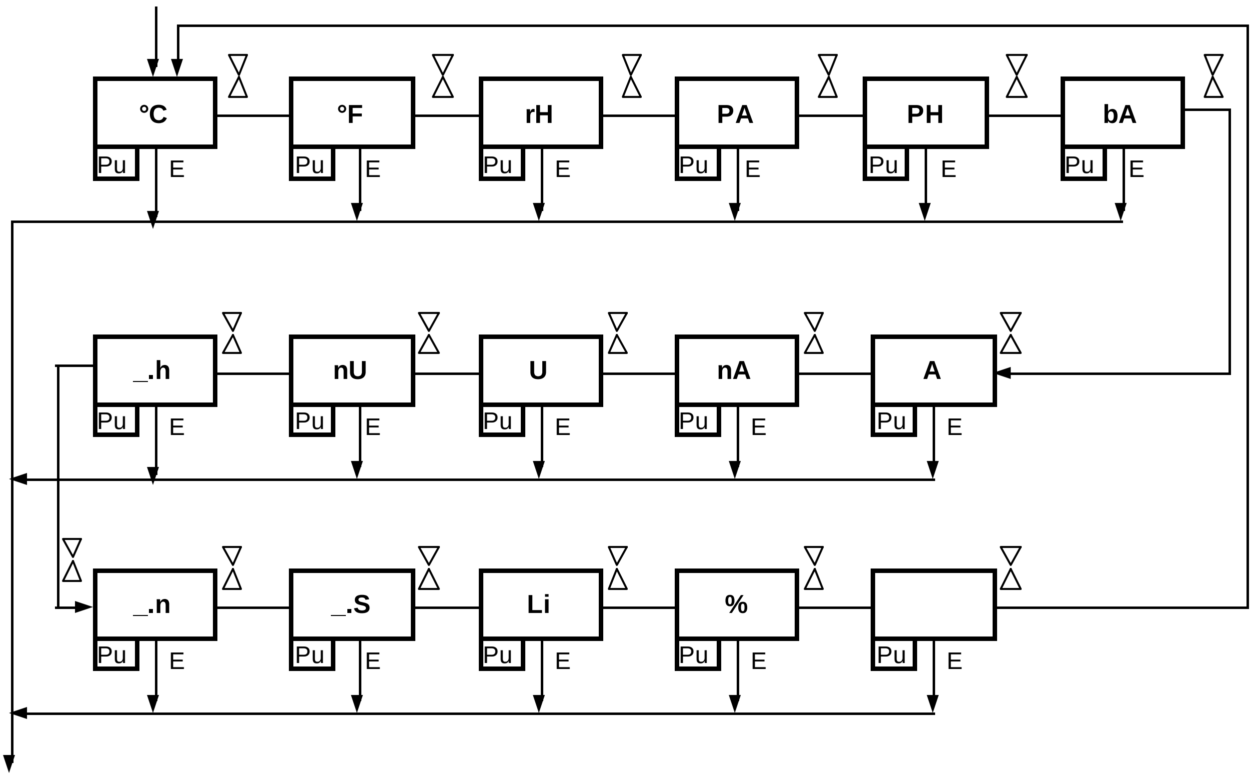
- **Lin** : Linear input signal

- **root** : Calculation of the square root of the input signal.

- Select temperature sensor: thermocouple or resistance probe linearized by the DP31 (see phase 3 of section 5.1.2 page 24).

- **STEP 5 : select decimal point position : parameter [dP]**
  - USEr, Lin or root input: dP = 0 - 0.0 - 0.00 - 0.000 - 0.0000
  - Thermocouple or resistance probe temperature sensor: dP = 0 – 0.0

- **STEP 6 : Select unit for the process variable to be measured: parameter [Pu]**



- **STEP 7 :** **Setting the scale limits for the input signal**

  - Parameter **[Lo]** : Low scale.

  - Parameter **[Hi]** : High scale.

  Input adjustment range:

  - Lin : -10000 to +20000 points
  - root : 0 to 20000 points.
  - Temperature sensors: within the specific limits of each type of sensor (see section 8.1.3).

- **STEP 8 :** If the input type **[USEr]** has been confirmed in step 4 there is a selection to be made between **tAbLE** and **tArE** modes: parameter **[in]**

  - **[tAbLE] mode : with single and differential measurements, it is possible to linearize the input signal in 25 stages.**

> † Linearization is only possible with increasing and decreasing monotonic functions. This consists of assigning a value for each breakpoint:
>
> - Input signal value in mA, mV or V within the limits set in step 3.
> - Number of points represented on-screen (from –10000 to +20000) corresponding to the resolution set in step 5.

Example: six segment table with seven breakpoints

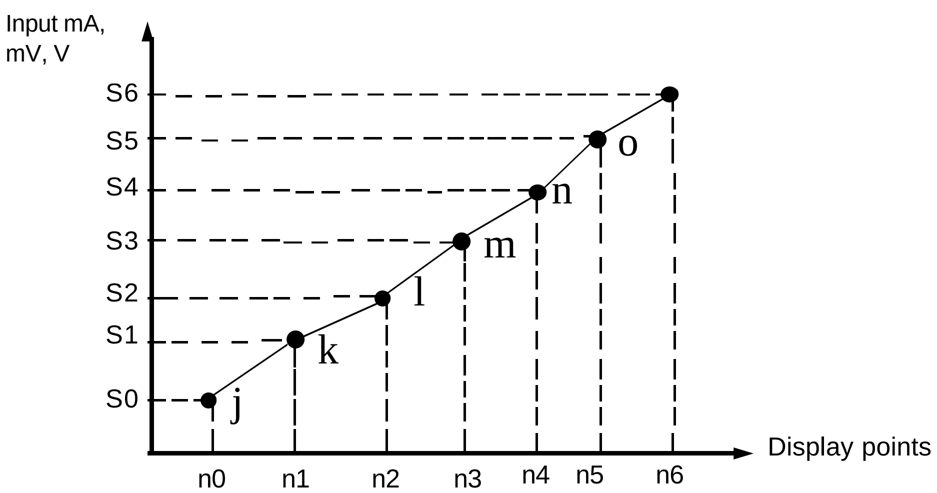


Figure 6

- Select the number of segments in table: parameter nS = 0 to 24.

- Assign a value to each breakpoint corresponding to the segments selected.
  So **:** input value in mA, mV or V for point O.
  no. **:** number of display points corresponding to the input value So

  Identical procedure for points S1, n1 to Sx, nx.

  As of the tenth breakpoint, the symbols displayed become:

  - 10, 11, 12 ... for the input values
  - 10**.**, 11**.**, 12**.** ... for the corresponding display points.

- **[tArE] mode: the changes in the input signal received on channel 1 may be linearized in 25 stages.**

  The measurement received via channel 1 is recorded as a dip value by the operator when it successively sets and confirms the corresponding numbers of display points: n0, n1, n2, …

> † This mode cannot be used for differential measurements. Display values are only taken into account when they are altered by pressing keys q and p. This allows the indicator to be reset to a calibration setting, with no need to change the values already memorized.

- **STEP 9 :** **Setting the shifted measurement signal threshold for line break detection:** parameter **[tb]**
  - 4/20 mA signal : 0 to 4 mA
  - 10/50 mV signal : 0 to 10 mV

- **STEP 10 :** **Selecting the position of the measurement protection device, for the detection of sensor failure and breaks in the measuring wire:** parameter **[in]**
  - ✍ **S.Lo** : low protection ⇨ measurement at minimum on scale
  - ✍ **S.Hi** : high protection ⇨ measurement at maximum on scale.

- **STEP 11 :** **Setting the measurement offset**
  - parameter **oF** : ± 500 display points

  With differential measurements, the offset is applied to the difference displayed (channel 1 – channel 2)

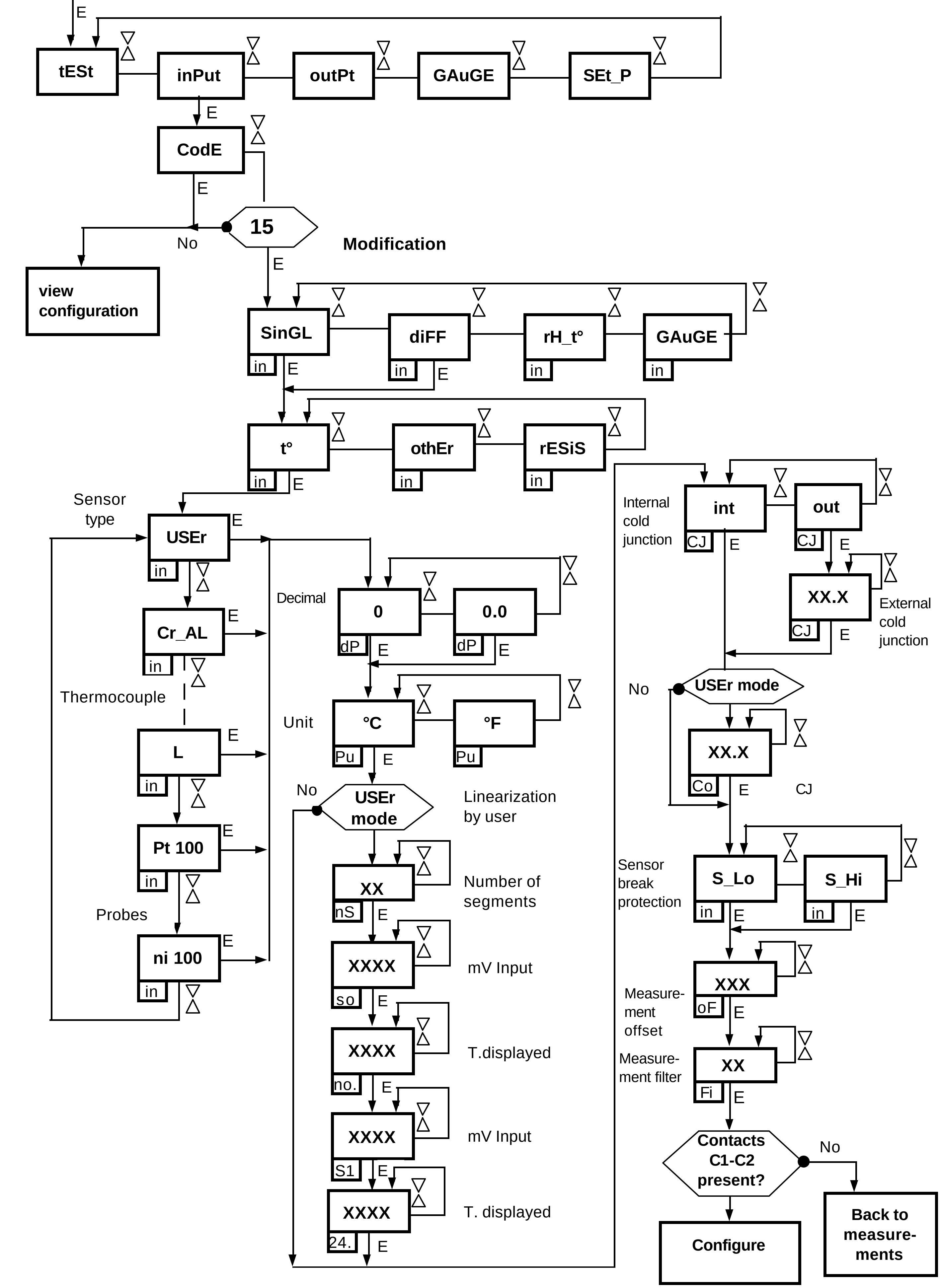
- **STEP 12 :** **Setting the measurement software filter**
  - parameter **Fi** : 0 to 20

- **STEP 13** : **Setting the totalizing time**
  - Only used with single measurements (channel 1)
  - parameter **dt** : 0 to 99999 seconds

  The time unit is linked to the choice of physical unit made in step 6. The unit is generally the second, except where set to:
  - .n ⇨ minute
  - .h ⇨ hour

- **STEP 14** : **Assignment of input contacts C1 - C2** where present
  ⇨ see section 5.2

5.1.2. TEMPERATURE INPUT FLOWCHART



¡ CONFIGURING TEMPERATURE INPUTS: MEASUREMENTS USING THERMOCOUPLES AND RESISTANCE PROBES

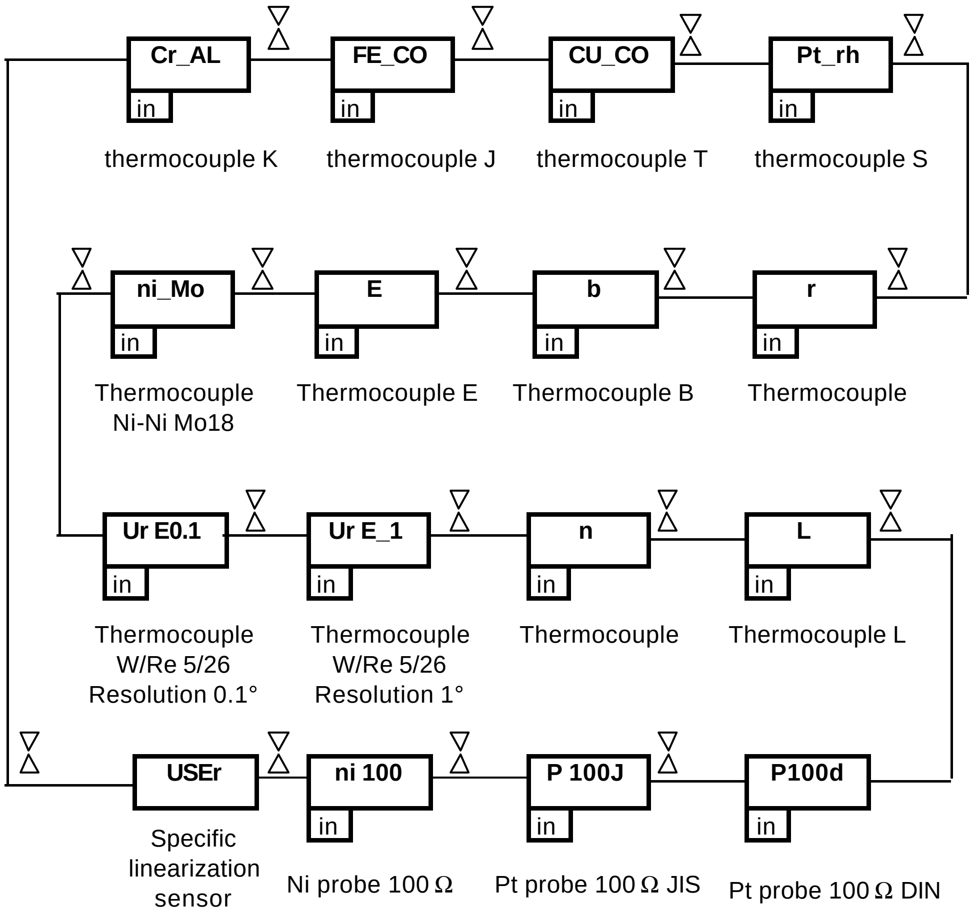
- **STEP 1 :** **Select measurement type**

  ✍ **SinGL** : single (on channel 1)

  ✍ **diFF** : differential (channel 1 - channel 2)

- **STEP 2 :** **Select input type [t°]**

- **STEP 3 :** **Select either thermocouple sensor or resistance probe**



- **STEP 4 :** **select decimal point position**
  - parameter **[dP]** : 0 or 0.0

- **STEP 5 :** **select unit**
  - parameter **[Pu]** : °C or °F

- **STEP 6 :** Specific linearization in up to 25 stages for any thermocouple not already supported in the internal tables (**[USEr]** selection made in step 3).

† Linearization is only possible with increasing or decreasing monotonic functions. This consists of assigning values for each breakpoint:

Sx : input voltage in mV (± 75.00 mV max.)

nx. : temperature displayed, corresponding to the resolution and unit selected (-10,000 to +20,000 points).

See **tAbLE** mode in step 8 of section 5.1.1

- **STEP 7 : Select cold junction compensation mode**
  - parameter **[CJ]**

    ✍ **int** : automatic internal compensation
    ✍ **out** : external compensation

- **STEP 8 : Adjust external cold junction value**
  - parameter **[CJ]** : 0 to 60°C or 32 to 140°F

- **STEP 9 : Adjust cold junction coefficient in USEr mode**
  - parameter **[Co]** : ± 1000 µV/°C

- **STEP 10 : Select the position of the measurement protection device used for detecting sensor failure and breaks in the measuring wire:**
  - parameter **[in]**

    ✍ **S-Lo** : low level ⇨ minimum measurement on scale
    ✍ **S-Hi** : high level ⇨ maximum measurement on scale

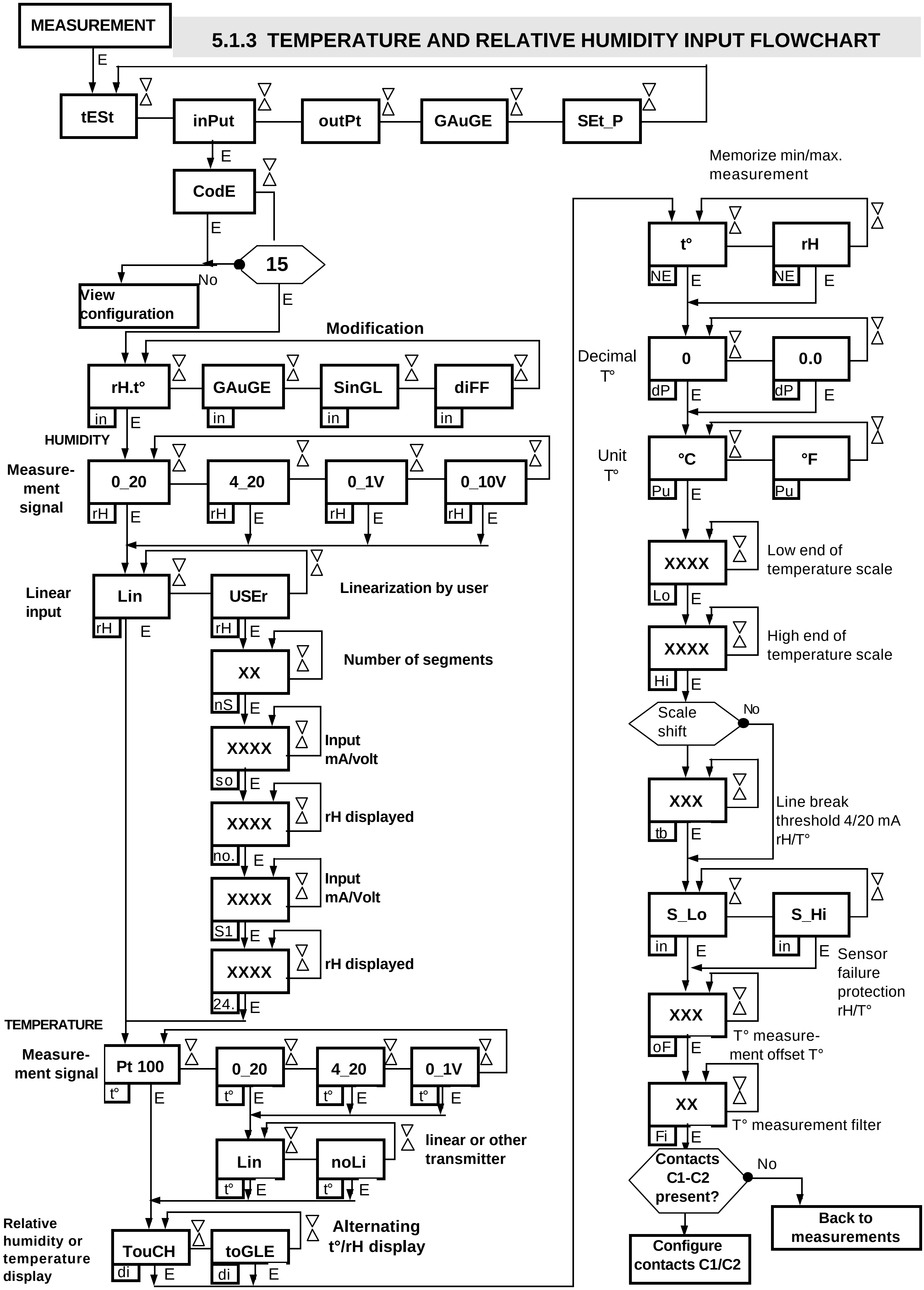
- **STEP 11 : Setting the measurement offset**
  - parameter **[oF]** : ± 500 display points

With differential measurements, the shift is applied to the difference displayed (channel 1 – channel 2)

- **STEP 12 : Adjust the measurement software filter**
  - parameter **[Fi]** : 0 to 20

- **STEP 13 : Assign input contacts C1 - C2 where present**
  See section 5.2

5.1.3 TEMPERATURE AND RELATIVE HUMIDITY INPUT FLOWCHART



¡ CONFIGURING TEMPERATURE AND RELATIVE HUMIDITY INPUTS

- **STEP 1 : Select input type [rH - t°]**

- **STEP 2 : Select input signal (channel 2) for relative humidity measurements**
  - parameter **[rH]**

    ✍ current mA : 0/20, 4/20
    ✍ voltage V : 0/1, 0/10

- **STEP 3 : Select relative humidity input type**
  - parameter **[rH]**

    ✍ **Lin** : Input signal with linear variations

> † The scale limits and measurement resolution are not adjustable. They are automatically set at 0.0 and 100.0% rH.

✍ **USEr**: specific linearization of the input signal in up to 25 stages - see **tAbLE** in step 8 of section 5.1.1

Adjustment of rH values displayed: 0.0 to 100.0%.

- **STEP 4 : Select input signal (channel 1) for the temperature measurement**
  - parameter **[t°]**

    ✍ Pt 100 : direct input for Pt 100 Ω DIN probe
    ✍ Current mA : 0/20, 4/20
    ✍ Voltage V : 0/1

> † The current and voltage signals, non-linearized, must be provided by temperature transmitters with a sensor consisting of a Pt 100 Ω resistance probe.

- **STEP 5 : Signal type sent by the temperature transmitter**
  - parameter **[t°]**

    ✍ **Lin** : signal linearized by the transmitter
    ✍ **noLin** : non-linearized signal. In such cases, the DP31 unit will use its internal Pt 100 Ω DIN resistance probe linearization table.

- **STEP 6 : Select rH and t° measurement display mode**
  - parameter **[di]**

    ✍ **TouCH** : static display. Switching between variables is performed by pressing the p and q keys.
    ✍ **toGLE** : display toggles between the two variables every three seconds.

- **STEP 7 :** **Set memorized variable for minimum and maximum measurements**
  - parameter **[nE]**

  ✍ **t°** : temperature
  ✍ **rH** : relative humidity

- **STEP 8 :** **Select decimal point position**
  - parameter **[dP]** : 0 or 0.0

- **STEP 9 :** **Select temperature unit**
  - parameter **[Pu]** : °C or °F

- **STEP 10 :** **Set temperature input scale limits**

  Max. temperature range: -200.0 to +800.0°C

  - parameter **[Lo]** : Low scale
  - parameter **[Hi]** : High scale

- **STEP 11 :** **Setting the line break detection threshold for 4/20 mA measurement signals**
  - parameter **[tb]** ; 0 to 4 mA.

  The threshold set by this means is applied to both measurement inputs (rH and t °), where they receive 4/20 mA signals.

- **STEP 12 :** **Selecting the position of the measurement protection device, for the detection of sensor failure (Pt 100 Ω probe) and breaks in the 4/20 mA wire**
  - parameter **[in]**

  ✍ **S-Lo** : low level ⇨ measurement at minimum on scale

  ✍ **S-Hi** : high level ⇨ measurement at maximum on scale

  The selection made is applied to both quantities - rH and t°.

- **STEP 13 :** **Setting the measurement offset**
  - parameter **[oF]** : ± 500 display points.

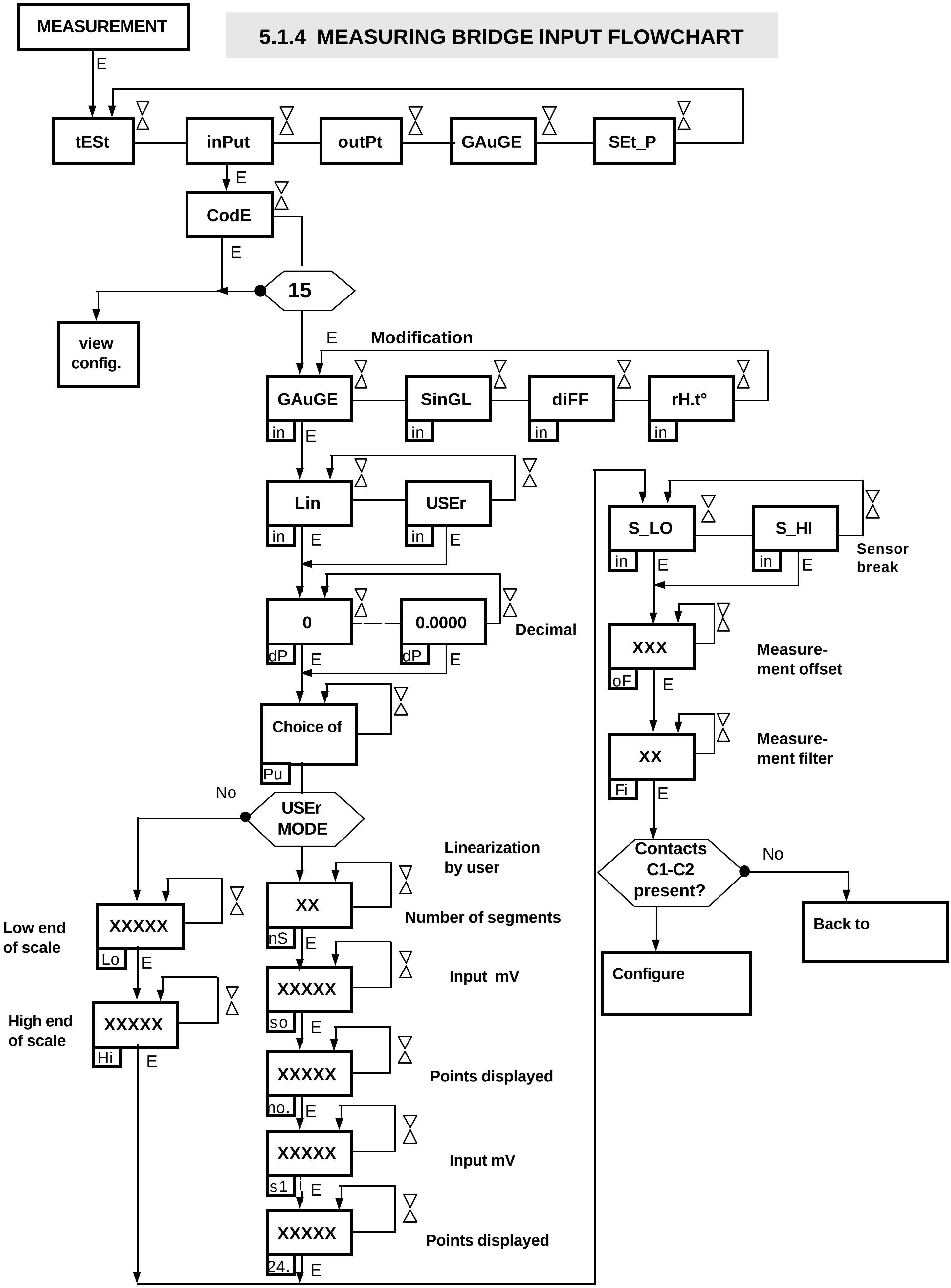
  - The relative humidity measurement may not be adjusted.

- **STEP 14** : **Setting the measurement software filter**
  - parameter **[Fi]** : 0 to 20

  This filter does not operate on the RH input.

- **STEP 15** : **Assignment of input contacts C1 - C2 where present**
  See Section 5.2

5.1.4 MEASURING BRIDGE INPUT FLOWCHART



¡ CONFIGURING THE MEASURING BRIDGE

- **STEP 1 :** **Select input type [GAuGE]**

  The amplitude of the measurement input signal is automatically set to ± 50 mV.

- **STEP 2 :** **Select input type**
  - parameter **[in]**

  ✍ **Lin** : Input signal with linear variation

  ✍ **USEr** : specific linearization of the input signal in up to 25 stages.

- **STEP 3 :** **Select decimal point position**
  - parameter **[dP]**

  dP = 0 - 0.0 - 0.00 - 0.000 - 0.0000

- **STEP 4 :** **Select unit for the process variable measured**
  - parameter **[Pu]** ⇨ see phase 6 of section 5.1.1

- **STEP 5 :** **Set scale limits (with Lin input)**

  Scale range: -10,000 to + 20,000 points.

  - parameter **[Lo]** : Low scale
  - parameter **[Hi]** : High scale

- **STEP 6 :** Where a USEr type input has been selected in step 2, enter the coordinates of each breakpoint on the specific linearization table

  Sx : input voltage in mV (± 50 mV max.)

  nx. : display points corresponding to resolution and unit selected (-10,000 to +20,000 points).

  See **tAbLE** mode in step 8 of section 5.1.1

- **STEP 7 :** **Select the position of the measurement protection device for detecting sensor failures and breaks in the measuring wire**
  - parameter **[in]**

  ✍ **S-Lo** : low level ⇨ minimum measurement on scale

  ✍ **S-Hi** : high level ⇨ maximum measurement on scale

- **STEP 8 :** **Set measurement offset**
  - parameter **[oF]** : ± 500 display points

- **STEP 9 :** **Set the measurement software filter**
  - parameter **[Fi]** : 0 to 20

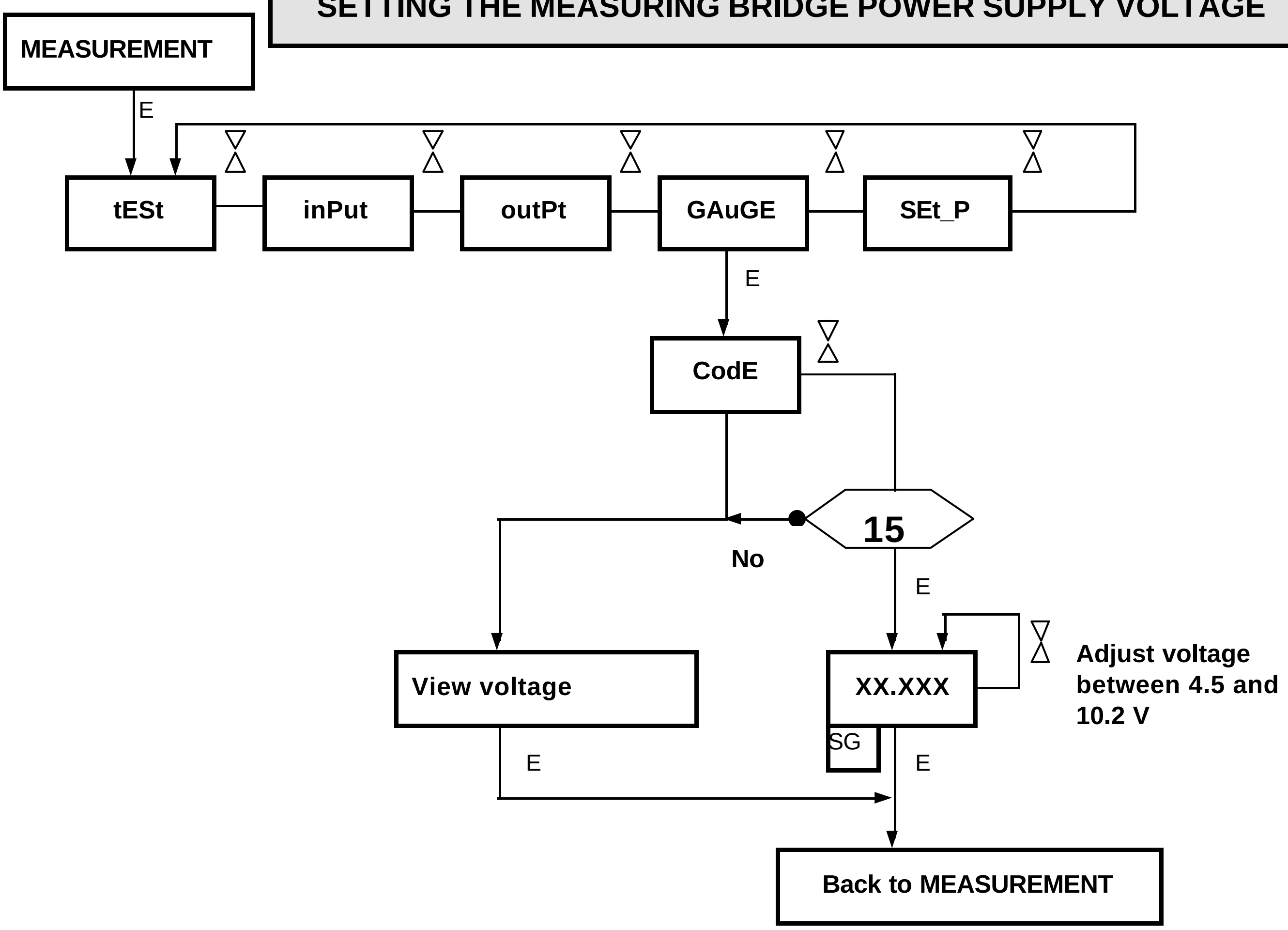
- **STEP 10 :** **Assign input contacts C1 - C2 where present**
  See Section 5.2

- **STEP 11 :** **Set measuring bridge power supply voltage**

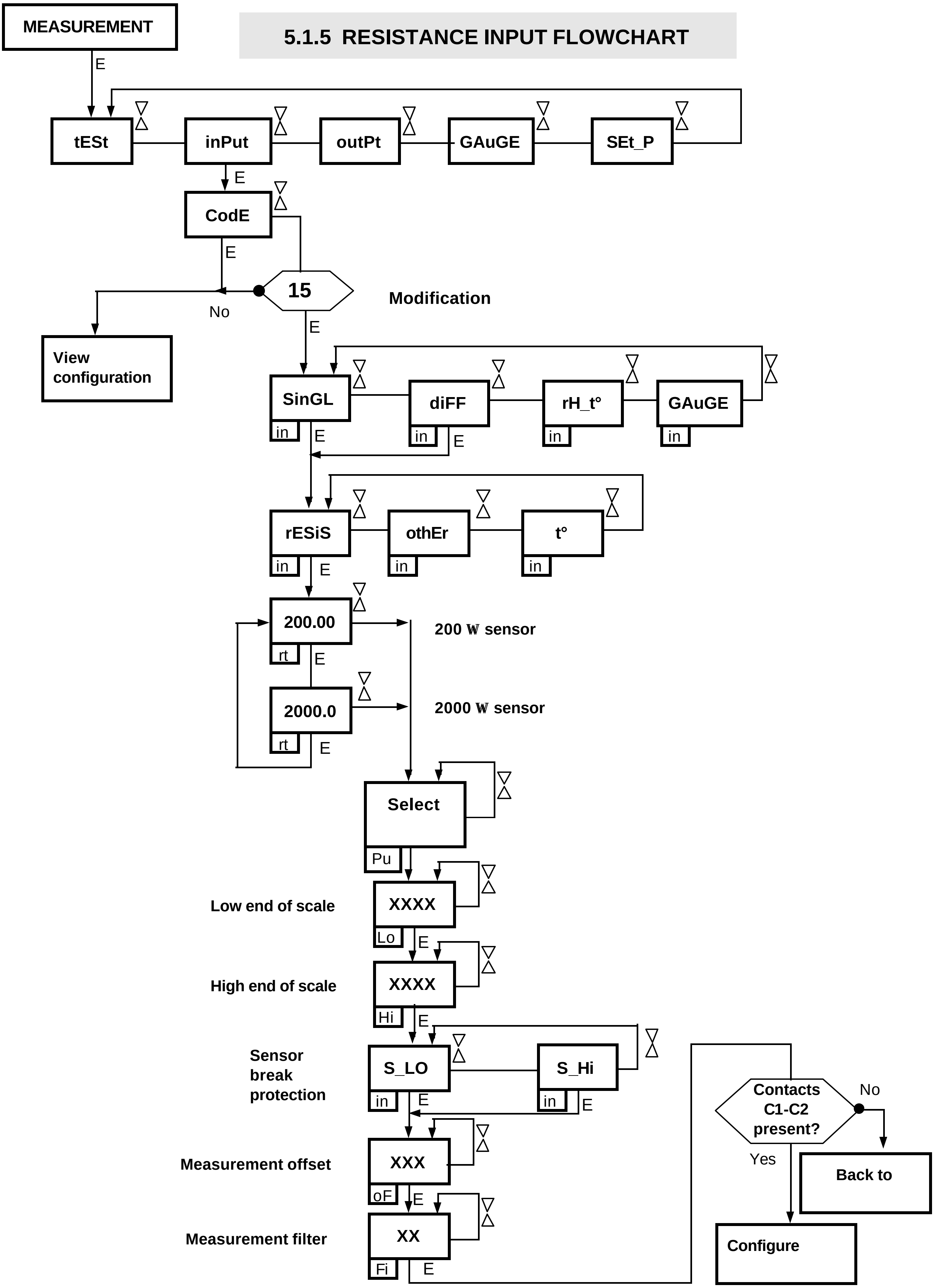
This adjustment may be made directly from the GAuGE menu by entering code 15. The measuring bridge's power supply voltage may be adjusted within the range 4.5 to 10.2 V, in 1 mV increments, by pressing the p and q keys. The voltage must be set such that the input signal varies with a maximum amplitude of ± 50 mV.

> † After configuring the measuring bridge input, check that the power supply selector is set to the appropriate position. - see Section 3.4.1

SETTING THE MEASURING BRIDGE POWER SUPPLY VOLTAGE



5.1.5 RESISTANCE INPUT FLOWCHART



¡ CONFIGURING RESISTANCE INPUTS

- **STEP 1 : Select measurement type**
  - parameter **[in]**

  ✍ **SinGL** : single on channel 1

  ✍ **diFF** : differential channel 1 - channel 2. This only operates with a 4 wire assembly and a 200.00 Ω sensor.

- **STEP 2 : Select input type [rESiS]**

- **STEP 3 : Select sensor type**
  - parameter **[rt]**

  ✍ **200.00 :** linear 200.00 Ω sensor with a 3 or 4 wire assembly
  ✍ **2000.0 :** linear 2000.00 Ω sensor with a 4 wire assembly only

- **STEP 4 : Select unit for physical quantity measured**
  - parameter **[Pu]** - see step 6 of section 5.1.1

- **STEP 5 : Set scale limits**

  Adjustment range: 0 to 20,000 points

  - parameter **[Lo]** : Low scale
  - parameter **[Hi]** : High scale

- **STEP 6 : Select position of the protection device for sensor failures and breaks in the measurement wire**
  - parameter **[in]**

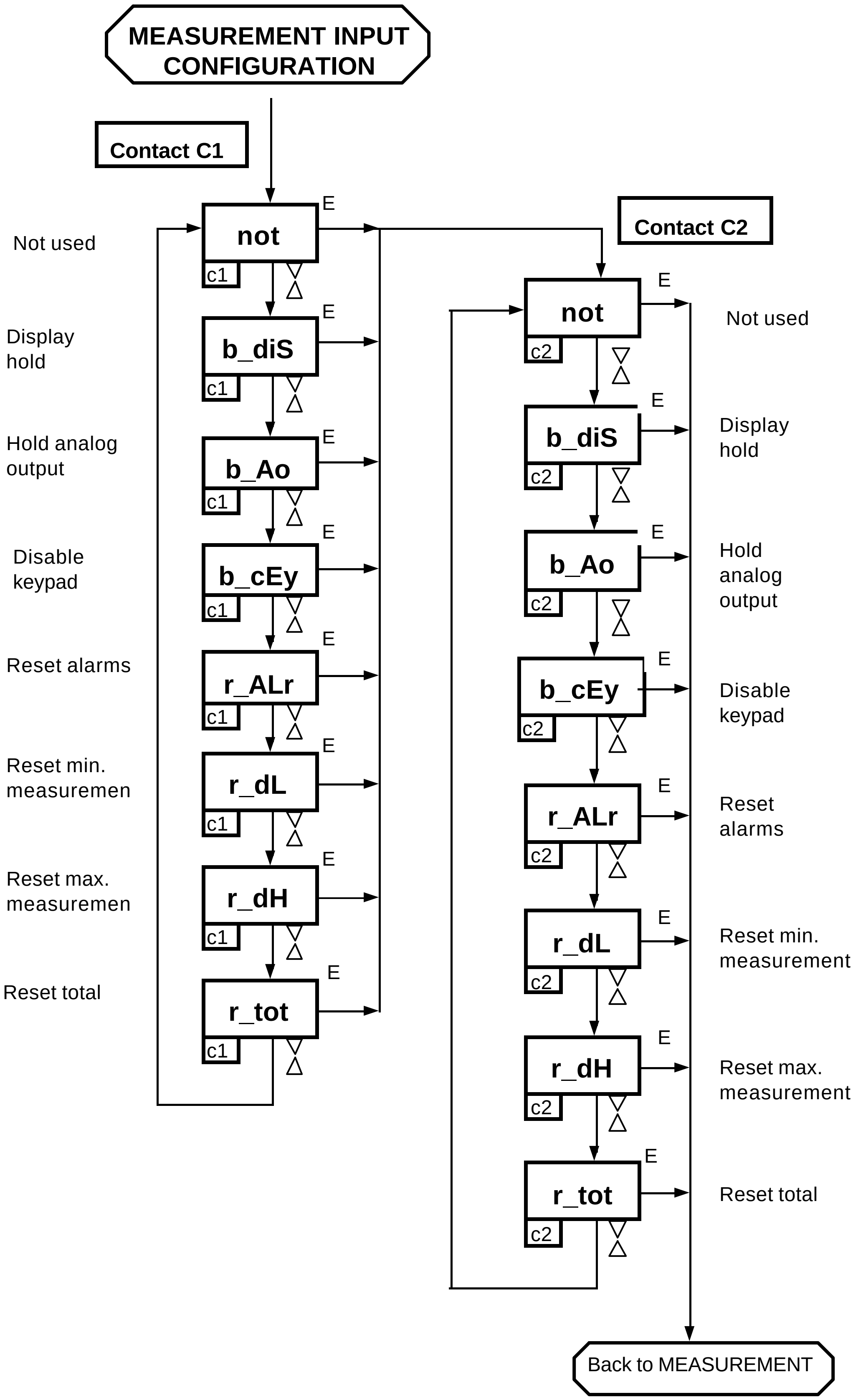
  ✍ **S-Lo** : low level ⇨ minimum measurement on scale
  ✍ **S-Hi** : high level ⇨ maximum measurement on scale

- **STEP 7 : Setting the measurement offset**
  - parameter **[oF]** : ± 500 display points

- **STEP 8 : Setting the measurement input software filter**
  - parameter **[Fi]** : 0 to 20

- **STEP 9 : Assignment of input contacts C1 - C2 where present**
  See section 5.2

5.2 FLOWCHART FOR THE EXTERNAL INPUT CONTACTS C1 AND C2



¡ CONFIGURING INPUT CONTACTS C1 - C2

The DP31 and DP31-R are not fitted with input contacts; this configuration menu does not therefore appear on this model.

- The configured function will be activated when the corresponding contact closes.

▪ **STEP 1 : Assign contact C1**
  - parameter **[C1]**

▪ **STEP 2 : Assign contact C2**
  - parameter **[C2]**

The functions which may be set for each input are:

✍ **not** : contact not used.

✍ **b-diS** : Holds the displayed value

With the inputs configured for relative humidity and temperature, the measurement of each process variable is frozen, regardless of display mode (**touCH or toGLE)**

† With this function active, all internal calculations, alarms and the analog output remain operational. The unit still uses the updated measurement value, with only the display being held.

✍ **b-AoP** : Holds the analog re-transmission at its current value.

✍ **b-cEy** : Disables the keypad: the keys do not respond to being pressed, and none of the menus are accessible.

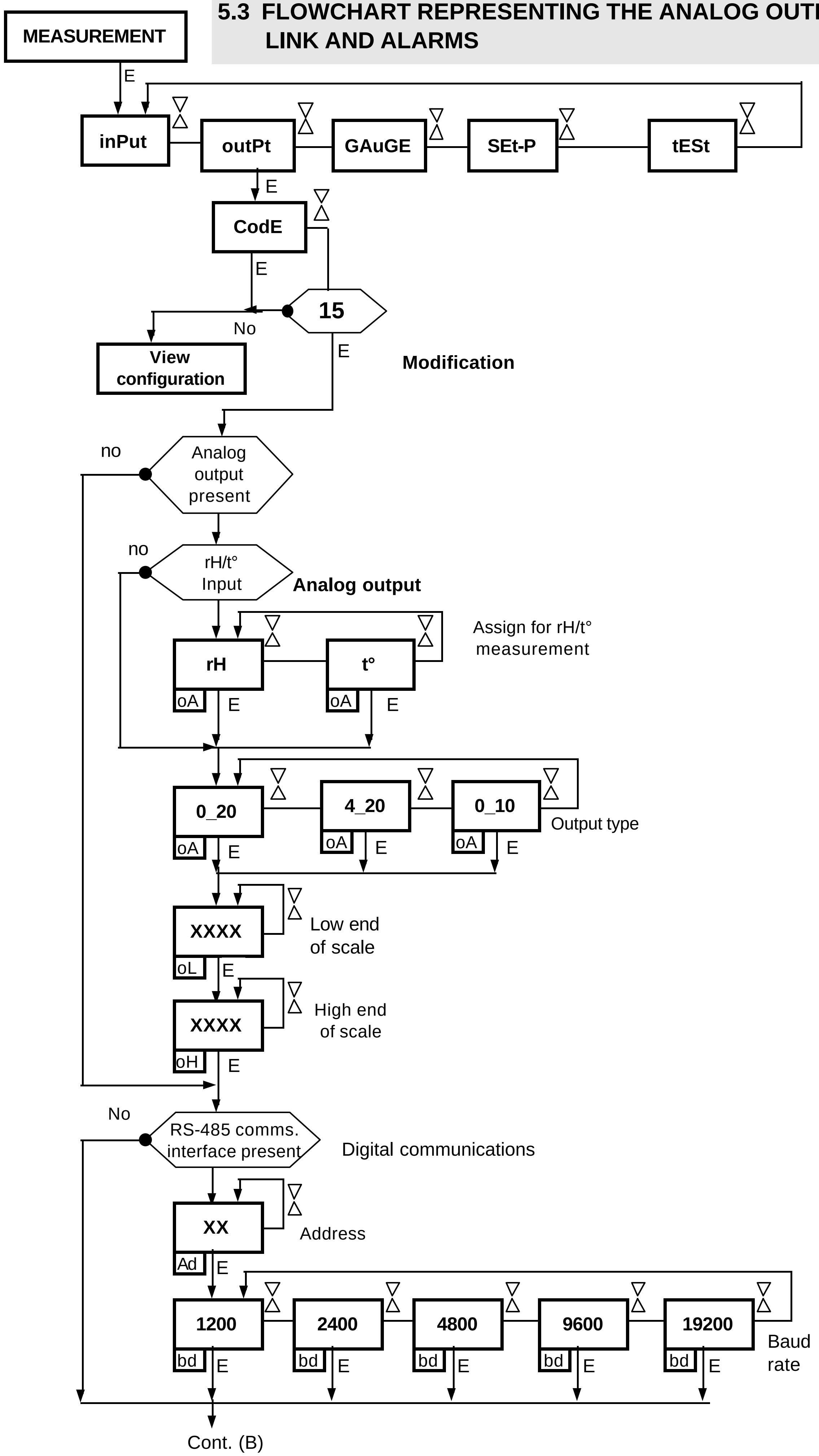
✍ **r-ALr** : Resets any latched alarms (if the measurement value has returned below the relevant threshold).

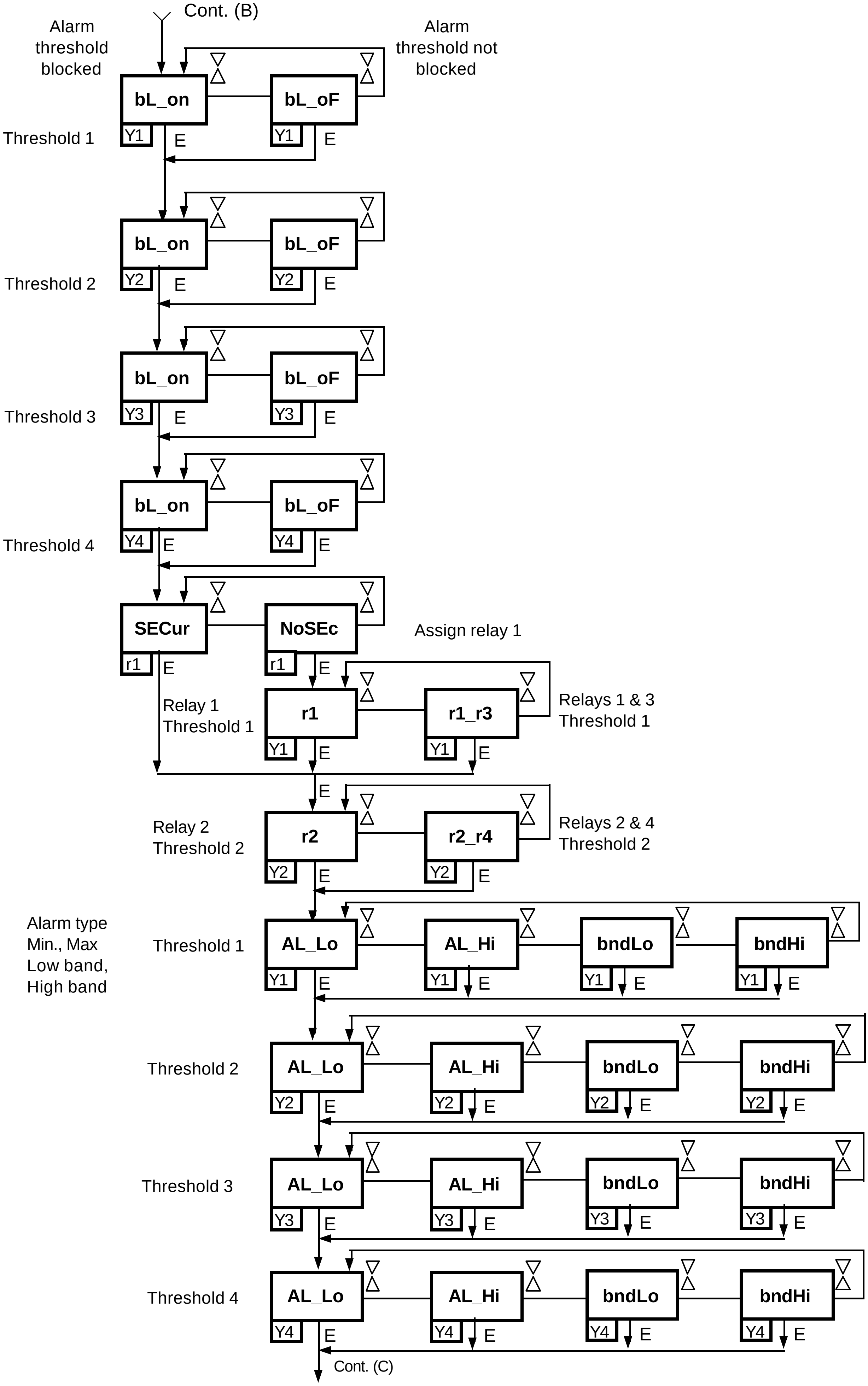
✍ **r-dL** : Resets the minimum measurement stored in memory.

✍ **r-dH** : Resets the maximum measurement stored in memory.

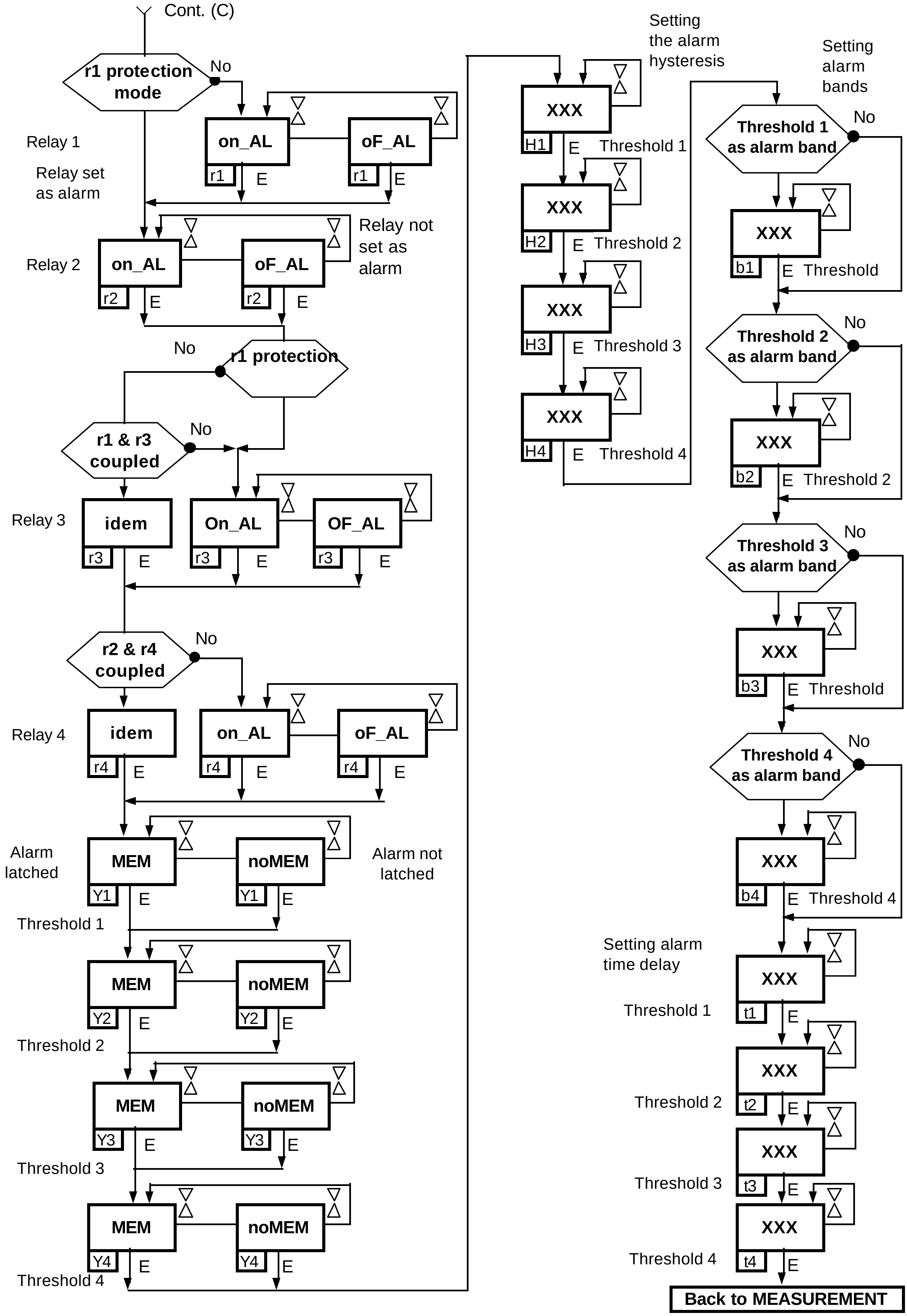
✍ **r-tot** : Resets the total and mean values (only with **sinGL** process input).

5.3 FLOWCHART REPRESENTING THE ANALOG OUTPUT, DIGITAL LINK AND ALARMS





Cont. (B)
Alarm threshold blocked
Alarm threshold not blocked
bL_on
bL_oF
Threshold 1
Y1
E
Threshold 2
Y2
Threshold 3
Y3
Threshold 4
Y4
SECur
NoSEc
Assign relay 1
r1
Relay 1 Threshold 1
r1_r3
Relays 1 & 3 Threshold 1
Relay 2 Threshold 2
r2
r2_r4
Relays 2 & 4 Threshold 2
Alarm type Min., Max Low band, High band
AL_Lo
AL_Hi
bndLo
bndHi
Cont. (C)


Cont. (C)
r1 protection mode
No
Relay 1
Relay set as alarm
on_AL
oF_AL
r1
E
Relay 2
Relay not set as alarm
r2
r1 protection
r1 & r3 coupled
Relay 3
idem
On_AL
OF_AL
r3
r2 & r4 coupled
Relay 4
r4
Alarm latched
MEM
noMEM
Alarm not latched
Y1
Threshold 1
Y2
Threshold 2
Y3
Threshold 3
Y4
Threshold 4
Setting the alarm hysteresis
XXX
H1
H2
H3
H4
Setting alarm bands
Threshold 1 as alarm band
b1
Threshold
Threshold 2 as alarm band
b2
Threshold 3 as alarm band
b3
Threshold 4 as alarm band
b4
Setting alarm time delay
t1
t2
t3
t4
Back to MEASUREMENT

¡ CONFIGURING THE ANALOG OUTPUT, DIGITAL COMMUNICATIONS AND ALARMS

To gain access to the output configuration menu:

- Select the **outPt** menu - see Section 4.3
- Enter code 15 to alter the configuration.

Depending on the DP31 model used, the following menus will appear:

- **on DP31 and DP31-R:** configure alarm relays and thresholds.
- **on DP31-AR**: configure the analog output, then the alarm relays and thresholds.
- **on DP31-CR**: configure digital communications, then the alarm relays and thresholds.

5.3.1 Configuring the analog output on DP31-AR

This output allows the analog re-transmission (current or voltage) of the measurement displayed.

- **STEP 1 : Select the process variable to be transmitted where the measurement inputs are configured for relative humidity and temperature**
  - parameter **[oA]**

  ✍ **rH** : relative humidity measurement
  ✍ **t°** : temperature measurement

- **STEP 2 : Select output signal**
  - parameter **[oA]**

  ✍ **Current:** 0/20 mA - 4/20 mA - max. load: 750 Ω
  ✍ **Voltage:** 0/10 V - min. load: 1000 Ω

- **STEP 3 : Set range of measurements to be transmitted**

This step involves calibrating the output for all or part of the input measurement range (zoom effect). There must be a minimum of 200 points, regardless of the resolution chosen (200 - 20.0 - 2.00 - 0.200 - 0.0200).

- parameter **[oL]** : Low scale
- parameter **[oH]** : High scale

> † The number values for the low and the high limits of the scale must fall within the input measurement ranges defined by the types of sensor used (thermocouples, resistance probes, etc.) and the mode selected (USEr, Lin, root).
> They may include the "minus" sign - (+ being implicit).
> The values for the low and high of the scale may be inverted. In this case, the analog output signal will follow the inverse of the measurement input signal.

5.3.2 Configuring digital communications (on DP31-CR)

- **STEP 1 : Set the equipment's address**
  - parameter **[Ad]** : 1 to 63

- **STEP 2 : Set baud rate**
  - parameter **[bd]** : 1200 - 2400 - 4800 - 9600 - 19200 bauds.

5.3.3 Configuring alarm relays and thresholds

All DP31 models are fitted with four fully configurable alarm thresholds. The assignment and operation of the alarm relays (1 on DP31 base unit, 4 on the other models), are also configurable.

> † LED's Y1, Y2, Y3 & Y4 indicate that the set thresholds have been exceeded, but do not show the alarm relay status. With relative humidity and temperature inputs, thresholds Y1 & Y2 are assigned to the relative humidity measurements, Y3 & Y4 being assigned to the temperature measurements.

The thresholds and relays are identified by the following messages:

Y1 ⇨ threshold 1, Y2 ⇨ threshold 2, Y3 ⇨ threshold 3, Y4 ⇨ threshold 4

r1 ⇨ relay 1, r2 ⇨ relay 2, r3 ⇨ relay 3, r4 ⇨ relay 4

During each step in the configuration procedure, the relevant thresholds and settings (hysteresis, time delay, etc.) are each allocated an identification number matching the appropriate threshold (e.g. hysteresis threshold Y1 ⇨ H1 ; time delay threshold Y3 ⇨ t3...).

- **STEP 1 : Access to the threshold settings:**

  - parameters **[Y1, Y2, Y3, Y4]**

  ✍ **bL_on** : threshold blocked ⇨ in the SET.P menu, it will only be possible to read the relevant threshold value.

  ✍ **bL_oF** : threshold not blocked ⇨ The SET.P menu may be used to alter the threshold value.

- **STEP 2 : Assign relay r1**

  - parameter **[r1]**

  ✍ **no SEc** : r1 is assigned to the alarm output for threshold 1.
  ✍ **SECur** : r1 is assigned to the alarm output in the event of sensor failure or breaks in the measurement wire.

> † In SECUr mode, the operational status of relay r1 is not displayed.

- **STEP 3 : Select alarm relay outputs for threshold Y1**
  - parameter **[Y1]**

Selection requires noSEC to be set in step 2.

✍ **r1** : relay r1 is independent and assigned to threshold Y1. Relay r3 is automatically assigned to threshold Y3.

✍ **r1- r3** : relays r1 & r3 are together assigned to threshold Y1. In this case, threshold Y3 has no alarm output relay

- **STEP 4 : Select alarm relay outputs for threshold 2**
  - parameter **[Y2]**

✍ **r2** : relay r2 is independent, and assigned to threshold 2. Relay r4 is automatically assigned to threshold 4.

✍ **r2- r4** : relays r2 & r4 are together assigned to threshold Y2. In this case, threshold Y4 has no alarm output relay

- **STEP 5 : Select alarm threshold type**
  - parameters **[Y1, Y2, Y3, Y4]**

✍ **AL-Lo** : alarm status triggered when measurement value falls below lower limit.

✍ **AL-Hi** : alarm status triggered when measurement value exceeds upper limit.

✍ **bnd Lo** : alarm status activated while measurement values are within a band surrounding the threshold.

✍ **bnd Hi** : alarm status activated while measurement values are outside a band surrounding the threshold.

- **STEP 6 : Select alarm relay operating mode**
  - parameters **[r1, r2, r3, r4]**

The alarm relays triggered by the crossing of their respective thresholds can be configured to operate in the following modes:

✍ **on-AL** : relay in alarm status when active (normal protection)

✍ **oF-AL** : relay in alarm status when idle (positive protection)

† Where relay r1 is assigned to a sensor failure protection role (see step 2), it is locked in normal protection mode.

Where relays r1 and r3 are both assigned to threshold 1 (see step 3), they operate identically, according to the mode defined for relay r1.

The same applies to relays r2 and r4 when assigned to threshold 2.

ALARM RELAY AND THRESHOLD OPERATING DIAGRAM

Y = alarm threshold (Y1, Y2, Y3, Y4)
H = alarm hysteresis (H1, H2, H3, H4)
B = alarm band (b1, b2, b3, b4)

▪ RELAY IN ALARM STATUS WHEN ACTIVE (on.AL - normal protection)

STATUS	RELAY	CONTACT WHEN ACTIVE	CONTACT WHEN IDLE	LED Yx
Alarm	active	closed	open	lit
No alarm	idle	open	closed	not lit

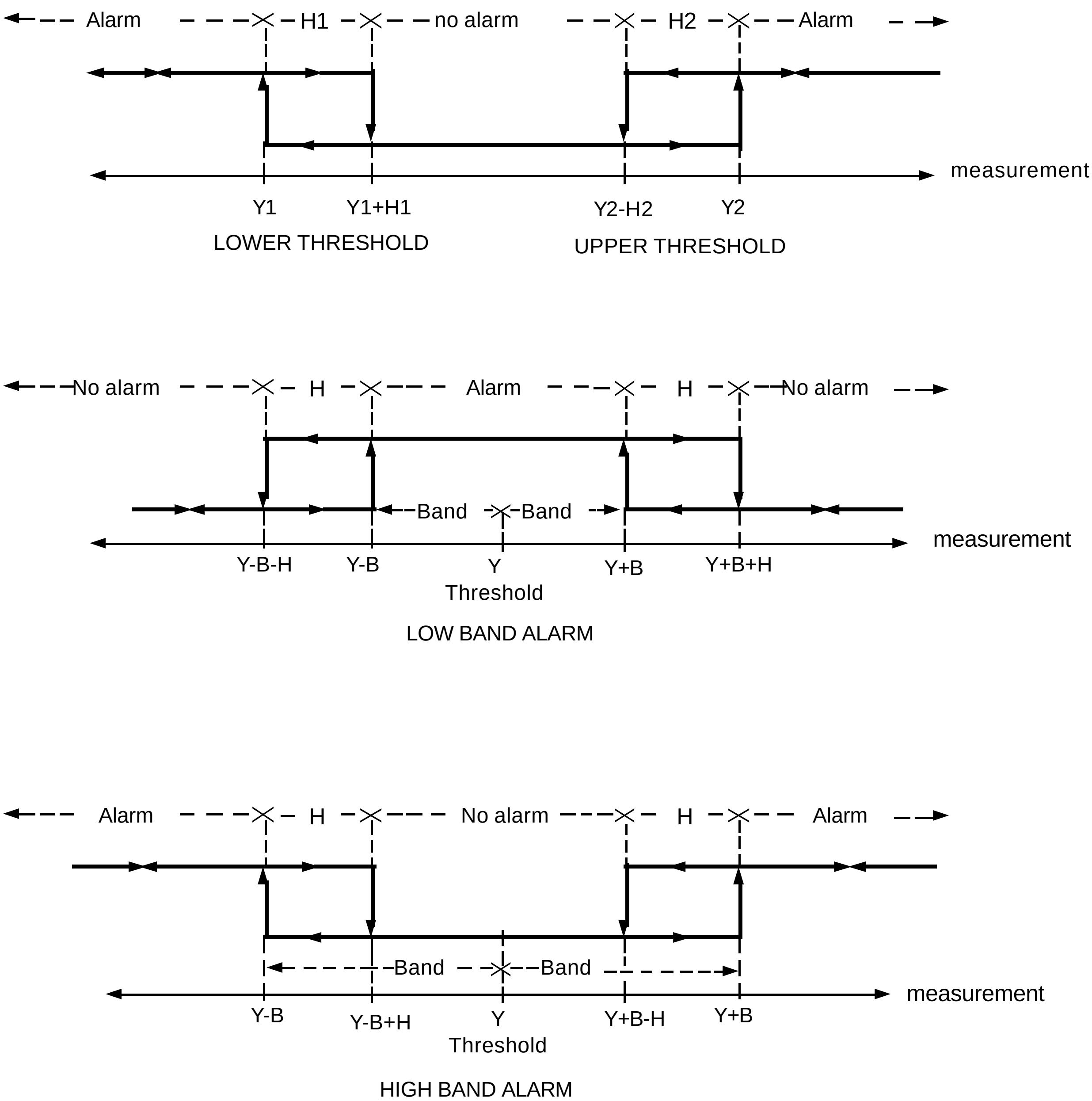
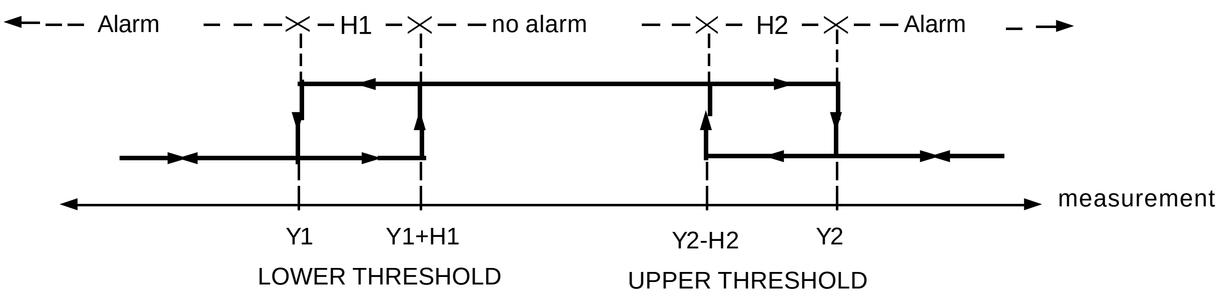
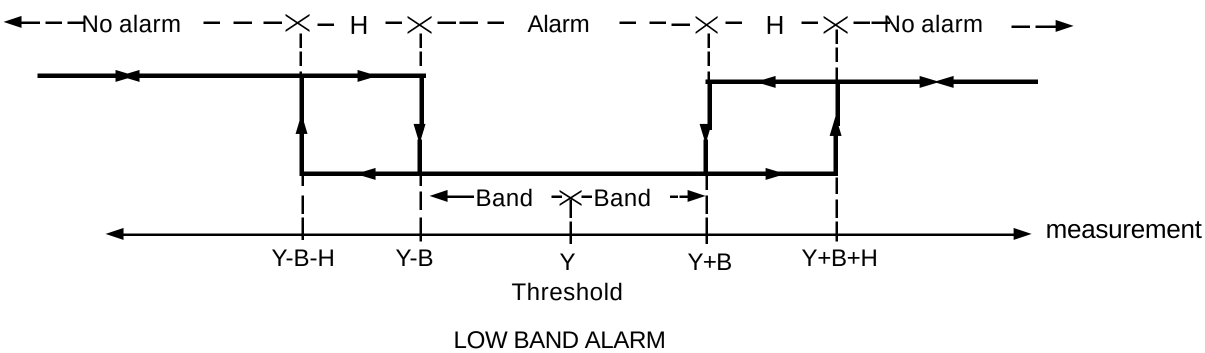


Figure 7

- **RELAY IN ALARM STATUS WHEN IDLE (of.AL - positive protection)**

STATUS	RELAY	CONTACT WHEN ACTIVE	CONTACT WHEN IDLE	LED Yx
Alarm	idle	open	closed	lit
No alarm	active	closed	open	not lit





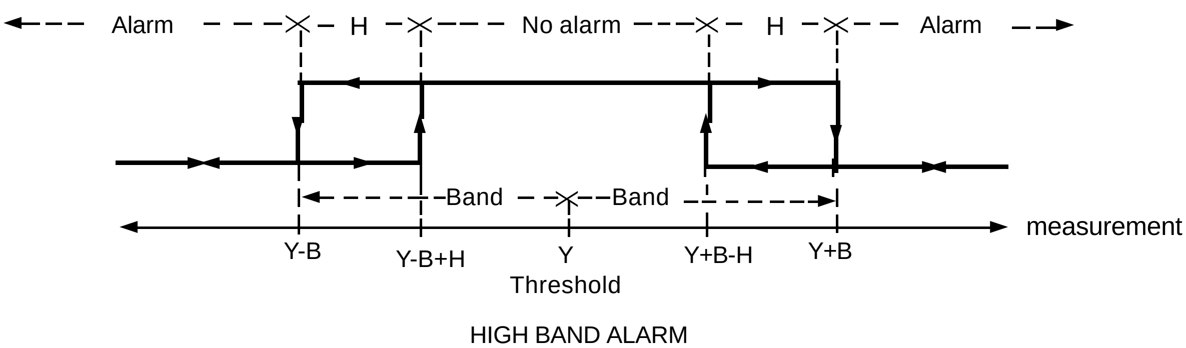


Figure 8

- **STEP 7 : Latched alarms:**
  - parameters **[Y1, Y2, Y3, Y4]**

Each alarm set for thresholds Y1 to Y4 may be latched individually. Latching allows the relay to be maintained in a state of alarm, with the corresponding indication on the display panel, after the measurement has returned to a normal level (measurement < upper threshold or measurement > lower threshold). The state of alarm is maintained until the alarm is reset (even if the unit's power supply is interrupted).

✍ **MEM** : alarm latched

✍ **noMEM** : alarm not latched

- **STEP 8 : Set alarm threshold hysteresis:**
  - parameters **[H1, H2, H3, H4]**

- Adjustable from 0 to 200 display points.

- **STEP 9 : Adjust alarm band:**
  - parameters **[b1, b2, b3, b4]**

- Applicable where the alarm is configured in step 5 as low band (**bnd Lo**) or high band (**bnd Hi**). The band may be adjusted to cover from 0 to 250 display points.

- The value set corresponds to a symmetrical band bracketing the alarm threshold (see step 6).

- **STEP 10 : Set time delay before alarm response after exceeding set threshold:**
  - parameters **[t1, t2, t3, t4]**

- Adjustable from 0 to 10 sec.

6 - OPERATION

6.1 SELF TEST SEQUENCE

Wire the **DP31** unit connected according to one of the diagrams in section 3.4. After powering up the meter a few seconds is required in order to initialize the meter. During this time, the messages **init,** followed by **end,** are displayed and:

- The minimum, maximum, mean and totalling values are reset to zero.
- The analog output is set to its minimum value.
- Any alarms latched before the power supply was interrupted are immediately activated.

At the end of this initialization period, the measurement is displayed. The input signal once digitally processed (scaling, linearization, filtering, etc.) is compared against the alarm threshold values. The unit's various functions (measurement, alarm latching, alarm relays, signalling, sensor failure, line break protection, analog transmission, digital communications, etc.) become operational at this point, depending on the model and the configuration defined by the user.

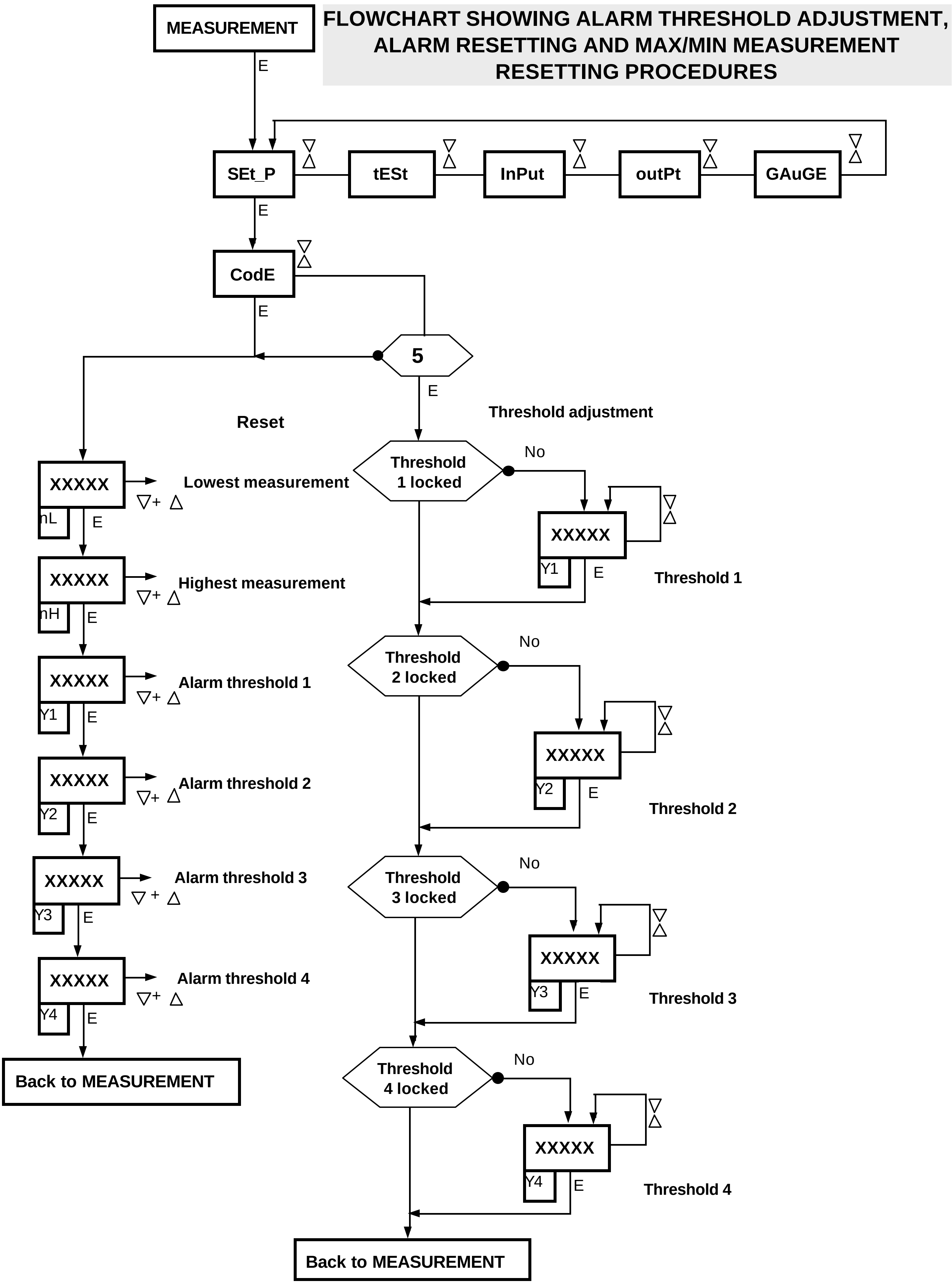
6.2 ADJUSTING THE ALARM THRESHOLDS

To gain access to the threshold settings:

- Select the SET-P menu
- Enter code 5
- Press key E to scroll through the various thresholds.

The four thresholds Y1 to Y4 may then be adjusted within the limits of the measurement range selected, provided that the configuration permits this operation for adjustment of unlocked thresholds (see step 1 of Section 5.3.3.).

† Hysteresis, time delay and alarm band adjustments are not possible via this menu. They are accessible in step 8, 9 and 10 of the outPt menu in Section 5.3.3. During the adjustment phase, the alarm function remains operational (relays and display). The new threshold value will be taken into account as soon as it is validated by pressing key E. The LED's Y1 to Y4 light up when the set threshold is exceeded, and remain lit until the corresponding alarm is reset (where alarms are latched). They do not indicate the status of the relays, which may be either active or idle while in alarm mode, depending on the configuration chosen (see step 6 of Section 5.3.3).


MEASUREMENT
FLOWCHART SHOWING ALARM THRESHOLD ADJUSTMENT, ALARM RESETTING AND MAX/MIN MEASUREMENT RESETTING PROCEDURES
E
SEt_P
tESt
InPut
outPt
GAuGE
CodE
5
Reset
Threshold adjustment
XXXXX
nL
Lowest measurement
nH
Highest measurement
Y1
Alarm threshold 1
Y2
Alarm threshold 2
Y3
Alarm threshold 3
Y4
Alarm threshold 4
Back to MEASUREMENT
Threshold 1 locked
No
Threshold 1
Threshold 2 locked
Threshold 2
Threshold 3 locked
Threshold 3
Threshold 4 locked
Threshold 4
Back to MEASUREMENT

6.3 DISPLAYING MEASUREMENTS AND ALARM THRESHOLDS

6.3.1 Displaying and resetting the minimum and maximum measurements and alarm thresholds

- Select the SET.P menu.
- Enter "code", without entering a value.
- Press key E to scroll through variables.

✍ **nL :** lowest measurement memorized since the unit was last switched on or reset.

✍ **nH :** highest measurement memorized since the unit was last switched on or reset.

✍ **Y1 to Y4 :** values of the four alarm thresholds.

There are three options for resetting the alarms and the minimum and maximum measurements:

- By simultaneously pressing keys q and p on the keypad, while the relevant variable is displayed.

- By remote control, via one of the input contacts C1 or C2, configured for this purpose. In this case, all the alarms in memory are reset at the same time.

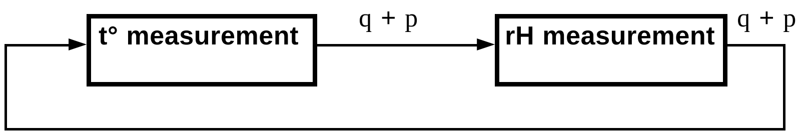
- By a command from an I/O executive transmitted via the digital link.

6.3.2 Relative humidity and temperature displays

Depending on the configuration chosen (see step 6 in Section 5.1.3) the display is either:

- Alternating (**toGLE** mode): where the variable displayed **rH/t°** switches approximately every three seconds ; or

- Static (**touCH** mode): one of the two variables is displayed constantly. Switching between variables is performed by pressing and holding keys q and p.



6.3.3 Displaying mean and totalizing functions

These functions are available when:

- the input is configured as **otHER SinGL** (channel 1) ; and
- the totalizing period is not set to zero: parameter dt > 0 (see step 13 in Section 5.1.1)

Totalizing begins every time the unit is switched on or the totalizing function is reset. Totalizing stops as soon as the time set by the dt parameter has elapsed.
The mean value is continuously updated. This value (parameter Au) corresponds to the average of the measurement values obtained after totalizing begins, up to the end of the allotted totalizing period.

To display the Mean and Total values from the measurement display:

- simultaneously press keys q and p

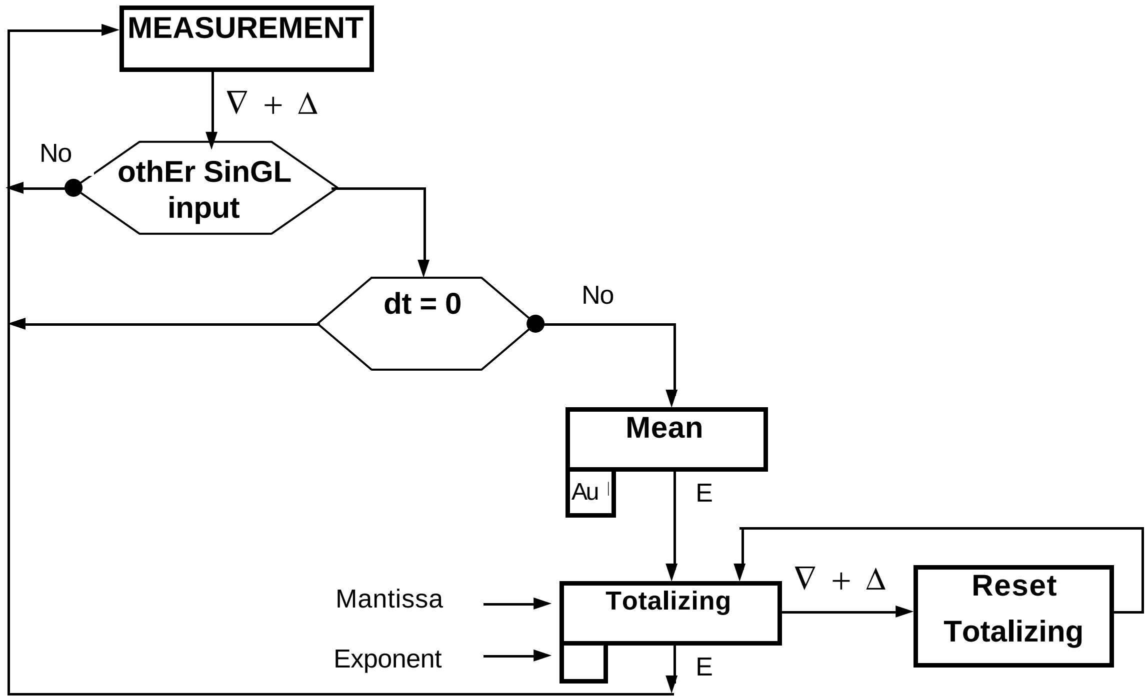
    ⇨ the mean value **[Au]** is displayed

- next, press key E

    ⇨ the totalizing value is displayed as a mantissa (on the five-digit display) and an exponent (power of ten on the two-digit display).

Example:

- The total and mean values displayed onscreen are updated every second.



The total and the mean values are reset together. This operation may be performed:

- By pressing the p and q keys simultaneously while the total is displayed.
- By remote control via either of the contact inputs C1 & C2.
- By altering the totalizing time dt.
- Automatically each time the instrument is switched on.
- By a command from an I/O executive transmitted via the digital link.

6.4 ANALOG RE-TRANSMISSION OF MEASUREMENTS

On the DP31-AR, the measurement displayed on-screen is also re-transmitted as an output signal isolated from the measurement input. The signal may be a 0/20 mA or 4/20 mA current, or a 0/10 V voltage (see configuration Section 5.3.1).

- Output behavior in the event of sensor failure and abnormal measurements.

MEASUREMENT STATUS	ANALOG OUTPUT		
	0/20 mA	**4/20 mA**	**0/10 V**
Sensor failure High protection	**> 22 mA**	**> 22 mA**	**> 11 V**
Sensor failure Low protection	0 mA	< 3,5 mA	0 V
Abnormally high measurement	20 mA < I < 22 mA	20 mA < I < 22 mA	10 V < U < 11 V
Abnormally low measurement	0 mA	3.5 mA < I < 4 mA	0 V

- Admissible load impedance:

. current output: max. 750 Ω - min. 0 Ω
. voltage output: ∞ max. - min. 1000 Ω

6.5 MALFUNCTION, ERROR MESSAGES AND SYSTEM TESTS

6.5.1 Sensor failure and breaks in the measurement wire

In these cases, a flashing warning is displayed on the five-digit display.

- ✍ **br - Lo** ➩ where measurement failure protection is set to low
- ✍ **br - Hi** ➩ where measurement failure protection is set to high.

If relay r1 is set in SECUR mode, it switches into the OFF position.

6.5.2 Error messages

These flashing messages appear on the five-digit display, in the following circumstances:

- ✍ **Err 1** : alarm threshold outside configured limits. In this event, the relevant threshold is automatically set to the lowest point on the scale

- ✍ **Err 2** : configuration error relative to sensor type or measurement resolution.

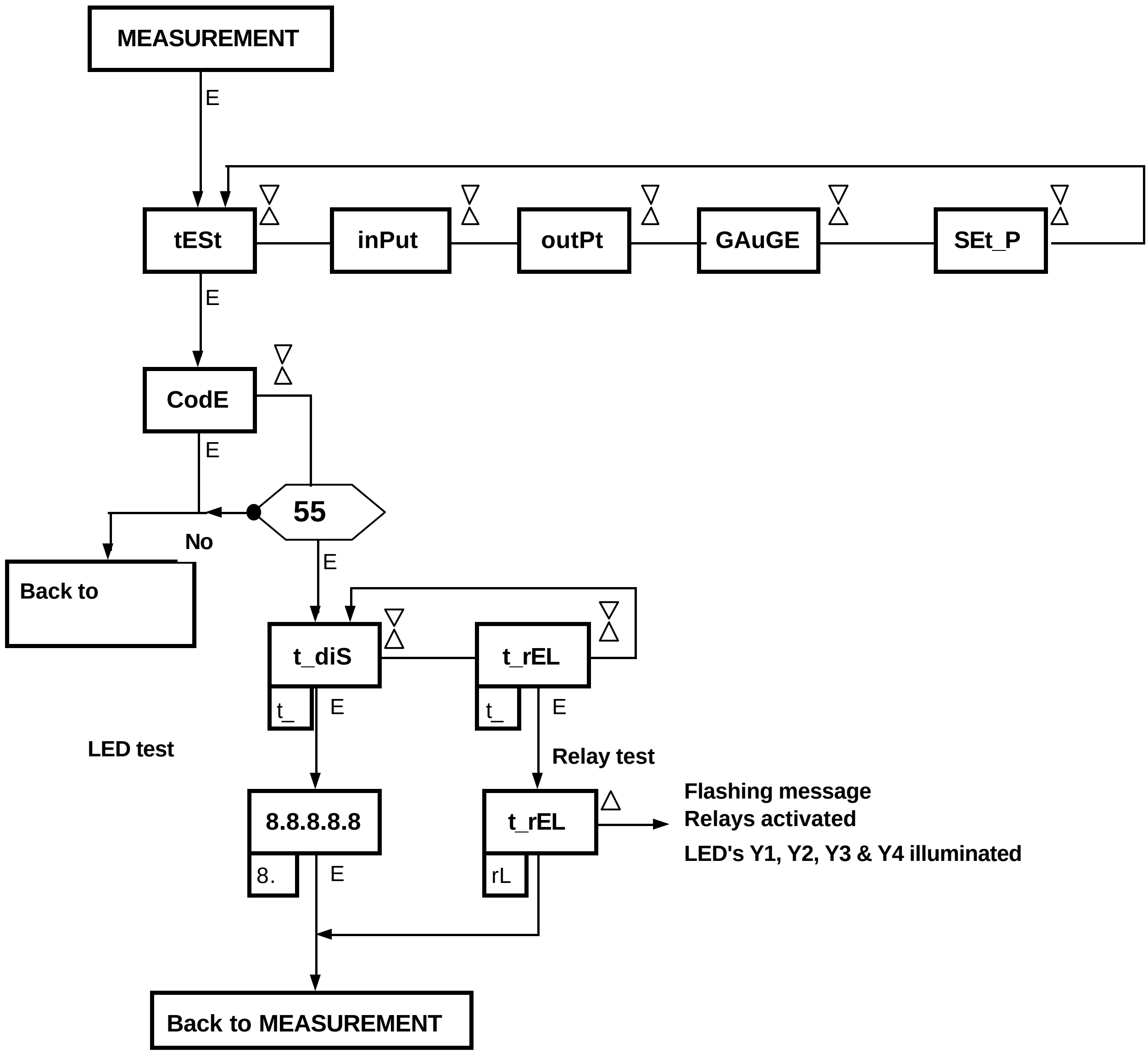
- ✍ **Err 3** : configuration error relative to analog output type or data transmission speed via the digital link.

- ✍ **Err 4** : totalizing time error - totalizing time not within the permitted adjustment range dt < 0 or dt > 99999.

6.5.3 Relay and display tests

- Select the test menu
- Enter code 55.

FLOWCHART FOR DISPLAY AND RELAY SYSTEM TESTS



- When message t-dIS is confirmed ⇨ all seven segments and the decimal points on all indicators should be lit, together with the five LED's.

- When parameter **[t-rEL]** is entered ⇨ the **[t-rEL]** message flashes.

  By pressing key p, all the alarm relays are switched into the active position, enabling the user to check the correct operation of their system.

6.6 DIGITAL COMMUNICATIONS

The DP31-CR is fitted with a digital communications system, allowing an I/O executive to be used to read measurements, adjust thresholds, reset alarms, configure the instrument, etc.

6.6.1 Physical connection and communications protocol

- **RS-485** : EIA standard, differential signals, with units connected in parallel by means of a two-wire cable (up to 32 DP31-CR units with no repeater).

  To ensure correct polarity when cabling the RS-485 network, the communications card is fitted with 301 kΩ resistors linking lines A and B to the +5 V and 0 V terminals.

- **Communications protocol**: MODBUS/J.BUS, in slave mode - binary code (RTU).

  - 8 bit characters with 1 start bit, 1 stop bit and no parity.
  - Configurable baud rates: 1200, 2400, 4800, 9600 and 19200 baud.
  - Each unit must be identified by means of a slave address from 1 to 63 (see Section 5.3.2).

  - **Instruction codes:**

    3 or 4 : read n words
    6 : write 1 word
    16 : write n words (maximum 10 consecutive words).

  Any decimals contained in the data will not be transmitted.

  - **Error codes:**

    1 : Unknown function code
    2 : Address incorrect
    3 : Incorrect data
    4 : Equipment busy or not ready

6.6.2 Variable/parameter addresses and accessibility

Using the MODBUS protocol, the addresses are the same as with the J.BUS-1 protocol. The addresses not mentioned are reserved by the system.

J-BUS Address	Access	Label	Parameters or variables
1	R	MES.U1	Measurement displayed from channel 1
2	R	MES.U2	Measurement displayed from channel 2
3	R	MES.nL	Lowest measurement in memory
4	R	MES.nH	Highest measurement in memory
5	R	MES.Au	Mean measurement value over totalizing period
10	R	TOT.LSB	Totalizing: LSB value of the mantissa
11	R	TOT.MSB	Totalizing: MSB value of the mantissa

J-BUS Address	Access	Label	Parameters or variables
12	R	TOT.EXP	Totalizing: exponent value
201	R/W	Y1	Alarm threshold Y1
202	R/W	Y2	Alarm threshold Y2
203	R/W	Y3	Alarm threshold Y3
204	R/W	Y4	Alarm threshold Y4
205	R/W	H1	Hysteresis H1 for threshold Y1: 0 to 200
206	R/W	H2	Hysteresis H2 for threshold Y2: 0 to 200
207	R/W	H3	Hysteresis H3 for threshold Y3: 0 to 200
208	R/W	H4	Hysteresis H4 for threshold Y4: 0 to 200
209	R/W	t1	Alarm delay Y1: 0 to 10
210	R/W	t2	Alarm delay Y2: 0 to 10
211	R/W	t3	Alarm delay Y3: 0 to 10
212	R/W	t4	Alarm delay Y4: 0 to 10
213	R/W	b1	Alarm band for threshold Y1: 0 to 250
214	R/W	b2	Alarm band for threshold Y2: 0 to 250
215	R/W	b3	Alarm band for threshold Y3: 0 to 250
216	R/W	b4	Alarm band for threshold Y4: 0 to 250
217	R/W	oL	Analog output - Low scale
218	R/W	oH	Analog output - High scale
219	R/W	oF	Measurement offset: ±500
220	R/W	Fi	Measurement filter: 0 to 20
222	R/W	CJ	Cold junction value for thermocouple input
223	R/W	Lo	Low limit measurement scale
224	R/W	Hi	High limit measurement scale
225	R/W	tb	line break detection threshold
226	R/W	AL.1	- **Bits 0 to 3** ⇨ position of measurement relative to thresholds. 0 = no alarm 1 = alarm - **Bit 0** ⇨ threshold Y1, **bit 1** ⇨ threshold Y2, **bit 2** ⇨ threshold Y3, **bit 3** ⇨ threshold Y4 - **Bit 4** ⇨ setting for min. and max. measurements in memory for the rH/t° input. 0 = t°, 1= rH - **Bit 5** ⇨ Assignment of relay r4 : 0 = threshold Y4 1 = threshold Y2 coupled with r2 **- Bit 6** ⇨ Assignment of relay r3 : 0 = threshold Y3

J-BUS Address	Access	Label	Parameters or variables
226	R/W	AL.1	- **Bit 7** ⇨ assignment of relay r1 : 0 = threshold Y1, 1 = sensor failure protection - **Bits 8 to 11** ⇨ alarm status latching 0 = not latched, 1 = latched **Bit 8** ⇨ r1, **Bit 9** ⇨ r2 **Bit 10** ⇨ r3, **Bit 11** ⇨ r4 **- Bit 12** ⇨ assignment of analog output with rH/t ° input o = t°, 1 = rH **- Bit 13** ⇨ assignment of USEr linearization with Process input 0 = table, 1=tare **- Bits 14-15** ⇨ not used
227	R/W	AL.2	- **Bits 0 to 3** ⇨ alarm latching setting: 0 = not latched, 1 = latched **bit 0** ⇨ threshold Y1, **bit 1** ⇨ threshold Y2 **bit 2** ⇨ threshold Y3, **bit 3** ⇨ threshold Y4 - **Bits 4 to 7** ⇨ status of relays in alarm mode 0 = oF - AL, 1= oN-AL **bit 4** ⇨ r1, **bit 5** ⇨ r2, **bit 6** ⇨ r3 **bit 7** ⇨ r4 - **Bits 8 & 9** ⇨ alarm type for threshold Y1: 0 = low, 1 = high, 2 = low band, 3 = high band - **Bits 10 & 11** ⇨ alarm type for threshold Y2: 0 = low, 1 = high, 2 = low band, 3 = high band - **Bits 12 & 13** ⇨ alarm type for threshold Y3: 0= low, 1= high, 2= low band, 3 = high band - **Bits 14 & 15** ⇨alarm type for threshold Y4: 0 = low, 1 = high, 2= low band, 3 = high band
228	R/W	InPut	- **Bits 0 & 1** ⇨ measurement input type: 0 = othEr process 1 = temperature t°, 2 = resistor - **Bits 2 & 3** ⇨measurement input type: 0 = SinGL, 1 = diFF, 2= rH/t° 3 = GAuGE - **Bits 4 to 7** ⇨ measurement input signal type: 0 = ± 20 mA, 1= 0/20 mA 2= 4/20 mA, 3 = ±50 mV 4 = 0/50 mV, 5 = 10/50 mV 6 = 0/0.1 V, 7 = 0/1V, 8= 0/10 V

J-BUS Address	Access	Label	Parameters or variables
228	R/W	InPut	- **Bits 8 to 12** ⇨ sensor type : 0 = K thermocouple, 1 = J thermocouple, 2 = T thermocouple, 3 = S thermocouple, 4 = R thermocouple, 5 = B thermocouple, 6 = E thermocouple, 7= Ni Ni Mo18 thermocouple , 8 = WRe 5/26 thermocouple at 0,1° 9 = WRe 5/26 thermocouple at 1°, 10 = N thermocouple, 11 = L thermocouple 12 = Pt100 D probe, 13= Pt 100 J probe, 14 = Ni 100 probe, 15 = UsER, 16 = linear, 17 = square root, 18 = 200.00 Ω RESiS 19= 2000.0 Ω RESIS . - **Bits 13 to 15** ⇨ decimal point setting 0 = 0 - 1=0.0 - 2=0.00 - 3= 0.000 4 = 0.0000
229	R/W	FLAG1	**- Bits 0 to 3** ⇨ measurement unit setting 0 = °C, 1=°F, 2=rH, 3=PA, 4=PH, 5=bA 6 = A, 7 = nA, 8=U, 9=nU, 10=.h, 11=.n 12=..S, 13=Li, 14=%, 15= no unit **- Bit 4** ⇨ Cold junction compensation 0 = internal CJ, 1= external CJ **- Bit 5** ⇨ Sensor failure measurement protection setting 0 = low (Lo), 1= high (Hi) **- Bit 6** ⇨ temperature measurement via rH/t° input 0 = linearized Lin, 1= non linearized noLin **- Bit 7 ⇨** Current display from process input 0 = mean value Au, 1= totalizing value - **Bits 8 to 11** ⇨ alarm threshold (Y1 to Y4) locking 0 = unlocked ur-oF, 1= locked ur.on **Bit 8** ⇨ Y1, **Bit 9** ⇨ Y2, **Bit 10** ⇨ Y3 **Bit 11** ⇨ Y4 - **Bits 12 & 13** ⇨ analog output specification 0 = 0/20 mA, 1=4/20 mA, 2=0/10V - **Bit 14** ⇨ rH/t° measurement display mode 0 = static touCh, 1= alternating ToGLE - **Bit 15** ⇨ Current display from rH/t° inputs 0 = measurement; t°, 1 = rH measurement

J-BUS Ad-dress	Access	Label	Parameters or variables
230	R/W	FLAG2	- **Bits 0 to 2** ⇨ baud rate via digital link 0=1200, 1=2400, 2=4800, 3=9600, 4=19200 - **Bit 3** ⇨ relative humidity input type 0 = USEr, 1= linear - **Bits 4 & 5** ⇨ temperature signal type via rH/t° input 0 = Pt100 Ω, 1=0/20 mA, 2= 4/20 mA, 3 = 0/1 V - **Bits 6 & 7** ⇨ humidity signal type via rH/t° input 0 = 0/20 mA, 1=4/20 mA, 2=0/1 V,3=0/10 V - **Bits 8 to 11** ⇨ assignment of contact input C1 0 = not used not, 1 = hold measurement b-diS, 2= hold analog output b-AoP, 3= disable keypad b-CEY, 4= reset alarms r-ALr, 5= reset min. measurement r-dL, 6=reset max. measurement r-dH, 7= reset totalization r-tot - **Bits 12 to 15** ⇨ assignment of contact input C2 : Same bits 8 to 11.
231	R/W	USG	Measuring bridge power supply voltage
233	R/W	nS	Number of segments in USEr linearization USEr : 0 to 24
234	R/W	Co	Cold junction for USEr thermocouple input
301	R/W	dt	Duration of totalizing period - LSB : 0 to 32767
302	R/W	dt	Duration of totalizing period - MSB : 32768 to 99999
501 to 550	R/W	TabLE	Variables in the user-defined linearization table See step 8 in Section 5.1.1 (page 21) - Addresses 229 & 230 MUST be correctly configured prior to programming this memory area. - The odd-numbered addresses 501, 503 ... 549 contain the measurement input values S0, S1, S2, etc., which must lie within the set scale limits. - The even-numbered addresses 502, 504 ... 550 contain the corresponding number of display points (-10,000 to + 20,000). **Segment 0** ⇨ 501 : input signal in mV, mA, V. 502 : number of points **Segment 1** ⇨ 503 : input signal in mV, mA,V. 504 : number of points **Segment 24** ⇨ 549 : input signal
600	W	r-ALM	0 ⇨ reset min. and max. measurements 1 ⇨ reset the four alarms stored in memory
601	W	r-tot	0 ⇨ reset mean and totalizing values, and reinitialize calculation period.

7 - CALIBRATION

Each DP31 unit leaving the factory complies with technical specifications, making calibration unnecessary when first using the equipment. Nevertheless, the characteristics of the electronic components may slowly change over time. Therefore, the input/output ports should be calibrated at regular intervals in order to preserve the unit's technical characteristics.

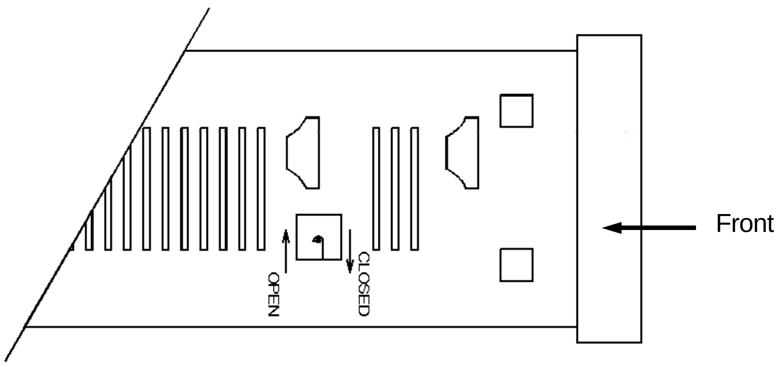
The DP31 is fitted with an automatic calibration system, eliminating the need to make adjustments inside the indicator. The system functions by using software correction to match internal reference values with the external calibration signals sent to the inputs.

7.1 CONDITIONS AND EQUIPMENT REQUIRED FOR CALIBRATION

- Stable ambient temperature of 23°C ±1°C
- Prior to calibration, the indicator should be switched on for 45 minutes
- Power supply voltage at nominal service rating ±1%.
- A stable, multiple voltage power supply, accuracy-rated to within 0.01%.
- A 200,000 point digital multimeter (class A)
- Two 385 Ω resistors - 0.02%
- One 2500 Ω resistor - 0.02%
- One 100 Ω resistor - 0.02%

† For safety reasons, access to the calibration menu is protected by an internal locking pin and a software code. This pin, located on the left side of the unit, must be set to “closed” in order to enter the **CALi** menu.

After selecting this menu, code -13 must be entered in order to access the various calibration procedures. These procedures require the input/outputs to be individually calibrated.

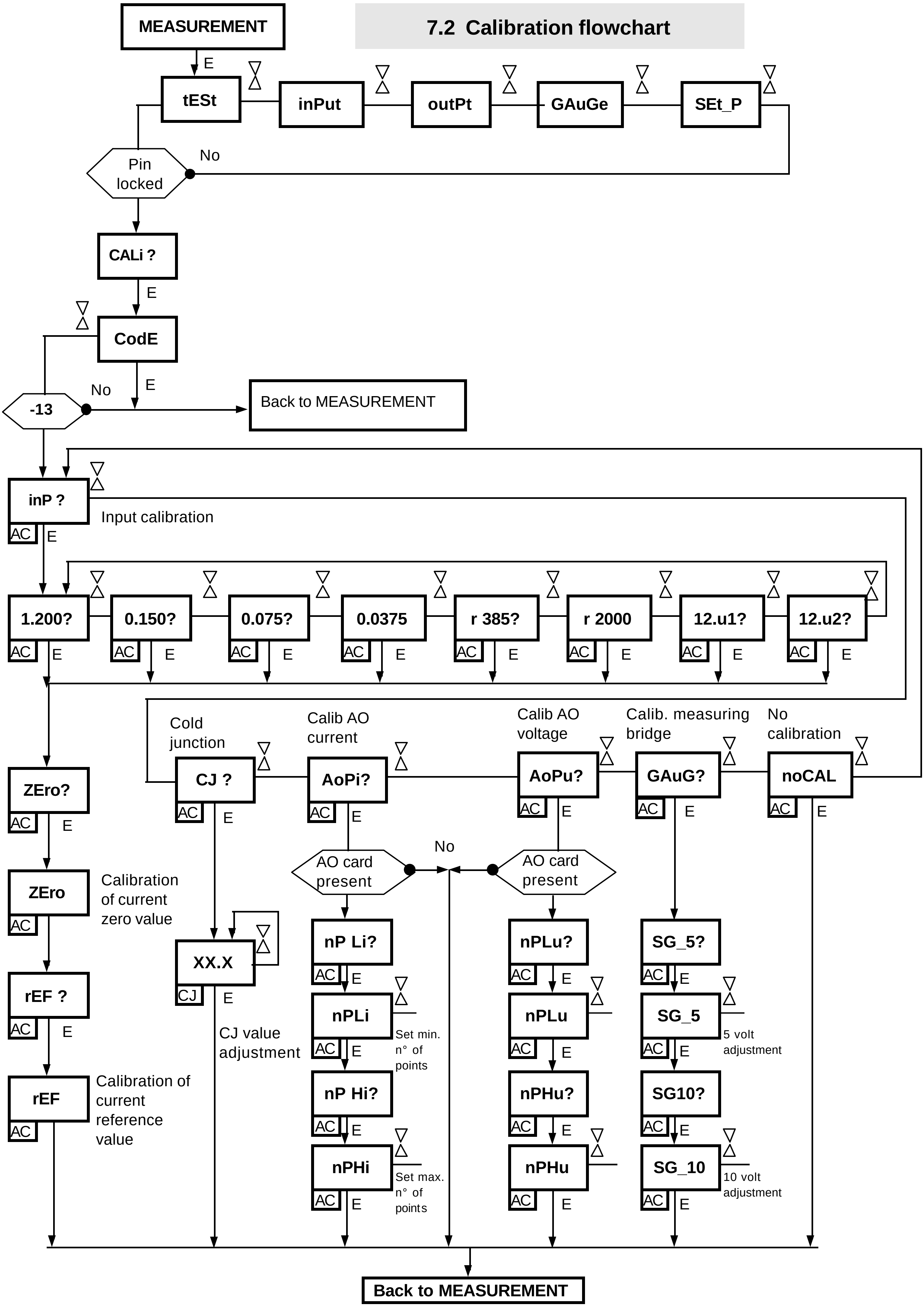


CLOSED = ACCESS TO CALIBRATION MENU
OPEN = USER MODE

Figure 9

† Upon completion of the calibration procedure, the locking pin must be opened to prevent further access to the **CALi** menu

7.2 Calibration flowchart



7.3 Calibrating the measurement inputs

Given the high degree of accuracy of the DP31 unit, eight types and levels of input are factory-calibrated.

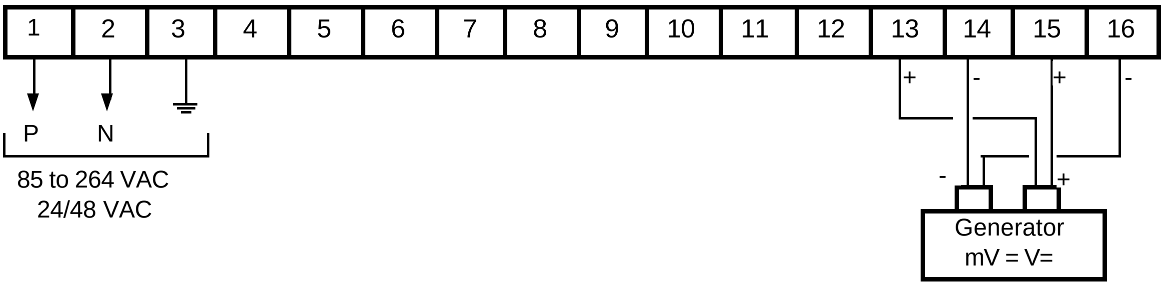
† Only one type of calibration by the user is necessary, depending on the type of signal used by the application.

Both measurement inputs are calibrated simultaneously, unless 0/10 V signals are used, in which case the calibration procedure must be performed for each channel individually.

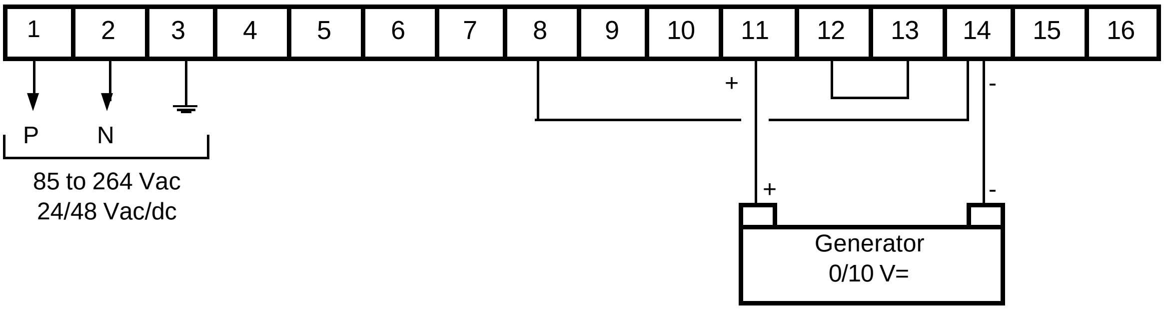
† Prior to calibration and checking procedures, always ensure the parameters oF (measurement offset) and Fi (measurement filter) are set to 0. If you find that they aren't, access the input configuration mode and set these parameters to 0.

7.3.1 Connections

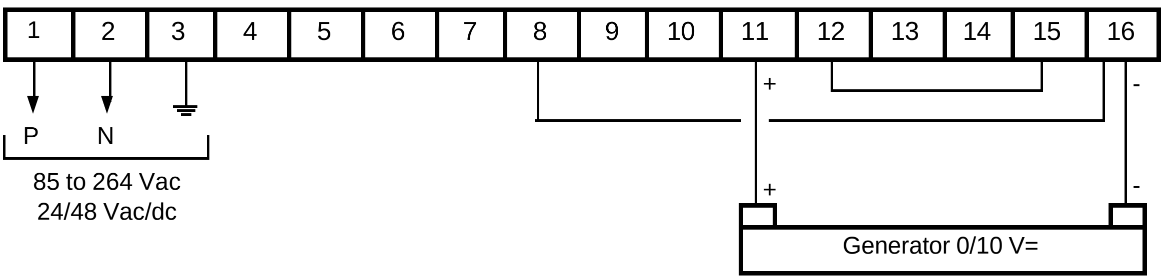
- **Input calibration: thermocouples, voltage: 0/50 mV, 10/50 mV, ±50 mV, 0/100 mV and 0/1 V; current 0/20 mA, 4/20 mA and ±20 mA.**



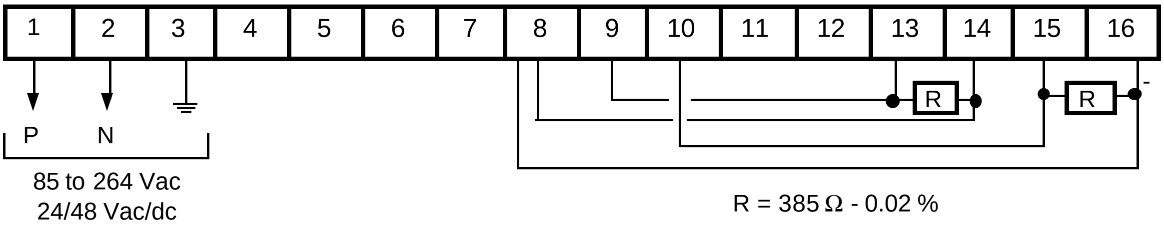
- **Calibration of the 10 V voltage input on channel 1**



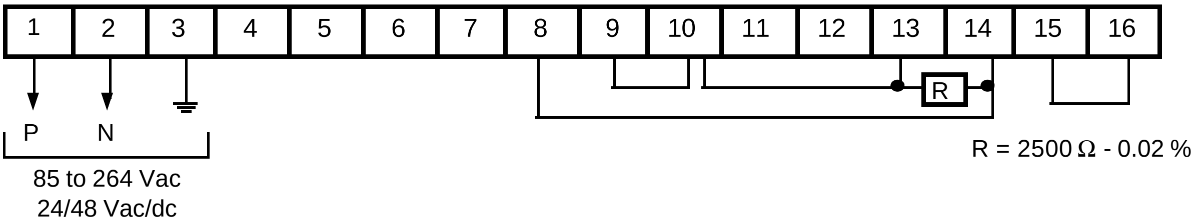
- **Calibration of the 10 V voltage input on channel 2**



- **Calibration of the resistance probe and 200 W resistor inputs**



- **Calibration of the 2,000 W resistance probe input** (channel 1 only)



7.3.2 Calibration procedure

- Connect the measurement inputs as indicated.
- Select the **inP** menu and press E.
- Select the appropriate menu for the type of input used and press E.

⇨ message [ZEro ? / AC] is displayed. Send the minimum value required to the measurement inputs and press E.

⇨ message [ZEro / AC] is displayed with the AC parameter flashing throughout the zeroing procedure. Once the minimum value has been calibrated:

⇨ message [rEF ? / AC] is displayed. Send the required reference value to the measurement inputs and press E.

⇨ message [rEF / AC] is displayed with the AC parameter flashing the reference calibration procedure. Once the reference value has been calibrated, the display returns to displaying the MEASUREMENT variable.

Input sensors or ratings	Calibration menu option	Required input values	
		Zero	Ref.
Thermocouples: B, R, S, T & W/Re	0.0375	0 mV	37.5 mV
Thermocouples: E, J, K, L, N & Ni-Ni Mo18 Voltage: 0/50 mV, 10/50 mV, ±50 mV	0.075	0 mV	75 mV
Voltage: 0/100 mV	0.150?	0 mV	150 mV
Voltage: 0/1 V	1.200?	0 V	1,200 V
Voltage: 0/10 V on channel 1	12.U1?	0 V	12,000 V
Voltage: 0/10 V on channel 2	12.U2?	0 V	12,000 V
Resistance probes: Pt 100 D, Pt 100 J & Ni 100	r385?	0 Ω	385 Ω
Resistor 0/2000 Ω	r2000	0 Ω	2,500 Ω

7.3.3 Cold junction temperature adjustment

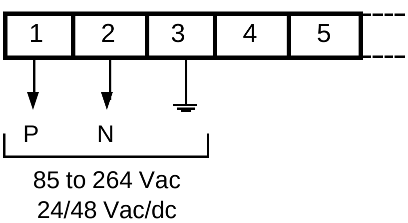
- Remove the connector from terminal strip 2 and measure the temperature between terminals 13 & 14 very accurately (resolution 0.1°).
- Select the **CJ ?** menu and press E
- Enter the internal temperature measurement obtained from the terminal strip by pressing the q and p keys, followed by E

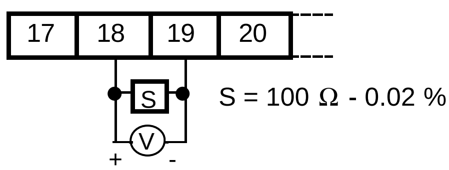
7.4 Calibrating analog outputs

The calibration procedure for the analog output on the DP31-AR requires no inputs to be connected to the instrument input circuitry. Two points are calibrated, corresponding to the upper and lower limits of the scale configured.

7.4.1 Calibrating current outputs

- Connect as follows:



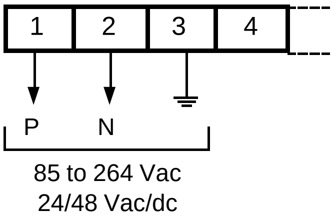


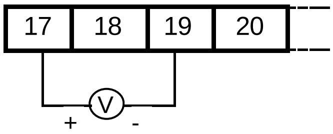
- Select the **AoPi?** menu and press E.
- Message **nPLi?** is displayed, requesting confirmation to set lower limit on scale. Confirm.
- Message **nPLi** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 0.04000 V (output current 0.4 mA).

- Confirm this setting.
- Message **nPHi?** is displayed, requesting confirmation to set upper limit on scale. Confirm.
- Message **nPHi** / **AC** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 2.00000 V (output current 20 mA).
- Confirm this setting ⇨ back to measurement display.

7.4.2 Calibrating voltage outputs

- Connect as follows:

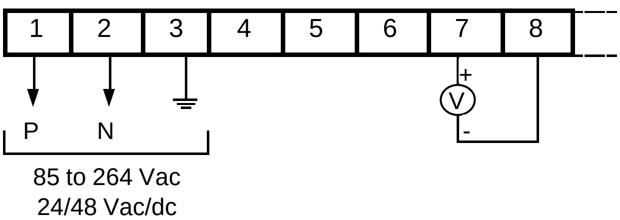




- Select the **AoPu?** menu and press E.
- Message **nPLu?** is displayed requesting confirmation to set lower limit on scale. Confirm.
- Message **nPLu** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 0.00000 V.
- Confirm this setting.
- Message **nPHu?** is displayed, requesting confirmation to set upper limit on scale. Confirm.
- Message **nPHu** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 10.0000 V
- Confirm this setting ⇨ back to measurement display.

7.5 Calibrating the measuring bridge power supply voltage

- Connect as follows:



- Select the **GAuG?** menu and press E.
- Message **SG-5?** is displayed, requesting confirmation to set the minimum voltage. Confirm.
- Message **SG-5** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 5.0000 V.
- Confirm this setting.
- Message **SG10?** is displayed, requesting confirmation to set maximum voltage. Confirm.
- Message **SG10** is displayed with the AC parameter flashing. Press the q and p keys until the voltage displayed on the voltmeter reads 10.0000 V.
- Confirm this setting ⇨ back to measurement display.

8 - TECHNICAL SPECIFICATIONS

The unit's technical characteristics are specified for the following reference conditions:

- Ambient temperature: 23°C ± 1°C
- Power supply: service voltage 230 Vac ± 1%
- Warm-up time: 45 min.

8.1 Measurement inputs

8.1.1 General characteristics

- Accuracy: ± 0.1 % of the maximum measurement range of the relevant input, ±1 digit.
- Effect of variations in power supply: none in the range 85 to 264 Vac - 45 to 65 Hz.
- Input resolution: 15 bits.
- Sampling time: :
  - 100 ms with single measurements current, voltage, RTD and T/C with external CJC
  - 200 ms with differential, rH/t° and T/C with internal CJC measurements
- Typical response time for a single measurement at 90 %:
  0.5 sec where filter Fi = 0
  5 secs where filter Fi = 10
  10 secs where filter Fi = 20

- Input impedance > 1 MΩ except for 10 V (100 KΩ) and mA inputs.
- Maximum input voltage tolerated: 10 times the input rating.
- Rejection ratios:

  . Serial mode: 80 dB
  . common mode: 150 dB

- Electrical strength:

  . input/ground 2000 V = / 1 mn
  . input/output: 1000 V =/ 1 mn

- Insulation resistance: > 10^5 MΩ

8.1.2 RTD probe temperature inputs

PROBE	MEASUREMENT RANGE		RESOLUTION ACCURACY IN °C	
	°C	°F	0.1°	1°
Pt 100 Ω DIN	-200/800	-328/1472	± 1.1	± 2
Pt 100 Ω JIS	-190/600	-310/1112	± 0.8	± 2
Ni 100 Ω	-60/180	-76/356	± 0.3	± 1

- Current through probes: 200 µA

- Intrinsic fluctuations within operating range (-5 to +55°C)
  . 2.3 mΩ/°C, (0.006°C/°C with Pt 100 Ω DIN probe).

- Effects of wiring resistance:
  . 3 wire assembly: 0.01°C per Ω
  . 4 wire assembly: 0.006°C per Ω.

- Sensor failure and measurement line break protection:

  . Time before protection activated (where filter Fi = 0): 1 sec.
  . Transition impedance: 380 Ω (sensor resistance).
  . Return time after circuit restored: 10 secs.

8.1.3 Thermocouple temperature inputs

THERMOCOUPLE TYPES	MEASUREMENT RANGE		RESOLUTION ACCURACY IN °C DISCOUNTING CJ	
	°C	°F	0.1°	1°
B (Pt30%Rh/Pt 6% Rh)	100/1800	212/3272	± 2	± 3
E (Ni-Cr/Cu-Ni)	-200/950	-328/1742	± 1.3	± 2
J (Fe/Cu-Ni)	-200/870	-328/1598	± 1.2	± 2
K (Ni-Cr/Ni-Al)	-200/1232	-328/2250	± 1.5	± 2
L (Fe/Cu-Ni)	-200/850	-328/1562	±1.2	± 2
N (Nicrosil/Nisil)	-200/1300	-328/2372	± 1.6	± 3
Ni/Ni-Mo 18	0/1,400	32/2,552	± 1.5	± 2
R (Pt 13% Rh/Pt)	-50/1760	-58/3200	± 1.9	± 3
S (Pt 10% Rh/Pt)	-50/1760	-58/3200	± 1.9	± 3
T (Cu/Cu-Ni)	-200/400	-328/752	± 0.7	± 2
W/Re 5/26 (Hoskins 1974)	0.0/1800.0	-32.0/3272.0	± 1.9	
W/Re 5/26 (Hoskins 1974)	0/2300	32/4172		± 3

- Cold junction compensation error: typically ± 1°C
- Intrinsic fluctuations within operating range (-5 to +55°C): 1 µV/°C including cold junction compensation.
- Effect of wiring resistance: 0.25 µV/Ω
- Sensor failure and measurement line break protection:

  . Time before protection activated (where filter Fi = 0):

    . 2 secs. with couples B, R, S, T, W/Re 5/26.
    . 4 secs. with couples E, J, K, L, Ni/Ni-Mo18,

- Transition impedance with protection active: > 80 kΩ
- Return time after circuit restored: 3 secs.

8.1.4 Process, current, voltage and measuring bridge inputs

- Current signal: 0/20 mA, 4/20 mA, ± 20 mA (with 2.5 Ω ± 0.1% external shunt).
- Voltage signal: 0/50 mV, 10/50 mV, ± 50 mV, 0/0.1 V, 0/1 V, 0/10 V.
- Measuring bridge: ± 50 mV
- Adjustable scale:
  . -10000 to +20000 points with LIN and USEr input modes
  . 0 to 20,000 points with square root calculations
- Accuracy (without external shunt): 0.1% of input signal rating.
- Decimal point position: 0 - 0.0 - 0.00 - 0.000 - 0.0000

8.1.5 Resistor inputs r200 & r2000

- Adjustable linear scale : 0.00 / 200.00 Ω
  0.0 / 2000.0 Ω

- Current through resistors:

  . 200 µA with r200
  . 400 µA with r2000

8.2 Analog output

- Current signal:

  . Rating: 0/20 mA, 4/20 mA
  . Min. load: 0 Ω
  . Max. load: 750 Ω

- Voltage signal:

  . Rating: 0/10 V
  . Minimum load: 1000 Ω

- Accuracy: 0.1% of relevant scale range for measurement displayed

- Resolution : 14 bits (16384 points)

- Refresh time: 100 ms.

- Electrical strength:

  . Measurement input / outputs: 1,000 V =
  . Output / ground: 1,000 V =

8.3 Alarm relays

- A dry reversing contact is available on each relay.
- Contact cut-off capability:

  - 5A - 230 Vac at 50/60 Hz with resistive load.

- number of operations on a resistance circuit:

  - 5,000,000 for 0.2 kW

8.4 Power supplies

- 85 to 264 Vac 50/60 Hz - 10 VA

- 24/48 Vac/dc ± 10% - 10 VA

- Electrical strength:
  . Power supply / input: 3500 V =
  . Power supply / output: 1 1000 V =
  . Power supply / ground: 2000 V =

- Insulation resistance:
  . Power supply / ground: > 10^5 MΩ
  . Other circuits / ground: > 10^5 MΩ

- Transmitter power supply: 24 V at a maximum of 30 mA - with short-circuit protection.

- Measuring bridge power supply: 4.5 to 10.2 V at a maximum of 30 mA. Adjustable in 1 mV increments.

8.5 Environmental and climatic conditions

- Nominal operating conditions:
  - temperature: -5 to +55°C
  - relative humidity: 10 to 90% with no condensation

- Storage temperature limits: -20 to +70°C

- Display panel sealing: IP65

- Terminal strip protection level: IP20

- Casing with automatic cut-out: UL 94-Vo

- Detachable terminal strips: screw terminal clamping area - 2.5 mm²

- Dimensions: 1.89” x 3.78” x 4.53” (48 x 96 x 115mm) behind flange

- Weight: 11.3 oz (320 g)

8.6 Electromagnetic compatibility

- DP31 equipment complies with European Community Directive 89/336

  . Emissions: EN 50081 - 1
  . Noise immunity: EN 50082 - 2

- DP31 equipment complies with CEE Directive 73/23, concerning low voltage equipment, modified by CEEE Directive 93/68

  . Safety rules EN 61010-1.

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