ÉTUDES ET RÉALISATIONS
ÉLECTRONIQUES / INSTRUMENTATIONS / AUTOMATISME

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DIGITAL PANEL METERS

programmable ±10 000 points

DIP 400
DIP 401
DIP 402



User handbook

Valid for the instruments with version 08.xx

ARDETEM®

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Soucieu en Jarrest - FRANCE

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Technical manual DIP 402

1. INTRODUCTION

The series **DIP 40-** offers a complete range of highly accurate programmable digital panel meters. Each instrument is equipped on front face with a five 14mm high red digits display whose brightness suits applications in industrial control rooms perfectly.
They allow the display, the checking and transmission of data from any measurable magnitudes.

• The **DIP 400** **(process inputs)** includes in standard:

A DC current or voltage input
Bidirectionnal ±100mV, ±1V, ±10V, ±300V, ±20mA.

- Accuracy: 0.1% of the full scale at +25°C
Thermic drift < 150 ppm/°C
- Measurable scale overstepping from -10% to +10%
- Scale factor programmable
- Enlarging effect - Square root extraction
- Special linearisation on 20 points
- Supply for 2 or 3 wire sensor 24 V_{DC} (±15%) -25 mA protected from short circuits

• The **DIP 401** **(temperature input)** includes as standard:

Either a thermocouple input:
(J, K, N, S, B, W5, T, R, E, W, W3, L)

- Accuracy: 0.1% of the full scale at +25°C, or 30µV typical (60µV max.)
- Thermic drift < 150ppm/°C
CJC efficiency: < 0.03°C/°C ± 0.5°C from -5°C to +55°C

Or a sensor input: Pt 100 Ω, Ni 100 Ω
- Line resistance influence in 3 wire measure within the class for 0<RI<25Ω
- Measurement of 2 wire Δ Pt100 from -200°C to +270°C (0<RI<10Ω) (R max. 400Ω)
- Max. measure current: 250 µA
- Accuracy: 0.1% of the full scale at +25°C
- thermic drift < 150ppm/°C.

• **The DIP 402** **(Process, temperature, resistance and potentiometer inputs)**

(See the features of the DIP 400 and DIP 401 on the left hand column)

Resistive sensors: calibers 0-400 Ω and 0-2 kΩ (0-8 kΩ optional)
- Accuracy: 0.1% for the calibers 0-400 Ω and 0-8 kΩ and 0.5% for the caliber 0-2 kΩ (of the full scale at +25°C)
- Thermic drift < 150ppm/°C

Potentiometers: from 100 Ω to 10 kΩ
- Accuracy: 0.1% of the full scale at +25°C
- Thermic drift < 150ppm/°C

AVAILABLE OPTIONS: ***(to be specified on order)***

Insulated analog output: A
Active or passive current, or voltage
Programmable scale ratio with enlarging effect.

Relay output: R or R4
2 or 4 relays: mode setpoint or mode window.
Recording of the alarms.
Time delay and hysteresis adjustable on each setpoint.
Alarm messages

Insulated digital output: N
RS 485 2 wire, protocole MODBUS-JBUS.

Logic input 2 insulated logic inputs with programmable functions
Display hold,
Moving of the decimal point,
Tare function,
zero reset of the min. and max.

Bargraph: (16 leds display): B
Allows a quick evaluation of the measured value variations.
Programmable scale factor

General features

- Sampling time: 100 ms
- Input impedance ≥ 1 MΩ for the voltage inputs
  Max. drop 0.9 V max. for the voltage input
- Common mode rejection rate: 130 dB
  Serial mode rejection rate: 40 dB 50/60 Hz
- Zero drift compensation and self-calibration
- Insulation: input / power supply: 2.5 kV eff. 50Hz-1min
  Input / output: 2.5 kV eff. 50Hz-1min

- **Universal power supply:**

  20...270 VAC and 20 ...300 VDC 50/60/400 Hz

- **Power draw**: 4 W max. 7.5 VA max.

- **Conform** with the standards IEC 61000-6-4 on rejections and IEC 61000-6-2; on immunity (industrial environment)
  IEC 61000-4-2 level 3, IEC 61000-4-3 level 3,
  IEC 61000-4-4 level 4, IEC 61000-4-6 level 3.
  CE marking according to the directive 2004/108/CE

Programming

- Via the keyboard
- With the configuration software SUPERVISION

To communicate with the series DIP400/DIP402 you will need a connection cable (M4 USB). To connect this cable to the DIP, insert the DIN contact into the especially foreseen female connector (on the instrument side). Then connect the USB cable to a PC. The software SUPERVISION allows reading the measures or modifications of the meter configuration.

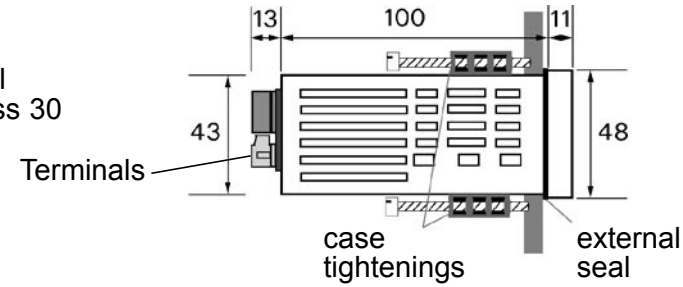
Each configuration is kept as a file stored on disk. These files can then be consulted, modified, duplicated or loaded into the meters. The files can be created with or without having a meter connected. This software also allows the saving of existing configurations from the instruments which are already in service. All the files can be edited on any type of printer.

2. SPACE REQUIREMENTS

Dimensions of the case: (with terminals)

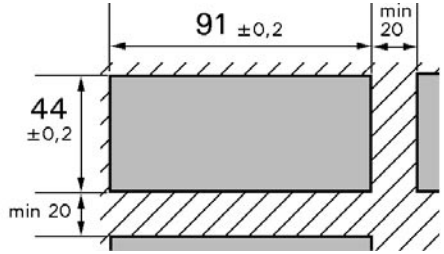
96 x 48 x 124 mm

Holding panel
max. thickness 30



Panel mounting

cut out 44 x 91 mm



Protection:
Front face: IP 65
Housing: IP20
Terminals: IP 20

Housing:
Self-extinguishing case of black UL 94 V0 ABS.

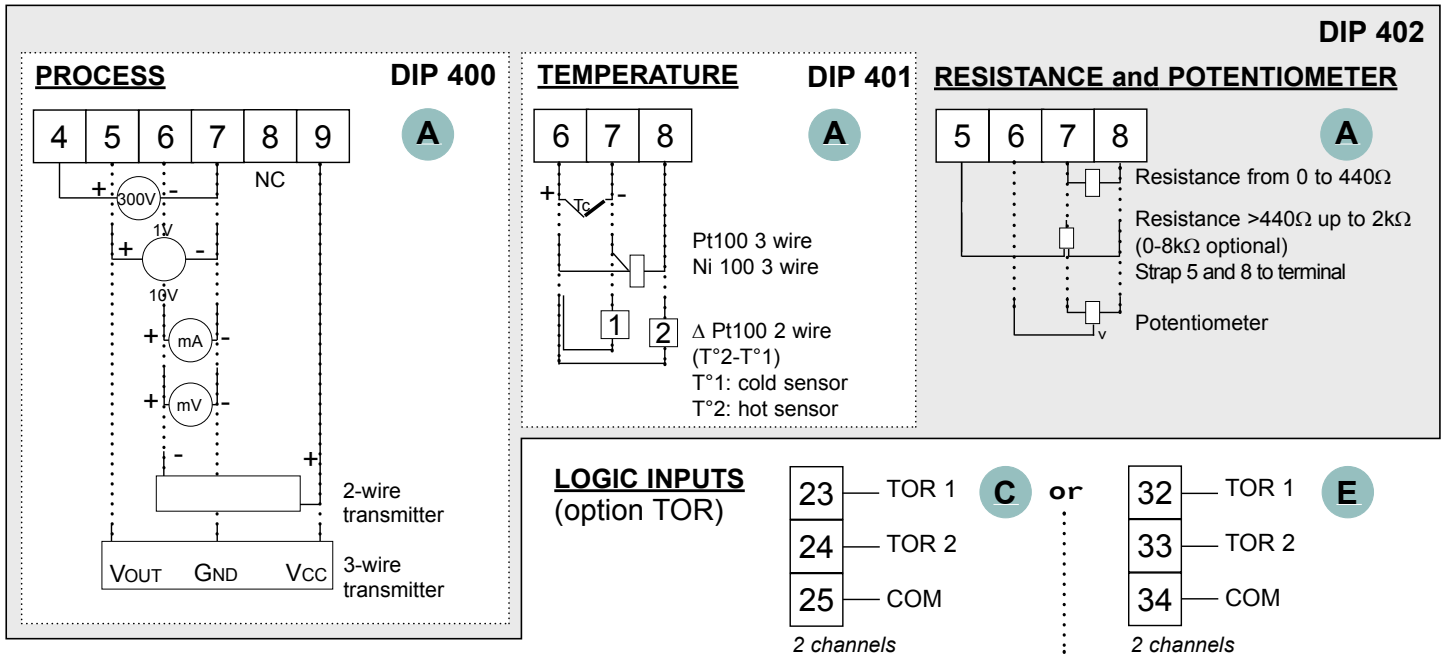
Connectors plug-off connectors on rear face for screwed connections (2,5mm², flexible or rigid)

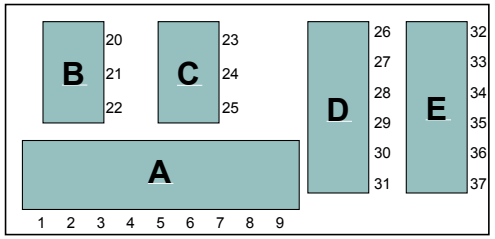
Display: ±10 000 points (14 mm)
Electroluminescent red (green optional)
4 alarm leds
+ 4 leds with programmable functions

-10 000/+100 000 points (14 mm) (optional)
-2 000 / +10 000 points (20 mm) (consult)

3. CONNECTIONS

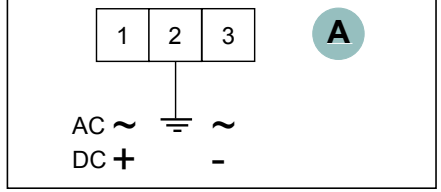
INPUTS





Location of the terminals
(view from case rear face)

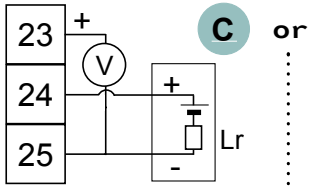
POWER SUPPLY



LOGIC INPUTS
(option TOR)

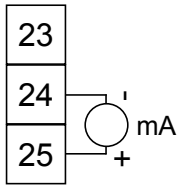
OUTPUTS (optional)

VOLTAGE
PASSIVE CURRENT

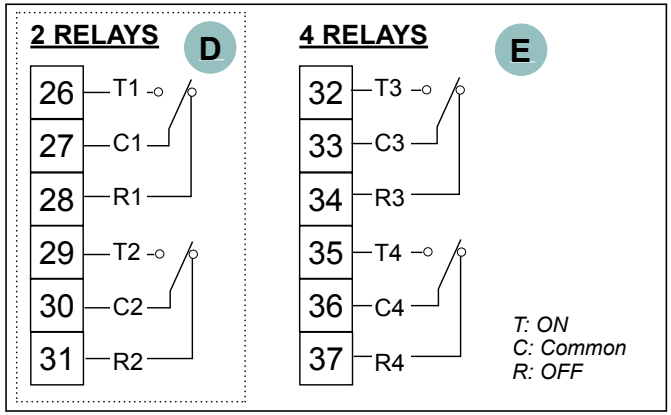


0-4/20mA pasive
external source 30 V max.

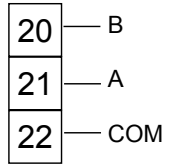
ACTIVE CURRENT



0-4/20mA active



DIGITAL

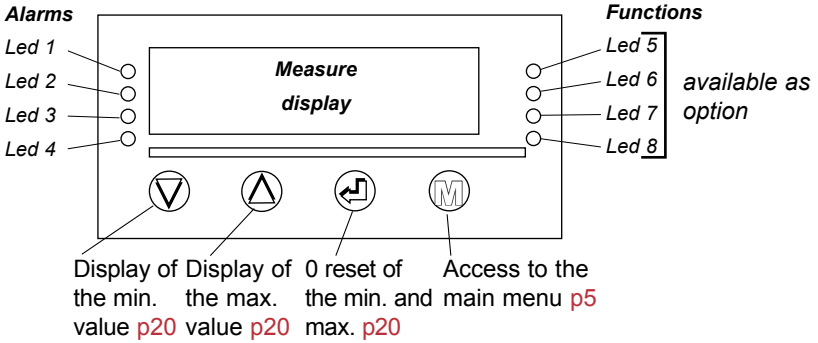


Data link RS 485

4. PROGRAMMING

4.1 Communication with the instrument

Several functions can be accessed directly on front face during the measure display:



Other functions can be accessed by pressing several keys simultaneously:

- ▲ + ▽ Setting of the display down scale; (see p21)
- ↵ + M Setting of the display full scale; (see p21)
- ▽ + M Visualisation of the direct measure; (see p21)
- ▲ + M Visualisation and setting of the alarm setpoints; (see p22)
- ▽ + ↵ Setting of the tare (except temperature inputs; (see p22)

Reading convention:

- Move through the main menu
- Revert to the previous menu
- Blinking display: awaiting validation or setting
- Alternating information display

Entering a parameter:

6888 First start by increasing or decreasing the 1st digit and the sign: from -9 to +9. ▲ and ▽

6588 The 2 nd from 0 to 9.

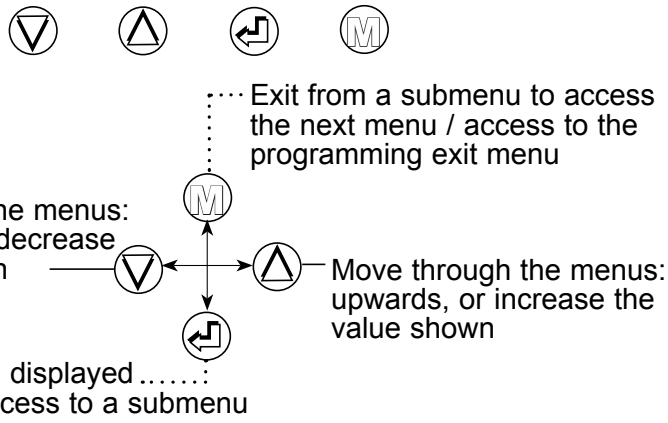
6528 The 3 rd from 0 to 9.

6520 The 4 th from 0 to 9.

Between each entering, validate the cipher with ↵

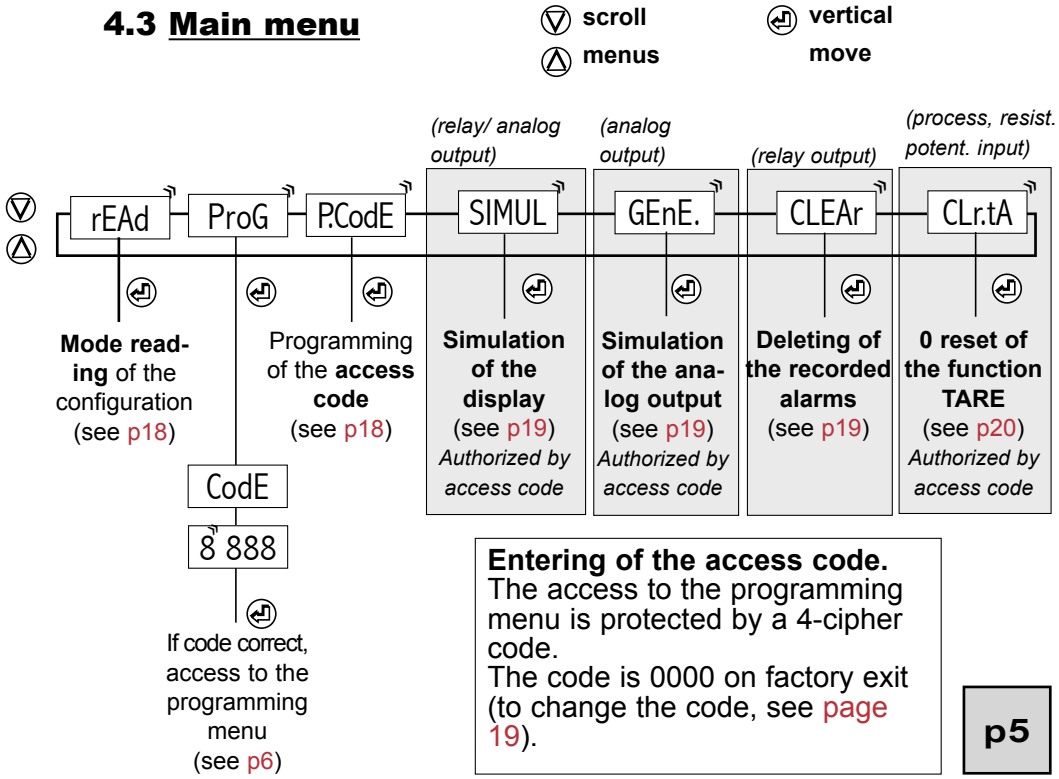
4.2 Orientation through the programming

The dialogue is ensured by 4 keys located on the front face.



Note: In mode programming the instrument will automatically revert to the measure with the former configuration if no key is pressed during 1min.

4.3 Main menu



Entering of the access code.
The access to the programming menu is protected by a 4-cipher code.
The code is 0000 on factory exit (to change the code, see page 19).

4.4 Programming menu *(according to options)*

InPut	Access to the programming of the input	p6
diSPL.	Access to the programming of the display factor	p8
AnA.	Access to the programming of the analog output *(option analog output)*	p8
JbuS	Access to the communication parameters *(option digital output)*	p9
tor	Access to the programming of the logic inputs *(option TOR)*	p9
rELAY	Access to the programming of the relays (2 or 4 relays) *(option relay output)*	p9
SECU	Access to the programming of the outputs, the, relays in case of self-diagnosis and/or sensor rutpure, and access to disconnecting the sensor rupture *(option analog output or relays)*	p10
Pr.diS	Access to the programming of the display: Leds, Bargraph, display brightness	p10
Out.P	Access to the programming exit menu with or without saving the configuration	p11

Note:
⇒ Press (M) to go directly to the menu Out.P

⇒ In mode programming, the instrument will automatically revert to the measure with the former configuration if no key is pressed during 1min.

Note:
Press (M) to go on to the next menu

(▽ △) Move through the menus / choice

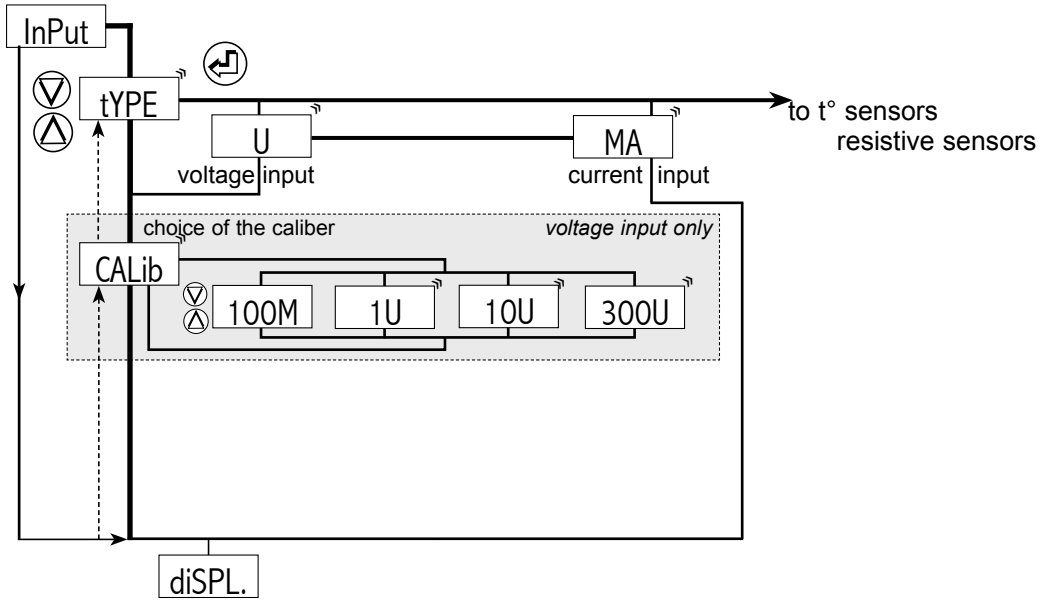
(M) Menu exit / access	(△) Upwards move / increase
(▽) Downwards move / decrease	(↵) Validation / vertical move

4.4.1 Programming of the input

a. Process signals

InPut

DIP 400
DIP 402

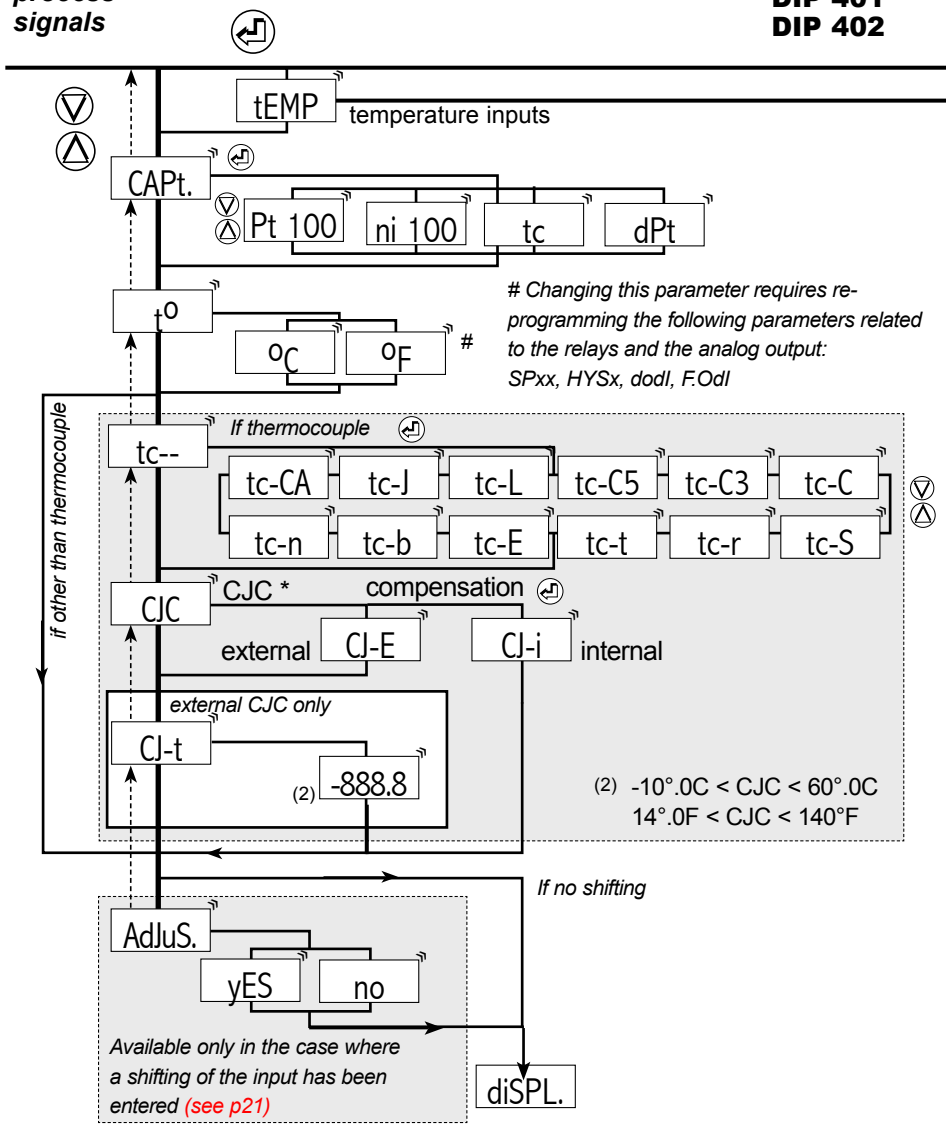


b. Temperature signals

InPut

DIP 401
DIP 402

process signals



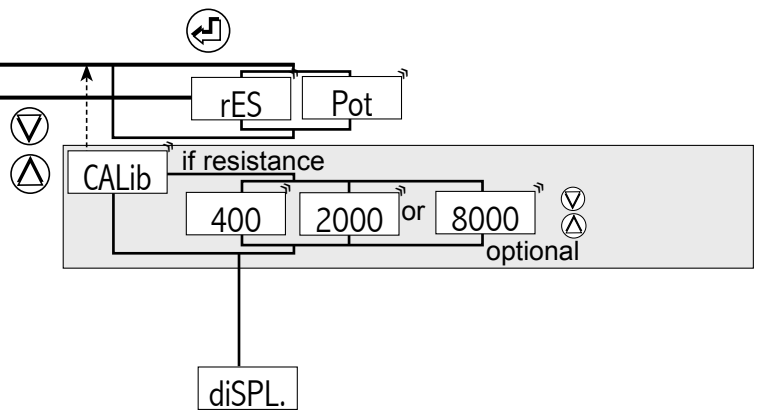
* cold junction compensation, except thermocouple B which is only in CJ-E.

c. Resistive sensors

InPut

DIP 402

temperature signals
process signals



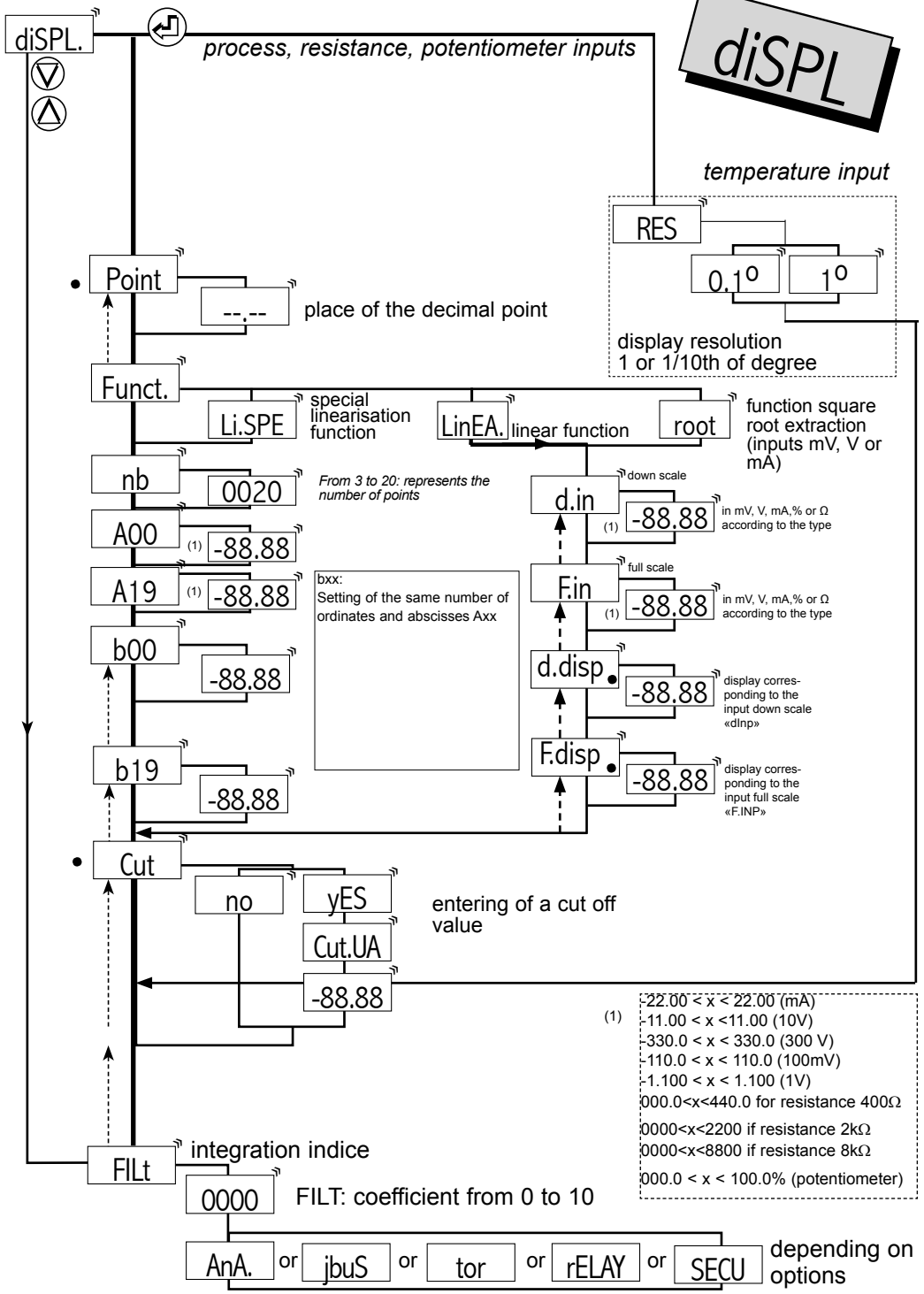
See also the features of the inputs p11

Note:
Press (M) to go on to the next menu

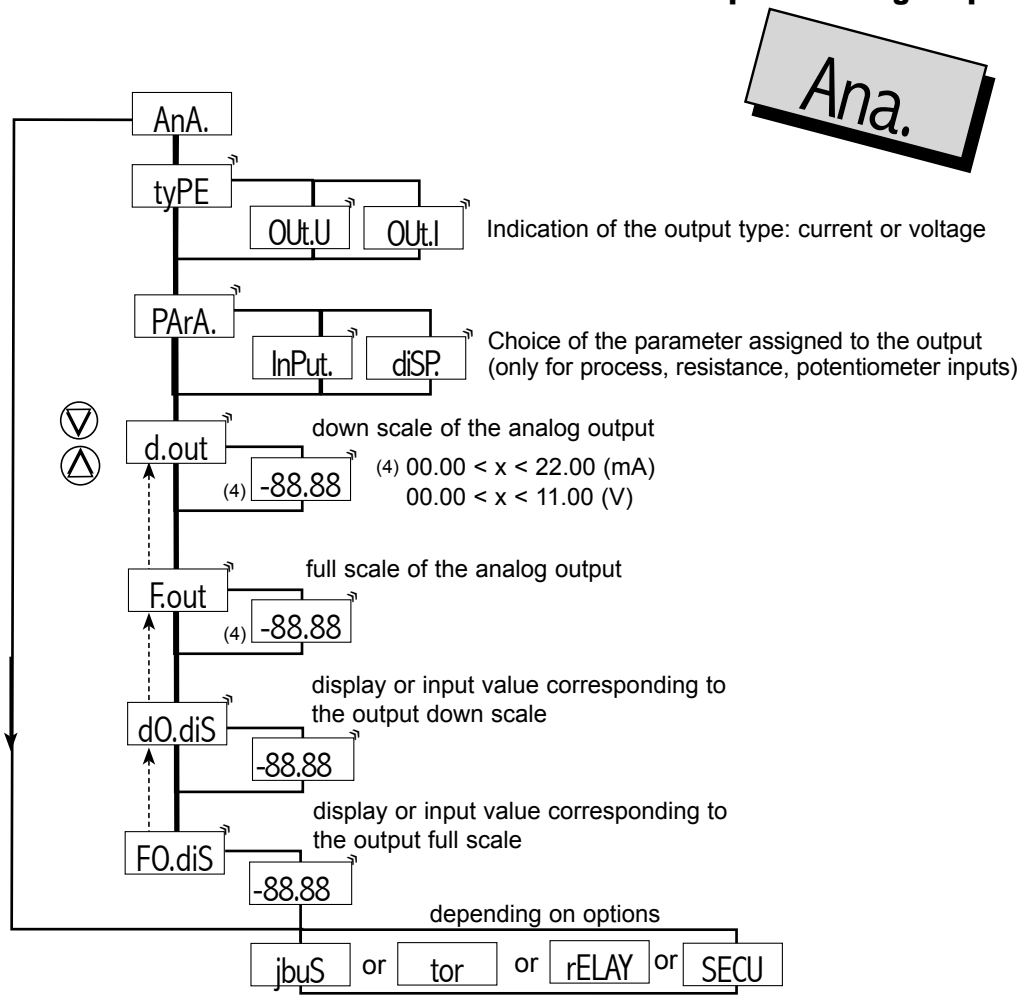
Move through the menus / choice

(M) Menu exit / access	Upwards move / increase
Downwards move / decrease	Validation / vertical move

4.4.2 Programming of the display



Option analog output



See also the features of the outputs p12

Communication parameters

Option digital output

JBuS

JBUS
- slave number
- SLAUE
  - -8888 — must be between 1 and 255
- bAUd — transmission speed
  - 19200 | 9600 | 4800 | 2400 | 1200
- PArit — Choice of the parity: NONE / EVEN / ODD
  - nonE | EUEn | Odd
- ForM — Transmission rank of the bytes in an integer: H-L: MSB transmitted first; L-H: LSB transmitted first
  - H-L | L-H
- dELAY — time lapse before any response
  - yES: typical delay 75ms | no: typical delay 10ms

tor or rELAY or SECU

See also the digital data link features p13

Option logic inputs

tor

tor 1
- Fct.P — function moving of the decimal point
- CLr.M — function 0 reset of the min. and max.
- HoLd — function display hold
- tArE — function tare *(only for process, resistance, potentiometer inputs)*

tor 2
- Fct.P
- CLr.M
- HoLd
- tArE

rELAY or SECU

See also the features of the logic inputs p12

Note:
Press M to go on to the next menu
▽ △ Move through the menus / choice

M Menu exit / access	△ Upwards move / increase
▽ Downwards move / decrease	↵ Validation / vertical move

Option output 2 or 4 relays

rELAY

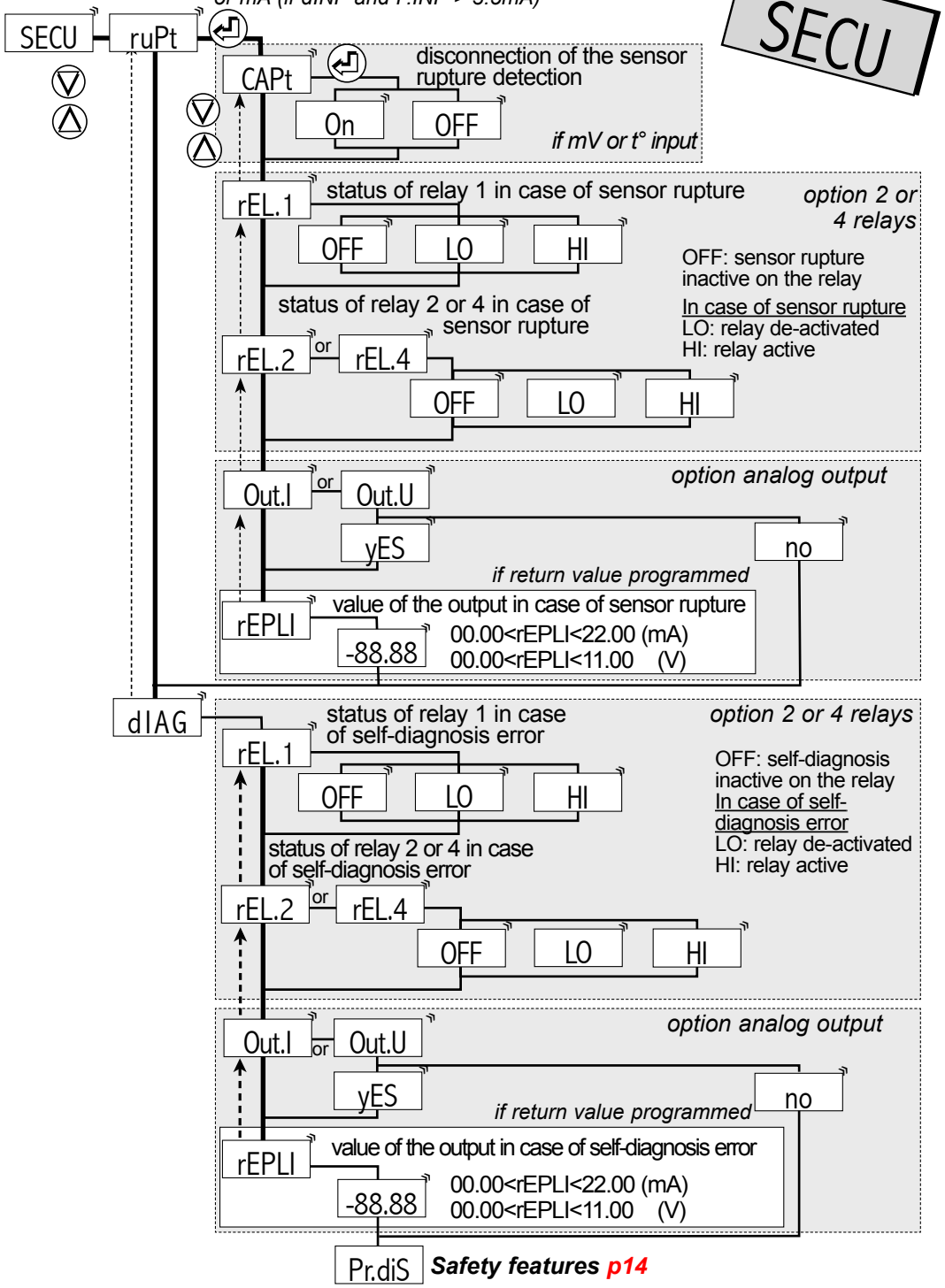
rELAY
- rEL.1
  - alarm
  - AL.1
    - active: On
    - de-activated: OFF
  - PARA1 — Choice of the parameter assigned to the relay (only for process, resistance, potentiometer inputs)
    - InPut. | diSP.
  - ModE.1 (5)
    - mode setpoint: access to SP1
    - mode windows: access to SP1.1
  - *if mode setpoint programmed*
    - SP 1 — 02.00
  - *if mode window programmed*
    - SP1.1 — 02.00
    - SP21 — SPI.2 must be ≥ SPI.I — 04.00

  (5) choice of the relay operating mode: mode setpoint or window (see page 13)
  - HYSt.1 — hysteresis — 00.00 — 0 < hys. < 9999 in display points
  - tiME.1 — time delay on the relay — 000.0 — 0 < tIME < 025.0 in 0.1 sec. increases
  - t.Act1 — if time.1 ≠ 0. Programming of the relay time delay position. — doubl | SiMPL
  - LEd 1 — *choice of the relay associated led status* — OFF | On — **ON**: led lit when relay active; **OFF**: led still when relay active
  - MEM.1 — no | YES — function recording of the alarm
  - MES.1 — no | yES — function display of alarm messages
    - MESS1
    - ABCDE — enter 5 characters
- rEL.2 — If option 2 relays, at the end of menu REL.2, if option 4 relays, at the end of menu REL.4 access to SECU or Pr.diS

idem rEL.1: rEL.2, rEL.3, rEL.4

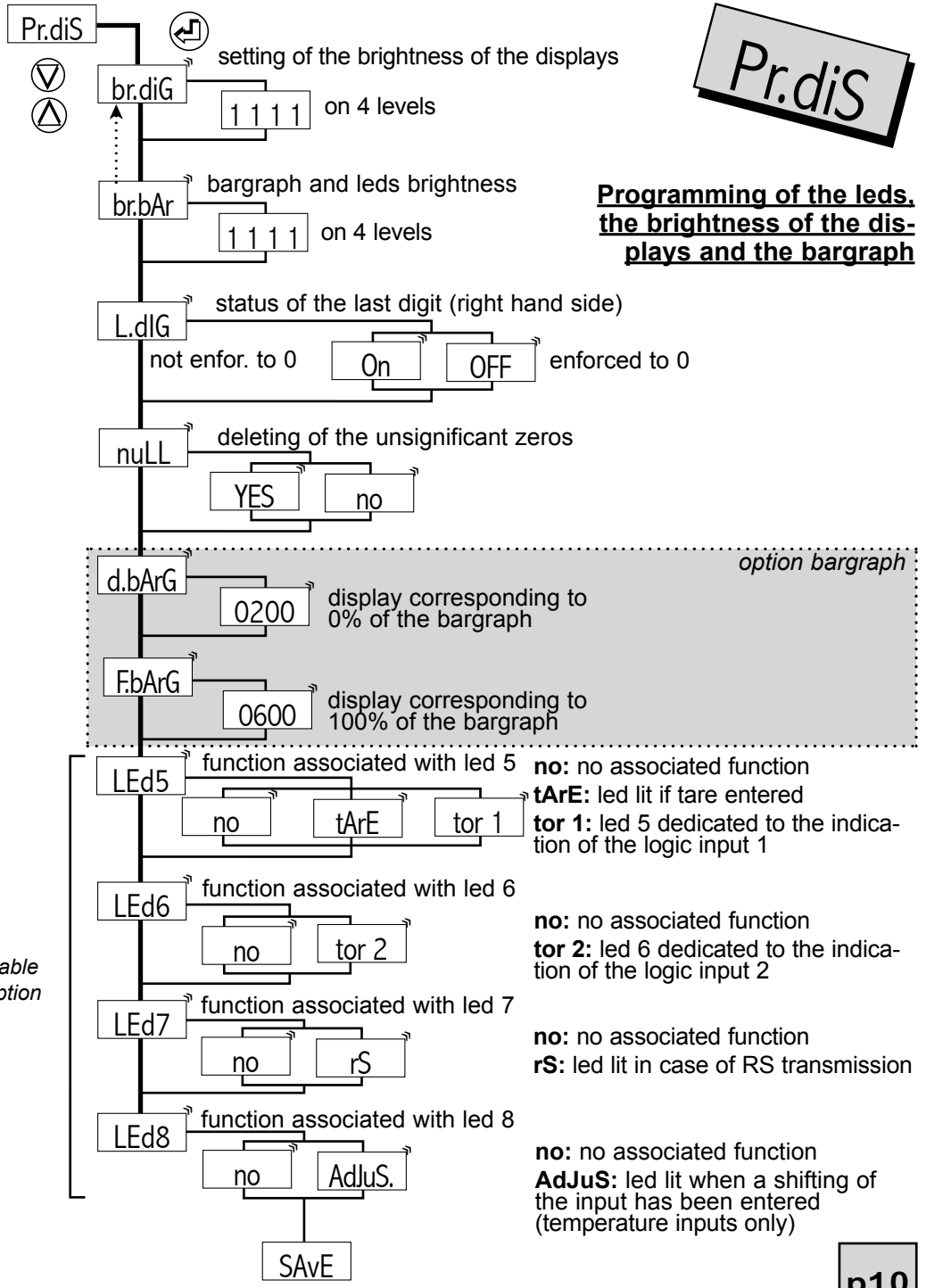
See also the features of the relay outputs p13

SECU



Safety features p14

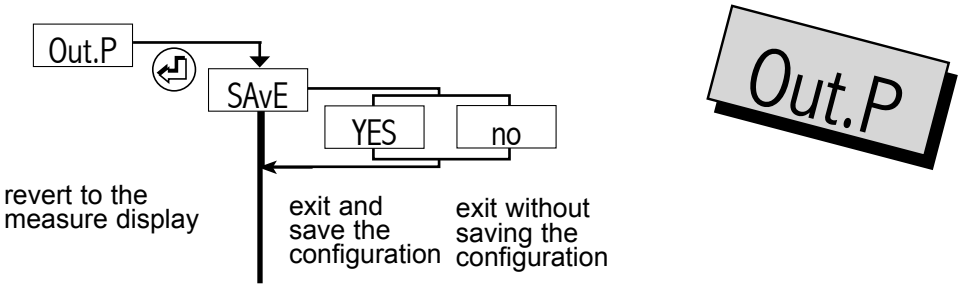
Pr.diS



Programming of the leds, the brightness of the displays and the bargraph

See also the display features p15

Exit from the programming with or without saving



Note: An exit from the programming mode with saving of the configuration (SAVE, YES) will automatically reset the tare, the min. and the max. as well as the alarm recordings to 0.

4.5 Features of the inputs and programming limits

4.5.1 Current input MA

• **Linear**:

Features

Caliber	Display resolution	Accuracy
from -20 to +20mA	± 1 digit	0.1% of the MR

Measurable limits of the input: -22 to 22 mA

4.5.2 Voltage input U

• **Linear**: Features

Caliber	Display resolution	Accuracy
-100 to +100 mV -1 to + 1 V -10 to +10 V -300 to 300 V	± 1 digit	0.1% of the MR

Measurable limits: -10% to +10%

That is for example for the caliber 1V: -1.1V to +1.1V

• **Unlinear:** (see page 17)

4.5.3 Temperature input Pt 100 dPt ni 100 tc

• Resistive sensor

Pt 100 Platinium sensor Pt 100 Ω in 3-wire mounting

dPt Measurement of Delta Pt100 2 wire

ni 100 ni 100 Ω nickel sensor

Sensor type	Measurable limits of the input	Accuracy (MR: measure range)
Pt 100	-200 / 850 °C -328 / 1562 °F	* ± 0.1% of the MR
ni 100	-60 / 260 °C -76 / 500 °F	± 0.1% of the MR
Delta Pt 100	-200 / 270 °C -328 / 518 °F	± 0.1% of the MR

* *The influence of the line resistance with 0<Rl<25Ω is included in the accuracy class.*

• Thermocouple tc

Type: J, K, N, S, B, W5, T, R, E, W, W3, L

Efficiency of the cold junction compensation:
0.03°C / °C ±0.5°C from -5°C to +55°C

Cold junction compensation CJC

Internal CJC-I

External CJC-E Programmable from -10°C to 60°C
+14°F to 140°F

Thermocouple		Measurable limit of the input °C	°F	Accuracy in % of the MR*
tc-j	J	-160 / 1200°C	-256 / 2192°F	0.1 %
tc-CA	K	-270 / 1370°C	-454 / 2498°F	0.1 %
tc-n	N	0 / 1300°C	32 / 2372°F	0.1 %
tc-5	S	-50 / 1770°C	-58 / 3218°F	0.1 %
tc-b	B	200 / 1820°C	392 / 3308°F	0.1 %
tc-C5	W5	0 / 2300°C	32 / 4172°F	0.1 %
tc-t	T	-270 / 410°C	-454 / 770°F	0.1 %
tc-r	R	-50 / 1770°C	-58 / 3218°F	0.1 %
tc-E	E	-120 / 1000°C	-184 / 1832°F	0.1 %
tc-C	W	1000 / 2300°C	1832 / 4172°F	0.1 %
tc-C3	W3	0 / 2480°C	32 / 4496°F	0.1 %
tc-L	L	-150 / 910°C	-238 / 1670°F	0.1 %

* 30µV typical (60µV max.) on the others

4.5.4 Resistance and potentiometer inputs

• Resistance

Caliber	Measurable limits of the input	Accuracy in % of the MR
0 / 400 Ω	0 / 440 Ω	0.1%
0 / 2000 Ω	0 / 2200 Ω	0.5%
0 / 8 KΩ (optional)	0 / 8.8 KΩ	0.1%

• Potentiometer:

Caliber	Accuracy in % of the MR
from 100Ω to 10 KΩ	0.1%

4.5.5 Logic inputs (option TOR)

• Board of 2 logic inputs: Input signal 24 Vdc

Possible functions:

HoLd — Display hold in case of activation of the logic function. The display and the analog output remain fixed in case of variation of the input signal. The relays keep reacting to the input signal.

CLr.M — Zero reset of the min. and the max. The activation of the logic function will reset the min. and the max. to 0.

tArE — Activation of the function tare. The meter switches to the mode tare, the tare being the display value present at the moment when it is activated.

Fct.P — Function moving of the decimal point

Point -.--- — In case of activation of the logic function the decimal places itself as has been programmed.

4.6 Features of the outputs and programming limits

4.6.1 Analog output AnA.

0/4-20mA active or passive current output (Vmax.=30VDC) or 0-10V voltage output

• Accuracy: 0.1 % in relation to the display (at +25°C)
• Residual ripple ≤ 0.2%
• Admissible load 0Ω ≤ Lr ≤ 600Ω (current)
Lr ≥ 5 kΩ (voltage)
• Programmable scale ratio with enlarging effect
• Response time: 40 ms in relation to the display

tyPE — Indication of the output type (voltage or current)

PArA. — Choice of the parameter assigned to the output for the down and full output scale (in display points if PArA. = diSP.) (in input scale points if PArA. = InPut.)

d.out — Down scale of the analog output (eg. 04.00 (4mA))

F.out — Full scale of the analog output (eg. 20.00 (20mA))

dO.diS — Display value corresponding to the output down scale

FO.diS — Display value corresponding to the output full scale

In mode measurement, the analog output can not overstepp 10% of the greatest of the 2 values: d.out and F.out

4.6.2 Digital output:

- RS485 (2 wire) digital data link
- Protocoles **MODBUS-JBUS** format of the data: integer and double integer
- Transmission format: 1 start bit
  8 bits without parity or 9 bits with parity
  1 stop bit

SLAUE	Slave number between 1 and 255
bAud	Transmission speed between 1200 and 19200 bauds
PAR	Transmission parity
ForM	Transmission format (rank of the bytes in a transmitted integer)
dELAy	Time lapse before any response: ON: 75ms OFF: 10ms

*Table of the **modbus addresses**, used functions, see the annexe p25.*

4.6.3 Relay outputs:

2 relay outputs rEL.1 rEL.2
or 4 relay outputs rEL.1 rEL.2 rEL.3 rEL.4

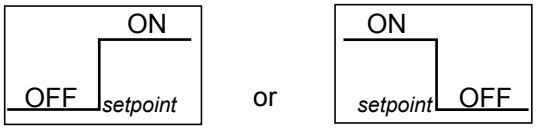
- Hysteresis independently programmable in the display unit
- Time delay independently programmable from 0 to 25 s, in 0.1 s increases
- NO-NC contact 8 A - 250 V on resistive load

Activation or de-activation of the alarm x AL.X

On	The status of the relay x depends on the entered programming
OFF	The relay x remains still.
PArAx	Programming of the parameter assigned to the alarm x
InPut.	Setpoints and hysteresis in input scale points
diSPL.	Setpoints and hysteresis in display scale points

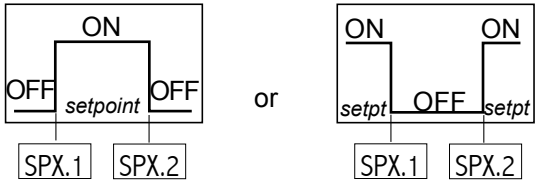
Choice of the operating mode: ModE.x

- **Mode setpoint**



Caption:
ON coil supplied
OFF coil not supplied

- **Mode window**



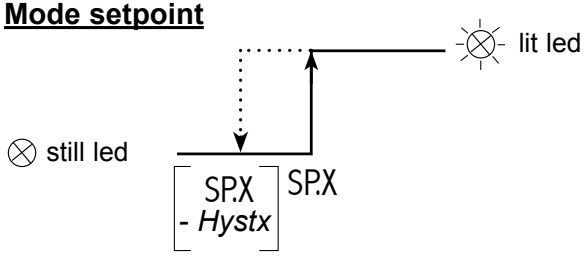
Choice of the status of the relay associated led LEdx

The led indicates the alarm status.

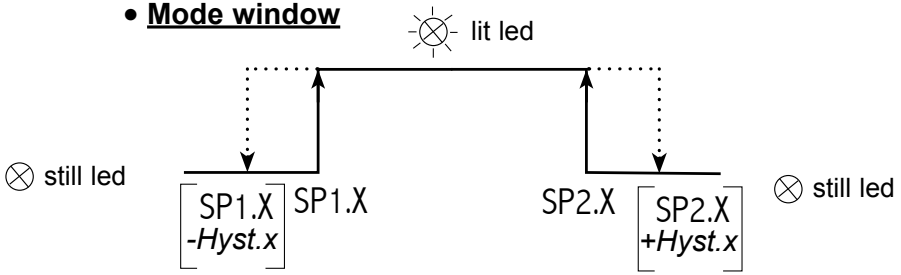
On	Led lit when relay active (coil supplied)
OFF	Led still when relay active (coild supplied)

HYSt.x Setting of the hysteresis in display points.
The hysteresis is active on switching from lit led to still led, that is to say on switching out of alarm, as the led represents the alarm status.

- **Mode setpoint**



- **Mode window**



• **Time delay on the alarm** tiME.x

The relay time delay is adjustable from 000.0 to 025.0s., in 0.1s increases. It is active both on switching and switching back.

• **Positionning of the time delay** t.ActX

SIMPL Time delay on the switching on alarm.

doubL Time delay on the switching on alarm and out of alarm.

• **Alarm recording** MEM.x

Allows recording the alarm after a setpoint has been passed. When the measure reverts below the alarm setpoint, the relay remains on and the led blinks to warn the user that the setpoint has been passed (to reset the alarm recordings to 0 see the menu CLEAr p19).

Note: An exit from the mode programming with saving of the configuration will reset the alarm recordings to 0.

• **Display of alarm messages** MESSx

A programmed alarm message can be made to appear alternating with the measure. The message will appear only during the alarm, that is to say while the associated led is lit.

• **Setting of the setpoints:** There are 2 ways to adjust setpoints:

- either in mode programming entering the correct access code
- or by pressing simultaneously (M) and (△) if the access to a quick entering has been allowed on the programming of the code (see page 18).

4.6.4 Safeties:

• **Self-diagnosis:** diAG

The meter permanently watches its components for any drifts. The self-diagnosis serves to warn the user in case of abnormal increase of these drifts before they may provoque false measures.

The self-diganosis error information can be reported:

· *On the display*: An error message appears alternating with the measure; an error code is registered and can be read in the menu About (see page 18).

Coding:
1 : Programming error
4 : Offset error
8 : Input calibration error
16 : Output calibration error
32 : Cold junction compensation error
64 : Upper or lower electrical overstepping of the input.

If the instrument detects for instance an offset error (4) and a programming error (1) **the error code will be 5** (4+1).

· *On the relays:*

OFF No influence on the relay in case of self-diagnosis error

LO Relay de-activated (coil supplied) in case of self-diagnosis error

HI Relay activated (coil supplied) in case of self-diagnosis error

Note: The led is either still or lit according to its programming in the menu rELAY.

· *On the analog output*

If a return value has been entered
Value between: 0 and 22 mA (current output)
or 0 and 11 V (voltage output)

• **Sensor rupture** ruPt

The sensor rupture can be detected on the inputs mV, Tc, Pt100, Ni100, ΔPT100, resistance, and current if down and full scale > 3.5 mA.

The sensor rupture information can be reported:

· *On the relay*

OFF No influence on the relay in case of sensor rupture

LO Relay de-activated (coil not supplied) in case of sensor rupture

HI Relay active (coil supplied) in case of sensor rupture

Note: The led is either still or lit according to its programming in the menu rELAY.

· *On the analog output*

If a return value has been entered
Value between: 0 and 22 mA (current output)
or 0 and 11 V (voltage output)

· *On the display*: Message OPEn

Note: The sensor rupture detection has a priority over the self-diagnosis.

• **Disconnection of the sensor rupture** *(If mV or temperature input)*

The sensor rupture can be disconnected in order not to disturb some calibrators which may be sensitive to the rupture detection current.

In the menu SECU:

CAPt Disconnection of the sensor rupture, or not

On Sensor rupture detection on

OFF Disconnection of the sensor rupture

4.6.5 Display features:

The parameters down and full display scale, cut-off and ordinates (if input linearised in segments) are to be considered in the magnitude of the programmed physical scale. The setpoints, hysteresis, dO.dis and FO.dis for the analog output can be programmed either in input magnitude or in displayed magnitude (according to PARA).

For the *example 1*, with PARA1 «diSP» validated, a setpoint on the relay 1 (SPl.l) with a value of 30.0 corresponds to a setpoint of 30.0 m3. If the display overstepps 30.0m3 (if the input exceeds 5,60 mA) the status of the relay 1 will change.

Point — Position of the decimal point for the inputs other than temperature inputs

rESOL. — Display resolution for the temperature inputs **0.1°** or **1°**

Funct

- LinEA — linear input
- root — square root extraction

  √ of the measure brought back in % of the programmed measure range

  Example for a 4-20mA input: 12mA gives 0.707 (√ 0.5)
- Li.SPE — The function square root tends to amplify the background noise of the input signal when getting near zero. To avoid the ripples caused by this noise, simply programme a cut-off value (in display points).
- special linearisation

d.diSP — Display corresponding to the input down scale (except temperature inputs) — d.in

F.diSP — Display corresponding to the input full scale (except temperature inputs) — F.in

Cut.vA — Only for process, resistance, potentiometer inputs, expressed in display points.

– If the display full scale > display down scale and if the display is ≤ than the cut off value then it will be held at the down scale.

– If the display full scale < display down scale and if the display is ≥ than the cut off value then it will be held at the down scale.

For a 4/20 mA signal from a level sensor on a tank, the following programming is displayed:
POINT **=** _ _ _ . _ FUNCT = LinEA
d.in = 4.00
F.in = 20.00
d.diSP = 000.0
F.diSP =300.0

for:
4 mA from the sensor, display = 000.0 m3
12 mA from the sensor, display = 150.0 m3
20 mA from the sensor, display = 300.0 m3

FiLt • **Response time**:

Integration indice of the digital filtering:
Programmable from 0 to 10; use in case of unsteady input signal.

FiLt	0	1	2	3	4	5
Typical response time at 90%	120 ms	400 ms	600 ms	1 s	1.4 s	2 s

6	7	8	9	10
3 s	5 s	7.5 s	10 s	15 s

To obtain the maximum response time add 240 ms.

Note: For the response time of the analog outpt, add 40ms to the values given in the table.
For the relays: add the time delay programmed on the alarms.

Setting of the digits brightness br.diG

1 1 1 1 Lowest brightness — 4444 Strongest brightness

• **Setting of the bargraph and the leds brightness** br.bAr

1 1 1 1 Lowest brightness 4444 Strongest brightness

The brightness level can be visualised directly on the leds 5 to 8 and on the bargraph.

Caution: during the setting, the 4 leds and the bargraph no longer represent the measure, including also in mode reading.

• **Inhibition of the last digit** *(bottom weight)* L.dIG

In the mode programming, the menu L.dIG allows suppressing the dislay of the last digit, the latter will be enforced to 0 if OFF is validated.

• **Deleting of the unsignificant zeros** nuLL

nuLL = YES Suppresses the display of the unsignificant zeros on the left hand side.

Eg.: Value to be displayed: 0015

nuLL = no Display = 0015

= YES Display = 15

Eg.: Value to be displayed: 00.15

nuLL = no Display = 00.15

= YES Display = 0.15

• **Display factor of the bargraph** (option bargraph only)

d.bArG Display corresponding to a still bargraph (0%)

F.bArG Display corresponding to a fully lit bargraph (100%)

In case of overstepping the bargraph starts to flash. A sensor rupture will be shown on the bargraph by the lighting of 1 led out of 2.

• **Programming of the leds 5 to 8** *(available as option)*

Programming of led 5 LEd5

no Led still (no associated function)

tArE The led 5 indicates that the instrument is in mode tare

tor 1 The led 5 will be lit when the logic input 1 is active

Programming of led 6 LEd6

no Led still (no associated function)

tor 2 The led 6 will be lit when the logic input 2 is active

Programming of led 7 LEd7

no Led still (no associated function)

rS The led 7 will be lit during the instrument response

Programming of led 8 LEd8

no Led still (no associated function)

AdJuS. The led 8 will be lit when a shifting of the down and/or full display scale (see page 21) has been entered *(temperature inputs only)*

Choice of the measure range:

The measure range (unidirectionnal or bidirectionnal scale) depends on the value entered for the paramters d.in and F.in

If the value d.in or F.in is negative the meter will operate with a bidirectionnal input scale.

If the values d.in and F.in are both positive the meter will operate with a unidirectionnal input scale.

Example for a 10V caliber:

d.in = -1.0V F.in = 10V (bidirectionnal input)

The measure range is from -11V to +11V

d.in = 0V F.in=10V (unidirectionnal input)

The measure range is from -1V to 11V

Thermic drift < 150 ppm/°C

• **Unlinear:**

Extraction of the square root root

Note: The function square root tends to amplify the background noise of the input signal when getting near zero.

To avoid the ripples caused by this noise, simply programme a cut-off value (in display points).

– If the display full scale > display down scale and if the display is ≤ than the cut off value then it will be held at the down scale.

– If the display full scale < display down scale and if the display is ≥ than the cut off value then it will be held at the down scale.

Special linearisation: Li.SPE

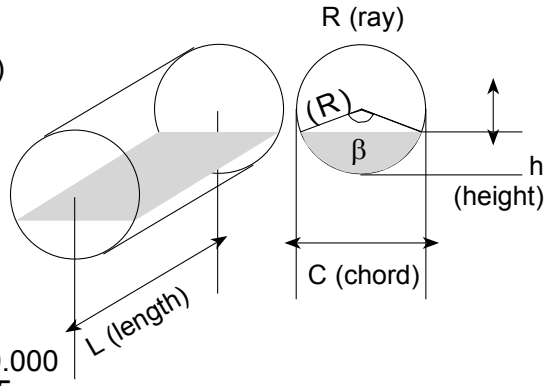
For specific applications such as the measurement of volumes, the meter can memorise an unlinear curve, programmable in X and in Y.

The curve resulting from your equation can be replaced by a series of linear segments, with a maximum of 20 points (19 segments).

Note: the values of the abscisses (x) must go increasing d.in < value of A01 < value of A02...< An-1.

Example:
For a layed cylindric tank, 1 meter high (h) and 1 meter long (l); a 0-20 mA linear sensor measures the height of the liquid surface line:

Input to the meter: height h
0 meters -> 0 mA (empty tank)
1 meter -> 20 mA (full tank)
with cos $\beta/2 = (R-h)/R$
Sin $\beta/2 = C/2R$



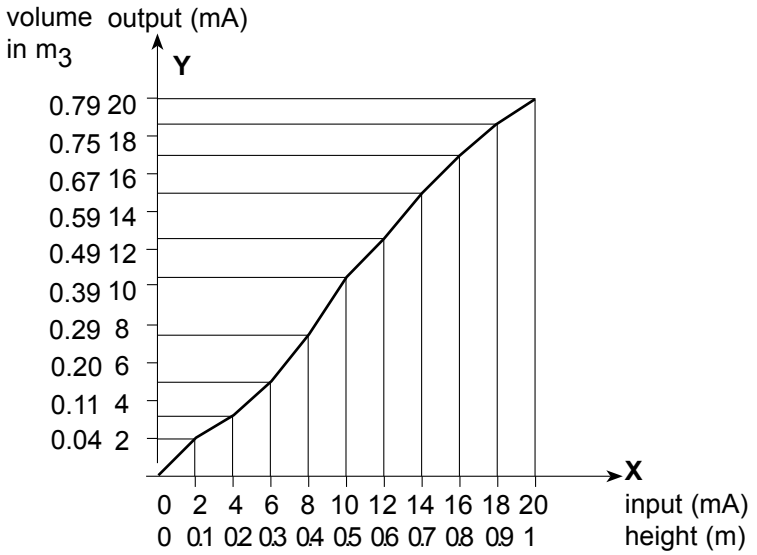
Display of the meter:
Empty tank volume d.diSP = 0.000
Full tank volume F.diSP =0.785

Volume = $L\ [\pi\ R^2\ \beta/360 - C(R-h)/2]$

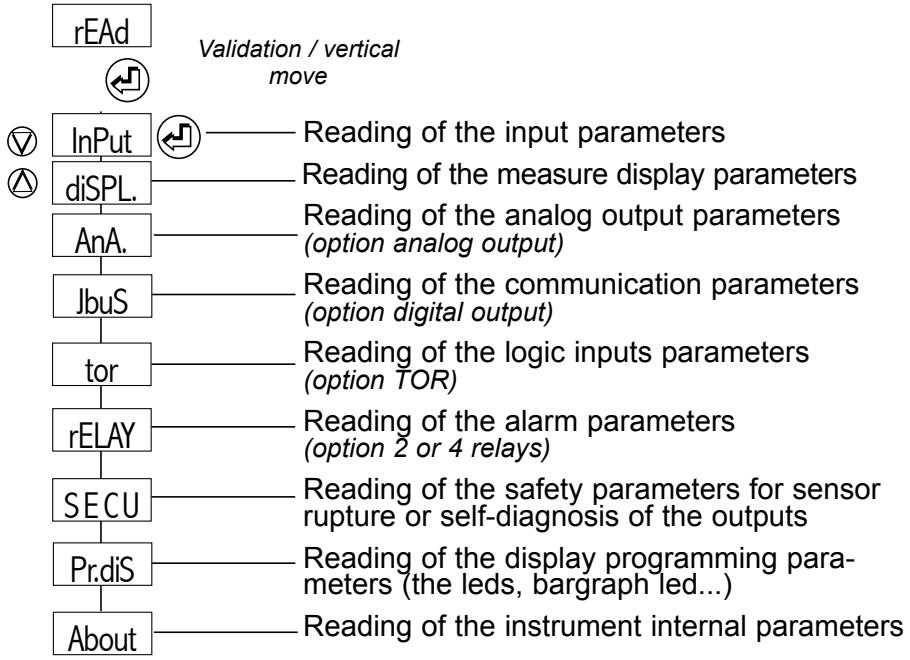
Say a curve of 10 equally long segments:
Measure range / number of segments = 20mA/10 = 2mA length of the segment. For 10 segments nbr = 11.

Input mA		Height m	Degree	Chord m	Volume m^3		Outputs in mA
A00	0	0.0	0.00	0.00	B00	0.000	00.00
A01	2	0.1	73.74	0.60	B01	0.041	01.04
A02	4	0.2	106.26	0.80	B02	0.112	02.85
A03	6	0.3	132.84	0.92	B03	0.198	05.04
A04	8	0.4	156.93	0.98	B04	0.293	07.47
A05	10	0.5	180.00	1.00	B05	0.393	10.00
A06	12	0.6	203.07	0.98	B06	0.492	12.54
A07	14	0.7	227.16	0.92	B07	0.587	14.96
A08	16	0.8	253.74	0.70	B08	0.674	17.17
A09	18	0.9	286.76	0.60	B09	0.745	18.98
A10	20	1.0	360.00	0.00	B10	0.785	20.00

Programming:
nb = II
Programming from A00 to A10 and from B00 to B10 according to the table.



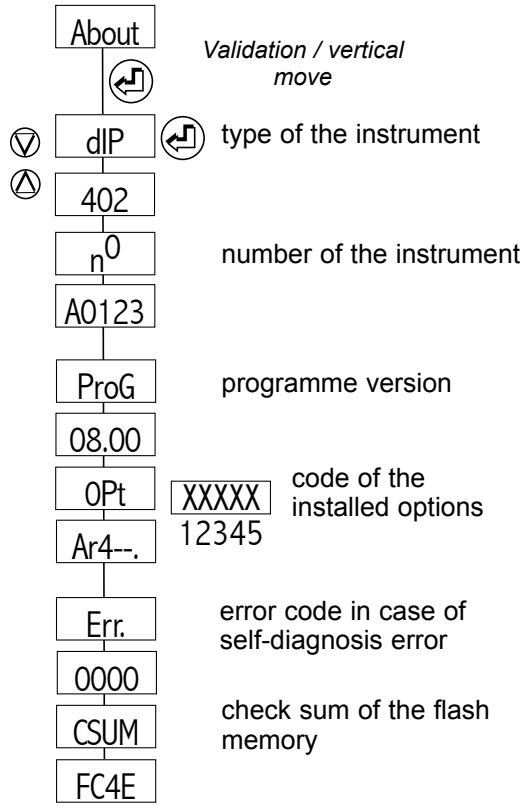
4.7 Reading of the configuration rEAd



In each reading submenu press ▽ and △ to move, and ↵ to visualise parameters.

If no key is pressed during 20 s. the instrument will revert to the measure display.

Submenu



XXXXX
12345

X1 : - : no analog output
A : analog output

X2 X3 : - - : no relay output
r- : output 2 relays
r4 : output 4 relays

X4 : - : no RS output
n : RS output

X5 - : no logic input
t : 2 logic inputs

(.) : decimal point still: no bagraph
"." : decimal point lit: option bargraph

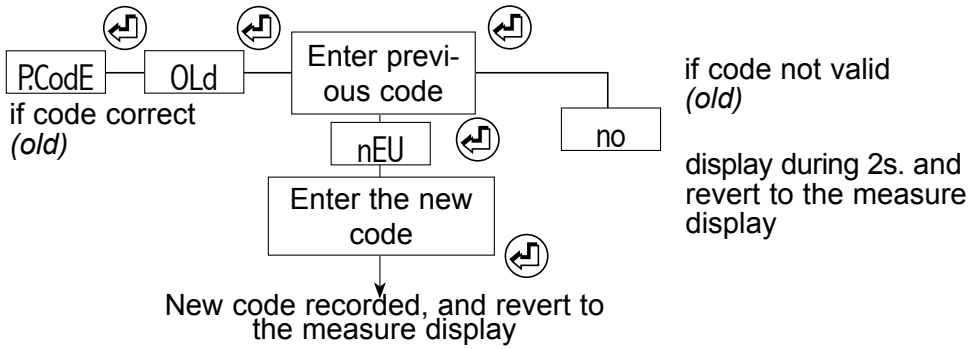
XXXXX
12345

4.8 Access code

An access code which can be set from 0000 to 9999 serves to protect the meter and its setpoints from unauthorized programming, and to lock the access to some functions.

0 0 0 0	Factory code
x x x x	
0 to 5	Access to the display shifting
6 to 9	No access
0 to 5	Access to the display and output simulations
6 to 9	No access
0 to 5	Access to the function "tare" (except temperature inputs)
6 to 9	No access
0 to 5	Access to the quick entering of alarm setpoints
6 to 9	No access

4.9 Programming of a new access code



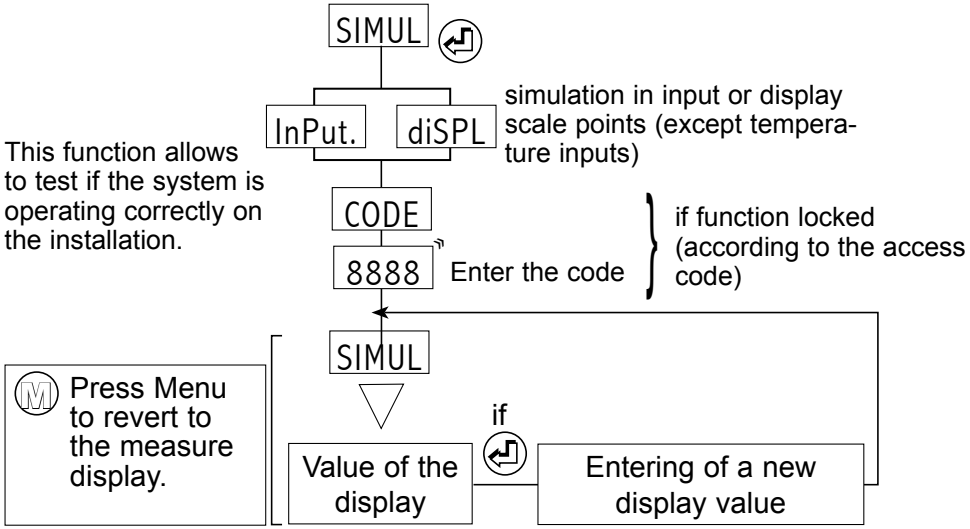
Reminder: If no key is pressed during 1 min. the instrument will revert to the measure display. The access code is 0000 on factory exit.

4.10 Functions which can be accessed from the main menu

4.10.1 Simulation of the display

(accessible according to the programmed access code and if option relays or analog output)

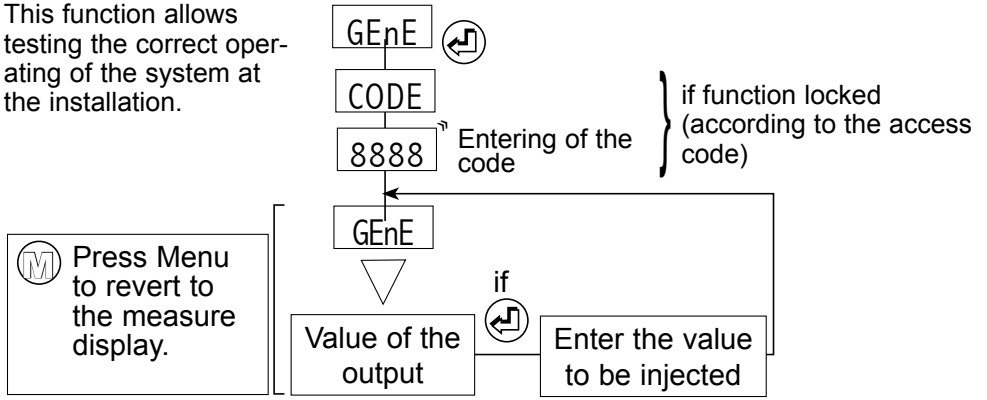
The display can be simulated with the meter in order to validate the configuration of the analog output and the relay outputs in the installation.



Note: The instrument no longer measures during the simulation. The analog output and the relay outputs will react according to the entered display. If alarm messages have been programmed they may appear during the simulation.

4.10.2 Simulation of the analog output *(mode generator)*

(accessible according to the programmed access code and if option analog output)

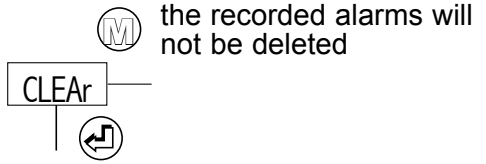


Note: The instrument will carry on measuring during the simulation. Only the analog output will no longer react to the measure.

4.10.3 Menu CLEAr : Deleting of the recorded alarms

If the function recording of the alarms has been programmed:
The status of the relay will be memorised after the setpoint has been passed.

If the setpoint is passed back the other way, the status of the relay does not change and the corresponding led starts to blink.
To come back to the normal status (led not blinking and relay in the correct status, use the menu CLEAr).

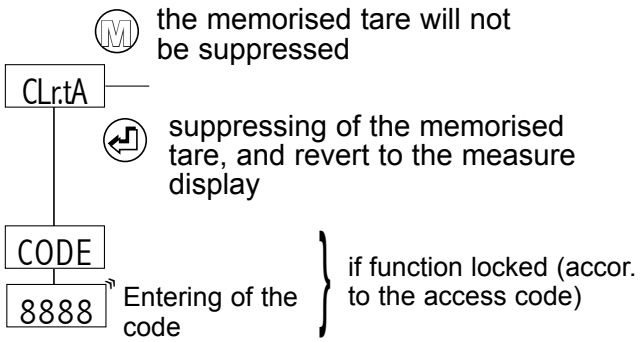


Reminder: If no key is pressed during 20 s. the instrument will revert to the measure display.

Note: An exit from the mode programming with saving of the configuration will reset the alarm recordings to 0.

4.10.4 Menu CLr.tA : Suppressing of the programmed tare

(accessible according to the programmed access code)

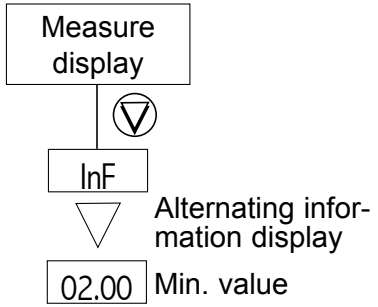


Reminder: If no key is pressed during 20 s. the instrument will revert to the measure display.

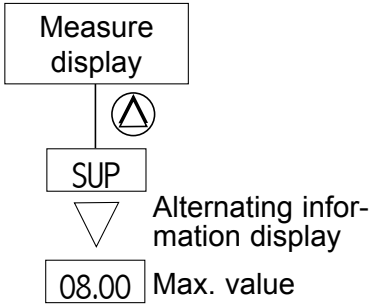
5. FUNCTIONS WHICH CAN BE ACCESSED DIRECTLY FROM THE MEASURE DISPLAY

5.1 Functions which require pressing only 1 key:

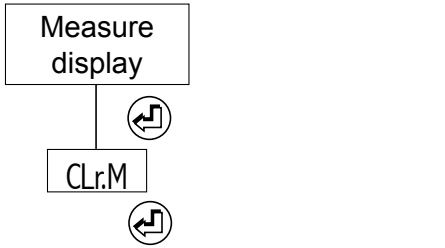
a / Display of the min. value



b/ Display of the max. value



c / Deleting of the min. and max. values



The instrument will revert to the measure display.

Reminder: If no key is pressed during 20 s. the instrument will revert to the measure display.

Note: An exit from the mode programming with saving of the configuration will reset the min. and max. values to 0.

5.2 Functions which require pressing several keys:

5.2.1 Display shifting

(accessible acc. to the programmed access code)

△ ▽ Shifting of the display down scale (AdJ.Lo)

↵ M Shifting of the display full scale (AdJ.Hi)

If the function has been locked (according to the access code) the code must be entered.

After injecting an input signal corresponding to the down (or full) display scale, press simultaneously △ and ▽ (or ↵ and M) The message AdJ.Lo (AdJ.Hi) will appear alternating with the value, to indicate that you are in the menu adjustment.

The down (or full) display scale can be increased or decreased by pressing △ and ▽.
If you keep pressing △ or ▽ during 3 seconds you can increase or decrease the display value quicker.
Press ↵ to validate the shifting. Once the shiftings have been validated, the input will keep the same shifting even after a setting off tension.
Press M (or do not press any key during 20 s) to revert to the measure display without modification.

• **Case of a process, resistance or potentiometer input**

The instrument will then re-adjust its scale factor and its display factor in order to obtain the required result on the display.

• **Case of a temperature input**

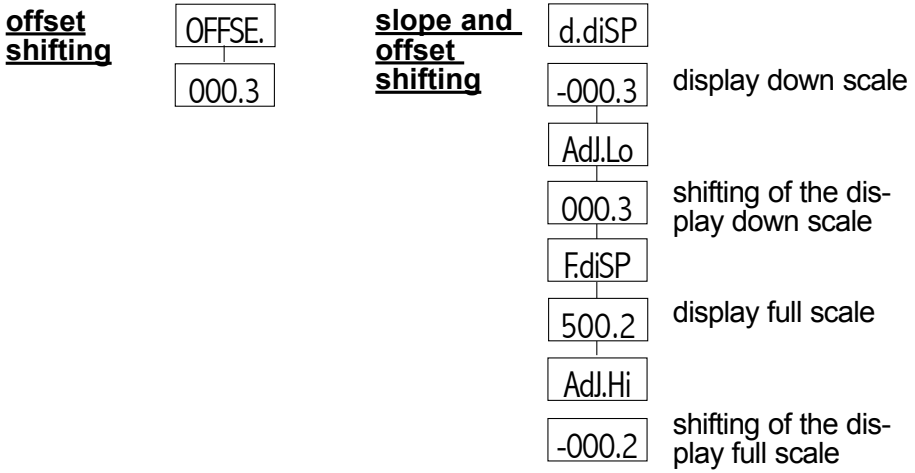
On a temperature input, if one of the two settings is performed this will correspond to an offset, which means that all points will be shifted by the same quantity.

But if the two settings are performed the slope and the offset will be corrected in order to obtain the required result.

example:

For a PT100 input for 0°C the obtained display is -000.3
For 500°C the obtained display is 0500.2. To correct this display, the display down scale must be shifted by 3 points to obtain 000.0 and the display full scale by -2 points to obtain 0500.0.

note: only for **temperature inputs**:
From the menu rEAd, the performed scale shiftings can be visualised in the submenu InPut:



Suppressing of the input shifting:
(Case of a temperature input only)
The menu AdJuS. in the mode programming of a temperature input allows to suppress the entered shifting, or not.

no: the instrument will revert to the factory settings
Yes: the instrument will take the programmed (offset and/or slope) adjustments into account.

5.2.2 Visualisation of the direct measure

Press ▽ and M to visualise the signal directly without any processing: scale factor, square root, linearisation

– in mV, V or mA for process inputs,
– in mV for the thermocouple input,
– in Ω for the Pt100, Ni100 input,
– in Ω for the resistance input,
– in percents for the potentiometer input,
– temperature of the hot sensor for the ΔPt100 input.

5.2.3 Visualisation and setting of the alarm setpoints

Option 2 or 4 relays

Setting of the setpoints: There are 2 ways to adjust setpoints:
- either in mode programming entering the correct safety access code (see p18)
- or by pressing simultanesously △ and Ⓜ

If the function has been locked (according to the access code) the code must be entered.

The meter will then show the message SP.x or SPx.x alternating with the value of the corresponding setpoint.

The various values of the setpoints can be accessed by ▽ and △.

These setpoints can then be modified (if access code < 6000 (see p18)) by pressing ↵

When the setpoint is adjusted press ↵ to revert to the setpoints reading menu.

Once all the setpoints have been adjusted, simply press Ⓜ and the meter will revert to the mode measure, taking the new values into account.
If no key is pressed after 60 s. the meter will revert to the measure display without modification of the setpoints value.

5.2.4 Setting of the tare (except temperature inputs)

(accessible according to the programmed access code)

Press ↵ and ▽ to enforce the signal currently present on the input as display down scale [d.disP]

If the function has been locked (according to the access code) the code must be entered.

Note: The tare will not be recorded in case of power supply cut.
To suppress the tare, validate the menu [CLr.tA] in the main menu p20.
An exit from the mode programming with saving of the configuration will reset the tare to 0.

6. ERROR MESSAGES

[2000]	Measure in overrange
[OPEn]	Sensor rupture
[Er.01]	Value set out of range
[----]	Upper or lower electrical overstepping of the input
[OL]	Displayable value overload
[Er.xx] or [E.xxx]	Self-diagnosis error (see page 14)

7. GENERAL WARRANTY TERMS

WARRANTY applying and duration
This appliance is garanteed for a duration of 1 year against any design or manufacturing defects, under normal operating conditions.

Processing conditions * : Processing not under warranty will be submited to the acceptance of a repair estimate. The customer will return the products at his charge, and they will be restored to him after processing. Without a written agreement on the repair estimate within 30 days, the products will not be held.

** Complete warranty terms and details available on request.*

8. LEXIQUE

Messages shown by the meter in mode programming and/or in mode reading

General access

[rEAd]	Access to the reading of the parameters
[ProG]	Access to the programming of the input and output parameters
[CodE]	Code for access to the programming of the input and output parameters
[P.CodE]	Programming of a new access code
[SIMUL]	Access to the display simulation
[GEnE]	Access to the simulation of the analog output
[CLEAr]	Deleting of the recorded alarms
[CLr.tA]	Suppressing of the tare

Inputs

InPut Access to the submenu programming of the input

- tYPE Type of the input
  - U Voltage input
  - MA Current input
  - tEMP Temperature input
  - Pot Potentiometer input
  - rES Resistance input

Voltage input and current input U MA

- CALib Choice of the voltage caliber
  - 0-10 Input 0 to 10 V (or -10/10V)
  - 300 Input 0 to 300 V (or -300/300V)
  - 0-0. 1 Input 0 to 100 mV (or -100/100mV)
  - 0-1 Input 0 to 1 V (or -1/+1V)

Temperature input tEMP

- CAPt. Type of temperature sensor
  - Pt 100 Pt100 input
  - tc Thermocouple input
    - tc-- Type of thermocouple
      - tc.CA Thermocouple K (see the table page 13)
    - CJC Type of cold junction compensation
    - CJC-I Internal CJC
    - CJC-E External CJC
    - CJ-t° Value of the external CJC
  - dPt Delta PT100 input
  - ni 100 NI100 input
- t° Type of degrees
  - °C Celsius degree
  - °F Farentheit degree
- AdJuS. Input shifting
- OFFSE. Offset shifting
- d.diSP Slope and offset shifting, display down scale
  - AdJ.Lo Adjusting of the display down scale
- F.diSP Slope and offset shifting, display full scale
  - AdJ.Hi Ajusting of the display full scale

Potentiometer input and resistance input Pot rES

Logic inputs (option TOR)

- tor Access to the submenu programming of the logic inputs
- tor 1 Programming of the logic input 1
- tor 2 Programming of the logic input 2
  - Fct.P Function moving of the decimal point
    - --.-- Place of the decimal point
  - CLr.M Function deleting of the min. and max.
  - HoLd Function display hold
  - tArE Function Tare

Display

- diSPL. — Access to the submenu programming of the display
  - Point — Choice of the decimal point location
    - --.-- — Place of the decimal point
  - d.in — Input down scale
  - F.in — Input full scale
  - Funct — Choice of the processing function
    - LinEA. — Linear
    - root — Extraction of the square root
    - Li.SPE — Special linearisation
      - nb — Number of linearisation points
      - Axx — Abscisse of a special linearisation point
      - Bxx — Ordinate of a special linearisation point
      - d.diSP — Display down scale
      - F.diSP — Display full scale
  - Cut.oF — Cut-off programmable or not
  - rESOL. — Display resolutation for the temperature inputs
    - 0.1 0 — Resolution 1/10th of degree
    - 1 0 — Resolution 1 degree
- FiLt. — Integration indice

Display parameters

- Pr.diS — Submenu programming of the display features
- br.diG — Setting of the digits brightness (4 levels)
  - 1 1 1 1 — Lowest brightness
  - 4444 — Strongest brightness
- br.bAr — Adjusting of the bargraph and the leds brightness
  - 1 1 1 1 — Lowest brightness
  - 4444 — Strongest brightness

- L.dIG — Last digit (bottom weight)
  - On — Last digit in service
  - OFF — Last digit enforced to 0
- nuLL — Deleting of the unsignificant zeros
  - YES — Yes
  - no — No
- d.bArG — display corresponding to 0% of the bargraph
- F.bArG — display corresponding to 100% of the bargraph
- LEdS — *Assignement of the led 5*
  - no — No attributed function
  - tArE — Led lit if a tare has been entered
  - tor 1 — Led 5 dedicated to the indication of the logic input 1
- LEd6 — *Assignement of the led 6*
  - no — No attributed function
  - tor 2 — Led 6 dedicated to the indication of the logic input 2
- LEd7 — *Assignement of the led 7*
  - no — No attributed function
  - rS — Led lit in case of transmission on the RS
- LEd8 — *Assignement of the led 8*
  - no — No attributed function
  - AdJuS. — Led lit when a shifting of the input has been entered (temperature inputs only)

Analog output

- Out.U — Access to the voltage output programming submenus
- Out.I — Access to the current output programming submenu
  - PArA.
    - InPut. — parameters in input scale points
    - diSPL. — parameters in display scale points
  - d.out — Down scale of the analog output
  - F.out — Full scale of the analog output
  - dO.diS — Access to the display corresponding to the output down scale
  - FO.diS — Access to the display corresponding to the output full scale

Digital output

JbuS Access to the RS output programming submenu

SLAvE Slave number

bAud Transmission speed (baud rate)

- 1200 Possible speed
- 19200 Possible speed

Parit Choice of the parity

ForM Transmission rank of the bytes of an integer

dELAY Time lapse before any response

- On 75ms
- OFF 20ms

Relay outputs: x: 1 to 4

rELAY Access to the relay outputs programming submenu

- rEL.x Access to the programming of the relay x

AL.x Activation of the relay output 1

- On Activation
- OFF De-activation

PArA.x

- InPut. Setpoints and hysteresis in input scale points
- diSPL. Setpoints and hysteresis in display scale points

ModE.x Operating mode of the relay x

- __1__ --1__ Mode setpoints
- _1--1_ -1__1- Mode window
- SPx Value of the setpoint in mode setpoint
- SPx.1 Value of the first setpoint in mode window
- SPx.2 Value of the second setpoint in mode window

HYSt.x Value of the hysteresis in display points

tiME.x Time delay on the relay X

t.Actx Positionning of the time delay

- SIMPL. Time delay on switching on alarm
- doubL Time delay on switching on alarm and off alarm

LEdx Programming of the relay associated led

- On Led lit when relay active (coil supplied)
- OFF Led still when relay active (coil supplied)

MEM.x Recording of the alarm X

- YES Recording
- no No recording

MESx Alarm message

- YES Message
- no No message

Safeties

SECU Access to the safeties programming submenu

rUPt Programming of the sensor rupture safety

- CAPt. Disconnection (or not) of the sensor rupture
  - OFF Disconnection active
  - On Disconnection inactive
- rEL.X Status of the relay X in case of sensor rupture
  - OFF No sensor rupture associated with the relay
  - LO Relay de-activated in case of sensor rupture (coil not supplied)
  - HI Relay activated in case of sensor rupture (coil supplied)
- out.U or out.I Return value (or not) of the output in case of sensor rupture
  - YES Return value requested
  - no No return value
- rEPLi Return value

dIAG. Programming of the self-diagnosis safety

- rEL.X Status of the relay X in case of self-diagnosis error
  - OFF No self-diagnosis associated with the relay
  - LO Relay de-activated in case of self-diagnosis error (coil not supplied)
  - HI Relay activated in case of self-diagnosis error (coil supplied)

out.U / out.I (or) Return value (or not) of the output in case of self-diagnosis error

YES Return value required

no No return value

rEPLi Return value

Saving of the configuration

SAvE Saving of the configuration

YES Saving

no No saving

Reading of the instrument internal features

About Access to the submenu reading of the internal features

d40x Type of the instrument: DIP400, DIP 401, DIP 402

n0 A0007 Identification numbers

ProG Programme version

08.00 Programme version number

OPt Option code

Ar---. Value of the option code

Err. Self-diagnosis error

0000 Error type

CSUM Display of the check sum

FC4E Value of the check sum

Other functions

InF Display of the minimum value

SUP Display of the maximum value

CLr.M Deleting of the min. and max.

Error messages

Er.01 Value set out of range

OPEn Sensor rupture

2000 Blinking measure: measure in overrange

OL Displayable value overload

---- Upper or lower electrical overstepping of the input

Er.xx / E.xxx Self-diagnosis error

9. ANNEXE: MODBUS

9.1 Table of the modbus addresses

Word address	Description
0	Sensor primary measure
1	decimal point / unit
2	final measure
3	decimal point / unit
4	final measure min.
5	decimal point / unit
6	final measure max.
7	decimal point / unit
8	value of the analog output n°1
9	decimal point / unit
12	Auto diag 1
13	Auto diag 2
14	Status of the relay 1
15	Status of the relay 2

Measures

The following parameters: sensor primary measure, final measure, min. and max. of the final measure and the values of the analog outputs are transmitted in the form of a module and a unit associated with a position of the decimal point.

Eg.:

Word address	Decimal value	Encoding
0	10 094	module
1	12 289	dec. point / unit

Encoding of the integer decimal point/ unit

H L

BYTE BYTE

dec. point unit: code of correspondance in the list hereunder

0: no decimal	0: none
16: 1 decimal	1: V
32: 2 decimals	2: kV
48: 3 decimals	etc ...

Eg.: 12 289 = 48 X 256 + 1

The integer encodes the unit V with 3 decimals.

The measure read is thus 10.094 V.

Table of the units

Code	Unit
000	
001	V
002	KV
003	A
004	KA
005	W
006	KW
007	MW
008	GW
009	VAr
010	KVAR
011	MVAR
012	GVAR
013	VA
014	KVA
015	MVA
016	GVA
017	Wh
018	KWh
019	MWh
020	GWh
021	VARh
022	KVARh

Code	Unit
023	MVARh
024	GVARh
025	Hz
026	Khz
027	Deg
028	Ohms
029	Kohms
030	h
031	mn
032	s
033	%
034	cos PHI
035	to 099 free

Code	Unit
100	°C
101	°F
102	%
103	mm
104	cm
105	m
106	km
107	mBar
108	Bar
109	Pa
110	Kpa
111	Kg/cm2
112	PSI
113	mCE
114	l/s
115	l/mn
116	l/h
117	m3/s
118	m3/mn
119	m3/h
120	tr/s
121	rad/s

Code	Unit
122	mm/s
123	cm/s
124	m/s
125	m/mn
126	m/h
127	mm3
128	cm3
129	m3
130	g
131	kg
132	t
133	l
134	hl
135	Rpm
136	CP/mn
137	PH
138	mV AC
139	V AC
140	KV AC
141	mA AC
142	A AC
143	KA AC

Code	Unit
144	mV DC
145	V DC
146	KV DC
147	mA DC
148	A DC
149	KA DC
150	Ohms
151	Kohms
152	Mohms
153	US.gal/s
154	US.gal/min
155	US.gal/h
156	US.gal
157	lb
158	C
159	imp
160	CP
161	mA
162	A
163	mA.h
164	A.h
165	µV
166	mV

Self-diagnosis integer n°1: (address 12)

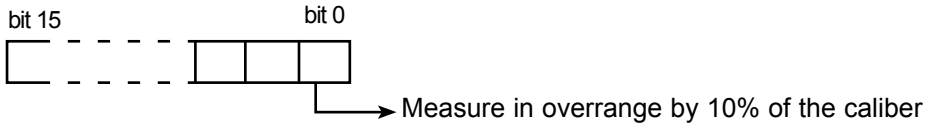
bit

(14)	(13)	(12)			(9)	(8)		(6)	(5)	(4)	(3)	(2)	(1)	(0)

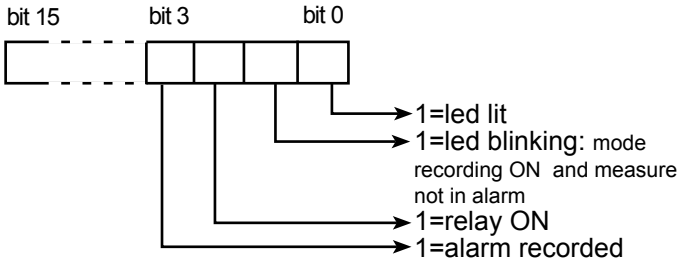
(6) measure in overrange by 10% of the caliber
(8) sensor rupture
(9) measure overload *(eg. a measure of 15 V on a 10 V caliber)*
(12) current output value error
(13) configuration internal error
(14) memory error

(0) programming error
(1) offset error
(2) input calibration error
(3) output calibration error
(4) reference error
(5) CJC error

Self-diagnosis integer n°2: (address 13)



Integer status of the relays 1 and 2: (address 14 and 15)



9.2 Correspondance with the DIP400/DIP402 version 7.0

Address		Format	nbr of words
200	Value of the analog output in µA (mA output) in mV (10V output)	double integer	2
202	Minimum value of the displayed value	double integer	2
204	Maximum value of the displayed value	double integer	2
206	Displayed measure	double integer	2
208	direct measure	double integer	2
290	Status of the relay 1	integer	1
291	Status of the relay 2	integer	1
292	Status of the relay 3	integer	1
293	Status of the relay 4	integer	1

• **Direct measure**:

Valu without scale factor for the inputs 100 mV, 1V, 10V, 300V, 20 mA:
- in mV for the 10V input
- in 1/10th of mV for the 1V input
- in µA for the mA input
- in 1/100th of mV for the mV input
- in 1/100th of V for the 300V input

Value of the resistance in 1/100th Ω for NI100 and Pt100

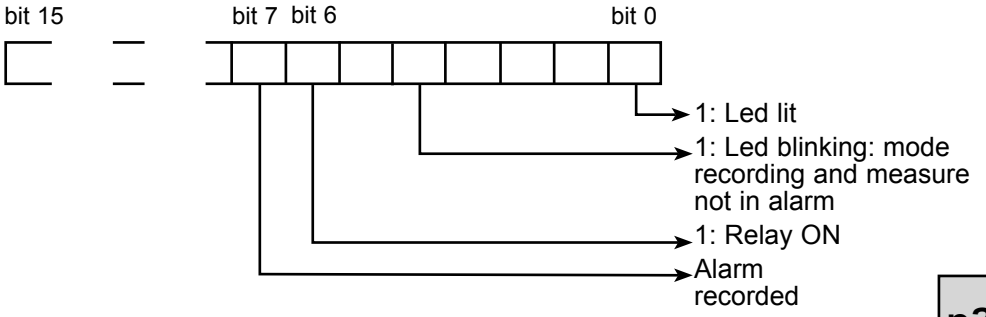
Value of the hot sensor temperature in 1/10th of degree for ΔPt100

Value of the resistance
- in 1/100th Ω for the resistance input 0-400Ω
- in 1/10th Ω for the resistance input 0-2000Ω
- in Ω for the resistance input 0-8000Ω

Value in µV for the thermocouple input

Value in 1/100th of % for the potentiometer input

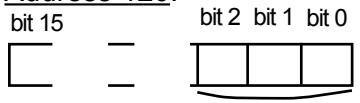
• **Status of the relays**:



• **Displayed measure**:

The value of the displayed measure is taken up without the decimal point.
To read the value of the decimal point, read the word at the address 120.

Address 120:



Position of the decimal point from 1 to 4 (version 10000 points)
from 0 to 4 (version 100000 points)

0: Display with 4 decimals (version 100000 points)
1: Display with 3 decimals
2: Display with 2 decimals
3: Display with 1 decimal
4: Display with 0 decimals

9.3 Description of the born modbus functions:

Reading of N words: Function n°3

Request sequence:

Slave number	Function 3 or 4	1st word address		Number of words		CRC 16
		MSB	LSB	MSB	LSB	
1 byte	1 byte	← 2 bytes		→ 2 bytes		→ 2 bytes

Response sequence:

Slave number	Function 3 or 4	Number of read bytes	1st word value		2nd word value		CRC 16
			MSB	LSB	MSB	LSB	
1 byte	1 byte	1 byte ←	2 bytes		→ 2 bytes		→ 2 bytes

Writing of N words: Function N°16:

Request sequence:

Slave number	Function 16	1st word address	Number of words to be enf.	Number of bytes to be enf.	Value of the words to be enforced	CRC 16
1 byte	1 byte	2 bytes	2 bytes	1 byte	← n bytes →	2 bytes

Response sequence:

Slave number	Function 16	1st word address	Number of words to be enf.	CRC 16
1 byte	1 byte	1 byte	2 bytes	2 bytes

Writing of 1 word: Function N°6:

Request sequence:

Slave number	Function 6	Adress of the word	Value of the word to be enf.	CRC 16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response sequence:

Slave number	Function 6	Address of the word	Value of the word to be enf.	CRC 16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Exception sequence:

Slave number	Function request-ed with MSB=1	Error code	CRC 16
1 byte	1 byte	1 byte	2 bytes

Value of the error codes:
1: Unknown function code
2: Address incorrect
3: Data incorrect
9: Writing impossible

9.4 Reading:

Example: Reading of the displayed measure

Request:

254	03	0	206	0	2	CRC 16
Slave number	Reading of n words	Address		Number of words		

• *Response with a positive measure*:

		← measure →				
254	3	4	19	136	0	0	CRC 16
			byte 1	byte 2	byte 3	byte 4	2 bytes

Value of the measure:

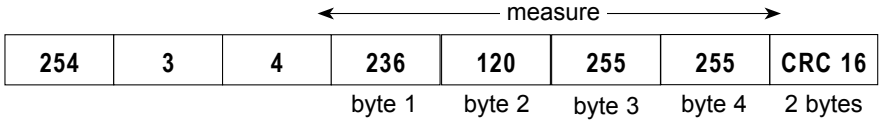
byte 3	byte 4	byte 1	byte 2
00000000	00000000	00010011	10001000
0	0	19	136

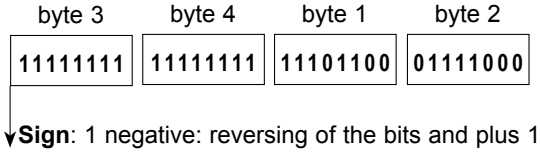
Sign: 0 positive
1 negative

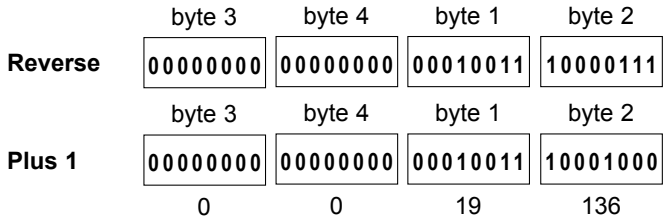
Measure = byte 3 x 256^3 + byte 4 x 256^2 + byte 1 x 256 + byte 2
= 0 x 256^3 + 0 x 256^2 + 19 x 256 + 136
= 5000

Reading of the address 120 => decimal point = 2 => displayed measure: 50.00

• *Response with a negative measure*:



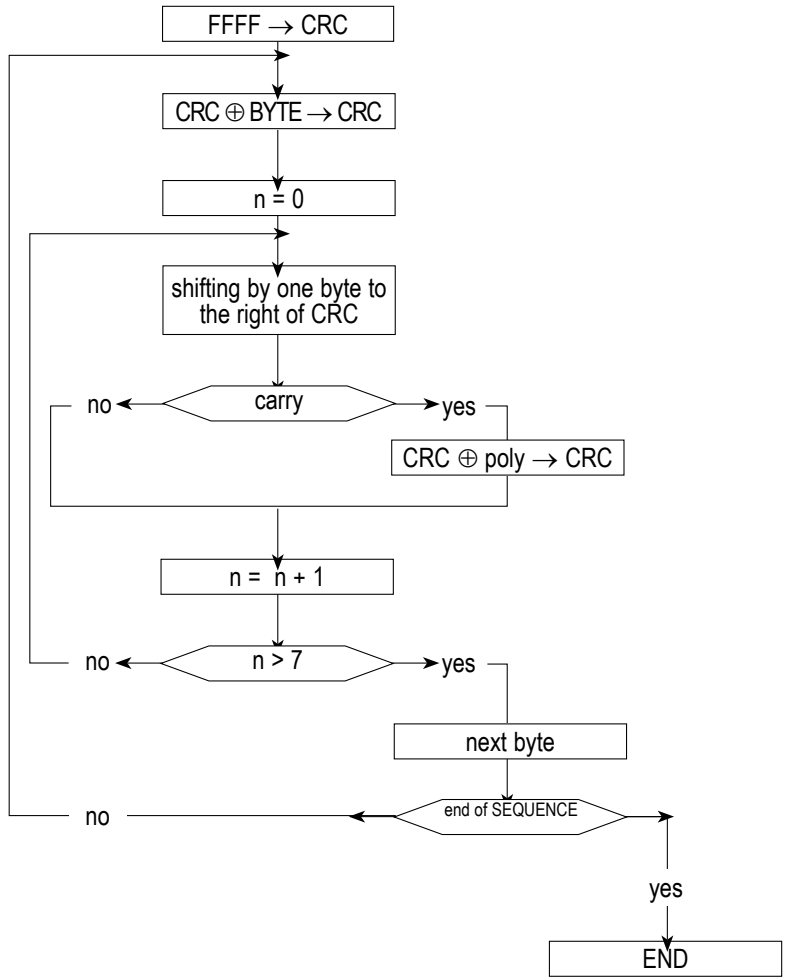




Measure = -(byte 3 x 256^3 + byte 4 x 256^2 + byte 1 x 256 + byte 2)
= -(0 x 256^3 + 0 x 256^2 + 19 x 256 + 136)
= -5000

Reading of the address 120 => decimal point = 2
=> displayed measure: -50.00

9.5 CRC 16 calculation algorythm:



Note 1: ⊕ = exclusive or.

Note 2: POLY = A001 (hex).

Note 3:
The CRC16 calculation applies to all bytes in the sequence (except CRC16).

Note 4:
Caution! In the case of CRC 16, the 1st sent byte is the LSB.

Example: Sequence = 1-3-0-75-0-2 CRC16 = 180-29 (the values are decimal).