USER MANUAL

MESURE
CONTROLE
COMMANDE

LIEDER “S”, “M”, “L”
Digital Controllers

48 x 48

48 x 96

96 x 96

Ref.: NE-201A-09-07

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User manual

1. GENERAL PRESENTATION

- ***2 input signals, 1 logic input***
- ***2 setpoints***
- ***Setpoint profiles generator***
- ***ON/OFF, PID, Heat-Cool, Auto-tune algorithms***
- ***Triple galvanic insulation***
- ***2 analog outputs, motorvalve drive***
- ***Configuration on front panel through a PC software or through infrared transfer***
- ***Digital communication, RTU Modbus***

GENERAL OVERVIEW

The LIEDER controllers belong to the second generation of the MCC single loop digital controllers. This range of controllers enjoys more than twelve years' experience in the industrial process control.

Two input signals, one logic input, one linearization on 20 segments and a 12-sequence profile generator are standard features as well as three different algorithms for the motorvalve control.

As a major asset, the LIEDER series is easy to implement with its two different configuration tools: one Windows software and one IRDA remote control that allows a bi-directional transfer of the controller's main data and program.

INPUTS / OUTPUTS RESOURCES

The main input admits all the standard process signals as well as frequency inputs. The second input can be dedicated to the remote setpoint or to the motorvalve position retransmission and as such, and accepts the temperature signals as well as potentiometer and voltage ones. The logic input, dry contact, NAMUR direct or voltage allows the setpoint commutation, the output driving or maintaining, the launching of a setpoint profile. In the four option slots some relay, retransmission, auxiliary power supply or digital RS communication boards can be installed.

VARIOUS PROCESSINGS

In the three different formats 1/16, 1/8 and 1/4 DIN, the following processing functions are integrated:

- Linearization on 20 segments that can be allocated to the input signal 1 or 2.
- A 12-sequence program generator (ramps + soaks).
- Heat / Cool and motorvalve algorithms.
- PID actions auto-tune according to the ZIEGLER-NICHOLS method.
- Four software alarms.

AN ERGONOMIC FRONT PANEL

The main display is dedicated to the input whereas the lower display enables to scroll the setpoint, the control output or the PID parameters.
The 5 LED indicate the operating mode (manual or automatic), the status of the local or remote setpoint, and of the alarms.
The whole configuration of the controller as well as its manual control can be performed with the four keys.
A window located on the front panel is kept for the infrared receiver for the bi-directional transfer of the configurations.

A SIMPLIFIED IMPLEMENTATION

The configuration of the LIEDER controllers is performed on the front panel or through the PC with the « OPUS » windows software.
Furthermore, MCC is the first manufacturer who offers the infrared transmission of the configuration for a panel-mounted controller.
A portable terminal (remote control) loads or transfers the whole configuration of the LIEDER controllers through infrared. The main parameters of the controllers can be conveyed through this medium. This is a relevant function for large quantities business and for OEM applications as the configuration can be instantaneously duplicated without any additional wiring.

2. TECHNICAL FEATURES

2.1. General features

2.1.1. LIEDER S

Mechanical	Weight	170g without options n°3 and n°4 ; 200g with options n°3 and n°4
	Case dimensions	Width : 48 mm ; Height : 48 mm Total depth : 113 mm (132 mm with options n°3 or n°4) Depth behind the collar : 101 mm (120 mm with options n°3 or n°4)
	Panel cut-out	45 x 45 mm (±0,6 mm)
	Casing	NORYL UL 94 V-0 auto-extinguishable
	Color	Black
	Fixing	With plastic-made fixing parts
	Protection	IP54 on front panel, IP20 on rear panel
	Electrical connections	Screw terminals 2 x 1.5mm²
Cycle time		200 ms
Power supply	Standard	85 to 265 V ac/dc
	Low voltage Option	18 to 54 V ac/dc
	Consumption	6VA
Display	4 red displays 10mm with 7-segment LED to display the process variable	
	4 green displays 8mm with 7-segment LED to display the setpoint, the control parameters…	
	5 lights to indicate the digital communication working, the alarms or control output, the setpoint evolution and the manual mode.	

2.1.2. LIEDER M

Mechanical	Weight	230g without option; 275g with options 1,3 and 4.
	Case dimensions	Width : 48 mm ; Height : 96 mm Total depth : 132 mm Depth behind the collar : 120 mm
	Panel cut-out	45 (+0.6) x 92 (+0.8) mm
	Casing	NORYL UL 94 V-0 auto-extinguishable
	Color	Black
	Fixing	With plastic-made fixing parts
	Protection	IP65 on front panel, IP20 on rear panel
	Electrical connections	Screw terminals 2 x 1.5mm²
Cycle time		200 ms
Power supply	Standard	85 to 265 V ac/dc
	Low voltage Option	18 to 54 V ac/dc
	Consumption	6VA
Display	4 red displays 10mm with 7-segment LED to display the process variable	
	4 green displays 8mm with 7-segment LED to display the setpoint, the control parameters…	
	5 lights to indicate the digital communication working, the alarms or control output, the setpoint evolution and the manual mode.	

2.1.3. LIEDER L

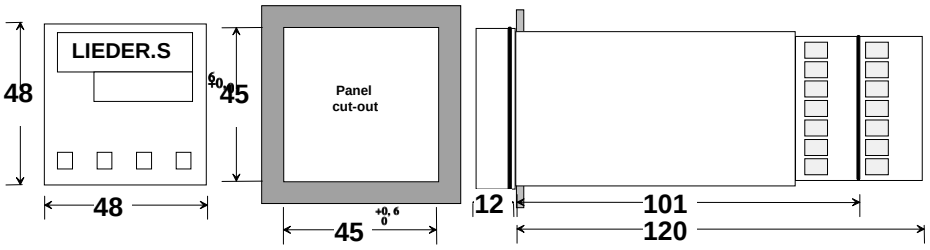
Mechanical	Weight	330g without option; 375g with options 1, 3 and 4.
	Case dimensions	Width : 96 mm ; Height : 96 mm Total depth : 141 mm Depth behind the collar : 120 mm
	Panel cut-out	92 x 92 (+0.8) mm
	Casing	NORYL, 10% Glass
	Color	Black
	Fixing	With plastic-made fixing parts
	Protection	IP65 on front panel, IP20 on rear panel
	Electrical connections	Screw terminals 2 x 1.5mm²
Cycle time		200 ms
Power supply	Standard	85 to 265 V ac/dc
	Low voltage Option	18 to 54 V ac/dc
	Consumption	6VA
Display	4 red displays 14mm with 7-segment LED to display the process variable	
	4 green displays 10mm with 7-segment LED to display the setpoint, the control parameters…	
	5 lights to indicate the digital communication working, the alarms or control output, the setpoint evolution and the manual mode.	

2.2. Standards

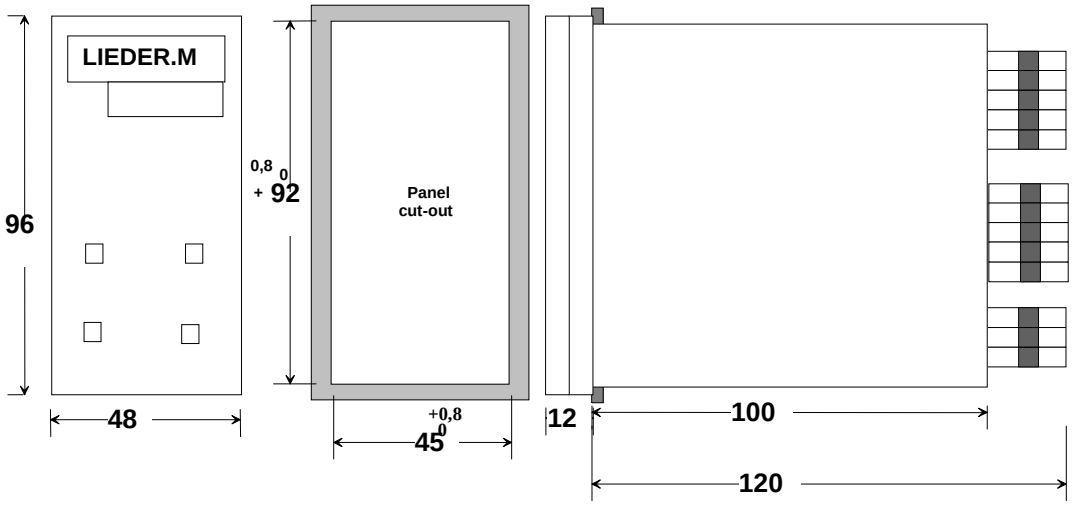
Type	Reference	Mentions	Limitations
Low voltage security	EN61010-1	Installation class	**CAT III**/265Vrms*
		Pollution degree	**2**
CEM immunity	EN50081-1	Emission	
	EN50082-2	Immunity	
Input	CEI584	Thermocouples	
	CEI751	RTD	
Sturdiness	EN60068-2-32	Fall	1 m
Protection	CEI529	On the front panel	See § 2.1
		On the rear panel	See § 2.1
Climatic conditions	10-90 % HR without condensation	Working	0 to +50°C
		Storage	- 20 to + 70°C

2.3. Panel cut-out

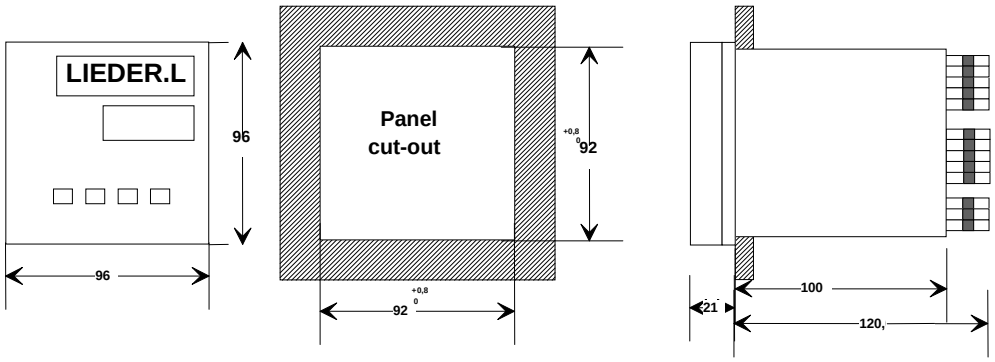
2.3.1. LIEDER S



2.3.2. LIEDER M



2.3.3. LIEDER L



* An operating voltage of 265 Vrms = a test voltage of 1350KV effective at 50-60Hz during 1 minute.

2.4. Inputs

2.4.1. Thermocouple input

Type	Range
Thermocouple K	-270 to 1372°C
Thermocouple J	-210 to 1200°C
Thermocouple T	-270 to 360°C
Thermocouple S	-50 to 1767°C
Thermocouple R	-50 to 1767°C
Thermocouple N	-270 to 1300°C
Thermocouple B	0 to 1820°C
Thermocouple E	-270 to 1000°C
Thermocouple W5	0 to 2300°C
Special couples	22/50/90mV

Characteristics	
Error due to the line resistance	0.1µV/Ω
Maximum line resistance	100Ω
Cold junction correction error	0.6°C +0.06°C/°C
Accuracy	0.1% range
Resolution	0.01% range
Temperature drift	60ppm/°C

2.4.2. Resistance input, 3-wire mode measurement

Type	Range
Three-wire Resistance	0 to 500Ω
RTD 100 ohms	-200 to 650°C

Characteristics	
Maximum line resistance	100 Ω
Error due to the line resistance	0.001 Ω/Ω
Accuracy	0.1% range
Resolution	0.01% range
Temperature drift	60 ppm/°C
Polarization current	200 µA

2.4.3. Potentiometer input

Range	0-100Ω ; 0-500Ω ; 0-100kΩ
Accuracy	0,1% range
Resolution	0,01% range
Temperature drift	60ppm/°C
Polarization current	200µA

2.4.4. Continuous voltage input

Range	±22mV ; ±50mV ; ±90mV ; ±900mV ; ±2.25V
Input impedance	5MΩ
Continuous over-voltage	35V (If U >2,5V activated protections, leads to a false measure)
Maximum temporary over-voltage (1s)	60V
Accuracy	0,1% range
Resolution	0,01%range
Temperature drift	60ppm/°C

2.4.5. Continuous current input

Range	0 to 20mA
Input impedance	≈80Ω
Continuous over-current	40mA
Accuracy	0,1% range
Resolution	0,01% range
Temperature drift	80ppm/°C

2.4.6. Digital and Frequency input

This input is at the same potential than the analog input signals.
The input types dry contact, NAMUR and voltage lower than 30Vdc are possible.

Input impedance	10MΩ
Logic level **1**	Open contact, NAMUR sensor with metal part or U > 2,6Vdc
Logic level **0**	Closed contact, NAMUR sensor without metal part or U < 2,4Vdc
Constant maximum voltage	U max. < 30Vdc
Maximum over-voltage (1s)	U max. < 80Vdc
Periodmeter	0,002 to 1000s (resolution 1,2uS)
Frequencymeter	Maximum frequency = 10Khz

Note : For the period or frequency measurement, the transition fronts slopes must be higher than 30V / ms.

2.5. Outputs

2.5.1. Optional auxiliary power supply output

Output voltage	22V to 28V
Maximum output current allowed	< 30mA
Protection	By a poly-switch fuse 200mA
Constant insulation voltage	U < 265Vrms (not insulated from the other input signals)

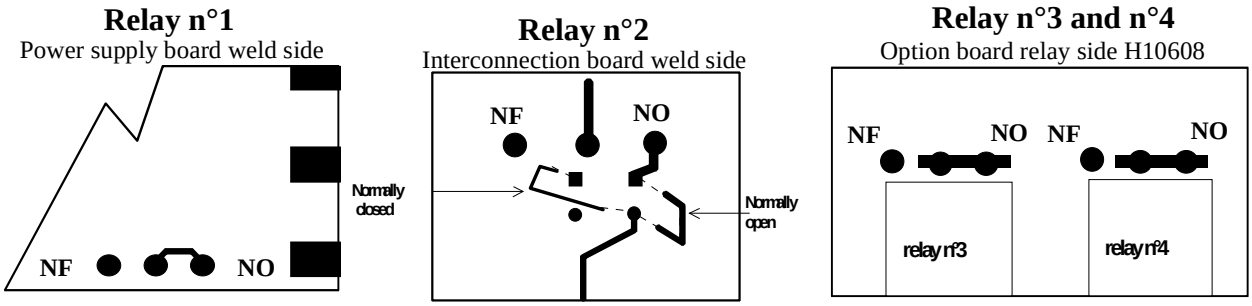
Note: This output option can be added to the relay n°2 option on the **LIEDER M &L** only.

2.5.2. Standard relay output n°1 and optional relay outputs n°2, 3 and 4

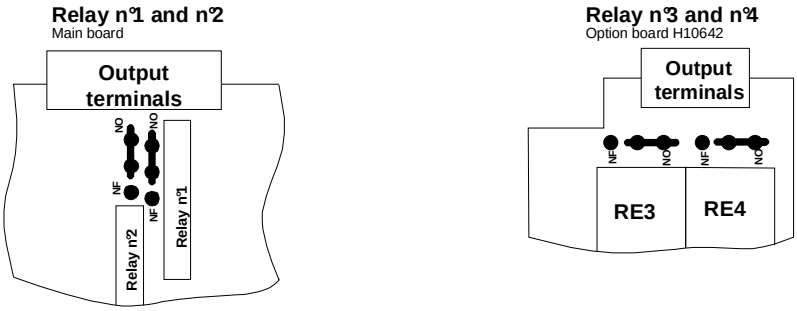
Contact type	NO/NF Selection through internal strap or jumper (see diagrams below). NO : Normally open / NF : Normally closed
Power cut-off	2A 250Vac or 30Vdc
Mechanical operations number	500 000

Note: The relays n°1 and 2 have one common point like the relays n°3 and 4.
In our factory, the relays are wired on the NO option.

2.5.2.1. Relays location in LIEDER S



2.5.2.2. Relays location in LIEDER M & L



2.5.3. Optional digital communication output (Enables the communication with a computer (master))

Type	RS485	RS 232
Continuous insulation voltage	U < 265Vrms	
Type	Multi-points	Single point
Wiring	1 pair	
Maximum distance	1000 meters	30 meters
Baud rate	1200 to 38400 bauds	
Protocol	Modbus / Jbus RTU **slave**	

2.5.3.1 Location in LIEDER S

On LIEDER S, you have to send us back the controller if you want to change from a RS 232 to RS485 communication.

2.5.3.2 Location in LIEDER M & L

2.5.4. Optional current or voltage outputs n°1 and n°2

Current output:

Output current	0-20mA
Maximum load	750Ω
Accuracy	0,1%
Resolution	0,03%
Temperature drift	80ppm/°C
Maximum output current allowed	< 22mA
Constant insulation voltage	U < 265Vrms

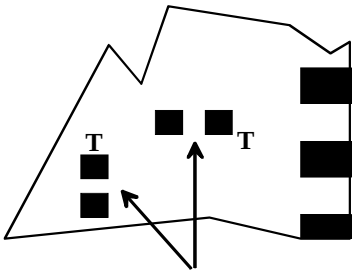
Voltage output:

Output voltage	0-10V or 0-5V (possible for output n°2 only)
Accuracy	0,1%
Resolution	0,025%
Temperature drift	80ppm/°C
Maximum output current allowed	< 20mA
Protection	By a poly-switch fuse 200mA
Constant insulation voltage	U < 265Vrms

The 0-20mA, 0-10V or 0-5V selection is done with the straps as shown in the diagram below.
Caution: The change of the output type requires a re-calibration of the output (see §9).

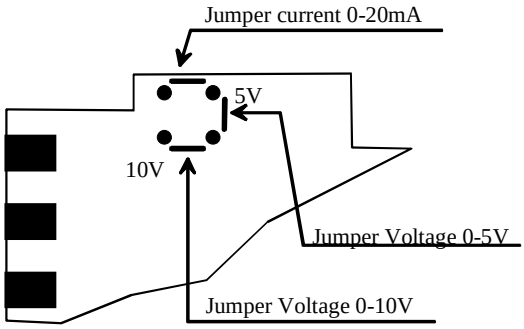
2.5.4.1. Straps location in LIEDER S

Output n°1 Power supply board welds side



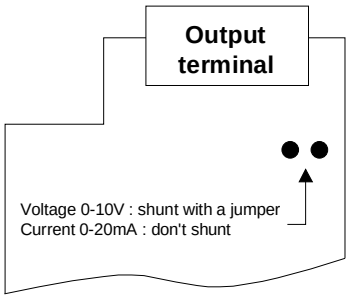
Voltage 0-10V : 2 straps 'T' set
Current 0-20mA : 2 straps 'T' removed

Output n°2 Option board H10609 & H10611

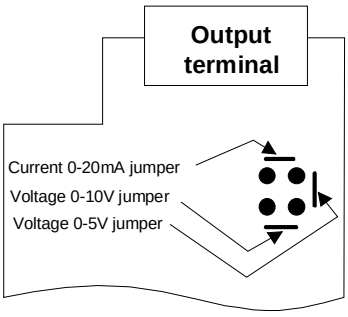


2.5.4.2. Straps location in LIEDER M & L

Output n°1
Option board H10643

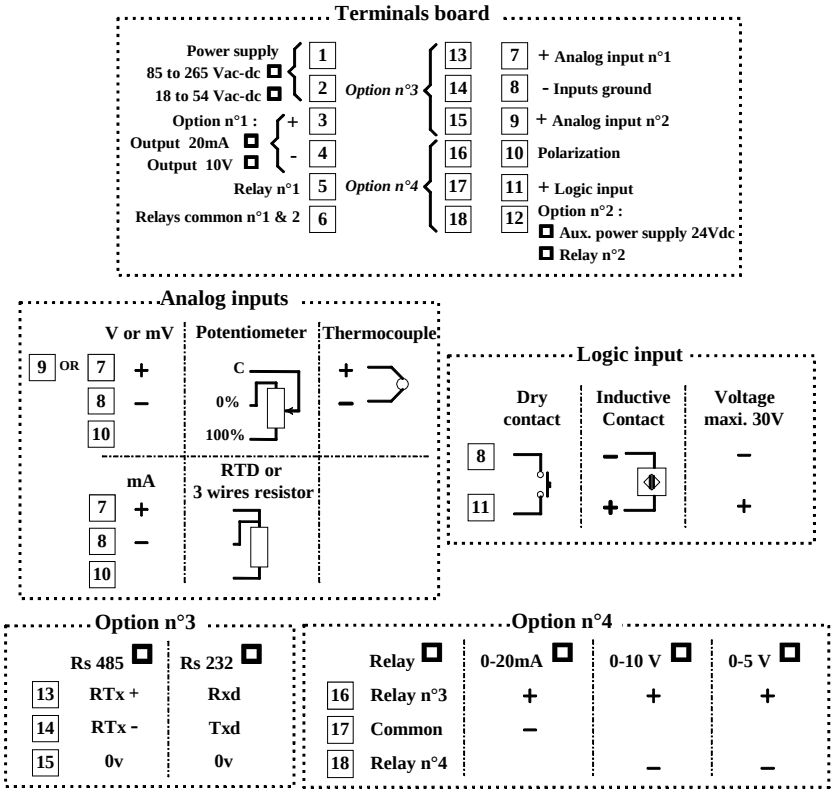


Output n°2
Option board H10644

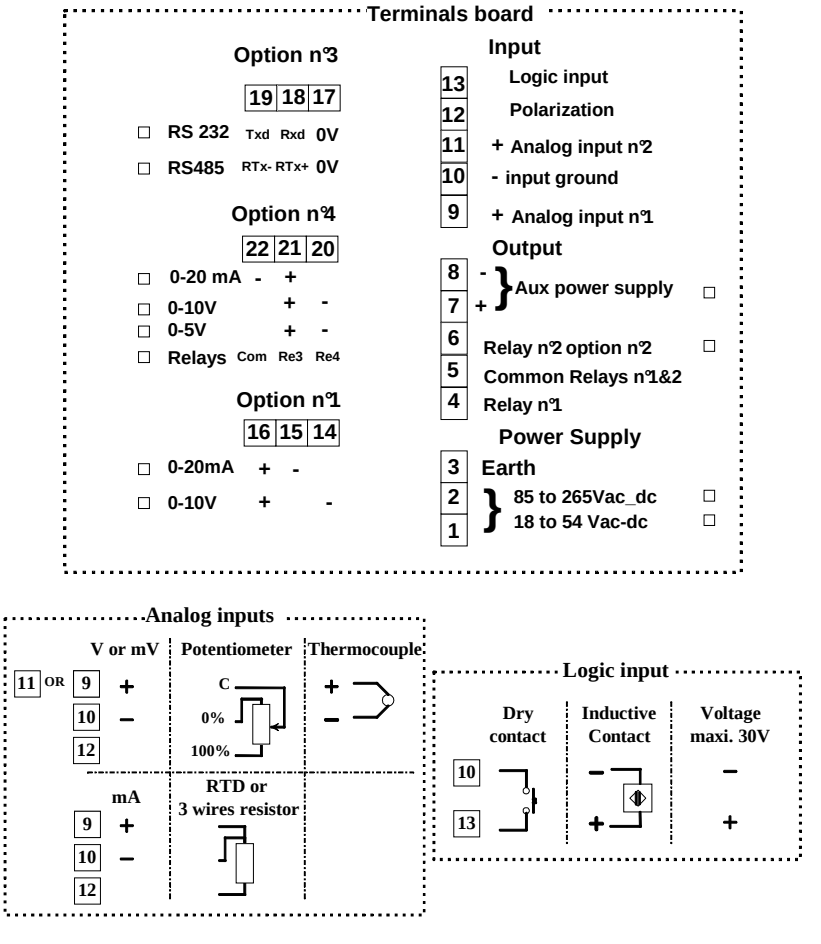


2.6. Connections

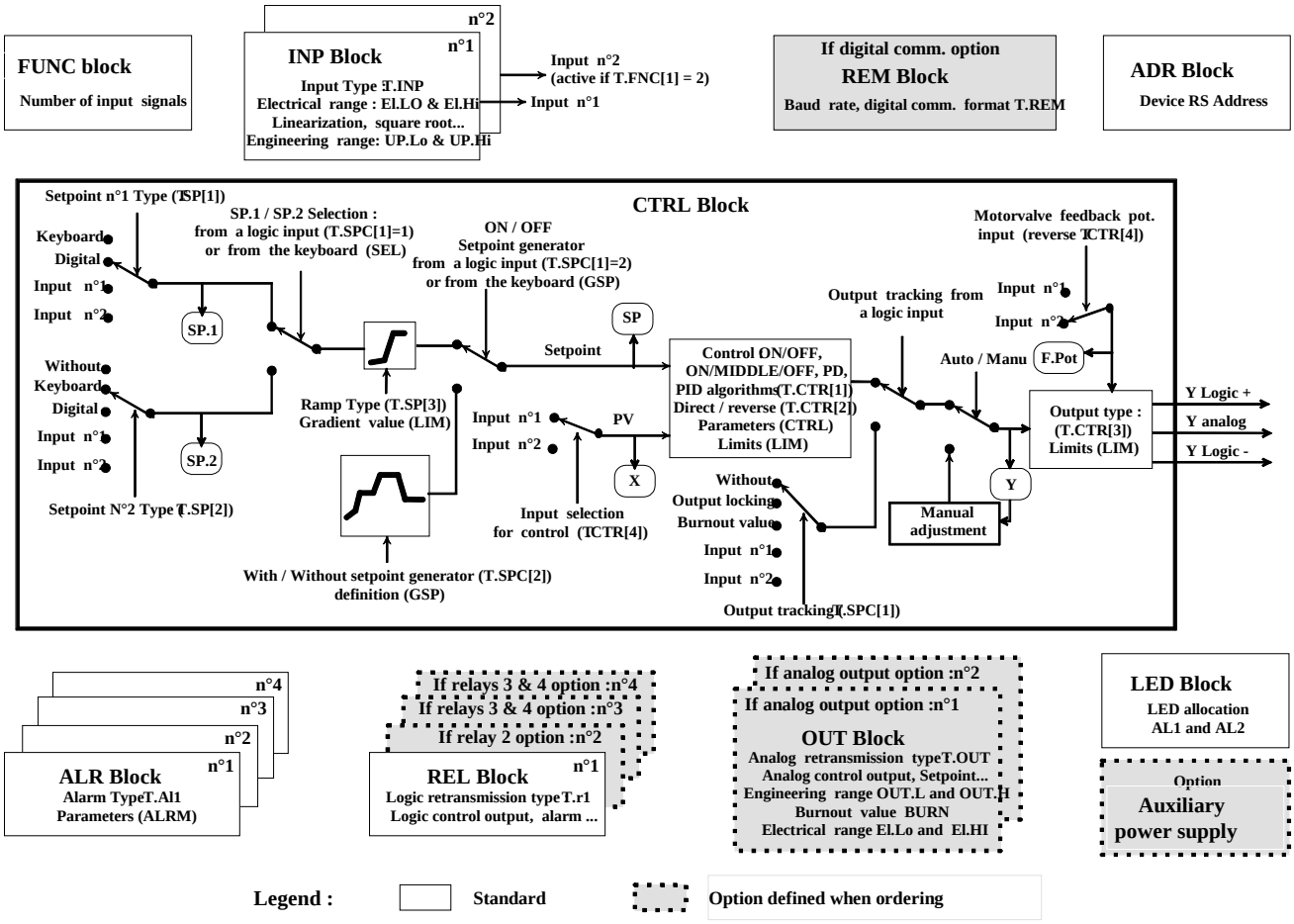
2.6.1. LIEDER S



2.6.2. LIEDER M & L



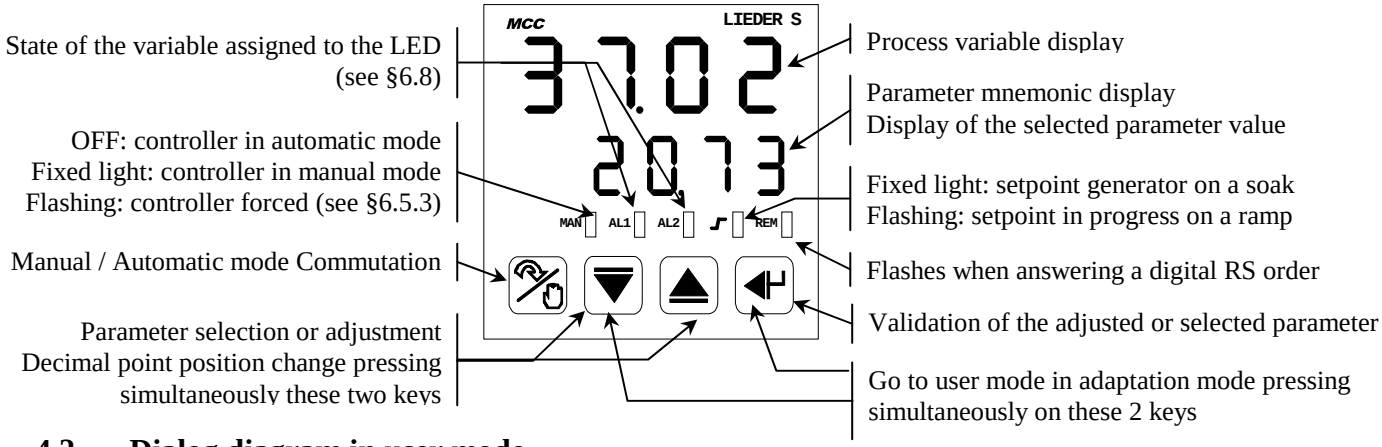
3. DEVICE INTERNAL BLOCK DIAGRAM



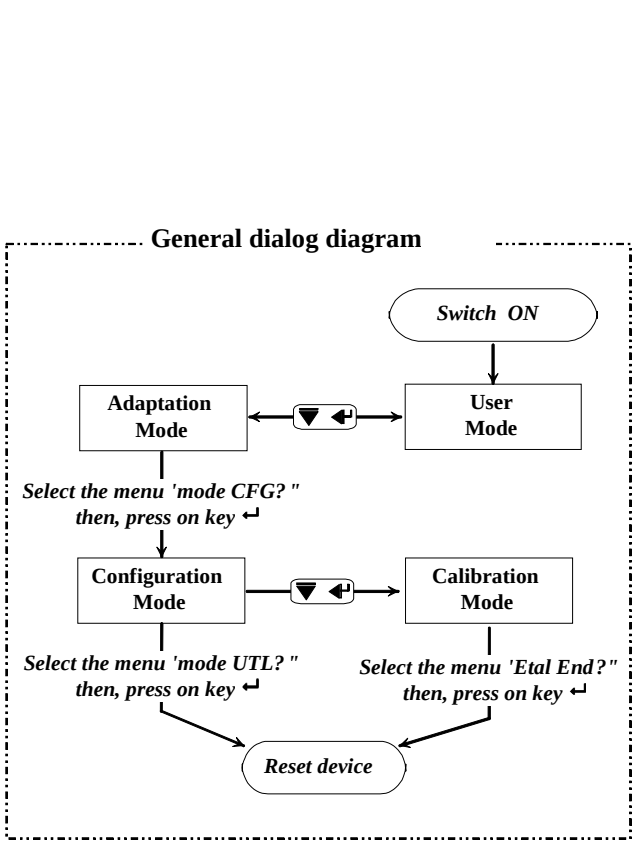
4. USER MODE

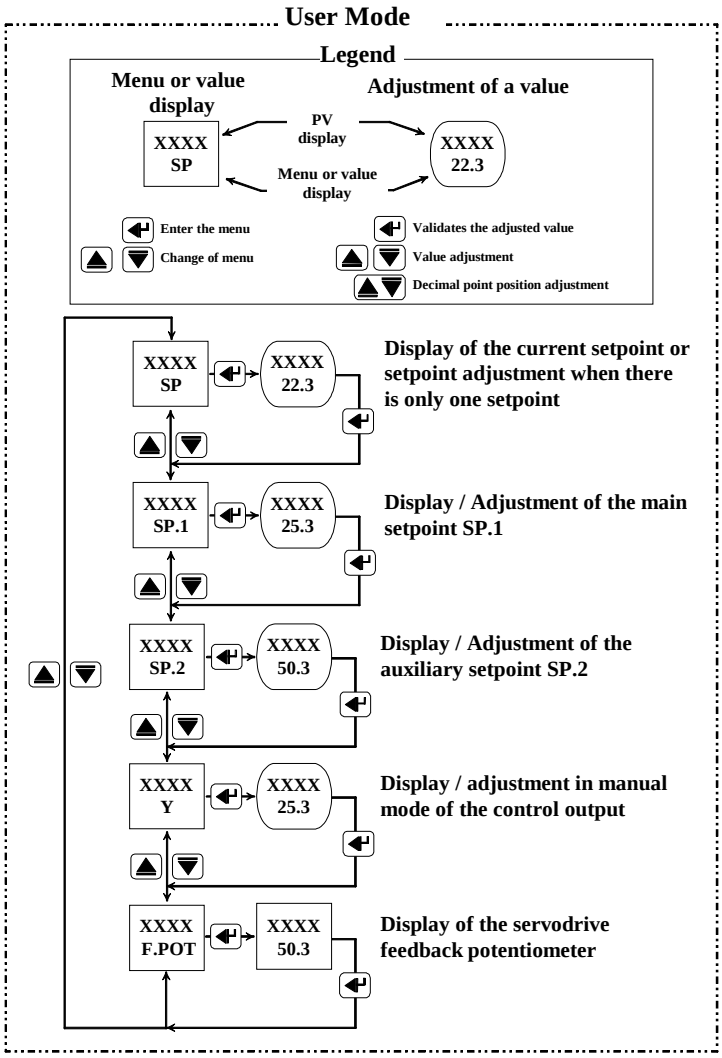
The User mode is the standard working mode of the controller. The loop measure is constantly displayed on the red display. The green display enables you to select the various parameters of the loop: Current setpoint **SP**, main setpoint **SP1**, second setpoint **SP2** (if it has been configured), control output **Y** and the valve feedback potentiometer value **F.POT** (if servodrive with feedback potentiometer algorithm).

4.1. Display and keys definition



4.2. Dialog diagram in user mode

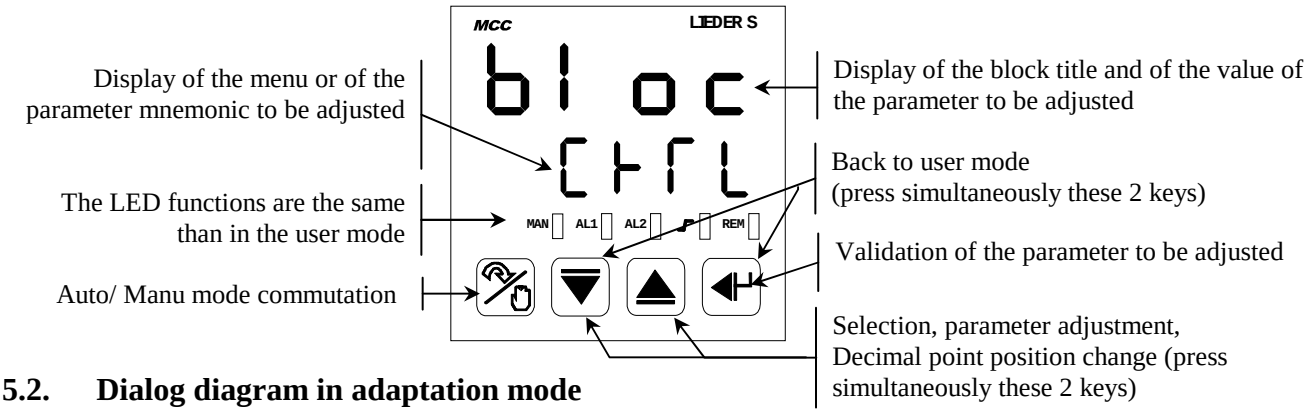




5. ADAPTATION

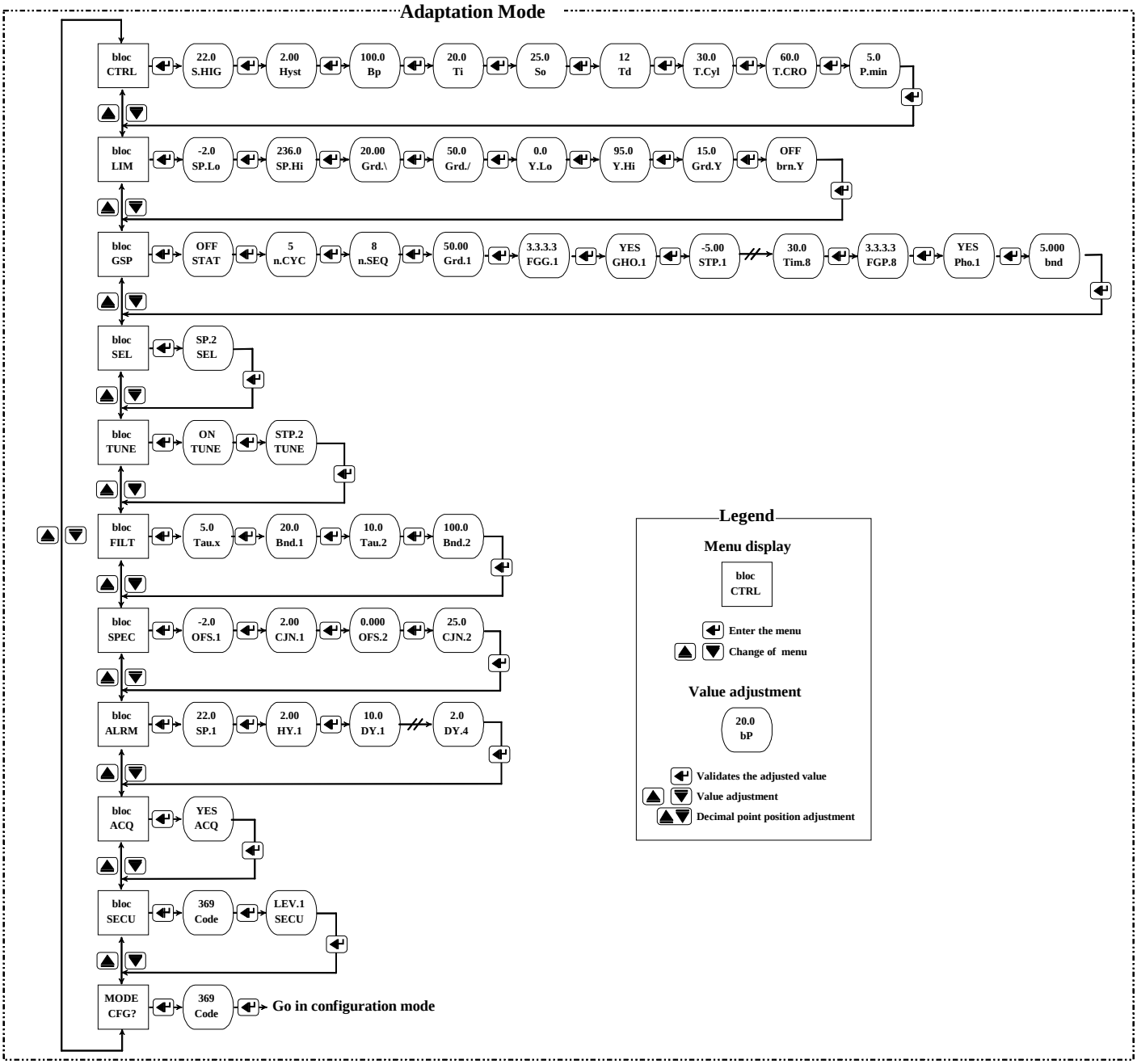
The adaptation mode enables you to adjust various parameters such as PID values, process variable filter etc.…while the controller is functioning.

5.1. Keys and display description



5.2. Dialog diagram in adaptation mode

Access to the Adaptation mode: from the user mode, press simultaneously the keys "▼" and "↵".
To go back to the user mode, proceed the same way or you automatically go back to the user mode if no key is pressed during 30 seconds approximately.



5.3. Control Block *CTRL*

Parameter	*Control*	*Definition*	*Limits*
S.HIG	ON, MIDDLE or OFF	Value of the ON threshold in engineering unit compared to the deviation on the setpoint in progress.	Process variable Min. to Max
Hyst	ON / OFF ON, MIDDLE or OFF	Control hysteresis	0 to 20 % of the measurement range
	Servodrive with feedback potentiometer	Servodrive hysteresis	0 to 20 % of the output
Bp	PD or PID	Proportional band	0,2 to 999,9 %
Ti	PID	Integral time	0,02 to 99,99 min
So	PD except Servodrive without feedback potentiometer	Band centering	0 to 100% of the output
Td	PD or PID	Derivative time, derived action inactive if Td=0	0 to 2000 sec
T.CYC	Discontinuous	Cycle time or valve modulation time	1 to 2000 sec
T.CRO	Servodrive without feedback potentiometer	Valve crossing time	1 to 2000 sec
P.min	Servodrive without feedback potentiometer	Minimum shifting time of the valve (minimum pulse time)	0,1 to 20 sec
band	With cool output	Dead band or overlap band	±100% of the output
S.Col	With ON/OFF cool output	Cool output triggering threshold	0 to 100% of the output
H.Col	With ON/OFF cool output	Cool output triggering hysteresis	0 to 20% of the output
G.Col	With discontinuous cool output	Cool output gain	0 to 10
C.Col	With discontinuous cool output	Cool output cycle time	1 to 2000 sec

5.4. Limits Block *LIM.*

Parameter	*Control*	*Definition*	*Limits*
SP.Lo	All	Low setpoint limit	Process variable Min. to Max.
SP.Hi	All	High setpoint limit	SP.Lo to Process variable Max.
Grd.	All if the setpoint is configured with a gradient (see § 5.5)	Setpoint downward gradient*, in engineering unit per minute	0.001 to 1000 Eu/min
Grd./	All if the setpoint is configured with a gradient (see § 5.5)	Setpoint upward gradient*, in engineering unit per minute	0,001 to 1000 Eu/min
Y.Lo	PD or PID different from servodrive without feedback potentiometer	Control output low limit	0 to 100% of the output
Y.Hi	PD or PID different from servodrive without feedback potentiometer	Control output high limit	Y.Lo at 100% of the output
Soft	PD or PID different from servodrive without feedback potentiometer	Gradient on the control output, in % per minute, Active only when starting. Inactive if higher than 9990 or when the controller is forced or when it is in manual mode.	0,01 to 9999 %/min
Grd.Y	PD or PID different from servodrive without feedback potentiometer	Gradient on the control output, in % per minute, inactive if higher than 9990 or when the controller is forced or when it is in manual mode.	0,01 to 9999 %/min
brn.Y	ON / OFF	Value or state of the output in case of a sensor failure	OFF / ON
	ON, MIDDLE, OFF		OFF / Mid / HIGH
	PD or PID different from servodrive without feedback potentiometer		0 to 100% of the output
	Servodrive without feedback potentiometer		OFF Closing ---- Remains like before ON Opening

* Warning : The gradient value must always be higher than the highest absolute value targeted, divided by 20000.
For example, if the highest value possible is 2500°C, the gradient must be higher than 2500/20000 = 0,125 Eu/min

5.5. Definition of the setpoint generator Block *GSP*

The parameters can be modified only if the generator is stopped.

Parameter	*Definition*	*Limits*
STAT	Start* or stop of the generator, except if it is launched by a logic input (See §6.5.3)	ON / OFF
n.CYC	Number of generator cycles. 0 to reloop infinitely.	0 to 255
n.SEQ	Number of sequences (Gradient + soak) of the generator.	1 to 12
Grd.x	Gradient value n°x† in Engineering unit per minute. Inactive if higher than 990.	0,1 to 999,0 Eu/min
FGG.x	Adjustment of the setpoint generator flags code on the gradient n°x.	

Digit n°1	Digit n°2	Digit n°3	Digit n°4
0.➔ Without	**0.➔** Without	**0.➔** Without	**0.➔** Without
1.➔ Flag n°1	**1.➔** Flag n°3	**1.➔** Flag n°5	**1.➔** Flag n°7
2.➔ Flag n°2	**2.➔** Flag n°4	**2.➔** Flag n°6	**2.➔** Flag n°8
3.➔ Flag n°1 & 2	**3.➔** Flag n°3 & 4	**3.➔** Flag n°5 & 6	**3.➔** Flag n°7 & 8

GHo.x	Gradient n°x fixed or not if the deviation is higher than the value **bnd** ‡	YES / NO
STP.x	Soak value n°x in Engineering unit (Eu)	-999 to 9999 Eu
Tim.x	Soak value n°x in minutes	0,1 to 999,0 min
FGP.x	Adjustment of the setpoint generator flags code on the soak n°x.	

Digit n°1	Digit n°2	Digit n°3	Digit n°4
0.➔ Without	**0.➔** Without	**0.➔** Without	**0.➔** Without
1.➔ Flag n°1	**1.➔** Flag n°3	**1.➔** Flag n°5	**1.➔** Flag n°7
2.➔ Flag n°2	**2.➔** Flag n°4	**2.➔** Flag n°6	**2.➔** Flag n°8
3.➔ Flag n°1 & 2	**3.➔** Flag n°3 & 4	**3.➔** Flag n°5 & 6	**3.➔** Flag n°7 & 8

PHo.x	Soak n°x fixed or not if the deviation is higher than the value **bnd** ‡	YES / NO
bnd	Absolute value, in Engineering unit (Eu), of the tolerated range when a gradient or a soak is defined as fixed on the deviation	0,001 to 9999 Eu

5.6. Setpoint selection Block *SEL.*

Parameter	*Definition*	*Limits*
SEL.	Selects the control setpoint (except when two setpoints are configured as selected by a logic input (See §6.5.3).	SP.1 / SP.2

5.7. PID actions autotune Block (ZIEGLER-NICHOLS method) *TUNE*

This block appears when the controller is in automatic mode and when the deviation between the process variable and the setpoint is higher than 10%.

Parameter	*Definition*	*Limits*
TUNE	Start of the autotune. To stop it, press on the auto-manu key.	STOP / RUN
TUNE	Display of the stage in progress.	STP.0 to 4

Warning :

- This procedure forces the controller output at 100% and 0% during a while. Check that the process accepts it.
- The risk of setpoint overshooting is possible for the processes with a large proportional band.

Autotune operating procedure:

- Set the controller in manual mode.
- Stabilize the controller at a process variable lower than at least 20% of the usual working process variable.
- Set the setpoint to the process variable value so as to have no deviation (process variable = setpoint).
- Set the controller in automatic mode.
- Increase the setpoint by 10% at least.
- Go quickly to the TUNE menu in the adaptation mode and start the autotune.
- When the autotune is finished, the auto-manu LED stops flashing and the controller goes back in automatic mode.

---

* When the setpoint generator is launched, if the first gradient is free from the deviation, the setpoint starts with the setpoint in progress value. If the first gradient is not free from the deviation, the setpoint starts with the process variable value.

† Warning : The gradient value must always be higher than the biggest absolute value targeted, divided by 20 000.
For example, if the biggest value possible is 2500°C, the gradient must be higher than 2500/20 000 = 0.125 Eu/mn

‡ When a soak or a gradient is not free from the deviation, the generator is waiting that the deviation enters in the defined range so as to go on.

5.8. Filter Block *FILT*

Parameter	*Definition*	*Limits*
Tau.x	Coefficient of the first order type filter of channel n°x.	0 to 60 sec
Bnd.x	Value of the channel n°x band (close to the present process variable) in which the filter is active. Any process variable variation higher than this band value is not filtered. The filter power is nominal (tau declared) close to the point, it decreases linearly and then it is canceled on the band limit.	0 to 100 %

5.9. Special Block *SPEC*

Parameter	*Definition*	*Limits*
OFS.x	Correction value of channel n°x in engineering unit. This value is reset at zero if you change the process variable type in the configuration.	-999 to 9999
CJC.x	Cold junction temperature value of channel n°x in °C or °F for thermocouples.	-999 to 9999

5.10. Alarms Block *ALRM*

Parameter	*Definition*	*Limits*
SP.x	Alarm x threshold value.	-999 to 9999
HY.x	Alarm x hysteresis value.	0 to 9999
DY.x	Alarm x temporization value. Considered as infinite if >= 9990 sec	0 to 9999 sec

5.11. Alarms acknowledgement Block *ACQ*

Parameter	*Definition*	*Limits*
ACQ.	Alarms acknowledgement with the arrow keys : **NO :** no alarms acknowledgement **YES :** Acknowledgement : the alarms allowed to be acknowledged disappear (See §6.6)	NO / YES

5.12. Security Block *SECU*

Device with firmware V1.05 and oldest firmware :

Parameter	*Definition*	*Limits*
Code	Access code value for the modification of the device locking level.	369
SECU	Locking level : **LEV 0** : All access authorized. **LEV 1** : Forbids the modification of the decimal point display. **LEV 2** : Lev 1 + Forbids the modification of the setpoint value. **LEV 3** : Lev 2 + Forbids the **Auto / Manu** commutation. **LEV 4** : Lev 3 + Forbids the **ADAPTATION** parameters modification. **LEV 5** : Any modification forbidden.	0 to 5

Device with firmware V1.06 and more (since end 2007) :

Code	Access code value for the modification of the device locking level.	369
PtD	Decimal point display modification **(0 forbidden , 1 Allowed)**	0 or 1
SP	Setpoint value modification **(0 forbidden , 1 Allowed)**	0 or 1
A/M	**Auto / Manu** commutation **(0 forbidden , 1 Allowed)**	0 or 1
ADAP	**ADAPTATION** parameters modification **(0 forbidden , 1 Allowed)**	0 or 1
Cfg	**CONFIGURATION** Access **(0 forbidden , 1 Allowed)**	0 or 1

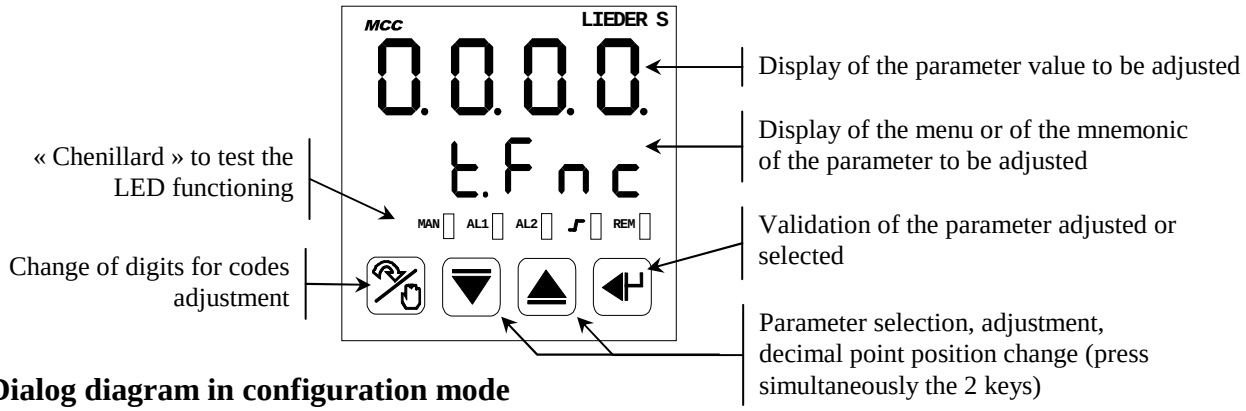
5.13. Access to the configuration mode block *CFG?*

Parameter	*Definition*	*Limits*
Code	Access code to the configuration. If the locking level is higher than 0.	369

6. CONFIGURATION

The configuration mode enables you to define the configuration of the following parameters : process variable, control algorithm, alarms and device output type.

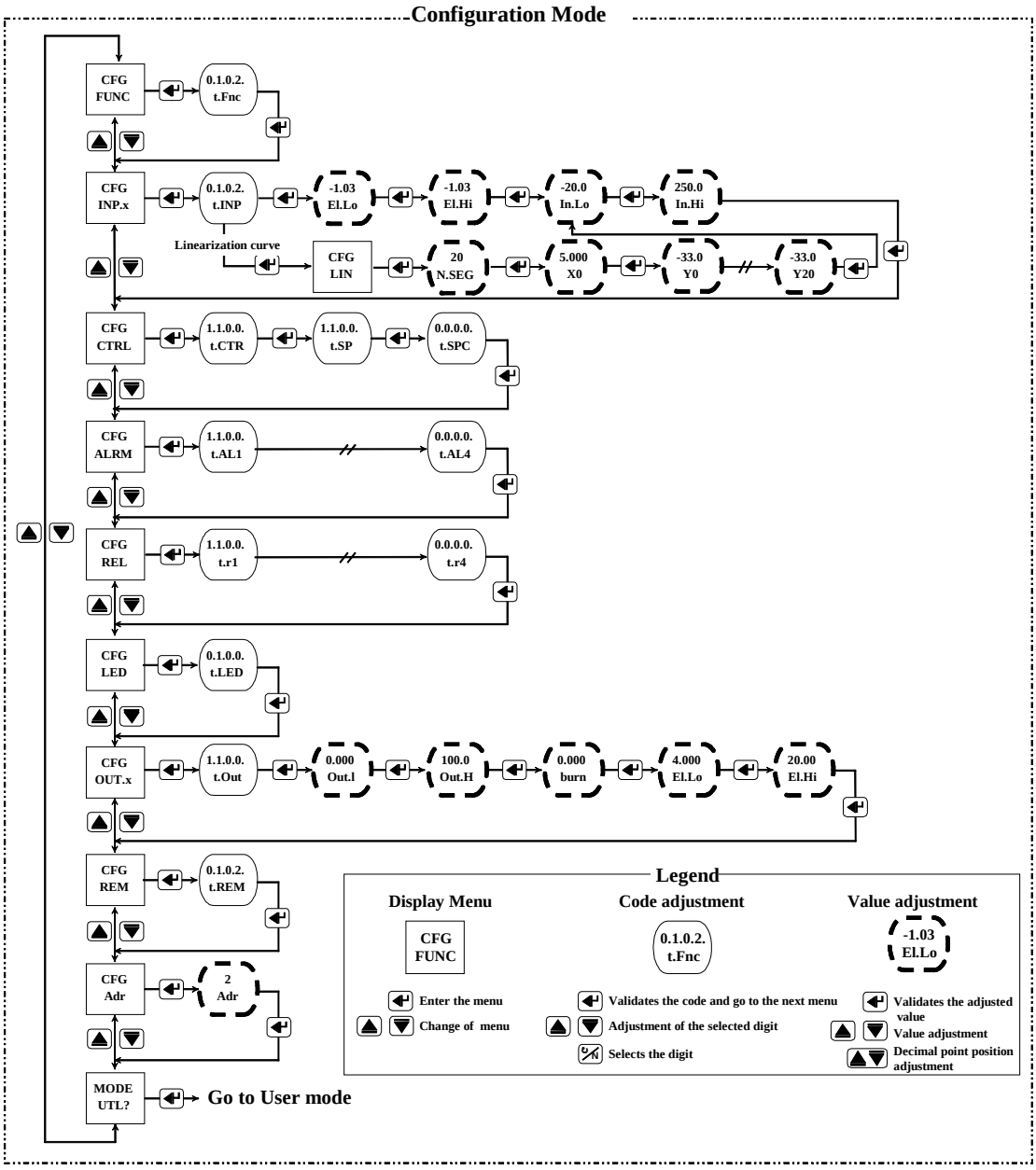
6.1. Display and keys description



6.2. Dialog diagram in configuration mode

Access to the configuration :

1. In the adaptation mode, when the message «MODE CFG?» appears, press on the key «↵» (the code 369 is required if a locking has been set, see §5.12).
2. Pressing simultaneously on the keys "▼" and "↵" during the display of the device version Vx.xx



6.3. Function Block *FUNC*

This block enables you to define the number of input channels to use.

T.FNC.			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Analog input number			
1.➔ 1	**0.**	**0.**	**0.**
2.➔ 2			

Warning : All the input types are not compatible between each other. See table hereafter:

Compatibility between the various types of inputs

Channel n°1 / Channel n°2	**Digital**	**Volts, millivolts, Thermocouple**	**Potentiometer**	**Milliamps**	**3-wire RTD Resistance**	**Frequency, Tachometer, Periodmeter**
Digital	Yes	Yes	Yes	Yes	Yes	Yes
Volts, millivolts, Thermocouple	Yes	Yes	Yes	Yes	Yes	Yes
Potentiometer	Yes	Yes	*No*	Yes	*No*	Yes

6.4. Inputs n°1 to 2 Block *INP.x*

This block enables to define the type of input processing to perform.
When you modify the input type, the offset (see §5.9) is reset at zero.
The block n°2 only appears if there are 2 input channels (see §6.3) .
Only one input channel can use the P terminal. For example, it is impossible to have an RTD for input n°1 and a potentiometer for input n°2.
Only one linearization table (curve type processing) is available.

6.4.1. Digital input

Value set by the digital RS (see §7.2).
If the time between two writings of the process variable is higher than the time defined by the digit n°4 then, then the process variable fails.

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type			**Time before sensor failure**
0.➔ Digital	**0.**	**0.**	**0.➔** Infinite
			1.➔ 10 seconds
			2.➔ 20 seconds
			3.➔ 30 seconds
			4.➔ 40 seconds
			5.➔ 60 seconds
			6.➔ 90 seconds
			7.➔ 120 seconds

The following analog parameters must be adjusted in the CONFIGURATION mode

1. Minimum (Engineering unit) **In.Lo**
2. Maximum (Engineering unit) **In.Hi**

6.4.2. High level voltage input

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	***Range***		***Treatment***
1.➔ Volt DC	**0.➔** ±2.25V	**0.**	**0.➔** Without
			1.➔ Curve
			2.➔ Square root

Following parameters must be adjusted

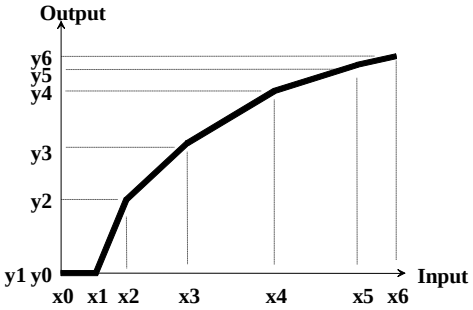
1. Electric Minimum in V **El.Lo**
2. Electric Maximum in V **El.Hi**
3. In the «Curve» case, declared linearization Eu = f(V)
4. Minimum (Eu: Engineering unit) **In.Lo**
5. Maximum (Eu :Engineering unit) **In.Hi**

Example :

Voltage input from – 1 to + 1 for a range of 0 to 3000 tons :
T.INP=1000, El.Lo=-1, El.Hi=1, In.Lo=0, In.Hi=3000

In case of a curve treatment (digit N°4=1). Following parameters must be adjusted

1. Number of segments of the curve (20 maximum) **N.seg**
2. Abscissa (X.n) in Electric Unit **X.n**
3. Ordinate (y.n) in Engineering Unit **Y.n**



6.4.3. Low level voltage input

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	***Range***		***Treatment***
2.➔ mV DC	**0.➔** ±22 mV	**0.**	**0.➔** Without
	1.➔ ±50 mV		**1.➔** Curve
	2.➔ ±90 mV		**2.➔** Square root
	3.➔ ±900 mV		

Following parameters must be adjusted

1. Electric Minimum in mV **El.Lo**
2. Electric Maximum in mV **El.Hi**
3. In the «Curve» case, declared linearization Eu = f(V)
4. Minimum (Eu : Engineering unit) **In.Lo**
5. Maximum (Eu : Engineering unit) **In.Hi**

Example :

Temperature measurement through sensor with emf of 400 mV for -50°C and 600 mV for 150°C :
T.INP=2300, El.Lo=400mV, El.Hi=600mV, In.Lo=-50°C, In.Hi=150°C

6.4.4. Thermocouple input

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	***Range***	***Compensation***	***Unit***
3.➔ Thermocouple	**0.➔** Special 22 mV	**0.➔** Internal	**0.➔** °C
	1.➔ Special 50 mV	**1.➔** Declared	**1.➔** °F
	2.➔ Special 90 mV	**2.➔** Without	
	3.➔ K : -270 to 1372 °C		
	4.➔ J : -210 to 1200 °C		
	5.➔ T : -270 to 360 °C		
	6.➔ S : -50 to 1767 °C		
	7.➔ R : -50 to 1767 °C		
	8.➔ N : -270 to 1300 °C		
	9.➔ B : 0 to 1820 °C		
	A.➔ E : -270 to 1000 °C		
	b.➔ W5 : 0 to 2320 °C		

Following analog parameters must be adjusted

1. In the case «Special», linearization in °C or °K = f(mV). must be defined in the other cases, range is internally predetermined.
2. Minimum measurement in °C or °F **In.Lo**
3. Maximum measurement in °C or °F **In.Hi**

Parameters to be adjusted in ADAPTATION mode in block SPEC

1. Connecting board temperature declared in °C or °F (digit N°3=1) **CJCP**

6.4.5. Potentiometer input

Warning: Only one input channel can use the P pin. This type of input is impossible for channel n°2 if channel n°1 is a potentiometer or 3 wires , pt100, RTD input signal.

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	**Range**		**Treatment**
4.➔ Potentiometer	**0.➔** <100 Ω	**0.**	**0.➔** Without
	1.➔ <500 Ω		**1.➔** Curve
	2.➔ <100 KΩ		

Following parameters must be adjusted in CONFIGURATION mode.

1. Minimum in % **El.Lo**
2. Maximum in % **El.Hi**
3. In «Curve» case, linearization in Eu = f(%) must be defined.
4. Minimum (Eu : Engineering unit) **In.Lo**
5. Maximum (Eu : Engineering unit) **In.Hi**

6.4.6. Low Level current input (only available in channel n°1*)

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	***Range***		***Treatment***
5.➔ mA DC	**0.➔**22 mA	**0.**	**0.➔** Without
			1.➔ Curve
			2.➔ Square Root

Following analog parameters must be adjusted

1. Electric Minimum in mA **El.Lo**
2. Electric Maximum in mA **El.Hi**
3. In «curve» case Linearization in Eu = f(mA) must be defined
4. Minimum (Engineering unit) **In.Lo**
5. Maximum (Engineering unit) **In.Hi**

* For an external setpoint in 4-20mA, you have to configure channel 2 as voltage VDC input and set a 50 Ω shunt between terminals 8&9.

6.4.7. 3 wires resistance input (only available in channel n°1)

Warning: Only one channel can use P pin.

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	**Range**		**Treatment**
6.➔ 3 Wires resistance	**0.➔** 0 to 100 Ω	**0.**	**0.➔** Without
	1.➔ 0 to 500 Ω		**1.➔** Curve

Following parameters must be adjusted in CONFIGURATION mode.

1. Minimum in Ω **El.Lo**
2. Maximum in Ω **El.Hi**
3. In «Curve» case Linearization in Eu = f(Ω) must be defined.
4. Minimum (Engineering unit) **In.Lo**
5. Maximum (Engineering unit) **In.Hi**

6.4.8. RTD, Pt100 3 wires input (only available in channel n°1)

Warning: Only one channel can use P pin.

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type	**Range**		**Unit**
7.➔ Pt100 ; RTD	**0.➔** -200 to 650 °C	**0.**	**0.➔** °C
			1.➔ °F

Following analog parameters must be adjusted in CONFIGURATION mode

1. Minimum in °C or °F **In.Lo**
2. Maximum in °C or °F **In.Hi**

6.4.9. Frequency input (only available in channel n°1)

Principle: Pulse counting on logic input in predetermined time 1KHz < Frequency < 10KHz

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type			**Treatment**
8.➔ Frequency	**0.**	**0.**	**0.➔** Without
			1.➔ Curve

Following analog parameters must be adjusted in CONFIGURATION mode

1. Frequency Minimum in hertz **F.Lo**
2. Frequency Maximum in hertz **F.Hi**
3. Integrative time in seconds **T.INT**
   Time for the unit will count the received pulses. This time will simultaneously define measurement accuracy and maximum frequency to be measured:

$$\frac{100}{\text{Accuracy }(\%) * \textit{Min Frequency }(\textit{hertz})} \leq \textit{Int TIME }(\text{sec}) \leq \frac{64000}{\textit{Max Frequency }(\textit{hertz})}$$

4. In «Curve » case linearization in Eu = f(hertz) must be defined.
5. Minimum (Engineering unit) **In.Lo**
6. Maximum (Engineering unit) **In.Hi**

6.4.10. Tachometer input through frequency measurement (Only available on channel n°1)

Principle: Pulse counting on logic input in predetermined time. 1KHz < Frequency < 10KHz

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type			**Time Unit**
9.➔ Tachometer through frequency	**0.**	**0.**	**0.➔** second
			1.➔ minute
			2.➔ hour

Following analog parameters must be adjusted in CONFIGURATION mode

1. Pulse number for one sensor rotation **P/T**
2. Conversion factor **F.CNV**
3. Integrative time in seconds **T.INT**
   Time for the unit to count the received pulse. It defines measurement accuracy. See formula §6.4.9 for integrative time calculation according to tachometer frequency definition:

$$\text{Frequency (hertz)} = \text{Pulse / Round} * \frac{\text{Speed (Rd/mn)}}{60}$$

4. Minimum (Engineering unit) **In.Lo**
5. Maximum (Engineering unit) **In.Hi**

Example:

RPM measurement from 0 to 1000 rpm through measurement wheel of 120 pulses per round.

- Rotating speed display in RPM :
  T.INP=9001, P/T=120, F.CNV=1, In.Lo=0, In.Hi=1000
- Linear speed (in m/min) display of a belt moving with 20 cm per wheel round :
  T.INP=9001, P/T=120, F.CNV=0.2*Pi = 0.628, In.Lo=0, In.Hi=1000 * 0.2*Pi

6.4.11. Periodmeter input (only available on channel n°1)

Principle: Time measurement between two fronts on logic input 1ms < period < 1000 sec (resolution 1.2 µsec)

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type			**Treatment**
A.➔ Period	**0.**	**0.**	**0.➔** Without
			1.➔ Curve

Following analog parameters must be adjusted in CONFIGURATION mode

1. Period Minimum in seconds **P.Lo**
2. Period Maximum in seconds **P.Hi**
3. Time in seconds before sensor failure * **T.Out**
4. In the «Curve» case Linearization in Eu = f(sec) must be defined.
5. Minimum (Engineering unit) **In.Lo**
6. Maximum (Engineering unit) **In.Hi**

6.4.12. Tachometer input through period measurement (only available on channel N°1)

Principle: Time measurement between two fronts on logic input. 1ms < period < 1000 sec (resolution 1.2 µsec)

T.INP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type			
b.➔ Tachometer through period	**0.**	**0.**	**0.**

Following parameters analog must be adjusted in CONFIGURATION mode

1. Period in seconds for physical maximum (In.Hi) **PER**
2. Time in seconds before sensor failure * **T.out**
3. Minimum (Engineering unit) **In.Lo**
4. Maximum (Engineering unit) **In.Hi**

Example:

Turbine measurement delivers one pulse for 1m3 of instantaneous flow going from 10 to 1000 m3/H :
T.INP=b000, PER=3.6 sec (3600/1000) and In.Lo=10, In.Hi=1000
T.Out=400: if no pulse is received for 400 sec, then measurement is on failure.

* If T.Out is equal to zero, then measurement doesn't go to failure if no pulse has been received but remains at the same value. This is used for pulse time measurement. Failure information will be activated only in case of over range.

6.5. Control function configuration *CTRL*

6.5.1. Control type configuration

T.CTR			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Control Algorithm	**Sense**	**Heat output**	**Cooling output**
0.➔ ON / OFF	**0.➔** Inverse	**0.➔** ON / OFF (logic +) OR ON / OFF 2 relays (logic ±)	**0.➔** Without
1.➔ ON / OFF 2 relays	**1.➔** Direct	**1.➔** Continuous (analog)	**1.➔** ON / OFF (logic -)
2.➔ PD		**2.➔** Discontinuous (logic +)	**2.➔** Discontinuous (logic -)
3.➔ PID		**3.➔** Servo-drive with feedback pot. (logic ±)	
		4.➔ Servo-drive without feedback pot.(logic ±)	

See parameters to be adjusted in ADAPTATION mode in the blocks REGU, LIM, SEL and GSP

Cooling output is only selectable with continuous and discontinuous heat outputs

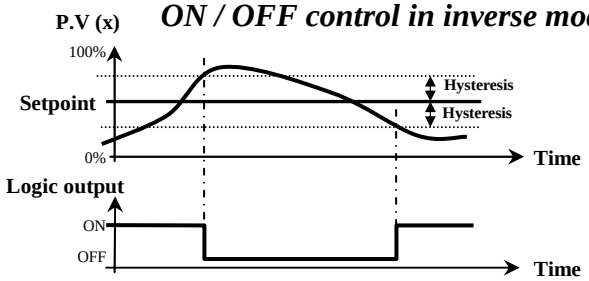
PID algorithm is serial – parallel type. Derivative action is on process variable with transitory gain value 3.

Transfer Function: $PID \quad \rightarrow Y = G \bullet Ecart \bullet \left(1 + \frac{1}{Ti \cdot p} + Td \cdot p\right)$ $\qquad PD \quad \rightarrow Y = G \bullet Ecart \bullet (1 + Td \cdot p) + So$

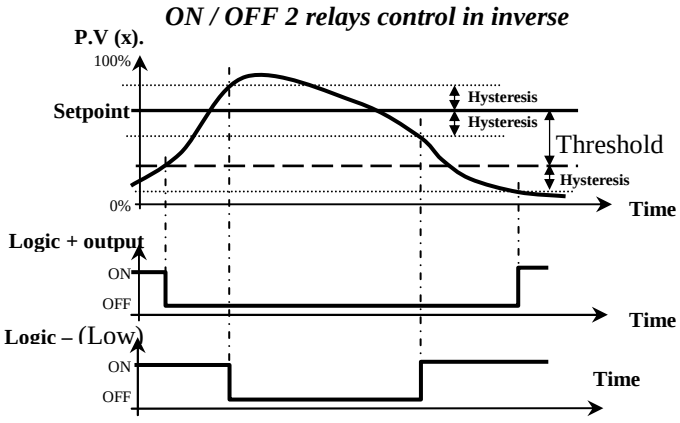
To drive the actuator it is necessary to configure in the analog output block (OUT.x) or in the output relays block (REL.x) one or several control output corresponding to the selected algorithm:

6.5.1.1. Control with only one output (heat control)

- Using ON/OFF control, control output is **logic + output**.



- In ON/OFF 2 relays control, the **logic – output** is for low output while the **logic + output** is for high action.



☞ For ON / OFF 2 relays algorithm type « **AND** » (when the « high » relay is active, the « low » relay is also active), configuration of the outputs (§6.7) as follows:
- Relay « high » on **logic + output**. Relays configuration code : T.Rx = 0.0.0.0.
- Relay « low » on **logic - output.** Relays configuration code : T.Rx = 1.0.0.0.

☞ For ON / OFF 2 relays algorithm type « **OR** » (When the « high » relay is active, the « low » relay is not active), configuration of the outputs (see §6.7) as follows :
- relay « high » on **logic + output**. Relays configuration code : T.Rx = 0.0.0.0.
- relay « low » on **logic - output** « **AND NOT** » the **logic + output.** Relays configuration code : T.Rx = 1.4.0.0.

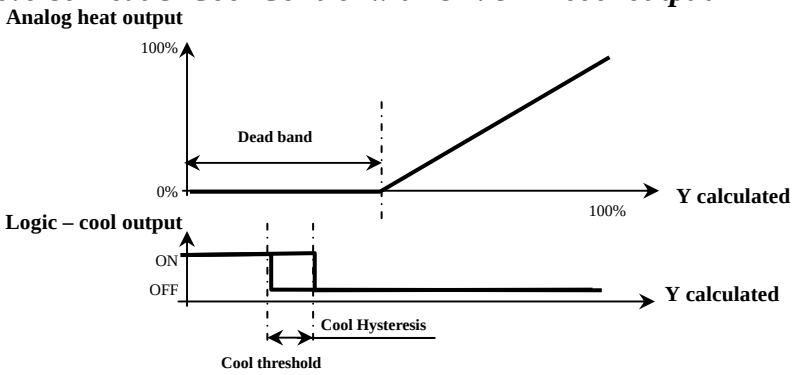
- Control output is the **analog output** for the continuous heat control algorithm.
- Control output is the **logic + output** for the discontinuous heat control algorithm.
- For a motorvalve with or without feedback potentiometer heat output control, the "opening" control output is the **logic+ output** and the "closing" control output is the **logic- output**.

6.5.1.2. Heat and cool output controls

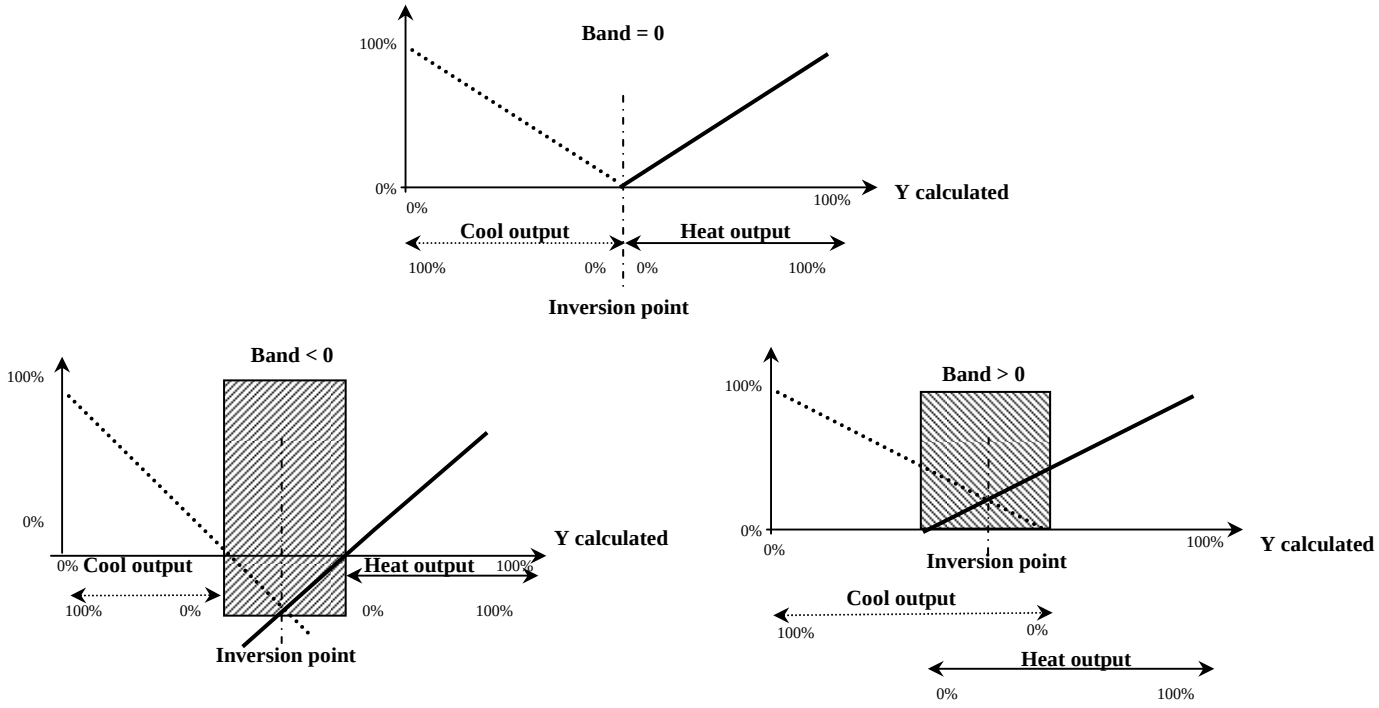
Cool output is always the **logic – output**

- In continuous heat control, control output is the **analog output**
- In discontinuous heat control, control output is the **logic + output**.

Reverse Heat & Cool Control with ON/OFF cool output



***Heat & Cool Reverse control** with discontinuous cool output*



Cool gain definition : $\mathrm{G.Col} = \dfrac{Cool\ output\ Course}{Heat\ output\ Course}$

If the cool control system is twice more powerful than the heat control system, the cool gain must be equal to ½ (= 0,5)

Outputs inversion point formula : $I(\%) = \dfrac{G.Col}{G.Col + 1} \times 100$

Calculation of the physical heat output : $Yc = Y\,calculated \times \left(1 + G.Col - \dfrac{Band}{100}\right) - 100 \times \left(G.Col - \dfrac{Band}{100}\right)$

Calculation of the physical cool output: $Yf = -Y\,calculated \times \dfrac{\left(1 + G.Col - \dfrac{Band}{100}\right)}{G.Col} + 100$

6.5.2. Setpoint type configuration

T.SP			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
1st setpoint (SP.1)	**2nd setpoint (SP.2)** *	**Ramp on setpoint changing**	**Following setpoint in manual mode** †
1.➔ Declared (keyboard)	**0.➔**Without	**0.➔** Without	**0.➔** No
2.➔ Digital	**1.➔**Declared (keyboard)	**1.➔** On every setpoint changing	**1.➔** Yes
3.➔ Remote channel 1	**2.➔**Digital	**2.➔** On setpoint type changing	
4.➔ Remote channel 2‡	**3.➔**Remote channel 1	**3.➔** On setpoint value changing	
	4.➔Remote channel 2 ‡		

See the parameters to be adjusted in the ADAPTATION mode in the blocks REGU, LIM, SEL and GSP

6.5.3. Special functions configuration

T.SPC			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
PV control channel	**Logic input function**§	**Setpoint generator** **	
0.➔ Channel n°1	**0.➔**Unused	**0.➔** Without	**0.**
1.➔ Channel n°2 ‡	**1.➔** Setpoint commutation (0→SP1, 1→SP2)	**1.➔** With	
	2.➔ ON / OFF setpoint generator (0→OFF, 1→ON)		
	3.➔ Output hold (0→Control, 1→Hold)		
	4.➔ Output = Failure value (0→Control, 1→ Failure)		
	5.➔ Output = channel 1 (0→Control, 1→Channel 1)		
	6.➔ Output = channel 2 (0→Control, 1→Channel 2 ‡)		

See the parameters to be adjusted in the ADAPTATION mode in the blocks REGU, LIM, SEL and GSP

* SP.1 or SP.2 selection is possible through logic input (see §6.5.3) or through keyboard in the SEL block in adaptation mode (See §5.6).

† Only the declared setpoints can follow the process measurement when controller is in manual mode.

‡ Channel 2 selection only possible when 2 control inputs have been declared (see §6.3)

§ If frequency period or tachometer has been selected for channel 1 (input types using the logic input terminal) then, the logic input will be available through a dry contact between the **ground** and the **analog input N°1**.

** The setpoint profile generator definition is performed in adaptation mode (see § 5.5)

6.6. Alarms 1 to 4 Block *ALRM*

This block defines the use of a software alarm. To drive a relay output, it is necessary to go in the selected relay block and dedicate this relay to the alarm.
An alarm can be delayed and (or) stored for a certain period of time or indefinitely (time >= 9990 seconds)
Alarm acknowledgement can be inactive, active of alarm condition is true, or active only when alarm has disappeared.
The acknowledgement is performed in ADAPTATION mode, in the ACQ block (§5.11).
The acknowledgement will cancel the alarm.
The alarm can also be used for the sensor failure situation.

T.Alx			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Type of alarm	**Input control failure**	**Delay**	**Acknowledgement authorization**
0.➔ Inactive	**0.➔** No effect	**0.➔** Without	**0.➔** Without
1.➔ High on process variable	**1.➔** Activated	**1.➔**Go (Delayed)	**1.➔** Always allowed
2.➔ Low on process variable	**2.➔** Activated if high failure	**2.➔** Back (Stored)	**2.➔** Forbidden if alarm active
3.➔ Difference setpoint - process variable (± Difference)	**3.➔** Activated if low failure	**3.➔** Go / Back (Delayed and stored)	
4.➔ PV lower than the setpoint (+ Difference)			
5.➔ PV higher than the setpoint (- Difference)			
6.➔ Analog control high output			
7.➔ Analog control low output			
8.➔ High on channel n°1			
9.➔ Low on channel n°1			
A.➔ High on channel n°2			
b.➔ Low on channel n°2			
C.➔ Absolute value of difference between channel n°1 and channel n°2			
d.➔ Channel n°1 lower than channel n°2			
E.➔ Channel n°1 higher than channel n°2			

Parameters to be adjusted in ADAPTATION mode in the ALRM block

1. Alarm threshold in Engineering unit (Eu) **SP.x**
2. Alarm Hysteresis in Eu **HY.x**
3. Delay value (DIGIT N°4≠0) from 0 to 9999 seconds **DY.x**

   If the delay value is higher than 9990 seconds, it is considered as infinite.

Parameters to be adjusted in ADAPTATION mode in the ACQ block

1. Alarms acknowledgement for the alarms allowed to be acknowledged.

6.7. Relays 1 to 4 Block *REL*

This relays 2 to 4 block only appears if these options have been installed. It is possible to fix a contact normally open or normally closed (See §0).

T.rx			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Operand 1	**Operator**	**Operand 2**	**Logic Sense**
0.➔ Logic + control output	**0.➔** Inactive	**0.➔** Logic + control output	**0.➔** Positive
1.➔ Logic – control output	**1.➔** OR	**1.➔** Logic – control output	**1.➔** Negative
2.➔ Alarm 1	**2.➔** OR NOT	**2.➔** Alarm 1	
3.➔ Alarm 2	**3.➔** AND	**3.➔** Alarm 2	
4.➔ Alarm 3	**4.➔** AND NOT	**4.➔** Alarm 3	
5.➔ Alarm 4	**5.➔** XOR	**5.➔** Alarm 4	
6.➔ Auto – Manual Status	**5.➔** XOR	**6.➔** Auto – Manual Status	
7.➔ Control on SP.2 setpoint	**6.➔** XOR NOT	**7.➔** Control on SP.2 setpoint	
8.➔ Control on setpoint generator		**8.➔** Control on setpoint generator	
9.➔ Failure on process variable		**9.➔** Failure on process variable	
A.➔High failure on process variable		**A.➔** High failure on process variable	
b.➔ Low failure on process variable		**b.➔** Low failure on process variable	
C.➔ Logic input		**C.➔** Logic input	
d.➔ Flag setpoint generator n°1		**d.➔** Flag setpoint generator n°1	
E.➔ Flag setpoint generator n°2		**E.➔** Flag setpoint generator n°2	
F.➔ Flag setpoint generator n°3		**F.➔** Flag setpoint generator n°3	
G.➔ Flag setpoint generator n°4		**G.➔** Flag setpoint generator n°4	
H.➔ Flag setpoint generator n°5		**H.➔** Flag setpoint generator n°5	
I.➔ Flag setpoint generator n°6		**I.➔** Flag setpoint generator n°6	
J.➔ Flag setpoint generator n°7		**J.➔** Flag setpoint generator n°7	
K.➔ Flag setpoint generator n°8		**K.➔** Flag setpoint generator n°8	
L.➔ Remote 1*		**L.➔** Remote 1*	
M.➔ Remote 2*		**M.➔** Remote 2*	
n.➔ Remote 3*		**n.➔** Remote 3*	
o.➔ Remote 4*		**o.➔** Remote 4*	

Examples:

- Active relay (power supplied) if alarm 1 AND NOT alarm 2 : T.REL=2430
- Inactive relay (no power supplied) if alarm 1 AND alarm 2 : T.REL=2331

6.8. Lights enabling block *LED*

This block allows enabling of the AL1 AND AL2 lights in user mode.

T.LED			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Light AL1	**Light AL2**		
0.➔ Always off	**0.➔** Always off	**0.**	**0.**
1.➔ Alarm 1	**1.➔** Alarm 1		
2.➔ Alarm 2	**2.➔** Alarm 2		
3.➔ Alarm 3	**3.➔** Alarm 3		
4.➔ Alarm 4	**4.➔** Alarm 4		
5.➔ Logic + control output	**5.➔** Logic + control output		
6.➔ Logic – control output	**6.➔** Logic – control output		
7.➔ Relay 1	**7.➔** Relay 1		
8.➔ Relay 2	**8.➔** Relay 2		
9.➔ Relay 3	**9.➔** Relay 3		
A.➔ Relay 4	**A.➔** Relay 4		

* Remote 1 to 4 are logic variables adjusted through digital communication (See §7.1)

6.9. Analog outputs 1 & 2 block *OUT.x*

Those blocks only appear if corresponding output have been installed.

T.OUT			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Enabling	**Failure** (except for control output)		
0.➔ Analog control output	**0.➔** Without	**0.**	**0.**
1.➔ Logic + control output	**1.➔** If process variable failure		
2.➔ Logic – control output	**2.➔** If high process variable failure		
3.➔ Retransmission	**3.➔** If low process variable failure		
4.➔ Setpoint			
5.➔ Difference (SP - PV)			
6.➔ Retransmission input n°1			
7.➔ Retransmission input n°2			

Following parameters must be adjusted in CONFIGURATION

1. Minimum output in Eu (Engineering units) for analog retransmissions **OUT.L**
2. Maximum output in Eu for analog retransmissions **OUT.H**
3. Output value in case of process variable failure (mA or Volts) **Burn**
4. Minimum Electric output (mA or Volts) **El.Lo**
   For analog output : value corresponding to minimum physic
   For logic output : value corresponding to low logic level (0)
5. Maximum Electric ouptut (mA or Volts) **El.Hi**
   For analog output :value corresponding to maximum physic
   For logic output : value corresponding to high logic level (1)

Examples :

- Output 4-20mA for analog control output 0 to 100%
  T.OUT=0000, OUT.L=0, OUT.L=100, El.Lo=4mA, El.Hi=20mA
- Output 0-20mA for input n°2 retransmission from –50 to 200°C with output =15mA in case PV failure
  T.OUT=7100, OUT.L=-50, OUT.L=200, burn=15mA, El.Lo=0mA, El.Hi=20mA
- Logic output 0-20mA for a logic + control output
  T.OUT=1000, El.Lo=0mA, El.Hi=20mA

6.10. Remote block *REM*

The block only appears if option has been installed.

T.REM			
DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Function	**Baud rate**	**Parity, stop bits number**	**Modbus resolution**
0.➔ Modbus slave RTU	**0.➔** 1200	**0.➔◆** Without 1 stop	**0.➔** 16 bits (0 to 65535)
	1.➔ 2400	**1.➔** Even, 1stop	**1.➔** 15 bits (0 to 32767)
	2.➔ 4800	**2.➔** Odd, 1stop	**2.➔** 14 bits (0 to 16383)
	3.➔ 9600		**3.➔** 13 bits (0 to 8191)
	4.➔ 19200		**4.➔** 12 bits (0 to 4095)
	5.➔ 38400		**5.➔** 11 bits (0 to 2047)

6.11. RS Address block *Adr*

1. Unit digital RS address between 1 and 255 **Adr**

7. MODBUS / JBUS SLAVE PROTOCOL

The MODBUS slave protocol allows connection of several units to a supervisor. This supervisor must ask for the right information to the slaves. The identified instructions are the following ones :

- Functions 1 and 2 Reading bit
- Functions 5 and 15 (0Fh) Writing bit
- Functions 3 and 4 Reading word
- Functions 6 and 16 (10h) Writing word

7.1. Cut out of the addressable bits memory

Bits can be reached through:

- Functions bits 1 and 2 in reading, 5 and 15 (0Fh) in writing
- Functions words 3, 4 in reading, 6 and 16 (10h) in writing to the addresses 2050 and 2051 (802 and 803) through 16 bits groups rowed as follows :

	Word															
	MSB byte								LSB Byte							
Word bit n°	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit N °	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8

Address		**R.W.S** *	**Description of the bits**
Decimal	**Hexadecimal**		
2	2	RWS	Auto (0) / Manu (1) mode
5	5	R	Alarm 1
10	A	R	Process variable failure
2048	800	R	Input N°1 failure
2049	801	R	Input N°2 failure
2050	802	RWS	Auto (0) / Manu (1) mode
2051	803	R	Logic + control output
2052	804	R	Logic – control output
2056	808	RWS	SP1 (0) / SP2 (1) Commutation
2057	809	RWS	OFF (0) / ON (1) setpoint profile generator
2064	810	RW	Alarms acknowledgement (pulse)
2065 to 2068	811 to 814	R	Alarm 1 to 4
2072 to 2077	818 to 81D	RW	Remote 1 to 6
2080 to 2087	820 to 827	R	Flag n°1 to 8 of profile generator

7.2. Cut out of the addressable words memory

Words can be reached through functions 3 and 4 in reading and 6 and 16 (10h) in writing, in mode:

- Relative according to configured MODBUS resolution (see §6.10).

  When the parameter address is not directly given, it can be calculated as follows:

  Address = 2048 (0x800) + **Offset**

  Example: To read process variable and setpoint in the relative mode, (Offset = 16) a reading instruction must be send to the address: 2048 + 16 = 2064 (0x810)

- IEEE format through groups of 2 words rowed in the following board :

	1st Word	**2nd Word**		
N° bit of Word	15 … 0	15	14…7	6…0
IEEE Value	Fraction	Sign	Exponent	Fraction
IEEE bit N°	15 … 0	31	30 … 23	22 … 16

  When the parameter address is not directly given, it can be calculated as follows:

  Address = 32768 (0x8000) + 2* **Offset**

  Example: To read process variable and setpoint in IEEE mode (Offset = 16) four registers reading instruction must be sent to the address : 32768 + 2*16 = 32800 (0x8020)

*****

R: Parameter you can only read.

RW: Parameter you can read and write but not save in E2prom (Reset on supply failure)

RWS: Parameter you can read and write (100000 times only because saved in E2prom).

Offset Decimal	Offset Hexadecimal	R.W.S *	Word scale	Description of the words
00	00	RW	Min. / Max. input 1	Input n°1
01	01	RW	Min. / Max. input 2	Input n°2
02	02	RWS	Bits on address 0x800 to 0x80F (see bits description board)	
03	03	RWS	Bits on address 0x810 to 0x81F (see bits description board)	
04	04	RWS	Bits on address 0x820 to 0x82F (see bits description board)	
05 to 08	05 to 08	RWS	-999 / 9999	Alarm threshold 1 to 4 in engineering units
09 to 12	09 to 0C	RWS	0 / 9999	Alarm Hysteresis 1 to 4 in engineering unit
16	10	R	Min. / max. control	Process variable
17	11	R	Min. / max. control	Setpoint in progress
18	12	RWS	0 à 1	Continuous control
			0 : Off ; 1 : On	ON / OFF control
			0 : Off; 1 : Mid; 2 : high	ON / OFF 3 position
			0 : Off ; 1 : ---- ; 2 : On	Servo drive control without feedback potentiometer
20	14	RW	Min. / max. control	Setpoint n°1 (SP.1)
21	15	RW	Min. / max. control	Setpoint n°2 (SP.2)
32	20	RWS	Min. / max. control	ON 3 Po. Algorithm on threshold in engineering unit
33	21	RWS	0 to 0,2	ON / OFF and ON / OFF 3 Po. Algorithm control : Hysteresis in %
34	22	RWS	0,2 to 999,9	PD and PID Algorithm: proportional band Bp in %
35	23	RWS	0,02 to 99.99	PID algorithm : integrative time ;Ti in minutes
36	24	RWS	0 to 2000	PD and PID Algorithm : derivative time Td in seconds
37	25	RWS	0 to 1	PD algorithm: band centering So in %
38	26	RWS	1 to 2000	PID discontinuous algorithm : cycle time in seconds
48	30	RW	Reading or keyboard simulation (Strong Weight → Key value, low weight → 0) Keys Value : A/M=0xFE =↓0xFD ↑=0xFB ↵= 0xF7 Keys arrangement are performed with a OR between the values	
60	3C	RWS	• MSB: Cycle number of the profile generator between 0 and 255 • LSB : Segment number of the profile generator between 1 and 12	
61	3D	RWS	bit n°X : n°X segment gradient fixed (1) or not (0) on difference	
62	3^E	RWS	bit n°X : n°X segment soak, fixed (1) or not (0) on difference ….	
63	3F	RWS	0,001 to 9999	Absolute value, in Eng. Unit, of admitted difference – free band
64 to 75	40 to 4B	RWS	0,1 to 999,0	Segment gradient value n°1 to 12 in engineering units per minute
79 to 91	50 to 5B	RWS	-999 to 9999	Segment soak value n°1 to 12 in engineering units
96 to 107	60 to 6B	RWS	0,1 to 999,0	Segment soak time n°1 to 12 in minute
112 à 123	70 à 7B	RWS	• MSB: Flag profile generator on segment gradient n°1 to 12 (bit 0 : Flag 1,… , bit 7 : Flag 8) • LSB: Flag profile generator on segment soak n°1 to 12 (bit 0 : Flag 1,…,bit 7 : Flag 8)	

Addresses Decimal	Addresses Hexadecimal	R.W.S *	Description of the words
1	1	R	CNOMO Process variable * 10^décimal point position
2	2	RW	CNOMO setpoint * 10^ decimal point position
3	3	R	CNOMO control output
6	6	RWS	CNOMO proportional band* 10
7	7	R	CNOMO control sense = 0
8	8	RWS	CNOMO Ti * 100
9	9	RWS	CNOMO Td
10	A	RWS	CNOMO Modulation time
11	B	R	CNOMO Minimum scale * 10^ decimal point position
12	C	R	CNOMO Maximum scale * 10^ decimal point position
13	D	RWS	CNOMO Alarm n°1 threshold * 10^ decimal point position
121	79	R	Manufacturer Identification : 0x0D00
122	7A	R	Tag number : 0x2800
123	7B	R	Apparatus version Example : V2.52 =>pFort=2 pFaible=52
57856	E200	RWS	• Writing of (X-1) registers from the OFFSET E2prom 1er register : OFFSET E2prom Following Registers : Value E2prom from OFFSET Example of frame to write to offset 20h of l'E2prom 4 bytes (12h 34h 56h 78h) Adr 10 E200 0003 06 0020 1234 5678 Chk • Reading of X registers from the OFFSET E2prom Example of frame to read to the offset 20h from l'E2prom 4 bytes : Adr 06 E200 0020 Chk (adjust the offset) Adr 03 E200 0002 Chk (Reading of 2 registers)
57859	E203	W	Reset apparatus with register value to 55Aah
57860	E204	RW	Reading of displays ASCII on 4 registers and writing only of the low display in ASCII : Example of frame to display the message « Good» on the low display : Adr 10 E204 0004 08 47 6F 6F 64 00 00 00 00 Chk

* R: Parameter you can only read.

RW: Parameter you can read and write but not saved in E2prom (Reset on supply failure)

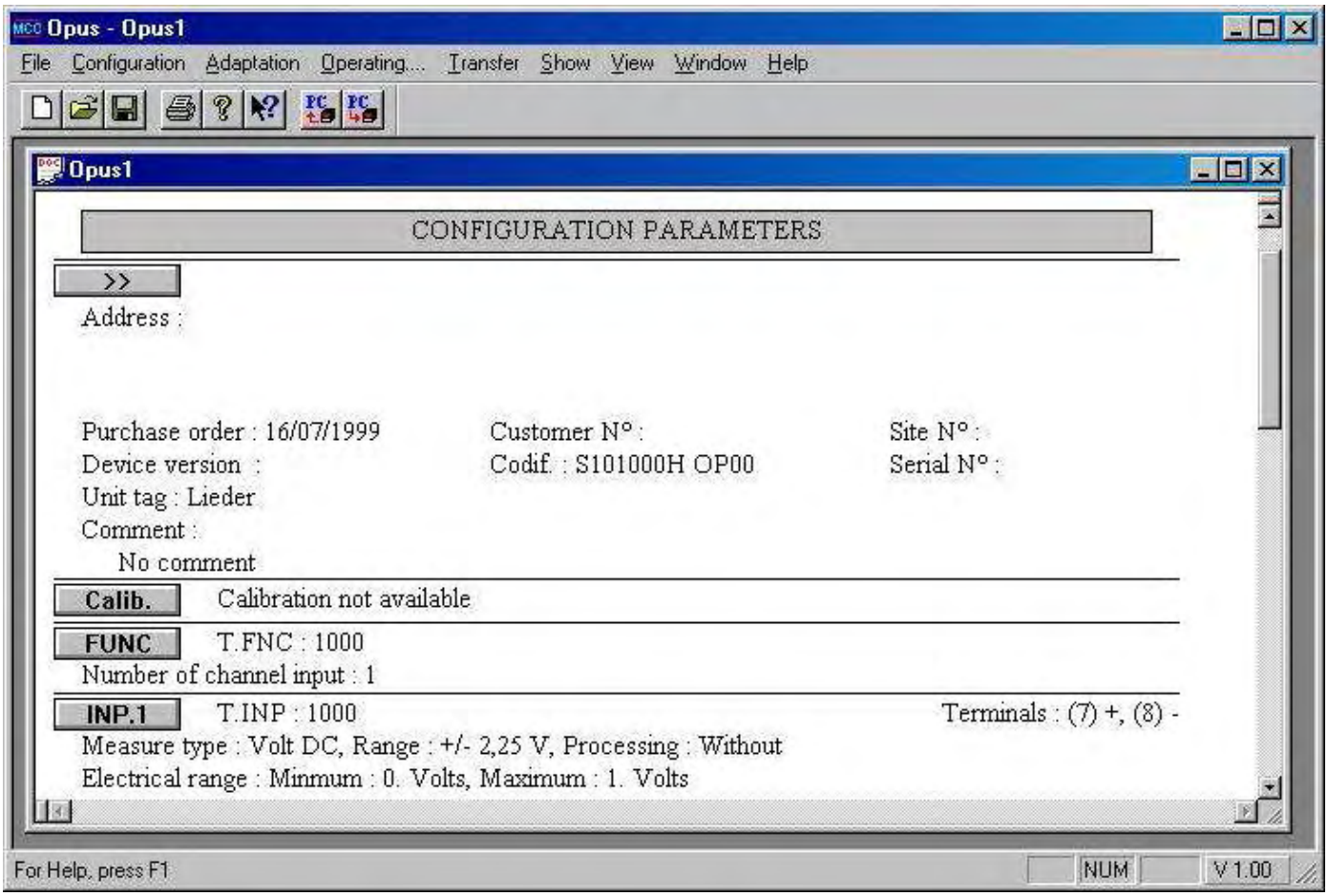
RWS: Parameter you can read and write (100000 time only because saved in E2prom).

8. «OPUS» CONFIGURATION SOFTWARE

This software for configuration of LIEDER controller works on *Windows95 or NT.* It is possible to set up the units through their fascia or through their connection board via RS232/485 interface if the option RS232 or RS485 has been selected.
The modification of any configuration can then be performed at distance on every unit and loaded on a computer.

Trend curves windows are configurable and allow visualization in real time of different parameters of the controllers.

This function is precious tool for the operator during commissioning on site.



9. CALIBRATION

Comment: In certain menu the unit propose an automatic calibration. This document only describes the manual method because automatic calibration requires specific tool.

♦ *Go to calibration:*
- Set up the unit in CONFIGURATION mode using message "CFG FUNC".
- Simultaneously press the keys "▼" and "↵".
- On message "***MODE CAL?***" press on "↵" and adjust cod "**27**".

♦ *On message "**CALb TYP?**" press on "↵"and declared in the board the material characteristic of the unit :*

DIGIT N°1	**DIGIT N°2**	**DIGIT N°3**	**DIGIT N°4**
Option n°1	**Option n°2**	**Option n°3**	**Option n°4**
0.➔ Without	**0.➔** Without	**0.➔** Without	**0.➔** None
1.➔ 0 to 20 mA (Current)	**1.➔** Transmitter supply	**1.➔** Digital Com RS 485	**1.➔** Relay n°3 and n°4
2.➔ 0 to 10 Volts (Voltage)	**2.➔** Relay n°2	**2.➔** Digital Com RS 232	**2.➔** 0 to 20 mA (Current)
	3.➔ Relay n°2 & Auxiliary power supply		**3.➔** 0 to 10 Voltage
			4.➔ 0 to 5 Volts (Voltage)

Note: For the options current and voltage, internal jumpers position has to be checked.

♦ *On message "**CALb VRF ?**" Press on "↵".*
- Check the analog input N°2 and polarization pins are not connected.
- On message "INP 0.0mV?" apply 0 mV ± 0.01% between ground and analog input N°1, pins then press "↵"
- On message "INP 20mV" apply 20 mV ±0.01% then press "↵".
- On message "INP 50mV" apply 50 mV ±0.01% then press"↵".
- On message "INP 90mV" apply 90 mV ±0.01% then press "↵".
- On message "INP 0.90V" apply 900 mV ±0.01% then press "↵".
- On message "INP 2.40V" apply 2.40 V ±0.01% then press "↵".
- On message "RAD=xxxx" check that displayed value is **2.5V ±5%** then press "↵".
- On message "VPl=xxxx" check that displayed value is **1V ±5%** then press "↵".
- Calibration of the controller references is achieved.

♦ *On message "**CALb mA ?**" press on "↵"*
- On message "INP=20.00" apply 20mA ±0.01% between ground and analog input N°1, pins then press ↵".
- On message "INP=2.00" apply 2mA ±0.01% then press"↵".
- On message "MES= xx" check that displayed value is equal to applied value at ±0.01% then press "↵".
- Calibration of milliamp DC input is achieved.

♦ *On message "**CALb RTD?**" press on "↵"*
- On message "INP 175o" connect a resistor 175Ω ±0.01% with 0Ω line resistor through 3 wires mounting like a RTD then press "↵".
- On message "INP L20o" connect a resistor 175Ω ±0.01% and 20Ω ±0.01% on serial mounting with each wire of precedent mounting then press "↵".
- On message "RP=xxxx" check that the displayed value is **4925Ω ±50Ω** then press "↵".
- On message "KA=xxxx" check that the displayed value is **-2 ±30%** then press "↵".
- On message "Rl=xxxx" check that the displayed value is **20Ω ±10%** then press "↵".
- Calibration of RTD input is achieved.

♦ *On message "**CALb KTY ?**" press on "↵"*
- Check that unit has been powered on from more than 30 min.
- On message "INP 0°C" Connect a thermocouple simulator T at 0°C with compensation cable between analog input N°1 and ground then press "↵".
- On message "dR=xxxx" check that the displayed value is less than **±100Ω** then press "↵".
- On message "Tbo=xxxx" check that the displayed value is ambient temperature **±7°C** then press "↵".
- Calibration of cold junction compensation is achieved.

♦ *On message "**CALb O1 ?**" or "**CALb O2 ?**" press on "↵". (only if current or voltage output is installed)*
- On message "10%=xxxx" connect a ammeter or voltmeter according to installed output then adjust with INC / DEC keys, the real value displayed on the control meter then press "↵".
- On message "90%=xxxx" adjust with INC / DEC keys the real value displayed on the meter then press "↵".
- On message "Out=50%?" check that the controller and the meter show the same display value :
  - For a current output display must be **10mA ±0.1%**
  - For voltage output 0-10V, display must be **5V ±0.1%**
  - For voltage output 0-5V, display must be **2,5V ±0.1%**

  then press "↵"
- Calibration of the output is achieved.

♦ *On message "**CALb End ?**", calibration is finished. Press on "↵" unit goes to USER MODE.*

10. CODIFICATION

LIEDER

TYPE
S Size 48x48 mm
M Size 48x96 mm
L Size 96x96 mm

VERSION
1 Standard

OPTION n° 1
0 Without
1 Isolated continuous output n°1 current (0-20 mA or 4-20mA)
2 Isolated continuous output n°1 voltage (0-10 Vcc)

OPTION n°2
0 Without
1 Auxiliary power supply 24 Vcc - 30mA
2 Relay n°2
3 Auxiliary power supply and Relay n°2 (available on Lieder M & L only)

OPTION n°3
0 Without
1 Digital RS485
2 Digital RS232

OPTION n°4
0 Without
1 2 relays n°3 and n°4 output
2 Isolated continuous output n°2 current (0-20mA or 4-20mA)
3 Isolated continuous output n°2 voltage (0-10 Vcc)
4 Isolated continuous output n°2 voltage (0-5 Vcc)

OPTION n°5
0 Without infrared communication
1 With infrared communication

POWER SUPPLY
H 85 to 265 V ac/dc
B 18 to 54 V ac/dc

OTHER OPTIONS
OP00 Without
OP01 Shunt (Specify its value)
OP02 Tropicalization
OP03 Customized configuration in factory
OP04 Calibration certificate

Example : LIEDER S 1 0 1 0 0 0 H OP00