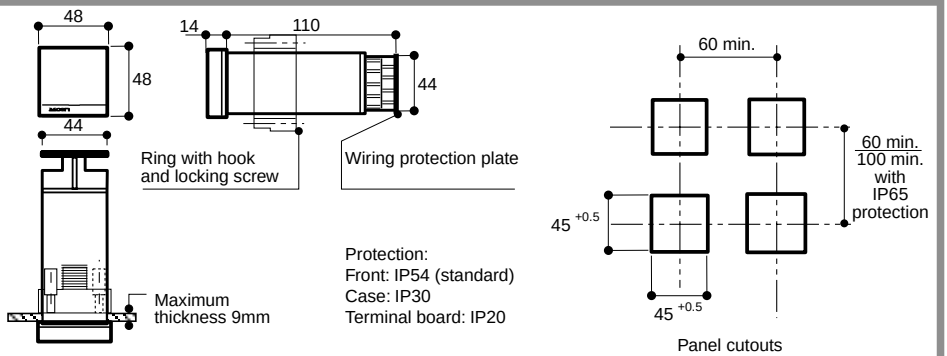
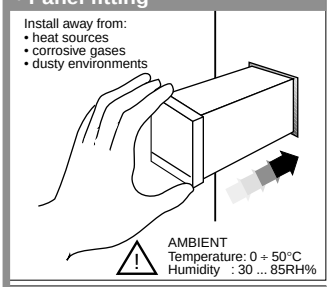
1 • INSTALLATION

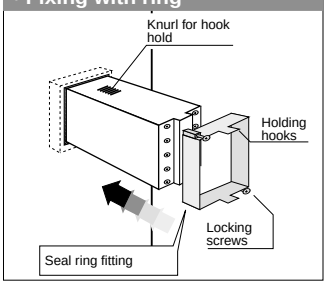
• Dimensions



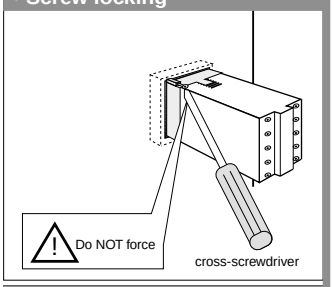
• Panel fitting



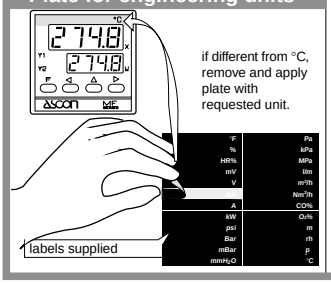
• Fixing with ring



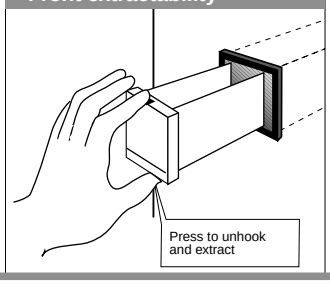
• Screw locking



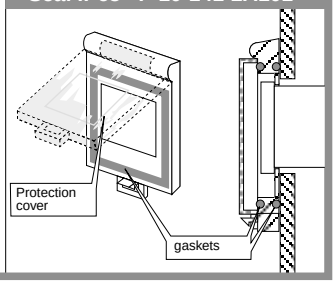
• Plate for engineering units



• Front extractability



• Seal IP65 F-10-141-2A101



Configurable Multi-input Controller
48x48 DIN

MF Series

INSTRUCTION MANUAL
96./03 - Code: ISTR_M_MF_E_01_--

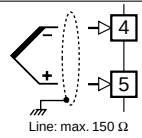
Ascon Tecnologic S.r.l.
via Indipendenza 56,
27029 - Vigevano (PV)
Tel.: +39 0381 69871,
Fax: +39 0381 698730
www.ascontecnologic.com

2 • CONNECTIONS

• Input

- Observe polarity
- For extension, use a compensation cable suitable for the thermocouple used
- The eventual shield must be well earthed at only one end

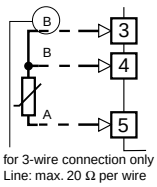
• For THERMOCOUPLES



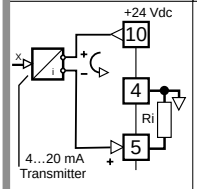
- For 3-wire connection, use wires of same section (min. 1 sq.mm)
- For 2-wire connection, use wires of adequate section (min. 1.5 sq.mm.)

Note:
with a 15 m. probe to controller distance and a 1.5 sq.mm. section cable, the error is about 1°C.

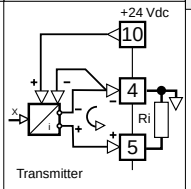
• For RTD Pt100



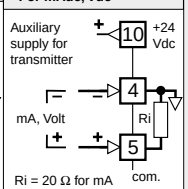
For 2-WIRE TRANSMITTER



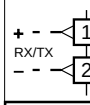
3 or 4-WIRE TRANSMITTER



• For mAdc, Vdc

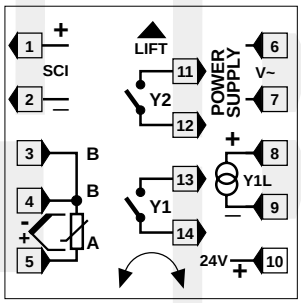


• Serial communication (option)

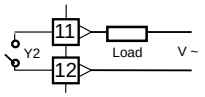


Passive and galvanically isolated interface

Consult Instruction Manual "SERIAL COMMUNICATION SUPPLEMENT" supplied separately

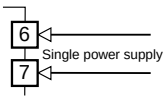


• Auxiliary output Y2



1 NO contact, rated 3A/250Vac for resistive loads (2×10^5 switchings min at 3A/250Vac)

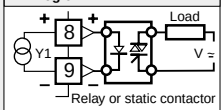
• Power supply



"Switching" type
• Standard: 85…264Vac, 50/60 Hz
• Low voltage: 18…28Vac, 50/60 Hz
20…30Vdc
Power: 3VA

• Main output Y1

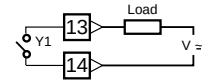
A • Logic



Output 0/24Vdc (20mA max)

It will appear only if configured (D = 1)

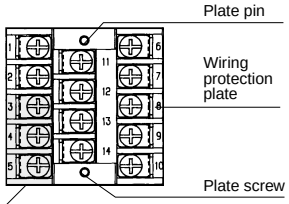
B • Relay



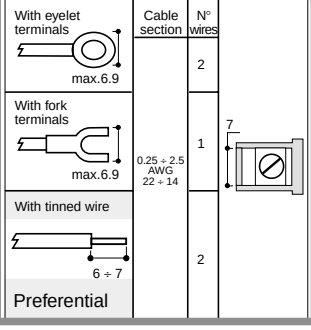
NO contact, rated 3A/250Vac for resistive loads (2×10^5 switchings min at 3A/250Vac)

• Terminal board

14 screw terminals M3.5



• Effecting connections



Precautions

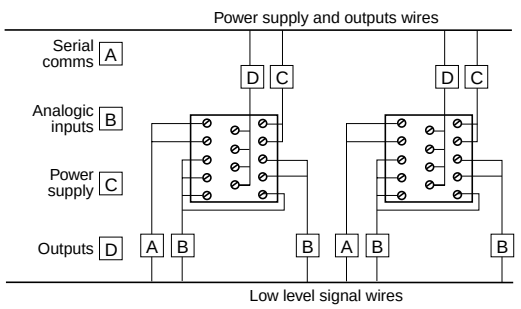
Although this controller is designed to resist the heaviest disturbances present in industrial environments (level IV of standard IEC 801-4), it is advised to keep to the following precautions:

Keep away supply line from others power lines

Keep away from electromagnetic contactors and motors

Keep away from SCR power units, especially if with phase control

Advised wiring



3 • CODIFICATION

Model

Model code	Configuration code	Beginning and end of scale (only for configurable scales)
MF - A B /	C D E F /	G. . . . H

Mains	A
85…264 v 50/60Hz	3
18…28V 50/60Hz and 20…30Vdc	5

Serial communication (option)	B
None	0
Fitted Ascon protocol (std.)	1
Fitted Mod/Jbus protocol	2

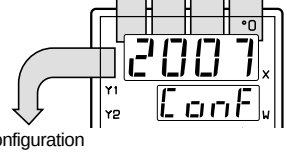
Configuration

Input type, scale range (1)			C
RTD IEC 751	Pt100	-200…600°C	0
	Pt100	-300…1100°F	0
	Pt100	-99,99…300,0°C	1
	Pt100	-99,9…500,0°F	1
Thermocouples IEC 584	Type J	0…600°C	2
	Type J	32…1032°F	2
	Type L	0…1200°C	3
	Type L	32…1032°F	3
	Type K	0…600°C	4
	Type K	32…2032°F	4
	Type S	0…1200°C	5
	Type S	32…2832°F	5
4…20mA		Conf. eng. units	6
0…20mA		Conf. eng. units	7
0…1 Vdc		Conf. eng. units	8
0…10 Vdc		Conf. eng. units	9

Output type Y1	D
Relay 3A/250 Vac	0
Logic 0/24 Vdc	1

Type of action and safety state Y1 (2)				E
On-Off	Reverse	Safety	0%	0
	Direct	Safety	0%	1
	Reverse	Safety	100%	2
	Direct	Safety	100%	3
Fuzzy	Reverse	Safety	0%	4
	Direct	Safety	0%	5
	Reverse	Safety	100%	6
	Direct	Safety	100%	7
	Reverse	Safety	-100%	8
	Direct	Safety	-100%	9

You can configure your instrument just entering trough the keyboard an **4** characters code



The configuration code indexes **C, D, E, F**

Type of Set point and control mode output Y2		F
Disabled		0
Heat-Cool (2)		1
Startup inhibition band	Active outside	2
Band	Active outside	3
	Active inside	4
Independent	Active high	5
	Active low	6
Deviation	Active high	7
	Active low	8
Loop - Break - Alarm		9

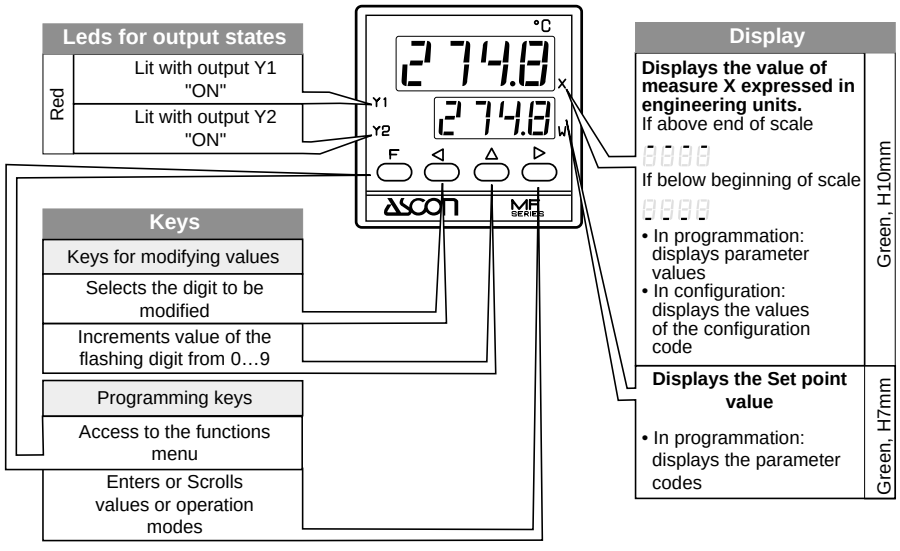
Note:

1 *For mA and Volt inputs the beginning and end scale values can be configured in engineering units between -999 and 9999. The minimum scale span is of 100 steps. The values can be expressed in units (xxxx), in tenths (xxx.x), hundredths (xx.xx) or thousandths (x.xxx).*

2 *The safety value assumed by Y1 and Y2 (if configured heat-cool) in case of failure in the control loop coincides respectively with the upper limit of Yh and Yh2.*

If at the power-up appears 9999 that means the controller **IS NOT CONFIGURED** (see instructions)

4 • KEYS AND DISPLAYS



Leds for output states

Red

- Lit with output Y1 "ON"
- Lit with output Y2 "ON"

Keys

- Keys for modifying values
- Selects the digit to be modified
- Increments value of the flashing digit from 0…9

Programming keys

- Access to the functions menu
- Enters or Scrolls values or operation modes

Display

Displays the value of measure X expressed in engineering units. Green, H10mm

If above end of scale 9999

If below beginning of scale -999

- In programmation: displays parameter values
- In configuration: displays the values of the configuration code

Displays the Set point value Green, H7mm

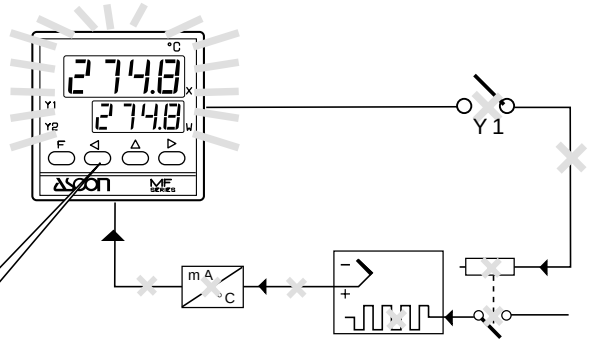
- In programmation: displays the parameter codes

"Loop-Break-Alarm" LBA (interruption/control loop failure)

With Y2 output active and configured as Loop-Break-Alarm

Any interruption in connections or any failure in the operation of one of the control loop components will cause after a few minutes the output Y2 to be energized and the entire front display to flash.

The alarm state stops when the failure having caused it disappears or pressing any key

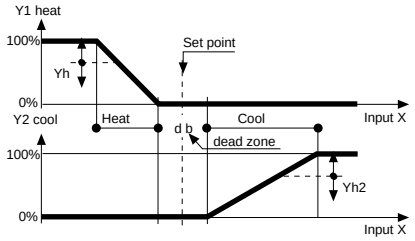


5 • AUXILIARY OUTPUT Y2

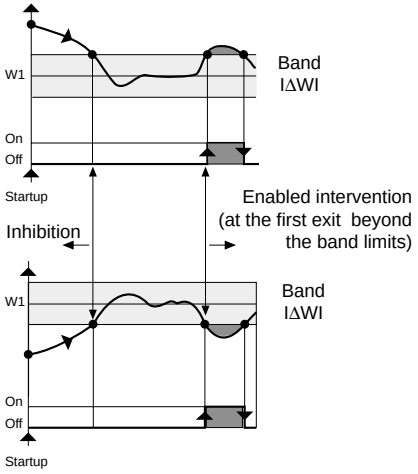
Double action (Heat-Cool)

With Y1 configured for reverse action (E =4.6 or 8) and Y2 configured for Heat-Cool operation (F=1) you obtain:

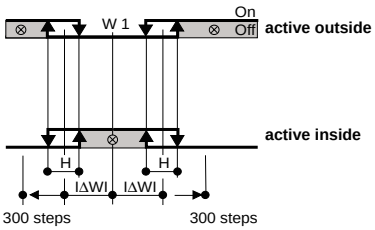
Yh : limits Y1 between 10 and 100%
Yh2 : limits Y2 between -10 and -100%
db : dead zone between 0.0 and 5.0%



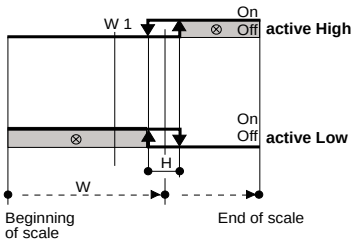
Band with inhibition



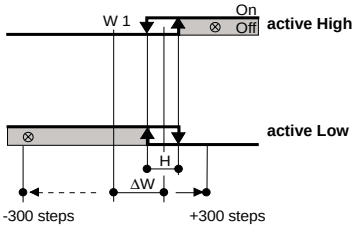
Band IΔWI



Independent W



Deviation ΔW



The Setting range of Y2 is not limited by the limits of main Set point W1 but only by the scale span

6 • PROGRAMMING

Functions menù

Access to functions (press F)

Normal operation

F → S.P. 1 → F → S.P. 2 → F → Pdr → F → tunE → F

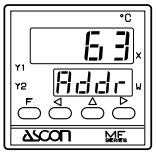
Note:
1 If ▷ or △ is not pressed within 10 seconds the instrument will time-out back to the process variable.

- **S.P. 1** → **Modifies Set point** (see overleaf)
- **S.P. 2** (only if enabled) → **Modifies Set point 2** (see overleaf)
- **Pdr** → **Modify or view parameters**
- **tunE** (only if enabled (index 1)) → **Auto Tune in course** (see overleaf)

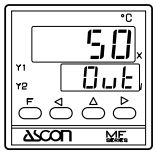
Normal operation

View configuration code

View Instrument **Device number 0...63**



View **% output** Instrument



Return to normal operation

Parameters

PASS Enter password of access (1111)

OK: NO → Return to normal operation

YES → Straightly of the configuration

t.c. 1 Cycling time of **Y1** (not displayed with ON-OFF action) — 30 — 1…200

HY. 2 Hysteresis **Y2** 0.1…10.0% scale — 0.5

Only for controllers with Heat-Cool action (configuration F=1)

- **db.** Dead band 0.0…5.0% output — 1.0
- **t.c. 2** Cycling time **Y2** 1…200 sec. — 30
- **r c r** Relative cool gain 0.1…3.0 — 1.0

- **P.b.** Proportional band 0.5…500% — 50
- **t. i.** Integral time 0.0…100.0 min. — 1.0
- **t.d.** Derivative time 0.00…10.00 min. — 0.20
- **F. Int** Fuzzy intensitive 0.0…90.0% — 50.0
- **F.Err** Fuzzy scale on error 1…500% — 20.00
- **F.dEr** Fuzzy scale on change on error 0.10...99.99% — 10.00

Note:
If the controller is configured as an ON/OFF controller the whole group parameters will be occulted and replaced by:

HY. Hysteresis (ON-OFF) 0.1…10.0% span — 0.5

- **Atu** Type of Tune available: 0 No Tune available, 1 Tune available — 1
- **SPL. I** Set point limit low from beginning to end of scale — beginnig of scale
- **SPL.H** Set point limit high from S.P.L.I. to end of scale — End of scale
- **SLOP** Set point slope 0.0…100.0 digit/min — 0.0 (see note)
- **In.Sh** Input shift -50…50 digit — 0
- **Yh 1** Maximum output value **Y1** 10…100% output — 100
- **Yh 2** Maximum output value **Y2** (cool) 10…100% output — 100
- **t.Sdn** Time sampling 1…30 sec. — 3

Only for models with Serial Communication option (see manual separately)

- **Addr** Addres 0…63 — 0
- **SCbr** Baud rate 0…4 — 1

Baude Rate	
9600 *	0
4800	1
2400	2
1200	3
600	4

* Only for B = 2 or 3

- **SCPa** Parity 0…4 — 0

Parity		Protoc.
None	0	Ascon
Odd	1	Ascon
Even	2	Ascon
None*	3	Modbus
None*	4	Jbus

* Only for B = 2 or 3

Return to 1th parameters

Return to normal operation

Note:
With slope gradient = 0.0 there will be a step change

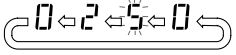
Note: ■ ***FACTORY SET VALUES (DEFAULT)***

Modification of a value

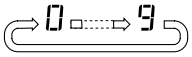
It is possible to modify any value by changing each digit in turn. The modified digit flashes.

Example: to change 250 to 260

Press △ to select the required digit. Each successive press of this button moves the flashing digit one place to the left:



Pressing ▷ increments the selected digit up to the desired value (for the first digit at left there is a - between 9 and 0)



Pressing ▷ to make operative the entered value.

NOTE FOR CONFIGURATION:
All the configuration data are continuously displayed.
There is no time-out.

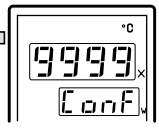
Configuration

PASS Entering password of access to configuration — 3333

OK: NO → Return to normal operation

YES → Entering the configuration

Straightly ← **if not configured at the power-up the main display will show:**



ConF Enter the 4 configuration index codes **C, D, E, F** (they appear on display X)

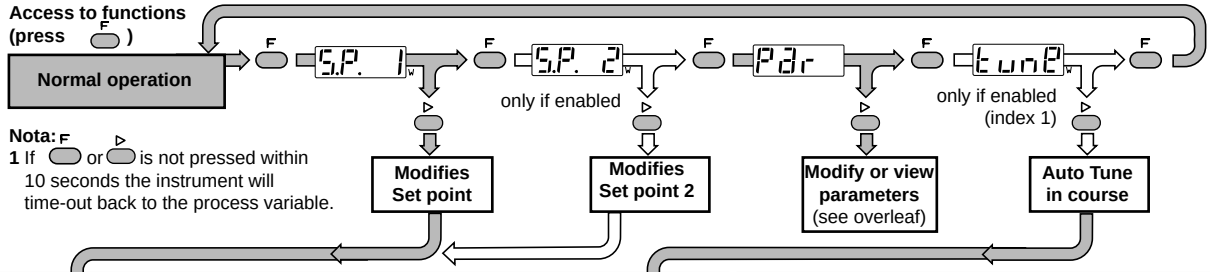
Only for mA and Volt inputs:
- **Scdd** Number of decimal digits 0…3 — 1
- **Sc.Io** Beginning scale value from beginning of scale to end of scale
- **Sc.hi** End scale value from beginning of scale to end of scale

C.F. Eng. unit 0 = °C 1 = °F

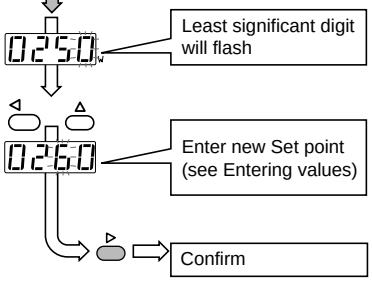
To the group of parameters

7 • PROGRAMMING INSTRUCTIONS

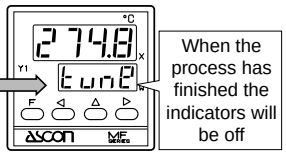
Menu of functions

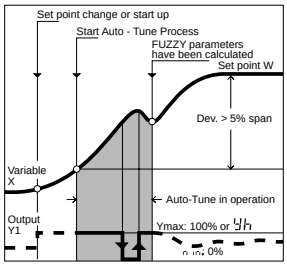


Modify Set point



Auto-Tune

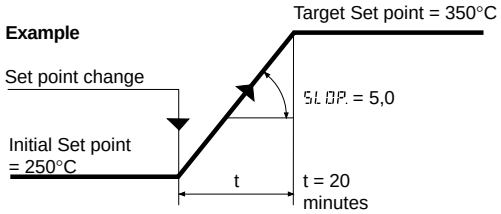




Auto-tune should be used when the instrument is first installed when nothing or little is known about it. Auto-tune identifies rapidly by request the process variables during Set point modification or startup.
When the auto-tune cycle is completed the calculated Fuzzy values will be automatically entered and the procedure shut off (One Shot).
Press any key to disactivate the auto-tune process.
If necessary, the Fuzzy values can be subsequently tuned.

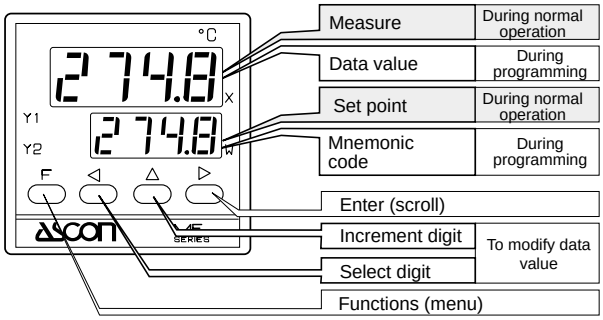
If enable the Auto-Tune function is available:
the deviation > 5% scale span
Auto-tune can be carried out:
if the X variable increases
if the heat/cool control is selected

Set point slope



Nota:
For any Set point change and under any operating condition the target value is reached gradually according to the set slope (SLOP.)
If SLOP. is set to Zero the Set point change is by step

Front panel



8 • TECHNICAL DATA

Accuracy (at 25°C amb.)	0,2% ± 1 digit (for RTD, Pt100 and thermocouples input)		
	0,1% ± 1 digit (for current and voltage input)		
Input "X"	RTD	Pt100, W @ 0°C, (IEC 751)	
	Thermocouple	J-K-S (IEC 584), L (DIN 43710)	
	Direct current	4..20mA, 0..20mA, Ri 20W	Configurable scale (engineering units)
	Direct voltage	0..1Vdc, 0..10Vdc, Ri 10KW	
Set point	1 Local		
	Gradient slope	0,1..100,0 digit/min, or by step	
	Upper and lower limits	from beginning to end of scale	
Control	Algorithm	PID, PID + FUZZY or On - Off	
	F.int	0.0…90.0%	
	F.Err	20…999.9% range	
	F.dEr	0.10…99.99% range/min	
	Cycling time	1..200sec.	
	Hysteresis	0,1..10% (for On - Off control)	
	Dead zone	0.0…5.0% (for heat-cool control)	
Auto - Tune	For automatic Fuzzy parameters adjustment (One shot)		
Main output Y1	Discontinuous with direct or reverse action		
	Relay	1 contact NO, 3A/250Vac, 2x10^5 switchings	
	Logic	0/18Vdc, 20mA max (for SSR)	
	Maximum output limit	10..100%	

Auxiliary output Y2	Relay	1 contact NO, 3A/250Vac	
	Action mode	Active high (above the Set point), Active low (below the Set point)	
	Hysteresis	0,1..10%	
	Max. output	-10…-100 % (if configurated Heat-Cool)	
	Type of Set point	Startup inhibition band	0..300 steps
		independent	from beginning to end of scale
		deviation	± 300 steps
	Special functions	Loop-Break-Alarm (signal of control loop defect)	
		double action "Heat-Cool"	
Serial communication (option)	interface passive and galvanically isolated For other data, see manual MIU-CS/E		
Protections	Immunity to EMI	level IV, standard IEC 801-4	
	All significant data are stored in a non-volatile memory		
Power supply (switching mode)	Standard model	100..240V, 48..63Hz, -15% + 10%	
	Low voltage model	24V, 48..63Hz, -15% +10% or 24Vdc ± 15%	
	Consumption power	about 3VA	
Auxiliary power supply	24Vdc ± 10%, 25mA max	For 2-wire or 3 or 4 wire transmitter	
General features	Isolation group	C according to VDE 0110	
	Climatic group	KWF according to DIN 40040	
	Ambient temperature	temperature 0..50°C, humidity 35..85HR%	
	Protection	Front: IP54 standard (IP65 with Kit F10-141-2A101) Cover IP30, terminal board IP20	
	Material	Self-extinguishing 94V1	
	Weight	about 200 gr.	
	Dimensions	48 x 48 depth. 110mm, according to DIN 43700	

PARAMETER DESCRIPTION

Entering parameters

Once the configuration stage has been completed, the controller will display in sequence all the parameters of the functions selected on which may be entered the required values.

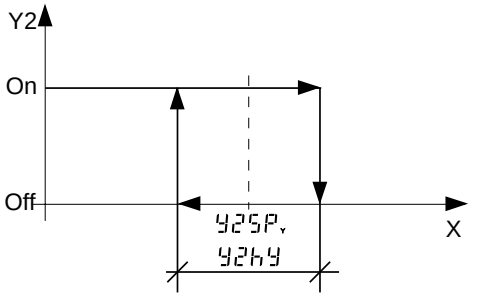
Cycle time of the output Y1 (E = 4...9)

This parameter is expressed in seconds and defines the total time of the On/Off states of the main output Y1 modulated in % of the PID + Fuzzy algorithm.

e.g. If Y1 = 20% and t.c. = 30", the On state = 6" and that of the Off = 24".

Hysterisis of output Y2 (F = 2...8)

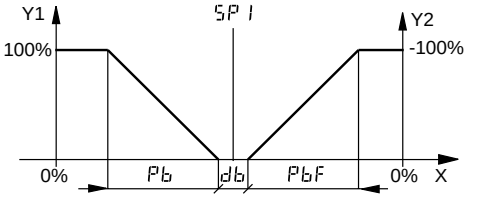
By hysterisis is meant a zone within which an output does not under go changes and maintains the state previously assumed. In order to obtain a change in the state of variable X it is necessary to go outside this zone. The amplitude of this hysterisis zone is expressed as an amplitude % of the configured scale.



HY Hysterisis of output Y1 (E = 0..2)

By hysterisis is meant a zone within which an output does not under go changes and maintains the state previously assumed. In order to obtain a change in the state of variable X it is necessary to go outside this zone. The amplitude of this hysterisis zone is expressed as an amplitude % of the configured scale.

db. The dead zone between the hot and cold outputs (E=4...9 and F=1).



If the variable X coincides with the set point SP1 and the output positions itself at 0% the system will tend to pass continually between hot and cold and vice versa. The parameter involved defines that the command at the output of the controller, whether it is hot or cold, will only be forwarded if it is greater than that written in the same parameter.

tc 2 Cycle time for "cold output" Y2 (E = 4...9 and F = 1).

This parameter is expressed in seconds and defines the total time of the On/Off states of the cold output Y1 modulated in % of algorithm PID + Fuzzy.

e.g. If Y = -20% and tc2 = 30", the On state = 6" and that of the Off = 24".

The output relay contacts are between the terminals 17 and 18.

rcr Relative gain of the "cold" output (E = 4...9 and F = 1).

There is a parameter that determines the amplitude of the proportional band of the cold with respect to that of the hot : PbF = Pb/rcr

PbF = Proportional band output Y2 "cold"

Pb = Proportional band output Y1 "hot"

Pb. Proportional band (E = 4....9)

The band within which commences the modulation of the output in direct proportion to the difference between the set point W and the variable X. It is calculated as a % of the scale amplitude and spread in a symmetrical mode with respect to the set point.

t.i Integral time (E = 4....9)

This is the time used by a single integral action to repeat the contribution supplied by the proportional action. This action is expressed in minutes.

t.d Derivative time (E = 4....9)

This is the time taken for a single proportional action to attain the same level as the P + D output. This action is expressed in minutes.

F.int Percentage intensity of fuzzy action (E = 4...9).

The main control output is composed of the sum of two control algorithms, Fuzzy and PID. This parameter permits the balancing as a % of the proportion of the fuzzy algorithm in relation to that of the PID.

F.Err Span of fuzzy operational zone (E = 4...9)

The parameter in question permits the definition of the zone of operation for the fuzzy algorithm and is calculated in % of scale. The optimum value of this zone can be calculated using the following formula:

F.Err = 4 x Pb

F.dEr Fuzzy derivative (E = 4...9).

This parameter permits "informing" the fuzzy algorithm of the speed of the process to be controlled. It is expressed as " % scale/minute" and its optimum value can be calculated with the formula : F.dEr = 2 x Pb / t.i

Pb = Proportional band expressed as a percentage

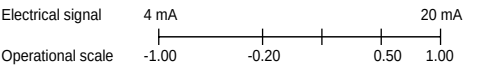
t.i = Integral time expressed in minutes.

Atu The purpose of this parameter is that of setting / tuning the automatic searching of PID and Fuzzy parameters. On entering "0" the tuning function is disabled and the "tune" parameter is no longer available in the main menu.

SPL l Limit of lower excursion of main set point SP1

SPLh Limit of upper excursion of main set point SP1

Example of imputting set point limits



The main control set point SP1 may only be freely entered between the two parameters SPLl and SPLh. trying to input an "external" set point beyond the limit values, will be taken to be the entering of the relative limit.

Rate of variation of the main set point SP1.

Any new value entered for the main set point SP1 will be associated with the speed of that parameter. On switching on the controller put W = X and it will settle on the target set (the SP1 previously entered) with the established speed. The slope is expressed in digits/minute.

A function that modifies the "calibration" of the start of the scale.

This parameter serves to transfer the value of the scale start for ±50 digits. This function is most useful in those cases where it is necessary to aline the reading of controllers with obtained sample values. Entering "0" returns the controller back to its original calibration.

The maximum value that may be assumed at Y1 (E = 4...7)

Normally the control output is free to move between 0% and 100%. With this parameter in use it is possible to limit the required maximum value by which the control output will be free to move between 0% and the value written in the parameter Yh.

The maximum value that may be assumed at Y2 (E = 4 ..9 and F = 1)

Normally the control output is free to move between 0% and 100%. With this parameter in use it is possible to limit the required maximum value by which the control output will be free to move between 0% and the value written in the parameter Yh.

Sampling time (E = 4...9)

This parameter determines the sampling time and is variable between 1 and 30 seconds max. The optimum sampling time is relative to the speed of the process to be controlled and is given by :

= x 60 / 4 x

= Proportional band expressed in % of scale

= Integral time expressed in minutes.

Recognition address of serial communication (B = 1)

Rate of serial communication (B = 1)

Parity control of serial communication (B = 1)

These three parameters are related to serial communication, they only appear during the setting up phase of the instrument (B = 1) and do not relate to the configuration.