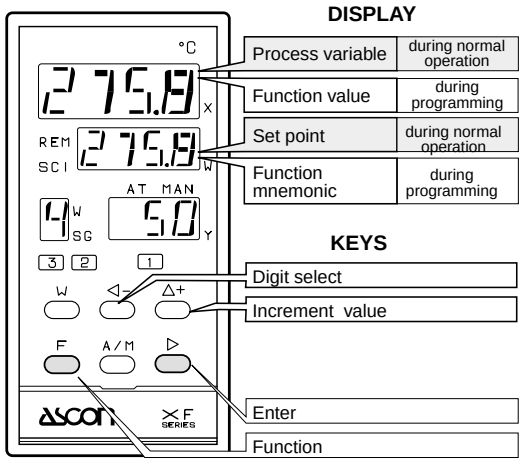
7•PROGRAMMING INSTRUCTIONS • XF SERIES CONTROLLERS

FUNCTIONS MENU

DISPLAY



To enter function mode, press F

Normal Operation

- View **Target Set point** (S.P. t)
- tunP → Run **Auto - Tune function**
- Par. → Modify or view **Parameters**
- View **Configuration code** (ConF) → 4230 / 7500 (Co) → **Start Configuration Procedure**
- only for models with serial comms: View instrument **Device number 0 … 63** (Addr → 63 / Addr)

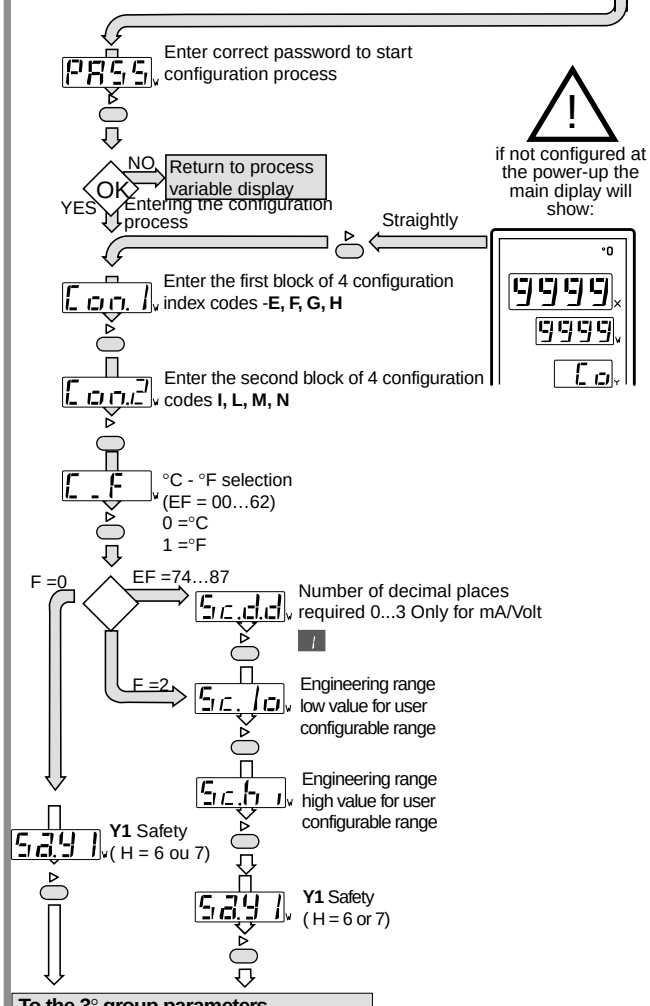
Serial Communication status enabled to write

Note:

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

2 If SL.u = SL.d = 0, will not appear.

CONFIGURATION

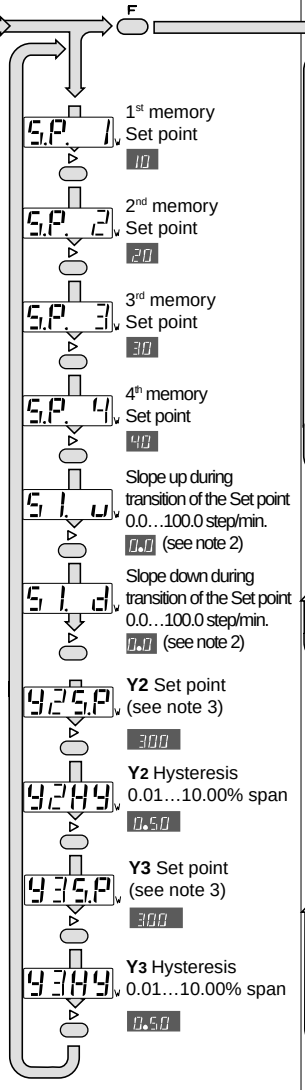


Exting the configuration process you will access straightly the 3° group of parameters to modify, if necessary, Set point limits, maximum power output etc…

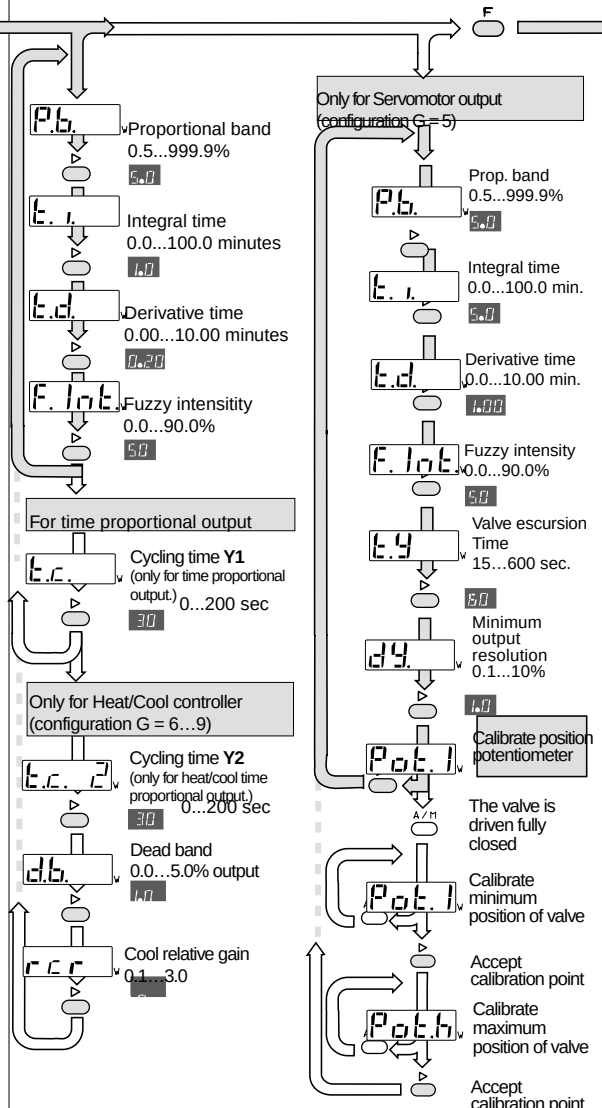
Note
The configuration code shall be continuosly shown. There is no time-out.

PARAMETERS

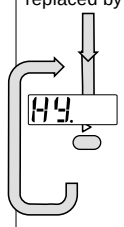
GROUP 1



GROUP 2



Note:
If the controller is configured as an ON/OFF controller the whole group 2 parameters will be occulted and replaced by:



Note:

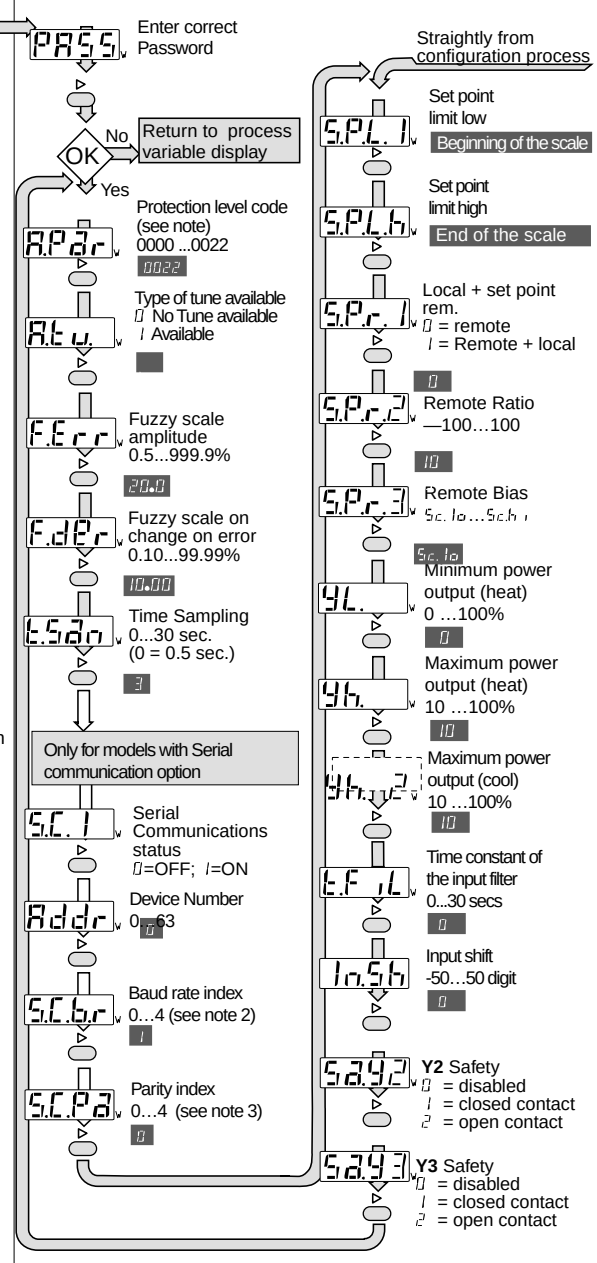
1 The 4 memory set point will only be shown if configuration code N=3

2 If slope gradient = 0 there will be a step change

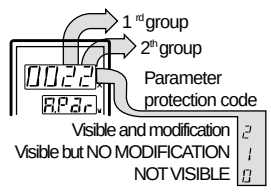
3 Allowable Set point values depend upon the type of alarm configuration
- Deviation alarm : -300…+300
- Band alarm: 0…300
- Independent: on full scale

4 Parameters Y2 and Y3 will not appear if in the configuration code (I = 0 and L =0)

GROUP 3



Note: Parameter protection



Note 2

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

* Only for B = 2 or 3

Note 3

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

* Only for B = 2 or 3

Note: ■ **factory set parameters**

CONFIGURATION CODE

Input type, scale range (1)			E	F
RTD Pt100 IEC 751		-200…600°C	0	0
	Conf.	-200…600°C	0	2
		-99.9…300,0°C	1	0
	Conf	-99,9…300.0°C	1	2
Thermocouple J Fe Cu 45%Ni IEC 584		0…600°C	2	0
	Conf.	within 0…600°C	2	2
Thermocouple L Fe-Const DIN 43710		0…600°C	3	0
	Conf.	0…600°C	3	2
Thermocouple K Cromel-Alumel IEC 584		0…1200°C	4	0
	Conf.	0…1200°C	4	2
Thermocouple S Pt10%RhPt IEC 584		0…1600°C	5	0
	Conf.	0…1600°C	5	2
Thermocouple R Pt13%RhPt IEC 584		0…1600°C	6	0
	Conf.	0…1600°C	6	2
4...20 mA	Conf.	eng. units	7	4
0...20 mA	Conf.	eng. units	7	5
0...1 Vdc	Conf.	eng. units	7	6
0...10 Vdc	Conf.	eng. units	7	7
4...20 mA	Conf. eng. units with √		8	4
0...20 mA	Conf. eng. units with √		8	5
0...1 Vdc	Conf. eng. units with √		8	6
0...10 Vdc	Conf. eng. units with √		8	7

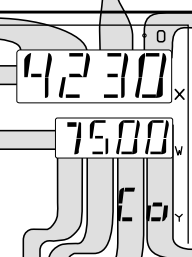
Type of output Y1 (2)	G
Relay (On - Off with hysteresis	0
Relay with time-proportioning	1
Logic 0/24 Vdc with time-proportioning	2
4…20 mAdc	3
0…10 Vdc	4
Servomotor output	5
Relay with time-proportioning *	6
Logic 0/24 Vdc with time-proportioning *	7
4…20 mAdc *	8
0….10 Vdc *	9

* **Only for Heat-Cool instruments**

Type of action and safety Y1(3)			H
Reverse	Safety	0%	0
Direct	Safety	0%	1
Reverse	Safety	100% (Yh)	2
Direct	Safety	100% (Yh)	3
Reverse	Safety	-100% (Yh2) *	4
Direct	Safety	-100% (Yh2) *	5
Reverse	Safety	Conf (4)	6
Direct	Safety	Conf (4)	7
Reverse	Safety	Off	8
Direct	Safety	Off	9

First block of 4 configuration code **E,F,G,H**

Second block of 4 configuration code **I,L,M,N**



You can configure your instrument just entering trough the keyboard an **8** characters code

if at the power-up you will see
9999 -9999
that means the instrument **IS NOT CONFIGURED**

Type of Set point and control mode output Y2		I
Disabled		0
Deviation with startup inhibition	Active high	1
	Active low	2
Band	Active outside	3
	Active inside	4
Independent	Active high	5
	Active low	6
Deviation	Active high	7
	Active low	8

Type of Set point and control mode output Y3		L
Disabled		0
Deviation with startup inhibition	Active high	1
	Active low	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

Type of Set point		N
Standard	1 Local	0
	1 Local and Remote 4…20 mA	1
	1 Local and Remote 0…10 Vdc	2
	1 Local + 4 stored	3

Retransmission output Y4		M
None (5)		0
4…20 mA	Retrasmission measurement X	1
	Retrasmission Set point W	2
	Retrasmission Y1 Cool	3
0…10Vdc (6)	Retrasmission measurement X	4
	Retrasmission Set point W	5
	Retrasmission Y1 Cool	6

NOTES:

1 For Pt100 and thermocouple inputs with configurable scale, it advised to select significant and round figure scale ranges (-50...150°C, 0...400°C). The minimum span should not be less than 25% of the maximum range. Keep in mind that, within the selected range, it is possible to limit the setting interval of the Set point between the lower and upper value.
For mA and Volts inputs, the beginning and end of scale values can be configured in engineering unit beetwen -999 and 9999. The minimum scale span is 100 steps.
The values can be expressed in units (xxxx), in tenth (xxx.x), hundredths (xx.xx), or thousandths x.xxx).

2 **In order to select some types of output. It is also necessary to set a switch placed inside the instrument.**
For heat-cool control, select the outputs with *.

3 The safety state is the value assumed by Y1 in case of failure in the control loop. Actually, it is the value defining the upper limit of Y1. Safety states with * (H-4) or (H-5) impose the maximum limit to Cool action.

4 Selecting H(6,7) is possible to setting the safety value assumed by Y1 in case of failure in the control loop.

5 Excluding the retrasmission output option (C-0) implies selecting (M-0) in configuration.

6 **Passing from 4...20 mA to 0...10V is obtained also by moving a jumper inside the instrument.**

Entering parameters

Once the configuration phase is completed, the controller will display all the parameters of functions that may be entered to their desired values. To simplify the exercise the parameters have been divided into two groups plus one. In the first group are listed all the parameters related to the set point of the instrument, in the second are inserted the PID control parameters and in the third group, which is protected by the password 1111, are inserted the access and/or operation indexes, the fuzzy control parameters, the parameters for the serial communication, all the limiting functions and safety states functions.

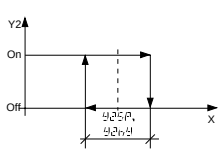
First group of parameters

SP.1 Stored set point **1** (N = 3)
SP.2 Stored set point **2** (N = 3)
SP.3 Stored set point **3** (N = 3)
SP.4 Stored set point **4** (N = 3)
The memorised set points are the preset values for operation, recalled through logic inputs, serial transfer or the front keyboard. When one of these set values is recalled the small auxiliary display on the front of the instrument shows the set number recalled.

SL. u Rate of variation in increase of the main set point SP.
Any new value of the main set point SP greater than that previously entered from the front keyboard, by linear transfer or recalled through logic or remote analogue inputs, will be associated with the rate established for that parameter. On switching on the controller put **W = X** and it will settle on the target set (the previously entered SP) at the established rate. The slope is expressed in digits/minute.

SL. d Rate of variation in decrease of the main set point SP.
Any new value of the main set point SP greater than that previously entered from the front keyboard, by linear transfer or recalled through logic or remote analogue inputs, will be associated with the rate established for that parameter. On switching on the controller put **W = X** and it will settle on the target set (the previously entered SP) at the established rate. The slope is expressed in digits/minute.

Y2SP Set point of output Y2 (I = 1.....8)
Y2HY Hysterisis of output Y2 (I = 1....8)
By hysterisis is means 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.



Y3SP Set point of output Y3 (L = 1....8)
See Y2SP
Y3HY Hysterisis of output Y3 (L = 1....8)
See Y2HY

Second group of parameters

HY Hysterisis of relay output Y1 (G = 0)
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. The output contacts are to be found between terminals 16 and 17.

Pb Proportional band (G = 1....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.

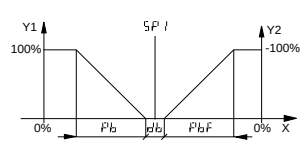
t.i Integral time (G = 1....9)
This is the time used by a single integral action to repeat the contribution supplied by the proportional action. This action is expressed in minutes.

t.d Derivative time (G = 1....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.mt Percentage intensity of fuzzy action (G = 1...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.

t.c Cycle time of the output Y1 (G = 1,2,6,7)
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".
If G = 1 or 6, the output relay contacts are between terminals 16 and 17.
If G = 2 or 7, the logic output as a voltage is available between the terminals 19(+) and 20(-).

tc 2 Cycle time for "cold output" Y1 (G = 6...9 and M = <> 3, <> 6).
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.



db The dead zone between the hot and cold outputs (G = 6...9)
If the variable X coincides with the set point SP 1 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.

rcr Relative gain of the "cold" output (G = 6...9).
This 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 Y1 "cold"
Pb = Proportional band output Y1 "hot"

tY Total rotation time for servomotor (G = 5)
This is the time used (expressed in seconds) for valve servomotors to travel from its lower run limit to its upper run limit. As a control algorithm of the "floating" type, this parameter is fundamental to a correct positioning of the valve servomotor.

dY Resolution of positioning or dead zone (G = 5).
This parameter expressed in actuator run %, defines the minimum movement required for the servomotor. All the commands given by the control algorithm with lower amplitudes than the value written in the dy parameter, will not be executed.

PoSt Input procedure for calibration of servomotor position (G=5)
This parameter is added if the A/M button is pressed to enter into the calibration phase and the controller automatically locks on the servomotor. When on the X display the numbers stop it signifies that the servomotor has reached its lower run limit. Pressing the A/M button again, the controller stores the "0%" position and drives the servomotor to its maximum opening. When on the X display the numbers stop it signifies that the servomotor has reached its upper limit. Pressing the A/M button again, the controller stores the "100%" position. At this point the calibration operation is concluded and to terminate it is necessary to press the "> enter" button. During the calibration phase it is useful to time with a stopwatch the rotation for later insertion in the ty parameter.

Third group of parameters

APAr Access password to parameter groups
This function permits the concealment, viewing , but not modifying or rendering completely accessible groups of parameters. The first digit on the right of the display corresponds to the second group, the second digit from the right corresponds to the first group of parameters. The significance of the numbers to be inserted is as follows:
- 0 Group not visible
- 1 Group visible, without any facility to modify parameter contents.
- 2 Group visible, with facility to modify parameter contents.

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.

FSPr Span of fuzzy operational zone (G = 1...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 : **FSPr = 4 x Pb**

FdPr Fuzzy derivative (G = 1...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 : **FdPr = 4 x Pb/t.i**
Pb = Proportional band expressed as a percentage
t.i = Integral time expressed in minutes.

t.Sam Sampling time (G = 1...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 :
t.Sam = t.i x 60 / FSPr
Pb = Proportional band expressed in % of scale
t.i = Integral time expressed in minutes.

SCnf Fixing of parameter levels by linear transfer (B = 1)

Addr Recognition address of serial communication (B = 1)

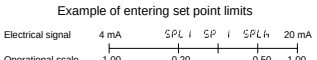
SCbr Rate of serial communication (B = 1)

SCPA Parity control of serial communication (B = 1)
These four 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.

SPL 1 Limit of lower excursion of main set point SP1

SPLh Limit of upper excursion of main set point SP1

Example of entering set point limits

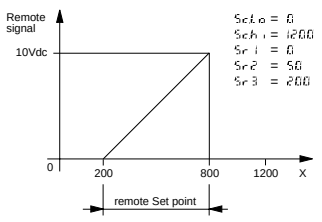


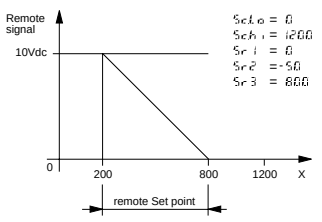
The main control set point SP 1 may only be freely entered between the two parameters SPLL and SPLh. Trying to input an "external" set point beyond the limit values, will be taken to be the entering of the relative limit.

SPr 1 Sum of Local + Remote Set Points (N = 1,2)
This function permits the adding together of the remote analogue set point and the value of the local set point.
- 0 Set point target = remote set point
- 1 Set point target = remote set point + local set point

SPA2 Gain control on remote analogue set point (N = 1,2)
This parameter determines the excursion limits of the remote set point.
The inputable values are compressed between - 100 and 100.
Entering a value compressed between 1 and 100 , if there is a direct action augments the analogue signal and augments the remote set point.
Entering a value compressed between - 1 and -100 , if there is an inverse action, augments the analogue signal and diminishes the remote set point.
Entering "0" will not result in any variation of the remote set point and will coincide with the written value in parameter SPr 3. In order to calculate the excursion amplitude of the remote set point the following formula may be used:
SPr = AS. x SPr2 / 100
- SPr = Amplitude of remote set point
- AS. = Scale amplitude expressed in operational units
- SPr2 = Number inserted in parameter

In order to better understand the functioning of these linearisation parameters refer to the two examples in the following drawings.





SPr3 Controlling zero on analogue remote set point (N = 1,2)
With this parameter it is possible to establish the starting point for the remote set point with the minimum remote input signal (0Vdc or 4mA). The inputable limit values correspond to the extreme values of the configured scale, SCLo and SCh i.

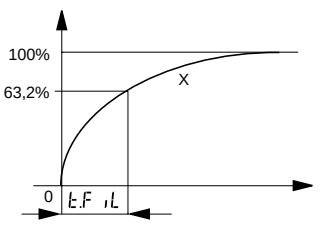
YL The minimum value that may be assumed at Y1 (G = 1...4)
Normally the control output is free to move between 0% and 100%. With this parameter in use it is possible to limit the required minimum value by which the control output will be free to move to that between the written value in the parameter YL and that written in the parameter Yh. In the event of variable X going outside the scale limits, the value written in the parameter will not be respected and the output will assume the defined value of the safety state of Y1. (Configuration position H)

Yh The maximum value that may be assumed at Y1 (G = 1...9)
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 YL and the value written in the parameter Yh. In the event of variable X going outside the scale limits, the value written in the parameter will not be respected and the output will assume the defined value of the safety state of Y1. (Configuration position H)

YL2 The maximum value that may be assumed at Y2 (G = 6...9)
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. In the event of variable X going outside the scale limits, the value written in the parameter will not be respected and the output will assume the defined value of the safety state of Y1. (Configuration position H)

tF iL Time constant of the agent digital filter on variable X.
This parameter defines the time constant of the digital filter positioned on the input variable X. Given an instantaneous variation between 0% and 100%, variable X will reach 63.2% in the time indicated in the parameter tF iL.

The affect of the time constant tF iL on the input signal X



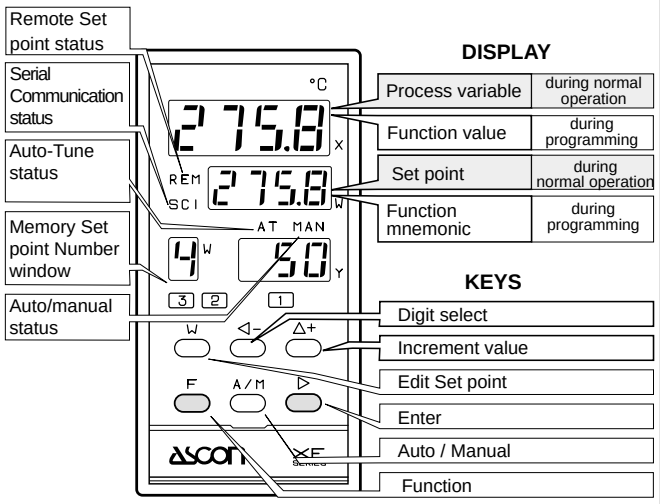
InSh A function that modifies the "calibration" of the start of the scale.
This parameter serves to transfer the value of the scale start for ±50 digits. This function is most useful in those cases where it is necessary to aline the reading of controllers with obtained sample values. Entering "0" returns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

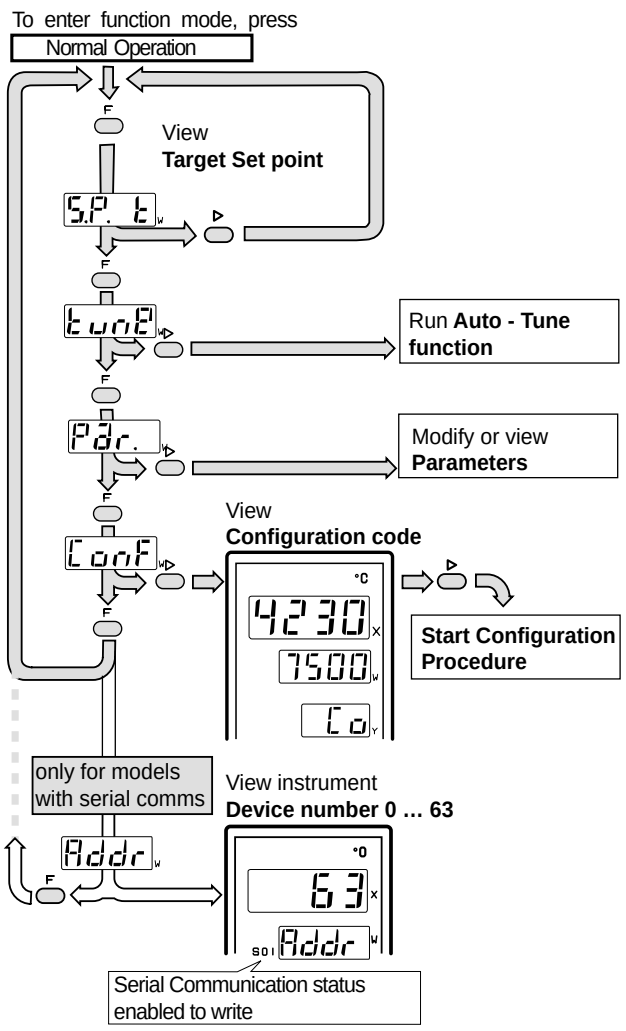
SAY2 Safety state of Y2 (I = 1...8)
With this parameter it is possible to define the state taken up by the output Y2 in the case of the output of the variable X going off scale whether it beyond the upper or lower limit.
- 0 Function excluded. Normal operation of alarm respected.
- 1 Output held in the On state.
- 2 Output held in the Off state

SAY3 Safety state of Y3 (I = 1...8)
With this parameter it is possible to define the state taken up by the output Y3 in the case of the output of the variable X going off scale whether it beyond the upper or lower limit.
- 0 Function excluded. Normal operation of alarm respected.
- 1 Output held in the On state.
- 2 Output held in the Off state.

8 • OPERATING INSTRUCTIONS • XF SERIES CONTROLLERS

FUNCTIONS MENU



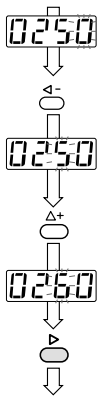


Note:

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

MODIFICATION OF A NUMERIC FIELD

It is possible to modify any numeric field by changing each digit in turn.



Example: to change 250 to 260

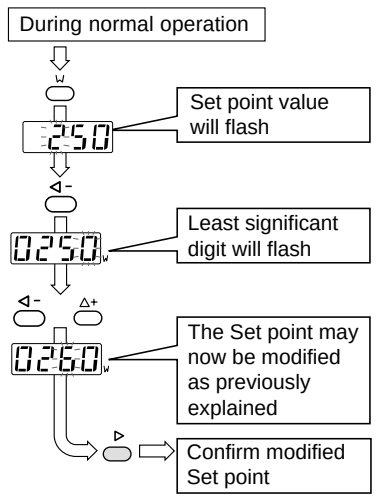
pressing ◁- to select the required digit.
Each successive press of this button moves the flashing digit one place to the left.

Pressing △+ increments the selected digit (for the most significant digit there is a - between 9 and 0)

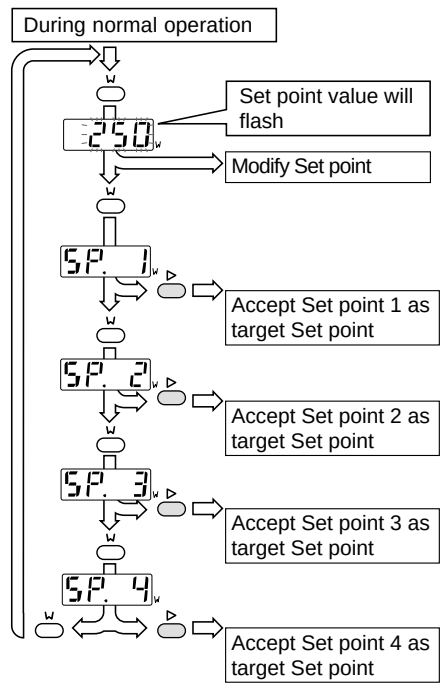
Pressing ▷ to accept the field or the field will be accepted automatically after the 10 seconds time-out.

SET POINT

Modify Set Point



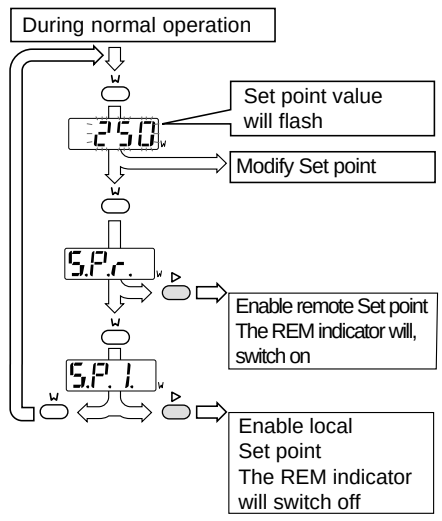
Procedure to recall a Set point from memory



Note:
The above Set points may be modified from the 1th group within the parameter menu.

The displayed Set point is only effective from when ▷ is pressed.

Local ⟺ Remote



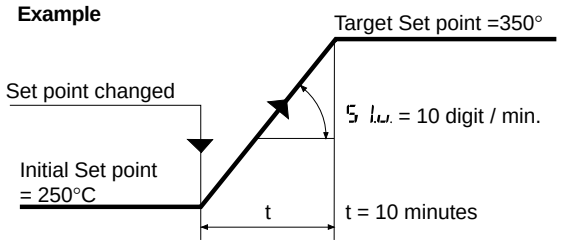
Note:
If a Remote Set point is selected, the instrument will store the Local Set point value shall be re-instated if the Local Set point mode is required

Note:
After the Set point has been modified the new target Set point will be reached after a period of time, depending upon the values entered in the SLu (Slope up) and SLd (Slope down) gradient parameters.
Whit Remote Set point we suggest, to set SLu and/or SLd to 0
The target Set point can be viewed at any time from the function menu.

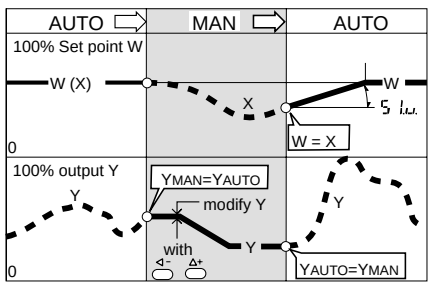
F ⇨ SP. t **Target Set point**

If slope gradient is equal to zero there will be a step change

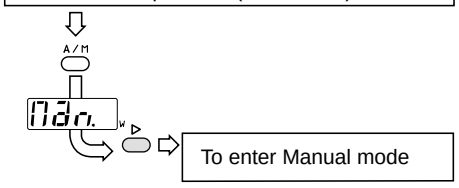
Example



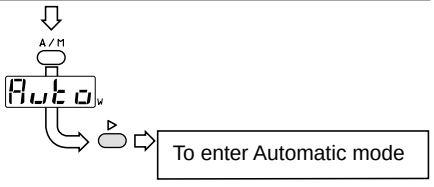
AUTO-MAN



From normal operation (Auto mode)



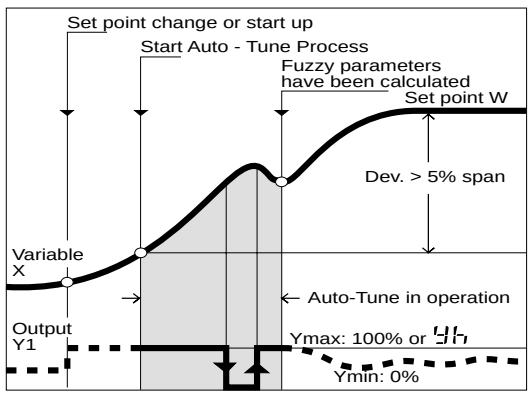
From normal operation (Manual mode)



TUNING

AUTO-TUNE

Auto-tune should be used when the instrument is first installed to provide approximate values for the FUZZY algorithm.
When the auto-tune cycle has been completed, the values for FUZZY (FEr; FdEr; tSan) will be automatically entered.
It is possible to escape from the auto-tune procedure at any time by pressing any key.



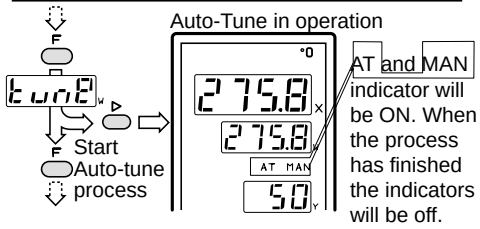
The Auto-tune function is available if the following requirements are met:

1. Parameter AtU = 1
2. The deviation > 5% span

Auto-tune will function correctly:

- if the X variable has to increase or decrease
- if the heat/cool facility is selected the Auto-tune process will calculate the FUZZY parameters for both heat and cool.

From normal operation (Auto mode)



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