

# Configurable Multi-Input, Multi-Set point Controller for servomotor 1/8 DIN - 48 x 96 mm XP line

A single loop process controller with innovative features, thanks to total configurability permitting selection of: input, outputs, alarms and operation modes directly from keyboard.

- **Accuracy:** 0,2
- **Input:** universal configurable (Pt 100, J, L, K, S, R, mA, Volt). Configurable scale range
- **Logic inputs:** 3
- **Control mode:** PID "floating motor-positioning" with approaches
- **Expert self-tuning:** for automatic adjustment and optimisation of PID parameters
- **Auto/Manual Station:** built-in
- **Main output:** 3 positions with 2 interlocked relays
- **Auxiliary outputs:** 2 with relay, configurable
- **Loop Break Alarm**
- **Set point:** local, remote, multi-Set point (up to 4)
- **Access to parameters:** on 3 different levels for: modification, display only, and no-access

- **Single power supply:** 100...240 Vac switching type, or 24 Vac and 24 Vdc
- **Auxiliary power supply for external transmitter:** 24 Vdc
- **Front protection:** IP54 standard, IP65 with optional front panel gasket
- **Front withdrawable**
- **Dimensions:** 48 x 96 DIN, depth 150

Options:

- **Serial communication**
- **Retransmission output:** 4...20mA or 0...10 V analogue signal
- **Programmable Set point:** 1 programme storable up to 11 segments



# An intelligent time positioning modulation control with XP Series Controller

This new series of controllers with truly innovative features is the outcome of ASCON's wide experience in electrical valve control combined with the use of the latest electronic technology.

## Total configurability from keyboard

All possible functions are simultaneously available in the instrument. Model and operation mode are selected according to the specific application through instrument configuration from the front keyboard or via a serial line with an eight figure code. Besides, it is very easy to reconfigure the controller on field to meet changing requirements. Total configurability concerns the input type and scale range, control action, safety state, Set points, the 3 auxiliary outputs.

## Automatic tuning

For simple and quick optimisation of control parameters.

## Serial communication

Configurable protocol and access to all controller parameters for working in a distributed control network.

## All types of Set point

The working Set point can be Local, Remote, Time programmed or can be selected among four stored ones, thus increasing automation level.

## Simple use

The most significant data appear clearly and completely on a "custom" display with different figure size and brightness for easy reading.

## Maximum protection

High immunity to interferences, guided procedures and 3 levels of access to control and operation parameters.

## In short ...

Maximum flexibility of use, high performance/price ratio, drop in stock costs.



Single power supply  
100 to 240 Vac

IP 54 or IP 65  
Front protection

Display of  
measurement or  
parameter values

Display of Set point or  
mnemonic parameter  
codes

Auto-tune in course

Decrease output  
"On"

Manual operation

Valve position  
display

Increase output  
"On"

Keyboard

Extraction screw

Remote Set point  
activated

Serial communication  
activated

Stored programme in  
course of execution

N° of the called  
Set point  
N° of the segment in  
execution

Standby of  
programme in  
execution

Auxiliary output Y3  
"On"

Auxiliary output Y2  
"On"

Model code plate

# General description

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## INPUT

Suitable for use with most common temperature probes (thermocouples J, L, K, S, R), resistance thermometers (Pt 100), as well as for normalised current (mA) or voltage (V) signals. Input type, scale range and full scale values can be programmed using the front panel keys.

## LOGIC INPUTS

According to the adopted configuration, 3 logic inputs can modify the controller modes of operation by means of external commands. For instance: Automatic-Manual-transfer, Local-Remote Set point switching, recalling a stored Set point, handling a stored programme (launching, temporary waiting, resetting).

## MAIN OUTPUT

Main output Y1 is a three-position output: Increase, Stop, Decrease. Supplies pulses by means of 2 interlocked contacts, suitable for actuators equipped with electrical constant speed servomotor (motorised valves, electrical pistons, locks, etc.). Inverse or direct action may be selected in the configuration phase.

## AUXILIARY OUTPUTS

Auxiliary outputs Y2 and Y3 are with relay (5A/250 Vac) and their actions are configurable from keyboard. The action mode (Active High/Active Low) and type of Set point (deviation, band or independent) can be selected for both outputs. With the "programmable Set point option", the 2 auxiliary outputs may be associated with the Set point, as logic outputs associated to the time-programmed Set point profile. Both can also be configured as deviation alarm with "startup inhibition", to avoid undesirable actions in the starting phase.

## LOOP BREAK ALARM

In order to signal failure or interruption of the control loop, auxiliary output Y3 may be used for "Loop Break Alarm" action. Simultaneous flashing of all controller displays signals the alarm.

## RETRANSMISSION OUTPUT

In option for retransmission of the measurement or of the Set point value. Galvanically isolated.

## CONTROL

Of "floating motor-positioning" type, which combines the advantages of "floating control" and "position feedback" while avoiding their disadvantages.

In critical operating conditions, the 3 actions P, I and D may be backed up by Approach High and Low action in order to improve the response in case of large Set point changes or in presence of strong disturbances on the process.

## AUTOMATIC TUNING

Automatic tuning for computation and automatic set of PID optimum parameters operates in two distinct ways.

Auto-tune identifies the parameters in open loop in the starting up phase, or when the Set point is modified, or in normal conditions whenever deemed useful by the operator. Enabled on the operator's request, it is automatically disconnected at the end of the operation (One shot).

The Expert-tune continually analyzes the closed loop response, in order to re-tune the parameters during working conditions. It operates in case of Set point deviation higher than 1%. Enabled by the operator, it remains active until disabled.

## SET POINT

The instrument can operate with either a local or remote Set point, or with a Set point selected out of 4 stored ones, that can be recalled from keyboard or external contact through the logic inputs.

An execution optionally supplied allows the instrument to operate with a local Set point or a time-programmable Set point with 11 segments.

This last option permits to program the number of cycle repetitions as well as the maximum deviation allowed during the dwell segment, in order to guarantee that the time spent at the required set point is as programmed. Launching and momentary or final halting of programme execution are

effected from the keyboard or external controls.

In any case, the passage from a Set point value to another can take place with a pre-settable gradient, distinct for ascent and descent.

## SERIAL COMMUNICATION

This is an option. It permits insertion of the controllers into a distributed control system: exchange of commands and information between instruments and a supervisor which may be a simple terminal or a process computer, is simple but efficient.

A traffic concentrator permits connection of up to 64 controllers with a single serial line of type EIA RS232C or EIA RS422 A or RS485, communicating with each one individually, thus creating a data transmission network permitting complete isolation of each instrument and guaranteeing service continuity, also in the event of instruments being removed from their case.

## CONFIGURATION

Configuration may be carried out via a serial line using a personal computer, or simply from the instrument front keyboard.

The configuration code is viewed on the measurement and Set point displays. If the instrument is not configured, the figures 9999 9999 appear, with direct access to configuration. If the instrument is already configured, the 8 configuration indexes are shown on the displays, and the secret code must be introduced in order to modify it.

## ACCESS TO PARAMETERS

In order to avoid tampering by unauthorized staff, or inadvertent alterations of parameter values, these have been divided into homogeneous groups.

The "level of accessibility" can be configured for each group as follows:

- 1st level: visible and modifiable parameters
- 2nd level: visible but non-alterable parameters
- 3rd level: hidden and therefore non alterable parameters operating with the preset values but not appearing on call from keyboard.

# Technical data

Configurability of the level of accessibility, combined with a secret code (Password) makes the instrument safer and at the same time easier to use for the final operator, without limiting its programming power.

## PROTECTION

All parameters and configuration values are stored in a non-volatile memory for an unlimited period of time. In the parameter setting phase, the following can be established: upper and lower limits of the Set point, an upper limit for the main output, a safety value for the main output to be activated in case of input signal failure. Furthermore, circuit protections give this controller a degree of immunity to electrical disturbances higher than the maximum level (IV) considered by standard IEC 801-4 for heavy industrial environments.

## INPUT X

### Common features

- A/D Converter: 50,000 points
- Measurement sampling time: 0.5 sec.
- Safety: measurement overshooting the scale range or a failure on the input line (interruption or short-circuiting) is displayed and imposes on output Y1 the safety state pre-selected during the configuration phase.
- For variations from 100 to 240 Vac in line voltage, the measurement error is irrelevant.

### Thermocouples

- Cold junction incorporated
- Line resistance: 150Ω max
- Measurement accuracy: 0.2% ± 1°C at 25°C ambient temp.
- Measurement drift: < 2μV/°C ambient temperature < 5μV/10Ω line resistance

### RTD Pt100

- 2 or 3-wire connection
- Line resistance: 20Ω max for 3-wire connection
- Measurement accuracy: 0.2% at 25°C ambient temp.
- Measurement drift: < 0.1°C/10°C ambient temp. < 0.5°C/10Ω line resistance (3 wires)

### DC current and voltage

- Input resistance: with current input: 15Ω with voltage input: 10kΩ
- Measurement accuracy: 0.1% at 25°C ambient temp.
- Measurement drift: < 0.1%/20°C ambient temp.

## MAIN OUTPUT Y1

With 2 interlocked relays 5A/250 Vac

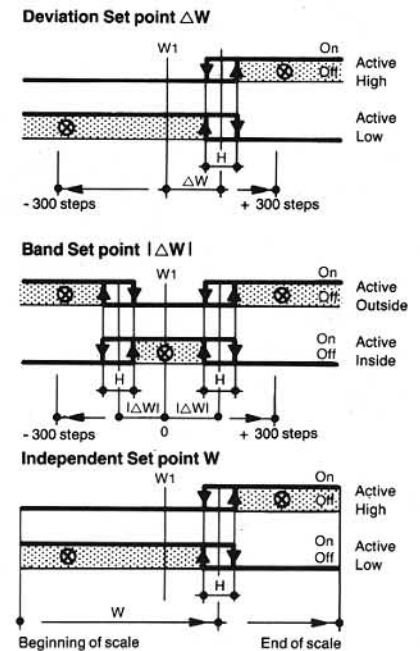
## AUXILIARY OUTPUTS Y2, Y3 and Y4

### Actions Y2 and Y3 (see fig. 1)

For every action, the following can be configured:

- The control mode: Active high or Active low (that is relay energised above or under the threshold)
- The type of Set point (in respect of W1) Deviation: from -300 to +300 display steps Band: from 0 to 300 display steps Independent: within the scale span
- Output: 1 NO contact, isolated, 5A/250 Vac
- Hysteresis: 0.1 to 10% of scale span

Fig. 1: Y2 and Y3 auxiliary controls



### Note

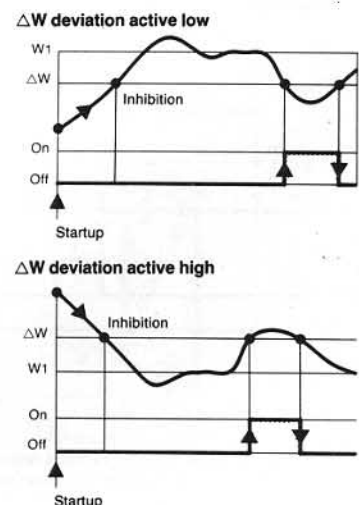
W1: Main Set point  
H: Auxiliary control hysteresis

## Notes

1 - The setting range of Set points Y2 and Y3 is not limited by the limits of the main Set point W1, but only by the scale span.

2 - The operation of Y2 and/or Y3 configured as Deviation alarm with inhibited startup is illustrated in fig. 2.

Fig. 2: Y2 and Y3 auxiliary controls with inhibited startup



### Retransmission output Y4

- Retransmitted signal: measurement X or Set point W1
- Output: 4...20 mA, 10 V max or 0...10 V, 20 mA max by means of a switch
- Accuracy: 0.1% at 25°C ambient temp.
- Resolution: 12 bits (0.025%)
- Isolation: 500 Vac/1' in respect of input

### CONTROL

- Proportional band: 0.5 to 1000%
- Integral action time: 0.1 to 100 minutes, excludable. Outside the proportional band, the integral action is neutralised.
- Derivative action time: 0.01 to 10 minutes, excludable
- High or low approaches: 0.01 to twice the proportional band
- Stroke time: 15 to 600 sec. (time needed by the actuator to cover its useful course)
- Minimum correction step: 0.1 to 10% of the stroke (resolution in positioning)

- Position potentiometer: 100Ω...10kΩ max  
**Note:** possibility of automatic calibration of the valve position indication

### SET POINT

The Set point variation speed in passing from a value to another can be set (separately for ascent and descent) from 0.1 to 120% scale/minute or as a normal step change.

#### Remote Set point

- Input: 4...20 mA on 15Ω or 0...10 V on 330kΩ
- Accuracy: 0.1% at 25°C ambient temp.
- Resolution: 50,000 points
- Not galvanically isolated from the main input

#### Stored Set points

- Up to 4 retrievable values

#### Programmable Set point (see fig. 4)

- Number of segments: 3 to 11 including 1 initial and 1 final segment

- Number of repetitions:
  - 1 to 9999 or continuous repetitions
  - Duration: 0.1 to 540.0 minutes (std) from 1 to 9999 minutes (on request)
- The following can be set for every single segment:
  - Maximum admitted deviation: 0.1 to 100% of scale
  - Final segment value
  - State of Y2 and Y3 logic outputs.

### AUTO/MAN STATION

- Built-in with Bumpless action
- AUTO/MAN transfer via keyboard, logic input and serial

### POWER SUPPLY FOR TRANSMITTER

- To supply a 2-wire 4...20 mA transmitter or a 3-wire 24 Vdc transmitter

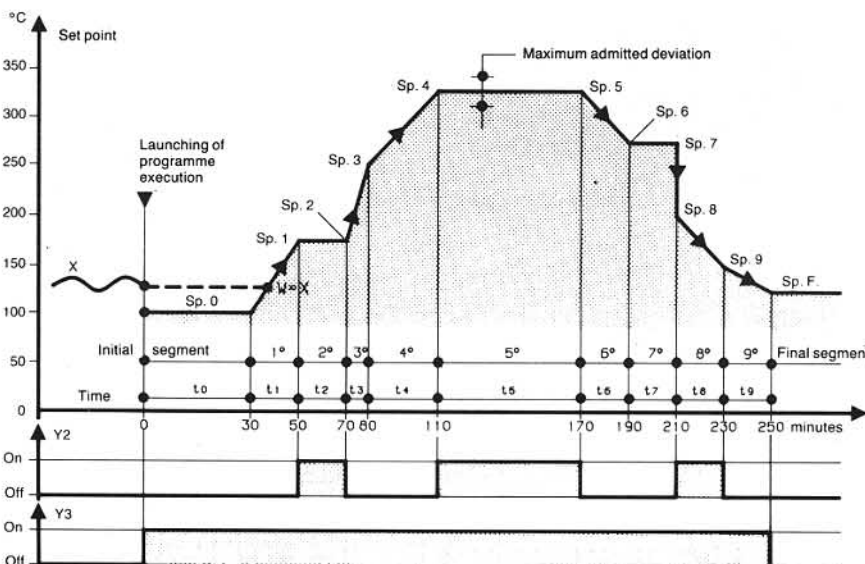
### SERIAL COMMUNICATION

- Passive isolated interface
- ASCII code
- Baud rate configurable between: 600, 1200, 2400, 4800 or 9600 (only for Modbus/Jbus) Bits/s
- Interface with RS232C, RS422A, RS485 port via traffic concentrator ALS type (it's possible to connect up to 64 ASCON instruments, also of different type)

### GENERAL DATA

- Power supply: 100...240 V, 48...63 Hz or 16...28 Vac, 50/60 Hz and 20...30 Vdc, 4 VA max
- Isolation class: C according to VDE 0110
- Climatic group: KWF according to DIN 40040
- Ambient operating temperature: 0 to 50°C
- Protection according to DIN 40050 front panel: IP54 case: IP20 terminal board: IP10 self-extinguishing material UL94 V1
- Weight: about 0.6 kg
- Dimensions: 48 x 96, depth 150 mm

Fig. 3: Example of Programmed Set point

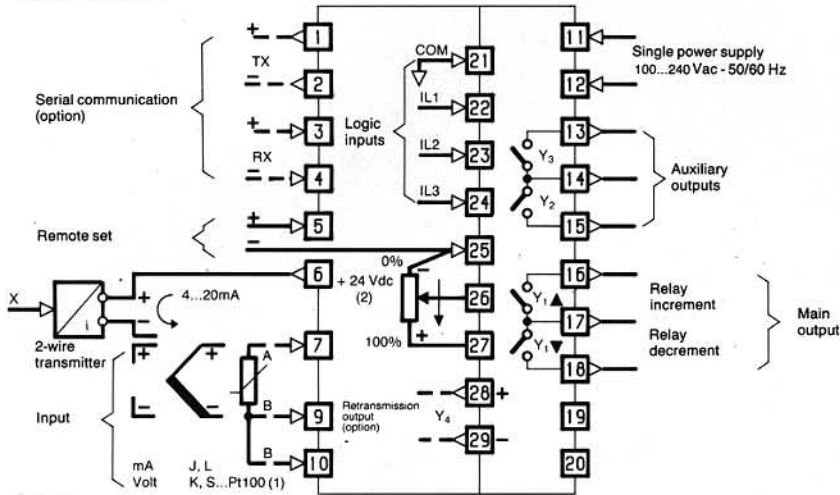


#### Notes:

- With duration of initial segment:  $t_0 = 0$ , execution begins from segment 1 with  $W = X$
- With a deviation higher than the maximum one set, time count stops in order to guarantee scheduled durations

# Connections and overall dimensions

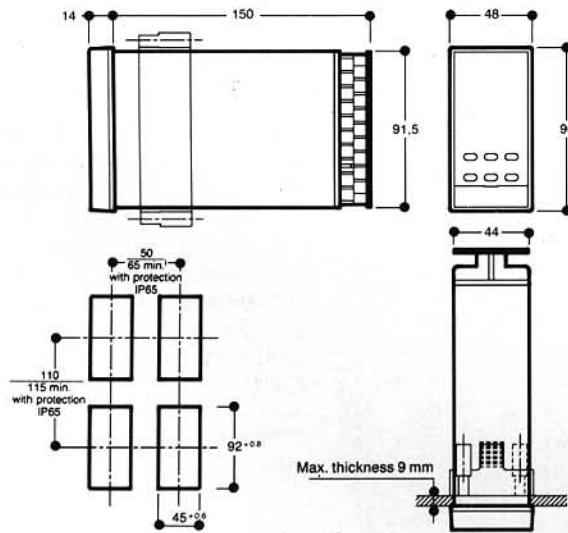
## CONNECTIONS



### Notes:

- To connect a 2-wire RTD Pt100, link terminals 9 and 10
- To supply 3 or 4-wire transmitters, use terminals 6 (+) and 9(-)

## DIMENSIONS



## ACCESSORIES

- SERIAL COMMUNICATION INTERFACE for 64 ASCON controllers

Model:

ALS —  /

Power supply

100...240V, 50/60 Hz

16...28V, 50/60 Hz

Interface

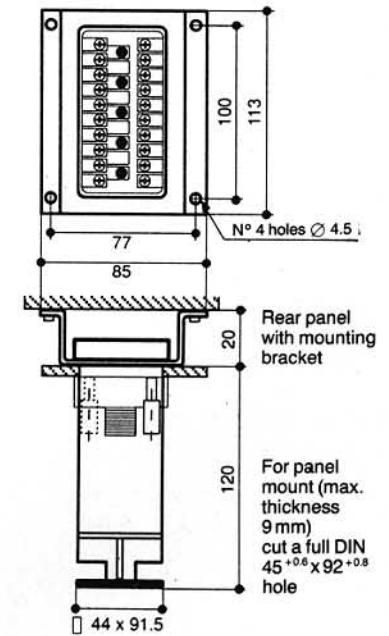
RS232

RS422

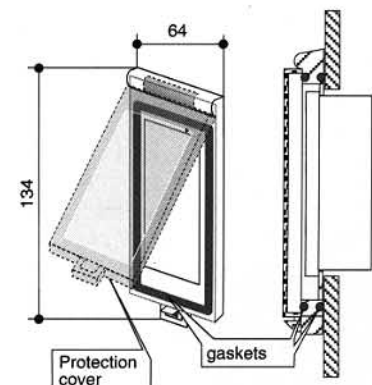
RS485



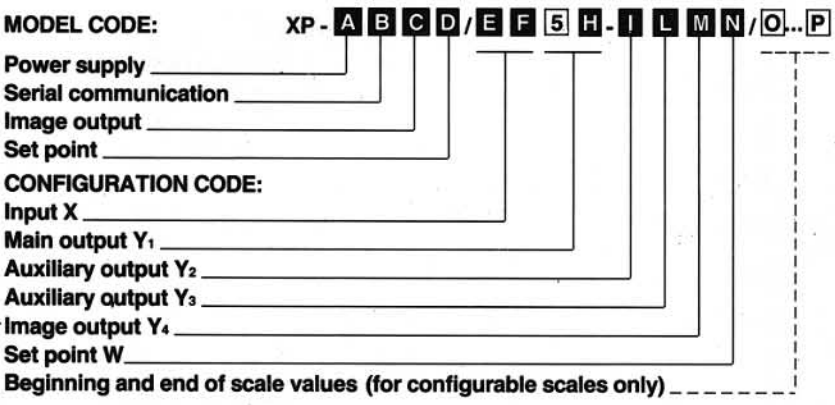
Panel or rear panel mount



- FRONT PROTECTION KIT IP65: mod. F10-141-1A1MS



# Models and configurations



**MODEL CODE:**

<b>Power supply</b>	<b>A</b>
100...240 V 50/60 Hz	3
16...28 V 50/60 Hz and 20...30 Vdc	5
<b>Serial communications</b>	<b>B</b>
None	0
20 mA C.L. Ascon std. protocol	1
20 mA C.L. Modbus/Jbus protocol	2
<b>Retransmission output Y<sub>4</sub></b>	<b>C</b>
None	0
Fitted (4...20 mA or 0...10 Vdc)	1
<b>Set point</b>	<b>D</b>
Standard (up to 4 mem. or Loc./Rem.)	0
Time-programmable (11 segments)	1

**CONFIGURATION CODE: (1)**

<b>Input type, scale range (2)</b>	<b>E</b>	<b>F</b>
RTD Pt100Ω IEC 751	-200...600°C	0 0
	Conf. -200...600°C	0 2
Thermocouple J Fe-Cu 45%Ni IEC 584	-99.9...300.0°C	1 0
	Conf. -99.9...300.0°C	1 2
Thermocouple L Fe-Const DIN 43710	0...600°C	2 0
	Conf. 0...600°C	2 2
Thermocouple K Chromel-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

<b>Type of action and safety state Y<sub>1</sub> (3)</b>	<b>H</b>
Reverse	Safety 0% 0
Direct	Safety 0% 1
Reverse	Safety 100% 2
Direct	Safety 100% 3

<b>Type of Set point and control mode output Y<sub>2</sub></b>	<b>I</b>
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
Time programmable (4)	9

<b>Type of Set point and control mode output Y<sub>3</sub></b>	<b>L</b>
Not active	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
Time programmable (5)	* 9

<b>Retransmission output Y<sub>4</sub> (6)</b>	<b>M</b>
None (7)	0
4...20 mA	Retransmission measurement X 1
	Retransmission Set point W 2
0...10 Vdc	Retransmission measurement X 4
	Retransmission Set point W 5

<b>Type of Set point</b>	<b>N</b>
Standard	1 Local + 4 stored 0
	1 Local and Remote 4...20 mA 1
	1 Local and Remote 0...10 Vdc 2
Time programmable (8)	3

**Notes on configuration**

- 1 - To receive a non-configured instrument, indicate code 9999 -9999.
- 2 - For Pt100 and thermocouple inputs with configurable scale, it is 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 units between -999 and 9999. The minimum scale span is 100 steps. The values can be expressed in units (xxxx), in tenths (xxx.x), hundredths (xx.xx), or thousandths (x.xxx).  
Lacking the indication of beginning and end of scale values, the instrument will be supplied with 0.0...100.0 scale.
- 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.
- 4 - The time-programmable logic output (I-9) is only possible with the programmable Set point option (D-1).
- 5 - Only available with the programmable Set point option (D-1). Replaces the Loop-Break-Alarm function.
- 6 - Passing from 4...20 mA to 0...10V is obtained also by moving a jumper inside the instrument.
- 7 - Excluding the retransmission output option (C-0) implies selecting (M-0) in configuration.
- 8 - The programmable Set point option (D-1) implies selecting (N-3) in configuration.

**Ordering examples:**

- XP-3100/4050-8700**  
configuration with defined scale range
- XP-3011/7450-5913/-50.0..150.0**  
configuration with scale range in engineering units
- XP-3100/9999-9999**  
not configured