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Process controller with Modbus Master/Slave & PROFIBUS DP

1/8 DIN - 48 x 96 mm Platinum™ Series X5000 Line

Sophisticated multifunction process controller with high level communications

By its three different kinds of serial communications:
- Modbus Slave
- Modbus Master
- PROFIBUS DP Slave

the Platinium™ X5000 line can interface, on different levels, with other devices, by exchanging information, after processing them via a mathematical package. The frequency input, added to the traditional inputs, two retransmission or control analogu outputs and four Setpoint programs allow you to use it for the most diversified control strategies.

Standard features include: Autotune software, dedicated auto/man key, five outputs, three digital inputs, IP65 front panel protection, remote setpoint input, potentiometer input, and auxiliary power supply.
Options include: serial communications, mathematical package, frequency input, second analog or digital output, and four setpoint programs.
Some standard features and options are mutually exclusive.

ATHENA®
The Temperature Control Company

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Tuning

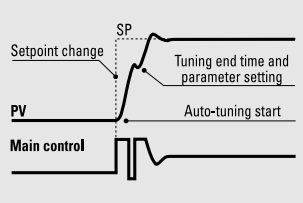
Two methods of tuning are available:
- one shot **initial Fuzzy-Tuning**
- self-teaching **continuous Adaptive-Tuning**

Fuzzy-Tuning

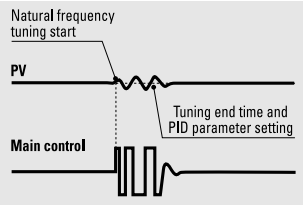
Two methods of initial tuning are available:
- **Auto-Tuning "one shot"**
- **Natural frequency "one shot"**

The **Fuzzy-Tuning** automatically selects one of the two methods which assure the best result for each condition.

The **Auto-Tuning** method works best on the step response basis.
When activated, if a deviation exists between the Setpoint and process variable larger than 5% of scale range, the controller modifies the output value. Then, in a short time, it calculates the PID parameters and the new algorithm is operational immediately .
The main advantages of this method are fast calculation



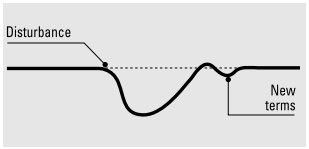
and quick implementation.
The **Natural frequency** method works best when the process variable is very near to the Setpoint. When activated, it causes a process oscillation around the Setpoint value.
The main advantage of this method is a reduced



disturbance to the process.

Adaptive-Tuning

It is self-teaching and waits for process change to recalculate the new PID parameters.
The new PID calculation does not influence the control output, avoiding any disturbance.
The PID optimisation is done only when necessary (e.g. Setpoint changes or process disturbances like load changes).
No action by the operator is required.
The operating mode of Adaptive-Tuning is safe and user friendly. It tests the process response after a disturbance, it memorises the intensity and frequency of the reaction, then the Adaptive-Tuning checks the new information with its statistical data base.
The correct PID algorithm is then ready to implement.
This tuning is ideal for non-linear processes where the PID parameters must be adapted to changing conditions.



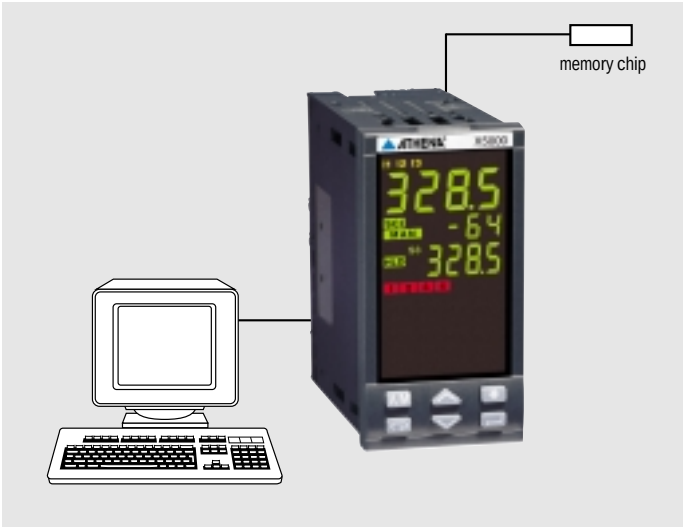
Integrity in data copy

Configuration software

A **software** tool is available to improve both the **configuration and the parameterization**.
All the data can be stored to file. It is also possible to down-load the linearisation of the "custom" input by using the polynomial's coefficients and to configure the PROFIBUS DP profile file.

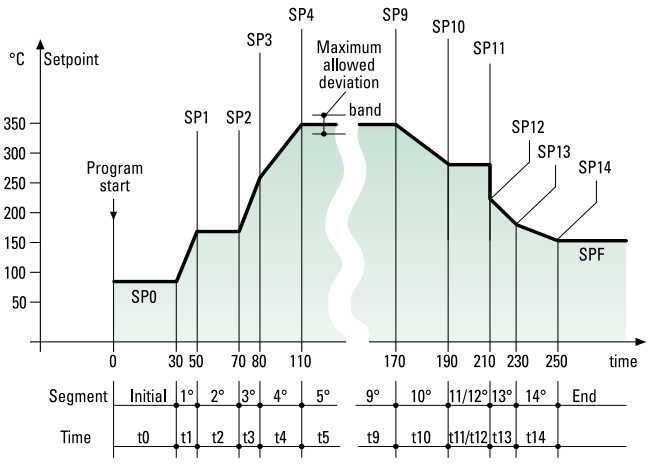
Memory chip

The **memory chip** makes possible a fast and safe transfer of data related to the configuration and all parameters.
With a simple operation, the information can be stored and copied to the **memory chip**.
The procedure can be protected by a password.



Setpoint programmer

Up to 4 profiles with 16 segments can be programmed.
Number of cycles as well as the max. allowed deviation can be configured.
The time base can be selected from seconds, minutes and hours. Run, Hold and Stop functions can be performed by means of the front keypad, by external commands or by serial communications.



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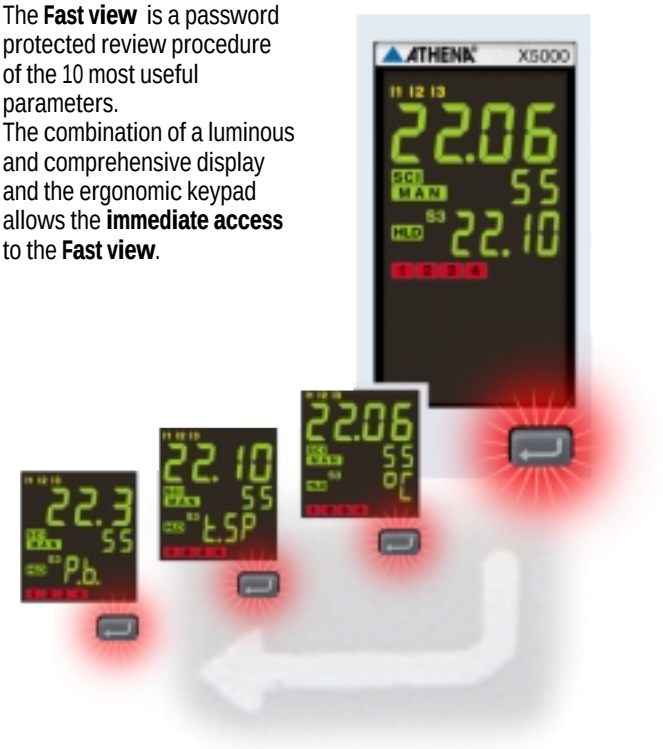
Fast view

The **Fast view** is a password protected review procedure of the 10 most useful parameters.
The combination of a luminous and comprehensive display and the ergonomic keypad allows the **immediate access** to the **Fast view**.



PROFIBUS DP Slave

Industrial standard for peripheral devices connection to a machine in a plant.

The protocol installed in this controller, offers the following advantages against the standard normally supplied by other suppliers:

- Communications baudrate **Up to 12 Mb/sec with electric isolation**
- The list of data transfer (profile file) is **user configurable**. It can be set by means the Platinium™ configuration software.

PROFI
PROCESS FIELD BUS
BUS

Modbus Master

Modbus serial communications allows a controller to exchange informations with other devices, Platinium™ series or others with Modbus Slave serial communications (PLC). For instance it is possible to read the acquired value from a Platinium™ C10 indicator with alarms and send this value as remote Setpoint to a Platinium™ X400 controller; or the Platinium™ X5000 controller can send the Setpoint profile of the running program to many X100 controllers without Setpoint programmer function.

An X5000 controller can realize a simple network for the low level data management. The X5000 can also reduce the work of the SCADA and grant the exchange of data in case of its failure.

Mathematical package

The **mathematical package** is able to process any information there is in the controller by using a simple set of mathematical operations. For instance it can compare two values by selecting higher or lower, to do the sum or the ratio and so on. **Together with Modbus Master**, it becomes a very powerful information handler;

it can, for example, send to different controllers the same Setpoint profile with different values for every controller.

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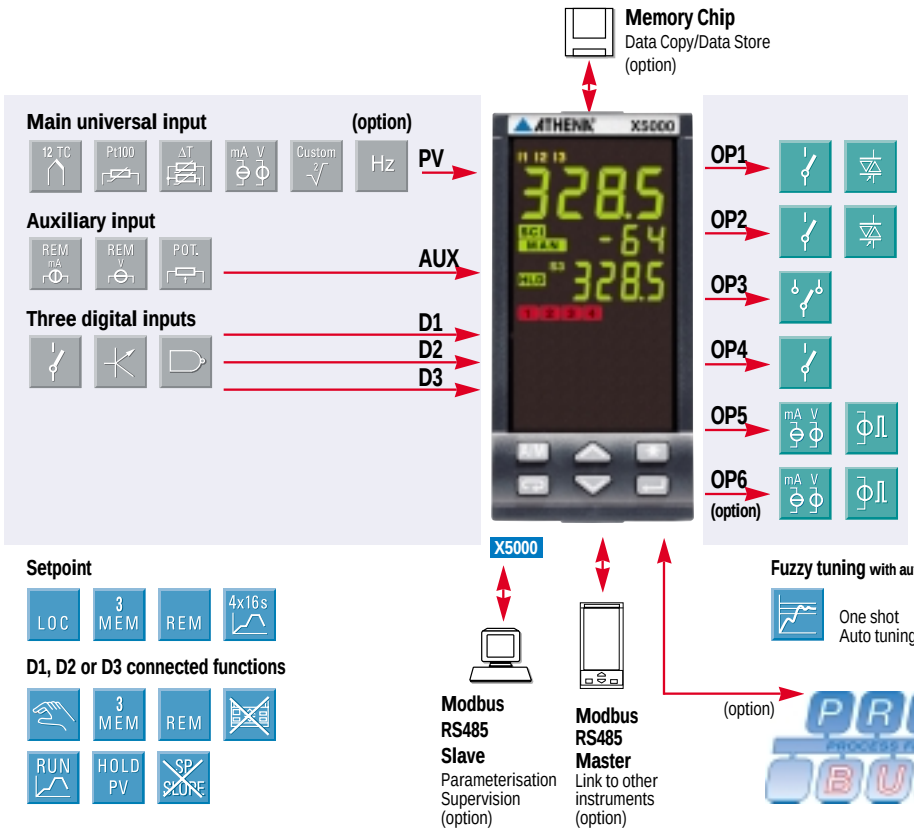
Your needs	Our solutions
High speed data acquisition and signal management	Sampling time: 100ms measure update time: 50 ms
Use of differents actuators	Two analog outputs, heat/cool, valve control output with potentiometer position feedback
Process with time variable characteristic	Two initial and one continuous calculations of the right control parameters
Alarm signalling and diagnostic	Absolute, band and deviation alarm, Latching/Blocking, loop break alarm
Interfacing with other devices	Serial communications at 19200 baud Modbus/Jbus Master and Slave, PROFIBUS DP at 12 Mbaud, two retransmission outputs, Remote Setpoint input, three digital inputs
Temperature profile	4 program with 16 segments, 3 stored Setpoints
Safe and reproducible configuration and parameter settings	Memory chip for data transfer and storing, configuration and parameterisation software
Environmental protection	IP65 front panel protection (indoor, dust and water protection)
Noise immunity	Electromagnetic compatibility
Universal input signals, linear as well as non-linear	Configurable input (TC, RTD, mA, Volt and ΔT, infrared sensor, frequency input up to 20 KHZ)
Reliability and safety	CE compatibility, 3 years warranty
Technical support	Technical application assistance from ATHENA sales and after sales service

Resources



Operating mode

		Control		Alarms				Retransmission	
								PV/SP	
1	Single output	OP1			OP2	OP3	OP4	OP5	OP6
2	Single output	OP5		OP1	OP2	OP3	OP4		OP6
3	Heat/Cool	OP1	OP2			OP3	OP4	OP5	OP6
4	Heat/Cool	OP1	OP5		OP2	OP3	OP4		OP6
5	Heat/Cool	OP5	OP2	OP1		OP3	OP4		OP6
6	Heat/Cool	OP5	OP6	OP1	OP2	OP3	OP4		
7	Valve	OP1	OP2			OP3	OP4	OP5	OP6

Fuzzy tuning with automatic selection

One shot Auto tuning

One shot Natural Frequency

Continuous tuning

Adaptive

Technical data

Features (at 25°C T. env.amb.)	Description			
Total configurability	From keypad or serial communication the user selects: - the type of input - the type of Setpoint - the type of control algorithm - the type of output - the type and functionality of the alarms - control parameter values - access levels			
PV input (for signal ranges see table 1)	Common characteristics	A/D converter with resolution of 160,000 points Update measurement time: 50 ms Sampling time (max. update time of the output adjustable): 0.1…10.0 sec. Configurable - Input shift: - 60…+ 60 digit Input filter with enable/disable: 0.1…999.9 seconds		
	Accuracy	0.25% ± 1 digits for temperature sensors 0.1% ± 1 digits (for mV and mA)		Between 100 and 240V~error is minimal
	Resistance thermometer (for ΔT: R1+R2 must be <320Ω)	Pt100Ω at 0°C (IEC 751) °C/°F selectable	2 or 3 wires connection Burnout (with any combination)	Max. wire Res.: 20 Ω max (3 wires) Sensitivity: 0.1°C/10°C E. T. <0.1°C/10 Ω Wire Res.
	Thermocouple	L,J,T,K,S,R,B,N,E, W3,W5 (IEC 584) Rj >10MΩ °C/°F selectable	Internal cold junction compensation with NTC Error 1°C/20°C ± 0.5°C Burnout	Line: 150Ω max Input drift: <2µV/°C Env. Temp. <5µV/10Ω Wire Res.
	DC input (current)	4-20mA, 0-20mA Rj >30Ω	Burnout. Engineering units, conf. decimal point, position with or without √— I. Sc.: -999…9999 F. Sc.: -999…9999 (min. range of 100 digit)	Input drift: <0.1% / 20°C Env. Temp. <5µV/10Ω Wire Res.
	DC input (voltage)	0-50mV, 0-300mV Rj >10MΩ		
		1-5, 0-5, 0-10V Rj >10KΩ		
	Frequency (option) 0-2.000 / 0-20.000Hz	Low level ≤2V High level 4-24V		
Auxiliary inputs	RemoteSetpoint not isolated accuracy 0.1% (not available with frequency input option)	Current 0/4-20mA Rj = 30Ω Voltage 1-5, 0-5, 0-10V Rj = 300KΩ	Bias in engineering units and ± range Ratio from -9.99…+99.99 Local + Remote Setpoint	
	Potentiometer	from 100Ω to 10KΩ	Feedback valve position	
Digital inputs 3 logic	The closure of the external contact produces any of the following actions:	Auto/Man mode change, Local/Remote Setpoint mode change, 3 Stored Setpoint activation, keyboard lock, measure hold, slope inhibit and output forcing		
		Program run/hold and selection (if option installed)		
Operating mode and Outputs	1 single or double action P.I.D. loop or On/Off with 1, 2, 3 or 4 alarms			
Control mode	Algorithm	P.I.D. with overshoot control or On/Off with valve drive algorithm, for controlling motorised positioners		
	Proport. band (P)	0.5…999.9%		Single output PID algorithm
	Integral time (I)	1…9999 sec	enabled disabled	
	Derivative time (D)	0.1…999.9 sec		
	Error dead band	0.1…10.0 digit		
	Overshoot control	0.01…1.00		
	Manual reset	0…100%		
	Cycle time (Time poportional only)	0.2…100.0 sec		
	Min./Max output limits	0…100% separately adjustable		
	Control output rate limit	0.01…99.99%/sec	enabled disabled	
	Soft-start output value	1…100% time 1…9999 sec		
	Output safety value	-100…100%		
	Control output forcing value	-100…100%		
	Control output hysteresis	0…5% Span in engineering units		On/Off algorithm
	Dead band	0.0…5.0%		Heat/Cool PID algorithm
	Cool proportional band (P)	0.5…999.9%		
	Cool integral time (I)	1...9999 sec	enabled disabled	
	Cool derivative time (D)	0.1...9999 sec		
	Cool cycle time (Time proportional only)	0.2…100.0 sec		
	Cool control output high limit	0…100%		
	Cool output max. rate	0.01...99.9/sec		

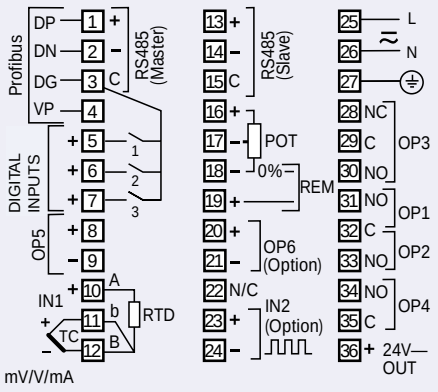
Input type	Scale range
RTD Pt100 IEC751	-99.9…300.0 °C -99.9…572.0 °F
	-200…600 °C -328…1112 °F
RTD 2xPt100 IEC751 per ΔT	-50.0…50.0 °C -58.0…122.0 °F
TC L Fe-Const DIN43710	0…600 °C 32…1112 °F
TC J Fe-CU45% NI IEC584	0…600 °C 32…1112 °F
TC T Cu-CuNi IEC584	-200…400 °C -328…752 °F
TC K Cromel-Alumel IEC584	0…1200 °C 32…2192 °F
TC S Pt10% Rh Pt IEC584	0…1600 °C 32…2912 °F
TC R Pt13% Rh Pt IEC584	0…1600 °C 32…2912 °F
TC B Pt30% Rh Pt 6% IEC584	0…1800 °C 32…3272 °F
TC N Nicrosil-Nisil IEC584	0…1200 °C 32…2192 °F
TC E Ni10% CR CuNi IEC584	0…600 °C 32…1112 °F
TC NI-NiMo18%	0…1100 °C 32…2012 °F
TC D W3%Re 25%Re IEC584	0…2000 °C 32…3632 °F
TC C W5%Re W26%Re IEC584	0…2000 °C 32…3632 °F
0/4…20 mA 0…50/300 mV 0/1…5 V 0…10 V	Configurable engineering units mA, mV, V, bar, psi, Rh, ph
Frequency (option)	0...2KHz or 0...20KHz

Table 1: PV input

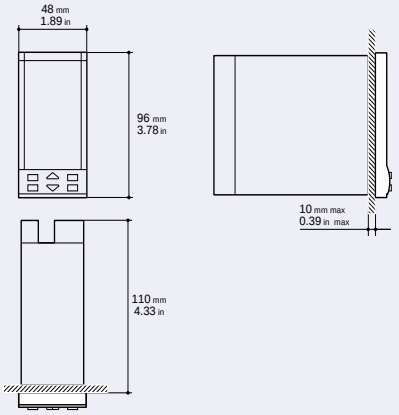
Technical data

Features (at 25°C T. env.amb.)	Description				
Control mode	Motor travel time	15…600 sec	Valve drive PID algorithm		
	Motor minimum step	to 0.1…5.0%			
	Feedback potentiometer	100Ω…10KΩ			
OP1-OP2 outputs	SPST relay N.O., 2A/250V~ for resistive load Triac, 1A/250V~ for resistive load				
OP3 output	SPDT relay N.O., 2A/250V~ for resistive load				
OP4 output	SPST relay N.O., 2A/250V~ for resistive load				
Analog / Logic OP5 and OP6 (option) outputs	Control or PV/SP retransmission	Galvanic isolation: 500V~ /1 min Short circuit protected Resolution 12 bit Accuracy: 0.1%	Analog: 0/1...5V, 0...10V, 500Ω / 20mA max 0/4…20mA, 750Ω /15V max Logic: 0/24V- ±10% - 30mA max for solid state relay		
AL1- AL2 - AL3 AL4 alarms	Hysteresis 0…5% Span in engineering units				
	Action	Active high	Action type	Deviation threshold	±range
		Active low		Band threshold	0…range
				Absolute threshold	whole range
		Special functions	Sensor break, heater break alarm		
			Acknowledge (latching), activation inhibit (blocking)		
			Connected to Timer or program (if options installed)		
Setpoint	Local + 3 stored	Up and down ramps 0.1…999.9 digit/min or digit/hour (OFF=0)			
	Remote only				
	Local and Remote	Low limit: from low range to high limit			
	Local with trim				
	Remote with trim	High limit: from low limit to high range			
	Programmable	If option installed	Remote Setpoint not available with frequency input		
Setpoint Program (option)	4 programs, 16 segments (1 initial and 1 end) From 1 to 9999 cycles or continuous cycling (OFF)				
	Time values in seconds, minutes and hours Start, stop, hold, etc. activated from the keypad, digital input and serial line				
Tuning	Fuzzy-Tuning type. The controller selects automatically the best method according to the process conditions	Step response Natural frequency			
	Adaptive Tune self-learning, not intrusive, analysis of the process response to perturbations and continuous calculation of the PID parameters				
Auto/Man selection	Standard with bumpless function, by keypad, digital or serial communications				
Serial comm.s (option)	RS 485 isolated, SLAVE Modbus/Jbus protocol, 1200, 2400, 4800, 9600, 19.200 bit/sec 3 wires RS 485 isolated, MASTER Modbus/Jbus protocol, 1200, 2400, 4800, 9600, 19.200 bit/sec 3 wires RS485 asynchronous / isolated, PROFIBUS DP protocol, from 9600 bit/sec at 12MB/sec selectable, max lenght 100m (at 12 Mb/sec.)				
Auxiliary supply	+24– ± 20% 30mA max - for external transmitter supply				
Operation alarm safety	Measure input	Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display			
	Control output	Safety and forcing value -100%...100% separately adjustable -100%…100%			
	Parameters	Parameter and configuration data are stored in a non volatile memory for an unlimited time			
	Access protection	Password to access the configuration and parameters data Fast view			
General characteristics	Power supply (fuse protected)	100-240~ (-15% + 10%) 50/60Hz or 24~ (-15% + 25%) 50/60Hz and 24V– (continuous) (-15% + 25%)	Power consumption 5W max		
	Safety	Compliance to EN61010-1 (IEC1010-1), installation class 2 (2500V) pollution class 2, instrument class II			
	Electromagnetic compatibility	Compliance to the CE standards			
	Protection EN60529 (IEC529)	IP65 front panel			
	Dimensions	1/8 DIN - 48 x 96, depth 110 mm, weight 380 gr apx.			
	Approvals	cULus			

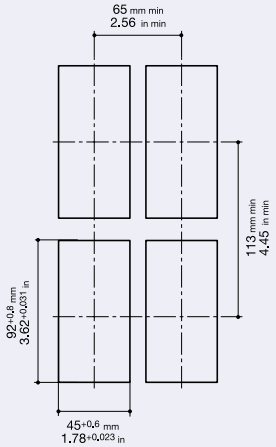
Electrical wirings



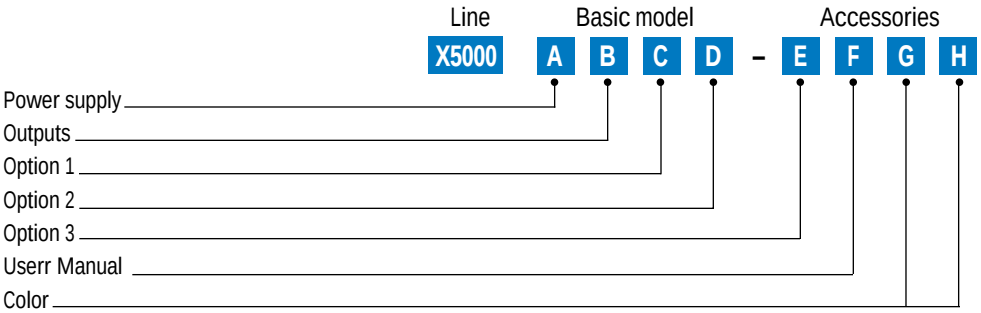
Dimensions



Panel cut-out



Ordering codes



Model Example: X5000-3551-0300

Power supply	A
100-240V~ (-15% +10%)	3
24V~ (-25% +12%) or 24V– (-15% +25%)	5

Output 1	Output 2	Output 3	Output 4	Output 5 [1]	B
Relay	Relay	Relay (alarm)	Relay (alarm)	Analog or Logic	1
Relay	Relay	Relay (alarm)	Relay (alarm)	Analog or Logic	5

Option 1 [2]	C
None	0
RS 485 Modbus/Jbus SLAVE + Mathematical package	5
RS 485 Modbus/Jbus SLAVE+MASTER + Mathematical package	6
PROFIBUS DP SLAVE + Mathematical package	7
RS 485 Modbus/Jbus SLAVE+PROFIBUS DP SLAVE + Mathematical package	8

Option 2	D
None	0
Frequency input (Remote Setpoint not available)	1
Second analog/logic output (OP6) [1]	4
Frequency input + second analog/logic output (OP6) (Remote Setpoint not available) [1]	6

Option 3	E
None	0
Setpoint Program - Four 16 segments programs	4

User Manual	F
English-Spanish	3

Front case color	GH
Dark Grey (std)	00
Beige	10

[1] Output 5 and 6 (OP5 & OP6) are field configurable as either analog or logic outputs via software configuration.
Analog Outputs 5 and 6 (OP5 & OP6) are field configurable for control or retransmission as 0-20 or 4-20mA.
The addition of Output 6 (OP6) does not affect any of the other five outputs.

[2] Math functions are only available via configuration software package part # APG2SW-A.

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