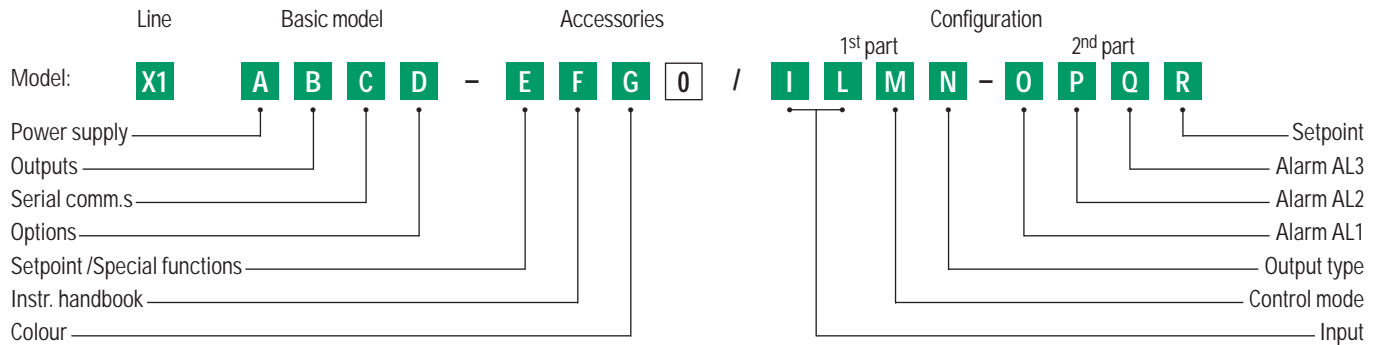


# Ordering codes



<b>Power supply</b>	<b>A</b>
100-240V- (-15% +10%)	3
24V- (-25% +12%) or 24V- (-15% +25%)	5
<b>OP1-OP2 outputs</b>	<b>B</b>
Relay-Relay	1
Triac-Triac	5
<b>Serial communications</b>	<b>C</b>
Not fitted	0
RS 485 Modbus/Jbus Slave	5
<b>Options</b>	<b>D</b>
None	0
Analogue output + Remote Setpoint	5
<b>Setpoint programmer - special functions</b>	<b>E</b>
Not fitted	0
Start-up + Timer	2
<b>Instruction handbook</b>	<b>F</b>
Italian-English (std)	0
French-English	1
German-English	2
Spanish-English	3
<b>Front case colour</b>	<b>G</b>
Dark (std)	0
Beige	1

Input type	Range scale	I	L
RTD Pt100 IEC751	-99.9...300.0 °C -99.9...572.0 °F	0	0
RTD Pt100 IEC751	-200...600 °C -328...1112 °F	0	1
TC L Fe-Const DIN43710	0...600 °C 32...1112 °F	0	2
TC J Fe-Cu45% Ni IEC584	0...600 °C 32...1112 °F	0	3
TC T Cu-CuNi	-200...400 °C -328...752 °F	0	4
TC K Chromel -Alumel IEC584	0...1200 °C 32...2192 °F	0	5
TC S Pt10%Rh-Pt IEC584	0...1600 °C 32...2912 °F	0	6
TC R Pt13%Rh-Pt IEC584	0...1600 °C 32...2912 °F	0	7
TC B Pt30%Rh-Pt	0...1800 °C 32...3272 °F	0	8
Pt6%Rh IEC584			
TC N Microsil-Nisil IEC584	0...1200 °C 32...2192 °F	0	9
TC E Ni10%CR-CuNi IEC584	0...600 °C 32...1112 °F	1	0
TC Ni-NiMo 18%	0...1100 °C 32...2012 °F	1	1
TC W3%Re-W25%Re	0...2000 °C 32...3632 °F	1	2
TC W5%Re-W26%Re	0...2000 °C 32...3632 °F	1	3
0...50mV linear	Engineering units	1	4
10...50mV linear	Engineering units	1	5
mV "Custom" scale	On request	1	6
<b>Control mode</b>			<b>M</b>
ON-OFF reverse action			0
ON-OFF direct action			1
P.I.D. single reverse action			2
P.I.D. single direct action			3
P.I.D. double action	Linear cool output		4
	ON-OFF cool output		5
	Water cool output		6
	Oil cool output		7
<b>Output type - Single action</b>	<b>Output type - Double action</b>		<b>N</b>
Relay	Heat Relay, Cool Relay		0
Digital	Heat Relay, Cool Digital		1
	Heat Digital, Cool Relay		2
<b>AL1-AL2-AL3 type and function</b>			<b>O-P-Q</b>
Disabled or (only AL3) used by Timer or related to the program			0
Sensor break/Loop break alarm			1
Absolute	active high		2
	active low		3
Deviation	active high		4
	active low		5
Band	active out		6
	active in		7
Heater break by	active during ON output state		8
CT (if present)	active during OFF output state		9
<b>Setpoint type</b>			<b>R</b>
Local only			0
Local and 2 tracking stored Setpoints			1
Local and 2 Stand-by stored Setpoints			2
Local and Remote			3
Local with trim			4
Remote with trim			5

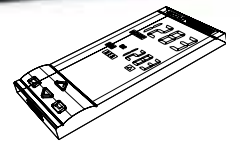
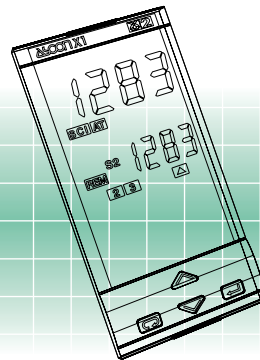
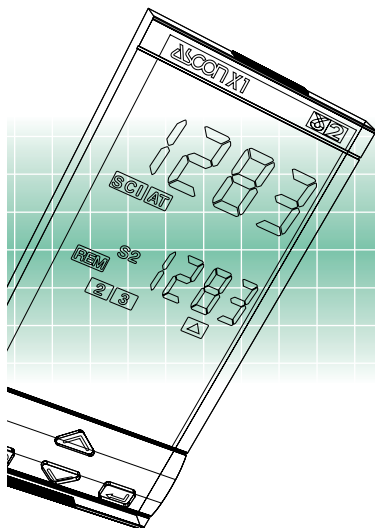
If not differently specified the controller will be supplied with standard version  
Model: X1 3100-0000

# Heat-Cool temperature controller 1/8 DIN - 48 x 96 mm gammadue<sup>®</sup> series X1 line

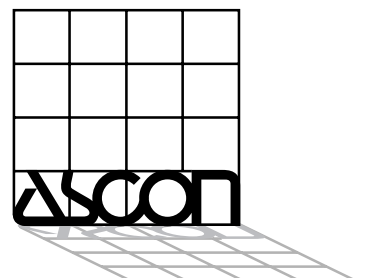


## Just what you need

Ideal for Heat-Cool control, with capability to check the load current by current transformer, with three relays outputs (one SPDT) and the analogue retransmission output, very useful Timer and Start-up special functions the X1 line, the gammadue<sup>®</sup> 48 x 96 simplest one, is a very essential instrument allowing you to buy only what you really need to satisfy your requirements.



E



## Technical data

Features at env. 25°C	Description		
Total configurability	From keypad or serial communications, the user selects: type of input - associated functions and corresponding outputs - type of control algorithm - type of output and safe conditions - alarm types and functionality - control parameter values		
PV input for signal ranges see table 1)	Common characteristics	A/D converter with 50.000 points Update measurement time : 0.2 sec Sampling time : 0.5 sec Input shift: - 60...+ 60 digit Input filter : 1...30 sec (OFF= 0)	
	Accuracy	0.25% ± 1 digit (T/C and RTD) 0.1% ± 1 digit (mA and mV)	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 wire connection Burnout (with any combination) Line: 20 Ω max (3wire) Thermal drift 0.1°C/10°C env. T. <0.1°C/10 Ω line resist.
	Thermocouple	L,J,T,K,S,R,B,N,E,W3,W5 (IEC 548) °C/°F selectable	Internal cold junction compensation with NTC Error 1°C/20°C ± 0.5°C Burnout Line: 150 Ω max Thermal drift <2μV/°C env. T. <0.5μV/10 Ω line resist.
	DC input (current)	0/4...20mA, 2.5Ωext. shunt Rj >10MΩ	Burnout. Engineering units, floating decimal point, configurable Input drift: <0.1% / 20°C env. T. <0.5μV/10 Ω line resist.
	DC input (voltage)	0/10...50mV, 0-50mV Rj >10MΩ	Low Range -999...9999 High Range -999...9999 100 digits minimum
Auxiliary input	Remote Setpoint (option) Not isolated accuracy 0.1%	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
	CT current transformer	50 or 100mA input hardware selectable	Current visualization 10...200 A with 1A resolution and Heater break alarm
	Operating modes	1 single or double action P.I.D. loop or ON/OFF with 1, 2 or 3 alarms	
Control mode	Algorithm	P.I.D. with overshoot control or ON/OFF	
	Proport. band (P)	0.5...999.9%	User Enabled/Disabled
	Integrale time (I)	0.1...100.0 min	
	Derivative time (D)	0.01...10.00 min	
	Error dead band	0.1...10.0 digit	
	Overshoot control	0.01...1.00	Single action PID algorithm
	Manual reset	0.0...100.0%	
	Cycle time (Time proportional only)	1...200 sec	
	Control output high limit	10.0...100.0%	
	Soft-start output value	0.1...100.0%	
	Output uscita	0.0...100.0% (-100.0...100.0% for Heat/Cool)	ON/OFF algorithm
	Hysteresis output safety value	0.1...10.0%	
	Dead band	-10.0...10.0%	
	Relative cool gain	0.1...10.0	
Cycle time (Time proportional only)	1...200 sec	Double action PID algorithm (Heat/Cool) with overlap	
Cool output high limit	10.0...100.0%		
Cool output hysteresis	0.1...10.0%		
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	SSR drive not isolated: 0/5V~, ± 10%, 30mA max.		

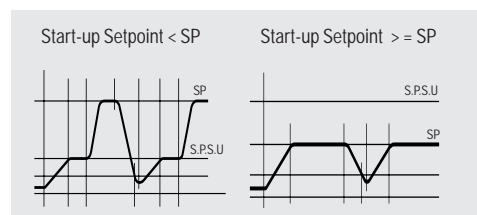
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	32...1112 °F
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	32...1112 °F
TC T Cu-CuNi	-200...400 °C
	-328...752 °F
TC K Cromel-Alumel IEC584	0...1200 °C
	32...2192 °F
TC S Pt10% Rh-Pt IEC584	0...1600 °C
	32...2912 °F
TC R Pt13% Rh Pt IEC584	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 W3%Re W25%Re	0...2000 °C
	32...3632 °F
TC W5%Re W26%Re	0...2000 °C
	32...3632 °F
0/4...20 mA	Configurable engineering units mA, mV, V, bar, psi, Rh, ph
0/10...50 mV	
mV Custom scale	

Table 1: PV input

## Special functions

To improve the instrument performance and to reduce the wiring and installation costs, two special functions are available:

### - Start-up



### - Timer



The use of these functions avoids additional device installation (e.g. external timer), therefore allowing a significant costs reduction.

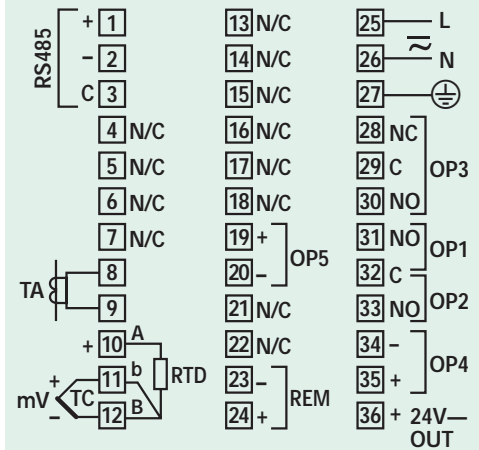
Moreover there are:

- **Keypad lock/unlock** function, to avoid incorrect operator actions
- **Outputs lock/unlock** function, at any moment it is possible to stop the control action, but not the process variable display, without switching-off the power supply.

## Technical data

Features at env. 25°C	Description		
OP5 (option) analogue control output	Control or PV/SP retransmission	Galvanically isolated: 500V~/1min Resolution: 12 bit Accuracy: 01%	In current: 0/4...20mA, 750Ω /15V max
AL1- AL2 - AL3 alarms	Hysteresis		0.1...10.0%
	Action	Active high	Action type
		Active low	Deviation threshold ± range Band threshold 0...range Absolute threshold, whole range
		Special functions	Sensor break, Heater break and Loop break detection Acknowledge (latching), activation inhibit (blocking) Connected to Timer or program (if options installed)
Setpoint	Local	Up and down ramps 0.1...999.9 digit/min.	
	Local plus two stored (tracking or Stand-by)	(OFF=0) Low limit:	
	Local and Remote	If option installed	from low range to high limit
	Local with trim		High limit:
	Remote with trim		from low limit to high range
Timer	Automatic start at the power on, manual start by keypad or serial comm.s Setting time: 1...9999 sec/min Stand-by Setpoint: from Setpoint low limit to Setpoint high limit		
Start-up	Start-up Setpoint: from Setpoint low limit to Setpoint high limit Hold time: 0...500 min Control output high limit: 5.0...100.0%		
One-shoot Fuzzy-Tuning	Depending on the process condition, the controller applies the best method	Step response	Natural frequency
Serial comm.s (option)	RS 485 isolated, Modbus/Jbus protocol 1200, 2400, 4800, 9600 bit/sec, three wires		
Auxiliary power supply	+24V- ±20%, 30 mA max for external transmitter supply		
Operational 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 value: -100%...100%	
	Parameters	A non volatile memory stores for unlimited time all the configuration and parameter values	
	Password	Password to access the configuration and parameters data, keypad lock, outputs lock	
General characteristics	Power supply (fuse protected)	100-240~ (-15% + 10%) 50/60Hz or 24~ (-15% + 25%) 50/60Hz and 24V- (analogue) (-15% + 25%)	Power consumption 4W max
	Safety	Compliance EN61010-1 (IEC 1010-1), installation class 2 (2500V), pollution class 2, class II instrument	
	Electromagnetic compatibility	Compliance to the CE standards for industrial system and equipment	
	Protection EN60529 (IEC529)	IP65 front panel	
	Dimensions	1/8 DIN - 48 x 96, depth 110 mm, weight 250g appr.	

### Electrical wirings



### Fuzzy-Tuning

Two methods of tuning are available:

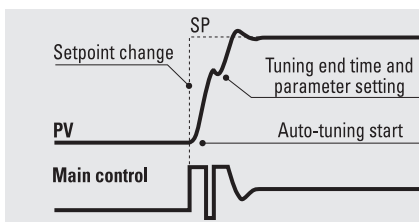
- Auto-Tuning "one shot"
- Natural frequency "one shot"

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.

