E

ASCON TECNOLOGIC

DIN rail mounting dual loop controller/ analogue acquisition module

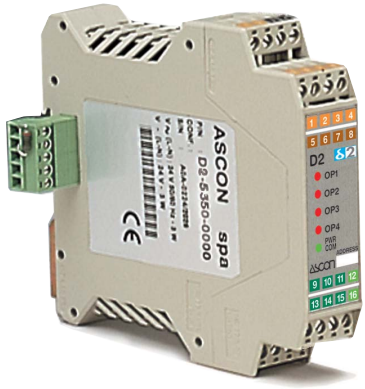
S E R I E S

D2 line

User manual

D2 line

User Manual • 04/10 • Code:ISTR_U_D2_E_01_--



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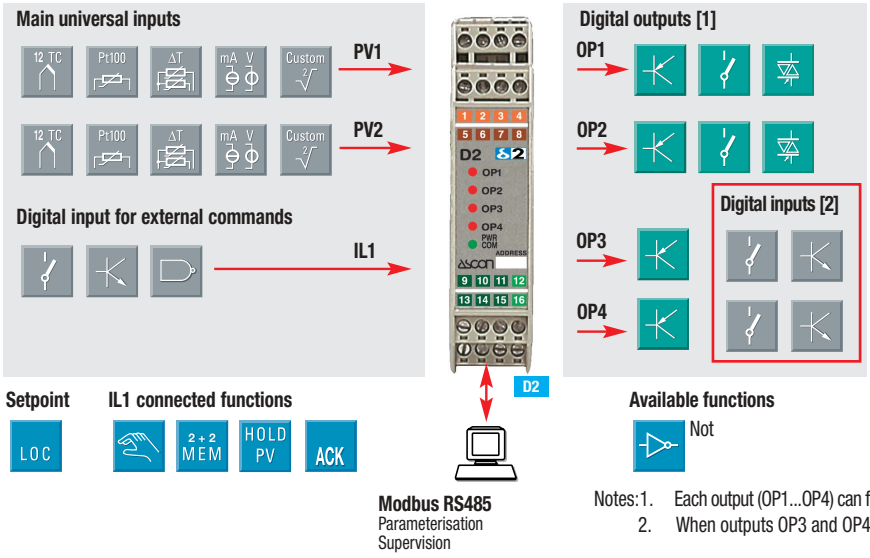
Ascon Tecnologic S.r.l.
viale Indipendenza 56,
27029 - Vigevano (PV)
Tel.: +39 0381 69871,
Fax: +39 0381 698730
www.ascontecnologic.com

Resources



Operating modes

		Control		Alarms			
PV1	0	Acquisition only		OP1		OP3	
	1	Single action	OP1			OP3	
	2	Single action	OP3	OP1			
PV2	3	Acquisition only			OP2		OP4
	4	Single action	OP2				OP4
	5	Single action	OP4		OP2		
PV1	6	Single action	OP1		OP2	OP3	
PV2	7	Single action	OP4				

Notes: 1. Each output (OP1...OP4) can freely be associated with one of the two inputs (PV1 or PV2).
2. When outputs OP3 and OP4 are not used as such, they can be used as voltage free or voltage digital inputs.

Model code

Configuration

Mod. **D 2** Line | **5 B 5 0** Basic | **0 F 0 0** Accessories | / **I L M N** 1st part | - **O P Q R** 2nd part

The product code indicates the specific hardware coniguration of the instrument, that can be modified by specialized engineers only

Line	D 2

Output OP1-OP2	B
Relay - Relay	1
Relay - SSR Drive	2
SSR Drive - SSR Drive	3
SSR - SSR	4
SSR - SSR Drive	5

User manual	F
Italian - English (std)	0
French - English	1
German - English	2
Spanish - English	3

Input type	Range		PV1	I	L
Input type	Range		PV2	M	N
TR Pt100 IEC751	-99.9…300.0 °C	-99.9…572.0 °F		0	0
TR 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 Pt6%Rh IEC584	0…1800 °C	32…3272 °F		0	8
TC N Nichrosil-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” input range	On request			1	6

Control mode	LOOP 1	0
Control mode	LOOP 2	P
ON-OFF reverse action		0
ON-OFF direct action		1
PID reverse single action		2
PID direct single action		3

Control output type	LOOP 1	Q
None		0
OP1		1
OP3		2

Control output type	LOOP 2	R
None		0
OP2		1
OP4		2

Table of standard parameters

If not specified, each the parameter must be doubled: one set for LOOP1 and one set for LOOP2. If the parameter is unique (1 parameter for both the loops) it is pointed out in the note column

Configuration

Mnemonic code	Parameter descritption	Setting range	Unit	Factory setting	Note
IL	Digital input function IL	see table 1		**not used**	**Valid for both the channels**
Prot	Communication protocol	M.bus/Jbus		**M.bus**	
baud	Baud rate	1200, 2400, 4800, 9600 baud		**9600**	
PStr	Instrument position	**Alone/left side/central/right side**		**Alone**	
Unit	Engineering unit	see table 2		**none**	
Sc.dd	N° of decimals	0...3		**0**	Linear scales only
Sc.Hi	Low range	-999...9999	Engineering unit	**Low range**	Range min. 100 digit (linear scales only)
Sc.Lo	High range	-999...9999	Engineering unit	**High range**	
S.SEL	Setpoint type	Local, SP.1, SP.2		**Local**	
O.C.rb	Enhanced overshoot management	0.2...5.0		**0.5**	For PID algorithm

Setpoint

Mnemonic code	Parameter descritption	Setting range	Unit	Factory setting	Note
A1S.P	AL1 alarm threshold	PV range	Engineering unit	**0**	Not enabled if the controller has been configured with alarm not active or of sensor break type
A2S.P	AL2 alarm threshold	PV range	Engineering unit	**0**	
A3S.P	AL3 alarm threshold	PV range	Engineering unit	**0**	
A4S.P	AL4 alarm threshold	PV range	Engineering unit	**0**	
SL. u	Setpoint ramp UP	OFF/0.1...999.9	Digit/min	**Inhibited**	With OFF the new Setpoint is reached immediately after being entered
SL. d	Setpoint ramp DOWN	OFF/0.1...999.9	Digit/min	**Inhibited**	
S.P. L	Setpoint low range	Low range...SP. H	Engineering unit	**Low range**	Min. Range 100 digit (linear scales only)
S.P. H	Setpoint high range	S.P L...high range	Engineering unit	**High range**	
S.P. 1	1st stored Setpoint	PV range	Engineering unit	**----**	
S.P. 2	2nd stored Setpoint	PV range	Engineering unit	**----**	
SP	Setpoint	PV range	Engineering unit	**----**	

Control mode

Mnemonic code	Parameter descritption	Setting range	Unit	Factory setting	Note	Algorithm type
hy.	Control output hysteresis	0.1...10.00	% range	**0.5**		ON - OFF
tune	Tune Run/Stop	**Stop/loop1 tune/loop2 tune**		**Stop**	**Valid for both the channels**	PID
P.b.	Proportional band	0.5...999.9	% range	**5.0**		
t.i.	Integral time	OFF/0.1...100.0	min	**5.0**		
t.d.	Derivative time	OFF/0.01...10.00	min	**1.0**		
O.C.	Overshoot control	0.01...1.00		**1.0**	If set to 1.00 is disabled	
M.res	Manual reset	0.0...100.0	% output	**50.0**	Without integral time	
D.err	Error dead band	OFF/0.01...10.0	digit	**Inhibited**		
t.c.	Cycle time	1...200	s	**20**	Time proportional only	
OP. H	Control output high limit	10.0...100.0	% output	**100.0**		
OP. L	Control output low limit	0.0...90.0	% output	**0.0**		
S.Out	Control output safety value	0.0...100.0	% output	**0**		
A.Man	Auto/Man selection	Auto/Man		**Auto**		

Alarms and auxiliary

Mnemonic code	Parameter descritption	Setting range	Unit	Factory setting	Note
A1hy	AL1 hysteresis	0.1...10.0	% range	**0.5**	The same parameters are available also for AL2, AL3 and AL4 alarms
A1SR	AL1 alarm source	Loop 1/loop 2		**Loop 1**	
A1.tp	AL1 alarm type	See table 3		**Inhibited**	
A1Lb	Latching/blocking alarm functions	**None/Ltch/Bloc/LtbL**		**None**	
A1.O	AL1 output	**Internal status/OP1/OP2/OP3/OP4**		**Internal status**	
t.Lba	LBA delay	OFF/1...9999	s	**Inhibited**	**Valid for both the channels**
t.Fil	Filter time constant	OFF/1...30	s	**Inhibited**	
In.Sh	Input shift	OFF/-60...+60	Digit	**Inhibited**	
Addr	Communications address	1...247		**247**	**Valid for both the channels**
Hi.PV	PV (measure) Hold	0/1		**0**	
OP.lk	Output lock	0/1		**0**	Locks the outputs OP1, OP2, OP3, OP4
Ack	Alarms acknowledge	0/1		**0**	**Valid for both the channels**
Nt.O1	Negate (NOT) OP1	0/1		**0**	Available also for OP2 - OP3 - OP4

Standard parameters description

The parameters shown in the table are divided into groups which work in the same way. Below they will be described as they are listed in the table.

Configuration

IL **Digital input function** - Table 1

Parameter decription
Not used
Loop 1 measure hold
Loop 2 measure hold
Hold both the measuring loops
Output locks
Alarms acknowledge
1st Stored Setpoint for loop 1
1st Stored Setpoint for loop 2
2nd Stored Setpoint for loops 1 and 2
Auto/manual for loop 1
Auto/manual for loop 2
Auto/manual for loops 1and 2

unit **Engineering units** - Table 2

Parameter description	Parameter description
°C (Centigrade degrees)	A (Ampere)
°F (Fahrenheit degrees)	bar
None	psi
mV (millivolt)	Rh
V (Volt)	pH
mA (milliampere)	

Setpoint (SP)

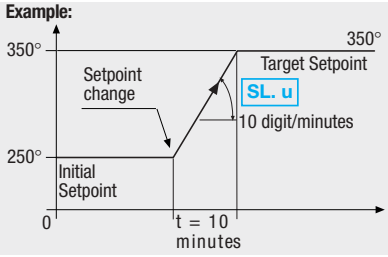
A1S.P **A2S.P** **A3S.P** **A4S.P** **AL1 - AL2 - AL3 - AL4 threshold**

Alarm occurrences of AL1, AL2, AL3 and OP4. The range of the alarm threshold correspond to the whole span and it is not limited by the SP Setpoint span.

SL. u ramp up **SL. d** ramp down **Setpoint ramp up- Setpoint ramp down**

This parameter specifies the maximum rate of change of the SP in digit/min. All the time the SP changes, the new value is reached according to the configured rate of change. The new SP value is called "Target SP" (available via serial communications).

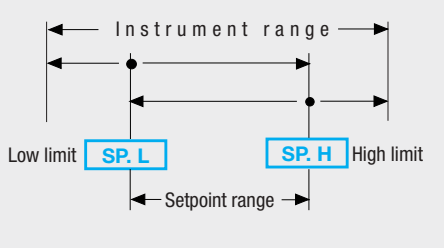
Example:



When the parameter is set to zero, the function is disabled and the new Setpoint is reached immediately after being entered.

Setpoint low limit and Sepoint high limit

Low/high limit of the Setpoint value.



SP. 1 **SP. 2** **1st - 2nd Stored Setpoint**

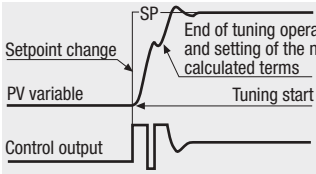
Values of the two Setpoints, that are activated by mean of digital input or communications parameters.

Control mode

tune **Automatic tune**

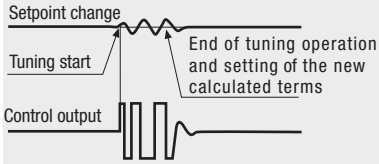
The Fuzzy-Tuning determines automatically the best PID term with respect to the process behaviour. The controller provides **2 types** of **"one shot"** tuning algorithm, that are selected automatically according to the process conditions when the operation is started

A - STEP response



This type is selected when, at autotune operation starting, the PV is far from the Setpoint of more than 5% of the span. This method has the big advantage of fast calculation, with a reasonable accuracy.

B - Natural frequency



This type is selected when the PV is close to the SP Setpoint. This method has the advantage of a better accuracy in the term calculation with a reasonable calculation speed.

The Fuzzy Tuning determines automatically the best method to use to calculate the PID term, according the process conditions.

P.b. **Proportional band**

The parameter specifies a change in the value of the control output that is proportional to the error SP - PV.

t.i. **Integral time**

The integral time specifies the time required by the integral term to generate an output equivalent to the proportional one. When OFF it is not included in the control algorithm.

t.d. **Derivative time**

It is the time required by the proportional term P to repeat the output provided by the derivative term D. When OFF it is not included in the control algorithm.

O.C. **Overshooot control**

Setting lower values (1.00 ⟶ 0.01) the overshoot generated by a Setpoint change is reduced. The overshoot control does not affect the effectiveness of the PID algorithm. Setting 1, the overshoot control has no influence.

OC.rb **Enhanced overshoot management**

Configuration parameter. Defines a zone across the Setpoint where the PID algorithm is not affected by overshoot control.
Setting range 0.2... 5.0.
Default value 0.5.
If OC.rb < 1 the non influenced zone is inside the proportional band, if OC.rb > 1 the non influenced zone is outside the proportional band
Reducing the OC.rb value causes higher overshooting effect and longer times in reaching the Setpoint.
Increasing the OC.rb value increases the zone, near the Setpoint, in which the PID functions with its natural dinamic mode, this reduces the time in reaching the Setpoint.

Setting procedure for OC and OC.rb parameters

1 Set O.C. = 1 and OC.rb = 0.5 and observe the process behaviour.
2 If overshoot or undershoot is not acceptable, set O.C. = 0.5.
3 If overshoot or undershoot is still not acceptable, reduce the O.C. value.
4 If there is no overshoot o undershoot, record the time required by the PV to reach the Setpoint.
5 If the time required by the process variable to reach the Setpoint value is too long, gradually increase the value of "OC.rb" (suggested steps = 0.5).
6 If an acceptable time to reach the Setpoint cannot be obtained with "OC.rb" values up to 2, increase the O.C. value and repeat the procedure re-starting from item 3.

M.res **Manual reset**

This specifies the control output value when PV = SP, in a PD only algorithm (lack of the integral term).

d.err **Error Dead Band**

To protect the actuator, inside the error dead band (PV-SP range), the control output does not change (output Stand-by).

t.c. control output **Control output cycle time**

It's the cycle time of the time proportioning control output. The PID control output is provided by the pulse width modulation of the waveform.

OP. H control output **Control output high limit**

It specifies the maximum value the control output can be set.

OP. L control output **Control output low limit**

It specifies the minimum value the control output can be set.

S.Out **Output safety value**

Output Value in case of input anomaly.

Auxiliary parameters

A1.tp **A2.tp** **A3.tp** **A4.tp** **Alarm type**

The parameter allows to specify how each shoud function.
The types of alarm available are:

Value	Action	
0	Disable	
1	Sensor/Loop Break	
2	Absolute high	Absolute
3	Absolute low	
4	Deviation high	Deviation
5	Deviation low	
6	Band, active out	Band
7	Band, active in	

In.Sh **Input shift**

This function shifts the whole PV scale of up to ±60 digits.

Addr **Controller address**

The address range is from 1 to 247 and must be unique for each instrument on the communications bus to the supervisor.

AL1 - AL2 - AL3 - AL4 alarms

OP1, OP2, OP3 and OP4 if not used as control outputs, can be used as alarm outputs only
For each alarm is possible to configure:

A - Source
B - The type and the operating condition of the alarm
C - The functionality of the alarm acknowledgement
D - The blocking function on start-up
E - Loop break or sensor break
F - Output linked

A - Source

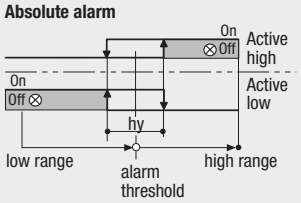
A1Sr
A2Sr
A3Sr
A4Sr

Alarm source
Each alarm AL1, AL2, AL3 and AL4 can be freeely associated to one of the two input channels.
If configured as absolute alarm, the threshold is compared with the Process Value (PV) of the selected channel.
If configured as Deviation or Band Alarm, the threshold is compared with the Setpoint of the selected channel (SP).

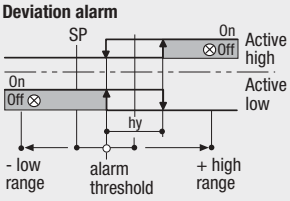
B - Alarm type and function

A1tp A2tp A3tp A4tp

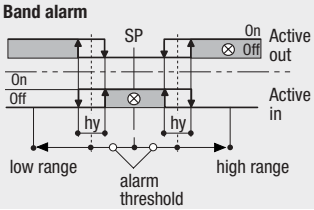
Absolute alarm



Deviation alarm



Band alarm



C/D - Latching, blocking and acknowledge functions enable

A1L.b
A2L.b
A3L.b
A4L.b

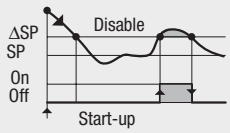
AL1, AL2, AL3 and AL4 latching and blocking
For each alarm it is possible to select the following functions:

- None
- Latching
- Blocking
- Both latching and blocking

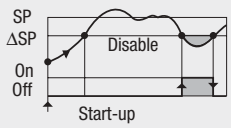
Alarm acknowledge function
The alarm, once occurred, is maintained until to the time of acknowledgement.
The acknowledge operation is performed by serial communications. ack
After this operation, the alarm leaves the alarm state only when the alarm condition is no longer present.

Start-up disabling

Ramp down



Ramp up



ΔSP Threshold = SP±range

E - "Loop Break Alarm" LBA or sensor break

LBA delay t.Lba

Setting "none"
the alarm works as Sensor break with immediate action.

Setting a value between 1 and 9999 s
the alarm works as LBA+Sensor break with delay.

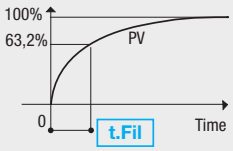
When the cause of the alarm disappears, the alarm status stops.

F - Alarm addressing

A1.O
A2.O
A3.O
A4.O

Physical Output linked to the alarm
When OP1, OP2, OP3 and OP4 are not used by the control process, one or more alarms (OR function) can be linked to the physical outputs.
The parameter can assume the following values: Internal status, OP1, OP2, OP3, OP4.

Input digital filter



Time constant, in seconds, of the RC input filter applied to the PV input.
When this parameter is set to "inhibited" the filter is bypassed.

Technical specifications

Features (at 25°C T. env.)	Description				
Total configurability	By means of the configuration tool it is possible to select: - type of input - the type of control input - type of output - type and functionality of the alarms - type of Setpoint - control parameter values				
PV1 and PV2 inputs	Common characteristics	A/D converter with resolution of 50,000 points Update measurement time: 0.2 s Sampling time: 0.5 s Input bias: -60…+60 digit Input filter: 1…30 s OFF = 0			
	Accuracy	0.25% ±1 digit (for temperature sensor) 0.1% ±1 digit (for mA and mV)	Between 100…240Vac the 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)	Line: 20Ω max. (3 wires) Input drift: 0.35°C/10°C Env. Temp. <0.35°C/10Ω Wire Res.	
	Thermocouple	L,J,T,K,S,R,B,N,E, W3,W5 (IEC 584) °C/°F selectable	Internal cold junction compensation with NTC Error 1...20°C ±0,5°C Burnout	Line 150Ω max. Input drift: <2µV/1°C Env. Temp. <5µV/10Ω Wire Res.	
	DC input (current)	0/4…20mA, 2.5Ω ext. shunt Rj >10MΩ	Burnout. Engieering inputs, decimal point position configurable	Input drift: <0.1%/20°C Env. Temp. <5µV/10Ω Wire Res.	
	DC input (voltage)	10...50mV, 0...50mV Rj >10MΩ	low range: -999…9999 high range: -999…9999 (min range: 100 digits)		
	Mutual isolation	Isolation voltage 500V			
Digital input	Closing the external contact allows:	Auto/Man mode change, switching between 2 stored Setpoints, measure hold, alarms acknowledge, outputs lock			
Operating mode	2 acquisition channels, 2 single action loops PID or ON-OFF with 1, 2, 3 or 4 alarms				
Control mode	Algorithm	PID with overshoot control or ON-OFF			
	Proportional band (P)	0.5…999.9%		Single action PID algorithm	
	Integral time (I)	0.1…100.0 min	OFF = 0		
	Derivative time (D)	0.01…10.00 min			
	Error dead band	0.1…10.0 digit			
	Overshoot control	0.01…1.00			
	Manual reset	0.0…100.0%			
	Cycle time (time proportional only)	1…200 s			
	Control output high limit	10.0…100.0%			
	Control output low limit	0.0…90.0%			
	Output safety value	0.0…100.0%			
	Control output hysteresis	0.1…10.0%		ON-OFF algorithm	
OP1 - OP2 outputs	SPST relay NO, 2A/250Vac (4A/120 Vac) for resistive load SSR, 1A/250Vac for resistive load SSR drive: 0/5Vdc, ±10% 30 mA max. To meet the double isolation requirements, OP1 and OP2 must have the same load type				
OP3 - OP4 outputs	Non isolated logic: 0/5Vdc, ±10% 30 mA max.				
Outputs functions	For all the outputs the inversion function (NOT) is available				
AL1 - AL2 AL3 - AL4 alarms	Hysteresis	0.1…10.0%			
	Action	Active high	Action type	Deviation threshold	±range
		Active low		Band threshold	0…range
				Absolute threshold	whole range
		Special functions	Sensor break, Loop break		
			Alarm acknowledge (latching), activation inhibit (blocking)		
	Alarm source	Assignes the alarms to the Process Value of LOOP 1/LOOP 2 (PV1 or PV2). If set as deviation or band, the reference value is the LOOP 1 or LOOP 2 Setpoint			
	Alarm output	Assignes the alarm condition to an output (OP1, OP2, OP3, OP4). If not configured, the alarm status is available on the coil			
Setpoint (for each loop)	Local	Up and down ramps 0.1…999.9 digit/min. (OFF=0)			
	Local + 2 Stand-by stored	Low limit: from low range to high limit. High limit: from low limit to high range			
Fuzzy-Tuning one shot (1 loop at a time)	The controller automatically selects the best method according to the process conditions	One shot Auto Tuning One shot Natural Frequency			
Auto/Man station	Standard with bumpless function, Switched by digital input or serial communications				
Serial communications	RS 485 isolated, Modbus/Jbus protocol, 1,200, 2,400, 4,800, 9,600 bit/s 2 wires				
Operational safety	Measure input	Detection of out of range, or input problems causes automatic activation of the safety strategies			
	Control output	Safety value: -100…100%			
	Parameters Outputs lock	Parameters and configuration data are stored in a non volatile memory for an unlimited time			
General characteristics	Power supply (PTC protected)	24Vac (-20...+12%) 50/60Hz and 24Vdc (-15...+25%)	Power consumption 3 W max.		
	Safety	EN61010-1 (IEC1010-1), installation class 2 (2.5kV), pollution degree 2, instrument class II			
	Electromagnetic compatibility	Compliance with the CE standards			
	Protection	Terminal blocks: IP20			
	Dimensions	Pitch: 22.5 mm - height: 99 mm - depth: 114.5 mm - height: 53 mm			
	Weight	156 g approx.			

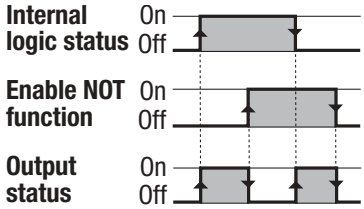
Commands

Alarms acknowledge — Ack

The acknowledge operation is performed by serial communications.

Negate output status — Nt.0x

Is possible to enable, separately for each output (DO1... DO4), the negate (NOT) fuction of the output internal logic status.



PV Measure Hold — HI.PV

Through the digital input IL is possible to hold the value of the PV measure (PV1, PV2 or PV1 and PV2).

Outputs lock — OP.lk

Output ports can be switched to OFF through the serial communications port.

⚠ **Outputs lock status is maintained if the module is powered OFF**

Digital input commands

Function	Performed operation: Off	Performed operation: On	Notes
None			Not used
Hold PV1 measure	Normal operation	PV1 is hold	The value of PV (PV1 or/and PV2) is "frozen" at the time the digital input goes to the close state
Hold PV2 measure	Normal operation	PV2 is hold	
Hold PV1 and PV2 measures	Normal operation	PV1 and PV2 are hold	
Outputs lock	Outputs status not influenced	Outputs in OFF status	The digital IL command inhibits all the outputs at the same time
Alarms acknowledge	Alarms active	Alarms acnowledged	The digital IL command acnowledges all the alarms active at the same time
Recalls the 1st stored Setpoint for LOOP1	Local	1st SP	Closing the contact **forces** the chosen stored value. Setpoint modification is not possible.
Recalls the 1st stored Setpoint for LOOP2	Local	1st SP	
Recalls the 2nd stored Setpoint for LOOP1 and LOOP 2	Local	2nd SP	
Auto/man LOOP1	Automatic	Manual	
Auto/man LOOP2	Automatic	Manual	
Auto/man LOOP 1 and LOOP 2	Automatic	Manual	

A function can be assigned, through the configuration procedure, to digital input. The configured function is activated when the digital input (free voltage contact or open collector output) is in the ON status (closed). The function is reset to the normal operation by setting the input to the OFF status (open).
Activating the function through the digital input has the highest priority than the keypad or the serial communications command activation.

Communications parameters reset

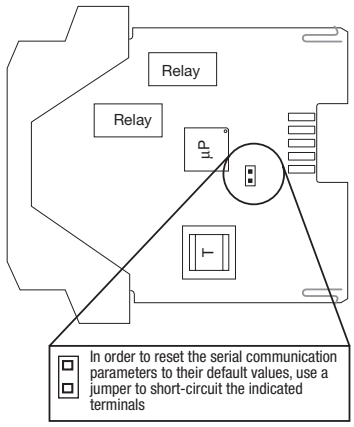
The serial communications parameters can be reset to the original factory settings (protocol: Modbus, Baud Rate: 9600, Address: 247).

The instructions to remove/re-insert the I/O module from/in its plastic case are described in the "Installation manual".

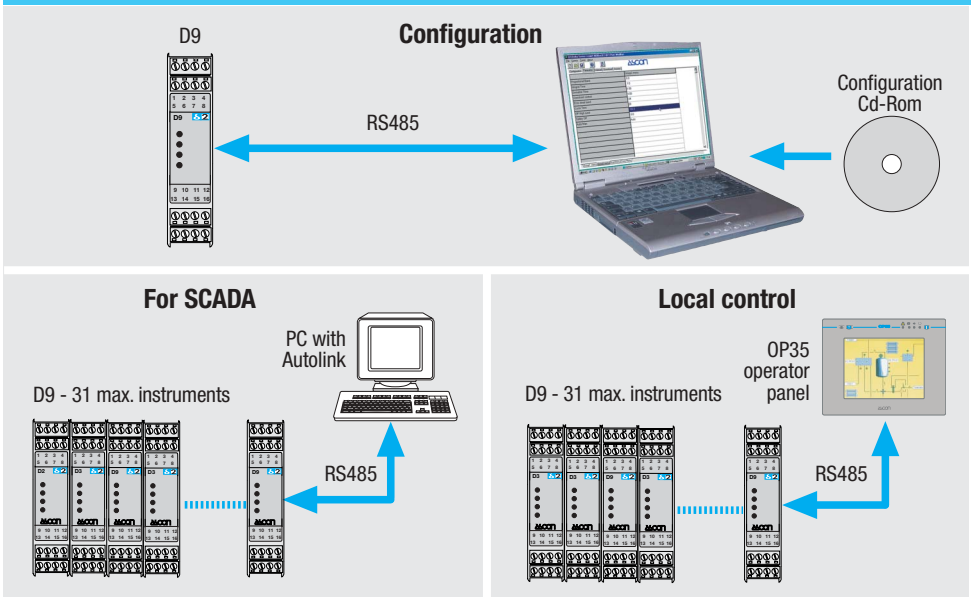
After having removed the module, use the instructions that follow to reset the communications parameters:

1) Use a jumper to short-circuit the terminals shown in the drawing that follows;
2) Insert the I/O module in its housing and power ON the instrument;
3) Extract the I/O module from its plastic case and remove the short circuit jumper;
4) Reinstall the module in its housing.

At the end to this procedure, the communications parameters will be reset to its factory settings.



Serial communications connection example



Warranty

We warrant that the products will be free from defects in material and workmanship for 3 years from the date of delivery.
The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.