

# SOLO SLM

## Quick Start Guide

AUTOMATIONDIRECT™

3505 HUTCHINSON ROAD  
CUMMING, GA 30040-5860

### SOLO Modular Temperature Controllers SLM Series

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5014147201-SMM1



This Quick Start Guide provides basic information on setting up the SOLO SLM temperature controllers. For advanced setup visit the AutomationDirect web site at [www.AutomationDirect.com](http://www.AutomationDirect.com).

### Product Support

- For product support, specifications, and installation troubleshooting, a complete User Manual can be downloaded from the On-line Documentation area of the AutomationDirect web site.
- For additional technical support and questions, call our Technical Support team @ 1-800-633-0405 or 770-844-4200.



### 1 Safety Information

**WARNING:** To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

*Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.*

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200. This publication is based on information that was available at the time it was printed. At AutomationDirect.com® we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without obligation. This publication may also discuss features that may not be available in certain revisions of the product.

**WARNING! ELECTRIC SHOCK DANGER**

1. The SLM series is an OPEN-TYPE device and therefore should be installed in an enclosure free of airborne dust, humidity, and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g. key or special tool is required to open the enclosure).

**THIS CONTROLLER IS AN OPEN-TYPE TEMPERATURE CONTROLLER. MAKE SURE TO EVALUATE ANY DANGEROUS APPLICATION IN WHICH A SERIOUS HUMAN INJURY OR SERIOUS PROPERTY DAMAGE MAY OCCUR.**

- Be sure to tighten terminals to the correct torque of 0.19 Nm. Use solid or twisted wire from 14AWG to 28AWG.
- Protect the controller from dust or foreign objects to prevent controller malfunction.
- Do not modify or disassemble the controller.
- Do not connect anything to the unused terminals.
- Make sure all wires are connected to the correct polarity of terminals.
- Do not install and/or use the controller in places subject to: (a) Dust or corrosive gases and liquid (b) High humidity (c) Vibration and shock (d) EMI / RFI (e) high temperature.
- Power must be turned off when wiring, installing or uninstalling expansion modules (SLM2), or changing a sensor.
- Be sure to use wires that match the thermocouple types when extending or connecting the thermocouple wires.
- Use wires with correct resistance when extending or connecting a platinum resistance thermometer (RTD).
- Keep the wire as short as possible when wiring a platinum resistance thermometer (RTD) to the controller and route power wires as far as possible from load wires to prevent interference and induced noise.
- This controller is an open-type unit and must be placed in an enclosure away from high temperature, humidity, dripping water, corrosive materials, airborne dust and electric shock or vibration.
- Make sure power cables and signals from instruments are all installed properly before energizing the controller, otherwise serious damage may occur.
- To prevent electric shock, do not touch the terminals in the controller or try to repair the controller when power is applied.
- Use a soft, dry cloth to clean the controller. Do not use acid or alkaline liquids for cleaning.
- This instrument is not furnished with a power switch or fuse. Therefore, if a fuse or power switch is required, install the protection close to the instrument.
- Note: This controller does not provide overcurrent protection. Use of this product requires that suitable overcurrent protection device(s) must be added to ensure compliance with all relevant electrical standards and codes. A suitable disconnecting device should be provided near the controller in the end-use installation.

### 2 General Description

AutomationDirect's SOLO Modular units are a single loop temperature controller that can control heating or cooling processes. Depending upon the particular model of controller, the available outputs include relay, voltage pulse, linear voltage, or current. Available with twelve selectable alarm types. SOLO Modular controllers have two control outputs that can be used for control of a heating or cooling applications, alarm output, or for retransmitting the process variable. Using both outputs for control output allows for both heating and cooling control or two stage heating or two stage cooling control. There are four types of control modes: PID, ON/OFF, RAMP/SOAK and Manual. SOLO Modular can accept various types of thermocouple and RTDs as well as 0-10V or 4-20 mA analog input signals.

Other features include:

- Auto Tuning (AT) function with PID control
- DIN rail mountable
- LEDs for indication and diagnostics
- Easy configuration using SL-SOFT SOLO configuration software or Modbus communications
- Selectable between °C and °F
- cULus and CE agency approvals

### 3 Specifications

Specifications	
<b>Operating Voltage Range</b>	21.6 to 26.4 VDC
<b>Power Consumption</b>	Rated 24 VDC, Max. 24 W combined, 3W + 3W x number of SLM2 controllers (Max. 7)
<b>Input Sensors</b>	Thermocouple: K, J, T, E, N, R, S, B, L, U, TXK Platinum RTD: Pt100, JPt100 Linear DC input: 0 ~ 5V, 0 ~ 10V, 0 ~ 20mA, 4 ~ 20mA, 0 ~ 50mV
<b>Input Accuracy</b>	Thermocouples: ±0.3% full scale RTD: ±0.2% full scale Analog input: ±0.3% full scale ± 1 digit
<b>Sampling Rate</b>	Analog input: 0.15 sec. Thermocouple or platinum RTD: 0.4 sec.
<b>Control Method</b>	PID, ON/OFF, Ramp / Soak control or Manual
<b>Output Types</b>	Relay: SPST, Max. load 250VAC, 3A resistive load Voltage pulse: 12VDC, Max. output current: 40mA Current: DC 4 ~ 20mA (Load resistance: < 500Ω) Analog voltage: 0 ~ 10V (Load resistance: > 1,000Ω)
<b>Output Function</b>	Control output, alarm output, retransmit output Retransmit output is available only when output 1 is linear voltage or current output.
<b>Alarm</b>	12 alarm modes
<b>Communication</b>	RS-485 communication, 2,400 bps ~ 38,400 bps
<b>Communication Protocol</b>	Modbus protocol, ASCII/RTU format
<b>Vibration Resistance</b>	10 ~ 55Hz, 10ms <sup>2</sup> for 10mins, each in X, Y and Z direction
<b>Shock Resistance</b>	Max. 300ms <sup>2</sup> , 3 times in each 3 axes, 6 directions
<b>Ambient Temperature</b>	0 to 50°C (32 to 122°F)
<b>Storage Temperature</b>	-20 to +65°C (-4 to 149°F)
<b>Altitude</b>	2,000m or less
<b>Ambient Humidity</b>	35% ~ 85% RH (non-condensing)
<b>Pollution Degree</b>	2

Input		
Hex - Address 1004H		
Input Sensor	Register Value	Available Range
0 ~ 50mV linear voltage input	17	0 ~ 50mV
4 ~ 20mA linear current input	16	4 ~ 20mA
0 ~ 20mA linear current input	15	0 ~ 20mA
0 ~ 10V linear voltage input	14	0 ~ 10V
0 ~ 5V linear voltage input	13	0 ~ 5V
Platinum RTD (Pt100)	12	-200 ~ 600°C (-328 ~ 1,112°F)
Platinum RTD (JPt100)	11	-20 ~ 400°C (-4 ~ 752°F)
Thermocouple TXK type	10	-200 ~ 800°C (-328 ~ 1,472°F)
Thermocouple U type	9	-200 ~ 500°C (-328 ~ 932°F)
Thermocouple L type	8	-200 ~ 850°C (-328 ~ 1,562°F)
Thermocouple B type	7	100 ~ 1,800°C (212 ~ 3,272°F)
Thermocouple S type	6	0 ~ 1,700°C (32 ~ 3,092°F)
Thermocouple R type	5	0 ~ 1,700°C (32 ~ 3,092°F)
Thermocouple N type	4	-200 ~ 1,300°C (-328 ~ 2,372°F)
Thermocouple E type	3	0 ~ 600°C (32 ~ 1,112°F)
Thermocouple T type	2	-200 ~ 400°C (-328 ~ 752°F)
Thermocouple J type	1	-100 ~ 1,200°C (-148 ~ 2,192°F)
Thermocouple K type	0	-200 ~ 1,300°C (-328 ~ 2,372°F)

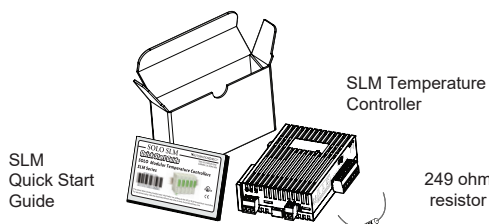
Note 1: Install the supplied 249 ohm resistor between terminal #1 and #2 for linear current inputs.

Note 2: Default setting: Pt100 input.

The range of linear input and feedback value is adjustable. Range of input feedback: -999 ~ 9,999. Take 0 ~ 20mA input as example, -999 refers to 0mA input, and 9,999 refers to 20mA input. If we change the range to 0 ~ 2,000, 0 will refer to 0mA input, and 2,000 will refer to 20mA input. 1 display scale = 0.01mA.

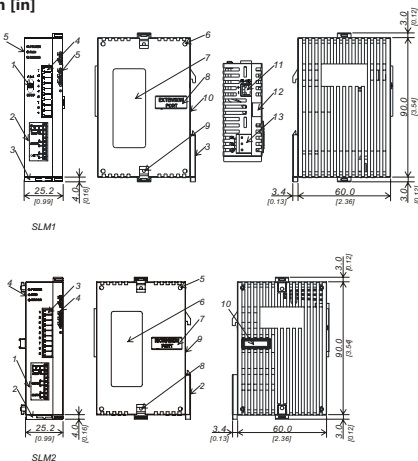
## 4 Box Contents and Unpacking Instructions

- Unpack the SOLO SLM temperature controller from its shipping carton. Included in the carton is the temperature controller, a 249 ohm resistor, and this Quick Start Guide.
- Inspect all equipment for completeness. If anything is missing or damaged, immediately call the AutomationDirect returns department @ 1-800-633-0405.
- Inspect the part number to ensure the model received matches the output type required.



## 5 Controller Dimensions

Dimensions  
mm [in]



	SLM1	SLM2
1	RUN/STOP switch	Wiring and Model name
2	Wiring and Model name	DIN rail clip
3	DIN rail clip	I/O terminals
4	I/O terminals	LED indicators
5	LED indicators	Mounting hole
6	Mounting hole	Specification label
7	Specification label	Extension port
8	Extension port	Extension clip
9	Extension clip	DIN rail
10	DIN rail	Extension port
11	RS-485 communication port	N/A
12	Extension clip	N/A
13	DC power input	N/A

## 6 LED Display

- When power is normal, POWER LED will be on.
- After SLM is switched on, all LEDs will be on. The communication protocol will be displayed for one second. See table below for LED values.
- RUN LED is on when the controller is active.
- ERROR LED is on when errors occur in input, memory or communication.
- When an output is active, its corresponding output LED will be on.
- AT LED flashes when PID parameters are being auto-tuned.
- RX LED flashes when SLM receives communication signals. TX LED flashes when SLM sends out communication signals. Communication protocol displayed on the LEDs after the power to the SLM is switched on:

LED	Baud Rate				
	2400	4800	9600	19,200	38,400
AT	Off	Off	Off	Off	On
TX	Off	Off	On	On	Off
RX	Off	On	Off	On	Off

LED	Parity		
	None	Even	Odd
01	Off	Off	On
02	Off	On	Off

LED	Modbus Format	
	ASCII	RTU
Err	Off	On

LED	Stop Bits	
	2	1
RUN	Off	On

## 7 Alarm Output

SLM series offers 12 alarm modes. See the alarm table below for a description of types of alarm.

Alarm Output		
Mode	Alarm Type	Alarm Output Operation
0	No alarm	OFF
1	Alarm output will be enabled when the temperature reaches upper and lower limits. • Alarm will be enabled when the PV exceeds SV + AL-H or falls below SV - AL-L.	ON OFF AL-L SV AL-H
2	Alarm output will be enabled when the temperature reaches the upper limit. • Alarm will be enabled when the PV exceeds SV + AL-H.	ON OFF SV AL-H
3	Alarm output will be enabled when the temperature reaches the lower limit. • Alarm will be enabled when the PV falls below SV - AL-L.	ON OFF AL-L SV
4	• Alarm will be enabled when the PV is between SV + AL-L and SV - AL-L.	ON OFF AL-L SV AL-H
5	Alarm output will be enabled when the temperature reaches the absolute value of the upper and lower limits. • Alarm will be enabled when the PV exceeds AL-H or falls below AL-L.	ON OFF AL-L AL-H
6	Alarm output will be enabled when the temperature reaches the absolute value of the upper limit. • Alarm will be enabled when the PV exceeds AL-H.	ON OFF AL-H
7	Alarm output will be enabled when the temperature reaches the absolute value of the lower limit. • Alarm will be enabled when the PV falls below AL-L.	ON OFF AL-L
8	Standby upper/lower limit alarm • Alarm will be enabled when the PV reaches SV and exceeds SV + AL-H or falls below SV - AL-L.	ON OFF AL-L SV AL-H
9	Upper limit standby alarm • Alarm will be enabled when the PV reaches SV and exceeds SV + AL-H.	ON OFF SV AL-H
10	Lower limit standby alarm • Alarm will be enabled when the PV reaches SV and falls below SV - AL-L.	ON OFF AL-L SV
11	Upper limit hysteresis alarm • Alarm will be enabled when the PV exceeds SV + AL-H and disabled when the PV falls below SV + AL-L.	ON OFF AL-L AL-H
12	Lower limit hysteresis alarm • Alarm will be enabled when the PV falls below SV - AL-H and disabled when the PV exceeds SV - AL-L.	ON OFF AL-H AL-L

Note: AL-H and AL-L include AL1H, AL2H, AL1L and AL2L. When Output 1 is set to Alarm Output, use AL1H (1024H) and AL1L (1025H). When Output 2 is set to Alarm Output, use AL2H (1026H) and AL2L (1027H).

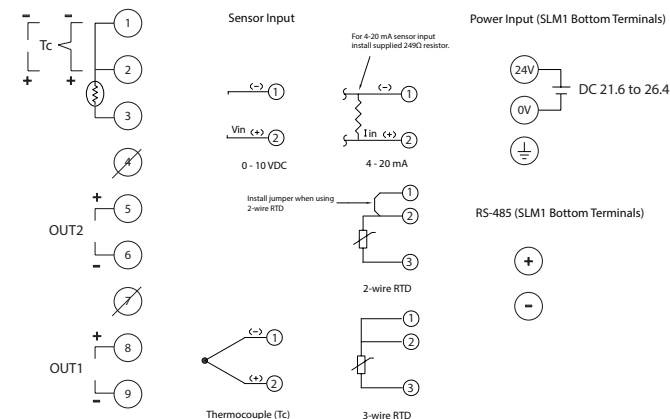
## 8 Terminal Identification



WARNING! ELECTRIC SHOCK DANGER

To prevent electric shock, do not connect AC power to your device until all input and output connections are completed.

Input and Outputs (SLM1 & SLM2 Front Terminals)



## RS-485 Communication

- Supports transmission speed: 2,400, 4,800, 9,600, 19,200, 38,400 bps;
- Communication protocol: Modbus ASCII/RTU;
- Function code: 03H (read Max. 8 words in register), 06H (write 1 word into register), 01H (read Max. 16 bits of data), 05H (write 1 bit into register).

Address	Setting	Parameter	R/W	Description
1000H		Present temperature value (PV)	R	Unit: 0.1 degree. Analog input: 1EU. The read values below indicate the occurrence of errors: 8002H: Temperature not acquired yet 8003H: Temperature sensor not connected 8004H: Incorrect sensor type 8006H: Unable to acquire temperature, ADC input error 8007H: Unable to read/write the memory
1001H	0	Set point (SV)	R/W	Unit: 0.1 degree. Analog input: 1EU.
1002H	6,000	Upper-limit of temperature range	R/W	The content shall not be bigger than the range. Unit: 0.1°
1003H	-200	Lower-limit of temperature range	R/W	The content shall not be smaller than the range. Unit: 0.1°
1004H	12	Input type	R/W	See the table in "Input" section.
1005H	0	Control method	R/W	0: PID, 1: ON/OFF, 2: Manual, 3: RAMP/SOAK
1006H	0	Control selection of Output 1	R/W	0: Heating, 1: Cooling, 2: Alarm, 3: Retransmit output
1007H	4	Control cycle of Output 1	R/W	0 ~ 99, 0: 0.5sec
1008H	4	Control cycle of Output 2	R/W	0 ~ 99, 0: 0.5sec (Invalid when the 2 outputs are the same control.)
1009H	476	Proportional band value	R/W	1 ~ 9,999, Unit: 0.1°. Analog input: 1EU
100AH	260	Integral Time	R/W	0 ~ 9,999
100BH	41	Derivative Time	R/W	0 ~ 9,999
100CH	0	Integral Offset	R/W	0 ~ 1,000, Unit: 0.1%
100DH	0	PD Control Offset	R/W	Offset compensation value for proportional control (when I=0) 0 ~ 1,000, Unit: 0.1%
100EH	100	Proportion Band Coefficient	R/W	COEF setting when in dual control output 1 ~ 9,999, Unit: 0.01
100FH	0	Dead Band	R/W	Dead band setting when in dual control output -999 ~ 9,999, Unit: 0.1° or 1EU
1010H	0	Hysteresis of Output 1	R/W	0 ~ 9,999, Unit: 0.1° or 1EU
1011H	0	Hysteresis of Output 2	R/W	0 ~ 9,999, Unit: 0.1° or 1EU
1012H	0	Output 1 Level	R/W	Read/write output percentage of Output 1 Unit: 0.1%. "Write" is only applicable in manual mode.
1013H	0	Output 2 Level	R/W	Read/write output percentage of Output 2 Unit: 0.1%. "Write" is only applicable in manual mode.
1014H	0	Upper-limit regulation for analog linear output	R/W	1 scale = 2.8μA = 1.3mV
1015H	0	Lower-limit regulation for analog linear output	R/W	1 scale = 2.8μA = 1.3mV
1016H	0	PV Offset	R/W	Temperature offset regulation value -999 ~ +999, Unit: 0.1° or 1EU
1019H	10	Temperature Filter Range	R/W	Range of temperature filter: 1~100, unit: 0.1°C
101AH	8	Temperature Filter Factor	R/W	Setting range: 0~50
1020H	0	Alarm 1	R/W	0 = Alarm 1 is disabled. 1-18 = Alarm type number
1021H	0	Alarm 2	R/W	0 = Alarm 2 is disabled. 1-18 = Alarm type number
1023H	0	Control selection of Output 2	R/W	0: Heating, 1: Cooling, 2: Alarm
1024H	40	Alarm 1 High Limit	R/W	See "Alarm Output" section.
1025H	40	Alarm 1 low Limit	R/W	See "Alarm Output" section.
1026H	40	Alarm 2 High Limit	R/W	See "Alarm Output" section.
1027H	40	Alarm 2 Low Limit	R/W	See "Alarm Output" section.
102AH		Status bits	R	Bit 0 = Not Used Bit 1 = ALM2 Bit 2 = °C Bit 3 = °F Bit 4 = ALM1 Bit 5 = OUT2 Bit 6 = OUT1 Bit 7 = AT
102CH	0	Positive/negative retransmit output	R/W	0: positive, 1: negative
102EH		LED Status	R	Bit 0 = RUN Bit 1 = ERR Bit 2 = O2 Bit 3 = O1 Bit 4 = RX Bit 5 = TX Bit 6 = AT Bit 7 = Not Used
102FH		Firmware version	R	V1.00 is indicated as 0x100
1030H	0	Starting Ramp / Soak Pattern	R/W	0 ~ 7
1032H		Current Step Time Remaining in Seconds	R	0 ~ 54000
1033H		Current Step Time Remaining in Minutes	R	0 ~ 900
1034H		Current Step Number	R	0 ~ 7

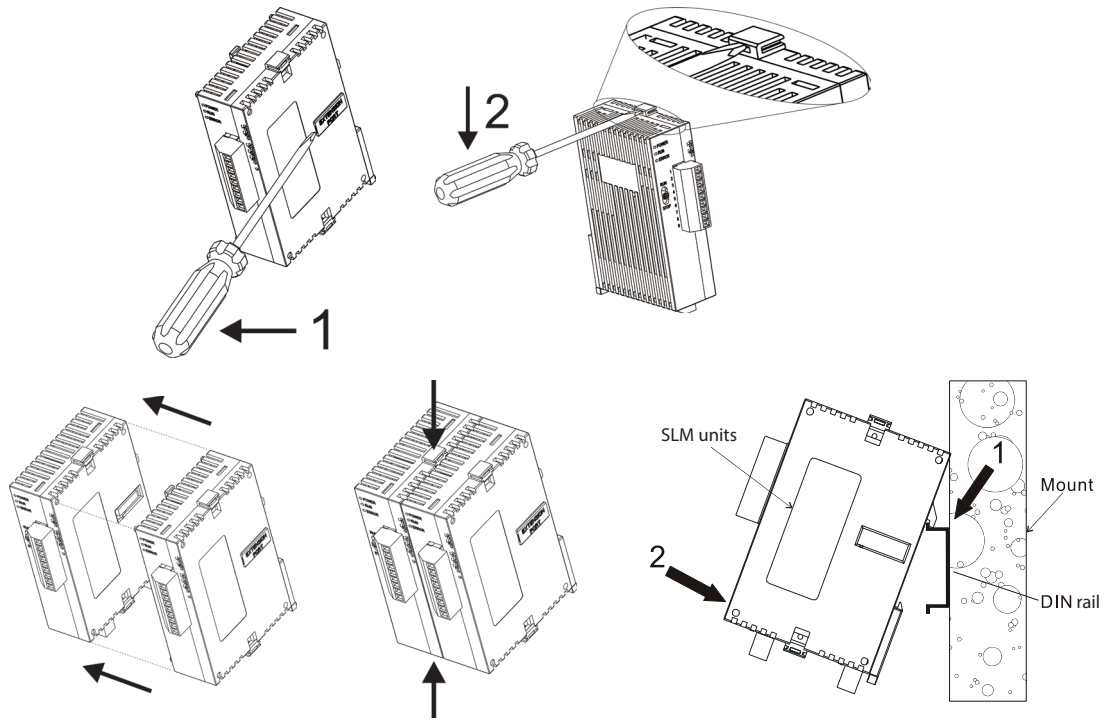
Address	Setting	Parameter	R/W	Description
1035H		Current Pattern Number	R	0 ~ 7
1036H		Ramp Set Point	R	Unit is 0.1 (°C or °F)
1037H	1,000	Upper limit of retransmit output	R/W	0 ~ 100% upper limit of analog output, Unit: 0.1%
1038H	0	Lower limit of retransmit output	R/W	0 ~ 100% lower limit of analog output, Unit: 0.1%
1040H~1047H	7	Last Step Number	R/W	0 ~ 7 = The last step number of the pattern
1050H~1057H	0	Additional Cycles	R/W	0 ~ 199
1060H~1067H	0	Next Pattern Number	R/W	0 ~ 7 = Next pattern number 8 = There is no next pattern
1068H	1	Run/Stop setting	R/W	0: Stop, 1: Run, 2: Program end, 3: Program hold
1069H (Duplicate Address)	0	Control selection of Output 1	R/W	0: Heating, 1: Cooling, 2: Alarm, 3: Retransmit output
106AH (Duplicate Address)	0	Control selection of Output 2	R/W	0: Heating, 1: Cooling, 2: Alarm
1071H	1	Network Address	R/W	1 ~ 247
1072H	0	Modbus Protocol	R/W	1: RTU, 0: ASCII
1073H	2	Baud Rate	R/W	0 ~ 4: 2,400 ~ 38,400
1074H	1	Bit Length	R/W	0: 8 bits, 1: 7 bits
1075H	1	Parity	R/W	0: None, 1: Even, 2: Odd
1076H	1	Stop Bit	R/W	0: 2 stop bits, 1: 1 stop bit
2000H~203FH	0	Ramp / Soak SV	R/W	-999 ~ 9999
2080H~20BFH	0	Ramp / Soak Time	R/W	0 ~ 1500 (15 hours 0 minutes)

0811H	Temperature unit display	0: °F, 1: °C (Default)
0813H	Read/write auto-tuning status	0: End (Default), 1: Start
0814H	Run/Stop setting	0: Stop, 1: Run (Default)
0815H	Program stop flag	1: Program stop
0816H	Program hold flag	1: Program hold

Ramp / Soak Program Alarms	
14	This alarm activates when the Ramp / Soak program has ended.
15	This alarm activates while the program is in RAMP UP status.
16	This alarm activates while the program is in RMP DOWN status.
17	This alarm activates while the program is in SOAK status.
18	This alarm activates while the program is in RUN status.

## 10 Mounting Instructions

How to connect a maximum of 8 controllers (Using a SLM1 with up to 7 SLM2 units) by using DIN rail.



### Notes

