SuperNova PD500 PID Process & Temperature Controllers

Instruction Manual

- 1/16, 1/8, and 1/4 DIN Auto-Tuning PID Process & Temperature Controllers
- Thermocouple and RTD Inputs
- DC Voltage and Current Inputs (1-5 V, 0-5 V, 0-10 V, 0-50 mV, 0-100 mV; 4-20 mA with Resistor)
- 250 Ω Resistor(s) Included Standard
- High Accuracy Auto-Tuning PID
- High Durability Front with Hard Plastic Pushbuttons
- Large Easy to Read 14-Segment PV Display up to 1.1" (29 mm)
- Input Power 100-240 VAC
- Heating, Cooling, and Heating & Cooling Control
- Primary Control Output Options: 4-20 mA (SCR), Voltage Pulse (SSR), or Relay
- Secondary Control Output Relay Standard on All Models
- Easily Switch Between Auto and Manual Control Modes
- Up to 2 Alarm Relays & 4-20 mA Retransmit Outputs
- Remote Set Value 1-5 V Input Option (4-20 mA with External Resistor)
- Digital Input Set Value Selection
- RS-485 Serial Communications Option
- Modbus® RTU/ASCII Communications
- Mini-USB Port Standard
- FREE Programming and Monitoring Software
- 1/16, 1/8, 1/4 DIN Sizes Available
- Shallow Depth Case Extends Only 2.5" (63 mm) Behind Panel
- IP65 Fronts
- UL & C-UL Recognized Process Control Equipment, Electrical - Component

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⚠ CAUTION

- Read complete instructions prior to installation and operation of the controller.

⚠ WARNINGS

- Risk of electric shock or personal injury.
- This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Precision Digital Corporation shall not be held liable for damages resulting from such improper use.

⚠ WARNING
Cancer and Reproductive Harm - www.P65Warnings.ca.gov

Operation & Care Notes

Limited Warranty

Precision Digital Corporation warrants this product against defects in material or workmanship for the specified period under "Specifications" from the date of shipment from the factory. Precision Digital's liability under this limited warranty shall not exceed the purchase value, repair, or replacement of the defective unit. See Warranty Information and Terms & Conditions on www.predig.com for complete details.

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Introduction

The SuperNova PD500 Series of PID Process & Temperature Controllers is a complete line of PID and on/off controllers. Available in popular 1/4, 1/8, and 1/16 DIN sizes, and with a shallow depth behind panel of only 2.5" (63 mm) it is easy to fit into almost any panel, product, or enclosure.

Voltage, current (with external resistor), and direct temperature thermocouple and RTD inputs make it an excellent choice for any control application requiring easy to change, visible set points.

This modern line of controllers shows the process variable (PV), set value (SV), and manipulated value (output level%, MV) on a striking reverse polarity LCD screen. Indicators for units (˚C, ˚F,%, or none)

Auto and manual control modes can be easily changed by holding two buttons, and this is indicated on the front panel to make it easy for operators to know how to use this feature.

Main control outputs can be 4-20 mA (SCR), voltage pulse (SSR), or relay outputs. A secondary relay control output is standard, which allow for one or two direction SV control (*i.e.,* heating and cooling).

Additional outputs may include two SPST alarm relays and a 4-20 mA retransmit output. Other options include a secondary 4-20 mA input to remotely control the set point, and RS-485 for Modbus communication.

A mini-USB port may be used for a direct PC connection to run the SuperNova software for monitoring, programming, and data logging. This USB port is located on the rear behind the panel for PD510 1/16 DIN models, and on the front behind a rubber tab on PD520 and PD530 1/8 and 1/4 DIN models.

Abbreviations

The following abbreviations are used throughout this manual.

General Controller Term Descriptions

Abbreviation	Full Meaning
PV	Process value
SV	Set value
MV	Manipulated value (Output value %)
AT	Auto-tuning
REM	Remote set value
RET	Retransmission 4-20 mA output
SUB1	SUB1 output (alarm relay 1)
SUB2	SUB2 output (alarm relay 2)
LBA	Loop break alarm
EU	Engineering unit
EUS	Engineering unit, total span

Range and Scale Descriptions

FR.L — Full Range Low: The temperature range is defined according to the thermocouple or RTD type selected. The minimum temperature value of this range is referred to as the FR.L (full range, low).

Example: For a type K thermocouple, the FR.L is -200 °C.

FR.H — Full Range High: The temperature range is defined according to the thermocouple or RTD type selected. The maximum temperature value of this range is referred to as the FR.H (full range, high).

Example: For a type K thermocouple, the FR.H is 1370 °C.

SL.L — Scale Limit Low: The scale range is used when the input is a process signal, voltage or current (with an external sense resistor). The minimum scale value of the process input is referred to as the SL.L. This value may be changed with the SL-L parameter to scale the process input to the desired engineering unit.

Example: For a 1 to 5 VDC input, the default SL.L is -1999. To represent an input value of 0 to 100%, the SL-L parameter would be changed to 0, making the SL.L 0.

SL.H — Scale Limit High: The scale range is used when the input is a process signal, a voltage or current (with an external sense resistor). The maximum scale value of the process input is referred to as the SL.H. This value may be changed with the SL-H parameter to scale the process input to the desired engineering unit.

Example: For a 1 to 5 VDC input, the default SL.H is 9999. To represent an input value of 0 to 100%, the SL-H parameter would be changed to 100, making the SL.H 100.

Engineering Unit Descriptions

During the programming of the controller, there are two types of engineering units referred to, EU, and EUS.

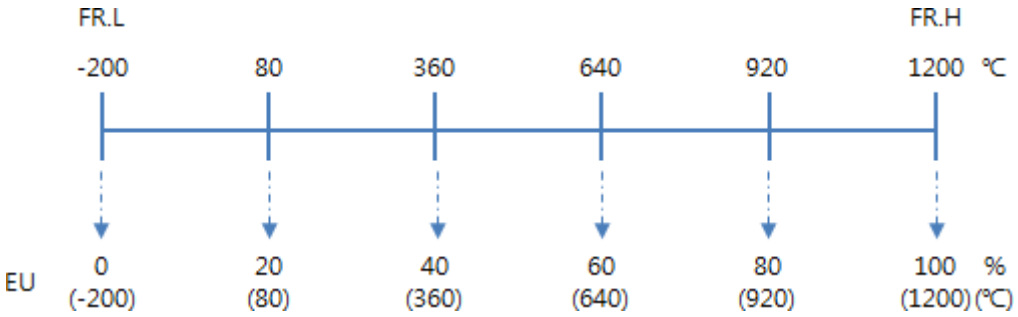
EU: The value in engineering units according to the input range.
EUS: The value in engineering units according to the full span of the input.

Engineering Units (EU)

A parameter or other value defined in EU is defined in the actual absolute engineering unit value of the input type (or scaled engineering units for the case of voltage or current inputs).

This means the EU value takes on the actual engineering unit value, which may be negative in some cases.

In the example below, the controller has been programmed for a type J thermocouple. A type J thermocouple has a range of -200°C (FR.L) to 1200°C (FR.H). Any parameter or value using EU unit definitions could be defined in values from -200°C to 1200°C.



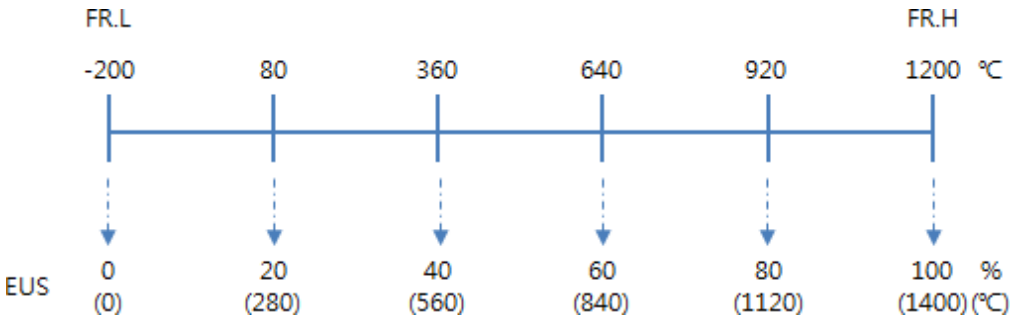
If the parameter or value is defined in EU, but listed as a percentage (EU %), 0% represents the value of -200°C and 100% represents a value of 1200°C.

Engineering Unit Span (EUS)

A parameter or other value defined in EUS is defined in the actual engineering units of the input type (or scaled engineering units for the case of voltage or current inputs) but represents the span value in those engineering units.

This means the EUS value is defined in engineering units, but begins at 0, representing the low range of input (FR.L or SL.L) and will not be a negative value, regardless of the actual input range.

In the example below, the controller has been programmed for a type J thermocouple. A type J thermocouple has a range of -200°C (FR.L) to 1200°C (FR.H), but a span of 1400°C. Any parameter or value using EUS unit definitions could be defined in values from 0°C to 1400°C.



If the parameter or value is defined in EUS, but listed as a percentage (EUS %), 0% represents the value of 0°C and 100% represents a value of 1400°C.

Ordering Information

Model Number	DIN Size	Main Control Output	Additional Features
PD510-A	1/16	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays
PD510-A-CD	1/16	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 2 Digital Inputs
PD510-A-CTR	1/16	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 4-20 mA SV Input
PD510-S	1/16	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays
PD510-S-CD	1/16	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 2 Digital Inputs
PD510-S-CTR	1/16	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 4-20 mA SV Input
PD510-R	1/16	Relay (On/Off)	Relay Control Output, 2 Alarm Relays
PD510-R-CD	1/16	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 2 Digital Inputs
PD510-R-CTR	1/16	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 4-20 mA SV Input
PD520-A	1/8 (V)	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays
PD520-A-CTD	1/8 (V)	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD520-A-CTDR	1/8 (V)	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input
PD520-S	1/8 (V)	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays
PD520-S-CTD	1/8 (V)	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD520-S-CTDR	1/8 (V)	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input
PD520-R	1/8 (V)	Relay (On/Off)	Relay Control Output, 2 Alarm Relays
PD520-R-CTD	1/8 (V)	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD520-R-CTDR	1/8 (V)	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input
PD530-A	1/4	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays
PD530-A-CTD	1/4	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD530-A-CTDR	1/4	4-20 mA (SCR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input
PD530-S	1/4	Voltage Pulse (SSR)	Relay Control Outputs, 2 Alarm Relays
PD530-S-CTD	1/4	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD530-S-CTDR	1/4	Voltage Pulse (SSR)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input
PD530-R	1/4	Relay (On/Off)	Relay Control Output, 2 Alarm Relays
PD530-R-CTD	1/4	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs
PD530-R-CTDR	1/4	Relay (On/Off)	Relay Control Output, 2 Alarm Relays, RS-485, 4-20 mA Retransmit, 2 Digital Inputs, 4-20 mA SV Input

Model	Model Number Digits						Description
PD5	☐	- ☐	- ☐	☐	☐	☐	PID Process & Temperature Controller
Size	10						(1/16 DIN) 1.9" x 1.9"x 2.5" (48 x 48 x 63 mm) (W x H x D)
	20						(1/8 DIN) 3.8" x 1.9" x 2.5" (48 x 96 x 63 mm) (W x H x D)
	30						(1/4 DIN) 3.8" x 3.8" x 2.5" (96 x 96 x 63 mm) (W x H x D)
Control & Alarm Outputs		A					Control OUT 1 = Current output (4-20 mA current output for PID control) Control OUT 2 = Relay output 2 SUB alarm relay outputs
		R					Control OUT 1 = Relay output for On/Off or time-proportional PID Control Control OUT 2 = Relay output 2 SUB alarm relay outputs
		S					Control OUT 1 = Voltage pulse output for On/Off or time-proportional SSR PID Control Control OUT 2 = Relay output 2 SUB alarm relay outputs
Communication (RS485)							None
			C				RS-485 communication
Retransmission Output (RET)							None
				T			Retransmission output (4-20 mA)
Digital Input (DI)							None
					D		2 digital inputs (DI 1-2)
Remote Input (REM)							None
						R	1 input, 4-20 mA (1-5 VDC)

Enclosures

Model/Series	Meters	DIN	Material
PDA2301-V	1	1/8 (V)	Plastic NEMA 4X
PDA2302-V	2	1/8 (V)	Plastic NEMA 4X
PDA2303-V	3	1/8 (V)	Plastic NEMA 4X
PDA2304-V	4	1/8 (V)	Plastic NEMA 4X
PDA2305-V	5	1/8 (V)	Plastic NEMA 4X
PDA2306-V	6	1/8 (V)	Plastic NEMA 4X
PDA2301-4	1	1/4	Plastic NEMA 4X
PDA2301-16	1	1/16	Plastic NEMA 4X
PDA3408	1	1/4	Plastic NEMA 4X with Clear Cover
PDA2600	1-6	1/8 (V)	Stainless Steel NEMA 4X
PDA2700	1-6	1/8 (V)	Painted Steel NEMA 4

Need help selecting the right enclosure?
Go to www.predig.com/esu

Accessories

Model	Description
PDX-RES2	250 Ω 0.1% Precision Resistor for SuperNova 4-20 mA Input
PDA7485-I	RS-232 to RS-485 isolated converter
PDA8485-I	USB to RS-485 isolated converter
PD9501	Multi-function calibrator
PDA-LH	Light / horn accessory
MOD-LH	Light / horn / enclosure modification
PDA-MINIUSB	USB Cable for SuperNova Series, Type A Male to Type Mini-B Male
PDX6901	Snubber: 0.01 µF/470 Ω, 250 VAC

Signal Splitter & Conditioner Accessories

Model	Description
PD659-1MA-1MA	Signal Isolator with One 4-20 mA Input and One 4-20 mA Output
PD659-1MA-2MA	Signal Splitter with One 4-20 mA Input and Two 4-20 mA Outputs
PD659-1V-1MA	Signal Conditioner with One 0-10 VDC Input and One 4-20 mA Output
PD659-1MA-1V	Signal Conditioner with One 4-20 mA Input and One 0-10 VDC Output

Specifications

Except where noted all specifications apply to operation at +25°C.

General

Display	Wide viewing angle reverse polarity LCD; PV: white, SV: green, MV: amber PD510: PV and SV display PD520: PV, SV, and MV display PD530: PV, SV, and MV display

Display Height	inches (mm)		
	PV	SV	MV
PD510	0.60 (15.2)	0.29 (7.4)	N/A
PD520	0.81 (20.5)	0.50 (12.8)	0.37 (9.3)
PD530	1.14 (29.0)	0.59 (15.0)	0.43 (11.0)

PV Display Update Rate	4/second (250 ms)
Non-Volatile Memory	Settings stored for a minimum of 10 years. EEPROM life: 1 million writes
Included Components	Controller with rubber gasket and mounting bracket, 250 Ω resistor (1%), and Quick Start Guide. Additional 250 Ω resistor (1%) provided for models with remote setpoint input option.
EEPROM Lock	Programmable lock or unlock write access to the EEPROM. When locked, setting changes stored in RAM (not saved on power down).
Power	100 - 240 VAC ±10%, 50 / 60 Hz 8.5 VA max.
Insulation Resistance	20 MΩ minimum, 500 VDC
Dielectric Strength	3,000 VAC; 50/60 Hz for 1 minute across power terminals
Environmental	Operating temperature range: -10 to 50°C (14 to 122°F) Storage temperature range: -25 to 65°C (-40 to 185°F) Relative humidity: 35 to 85% non-condensing
Front Panel	IP65
Depth Behind Panel	Case extends 2.5 in (63 mm) behind panel.
Required Fuse	UL Recognized, 250 VAC 0.5 A max, slow-blow fuse. Use fuses or circuit breakers compliant with IEC60947-1 or IEC60947-3
Connections	Fixed rear screw terminals and mini-USB
Mounting	1/4, 1/8, or 1/4 DIN panel cutout required: panel mounting bracket assemblies are provided.
Weight	PD510: 4.2 oz (120 g) PD520: 7.1 oz (202 g) PD530: 10.2 oz (290 g)
Warranty	1 year parts & labor. See Warranty Information and Terms & Conditions on www.predig.com for complete details.

Process Input

Process Input Selection	Voltage or current (with external resistor)
Process Input	1-5 V (4-20 mA), 0-5 V, 0-10 V, 0-50 mV, 0-100 mV External 250 Ω resistor required to read 4-20 mA. Recommended accessory PDX-RES2.
Decimal Point	Up to 3 decimals.
Input Sampling	20 samples/sec (50 ms per sample). For display update rate, see *Display Update Rate*

Input Accuracy

Input Type	Prog. No.	Display	Scale Range	Accuracy
4-20 mA*	30	1-5	-1999 to 9999	±0.2% of FS ± 1 digit
1-5 V	30	1-5		
0-5 V	31	5V		
0-10 V	32	10V		
0-50 mV	33	0.05V		
0-100 mV	34	0.1V		

*To achieve the highest accuracy with a 4-20 mA input to the controller, connect a 250 Ω (0.1% or higher precision) resistor across the input terminals. The 250 Ω (1%) resistor included with the product is not a precision resistor. For precision resistor, order PDX-RES2.

Temperature Input

Temperature Input Selection	Field programmable for thermocouple or RTD
Thermocouple Type	K, J, E, T, R, B, S, L, N, U, W, PLII
RTD Type	JPT100, PT100
Cold Junction Compensation (RJC)	±1.5°C (-10 to 50°C)
RTD Max Line Resistance	Three wire RTD with identical line resistance up to 10 Ω
Input Sampling	20 samples/sec (50 ms per sample). For display update rate, see *Display Update Rate*

Input Accuracy

Input Type	Prog. No.	Display	Range	Accuracy
K	1	K0	-328 to 2498°F -200 to 1370°C	±0.2% of FS ± 1 digit
	2	K1	-148 to 932°F -100.0 to 500.0°C	
J	3	J0	-328 to 2192°F -200 to 1200°C	
	4	J1	-328 to 1652°F -199. To 900.0°C	
E	5	E1	-328 to 1652°F -199.9 to 900.0°C	
T	6	T1	-328 to 752°F -199.9 to 400.0°C	
R	7	R0	32 to 3092°F 0 to 1700°C	
B	8	B0	212 to 3272°F 100 to 1800°C	±0.2% of FS ± 1 digit 100 to 200°C: ±2.0% of FS ± 1 digit
S	9	S0	32 to 3092°F 0 to 1700°C	±0.2% of FS ± 1 digit
L	10	L1	-328 to 1652°F -199.9 to 900.0°C	
N	11	N0	-328 to 2372°F -200 to 1300°C	
U	12	U1	-328 to 752°F -199.9 to 400.0°C	
W	13	W0	32 to 4172°F 0 to 2300°C	
PLII	14	PL0	32 to 2372°F 0 to 1300°C	
JPt100	20	JPt0	-328 to 932°F -200 to 500°C	
	21	JPt1	-328 to 932°F -199.9 to 500.0°C	
Pt100	22	Pt0	-328 to 1184°F -200 to 640°C	
	23	Pt1	-328 to 1184°F -199.9 to 640.0°C	

Control Outputs

Control Outputs	Each controller has a main control output and a secondary control relay output for two directions of control. The secondary control relay output is always used for On/Off operation.
Main Control Output	4-20 mA output (SCR), voltage pulse (SSR), or electromechanical relay (On/Off) outputs available.
Control Type	ON/OFF, PID control
Output Operation	Programmable for reverse or direct action.
Current SCR Output	4-20 mA linear current output Load resistance: 600 Ω maximum ± 0.2% of FS ± 1 digit
Voltage Pulse SSR Output	12 V ± 1 VDC Load resistance: 600 Ω minimum Recommended minimum cycle time: 1 sec
Relay Output	Rated resistive load switching capacity: 5 A, 250 VAC; 5 A, 30 VDC Max switching power: 750 VA, 90 W Max switching voltage: 250 VAC, 110 VDC Max switching current: 5 A Mechanical life: 20 million cycles (at 180 CPM) Recommended minimum cycle time: 20 sec

Alarm Relay Outputs

Function	Programmable for 13 different alarm types or off.
Number	Two alarm relays standard on all models.
Alarm Relay Ratings	Rated resistive load switching capacity: 5 A, 250 VAC; 5 A, 30 VDC
Deadband	0-100% FS, user selectable
High or Low Alarm	User may program any alarm for high, low, or high-low range operation.
Absolute or Deviation Alarm	User may program any alarm as an absolute value alarm or a set value deviation alarm.
Loop Break Alarm	User may program any SUB alarm relay as a loop break alarm.
Alarm Relay Operation	• Automatic (non-latching) and/or manual reset • Latching (requires manual acknowledge) with/without clear • Off (disable unused relays)
Relay Reset (Acknowledge)	Automatic, front panel button, in setup parameter menu, or through serial communications
Time Delay	0 to 999 seconds, on and off delays; programmable for each SUB relay.
Fail-Safe Operation	Programmable, independent for each alarm relay. Relay coils are energized in non-alarm condition. In case of power failure, relays will go to alarm state.
Standby Operation	Programming, independent for each alarm relay
Auto Initialization	When power is applied to the controller, relays will reflect the state of the input to the controller unless standby mode is enabled.

4-20 mA Retransmit Output

Function	4-20 mA linear current output
Scaling Range	0-100% of full scale
Output Loop Resistance	600 Ω maximum load
Output Accuracy	±0.2% of full scale ± 1 digit
0-10 VDC Output	The PD659-1MA-1V can convert the optional 4-20 mA output to a 0-10 VDC output

Remote SV Process Input

Function	Process input to remotely change SV
Input Type & Range	1-5 V, 4-20 mA External 250 Ω resistor required to read 4-20 mA.
Input Accuracy	±0.2% of full scale ± 1 digit

USB Connection

Function	SuperNova software connection only
Location	PD510: Top, behind panel PD520 & PD530: Front mounted behind rubber seal, accessible from front panel
Communication	UMS (USB Mass Storage) 2.0
Compatibility	USB 2.0 Standard, Compliant
Connector Type	Mini-USB receptacle
Cable	USB A Male to Mini-USB Cable
Protocol	Protocol: PC-LINK Baud rate: 38400 bps Start bit: 1 bit Data bits: 8 bits Parity bit: None Stop bit: 1 bit
Communication Distance	16.4 ft (5 m) maximum

Digital Inputs

Function	Digital Input 1: Select Run/Stop Mode Digital Input 2: Select SV 1 or SV4/REM
Contacts	DI1 and DI2, shared common
Logic Levels	On: 1.5 V; Off: 0.1 V
Input Current	Approximately 2 mA each contact
Input Impedance	On : 1 kΩ max, Off: 100 kΩ min.
Open Contact Voltage	Open contact voltage approximately 5 VDC

Modbus® RTU Serial Communications

Communication Method	EIA RS-485 standard, 2-wire half-duplex with grounded, shielded cable
Slave Id	1 – 99 (Controller address); 31 maximum bus connections
Max Range	3,937 ft (1.2 km)
Baud Rate	Programmable for 4800, 9600, 14400, 19200, 38400, 57600 bps.
Start Bit	1 bit
Data Bits	Programmable for 7 or 8 bits
Parity	Programmable for none, even, or odd.
Stop Bit	Programmable for 1 or 2 bits
Protocol	PC-LINK STD, PC-LINK SUM, MODBUS-ASCII, MODBUS-RTU
Response Time	Actual response time = processing time + (response time x 50 ms)

SuperNova TCS Software

Availability	Download directly from www.predig.com/download_software
Operating System Requirements	Microsoft® Windows® 7/8/10 64-bit (x64) or 32-bit (x86)
Minimum Hardware Requirements	Pentium 1 GHz 512 MB RAM 1 GB available hard drive space (x86) 2 GB available hard drive space (x64)
Communications	USB 2.0 (single controller only) (Standard USB A to Mini-B USB) RS-232 to RS-485 converter or USB to RS-485 converter (programming, monitoring, and data logging of multiple units)
Configuration	Configure parameters of all connected controllers.
Data Log	Data log onto computer hard drive. Data log files may be exported to HTML, .xls, .xlsx, or .pdf format as graphs or data tables. Graphs may also be exported as .bmp, .gif, .jpeg, or .png. Data tables may also be exported as .csv.
USB Powered	USB port provides power to the controller for programming. Apply normal power for general controller operations.

Compliance Information

Safety

UL & C-UL Recognized Component	USA & Canada Process Control Equipment, Electrical – Component Process Control Equipment, Electrical Certified for Canada - Component
UL File Number	E171428

Electromagnetic Compatibility

CE Marked	EN 55022 Class A ITE emissions requirements
Electrostatic Discharge	KN61000-4-2
Electrical Fast Transients	EFT(RS): KN61000-4-3
Surge	KN61000-4-5
Conductivity RF (CS)	KN61000-4-6

Note:

Testing was conducted on controllers installed through the covers of grounded metal enclosures with cable shields grounded at the point of entry representing installations designed to optimize EMC performance.

Safety Information

⚠ CAUTION

- Read complete instructions prior to installation and operation of the controller.
- Install outdoors only with appropriate protection.
- Use it only in the ambient temperature and humidity ranges indicated in this manual.
- Do not use in locations where corrosive and flammable gases are present.
- Use it in places where vibrations and impacts are not directly applied to the unit.
- Use it in places without liquids, oils, chemicals, steam, dust, salt, iron, etc. (pollution degree 1 or 2).
- Avoid places where large amounts of inductive or electromagnetic noise or static electricity are generated.
- Avoid places with heat accumulation caused by direct sunlight, radiant heat, etc.
- Use it in places with elevation below 2000 m.
- Installation Category II.

⚠ WARNINGS

- Risk of electric shock or personal injury.
- The input/output terminals are subject to electric shock risk. Never let the input/output terminals come in contact with your body or a conductive material.
- This product is not recommended for life support applications or applications where malfunctioning could result in personal injury or property loss. Anyone using this product for such applications does so at his/her own risk. Precision Digital Corporation shall not be held liable for damages resulting from such improper use.
- This controller is not equipped with a power switch or fuse, install them separately (fuse rating: 250 VAC, 0.5 A).
- Supply the rated power voltage to prevent product damage or malfunction.
- To reduce risk of electric shocks, do not supply power until all installation wiring is complete.
- Do not connect or disconnect any wiring while the power terminal wires are live.
- The product has no hazardous area classifications. Use only in safe areas.
- Never modify, repair, or disassemble this controller. This may result in electric shock, fire, or damage to the controller.
- Please use this controller only after installing it to a panel to reduce risk of shock or injury.
- When used in equipment with a high risk of personal injury or property damage, installing a redundant fuse and other safety devices is recommended.

Operation & Care Notes

- Please do not clean the controller with organic solvents such as alcohol, benzene, etc. Clean it with neutral detergents.
- If water enters the unit, a short circuit or fire may occur, so please inspect the product carefully.
- For thermocouple input, use the predetermined compensating cable (temperature errors occur when using ordinary cable).
- For RTD input, use a cable with small lead wire resistance and without resistance difference among the 3 wires (temperature errors occur if the resistance value among the 3 wires is different).
- Keep the input signal line away from power line and load line to avoid the influence of inductive noise.
- The input signal line and the output signal lines should be separated from each other. If separation is not possible, use shield wires for the input signal line.
- Use a non-grounded sensor for thermocouple (using a grounded sensor may cause malfunctions).
- When there is a lot of noise from the input power source, we recommend using an isolation transformer and noise filter. Please install the noise filter to a grounded panel or structure and make the wiring of the noise filter output to the controller power supply terminal as short as possible.
- Tightly twisting the power cables helps prevent noise.
- Be sure to program the alarm functions to behave as desired in the case of abnormal operation. Confirm this before operation.
- When replacing the sensor, be sure to turn off the power to the controller.
- Use an intermediate relay when the frequency of operation (such as proportional operation) is high, because connecting the load to the output relay directly may shorten the life of the controller. In these cases, using the voltage pulse/SSR drive output type is recommended.
- When using an electromagnetic relay for control, set the proportional cycle to at least 20 sec.
- When using SSR output for control, set the proportional cycle to at least 1 sec.
- Do not wire anything to unused terminals.
- Confirm all terminal polarities before wiring any inputs or outputs to avoid damage.
- When you install this product to a panel, use switches or circuit breakers compliant with IEC60947-1 or IEC60947-3.
- Install switches or circuit breakers at close distance for easy user accessibility.
- Specify on the panel that, since switches or circuit breakers are installed, if the switches or circuit breakers are open, the power will be cut off.

Installation

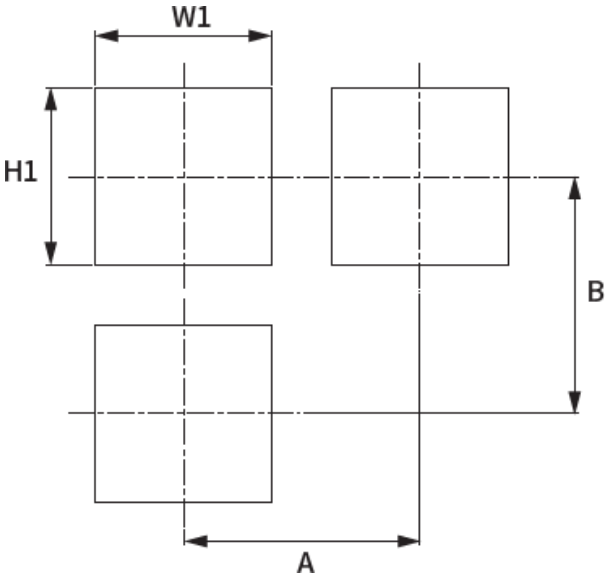
There is no need to remove the controller from its case to complete the installation, wiring, and setup of the controller.

Unpacking

Remove the controller from box. Inspect the packaging and contents for damage. Report damages, if any, to the carrier.
If any part is missing or the controller malfunctions, please contact your supplier or the factory for assistance.

Panel Mounting Instructions

- Prepare the appropriate standard DIN panel cutout. Refer to *Figure 1. Panel Cutout Dimensions* below for more details.
- Clearance: allow at least 3.5" (88.4 mm) behind the panel for wiring.
- Panel thickness: 0.04" - 0.28" (1.0 mm - 7.0 mm).
- Remove the mounting bracket(s) provided with the controller.
- Insert controller into the panel cutout.
- Install mounting bracket(s) and tighten the screws against the panel. To achieve a proper seal, tighten the mounting bracket screws evenly until controller is snug to the panel. DO NOT OVER TIGHTEN, as the rear of the panel may be damaged. See *Figure 2. PD510 Mounting Bracket Installation*
- and *Figure 3. PD520 and PD530 Mounting Bracket Installation*.



Panel Cutout Units: in (mm)			
Dimension	**PD510**	**PD520**	**PD530**
W1[1]	45.0	45.0	93.0
H1[1]	45.0	93.0	93.0
A	60.0	70.0	117.0
B	60.0[2]	122.0	117.0

1.+0.5 mm tolerance applied.

2. Allow 3.9 in (100.0 mm) above controller for use of a USB cable with PD510.

Figure 1. Panel Cutout Dimensions

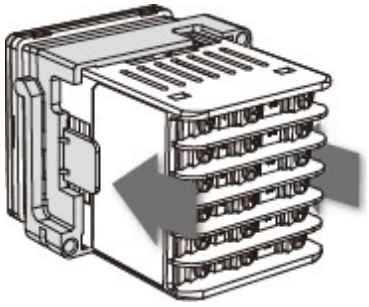


Figure 2. PD510 Mounting Bracket Installation

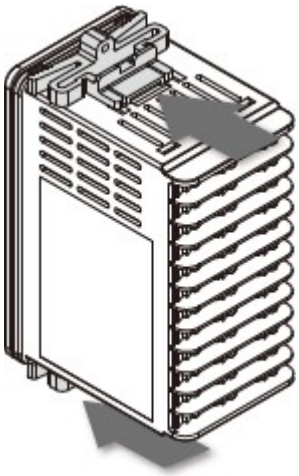
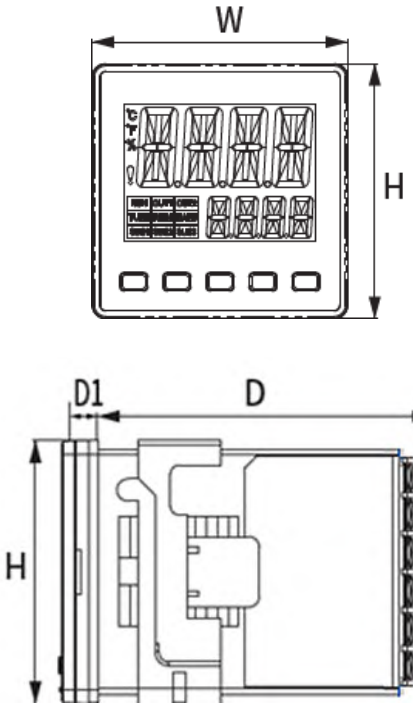


Figure 3. PD520 and PD530 Mounting Bracket Installation

Controller Dimensions



Controller Dimensions Units: in (mm)			
Dimension	**PD510**	**PD520**	**PD530**
W	48.0	48.0	96.0
H	48.0	96.0	96.0
D	63.0	63.0	63.0
D1	5.0	5.0	5.5

Figure 4. Controller Dimensions

Connections

All connections are made to non-removable screw terminal connectors located at the rear of the controller.

The mini-USB connector is located at the front of the PD520/PD530 and at the top of the PD510.

⚠ CAUTION

- Use copper wire with 60°C or 60/75°C insulation for all line voltage connections. Observe all safety regulations. Electrical wiring should be performed in accordance with all applicable national, state, and local codes to prevent damage to the controller and ensure personnel safety.
- Use spade or ring terminals to secure wires.

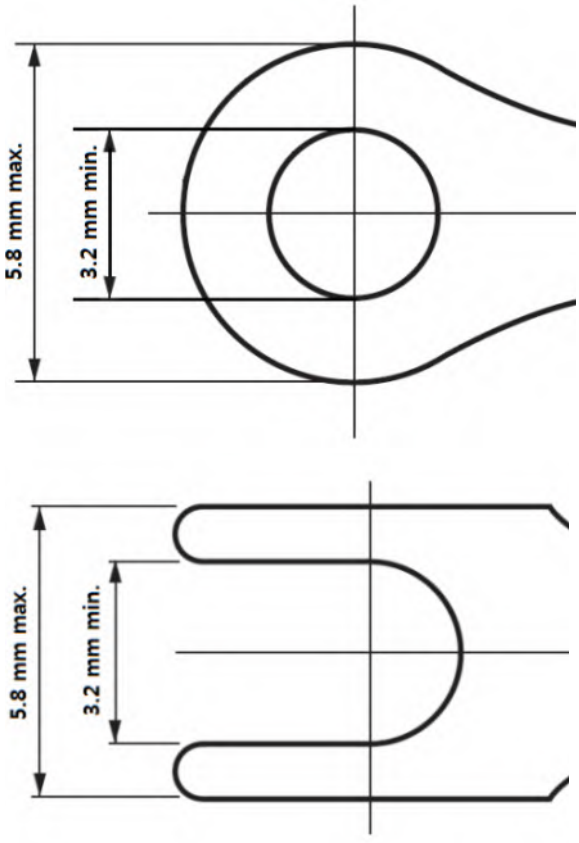


Figure 5. Recommended Terminal Connectors

Connectors Labeling

The connector labelling diagraph marked on the controller shows the location of all connectors available with requested configuration.

All options are shown in the diagrams below, though only installed options will appear on a controller.

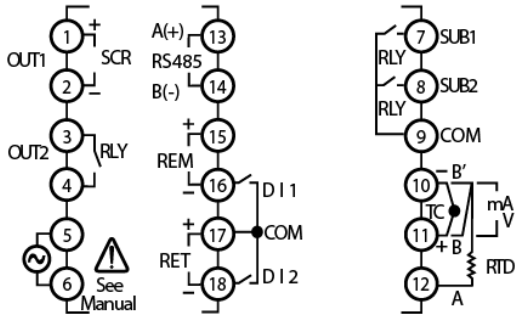


Figure 6. PD510 Connector Diagram

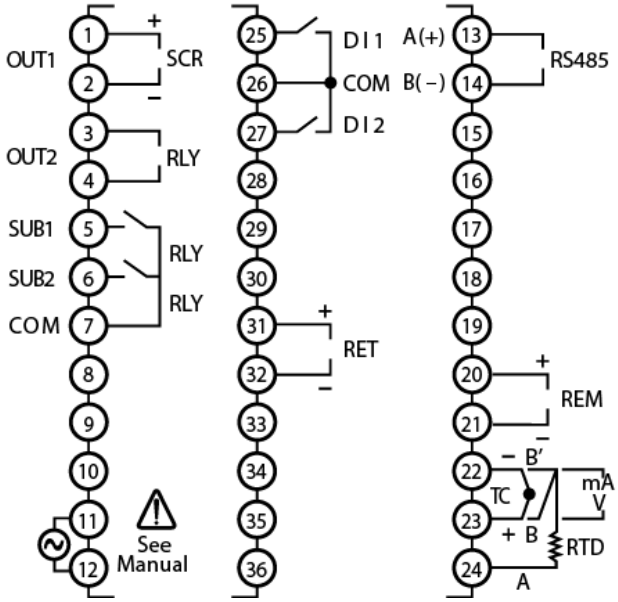


Figure 7. PD520 & PD530 Connector Diagram

Power Connections

Power connections are made to two terminals.

Figure 8. PD510 Power Connection

Figure 9. PD520 & PD530 Power Connection

Signal Connections

Signal connections are made to a group of three terminals. Use the labeling appropriate to the desired input.

Additional setup and programming is performed using the SuperNova software or through the front panel buttons.

Thermocouple

Connect the thermocouple with the positive side to plus and the negative side (typically red) to minus.

RTD

For a three-wire RTD, connect the single lead to terminal A. Connect the identical leads to terminal B and B' to compensate for lead resistance (typically identical colors).

Voltage

Connect the positive and negative of the voltage source device to the positive and negative terminals.

Current

To accept a 4-20 mA input, connect the positive terminal to + and the negative, return, or common wire to -. In addition, connect an external 250 Ω resistor across the + and – terminals.

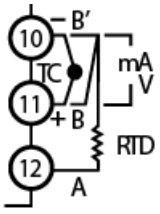


Figure 10. PD510 Signal Connection

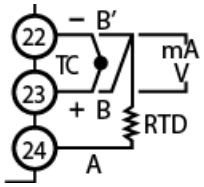


Figure 11. PD520 & PD530 Signal Connection

Relay Connections

Each controller has 3 or 4 relay outputs, one or two control relays and 2 alarm relays.

If the controller has a main control relay, OUT1 will be labelled as a relay (RLY) output. Control output 2 is always OUT2, and is always a relay (RLY) output.

The alarm relay connections are made to terminals SUB1 and SUB2.

Each relay is a form A relay with a normally open (NO) and common (COM) contact. OUT1 and OUT2 are isolated. SUB1 and SUB2 alarm relays share a common COM contact.

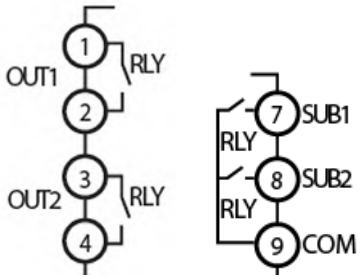


Figure 12. PD510 Relay Connections

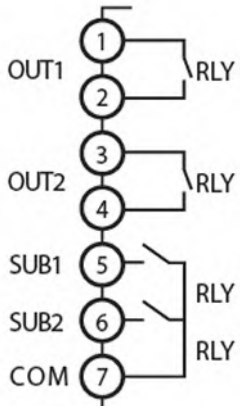


Figure 13. PD520 & PD530 Relay Connections

4-20 mA Output Connections

Connections for the 4-20 mA retransmit output are made to the connector terminals labeled mA OUT. The 4-20 mA output is an active output, powered by an internal 12 VDC power supply.

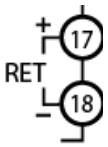


Figure 14. PD510 4-20 mA Retransmit Connections

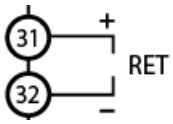


Figure 15. PD520 & 530 4-20 mA Retransmit Connections

Digital Input Connections

Connections to the optional digital inputs are made to the connector terminals labeled DI1, DI2, and COM. Closing DI1 or DI2 to COM will activate that digital input. Both digital inputs share a single common.

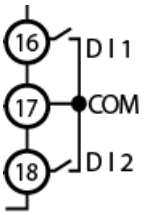


Figure 16. PD510 Digital Input Connections

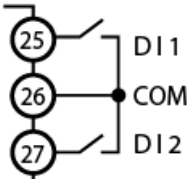


Figure 17. PD520 & PD530 Digital Input Connections

Remote SV Input Connections

Connections to the remote set value input are made to the connector terminals labeled REM+ and REM-. This input accepts a 1-5 VDC input. Connect the positive and negative of the voltage source device to the positive and negative terminals.

To accept a 4-20 mA input, connect the positive terminal to + and the negative, return, or common wire to -. In addition, connect an external 250 Ω resistor across the + and – terminals.

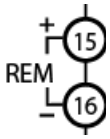


Figure 18. PD510 Remote SV Input Connections

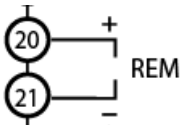


Figure 19. PD520 & PD530 Remote SV Input Connections

Modbus RTU Serial Communications

Serial communications connection is made to two terminals for RS-485 half-duplex communication.

Figure 20. PD510 RS-485 Connection

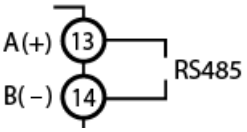


Figure 21. PD520 & PD530 RS-485 Connection

Digital Input Connections

Connections to the optional digital inputs are made to the connector terminals labeled DI1, DI2, and COM. Closing DI1 or DI2 to COM will activate that digital input. Both digital inputs share a single common.

Controller Operation

The controller can accept thermocouple, RTD, voltage, or current inputs (4-20 mA with an external resistor). The temperature or process input is displayed as the Process Value (PV), in engineering units from -999 to 9999.

A second line displays the Set Value (SV). This is the desired value the controller will maintain. This value can display -999 to 9999.

The PD520 and PD530 have a third line, the Manipulated Value (MV) or output value. This is the percent full scale of the control outputs. The MV may be displayed on the SV display of a PD510 by pressing the MD key.

⚠ IMPORTANT

Controller Powers-On in STOP Mode

For safety reasons, the controller enters STOP mode on power-up by default. To enter RUN mode and enable the control outputs, press and hold the SHIFT key ⏮ for two seconds.

In STOP mode, the controller will not display the MV output percent, and the control outputs will be off.

The power-on mode may be changed in the Power-On Operation Mode (PO.OM) parameter in the Settings Group (G.SET).

Change Control Set Value (SP)

The Set Value can be easily changed to a new control set point by pressing the SET key, and using the UP, DOWN, and SHIFT keys to enter the new set point. When the new Set Value is entered, press the SET key to confirm.

The front panel function keys are also used to change between automatic and manual control modes and lock the controller to prevent accidental changes.

RUN/STOP Modes

The controller has a RUN and STOP mode. Switching between these modes is done by pressing the SHIFT (PAUSE/LEFT arrow) key for two seconds, or by using digital inputs.

In RUN mode, control outputs, SUB alarm outputs, communication, and all other functions operate normally. Auto-tuning can only begin while in run mode.

In STOP mode, control output will operate at 0%, and auto-tuning will not be possible. The MV display will not appear when in STOP mode. Other functions will behave normally.

Menu Timeout

If the controller is left in the programming menus or changing a parameter or set value, it will return to the normal run mode display in 30 seconds.

Front Panel

	Key	Operation mode		Menu mode	
		Control/Monitoring	SV Change	Programming Menu	Change Parameters
MODE	MD	Hold to enter programming menu	-	Hold to return to run mode display	-
SET	SET	Enter a new SV	Save SV value	Change a parameter or enter group	Move to the next parameter after saving value
SHIFT	⏮	-	Shift digit position	-	Shift digit position
DOWN	⏬	-	Decrease value	Move among parameters or groups	Decrease numeric value of change parameter
UP	⏫		Increase value		Increase / change value

Function Key	Operation
Hold SET and ⏮ for 3 seconds	Lock or unlock SV and setting changes
Hold SET and ⏬ for 3 seconds	Change manual / automatic output modes
Hold SET + ⏫ for 3 seconds	Start auto-tuning process
Hold ⏮ for 2 seconds	Change RUN / STOP modes
Press ⏬ or ⏫ while alarm is active	Acknowledge latching alarm

Front Panel Buttons and Status Indicators

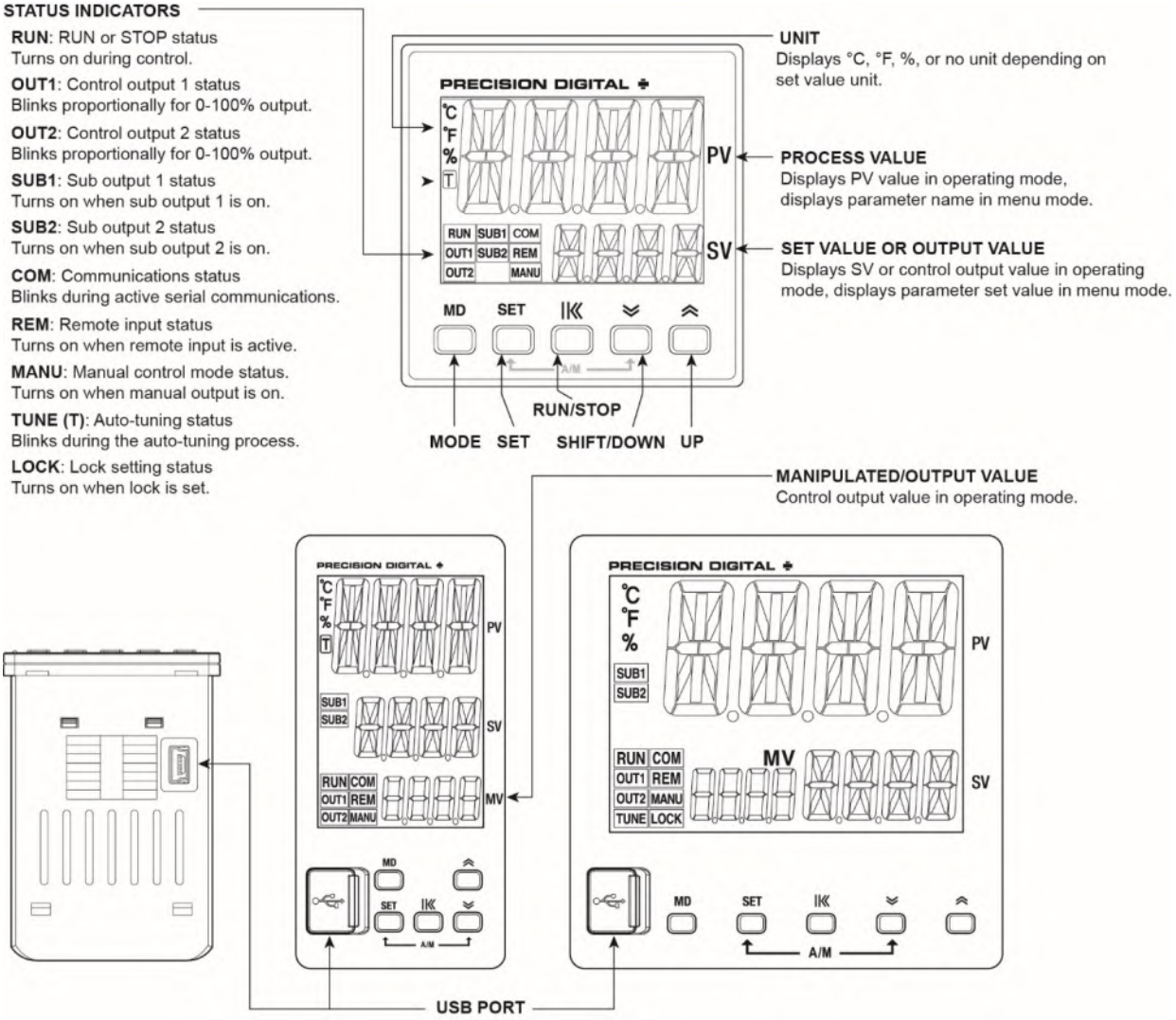


Figure 22. Front Panel Buttons and Indicators

Setup and Programming

There is **no need to recalibrate** the controller when first received from the factory.

The controller is **factory calibrated** for all input types prior to shipment on calibration equipment that is certified to NIST standards.

Overview

There are no jumpers to set for the controller input selection.
Setup and programming are done using SuperNova software or through the front panel buttons.
After power and input signal connections have been completed and verified, apply power to the controller.

Setting Up the Controller

The Programming Menu is organized into various Groups. These Groups contain individual parameters to configure the functions of the controller.

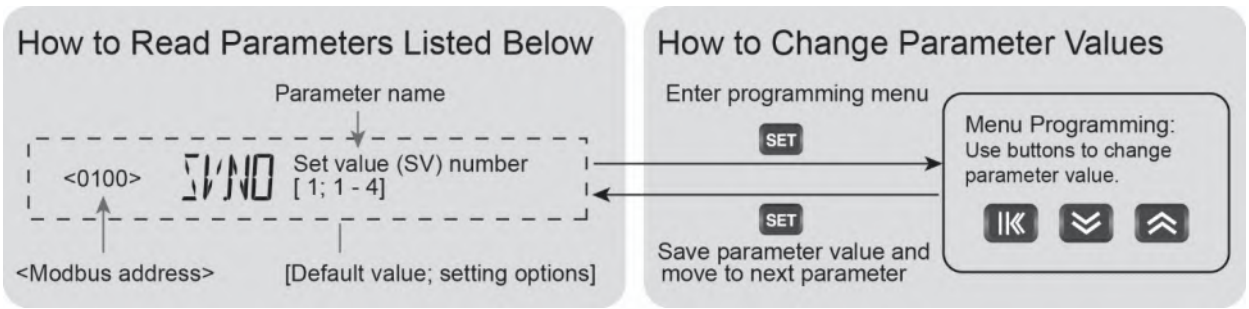
⚠ IMPORTANT

It is recommended to **begin programming by configuring the Input Group (G.IN)**. Changing certain input parameters will reset most other setup parameters.

Configure the Input Group first. It is then recommended that you proceed to the Output Group, Setup Group, and continue in order, ending with the Set Value Group to enter a control set point. Finally, for most applications, initial auto-tuning in the Control Group.

Group Display	Group Name	General Description
G.SV	Set Value Group	Select active Set Values and Set Value limits.
G.IN	Input Group	Configure input type and display scaling.
G.OUT	Output Group	Configure control outputs.
G.SET	Set Group	Activate digital inputs and view system information.
G.COM	Comm Group	Configure Modbus RS-485 parameters.
G.SUB	Sub Group	Assign alarm relays, set delays and relay operation.
G.TRS	Transmit Group	Configure retransmit output and remote SV input.
G.ALM	Alarm Group	Configure alarm types and related parameters.
G.CTL	Control Group	Configure for auto-tuning, PID zones, and SV ramps.

- Press and hold the Mode button (MD) for one second to enter Programming Mode then press the Down (or Up) arrow button to scroll through the programing groups.
- Hold Mode (MD) at any time to exit and return to Run Mode. Changes made to settings prior to pressing Enter are not saved.
- To enter a Group or change a parameter, press SET.
- Press the Down (or Up) arrow key to scroll through individual parameters within a Group.
- Press the Mode (MD) key when navigating parameters to return to the group menu.
- Changes to the settings are saved to memory only after pressing SET.
- The display moves to the next menu every time a setting is accepted by pressing SET.

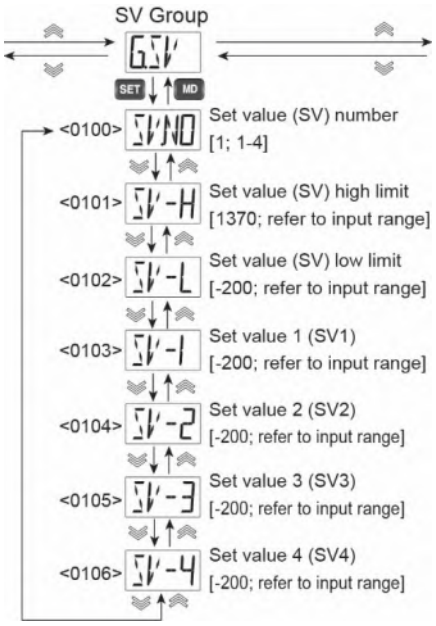


Programming the Controller

The following section defines the parameters in each of the setup Group menus.

Set Value Group (G.SV)

The Set Value (SV) Group contains parameters used to program a new Set Value, set limits on the Set Value, or select from existing Set Values.



Set Value and Set Value Number (SV.NO)

The active Set Value is the set point the controller will attempt to maintain. There are four programmable Set Values (SV1 to SV4).

The Set Value Number (SV.NO) parameter selects which programable Set Value number, 1 to 4, is active.

In addition to setting this parameter directly, digital inputs may be used to select from SV1 and SV4 or the remote Set Value input (REM).

The use of digital inputs and the remote SV input will change the behavior of this parameter and selecting which Set Value is used.

- When the digital inputs are enabled the digital input selection will take precedence over the Set Value Number selected.
- When the remote SV input (REM.E) is ON, the set value number and programmed set points will be ignored.
- When both the digital inputs are enabled, and the remote SV input is enabled, using the digital inputs to select SV-4 will use the REM input to select the Set Value.

SV-1 to SV-4 must be within the limits set by the SV High Limit (SV-H) and SV Low Limit (SV-L) parameters.

Set Value High Limit (SV-H) and Set Value Low Limit (SV-L)

These may be used to prevent the setting of unintentional Set Values. Both the selections of SV.NO, as well as the REM SV are limited by these parameters.

The Set Value High Limit (SV-H) will define the high limit of the Set Value.

The Set Value Low Limit (SV-L) will define the low limit of the Set Value.

Set Value 1, 2, 3, and 4 (SV-1, SV-2, SV-3, SV-4)

SV-1, 2, 3, and 4 are the Set Values the controller will try to maintain. Only one Set Value may be used at a time by the controller.

G.SV Parameter Details

Parameter	Setting Range	Unit	Default Value	Parameter Display Condition
SV.NO	1 - 4	-	1	
SV-H	FR-L to FR-H (Note 2) SL-L to SL-H (Note 3) Also, SV-L < SV-H	Note 1	FR.H (Note 2) SL.H (Note 3)	
SV-L			FR.L (Note 2) SL.L (Note 3)	
SV-1	SV-L to SV-H	Note 1	SV-L	
SV-2				
SV-3				
SV-4				

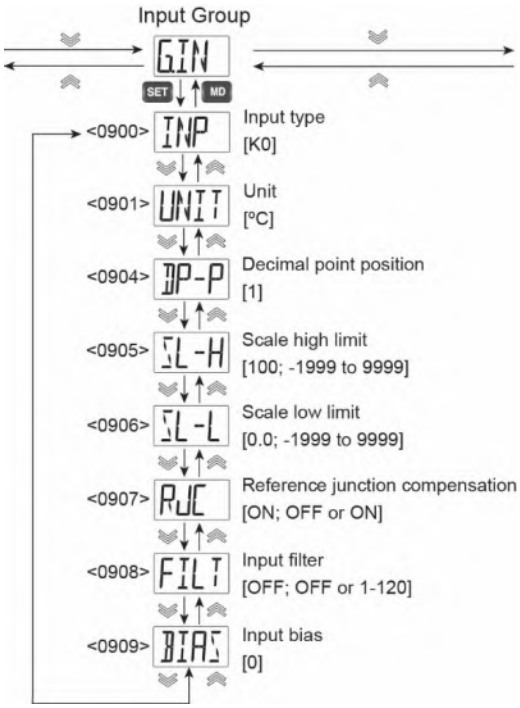
1. Default value determined by the default unit of the selected input type.
2. The high and low SV limits are the high and low limit for the selected input type. FR.H/L is used when thermocouple or RTD inputs are selected.
3. The high and low SV limits are the high and low limit for the selected input type. SL.H/L is used when mA, VDC, or mVDC inputs are selected.

Input Group (G.IN)

The Input Group includes parameters to select the input type, define display units, and scale a process input.

It also contains parameters related to the temperature reference junction, input filtering, and making input calibration adjustments.

> **⚠ CAUTION**
> It is recommended to **begin programming by configuring the Input Group (G.IN)**. Changing certain input parameters will reset most other setup parameters.



Input Type (INP)

The Input Type (INP) parameter is for selecting the input type. Refer *to Figure 23. Input Type and Range Selection* to find the parameter setting display selection for the desired input type.

Unit (UNIT)

UNIT can be set to °C and °F when a thermocouple or RTD input is selected. The calculation to display each unit type is done automatically.

For mA, VDC, or mVDC inputs, the units may be set to °C and °F, %, or no unit (NONE). The selected unit is displayed, but scaling must be done to properly read the selected unit.

Decimal Point Position (DP-P)

This parameter sets the number of decimal places to be used for mA, VDC, and mVDC inputs. It is used for the display values as well as the scaling parameters SL-L and SL-H.

Input Type	Display	Range
K	K0	-328 to 2498°F -200 to 1370°C
	K1	-148 to 932°F -100.0 to 500.0°C
J	J0	-328 to 2192°F -200 to 1200°C
	J1	-328 to 1652°F -199.9 To 900.0°C
E	E1	-328 to 1652°F -199.9 to 900.0°C
T	T1	-328 to 752°F -199.9 to 400.0°C
R	R0	32 to 3092°F 0 to 1700°C
B	B0	212 to 3272°F 100 to 1800°C
S	S0	32 to 3092°F 0 to 1700°C
L	L1	-328 to 1652°F -199.9 to 900.0°C
N	N0	-328 to 2372°F -200 to 1300°C
U	U1	-328 to 752°F -199.9 to 400.0°C
W	W0	32 to 4172°F 0 to 2300°C
PLII	PL0	32 to 2372°F 0 to 1300°C
JPt100	JPt0	-328 to 932°F -200 to 500°C
	JPt1	-328 to 932°F -199.9 to 500.0°C
Pt100	Pt0	-328 to 1184°F -200 to 640°C
	Pt1	-328 to 1184°F -199.9 to 640.0°C
4-20 mA	1-5V*	-1999 to 9999
1-5 VDC	1-5V	
0-5 VDC	5V	
0-10 VDC	10V	
0-50 mVDC	0.05V	
0-100 mVDC	0.1V	

*Connect a 250 Ω resistor across the input terminals.

Figure 23. Input Type and Range Selection

Scale High Limit (SL-H)

Set the display value for the desired units when at the high limit of the selected mA, VDC, or mVDC input type. Refer *to Figure 23. Input Type and Range Selection* to see the default high limit of an input type.

Scale Low Limit (SL-L)

Set the display value for the desired units when at the low limit of the selected mA, VDC, or mVDC input type. Refer *to Figure 23. Input Type and Range Selection* to see the default high limit of an input type.

Cold Junction Compensation (RJC)

Reference junction compensation, or cold junction compensation, is used if a thermocouple input type is selected. It is used to maintain an accurate reading of the thermocouple input. This may be turned off for specific applications where this is necessary.

Filter Time (FILT)

The input noise filter is used to compensate for noise of unsteady readings of the input. Noise may impact the PV reading and will also results in sudden changes to the output. Increasing the Filter time will help eliminate the effects of this noise.

However, greatly increasing the filter time will result in a longer delay before changes to the input signal are reflected in the display and control outputs.

Bias Offset for Calibration (BIAS)

This parameter is present when a thermocouple or RTD input type is selected. It allows for an offset to be programmed into the display value. This can be used to adjust the input display value.

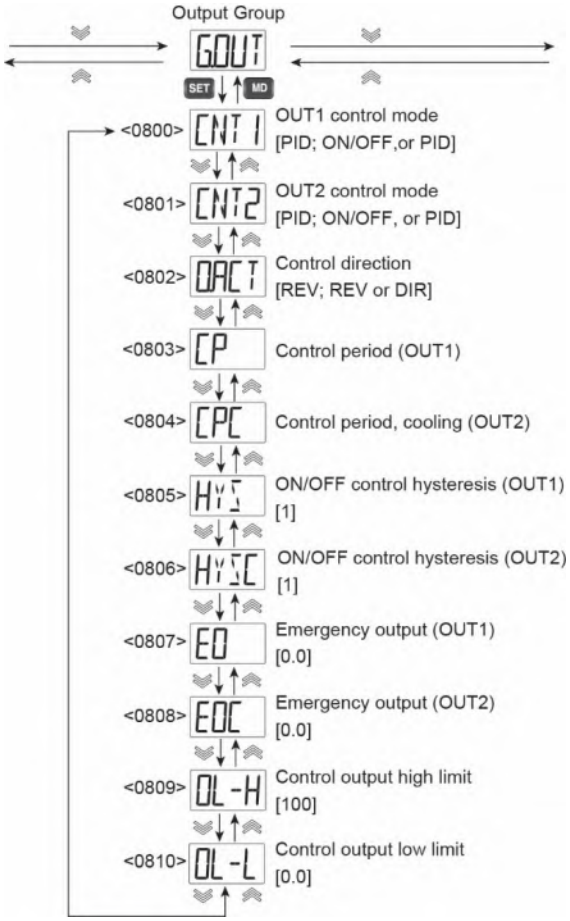
G.IN Parameter Details

Parameter	Setting Range	Unit	Default Value	Parameter Display Condition
INP	K0 through 0.1 VDC	-	K0	
UNIT	°C, °F (Note 2) °C, °F, %, no unit (Note 3)	-	°C	
DP-P	0 – 3	-	1	Input selected is mA, VDC, or mVDC input type
SL-H	-1999 - 9999 (however, SL-L < SL-H)	Note 1	100.0	
SL-L		Note 1	0.0	
RJC	OFF, ON	-	ON	Input selected is a thermocouple input type
FILT	OFF, 1 - 120	Time (seconds)	OFF	
BIAS	EUS (-100.0-100.0)%	Note 1	EUS 0.0%	

1. Default value determined by the default unit of the selected input type.
2. Selections when thermocouple or RTD input type selected.
3. Selections when mA, VDC, or MVDC input type selected.

Output Group (G.OUT)

The Output Group includes parameters used to configure the general operation of the control outputs.



OUT1 Control Mode (CNT1)

The control output mode of OUT1 can be selected from On/Off (ONOF) or PID.

OUT2 Control Mode (CNT2)

The control output mode of OUT2 can be selected from NONE, On/Off (ONOF) or PID.

Output Action (O.ACT)

The operation in which the control amount increases when the deviation (PV - SV) is positive is referred to as a direct action, and the operation in which the control amount increases when the deviation is negative is referred to as a reverse action.

You can select direct or reverse action only when OUT2 Control Mode (CNT2) is set to NONE

Heating & Cooling Control Mode

When OUT2 is set to either ONOF or PID, the controller will automatically enter heating and cooling control mode.

In heating and cooling control mode, the Output Action O.ACT parameter is disabled. OUT1 is always the heating side control output, and OUT2 is always the cooling side control output.

Disable Heating & Cooling Control

To disable Heating & Cooling control mode, set OUT2 Control Mode (CNT2) to NONE. When this is done, the Output Action (O.ACT) parameter is used to selecting heating (reverse) or cooling (direct) control for OUT1.

Control Period, Heating (CP)

This parameter is used to set the on/off cycle time of OUT1 when in OUT1 Control Mode (CNT1) is set to On/Off (ONOF) control mode. This parameter is only used when OUT1 is a relay or SRR output.

⚠ CAUTION

When using a mechanical relay for control, set the control period to at least 20 seconds.

When using SSR output for control, set the control period to at least 1 second.

Control Period, Cooling (CPC)

This parameter is used to set the on/off cycle time of the OUT2 relay when in OUT2 Control Mode (CNT2) is set to On/Off (ONOF) control mode.

⚠ CAUTION

When using a mechanical relay for control, set the control period to at least 20 seconds.

When using SSR output for control, set the control period to at least 1 second.

Hysteresis, Heating (HYS) and Hysteresis, Cooling (HYSC)

When using on/off control, the hysteresis sets the difference from the on state and the off state of the heating or heating & cooling outputs.

The output deadband of the heating side and cooling sides can be set individually.

The deadband during heating & cooling on/off control is as follows.

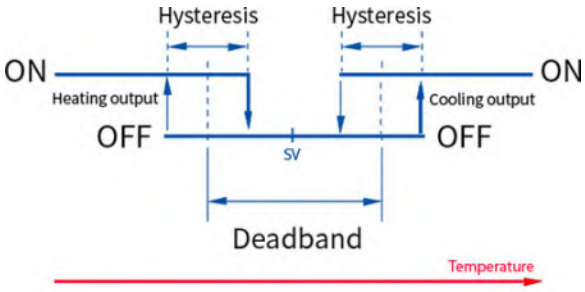


Figure 24. Heating & Cooling Hysteresis

Hysteresis (HYS) and Cooling Hysteresis (HYSC) are displayed only when Out1 Control Mode (CNT1) and OUT2 Control Mode (CNT2) are programmed for On/Off (ONOF) control respectively.

Emergency Output, Heating (EO) and Emergency Output Cooling (EOC)

This parameter sets the output levels in the case of internal PV calculation error or an input sensor burn out error.

The output conditions of EO and EOC according to the conditions are as follows.

When using only CNT1 (CNT2 as NONE or models without OUT2 option), emergency output EO is generated as shown below according to On/Off and PID settings.

Emergency Output when Control Output 2 (CNT2) is NONE.		
CNT1 Mode	On/Off (ONOF)	PID
EO or EOC Range	EO = 0.0% or EO = 100.0%	0.0 ≤ EO ≤ 100.0%
OUT1 or OUT 2 Output in Emergency/ Error State	MV = EO	If OL-L > EO, (MV = 0.0%)
		If OL-H < EO, MV = OLH
		If OL-L ≤ EO ≤ OL-H, MV = EO

When both CNT1 and CNT2 are used, EO and EOC are generated as follows.

HOUT Emergency Output when Control Output 1 (CNT1) and Control Output 2 (CNT2) in Use		
CNT1 Mode	On/Off (ONOF)	PID
EO Range	EO = 0.0% or 100.0%	0.0 ≤ EO ≤ 100.0
HOUT Output	If OLH < 100.0, HOUT = 0.0	If OL-H < EO, HOUT = OL-H
	HOUT = EO	If 0 ≤ EO ≤ OL-H, HOUT = EO

Note that when using on/off control, if parameter Output Limit High (OL-H) is set to less than 100%, the emergency condition output will remain 0%, regardless of the setting for Emergency Output, Heating (EO).

COUT Emergency Output when Control Output 1 (CNT1) and Control Output 2 (CNT2) in Use		
CNT2 Mode	On/Off (ONOF)	PID
EOC Range	EOC = 0.0% or 100.0%	0.0% ≤ EOC ≤ 100.0%
COUT Output	If OLH < 100.0%, COUT = 0.0%	If OL-H < EOC, COUT = OL-H
	COUT = EO	If 0 ≤ EOC ≤ OL-H, COUT = EOC

Note that when using on/off control, if parameter Output Limit Low (OL-L) is set to less than 100%, the emergency condition cooling output will remain 0%, regardless of the setting for Emergency Output, Cooling (EOC).

Output Limit High (OL-H) and Low (OL-L)

The output limits high and low restrict the control output (MV) percent output to greater than the minimum and less than the maximum output levels. For models where parameter OUT2 Control Mode (CNT2) is set to NONE, Output Limit High (OL-H) is the output high limit and Output Limit Low (OL-L) is the output low limit. The minimum output is 0%, and the maximum output is 100%.

If OUT2 Control Mode (CNT2) is not NONE, the OL-H parameter is the heating output high limit, and the OL-L is the cooling output high limit.

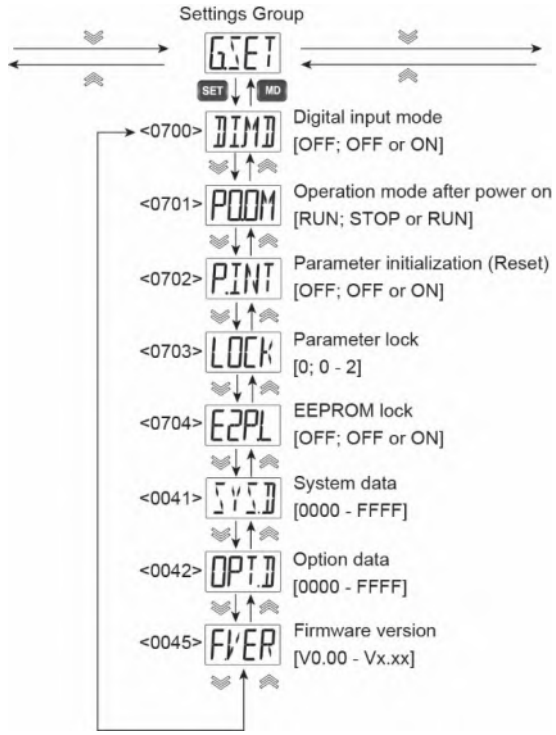
G.OUT Parameter Details

Parameter	Setting Range	Unit	Default Value	Parameter Display Condition
CNT1	ONOF, PID		PID	
CNT2	NONE, ONOF, PID		NONE	
O.ACT	REV, DIR		REV	OUT2 control mode CNT2 is set to NONE
CP	1 - 1000 s	Time (seconds)	RLY : 20 SSR : 2	OUT1 option is RLY or SSR and OUT1 control mode CNT1 is set to PID.
CPC	1 - 1000 s	Time (seconds)	20	OUT2 control mode CNT2 is set to PID.
HYS	EUS (0.0 - 100.0) %	Note 1	1	OUT1 control mode CNT1 is set to ONOF.
HYSC	EUS (0.0 - 100.0) %	Note 1	1	OUT2 control mode CNT2 is set to ONOF.
EO	(-5.0 - 105.0) % (Note 2) (0.0 - 105.0) % (Note 3)	%	0.0	
EOC	(0.0~105.0) %	%	0.0	OUT2 control mode CNT2 is set to ONOF or PID.
OL-H	(-5.0 - 105.0) % (Note 2) (0.0 - 105.0) % (Note 3) (However, OL-L < OL-H)	%	100.0	OUT1 control mode CNT1 is set to PID.
OL-L	(-5.0~105.0) % (Note 2) (0.0~105.0) % (Note 3) (However, OL-L < OL-H)	%	0.0	OUT1 control mode CNT1 or OUT2 control mode is set to PID.

1. Set by G.IN parameter UNIT.
2. Selections when thermocouple or RTD input type selected.
3. Selections when mA, VDC, or MVDC input type selected.

Settings Group (G.SET)

The Settings Group includes parameters for general controller setup, such as power-on operation, resetting to factory default settings, or locking parameters to prevent accidental changes. It also contains information on the controller build and firmware version.



Digital Input Mode (DI.MD)

The digital inputs may be enabled (ON) or disabled (OFF).

If enabled, the digital inputs will function per the table below, with digital input 1 (DI1) controlling run/stop mode, and digital input 2 (DI2) determining the use of set value 1 (SV1) or set value 4 (SV4).

In a controller with the remote set value input option, DI2 will determine the use of SV1 or the remote set value input to set the set value.

Function		DI 1	DI 2
R/S	STOP	0	-
	RUN	1	-
SV	SV1	-	0
	SV4 or REM	-	1

Power-On Operation Mode (POOM)

The controller can be programmed to enter RUN or STOP mode when it powers on.

Set PO.OM to RUN to be in RUN or control mode when powered on, and PO.OM to STOP to be in STOP or monitoring mode when powered on.

Parameter Initialization (P.INT)

This parameter restores all other parameter settings in the controller to the factory default settings.

> It is recommended to save your settings using the SuperNova Programming Software before resetting all parameters to factory default.

To reset to factory defaults, set this parameter to ON. Once this is done, a Y/N confirmation request will be displayed. Select YES to reset the unit to factory defaults, and NO to cancel the reset request.

Parameter Lock (LOCK)

Use of the parameter lock prevents accidental changes to settings in the controller.

The Lock parameter may be set to the following levels.

If LOCK is set to 0, the parameter lock is off.

If LOCK is set to 1, all parameters except LOCK and all parameters in the G.SV group are locked.

If LOCK is 2, all parameters except LOCK are locked.

The parameter lock may be set by holding the SHIFT and SET keys for three seconds. When this is done, LOCK setting 2 is enabled.

Locked parameter groups are read-only accessible by serial communications, and the settings in them cannot be changed via the programming software or Modbus communications.

If you press the SET button to change a parameter has been locked, LOCK will blink. Press the DOWN, UP or MD keys to move to navigate to the next parameter or group.

EEPROM Lock (E2P.L)

The programmed settings of the controller are stored in two types of hardware memory, short-term use RAM and long-term and secure EEPROM.

Very rarely, it is necessary for an application to write new settings by serial communications so often to the controller that it risks reaching the maximum number or read/write operations of EEPROM hardware.

To prevent this, when the EEPROM Lock is ON, all data written by serial communications will be stored in RAM only and will not be stored in EEPROM. Only the Parameter Lock (LOCK) and the EEPROM Lock (E2P.L) will be stored in EEPROM.

As a result of turning on the EEPROM Lock, when a power cycle occurs on the controller, all settings and data received by serial communications will be lost.

System Data (SYS.D)

This parameter displays system data useful to the factory for troubleshooting.

Option Data (OPT.D)

This parameter displays build option data useful to the factory for troubleshooting.

Firmware Version (F.VER)

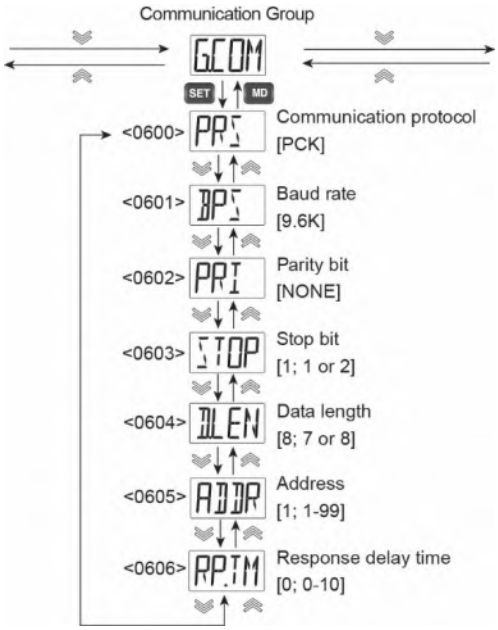
This parameter displays the firmware version installed on the controller.

G.SET Parameter Details

Parameter	Setting Range	Unit	Default Value	Parameter Display Condition
DI.MD	OFF, ON	-	OFF	Models with digital inputs only
PO.OM	STOP, RUN	-	STOP	
P.INT	OFF, ON	-	OFF	
Y/N	NO, YES	-	NO	Only for parameter initialization
LOCK	0, 1, 2	-	0	
E2P.L	OFF, ON	-	OFF	

Communication Group (G.COM)

The Communication Group includes parameters for configuring RS-485 serial communications. The controller supports PC Link and Modbus protocols, with 2-wire half-duplex configuration per the EIA RS-485 standard.



Protocol Select (PRS)

Select the protocol for serial communications. There are four protocols supported.

Protocol	Menu Selection
PC Link without Checksum	PCK
PC Link with Checksum	PCKS
Modbus ASCII	ASCI
Modbus RTU	RTU

PC Link without Checksum does not have a checksum, it cannot verify data integrity if data is distorted due to communication line noise or other problems. However, PC Link with Checksum and Modbus ASCII or RTU can verify data integrity with a checksum, so it can be used more reliably. Therefore, we recommend not to use PC Link without Checksum if avoidable.

Bits per Second (BPS)

Set the communication speed in bits per second (BPS). Select from the following 6 communication speeds: 4,800 (4.8k), 9,600 (9.6k), 14,400 (14.4k), 19,200 (19.2k), 38,400 (38.4k), or 57,600 (57.6k) bps

Parity Bit (PRI)

Select if parity bit function as none (NONE), even (EVEN), or odd (ODD) parity.

Stop Bit (STOP)

Select 1 or 2 stop bits.

Data Length (D.LEN)

Select the data length to be 7 or 8 bits.

Address (ADDR)

The controller communication address can be set as address 1 to 99. Up to 31 devices can be connected on the RS-485 bus, each requiring a unique communication address.

Response Time delay (RP.TM)

The response time delay parameter increases the response time during communications. The response time is the time from the handling of the received data to the start of transmission and is calculated as follows:

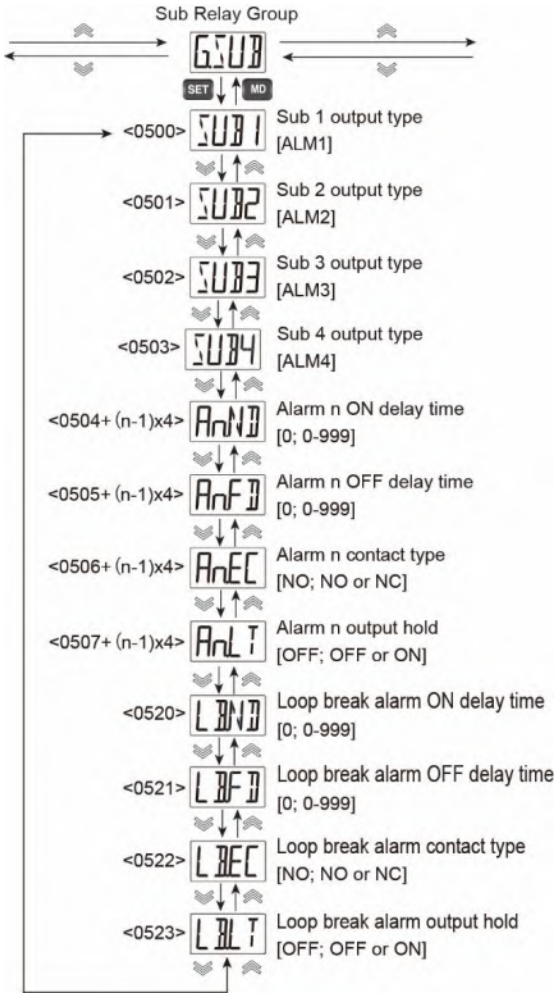
Response Time = (Received Data Handling Time) + (Response Time delay Setting X 50 milliseconds)

G.COM Parameter Details

Parameter	Setting Range	Unit	Default Value	Parameter Display Condition
PRS	PCK, PCKS, ASCI, RTU		PCK	Only on models with RS-485 option
BPS	4.8K, 9.6K, 14.4K, 19.2K, 38.4K, 57.6K	BPS	9.6K	
PRI	NONE, EVEN, ODD	bit	NONE	
STOP	1 or 2	bit	1	
D.LEN	7 or 8	bit	8	
ADDR	1 - 99		1	
RP.TM	0 - 10	Number of 50 ms time increments	0	

Sub Relay Group (G.SUB)

The Sub Relay Group is used to assign alarms to the Sub relays and set relay controls such as on and off delays, fail-safe mode, and latching functions.



Sub Output Number & Type (SUBn)

The Sub relay outputs can be used for general alarms or loop break alarms.

To set a Sub relay output to be a specific alarm, configure the alarm in the Alarm Group and select the desired alarm as the alarm Type.

For example, to have Sub relay 1 trigger based on the programming for Alarm 3, select ALM3 as the setting for parameter SUB1.

Because only two Sub relay outputs exist on the PD510, the OUT2 relay of the PD510 may be configured to operate as an alarm output.

To setup the OUT2 relay of the PD510 as an alarm output:

1. Set the G.OUT group parameter CNT2 to NONE.
2. Set the G.SUB group parameter SUB3 to ALM3.
3. Set the parameters related to alarm 3 in the G.ALM group.

Alarm ON Time Delay (An.ND)

When an alarm condition occurs, the alarm will turn on only after the ON time delay. Set the ON time delay in seconds. If the ON time delay is set to zero, the alarm turns on immediately.

Alarm OFF Time Delay (An.FD)

When the alarm condition is cleared, the alarm will turn OFF only after the OFF time delay. Set the OFF time delay in seconds. If the OFF time delay is set to zero, the alarm turns OFF immediately.

While the alarm OFF time delay is set, the latch release function will not operate immediately upon the alarm condition being cleared. The latching alarm may only be reset after the alarm OFF time delay has elapsed.

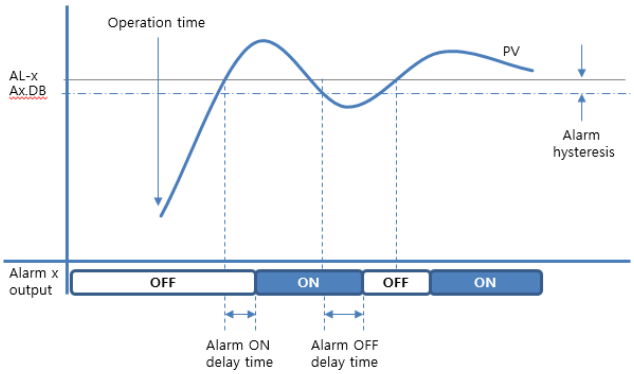


Figure 25. Alarm Operation when ON & OFF Time delays are Set

Alarm Fail-Safe (An.EC)

The sub output relays are type A electromechanical relays. Each has a NO: Normally Open contact.

However, it may be made to function as a Normally Closed contact with the Alarm Fail-Safe parameter.

If NO is selected, the relay functions normally, and energizes in the alarm condition.

If NC is selected, the relay is energized in normal conditions, and de-energizes in alarm conditions. This also means that in the case of a power failure, the relay contact will be de-energized, similar to when in alarm condition.

Alarm Latch (An.LT)

The latch function is used to hold the alarm output state even after the alarm condition has been cleared (including the deadband).

When An.LT is set to ON, the Alarm Group (G.ALM) parameter An.LR becomes accessible, where n can be any of alarms 1, 2, 3, or 4. The An.LR parameter is set to RST when there is no alarm and becomes SET when an alarm condition occurs.

To release the alarm condition, the Alarm Group (G.ALM) parameter Ax.LR must be set to RST while the alarm condition is cleared. As a shortcut, the operator may press the DOWN or UP arrow keys to reset a latched alarm after the alarm condition has cleared (including the deadband).

Loop Break Alarm ON Time delay (LB.ND)

When a loop break alarm condition occurs, the alarm will turn on only after the ON time delay. Set the ON time delay in seconds. If the ON time delay is set to zero, the alarm turns on immediately.

Loop Break Alarm OFF Time delay (LB.FD)

If a loop break alarm (LBA) is generated and the control output is not 0% or 100%, or the PV enters the Loop Break Deadband (LB.DB) range, the LBA is released. At this time, if LB.FD is set to a value other than zero, it will be released after that many seconds elapse.

Loop Break Alarm Fail-Safe (LB.EC)

The sub output relays are type A electromechanical relays. Each has a NO: Normally Open contact.

However, it may be made to function as a Normally Closed contact with the Loop Break Alarm Fail-Safe parameter.

If NO is selected, the relay functions normally, and energizes in the loop break alarm condition.

If NC is selected, the relay is energized in normal conditions, and de-energizes in loop break alarm conditions. This also means that in the case of a power failure, the relay contact will be de-energized, similar to when in loop break alarm condition.

Loop Break Alarm Latch (LB.LT)

The latch function is used to hold the alarm output state even after the loop break alarm condition has been cleared.

When LB.LT is set to ON, the Alarm Group (G.ALM) parameter LB.LR becomes accessible. The LB.LR parameter is set to RST when there is no alarm and becomes SET when an alarm condition occurs.

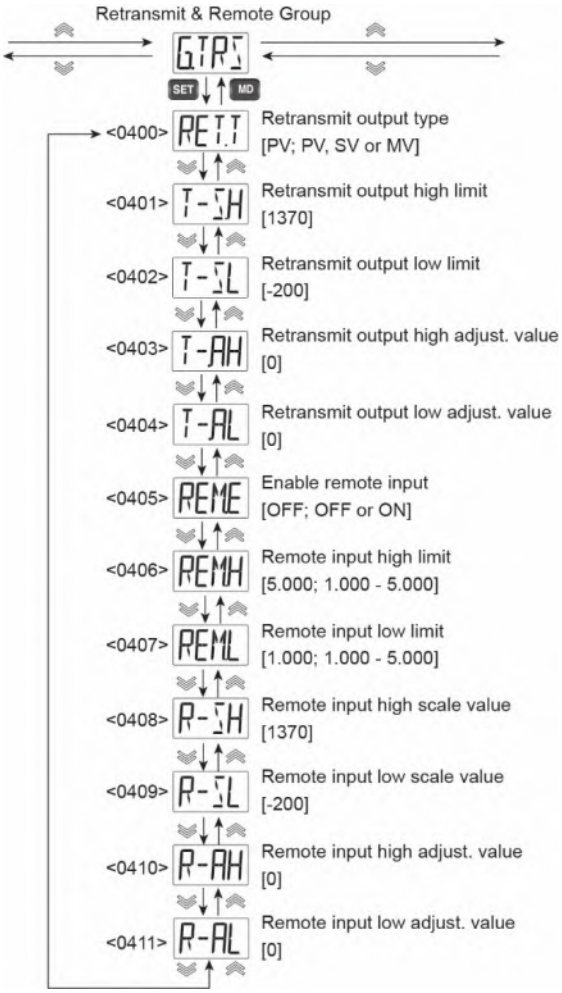
To release the loop break alarm condition, the Alarm Group (G.ALM) parameter LB.LR must be set to RST while the alarm condition is cleared. As a shortcut, the operator may press the DOWN or UP arrow keys to reset a latched loop break alarm after the alarm condition has cleared

G.SUB Parameter Details

Parameter	Setting range	Unit	Default Value	Parameter Display Condition
SUB1	NONE, ALM1, ALM2, ALM3, ALM4, LBA		ALM1	
SUB2			ALM2	
SUB3			ALM3	PD510: Only when the OUT2 control type parameter is set to NONE.
A1.ND	0 - 999	Time (seconds)	0	When a SUBx parameter to set to ALM1.
A1.FD	0 - 999	Time (seconds)	0	
A1.EC	NO, NC		NO	
A1.LT	OFF, ON		OFF	
A2.ND	0 - 999	Time (seconds)	0	When a SUBx parameter to set to ALM2.
A2.FD	0 - 999	Time (seconds)	0	
A2.EC	NO, NC		NO	
A2.LT	OFF, ON		OFF	
A3.ND	0 - 999	Time (seconds)	0	When a SUBx parameter to set to ALM3.
A3.FD	0 - 999	Time (seconds)	0	
A3.EC	NO, NC		NO	
A3.LT	OFF, ON		OFF	
A4.ND	0 - 999	Time (seconds)	0	
A4.FD	0 - 999	Time (seconds)	0	
A4.EC	NO, NC		NO	
A4.LT	OFF, ON		OFF	
LB.ND	0 - 999	Time (seconds)	0	
LB.FD	0 - 999	Time (seconds)	0	
LB.EC	NO, NC		NO	
LB.LT	OFF, ON		OFF	

Transmit & Remote Group (G.TRS)

The Transmit and Remote Group is used to configure the 4-20 mA retransmission output as well as the 4-20 mA remote SV input.



Retransmission Type (RET.T)

The 4-20 mA retransmit output can be based on the process variable (PV), set value (SV), or manipulated PID output value (MV). This parameter sets which of the three values will be the basis of the retransmitted proportional 4-20 mA RET output.

Retransmission Scale High (T-SH) and Low (T-SL)

Retransmission Scale High and Low (T-SH, T-SL) are used to scale the 4-20 mA retransmit output.

The RET output will transmit 20 mA at the value entered for T-SH, and 4 mA at the value entered for T-SL. The 4-20 mA output will linearly scale between the high and low range.

The high and low scale values must be within the full range scale set for the input.

Retransmit Adjustment High (T-AH) and Low (T-AL)

The Retransmit Adjustment High (T-AH) and Retransmit Adjustment Low (T-AL) parameters are used to recalibrate the 4-20 mA retransmit output.

The output may be calibrated by changing the high and low scale PV, SV, or MV values within ±5% of the full scale of the value.

Remote input Operation (REM)

Analog signals from 4 -20 mA (or 1-5 V) can be input to change the set value (SV) remotely.

To accept a 4-20 mA input, connect 250 Ω resistor in parallel to the REM input (a 0.1% high-precision resistor is recommended) and the high and low voltage input ranges of the remote input should be set to 1.000 and 5.000 VDC.

Remote Input Enable (REM.E)

Units with the remote input option can turn on this input by setting the Remote Input Enable (REM.E) parameter to ON.

When REM.E is turned on, the value remotely input to the REM terminals is used as the SV regardless of the set value number selected in the SV.NO parameter.

Remote Input Voltage High (REM.H) and Low (REM.L)

Set the voltage maximum and minimum voltage range for the REM input.

Remote Input Scale High (R-SH) and Low (R-SL)

The REM input will set the SV to the Remote Input Scale High (R-SH) value when the high input range is detected, and to the Remote Input Scale Low (R-SL) value when the low input range is detected. The remove input SV range will linearly scale between the high and low range values.

The high and low scale values must be within the voltage high and low range set for the REM input.

Remote Input Adjustment High (R.AH) and Low (R.AL)

The Remote Input Adjustment High (R.AH) and Remote Input Adjustment High (R.SL) parameters are used to recalibrate the 4-20 mA remote SV input.

The input may be calibrated by changing the high and low scale of the input values within ±5% of the full scale of the remote input voltage range.

G.TRS Parameter Details

Parameter	Setting range	Unit	Default Value	Parameter Display Condition
RET.T	PV, SV, MV		PV	Models with RET option only.
T-SH	FR.L - FR.H (Note 2) SL.L - SL.H (Note 3) However, T-SL < T-SH	Note 1	EU 100 %	Models with RET option only and TR.MD set to PV or SV.
T-SL			EU 0 %	
T-AH	PV, SV : EUS (-5.0~5.0) % MV : EU (95.0~105.0) %	PV, SV: °C MV: %	PV, SV: EUS 0% MV: EU 100%	Models with RET option only.
T-AL	PV, SV : EUS (-5.0~5.0) % MV : EU (-5.0~5.0) %		PV, SV: EUS 0% MV: EU 0%	
REM.E	OFF, ON		OFF	Models with REM option only.
REM.H	1 V ≤ REM.L < REM.H ≤ 5 V	V	5.000	
REM.L			1.000	
R-SH	FR.L - FR.H (Note 2) SL.L - SL.H (Note 3) However, R-SL < R-SH	Note 1	FR.H (Note 2) SL.H (Note 3)	
R-SL			FR.L (Note 2) SL.H (Note 3)	
R-AH	EUS (-5.0 ~ 5.0) %	Note 1	EUS 0.0 %	
R-AL	EUS (-5.0 ~ 5.0) %		EUS 0.0 %	

1. Set by G.IN parameter UNIT.
2. Selections when thermocouple or RTD input type selected.
3. Selections when mA, VDC, or MVDC input type selected.

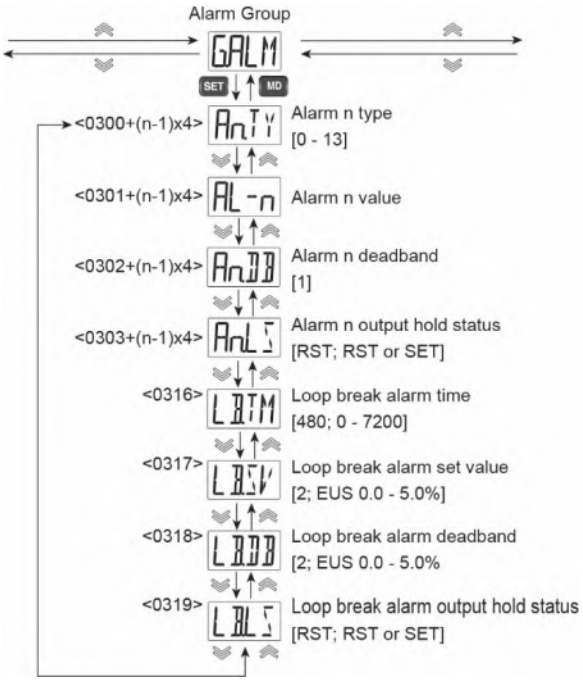
Alarm Group (G.ALM)

The Alarm Group contains parameters to establish alarm conditions for up to four alarms. These alarms may be assigned to the SUB1 or SUB2 alarm output relays.

This group also contains the programming of the loop break alarm (LBA). This is a special type of alarm that can be assigned to a Sub relay.

During programming of the Alarm Group, references to “n” in the programming menus refers to the number 1, 2, 3, or 4; the alarm number the parameter applies to. For example, An.TY could appear as A1.TY, A2.TY, A3.TY, or A4.TY, each referring to alarm 1, 2, 3, and 4.

Only alarm numbers or LBA settings assigned to the SUB1 or SUB2 relay in the Sub Relay Group (G.SUB) will appear in the Alarm Group (G.ALM). Alarm numbers or LBA settings that are not assigned to a Sub relay will retain their programming and appear in the G.ALM menu if again assigned to a Sub relay.



Alarm Number n Type (An.TY)

With An.TY, you can choose between 'Alarm off' and 13 alarm types listed in the *Alarm Type and Number Table.*

Each type is divided into absolute alarm and deviation alarm, with or without standby mode.

An.TY No.	Alarm Name	Absolute Value or Deviation Alarm	Standby
0	Alarm Off	Deviation	
1	High Absolute	Absolute	
2	Low Absolute	Absolute	
3	High Deviation	Deviation	
4	Low Deviation	Deviation	
5	High-Low Deviation	Deviation	
6	High-Low Range	Deviation	
7	High absolute with standby sequence	Absolute	Yes
8	Low absolute with standby sequence	Absolute	Yes
9	High deviation with standby sequence	Deviation	Yes
10	Low deviation with standby sequence	Deviation	Yes
11	High-Low deviation with standby sequence	Deviation	Yes
12	High-Low range with standby sequence	Deviation	Yes
13	Sensor error	Absolute	

Figure 26. Alarm Type and Number Table

Alarm Number n Value (AL-n)

The AL-n parameter sets the alarm value for alarms 1, 2, 3, or 4; as indicated in the “n” position of the parameter name.

When the alarm is set as an absolute value alarm, the setting can be any value within the limits of the input type. AL-n is entered as the displayed value, in displayed engineering units, at which the alarm is to turn on.

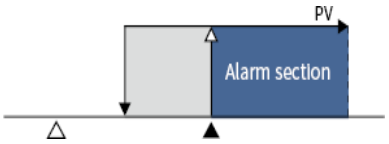
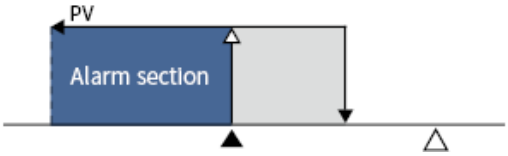
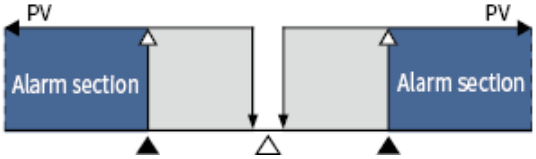
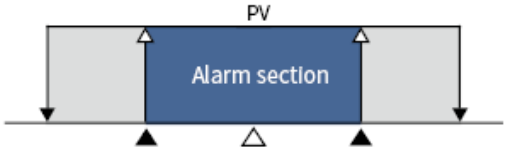
When the alarm is set as a deviation alarm, the setting can be 0 to 100% of the full range of the input, and is entered in the displayed engineering units, but the number represents the absolute value of the deviation amount at which the alarm turns on.

For example, when a type K thermocouple is used, and the alarm type is set as a high absolute (An.TY set to 1), the setting range of AL-n cab be -200°C to 1,370°C

When the alarm type is set as a high deviation (An.TY is set to 3), the setting range of AL-n can be 0.0°C to 1,570.0°C.

Alarm Number n Deadband (An.DB)

The alarm deadband is the different between the set and reset points of an alarm. An.DB is entered as the deadband for the alarm, entered in displayed engineering units. The alarm deadband can be set as 0 to 100% of the full range of the input, regardless of the alarm being an absolute or deviation alarm

An.TY No.	Alarm Name	Alarm Operation	Absolute Value or Deviation Alarm	Standby
0	Alarm off			
1	High absolute		Absolute	
(7)	High absolute with standby sequence			Yes
2	Low absolute		Absolute	
(8)	Low absolute with standby sequence			Yes
3	High deviation		Deviation	
(9)	High deviation with standby sequence			Yes
4	Low deviation		Deviation	
(10)	Low deviation with standby sequence			Yes
5	High-low deviation		Deviation	
(11)	High-low deviation with standby sequence			Yes
6	High-low range		Deviation	
(12)	High-low range with standby sequence			Yes
13	Sensor error	Burn-out	Absolute	

▲: AL-n Alarm value. This is the specific PV value, or for deviation alarms the deviation amount from the SV, when the alarm activates.

△: Set value. For deviation alarms only, indicates the alarm operation as high, low, or both in relation to the SV.

: Alarm activates.

: Alarm deactivates.

: The grey area indicates the alarm deadband, the difference between the activation and reset point of the alarm.

Figure 27. Alarm Operation Description Table

Alarm Operation Examples

High Absolute Alarm Operation

The example below illustrates the operation of a high absolute alarm The alarm turns on when the set point entered in parameter AL-x is reached, where x can be any of alarms 1, 2, 3, or 4. The alarm resets when the PV is below the set point by the Ax.DB number.

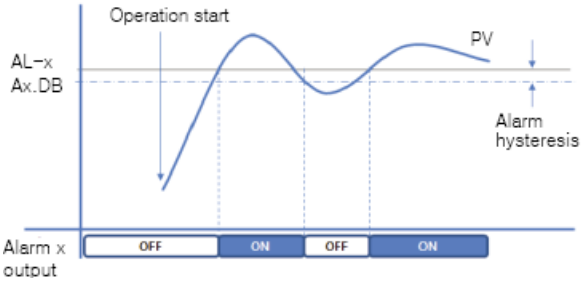


Figure 28. High Absolute Alarm Operation

Alarm Standby Mode Operation

Alarms with standby mode will ignore the alarm condition when the alarm on condition is satisfied at the time of power on, changes from STOP to RUN mode, an SV change, or a change to the alarm program settings. The standby alarm will turn on after the alarm release condition has been set.

In the below example, when power is applied to the controller and operation begins, the PV is already in the alarm state, being greater than the AL-x alarm set point. In the case of the standard high absolute alarm, the alarm turns on. However, if a high absolute alarm with standby is used, the alarm will not turn on until after the PV passes below deadband and reset point, and then returns to the higher alarm state.

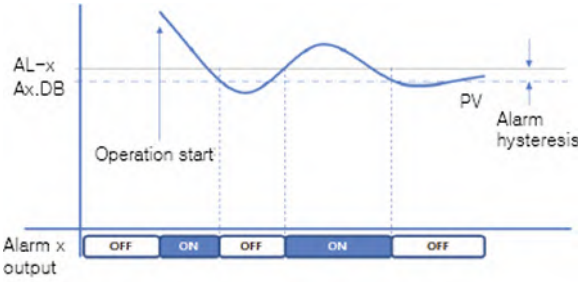


Figure 29. High Absolute Alarm Operation without Standby

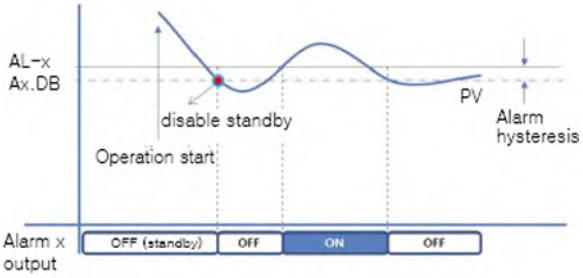


Figure 30. High Absolute Alarm Operation with Standby

Alarm Number n Latch Status (An.LS)

An.LS is the alarm latch reset function, where n can be any of alarms 1, 2, 3, or 4. This parameter is accessible if the Sub Relay Group (G.SUB) parameter An.LT is set to ON.

If the Sub Relay Group (G.SUB) parameter An.LT is set to OFF, this parameter does not appear in the menu. The alarm will automatically reset when the alarm condition is cleared (including deadband).

Releasing an Alarm in Latch State

To release an alarm with the latch status ON, the operator must change this parameter to RST after the alarm condition has cleared (including the deadband).

As a shortcut, the operator may press the DOWN or UP arrow keys to reset a latched alarm after the alarm condition has cleared (including the deadband).

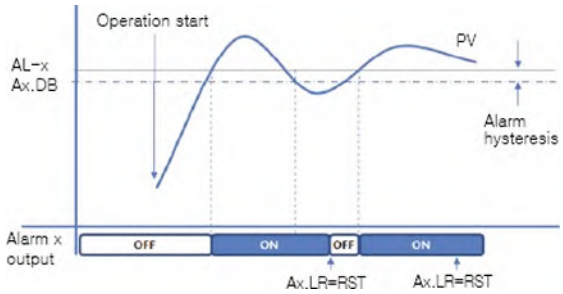


Figure 31. High Absolute Alarm with Latch Function

Loop Break Alarm (LBA)

The loop break alarm (LBA) is a special type of alarm used to alert operators to a heater break, wiring error, output circuit problems, or other issue with the control loop.

When the control output value in PID or on/off control modes reaches 0% or 100%, the LBA monitors the rate of process variable (PV) change. If the PV does not change by at least the loop break set value amount over the loop break alarm time, the LBA turns on.

Reverse Action LBA Operation

When the control output value is 100% in the reverse action mode (heating control), the LBA alarm output turns on when the temperature does not rise at least the LB.SV value within the LB.TM set time. Also, when the control output value is 0%, the LBA output turns on when the temperature does not fall at least the LB.SV value within the LB.TM setting time.

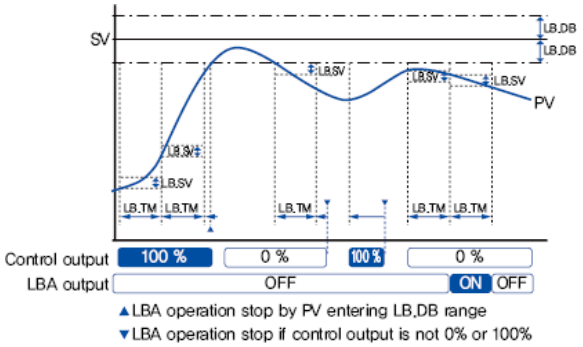


Figure 32. Loop Break Alarm (LBA) Operation in Reverse Action Mode

Direct Action LBA Operation

When the control output value is 100% in the direct action mode (cooling control), the LBA output turns on when the temperature does not fall at least the LB.SV value within the LB.TM set time. Also, when the control output value is 0%, the LBA output turns on when the temperature does not rise at least the LB.SV value within the LB.TM set time.

Heating & Cooling Control LBA Operation

When OUT1 and OUT2 are both configured for control outputs, the controller automatically enters heating and cooling mode. In heating and cooling mode, the controller is automatically set to reverse acting. However, the LBA operates as follows.

When the control output value is 100% on the heating output (H), the LBA alarm output turns on when the temperature does not rise at least the LB.SV value within the LB.TM set time.

When the control output value is 100% on the cooling output (C), the LBA alarm output turns on when the temperature does not rise at least the LB.SV value within the LB.TM set time.

LBA Alarm Clear

The LBA is automatically released under the following conditions.

- When the difference between the set value (SV) and process variable (PV) is less than or equal to the Loop Break Alarm Deadband (LB.DB) value.
- When there is no sub relay output assigned to the LBA.
- When the controller is set to the STOP state.
- When performing an auto-tune.

Loop Break Detection Time (LB.TM)

The loop break detection time is usually set to about twice the value of PID coefficient 1. When auto-tuning is executed, the LB.TM value is automatically set to twice the PID coefficient 1 value.

However, when on/off control is used, LB.TM is not set automatically, so it must be input manually by the user.

Loop Break Set Value (LB.SV)

When the control output reaches 100% or 0%, an alarm is generated if the change of the temperature deviation after LB.TM time does not change by more than the Loop Break Alarm Set Value (LB.SV).

Loop Break Alarm Deadband (LB.DB)

To prevent malfunctions of the loop break alarm during normal control, set the Loop Break Alarm Deadband (LB.DB). If the PV enters the range of SV ± LB.DB, the LBA will not turn on, or turn off if already on.

The LBA will only work if the PV is less than SV-LB.DB or if PV is greater than SV + LB.DB.

Loop Break Alarm Latch Status (LB.LS)

LB.LS is the loop break alarm latch reset function. This parameter is accessible if the Sub Relay Group (G.SUB) parameter LB.LT is set to ON.

If the Sub Relay Group (G.SUB) parameter LB.LT is set to OFF, this parameter does not appear in the menu. The alarm will automatically reset when the alarm condition is cleared (including deadband).

Releasing a Loop break Alarm in Latch State

To release a loop break alarm with the latch status ON, the operator must change this parameter to RST after the loop break alarm condition has cleared.

As a shortcut, the operator may press the DOWN or UP arrow keys to reset a latched alarm after the alarm condition has cleared.

G.ALM Parameter Details

Parameter	Setting range	Unit	Default Value	Parameter Display Condition
RET.T	PV, SV, MV		PV	Models with RET option only.
A1.TY	0 - 13		3	G.SUB parameter SUBx is ALM1
AL-1	Absolute: EU (0.0 - 100.0) % Deviation: EUS (0.0 - 100.0) %	Note 1	EUS 100.0%	G.SUB parameter SUBx is ALM1 G.ALM parameter A1.TY ≠ OFF (0)
A1.DB	EUS (0.0 - 100.0) %	Note 1	1.0 ℃	
A1.LS	RST, SET		RST	G.SUB parameter SUBx is ALM1 G.SUB parameter A1.LT is ON G.ALM parameter A1.TY ≠ OFF (0)
A2.TY	0 – 13		10	G.SUB parameter SUBx is ALM2
AL-2	Absolute: EU (0.0 - 100.0) % Deviation: EUS (0.0 - 100.0) %	Note 1	EUS 100.0%	G.SUB parameter SUBx is ALM2 G.ALM parameter A2.TY ≠ OFF (0)
A2.DB	EUS (0.0 - 100.0) %	Note 1	1.0 ℃	
A2.LS	RST, SET		RST	G.SUB parameter SUBx is ALM2 G.SUB parameter A2.LT is ON G.ALM parameter A2.TY ≠ OFF (0)
A3.TY	0 - 13		1	G.SUB parameter SUBx is ALM3
AL-3	Absolute: EU (0.0 - 100.0) % Deviation: EUS (0.0 - 100.0) %	Note 1	EU 100.0%	G.SUB parameter SUBx is ALM3 G.ALM parameter A3.TY ≠ OFF (0)
A3.DB	EUS (0.0 - 100.0) %	Note 1	1.0 °C	
A3.LS	RST, SET		RST	G.SUB parameter SUBx is ALM3 G.SUB parameter A3.LT is ON G.ALM parameter A3.TY ≠ OFF (0)
A4.TY	0 - 13		2	G.SUB parameter SUBx is ALM4
AL-4	Absolute: EU (0.0 - 100.0) % Deviation: EUS (0.0 - 100.0) %	Note 1	EU 0.0%	G.SUB parameter SUBx is ALM4 G.ALM parameter A4.TY ≠ OFF (0)
A4.DB	EUS (0.0 - 100.0) %	Note 1	1.0 ℃	
A4.LS	RST, SET		RST	G.SUB parameter SUBx is ALM4 G.SUB parameter A4.LT is ON G.ALM parameter A4.TY ≠ OFF (0)
LB.TM	0 - 7200	Time (sec)	480	G.SUB parameter SUBx is LBA
LB.SV	EUS (0.0 - 5.0)%	Note 1	EUS 0.15%	
LB.DB	EUS (0.0 % + 1 digit) - 5.0 %	Note 1	EUS 0.15%	
LB.LS	RST, SET		RST	G.SUB parameter SUBx is LBA G.SUB parameter LB.LT is ON

1. Set by G.IN parameter UNIT.

Control Group (G.CTL)

The Control Group contains parameters to begin and adjust auto-tuning, set manual PID parameters, and perform basic control functions such as set value ramp up and down behavior.

During programming of the Control Group, references to “n” in the programming menus refers to the number 1, 2, 3, or 4; the PID group number the parameter applies to. For example, n.PID could appear as 1.PID, 2.PID, 3.PID, and 4.PID.

Auto-Tuning Process

The auto-tuning function automatically measures, computes the control system characteristics, and sets the optimum proportional band (P), integral time (I), and derivative time (D) constants.

When auto-tuning starts, the control output is changed temporarily to ON/OFF control and the optimum PID constants are computed and set from system response data. The TUNE or [T] icon on the display will blink during the auto-tune process.

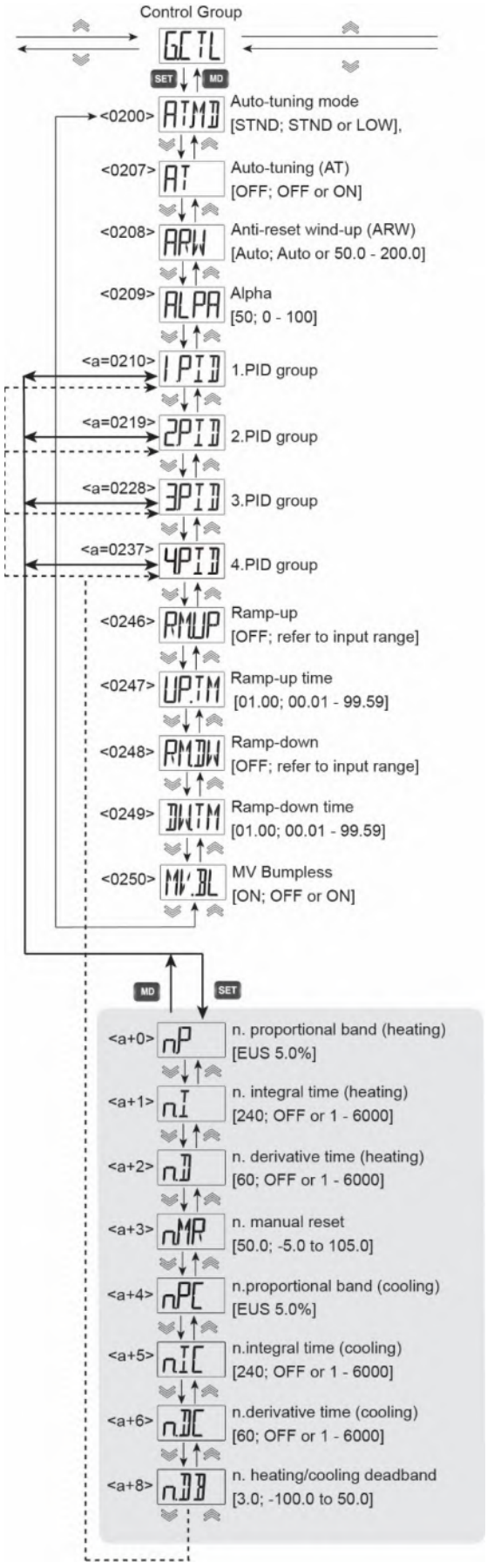
When the auto-tuning process is complete, the TUNE or [T] icon will turn off and stop blinking.

The time required for AT depends greatly on the control system.

If the auto-tune process has not ended after 24 hours, auto-tune process is automatically canceled, and no PID parameters are set.

If the auto-tune process exceeds 24 hours, the control output will generate an emergency output, the TUNE or [T] icon will keep blinking, and AT.E will be displayed on the PV window.

The SV used for auto-tune is either the SV of the set value number set by parameter SV.NO, or the remote SV if the remote SV input (REM) is selected.



Auto-Tuning Mode (AT.MD)

There are two types of auto-tuning (AT): standard type and low PV type.

Standard type auto-tuning is auto-tuning based on set value (SV).

Low PV type auto-tuning is auto-tuning based on a value 10% lower than set value (SV).

When low PV type auto-tuning is performed, the selected SV is displayed on the device, but the actual operation executes the auto-tuning at SV minus 10%.

For example, if the SV is set to 200°C with a type k thermocouple input type, and the low PV type auto-tuning is performed, the SV displayed on the device remains 200°C, but the actual auto-tune operation executes the auto-tuning at 160°C.

The calculation formula is as follows.

Target value of low PV mode auto-tune = (SV – FRL) x 0.9 – FRL
= (200 – (-200)) x 0.9 – FRL
= 160

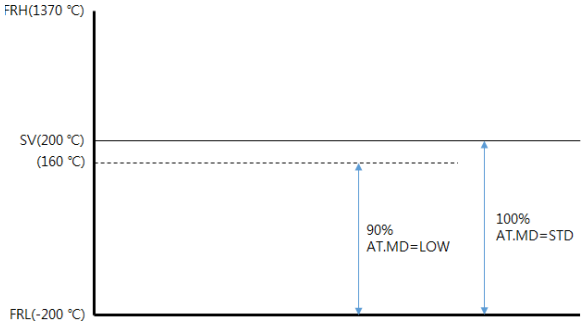


Figure 33. Standard and Low PV Auto-Tuning SV

Auto-Tuning (AT)

This parameter is used to activate the auto-tuning mode.

If AT is set to ON, or if the front panel SET and UP keys are held together for 3 seconds when in run mode, auto-tuning starts.

The AT sequence is as follows:3

1. Select the set value number (SV.NO) to execute the auto-tuning on. In many applications, only one SV number will be used, and the default set value number of one is used
2. Set the desired set value for the selected set value number. It is best to auto-tune to a SV that is in the range the application normally requires.
3. Select from standard or low PV type in parameter AT.MD.
4. Verify the controller is set to run mode. RUN will appear as one of the front panel display indicators.
5. Begin the auto-tuning process with one of the following methods:
    a. Set the Control Group (G.CTL) parameter Auto-Tune (AT) to ON.
    b. Press and hold the front panel keys SET and UP for 3 seconds.
6. When auto-tuning process has started, the TUNE or [T] indicator will blink. This indicator will turn off when the auto-tuning process is completed.
7. To end the auto-tuning process before it is automatically completed:
    a. Set the Control Group (G.CTL) parameter Auto-Tune (AT) to OFF.
    b. Press and hold the front panel keys SET and UP for 3 seconds.

If the auto-tuning process is completed successfully, the P, I, and D values are automatically set. The P, I, and D parameters are set in the PID group number that matches the selected set value number during the auto-tuning process.

For example, if the set value number selected is set value number 1, then the PID group P, I, and D parameters set are also from PID group number 1.

If the remove SV input is selected for the set value number selected, the P, I, and D values will be set in PID group number 4.

The P, I, and D values are not changed if auto-tuning process is cancelled, fails, or is otherwise ended early.

Anti-Reset Wind-Up (ARW)

When the control output value (MV) reaches the limit value (OLH, OLL), it executes the anti-reset wind-up operation to prevent over-integration.

Alpha (ALPA)

The response in a typical closed loop control system can be broadly divided into response to set value change and response to disturbance. The normal PID (one-degree-of-freedom) algorithm has the limitation that it can only optimize one response for these two issues. To overcome this limitation, with the application of the two-degree-of-freedom PID algorithm, you can optimize the response to the set value change and obtain an appropriate response to disturbances.

The ALPHA parameter is used to adjust the response characteristics to the set value (SV) changes.

If ALPHA is set to 0%, it is the same as the normal PID control response.

If ALPHA is set to 100%, it may take a long time to reach a normal state, but overshoot and undershoot will be minimized.

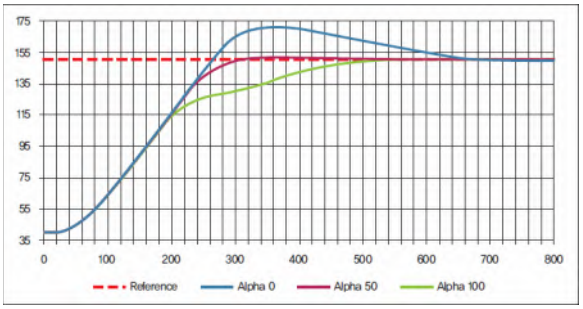


Figure 34. Response Adjustment with Alpha

When the Integral Time (n.I) parameter is set to 0 (OFF), the Alpha (ALPA) parameter value will be set to 0 and the ALPA parameter will not appear in the Control Group (G.CTL), and the n.MR parameter will be visible.

If the Integral Time (n.I) parameter is not set to 0 (OFF) in the G.CTL group, the Alpha (ALPA) value will be reset internally to the previously set ALPA value, the n.MR parameter will not be visible in in the Control Group (G.CTL), and the Alpha (ALPA) parameter will be visible.

PID Group Number (n.PID)

N.PID represents selections 1.PID, 2.PID, 3.PID, and 4.PID, PID group numbers 1, 2, 3, and 4. When a group is selected, the P, I, D, and MR values for that group are displayed.

n.P, n.I, n.D values are heating PID parameters, and n.Pc, n.Ic, n.Dc are cooling PID parameters.

The cooling parameters are displayed when Output Group (G.OUT) parameter OUT2 Control Mode (CNT2) is set to PID or ONOF. The PID coefficients are automatically set when auto-tuning is completed, however these parameters allow them to be set directly if the user already knows them, or modifications are desired to the auto-tuning acquired values.

Set Value Ramp

When the ramp functions are used, the set value (SV) changes over time to reach a newly selected set value. When ramp functions are not used, a newly selected SV immediately becomes the active SV.

To set the ramp function, the ramp time and the amount of SV change desired in that ramp time must be set.

The SV Ramp Up or SV Ramp Down functions are applied when the SV value is changed, or when changing from STOP to RUN modes. When the set SV is changed, the starting SV for the ramp is the current SV. When changing from STOP to RUN mode, the SV starts from current PV and ramps to the new SV.

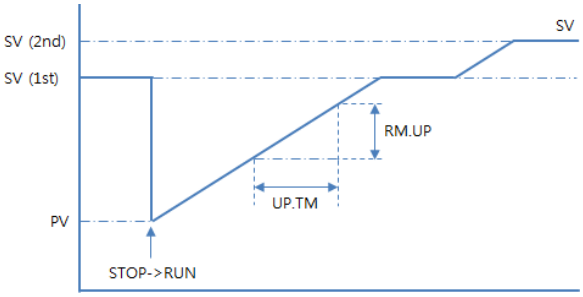


Figure 35. Set Value Ramp Up

SV Ramp Up (RM.UP)

This parameter sets the amount the set value (SV) will ramp up over the desired SV ramp up time.

SV Ramp Up Time (UP.TM)

This parameter sets the ramp time required for the set value (SV) to increase the amount set in the SV Ramp Up (RM.UP) parameter. The time is entered in hours and minutes, in the format hh.mm.

For example, if RM.UP is 60°C and UP.TM is 1 minute, the SV value has a ramp up rate of 1.0°C per second.

SV Ramp Down (RM.DW)

This parameter sets the amount the set value (SV) will ramp down over the desired SV ramp down time.

SV Ramp Down Time (DW.TM)

This parameter sets the ramp time required for the set value (SV) to decrease the amount set in the SV Ramp Down (RM.DW) parameter. The time is entered in hours and minutes, in the format hh.mm.

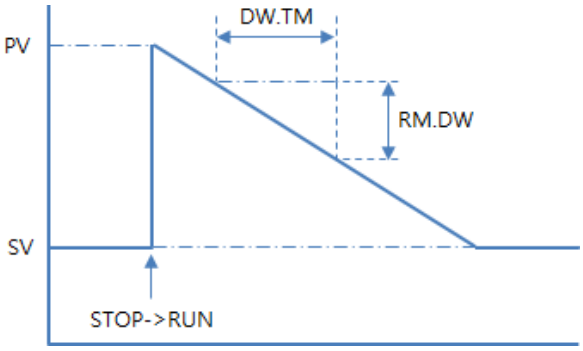


Figure 36. Set Value Ramp Down

For example, if RM.DW is 60°C and DW.TM is 1 minute, the SV value has a ramp down rate of 1.0°C per second.

G.CTL Parameter Details

Parameter	Setting range	Unit	Default Value	Parameter Display Condition
AT.MD	STD, LOW		STD	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID.
AT	OFF, ON		OFF	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID. Displays only in RUN mode.
ARW	Auto, (50.0 - 200.0) %	%	50.0	G.OUT parameter CNT2 is ONOF or PID.
ALPA	0 – 100		50	G.OUT parameter CNT1 or CNT2 are set to PID.
1.PID	PID No 1 selection			G.OUT parameter CNT1 or CNT2 are set to PID.
1.P	EUS (0.15 - 100.0) % (Note 4) EUS (0.0 - 100.0) % (Note 5)	Note 1	EUS 5.0 %	G.OUT parameter CNT1 is set to PID.
1.I	OFF, 1 - 6000	Seconds	240	
1.D	OFF, 1 - 6000	Seconds	60	
1.MR	-5.0 - 105.0	%	50.0	G.OUT parameter CNT1 is set to PID and 1.I is set to OFF.
1.Pc	EUS (0.0 - 100.0) %	Note 1	EUS 5.0 %	G.OUT parameter CNT2 is set to PID.
1.Ic	OFF, 1 - 6000	Seconds	240	
1.Dc	OFF, 1 - 6000	Seconds	60	
1.DB	-100.0 - 50.0	%	3.0	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID and CNT2 is not set to NONE.
2.PID	PID No 2 selection			G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID.
2.P	EUS (0.15 - 100.0) % (Note 4) EUS (0.0 - 100.0) % (Note 5)	Note 1	EUS 5.0 %	G.OUT parameter CNT1 is set to PID.
2.I	OFF, 1 - 6000	Seconds	240	
2.D	OFF, 1 - 6000	Seconds	60	
2.MR	-5.0 - 105.0	%	50.0	G.OUT parameter CNT1 is set to PID and 1.I is set to OFF.
2.Pc	EUS (0.0 - 100.0) %	Note 1	EUS 5.0 %	G.OUT parameter CNT2 is set to PID.
2.Ic	OFF, 1 - 6000	Seconds	240	
2.Dc	OFF, 1 - 6000	Seconds	60	
2.DB	-100.0 - 50.0	%	3.0	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID and CNT2 is not set to NONE.
3.PID	PID No 3 selection			G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID.
3.P	EUS (0.15 - 100.0) % (Note 4) EUS (0.0 - 100.0) % (Note 5)	Note 1	EUS 5.0 %	G.OUT parameter CNT1 is set to PID
3.I	OFF, 1~6000	Seconds	240	
3.D	OFF, 1~6000	Seconds	60	
3.MR	-5.0 - 105.0	%	50.0	G.OUT parameter CNT1 is set to PID and 3.I is set to OFF.
3.Pc	EUS (0.0 - 100.0) %	Note 1	EUS 5.0 %	G.OUT parameter CNT2 is set to PID
3.Ic	OFF, 1 - 6000	Seconds	240	
3.Dc	OFF, 1~6000	Seconds	60	
3.DB	-100.0 ~ 50.0	%	3.0	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID and CNT2 is not set to NONE.
4.PID	PID No 4 selection			G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID.
4.P	EUS (0.15 - 100.0) % (Note 4) EUS (0.0 - 100.0) % (Note 5)	Note 2	EUS 5.0 %	G.OUT parameter CNT1 is set to PID.
4.I	OFF, 1 - 6000	Seconds	240	
4.D	OFF, 1 - 6000	Seconds	60	

Parameter	Setting range	Unit	Default Value	Parameter Display Condition
4.MR	-5.0 - 105.0	%	50.0	G.OUT parameter CNT1 is set to PID and 4.I is set to OFF.
4.Pc	EUS (0.0 - 100.0) %	Note 1	EUS 5.0%	G.OUT parameter CNT2 is set to PID.
4.Ic	OFF, 1 - 6000	Seconds	240	
4.Dc	OFF, 1 - 6000	Seconds	60	
4.DB	-100.0 - 50.0	%	3.0	G.OUT parameter CNT1 is PID or G.OUT parameter CNT2 is PID and CNT2 is not set to NONE.
RM.UP	OFF, EUS (0.0 % + 1Digit) - 100.0%	Note 1	OFF	
UP.TM	00.01 ~ 99.59	hh:mm	01.00	G.SV parameter RM.UP is not set to OFF.
RM.DW	OFF, EUS (0.0 + 1Digit) - 100.0%	Note 1	OFF	
DW.TM	00:01 - 99:59	hh:mm	01.00	G.SV parameter RM.DW is not set to OFF.

1. Set by G.IN parameter UNIT.
4. Heating or cooling mode, CNT2 is set to None
5. Heating and cooling mode only, CNT2 is set to ONOF or PID.

SuperNova TCS Software

The SuperNova line of controllers includes the FREE SuperNova TCS monitoring and programming software.

The easiest and quickest way to connect to the SuperNova TCS software is to use the on-board mini-USB port available on all SuperNova controllers.

This software can be used for monitoring, data logging, programming, and troubleshooting SuperNova controllers.

SuperNova TCS software can connect to a maximum of 31 units when using the RS-485 communications option. A single unit can be connected via the USB connection.

Remote Programming

SuperNova TCS software allows all setup parameters to be programmed remotely from a PC and saved to a file for reporting or programming other controllers.

We recommend the following sequence for getting the controller into service using the SuperNova TCS software:

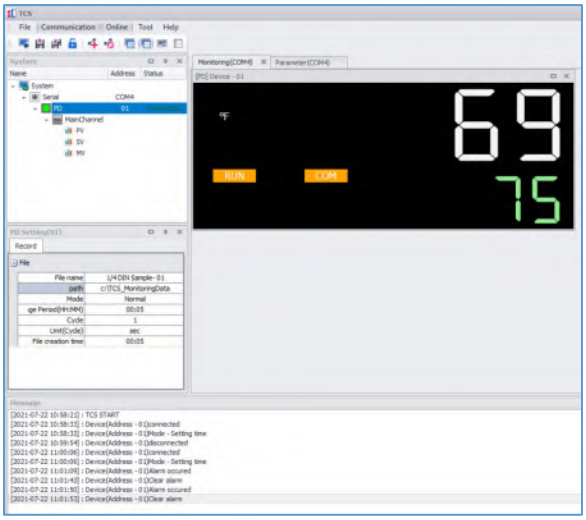
1. There is no need to apply AC power to the controller for parameter setup.
2. Connect the controller to the PC with the USB cable provided.
3. If SuperNova TCS software (TCS) is already installed in your computer, then double click the TCS icon or select TCS from your list of programs by selecting the PD folder, and then TCS software.
4. If the SuperNova TCS software is not installed, follow the instructions provided below.
5. Use SuperNova TCS software to configure the controller for your application.
6. Disconnect the USB cable from the controller.
7. Apply power and signal and check operation of the controller.
8. Install the controller and put into service.
9. Make any programming adjustments using the front panel buttons.

Data Acquisition

SuperNova TCS software provides a convenient way to collect the data from the SuperNova controller. The user can select the logging time interval. Data can be written to a file, which can then be imported into a spreadsheet or other application or viewed in the SuperNova TCS software.

Monitoring

SuperNova TCS software can be used to monitor up to 31 SuperNova controllers on a PC. The screenshot below shows SuperNova TCS software monitoring a single SuperNova controller.



Monitoring with RS-485 Connection

SuperNova TCS software may be connected directly to the controller using the on-board USB connector. However, if used in the application, it may be convenient to use the RS-485 connection to connect to a computer. This method is also required when monitoring multiple SuperNova controllers.

To connect the SuperNova controllers with the RS-485 option to a computer, the PDA8485 USB to RS-485 Isolated Converter is recommended.

One PDA8485-I may support all SuperNova controllers, up to 31 units, connected.

Quantity	Model	Description
1	PDA8485-I	USB to RS-485 Isolated Converter

SuperNova TCS Installation

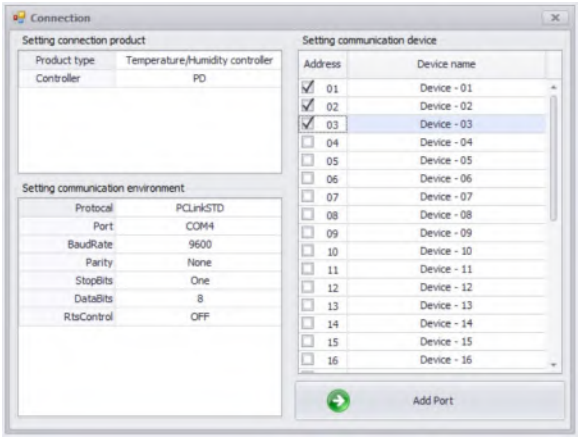
1. Go to www.predig.com and download the SuperNova TCS software.
2. Read all SuperNova and SuperNova TCS instructions.
3. Download Installation file to computer
4. Double-click installation file to open it
5. Double-click the appropriate setup file to begin installation:
   6. TCS-1.0.2_(x86).exe for 32-bit operating systems.
   7. TCS-1.0.2_(x64).exe for 64-bit operating systems.
8. Follow on-screen instructions

Running SuperNova TCS the First Time

The first time SuperNova TCS is run it is necessary to set up the serial communication settings of the program.

Click the Add Serial Communications icon in the upper left menu, as identified below.

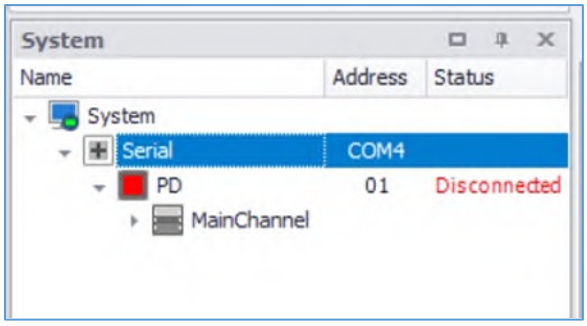
Select the communication port, protocol, baud rate, serial communications parameters, and addressed of the controller(s) connected. Once the configuration is complete, select Add Port.



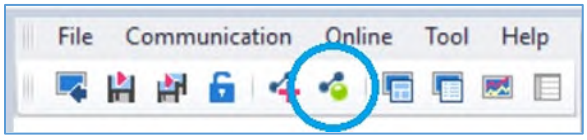
Note that for USB connections, it may be required to check what virtual com port is being used for the USB connection in the computer's Device Manager tool.

Once the port is added, the port(s) and controllers(s) selected will appear in the System menu box on the left side of the screen.

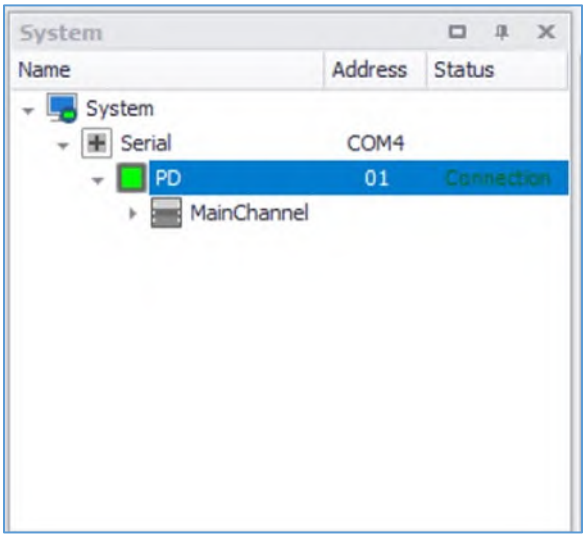
The image below shows on controller assigned address 01 connected to COM4.



To connect to the controller(s) assigned to the active port(s), click the Connect icon shown below.



When connected, the Disconnected message for the port will be replaced with a "Connected" message, and monitoring will begin for the assigned addresses.



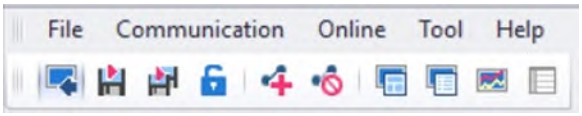
SuperNova TCS Main menu

The main SuperNova TCS menu consist of various commands as show below.

For a more detailed listing of all SuperNova TCS software capabilities and controls, refer to the Help selection in the Help menu for a complete software manual.

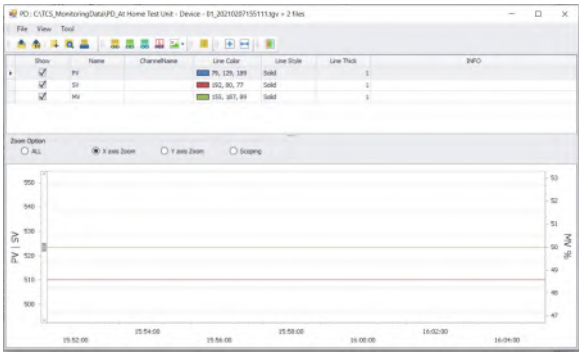
Top Level Menus

The File, Communication, and Online menus have icons that appear automatically below the menus.



Load monitoring data

Open the Graph Viewer to see previously data logged information in chart or table form and export it into various file formats.



Monitoring data saving start

Starts data logging for the selected units in the System menu list.

Start saving all the monitoring data

Starts data logging for all connected units on a port.

/ Lock or Unlock

Locks or unlocks all the functions of the SuperNova TCS software.

Add serial communications

Opens the new serial communications menu to setup a new port.

/ Connect or Disconnect

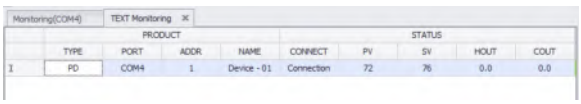
Connect or disconnect all the controllers connected a port.

Monitoring

Opens the graphical monitoring screen for the selected controller.

Text Monitoring

Opens a chart listing the monitoring information for all connected controllers.



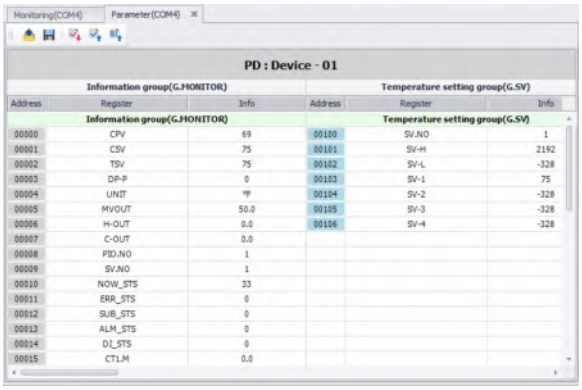
Multitrend

Opens the trend graph monitoring screen for all connected controllers.

Parameter

Opens the parameter list and parameter settings for the selected controller. Changes to the parameters and setup may be done from this screen.

Parameter configurations may be uploaded from the controller, downloaded to the controller, saved as a file, or loaded from a file.



Tool Menu

This menu is used to open the Graph Viewer to see previously data logged information in chart or table form and export it into various file formats.

It also contains the Settings menu. The Settings menu is used to select English or Spanish language text, and to set a password to lock the software setup from changes.

Help Menu

Use the Help selection to open the SuperNova TCS complete manual. Use the Program Info selection to view the software version information.

Troubleshooting Tips

Symptom	Check/Action
No display at all	Check power at power terminals.
The MV display is blank.	The controller is in STOP mode. Change it to RUN mode by holding the shift key for 2 seconds.
The control outputs are not working.	Verify the controller is not in STOP mode. Change it to RUN mode by holding the shift key for 2 seconds. Verify the controller is not in manual mode. If in manual mode, the MANU indicator will display on the controller. Hold the SET and down keys for 3 seconds to change from manual to automatic mode.
The controller displays LOCK in the SV window when attempting to change the SV or menu parameters.	The controller settings lock is enabled. Hold the SET and shift keys for 3 seconds to turn the lock off. Consider turning the lock back on when changes are competed.
The control outputs are not changing and the MANU light is on the display	The controller is in manual mode. Change the controller to automatic mode by holding the SET and down keys for three seconds.
The controller is in heating and cooling mode and only heating or cooling mode is needed.	To operate as a heating or cooling controller, disable the Output Group (G.OUT) parameter CNT2. Set CNT2 to NONE. This will disable the heating and cooling output indication of H or C before the MV % output display digits. After setting CNT2 to NONE, set the Group (G.OUT) parameter O.ACT to reverse acting (REV) for heating control, or direct acting (DIR) for cooling control.
The MV display shows a H or C when heating and cooling mode is not required.	
Other symptoms not described above	Call Technical Support for assistance.

Note: Certain sequences of events can cause unexpected results. To solve these issues, it is best to start fresh from factory defaults and use the manual as a step-by-step programming guide, rather than a random approach to programming. To reset the controller to factory defaults, use the Parameter Initialization (P.INT) parameter in the Settings Group (G.SET).

In addition, for best results, we recommend using the free SuperNova TCS software to review all of the controller settings.

Error Messages

No	Display	Error Type	Cause and Action
1		System Data	System data error (please contact technical support)
2		Option Data	Option data error (please contact technical support)
3		EEPROM	EEPROM error (please contact technical support)
4		AD Converter	AD Converter error (please contact technical support)
5		Calibration	Calibration value setting error (please contact technical support)
6		RJC	Reference junction compensation error (please contact technical support)
7		Auto-tuning	Auto-tuning has taken more than 24 hours to complete, which will cancel the auto-tuning process. Check if the programmed input type and actual sensor match. Confirm that when the control output value (MV) indicates 100%, the output signal is correct. If it is not, please contact technical support. Confirm the PV changes if the control output value (MV) is 100 If the PV does not change enough to allow an auto-tuning within 24 hours, check the system wiring and other equipment. Confirm the PV changes when the control output value is 0%. If the PV does not change enough to allow an auto-tuning within 24 hours, check the system wiring and other equipment. If the system is too slow to respond, and auto-tuning would take more than 24 hours, manually setting the PID values will be required.
8		Burnout	The sensor appears to be disconnected. Check sensor wiring and the condition of the sensor. Confirm the correct input type is selected for the attached sensor. Measure the input signal, and verify it is within the sensor input maximum and minimum signal.
9		+Over	This error occurs when the input signal exceeds +5% (full scale) of the sensor input maximum range. Confirm the correct input type is selected for the attached sensor.
10		-Over	This error occurs when the input signal is less than -5% (full scale) of the sensor input minimum range. Confirm the correct input type is selected for the attached sensor. Check the sensor setting state.

Modbus Register Tables

Fixed Modbus Tables

General Process and Indication, Address 0 - 99

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40001	9C41	0	0000	CPV	Current PV	RO	O
40002	9C42	1	0001	CSV	Current set value	RO	O
40003	9C43	2	0002	TSV	Final set value	RO	O
40004	9C44	3	0003	DP-P	Number of decimal points	RO	O
40005	9C45	4	0004	UNIT	Unit	RO	O
40006	9C46	5	0005	MVOUT	Output level %	RO	O
40007	9C47	6	0006	OUT1 (Heat)	Heating output %	RO	O
40008	9C48	7	0007	OUT2 (Cool)	Cooling output %	RO	O
40009	9C49	8	0008	PID.NO	PID number	RO	O
40010	9C4A	9	0009	SV.NO	SV number	RO	O
40011	9C4B	10	000A	NOW_STS	Current state	RO	O
40012	9C4C	11	000B	ERR_STS	Error status	RO	O
40013	9C4D	12	000C	SUB_STS	Sub output status	RO	O
40014	9C4E	13	000D	ALM_STS	Alarm status	RO	O
40015	9C4F	14	000E	DI_STS	DI status	RO	O
40018	9C52	17	0011	R/S	Run/stop mode	RO	O
40019	9C53	18	0012	AT	Auto-tuning	RO	O
40020	9C54	19	0013	A/M	Auto/manual mode	RO	O
40021	9C55	20	0014	AL1.M	ALM1 monitoring	RO	O
40022	9C56	21	0015	AL2.M	ALM2 monitoring	RO	O
40023	9C57	22	0016	AL3.M	ALM3 monitoring	RO	O
40024	9C58	23	0017	AL4.M	ALM4 monitoring	RO	O
40025	9C59	24	0018	LBA.M	LBA monitoring	RO	O
40026	9C5A	25	0019	HBA.M	HBA monitoring	RO	O
40032	9C60	31	001F	A/M	Auto/manual mode	RW	O
40033	9C61	32	0020	MV IN	Manual output % value	RW	O
40034	9C62	33	0021	R/S	Run/stop mode	RW	O
40042	9C6A	41	0029	SYS	System data	RO	
40043	9C6B	42	002A	OPT	Option data	RO	
40044	9C6C	43	002B	SP1	Special data (1)	RO	
40045	9C6D	44	002C	SP2	Special data (2)	RO	
40046	9C6E	45	002D	FWV	Firmware version	RO	

Set Value Group (G.SV), Address 100 - 199

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40101	9CA5	100	0064	SV.NO	Set value number selection	R/W	
40102	9CA6	101	0065	SV-H	SV setting high limit value	R/W	
40103	9CA7	102	0066	SV-L	SV setting low limit value	R/W	
40104	9CA8	103	0067	SV-1	Set value 1	R/W	
40105	9CA9	104	0068	SV-2	Set value 2	R/W	
40106	9CAA	105	0069	SV-3	Set value 3	R/W	
40107	9CAB	106	006A	SV-4	Set value 4	R/W	

Control Group (G.CTL), Address 200 - 299

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40201	9D09	200	00C8	AT.MD	Auto-tuning mode	R/W	
40202	9D0A	207	00C9	AT	Auto-tuning	R/W	O
40205	9D0D	208	00CC	ARW	Anti-reset Windup	R/W	
40206	9D0E	209	00CD	ALPA	Alpha	R/W	
-	-	-	-	PID.N	PID number	R/W	O
40211	9D13	210	00D2	1.P	Heating proportional band	R/W	
40212	9D14	211	00D3	1.I	Heating integral time	R/W	
40213	9D15	212	00D4	1.D	Heating derivative time	R/W	
40214	9D16	213	00D5	1.MR	Manual reset	R/W	
40215	9D17	214	00D6	1.Pc	Cooling proportional band	R/W	
40216	9D18	215	00D7	1.Ic	Cooling integral time	R/W	
40217	9D19	216	00D8	1.Dc	Cooling derivative time	R/W	
40218	9D1A	217	00D9	-	-	-	
40219	9D1B	218	00DA	1.DB	Heating / cooling deadband	R/W	
40220	9D1C	219	00DB	2.P	Heating proportional band	R/W	
40221	9D1D	220	00DC	2.I	Heating integral time	R/W	
40222	9D1E	221	00DD	2.D	Heating derivative time	R/W	
40223	9D1F	222	00DE	2.MR	Manual reset	R/W	
40224	9D20	223	00DF	2.Pc	Cooling proportional band	R/W	
40225	9D21	224	00E0	2.Ic	Cooling integral time	R/W	
40226	9D22	225	00E1	2.Dc	Cooling derivative time	R/W	
40227	9D23	226	00E2	-	-	-	
40228	9D24	227	00E3	2.DB	Heating / cooling deadband	R/W	
40229	9D25	228	00E4	3.P	Heating proportional band	R/W	
40230	9D26	229	00E5	3.I	Heating integral time	R/W	
40231	9D27	230	00E6	3.D	Heating derivative time	R/W	
40232	9D28	231	00E7	3.MR	Manual reset	R/W	
40233	9D29	232	00E8	3.Pc	Cooling proportional band	R/W	
40234	9D2A	233	00E9	3.Ic	Cooling integral time	R/W	
40235	9D2B	234	00EA	3.Dc	Cooling derivative time	R/W	
40236	9D2C	235	00EB	-	-	-	
40237	9D2D	236	00EC	3.DB	Heating / cooling deadband	R/W	
40238	9D2E	237	00ED	4.P	Heating proportional band	R/W	
40239	9D2F	238	00EE	4.I	Heating integral time	R/W	
40240	9D30	239	00EF	4.D	Heating derivative time	R/W	
40241	9D31	240	00F0	4.MR	Manual reset	R/W	
40242	9D32	241	00F1	4.Pc	Cooling proportional band	R/W	
40243	9D33	242	00F2	4.Ic	Cooling integral time	R/W	
40244	9D34	243	00F3	4.Dc	Cooling derivative time	R/W	
40245	9D35	244	00F4	-	-	-	
40246	9D36	245	00F5	4.DB	Heating / cooling deadband	R/W	
40247	9D37	246	00F6	RM.UP	Ramp-up temperature	R/W	
40248	9D38	247	00F7	UP.TM	Ramp-up time	R/W	
40249	9D39	248	00F8	RM.DW	Ramp-down temperature	R/W	
40250	9D3A	249	00F9	DW.TM	Ramp-down time	R/W	

Alarm Group (G.ALM) Address, 300 - 399

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40301	9D6D	300	012C	A1.TY	Alarm 1 type	R/W	
40302	9D6E	301	012D	AL-1	Alarm 1 set value	R/W	
40303	9D6F	302	012E	A1.DB	Alarm 1 deadband	R/W	
40304	9D70	303	012F	A1.LS	Alarm 1 output hold status	R/W	O
40305	9D71	304	0130	A2.TY	Alarm 2 type	R/W	
40306	9D72	305	0131	AL-2	Alarm 2 set value	R/W	
40307	9D73	306	0132	A2.DB	Alarm 2 deadband	R/W	
40308	9D74	307	0133	A2.LS	Alarm 2 output hold status	R/W	O
40309	9D75	308	0134	A3.TY	Alarm 3 type	R/W	
40310	9D76	309	0135	AL-3	Alarm 3 set value	R/W	
40311	9D77	310	0136	A3.DB	Alarm 3 deadband	R/W	
40312	9D78	311	0137	A3.LS	Alarm 3 output hold status	R/W	O
40313	9D79	312	0138	A4.TY	Alarm 4 type	R/W	
40314	9D7A	313	0139	AL-4	Alarm 4 set value	R/W	
40315	9D7B	314	013A	A4.DB	Alarm 4 deadband	R/W	
40316	9D7C	315	013B	A4.LS	Alarm 4 output hold status	R/W	O
40317	9D7D	316	013C	LB.TM	Loop break alarm time	R/W	
40318	9D7E	317	013D	LB.SV	Loop break alarm temperature	R/W	
40319	9D7F	318	013E	LB.DB	Loop break alarm deadband	R/W	
40320	9D80	319	013F	LB.LS	Loop break alarm latch status	R/W	O
40321	9D81	320	0140	HB-1	Heater break alarm 1 current	R/W	
40322	9D82	321	0141	H1.DB	Heater break alarm 1 current deadband	R/W	
40323	9D83	322	0142	HB-2	Heater break alarm 2 type	R/W	
40324	9D84	323	0143	H2.DB	Heater break alarm 2 current deadband	R/W	
40325	9D85	324	0144	HB.LS	Heater break alarm latch status	R/W	O

Transmit Group (G.TRS), Address 400 - 499

Address		D-register		Parameter		R/W	RAM (Only)
DEC		HEX					
40401	9DD1	400	0190	RET.T	Retransmission output type	R/W	
40402	9DD2	401	0191	RET.H	Retransmission output high scale value	R/W	
40403	9DD3	402	0192	RET.L	Retransmission output low scale value	R/W	
40404	9DD4	403	0193	T-AH	Retransmission output high adjust value	R/W	
40405	9DD5	404	0194	T-AL	Retransmission output low adjust value	R/W	
40406	9DD6	405	0195	REM.E	Remote input selection	R/W	
40407	9DD7	406	0196	REM.H	Remote input high voltage setting	R/W	
40408	9DD8	407	0197	REM.L	Remote input low voltage setting	R/W	
40409	9DD9	408	0198	R-SH	Remote input high scale value	R/W	
40410	9DDA	409	0199	R-SL	Remote input low scale value	R/W	
40411	9DDB	410	019A	R-AH	Remote input adjust high value	R/W	
40412	9DDC	411	019B	R-AL	Remote input adjust low value	R/W	

SUB Relay Group (G.SUB), Address 500 - 599

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40501	9E35	500	01F4	SUB1	Sub1 output type	R/W	
40502	9E36	501	01F5	SUB2	Sub2 output type	R/W	
40503	9E37	502	01F6	SUB3	Sub3 output type	R/W	
40504	9E38	503	01F7	SUB4	Sub4 output type	R/W	
40505	9E39	504	01F8	A1.ND	Alarm 1 on delay time	R/W	
40506	9E3A	505	01F9	A1.FD	Alarm 1 off delay time	R/W	
40507	9E3B	506	01FA	A1.EC	Alarm 1 contact type	R/W	
40508	9E3C	507	01FB	A1.LT	Alarm 1 output lock	R/W	
40509	9E3D	508	01FC	A2.ND	Alarm 2 on delay time	R/W	
40510	9E3E	509	01FD	A2.FD	Alarm 2 off delay time	R/W	
40511	9E3F	510	01FE	A2.EC	Alarm 2 contact type	R/W	
40512	9E40	511	01FF	A2.LT	Alarm 2 output lock	R/W	
40513	9E41	512	0200	A3.ND	Alarm 3 on delay time	R/W	
40514	9E42	513	0201	A3.FD	Alarm 3 off delay time	R/W	
40515	9E43	514	0202	A3.EC	Alarm 3 contact type	R/W	
40516	9E44	515	0203	A3.LT	Alarm 3 output lock	R/W	
40517	9E45	516	0204	A4.ND	Alarm 4 on delay time	R/W	
40518	9E46	517	0205	A4.FD	Alarm 4 off delay time	R/W	
40519	9E47	518	0206	A4.EC	Alarm 4 contact type	R/W	
40520	9E48	519	0207	A4.LT	Alarm 4 output lock	R/W	
40521	9E49	520	0208	LB.ND	Loop break alarm on delay	R/W	
40522	9E4A	521	0209	LB.FD	Loop break alarm off delay	R/W	
40523	9E4B	522	020A	LB.EC	Loop break alarm electric Contact	R/W	
40524	9E4C	523	020B	LB.LT	Loop break alarm latch	R/W	

Communication Group (G.COM), Address 600 - 699

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40601	9E99	600	0258	PRS	Protocol	R/W	
40602	9E9A	601	0259	BPS	Baud rate	R/W	
40603	9E9B	602	025A	PRI	Parity bit	R/W	
40604	9E9C	603	025B	STOP	Stop bit	R/W	
40605	9E9D	604	025C	D.LEN	Data length	R/W	
40606	9E9E	605	025D	ADDR	Address	R/W	
40607	9E9F	606	025E	RP.TM	Response delay time	R/W	

Set Value Group (G.SET), Address 700 - 799

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40701	9EFD	700	02BC	DI.MD	DI mode	R/W	
40702	9EFE	701	02BD	PO.OM	Operation mode after power on	R/W	
40703	9EFF	702	02BE	P.INT	Parameter initialization	R/W	O
40704	9F00	703	02BF	LOCK	Setting lock	R/W	
40705	9F01	704	02C0	E2P.L	EEPROM lock	R/W	

Output Group (G.OUT), Address 800 - 899)

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40801	9F61	800	0320	CNT1	OUT1 output control selection	R/W	
40802	9F62	801	0321	CNT2	OUT2 output control selection	R/W	
40803	9F63	802	0322	O.ACT	Direct/reverse output action	R/W	
40804	9F64	803	0323	CP	Heating control period	R/W	
40805	9F65	804	0324	CPC	Cooling control period	R/W	
40806	9F66	805	0325	HYS	Hysteresis	R/W	
40807	9F67	806	0326	HYSC	Hysteresis (cooling)	R/W	
40808	9F68	807	0327	EO	Heating emergency output	R/W	
40809	9F69	808	0328	EOC	Cooling emergency output	R/W	
40810	9F6A	809	0329	OL-H	Output high limit	R/W	
40811	9F6B	810	0330	OL-L	Output low limit	R/W	

Input Group (G.IN), Address 900 - 999

Address		D-register		Parameter		R/W	RAM (Only)
DEC	HEX	DEC	HEX				
40901	9FC5	900	0384	INP	Input Type selection	R/W	
40902	9FC6	901	0385	UNIT	Unit selection	R/W	
40905	9FC9	904	0388	DP-P	Dot point position selection	R/W	
40906	9FCA	905	0389	SL-H	Scale high limit	R/W	
40907	9FCB	906	038A	SL-L	Scale low limit	R/W	
40908	9FCC	907	038B	RJC	Reference junction compensation	R/W	
40909	9FCD	908	038C	FILT	Input display value filter	R/W	
40910	9FCE	909	038D	BIAS	PV bias	R/W	

User Defined Modbus Map

It is possible to map the controller's fixed Modbus registers to a set of Modbus D-registers from 1200 – 1219. These user defined registers can be any Modbus registers from the set of tables above.

The user defined Modbus map is assigned using D-registers 721 – 740 (addresses 40722 – 40741). To create the user defined Modbus map, write the D-register number of the desired parameters to D-register 721 (address 40722). That parameter's value will be available in Modbus D-register 1200 (address 41201).

For example, to configure a custom Modbus map of D-register 1200 to D-register 0 for NPV, D-register 1201 to D-register 1 for NSV, D-register 1202 to D-register 5 for MVOUT, D-register 1203 to D-register 207 for AT, D-register 1204 to D-register 210 for 1.P, D-register 1205 to D-register 211 for 1.C, and D-register 1206 to D-register 212 for 1.D, set the user defined Modbus map as shown below.

Desired Parameter		Assignment Address		Assignment D-register		User Map Address		User Map D-Register	
D-Register #	Parameter Name	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX
0	NPV	40722	9F12	721	02D1	41201	A0F1	1200	04B0
1	NSV	40723	9F13	722	02D2	41202	A0F2	1201	04B1
5	MVOUT	40724	9F14	723	02D3	41203	A0F3	1202	04B2
207	AT	40725	9F15	724	02D4	41204	A0F4	1203	04B3
210	1.P	40726	9F16	725	02D5	41205	A0F5	1204	04B4
211	1.I	40727	9F17	726	02D6	41206	A0F6	1205	04B5
212	1.D	40728	9F18	727	02D7	41207	A0F7	1206	04B6

Modbus Register Bit Information

Some Modbus registers contain information that is determined on a bit-by-bit basis. The following tables define these register names, what each bit represents, and the values of the settings of each bit.

Register Bit Assignment

Register Name	NOW_STS	ERR_STS	SUB_STS	ALM_STS	DI_STS
Register Address	40011	40012	40013	40014	40015
Bit					
15		SYS.Err			
14		OPT.Err			
13		E2P.Err			
12		ADC.Err			
11		CAL.Err			
10		RJC.Err		HBA.M	
9		AT.Err		LBA.M	
8		COMM.Err			
7	LOCK	B.OUT			
6		+OVER			
5	STD/HC	-OVER			
4	RAMP				
3	REM		SUB4 OUT	AL4.M	DI4 IN
2	Auto/Manual		SUB3 OUT	AL3.M	DI3 IN
1	AT		SUB2 OUT	AL2.M	DI2 IN
0	RUN/STOP		SUB1 OUT	AL1.M	DI1 IN

Bit Definitions

The following tables define what the values for each bit represent.

Now STS (Now Status) Description

Bit	Status (0)	Status (1)
15		
14		
13		
12		
11		
10		
9		
8		
7	No lock	Lock set
6		
5	STD (heating or cooling control)	HC (heating & cooling control)
4	SV Ramp parameter not in use	SV Ramp parameter in use
3	SV.NO in use	REM in use
2	Automatic output mode	Manual output mode
1	Normal (not auto-tuning)	Running at
0	STOP (monitoring only) Mode	RUN Mode

ERR_STS (Error Status) Description

Bit	Status (0)	Status (1)
15	Normal	System code error
14		Option code error
13		EEPROM error
12		ADC error
11		Calibration error
10		RIC error
9		Auto-tuning error
8		Communication error
7		Burn out
6		PV value +OVER
5		PV value -OVER
4		
3		
2		
1		
0		

ALM_STS (Alarm Status) description

Bit	Status (0)	Status (1)
15	Normal	
14		
13		
12		
11		
10		HBA on
9		LBA on
8		
7		
6		
5		
4		
3		HBA on
2		LBA on
1		HBA on
0		LBA on

SUB_STS (Sub Output Status) Description

Bit	Status (0)	Status (1)
15	Normal	
14		
13		
12		
11		
10		
9		
8		
7		
6		
5		
4		
3		SUB4 output on
2		SUB3 output on
1		SUB2 output on
0		SUB1 output on

DI_STS (Digital Input Status) description

Bit	Status (0)	Status (1)
15	Normal	
14		
13		
12		
11		
10		
9		
8		
7		
6		
5		
4		
3		DI4 on
2		DI3 on
1		DI2 on
0		DI1 on

EU Declaration of Conformity

Issued in accordance with ISO/IEC 17050-1:2004.

We,

Precision Digital Corporation
233 South Street
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as the manufacturer, declare under our sole responsibility that the product(s),

Models PD510, PD520, and PD530 SuperNova Consollers

to which this declaration relates, is in conformity with the European Union Directives shown below:

2014/35/EU	**Low Voltage Directive**
2014/30/EU	**EMC Directive**
2011/65/EU	**RoHS Directive**

This conformity is based on compliance with the application of harmonized or applicable technical standards and, when applicable or required, a European Union notified body certification.

Standards:

EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61000-6-2:2005
EN 61000-6-4:2007+A1:2011
EN 61010-1:2010

The standards EN 61000-3-2:2014, EN 61000-3-3:2013, EN 61000-6-2:2005, EN 61000-6-4:2007+A1:2011, and EN 61010-1:2010 are no longer harmonized. The requirements of these standards have been checked against the harmonized standards EN 61000-3-2:2019, EN 61000-3-3:2013+A1:2019, EN 61000-6-2:2019, EN 61000-6-4:2019, and EN 61010-1:2010+A1:2019 and there were no major technical changes affecting the latest technical knowledge for the products listed above.

Product Markings:

CE

Signed for and on behalf of Precision Digital Corporation:

Name: Jeffrey Peters
Company: Precision Digital Corporation
Title: President
Date: June16, 2021

Document No: DoC SuperNova {061621}

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