

# PROCESS & TEMPERATURE CONTROLLERS

## NOVA PD540 Series



- Thermocouple, RTD, & Process Inputs
- High Accuracy Auto-Tuning PID
- Heating & Cooling Models
- Universal Power Supply 100-240 VAC
- Up to 3 Relays & 2 Analog Outputs
- Digital Input Set Point Selection
- RS-485 Serial Communications Option
- Modbus® RTU/ASCII Communications
- Free Operating & Data Logging Software
- IP55 & IP65 Fronts
- 1/16, 3/16, 1/8, 1/4 DIN Sizes
- 3 Year Warranty

**PRECISION  
DIGITAL** ÷

## CUSTOM OPERATING DISPLAYS

The Nova Digital Controller has dual four-digit LEDs and can display commonly used setup parameters defined by the user.

### Operating Display Navigation

To access additional display information without the need to enter the setup menus, simply press the **SET/ENT** button.

#### Main Operating Display

- PV window displays process variable
- SP window displays set point
- Press the **SET/ENT** button to move to the next display window



#### Percent Output Display

- PV window displays process variable
- SP window displays the operating level of the control outputs as % of full scale
- Press the **SET/ENT** button to move to the next display window

#### User Defined Display 1

- Display any setup parameter
- Parameters are fully functional, and can be set through this display
- Set by the user with parameter **US1**
- Press the **SET/ENT** button to move to the next display window



#### User Defined Display 2

- Display any setup parameter
- Parameters are fully functional, and can be set through this display
- Set by the user with parameter **US2**
- Press the **SET/ENT** button to return to the main operating display



## EASY SETUP & PROGRAMMING

All programming of a Nova Digital Controller is done through the front panel. No switches or jumpers are required.

### Front Panel Buttons

- Press the **SET/ENT** button to confirm an entered value. Hold the button for 3 seconds to enter or exit the setup groups. Press the **SET/ENT** button to access the next parameter when in a setup group.
- Press the **Up** arrow button to increase numerical values or scroll through parameter options and group menus.
- Press the **Down** arrow button to decrease numerical values or scroll through parameter options and group menus.
- Press the **LEFT** arrow button to move to the next digit during numerical value programming.

### Setup Group Menus

For easy setup parameter navigation, all parameters are grouped by category. To access the group menus, press and hold the **SET/ENT** button for 3 seconds. Navigate through the group menus using the **UP** or **DOWN** arrow buttons as shown. To enter a group menu to access setup parameters, press the **SET/ENT** button.

| Button | PV Display | Group Definition      |
|--------|------------|-----------------------|
| ▼      | G.Rt       | Auto-Tuning Group     |
| ▲▼     | G.SP       | Set Point Group       |
| ▲▼     | G.P Id     | P.I.D. Group          |
| ENT    | P.yd       | Password              |
| ▲▼     | G.CtL      | Control Group         |
| ▲▼     | G.In       | Input Group           |
| ▲▼     | G.oUt      | Output Group          |
| ▲▼     | G.ALn      | Alarm Group           |
| ▲▼     | G.rEt      | Retransmission Group  |
| ▲▼     | G.Coñ*     | Communications Group* |

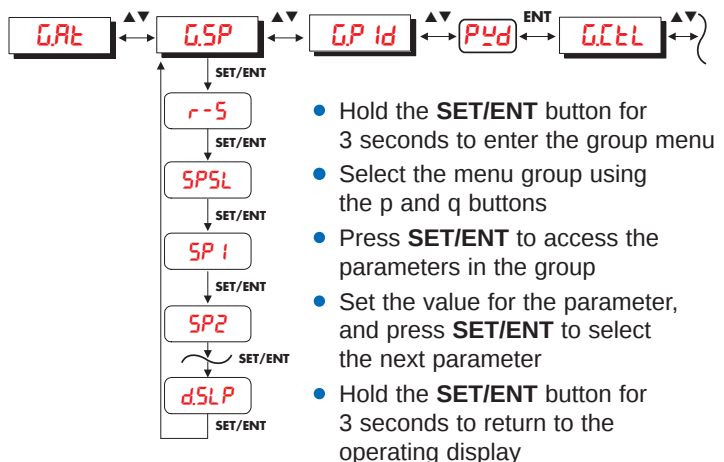
\*This group menu appears only on models with the serial communications option.

### Menu Password

To prevent unauthorized changes to key parameters, a user defined lockout password must be entered to access the group menus that are not commonly used during operation. Enter the password at the prompt when navigating the group menus by pressing the **SET/ENT** button. The default password is 0.

### Easy to Use Menu Structure

Each parameter is located in an associated menu group.



For a complete list of setup parameters, their functions, and setting options, refer to the PD540 Series Instruction Manual.

## PROCESS & TEMPERATURE INPUTS

Nova Controllers use a single universal input that accepts process and temperature inputs.

**Thermocouple:** J, K, T, E, R, B, S, L, N, U, W, Platinel II

**RTD:** Pt100 (0.00385), JPt100 (0.00392)

**Process:** -10 to 20 mV, 0 to 100 mV  
0.4 to 2 V, 1 to 5 V, 0 to 10 V  
4 to 20 mA input with a resistor shunt

## VERSATILE OPERATION

Powerful standard and optional features such as universal inputs, up to three relays and two analog outputs, two digital inputs, and serial communications make this controller applicable for most process or temperature control applications.

### Programmable Relays

All PD540 Series controllers have a standard 3 A Form C (SPDT) relay. Up to two additional 1 A Form A (SPST) relays. All relays can be programmed for numerous control or alarm functions.

- Time-Proportional PID Control
- On/Off Control
- High/Low Alarms
- Set Point Deviation Alarms
- Fail-Safe and Standby Alarms
- Alarm Delays and Deadbands

### Analog Output Configurations

Up to two analog outputs are available on all PD540 Series controllers. Each analog output can be programmed independently, and numerous output types are selectable.

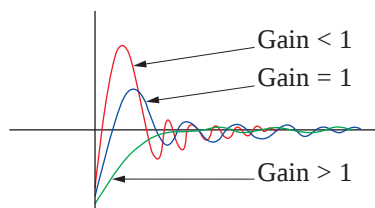
- 4-20 mA PID Control
- 4-20 mA Retransmitting
- Time-Proportional PID Voltage Pulse
- Transmitter Loop Power Supply

### Auto-Tuning PID

A high accuracy auto-tuning function using Fuzzy Logic calculates the PID values for your system with the push of a button, eliminating the need for complex PID calculations and time consuming setup. After several on/off cycles, the PID values will be setup automatically.

### Gain Adjustment

Adjustments to system control characteristics can be done after auto-tuning with the programmable Gain function. Increasing the Gain will increase accuracy and reduce overshoot. Lowering the Gain will let the system reach the set point faster.



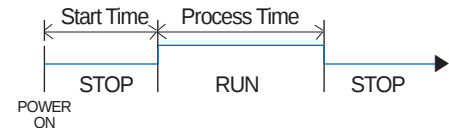
PV Reactions to SP Change Based on Gain

### Input Bias Adjustment

Up to five bias points can be used to provide precise offset adjustments at specific input values. The controller will use the offset to create a smooth input value curve leading up to the bias points.

### On/Off Timers

The start timer delays control output operation from power-up. The process timer determines how long the control outputs will run after starting. These timers may run up to 99 hours 59 minutes, or be turned off.



### Digital Input Set Point Selection

Two digital inputs can be added as an optional feature. Digital inputs are activated by closing contacts or low logic levels. The configuration of the two inputs can select which of the 4 programmable set points to run or turn the control outputs on and off while selecting one of two programmable set points.

| DI Selection | Input 1 | Input 2 | Function |
|--------------|---------|---------|----------|
| 1            | off     | —       | STOP     |
|              | on      | —       | RUN      |
|              | —       | off     | SP1      |
|              | —       | on      | SP2      |
| 2            | off     | off     | SP1      |
|              | on      | off     | SP2      |
|              | off     | on      | SP3      |
|              | on      | on      | SP4      |

Normally open switches (external excitation not required) or open collector transistor

### Serial Communications & Adapters

Nova controllers with the serial communications option can be used for data acquisition, master/slave set point control, or Modbus communication (RTU and ASCII). Nova controllers transmit via RS-485. The PDA7485 RS-232 to RS-485 and PDA8485 USB to RS-485 converters are available for use with the Nova Multi-Monitoring software or other PC applications.



PDA8485

PDA7485

## Sync Master/Slave Set Point Control

PD540 Series Digital Controllers with the serial communications option can use Sync set point control. By connecting controllers together using the RS-485 serial communication capability, one controller can control the set point of an entire string.

Sync Master



Changing the set point of the Sync Master controller will change the set points on all Sync Slave controllers.



## NOVA PC SOFTWARE

Any Nova Controller with the serial communications option can be configured to interface with the Nova Multi-Monitoring PC software. Up to 30 controllers can be monitored and operated, and each can use independent data logging.

- Easy to Set Up and Use
- Connect up to 30 Nova Controllers
- View PV, SP, and Alarm Status Simultaneously
- Control Set Points
- Log, View, and Save Data in Spreadsheet Files

## Specifications

**System Requirements:** Windows® 95/98/ME/2000/XP

**Communications:** An RS-232 to RS-485 or USB to RS-485 converter may be used for communication with a PC and Nova Multi-Monitoring Software.

**Number of Units:** Up to 30 Nova Controllers

**Baud Rate:** 9,600 to 19,200 bps

**Data Logging:** Graph and save data as .hdr format. Each controller saves graphs independently. Data exportable in spreadsheet format.

**Logging Interval:** 1 second to 24 hours

## Simultaneous Monitoring

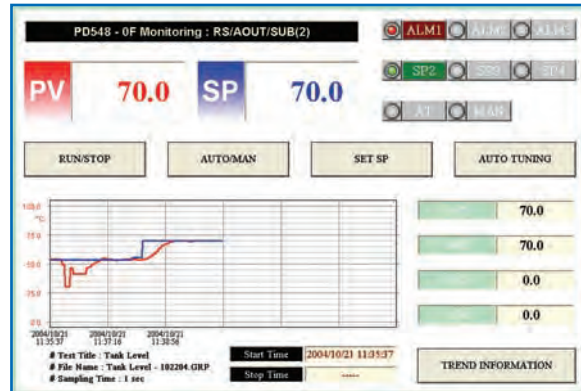
Simultaneously monitor up to 30 Nova Controllers and view the PV, SP, and alarm status for all connected controllers. The main view screen also displays the basic model numbers of all connected units. Any series of Nova Controllers with the serial communications option may be monitored with this software.



Simultaneously View Up to 30 Nova Controllers

## Remotely Control Set Points

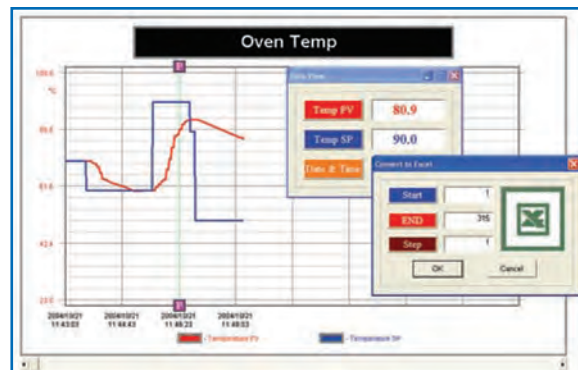
Program each of the 4 set points through a detailed operation screen available for every connected controller. In addition, control outputs can be set to run or stop, auto tuning enabled, and automatic or manual control established.



Monitor and Control Common Parameters

## Data Acquisition

PV and SP data can be logged independently for each unit. This data can be graphed using the Data Viewer for quick and clear analysis. Logged data can be exported into spreadsheet format.

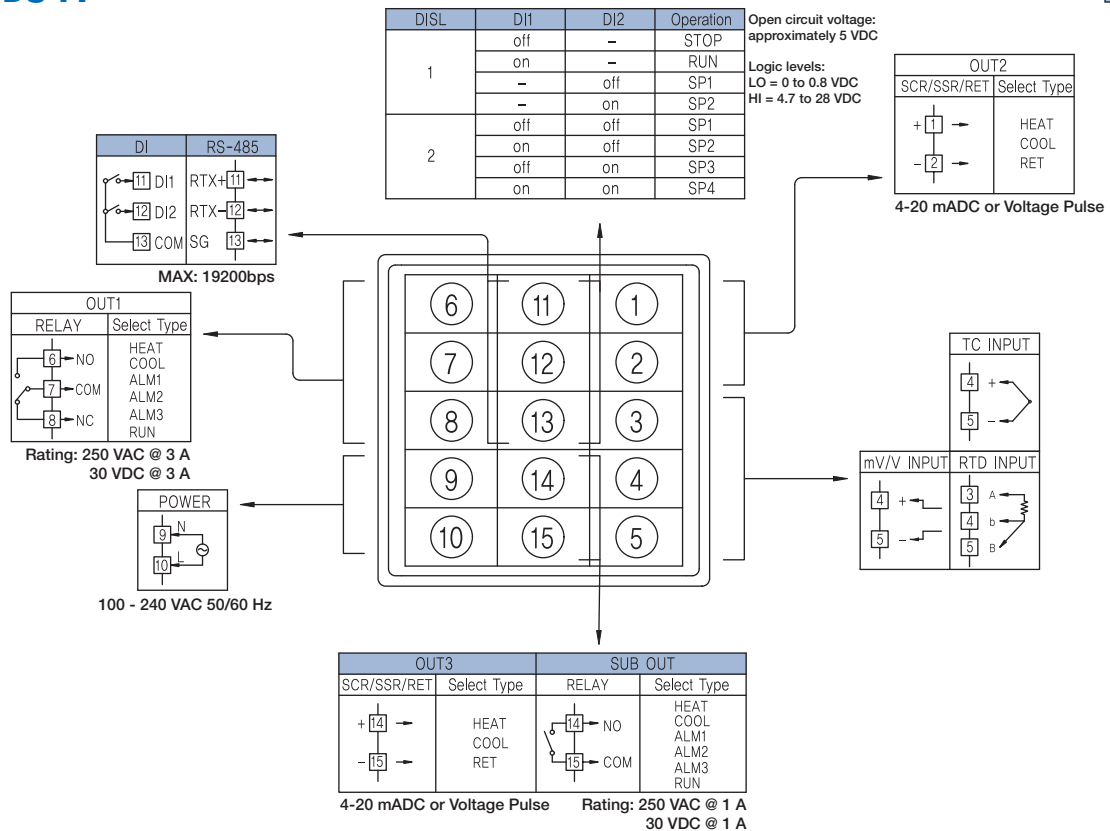


View Logged Data Graphs and Export Data

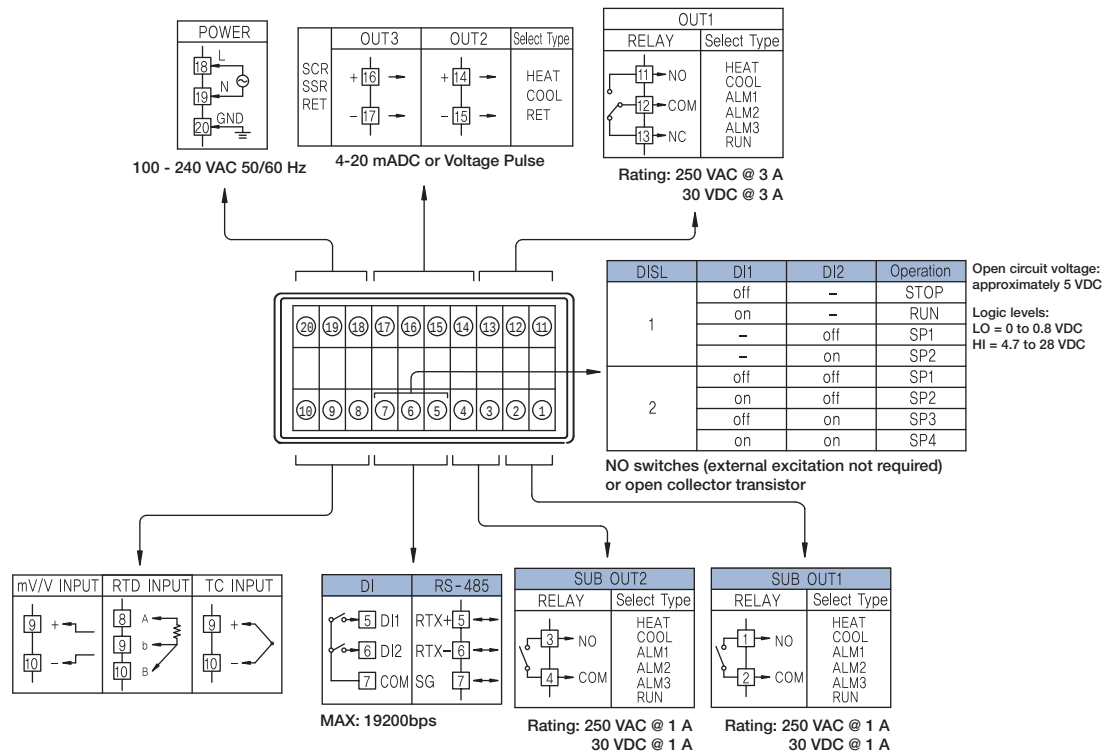
## CONNECTIONS

### PD540 & PD541

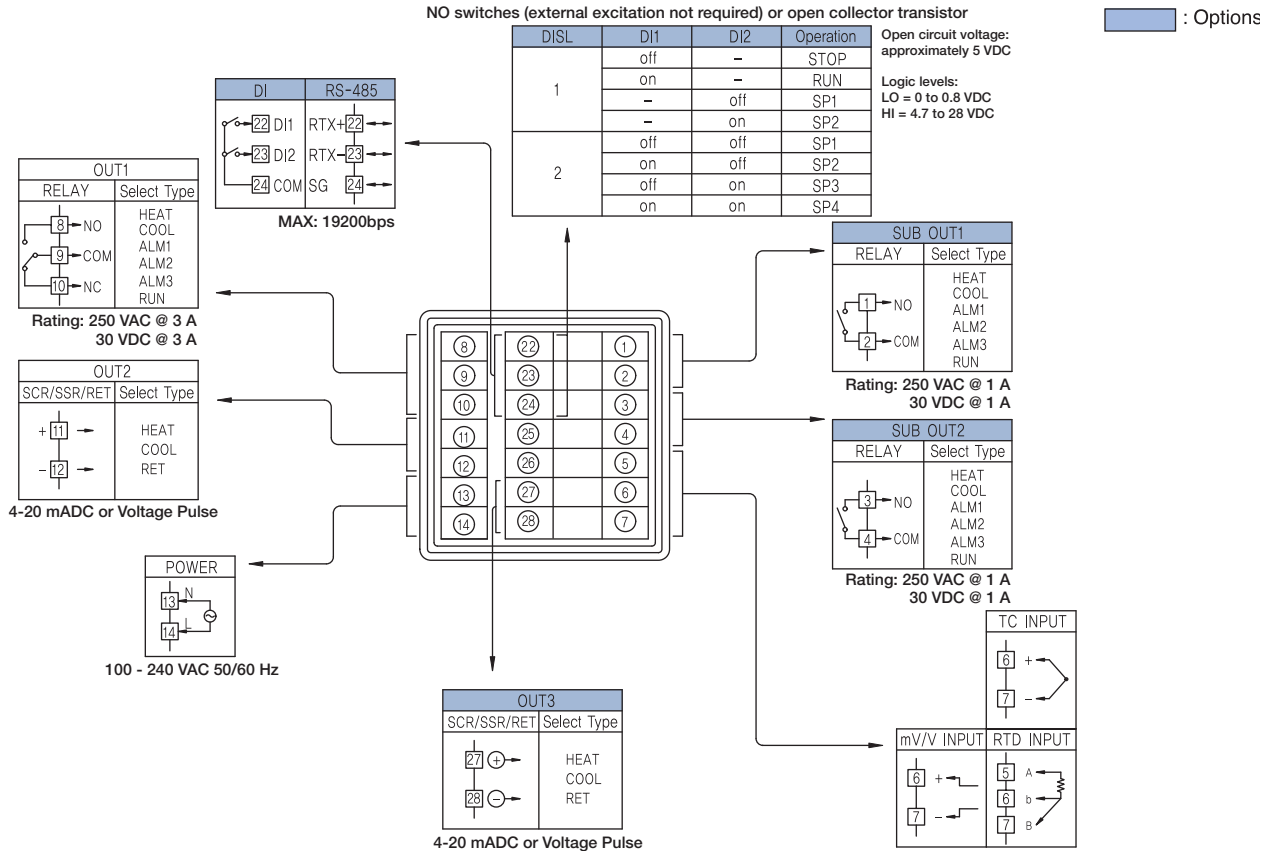
 : Options



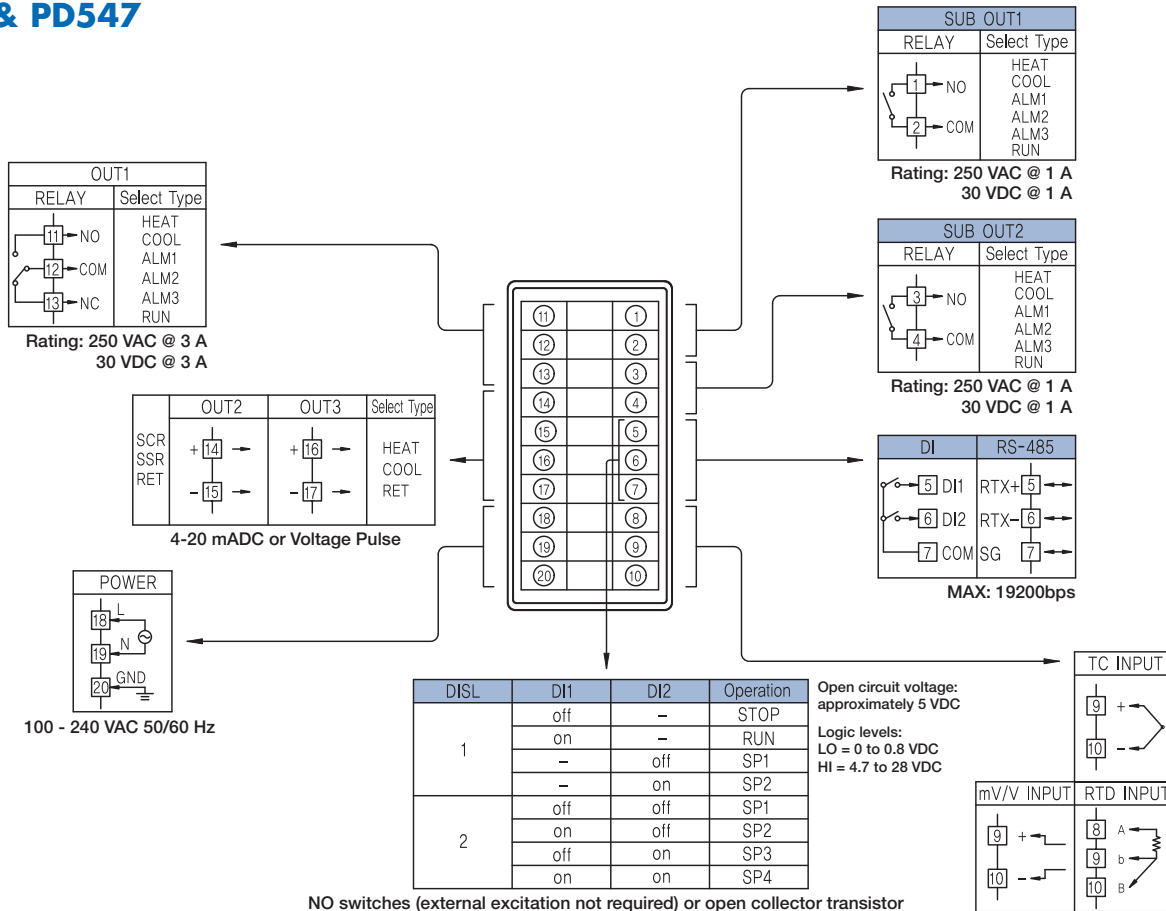
### PD542 & PD543



## PD544 & PD545

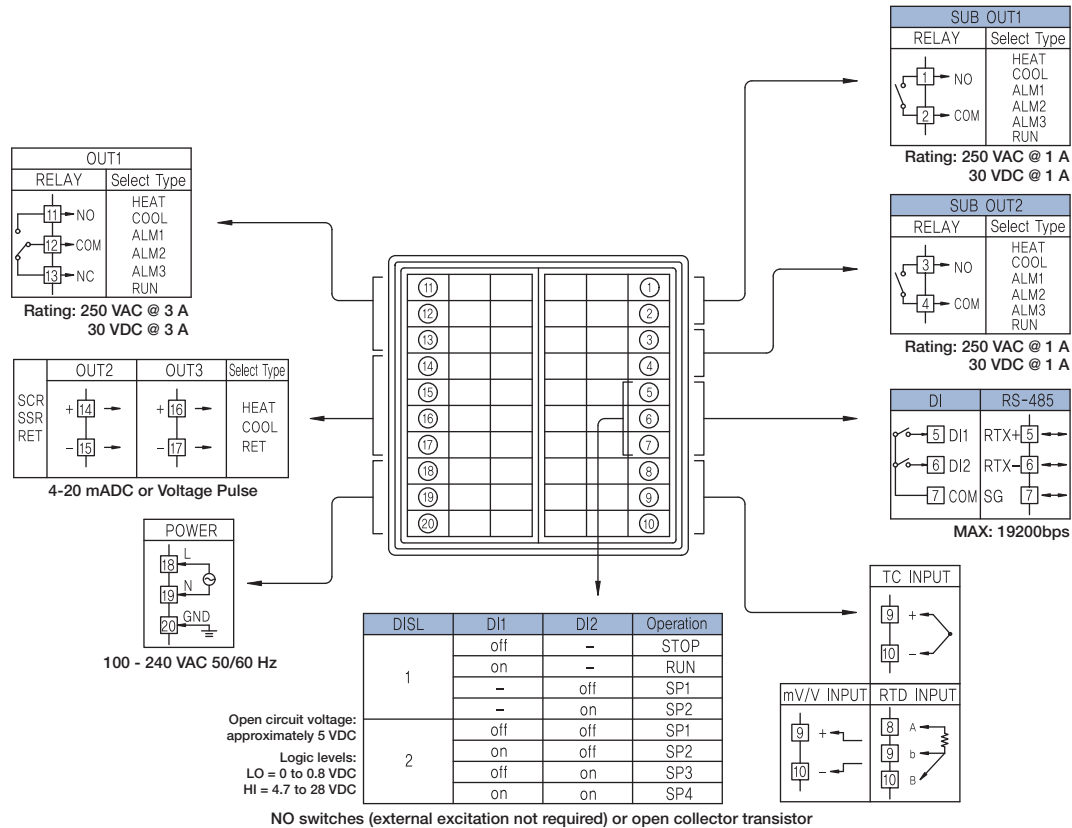


## PD546 & PD547



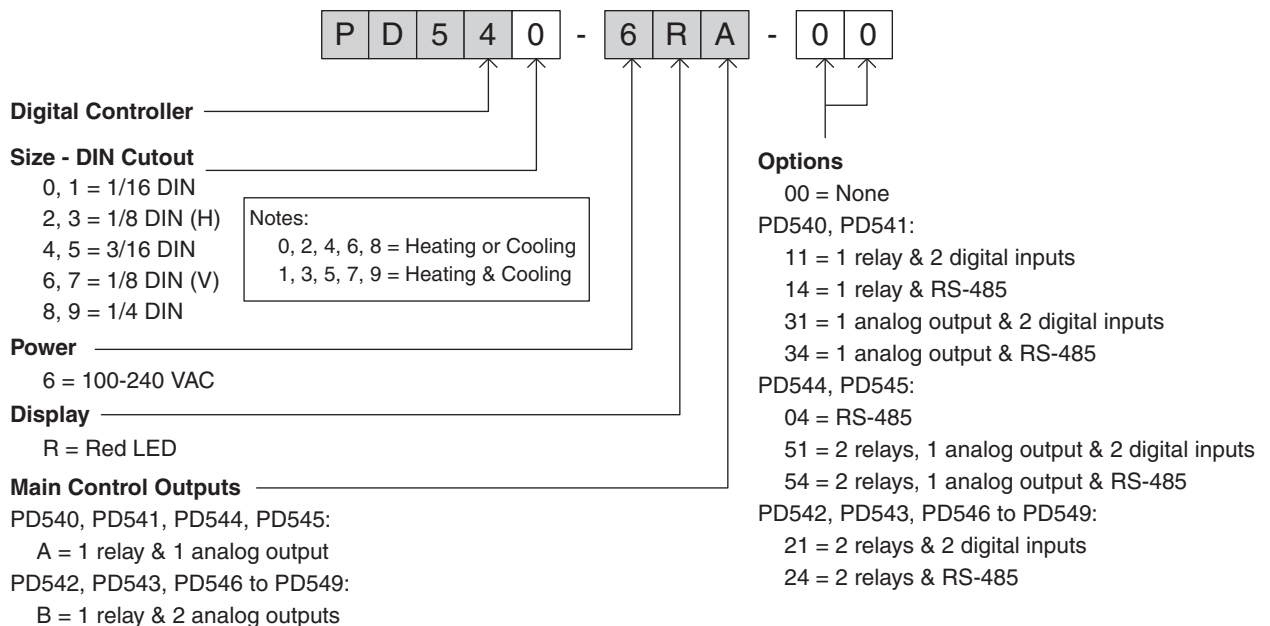
## PD548 & PD549

Options



## MODEL NUMBER GUIDE

The following guide describes the possible PD540 Series Nova Digital Process & Temperature Controller model numbers. Refer to the price list for the complete list of models and accessories.

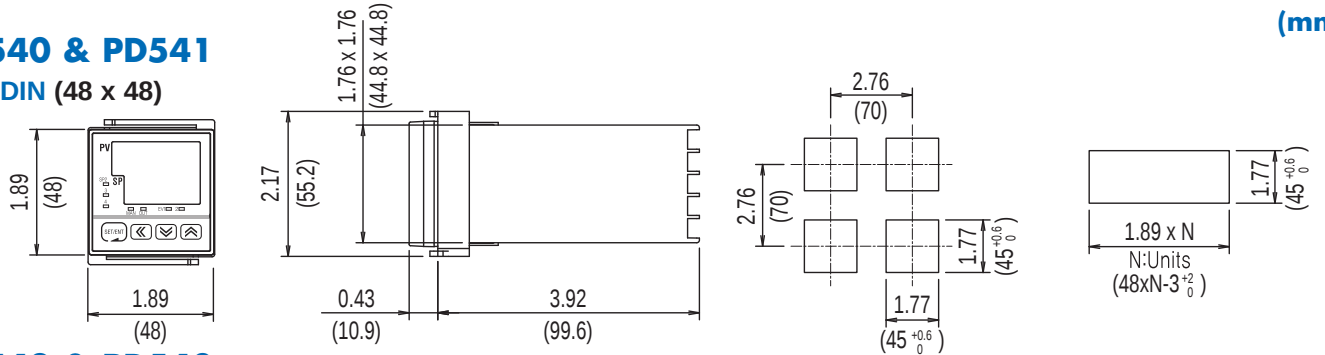


## DIMENSIONS AND PANEL CUTOUTS

Units: inches  
(mm)

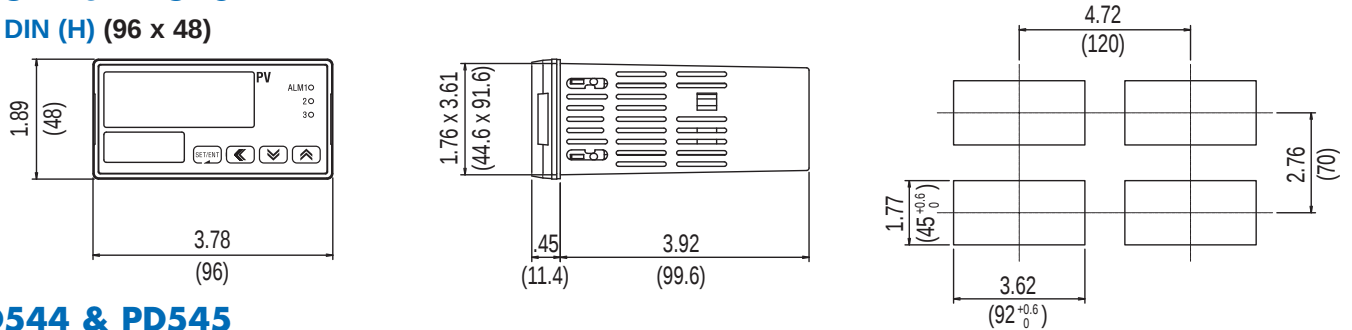
### PD540 & PD541

1/16 DIN (48 x 48)



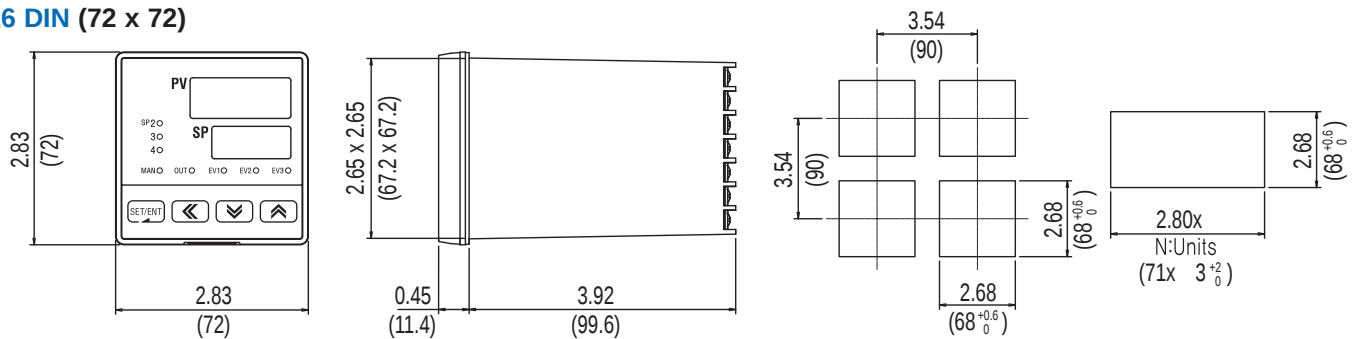
### PD542 & PD543

1/8 DIN (H) (96 x 48)



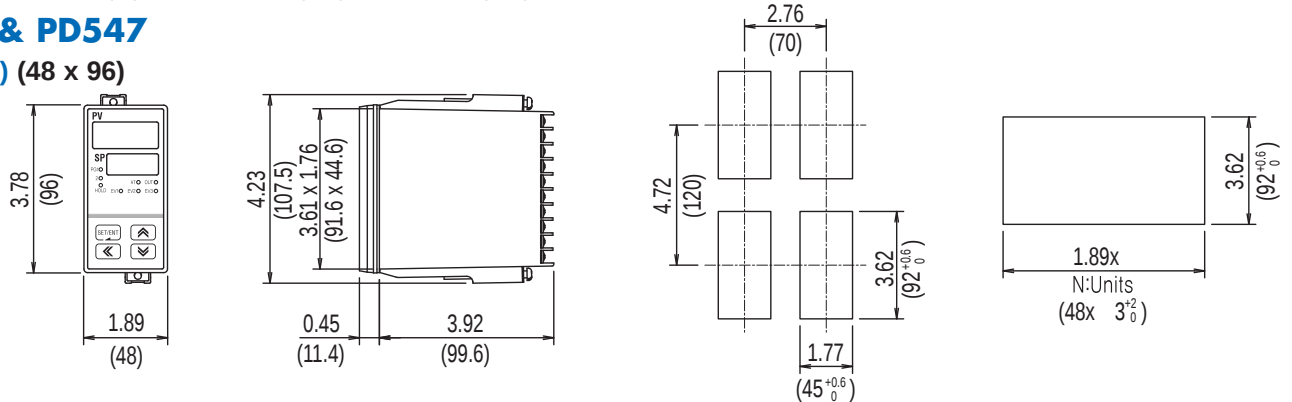
### PD544 & PD545

3/16 DIN (72 x 72)



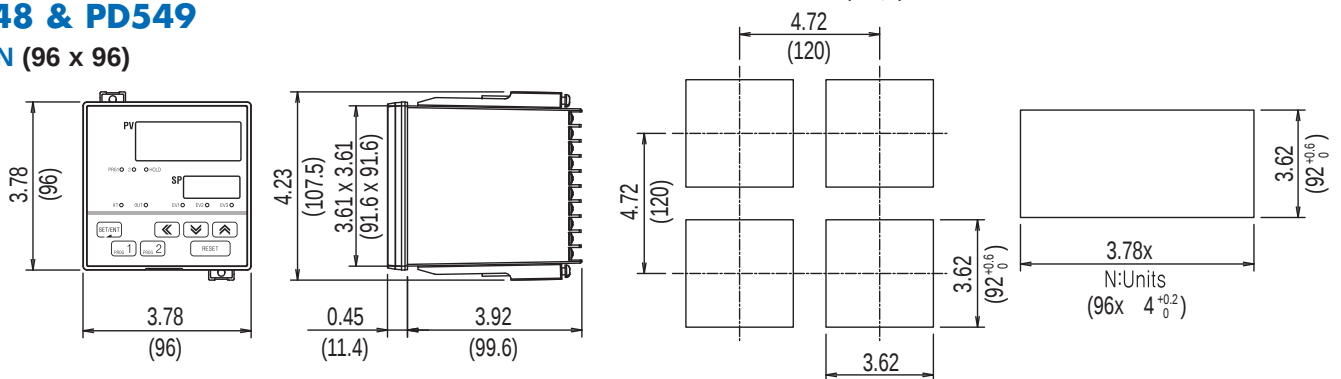
### PD546 & PD547

1/8 DIN (V) (48 x 96)



### PD548 & PD549

1/4 DIN (96 x 96)



## SPECIFICATIONS

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

### General

**Display:** Dual 4 digits, red LED, -1999 to 9999

| DIN Sizes | PV Display Inch (mm) | SP Display Inch (mm) | Weight oz (g) |
|-----------|----------------------|----------------------|---------------|
| 1/16      | 0.45 (11.3)          | 0.37 (9.5)           | 7.0 (198)     |
| 3/16      | 0.55 (14.0)          | 0.47 (12.0)          | 11.4 (324)    |
| 1/8 (H)   | 0.78 (19.8)          | 0.45 (11.5)          | 10.8 (306)    |
| 1/8 (V)   | 0.54 (13.6)          | 0.41 (10.5)          | 10.7 (304)    |
| 1/4       | 0.81 (20.5)          | 0.43 (11.0)          | 13.7 (389)    |

**Front Panel:** Panel gasket provided.

1/16 & 1/8 DIN: IP65, 3/16 & 1/4 DIN: IP55

**Programming Methods:** Four front panel buttons and Modbus

**Number of Set Points:** Four programmable set points

**Noise Filter:** Programmable 1 to 120 seconds or off

**Display Update Rate:** 4/second

**Password:** Restricts modification of programmed settings.

**Non-Volatile Memory:** Settings stored for a minimum of 10 years.

**Power:** 100-240 VAC, 50/60 Hz, 10 W

**Required Fuse:** UL Recognized, 1 A, 250 V, slow-blow

**Isolation:** 2300 V input/output-to-power line; 4 kV relay output-to-input/output/power line.

**Operating Temperature:** 10 to 50°C

**Storage Temperature:** -40 to 85°C

**Relative Humidity:** 20 to 90% non-condensing

**Enclosure:** 1/16, 3/16, 1/8(H), 1/8(V), 1/4 DIN; impact-resistant plastic; color: black

**Approvals:** UL & C-UL Recognized, CE Compliant

**UL File Number:** E244207; Process Control Equipment

**Warranty:** 3 years parts & labor

**Extended Warranty:** 1 or 2 years, refer to Price List for details.

### Temperature Inputs

**Inputs:** Factory calibrated, field selectable: J, K, T, E, B, R, S, L, U, N, W, Platinum II thermocouples, and 100  $\Omega$  platinum RTD (0.00385 or 0.00392 curve)

**Cold Junction Reference:** Automatic or off

**Offset Adjustment:** Four programmable input bias zones

**Sensor Break:** Up or down scale, user selectable; display reads S.OPN; alarm relays will follow the up or down scale selection.

| Type         | Range (°C)  | Range (°F)      | Accuracy*       |
|--------------|-------------|-----------------|-----------------|
| Thermocouple | K1          | -200 to 1370    | -300 to 2500    |
|              | K2          | -199.9 to 999.9 | 0 to 2300       |
|              | J           | -199.9 to 999.9 | -300 to 2300    |
|              | T           | -199.9 to 400.0 | -300 to 750     |
|              | E           | -199.9 to 999.9 | -300 to 1800    |
|              | B           | 0 to 1800       | 32 to 3300      |
|              | R           | 0 to 1700       | 32 to 3100      |
|              | S           | 0 to 1700       | 32 to 3100      |
|              | L           | -199.9 to 900.0 | -300 to 1600    |
|              | U           | -199.9 to 400.0 | -300 to 750     |
|              | N           | -200 to 1300    | -300 to 2400    |
|              | W           | 0 to 2300       | 32 to 4200      |
| RTD          | Platinel II | 0 to 1390       | 32 to 2500      |
|              | PtA         | -199.9 to 850.0 | -300 to 1560    |
|              | PtB         | -199.9 to 500.0 | -199.9 to 999.9 |
|              | PTC         | -19.99 to 99.99 | -4.0 to 212.0   |
|              | JPtA        | -199.9 to 500.0 | -199.9 to 999.9 |
|              | JPtB        | -150.0 to 150.0 | -199.9 to 300.0 |
|              |             |                 |                 |

### Process Inputs

**Inputs:** Field selectable: 0.4 to 2.0 V, 1 to 5 V, 0 to 10 V, -10 to 20 mV, 0 to 100 mV. 4-20 mA input requires 100  $\Omega$  resistor connected across input terminals (order P/N: PDX-RES1).

**Accuracy:**  $\pm 0.1\%$  FS  $\pm 1$  count

**Decimal Point:** Up to 3 decimals: 9.999, 99.99, 999.9, or 9999

**Calibration:** All inputs are calibrated at the factory

**Scale Range:** User programmable over entire range

**Transmitter Supply:** 14 to 18 VDC @ 20 mA; available at terminals OUT2 or OUT3, instead of retransmitting analog output; selection through front panel.

### Relays

**Ratings:** 1 Form C (SPDT) standard; rated 3 A @ 30 VDC or 3 A @ 250 VAC resistive load. 1 or 2 Form A (SPST) optional; rated 1 A @ 30 VDC or 1 A @ 250 VAC resistive load.

**Relay Operation:** Time proportional PID control, on/off control, forward or reverse (fail-safe) alarm, or run status

**Cycle Time:** 1 to 300 seconds; time proportional PID control only

**On/Off Hysteresis:** For standard models, 0-10.0% of sensor range for independent high and low hysteresis limit. For heating & cooling models, 0-10.0% of sensor range full hysteresis band.

**High/Low Alarm:** User may program any alarm for absolute high or low trigger values.

**Deviation Alarm:** User may program any relay for high, low, or high/low range set point deviation alarm.

**Alarm Deadband:** 0-100% FS, user selectable

**Alarm Delay:** 0 to 99 minutes and 59 seconds

**Reverse Operation (Fail-Safe):** Programmable, independent for each alarm. Relay coils are energized in non-alarm condition. In case of power failure, relays will go to alarm state.

**Forward Operation:** Relay coils are energized in alarm condition. In case of power failure, relays will go to non-alarm state.

**Auto Alarm Initialization:** Normal and standby operation independent for each alarm. Normal alarms will reflect the state of the input to the controller at all times. Standby alarms will not trigger if the change to alarm state is a result of power up cycle, set point change, or alarm configuration change.

**Run Status:** Relays will energize when PID outputs are running.

### Analog Outputs

**Scaling Range:** Retransmitting 4-20 mA outputs can be scaled for any display range.

**Accuracy:**  $\pm 0.1\%$  FS

**Availability:** 1/16 & 3/16 DIN: 1 standard, 1 optional  
1/8 & 1/4 DIN: 2 standard

**Output Operation:** 4-20 mA PID control, time proportional voltage pulse PID control, or 4-20 mA retransmitting

**Ratings:** Continuous 4-20 mA PID or retransmitting: 600  $\Omega$  max  
Time Proportional PID: 15 VDC pulse high, less than 0.1 VDC pulse low; 600  $\Omega$  minimum, current limited at 30 mA

**Cycle Time:** 1 to 300 seconds; time proportional PID control only

**Power:** Internally powered 4-20 mA output

**Isolation:** 500 V input-to-output

**Output Loop Resistance:** 600  $\Omega$  max

### Digital Inputs

**Configuration:** Two contacts, two operating modes

**Contacts:** Normally open switches (external excitation not required) or open collector transistor

**Open Circuit Voltage:** Approximately 5 VDC

**Logic Levels:** LO = 0 to 0.8 VDC, HI = 4.7 to 28 VDC

**Operation Modes:** Mode 1: Control output run or stop, selection of set point 1 or 2. Mode 2: Selection of set points 1 to 4.

### Serial Communications

**Compatibility:** EIA-485

**Protocol:** PC, Modbus (ASCII, RTU), Sync (Master/Slave SP Control)

**Address:** 1 to 99 (Max 31 units connected)

**Baud Rate:** 600 to 19,200 bps

**Transmit Time Delay:** 0 to 100 ms

**Data:** 7 or 8 bit, automatic when using Modbus protocol

**Stop Bit:** 1 or 2

**Parity:** None, even, or odd