# PROGRAMMABLE
# RAMP & SOAK CONTROLLER


# NOVA PD550 Series

## Instruction Manual

PD550 - PD558

**PRECISION DIGITAL CORPORATION**
89 October Hill Road • Holliston MA 01746 USA
Tel (800) 343-1001 • Fax (508) 655-8990

## Disclaimer

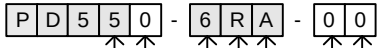
The information contained in this document is subject to change without notice. Precision Digital Corporation makes no representations or warranties with respect to the contents hereof, and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.

## Registered Trademarks

MODBUS® is a registered trademark of Schneider Automation Inc. All other trademarks mentioned in this document are the property of their respective owners.

**Visit our Web Site**
**http://www.predig.com**

## Nova PD550 Series Model Number Guide




**Programmable**
**Ramp & Soak Controller**

**Size - DIN Cutout**
0 = 1/16 DIN
4 = 3/16 DIN
6 = 1/8 DIN (V)
8 = 1/4 DIN

**Power**
6 = 100-240 VAC

**Display**
R = Red LED

**Main Control Output**
PD540, PD554:
A = 1 relay & 1 analog output
PD556, PD558:
B = 1 relay & 2 analog outputs

**Options**
00 = None
**PD550:**
02 = 2 digital outputs
03 = 4 digital outputs
11 = 1 relay & 2 digital inputs
14 = 1 relay & RS-485
31 = 1 analog output & 2 digital inputs
34 = 1 analog output & RS-485
**PD554:**
02 = 2 digital outputs
03 = 4 digital outputs
04 = RS-485
51 = 2 relays, 1 analog output & 2 digital inputs
52 = 2 relays, 1 analog output & 2 digital outputs
53 = 2 relays, 1 analog output & 4 digital outputs
54 = 2 relays, 1 analog output & RS-485
**PD556 & PD558:**
21 = 2 relays & 2 digital inputs
24 = 2 relays & RS-485
25 = 2 relays & digital inputs
26 = 2 relays, RS-485 & 4 digital outputs

**Table of Contents**

## Appendix



## Tables and Figures

# 1. Safety Guide and Specifications

**CAUTION**

The following safety symbols are used in this manual

(1) This symbol notifies the user of specific information relating to the safe operation of the controller. Information noted with this symbol must be observed to protect the user from injury and to prevent damage to the product.

(A) For User: Be aware of this marking in the manual and refer to the explanation in the manual to prevent injury and damage.

(2) For Installer: Study the warnings marked to prevent injury and damage.

(2) Functional earth terminal: This symbol indicates that the terminal must be connected to ground.

**NOTE**

(3) This symbol indicates additional information on the features of the product.

(4) This symbol directs the reader to further information on the current topic.

**CAUTION**

## Precautions Regarding This Instruction Manual

(1) This manual must be kept in the possession of the end user and in a suitable place for the operator to study and to check the functions of the product.

(2) The installer and operator should carefully study and understand how to operate this product before use.

(3) This manual describes the functions of the product. Precision Digital Corporation does not guarantee that the functions will suit a particular purpose.

(4) The contents of this manual have been reviewed for accuracy and correctness. However, should any errors or omissions come to the attention of the user, contact technical support as listed on the back of this manual

**CAUTION**

## Safety Procedures and Unauthorized Modification Warning

(1) In order to protect this product and the system controlled by it against damage and ensure its safe use, make certain that all of the safety instructions and precautions in this manual are strictly adhered to.

(2) Precision Digital Corporation does not guarantee safety if the products are not handled in accordance with this instruction manual.

(3) If separate protection or safety circuits are to be installed in the system which is controlled by this product, ensure that such circuits are installed external to this product.

(4) Do not make modifications or additions internally to the product. It may cause personal injury to the user or damage to the product.

(5) Contact technical support as listed on the back of the manual for warranty and repair issues.

(6) Exposure to excessive moisture, electrical overloads, or mechanical vibration may damage the product.

**CAUTION**

## Limited Liability

Precision Digital Corporation assumes no liability to any party for any loss or damage, direct or indirect, caused by the use of or any unpredictable defect of the product.

CAUTION

## Operational Environment Precautions

(1) Only operate the controller when it is properly installed.
(2) When installing the controller, select a location where:
- Rear terminals are protected from accidental contact.
- Mechanical vibrations are minimal.
- No corrosive gas is present.
- Temperature fluctuation is minimal.
- Temperature can be maintained between 10 and 50 ºC (50 and 110ºF) with 20 to 90% RH.
- No direct heat radiation is present.
- High levels of electromagnetic interference are not present
- The unit is not exposed to water.
- No flammable materials are present.
- Dust particles are not present in the air.
- Exposure to ultraviolet rays is minimal.
- Openings on the rear of the controller are not blocked.

(3) This unit is suitable for installation in an enviornment classified as Pollution Degree 2.
(4) This unit is designated as Installation Category II.
(5) If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
(6) A switch or circuit-breaker acting as the disconnect device shall be included in the application or the installation.

CAUTION

## Controller Mounting Precautions

- Keep the input circuit wiring as far as possible away from power and ground circuits.
- Keep the units in 10 to 50ºC (50 to 110ºF) with 20% to 90% relative humidity (RH). The controller may need a warm up period to return to operating temperature ranges when below 10ºC.
- To prevent electric shock, be sure to turn off the power source and circuit breaker before wiring.
- The power requirements are 100 to 240 VAC, 50/60 Hz, 10 VA max. Do not switch power supplies without first disconnecting the power supply.
- Follow the operating procedures and precautions in the manual to avoid fire, shock, damage to the unit, or injury. Follow the operations and mounting directions indicated in this manual.
- Always create a ground connection where indicated, however do not ground to gas pipes, water pipes, lightening rods, or other potentially hazardous metal objects.
- Do not apply power to the unit until all connections have been made.
- Do not cover the venting holes in the rear of the unit.

## 1.1 SPECIFICATIONS

*Except where noted all specifications apply to operation at 23ºC.*

### General

| | |
|---|---|
| DISPLAY | Dual 4 digits, red LED, -1999 to 9999 |

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

| | |
|---|---|
| FRONT PANEL | 1/16 & 1/8 DIN: IP65; 3/16 & 1/4 DIN: IP55 |
| SAMPLING TIME | 250 ms |
| OVERRANGE | Over range PV reads oVr, under range PV reads -oVr |
| PROGRAMMING METHODS | Four front panel buttons and Modbus |
| PID ZONES | 3 programmable PID zone ranges, 1 PID PV deviation zone |
| NOISE FILTER | Programmable from 1 to 120 |
| CALIBRATION | All ranges are calibrated at the factory |
| PASSWORD | Programmable password restricts modification of programmed settings |
| POWER | 100-240 VAC, 50/60 HZ, 10 Watts |
| FUSE | Required fuse: UL Recognized, 1 A, 250 V, slow blow |
| ISOLATION | 2300 V input-to-output-to-power line;<br>4 kV relay output-to-input/output/power line. |
| PROGRAMMING CAPACITY | 2 set point program patters of 15 segments each<br>Segment repeat and program loop functions |
| ENVIRONMENTAL | Operating temperature range: 10ºC to 50ºC (50ºF to 110ºF)<br>Relative humidity: 20 to 90% non-condensing |
| MOUNTING | 1/16, 3/16, 1/8, or 1/4 DIN size cutout required<br>Two panel mounting bracket assemblies provided<br>One one-piece bracket provided for the PD550 |
| WARRANTY | Three years parts and labor |

## Process and Temperature Inputs

| | |
|---|---|
| TEMPERATURE DRIFT | Refer to accuracy specifications below |
| DECIMAL POINT | Up to three decimal places for process inputs: 9.999, 99.99, 999.9, or 9999 |
| REAR JUNCTION COMPENSATION | Automatic or off settings for temperature inputs. No user calibration required. |
| OFFSET ADJUSTMENT | Four programmable input bias zones |
| SENSOR BREAK DETECTION | Open sensor indicated by PV display flashing S.OPn. All PID control outputs transmit at the user programmed percent of full output scale set in parameter Po. Up or down scale, user selectable; alarm relays will follow the up or down scale selection. |
| TRANSMITTER SUPPLY | 14 to 18 VDC @ 20 mA; available at terminals OUT2 or OUT3, instead of a retransmitting analog output |

UNIVERSAL INPUT TYPE AND ACCURACY

| Input Type | | Temp Range (°C) | Temp Range (°F) | Accuracy* |
|---|---|---|---|---|
| Thermocouple | K1<br>K2<br>J<br>T | -200 to 1370<br>-199.9 to 999.9<br>-199.9 to 999.9<br>-199.9 to 400.0 | -300 to 2500<br>0 to 2300<br>-300 to 2300<br>-300 to 750 | > 0°C : ±0.1% FS ±1 digit<br>< 0°C : ±0.2% FS ±1 digit |
| | B | 0 to 1800 | 32 to 3300 | > 400°C : ±0.15% FS ±1 digit<br>< 400°C : ±5% FS ±1 digit |
| | R<br>S | 0 to 1700<br>0 to 1700 | 32 to 3100<br>32 to 3100 | ±0.15% FS ±1 digit |
| | E<br>L<br>U | -199.9 to 999.9<br>-199.9 to 900.0<br>-199.9 to 400.0 | -300 to 1800<br>-300 to 1600<br>-300 to 750 | > 0°C : ±0.1% FS ±1 digit<br>< 0°C : ±0.2% FS ±1 digit |
| | N | -200 to 1300 | -300 to 2400 | > 0°C : ±0.1% FS ±1 digit<br>< 0°C : ±0.25% FS ±1 digit |
| | W | 0 to 2300 | 32 to 4200 | ±0.2% FS ±1 digit |
| | Platinel II | 0 to 1390 | 32 to 2500 | ±0.1% FS ±1 digit |
| RTD | PtA<br>PtB | -199.9 to 850.0<br>-199.9 to 500.0 | -300 to 1560<br>-199.9 to 999.9 | ±0.1% FS ±1 digit** |
| | PtC | -19.99 to 99.99 | -4.0 to 212.0 | ±0.2% FS ±1 digit |
| | JPtA<br>JPtB | -199.9 to 500.0<br>-150.0 to 150.0 | -199.9 to 999.9<br>-199.9 to 300.0 | ±0.1% FS ±1 digit** |
| Process | 0.4 to 2.0 V<br>1 to 5 V<br>0 to 10 V<br>-10 to 20 mV<br>0 to 100 mV | 0.400 to 2.000<br>1.000 to 5.000<br>0.00 to 10.00<br>-10.00 to 20.00<br>0.0 to 100.0 | | ±0.1% FS ±1 digit<br>Display range can be scaled between -1999 and 9999.<br><br>4 to 20 mA Input<br>To accept a 4 to 20 mA signal select 0.4 to 2.0 VDC input and connect a 100 Ω resistor across the input terminals. |

*Performance within recommended operating conditions (10 to 50°C, 20 to 90% RH)
**For a range scale of 0 to 100°C: +0.3°C +1 digit, and for a range scale of -100 to 100°C: +0.5°C +1 digit

**Relay Outputs**

| | |
|---|---|
| RATINGS | Out1: 250 VAC @ 3 A or 30 VDC @ 3 A (resistive load)<br>Sub1, Sub2: 250 VAC @ 1 A or 30 VDC @ 1 A (resistive load) |
| ELECTRICAL NOISE SUPPRESSION | A suppressor (snubber) should be connected to each relay contact switching inductive loads, to prevent disruption to the microprocessor's operation. Recommended suppressor value: 0.1 μF/470 Ω, 250 VAC (PDX6901) |
| DEADBAND | For alarm operations, 0-100% of full scale, user selectable |
| HIGH OR LOW ALARM | User may program any relay for high or low trip point |
| DEVIATION ALARM | User may program any relay for a high, low, or range set point deivation alarm. |
| RELAY OPERATION | Any relay may be set as an alarm relay or for time proportional PID control |
| TIME DELAY | 0 to 99 minutes 59 seconds alarm trip delay user selectable for each alarm. Time proportional PID control relay activation time delay of 0 to 99 minutes 59 seconds user selectable. |
| FAIL-SAFE OPERATION | Programmable<br>Independent for each alarm relay |
| AUTO INITIALIZATION | When power is applied to the controller, alarm relays will reflect the state of the input to the controller except standby alarms. |

**Analog Outputs**

| | |
|---|---|
| OUTPUT RANGE | Continuous PID or retransmitting: 4-20 mA (600 W maximum)<br>Time Proportional PID: 15 VDC pulse (600 W minimum, current limited at 30 mA) high, less than 0.1 VDC low, cycle time 1 to 300 seconds, user selectable |
| SCALING RANGE | Retransmitting 4-20 mA outputs can be scaled for any display range low and high |
| ACCURACY | +0.1% of full scale |

**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 | Mode 1: Program hold and step<br>Mode 2: Program run or reset |

**Digital Outputs**

| | |
|---|---|
| CONFIGURATION | 2 or 4 open collector transistor |
| OPERATION MODES | Alarms, inner signal PV or SP zones, program segment time signals, SP status (ramp up/down or soak), program run or end alerts |
| TRANSISTOR RATING | 24 VDC @ 50 mA |

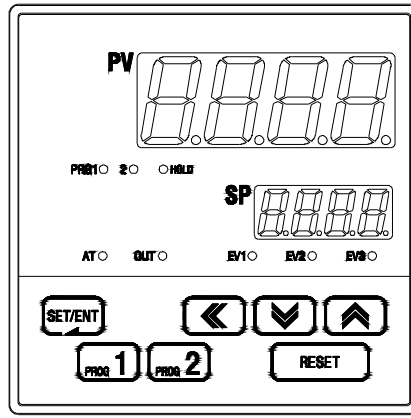
**Serial Communications**

| | |
|---|---|
| PROTOCOLS | Modbus (ASCII, RTU), PC software,<br>SYNC (master SP control) |
| UNIT ADDRESS | 1 to 99 (Max 31 units connected) |
| BAUD RATE | 600, 1200, 2400, 4800, 9600, 19200 bps, user selectable |
| RESPONSE TIME | 0 to 100 ms delay response time<br>10 ms increments user selectable |
| DATA | 7 or 8 bit user selectable |
| PARITY | None, even, or odd |

**Approvals**

| | |
|---|---|
| UL RECOGNIZED | USA and Canada<br>Process Control Equipment |
| UL FILE NUMBER | E244207 |
| CE COMPLIANT | |

## 2. Front Panel Buttons and LED Indicators



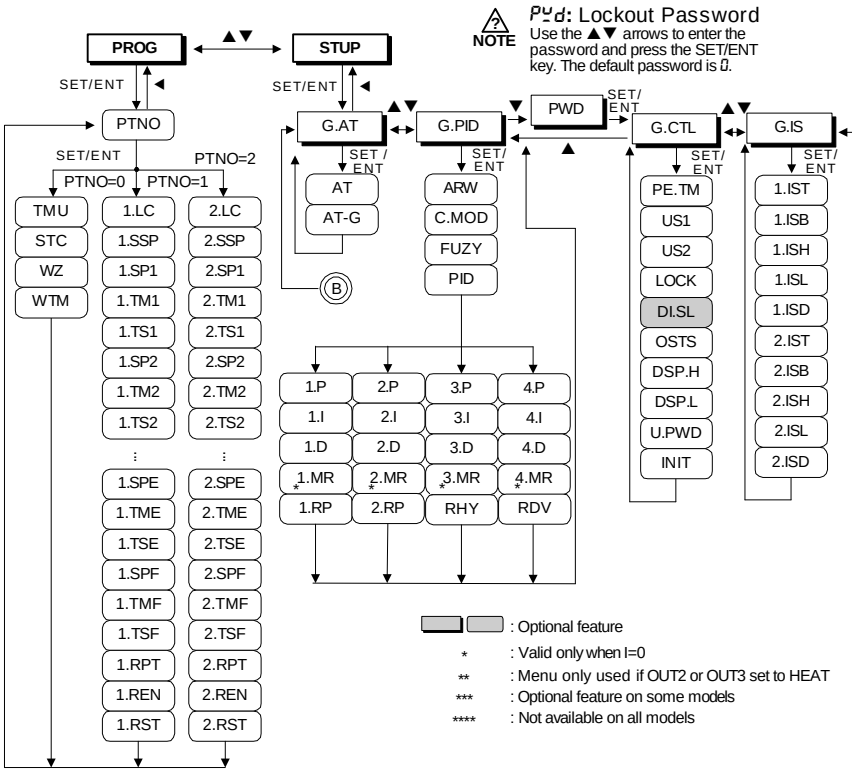

### Control Keys

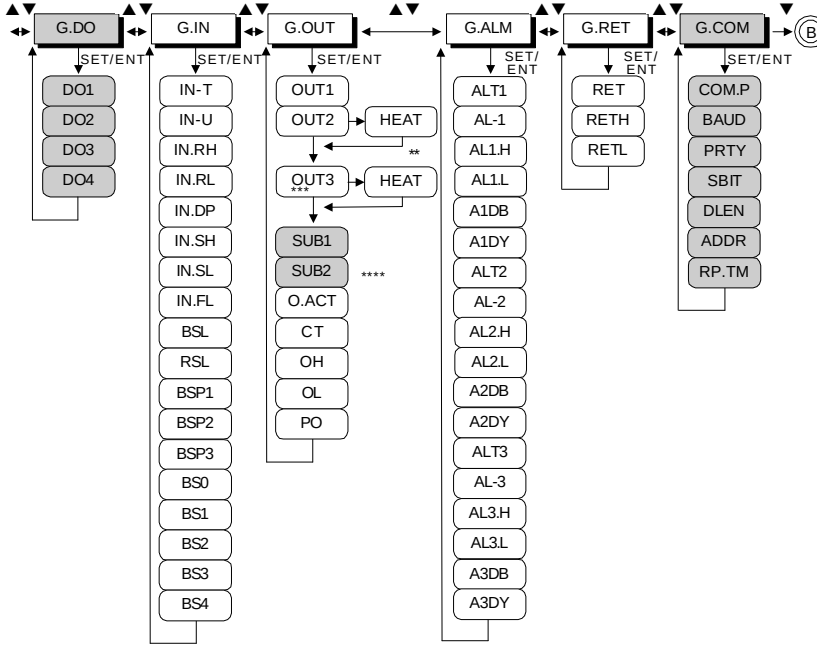
| KEY | Function |
|---|---|
| SET/ENT (ENTER) | Pressing SET/ENT key for at least 3 seconds switches between the operating display and the parameter setting display. This key is used to verify and bypass parameter settings when in the parameter group display. |
| ▲ / ▼ (UP/DOWN) | Used to change the value of digits when setting parameters.<br>Used to move between parameter groups. |
| ◀ (SHIFT) | Used to move to the next digit when setting parameters. |
| PROG1 (P1)<br>PROG2 (P2)<br>RESET (RST) | Pressing program button 1 for 1 second runs program 1.<br>Pressing program button 2 for 1 second runs program 2.<br>Pressing the rest button for 1 second after a program runs will reset the controller to "STOP" mode and end all programs. |

### LED Display

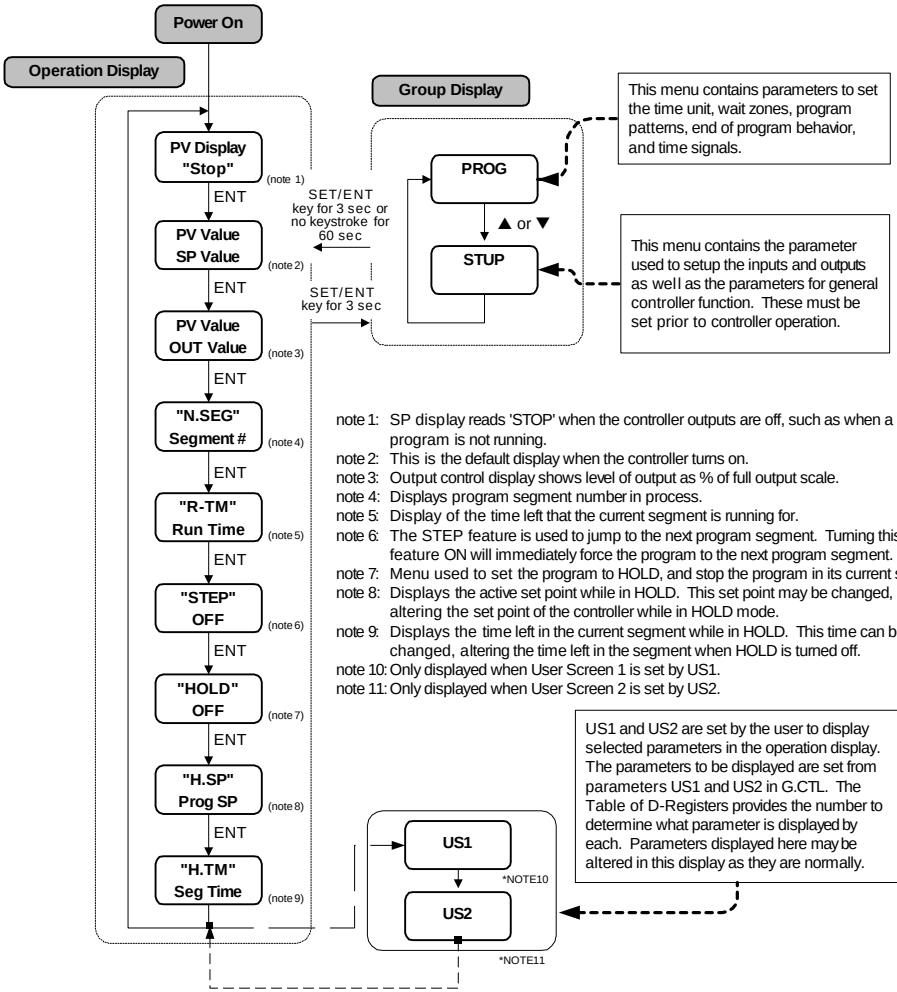
| LED | Function |
|---|---|
| EV1,2,3 | LEDs light when c orresponding relays are energized. |
| OUT | LED lights to display when control output is active. |
| AT | LED lights when auto-tuning is in process. |
| PRG1 | LED lights while program 1 is running. |
| PRG2 | LED lights whil e program 2 is running. |
| HOLD | LED lights when the program has been paused through the HOLD feature. |

## 3. Parameter Map




G.DO
G.IN
G.OUT
G.ALM
G.RET
G.COM
B
SET/ENT
SET/ ENT
DO1
DO2
DO3
DO4
IN-T
IN-U
IN.RH
IN.RL
IN.DP
IN.SH
IN.SL
IN.FL
BSL
RSL
BSP1
BSP2
BSP3
BS0
BS1
BS2
BS3
BS4
OUT1
OUT2
HEAT
**
OUT3
***
HEAT
SUB1
SUB2
****
O.ACT
CT
OH
OL
PO
ALT1
AL-1
AL1.H
AL1.L
A1DB
A1DY
ALT2
AL-2
AL2.H
AL2.L
A2DB
A2DY
ALT3
AL-3
AL3.H
AL3.L
A3DB
A3DY
RET
RETH
RETL
COM.P
BAUD
PRTY
SBIT
DLEN
ADDR
RP.TM

## 4. Operation Flow Chart




note 1: SP display reads 'STOP' when the controller outputs are off, such as when a program is not running.
note 2: This is the default display when the controller turns on.
note 3: Output control display shows level of output as % of full output scale.
note 4: Displays program segment number in process.
note 5: Display of the time left that the current segment is running for.
note 6: The STEP feature is used to jump to the next program segment. Turning this feature ON will immediately force the program to the next program segment.
note 7: Menu used to set the program to HOLD, and stop the program in its current state.
note 8: Displays the active set point while in HOLD. This set point may be changed, altering the set point of the controller while in HOLD mode.
note 9: Displays the time left in the current segment while in HOLD. This time can be changed, altering the time left in the segment when HOLD is turned off.
note 10: Only displayed when User Screen 1 is set by US1.
note 11: Only displayed when User Screen 2 is set by US2.

# 5. Controller Parameter Setup

## 5.1 Input Group (G.IN)


Press SET/ENT key to select input group. Press press ▲ or ▼ key to cycle through groups as shown below. (Refer to parameter map in section 3.)

G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO
↕
G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ ***G.IN***

**CAUTION** Input group parameters should be established first, as changes to the input type may reset other parameter settings in other groups to their default value.


This parameter selects the type of input sensor used. Its default setting is type TC.K1. Refer to the following table showing the type of sensor inputs and select the desired input type.

**Table 1: Universal Input Selection** *display range : -5% to 105%*

| No. | TYPE | Temp.Range (°C) | Temp.Range (°F) | Group | DISP |
|---|---|---|---|---|---|
| 1 | K1 | -200 to 1370 | -300 to 2500 | Thermocouple | tC.K1 |
| 2 | K2 | -199.9 to 999.9 | 0 to 2300 | | tC.K2 |
| 3 | J | -199.9 to 999.9 | -300 to 2300 | | tC.J |
| 4 | E | -199.9 to 999.9 | -300 to 1800 | | tC.E |
| 5 | T | -199.9 to 400.0 | -300 to 750 | | tC.t |
| 6 | R | 0 to 1700 | 32 to 3100 | | tC.r |
| 7 | B | 0 to 1800 | 32 to 3300 | | tC.b |
| 8 | S | 0 to 1700 | 32 to 3100 | | tC.S |
| 9 | L | -199.9 to 900.0 | -300 to 1600 | | tC.L |
| 10 | N | -200 to 1300 | -300 to 2400 | | tC.n |
| 11 | U | -199.9 to 400.0 | -300 to 750 | | tC.U |
| 12 | W | 0 to 2300 | 32 to 4200 | | tC.W |
| 13 | Platinel II | 0 to1390 | 32 to 2500 | | tC.PL |
| 14 | PtA | -199.9 to 850.0 | -300 to 1560 | RTD (0.00385) | PtA |
| 15 | PtB | -199.9 to 500.0 | -199.9 to 999.9 | | Ptb |
| 16 | PtC | -19.99 to 99.99 | -4.0 to 212.0 | | PtC |
| 17 | JPtA | -199.9 to 500.0 | -199.9 to 999.9 | RTD (0.00392) | JPtA |
| 18 | JPtB | -150.0 to 150.0 | -199.9 to 300.0 | | JPtb |
| 19 | 0.4 to 2.0V | 0.400 to 2.000V | | VDC | 2V |
| 20 | 1 to 5V | 1.000 to 5.000V | | | 5V |
| 21 | 0 to 10V | 0.00 to 10.00V | | | 10V |
| 22 | -10 to 20mV | -10.00 to 20.00mV | | mVDC | 20mV |
| 23 | 0 to 100mV | 0.0 to 100.0mV | | | 100n |

**NOTE** **4-20 mA Input Selection:**
To accept a 4-20 mA signal, select 0.4 to 2.0 VDC input and connect a 100 Ω resistor across the input terminals.

| | |
|---|---|
| PV In-U | This parameter sets the display temperature unit for ºC or ºF.<br>Its default selection is ºC.<br>Refer to Table 1 when changing the temperature unit for the temperature input range. |
| PV InrH | This parameter sets the high limit of the temperature display range (maximum temperature displayed). For mV and V inputs, this sets the value of the high input of the input scale defined in In.SH. |
| PV InrL | This parameter sets the low limit of the temperature display range (minimum temperature displayed). For mV and V inputs, this sets the low input of the input scale defined in In.SL. |
| PV IndP | This parameter sets the position of the decimal point for mV or V inputs. The position of the decimal point can be set as 9999, 999.9, 99.99, or 9.999. Its default set value is 1. |
| PV InSH | The parameter to set the high limit of the mV or V display scale. This value will be displayed when the input is set to the high input established in In.rH.<br>Its default value is 100.0. |
| PV InSL | The parameter to set the low limit of the mV or V display scale. This value will be displayed when the input is set to the low input established in In.rL.<br>Its default value is 0.0. |
| PV InFL | The parameter to set the PV filter for stabilization from electromagnetic noise and interference. This will effect the rate of change in the PV display value. Its default setting is OFF, and can be set within 1 to 120 seconds. |
| PV bSL | This parameter to establishes PV behavior when an open input sensor is detected. When BSL is set to UP, the PV operates as if at the high input range. When BSL is set to DOWN, the PV operates as if at the low input range. Its default setting is UP. In the case of mV or V inputs, the default setting is OFF. An open sensor check is not performed in 10 V, 20 mV, or 100 mV input settings. |
| PV rSL | This parameter determines if RJC for thermocouple inputs is used. RJC can be turned on or off. Its default setting is ON. |
| PV bSP1<br>⋮<br>PV bSP3 | This parameter sets where the PV bias points occur. See Fig 1 and Fig 2 for further information about input bias operation. |
| PV bS0<br>⋮<br>PV bS4 | This parameter sets the bias value at the corresponding bias point input values. These parameters establish the value of the offset at each of the defined BSP1 - BSP3 points. See Fig 1 and Fig 2 for further information about input bias operation. |

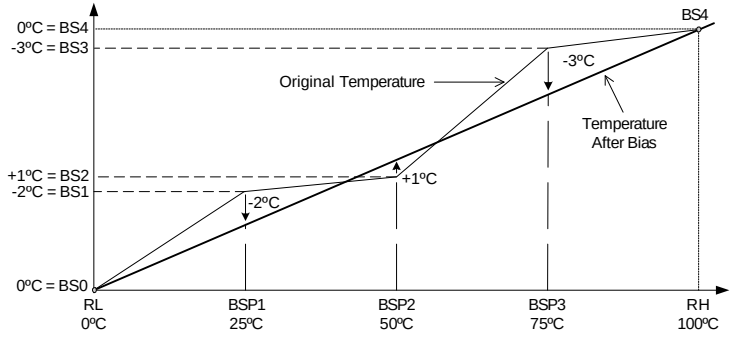



**Fig 1: Temperature Bias**

Example 1: The original temperature is shown within the range of 0ºC (Range Low) and 100ºC (Range High). Bias points have been used to adjust the displayed temperature as shown in the graph in Fig 1.

To establish this bias, the settings are shown below.

| Temperature Settings to Establish Where the Bias Occurs | | | | |
|---|---|---|---|---|
| RL | BSP1 | BSP2 | BSP3 | RH |
| 0ºC | 25ºC | 50ºC | 75ºC | 100ºC |
| **Bias Offset for Each Point** | | | | |
| BS0 | BS1 | BS2 | BS3 | BS4 |
| 0ºC | -2ºC | +1ºC | -3ºC | 0ºC |

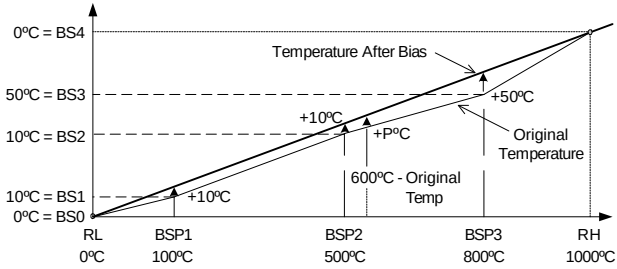



**Fig 2: Bias Formula Calculation**

Example 2: Temperature Bias Value (BS0 through BS4) = Temperature After Bias - Actual Temperature
Display temperature after bias at 600ºC actual temperature = P

$$P = 600 + (600 - BPS2) \times \frac{BS3 - BS2}{BSP3 - BSP2} + BS2$$

$$P = 600 + (600 - 500) \times \frac{50 - 10}{800 - 500} + 10 = 623ºC \text{ Temperature After Bias}$$

**Input Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| IN-T | Input Type | Refer to Table 1: Universal Input Selection | ABS | TC.K1 | |
| IN-U | Display Unit | ºC / ºF | ABS | ºC | T/C, RTD |
| IN.RH | Max PV Display Range | Within sensor input range Refer to Table 1 INRH > INRL | AEU | 1370 | |
| IN.RL | Min PV Display Range | | AEU | -200 | |
| IN.DP | Decimal Point Position | 0, 1, 2, or 3 | ABS | 1 | mV, V |
| IN.SH | Max Input Value Scale | -1999 to 9999 INSH > INSL Decimal position determined by IN.DP | ABS | 100.0 | mV, V |
| IN.SL | Min Input Value Scale | | | 0.0 | mV, V |
| IN.FL | PV Filter | OFF, 1 to 120 | sec | OFF | |
| BSL | Open Sensor Behavior | OFF, UP, DOWN | ABS | UP | Not Used for VDC Input |
| RSL | RJC Operation | ON, OFF | ABS | ON | Only Used for TC Input |
| BSP1 | Reference Bias Point 1 | AEU (0.0 to 100.0%), RL≤BSP1≤BSP2≤BSP3≤RH | AEU | AEU (100.0%) | |
| BSP2 | Reference Bias Point 2 | AEU (0.0 to 100.0%), RL≤BSP1≤BSP2≤BSP3≤RH | AEU | AEU (100.0%) | |
| BSP3 | Reference Bias Point 3 | AEU (0.0 to 100.0%), RL≤BSP1≤BSP2≤BSP3≤RH | AEU | AEU (100.0%) | |
| BS0 | Bias Value for RL Point | GEU (-100.0 to 100.0%) | GEU | 0 | |
| BS1 | Bias Value at BSP1 | GEU (-100.0 to 100.0%) | GEU | 0 | |
| BS2 | Bias Value at BSP2 | GEU (-100.0 to 100.0%) | GEU | 0 | |
| BS3 | Bias Value at BSP3 | GEU (-100.0 to 100.0%) | GEU | 0 | |
| BS4 | Bias Value at RH | GEU (-100.0 to 100.0%) | GEU | 0 | |

**NOTE** There are two types of engineering units values used in the setting of parameters, absolute engineering units (AEU) and general engineering units (GEU). An AEU parameter is set using an absolute value engineering unit that represents a specific point, such as a specific temperature or voltage level. An GEU parameter is set using engineering units, however it is a general value, and not tied to any input or output level.

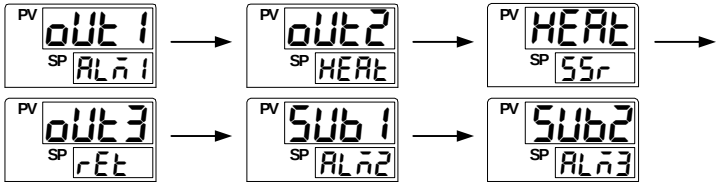
For example: When establishing input bias, parameter BSP1 sets the specific PV value where bias point one will occur. This parameter has a unit designation of AEU. BS1, the amount of offset at BSP1 is set in engineering units, however this parameter occurs at whatever BSP1 is set to, and therefore does not have an absolute setting related to any input or output, it is just the amount of offset at where BSP1 occurs. While one is related to an absolute input value, and the other stand alone value, both are set as engineering units, such as BSP1 set as 100ºC and BS1 set as 3ºC.

## 5.2 Output Group (G.OUT)

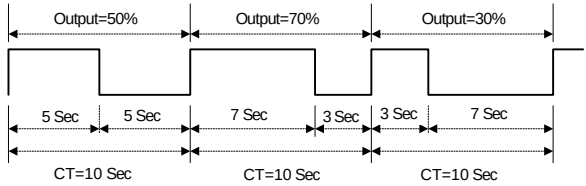
| | |
|---|---|
| PV G.OUT | Press SET/ENT key to select input group. (Refer to parameter map in section 3.)<br>G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO<br>G.COM ↔ G.RET ↔ G.ALM ↔ ***G.OUT*** ↔ G.IN |
| PV OUT1 | This parameter sets the type of operation for output 1. (OUT1: relay output) The output can be set to HEAT (PID Control), ALM1, ALM2, ALM3, RUN, IS1, IS2, TS, or PEND. Its default setting is ALM1. See Notes below. |
| PV OUT2 | This parameter establishes the type of operation for output 2. (OUT2: 4-20 mA or voltage pulse) This output can be set for HEAT (PID Control) or RET (Retransmitting). Its default setting is HEAT. |
| PV OUT3 | This parameter establishes the type of operation for output 2. (OUT3: 4-20 mA or voltage pulse) This output can be set for HEAT (PID control) or RET (retransmitting). Its default setting is HEAT. Menu appears only on models with the OUT3 output. |
| PV HEAT | This parameter selects the type of output signal for each analog output (OUT2 and OUT3) when they are set to HEAT. The outputs can be set to SSR (pulse output) or SCR (4-20 mA). Its default setting is SSR. |
| PV SUB1 | This parameter sets the type of operation for auxiliary output 1 (SUB1: relay output) Output can be set to HEAT, ALM1, ALM2, ALM3, RUN, IS1, IS2, TS, or PEND. Its default setting is ALM2. Menu appears only on models with the SUB1 output option. |
| PV SUB2 | This parameter sets the type of operation for auxiliary output 1 (SUB2: relay output) Output can be set to HEAT, ALM1, ALM2, ALM3, RUN, IS1, IS2, TS, or PEND. Its default setting is ALM2. Menu appears only on models with the SUB2 output option. |

**NOTE** Output Operation Settings:
HEAT is used to set the output for PID control, as time-proportional control for relay outputs or 4-20 mA or voltage pulse outputs for analog outputs. RUN will set the relays to always on. If set for TS (time signal) the relays will trigger if the time signal is on for the current program segment (see 1.TS1 under PROG menu). PEND will trigger relay outputs after the program cycle ends for the time set in PE.TM under G.CTL. For additional information on the setup of ALM1, ALM2, ALM3 (alarm), IS1, and IS2 (inner signal) refer to G.ALM and G.IS.

**NOTE** Output Group Menu Progression Example:
The following settings establish relay output 1 (OUT1) to trigger based on alarm 1, for analog output 2 (OUT2) to operate as a heating temperature controller outputting a voltage pulse, for analog output 3 (OUT 3) to output a retransmitting 4-20 mA signal, and for auxiliary relay outputs SUB1 and SUB2 to trigger with alarm 2 and alarm 3.



| | |
|---|---|
| PV oACt | This parameter establishes reverse (REV) or forward (FWD) activation of the control outputs. In forward operation, the control outputs will be most active when the PV value is higher than the SP, as the controller acts to lower the PV. In reverse operation, the control outputs will be most active when the PV value is lower than the SP value, as the controller acts to increase the PV. The default setting is REV. |
| PV Ct | This parameter establishes the cycle time for use with time-proportional PID relay or voltage pulse control when the outputs are set to HEAT or COOL. The cycle time can be set from 1 to 300 seconds. Its default setting is 2 seconds. |




Cycle Time (CT) set to 10 seconds

**Fig 3: Time-Proportional PID Control Output**

| | |
|---|---|
| PV oH | This parameter sets a high limit for the levels of the control output. This limits the output levels based on a percentage of their full scale. Its default setting is 100 (%). |
| PV oL | This parameter sets a low limit for the levels of the control output. This prevents the outputs from dropping below a certain level based on a percentage of their full scale. Its default setting is 0 (%). The outputs are limited by both the the low and high limits. |
| PV Po | This parameter establishes the percent output transmitted by the control outputs when the controller is in STOP mode, or when an error condition occurs such as a PID algorithm error, A/D error, or open sensor error is detected. |

**Output Group Parameter Summary**

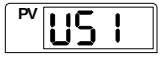
| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| OUT1 | Select Output | HEAT, ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, RUN | ABS | ALM1 | |
| OUT2 | Select Output | HEAT, RET | ABS | HEAT | |
| OUT3 | Select Output | HEAT, RET | ABS | RET | Models with OUT3 Only |
| HEAT | Select Output Type | SSR, SCR | ABS | SSR | When OUT2 or 3 is Set to HEAT |
| SUB1 | Select Output | HEAT, ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, RUN | ABS | ALM2 | Option |
| SUB2 | Select Output | HEAT, ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, RUN | ABS | ALM3 | Option |
| O.ACT | Reverse and Forward | REV, FWD | ABS | REV | |
| CT | Cycle Time 1 | 1 to 300 seconds | sec | 2 sec | |
| OH | High Limit of Output | OL + 1 digit to 105.0% OH>OL | % | 100.0% | |
| OL | Low Limit of Output | -5.0% to OH setting OH>OL | % | 0% | |
| PO | Preset Output | -5.0 to 105.0% | % | 0.0% | |

## 5.3 Control Group (G.CTL)


Press SET/ENT key to select control group. (Refer to parameter map in section 3.)

G.AT ↔ G.PID ↔ PWD ↔ ***G.CTL*** ↔ G.IS ↔ G.DO
G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN


This parameter establishes how long after a program ends the relay outputs will trigger for if set to PEND. Its default setting is 15 seconds. This parameter is always set in seconds.

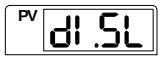




This parameter establishes the user screens for viewing, confirmation, and setup of commonly used parameters from the operation display. To add the parameter to the operation display, enter the corresponding number for the parameter from the Table of D-Registers as either US1 or US2. The default settings are OFF.

See page 14 and the Operation Flow Chart for a map of the operation display.


Turning ON this parameter locks all settings from being changed. This applies to the operation display functions, such as changing the set point, as well as setting group parameters. If ON, only the LOCK parameter may be changed. The default setting is OFF.




This parameter establishes the operation of the digital input (DI) external contacts. The digital input operating configurations are shown in Table 2: DI Operation. This feature is only valid for models with digital inputs.

**Table 2: DI Operation**

| DI.SL | DI1 | DI2 | Operation |
|---|---|---|---|
| OFF | - | - | DI Disabled |
| 1 | off | - | HOLD OFF |
| | on | - | HOLD ON |
| | - | off | STEP OFF |
| | - | on | STEP ON |
| 2 | off | - | RESET |
| | on | - | PROG RUN |
| | - | off | PROG1 |
| | - | on | PROG2 |

| | |
|---|---|
| PV oSt5 | When this parameter is on, the output settings will be displayed in the operation display. The settings of parameters OUT1, OUT2, OUT3, SUB1, and SUB2 will be shown. Only outputs built into the model being used will display. Its default setting is OFF. |
| PV dSP.H | This parameter sets the high limit of the sensor input in the PV display. The PV value will not display higher than this limit, however the control functions will operate based on the actual input value. |
| PV dSP.L | This parameter sets the low limit of the sensor input in the PV display. The PV value will not display lower than this limit, however the control functions will operate based on the actual input value. |
| PV U.Pwd | This parameter establishes the password for the controller. This password must be entered at the PWD screen before accessing the control group (G.CTL) or it will not access the setting groups after the PWD prompt. The default setting is "0". See the parameter map in section 3 for the location of the PWD prompt in the group menus. |

**CAUTION** Be sure not to forget the password once it has been set. If the password is forgotten, contact technical support as listed on the back of this manual.

| | |
|---|---|
| PV Init | This parameter resets most parameters to their factory settings. To reset the controller, set this parameter to ON. After reset, it will return to the OFF setting. |

**CAUTION** Most parameters will be reset to their default settings when the controller is initialized. Note the current settings before this is done so they can easily be restored after controller initialization.

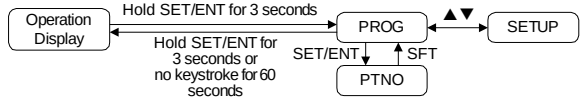
**Control Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| PE.TM | Pattern End Alarm Time | OFF, 1 to 9999 sec seconds | ABS | 15 (sec) | |
| US1 | User Screen | OFF, D-Register Number 1 to 1299 | ABS | OFF | |
| US2 | User Screen | OFF, D-Register Number 1 to 1299 | ABS | OFF | |
| LOCK | Parameter Lock | OFF, ON (No Editing) | ABS | OFF | |
| DI.SL | DI Selection | OFF, 1, 2 | ABS | OFF | DI Option |
| OSTS | Output Status Display | OFF, ON | ABS | OFF | |
| DSP.H | Display High Limit | AEU (-5.0 to 105.0%), DSP.L<DSP.H | AEU | AEU (105.0%) | |
| DSP.L | Display Low Limit | AEU (-5.0 to 105.0%), DSP.L<DSP.H | AEU | AEU (-5.0%) | |
| U.PWD | User password | 0 to 9999 | ABS | 0 | |
| INIT | Factory Initialization | OFF, ON | ABS | OFF | |

## 5.4 Program Group (G.PROG)

PV ProG

Select PROG group from the group display. (Refer to parameter map in section 3.)




PV tiU

This parameter establishes the time units the controller uses for programs and parameters. This can be set to the format of HH.MM (hours.minutes) or MM.SS (minutes.seconds). Its default setting is HH.MM.

PV StC

This parameter sets the start code to determine what method of SP operation is used when a program starts. STC (start code) can be set for SSP (starting set point) or PV (process variable start). See below for details. The default start code is PV.

**NOTE** **STC Operation**

SSP START (STC set to SSP)

In Start Set Point mode, the program will begin with at the default set point set in the program (SSP) and ramp to the set point value for segment 1 (SP1) over the time designated in time segment 1 (TM1).

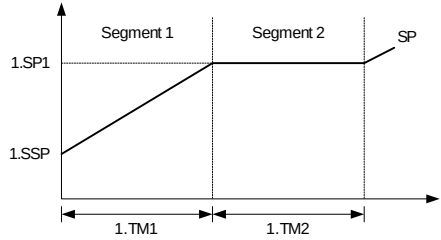



**Fig 4: Start Code SSP Start**

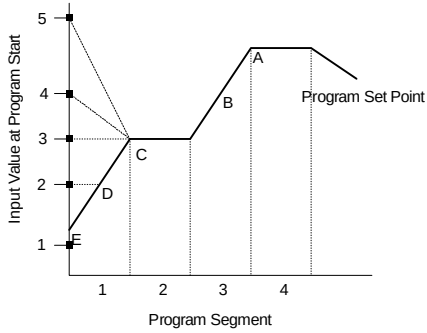
For a soak segment, the set point for the segment is the same as the set point prior to the soak segment. In this case, the program will hold the set point at that value for the length of the segment. In the above example, 1.SP1 and 1.SP2 are the same, and the set point is steady for the time indicated in 1.TM2.

PV Start (STC set to PV)

In PV mode, the program will immediately start at the point in the program where the set point is equal to the PV value when the program starts running. In the case where the PV is beyond any set point in the program, the program will immediately start at beginning of the first soak segment. If no soak segment is present in the program, it will start at the point closest to the PV.

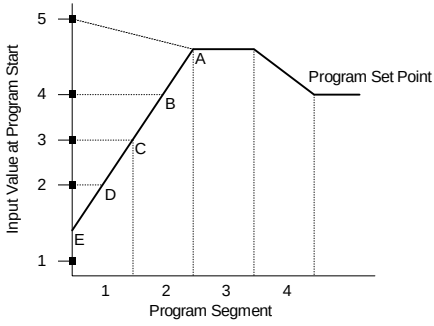
If the starting point of the program, based on the PV at the start of the program, would occur during a ramp segment, the program will recalculate the time left in the ramp segment. The rate of set point change in the ramp will remain the same, and the program will calculate how much time remains in that segment based on the original rate of change characteristics from the set point of the last segment to the SP of the ramp segment. Refer to the graphics on the following pages for additional information.

STC set to PV, first soak at segment 2



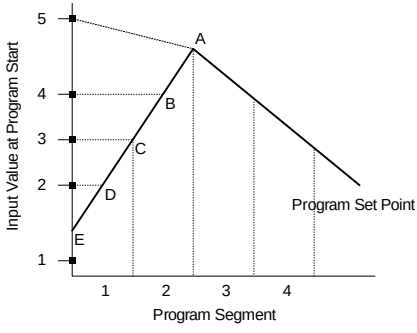

| Starting PV At Program Activation | Immediate Program Start Point |
|---|---|
| 5 | C |
| 4 | C |
| 3 | C |
| 2 | D |
| 1 | E (SSP) |

STC set to PV, first soak at segment 3



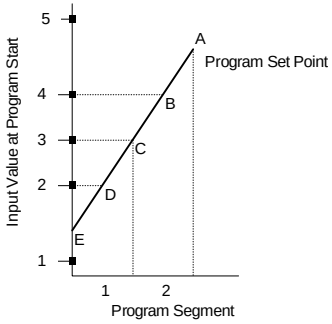

| Starting PV At Program Activation | Immediate Program Start Point |
|---|---|
| 5 | A |
| 4 | B |
| 3 | C |
| 2 | D |
| 1 | E (SSP) |

STC set to PV, with no soak segment in the program

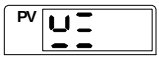



| Starting PV At Program Activation | Immediate Program Start Point |
|---|---|
| 5 | A |
| 4 | B |
| 3 | C |
| 2 | D |
| 1 | E (SSP) |

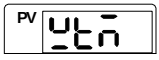
STC set to PV, with only ascending ramp segments




| Starting PV At Program Activation | Immediate Program Start Point |
|---|---|
| 5 | Program Will Not Start |
| 4 | B |
| 3 | C |
| 2 | D |
| 1 | E(SSP) |




This is parameter establishes the wait zone range for the wait function. This sets the deviation value used for the wait function. When set, a running program will not move to the next segment until the PV is within the wait zone, or the wait time has passed. When OFF, the wait function will not be enabled. See Fig 5 for more information about this process.




This is the wait time parameter for the wait function, which sets the time the program will wait for the PV to enter the wait zone before starting the next program segment. The setting range is OFF (0) to 99.59 (time units set by TMU). When OFF, the wait function will not be enabled. See Fig 6 for more information.

NOTE

Wait Function

The wait function delays the start of the next program segment, if the next segment is a soak segment (the new target set point is the same as the previous target set point), until the PV is within a specified deviation range from the SP, or until the wait time has expired. The wait zone defines the deviation range from the SP the PV must reach to activate the next segment and the wait time establishes a limit on how long the program will wait for this to occur before activating the next segment. Note that this function will only activate when progressing into a set point soak segment.

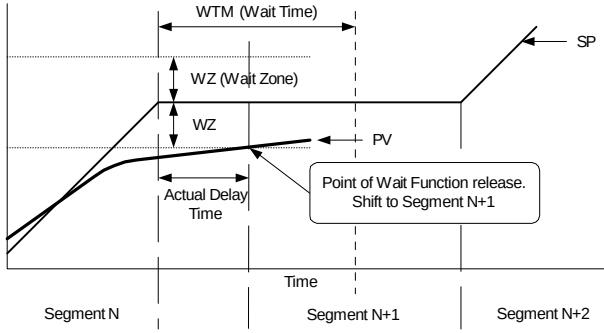



**Fig 5: Wait Function Wait Zone Release**

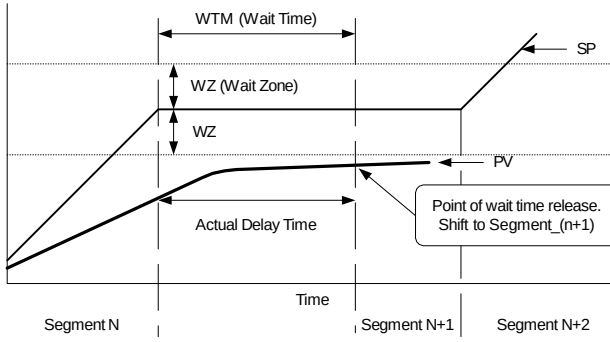
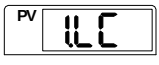


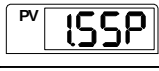

**Fig 6: Wait Function Wait Time Release**




The link parameter establishes the operation of the controller when a program has finished running. The link codes that determine the controller operation when a program ends are shown in Table 3 below.

**Table 3: Link Codes**

| Link Code | Controller Operation When a Program is Complete |
|---|---|
| RST | Shift to RESET (Stop)<br>(All operation stops) |
| HOLD | Continues to run at the last set point<br>(Will enter STOP mode when RST key pressed) |
| PTN1 | Runs PTN1 (Program 1)<br>(Program 1 will infinitely repeat if set in 1.LC) |
| PTN2 | Runs PTN2 (Program 2)<br>(Program 2 will infinitely repeat if set in 2.LC) |




This parameter sets the starting set point for program 1. This set point is used when the program is set for a STC of SSP, or to calculate the ramp time for segment 1 if needed when STC is set to PV.

| | |
|---|---|
| PV 1SP1 | This parameter sets the target set point (TSP) for program segment 1. The parameter is set in the same way for segments 1 to 15 (1.SP1 to 1.SPF). |
| PV 1tn1 | This parameter sets the running time for the segment. This can be set as OFF or 1 to 99.59 (time unit set in TMU). In the case of an OFF setting, the program will stop running after the previous segment. This parameter is set in the same way for segments 1 to 15 (1.TM1 to 1.TMF). |
| PV 1tS1 | This parameter determines if the status of time signal (TS) relay outputs are ON or OFF for the duration of the program segment. This parameter is set in the same way for segments 1 to 15 (1.TS1 to 1.TSF). |
| . . . | . . . |
| PV 1SPF | This parameter sets the target set point (TSP) for program segment 15. |
| PV 1tnF | This parameter sets the running time for segment 15. This can be set as OFF or 1 to 99.59 (time unit set in TMU). In the case of an OFF setting, the program will stop running after the previous segment. |
| PV 1tSF | This parameter determines if the status of time signal (TS) relay outputs are ON or OFF for the duration of program segment 15. |
| PV 1rPt | This repeat parameter allows segments set with 1.REN and 1.RST to be repeated during the program. This setting is the number of times the repeated segments will used in the program. If set as 0, the repeated segments will repeat infinitely. The default setting it 1. |
| PV 1rEn | This parameter establishes the repeat end segment. This is the last segment that will be repeated. After this segment, the program will cycle back to the segment defined in 1.RST. The repeated segments will appear a number of times as defined in 1.RPT. |
| PV 1rSt | This parameter establishes the repeat start segment. This is the first segment that will be repeated. If the program is set to repeat, after the segment defined in 1.REN the program will loop back to the segment defined by this parameter. |
| . . . | The parameters used to set up program 2 are the same as those used for program 1. |

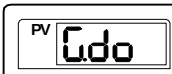
**NOTE** Reminder: If a program requires less than the 15 segments possible, set the running time for the segment after the last segment needed to OFF, and only the segments prior to that segment will be used. For example, to use only 5 segments, set 1.TM6 to OFF.

**Program Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| TMU | Time Unit | HH.MM, MM.SS | ABS | HH.MM | |
| STC | Start Code | SSP, PV | ABS | PV | |
| WZ | Wait Zone | OFF (0), GEU (0.0% +1 digit to 00.0%) | GEU | OFF (0) | |
| WTM | Wait Time | OFF (0.00) to 99.59 | TIME | OFF (0.00) | |
| n.LC | Link Code | RST, HOLD, PTN1, PTN2 | ABS | RST | |
| n.SSP | Program Start SP | AEU (0.0 to 100.0%) | AEU | AEU (0.0%) | |
| n.SP1 | Target SP 1 | AEU (0.0 to 100.0%) | AEU | AEU (0.0%) | |
| n.TM1 | Segment Time 1 | OFF, 0.00 to 99.59 | TIME | OFF | |
| n.TS1 | Time Signal 1 On/Off | ON, OFF | ABS | OFF | |
| n.SP2 | Target SP 2 | AEU (0.0 to 100.0%) | AEU | AEU (0.0%) | |
| n.TM2 | Segment Time 2 | Time Set : OFF, 0.00 to 99.59 | TIME | OFF | |
| n.TS2 | Time Signal 2 On/Off | ON, OFF | ABS | OFF | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| n.SPF | Target SP 15 | AEU (0.0 to 100.0%) | AEU | AEU (0.0%) | |
| n.TMF | Segment Time 15 | OFF (0), 0.00 to 99.59 | TIME | OFF | |
| n.TSF | Time Signal 15 On/Off | ON, OFF | ABS | OFF | |
| n.RPT | Segment Repeat | 0 to 999 (0 : Infinite Repeat ) | ABS | 1 | |
| n.REN | Repeat End Segment | 0, 1 ≤ RST ≤ n.REN ≤ 15(F) | ABS | 0 | |
| n.RST | Repeat Start Segment | 0, 1 < RST < n.REN < 15(F) | ABS | 0 | |

## 5.5 Digital Output Group (G.DO)

**NOTE** Digital Outputs are an optional feature. These parameters are only used when appropriate for a controller with 2 or 4 digital outputs as an optional feature




Press SET/ENT key to select the digital output group. (Refer to parameter map)

G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ **G.DO**
↕
G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN


This parameter establishes the function of digital output 1 (DO1). This function sets what conditions will activate the output. The settings and functions that can be selected are shown in Table 4 below.


This parameter establishes the function of digital output 2 (DO2). This function sets what conditions will activate the output. The settings and functions that can be selected are shown in Table 4 below.


This parameter establishes the function of digital output 3 (DO3). This function sets what conditions will activate the output. The settings and functions that can be selected are shown in Table 4 below.


This parameter establishes the function of digital output 4 (DO4). This function sets what conditions will activate the output. The settings and functions that can be selected are shown in Table 4 below.

**Table 4 : DO Settings and Functions**

| DO Setting | Function |
|---|---|
| ALM1 | Alarm 1 |
| ALM2 | Alarm 2 |
| ALM3 | Alarm 3 |
| IS1 | Inner Signal 1 |
| IS2 | Inner Signal 2 |
| TS | Segment Time Signal |

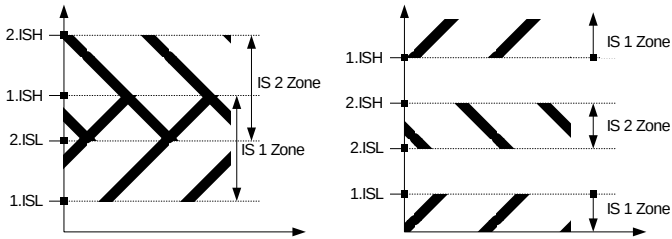
| DO Setting | Function |
|---|---|
| PEND | Activate when a program ends |
| UP | Activate during an ascending ramp segment |
| DOWN | Activate during a descending ramp segment |
| SOAK | Activate during an soak segment |
| RUN | Activate when a program is running |

**Digital Output Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| DO1 | DO1 Type | ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, UP, DOWN, SOAK, RUN | ABS | OFF | Option |
| DO2 | DO2 Type | ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, UP, DOWN, SOAK, RUN | ABS | OFF | Option |
| DO3 | DO3 Type | ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, UP, DOWN, SOAK, RUN | ABS | OFF | Option |
| DO4 | DO4 Type | ALM1, ALM2, ALM3, IS1, IS2, TS, PEND, UP, DOWN, SOAK, RUN | ABS | OFF | Option |

## 5.6 Inner Signal Group (G.IS)

| | |
|---|---|
| PV G.IS | Press SET/ENT key to select the inner signal group. (Refer to parameter map)<br>G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ ***G.IS*** ↔ G.DO<br>G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN |
| PV 1.St | The parameter to set the basis of inner signal activation. The settings are NPV (current value of the PV), NSP (current value of the SP), or TSP (target set point of the current program segment). Its default setting is NPV. |
| PV 1.Sb | This parameter sets the inner signal activation zone to be inside or outside the IS band. When the value set in 1.ISB enters the inner signal zone, outputs set to inner signal 1 will activate. The settings are I.BD (in band) and O.BD (out band) where the bands are determined by the values in 1.ISH and 1.ISL (See Fig 7). |
| PV 1.SH | The parameter to establish the high value for the setup of the inner signal band. |
| PV 1.SL | The parameter to establish the low value for the setup of the inner signal band. |
| PV 1.Sd | The parameter to set the inner signal delay. This is the delay time from when the inner signal activation conditions are met to when the outputs activate. |
| . . . | The parameters used to setup inner signal 2 is the same as those used for inner signal 1. |




a) 1.ISB and 2.ISB are set as I.BD

b) 1.ISB is set to I.BD and 2.ISB is set to O.BD

**Fig 7: Inner Signal Zones**

**Inner Signal Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| 1.IST | Inner Signal Type | NPV, NSP, TSP | ABS | NPV | |
| 1.ISB | Inner Signal Band Direction | I.BD (In Band), O.BD (Out Band) | ABS | I.BD | |
| 1.ISH | Inner Signal Range High 1 | AEU (0.0 to 100.0%), but 1.ISH ≥ 1.ISL | AEU | AEU (0.0%) | |
| 1.ISL | Inner Signal Range Low 1 | AEU (0.0 to 100.0%), but 1.ISH ≥ 1.ISL | AEU | AEU (0.0%) | |
| 1.ISD | Inner Signal Delay Time | OFF (00.00) to 99.59 (MM.SS) | TIME | OFF | |
| 2.IST | Inner Signal Type | NPV, NSP, TSP | ABS | NPV | |
| 2.ISB | Inner Signal Band Direction | I.BD (In Band), O.BD (Out Band) | ABS | I.BD | |
| 2.ISH | Inner Signal Range High 2 | AEU (0.0 to 100.0%), but 2.ISH ≥ 2.ISL | AEU | AEU (0.0%) | |
| 2.ISL | Inner Signal Range Low 2 | AEU (0.0 to 100.0%), but 2.ISH > 2.ISL | AEU | AEU (0.0%) | |
| 2.ISD | Inner Signal Delay Time | OFF (00.00) to 99.59 (MM.SS) | TIME | OFF | |

## 5.7 PID Group (G.PID)

PV G.PId

Press SET/ENT Key to select PID Group after press ¡ã or ¡å Key in Menu display

G.AT ↔ **G.PID** ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO
↑ ↕
G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN

PV Ary

The parameter sets the PV deviation width to prevent overshoot. When the control outputs reach this high limit value, they stop ordinary output action for integral control and use ARW (Anti-Reset Windup). When the setting is AUTO, this parameter is calculated automatically.

PV C.mod

This parameter establishes the control mode. It can be set to Differential of Deviation Value (*d. dV*) or Process Variable (*d. PV*). Dviation Value mode will reduce overshoot. Process Variable mode will more quickly raise and lower the PV. The default setting is d. dv.

PV FUZY

This parameter activates the use of fuzzy logic. Fuzzy logic can be effective in suppressing overshoot and reducing PV variation that may occur once the PV has reached the SP. Refer to Fig 5: Overshoot Suppression with Fuzzy Logic.

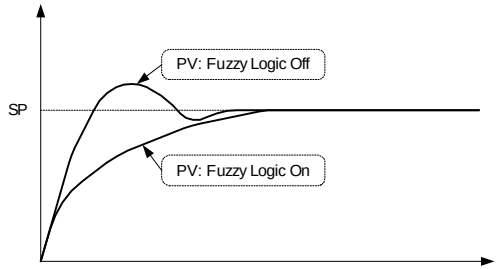



**Fig 8: Overshoot Suppression with Fuzzy Logic**

PV PId

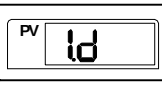
This parameter establishes the number of PID setting groups to be used in control output calculation. Up to 4 user defined groups of proportional, integral, and derivative value zones can be established. Use this setting to enter the setting menus for each PID group.

PV 1.P

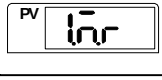
The parameter to set the proportional operation for PID control.
Setting range of 1.P is 0.1 to 999.9%.
Its default setting is 10.0%.

PV 1.I

The parameter to set the integration time for PID control.
Setting ranges of 1.I are OFF or 1 to 6000 seconds.
Its default setting is 120 seconds




The parameter to set derivation time for PID control.
Setting ranges of 1.D are OFF or 1 to 6000 seconds.
Its default setting is 30 seconds.




The parameter to set the manual reset in the PID calculation. This setting only functions if the integral time setting is OFF. This setting always functions for H/C models.

. . .

Note: The contents of PID Groups 2, 3, and 4 are the same as PID Group 1.


This parameter establishes the PV range of each of the 3 main PID zones. The range of PID zone 1 is IN.RL (IN.SL if set for mV or V input) to 1.RP. The range of PID zone 2 is 1.RP to 2.RP. The range of PID zone 3 is 2.RP to IN.RH (IN.SH if set for mV or V input).


This parameter establishes the range of each of the 3 main PID zones. The range of PID zone 1 is IN.RL (IN.SL if set for mV or V input) to 1.RP. The range of PID zone 2 is 1.RP to 2.RP. The range of PID zone 3 is 2.RP to IN.RH (IN.SH if set for mV or V input).


This parameter establishes the hysteresis width of the PID zone.


This parameter sets the range of deviation for PID zone 4. When the difference between the PV and SP is greater than this deviation range, the controller will utilize PID group 4 for PID settings. While the PV and SP are within this deviation difference, the controller will utilize whatever zone would normally be used based on the PV value.

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| ARW | Anti-Reset Wind-Up Select | Auto or 50.0 to 200.0% | % | Auto | |
| C.MOD | Control Mode | Differential of Deviation Value (d. dV) or Process Variable (d. PV) | ABS | d. dV | |
| FUZY | Fuzzy | OFF, ON | ABS | OFF | |
| PID | PID Number | MENU (0) or 1, 2, 3 or 4 | ABS | MENU | |
| n.P | n.Proportional | 0.1 to 999.9% | % | 10.0% | |
| n.I | n.Pro/Time | OFF, 1 to 6000 sec | sec | 120 sec | |
| n.D | n.Derivation time | OFF, 1 to 6000 sec | sec | 30 sec | |
| n.MR | n.Manual Reset | -5.0 to 105.0% | % | 50.0% | For Use When I=0 |
| 1.RP | Reference Point 1 | AEU (0.0%), 1.RP ≤ 2.RP | AEU | AEU (100.0%) | PID Zone 1 |
| 2.RP | Reference Point 2 | 1.RP ≤ 2.RP ≤ AEU (100.0%) | AEU | AEU (100.0%) | PID Zone 2 |
| RHY | Reference Hysteresis | GEU (0.0 to 10.0%) | GEU | AEU (0.3%) | PID Zone 3 |
| RDV | Reference Deviation | GEU (0.0 to 100.0%) | GEU | AEU (0.0%) | PID Zone 4 |

## 5.8 Auto-Tuning Group (G.AT)

| | |
|---|---|
| PV  | Press SET/ENT key to select the auto-tuning group. (Refer to parameter map)<br>***G.AT*** ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO<br>G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN |
| PV  | The parameter to activate the auto-tuning function. When AT is set to ON, auto-tuning will begin, indicated by the AT light blinking. This parameter cannot be used if the controller does not have an active set point, either from running a program, or being in HOLD mode. |

**NOTE** **AUTO-TUNING (AT)**

The auto-tuning feature is used to let the controller measure process characteristics and automatically set the most appropriate values for the PID parameters. During the default auto-tuning process, the control outputs will function in an On/Off mode, and the controller will use the responses to calculate the needed PID values. During this setup process, the AT LED on the controller will blink.

Start the auto-tuning process while the controller is maintaining a set point, either while running a program, or while in HOLD mode. Auto-tuning will set the PID parameters for the PID zone which the set point is in, based on the PID reference point (RP) entered.

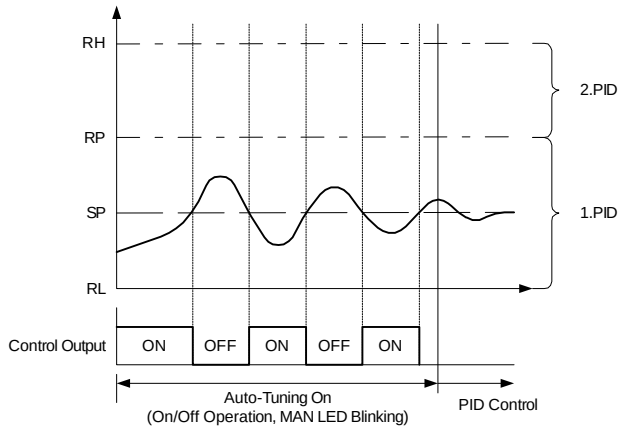


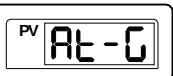

**Fig 9: Auto-Tuning**

Display During Auto-Tuning:
The AT LED on the front panel will blink at a 500 ms time interval.

Changing the Set Point During Auto-Tuning:
If the set point is changed during the auto-tuning process, the original set point will be maintained for the duration of the auto-tuning process. After auto-tuning is complete, the controller will change to the new set point.

Changing PID Parameters During Auto-Tuning:
The PID values can be changed during the auto-tuning process. After auto-tuning is complete, it will then use the auto-tune calculated PID values. Values changed after auto-tuning will remain set until auto-tuning is run again.

Auto-Tuning Interruptions or Errors:
The auto-tuning process will end without effect for any of the following reasons:
- Auto-tuning forced to end (Example: Controller power down or stop condition)
- Open sensor (S.OPN) input error detected during the auto-tuning process
- Auto-tuning cycle exceeds 24 hours.
- Control changed to manual (MAN) operation during auto-tuning.




This parameter effects the proportional value derived by auto-tuning. Reduce the AT-G gain value and the cycle becomes more rapid, but more unstable. Increasing gain slows system reaction time, but system stability increases.

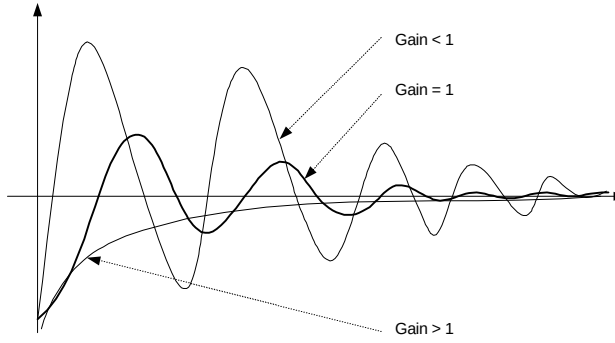



**Fig 10: Auto-Tuning Gain**

**PID Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| AT | Auto Tuning | OFF, ON | ABS | OFF | Auto-Tune Activation |
| AT-G | AT Gain | 0.1 to 10.0 | ABS | 1.0 | Gain Value |

## 5.9 Alarm Group (G.ALM)

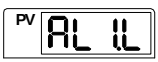

Press SET/ENT key to select the alarm group. (Refer to parameter map in section 3.)

G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO
↕
G.COM ↔ G.RET ↔ ***G.ALM*** ↔ G.OUT ↔ G.IN

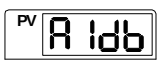

The parameter to set the type of alarm to be set for alarm 1.
The types of alarms selectable are shown in Table 3: Alarm Selection.


The parameter to set the alarm trigger point for the alarm set in ALT1.
This parameter displays if a high, low, or high and low limit alarm was selected for ALT1.

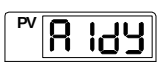

This establishes the high deviation range to trigger the alarm of deviation. This parameter displays if a deviation alarm was selected in ALT1.




This establishes the low deviation range to trigger the alarm of deviation. This parameter displays if a deviation alarm was selected in ALT1.




The parameter to set the dead band (Hysteresis) of alarm 1.

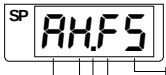



The parameter to set the delay time before of alarm 1 is triggered.

. . .

Note: The menus for alarm 2 and 3 are the same as alarm 1.

**NOTE** **Alarm Types and LED Display**




- **S** indicates standby operation
- **F** for forward operation
- **r** for reverse (failsafe) operation
- Decimal point always displayed
- **H** indicates a high alarm
- **L** indicates a low alarm
- **o** for outside range of deviation band
- **I** for inside range of deviation band
- **A** indicates an absolute value alarm
- **d** indicates a deviation alarm

Alarm Output Settings:
- Forward: Relay energized in alarm condition
- Reverse: Failsafe operation. Relay energized during normal operating conditions

Standby Operation:
The alarm will not trigger if the alarm condition occurs during the following activities...
- during power-up
- the set point is changed
- the type of alarm is changed

**Table 3: Alarm Selection**

| No. | Alarm Type | Operation | | Standby | | Display Data |
|---|---|---|---|---|---|---|
| | | For | Rev | On | Off | |
| 1 | Absolute Value High Limit Alarm | ✓ | | ✓ | | AH.F |
| 2 | Absolute Value Low Limit Alarm | ✓ | | ✓ | | AL.F |
| 3 | High Limit Deviation Alarm | ✓ | | ✓ | | DH.F |
| 4 | Low Limit Deviation Alarm | ✓ | | ✓ | | DL.F |
| 5 | High Limit Deviation Alarm | | ✓ | ✓ | | DH.R |
| 6 | Low Limit Deviation Alarm | | ✓ | ✓ | | DL.R |
| 7 | High and Low Limit Deviation Alarm | ✓ | | ✓ | | DO.F |
| 8 | High and Low Limit Range Deviation Alarm | ✓ | | ✓ | | DI.F |
| 9 | Absolute Value High Limit Alarm | | ✓ | ✓ | | AH.R |
| 10 | Absolute Value Low Limit Alarm | | ✓ | ✓ | | AL.R |
| 11 | Absolute Value High Limit Alarm with Standby | ✓ | | | ✓ | AH.FS |
| 12 | Absolute Value Low Limit Alarm with Standby | ✓ | | | ✓ | AL.FS |
| 13 | High Limit Deviation Alarm with Standby | ✓ | | | ✓ | DH.FS |
| 14 | Low Limit Deviation Alarm with Standby | ✓ | | | ✓ | DL.FS |
| 15 | High Limit Deviation Alarm with Standby | | ✓ | | ✓ | DH.RS |
| 16 | Low Limit Deviation Alarm with Standby | | ✓ | | ✓ | DL.RS |
| 17 | High and Low Limit Deviation Alarm with Standby | ✓ | | | ✓ | DO.FS |
| 18 | High and Low Limit Range Deviation Alarmwith Standby | ✓ | | | ✓ | DI.FS |
| 19 | Absolute Value High Limit Alarm with Standby | | ✓ | | ✓ | AH.RS |
| 20 | Absolute Value Low Limit Alarm with Standby | | ✓ | | ✓ | AL.RS |

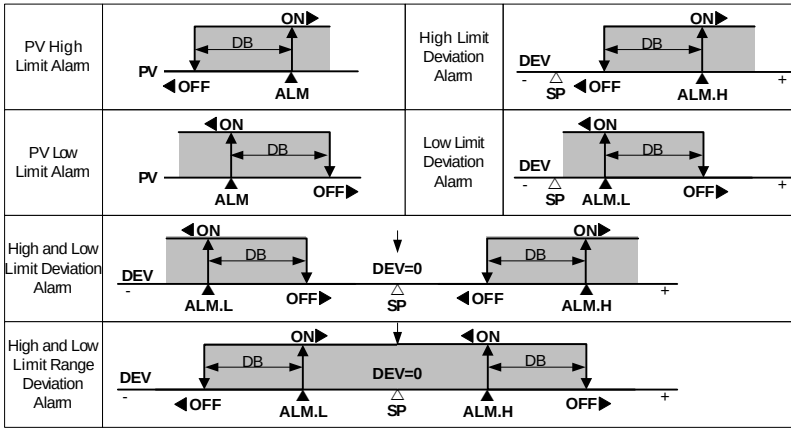



**Fig 11: Alarm Operation**

**Alarm Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| ALT1 | Alarm Type 1 | Refer to Table 5: Alarm Selection | ABS | AH.F | |
| AL-1 | Set value of ALT1 | AEU (-100.0 to 100.0%) | AEU | AEU (100.0%) | Absolute Value Alarm |
| AL1.H | High Deviation Limit of Alarm 1 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| AL1.L | Low Deviation Limit of Alarm 1 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| A1DB | Alarm 1 DB | GEU (0.0 to 100.0%) | GEU | GEU (0.5%) | |
| A1DY | Delay Time of Alarm 1 | 0.00 to 99.59 | MM.SS | 0.00 | |
| ALT2 | Alarm Type 2 | Refer to Table 5: Alarm Selection | ABS | AH.F | |
| AL-2 | Set value of ALT2 | AEU (-100.0 to 100.0%) | AEU | AEU (100.0%) | Absolute Value Alarm |
| AL2.H | High Deviation Limit of Alarm 2 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| AL2.L | Low Deviation Limit of Alarm 2 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| A2DB | Alarm 2 DB | GEU (0.0 to 100.0%) | GEU | GEU (0.5%) | |
| A2DY | Delay Time of Alarm 2 | 0.00 to 99.59 | MM.SS | 0.00 | |
| ALT3 | Alarm Type 3 | Refer to (Table 5: Alarm Selection) | ABS | AH.F | |
| AL-3 | Set value of ALT3 | AEU (-100.0 to 100.0%) | AEU | AEU (100.0%) | Absolute Value Alarm |
| AL3.H | High Deviation Limit of Alarm 3 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| AL3.L | Low Deviation Limit of Alarm 3 | GEU (-100.0 to 100.0%) | GEU | GEU (0.0%) | Deviation Alarm |
| A3DB | Alarm 3 DB | GEU (0.0 to 100.0%) | GEU | GEU (0.5%) | |
| A3DY | Delay Time of Alarm 3 | 0.00 to 99.59 | MM.SS | 0.00 | |

## 5.10 Retransmission Group (G.RET)

PV GrEt

Press SET/ENT key to select the retransmission group. (Refer to parameter map)

G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO
↕
G.COM ↔ ***G.RET*** ↔ G.ALM ↔ G.OUT ↔ G.IN

PV rEt

This parameter sets the type of retransmission used. The options are PV, SP, MV, or LPS. See notes below for an explanation of the retransmission types.
Its default setting is PV.

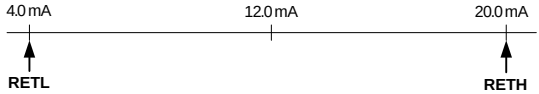
PV rEtH

PV rEtL

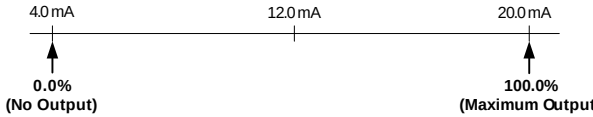
These parameters are used to scale the retransmitting output. They set the high and low limits for the retransmission output scale, as shown below. The retransmitting outputs will transmit 4 mA at the low limit (RETL) and 20 mA at the high limit (RETH) values. These limits are used when the retransmission type is set to PV or SP.

**NOTE**

**PV and SP Type Retransmission Scale**
PV type retransmits based on the input value, SP retransmits based on the set point value.




**MV Type Retransmission Scale**
MV type retransmits based on the full scale output and what is currently being transmitted by the control outputs




**LPS Type Retransmission**
LPS (Loop Power Suppy) retransmitting outputs will transmit a 14-18 VDC @ 20 mA power supply output.

**Retransmission Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| RET | Select Ret Type | PV, SP, MV, LPS | ABS | PV | |
| RETH | Ret Scale High Limit | T/C, RTD: INRH to INRL<br>mV, V: INSH to INSL<br>RETH > RETL | AEU | INRH | Only Valid when RET is Set to PV or SP |
| RETL | Ret Scale Low Limit | | AEU | INRL | |

## 5.11 Communication Group (G.COM)

| | |
|---|---|
| PV G.Con | Press SET/ENT key to select the communication group. (Refer to parameter map)<br>G.AT ↔ G.PID ↔ PWD ↔ G.CTL ↔ G.IS ↔ G.DO<br>G.COM ↔ G.RET ↔ G.ALM ↔ G.OUT ↔ G.IN |
| PV Con.P | The parameter to select the type of communication protocol to be used. |
| PV bAUd | The parameter to set the communication speed (baud rate).<br>The baud rate can be set at 600 to 19200 bps (bytes per second).<br>The default setting is for 9600 bps. |
| PV Prty | The parameter to set communication parity.<br>This can be set to NONE, EVEN, or ODD.<br>The default setting is NONE. |
| PV Sbit | The parameter to set the communication stop bit.<br>This can be set as 1 or 2.<br>It is initially set as 1. |
| PV dLEn | The parameter to set the communication data length.<br>This can be set to 7 or 8. The default setting is 8.<br>This parameter is not displayed when the communication protocol (COM.P) is set for MODBUS ASCIII or RTU. |
| PV Addr | The parameter to set the communication address for the controller.<br>This can be set as 1 to 99 pcs address.<br>Its default setting is 1. |
| PV rPtn | The parameter to set communication response time.<br>The RP.TM is the delay to return data to the upper level device after processing commands received from the upper level device.<br>The setting RP.TM is based on the number of 10 ms intervals to delay (example: a setting of 2 will result in a 20 ms delay). If RP.TM is set to 0 it will immediately return a response once the command processing is complete. |

**Communication Group Parameter Summary**

| Display | Parameter | Setting Range | Unit | Default | Remark |
|---|---|---|---|---|---|
| COM.P | Communication Protocol | PCC0, PCC1, Modbus ASCII, Modbus RTU, Sync-Master, Sync-Slave | ABS | PCC0 | Option |
| BAUD | Baud Rate | 600, 1200, 2400, 4800, 9600, 19200 | ABS | 9600 | Option |
| PRTY | Parity | None, Even, Odd | ABS | None | Option |
| SBIT | Stop Bit | 1, 2 | ABS | 1 | Option |
| DLEN | Data Length | 7, 8 (not used when set for MODBUS) | ABS | 8 | Option |
| ADDR | Address | 1 to 99 (maximum of 31 connected at once) | ABS | 1 | Option |
| RP.TM | Response Time | 0 to 10 (number of 10 ms intervals) | ABS | 0 | Option |

## 6. Error Display and Correction

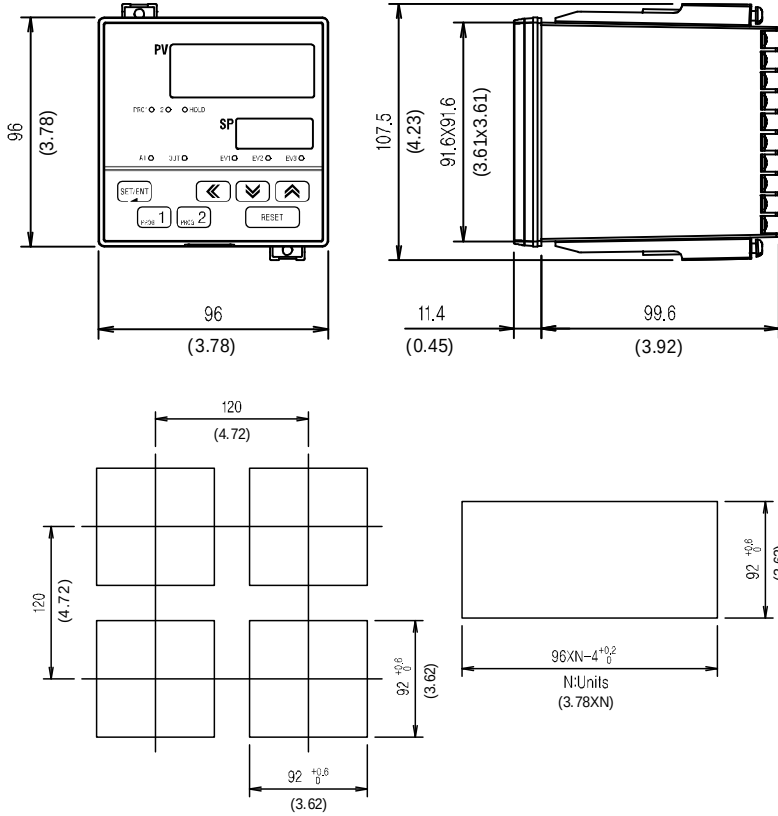
| Error Message | Error Incident | Action Needed |
|---|---|---|
| E.SYS | EEPROM, DATA Loss | Needs Repair |
| E.RJC | RJC SENSOR Failure | Needs Repair |
| SP Decimal Flashing | Communication Failure | Check Comm Cable |
| S.OPN | Open Sensor Detected | Check Sensor |
| E.AT | Auto-Tune Timed Out (Over 24 Hours) | Check Process |

## 7. Installation

### 7.1 Dimensions and Panel Cutouts

**PD558**

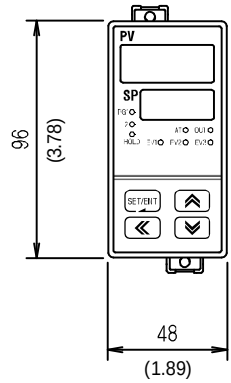
**1/4 DIN**

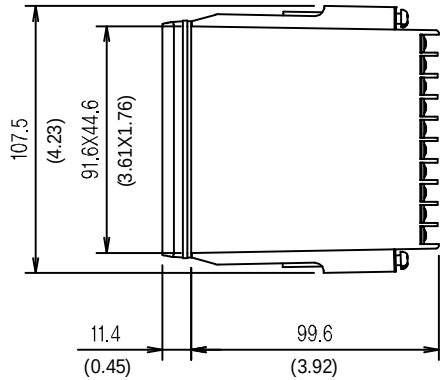


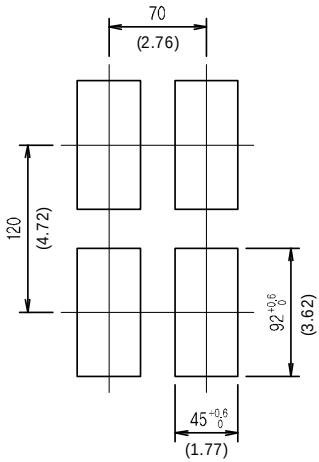

Units: mm
(inch) - for reference only

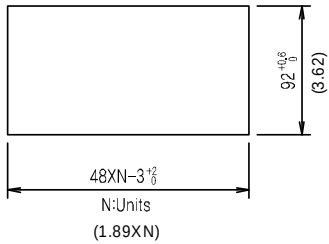
**PD556**

**1/8 (V) DIN**



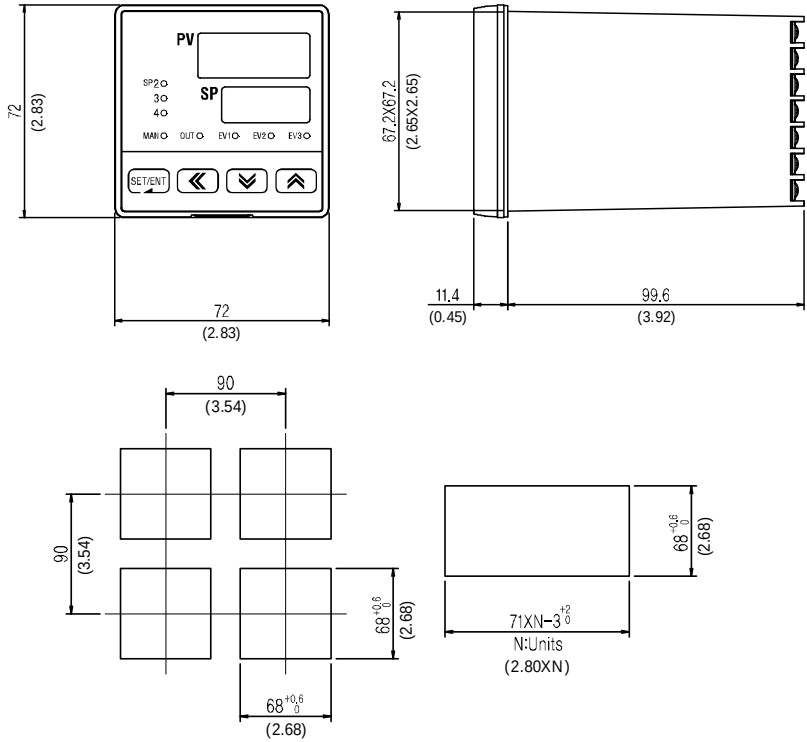




Units: mm
(inch) - for reference only

**PD554**

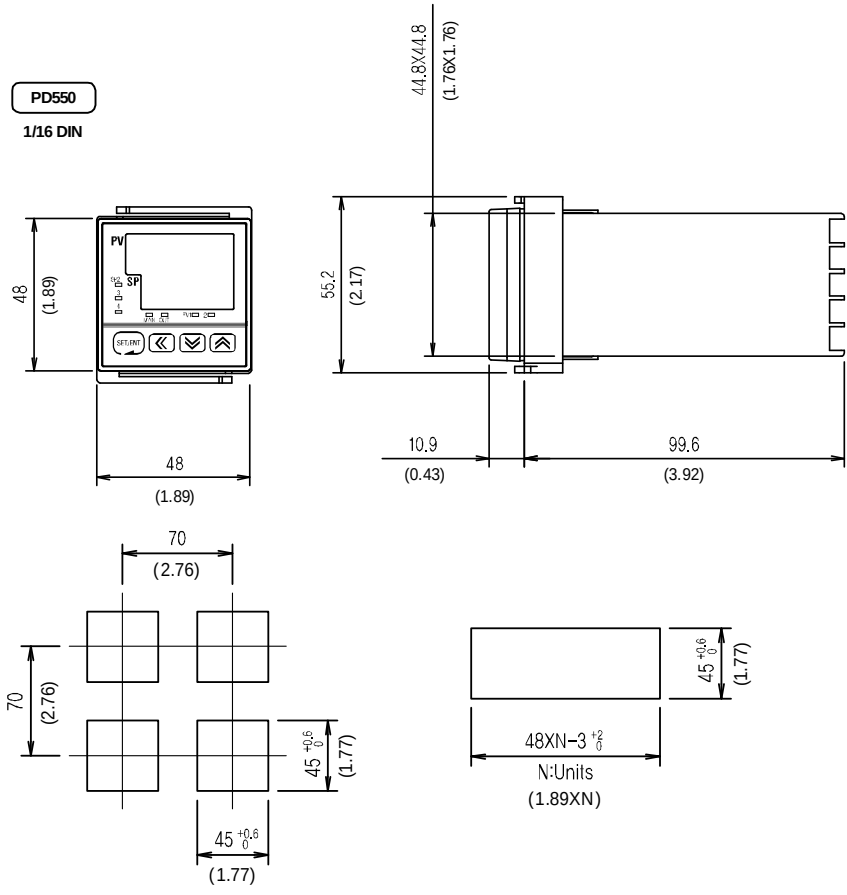
**3/16 DIN**




Units: mm
(inch) - for reference only

**PD550**

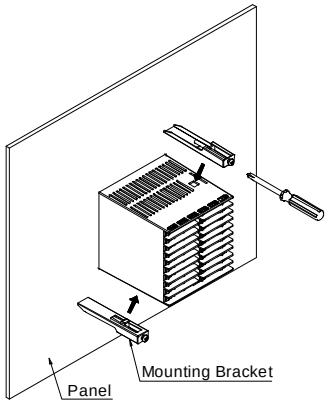
**1/16 DIN**



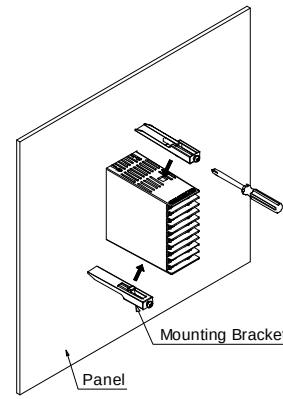

Units: mm
(inch) - for reference only

## 7.2 Panel Mounting

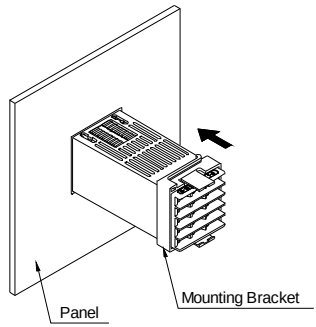
**PD558** **PD554**

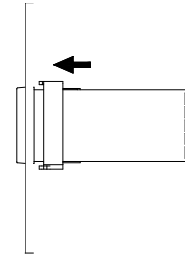



**PD556**




**PD550**



**Installation Steps**

1. Cut the mounting panel. (Refer to 7.1 Dimensions and Panel Cutouts)
2. Insert the controller through the front of the panel rear terminals first.
3. On applicable models, attach the right and left mounting bracket and secure it to the panel.
4. On 1/16 DIN controller models, slide the mounting bracket onto the back of the controller as shown, and slide it forward on the controller until the bracket locks in place, and the controller is secure.

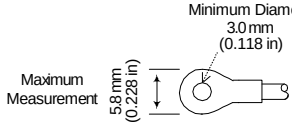
**CAUTION** Do not excessively tighten the mounting bracket screws. Excessive tightening may lead to controller or panel damage.

## 7.3 Power Cable Specification

Make power connections using 0.9 to 2.0 $mm^2$ or 16 AWG vinyl insulated wire. (Voltage rating of 300 VAC)

## 7.4 Terminal Specification

Use M3.5 screw-compatible crimp on terminals with insulating sleeve as shown below.




Note: Inches for reference only.

Use copper conductors only if the terminal is for connection to copper wire only.

**CAUTION**

Always turn off the source circuit breaker and check to ensure the power is off to the controller through the use of a tester prior to working on the wiring terminals.

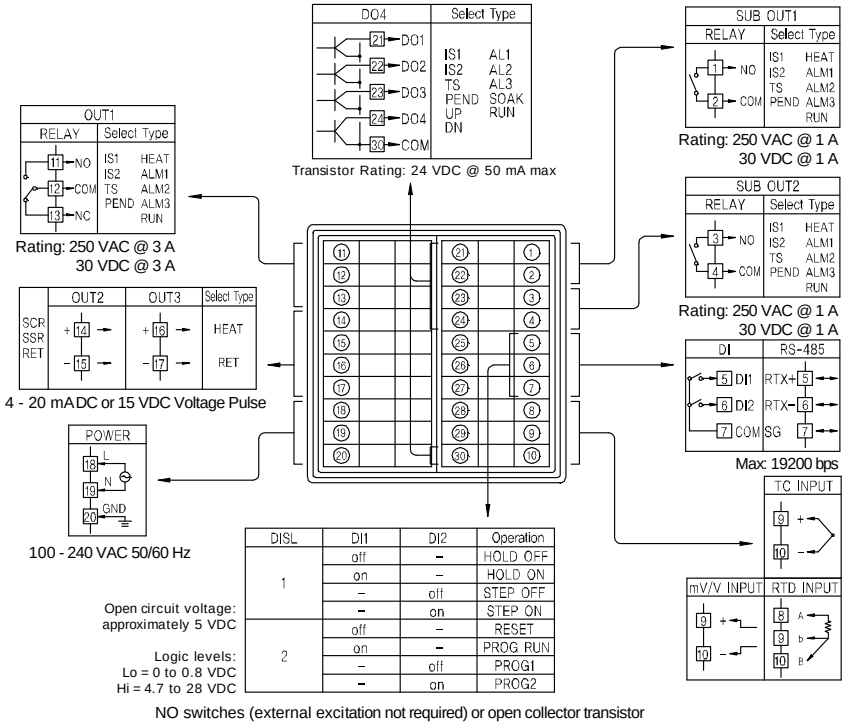
- Never touch the terminals in the rear panel when power is supplied to the controller.
- Be sure to turn off the electric power before wiring any terminals.

**CAUTION**

Bind the wires connected to the controller terminals neatly together in order to prevent electromagnetic interference.

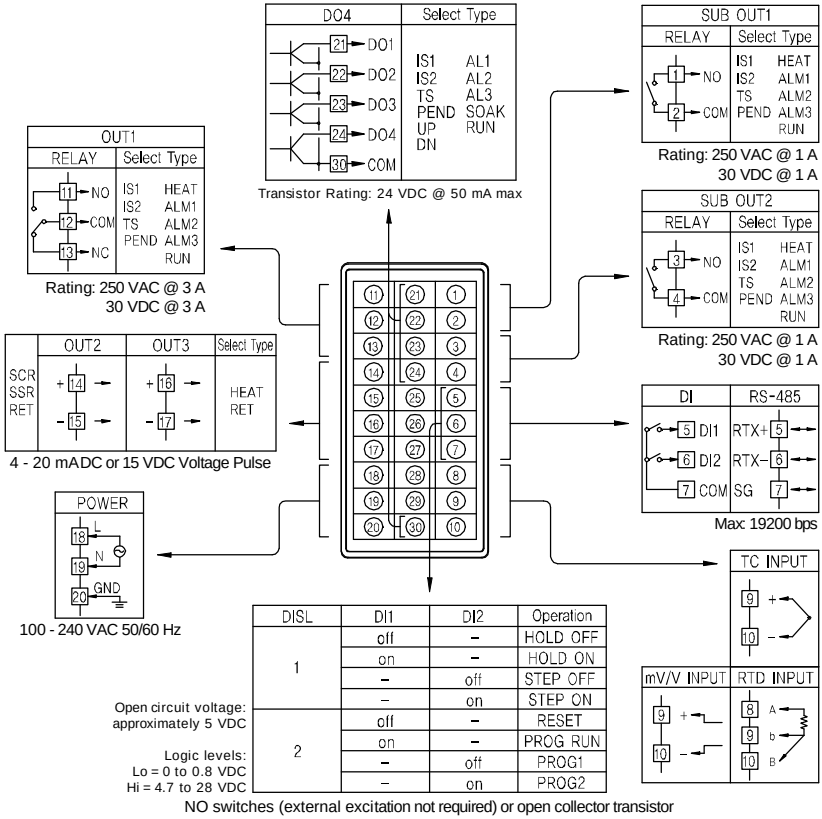
## 7.5 Terminal Assignment, Connections, and Ratings

**PD558**




| DISL | DI1 | DI2 | Operation |
|---|---|---|---|
| 1 | off | – | HOLD OFF |
| | on | – | HOLD ON |
| | – | off | STEP OFF |
| | – | on | STEP ON |
| 2 | off | – | RESET |
| | on | – | PROG RUN |
| | – | off | PROG1 |
| | – | on | PROG2 |

**PD556**

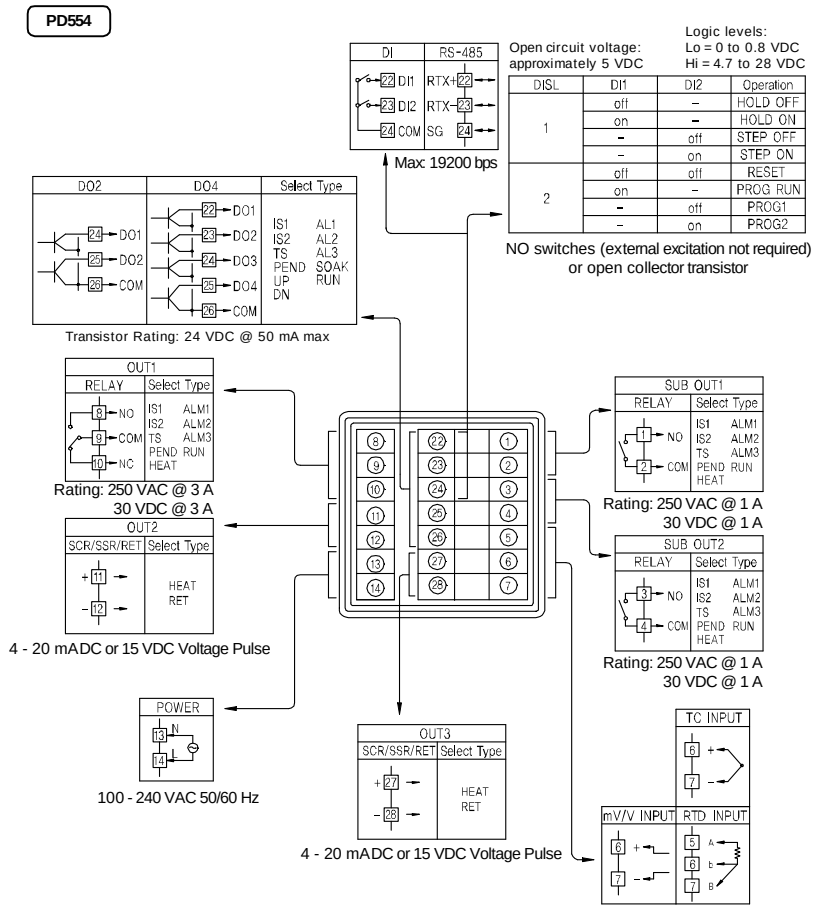



| DISL | DI1 | DI2 | Operation |
|---|---|---|---|
| 1 | off | – | HOLD OFF |
| | on | – | HOLD ON |
| | – | off | STEP OFF |
| | – | on | STEP ON |
| 2 | off | – | RESET |
| | on | – | PROG RUN |
| | – | off | PROG1 |
| | – | on | PROG2 |

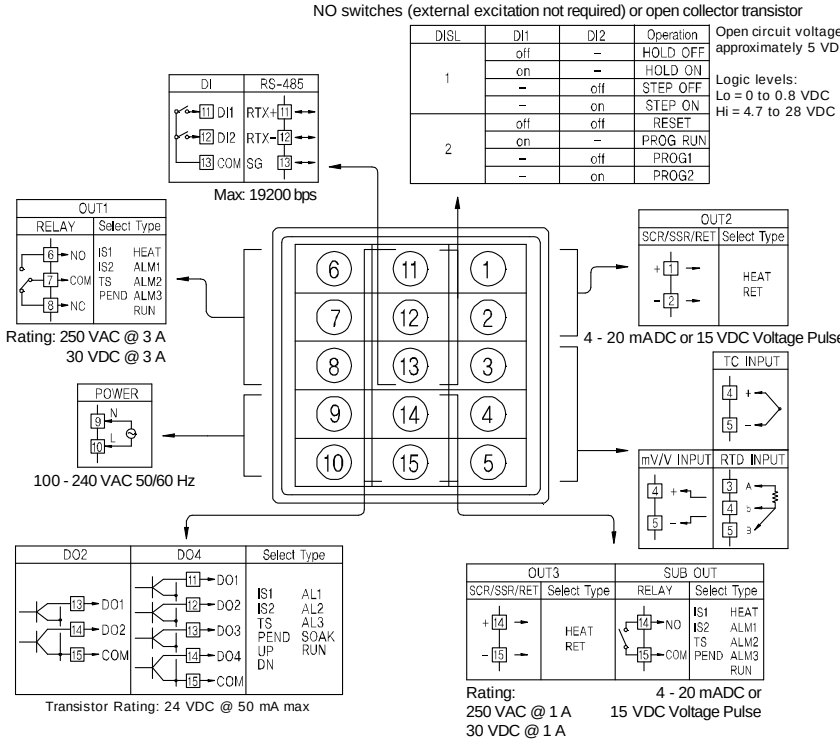
Open circuit voltage: approximately 5 VDC

Logic levels:
Lo = 0 to 0.8 VDC
Hi = 4.7 to 28 VDC

NO switches (external excitation not required) or open collector transistor

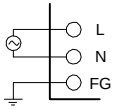

PD554
DI
RS-485
22 DI1
23 DI2
24 COM
RTX+ 22
RTX- 23
SG 24
Max 19200 bps
Open circuit voltage: approximately 5 VDC
Logic levels: Lo = 0 to 0.8 VDC Hi = 4.7 to 28 VDC
DISL | DI1 | DI2 | Operation
1 | off | – | HOLD OFF
on | – | HOLD ON
– | off | STEP OFF
– | on | STEP ON
2 | off | off | RESET
on | – | PROG RUN
– | off | PROG1
– | on | PROG2
NO switches (external excitation not required) or open collector transistor
DO2
DO4
Select Type
24 DO1
25 DO2
26 COM
22 DO1
23 DO2
24 DO3
25 DO4
26 COM
IS1 AL1
IS2 AL2
TS AL3
PEND SOAK
UP RUN
DN
Transistor Rating: 24 VDC @ 50 mA max
OUT1
RELAY
Select Type
8 NO
9 COM
10 NC
IS1 ALM1
IS2 ALM2
TS ALM3
PEND RUN
HEAT
Rating: 250 VAC @ 3 A
30 VDC @ 3 A
OUT2
SCR/SSR/RET
Select Type
+ 11
– 12
HEAT
RET
4 - 20 mADC or 15 VDC Voltage Pulse
POWER
13 N
14 L
100 - 240 VAC 50/60 Hz
OUT3
SCR/SSR/RET
Select Type
+ 27
– 28
HEAT
RET
4 - 20 mADC or 15 VDC Voltage Pulse
SUB OUT1
RELAY
Select Type
1 NO
2 COM
IS1 ALM1
IS2 ALM2
TS ALM3
PEND RUN
HEAT
Rating: 250 VAC @ 1 A
30 VDC @ 1 A
SUB OUT2
RELAY
Select Type
3 NO
4 COM
IS1 ALM1
IS2 ALM2
TS ALM3
PEND RUN
HEAT
Rating: 250 VAC @ 1 A
30 VDC @ 1 A
TC INPUT
6 +
7 –
mV/V INPUT
RTD INPUT
6 +
7 –
5 A
6 b
7 B

**PD550**


NO switches (external excitation not required) or open collector transistor
DISL | DI1 | DI2 | Operation
1 | off | – | HOLD OFF
1 | on | – | HOLD ON
1 | – | off | STEP OFF
1 | – | on | STEP ON
2 | off | off | RESET
2 | on | – | PROG RUN
2 | – | off | PROG1
2 | – | on | PROG2
Open circuit voltage: approximately 5 VDC
Logic levels:
Lo = 0 to 0.8 VDC
Hi = 4.7 to 28 VDC
DI
RS-485
11 DI1
12 DI2
13 COM
RTX+ 11
RTX- 12
SG 13
Max: 19200 bps
OUT1
RELAY
Select Type
6 NO
7 COM
8 NC
IS1 HEAT
IS2 ALM1
TS ALM2
PEND ALM3
RUN
Rating: 250 VAC @ 3 A
30 VDC @ 3 A
OUT2
SCR/SSR/RET
Select Type
+ 1
- 2
HEAT
RET
4 - 20 mADC or 15 VDC Voltage Pulse
TC INPUT
4 +
5 -
mV/V INPUT
RTD INPUT
4 +
5 -
3 A
4 B
5 B
POWER
9 N
10 L
100 - 240 VAC 50/60 Hz
DO2
DO4
Select Type
13 DO1
14 DO2
15 COM
11 DO1
12 DO2
13 DO3
14 DO4
15 COM
IS1 AL1
IS2 AL2
TS AL3
PEND SOAK
UP RUN
DN
Transistor Rating: 24 VDC @ 50 mA max
OUT3
SCR/SSR/RET
Select Type
+ 14
- 15
HEAT
RET
SUB OUT
RELAY
Select Type
14 NO
15 COM
IS1 HEAT
IS2 ALM1
TS ALM2
PEND ALM3
RUN
Rating:
250 VAC @ 1 A
30 VDC @ 1 A
4 - 20 mADC or
15 VDC Voltage Pulse

## 7.6 Grounding and Power Cable Connection

- Use a thick grounding cable of at least 2 $mm^2$ or 14 AWG and shorter than 20 m (approximately 22 ft) for class-3 grounding or better with a grounding resistance of less than 100 Ω.
- Be sure to ground from the grounding terminal to an independent grounding point. (1 point grounding)
- Use 0.9 to 2.0 $mm^2$ or 16 AWG vinyl insulated wire (Voltage rating 300VAC) or thicker for power cable connection.




**CAUTION** Be sure to connect L (Hot), N (neutral), and GND (ground) as indicated. Failure to wire the power and ground as indicated could result in damage to the controller.

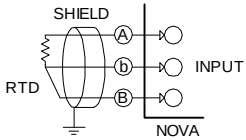
**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

**CAUTION**

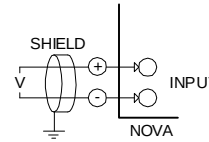
- Be sure to connect to correct polarities. Connecting to a wrong polarity may cause damage or malfunction.
- Use shielded wires and ground the shielding to an independent grounding point.
- Keep the input signal and output wiring as far as possible away from the power and ground circuit.
- Use a wire with low conductive resistance and no three-wire resistance differential.

## 7.7 Signal Input Connection

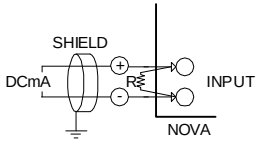
(1) RTD Input




(2) DC Voltage Input




(3) DC Current Input



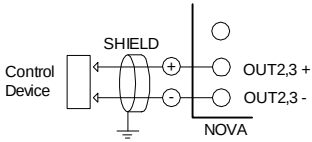

To accept a 4-20 mA signal, select 0.4 to 2.0 VDC input and connect a 100 Ω resistor across the input terminals as shown.

## 7.8 Analog Output Connection

**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

**CAUTION**
- Be sure to connect to correct polarities. Connecting to a wrong polarity may cause a controller malfunction.
- Use shielded wires for the wiring and connect independently to ground (1 point grounding).

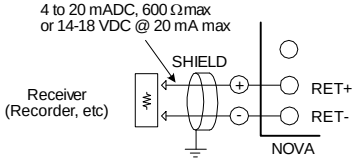
(1) Voltage Pulse Output (SSR) / Current Output (SCR)




SCR : 4 to 20 mADC, 600 Ω maximum
SSR : 12 VDC min, 600 Ω minimum

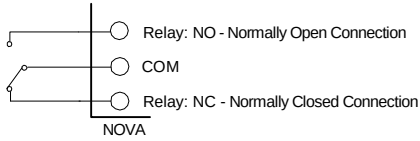
**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

(2) Retransmitting Output (RET)




**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

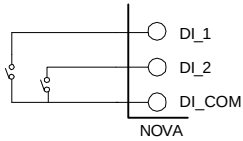
## 7.9 Relay Output Connection (RELAY)



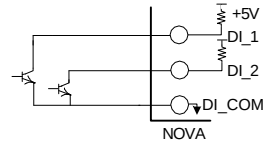

**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

## 7.10 Digital Input Connection (DI)

- Use a no-voltage contact switch such as relay.
- The controller supplies the needed voltage (approx. 5 VDC) and current (approx. 1 mA) to trigger the input.
- When using an Open Collector (TR) as a trigger, use one with a 2V or lower voltage rating when "on" and 100 μA or less leakage current when it is OFF.




▲ Relay Contact Connection




▲ Transistor Contact Connection

**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

## 7.11 Use of an External Relay

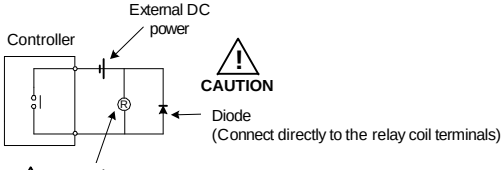
Switching Inductive Loads

When using switching in ductive loads, the use of RC networks (snubbers) for AC loads or diodes for DC loads is recommended to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. Suppression can be obtained with resistor-capacitor (RC) networks or diodes assembled by the user or purchased as complete assemblies.
For AC loads, choose R and C as follows:
R: 0.5 to 1 Ω for each volt across the contact
C: 0.5 to 1 μF for each amp through closed contacts

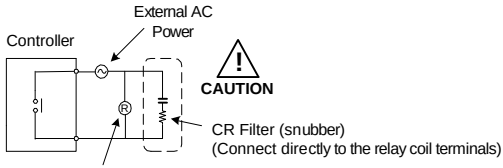
Notes:
1. Use capacitors rated for 250 VAC.
2. RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
3. RC networks are available from Precision Digital and should be applied to each relay contact switching an inductive load. Part number: PDX6901

**CAUTION** If the load inductance is over the controller specifications, the output may need a RC filter (snubber) or diode to properly handle frequent relay switching operations.

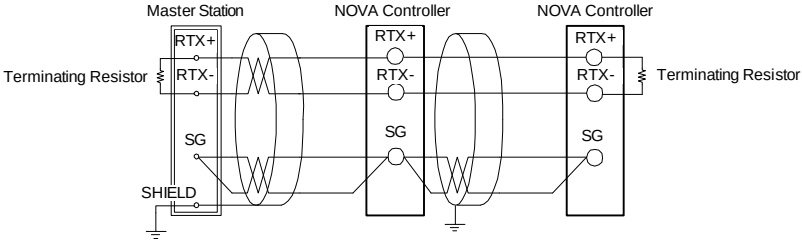
(1) DC Auxiliary Relay




(2) AC Auxiliary Relay




## 7.12 Communication Wiring (RS-485)




- Up to 31 slave controllers (Nova series controllers equipped with the RS-485 serial communication option) can be connected.
- Be sure to connect terminating resistors (220 Ω, 1/4 W) to slave and master controllers at communication channel ends as shown above.

**CAUTION** To prevent electric shock, be sure to turn off power to the Nova Controller and the source circuit breaker before wiring.

**Table of D-Registers:**
The following data registers are used to direct the US1 and US2 commands or for Modbus communication.

| NO. | PROCESS | FUNCTION | SET POINT | SIGNAL | ALARM | PID | IN/OUT |
|---|---|---|---|---|---|---|---|
| | 0 | 100 | 200 | 300 | 400 | 500 | 600 |
| 0 | | | | | | | |
| 1 | NPV | | | 1.IST | ALT1 | ARW | IN-T |
| 2 | NSP | | | 1.ISB | ALT2 | FUZZY | INT-U |
| 3 | TSP | | | 1.ISH | ALT3 | C.MOD | IN.RH |
| 4 | | | | 1.ISL | | | IN.RL |
| 5 | | | | 1.ISD | | | IN.DP |
| 6 | MVOUT | | | 2.IST | AL-1 | | IN.SH |
| 7 | | | | 2.ISB | AL-2 | | IN.SL |
| 8 | | | | 2.ISH | AL-3 | | IN.FL |
| 9 | PIDNO | | | 2.ISL | | | BSL |
| 10 | NOWSTS | | | 2.ISD | | | RSL |
| 11 | | F.KEY, RST/P1/P2 | | DO1 | A1DB | 1.P | BSP1 |
| 12 | | HOLD,OFF/ON | | DO2 | A2DB | 1.I | BSP2 |
| 13 | | STEP,OFF/ON | | DO3 | A3DB | 1.D | BSP3 |
| 14 | ALSTS | | | DO4 | | 1.MR | |
| 15 | | | | | | | BS0 |
| 16 | | | | | A1DY | | BS1 |
| 17 | SIGNAL.STS | | | | A2DY | | BS2 |
| 18 | | | | | A3DY | | BS3 |
| 19 | ERROR | | | | | RP1 | BS4 |
| 20 | | | | | | | |
| 21 | | AT | | | AL1.H | 2.P | OUT1 |
| 22 | | AT-G | | | AL2.H | 2.I | OUT2 |
| 23 | | | | | AL3.H | 2.D | OUT3 |
| 24 | | | | | | 2.MR | |
| 25 | PTNO | | | | | | SUB1 |
| 26 | SEG.NO | | | | AL1.L | | SUB2 |
| 27 | END.SEG.NO | | | | AL2.L | | |
| 28 | RUN.TIME | | | | AL3.L | | |
| 29 | SET.TIME | | | | | RP2 | |
| 30 | | | | | | | |
| 31 | LINK.CODE | | | | | 3.P | HEAT2 |
| 32 | RPT | | | | | 3.I | |
| 33 | RST | PE-TM | | | | 3.D | HEAT3 |
| 34 | REN | | | | | 3.MR | |
| 35 | | US1 | | | | | |
| 36 | WAIT.TIME | US2 | | | | | |
| 37 | | LOCK | | | | | O.ACT |
| 38 | | DI.SL | | | | | CT |
| 39 | | DSP.H | | | | RHY | |
| 40 | | DSP.L | | | | | |
| 41 | | | | | | 4.P | OH |
| 42 | | | | | | 4.I | OL |
| 43 | | | | | | 4.D | |

| NO. | PROCESS | FUNCTION | SET POINT | SIGNAL | ALARM | PID | IN/OUT |
|---|---|---|---|---|---|---|---|
| | 0 | 100 | 200 | 300 | 400 | 500 | 600 |
| 44 | | | | | | 4.MR | |
| 45 | | | | | | | |
| 46 | | | | | | | PO |
| 47 | | | | | | | |
| 48 | | | | | | | |
| 49 | | | | | | RDV | |
| 50 | | | | | | | |
| 51 | | | | | | | RET |
| 52 | | | | | | | RETH |
| 53 | U | | | | | | RETL |
| 54 | s | | | | | | |
| 55 | e | | | | | | |
| 56 | r | | | | | | |
| 57 | | | | | | | |
| 58 | A | | | | | | |
| 59 | r | | | | | | |
| 60 | e | | | | | | |
| 61 | a | | | | | | COM.P |
| 62 | | | | | | | BAUD |
| 63 | | | | | | | PRTY |
| 64 | | | | | | | SBIT |
| 65 | | | | | | | DLEN |
| 66 | | | | | | | ADDR |
| 67 | | | | | | | RP.TM |
| 68 | | | | | | | |
| 69 | | | | | | | |
| 70 | | | | | | | |
| 71 | | | | | | | |
| 72 | | | | | | | |
| 73 | | | | | | | |
| 74 | | | | | | | |
| 75 | | | | | | | |
| 76 | | | | | | | |
| 77 | | | | | | | |
| 78 | | | | | | | |
| 79 | | | | | | | |
| 80 | | | | | | | |
| 81 | | | | | | | |
| 82 | | | | | | | |
| 83 | | | | | | | |
| 84 | | | | | | | |
| 85 | | | | | | | |
| 86 | | | | | | | |
| 87 | | | | | | | |

| NO. | PROCESS | FUNCTION | SET POINT | SIGNAL | ALARM | PID | IN/OUT |
|---|---|---|---|---|---|---|---|
| | 0 | 100 | 200 | 300 | 400 | 500 | 600 |
| 88 | | | | | | | |
| 89 | | | | | | | |
| 90 | | | | | | | |
| 91 | | | | | | | |
| 92 | | | | | | | |
| 93 | | | | | | | |
| 94 | | | | | | | |
| 95 | | | | | | | |
| 96 | | | | | | | |
| 97 | | | | | | | |
| 98 | | | | | | | |
| 99 | | | | | | | |

NOTE

Read Only Location

| NO. | RESERVED | RESERVED | RESERVED | PT INFO | PT1 | PT2 | RESERVED |
|---|---|---|---|---|---|---|---|
| | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 |
| 0 | | | | | | | |
| 1 | | | | TMU | 1.LC | 2.LC | |
| 2 | | | | STC | 1.SSP | 2.SSP | |
| 3 | | | | WZ | | | |
| 4 | | | | WTM | 1.SP1 | 2.SP1 | |
| 5 | | | | | 1.TM1 | 2.TM1 | |
| 6 | | | | | 1.TS1 | 2.TS1 | |
| 7 | | | | | 1.SP2 | 2.SP2 | |
| 8 | | | | | 1.TM2 | 2.TM2 | |
| 9 | | | | | 1.TS2 | 2.TS2 | |
| 10 | | | | | 1.SP3 | 2.SP3 | |
| 11 | | | | | 1.TM3 | 2.TM3 | |
| 12 | | | | | 1.TS3 | 2.TS3 | |
| 13 | | | | | 1.SP4 | 2.SP4 | |
| 14 | | | | | 1.TM4 | 2.TM4 | |
| 15 | | | | | 1.TS4 | 2.TS4 | |
| 16 | | | | | 1.SP5 | 2.SP5 | |
| 17 | | | | | 1.TM5 | 2.TM5 | |
| 18 | | | | | 1.TS5 | 2.TS5 | |
| 19 | | | | | 1.SP6 | 2.SP6 | |
| 20 | | | | | 1.TM6 | 2.TM6 | |
| 21 | | | | | 1.TS6 | 2.TS6 | |
| 22 | | | | | 1.SP7 | 2.SP7 | |
| 23 | | | | | 1.TM7 | 2.TM7 | |
| 24 | | | | | 1.TS7 | 2.TS7 | |
| 25 | | | | | 1.SP8 | 2.SP8 | |
| 26 | | | | | 1.TM8 | 2.TM8 | |
| 27 | | | | | 1.TS8 | 2.TS8 | |

| NO. | RESERVED | RESERVED | RESERVED | PT INFO | PT1 | PT2 | RESERVED |
|---|---|---|---|---|---|---|---|
| | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 |
| 28 | | | | | 1.SP9 | 2.SP9 | |
| 29 | | | | | 1.TM9 | 2.TM9 | |
| 30 | | | | | 1.TS9 | 2.TS9 | |
| 31 | | | | | 1.SPA | 2.SPA | |
| 32 | | | | | 1.TMA | 2.TMA | |
| 33 | | | | | 1.TSA | 2.TSA | |
| 34 | | | | | 1.SPB | 2.SPB | |
| 35 | | | | | 1.TMB | 2.TMB | |
| 36 | | | | | 1.TSB | 2.TSB | |
| 37 | | | | | 1.SPC | 2.SPC | |
| 38 | | | | | 1.TMC | 2.TMC | |
| 39 | | | | | 1.TSC | 2.TSC | |
| 40 | | | | | 1.SPD | 2.SPD | |
| 41 | | | | | 1.TMD | 2.TMD | |
| 42 | | | | | 1.TSD | 2.TSD | |
| 43 | | | | | 1.SPE | 2.SPE | |
| 44 | | | | | 1.TME | 2.TME | |
| 45 | | | | | 1.TSE | 2.TSE | |
| 46 | | | | | 1.SPF | 2.SPF | |
| 47 | | | | | 1.TMF | 2.TMF | |
| 48 | | | | | 1.TSF | 2.TSF | |
| 49 | | | | | | | |
| 50 | | | | | | | |
| 51 | | | | | 1.RPT | 2.RPT | |
| 52 | | | | | 1.RST | 2.RST | |
| 53 | | | | | 1.REN | 2.REN | |
| 54 | | | | | | | |
| 55 | | | | | | | |
| 56 | | | | | | | |
| 57 | | | | | | | |
| 58 | | | | | | | |
| 59 | | | | | | | |
| 60 | | | | | | | |
| 61 | | | | | | | |
| 62 | | | | | | | |
| 63 | | | | | | | |
| 64 | | | | | | | |
| 65 | | | | | | | |
| 66 | | | | | | | |
| 67 | | | | | | | |
| 68 | | | | | | | |
| 69 | | | | | | | |
| 70 | | | | | | | |
| 71 | | | | | | | |

| NO. | RESERVED | RESERVED | RESERVED | PT INFO | PT1 | PT2 | RESERVED |
|---|---|---|---|---|---|---|---|
| | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 |
| 72 | | | | | | | |
| 73 | | | | | | | |
| 74 | | | | | | | |
| 75 | | | | | | | |
| 76 | | | | | | | |
| 77 | | | | | | | |
| 78 | | | | | | | |
| 79 | | | | | | | |
| 80 | | | | | | | |
| 81 | | | | | | | |
| 82 | | | | | | | |
| 83 | | | | | | | |
| 84 | | | | | | | |
| 85 | | | | | | | |
| 86 | | | | | | | |
| 87 | | | | | | | |
| 88 | | | | | | | |
| 89 | | | | | | | |
| 90 | | | | | | | |
| 91 | | | | | | | |
| 92 | | | | | | | |
| 93 | | | | | | | |
| 94 | | | | | | | |
| 95 | | | | | | | |
| 96 | | | | | | | |
| 97 | | | | | | | |
| 98 | | | | | | | |
| 99 | | | | | | | |

# Notes

NOTE

## Warranty and Return Information

Precision Digital warrants this product to be free from material defects and workmanship under normal use and service for three years.

Please contact Precision Digital Technical Support at (800) 610-5239 or e-mail at *support@predig.com* prior to any product return. When Technical Support determines a product should be returned, a Return Material Authorization (RMA) # which must be included on the return shipping label. Please also include the reason for return, date of purchase, contact name, and how to contact. Products returned for reasons other than repair may be subject to a restocking fee. Any returns under a warranty claim should be returned freight prepaid. Upon warranty confirmation Precision Digital will repair or replace and return the unit at no charge via UPS Ground. Other shipping is available upon request and at customer expense. All product returns should be shipped to:
Return Authorization # _____
Precision Digital, 89 October Hill Road Ste 5, Holliston, MA 01746 USA
Attention: Technical Support

Precision Digital Technical Support is trained and eager to serve you. We have found most start-up problems to be the result of incorrect signal connections and/or programming. Most often Precision Digital Technical Support can quickly correct these issues over the telephone.

# How to Contact Precision Digital

- For Technical Support
  Call: (800) 610-5239 or (508) 655-7300
  Fax: (508) 655-8990
  Email: support@predig.com

- For Sales Support or to place an order please
  Call: (800) 343-1001 or (508) 655-7300
  Fax: (508) 655-8990
  Email: sales@predig.com

- For the latest version of this manual, please visit
  **www.predig.com**