



Temperature Phoenix II P20 PID Controller

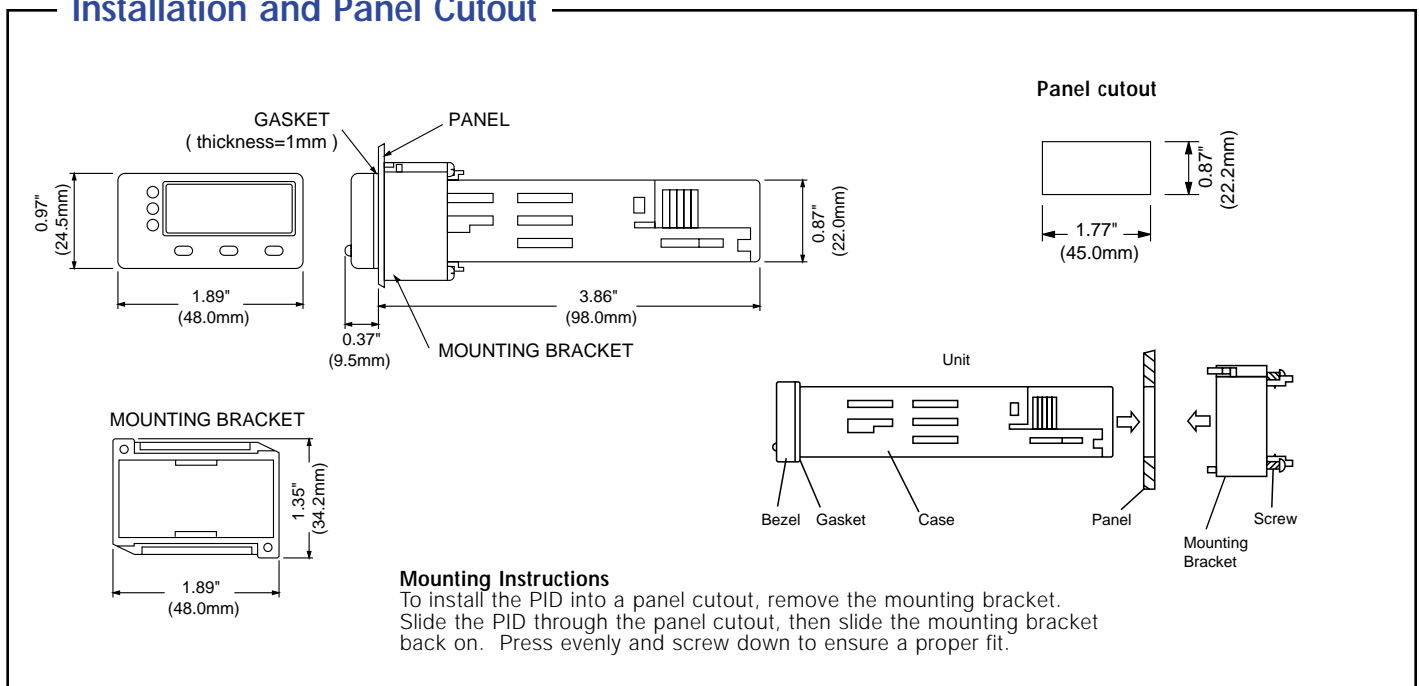
- Fuzzy Logic With Auto-Tune to Optimize Control and Eliminate Overshoot
- Eight-Segment Ramp/Soak is Standard
- Optional Features Include: 2nd Control Output and High/Low Alarm
- Unwanted Parameters Can be Hidden From the Operator
- Screw Terminal Connectors for Easy Installation
- Rugged, High-Impact Plastic Case Fits Standard 1/32 DIN Cutout
- NEMA 4X-Rated Front Panel
- Input Variety: Choose from 14 Thermocouple, RTD, and Process Inputs
- CE certified, UL and cUL recognized



The P20 is a small, yet sophisticated PID controller. By using fuzzy logic and PID auto-tuning, this controller virtually eliminates overshoot and ensures a process remains at set point. And provides this operation using only a standard 1/32 DIN cutout, with a depth of 4" behind the panel. Mounting brackets with screw-down termination and bezel gasket are standard for easy mounting installation and provide NEMA 4X-rated protection against dust and moisture.

The P20 is powered from 85-264 VAC or an optional 24V/DC and offers programmable 8-segment ramp/soak function, an adjustable set point range, and a programmable decimal point as standard features. The P20 also has multiple-input capability, relay and SSR drive outputs, and many levels of security to prevent unauthorized use. These features combine to form a versatile PID controller capable of performing a variety of temperature control functions.

Installation and Panel Cutout



Specifications

DISPLAY

Type: 4 digit, 7 segment green LED

Height: .PV/SV, .32 (8.12mm)

Decimal point: 3 position user-programmable

Overrange indication: Most significant digit = "1"

Polarity: Auto with "-" indication, "+" implied

POWER REQUIREMENTS

AC Volt: 85-264 VAC @40-440 Hz

DC Volt: 24VDC/AC

Power Consumption:

100 VAC: 5VA or less

240 VAC: 8VA or less

Dielectric Strength: 1500VAC for 1 min between power source terminal and input and output terminals. 500VAC for 1 min at other locations

Isolation Resistance: 20MΩ min. at 500 VDC

Rated Circuit to Ground Voltage: 750 VRMS

ACCURACY @ 25°C

0.5% FS ±1 digit

R T/C: 0-400°C ±1% FS ± 1 digit

B T/C: 0-500°C ±5% FS ± 1 digit

ENVIRONMENTAL

Operating Temperature: -10 to 55°C

Storage Temperature: -20 to 60°C

Relative Humidity: 0 to 90% non-condensing @ 40°C

Temperature Coefficient: (± 0.02% of input ± 0.2 digits) / °C

Warmup time: 30 minutes

NOISE REJECTION

NMRR: 50 dB, 50/60 Hz

CMRR: (w/1 KΩ unbalanced @ 60 Hz): 140 dB min

CONTROL FUNCTIONS

Fuzzy Control: Basic actions in PID control have been realized according to fuzzy control rules.

PID Control W/Auto-Tuning:

Proportional band (P) 0-999.9% FS (ON/OFF action when P=0)

Reset Time (I) 0-3200 sec (No integral action when I=0)

Rate time (D) 0-999.9 sec (No derivative action when D=0)

Sampling Cycle: 0.5 sec

Output Cycle: 1-150 sec

Hysteresis Width: 0-50% (ON/OFF control)

Ramping SV: 8-segment ramp/soak (SV: 0-100% FS/Time: 0-99 hr. 59 min)

Power on start of ramping SV is possible

MECHANICAL

Bezel: 1.89" x .96" x .37" (48mm x 24.5mm x 95mm)

Depth: 4"

Panel Cutout: 1.77" x .87" (45mm x 22.2mm)

Weight: 3.53oz (100g)

INPUT RATINGS

Input Signal	Input Range (°C)	Input Range (°F)	Remarks
Thermocouple			
J	0-800	32-1472	Cold Junction compensating function built-in
K	0-1200	32-2192	
R	0-1600	32-2912	
B	0-1800	32-3272	
S	0-1600	32-2912	
T	-199-200	328-392	
T	-150-400	-238-752	
E	-199-800	-328-1472	
N	0-1300	32-2372	
PL2	0-1300	32-2372	
RTD			
Pt100	-150-850	-238-1562	Allowable wiring resistance 10 ohms max (per wire)
DC Voltage/Current			
1-5V	Scaling Range: -1999 to 9999 Engineering Units		For current input, use the 250Ω resistor to obtain 1-5V or 0-5V DC input
0-5V			
4-20mA			
0-20mA			

OUTPUT

Relay Contact Output: 220VAC/30VDC 2A (resistive load)

SSR Driver Output: On: 5VDC typ. (5.5V ± 1V), 20mA max.

Off: 0.5V or less

Alarm Output/2nd Control Output: 220VAC/30VDC 2A (resistive load)

Alarm: Configurable from the front panel keys as Absolute, Deviation, Zone, or Combination alarms with or without the hold feature.

Programming

The P20 controller programming menu consists of three blocks - SET POINT MENU, PROGRAMMING MENU, and CONFIGURATION MENU. At power up, the controller will be in the operational mode, and process variable (PV) and set point variable (SV) will be displayed. PV is the variable that is being controlled, and it is not programmable. When setting the parameters, turn off the power to the load (operating equipment) to ensure safety. Since it takes 30 minutes for the unit to stabilize in terms of temperature, all measurements should be carried out at least 30 minutes after the power is turned on. Option-related features are displayed only when the options are used.

Viewing and Setting Parameters

The data is automatically registered in 3 seconds after the setting. It can also be registered by pressing the SEL key.

How to set Set Point Value (SV)

Operation

1. Power on.
2. Press UP or DOWN key

Display

Operational mode
-SV value changes accordingly

SET POINT MENU

Operation

1. Operational mode
2. Press SEL key for 3 seconds
3. Press UP or DOWN key
4. Press SEL key to access the next parameter
5. Press SEL key for 3 secs.

Display

-PV, SV
-'H' LED blinks; AH data (for units with alarm option)
-AH data changes
-'L' LED blinks, ...
-Operational mode

PROGRAMMING MENU

Operation

1. Operational mode
2. Press SEL key for 7 seconds
3. Release and press SEL key again
4. Press UP or DOWN key
5. Press SEL key once
6. Press DOWN key to scroll down the menu
7. Press SEL key for 3 secs.

Display

-PV, SV
-3 seconds later, "H" LED blinks
7 seconds later, "P"
-"P" data
-"P" data changes accordingly
-"P"
-"i", "d", ... "Mod"
-Operational mode

CONFIGURATION PRESET MENU

Operation

1. Operational mode
2. Press SEL key for 9 seconds
3. Release and press SEL key again
4. Press UP or DOWN key
5. Press SEL KEY ONCE
6. Press DOWN key to scroll down the menu
7. Press SEL key for 3 secs.

Display

-PV, SV
-3 seconds later, "H" LED blinks
7 seconds later, "P"
9 seconds later, "P-n1"
-"P-n1" data
-"P-n1" data changed
-"P-N1"
-"P-df", "dsp7"
-Operational mode

Quick Reference

SET POINT MENU						Parameter		Range	Description	Default settings	DSP settings
Parameter		Range	Description	Default Settings	DSP Settings	P-SU	P-SU				
roFF-rHLd		roFF/rrUn/rHLd	Ramp/soak command	roFF	dSP1-1	P-dP	P-dP	0 - 2	Decimal point position	0	dSP3-16
H	AH	0 - 100% FS	High Alarm Set Point	10	dSP1-2	P-AH	P-AH	0 - 11	Alarm Type 1 code	5	dSP3-32
HB	Hb	0.0 - 50.0A	Heater break alarm set point	0.0	dSP1-8	PV0F	PVOF	-10 - 10% FS	PV offset	0	dSP3-128
AT	AT	0 - 2	Auto-tuning	0	dSP1-16	SV0F	SVOF	-50 - 50% FS	SV offset	0	dSP4-1
LoC	Loc	0 - 2	Lock-out	0	dSP1-32	P-F	P-F	°C/°F	°C/°F selection	†	dSP4-2
PROGRAMMING MENU						STAT	STAT	--	Ramp/soak status	oFF	dSP4-4
P	P	0.0 - 999.9% FS	Proportional band	5.0	dSP1-128	SV-1	SV-1	0 - 100% FS	1st set point	0% FS	dSP4-8
I	I	0 - 3200 sec	Integral time	240	dSP2-1	TM1r	TM1r	0 - 99hr 59min	1st ramping time	0.00	dSP4-16
D	D	0.0 - 999.9 sec	Derivative time	60	dSP2-2	TM1S	TM1S	0 - 99hr 59min	1st soaking time	0.00	dSP4-32
TC	TC	1 - 150 sec	Cycle Time (output #1)	†	dSP2-4	SV-2	SV-2	0 - 100% FS	2nd set point	0% FS	dSP4-64
HYS	HYS	0 - 50% FS	Hysteresis	1	dSP2-8	TM2r	TM2r	0 - 99hr 59min	2nd ramping time	0.00	dSP4-128
TC2	TC2	1 - 150 sec	Cycle Time (output #2)	†	dSP2-16	TM2S	TM2S	0 - 99hr 59min	2nd soaking time	0.00	dSP5-1
Cool	Cool	0.0 - 100.0	Proportional band coefficient for cooling	1.0	dSP2-32	SV-3	SV-3	0 - 100% FS	3rd set point	0% FS	dSP5-2
db	db	-50.0 - 50.0% FS	Deadband / Overlap	0.0	dSP2-64	TM3r	TM3r	0 - 99hr 59min	3rd ramping time	0.00	dSP5-4
bAL	bAL	0 - 100%	Balance	0.0/50.0	dSP2-128	TM3S	TM3S	0 - 99hr 59min	3rd soaking time	0.00	dSP5-8
Ar	Ar	0 - 100% FS	Anti-reset wind-up	100% FS	dSP3-1	SV-4	SV-4	0 - 100% FS	4th set point	0% FS	dSP5-16
P-n2	P-n2	0 - 16	Input type code	†	dSP3-2	TM4r	TM4r	0 - 99hr 59min	4th ramping time	0.00	dSP5-32
P-SL	P-SL	-1999 - 9999	Lower range of input	0% FS	dSP3-4	TM4S	TM4S	0 - 99hr 59min	4th soaking time	0.00	dSP5-64
						MOD	MOD	0 - 15	Ramp/soak Mode code	0	dSP5-128

† Based on the model

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CONFIGURATION MENU					
Parameter		Range	Description	Default Settings	DSP Settings
P-n1	P-n1	0 -19	Control Action code	†	dSP6-2
P-dF	P-dF	0.0 - 900.0 sec	Input Filter Constant	5.0	dSP6-4
P-AH	P-AH	0 - 50% FS	Alarm Hysteresis	†	dSP6-8
rCJ	rCJ	-	N/A	ON	dSP-6-16
PLC1	PLC1	-	N/A	-3.0	dSP6-32
PHC1	PHC1	-	N/A	103.0	dSP6-64
PLC2	PLC2	-	N/A	-3.0	dSP6-128
PHC2	PHC2	-	N/A	103.0	dSP7-1
PCUT	PCUT	-	N/A	0	dSP7-2
FUZY	FUZY	OFF/ON	Fuzzy control	OFF	dSP7-4
GAIN	GAIN	-	N/A	1	dSP7-8
ADJ0	ADJ0	-	Zero calibration	0	dSP7-16
ADJ5	ADJ5	-	Span calibration	0	dSP7-32
OUT	OUT	-	N/A	-3.0	dSP7-64
dSP1 - 7	dSP1 - 7	0-255	Parameter mask	†	-

† Based on the model

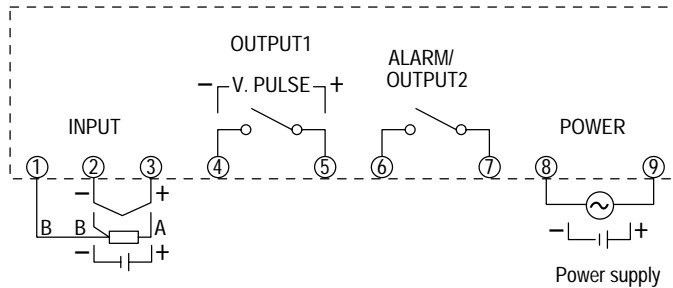
Wiring Diagram

Terminal connection

Warning



Be sure to use the rated power supply voltage and polarity.

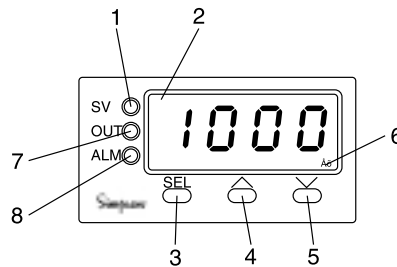


*For current input, install the 250Ω precision resistor (accessory) before using the unit.

Wiring material

1. For terminals 1, 2, 3, use 18-26 gauge wire.
2. For terminals 4-9, use 14-24 gauge wire.

P20 Display



NAME

FUNCTION

- | | | |
|---|---|--|
| 1 | Set value (SV) indication lamp | Comes on when a set value (SV) is displayed. |
| 2 | Process value (PV)/ Set value (SV)/ parameter display | Process value (PV), Set point value (SV), or parameter symbols and codes are displayed. |
| 3 | Select key | To be used when the first, second, or third block parameters are selected. |
| 4 | UP key | Pressing the key once will increase the value by one. By pressing it in succession, the value is continuously incremented. |
| 5 | DOWN key | Pressing the key once will decrease the value by one. By pressing it in succession, the value is continuously decremented. |
| 6 | Autotuning indication lamp | Blinks while the PID auto-tuning is being performed. |
| 7 | Control output indication lamp | Comes on when the control output is ON. |
| 8 | Alarm indication lamp | Comes on when the alarm is activated. Blinks while the alarm is being set. |

Auto Tuning

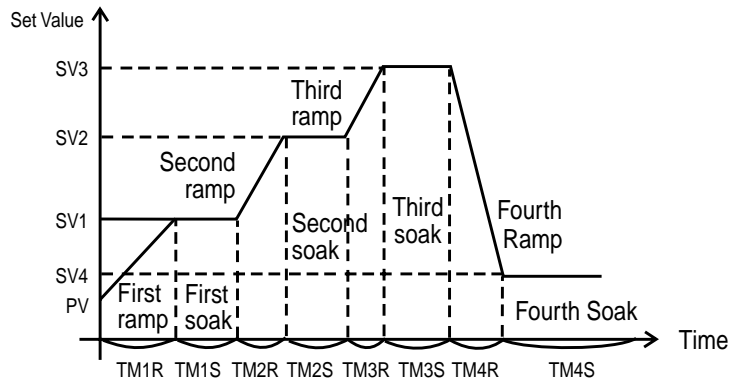
By Auto Tuning, the controller selects what it calculates to be the optimum PID and balance parameters for a particular process and stores them in memory for future use. The controller will not need to go through auto-tuning upon each power up, as long as the system requirements and characteristics remain the same. The auto-tune parameters selected are good only for the process for which it has been auto tuned. If the set point, input device, output device (load), or any portion of your system changes, auto tune must be initiated again.

These factors can upset the auto tuning function:

1. The system is affected by process disturbances external to the control loop. Adjacent heater zones, changing material levels, and exothermic reactions are examples of process disturbances which are external to the control loop.
2. The system is dynamic. The process variable changes quickly. Certain pressure and flow applications would be characterized as very dynamic. Because of how the auto tune function is performed, a dynamic system, when auto tuning, would create considerable overshoot that could jeopardize the process.
3. The system is insulated and cannot cool down in a timely manner. The system retains heat. With such heating systems, the auto tuning function would take a long time to complete and with questionable results.

Ramp / Soak

The Ramp / Soak program automatically changes the set point value with time in accordance with a preset pattern, as shown in the figure. This device allows a maximum of four ramp and four soak segments. Ramp is the region in which SV changes toward the target value. Soak is the region in which the target value is maintained.



Ramp: Region in which the set point changes toward the target value.

Soak: Region in which the set point stays unchanged at the target value.

Note 1: SV cannot be changed while the operation is running or suspended.

Note 2: The use of fuzzy control is inhibited while Ramp/Soak operation is being performed.

Ordering Information

Your Phoenix II PID Controller can be configured by making an entry for each box.

Model P20

P20	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Unit Size	Power Supply	Input Signal	Control Output 1	Control Output 2	Alarm Options
	1/32 DIN <input type="text" value="0"/>	85-265 VAC <input type="text" value="0"/> 24 V AC/DC <input type="text" value="1"/>	Thermocouple/RTD <input type="text" value="1"/> Current/Voltage <input type="text" value="2"/>	Relay <input type="text" value="1"/> SSR <input type="text" value="2"/>	None <input type="text" value="0"/> Relay <input type="text" value="1"/>	None <input type="text" value="0"/> High/Low Alarm* <input type="text" value="1"/>

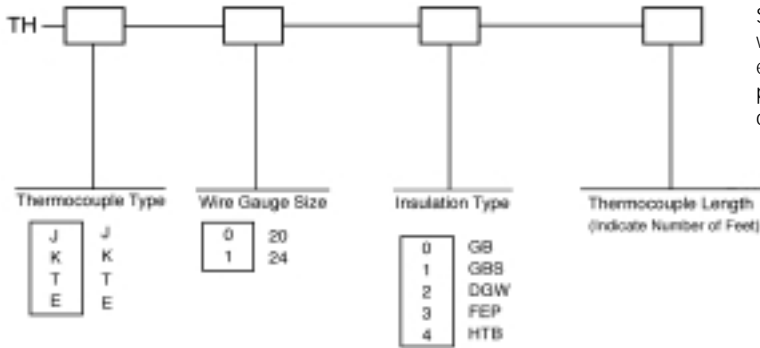
*Not available with Control Output2.

Accessories

Insulated Thermocouples

Simpson thermocouples are available in custom lengths per your application. Calibration type, wire gauge, insulation type, and length are determined by your specs, and entered into the following ordering diagram.

Thermocouple Ordering Information (Termination End: HJ-Beaded, CJ-Solid Bare Wire)



Thermocouple Probes (Quick Disconnect)

Simpson offers "Quick Disconnect" style thermocouples which include a probe and an ANSI color coded jack and plug. Each 12 inch thermocouple probe is compacted with MgO insulation, with 316 stainless steel and 0.188 inch diameter outer sheath. Extra plugs and jacks are sold separately. See the table below for ordering information.

Thermocouple Probes (48" Lead Wire)

Simpson's transition joint thermocouple probes are constructed with MgO insulation. The probe includes 48" of Teflon® coated thermocouple wire and stripped leads. An adjustable compression fitting is available separately. See the table below for ordering information.

Type	T/C Type	Gauge Size
GB (Glass Braid)	J, K, T	20, 24
GBS (Glass Braid with Stainless steel wrap)	J, K	20
DGW (Double Glass Wrap)	J, K	24
FEP (High temperature plastic equal to Teflon® -registered trademark of Dow Chemical)	J, K	20
HTB (High Temperature Glass Braid)	E	20

Type	ANSI Color Code	Quick Disconnect Assembly	48 inch Lead Wire Assembly	Plug Only	Jack Only
J	Black	21238	21242	21245	21249
K	Yellow	21239	21243	21246	21250
T	Blue	21240	-----	21247	21251
E	Purple	21241	-----	21248	21252
RTD	-----	-----	21244	-----	-----

Note: 3/16" compression fitting is available separately for assemblies. Catalog Number 21253.

Transmitters

Simpson offers isolated (TR-700) and non-isolated (TR-800) two-wire transmitters which fit in standard size thermal heads. These indicators work with Simpson 4-20 mA process indicators, and are for use where high noise and/or long distances make direct thermocouple applications impractical. If your application changes, the field ranging kit (catalog number 21254) provides recalibration information for your transmitter.

