

7SD/7SH/7SM Temperature Controllers

ADVANTAGE EZ Series 7SD, 7SH, 7SM 1/16 DIN Temperature Controllers

- 3-Digit LED Display
- Thermocouple and RTD Input
- Autotuning
- NEMA 4X
- Field Configurable
- 100 to 240 Vac
Switching Power Supply
- Programmable Soft Start
- Setpoint Ramp
- Password Security
- Alarm Standby



The Advantage EZ 1/16 DIN Controllers are configurable general purpose controllers for applications where input ranges do not exceed 999.

Optional Features

- Heat/Cool Control (7SH)
- 24 Vac/Vdc Supply
- Relay or SSR DRIVER Output
- Alarm Relay

Introduction

The Barber-Colman Series 7 establishes a new class of microprocessor based temperature controllers. As part of the Series 7 family, the 7SD, 7SM and 7SH offer outstanding performance features in a cost effective package. Designed specifically for equipment manufacturers who demand tight process control, the 7SD, 7SM and 7SH offer a variety of standard features commonly found as options on our competitors controllers. NEMA 4X faceplates allow these units to be used in applications where washdowns and dust conditions exist. The three digit display offers complete coverage for plastics, packaging and environmental chamber applications without excess cost for unused digits.

These controllers are light and compact (1/16 DIN size). They perform reliably in the most demanding applications.

Even operators without skills in temperature process control or knowledge of PID control parameters can obtain perfect control. For the best results in control stability, simply:

- wire the instrument
- configure the setpoint and alarm thresholds
- initiate the autotune function

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Specifications

General

Case:	Polycarbonate in dark grey. Self-extinguishing degree V-0 according to UL-94.
Front Protection:	Designed and tested for IP65 and NEMA 4X for indoor locations (when panel gasket is installed).
Installation:	Panel mounting.
Rear Terminal Block:	Ten screw terminals with safety rear cover.
Dimensions:	48 x 48 mm (1.890 x 1.890 in.) according to DIN 43700; 100 mm (3.937 in.) depth.
Cutout:	45 x 45 mm -0 mm, +0.6 mm. (1.772 x 1.772 in. -0 in, +0.024)
Weight:	160 grams (6.6 ounces).
Power Supply:	From 100 to 240 Vac, 50/60 Hz, or 24 Vac/Vdc.
Power Supply Variation:	-15% to +10% of nominal value.
Power Consumption:	5 VA.
Insulation Resistance:	Less than 100 M Ω (Class III apparatus) according to IEC 348.
Isolation Voltage:	1500 Vrms.
D/A Conversion:	Dual slope integration.
Noise Immunity:	a) Electrical fast transient/burst requirements: Severity Level 3 (according to IEC 801-4). b) Electrical discharge requirements: Severity Level 8 (according to IEC 801-2).
Sampling Time:	500 ms typical.
Accuracy:	$\pm 0.3\%$ full scale value ± 1 digit @ 25 °C and nominal power supply value.
Temperature Drift:	Less than 200 ppm/°C of full scale value selected (RJ excluded). Less than 400 ppm/°C of full scale value for RTD range -19.9 to 99.99.
Reference Junction Drift:	0.1 °C/°C.
Common Mode	
Rejection Ratio:	120 dB @ 50/60 Hz.
Normal Mode	
Rejection Ratio:	60 dB @ 50/60 Hz.
Operating Temperature:	0 to 50 °C.
Storage Temperature:	-30 to 70 °C.
Humidity:	From 20% to 85% RH non-condensing.

Control Actions

On/Off, PID or Smart AT Autotuning

Special Function:	Standby alarm sequence.
Protection:	Internal jumper for calibration and configuration parameter protection.

Inputs (All inputs are factory calibrated and selectable by front keyboard.)

Input:	Thermocouples (J, L, K, N) or RTD Pt 100. Input types are keyboard programmable.
Engineering Units:	°C or °F configurable.
Reference Junction:	Automatic compensation from 0 to 50 °C.
Line Impedance:	100 Ω max for TC input. Less than 4 Ω per wire for RTD input.
Sensor Break:	Downscale or upscale programmable. On RTD input, a special test is provided to signal OVERRANGE when input resistance is less than 15 Ω . (Short circuit sensor detection.)
Calibration:	According to IEC 584-1 and DIN 43710-1977.

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Specifications (continued)

Input	Ranges		
TC L	0 to 800 °C	0 to 900 °F	DIN 43710-1977
TC J	0 to 800 °C	0 to 999 °F	IEC 584-1
TC K	0 to 999 °C	0 to 999 °F	IEC 584-1
TC N	0 to 999 °C	0 to 999 °F	IEC 584-1
RTD Pt 100	-19.9 to 99.9 °C		DIN 43760
RTD Pt 100	-199 to 500 °C	-199 to 999 °F	DIN 43760

Outputs

Main Output:

- a) Relay SPDT, contact rating 3 Amps @ 250 Vac on resistive load.
- b) Logic output for SSR, 700 Ω maximum load, short circuit protected.

Logic Level 1:

- 14 Vdc $\pm 20\%$ @ 20 mA max
- 24 Vdc max $\pm 20\%$ @ 1 mA

Logic Level 0:

- Less than 0.5 Vdc

Cooling Output (7SH only)

- a) Relay SPST and contact normally open, contact rating 1 Amp @ 250 Vac on resistive load.
- b) Logic output for SSR, 700 Ω maximum load, short circuit protected.

Logic Level 1:

- 14 Vdc $\pm 20\%$ @ 20 mA max
- 24 Vdc max $\pm 20\%$ @ 1 mA

Logic Level 0:

- Less than 0.5 Vdc

Alarm

Alarm Functions:

- Process Alarm
- Deviation Alarm
- Band Alarm
- Instrument Malfunctioning Annunciator

Type of Alarm:

- High/Low (Outside/Inside for band alarm)
- Direct/Reverse
- Standby Sequence/No Standby Sequence

Alarm Hysteresis:

- 0.1 to 10.0% of input span or 1 least significant digit.

Alarm Output:

- Relay SPST 1 Amp @ 250 Vac resistive load.

7SD Characteristics

Display:

- 3 digit 7 segment LED display; 10 mm high.

Bargraph:

- 1 green LED + 2 red LEDs for 5 level deviation indication.

Indicators:

- 1 red LED when heating output is ON.
- 1 red LED when Alarm 1 is ON.
- 1 green LED when Smart AT is enabled.

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Specifications (continued)

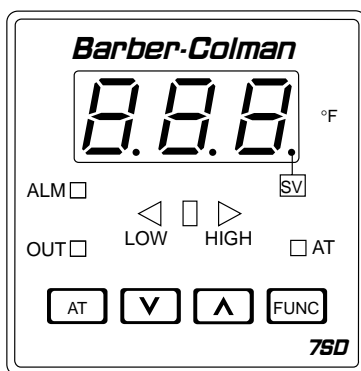
7SM and 7SH Characteristics

Upper Display:	3 digit 7 segment LED display; 10 mm high.
Lower Display:	3 digit 7 segment LED display; 7.6 mm high.
Indicators:	1 red LED when heating output is ON. 1 red LED when cooling output is ON or alarm is ON. 1 green LED when Smart AT is enabled.
Cooling Output (7SH only):	a) Relay SPST and contact normal open, contact rating 1 Amp @ 250 Vac on resistive load. b) Logic output for SSR 700 Ω maximum load, short circuit protected. Logic Level 1: 14 Vdc $\pm 20\%$ @ 20 mA max 24 Vdc max $\pm 20\%$ @ 1 mA Logic Level 0: Less than 0.5 Vdc

Operator Interface

7SD Front Panel Description

Keyboard Description	
	Enables the self-tuning function (Smart AT) or, during configuration/calibration procedure, scrolls back through parameters without saving them.
	Decreases the selected parameter.
	Increases the parameter or toggles between measured value and setpoint indication.
	Stores the parameter into memory and scrolls to the next parameter display.



Display

Shows the measured value. During configuration, the display toggles between the selected parameter and configured value.





Indicators

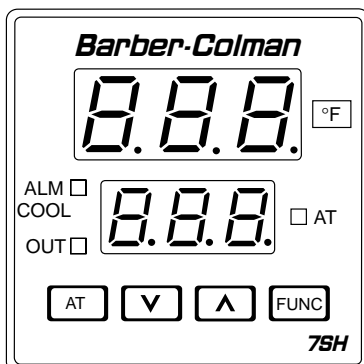
ALM	Lit when alarm condition is present.
OUT	Lit during the ON period of the heating cycle.
AT	Lit when Smart AT function is active.
SV	Flashing when the display shows the setpoint.

Bargraph

Shows the deviation between process and setpoint. Five levels of deviation can be shown.

7SM and 7SH Front Panel Description

Keyboard Description	
	Enables the self-tuning function (Smart AT) or, during configuration/calibration procedure, scrolls back through parameters without saving them.
	Decreases the selected parameter.
	Increases the parameter or toggles between measured value and setpoint indication.
	Stores the parameter into memory and scrolls to the next parameter display.



Upper Display

Shows the measured value. During configuration procedure, it shows the configured setting of the selected parameter.

Lower Display

Shows the setpoint. During configuration procedure, it shows the parameter code.

Indicators

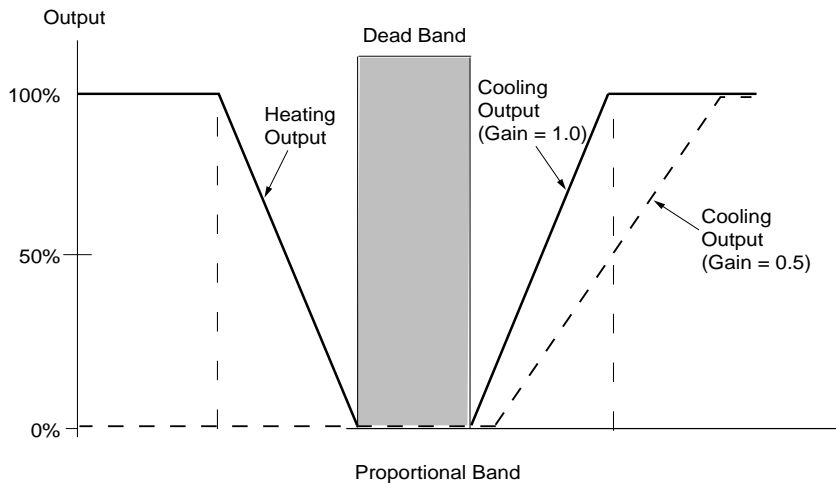
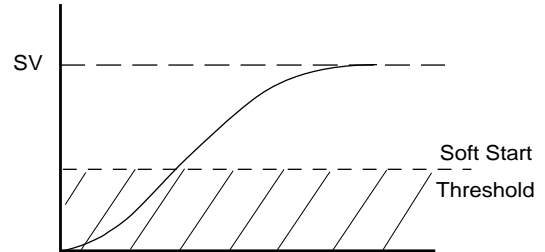
ALM	Lit during the ON period of the cooling cycle (7SH only). Lit when alarm condition is present.
OUT	Lit during the ON period of the heating cycle.
AT	Lit when Smart AT is active.

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Operator Interface (continued)

Soft Start

A configurable threshold can be used to limit output power during initial startup. Used when the impedance of heating loads change with process temperature increases.

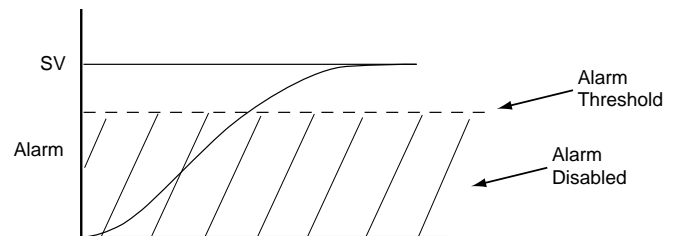


Cooling Gain (7SH only)

Relative cooling gain can be set from 1.0 to 0.2 (1x to 5x the heating proportional band). Configurable overlap/deadband allows customization of the 7SH to your unique process requirements.

Alarm Standby

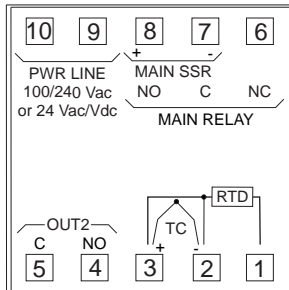
Alarm Standby is configurable ON/OFF to allow masking of alarm conditions when process low alarms are employed and the process value has not yet reached the alarm threshold.



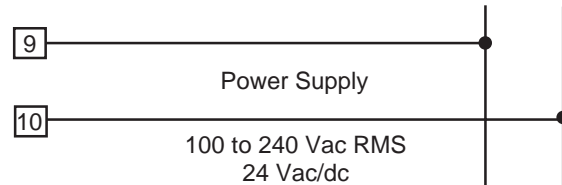
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Wiring

Rear Terminal Block

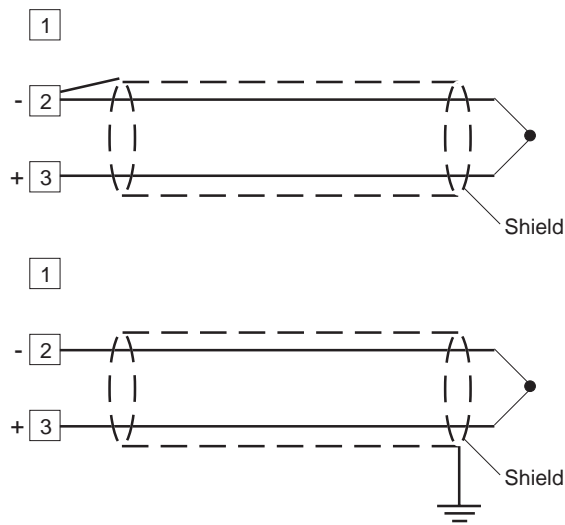


Power Line Wiring

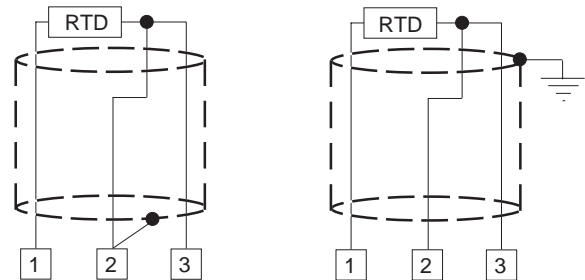


NOTE: To avoid electric shock, connect power line at the end of the wiring procedure.

Input Wiring



Thermocouple Input Wiring



NOTE: Do not run RTD wires together with power cables. If shielded cable is used, it should be grounded at one point only. Use copper wires of appropriate size (see "Product Specifications"). The resistance of the 3 wires must be the same.

NOTE: Do not run input wires together with power cables. For TC wiring use proper compensating cable, preferably shielded. If shielded cable is used, it should be grounded at one point only.

Any external components (like zener diodes, etc.) connected between sensor and input terminals may cause errors in measurement due to excessive or unbalanced line resistance, or possible leakage currents.

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Wiring (continued)

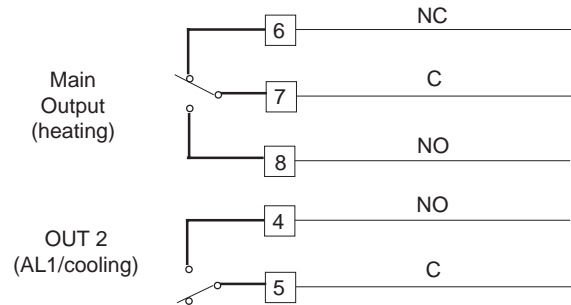
Output Wiring

Relay Outputs

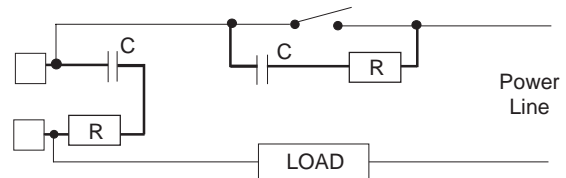
The MAIN OUTPUT and OUT 2 relays are internally protected with a varistor. The contact rating for the main output is 3 Amps/250 Vac on a resistive load. The contact rating for OUT 2 is 1 Amp/250 Vac on a resistive load.

Inductive Loads

High voltage transients may occur when switching inductive loads. These transients may introduce disturbances which can affect the performance of the instrument. The internal varistor assures protection up to 0.5 Amp of inductive component of the load. The same problem may occur when a switch is used in series with the internal contacts. In this case, it is recommended to install an additional RC network across the external contacts as shown.



Relay Output Wiring



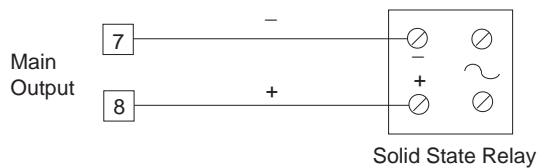
External Switch in Series with the Internal Contact

The value of capacitor (C) and resistor (R) are shown in the following table.

Load Current	C (uF)	R (Ω)	Resistance Power(W)	Resist. and Capac. Voltage
< 150 mA	0.1	22	2	260
< 0.5 Amp	0.33	47	2	260
< 1 Amp	0.47	47	2	260

Relay output wiring must be as far away as possible from input or communication cables.

Voltage Outputs for SSR Drive



SSR Drive Output Wiring

Logic voltage for SSR drive (time proportioning).

Logic status 1: 24V \pm 20% @ 1 mA
14 V \pm 20% @ 20 mA
Logic status 0: Less than 0.5 V

NOTE: This output is not isolated. Isolation between instrument output and power supply must be assured by the external solid state relay.

See "Controller Mounting Dimensions" at the end of this section.