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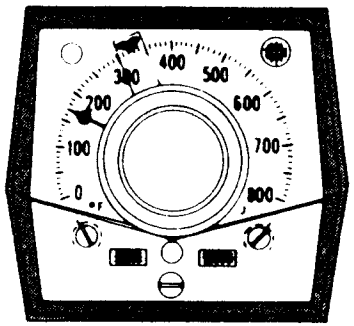
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48, 49 and 50
Proportional and Limit Controllers

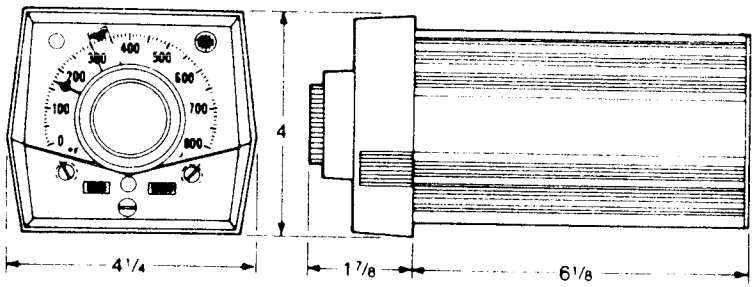


OMEGA®
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Operator's Manual
M21/0589

Models 48, 49 and 50 Controllers

Dimensions



CUT-OUT FOR ALL MODELS: 3⅝ × 3⅝

Instructions for Models 48, 49 and 50 Controllers

MODEL IDENTIFICATION

The basic model number appears in the lower left hand corner of the instrument front plate or on the scale behind the upper portion of the Knob. This model number also appears on the side plate of the plug-in chassis along with any option or special numbers.

MODEL 48 ON-OFF CONTROLLER

This model will cycle the heat on and off within a very narrow differential to maintain the set temperature.

MODEL 49 PROPORTIONING CONTROLLER

This model automatically proportions the relay on and off time in accordance with the demand of the process. The proportioning action occurs within a band around the set point called the proportioning band. The Model 49 band width is 2% of scale range. Within this band, various on time to off time ratios occur. At the very edge of the band, below set point, power to the heaters is on 100% of the time. As the controlled temperature enters the proportioning band, the on time decreases steadily until the upper edge of the band is reached, where the on time would be 0%. The adjusted on to off time ratio allows the controller to proportion the heat on and off *without* a change in the actual controlled temperature. In this way uniform process temperature control is achieved.

While most controls of the type have a fixed or manually adjusted proportioning time cycle, this model features automatic rate action which varies the cycle time in accordance with the demands of the process.

MODEL 50 ON-OFF OR LIMIT CONTROLLER

This model is unique in that it is four controllers in one: heating On-Off, cooling On-Off, High Limit or Low Limit. Control function is selected by jumpers. The heating On-Off control function simply turns the power on and off to the heating load. The cooling On-Off turns power on and off to the cooling device. The on-off differential is 0.1% of the scale range or 80 μV., whichever is larger.

In the High Limit function the control relay drops out upon a temperature rise to the set point and an amber limit light flashes a limit warning. A limit reset button is built-in (terminals are also provided for remote reset if desired) to reset the controller upon return to a temperature decrease below the set point. The control can also be used for heat treating furnaces requiring shut down at a preset temperature. Re-starting for a new run is simply achieved by pushing the limit reset button.

By selecting the Low Limit function, the control relay drops out upon a temperature decrease to the set point and the amber limit light flashes a warning. The control may be reset by depressing the limit reset button upon return to a temperature increase over the set point.

MOUNTING

The controller does not have to be removed from its housing for mounting. However, the controller may be removed by turning the jack screw located below the set point knob in a counter-clockwise direction until loose and then pulling the controller forward to slide it out of the housing. To replace, slide chassis into housing in its proper slots until jack screw is engaged. Turn jack screw clockwise until tight. The jack screw automatically unplugs and replugs the controller.

All models mount in a 3⅝ in. x 3⅝ in. cutout. No other holes are required. Each controller is equipped with a special panel clip mounted on all four sides. The controller is simply pushed through the cutout until the panel stop on all four clips seats against the panel. If the controller has been removed from the housing, be sure the threaded jack screw stud is at the bottom of the housing. No screws or other mounting hardware are necessary.

Normally the housing never has to be removed again since the rear terminal panel may be removed without taking the housing out of the panel. If it is necessary to take the whole housing out of the panel after it has been installed, place metal shim stock or other thin metal between the teeth in each clip and the edge of the cutout. This covers the teeth and prevents them from biting into the panel edge. Then push the housing out from the back of the panel.

All controllers may be mounted with the scale plate tilted up to 30° (back or forward) from vertical without degrading the indicator accuracy.

GENERAL WIRING INFORMATION

It is advisable to fuse the incoming power line (to terminal 3) with a 1/10 amp. slow-blow fuse. Be sure that it fuses the instrument power input only and not the load also.

Follow the wiring for your model shown on the following pages. Be sure that one of the four corner screws holding the rear terminal panel is connected to a good *earth* ground such as a conduit or cold water pipe. Thermocouple leads should not be run in the same conduit as power leads. Generally, the red wire from the thermocouple is negative. Use only the type of thermocouple specified for your controller range. The thermocouple type is marked at the high end of the scale by its letter designation as follows:

J=Iron/Constantan	E=Chromel/Constantan
K=Chromel/Alumel	R=Plat. 13% RH./Plat.
T=Copper/Constantan	S=Plat. 10% RH./Plat.

Your Controller is equipped with automatic thermocouple break protection. Upon thermocouple break, the indicating pointer will go to full scale and remain there. The heating load will turn off. For controls with downscale thermocouple break protection (Option 842), the indicating pointer will go completely downscale and remain there. No wiring is required.

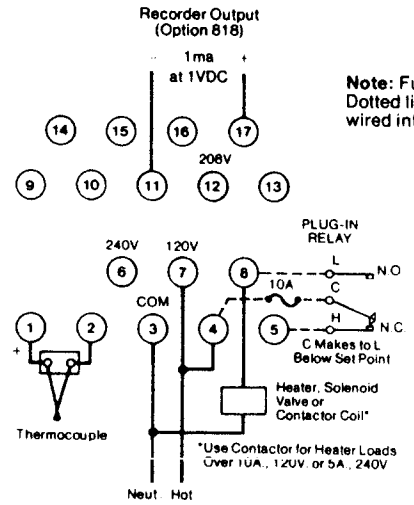
MODEL 48 WIRING

Use same wiring as for Model 49.

MODEL 49 WIRING

(If your unit is equipped with the solid state relay, Option 813 or 844, ***do not*** use this wiring diagram, use special diagram shown under this option.)

Model 49



Note: Fuse, Relay and Dotted line wiring are wired internally.

Note: Wiring is Shown for 120 V.A.C., 50/60 Hz
For 240V Use Terminal 6 Instead of 7
For 208V Use Terminal 12 Instead of 7.

MODEL 50 WIRING

On-Off Control. The Model 50 has been shipped from the factory wired as a high limit controller. For on-off operation (automatic limit reset) jumper terminals 11 and 15 on the rear terminal board. The relay is energized below the set point. The amber lamp flashes when the relay is de-energized as received from the factory. To de-activate the amber lamp, locate red jumper at the front of the controller inside the chassis. Unplug it from the lower pin (pull straight out) and plug it into (push on) the upper pin.

Reverse Acting On-Off (Cooling On-Off). A yellow chassis jumper located on the controller circuit board is soldered to a pin marked COM and plugged into a pin marked HI as shipped from the factory. Unplug (pull straight up) the yellow jumper from the HI pin and plug into (push straight down) the LO pin. Jumper terminals 11 and 15 on the rear terminal board. The relay is energized above the set point. De-activate the amber lamp in the same way as for On-Off Control.

High Limit Operation. The Model 50 has been shipped from the factory wired as a high limit controller. The relay will be energized below the set point by depressing the Limit Reset button on the front of the controller. When the temperature reaches the set point, the relay will de-energize and will not re-energize unless the Limit Reset button is depressed and the temperature has fallen below the set point. The amber lamp will flash when the relay is de-energized. For remote Limit Reset, a normally open push button switch may be connected across terminals 11 and 15 on the rear terminal board.

Low Limit Operation. A yellow chassis jumper located on the controller circuit board is soldered to a pin marked COM and plugged into

a pin marked HI as shipped from the factory. Unplug (pull straight up) the yellow jumper from the HI pin and plug it into (push straight down) the LO pin. The relay will be energized above the set point by depressing the Limit Reset button on the front of the controller. When the temperature drops to the set point, the relay will de-energize and will not re-energize unless the Limit Reset button is depressed and the temperature has risen above the set point. The amber lamp will flash when the relay is de-energized. For remote Limit Reset, a normally open push button switch may be connected across terminals 11 and 15 on the rear terminal board.

MODEL 48 OPERATION

This operation is the same as the first paragraph of the Model 49 operation.

MODEL 49 OPERATION

After mounting and wiring, turn red pointer to desired control point by depressing inner knob and turning. *Do not* try to turn outer knob housing. Power the system. The green pilot light will light momentarily and then the red light will light. The heating system is now energized. The green indicating pointer will continuously read the temperature at the thermocouple. The control will cycle the heat on and off at the set temperature. (For units with solid state relay, Option 813 or 844, see "options" for pilot light operation.)

In all proportioning controllers the controlled temperature can stabilize at any temperature within the proportioning band. If stabilization occurs either above or below the set point, this is called "offset".

If, after the temperature reaches the set point, it stabilizes below the set point, turn the Offset Correct adjustment on the front of the controller *clockwise* a small amount and wait. If more correction is needed turn it farther until the indicating pointer settles out at the set temperature.

If the indicating pointer settles above the set temperature, turn the Offset Correct *counter-clockwise*.

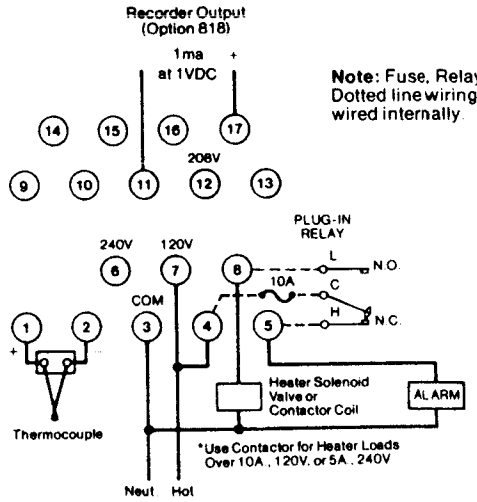
On units equipped with Automatic Offset Correct (Option 814), the manual offset correct adjustment is eliminated.

MODEL 50 OPERATION

On-Off Control. Set desired set point. The green pilot light will light momentarily and then the red light will light. The green indicating pointer will read the temperature at the thermocouple. The control will cycle the heat on and off at the set temperature.

Reverse Acting On-Off (Cooling Control). Set desired set point. If the starting temperature is above the set point, the green light will light momentarily and then the red light will light. The green indicating pointer will read the temperature at the thermocouple. The control will cycle the cooling device on and off at the set temperature.

Model 50



Note: Fuse, Relay and Dotted line wiring are wired internally.

Note: Wiring is Shown for 120 V.A.C. 50/60 Hz.
For 240V Use Terminal 6 instead of 7.
For 208V Use Terminal 12 instead of 7.

See Limit Control instructions for activating amber alarm light.

JUMPER CONNECTIONS

CONTROL DESIRED	YELLOW JUMPER POSITION	BACK CONNECTIONS
ON-OFF	HI	JUMPER 11 TO 15
REVERSE ACTING ON-OFF	LO	
HIGH LIMIT	HI	NONE*
LOW LIMIT	LOW	

*A Normally Open Push Button may be Used Across Terminals 11 and 15 if Remote Limit Reset is Desired.

High Limit. Set the desired set point. The green pilot light will light. Depress the Limit Reset button on the front of the control. The red light will light. The green indicating pointer will read the temperature at the thermocouple. When the temperature reaches the set point, the green light will light, heat will be shut off, the external alarm will be energized (if connected) and the amber light on the control will flash (if it was activated as shown under Wiring). The control can be reset by depressing the Limit Reset button only after the temperature has dropped below the set point.

Low Limit. Set desired set point. The green light will light. Depress the Limit Reset button on the front of the control. The red light will light if the starting temperature is *above* the set point. The green indicating pointer will read the temperature at the thermocouple. When the temperature reaches the set point, the green light will light, cooling device will shut off, the external alarm will be energized (if connected) and the amber light on the control will flash (if it was activated as shown under Wiring). The control can be reset by depressing the Limit Reset button only after the temperature rises *above* the set point

SPECIFICATIONS

Input: Thermocouple (RTD and Thermistor also available)
Input Impedance: 300,000 Ohms minimum.
Common Mode Rejection: 120 DB at 240 V.A.C., 60 Hz.
Maximum Series Mode Voltage: 5 times span.
Accuracy: ±0.5% or 85 μV., whichever is greater.
Repeatability: ±0.1% of span.
Proportioning Band: 2% F.S. Proportioning Models only.

On-Off Differential: Less than 0.1% of F.S. or 80 μV, whichever is greater. On-Off Models only. Larger differential can be supplied on special order. See option list.
Scale Length: 5 3/4".
Indicator Accuracy: ±1.0%.
Maximum Thermocouple Resistance: 200 Ohms with rated accuracy.
Supply Voltage: 120/208/240 V.A.C., 50/60 Hz., by terminal selection.
Line Voltage Stability: ±0.2% of full scale maximum, within 85 to 110% of rated line.

Control Relay: Plug-in, 10A (120 V.A.C.); 5A (240 V.A.C.) non-inductive. Second relay in three position models rated at 5A. (120 V.A.C.) 2 1/2A. (240 V.A.C.) non-inductive. Both relays have single pole, double throw contacts.
Fuse: Common contact of main set point relay is internally fused for 10A. with 3AB 250V. fuse. Solid state relay options 813 and 844 are supplied with an externally mounted fuse block and very fast blow fuse type KAX 10 (10A.). See "options".
Ambient Temperature Range: 2 to 60°C. (35 to 140°F.) maximum.
Temperature Stability: 8 μV./°C. (4.5 μV./°F.) maximum.
Humidity Conditions: 0 to 70% R.H. normal operation; 0 to 90% R.H. extreme operating conditions.
Thermocouple Break Protection: Built-in, fail safe, if thermocouple breaks. Upscale standard, downscale, optional.
Weight: Approx. 3 lbs.

GENERAL INFORMATION

Fuse: The fuse is located on the chassis board alongside the relay. It is in series with the load contacts of the relay. It is a standard 3AB-10AMP cartridge fuse with medium time lag and with a ceramic body.

Relay: The relay used in your unit is an octal plug-in relay with a plastic dust cover, 2 pole, double throw, 10 amp contacts. The coil voltage is 24 V.D.C. The **OMEGA** relay is an extended life unit and will last longer than most relays. Reorder as **OMEGA** part no. 541-1.

OPTIONS

Built-in On-Off Switch. Option 812. This switch is located in the upper left hand corner of the controller. It disconnects power to the instrument and de-energizes the control relay. This a push-push type switch. It is pushed to turn on and off. The "in" position is on and the "out" position is off.

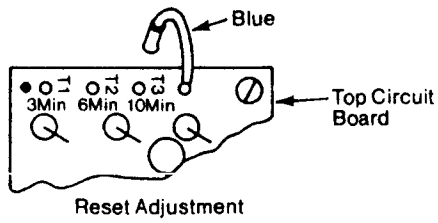
Three Mode Controller. Option 814. This feature adds automatic rate, adjustable reset and overshoot or undershoot inhibit to any proportioning model.

The rate function is automatic and anticipates sudden line, load or process upsets applying immediate correction.

Overshoot or undershoot inhibit automatically removes the reset term until the temperature to be controlled is within the proportional band, eliminating reset windup thereby allowing the process to cut back before the control temperature is reached (either in coming up to temperature or going down to a new temperature).

Automatic reset may be adjusted in three steps. This allows you to get the optimum results for your process. Select the fastest reset time (T1, T2 or T3) that will allow minimum excursion above the set point upon initial heat-up or when an upset occurs. An upset can be simulated by moving the set point up or down scale to a new set point, after the controlled temperature has settled out at the initial set point.

To adjust Reset (see diagram below); Unplug (pull straight up) the blue jumper on the top circuit board and plug (push straight down) into T2 (6 min.) or T3 (10 min.). Note: If 3 minutes (T1) reset time is desired there is no need to make this adjustment (shipped this way from the factory).



Reset Adjustment

Non-Indicating Controller. Option 816. The indicator is not installed.

Recorder Output Terminals. Option 818. An output of 0-1 MA. at 0-1 V.D.C. is provided. This signal can be fed to any recorder having an input range of 0-1 V.D.C. Use a standard temperature chart for your recorder brand in the same range and thermocouple as the controller. The recorder does not require ambient temperature compensation. Wire as shown in drawings. A 3AG 1/16A. fuse should be inserted in the negative (–) leg of the recorder output terminals.

Limit Control Power Interruption Circuit. Option 815. For Model 50 only. This circuit automatically resets the limit controller after a line power interruption. Upon power interruption, and subsequent restoration, the control will return to the condition (normal or alarm) which existed prior to the interruption, if that condition still exists. No extra wiring is required.

Wide On-Off Differential. Option 89. For Model 50 only. This feature is used for incinerators, furnaces or ovens where the control will turn off at the set point and will remain off until the controlled temperature drops to a predetermined temperature below the set point as specified in your order. Differentials of up to 20% of range can be furnished.

Rear Terminal Enclosure. Option 817. The enclosure may be used to simply cover the rear terminals or to surface mount the controller. To mount the enclosure to the controller, remove the four Phillips head screws from the rear terminal panel and mount the metal bars provided in the enclosure kit, on the outside of the terminal panel to the rear of the housing. Mounting the bars vertically will allow the cover to swing up or down for wiring. Mounting the bars horizontally will allow the cover to swing right or left.

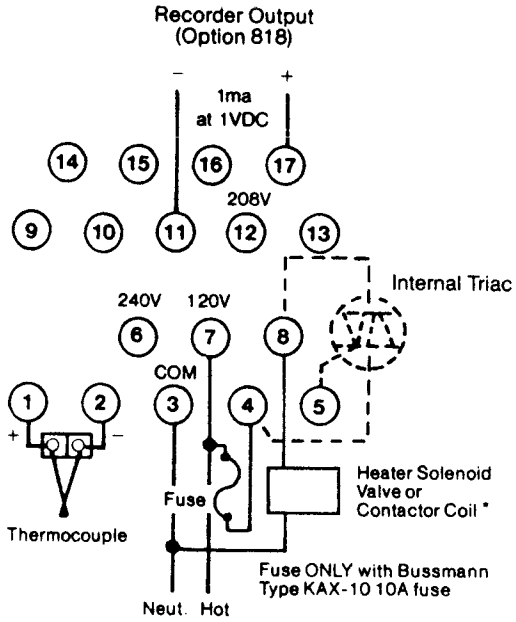
Mount the cover to the bars with four screws provided. By removing two screws and sliding the cover back, the cover will hinge.

For surface mounting the cover may be mounted to any flat surface. The controller will hinge up or down or right or left, depending upon how the bars have been mounted to the rear.

Wiring can be done through the enclosure knockouts. Do not use too large a wire gauge or the terminals may be damaged while hinging. Use stranded wire if possible.

Solid State Relay. Option 813 or 844. This circuit takes the place of the plug-in relay. The load must be wired in accordance with the wiring diagram shown for this feature. The output is single pole, single throw. The pilot lights do not operate in the same manner as for the plug-in relay. The green light is on continuously, showing the controller is powered. The red light will cycle on and off to show power being supplied to the heater load. Option 813 is slow cycling to operate contactors. Option 844 is fast cycling to operate small heater loads directly. It is more desirable to have the heater load and the controller powered from the same line phase.

Adjustable Proportional Bandwidth. Option 8142. For Model 49 without Option 814 (three mode controller). Bandwidth is adjustable from 2 to 10% of range. Set the bandwidth adjustment to its middle position (approx. 6%). This adjustment should finally be set to the narrowest bandwidth possible that does not allow cycling of temperature about the set point. Too narrow an adjustment will allow cycling, while too wide an adjustment will allow drifting of the set temperature over longer periods.



Note: Make No Connections To Terminal 5, Internal Tie Point.

Note: Wiring is Shown for 120 V.A.C., 50/60 Hz.
For 240V Use Terminal 6 instead of 7.
For 208V Use Terminal 12 instead of 7.

***CAUTION:** Load limit 10A up to 240 V.A.C. non-inductive. For Inductive Loads, inrush MUST NOT exceed 50A.

Adjustable Proportional Bandwidth. Option 8143. For Model 49 with Option 814 (three mode controller). Bandwidth is adjustable from 0.5% to 10% of range. Set the bandwidth adjustment to its middle position (approx. 5¼%). Then follow instructions shown for Option 8142.

Thermistor Input. Option 837. Connect thermistor as shown. All other wiring remains the same. See wiring diagram for your basic model.

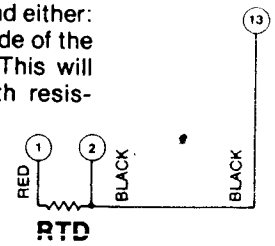


Thermistor

Resistance Temp. Detector Input (Resistance Bulb). Option 838. Connect a three wire RTD as shown. All other wiring remains the same. See wiring diagram for your basic model. If a two wire RTD is used, connect it across terminals 1 and 2 and either:

a) Run a wire from terminal 13 to the side of the probe that connects to terminal 2. This will partially compensate for lead length resistances.

b) Jumper terminal 13 to terminal 2. This method will not compensate for lead resistance.



RTD

Digital Set Point. Option 860. The digital set point is set by turning each thumbwheel so that desired set point temperature is indicated.

Over range protection is provided. Control will automatically be limited to the approx. maximum temperature of your range or will automatically be set below ambient temperature if digital switch is set beyond the range of the controller.

Secondary Output of 4 to 20 MA. for 0-100% of full scale. Option 8177. Output load may be any resistance from 0-1000 Ohms. Output is short circuit protected. The output circuit and the input sensor **must not share** any common power lines or grounds either directly or indirectly. This output is available at special terminals located on standoffs at the top of the rear terminal panel. The left terminal is plus (+) and the right terminal is minus (–). All other wiring is as shown for the Model 49 or 50.

Adjustable Wide On-Off Differential. Option 870, for Model 50 only. Same as option 89, except differential is adjustable up to 15% of range. To change the on-off differential, loosen jack screw located below set point knob and pull the controller chassis forward about one inch. The differential adjustment is located on the right side when viewing the controller from the front.

When shipped from the factory, the adjustment is set fully counterclockwise. Differential in this position is minimum. If the adjustment is turned fully clockwise, the differential will be approximately 15% of full span. The final setting should be for the differential desired.

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