



The tekmar One Stage Setpoint Control 150 is a microprocessor-based control that can be programmed to maintain a fixed setpoint temperature by cycling a heating or cooling device using either bang-bang or Pulse Width Modulated (PWM) output control.

This reliable and versatile control has a very wide setpoint range, an adjustable differential and time delay that makes it useable in many different applications. The control has a digital LCD window that normally shows the actual sensor temperature and can be used to view the setpoint as well as the other programmed settings.

A Universal sensor 071 is supplied with the control. The wire to the sensor may be extended up to 500 ft. (150m) by standard 18 AWG low voltage wire. The display will indicate a sensor fault whenever the sensor is either open or short circuited.

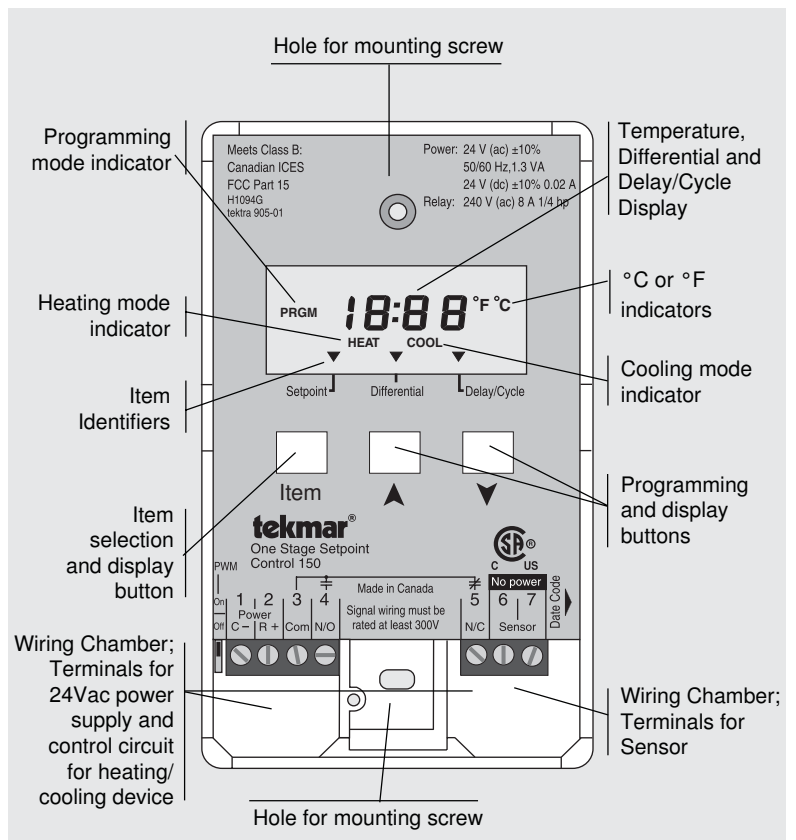
Technical Data

Technical specifications

Dimensions	— 2-7/8" x 4-3/4" x 7/8" (74 x 120 x 22 mm)
Gross Weight	— 1 lb (450g)
Ambient	— -20 to 120°F (-30 to 50°C) <90 % RH non-condensing
Power supply	— 24 V (ac) ±10%, 50/60 Hz, 1.3 VA 24 V (dc) ±10% 0.02 A
Relay	— 240 V (ac) 8 A 1/4 hp
Sensor	— 10 kΩ @77°F (25° ± 0.2°C), curve 3, NTC thermistor accurate with up to 500 ft. (150m) of 18 gauge wire
Control accuracy	— ±0.5°F (±0.3°C) at 70°F (21°C)

Settings

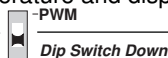
Temperature display	— -85 to 302°F (-65 to 150°C)
Setpoint	— -40 to 239°F (-40 to 115°C)
Differential (Bang/Bang)	— 1 to 40°F (1 to 22°C)
Differential range (PWM)	— 3 to 40°F (2 to 22°C)
Time delay (Bang/Bang)	— 0 to 19 min. 50 sec. (10 second increments)
Cycle length (PWM)	— 30 sec. to 19 min. 50 sec. (10 second increments)
Operating mode	— Heating/Cooling
Temperature scale	— Fahrenheit/Celsius
Programmed settings	— Ten year memory backup



Sequence of Operation

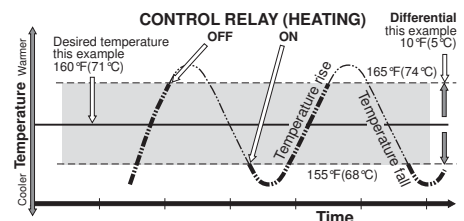
- When the One Stage Setpoint Control 150 is powered-up the digital display will show all of the display elements. The control will then monitor the sensor temperature and display it in the digital display. (See diagram)

Bang - Bang Operating Mode

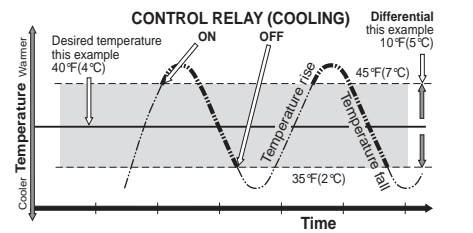


Bang-Bang control outputs turn equipment on when there is a demand for heating or cooling, and then shut it completely off when the demand is satisfied.

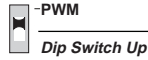
- If the control is programmed for "Heat" in this mode, it turns on its relay and the "HEAT" display element when the sensor temperature is (a) — 1/2 the differential setting below the setpoint, and (b) — the delay has timed out. When the sensor temperature rises 1/2 the differential setting above the setpoint, the relay switches off, the "HEAT" display element turns off and the delay starts to time out. During the time out period, the Delay/Cycle pointer will flash if heating is needed.



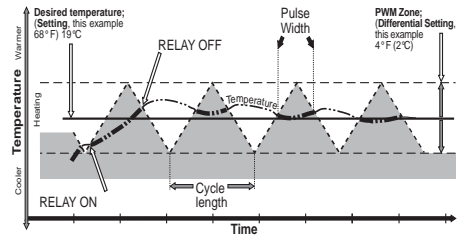
- If the control is programmed for “Cool” in this mode, it turns on its relay and shows the “COOL” display element when the sensor temperature is (a) — 1/2 the differential setting above the setpoint, and (b) — the delay has timed out. When the sensor temperature drops 1/2 the differential setting below the setpoint, the relay switches off, the “COOL” display element turns off and the delay starts to time out. During the time out period, the Delay/Cycle pointer will flash if cooling is needed.



PWM Operating Mode



The Pulse Width Modulation (PWM) control output is an on/off action, but differs from the simple bang-bang by changing the length of the “on” time based on how much the actual temperature differs from the desired temperature. With the advance to PWM output, overshoot and undershoot is reduced by adding a quantity based function. The heating device is not simply operated “when” heat is needed but the operation is varied depending on “how much” heat is needed.



- If the control is programmed for “Heat” in this mode, the relay is off as long as the sensor temperature is 1/2 the differential setting above the setpoint. The relay is continually on when the sensor temperature is 1/2 the differential below the setpoint. If the sensor temperature is between these two points, PWM action occurs. As more heat is required, the relay “on” time is increased and the “off” time is decreased within each cycle. As less heat is required, the relay “on” time is decreased and the “off” time is increased within each cycle.
- If the control is programmed for “Cool” in this mode, the relay is continually on when the sensor temperature is 1/2 the differential setting above the setpoint. The relay is off when the sensor temperature is 1/2 the differential below the setpoint. If the sensor temperature is between these two points, PWM action occurs. As more cooling is required, the relay “on” time is increased and the “off” time is decreased within each cycle. As less cooling is required, the relay “on” time is decreased and the “off” time is increased within each cycle.

Caution — If PWM is selected, the minimum time delay is disabled.

Installation

Caution

Improper installation and operation of this control could result in damage to equipment and possibly even personal injury. It is your responsibility to ensure that this control is safely installed according to all applicable codes and standards.

Step One — Getting ready

Check the contents of this package. If any of the contents listed are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or tekmar sales agent for assistance.

Type 150 includes:

- One Control 150 • One Universal Sensor 071
- One Data Brochure D 150 • One Data Brochure D 001 • One Data Brochure D 070

Other information available:

- Essay E 001

Note: Carefully read the Sequence of Operation section in this brochure to ensure that you have chosen the proper control and understand its functions within the operational requirements of your system.

Step Two — Mounting

The control is mounted in accordance with the instructions in the Data Brochure D 001.

Step Three — Rough-in wiring

All electrical wiring terminates in the two wiring chambers at the bottom front of the control. If the control is to be mounted on an electrical box, the wiring can be roughed-in at the electrical box prior to installation of the control (see Brochure D 001). Standard 18 AWG solid wire is recommended for all low voltage wiring to this control.

Caution: Power should not be applied to any of the wires during this rough-in wiring stage.

- Install the Universal Sensor 071, according to the instructions in Data Brochure D 070 and run the wiring back to the control but don't connect.
- Install a 24 V (ac) Class 2 transformer with a minimum 5 VA rating close to the control, and run the wiring from the transformer to the control. A Class 2 transformer must be used. Do not connect any of the transformer terminals to ground.
- Install the wiring from the heating/cooling device control circuit to the control.

Step Four — Testing and connecting the wiring

Caution

These tests are to be performed using standard testing practices and procedures and should only be carried out by a properly trained and experienced technician. A good quality electrical test meter, capable of reading from at least 0 — 200 Volts AC, and at least 0 — 2,000,000 Ohms, is essential to properly test this control. At no time should voltages in excess of 28 V (ac) be measured at any of the wires connected to this control.

Test the sensor

This test must be performed *before* power is applied to the control and *before* the sensor is connected to the terminal strip. Test the sensor according to the instructions printed in the enclosed Data Brochure D 001.

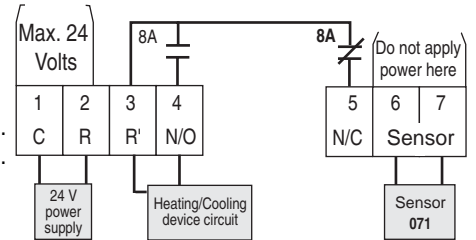
Test the power supply

- Ensure that the wires from the power supply transformer are not touching each other, any other wires, or ground. Turn on the power and, using an AC voltmeter, you should measure between 20 and 28 volts at the secondary side of the transformer.
- Turn off the power and complete the electrical connections to the terminal strip of the control.

Electrical connections

Power and output connections — **Caution, Maximum 24 Volts A.C.**

- Connect — the transformer to terminals **C** — **R** (1 and 2)
 — the heating/cooling device circuit to terminals:
R — **N/O** (3 + 4) is normally open (N/O) and closes when the relay turns on.
R — **N/C** (3 + 5) is normally closed (N/C) and opens when the relay turns on.



Sensor connection **Caution, voltage is never applied to these terminals**

Connect the Universal Sensor 071 to terminals **Sensor** (6 and 7)

Settings

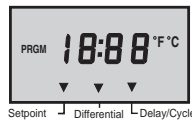
The digital display on the One Stage Setpoint Control 150 has the following uses:

- To display the actual temperature during normal operating mode.
- To allow the user to view and program the various control settings.
- To display control operation. ("HEAT" display element comes on when the relay closes to operate a heat source and "COOL" display element comes on when the relay closes to operate a cooling device.)
- To display sensor faults. (Display will show "Err" when the sensor is either open or short circuited.)

The following diagram illustrates how to operate the keypad buttons in order to view settings and program the control.

POWER ON

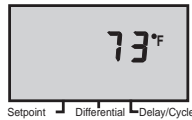
When the control is powered-up, all display elements turn on.



After approximately 5 seconds, the control automatically goes into operating mode.

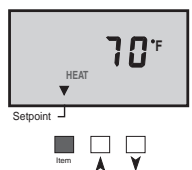
OPERATING MODE

When in operating mode, the measured temperature will be displayed.

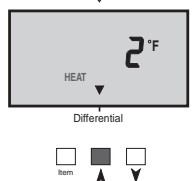


DISPLAY MODE

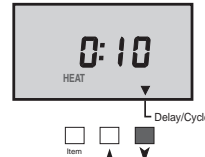
Push and Hold the "Item" button. The programmed Heating or Cooling Setpoint will be displayed.



Push and Hold the **▲** button. The programmed Differential will be displayed.



Push and Hold the **▼** button. The programmed Delay or PWM cycle length will be displayed.



PROGRAM MODE

Push all three buttons **at the same time**. "PRGM" will appear and the **Setpoint** pointer will flash. The control will be in programming mode.



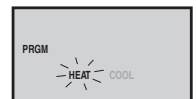
Pushing the "Item" button changes the flashing pointer to **Differential**



Pushing the "Item" button changes the flashing pointer to **Delay / Cycle**

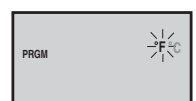


Pushing the "Item" button allows **Heating** or **Cooling** operation to be selected



Push **▲** or **▼** to select between Heating or Cooling operation

Pushing the "Item" button allows the Fahrenheit or Celsius scale to be selected

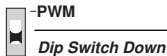


Push **▲** or **▼** to select between Fahrenheit or Celsius scales

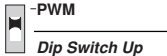
— The control automatically goes back to operating mode when the buttons are left alone for 20 seconds —

Differential (Bang - Bang) 

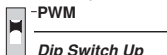
Setting the Differential on any control depends entirely on the actual operating characteristics of heating/cooling equipment in each specific application. Differential settings should normally be set as small as possible for greatest accuracy, but care must be taken to avoid short cycling of equipment. Experience, plus trial and error during actual operating conditions is usually the way most installers determine the correct differential setting.

Delay (Bang - Bang) 

Setting the time delay also depends on the actual operating characteristics of heating/cooling equipment in a specific application. With some equipment, time delays are unnecessary and the delay setting can be set to zero time delay. Other types of equipment depend on a fixed off delay to prevent damage to equipment components, particularly in the case of certain types of refrigeration equipment. Consult the manufacturer's operating and installation instructions for advice on recommended time delays.

Differential (PWM) 

The Differential setting determines the temperature range in which PWM action occurs. This setting should be adjusted to allow PWM action to occur the majority of the time. Cycle and Differential settings both affect relay "on" and "off" time.

Cycle (PWM) 

Cycle provides the greatest control of how often the relay is turning on and off when the measured temperature is in the differential range. Increasing Cycle will cause the relay to stay on and off longer (when temperature remains at setpoint). When controlling loads that respond slowly to the heating/cooling input, the Cycle should be long. When loads respond quickly to heating/cooling input, a short Cycle is used.

Testing and Troubleshooting

If troubleshooting becomes necessary with the One Stage Setpoint Control 150, follow the testing procedure in step four of the installation procedure on page 2 of this brochure.

If the display window shows "Err", the sensor is either open or short circuited, or the sensor temperature is outside the temperature range of the control. If this type of fault occurs, the control will turn off its relay.

If you do not think the control is operating properly, check to see that the settings have been made correctly and that the problem is not a result of external causes. Make sure that all wiring connections are solid and the sensor is located in the correct location.

Before you leave

- Install the wiring cover over the wiring chamber and secure it with the screw provided.
- Place the front cover on the control to cover the setting dials and snap it into place.
- Place this brochure, and all other brochures relating to the installation, in the protective plastic bag supplied with the control.
- Place the bag in a conspicuous location near the control for future reference.
- It is important to explain the operation of this control within the system to the end user, and anyone else who may be operating the system.

Limited Warranty and Product Return Procedure

Limited Warranty The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product ("Product"), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale and acknowledges that it has read and understands same.

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer's pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship and materials if the Product is installed and used in compliance with tekmar's instructions, ordinary wear and tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar's sole discretion: the cost of parts and labor provided by tekmar to repair defects in materials and / or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser's agreement and warranty with its customers.

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are the Purchaser's sole responsibility and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar's instructions and / or the local codes and ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar's instructions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser's customers, regarding a potential warranty claim, tekmar's sole obligation shall be to provide the address and other contact information regarding the appropriate Representative.

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