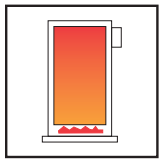
tekmar® - Data Brochure

Two Stage Boiler Control 255



D 255

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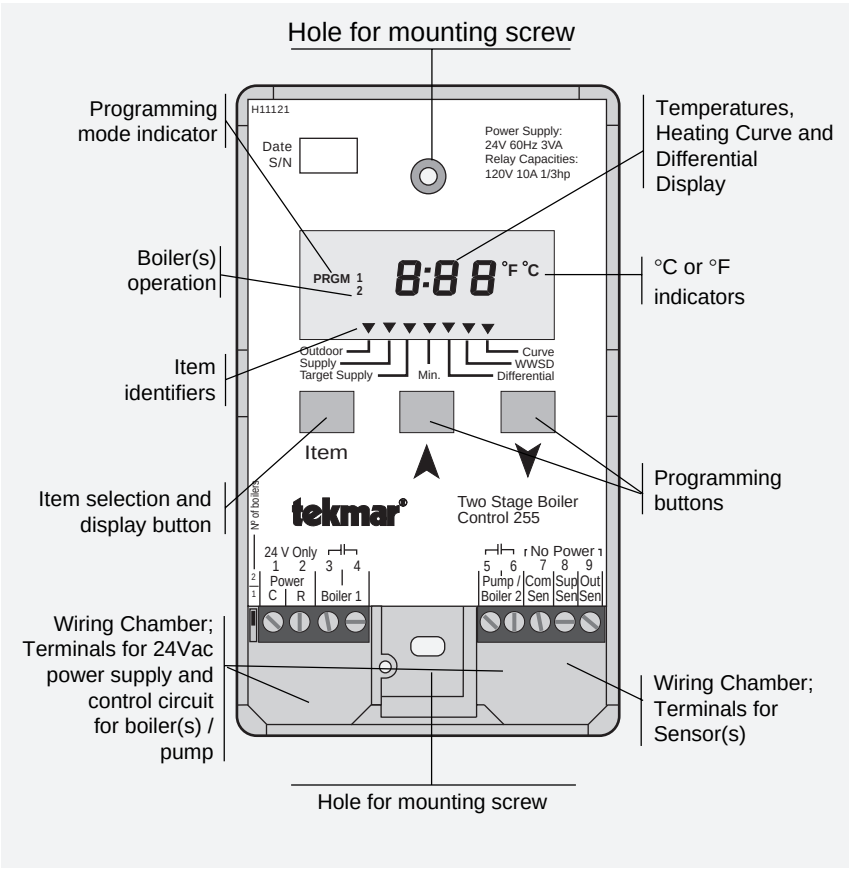
The tekmar Two Stage Boiler Control 255 is a microprocessor-based outdoor reset control that is designed to regulate the supply water temperature from one or two boilers based on the outdoor air temperature. If one boiler is used, a system pump output is available.

The control has programmable settings for minimum supply temperature, differential, heating curve, and warm weather shut down temperature. The control has a digital liquid crystal display (LCD) window that normally shows the outdoor temperature and can be used to display supply, target supply and programmable settings.

The Two Stage Boiler Control 255 is a cost effective answer for outdoor reset of many single and dual boiler applications.

Sequence of Operation

- When the Two Stage Boiler Control 255 is powered-up, the digital display will show all of the display elements. The control will then monitor the outdoor temperature and display it on the digital display. Pressing and releasing the Item button will toggle to the supply temperature. Pressing and releasing the Item button again will toggle the display to the Target Supply temperature.
- If the outdoor temperature is warmer than the WWSD point, the "WWSD" pointer will flash on and off, and the control will keep the boiler(s) off.
- If the outdoor temperature is colder than the WWSD point, the control calculates the desired supply temperature based on the requirements of the Heating Curve or on the Boiler Minimum setting, whichever is greater. If the Boiler Minimum setting is higher than the Heating Curve requirement, the "Min." pointer will flash on and off and the control will maintain the supply temperature at the Boiler Minimum setting. If the outdoor temperature is cold enough to operate on the Heating Curve, the "Min" pointer will turn off, and the control will maintain the supply water temperature at the Heating Curve desired temperature.
- *There is a minimum time delay between a boiler being turned off and then back on. For the first boiler, this time is preset to 30 seconds. When two boiler operation is selected, the delay between the boiler stages is adjustable from 30 seconds to 4 minutes.*

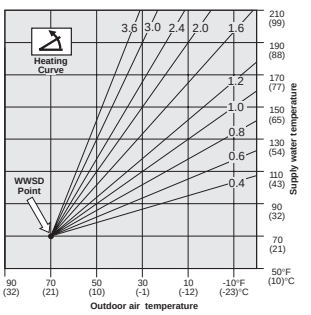


- *To obtain the best operation from a reset control, it is important to measure the system supply temperature as accurately as possible. Whenever the control is energized, the system pump must operate to maintain continuous water flow across the supply temperature sensor. Refer to the application drawings A 255 for plumbing concepts.*

Outdoor Reset Strategy

Heating Curve

As the outdoor temperature becomes colder heat losses from a building increase, requiring more heat be added to prevent the indoor temperature from also becoming colder. This tekmar reset control measures the outdoor temperature and, as it becomes colder, the control balances the heat loss by making the heating supply water hotter. The Heating Curve is used to calculate exactly how hot to make the supply water at different outdoor temperatures. It determines the number of degrees the supply water temperature is raised for each degree the outdoor temperature falls.



- *If the Heating Curve selected is too low,* the supply temperature will not be hot enough to keep the room temperature warm during cold weather.
- *If the Heating Curve selected is too high,* the supply temperature will be hotter than necessary and energy will be wasted.

Warm Weather Shut Down (WWSD)

This control shuts off the boiler(s) when the outdoor temperature is above the WWSD point and heat is no longer needed. When the correct WWSD point has been selected, overheating is prevented and comfort and energy savings are increased. When the outdoor temperature cools off again, the heating system is turned on at the WWSD point to start delivering heat. The WWSD point is usually the desired room temperature in the building, however internal heat gains (from appliances, people, etc.) can change heat requirements and a lower WWSD point may be selected through trial and error.

- *When the system is operating near the WWSD point and the building is too cold,* the WWSD point should be raised.
- *When the system is operating near the WWSD point and the building is too warm,* the WWSD point should be lowered.

Installation

Caution

Improper installation and operation of this control could result in damage to the 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. This electronic control is not intended for use as a primary limit control. Other controls that are intended and certified as safety limits must be placed into the control circuit.

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 255 includes: • One Two Stage Boiler Control 255 • One Outdoor Sensor 070 • One Supply Sensor 071 • One Data Brochure D 255 • One Data Brochure D 001 • Application Brochures A 255

Other information available: • Essay E 000 • Essay E 200

Read Application Brochures A 255 and select the correct Application for your job.

Note: *Carefully read the details of the Application, and 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 Outdoor Sensor 070 and the Supply Sensor 071 according to the instructions in Data Brochure D 001 and run the wiring back to the control.
- Install a 24 V ac Class II transformer with a minimum 5 VA rating and run the wiring from the transformer to the control. *A Class II transformer must be used. Do not connect any of the transformer terminals to ground.*
- Install the wiring from the boiler(s) and pump circuits 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 person. 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 the control.

Test the sensors

These tests must be performed *before* power is applied to the control and *before* the sensors are connected to the terminal strip. Test both sensors according to the instructions printed in the 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 strips of the control.

Power and output connections ***Caution, Maximum 24 Volts***

Connect the transformer to terminals *Power C—R* (1 and 2).

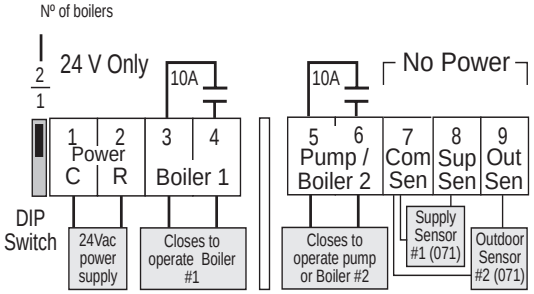
Connect the boiler #1 circuit to terminals *Boiler 1* (3 and 4)

- If two boilers (stages) are to be operated, slide the DIP switch to the "2" position and wire boiler #2 to terminals *Pump / Boiler 2* (5 and 6). For single boiler operation, slide the DIP switch to the "1" position and wire the system pump circuit to terminals *Pump / Boiler 2 (5 and 6).*

Sensor connections ***Caution, never apply power to these terminals.***

Connect the Outdoor Sensor 070 to terminals *Com Sen — Out Sen* (7 and 9).

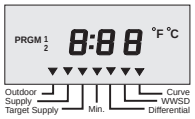
Connect the Supply Sensor 071 to terminals *Com Sen — Sup Sen* (7 and 8).



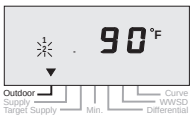
Settings

POWER ON

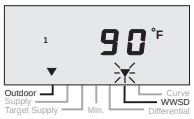
When the control is powered-up, all display elements are turned on. After approximately 3 seconds, the control automatically goes into operating mode.



When in operating mode, the Outdoor temperature will be displayed. Boiler(s) output is on when number segment is on. When number is flashing, delay on is occuring.

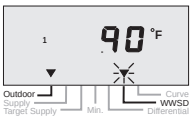


When only one boiler is selected, the Pump output contact will be on continuously until WWSD occurs. A slow flashing pointer indicates control action.

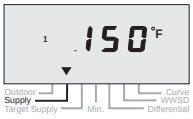


VIEWING

The display defaults to outdoor temperature after power up, or if the control has been left alone in programming longer than 20 seconds.



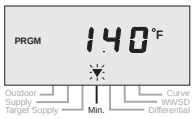
Press and Release the "Item" button. The Supply temperature will be displayed.



Press and Release the "Item" button. The Target Supply temperature will be displayed.

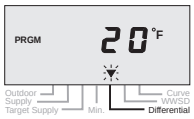
PROGRAMMING

Press and Release the "Item" button. The programmed Minimum supply temperature setting will be displayed. A fast flashing pointer indicates programming is active.



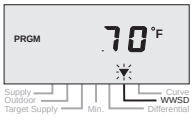
Push ▲ or ▼ to change Minimum supply temperature

Press and Release the "Item" button. The programmed Differential setting will be displayed.



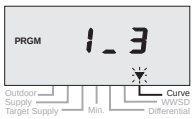
Push ▲ or ▼ to change Differential

Press and Release the "Item" button. The programmed Warm Weather Shut Down setting will be displayed.



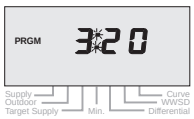
Push ▲ or ▼ to change WWSD setting

Press and Release the "Item" button. The programmed Heating Curve setting will be displayed.



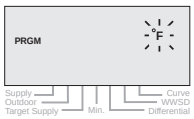
Push ▲ or ▼ to change Heating Curve (underscore is decimal point)

Press and Release the "Item" button. Only with two boiler option will the minimum boiler staging delay be displayed.



Push ▲ or ▼ to change minumum boiler staging delay

Press and Release the "Item" button. The Fahrenheit or Celsius scale may be selected.



Push ▲ or ▼ to select between Fahrenheit or Celsius scales

The control automatically goes back to viewing when the buttons are left alone for 20 seconds

Heating Curve

To calculate the correct setting for the Heating Curve, use the following formula:

$$\text{Heating Curve} = \frac{\text{design supply temperature} - \text{WWSD temperature}}{\text{WWSD temperature} - \text{design outdoor temperature}}$$

For example:
- **design outdoor temperature = 5°F (-15°C)**
- **WWSD temperature = 70°F (21°C)**
- **design supply temperature = 160°F (71°C)**

$$\text{Heating Curve} = \frac{160°F - 70°F}{70°F - 5°F} = \frac{90°F}{65°F} = 1.4$$

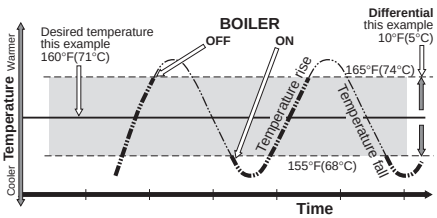
If the system design supply water temperature is unknown, a trial setting can be calculated using these typical supply temperatures:
• Fan coils or convectors …180 to 210°F (82 to 99°C) • Hydronic radiant floors …100 to 130°F (38° to 54°C).

Warm Weather Shut Down (WWSD)

The WWSD can be adjusted from 35 to 105°F (2 to 41°C) and its function is covered under the Outdoor Reset Strategy section on page 2. If the DIP switch is selected for one boiler operation, the pump output will cycle on for 20 seconds every three days during WWSD.

Differential and Time Delay

The differential adjustment sets how far the actual supply water temperature may deviate from the desired temperature before a boiler is turned on or off, and is determined by the flow rate through the system pump relative to the amount of heat produced. When using two boilers, boiler # 2 will be staged on when the actual supply temperature drops below the control's calculated target supply minus the differential setting. Note: Boiler # 2 delay time must have expired before boiler # 2 is fired. To prevent short boiler cycles, the control has a minimum time delay of 30 seconds between firing cycles for the first boiler. When two boiler operation is selected, the minimum delay between stages is adjustable from 30 seconds to 4 minutes.



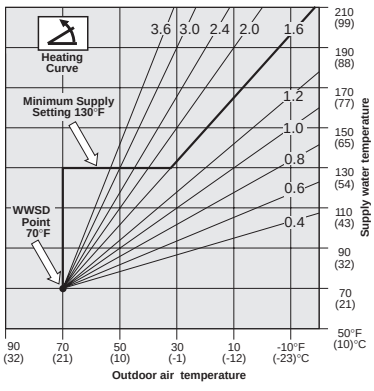
In the following example, boiler # 1 will turn on when the actual temperature falls 5°F (3°C) below the desired temperature and will turn off when the actual temperature rises 5°F (3°C) above the desired temperature.

$$\text{Differential} = \frac{\text{Btu/hr of each stage}}{\text{System US GPM x 500}} = \frac{\text{100,000 Btu/hr}}{\text{20 US GPM x 500}} = \text{10°F (6°C)}$$

Minimum Boiler Operating Temperature

This adjustment should be set according to the requirements specified by the boiler manufacturer. Many boilers require a minimum operating temperature to prevent corrosion from flue gas condensation. The control raises the supply temperature to the Minimum when the outdoor temperature drops below the WWSD setting, and holds it there until the outdoor temperature becomes cold enough to require operation on the heating curve.

Typical Minimum Boiler Operating Temperatures: • Steel Tube Boilers …140° to 180°F (60° to 82°C) • Cast Iron Boilers …130 to 150°F (54 to 66°C) • Copper Tube Boilers …105 to 150°F (41 to 66°C) • Condensing or Electric Boilers …off



Testing and Troubleshooting

If troubleshooting becomes necessary with the Two Stage Boiler Control 255, follow the testing procedure in step four of the installation procedure on page 2 of this brochure.

If the display window is flashing “Err” and the outdoor pointer, the outdoor sensor is either open or short circuit. The control is programmed to assume an outdoor temperature of 32°F (0°C) and control the supply temperature accordingly. If the display window is flashing “Err” and the supply pointer, the supply sensor is either open or short circuit. If this type of fault occurs, the control will turn off its relays in order to shut down the heating equipment it is controlling.

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 sensors are correctly located.

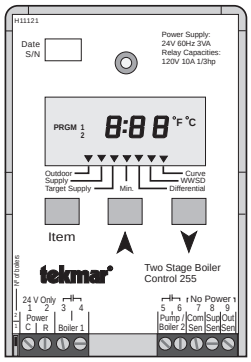
Before you leave

• Install the wiring cover over the wiring chamber and secure it with the screw provided. • Place the front cover on the control 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.

Technical Data

Two Stage Boiler Control 255

Literature	—	D 255, A 255, D 001, E 000, E 200
Control	—	Microprocessor PI control; This is **not a safety (limit) control**.
Packaged weight	—	1.0 lb. (450 g), Enclosure C, PVC plastic
Dimensions	—	4-3/4” H x 2-7/8” W x 7/8” D (120 x 74 x 22 mm)
Approvals	—	Meets DOC regulations for EMI/RFI.
Ambient conditions	—	Indoor use only, 15 to 120°F (-10 to 50°C), < 90% RH non-condensing.
Power supply	—	Class 2, 24 V ac ±10% 50/60 Hz 3 VA
Relays	—	120 V ac 10 A 1/3 hp, pilot duty 240 VA 2 A
Sensors included:	—	NTC thermistor, 10 kΩ @ 25°C ±0.2°C ß=3892 Outdoor Sensor 070 and Universal Sensor 071.
Control accuracy	—	±0.5°F (±0.25°C) with up to 1000 feet (300m) of 18 AWG wire to sensors.
Min. Boiler Supply	—	Off, 70 to 170°F (Off, 21 to 77°C)
Differential	—	2 to 45°F (1 to 25°C)
WWSD	—	35 to 105°F (2 to 41°C)
Heating Curve	—	0.4 to 3.6
Stage 2 Delay	—	0:30 to 4:00 minutes



The installer must ensure that this control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise. Conversely, this control does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications. If this equipment does cause interference, the user is encouraged to try and correct the interference by reorienting the receiving antenna and/or relocating the receiver with respect to this equipment. Le présent numérique n’émete pas de bruits radioeléctriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le réglement sur le brouillace radioeléctrique édicté par le Ministére des Communications du Canada.

Limited Warranty and Product Return Procedure

Limited Warranty: tekmar warrants to the original purchaser each tekmar product against defects in workmanship and materials when the product is installed and used in compliance with tekmar's instructions. This limited warranty covers the cost of parts and labour provided by tekmar to correct defects in materials and/or workmanship. Returned products that are fully operational are not considered a warranty case. tekmar also does not cover parts or labour to remove, transport or reinstall a defective product. tekmar will not be liable for any damage other than repair or replacement of the defective part or parts and such repair or replacement shall be deemed to be the sole remedy from tekmar. This warranty shall not apply to any defects caused or repairs required as a result of unreasonable or negligent use, neglect, accident, improper installation, or unauthorized repair or alterations. In case of defect, malfunction or failure to conform to warranty, tekmar will, for a warranty period of 24 months from the date of invoice to the original purchaser or 12 months from the date of installation of the product, whichever occurs first, repair, exchange or give credit for the defective product. Any express or implied warranty which the purchaser may have, including merchantability and fitness for a particular purpose, shall not extend beyond 24 months from the date of invoice or 12 months from the date of installation of the product, whichever occurs first.

Replacements: tekmar can send replacement products if requested. All replacements are invoiced. Any possible credit for the replacement will only be issued once the replaced product has been returned to tekmar.

Product Return Procedure: Products that are believed to have failed must be returned to tekmar Control Systems Ltd. 4611-23rd Street, Vernon B.C. Canada V1T 4K7 when agreed to by tekmar. The installer or other qualified service person must, at the owner's expense, determine which component has failed. The product must be returned complete withall of its components (sensors, base, etc.). Products must be returned together with the proof of purchase to the original purchaser who then returns the product to tekmar after receiving a Return Goods Authorization (RGA) number from tekmar.

Please include the following information with the product. The full address of the original purchaser, the RGA number and a description of the problem.

From the U.S.A., in order to avoid customs charges, products must be returned via US Post with the package clearly marked with the RGA number, product type and the statement "Canadian Product returned for repair". For shipping purposes the product can be valued at one half list price.

1) If returned during the warranty period and the product is defective, tekmar will issue full credit for the returned product less cost of missing parts.
2) If returned during the warranty period and the product is fully operational, tekmar will return the product to the original purchaser for a testing cost of $30.00 plus postage.
3) If returned during the warranty period and the product is not damaged and is fully opera tional, tekmar can take back the product for a return charge of 40% of the product's net value. This request has to be specified otherwise the product will be returned with a testing cost of $30.00 plus postage.
4) If returned after the warranty period and the product needs repair, tekmar will repair and return the product. Repair and postage costs will be invoiced. tekmar's repair costs are calculated at $30.00 / hour plus the cost of parts. If the repair costs will be more than $60.00 a repair estimate will be sent to the original purchaser.

In North America: tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
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