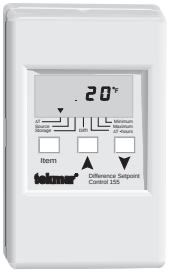
tekmar® - Data Brochure

Difference Setpoint Control 155

D 155

09/94



The Difference Setpoint Control 155 is a microprocessor-based control that allows the transfer of heat from a source to a storage tank whenever the temperature difference between the two is greater than the selected ΔT setpoint. Additional setpoints are also included to help prevent the storage tank from overheating or the source from freezing. Both drainback and draindown systems can be used with this control.

Several displays provide a variety of useful information. The control can display the Maximum and Minimum temperatures measured by both the Storage and Source sensors as well as the total heat transferred from the source to the storage.

Sequence of Operation

Powering up the control

After the Difference Setpoint Control 155 is powered up, the LCD segments are turned on for 3 seconds.

ΔT Setpoint

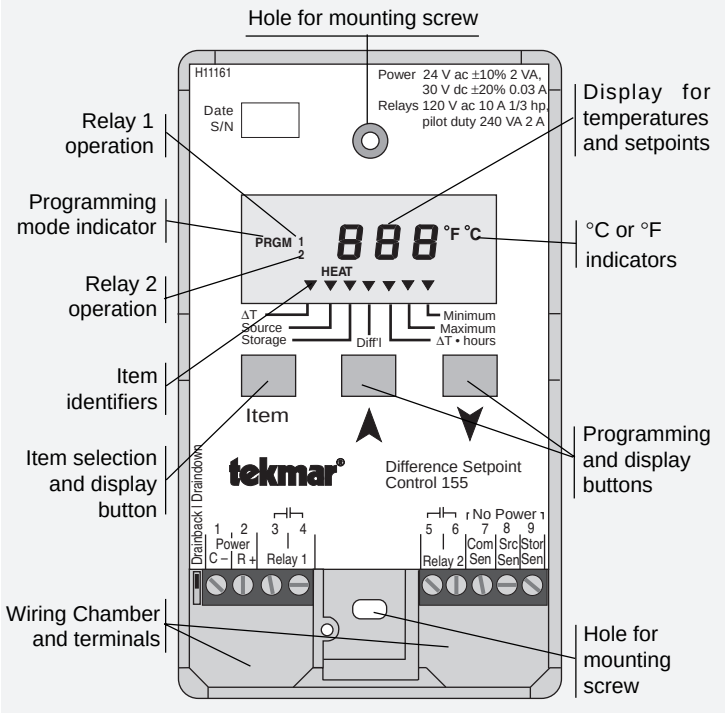
The control measures the difference between the Source and the Storage temperatures (ΔT). When this ΔT is greater than the ΔT setpoint, Relay 1 is turned on to transfer heat from the source to the storage. If the ΔT drops below the ΔT setpoint less the ΔT differential, Relay 1 is turned off.

Maximum Storage Setpoint

If the Storage temperature rises above the Maximum Storage setting, Relay 1 is turned off. This relay remains off until the Storage temperature drops below the Maximum Storage setting less its differential.

Minimum Source Setpoint

If the Source temperature drops below the Minimum Source setting, Relay 1 is turned off. This relay remains off until the Source temperature rises above the Minimum Source setting plus its differential.



Draindown

When the DIP switch is set to draindown, Relay 2 is closed until the Source temperature drops below the Minimum Source setting. If Relay 2 is connected to a drain valve, the heat transfer fluid can be drained from the source when Relay 2 is opened. Once the Source temperature rises above the Minimum Source setting plus the Minimum Source Differential, Relay 2 is closed and the control continues with ΔT setpoint operation. See the Application Brochures A 155 for the correct wiring of Relay 2.

Drainback

If the DIP switch is set to drainback, Relay 2 is turned on (closed) for 3 minutes whenever Relay 1 is turned on. Relay 2 is typically connected to a booster pump to overcome gravity head and prime a siphon.

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 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 155 includes:
- One Difference Control 155 • Two Universal Sensors 071
- One Data Brochure D 155 • One Data Brochure D 001 • Application Brochures A 155

Other information available:
- Essay E 000, E 100

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.

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

- Install the Source and Storage Sensors 071 according to the instructions in Data Brochure D 001 and run the wiring back to the control. Do not connect the wires to the terminals yet.
- **EITHER:** 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** either of the transformer secondary wires to ground. **OR:** Install a 30 V dc source and run the wiring back to the control.
- Run wiring back to the control from the devices connected to Relay 1 and Relay 2.

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 properly trained and experienced persons. A good quality electrical test meter, capable of reading from at least 0 — 200 Volts, 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 or 36 V dc be measured at any of the wires connected to the control.*

Test the sensors

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

Test the power supply

- Ensure exposed wires are not grounded or in contact with other wires, then turn on the power supply. If a 24 V ac transformer is used, make sure the voltmeter is set to AC. With the voltmeter leads connected to the secondary side of the transformer, you should measure between 20 and 28 V ac. If a DC power supply is used, make sure the voltmeter is set to DC. Connect the positive lead from the voltmeter to the positive terminal on the DC source and the negative lead from the voltmeter to the negative terminal on the DC source. The voltmeter should measure between 24 and 36 V dc.
- Turn off the power and complete the electrical connections to the terminal strip of the control.

Power and output connections

The installer should test to confirm that no voltage is present at any of the wires.

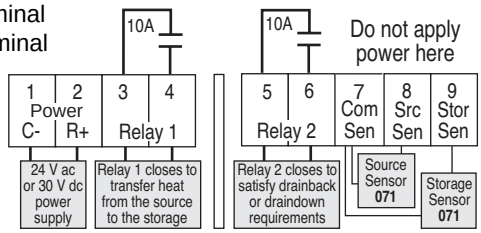
- **EITHER:** Connect the 24 V ac power supply to terminals *Power C- and R+* (1 and 2)
  OR: Connect the negative (-) lead from the 30 V dc source to the Power C- terminal
  Connect the positive (+) lead from the 30 V dc source to the Power R+ terminal

Note: The control will not operate if the DC leads are reversed.

- Connect the Relay 1 controlled device to terminals *Relay1* (3 and 4)
- Connect the Relay 2 controlled device to terminals *Relay 2* (5 and 6)

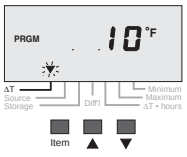
*Sensor connections — **Caution, voltage is never applied to these terminals***

- Connect the Source Sensor 071 to terminals *Com Sen and Src Sen* (7 and 8)
- Connect the Storage Sensor 071 to terminals *Com Sen and Stor Sen* (7 and 9)



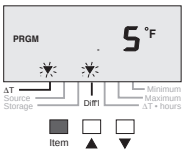
Settings

PROGRAMMING

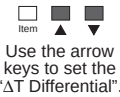


Press and Hold all three buttons at the same time to begin programming. The first item displayed is the "ΔT setpoint".

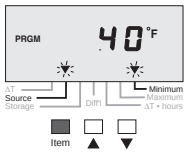
Use the arrow keys to set the "ΔT setpoint".



Press and Release the "Item" button to change the display to the "ΔT Differential".

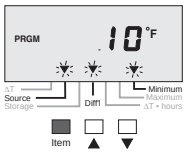


Use the arrow keys to set the "ΔT Differential".



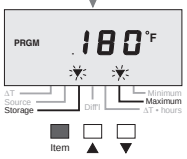
Press and Release the "Item" button to change the display to the "Minimum Source Setpoint".

Use the arrow keys to set the "Minimum Source Setpoint".



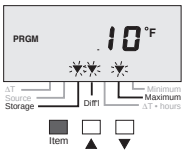
Press and Release the "Item" button to change the display to the "Minimum Source Differential".

Use the arrow keys to set the "Minimum Source Differential".

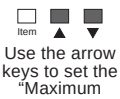


Press and Release the "Item" button to change the display to the "Maximum Storage Setpoint".

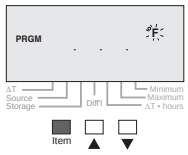
Use the arrow keys to set the "Maximum Storage Setpoint".



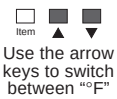
Press and Release the "Item" button to change the display to the "Maximum Storage Differential".



Use the arrow keys to set the "Maximum Storage Differential".



Press and Release the "Item" button to change the display to "°F" or "°C".



Use the arrow keys to switch between "°F" and "°C".

Note: The control automatically exits programming when the buttons are left alone for 20 seconds.

ΔT Setpoint. If the difference between the Source and Storage temperatures (ΔT) is greater than this setpoint, Relay 1 is turned on and heat is transferred from the source to the storage.

ΔT Differential. This differential setting is used to prevent short cycling of the heat transfer device when the ΔT is near the ΔT setpoint.

Maximum Storage Setpoint. If the Storage temperature rises above this setpoint, Relay 1 is turned off.

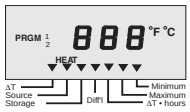
Maximum Storage Differential. This differential setting is used to prevent short cycling of the heat transfer device when the Storage temperature is near the Maximum Storage setpoint.

Minimum Source Setpoint. If the Source temperature drops below this setpoint, Relay 1 is turned off and Relay 2 operates according to the requirements of the Draindown or Drainback system.

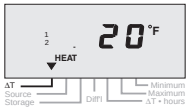
Minimum Source Differential. This differential setting is used to prevent short cycling of the heat transfer device when the Source temperature is near the Minimum Source Setpoint.

DISPLAY OPERATION

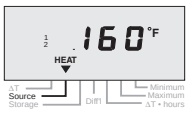
When the control is powered-up, all LCD segments are turned on for 3 seconds.



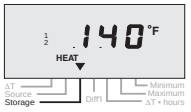
The current "ΔT" is then displayed. If Relay 1 is closed, a "1" and the word "HEAT" is displayed. If Relay 2 is closed, a "2" is displayed.



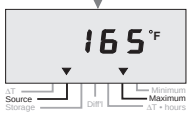
Press and Release the "Item" button to view the current "Source" temperature.



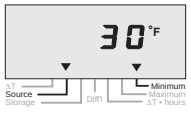
Press and Release the "Item" button to view the current "Storage" temperature.



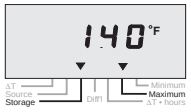
Press and Release the "Item" button to view the "Maximum Source" temperature measured since this display was cleared.



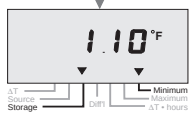
Press and Release the "Item" button to view the "Minimum Source" temperature measured since this display was cleared.



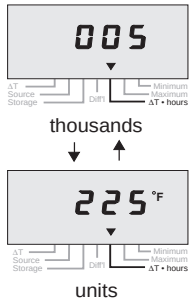
Press and Release the "Item" button to view the "Maximum Storage" temperature measured since this display was cleared.



Press and Release the "Item" button to view the "Minimum Storage" temperature measured since this display was cleared.



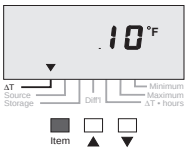
Press and Release the "Item" button to view the "ΔT•hours". The numbers shown to the right indicate 5225 °F•hours.



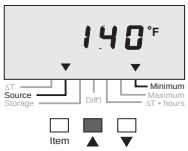
Note: The control changes from the above displays to the ΔT display if the buttons are left alone for 20 seconds.

Viewing programmed setpoints

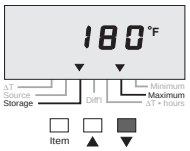
While the control is displaying any of the current sensor measurements, the setpoints can be viewed by the following:



Press and Hold the "Item" button to view the "ΔT" setpoint.



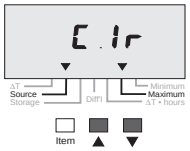
Press and Hold the "Up" button to view the "Minimum Source" setpoint.



Press and Hold the "Down" button to view the "Maximum Storage" setpoint.

Resetting Maximum or Minimum Displays

The above Maximum or Minimum displays can be reset by the following:



Press and Hold the "Up" and "Down" buttons for 1 second. The word "Clr" is displayed and the value is reset to the current sensor measurement.

Source temperature is the temperature measured by the Source Sensor.

Storage temperature is the temperature measured by the Storage Sensor.

ΔT is the calculated difference between the Source and Storage temperatures.

Maximum Source is the Maximum temperature measured by the Source Sensor since this item was last cleared.

Minimum Source is the Minimum temperature measured by the Source Sensor since this item was last cleared.

Maximum Storage is the Maximum temperature measured by the Storage Sensor since this item was last cleared.

Minimum Storage is the Minimum temperature measured by the Storage Sensor since this item was last cleared.

Energy Transfer (ΔT•hours). This display allows the user to estimate the amount of energy transferred from the source to the storage. The energy transfer is displayed by alternating between two numbers. When the °C or °F segment is off, the thousands are displayed. When the °C or °F segment is on, the units are displayed. The energy transfer can be estimated by multiplying the ΔT •hours by the system flow rate (in US GPM) and by the constant K given in the adjacent table.

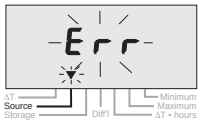
Example Energy Transfer = ΔT •hours x System flow x K
ΔT• hrs = 005 (thousands) 225 °F (units) = 5225 °F •hours
System flow = 20 US GPM
Fluid = 20% glycol & 80% water, therefore K = 487
Energy Transfer = 5225 x 20 x 487 = 50,892,000 BTU

% Glycol by weight	Freezing point	K @ 10°F
0%	32°F	500
10%	25°F	496
20%	15°F	487
30%	3°F	477
40%	-13°F	462
50%	-35°F	439

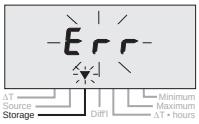
K values are calculated averages for most ethylene glycol solutions at 50°F (10°C). K increases with higher temperatures.

Step Five — Troubleshooting

First observe the system operating parameters. The source of the problem can often be identified by noting a display item which seems unreasonable. Observing what the control is doing, and understanding the sequence of operation greatly aids in troubleshooting. If there is a sensor fault, the control displays an error message. Use the error message table provided below to determine which circuit has the fault and then refer to Step Four for testing of the wiring and sensors.



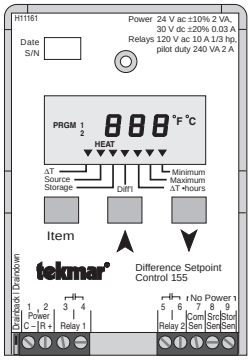
Source Sensor Open/Short Circuit
The display flashes "Err" and the "Source" pointer. Both relays are kept off with this error.



Storage Sensor Open/Short Circuit
The display flashes "Err" and the "Storage" pointer. Both relays are kept off with this error.

Difference Setpoint Control 155

Literature	—	D 155, A 155, D 001, E 000, E 100
Control	—	Microprocessor 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, -20 to 120°F (-30 to 50°C), < 90% RH non-condensing.
Power supply	—	Class 2, 24 V ac ±10% 2 VA OR 30 V dc ±20% 0.03 A
Relays	—	120 V ac 10 A 1/3 hp, pilot duty 240 VA 2A
Sensors included:	—	NTC thermistor, 10 kW @ 25°C ±0.2°C ß=3892 Two of Universal Sensor 071.
Control accuracy	—	±0.5°F (±0.25°C) with up to 1000 feet (300m) of 18 AWG wire to sensors.
ΔT Setpoint	—	2 to 90°F (1 to 50°C)
ΔT Differential	—	2 to 45°F (1 to 25°C)
Minimum Source	—	-22 to 185°F (-30 to 85°C)
Min. Source Diff'l	—	2 to 45°F (1 to 25°C)
Maximum Storage	—	-4 to 248°F (-20 to 120°C)
Max. Storage Diff'l	—	2 to 45°F (1 to 25°C)



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 with all 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 operational, 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
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