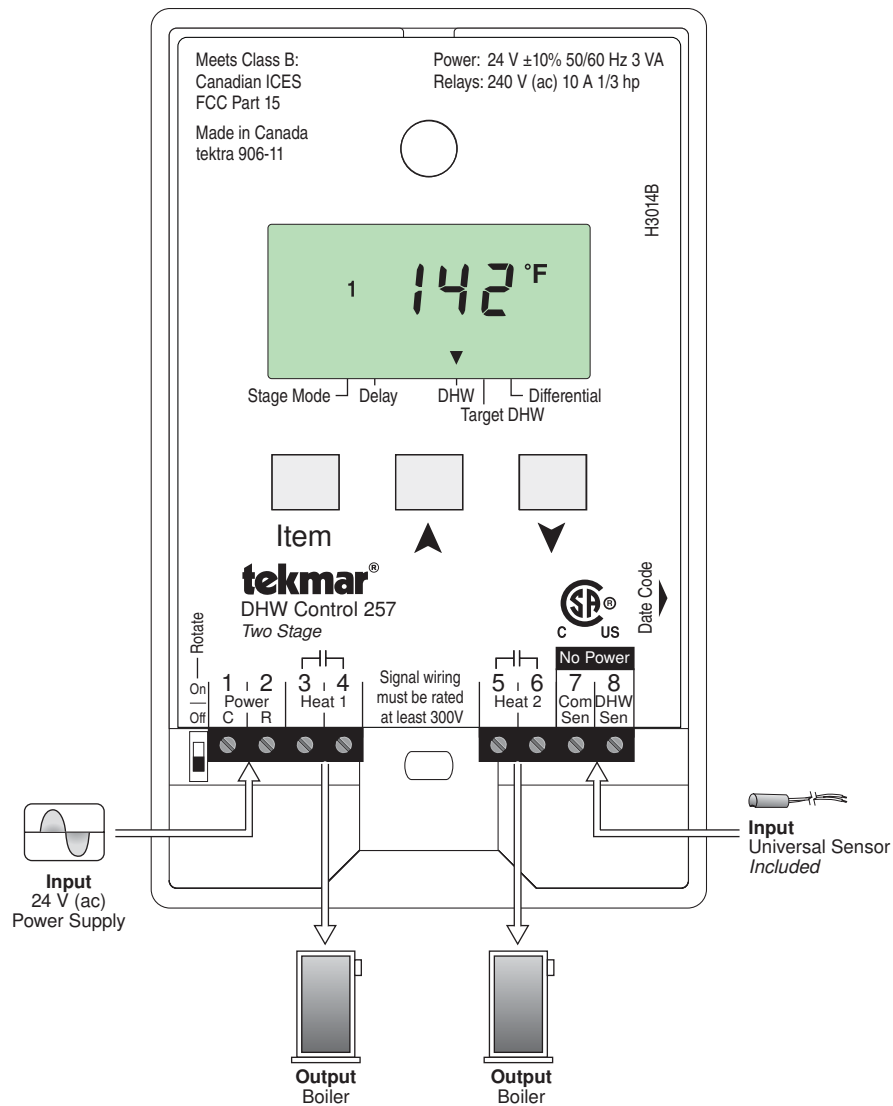


The DHW Control 257 is used for dedicated domestic hot water systems. The control operates two on/off boilers, or one two-stage boiler to maintain the DHW Target temperature at the DHW Sensor. The control can operate in Proportional (P) mode, or Proportional, Integral, Derivative (PID) mode.

**Additional functions include:**

- Boiler rotation
- Cumulative boiler run time hours
- P or PID staging modes of operation
- CSA and UL certified for use in the USA and Canada



## How to Use the Data Brochure

This brochure is organized into three main sections.

They are: 1) Sequence of Operation, 2) Installation, and 3) Control Settings.

The Control Settings section of this brochure describes the various items that are adjusted and displayed by the control. The control functions of each adjustable item are described in the Sequence of Operation.

## Table of Contents

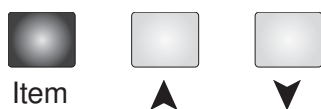
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## User Interface

The 257 uses a Liquid Crystal Display (LCD) to display information. Use the LCD to set up and monitor the operation of the system. The 257 has three push buttons (Item, ▲, ▼) for selecting, viewing, and adjusting settings. As you program the control, record the settings in the ADJUST menu table which is found in the second half of this brochure.

### Item

The selected item will be displayed using a pointer in the display. To view the next available item, press the **Item** button. Once you have reached the last available item, pressing the **Item** button again will return the display to the first item.

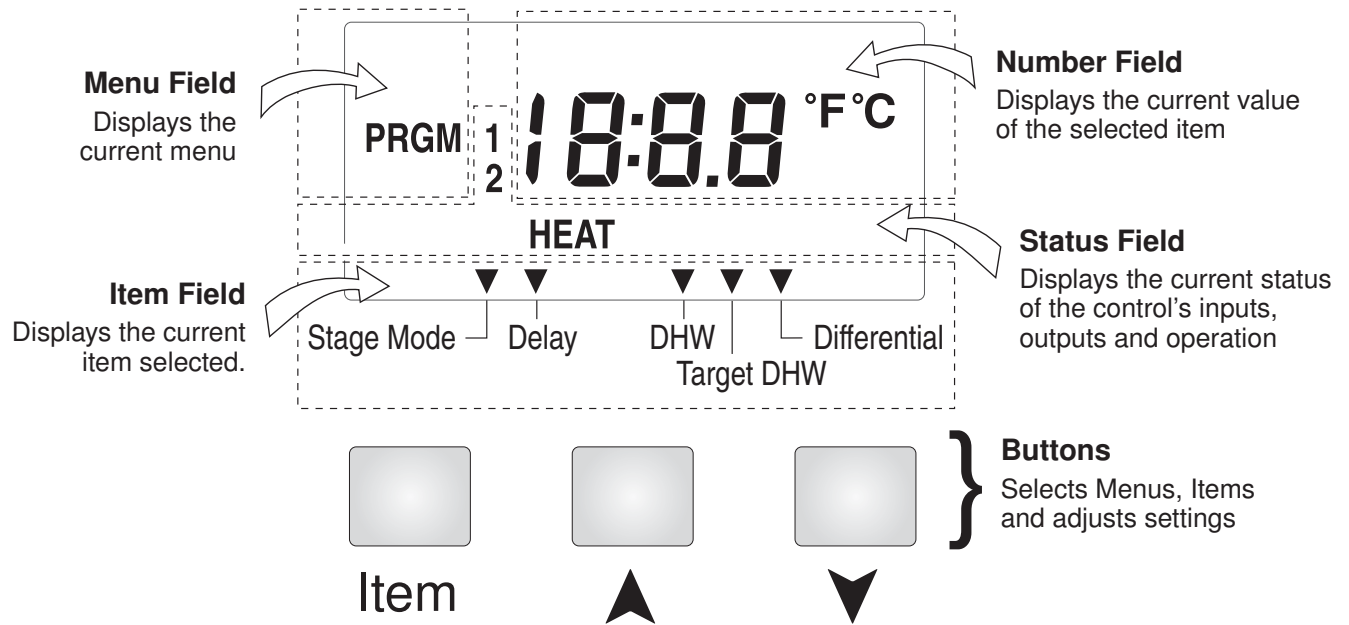


### Adjust

To make an adjustment to a setting in the control, press and hold simultaneously for 1 second all three (3) buttons. The display will then show the word PRGM. Select the desired item using the **Item** button. Finally, use the ▲ or ▼ button to make the adjustment.



## Display



## Symbol Description

▼	<b>POINTER</b> Displays the control operation as indicated by the text.	°F °C	°F, °C Units of measurement
1 HEAT	<b>HEAT RELAY</b> Displays when the HEAT 1 relay is closed.	<b>PRGM</b>	<b>PROGRAM MENU</b> Program the control settings.
2 HEAT	<b>HEAT RELAY</b> Displays when the HEAT 2 relay is closed.		

# Sequence of Operation

## Powering Up the Control

When the DHW Control 257 is powered up all LCD segments are displayed for 2 seconds followed by the version number being displayed for 2 seconds. The control then enters

into the normal operating mode and the LCD defaults to displaying the current DHW temperature.

## Staging Operation

### Proportional Staging Mode (P)

When the Stage Mode is set to P, the on/off points of the HEAT 1 and HEAT 2 relays are determined by the Target DHW setpoint, the Differential 1 and the Differential 2 settings. This is a manual way of staging the boilers. See figure 1 for a visual representation.

### Differential 1 & Differential 2 (P Mode)

Manually adjust Differential 1 and 2 to set the on points of stage 1 and 2. Stage 1 will fire when the temperature falls below Target DHW minus Differential 1. Stage 2 will fire when the temperature falls below Target DHW minus differential 1 minus differential 2.

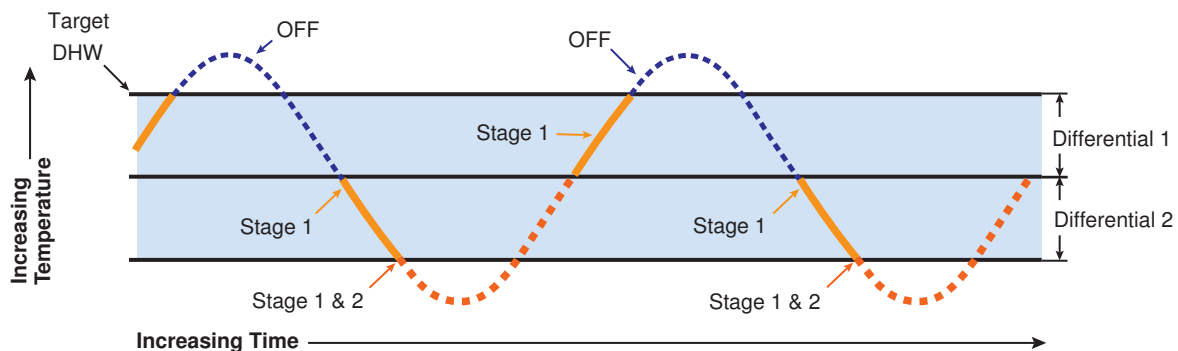


Figure 1 - Staging operation for proportional logic

### Proportional, Integral, Derivative Staging Mode (PID)

To provide proper boiler staging and accurate DHW Target temperatures, PID mode should be used. When the Stage Mode is set to PID, the on and off points of the HEAT 1 and HEAT 2 relays are determined by PID logic and the differential setting.

#### What is PID?

- Proportional Error - How far is the temperature from the Target?
- Integral Error - How long has the temperature been there?
- Derivative Error - How fast it is the temperature changing?

By considering these three errors, the control can better decide when to turn on a boiler stage. This function provides greater boiler plant efficiency and also prevents water temperature drop that is commonly seen on proportional staged systems.

### Differential (PID Mode)

If Differential is set to Auto, the control will calculate an appropriate differential to reduce boiler short cycling. If a boiler short cycles, the differential is automatically increased. If auto differential is not desirable, the installer may select a manual differential.

### Minimum On and Off Times

The minimum on and off time for each boiler is 30 seconds.

### DHW Maximum

If the DHW temperature rises 2°F above the Target DHW setpoint due to minimum boiler on times, the control will open both the Heat 1 and Heat 2 relays.

## Rotation

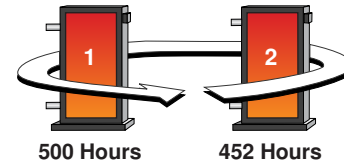
This function rotates the firing sequence of the two boilers based on the accumulated running hours of each stage. The **HEAT 1** and **HEAT 2** items in the default menu display the accumulated running hours of each stage. When one stage has accumulated 48 hours more running hours than the other stage, the operating sequence is rotated. The stage with less running hours is rotated in the firing sequence to turn on first, while the stage with more running hours will turn on last. This function increases the quality and reliability of the boiler plant by ensuring equal running times of both boilers. When this item is set to off, **HEAT 1** is always the first stage to fire.

### Forced Rotation:

If the difference in run times reaches 60 hours, then boiler rotation takes place immediately. This could occur if the DHW tank has a constant load causing one boiler to fire for an extended period of time.

## Relay Run Times

The control logs the number of run time hours for the **HEAT 1** and **HEAT 2** relay in the default menu. To reset back to zero hours, press and hold the up and down buttons for 3 seconds.



### Reset Rotation:

To reset the rotation sequence back to 1-2, clear both run time hours in the default menu by pressing and holding the up and down buttons. Next, switch the rotation dip switch to the off position and then back to the on position. Both stages now have 0 hours accumulated run time and the firing sequence is 1-2.

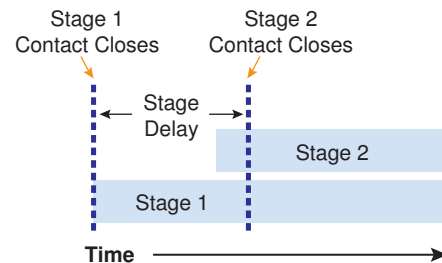
## Delay

When P Staging Mode is selected, you are then able to adjust the minimum stage delay between when stage 1 and stage 2 fires. This item is default at 30 seconds and is adjustable between 0 seconds and 19 minutes 50 seconds.

When PID Staging Mode is selected, PID logic is able to determine when to bring on stage 1 and stage 2. The minimum stage delay now becomes the default 30 seconds.

### Selecting a Delay Time:

- For low mass boilers, select a shorter delay time.
- For high mass boilers, select a longer delay time.



# 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 contact your wholesaler or tekmar sales representative for assistance.

Type 257 includes: One DHW Control 257, One Universal Sensor 082 Data Brochures D 257, D 070, D 001, Application Brochure A 257.

**Note:** Carefully read the details of the Sequence of Operation to ensure that you have chosen the proper control for your application.

## Step Two — Mounting

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

## Step Three — Rough-in Wiring

The wiring terminates in the two wiring chambers on the control. Determine whether the low voltage wiring enters the wiring chamber through the back or the bottom of the control. The wiring is roughed-in prior to installation of the control (see Brochure D 001). Standard 18 AWG solid wire is recommended for all low voltage wiring, and multi-strand 16 AWG wire is recommended for 120 V (ac) wiring.

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

- Install the DHW Sensor 082 according to the instructions in the Data Brochure D 070, and run the wiring back to the control.
- Run wires from the 24 V (ac) power to the control. Use a clean power source to ensure proper operation.

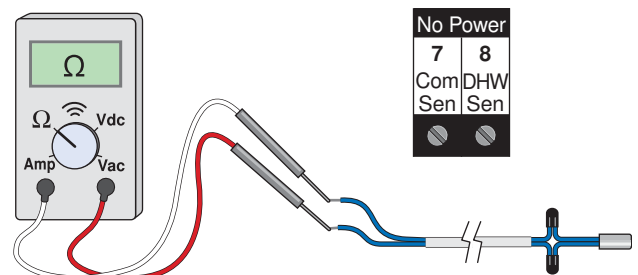
## Step Four — Testing the Wiring

The following 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 - 300 V (ac) and at least 0 - 2,000,000 Ohms, is essential to properly test the wiring and sensors.

### Test the Sensors

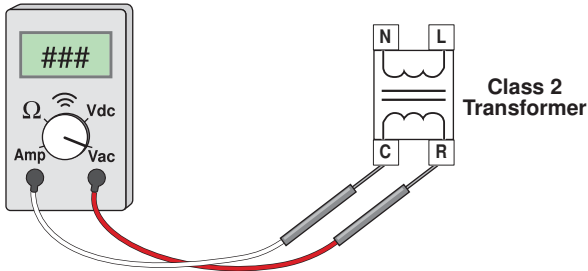
In order to test the sensors, the actual temperature at each sensor location must be measured. A good quality digital thermometer with a surface temperature probe is recommended for ease of use and accuracy. Where a digital thermometer is not available, a spare sensor can be strapped alongside the one to be tested, and the readings compared. Test the sensors according to the instructions in the Data Brochure D 070.



## Test the Power Supply

Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces.

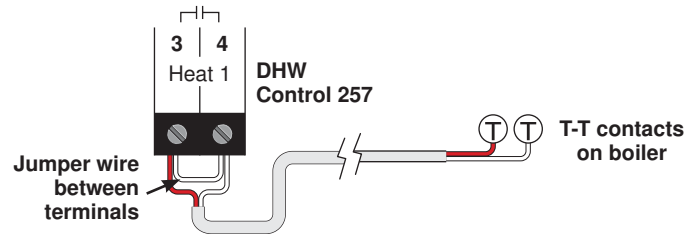
If a 24 V (ac) transformer is used, make sure the voltmeter is set to AC. Turn on the power and measure the voltage across the 24 V (ac) power supply. The reading should be between 22 and 26 V (ac).



## Test the Outputs

### Heat 1 and Heat 2

Make sure power is off to the boiler circuits and connect the TT contacts on the boilers to the Heat 1 and Heat 2 contacts on the control. Install jumpers at the Heat 1 and Heat 2 terminals to externally close the switch. When the boiler circuits are powered up, the boilers should fire. If the boilers do not turn on, refer to any installation or troubleshooting information supplied with the boilers (the boilers may have a flow switch that prevents firing until the boiler pumps are running). If the boilers operate properly, disconnect the power and remove the jumpers.



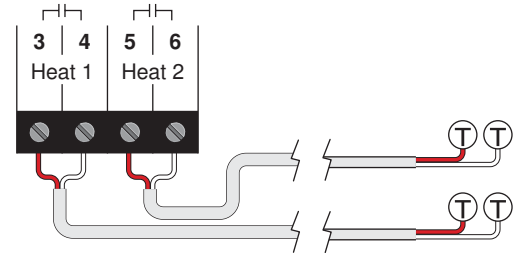
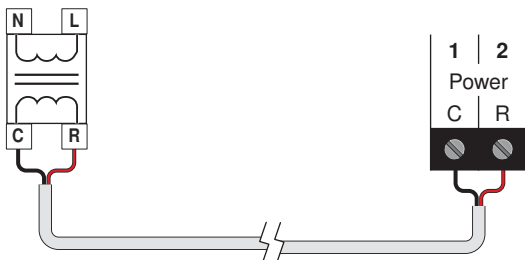
## Step Five — Electrical Connections to the Control

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

### Powered Input Connections

#### 24 V (ac) Power

Connect the 24 V (ac) power supply to the Power C and Power R terminals (1 and 2). This connection provides power to the microprocessor and display of the control.

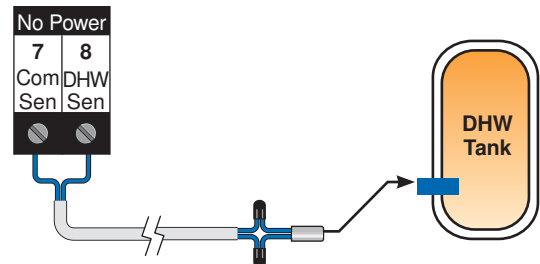


### Sensors

**Do not apply power to these terminals as this will damage the control.**

#### DHW Sensor

Connect the two wires from the DHW Sensor 082 to the Com and DHW terminals (7 and 8). The DHW Sensor is used by the 257 to measure the DHW tank temperature.



### Output Connections

#### Heat 1 and Heat 2 Contacts

The Heat 1 and Heat 2 contacts are an isolated output in the 257. There is no power available on these terminals from the control. These terminals are to be used as a switch to either make or break the boiler TT circuit. When the 257 requires boiler 1 to run, it closes the contact between terminals 3 and 4, and when the 257 requires boiler 2 to run, it closes the contact between terminals 5 and 6.

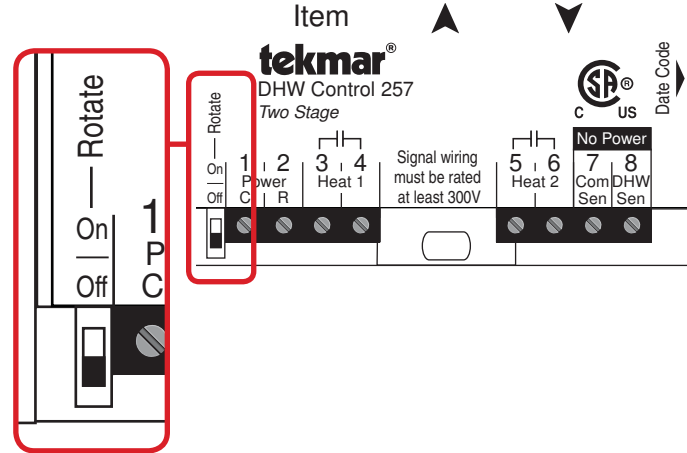
Locate the sensor in a well in the tank. The 082 sensor is 3/8" OD and will insert into a standard 1/2" well.

# Control Settings

## DIP Switch Settings

### Off | On - Rotate

The Off | On – Rotate DIP switch is used to turn boiler rotation on or off. When using a single boiler with two stages, the DIP switch should be in the off (down) position. When using two single-stage boilers, the DIP switch should be in the on (up) position.





## Default Menu

View Next Item



Item

The Default menu items display current operating temperatures and system status information. Use the Item button to view items in this menu.

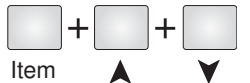
DEFAULT MENU

Item Field	Range	Description
	-60 to 255°F (-51 to 124°C)	<b>DHW TEMPERATURE</b> The current DHW temperature as measured by the DHW sensor. HEAT is displayed with a 1 or 2 when either the Heat 1 or Heat 2 relay is closed.
	70 to 190°F (21 to 88°C)	<b>TARGET DHW</b> The current DHW target as programmed in the PRGM menu. HEAT is displayed with a 1 or 2 when either the Heat 1 or Heat 2 relay is closed.
	0 to 1999 Hours	<b>HEAT 1 RUN TIME</b> The total running time in hours of the HEAT 1 relay since this item was last cleared. To clear, press the ▲ and ▼ buttons simultaneously while viewing this item.
	0 to 1999 Hours	<b>HEAT 2 RUN TIME</b> The total running time in hours of the HEAT 2 relay since this item was last cleared. To clear, press the ▲ and ▼ buttons simultaneously while viewing this item.

After the last item, the control returns to the first item in the menu.

## Program Menu

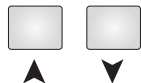
Enter Program Menu



Next Item



Change Value



The Program menu items are the programmable settings used to operate the system. **Press and hold all three buttons simultaneously** to enter the Program menu.

PROGRAM MENU

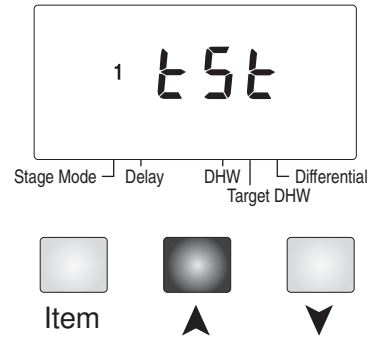
Item Field	Range	Description	Actual Setting
	70 to 190°F (21 to 88°C) Default = 140°F (60°C)	<b>TARGET DHW</b> The DHW tank target temperature.	
	AU, 1 to 42°F (Au, 1 to 23°C) Default = Au	<b>DIFFERENTIAL</b> The differential the control will use when operating the boilers in PID mode. (Stage Mode is set to PID)	
	1 to 42°F (1 to 23°C) Default = 2°F (1°C)	<b>DIFFERENTIAL 1</b> The differential the control will use for the turn on point of the Heat 1 relay (all below target DHW). (Stage Mode is set to P)	
	1 to 42°F (1 to 23°C) Default = 2°F (1°C)	<b>DIFFERENTIAL 2</b> The differential the control will use for the turn on point of the Heat 2 relay (all below Differential 1). (Stage Mode is set to P)	
	0:00 to 19:50 minutes Default = 00:30	<b>DELAY</b> The minimum time delay between the operation of stages. (Stage Mode is set to P)	
	PID, P Default = PID	<b>STAGE MODE</b> Selects the mode of operation for staging.	
	°F, °C Default = °F	<b>UNITS</b> The units of measure that all of the temperatures are to be displayed in the control.	

After the last item, the control returns to the first item in the menu.

## Field Test

To test the control, push and hold the up button for 3 seconds while in the default menu. While in Field Test “tSt” is displayed.

- Step 1:** Heat 1 relay will close and Heat 2 relay will open for 10 seconds
- Step 2:** If rotate switch is off, both Heat 1 and Heat 2 relays will close for 10 seconds. If rotate switch is on, Heat 1 relay will open and Heat 2 relay will close for 10 seconds.
- Step 3:** The test routine ends and the control resumes normal operation.



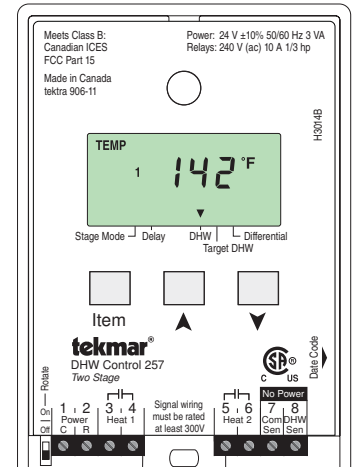
## Error Messages

<p>The display shows the error code 'E01'. Below the display are four labels: 'Stage Mode', 'Delay', 'DHW', and 'Differential Target DHW'.</p>	<p><b>EEPROM READ ERROR</b></p> <p>The control was unable to read a piece of information stored in it's memory. Because of this, the control was required to reload factory settings for all items in the PRGM menu. The control will stop operation until all of the items in the PRGM menu have been checked.</p>
<p>The display shows the error code 'Err'. Below the display are four labels: 'Stage Mode', 'Delay', 'DHW', and 'Differential Target DHW'.</p>	<p><b>DHW SENSOR ERROR</b></p> <p>The control is no longer able to read the DHW Sensor due to an open or short circuit. Locate and repair the problem as described in the Data Brochure D070. The outputs will not operate until the error is cleared.</p>

## Technical Data

### DHW Control 257 Two Stage

Literature	— D 257, A 257, D 001, D 070
Control	— Microprocessor control; This is <b>not a safety (limit) control</b>
Packaged weight	— 0.78 lb. (355 g)
Dimensions	— Enclosure C, White PVC Plastic
Approvals	— 4-3/4" H x 2-7/8" W x 7/8" D (120 x 74 x 22 mm)
Approvals	— CSA C US, CSA 22.2 N°24 and UL 873, meets class B: ICES & FCC Part 15
Ambient conditions	— Indoor use only, 32 to 122°F (0 to 50°C), < 90% RH non-condensing
Power supply	— 24 V (ac) ±10%, 50/60 Hz, 3 VA
Relay	— 240 V (ac) 10 A 1/3 hp
Sensors	— NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) β=3892
included:	— 1 of Universal Sensor 82
optional:	— tekmar type # 078



## 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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