Guidelines for Use

Fault Finder

Order Number 81002502

The following are guidelines for using the Fault Finder test tool. These procedures and the equipment provided are only to be used on a Watts Radiant heating cable or heating mat that is known, or is believed to be damaged. Results are not guaranteed.

⚠ WARNING

To prevent the risk of personal injury and/or death, proper electrical safety protocol must be observed at all times. **Any troubleshooting work should be performed with the power removed from the circuit.**

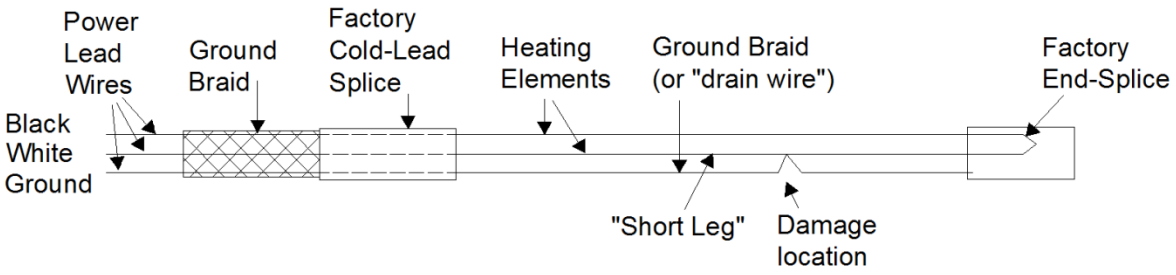
Watts Radiant will accept no liability or responsibility for injury or damage to person or property that may result from attempting to follow these procedures or from using the equipment.

The GOAL

The goal when using this test tool is to give a distance in feet to a possible fault in a heating cable or mat. This requires knowing how the cable or mat is laid out in the floor. If you do not know the layout, the distance may not give enough information to help and a ProTracer (order no. 81007166) may need to be rented instead.

The Fault Finder works by sending a signal into the wire and, similar to sonar, the signal reflects back at a break. It will only display the first break in the wire. If the damage is minor, it may not be able to find it.

Terminology



1 – Before Using the Fault Finder

Q1: What is the nature of the problem you have with the electric floor warming system?

The heating cable ohm reading shows an Open Circuit using my multi-meter.

Make sure you are using a digital multi-meter set to the proper “scale” when testing the cable, typically the lowest resistance scale. See **Q2**.

The thermostat GFCI trips when the control tries to heat the floor.

There may be several reasons for this, including a loose wire connection, or water content in the floor mortar, or current from the heating circuit leaking to ground through a pinch or nick in the wire.

First, take ohm readings from the heating cable power leads to its ground wire, see **Q2**. Then see **Q3**.

Q2: What are the ohm readings from this heating cable or mat? Digital multi-meter readings from the cable in the floor are needed to get the best results while using the Cable Fault Finder tool.

Turn off power at the circuit breaker, remove the thermostat, and disconnect the Power Lead Wires from the thermostat and from house ground and from any other Power Lead Wires from other heating cables.

Set your multi-meter to 200Ω (200 ohms) scale and measure between the black and white (or blue if 240V) Power Lead Wires. If the meter shows "open" (O.L, or "1" to the left on the display) then set your meter to 2000Ω (2kΩ) and re-measure. If it shows "0.090", this may be 90 ohms due to the scale factor.

Black to White (or blue if 240V): _____ (note if your display shows Ω, or kΩ, MΩ)

Measure again between each Power Lead Wire and Ground. A good cable should show "O.L" or "1" to left in the display, showing there is no continuity.

Black to ground: _____ (note if your display shows Ω, or kΩ, MΩ)

White (or Blue if 240V) to Ground: _____ (note if your display shows Ω, or kΩ, MΩ)

If an ohm reading to ground measures over 10 kΩ, the Cable Fault Finder generally will not be able to detect the location where there may be a problem. The problem might also be related to residual moisture in the floor, please see **Q3.**

If an ohm reading to ground measures less than 10kΩ, the Cable Fault Finder may be useful.

If an ohm reading to ground measures less than half of the Resistance Range of this heating cable, this ohm reading may be used to calculate an approximate distance down the heating cable to the damage. This can help support your results obtained using the Fault Finder.

Approximate % distance to damage = Measured ohm reading / [(Average of Resistance Range shown on product tag) / 2]

Approximate length of heating wire to damage = (Length of heating wire x Approximate % distance to damage)

Q3: If the GFCI in the floor control has been tripping, how long has the mortar bed been allowed to cure and dry out?

Residual moisture in the mortar bed can cause faulty ohm readings and can cause the GFCI in the thermostat to trip when nothing is really damaged. If the self-leveling compound, thin set, mortar and grout are less than 3 weeks old, the floor generally needs more curing time before use. Use of moisture barrier products during floor construction and larger glazed ceramic or porcelain tile can extend the required curing and drying time considerably. Additional drying time might resolve the problem.

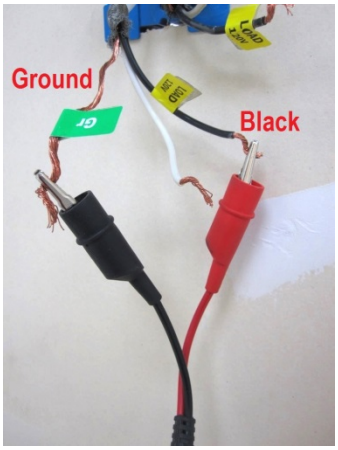
2 – Preparation

1. Turn off power at the circuit breaker, remove the thermostat, and disconnect the Power Lead Wires from the thermostat and from house ground as noted in Q2.
2. Attach the test leads that come with the Fault Finder to the connector on top. Twist to lock it in.
3. Press and hold the UP button. Press and release the ON/STANDBY button. Release the UP button. The display should alternate between "0" and a value called the VOP (Velocity of Propagation).
4. Press the UP or DOWN button to adjust this VOP to 60. IF your cable has a Stainless Steel braided ground shield on the heating cable, adjust the VOP to 65. (The braided shield on the Power Lead Wires is Tinned Copper; do not confuse this with the braided shielding on the heating cable.)
5. Turn off the Fault Finder, then turn it back on with only the ON/STANDBY button. The display should show a steady "0".
6. Temporarily touch the tips of the test leads together. It should make a tone, indicating continuity.

If the Fault Finder does not show steady values, or does not tone when touching test leads together, replace the "AA" batteries.

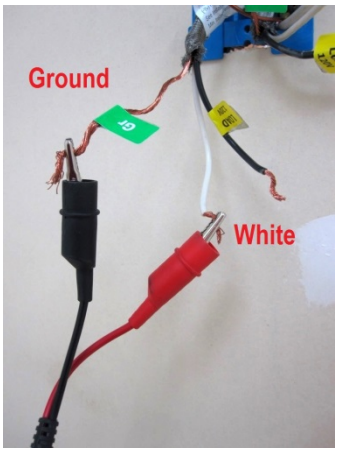
3 – Measure Distance to a Fault

1. Clip the black test lead to the Power Lead ground wire and the red test lead to the Power Lead black wire. Note the display reading.

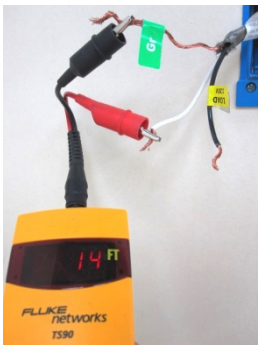


Black to ground: _____ ft

2. Move the red test lead clip to the Power Lead white wire (or blue wire for 240V). Note the display reading.



White (or Blue if 240V) to Ground: _____ ft



4 – Determine Location of Fault

The display shows the distance in feet of wire to the closest fault it can detect. This includes the length of Power Leads, so remember to subtract the Power Lead length before considering how far a problem is into the heating wire itself.

Table 1 shows typical display indications.

Table 1. Display Indications

Display Reading	Indication	Action / Possible Cause
-Err	The meter leads may be too near each other.	Separate the meter leads and re-measure.
Solid tone with any measurement	Continuity of 75 ohms or less.	Some ohm readings can be useful to locate the damage. See Q2.
2 or less	The problem may be very close to the meter connections.	Inspect the exposed cable very closely.
Less than 10	The problem may be in the Power Leads.	Check for a nail in a baseboard that may have punctured the Power Leads
8 to 20	The problem may be in the Factory Cold-Lead Splice	Check if this Factory Splice is bent or is located partially or fully in the wall. This can cause it to overheat.
LLLL measurements are about 5 feet difference of each other	This is within the accuracy of the meter.	Average the two measurements to help estimate the location of the problem.

L.LLL (blinking dot)	Low battery.	Low battery will affect accuracy of the measurements. Replace batteries and re-set the VOP (see **2-Preparation**).
LLLL approximately the same as the length of the heating wire	The problem may be near or in the Factory End-Splice	Check if the Factory End-Splice has been bent, damaged, or located in an air pocket. Use your knowledge of the location of the Factory-End Splice to uncover.
LLLL more than 20 feet, but less than the full length of the heating wire.	The problem is in the heating wire.	Use your knowledge of the wire layout to estimate the location of the problem. If you have a mat, you may use the **Calculations for Mat** below to help location the problem.
LLLL approximately twice the length of the heating wire	The meter is unable to see a problem on this heating wire.	
LLLL more than the length of the heating wire, but less than twice the length of the heating wire	The signal has traveled the full length of the heating wire and come back on the other heating wire, reflecting back at the problem in the heating wire. This would be the "long leg" and may be helpful, but less accurate than desired. See if you get a shorter distance with the other Power Lead and the Ground, then use it for calculations.	Distance of the problem from the **beginning** of the heating wire = (2 x length of heating wire) – measurement. Distance of the problem from the **end** of the heating wire = measurement – length of heating wire.

Calculations for Mat

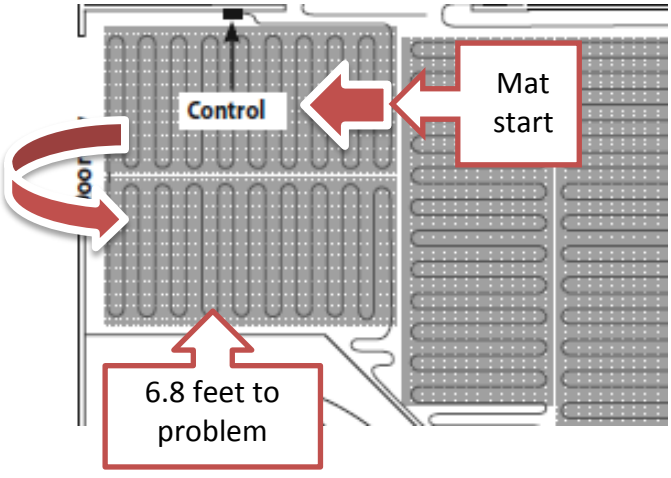
Since heating mats have a definite wire layout, it can sometimes help by determining the length of mat to the problem.

Example: 2'x20' mat (made in 2016)
Display: LLLL = 64 feet
Subtract the length of the Power Leads: LLLL = 64 – 10 = 54 feet
Divide LLLL by the Width Factor for this mat in Table 2: 54 / 7.9 = 6.8 feet of heating mat to the problem

Table 2. Mat Width Factors

Mat Width	TapeMat made after July 2014	TapeMat made 2012 to July 2014	Woven mat (prior 2012)
1'	n/a	n/a	4.48
2'	7.9	9.4	8.93
2.5'	9.9	10.83	10.86
3'	11.9	14.2	12.9

Use your knowledge of the mat layout to estimate the approximate location of the problem:



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