

MODEL 540 USER MANUAL
INCORPORATING
MODEL 530
TEMPERATURE CONTROLLER

Signal Group Limited
12 Doman Road, Camberley
Surrey, GU15 3DF
England

Tel: +44 (0) 1276 682841
Fax: +44 (0) 1276 691302
e-mail: instruments@signal-group.com

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ADDENDUM TO 540/530 USER MANUAL

The following caution applies to all issues of this manual,
up to and including issue 5.01

CAUTION

Take care to avoid skin contact with the line ends while
disconnecting and transporting a hot line.

Tightly coiling a hot line can cause the PTFE inner tubing to kink
causing restricted flow next time it is used.

Switch the controller off and allow cool air to purge through the
line until it is cool (about 60 °C to 70 °C). If the line must be
transported while still hot, only **LIGHTLY** coil it.

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SIGNAL HEATED LINE

1.0 INTRODUCTION

- 1.1 The SIGNAL Heated Line was primarily developed for carrying heated diesel exhaust gas to Hydrocarbon and NOx analysers such as the SIGNAL 3000 and 4000 series. If the temperature of the sample gas falls below the dew-point of the gas being measured, then the gas will become liquid and condense in the sample line. Since the analysers can only measure gases it is essential to avoid such condensation.
- 1.2 A constant high temperature must be maintained throughout the entire line assembly, and this is achieved by the use of a braided heating element. The braiding is made from stainless steel wire, which completely surrounds an inner PTFE tube. The whole is bedded in a silicone sponge for thermal insulation, and a sleeve of wire reinforced, anti-scuff, PVC hosing completes the assembly.
- 1.3 This method of heating ensures a constant high temperature throughout the sample line, with no cold spots. Despite internal temperatures of up to 200 degC, the efficiency of the insulation keeps the line relatively cool on the outside and therefore quite comfortable to handle.
- 1.4 The temperature of the braid is sensed by a type K thermocouple in thermal contact with, but electrically isolated from the braid. The thermocouple leads and electrical terminations to the braid, are brought out at one end of the line for connection to a temperature controller and isolating transformer.
- 1.5 Heating is achieved by passing a current through the braid to raise it's temperature. SIGNAL have designed the heating method with safety as a major consideration, and therefore an isolating transformer is supplied with the line. This transformer is designed and wound to suit an individual line, according to the voltage required to drive the correct current through the length of braid.
- 1.6 Temperature control is achieved by a solid state, purpose built controller, SIGNAL MODEL 530, which has been designed to drive the primary side of the isolating transformer. This gives a lower power loss in the controller. Special circuit techniques are used to reduce the high inrush current normally associated with transformer loads, and ensure that the DC component of the drive current is minimised.
- 1.7 The SIGNAL 540 ENCLOSURE, containing the 530 controller and the isolating transformer, provides a compact and transportable system for customers who wish to use heated line in a laboratory, or on site, and heated line facilities are not available in their own systems.

540 ENCLOSURE

2.0 INTRODUCTION

- 2.1 The Model 540 enclosure provides a convenient, transportable package for the 530 temperature controller and isolating transformer that are required to control a length of heated line.
- 2.2 The enclosure is suitable for loads up to 1800 watts (20 metres) on 240 volt 50/60 Hz supplies and 900 watts (10 metres) on 110 volt 50/60 Hz supplies. An enclosure is customised for one length and size of heated line only. They are not interchangeable.
- 2.3 A 2 metre length of mains lead is provided for local mains connection which should be terminated with a fused plug to suit the outlet.
- 2.4 The heated line is attached via a 9 pin connector providing power and thermocouple connections.

3.0 SPECIFICATION

- 3.1 Mains Supply** 200 - 260 Vac 50/60 Hz or
100 - 130 Vac 50/60 Hz
Check serial number plate for detail.
- 3.2 Ambient Temperature** 5 to 30 degC
- 3.3 Relative Humidity** 90% non-condensing
- 3.4 Power Requirement** 90 Watts/metre length of heated line plus 10 watts.
Maximum 1810 watts.
- 3.5 Fuse Rating** Depends upon length of heated line and mains supply.

Fuse	Part No.	240 Vac	110 Vac
3A	FUS/021	0 - 200W	0 - 100W
7A	FUS/022	200 - 360W	100 - 180W
10A	FUS/023	360 - 760W	180 - 380W
16A	FUS/024	760 - 1800W	380 - 900W

- 3.6 Temperature Control Range** 0 - 200 degC
- 3.7 Size** 225 mm width and depth
320 mm height
- 3.8 Weight** Depends upon length of line 25 kg maximum excluding line.

4.0 INSTALLATION

4.1 Connect the mains lead to a suitably rated and fused connector with safety earth. The wires should be connected as follows:-

Brown	Live
Blue	Neutral
Green/Yellow	Earth

4.2 Connect the 9 pin plug on the heated line to the mating socket on the enclosure.

4.3 To prevent problems that can arise from connecting the wrong length line to the enclosure, the transformer secondary is fused and thermocouple connections are made to specific pins for particular load ranges. Thus the T/C ERROR indicator on the controller will be on if the thermocouple has gone open circuit ~ the wrong length line is fitted. These connections are shown on the wiring schematic 107308.

5.0 OPERATION

5.1 Switch on the mains supply at the local outlet.

Check that the POWER indicator is on.

5.2 Check that the T/C ERROR indicator is off. If not, check that the serial numbers of the heated line and enclosure are the same.

Check for a low resistance between the thermocouple leads, and for a high resistance between the thermocouple and heater leads.

5.3 Set the required temperature on the front panel control.

Check that the HEATER indicator turns on showing that power is being applied to the line, and that it cycles on and off when the working temperature is reached.

5.4 The proportional band has been factory set to suit the heated line. This is the range over which power is proportionally applied and is centred around the set temperature.

If the temperature control accuracy needs to be improved then the proportional band should be reduced.

If the temperature overshoots the set point by an unacceptable level, then the proportional band should be increased.

A small screwdriver can be used to adjust the P.BAND control, accessible from the front panel. One turn anticlockwise will reduce the proportional band by about 4 degC. One turn clockwise will increase it by about 4 degC. Adjust until an acceptable control is achieved.

5.5 Due to the method of heated line construction, small variations in temperature along the length of the line will be experienced.

TEMPERATURE CONTROLLER

6.0 INTRODUCTION

This section applies when the controller and heated line are supplied without the enclosure and are to be installed in an OEM or USER system.

- 6.1 The 530 temperature controller is designed to control the temperature of the SIGNAL HEATED SAMPLE LINE. The advantage of this unit is the ability to drive the primary side of the line transformer. The high surge current that can occur at switch-on is significantly reduced by special circuit techniques giving improved reliability and reduced line interference. This feature is not available on most standard temperature controllers.
- 6.2 An output is available to drive a solid state relay for loads greater than specified. The user must ensure that adequate heat sinking is provided for the relay.

8.0 INSTALLATION

8.1 Power Connections and Fuse Selection

Power and transformer connections are made at the terminal block on the rear panel. They are labelled as follows going from left to right.

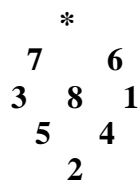
H2	Transformer (switched)
Hi	Transformer (live)
L	Power Live
M	Power Neutral
E	Earth

When the controller is supplied together with a heated line and transformer, a suitable rated fuse is factory fitted. When supplied on its own, it is fitted with a 16 amp fuse and is rated for the maximum load. This fuse will protect the controller. To protect a load of lower power rating a smaller fuse rating should be fitted. Suitable values and part numbers are given in section 7.9.

8.2 Thermocouple and other connections

Input and Output connections are made at the rear panel 8 pin DIN connector as shown below. Pin 8 is the centre pin.

Pin	Connection
1	Thermocouple +ve
8	Thermocouple -ve
6	Temperature Output 10 mV/degC
5	Temperature output return
7	Control output for solid state relay (+ve)
3	Control output return
2	Not used
4	Not used



* = polarising slot

8.3 120/240 volt operation

The controller is factory set for the mains voltage requested. To change the operation voltage it is necessary to remove the top cover.

WARNING

Removal of the covers will expose the mains terminals and wiring.

To ensure safety, always disconnect the unit from the mains supply and only allow qualified personnel to gain access.

Remove the top cover. Identify SW1 between the main connector and the transformer. Set the switch to the 120V or 240V position according to the mains supply available. Refit the cover.

Please ensure that you do not try to use a transformer on the wrong supply voltage.

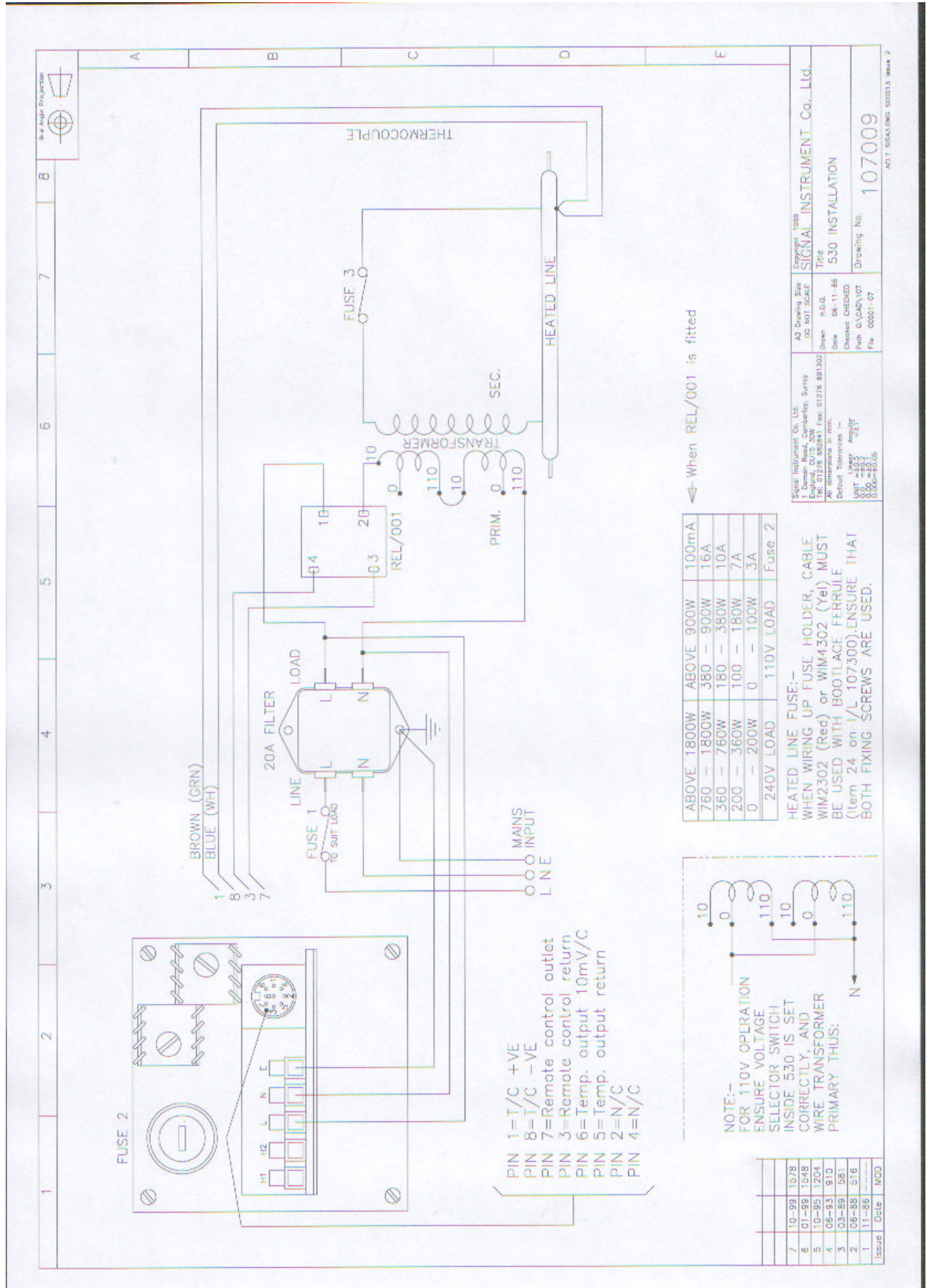
CHANGING THE SWITCH IN THE 530 DOES NOT ALTER THE TRANSFORMER RATING.

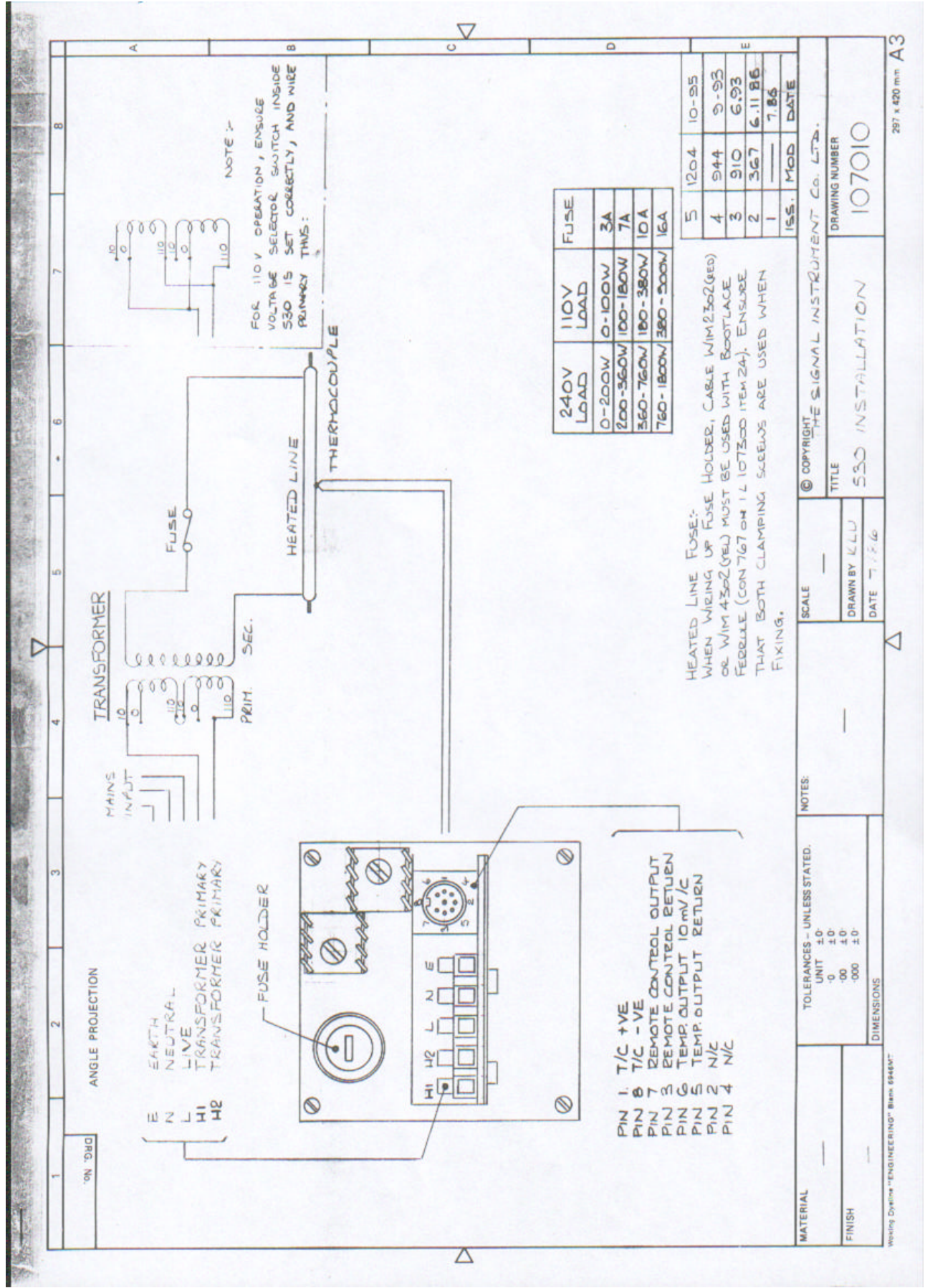
8.4 External Solid State Relay

When extra long lines are to be driven, up to a maximum of 55 metres (28 metres for 120 Vac), a solid state relay, part No. REL/001 must be used to drive the transformer. It is important that only SIGNAL approved components are fitted to preserve the low surge current and noise features.

This component must be provided with adequate heat sinking. The heat sink should be chosen to keep the base plate temperature below 90 degC when dissipating 30 watts. The effect of ambient temperature must be taken into account. In some circumstances, fan assisted cooling will be necessary.

Refer to the installation drawing for wiring information.





9.0 OPERATION

9.1 Set the temperature control to the required position.

9.2 Apply power to the unit.

Confirm that the POWER light is on and that the HEATER light is on and cycles on and off when the operating temperature is reached.

9.3 The proportional band control has been factory set for a 40 degC band. This is the range over which power is proportionally applied and is centred around the set temperature.

If the temperature control accuracy needs to be improved, then the proportional band should be reduced.

If the temperature overshoots the set point by an unacceptable level, then the proportional band should be increased.

A small screwdriver can be used to adjust the P.BAND control, accessible from the front panel. One turn anticlockwise will reduce the proportional band by about 4 degC. One turn clockwise will increase it by about 4 degC. Adjust until an acceptable control is achieved.

9.4 If the T/C FAULT light is on then a fault exists in the line thermocouple, or in it's connections to the controller. Check for as low resistance between the thermocouple leads, and for a high resistance between the thermocouple leads and the heater leads. Trace the leads through to the controller and transformer and confirm that they are correctly wired.