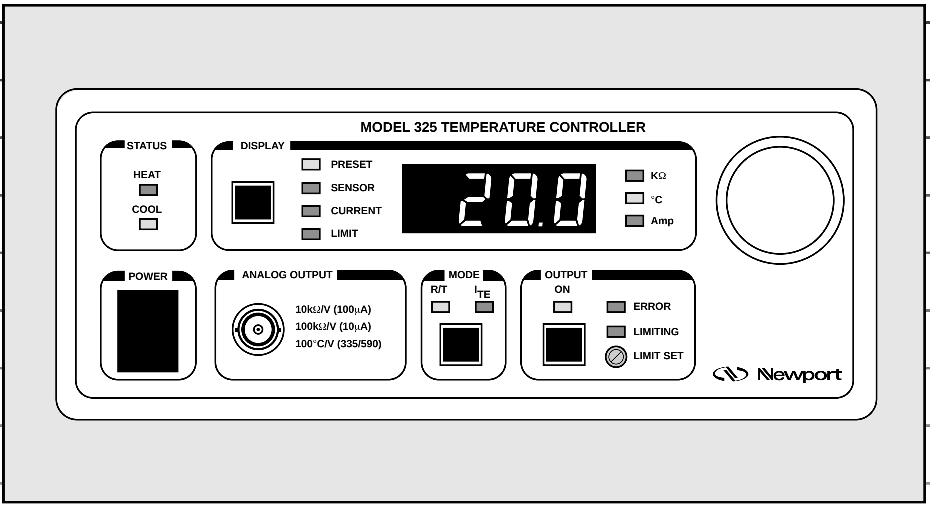
Model 300 Series Temperature Controllers



OPERATING MANUAL

Newport

Model 300 Series Temperature Controllers Operating Manual

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part. This warranty also does not apply to fuses.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

1791 Deere Ave
Irvine, CA 92606
(949) 863-3144

P/N 21206-01, Rev. B
IN-04952 (10-99)

EC DECLARATION OF CONFORMITY

Active Isolation Module Set Series

We declare that the accompanying product, identified with the "CE" mark, meets the intent of the Electromagnetic Compatability Directive, 89/336/EEC and Low Voltage Directive 73/23/EEC.

Compliance was demonstrated to the following specifications:

EN50081-1 EMISSIONS:
Radiated and conducted emissions per EN55011, Group 1, Class A

EN50082-1 IMMUNITY:
Electrostatic Discharge per IEC 1000-4-2, severity level 3
Radiated Emission Immunity per IEC 1000-4-3, severity level 2
Fast Burst Transients per IEC 1000-4-4, severity level 3
Surge Immunity per IEC 1000 4-5, severity level 3

IEC SAFETY:
Safety requirements for electrical equipment specified in IEC 1010-1.

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VP European Operations
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CAUTION

Check that all equipment is unplugged before connecting

Check that the selector is set at the position which corresponds to your mains voltage

All units are factory preset to operate at 180–250 V_{AC}, 50–60 Hz. (See AC Power Inlet, in Section 2.3.5)

Notes

Section 1
General Information

1.1 Introduction

Two controllers, the Model 325 and 350, provide superior temperature stability and a wide range of power outputs. Each has a fast settling, hybrid P-I control loop that delivers a low noise, bipolar current output in three operating modes: 1) constant R (thermistor), 2) constant T (IC sensors), or 3) constant I_{TE} . A user adjustable I_{TE} current limit setting unconditionally protects the TE modules from damage by excessive drive current independent of the operating mode. The Model 300 Series is compatible with thermistors, and AD590 and LM335 Series IC temperature sensors. Temperature readings (°C) are displayed when using one of these IC sensors. Model 325 AN and 350 AN include an Analog Interface allowing remote instrument control and monitoring of display levels.

1.2 Specifications

	Model 325 Model 325AN	Model 350 Model 350AN
Output		
Output Type	Bipolar, constant current source	Bipolar, constant current source
Control Loop Type	Hybrid P-I	Hybrid P-I
Maximum Current	±2.5 Amps	±5 Amps
Compliance Voltage	>6 Volts	>10 Volts
Available Output Power	15 Watts	50 Watts
Current Limit		
Range	0 to 2.5 Amps	0 to 5 Amps
Accuracy	±10 mA	±20 mA
Ripple/Noise (rms)	< 1 mA	< 2 mA
Stability		
Short Term (10 to 30 min.)	0.005 °C	0.005 °C
Long Term (24 hour period)	0.01 °C	0.01 °C

	Model 325 Model 325AN	Model 350 Model 350AN
Display		
Range:		
Temperature	–50.0 to +150.0°C	–50.0 to +150.0°C
Resistance (10 µA)	0.1 kΩ to 199.9 kΩ	0.1 kΩ to 199.9 kΩ
Resistance (100 µA)	0.01 kΩ to 19.99 kΩ	0.01 kΩ to 19.99 kΩ
TE Current	–2.50 Amps to +2.50 Amps	–5.00 Amps to +5.00 Amps
Resolution:		
Temperature	0.1°C	0.1°C
Resistance (10 µA)	100 Ω	100 Ω
Resistance (100 µA)	10 Ω	10 Ω
TE Current	10 mA	10 mA
Accuracy:		
Temperature	±0.2 °C	±0.2 °C
Resistance (10 µA)	±200 Ω	±200 Ω
Resistance (100 µA)	±20 Ω	±20 Ω
TE Current	±10 mA	±20 mA

Temperature Sensors

Sensor Types	Thermistor (NTC 2-wire)	AD590	LM335
Temperature Resolution	0.1 °C	0.1 °C	0.1 °C
Temperature Accuracy (at 25°C)	0.2 °C	0.5 °C	3.0 °C
Sensor Bias	10 µA/100 µA	+12 Volts	1 mA

General

Input Power	90–125, 180–250 V_{AC}, 50–60 Hz
Chassis Ground	4 mm banana jack
Size, H x W x D	88 x 215 x 280 mm (3.5" x 8.5" x 11")
Weight	
Model 325 & 350	2.9 kg (6.5 lbs.)
Operating Temperature	0°C to +50°C
Storage Temperature	–40°C to +70°C
Humidity	< 90% relative, non-condensing
Connectors	
Output	15-pin, D-sub (female)
Analog Output	Isolated BNC
Analog Interface (Model 325AN & 350AN)	15-pin, high density D-sub (female)

1.3 Accessories

The Model 300 Series Temperature Controllers come with a line cord for connection to AC power. To order accessories use the following part numbers:

PART #	DESCRIPTION
300-02	Temperature Controller Cable
300-04	Temperature Controller/Mount Cable
300-16	10.0 kΩ thermistor (±0.2°C)
300-22	AD592CN IC Sensor
35-RACK	Rack Mount Kit

Section 2
System Operation

2.1 Introduction

The Model 300 Series Temperature Controllers have been engineered to simplify the use of thermoelectric (TE) modules for cooling or heating laser diodes, IR detectors and other semiconductor devices.

2.2 Front Panel

The front panel is outlined with six functional areas and a multi-turn control knob used to set a stable output value.

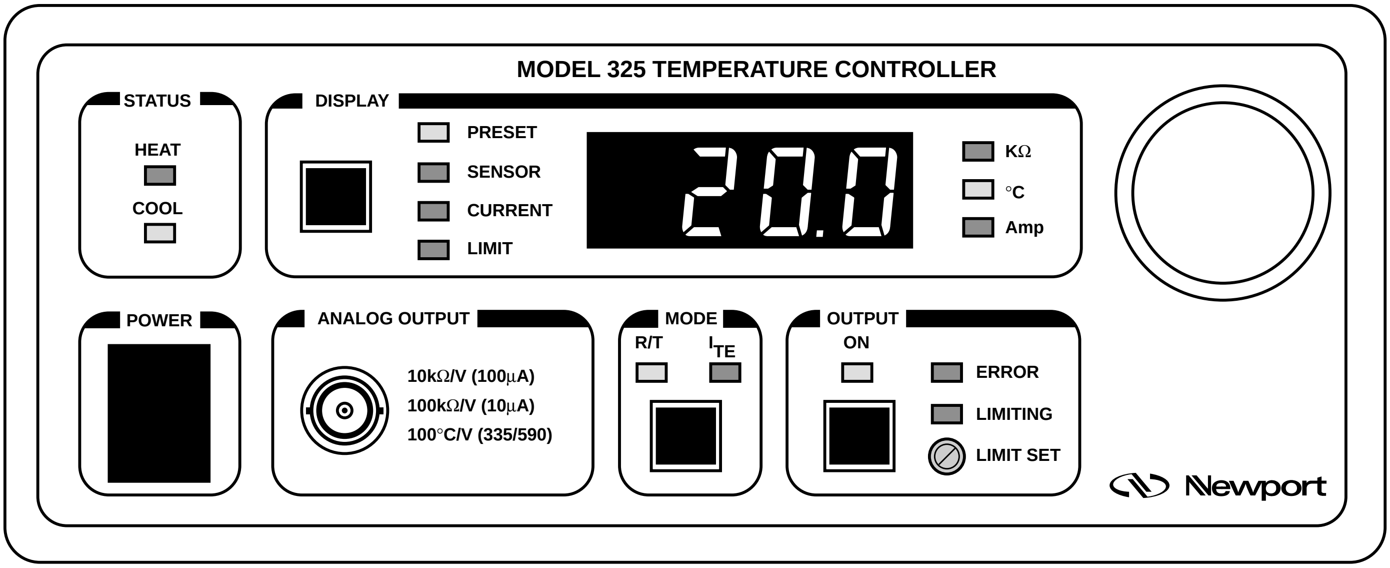

Figure 1: Front panel layout

2.2.1 AC Power Switch

When the AC power is turned on the unit starts up with the OUTPUT off, R/T MODE selected, and the display in the PRESET mode.

2.2.2 Analog Output

A BNC connector can be used to monitor the temperature sensor value. The transfer function of the output is dependent on the sensor type selected. The thermistor current selection values are either 10µA or 100µA and result in either 100 kΩ/V or 10 kΩ/V respectively. Both IC sensors have a transfer function of 100°C/V.

2.2.3 Mode Switch

The Model 300 Series can be operated in either 1) constant R (thermistor resistance), 2) constant T (IC sensors), or 3) constant I_{TE} mode. The R/T mode is used with temperature sensors and the I_{TE} mode to maintain a constant output current.

2.2.4 Output Section

Output ON Switch

Pushing this switch allows current flow to the TE module. The output stays on, as indicated by the green LED above, until the switch is pushed again or an error condition occurs.

Error Indicator LED

An ERROR condition occurs when there is an open circuit to the TE module or temperature sensing device. The output current is automatically turned off. Once the device is replaced or reconnected, pushing the output switch twice will clear the error indication and restore the output on condition.

Limiting Indicator LED

This LED lights up whenever the output current reaches a user adjustable threshold, limiting the current flow to the TE module. It usually occurs during initial startup as the drive circuitry attempts to reach equilibrium.

Limit Set

A small slotted screwdriver is used to access a recessed trimpot to adjust the unit's output current limiting level. Toggle the DISPLAY section push-button to the LIMIT indicator and adjust the readout (in Amps) with a clockwise rotation to increase the protection level.

2.2.5 Status

The STATUS indicator LEDs show whether the device under temperature control is being heated or cooled.

2.2.6 Display

A 3 1/2 digit green LED display is located in the top center of the front panel. It reads in kΩ when displaying a thermistor resistance value, °C when displaying an IC sensor temperature, or Amps when in the constant current I_{TE} mode. Pushing the switch cycles through the display values as described below. Display modes can be toggled with the output on or off.

Preset Display

The PRESET display mode is used to set the appropriate output value using the rotary control knob before turning the OUTPUT on. Once the control level is set, the OUTPUT may be turned on and the actual SENSOR or CURRENT value can be monitored.

Sensor Display

The actual temperature sensor value is monitored in this mode. The value displayed depends on the sensor being used with °C displayed for IC sensors and kΩ for thermistors.

Current Display

This readout monitors the actual current level in Amps being supplied to the TE module. When the OUTPUT is first selected this current value may be as high as the LIMIT value. As the temperature stabilizes the output current will decrease.

Limit Display

This value is set by the limit set screw adjustment. See Limit Set, 2.2.4.

Indicator LEDs

To the right of the numeric display are three LEDs which indicate measurement units: 1) resistance in kΩ, 2) temperature in °C, or 3) output current in Amps.

2.2.7 Control Knob

The knob control on the right side of the front panel sets the appropriate reference value corresponding to either resistance (thermistor), temperature (IC sensors), or TE current (I_{TE}) to be maintained by the Model 300 Series Temperature Controller.

2.3 Rear Panel

Figure 2 shows the layout of the rear panel which contains the ANALOG INTERFACE and OUTPUT connectors, a REMOTE/ LOCAL switch, the sensor select switch, GAIN ADJUST screw, and the AC power inlet.

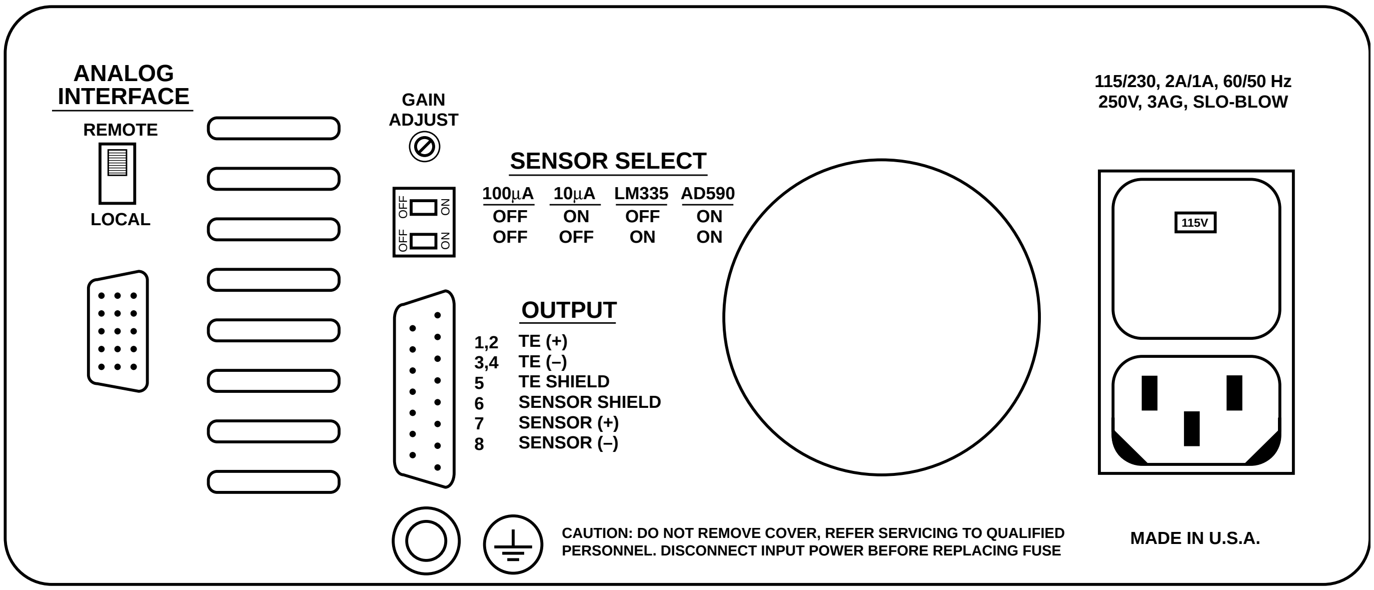

Figure 2: Rear panel layout.

2.3.1 Analog Interface

Model 325AN and 350AN include a Analog Interface card, located at the far left of the rear panel. A 15-pin, high density, D-sub connector is used for the input and output lines. Above the connector is the REMOTE/LOCAL switch used to activate the set-point control line which is disabled in the LOCAL mode. The status lines are always available whether the REMOTE or LOCAL mode is selected.

How To Use The Analog Interface

The Analog Interface may be used with chart recorders, X-Y recorders or can be operated via a computer using a multiple function I/O card such as the National Instruments LAB-PC data acquisition card. One data acquisition card will control two Model 300 temperature controller units or one Model 300 and one Model 500 laser diode driver unit. The Output Set-point is set using one of the analog outputs from the data acquisition card. Other TTL signals of the Analog Interface card are controlled by the digital I/O lines. R/T Monitor data, such as temperature, is then acquired using the analog input line of the data acquisition card.

Analog Interface Connections

Pin #	Designation	Function
1	ON/OFF	TTL momentary low toggles output on/off
2	ENABLE	TTL low = remote level control enabled*
3	STATUS	TTL low = output on
4	LIMIT	TTL low = output limiting
5	ERROR	TTL low = output error
6	MODE	TTL low = R/T, TTL high = I_{TE}
7	DGND	Digital Common for TTL signals
8	EGND	Earth Ground for shielding TTL signals
9	LEVEL (+)	Input signal for level control (charts below)*
10	LEVEL (–)	Input signal DC Common
11	ANALOG OUT	DC output voltage for actual R/T (chart below)
12	AGND	DC Common for Analog Output
13	-	Not Used
14	-	Not Used
15	EGND	Earth ground for shielding analog signals

* Front panel control knob is bypassed

External Level Input, V_{DC} (Pin 9 With Respect To Pin 10)

R/T MODE

Range	Input Voltage Level	Corresponding R/T Value
100µA	0 to 2V	0 to 20 kΩ
10µA	0 to 2V	0 to 200 kΩ
AD590	–0.50V to +1.50V	–50.0°C to +150°C
LM335	–0.50V to +1.50V	–50.0°C to +150°C

I_{TE} MODE

Model	Input Voltage Level	Output Current Level
325/325AN	–250 mV to +250 mV	–2.50 A to +2.50 A
350/350AN	–500 mV to +500 mV	–5.00 A to +5.00 A

Analog Output Level, V_{DC} (Pin 11 With Respect To Pin 12)

R/T or I_{TE} MODE

Range	Output Voltage Level	Corresponding R/T Value
100µA	0 to 2V	0 to 20 kΩ
10µA	0 to 2V	0 to 200 kΩ
AD590	–0.50V to +1.50V	–50.0°C to +150°C
LM335	–0.50V to +1.50V	–50.0°C to +150°C

2.3.2 Gain Adjust

The GAIN ADJUST varies the overshoot and stability of the control loop circuitry in order to accommodate different thermal characteristics of thermistors, the TE module and heatsink, and mounting structures. Sections 3.2, 3.3, 3.4 and 3.5 present the details of using TE modules, IC sensors, thermistors, and how physical mounting arrangements affect the operation of the Model 300 Series Temperature Controllers. An initial GAIN value is set at the factory and should be satisfactory for most mounts. Adjusting the GAIN is described in Section 3.6.2 (i).

2.3.3 Sensor Select Switch

This 2-position DIP switch is used to select the appropriate bias for each one of the sensor types. The switch position for each sensor is printed on the rear panel next to the switch.

2.3.4 Output Connector

Connection to the TE module and temperature sensor are made using a 15-pin, D-sub connector. There are two pins each for the TE+ and TE– connections to provide redundancy and reduce the voltage drop in the cable.

Pin #	Connection	Wire Color (300-02 cable)
1 & 2	TE +	RED
3 & 4	TE –	BLACK
5	TE SHIELD	
6	SENSE SHIELD	
7	SENSOR +	GREEN
8	SENSOR –	WHITE

2.3.5 AC Power Inlet

The input voltage setting is indicated in a small window on the face of the power module. A small screwdriver is needed to flip down the panel once the AC line cord is removed. Carefully rotate the plastic tumbler so the proper range is indicated. The fuse is also located behind this panel and can be pulled out, to be replaced with the appropriate size indicated on the back panel.

All units are preset at the factory for operation at 180–250 V_{AC}, 50–60 HZ. The line cord supplied with each unit should be plugged only into a properly grounded three prong outlet to prevent electrical shock in the event of an internal short circuit to the metal cabinet.

Section 3
Principles of Operation

3.1 Introduction

Three factors must be taken into account when optimizing the operation of a Model 300 Series Temperature Controller: selection of both the appropriate temperature sensor and TE module heat sink, and the manner in which they are mounted. Selecting the proper thermistor to cover a specific temperature range of operation is a simple but important procedure. The proper TE module must be selected to remove the heat dissipated by the laser diode or other device. Finally, the arrangement of the TE module and the heat sink, as well as the heat sink size, are crucial in maximizing the heat transfer efficiency.

3.2 Thermistors

Model 300 Series Temperature Controllers are designed to operate using a thermistor as one of the temperature sensing devices. Temperature is displayed as a resistance (kΩ) corresponding to the temperature of the thermistor. The actual temperature of the thermistor can be determined from the manufacturers curves or tables listing temperature vs. resistance. Two precision current sources, 10μA and 100μA, are used to generate a voltage across the thermistor and it is this voltage that is read on the front display. For the 10μA current source the maximum resistance that can be displayed is 199.9 kΩ, while for the 100μA source the maximum reading is 19.99 kΩ. The minimum resistance value that can accurately be read is 200 ohms (100μA current source). These two current values allow a wide range of temperatures to be controlled by the Model 300 Series Temperature Controllers. Different ranges of temperatures can be adjusted for by selecting the proper thermistor value. The following table illustrates this point:

Temperature vs. Thermistor Resistance

Thermistor value @ 25°C	1k	10k	100k
200 kΩ	–75°C	–37°C	–11°C
100 kΩ	–66°C	–24°C	25°C
20 kΩ	–40°C	8°C	65°C
10 kΩ	–27°C	25°C	85°C
1 kΩ	25°C	93°C	>150°C
100 Ω	100°C	>150°C	>150°C

Careful thermistor value selection therefore enables control over a wide temperature range.

The temperature resolution and thermistor sensitivity must also be taken into account. Thermistors achieve their highest sensitivity at the lower end of their temperature range. Therefore, the lower the absolute temperature to be maintained, the lower the resistance value the thermistor should be. For example, to operate at 0°C a 10k ohm thermistor would be the best selection while at 100°C a 1k ohm thermistor would be a better selection. The rule of thumb is to operate the thermistor near the lower end of its temperature range and use the 100µA current bias. Please contact Newport's applications engineers if you have any questions regarding the selection of the proper thermistor for your application.

3.3 Working With IC Sensors

Two IC temperature sensors may be used with the Model 300 Series Temperature Controllers, the AD590 Series and the LM335 Series. Both come in several different package types having various accuracy and stability characteristics. These temperature sensors are easy to use and give a temperature reading directly in °C on the Model 300 Series display.

3.3.1 AD590 SERIES IC SENSORS

The AD590 Series devices are two-terminal IC temperature sensing devices, which produce an output current directly proportional to the absolute temperature at 1µA/°K. The AD590 Series sensor is particularly useful in remote sensing applications where long cable lengths are used, due to its high impedance current output. A linear output is displayed in °C on the Model 300 Series Temperature Controller, which makes it ideally suited for most temperature sensing applications. The recommended upper operating limit for AD590 Series devices is 150°C.

3.3.2 LM335 SERIES IC SENSORS

The LM335 Series devices are similar to the AD590 in that they are two terminal devices and their output is directly proportional to absolute temperature. Operating like a two terminal zener diode, the LM335 Series temperature sensors have a breakdown voltage directly proportional to absolute temperature at +10mV/°K. When using the LM335 Series sensors, voltage drops resulting from using long cables will introduce inaccuracies in the temperature display measurement.

3.4 Using Thermo-Electric Modules

Thermo-electric (TE) modules are semiconductor devices that act as heat pumps when a voltage is applied to them. This effect is called Peltier cooling or heating. The direction of the current flow determines whether the TE module is cooling or heating a device such as a laser diode or IR detector. A TE module consists of a matrix of thermoelectric couples made of p-type and n-type semiconductor material. A TE module can be fabricated with as few as one couple or with as many as several hundred couples sandwiched between two ceramic plates. The ceramic plates form the top and bottom of the TE module and provide structural integrity as well as electrical insulation from, and thermal conduction to, the heat sink and the device being cooled or heated.

Model 300 Series Temperature Controllers are designed to control the rate and amount of cooling or heating through the use of a feedback loop. The arrangement of the TE module in the cooling mode is shown in Figure 3. When a positive DC voltage is applied to the n-type element, electrons pass from the p-type to the n-type elements and the temperature decreases as heat is absorbed by the cold side of the TE module. The heat absorbed is proportional to the amount of current flowing through the TE module and the number of p-type and n-type elements in the TE module.

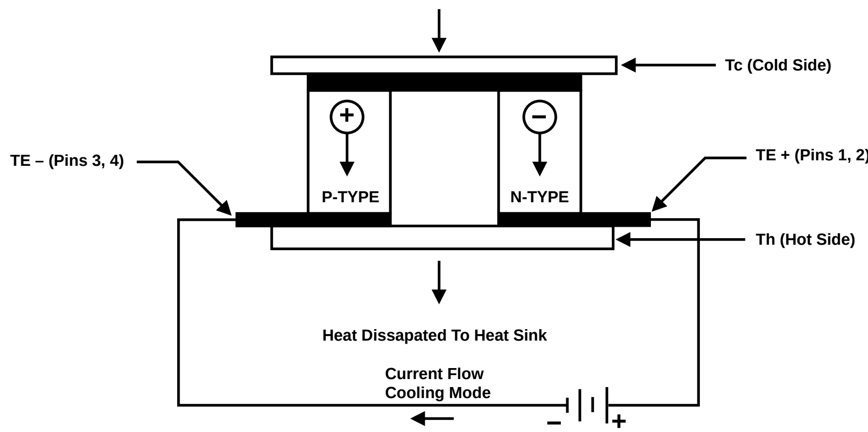

Figure 3: TE module configuration

It is necessary to remove the heat from the hot side of the TE module. The amount of heat to be dissipated is equal to the heat pumped from the cold side plus the input power to the TE module. Although the amount of cooling is proportional to the current flowing through the TE module, the power dissipated by Joule heating (input power heating) in the TE module is proportional to the square of the current. Half of this heat must be pumped from the cold side of the TE module. When exceeding a maximum current value (Imax), which is device dependent, the net cooling of the TE module decreases because Joule heating is increasing at a greater rate than Peltier cooling. The manufacturer of the TE module will state the maximum current for each TE module and this current value should not be exceeded. The LIMIT SET feature on the Model 300 Series Temperature Controllers allows you to limit the maximum current flowing through the TE module.

3.5 Mounting Considerations

The physical arrangement of the TE module, thermistor, heatsink, and the device to be cooled or heated are crucial to the operation of a Model 300 Series Temperature Controller. This arrangement determines the thermal load and the rate of heat dissipation to which the control circuitry must respond. To achieve optimum temperature control the thermal path between the device to be cooled or heated and the face of the TE module must be as short as possible and must have high thermal conductivity. This arrangement also determines the delay that the control circuitry must respond to, and affects the gain setting of the control loop. Another factor that must be taken into account is the mass of the heat sink required to dissipate heat from the TE module. The better the heat sink dissipates heat, thus reducing the thermal gradient across the TE module, the more efficient the TE module is at removing heat from the device being cooled.

Figure 4 shows an arrangement that optimizes the cooling and temperature stability achievable with the Model 300 Series Temperature Controller. Two TE modules connected in parallel are shown in the diagram. The actual connection of the TE module depends on the manufacturer's specifications for the voltage drop across the TE module and its current requirement.

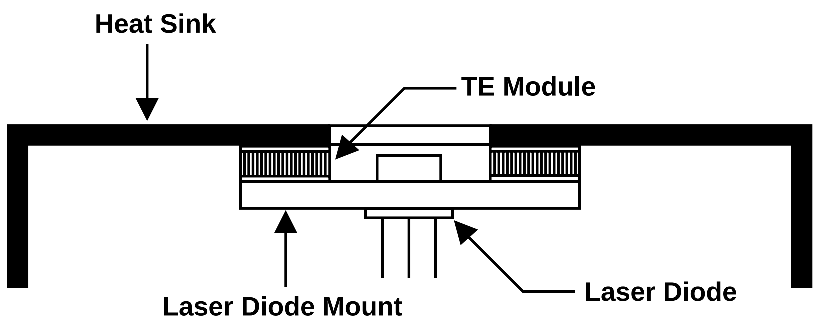

Figure 4: Mounting arrangement of a TE module, heat sink and laser diode

3.6 Model 300 Series Setup

Setting up the Model 300 Series Temperature Controller is a simple procedure. An AC power cord, supplied with each unit, must be plugged into a properly grounded outlet. The tilt up feet, at the bottom of the unit, may be extended to enhance the viewing angle of the front panel. Connection to TE modules and temperature sensors are made with one of the accessory cables (part #300-02 or #300-04). The Analog Interface card, only available in Models 325AN and 350AN, may be connected to either a plotter, a X-Y plotter or to a computer.

3.6.1 Rack Mounting Model 300 Series Units

Two units, either Model 300's or Model 500's or one of each, may be mounted side by side in the standard rack mount kit (part #35-RACK). Remove the four feet on the bottom of the instrument. Use the screws supplied with the rack mount kit and secure the bottom of the unit(s) to the bracket using the two original front feet mounting positions. After tightening the screws the unit(s) may be slid into a 19" rack and secured to the side rails.

3.6.2 Model 300 Series Operating Checklist

The following steps should be followed when operating a Model 300 Series Temperature Controller.

a) Check the AC voltage selection of the unit to be sure that it is compatible with the outlet to be used. All units are factory preset for operation from 180–250 V_{AC}.

b) Connect the temperature sensor and TE module to the 15-pin output connector.

c) Check that the proper temperature sensor bias is selected.

d) Turn on the AC power switch and the unit will start-up with the output to the TE module off. The display will be in the PRESET mode.

e) Before setting any values on the DISPLAY select the operating mode, R/T or I_{TE}.

f) Change the display to the LIMIT display mode and set the maximum current allowed to the TE module. The limit set point is adjusted using the recessed LIMIT SET screw.

NOTE: The maximum current is specified by the manufacturer and must not be exceeded or damage to the TE module may occur.

g) If the operating set-point has not been set or needs to be changed, select the PRESET display mode and use the control knob to set the correct value. The operating temperature, resistance or TE current is set before turning the OUTPUT on.

h) The OUTPUT can now be turned on and the Model 300 Series Temperature Controller will automatically control the temperature or I_{TE}. Push the OUTPUT switch once to turn the current on to the TE module and a second time to turn the current off. If there is an error condition the current will not turn on and the ERROR indicator LED will come on. If this occurs verify that the temperature sensor and TE connections are correct. After an ERROR condition has occurred the OUTPUT switch must be pushed once to reset the control circuitry. After the fault is corrected and the circuitry is reset the OUTPUT switch can be pushed a second time and the output current will turn on.

i) When the output is turned on the temperature should be monitored for overshoot and stability. The gain of the control loop can be adjusted to accommodate various thermal time constants of different laser diode mounting arrangements. Figure 5 shows three possible gain adjust settings for a given system. When the gain setting is too high the temperature overshoots the temperature setpoint (Tset) and oscillates around it. If the gain is set too low the temperature never reaches the setpoint. For most telecommunication packaged laser diodes the gain will be at the minimum gain setting which is in the farthest counter clockwise position. For larger mounts the gain adjust setting may have to be increased by turning the adjustment screw in a clockwise direction. If there is too much overshoot in the temperature the GAIN adjustment screw on the back panel must be adjusted.

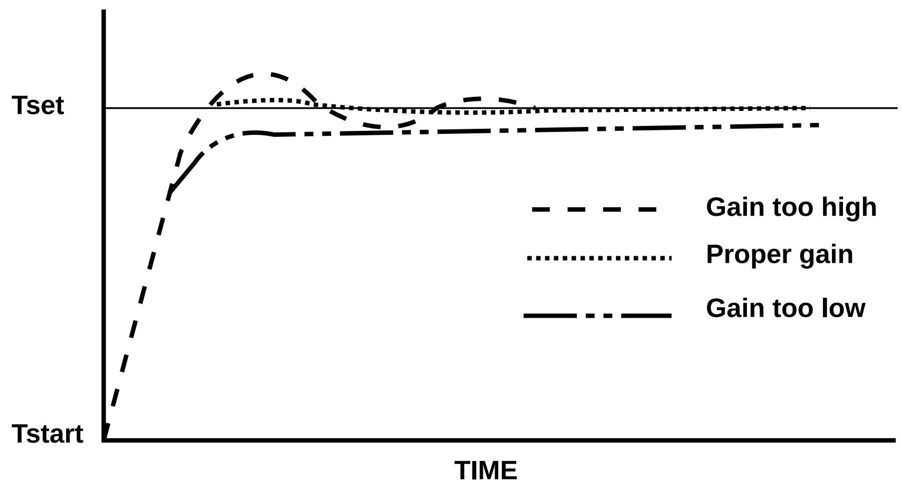

Figure 5: Gain Adjust Settings

To reduce overshoot the GAIN ADJUST screw must be turned counter clockwise. Turn the output off using the OUTPUT switch and turn the GAIN adjustment screw a small amount. Then turn the output back on and monitor the output again. Repeat this procedure until the temperature ramps up to the set point in a satisfactory manner. When a system is underdamped, having too low a gain, repeat the above procedure, but increase the gain by turning the GAIN ADJUST screw in a clockwise direction. If you have any questions on GAIN adjustment call Newport Corporation and one of our applications engineers will assist you.

j) During the operation of the Model 300 Series Temperature Controller any of the parameters may be displayed and the status of the Model 300 Series Temperature Controller may be monitored.

k) To monitor and record the temperature sensor output, a strip recorder or an X-Y recorder may be connected to the ANALOG OUTPUT BNC connector. The output gain of this monitoring output is printed next to the BNC connector on the front panel.

Section 4
Factory Service

4.1 Introduction

This section contains information regarding obtaining factory service for the Model 300 Series Temperature Controller. Any maintenance or service of this instrument should be referred to Newport Corporation factory service personnel. Contact Newport Corporation or your Newport representative for assistance.

The Model 300 Series Temperature Controller contains no user serviceable parts. Its calibration accuracy is warranted for a period of 1 year. After 1 year, the unit should be returned to Newport Corporation for recalibration.

4.2 Obtaining Service

To obtain information concerning factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Instrument model number (On front panel)
2. Instrument serial number (On bottom of unit)
3. Description of the problem.

If the instrument is to be returned to Newport Corporation, you will be given a Return Number, which you should reference in your shipping documents.

Please fill out the service form, located on the following page, and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

Service Form

Newport Corporation
U.S.A. Office: 949/863-3144
FAX: 949/253-1800

Name ____ RETURN AUTHORIZATION # ______________

Company ____ (Please obtain prior to return of item)

Address ____

Country ____ Date ___________________________

P.O. Number _______________________________________ Phone Number ____________________

Item(s) Being Returned:

Model # ____________________________________ Serial # ____________________________________

Description ____

Reason for return of goods (please list any specific problems) ______________________________

____

List all control settings and describe problem ____

____

____

____(Attach additional sheets as necessary).

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not).

Where is the Instrument Being Used?

(factory, controlled laboratory, out-of-doors, etc.) ____

What power line voltage is used? ______________________ Variation? __________________________

Frequency? __________________________ Ambient Temperature? ______________________________

Variation? ___________________°F. Rel. Humidity? __________________ Other? __________________

Any additional information. (If special modifications have been made by the user, please describe below).

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____

____

____

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