

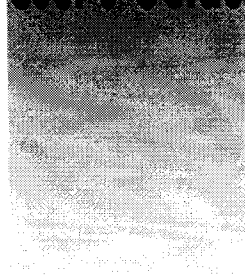
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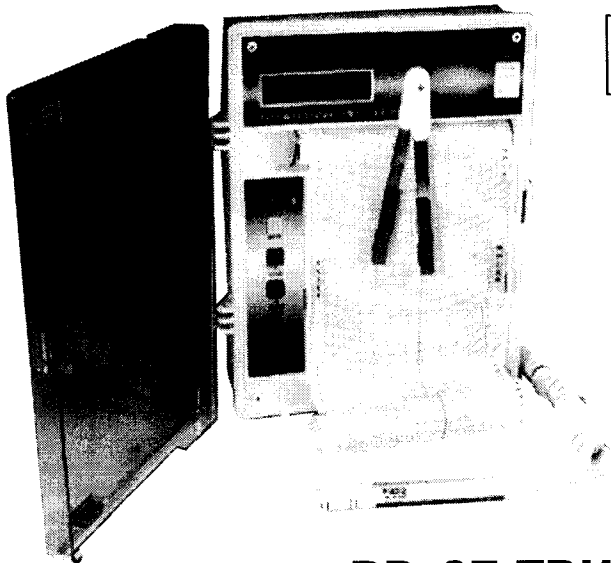
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RD-87-TRH **Strip Chart Recorders**

Instruction Manual

Version 2.0

RD-87-TRH:

The RD-87-TRH is a precision temperature, relative humidity and dew point recorder with a digital display. The recorder was designed with the user in mind. No special knowledge is required to operate the RD-87-TRH. The menu driven setup is logically simple and user friendly. All parameters are shown on a two line alphanumeric LCD display

The RD-87-TRH uses two independent pens and records information on a twenty foot long, four and three quarter inch wide strip chart. Each pen is uniquely colored to maximize chart readability.

In addition, a full function alarm feature is provided. The alarm of the RD-87-TRH can be set to sound an audible signal when the temperature and / or humidity have exceeded an upper or lower limit. Each limit is individually set from the front panel. A delay time before the alarm is activated may be set by the user to prevent nuisance alarms. Low power normally open relay contacts are provided to allow activation of a remote alarm, phone dialer or annunciator.

All functions of the RD-87-TRH are accessed through three pushbuttons located on the front panel. Selectable functions are retained in a memory to avoid re-entering settings in the event of a power failure.

Power is supplied through a 120 VAC 50/60 Hz plug-in adapter. External power may be supplied from any 12 VDC source such as automotive, marine, or other battery. Battery backup for 48 hours is featured to provide operation during temporary power loss.

SELECTING US OR METRIC UNITS

The RD-87-TRH can be configured to use US or Metric units of measure. Each system of measurement has a unique chart that will cover all ranges of chart speed and temperature scales. In the US units of operation the chart will move in inches per minute / hour and the temperature will be displayed in Fahrenheit.

In Metric units of operation the chart will move in cm per minute / hour and the temperature will be displayed in Celsius.

A special startup menu is used to select units of measure.

1. Press and hold the A and B buttons while turning the power switch to ON.
2. The display will indicate the current units of measurement selected.
3. Use the A or B buttons to change the units of measurement (US or Metric) and when the desired units are selected press the Menu button to continue.
4. The display will next show the option of calibrating the chart scale. Use the A button for Yes and the B button for No.
5. If you are calibrating the scale continue otherwise skip to step 19.
6. The pens will move to the Home position and the display will show the option to adjust the Home position of the Red Pen.
7. Press the A button to adjust the Home position of the Red Pen, press the B button to advance the chart. To continue with no adjustment to the home position of the Red Pen press the Menu button and skip to step 10.
8. The display will show the Adjust Red Pen Home message. Use the A button to move the pen to the left and the B button to move the pen to the right. Adjust the pen so that the tip of the pen is directly on the rightmost line of the chart. When the pen is properly positioned press the Menu button to return to the Adjust Red Pen display.

9. Press the menu button again to advance to the Adjust Blue Pen Home position message.
10. Press the A button to adjust the Home position of the Blue Pen, press the B button to advance the chart. To continue with no adjustment to the home position of the Blue Pen press the Menu button and skip to step 12.
11. The display will show the Adjust Blue Pen Home message. Use the A button to move the pen to the left and the B button to move the pen to the right. Adjust the pen so that the tip of the pen is directly on the rightmost line of the chart. When the pen is properly positioned press the Menu button to return to the Adjust Blue Pen display.
12. Press the menu button again and the pens will move to the left side of the chart and the display will show the Moving to Max Please Wait message.
13. The pens will move to the Maximum position and the display will show the option to adjust the Max position of the Red Pen.
14. Press the A button to adjust the Max position of the Red Pen, press the B button to advance the chart. To continue with no adjustment to the maximum position of the Red Pen press the Menu button and skip to step 16.
15. The display will show the Adjust Red Pen Max message. Use the A button to move the pen to the left and the B button to move the pen to the right. Adjust the pen so that the tip of the pen is directly on the leftmost line of the chart. When the pen is properly positioned press the Menu button to return to the Adjust Red Pen display.
16. Press the menu button again to advance to the Adjust Blue Pen Max position message.
17. Press the A button to adjust the Max position of the Blue Pen, press the B button to advance the chart. To continue with no adjustment to the maximum position of the Blue Pen press the Menu button and skip to step 19.
18. The display will show the Adjust Blue Pen Max message. Use the A button to move the pen to the left and the B button to move the pen to the right. Adjust the pen so that the tip of the pen is directly on the leftmost line of the chart. When the pen is properly positioned press the Menu button to return to the Adjust Blue Pen display.
19. Press the Menu button to advance to the Adjust Temperature display. This will allow the user to adjust the temperature reading up to +/- 5 degrees.
20. Press the A button to adjust the temperature reading (Yes) or the B button (No) to skip to the adjust Humidity Reading. If you are not adjusting the temperature reading skip to step 24.
21. The display will show the Set Temperature message and the temperature the RD-87-TRH probe is reading.
22. Press the A button to increase the temperature reading or the B button to decrease the temperature reading.
23. When the temperature display is adjusted press the Menu button to continue to the Calibrate Humidity message.
24. The display will show the Calibrate Humidity message. Press the A button for Yes or the B button to exit to the Run Mode of the recorder.
25. The display will show the Adjust Humidity message. The relative humidity reading at the RD-87-TRH probe will be displayed below this message. The humidity reading can be adjusted +/- 5%.
26. Press the A button to increase the humidity reading and the B button to decrease the humidity reading.
27. When humidity reading is adjusted press the Menu button to exit to the Run mode of the recorder.

QUICK START

1. Connect power supply to RD-87-TRH through jack on right side of unit.
2. Plug power supply into a 120 VAC outlet.
3. Press the power switch to **ON**.
4. Pens will move to the "**Home**" position. (the right hand side of the chart.)
5. Pens will move to a position on the chart according to the display reading. This is called the **RUN Mode**. (Unit is always in the **ON** or **RUN Mode** when display is showing temperature, humidity and dew point readings.)

MENU OR RUN?

The RD-87-TRH has two basic modes of operation:

MENU mode. To review or change settings.

RUN mode. To display present conditions and record them.

If **MENU** mode is selected the user can:

Turn Beeper ON or OFF.

Set Chart Speed/Range.

Set Blue Pen to record Humidity or Dewpoint.

Set Alarm Status (Alarm delay section of **MENU** will not show when the alarm is disabled.):

Alarm Delay = 0

Alarm Delay = 10 Minutes /20 Minutes /1 Hour 90 Minutes /2 Hours

If the **ALARM** is Enabled the following Menu Selections will be available;

Set Temperature High Limit

Set Temperature Low Limit.

Set Humidity High Limit.

Set Humidity Low Limit.

After menu setting, unit will automatically go into the RUN Mode after 30 seconds.

If the **RUN** Mode is selected:

The display will show Temperature, Humidity, and Dewpoint.

While in the **RUN** mode, the user can:

Home the Pens by pressing the **HOME** switch. (Allows for easy changing of charts and pens.)

Set Blue Pen position.

Set Red Pen position.

Advance the chart by pressing the **ADV** button.

How to Change the Chart

1. Press the **HOME** button to move the pens to the outer edge of the chart. Turn unit off.
2. Remove the chart retaining strip by lifting the middle portion to flex the strip and dis-engage the two end tabs.
3. Remove the old chart.
4. Install the new chart into the chart holder cavity.
5. Pull out enough of the chart to reach the end of the front panel. Slide the new chart underneath the pens. Align the holes along the chart edge with the drive spindles.
6. Replace the chart-retaining strip beveled side down.
7. Turn unit on it will be in **RUN** Mode.
8. If the pen(s) position needs adjustment, see Pen Adjustment section below.

CHART SPEED AND RANGE

The RD-87-TRH offers 54 combinations of Chart Ranges and Chart Speeds to match a wide variety of applications. All functions of Chart Speed and Chart Range have been combined in one menu to make the necessary selections as easy and as fast as possible. Chart Speed is the term used to describe the time it takes for the recording chart to advance a specific amount of distance. The RD-87-TRH allows the user to select inches or cm as the unit of distance. Different applications will require different chart speeds. For example, the 1/4 inch/hour would generally be used where long term monitoring is required and frequent changing of the strip chart would be undesirable. The main disadvantage of this is that short-term variations in temperatures will record as a single line or step on the chart. In applications that have short-term temperature or humidity variations the user may prefer a faster chart speed for more accurate analysis. The fastest chart speed is two inches / minute. This would allow a maximum recording time of two hours. This allows the user to record short-term variations in temperature or humidity in great detail. An example of this would be to observe the settling time of a temperature control system. If the chart speed is selected for cm then the temperature readings will be in degrees C. If the chart speed is selected for inches then the temperature reading will be in degrees F. The recorder will retain this information even when the power is disconnected or the unit turned off. If the measured temperature is out of range (for the chart selection), the display will read the actual temperature, but the pen will not go beyond limit of the chart edge.

How to Set the Chart Speed and Range.

1. While in the **RUN** mode, press the **MENU** button. This will show the Beeper is ON (OFF) message. Press the **MENU** button again and the display will present the setting for chart speed.
2. To select a longer chart speed, press the **A** button, for shorter chart speeds press the **B** button. Each time the **A** or **B** button is pressed, the speed will change. Whatever speed is on the display will become the chart speed. The available chart speeds are listed below;

Chart Speeds		Total Chart Time
US	METRIC	
1/4 inch/hour	1/2 cm/hour	40 Days
1 inch/hour	2 cm/hour	10 Days
2 inches/hour	4 cm/hour	5 Days
4 inches/hour	8 cm/hour	2 1/2 Days
8 inches/hour	16 cm/hour	30 Hours
1/4 inch/minute	1/2 cm/minute	16 hours
1/2 inch/minute	1 cm/minute	8 Hours
1 inch/minute	2 cm/minute	4 Hours
2 inches/minute	4 cm/minute	2 Hours

3. Press the **MENU** button again to go to the chart selection menu. To change the chart range press the **A** or **B** button. Each time the **A** or **B** button is pressed, the range will change. Whatever range is on the display will become the chart range. Note that the display will show chart ranges in degrees F for the chart speeds in inches and degrees C for the chart speeds in cm. As a reminder the second line of the display will show "USE INCH CHART" or "USE METRIC CHART"

The available chart ranges are listed below;

-40°F to +60°F	-40°C to +60°C
+50°F to +150°F	-30°C to +20°C
0°F to 100°F	0°C to +50°C

4. Press **MENU** to proceed in **MENU** Mode. If no button is pressed for 30 seconds the recorder will automatically return to the **RUN** Mode, or to go to **RUN** Mode from here, press **MENU** once, then press **B** for **RUN**.

RED PEN MODE

The blue pen may be used to record Humidity or Dewpoint. The red pen will always record Temperature.

How to Select Blue Pen to Record Humidity or Dewpoint

1. Press **MENU** until "Blue Pen =..." message appears.
2. Press **A** to toggle between Humidity and Dewpoint, Press **MENU** to get **RUN** Mode.

ALARM AND DELAY

When temperature, humidity or both measurements pass above or below the thresholds set in the menu function, the RD-87-TRH will execute a preset operation. This operation is described as an Alarm condition or a Delay condition and is referred to simply as Alarm or Delay.

Alarm indicates that one or both measurements are above or below the preset thresholds and the RD-87-TRH is sounding the audible alarm and has closed the relay contacts. The display will also be flashing the parameter that has caused the Alarm condition.

Delay is a condition in which one or both thresholds have been passed, but the audible alarm and relay contacts are not activated for a preset delay time. Delay is used to prevent nuisance and false alarms.

For Example:

In the normal operation of an environmentally controlled chamber the door will be periodically opened to access the contents within. When this happens warm humid air will enter the chamber causing a momentary increase in temperature and relative humidity. Without the Delay function this would cause a false alarm indicating a controller failure when in fact no failure has occurred.

The Delay can also be used to prevent nuisance alarms on coolers or similar devices that have frequent door openings. Without the Delay function an alarm would be started as a result of a short-term increase in temperature caused by the door being opened and again no failure of the system has occurred.

The RD-87-TRH allows the user to select one of six Delay times, Zero Delay, 10 minutes, 20 minutes, 1 hour, 90 minutes or 2 hours. The delay time selected will depend on the application and will vary from installation to installation. It is up to the judgment of the user to determine the best Delay time for a given application. When a Delay time of zero is selected the Delay function is disabled. When a temperature or humidity threshold is passed the audible alarm and relay contacts will close immediately. When a Delay Time other than zero is selected the audible alarm and relay contacts will not activate until one or both temperature and humidity thresholds have been exceeded continuously for the period of the Delay Time. The display will flash the parameter that has caused the Delay condition to alert the user that one or more thresholds have been passed. At the end of the Delay time the audible alarm will sound and the relay contacts will close.

In RUN Mode:

If a temperature limit has caused the alarm, the temperature reading will blink until the condition returns to normal. If a humidity limit has caused the alarm, the humidity reading will blink until the condition returns to normal. When the condition that caused the alarm is no longer present, the alarm and relay will be reset, and the display will stop blinking and the alarm will be automatically reset. To disable the relay contacts and the blinking parameter(s), the alarm must be disabled. See How to Set Alarm and Delay below.

HOW TO SILENCE THE ALARM: (Relay contacts remain closed.)

1. Press **MENU** and the display will show "**Beeper is ON**" message.
2. Press **A** to turn off alarm (only sound will be turned off, relay will be closed).
3. Press **B** to turn alarm (sound) on.
4. Press **MENU** to continue in **MENU** Mode.

How to Set the Alarm & Delay

1. Press **MENU** button until alarm status message appears.
2. Press button **A** to scroll through options:

Alarm Disabled (If the alarm is disabled, you must enable the alarm to get the delay sections of the MENU.)

0 Delay
10 Min. Delay
20 Min. Delay
1 Hour Delay
90 Min. Delay
2 Hour Delay

3. **MENU** to get to **RUN** Mode.

TEMPERATURE AND HUMIDITY LIMITS

The Temperature and Humidity Upper and Lower Limits allow the user to customize the alarm settings of the RD-87-TRH to provide the greatest degree of protection while at the same time preventing unnecessary alarms. Since each application is unique, careful selection of the temperature and humidity thresholds are required to provide the maximum degree of protection. Both Temperature and Humidity high and low limits may be set. If the alarm is enabled, and any of these limits are exceeded, the display will blink the reading that went beyond the limit. An audible alarm (Beeper) will sound and the relay contacts will close after the delay time has elapsed. If the Alarm is not disabled, any of the four limits could trip the alarm, therefore all upper and lower limits must be set.

SETTING THE LIMITS

How to Set the Temperature High Limit

1. Press MENU until "Temperature High Limit" appears.
2. Press A to increase the limit, B to decrease the limit, or MENU to go to the Temperature Low Limit. The A or B button can be held down continuously scroll the set point.

How to Set the Temperature Low Limit

1. Press MENU until "Temperature Low Limit" appears.
2. Press A to increase the limit, B to decrease the limit, or MENU to go to Set Humidity High Limit.

How to Set the Humidity High Limit

1. Press MENU until "Humidity High Limit" appears.
2. Press A to increase the limit, B to decrease the limit, or MENU to go to Set Humidity Low Limit.

How to Set the Humidity Low Limit

1. Press MENU until "Humidity Low Limit" appears.
2. Press A to increase limit, B to decrease limit.
3. Press MENU once and you will return to the RUN mode.

TEMPERATURE AND HUMIDITY PEN POSITION ADJUSTMENT

NOTE: *The blue pen has a longer arm to allow it to move over the red pen. Therefore one pen will record at real time and the other will lag or lead by 3/16". In the normal course of operation charts, and eventually, pens will have to be changed on the RD-87-TRH. When this occurs it may be necessary to adjust the pen position to match the reading of the display. This is most likely to occur when changing a pen.*

How to Adjust the Blue Pen Position on the chart (Humidity/Dewpoint).

1. Press the HOME button until the display reads "Homing the Pens Please Wait"
2. Press button A to select the pen adjustment menu.
3. Press button B to move blue pen in (towards the left) and button A to move blue pen out.
4. Press MENU to select red pen adjustment menu.
5. Press MENU again if no adjustment of the red pen is required otherwise go to the "Adjust Red Pen " instruction (next section).

How to Adjust the Red Pen Position on the chart (Temperature)

1. Press button A to move the red pen right.
2. Press button B to move the red pen left.
3. Press MENU to return to the RUN mode.

TEMPERATURE / HUMIDITY PROBE

The Temperature / Humidity probe contains the sensors needed to convert temperature and relative humidity to electrical signals that the recorder uses to record and display temperature and relative humidity.

The probe will measure Temperature from -20°F to +130°F. (-30 to +54°C).

The probe will measure Relative Humidity from 0 to 100% non condensing, non corrosive. The Dewpoint is calculated from these two measurements, and will range from -20°F to 130°F (-30°C to +54°C). Any readings of Dewpoint outside of these limits will be invalid.

The probe must not be immersed in any liquid, or corrosive atmosphere and must not be subjected to temperatures outside the -20 to +120F range. Each probe is field replaceable and no calibration is necessary when using a new or different probe.

BATTERY BACKUP OPERATION

Battery backup allows the RD-87-TRH to continue operation in the event of a power loss. Actual operating time will depend upon the condition of the batteries. With fresh alkaline batteries the typical operating time will be 48 hours. Alkaline batteries are essential for this type of application.

When the main power is lost the RD-87-TRH will sense this and a "B" will be displayed in the upper right hand corner of the display to advise the operator the RD-87-TRH is operating on battery power. No other indication will be visible. The temperature and chart recording will continue until the batteries have been exhausted or the AC power is restored.

The RD-87-TRH will monitor the battery power and when the batteries are almost exhausted, a "Low Battery" message will appear on the display. The batteries should be replaced as soon as possible to avoid erroneous readings. This prevents possible damage due to battery leakage and also assures that the RD-87-TRH will remain in operation in the event of another power failure. The suggested battery backup consists of eight AA cells, however, a standard nine volt battery could be used to provide approximately one hour of backup. The following chart shows the life expectancy of various types of batteries.

1. Eight Alkaline AA cells	48 Hours
2. Eight Rechargeable NiCad AA cells	24 Hours
3. Standard 9 Volt Alkaline Battery	1 Hour

It is good practice to replace batteries every year.
Do not keep batteries in RD-87-TRH when not in use.

RS-232 Port

The RD-87-TRH provides an optional RS-232C port to allow the user to connect the recorder to a computer or network and allows continuous monitoring of the data being recorded.

Data is transmitted every time the probe is sampled and is only interrupted during an update of the pen position.

The data is delimited ASCII text and will be transmitted as temperature, relative humidity, and dewpoint.

The port parameters are as follows;

4800 baud
8 Data Bits
No Parity
1 Stop Bit

RD-87-TRH SPECIFICATIONS

Operating ambient temperature range	32°F to 120°F (0°C to 50°C)
Storage temperature	0°F to 120°F (-18°C to 50°C)
Primary power	115 VAC, 50/60 Hz Adapter (220-240 VAC, 50 Hz. optional)
Backup power	8 AA alkaline batteries (not supplied)
Alternative power	12 Volt vehicle operation with optional adapter
Temperature Accuracy	+/- 2°F (+/- 1°C)
Relative Humidity Range	0 - 100% Non condensing
Relative Humidity Accuracy	+/- 2% (0 - 95% RH)
Dewpoint Range	32 to 130°F (0 to 50°C)
Probe	Combined Temperature/humidity with 6' cable
Chart	Strip chart (20" x 4 3/4")
Chart Ranges	-40°F to +60°F -40°C to +60°C +50°F to +150°F -30°C to +20°C 0°F to 100°F 0°C to +50°C

Chart Speeds	US	Metric	
	1/4 inch/hour	1/2 cm/hour	40 Days
	1 inch/hour	2 cm/hour	10 Days
	2 inches/hour	4 cm/hour	5 Days
	4 inches/hour	8 cm/hour	2 1/2 Days
	8 inches/hour	16 cm/hour	30 Hours
	1/4 inch/minute	1/2 cm/minute	16 hours
	1/2 inch/minute	1 cm/minute	8 Hours
	1 inch/minute	2 cm/minute	4 Hours
	2 inches/minute	4 cm/minute	2 Hours
Chart Speed Accuracy	+/- 1 %		
Display	Alphanumeric LCD		
	16 characters 2 line		
Temperature Alarm Range	-40°F to + 150°F (-40°C to +60°C)		
Alarm Delay Range	0 delay, 10 min., 30 min., 1 Hr. 90 min. or 2 Hr.		
Remote Alarm Connection	Normally open contacts 48 VAC/DC, 0.1 amp dry contacts		
Mounting	Vertical or horizontal, free standing or wall mounted		
Dimensions	9.25" x 7.25" x 2"		
Weight	2lb.		
Power Consumption	3.5 Watts max.		



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
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- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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