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# User's Manual

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## **DR 5000**

### **Circle Chart Recorder**



**FUTUREDESIGN**  
C O N T R O L S

## Warning Symbol



This  Symbol calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury or damage to or destruction of part or all of the product and system. Do NOT proceed beyond a warning symbol until the indicated conditions are fully understood and met.

## Use the Manual

- Installers                      Read Chapter 1, 2, 3
- System                            Read All Chapters

### NOTE:

It is strongly recommended that a process should incorporate a LIMIT like Future Design's L91 which will shut down the equipment at a preset process condition in order to preclude possible damage to products or system.

Information in this user's manual is subject to change without notice.

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# **Contents DR5000 Recorder**

	<b>Page Number</b>
<b>Chapter 1 Overview</b>	
1-1 General	4
1-2 Ordering Code	5
<b>Chapter 2 Installation</b>	
2-1 Unpacking	6
2-2 Mounting	6
2-3 Case Location	7
2-4 Wiring Precautions	8
2-5 Power Wiring	9
2-6 Sensor Installation Guidelines	10
2-7 Thermocouple Input Wiring	11
2-8 RTD Input Wiring	12
2-9 Linear DC Input Wiring	12
2-10 Alarm Relays	13
2-11 Changing the Chart	14
2-12 Marking Systems	14
2-13 Replacement of Pen Ink Style	15
2-13-1 Replacement of Thermal Head	16
2-14 Battery Backup	17
<b>Chapter 3 Programming</b>	
<b>3-1 Recorder Setup</b>	
3-1-1 Single Pen Ink	18
3-1-2 Dual Pen "OEM" Ink	19
3-1-3 Dual Pen Universal Input Ink	20
3-1-4 Thermal Recorder	21
<b>3-2 Alarm Settings</b>	22
3-2-1 Ink Style	22
3-2-2 Thermal Style	23
<b>Chapter 4 Calibration</b>	
4-1 Pen Zero and Span Ink Style	24
4-2 Probe Offset Ink Style	25
4-3 Probe Offset Thermal Style	26
<b>Chapter 5 Specifications</b>	27
<b>Chapter 6 Defaults/Glossary</b>	29
<b>Chapter 7 Troubleshooting</b>	29
<b>Chapter 8 Spare Parts</b>	31

# Chapter 1 Overview

## 1-1 General

The DR 5000 is a microprocessor based circle chart recorder. Programmable alarm options combined with “ease of setup” provide the flexibility required for multiple recording applications. This manual will cover both ink type and thermal print versions.

The DR 5000 is the first recorder to “self document” setup configuration during initial setup and can operate using standard or competitive charts. The battery backup option (on ink type units) provides up to 48 hours of recording in the event of power loss, thereby providing an additional degree of protection for customer processes. A green LED indicates battery condition, see section 2-14.

The Thermal print version offers a single chart inventory for all recording needs. “Print your own” chart technology includes real time trend and digital data directly on the chart.

The unit is powered by 110/220VAC, 50/60Hz. Programmable inputs for thermocouple types J, K, T, R, B and S as well as 4-20mA or 0-5VDC are standard. Optional alarm relays are available and programmable for low, high or band operation. A green LED indicates unit is recording.

A unique setup chart provides the user with an “on the spot” manual. This setup chart will also self document the current setup for quick review by an operator.

High accuracy, maximum flexibility, fast response and a simple user interface are the main benefits of the DR 5000 recorder.

# 1-2 DR 5000 Ordering Code

**DR 5000** —

**Power Input**

1: 110/220VAC 50/60HZ  
Selectable

**Recording Style**

1: 1 Pen Ink  
2: 2 Pen Ink  
3: 1 Pen Thermal  
4: 2 Pen Thermal  
5: 2 Pen OEM \* (Ink Style)

**Outputs**

0: None (Standard on OEM style, no relays)  
1: 1 Relay, DPDT 1A/240VAC resistive\*\*  
2: 2 Relay, DPDT 1A/240VAC resistive\*\*

**Display Options**

0: None

**Chart Option**

1: 10" Counterclockwise Rotation  
2: 10" Clockwise Rotation  
"Counterclockwise ONLY on thermal units"

**Enclosure Options**

1: Standard (Nema 3)  
2: Nema 4X  
3: Platen Mount

**Special Options**

0: None  
1: Battery Backup\*\*\*

Suffix Blank Standard FDC Namestrip  
Suffix AA-ZZ Door Namestrip Identifier

\*OEM Unit - Pen 1 Universal Input, Pen 2 4/20 ma ONLY, No relays

\*\* Recording style 1 and 2 only allow 1 relay per pen.

\*\*\* Ink Recorders ONLY. Allows 48 hours of continuous recording upon power loss.

# Chapter 2 Installation



Dangerous voltages capable of causing death are sometimes present when wiring the instrument. Before installation or beginning any troubleshooting procedures the power to all equipment must be switched off and isolated. Units suspected of being at fault must be disconnected and removed to a properly equipped workshop for testing and repair. Component replacement and internal adjustments must be made by qualified personnel only. This recorder operates on 110 or 220 (50-60hz), be sure line voltage is OFF before connecting recorder.



This symbol represents Earth Ground connection



To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture.



Do not use this instrument in areas under hazardous conditions such as excessive shock, vibration, dirt, moisture, corrosive gases or oil. The ambient temperature of the areas should not exceed the maximum rating specified in Chapter 5.

## 2 - 1 Unpacking

Upon receipt of the shipment remove the unit from the carton and inspect the unit for shipping damage.

If any damage due to transit, report and claim with the carrier. Write down the model number, serial number, and date code for future reference when corresponding with our service center. The serial number (S/N) and date code (D/C) are labeled on the box and the bottom side of the recorder. Make sure that all items are accounted for:

- 1: Battery (for optional battery backup)
- 2: Ferrite Bead
- 3: Installation manual

## 2 - 2 Mounting

Make panel cutout to dimension shown in Figure 2.1.

Install both mounting clamps and insert the case into panel cutout.

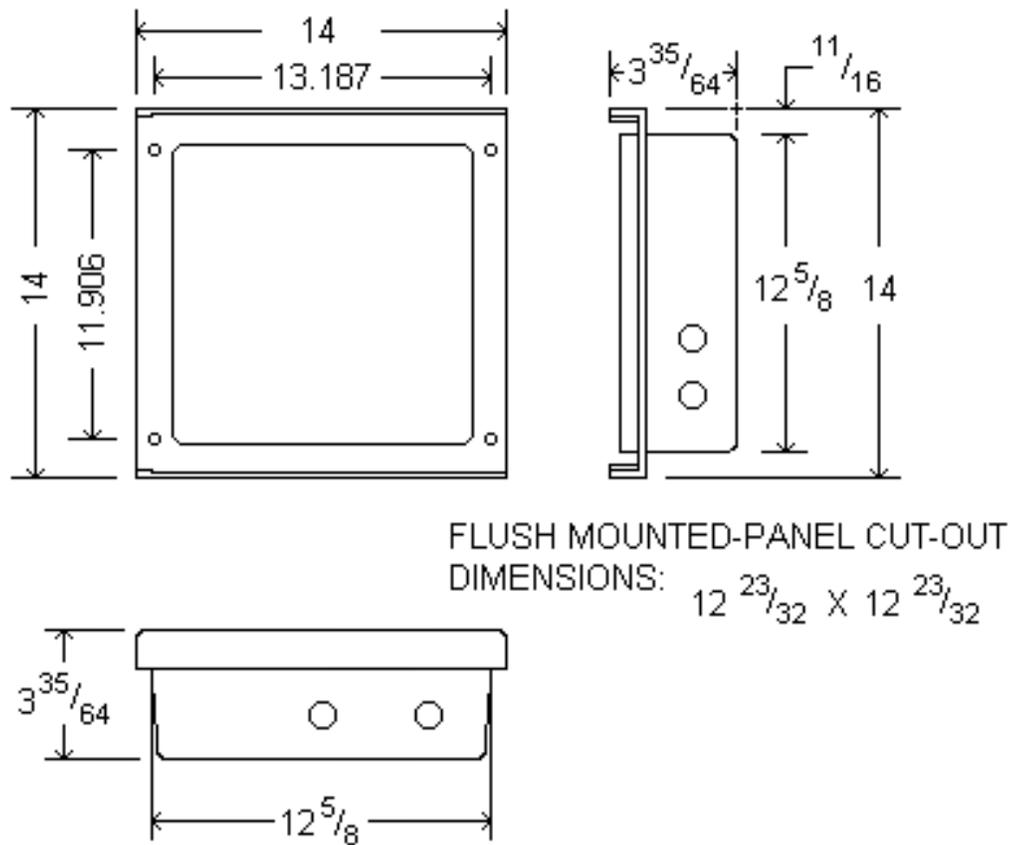


Figure 2.1 Mounting Diagram

## 2 - 3 Case Location

- \* Upon unpacking, find a suitable location to mount the recorder before wiring power to the unit. After the recorder has been connected to the main AC power supply, connect the battery (optional) to the battery strap and place the battery in its holder.

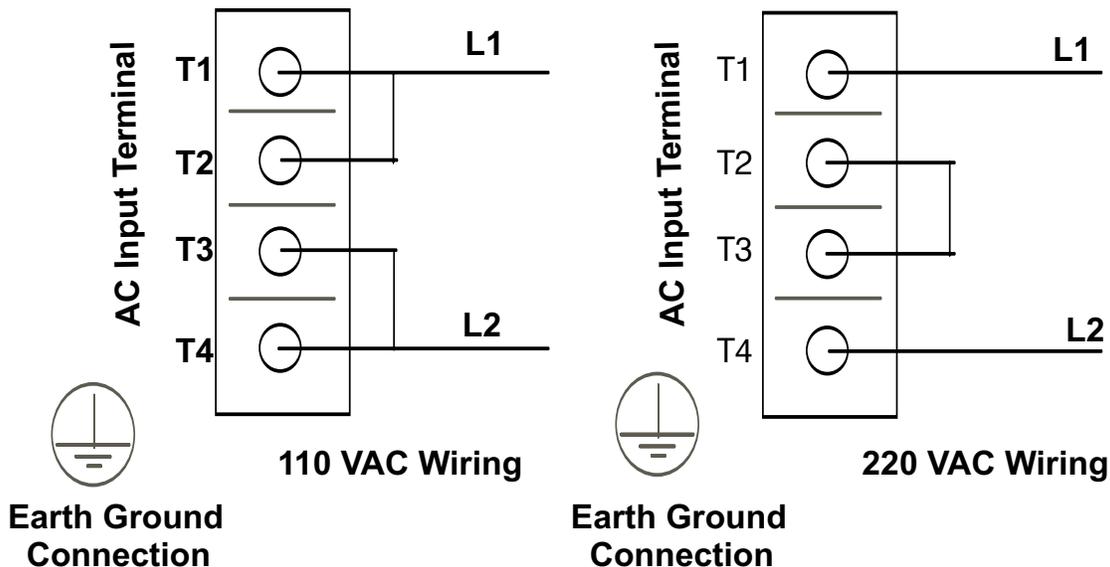
Select a location that is well lighted, free from dust, dirt or corrosive fumes. The instrument should not be located near any sources of heat or be subject of sudden or extreme temperature changes. It should be mounted on a rigid support that is not subject of vibration. Refer to figure 2.1 for recorder case dimensions.

## 2 - 4 Wiring Precautions

- \* Before wiring, verify the label for correct model number and options. Switch off the power when checking.
- \* Care must be taken to ensure that maximum voltage rating specified on the label are not exceeded.
- \* It is recommended that power of these units to be protected by fuses or circuit breakers rated at the minimum value possible.
- \* All units should be installed inside a suitably grounded metal enclosure to prevent live parts being accessible from human hands and metal tools.
- \* All wiring must conform to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for maximum voltage, current, and temperature rating of the system.
- \* Take care not to over-tighten the terminal screws.
- \* Unused control terminals should not be used as jumper points as they may be internally connected, causing damage to the unit.
- \* Verify that the ratings of the output devices and the inputs as specified in Chapter 5 are not exceeded.
- \* Electric power in industrial environments contains a certain amount of noise in the form of transient voltage and spikes. This electrical noise can enter and adversely affect the operation of microprocessor-based controls. For this reason we strongly recommend the use of shielded thermocouple extension wire which connects the sensor to the unit. This wire is a twisted-pair construction with foil wrap and drain wire. The drain wire is to be attached to earth ground at the sensor end only.

## 2-5 Power Wiring

The unit is supplied to operate at 110/220VAC 50/60Hz. Check that the installation voltage corresponds with the power rating indicated on the product label before connecting power to the unit.



**Figure 2.2  
Power Supply**

The recorder uses AC power when it is operating normally. The battery back-up option, on ink recorders, will allow the recorder to operate for approximately 48 hours in case of a power loss. AC input can be fused with a 250VAC, .5 Amp fuse.

In order to connect the recorder to the main AC power, you must first gain access to the microprocessor PC board that is mounted to the back of the chart plate. Your recorder will have a hinged chart plate held in place by two (2) screws located on the right hand side of the chart plate. Remove these two screws and open the hinged chart plate. If you are not sure how to access the back of the chart plate, please contact FUTURE DESIGN CONTROLS before continuing.

The AC power connections are made to the 4 pin terminal block located on back side of platen. All AC and ground wires must be a minimum of 16 AWG.

Refer to Figure 2.2 for proper connection to the main AC power.

Earth Ground must be connected at ground lug provided. See Figure 2.2

 This equipment is designed for installation in an enclosure which provides adequate protection against electric shock. Grounding of this recorder must meet national and local codes. Ground wire should be Color coded GREEN or GREEN with a YELLOW stripe.

Local requirements regarding electrical installation should be rigidly observed. Consideration should be given to prevent unauthorized persons access to the power terminals.

## 2-6 Sensor Installation

Proper sensor installation can eliminate many problems in a control system. The probe should be placed so that it can detect any temperature change with minimal thermal lag. In a process that requires fairly constant heat output, the probe should be placed close to the heater. In a process where the heat demand is variable, the probe should be close to the work area. Some experiments with probe location are often required to find this optimum position.

Proper sensor type is also a very important factor to obtain precise measurements. The sensor must have the correct temperature range to meet the process requirements. In special processes the sensor might need to have different requirements such as leak-proof, anti-vibration,

Standard thermocouple sensor limits of error are 4 degrees F ( 2 degrees C ) or 0.75% of sensed temperature plus drift caused by improper protection or an over-temperature occurrence. This error is far greater than controller error and cannot be corrected at the sensor except by proper selection and replacement.

In order to connect the probe input device to the recorder, you must first gain access to the microprocessor PC board that is mounted to the back of the chart plate.

A ferrite bead has been included to provide additional protection for electrical "Noise" sensor signal wires can pick up. See drawing below for correct installation of this device. Figure 2.3

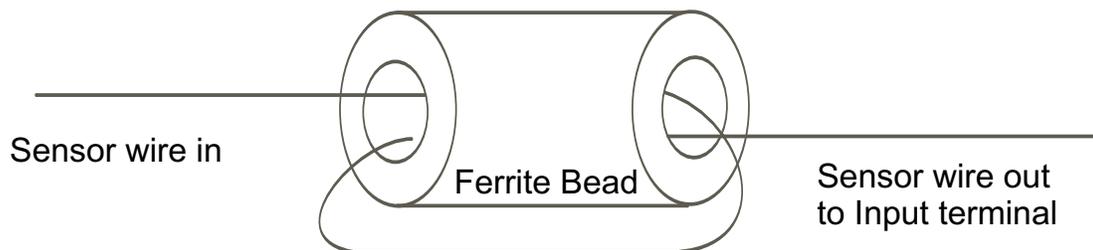


Figure 2.3



**CAUTION! DO NOT TOUCH** the terminals of the transformer while the recorder is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the recorder from the main power supply before attempting to open the recorder. If the recorder is installed with the battery back-up option, disconnect the 9 Volt battery to avoid damaging the recorder and draining the battery.

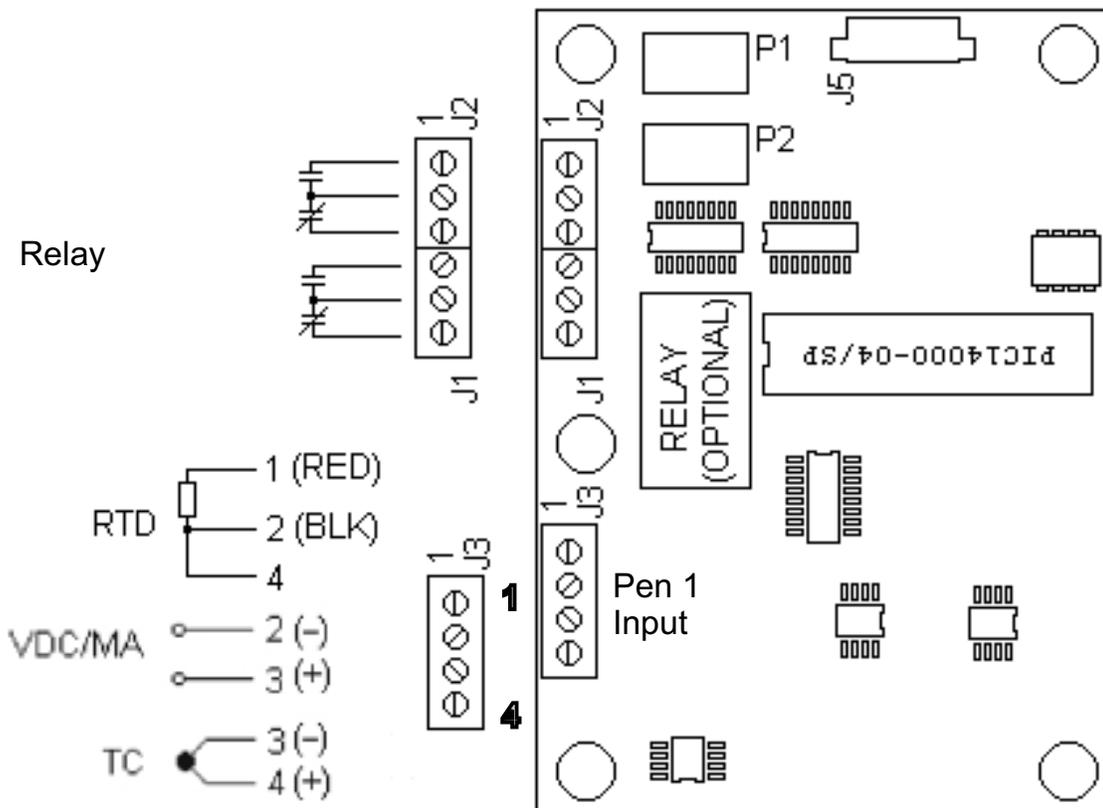
Your recorder will have a hinged chart plate held in place by two (2) screws located on the right hand side of the chart plate. Remove these two screws and open the hinged chart plate. If you are not sure how to access the back of the chart plate, please contact FUTURE DESIGN CONTROLS before continuing.

## 2-7 Thermocouple Input Wiring

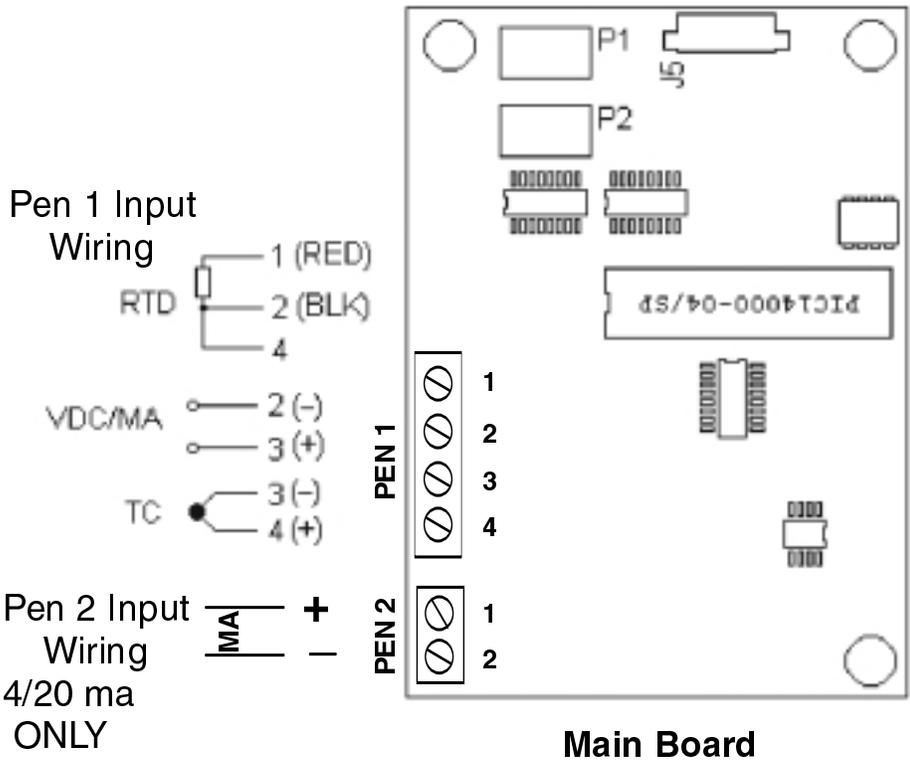
Thermocouple input connections are shown in the following figures. The correct type of thermocouple extension lead-wire or compensating cable must be used for the entire distance between the unit and the thermocouple, ensuring that the correct polarity is observed throughout. Splices in the cable should be avoided, if possible. A Ferrite bead is supplied with the DR5000 recorder to provide additional isolation against input noise. Input wiring should be wrapped around the core before wiring to the recorder inputs. See Figure 2.3

If the length of thermocouple plus the extension wire is too long, it may affect the temperature measurement. A 400 ohms K type or a 500 ohms J type thermocouple lead resistance will produce approximately 1 degree C temperature error .

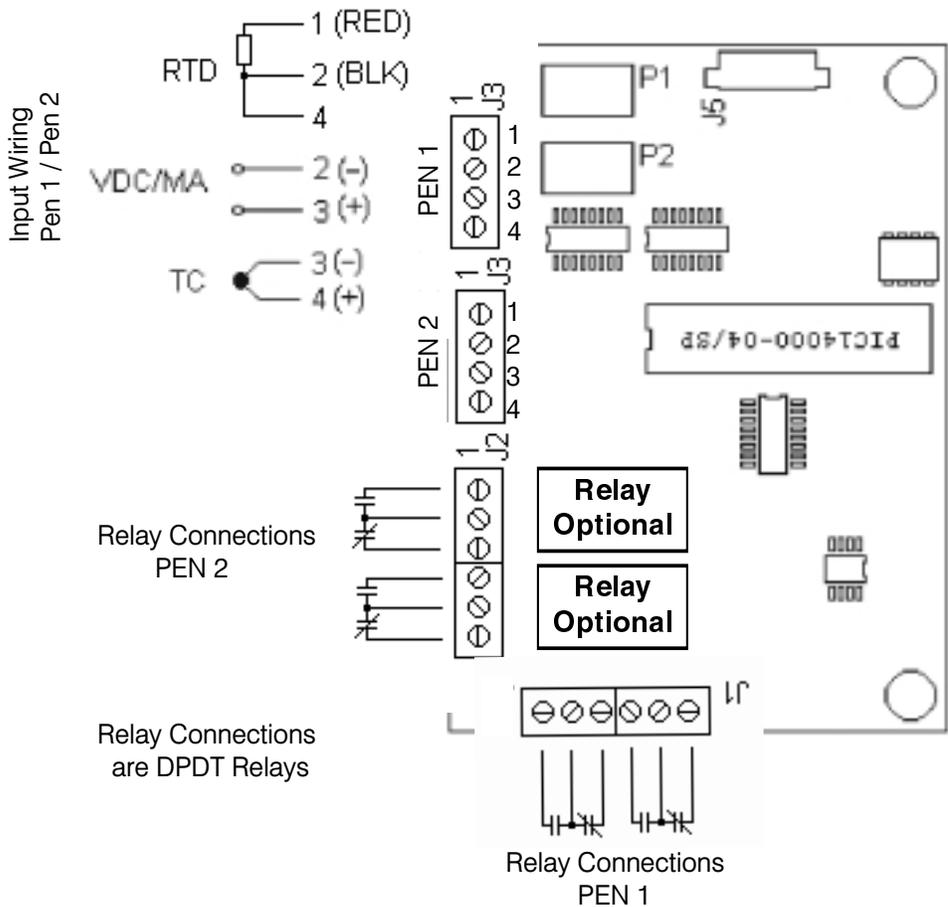
**Figure 2.4 Single Pen Ink Style Inputs**



### Figure 2.5 Two Pen OEM Ink Style Inputs



### Fig. 2.6 Two Pen Universal and Thermal Inputs



## 2-8 RTD Input Wiring

RTD connections are shown in the previous, with the compensating lead connected to terminal 4. For two-wire RTD inputs, terminals 2 and 4 should be linked. The three-wire RTD offers the capability of lead resistance compensation provided that the three leads are of same gauge and equal length.

Two-wire RTD should be avoided, if possible, for the purpose of accuracy. A 0.4 ohm lead resistance of a two-wire RTD will produce 1 degree C temperature error.

## 2-9 Linear DC Input Wiring Pen 1/Pen 2

DC linear voltage and linear current connections are also shown in the previous input wiring figures.

## 2-10 Alarm Relays

If your recorder has the optional relay contacts installed, then terminal blocks J1 and J2 have been provided for connection to the relay on the microprocessor PC board of the recorder.

Refer to Figure 2.4 for Single Pen Units.

Refer to Figure 2.6 for Dual Pen Ink and Thermal Units.

NOTE; OEM unit has no Alarm relay outputs.



**CAUTION! DO NOT TOUCH** the terminals of the transformer while the recorder is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the recorder from the main power supply before attempting to access the terminals of the relay. If the recorder is installed with the battery back-up option, disconnect the 9 Volt battery to avoid damaging the recorder and draining the battery.

Your recorder will have a hinged chart plate held in place by two (2) screws located on the right hand side of the chart plate. Remove these two screws and open the hinged chart plate. If you are not sure how to access the back of the chart plate, please contact FUTURE DESIGN CONTROLS before continuing.

The relays are rated for the following maximum Values:

2.0 AMPS at 25VDC

1.0 AMP at 120VAC

Warning: Damage to the recorder may result if the ratings for the relays are exceeded.

## 2-11 Changing the Chart

Press and release the CHANGE CHART key (3 on Figure 2.7). The pen(s) will move to the left of the chart and green LED will flash rapidly. Wait until the pen(s) stops above outer ring AND green LED goes to on steady.

Unscrew the chart "hub" knob at the center of the chart. Remove the old chart paper and position the new one so that the correct time line coincides with the time line groove on the chart plate. Refer to Figure 2.10 (Page 17) for the location of the time line groove.

Re-attach the chart "hub" knob and screw securely (by hand) against the chart. Press and release the CHANGE CHART key (3). The pen(s) will move to the outer ring, then pause. The green LED will remain on. Pen(s) will then go to current recording value.

Check to make sure that the pen(s) is marking on the chart paper. If it is not, then carefully adjust the pen arm to establish contact with the paper. On a thermal print recorder, the thermal stylus does not need adjustment.

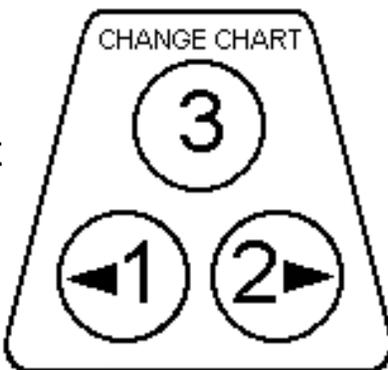
## 2-12 Marking Systems - "Ink Type Pens"

This type of pen consists of a self contained ink reservoir with a porous plastic stylus which is snapped around the outer edge of the metal pen arm.

A pen cap is provided to extend the life of the ink pen during shipping or when the recorder is not in service. To remove the pen cap, gently lift the pen arm away from the chart paper. Remove the black plastic pen cap to expose the fiber tip of the ink pen and gently place the pen back onto the chart paper. Do not let the pen arm "snap" back onto the chart paper. This will flatten the fiber tip of the pen and will no longer give you a fine line marking on the chart paper. Place the pen cap in a safe place for future use.

If the stylus does not touch the chart, adjustment can be made by slightly bending the metal pen arm in the center towards the chart paper. Do not use more pressure than is necessary to create a fine line marking on the chart paper. Note: As the pen ink supply runs out, the pen color will become lighter. This indicates that the pen should be replaced.

Figure 2.7  
Keypad Layout



## 2-12-1 Marking Systems - Thermal

This type of pen consists of a self contained thermal print head that is attached to a metal "Stylus" pen arm assembly.

Periodic maintenance is not required for this pen type. Since the thermal print head creates it's own chart, adjustment for outer ring are made automatically during each chart change. Replacement of the thermal print head is covered in 2-13-1. (Pg.16)

## 2-13 Replacement of Pen "Ink Type"

Recorders that are equipped with fiber tipped cartridge pens are colored coded RED for pen 1 and BLUE for pen 2.

The pen cartridge is securely fastened to the metal pen arm using a special "U" clip tab.

For ease of replacement, it is suggested that the two (2) screws that hold the pen arm be loosened and the pen cartridge and metal pen arm be removed as an assembly. Refer to Figure 2.10 (page 17) for the location of the pen arm screws. Unsnap the plastic "U" clip tab of the pen cartridge from the metal pen arm, remove and discard the old pen cartridge. Replace the new cartridge by opening the hinge and snapping it securely around the metal pen arm. Refer to Figure 2.8 for pen cartridge replacement.

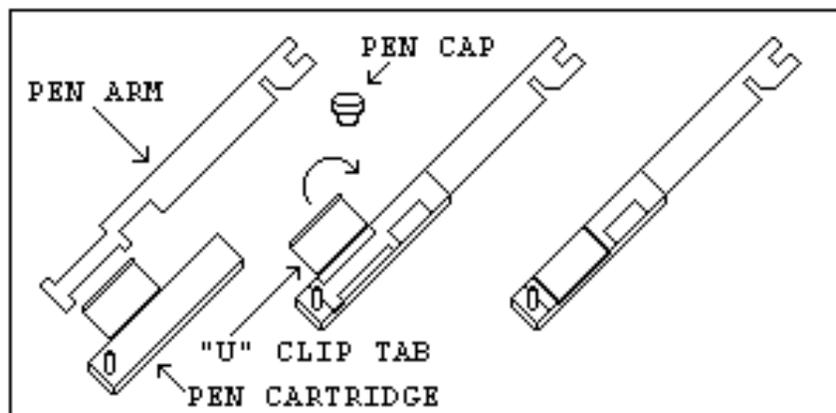


Figure 2.8 Pen Replacement

## 2-13-1 Replacement of Thermal Stylus

The thermal print head is securely fastened to the metal stylus arm which is attached to the pen motor drive assembly.

For ease of replacement, it is suggested that the stylus (with print head attached) be removed as a complete assembly.

- 1.) Disconnect AC power from unit.
- 2.) Remove the two platen screws located on the front of the platen at the right center of the platen.
- 3.) Follow the thermal pen leads to the main "mother" board located on the back of the recorder platen.
- 4.) Remove the "plug in" thermal print head leads from the main "mother" board.
- 5.) Remove the pen arm screws that attach the pen arm stylus to the pen arm motor assembly located on the front of the platen.
- 6.) Remove the pen arm assembly.
- 7.) Install new pen arm assembly in the reverse order of disassembly.
- 8.) Reconnect AC power to unit. Pen will align itself and begin normal recording.

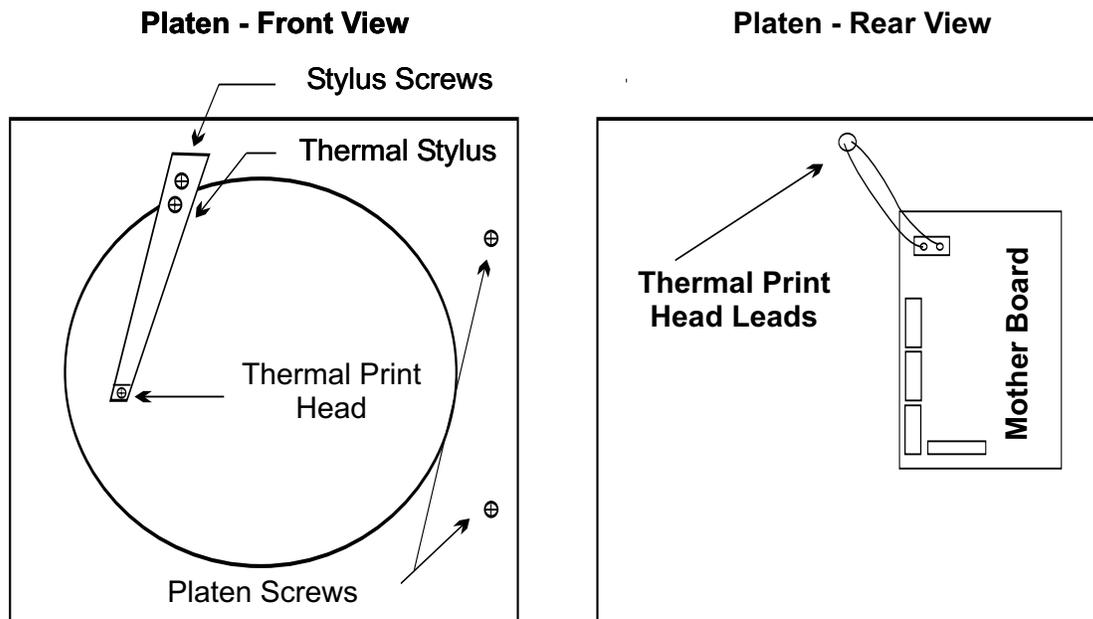


Figure 2.9 Thermal Recorder Platen Layout

## 2-14 Battery Backup “Ink Style” Units

Having the optional 9 volt DC battery back-up in place, will allow the recorder to continue to function normally for approximately 48 hours in the event of a power failure.

The green LED assists in indicating battery condition. When a recorder has this option feature.

If green LED is on continuous, battery voltage is acceptable.

If green LED is flashing rapidly, battery voltage is below 7.5 VDC, replace battery.

If green LED is not on battery voltage is insufficient and AC power off.

The battery strap and battery holder are located on the front of the chart plate (refer to Figure 2.10). In order to change the battery, you must open the recorder case door. Note: Use only NEW 9 volt alkaline replacement batteries.

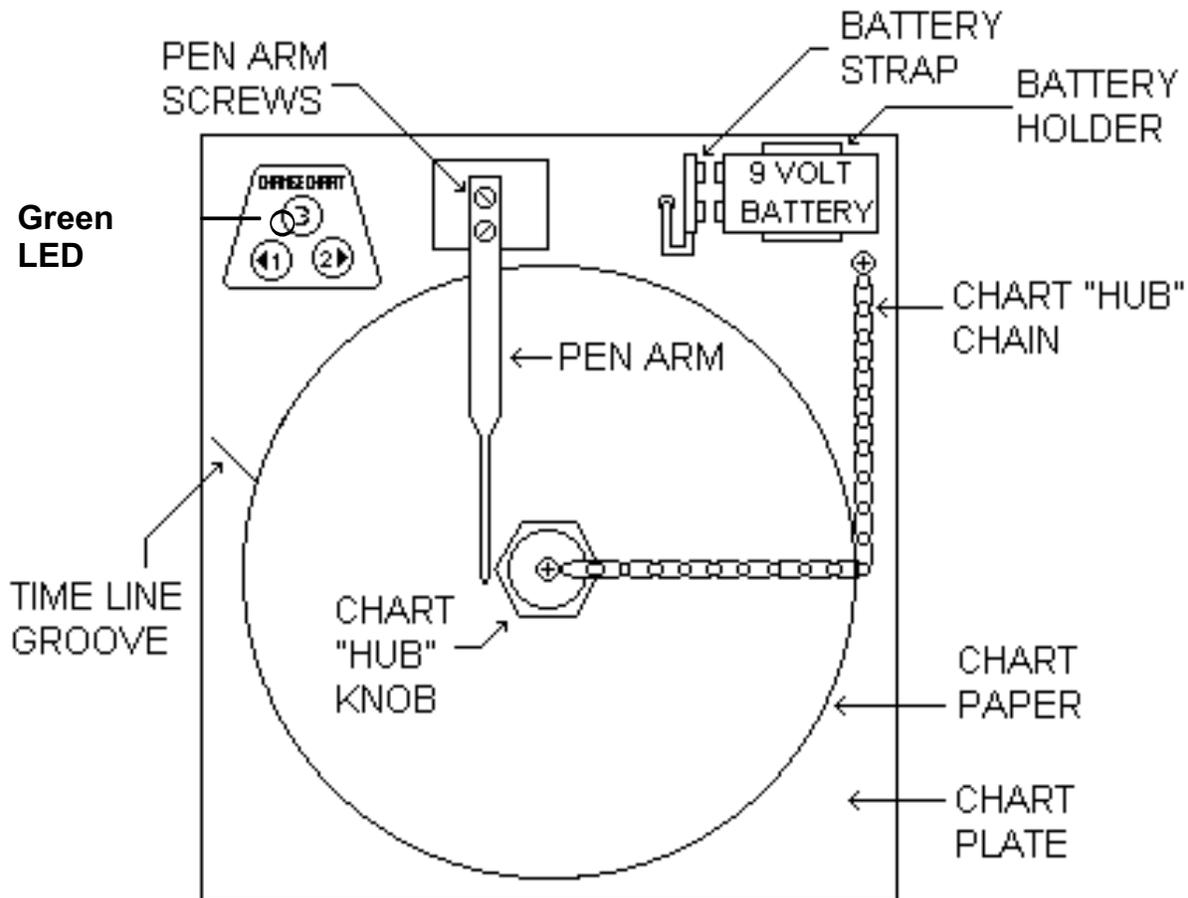


Figure 2.10 Recorder Platen Layout/Battery Installation

# Chapter 3 Programming

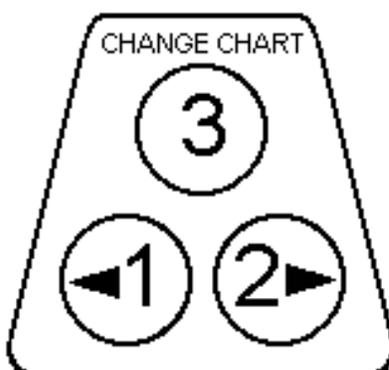
## 3-1-1 Recorder Setup “Single Pen Ink Type”

In order to configure the recorder, you will need the recorder SET-UP CHART, P/N R18-270 for CCW or P/N R18-272 for CW rotation.

This chart contains the configuration categories of the recorder (Probe Input, Inner Chart Values, Outer Chart Values, Units, Chart Rotation, Input Averaging and Relay Options). Place the SET-UP CHART onto the recorder. This setup chart should be saved for future reference once setup complete.

1. Place SETUP CHART on recorder (P/N R18-270 for CCW, and P/N R18-272 for CW)
2. Press and release CHANGE CHART key (3).
3. Wait until pen moves above scale and green LED stops flashing.
4. Press and hold LEFT arrow key (1) until LED goes off, then release key.
5. Pen will move to outer ring of chart. Wait for LED to flash slowly. (.8sec on / .8 sec off) LED will continue to flash slowly during setup.
6. Loosen Chart knob and rotate chart to position RED pen in the middle of the START CIRCLE.
7. Tighten chart knob. Press and release the CHANGE CHART key (3). Pen will move to PROBE INPUT column on the setup chart.
8. Position pen to the desired selection using LEFT (1) and RIGHT (2) keys.
9. Press and release CHANGE CHART key (3) to store selection and advance to next category.
10. Repeat selection process until all categories are selected. You must Press and release CHANGE CHART key (3) after last category.
11. After all categories are selected, pen will move off scale and LED will Stop flashing. (Steady on)
12. Remove SETUP CHART and save. Install actual recording chart.
13. Press and release CHANGE CHART key (3).
14. LED will remain on steady, pen will stop at 100% ring, then to alarm setpoint values (if enabled). LED will turn off when pen(s) reaches alarm setpoint. Use RIGHT/LEFT arrow keys to adjust alarm value(s) for pen. LED is on steady when pen(s) are recording actual values.

Figure 3.1  
Keypad Layout



## 3-1-2 Setup Of Dual Pen “OEM” Ink Style

In order to configure the recorder, you will need the recorder SET-UP CHART, P/N R18-270 (CCW) or P/N R18-272 (CW). The second pen (Blue) on OEM type recorders is fixed for 0/100% of the analog input.

The setup chart contains the configuration categories of the recorder (Probe Input, Inner Chart Values, Outer Chart Values, Units, Chart Rotation, Input Averaging and Relay Options). Place the SET-UP CHART onto the recorder. This setup chart could be left on the recorder behind the normal recording chart for easy access or behind the platen assembly.

1. Place SETUP CHART on recorder.
2. Press and release CHANGE CHART key (3), pens will begin move off scale and green LED will flash rapidly. Wait until pens are off scale AND Green LED goes to on steady.
3. Press and hold LEFT arrow key (1) until green LED turns off. Then release key. Pens will move to outer ring. Wait for green LED to flash slowly. (.8sec on/.8sec off) Note; Green LED will continue to flash slowly during setup mode.
4. Blue Pen will move to outer ring of SETUP CHART first. Then Red pen will then move to outer ring. Please note: Blue pen will remain at outer ring of chart during setup. Pen 2 is fixed for 0/100% for analog input.
5. Loosen chart knob and rotate chart to position Red pen in middle of the START CIRCLE.
6. Tighten chart knob. Press and release the CHANGE CHART key (3). Red Pen will move to first selection category to current value. Position red pen to desired selection using LEFT (1) and RIGHT (2) keys.
7. Press and release the CHANGE CHART key (3) to store selection.
8. Repeat selection process in EACH category until all categories are Selected.
9. After last category(Relay) is selected ( this setting should be set to “ DISABLED”), press and release CHANGE CHART key (3). Pens will move off scale. Green LED will flash rapidly. Wait until Green LED goes to on steady. Setup is now complete.
10. Remove and store SETUP CHART. Install actual recording chart to be used.
11. Press and release CHANGE CHART (3) key. Pens will move to 100% ring. Then to actual recording values.

### 3-1-3 Setup Of Dual Pen (Universal) Ink Style

In order to configure the recorder, you will need the recorder SET-UP CHART, P/N R18-270 for CCW or P/N R18-272 for CW rotation. Universal Inputs allow the user to select a different type of input for each pen.

The setup chart contains the configuration categories of the recorder (Probe Input, Inner Chart Values, Outer Chart Values, Units, Chart Rotation, Input Averaging and Relay Options). Place the SET-UP CHART onto the recorder. This setup chart should be saved for future reference once setup complete.

1. Place SETUP CHART on recorder (P/N R18-270 for CCW or P/N R18-272 for CW)
2. Press and release CHANGE CHART key (3).
3. Wait until pens moves above scale and green LED stops flashing.
4. Press and hold LEFT arrow key (1) until LED goes off, then release key.
5. Blue Pen will move to outer ring of SETUP CHART. Red pen will then move to outer ring. Please note Blue pen setup selections allowed are categories Input Probe and Relay selections only. Wait for LED to flash slowly. (.8sec on / .8 sec off) LED will continue to flash slowly during setup.
6. Loosen Chart knob and rotate chart to position RED pen in the middle of the START CIRCLE.
7. Tighten chart knob. Press and release the CHANGE CHART key (3). Pen will move to PROBE INPUT column on the setup chart.
8. Position pen to the desired selection using LEFT (1) and RIGHT (2) keys.
9. Press and release CHANGE CHART key (3) to store selection and advance to next category.
10. Repeat selection process until all categories are selected. You must Press and release CHANGE CHART key (3) after last category.
11. After all categories are selected, pen will move off scale and LED will Stop flashing. (Steady on)
12. Remove SETUP CHART and save. Install actual recording chart.
13. Press and release CHANGE CHART key (3).
14. LED will remain on steady, pen will stop at 100% ring, then to alarm setpoint values (if enabled). LED will turn off when pen(s) reaches alarm setpoint. Use RIGHT/LEFT arrow keys to adjust alarm value(s) for pen. LED is on steady when pen(s) are recording actual values.

## 3-1-4 Setup Of Thermal Recorders.

In order to configure the recorder, you will need the recorder SET-UP CHART, P/N R18-271. Thermal print recorders use a single thermal printhead for single and two channel units.

The setup chart contains the configuration categories of the recorder (Probe Input, Inner Chart Values, Outer Chart Values, Units, Chart Rotation, Input Averaging and Relay Options). Place the SET-UP CHART onto the recorder. This setup chart should be saved for future reference once setup complete.

1. Place SETUP CHART on recorder (P/N R18-271)
2. Press and release CHANGE CHART key (3).
3. Wait until stylus moves to top of chart and green LED stops flashing.
4. Press and hold LEFT arrow key (1) until LED goes off, then release key.
5. Thermal stylus will move to outer ring of setup chart. The left and right arrow keys can be used to adjust the center line on the print head to the outer ring of the setup chart at this time. Wait for LED to flash slowly. (.8sec on / .8 sec off) LED will continue to flash slowly during setup.
6. Loosen Chart knob and rotate chart to position the center of the printhead in the middle of the START CIRCLE.
7. Tighten chart knob. Press and release the CHANGE CHART key (3). Pen will move to PROBE INPUT column on the setup chart.
8. Position pen to the desired selection using LEFT (1) and RIGHT (2) keys.
9. Press and release CHANGE CHART key (3) to store selection and advance to next category.
10. Repeat selection process until all categories are selected. You must Press and release CHANGE CHART key (3) after last category.
11. After all categories are selected, pen will move off scale and LED will Stop flashing. (Steady on)
12. Remove SETUP CHART and save. Install actual recording chart. Recording Chart Part number 00218001.
13. Press and release CHANGE CHART key (3).
14. The thermal stylus will now begin printing the chart. The thermal stylus will print all scales, date/time and trend lines automatically.

## 3-2-1 Alarm Settings Ink Style Recorders

Alarm setpoint values are selected by positioning the pen to the actual value on the recording chart. Alarm settings can be selected or viewed after CHART CHANGE, recorder setup or during initial power up. To set the alarm setpoint during normal recording operation, complete the following steps.

Press and release the CHANGE CHART key ( 3 on Figure 3.2). Wait until pen(s) moves off scale and LED status changes from flashing to steady. Press and release the CHANGE CHART (3) again, the pen will begin to move back onto the chart briefly stopping at (or close to) the outermost graduation of the chart. Green LED remains on steady during this time.

### ***Single Alarm Setting***

After the above operation is complete, the active pen(s) arm will move to the current alarm setpoint position on the chart (one pen at a time). The green LED will go out, during this time the alarm setpoint (for each pen) can be adjusted using the LEFT arrow (1) or the RIGHT arrow (2) keys on the keypad. Once the alarm setpoint is set, wait for the green LED will turn on and the pen arm will move to indicate the probe's temperature and the unit will begin normal recording operation.

### ***Band Alarm Setting***

When programming the recorder for band alarm operation, the active pen(s) will move to the first band setpoint on the chart. The green LED will go out. The alarm band 1 setpoint can now be adjusted using the LEFT arrow (1) or the RIGHT arrow (2) keys, once set, wait for the green LED to turn on. The active pen will then move to the second band alarm setpoint. The green LED will go out. The alarm band 2 can now be adjusted. When pen(s) alarm setpoints adjustments are completed, wait for the green LED to turn on and the pen arm will move to indicate the probe's temperature and the unit will begin normal recording operation.

The "Change Chart" key is the "RESET" when the recorder is programmed for latching alarm operation.

**NOTE; Alarm reset occurs upon depressing "Change Chart" (3) key regardless of alarm condition.**

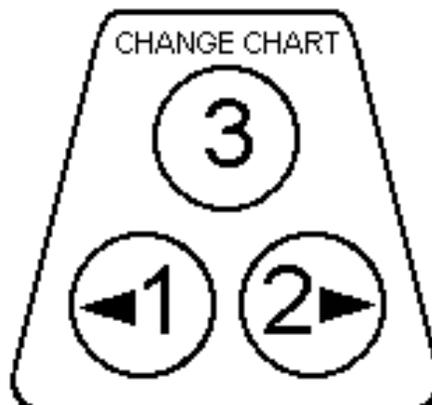


Figure 3.2  
Keypad Layout

## 3-2-2 Alarm Settings Thermal Style Recorders

Thermal alarm relay settings can only be set or reviewed from the Setup mode.

Install setup chart part number R18-271. Follow the thermal setup Instructions found in Chapter 3-1-4. (Pg. 21).

Alarm settings are set under Alarm #1 and Alarm # 2 setpoint categories. The setup procedure must be followed completely to properly store selected alarm values. Alarms are programmable for hi or low alarm action as well as latching or non-latching. Latching alarms require a manual "reset" which is performed by depressing "change chart" key (3).

***Note: Alarms will "reset" when pressing the "Change Chart" key REGARDLESS of the current alarm condition.***

**Thermal alarms can be programmed as follows:**

- P1(Hi):** Process high alarm (on above setpoint) assigned to Pen1.
- P1(Low):** Process low alarm (on below setpoint) assigned to Pen 1.
- LP1(Hi):** Latching high alarm.
- LP1(Low):** Latching low alarm
- P1(Hi/Low):** Pen 1 uses both optional relays for alarm.  
Alarm 1 is a high alarm. Alarm 2 is a low alarm
- LP1(Hi/Low):** Pen 1 uses both optional relays for latching alarms.  
Alarm 1 is a high latching alarm. Alarm 2 is a low latching alarm.

## 3-2-1 OEM Style Recorders

No alarm relay options are available on this style recorder.

# Chapter 4 Calibration - Ink Type Only

## 4-1 Pen Arm Calibration (Zero and Span)

Pen calibration applies to ink type units only and is a two point calibration. Since Thermal stylus unit print their own outer/inner ring, calibration is not necessary. To check and/or adjust the recording pen(s) calibration to the inner and outer graduations of the chart on ink type units, Perform the following.

1. Remove power to instrument. If unit has battery option also remove battery.
2. With all power removed, press and hold the CHANGE CHART key (3). While holding the CHANGE CHART key(3), re-apply power. Release key upon applying power, either AC or battery which ever is convenient.
3. The pen(s) will move off scale, LED will flash rapidly. Green LED will then go on steady. If 1 pen ink unit go to step 5 next.
4. The blue pen will then move to 100% ring. Adjust blue pen, if necessary, using LEFT (1) and RIGHT (2) keys to position pen on 100% ring, then Wait.
5. Red pen will then move to 100% ring. Adjust this pen, if necessary, to 100% ring, using LEFT (1) and RIGHT (2) keys, then wait.
6. Red pen will then move to 0% ring. Adjust pen using LEFT (1) and RIGHT (2) keys, then wait. Pen will then move full upscale. If 1 pen unit go to step 8.
7. Blue pen will move to 0% ring. Adjust pen to 0%, using LEFT (1) and RIGHT (2) keys, then wait. Blue pen will now travel full upscale.
8. Pen(s) calibration is now complete.

Pen(s) will then go directly to actual recording values.

Each time the chart paper or fiber tip pen cartridge is changed, you should make sure that each pen stops at the inner and outer most temperature graduation of the chart paper. Otherwise, this pen offset can cause the unit to record an incorrect temperature on the chart.

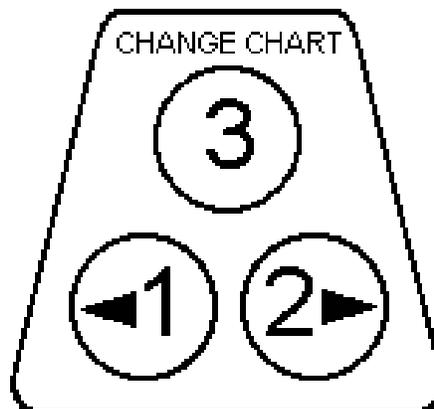


Figure 4.1 Keypad

## 4-2 Ink Style Probe Offset Adjust (Pen Offset)

This recorder has been accurately calibrated at the factory. Before making any adjustments, this instrument should be in service for 24 hours. Thereafter, if any adjustment is required, perform the following procedure.

1. Place a Certified Test Thermometer(s) alongside the recorder's sensor probe(s) in a monitored controlled condition.
2. Once the temperature has leveled out, compare the position of the pen on the recorder to the test thermometer's reading, also compare the Certified Test Thermometer's reading to the second pen of the recorder.
3. If an adjustment is required, for a single pen unit, depress and hold either the LEFT (1) or RIGHT (2) arrow key. The pen will begin to move after approximately ten (10) seconds. Using the LEFT arrow (1) or RIGHT (2) arrow keys, position the pen on the chart to correspond to the temperature of the Certified Thermometer. Once the corrected value is obtained no further keystrokes are required.
4. For two (2) pen ink recorders, you must first select the pen that you wish to calibrate. This is done by pressing the LEFT (1) arrow key to select the Red pen or the RIGHT (2) arrow key to select the Blue pen. The appropriate arrow key must be held down for approximately five (5) seconds, after which the green LED will go out. Release the key. The green LED will begin to flash. Adjust the pen to the desired value. This is done using the LEFT (1) or RIGHT (2) arrow keys. Once the corrected value is obtained, wait. Green LED will go to on steady indicating normal recording mode.

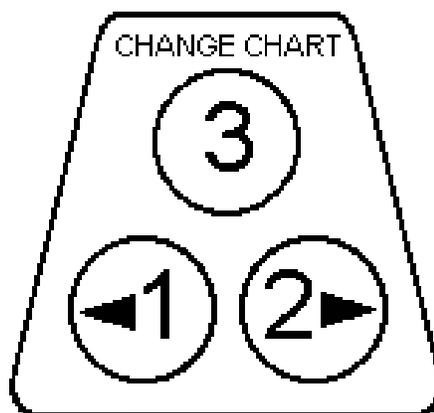


Figure 4.2 Keypad  
Layout

## 4-3 Thermal Style Probe Offset (Pen Offset)

This recorder has been accurately calibrated at the factory. Before making any adjustments, this instrument should be in service for 24 hours. Thereafter, if any adjustment is required, perform the following procedure.

1. Place a Certified Test Thermometer(s) alongside the recorder's sensor probe(s) in a monitored controlled condition.
2. Once the temperature has leveled out, compare the position of the pen on the recorder to the test thermometer's reading, also compare the Certified Test Thermometer's reading to the second pen of the recorder.
3. If an adjustment is required, for a single pen unit, depress and hold either the LEFT (1) or RIGHT (2) arrow key. The printhead will move to current trend line value. Using the LEFT (1) and RIGHT (2) arrow keys adjust the center scribe mark on printhead to desired recording location. Once adjusted wait. Green LED will go to on steady. Printhead will then resume normal printing operation.
4. For two (2) pen thermal recorders, you must first select the trend line that you wish to calibrate. This is done by pressing the LEFT (1) arrow key to select trend for pen 1 or the RIGHT (2) arrow key to select trend for pen 2. Hold the selected key until green LED goes out. Then release the key. The green LED will begin to flash. The printhead will now move to the current trend line value. Using LEFT (1) and RIGHT (2) arrow keys adjust the center scribe mark on printhead to desired recording location. Once adjusted, wait. Green LED will go to on steady. Printhead will then resume normal operation.

The remaining pen can now be selected and adjusted, if necessary Using instructions above.

# Chapter 5

## Power

Line Voltage: 110/220VAC, 50/60Hz  
Power Consumption: 15 VA maximum

## Input

Thermocouple (T/C): Type J, K, T, R, B, S,  
RTD: PT 100 ohm RTD (385 curve)  
Linear: 4-20 mA, 0-5 VDC  
Range: Programmable See Table 5.1  
Common Mode Rejection: > 120dB at 60 Hz  
Cold Junction Accuracy:  $\pm 0.2^{\circ}\text{C}@25^{\circ}\text{C}$  ambient  
Cold Junction Error:  $\pm 0.2^{\circ}\text{C}@25^{\circ}\text{C}$  ambient  
Ambient Error:  $\pm 0.01\%$  span/ $^{\circ}\text{C}$  from  $25^{\circ}\text{C}$  ambient  
Isolation: Inputs isolated from outputs

## Recording

Chart Size: 10"  
Recording Accuracy:  $\pm 0.5\%$  of span (100 division span)  
Sensor Break: Full scale Pen < 10 seconds  
Chart Speed Ink: Configurable for 4,8,12,24,48,72 or 168 hours  
Chart Speed Thermal: Configurable for 12,24,48,72 or 168 hours  
Input Filtering: Programmable up to 120 seconds

## Options

Relay: DPDT, 1.0 Amps @120 VAC resistive  
Relay Program: Process, Band, Non-latching, Latching  
Error Protection: De-energized during sensor break  
Hysteresis: Set at 2 units, activation is safe sided  
Battery Back up:  
Ink Style: Up to 48 hours of recording (optional)  
Thermal Print Style: Maintains real time clock

## Environmental and Physical

Operating Temperature: 0 to  $60^{\circ}\text{C}$   
Storage Temperature:  $-40$  to  $65^{\circ}\text{C}$   
Humidity: 0-90% RH (non-condensing)  
Agency Approvals: UL / CUL File #E232762, CSA File  
Installation Category: II  
Pollution Degree: 2  
Altitude: 2000 meters  
Vibration: 0.3 to 100Hz @0.2g  
Mounting:  $\pm 20$  degrees of vertical  
 $\pm 10$  degrees of horizontal  
Moldings: Fire retardant Noryl w/acrylic window  
Panel Rating : Nema 12X std (Nema 4 optional)  
Dimensions: 14.00 (H) x 14.00 (W) x 3.80 (D)  
Panel Cutout: Industry Standard 12.70 x 12.70  
Weight: 7 pounds maximum

# 5-1 Input Range Table:

Type	Range	Color Code / Polarity
J	-130° C / 760° C ( -202° F / 1400° F )	White + Red -
K	-130° C / 1370° C ( -202° F / 2498° F )	Yellow + Red -
T	-200° C / 400° C ( -328° F / 752° F )	Blue + Red -
B	100° C / 1824° C ( 212° F / 3315° F )	Gray + Red -
R	0° C / 1650° C ( 32° F / 3002° F )	Black + Red -
S	0° C / 1649° C ( 32° F / 3000° F )	Black + Red -
PT100 ( DIN )	-210° C / 440° C ( -346° F / 824° F )	
mA	4mA / 20mA	
V	0V / 5VDC	

**Table 5-1 Input Characteristics**

Lower Chart Range Selection:  
 Programmable from - 999 to 9999 Units

Upper Chart Range Selection:  
 Programmable from - 999 to 9999 Units

## Table 5-2 Upper/Lower Chart Ranges

Note: Recommended minimum chart span for thermocouple inputs is 100

# Chapter 6 Default Settings / Glossary

## FACTORY SET DEFAULTS

Defaults settings are identical for 1 and 2 pen ink or thermal recorders.

Input ----- J T/C \*

Unit ----- Fahrenheit

Scale ----- 0/100

Rotation ----- 24 hour

InputAver. ----- 4

Optional alarms when ordered

Alarms - High ALarm

Setpoint - 90 F

\* Input for pen 2 on OEM recorder is defaulted to 4/20 ma, scaled 0/100

## GLOSSARY

Input Averaging - The number of input readings (in seconds) held and averaged as pen is recording. The larger the number the more pen response is dampened.

High Alarm - Output relay energized when process variable above set value.

Low Alarm - Output relay energized when process variable below set value.

Band Alarm - Output relay is energized when process variable is above high set value or below low set value.

Latching - Output relay requires a "Reset" (depress 3 key) to de-energize relay after activating.

Note: "Reset" occurs regardless of alarm condition.

## Chapter 7 Troubleshooting

### GREEN LED LIGHT SEQUENCE GUIDE

- 1.) LED on steady and pen(s) within chart range, unit is recording normally.
- 2.) LED on steady and pen(s) above 100 % ring indicates unit is in "CHART CHANGE" mode. *Action: Press and release "CHART CHANGE" key to return to normal recording mode.*
- 3.) LED flashing RAPIDLY and pen(s) within chart range indicates battery voltage is low. *Action: Replace battery. (If option is applicable)*
- 4.) LED flashing RAPIDLY and pen(s) at 0 or 100 % ring indicates that input sensor(s) are in a break condition. *Action: Check or replace sensor, validate setup information for sensor.*
- 5.) LED flashing slowly (.8 sec.. On/ .8 sec. off) unit in setup mode. *Action: Complete setup procedure of recorder. Or performing Probe offset procedure.*
- 6.) LED not on indicates no power to unit. *Action: Check to see if AC present on power terminals. If battery option exists check and/or replace battery.*

# Warranty

Future Design Controls warranties or representations of any sort regarding the fitness for use, or the application of its products by the Purchaser. The selection, application or use of Future Design products is the Purchaser's responsibility. No claims will be allowed for any damages or losses, whether direct, indirect, incidental, special or consequential.

Specifications are subject to change without notice. In addition, Future Design reserves the right to make changes without notification to Purchaser to materials or processing that do not affect compliance with any applicable specification.

Future Design products are warranted to be free from defects in material and workmanship for one year after delivery to the first purchaser for use. An extended period is available with extra cost upon request. Future Design's sole responsibility under this warranty, at Future Design's option, is limited to replacement or repair, free of charge, or refund of purchase price within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

## **RETURNS**

No product can be returned without a completed Return Material Authorization (RMA) form. Please contact Future Design Controls for an authorization number.

# Chapter 8 Spare Parts

Red Pens	P/N	R25-2
Blue Pens	P/N	R25-3
Ink Pen Blades CCW	P/N	R13-9-04
Ink Pen Blades CW	P/N	R13-9-05
Thermal Print Arm Assembly	P/N	R27-76
Setup Charts Ink CCW	P/N	R18-270
Setup Charts Ink CW	P/N	R18-272
Setup Charts Thermal	P/N	R18-271

## Standard Charts

Blank Thermal Charts 50/box	P/N	00218001
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# **DR 5000**

## **Circle Chart Recorder**

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