
User's Manual



DR 5000 Circle Chart Recorder



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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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. The 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 printed time and date directly on the chart. The Thermal Recorder provides dual channel recording as standard. Each channel is configurable for universal inputs. Unit can easily be configured, in field, to single channel via keypad.

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 VDC are standard. Optional alarm relays are available and programmable for low, high or band operation. The Green LED indicates unit is powered.

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: 115/230VAC 50/60HZ
 Selectable

Recording Style —
 1: 1 Pen Ink
 2: 2 Pen Ink
 3: Thermal Print Recorder *
 5: 2 Pen OEM ** (Ink Style)
 6: 2 Pen OEM ** (Ink Style)

Outputs —
 0: None
 1: 1 Relay, DPDT 1A/240VAC resistive***
 2: 2 Relay, DPDT 1A/240VAC resistive***

Display Options —
 0: None
 1: LED Display****

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 Namestrip
 Suffix AA-ZZ Door Namestrip Identifier

* Thermal Version units UL/CUL Pending. Thermal recorder comes standard as dual channel recorder. Unit can be configured, in field to a single channel via keypad.

** OEM Units - No Relays are allowed on OEM units.
 Code 5 - Pen 1 Universal Input, Pen 2 4/20 ma or 1/5 VDC
 Code 6 - Pen 1 Universal Input, Pen 2 0/20ma or 0/5VDC

*** Recording style 1 and 2 only allow 1 relay per pen.
 **** Available in Recording Style 1, 2 and 3 ONLY. UL/CUL Pending
 ***** Available on INK recorders ONLY.

48 hour rotation on power loss for units with NO display.
 24 hour rotation on power loss for units WITH display.
 Above rotation values are dependent on battery condition.

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.

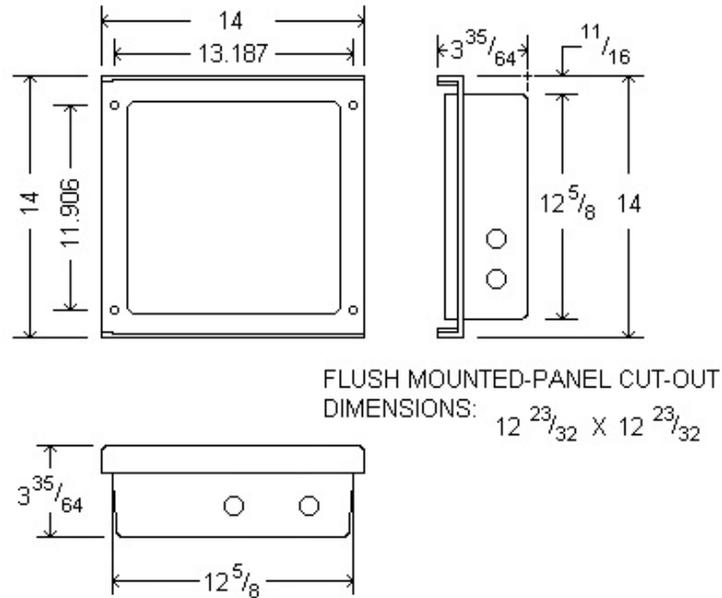


Figure 2.1 Mounting Diagram

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 it's 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.

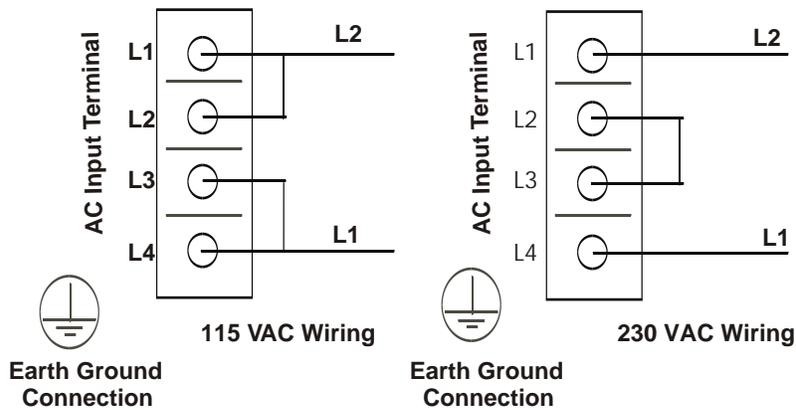


Figure 2.2
Power Supply

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 16AWG.

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

Ungrounded thermocouples recommended on 2 pen units.

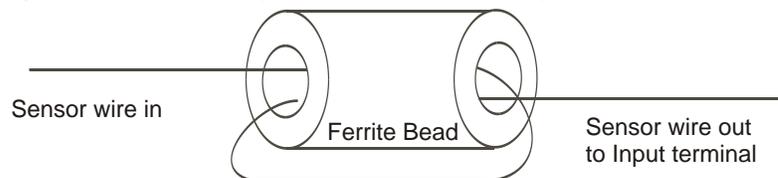


Figure 2.3



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

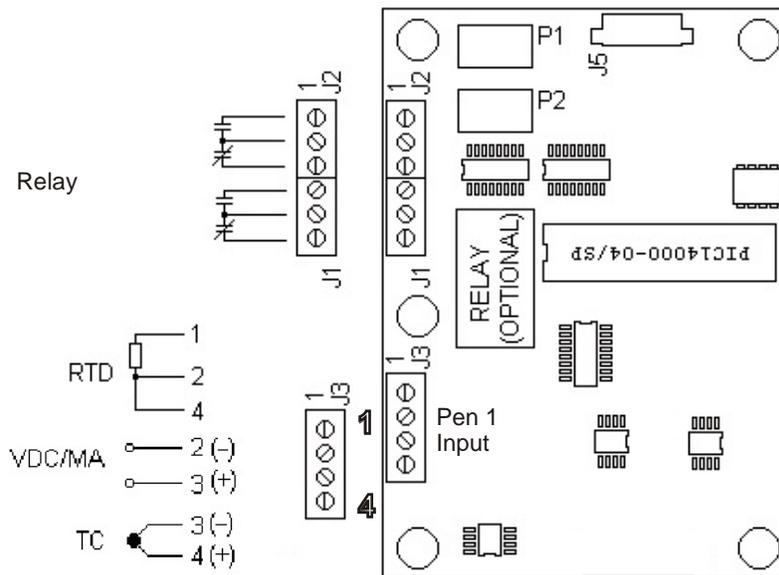


Figure 2.5 Two Pen OEM Ink Style Inputs

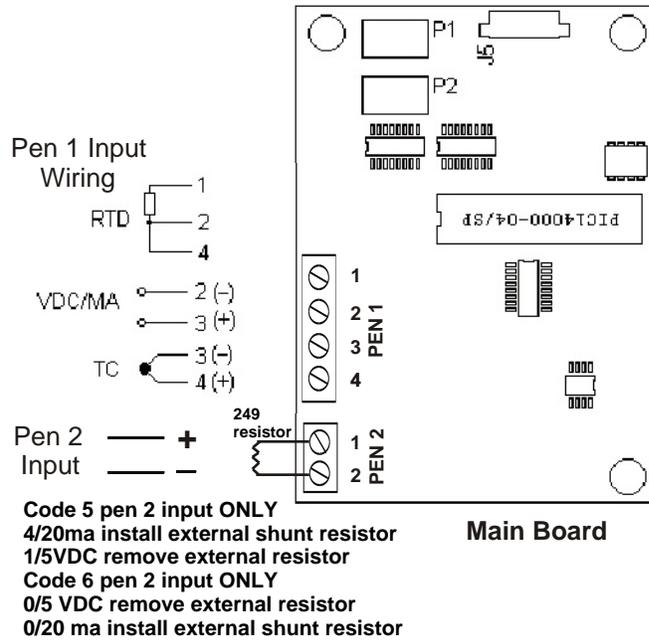
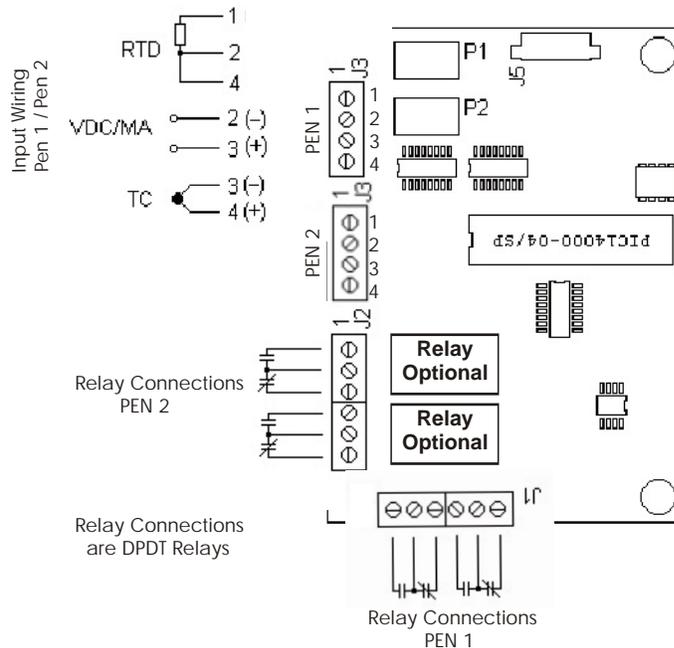


Fig. 2.6 Two Pen Universal and Thermal Inputs



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.

NOTE: Order Codes 5 and 6on PEN2 ONLY mA inputs require external shunt resistor (250 Ohms) supplied with unit. Resistor is attached across Ma/DC input terminals.

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. If ink pen(s) did not accurately pause at the 100% line see Section 4-1.

If unit has display option see page 23 for display function.

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.

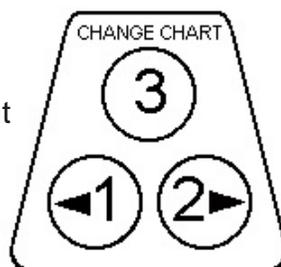
2-12 Marking Systems - "Ink Type Pens"

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 Marking Systems - Thermal Type

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.

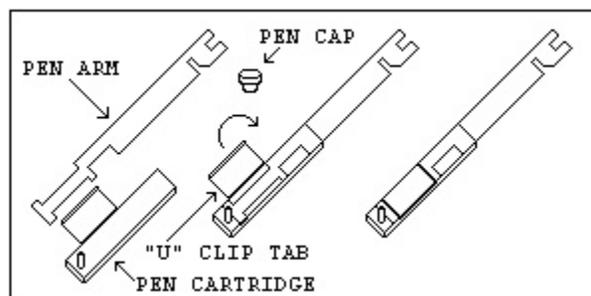


Figure 2.8 Pen Replacement

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.
- 9.) Contrast can be adjusted if darker recording required.
See Section 4.4 (pg.26)

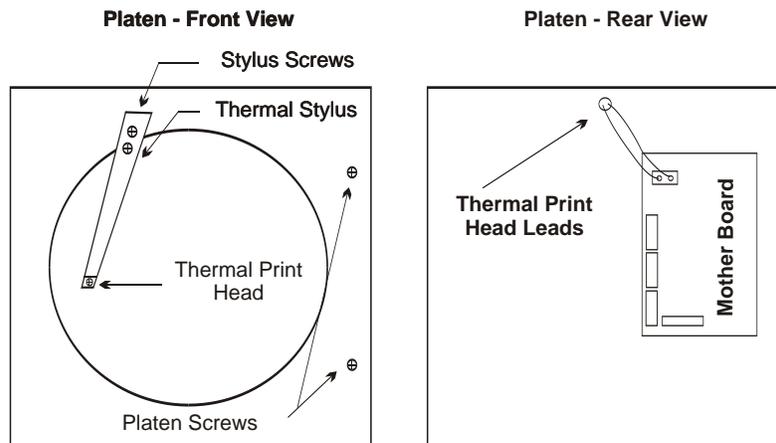


Figure 2.9 Thermal Recorder Platen Layout

2-14 Battery Backup “Ink Style” Units

The optional 9 volt DC battery back-up will allow the recorder to continue to function normally for approximately 48 hours in the event of a power failure. Units with display option will maintain 24 hours of operation upon power loss.

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.

NOTE: Units with optional display. Display will go BLANK upon AC power loss.

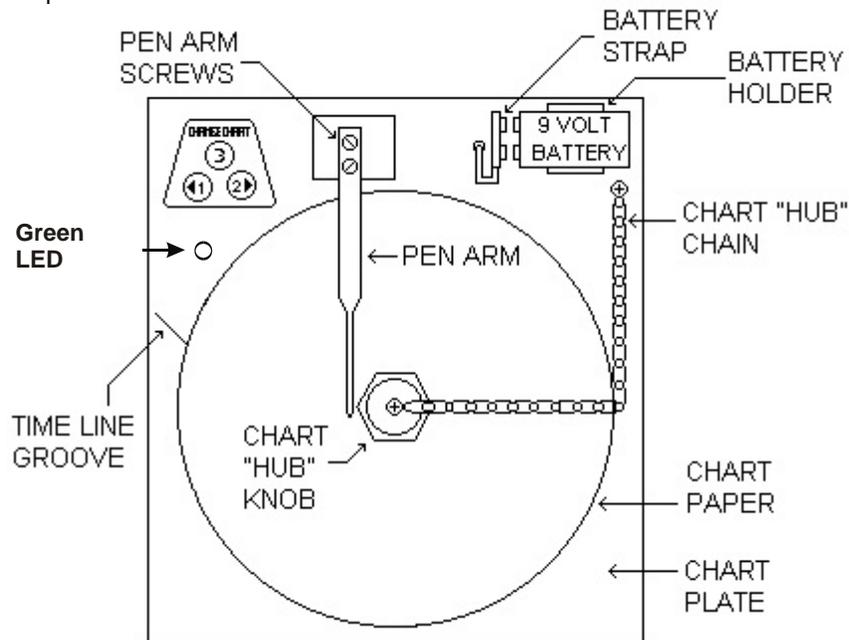


Figure 2.10 Recorder Platen Layout/Battery Installation

Chapter 3 Programming

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

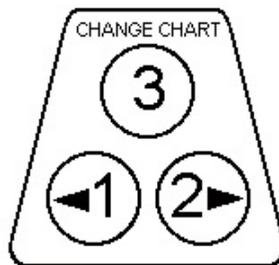
In order to configure the recorder, you will need the recorder SET-UP CHART, P/N R18-270 for CCW or P/N R18-272 for CW rotation.

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.

NOTE: Units with optional display, display goes to ---- during setup.

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.

Note: If unit has optional display, display goes to ---- during setup.

3-1-4 Setup Of Thermal Recorders.

All Thermal recorders come standard setup for dual channel operation. Units can be configured for single channel operation as follows:

1. Disconnect power from the unit to be configured.
2. To configure unit for single channel operation, depress and hold the LEFT arrow (1) key. While holding key re-apply power to unit.
3. Hold key depressed for 15 seconds after which, Green LED will turn on. Print arm will begin to move. Unit is now configured for single channel operation.

If conversion back to DUAL channel required. Please perform the above operation, only depress the RIGHT arrow (2) key and hold upon power up.

After configuring, please proceed with recorder SET-UP procedure below.

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.
- NOTE: if unit has optional display, display goes to ---- during setup.

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.

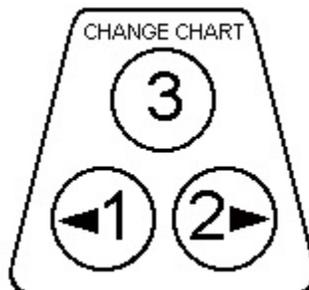


Figure 3.2
Keypad Layout

3-2-2 Alarm Settings Thermal Style Recorders

Thermal alarm relay settings can only be set or reviewed from the Setup mode. The SETUP chart must be used for this.

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 assigned to Pen 1.

LP1(Low): Latching low alarm assigned to Pen 1.

P2(Hi) or P2(Low): Same as P1 operation only for Pen 2

LP2(Hi) or LP2(Low): Same as LP1 operation only for Pen 2

OR can use both relays if available for PEN 1 ONLY

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.

P2(Hi) or P2(Low): Same as P1 operation only for Pen 2

LP2(Hi or LP2(Low): Same as P1 operation only for Pen 2

NOTE: Units with optional display, Alarm setpoint will be indicated on LED.

3-2-3 OEM Style Recorders

No alarm relay options are available on this style recorder.

3-2-4 Display Option Features

The single red LED display indicates input(s) process variable value with unit(s) during normal operation. In 2 pen units with display, LED display cycles between Pv1 value and Pv2 value. As PV value cycles an additional LED indicates which Pv(1 or 2) value is being displayed.

LED display will indicate Hi or Lo if process input variable goes above(Hi) or below(Lo) the programmed range of the recorder scale.

When battery option is included on Ink style recorders, display will go to ---- upon loss of AC power. Green LED indicator will remain on, see battery status information, page 17.

When OFFSET is used to adjust a pen recording position. The LED display will indicate the actual number of units the selected recording pen has been adjusted (OFFSET) by. This can be a positive(+) or negative(-) value.

For Thermal units ONLY, if alarm setpoints are used, these values will be shown upon any chart change operation. See Chart Change page 14.

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 to 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.
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 outer most temperature graduation of the chart paper. If ink pens do not accurately stop at outer graduation recording error can occur and recorder's calibration should be reviewed.

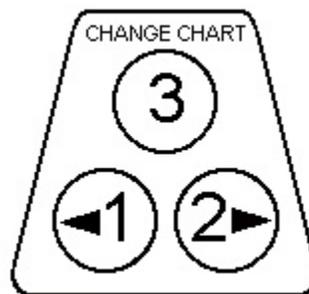


Figure 4.1 Keypad

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. The green LED will come on steady (approximately 10 seconds). Unit will then resume normal print operation.

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

NOTE: If unit has optional display, OFFSET value will be shown on LED.

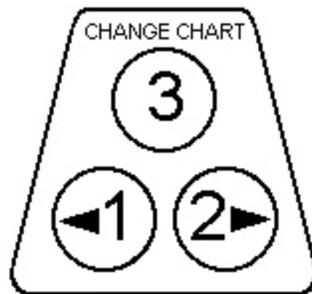


Figure 4.2 Keypad
Layout

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 (approx. 10 sec.). Printhead will then resume normal print 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 (approx. 10 sec.). Printhead will then resume normal print operation.
The remaining pen can now be selected and adjusted, if necessary Using instructions above.

NOTE: if unit has optional display, display will indicate the OFFSET value.

4-3 Thermal Print Contrast Adjustment

If print recording is "light". The contrast can be darkened by the following procedure. Please note the darker the print setting can shorten printhead life span. Adjust only if print contrast is needed to improve readability.

1. Remove power from instrument.
2. Prior to powering up depress and hold the "Change Chart" (#3) key.
3. While holding key power instrument up.
4. Upon power up, release key. Pen will travel full upscale. Pen will then begin to sweep across chart printing a line with current contrast value.
5. Depress and hold LEFT arrow (1) key to DECREASE contrast. Depress and hold RIGHT arrow (2) key to INCREASE contrast.
6. Once contrast setting is acceptable, depress the "Change Chart" (3) key to store contrast setting.
6. Unit will begin recording properly with new setting applied.

Chapter 5

Power

Line Voltage: 115/230VAC, (+/- 10%), 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
Ambient Error: $\pm 0.01\%$ span/ $^{\circ}\text{C}$ from 25°C ambient
Isolation: Inputs isolated from outputs
Input Impedance: T/C 470K Ohm, DC/Ma 250 Ohm
Input Impedance OEM Pen2 VDC Only: 470 K Ohm
RTD Excitation: 1.12 MA

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

Display: Red LED 0.4" high 4 Digit Displays process variable and units
Relay: DPDT, 1.0Amps @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°C
Storage Temperature: -40 to 65°C
Humidity: 0-90% RH (non-condensing)
Agency Approvals: UL / CUL * File #E223369
Installation Category: II
Pollution Degree: 2
Altitude: 2000 meters
Vibration: 0.3 to 100Hz @0.2g
Mounting: ± 20 degrees of vertical
 ± 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

* NOTE: Thermal and units with display are UL/CUL PENDING

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	4/20ma	
V	0/5, 1/5 VDC	

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 ----- JT/C *
Unit ----- Fahrenheit
Scale ----- 0/100
Rotation ----- 24 hour
Input Aver. ---- 8
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(Hi) - Output relay energized when process variable above set value.

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

Band Alarm (Band) - Output relay is energized when process variable is above high set value or below low set value. NOTE Band alarm only available programming on Ink style recorders.

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 or input out of programmed chart range.
Action: Check or replace sensor, validate setup information for sensor and chart range programmed. Validate both inputs for 2 pens.
- 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 and Return Statement:

Warranty:

Future Design Controls products described in this brochure are warranted to be free from functional defects in material and workmanship at the time the products leave Future Design Controls facilities and to conform at that time to the specifications set forth in the relevant Future Design Controls manual, sheet or sheets for a period of TWO years after delivery to the first purchaser.

There are no expressed or implied Warranties extending beyond the Warranties herein and above set forth.

Limitations:

Future Design Controls provides no warranty or representations of any sort regarding the fitness of use or application of its products by the purchaser. Users are responsible for the selection, suitability of the products for their application or use of Future Design Controls products.

Future Design Controls shall not be liable for any damages or losses, whether direct, indirect, incidental, special, consequential or any other damages, costs or expenses excepting only the cost or expense of repair or replacement of Future Design Control products as described below.

Future Design Controls sole responsibility under the warranty, at Future Design Controls option, is limited to replacement or repair, free of charge, or refund or purchase price within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

Future Design Controls reserves the right to make changes without notification to purchaser to materials or processing that do not effect compliance with any applicable specifications.

Return Material Authorization:

Contact Future Design Controls for Return Material Authorization prior to returning any product to our facility.

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Chapter 8 Spare Parts

Red Pens (6pcs/pk)	P/N	R25-2 (Pen 1)
Blue Pens (6pcs/pk)	P/N	R25-3 (Pen 2 only)
Green Pens (6pcs/pk)	P/N	R25-4 (Pen 2 only)

Ink Pen Blade CCW	P/N	R13-9-04
Ink Pen Blade 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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Visit our Web Site for additional preprinted chart selection.
www.futuredesigncontrols.com

Replacement Circuit Boards and Components

Ink style 1 pen		
W/battery backup & relay	P/N	R53-56-02
Ink style 2 pen		
W/ battery backup & relay	P/N	R53-63-02
Ink style OEM recorder	P/N	R53-60-01
Main Transformer	P/N	R24-31

Chart Drives Motors

CCW Rotation Ink and Thermal	P/N	R27-61-00
CW Rotation Ink only	P/N	R27-61-02

Pen Drive Motors

Ink (Single Pen Only)	P/N	R27-70
Thermal	P/N	R27-87

Keypad	P/N	R24-12
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DR 5000

Circle Chart Recorder

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