Honeywell

DR4200
Circular Chart Recorder
GP Model
Product Manual

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TotalPlant®

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Honeywell
Industrial Automation and Control
Automation College
2820 West Kelton Lane
Phoenix, Arizona 85023

About This Publication

How this manual is organized

This Product Manual is divided into ten sections. These sections contain all the information you need to set up, configure, operate, monitor, and troubleshoot your recorder.
To find information quickly, use the comprehensive Table of Contents in the front of the manual and the Index located in the back of the manual.

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows:

The DR4200 Model GP Circular Chart Recorder carries a two year warranty. This warranty includes immediate technical assistance via a toll-free telephone number and complete replacement of the recorder, if necessary.

Technical assistance

If you encounter a problem with your DR4200 recorder, review all the Set Up, Installation, and Configuration data to verify that your selections are consistent with your application. If the problem persists after checking the above, you can get technical assistance by dialing

1-800-423-9883 USA and Canada
(between the hours of 8:00 am and 6:00 pm EST USA)

An engineer will discuss your problem with you. **Please have your complete model number, serial number, and software version available.** The model and serial numbers can be found on the chart plate.
If it is determined that a hardware problem exists, a replacement recorder or part will be shipped with instructions for returning the defective unit.
Do not return your recorder without authorization from Honeywell's Technical Assistance Center or until the replacement has been received.
For a list of frequently asked questions and their answers, dial Honeywell's **Faxback** 24-hour Service:

1-888-534-9883 USA

Or check out Honeywell **web site** at

http://support.totalplant.honeywell.com

Symbol Definitions

This **CAUTION** symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.

WARNING—risk of electric shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible.

Protective earth terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.

Functional earth terminal. Used for non-safety purposes such as noise immunity improvement.

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Acronyms

EMI ..... electromagnetic interference
GP ..... General Purpose
HID ..... high intensity discharge
MOV ..... Metal Oxide Varistor
PCB ..... Printed Circuit Board
RC ..... resistance-capacitance
RFI ..... radio frequency interference
RH ..... Relative Humidity
SCR ..... Silicon controlled rectifier

References

Publication Title	Publication Number
DR4200 EV Model Circular Chart Recorder Product Manual	44-01-25-09
Surge Withstand Capacity Test	IEEE Standard 472-1974

Section 1 – Overview

1.1 Introduction

Function

The DR4200 General Purpose (GP) Recorder is a one or two pen microprocessor-based circular chart recorder that generates dependable pen drawn analog traces on preprinted 10-inch (250 mm) charts.

User configuration allows setting and/or altering operating parameters to fit your application requirements. You configure the recorder by positioning jumpers and DIP switches on a printed circuit board. The configuration parameters include type of input, chart speed, chart range, alarm settings, control settings, and others.

Both one-pen and two-pen models accept inputs from any one of a variety of sensors and transmitters within the configurable range limits.

Also, models are available with one or two relay outputs for one or both pens to provide alarm, on-off control, and limit control output signals to sound alarms, operate valves, and shutdown processes.

CE Conformity (Europe)

Indicated models of this product are in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.

Deviation from the installation conditions specified in this manual, and the special conditions for CE conformity in Section 4.1, may invalidate this product's conformity with the Low Voltage and EMC Directives.

ATTENTION

The emission limits of EN 50081-2 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters (98 feet) to the antenna(e). In special cases, when highly susceptible apparatus is used in close proximity, the user may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

Microprocessor controlled recording

Both the chart and the pen are driven by stepper motors controlled by the microprocessor. Since chart speed is configurable, you can easily alter the chart speed through the DIP switch settings.

The microprocessor uses the configured chart range data as well as the input data to determine proper pen position. The stepper motor accurately positions the pen drive.

Continued on next page

Input processing

The input can be one of any standard low-level electrical signals. The input type and range are configurable and can be expanded and compressed within their limits to meet specific measurement needs.

You can select upscale or downscale sensor break protection for most actuations. Analog and digital filters with fixed time constants provide input signal smoothing.

Construction

All DR4200 recorders are housed in a molded case which can be panel or surface mounted. A glass-windowed, gasketed door protects internal components from harsh environments while allowing easy access to the chart.

1.2 Model Number and Hardware Description

Introduction

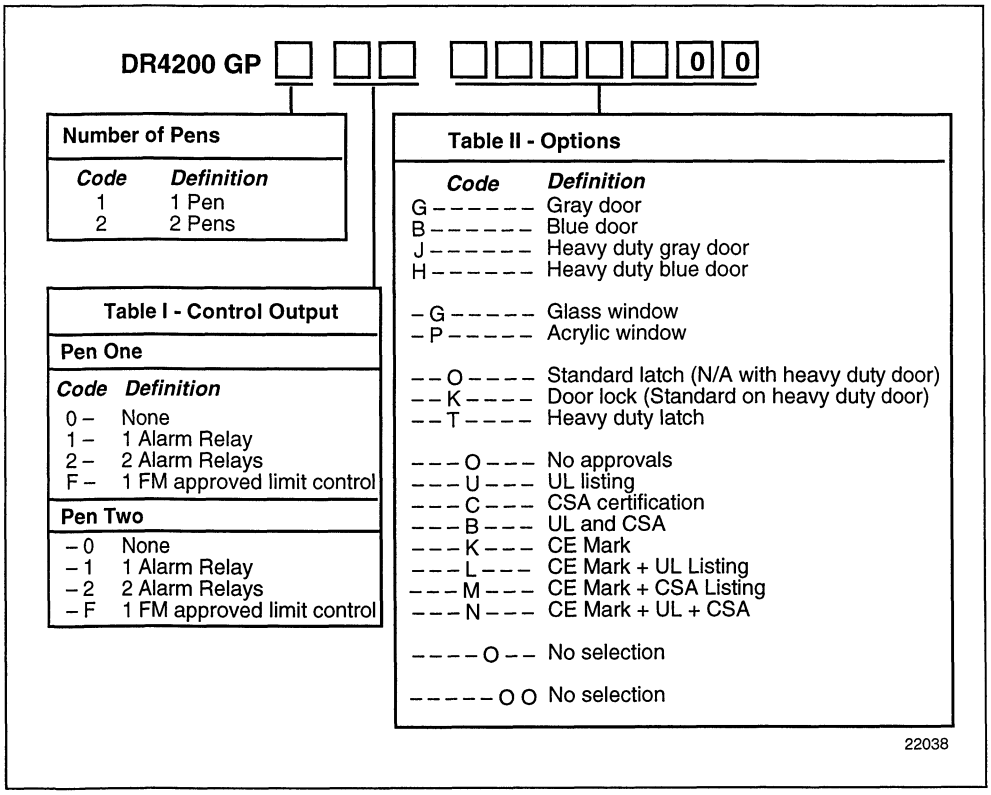
The DR4200 circular chart recorder is available in one-pen and two-pen models, with or without relays for on-off control and/or alarm outputs.

Since this manual covers all models, we recommend that you decode your recorder's model number first as described below so you can easily identify pertinent instructions in this manual.

Decoding the recorder's model number

Copy the model number that appears on the label on the front of the recorder's chart plate into the boxes shown in Figure 1-1. Use the model number "Table" code definitions to decode your recorder's given hardware characteristics.

Figure 1-1 Model Number Interpretation



ATTENTION Every DR4200 Recorder has all the available input actuations stored in its nonvolatile memory. Therefore, you must select the input actuation in the field by setting DIP Switches, selecting jumper positions, and making input wiring connections, as applicable.

Continued on next page

1.2 Model Number and Hardware Description, Continued

Component location

Refer to the views in Figure 1-2 (DR4200GP1) and Figure 1-3 (DR4200GP2) to match given hardware characteristics (Table selections) with the location of actual hardware components in your recorder. This will help you determine applicable input/output wiring needs as well as identify appropriate setup tasks to prepare the recorder for operation later.

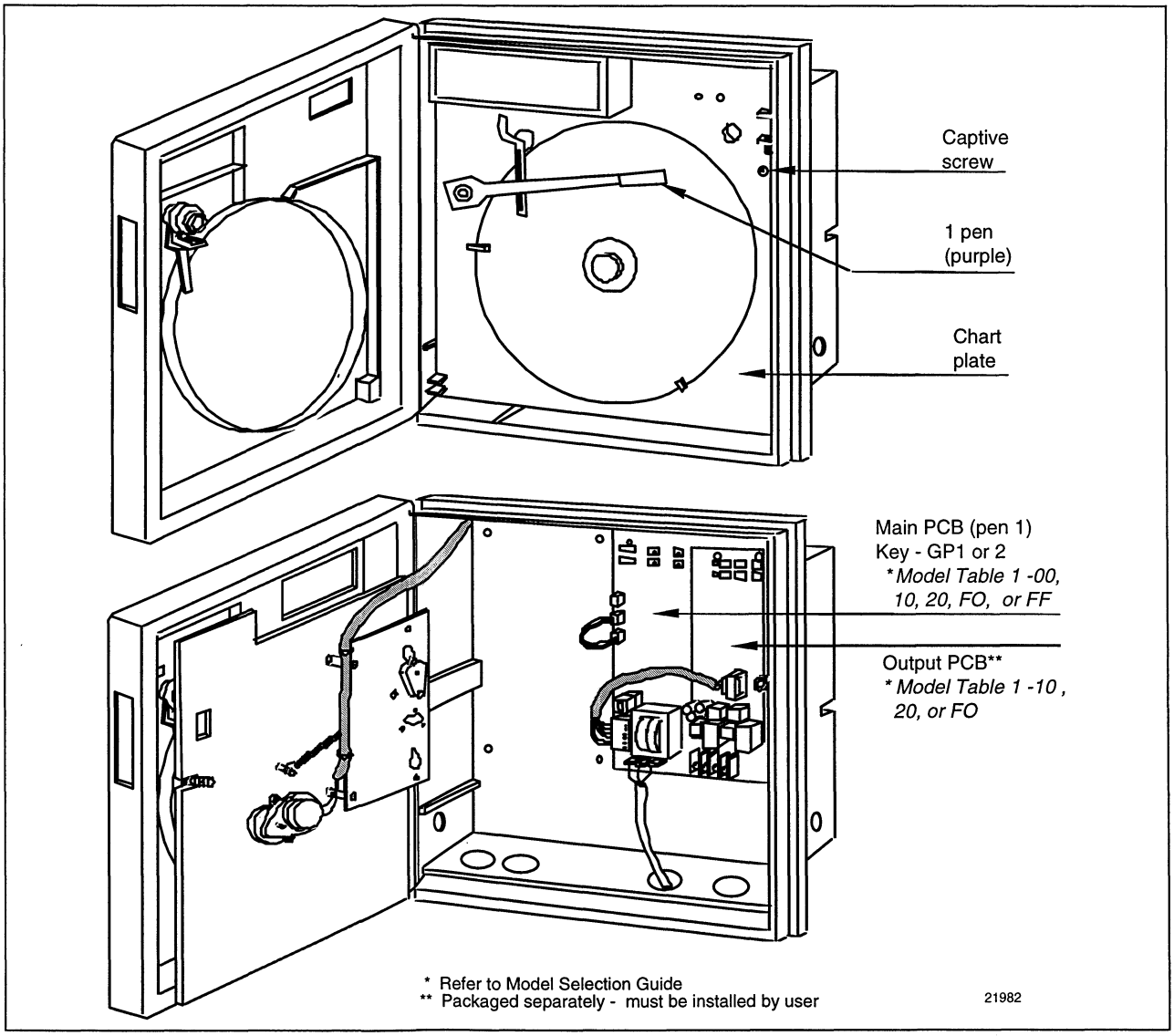
To view actual components inside your recorder:

- Push in the button on the recorder door and swing the door open.
- Loosen the captive screw on the right-hand side of the chart plate and swing the chart plate out.

Model DR4200GP1

Figure 1-2 is a view of the hardware components versus "Table" selections for Model DR4200GP1.

Figure 1-2 Hardware Components for Model DR4200GP1



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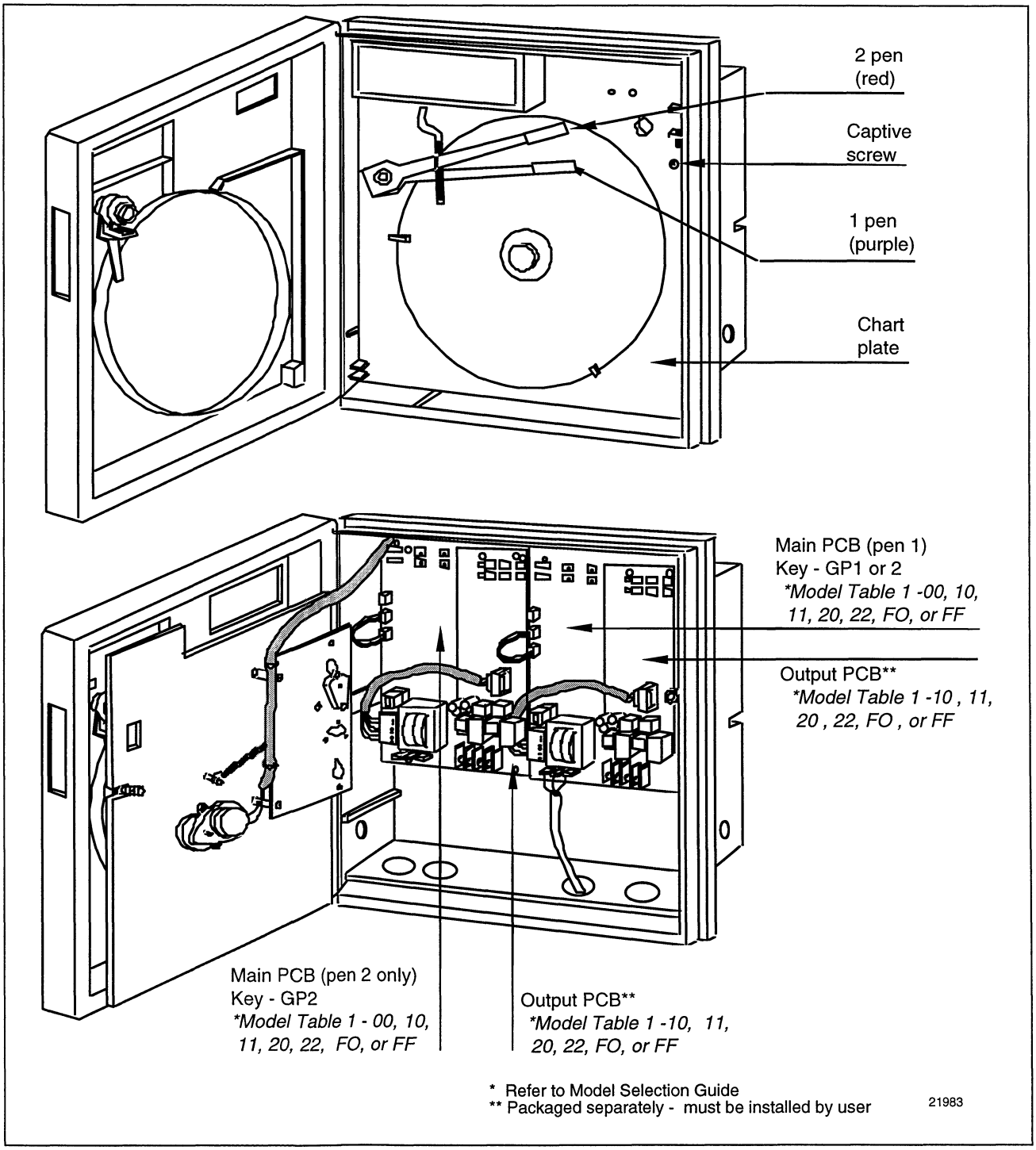
Model DR4200GP2

Figure 1-3 is a view of the hardware components versus "Table" selections for Model DR4200GP2.

Figure 1-3 Hardware Components for Model DR4200GP2



1.3 Pre-Setup Operational Check

Summary

The DR4200 GP recorder includes a self-test feature that checks the operational status of major recorder functions. You can run the self-test before you setup the recorder for your application requirements. This test will verify that the recorder is operating properly as received from the factory.

For the procedure to run the self-test, refer to subsection 5.3 - *Running the Optional Self-Test.*

Section 2 – Recording Set Up

2.1 Introduction

Overview

Recording Set Up consists of checking or setting jumper positions and DIP switch and rotary switch selections for Pen #1 and Pen #2 on each main printed circuit board.

This section contains the set-up tasks required to prepare your recorder for operation. Each separate task includes a general overview of that task and a procedure for you to follow to accomplish it. Unless noted, the procedural steps apply for both Pen #1 and Pen #2 main printed circuit boards.

To help you, there is a composite view of the component locations as well as the factory settings for the jumpers and DIP switches.

Appendix A is a summary of DIP switch and jumper selections on the main printed circuit boards.

If your recorder is supplied with Relay Output (optional), you must also mount the output printed circuit board onto the main printed circuit board and check the DIP switch and jumper locations on that board. Set up the main printed circuit board before installing the output printed circuit board. Refer to *Section 3 - Optional Relay Output Set Up* for further information.

ATTENTION You can run the pre-operational check given in subsection 5.3 - *Running the Optional Self-Test* before you set-up the recorder and, if desired, you can mount the recorder as outlined in *Section 4 - Installation*.

What's in this section?

The following topics are covered in this section:

2.2 Configuration Selections for Recording

Introduction

There are nine configuration selections that you must make or check to get the recorder to operate in accordance with your application needs:

- Line Voltage
- Run or Set-up Mode
- Burnout
- Chart Linearity
- Zero-and Full-Scale Values
- Temperature Units
- Input Actuation
- Chart Speed
- Main Printed Circuit Board Pen Configuration

How to make selections

This section provides a graphic summary of these configuration settings, and to assist you in the process of selection, it includes configuration worksheets on which you can note the configuration settings you require.

Review the Sample Chart (Figure 2-1) and Sample Worksheet (Figure 2-2). Use the configuration graphics to understand how the sample worksheet was constructed.

Get a copy of the chart that you will be using on your DR4200 recorder and, using Figure 2-1 as a guide, note the configuration selections you must make for your particular recording needs.

View the pertinent configuration selection illustrations for recording and mark the required settings on the Configuration Worksheet provided in the back of this section. If you have a two-pen recorder, mark the worksheet provided for Pen #2.

Make the actual configuration settings on the Main printed circuit board in the recorder to match the worksheet.

The recorder is now ready for operation.

WARNING To avoid personal injury never access components inside the case with power applied.

Continued on next page

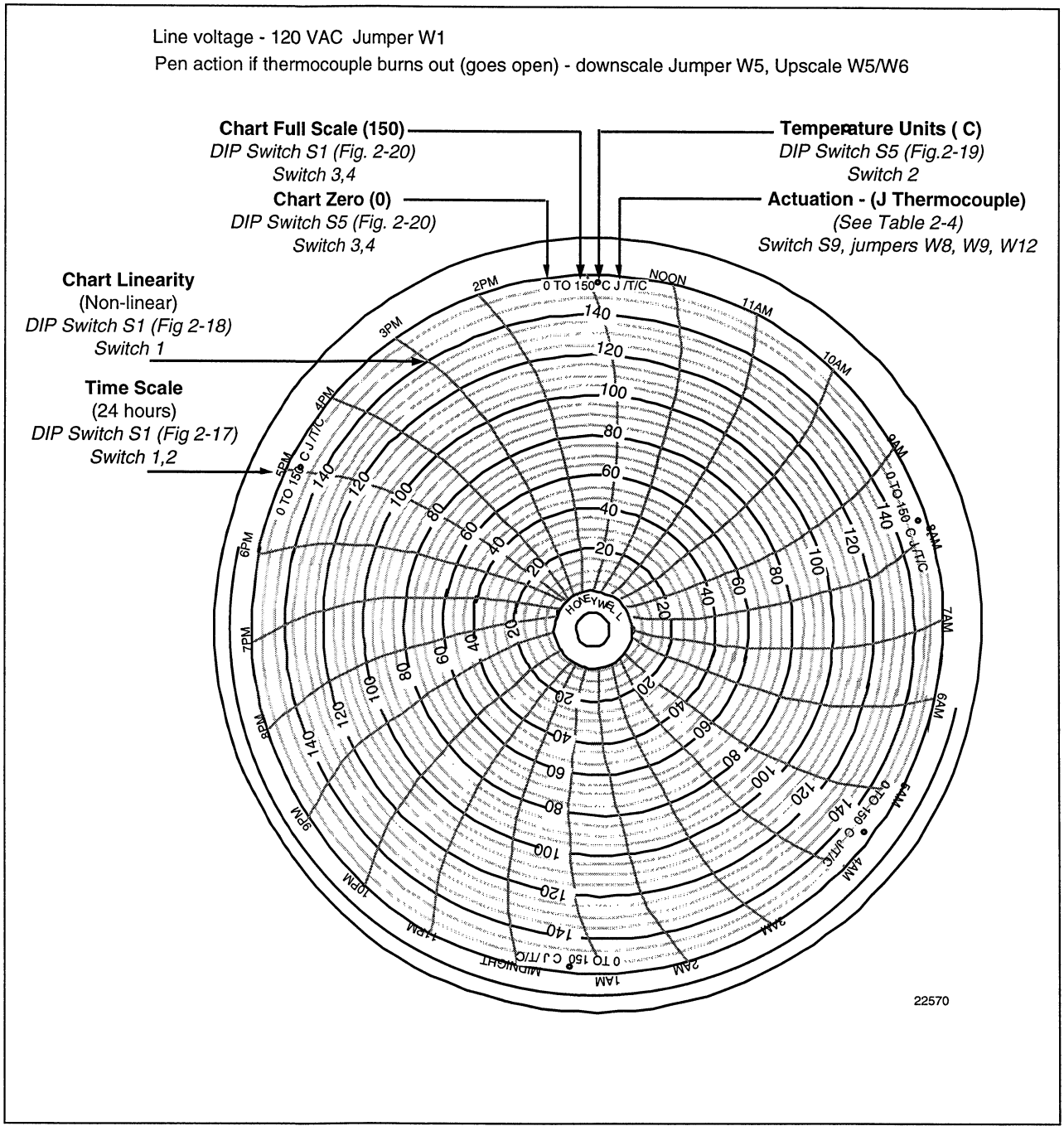
Sample chart

Figure 2-1 is a sample chart for a one-pen recorder.

The configuration selections noted in this figure are taken from the sample chart. It tells you which switch and jumper settings are affected by each.

Figure 2-2 shows the worksheet switch setting based on the sample chart.

Figure 2-1 Sample Chart for One-Pen Recorder

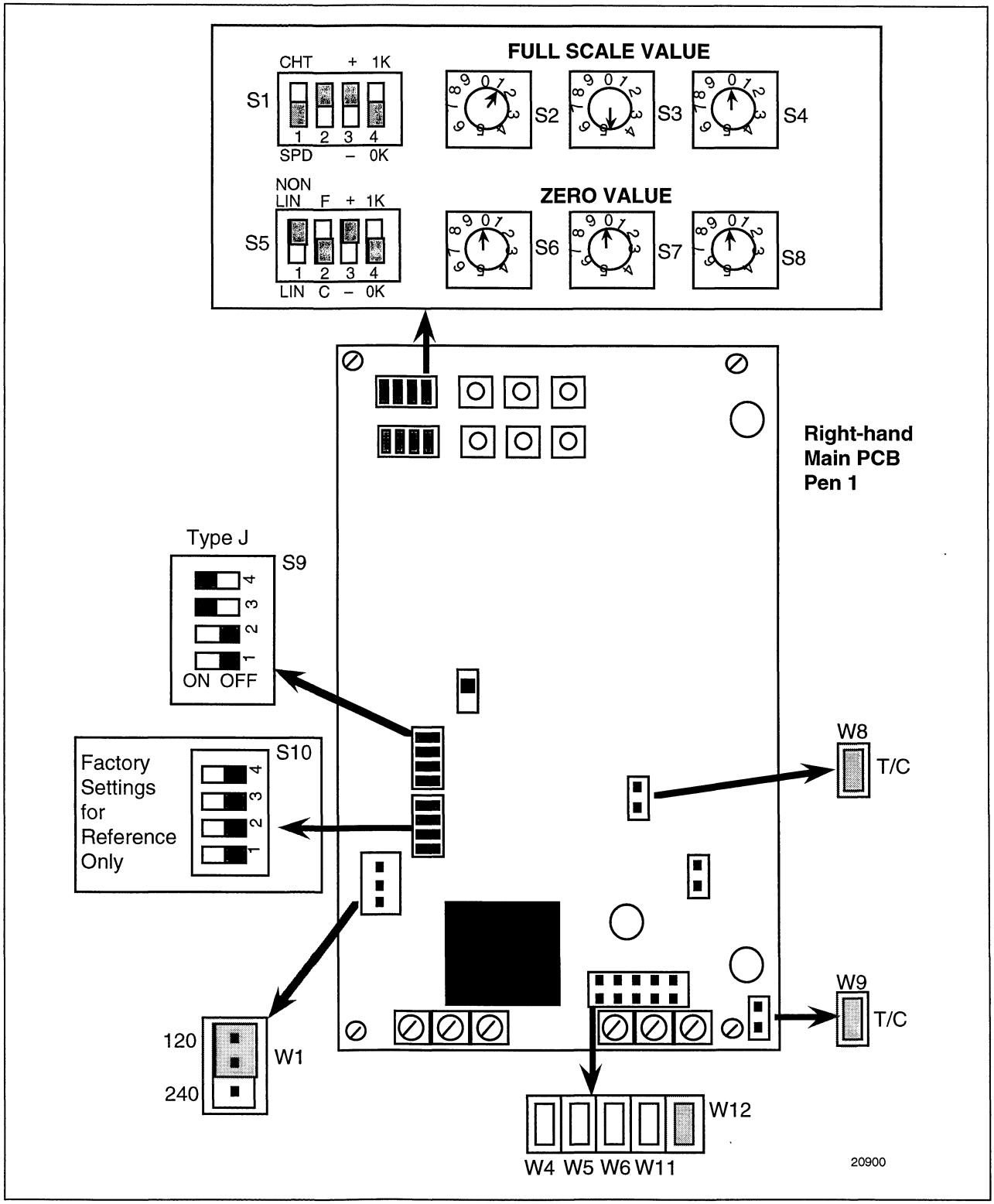


2.3 Sample Configuration Worksheet for Recording

Sample worksheet

Figure 2-2 is a sample Configuration Worksheet for the one-pen recorder chart shown in Figure 2-1.

Figure 2-2 Sample Configuration Worksheet for One-Pen Recorder

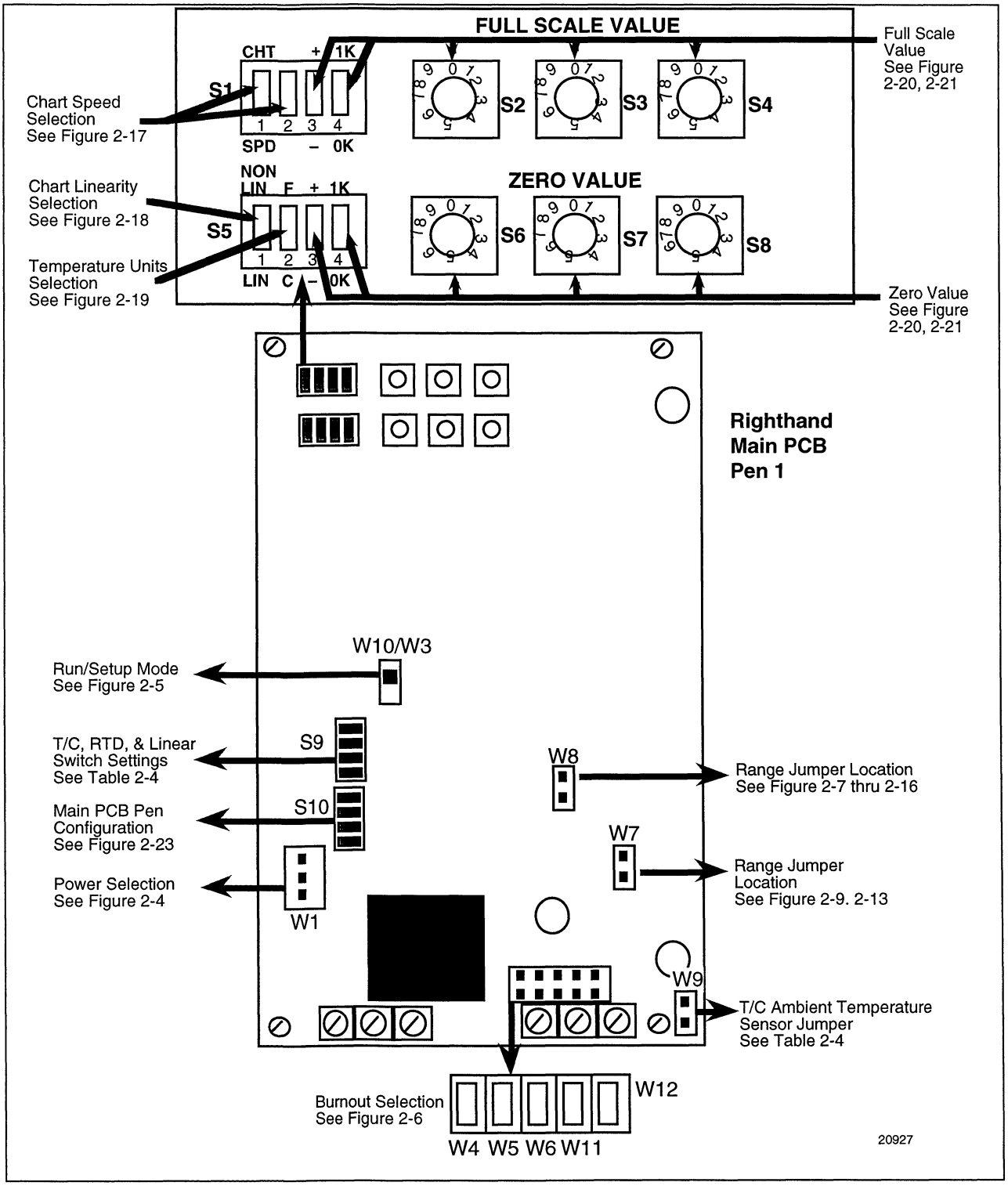


2.4 Overview of Main PCB DIP Switches and Jumper Locations

Introduction

Figure 2-3 is an overview of the DIP switch and jumper locations. Each location references a figure or table that contains the information you need to check or set the switches and jumpers.

Figure 2-3 DIP Switch and Jumper Locations



2.5 Checking Line Voltage Requirements

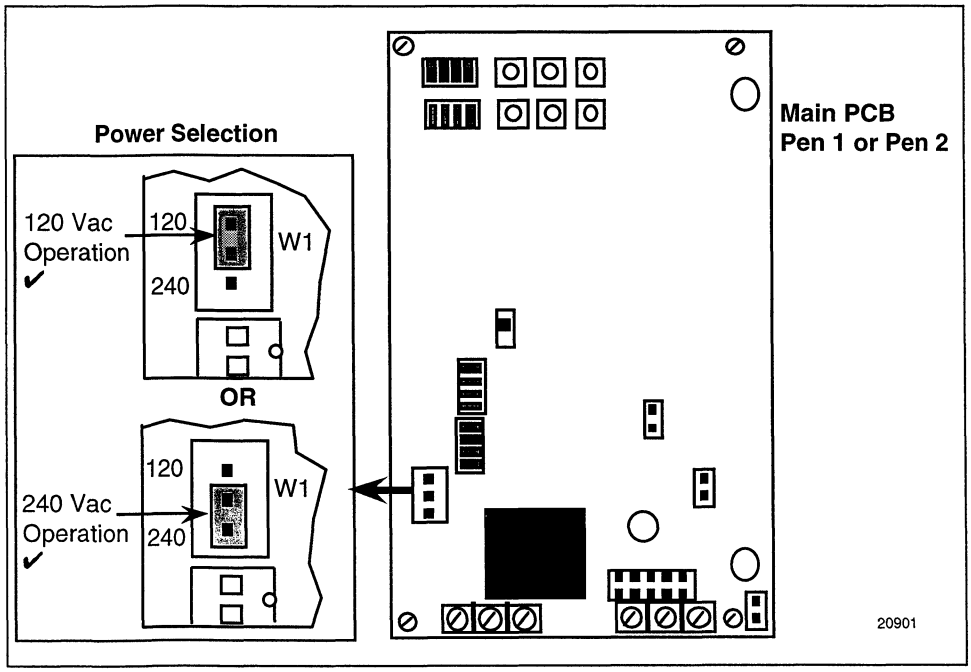
Introduction

Refer to Figure 2-4 and follow the procedure in Table 2-1 to make sure the recorder's power requirement matches the available AC line power.

Table 2-1 AC Line Power Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate Jumper W1 next to the transformer on the left side of the Main printed circuit board for Pen #1. See Figure 2-4
3	Position the jumper as follows: Line Voltage — Jumper Location 120Vac 50/60 Hz — 120 (factory setting) 240Vac 50/60 Hz — 240 **CAUTION** Be sure Jumper 1 on the Main printed circuit board for Pen #2 is in the same position.
4	If the jumper W1 position is set for 240, be sure to note power requirement on the label on the front of the chart plate.

Figure 2-4 Jumper W1 Positions (AC Line Power)



2.6 Putting the Recorder in the Run or Set Up Mode

Introduction

You can put the recorder in the normal RUN mode or the SETUP mode.

SETUP allows you to set DIP switches S9 position 1 to make a pen alignment check (subsection 6.4 and 6.5) or run a self-test. (subsection 5.3).

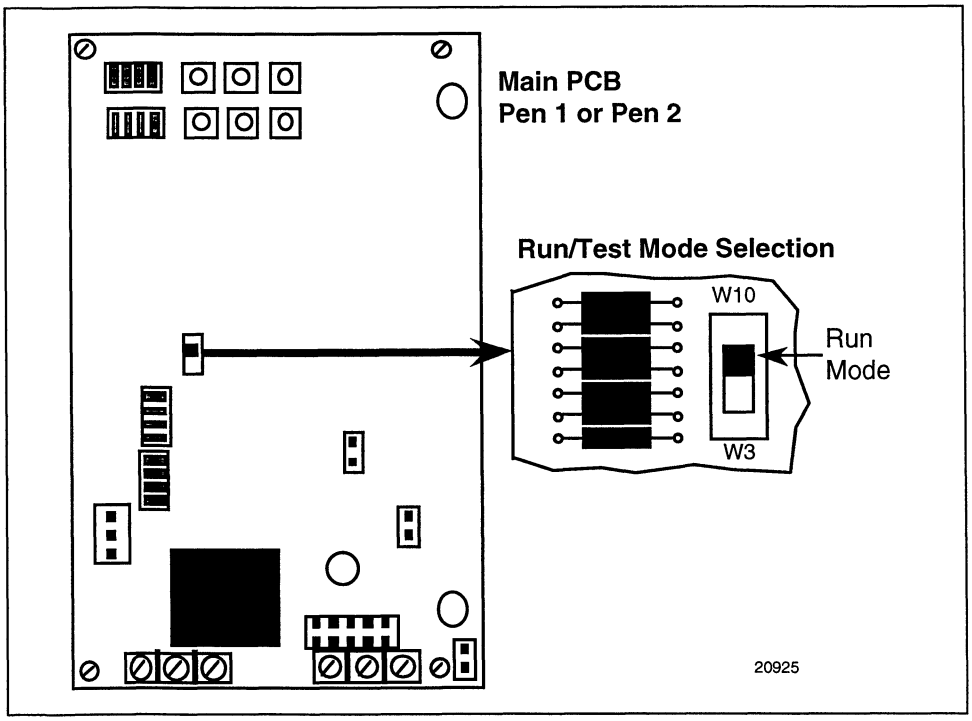
RUN allows you to prepare the recorder for operation. However, you can leave the recorder in the SETUP mode, but it will run the self-test every time power is cycled on/off.

Refer to Figure 2-5 and follow the procedure in Table 2-2 to position slide switch W3/W10 and put the recorder in the RUN mode.

Table 2-2 Switch W3/W10 Positions (Run/Setup Mode)

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate W3/W10 slide-switch near the left center of the Main printed circuit board for Pen #1 (see Figure 2-5).
3	Check that the slide-switch is in its RUN mode position as follows... Mode of Operation — Switch Position RUN — W10 (UP) SETUP — W3 (DOWN) - factory setting
4	Repeat steps 2 and 3 for Pen #2 Main printed circuit board

Figure 2-5 Switch W3/W10 Positions (Run Mode)



2.7 Selecting Upscale or Downscale Burnout

Introduction

You can select Upscale or Downscale burnout for *Thermocouple* or *Millivolt* actuations. This means that the pen will be driven to its full upscale or downscale position if the Process Variable (PV) goes out-of-range (open input sensor) or the recorder detects a self-check failure.

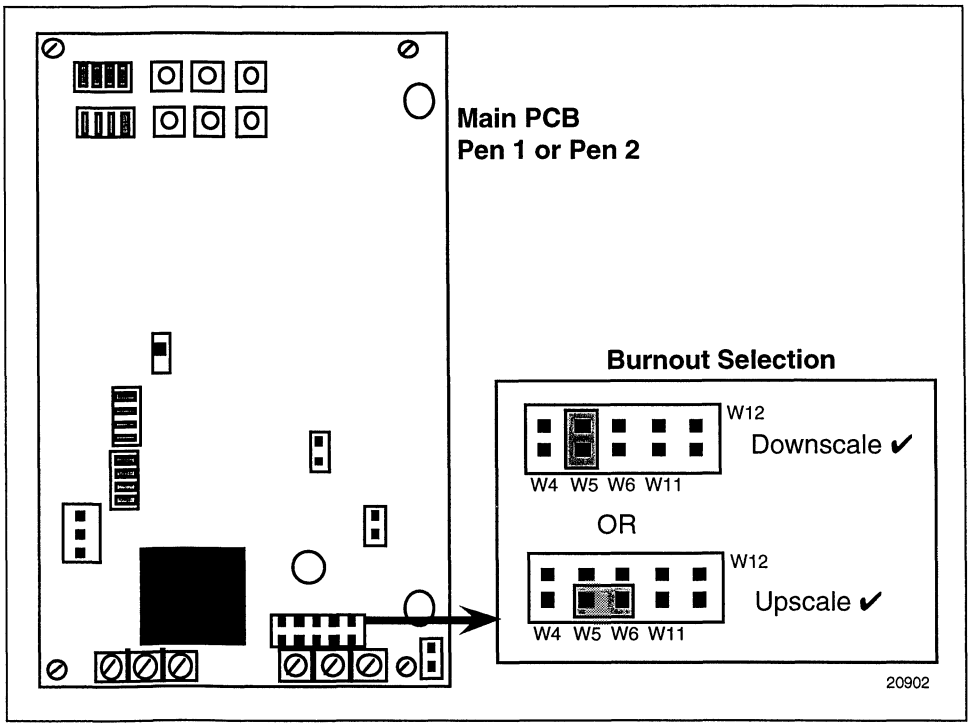
ATTENTION You can select downscale burnout for RTD, Voltage, and mA actuations, but there is no guarantee that an out-of-range PV condition will be detected.

Refer to Figure 2-6 and follow the procedure in Table 2-3 to position jumpers W5 or W6 to select upscale or downscale burnout.

Table 2-3 Jumpers W5 or W6 Positions (Burnout)

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate W5 and W6 jumpers near the left center of the Main printed circuit board for Pen #1 (see Figure 2-6).
3	Position the jumper as follows... Burnout Direction — Jumper Location Downscale — W5 Upscale — W5/W6 None — None (factory setting)
4	Repeat steps 2 and 3 for Pen #2 Main printed circuit board

Figure 2-6 Jumpers W5/W6 Positions (Burnout)



2.8 Selecting the Input Actuation Type/Range

Introduction

You must configure the recorder to accept the desired input actuation for the given pen by setting DIP switch S9 positions and positioning the applicable range jumpers on the Main printed circuit boards for Pen #1 and Pen #2, if applicable.

Refer to Table 2-4 to identify DIP switch settings and range jumper positions for the desired actuation type.

Refer to the figure number listed in Table 2-4 for your particular actuation. It gives you a graphic view of the DIP Switch settings and jumper positions that are noted in the table for your particular requirement.

Note the configured actuation type for each pen on the wiring label on the back of the chart plate.

ATTENTION Be sure that a matching sensor input is wired to the input terminals.

DIP switch settings and jumper locations

Table 2-4 is a list of actuations, S9 switch positions and settings, range jumper locations, and reference figure numbers.

ATTENTION Switch S9-Position 1 is OFF, **DO NOT CHANGE.**

Table 2-4 Actuation Switch Settings and Jumper Locations

Actuation	Type	S9 Switch Positions and Settings			Range Jumper Locations	Refer to Figure
		2	3	4		
Thermocouple	J	OFF	ON	ON	W8, W9, W12	2-7
Thermocouple	K	OFF	ON	OFF	W8, W9, W12	2-8
Thermocouple	T	OFF	OFF	ON	W7, W9, W12	2-9
RTD*	100 Ohm*	OFF*	OFF*	OFF*	W6, W8, W12*	2-10
Linear	0-20mA	ON	OFF	OFF	W4, W8, W11	2-11
Linear	4–20 mA	ON	OFF	ON	W4, W8, W11	2-12
Linear	0–20 mV	ON	ON	ON	W7, W12	2-13
Linear	0–50 mV	ON	ON	OFF	W8, W12	2-14
Linear	0–5 Vdc	ON	OFF	OFF	W8, W11	2-15
Linear	1–5 Vdc	ON	OFF	ON	W8, W11	2-16

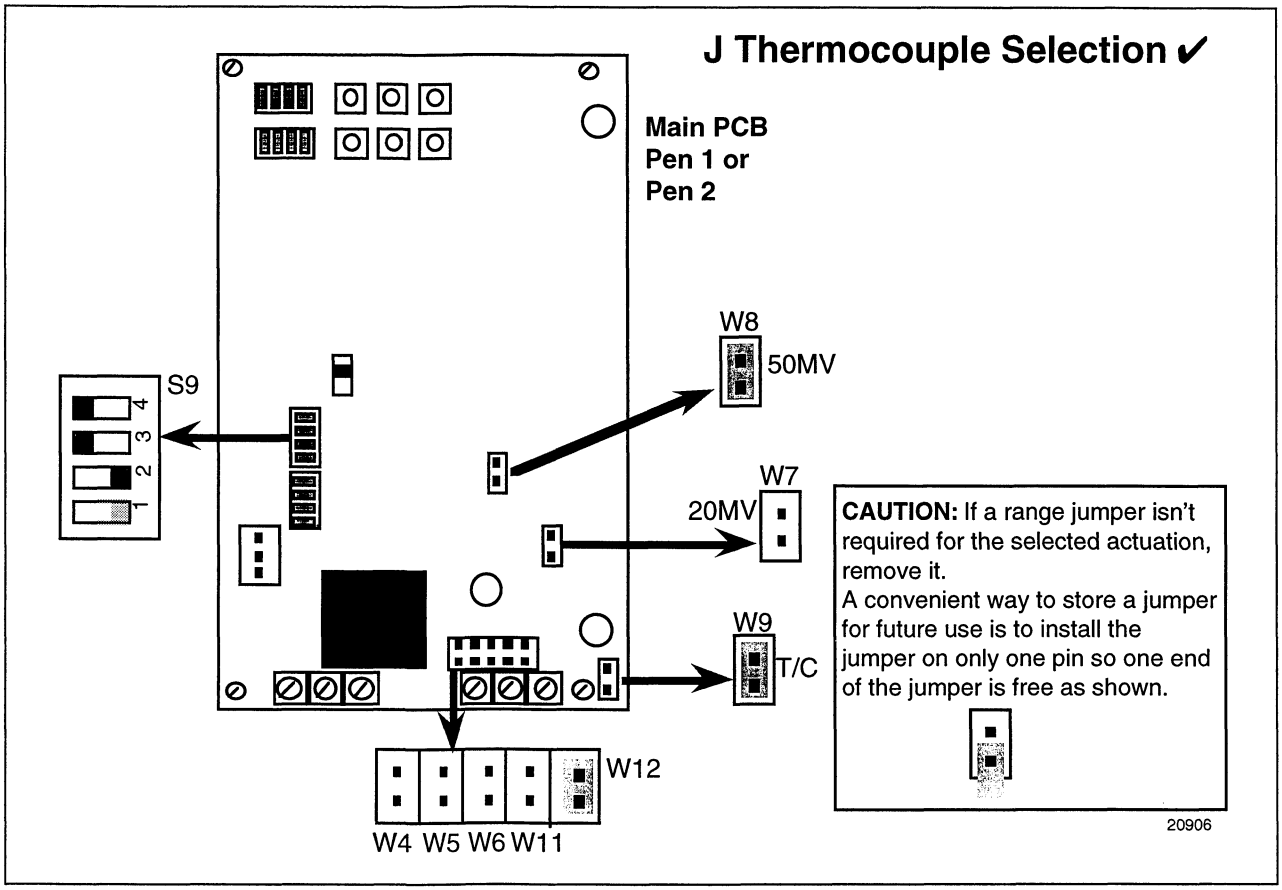
* Factory setting

Continued on next page

Type J thermocouple

Figure 2-7 is a graphic view of the S9 DIP switch settings and jumper locations for type J thermocouple actuation. Make the settings as shown in this figure.

Figure 2-7 Type J Thermocouple Actuation Switch and Jumpers



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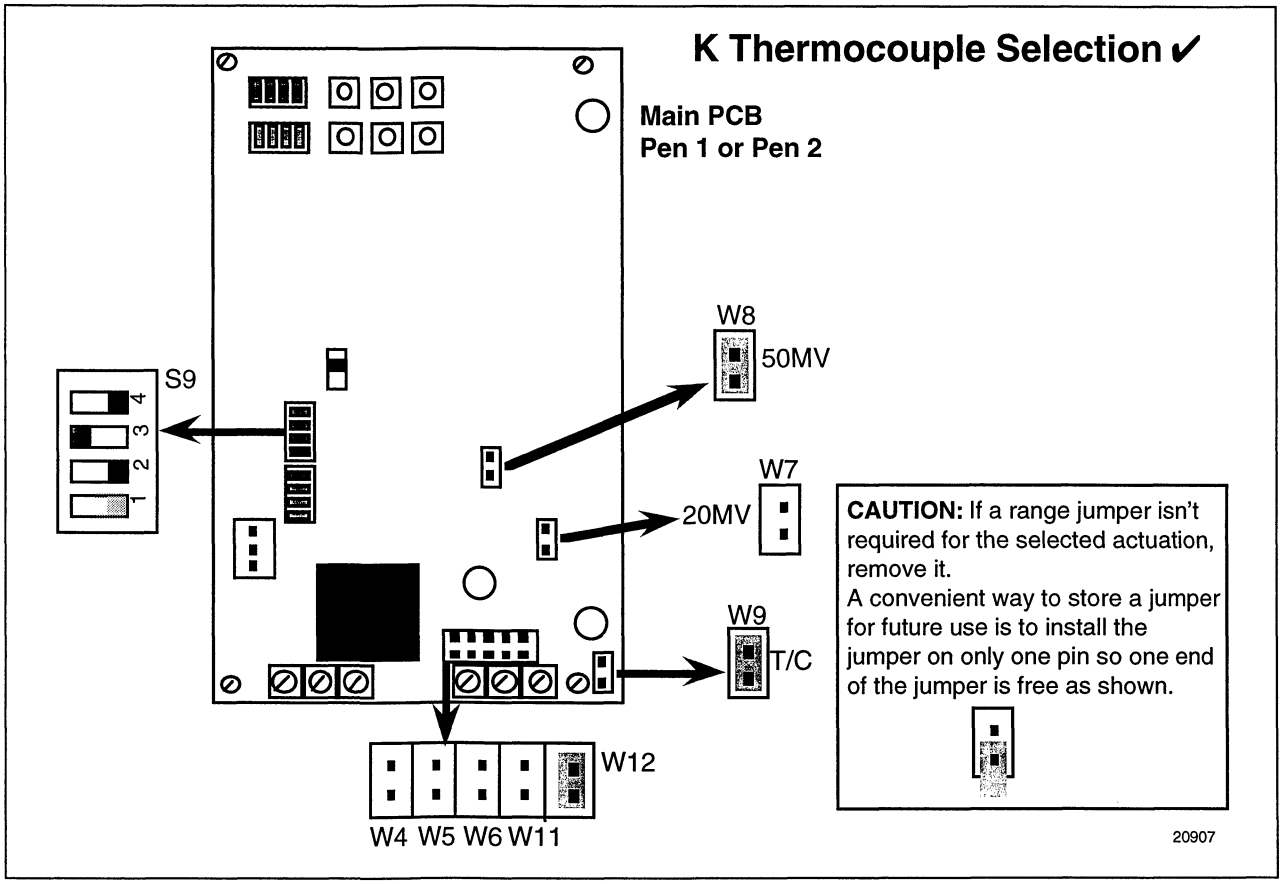
Type K thermocouple

Figure 2-8 is a graphic view of the S9 DIP switch settings and jumper locations for type K thermocouple actuation. Make the settings as shown in this figure.

Figure 2-8 Type K Thermocouple Actuation Switch and Jumpers



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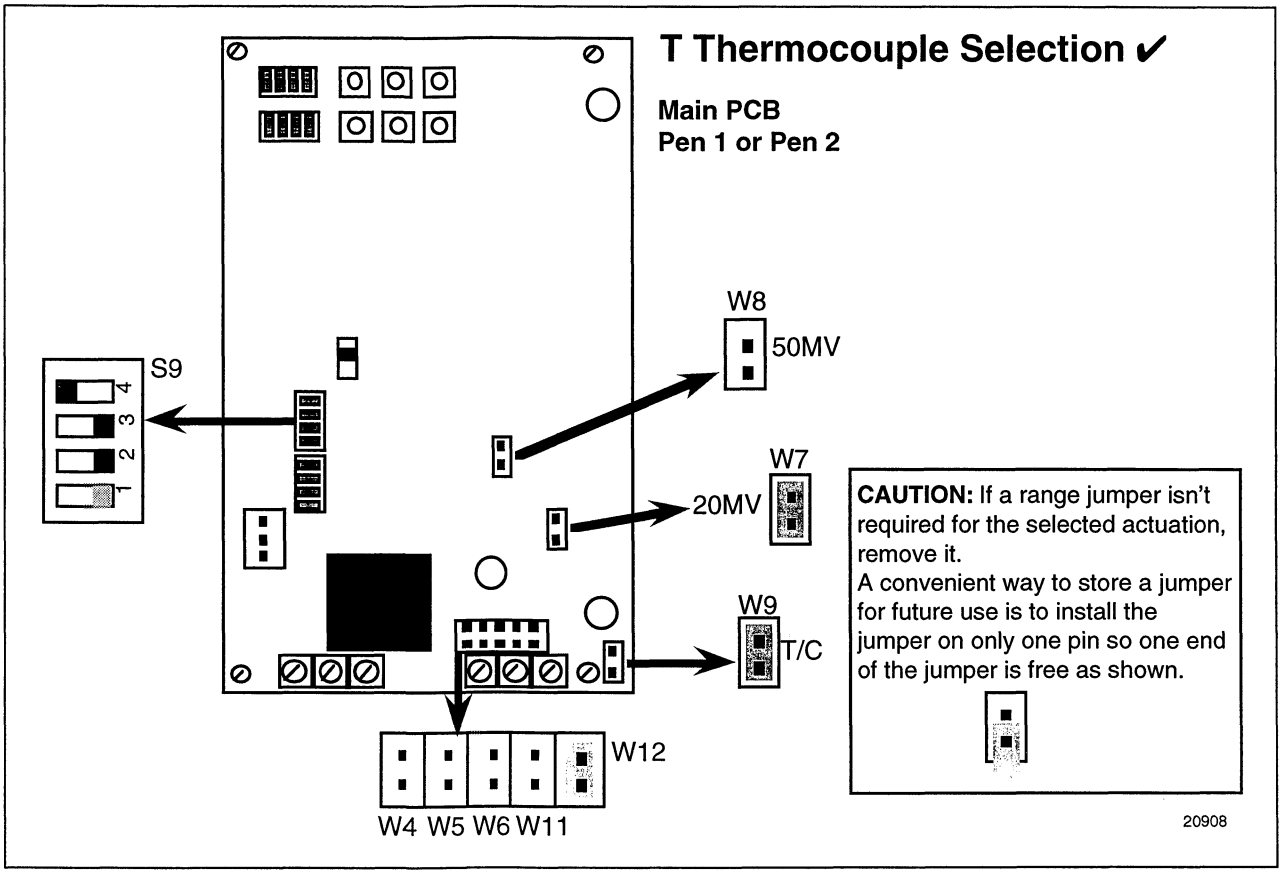
Type T thermocouple

Figure 2-9 is a graphic view of the S9 DIP switch settings and jumper locations for type T thermocouple actuation. Make the settings as shown in this figure.

Figure 2-9 Type T Thermocouple Actuation Switch and Jumpers



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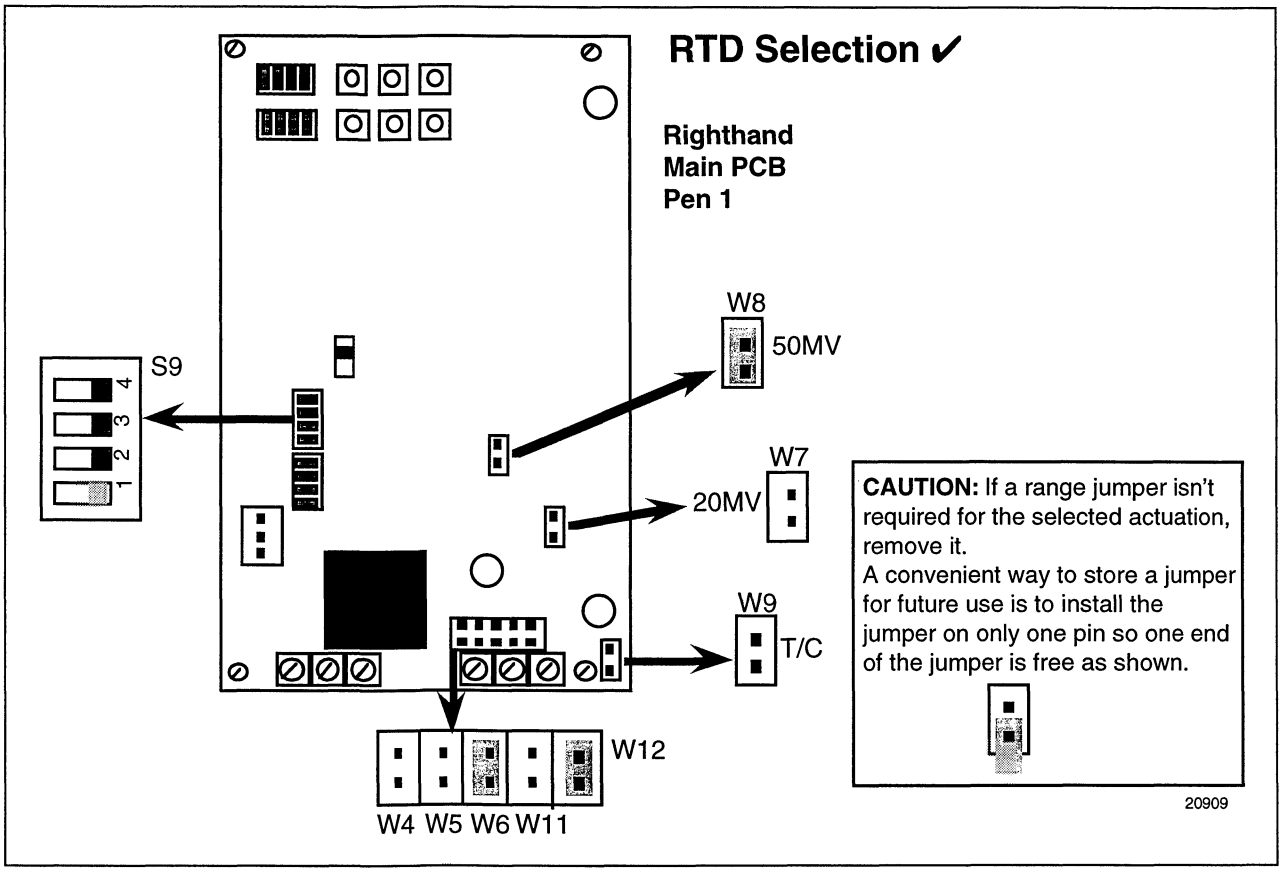
Type RTD

Figure 2-10 is a graphic view of the S9 DIP switch settings and jumper locations for type RTD (Resistance Thermometer Device) actuation. Make the settings as shown in this figure.

Figure 2-10 Type RTD Actuation Switch and Jumpers



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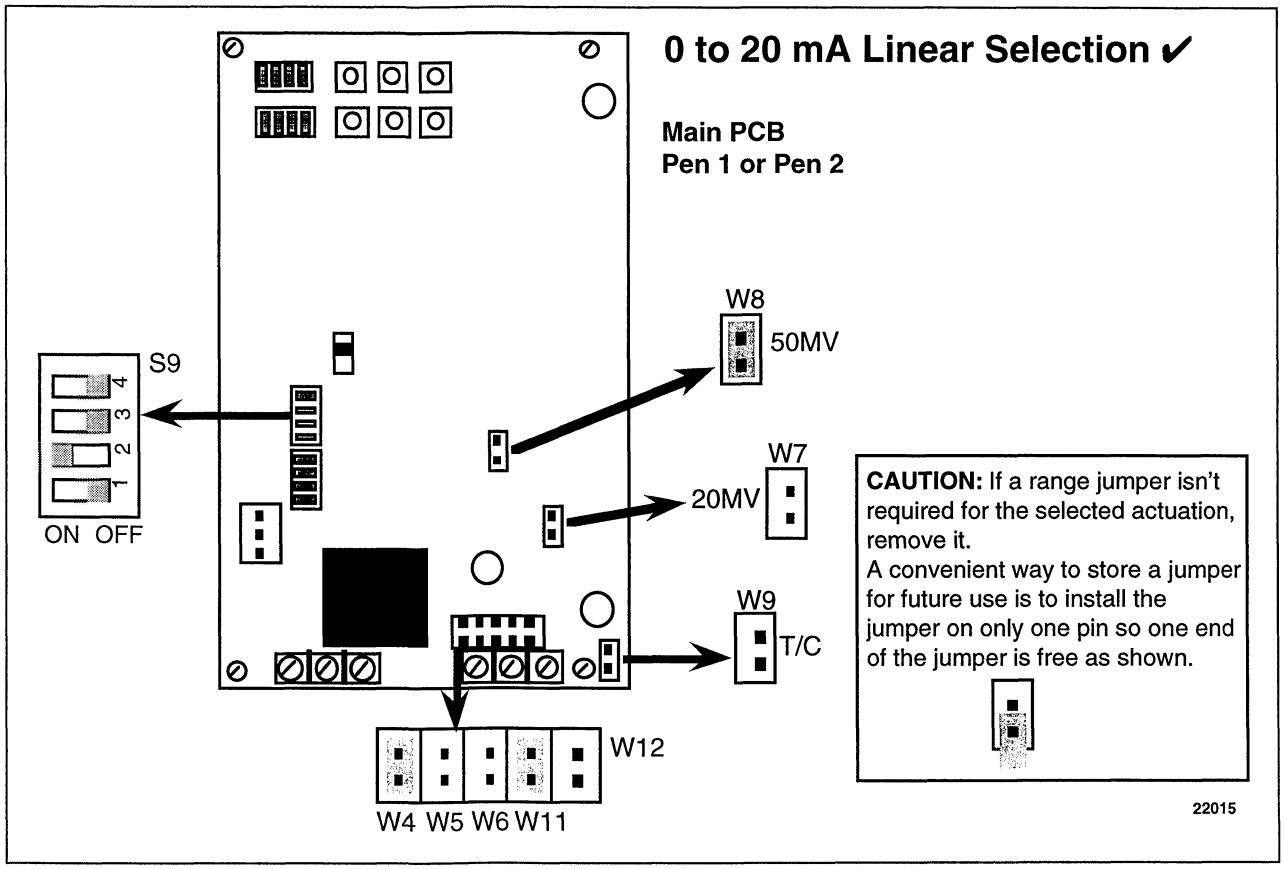
Type 0–20 mA linear

Figure 2-11 is a graphic view of the S9 DIP switch settings and jumper locations for type 0–20 mA linear actuation. Make the settings as shown in this figure.

Figure 2-11 Type 0–20 mA Linear Actuation Switch and Jumpers



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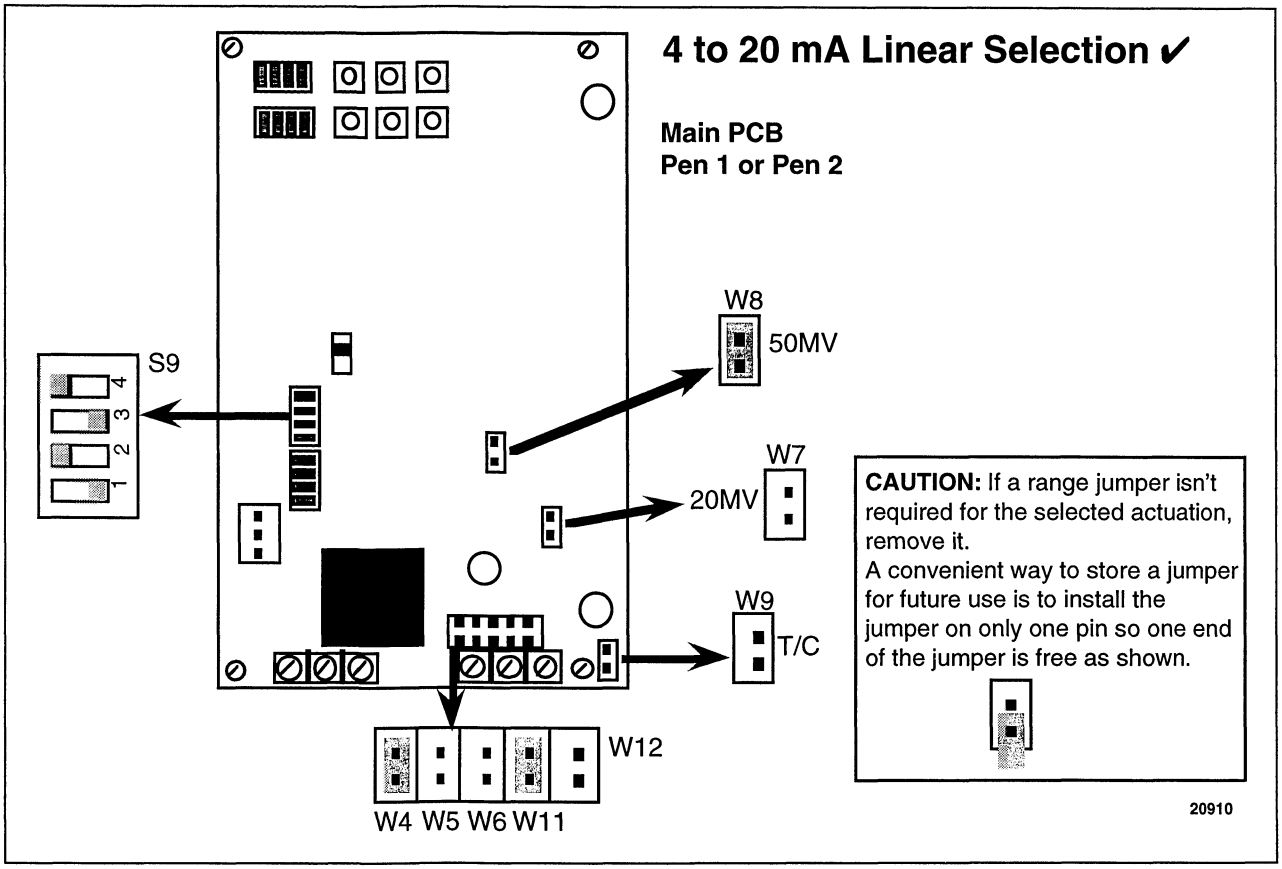
Type 4–20 mA linear

Figure 2-12 is a graphic view of the S9 DIP switch settings and jumper locations for type 4–20 mA linear actuation. Make the settings as shown in this figure.

Figure 2-12 Type 4–20 mA Linear Actuation Switch and Jumpers



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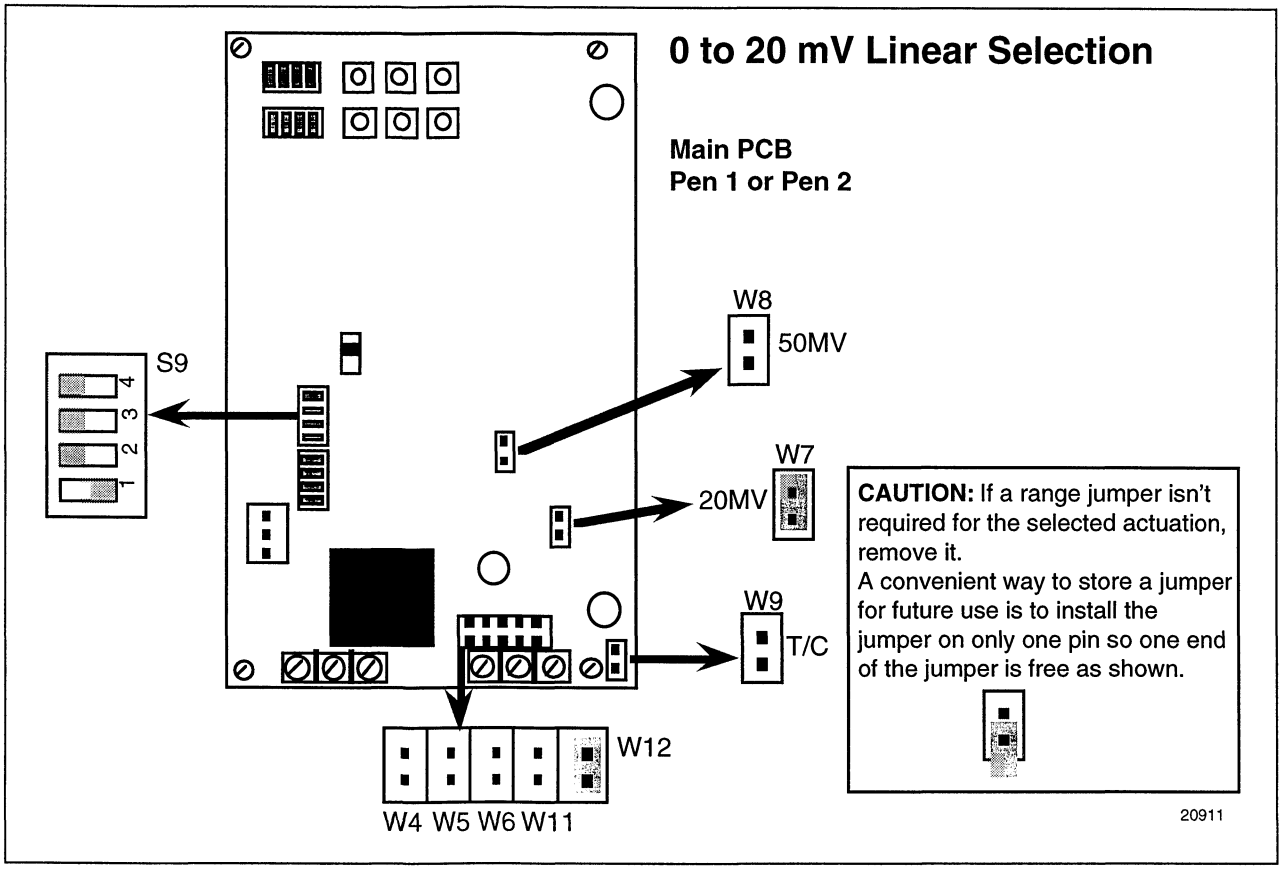
Type 0–20 mV linear

Figure 2-13 is a graphic view of the S9 DIP switch settings and jumper locations for type 0–20 mV linear actuation. Make the settings as shown in this figure.

Figure 2-13 Type 0–20 mV Linear Actuation Switch and Jumpers



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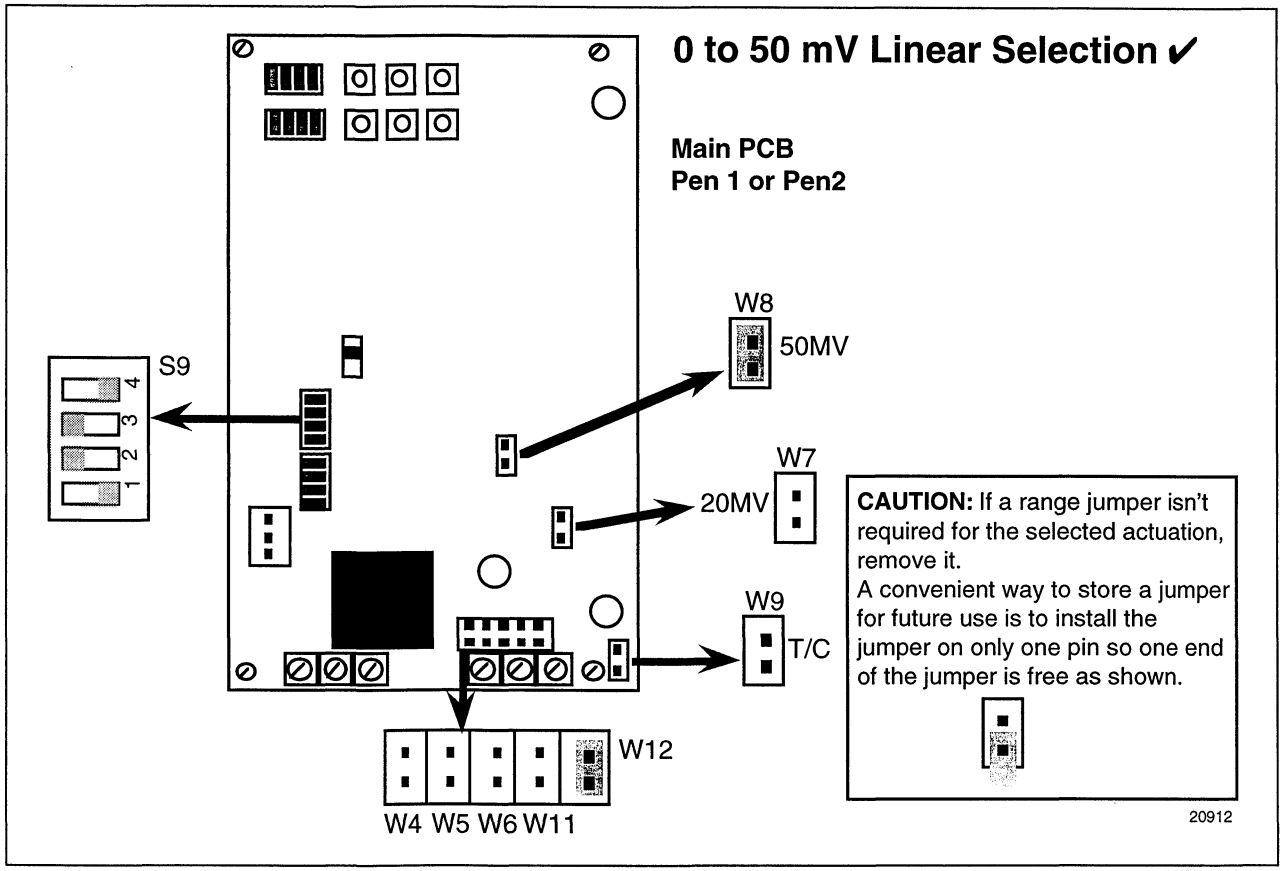
Type 0–50 mV linear

Figure 2-14 is a graphic view of the S9 DIP switch settings and jumper locations for type 0–50 mV linear actuation. Make the settings as shown in this figure.

Figure 2-14 Type 0–50 mV Linear Actuation Switch and Jumpers



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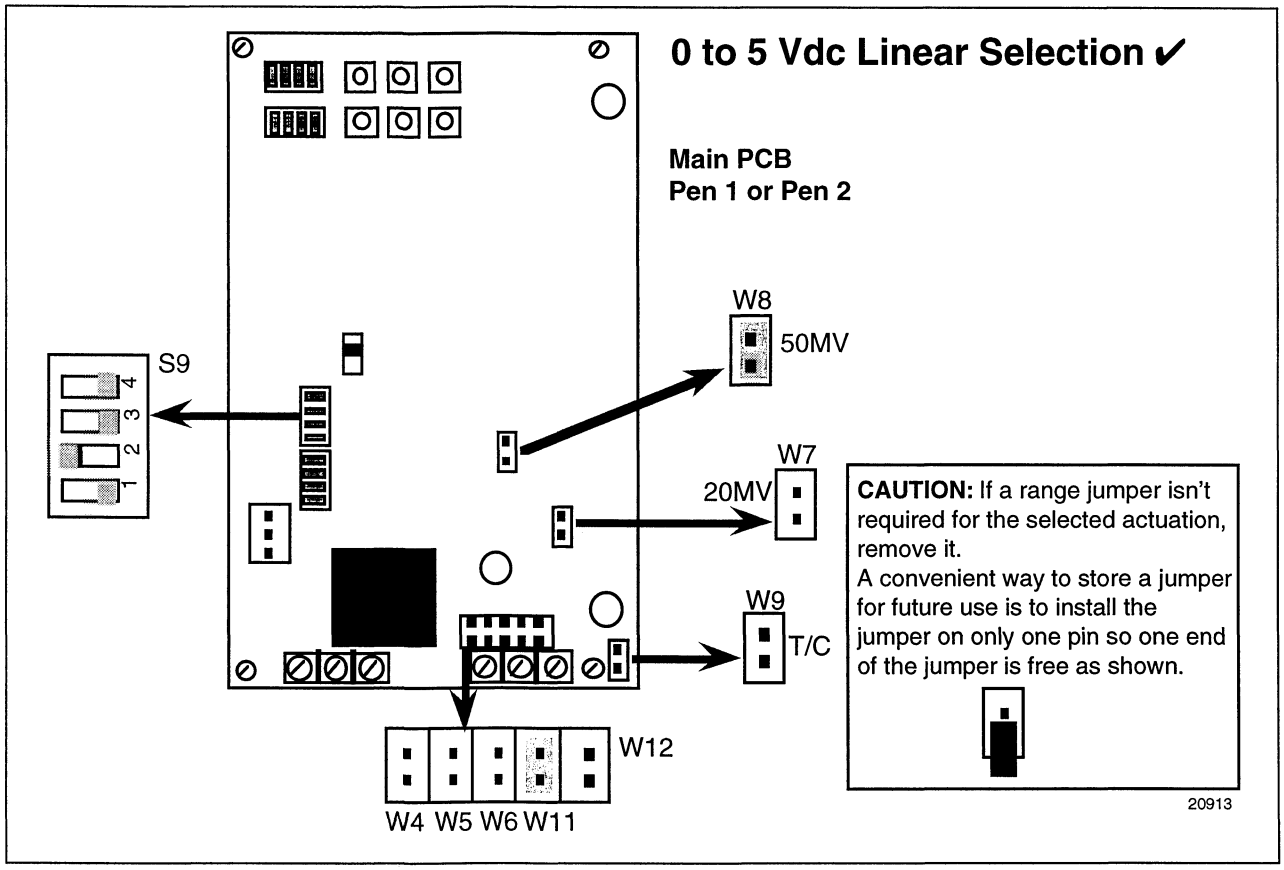
Type 0–5 Vdc linear

Figure 2-15 is a graphic view of the S9 DIP switch settings and jumper locations for type 0–5 Vdc linear actuation. Make the settings as shown in this figure.

Figure 2-15 Type 0–5 Vdc Linear Actuation Switch and Jumpers



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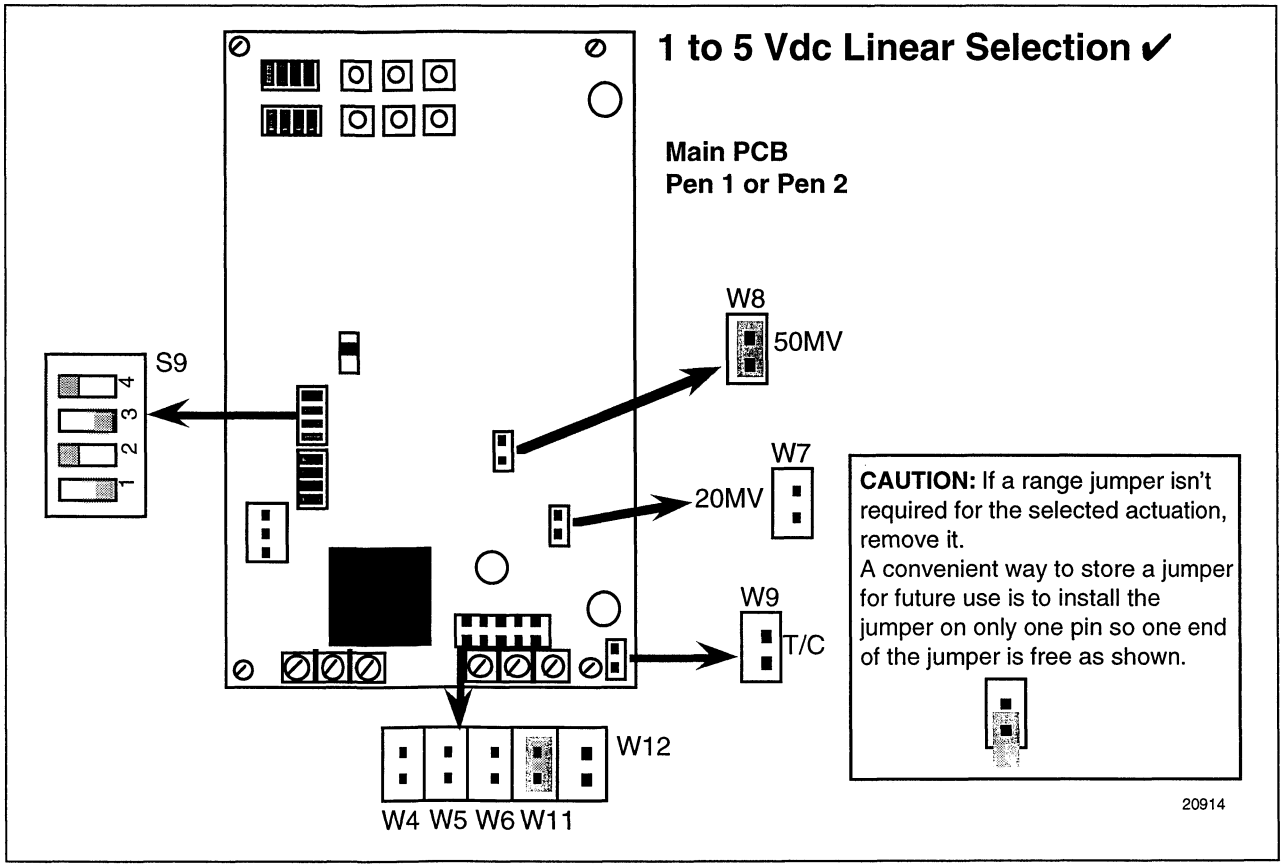
Type 1–5 Vdc linear

Figure 2-16 is a graphic view of the S9 DIP switch settings and jumper locations for type 1–5 Vdc linear actuation. Make the settings as shown in this figure.

Figure 2-16 Type 1–5 Vdc Linear Actuation Switch and Jumpers



2.9 Setting the Chart Speed

Introduction

You can set the time it takes the chart to travel one complete revolution by setting DIP Switch S1 positions 1 and 2 on the Main printed circuit board for Pen #1.

ATTENTION The chart speed setting does not apply for DIP switch S1 on Main printed circuit board for Pen #2.

Refer to Table 2-5 to identify DIP switch settings and range jumper positions for the desired chart speed.

Refer to Figure 2-17 to set your particular chart speed. It gives you a graphic view of the DIP switch settings and jumper positions that are noted in the table.

Switch S1 positions

Table 2-5 is a list of the chart speed switch positions and settings.

Table 2-5 Chart Speed Switch Settings

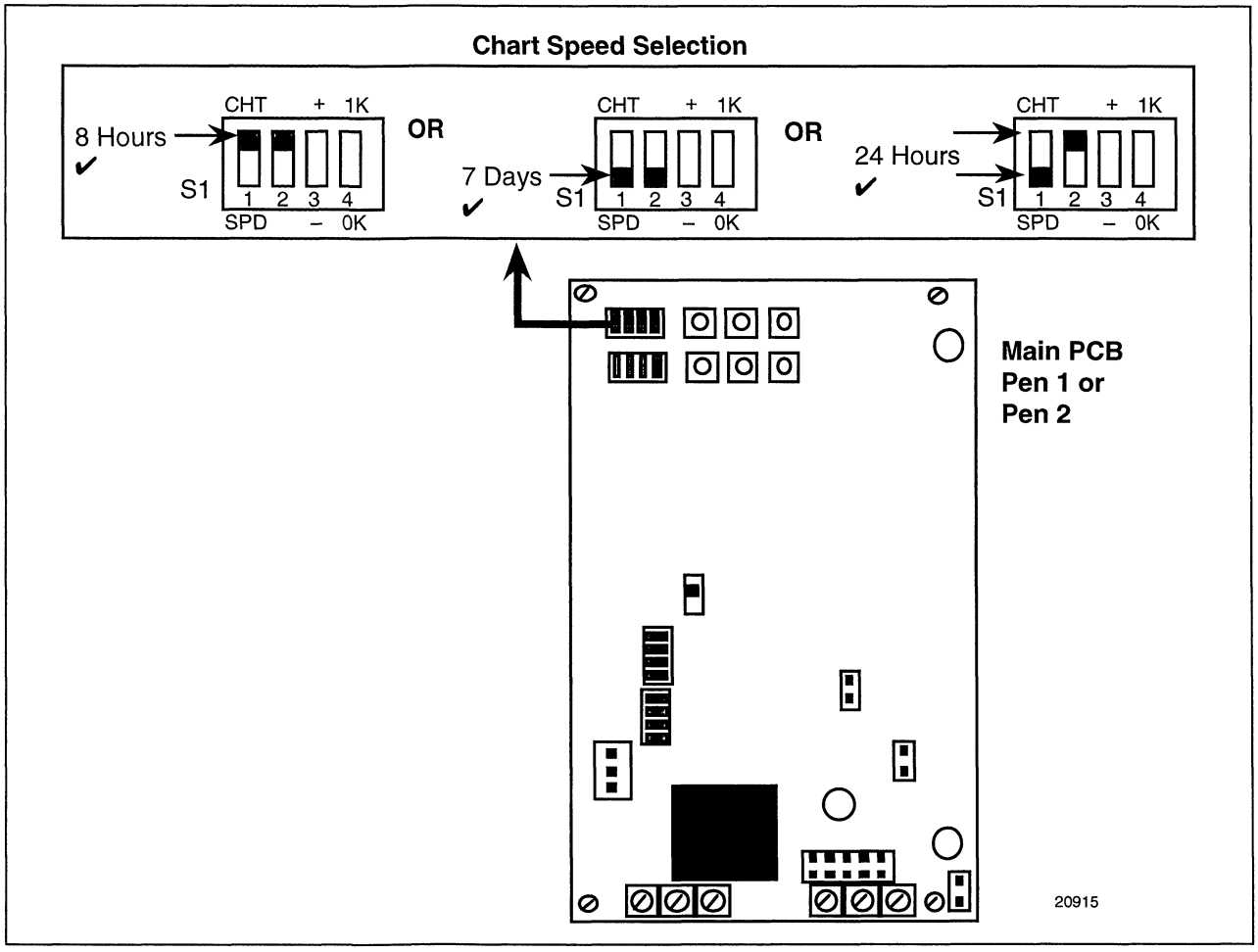
Chart Speed (Time for one revolution)	S1 Switch Position & Settings	
	1	2
8 Hours	ON	ON
Test (For factory use only)	ON	OFF
24 Hours (Factory setting)	OFF	ON
7 Days	OFF	OFF

Continued on next page

Charts speed switch settings

Figure 2-17 is a graphic view of the S1 DIP switch settings and jumper locations for your chart speed. Make a setting for your desired chart speed as shown in this figure.

Figure 2-17 Chart Speed Switch Settings



2.10 Selecting Linear or Nonlinear Chart

Introduction

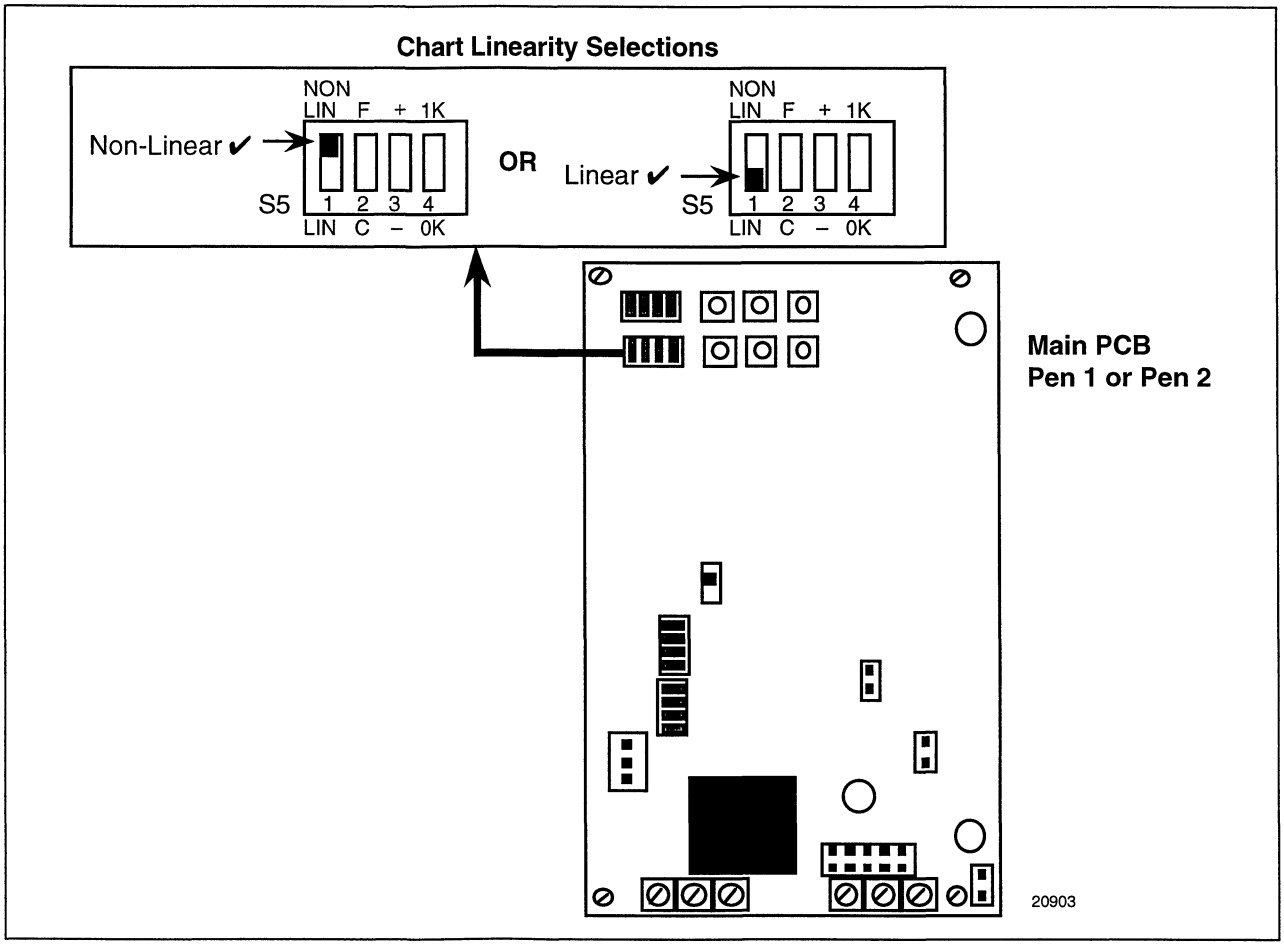
You can specify if the input signals are to be recorded on a Linear (for example: even 100 division), or Nonlinear (for example: Type T thermocouple or platinum RTD) chart.

Refer to Figure 2-18 and follow the procedure in Table 2-6 to select a linear or nonlinear chart .

Table 2-6 Linear or Non-Linear Chart

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate DIP switch S5 in the upper left corner of the Main printed circuit board for Pen #1 (see Figure 2-18).
3	Set position 1 to up/ON if you will be using a nonlinear chart, or down/OFF (factory setting) if you will be using a linear chart. This selection applies to both Pen #1 and Pen #2.

Figure 2-18 Linear or Nonlinear Chart Selection



2.11 Selecting Temperature Units

Introduction

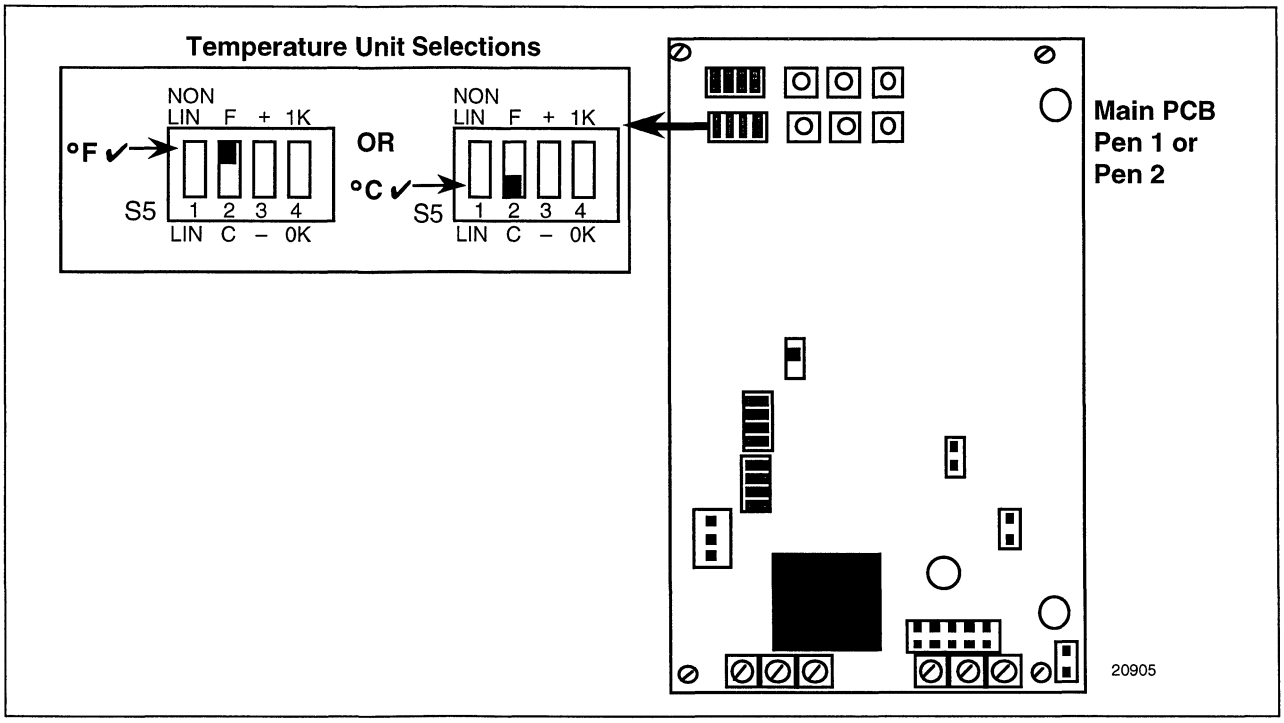
You can select if the temperature unit for the input signal is to be in degrees Fahrenheit or degrees Celsius.

Refer to Figure 2-19 and follow the procedure in Table 2-7 to select a temperature unit.

Table 2-7 Temperature Units Selection

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate DIP Switch S5 in the upper left corner of the Main printed circuit board for Pen #1 (see Figure 2-19).
3	Set position 2 to up/ON(factory setting) if the input temperature is to be measured in °F, or down/OFF if the input temperature is to be measured in °C. Be sure to check this setting on S5 on the Main printed circuit board for Pen #2 also.

Figure 2-19 Temperature Units Selection



2.12 Setting Chart Zero and Full Scale Values

Introduction

You must set the values that represent the zero and full scale range for the process variable that you are recording.

Refer to Table 2-8 for the actuation minimum and maximum range values.

Refer to Figure 2-20 and follow the procedure in Table 2-9 to set the zero and full scale values of a T/C or RTD actuation.

Refer to Figure 2-21 and follow the procedure in Table 2-10 to set the zero and full scale values of a linear actuation.

Minimum and maximum range values

Table 2-8 lists the minimum and maximum range values for each type actuation listed. Use these values when setting your zero and full scale values.

Table 2-8 Actuation Minimum and Maximum Range Values

Actuation	Type	Range Values		
		°F	°C	Even
Thermocouple	J	0 to 1600	–18 to 871	—
Thermocouple	K	–320 to 1999*	–196 to 1371	—
Thermocouple	T	–300 to 700	–184 to 371	—
RTD	100 Ohm	–300 to 900	–184 to 482	—
Linear	4–20 mA	—	—	0 to 100
Linear	0–20 mV	—	—	0 to 100
Linear	0–50 mV	—	—	0 to 100
Linear	0–5 Vdc	—	—	0 to 100
Linear	1–5 Vdc	—	—	0 to 100

*** Limited by switch settings - to use 0 to 2400°F chart, convert range to –18 to 1316°C.**

Continued on next page

T/C or RTD actuations

Refer to Figure 2-20 and follow the procedure in Table 2-9 to set the zero and full scale values of a T/C or RTD actuation.

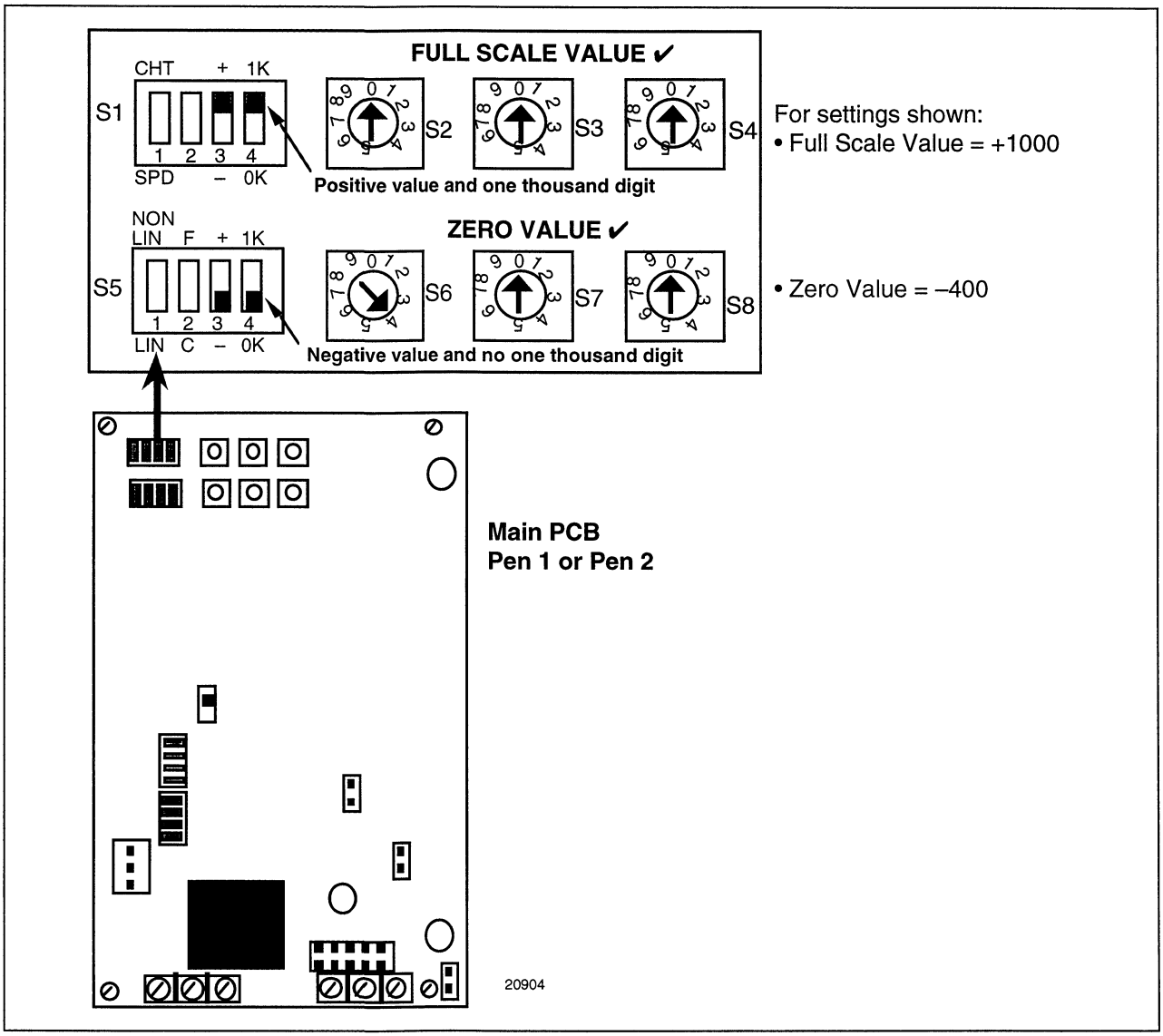
Table 2-9 Chart Zero and Full Scale Values (T/C or RTD Actuations)

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
Full Scale Value	
2	Locate DIP Switch S1 in the upper-left corner of the Main printed circuit board for Pen #1 (see Figure 2-20).
3	Set position 3 to up/ON(factory setting) for positive value or down/OFF for a negative one.
4	Set position 4 to up/ON for one thousand digit or down/OFF (factory setting) for zero thousand digit.
5	Turn the arrow in the center of the rotary DIP switches S2, S3, and S4 to point to the desired number for 100, 10, and 1 digit places in Full Scale value. Figure 2-20 shows an example for a –400 to +1000 degree chart [–400 (zero) and +1000 (full scale)].
Zero Scale Value	
6	Locate DIP Switch S5 in the upper left corner of the Main printed circuit board for Pen #1 (see Figure 2-20).
7	Set position 3 to up/ON(factory setting) for positive value or down/OFF for a negative one.
8	Set position 4 to up/ON for one thousand digit or down/OFF (factory setting) for zero thousand digit.
9	Turn the arrow in the center of the rotary DIP switches S6, S7, and S8 to point to the desired number for 100, 10, and 1 digit places in Zero Scale value. Figure 2-20 shows an example for a –400 to +1000 degree chart [–400 (zero) and +1000 (full scale)].

Continued on next page

T/C or RTD actuations, continued

Figure 2-20 DIP Switch Settings for Chart Zero and Full-Scale Values (T/C or RTD Actuations)



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Linear actuations

Refer to Figure 2-21 and follow the procedure in Table 2-10 to set the zero and full scale values of a Linear actuation.

Set the scale values as shown in Table 2-10, but multiply settings 1K, 100, 10, and 1 by **0.1**.

The input range for any linear input always equals **0 to 100%**.
For example: with a 4–20mA input, 4mA equals 0% and 20mA equals 100%. Thus, regardless of the printed chart range for the Process Variable being measured, you must set the zero and full scale values based on 0 to 100%.

To narrow the range of measurement, refer to Figure 2-22.

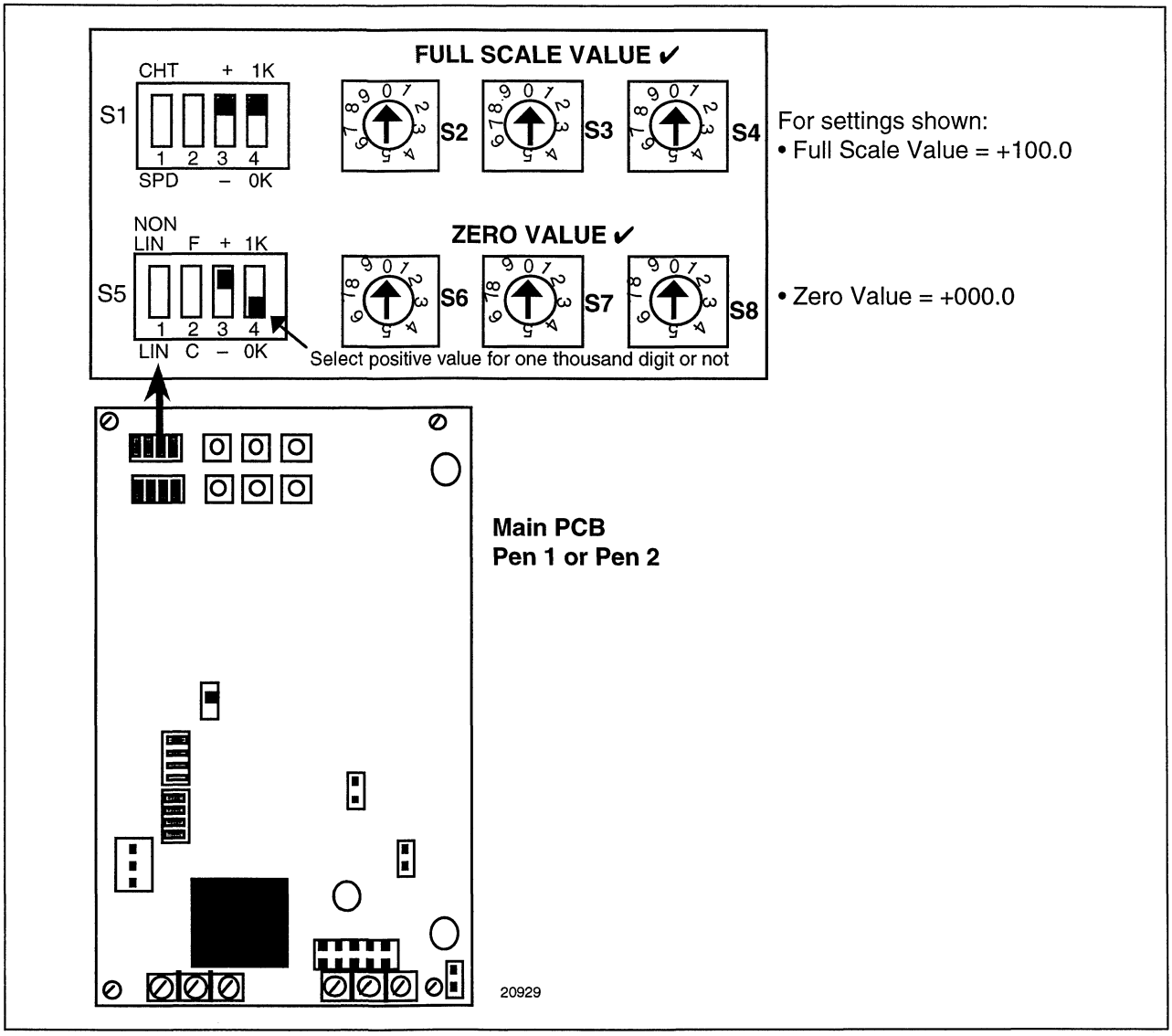
Table 2-10 Chart Zero and Full Scale Values (Linear Actuations)

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
Full Scale Value	
2	Locate DIP Switch S1 in the upper left corner of the Main printed circuit board for Pen #1 (see Figure 2-21).
3	Set position 3 to up/ON for positive value or down/OFF for a negative one.
4	Set position 4 to up/ON) for one thousand digit or down/OFF (factory setting) for zero thousand digit.
5	Turn the arrow in the center of the rotary DIP switches S2, S3, and S4 to point to the desired number for 100, 10, and 1 digit places in Full Scale value. **You must multiply these settings by 0.1.** Figure 2-21 shows an example for +000.0 (zero) and +100.0 (full scale).
Zero Scale Value	
6	Locate DIP Switch S5 in the upper-left corner of the Main printed circuit board for Pen #1 (see Figure 2-20).
7	Set position 3 to up/ON for positive value or down/OFF for a negative one.
8	Set position 4 to up/ON for one thousand digit or down/OFF (factory setting) for zero thousand digit.
9	Turn the arrow in the center of the rotary DIP switches S6, S7, and S8 to point to the desired number for 100, 10, and 1 digit places in Zero Scale value. **You must multiply these settings by 0.1.** Figure 2-21 shows an example for +000.0 (zero) and +100.0 (full scale).

Continued on next page

Linear actuations, continued

Figure 2-21 DIP Switch Settings for Chart Zero and Full Scale Values (Linear Actuations)



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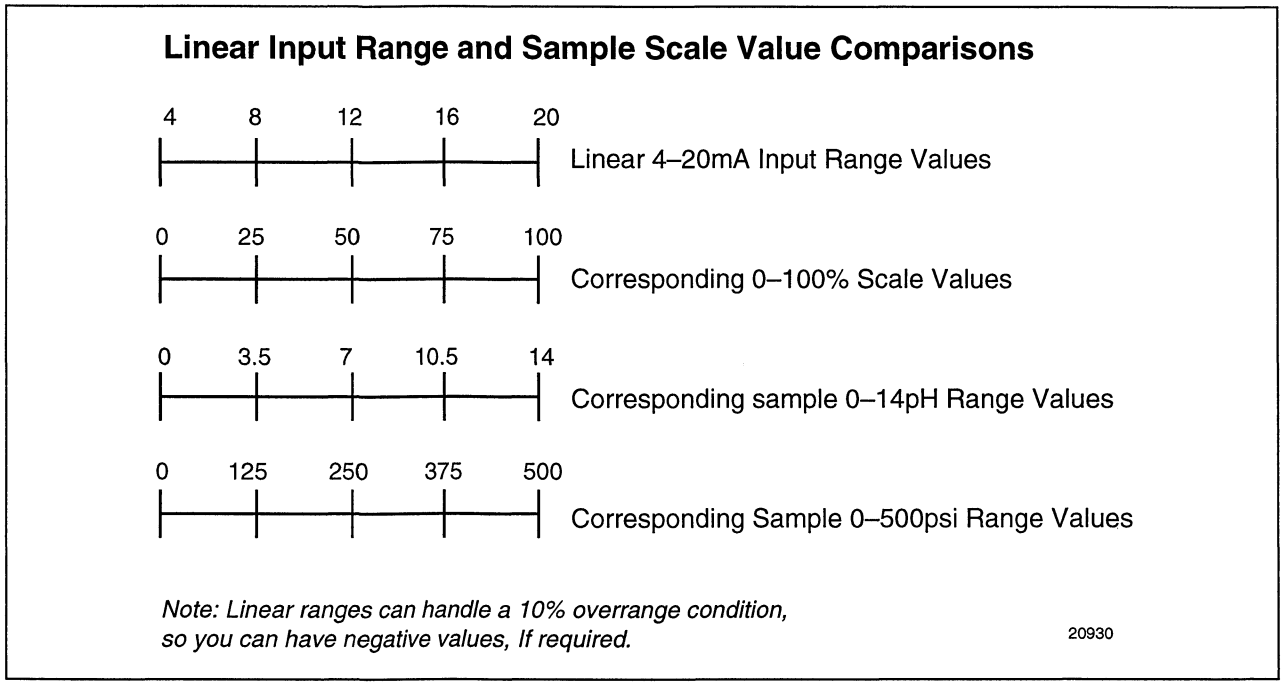
Narrowing the range of measurement

You can narrow the range of measurement on a linear range by setting the corresponding scale percentage.

For example: If 4 to 20mA is being used to measure 0 to 14pH on a chart graduated for 0 to 14pH, the zero value must be set to 0 and the full scale value must be set to 100 in order to record the full scale range of 0 to 14pH.

You can narrow the range of measurement by setting the corresponding scale percentage. To record values between 3.5 and 10.5pH only, the zero scale value must be set to 25% and the full scale value must be set to 75%. The 25% and 75% values correspond with the 3.5 and 10.5pH measurements within the 0 to 14pH (0 to 100%) range as shown in Figure 2-22.

Figure 2-22 Narrow Range Measurement



2.13 Checking the Main Printed Circuit Board Pen Configuration

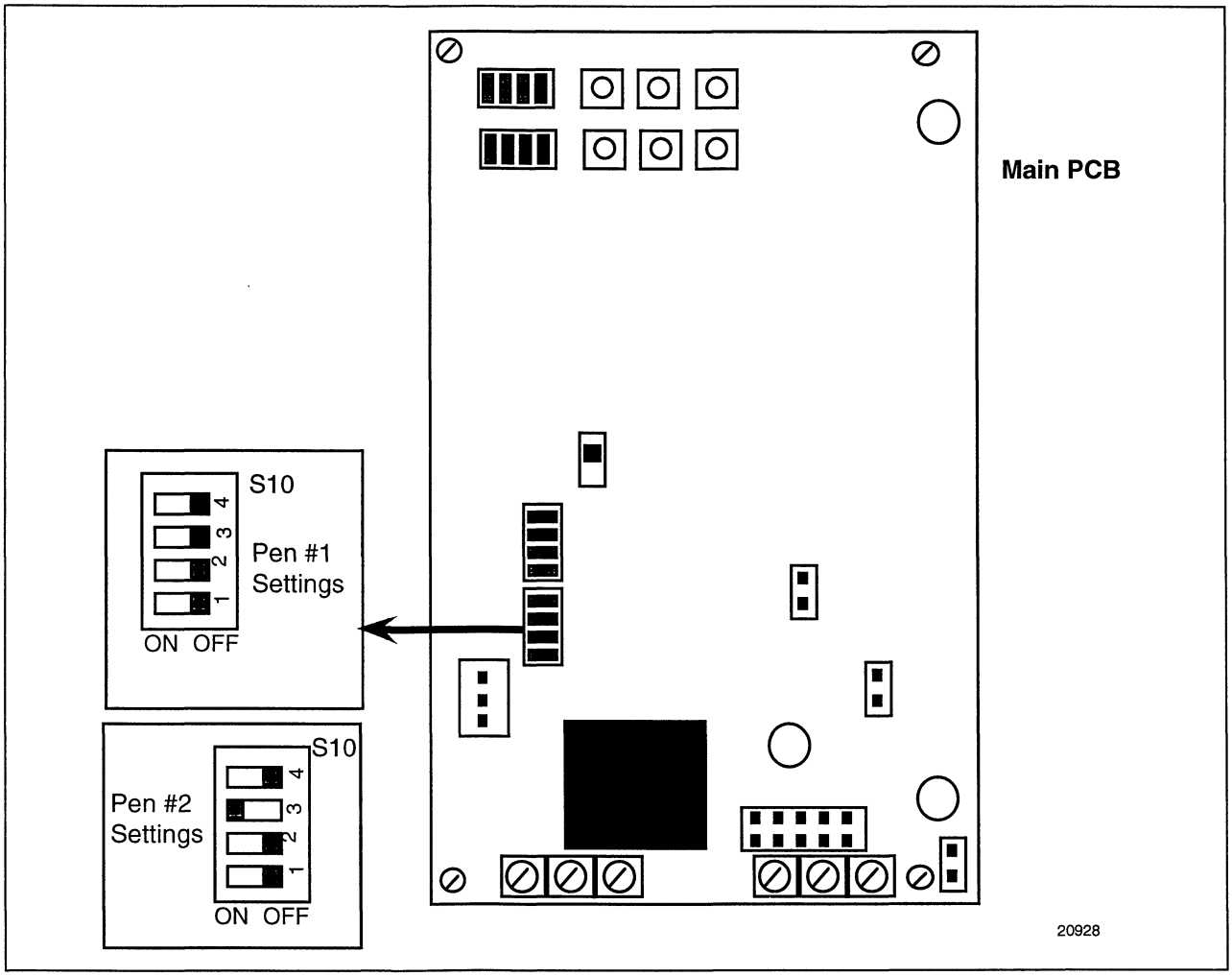
Pen configuration

Since the Main printed circuit board used for Pen #1 is identical to the one used for Pen #2, you must check the DIP switch S10, position 3, to be sure the Main PCB is configured to support the correct pen.

The Main printed circuit board for Pen #1 is always mounted on the right-hand side of the case, and the one for Pen #2 is always mounted on the left-hand side of the case. **The DIP switch is factory set for the correct pen.**

Refer to Figure 2-23 to check the Pen configuration; refer to Figure 2-24 for a Configuration Worksheet for recording pen #1, and to Figure 2-25 for a Configuration Worksheet for recording pen #2.

Figure 2-23 Pen Configuration.



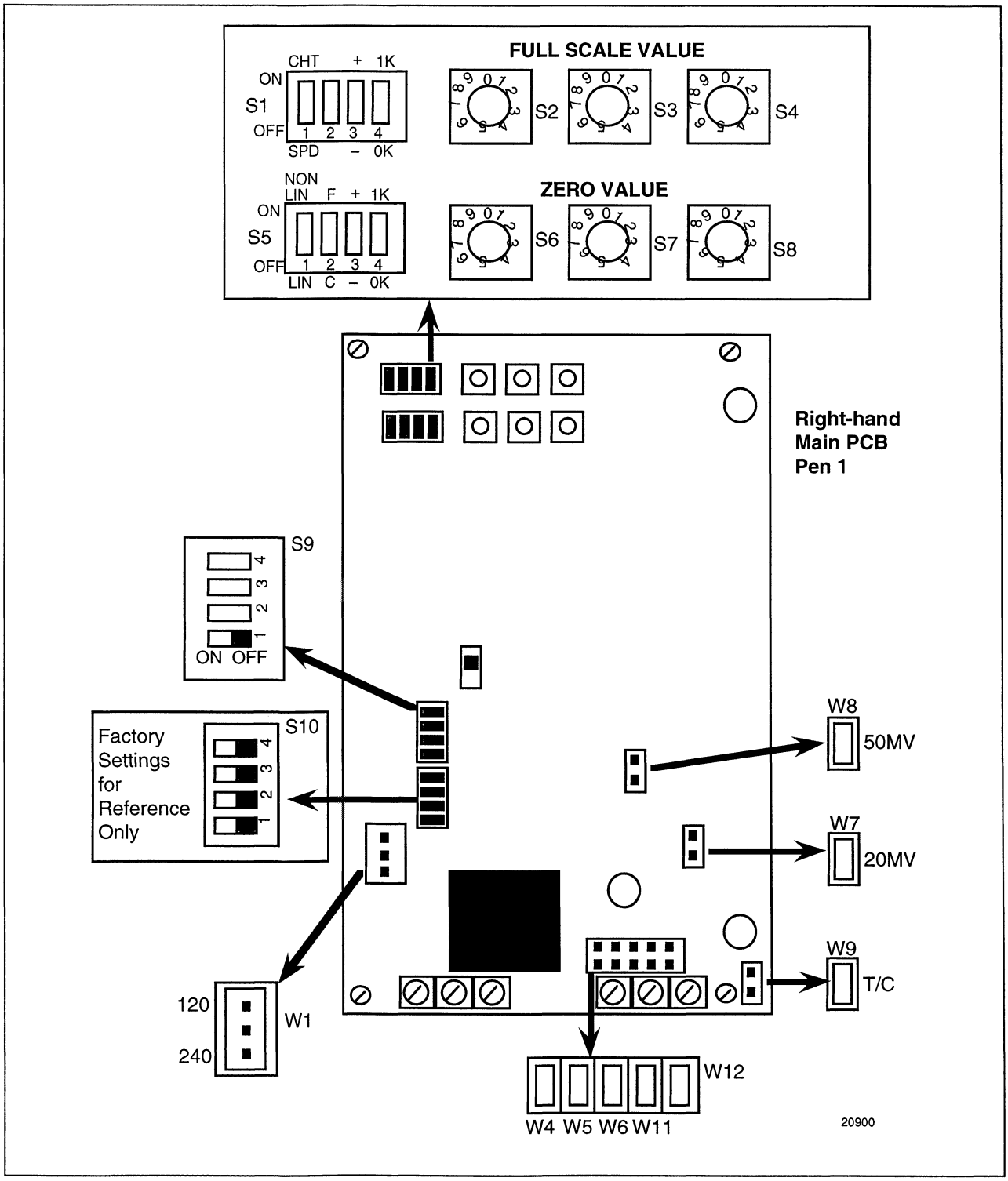
2.14 Configuration Worksheet for Recording Pen #1

Configuration worksheets

Refer to Figure 2-24 for a Configuration Worksheet for recording pen #1, and to Figure 2-25 for a Configuration Worksheet for recording pen #2.

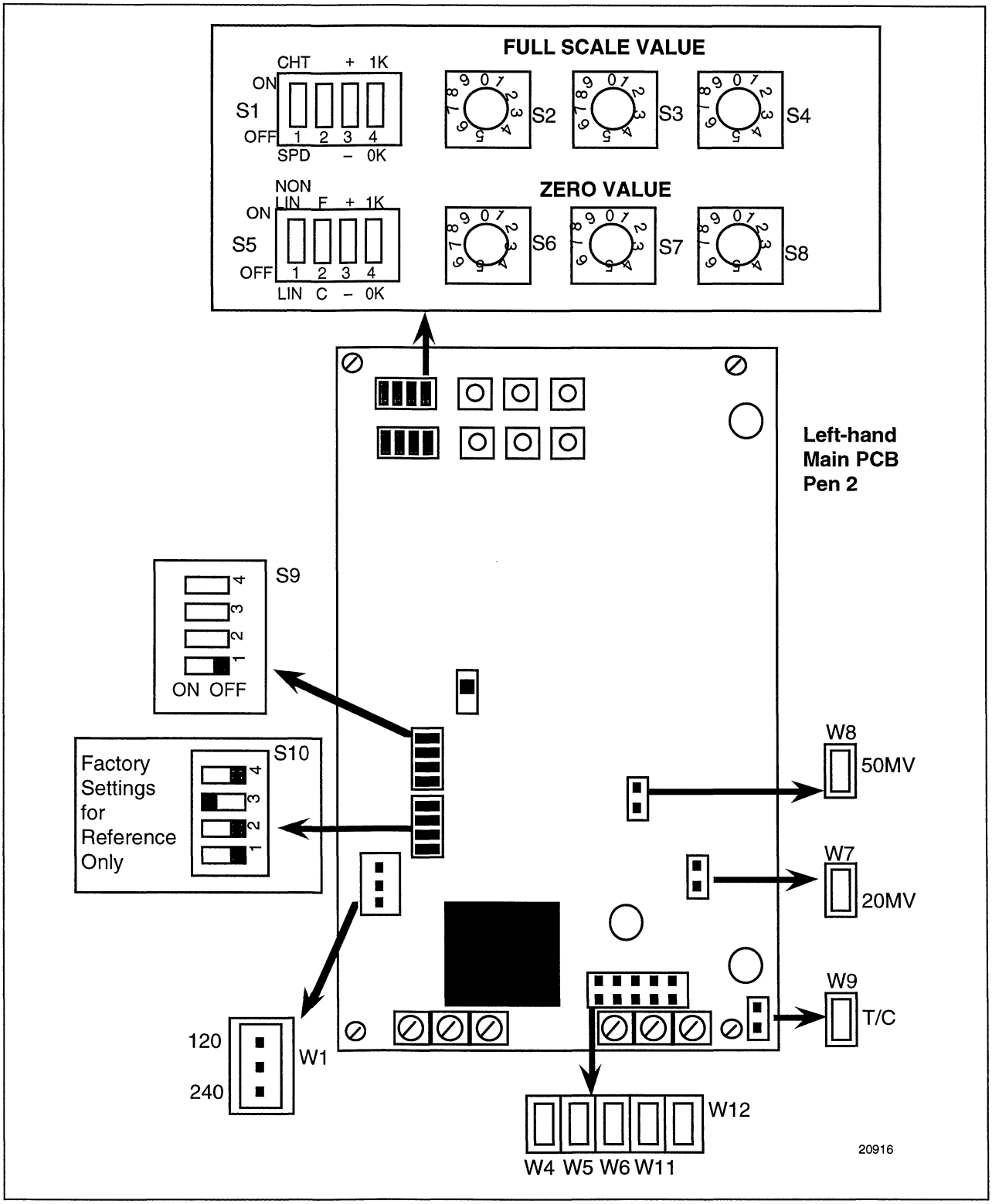
Mark up the worksheets based on your chart selection as shown in the example in Figure 2-1.

Figure 2-24 Pen #1 Configuration - DIP Switch Positions



2.15 Configuration Worksheet for Recording Pen #2

Figure 2-25 Pen #2 Configuration - DIP Switch Positions



Section 3 – Optional Relay Output Set Up

3.1 Introduction

Overview

Optional Relay Output Set Up consists of mounting the Output printed circuit board(s) and checking or setting jumper positions and DIP switch selections on each.

This section contains the Set-up tasks required to prepare your recorder for Relay Output operation. Each separate task includes a general overview of that task and a procedure for you to follow to accomplish it. Unless noted, the procedural steps apply for both Relay Output printed circuit boards.

To help you, there is a composite view of the component locations as well as the factory settings for the jumpers and DIP switches

ATTENTION Set up the Main printed circuit board(s) before mounting and checking the jumper positions and DIP switch settings on your Relay Output board. Refer to *Section 2- Recording Set Up* for further information.

What's in this section?

The following topics are covered in this section:

3.2 Configuration Selections for Relay Output

Introduction

If you ordered a recorder with relay output, a separately packaged Output printed circuit board is supplied with your recorder. You must mount the Output printed circuit board on the Main printed circuit board, and make some configuration selections to set up the relay output function.

There are six configuration selections that you must make or check to get the recorder to operate in accordance with your application needs.

- Relay 1 Action (N.O. / N.C.)
- Relay 1 Type
- Relay 1 Alarm/Control Setpoint
- Relay 2 Action (N.O. / N.C.)
- Relay 2 Type
- Relay 2 Alarm Setpoint

Relay configuration definitions

Table 3-1 defines selections associated with relay configuration parameters.

Table 3-1 Relay Configuration Parameters

Parameter	Selection	Definition
Relay Action	Normally Open	Refers to relay contacts being **OPEN** when the relay is de-energized.
	Normally Closed	Refers to relay contacts being **CLOSED** when the relay is de-energized.
Relay Type	A. ON-OFF Control (Direct)	Relay is **ENERGIZED** when the Process Variable (PV) is **ABOVE** the Setpoint (SP).
	B. ON-OFF Control (Reverse)	Relay is **ENERGIZED** when the PV falls **BELOW** the SP.
	C. High Alarm	Relay is **DE-ENERGIZED** when the PV is **ABOVE** the SP.
	D. Low Alarm	Relay is **DE-ENERGIZED** when the PV is **BELOW** the SP.
	E. High Limit Control*	Same as High Alarm, but remains **DE-ENERGIZED** until **MANUALLY** reset.
	D. Low Limit Control*	Same as Low Alarm, but remains **DE-ENERGIZED** until **MANUALLY** reset.

* These only operate with thermocouple and RTD inputs.

Continued on next page

Sample output function

Table 3-2 lists selections for a sample output function.

Table 3-2 Selections for **Sample** Output Function

Item	Parameter	Second	Item	Parameter	Second
1	Relay #1 Action	Normally Open	4	Relay #2 Action	Normally Open
2	Relay #1 Type	Low Alarm	5	Relay #2 Type	High Alarm
3	Alarm/Control SP Relay #1	+1000	6	Alarm SP Relay #2	+1000

How to make selections

This section provides a graphic summary of these configuration settings, and to assist you in the process of selection, it includes configuration worksheets on which you can note the configuration settings you require.

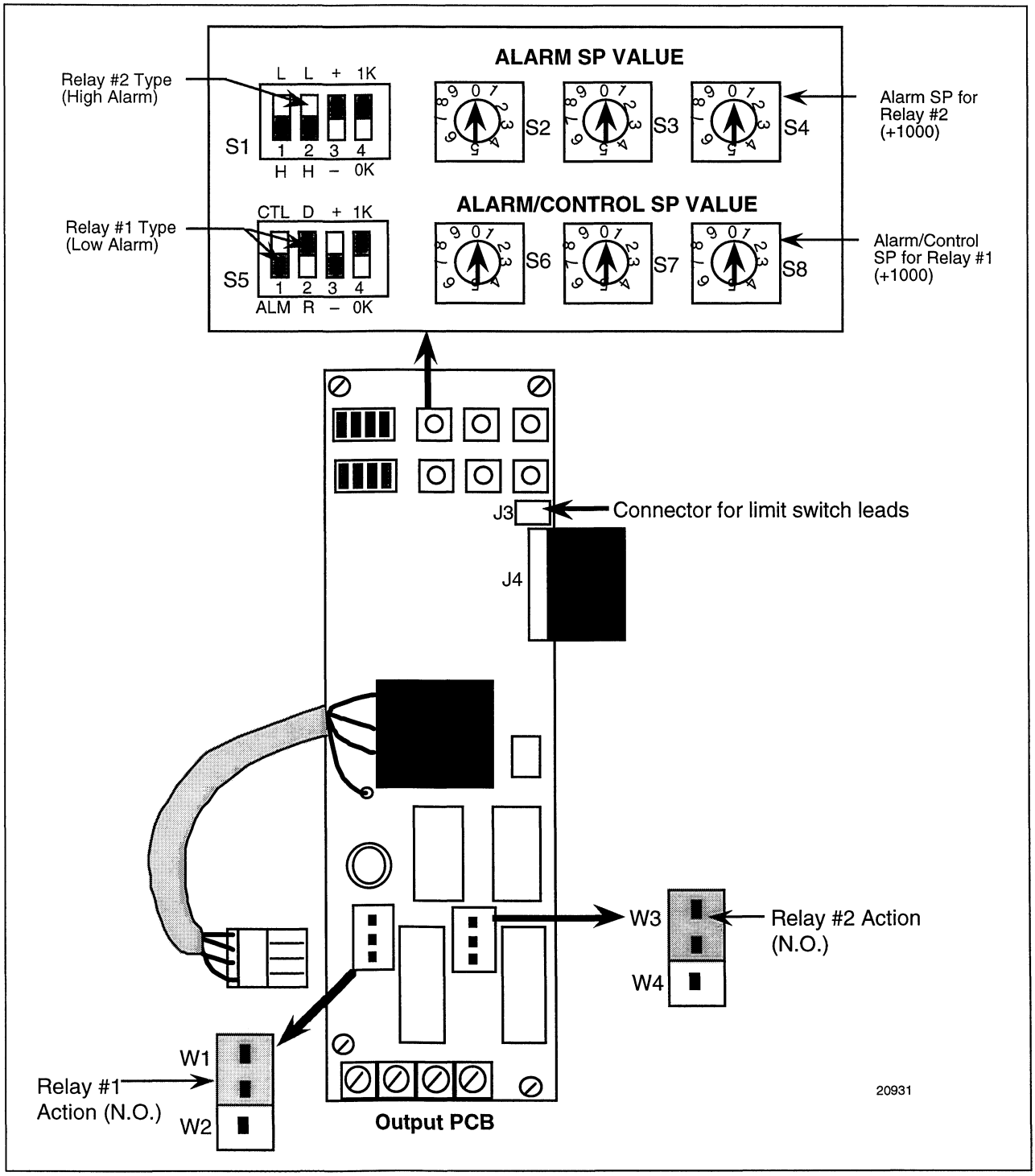
- Review the Sample Output functions in Table 3-2 and the Sample Worksheet (Figure 3-1). Refer to Figure 3-3 and mount the Relay Output board using the procedure in Table 3-3. Use the configuration graphics to understand how the sample worksheet was constructed.
- View the pertinent configuration selection illustrations for the Optional Relay Output board and mark the required settings on the Configuration Worksheet provided in the back of this section.
- Make the actual configuration settings on the Main printed circuit board in the recorder to match the worksheet.
- If you have a two-relay model, repeat the procedure to add and configure the Relay Output board for the Main printed circuit board for Pen #2.
- The recorder is now ready for operation with optional Relay Output.

3.3 Sample Configuration Worksheet for Relay Output

Sample Worksheet

Figure 3-1 is a sample Configuration Worksheet for the Relay Output selections in Table 3-2.

Figure 3-1 Sample Configuration Worksheet for Output Selections in Table 3-2;



3.4 Checking the Main Printed Circuit Board Pen Configuration

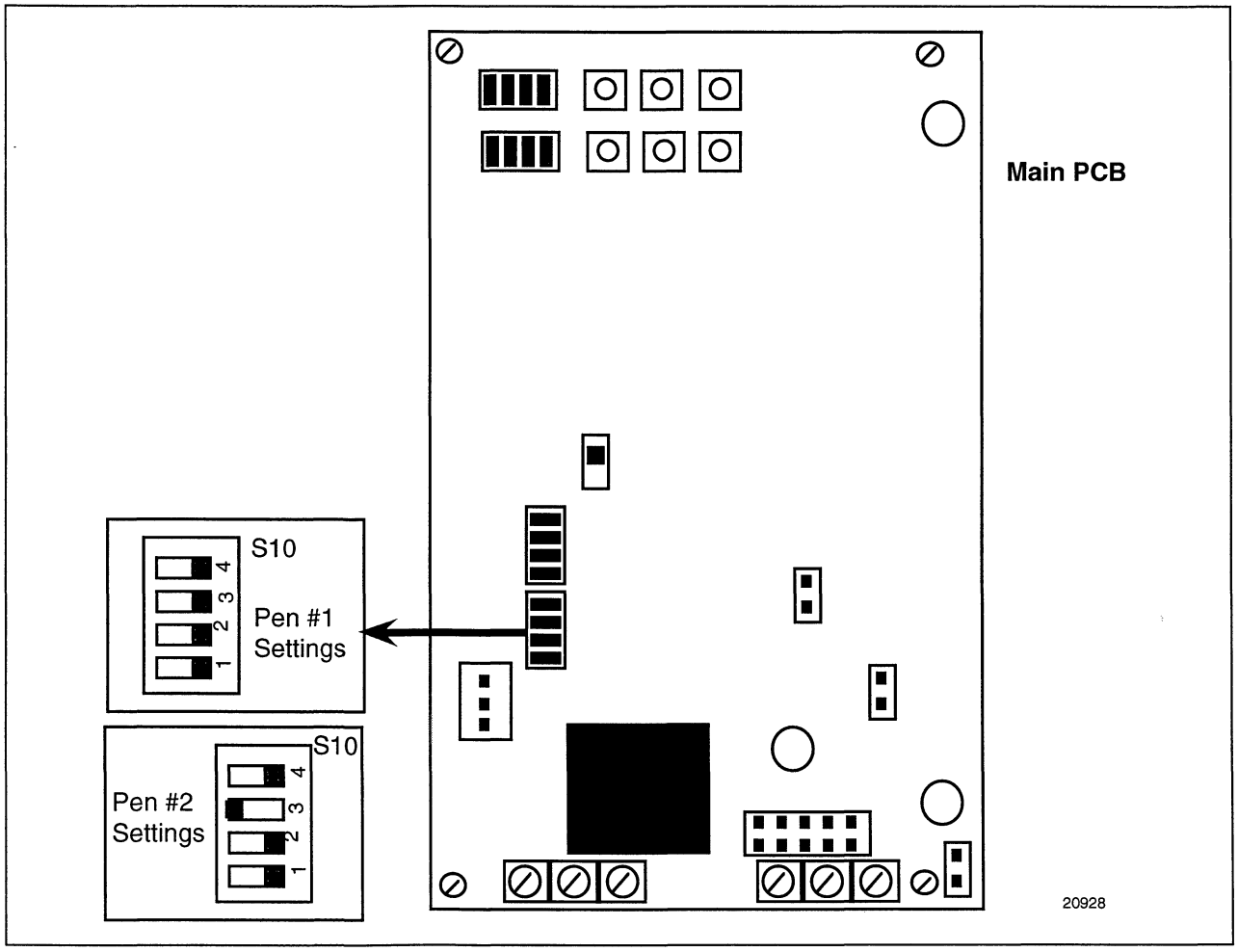
Introduction

Since the Main printed circuit board used for Pen #1 is identical to the one used for Pen #2, you must check the DIP switch S10, position 3, to be sure the Main PCB is configured to support the correct pen.

The Main printed circuit board for Pen #1 is always mounted on the right-hand side of the case, and the one for Pen #2 is always mounted on the left-hand side of the case. **The DIP switch is factory set for the correct pen.**

Refer to Figure 3-2 to check the Pen configuration.

Figure 3-2 Pen Configuration



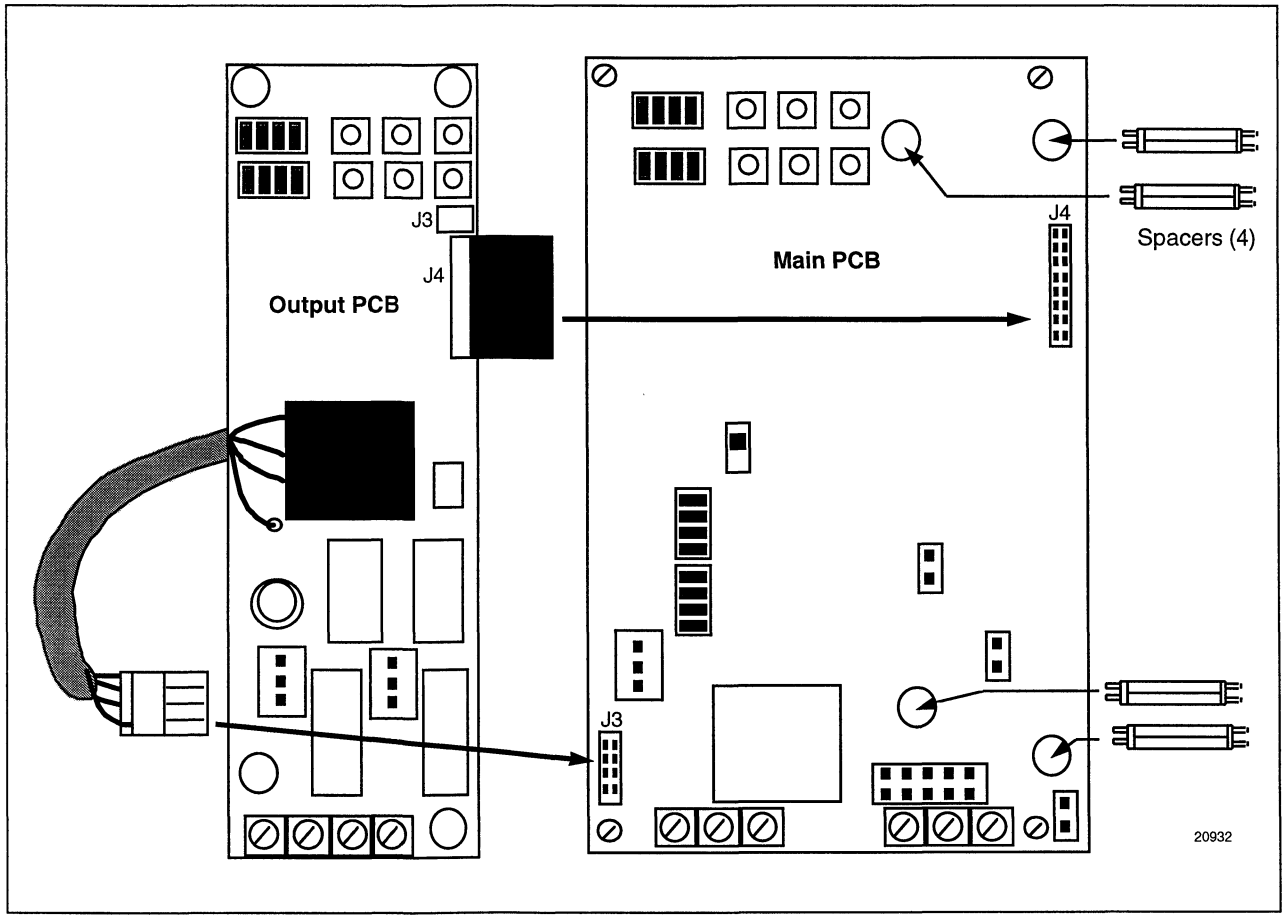
3.5 Mounting the Optional Relay Output Board

Introduction

If you ordered a recorder with relay output, you must mount the Relay Output printed circuit board on the Main printed circuit board. Refer to Figure 3-3 and follow the procedure in Table 3-3 to mount the board.

ATTENTION Be sure that you have set all the jumper positions on the Main printed circuit board before proceeding.
See *Section 2 - Recording Set Up*.

Figure 3-3 Mounting the Output Printed Circuit Board on the Main Printed Circuit Board



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Procedure

Follow the procedure in Table 3-3 to mount the Relay Output printed circuit board.

ATTENTION If Table I in the model number is 11, 22, or FF, repeat this procedure for the Main printed circuit board for Pen #2.

Table 3-3 Procedure for Mounting Relay Output Printed Circuit Board

Step	Action
1	Push the four plastic spacers (supplied with Output printed circuit board) into the holes on the right side of the Main printed circuit board for Pen #1 or Pen #2.
2	Hold the Output printed circuit board so that its mounting holes align with the spacers and plug the multi-pin connector from the Output printed circuit board into J4 connector on the Main printed circuit board. Be sure that the plug positions are aligned and matched with the pins on J4.
3	Push down on each corner of the Output printed circuit board in turn to seat the board on the spacers.
4	Plug the 4-pin connector from the transformer on the Output printed circuit board into the J3 connector on the Main printed circuit board.

3.6 Overview of Optional Relay Output Printed Circuit Board DIP Switch and Jumper Location

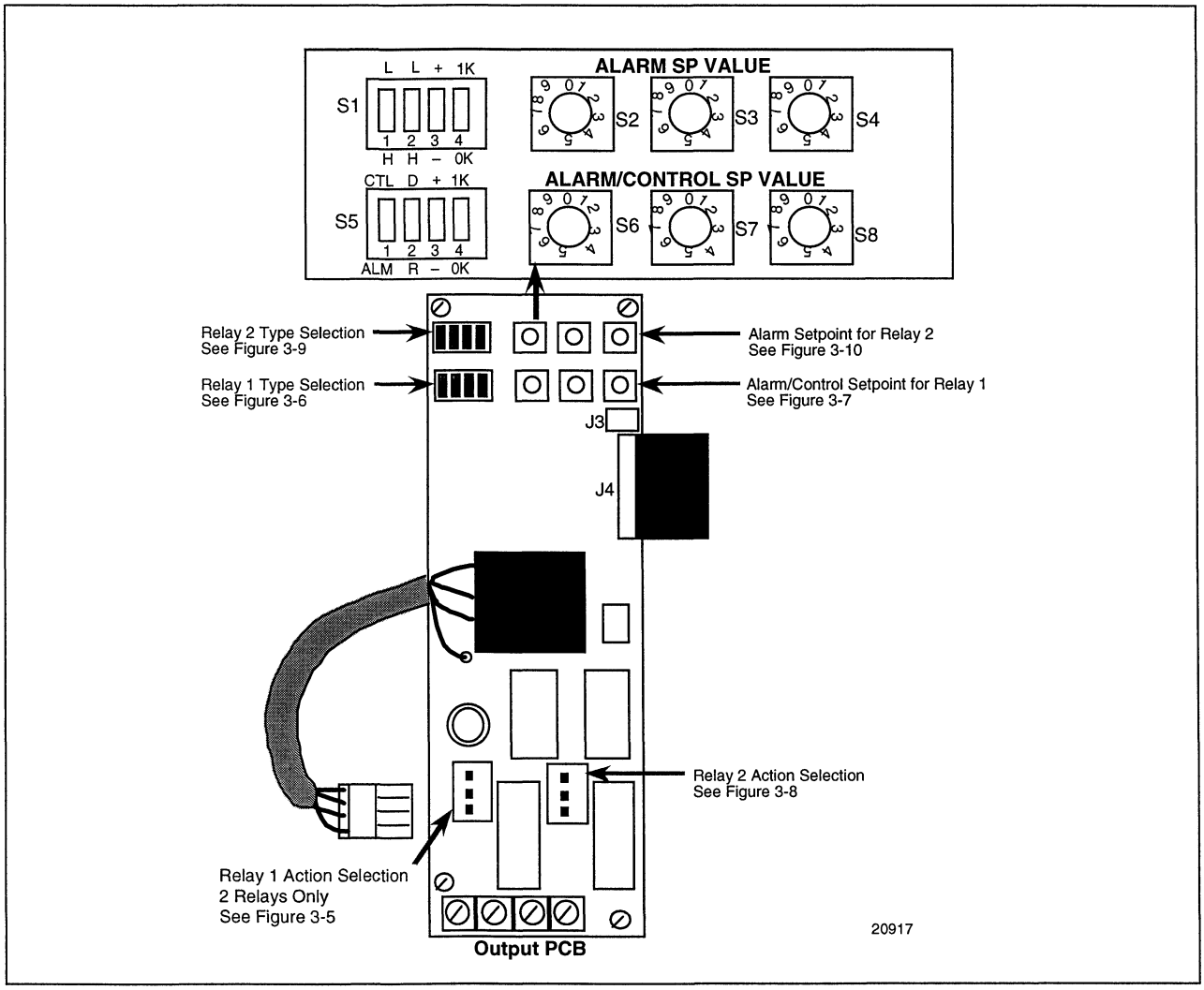
Introduction

Depending on the number of relays specified in Table I of the model number, you can configure the relay output function through the DIP switches on the Output PCB to be one of the following:

Output Function	Model Selection Table I =
Relay #1 is for ON/OFF Control & Relay #2 is for Alarm	20 or 22
Relays #1 and #2 are for Alarms	20 or 22
Relay #1 is for Alarm, ON/OFF Control, or Limit Control	10, 11, FO, or FF

Figure 3-4 is an overview of the DIP switch and jumper locations. Each location references a figure that contains the information you need to check or set the switches and jumpers.

Figure 3-4 Overview of Relay Output DIP Switch and Jumper Locations



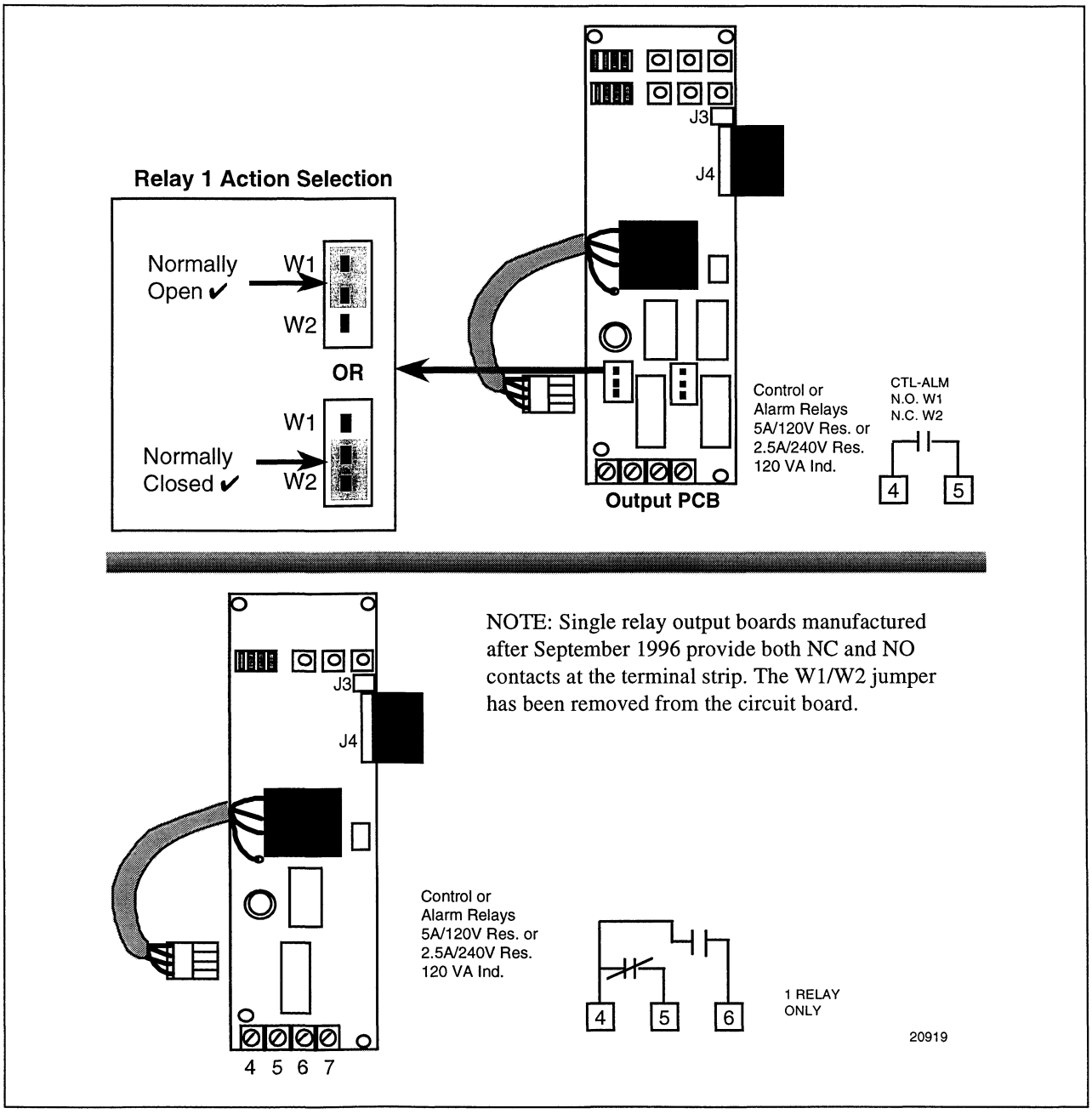
3.7 Selecting Relay #1 Action

Introduction

Figure 3-5 is a graphic view of the jumper locations for setting Relay #1 Action. Select the Output relay action as N.O. or N.C as shown in this figure. Note the selected action on the wiring label on the back of the chart plate for future reference.

This selection also applies for the Output PCB on the Main PCB for Pen #2, if Table I is 11, 22 or FF.

Figure 3-5 Jumper Locations for Relay #1 Action



3.8 Selecting Relay #1 Type

Introduction

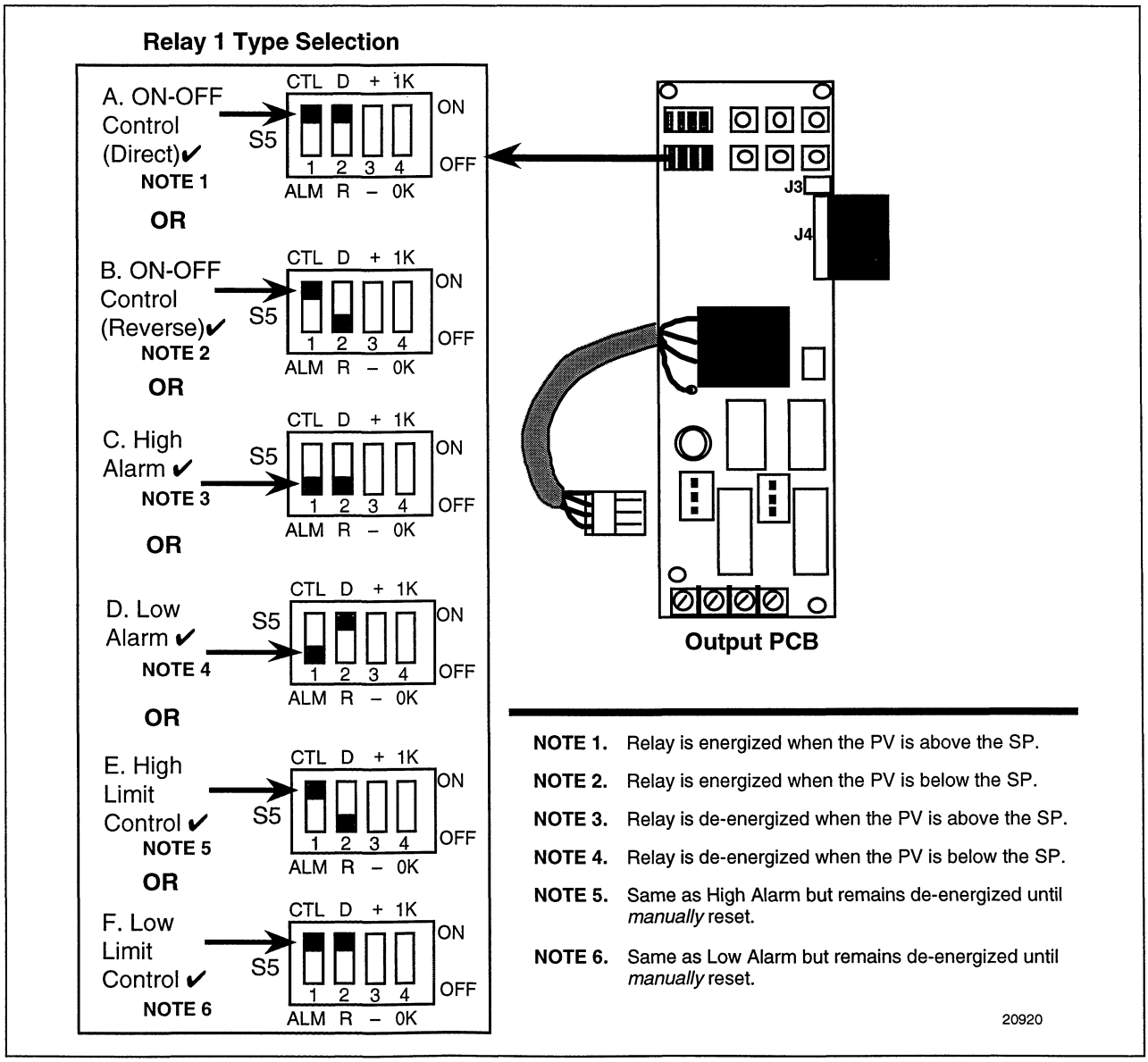
Figure 3-6 is a graphic view of the jumper locations for selecting Relay #1 Type. Set the DIP switches at location S5 as shown in this figure to select the desired Relay #1 Type. The selection can be one of the following:

- ON/OFF Control - Direct Action
- ON/OFF Control - Reverse Action
- High Alarm
- Low Alarm
- High Limit Control
- Low Limit Control

Note the selected action on the wiring label on the back of the chart plate for future reference.

ATTENTION If you select Limit Control refer to Figure 3-11 to install the manual reset switch required for Limit Control.

Figure 3-6 DIP Switch Settings for Relay #1 Type



3.9 Selecting Relay #1 Alarm/Control Setpoint

Introduction

You select the Relay #1 Setpoint for one of the Relay #1 types you have selected:

- Direct or Reverse acting ON/OFF control output
- High or Low Limit Control
- High or Low PV Alarm

Setpoint Value Limits

The setpoint value must be within the zero- and full-scale range for a given actuation type.

Be sure to use 0-100% scale values for linear inputs instead of actual measurement range values, and multiply the switch settings by 0.1 as for chart range values.

ON/OFF control

ON/OFF control operates on the sign of the error signal. Thus, for direct acting control, the output is ON whenever the PV is greater than the Setpoint; and for reverse acting control the output is ON whenever the PV is less than the Setpoint.

Hysteresis

Both the control and alarm actions have a fixed hysteresis of 1% of the chart range. This means that the output will turn ON at exactly the Setpoint value, but it won't turn OFF until the PV equals the SP minus the hysteresis value. The relays will de-energize during a power loss allowing this condition to be alarmed.

Procedure

Figure 3-7 is a graphic view of the S5 DIP switch settings and rotary switch locations for Control/Alarm setpoints. Follow the procedure in Table 3-4 and make the settings as shown in this figure.

Table 3-4 Selecting Relay #1 Alarm/Control Setpoint

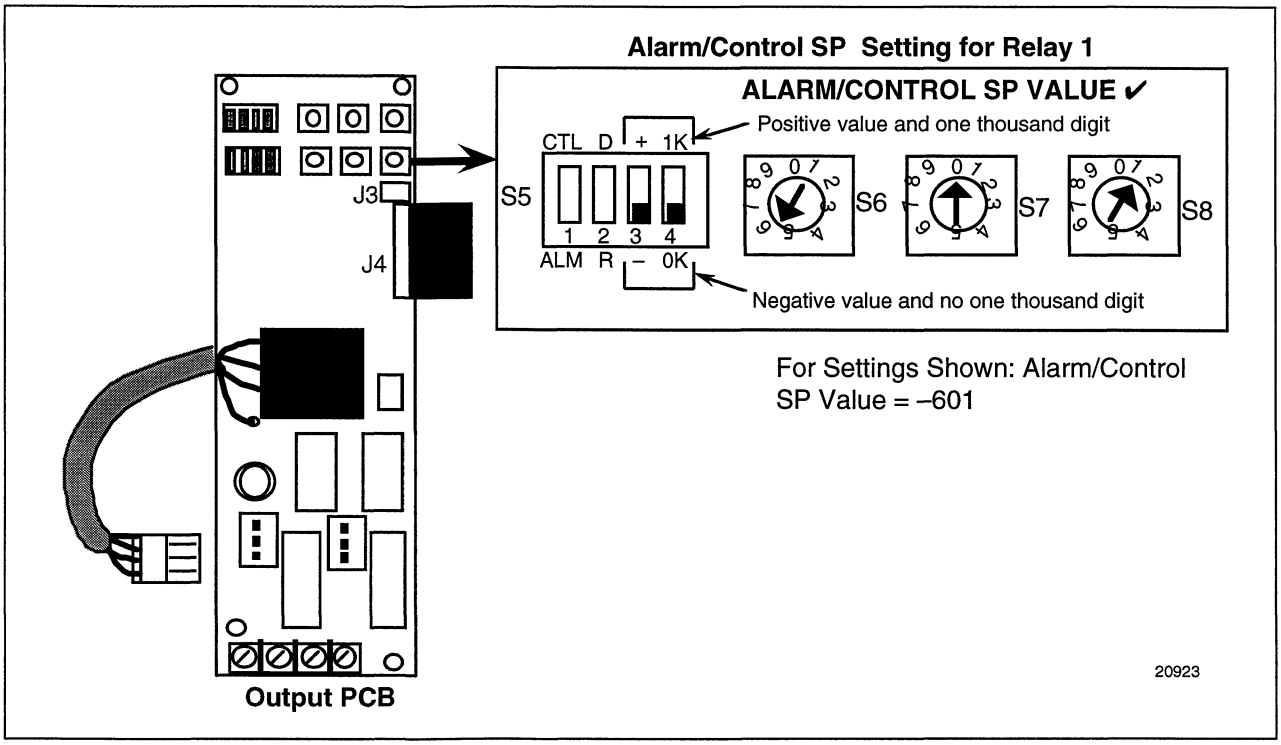
Step	Action
1	Locate DIP switch S5 in the upper left corner of the Output printed circuit board for Pen #1 or Pen #2.
2	Set position 3 to up/ON for a positive value, or down/OFF for a negative one.
3	Set position 4 to up/ON for one thousand digit, or down/OFF for a zero thousand digit.
4	Turn the arrow in the center of the rotary DIP switches S6, S7, and S8 to point to the desired number for 100, 10, and 1 digit places in Control or Alarm SP value for Relay #1.

Continued on next page

DIP switch and rotary switch locations

Figure 3-7 is a graphic view of the S5 DIP switch settings and rotary switch locations for Control/Alarm setpoints.

Figure 3-7 Relay #1 Control/Alarm Setpoints DIP Switch Settings



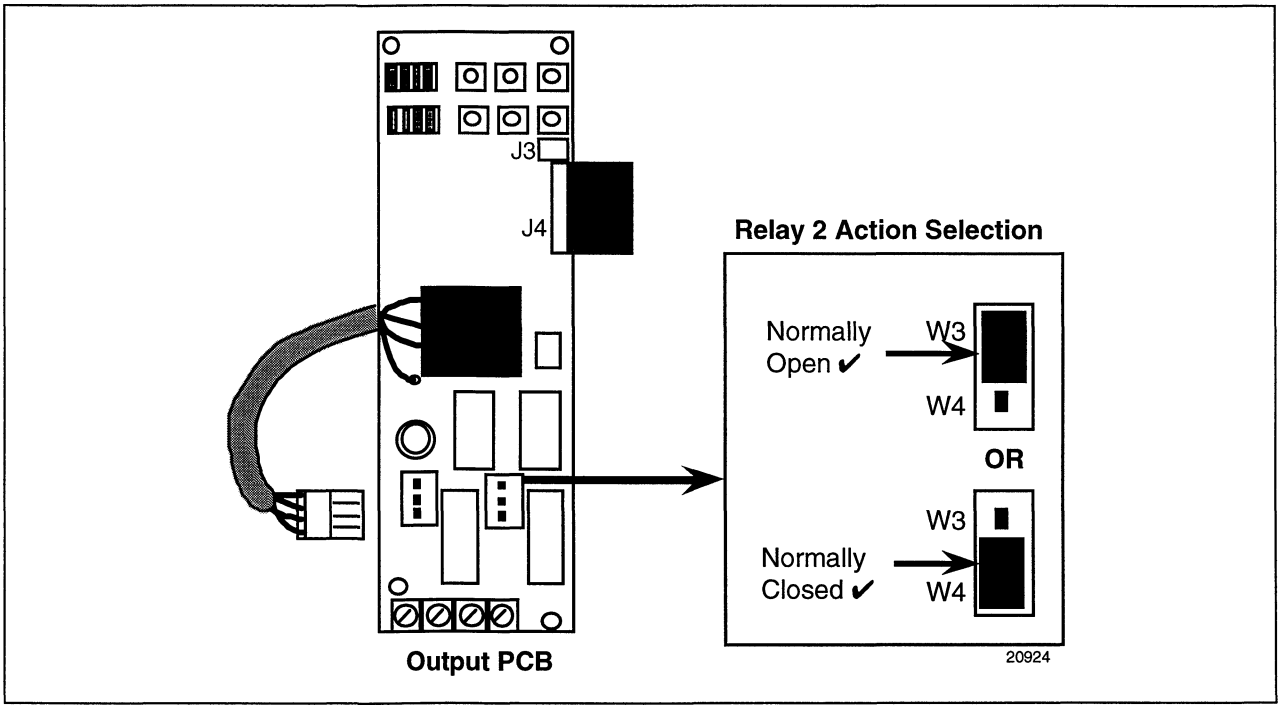
3.10 Selecting Relay #2 Action

Introduction

Figure 3-8 is a graphic view of the jumper locations for setting Relay #2 Action (Model Table I is 20 or 22 only). Select the Output relay action as N.O. or N.C as shown in this figure. Note the selected action on the wiring label on the back of the chart plate for future reference.

- This selection also applies for the Output printed circuit board on the Main printed circuit board for Pen #2, if Model Table I is 22.

Figure 3-8 Jumper Locations for Relay #2 Action



3.11 Selecting Relay #2 Type

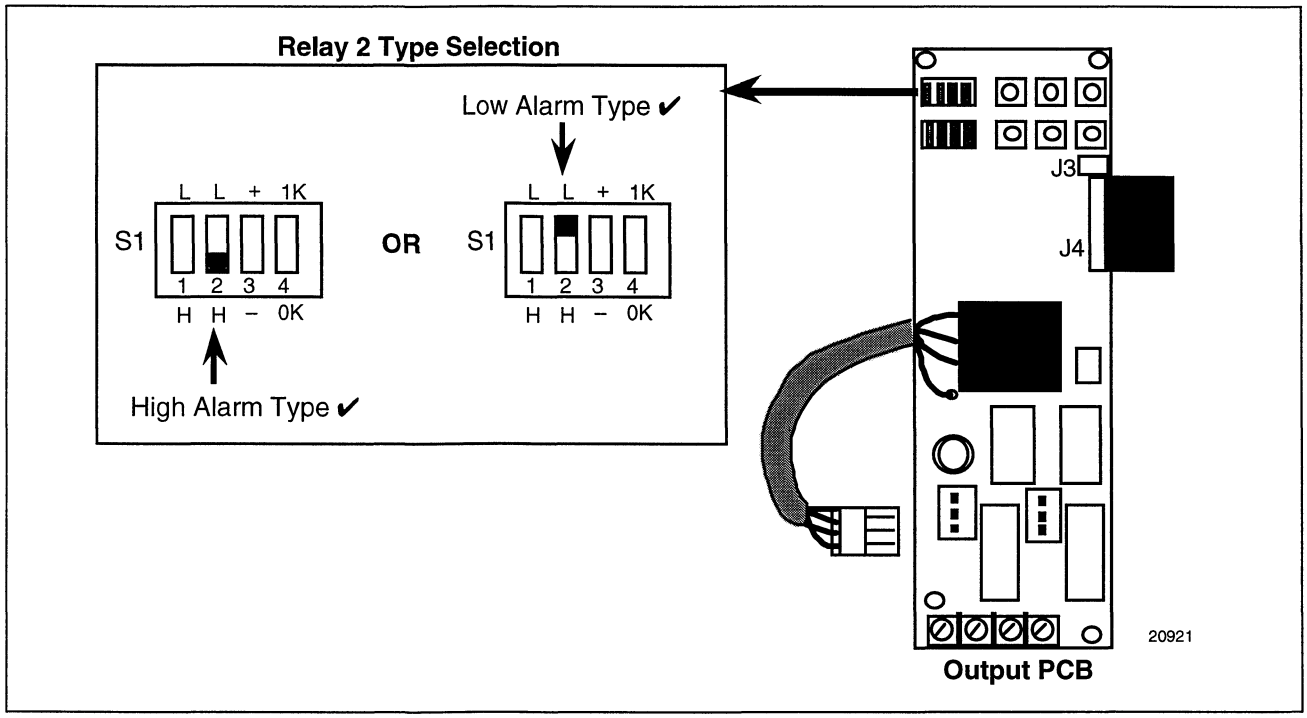
Introduction

Figure 3-9 is a graphic view of the jumper locations for selecting Relay #2 Type. Set the DIP switches at location S1 as shown in this figure to select the desired Relay #2 Type. The selection can be one of the following:

- High Alarm Type
- Low Alarm Type

Note the selected action on the wiring label on the back of the chart plate for future reference.

Figure 3-9 DIP Switch Settings for Relay #2 Type



3.12 Selecting Relay #2 Alarm Setpoint

Introduction

You select the Relay #2 Alarm Setpoint for one of the Relay #2 types you have selected:

- High Alarm Type
- Low Alarm Type

Hysteresis

Both the control and alarm actions have a **fixed hysteresis of 1%** of the chart range. This means that the output will turn ON at exactly the Setpoint value, but won't turn OFF until the PV equals the SP minus the hysteresis value. Also, alarms will still turn ON when power is removed from the recorder.

"No" alarm condition

A "NO" alarm condition energizes the alarm relay. Thus, if you want the relay to de-energize on an alarm condition, be sure to use the W4 jumper (refer to Figure 3-8).

Procedure

Figure 3-10 is a graphic view of the S1 DIP switch settings and rotary switch locations for Alarm setpoints. Follow the procedure in Table 3-5 and make the settings as shown in this figure.

Table 3-5 Selecting Relay #2 Alarm Setpoint

Step	Action
1	Locate DIP switch S1 in the upper left corner of the Output printed circuit board for Pen #1 or Pen #2.
2	Set position 3 to up/ON for a positive value, or down/OFF for a negative one.
3	Set position 4 to up/ON for one thousand digit, or down /OFF for a zero thousand digit.
4	Turn the arrow in the center of the rotary DIP switches S2, S3, and S4 to point to the desired number for 100, 10, and 1 digit places in Alarm SP value for Relay #2.

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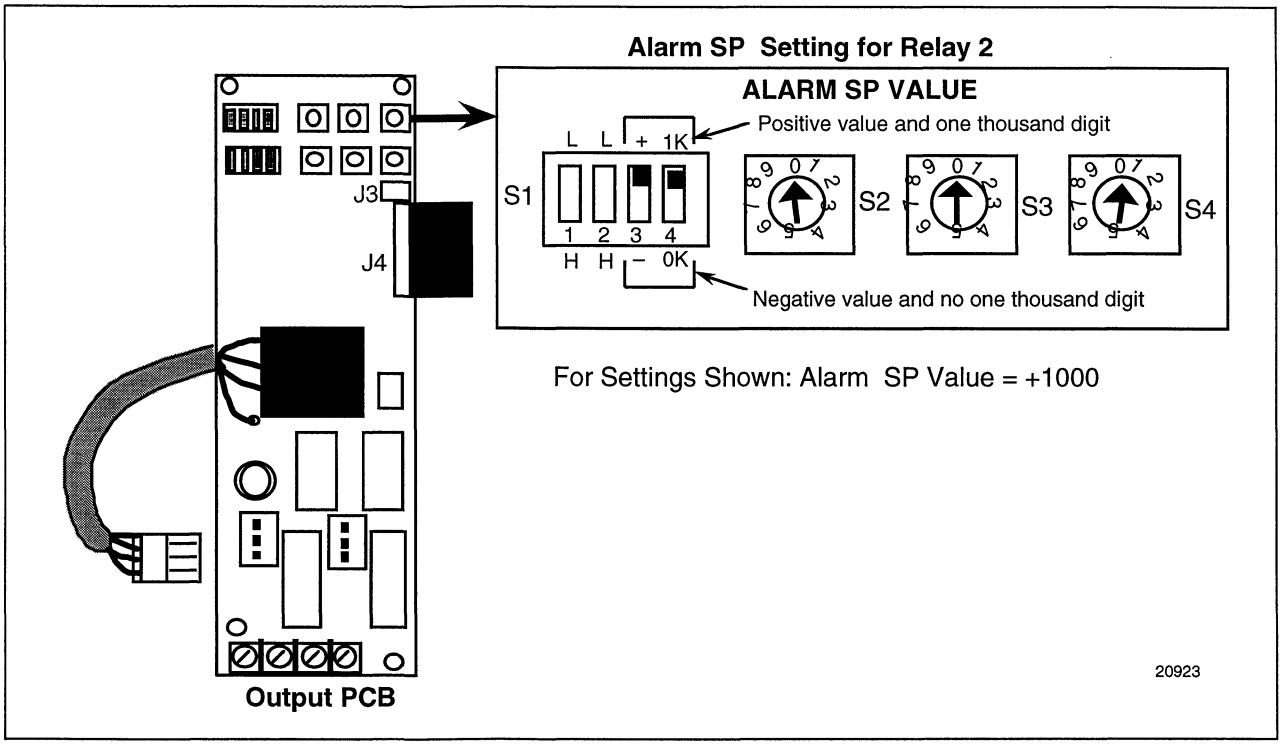
3.12 Selecting Relay #2 Alarm Setpoint, Continued

DIP switch and rotary switch locations

Figure 3-10 is a graphic view of the S1 DIP switch settings and rotary switch locations for Alarm setpoints.

Figure 3-10 Relay #2 Alarm Setpoints DIP Switch Settings



3.13 Installing a Manual Reset Switch for Limit Control

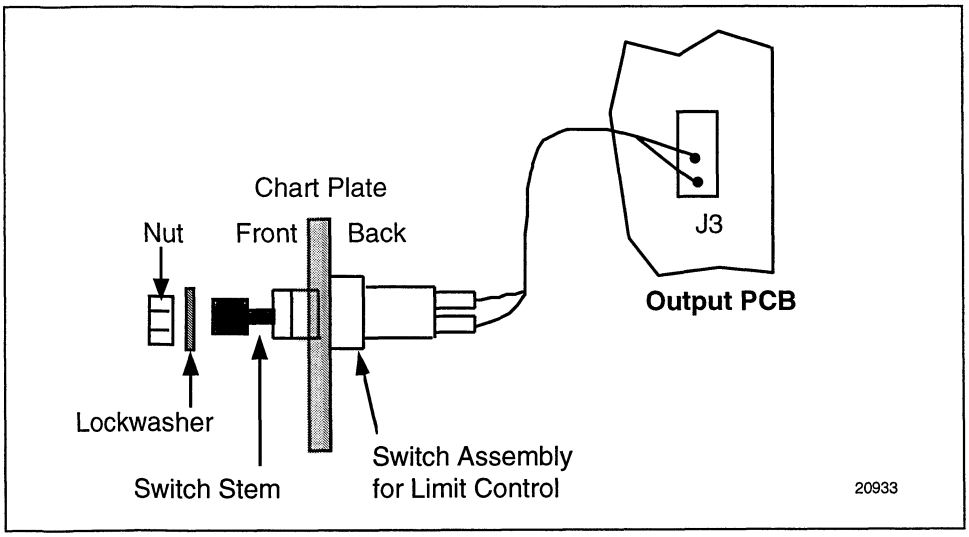
Introduction

If you have Limit Control, you must install the manual reset switch assembly supplied with the Output printed circuit board. Refer to Figure 3-11 and follow the procedure in Table 3-6.

Table 3-6 Installing the Manual Reset Switch

Step	Action
1	Route the 2-wire cable along side other cables from the Main printed circuit board to the back of the chart plate and secure it with cable ties or tape.
2	Remove the nut and lockwasher from the pushbutton switch stem. From the back of the chart plate, insert the switch stem into one of the 1/4" (6.4mm) holes in the upper left corner of the chart plate and secure the switch with the nut and lockwasher from the front of the chart plate.

Figure 3-11 Installing the Manual Reset Switch

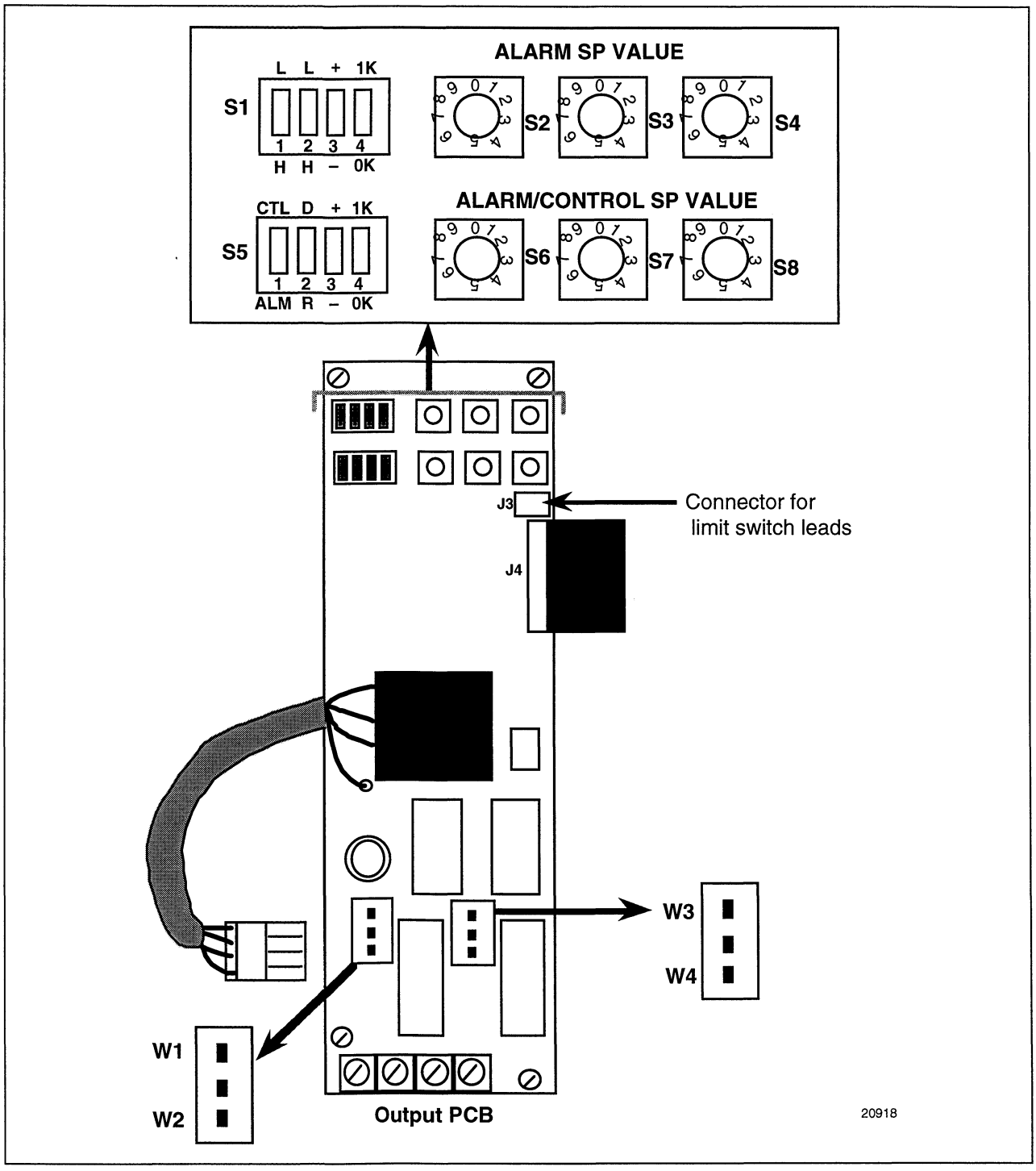


ATTENTION

- Refer to Figure 3-12 for a Configuration Worksheet for Relay Output #1.
- Refer to Figure 3-13 for a Configuration Worksheet for Relay Output #2.

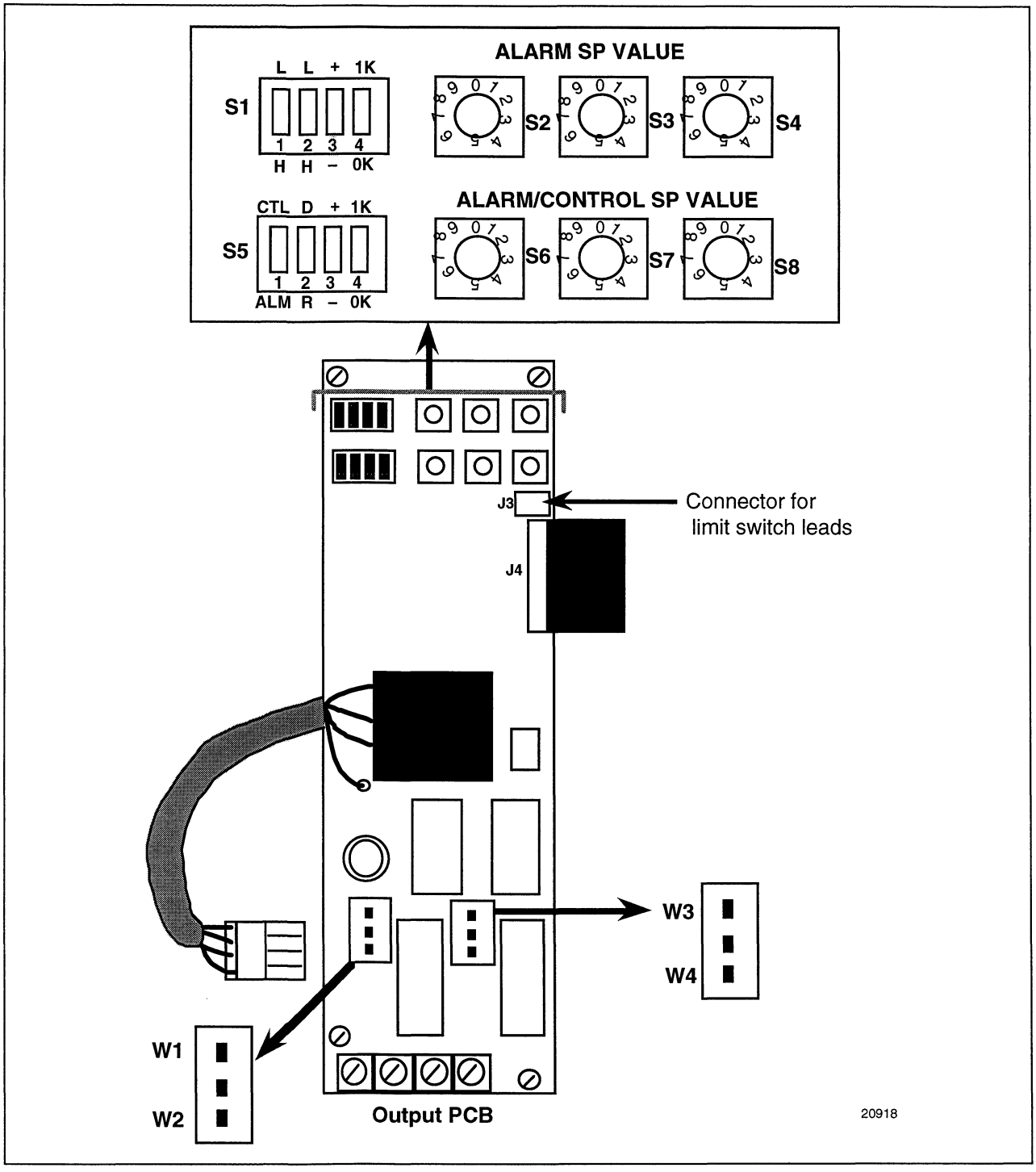
3.14 Configuration Worksheet for Relay Output #1

Figure 3-12 Configuration Worksheet for Relay Output #1



3.15 Configuration Worksheet for Relay Output #2

Figure 3-13 Configuration Worksheet for Relay Output #2



Section 4 – Installation

4.1 Overview

Introduction

Installation of the DR4200 Model GP Recorder consists of mounting and wiring the recorder according to the instructions given in this section.

Read the pre-installation information, check the model number interpretation in Section 1, and become familiar with your model selections, then proceed with installation.

What's in this section?

This section contains the following information:

Pre-installation information

If the recorder has not been removed from its shipping carton, inspect the carton for damage and remove the recorder. Inspect the unit for any obvious shipping damage and report any damage due to transit to the carrier.

- Make sure a bag containing mounting hardware is included in the carton with the recorder.
- Check that the model number shown on the chart plate agrees with what you have ordered.

CE Conformity special conditions (Europe)

Shielded twisted pair cables are required for all Analog I/O, Process Variable, RTD, Thermocouple, dc millivolt, low level signal, 4-20 mA, and computer interface circuits. Supplementary bonding of the recorder enclosure to a local ground, using a No. 11 ($4mm^2$) braided copper conductor, is required. Ferrite suppression filters (see Subsection 4.4 for Wiring Prerequisites) shall be installed on all cables connected to the recorder/controller.

Refer to Appendix B - Severe Electrical Noise Environments for additional installation guidance.

Continued on next page

Operating limits

We recommend that you review and adhere to the operating limits listed in Table 4-1 when you install your recorder.

Table 4-1 Operating Limits and Condensed Specifications

Condition	Specifications
Accuracy	See Appendix C
Ambient Temperature	32 to 131°F (0 to 55°C)
Relative Humidity	5 to 90% RH at 40°C (104°F)
Vibration **Frequency** **Acceleration**	 0 to 200Hz 0.5g
Mechanical Shock **Acceleration** **Duration**	 5g 30ms
Mounting Position from Vertical **Tilted Forward** **Tilted Backward** **Tilted to side(±)**	 5° 90° 20°
Power **Voltage(VRMS)** **Frequency(Hz)**	 102 to 132 Vac 204 to 264 Vac 49 to 51 Hz 59 to 61 Hz
Power Consumption	9 Watts Maximum
Type of Actuations	*Thermocouple:* J, K, or T *RTD:* Platinum 100 Ohms* *Linear:* 4–20mAdc, 0–20mAdc,0–50mVdc, 0–5Vdc, 1–5Vdc * IEC Alpha = 0.00385
Minimum Input Span	Range is fully configurable within span limitation of the sensing element.
Input Impedance	*0-20 mA dc, 4-20 mA dc:* 250 ohms *0-5 and 1-5 Vdc:* 200K ohms *RTD:* 13.3K ohms *All others:* 10 Megohms
Span Step Response Time	7 seconds maximum
Reproducibility	0.1 percent of span
Sampling Rate	Input sampled 2 times every 1.3 seconds
Input Filter	Analog with time constant of 3 seconds and digital with time constant of 1 second

Continued on next page

Table 4-1 Operating Limits and Condensed Specifications, continued

Condition	Specifications
Case	Molded, foamed-Noryl* with gasketed door to meet NEMA 3 enclosure requirements.
Pen	Disposable fiber-tip ink cartridge, line length per cartridge more than 1000ft (305m) *One Pen:* Purple *Two Pen:* Purple (pen one) and red (Pen two)
Chart	10.34-inch (260 mm) diameter chart with standard preprinted markings and a calibrated width of 4 inches (100 mm).
Wiring Connections	Screw terminals
Color	*Case:* Black *Door (standard):* Caribbean blue or gray
Weight	12 lbs (5.4 kg)
Mounting	Panel or surface mounted
Options	
Relay Output	Two SPST relays *Relay Contact Ratings:* Resistive Load: 5A @ 120 Vac or 2.5A @ 240 Vac. Inductive Load: 50 VA @ 120 Vac or 240 Vac.
Approval Bodies	UL, CSA, FM (Limit Control)
CE Conformity (Europe)	This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.
Product Classification	Class 1: Permanently connected, Panel/Surface Mounted Industrial Control Equipment with protective earthing (grounding). (EN 61010-1)
Enclosure Rating	Panel/Surface Mounted Equipment, IP 54. (ref. IEC 529)
Installation Category (Overvoltage Category)	Category II: Energy-consuming equipment supplied from the fixed installation. Local level appliances, and Industrial Control Equipment. (EN 61010-1)
Pollution Degree	Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (ref. IEC 664-1)
EMC Classification	Group 1, Class A, ISM Equipment (EN 55011, emissions), Industrial Equipment (EN50082-2, immunity)
Method of EMC Assessment	Technical File (TF)
Declaration of Conformity	Document #51197627-000

4.2 Mounting Considerations and Overall Dimensions

Physical considerations

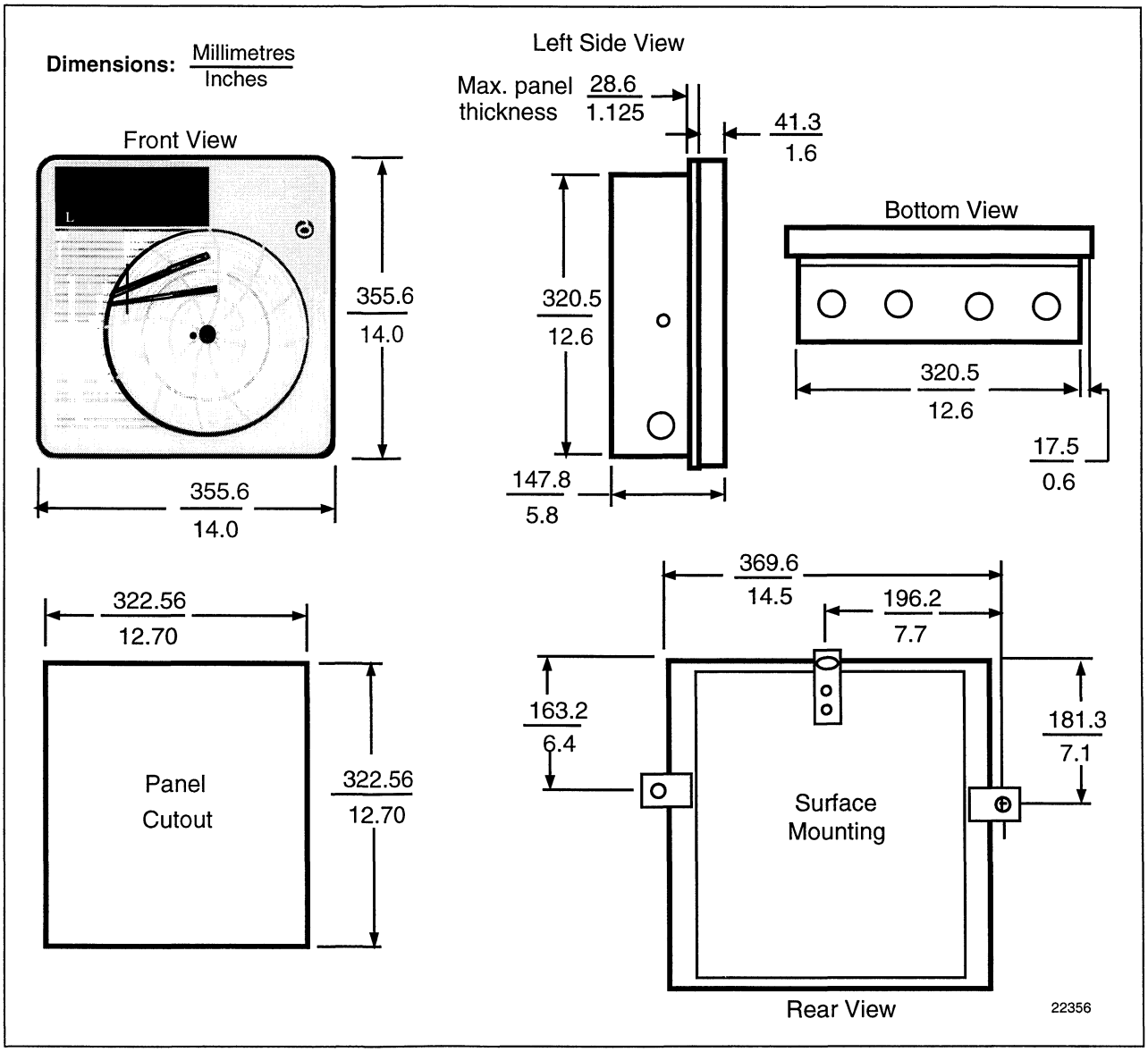
The recorder can be mounted flush in a panel or on the surface of a panel or wall using the mounting kit supplied with the recorder. Adequate access space must be available at the back of the panel for installation and servicing activities.

- The overall dimensions and panel cutout requirements for mounting the recorder are shown in Figure 4-1.

Overall dimensions

Figure 4-1 shows the overall dimensions for mounting the recorder.

Figure 4-1 Overall Dimensions



4.3 Mounting Methods

Introduction

There are two methods available for mounting your recorder. They are:

- Flush in Panel (New Panel Cutout)
- On Surface (of Panel or Wall)

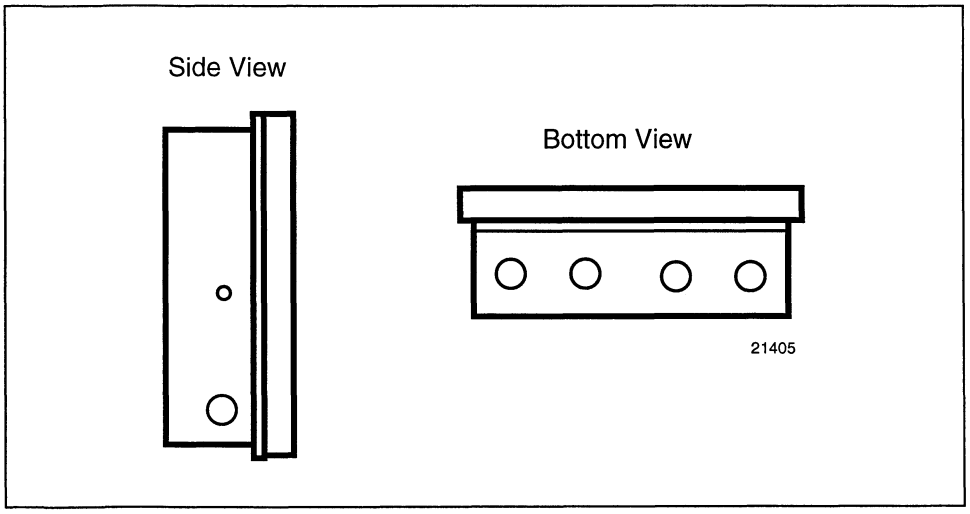
Procedures for each method follow. Choose the one that meets your mounting requirements. Use the associated dimension drawings for reference.

How to remove knockouts for conduits

Before you mount the recorder, remove the appropriate "knockouts" in the bottom and/or sides of the recorder case for wire entry via 1/2" (12.7mm) conduits. Refer to Figure 4-2 for knockout locations.

ATTENTION The knockouts are really plugs that you just have to push out to remove.

Figure 4-2 Knockout Locations



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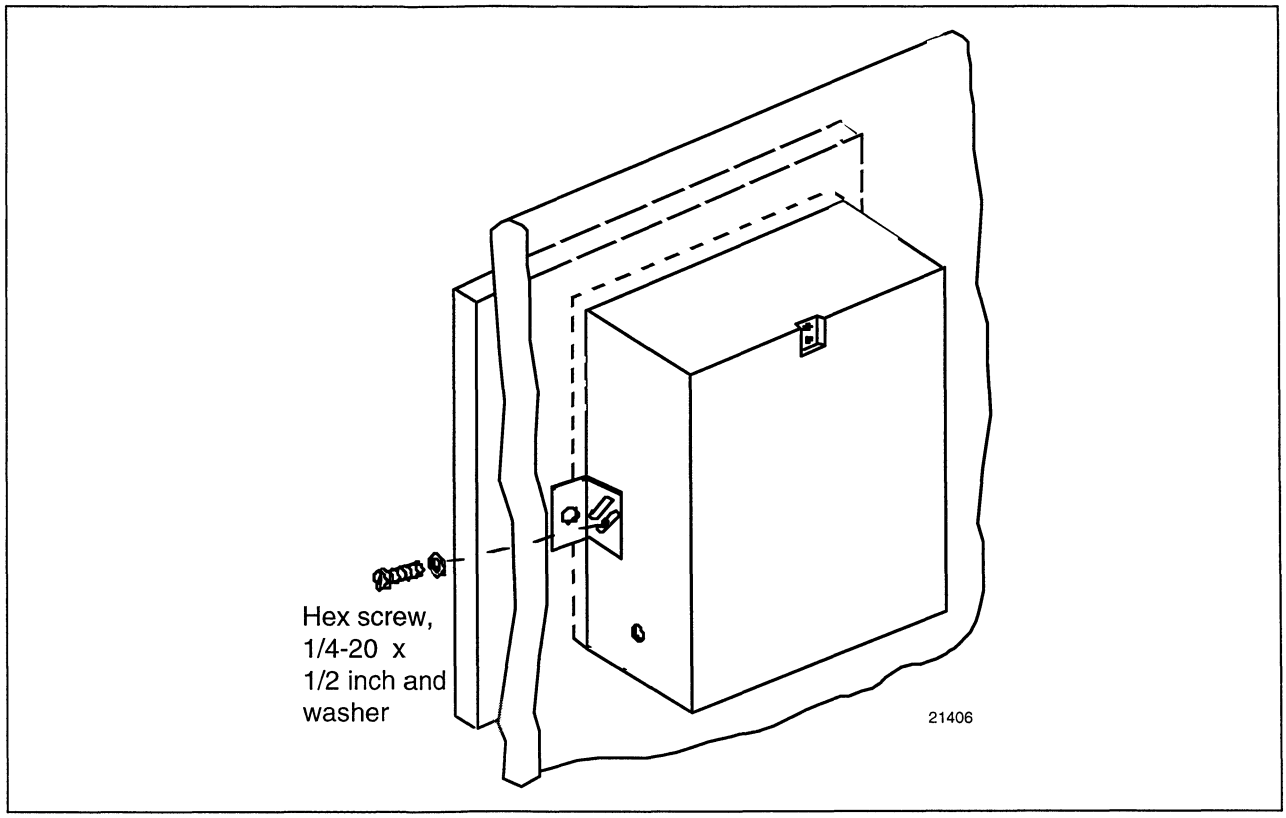
Mounting flush in panel (New panel cutout)

Refer to Figure 4-3 and follow the procedure in Table 4-2 to make a new cutout in a panel and mount your recorder in the cutout.

Table 4-2 Mounting Flush in a New Panel Cutout

Step	Action
1	At the appropriate location, make a square cutout in the panel measuring 12.7 ±0.060 inches by 12.7 ±0.060 inches (322.56 ±1.52 by 322.56 ±1.52 millimeters). See Figure 4-3.
2	Orient the recorder case properly and slide it into the cutout from the front of the panel. Support the recorder as shown in steps 3 and 4.
3	Refer to Figure 4-3. From the back of the panel, attach a mounting bracket to each side of the recorder case using a 1/4-20 x 1/2 inch hex screw for each bracket (mounting hardware supplied with recorder). Leave the screws slightly loose so you can adjust the brackets.
4	While holding the recorder firmly against the panel, slide each bracket against the back of the panel and tighten the screws.

Figure 4-3 Mounting Flush in a New Panel Cutout



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Mounting on surface (of panel or wall)

Refer to Figure 4-4 and follow the procedure in Table 4-3 to mount your recorder on a surface (Panel or Wall).

ATTENTION Three (3) screws must be supplied by the user for attaching the mounting hardware (brackets and support hook) to panel or wall.

Table 4-3 Mounting Flush on a Surface (of Panel or Wall)

Step	Action
1	Using two flat-head 10-32 x 1/4-inch screws supplied with the recorder, fasten the support hook into the recess at the back of the recorder case as shown in Figure 4-4.
2	Using 1/4-20 x 1/2-inch hex screws and lockwashers, attach a mounting bracket to each side of the case. Leave the screws slightly loose so as to permit some adjustments of the brackets.
3	On the panel, mark the locations for the three holes, as shown by the hole pattern in Figure 4-4.
4	Using a drill of appropriate size for user-supplied screws, drill a hole in the front of the panel for the eye of the support hook.
5	Insert the screws for the support hook into the panel, allowing the screw head to protrude approximately 5/16-inch.
6	Hang the recorder support hook on the screw. Make sure that the locations for the other two holes (marked in step three) are correct. If not, make sure that the recorder is aligned vertically, and use the brackets as templates to mark the proper locations.
7	Remove the recorder from the panel and drill the other two holes.
8	Hang the recorder on the screw by the support hook and insert the other two user-supplied screws through the brackets into the panel. Tighten the two hex screws that attach the brackets to the case.

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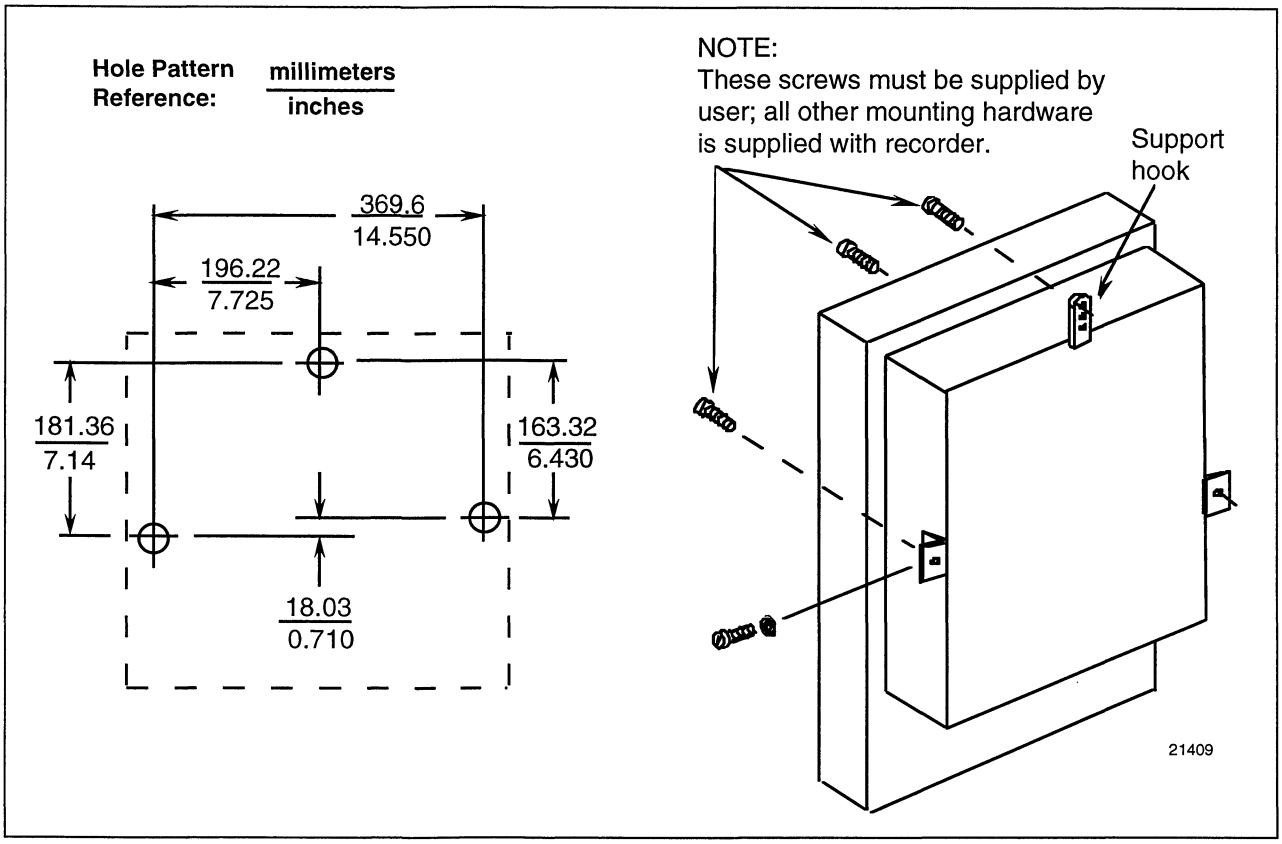
Mounting on surface (of panel or wall), continued

Figure 4-4 Mounting Flush on a Surface (of Panel or Wall)



4.4 Wiring Prerequisites

Electrical considerations

The recorder is considered "rack and panel mounted equipment" per EN 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements.

Recorder grounding

PROTECTIVE BONDING (grounding) of this recorder shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the recorder enclosure to a local ground, using a No. 11 (4 mm^2) braided copper conductor, is recommended.

CE Conformity Special Conditions (Europe)

Shielded cables with a drain wire are required for all Input I/O and Output Relay cables. All instrument shielded cable drain wires must be connected to a low impedance earth ground at the entry fitting. Cable/conduit entry fittings shall effectively terminate the cable shield connecting the shield to the enclosure conductive coating. The shielded cable shield shall not extend into the instrument closure.

Inside of the enclosure, the user must install ferrite suppression filters on all wires connected to the recorder. ©Fair-Rite Products Corp. part number 0443164151, or equivalent, shall be installed as shown in Figures 4-5 to 4-10, one filter for each circuit group. Cable with an outer jacket diameter larger than 6.7 mm (0.264 in.) may require the outer jacket to be removed to fit the required one turn in the filter, or the selection of a different cable.

Taking electrical noise precautions

Electrical noise is composed of unabated electrical signals which produce undesirable effects in measurements and control circuits.

Digital equipment is especially sensitive to the effects of electrical noise. Your recorder has built-in circuits to reduce the effect of electrical noise from various sources. If there is a need to further reduce these effects:

- **Separate External Wiring** - separate connecting wires into bundles (see Table 4-4) and route the individual bundles through separate conduits or metal trays.
- **Use Suppression Devices** - for additional noise protection, you may want to add suppression devices at the external source. Appropriate suppression devices are commercially available.

NOTE For additional noise information, refer to *Section 9 - Appendix B.*

Continued on next page

Permissible wire bundling

Table 4-4 shows which wire functions should be bundled together.

Table 4-4 Permissible Wiring Bundling

Bundle No.	Wire Functions
1	• Line power wiring • Earth ground wiring • Control relay output wiring • Line voltage alarm wiring
2	Analog signal wire, such as: • Input signal wire (thermocouple, 4 to 20 mA, etc.) • 4-20mA output signal wiring
3	• Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits

Identify your wiring requirements

To determine the appropriate diagrams for wiring your recorder, refer to the model number interpretation in *Section 1 - Overview* . The model number of the recorder can be found on the chart plate.

4.5 Input Wiring Procedures

Wiring the recorder

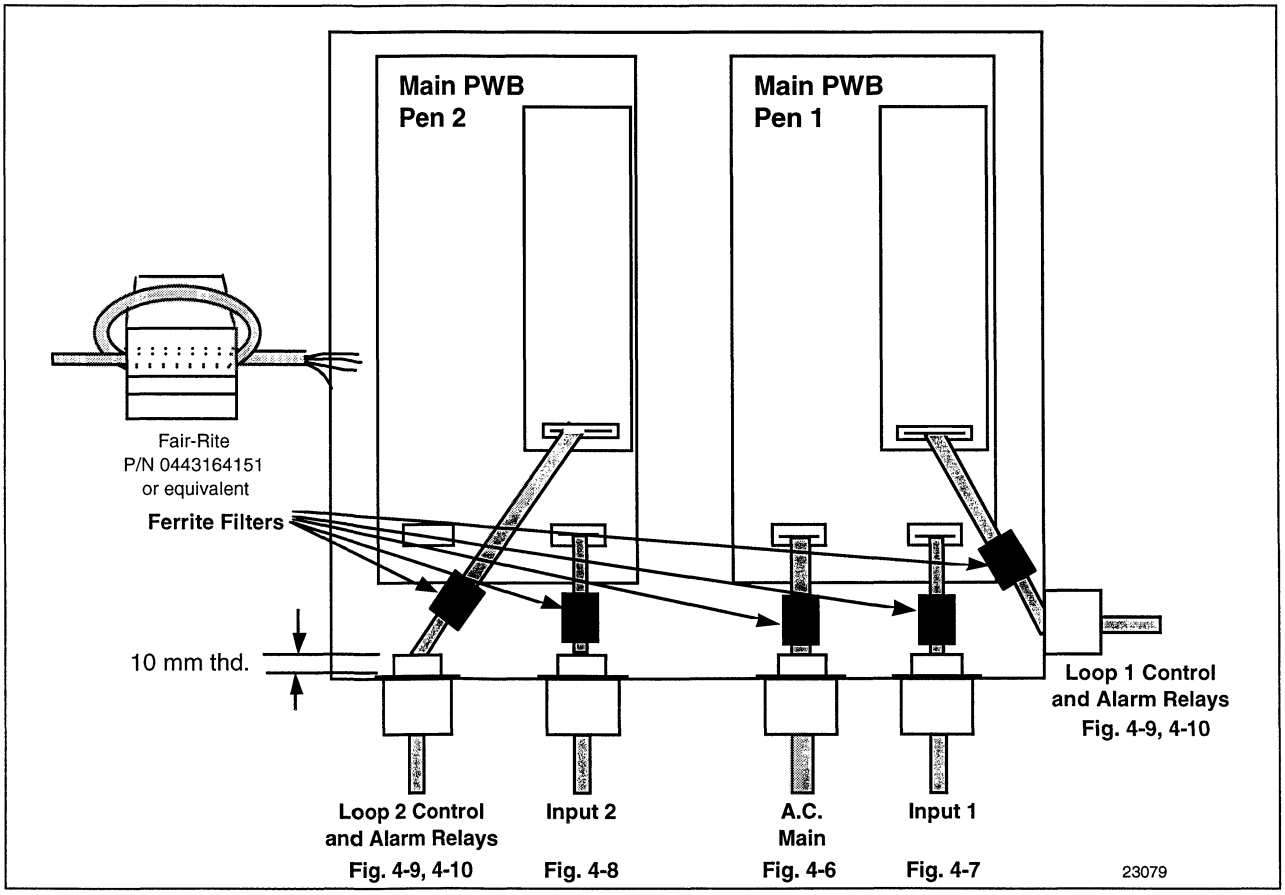
Using the information contained in the model number, select the appropriate wiring diagrams from the figures listed below and wire the recorder accordingly.

Wiring Requirements	Figure
Ferrite Filter Locations (CE Mark)	4-5
AC Line Power	4-6
Input 1	4-7
Input 2	4-8
Relay Output (1 or 2 pen)	4-9
Relay Output (2 pens)	4-10

Ferrite filter locations (CE Mark)

Inside of the enclosure, install ferrite suppression filters on all wires connected to the recorder. ©Fair-Rite Products Corp. part number 0443164151, or equivalent, shall be installed as shown in Figures 4-5, one filter for each circuit group. Cable with an outer jacket diameter larger than 6.7 mm (0.264 in.) may require the outer jacket to be removed to fit the required one turn in the filter, or the selection of a different cable.

Figure 4-5 Ferrite Filter Locations (CE Mark)



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AC Line Power

Refer to Figure 4-6 and follow the procedure in Table 4-5 to connect the AC line power.

WARNING Be sure that the line voltage is OFF before connecting the power wires to the recorder.

This equipment is suitable for connection to 120/240 Vac, 50/60 Hz, power supply mains. It is the user's responsibility to provide a switch and non-time delay (North America), quick-acting, high breaking capacity, Type F, (Europe) 1/2 A, 250 V fuse(s) or circuit-breaker as part of the installation. The switch or circuit-breaker shall be located in close proximity to the recorder, within easy reach of the OPERATOR. The switch or circuit-breaker shall be marked as the disconnecting device for the recorder.

Table 4-5 AC Line Power Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate terminal block TB1 on the bottom left edge of the Main printed circuit board for pen 1 (refer to Figure 4-6).
3	Run the power wires separately through second conduit from the right on the bottom of the case.
4	For CE Mark conformity, install the ferrite filter as shown in figure 4-5.
5	Strip 3/4-inch maximum of insulation from the end of each wire and form end to fit under a screw connection.
CAUTION To avoid damaging the recorder, be sure that you install the power wires into the correct screw terminals. **Be sure you have positioned Jumper W1 (See Section 2 - Set Up) to match the given supply voltage rating - 120 or 240 Volts for both pen 1 and pen 2 Main printed circuit boards. The factory setting is 120 Volts.**	
6	Insert the *green* wire (G) under the first screw from the right, the *white* wire (N/L2) under the second screw from the right, and the *black* wire (L/L1) under the third screw from the right. Tighten the screws to secure the wires. **ATTENTION** On recorders with two pens, an internal cable channels power to TB1 on the main printed circuit board for pen 2 from TB1 on the main printed circuit board for pen 1.
7	Dress the wires as slack as possible. This keeps the noise signal on these wires from bypassing built-in suppression. Also, do not bundle any low level signal wires with the power wires. Refer to Table 4-4 for permissible wire bundling. Refer to Appendix B for additional information concerning noise interference prevention.
WARNING Input line voltage will be present on the instrument ground plane if safety ground is not attached.	

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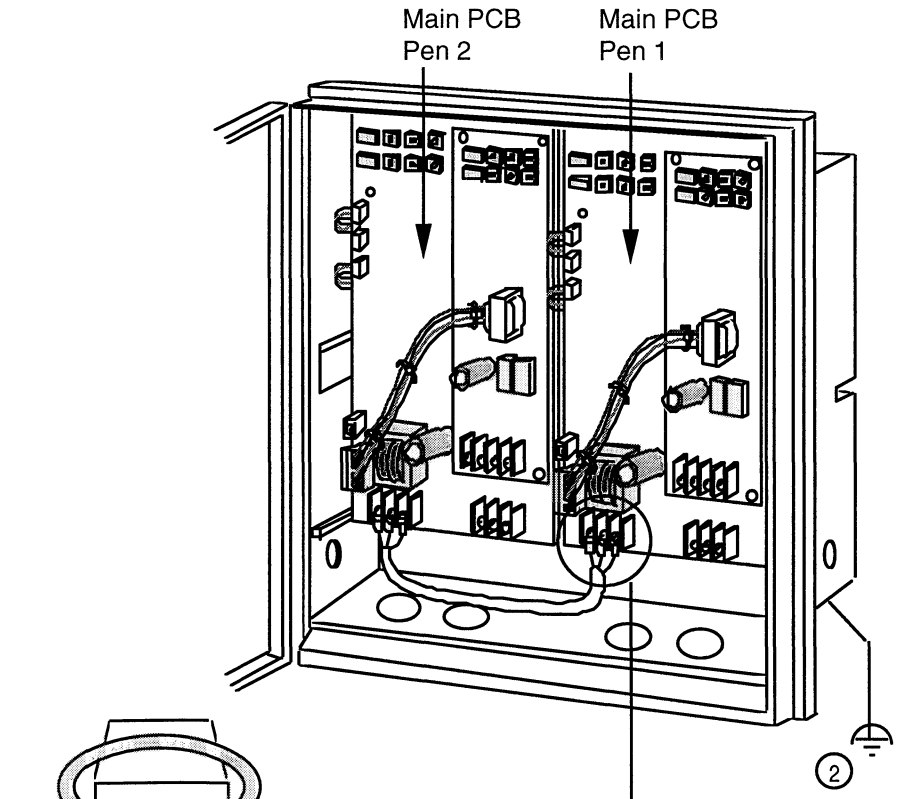
AC line power, continued

Figure 4-6 AC Line Power Wiring



(1) It is the user's responsibility to provide a switch and non-time delay (North America), quick-acting, high breaking capacity, Type F, (Europe) 1/2 A, 250 V fuse(s) or circuit-breaker as part of the installation.

(2) PROTECTIVE BONDING (grounding) of this recorder and the enclosure in which it is installed shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the recorder enclosure to a local ground, using a No. 11 (4 mm2) braided copper conductor, is recommended.

(3) Required for CE Mark Conformity - Kit supplied, Part No. 51197612-502, contains 2 ferrite filters. More than one kit may be supplied. Install inside of case, see Figure 4-5.

Continued on next page

Input 1

You can wire Input 1 for Thermocouple, RTD, mA, mV, or Volt actuations. Refer to Figure 4-7 and follow the procedure in Table 4-6 to wire the input.

ATTENTION Make sure you have configured the recorder to accept the desired input type. Refer to *Section 2 - Recording Set Up.*

Table 4-6 Input 1 Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate terminal block TB2 on the bottom right edge of the Main printed circuit board for pen 1 (refer to Figure 4-7).
CAUTION Remove the factory installed jumper across the (–) and (R) terminals on TB2 before making input connections.	
3	Run the input wires through the desired conduit - DO NOT bundle them with the power wires.
4	For CE Mark conformity, install the ferrite filter as shown in figure 4-5.
5	Strip 3/4-inch maximum of insulation from the end of each wire and form end to fit under a screw connection.
6	Insert the wires under the appropriate screws for the applicable input type. See Figure 4-7 for specific input actuation wiring. Tighten the screws to secure the wires.

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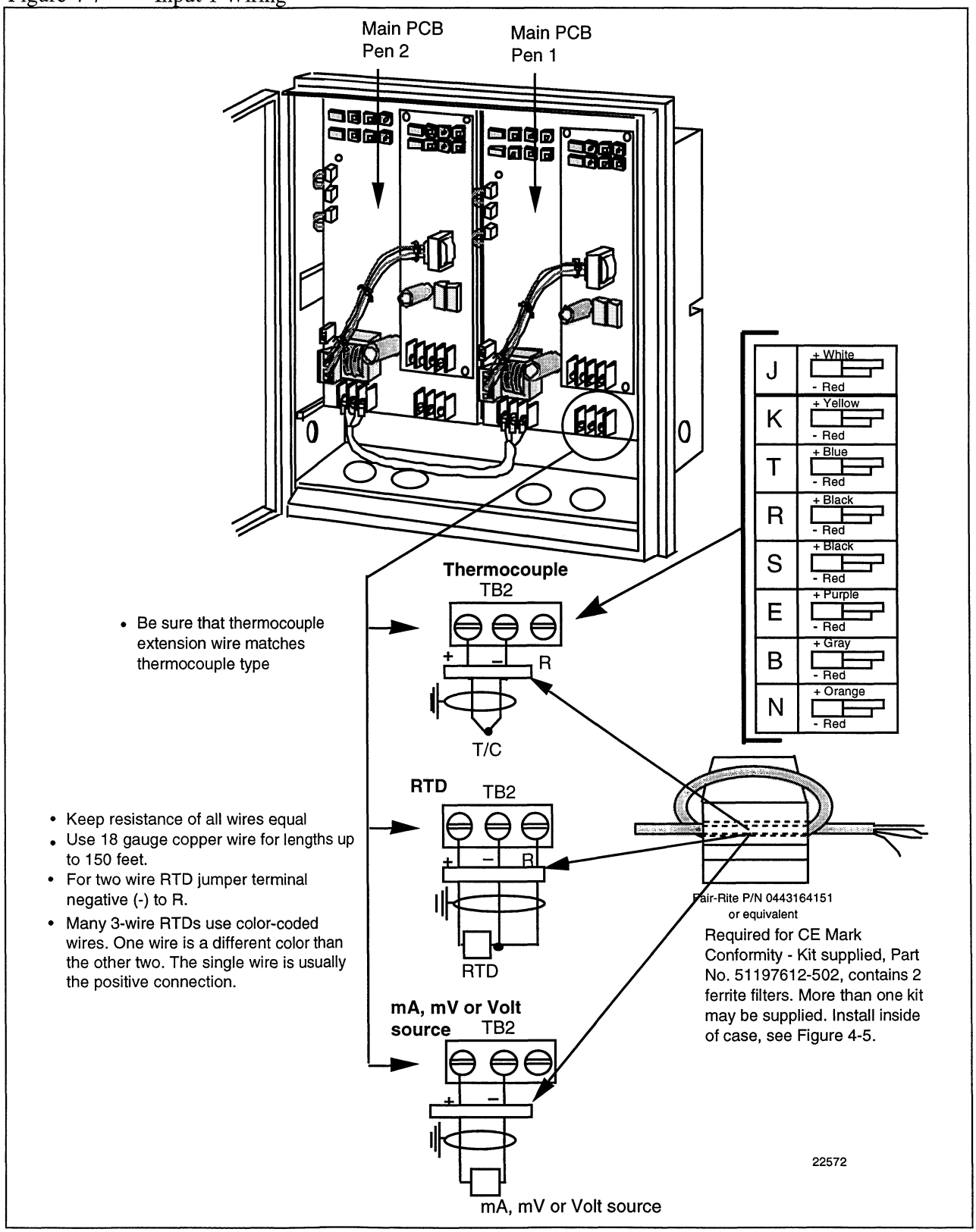
Input 1, continued

Figure 4-7 Input 1 Wiring



Input 2

You can wire Input 2 for Thermocouple, RTD, mA, mV, or Volt actuations. Refer to Figure 4-8 and follow the procedure in Table 4-7 to wire the input.

ATTENTION Make sure you have configured the recorder to accept the desired input type (refer to *Section 2 - Recording Set Up*).

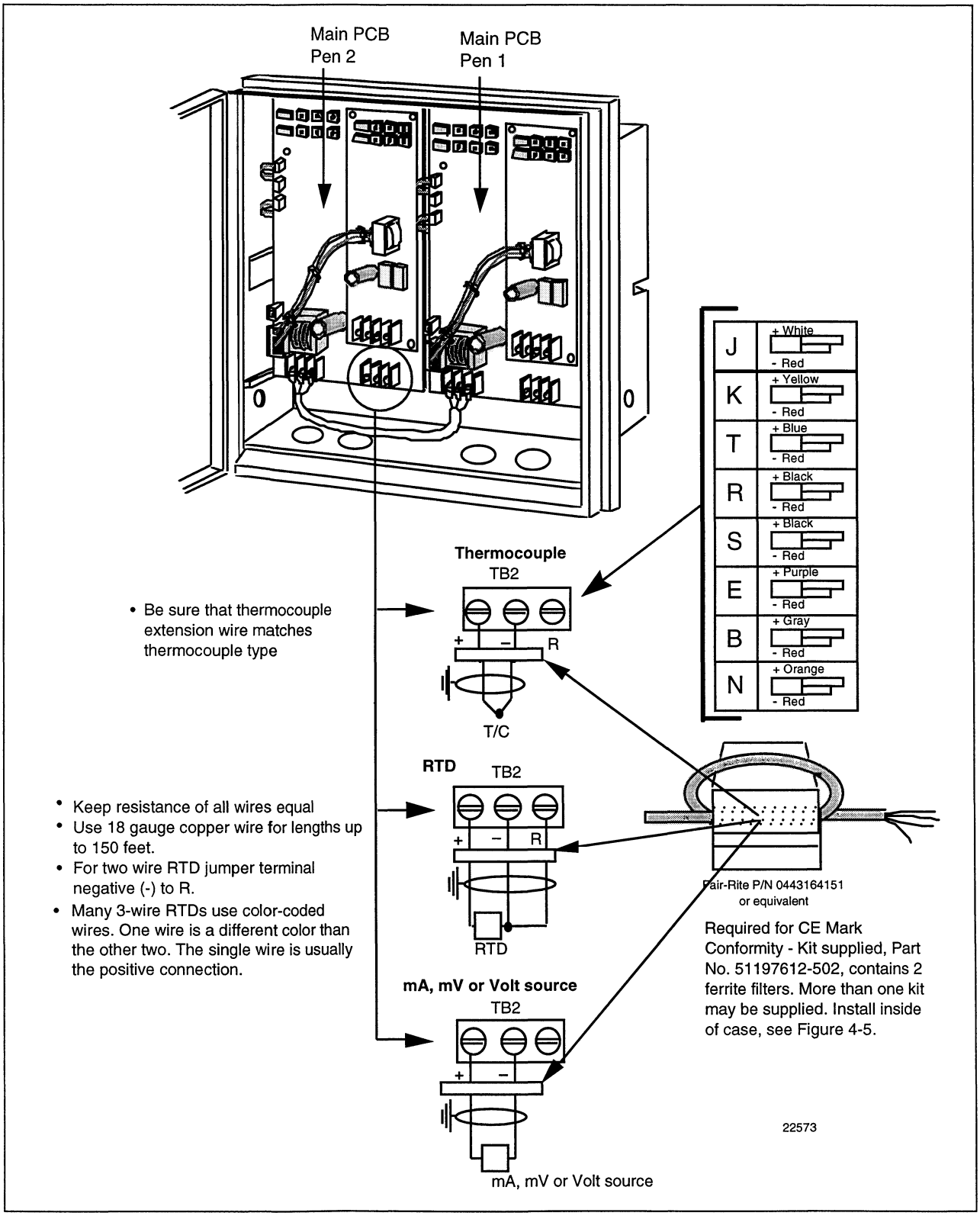
Table 4-7 Input 2 Wiring

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate terminal block TB2 on the bottom right edge of the main printed circuit board for pen 2 (refer to Figure 4-8).
CAUTION Remove the factory installed jumper across the (–) and (R) terminals on TB2 before making input connections.	
3	Run the input wires through the desired conduit - DO NOT bundle them with the power wires.
4	For CE Mark conformity, install the ferrite filter as shown in Figure 4-5.
5	Strip 3/4-inch maximum of insulation from the end of each wire and form end to fit under a screw connection.
6	Insert the wires under the appropriate screws for the applicable input type. See Figure 4-8 for specific input actuation wiring. Tighten the screws to secure the wires.

Continued on next page

Input 2, continued

Figure 4-8 Input 2 Wiring



4.6 Output Wiring Procedures

Relay output wiring (1 or 2 Pen Models)

The insulation of wires connected to the Relay Output terminals shall be rated for the highest voltage involved. Extra Low Voltage (ELV) wiring (input, current output, and low voltage control/alarm circuits) shall be separated from HAZARDOUS LIVE (>30 Vac, 42.4 Vpeak or 60 Vdc) wiring per Table 4-4.

You can wire the Relay Output as follows:

For 1 Relay - Pen 1 or Pen 2
(Model Number Table 1 = 10, 20, F0),

or

For 2 Relays - Pen 1 or Pen 2
(Model Number Table 1 = 11, 22, FF, 2F)

ATTENTION

Make sure you have configured the recorder to provide the desired control/alarm function and action, as applicable. Refer to *Section 2 - Set Up*.

Refer to Figure 4-9 and follow the procedure in Table 4-8 to wire the Relay Outputs.

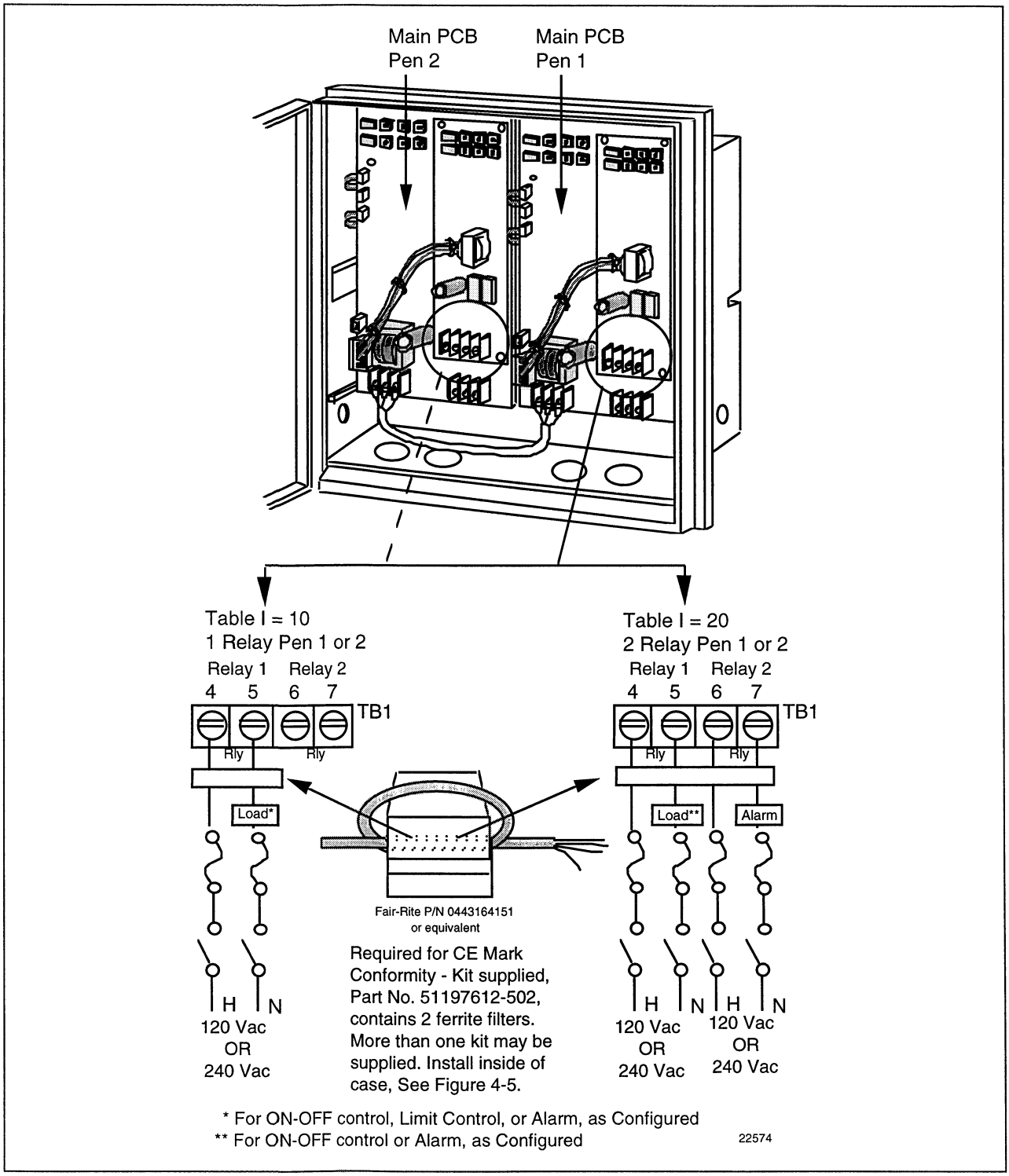
Table 4-8 Relay Output Wiring - 1 or 2 Pen Models

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate terminal block TB1 on the bottom edge of the Output printed circuit board on the Main printed circuit board for pen 1 or pen 2. (Refer to Figure 4-9 for location.)
3	For CE Mark conformity, install the ferrite filter as shown in Figure 4-5.
4	Run the output wires through the desired knockout. DO NOT bundle them with Input wires.
5	Strip 3/4-inch maximum of insulation from the end of each wire and form end to fit under a screw connection.
6	Insert the wires under the appropriate screws for the applicable relay output as shown. (Refer to Figure 4-9.) Tighten the screws to secure the wires.

Continued on next page

Relay output wiring (1 or 2 Pen Models), continued

Figure 4-9 Relay Output Wiring - 1 or 2 Pen Models



Relay output wiring (2 Pen Models)

The insulation of wires connected to the Relay Output terminals shall be rated for the highest voltage involved. Extra Low Voltage (ELV) wiring (input, current output, and low voltage control/alarm circuits) shall be separated from HAZARDOUS LIVE (>30 Vac, 42.4 Vpeak or 60 Vdc) wiring per Table 4-4.

You can wire the Relay Output as follows:

For 1 Relay per pen - 2 pen models (Model Number Table 1 = 11), or
For 2 Relays per pen - 2 pen models (Model Number Table 1 = 22)

ATTENTION

Make sure you have configured the recorder to provide the desired control/alarm function and action, as applicable. Refer to *Section 2 - Recording Set Up*.

Refer to Figure 4-10 and follow the procedure in Table 4-9 to wire the Relay Outputs.

Table 4-9 Relay Output Wiring - 2 Pen Models

Step	Action
1	Open the recorder door. Loosen the captive screw in the chart plate and swing the plate out.
2	Locate terminal block TB1 on the bottom edge of the Output printed circuit board on the Main printed circuit board for pen 1 and the Output printed circuit board on the Main printed circuit board for pen 2 (refer to Figure 4-10 for location).
3	For CE Mark conformity, install the ferrite filter as shown in Figure 4-5.
4	Run the output wires through the desired knockout. DO NOT bundle them with Input wires.
5	Strip 3/4-inch maximum of insulation from the end of each wire and form end to fit under a screw connection.
6	Insert the wires under the appropriate screws for the applicable relay output as shown (refer to Figure 4-10). Tighten the screws to secure the wires.

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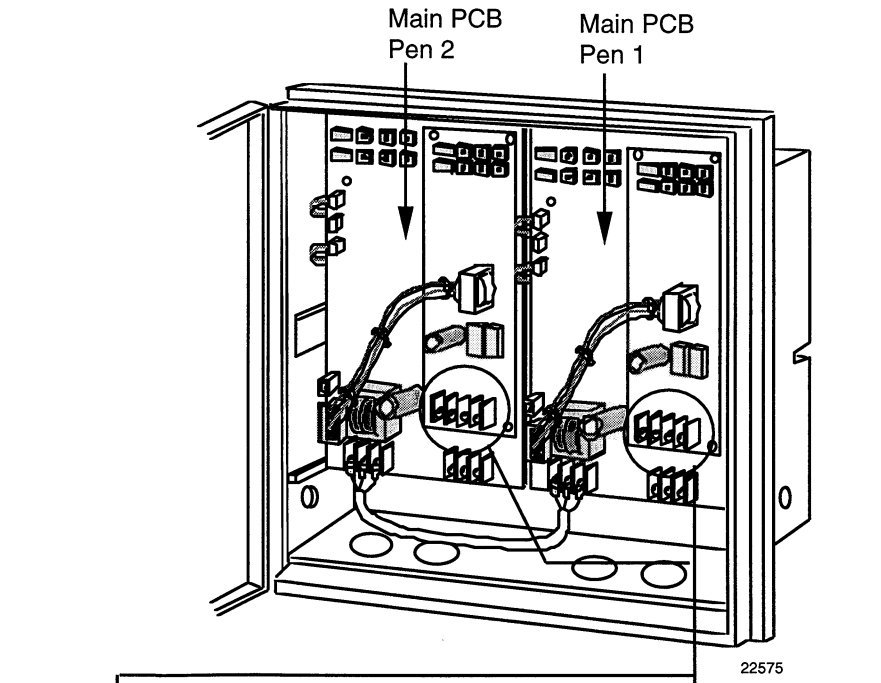
Relay output wiring (2 Pen Models), continued

Figure 4-10 Relay Output Wiring - 2 Pen Models



* For Table 1 = 11, load is Alarm, ON-OFF control or Limit control for given pen, as configured

** For Table 1 = 22, load is ON-OFF control or Alarm control for given pen, as configured

Section 5 – Operation and Maintenance

5.1 Overview

Introduction

This section provides procedures and reference data for operating the recorder and for doing routine maintenance tasks. It assumes that the recorder has been properly prepared, mounted, and wired in accordance with the instructions in Sections 2, 3, and 4.

Some of the procedures in this section are required only initially, and some are required randomly, as conditions dictate. Once the recorder is up and running, operator actions are required infrequently and are straightforward.

What's in this section?

This section contains the following information:

WARNING—SHOCK HAZARD

START-UP AND MAINTENANCE MAY REQUIRE ACCESS TO HAZARDOUS LIVE CIRCUITS, AND SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL. MORE THAN ONE SWITCH MAY BE REQUIRED TO DE-ENERGIZE UNIT BEFORE SERVICING.

5.2 Preparing the Recorder for Operation

Introduction

Before applying power to the recorder, complete these preliminary preparation tasks to prepare your recorder for operation.

ATTENTION If you ran the Pre-Setup Operational Check (subsection 1.3), you can skip this procedure.

WARNING Never access components inside the case with power applied.

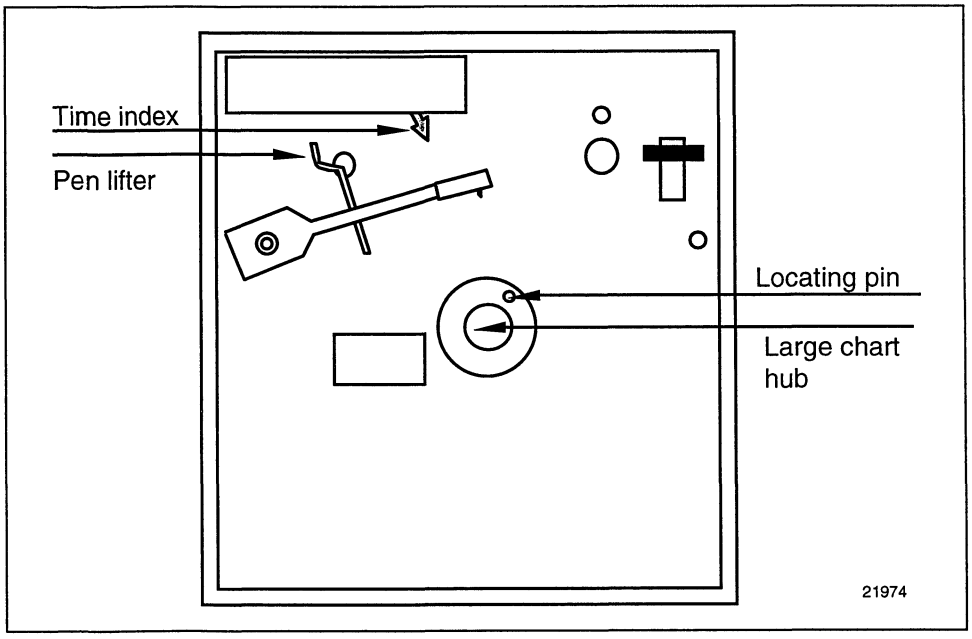
Procedure

Refer to Figure 5-1 to identify the basic chart plate components and follow the procedure in Table 5-1 to prepare the recorder for operation.

Table 5-1 Preparing the Recorder for Operation

Step	Action
1	Push in the button on the door and swing it open.
2	Pull up on the pen lifter to raise the pen(s) from the chart plate and remove the protective cap from the pen tip.
3	Slip the new chart under the pen lifter, pen and time index, and press it into place over the chart hub and locating pin.
4	Be sure that the chart zero, full scale settings, and alarm/control setpoints are correct (see Sections 2 and 3).

Figure 5-1 Basic Chart Plate Components



5.3 Running the Optional Self-Test

Introduction

You can have the recorder run its self-test when power is applied by setting a DIP switch and slide-switch on the Main printed circuit board.

- This test verifies that the electronic components and the pen and chart drive functions are operating properly by printing a step pattern, which is independent of any chart settings, with horizontal lines drawn at each 10% increment on the chart.
- The test will run for one complete revolution of the chart, so it will take a while to complete.
- You do not have to run the self-test before putting the recorder into operation, but doing so will verify the general operational status of the recorder.

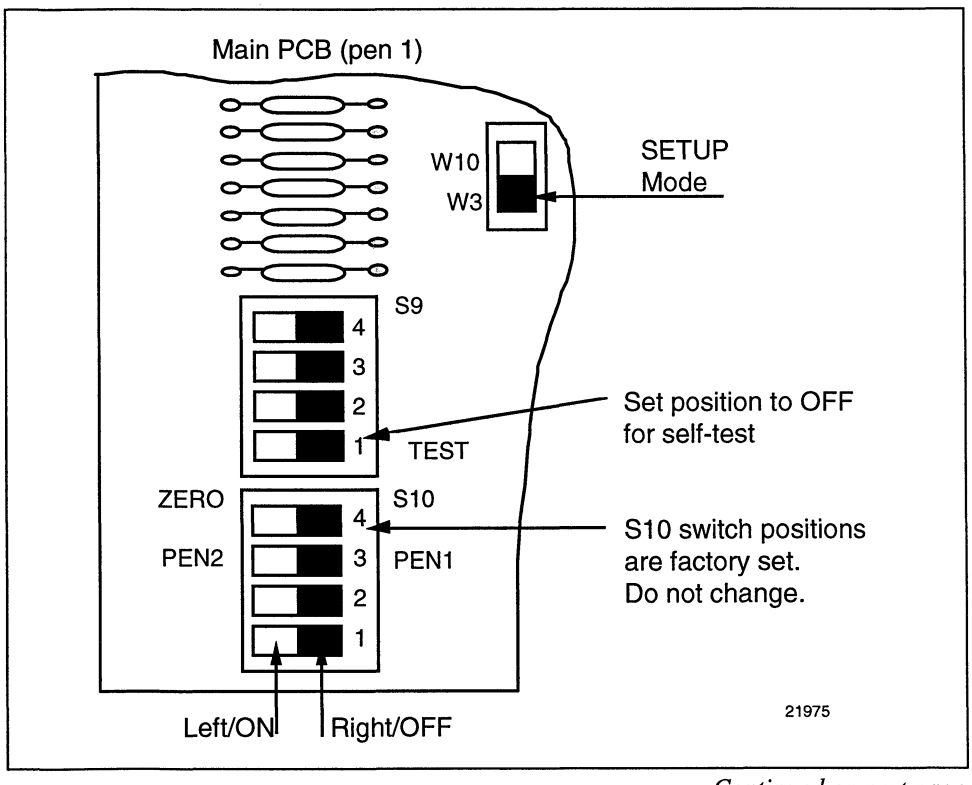
ATTENTION If the self-test does not run, recheck the DIP switch and jumper positions as well as power connections. Be sure that all the cable plugs are fully seated on the connectors on the Main printed circuit board.

WARNING Do not make DIP switch changes with power applied to the recorder since the chance for electrical shock exists.

Procedure

Refer to Figure 5-2 for DIP-switch and jumper locations and follow the procedure in Table 5-2 to run the self-test.

Figure 5-2 DIP Switch and Jumper Locations for Running the Self-Test



Continued on next page

Procedure, continued

Table 5-2 Running the Self-Test

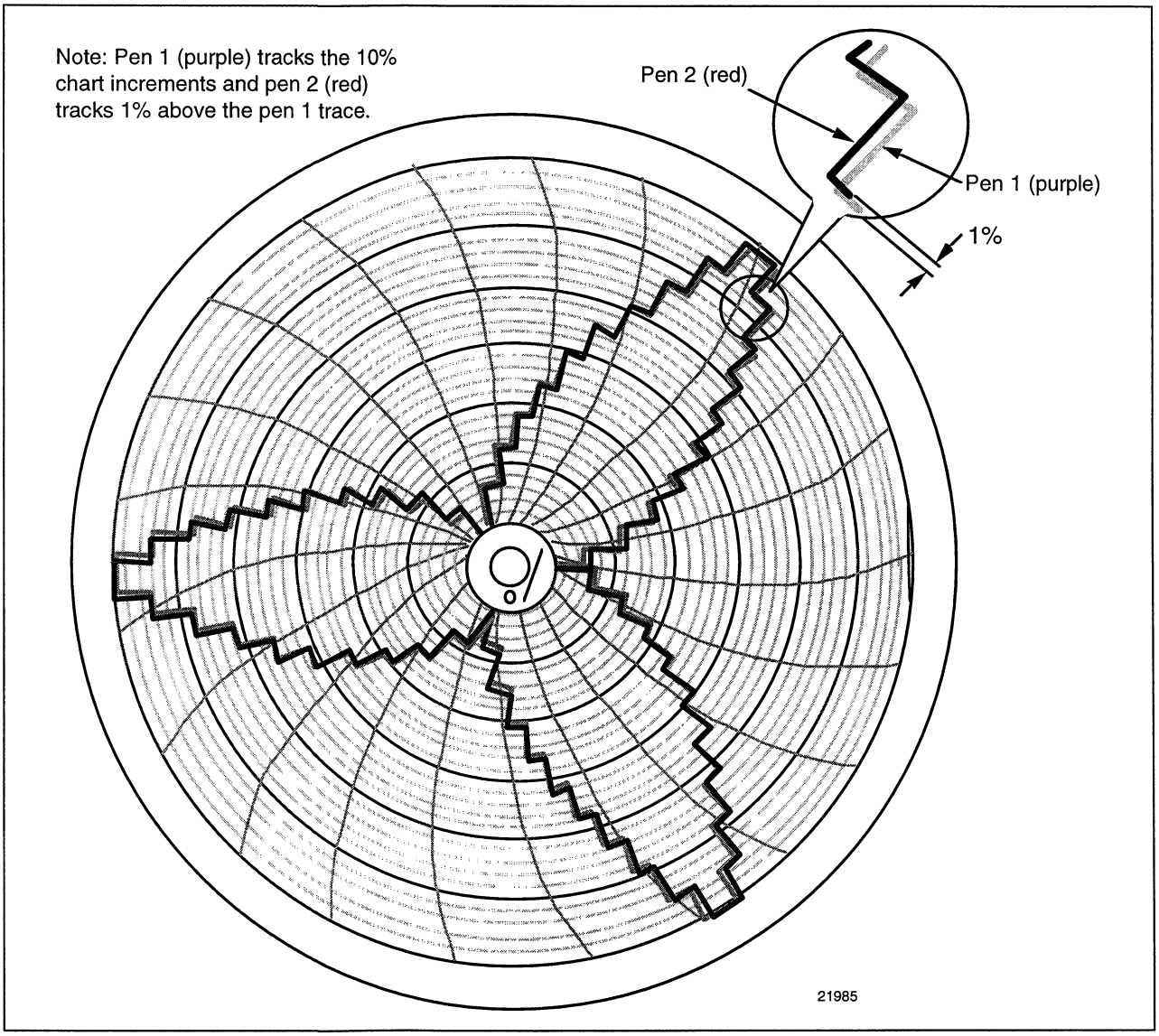
Step	Action
1	Loosen the captive screw in the chart plate and swing the chart plate out.
2	Locate DIP switch S9 on the lower left side of the Main printed circuit board for Pen #1 (see Figure 5-2 for location).
3	Set position 1 to the **right/OFF**.
4	Find W3/W10 slide-switch, which is located just to the right and above S9 DIP-switch on the Main printed circuit board for Pen #1, and put it in its W3 position for Set-Up mode.
5	Repeat steps 2 through 5 for Pen #2 Main printed circuit board.
CAUTION If your recorder has relay output, the relay(s) will be turned ON/OFF during the self-test. Be sure that your process can tolerate some upsets during the self-test cycle, or disconnect the output wiring.	
6	Be sure the cap is removed from the pen tip and the chart is installed (see subsection 5.4 - Start-up). Close the chart plate, apply power to the recorder, and check periodically to see that it is generating a step pattern on the chart as shown in Figure 5-3.
ATTENTION You can interrupt the self-test cycle by removing power and returning the slide-switch to its W10 position.	
7	At the completion of the self-test, the recorder automatically returns to the Run mode.
8	If you do not want the self-test to run every time power is cycled On/Off, return the slide-switch to the W10 position.

Continued on next page

Chart step pattern

Figure 5-3 is a typical chart step pattern generated by the recorder in the self-test.

Figure 5-3 Typical Chart Step Pattern



5.4 Start-up

Procedure

Once the recorder is Set up, mounted, wired, has had the chart installed and the operating parameters are set, you only have to:

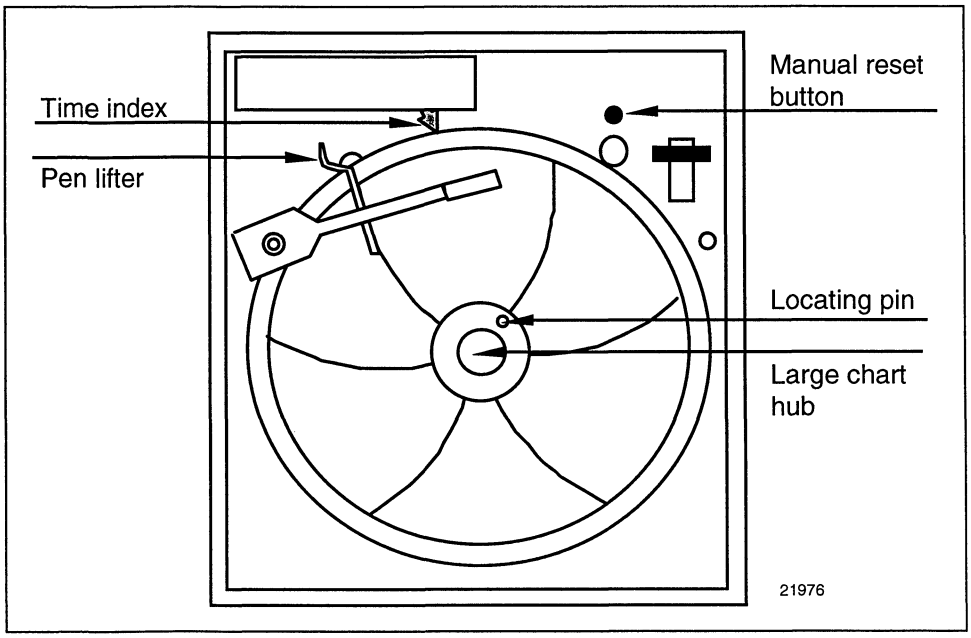
- set the chart time
- apply the power
- manually reset the limit relay, if the recorder is set-up for Limit control.

Refer to Figure 5-4 for the component locations and follow the procedure in Table 5-3 start-up the recorder.

Table 5-3 Start-Up Procedure

Step	Action
1	Push in the button on the door and swing it open.
2	Pull up the pen lifter to raise the pen(s) from the chart plate.
3	Grasp the chart hub and locating pin and turn the chart until the desired time line on the chart is aligned with the time index on the chart plate and Pen #1. Push down the pen lifter to return the pen(s) to the chart.
4	Close the door and apply power. The recorder pen will start to track the input value, after pen initialization.
5	If the Limit control output relay is latched at start-up, open the door and press the reset button on the chart plate to reset the relay.

Figure 5-4 Setting Chart Time to Time Index



5.5 Routine Maintenance

Introduction

The DR4200 recorder does not require any periodic maintenance as such. You will, however, have to replace the chart and ink cartridges as required.

Also, it does not require field calibration since its input range data including zero and full scale values are continually read and the input value is auto-calibrated.

However, humidity can affect the size of the chart such that the pen is offset from the proper chart increment. See subsection 6.5 - *"Checking Electrical Pen Alignment at Span and Zero"* to be sure that the pen and chart are aligned.

Replacing the ink cartridge

Refer to Figure 5-5 and follow the procedure in Table 5-4 to replace the ink cartridge.

Table 5-4 Replacing the Ink Cartridge

Step	Action
1	Remove the power from the recorder. Push in the button on the door and swing the door open.
2	Pull up on the pen lifter to raise the pen(s) from the chart plate.
CAUTION Be careful not to move the pen arm while removing and installing the ink cartridge.	
3	Unclip and remove the purple (Pen #1) or red (Pen #2) ink cartridge from the pen arm.
4	Remove the protective cap from the pen tip on the new cartridge and open its clip.
5	Slide the new cartridge onto the pen arm so that its tip fits into the notch at the end of the pen arm and close the clip to secure the cartridge to the pen arm.
6	Push down the pen lifter to return the pen tip to the chart.
7	Close the door and apply power.

Continued on next page

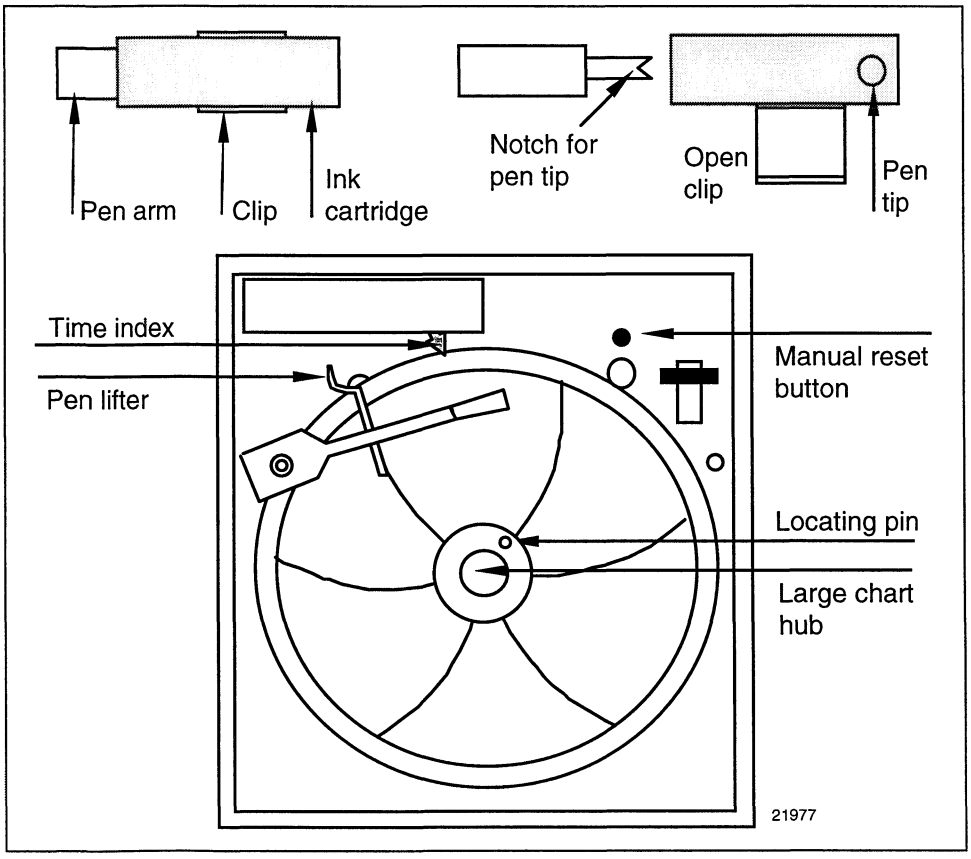
Replacing the chart

Refer to Figure 5-5 and follow the procedure in Table 5-5 to replace the chart.

Table 5-5 Replacing the Chart

Step	Action
1	Push in the button on the door and swing the door open.
2	Pull up on the pen lifter to raise the pen(s) from the chart plate.
3	Lift the chart from the hub and locating pin and slide it from under the pen(s) to remove it from the chart plate.
4	Slip the new chart under the pen lifter, pens and time index; and press the chart into place over the chart hub and locating pin.
5	Grasp the chart hub and locating pin and turn the chart until the desired time line on the chart is aligned with the time index on the chart plate and Pen #1. Push down the lifter to return the pen(s) to the chart.
6	Close the door.

Figure 5-5 Replacing the Ink Cartridge and Chart.



Section 6 – Service/Troubleshooting

6.1 Overview

Introduction

This section provides general troubleshooting procedures based on some visual failure symptoms. It also contains a procedure for aligning the pen arm with the chart.

- Using an optimum replacement unit repair philosophy, trouble is traced to a printed circuit board (PCB) hardware level rather than to an individual PCB/hardware assembly component level.
- While troubleshooting the DR4200 is straightforward, we recommend that only trained service technicians repair the recorder.

Customer support

If you cannot find and/or repair the problem using the information in this section, note the recorder's model and serial number (see label on the chart plate) and call our Technical Assistance Center at:

1-800-423-9883 U.S.A. and Canada
(between the hours of 8:00 am and 6:00 pm E.S.T. in U.S.A.)

If it is determined that a hardware problem exists and the recorder is within the TWO-YEAR WARRANTY, a replacement recorder or part will be shipped with instructions for returning the defective one.

What's in this section

This section contains the following topics:

6.2 Troubleshooting

Introduction

Before troubleshooting hardware and software related problems, we recommend that you check for Installation and Setup related problems.

- Check *Section 2 - Recording Set-up and Section 4 - Installation"* of this manual to be sure that the recorder is set-up and wired correctly.
- Run the Self-Test that is outlined in the *Section 5 - Operation/Maintenance* to confirm the existing symptom.

Symptoms

The following visual failure symptoms identify some problems that you may observe during operation. There are progressive corrective steps given to aid in finding and fixing the problem.

A list of symptoms is given in Table 6-1 and a procedure reference that will help you troubleshoot the symptom.

Table 6-1 Failure Symptoms and Procedure Reference

Symptom	Troubleshooting Procedure
Recorder will not operate	1
Recorder operation normal but pen trace incorrect	2
Chart rotates at the wrong speed or not rotating	3
Pen remains at the high or low end of the range	4

Continued on next page

Procedure #1

Symptom: Recorder will not operate.

Follow the procedure in Table 6-2 to troubleshoot the above mentioned symptom.

Table 6-2 Recorder Will Not Operate

What to do	How to Do It or Where to Find the Data
1. Check the supply voltage.	1. Measure the line voltage across the connections to TB1 on the Main printed circuit board for Pen #1.
2. Check the connections to TB1 on the Main printed circuit board for Pen #1	2. Refer to the wiring portion of *Section 4 - Installation.*
3. Check the Power Requirement Setup.	3. Refer to *Section 2 - Recording Set Up.*
4. Check the Pen Setup	4. Refer to *Section 2 - Recording Set Up*
5. Replace the Main printed circuit board.	5. Refer to subsection 6.3 - *"Replacement Procedures"*

Procedure #2

Symptom: Recorder operation normal but pen trace incorrect.

Follow the procedure in Table 6-3 to troubleshoot the above mentioned symptom.

Table 6-3 Pen Trace Incorrect

What to do	How to Do It or Where to Find the Data
1. Check the ink cartridge for proper installation.	1. Reposition or replace the pen cartridge. If the pen arm is severely warped and prevents proper installation, replace the pen arm.
2. Check that the chart agrees with actuation type and chart setup.	2. Replace the wrong chart with the correct chart. Refer to *Section 2 - Recording Set Up.*
3. Check the sensor for proper type and ability to function.	3. Verify actuation Set Up data and operation of the sensor.
4. Replace the Servo Plate assembly.	4. Refer to Subsection 6.3 *"Replacement Procedures".*
5. Replace the Main printed circuit board.	5. Refer to subsection 6.3 *"Replacement Procedures"*.

Continued on next page

Procedure #3

Symptom: Chart rotates at wrong speed or not at all.

Follow the procedure in Table 6-4 to troubleshoot the above mentioned symptom.

Table 6-4 Chart Rotates at Wrong Speed or Not At All

What to do	How to Do It or Where to Find the Data
1. Check the chart installation.	1. Be sure the locating pin is in the drive hole on the chart.
2. Check the Set Up chart speed value and change, if required.	2. Refer to *Section 2 - Recording Set Up*
3. Check the motor cable plug connection at J3 connector on the Main printed circuit board for Pen #1.	3. Visually examine the plug and reseat it.
4. Replace the Chart Motor.	4. Refer to subsection 6.3 *"Replacement Procedures"*.
5. Replace the Main printed circuit board.	5. Refer to subsection 6.3 *"Replacement Procedures"*.

Procedure #4

Symptom: Pen Remains at High or Low End of Range.

Follow the procedure in Table 6-5 to troubleshoot the above mentioned symptom.

Table 6-5 Pen Remains at High or Low End of Range

What to do	How to Do It or Where to Find the Data
1. Check the sensor and leadwires for continuity. Check the input connections to TB2 on the Main printed circuit board.	1. Replace the sensor or leadwires as needed. Refer to the wiring portion of *Section 4 - Installation.*
2. Check the pen and actuation type Set Up data.	2. Refer to *Section 2 - Recording Setup.*
3. Run the self-test.	3. Refer to *Section 5 - Operation and Maintenance*
4. Replace the Servo Plate assembly.	4. Refer to subsection 6.3 *"Replacement Procedures"*.
5. Replace the Main printed circuit board.	5. Refer to subsection 6.3 *"Replacement Procedures"*.

6.3 Replacement Procedures

Introduction

The procedures listed here assume that the chart door is opened, the chart plate is swung out, and power is removed. Refer to *Section 7 - Parts List* for a general orientation of the components.

WARNING To avoid personal injury, never access the components inside the case with power applied.

Replacing the No. 1 pen arm

Follow the procedure in Table 6-6 to replace the No. 1 pen arm.

Table 6-6 Replacing the No. 1 Pen Arm

Step	Action
1	Note the location of the pen (purple) on the chart. Pull the lifter up to raise the pen from the chart.
2	Remove the ink cartridge.
3	Remove the screw, lockwasher, and flat washer that hold the pen arm to the servo shaft. Remove the pen arm.
4	Replace the pen arm, flat washer, lockwasher, and screw, but leave the screw slightly loose. Replace the ink cartridge.
5	Push down the pen lifter and carefully position the pen to the location noted in step 1. Tighten the pen arm screw.
6	Refer to subsection 6.4 and 6.5 in this section.

Continued on next page

Replacing the No. 2 pen arm

Follow the procedure in Table 6-7 to replace the No. 2 pen arm.

Table 6-7 Replacing the No. 2 Pen Arm

Step	Action
1	Note the location of pens on the chart. Pull the lifter up to raise the pens from the chart.
2	Remove the ink cartridges.
3	Remove the screw, lockwasher, and flat washer that hold the #1 pen arm to the servo shaft. Remove the pen arm.
4	Remove the screw, lockwasher, and flat washer that hold the #2 pen arm to the servo shaft. Remove the pen arm.
5	Replace the #2 pen arm, flat washer, lockwasher, and screw, but leave the screw slightly loose.
6	Replace the red ink cartridge on the No. 2 pen arm..
7	Push down the pen lifter and carefully position the #2 pen to the location noted in step 1. Tighten the No. 2 pen arm screw.
8	Replace the No. 1 pen arm, flat washer, lockwasher, and screw, but leave the screw slightly loose.
9	Raise the pen lifter and replace the purple ink cartridge on the No. 1 pen arm.
10	Push down the pen lifter and carefully position the #1 pen to the location noted in step 1. Tighten the No. 1 pen arm screw.
11	Refer to subsection 6.4 and 6.5 in this section.

Continued on next page

Replacing the servo plate

ATTENTION Complement this procedure with the appropriate pen arm replacement procedure - No. 1 pen arm for 1-pen model or No. 2 pen arm for 2-pen model.

Follow the procedure in Table 6-8 to replace the Servo Plate.

Table 6-8 Replacing the Servo Plate

Step	Action
1	Remove the pen arm(s).
2	Note how the spring(s) is (are) attached to the servo plate. Disconnect the spring(s) from the servo plate.
3	Disconnect the No. 1 pen motor cable plug from J1 connector on the Main printed circuit board for pen #1 and the No. 2 pen motor cable from J2 connector on the Main printed circuit board for pen #2. Remove the cable(s) from the clamps in the rear of the case.
4	Remove the screws that hold the servo plate to the chart plate. Remove the servo plate.
5	Replace the servo plate and secure with the screws. Dress the cable(s) in the clamps and connect the cable plugs to the appropriate connector on the given Main printed circuit board. Connect the spring(s) to the servo assembly as noted in step 2.
6	Replace the pen arm(s).
7	Refer to subsection 6.4 and 6.5 in this section.

Replacing the chart motor

Follow the procedure in Table 6-9 to replace the Chart Motor.

Table 6-9 Replacing the Chart Motor

Step	Action
1	Pull up the pen lifter to raise the pen(s) from the chart.
2	Remove the chart. Pull the chart hub assembly from the motor shaft.
3	Disconnect the motor cable plug from J3 connector on the Main printed circuit board for Pen #1 and remove the cable from the clamps in the rear of the case.
4	Remove the screws holding the motor to the chart plate and remove the chart motor.
5	Replace the motor and secure it with screws. Dress the cable in the clamps and connect plug to J3 on the Main PC board for Pen #1.
6	Push the chart hub assembly that was removed in step 2 onto the motor shaft.
7	Close the chart plate and replace the chart. Set the chart time to the time index on the chart plate and push down the pen lifter.

Continued on next page

Replacing the main printed circuit board

Follow the procedure in Table 6-10 to replace the Main printed circuit board.

Table 6-10 Replacing the Main Printed Circuit Board

Step	Action
1	Tag and disconnect all the cable plugs from the connectors and the wiring from the terminal blocks on the Main printed circuit board.
2	Remove the screws from the corners of the Main printed circuit board and lift the board from the case.
ATTENTION If there is an Output printed circuit board mounted on the Main printed circuit board go to step 3, if not go to step 10.	
3	Remove the 4-pin connector from TB3 on the Main printed circuit board.
4	Remove the Output printed circuit board cable from J4 on the Main printed circuit board.
5	Remove the Output printed circuit board from the four spacers holding it to the Main PCB. Remove the four spacers from the Main printed circuit board.
6	Push the four plastic spacers into the holes on the right side of the new Main printed circuit board.
7	Hold the Output printed circuit board so that its mounting holes align with the spacers and plug the multi-pin connector from the Output printed circuit board into J4 connector on the Main printed circuit board. Be sure that the plug positions are aligned and matched with the pins on J4. (Red stripe on cable goes toward top of connector.)
8	Push down on each corner of the Output printed circuit board in turn to seat the board on the spacers.
9	Plug the 4-pin connector from the transformer on the Output printed circuit board into the TB3 connector on the Main printed circuit board.
10	Position the new Main printed circuit board in the case and secure with the screws.
11	Replace the cable plugs and wiring to the connectors and terminal block as noted in step 1.
12	Refer to *Section 3 - Optional Relay Output Set Up* and *Section 5 - Operation and Maintenance* to check the Main printed circuit board setup and operating parameter values.

6.4 Checking Mechanical Pen Alignment at Zero

Introduction

You can have the recorder drive the pen to the zero position on the chart by setting a DIP switch and slide-switch on the Main printed circuit board. This will let you mechanically adjust the pen tip to the zero line on the chart.

Procedure

Refer to Figure 6-1 and follow the procedure in Table 6-11 to check the mechanical pen alignment at zero.

Table 6-11 Check the Mechanical Pen Alignment

Step	Action
1	Loosen the captive screw in the chart plate and swing the chart plate out.
WARNING Do not make DIP switch changes with power applied to the recorder, since the chance for electrical shock does exist.	
2	Locate DIP Switch S9 on the lower left side of the Main printed circuit board (see Figure 6-1).
3	Set position 1 on the S9 switch to left/ON.
4	Locate the W3/W10 slide-switch which is just to the right and above S9 DIP-switch on the Main printed circuit board (see Figure 6-1).
5	Put the slide-switch in its W3 position for SETUP mode, and close the chart plate.
6	Apply power to the recorder.
ATTENTION If the recorder is a 2-pen model, repeat steps 2 through 6 on the Main printed circuit board for Pen #2 to adjust the Pen #2 position first.	
7	Loosen the screw holding the No. 1 pen arm to the servo shaft and move the pen arm to access the locking screw in the No. 2 pen arm, if applicable.
8	Align the pen tip for the No. 2 pen with the zero line on the chart and tighten the locking screw, if applicable.
9	Align the pen tip for the No. 1 pen with the zero line on the chart and tighten the screw.
10	Remove the power, open the door, and swing the chart plate out. Return the slide-switch to the W10 position.
11	Return the S9 switch to right/OFF.
12	Close the chart plate and door and apply power.

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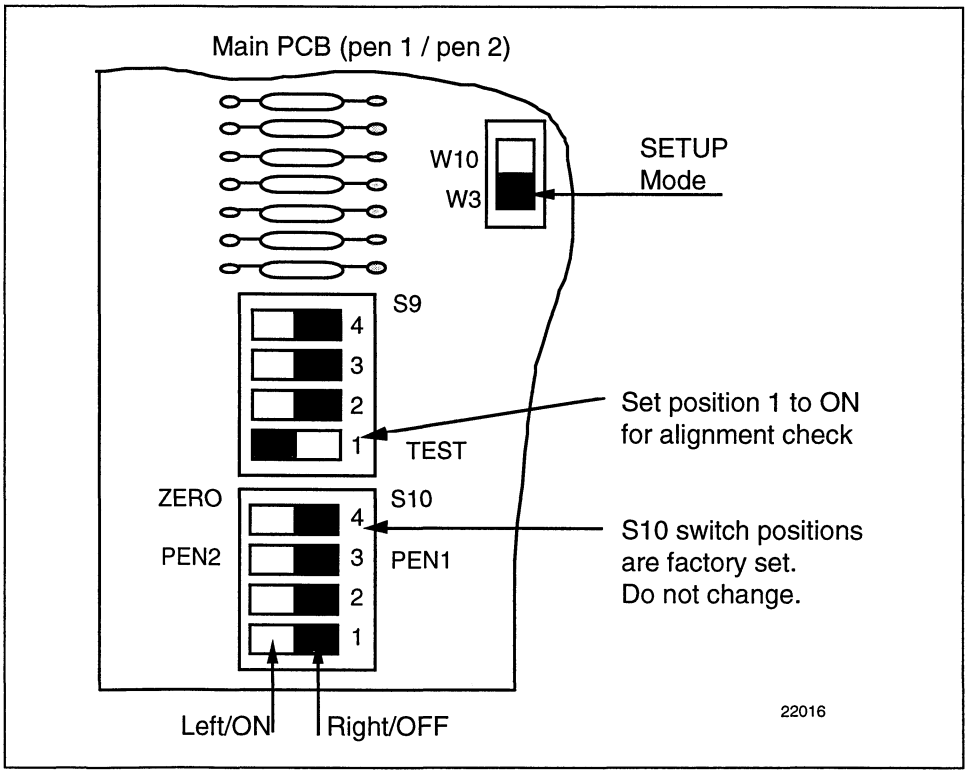
Procedure, continued

Figure 6-1 DIP Switch and Jumper Locations for Pen Alignment Check



Various pen positions can be tested using the switch combinations below.

S10 Position 4	S9 Position 1	Pen Position
OFF	ON	Zero
ON	OFF	50%
ON	ON	100%

Introduction

If the pen trace does not track at the correct chart increment with a known input value, you can use the following procedures to adjust the pen travel at zero and span (full scale) to compensate for the effects of humidity on the chart size.

Equipment needed

The following items will be needed to help you accomplish the pen alignment:

- The correct chart for your application
- Voltage and resistance equivalents for the range values of your input type - See Table 6-12
- Voltage/current calibration source for thermocouple and linear actuations
- Decade box as a calibration source for RTD actuation
- Copper leads
- Thermocouple extension wire for thermocouple actuation.

Voltage/ resistance equivalents

Use the Voltage and Resistance equivalents listed in Table 6-12 when making your alignment check.

Table 6-12 Voltage and Resistance Equivalents for 0% and 100% Range Values

Sensor Type	PV Input Range		Range Values	
Thermocouples	**°F**	**°C**	**0%**	**100%**
J	0 to 1600	–18 to871	–0.885 mV	50.059 mV
K	ñ320 to 2500	–196 to1371	–5.822 mV	54.845 mV
T	ñ300 to 700	–184 to371	–5.341 mV	19.095 mV
RTD (IEC = 0.00385) 100Ω	ñ300 to 900	–184 to484	25.18Ω	274.96Ω
Milliamps	0 to 20 mA 4 to 20 mA		0 mA 4 mA	20 mA 20 mA
Millivolts	0 to 20 mV		0 mV	20 mV
	0 to 50 mV		0 mV	50 mV
Volts	0 to 5 Volts		0 Volt	5 Volts
	1 to 5 Volts		1 Volt	5 Volts

Continued on next page

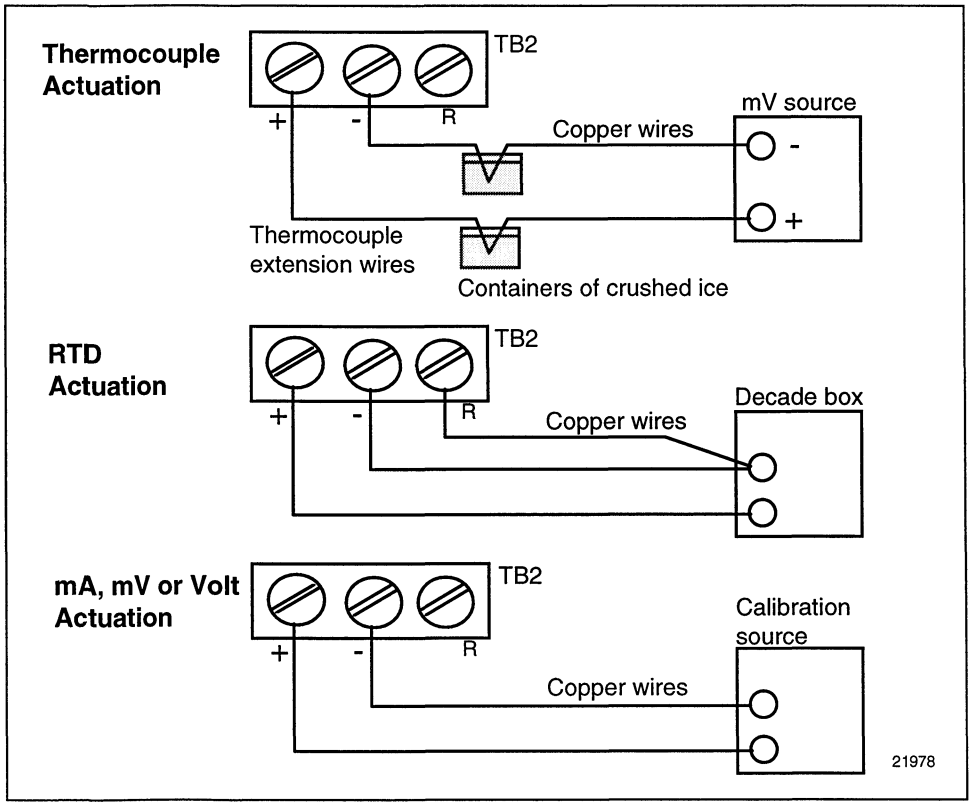
Preparing for alignment check

Refer to Figure 6-2 and follow the procedure in Table 6-13 to prepare the recorder for an alignment check.

Table 6-13 Preparing for Alignment Check

Step	Action
1	Remove the power from the recorder, open the door, and swing the chart plate out.
2	Disconnect the input connections from the terminal block TB2 on the bottom edge of the Main printed circuit board for Pen #1.
3	Connect the calibration source as appropriate for the given actuation (see Figure 6-2 for connections).
4	If required, use Table 6-12 to convert zero and full scale actuation value to the equivalent mV or resistance values.
5	Set the calibration source to the equivalent zero value.
6	Apply power and let the recorder warm-up for thirty minutes.

Figure 6-2 Calibration Source Connections for Alignment



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Making the alignment check

Refer to Figure 6-3 and follow the procedure in Table 6-14 to make the alignment check.

Table 6-14 Making the Alignment Check

Step	Action
1	Set the calibration source to the equivalent zero scale value for your sensor type, as shown in Table 6-12.
2	Check that the pen trace tracks at the zero chart increment.
3	Use the rotary DIP switches S6, S7, and S8 to raise or lower the zero scale value to move the pen up or down as required so it tracks at zero scale chart increments. See Figure 6-3.
ATTENTION You may have to change DIP switch S5 position 3 or 4 to get negative values or values above or below 1000.	
4	Set the calibration source to the equivalent full scale value for your sensor type, as shown in Table 6-12.
5	Check that the pen trace tracks at the full-scale chart increment.
6	Use rotary DIP switches S2, S3, and S4 to raise or lower the full scale value to move the pen up or down as required so that it tracks at full scale chart increment. See Figure 6-3.
ATTENTION You may have to change DIP switch S1 position 3 or 4 to get negative values or values above or below 1000.	
7	Remove the power, calibration source and connections, and connect the input actuation to TB2.
8	Repeat the procedure for Pen #2, if applicable.
9	Close the chart plate, door, and return the recorder to operation.

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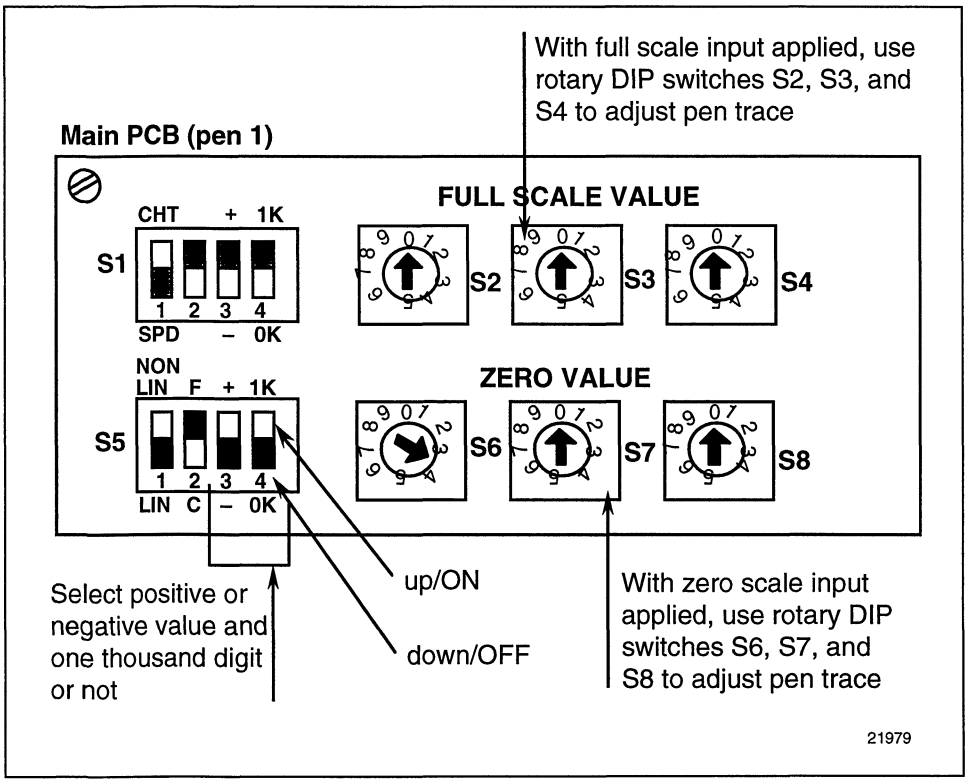
Making the alignment check, continued

Figure 6-3 Adjustment for Span (full scale) and Zero



Section 7 – Parts List

7.1 Overview

Introduction

This section provides the replacement parts lists for the DR4200 Model GP Circular Chart Recorder. Most parts are supplied on an optimum replacement unit basis; that is, part numbers are given for complete printed circuit boards rather than for individual PCB components.

- The figures that follow are exploded views of the DR4200 Model GP recorder. Each part is labeled with a key number and the key numbers are listed in tables with associated part numbers.
- When ordering parts, be sure to specify your recorder's serial and model numbers (on chartplate) as well as the part identification.

What's in this section?

This section contains the following topics:

7.2 Exploded Views

Door assembly

Figure 7-1 is an exploded view of the Door Assembly.

- Table 7-1 is a list of the associated part numbers.

Figure 7-1 Door Assembly

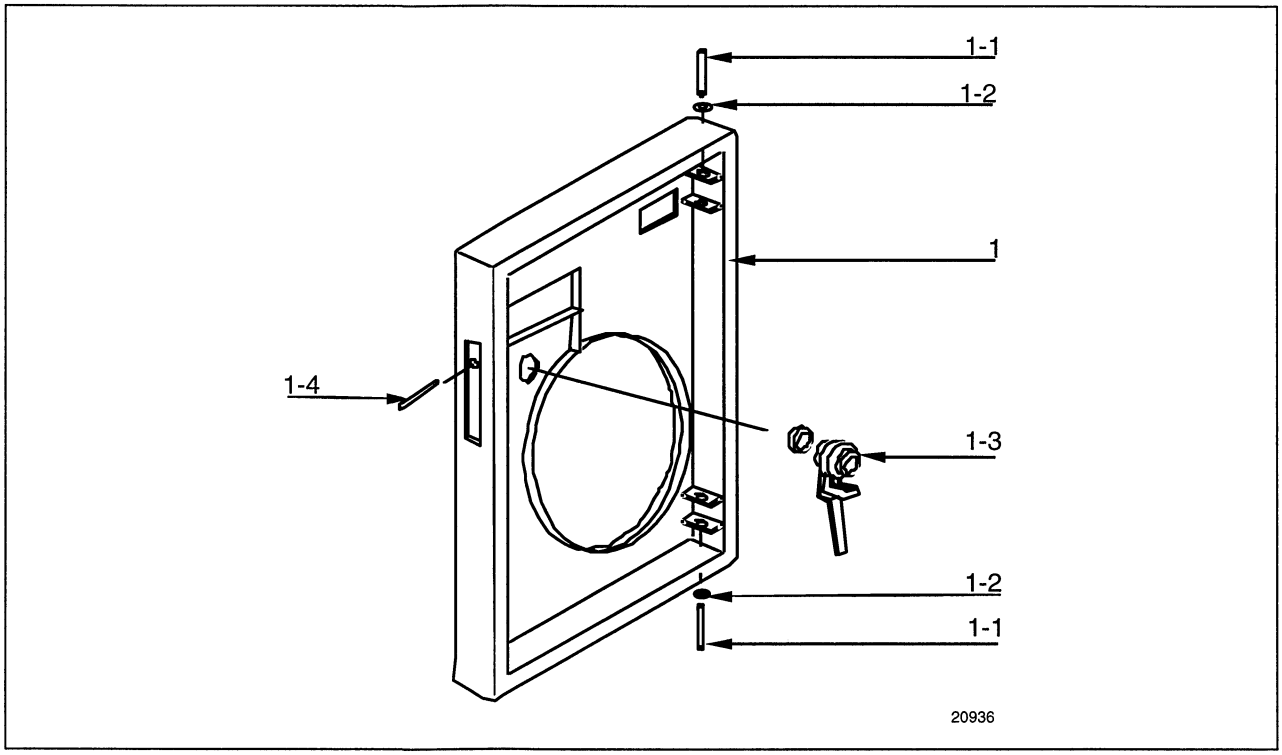


Table 7-1 Door Assembly Parts

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1		Door Assembly			1
	30755825-501	Blue Door - Glass Window and Latch			
	30755825-502	Blue Door - Acrylic Window and Lock			
	30755825-503	Blue Door - Glass Window and Lock			
	30755825-504	Blue Door - Acrylic Window and Latch			
	30755825-505	Black Door - Glass Window and Latch			
	30755825-506	Black Door - Acrylic Window and Lock			
	30755825-507	Black Door - Glass Window and Lock			
	30755825-508	Black Door - Acrylic Window and Latch			
	30755825-509	Beige Door - Glass Window and Latch			
	30755825-510	Beige Door - Acrylic Window and Lock			
	30755825-511	Beige Door - Glass Window and Lock			
	30755825-512	Beige Door - Acrylic Window and Latch			
	30755825-513	Gray Door - Glass Window and Latch			
	30755825-514	Gray Door - Acrylic Window and Lock			
	30755825-515	Gray Door - Glass Window and Lock			
	30755825-516	Gray Door - Acrylic Window and Latch			
	30755825-517	Blue Door - Glass Window and Heavy Duty Latch			
	30755825-518	Blue Door - Acrylic Window and Heavy Duty Latch			
	30755825-519	Black Door - Glass Window and Heavy Duty Latch			

Table 7-1 is continued on next page

Door assembly

Table 7-1 Door Assembly Parts, continued

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1		Door Assembly, continued			1
	30755825-520	Black Door - Acrylic Window and Heavy Duty Latch			
	30755825-521	Beige Door - Glass Window and Heavy Duty Latch			
	30755825-522	Beige Door - Acrylic Window and Heavy Duty Latch			
	30755825-523	Gray Door - Glass Window and Heavy Duty Latch			
	30755825-524	Gray Door - Acrylic Window and Heavy Duty Latch			
	30756045-501	Heavy Duty Gray Door - Acrylic Window and Lock			
	30756045-502	Heavy Duty Blue Door - Acrylic Window and Lock			
	30756045-503	Heavy Duty Gray Door - Glass Window and Lock			
	30756045-504	Heavy Duty Blue Door - Glass Window and Lock			
	30756045-505	Heavy Duty Beige Door - Plastic Window and Lock			
	30756045-506	Heavy Duty Black Door - Plastic Window and Lock			
	30756045-507	Heavy Duty Beige Door - Glass Window and Lock			
	30756045-508	Heavy Duty Black Door - Glass Window and Lock			
	30756045-509	Heavy Duty Gray Door - Acrylic Window and Heavy Duty Latch			
	30756045-510	Heavy Duty Blue Door - Acrylic Window and Heavy Duty Latch			
	30756045-511	Heavy Duty Gray Door - Glass Window and Heavy Duty Latch			
	30756045-512	Heavy Duty Blue Door - Glass Window and Heavy Duty Latch			
	30756045-513	Heavy Duty Beige Door - Acrylic Window and Heavy Duty Latch			
	30756045-514	Heavy Duty Black Door - Acrylic Window and Heavy Duty Latch			
	30756045-515	Heavy Duty Beige Door - Glass Window and Heavy Duty Latch			
	30756045-516	Heavy Duty Black Door - Glass Window and Heavy Duty Latch			
1-1	(K)30756409-001	Hinge Pin*			2
1-2	(K)30756409-001	Retaining Ring*			2
1-3	(K)30756409-001 30756584-001 30756584-002	Latch without lock and with gasket Latch Assembly for Heavy Duty Door Lock Assembly Kit	1	3	1
1-4	(K)30756409-001	Latch Pin*			1
	30755822-001	Graphic Overlay for Door - not shown*			1

*Parts included with applicable door assembly.
(K) denotes that the part number is for the parts kit in which the described part is included. The described part cannot be ordered separately.

Chart plate

Figure 7-2 is an exploded view of the Chart Plate Assembly.
• Table 7-2 is a list of the associated part numbers.

Figure 7-2 Chart Plate Assembly

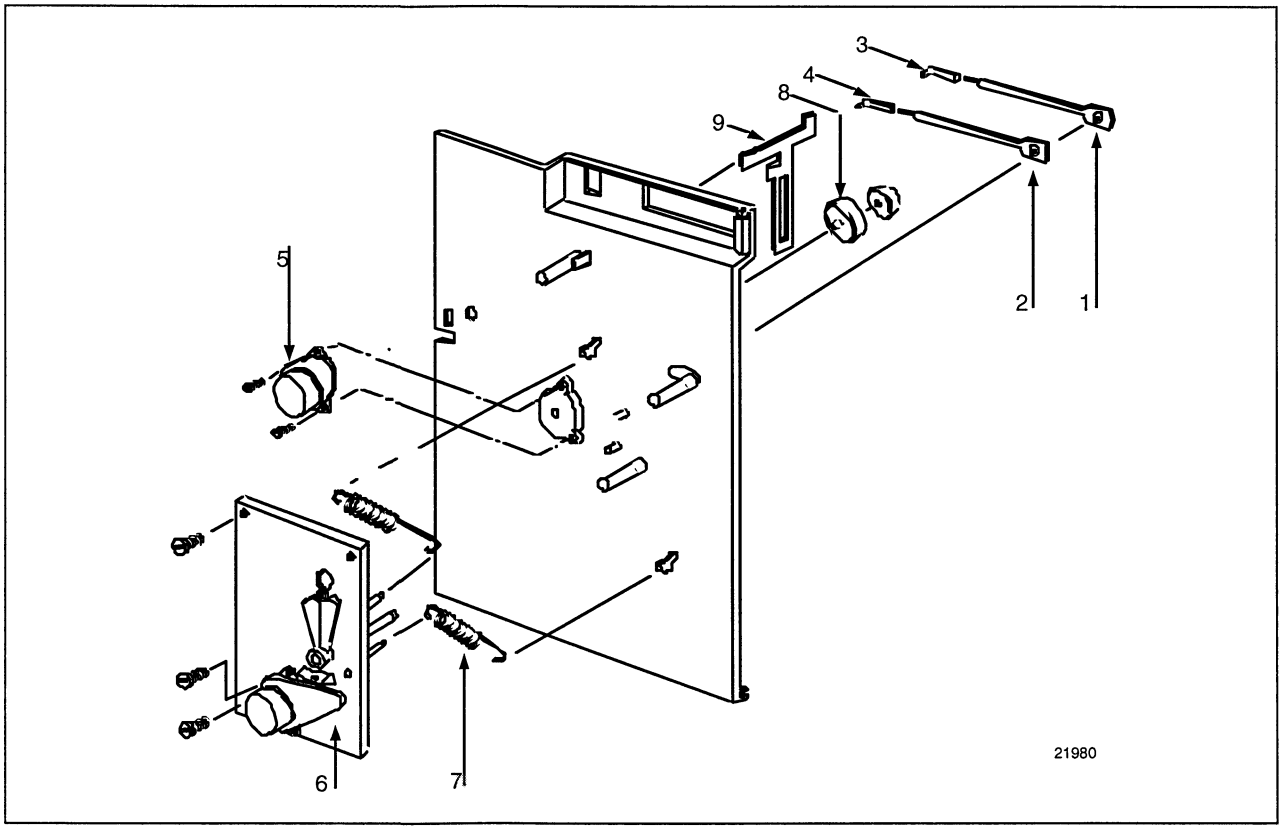


Table 7-2 Chart Plate Assembly Parts

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	(K)30756409-002	No. 1 Pen Arm	1	5	1
2	(K)30756409-002	No. 2 Pen Arm (2-pen model only)	1	5	1
3	30735489-007	No. 1 Purple Pen Cartridge (Six Pack)	1	3	1
4	30735489-002	No. 2 Red Pen Cartridge (Six Pack)	1	3	1
5	30756113-501	Chart Motor	1	3	1
6	30755833-501 30755833-502	Servo Motor Assembly 1-pen model 2-pen model			1
7	(K)30756409-002	Spring, Tension			1/2
8	(K)30756150-001	Chart Hub Kit (includes 2 hubs and 2 adapters)			1
9	(K)30756409-002	Pen Lifter Retainer			1

(K) denotes that the part number is for the parts kit in which the described part is included. The described part cannot be ordered separately.

Continued on next page

Basic recorder components without options

Figure 7-3 is an exploded view of the Basic Recorder components without options.

- Table 7-3 is a list of the associated part numbers.

Figure 7-3 Basic Recorder Components without Options

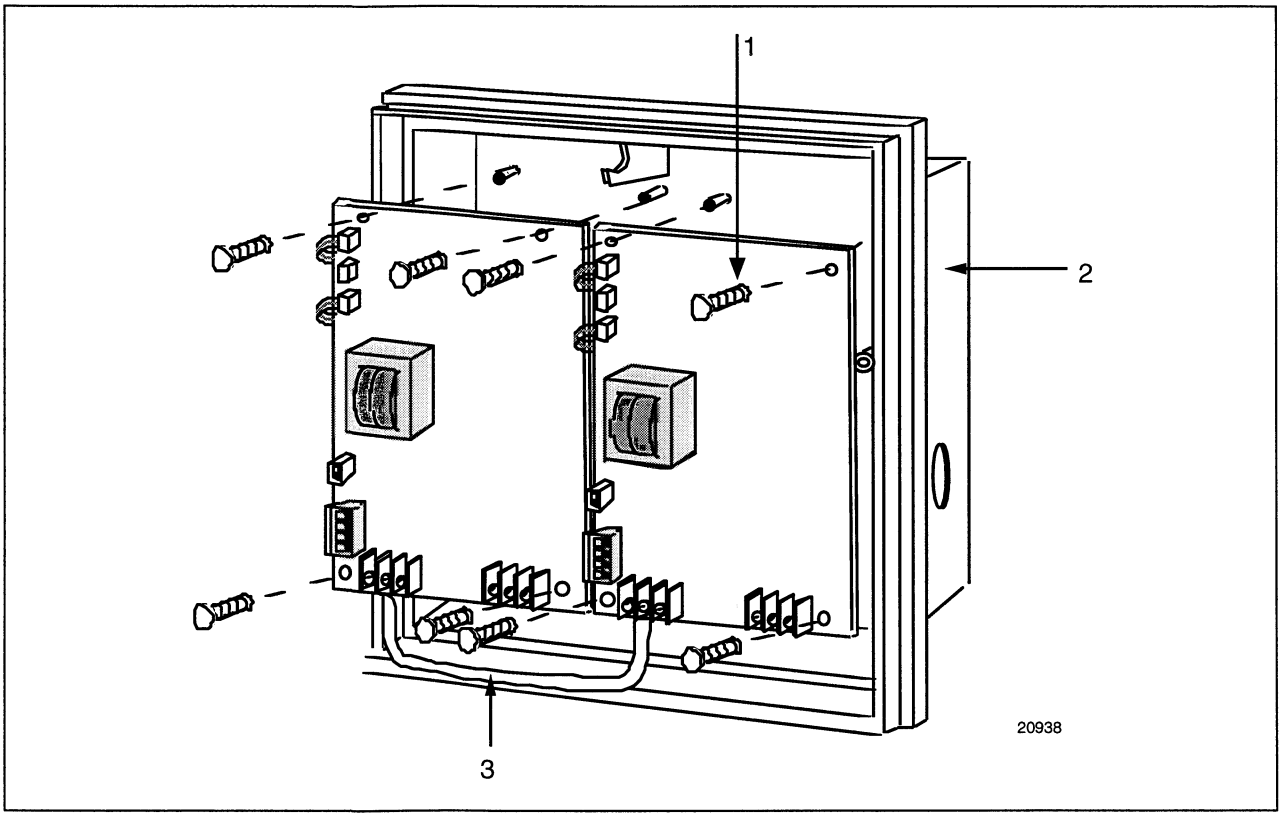


Table 7-3 Basic Recorder Parts Without Options

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	30755804-501 51309333-501	Main Printed Circuit Board Main printed Circuit Board (CE Mark)	1	3	1/2
2	30755800-501 30755800-502	Case Case (CE Mark)	1	3	1
3	30757235-001 51197653-001	Cable Replacement kit Cable Replacement kit (CE Mark)–includes connectors	1	3	1
Parts Not Shown					
	51197612-502	Round cable suppression cores (CE Mark), package of 2	1	3	up to 3
	51197612-508	Round cable suppression cores (CE Mark), package of 8	1	1	1

Continued on next page

Additional recorder components associated with options

Figure 7-4 is an exploded view of the Recorder components associated with options.

- Table 7-4 is a list of the associated part numbers.

Figure 7-4 Recorder Components Associated With Options

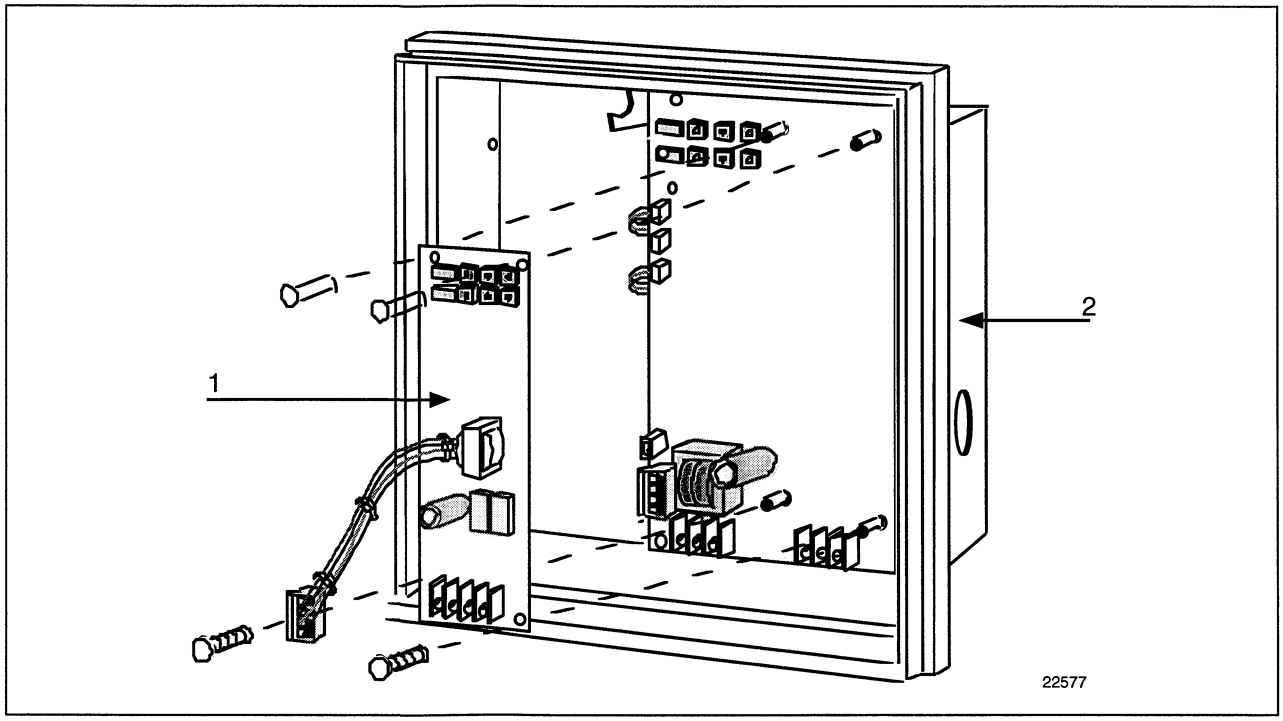


Table 7-4 Recorder Parts Associated With Options

Key	Part Number	Description	Recommended Spare Parts Per		Quantity per Unit
			10	100	
1	 30755808-501 30755808-502 30755808-504	Output Printed Circuit Board (includes four standoffs) -- One relay -- Two relays -- FM approved Limit Control Relay (includes manual reset switch assembly)	1	5	1/2 1
	(K) 30755980-003	Four-position connector			1

(K) denotes that the part number is for the parts kit in which the described part is included. The described part cannot be ordered separately.

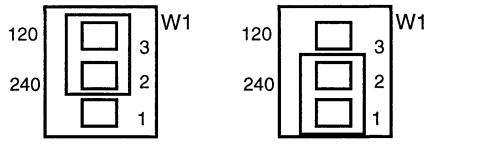
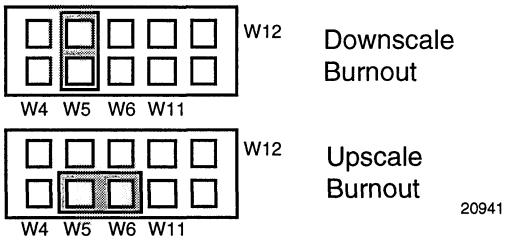
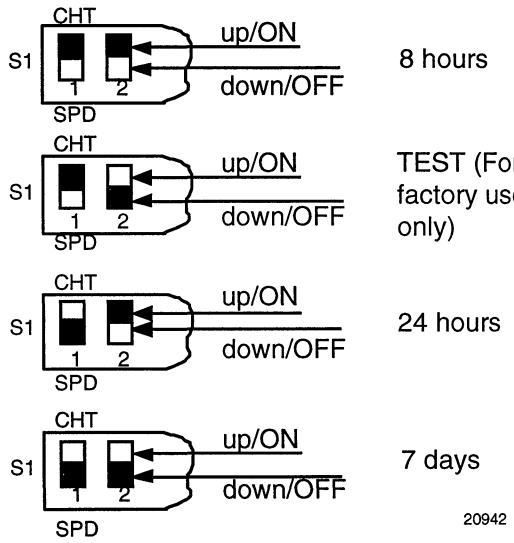
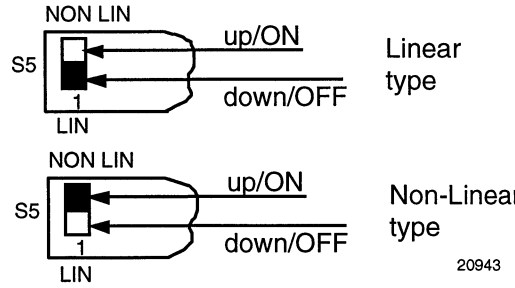
Appendix A

A.1 Summary of DIP Switch and Jumper Selections on Main Printed Circuit Board

Introduction

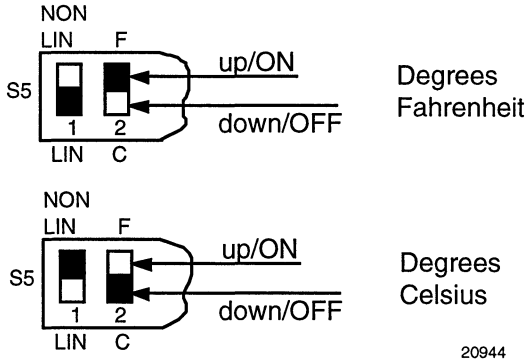
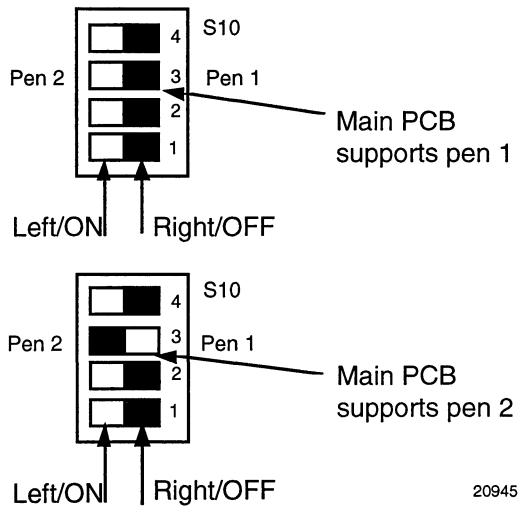
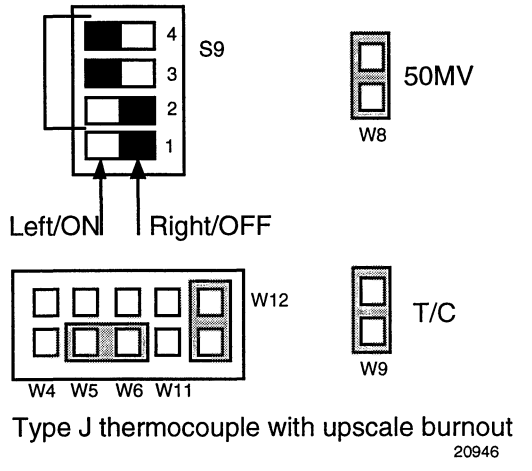
Table A-1 is a summary of all the DIP switch and jumper selections on the Main printed circuit board. The table lists the jumper or DIP switch number, its function, and a graphic view of the switches and jumpers selections.

Table A-1 Summary of DIP Switches and Jumpers

Jumper or DIP-Switch Number	Function	Selections
W1	Select power requirement.	
W5/W6	Select upscale or downscale burnout.	
S1	Select chart speed with positions 1 and 2 on switch.	
S5	Select chart type with position 1 on switch.	

A.1 Summary of DIP Switch and Jumper Selections on Main Printed Circuit Board, Continued

Table A-1 Summary of DIP Switches and Jumpers, continued

Jumper or DIP-Switch Number	Function	Selections
S5	Select the temperature unit with position 2 on switch.	
S10	Verify the pen position for the Main printed circuit board with position 3 of the switch. **CAUTION** S10 switch positions are factory set - do not change without first contacting our technical assistance center.	
S9, W4, W6, W7, W8, W9, W11, W12	Select Input actuation type/range with positions 2, 3, and 4; and jumpers.	

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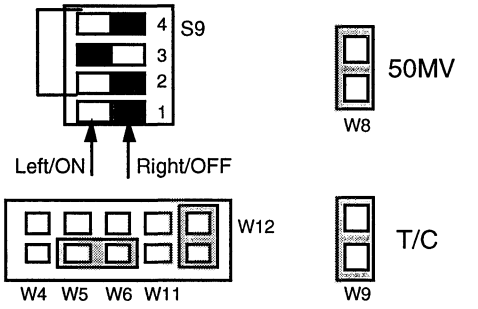
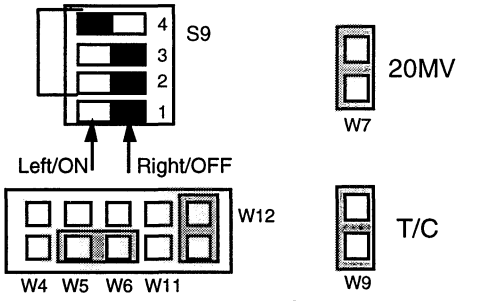
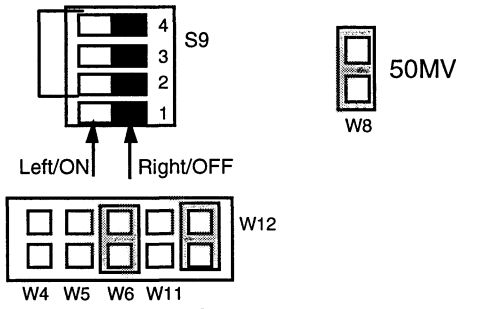
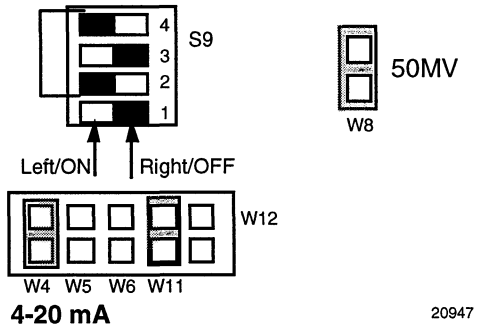
A.1 Summary of DIP Switch and Jumper Selections on Main Printed Circuit Board, Continued

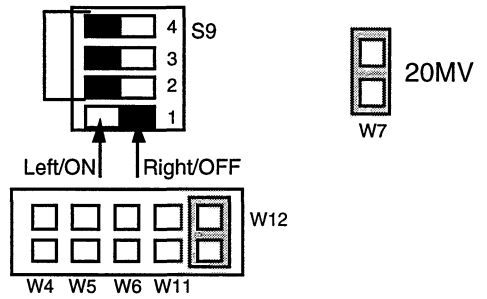
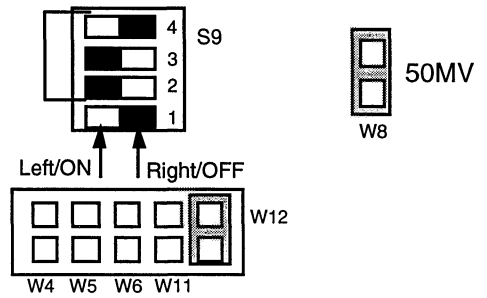
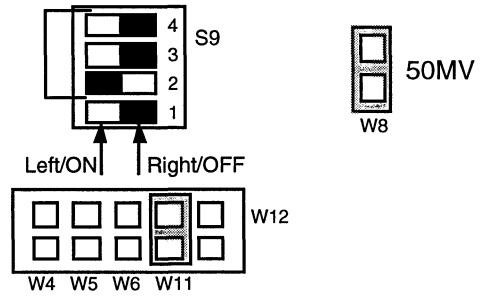
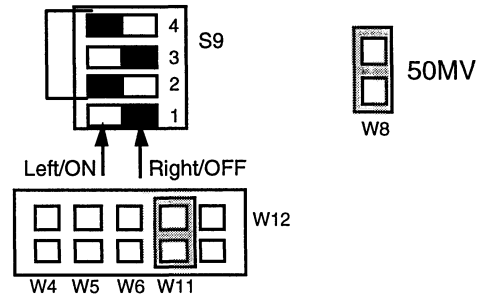
Table A-1 Summary of DIP Switches and Jumpers, continued

Jumper or DIP-Switch Number	Function	Selections
S9, W4, W6, W7, W8, W9, W11, W12 continued	Select Input actuation type/range with positions 2, 3, and 4; and jumpers.	 **Type K thermocouple with upscale burnout**
		 **Type T thermocouple with upscale burnout**
		 **100 ohm RTD without burnout**
		 **4-20 mA** 20947

Continued on next page

A.1 Summary of DIP Switch and Jumper Selections on Main Printed Circuit Board, Continued

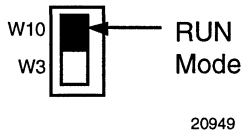
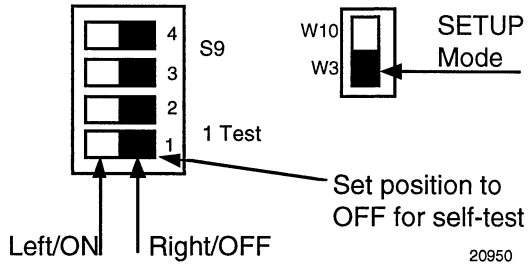
Table A-1 Summary of DIP Switches and Jumpers, continued

Jumper or DIP-Switch Number	Function	Selections
S9, W4, W6, W7, W8, W9, W11, W12 continued	Select Input actuation type/range with positions 2, 3, and 4; and jumpers.	 **0-20 mV without burnout**  **0-50 mV without burnout**  **0-5 Vdc**  **1-5 Vdc** 20948

Continued on next page

A.1 Summary of DIP Switch and Jumper Selections on Main Printed Circuit Board, Continued

Table A-1 Summary of DIP Switches and Jumpers, continued

Jumper or DIP-Switch Number	Function	Selections
W3/W10	Select Run mode.	
W3/W10, S9	Select Set-up mode.	
S1, S2, S3, S4, S5, S6, S7, S8	Set Chart Zero and Full Scale Values.	Refer to *Section 2 - Recording Set-up* for instructions

Appendix B

How to Apply Digital Instrumentation in Severe Electrical Noise Environments

B.1 Overview

Guideline overview

Products that incorporate digital technology provide recognized performance advantages over conventional analog instrumentation used for process control. These advantages can result in better product uniformity and greater overall efficiency when used correctly.

There are, however, certain guidelines regarding installation and wiring which must be carefully followed in order to achieve this performance. In addition to the traditional precaution of the separation of signal and power wiring in separate conduits, other measures must be taken to minimize the effects of electromagnetic interference (EMI) and radio frequency interference (RFI) on the operation of the equipment. Otherwise, if high level, short duration, noise spikes are permitted to enter the digital equipment, the noise can be transferred into the system's logic networks and can be misinterpreted as signal data, resulting in erroneous system operation and other unpredictable responses.

What's in this section

This section contains the following information:

B.2 Potential Noise Sources

Overview

Noise can enter electronic equipment via three methods of coupling, namely:

- Capacitive (or electrostatic)
- Inductive (or magnetic)
- Impedance

Capacitive and inductive coupling

Capacitive and inductive coupling have the same essential effect — they couple current or voltage, without any actual connection of the two circuits. Impedance coupling requires a connection between the two circuits. Typical noise-generating sources that could affect electronic equipment through capacitive and inductive coupling include:

- Relay coils
- Solenoids
- AC power wires — particularly at or above 100 Vac
- Current carrying cables
- Thyristor field exciters
- Radio frequency transmissions

Impedance coupled noise

Impedance-coupled noise may enter by way of the lines used to power the digital equipment or by way of improper grounding. Most power lines, at typical industrial locations, are far from noise-free. The noise on them can be generated in many ways, but are nearly always associated with switching circuits of some nature.

These include:

- Large relays
- Contactors
- Motor starters
- Business and industrial machines
- Power tools
- HID (high-intensity discharge) lights
- Silicon controlled rectifiers (SCRs) that are phase-angled fired

These devices generate noise by lowering the line voltage during energization when large currents are drawn for short periods of time.

B.3 Prevention Methods

Introduction

There are three ways to prevent electrical noise from interfering with the operation of the electronic digital equipment:

- Built-in noise rejection
- Separation of signal and power lines
- Noise suppression at source

Built-in noise rejection

The first method is to design the digital equipment with a high degree of noise rejection built-in. This includes housing the equipment in a case that will provide shielding, liberal use of noise rejection filters and opto-isolators, and the use of noise suppressors on potential noise sources within the equipment itself. This, of course, is the responsibility of the manufacturer who usually performs extensive laboratory and field testing of newly designed digital equipment to insure the adequacy of its immunity to noise. As a minimum requirement, the equipment should be able to pass the tests outlined in the IEEE Standard 472-1974 *(Surge Withstand Capacity Tests).*

Signal and power line separation

The second method is to prevent noise from getting on the signal and power lines that are connected to the equipment. This is achieved by proper separation and shielding of those lines. In some cases, separate power lines or special power line regulation or filtering may be required for satisfactory electronic digital equipment operation. It is the responsibility of the installer to follow good wiring practices.

Suppression at the source

The third prevention method is to suppress the noise at its source. This is the most effective but also the most difficult because it is not easy to identify all of the potential noise sources in a typical industrial installation. Therefore, "suppression" is usually a last resort for those extreme situations where the other methods are insufficient by themselves. See *Noise Suppression at Source* which follows.

B.4 Recommended Wiring Practices

General rules

- All wiring must conform to local codes and practices.
- Wires carrying similar types of signals (Table B-1) may be bundled together, but bundles with different types of signals must be kept separated to prevent inductive or capacitive coupling.

Wire bundling

Table B-1 shows what wiring should be bundled together to prevent inductive or capacitive coupling.

Table B-1 External Wiring

Wire Function		Bundle No.	Are Shielded Twisted Wires Recommended?
No.	**Type**		
	HIGH VOLTAGE	1	NO
1	Line Power		
2	Earth Ground		
3	Line Voltage		
	ANALOG I/O	2	YES
4	Process Variable		
	RTD		
	Thermocouple		
	dc Millivolts		
5	Low level (<100V)		
	4-20 mA dc		
	1-5 Vdc		
6	RELAY OUTPUTS	3	YES

Continued on next page

Additional rules

Please observe these additional rules for wire bundling:

- For distances over five (5) feet, and when shielding is recommended, use a separate metal tray or conduit for each bundle. Where conduits or trays are not practical, use twisted wires with a metal overbraid and provide physical separation of at least one foot.
- Tray covers must be in continuous contact with the side rails of the trays.
- When unlike signal levels must cross, either in trays or conduits, they should cross at a 90-degree angle and at a maximum spacing. Where it is not possible to provide spacing, a grounded steel barrier or grid should be placed between the unlike levels at the crossover points.
- Trays containing low level wiring should have solid bottoms and sides. Tray covers must be used for complete shielding. Tray cover contact with side rails must be positive and continuous to avoid high reluctance air gaps, which impair shielding. Trays for low level cables should be metal and solidly grounded.
- Wires containing low level signals should not be routed near any of the following:
  - Contactors
  - Motors
  - Generators
  - Radio transmitters
  - Wires carrying high current that is being switched on and off
- Use a 12-gage (or heavier) insulated stranded wire for the ground connection. Attach it firmly to a proven good earth ground such as a metal stake driven into the ground.
- All shields should be grounded at one end only — preferably the instrument end.

B.5 Power Source Considerations

Operate within limits

The AC power for the digital electronic equipment must be within the voltage and frequency limits specified for that equipment. Attempts to operate outside the specified limits will result in no performance. For those installations where the supply voltage will not stay within the specified limits, a ferroresonant transformer, for voltage resolution, should be used.

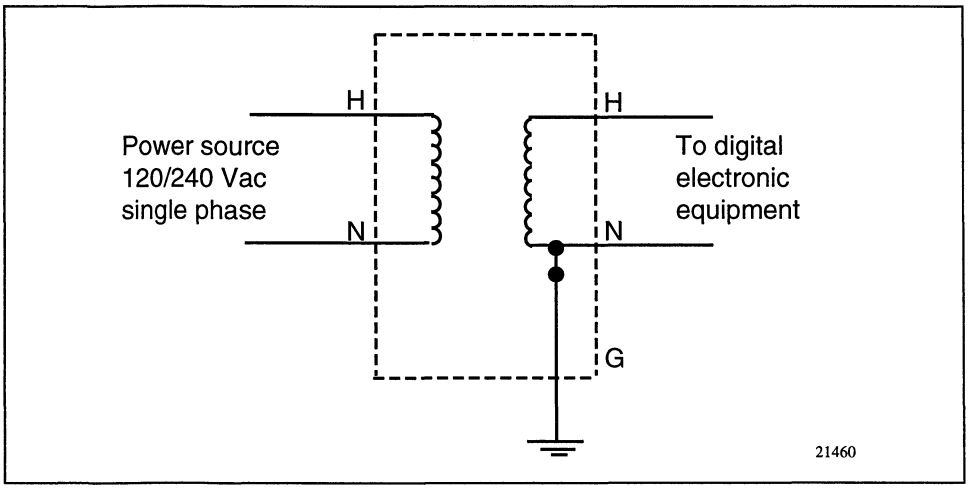
Independent AC source

For protection against noise, the AC source for the digital electronic equipment should be independent of all other loads especially when switching loads are involved. For example, it should not provide power for air-conditioning, convenience outlets, lighting, motors, or similar noise-generating devices. To obtain electrical isolation (see Figure B-1) a separate transformer is required to supply power to the digital equipment. For additional noise and transient rejection, shielded primary and secondary windings may be required. And, if necessary, power line filters may be added to attenuate noise signals that have a higher frequency than the power line frequency.

Transformer for digital equipment

Figure B-1 is an illustration of a separate transformer required to supply power to digital equipment.

Figure B-1 Transformer for Digital Equipment



B.6 Noise Suppression at the Source

Introduction

Generally speaking, when good wiring practices are used with well-designed digital electronic equipment, no further noise protection is necessary. However, in some severe electrical environments, the magnitude of the electrical noise is so great that it must be suppressed at the source. In most control cabinets, the main sources of noise are motor starters, contactors, relays, and switching gear. For this reason, many manufacturers of these devices supply "surge suppressors" which mount directly on the noise source, (for example, on the coil of a control relay or motor starter).

For those devices that do not have accessory "surge suppressors," (RC) circuits and/or voltage limiters such as metal varistors may be added when and where needed. This can be broken down into two categories, namely inductive loads (for example, a relay switch in series with a relay coil) and contacts.

Inductive coils

Metal Oxide Varistors (MOVs) are recommended for transient suppression in inductive coils. An MOV is connected in parallel with the coil and is as close as physically possible to the coil (see Figure B-2). MOV devices (listed in Table B-2) are recommended for general purpose applications.

• Table B-2 lists part numbers for recommended MOV devices.

Table B-2 MOV Devices

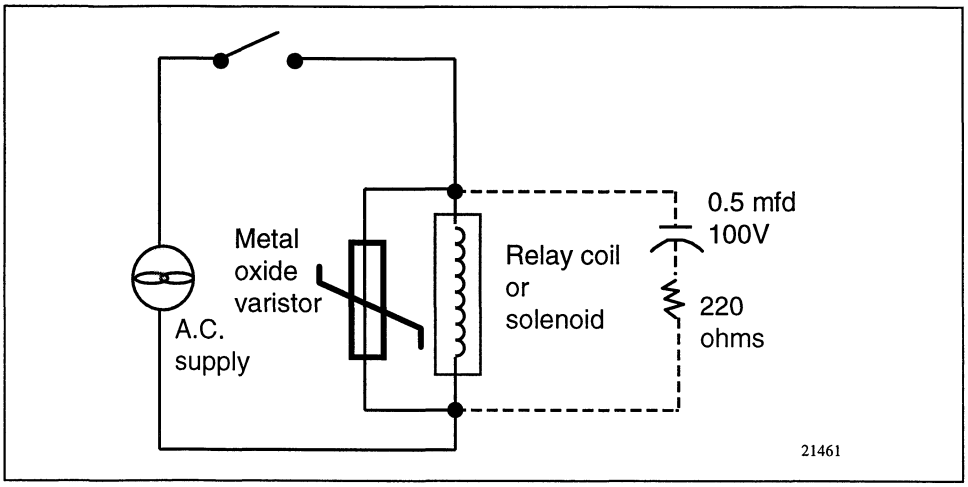
Part Number	30732481-501*	30732481-502
Maximum AC	130V	275V
Energy Pulse Rating	10 Joules	15 Joules
Supplier (General Electric)	V130LA10A	V275LA15A

Continued on next page

Inductive coils, continued

Figure B-2 is an illustration of transient suppression in inductive coils.

Figure B-2 Transient Suppression in Inductive Coils



Additional protection may be provided by adding an RC circuit in parallel with the MOV. This consists of a 220-ohm resistor in series with a 0.5 microfarad, 1000V capacitor. The power rating of the resistor will depend on the voltage rating of the coil (see Table B-3).

Table B-3 Coil Voltage vs. Resistor Voltage Rating

Coil Voltage	Resistor Voltage Rating
115V	1/4 Watt
230V	1 Watt
460V	3 Watt
550V	5 Watt

Continued on next page

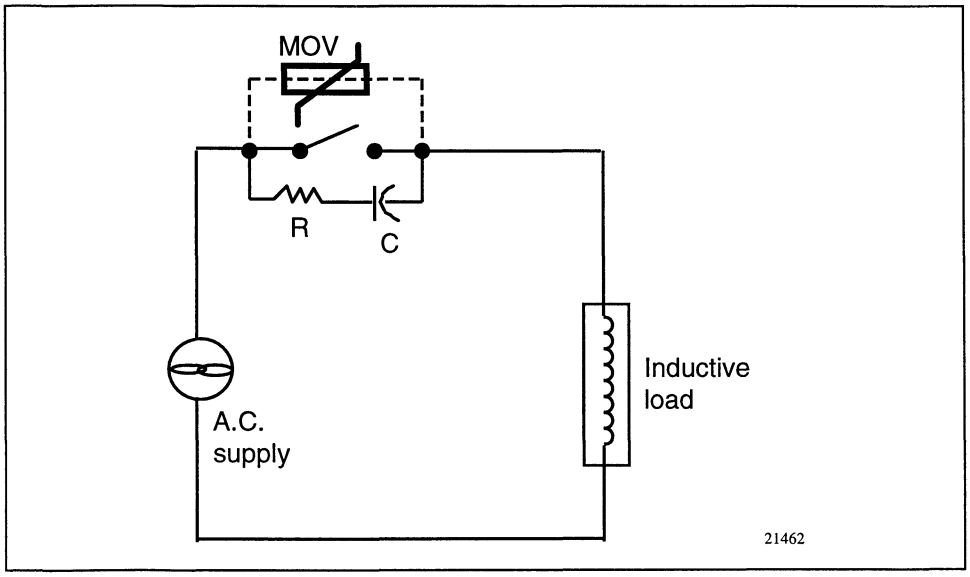
Contacts

When a contact interrupts an inductive load, a certain amount of energy is stored in the load. An MOV or RC circuit in parallel with the load provides a place where this energy may be dissipated. However, if there is no MOV or RC circuit, the energy may create a visible electrical arc across the open contacts. This, in turn, results in electrical noise as well as damage to the contacts.

One way to eliminate this arc is to connect a resistor and capacitor across the contacts (see Figure B-3). A combination of 47 ohms and 0.1 microfarads (1000 Vdc) is recommended for circuits up to 3 amps and 300 Vac. For voltages above 2000 Vac, an MOV across the contact may be added for extra protection.

- Figure B-3 is an illustration of a resistor and capacitor connected across a contact to eliminate electrical noise.

Figure B-3 Contact Noise Suppression



For large load currents, a rule of thumb is to size the capacitor so that the number of microfarads equals the number of amperes in the load current, and the resistor has the same resistance value as the load. The objective is to eliminate the visible arc.

Either discreet resistors and capacitors or packaged RC networks may be used. An RC network (47 ohms and 0.1 microfarad) is available from Honeywell as part number 30371852-001. Similar RC networks are available from Electrocube Inc. (part number RG1782-3) and from Industrial Condensor Corporation.

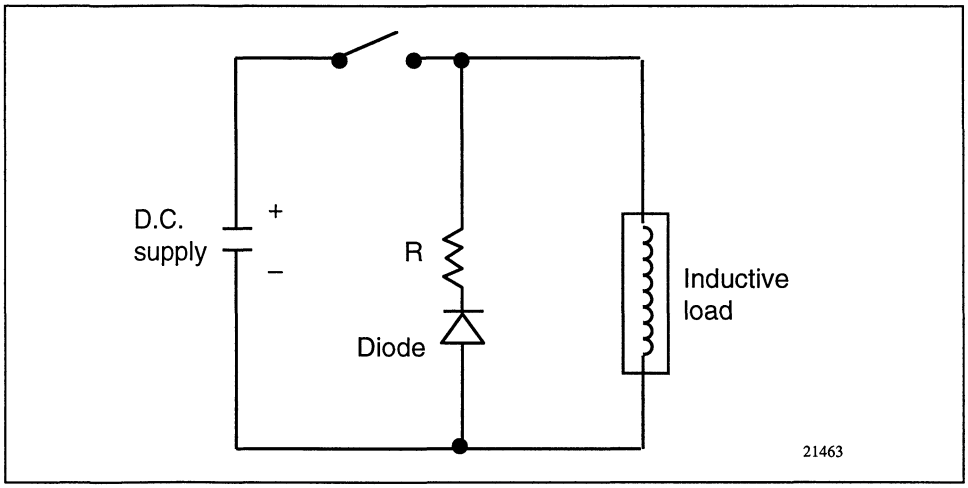
Continued on next page

Contacts, continued

In DC circuits, the power dissipation under steady state condition can be eliminated by placing a diode (in series with a resistor) in parallel with the load (see Figure B-4). The value of R should be less than or equal to the DC resistance of the inductive load.

• Figure B-4 is an illustration of DC load noise suppression.

Figure B-4 DC Load Noise Suppression



Appendix C - Accuracy

C.1 Overview

Reference accuracy

The Reference Accuracy varies according to the type of input actuation.

Table C-1 lists the types of input actuations and their reference accuracy.

These figures include reference junction calibration of ±0.01 degrees using the standard "ice bath" method of calibration. Factory calibration at reference ±1.2°F. Note that factory calibration may have typical variations of ±150 microvolts or ±0.6 ohms for RTDs which means recalibration may be required to achieve stated accuracy.

Table C-1 Reference Accuracy

Types of Input Actuations	Range		Reference Accuracy		Temp Stability ± degrees error per 1 degree ΔT
	°F	°C	± °F	± °C	
Thermocouples	**0 to 1600**	**–18 to 871**			
J	0 to 1200	–18 to 649	3.5	2.0	0.21
	1200 to 1600	649 to 871	4.5	2.5	0.21
K	**–320 to 2500**	**–196 to 1371**			
	–320 to 0	–196 to –18	6.0	3.3	0.70
	0 to 2000	–18 to 1093	5.0	2.8	0.30
	2000 to 2500	1093 to 1371	7.5	4.2	0.40
T	**–300 to 700**	**–184 to 371**			
	–300 to –200	–184 to –129	4.5	2.5	0.22
	–200 to 700	–129 to 371	3.0	1.7	0.16
RTD					
Platinum					
100 ohms*	–300 to 900	–184 to 482	3.0	1.7	0.15
Linear					
Milliamperes dc	0 to 20	—	0.06 mA	—	0.011%/°F
	4 to 20	—	0.06 mA	—	0.011%/°F
Millivolts dc	0 to 20	—	0.08 mV	—	0.011%/°F
	0 to 50	—	0.19 mV	—	0.011%/°F
Volts dc	0 to 5	—	0.015V	—	0.011%/°F
	1 to 5	—	0.012V	—	0.011%/°F

* IEC Alpha = 0.00385

Appendix D - Available 10-inch Charts

D.1 Single Range Charts

Introduction

Table D-1 lists the chart part numbers for the available 10-inch single range charts.

Table D-1 10-inch Single Range Chart Part Numbers

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
B Thermocouple	0 to 1800	C	135	
J Thermocouple	–18 to 425	C	028	028
	–45 to +150	C	027	027
	–50 to +300	F	019	019
	0 to 150	C	070	070
	0 to 200	F	114	
	0 to 250	C	024	024
	0 to 300	F	002	002
	0 to 300	C	062	062
	0 to 400	F	012	006
	0 to 400	C	063	063
	0 to 500	F	013	007
	0 to 600	F	003	008
	0 to 800	F	014	009
	0 to 1000	F	015	010
	0 to 1200	F	004	011
	0 to 1600	F	018	018
	10 to 340	C	057	057
	10 to 76	C	030	030
	50 to 1400	F	029	029
	50 to 650	F	056	056
	100 to 260	C	094	
	150 to 750	F		150
	810 to 910	F	230	

Table D-1 continued on next page

D.1 Single Range Charts, Continued

Table D-1 10-inch Single Range Chart Part Numbers, Continued

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
K Thermocouple	–18 to 1320	C	031	031
	0 to 200	C	086	
	0 to 400	F	053	053
	0 to 400	C	064	064
	0 to 500	C	205	
	0 to 600	C	059	059
	0 to 800	C	060	060
	0 to 1000	F	007	016
	0 to 1000	C	049	049
	0 to 1200	F	006	012
	0 to 1200	C	065	
	0 to 1600	F	016	013
	0 to 2000	F	005	014
	0 to 2400	F	009	015
	800 to 1000	F	227	
R Thermocouple	0 to 1600	C	017	017
	0 to 2500	F	025	025
	30 to 2900	F	032	032
	800 to 2500	C	089	
S Thermocouple	0 to 1600	C	066	
	0 to 3000	F	147	147
T Thermocouple	–250 to +150	F	042	042
	–130 to +410	F	033	033
	–100 to +100	C	069	069
	–90 to +210	C	034	034
	0 to 100	C		100
	0 to 150	C	103	201
	0 to 300	C		079
	75 to 200	C		058
	+125 to -1-5		098	
W5W26 Thermocouple	0 to 1800	C	157	

Table D-1 continued on next page

Table D-1 10-inch Single Range Chart Part Numbers, Continued

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
Linear	–200 to +200			199
	–100 to +200		232	178
	–100 to +100	F	201	
	–85 to +190		179	
	–75 to +260		178	179
	–60 to +215		088	
	–50 to +50			218
	–40 to +10			142
	–30 to +170			087
	–30 to +100	C	210	
	–30 to +20	F	204	
	–18 to 94		035	
	–10 to 100			149
	–5 to 50	C	022	197/022
	0 to .1		170	170
	0 to .2		171	171
	0 to .5		172	172
	0 to .6			203
	0 to 1		211	202
	0 to 2	MG/L		217
	0 to 2	MGD	175	129
	0 to 5		074	074
	0 to 8		212	
	0 to 10		076	076
	0 to 10		168	168
	0 to 14		036	036
	0 to 14	PH	073	
	0 to 15		119	085
	0 to 20		071	071
	0 to 24	FEET		196
	0 to 25		095	095
	0 to 30		040	040
	0 to 40		110	041

Table D-1 continued on next page

Table D-1 10-inch Single Range Chart Part Numbers, Continued

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
Linear (continued)	0 to 45		078	
	0 to 50		104	051
	0 to 55		130	
	0 to 70			075
	0 to 80		120	
	0 to 100		001	001
	0 to 120		054	
	0 to 150		180	
	0 to 200		010	004
	0 to 300		050	050
	0 to 350		037	037
	0 to 400		011	005
	0 to 600		052	
	0 to 750		223	
	0 to 800		137	
	0 to 1000		173	
	0 to 1200			108
	0 to 1600			109
	0 to 2000	F	202	
	0 to 2400	GPM		219
	0 to 2500		113	
	0 to 7000		123	
	0 to 8000		208	
	0 to 25000		111	
	0.2 to 2.0		176	176
	1.3 to 1.8			
	4 to 10		177	177
	5 to 9	PH		093
	10 to 20	METER	231	
	20 to 120		039	039
	40 to 70			125
	50 to 70			141
	50 to 250		008	003

Table D-1 continued on next page

D.1 Single Range Charts, Continued

Table D-1 10-inch Single Range Chart Part Numbers, Continued

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
Linear (continued)	70 to 140		038	038
	100 to 200		132	
	100 to 300	F	131	
	100 to 600	F	140	
	1500 to 2500			
	2250 to 2500	F	209	
	1300 to 3600	F	203	
RTD-PT100 a=.00391	–200 to +100	F	044	044
	–125 to +375	F	020	020
	–100 to +50	C	091	
	–100 to +100	C	080	080
	–100 to +200	C	021	021
	–100 to +500	F	099	
	–85 to +190	C	047	
	–75 to +260	C	055	055
	–50 to +25	C	048	048
	–50 to +50	C	092	
	–35 to +75	C	023	023
	–30 to +170	F	087	087
	–25 to +125	C	045	045
	–20 to +30	F		117
	0 to –100	C		084
	0 to 60		161	
	0 to 120	C	144	
	0 to 150	C	122	
	0 to 250	C	068	
	0 to 400	C	081	081
	49 to –95	C		083
	50 to 100	C	061	
	50 to 150	C	116	116
	50 to 250		096	
	100 to 200	F	132	

Table D-1 continued on next page

Table D-1 10-inch Single Range Chart Part Numbers, Continued

Chart Type	Range	Units	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
RTD-PT100 a=.00391 (continued)	120 to –140	F	082	
	180 to 30	F	121	
	250 to 300	F	106	
RTD-PT100 a=.00385	–100 to +100	C	080	080
	–40 to +60	C	067	067
	50 to 100		061	061
	50 to 120		134	
	0 to 250	C	068	
	0 to 400		081	081

D.2 Dual Range Charts

Introduction

Table D-2 lists the chart part numbers for the available 10-inch dual range charts.

Table D-2 10-inch Dual Range Chart Part Numbers

Calibration	Range 1	Range 2	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
Linear/Linear	0 to 15	0 to 3,000,000	200	
	–100 to +200	35 to 0	600	600*
	0 to 200	63 to 0		602*
	0 to 2000	0 to 90		633*
	–18 to +94	35 to 0	603	
	–18 to +94	35 to 0		603
	–22 to +158	0 to 10	174*	
	0 to 50	0 to 100	606*	606
	0 to 60	0 to 100	138*	
	0 to 100	–30 to +70	601	
	0 to 100	0 to 14	621*	
	0 to 100	–30 to +70		601
	0 to 100	–80 to +20		653*
	40 to 140	30 to 40		148*
	50 to 150	0 to 100	097	
	50 to 150	20 to 0	609	
	50 to 150	0 to 100		097
Linear %/Linear PH	0 to 100	0 to 14		213
Linear/K T/C Deg. F	0 to 100	0 to 2000F	640*	
Linear/RTD Deg. C	0 to 100	–87 to +191C	145*	
Linear Deg. C/Linear	–40 to +150C	0 to 100 RH	660*	660*
Linear Deg. F/Linear %RH	0 to 120F	0 to 100	207	
Linear Deg. C/Linear %RH	–90 to +190C	0 to 100	197	
Linear Deg. C/Linear	–18 to +37C	0 to 100		620*
Linear Deg. F/Linear	–40 to +300F	0 to 100 RH	661*	661*
Linear Deg. F/K T/C Deg. F	0 to 3000F	0 to 2000F	645*	
Linear Deg. F/Linear	32 to 122F	0 to 100		151*
Linear Deg. F/Linear %RH	–125 to +375F	0 to 100	195	
	–125 to 375F	0 to 100		194
Linear Deg. F/PSI Linear	0 to 1400F	0 to 5000		
Linear Deg. C/Linear	–18 to +37C	0 to 100		637*

*minimum purchase required

Table D-2 continued on next page

Table D-2 10-inch Dual Range Chart Part Numbers, Continued

Calibration	Range 1	Range 2	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
Linear GPM/Linear PH	0 to 100	0 to 14		214
	0 to 250	0 to 14		200
Linear PSI/Linear GPM	0 to 15	0 to 7800		204
J T/C Deg. F/Linear	0 to 600F	0 to 2000 PSI	647*	
	0 to 300F	0 to 100	617*	617*
	0 to 300F	0 to 400	656*	
	0 to 400F	0 to 100	124*	
	0 to 400F	0 to 800	629*	
	0 to 600F	0 to 100	611*	
	0 to 300F	0 to 500	636*	
J T/C Deg. C/K T/C Deg. C	0 to 300C	0 to 1200C	143*	
	–18 to +315C	–18 to +1315C	112*	
J T/C Deg. F/J T/C Deg. C	95 to 455F	35 to 235C	026*	026*
J T/C Deg. F/J T/C Deg. F	1300 to 2000F	400 to 800F	649*	
	0 to 300F	0 to 1600F	651*	
J T/C Deg. F/K T/C Deg. F	0 to 300F	0 to 1500F	186	
	0 to 600F	0 to 2400F	604*	
K T/C Deg. F/Linear	–100 to +900F	0 to 10	635*	
	0 to 2000F	0 to 2	163*	
	500 to 2000F	0 to 1.5	127*	
T T/C Deg. C/Linear	–87 to +191C	0 to 100	153*	
T T/C Deg. F/Linear	50 to 250F	0 to 100	643*	
	–50 to +300F	0 to 100		631*
T T/C Deg. C/Linear	–100 to +100C	0 to 100		162*
	–80 to +180C	0 to 100	657*	
RTD Deg. F/Linear	100 to 300F	0 to 160	152*	
RTD Deg. C/Linear	–5 to +50C	0 to 100		102*
	–10 to +60C	0 to 100		616*
	–35 to +75C	0 to 100		101*
	–76 to +100C	35 to 0	607*	
	–50 to +100C	0 to 100	638*	638*
	–76 to +100C	35 to 0		607*
	–75 to +1800C	35 to 0	608*	
	–85 to +190C	0 to 100	154*	

*minimum purchase required

Table D-2 continued on next page

Table D-2 10-inch Dual Range Chart Part Numbers, Continued

Calibration	Range 1	Range 2	24 HR P/N 24001660-XXX	7 DAY P/N 24001661-XXX
RTD Deg. C/Linear	–85 to +190C	0 to 100	659*	
	–5 to +50C	0 to 100		627*
	12 to 93C	0 to 1000	644*	
	50 to 150C	0 to 50	646*	
RTD Deg. F/Linear	–50 to +250F	0 to 1000		642*
	50 to 250F	0 to 100		626*
	0 to 300F	0 to 100	632*	
	100 to 300F	0 to 160	652*	
	–10 to +60F	0 to 100	616*	
RTD Deg. C/Linear	–100 to +100C	0 to 100	628*	628*
	–18 to +94C	0 to 100	155*	
RTD Deg. C/Linear PSIA	0 to 150C	0 to 25	222	
RTD Deg. C/RTD Deg. C	0 to 100C	50 to 120C		641*
	–23.3 to +93.3C	–87.2 to +177C	206	
RTD Deg. F/RTD Deg. F	14 to 122F	104 to 212F	619*	
RTD Deg. C/RTD Deg. C	–10 to +50C	40 to 100C	618*	

*minimum purchase required

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