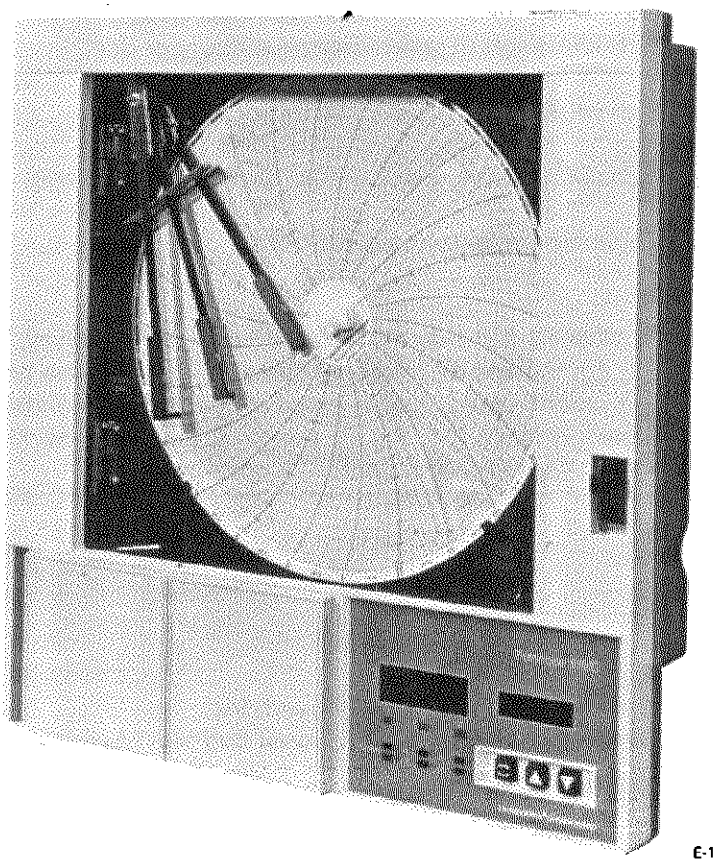
Instructions for FULSCOPE® ER/C Recorder

IB-13D300
Issue 3
May 1990

1911J, 1912J, 1913J Model A



E-1107-9A

ABB Kent-Taylor

ASEA BROWN BOVERI

NOTICE

Use of **DANGER, WARNING, CAUTION** and **NOTE**

This publication includes **DANGER, WARNING, CAUTION** and **NOTE** information where appropriate to point out safety related or other important information.

DANGER - Hazards which will result in severe personal injury or death.

WARNING - Hazards which could result in personal injury.

CAUTION - Hazards which could result in equipment or property damage.

NOTE - Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER, WARNING** and **CAUTION** notices.

TRADEMARKS

FULSCOPE is a registered trademark of Asea Brown Boveri, Inc.
IBM Personal Computer XT is a trademark of International Business Machines Corporation.

Prepared by:
MARKETING COMMUNICATIONS DEPARTMENT 505

ABB Kent-Taylor P.O. Box 110 Rochester, NY 14692-0110

Printed in U.S.A.

TP-15833

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

ILLUSTRATIONS

ILLUSTRATIONS (Cont'd)

TABLES

SECTION 1
INTRODUCTION

1.1 DESCRIPTION

1.1.1 General

The Taylor Fulscope ER/C Recorders, 1911J, 1912J, and 1913J are microprocessor based recording instruments which can record as many as three process variable inputs. Any one of the recorded inputs can be selected for digital display on the front panel of the recorders.

The recorder accepts direct connection of thermocouple, RTD (resistance temperature detector), millivolt dc, volt dc, and milliampere dc inputs. Ranging of thermocouple and RTD inputs is automatic. Each input signal is galvanically isolated from the rest of the instrument circuitry, and thermocouple cold junction compensation is provided at the connection terminals in the instrument. Thermocouple and RTD inputs are automatically linearized, and square law linearization is configurable for differential pressure inputs. A nonisolated 24 volt dc transmitter power supply is provided for use with milliamp dc inputs from 2-wire transmitters.

Input signals enter the recorder through an I/O circuit board associated with each pen, Figure 1-1. Any I/O board can be configured via jumper settings to accept any input signal. DIP Switches on the processor circuit board are configured for each pen to key the processor to the input type so that functions such as thermocouple or RTD linearization, square law, and automatic ranging are properly applied.

Recording functions, chart speed, alarm settings, and other parameters are configured using the keys on the front panel, Figure 1-2. The front panel displays provide a series of prompts to help the user set up the recorder for a specific application. All configuration data is protected by a security access system and is stored in nonvolatile memory.

The recorder can operate on either 120 or 240 volt ac power at 50 or 60 Hz. Operating voltage is selected by positioning jumpers on the power connection terminal block. Provision is made for split grounding so that the logic circuitry ground can be separated from the power ground when necessary.

The instrument housing is molded glass-fiber-filled reinforced polyester that provides excellent corrosion resistance. The instrument has a fully gasketed door and meets NEMA 3 requirements. The housing can be either panel or surface mounted.

1.1.2 Recording

The recorder has a 10-inch circular chart with a 4-1/8 inch calibrated width. Charts are available in a wide selection of standard ranges. The chart speed is adjustable from one revolution per hour to one revolution per 168 hours (7 days). Chart speed settings can be made in increments of one hour.

The 1911J Recorder has one pen (red), the 1912J has two pens (red, green), and the 1913J has three pens (red, green, blue). All pens are the disposable fiber tip type.

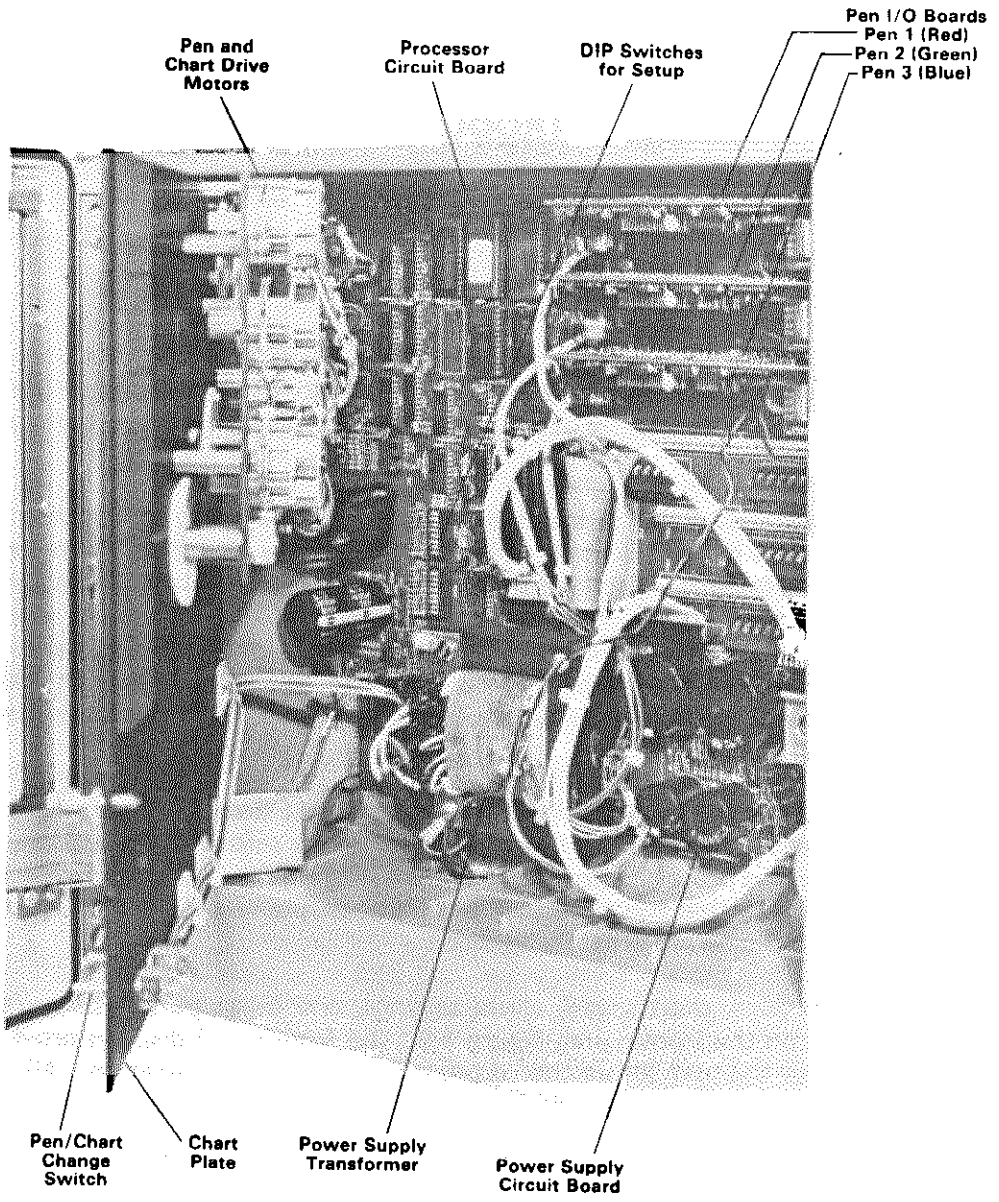


Figure 1-1. Location of Recorder Components

Any pen can record any process input accepted by the recorder or any pen can be selected as an event marker. An event marker pen will provide a chart record of the start and duration of any event which can be sensed by transfer of an external switch contact.

A convenient pen/chart change switch located on the chart plate, Figure 1-1, provides quick and unobstructed access to the chart or pens for easy replacement. A simple snap-down chart hub simplifies chart changes.

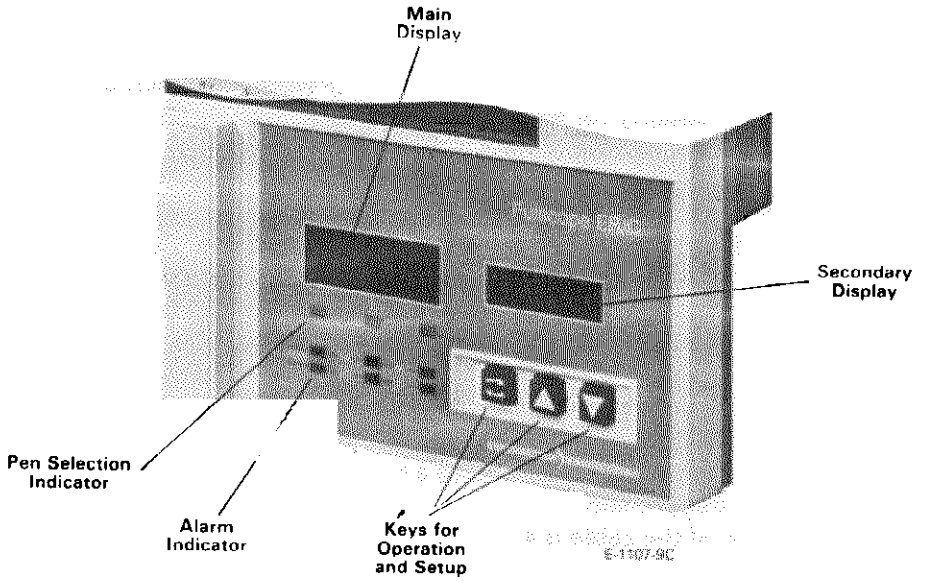


Figure 1-2. Front Panel Controls and Displays

1.1.3 Displays

The recorder has two digital displays on the front panel, Figure 1-2. The main display is configurable to indicate the measured value of a process variable input. The secondary display is used to indicate detection of input failure, and for instrument configuration prompts. Both displays are used to show totalized values when the totalizer is on.

Any process variable can be selected for read out on the main display. The illuminated pen selection indicator identifies the pen which is recording the displayed variable.

A set of high and low alarm indicators is located directly below each pen selection indicator. A high or low indicator lights when its respective process variable reaches the alarm trip-point setting. The alarm indicators can be configured to permit acknowledgement of an alarm using the front panel keys.

1.1.4 Alarms

An SPDT (single-pole double-throw) relay is provided on the I/O circuit board associated with each pen. The relay is activated to provide an alarm output when the process input reaches either the high or low alarm trip-point. The high and low alarm trip-points are configurable over the full process input range.

Dual SPDT relays are provided on a digital option board which is available for the red pen and green pen. The dual relays provide independent high and low alarm outputs for their associated pens.

1.1.5 Event Marker Relays

When a pen is selected as an event marker, the relay on the I/O board changes state when an event occurs. This provides an alarm output as a function of event activity. If there is a digital option board available for the event pen (red or green only), the two relays on the option board respond to event activity in the same manner as the relay on the I/O board.

1.1.6 Retransmission Output

A 4 to 20 mA dc retransmission output signal is provided on the red and green pens and is available when a process input exists. The retransmission limits are determined by the chart limits and the signal is directly proportional to process input actuating the pen. It provides additional load capability for transmitting the measured variable to a remote location.

1.1.7 RS-422 Serial Communication Port

The recorder may be specified with a RS-422 serial communications port. The RS-422 functionality is contained in the instrument firmware. Recorder terminal block TB7, which is available in all recorders, provides RS-422 cable connection terminals. The terminal block is activated on those instruments which have the RS-422 option.

The RS-422 serial communications option provides the means for a host computer to communicate with Fulscope ER/C and MICRO-SCAN Instruments. As many as 16 instruments in any combination can be connected to a host computer serial port. The instruments may be connected in a daisy chain configuration using dual twisted-pair, shielded cable. The maximum length of the cable is 4000 ft (1200 m).

The interface uses an asynchronous mode of communication. Baud rate, word length and parity are configurable via setup level 6 (**See Section 3, Setup** for an explanation of levels). The baud rate options are: 1200, 2400, 4800 and 9600 baud. Word length and parity options are: 8 bits with no parity, 7 bits with even parity, and 7 bits with odd parity. The interface uses one stop bit. This parameter is not configurable.

1717S PC-30 Fulscope ER/C Interface Software for IBM PC AT compatibles is available when using the PC-30 workstation as described in **IB-23H125**. The interface software supports instrument functions that can make the instrument part of an overall control scheme. If desired, communications programs can be written using the protocol described in **IB-11D120**.

The following transactions are possible between the computer and recorder:

- Read instrument type (Recorder)
- Read process variable data (input type, status, and value)
- Read input status data (cause of failure, high/low alarm status, high/low alarm relay status).
- Acknowledge alarms
- Acknowledge input failure
- Read/write various parameters as described in **IB-11D120**

1.1.8 Integration/Totalization Function

The integrator/totalizer provides the capability to integrate process flow rate signals and display totalized flow values on the recorder front panel, Figure 1-3. The integration/ totalization function is available on each installed pen with a flow input. The process flow signal can be in millivolts, volts, or milliamperes from a two-wire or non two-wire transmitter. Signals which have a linear relationship with flow can be integrated and totalized directly. Flow signals, which are proportional to differential pressure, require the application of square law linearization which is available as a standard recorder function. Integration/ totalization does not apply to thermocouple, RTD or event inputs.

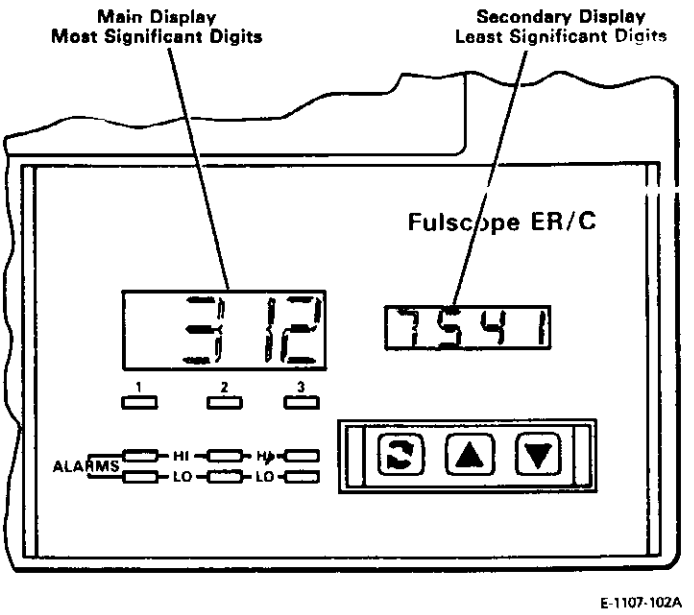


Figure 1-3. Recorder Displays Showing Totalized Value

The integrator/totalizer algorithm converts process flow signals representing flow in terms of volume per unit time (i. e., gal/hr) into counts which are summed to provide a continuous readout of total flow. The integrator/totalizer can be configured to accept flow rate time bases in hours, minutes or seconds.

The totalized value for any pen can be selected for readout on the front panel displays using the control keys. When the totalizer display is selected, the total value is continuously displayed until the operator selects another display. The displayed total is a 7-digit number with a sign. Only the negative sign is displayed, and leading zeros are not suppressed. To accommodate the eight characters required, the most significant digits are shown on the main display, and the least significant digits are shown on the secondary display. For example, if the total value is -860,372 the display reading is [-086] [0372].

Integrator/totalizer parameters are configured using the front panel keys in the same manner as for other recording parameters. Features which can be configured are as follows:

- Preset Value
  The value from which the totalizer starts its count. It can be zero or any positive or negative number.
- Predetermined Count
  The value at which the totalizer automatically resets when the wrap function is selected. Also, optional relays trip when the count reaches the predetermined count.
- Wrap Function
  When selected, the wrap function causes the totalizer to automatically reset to the preset value and start over each time the predetermined count is reached.
- Reset
  The reset feature allows the totalizer to be manually reset to the preset value selected in the Level 2 setup procedure.

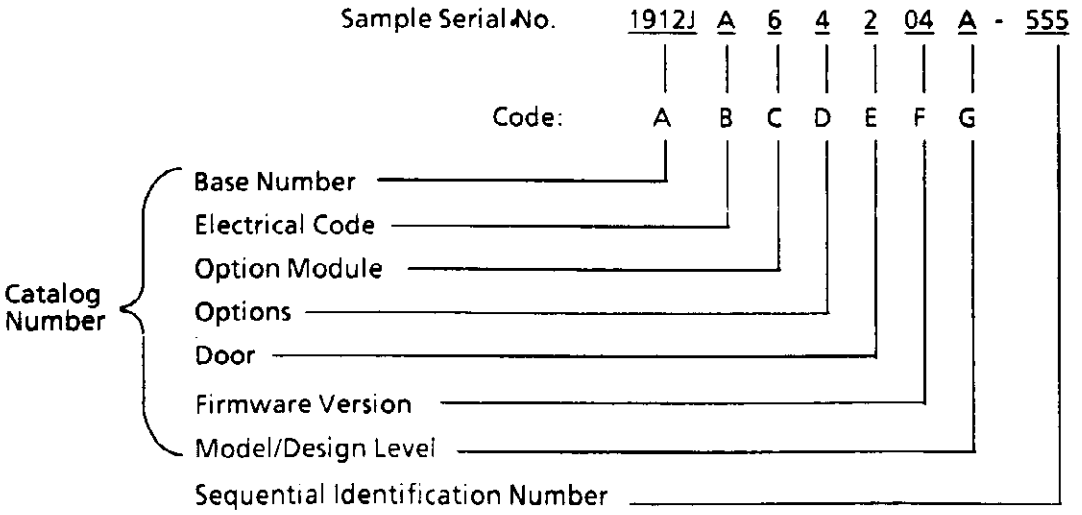
- Threshold Value
  The process input value below which the signal is not totalized.
- Totalizer Type
  This feature permits the totalizer to be set up to count either up or down.
- Scale Factor
  Selection of one of three available scale factors determines the position of the decimal point in the totalized value as it appears on the display.

When the red or green pen totalizer is running, the function of the two independent alarm relays found on the digital option module changes. They signal the point at which the totalized value reaches the predetermined count instead of signaling a process alarm condition. Both relays transfer simultaneously when the predetermined count is reached. This action is not indicated on the front panel. The front panel alarm lights continue to provide high/low alarm indication; they are not affected by totalizer operation. The function of any relay used for control purposes or the standard alarm relay on each I/O circuit board is not affected by totalizer operation.

When a totalizer is turned off, the optional relays associated with that totalizer automatically revert to their normal process alarm function without any other setup changes. High and low trip points will be those set up for the pen in setup Level 3. Process actuation of these relays can be avoided by setting the trip points beyond the maximum and minimum process input values.

1.2 EXPLANATION OF SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. An X before the serial number indicates that the instrument was built to meet a customer's special requirements. The serial number, which is described below, contains a series of single and multiple-character codes. These codes provide specific information concerning various electrical and/or structural options that may or may not be currently available. Each code is assigned a code identifier letter for reference within these instructions.



BASE NUMBER (CODE A)
1911J – Fulscope ER/C Recorder, One Pen (Red)
1912J – Fulscope ER/C Recorder, Two Pens (Red, Green)
1913J – Fulscope ER/C Recorder, Three Pens (Red, Green, Blue)

ELECTRICAL CODE (CODE B)
A – General Purpose, Taylor Standard
B – General Purpose, CSA Certified

OPTION MODULE (CODE C)
0 – None
2 – Digital Option Module on Red or Green Pen
6 – Digital Option Modules on Red and Green Pens

OPTIONS (CODE D)
0 – None
1 – RS-422 Serial Communications Port
3 – Integrator/Totalizer
4 – Combination of 1 and 3

DOOR (CODE E)
1 – Without Door Lock
2 – With Door Lock

FIRMWARE VERSION (CODE F)
01 – Version 1 (Does not support options 1, 3, and 4)
02 – Version 2 (Does not support options 1, 3, and 4)
03 – Version 3
04 – Version 4

MODEL/DESIGN LEVEL (CODE G)
A – Model A

EXAMPLE:
Serial number 1912JA64204A-555 identifies an ER/C Recorder with two pens, red and green (1912J, Code A). The electrical code is general purpose, Taylor standard (A, Code B). The recorder has a digital option module on the red and green pens (6 Code C), integration/totalization and RS422 communications options (4, Code D), and a door lock (2, Code E). The recorder firmware is version 4 (04, Code F), and the design level is Model A (A, Code G). The sequential identification number is 555.

1.3 TECHNICAL CHARACTERISTICS

PROCESS INPUTS

Range Limits

Thermocouple	See Table 1-1
RTD:	See Table 1-1
Millivolts:	0 to 100 mV dc
Volts:	0 to 10V dc
Current:	4 to 20 mA dc

Table 1-1. Range Limits for Temperature Inputs

Thermocouple or RTD	Measuring Range Limits			
	°F		°C	
	Lower	Upper	Lower	Upper
Type J	– 328	2192	– 200	1200
Type K	– 328	2498	– 200	1370
Types R and S	32	3002	0	1650
Type E	– 328	1832	– 200	1000
Type T	– 328	752	– 200	400
RTD*	– 328	1562	– 200	850

* Resistance Temperature Detector, 3-Wire Platinum, 100 ohm per DIN standard 43760 (IEC751)

Span

Thermocouple:	Automatic ranging for all thermocouple inputs. Minimum chart span is 3 mV dc.
RTD:	Automatic ranging for all RTD inputs. Minimum chart span is 20.0 ohms.
Millivolts:	Span adjustable from 20 to 100 mV dc
Volts:	Span adjustable from 0.1 to 10V dc
Current:	Span adjustable from 1 to 16 mA dc

INPUT IMPEDANCE

Millivolt:	10 M ohms minimum
Volt:	10 M ohms minimum
Current:	100 ohms nominal, 200 ohms maximum

INPUT LINEARIZATION

Thermocouples:	Automatic linearization per NBS 125 and IEC 584 standards
RTD:	Automatic linearization per IEC 751 and DIN 43760 standards
Current and Voltage:	Configurable for square law

INPUT ISOLATION

Galvanic isolation, 10M ohms minimum on all process inputs; 45V dc

TRANSMITTER POWER SUPPLY

Nonisolated 24V dc selectable for 20 mA dc current input from 2-wire transmitter

CONTACT INPUT
External switch transfer actuates event marker pen. Any pen can be selected as an event marker.

RETRANSMISSION OUTPUT
4 to 20 mA dc into 750 ohms maximum load

ALARMS

Relay Type:	SPDT (one on each pen I/O board and two on each digital option board)
Contact Rating:	5A at 120/240V ac

POWER SUPPLY
120/240V ac ± 10%, 50/60 Hz (Selectable)

POWER CONSUMPTION
30W

CHART SPEED
User configurable from 1 revolution per hour to 1 revolution per 168 hours (7 days) in increments of 1 hour.

PEN RESPONSE TIME
9 seconds typical for full scale travel (time constant configurable from 1 to 300 seconds)

DIGITAL DISPLAYS

Main:	4-digit, 0.56" high red 7-segment LEDs
Secondary:	4-digit, 0.3" high red 7-segment LEDs
Digits:	– 999 to 9999 with automatic positioning of minus (–)
Resolution	
Temperature Input:	0.1°
V, mV, mA Inputs:	Decimal point position selectable at 0001., 000.1, 00.01, 0.001

DATA RETENSION
Nonvolatile memory storage of configuration data for 10 years unpowered. Approximately 10,000 cycles permitted.

OPERATING CONDITIONS

Ambient Temperature Limits:	32 to 131° F (0 to 55°C)
Humidity:	5 to 90% RH
Thermocouple Resistance:	1000 ohms maximum
RTD Resistance:	10 ohms per load (3-wire connection)

WEIGHT (Approximate)
18 lb (8.2 kg)

SECTION 2
INSTALLATION

CAUTION

Prior to shipment the recorder has been configured to operate on 120V ac power, and to accept a thermocouple process input to each installed pen. Refer to ***2.5.1 Power Connections*** *before applying power, and refer to* ***3.2 Shipped Configuration*** *for process input configuration.*

2.1 GENERAL

Read through these instructions before starting installation. Installation personnel must be qualified technicians. Observe all electrical code requirements and applicable safety standards during installation.

Installing the recorder involves:

- Unpacking
- Mounting
- Making wiring connections
- Installing circuit board(s), chart plate, and pen(s)

NOTE

Certain circuit boards are not installed in the instrument when shipped. This allows easy access to the several terminal blocks inside the housing that are used for wiring connections. Before installing the I/O circuit boards in the instrument, verify the DIP switch and jumper settings as described in the setup procedures of **Section 3**.

2.2 UNPACKING

Unpack and visually inspect the recorder. Normal shipment includes a box of standard charts, a package containing electrical jumper devices, pen arms, and pen tips, and a foam-in-place package for the I/O circuit board(s) and option module circuit board(s).

The electrical jumpers may be required if it is necessary to change the as-shipped configuration of an I/O circuit board as described in **paragraph 3.2**. The quantity of pen arms depends upon whether a 1, 2, or 3-pen recorder is purchased. For example, with a two-pen 1912J Recorder, two packs of pen tips (red, green) and two pen arms are shipped. Pen arms are all identical.

The number of I/O boards will correspond to the number of installed pens. All I/O boards are identical, but they can be configured to accept various process input signals via jumper positioning. Option module boards are supplied as specified on the instrument order. The instrument accepts a maximum of two digital option boards. Do not install any of the boards until after the required DIP switch and jumper settings are made in the setup procedures of **Section 3**.

Save packing materials for any reshipment, or to support any claim of shipment damage. All damage claims are made against the carrier and are the responsibility of the customer.

2.3 MOUNTING

Select a mounting location where there is minimum vibration. The ambient temperature must be between 32 and 131° F (0 and 55° C). Figure 2-1 shows installation views for the recorder, gives panel mounting dimensions, and shows the threaded-insert holes available for surface mounting.

The panel must provide rigid support for the 18-pound (8.2 kg) recorder unit and any other panel devices. Adjacent recorders may be mounted within 2 inches horizontally and 3 inches vertically if support is adequate. Assure that cable/conduit routing and support are planned. Mounting requires preparation of electrical knockouts, after which the recorder may be panel mounted, or surface mounted. Other mounting options are available as kits as described in paragraph 6.6.

2.3.1 Preparing Knockouts

Electrical knockouts on the bottom of the recorder are removed by scoring the circumference groove of the knockout with a sharp knife prior to knockout removal. Be careful not to damage the power supply circuit board, Figure 2-2, when removing knockouts.

Open the required electrical connection holes by removing knockouts before mounting the instrument. Remove a knockout near the right side of the instrument to allow for signal wiring entry. The knockout directly below the power connection terminals has been removed prior to shipment to allow separate entry of ac power wiring.

2.3.2 Panel Mounting

1. Make panel cutout and drill four mounting holes as shown in panel cutout view, Figure 2-1. Use of 1/4-inch mounting hardware is recommended. Panel holes can either be tapped or drilled for clearance if bolt and nut fastening is to be used.

2. Insert instrument into panel cutout, then open door and fasten recorder to panel using the four mounting holes in the instrument housing.

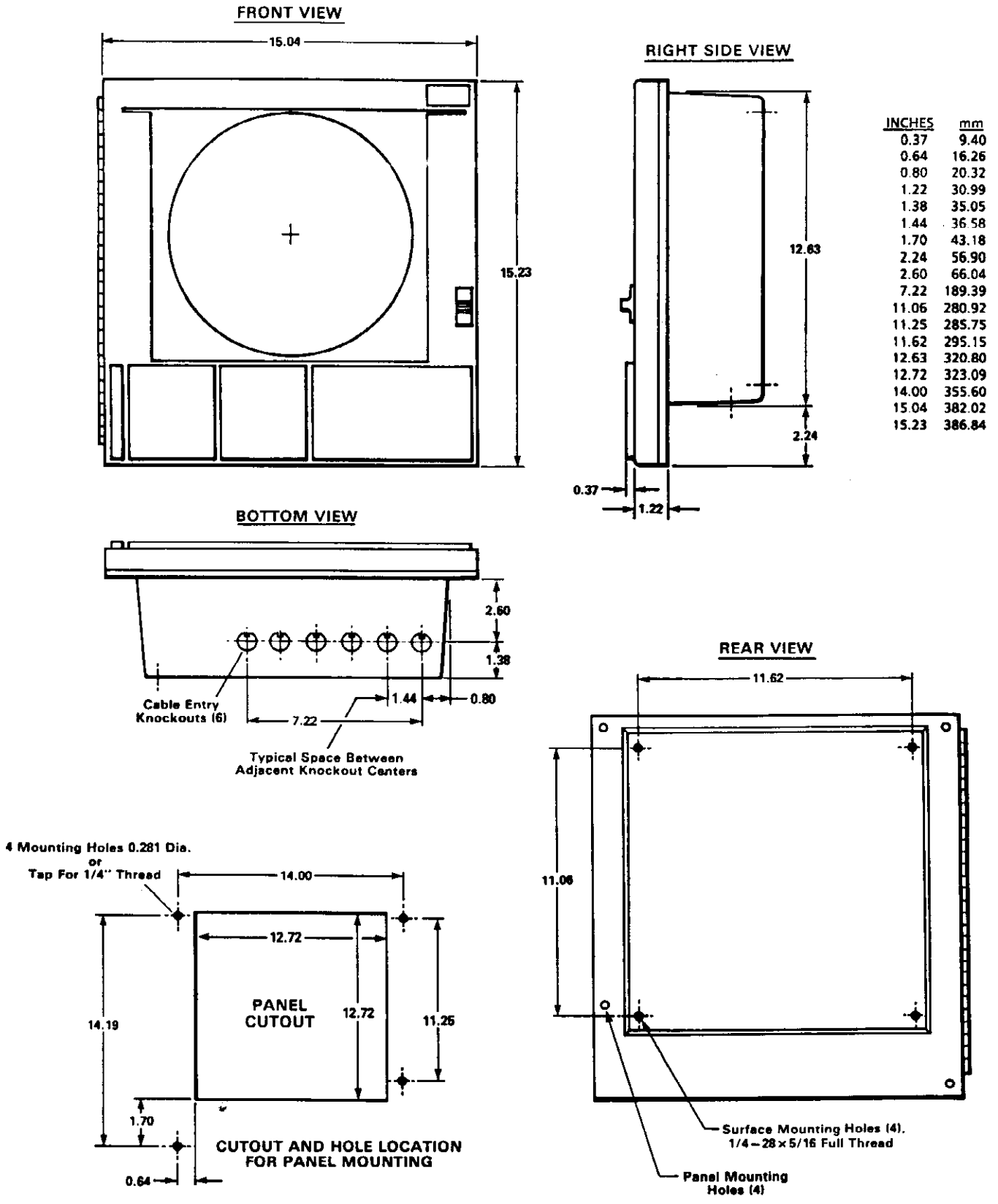
2.3.3 Surface Mounting

The instrument can be surface mounted by drilling clearance holes through a panel and fastening the unit with 1/4-inch screws through the back of the panel. Proceed as follows:

1. Determine location of mounting holes to mate with threaded surface mounting holes shown in rear view of Figure 2-1.

2. Drill four clearance holes for 1/4-inch screws (0.281-inch diameter).

3. From back of panel, mount instrument using 1/4-28 screws. Note that depth of threaded holes in instrument case is 5/16 inch. Draw all screws up fully and tighten carefully. Do not over-torque.



INCHES	mm
0.37	9.40
0.64	16.26
0.80	20.32
1.22	30.99
1.38	35.05
1.44	36.58
1.70	43.18
2.24	56.90
2.60	66.04
7.22	189.39
11.06	280.92
11.25	285.75
11.62	295.15
12.63	320.80
12.72	323.09
14.00	355.60
15.04	382.02
15.23	386.84

All dimensions in inches.
Not for construction purposes.

E-1107-6(4)

Figure 2-1. Mounting Dimensions

2.4 PREPARATION FOR WIRING

> **WARNING**
> *Avoid electrical shock. AC power wiring must not be connected at the distribution panel (ac source) until all wiring procedures within the instrument are completed.*

All wiring connections are made with the instrument installed in its operating location. The chart plate, and any installed I/O circuit boards and option module boards must be temporarily removed for access to the connection terminals. Proceed as follows:

1. Open instrument door, then loosen chart plate screw and swing chart plate open.

2. Disconnect cable and ground strap connections to chart plate as follows:

   a. Disconnect plugs P8, P9, P10, P11, and P12 near upper left corner of housing, Figure 2-2 (1900J shown, see Figure 3-2 for 1900JB).

   b. Disconnect plug P1 near power transformer.

   c. Disconnect ground strap spade lug at transformer.

3. With chart plate in open position, carefully remove plate by lifting it up off its hinges.

> **CAUTION**
> *Improper removal of I/O boards may damage boards and cause personal injury. Carefully follow procedure in Step 4 when removing boards.*

4. Remove installed I/O circuit boards and option module circuit boards. Extract board nearest power transformer first, then each successive board.

   Substantial pulling force is required to remove I/O boards. For easy removal, insert a small plastic cable tie or wire through hole in right front corner of board; make a loop and carefully pull out board using loop.

   The I/O circuit boards contain solid state devices which are subject to damage from electrostatic discharge. After removal, handle board only by edges; do not touch traces or pins.

5. For positive identification, tag boards according to their associated pens.

> NOTE
> Circuit boards and chart plate must be left out of instrument until jumper and DIP switch setting procedures are completed in Section 3.

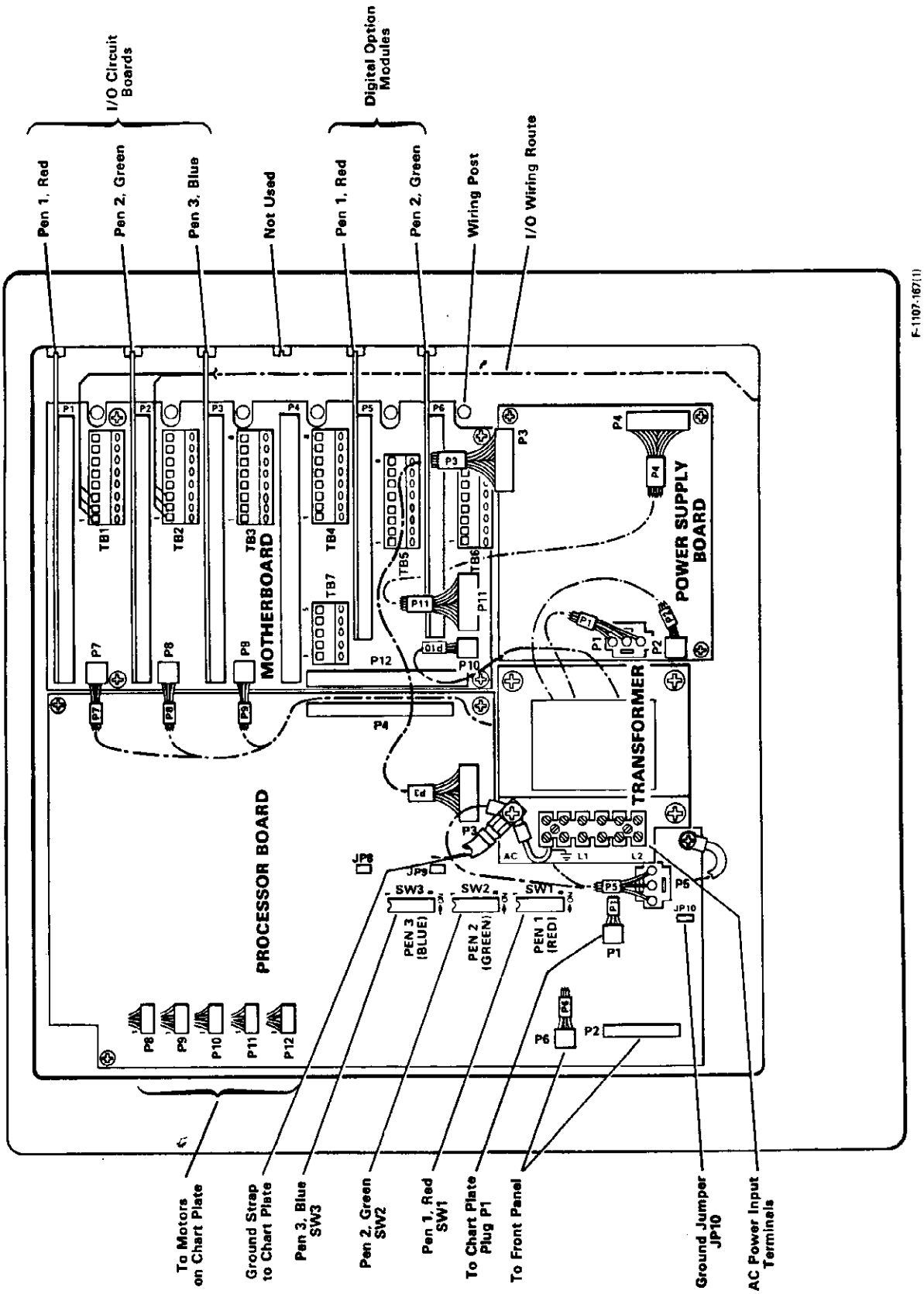


Figure 2-2. Interior Layout (1900JA Shown)

2.5 POWER AND GROUND CONNECTIONS

> **WARNING**
> *Avoid electrical shock. AC power wiring must not be connected at the distribution panel (ac source) until all wiring procedures are completed.*

2.5.1 Power Connections

The ac power connections to the power input terminals of the recorder are illustrated in Figures 2-3 and 2-4.

1. Route ac power cable through the power-entry knockout. Wiring conduit is required for NEMA 3 installations, and is recommended for all installations. Knockouts accept 3/4-inch conduit.

2. Make connections to the appropriate terminals as shown in Figures 2-3 and 2-4. **Jumpers for 120V ac power are installed at the factory.** If 240V power is to be used, remove both jumpers and reconnect one jumper for 240V power as shown.

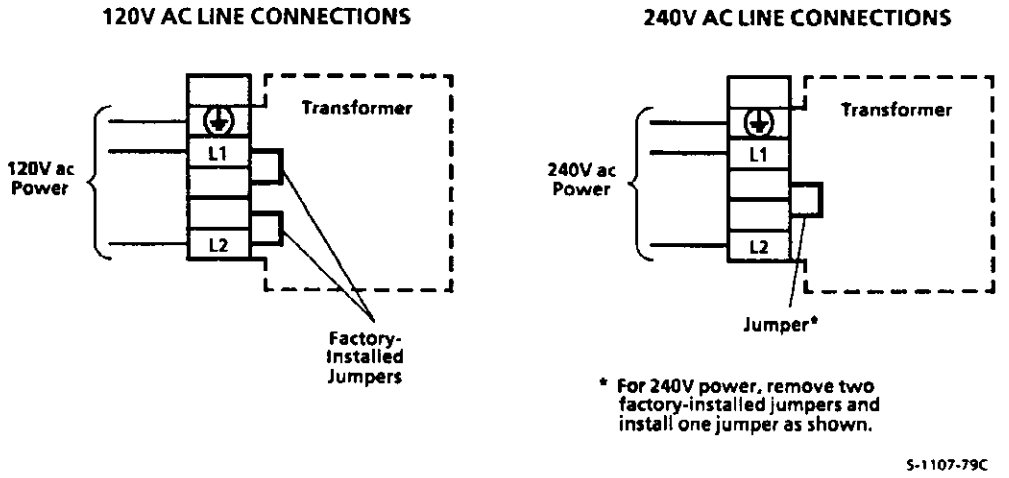


Figure 2-3. AC Power Connections (Electrical Code A)

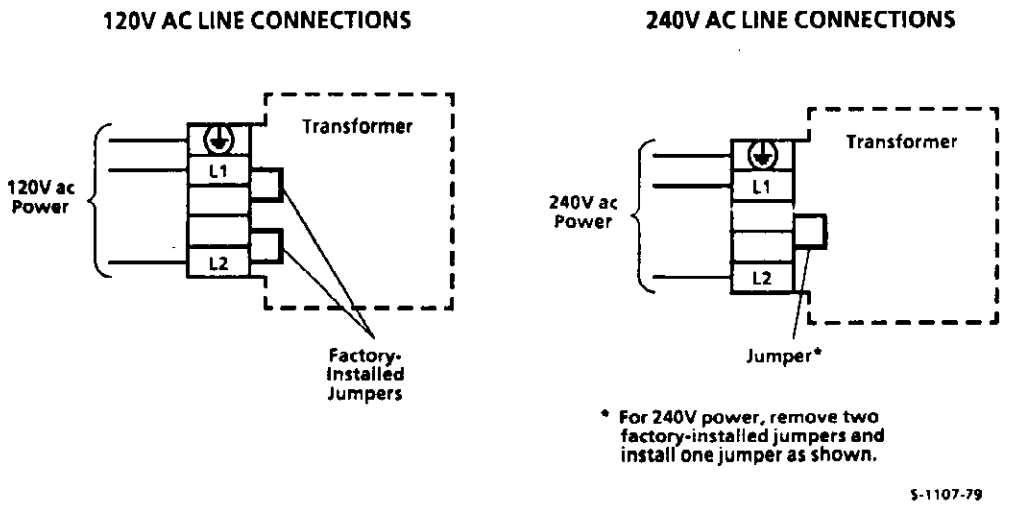


Figure 2-4. AC Power Connections (Electrical Code B)

2.5.2 Ground Connections

The recorder can use a single equipment ground, or the logic ground (common) can be separated from the safety (power) ground to prevent any ac influence upon the logic circuitry. This splitting into separate safety grounding and logic grounding networks is often used in large installations.

Jumper JP10 on the processor board, Figure 2-2, determines whether there is split grounding or not. Select grounding scheme as follows:

- Single Ground
  For single ground (logic and safety ground are same), ensure that ground jumper JP10 is installed on processor board. With JP10 in place, logic and power circuits are both grounded through the earth ground connection on the power terminal block, Figures 2-3 or 2-4.

- Split Ground

NOTE

To obtain split grounding the recorder must have a 4 to 20 mA dc retransmission output. If it does not, use the single ground arrangement.

1. Ensure that safety (power) ground is connected to the earth ground terminal on the power terminal block, Figures 2-3 or 2-4.

2. Remove ground jumper JP10 from processor board, Figure 2-2.

3. Refer to Figure 2-5 and connect external logic-ground to terminal 5 of TB1 (common terminal of retransmission output).

4. If a digital option board is installed for the red or green pen, each board must be grounded. Refer to Figure 2-5 and connect external logic-ground to terminal 2 or 5 of TB5 or TB6 to provide option board grounding.

2.6 SIGNAL WIRING GUIDELINES

NOTE

A Thermistor for cold junction compensation is connected to the process input terminals prior to shipment. This thermistor must be removed if the input is not a thermocouple.

A Wiring Planning Sheet is provided in **Appendix A** of this book. It is recommended that a copy of the planning sheet be used to plan and document signal wiring connections. A fully equipped recorder can have as many as six terminal blocks with a total of 45 terminals. The planning sheet should be retained as a record of the connections. The terminals are not readily visible when all I/O circuit boards and option modules are in place.

Figure 2-5 shows terminal connections available for inputs, the standard alarm relay, and for optional alarm relays. Figure 2-6 gives connection details for specific input types. The recommended wiring procedure is as follows:

1. On copy of the Wiring Planning Sheet, list each signal wire connection.

2. Strip approximately 1/2 inch (12.7 mm) of insulation from end of each wire for insertion into connection terminal. No. 16 AWG (1.29 mm) wire is recommended.

3. Route signal wires through signal entry knockout(s) and along right side of housing as shown in Figure 2-2. Wiring conduit is required for NEMA 3 installations and is recommended for all installations. Knockouts accept 3/4-inch conduit. Distribute wires to terminal blocks as required.

4. Make connections to terminal blocks on I/O motherboard or digital option module as shown on the connection diagrams, Figure 2-5. Use a small, flat-blade screwdriver to loosen appropriate connection screws on I/O motherboard terminals.

5. Check that all wiring is present and dress wiring so that it does not interfere with insertion of circuit boards.

6. After all connections are completed, proceed to **Section 3 Setup.** Do not install I/O circuit boards or chart plate until the DIP switch and jumper setting procedures of **Section 3** have been completed.

2.7 PROCESS INPUT SIGNAL CONNECTIONS

2.7.1 Thermocouple Input

Make thermocouple connections as shown in the thermocouple input views of Figure 2-6. The recording controller is shipped ready to accept a thermocouple input to each installed pen. Therefore, the I/O terminal blocks have the required cold junction compensation thermistor connected as shown in Figure 2-5. The thermistor provides the cold junction compensation required at the junction of thermocouple material and terminal material.

When connecting the thermocouple, the lead connecting to terminal number 3 must share the terminal with a cold junction compensator lead. It is very important to achieve good electrical contact between the terminal and both leads. When the thermocouple wire size permits, good contact can usually be achieved by removing the compensator and wrapping the thermocouple lead around the compensator lead so that both wires will be securely clamped when reinstalled. The most reliable method of achieving good contact is to solder the thermocouple lead to the compensator lead and insert the soldered assembly into the connection terminal.

NOTES

1. If an external cold-junction is used (thermocouple junction with non-thermocouple material is located external to the instrument), then the thermistor shown under the thermocouple input in Figure 2-6 must be removed and replaced with an appropriate precision resistor.

2. The thermistor used for internal cold-junction compensation of a thermocouple input, Figure 2-6, is a special type. Replace only with Taylor part number 500P1269.

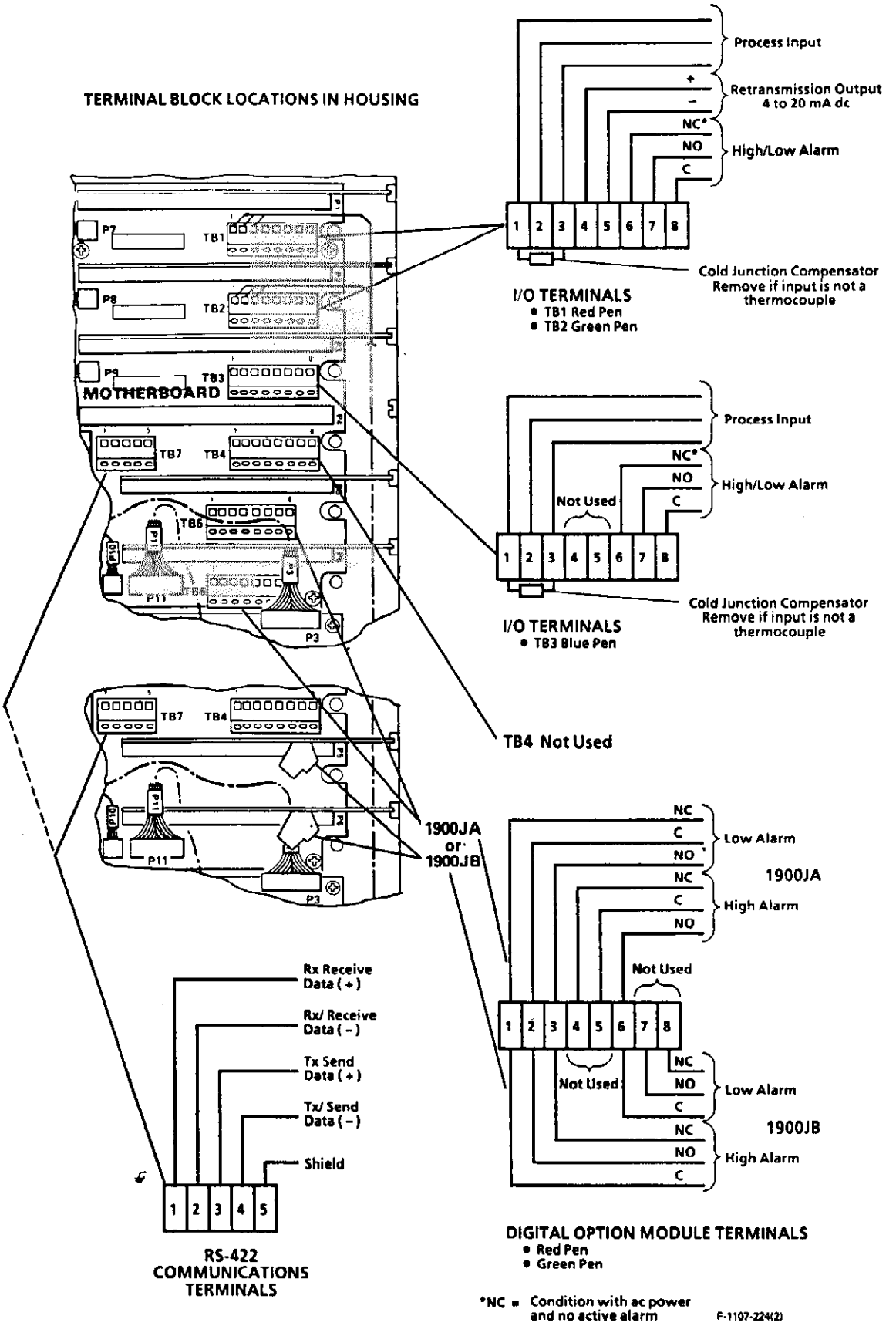


Figure 2-5. Signal Connection Diagram

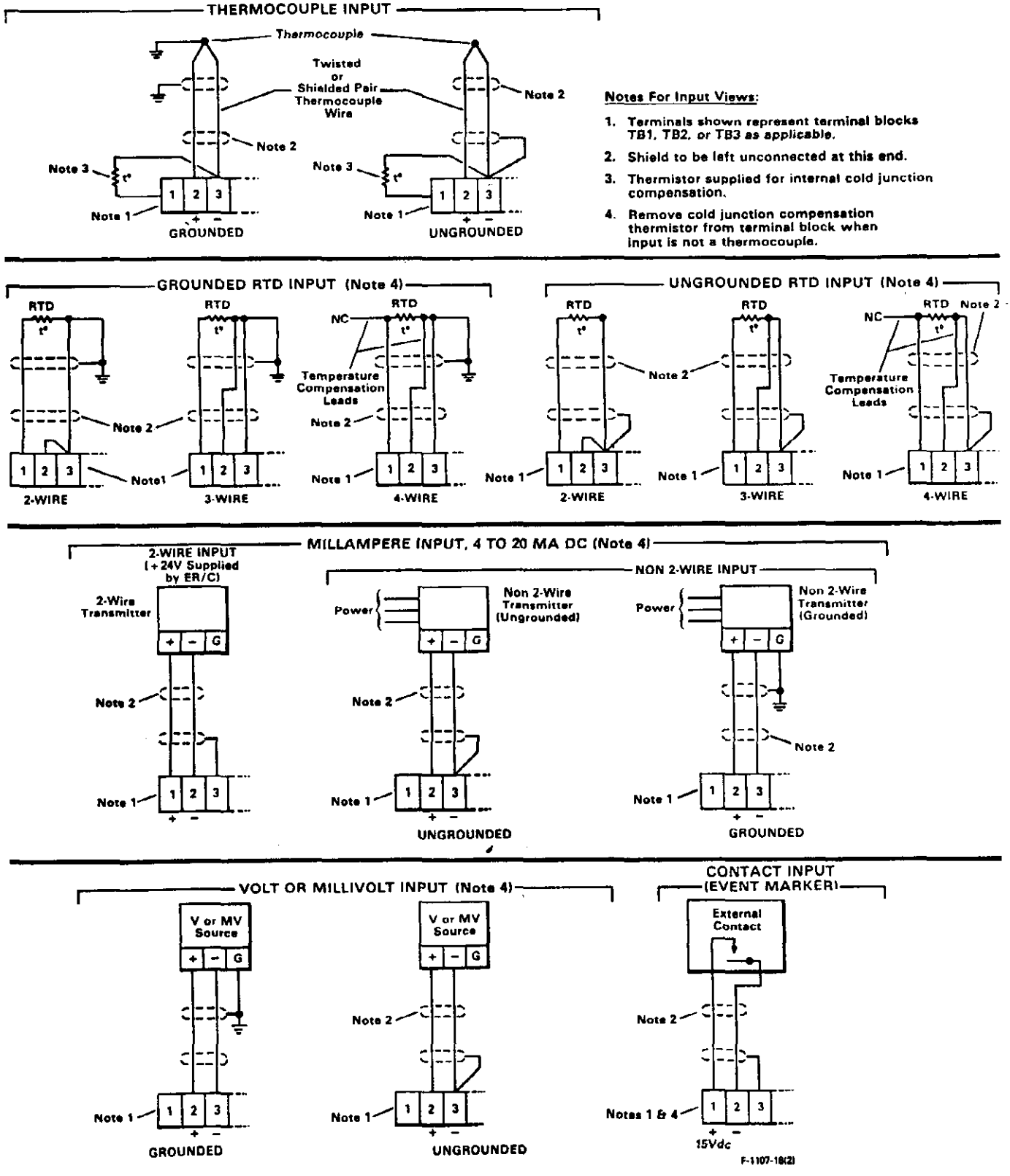


Figure 2-6. Process Input Connections

2.7.2 RTD Input

Make RTD connections as shown in the RTD input views of Figure 2-6. Remove the cold junction compensation thermistor connected between terminals 1 and 3. It is required only for thermocouple inputs.

An RTD input device may be a 2-wire, 3-wire, or 4-wire RTD. All types are shown in both the grounded and the ungrounded RTD views in Figure 2-6. The third and fourth leads on an RTD are wire-drop compensation leads. The third wire on both the 3-wire and the 4-wire types connects the "common" side of the RTD to terminal 2 on the pen terminal block. The fourth wire, on a 4-wire RTD, is not used for recorder applications.

2.7.3 Milliampere Input

Make current input connections as shown in the milliampere input views of Figure 2-6. Remove the cold junction compensation thermistor connected between terminals 1 and 3. It is required only for thermocouple input.

The 2-wire transmitter version of the milliampere input receives its loop current from a 24V dc current supply built into each I/O circuit board. This current supply is automatically connected in the circuit when the 2-wire input connection is made. The output load on the 2-wire transmitter is nominally 100 ohms.

> **CAUTION**
>
> *The 2-wire current input circuit contains a 100 mA current limiting fuse. With instrument power on, shorting terminals 2 and 3 on TB1, TB2, or TB3 will blow this fuse. Be sure power is off when making connections.*

The non-2-wire transmitter version of the milliampere input receives its loop current from a supply in the transmitter. The output load on the transmitter is nominally 100 ohms. The transmitter may be grounded or ungrounded.

2.7.4 Volt or Millivolt Input

Make volt or millivolt connections as shown in the volt and millivolt input views in Figure 2-6. Remove the cold junction compensation thermistor connected between terminals 1 and 3. It is required only for thermocouple input. The only difference between a volt and millivolt input is signal amplitude. Grounded and ungrounded versions are shown in Figure 2-6.

2.8 ALARM RELAY CONNECTIONS

2.8.1 General

The high/low alarm output for each pen is provided by the SPDT relay on each I/O circuit board. If a pen is designated as an event marker, the relay tracks event status as described in paragraph 2.9.

Two additional alarm outputs are provided on the red and green pens when their associated digital option modules are installed. The digital option modules provide independent high and low alarm relay outputs except for event-marker pens, or pens with totalizer turned on as described in paragraph 2.10.

2.8.2 Alarm Connections on I/O Circuit Board

The alarm relay on each pen I/O board is connected to both the high and low alarms and gives an alarm for either condition. Alarm high or alarm low is indicated by front panel alarm lights. As shown by Figure 2-5, TB1-TB3, the relay-use terminals are numbered 6 (NC), 7 (NO), and 8 (C). "NO" and "NC" on the diagram indicate relay contact status when the recorder is powered (ac applied) and there is no active alarm.

The pen I/O board relay has continuity between NO and C when the recorder has power and an alarm or event is present or when the recorder has no power. When the recorder has power and no alarm or event exists, NC and C have continuity.

2.8.3 Alarm Connections on Digital Option Board

The alarm relays on each digital option board are connected independently to the high and low alarms. The relay-use terminals, TB5 and TB6 are shown in Figure 2-5. "NO" and "NC" on the diagram indicate relay contact status when the recorder is powered (ac applied) and there is no active alarm.

The digital option board relays have continuity between NO and C when the recorder has power and an alarm (high or low as appropriate) or event is present or when the recorder has no power. When the recorder has power and no alarm or event exists, NC and C have continuity.

2.9 CONTACT INPUT (EVENT MARKER) CONNECTIONS

Make contact input connections as shown in the contact input view in Figure 2-6. Closure of the external dry contact completes the input signal circuit and produces an event record on the chart. Remove the cold junction compensation thermistor connected between terminals 1 and 3. It is required only for thermocouple input.

NOTE

When a pen is designated as an event marker the relays on the I/O board and digital option board (if installed) will track the event marker status; i.e., alarm relay contacts will transfer to follow event marker contact transfers.

2.10 DIGITAL OUTPUT MODULE RELAY CONNECTIONS FOR TOTALIZER

The independent high and low alarm connections for either the red or green digital option module as shown in Figure 2-5 are used as predetermined count single event states when its associated red or green pen is used for totalization. When the totalizer reaches a predetermined count, the relays go on and stay on until the totalizer is turned off or reset. When the wrap function is on, the relays switch momentarily before going back off.

2.11 RETRANSMISSION OUTPUT CONNECTIONS

Make retransmission output connections to terminal block TB1 (red pen) or TB2 (green pen). The hi and low limits are determined by the chart limits. See Figure 2-5 for terminal block locations and for 4 to 20 mA terminal connections. The retransmission output is a 4 to 20 mA dc signal. The maximum allowable load is 750 ohms.

2.12 RS-422 SERIAL COMMUNICATIONS PORT CONNECTIONS

The instrument is equipped with the communications option when the serial number stamped on the data plate contains catalog number code D1. The terminals for the RS-422 port are located on terminal block TB7, Figure 2-7.

As many as 16 instruments can be connected to a serial port on a host computer. The instruments should be connected in a daisy-chain configuration using dual twisted-pair, shielded cable, Figure 2-7.

2.12.1 Cabling

For short runs of 10 to 25 ft (3 to 6m), virtually any 4-wire shielded or twisted pair will be suitable.

For runs up to 1000 ft (305 m), Belden 9502 Cable or an equivalent cable is recommended. This cable is a dual 24 AWG (0.5 mm) twisted pair with an overall foil shield. A drain wire is provided for grounding the shield.

For runs up to 4000 ft (1200 m), Belden 9729 Cable or an equivalent cable is recommended. This cable is a dual 24 AWG (0.5 mm) twisted pair with a foil shield for each pair. The cable insulation is low dissipation (polypropylene). Two separate drain wires are provided for grounding the shields.

2.12.2 Electrical Connections and Termination Resistors

Make connections for RS-422 serial communications at TB7 as shown in Figure 2-5.

Termination resistors are required for THE LAST instrument in the daisy-chain. These resistors are factory-installed on the processor board in all instruments and are connected in the circuit via jumpers. In the recorder they are connected in the circuit via jumpers JP8 and JP9 on the processor board, Figure 2-8. For information regarding the termination resistors in instruments other than the recorder, consult the applicable instruction book.

Check the processor board of all instruments in the network to determine whether or not the termination resistors are connected. Disconnect the termination resistors in all but the last instrument in the network by removing the appropriate jumpers (JP8 and JP9 on the recorder processor board). Leave the termination resistors connected in the last instrument by simply leaving the jumpers installed.

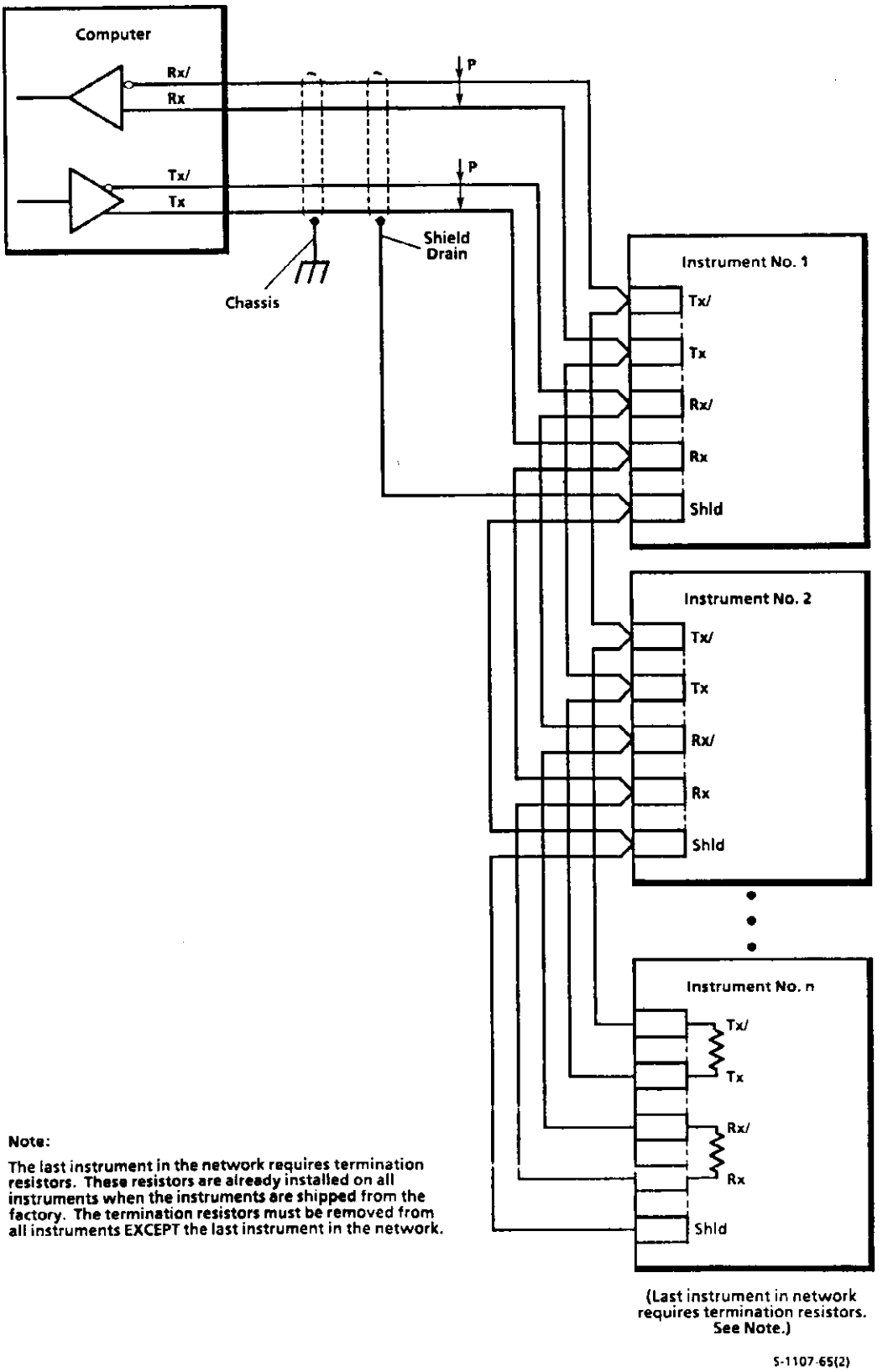


Figure 2-7. Instruments Connected to Computer in Daisy Chain Configuration

2.12.3 Connections to an IBM Personal Computer

A communications adapter will be required when the computer uses RS-232 communications rather than RS-422 communications. This is the case for most IBM Personal Computers and IBM-Compatible Personal Computers. Use an RS-232/RS-422 communications adapter such as the Taylor 1749F Communication Link Interface Unit or an equivalent unit. Connect the adapter to the RS-422 communications cable and the computer RS-232 port as shown in Figure 2-9.

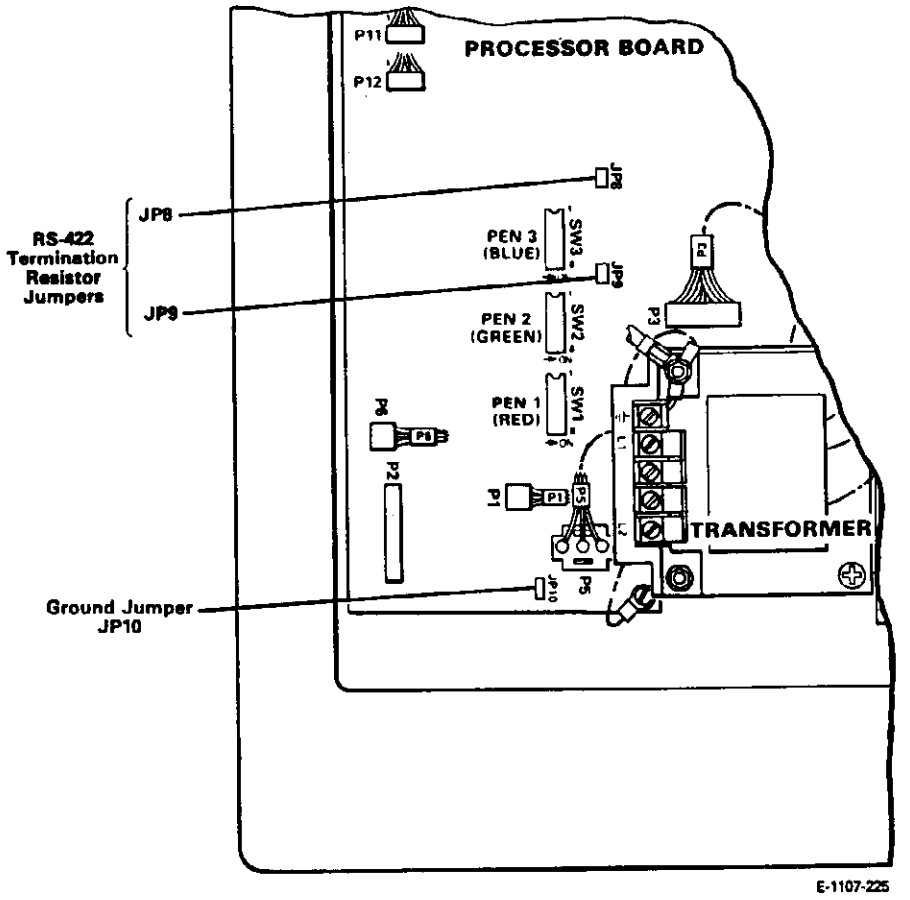
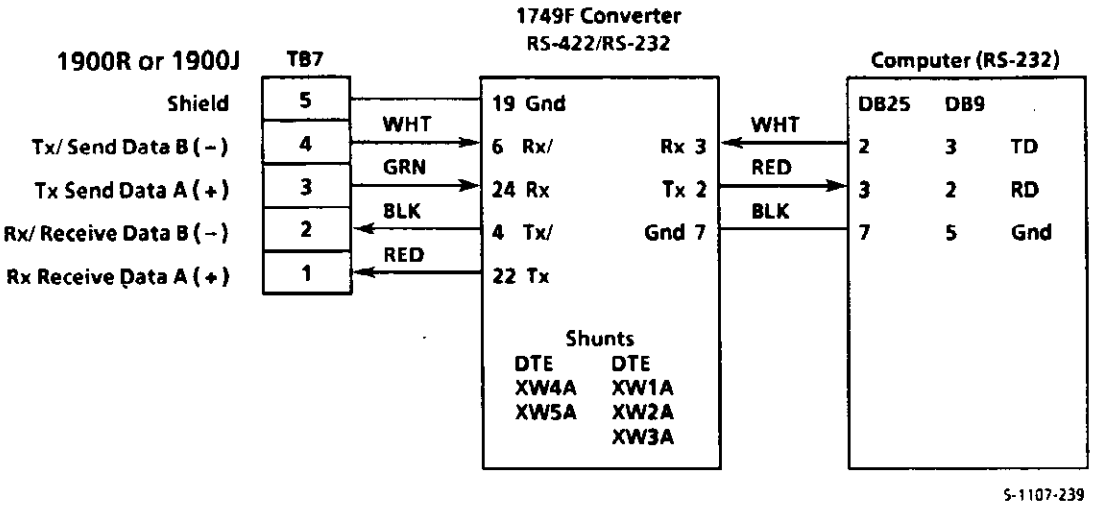


Figure 2-8. Location of RS-422 Termination Jumpers



2-9. Instruments Connected to Computer via RS-232/RS-422 Adapter

SECTION 3
SETUP

3.1 INTRODUCTION

After installation is complete, the setup procedures must be performed to prepare the recorder for operation. These procedures include positioning jumpers, setting DIP switches, installing I/O circuit boards, selecting specific recorder parameters, and entering data.

Specific jumper placements and DIP switch settings are made at the factory prior to shipment. This as-shipped configuration is described in **paragraph 3.2**. If this configuration is not suitable for the planned application of the instrument, the settings can be changed as described in **paragraphs 3.3 and 3.4**. Jumper positions and DIP switch settings must be established before installing the I/O circuit boards.

Parameter selections and data entries are made via the front panel control keys in response to a series of display prompts. For ease of use the operational and setup activities have been divided into several functional levels. The first level is for daily continuing operations. The remaining levels are for setup. The levels are defined as follows:

Level	Used For
Level 1, Display	Process variable display, totalizer display, alarm indication, operator activities
Level 2, Pen Setup	Defining inputs, setting totalizer, setting chart limits, and setting chart speed
Level 3, Alarms	Setting Alarms
Level 4, Pen Calibration	Calibrating pens for process input
Level 5, Temperature Calibration	Fine adjustment of thermocouple or RTD temperature calibration
Level 6, RS-422	Setting communications parameters for RS-422 port

Associated with each level is a unique series of displays which are accessed by the front panel control keys. The controls and displays are described in **paragraph 3.6**, and the setup procedures are provided in **paragraphs 3.7 and 3.8**. Note that the setup procedures for levels 2, 3, and 4 must always be performed before putting the recorder into operation. The setup procedure for temperature calibration, Level 5, is required only when the process input is a thermocouple or RTD. The procedure for RS-422 setup, recorder Level 6, is required only when the instrument has the communications option.

3.2 SHIPPED CONFIGURATION

The as-shipped configuration of the recorder is based on the insertion of specific I/O board jumpers and the setting of DIP switches to specific positions at the time of shipment from the factory.

3.2.1 Jumper Locations

Each I/O board is set up at the factory to accept a grounded thermocouple input. Jumpers are installed in positions J1, J3 and J7. All other jumper positions are left vacant. Jumper locations are shown in Figure 3-1.

3.2.2 DIP Switch Settings

DIP switches SW1, SW2, and SW3, Figure 3-2, are set at the factory for each installed pen. The factory DIP switch settings provide the following features:

- Process Input: Thermocouple for each installed pen
- Operator Access: Recorder lock off

3.3 PLACING I/O CIRCUIT BOARD JUMPERS AND INSTALLING BOARDS

Before installing I/O circuit boards, jumpers must be properly located to match each board to the type of process input signal it is to receive. All I/O circuit boards are identical. Jumper placement customizes each board to accept a specific input. The location of all I/O board jumpers is shown in Figure 3-1 and the jumper position requirements for the various input types are shown in Table 3-1.

If the as-shipped jumper locations for thermocouple input are acceptable, no jumper changes are required. For other inputs, locate jumpers as specified in Table 3-1. Be sure that only the specified jumpers are installed, all other input jumper locations must be open.

> **CAUTION**
> *On some instruments, I/O circuit board connectors are not keyed with mating pins on the motherboard. Be very careful to ensure that all pins are aligned with connector when installing board.*

After all required jumpers have been inserted, plug each I/O board into instrument, Figure 3-2. Be sure that each board is in correct location for its associated red, green or blue pen.

Note that substantial force is required to fully engage all connector pins; be sure board is seated firmly against mother board in back of housing.

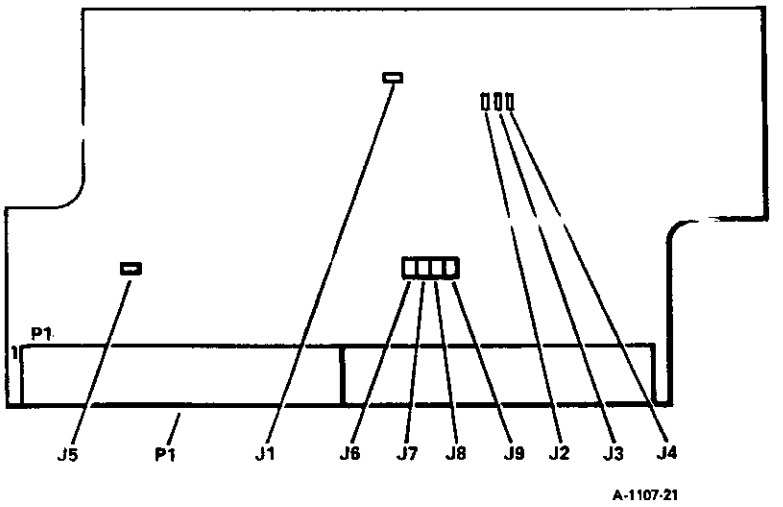


Figure 3-1. Jumper Locations - I/O Board

Table 3-1. I/O Board Jumpers

Input Type	Input-Device Grounding ***	Jumpers*								
		J1	J2	J3	J4	J5	J6	J7	J8	J9
Thermocouple	Grounded	X		**	**			X		
	Ungrounded	X		**	**	X		X		
RTD	Grounded	X		X				X		
	Ungrounded	X		X		X		X		
Milliamperes (2-Wire Xmtr)	Ungrounded		X			X	X			X
Milliamperes (Non 2-Wire Xmtr)	Grounded		X				X			
	Ungrounded		X			X	X			
Millivolts	Grounded	X		X			X			
	Ungrounded	X		X		X	X			
Volts	Grounded			X			X			
	Ungrounded			X		X	X			
Relay Contact (Event Marker)	Ungrounded		X			X	X		X	

* An X mark indicates an installed jumper. All other jumper locations on board must be open.

** For thermocouple input, install jumper at J4 for fail high (top of range) process input display, or install jumper J3 for fail low (bottom of range) process input display. Never install J3 and J4 together.

*** See Figure 2-6 for connection types Assume grounded if you don't know (don't install J5).

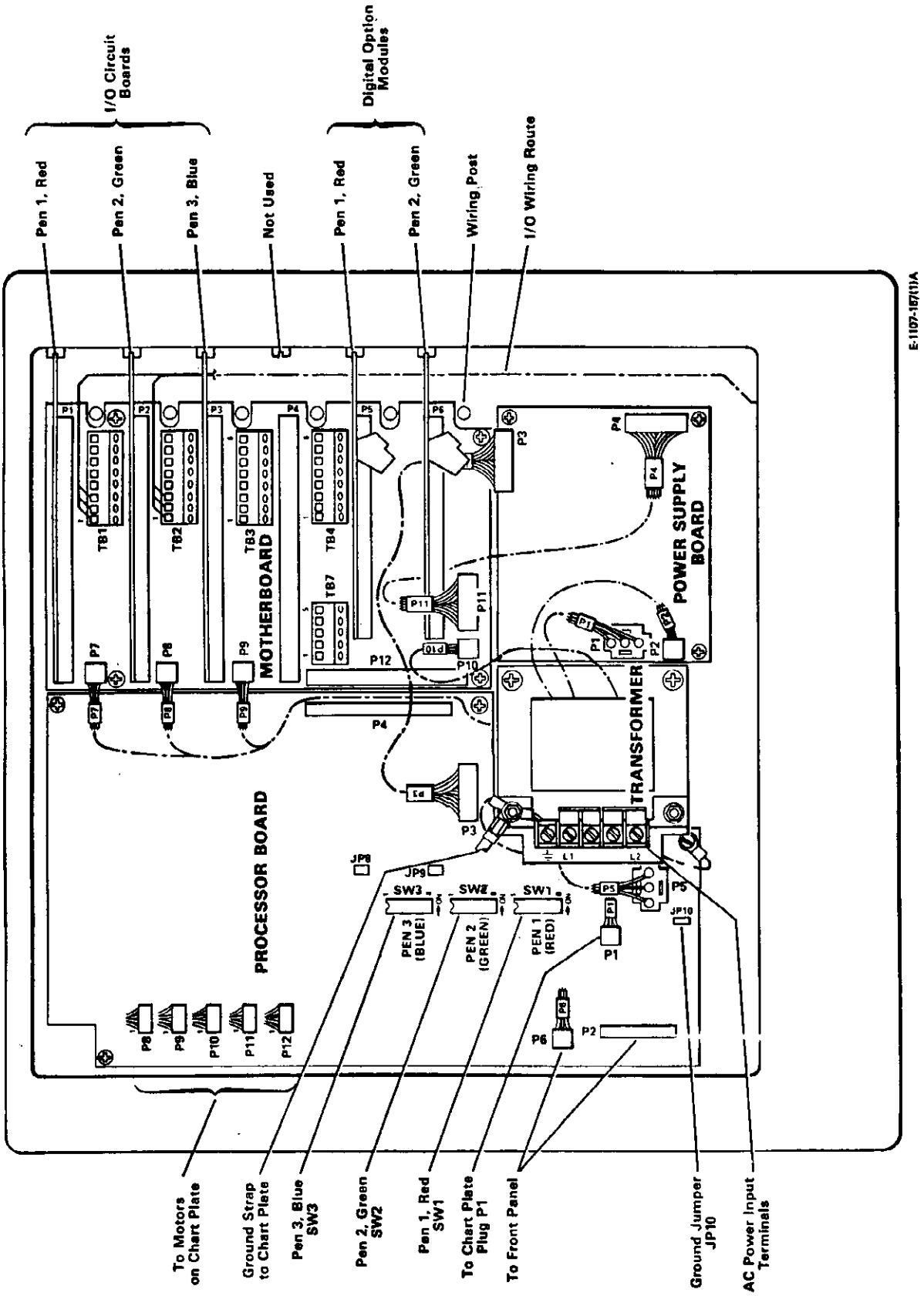


Figure 3-2. Location of Components (1900/B Shown)

3.4 SETTING DIP SWITCHES

WARNING
Avoid electrical shock. Turn off instrument power before setting DIP switches.

3.4.1 General

There are three eight-segment DIP switches on the processor board, Figure 3-2. Switch SW1 is associated with the red pen, SW2 is associated with the green pen, and SW3 is associated with the blue pen. The DIP switch settings tell the microprocessor whether the pen is installed, the type of process input signal that applies, or whether the pen is used as an event marker. They also enable the use of the front panel lock feature.

The DIP Switches must be set before performing the setup procedure in **paragraphs 3.7 and 3.8**. Settings should be made with the power off. DIP Switch settings are read into the microprocessor when the power is later applied.

The DIP switch settings made at the factory prior to shipment are described in **paragraph 3.2**. The settings required for the various process input selections are shown in Figure 3-3. Record these settings in **Appendix A**. Note that segments 2, 3, 4, and 8 are unused and thus the form shows them in the "off" position. Segment 1 is used only on SW3 (for Lock).

3.4.2 Input Selection Settings

The type of process input to each pen is determined at the time of installation per **paragraph 2.7**. Set DIP switch segments 5, 6, 7 to correspond to the input type. See Figure 3-3 for process input DIP switch settings.

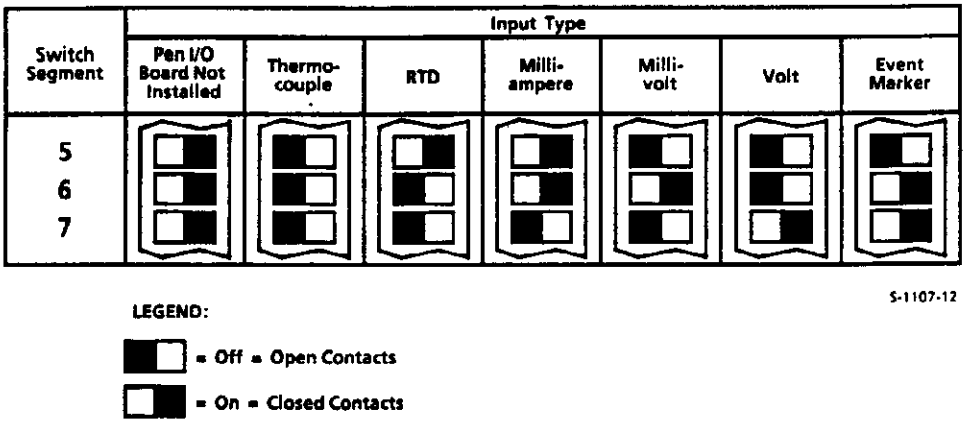


Figure 3-3. DIP Switch Setting for Various Input Types

3.4.3 Lock Setting

DIP switch segment 1 on switch SW3 controls the selection of recorder lock. When SW3-1 is on (closed), the FRONT PANEL switch on the chart plate is disabled. The recorder front panel can be used for normal operator activities in Level 1. Access to higher levels is limited to read only; no setup changes can be made.

When SW3-1 is off (open), the FRONT PANEL switch is enabled. With the FRONT PANEL switch in the LOCK position, access to Levels higher than 1 is limited to read only. In the UNLOCK position, full access is permitted for all operational and setup activities.

Additional capability to limit access to all instrument operational and setup controls is provided by an optional key lock on the door and/or a wire seal threaded through holes in the chart plate and its closure screw.

3.5 INSTALLING CHART PLATE

After installation of all I/O circuit boards and completion of DIP switch settings, install the chart plate as follows:

1. Observe orientation of chart plate cable plugs shown in Figure 3-2. Note that wires from plug P1 face transformer, and wires from plugs P8 through P12 face top of housing. Ensure that these plug orientations are maintained when plugs are inserted.

2. Hold chart plate close to front of instrument and connect plug P1, then place chart plate on its hinges.

3. Connect stepper motor plugs P8 through P12 as shown in Figure 3-2.

4. Connect ground strap to spade lug at transformer as shown in Figure 3-2.

5. Close chart plate.

3.6 DESCRIPTION OF SETUP CONTROLS AND DISPLAYS

The setup levels, the method of moving from one level to another, and the operational loop associated with each level is shown in Figure 3-4. Data entries are made by scrolling through the steps in each level of the setup procedure, and making an appropriate response to each step.

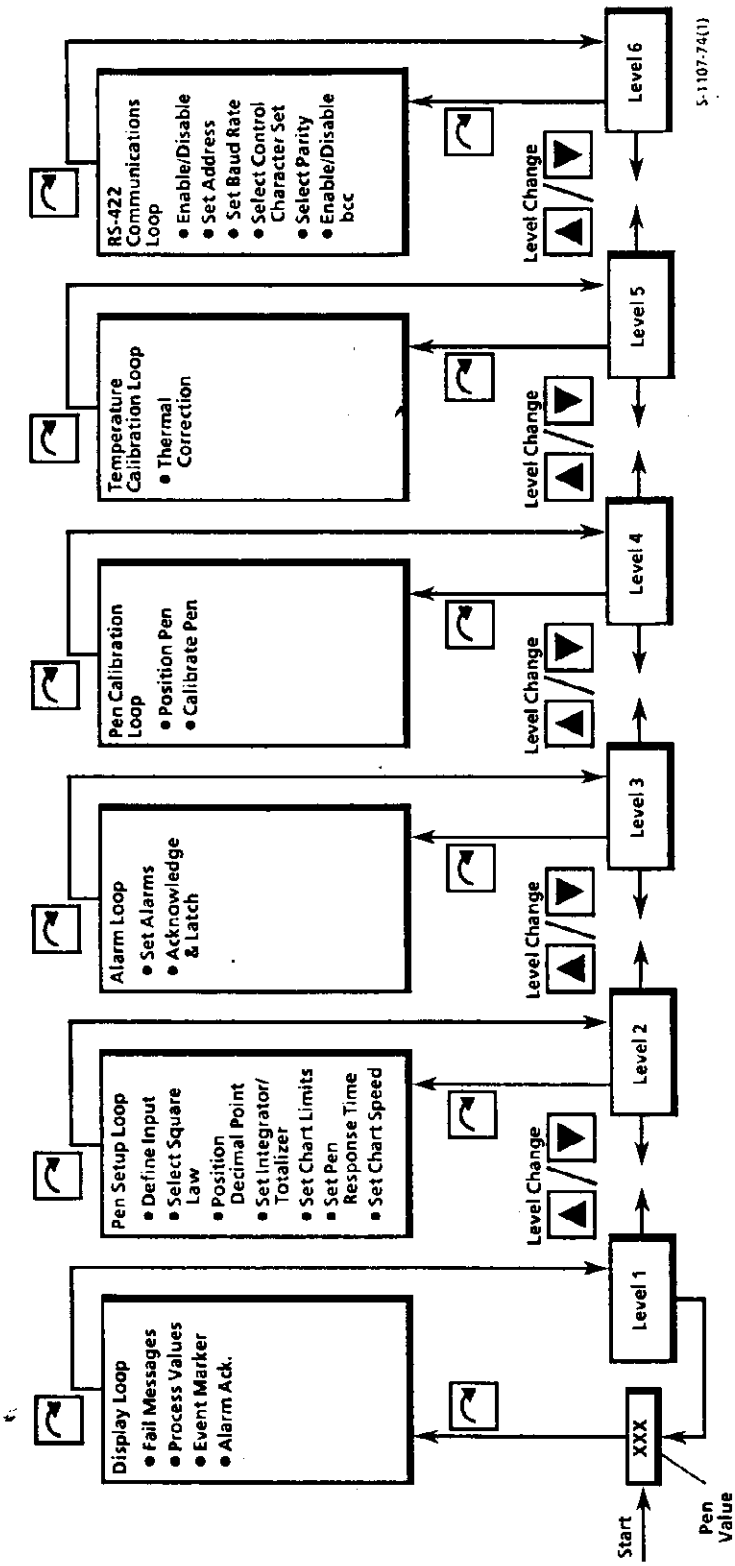


Figure 3-4. Relationship of Levels and Loops

3.6.1 Controls

The front panel of the recorder is shown in Figure 3-5. The setup procedures for all levels require the use of the Up and Down control keys (UP and DN herein) and the scroll control key. Basic uses for the keys are listed in Table 3-2.

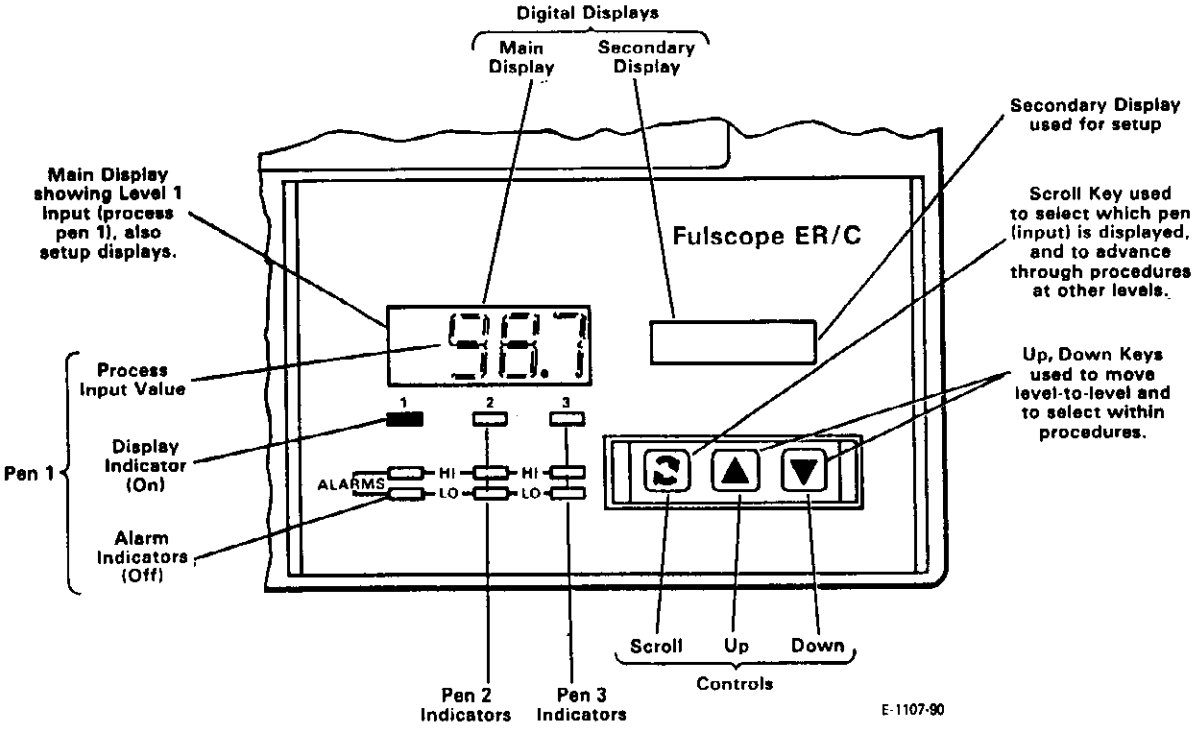


Figure 3-5. Recorder Front Panel with Typical Pen 1 Display

Table 3-2. Use of Controls

Scroll	UP	DN
Used To: • Select pen for display • Move through some setup steps. • Move through operational display steps.	**Used To:** • Increase values being set • Ascend Levels • Move through some steps • Affirmative (yes) selection • View Totalizer	**Used To:** • Decrease values being set • Descend Levels • Negative (no) selection • Clear input failure messages

3.6.1.1 UP/DN Operating Rates

Use UP (with DN) to vary rate of increase of values:

- For slow rate, press and hold UP (Δ)
- For intermediate rate, hold UP and press DN (∇) once
- For fast rate, hold UP and press and hold DN

In a similar manner as described above, use DN (with UP) to vary rate of decrease of values.

3.6.1.2 Scroll Speed

Normal scrolling is done by press/release action of the Scroll key. This advances the display to the next station. A quick exit feature works by pressing and holding the scroll key for immediate return to the level entry display (levels 3 and 6) or the next pen (levels 2 and 4).

3.6.2 Displays

The recorder front panel has a main and secondary alphanumeric display, Figures 3-5. Table 3-3 illustrates and defines the words displayed by the recorder during setup and operational use. Figure 3-6 shows the conversion between the alphabet and the 7-segment LED display. The display presentations seen during specific setup and operating procedures will vary depending on the input type. The sequence of words (prompts) applicable to specific setup procedures is described in **paragraphs 3.8.** The sequence of prompts applicable to specific operating procedures is described in **Section 4.**

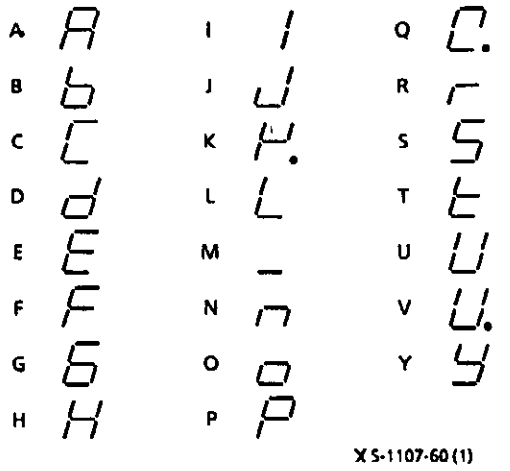


Figure 3-6. Alphabet to 7-Segment LED Display Conversion Table

Table 3-3. Operation and Setup Display Listing

FUNCTION	DISPLAY MAIN	DISPLAY SECONDARY	DESCRIPTION
RECORDER LEVEL 1 Process Variable Display	58.4		Typical digital display of process variable for Pen 1, 2 or 3.
	076	5246	Typical digital display of positive totalized value for Pen 1, 2 or 3.
	-893	1732	Typical digital display of negative totalized value for Pen 1, 2 or 3.
	totL	oFF	Totalizer off. *Totalizer can be turned on or off for each pen in Level 2.*
	oFF.		Open contact, event marker pen.
	on.		Closed contact, event marker pen.
	LEU.1	dSPL.	Level 1 Display. *Point of entry to setup levels.*
	AL-S.	ACH.-	Alarm acknowledge.
	XXXX	XXXX	Failure and error messages. (See Table 6-1)
RECORDER LEVEL 2 Pen Setup and Chart Speed	LEU.2	SEt	Level 2 Set.
	Thermocouple and RTD Inputs:		
	PEn. 1	SEt	Pen 1, 2, or 3 set.
	not	InSt	Not installed. *No pen 2 or 3.*
	d.P.--	0.0	Decimal point location.
	CH.Lo		Chart, low. *Lower range value of chart.*
	CH.H 1		Chart, high. *Upper range value of chart.*

S-1107-8(1)
Sheet 1 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER LEVEL 2 Pen Setup and Chart Speed (cont'd)	tYPE	J-tC	Type J thermocouple.
	tYPE	K-tC	Type K thermocouple
	tYPE	E-tC	Type E thermocouple.
	tYPE	r-tC	Type R thermocouple.
	tYPE	S-tC	Type S thermocouple.
	tYPE	t-tC	Type T thermocouple.
	dEG.C	YES	Degrees Centigrade.
	dEG.C	no	Degrees Fahrenheit.
	FILt.	no	Filter, no. *Normal pen response time.*
	FILt.	YES	Filter, yes. *Allows selection of time constant.*
	SECS	8	Seconds. *Time constant shown at 8 seconds.*
	Milliamp, Volt and Millivolt Inputs:		
	PEn.1	SEt	Pen 1, 2 or 3 set.
	not	inSt	Not installed. *No pen 2 or 3.*
	InP.H		Input, high. *Upper range value in current or voltage units.*
	InP.L		Input, low. *Lower range value in current or voltage units.*

S-1107-8(1)
Sheet 2 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER LEVEL 2 Pen Setup and Chart Speed (cont'd)	SC.-L.	no	Square law not applied.
	SC.-L.	YES	Square law linearization of process input signal.
	d.P.--	0.00	Decimal point location.
	EnG.L		Engineering units, low.
	EnG.H		Engineering units, high.
	totL	CnFG	Totalizer Configuration. *Starting point for totalizer setup.*
	r SEt	YES.	Reset, yes. *Reset current total to preset value.*
	r SEt	no	Reset, no. *Allows current totalized value to remain unchanged.*
	r AP	YES.	Wrap, yes. *Causes totalized count to reset to preset value and start again each time predetermined count is reached.*
	r AP	no	Wrap, no. *Totalizer counts continuously until reaching maximum display number, then holds until operator intervenes.*
	tHLd	8	Threshold. *Value below which process input signal is not totalized; shown at 8 engineering units.*
	t.on	YES.	Totalizer on, yes; no go, totalizer on. *Input signal is currently being totalized, and totalizer must be turned off before further setup activity is allowed.*
	no.Go.	t.on	
	t.on	no	Totalizer on, no. *Totalizer is off.*

S-1107-8(1)
Sheet 3 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY MAIN	DISPLAY SECONDARY	DESCRIPTION
RECORDER LEVEL 2 Pen Setup and Chart Speed (cont'd)	UP.t	YES	Up totalizer, yes. *Totalizer counts up.*
	UP.t	no	Up totalizer, no. *Totalizer counts down.*
	rAtE		Rate. Flow rate time base.
		HoUr	Hours (eng. units/hour).
		_ in	Minutes (eng. units/min).
		SEC	Seconds (eng. units/sec).
	S.FAC		Scale factor. *Positions decimal point in displayed total.*
		1	Decimal same as process engineering units.
		10	Decimal is one digit to right of process engineering units.
		100	Decimal is two digits to right of process engineering units.
	PSt.L	0500	Preset low. *Least significant four digits of 7-digit preset value.*
	PSt.H	0800	Preset high. *Most significant three digits of 7-digit preset value. Leading zero shown occupies the sign position. Minus sign is displayed when value is negative. (Preset value for high and low setting shown is 8,000,500.)*
	PdC.L	0500	Predetermined count, low. *Least significant four digits of 7-digit predetermined count value.*
	PdC.H	-001	Predetermined count, high. *Most significant three digits of 7-digit predetermined count value. Minus sign is replaced by a leading zero for positive numbers. (Predetermined count value for high and low setting shown is -10,500.)*

S-1107-8(1)
Sheet 4 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER LEVEL 2 Pen Setup and Chart Speed (cont'd)	t.on	no	Totalizer on, no. *Totalizer is off; prompt allows turn on before continuing with pen setup.*
	t.on	YES	Totalizer on, yes. *Setup is completed and totalizer is turned on.*
	CH.Lo		Chart, low. *Eng. unit value at bottom of chart.*
	CH.H I		Chart, high. *Eng. unit value at top of chart.*
	FILt.	no	Filter, no. *Normal pen response time.*
	FILt.	YES	Filter, yes. *Allows selection of time constant.*
	SECS	8	Seconds. *Time constant shown at 8 seconds.*
	Contact Input:		
	EUnt	PEn	Event pen.
	Chart Speed:		
	CHrt	SPEd	Chart speed.
	SPEd	127	Speed. *Shown at 127 hrs/rotation.*
RECORDER LEVEL 3 Alarm Settings	LEU.3	ALrS.	Level 3 Alarms.
	PEn. 1	ALrS.	Pen 1 alarms.
	SEE	Cont.	See controller. *Use red control unit to set alarms.*
	PEn.2	ALrS.	Pen 2 alarms.
	SEE	Cont.	See controller. *Use green control unit to set alarms.*

S-1107-8(1)
Sheet 5 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY MAIN	DISPLAY SECONDARY	DESCRIPTION
RECORDER LEVEL 3 Alarm Settings (cont'd)	PEn.3	AL-S.	Pen 2 or 3 alarms. *Pen 2 setup appears when there is no green control unit.*
	ALr.H		Alarm, high. *High trip point setting.*
	ALr.L		Alarm, low. *Low trip point setting.*
	A.HYS.		Alarm hysteresis; deadband. (Same units as input)
	ACK.-	no	Acknowledge, no. *Alarm can't be acknowledged.*
	ACK.-	YES	Acknowledge, yes. *Alarm can be acknowledged.*
	LAt.	no	Latch, no. *Alarm relay does not latch.*
	LAt.	YES	Latch, yes. *Alarm relay latches.*
	EU.nt	PEn	Event pen. *No alarm settings.*
RECORDER LEVEL 4 Pen Calibration	LEU.4	A.CAL	Level 4 Pen Calibration.
	no	Go	No go, lock on or No go, in service.
	LoCK.	on	
	In	SErU.	
	L IFt		Lift pen(s) and move to top of chart.
	droP		Drop pen(s) at top of chart.

S-1107-8(1)
Sheet 6 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER LEVEL 4 Pen Calibration (cont'd)	CAL.H.		Calibrate, high (all pens).
	LIFt		Lift pen(s) and move to bottom of chart.
	droP		Drop pen(s) at bottom of chart.
	CAL.L.		Calibrate, low (all pens).
	LIFt		Lift pen(s) and move to operational chart reading.
	droP		Drop pen(s) at operational chart reading.
RECORDER LEVEL 5 Temperature Calibration	LEU.5	t.CAL	Level 5 Temperature Calibration.
	PEn.1	t.CAL	Pen 1, 2 or 3 temperature calibration.
	32.0	1.6	32.0°F temperature with 1.6°F correction.
	not	tE_P.	Not temperature input.
RECORDER LEVEL 6 RS-422 Communica- tions	LEU.6	422	Level 6 RS-422 Communications.
	EnbL.	no	Enable communications, no. *RS-422 Communications disabled.*
	EnbL.	YES.	Enable communications, yes. *RS-422 Communications enabled.*

S-1107-8(1)
Sheet 7 of 8

Table 3-3. Operation and Setup Display Listing (Cont'd)

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER LEVEL 6 RS-422 Communica- tions (cont'd)	Addr.	1	Instrument address, 1 to 99. *Each instrument communicating over RS-422 interface requires a unique address.*
	bAUd	1200	Baud rate, 1200.
	bAUd	2400	Baud rate, 2400.
	bAUd	4800	Baud rate, 4800.
	bAUd	9600	Baud rate, 9600.
	ALt.C.	no	Alternate character set, no. *ASCII control characters will be used.*
	ALt.C.	YES.	Alternate character set, yes. *Alternate character set will be used in place of ASCII control characters.*
	PAr.	YES.	Parity, yes. *Parity check will be implemented. Word length will be 7 bits.*
	PAr.	no	Parity, no. *Parity check will not be implemented. Word length will be 8 bits.*
	odd	no	Odd parity, no. *Parity will be even.*
	odd	YES.	Odd parity, yes. *Parity will be odd.*
	bCC	YES.	Block check code, yes.
	bCC	no	Block check code, no.

S-1107-8(1)
Sheet 8 of 8

3.7 PREPARATION FOR SETUP

Before starting the step-by-step setup procedures given in **paragraph 3.8** prepare the instrument as follows:

1. Be sure that I/O circuit board jumpers and DIP switches have been properly set, and that the chart plate and all circuit boards are correctly installed. Refer to **paragraphs 3.3, 3.4, and 3.5.**

2. At the ac power source, turn on power to instrument. When power is turned on, the recorder activates at Level 1, and the front panel displays illuminate. The recorder displays indicate [A.C.] [FAIL] showing that power has been off.

3. On recorder front panel perform the following operations:

   a. Scroll (press and release scroll key) repeatedly until display indicates [LEU.1] [dSPL].

   b. Press UP (Δ) to go to Level 2. Display indicates [LEU.2] [SEt]. This is the starting point for the recorder setup procedure of **paragraph 3.8.**

4. On the chart plate, Figure 3-7, place FRONT PANEL switch in UNLOCK position and PEN switch in PEN CHANGE position.

5. Locate pen arms and pen tips packaged with recorder (not installed). A pen arm and a supply of pen tips is included for each pen ordered (red, green, blue). Pen arms are all identical.

6. For each pen color, take a pen tip and remove its cap. Slide the pen tip fully onto the pen arm.

7. Slide assembled pen-and-arm on to the color-dot coded pen arm holder for that color pen. The pen arms slide between the arm holder pins and latch in place as shown in Figure 3-8.

8. Operate PEN switch to RUN position.

9. If a chart is to be installed or changed proceed as follows:

   a. Place PEN switch in CHART CHANGE position and wait for pens to move aside.

   b. Release chart hub and remove old chart.

   c. Insert new chart over hub and under edge retainers, Figure 3-7. Rotate chart until correct time mark on chart perimeter is aligned with START TIME guide line on chart plate.

10. Proceed to **paragraph 3.8** for the recorder setup procedure. The recorder is now ready for setup, starting with Level 2. Read the procedure through before starting.

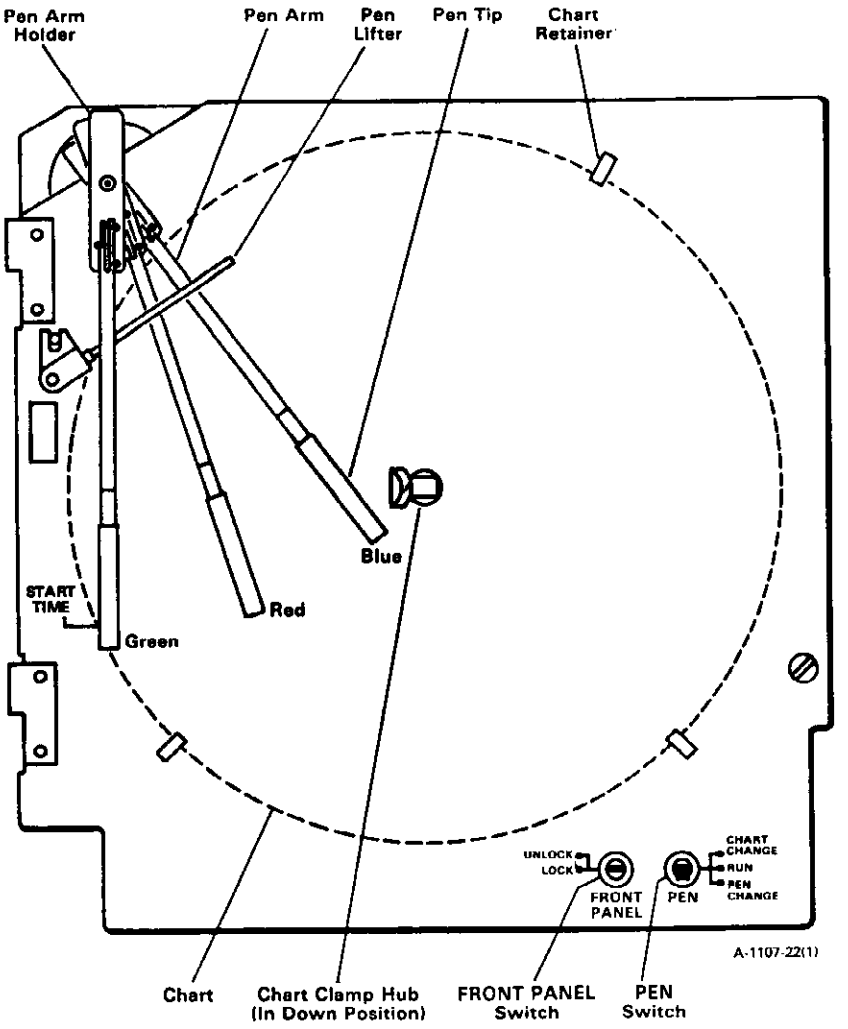


Figure 3-7. Chart Plate with Pens in Pen-Change Position

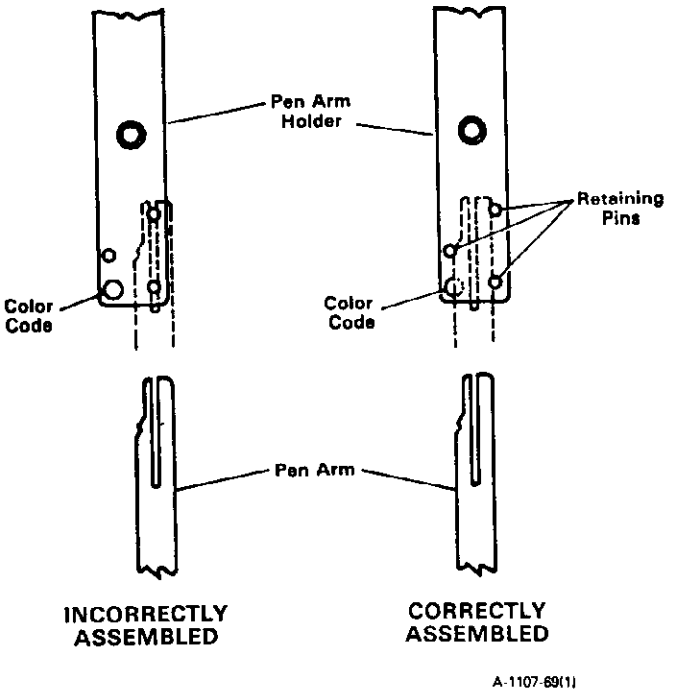


Figure 3-8. Assembling Pen Arms

3.8 RECORDER SETUP PROCEDURE

3.8.1 Introduction

Step-by-step recorder setup procedures are given in Tables 3-4 through 3-11. Each table gives the display sequence and parameters for one of the five recorder setup levels. For a first-time setup, it is recommended that the setup procedures be performed in ascending numerical order as presented herein. Read through the instructions for each successive level before performing the setup procedure for that level. Recorder setup concludes with Levels 4, 5 or 6. Level 5, temperature calibration is applicable only to pens which have a thermocouple or RTD process input. Level 6 is used only when the instrument is equipped with the RS-422 communications option.

3.8.2 Pen Setup (Level 2)

The parameters for pen setup are given in the loop accessed via Level 2 as shown in Figure 3-4. The loop allows the following setup activities.

- Chart range limits
- Fahrenheit or Celsius scale selection for thermocouple or RTD inputs
- Thermocouple type identification
- Current and voltage input signal limits
- Square law linearization
- Decimal point placement
- Process variable input limits in engineering units
- Input Filtering (pen response time)
- Chart speed setting
- Set Integrator/Totalizer

Make setup entries using the procedures shown in Table 3-4. Tables 3-5 and 3-6 are referenced in Table 3-4. Table 3-5 applies to thermocouple and RTD. Table 3-6 applies to milliampere, millivolt, and volt inputs. Scroll through the listed steps and make an appropriate response at each applicable step.

Table 3-4. Recorder Level 2 – Setup Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Level Selection	LEU.2	SEt	Scroll to begin pen setup. (UP,DN change level.)
b	Pen 1 Sequence	PEn.1	SEt	Pen 1 indicator lights. The pen 1 setup sequence depends upon the pen 1 input selection DIP switch settings. Use UP to start one of the following setup sequences. • Thermocouple/RTD, go to Table 3-5. OR • Milliamp/Millivolt/Volt, go to Table 3-6. OR • Event Pen, go to step c. OR • Not Installed, go to step d. Scroll to advance to Pen 2 sequence, Step e.
c	Event Pen	EU.nt	PEn	For any pen that has been designated as an event marker, no pen setup sequence is required. An event pen is designated by DIP switch setting. Refer to Figure 3-3. Display automatically advances to next pen in sequence or chart speed.
d	No Pen installed	not	InSt.	For any pen that has been designated as not installed, no pen setup sequence is required. A pen is designated as not installed by DIP switch setting. Refer to Figure 3-3. Display automatically advances to next pen in sequence or chart speed.
e	Pen 2 Sequence	PEn.2	SEt	Pen 2 indicator lights. The pen 2 setup sequence depends upon the pen 2 input selection DIP switch settings. Use UP to start one of the following setup sequences. • Thermocouple/RTD, go to Table 3-5. OR • Milliamp/Millivolt/Volt, go to Table 3-6. OR • Event Pen, go to step c. OR • Not Installed, go to step d. Scroll to advance to Pen 3 sequence, Step f.
f	Pen 3 Sequence	PEn.3	SEt	Pen 3 indicator lights. The pen 3 setup sequence depends upon the pen 3 input selection DIP switch settings. Use UP to start one of the following setup sequences. • Thermocouple/RTD, go to Table 3-5. OR • Milliamp/Millivolt/Volt, go to Table 3-6. OR • Event Pen, go to step c. OR • Not Installed, go to step d. Scroll to advance to Pen 3 sequence, Step g.

Table 3-4. Recorder Level 2 – Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
g	Chart Speed	CHrt	SPEd	Use UP to continue speed-set sequence. Scrolling returns to beginning of this table.
h	Speed Selection	SPEd	xx (1 to 168)	Use UP, DN to select chart rotation speed in hours/revolution. Scrolling returns to beginning of this table.

Table 3-5. Recorder Level 2 – Thermocouple & RTD Input Setup Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Decimal Point	d.P.--	xx.	Use UP, DN to position decimal point (0. for units or 0.0 for tenths of units). Scroll to continue. Positioning of the decimal point in this recorder level sets the decimal location for all recorder levels as follows: Recorder Level 2 (Chart high/low limits), Recorder Level 3 (Process alarm and alarm hysteresis engineering units). Note that setting the decimal point to the tenths (0.1) position limits the thermocouple temperature readout to 999.9 degrees. Should the temperature rise over 1000 degrees, the display would read 999.9 until the temperature fell below that level.
b	Chart Low Limit	CH.Lo	xx. (-999 to 9999)	Use UP, DN to set temperature value at inside edge of chart. Scroll to continue. Settings for high and low limits are determined by the specific process measurement requirements. For example, assume that the process temperature is being measured with a Type T Thermocouple. The range limits for Type T are between -328°F and 752°F. The normal process operating temperature is approximately 120°F and a 60 to 180°F chart has been selected. The chart low and high limits for this case would be set at 60°F and 180°F respectively.
c	Chart High Limit	CH.HI	xx. (-999 to 9999)	Use UP, DN to set set temperature value at outside edge of chart. Scroll to continue with step d for thermocouple inputs or step e for RTD inputs.
d	Thermocouple Type	tyPE	x-tC	Thermocouple Type (x) = J, K, E, R, S, T. Use UP,DN to display types. Scrolling to next step will select type on display.
e	Temperature Units	dEG.C	no or YES.	From yes, DN = no. From no, UP = Yes. Yes selects.Celsius. No selects Fahrenheit. Scroll to continue.

Table 3-5. Recorder Level 2 – Thermocouple & RTD Input Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
f	Input Filtering	FILt	no or YES.	From No, UP = Yes. From yes DN = no. No selects nominal response time; typically 9 seconds for full scale pen travel. Yes selects adjustable time constant. Scrolling from no advances to next pen or chart speed (Table 3-4). Scrolling from yes continues with Step g. The normal response time obtained by selecting no filtering is typically 9 seconds for full scale pen travel. If filtering is selected, the time constant can be set at any value between 1 and 300 seconds. The time constant is defined as the time required for a pen to travel 63.2% of the full travel which would result from a step change in process input. For example, assume that the time constant is set for 4 seconds, and that a process input step change of 20% of full chart occurs. The pen will travel 12.6% of full chart in 4 seconds. The full 20% change will require approximately 16 seconds.
g	Set time constant	SEC.S	xx (1 to 300)	Use UP, DN to set time constant in seconds. Scroll to continue with next pen or chart speed (Table 3-4).

Table 3-6. Recorder Level 2 – Milliampere, Millivolt, and Volt Input Setup Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Input High Value	InP.H	xx	Use UP,DN to set high value of electrical process input. Recommended ranges for high value settings are: mA: 5.0 to 20.00 mA dc mV: 20.0 to 100 mV dc Volt: 0.1 to 10.00V dc Scroll to continue. The ranges for the different input types are based on the minimum span for the input. For example, millivolt inputs have a minimum span of 20 mV dc which allows the minimum high value to be 20 or the maximum low value to be 80.
b	Input Low Value	InP.L	xx	Use UP,DN to set low value of electrical process input. Recommended ranges for low value settings are: mA: 4.0 to 19.00 mA mV: 0.0 to 80 mV Volt: 0.00 to 9.90V Scroll to continue.
c	Square Law	SQ.-L	no or YES	From no, UP = yes. From yes, DN = no. Scrolling when yes selects square law linearization of input and sets engineering units low value to zero (step e is skipped). Scrolling when no means no square law applied.
d	Decimal Point	d.P.--	xx.	Use UP,DN to position decimal point (0., 0.0, 0.00, 0.000). Scrolling continues with Step e if square law was not selected, or advances to Step f if square law was selected. In addition to the parameters referenced, input engineering units, preset value, and predetermined count in recorder level 2 are also affected by the placement of the decimal.
e	Engineering Units, Low (Applies only when square law is not selected)	EnG.L	xx. (9990 to -990)	Use UP,DN to set engineering units that correspond to the low input of Step b. Scroll to continue. Settings for high and low engineering unit values are determined by the specific process measurement requirement. For example, assume that the process input signal is 4 to 20 mA dc, and this signal represents flow measurement between 0 gallons/hr and 580 gallons/hr. The engineering unit low setting would be 0 and the high setting would be 580 corresponding to the 4 to 20 mA current input. Step f describes how engineering units can also be used as a multiplier.

Table 3-6. Recorder Level 2 – Milliampere, Millivolt, and Volt Input Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
f	Engineering Units, High	EnG.H	xx. (9999 to -990)	Use UP, DN to set engineering units that correspond to the high input of Step a. Scroll to continue. When totalizing on a high flow rate, some multiple other than one (0-580) may be required to prevent to frequent a rollover (4.789 hrs in this example) of the totalizer display (or to frequent a wrap). Engineering units can be used to change the displayed or totalized value. For example, the units could be set at 0 to 58 (a factor of 10) for a 47.89 hour rollover, or, with proper use of the decimal point, the units could be set a 0 to 0.58 (a factor of 1000) for a 199.5 day rollover!
g	Start Totalizer Setup	totl	CnFG	Use UP to start totalizer setup. Scrolling bypasses totalizer and advances to step u [CH.Lo] prompt in pen setup sequence.
h	Reset totalized value	rSEt	no or YES.	From no, UP = yes. From yes, DN = no. Yes resets current totalized value to the preset value. No leaves current total unchanged. Scroll to continue. NOTE Total is reset immediately when [YES] is selected, and the reset cannot be canceled by subsequent selection of [No]. Reset returns the totalized value to the preset value. The preset value is the number from which the totalizer starts counting. It is commonly zero, but it can be set at any required value as described in Steps p and q.
i	Wrap Feature	rAP	no or YES.	From No, UP = yes. From yes, DN = no. Yes selects wrap feature. Scroll to continue. Selection of the wrap function means that the totalizer will count until the predetermined count is reached, then reset to the preset value and start counting again. Without wrap, the totalizer will continue to count until it is turned off or until the maximum count is reached. Maximum counts are 9,999,999 or -9,999,999. When the maximum count is reached, the totalizer will hold until there is operator intervention such as a reset in Step h.
j	Set threshold value	tHLd	xx (0 to 9999)	Use UP, DN to set threshold value in engineering units (limited by engineering units high value). Process input signals below threshold are not totalized. Scroll to continue. (Continued on next page)

Table 3-6. Recorder Level 2 – Milliampere, Millivolt, and Volt Input Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
j	Set threshold value (Cont'd)			The threshold value permits filtering of the low end of the process input signal range. The totalizer will not count signals below the threshold value. The decimal point location in the threshold value is the same as the decimal location in the process input engineering units.
k	Totalizer Status	t.on	no or YES.	From no, UP = yes. From yes, DN = no. No turns totalizer off. Yes indicates totalizer is running. Scrolling from no advances to Step m and permits continuation of totalizer setup procedure. If totalizer is configured, exit the setup routine, by scrolling from yes and continuing with Step l. This step prevents inadvertent upset of the count when the totalizer is running. If the totalizer must not be shut off, discontinue the totalizer setup activity per Step l.
l	Exit totalizer and Pen Setup	t.on no.Go	YES. t.on	Press and hold scroll key while flashing [no.Go] [t.on] prompt is on to advance to [PEn.2] from pen 1, or [PEn.3] from pen 2, or [CHrt SPEd] from pen 3. See Table 3-4.
m	Select totalizer type	UP.t	no or YES.	From no, UP = yes. From yes, DN = no. No means totalizer counts down. Yes means totalizer counts up. Scroll to continue.
n	Select flow rate time base	rAtE	HoUr or _In or SEC	Use UP, DN to select rate in engineering units per hour, minute, or second. Scroll to continue.
o	Select Scale Factor	S.FAC	1 or 10 or 100	Use UP, DN to select factor. Scroll to continue. The scale factor allows the decimal point in the displayed total to be positioned at any one of three locations relative to the decimal location in the process variable engineering units. The scale factor selection choices and the resulting decimal locations are shown in Table 3-7. The table shows that some scale factor selections are not valid when the process variable decimal is in the units or tenths position. If an invalid selection is made, the choice will be ignored and the process variable decimal point location will be used.
p	Set least significant digits of preset value	PSt.L	xx. (-999 to 9999)	Use UP, DN to set least significant digits (____nnnn) in engineering units. Scroll to continue. See paragraph 3.8.2.1 for reference information.

Table 3-6. Recorder Level 2 – Milliampere, Millivolt, and Volt Input Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
q	Set most significant digits of preset value	PSt.H	xx. (-999 to 999)	Use UP, DN to set most significant digits (±nnn____) in engineering units. Complete preset value now has the form: ±nnnnnnn. Scroll to continue. See paragraph 3.8.2.1 for reference information.
r	Set least significant digits of predetermined count	PdC.L	xx. (-999 to 9999)	Use UP, DN to set least significant digits (____nnnn) in engineering units. Scroll to continue. See paragraph 3.8.2.2 for reference information.
s	Set most significant digits of predetermined count	PdC.H	xx. (-999 to 999)	Use UP, DN to set most significant digits (±nnn____) in engineering units. Complete predetermined count now has the form: ±nnnnnnn. Scroll to continue. See paragraph 3.8.2.2 for reference information.
t	Totalizer Status (End of totalizer setup procedure)	t.on	no or YES.	From no, UP = yes. From yes, DN = no. Yes turns totalizer on. No leaves totalizer off. Scroll to continue. This totalizer status prompt is a duplicate of Step k. It allows the totalizer to be turned on at the end of totalizer setup without returning to Step k.
u	Chart Low Limit	CH.Lo	xx. (9990 to -999)	Use UP,DN to set engineering unit value at inside edge of chart. Scroll to continue.
v	Chart High Limit	CH.HI	xx. (9990 to -999)	Use UP,DN to set engineering unit value at outside edge of chart. Scroll to continue. The chart low and high limits are set to correspond to the low and high engineering units.
w	Input Filtering	FILt.	NO or YES	From No, UP = yes. From yes, DN = No. No selects nominal response time; typically 9 seconds for full scale pen travel. Yes selects adjustable time constant. Scrolling from no advances to [PEn.2] from pen 1, or [PEn.3] from pen 2, or [CHrt SPEd] from pen 3. See Table 3-4. Scrolling from yes continues with Step x.
x	Set Time Constant	SEC.S	xx (1 to 300)	Use U, DN to set time constant in seconds. Scroll to advances to [PEn.2] from pen 1, or [PEn.3] from pen 2, or [CHrt SPEd] from pen 3. See Table 3-4.

Table 3-7. Valid Scale Factor Selections

Decimal Location in Process Variable	Decimal Location in Totalized Display		
	Scale Factor = 1	Scale Factor = 10	Scale Factor = 100
nnnn.	nnnnnnn.	Not Allowed	Not Allowed
nnn.n	nnnnnn.n	nnnnnnn.	Not Allowed
nn.nn	nnnnn.nn	nnnnnn.n	nnnnnnn.
n.nnn	nnnn.nnn	nnnnn.nn	nnnnnn.n

3.8.2.1 Step p and q - Preset Value

The preset value is the number from which the totalizer starts counting. The value must be entered as a seven digit number with a sign. Leading zeros must be entered. For setup purposes the number shares the main and secondary displays. The sign and the three most significant digits are shown on the main display (preset high), and the four least significant digits are shown on the secondary display (preset low). The decimal point location in the preset value is the same as the decimal location in the process variable engineering units.

It is recommended that the high and low entries be made so that they can be viewed as a continuous string of digits which form the preset value. For example, the entries for positive values of 10,500 and 3,450 are as follows:

Preset High = [001]
Preset Low = [0500]
Equivalent Preset Value = 0010500 (10,500)

Preset High = [000]
Preset Low = [3450]
Equivalent Preset Value = 0003450 (3,450)

When the preset value is a negative number, the minus sign must be entered as part of the high value when the number is -10,000 or more, and as part of the low value if the number is between -1 and -999. For example, entries for -12,000 and -500 are as follows:

Preset High = [-001]
Preset Low = [2000]
Equivalent Preset Value = -0012000 (-12,000)

Preset High = [000]
Preset Low = [-500]
Equivalent Preset Value = -0000500 (-500)

If a negative preset value between 1000 and 9999 is required, the number must include at least one decimal place. To obtain this decimal positioning, at least one decimal place must be configured in the process variable engineering units. An example of the entries for -3,450.0 is as follows:

Preset High = [-003]
Preset Low = [450.0]
Equivalent Preset Value = -003450.0 (-3,450.0)

In the previous example, note that the use of one decimal place makes the preset high entry a number other than zero. The preset value cannot be entered as a negative whole number (-3450) because the required high entry would be [-000] which is not available.

The available negative entries for preset low (-001 to -999) can be used in combination with high entries greater than zero. This is not recommended because the resulting preset value is not obvious from the display when this method is used. An example of entering a negative low value and a positive high value is:

Preset High = [001]
Preset Low = [-500]
Equivalent Preset Value = 0009500 (9,500)

A better method of entering 9,500 is:

Preset High = [000]
Preset Low = [9500]
Equivalent Preset Value = 0009500 (9,500)

3.8.2.2 Steps r and s - Predetermined Count

The predetermined count is the value at which the totalizer resets and starts over when the wrap function is enabled in Step k. If the recorder is equipped with an option module(s), the optional relays transfer to signal that the predetermined count has been reached.

The predetermined count has the same form as the preset value, and its decimal point location is the same as the decimal location in the process variable engineering units. Setup entries for the predetermined count are made in the same manner as for the preset value, and all the same limitations apply. Refer to Steps r and s.

When the wrap function is enabled, entries for the predetermined count are restricted as follows:

1. The predetermined count must not be equal to the preset value. The totalizer cannot be turned on if this condition exists.

2. The predetermined count must be greater than the preset value if the totalizer is configured to count up, and less than the preset value if the totalizer counts down. For example, if the preset value is zero and the predetermined count is -10, the totalizer must count down. If it is configured to count up, it cannot be turned on.

3. The predetermined count must be set at a value which makes the difference between the preset value and the predetermined count greater than the maximum value of the process variable engineering units. Otherwise the optional totalizer relays will not function correctly.

If the wrap function is not enabled, violation of restrictions 1 and 2 will not prevent the totalizer from being turned on. Restriction 3 does not apply when wrap is off. The optional relays will function correctly for any predetermined count value except the value which equals the preset value.

3.8.3 Alarm Settings (Level 3)

The alarm setup parameters are given in the alarm loop accessed by Level 3, as shown in Figure 3-4. This loop allows the following setup activities.

- Process alarm settings
- Alarm hysteresis setting
- Alarm acknowledgment selection
- Latching alarm relay selection

Make setup entries using the procedure shown in Table 3-8. Scroll through the listed steps and make an appropriate response at each applicable step.

Table 3-8. Recorder Level 3 – Alarm Setup Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Level Selection	LEU.3	ALrS	Scroll to begin alarm setup. (UP,DN change level.)
b	Pen 1 Alarms	PEn.1	ALrS	Pen 1 indicator lights. Use UP to continue Pen 1 alarm setup. Each pen I/O board has an alarm relay which operates when the pen signal reaches an alarm trip-point. The relay is activated by both high and low alarms and gives an alarm output for either condition. High and low alarms are separately indicated by the front panel alarm lights. If the recorder has a digital option board, the independent high and low alarm relays on the option board are configured by the entries made in the setup procedure of this table. These relays provide independent high and low alarm outputs. The trip-points and acknowledgment and latch options are identical to those configured for the corresponding pen I/O board alarm relay.
c	Alarm High Limit	ALr.H	xx. (9999 to -999)	Use UP,DN to set alarm high limit for pen. High limit of range is 9999. Scroll to continue.
d	Alarm Low Limit	ALr.L	xx. (9999 to -999)	Use UP,DN to set alarm low limit for pen. Low limit of range is -999. Scroll to continue.
e	Alarm Hysteresis	A.HYS	xx. (0 to 1000)	Use UP,DN to select amount of dead band (hys. factor in engineering units) to use. Scroll to continue. This parameter provides an adjustable dead

Table 3-8. Recorder Level 3 – Alarm Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
e	Alarm Hysteresis (Cont'd)			band at the alarm trip-point. When a changing process variable trips an alarm, the dead band causes the alarm output to be sustained after the process value returns to the trip-point. The alarm output turns off only after the process value has moved into the safe region by an amount equal to the dead band setting.
f	Alarm Acknowledge	ACk.-	no	From no, DN = yes. From yes, UP = no. Scrolling when yes selects requirement to acknowledge alarm. Scroll when no means no acknowledgment. Selection of the alarm acknowledge feature means that the alarm indicator light will flash until the alarm is acknowledged. After acknowledgment, the indicator light changes to a steady-on condition for as long as the alarm state remains. If the alarm state ceases before acknowledgment, the flashing light turns off when the alarm is acknowledged. Acknowledgment of an alarm does not change the alarm output. The alarm output follows the alarm state; it turns on when the process variable trips the alarm and turns off when the alarm state ceases.
g	Alarm Latch	LAt.	no	From no, DN = yes. From yes, UP = no. Scrolling when yes selects latching response of alarm relay. Scroll when no means no latch. When latch is selected, operation of the alarm indicator light is the same as described above for alarm acknowledge. The alarm output is turned off only by acknowledgment of the alarm. If the alarm state ceases before acknowledgment, the alarm output remains on until acknowledged.
h	Pen 2 Alarm	PEn.2	ALrS	Pen 2 indicator lights. If no Pen 2/Pen 3 exist, Scroll through to Level Selection, Step a of table. Use UP to continue Pen 2 alarm setup. Repeat Steps c through g, then go to Step i.
i	Pen 3 Alarm	PEn.3	ALrS	Pen 3 indicator lights. If no Pen 3 exists Scroll through to Level Selection, Step a of table. Use UP to continue Pen 3 alarm setup. Repeat Steps c through g, then Scroll to Level Selection, Step a of table.

3.8.4 Pen Calibration (Level 4)

The pen calibration loop is accessed by Level 4, as shown in Figure 3-4. This loop allows the pen(s) to be adjusted such that their maximum point of travel is precisely at the outside edge of the chart scale, and their minimum point of travel is precisely at the inside edge of the chart scale. The calibration scheme moves all pens simultaneously to the outer edge of the chart grid, where they are individually adjusted. All pens are then moved to the inner edge of the grid and again individually adjusted. Table 3-9 provides the Level 4 pen calibration procedure. Pen calibration cannot be performed when the recorder lock switch is set [no Go LoCk on], or when the chart or pen change switch is set [no Go In SErU.].

3.8.5 Temperature Calibration (Level 5)

The Level 5 loop, Figure 3-4, allows temperature calibration to correct for minor differences from one thermocouple or RTD to another. The correction range of ± 15° accommodates thermocouple and RTD variations. Table 3-10 provides the Level 5 setup procedure to be used once the following ice bath standard has been prepared.

A melting ice bath is recommended for use as a temperature standard. The ice bath will produce a precise 32°F (0°C) temperature which is within the range of all thermocouples and RTDs used with the recording controller.

Proceed as follows:

1. For thermocouple inputs, allow instrument to warm up for at least 1/2 hour to ensure that the cold junction compensator inside the case has reached a stable temperature.

2. Be sure that any length of thermocouple extension wire or RTD lead wire which will be used in the installation is connected for this procedure. If it is not possible to use the extension or lead wire, an equivalent resistor should be used.

3. Put melting ice and water mixture in a thermos to establish 32°F (0°C).

4. Immerse thermocouple or RTD in the ice water.

5. Primary display should read 32°F (0°C). If it does not, apply the required correction as described in Table 3-10.

NOTE

An alternate method for an RTD is to connect a 100-ohm 0.1% resistor to the RTD lead wires in place of the actual RTD. The primary display should read 32°F (0°C) because a standard RTD (DIN Std. 43760) has a resistance of 100 ohms at 32°F.

Table 3-9. Recorder Level 4 – Pen Calibration Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Level Selection	LEU.4	P.CAL	Scroll to begin pen calibrate. (UP,DN change level.)
b	Pen Group Lift	LIFt		Automatic operation: All pens lift and move towards outside edge of chart.
c	Pen Group Drop	droP		Automatic operation: All pens drop near outside edge of chart.
d	Calibrate High Limit, Pen 1	CAL.H	xx	Pen 1 indicator lights. Use UP, DN to position Pen 1 precisely at outside edge of chart. Numbers shown on secondary display indicate pen movement but do not correspond to any particular pen position. Scroll to continue with Step e or advance to Step g if Pens 2 and 3 are not installed.
e	Calibrate High Limit, Pen 2	CAL.H	xx	Pen 2 indicator lights. Use UP, DN to position Pen 2. Scroll to continue with Step f or advance to Step g if Pen 3 is not installed.
f	Calibrate High Limit, Pen 3	CAL.H	xx	Pen 3 indicator lights. Use UP, DN to position Pen 3. Scroll to continue.
g	Pen Group Lift	LIFt		Automatic operation: All pens lift and move toward inside edge of chart.
h	Pen Group Drop	droP		Automatic operation: All pens drop near inside edge of chart.
i	Calibrate Low Limit, Pen 1	CAL.L	xx	Pen 1 indicator lights. Use UP, DN to position Pen 1 precisely at inside edge of chart. Scroll to continue with Step j or advance to Step l if Pens 2 and 3 are not installed.
j	Calibrate Low Limit, Pen 2	CAL.L	xx	Pen 2 indicator lights. Use UP, DN to position Pen 2. Scroll to continue with Step k or advance to Step l if Pen 3 is not installed.
k	Calibrate Low Limit, Pen 3	CAL.L	xx	Pen 3 indicator lights. Use UP, DN to position Pen 3. Scroll to continue.
l	Pen Group Lift	LIFt		Automatic operation: All pens lift and move towards their respective operational values based on process input of each pen.
m	Pen Group Drop	droP		Automatic operation: All pens drop, each at its correct pen input value. Display returns to Level Selection, Step a of this table.

Table 3-10. Recorder Level 5 – Temperature Calibration Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Level Selection	LEU.5	t.CAL	Scroll to begin temperature calibration procedure. (UP, DN change level.)
b	Pen 1 Selection	PEn.1	t.CAL	Pen 1 indicator lights. Use UP to continue Pen 1 temperature calibration.
c	Apply Calibration Correction for Pen 1	32.0	+0.9	With thermocouple at 32°F (0°C) per paragraph 3.8.5, use UP,DN to select correction to give 32°F (0°C) reading on main display. Apply correction input gradually, and allow a response interval after each input change. Scroll to enter correction and continue.
d	Pen 2 Selection	PEn.2	t.CAL	Pen 2 indicator lights. If Pens 2 and 3 are not present, scroll to return to beginning of this table. Use UP to continue Pen 2 temperature calibration
e	Apply Calibration Correction for Pen 2	xx	xx	Repeat Step c procedure for Pen 2. Scroll to continue.
f	Pen 3 Selection	PEn.3	t.CAL	Pen 3 indicator lights.If pen 3 is not present, scroll to return to beginning of this table. Use UP to continue Pen 3 temperature calibration
g	Apply Calibration Correction for Pen 3	xx	xx	Repeat Step c procedure for Pen 3. Scroll to return to beginning of this table.

3.8.6 RS-422 Serial Communications Port Setup (Recorder Level 6)

NOTE

The communications function and the Level 6 setup loop are available only when the recording controller is equipped with the RS-422 Serial Communications Option, Catalog No. Code D1.

The setup parameters for the RS-422 serial communications port are given in the RS-422 communications loop accessed by Level 6 as shown in Figure 3-4. This loop allows the following setup activities.

- Enabling or disabling of communications feature
- Address assignment
- Baud rate selection
- Control character set selection
- Parity selection
- Error checking selection

Make setup entries using the procedure shown in Table 3-11. Scroll through the listed steps and make an appropriate response at each applicable step.

Table 3-11. Recorder Level 6 – RS-422 Interface Setup Procedure

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
a	Level Selection	LEV.b	422	Scroll to begin RS-422 Interface Setup. (DN to change level.)
b	Enable/Disable	EnbL.	no or YES	From no, UP = YES, from yes, DN = NO. Scrolling when yes selects enable. Scrolling when no selects disable. Also, scrolling advances to next step. The enable/disable entry provides the means to disable the RS-422 Serial Communications Port and lock out the computer. When the interface is enabled, operations can be implemented from the instrument front panel, or from a remote computer. The instrument will act upon the most current command (either from the front panel controls, or from a computer via the RS-422 Interface). When the serial communications port is disabled, operations can only be implemented from the front panel.
c	Establish Address	Addr.	1 to 99	Use UP, DN to select instrument address. Scroll to continue. Each instrument connected to the computer via the RS-422 Interface requires a unique address (1 to 99). Address 0 is a reserved address and should not be assigned to an instrument communicating on the RS-422 communications network.

Table 3-11. Recorder Level 6 – RS-422 Interface Setup Procedure (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Procedure
c	Establish Address (Cont'd)			NOTE Failure to assign a unique address to each instrument in a network may result in an invalid configuration, duplicate messages, or other communication problems.
d	Establish Baud Rate	bAUd	1200, 2400, 4800, 9600	Use UP, DN to select baud rate. Scroll to continue.
e	Select ASCII Control Characters or Alternate Character Set	ALt.c.	no or YES	From no, UP = YES, from yes, DN = NO. Scrolling when no selects ASCII Control Character set. Scrolling when yes selects Alternate Character Set. Also, scrolling advances to next step. On some computers, the communications drivers will filter out ASCII control codes. Select the alternate character set if the ASCII codes are filtered.
f	Select Parity	PAr.	YES or no	From yes, DN = NO. From no, UP = YES. Scrolling when yes selects parity (word length = 7 bits). Scrolling when no selects no parity (word length = 8 bits). Also, when yes is selected, next prompt will be Odd (Step g) to select odd or even parity. When no is selected next prompt will be bCC (Step h).
g	Select odd or even parity	odd	no or YES	From no, UP = YES, from yes, DN = NO. Scrolling when no selects even parity. Scrolling when yes selects odd parity. Also, Scroll advances to next step.
h	Enable/Disable bCC	bCC	YES or no	From yes, DN = NO. From no, UP = YES. Scrolling when no disables bCC. Scrolling when yes enables bCC. Also, scrolling returns to beginning of this table. The block check character (bcc) is a means of checking the integrity of the data transmitted over the RS-422 interface. bcc is the bitwise exclusive OR of the Start-Of-Text (STX), message, and End-Of-Text (ETX) elements of the communications protocol. The operation of bcc is determined by the combination of the bcc and alternate character field definitions. When bcc is enabled (bCC = YES), bcc is calculated in the usual way for both the alternate character set and the ASCII control character set. When bcc is disabled (bCC = no) and the alternate character set is chosen, a control-J (line feed character, hexadecimal 0A) is sent in the bcc position. When bcc is disabled and the ASCII control character set is chosen, an ASCII "b" is sent in the bcc position.

SECTION 4
OPERATION

4.1 GENERAL

The process monitoring operations for the recorder are done at Level 1, Display (operator level). Some operator activities may also be associated with totalization, level 2, and alarm settings, level 3. The other activities in levels, 2 through 6, are for entries for setup and calibration. Operator access to levels 2 through 6 may be limited to a read-only mode. This means that all setup entries can be viewed but cannot be changed.

The range of operator activities available comprises:

- Monitoring process input values
- Monitoring totalization values
- Monitoring for Event Marker activity
- Monitoring for alarms
- Acknowledging alarms

The operator uses the front panel on the recorder door to monitor up to three process inputs (3 recording pens).

4.2 FRONT PANEL DISPLAYS, INDICATORS, AND CONTROLS

The front panel has two digital displays, three pen-monitor indicators, a high and a low alarm indicator for each pen, and three control keys. Figure 4-1 further describes the panel.

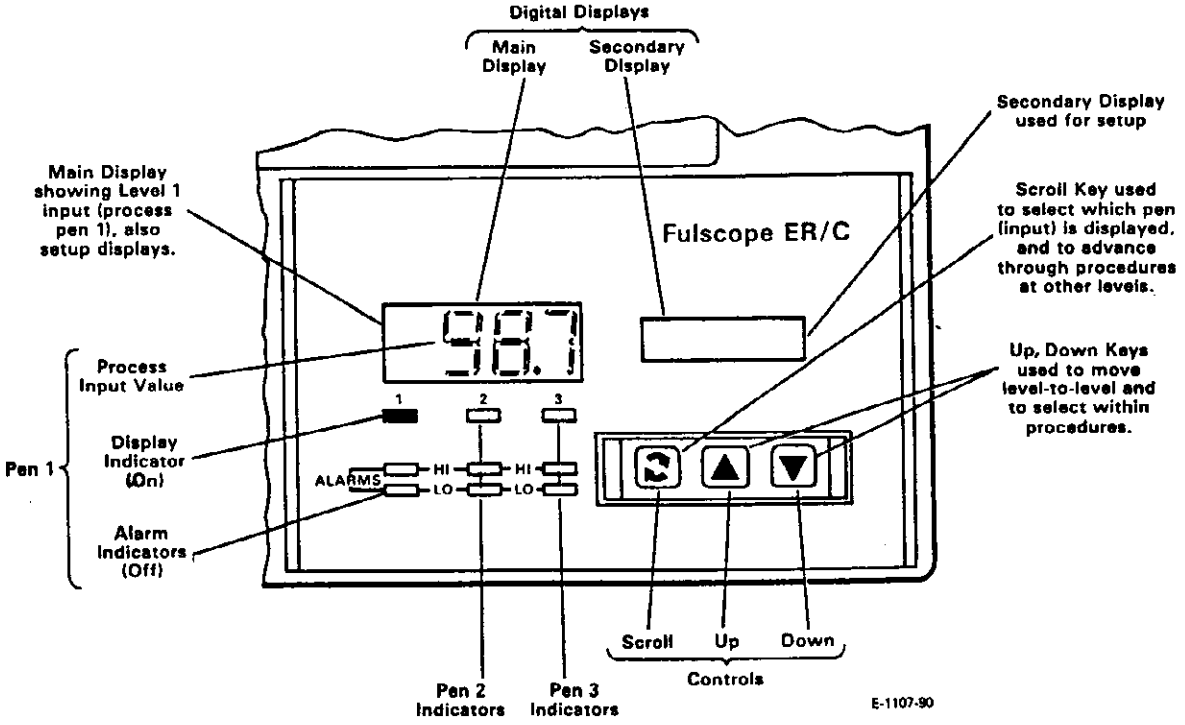


Figure 4-1. Front Panel with Typical Pen 1 Display

4.2.1 Digital Displays

Both of the digital displays have four character positions. Each character has 7 elements and a decimal point and can produce numeric characters 0-9 and certain "alpha" characters. The displays seen during operation at Levels 1 through 6 are given by Table 3-3.

4.2.2 Indicator Lights

There are three groups of indicator lights, one group for each pen position. As seen in Figure 4-1, the number 1 light (shown on) is associated with Pen 1 and is on because the process input value being recorded by Pen 1 is also being displayed.

Directly under each numbered pen light are the high and low alarm lights associated with that pen. See paragraph **4.4, Alarms**.

4.2.3 Control Keys

The three operating control keys are:

Scroll: Press as directed to advance to next position in a procedure. Used to acknowledge alarms.

Up: Press to advance to higher level when [LEU.] display present. Used to view totalized counts counts for level 1 pen display. Used to acknowledge alarms. Used at Levels 2 through 6, in conjunction with Down button, to enter setup values.

Down: Press to drop to lower level when [LEU.] display present. Used to acknowledge alarms. Used at Levels 2 through 6, in conjunction with Up button, to enter setup values.

4.3 OPERATING PROCEDURE FOR RECORDER WITHOUT TOTALIZATION

Operator functions include chart and display monitoring, alarm monitoring, and alarm acknowledgment if applicable. The monitoring activities are carried out at Level 1 of the recorder's five levels. Levels 2 through 6 are provided for setting up the recorder's operating characteristics, specifying alarm usage, and calibrating to specific requirements.

Application of ac power activates the recorder front panel at Level 1. The first display is [A.C.] [FAIL] indicating that instrument power has been off. Pressing any key increments the display to start the operating sequence. The operational displays and the sequence of their appearance are shown in Figure 4-2. The operator can scroll (press, then release scroll key) to advance through the applicable display positions. The curved arrow symbol shows where scroll action is used. The up and down arrow symbols show where the up and down keys are used for level change.

The display of the process input value for pen 1 is always available. Scrolling from the pen 1 display advances to the display of the process input for pen 2 and pen 3 if these pens are installed. In Figure 4-2 pen 3 has been set up as an event marker and the display shows the status of the contact input instead of a numerical value. The [OFF] display indicates that the relay providing the contact input is open awaiting an event which will cause closure. The relay closure will change the display to [ON] and pen 3 will produce a chart record of the event. Refer to **4.5 Event Marker** for additional information.

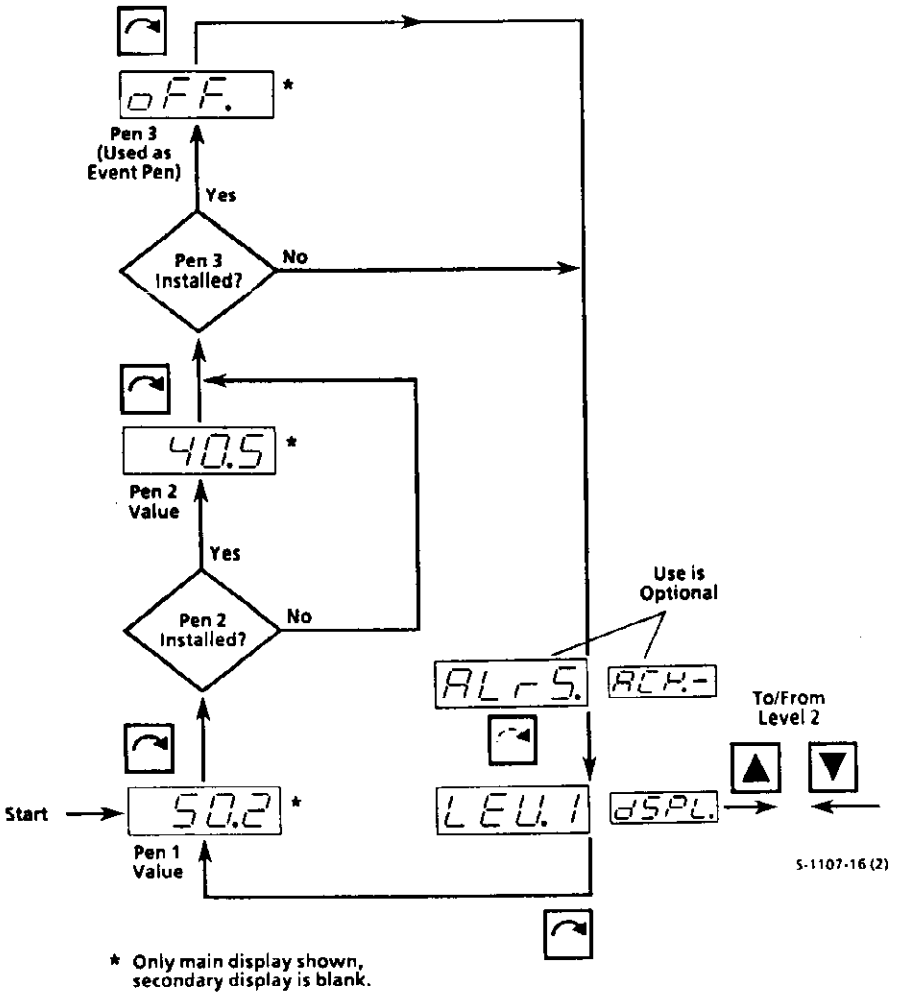


Figure 4-2. Level 1, Pen Selection and Display

The acknowledge display appears only if the feature has been enabled and an alarm is present. Refer to **4.4 Alarms** for additional information..

4.4 ALARMS

4.4.1 General

An alarm is activated when the process input reaches a preset high or low trip-point, or when an open input circuit is detected. Alarms resulting from rising input are defined as high, and those resulting from falling input are defined as low.

Monitoring and acknowledging alarms are basic operator activities. Acknowledgment may or may not be required, depending upon the way the recorder is set up.

4.4.2 Alarm Conditions

The high and low alarm trip-points for each pen are determined at the time of setup of the recorder (level 3). Refer to paragraph 3.8.3.

An alarm is activated when the input to a recorder pen, Pen 1 for example, reaches an alarm limit. The front panel alarm indicator for the appropriate high or low Pen 1 alarm lights, and the relay for external alarm use is activated. If an external alarm is connected to the pen I/O board, it will signal an alarm, but will not distinguish between high and low alarms. Individual high and low alarms are indicated through the digital option board.

The alarm light remains on until the process input returns to a value within the preset limits; then it extinguishes.

4.4.3 Hysteresis

There is a hysteresis (dead band factor) which is used to prevent "fluttering" when the process remains near an alarm trip-point and could be repeatedly tripping the alarm. An appropriate hysteresis requires that the process, when in the alarm state, must change by a predetermined amount before the alarm stops.

4.4.4 Alarms With Acknowledgment

The acknowledgment feature causes alarm indicators to flash instead of light in a steady-on mode. The flashing light remains until the alarm is acknowledged. If the alarm condition still persists at the time of acknowledgment, the flashing mode changes to a steady-on condition to show that the alarm has been acknowledged. When the alarm condition finally stops, the light extinguishes.

If there is an alarm at one limit that has not been acknowledged (e.g. high), and then the process subsequently trips the alarm at the other limit (low), the high and low alarm indicators will be flashing simultaneously. If the low alarm remains when the alarm is acknowledged, the high alarm will extinguish and the low alarm will assume a steady-on condition.

Acknowledgment of an alarm does not change the alarm output. The alarm output follows the alarm state; it turns on when the process variable or deviation trips the alarm and turns off when the alarm state ceases.

4.4.5 Alarms with Acknowledgment and Latch

When the instrument has been set up to include the latch feature along with acknowledgment, operation of the alarm indicators is the same as described in paragraph 4.4.4.

With latch, the alarm output can be turned off only by acknowledgment of the alarm. If the alarm state ceases before acknowledgment, the alarm output remains on until acknowledged.

4.4.6 Acknowledgment Procedure

Operate the scroll key until the [ALrS ACk-] display appears. Press any key (UP, DN, Scroll) to acknowledge all active alarms. Individual acknowledgment of separate alarms is not used.

4.5 EVENT MARKER

A pen used as an event marker responds to a change of input (dry contact closure) by marking the change on the chart. An event signal received at pen 1 (red) causes the pen to mark a 15% drop on the chart and then remain at the new level until the signal is removed. For pen 2 (green) the drop is 10% and for pen 3 (blue) the drop is 5%. Thus each pen has a distinctive marking level for a received event signal.

When an event signal is being received, the main display for that pen shows [on]. At the end of the event (signal removed) the pen returns to its outer (inactive) position on the chart and the main display for that pen shows [oFF].

Alarm relay action (pen I/O board and digital option board) will track the event status, i.e., alarm relay contacts transfer as event contacts transfer.

4.6 OPERATING PROCEDURE FOR RECORDER WITH TOTALIZATION

The operating procedure for a recording controller with integration/totalization is very similar to that of a non totalizing recording controller. Application of power activates the front panel at Level 1. The first display is [AC] [FAIL] indicating that instrument power has been off. Pressing any key increments the display to start the operating sequence.

A flow chart showing the operating displays and the sequence of their appearance is shown in Figure 4-3. The up, down, and curved arrow symbols show where key strokes are used to advance to the next display.

When a process input value is being displayed, the totalized value for that input can be viewed by pressing the UP key. As shown in Figure 4-3, scrolling from the Pen 1 total returns to the process variable display, and a second scroll advances to the Pen 2 process display where another total is available via the UP key.

NOTE

To view the totalizer display, do not press and hold the UP key. Instead, press the UP key once with a firm tap. The totalizer display should appear within a second if the UP key was pressed properly.

When a totalizer is off the [totL] [oFF] display appears, and scrolling returns to the process display. There are no totalizer displays associated with event pens or pens which have thermocouple or RTD process input.

The totalizer can be turned off or reset at any time by advancing to Level 2. In Level 2 a yes response to the [rSEt] prompt resets the totalizer to its preset value, and a yes/no response to the [t.on] prompt turns the totalizer on or off. Also in Level 2, the threshold value and wrap selection can be changed while the totalizer is running.

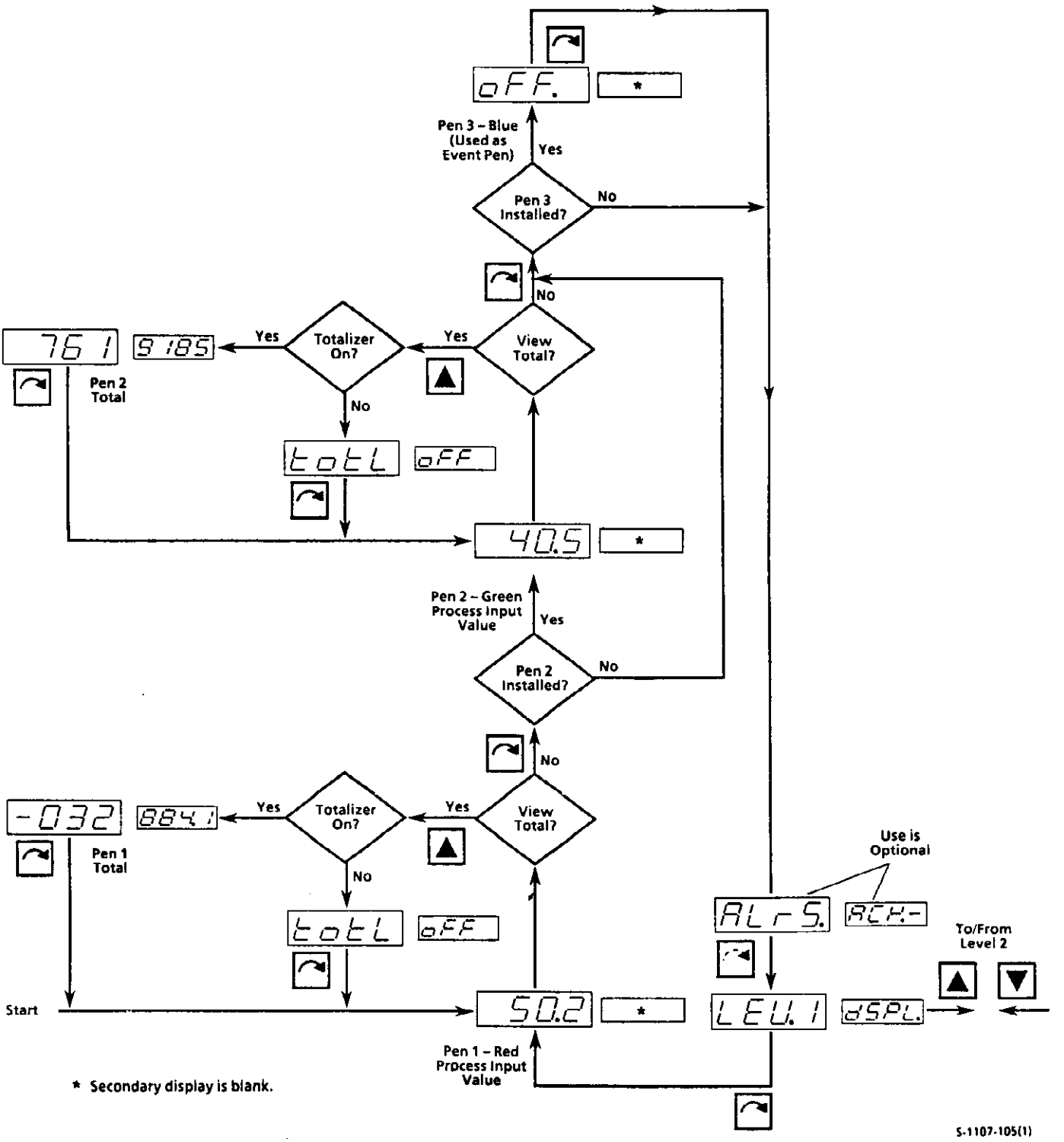


Figure 4-3. Operation Flow Chart for Recorder with Totalization

SECTION 5
MAINTENANCE

5.1 GENERAL

The maintenance information in this section includes changing the recorder's chart paper and pen tips, cleaning display faces, calibration procedures, and fault location. The corrective maintenance information provides data useful in locating a faulty circuit board or in defining a basic electrical problem.

Basic troubleshooting locates circuit faults to the board level. Some of the items to be checked are ac power, dc and ac supply voltages, correct insertion and seating of connectors, and signal inputs/outputs. Troubleshooting is normally an off-line activity.

5.2 CHANGING CHART

1. Operate **PEN** switch on chart plate, Figure 3-6, to its **CHART CHANGE** position and wait for the pens to move aside.
2. Release the chart hub and remove the old chart.
3. Insert the new chart over the hub and under the edge retainers, Figure 3-6. Rotate chart until correct time mark on chart perimeter is aligned with the **START TIME** guide line on the chart plate.
4. Clamp the hub to retain the chart at the adjusted position.
5. Return the **PEN** switch to its **RUN** position.

5.3 CHANGING PENS

1. Operate the **PEN** switch on chart plate, Figure 3-6, to its **PEN CHANGE** position and wait for the pens to spread apart.
2. For the pen to be changed, remove the pen arm with pen tip, Figure 3-6.
3. Obtain new pen tip of correct color and remove its protective tip cover.
4. Remove old pen tip from pen arm and replace with new pen tip. Be sure new tip is inserted fully on pen arm.
5. Replace pen arm in its holder. See Figure 3-7.
6. Return the **PEN** switch to its **RUN** position.

5.4 CLEANING DISPLAYS

The face of the displays, while made of scratch resistant plastic, can be abraded by harsh materials such as paper towels and industrial wipes. Lens cleaning tissues and soft cloths are suitable for cleaning displays.

5.5 INPUT FAILURE AND POWER FAILURE DETECTION

5.5.1 Recorder Input Failure Detection

If there is a process input failure the recorder responds as follows:

- Affected pen moves to inner most chart circle.
- If pen was set for low alarm application, alarm indication will be given.
- If display for failed pen is active (pen indicator lit), the main display gives a random (not useful) output and the secondary display gives a failed-input message per Table 5-1.
- If display for failed pen is not active, the pen position (at inner most chart circle) is the failure indication. Failure is further defined by calling-up the display of the failed pen.
- If the failure condition disappears, such as with an intermittent open, the pen resumes tracking activity, based on the input. However, the failed-input message remains on the secondary display until cleared by operating the UP (Δ) key or the DN (∇) key, causing the secondary display to assume its normally-blank condition (unless totalization is configured and the up key is pressed).

5.5.2 Power Failure Detection

If there is a power failure or shutdown, the relays fail-safe by going to their alarm state. Upon restart, the primary and secondary recorder displays indicate [A.C.] [FAIL], the relays remain in their alarm state until an accurate process input reading is made (about 10 seconds), after which the relays follow their configured action. Also during startup, the chart is marked at the outer limits by all pens.

NOTE

The [A.C.][FAIL] display appears upon return of power after any shutdown

5.6 DIAGNOSTIC MESSAGES

The recorder provides several diagnostic messages which alert the user to operational or setup problems. The diagnostic message displays are listed in Table 5-1 and described below.

5.6.1 Process Input Failure Messages and Responses

An input failure message appears in the secondary display of the recorder with the process display of the failed input. Scrolling from this display advances through the other operational displays in Level 1 which are not affected by the failure message. The process/failure display exists as long as the failure conditions persists. After the failure is corrected (i.e. repair of an open thermocouple), pressing the UP (Δ) key (except when totalizer is present) or the DN (∇) key clears the failure message and display operation returns to normal.

Table 5-1. Diagnostic Message Display Listing

FUNCTION	DISPLAY		DESCRIPTION
	MAIN	SECONDARY	
RECORDER Failure and Error Messages	**Input Failure Messages:**		
	XXXX Range limit or random values during input failure	F.tC.L	Failed thermocouple, low
		F.tC.H	Failed thermocouple, high
		F.rt.H	Failed RTD, high
		F.rt.L	Failed RTD, low
		F.CJC	Failed cold junction compensating thermistor
		F._AL	Failed 4-20 mA input, low
		F._AH	Failed 4-20 mA input, high
		F.HI	Over voltage
		F.LO	Under voltage
		F.brd	Failed or missing pen I/O board
	Other Messages:		
	A.C.	FAIL	AC power failure. *First display after any shutdown.*
	CnFG	FAIL	Configuration failure. *NOVRAM does not pass checksum test.*
	Prog.	CHnG	Program change. *PROM checksum and/or version changed during power shutdown.*
	rCAL.	ALL	Recalculated all configuration variables and set to default values.
	8 H.	Stor.	8000 stores. *NOVRAM can have 10000 power up/down storage cycles.*
	TEST	_odE	Test mode. *For factory use only. Exit using down key.*

S-1107-17(2)

5.6.2 Other Messages

The other diagnostic messages appear as follows:

- [A.C.] [FAIL]
  This is always the first display to appear after power-up. It provides indication that the power has been off due either to a normal shut down or an accidental power failure. Pressing any key clears this message and starts the operating display sequence after additional diagnostic messages, if present.
- [CnfG] [FAIL]
  This configuration change message is produced if nonvolatile random access memory (NOVRAM) does not pass checksum test. Replace Processor board if NOVRAM is not socketed. Replace NOVRAM if it is socketed.
- [ProG] [ChnG]
  This configuration change message is produced if the programmable read only memory (PROM) checksum and/or version changed during power shutdown. The next scroll clears the message and allows operation and setup activity to continue.
- [rECAL] [ALL]
  This configuration change message is produced if all configuration variables were reset to the default values. The next scroll clears the message and allows operation and setup activity to continue.
- [8 K.] [Stor.]
  This diagnostic message is produced if the NOVRAM has been through 8000 power down cycles. The next scroll clears the message and allows operation and setup activity to continue.
- [tESt] [odE]
  This display appears when scrolling past recorder level 5 or 6 after power-up. It is used for factory test purposes only. Pressing the down key clears this message and returns the recorder to the appropriate level. The test mode cannot be reentered.

5.7 TROUBLESHOOTING

Troubleshooting of the recorder seeks to locate faults to the circuit board level. Specifically, the items for checkout are the pen I/O circuit boards that plug into the I/O motherboard, the I/O motherboard, the display board, the power supply board, the power transformer, and the processor board.

In general, if a trouble affects one pen and not others, the problem is with the pen I/O board for that pen. After checking that supply voltages to the board's connector are correct, insertion of the spare known-good pen I/O board is used to confirm that the trouble was with the original board. Jumper locations on spare board must match jumper locations on board being replaced.

The symptoms shown in the troubleshooting chart, Table 5-2, provide a guide for isolating a hardware fault to one of the circuit boards or the power transformer. Before concluding that a problem is caused by a hardware fault, carefully check the following.

- All jumpers are properly positioned. Refer to paragraph 3.3.
- All connectors in assembly are fully seated. Refer to Figure 3-2.
- Power and I/O wiring connections are correct. Refer to Section 2.
- Recorder is properly configured for the required application via setup levels 2 through 6. Refer to paragraphs 3.7 and 3.8.

If none of the listed items is the source of the problem, refer to Table 5-2 to isolate the most probable cause. For a trouble where pen I/O and display boards are not faulty, voltages are correct, motherboard and connectors are operative, and stepper motors are working correctly, then the suspected faulty component is the processor board. Contact your authorized service representative to arrange replacement.

The front panel lights are checked by operating the FRONT PANEL switch momentarily to its unmarked (bottom) position. This activates all elements of all panel lights.

5.7.1 Recommended Test Equipment

In addition to the basic hand tools for maintenance and troubleshooting, the following test equipment is specified:

- Spare Pen I/O Board, Taylor part no. 500S1166:
  Substitution for checkout of Pen I/O Boards.
- Precision dc Voltage Source [Calibrations]:
  Supply 17 mV dc ± 0.001 mV dc.

  Supply 2V dc ± 0.001V dc.
- Digital Voltmeter [Supply Voltage Checkout, Calibrations]:
  Measurements at 0 to 10V dc ± 0.001V dc.
  Measurements at 17 mV dc ± 0.001 mV dc.

5.7.2 Disassembly/Reassembly

To Disassemble

1. Turn off ac power to recorder.
2. Open recorder door.
3. Open chart plate.
4. On Processor board, Figure 5-1, disconnect plugs P8-P12 (stepper motors), plug P1 (lock and pen switches on chart plate), and ground strap spade lug at transformer.
5. With chart plate in open position, carefully lift chart plate up off hinges and remove it.

To Reassemble

1. Turn off power to recorder.
2. Remove all test equipment.
3. Ensure that proper I/O wiring connections are completed.
4. Ensure that DIP switch settings are correct.
5. While supporting chart plate, replace chart plate plug P1 into the P1 socket on processor board. Orient per Figure 5-1.
6. Replace stepper motor plugs P8 through P12 into correct numbered sockets on processor board. Orient plugs per Figure 5-1.

Table 5-2. Troubleshooting Chart

Problem	Possible Cause	Action
No display	a. No power. b. Incorrect power connections. c. Power I/O Circuit board fault. d. Transformer Fault.	a. Turn on power. b. Check power connections. Refer to Figure 2-2. c. Replace circuit board. d. Replace Transformer.
Display of process value is erratic.	Power I/O circuit board fault.	Replace circuit board.
Main and/or Secondary displays are wrong or intermittent.	Poor connection between front panel assembly and processor circuit board.	Check to see that processor board connector is fully engaged with pins on front panel.
Alarm or status indicator lights are inaccurate.	a. Display circuit board fault. b. Processor board fault.	a. Replace display circuit board. b. Replace circuit board.
No retransmission output.	Pen I/O board fault.	Replace pen I/O board.
Digital Input is nonfunctional.	Digital Option Module fault.	Replace digital option module circuit board.
RS-422 Communication is nonfunctional.	a. Incorrect connections. b. Processor board has wrong PROM.	a. Check wiring connections. Refer to paragraph 2.11. b. Replace PROM with version containing communications function.
Display diagnostic message indicates 4 to 20 mA low input failure when transmitter and input wiring are ok.	Blown fuse.	Replace fuse F1 on motherboard for appropriate input.

7. Connect ground strap spade lug to transformer.
8. Close chart plate and secure with screw.
9. Turn on power to recorder, as appropriate.
10. If setup operations of Section 3 are required, proceed to that section before putting recorder into operation.

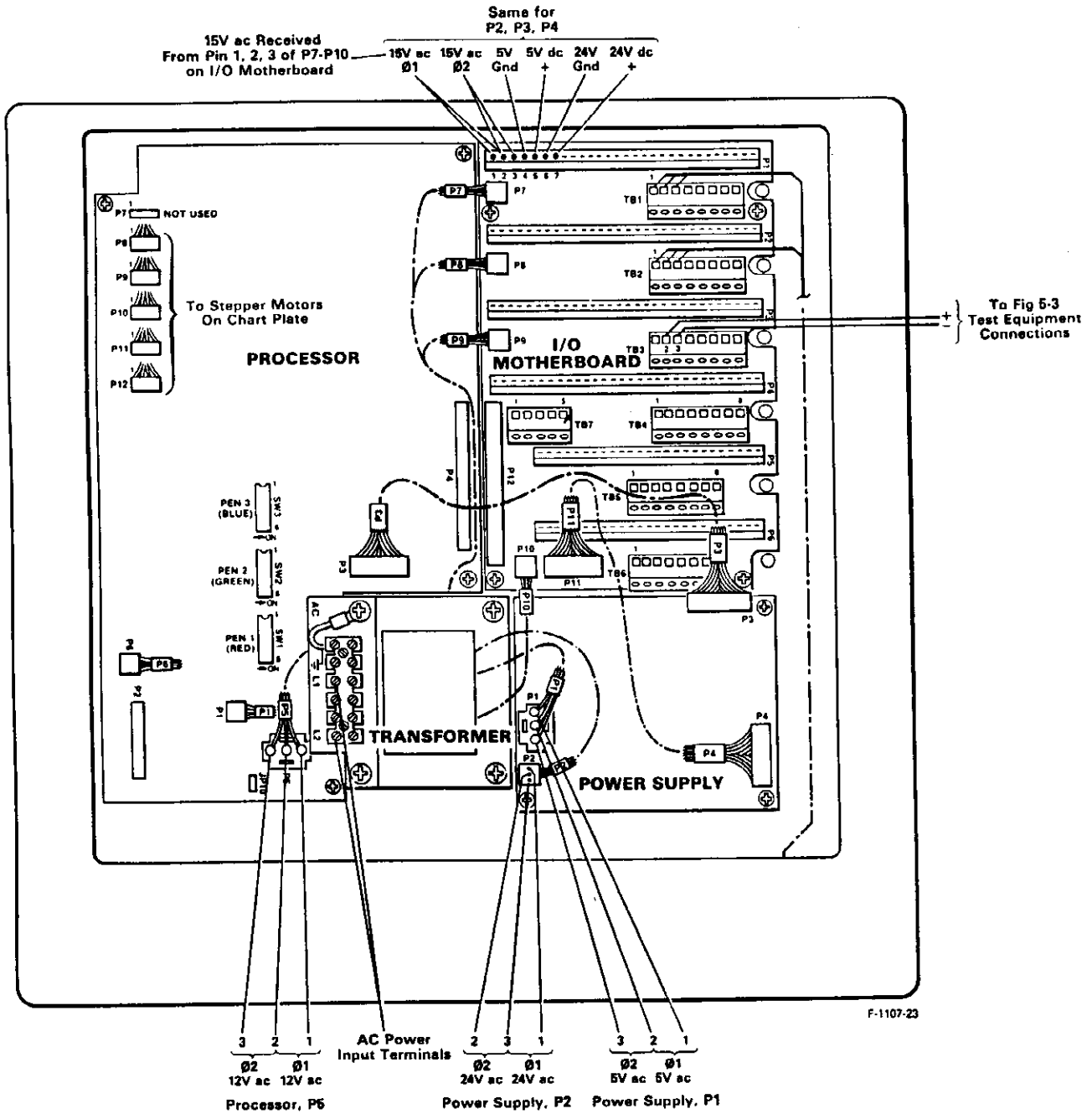


Figure 5-1. Voltage Measurement and Test Connection Diagram

5.7.3 Voltage Checks

To assure that the power system is providing proper dc supply voltages, refer to Figure 5-1 and use a voltmeter to check voltages to circuit boards and stepper motors, as applicable.

WARNING

Avoid any exposed ac line voltage locations while troubleshooting within the recorder.

5.7.3.1 Power Transformer Outputs

1. Turn on ac power to recorder.

NOTE

Plugs P5 (12V ac) and P1 (24V ac) allow needle-probe insertion into back of plug.

2. Check 12V ac at Processor plug P5. Pin 2 is common for 01 and 02.
3. Check 5V ac at Power Supply plug P1. Pin 2 is common for 01 and 02.
4. Remove Power Supply plug P2 and check for 24V ac. Pin 3 is common for 01 and 02.

5.7.3.2 Pen I/O Board Voltages

Each of four pen I/O board connectors, P1-P4 on I/O motherboard, supplies operating voltages to I/O boards through pins 1-7, per Figure 5-1.

CAUTION

Avoid using tools and metal objects in vicinity of the projecting pins of the motherboard connectors P1-P6. These are active circuit terminals and, as noted in the following voltage checks, some adjacent pins are voltage-supplying pairs which must not be "shorted".

WARNING

Avoid using tools and metal objects in vicinity of the projecting pins (26, 28, and 30) of the motherboard connectors P1-P3. These circuit terminals may have high voltage field I/O wiring connected through the associated terminal block (TB1, TB2, and TB3).

1. Check 15V ac at pins 1-3. Pin 2 is common for 01 and 02. If 15 volts is defective, check input from ac transformer at the appropriate motherboard plug, P7-P10.
2. Check 5V dc at pins 4 and 5. Pin 5 is plus (+).
3. Check 24V dc at pins 6 and 7. Pin 7 is plus (+).

The digital option module connectors, P5 and P6 on I/O motherboard, supplies operating voltages to modules through pins 1-4, per Figure 7-1.

1. Check 5V dc at pins 1 and 2. Pin 2 is plus (+).
2. Check 24V dc at pins 3 and 4. Pin 4 is plus (+).

5.7.3.3 Stepper Motors Power

The stepper motors on the chart plate are identified in Figure 5-2.

The chart drive motor is checked by setting chart speed to maximum (1 rev./hr.) and noting operation. There should be observable movement, equal to 1/4 revolution in 15 minutes.

Pen lift and pen operate motors are checked by operating the PEN switch to its PEN CHANGE position and observing that pens lift and separate correctly.

If a drive motor fault is found, check the voltage (12V dc ±0.5V) supplied to the motor (P8-P12, Processor Board). If the voltage is satisfactory and the drive mechanism is not damaged, replace the motor. If the motor's drive voltage is not correct, check all connections associated with that motor and isolate the circuit defect.

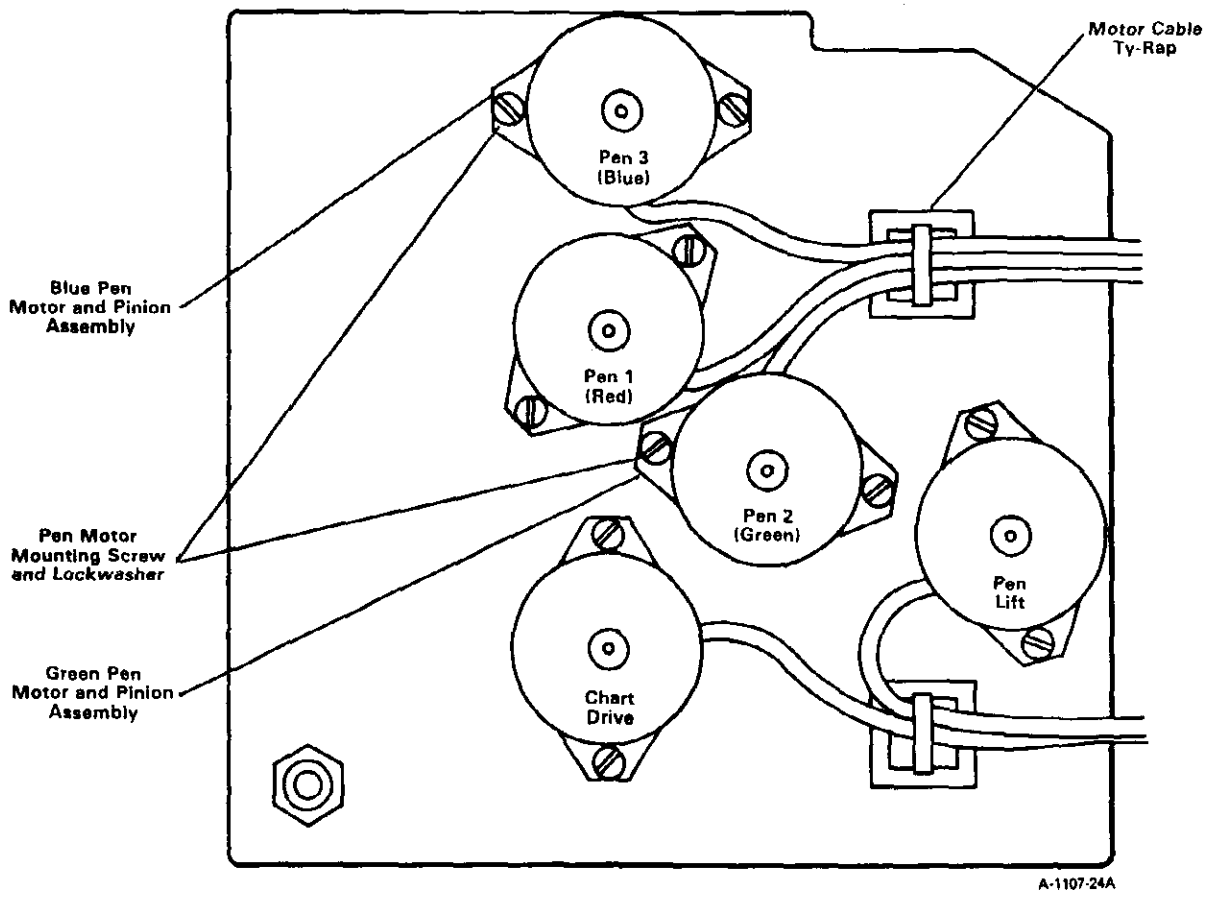


Figure 5-2. Back of Chart Plate with Drive Motors Identified

5.8 PEN I/O BOARD INPUT CALIBRATION

New-equipment boards are factory calibrated and will not normally require further adjustment. Calibration involves inputting a reference signal and adjusting a potentiometer on the pen I/O board being calibrated. This is done first with a high-level (V) signal, and then with a low-level (mV) signal. Calibration is an off-line procedure. To calibrate pen I/O boards, use an operable recorder with a vacant Pen 3 I/O board position. Calibrate all boards for high-level input and then calibrate all for low-level input.

5.8.1 High-Level Calibration

1. Turn off ac power to recorder.
2. Open recorder door.
3. Open chart plate.
4. Refer to Figure 5-1 and locate TB3 terminals 2 and 3 (input) on Pen 3 I/O board location.
5. Refer to Figure 5-3 for test setup connections, and to paragraph 5.7 for test equipment specifications.
6. Set SW3 DIP switch (Figure 5-1) as diagrammed in Figure 5-4 View B, for high-level (V) calibration.
7. Set chart plate FRONT PANEL switch to UNLOCK position.
8. On all Pen I/O Boards to be calibrated, insert jumper at location J6 only. All other jumper locations on these boards are left vacant. See Figure 5-5.
9. Insert pen I/O board in Pen 3 board location on I/O motherboard.
10. Set precision voltage source for 2.000 V dc signal (input to TB3).
11. Turn on ac power to recorder.
12. Refer to Table 5-3 and scroll through its menu, following the step responses given.

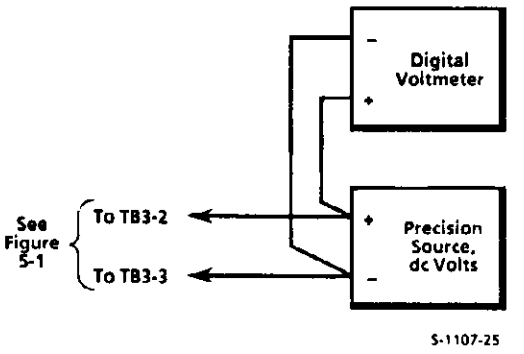


Figure 5-3. Test Equipment, Pen I/O Board Calibration

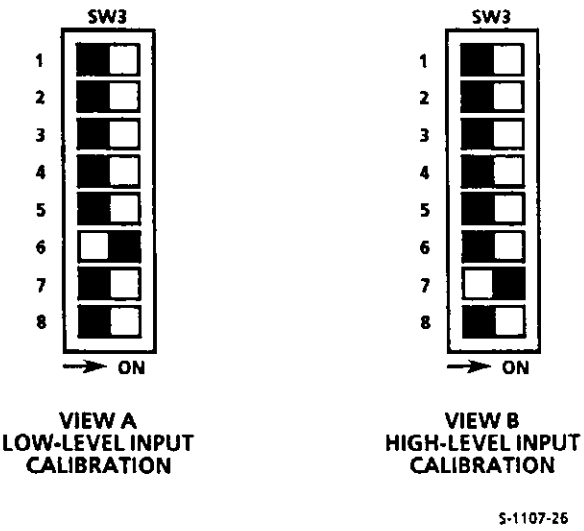


Figure 5-4. Settings of SW3 for Low-Level Calibration (View A) and High-Level Calibration (View B)

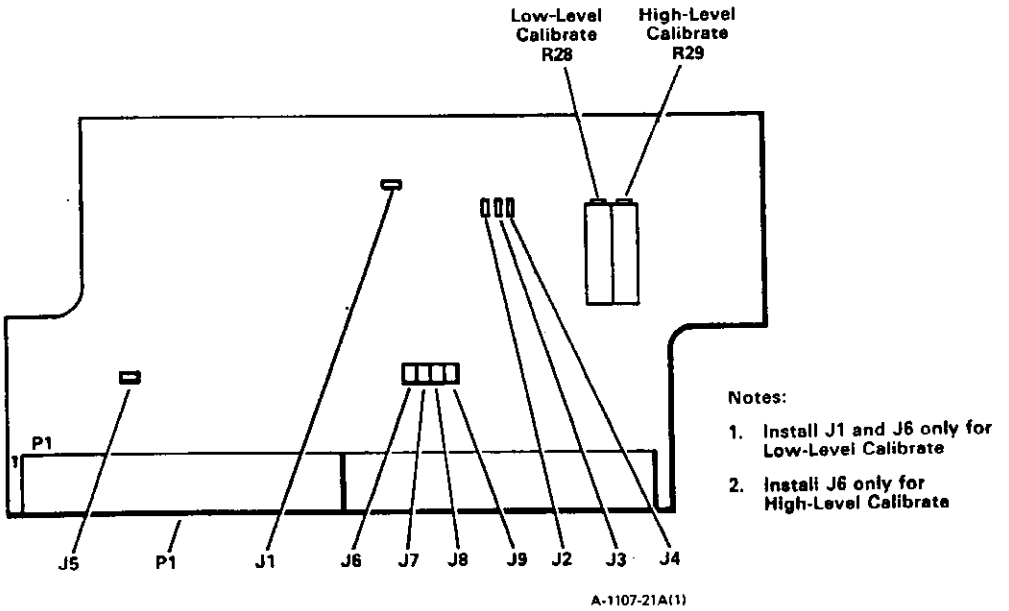


Figure 5-5. Pen I/O Board, Input Calibration Adjustments

Table 5-3. High-Level (V) Input Calibration

Step	Step Description	Main Display Readout	Secondary Display Readout	Remarks
a	Level Selection	LEU.2	SEt	Scroll to begin pen setup.(UP,DN change level.)
b	Pen 1 Sequence	PEn.1	SEt	Pen 1 indicator lights. Scroll to continue.
c	Pen 2 Sequence	PEn.2	SEt	Pen 2 indicator lights. Scroll to continue.
d	Pen 3 Sequence	PEn.3	SEt	Pen 3 indicator lights. Use UP to continue.
e	Input High Limit	InP.H	5.00	Use UP,DN to set high limit of input to 5.00. Scroll to continue.
f	Input Low Limit	InP.L	.00	Use DN to set low limit of input to .00. Scroll to continue.
g	Square Law	SQ.-L	no	Scroll to continue (selects no Sq.Law).
h	Decimal Point	d.P.-	0.000	Use UP,DN to select 3-place decimal accuracy. Scroll to continue.
i	Engineering Units, Low	EnG.L	.000	Use DN to set engineering units low to .000 Scroll to continue.
j	Engineering Units, High	EnG.H	5.000	Use UP,DN to set engineering units high to 5.000. Scroll to continue.
k	Totalizer Setup	totL	CnFG	Scroll to continue.
l	Chart Low Limit	CH.Lo	.000	Use DN to set chart low limit to .000. Scroll to continue.
m	Chart High Limit	CH.H	5.000	Use UP,DN to set chart high limit to 5.000. Scroll to continue.
n	Input Filtering	FILt	no	Scroll to continue.
o	Chart Speed	CHrt	SPEd	Use UP to continue speed-set sequence.
p	Speed Selection	SPEd	1	Use UP,DN to select chart rotation speed of 1 revolution/hour. Scroll to enter value, and to return to beginning of this table.
q	Level Selection	LEU.2	SEt	Use DN to return to Level 1.
r	Pen 3 Select	LEU.1	DSPL	Scroll to Pen 3 display. Pen 3 indicator lights
s	Pen 3 Display	1x.xx		Main display gives reading of precision voltage input. Precision source is set at 2.000V dc. Deviation above or below 2.000V dc is the correction factor needed to calibrate at high-level.

Table 5-3. High-Level (V) Input Calibration (Cont'd)

Step	Step Description	Main Display Readout	Secondary Display Readout	Remarks
t	Calibrate	2.000		Adjust R29, Figure 5-5, to obtain 2.000V dc on main display.
u	Continuation			Remove the installed Pen I/O board from the I/O Motherboard. For additional Pen I/O boards to be calibrated: Insert each I/O board into the Pen 3 board location and do high-level calibration for each, as given in this table, before changing setup for low-level calibration. When all high-level calibrations are done, proceed next to low-level calibration.

5.8.2 Low-Level (mV) Calibration

When all boards to be calibrated have received high-level calibration, proceed with the following steps and then follow Table 5-4 for low-level calibration.

1. Leave equipment as already connected (Figure 5-3).
2. Set SW3 DIP switch (Figure 5-1) as diagrammed in Figure 5-4 View A, for low-level calibration.
3. On all pen I/O boards being calibrated, add jumper to location J1. Jumpers J1 and J6 are the only jumpers still installed on pen I/O board(s).
4. Insert pen I/O board in Pen 3 board location on I/O motherboard.
5. Set precision voltage source for 17.00 mV dc signal (input to TB3).
6. Refer to Table 5-4 and scroll through its menu, following the step responses given.
7. After completing the procedure in Table 5-4, proceed as follows to return the recorder to operational status:

   a. Turn off ac power to recorder.

   b. Remove test equipment setup.

   c. Set SW3 DIP switch segments to agree with intended use of I/O board location for Pen 3. See Figures 2-4 and 3-1.

   d. Perform the I/O board jumpering and reassembly operations as given in paragraph **2.4.5**.

   e. Perform other setup and/or connection details as required.

Table 5-4. Low-Level (mV) Input Calibration

Step	Step Description	Main Display Readout	Secondary Display Readout	Remarks
a	Level Selection	LEU.2	SEt	Scroll to begin pen setup.(UP,DN change level.)
b	Pen 1 Sequence	PEn.1	SEt	Pen 1 indicator lights. Scroll to continue.
c	Pen 2 Sequence	PEn.2	SEt	Pen 2 indicator lights. Scroll to continue.
d	Pen 3 Sequence	PEn.3	SEt	Pen 3 indicator lights. Use UP to continue.
e	Input High Limit	InP.H	20.00	Use UP,DN to set high limit of input to 20.00. Scroll to continue.
f	Input Low Limit	InP.L	4.00	Use DN to set low limit of input to 4.00. Scroll to continue.
g	Square Law	SQ.-L	no	Scroll to continue (selects no Sq.Law).
h	Decimal Point	d.P.-	0.00	Use UP,DN to select 2-place decimal accuracy. Scroll to continue.
i	Engineering Units, Low	EnG.L	4.00	Use DN to set engineering units low to 4.00. Scroll to continue.
j	Engineering Units, High	EnG.H	20.00	Use UP,DN to set engineering units high to 20.00. Scroll to continue.
k	Totalizer Setup	totL	CnFG	Scroll to continue.
l	Chart Low Limit	CH.Lo	4.00	Use DN to set chart low limit to 4.00. Scroll to continue.
m	Chart High Limit	CH.HI	20.00	Use UP,DN to set chart high limit to 20.00. Scroll to continue.
n	Input Filtering	FILt.	no	Scroll to continue.
o	Chart Speed	CHrt	SPEd	Scroll to continue, thus leaving speed at 1 revolution per hour, as previously set.
p	Level Selection	LEU.2	SEt	Use DN to return to Level 1.
q	Pen 3 Select	LEU.1	DSPL	Scroll to Pen 3 display. Pen 3 indicator lights.
r	Pen 3 Display	x.xxx		Main display gives reading of precision voltage input. Precision source is set at 17.00 mV dc. Deviation above or below 17.00 mV dc is the correction factor needed to calibrate at low level.
s	Calibrate	17.00		Adjust R28, Figure 5-5, to obtain 17.00 mV dc on main display.
t	Continuation			Remove the installed pen I/O board from the I/O motherboard. For additional pen I/O boards to be calibrated: Insert each I/O board into the Pen 3 board location and do low-level calibration for each, as given in this table. When all low-level calibrations are done, the calibration procedure is complete.

SECTION 6
PARTS LIST

6.1 ORDERING INFORMATION

When ordering parts always specify the complete serial number of the instrument.

6.2 RECOMMENDED SPARE PARTS

A plus (+) sign before the item number indicates that the item is a recommended spare part.

6.3 PARTS AVAILABILITY

This parts list may contain parts that are not saleable. These parts are identified with an asterisk (*) in the part number column. They are listed and shown as required to provide a comprehensive breakdown of the assembly.

6.4 PARTS IDENTIFICATION

A dash (-) in the item number column indicates that the part is not illustrated in the referenced figure. A dash (-) in the part number column indicates there is not part identification available.

Some part descriptions have dots preceding them. These dots indicate that the parts are components of the assembly or subassembly (SA) which immediately proceeds them in the listing.

6.5 PARTS LISTING

Recorder Assembly
Refer to Figure 6-1

NOTE

Parts in this recorder assembly listing are divided into groups. The first group includes those parts which are common to all recorders. The remaining groups list the additional parts required for specific features identified by catalog number codes.

Common Parts - 1911J,1912J,1913J

Item	Part No.	Description	No. Req'd
	500S1166	I/O Circuit Board - 1911J	1
+ 1	500S1166	I/O Circuit Board - 1911J,1912J	2
	500S1166	I/O Circuit Board - 1911J,1912J,1913J	3
2	500P1063	Housing	1
3	500S1003-1	Chart Drive SA (Refer to page 7-8 for listing of parts)	1
+ 4	500S1160-1	Processor Circuit Board	1
5	500P1121	Latch Bracket	1
6	500S1122	Bracket Support SA	1
7	500P1129	Cable Bracket and Link Guide	1
8	500P1116	Cable Bracket and Link Mtg Washer	1
9	500P1387	Cable Bracket and Link Mtg Spacer	1
10	500P1031-2	Chart Plate Hinge	2
11	500P1155-2	Chart Plate Latch and Hinge Mtg Screw	6
	500P1139-1	Component Mtg Screw - 1911J	15
12	500P1139-1	Component Mtg Screw - 1912J	17
	500P1139-1	Component Mtg Screw - 1913J	19
13	500P1139-9	Door Hinge and Latch Mtg Screw	4
	500P1068	Pen Arm - 1911J	1
14	500P1068	Pen Arm - 1912J	2
	500P1068	Pen Arm - 1913J	3
+ 15A	500S1150-1	Fiber Tip Pen, red - 1911J,1912J,1913J	1
+ 15B	500S1150-2	Fiber Tip Pen, green - 1912J,1913J	1
+ 15C	500S1150-3	Fiber Tip Pen, blue - 1913J	1
16	500P1191-4	Door Hinge and Latch Mtg Nut	4
17A	500S1104-1	Motor and Pinion - 1911J	1
17B	500S1104-1	Motor and Pinion - 1912J	2
17C	500S1104-1	Motor and Pinion - 1913J	3
	500P1190-3	Motor and Pinion Mtg Lockwasher - 1911J	2
18	500P1190-3	Motor and Pinion Mtg Lockwasher - 1912J	4
	500P1190-3	Motor and Pinion Mtg Lockwasher - 1913J	6
19	500P1190-3	Processor Board Ground Mtg Lockwasher	1
20	500P1155-1	Cable Bracket and Link Mtg Screw	1
	500P1269	Cold Junction Temperature Compensator - 1911J	1
+ 21	500P1269	Cold Junction Temperature Compensator - 1912J	2
	500P1269	Cold Junction Temperature Compensator - 1913J	3

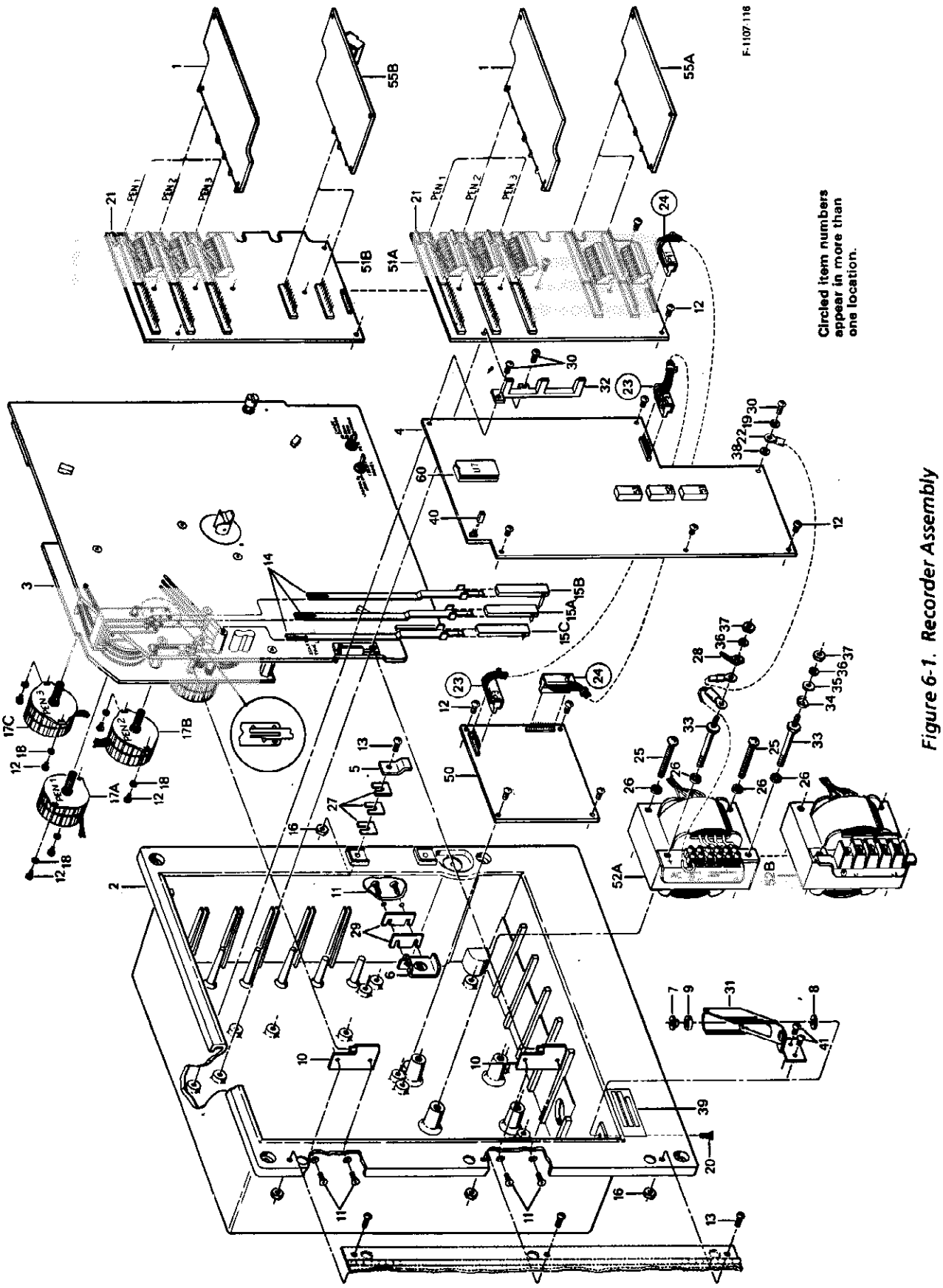


Figure 6-1. Recorder Assembly

Refer to Figure 6-1

Item	Part No.	Description	No. Req'd
22	500S1381	Processor Board Ground Cable	1
23	500S1242	Processor Board Cable SA, P3	1
24	500S1243	Power Supply Board Cable SA, P4	1
25	500P1139-12	Transformer Mtg screw	2
26	500P1190-5	Transformer Mtg Lockwashers	4
27	500P1319	Latch Shim	3
28	500P1322	Spade Lug Faston Tab	1
29	500P1325	Chart Plate Latch Shims	2
30	500P1139-14	Circuit Board and Terminal Lug Mtg Screw	3
31	500S1385	Door Bracket and Ribbon Cable Guide	1
32	500P1388	Circuit Board Guide	1
33	500P1377	Ground and Mounting Stud	2
34	22P1416	Terminal Retaining Cup	1
35	500P1212-4	Terminal Mtg Washer	1
36	500P1190-4	Terminal Mtg Lockwasher	2
37	500P1191-6	Terminal Mtg Nuts	2
38	500P1190-3	Terminal Mtg Lockwasher	1
39	*	Data Plate	1
-	500P1235	Chart Symbol	1
40	500P1268	Jumper	6
41	500P1139-11	Cable Bracket Mtg Screw	2

Electrical Code, Catalog No. Code-B
Refer to Figure 6-1

Item	Part No.	Description	No. Req'd
+ 50	500S1162	Power Supply Circuit Board, Code-BA	1
	500S1370	Power Supply Circuit Board, Code-BB	
+ 51A	500S1164	Mother Circuit Board, Code-BA	1
+ 51B	500S1374-1	Mother Circuit Board, Code-BB	
52A	500S1178	Transformer Assembly, Code-BA	1
52B	500S1373	Transformer Assembly, Code-BB	
-	500P1337-3	Door Display Circuit Board Shield, Code-BA	1
	500P1337-1	Door Display Circuit Board Shield, Code-BB	
-	500P1137-5	Shield Mtg Screw, Code-BA	4
	500P1137-4	Shield Mtg Screw, Code-BB	

* Refer to **Parts Availability** on page 6-1.

Option Module, Catalog No. Code-C
Refer to Figure 6-1

Item	Part No.	Description	No. Req'd
+ 55A	500S1170	Digital I/O Circuit Board, 1911JA, Code-C2	1
	500S1170	Digital I/O Circuit Board, 1912JA,1913JA, Code-C6 2	2
+ 55B	500S1338	Digital I/O Circuit Board, 1911JB, Code-C2	1
	500S1338	Digital I/O Circuit Board, 1912JB,1913JB, Code-C6 2	2

Firmware Options, Catalog No. Code-D
Refer to Figure 6-1

Item	Part No.	Description	No. Req'd
60	–	PROM, U7	1

NOTE

When ordering a replacement PROM, specify part number printed on the label on the face of each PROM.

Door Lock, Catalog No. Code-E2
Refer to Figure 6-2

Item	Part No.	Description	No. Req'd
40	500P1143	Lock	1
-	500P1389	Key	1
42	500P1324	Cam Lock	1
43	500P1139-9	Screw	1
44	500P1191-4	Nut	1
45	500P1095	Chart Support Bracket	1

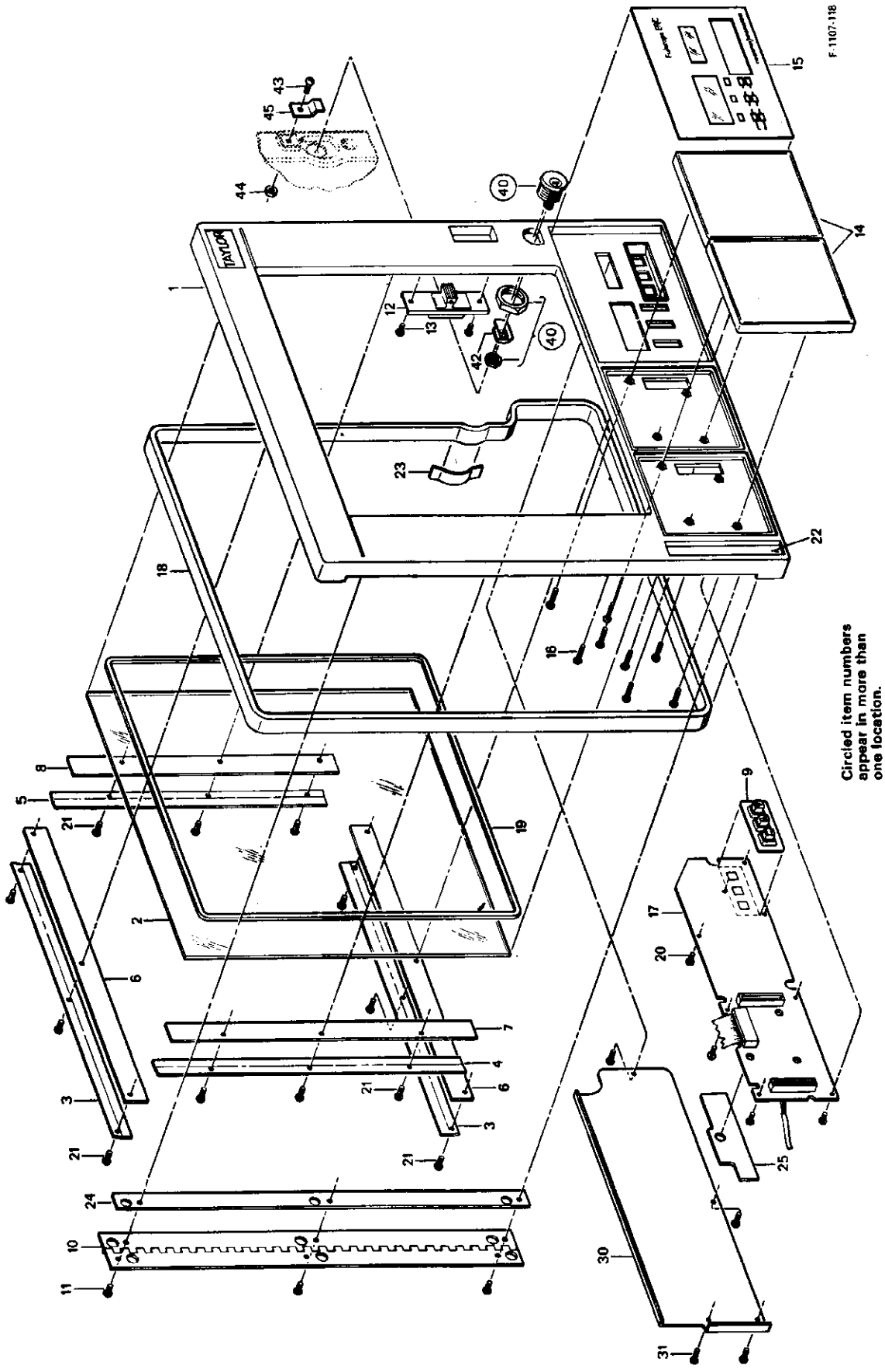


Figure 6-2. Door Subassemblies

Door Subassemblies
500S1006-1, Without Door Lock, Catalog No. Code-E1
500S1006-2, With Door Lock, Catalog No. Code-E2
Refer to Figure 6-2

Item	Part No.	Description	No. Req'd
1	500P1089-1	Door	1
+ 2	500P1090	Window	1
3	500P1085	Window Retaining Bracket	2
4	500P1086	Window Retaining Bracket, Right Hand	1
5	500P1087	Window Retaining Bracket, Left Hand	1
+ 6	500P1099	Bracket Gasket	1
+ 7	500P1100	Bracket Gasket, Right Hand	1
+ 8	500P1101	Bracket Gasket, Left Hand	1
9	500P1210	Rubber Contact Switch, 3 position	1
10	500P1084	Door Hinge	2
11	500P1139-11	Hinge Mtg Screw	3
12	500S1092	Latch Assembly	1
13	500P1139-6	Latch Mtg Screw	2
14	500P1126	Cover	2
15	500P1140	Front Panel Display Window	1
16	500P1136-3	Cover and Front Panel Display Mtg Screw	8
17	500S1096-1	Front Panel Display Circuit Board, Code BA	1
	500S1096-3	Front Panel Display Circuit Board, Code BB	
+ 18	500P1002-3	Door Gasket	1
+ 19	500P1091	Window Gasket	1
20	500P1137-3	Front Panel Display Circuit Board Mtg Screw	8
21	500P1137-5	Bracket Mtg Screw	12
22	500P1153	Decorative Label	1
23	500P1261	Door Gasket and Retaining Spring	1
24	500P1318	Door Hinge Spacer	1
25	500P1391	Cable Insulator	1

Electrical Code, Catalog No. Code-B
Refer to Figure 6-2

Item	Part No.	Description	No. Req'd
30	500P1337-3	Display Circuit Board Shield, Code-BA	1
	500P1337-1	Display Circuit Board Shield, Code-BB	
31	500P1137-5	Shield Mtg Screw, Code-BA	4
	500P1137-4	Shield Mtg Screw, Code-BB	

Chart Drive Subassembly, 500S1003-1
Refer to Figure 6-3

Item	Part No.	Description	No. Req'd
1	500P1146	Chart Plate Latching Screw	1
2	500P1031-1	Chart Plate Hinge	2
3	500P1139-6	Hinge Mtg Screw	3
4	500P1315	Latch Screw Washer	1
5	500P1147	Chart Retaining Clips	3
6	500S1220-1	Toggle Switch, On-Off-On (PEN)	1
7	500S1220-2	Toggle Switch, On-Off-Manual (FRONT PANEL)	1
8	500S1237	Switch Cable	1
9	500P1236	Rubber Pad	1
10	505M142	Ground Mtg Screw	1
11	543M60	Ground Mtg Nut	1
12	548M27	Ground Mtg Lockwasher	1
13	500S1380	Ground Cable	1
14	500P1392	Insulator	1
15	5000M125	Ty-Rap-Pad	1
16	500P1139-1	Motor Mtg Screw	6
17	500P1190-3	Motor Mtg Lockwasher	6
18	500S1104-1	Chart Drive and Number 1 Pen Motor and Pinion	2
19	500S1104-2	Pen Lifter Motor	1

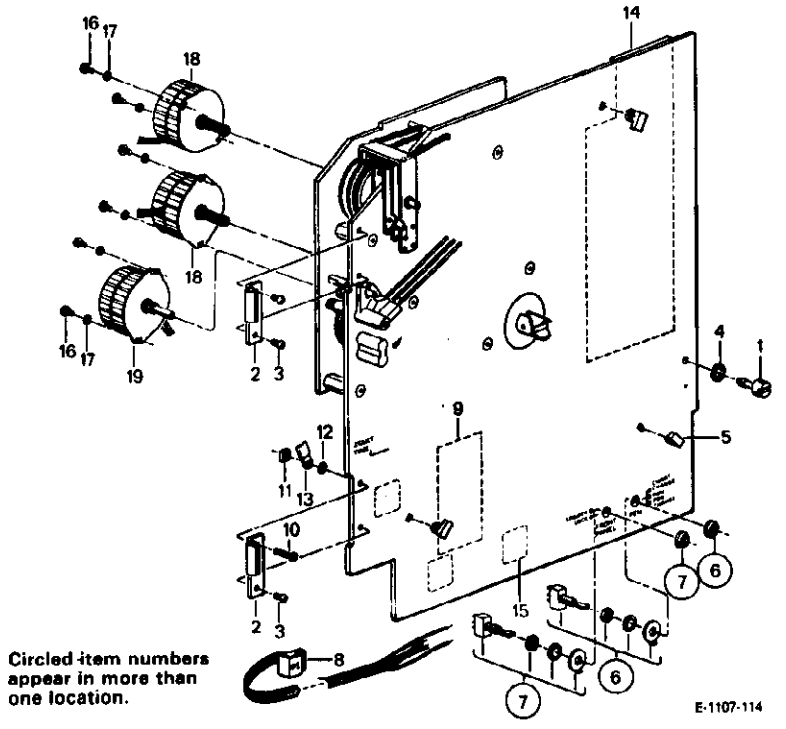


Figure 6-3. Chart Drive Subassembly

6.6 KITS AVAILABLE FOR THE 1900J SERIES RECORDERS

1900FZ00000A	Pipe Mounting Bracket Kit
1901FZ00000A	Surface Mounting Bracket Kit
1902FZ00000A	Panel Mounting Bracket Kit for Kent Clearspan, Partlow IV, and Honeywell AR100 cut-outs
1910FZ00000A	Panel Adapter Mounting Kit for Taylor Fulscope 76J and 120R series, Honeywell Servoline and Foxboro 40P cut-outs
1911FZ00000A	Panel Adapter Mounting Kit for Honeywell Servoline with optional bypass panel and Bristol Series 502D cut-outs
1920FZ00001A	RS-422 Communications Port Conversion Kit
1920FZ00003A	Integrator/Totalizer Conversion Kit
1920FZ00004A	Integrator/Totalizer plus RS-422 Communications Port Conversion Kit
1920FZ00020A	Digital Option Module Kit for 1900JA
1920FZ00030A	Digital Option Module Kit for 1900JB
1920FZ01000A	Number 2 Pen (Green) Conversion Kit
1920FZ02000A	Number 3 Pen (Blue) Conversion Kit

APPENDIX A
PLANNING FORMS

GENERAL

The planning forms in this appendix may be copied as necessary to record the configuration of the 1900J Recorder. Table A-1 lists the steps in all recorder levels that require a data base entry. A space is provided in the table to record the value entered in the secondary display entry column. A wiring planning sheet is also provided and may also be used to record dip switch settings. The contents of each page are:

Page A-2:

- Wiring Planning Sheet

Page A-3:

- Recorder Level 2 – Input Record (Pen 1)
- Recorder Level 2 – Input Record (Pen 2)
- Recorder Level 2 – Input Record (Pen 3)

Page A-4:

- Recorder Level 2 – Input Record (Chart Speed)
- Recorder Level 3 – Alarm Record (Pens 2 and 3)
- Recorder Level 4 – Pen Calibration Record
- Recorder Level 5 – Temperature Calibration Record
- Recorder Level 6 – RS-422 Interface Record

APPENDIX A

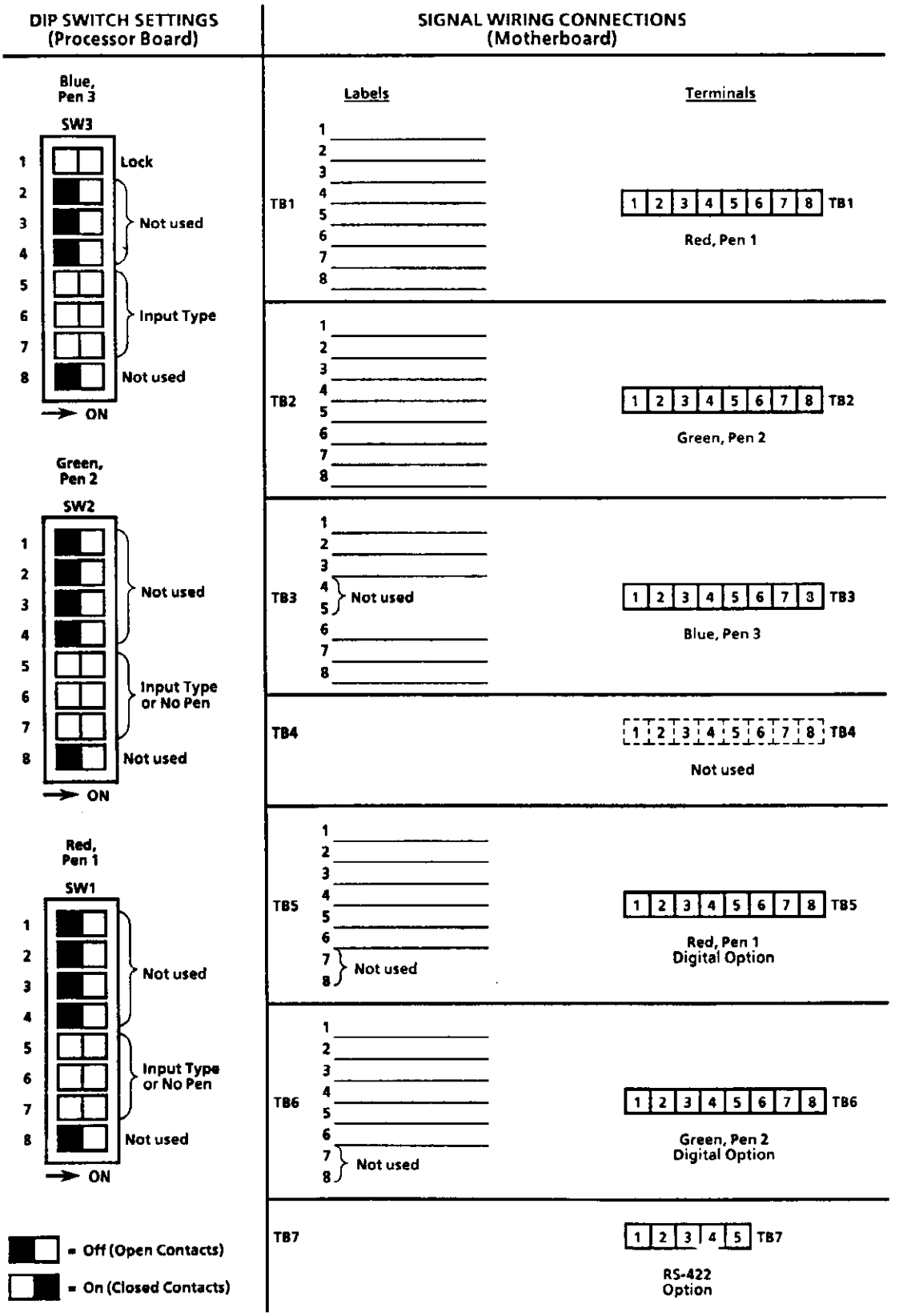

DIP SWITCH SETTINGS
(Processor Board)
SIGNAL WIRING CONNECTIONS
(Motherboard)
Blue,
Pen 3
SW3
1
2
3
4
5
6
7
8
Lock
Not used
Input Type
Not used
ON
Green,
Pen 2
SW2
Not used
Input Type
or No Pen
Not used
ON
Red,
Pen 1
SW1
Not used
Input Type
or No Pen
Not used
ON
= Off (Open Contacts)
= On (Closed Contacts)
Labels
Terminals
TB1
1 2 3 4 5 6 7 8 TB1
Red, Pen 1
TB2
1 2 3 4 5 6 7 8 TB2
Green, Pen 2
TB3
4 5 Not used
1 2 3 4 5 6 7 3 TB3
Blue, Pen 3
TB4
1 2 3 4 5 6 7 8 TB4
Not used
TB5
7 8 Not used
1 2 3 4 5 6 7 8 TB5
Red, Pen 1
Digital Option
TB6
7 8 Not used
1 2 3 4 5 6 7 8 TB6
Green, Pen 2
Digital Option
TB7
1 2 3 4 5 TB7
RS-422
Option
S-1107-14(1)

Table A-1. Recorder Data Base Record

Level Description	Main Display	Secondary Disp. Entry	Main Display	Secondary Disp. Entry	Main Display	Secondary Disp. Entry
Recorder Level 2 Input Setup	LEU.2	SEt				
	PEn.1 (Tc/RTD)	SEt	PEn.2 (Tc/RTD)	SEt	PEn.3 (Tc/RTD)	SEt
	d.P.--		d.P.--		d.P.--	
	CH.Lo		CH.Lo		CH.Lo	
	CH.HI		CH.HI		CH.HI	
	tYPE		tYPE		tYPE	
	dEG.C		dEG.C		dEG.C	
	FILt.		FILt.		FILt.	
	SEC.S		SEC.S		SEC.S	
	PEn.1 (amp/volt)	SEt	PEn.2 (amp/volt)	SEt	PEn.3 (amp/volt)	SEt
	InP.H		InP.H		InP.H	
	InP.L		InP.L		InP.L	
	SQ-L		SQ-L		SQ-L	
	d.P.--		d.P.--		d.P.--	
	EnG.L		EnG.L		EnG.L	
	EnG.H		EnG.H		EnG.H	
	totL	CnFG	totL	CnFG	totL	CnFG
	rSEt		rSEt		rSEt	
	rAP		rAP		rAP	
	tHLd		tHLd		tHLd	
	t.on		t.on		t.on	
	UP.t		UP.t		UP.t	
	rAtE		rAtE		rAtE	
	S.FAC		S.FAC		S.FAC	
	PSt.L		PSt.L		PSt.L	
	PSt.H		PSt.H		PSt.H	
	PdC.L		PdC.L		PdC.L	
	PdC.H		PdC.H		PdC.H	
	CH.Lo		CH.Lo		CH.Lo	
	CH.HI		CH.HI		CH.HI	
	FILt.		FILt.		FILt.	
	SEC.S		SEC.S		SEC.S	

Table A-1. Recorder Data Base Record (Cont'd)

Level Description	Main Display	Secondary Disp. Entry
Recorder Level 2 (Cont'd)	CHrt	SPEd
	SPEd	
Recorder Level 3 Alarm Setup	LEU.3	ALrS.
	PEn.1	ALrS.
	ALr.H (pen 2)	
	ALr.L (pen 2)	
	A.HYS. (pen 2)	
	ACk- (pen 2)	
	LAt. (pen 2)	
	PEn.2	ALrS.
	ALr.H (pen 2)	
	ALr.L (pen 2)	
	A.HYS. (pen 2)	
	ACk- (pen 2)	
	LAt. (pen 2)	
	PEn.3	ALrS.
	ALr.H (pen 3)	
	ALr.L (pen 3)	
	A.HYS. (pen 3)	
	ACk- (pen 3)	
	LAt. (pen 3)	

Table A-1. Recorder Data Base Record (Cont'd)

Level Description	Main Display	Secondary Disp. Entry
Recorder Level 4 Pen Calibration	LEU.4	P.CAL
	CAL.H (pen 1)	
	CAL.H (pen 2)	
	CAL.H (pen 3)	
	CAL.L (pen 1)	
	CAL.L (pen 2)	
	CAL.L (pen 3)	
Recorder Level 5 Temper-ature Calibration	LEU.7	t.CAL
	PEn.1	t.CAL
	xx	
	PEn.2	t.CAL
	xx	
	PEn.3	t.CAL
	xx	
Recorder Level 6 RS-422 Interface	LEU.6	422
	EnbL.	
	Addr.	
	bAUd	
	ALt.c.	
	PAr.	
	odd	
	bCC	

APPENDIX B
SUMMARY OF FIRMWARE CHANGES

GENERAL

This summary of the firmware version changes for the 1900J Recorder is provided as a reference aid when this document is used to support previous firmware versions. The summary assumes a version 4 PROM is installed. The catalog number identifies the version level of the instrument. If a kit with firmware has been applied, the PROM part number, printed on the label on the face of each PROM, can be used to identify the firmware version as listed below.

PROM Part No.	Firmware Version No.
500S 1275	Version 1
500S 1363	Version 2
500S 1540	Version 3
500S 1541	Version 3 with RS-422
500S 1542	Version 3 with Totalizer and RS-422
500S 1545	Version 3 with Totalizer

When using this document to support version 3 PROMs, the following differences between versions 4 and 3 should be noted.

- Tenth Degree Temperature Display
  In version 3 instruments with a thermocouple or RTD input, the temperature display can not be configured to indicate tenths of a degree. The setup prompt for positioning the decimal (d.P.--) in recorder level 2 is not present.
- Alarm Action After Power-up
  Version 3 recorders looked at the alarm configuration before the process input which could cause relay chatter. Version 4 instruments hold all alarm relays in the power-down state until accurate process input readings are available (approximately 10 seconds after power-up), then the relays follow their configured action.
- Test Mode
  Version 3 recorders do not have a factory test level. The display [tESt] [odE] will not appear on the recorder front panel if the UP key is pressed to advance past level 5 or 6.

When using this document to support version 1 or 2 PROMs, the following differences between versions 3 and 1 or 2 should be noted.

- Integration/Totalization and RS-422
  Version 1 and 2 recorders do not include an integration/totalization or RS-422 option.
- Alarm Latching
  In Versions 1 and 2 recorders, the alarm output is not turned off by acknowledgment of the alarm unless the alarm state has ceased. The alarm output remains on until both an acknowledge and removal of the alarm state have occurred. When the latch feature is selected in Version 3, an alarm output can be turned off only by acknowledgment of the alarm. If the alarm state ceases before acknowledgment, the alarm output remains on until acknowledged.

- Input Filtering
  In Version 1 recorders, the input filtering feature is not available. In Version 2 recorders, selection of filtering provides a slower pen response than the typical 9-second response for full scale pen travel (response time is not adjustable). In Version 3 recorders, the input filter prompt in setup Level 2 provides an adjustable time constant. The normal pen response time obtained by selecting no filtering is typically 9 seconds for full scale pen travel. If filtering is selected, the time constant can be set at any value between 1 and 300 seconds. The time constant is defined as the time required for a pen to travel 63.2% of the full travel which would result from a step change in process input.

- Power-Up Display
  In Version 3 the first display after any power shut down is [A.C.] [FAIL]. In Versions 1 and 2 recorders the first display is [tUrN] [on].

- Engineering Units Range
  In Versions 1 and 2 recorders the engineering unit low range is 9990 to -999 and the high range is 9999 to -990. The available range of engineering unit values in Version 3 recorders is equal to the full capacity of the secondary display; 9999 to -999.

INDEX

ASEA BROWN BOVERI

ABB Kent-Taylor
95 Ames Street
P.O. Box 110
Rochester, New York 14692