GOULD

MANUAL PART NO.
2007-804XXX-XX

2400 SERIES RECORDERS

US INSTRUMENT RENTALS, INC. ALL MODELS

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Gould Inc., Instruments Division
3631 Perkins Avenue, Cleveland, Ohio 44114

14TH PRINTING
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WARRANTY

Each instrument manufactured by Gould Inc., Instruments Division is warranted to be free from defects in material and workmanship and to operate in accordance with published specifications when used with the recommended associated equipment and with Gould approved supplies. Liability under this warranty is limited to servicing and replacement of any defective parts, except tubes, pens, styli, fuses and batteries, and excludes calibration and minor maintenance as outlined in Gould Operating Manuals. (Exception: The thermal pen in the 110 Strip Chart Recorder is guaranteed for life.)

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WARNING

IN PATIENT CARE APPLICATIONS

ISOLATION TRANSFORMER

(Gould P. N. 882895-1 or equal)

MUST BE CONNECTED BETWEEN

POWER SOURCE AND RECORDER

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LIST OF TABLES

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SECTION I

GENERAL INFORMATION

1.1 SCOPE

This manual describes the Gould 2000 Series Analog Recorders (Figure 1-1), and provides instructions for installation, operation, troubleshooting, and maintenance. Theory of operation and calibration procedures are also provided. An illustrated parts breakdown is located in the rear of the manual.

Instructions for preamplifiers which may be used with these recorders are contained in their own applicable instruction manuals.

1.2 DESCRIPTION

The 2000 Series is a family of high performance analog recorders. They are self-contained units housed in 250mm or 380mm mainframe chassis to accomodate 2 to 6 isolated recording channels. Each recording channel incorporates frictionless feedback sensors for closed loop control of the pen at high speeds.

Standard to each model are chart speeds of 5, 10, 25, 50, 100, and 200 millimeters per second plus a divide by 100 or 60 (as ordered) for each writing speed. All chart writing speeds are electrically selected by pushbuttons on the front panel. Two standard event markers are provided and are located on the right and left hand margins.

The 2000 Series uses a pressurized ink writing system. The pressurized inking system uses fast drying ink which is applied to specially coated chart paper. The ink is contained in disposable plastic cartridges which can be replaced in minutes. Pen motion is rectilinear.

1.3 MODEL NUMBERING SYSTEMS

The model number of the 2000 Series Recorder designates mounting type, chassis (mainframe) size, number of recording channels, preamplifier cage configuration, type of writing system and variations. The tables on the pages that follow "Specifications", and "Supplies and Accessories", describe the 2000 Series model numbering systems. Appropriate recorder outline dimensionals accompany each model numbering table.

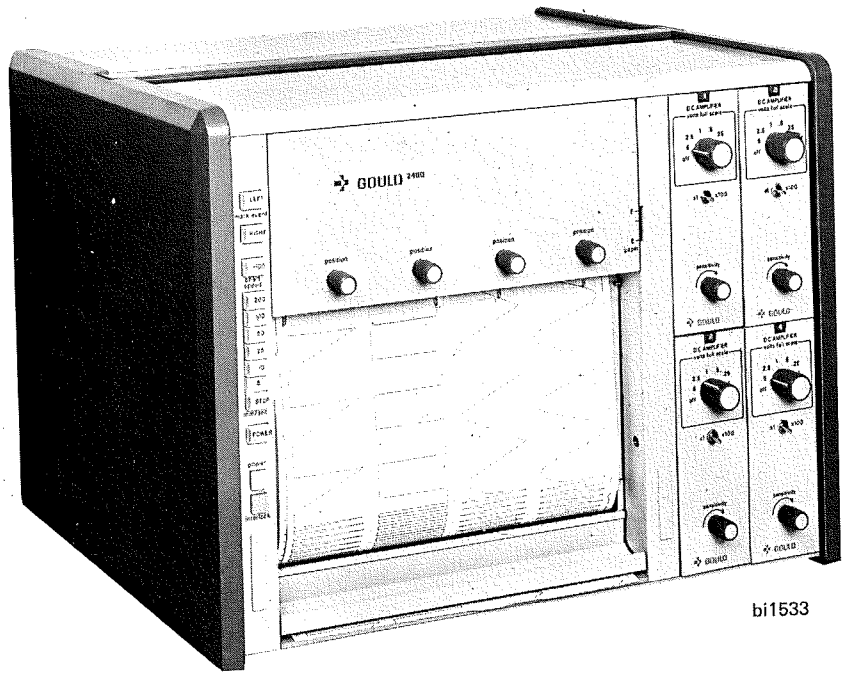


FIGURE 1-1 GOULD 2000 SERIES RECORDER

1.4 SPECIFICATIONS

a. General

Number of Analog Channels	Two to Six (Depending upon Model Number).
Number of Event Marker Channels	Left & Right Margin. Additional are Optional.
Channel Span	50 or 100 mm (Depending upon Model Number).
Trace Presentation	Rectilinear
Trace Width	0.01 inch nominal at 5mm/sec chart speed.
Marking Method	Pressured ink.
Marking Fluid Capacity	One or two one-ounce replaceable throw away cartridges (sufficient for one year under normal operation).
Chart Speeds	5,10,25,50,100, and 200 mm/sec plus divide by 60 or 100.
Chart Speed Accuracy	±0.5% synchronous with line frequency.
Chart Length	275 feet (83 meters)
Chart Width	250mm and 380mm
Divisions per Channel	50 Divisions on 50 mm Channels 100 Divisions on 100 mm Channels
Time Lines	Every mm, accentuated at 5 and 100mm.
Chart Travel Direction	Top to Bottom
Paper Discharge	Front
Chart Wander	± 0.25 mm
Operating Temperature Range	0° to +50°C (+32° to +122°F)
Storage Temperature Range	-40° to +70°C (-40° to +158°F)
Humidity	95% at 32°C (+90°F) Non-Condensing
Vibration and Shock	Standard Commercial Practice.
Principle Dimensions	Refer to Outline Dimensions (Following Model Numbering System Tables).

1.4 SPECIFICATIONS (Cont'd)

b. Electrical

Input Circuit ..... Single ended, floating (Phone jack or preamp connector)

Input Impedance ..... 100K ohms ±1% (Recorder without Preamplifiers)

Input Signal ..... ±2.5V for full scale deflection of 50, or 100 mm channels.

Frequency Response ..... At 100 millimeter amplitude: d-c to 30Hz ±1mm
At 50 millimeter amplitude: d-c to 50Hz ±1mm
At 40 millimeter amplitude: d-c to 60Hz ±1mm
At 10 millimeter amplitude: d-c to 100Hz ±1mm, 3 dB down at 125Hz

Rise Time (10% to 90% full scale with less than 1% overshoot) ..... At 100 millimeter amplitude: less than 8 milliseconds
At 50 millimeter amplitude: less that 5 milliseconds
At 40 millimeter amplitude: less than 4 milliseconds

Non-Linearity ..... ±0.35% of full scale

Pen Position Control ..... Infinitely adjustable ±5 volts d-c. One per channel.

Maximum Allowable Signal Input Voltage to Avoid Damage ..... ±50 volts dc or peak ac (recorder without preamplifiers).

Maximum Safe Common Mode Voltage ..... 500 volts dc or peak ac.

Common Mode Rejection Ratio ..... 60 dB at 60Hz (R_s = 1 kilohm, without preamplifiers).
80 dB at dc (R_s = 1 kilohm, without preamplifiers)

Signal Limiters ..... Built-in adjustable electronic and mechanical

Zero-Line Instability (Drift) After ..... ±0.1% of full scale for 24 hours
15 Minute Warm-Up ..... ±0.025% of full scale per ° C
±0.10% of full scale for ±10% line voltage change

Gain Instability ..... ±0.1% of reading for 24 hours
±0.05% of reading per ° C
±0.05% of reading for ±10% line voltage change

Remote Chart Drive Start/Stop (Standard on all Recorders) ..... Actuated by an external switch closure at any preselected chart speed.

Internal Timer (Standard on all Recorders) ..... Produces 10 millisecond duration pulses at programmable repetition rates depending upon line frequency as follows:

Line Frequency	Programmable Repetition Rates
50 or 60 Hz	0.1, 1, 10 and 100 second; 0.01, 0.1 and 1 minute
400 Hz	0.1, 1 and 10 second; 0.001, 0.01 and 0.1 minute

Power Consumption ..... 50 to 60Hz: 160VA +50VA per channel (100W+41W per channel) 400Hz: 300VA +50VA per channel (200W+41 W per channel).

1.5 SUPPLIES AND ACCESSORIES

a. Supplies

Chart Paper (All Models)
High Contrast, Kromekote (275 feet) 1 mm time line

2400 Series - 250 mm wide

2-100 mm channels	11-2923-34
1-100 mm channel, 2-50 mm channels	11-2933-30
4-50 mm channels	11-2943-30
2-100 mm channels, Semi-Perforated	11-2923-301
1-100 mm channel, 2-50 mm channels, Semi-Perforated	11-2933-300
4-50 mm channels, Semi-Perforated	11-2943-300

2600 Series - 380 mm wide (15 inches)

3-100 mm channels	11-2933-31
1-100 mm channel, 4-50 mm channels	11-2953-30
6-50 mm channels, Semi-Perforated	11-2963-300

Drive Amplifier Extender Card	887526
Analog Pen (Includes ink tube, lapping paper, and pen pressure adjustment wrench.)	11-2823-42
Event Marker Pen	267884-5
Ink Cartridge (1oz)	11-2730-01
Pen Pressure Adjustment-Wrench	1-120922-18
Band, Penmotor	684999
Gram Gage	240610-910
Tube Replacement Tool	267528

b. Accessories

Starter Kits
All starter kits include 12 rolls of high contrast chart paper, gram gage, one analog pen, lapping paper and pen pressure adjustment wrench. Below are starter kit model numbers.

1-100 mm and 2-50 mm channels	11-6250-03
4-50 mm channels	11-6250-04
2-100 mm channels	11-6250-05
6-50 mm channels, Semi-Perforated	11-6250-10
3-100 mm channels	11-6250-11
1-100 mm and 4-50 mm channels	11-6250-12
1-100 mm and 2-50 mm channels, semi-perforated	11-6250-16
4-50 mm channels, semi-perforated	11-6250-17
2-100 mm channels, semi-perforated	11-6250-18

Rack Mounting Kits (For Conversion of Portable Units)

2400 Series without Preamps	11-1202-11
2400 Series with 2 Preamp cage	11-1202-12
2400 Series with 4 Preamp cage	11-1202-13
2600 Series without Preamps	11-1202-15

Mobile Carts

2400 Series (250 mm Chassis)	11-6405-01

Chart Takeups

2400 Series (250 mm Chassis)	11-6402-11
2600 Series (380 mm Chassis)	11-6402-12

Interchannel Event Marker (without harness)	887181

2400 Series (with harness)	11-2123-35
2600 Series (with harness)	11-2123-36

Blank Preamp Module	13-4615-09

Preamp Panel Assembly, Blank	887005

TABLE 1-1 2400 SERIES MODEL NUMBERING SYSTEM

MODEL NUMBER

2007 – XXXX – XX

CODE DESCRIPTION

Operating Voltages

00	115V ± 10%, 60Hz, divide by 100 chart speeds
04	115V ± 10%, 400 Hz, divide by 100 chart speeds
05	115V ± 10%, 50Hz, divide by 100 chart speeds
06	230V ± 10%, 50Hz, divide by 100 chart speeds
10	115V ± 10%, 60Hz, divide by 60 chart speeds
14	115V ± 10%, 400 Hz, divide by 60 chart speeds
15	115V ± 10%, 50 Hz, divide by 60 chart speeds
16	230V ± 10%, 50Hz, divide by 60 chart speeds

Type of Mounting and Preamplifier Cage Configuration

00	Portable case for recorder only
02	Portable case & two-preamp cage
04	Portable case & four-preamp cage
10	Rack mounting kit & shipping frame for recorder only
12	Rack mounting kit, two-preamp cage & shipping frame
14	Rack mounting kit, four-preamp cage & shipping frame
20	Rack mounting kit & vertical cabinet for recorder only
22	Rack mounting kit, two-preamp cage & vertical cabinet
24	Rack mounting kit, four-preamp cage & vertical cabinet
30	Rack mounting kit, shipping frame & 500uA power kit for recorder only
32	Rack mounting kit, two-preamp cage, shipping frame, & 500uA power kit
34	Rack mounting kit, four-preamp cage, shipping frame, & 500uA power kit
40	Rack mounting kit, vertical cabinet & 500uA power kit for recorder only
42	Rack mounting kit, two-preamp cage, vertical cabinet & 500uA power kit
44	Rack mounting kit, four-preamp cage, vertical cabinet & 500uA power kit
50	Rack mounting kit, shipping frame & 30uA power kit for recorder only
52	Rack mounting kit, two-preamp cage, shipping frame & 30uA power kit
54	Rack mounting kit, four-preamp cage, shipping frame & 30uA power kit
60	Rack mounting kit, vertical cabinet & 30uA power kit for recorder only
62	Rack mounting kit, two-preamp cage, vertical cabinet & 30uA power kit
64	Rack mounting kit, four-preamp cage, vertical cabinet & 30uA power kit
70	Rack mounting kit, recorder only
72	Rack mounting kit, two-preamp cage
74	Rack mounting kit, four-preamp cage

Number of Channels

42	Two 100 millimeter channels, chassis asm., drive amps & timer
43	One 100 millimeter channel, two 50 millimeter channels, chassis asm., drive amps & timer
44	Four 50 millimeter channels, chassis asm., drive amps & timer

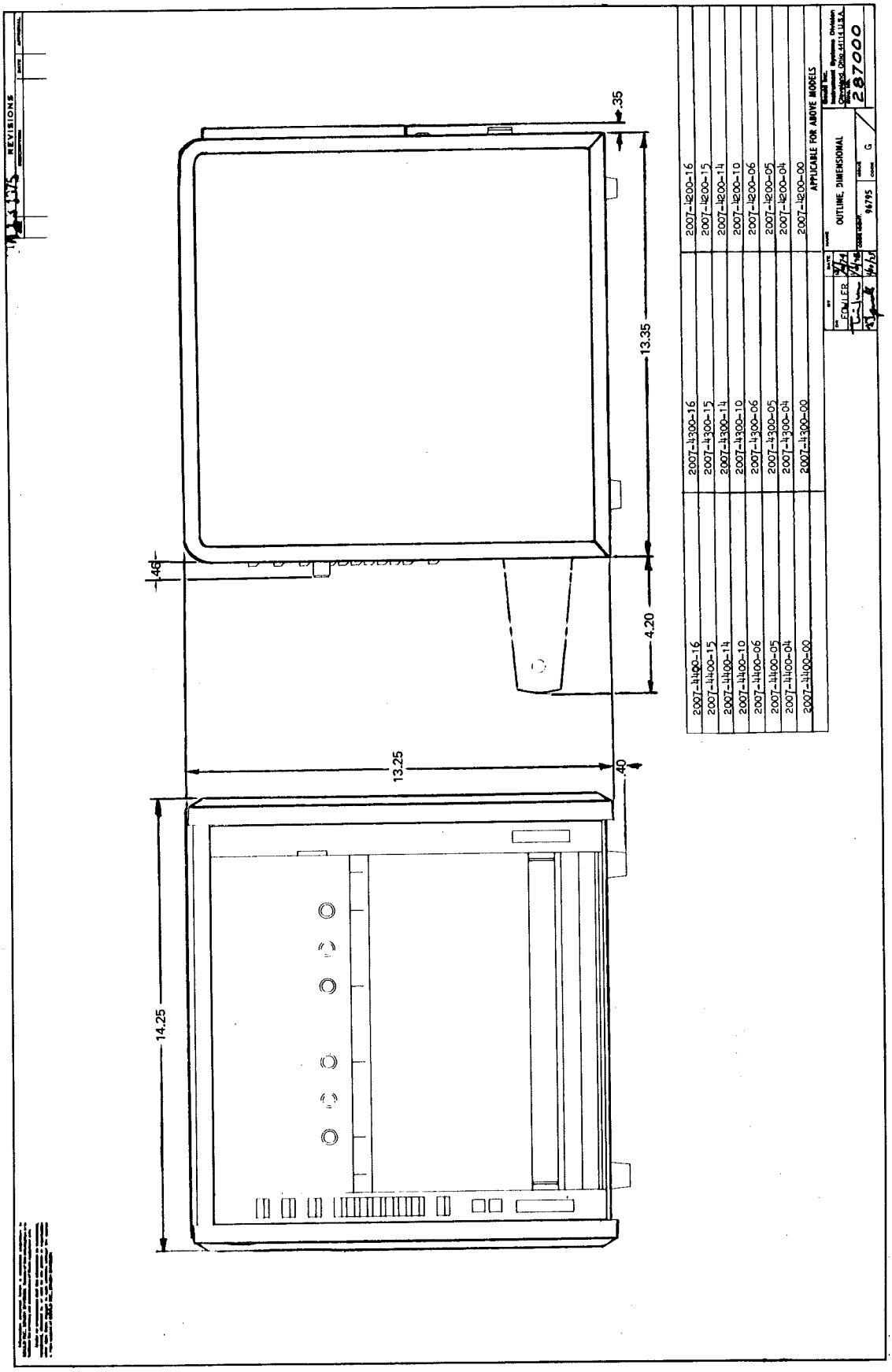


FIGURE 1-2 OUTLINE DIMENSIONS – 2400 SERIES

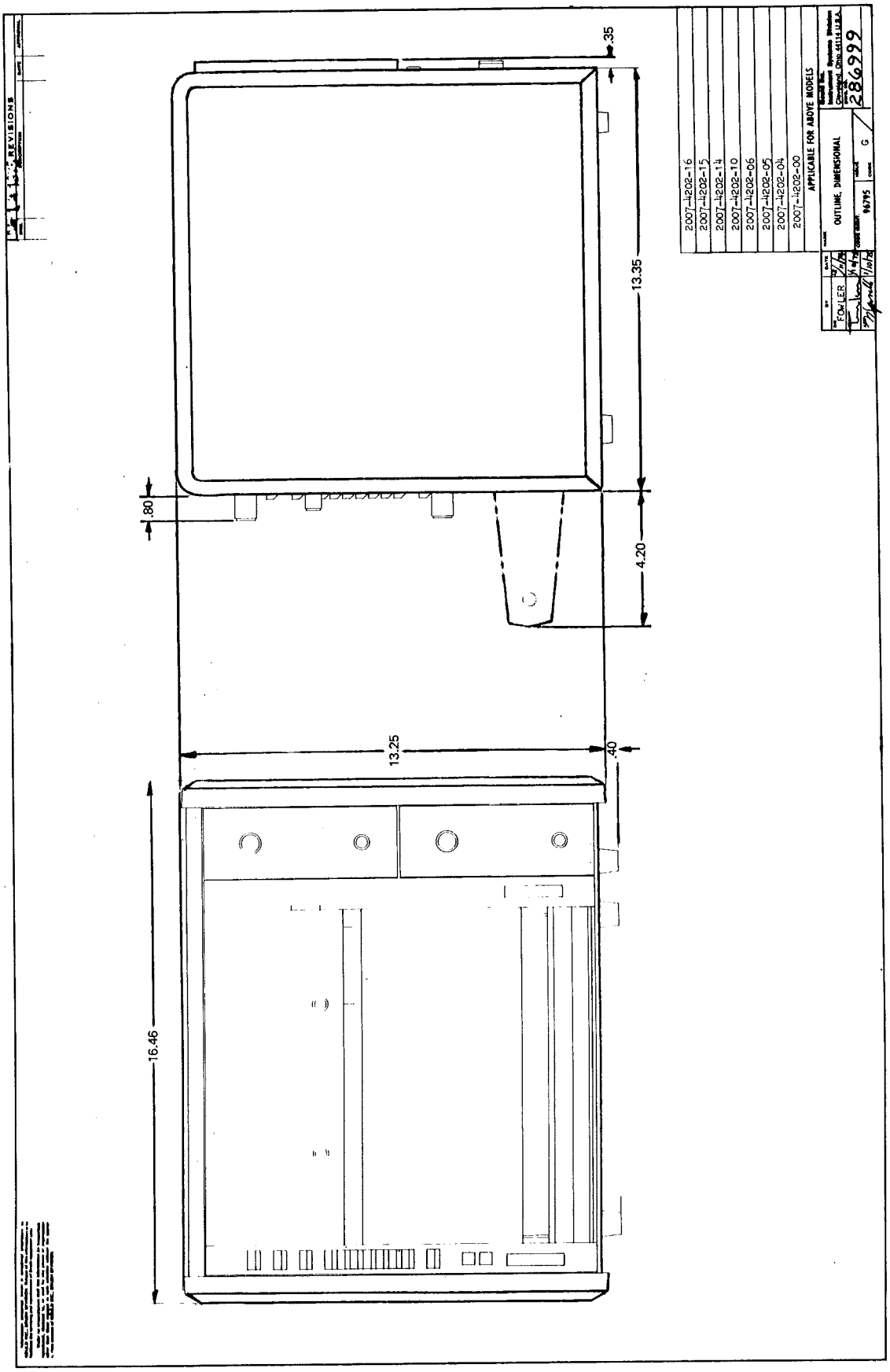


FIGURE 1-3 OUTLINE DIMENSIONS – 2400 SERIES WITH 2 PREAMPS

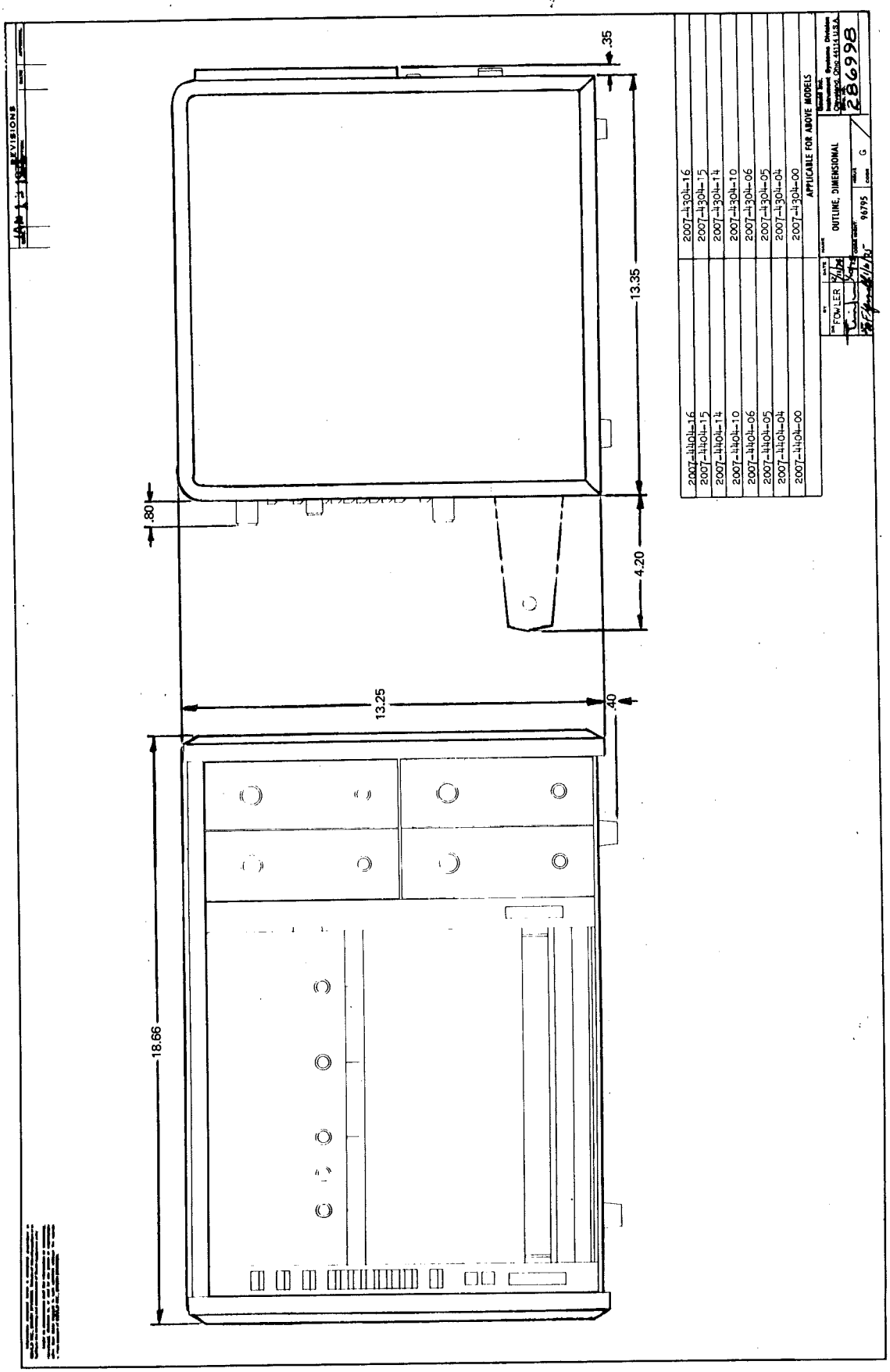


FIGURE 1-4 OUTLINE DIMENSIONS – 2400 SERIES WITH 3 or 4 PREAMPS

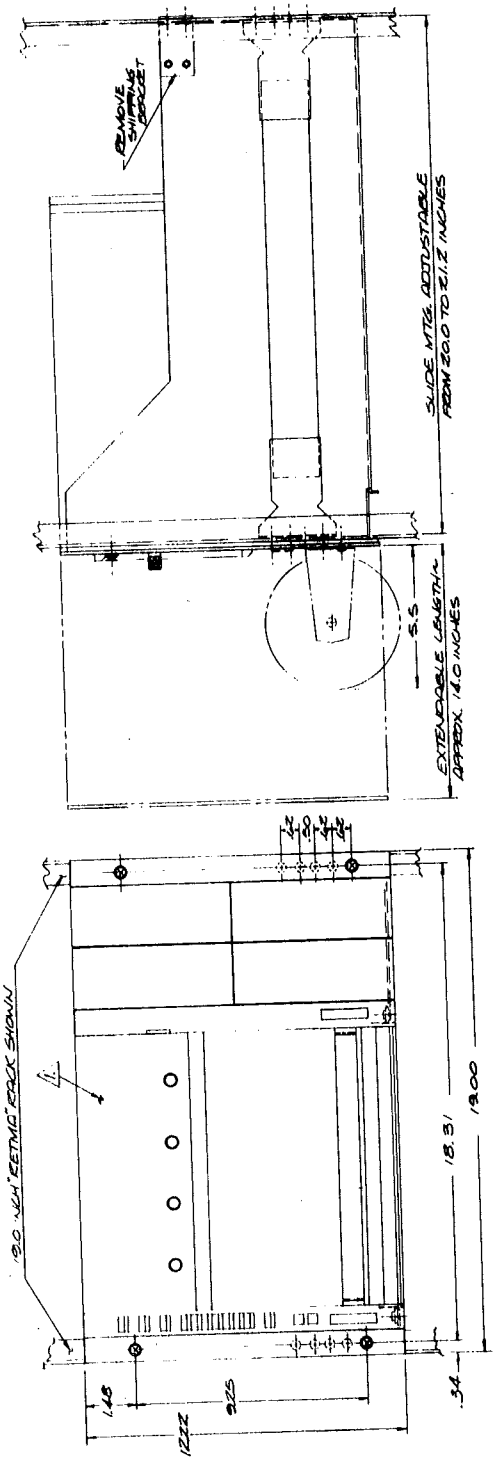


FIGURE 1-5 OUTLINE DIMENSIONS 2400 RACK MOUNT

TABLE 1-2 2600 SERIES MODEL NUMBERING

MODEL NUMBER

2007 - XXXX - XX

Operating Voltages

00	115V +10%, 60Hz, divide by 100 chart speeds
04	115V +10%, 400Hz, divide by 100 chart speeds
05	115V +10%, 50Hz, divide by 100 chart speeds
06	230V +10%, 50Hz, divide by 100 chart speeds
10	115V +10%, 60Hz, divide by 60 chart speeds
14	115V +10%, 400Hz, divide by 60 chart speeds
15	115V +10%, 50Hz, divide by 60 chart speeds
16	230V +10%, 50Hz, divide by 60 chart speeds

Type of Mounting and Preamplifier Cage and Frame Configuration

00	Portable case for recorder only
04	Portable case and four preamp cage (for 3-100mm channel recorder only)
06	Portable case and six preamp cage (for 1-100mm & 4-50 mm channel recorder and 6-50 mm channel recorders only)
10	Rack mounting kit and shipping frame for recorder only
18	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and shipping frame
20	Rack mounting kit and vertical cabinet for recorder only
28	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and vertical cabinet
30	Rack mounting kit, shipping frame and 500 microampere power kit for recorder only
38	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, shipping frame and 500 microampere power kit
40	Rack mounting kit, vertical cabient and 500 microampere power kit for recorder only
48	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, vertical cabinet and 500 microampere power kit
50	Rack mounting kit, shipping frame and 30 microampere isolated power kit for recorder only
58	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, shipping frame and 30 microampere isolated power kit
60	Rack mounting kit, vertical cabient and 30 microampere isolated power kit for recorder only
68	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, vertical cabinet and 30 microampere isolated power kit
70	Rack mounting kit, recorder only
78	Rack mounting kit, 8 cahnnel preamp frame for 4600 Series preamps

Number of Channels

63	Three 100 millimeter channels, chassis assembly, drive amplifiers and timer
65	One 100 millimeter channel, four 50 millimeter channels, chassis assembly, drive amplifiers and timer
66	Six 50 millimeter channels, chassis assembly, drive amplifiers and timer

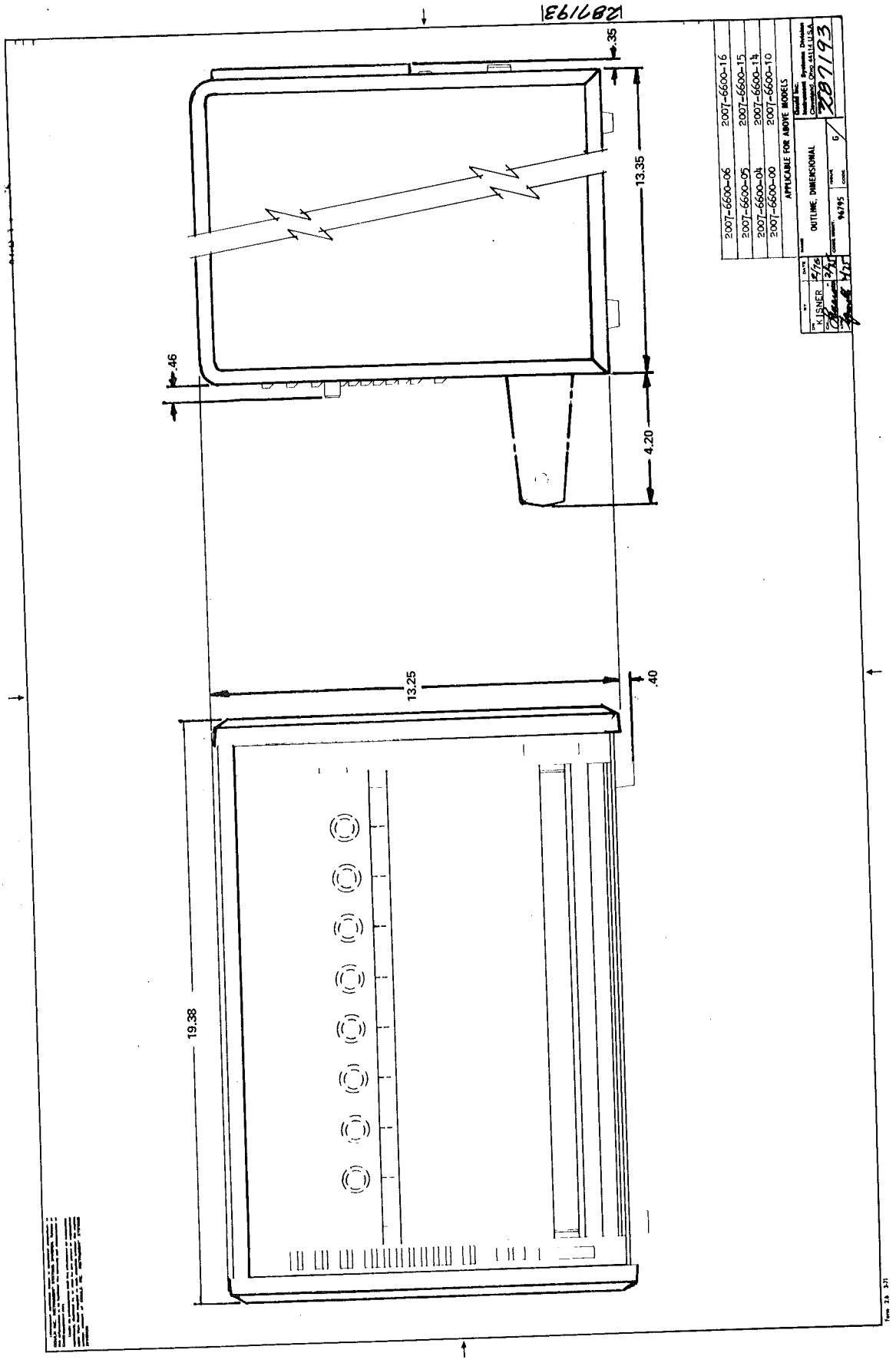


FIGURE 1-6 OUTLINE DIMENSIONS - 2600 SERIES

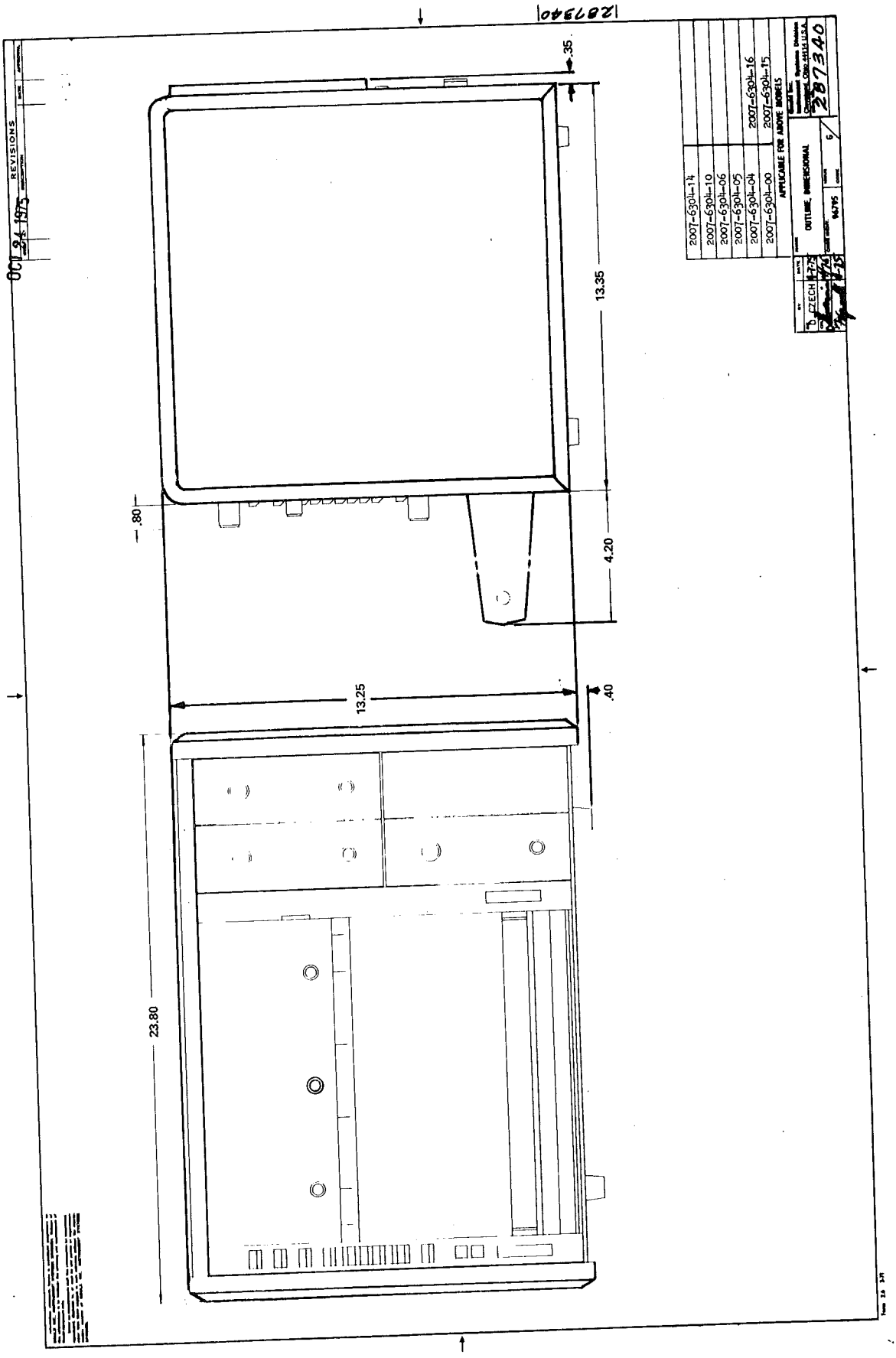


FIGURE 1-7 OUTLINE DIMENSIONS - 2600 SERIES WITH 3 PREAMPS

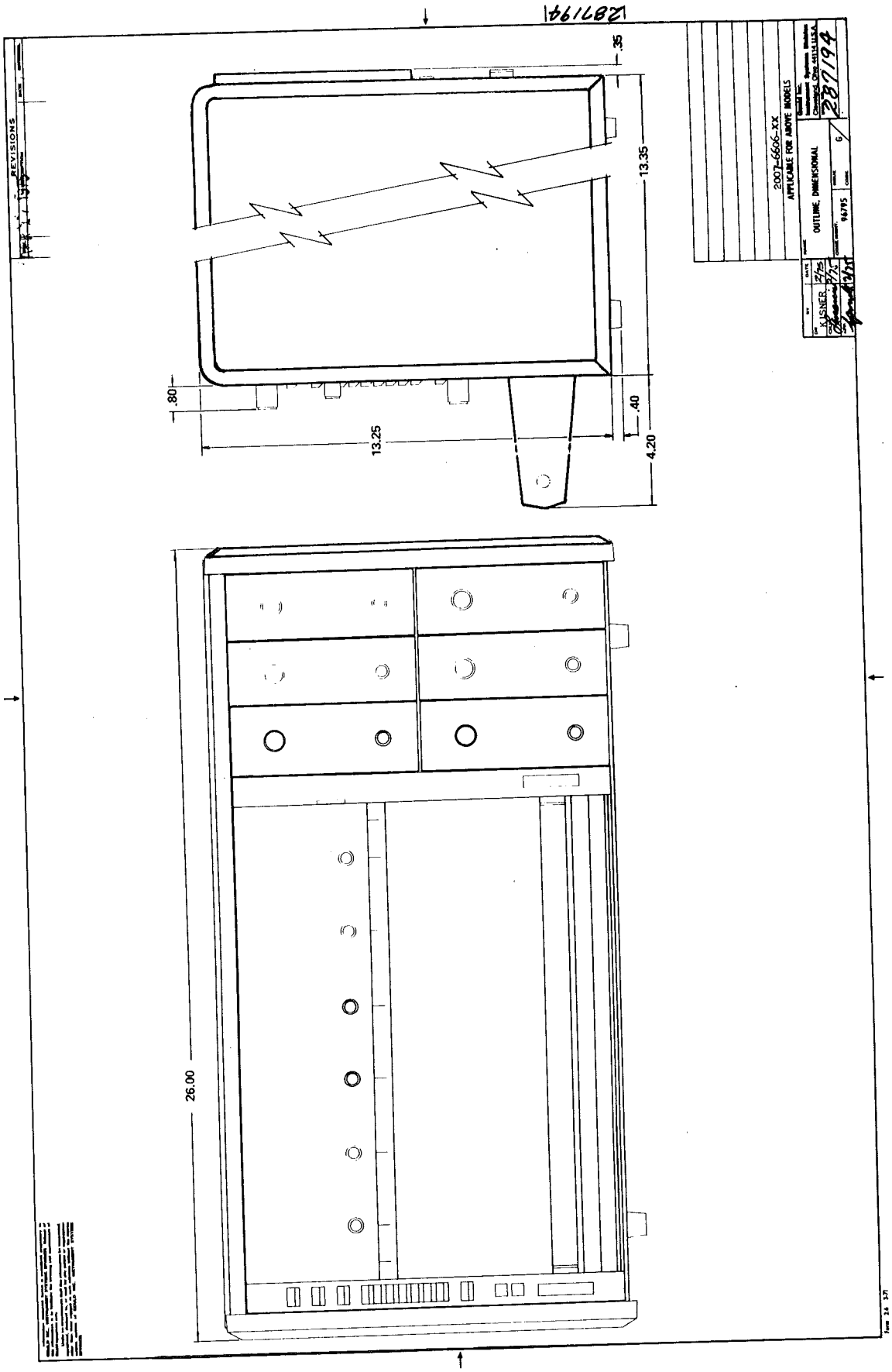


FIGURE 1-8 OUTLINE DIMENSIONS - 2600 SERIES WITH 5 or 6 PREAMPS

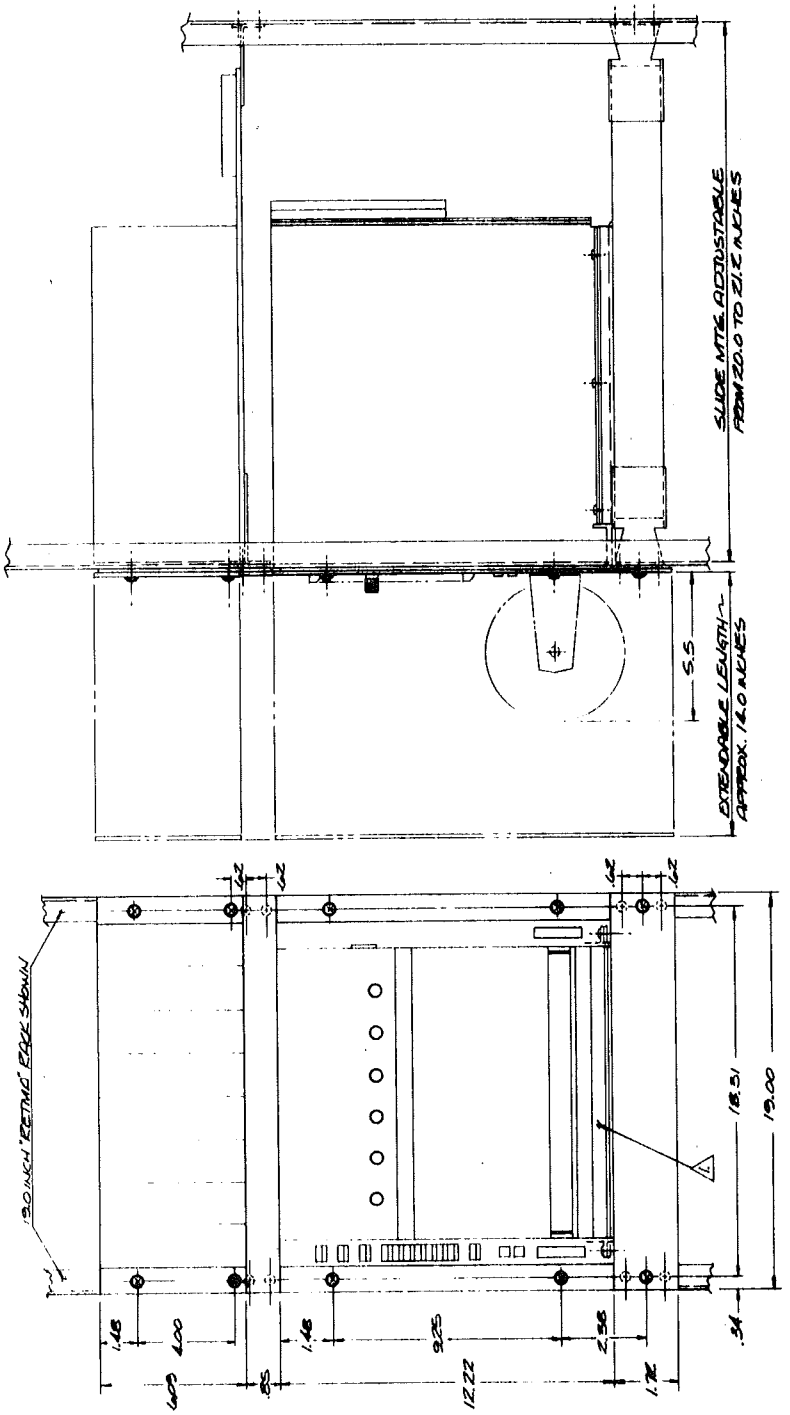


FIGURE 1-9 OUTLINE DIMENSIONS 2600 RACK MOUNT

SECTION II

INSTALLATION

2.1 GENERAL

This section contains information necessary to put the recorder into service, including installation of optional equipment.

2.2 SERVICE UPON RECEIPT

Before making signal connections and applying power to the recorder, the following service must be performed:

1. Remove sheet of chart paper from under pens and load roll of chart paper as described in Section VI.
2. Turn ON all ink solenoid valves. These are located behind the pen access cover. Raise cover by pulling out on bottom and sliding back into recorder. Turn on ink cartridges.
3. Remove top access cover and check ink supply. Ink cartridge(s) should be near full. Cover is removed pushing back with palm of hand, then lifting up.
4. Make sure POWER pushbutton is released (OFF).

2.3 LINE VOLTAGE REQUIREMENTS

The last digit of the model number designates line voltage and frequency. Listed below are last digit of model number and line voltage and frequency required.

DIGIT	LINE VOLTAGE & FREQUENCY
0	115 vac @ 60 Hz
4	115 vac @ 400 Hz
5	115 vac @ 50 Hz
6	230 vac @ 50 Hz

2.4 ANALOG SIGNAL CONNECTIONS

a. Without Preamplifiers

On recorders not supplied with preamplifiers, signal input connections are made directly to pen drive amplifiers. Two phone jacks are provided on each drive amplifier. They are located on the rear of the recorder. (Figure 2-1 represents only the Signal Input Jacks (Drive Amp – Channel 1, etc.). Monitor Jacks are located directly above the Signal Input Jacks.) Use shielded cable (Belden 8422 or equal). Tip is high; ring is low; barrel is common.

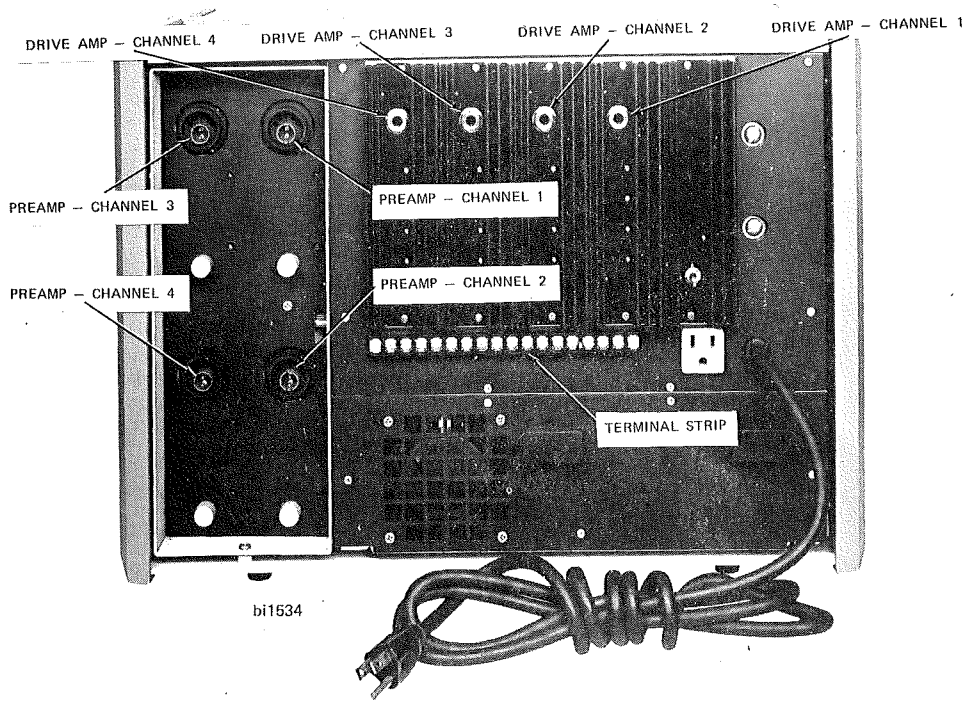


FIGURE 2-1. SIGNAL INPUT CONNECTIONS

b. With Preamplifiers

On recorders supplied with preamplifiers, signal input connections are made via a connector located in the preamplifier cage. Refer to applicable preamplifier manual for their signal input connections.

2.5 EVENT MARKER INPUTS

a. Standard Event Markers

Left and right markers are standard. Actuation is made by momentary switches on front panel or externally via the terminal strip located on recorder rear panel. External actuation may be made by contact closure or TTL signal input. Refer to Figure 2-2 for connections.

b. Optional Event Markers

Interchannel optional event markers are actuated by a contact closure via the rear panel terminal strip. Refer to Figure 2-2 for connections.

2.6 REMOTE CHART DRIVE (Stop/Start)

For remote chart drive operation, remove jumper between pins 3 and 4 on rear panel terminal strip. A contact closure across these pins will remote enable chart drive motor. Refer to Figure 2-2. Chart SPEED must be preselected.

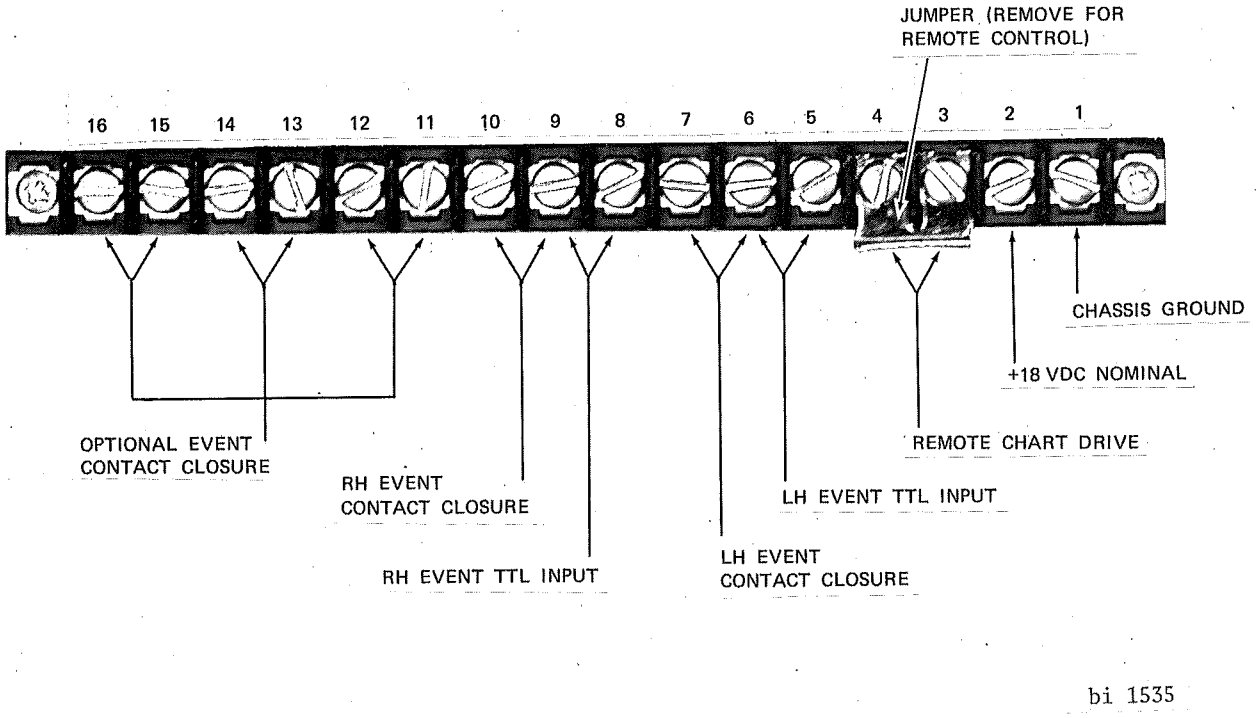


FIGURE 2-2. REAR PANEL TERMINAL CONNECTIONS

2.7 CHART TAKEUP INSTALLATION

Refer to Figure 2-3, and install the optional chart takeup as follows:

1. Disconnect recorder from power source.
2. Remove case from recorder as described in Section VI.
3. Remove plastic caps covering slots in front panel.
4. Position chart takeup on front panel with drive belt on left side. Secure with screws and lockwashers.
5. Slide pulley onto drive roll shaft, and secure with cotter pin.
6. Position drive belt over pulley.
7. Reinstall case.

2.8 RACK MOUNTING KITS

A list of rack mounting kits for all 2000 series recorders is found in Section I. Installation instructions are included with each kit.

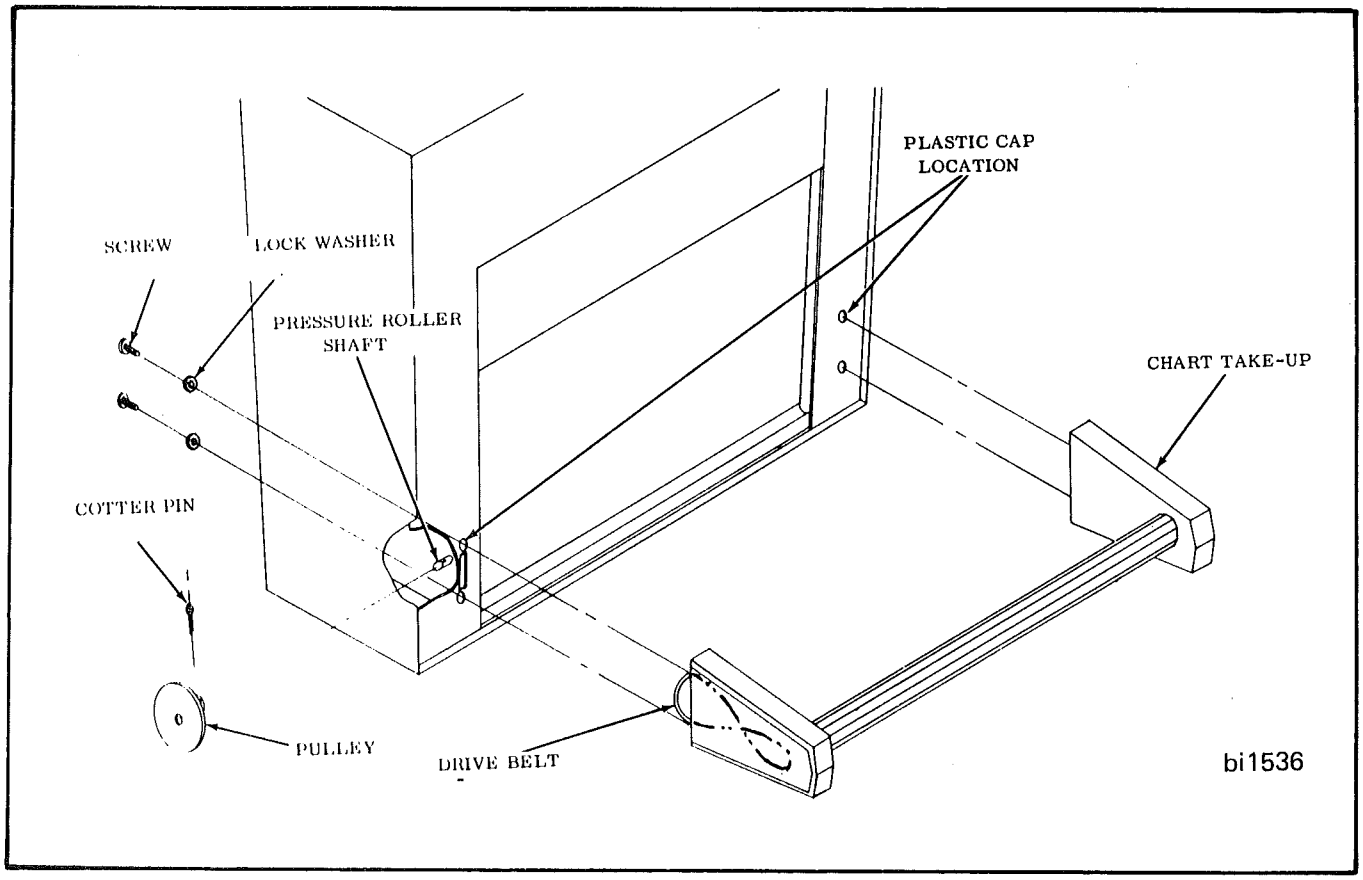


FIGURE 2-3. CHART TAKEUP INSTALLATION

SECTION III

OPERATION

3.1 GENERAL

This section provides complete instructions for operation of the recorder. Functional descriptions of the controls and indicators are provided. If the recorder is equipped with preamplifiers, refer to their applicable instruction manuals for operating instructions.

3.2 FRONT PANEL CONTROLS & INDICATORS

Figure 3-1 illustrates the front panel controls and indicators. The following list corresponds to the items called out on Figure 3-1.

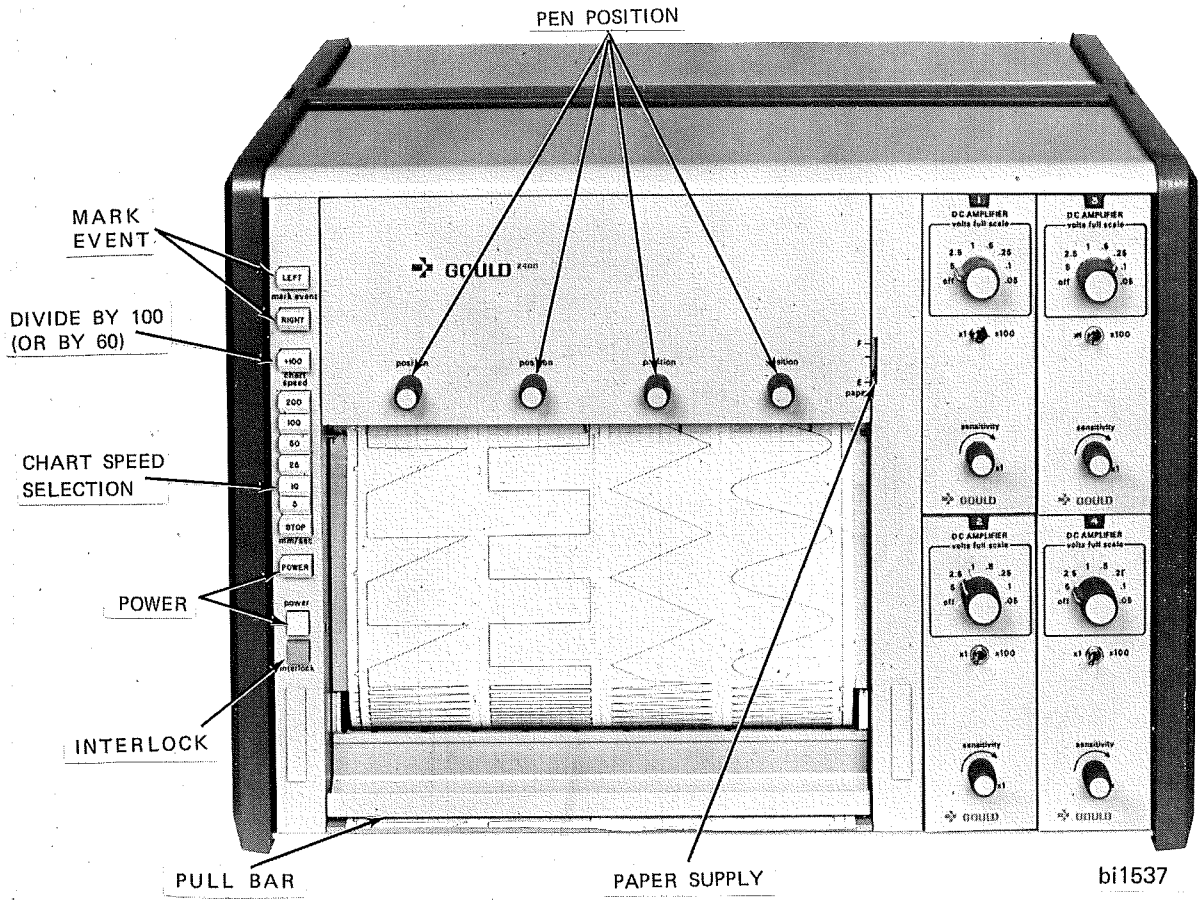


FIGURE 3-1. FRONT PANEL CONTROLS & INDICATORS (TYPICAL)

CONTROLS	DESCRIPTION
POWER	Controls AC to recorder. Depress to turn recorder ON or OFF. POWER lamp illuminates when recorder is ON.
CHART SPEED	Permits selection of six chart speeds and STOP. When in STOP position chart drive is off, and pens will not respond to input signals. Depressing any chart speed button will activate the chart drive at the selected speed. Chart speeds may be changed while chart drive is running.
DIVIDE BY 100 (or by 60)	When depressed, chart speeds become 0.05, 0.10, 0.25, 0.50, 1.0, and 2.0 mm/sec (divide by 60 becomes 5, 10, 25, 50, 100, and 200 mm/min.
MARK EVENT	Two momentary switches permit manual marking of an event. When left MARK EVENT button is depressed the left event marker pen will deflect to the left. When the right MARK EVENT button is depressed the right event marker pen will deflect to the left. **NOTE: The EVENT MARKER pens will remain deflected until the mark event button is released.**
POSITION	Permits pen positioning anywhere within the channel.
PULL BAR INDICATOR	Pull to gain access to chart paper supply roll.
INTERLOCK INDICATOR	Lamp illuminates when writing table is not completely closed or paper supply is exhausted.
POWER	Lamp illuminates when POWER switch is depressed.
PAPER SUPPLY INDICATOR	Gauge to indicate quantity of chart paper remaining.

3.3 REAR PANEL

Figure 3-2 illustrates the recorder rear panel. The following list corresponds to the figure.

CONTROL	DESCRIPTION
PREAMP CAGE	If equipped, houses preamplifiers.
SIGNAL INPUT	Jacks for signal input direct to drive amplifiers.

TERMINAL STRIP	Refer to Section II for connections.
TIMER	ON/OFF toggle switch for timed left hand event marker activation.
ACCESSORY OUTLET	Provides ac power for other equipment.
CARTRIDGE ON/OFF	Turns ink supply ON or OFF.
DRIVE AMPLIFIER MONITOR JACKS	Monitors output of preamplifier (regardless of chart display). For use on Scope, Meter, Output panel, etc.

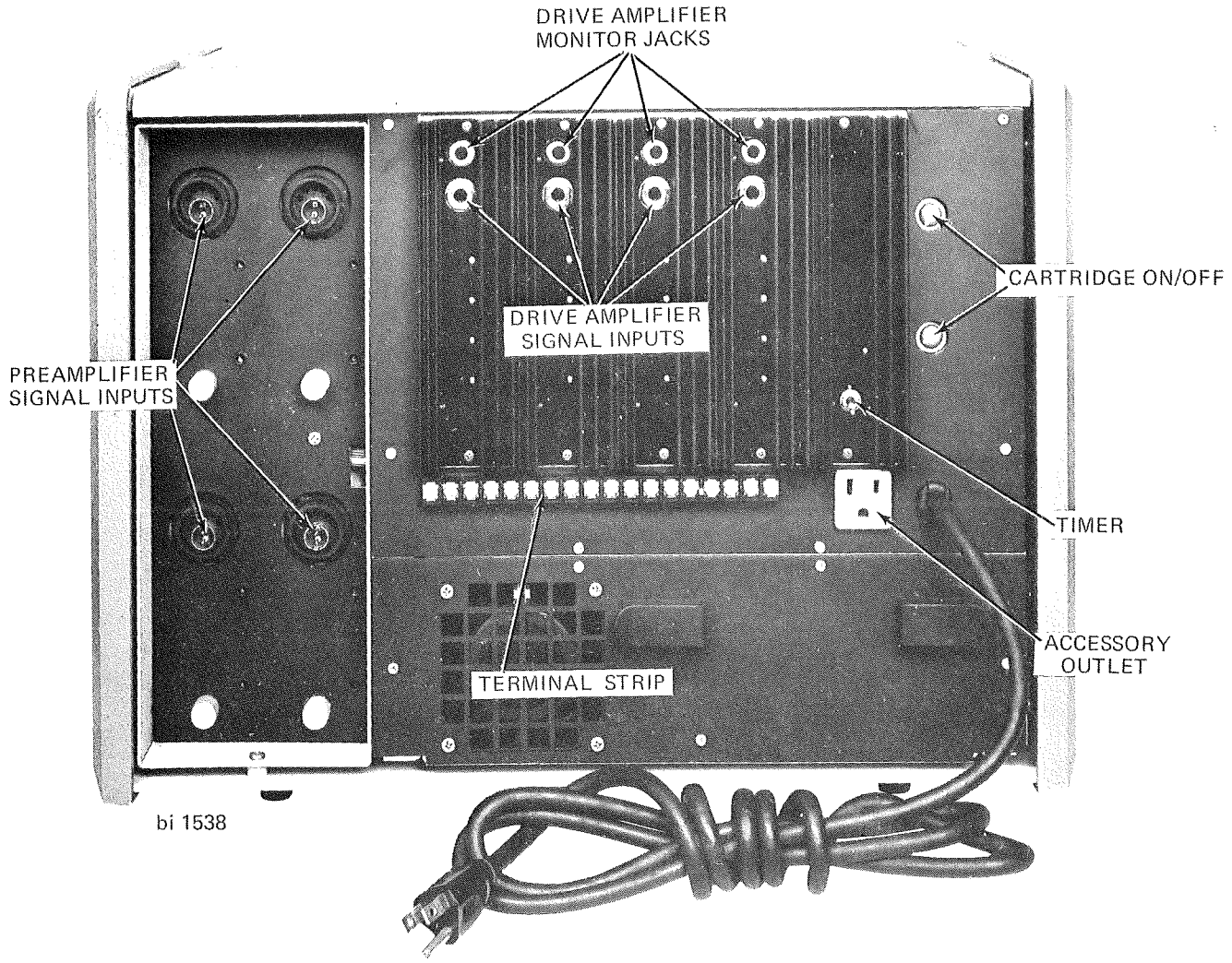


FIGURE 3-2 REAR PANEL

3.4 TIMER SETTING

The timer actuates left event markers at programmed repetition rates. Selection of repetition rates is made via switch S-104 on the control board. Set rate as follows:

1. Turn recorder power OFF.
2. Loosen the two screws which secure the control board and pull out of the recorder.
3. Set switch positions for desired repetition rate per Table 3-1.

NOTE: Use switch positions for line frequency recorder operates on.

4. Replace control board and secure with screws.
5. Turn recorder power ON.
6. Turn TIMER switch ON. Timer ready for operation.

3.5 SETUP AND OPERATION

Prepare recorder for operation as follows:

CAUTION: MAKE SURE ALL PROCEDURES DESCRIBED IN SECTION II, INSTALLATION HAVE BEEN PERFORMED.

1. Check paper supply level. Make sure an adequate supply present for length of time recorder is to be operated and it is properly threaded.
2. Make sure chart STOP pushbutton is depressed.
3. Depress POWER pushbutton. POWER lamp should illuminate.
4. Depress 5mm/sec chart speed pushbutton, and allow chart to travel about one foot. If no pen trace is present, refer to Section VI.
5. Set pen to show full scale deflection within channel limits.
6. Apply input signal to recorder.
7. Set chart SPEED to that which will best display signal.

TABLE 3-1. SWITCH SETTINGS VS TIMER REPETITION RATE FOR VARIOUS POWER LINE FREQUENCIES

REPETITION RATE	60 HZ LINE		50 HZ LINE		400 HZ LINE	
	SW ON	SW OFF	SW ON	SW OFF	SW ON	SW OFF
0.1 SECOND	2,3,5	1,4,6,7,8	1,3,5	2,4,6,7,8	3,6	1,2,4,5,7,8
1.0 SECOND	2,3,6	1,4,5,7,8	1,3,6	2,4,5,7,8	3,7	1,2,4,5,6,8
10.0 SECONDS	2,3,7	1,4,5,6,8	1,3,7	2,4,5,6,8	3,8	1,2,4,5,6,7
100.0 SECONDS	2,3,8	1,4,5,6,7	1,3,8	2,4,5,6,7	—	—
0.01 MINUTE	2,4,6	1,3,5,7,8	1,4,6	2,3,5,7,8	4,7	1,2,3,5,6,8
0.10 MINUTE	2,4,7	1,3,5,6,8	1,4,7	2,3,5,6,8	4,8	1,2,3,5,6,7
1.00 MINUTE	2,4,8	1,3,5,6,7	1,4,8	2,3,5,6,7	—	—

SECTION IV

THEORY OF OPERATION

4.1 GENERAL

The 2000 Series Recorder is a modular-constructed unit consisting of a mainframe and analog recording channels. One of three mainframe sizes is used depending upon the number of analog recording channels incorporated. Each mainframe is identical except for its physical size. Each analog recording channel is electrically identical. Figure 4-1 illustrates a block diagram of the basic recorder.

Preamplifiers are optional and are discussed in their respective instruction manuals.

4.2 MAINFRAME

The mainframe contains a switchboard, control board, control transformer, chart drive motor and transmission and event markers.

a. Switchboard

The switchboard is mounted on the left side of the front panel. It contains the operator controls: switches for POWER ON/OFF, CHART SPEED selection, and EVENT marker actuation; and indicators for POWER ON and INTERLOCK.

The POWER switch is a set-reset pushbutton which interrupts both phase and neutral sides of the ac power line.

Chart speed selection is made by depressing one of six SPEED, a DIVIDE, or STOP pushbutton. The SPEED and STOP pushbuttons are mechanically interlocked to reset a previously selected pushbutton. The DIVIDE is a set/reset pushbutton. A combination of three transmission solenoids are activated by the SPEED pushbuttons to obtain the desired chart speed. Table 4-1 defines chart speed versus solenoid activation. Each chart speed may be divided by 60 or 100 (depending upon model number) by depressing the DIVIDE pushbutton. This activates solenoid L101. The STOP pushbutton interrupts power to the motor/transmission via relay K-101 and resets the SPEED pushbuttons.

When the LEFT or RIGHT MARK EVENT pushbuttons are depressed, solenoids L108 and

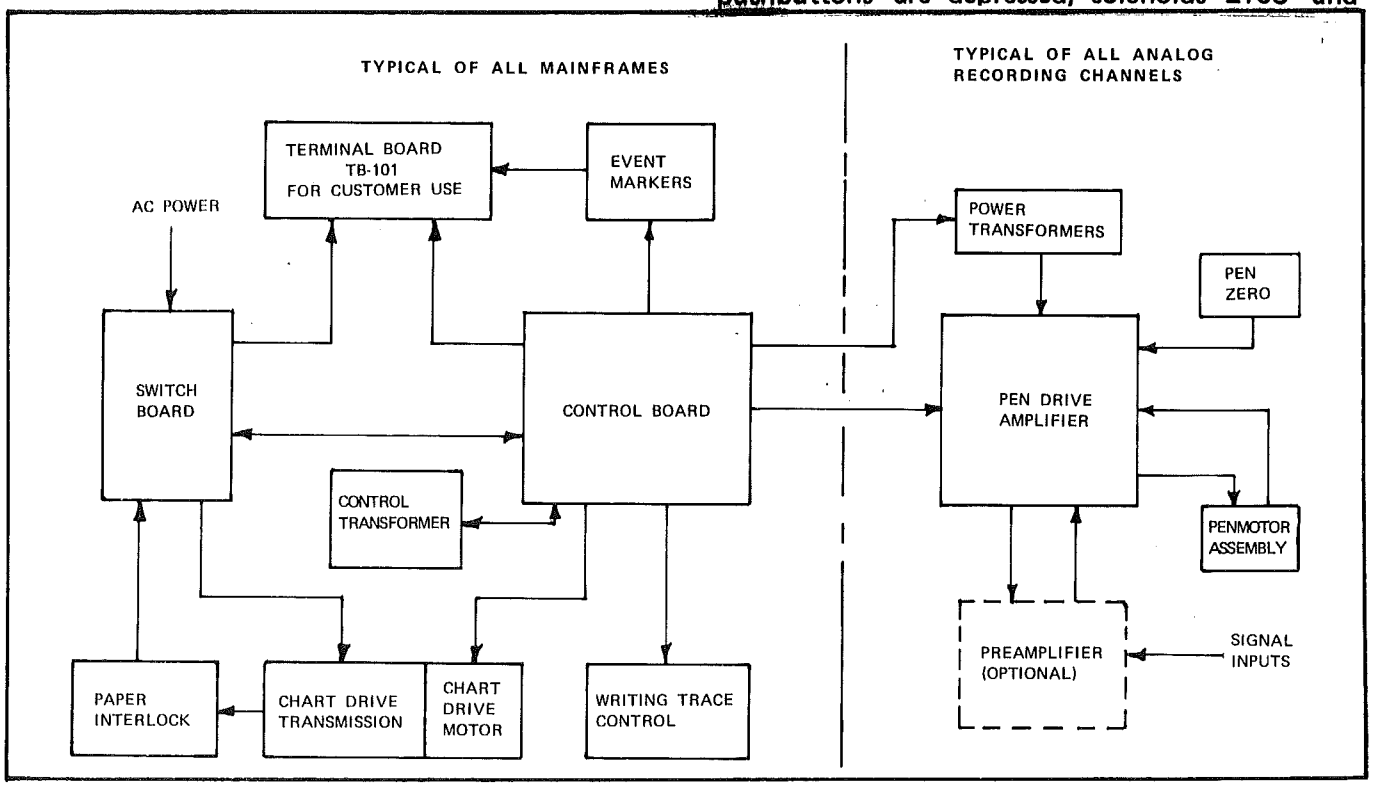


FIGURE 4-1. BASIC RECORDER BLOCK DIAGRAM

L 109 respectively are energized activating the left or right event markers. These are momentary pushbuttons, and reset when released.

TABLE 4-1.
CHART SPEEDS VS SOLENOID ACTIVATION

CHART SPEED (MM/SEC)	SOLENOID ACTIVATED L-102	L-103	L-104
5.0	x	x	
10	x		x
25		x	x
50		x	
100			x
200			

b. Control Board

The control board is mounted in the card cage in the rear of the recorder. Contained in the control board are the branch fuses, start/stop relay K-101, the +5Vdc and +28Vdc power supplies, and timer.

Fuses are provided to protect each power branch. Table 4-2 shows fuse and circuit protected.

DPDT relay K 101 controls power to the chart drive motor, ink solenoids, standard event markers, and optical couplers located in the pen drive amplifiers. It is energized when the chart STOP pushbutton is released. When energized, one set of contacts supplies power to the chart drive motor thru fuse F112 and activates the ink manifold solenoids. When de-energized, the other set of contacts inhibit the event markers and optical couplers in the pen drive amplifiers.

The control board contains two dc power supplies: +28V and +5V. The +28Vdc power source is obtained from bridge rectifier CR102 and control transformer T109. The unfiltered section of this section of the supply provides power to relay K101, optional event marker solenoids, and the indicator lamps. The filtered section of this supply provides power to the standard event markers to insure accuracy when precise time events are required. The +5Vdc power source is obtained thru CR102 from a second winding on control transformer T109. This supply is filtered and reulated to provide power for the pen drive amplifier optical couplers and timer.

Pulsating dc voltage is provided from bridge rectifier CR101 to operate the ink supply solenoids.

TABLE 4-2. FUSE VS CIRCUIT PROTECTED

FUSE	CIRCUIT PROTECTED
F101 To F108	Analog channel power transformers T 101 to T 108. Fuses and transformers supplied according to number of channels in recorder.
F109	Control transformer T 109 which supplies power for the +5V and +28V dc power supplies.
F110	Fan motor B-102 on the 250 mm and 380 mm models.
F111	Ink solenoids
F112	Chart Drive Motor
F113	115Vac convenience outlet.

The timer operates as a function of ac line frequency. Optical coupler U107 shapes the sinusoidal wave into a square wave. Binary counters U102 through U105 count the square wave pulses. Switch S104 selects combinations of U102 through U105 for the output pulse repetition rate (time interval) desired. The output pulse drives monostable multivibrator U106. Output from U106 turns on Q101 or Q102, activating the left event markers. (See Table 3-1).

c. Event Markers

Left and right standard event markers are activated by the MARK EVENT switches, optional timer, or remote application of TTL signals or contact closure. Depressing a MARK EVENT switch permits current to flow from CR106 through the mark event solenoid, activating the event marker.

NOTE: TTL and switch closure are described for left event marker only. Right event marker is identical.

Placing a switch closure (short) across terminals 6 and 7 of TB101, permits current to flow from CR106 through the mark event solenoid, activating the event marker. Application of a TTL signal across terminals 5 and 6 of TB101, causes Q101 to conduct, activating the event marker.

4.3 ANALOG RECORDING CHANNELS

a. General

Each analog recording channel consists of a power transformer, pen drive amplifier, and penmotor. The channels are isolated from one another by using separate transformer power supplies and optical couplers. The optical coupler disables the pen drive amplifier whenever relay K101 on the control board is de-energized from depressing chart STOP pushbutton or upon loss of ac power.

Each power transformer has two primary and three secondary windings. The primary windings can be wired in parallel for 115vac operation or in series for 230 vac operation. Two of the secondary windings (±35 and ±15 volts) provide power for the pen drive amplifier. The third (13Vac) may be used in preamplifiers requiring isolated power supplies for bridge excitation or suppression.

Figure 4-2 shows a block diagram of an analog channel. The penmotor drive amplifier is a complete servo system and uses a linear voltage displacement transformer (Metrisite*) in the penmotor to develop position, and a velocity transducer for velocity. These signals are summed with the input signal in a dc error amplifier which, after amplification, drives the penmotor.

b. Signal Limiter

The input signal enters the signal limiter and is summed with the pen zero signal. The summed signal is fed to a diode bridge circuit. Output from the bridge is limited to ±2.6 volts.

c. Frequency Compensation Network

Output from the signal limiter is fed to a frequency compensation network. Here, the signal's frequency response is adjusted to be flat within 2% from DC to 30Hz for 100 mm pen deflection and from dc to 50 Hz for 50 mm pen deflection. The circuit also provides a gain change to allow use with either 50 or 100 mm penmotors. The frequency compensated signal is then fed to summing network where it is combined with error and velocity signals.

d. Oscillator and Demodulator

Position feedback is obtained from the Metrisite. Excitation for the Metrisite is obtained from a 20 KHz Wein Bridge Oscillator. A demodulator attenuates the 20KHz carrier. Output from the demodulator is the position feedback signal.

e. Servo Control Amplifier

The compensated input signal, position feedback, and velocity are summed at the input of the servo amplifier. The output of this stage drives a Class B amplifier, which drives the pen to the proper position on the chart. This occurs when the summed signal is reduced to zero.

* Registered Trademark of Gould Inc.

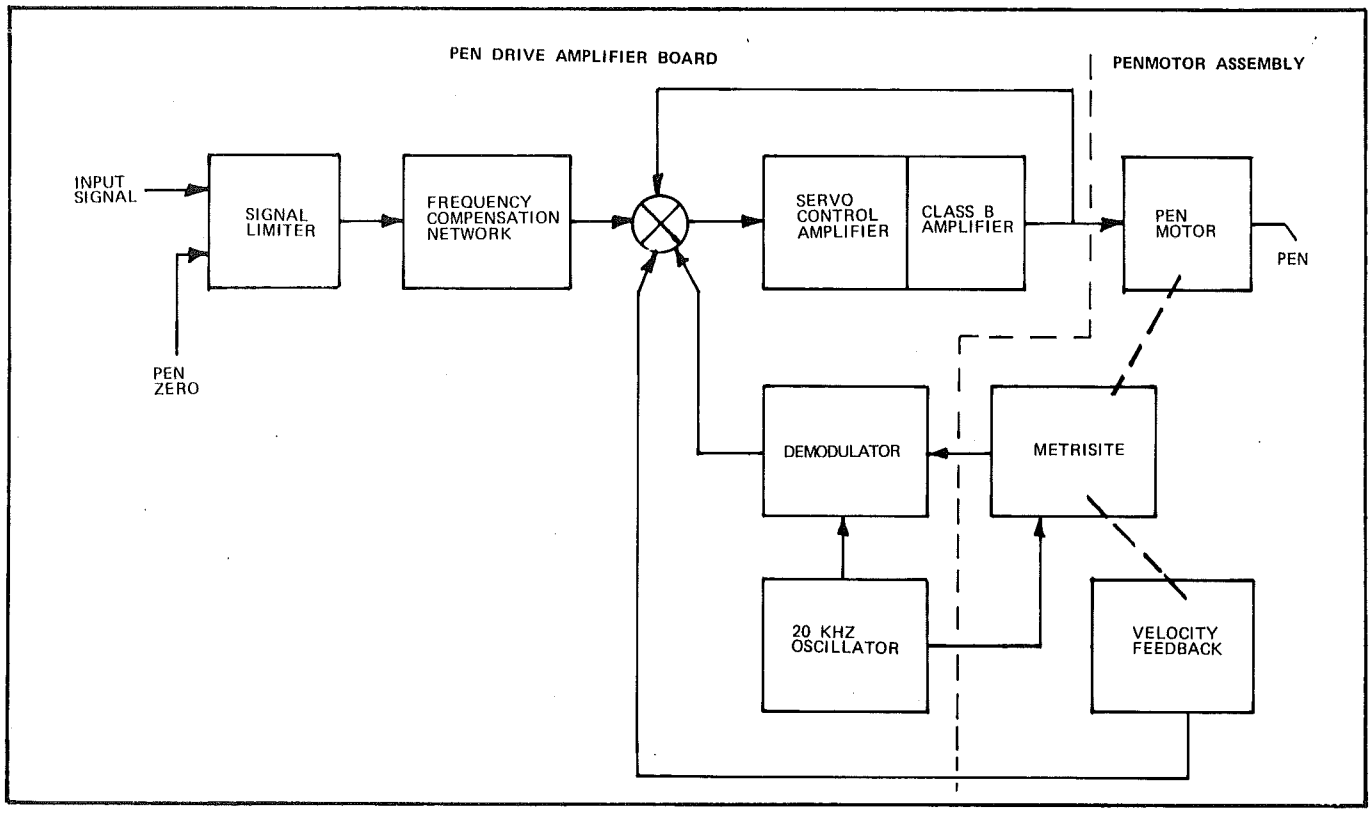


FIGURE 4-2. ANALOG CHANNEL BLOCK DIAGRAM

SECTION V

TROUBLESHOOTING

5.1 GENERAL

This section provides troubleshooting hints to assist the operator and/or serviceman in locating malfunctions that are the possible causes and remedy. If a problem exists which is not identified in this section, contact the factory for assistance.

5.2 ELECTRICAL POWER MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Recorder inoperative (Power ON and INTER-LOCK Lamps are extinguished with POWER ON switch depressed.	a. Recorder not connected to power source.	a. Connect to power source.
	b. Fuse F109 blown.	b. Replace fuse.
	c. POWER ON switch defective.	c. Replace switch.
2. Recorder Inoperative (POWER ON and INTER-LOCK Lamps are illuminated.	a. Chart Paper torn or supply is depleted.	a. Rethread or replace chart paper.
	b. INTERLOCK switch defective.	b. Replace switch.

5.3 CHART DRIVE MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Inoperative	a. Desired Chart SPEED button not depressed.	a. Depress desired chart speed button.
	b. Drive belt worn or broken.	b. Replace drive belt.
	c. Jumper between pins 3 & 4 of TB101 missing.	c. Replace Jumper.
	d. Fuses F111 or F112 blown.	d. Replace Fuse.
	e. Motor defective.	e. Replace motor.
	f. Chart speed switch defective.	f. Replace switch board assy.
	g. Relay K101 defective.	g. Replace relay.
2. Operative on only some speeds.	a. Chart speed switches defective.	a. Replace switch board assy.
	b. Transmission defective	b. Replace transmission.
	c. Broken wire on transmission terminal.	c. Repair connection.

5.3 CHART DRIVE MALFUNCTIONS (continued)

MALFUNCTION	CAUSE	REMEDY
3. Inoperative on divide by 100 speed.	a. Transmission defective	a. Replace transmission.
	b. Switch defective.	b. Replace switch.
	c. Broken wire to transmission.	c. Replace wire.
4. Chart speed not accurate or is erratic.	a. Drive roll worn excessively.	a. Clean or replace drive roll.
	b. Transmission defective	b. Replace transmission.

5.4 WRITING SYSTEM MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Trace missing or faint.	a. Ink supply exhausted.	a. Replace ink cartridge.
	b. Screw on ink cartridge not fully counterclockwise.	b. Turn screw fully counterclockwise.
	c. Ink manifold valves not in full ON position.	c. Rotate to full ON position.
	d. Pens clogged.	d. Clean or replace pens.
	e. Ink manifold solenoid defective.	e. Replace solenoid.
	f. Ink manifold solenoid de-energized.	f. Fuse F112 blown: replace fuse.
	g. Air in System	g. Bleed System.
2. Trace heavy or wet; pen gouges paper.	a. Pen excessively worn.	a. Replace pen.
	b. Pen not properly lapped	b. Lap pen.
	c. Improper pen pressure.	c. Adjust pen pressure.
3. All pens not on same time line.	a. Pen (s) out of alignment.	a. Align Pen (s).
4. Pen fails to return to same position each time.	a. Loose pen.	a. Align and tighten pen.
	b. Loose penmotor linkage.	b. Replace penmotor.

5.5 SIGNAL MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Trace unusually wide.	a. Noise appearing at the pen tip.	a. Check input signal and connections. Defective drive amplifier or preamplifier boards; repair or replace.
2. No signal on any or all channels.	a. Drive amplifier or preamplifier defective.	a. Replace drive amplifier or preamplifier.
	b. Drive amp fuse (s) blown.	b. Replace fuse (s) after correcting malfunction.
	c. Chart speed stop switch defective.	c. Replace switch.
3. Pens limp or biased to either side.	a. Drive amplifier or preamplifier defective.	a. Repair or replace drive amplifier or preamplifier
	b. Recorder requires calibration.	b. Calibrate recorder.
	c. Pen loose.	c. Align and tighten pen.
	d. Defective pen position pot.	d. Replace pen position pot.
4. Trace not in sync with time divisions on chart, or time pulses are erratic.	a. Excessive line noise may be creating problem.	a. Place "Transzorb" in power line (Gould P/N 290138-1). NOTE: Low Frequency noises will be absorbed.
		b. Operate recorder on separate power source.

SECTION VI

MAINTENANCE

6.1 GENERAL

This section contains information for use in preventive and corrective maintenance of the 2000 Series Recorder. Refer to Section V, Troubleshooting for guidelines in localizing problem areas.

6.2 CLEANING

a. General Cleaning

CAUTION: AVOID USE OF CHEMICAL CLEANING AGENTS WHICH MIGHT DAMAGE PLASTIC OR PAINTED SURFACES. DO NOT USE CHEMICAL WHICH CONTAIN TOLUENE, ACETONE, OR SIMILAR SOLVENTS.

EXTERIOR: Remove loose dust with a soft cloth or small paint brush. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

INTERIOR: Dust in recorder interior should be removed occasionally due to its electrical conductivity under high-humidity conditions. Blow off accumulated dust with dry, low-pressure air. Remove any dirt which remains with a soft paint brush or a soft cloth dampened in a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces and/or printed circuit boards.

b. Ink Removal

NOTE: The recommended ink remover is ANCHOR HAND CREAM, No. 25 obtainable from Anchor Office Supply Co. of Cleveland, Ohio.

1. Blot up any excess ink with a tissue or paper towel.
2. Apply ink remover to the inked area ONLY. DO NOT attempt a general cleaning.
3. Gently rub the area with a soft cloth until the ink spot is removed.
4. Wipe the area thoroughly with a damp cloth.
5. Allow cleaned area to dry at least ten minutes before using recorder.

6.3 CHART PAPER REPLACEMENT

1. Depress chart STOP pushbutton and release power pushbutton.
2. Grasp pull bar (Figure 6-1) and open writing table.

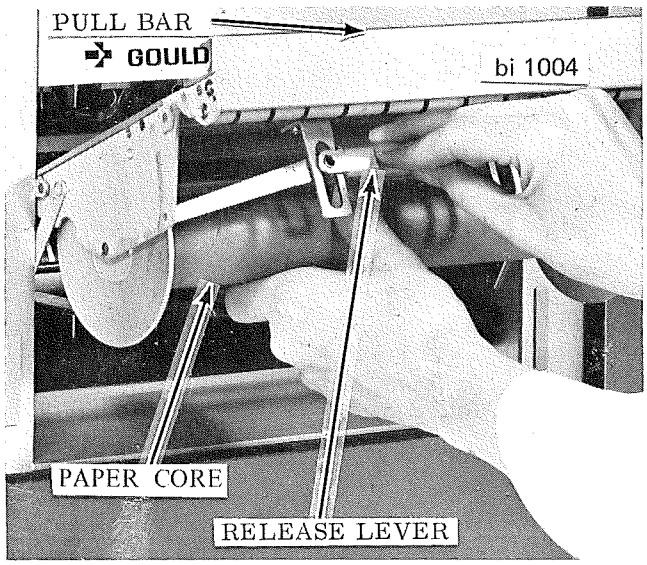


FIGURE 6-1. PAPER ROLL REMOVAL

3. Hold paper supply roll and pull down on paper supply release lever. Remove paper supply roll.
4. Unscrew right flange from paper supply roll. Remove and discard core (Figure 6-2).
5. Slide new paper roll onto supply shaft. Make sure notches in paper core align with guide pins on left flange and paper edge is facing forward and down.
6. Screw right flange onto supply shaft until it is snug against paper edge.
7. Insert paper roll into writing table assembly. Push release lever up to lock into position.

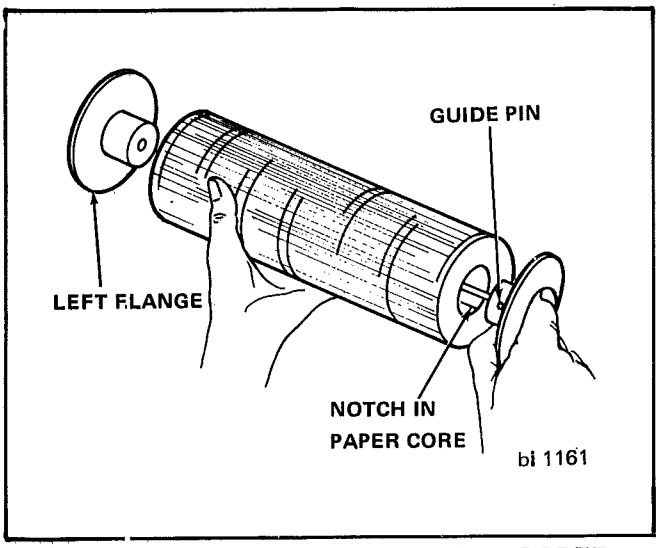


FIGURE 6-2. CHANGING CHART PAPER

CAUTION: MAKE SURE SHAFT IS SEATED PROPERLY AND ROTATES FREELY. USE CARE WHEN THREADING PAPER SO NOT TO DAMAGE PENS.

8. Refer to Figure 6-3. Feed paper over writing bar, down through slot between pull bar and drive roll, around pressure roll, and out to front of writing table assembly.

9. Slowly close writing table while gently pulling on chart paper. When friction resists rotation of paper roll, pull paper taut and center, and close writing table assembly. Make sure table is completely closed.

10. Turn recorder on and run out about two feet of chart paper at 100 mm/sec to align on writing table.

6.4 INK CARTRIDGE REPLACEMENT

Ink supply should be sufficient for one year under normal conditions. Cartridge(s) are located in rear of recorder. Follow procedure below to replace:

WARNING: MAKE SURE POWER IS OFF AND RECORDER IS DISCONNECTED FROM POWER SOURCE.

1. Loosen two screws and pull control board assembly and first drive amplifier board assembly from rear of recorder. Remove top rear cover by sliding it back and lifting out. Refer to Figure 6-4.

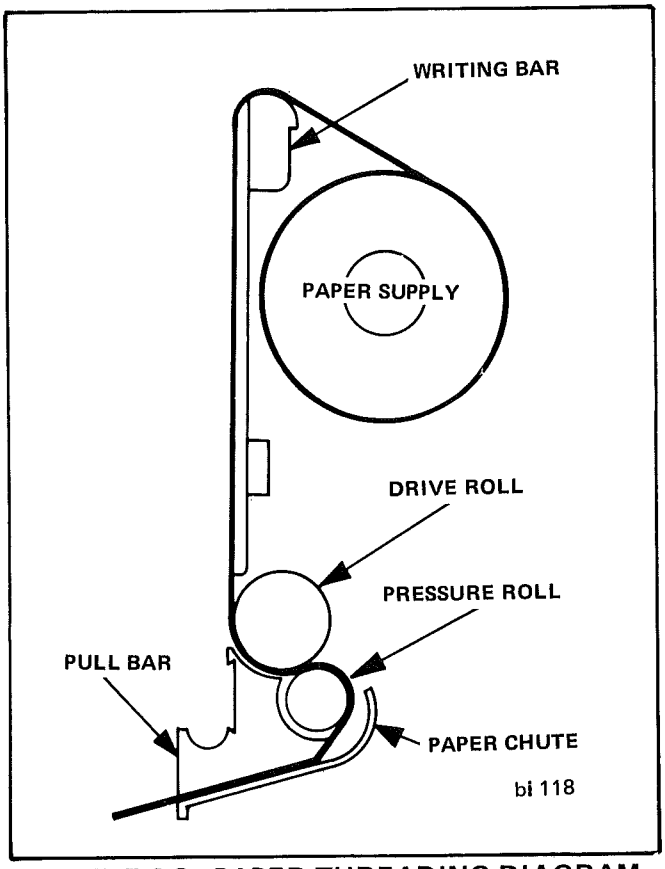


FIGURE 6-3. PAPER THREADING DIAGRAM

2. Turn activating screw clockwise until compression spring in ink plunger assembly is drawn up tight.

CAUTION: DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS UNDER INK SYSTEM.

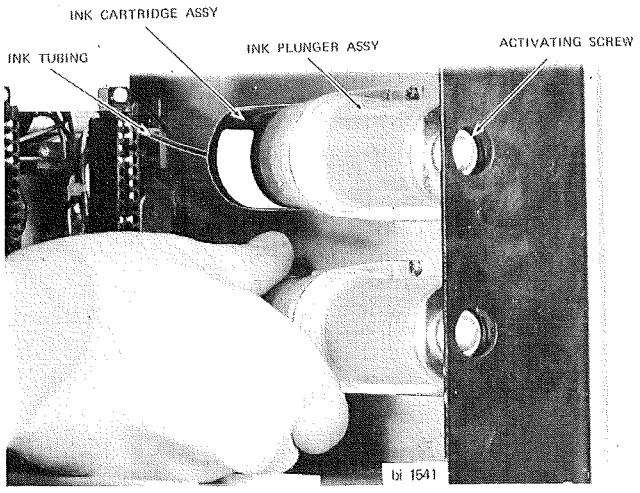


FIGURE 6-4. INK CARTRIDGE REPLACEMENT

3. Carefully pull ink tubing off of ink cartridge.

CAUTION: DO NOT USE TOOLS WHICH MAY GOUGE OR CUT THE INK TUBING.

4. Unscrew ink cartridge from plunger assembly and discard. Refer to Figure 6-5.

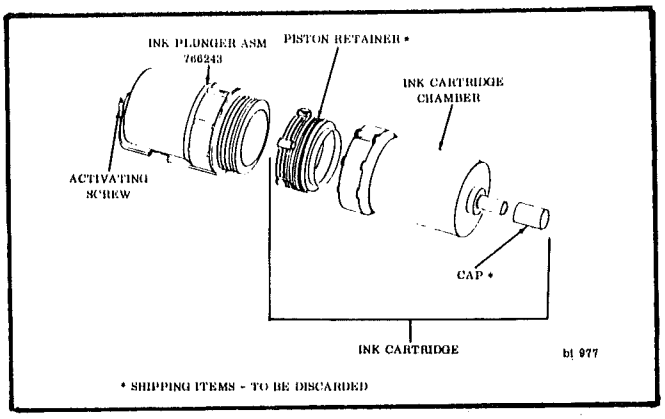


FIGURE 6-5. INK CARTRIDGE ASSEMBLY

5. Remove piston retainer from replacement cartridge and discard.

6. Install cartridge in plunger assembly and tighten firmly.

7. Remove shipping cap from ink cartirdge and discard.

8. Install ink tube on ink cartridge.

9. Turn activating screw counterclockwise until snug to pressurize ink system. Check for leaks.

10. Replace control and drive amp boards and top rear cover.

NOTE: Access to ink cartridge on 2200 series recorders is thru rectangular hole on left plate. Recorder assembly must be removed from case. Procedure for cartridge replacement is the same.

6.5 PEN PRESSURE ADJUSTMENT

Analog or event marker pen pressure should be checked if trace is excessively wide (low pen pressure) or pen gouges chart paper (high pen pressure). A gram gauge (Gould part number 240601-910) is used to measure both analog and event marker pen pressure. Both analog and event marker pens are measured in the same way. Measure pen pressure as follows:

1. Raise pen access cover by pulling out on bottom and sliding back into recorder.

2. Turn ON recorder and set chart SPEED at 5 mm/sec.

3. Place gram gage hook under pen as close as possible to top. Form a right angle to pen shaft with hook (Figure 6-6).

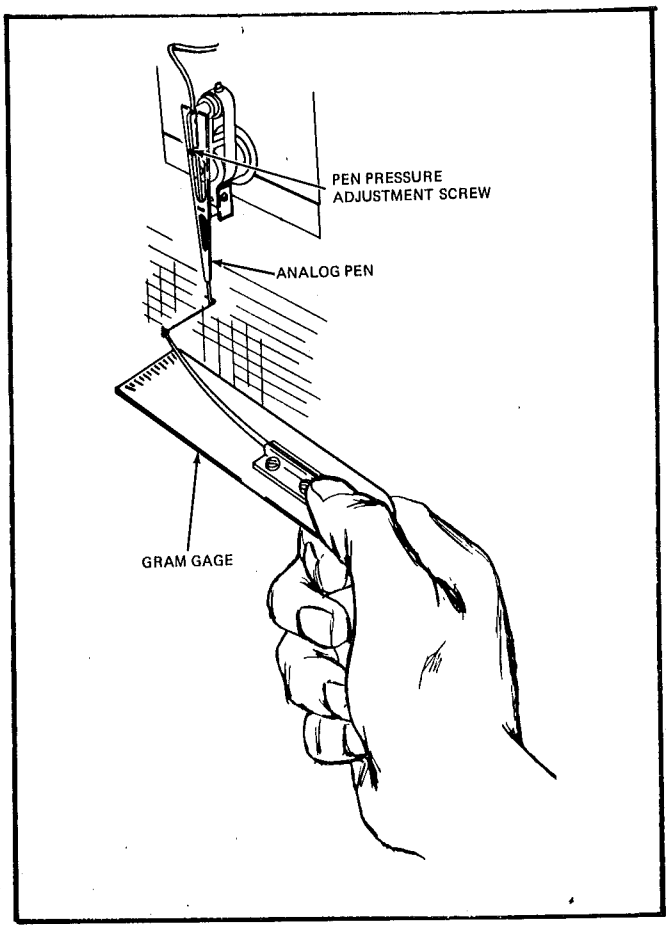


FIGURE 6-6. PEN PRESSURE MEASUREMENT

4. Slowly pull pen from chart paper. Read gage the moment excessive ink starts flowing from pen tip. Proper pressure for analog pens is 30 ±2 grams, for event marker pens 25 ±2 grams.

5. If pen pressure is not within specified limits, adjust pressure using special pen adjustment wrench (Gould part number 1-120922-18). Refer to Figure 6-7. Turn screw clockwise to increase pressure, counterclockwise to decrease pressure.

6. Recheck pen pressure per steps 3 and 4.

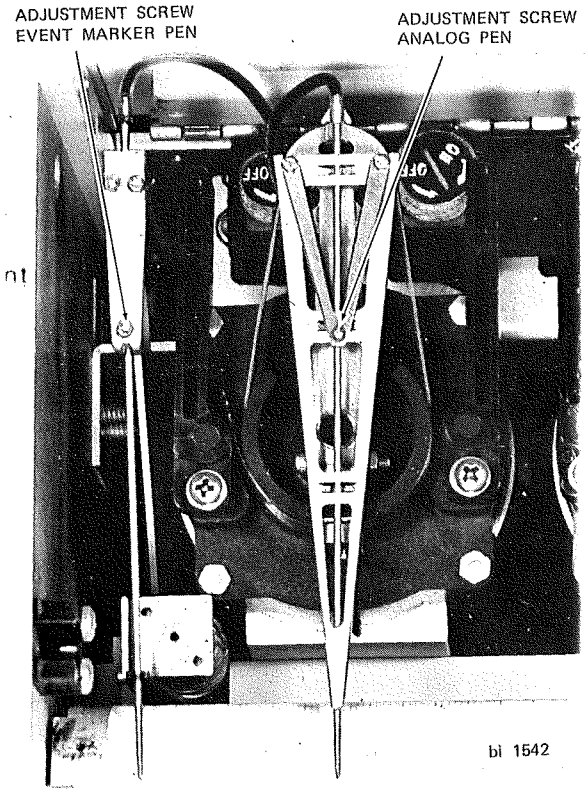


FIGURE 6-7. PEN PRESSURE ADJUSTMENT

6.6 PEN LAPPING

a. General

This paragraph describes and illustrates the proper procedures for lapping the analog and event pens. Intermittent or "wet" ink trace are indications that pen pressure is incorrect or that pen requires lapping. Check for "wet" writing by operating the recorder (no signal applied). Check pen trace by wiping index finger, with moderate pressure, across trace approximately one inch below pen tip. If ink does not smear, pen is properly lapped. If trace smears, check and adjust pen pressure (Para. 6.5). Repeat test, and if trace continues to smear, lapping is required.

b. Lapping Procedures

CAUTION: LAPPING SHOULD ONLY BE DONE WHEN ABSOLUTELY NECESSARY. EXCESSIVE LAPPING WILL SHORTEN PEN LIFE.

1. Turn OFF recorder.

2. Raise pen access cover by pulling out on bottom and sliding it back into recorder.

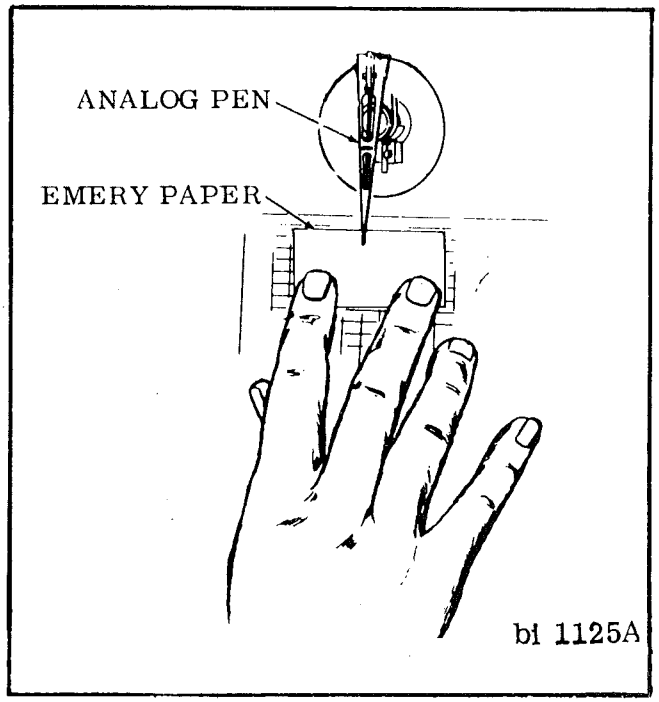


FIGURE 6-8. PEN LAPPING

3. Carefully raise pen tip just enough to slide a small strip of emery paper (600A, Gould part number 669234) under pen tip.

4. Refer to Figure 6-8. Hold emery paper flat against writing table and move it in a circular motion several times while gently pressing pen tip with finger.

5. Remove emery paper and clean debris from pen tip. Operate recorder at 5 mm/sec chart SPEED.

6. Check pen trace by wiping index finger, with moderate pressure, across trace about one inch below pen tip. If ink does not smear, pen is properly lapped. If ink smears, check pen pressure per paragraph 6.5.

7. Repeat lapping procedure if necessary.

8. If pen tip should become blocked during lapping operation, touch pen at top of pen (above tip) with a hot soldering iron for a few seconds with the pen tip raised slightly off the paper. This will usually start ink flowing and flush out abrasive.

9. When dry trace is achieved, turn recorder off.

6.7 PEN REPLACEMENT

Pens should only be replaced when excessively worn or broken. Replacement should be performed only by personnel who are familiar with the recorder. Replace and adjust one pen at a time.

a. Analog Pen

1. Press chart speed STOP button and release POWER button.

2. Raise pen access cover by pulling out on bottom and sliding back into recorder.

3. Turn pen ink valve OFF with a flat-blade screwdriver. Refer to Figure 6-9.

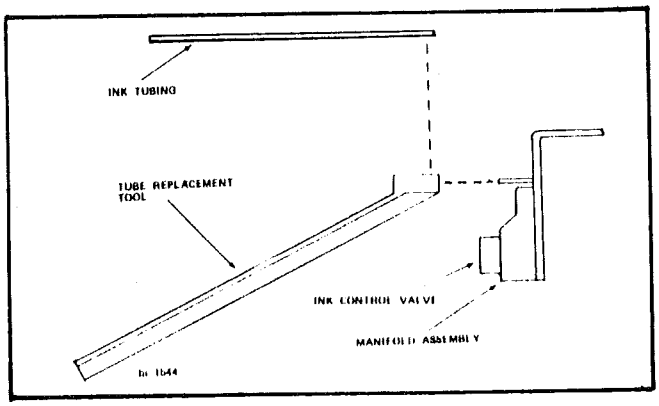


FIGURE 6-9. INK TUBE REMOVAL

4. Carefully remove ink tube from manifold and pen. Wipe of excess ink.

CAUTION: DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS AROUND AREA.

5. Loosen two screws which secure pen to drive arm and carefully slide pen off (Figure 6-10).

6. Carefully slide new pen onto drive arm. Snug the two screws to secure pen.

7. Install new tubing between manifold and pen.

8. Turn ON ink valve.

9. Turn recorder ON and run at a chart speed of 5 mm/sec.

10. Carefully lift pen slighty and allow ink to bleed through pen tip.

11. Shut down recorder.

12. Gently grasp pen near hub and move pen across entire channel. If trace is not parallel to a horizontal line and/or pen is not on same line as other pens, turn pen in screw slots and slide pen vertically. Tighten screws.

13. **Lap and set pen pressure per paragraphs 6.5 and 6.6.**

b. Event Marker Pen

1. Press chart speed STOP button and release POWER button.

2. Raise pen access cover by pulling out on bottom and sliding back into recorder.

3. Turn pen ink valve OFF with a flat blade screwdriver. Refer to Figure 6-9.

4. Carefully remove ink tube from pen and manifold.

5. Loosen adjustment screw and two screws which secure pen to arm, and carefully slide pen off. Refer to Figure 6-10.

6. Carefully slide new pen onto arm. Snug screws to secure pen. (Pen should be perpendicular to writing surface).

7. Install new tubing between manifold and pen.

8. Turn ON ink valve.

9. Turn recorder ON and run at a chart speed of 5 mm/sec. Adjust pen ZERO to set pen on event gridline.

10. Carefully lift pen slightly and allow ink to bleed through pen tip.

11. Shut down recorder.

12. If pen tip is not on same line as other pens, loosen screws and slide pen vertically. Tighten screws.

13. **Lap and set pen pressure per paragraphs 6.5 and 6.6.**

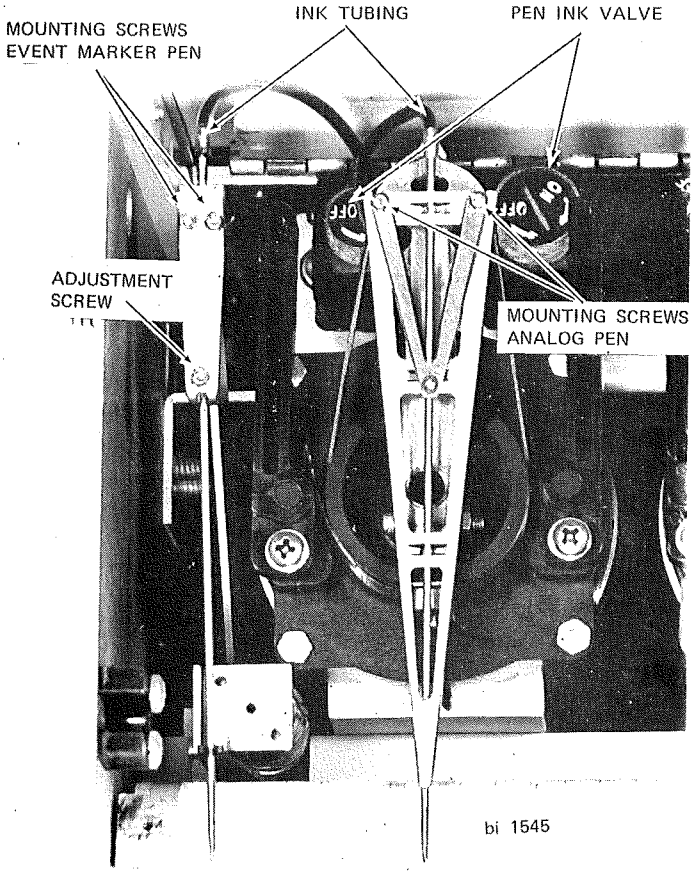


FIGURE 6-10. PEN REPLACEMENT

6.8 PEN CLEANING

Intermittent, missing, or faint traces may be indications of a clogged pen. The following cleaning procedure is intended as a guide, but may not always prove effective.

1. Turn recorder OFF.
2. Close ink valve on affected channel.
3. Remove ink tubing from manifold (Fig.6-9).
4. Remove pen (Para, 6.7a or 6.7b).

NOTE: Do not remove tubing from pen unless tubing is kinked or suspected of being defective.

5. Modify No. 18 hypodermic needle per Figure 6-11.

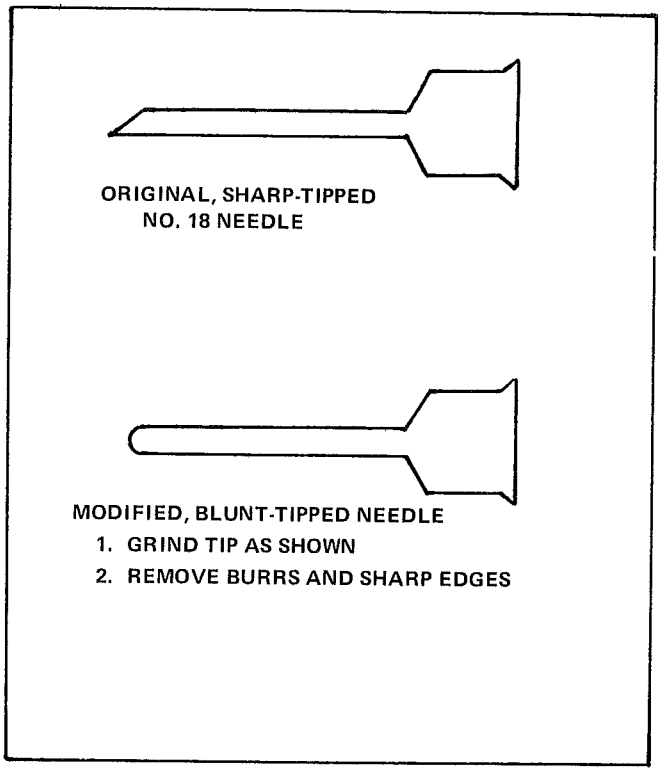


FIGURE 6-11. HYPODERMIC NEEDLE MODIFICATION

6. Attach modified needle onto 2cc hypodermic syringe.
7. With syringe plunger depressed, insert needle in pen tubing.
8. Immerse pen tip in cleaning agent (Isopropyl Alcohol, Cell-O-Solve or equivalent).
9. Back-flush by slowly withdrawing syringe plunger.

NOTE: If may be necessary to allow the pen to remain for a brief period in the cleaning agent to dissolve dried ink at pen tip.

10. Install pen (para. 6.7a or 6.7b).

6.9 CASE REMOVAL

When removing the case, be careful not to damage gears or switchboard.

1. Remove four large machine screws from bottom of case.
2. If recorder is equipped with preamplifiers, remove channel 2 preamplifier, slide hand into preamp cage, and unplug connector. Pull from connector body, not from harness.
3. Slide recorder out from front of case. Push from rear and/or pull from side plates. Do not pull from top front of recorder.

6.10 DRIVE ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdowns of Recorder Assembly, L.H. Plate Assembly, Chassis Assembly, and Drive Assembly in Section VIII.

Remove the drive assembly as follows:

1. Remove case per paragraph 6.9.
2. Remove rear cover assembly (item 27) from recorder assembly.
3. Remove blue wire from TB102-2, green/orange wire from TB102-5 and black wire from TB102-6. TB102 is located on L.H. plate assembly.
4. Remove timing belt (item 45) and pulley (item 44) from recorder assembly.
5. Remove 3 machine screws securing transmission to right hand plate assembly and 2 screws securing motor mounting bracket to chassis.
6. Slide drive assembly out of hole in L.H. plate assembly.
7. Slide new or repaired drive assembly into recorder. Watch routing of leads. Be careful not to pinch brown and gray wires going to TB104 on chassis assembly.
8. Secure transmission to right hand side plate assembly and motor mounting bracket to chassis. Replace timing belt and pulley.
9. Replace wires on TB102; blue, TB102-2; green/orange, TB102-5; black, TB102-6.
10. Replace rear cover.
11. Install recorder in case.

6.11 POWER TRANSFORMER REPLACEMENT

NOTE: Refer to illustrated parts breakdown of chassis assembly in Section VIII.

Replace power transformer(s) (item 5) as follows:

1. Remove recorder from case per paragraph 6.9.
2. Remove paper supply roll per paragraph 6.3.
3. Remove two machine screws securing transformer to chassis (4).
4. Slide out defective transformer and replace.
5. Secure transformer with machine screws.
6. Replace paper supply roll and install recorder in case.

6.12 TABLE ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdowns of L.H. Plate & Writing Table assemblies in Section VIII.

Replace table assembly as follows:

1. Remove recorder from case per paragraph 6.9.
2. Remove paper supply roll per paragraph 6.3.
3. Remove catch (item 15) from L.H. Plate Assembly.
4. Remove retaining rings from table arms and carefully pry arms out of plate assemblies. Do not bend arms.
5. Tilt table slightly and pull out of recorder removing right and left hand lever assemblies.
6. Mount new or repaired table assembly on lever assemblies. Slide table into recorder and snap arms into side plate holes. Replace retaining rings.

7. Replace catch and washer. Make sure lever is below catch.

8. Replace paper supply roll and install recorder in case.

6.13 MANIFOLD ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdown of recorder assembly in Section VIII.

Replace manifold assembly (item 25) as follows:

1. Remove recorder from case per paragraph 6.9.

2. Turn OFF cartridge(s) and all ink valves.

3. Place paper towels around area underneath manifold assembly.

4. Pull off ink tubing from manifold to pens and manifold to ink cartridge(s).

5. Remove four machine screws which secure manifold assembly to side plates. Lift out manifold assembly.

6. Install new or repaired manifold assembly.

7. Replace tubing to manifold assembly.

8. Turn ON ink cartridge(s) and ink valves. Check for leaks.

9. Install recorder in case.

6.14 PENMOTOR REPLACEMENT

NOTE: Refer to illustrated parts breakdowns of recorder assembly, manifold assembly and penmotor bar assembly.

Replace penmotor as follows:

1. Remove recorder from case per paragraph 6.9.

2. Turn OFF manifold valve to penmotor to be replaced.

3. Place paper towels around area underneath penmotor to be replaced.

4. Pull of ink tubing from pen assembly.

5. Loosen the four machine screws which secure the manifold assembly. Raise manifold assembly as far as it will go and snug screws.

6. Remove paper supply roll (see paragraph 6.3).

7. Remove pen assembly by loosening the two screws which secure it to drive arm and carefully slide off. Refer to Figure 6-10.

8. Remove two socket head screws which secure penmotor to penmotor bar. Disconnect plug and pull penmotor out of recorder. The saddle is a loose part.

9. Install new penmotor, securing with the two socket head screws. Connect plug to penmotor.

10. Loosen manifold assembly screws, lower manifold assembly, and tighten screws.

11. Replace paper supply roll and close table.

12. Install pen assembly per paragraph 6.7a, steps 6 through 13.

13. Install recorder in case.

6.15 REPLACING PENMOTOR DRIVE BAND (684999)

CAUTION: IT IS RECOMMENDED THAT THE DRIVE BAND BE REPLACED AT THE FACTORY SO THAT PROPER BAND TENSION IS MAINTAINED. SHOULD FIELD REPLACEMENT BECOME NECESSARY, PERFORM THE FOLLOWING STEPS.

NOTE: Refer to Figure 6-12 for location of parts in capital letters.

a. Band Removal

1. Remove Analog Pen Assembly.
2. Loosen (but do NOT remove) screws securing FRONT and REAR BAND CLAMPS.
3. Remove DRIVE BAND by sliding FREE END in counterclockwise direction from between REAR CLAMP and ANCHOR, then from between FRONT CLAMP and PULLEY.
4. Conclude removal by gently unhooking band from BAND ANCHOR.

b. Band Replacement

1. Place hooked (or bent) end of DRIVE BAND over ANCHOR as shown, and reinstall in clockwise direction between FRONT CLAMP and PULLEY, then between REAR CLAMP and ANCHOR.
2. Apply 5.5 to 6.5 pounds tension to FREE END OF BAND with a spring clamp and spring tension scale or equivalent.

NOTE: Be sure that tension is applied directly in line with band i.e., does not pull band forward or back.

3. Maintaining tension, fully tighten all screws and apply a drop of Red Glyptal or equal at screwheads and mating surfaces.
4. Remove spring scale and spring clamp.
5. Reinstall Analog Pen.
6. Check frequency response for compliance with specifications given in Section I.

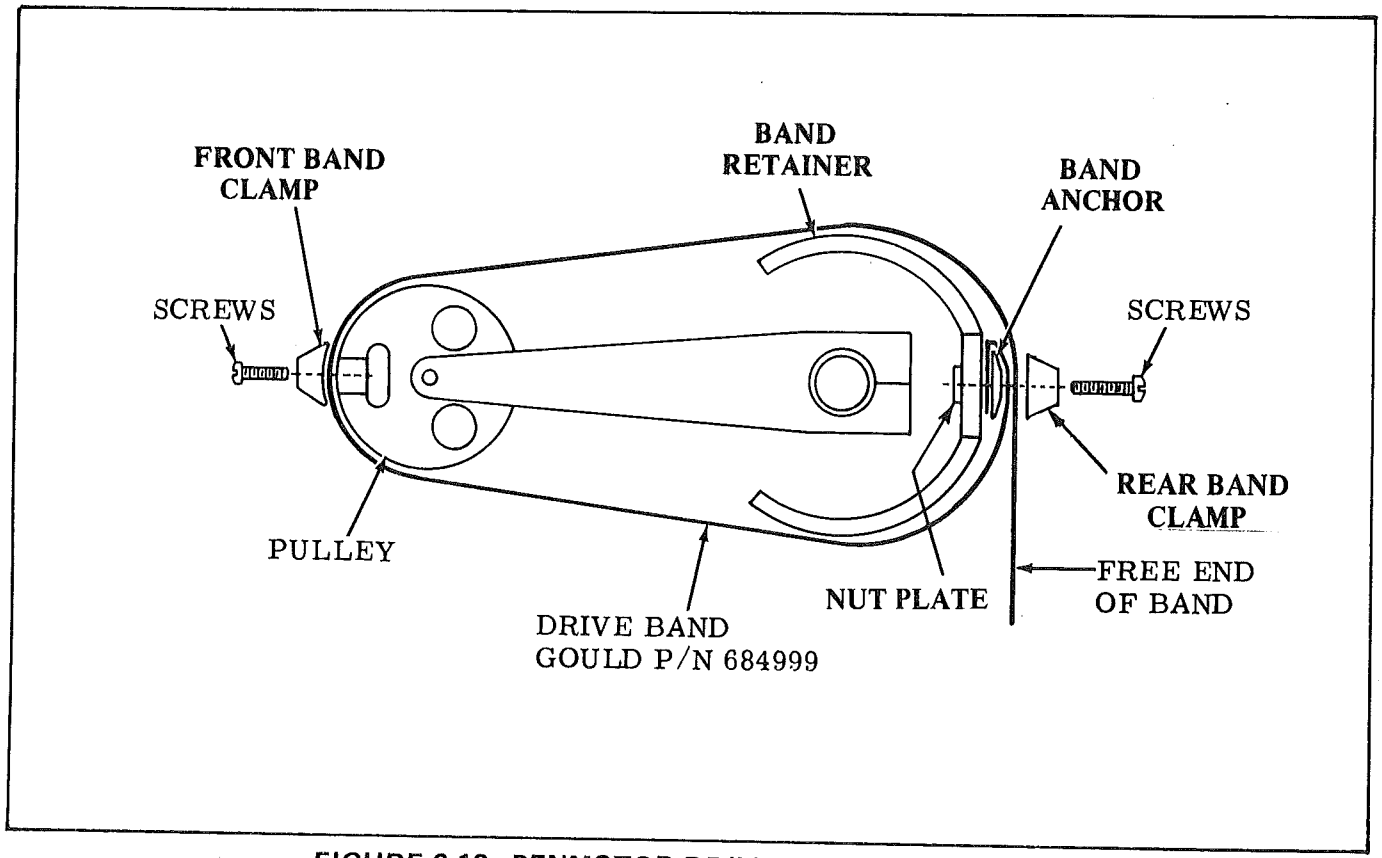


FIGURE 6-12 PENMOTOR DRIVE BAND REPLACEMENT

SECTION VII

CALIBRATION

7.1 GENERAL

The Gould 2000 Series Recorder has been factory calibrated. Under normal conditions, it will not be required. However, calibration may be required when parts are replaced. This section describes the procedures necessary to calibrate the 2000 Series Recorder. Calibration should only be performed by qualified individuals.

7.2 TEST EQUIPMENT REQUIRED

Proper test equipment is essential. Use the equipment specified below or its equal.

a. Function Generator - Wavetek Model 110.

b. DC Calibration Source - Digitec Model 311.

7.3 PRELIMINARY SETUP

a. If the recorder contains preamplifiers, remove each preamplifier from its cage prior to calibrating the channel.

b. Depress recorder STOP button.

c. Plug ac line cord into the proper ac voltage source.

d. Turn ON the recorder.

7.4 CALIBRATION PROCEDURE

Calibration is required on pen drive amplifiers (one per channel) and preamplifiers (if recorder is so equipped). Only pen drive amplifier calibration is discussed in this manual. Refer to the applicable preamplifier manual for its calibration.

Calibration controls and procedures are identical for all channels. Refer to Figure 7-1 and calibrate each pen drive amplifier as follows:

1. Remove the Recorder top rear cover to gain access. Slide cover back and lift out.

2. Connect dc calibration source to phone jack input of drive amplifier. Tip is high, ring is low.

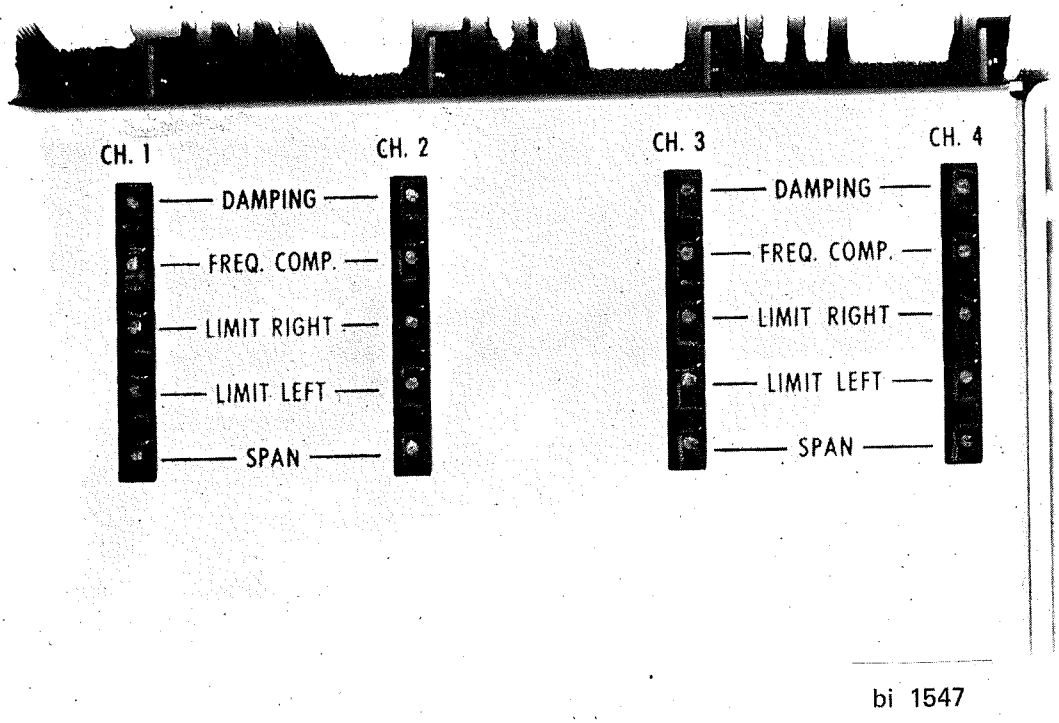


FIGURE 7-1. CALIBRATION CONTROLS

3. Press recorder 5mm/sec CHART SPEED pushbutton.

4. Set dc calibration source to ZERO.

5. Set pen at channel center with pen position control.

6. Apply a +2.5 vdc ±0.25 mv signal to drive amplifier and adjust SPAN potentiometer (R-260) for full scale deflection within 0.1%.

7. Return dc calibration source to zero.

8. Turn pen position control full counterclockwise. Pen should deflect left to between 1.0 and 2.0 mm beyond full scale.

9. If deflection is NOT between 1.0 and 2.0 mm beyond full scale, adjust LEFT LIMIT potentiometer (R-208) for a 1.5 ±0.25 mm deflection beyond full scale.

10. Turn pen position control full clockwise. Pen should deflect right go between right to between 1.0 and 2.0 mm beyond full scale.

11. If deflection is NOT between 1.0 and 2.0 mm beyond full scale, adjust RIGHT LIMIT potentiometer (R-205) for a 1.5 ±0.25 mm deflection beyond full scale.

12. Connect function generator.

13. Apply a 4V p-p square wave with a 1.0Hz repetition rate.

14. Turn DAMPING potentiometer (R-231) clockwise until an overshoot is obtained. Then, turn slowly counterclockwise until overshoot is reduced to zero.

15. Check overshoot at 20 and 100 percent pen deflection. No overshoot should be present. Repeat Step 14 if necessary.

16. Increase chart speed to 25 mm/sec.

17. Apply a 5Hz sine wave, and adjust amplitude to obtain a 40 mm pen deflection.

18. Slowly increase frequency to 50Hz. Pen deflection should be within 0.5 mm of that at 5Hz.

19. If necessary, adjust FREQUENCY COMP potentiometer (R-209) until 50Hz deflection is within 0.5 mm of the 5Hz deflection.

SECTION VIII

PARTS IDENTIFICATION

8.1 GENERAL

This Gould 2400 Series Recorder has been accurately calibrated and adjusted before shipment from the factory, and should give long trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact your nearest Gould Service Engineer listed on the warranty card shipped with the recorder.

The following parts lists and schematic diagram are designed to assist in servicing and repairing the recorder. For replacement parts, refer to the appropriate Figure and Parts List that follow. The items listed do not necessarily imply they are procurable. If an item is marked with an asterisk (*), it is unprocurable.

To assure prompt and satisfactory delivery of replacement parts, include the following information with your purchase order:

1. Name and model number of the instrument.
2. Description of part as listed in this manual.
3. Gould part number.

NOTE: Do not use the SYMBOL NUMBER from the parts list for identifying desired parts on the order.

8.2 PARTS USED ON OTHER MODELS

The USED ON column identifies the recorder on which the part is used. If on code is not present, part is common to all models. Below are the codes and explanations:

CODE	EXPLANATION
250-2	250 mm chassis, 2 channel
250-3	250 mm chassis, 3 channel
250-4	250 mm chassis, 4 channel
250-XP	250 mm chassis, (X) channel with preamps

8.3 LIST OF ILLUSTRATIONS

8.4 LIST OF TABLES

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL PORTABLE MODELS
FIGURE 8-1

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	2007-42XX-XX	2400 Recorder, 2 Channel	
	2007-43XX-XX	2400 Recorder, 3 Channel	
	2007-44XX-XX	2400 Recorder, 4 Channel	
1	2007-4290-XX	Recorder Assy, 2 Channel (See Fig. 8-3)	250-2&2P
	2007-4390-XX	Recorder Assy, 3 Channel (See Fig. 8-3)	250-3&3P
	2007-4490-XX	Recorder Assy, 4 Channel (see Fig. 8-3)	250-4&4P
2	886569	Case Assy, Recorder (See Fig. 8-18)	250-2, 3, & 4
	886492	Case Assy, Recorder, 2 Ch. (See Fig. 8-18)	250-2P
	886399	Case Assy, Recorder, 3 & 4 Ch. (See Fig. 8-18)	250-3P & 4P
3	287083	Bracket, Angle, Cage Support	250-XP
4	287084	Bracket, Cage Support	250-XP
5	888321	Cage Assy, Preamp, 2 Ch. (See Fig. 8-19)	250-2P
	886400	Cage Assy, Preamp, 3 & 4 Ch. (See Fig. 8-19)	250-3P&4P
6	887005	Panel Assy	250-3P
7	11-6402-11	Chart Takeup Assy (See Fig. 8-23)	

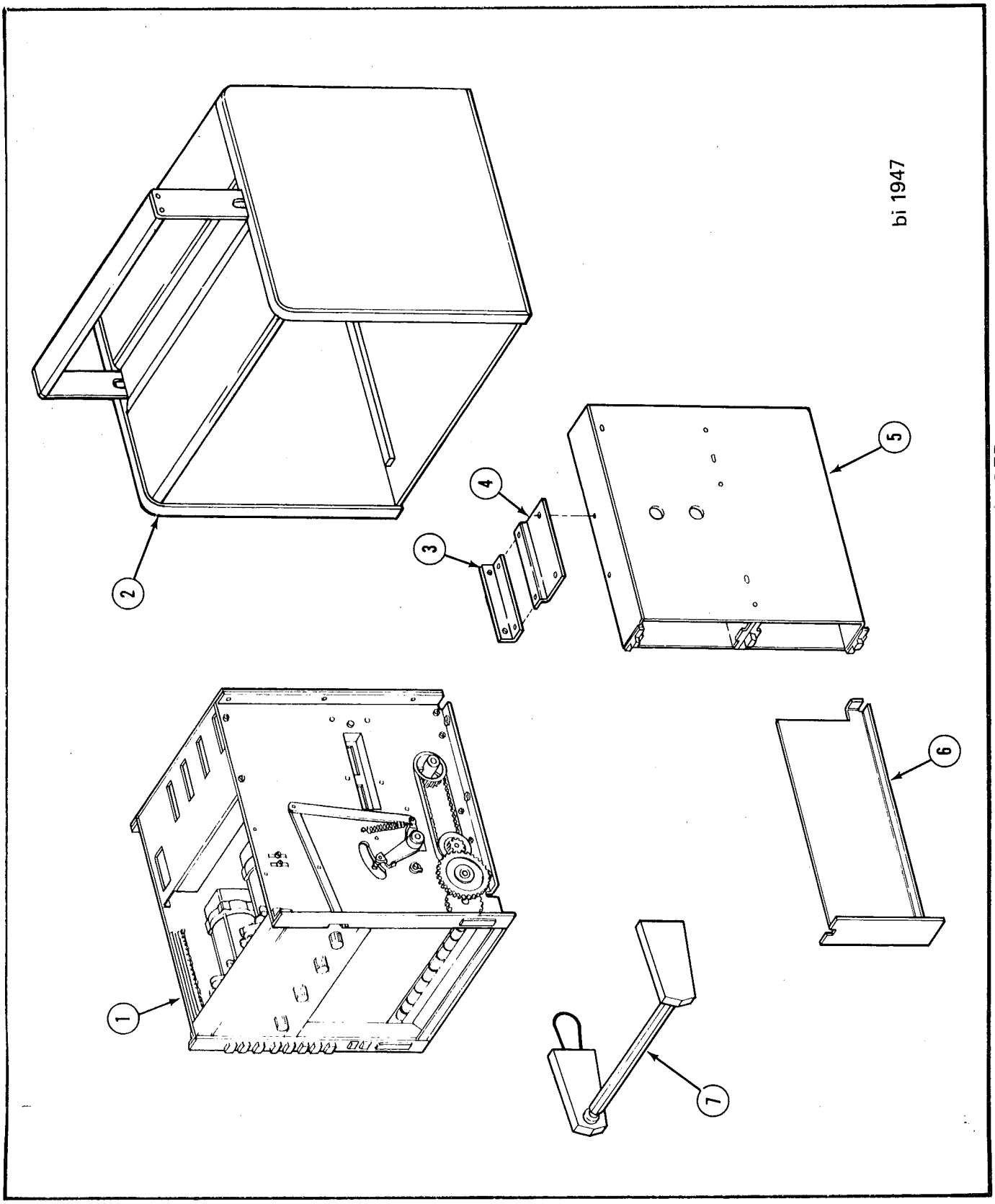


FIGURE 8-1 2400 SERIES RECORDER, PORTABLE

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – RACK MOUNTED MODELS
FIGURE 8-2

ITEM NO	PART NUMBER	DESCRIPTION	USED ON
	2007-42XX-XX	2400 Recorder, 2 Channel	
	2007-43XX-XX	2400 Recorder, 3 Channel	
	2007-44XX-XX	2400 Recorder, 4 Channel	
1	2007-4290-XX	Recorder Assy, 2 Chan. (See Fig. 8-3)	250-2&2P
	2007-4390-XX	Recorder Assy, 3 Chan. (See Fig. 8-3)	250-3&3P
	2007-4490-XX	Recorder Assy, 4 Chan (See Fig. 8-3)	250-4&4P
2	467037	Frame, Shipping	
3	11-1154-61	Cabinet Assembly	
4	887005	Panel Assembly	250-3P
5	888321	Cage Assy, Preamp (See Fig. 8-19)	250-2P
	886400	Cage Assy, Preamp (See Fig. 8-19)	250-3P & 4P
6	11-6402-11	Chart Take-up Assy (See Fig. 8-23)	
Not Shown	** 687330	Kit Assy, Model 11-1202-11 (See Fig. 8-20) (Rack Mount Installation Instructions, Recorder only.	
Not Shown	** 687363	Kit Assy, Model 11-1202-12 (See Fig. 8-21) (Rack Mount Installation Instructions, Recorder with 2-preamp cage).	
Not Shown	** 687361	Kit Assy, Model 11-1202-13 (See Fig. 8-22) (Rack Mount Installation Instructions, Recorder with 4-preamp cage)	

**Use Kit Model number for ordering purposes.

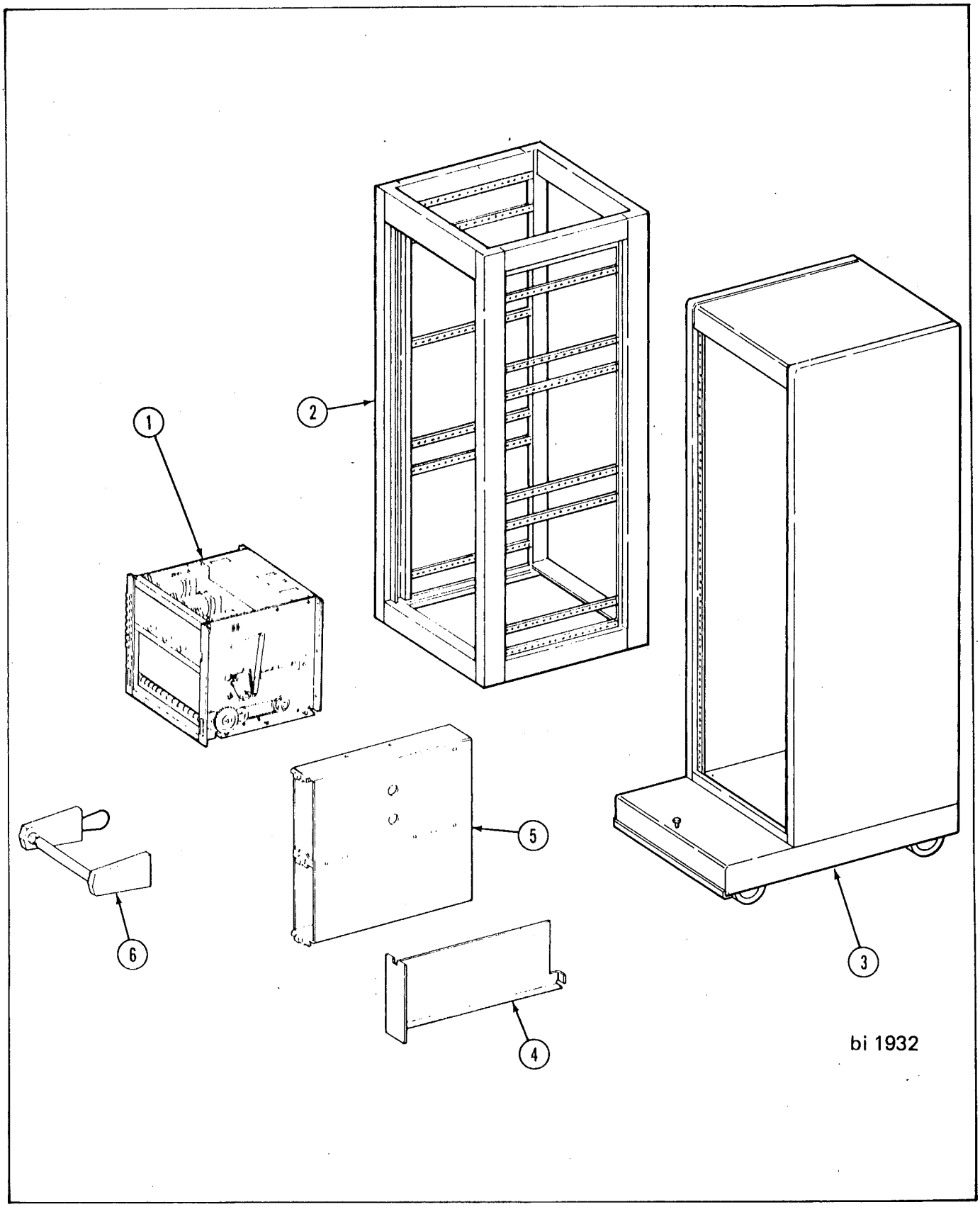


FIGURE 8-2 2400 SERIES RECORDER, RACK MOUNTED MODELS

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
RECORDER ASSEMBLY 250mm CHASSIS – 2007-4X90-XX
FIGURE 8-3

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
1	886772-1	Board Assy Sw, ÷ 60, (See Fig. 8-4)	A-110	
	886772	Board Assy Sw, ÷ 100, (See Fig. 8-4)	A-110	
2	286767	Insulator		
3	248169-2	Spacer		
4	11-2730-01	Ink Cartridge		
5	885098-1	Plate Assy, L.H. (See Fig. 8-5)		250-2
	885098	Plate Assy, L.H. (See Fig. 8-5)		250-3 & 4
6	885291	Connector Assy (See Fig. 8-6)		250-4
	886771	Connector Assy (See Fig. 8-6)		250-3
	886773	Connector Assy (See Fig. 8-6)		250-2
7	785170-1	Door Assembly		250-4
	785170-2	Door Assembly		250-2
	785170-3	Door Assembly		250-3
8	285651-3	Knob		
9	386274	Slide		
10	285711	Spring		
11	886031	Bracket Assy, Bottom		
12	286027	Panel, Filler		250-2 & 3
13	886220	Board Assy, Drive Amp (See Fig. 8-8)	A-101 thru A-104	
14	886327	Board Assy, Control (See Fig. 8-7)	A-109	
15	886033	Bracket Assy, Top		
16	116198-X	Fuse (115V Models) } See Table 8-1, Fuse Table		
	266924-X	Fuse (230V Models) } Following Fig. 8-3 Parts List		
17	114816-15	Plug	P-201	
18	289046	Plug	P-202	
19	786028	Cover Assembly, Rear		
20	108572-11	Strain Relief		
21	3-113294-61	Button, Plug		250-2
22	244165	Connector, Receptacle	J-102	
23	1-286155-16	Terminal Board	TB-101	
24	129699	Jumper		
25	289225-2	Shield		
26	1-280875-8	Spacer, Threaded		
27	681257-1	Cable Assy, Power	P-101	
28	1-280875-7	Spacer, Threaded		
29	289227-2	Shield, Insulation		
30	886568	Manifold Assy – 115V Models		250-2
	886777	Manifold Assy – 230V Models		250-2
	886573	Manifold Assy – 115V Models		250-3, 250-4
	886780	Manifold Assy – 230V Models		250-3, 250-4
30A	266888-2	Solenoid – 115V Models (Not Shown)	L105, L106	
	266888-3	Solenoid – 230V Models (Not Shown)	L105, L106	
30B	269256-7	Diode, 1N4007 (Not Shown)	CR111, CR112	
30C	684169-1	Valve Assy (Not Shown)		

887-1300 X262

33-30

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
RECORDER ASSEMBLY 250mm CHASSIS - 2007-4X90-XX
FIGURE 8-3 (Cont'd)

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
31	886667	Bracket Assy, Shield-60Hz Models (See Fig. 8-9)		
	887098	Bracket Assy, Shield - 400Hz Models (See Fig. 8-9)		
	886921	Bracket Assy, Shield - 50Hz Models (See Fig. 8-9)		
32	786034	Shield		
33	786030	Cover Assy, Rear - 50/60Hz Models		
	787099	Cover Assy, Rear - 400Hz Models		
34	1-286404-1	Fan Motor - 115V/50-60Hz Models	B-102	
	1-286404-2	Fan Motor - 230V/50 Hz Models	B-102	
	1-286690-1	Fan Motor - 115V/400 Hz Models	B-102	
35	287389	Bracket Connector		250-2
36	885083	Plate Assy, R.H. (See Fig. 8-13)		
37	243542-6	Belt, Timing		
38	385806	Pulley		
39	686429	Indicator Assy		
40	286592	Spring		
41	1-227070-3	Retaining Ring		
42	683485	Brake Assy (See Fig. 8-12)		
43	286531	Spring		
44	1-227070-9	Ring, Retaining		
45	127271	Washer		
46	269491	Gear, Dual		
47	385710	Gear-Pulley		
48	269499	Gear, Spur		
49	1-227070-9	Ring, Retaining		
50	127271	Washer		
51	265741-1	Bearing, Ball		
52	265745-1	Washer, Mylar		
53	241513-206	Capacitor, 115V Models	C-108	
	231449-27	Capacitor, 230V Models	C-108	
*54	See Table 8-2 Following Fig. 8-3 Parts List	Chassis Assembly (See Fig. 8-15)		
55	785133	Harness Assembly, Transmission		
56	286770	Cover, Panel		
57	786396	Panel Assy, Front R.H.		
58	785701-1	Chute, Paper		
59	267426-1	Paper Deflector		

*Item 54 is not procurable. Refer to Figure 8-15 parts list.

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
RECORDER ASSEMBLY 250mm CHASSIS - 2007-4X90-XX
FIGURE 8-3 (Cont'd)

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
60	685719	Roll, Drive		
61	783590	Sensor Assembly (See Fig. 8-14)		
*62	785169	Bar Assy, Penmotor 4 Channel (See Fig. 8-10)		250-4
	785171	Bar Assy, Penmotor 2 Channel (See Fig. 8-10)		250-2
	785175	Bar Assy, Penmotor 3 Channel (See Fig. 8-10)		250-3
63	11-2823-42	Pen Assembly		
63A	687477-1	Ink Tube (Analog Pen-Not Shown)		
64	11-2123-35	Interchannel Event Marker (See Fig. 8-11)		
64A	667447-3	Ink Tube (Event Marker - Not Shown)		250-2
64B	667277	Ink Tube (Event Marker - Not Shown)		250-3, 250-4
65	285357-1	Shaft		
66	785745	Shaft Assy, Supply		
67	785718	Flange Assy, Supply		
68	885748	Table Assy, Writing (See Fig. 8-17)		
69	285765-1	Lamp	DS-101,DS-102	
70	685196-1	Lampholder, Assembly		
71	685196-2	Lampholder, Assembly		
72	285764-4	Lens		
73	285764-1	Lens		
74	786393	Panel Assy, Front L.H.		
75	2-240731-10	Ring, Retaining		
76	691288	Jumper Assy (Not Shown - Connects inner surface of door Assy, item 7, and inner surface of R.H. Plate Assy, item 36.)		

*Item 62 is not procurable. Order parts from Figure 8-10 itemized parts list.

TABLE 8-1 FUSE TABLE (ITEM 16)

FUSE SYMBOL	LINE VOLTAGE & FREQUENCY			
	115V/60HZ	115V/50HZ	115V/400HZ	230V/50HZ
F101 thru F104	116198-9 3/4A, 125V	116198-10 1A, 125V	116198-9 3/4A, 125V	266924-7 1/2A, 250V
F109	116198-6 1/4A, 125V	116198-7 3/8A, 125V	116198-6 1/4A, 125V	266924-2 1/4A, 250V
F110	116198-6 1/4A, 125V	116198-6 1/4A, 125V	116198-6 1/4A, 125V	266924-4 1/8A, 250V
F111 W/1-Ink Solenoid	116198-6 1/4A, 125V	116198-6 1/4A, 125V	116198-6 1/4A, 125V	266924-4 1/8A, 250V
F111 W/2-Ink Solenoids	116198-8 1/2A, 125V	116198-8 1/2A, 125V	116198-8 1/2A, 125V	266924-2 1/4A, 250V
F112	116198-11 1.5A, 125V	116198-11 1.5A, 125V	116198-36 7A, 125V	266924-6 3/4A, 250V
F113	116198-13 3A, 125V	116198-13 3A, 125V	116198-13 3A, 125V	266924-1 1.5A, 250V

TABLE 8-2 CHASSIS ASSEMBLY TABLE (**ITEM 54**)

LINE VOLTAGE, FREQUENCY & CHART SPEED DIVISOR	CHASSIS ASSEMBLY PART NUMBER		
	4 CHANNEL	3 CHANNEL	2 CHANNEL
115V/60Hz, ÷ 100	786572	785176	786570
115V/50Hz, ÷ 100	786778	786839	786881
*115V/400Hz, ÷ 100	887097-1	887097-3	887097-2
230V/50Hz, ÷ 100	786899	786897	786895
115V/60Hz, ÷ 60	786572-1	785176-1	786570-1
115V/50Hz, ÷ 60	786778-1	786839-1	786881-1
*115V/400Hz, ÷ 60	887097-1	887097-3	887097-2
230V/50Hz, ÷ 60	786899-1	786897-1	786895-1

*NOTE: TRANSMISSION & MOTOR ASSEMBLY FOR 115V/400HZ, ÷ 100 MODELS ARE 12-2202-16 AND FOR 115V/400Hz ÷ 60 MODELS ARE 12-2203-16.

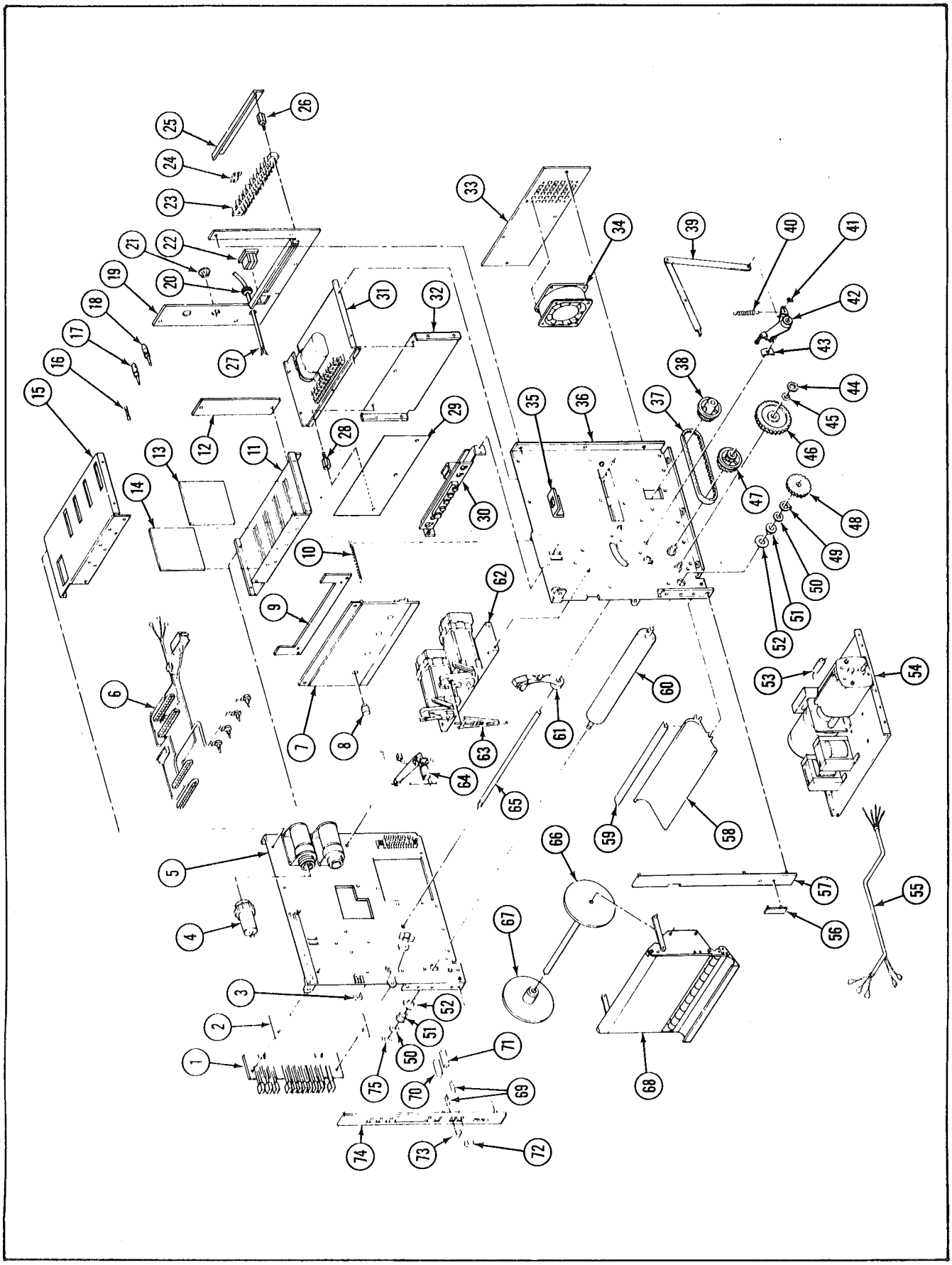


FIGURE 8-3 RECORDER ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
BOARD ASSEMBLY, SWITCH
FIGURE 8-4

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	886772	Board Assy, Switch		÷ 100 Models
	886772-1	Board Assy, Switch		÷ 60 Models
1	385804	Board Printed Circuit		
2	285758	Switch, Speed Select	S-101	
3	786080-1	Button, Switch – "POWER"		
	786080-2	Button, Switch – "STOP"		
	786080-3	Button, Switch – "5"		
	786080-4	Button, Switch – "10"		
	786080-5	Button, Switch – "25"		
	786080-6	Button, Switch – "50"		
	786080-7	Button, Switch – "100"		
	786080-8	Button, Switch – "200"		
	786080-9	Button, Switch – "÷ 100"		÷ 100 Models
	786080-10	Button, Switch – "LEFT"		
	786080-11	Button, Switch – "RIGHT"		
	786080-12	Button, Switch – "÷ 60"		÷ 60 Models
4	265763-3	Contact		

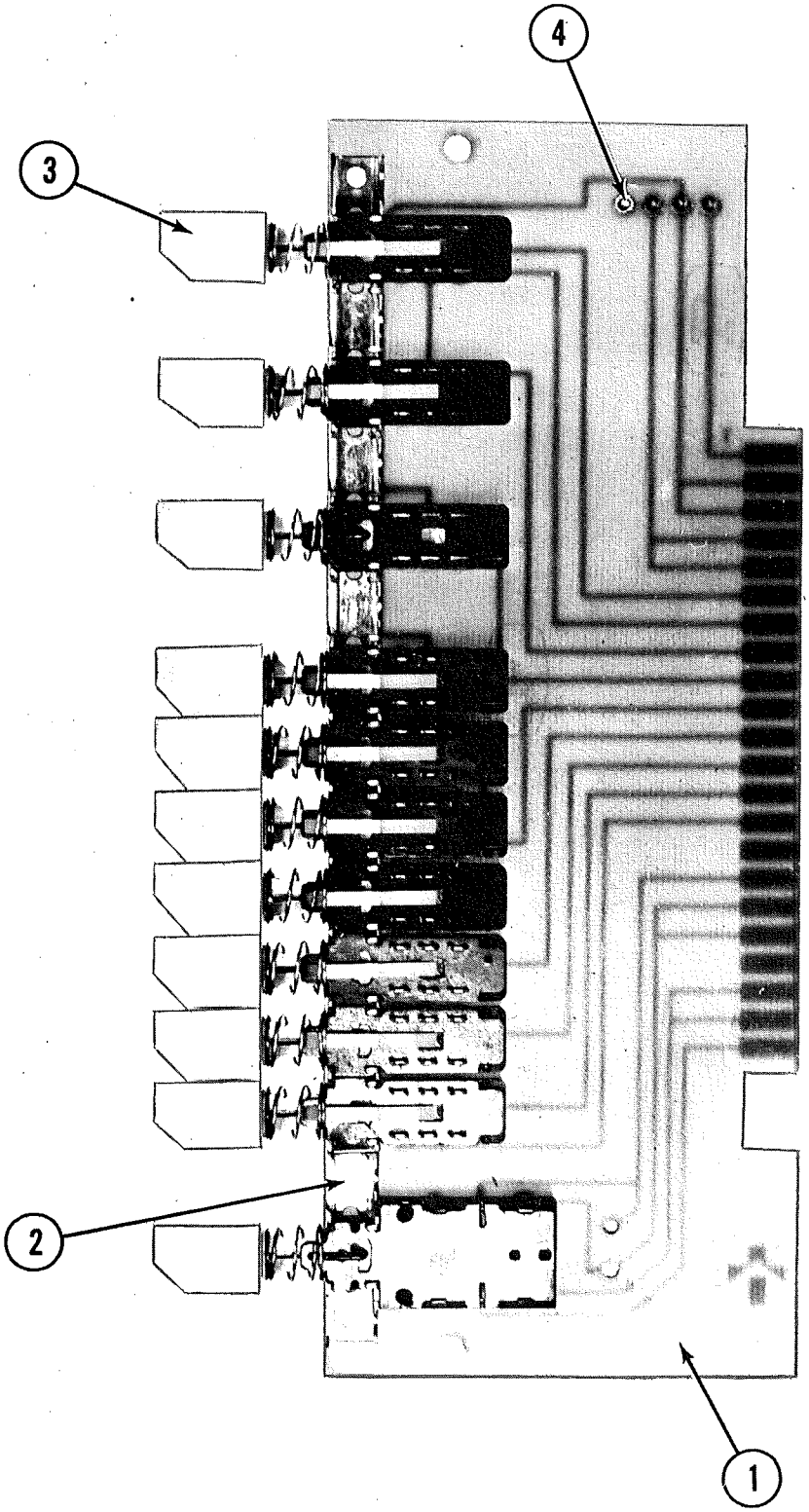


FIGURE 8-4 SWITCH BOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
PLATE ASSEMBLY, L.H.
FIGURE 8-5

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	885098	Plate Assembly, L.H.		250-3 & 4
	885098-1	Plate Assembly, L.H.		250-2
1	385619	Bracket, Connector		
2	1-265849-4	Bracket		
**3	885046	Plate Subassy		
4	385543-2	Guide		
5	766243	Ink Plunger Assy		
5A	766243	Ink Plunger Assy		250-3 & 4
6	2-128693-3	Grommet		
7	243622	Pad, Friction		
8	243623	Spring		
9	243611-910	Lever Assy		
9A	243440	Bumper		
9B	265711	Catch		
10	285929	Bracket, L.H.		
11	285599	Catch		
12	127271	Washer		
13	1-227070-9	Ring, Retaining		
14	286015-1	Filter, RFI	FL101	
15	265814-6	Terminal Board	TB102	

**Items 9A and 9B part of item 3.

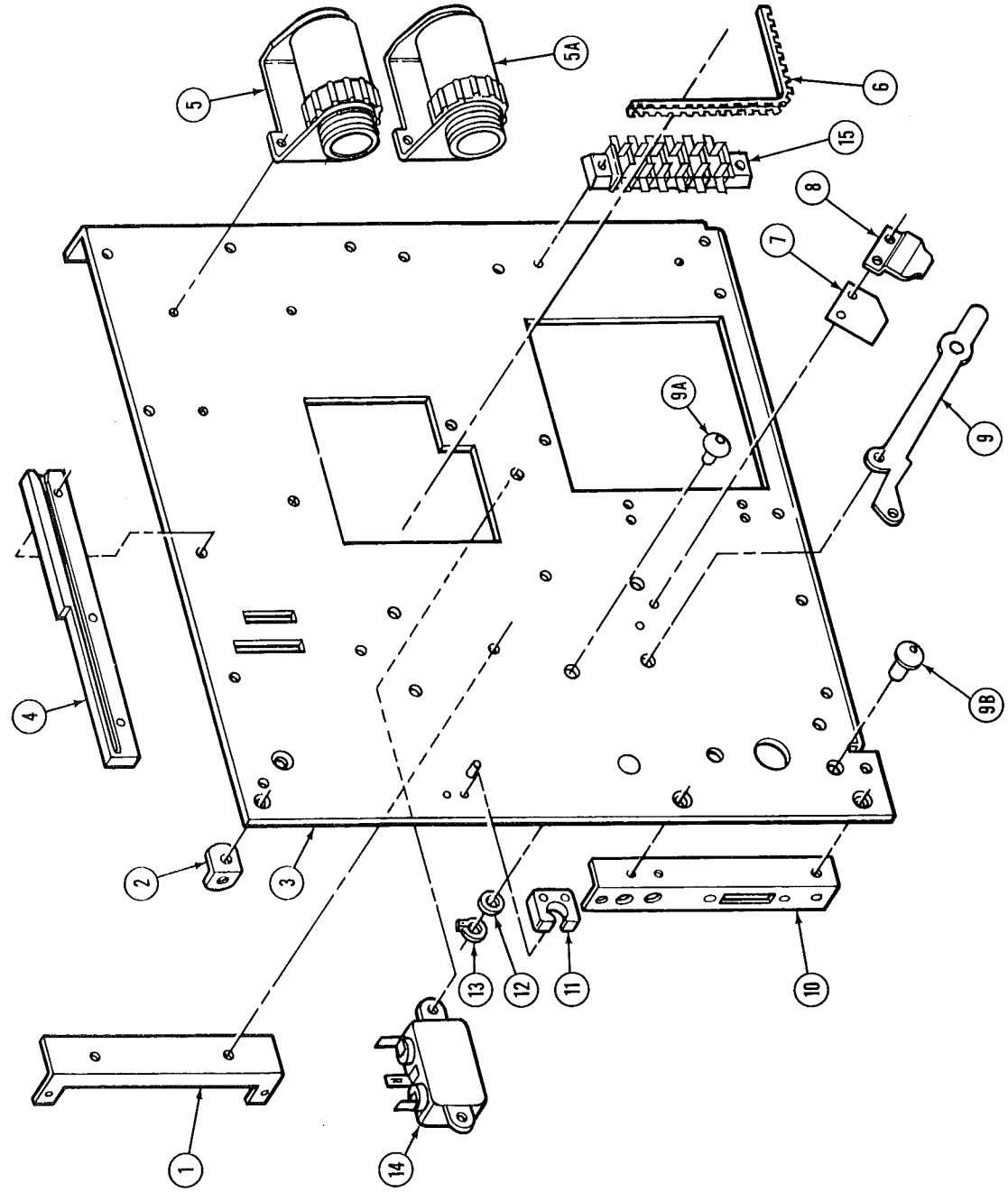


FIGURE 8-5 L. H. PLATE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
CONNECTOR ASSEMBLY – 250mm MAINFRAME
FIGURE 8-6

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
	885291	Connector Assy - 4 Channel		250-4
	886771	Connector Assy - 3 Channel		250-3
	886773	Connector Assy - 2 Channel		250-2
1	785087	Harness Assy, Penmotor		
2	9-281501-82	Connector	XM-101-XM-104	
3	281506-3	Contact, Electrical		
4	1-283408-2	Contact, Electrical		
5	885261	Harness Assy, Switchboard		
6	283420-44	Connector	XA-101-104, XA-109, 110	
7	265840-1	Terminal Lug		
8	270160-1	Terminal Lug		
9	265915-1	Terminal Lug		
10	785089	Harness Assy, Power Xfmr		
11	885274	Harness Assy, Pen Position		250-2
	885282	Harness Assy, Pen Position		250-3
	885095	Harness Assy, Pen Position		250-4
12	10-286044-103	Resistor, Variable	R-101-104	
13	887399	Harness Assy, Drive Amp		250-2
	886602-2	Harness Assy, Drive Amp		250-3
	886602-3	Harness Assy, Drive Amp		250-4
14	9-270159-2	Connector	P-105, 106	
15	270154-1	Contact, Electrical		
16	1-283408-1	Contact, Electrical		
	1-283408-2	Contact, Electrical (use on teflon wire only)		
17	286598	Commoning Spring (Jumper)		
18	286594-1	Terminal Lug		
19	0-270156-1	Connector	J-103	

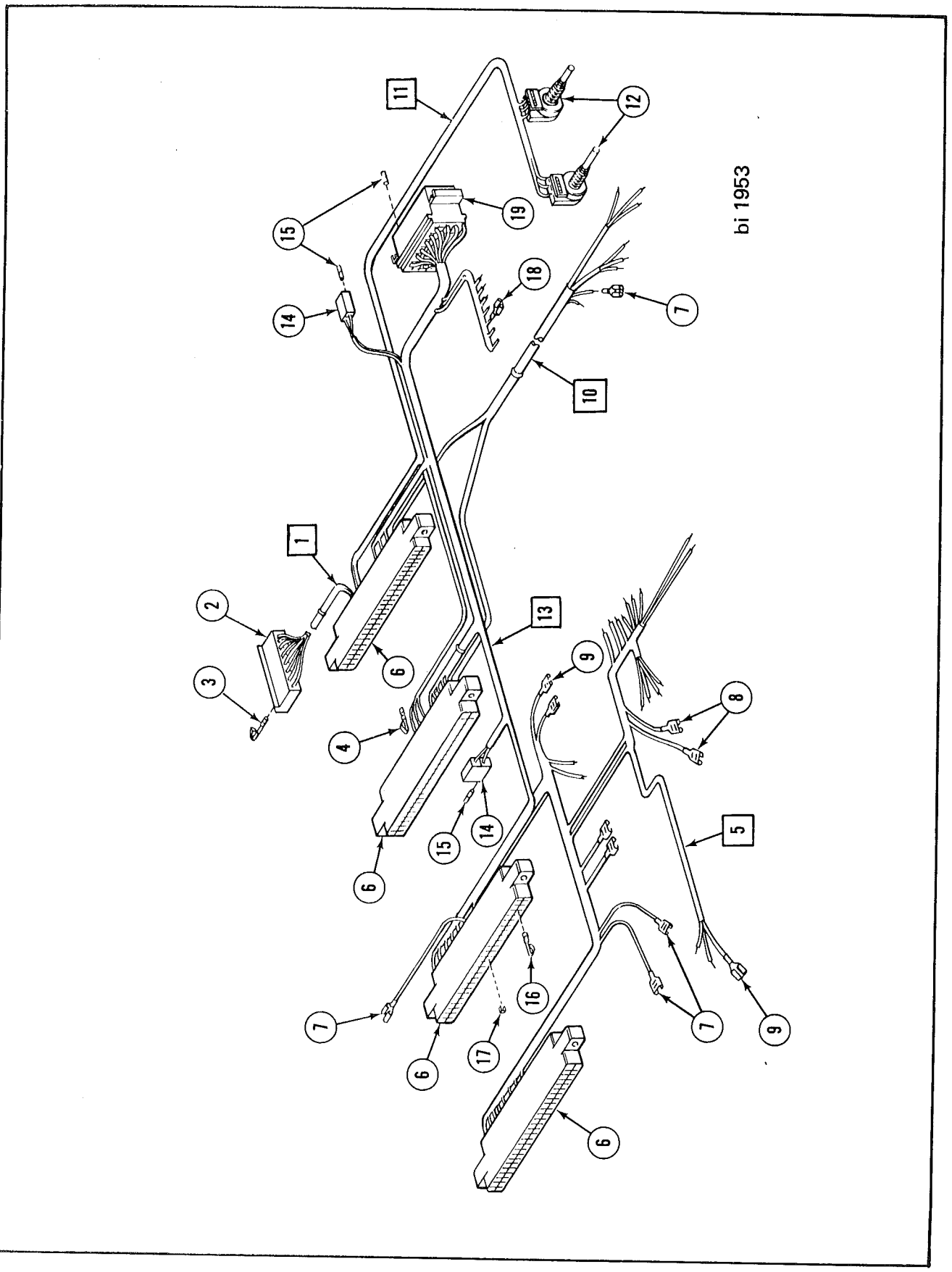


FIGURE 8-6 CONNECTOR ASSEMBLY

ELECTRICAL PARTS LIST
2400 SERIES RECORDER – All Models
CONTROL-TIMER BOARD ASSEMBLY – 886327 (Schematic 292274)
FIGURE 8-7

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C101, 102	243037-507	Capacitor
C103	262585-106	Capacitor
C104	240352-102	Capacitor
C105	262585-475	Capacitor
C106	230098-104	Capacitor
CR101	286018-2	Diode, MDA104
CR102, 103	286018-1	Diode, MDA101
CR104	Not Used	
CR105, CR106	269256-7	Diode, 1N4007
CR123	280440	Diode, 1N4148
Jumper	267235	Jumper Circuit
K101	289048-24	Relay
Q101,102,104	292538-2	Transistor, 2N6427
R101, 102	5-241111-302	Resistor
R103	5-241111-242	Resistor
R104, 105	5-241111-103	Resistor
R106	5-241111-271	Resistor
R107	5-241111-103	Resistor
R108	5-241111-302	Resistor
S103	268923	Switch (A-P)
	285179	Switchplate
	31-119918-4004	Screw
	1-118195-304	Washer, Plain
	1-216741-411	Lockwasher
	------ * ------	
S104	286142-8	Switch
U101	285317	Voltage Regulator, MC7805CP (A-P)
	31-119918-4004	Screw
	------ * ------	
U102 thru U105	270622	Integrated Circuit, 7493
U106	286016	Integrated Circuit, SN74121
U107	285589	Isolator, Led, 4N28
HS	686397	Heatsink (A-P)
	31-119918-4004	Screw
	1-118195-304	Washer, Plain
	1-216741-411	Lockwasher
	------ * ------	
FC	285577	Fuse Clip

NOTE: See Table 8-1, Fuse Table, for fuse ratings.

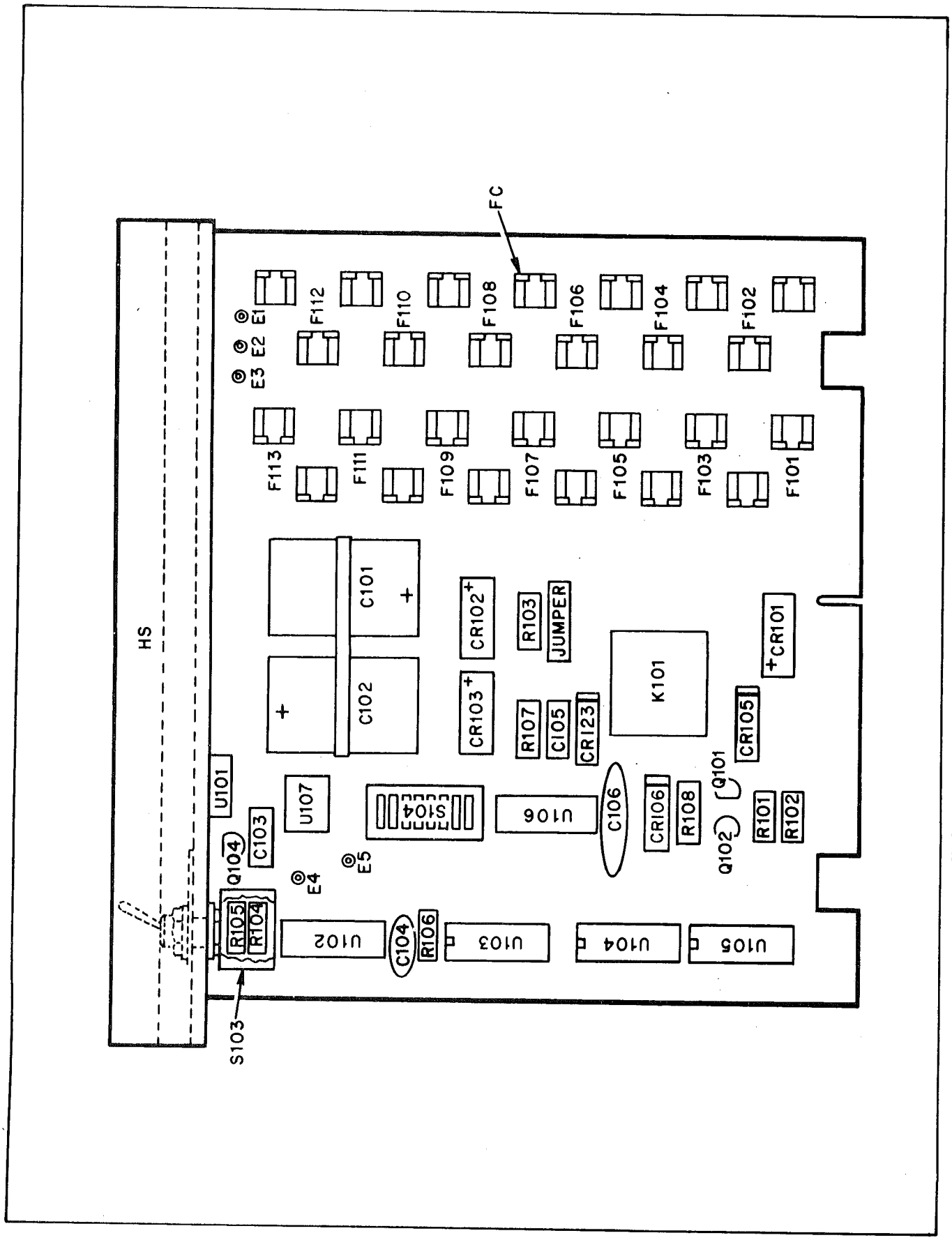


FIGURE 8-7 CONTROL TIMER BOARD ASSEMBLY

ELECTRICAL PARTS LIST
2400 SERIES RECORDER – All Models
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220 (Schematic 292273)
FIGURE 8-8

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
C201	10-125904-223	Capacitor	
C202	10-247116-102	Capacitor	
C203, 204	10-247116-102	Capacitor	
C205	240352-501	Capacitor	
C206	10-247116-103	Capacitor	
C207	240352-501	Capacitor	
C208	262585-106	Capacitor	
C209	10-247116-103	Capacitor	
C210, 211	10-247116-102	Capacitor	
C212	240352-202	Capacitor	
C213	10-125904-503	Capacitor	
C214	10-125904-223	Capacitor	
C215	281509-507	Capacitor	
C216	262585-106	Capacitor	
C217	281509-507	Capacitor	
C218	262585-106	Capacitor	
C219-222	286010-108	Capacitor	
C223	288755-104	Capacitor	
CR201, 202	263727	Diode, 1N961B	
CR203-208	270508	Diode, 1N4454	
CR209, 210	286018-1	Diode, MDA-101	
CR211	269256-7	Diode, 1N4007	
CR212	270508	Diode, 1N4454	
Q201	281703-2	Transistor, 2N4403	
Q202	281702-2	Transistor, 2N4401	
Q203-205	286141	Transistor, 2N3904	
Q206	1-230057-3	Transistor, 2N4923	
Q207	1-286145-1	Transistor, 2N5982 (A-P)	
	31-119918-4005	Screw	
		------ * ------	
Q208	1-230058-3	Transistor, 2N4920	
Q209	1-286147-1	Transistor, 2N5985 (A-P)	
	31-119918-4005	Screw	
		------ * ------	
Q210	281857-2	Transistor, 2N5033	
R201	1-281851-30002	Resistor	
R202	1-281851-1002	Resistor	
R203	1-281851-43201	Resistor	
R204	1-281851-10002	Resistor	

ELECTRICAL PARTS LIST
2400 SERIES RECORDER – All Models
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220 (Schematic 292273)
FIGURE 8-8

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
R205	282299-103	Resistor
R206, 207	1-281851-69000	Resistor
R208	282299-103	Resistor
R209	282299-202	Resistor
R210	1-281851-200R0	Resistor
R211	1-281851-10002	Resistor
R212, 213	1-281851-10001	Resistor
R214	1-281851-16601	Resistor
R215, 216	1-281851-10000	Resistor
R217, 218	1-281851-80000	Resistor
R219	1-281851-72001	Resistor
R220	1-281851-40000	Resistor
R221	1-281851-80001	Resistor
R222	1-281851-40001	Resistor
R223, 224	5-241111-622	Resistor
R225	5-241111-392	Resistor
R226, 227	1-281851-50001	Resistor
R228	1-281851-10002	Resistor
R229	1-281851-60001	Resistor
R230	1-281851-60000	Resistor
R231	282299-502	Resistor
R232	1-281851-500R0	Resistor
R233	1-281851-10003	Resistor
R234	1-281851-26501	Resistor
R235	5-241111-104	Resistor
R236	5-241111-203	Resistor
R237	5-241111-822	Resistor
R238	5-241111-102	Resistor
R239, 240	5-241111-202	Resistor
R241	5-241111-391	Resistor
R242	5-241111-102	Resistor
R243	5-286587-181	Resistor
R244	5-283654-220	Resistor
R245	5-286587-181	Resistor
R246	5-241111-102	Resistor
R247	1-281851-20001	Resistor
R248	1-281851-500R0	Resistor
R249, 250	1-281851-80000	Resistor
R251	5-241111-104	Resistor
R252, 253	5-241111-103	Resistor

ELECTRICAL PARTS LIST
2400 SERIES RECORDER – All Models
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220 (Schematic 292273)
FIGURE 8-8 (Continued)

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
R254	1-281851-16001	Resistor
R255	1-281851-50000	Resistor
R256	5-241111-101	Resistor
R257	1-281851-20001	Resistor
R258	Not Used	
R259	1-282851-40001	Resistor
R260	282299-103	Resistor
R261	Not Used	
R262	5-241111-104	Resistor
R263, 264	5-130340-2R0	Resistor
R265	5-241111-822	Resistor
U201-204	280863-3	Integrated Circuit, 741C
U205	269941-2	Integrated Circuit, 1439P1
U206	280863-3	Integrated Circuit, 741C
U207	285461	Voltage Reg., MC 7815
		(A-P)
	31-119918-4005	Screw
		------ * ------
U208	285778	Voltage Reg., MC 7915
		(A-P)
	31-119918-4005	Screw
		------ * ------
U209, 210	Not Used	
U211	285589	Isolator, LED, 4N28
HS	686391	Heatsink
		(A-P)
	31-119918-4005	Screw
	1-118195-304	Washer
	1-216741-411	Lockwasher
		------ * ------
---	685187	Jack Assembly
J201	285315	Jack
J202	289045	Jack
		(A-P)
	1-120052-211	Lockwasher
		------ * ------
E1 thru E4	265763-3	Contact

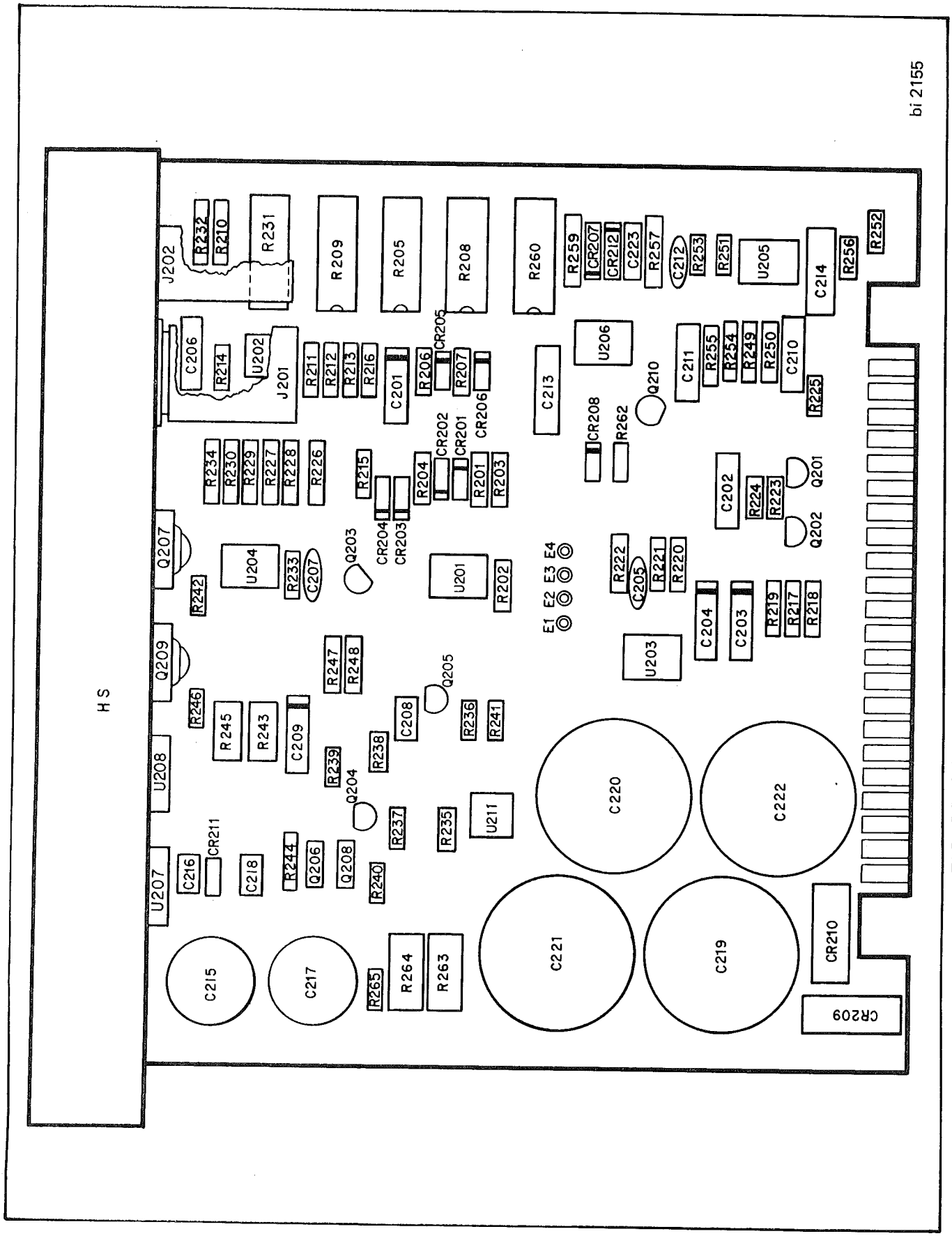


FIGURE 8-8 DRIVE AMPLIFIER BOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
BRACKET ASSEMBLY, SHIELD
FIGURE 8-9

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	886667	Bracket Assy, Shield		60Hz Models
	886921	Bracket Assy, Shield		50Hz Models
	887098	Bracket Assy, Shield		400Hz Models
1	263394-1	Clamp, Capacitor		
2	1-263395-405	Capacitor, 4µfd	C-106	60Hz Models
	1-263395-505	Capacitor, 5µfd	C-106	50Hz Models
	1-263395-205	Capacitor, 2µfd	C-106	400Hz Models
3	2-128693-1	Grommet, Catapillar		
4	386029	Bracket, Shield		50/60Hz Models
	387227	Bracket, Shield		400Hz Models
5	265814-15	Terminal Board, Q.D.	TB-103	
6	281852-563	Capacitor, .056µfd (Not Shown)	C-107	400Hz Models
7	234623-16	Clamp (Not Shown)		400Hz Models
8	265814-3	Terminal Board (Not Shown)	TB-105	400Hz Models

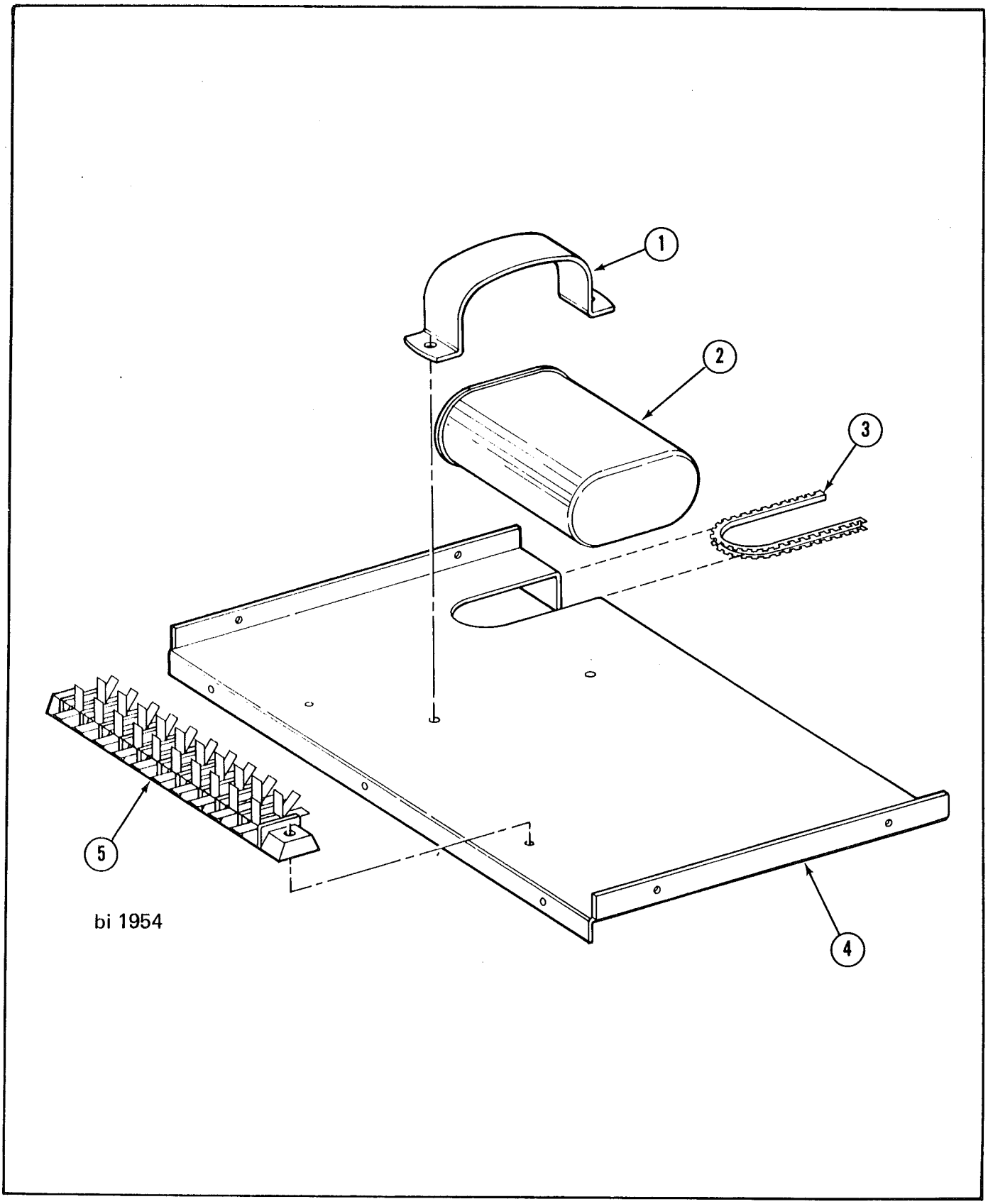


FIGURE 8-9 BRACKET ASSEMBLY, SHIELD

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
BAR ASSEMBLIES, PENMOTOR – 250mm MAINFRAME
FIGURE 8-10

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
	785171	*Bar Assy, Penmotor - 2 Channel		250-2
	785175	*Bar Assy, Penmotor - 3 Channel		250-3
	785169	*Bar Assy, Penmotor - 4 Channel		250-4
1	884320	Penmotor Assembly	M-101-104	
2	287184	Shield		250-3&-4
3	2-128693-1	Grommet		
4	385704	Bar, Penmotor		
5	684853	Saddle, Penmotor		
6	384597	Stop (A-P)		
	31-119918-4008	Screw		
	1-118195-304	Washer		
		------ * ------		
7	684896	Band Clamp, Rear (A-P)		
	265424-09010	Screw		
	284924	Plate, Nut		
		------ * ------		
8	285273	Anchor, Band		
9	684999	Band, Drive		
10	284993	Bracket, Pen (A-P)		
	31-119914-0004	Screw		
	241073-0803	Set Screw (Pen Adjust		
		------ * ------		
11	784583	Drive Arm Assembly (A-P)		
	31-119922-2608	Screw		
	31-119998-26	Nut, Hex		
		------ * ------		
12	684896	Band Clamp, Extrusion (A-P)		
	265424-09008	Screw		
		------*------		
13	284924	Plate, Nut		

*Penmotor Bar Assemblies not procurable, use item 1 thru 13 and attaching parts, (A-P).

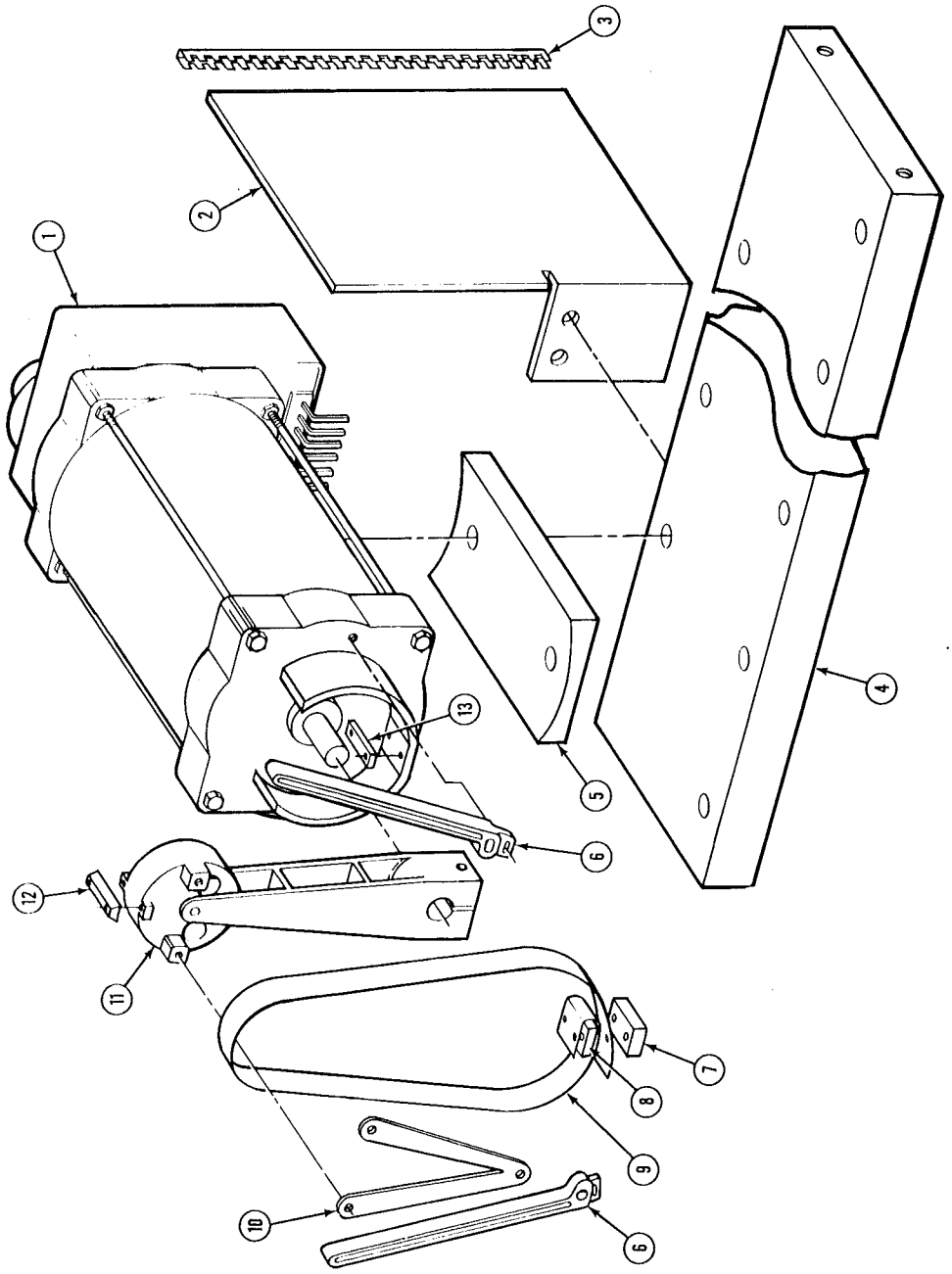


FIGURE 8-10 BAR ASSEMBLY, PENMOTOR

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
*INTERCHANNEL EVENT MARKER–11-2123-35(Including Harness)
FIGURE 8-11

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	887181	Interchannel Event Marker Assy (less harness)		
1	286619	Nut, Plate		
2	Not Used			
3	786658	Bracket Assy		
4	270153-1	Contact		
5	9-270158-2	Connector, Plug	J-105 thru J-109	
6	269256-7	Diode	CR-114 thru CR-118	
7	3-227070-2	Ring, Retaining		
8	385930	Pivot, Pen		
9	286416	Spring, Helical		
10	249249-14	Pin		
11	260742-1	Washer, Flat		
12	286415	Solenoid	L-108 thru L-112	
13	267884-5	Tube, Pen		
14	241073-0803	Screw, Set		
15	285166	Bracket, Pen Pressure		

* Model 11-2133-35 includes harness for 3 event markers plus one interchannel event marker (887181).

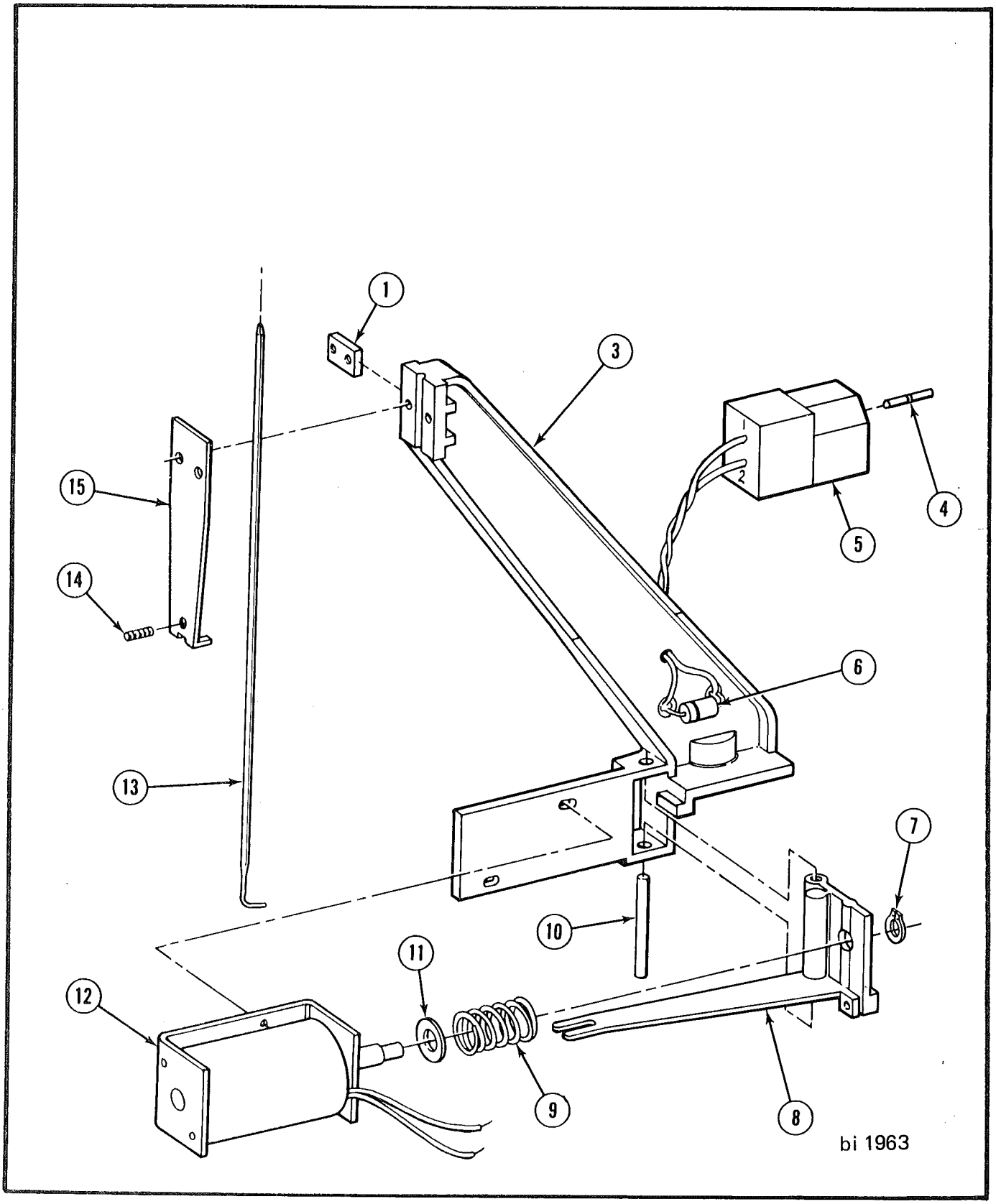


FIGURE 8-11 INTERCHANNEL EVENT MARKER

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER –All Models
BRAKE ASSEMBLY 683485
FIGURE 8-12

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
1	685127	Disk Assy		
2	269291	Spring		
3	0-108400-15	Insulation, Flex Sleeve		
4	743913-10	Arm Subassy		
5	0-240731-2	Ring, Retaining		

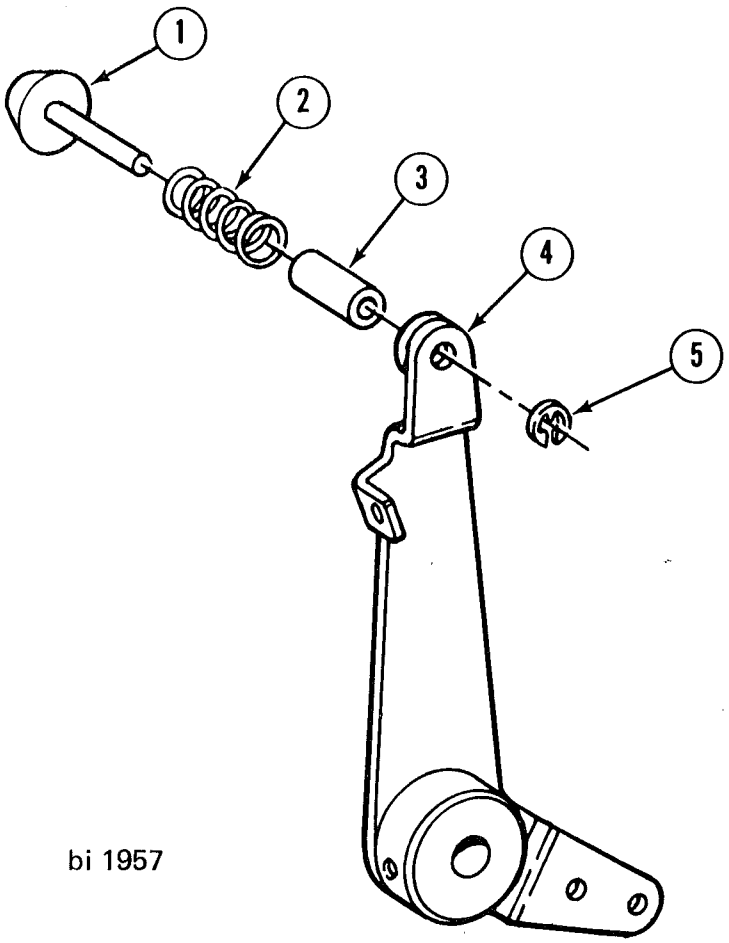


FIGURE 8-12 BRAKE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
PLATE ASSEMBLY, R.H.
FIGURE 8-13

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	885083	Plate Assembly, R.H.	250-3 & 4
	885083-6	Plate Assembly, R.H.	250-2
1	385543-1	Guide	
**2	886560	Plate Subassy	250-3 & 4
	886560-5	Plate Subassembly	250-2
3	286130	Bracket, Connector	
4	286186	Shaft	
5	286184	Shaft	
6	285712	Bracket, R.H.	
7	265711	Catch	
8	1-227070-9	Ring, Retaining	
9	127271	Washer	
10	243898-62	Nut Assy	
11	243622	Pad, Friction	
12	243623	Spring	
13	665789	Lever Assy, R.H.	
14	285599	Catch	
15	1-265849-4	Bracket	

**Items 4, 5 & 7 part of item 2.

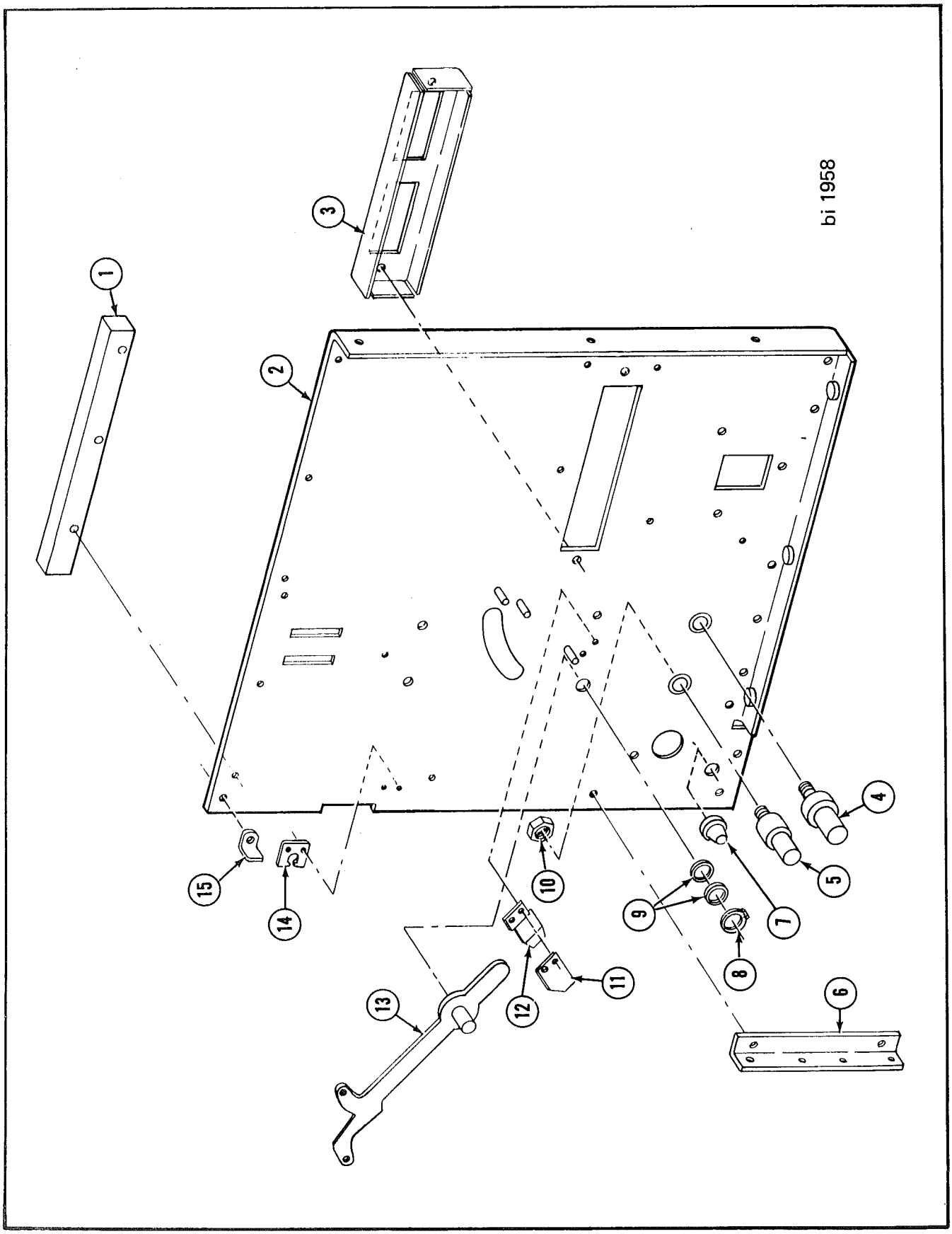


FIGURE 8-13 R.H. PLATE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
SENSOR ASSEMBLY
FIGURE 8-14

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	783590	Sensor Assembly		
1	286154	Switch, Sensitive	S-102	
2	286386	Arm Switch		
3	743915	Arm Assy, Sensor		
4	286385	Spring, Torsion		
5	286384	Pin		

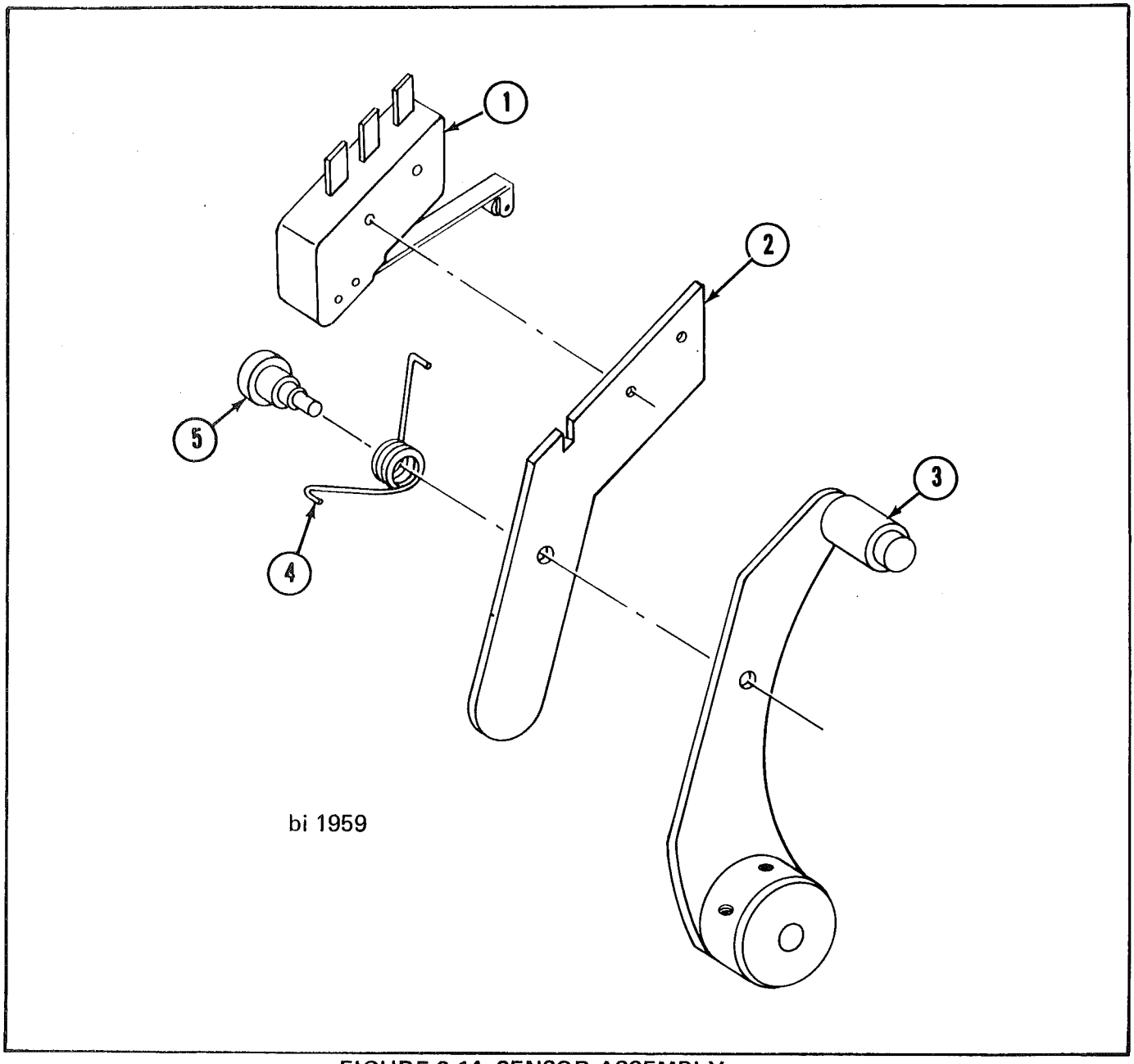


FIGURE 8-14 SENSOR ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
*CHASSIS ASSEMBLIES – 250 MM MAINFRAME (See Table 8-2)
FIGURE 8-15

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
*1	785129	Drive Assy, 115V/60Hz – 100 (See Fig. 8-16)		
	785129-1	Drive Assy, 115V/60Hz – 60 (See Fig. 8-16)		
	786837	Drive Assy, 115V/50Hz – 100 (See Fig. 8-16)		
	786837-1	Drive Assy, 115V/50Hz – 60 (See Fig. 8-16)		
	786886	Drive Assy, 230V/50Hz – 100 (See Fig. 8-16)		
	786886-1	Drive Assy, 230V/50Hz – 60 (See Fig. 8-16)		
2	265814-4	Board, Terminal	TB-104	
3	286484	Bracket		
4	486072	Chassis		
5	286026	Transformer, Power	T-101 thru T-104	
6	286024	Transformer, Control	T-109	

*Chassis Assemblies and Drive Assemblies are not procurable. For Chassis parts order from items 2 thru 6 on this page, and for drive assy parts refer to Figure 8-16 parts list.

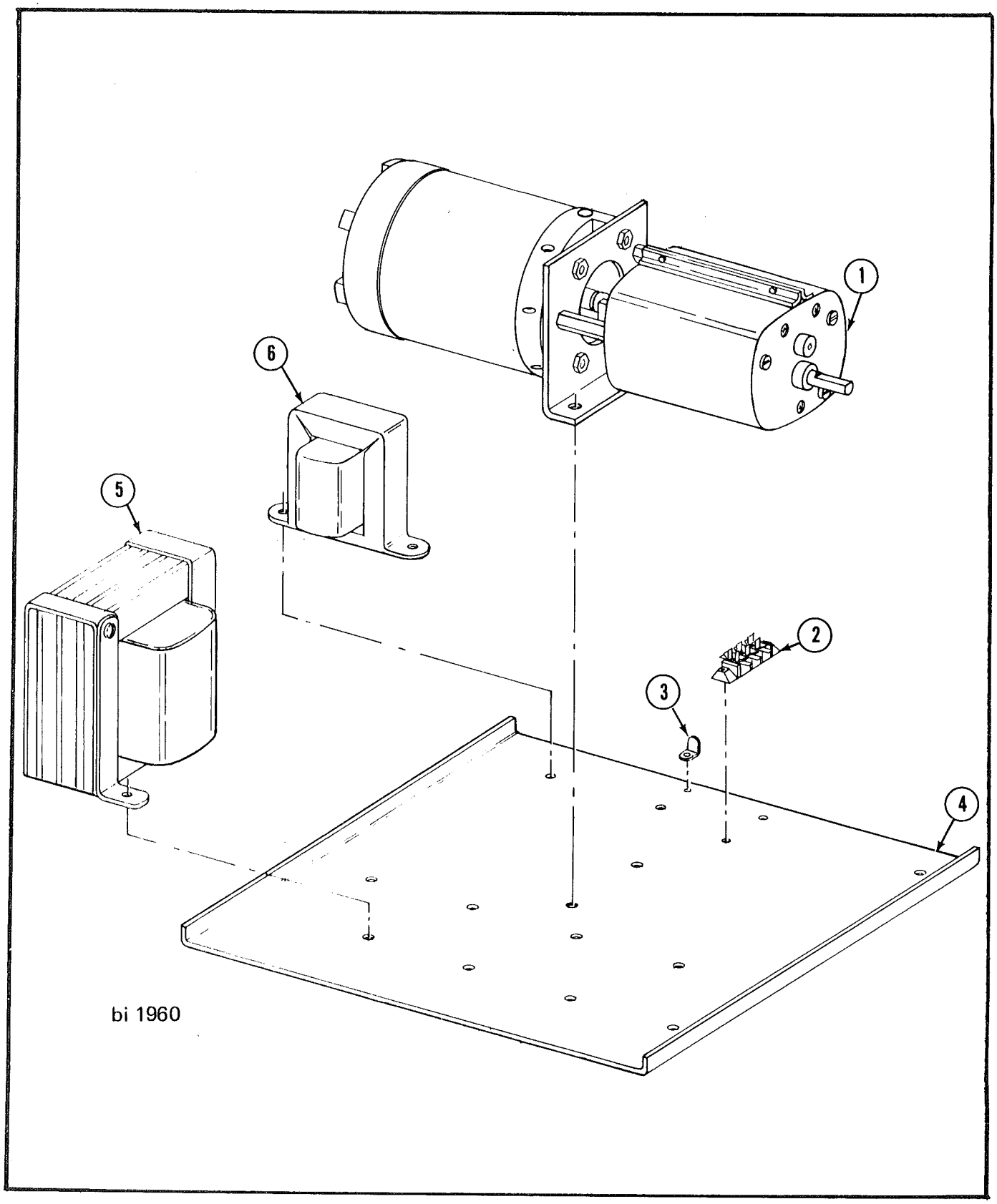


FIGURE 8-15 CHASSIS ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Models
DRIVE ASSEMBLIES – 250 mm MAINFRAME
FIGURE 8-16

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	*785129	Drive Assembly		
	*785129-1	Drive Assembly		
	*786837	Drive Assembly		
	*786837-1	Drive Assembly		
	*786886	Drive Assembly		
	*786886-1	Drive Assembly		
	**12-2202-16	Transmission & Motor Assy (115V/400Hz, ÷ 100 Models)		
	**12-2203-16	Transmission & Motor Assy (115V/400Hz, ÷ 60 Models)		
1	12-2158-16	Transmission Assy – 16SPD (60Hz, ÷ 100 Models)	A-111	
	12-2160-16	Transmission Assy – 16SPD (60Hz, ÷ 60 Models)	A-111	
	12-2159-16	Transmission Assy – 16SPD (50Hz, ÷ 100 Models)	A-111	
	12-2161-16	Transmission Assy – 16SPD (50Hz, ÷ 60 Models)	A-111	
2	127913	Coupling, Universal		
3	127911	Post		
4	123695	Core, Coupling		
5	127912	Coupling, Universal		
6	385617	Bracket, Motor Mounting		
7	232997-23	Strap, Retaining		
8	265840-2	Terminal Lug		
9	387919	Motor, 115V/60Hz	B-101	
	287170	Motor, 115V/50Hz	B-101	
	267590	Motor, 230V/50Hz	B-101	

*Drive assemblies are not procurable. Order desired parts from itemized list on this page.

**This model not exploded.

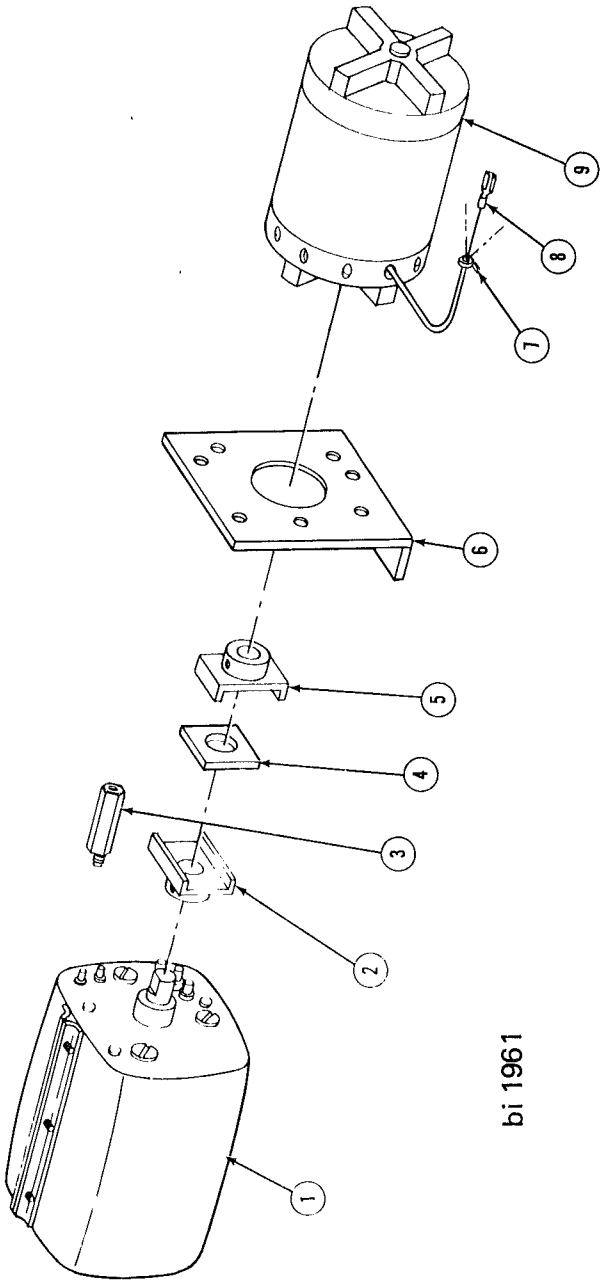


FIGURE 8-16 DRIVE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER — All Models
TABLE ASSEMBLY, WRITING
FIGURE 8-17

ITEM NO	PART NUMBER	DESCRIPTION
	885748	Table Assembly, Writing
1	785703	Bar Assy, Writing
2	785746	Paper Release Assy
3	343616-910	Support Assy, Right
4	4-112468-21	Roll Pin
5	1-210761-6	Bearing, Ball
6	285618	Roll, Pressure
7	685620	Bar Subassy, Pull
8	243867-1	Packing, Preformed
9	343617-910	Support Assy, Left

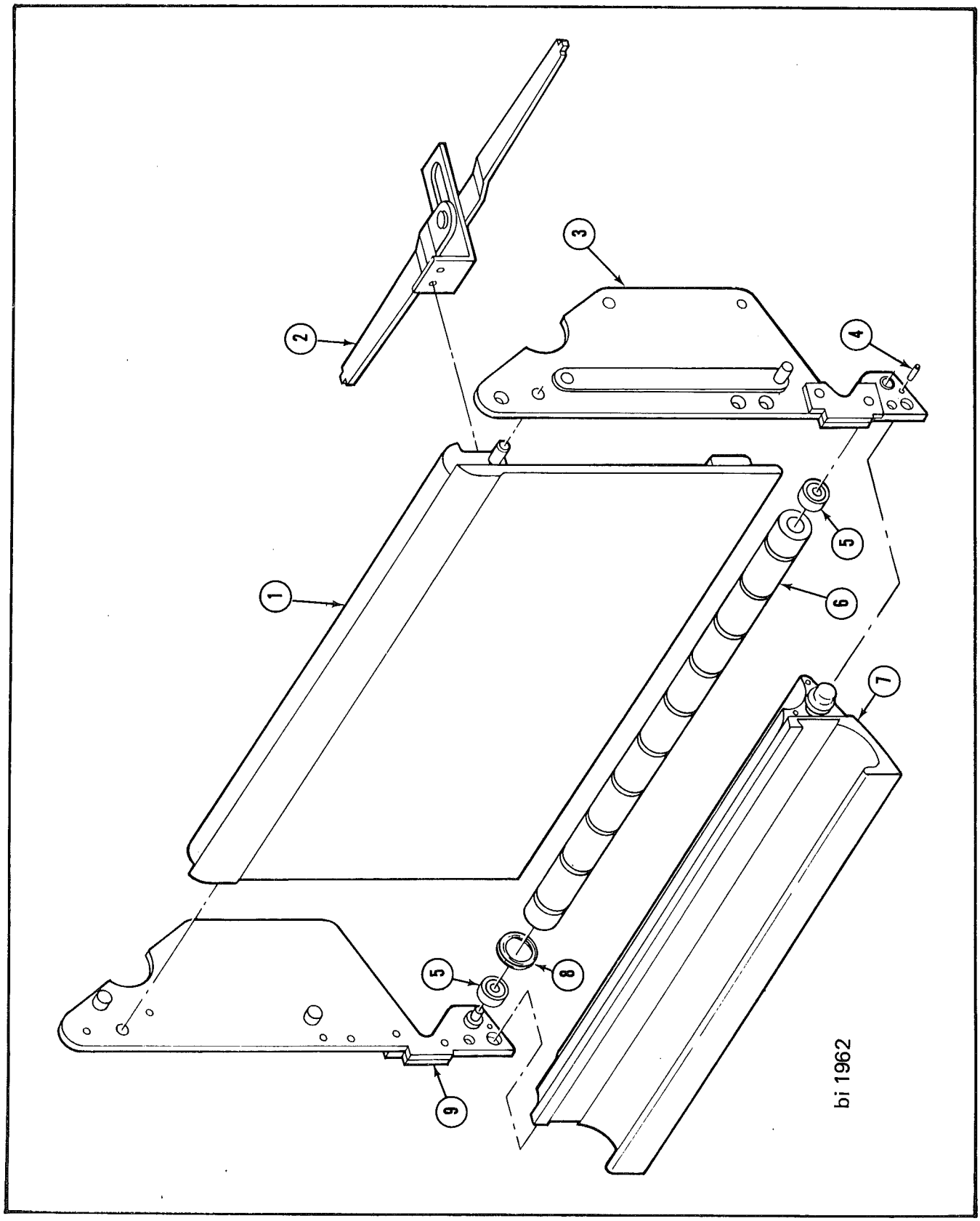


FIGURE 8-17 TABLE ASSEMBLY, WRITING

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All Portable Models
CASE ASSEMBLY 2, 3 & 4 CHANNEL
FIGURE 8-18

ITEM NO	PART NUMBER	DESCRIPTION	USED ON
	886569	Case Assembly (w/o Preamps)	250-2, 3 & 4
	886492	Case Assembly (w/2 Ch Preamp Cage)	250-2P
	886399	Case Assembly (w/4 Ch Preamp Cage)	250-3P & 4P
1	486081	Panel	
2	785099-3	Handle Assy	250-2, 3 & 4
	785099-2	Handle Assy	250-2P
	785099-1	Handle Assy	250-3P & 4P
3	686049-3	Cover, Center	250-2, 3 & 4
	686049-2	Cover, Center	250-2P
	686049-1	Cover, Center	250-3P & 4P
4	286048	Support, Handle	
5	486075-2	Guide, Left	
6	486075-1	Guide, Right	
7	686051-3	Cover, Front & Rear	250-2, 3 & 4
	686051-2	Cover, Front & Rear	250-2P
	686051-1	Cover, Front & Rear	250-3P & 4P
8	1-232736-16	Tape, Teflon	
9	4-266107-5	Bail Assy	250-2, 3, 4 & 2P
	267451-5	Bail Assy	250-3P & 4P
10	485177	Saddle, Recorder	250-2, 3 & 4
	886474	Saddle, Recorder	250-2P
	886060	Saddle, Recorder	250-3P &4P
11	287185	Bar, Support	
12	292817-1	Spacer	250-2P
	292817-2	Spacer	250-3P & 4P

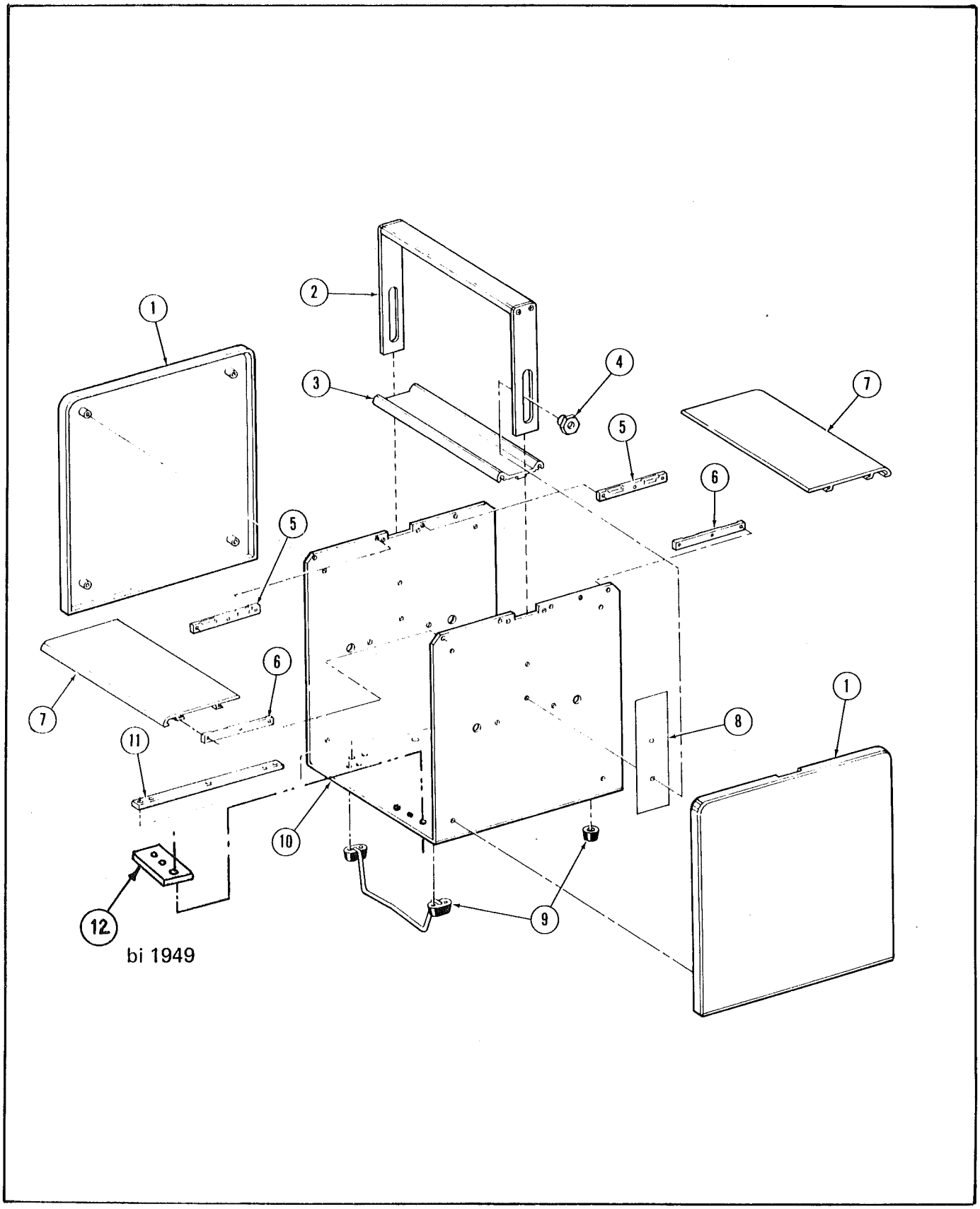


FIGURE 8-18 CASE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – ALL MODELS
CAGE ASSEMBLY, PREAMP
FIGURE 8-19

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
	888321	Cage Assy, Preamp, 2 Channel		250-2P
	886400	Cage Assy, Preamp, 3 & 4 Channel		250-3P & 4P
1	786056-1	Guide, Engraved "1"		
	786056-2	Guide, Engraved "2"		
	786056-3	Guide, Engraved "3"		
	786056-4	Guide, Engraved "4"		
2	386058-2	Guide, Preamp		
3	386476	Shelf		250-2P
	386059	Shelf		250-3P & 4P
4	486461	Enclosure, Preamp		250-2P
	486061	Enclosure, Preamp		250-3P & 4P
*5	788280	Cage Assy- Rear		250-2P
	786567	Cage Assy - Rear		250-3P & 4P
6	286052	Screw, Shoulder		
7	786475	Panel Assy, Rear		250-2P
	786055	Panel Assy, Rear		250-3P & 4P
8	234623-6	Clamp, Loop		
9	3-240731-10	Ring, Retaining		
10	787422	Harness Assy		250-2P
	885131-1	Harness Assy		250-3P & 4P
11	286410-16	Connector	XA-201, 202 203, 204	
12	1-283408-2	Contact, Electrical (for item 11)		
13	270153-1	Contact, Electrical (for item 14)		
14	0-270155-1	Connector	P-203	250-3P & 4P
	9-270158-15	Connector	P-203	250-2P

*Item 5, Cage Assemblies-Rear, not available. Use idented items 6 thru 14 or appropriate Cage Assy at top of list.

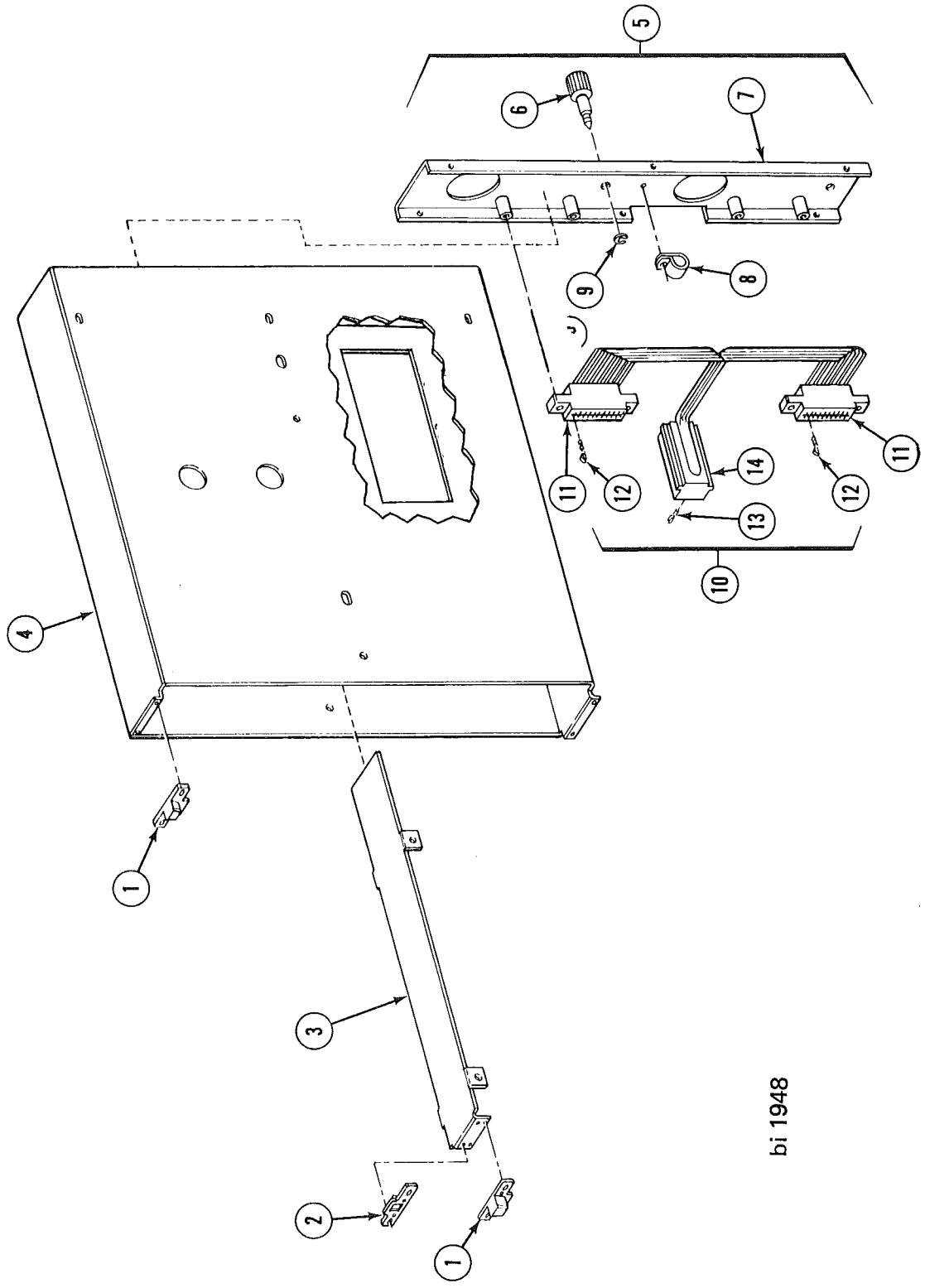


FIGURE 8-19 CAGE ASSEMBLY

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDERS
RACK MOUNT INSTALLATION INSTRUCTIONS – RECORDER ONLY (687330)
FIGURE 8-20

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-4X90-XX	Recorder Assy
2	31-119998-02	Nut
3	1-216741-430	Lockwasher
4	287011	Bracket
5	31-119918-0208	Screw
6	31-119998-82	Nut
7	1-216741-425	Lockwasher
8	269569-1	Slides, Pair
9	287148	Nut Plate
10	31-119918-8206	Screw
11	287153	Spacer
12	31-119920-0208	Screw
13	887154	Saddle Assy
14	13-262716-4004	Screw
15	387145	Bracket
16	787144	Panel Assy, Front
17	248352-0218	Screw
18	245244-02	Nut
19	11-1202-11	Kit Assy, Rack (includes items 2 thru 18 plus 20).
20	287653	Spring, Rack Lock
	269569-2	*Front Bracket (Part of item 8)
	269569-3	*Rear Bracket (Part of item 8)
	269569-4	*Nut Bar (Part of item 8

* Order Separately

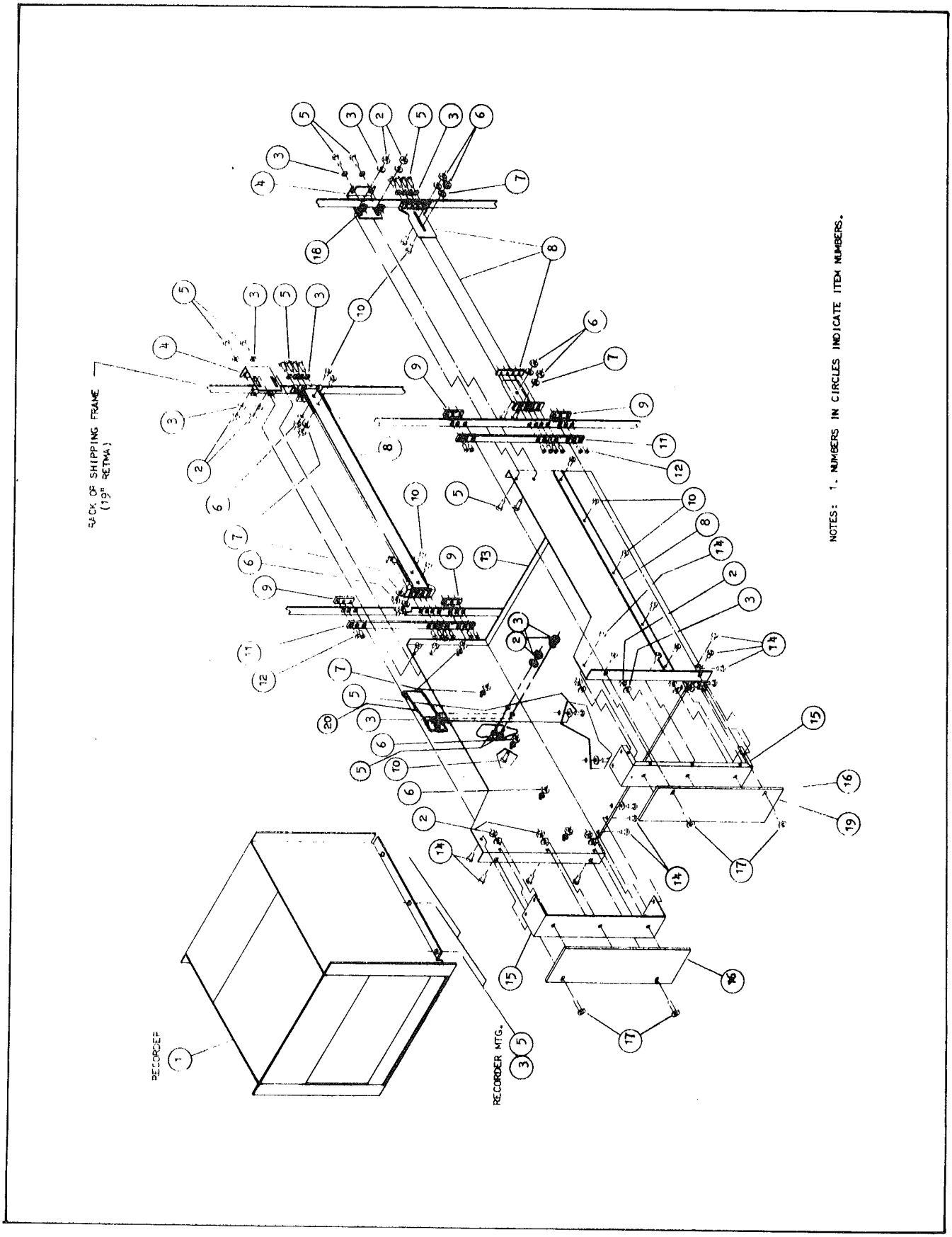


FIGURE 8-20 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER ONLY (687330)

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER
RACK MOUNT INSTALLATION INSTRUCTIONS – Recorder with 2 Channel Preamp Cage (687363)
FIGURE 8-21

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-4290-XX	Recorder Assy
2	287083	Bracket, Angle
3	31-126906-405	Screw
4	13-262716-4004	Screw
5	10-120053-101	Lockwasher
6	287084	Plate, Support
7	888321	Cage Assy
8	31-119918-8204	Screw
9	1-216741-425	Lockwasher
10	1-118195-307	Washer
11	13-262716-8204	Screw
12	10-120053-103	Lockwasher
13	1-216741-430	Lockwasher
14	31-119998-02	Nut
15	31-119998-82	Nut
16	269569-1	Slides, Pair
17	31-119918-8206	Screw
18	287148	Nut Plate
19	287153	Spacer
20	31-119920-0208	Screw
21	269548-1	Spacer
22	31-119918-0208	Screw
23	887089	Saddle Assy
24	31-119918-6204	Screw
25	1-216741-420	Lockwasher
26	1-265849-4	Bracket
27	787146	Panel Assy, Front
28	248352-0218	Screw
29	245244-02	Nut
30	287011	Bracket
31	11-1202-12	Kit Assy, Rack (includes items 2 thru 6, 8 thru 30, plus 32 and 33)
32	287653	Spring, Rack Lock
33	243898-82	Nut, Assembled Lock
	269569-2	*Front Bracket (Part of item 16)
	269569-3	*Rear Bracket (Part of item 16)
	269569-4	*Nut Bar (Part of item 16)

* Order Separately

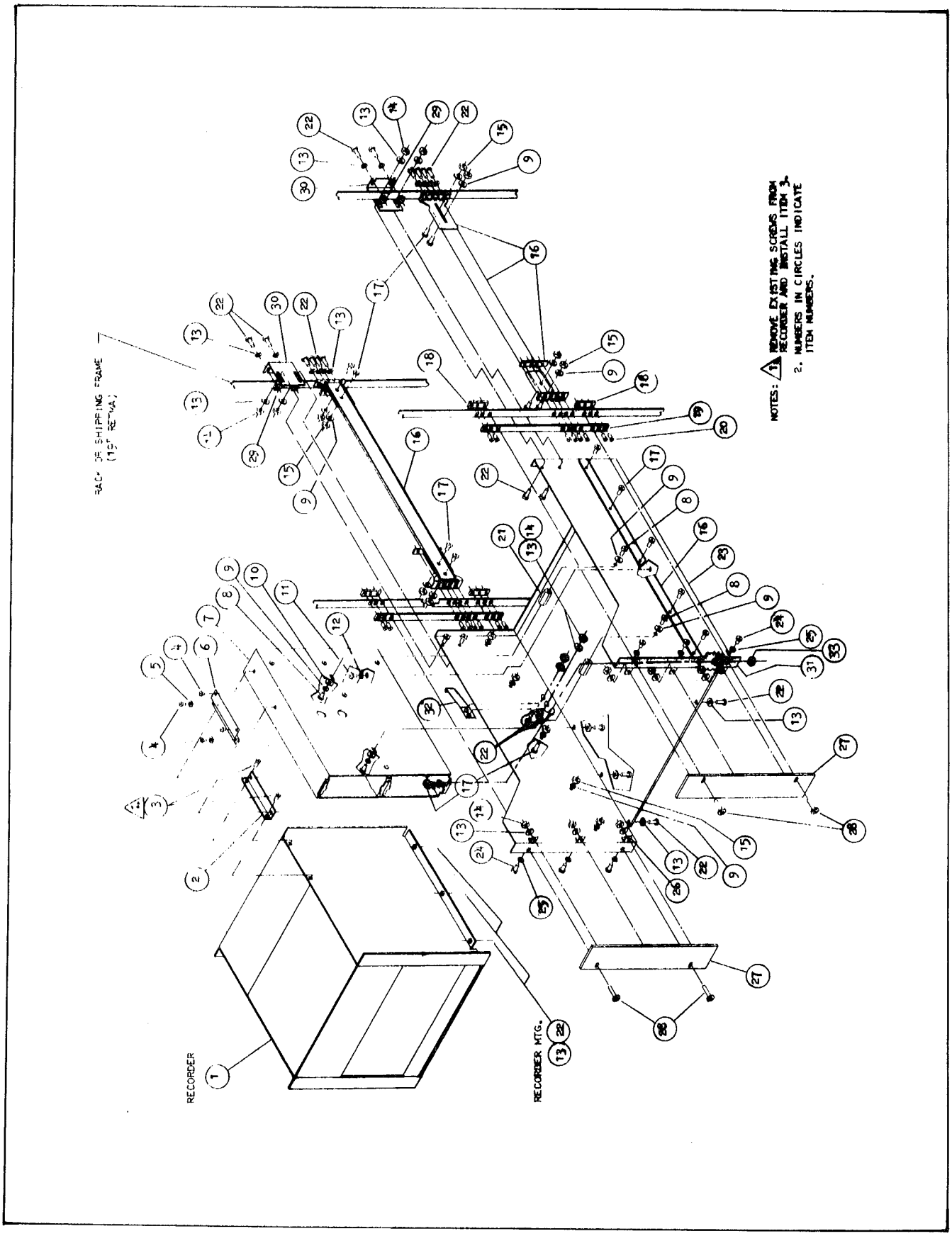


FIGURE 8-21 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER WITH 2-CHANNEL PREAMP CAGE (687363)

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER
RACK MOUNT INSTALLATION INSTRUCTIONS – RECORDER with 4 Channel Preamp Cage (687361)
FIGURE 8-22

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-4X90-XX	Recorder Assy
2	287083	Bracket, Angle
3	31-126906-405	Screw
4	13-262716-4004	Screw
5	10-120053-101	Lockwasher
6	287084	Plate, Support
7	886400	Cage Assy
8	13-262716-8204	Screw
9	1-216741-425	Lockwasher
10	1-118195-307	Washer
11	10-120053-103	Lockwasher
12	245244-02	Nut
13	31-119998-02	Nut
14	1-216741-430	Lockwasher
15	287011	Bracket
16	31-119918-0208	Screw
17	31-119998-82	Nut
18	32-119918-8206	Screw
19	887063	Saddle Assy
20	269569-3	Rear Bracket
21	269569-4	Bar Nut
22	269569-2	Front Bracket
23	287148	Nut Plate
24	287153	Spacer
25	31-119920-0208	Screw
26	287137	Panel, Front
27	248352-0218	Screw
28	11-1202-13	Kit Assy, Rack (includes items 2 thru 6, 8 thru 27, plus 29.)
29	287653	Spring, Rack Lock

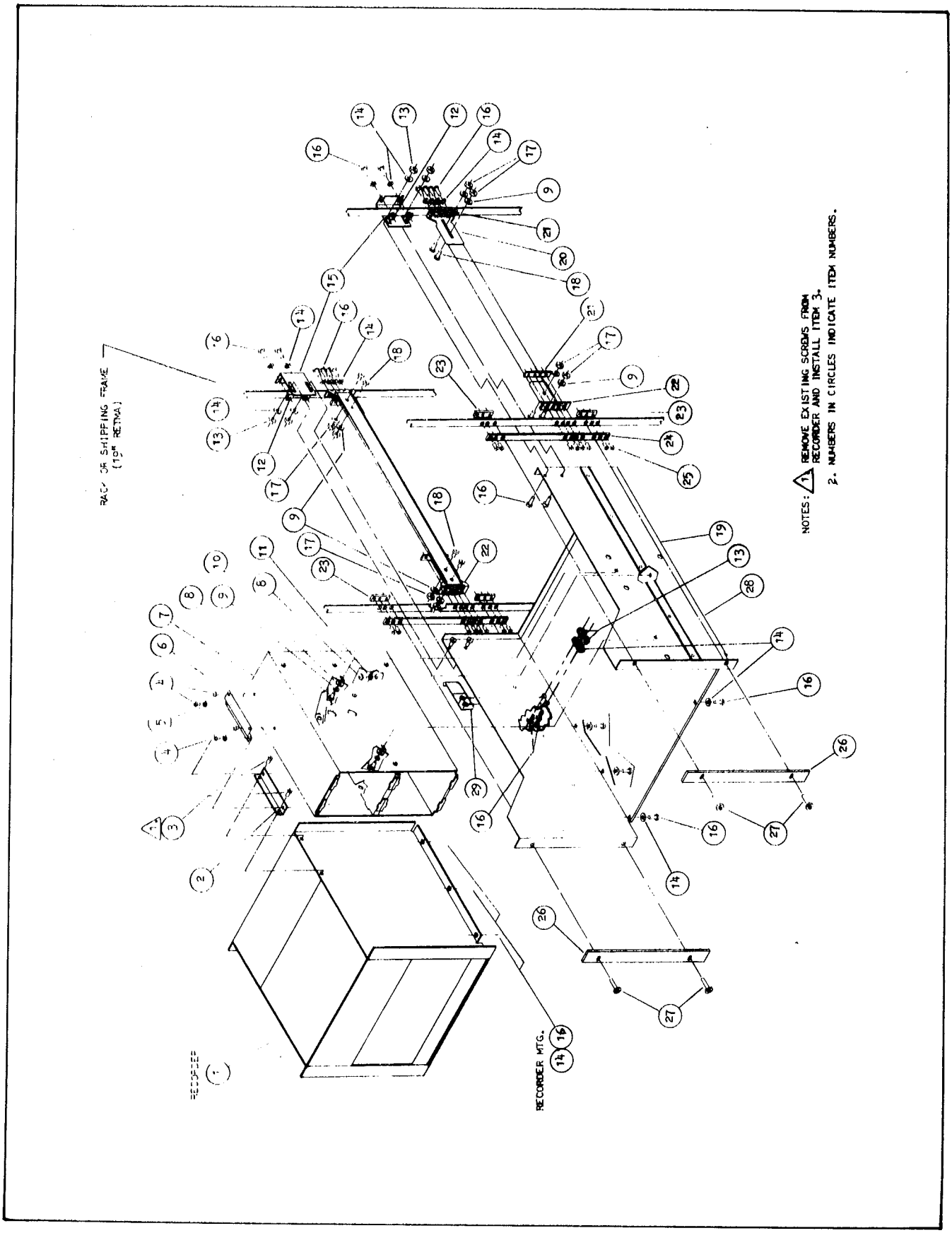


FIGURE 8-22 RACK MOUNT INSTALLATION INSTRUCTIONS - RECORDER WITH 4-CHANNEL PREAMP CAGE (687361)

EXPLODED VIEW PARTS LIST
2400 SERIES RECORDER – All models
CHART TAKEUP ASSEMBLY 11-6402-11
FIGURE 8-23

ITEM NO	PART NUMBER	DESCRIPTION
1	249617-4	Plt. Cover - R
2	243867-12	"O" Ring
3	246651	Roller, Guide
4	246307	Block
5	236865-3	Cotter Pin
6	266046	Pulley
7	767254-5	Arm Assembly, L.H.
8	9-249640-8206	Screw Fl. Hd.
9	686704	Shaft Assembly
10	247523-106	Plate, Ident. Mod. No.
11	767249-5	Arm, Right
12	249618-4	Plate Cover - L.
13	267253	Spring Compression
14	266184	Shaft, Shouldered
15	667251	Shaft Assembly Shouldered
16	243696	Retainer, Bearing
17	267257	Pulley

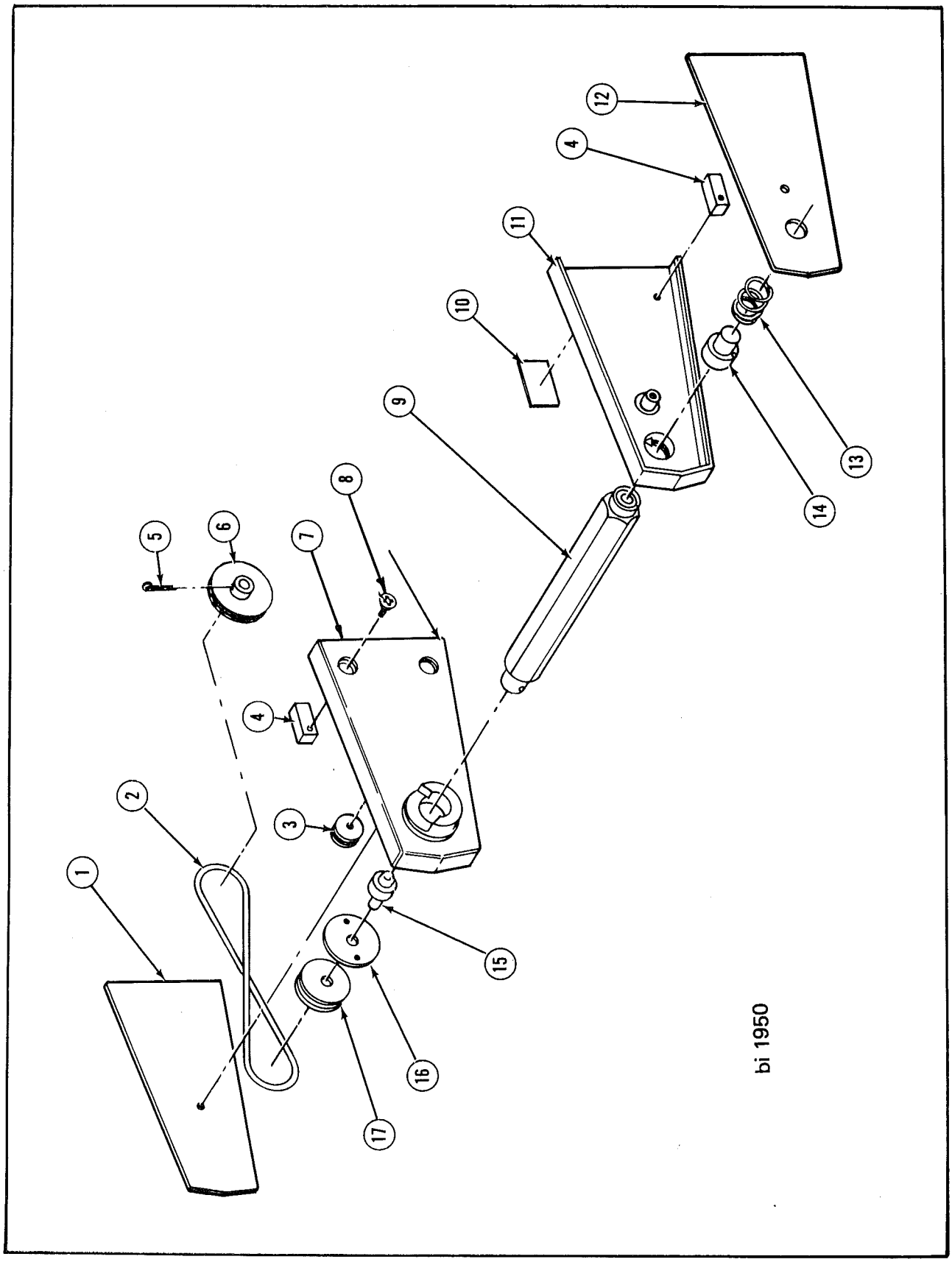


FIGURE 8-23 CHART TAKEUP ASSEMBLY

REV. X-1

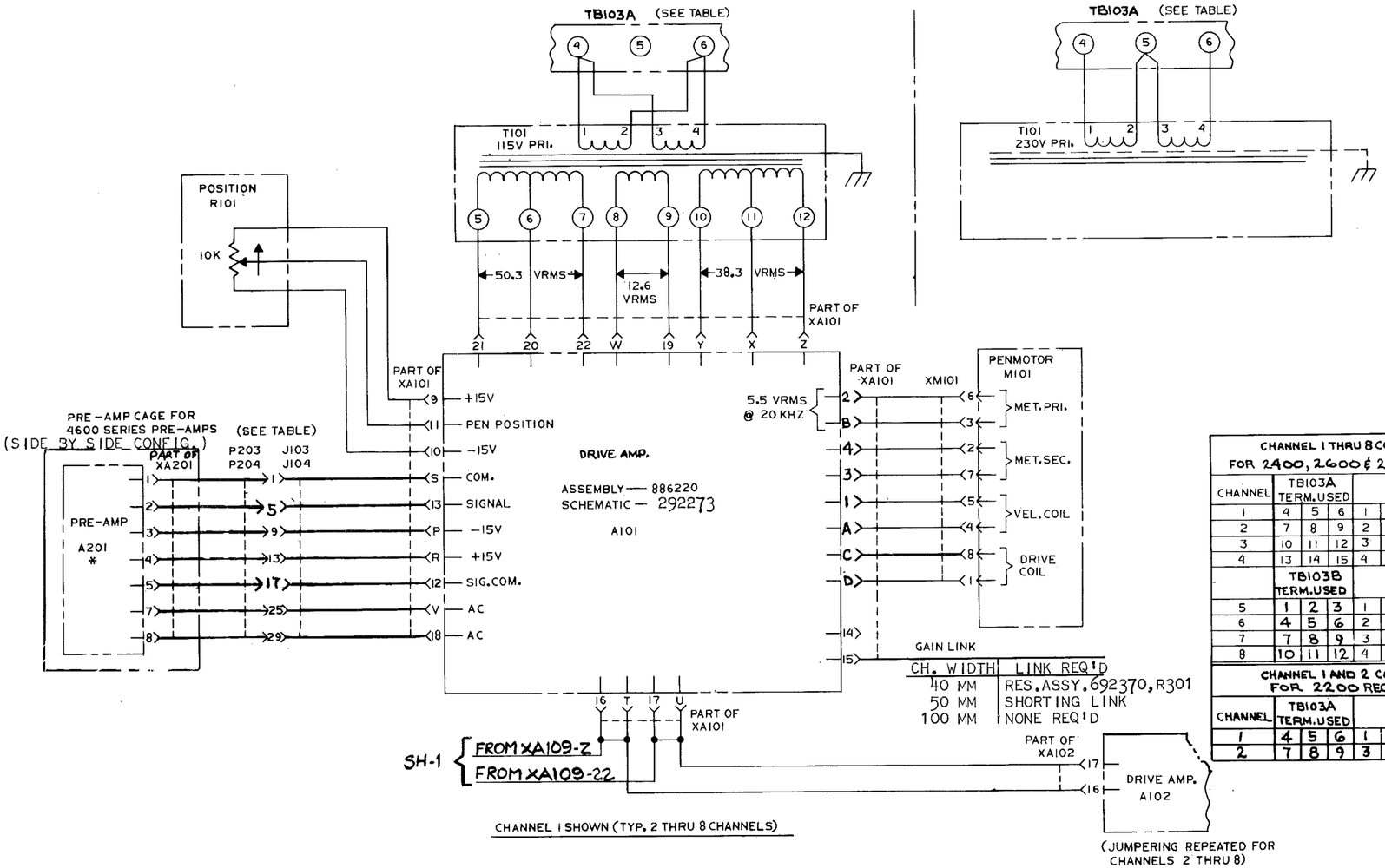
BD. ASSY. SWITCH 886772-1 ÷60
BD. ASSY. SWITCH 886772 ÷100
A110
XA110
S101
LEFT MARK EVENT
RIGHT
÷60/÷100
CHART SPEED MM/SEC
200
100
50
25
10
5
STOP
POWER
INTERLOCK
S102
TRANSMISSION A111
L101 CR107
L102 CR108
L103 CR109
L104 CR110
DRIVE MOTOR B101
TB104 FAN B102
C107 .056MFD
AC LINE FILTER FL101
C106
TB 102
POWER DS101 W
INTERLOCK DS102 Y
E2 E3 E4 E1
PART OF XA109
BD. ASSY. CONTROL 886327 A109
SCHEMATIC - 292274
OPT. EVENT MARKER 2200
OPT. EVENT MARKERS 2400
OPT. EVENT MARKERS 2600
OPT. EVENT MARKERS 2800
STD. EVENT MARKER
LEFT HAND CR114 IN4007 L108
RIGHT HAND CR115 IN4007 L109
CR116 IN4007 L110
CR117 IN4007 L111
CR118 IN4007 L112
CR119 IN4007 L113
CR120 IN4007 L114
CR121 IN4007 L115
CR122 IN4007 L116
J105 J106 J107 J108 J109 J110 J111 J112 J113
P105 P106 P107 P108 P109 P110 P111 P112 P113
28V REMOTE +IN +IN
TB101
PART OF XA109
AC NEUTRAL
T109 115V PRI.
T109 230V PRI
TB103A
22.9VRMS
11.7VRMS
TO XA101-17
TO XA101-16
SHEET 2
PART OF XA109
TB104
C108 20
CR111 IN4007 L105 INK SOLENOID
CR112 IN4007 L106 INK SOLENOID
PART OF XA109
AC NEUTRAL
TB103A TB103B TB103A TB103B
SEE CONNECTION TABLE-SHEET 2
P101 AC LINE
J102 AC OUTLET

NOTES:
1. UNLESS OTHERWISE INDICATED ALL CAPACITANCE IN MICROFARADS
ALL RESISTORS IN OHMS
ALL RESISTORS 1/8W, 1%
2. RESISTOR TOLERANCE
J = 5%
K = 10%
3. ▽ = DRIVE AMP. COMMON ALL CHANNELS ISOLATED FROM EACH OTHER
4. ▽ = CONTROL BD COMMON
5. C107 (.056MFD) FOR 115V 400 HZ MOTOR
6. C106 CAP VALUE FOR:
115V 50HZ MTR. = 5MFD
115V 60HZ MTR. = 4MFD
115V 400HZ MTR. = 2MFD
230V 50HZ MTR. = 5MFD
7. [ ] = E.I.A. COLOR CODE
8. NOT SUPPLIED ON 2200 RECORDER
9. USED ONLY ON 2200 RECORDER
10.
11. CONNECTION FOR 2200 RECORDER
12. CONN. FOR 230V 50 HZ MTR. ON 2400, 2600 & 2800 RECORDER

THIS DRAWING IS USED BY OTHER GOULD DIVISIONS AND/OR LOCATIONS. A F

RECORDER ASS'Y.

BY	DATE	NAME	
DR. D. CZECH	8-10-74	SCHEMATIC 2000 SERIES	Gould Inc. Instrument Systems Division Cleveland, Ohio 44114 U.S.A.
CH.	9/24/74	CODE IDENT. 96795	ISSUE CODE G
APP.	9/25/74		DWG. NO. 285851 PG. 1 OF 2



* FOR 6 & 8 CH. RECORDER RACK MOUNTED CONFIGURATION, SEE WIRING DIAGRAM 292226 (11-1202-15) FOR PREAMP TO DR. AMP. WIRING.

CHANNEL 1 THRU 8 CONNECTION TABLE FOR 2400, 2600 & 2800 RECORDER

CHANNEL	TB103A TERM. USED			P203/J103 TERM. USED						
1	4	5	6	1	5	9	13	17	25	29
2	7	8	9	2	6	10	14	18	26	30
3	10	11	12	3	7	11	15	19	27	31
4	13	14	15	4	8	12	16	20	28	32
	TB103B TERM. USED			P204/J104 TERM USED						
5	1	2	3	1	5	9	13	17	25	29
6	4	5	6	2	6	10	14	18	26	30
7	7	8	9	3	7	11	15	19	27	31
8	10	11	12	4	8	12	16	20	28	32

CHANNEL 1 AND 2 CONNECTION TABLE FOR 2200 RECORDER

CHANNEL	TB103A TERM. USED			P203/J103 TERM. USED						
1	4	5	6	1	4	7	10	13	11	14
2	7	8	9	3	6	9	12	15	2	5

RECORDER ASS'Y.

THIS DRAWING IS USED BY OTHER GOULD DIVISIONS AND/OR LOCATIONS. A F

BY	DATE
DR. D. CZECH	9-10-74
CH.	9/12/74
APP. McNeill	9/12/74

NAME: SCHEMATIC 2000 SERIES

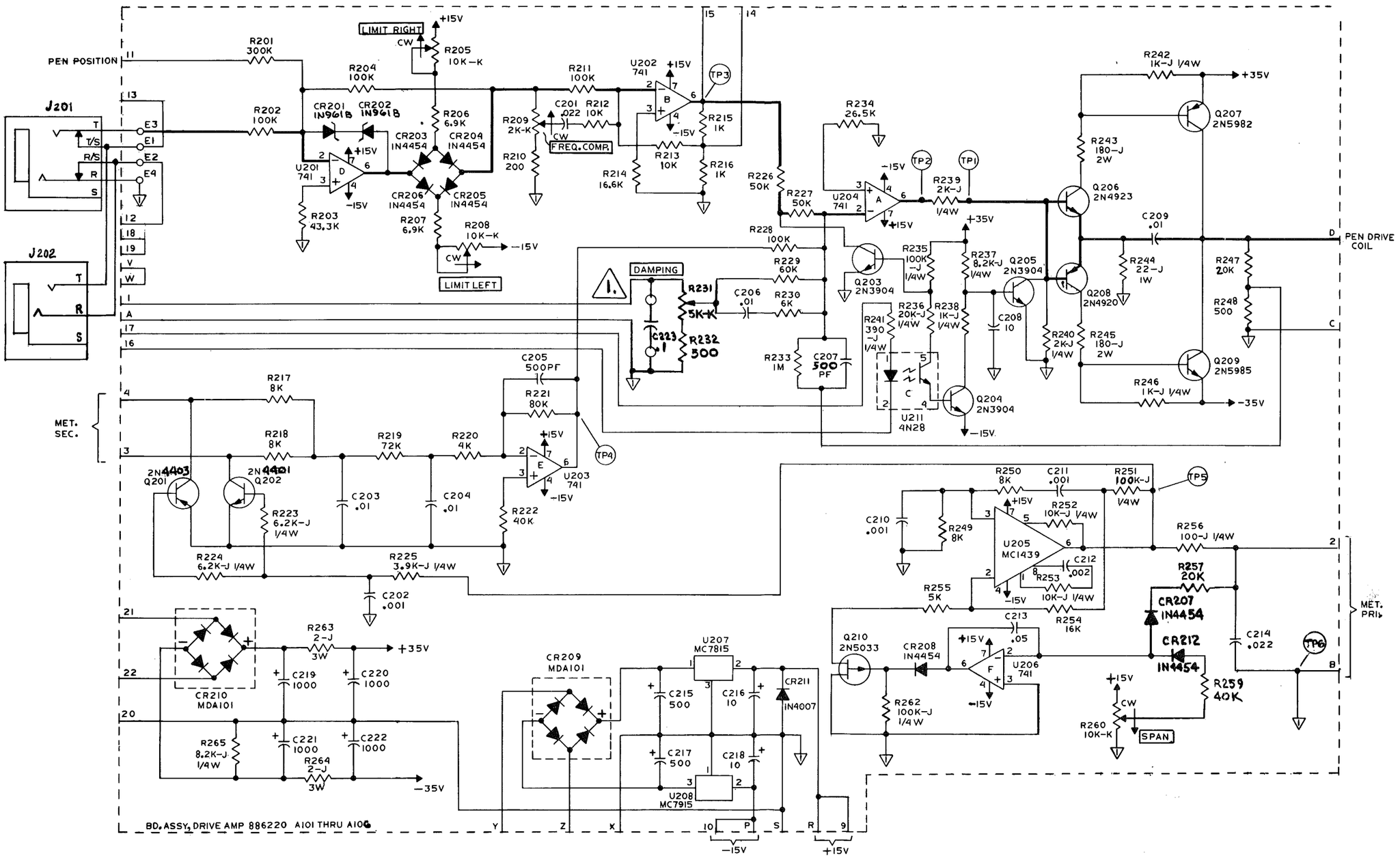
CODE IDENT.: 96795 ISSUE CODE: G

Gould Inc. Instrument Systems Division Cleveland, Ohio 44114 U.S.A.

DWG. NO. 285851

PG. 2 OF 2

REV. B-1



1 C223 USED ONLY IN 80 MM APPLICATIONS.

NOTES:

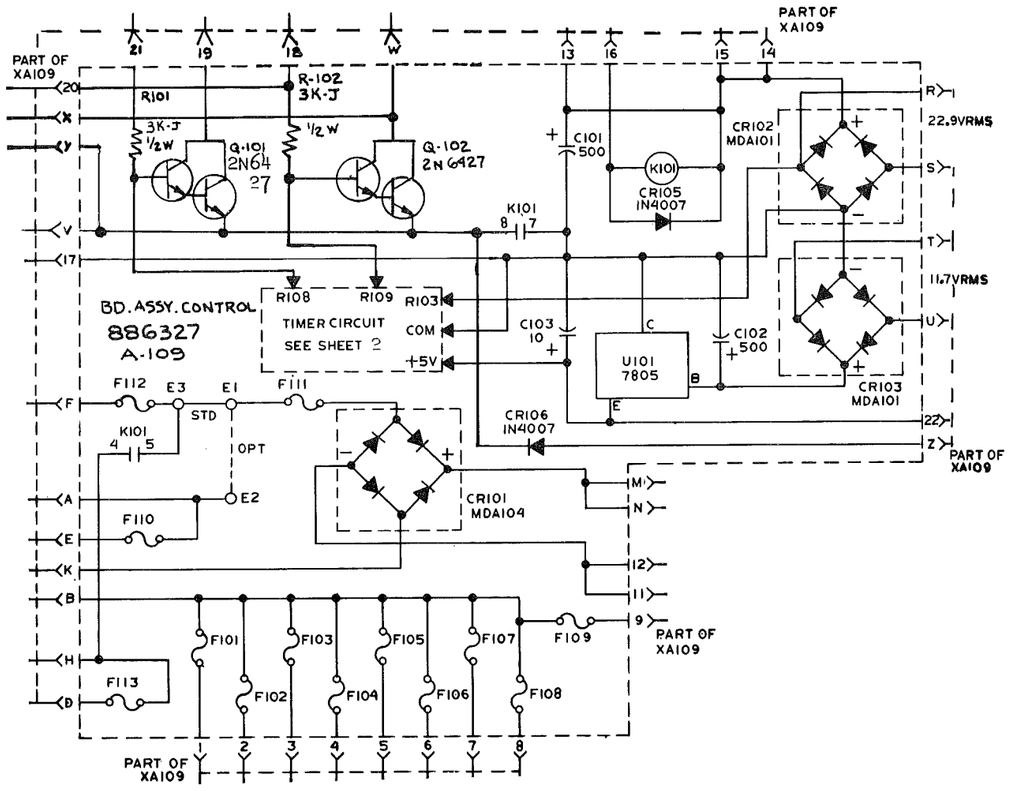
BY	DATE	NAME	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
DR R. CLARK	12/9/71	SCHEMATIC AMPLIFIER ASSY, DRIVE 886220	
CH.		CODE IDENT. 96795	ISSUE CODE G
APP'D			DWG 292273

292273

Form 419 6-72

REVISIONS		
SYM.	DESCRIPTION	DATE

REV. A-1



INK RECORDER FUSE TABLE						
FUSE SYMBOL	LINE VOLTAGE & FREQ. 115V 60HZ	115V 400HZ	230V 50HZ	115V 50HZ	COMPONENT FUSED	
F101 - F108	3/4A 125V	3/4A 125V	1/2A 250V	1A 125V	T101-T108	3.
F109	1/4A 125V	1/4 125V	1/4 250V	3/8A 125V	T109	
F110	1/4A 125V	1/4 125V	1/8A 250V	1/4 125V	B102	1.
F111 W/1 INK SOLENOID	1/4A 125V	1/4A 125V	1/8A 250V	1/4A 125V	L105	
F111 W/2 INK SOLENOID	1/2A 125V	1/2A 125V	1/4A 250V	1/2A 125V	L105 L106	
F111	1/8A 125V	———	1/16A 250V	1/8A 125V	L105	2.
F112	2A 125V	———	3/4A 250V	2A 125V	B101	2.
F112	1.5A 125V	7A 125V	3/4A 250V	1.5A 125V	B101	
F113	3A 125V	3A 125V	1.5A 250V	3A 125V	J102	1.

THERMAL FUSE TABLE					
FUSE	LINE VOLTAGE & FREQ. 115/60	230/50	115/50	COMP. FUSED	
F101	3/4A	1/2A	1A	T101-T108	
F109	1/4A	1/4A	3/8A	T109	
F110	1/4A	1/8A	1/4A	B102	1.
F111	5A	2-1/2A	5A	PEN HEAT	
F112	1-1/2A	3/4A	1-1/2A	B101	
F113	3A	1-1/2A	3A	J102	1.

3. ONLY FUSES SUPPLIED ON MODEL 200 RECORDER.

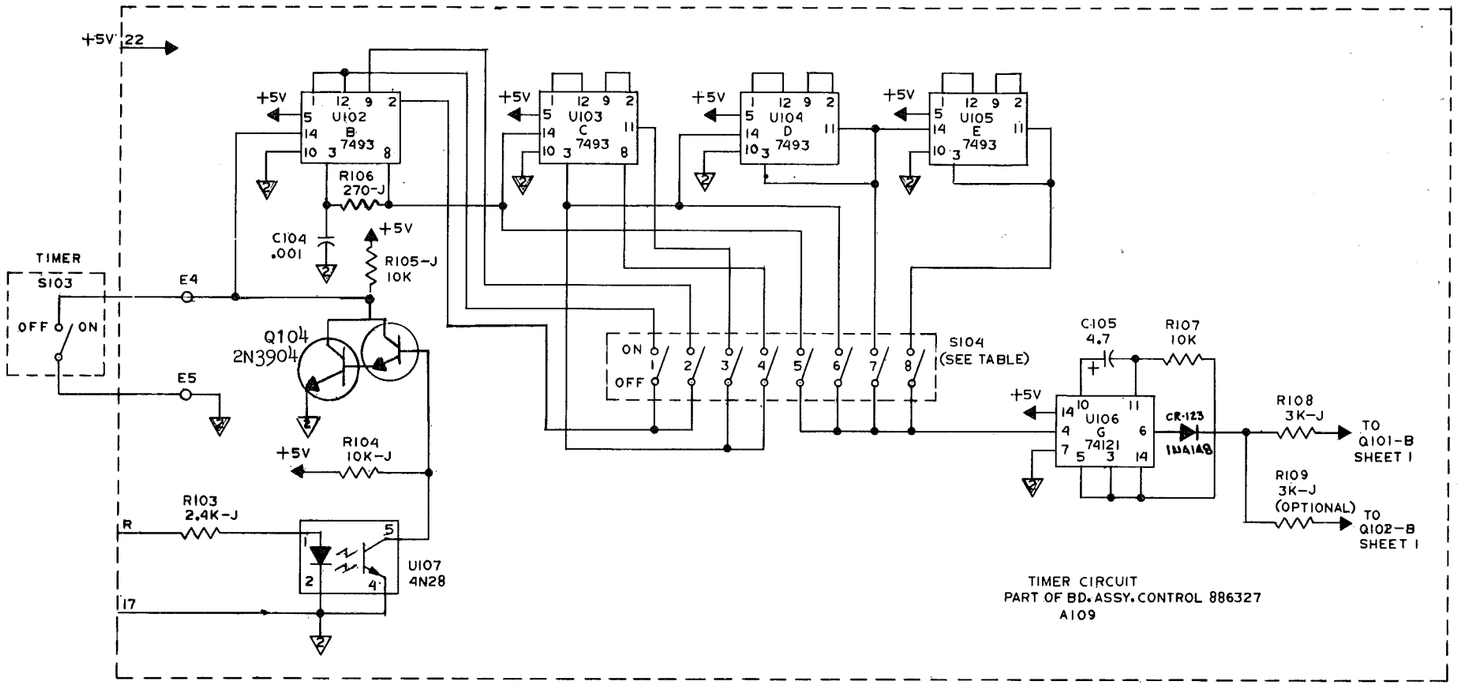
2. USED ONLY ON 2200 RECORDER.

1. NOT SUPPLIED ON 2200 RECORDER.

NOTES:

BY	DATE	NAME	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
DR R. CLARK	2/9/77	SCHEMATIC BOARD ASSY, CONTROL 886327	
CH [illegible]	2/77		
APP R. GEN	2/77		
		CODE IDENT. 96795 ISSUE CODE G	DWG NO. 292274
			PG. 10F 2

REVISIONS		
SYM.	DESCRIPTION	DATE



TIMER CIRCUIT
PART OF BD. ASSY. CONTROL 886327
A109

S104 SW. SETTINGS FOR VARIOUS REPETITION RATES

LINE FREQ.	50 HZ		60HZ		400 HZ	
REP. RATE	SW ON	SW OFF	SW ON	SW OFF	SW.ON	SW OFF
.1 SEC	1 3 5	2 4 6 7 8	2 3 5	1 4 6 7 8	3 6	1 2 4 5 7 8
1.0 SEC	1 3 6	2 4 5 7 8	2 3 6	1 4 5 7 8	3 7	1 2 4 5 6 8
10.0 SEC	1 3 7	2 4 5 6 8	2 3 7	1 4 5 6 8	3 8	1 2 4 5 6 7
100.0 SEC	1 3 8	2 4 5 6 7	2 3 8	1 4 5 6 7	——	——
.01 MIN	1 4 6	2 3 5 7 8	2 4 6	1 3 5 7 8	4 7	1 2 3 5 6 8
.10 MIN	1 4 7	2 3 5 6 8	2 4 7	1 3 5 6 8	4 8	1 2 3 5 6 7
1.0 MIN	1 4 8	2 3 5 6 7	2 4 8	1 3 5 6 7	——	——

	BY	DATE
DR	R. CLARK	3/9/79
CH		3/9/79
APP	R. GEIL	3/79

NAME: SCHEMATIC BOARD ASSY, CONTROL 886327

CODE IDENT. 96795 | ISSUE CODE G

Gould Inc.
Instruments Division
Cleveland, Ohio 44114 U.S.A.

DWG NO. 292274