



GOULD BRUSH

MANUAL PART NO.
2007-802XXX-XX

Event: 2nd, 50MA

2200 SERIES RECORDERS ALL MODELS

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SECTION I

GENERAL INFORMATION

1.1 SCOPE

This manual describes the Gould 2200 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 2200 Series Recorder is a high performance analog recorder. It is a self-contained unit housed in a 130mm mainframe chassis to accommodate 1 or 2 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 2200 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 SYSTEM

The model number of the 2200 Series Recorder designates mounting sype, chassis (mainframe) size, number of recording channels, preamplifier cage configuration, type of writing system and variations. The table on the page that follows "Specifications", and "Supplies and Accessories", describes the 2200 Series model numbering system. Appropriate recorder outline dimensionals accompany the model numbering table.

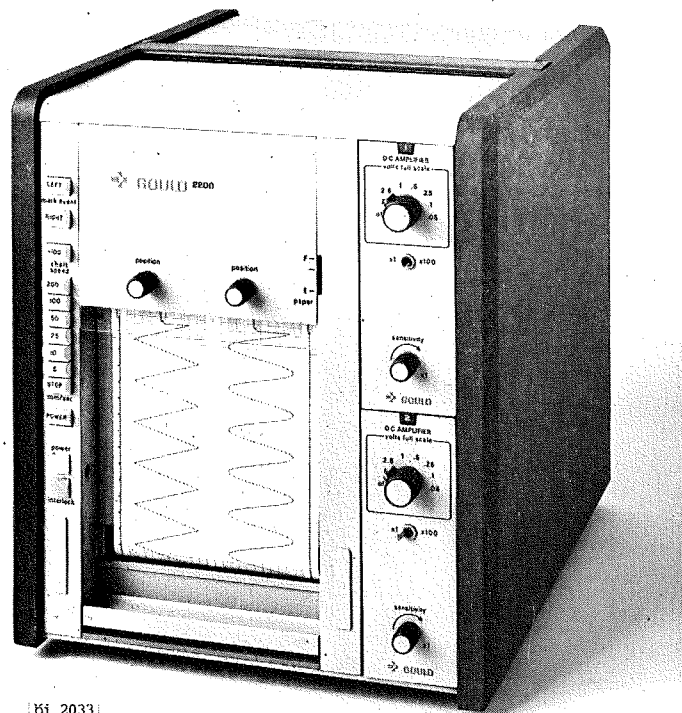


FIGURE 1-1 GOULD 2200 SERIES RECORDER

1.4 SPECIFICATIONS

a. General

Number of Analog Channels	One or Two (Depending upon Model Number).
Number of Event Marker Channels	Left & Right Margin. Additional is 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-ounce replaceable throw away cartridge (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	$\pm 0.5\%$ synchronous with line frequency.
Chart Length	275 feet (83 meters)
Chart Width	130mm.
Divisions per Channel	50 Divisions on 50mm Channels 100 Divisions on 100 mm Channel
Time Lines	Every mm, accentuated at 5 and 100mm.
Chart Travel Dirction	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 Commerical Practice.
Principle Dimensions	Refer to Outline Dimensions (Following Model Numbering System Table).

b. Electrical

Input Circuit	Single ended, floating (isolated from ground).
Input Impedance	100K ohms $\pm 1\%$ (Recorder without Preamplifiers).

b. Electrical (Cont'd)

- Input Signal $\pm 2.5V$ for full scale deflection of 50, or 100 mm channels.
- Frequency Response At 100 millimeter amplitude: d-c to 30Hz ± 1 mm
 At 50 millimeter amplitude: d-c to 50Hz ± 1 mm
 At 40 millimeter amplitude: d-c to 55Hz ± 1 mm
 At 10 millimeter amplitude: d-c to 100Hz ± 1 mm,
 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 than 5 milliseconds.
 At 40 millimeter amplitude: less than 4 milliseconds
- Non-Linearity $\pm 0.35\%$ 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 $\pm 0.1\%$ of full scale for 24 hours.
- 15 Minute Warm-Up $\pm 0.025\%$ of full scale per $^{\circ}C$.
 $\pm 0.10\%$ of full scale for $\pm 10\%$ line voltage change.
- Gain Instability $\pm 0.1\%$ of reading for 24 hours.
 $\pm 0.05\%$ of reading per $^{\circ}C$.
 $\pm 0.05\%$ of reading for $\pm 10\%$ 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 60Hz | 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	
1-100 mm channel	11-2913-30
2-50 mm channels	11-2923-35

Analog Pen (ink tube included)	11-2823-42
Event Marker Pen	267884-5
Ink Tube (Event Marker Pen)	667447-1
Ink Cartridge (1oz. Blue Ink)	11-2730-01
Gram Gage	240601-910

b. Accessories

Starter Kits

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.

2-50 mm channels	11-6250-13
1-100 mm channel	11-6250-14
Drive Amplifier Extender Card	887526
Pen Pressure Adjustment-Wrench	1-120922-18
Band, Penmotor	684999
Ink Tube Replacement Tool	267528
Ink Remover	282920
Rack Mounting Kits (For Conversion of Portable Units)	
2200 Series with Preamp cage	11-1202-16
2200 Series without Preamp cage	11-1202-17
Mobile Carts	11-6405-02
Chart Takeup	11-6402-13
Interchannel Event Marker (includes pen when ordered with recorder)	887181

TABLE 1-1 2200 SERIES MODEL NUMBERING SYSTEM

MODEL NUMBER	CODE DESCRIPTION
2007-XXXX-XX	
	Operating Voltages
	00 115V + 10%, 60 Hz, divide by 100 chart speeds
	05 115V + 10%, 50 Hz, divide by 100 chart speeds
	06 230V + 10%, 50 Hz, divide by 100 chart speeds
	10 115V + 10%, 60 Hz, divide by 60 chart speeds
	15 115V + 10%, 50 Hz, divide by 60 chart speeds
	16 230V + 10%, 50 Hz, divide by 60 chart speeds
	Type of Mounting and Preamp Configuration
	00 Portable case for recorder only
	02 Portable case and two-preamp cage
	70 Rack mounting kit, recorder only
	72 Rack mounting kit, two-preamp cage
	Number of Channels
	21 One 100 millimeter channel, chassis asm., drive amp and timer
	22 Two 50 millimeter channels, chassis asm., drive amps and timer

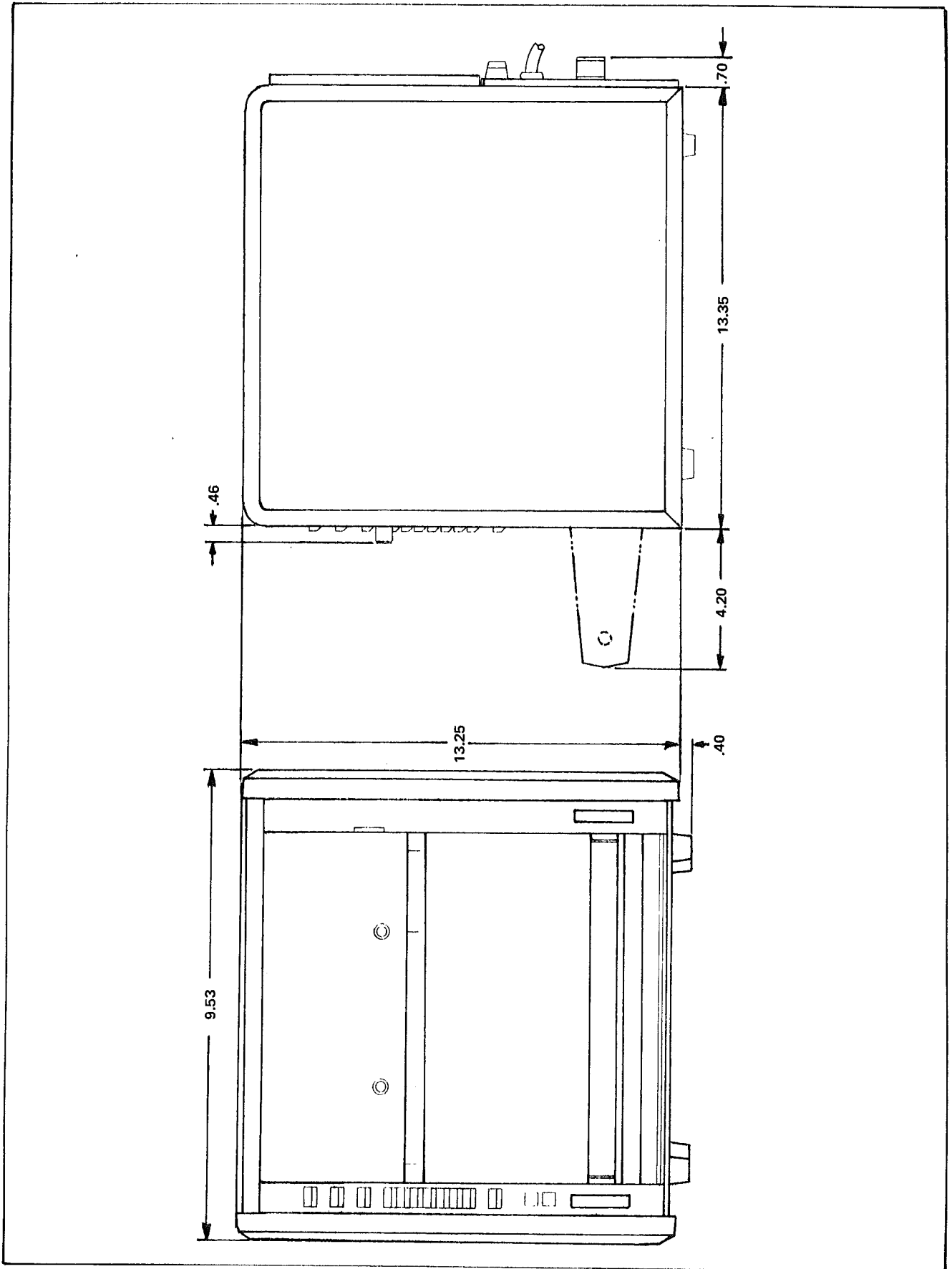


FIGURE 1-2 OUTLINE DIMENSIONS - 2200 SERIES

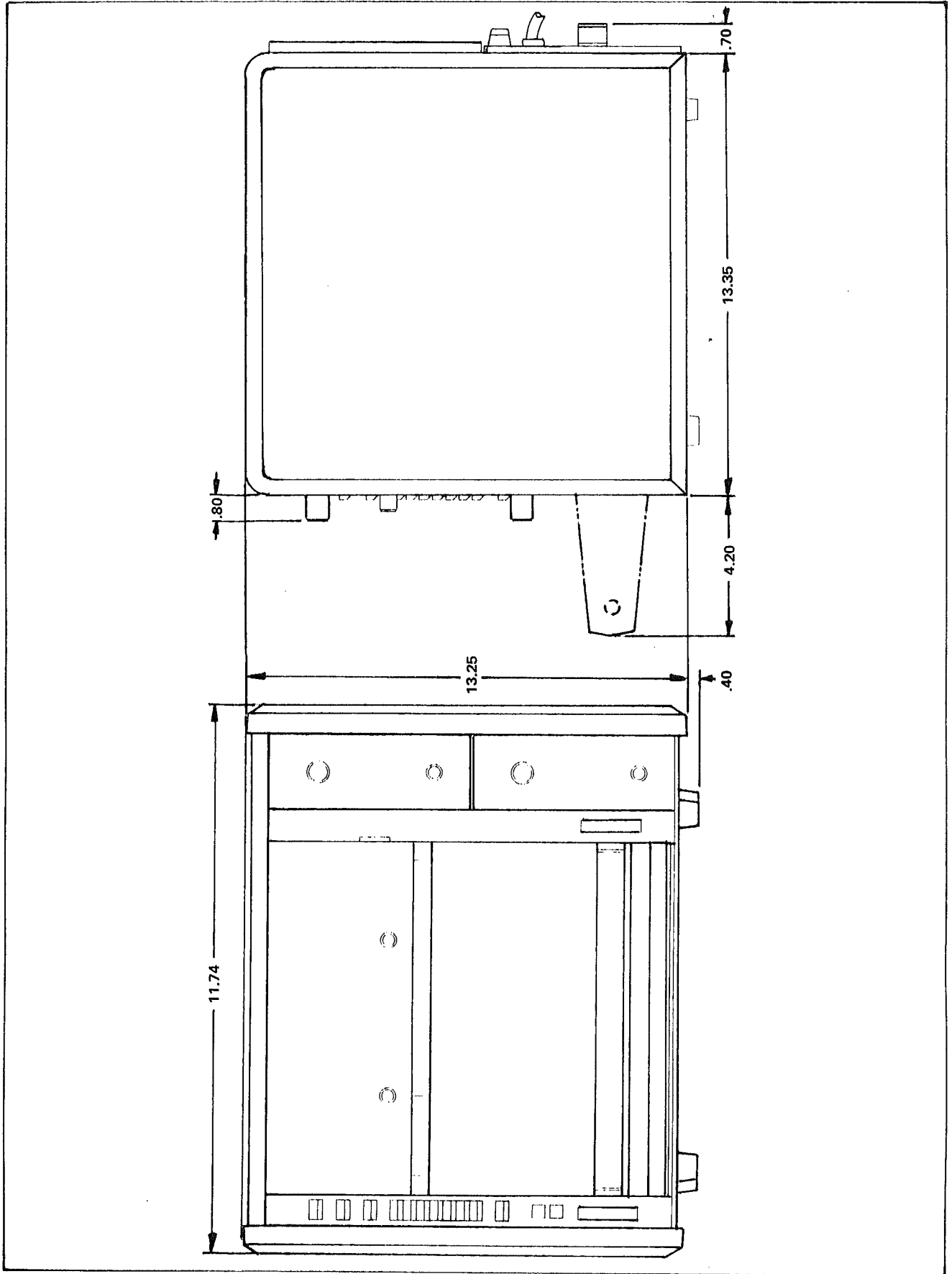
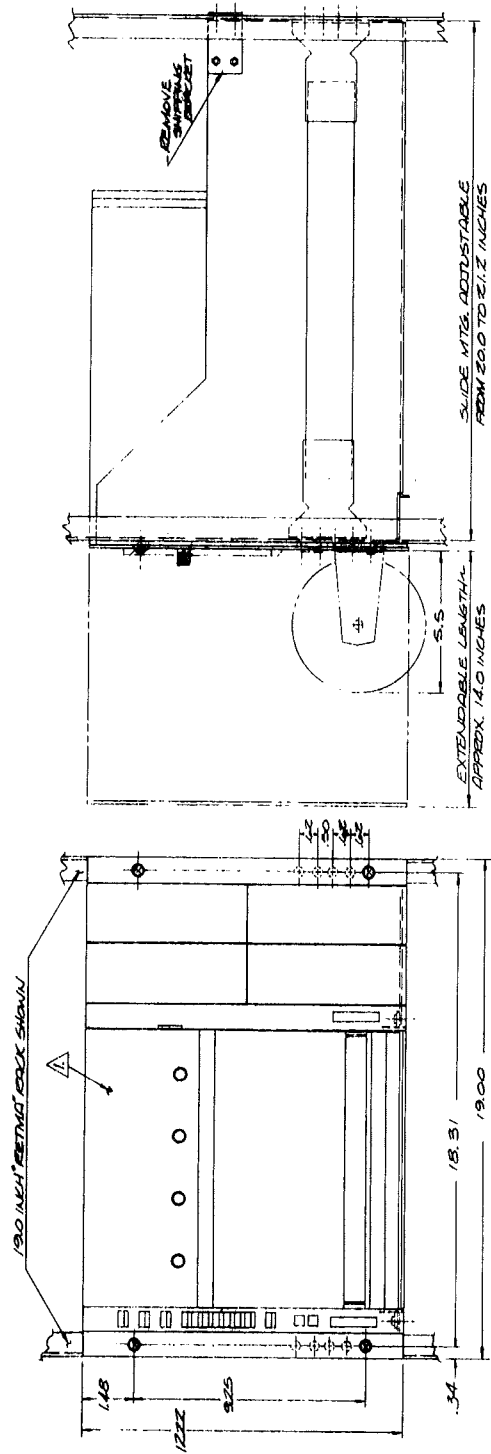


FIGURE 1-3 OUTLINE DIMENSIONS - 2200 SERIES WITH PREAMPS



1. FRONT VIEW OF 2007-4474-XX IS SHOWN. DIMENSIONS REMAIN THE SAME FOR ALL OTHER RACK MOUNTED VERSIONS OF 2200 & 2400 RECORDERS.

FIGURE 1-4 OUTLINE DIMENSIONS - 2200 SERIES 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

CAUTION: POWER MUST BE OFF DURING THE FOLLOWING SEQUENCE.

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. Slide all manual ink valves with tubing attached to ON position. (Follow direction of arrows on manifold bar.) Valves are located on top of recorder. Remove the recorder top front cover to gain access to valves. Slide cover forward and lift out. (If recorder is rack mounted, slide recorder out of rack.)
3. Ink cartridge and ink solenoid valve is turned on prior to shipment from factory.

NOTE: Ink cartridge should be near full.

4. Place cover back in position (or slide recorder back into rack and secure).

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). Use shielded cable (Belden 8422 or equal). Tip is high; ring is low; barrel is common.

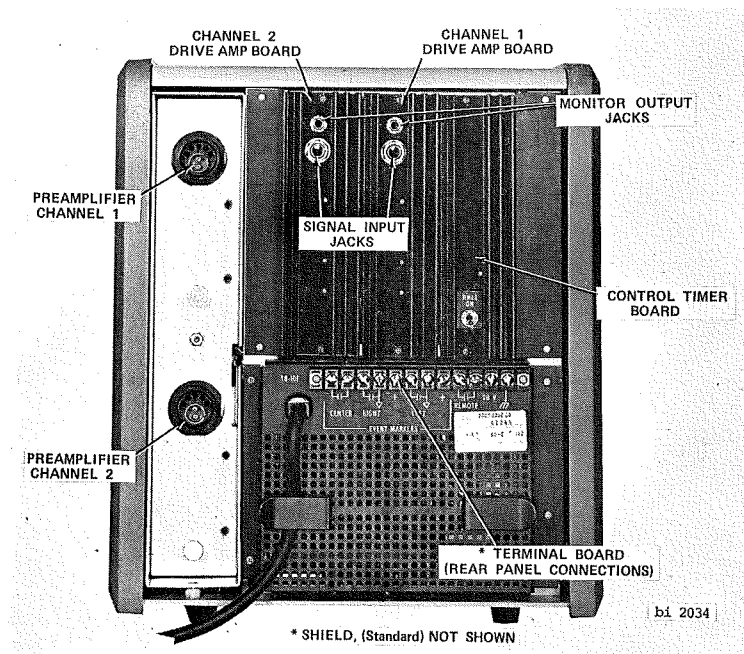


FIGURE 2-1 SIGNAL INPUT CONNECTIONS

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

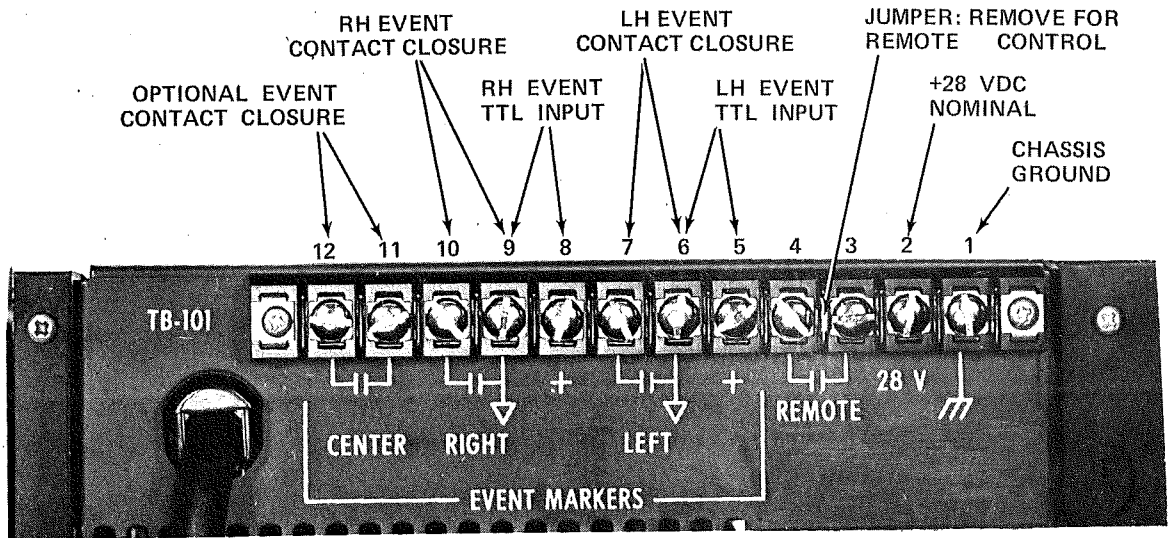
made by contact closure or TTL signal input. Refer to Figure 2-2 for connections.

b. Optional Event Marker

Interchannel optional event marker is 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.



NOTE: "L" SHAPED SHIELD, STANDARD, (not shown) PROTECTS TERMINAL BOARD.

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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 (or slide recorder about 6 inches out of rack).
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

Rack mounting kit for recorder only is Model 11-1202-17; for recorder with 2 channel preamp cage use Model 11-1202-16. Installation instructions are included with each kit.

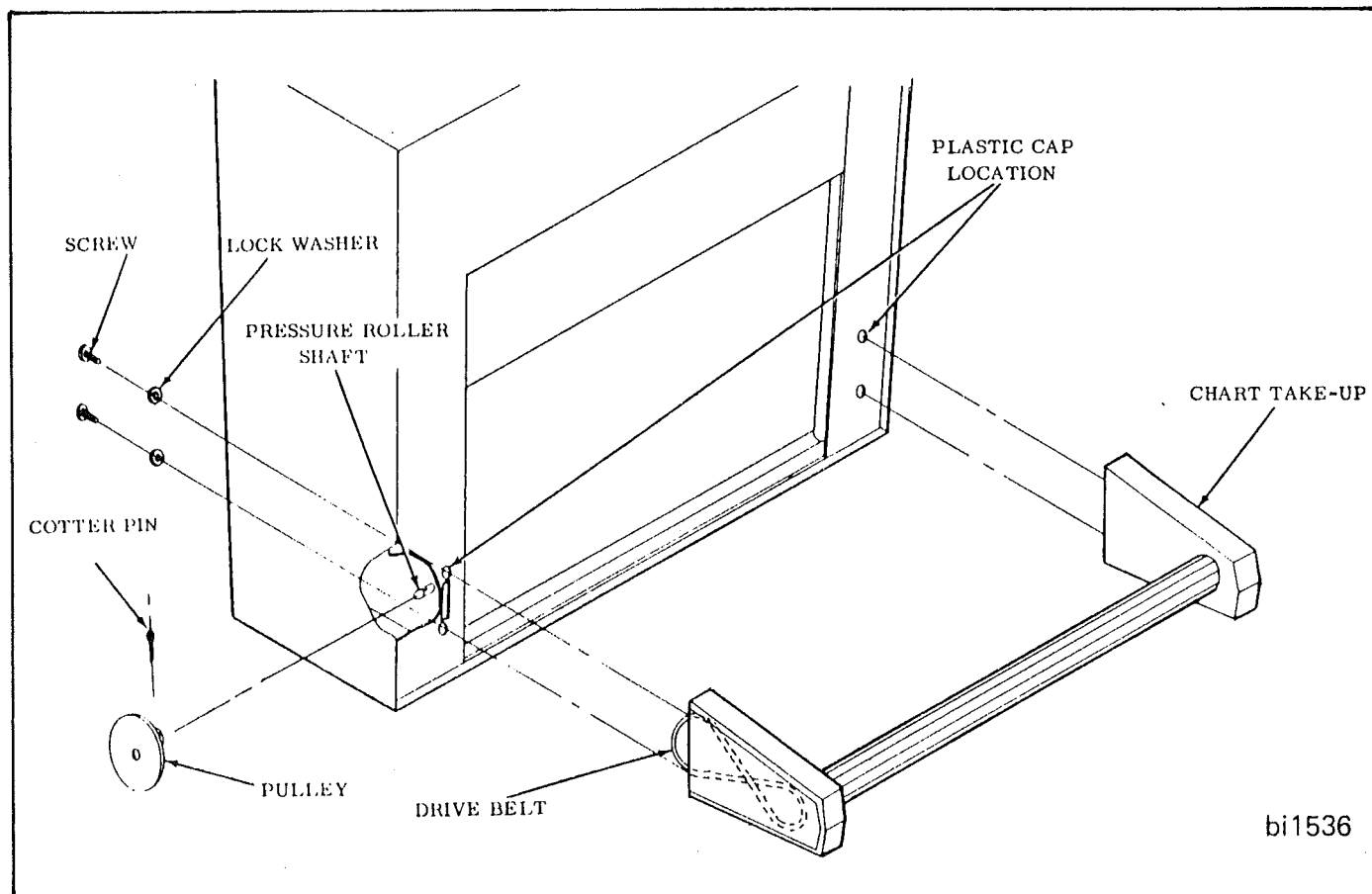


FIGURE 2-3 CHART TAKEUP INSTALLATION

SECTION III

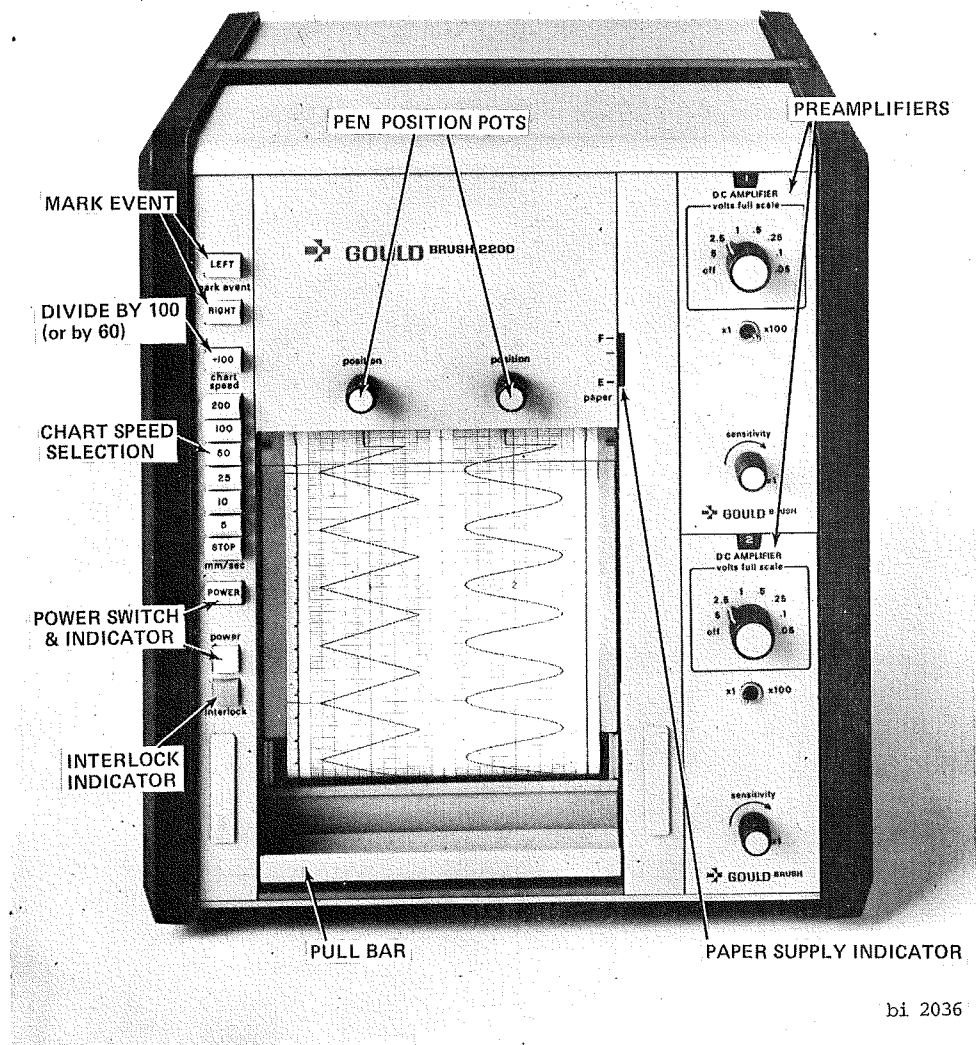
OPERATION

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.



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FIGURE 3-1 FRONT PANEL CONTROLS & INDICATORS

CONTROLS	DESCRIPTION
POWER SWITCH	Controls AC to recorder. Depress to turn recorder ON or OFF. POWER lamp illuminates when recorder is ON.
CHART SPEED SELECTION	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	When depressed, chart speeds become 0.05, 0.10, 0.25, 0.50, 1.0, and 2.0 mm/second (divide by 60 becomes 5, 10, 25, 50, 100, and 200 mm/minute).
(or by 60)	
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.
PEN POSITION POTS	Permits pen positioning anywhere within the channel.
PULL BAR	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 INDICATOR	Lamp illuminates when POWER switch is depressed.
PAPER SUPPLY INDICATOR	Gauge to indicate quantity of chart paper remaining.
PREAMPLIFIERS	Refer to applicable Preamplifier manuals for operating instructions.

3.3 REAR PANEL

Figure 3-1 illustrates the recorder rear panel. The following list corresponds to the figure.

CONTROLS	DESCRIPTION
PREAMP CAGE	Houses preamplifiers if part of the recorder system.
SIGNAL INPUT	Jacks for signal input direct to drive amplifiers.

CONTROLS	DESCRIPTION
TERMINAL STRIP	Refer to Section II for connections.
TIMER	ON/OFF toggle switch for timed left hand event marker activation.
MONITOR JACK	Monitors output of preamplifier (regardless of chart display). For use on Scope, Meter, Output panel, etc.

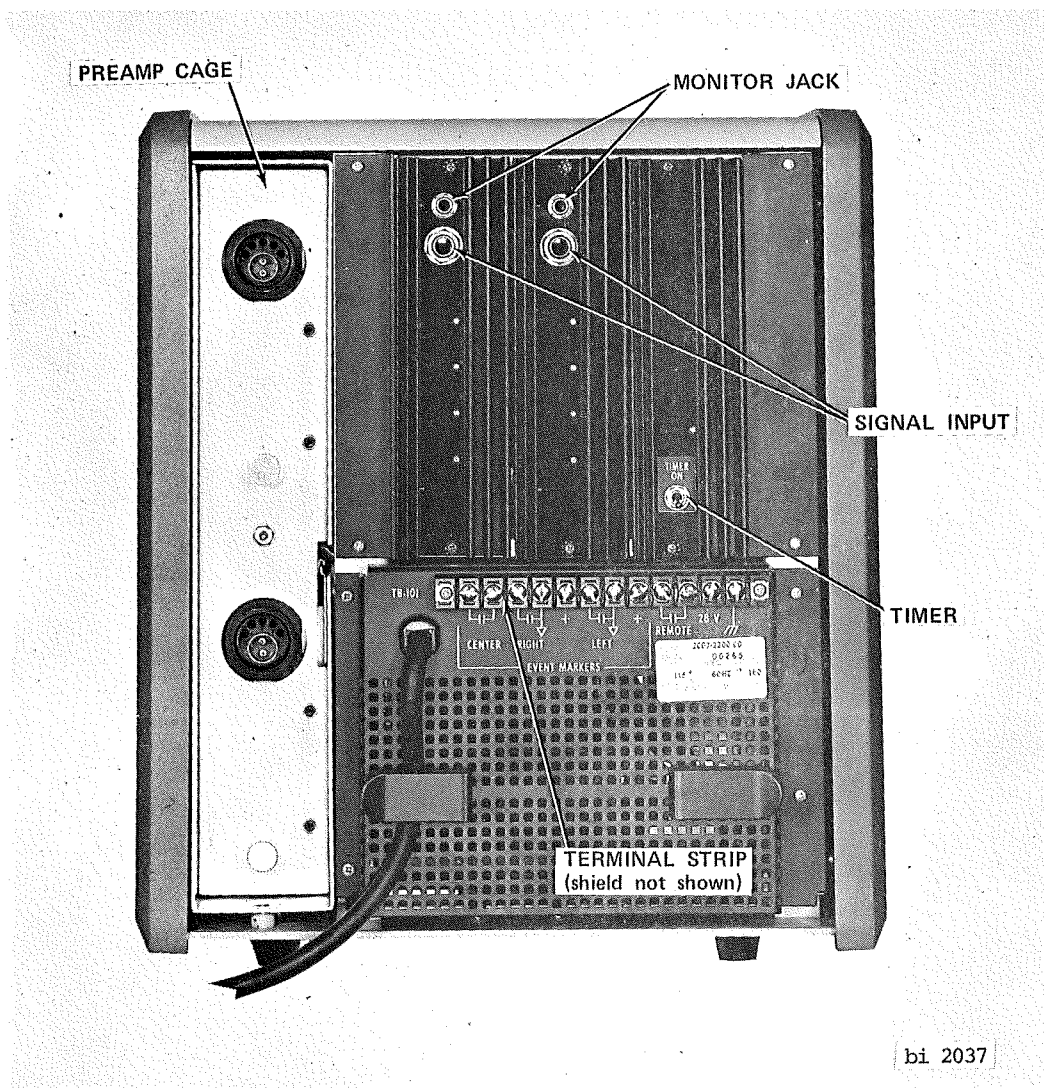


FIGURE 3-2 REAR PANEL

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 2200 Series Recorder is a modular-constructed unit consisting of a 130mm (total chart width) mainframe and 1-100mm or 2-50 mm analog recording channels. Each 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 reset the SPEED pushbuttons.

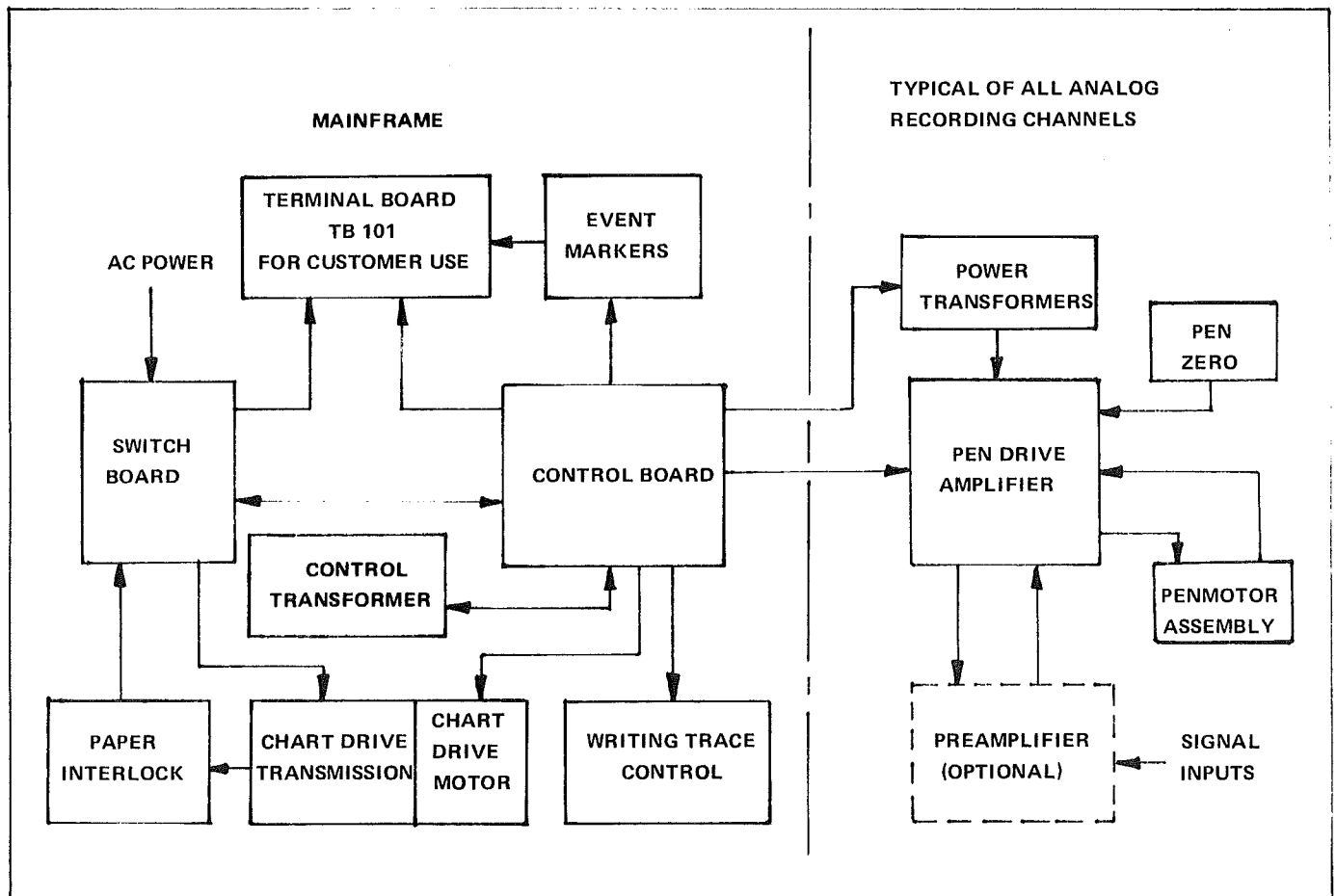


FIGURE 4-1 BASIC RECORDER BLOCK DIAGRAM

When the LEFT or RIGHT MARK EVENT push-buttons are depressed, solenoids L108 and L109 respectively, are energized activating the left or right event markers. These are momentary push-buttons, 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			

NOTE: Divide by 100 (or 60) activates L-101.

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 K101 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 push-button is released. When energized, one set of contacts supplies power to the chart drive motor thru fuse F112 and activates the ink manifold solenoid. When de-energized, the other set of contacts inhibit the event markers and optical couplers in the pen drive amplifier(s).

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 regulated 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, (F102)	Analog channel power transformers T101 (and T102).
F109	Control transformer T109 which supplies power for the +5V and +28V dc power supplies.
F111	Ink solenoid
F112	Chart Drive Motor

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 Q102 or Q103, 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 65 Hz pen deflection and from dc to 125 Hz for 10 division pen deflection. 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.

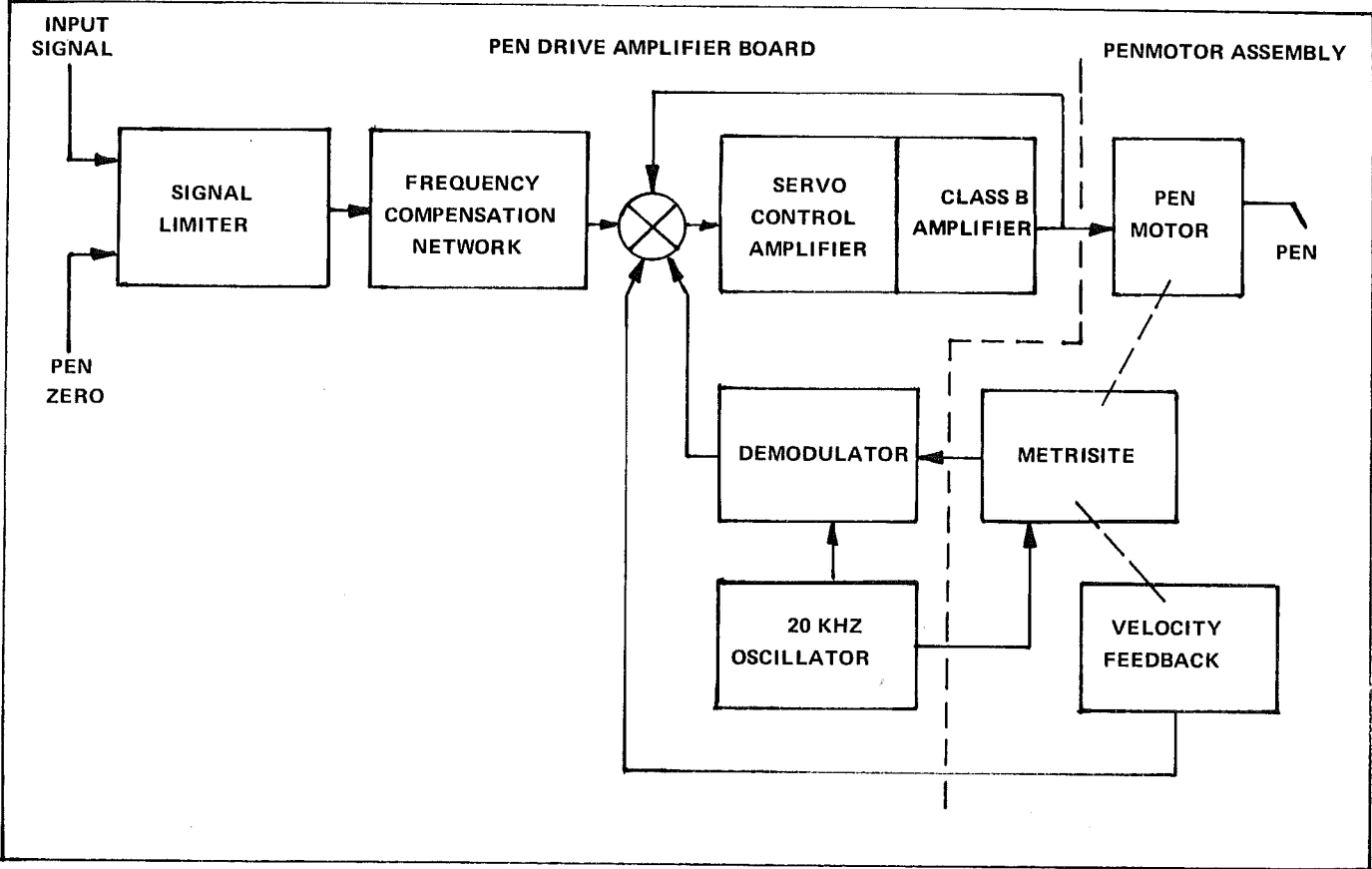


FIGURE 4-2 ANALOG CHANNEL BLOCK DIAGRAM

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 (or 60) 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.

SECTION VI MAINTENANCE

6.1 GENERAL

This section contains information for use in preventive and corrective maintenance of the 2200 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

CAUTION: USE ONLY GOULD INK REMOVER (P/N 282920) TO REMOVE SPILLED INK. THE USE OF OTHER INK REMOVING SOLVENTS IS NOT RECOMMENDED.

1. Blot up any excess ink with a tissue or paper towel.
2. Apply ink remover (P/N 282920) 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.

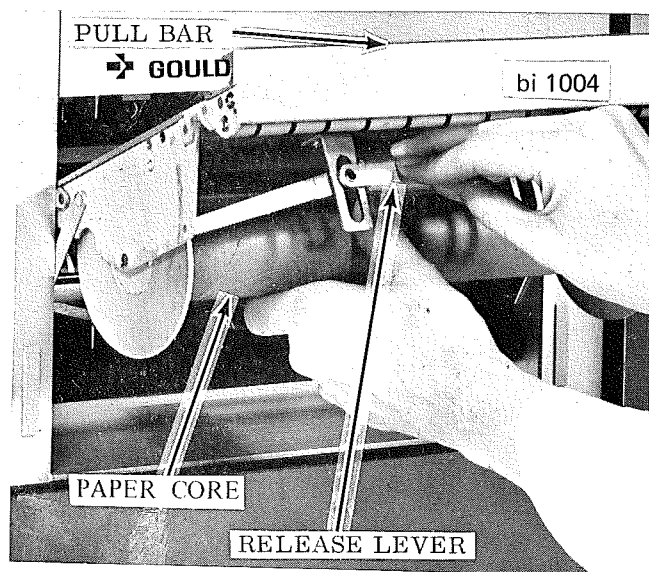


FIGURE 6-1 PAPER ROLL REMOVAL

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.

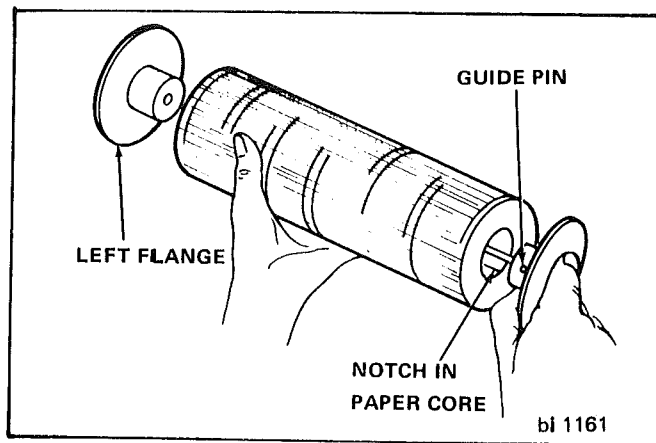


FIGURE 6-2 CHANGING CHART PAPER

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 PEN PRESSURE MEASUREMENT

Analog or event marker pen pressure should be checked if the ink trace is excessively wide (bleeding), indicating low pen pressure or if pen gouges the chart paper, indicating excessive pen pressure.

NOTE: Wide trace may also indicate an improperly lapped pen. Refer to Paragraph 6.5 for pen lapping procedures.

The gram gage (part number 240601-910) is used to measure the pressure of the analog and event marker pens 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.

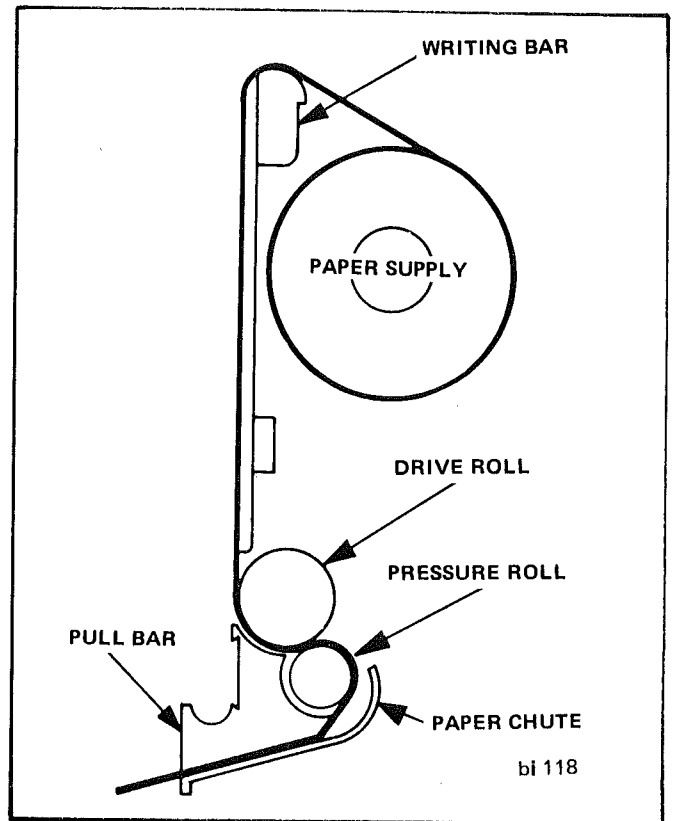


FIGURE 6-3 PAPER THREADING DIAGRAM

3. Place gram gage hook under pen as close as possible to top. Form a right angle to pen shaft with hook (Figure 6-4).

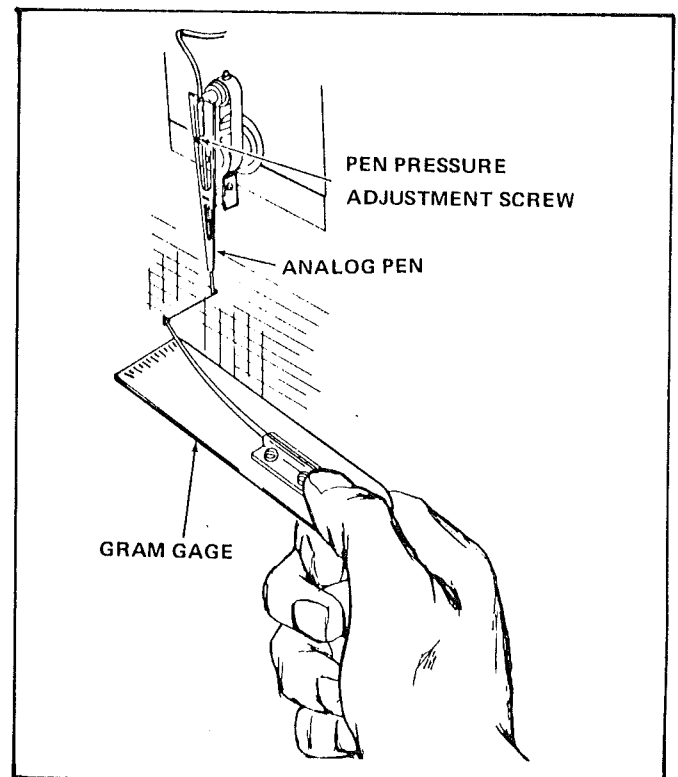
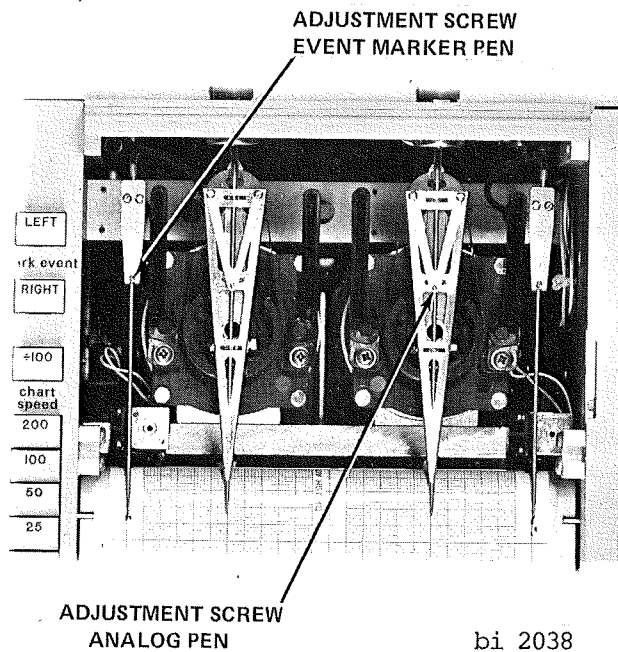


FIGURE 6-4 PEN PRESSURE MEASUREMENT

4. Pull pen from chart as shown in Figure 6-4 and take reading on gage the moment excessive ink starts to flow from pen.
5. Proper pressure for analog pens is 30 \pm 2 grams, for event marker pen 25 \pm 2 grams
6. If pen pressure is not within specified limits, adjust pressure using special pen adjustment wrench (Gould part number 1-120922-18). Refer to Figure 6-5. Turn screw clockwise to increase pressure, counterclockwise to decrease pressure.
7. Recheck pen pressure per steps 3, 4 and 5.



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FIGURE 6-5 PEN PRESSURE ADJUSTMENT

6.5 PEN LAPPING

a. General

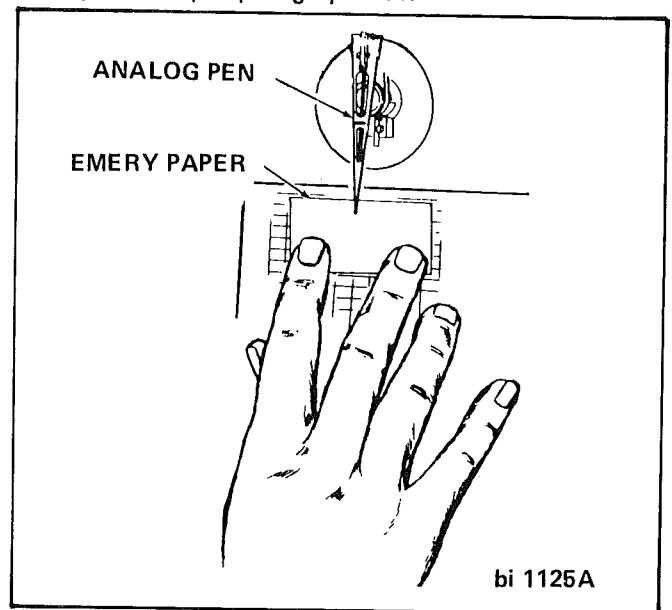
This paragraph describes and illustrates the proper procedures for lapping the analog and event pens. Intermittent or "wet" ink trace are indications that pen pressure is incorrect or that pen requires lapping. Check for "wet" writing by operating the recorder (no signal applied). Check pen trace by 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. 6.4). 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.
3. Carefully raise pen tip just enough to slide a small strip of lapping paper (Gould P/N 669234, Silicon Carbide, M-600 grit) under pen tip.
4. Refer to Figure 6-6. Hold lapping paper flat against writing table and move it in a circular motion several times while gently pressing pen tip with finger.
5. Remove lapping 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 6.4.



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FIGURE 6-6 PEN LAPPING

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.

6.6 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.

CAUTION: POWER IS TURNED OFF.

a. Analog Pen

NOTE: Analog Pen part number is Model 11-2823-42. Ink tubing is included with pen.

1. Remove top front cover from recorder. (Slide cover forward and lift out.) This gains access to individual manual valves.
2. Slide ink valve of pen to be changed to "OFF" position. Follow direction of arrows on manifold bar.

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

3. Carefully remove ink tube from manifold valve nipple. Wipe excess ink from nipple.
4. Raise pen access cover by pulling out on bottom and sliding back into recorder. Cover will be parallel with top of recorder.
5. Raise front of cover with one hand and carefully remove ink tube from pen with other hand. Discard ink tube.
6. Loosen two screws (do not remove) which secure pen to drive arm and carefully slide pen off in downward motion. (Figure 6-7).

NOTE: If pen does not readily slide off, it may be necessary to loosen pen pressure adjustment screw also.

7. Carefully slide new pen onto drive arm. Snug the two screws to secure pen. (Pen should be perpendicular to writing surface.)
8. Install new ink tubing between valve nipple and pen.

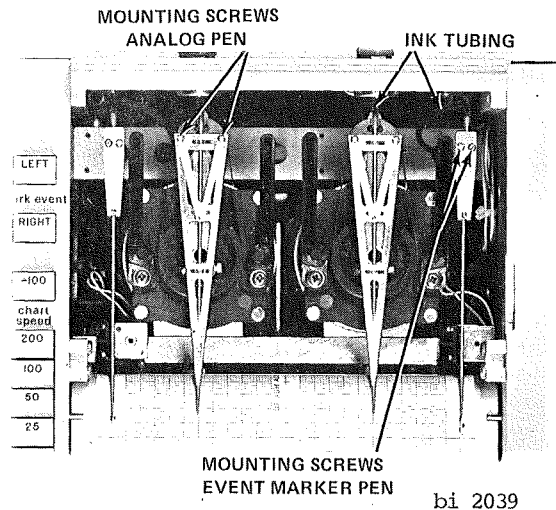


FIGURE 6-7 PEN REPLACEMENT

9. Slide ink valve to "ON" position. Follow direction of arrows on manifold bar.
10. Turn recorder ON and run at a chart speed of 5mm/sec.
11. Carefully lift pen slightly and allow ink to bleed through pen tip.
12. Shut down recorder.
13. Gently grasp pen near top and move it 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.
14. Lap pen per paragraph 6.5 if necessary.
15. Measure pen pressure per paragraph 6.4.

b. Event Marker Pen

NOTES:

1. Use steps 1 thru 5 from paragraph 6.6a; Analog Pen, for changing Event Marker Pen.
2. Event marker Pen number is 267884-5; ink tubing P/N is 667447-1.

1. Loosen two screws (do not remove) which secure pen to bracket assembly and carefully slide pen off in downward motion (Figure 6-7).

NOTE: If pen does not readily slide off, it may be necessary to loosen pen pressure adjustment screw also.

2. Carefully slide new pen between pen pressure bracket and bracket assembly. Snug the two screws to secure pen. (Pen should be perpendicular to writing surface.)
3. Install new ink tubing between valve nipple and pen.
4. Slide ink valve to "ON" position.
5. Turn recorder ON and run at a chart speed of 5 mm/sec. Adjust pen ZERO to set pen on event gridline.
6. Carefully lift pen slightly and allow ink to bleed through pen tip.
7. Shut down recorder.
8. If pen tip is not on same line as other pens, loosen screws and slide pen vertically. Tighten screws.
9. Lap pen per paragraph 6.5 if necessary.
10. Measure pen pressure per paragraph 6.4.

6.7 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. Access to individual manual valves is required.

1. Turn recorder OFF.
2. Slide ink valve of pen to be cleaned to "OFF" position. Follow arrows.
3. Remove ink tubing from manifold valve nipple.
4. Remove pen (Para. 6.6a or 6.6b).
5. Modify No. 18 hypodermic needle per Figure

6-8.

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: It 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. 6.6a or 6.6b).

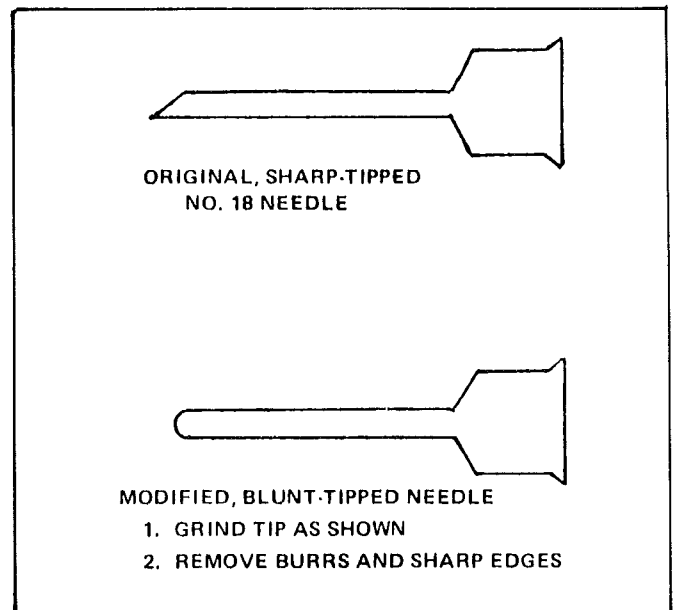


FIGURE 6-8 HYPODERMIC NEEDLE MODIFICATION

6.8 CASE REMOVAL (Portable Models)

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

1. Remove front and rear slide covers from top of recorder case.
2. If recorder is equipped with preamplifiers, remove retainer. (Hardware linking preamp cage with recorder, at top of recorder.)

3. If recorder is equipped with preamplifiers, disconnect preamp cage connector (P203) at top of recorder just behind where retainer was.
4. Remove 5 large machine screws from bottom of case.
5. Slide recorder out from FRONT of case. Push from rear and/or pull from side plates. Do not pull from top front of recorder or chart take-up.

6.9 INK CARTRIDGE REPLACEMENT

Ink supply should be sufficient for one year under normal conditions. Cartridge is located behind left hand plate assembly, and visible thru hole in same plate assembly. See Figure 6-9. Procedure follows:

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

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder a little more than halfway out of rack.)

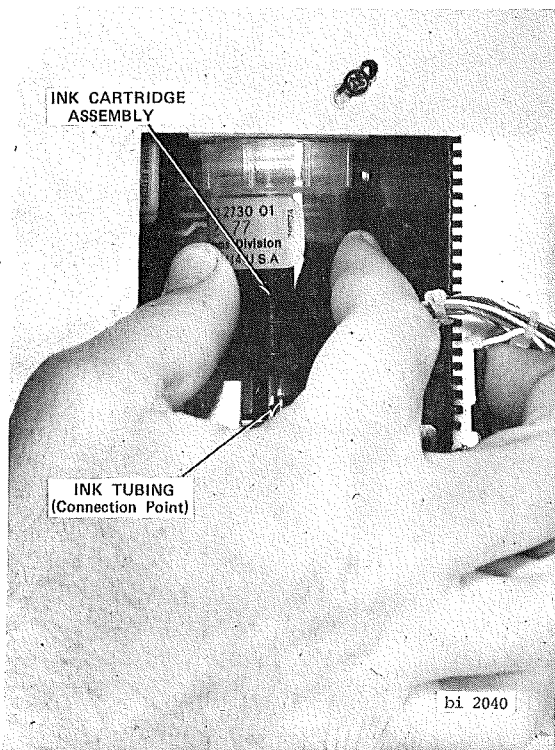


FIGURE 6-9 INK CARTRIDGE REPLACEMENT

2. Observe activating screw, (Figure 6-10). Turn screw clockwise until spring in ink plunger is drawn up tight.

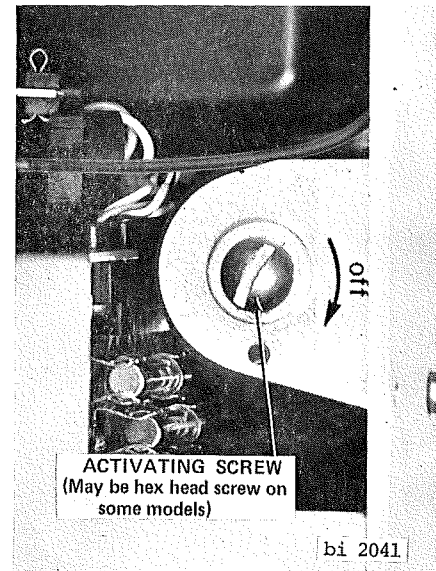


FIGURE 6-10 INK TURN OFF AND TURN ON

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

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. (Figure 6-9).
5. Remove piston retainer from replacement cartridge and discard. (Figure 6-11)

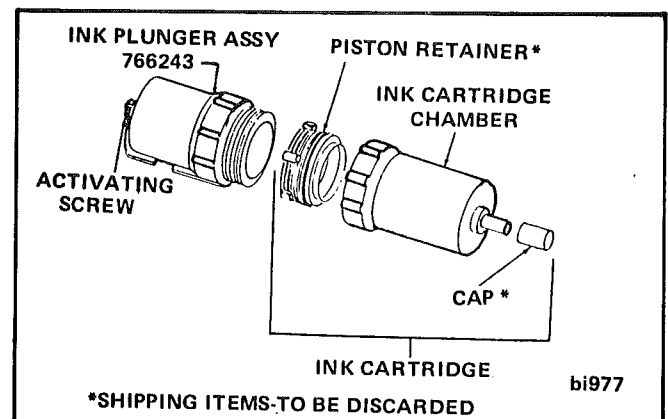


FIGURE 6-11 INK CARTRIDGE ASSEMBLY

6. Install cartridge in plunger assembly and tighten firmly. (Figure 6-9).
7. Remove shipping cap from ink cartridge and discard.
8. Install ink tube on ink cartridge.
9. Turn activating screw counterclockwise (Figure 6-10) until snug to pressurize ink system. Check for leaks.
10. It may be desirable to bleed the inking system at this point. Refer to paragraph 6.12 for procedure.
11. Install recorder in case or slide recorder into rack and secure.

6.10 SOLENOID VALVE ASSEMBLY REPLACEMENT

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

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

Replace solenoid valve assembly (item 9) as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder completely out of rack.)
2. Turn OFF ink cartridge. (Activating Screw, Figure 6-10.)

NOTE: If solenoid only is to be replaced, turning ink off is not required.

3. Remove Drive Amp board(s) and/or panel filler (for 1 channel recorders) from rear of recorder.
4. In cavity left by Drive Amp boards remove and retain 2 screws and washers in area of Drive Amp board connectors. Solenoid Valve Assembly will fall away from opposite side of bracket wall.
5. Place paper towels around area underneath solenoid valve assembly.

6. If entire assembly is to be replaced perform the following:
 - a. Disconnect yellow and orange leads from solenoid terminals. Tag leads.
 - b. Pull ink tubing from both valve nipples.
 - c. Make connections to new solenoid valve assembly in reverse order of "a" and "b" above. Attach assembly to bracket wall.
 - d. It may be desirable to bleed the inking system at this point. Refer to paragraph 6.12 for procedure.
7. If solenoid and diode only are to be replaced perform the following:
 - a. Disconnect yellow and orange leads from solenoid terminals. Tag leads.
 - b. Remove and retain cotter pin connecting solenoid plunger and valve link.
 - c. Remove and retain 2 screws and washers from solenoid housing. Solenoid diode assembly will fall away from housing.
 - d. Install new solenoid/diode assembly and make connections in reverse order of "a", "b" and "c" above. Attach solenoid valve assembly to bracket wall.
8. Install Drive Amp board(s) and/or panel filler.
9. Install recorder in case (or rack).

6.11 MANIFOLD ASSEMBLY REPLACEMENT

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

Replace manifold assembly (item 34) as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder a little more than halfway out of rack.)
2. Turn OFF ink cartridge and solenoid ink valve.

3. Place paper towels around area underneath manifold assembly.
4. Pull off ink tubing from manifold to pens and manifold to ink cartridge.
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 ink tubing to manifold assembly.
8. Turn ON ink cartridge and solenoid ink valve. Check for leaks.
9. Bleed the inking system per paragraph 6.12.
10. Install recorder in case or slide recorder into rack and secure.

6.12 MANIFOLD BLEEDING PROCEDURE

a. General

After changing or replacing the manifold assembly, it is imperative that the inking system is bled before operating the recorder. This is necessary so that any air trapped in the system is removed to guarantee uninterrupted writing. It may be desirable to bleed the system when changing the ink cartridge and solenoid valve assembly also.

b. Bleeding Procedure

1. Use Figure 6-12 as an aid with the procedure that follows.
2. Slide all manual ink valves (6) to OFF position. Follow arrows on manifold bar.
3. Turn ink solenoid valve OFF. Use screwdriver thru hole in left hand plate assy.
4. Disconnect all pen tubing only from manifold valve nipples. Replace with ink outlet caps (PN 249360). All 5 valve nipples on pen side of manifold must be capped.
5. If inking system is not under pressure turn activating screw on ink plunger assembly counterclockwise until ink fills tubing linking ink cartridge with solenoid valve.

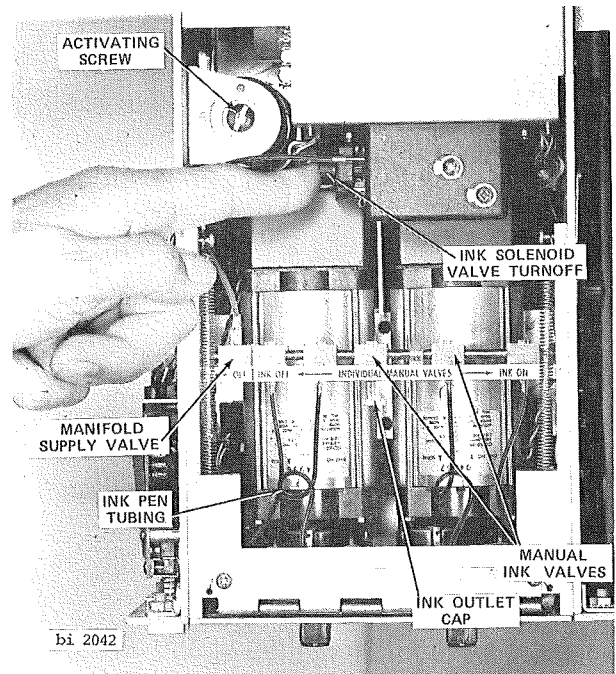


FIGURE 6-12 BLEEDING THE INKING SYSTEM

6. Turn ink solenoid valve ON. Push hinged valve closed with finger. (Figure 6-12.) Solenoid plunger will close, opening diaphragm in valve assembly. Hold closed. Ink should fill tubing linking solenoid valve with manifold supply valve.
7. Open manifold supply valve. Slide to "ON" position. Manifold should fill with ink.
8. Place paper towels under 5 capped manifold valve nipples.
9. Remove cap from valve nipple farthest from manifold supply valve.
10. Allow a few drops of ink to drip from the nipple by sliding the valve directly behind it in the direction of the arrow to "INK ON".
11. Turn the ink off by sliding the valve in the direction of the arrow to "INK OFF". Wipe the nipple free of excess ink and replace the outlet cap.

12. Repeat steps 9 thru 11 for the next closest nipple to the supply valve and so on until all 5 nipples are bled.
13. Replace ink outlet caps with pen tubing where removed in step 4.

6.13 TABLE ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdown of Recorder assembly and Writing Table assembly in Section VIII.

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder a little more than halfway out of rack.)
2. Remove paper supply roll per paragraph 6.3.
3. Remove timing belt and pulley assembly from R.H. Plate Assy.
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, pulley assy and timing belt.
7. Replace paper supply roll and install recorder in case (or rack).

6.14 DRIVE MOTOR REPLACEMENT

NOTE: Refer to illustrated parts breakdown of Recorder Assembly, Section VIII.

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

Remove the Motor (B101) as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder completely out of rack.)
2. Remove rear cover assembly. (Contains AC power cord and TB101.) Move cover away

from rear of recorder. (If it becomes necessary to disconnect any leads, make sure they are tagged.)

3. Disconnect 2 black leads from motor. Leads terminate at terminals 2 and 5 of TB102.
4. Remove timing belt from small (9 tooth) pulley.
5. Turn recorder on side. Remove 4 motor mounting screws and rubber pads. Remove motor from recorder.
6. Remove and retain 9 tooth pulley (gear) from motor shaft.
7. Install 9-tooth pulley (gear) on shaft of new motor.
8. Install new motor in reverse order of the above procedure.

6.15 TRANSMISSION REPLACEMENT

NOTE: Refer to illustrated parts breakdown of Recorder Assembly, Section VIII.

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

Remove the Transmission as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder completely out of rack.)
2. Remove timing belt linking transmission and drive motor. (Access thru square hole in L.H. plate assembly.)
3. Disconnect 5 leads from transmission.
4. Remove timing belt linking transmission and drive roll pulley. (Outside of R.H. plate assembly.)
5. Remove and retain 9 tooth pulley (small gear) from transmission.
6. Remove 3 screws securing transmission to R.H. plate assembly. Remove transmission from recorder assembly.

7. Remove and retain (large gear) pulley from transmission.
8. Install (large gear) pulley on new transmission.
9. Install new transmission in reverse order of the above procedure.
10. Connect leads onto transmission terminals as follows:

TERMINAL	LEAD COLOR
A	Wht/Blk/Grn
B	Wht/Blk/Yel
C	Wht/Blk/Orn
D	Wht/Blk/Red
E	Wht/Blk/Brn

6.16 POWER TRANSFORMER REPLACEMENT

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

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

Replace power transformer(s) (item 64) as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder a little more than halfway out of rack.)
2. Remove paper supply roll per paragraph 6.3.
3. Remove 2 screws securing transformer to chassis.
4. Note terminal/color code lead connections while disconnecting lugs and before transformer removal.

NOTE: Twelve connections per transformer as follows:

- 1) Eight lugs on top of transformer.
 - 2) Four leads at bottom of transformer which terminate at TB-103A.
5. Remove defective transformer thru hole in front of recorder.
 6. Install new transformer in reverse order of steps 3, 4 & 5.

7. Install paper supply roll.
8. Install recorder in case (or rack).

6.17 PENMOTOR REPLACEMENT

NOTE: Refer to illustrated parts breakdown of recorder assembly and penmotor bar assembly.

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

Remove penmotor as follows:

1. Remove recorder from case per paragraph 6.8. (If recorder is rack mounted, slide recorder completely out of rack).
2. Remove paper supply roll per paragraph 6.3.

NOTE: To make room for penmotor to be removed from recorder assembly the manifold and valve solenoid assemblies must first be removed. Refer to paragraphs 6.10 and 6.11.

3. Remove pen assembly by loosening 2 screws which secure it to drive arm. Slide pen down and away from penmotor. Refer to Figure 6-7.
4. Remove 2 socket head screws which mount penmotor to penmotor bar. Disconnect connector and remove penmotor from recorder.
5. Install new penmotor in reverse order of procedure above.
6. Install recorder in case (or in rack).
7. Perform calibration on penmotor drive amp after completing installation.

6.18 REPLACING PENMOTOR DRIVE BAND (684999)

NOTE: Prior to replacing drive band, penmotor assembly must be removed from recorder. Refer to Paragraph 6.17 for removal and reinstallation. Frequency Response Spec. should be re-checked after reinstallation. Refer to Section I.

CAUTION: IT IS RECOMMENDED THAT THE DRIVE BAND BE REPLACED AT THE FACTORY SO THAT PROPER BAND TENSION IS MAINTAINED. SHOULD FIELD REPLACE-

MENT BECOME NECESSARY, PERFORM THE FOLLOWING STEPS.

NOTE: Refer to Figure 6-13 for sequence of replacement.

a. Band Removal

1. Remove Analog Pen Assembly.
2. Loosen (but do NOT remove) screws from either end of assembly.
3. Remove band by sliding free end in counter-clockwise direction thru outer clamp and inner clamp; then thru extrusion and pulley on drive arm assembly.
4. Conclude removal by gently pulling band from inner clamp.

b. Band Replacement

1. Place hooked (or bent) end of band over inner clamp as shown, and restring in clockwise direction thru pulley and extrusion, and inner and outer clamps.
2. Snugly tighten all screws.
3. Apply 5.5 to 6.5 lbs of tension to free end of band with spring tension scale or other means.
4. Maintaining tension, fully tighten all screws and apply Glyptal cement (Gould P/N 11370) or equal at screwheads and mating surfaces.
5. Remove tension.
6. Reinstall Analog Pen.

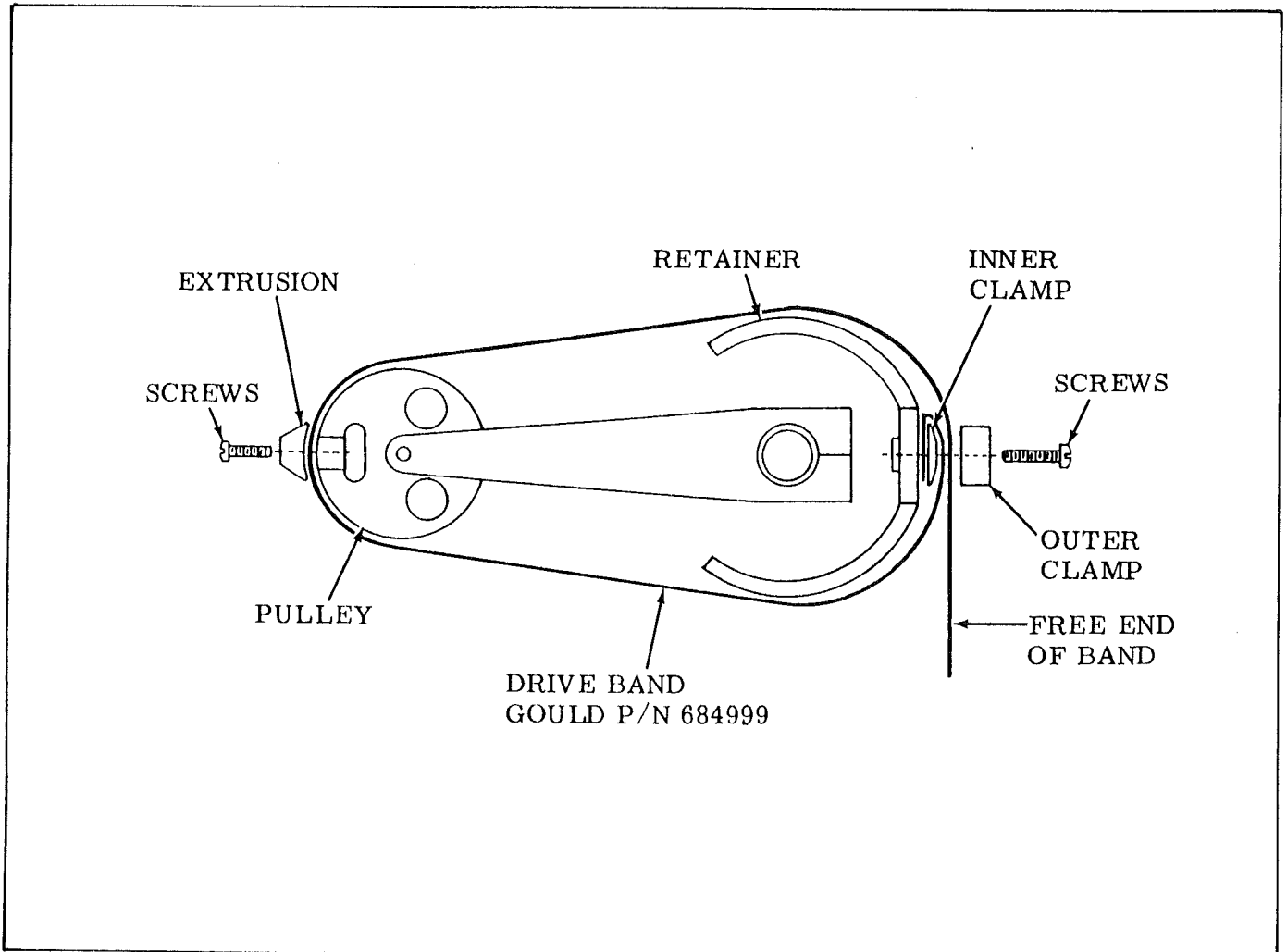


FIGURE 6-13 PENMOTOR DRIVE BAND REPLACEMENT

SECTION VII

CALIBRATION

7.1 GENERAL

The Gould 2200 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 2200 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 ac calibration source to phone jack input of drive amplifier. Tip is high, ring is low.

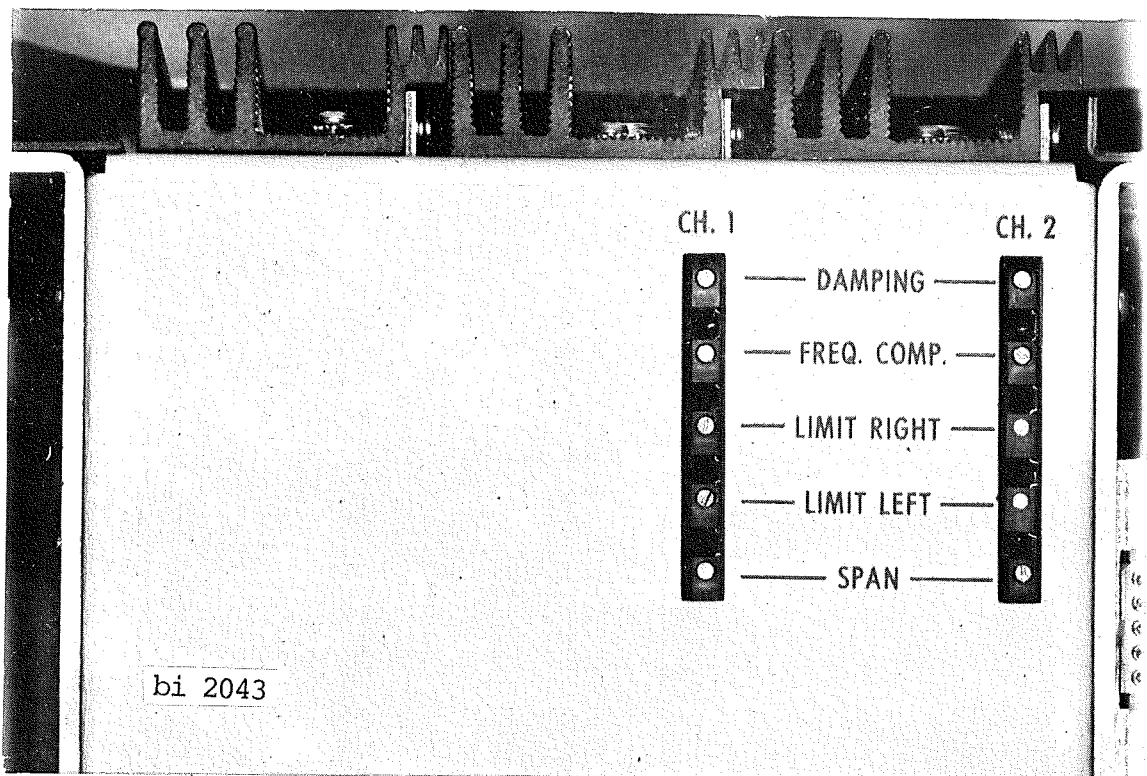


FIGURE 7-1 CALIBRATION CONTROLS

CALIBRATION

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-201) 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 2.0mm beyond full scale, adjust LEFT LIMIT potentiometer (R-202) for a 1.5 ± 0.25 mm deflection beyond full scale.
10. Turn pen position control full clockwise. Pen should deflect right to between 1.0 and 2.0 mm beyond full scale.
11. If deflection is NOT between 1.0 and 2.0mm beyond full scale, adjust RIGHT LIMIT potentiometer (R-203) for 1.5 ± 0.25 mm deflection beyond full scale.
12. Connect function generator.
13. Apply a 4V p-p square wave with a 1.0 Hz repetition rate.
14. Turn DAMPING potentiometer (R-204) 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 0.5mm of that at 5Hz.
19. If necessary, adjust FREQUENCY COMP potentiometer (R-205) until 50Hz deflection is within 0.5 mm of the 5Hz deflection.

SECTION VIII
PARTS IDENTIFICATION

8.1 GENERAL

This Gould 2200 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 diagrams 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 not procurable.

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
130-1	130 mm chassis, 1 channel
130-2	130 mm chassis, 2 channel
130-XP	130 mm chassis,(X) channel with preamps.

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER—All Portable Models
 FIGURE 8-1

ITEM NO	PART NUMBER	DESCRIPTION	USED ON
	2007-21XX-XX	2200 Recorder, 1 Channel	
	2007-22XX-XX	2200 Recorder, 2 Channel	
1	2007-2190-XX	Recorder Assy, 1 Channel (see Fig. 8-3)	130-1
	2007-2290-XX	Recorder Assy, 2 Channel (see Fig. 8-3)	130-2
2	887336	Case Assy w/o preamps (see Fig. 8-15)	
	887334	Case Assy w/preamps (see Fig 8-15)	130-XP
3	287387	Retainer	130-XP
4	888321	Cage Assy, preamp (See Fig. 8-16)	130-XP
5	887005	Panel Assy	130-XP
6	11-6402-13	Chart Take-up (see Fig. 8-17)	

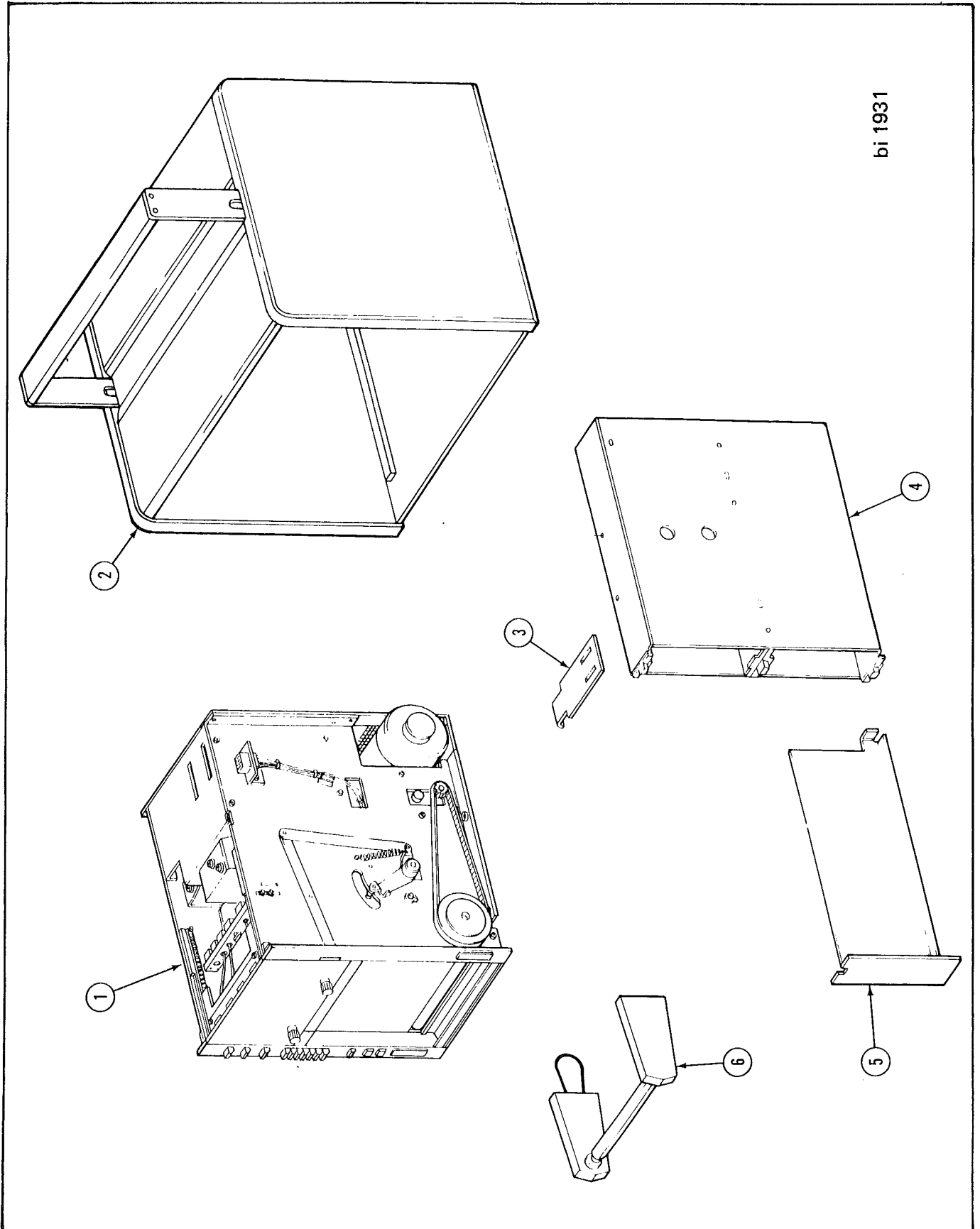
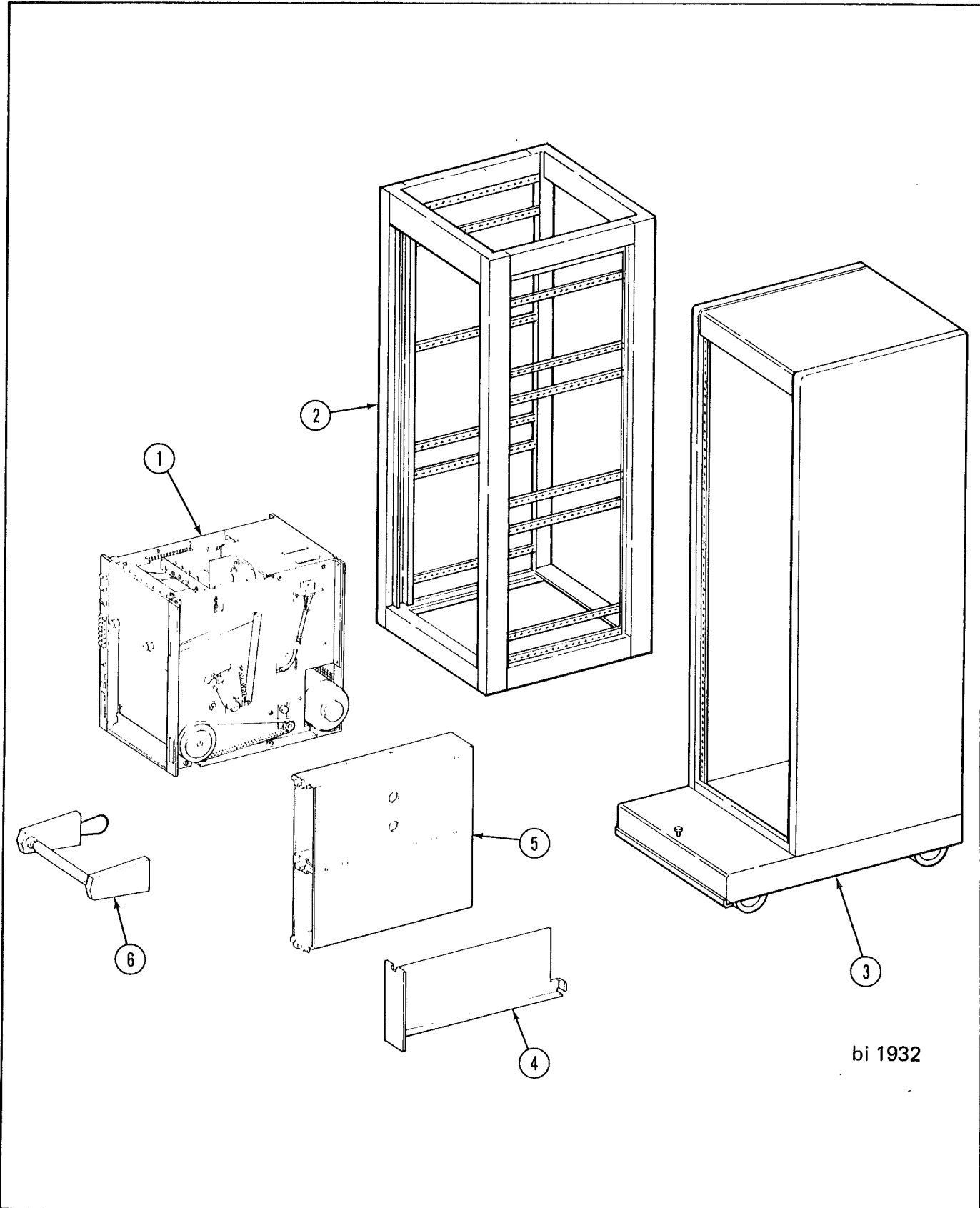


FIGURE 8-1 2200 SERIES RECORDER, PORTABLE

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – RACK MOUNTED MODELS
 FIGURE 8-2

ITEM NO	PART NUMBER	DESCRIPTION	USED ON
	2007-21XX-XX	2200 Recorder, 1 Channel	
	2007-22XX-XX	2200 Recorder, 2 Channel	
1	2007-2190-XX	Recorder Assy, 1 Chan. (See Fig. 8-3)	130-1
	2007-2290-XX	Recorder Assy, 2 Chan. (See Fig. 8-3)	130-2
2	467037	Frame, Shipping	
3	11-1154-61	Cabinet Assembly	
4	887005	Panel Assembly	
5	888321	Cage Assy, preamp (See Fig. 8-16)	130-2P
6	11-6402-13	Chart Take-up Assy (See Fig. 8-17)	
Not Shown	**688007	Kit Assy, Model 11-1202-17 (See Fig. 8-18) (Rack Mount Installation Instructions, Recorder Only)	
Not Shown	**688008	Kit Assy, Model 11-1202-16 (See Fig. 8-19) (Rack Mount Installation Instructions, Recorder and Preamp Cage)	

**Use Kit Model number for ordering purposes.



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FIGURE 8-2 2200 SERIES RECORDER, RACK MOUNTED MODELS

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – ALL MODELS
 RECORDER ASSEMBLY – 130 mm CHASSIS – 2007-2X90-XX
 FIGURE 8-3

PARTS IDENTIFICATION

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
1	886772	Board Assy, Switch ÷ 100 (see Fig. 8-4)	A-110	
	886772-1	Board Assy, Switch ÷ 60 (see Fig. 8-4)	A-110	
2	286767	Insulator		
3	242461-45	Nut		
4	248169-2	Spacer		
5	885098-2	Plate Assy., L.H. (see Figure 8-5)		
6	287595	Cover, Rear		
7	887593	Connector Assy, 2 Ch. (see Fig. 8-6)		130-2
	887593-1	Connector Assy 1 Ch. (see Fig. 8-6)		130-1
8	666582-2	Ink Tube (Valve Assembly to Manifold)		
9	887425	Valve Assy, Solenoid 115V		
	887425-1	Valve Assy, Solenoid 230V		
9A	282285-3	Solenoid 115V (Not Shown)	L-105	
	282285-4	Solenoid 230V (Not Shown)	L-105	
9B	269256-7	Diode, 1N4007 (Not Shown)	CR-111	
9C	684169-1	Valve Assy (Not Shown)		
10	786978	Bracket Assy, Top		
11	886327	Board Assy, Control (see Figure 8-7)	A-109	
12	886220	Board Assy, Dr. Amp (see Fig. 8-8)	A-101;A-102	
13	116198-X	Fuse (115V Models)	See Table 8-1, Fuse Table Following Fig. 8-3 Parts List	
	266924-X	Fuse (230V Models)		
14	114816-15	Plug	P-201	
15	289046	Plug	P-202	
16	287597	Panel, Filler (1 Ch. only)		130-1
17	786975	Bracket Assy, Bottom		
18	265814-6	Terminal Board	TB-102	
19	241026-2	Terminal Lug		
20	265840-2	Terminal Lug		
21	241513-206	Capacitor (115V Models)	C-108	
	231449-27	Capacitor (230V Models)	C-108	
22	265840-1	Terminal Lug		
23	286024	Transformer, Control	T-109	
24	285711	Spring		
25	243225-4	Clamp		
26	286971	Slide		
27	786977-1	Door Assy (2 Ch.)		130-2
	786977-2	Door Assy (1 Ch.)		130-1
28	285651-3	Knob		
29	667447-1	Ink Tube (Event Marker Pens)		
30	887181	Event Marker Assy (see Fig.8-9)		
31	11-2823-42	Pen Assy		
31A	687477-1	Ink Tube (Analog Pen Not Shown)		
*32	787394	Bar Assy, Penmotor 2 Ch. (see Fig. 8-10)		
	787392	Bar Assy, Penmotor 1 Ch. (see Fig. 8-10)		

*Item 32 not procurable, but all items listed in Fig. 8-10 parts list are.

EXPLODED VIEW PARTS LIST (Continued)
 2200 SERIES RECORDER — ALL MODELS
 RECORDER ASSEMBLY — 130 mm CHASSIS — 2007-2X90-XX
 FIGURE 8-3

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
33	289238	Shield		
34	787391	Manifold		
35	1-280875-9	Spacer, Threaded		
36	265814-9	Board, Term.	TB-103A	
37	686973	Shield Assy		
38	1-286155-12	Board, Term.	TB-101	
39	1-280875-8	Spacer, Threaded		
40	129699	Jumper		
41	289225-1	Shield		
42	681257-1	Cable	P-101	
43	108572-12	Strain, Relief		
44	787641	Cover Assy, Rear		
45	287599	Cover, Rear		
46	643785-10	Pulley Assy., Trans.		
47	12-2158-16	Transmission Assy ÷ 100, 60 Hz	A-111	
	12-2160-16	Transmission Assy ÷ 60, 60 Hz	A-111	
	12-2159-16	Transmission Assy ÷ 100, 50 Hz	A-111	
	12-2161-16	Transmission Assy ÷ 60, 50 Hz	A-111	
48	686429	Indicator Assy		
49	243457	Spring		
50	1-227070-3	Ring, Ret.		
51	683485	Brake Assy (see Fig. 8-11)		
52	286531	Spring		
53	263526	Pulley, 9T		
54	243542-11	Belt, Timing		
55	270903-11	Clamp		
56	783590	Sensor Assy (see Fig. 8-13)		
57	285357-3	Shaft		
58	686966	Roll, Drive		
59	267426-3	Paper Deflector		
60	785701-3	Chute, Paper		
61	885083-1	Plate Assy., R.H. (see Fig. 8-12)		
62	265745-1	Washer, Mylar		
63	265741-1	Bearing, Ball		
64	127271	Washer		
65	123913	Washer, Spacer		
66	243542-12	Belt, Timing		
67	288698	Pulley, 9 Tooth		
68	287499	Motor, Gear, AC (115V, 60Hz)	B-101	
	287649	Motor, Gear, AC (115V, 50Hz)	B-101	
	287651	Motor, Gear, AC (230V, 50Hz)	B-101	
69	289049-1	Grommet, Rubber		
70	288710	Bracket		

EXPLODED VIEW PARTS LIST (Continued)
 2200 SERIES RECORDER – ALL MODELS
 RECORDER ASSEMBLY – 130 mm CHASSIS – 2007-2X90-XX
 FIGURE 8-3

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER	USED ON
71	487327	Chassis		
72	286026	Transformer, Power	T-101;T-102	
73	787589	Harness Assy, Transmission		
74	786396	Panel Assy, Ft. R.H.		
75	286770	Cover, Panel		
76	887393	Table Assy, Writing (see Fig. 8-14)		
77	127271	Washer		
78	1-227070-9	Ring, Ret.		
79	785718	Flange Assy, Supply		
80	787467	Shaft Assy, Supply		
81	11-2730-01	Ink Cartridge		
82	685196-2	Lampholder Assy		
83	685196-1	Lampholder Assy		
84	285765-1	Lamp	DS-101;DS-102	
85	285764-4	Lens		
86	285764-1	Lens		
87	786393	Panel Assy, Ft. L.H.		
88	2-240731-10	Ring, Ret.		

TABLE 8-1 FUSE TABLE (ITEM 13)

FUSE SYMBOL	LINE VOLTAGE & FREQUENCY		
	115V/60HZ	115V/50HZ	230V/50HZ
F101, F102	116198-9 3/4A, 125V	116198-10 1A, 125V	266924-7 1/2A, 250V
F109	116198-6 1/4A, 125V	116198-7 3/8A, 125V	266924-2 1/4A, 250V
F111	116198-4 1/8A, 125V	116198-4 1/8A, 125V	266924-5 1/16A, 250V
F112	116198-12 2A, 125V	116198-12 2A, 125V	266924-6 3/4A, 250V

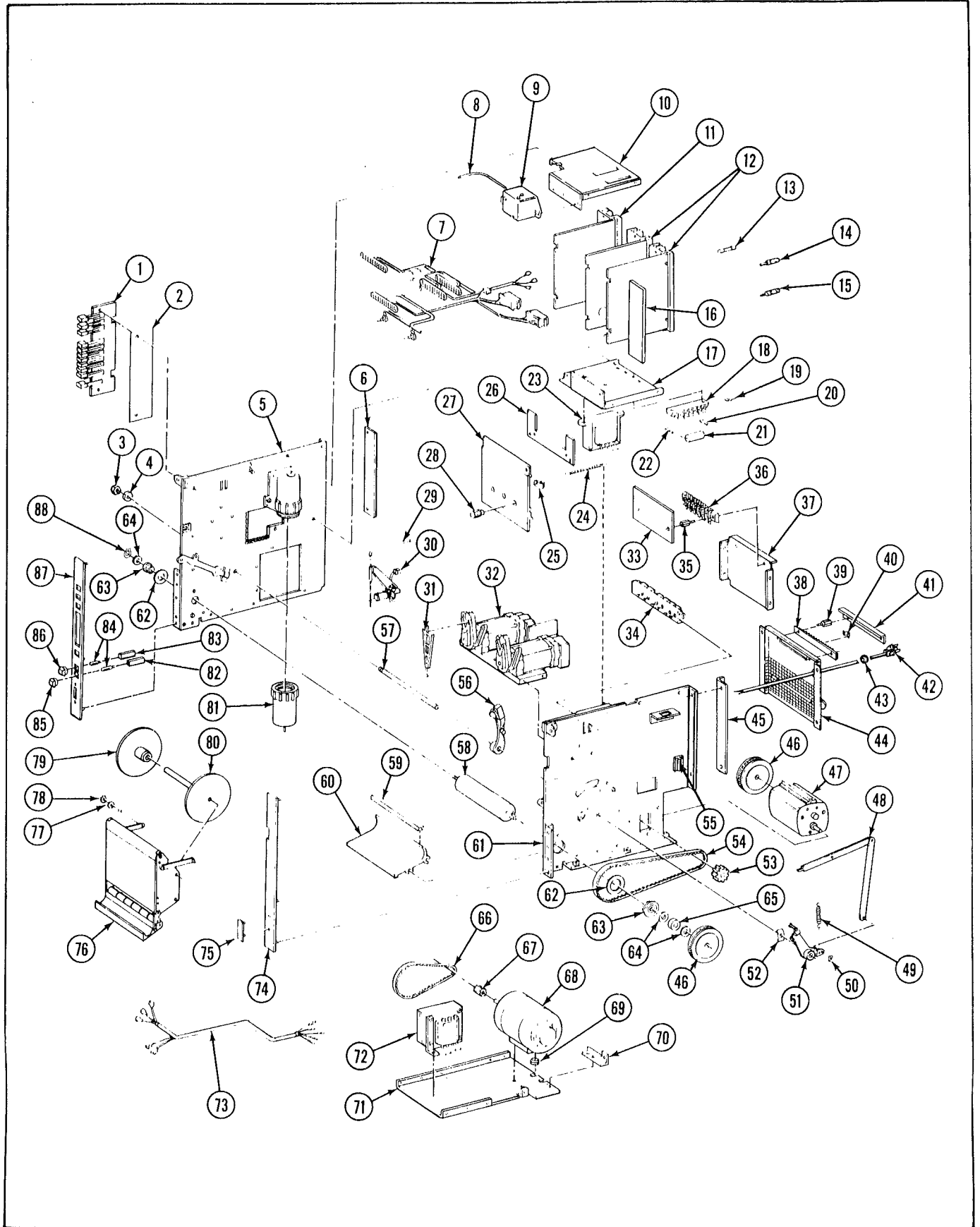
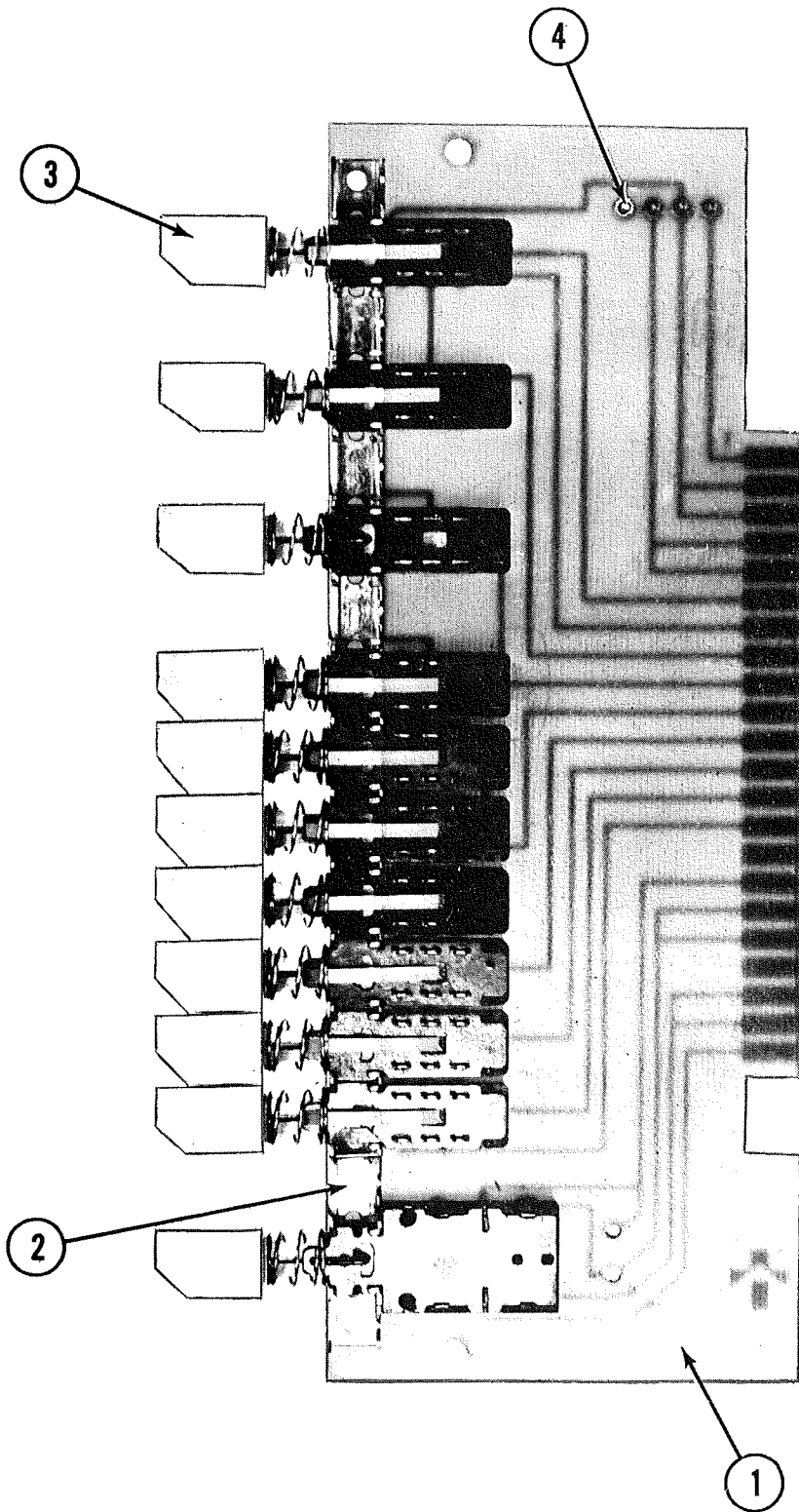


FIGURE 8-3 2200 RECORDER ASSY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – All Models
 BOARD ASSEMBLY, SWITCH
 FIGURE 8-4

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
1	886772	Board Assy, Switch		÷ 100 Models
	886772-1	Board Assy, Switch		÷ 60 Models
2	385804	Board Printed Circuit		
	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		



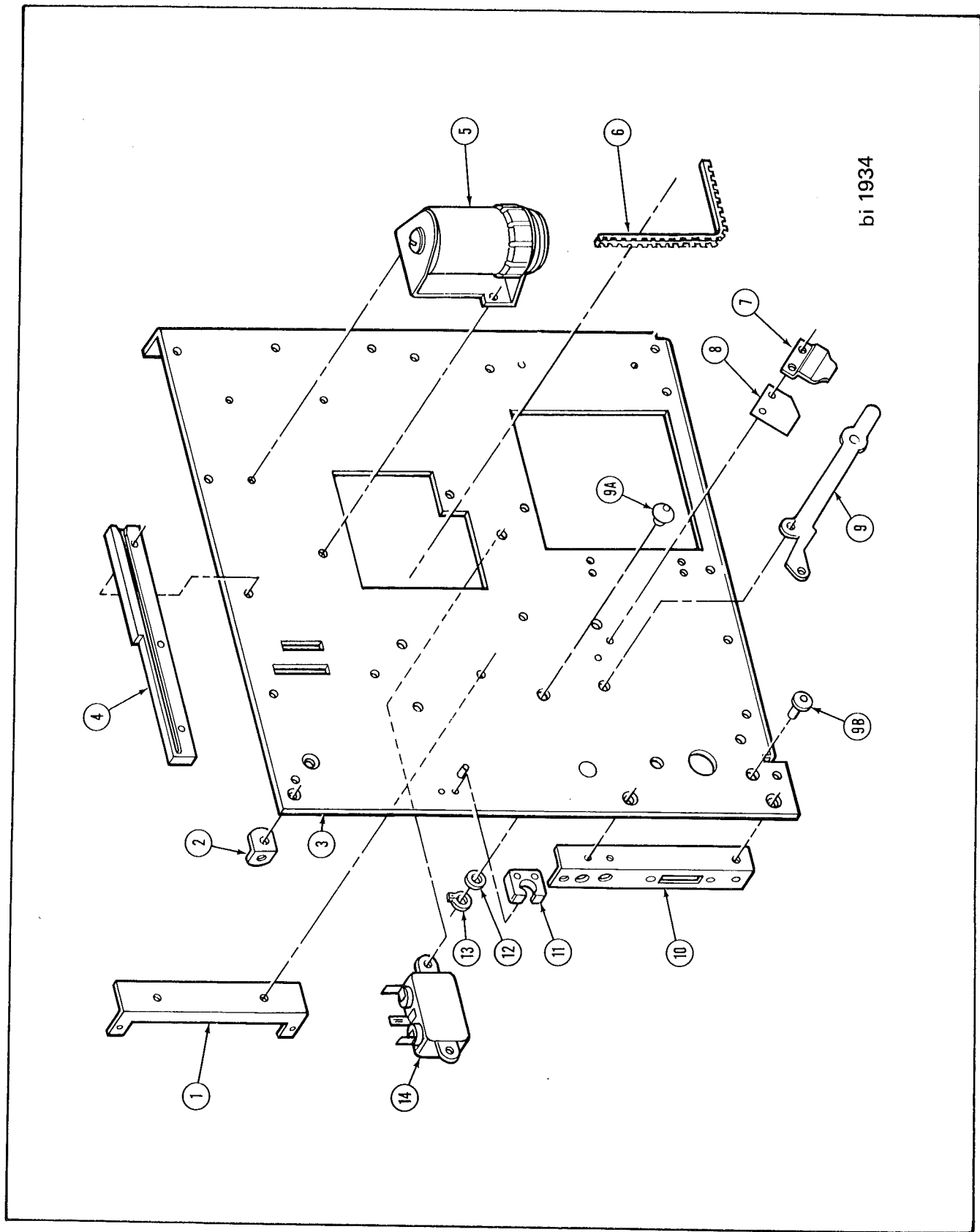
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FIGURE 8-4 SWITCHBOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – All Models
 PLATE ASSEMBLY, L.H.
 FIGURE 8-5

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
1	885098-2 385619	Plate Assy, L.H. Bracket, Connector	
2	1-265849-4	Bracket	
**3	885046-1	Plate Subassy	
4	385543-2	Guide	
5	766243	Ink Plunger Assy	
6	2-128693-3	Grommet	
7	243623	Spring	
8	243622	Pad, Friction	
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	FL-101

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



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FIGURE 8-5 PLATE ASSY, L.H.

PARTS IDENTIFICATION

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER—All Models
 CONNECTOR ASSEMBLY—130mm MAINFRAME
 FIGURE 8-6

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	887593-1	Connector Assembly, 1 Channel		130-1
	887593	Connector Assembly, 2 Channel		130-2
	785087	Harness Assembly, Penmotor		
1	9-281501-82	Connector	XM-101, XM-102	
2	281506-3	Contact, Elec.		
3	1-283408-2	Contact, Elec.		
	887591	Harness Assembly		
4	283420-44	Connector	XA109, XA110	
5	1-283408-2	Contact, Elec.		
6	265840-1	Lug, Terminal		
7	265915-1	Lug, Terminal		
8	284700	Key, Polarizing		
	785089	Harness Assembly, Power Transformer		
9	1-283408-2	Contact, Elec.		
10	265840-1	Lug, Terminal		
	788091	Harness Assembly, Pen Position		130-1
	787424	Harness Assembly, Pen Position		130-2
11	1-283408-1	Contact, Elec.		
12	10-286044-103	Resistor, Variable	R-101, R-102	
	887399	Harness Assembly		
13	9-270159-2	Connector	P-105 thru P-107	
14	270154-1	Contact, Elec.		
15	1-283408-1	Contact, Elec.		
16	283420-44	Connector	XA-101, XA-102	
17	286598	Spring, Commoning		
18	265840-1	Lug, Terminal		
19	265915-1	Lug, Terminal		
20	286594-1	Lug, Terminal		
21	9-270159-15	Connector	J-103	
22	284700	Key, Polarizing		
23	265840-1	Lug, Terminal		
24	1-283408-2	Contact, Elec.		

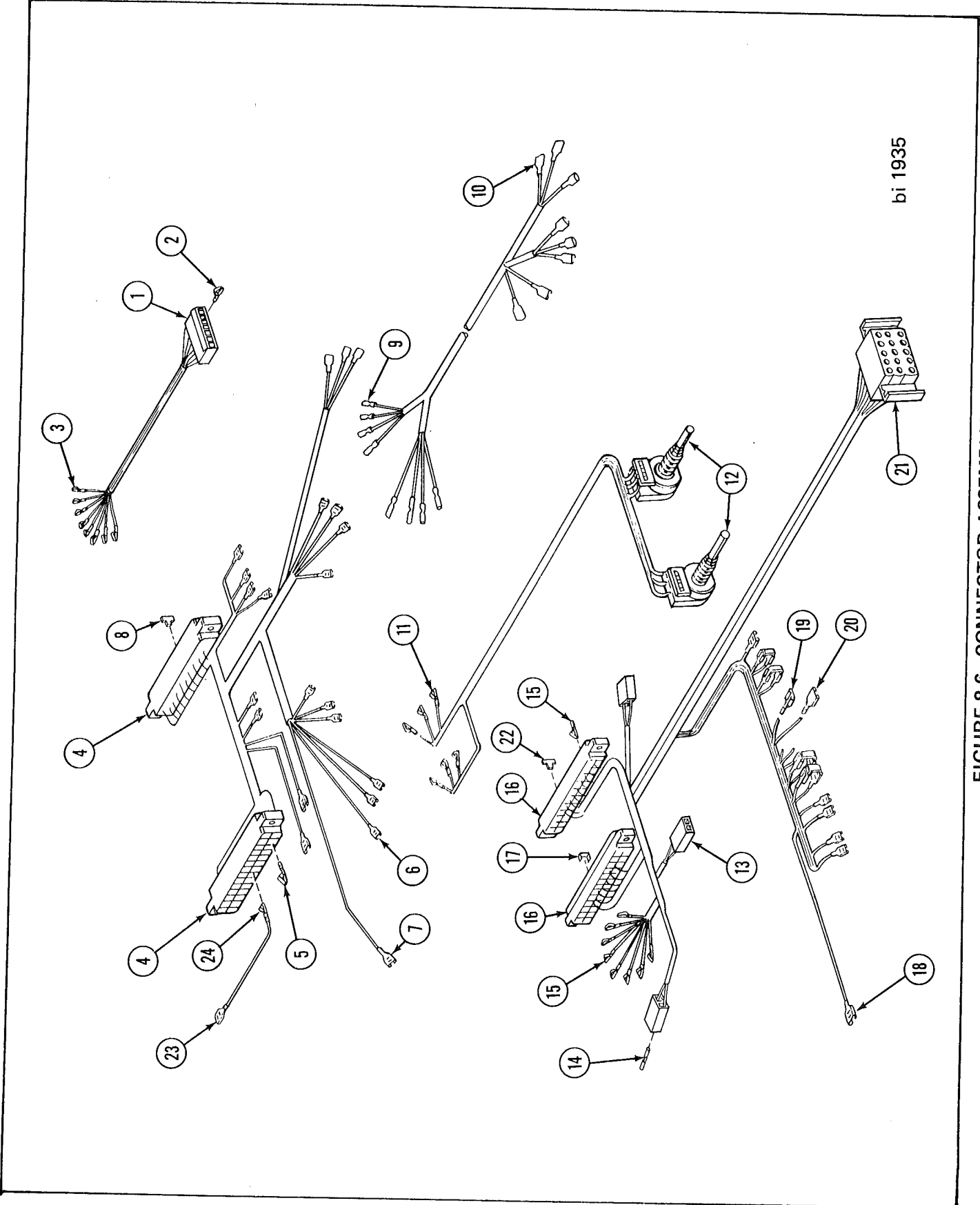


FIGURE 8-6 CONNECTOR ASSEMBLY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER—All Models
 BOARD ASSEMBLY
 CONTROL-TIMER 886327
 FIGURE 8-7

SYMBOL NO	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	286141	Transistor, 2N3904
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
S104	286142-8	Switch
U101	285317	Voltage Regulator, MC7805CP
U102 thru U105	270622	Integrated Circuit, 7493
U106	286016	Integrated Circuit, SN74121
U107	285589	Isolater, Led, 4N28
---	285179	Switchplate (Not shown, mounted on Heatsink)
---	686397	Heatsink (Rectangular black object, top of view)

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

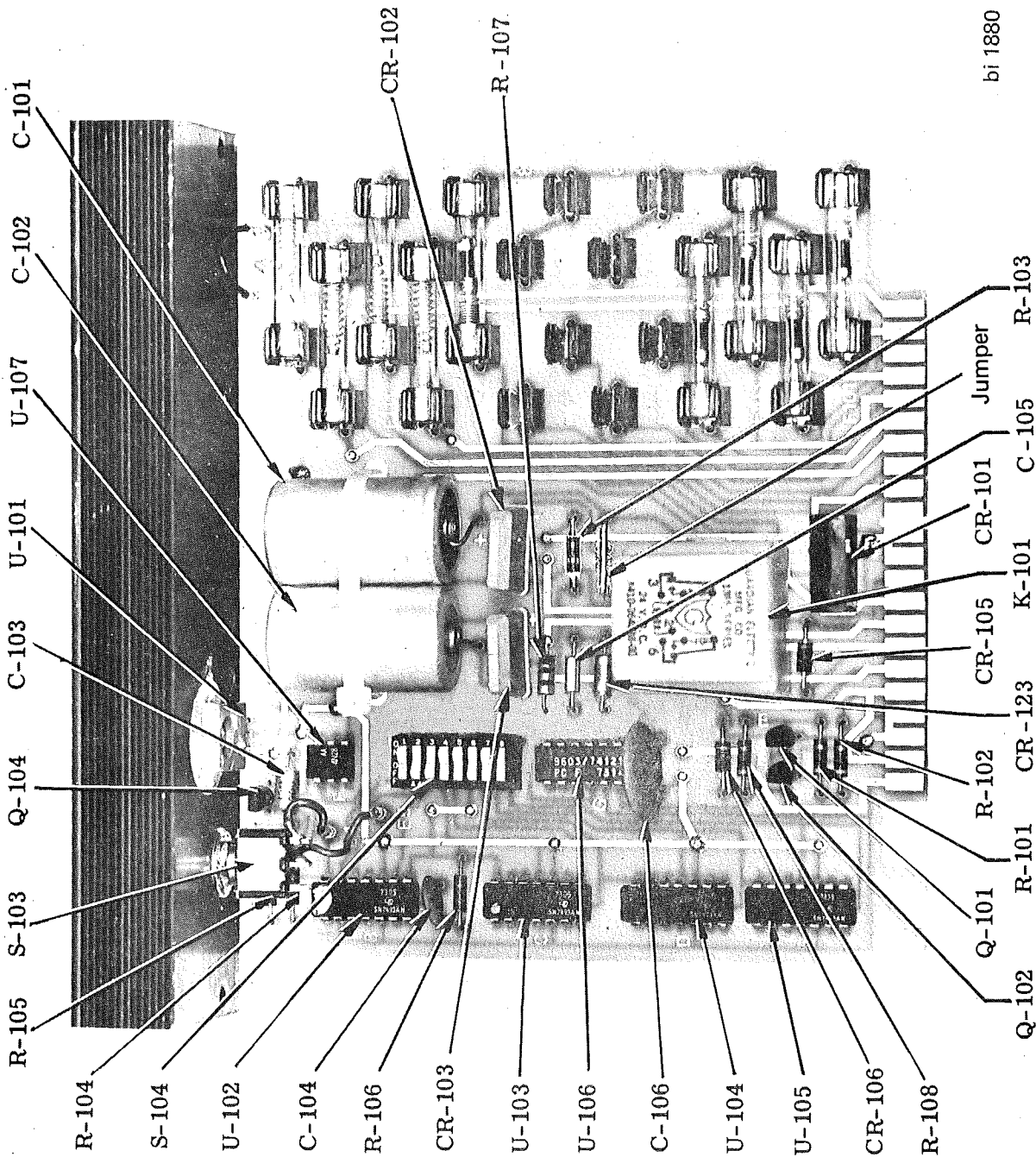


FIGURE 8-7 CONTROL TIMER BOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – All Models
 BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220
 FIGURE 8-8 (2 Sheets)

SYMBOL NO	PART NUMBER	DESCRIPTION
C201	10-125904-223	Capacitor
C202	10-247116-102	Capacitor
C203, 204	10-247116-103	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
CR201, 202	263727	Diode, 1N961B
CR203-208	270508	Diode, 1N4454
CR209, 210	286018-1	Diode, MDA-101
CR211	269256-7	Diode, 1N4007
Q201	286143	Transistor, 2N3906
Q202-205	286141	Transistor, 2N3904
Q206	1-230057-3	Transistor, 2N4923
Q207	1-286145-1	Transistor, 2N5982
Q208	1-230058-3	Transistor, 2N4920
Q209	1-286147-1	Transistor, 2N5985
Q210	281857-2	Transistor, 2N5033
R201	1-281851-30002	Resistor
R202	1-281851-10002	Resistor
R203	1-281851-43201	Resistor
R204	1-281851-10002	Resistor
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

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – All Models
 BOARD ASSEMBLY, DRIVE AMPLIFIER–886220 (Continued)
 FIGURE 8-8 (2 Sheets)

SYMBOL NO	PART NUMBER	DESCRIPTION
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
R254	1-281851-16001	Resistor
R255	1-281851-50000	Resistor
R256	5-241111-101	Resistor
R257	1-281851-20001	Resistor
R258, 259	1-281851-10002	Resistor
R260	282299-103	Resistor

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER — All Models
 BOARD ASSEMBLY, DRIVE AMPLIFIER—886220 (Continued
 FIGURE 8-8 (2 Sheets)

SYMBOL NO	PART NUMBER	DESCRIPTION
R261	1-281851-15301	Resistor
R262	5-241111-104	Resistor
R262, 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
U208	285778	Voltage Reg., MC 7915
U209, 210	Not Used	
U211	285589	Isolator, LED, 4N28
----	686391	Heatsink (Rectangular black object top of view)
----	685187	Jack Assembly (Not shown, mounted on heatsink) Consisting of:
J201	285315	Jack
J202	289045	Jack
**P201	114816-15	Plug
**P202	289046	Plug

* Case shape is actually rectangular (626 MINI-DIP)

** Shipped loose. See items 14 & 15 Recorder Assy (Fig. 8-3)

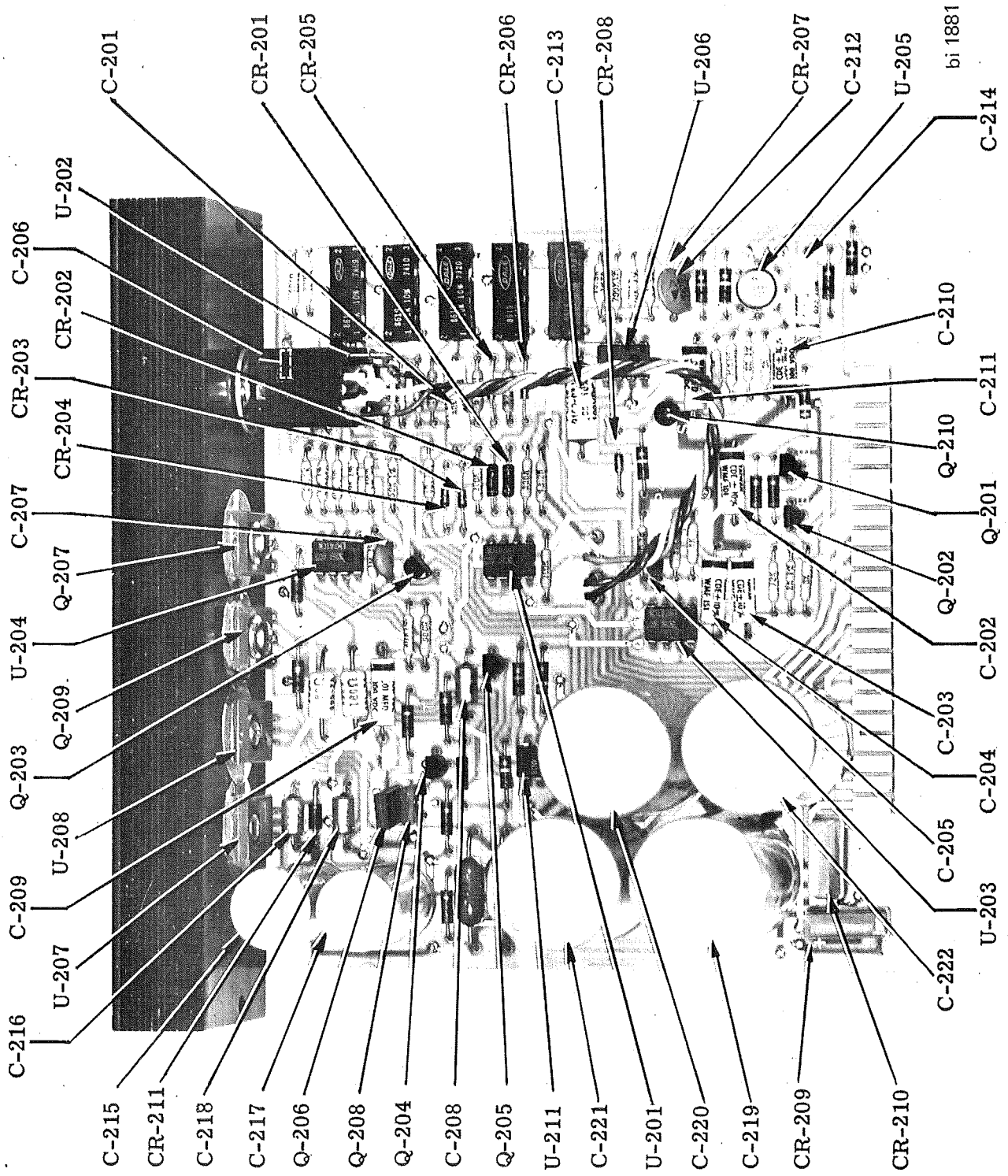


FIGURE 8-8 DRIVE AMPLIFIER ASSEMBLY (Sheet 1 of 2)

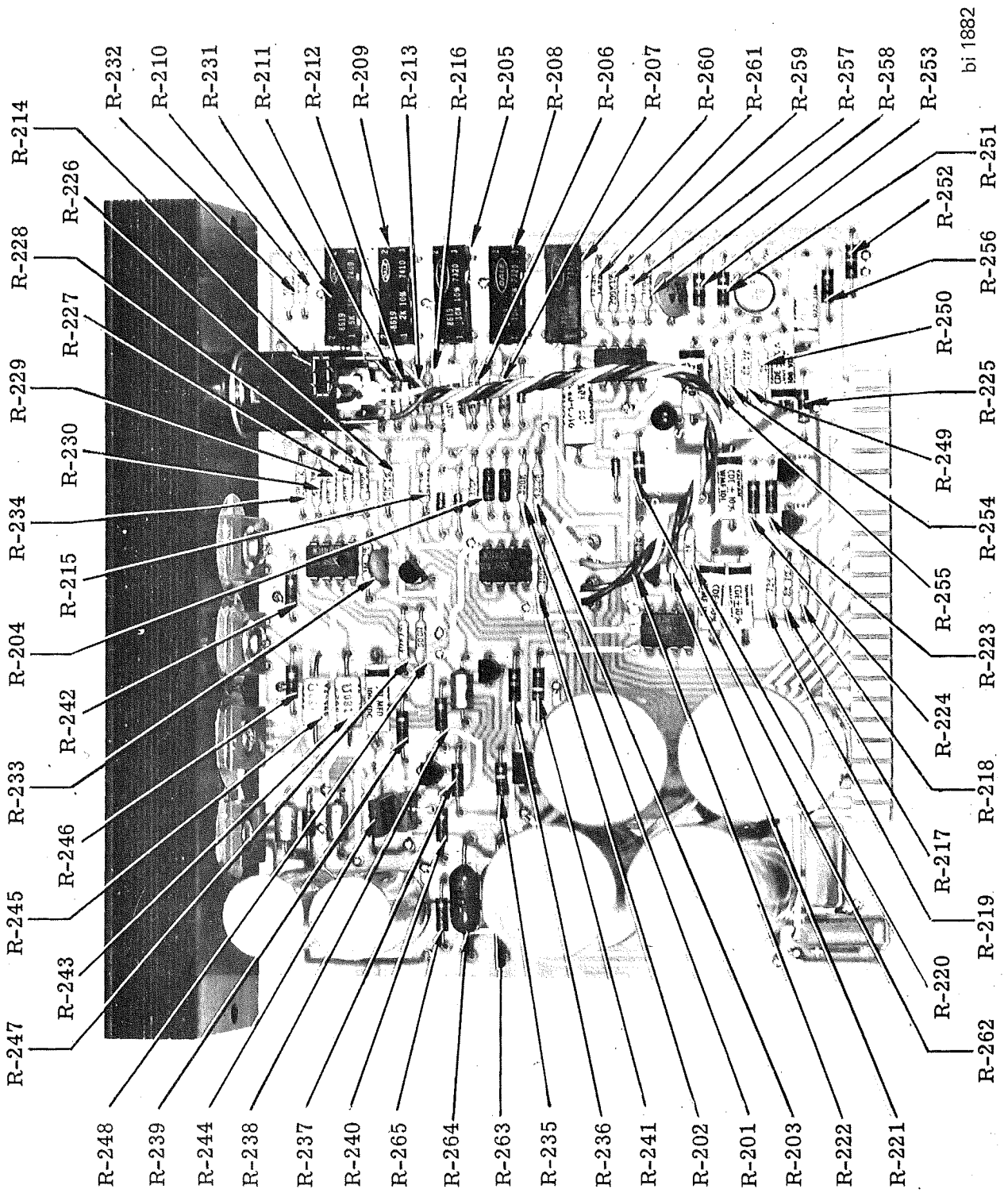
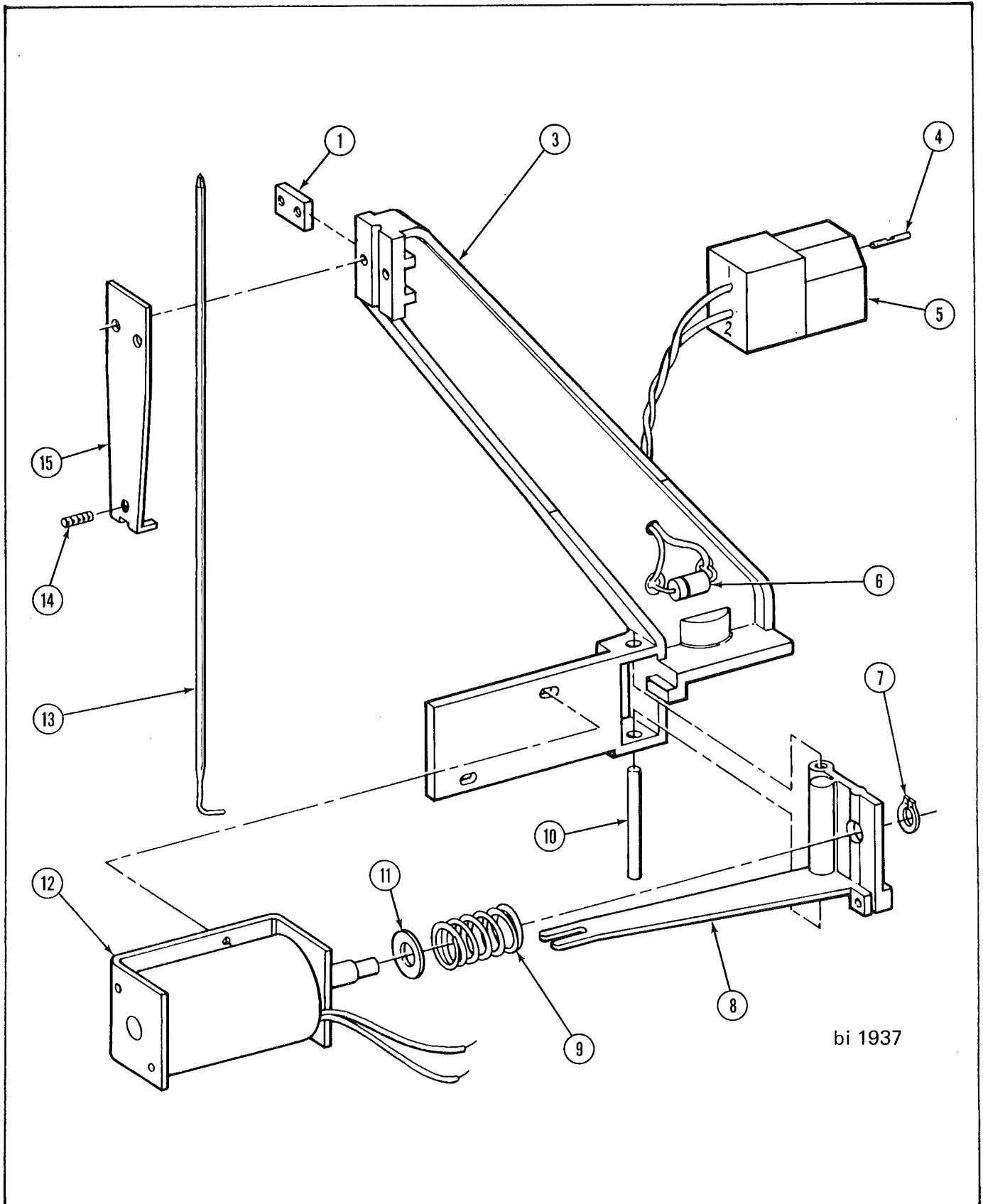


FIGURE 8-8 DRIVE AMPLIFIER ASSEMBLY (Sheet 2 of 2)

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER—All Models
 INTERCHANNEL EVENT MARKER—887181
 FIGURE 8-9

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	887181	Interchannel Event Marker Assy		
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-107	
6	269256-7	Diode	CR-114 thru CR-116	
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-110	
13	267884-5	Tube, Pen		
14	241073-0803	Screw, Set		
15	285166	Bracket, Pen Pressure		

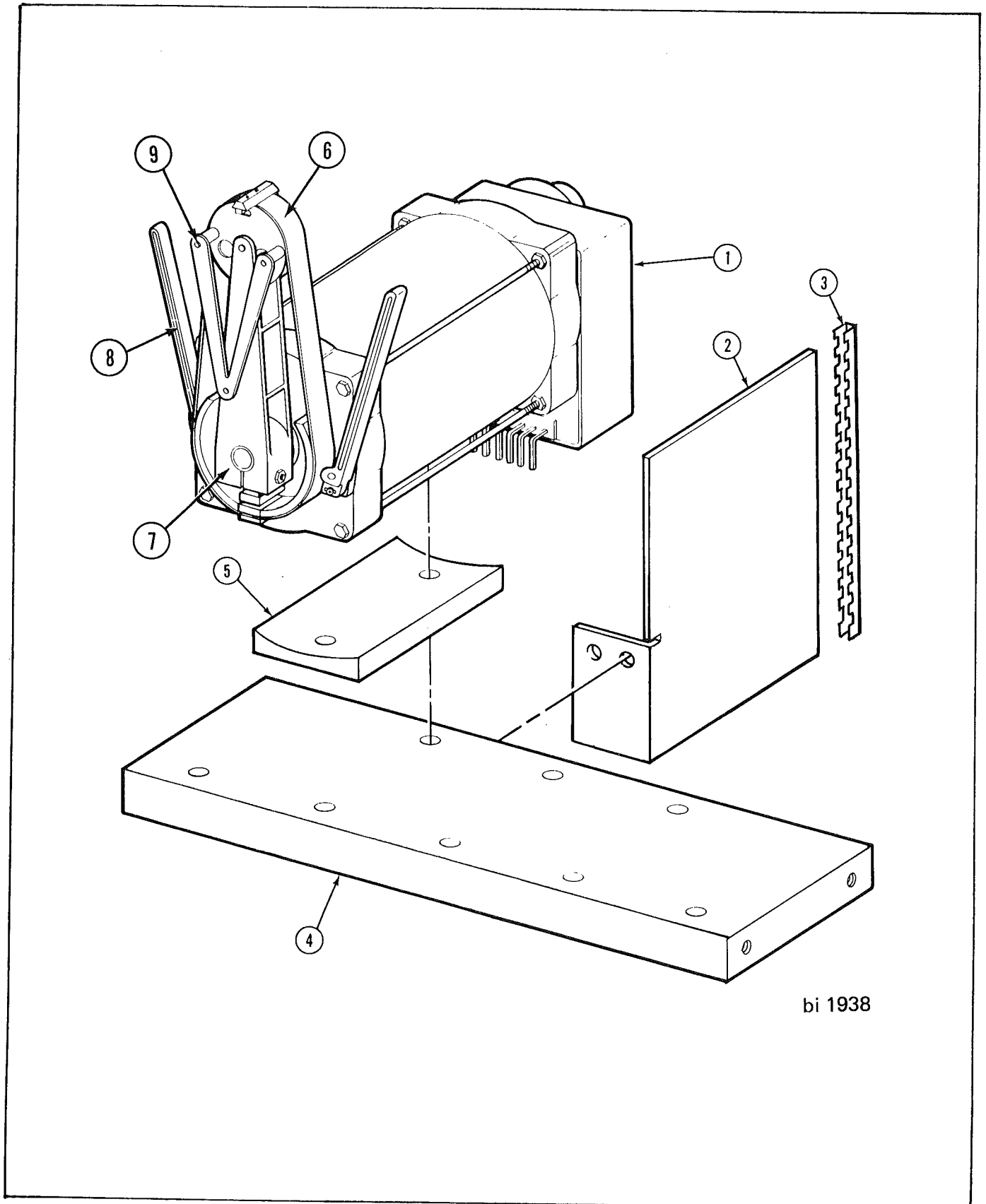


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FIGURE 8-9 INTERCHANNEL EVENT MARKER

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – ALL MODELS
 BAR ASSEMBLIES, PENMOTOR – 130mm MAINFRAME
 FIGURE 8-10

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
1	787392	*Bar Assy, Penmotor - 1 Ch.	M-101, M-102
	787394	*Bar Assy, Penmotor - 2 Ch.	
	884320	Penmotor Assy	
2	287184	Shield (130-2 or 2P only)	
3	2-128693-1	Grommet (130-2 or 2P only)	
4	286972	Bar, Mtg.	
5	684853	Saddle, Penmotor	
6	684999	Band, Penmotor (part of item 1)	
7	784583	Drive Arm Assembly (Part of Item 1) (A-P)	
	31-119922-2608	Screw	
	31-119998-26	Nut	
		----- *	
8	384597	Stop (Part of Item 1) (A-P)	
	31-119918-4008	Screw	
	1-118195-304	Washer	
		----- *	
9	284993	Pen Bracket (Part of Item 1) (A-P)	
	31-119914-0004	Screw	
	241073-0803	Set Screw (Pen Adjust)	
*Penmotor Bar Assemblies not procurable. Use items 1 thru 9 and attaching parts (A-P).			



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FIGURE 8-10 PENMOTOR BAR ASSEMBLY

EXPLODED VIEW PARTS LIST
2200 SERIES RECORDER— All Models
BRAKE ASSEMBLY 683485
FIGURE 8-11

ITEM NO	PART NUMBER	DESCRIPTION
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

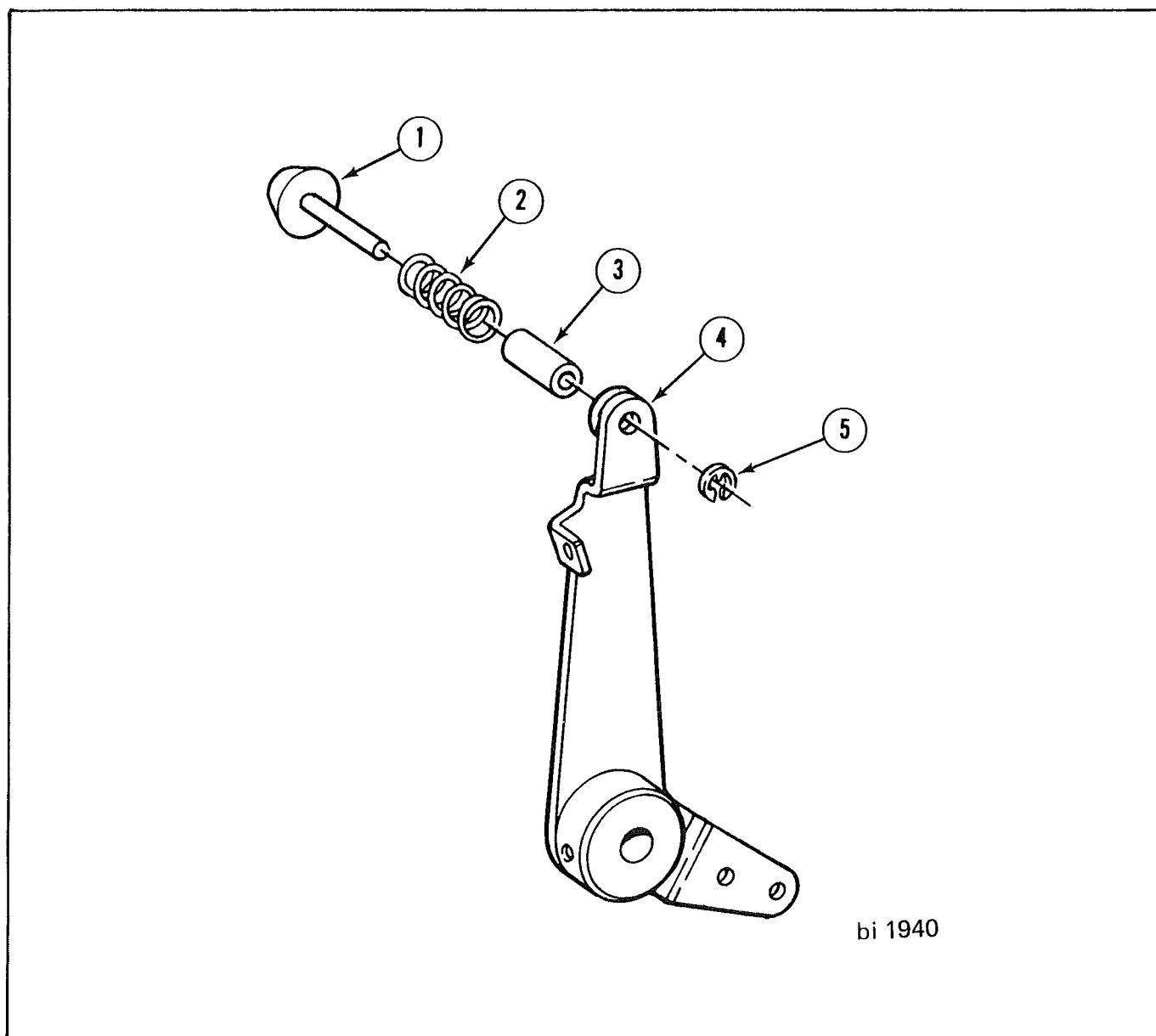


FIGURE 8-11 BRAKE ASSEMBLY

EXPLODED VIEW PARTS LIST
2200 SERIES RECORDER—All Models
PLATE ASSEMBLY, R.H.
FIGURE 8-12

ITEM NO	PART NUMBER	DESCRIPTION
1	885083-1	Plate Assy, R.H.
2	385543-1	Guide
3	886560-1	Plate Subassy
4	287389	Bracket, Conn.
5	127271	Washer
6	1-227070-9	Ring, Retaining
7	285712	Bracket, R.H.
8	265711	Catch
9	665789	Lever Assy, R.H.
10	243622	Pad, Friction
11	243623	Spring
12	285599	Catch
	1-265849-4	Bracket

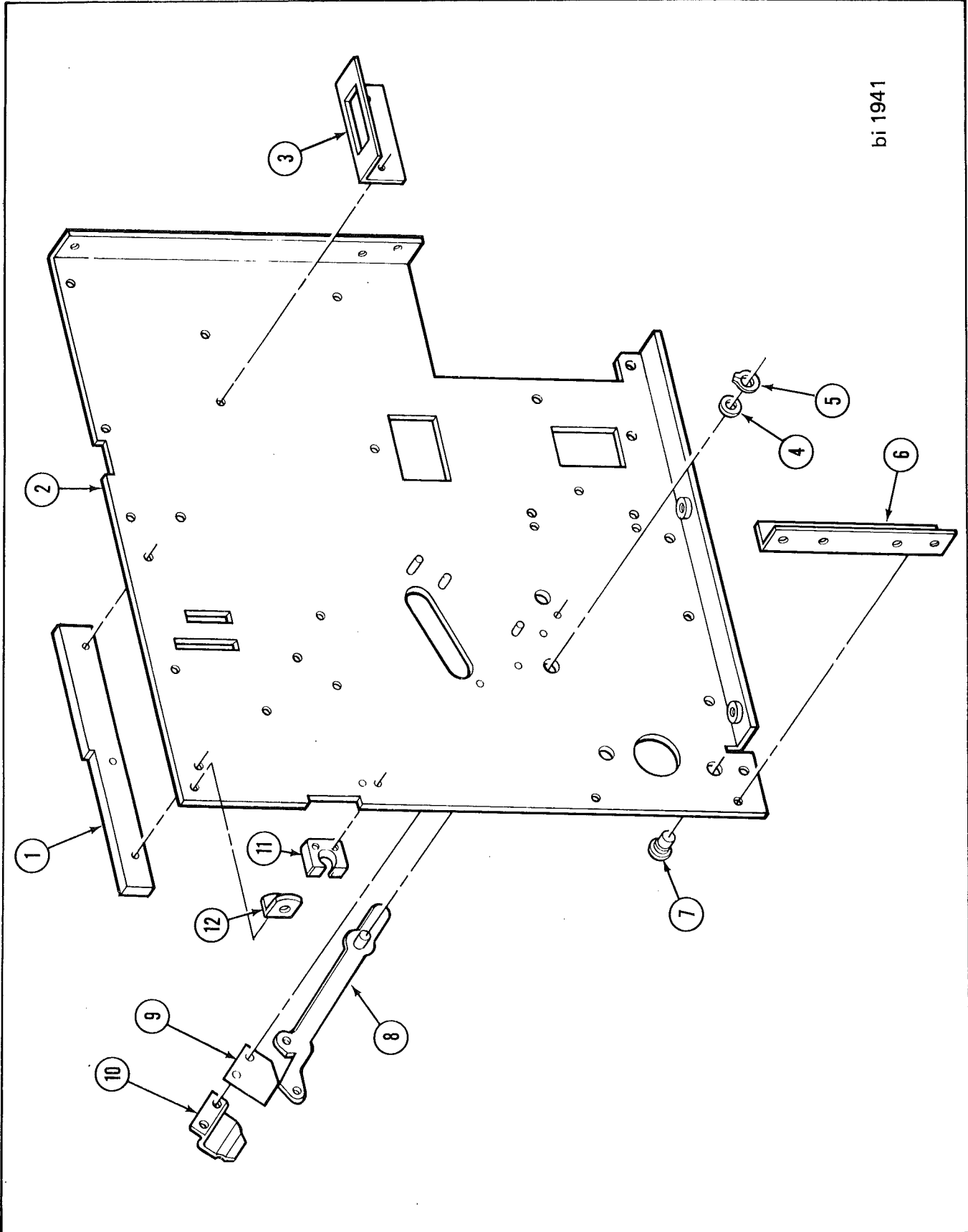


FIGURE 8-12 R. H. PLATE ASSEMBLY

EXPLODED VIEW PARTS LIST
2200 SERIES RECORDER—All Models
SENSOR ASSEMBLY
FIGURE 8-13

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

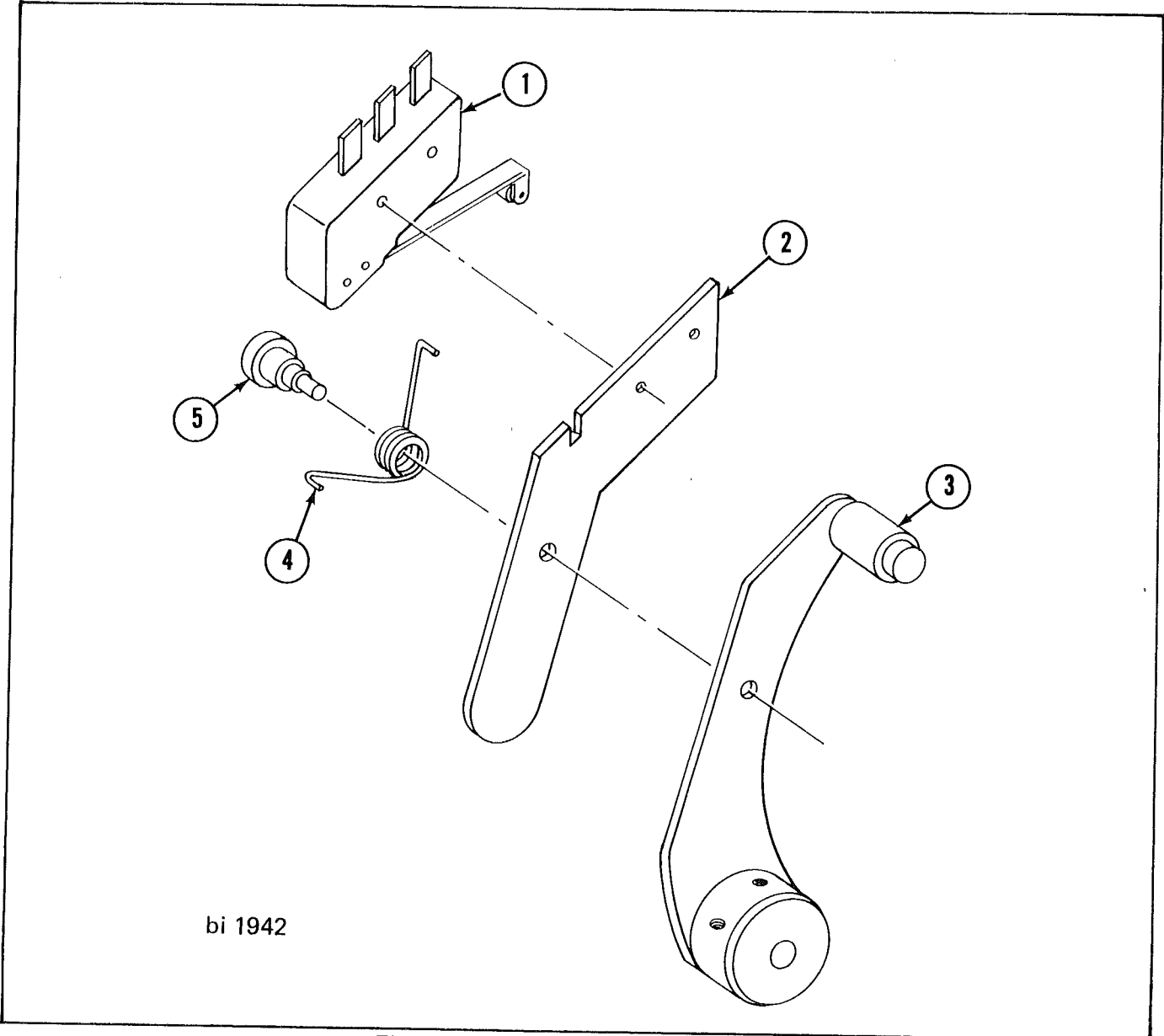


FIGURE 8-13 SENSOR ASSEMBLY

EXPLODED VIEW PARTS LIST
2200 SERIES RECORDER--All Models
TABLE ASSEMBLY, WRITING
FIGURE 8-14

ITEM NO	PART NUMBER	DESCRIPTION
1	887393	Table Assy, Writing
2	787396	Bar Assy, Writing
3	687390	Paper Release Assy
4	343616-910	Support Assy, Right
5	4-112468-21	Roll Pin
6	1-210761-6	Bearing, Ball
7	286974	Roll, Pressure
8	685620-1	Bar Assy, Pull
9	243867-1	Packing, Preformed
	343617-910	Support Assy, Left

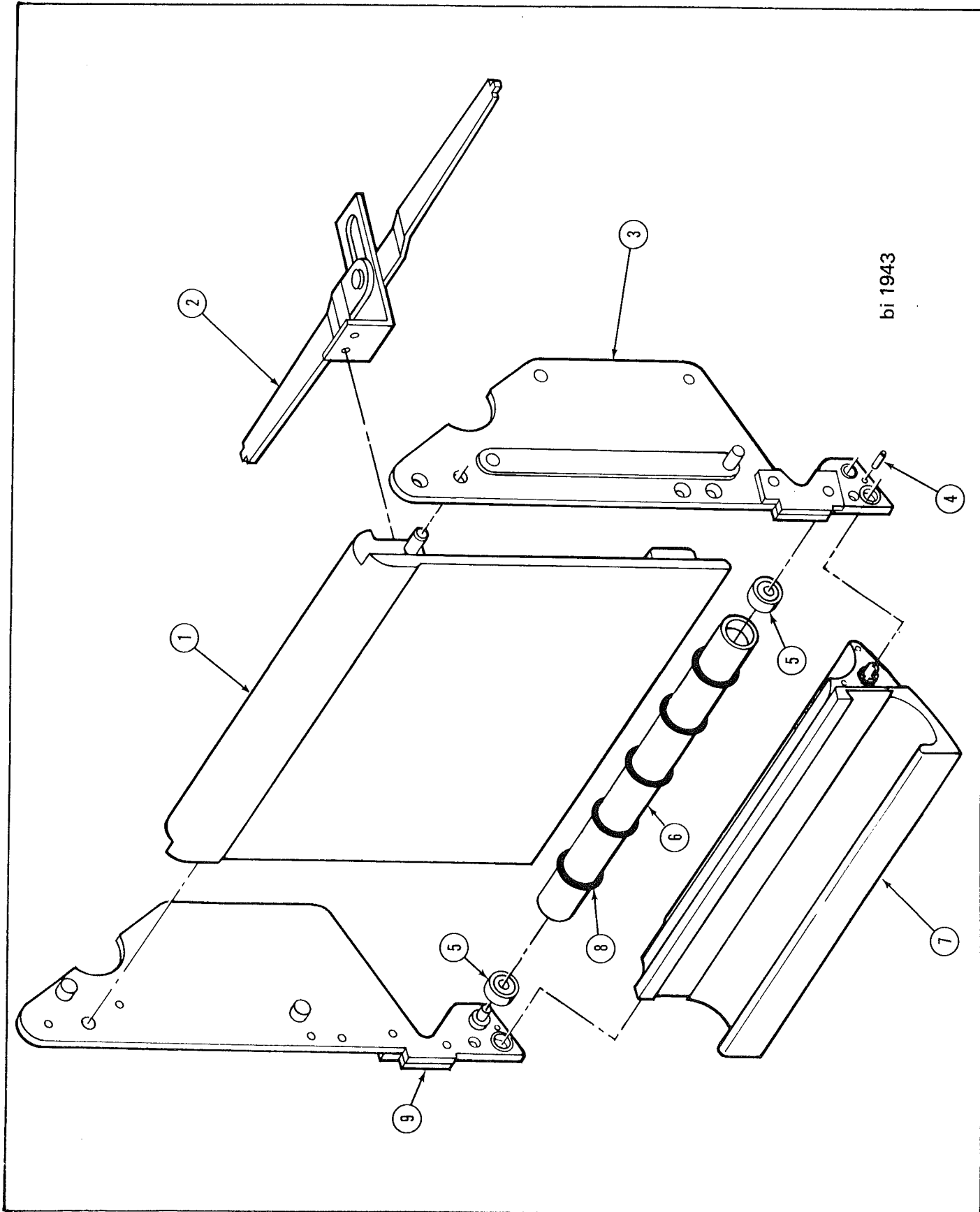


FIGURE 8-14 WRITING TABLE ASSEMBLY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER
 CASE ASSEMBLY
 FIGURE 8-15

ITEM NO	PART NUMBER	DESCRIPTION	USED ON
	887336	Case Assembly <i>NO CAGE</i>	130-1 & 2
	887334	Case Assembly <i>2 CH CAGE</i>	130-XP
1	486081	Side Panel	
2	785099-7	Handle Assembly	130-1 & 2
	785099-6	Handle Assembly	130-XP
		consisting of:	
	286050	Slide, Handle	
	686074-7	Handle	130-1 & 2
	686074-6	Handle	130-XP
3	686049-7	Cover, Center	130-1 & 2
	686049-6	Cover, Center	130-XP
4	286048	Support, Handle	
5	486075-2	Guide, Left	
6	486075-1	Guide, Right	
7	686051-7	Cover, Front & Rear	130-1 & 2
	686051-6	Cover, Front & Rear	130-XP
8	1-232736-16	Tape, Teflon	
9	3-266107-5	Bail Assembly	
10	487326	Saddle Assembly	130-1 & 2
	887328	Saddle Assembly	130-XP
11	287185	Bar Support	

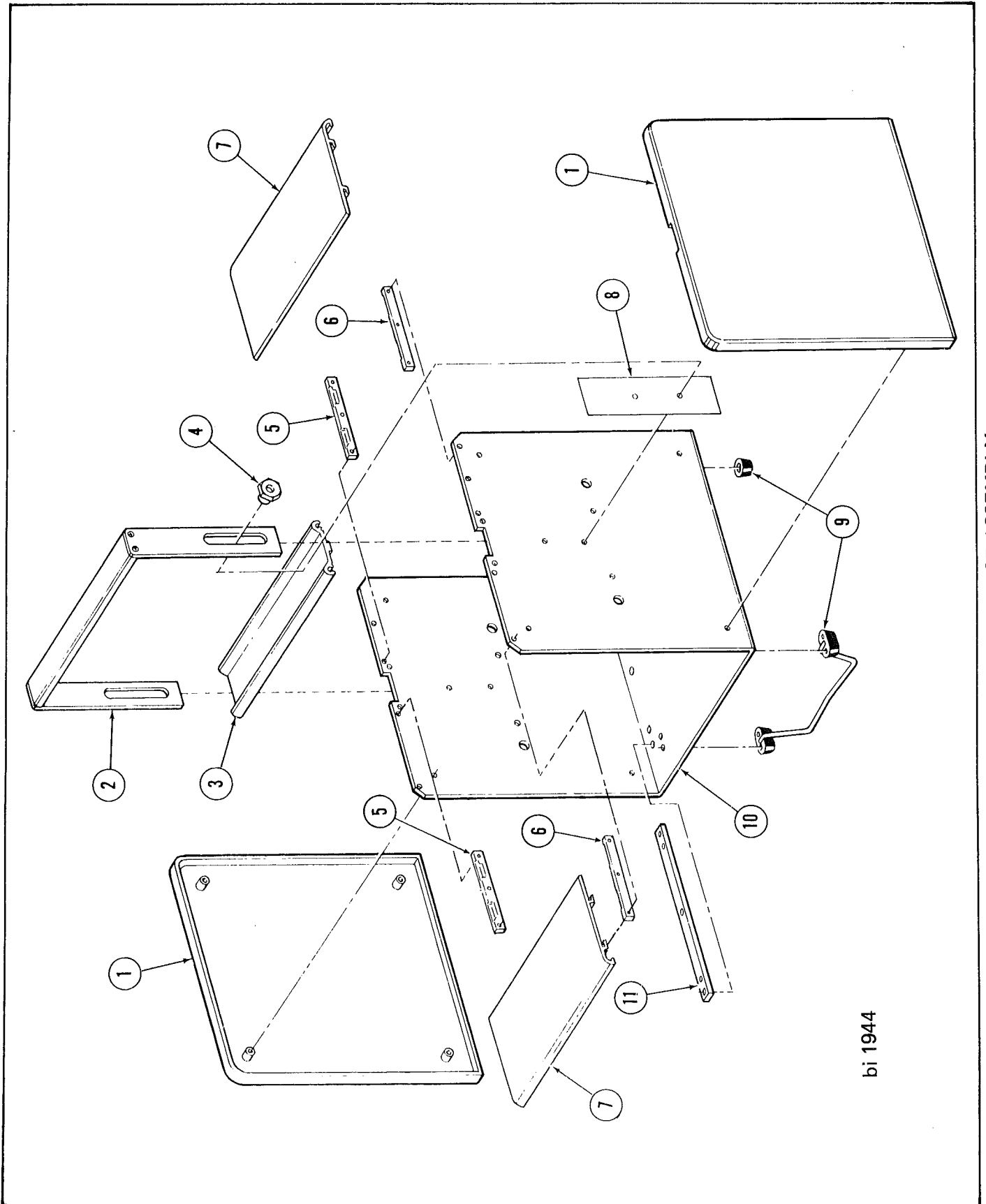


FIGURE 8-15 CASE ASSEMBLY

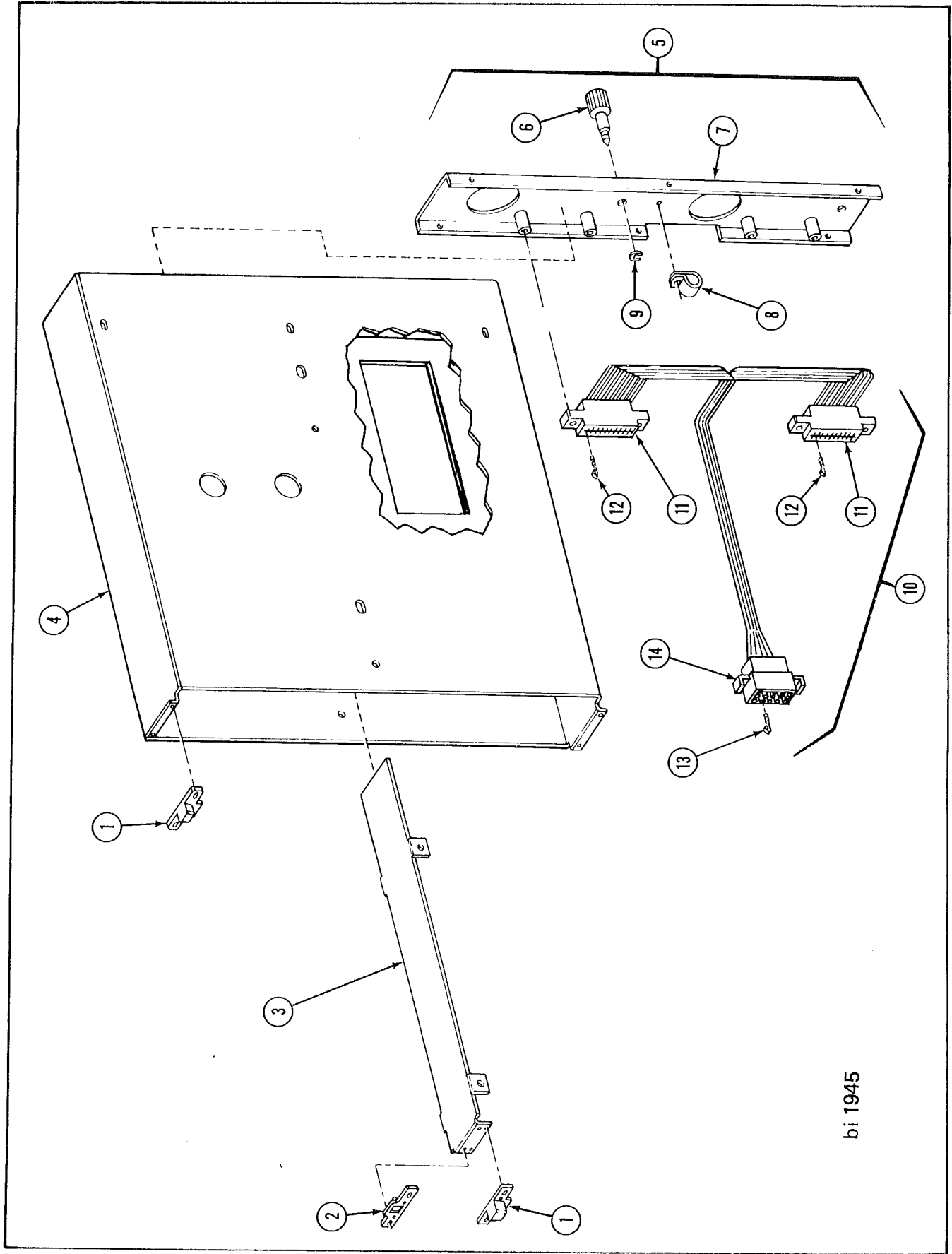
bi 1944

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER
 CAGE ASSEMBLY PREAMP
 FIGURE 8-16

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
1	888321 786056-1 786056-2	Cage Assembly, Preamp, 2 Channel Guide, Engraved "1" Guide, Engraved "2"	
2	386058-2	Guide, Preamp	
3	386476	Shelf	
4	486461	Enclosure, Preamp	
*5	788280	Cage Assembly, Rear consisting of:	
6	286052	Screw, Shoulder	
7	786475	Panel Assembly, Rear	
8	234623-6	Clamp, Loop	
9	0-240731-10	Ring, Retaining	
10	787422	Harness Assembly consisting of:	
11	286410-16	Connector	XA201,202
12	1-283408-2	Contact (for item 11)	
13	270153-1	Contact (for item 14)	
14	9-270158-15	Connector	P203

*Item 5, Cage Assembly—Rear, not procurable. Use indented items 6 thru 14 or Preamp Cage Assembly at top of list.

PARTS IDENTIFICATION



bi 1945

FIGURE 8-16 CAGE ASSEMBLY

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDER – All Models
 CHART TAKE-UP ASSEMBLY 11-6402-13
 FIGURE 8-17

ITEM NO.	PART NUMBER	DESCRIPTION
1	249617-4	Plate Cover - R
2	243867-12	"O" Ring
3	246651	Roller, Guide
4	246307	Block
5	236865-3	Cotter Pin
6	266046	Pulley
7	9-249640-8206	Screw, Flat Head
8	767254-5	Arm Assembly – L.H.
9	687668	Shaft Assembly
10	247523-117	Plate Ident. Model No.
11	767249-5	Arm Assembly - R.H.
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
18	31-119918-8208	Screw, Pan Head (Not Shown) For holding Chart Takeup Assy to Recorder

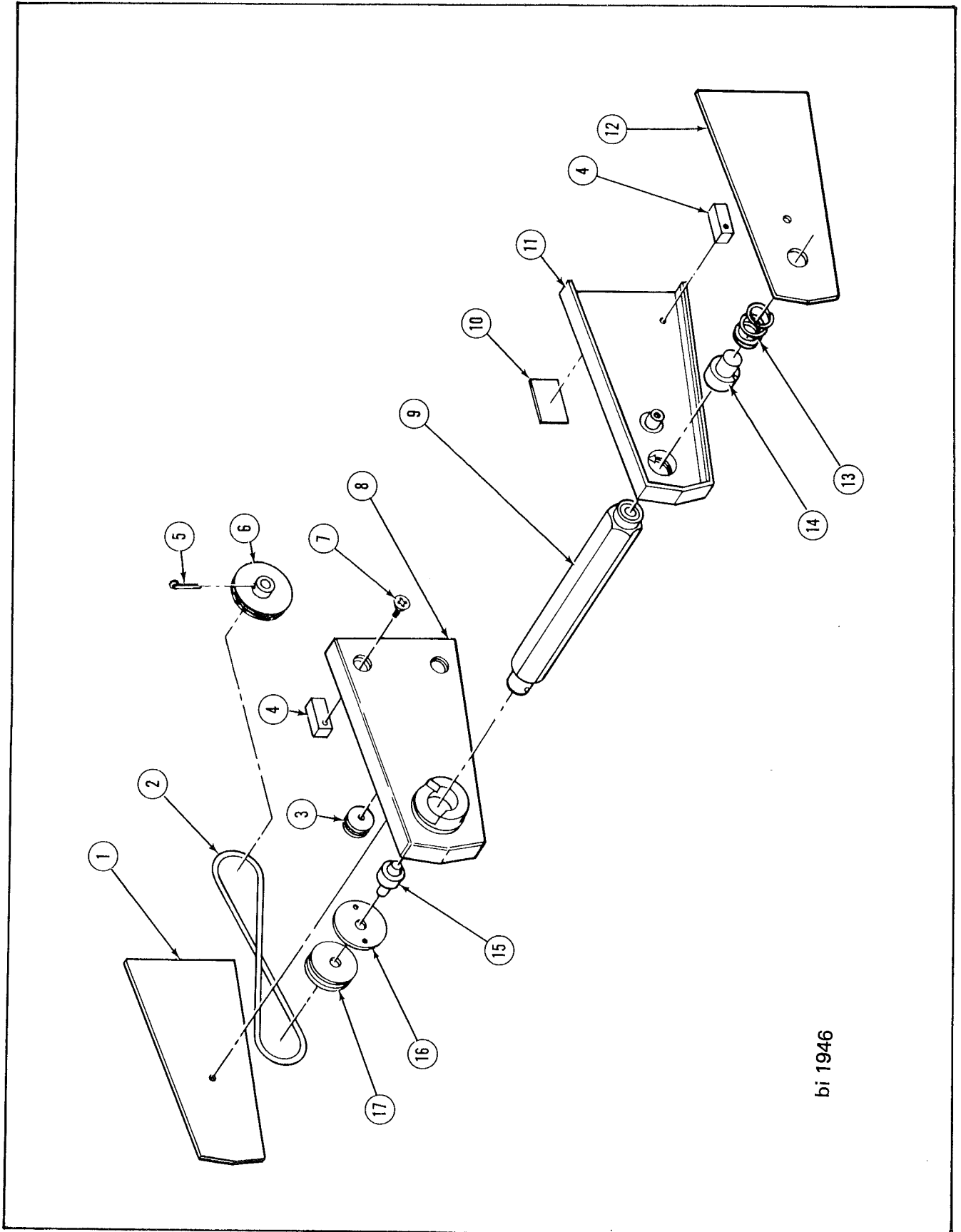


FIGURE 8-17 CHART TAKEUP ASSEMBLY

bi 1946

EXPLODED VIEW PARTS LIST
 2200 SERIES RECORDERS
 RACK MOUNT INSTALLATION INSTRUCTIONS—RECORDER ONLY (688007)
 FIGURE 8-18

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-2X90-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	269569-5	Slides, Pair
9	287148	Nut Plate
10	31-119918-8206	Screw
11	287153	Spacer
12	31-119920-0208	Screw
13	487857	Saddle Assy Rack
14	13-262716-4004	Screw
15	387863	Bracket
16	787868	Panel Assy, Front
17	248352-0218	Screw
18	245244-02	Nut
19	Not Used	
20	287653	Spring, Rack Lock

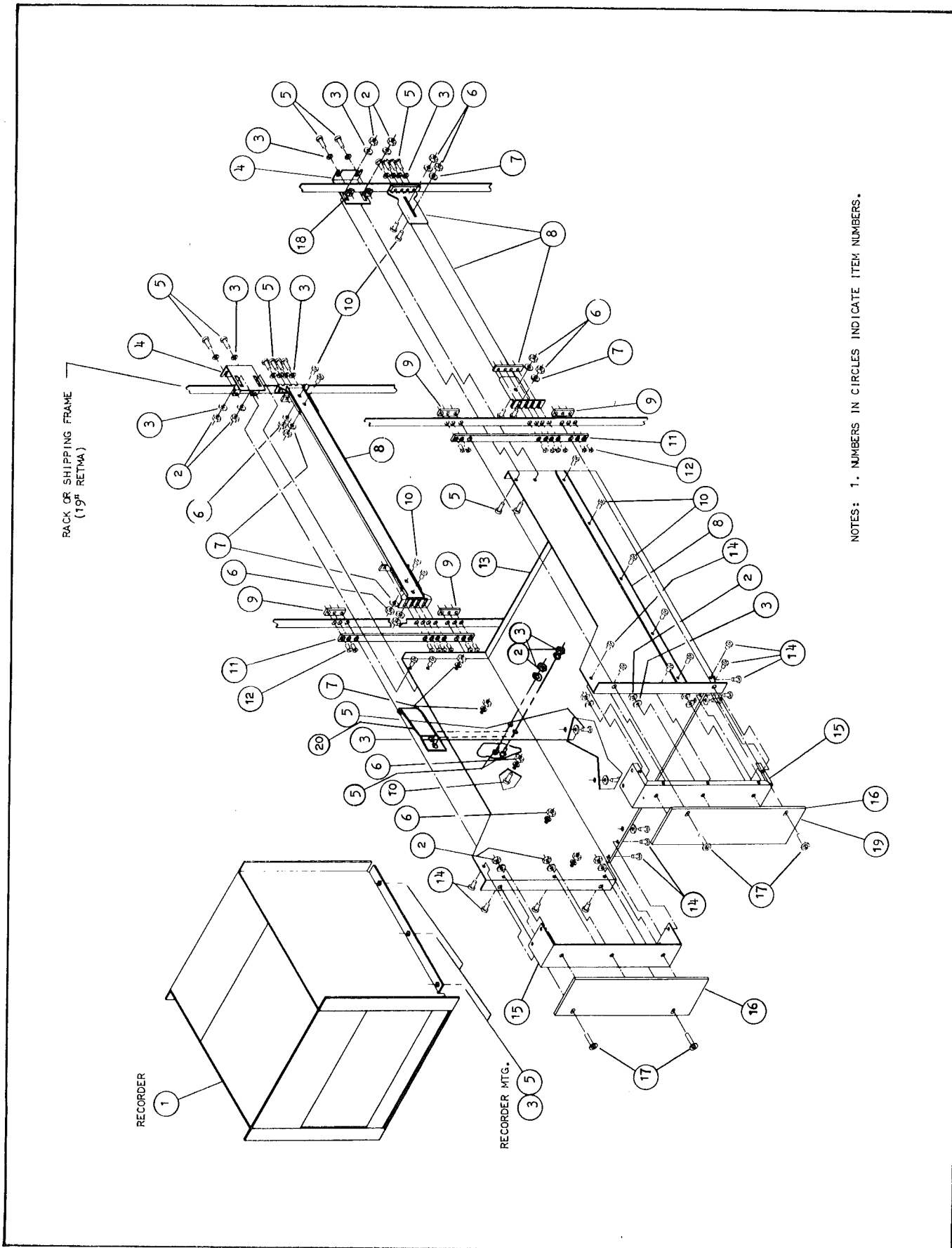


FIGURE 8-18 RACK MOUNT INSTALLATION, RECORDER ONLY

EXPLODED VIEW PARTS LIST

2200 SERIES RECORDERS

RACK MOUNT INSTALLATION INSTRUCTIONS—Recorder with Preamp Cage (688008)

FIGURE 8-19

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-2X90-XX	Recorder Assy
2	287387	Retainer
3	387863	Bracket
4	13-262716-4004	Screw
5	1-118195-304	Washer, Plain
6	Not Used	
7	888321	Cage Assy
8	13-262716-8204	Screw
9	1-216741-425	Lockwasher
10	Not Used	
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	269569-5	Slides, Pair
17	31-119918-8206	Screw
18	287148	Nut Plate
19	287153	Spacer
20	31-119920-0208	Screw
21	287856	Bracket
22	31-119918-0208	Screw
23	487857	Saddle Assy, Rack
24	Not Used	
25	Not Used	
26	Not Used	
27	787870	Panel Assy, Front
28	248352-0218	Screw
29	245244-02	Nut
30	287011	Bracket
31	Not Used	
32	287653	Spring, Rack Lock

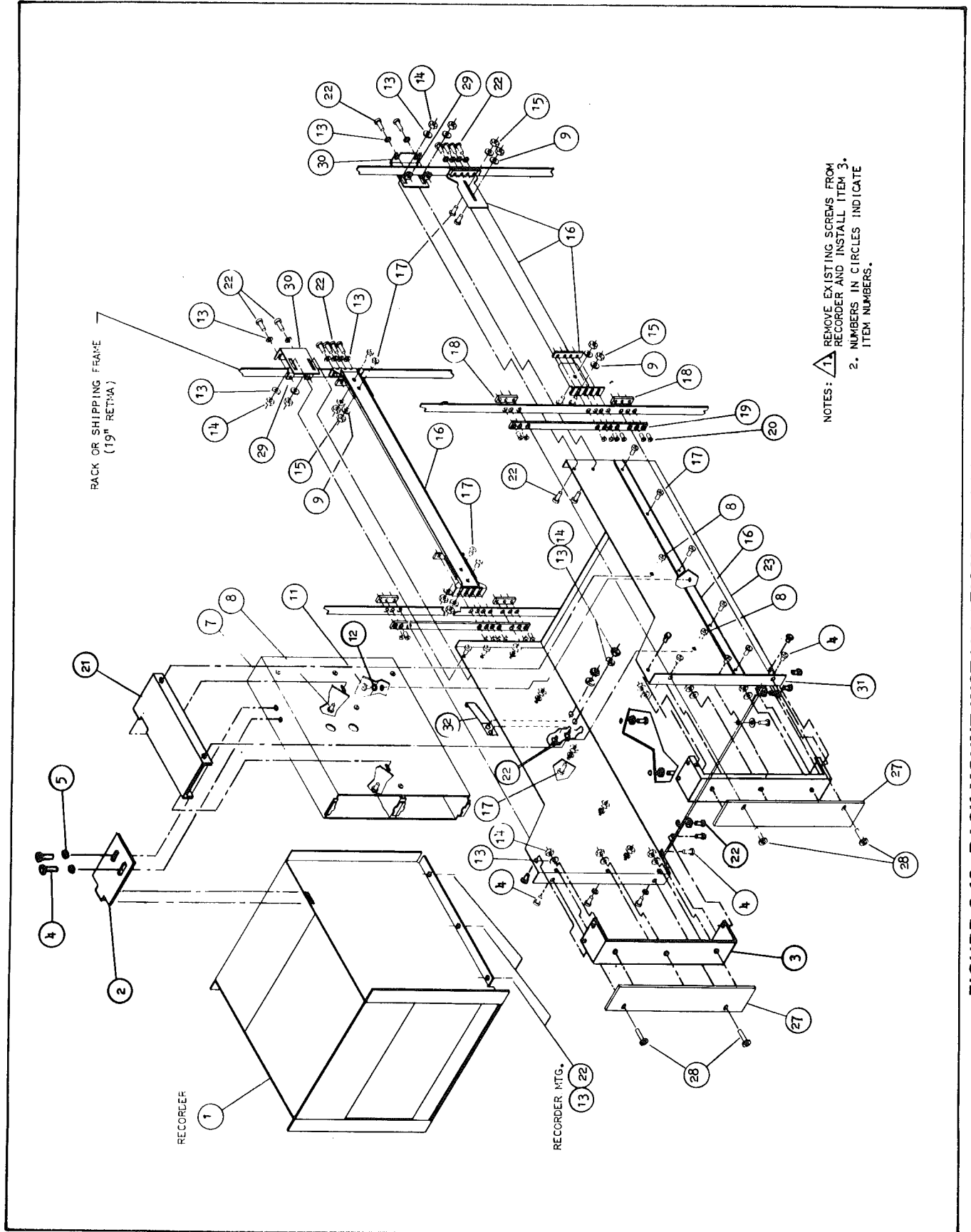
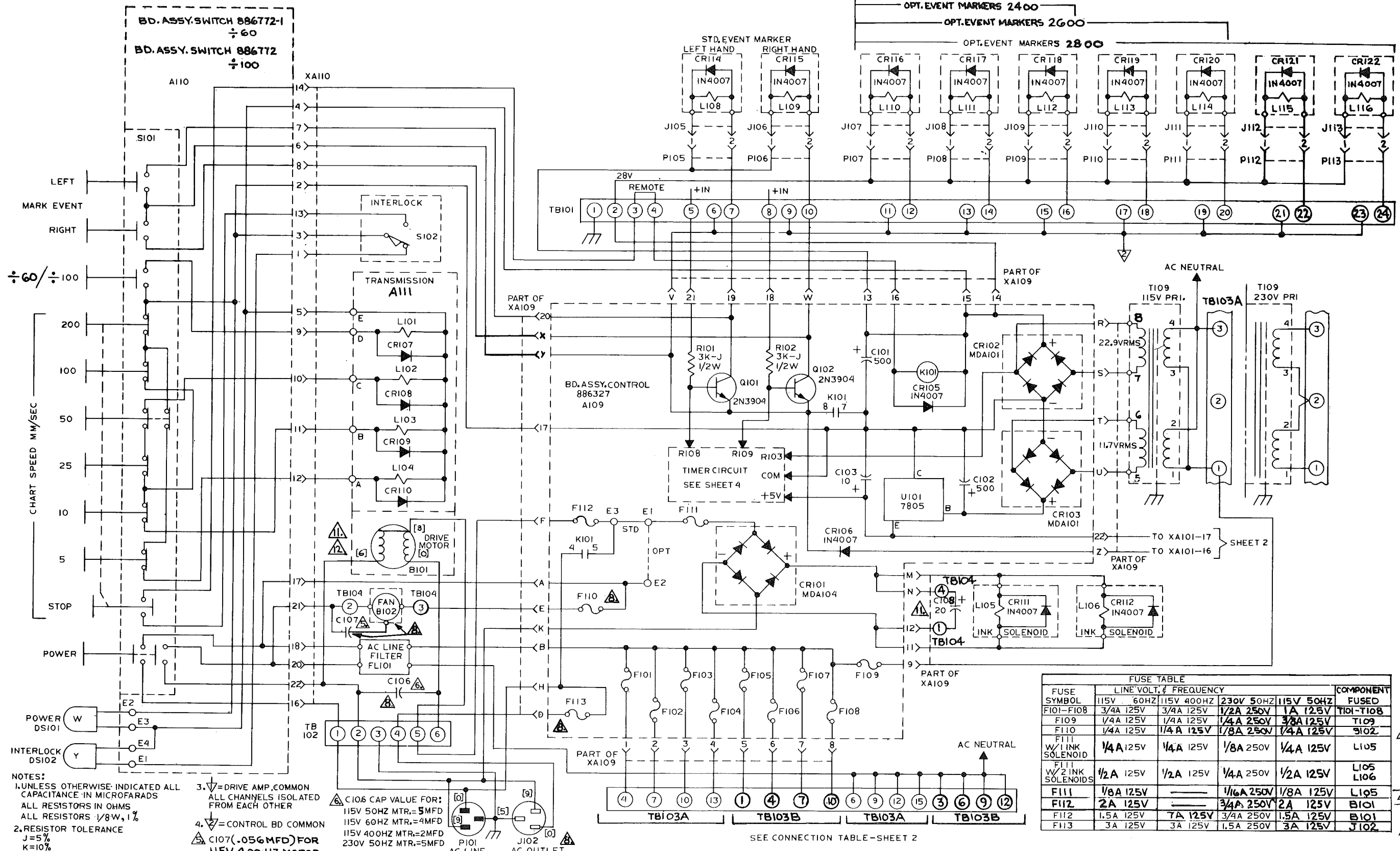


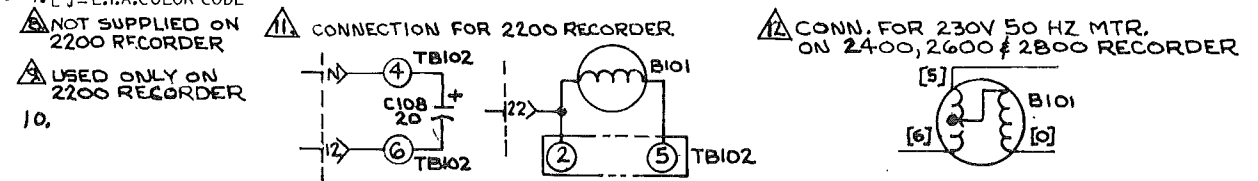
FIGURE 8-19 RACK MOUNT INSTALLATION, RECORDER WITH PREAMP CAGE



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. Δ C107 (-0.056MFD) FOR 115V 400 HZ MOTOR
 6. Δ 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.

FUSE SYMBOL	LINE VOLT. & FREQUENCY				COMPONENT
	115V 60HZ	115V 400HZ	230V 50HZ	115V 50HZ	
F101-F108	3/4A 125V	3/4A 125V	1/2A 250V	1A 125V	F101-F108
F109	1/4A 125V	1/4A 125V	1/4A 250V	3/8A 125V	T109
F110	1/4A 125V	1/4A 125V	1/8A 250V	1/4A 125V	F102
F111	1/4A 125V	1/4A 125V	1/8A 250V	1/4A 125V	L105
F112	1/8A 125V	1/2A 125V	1/4A 250V	1/2A 125V	L105
F113	2A 125V	3A 125V	3/4A 250V	1.5A 125V	B101

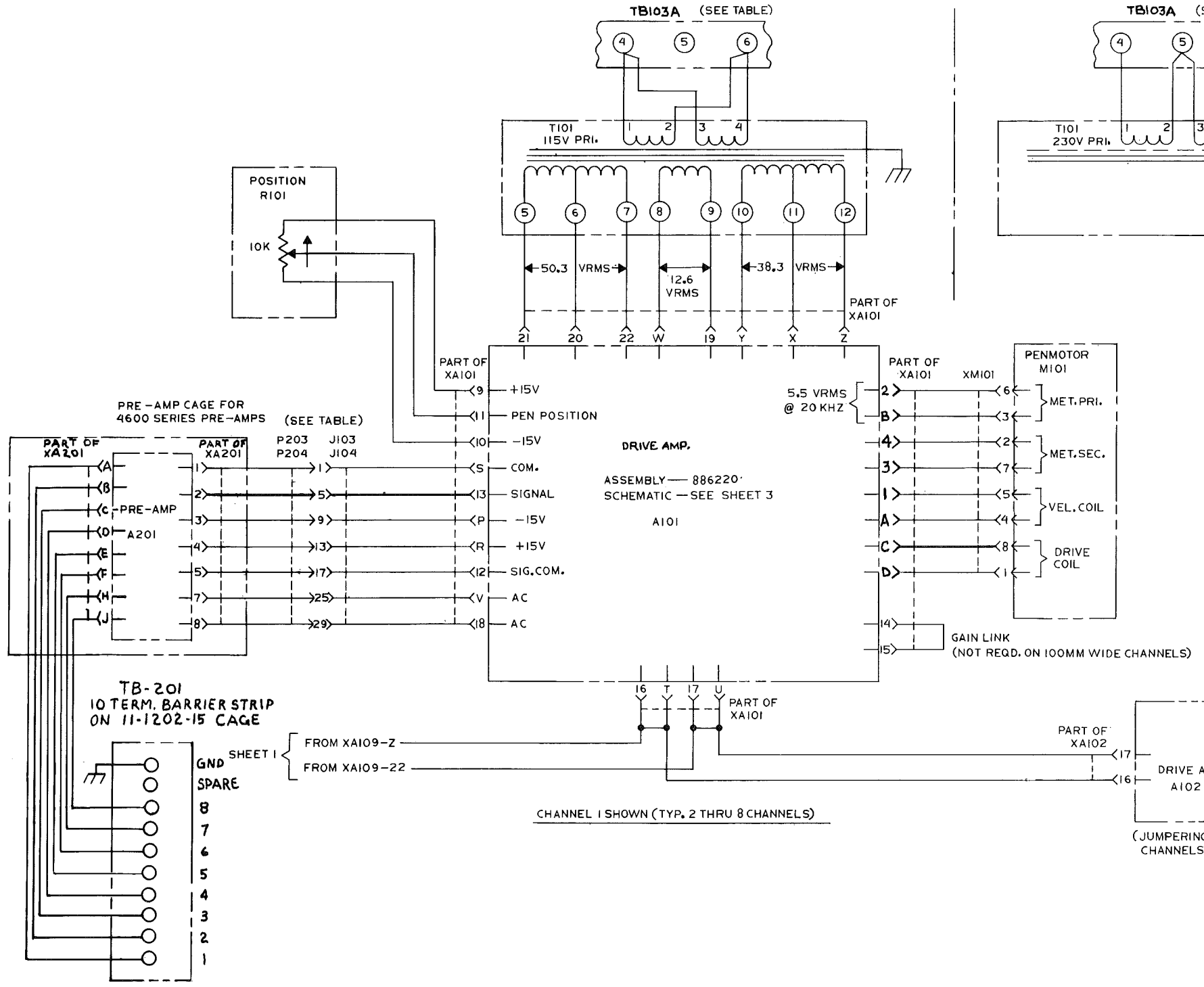
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RECORDER ASS'Y.

DR	BY	DATE	NAME	SCHMATIC
CH	D. CZECH	7-10-74		2000 SERIES
APP	Mr. Mill	7/27/74		
CODE IDENT.	96795	ISSUE	6	
PG.	1	OF	4	

Gould Inc. Instrument Systems Division Cleveland, Ohio 44114 U.S.A. 285851



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

CHANNEL	TB103A TERM. USED				P203/J103 TERM. USED							
	4	5	6	6	1	5	9	13	17	25	29	
1	4	5	6	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							
	1	2	3	1	5	9	13	17	25	29		
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							
	4	5	6	6	1	4	7	10	13	11	14	
1	4	5	6	6	1	4	7	10	13	11	14	
2	7	8	9	3	6	9	12	15	2	5		

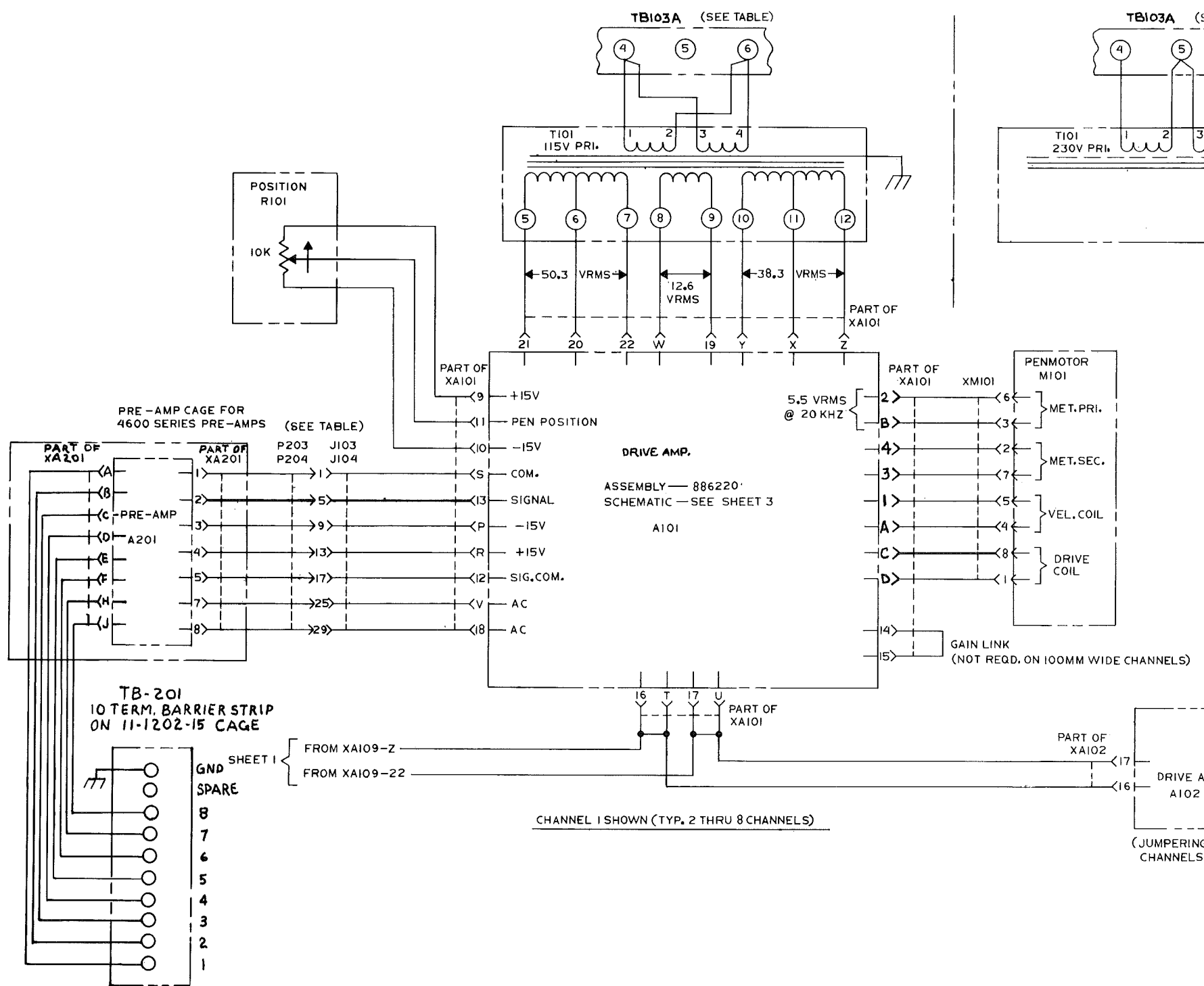
CHANNEL 1 SHOWN (TYP. 2 THRU 8 CHANNELS)

(JUMPERING REPEATED FOR CHANNELS 2 THRU 8)

RECORDER ASS'Y.

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

BY	DATE	NAME	SCHEMATIC		Gould Inc. Instrument Systems Division Cleveland, Ohio 44114 U.S.A.
DR. CZECH	9-10-74		2000 SERIES		
CH.			CODE IDENT.	ISSUE	Dwg. No. 285851
APP.			96795	CODE	PG. 2 OF 4



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

CHANNEL	TB103A TERM. USED				P203/J103 TERM. USED							
	4	5	6	1	5	9	13	17	25	29		
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		
CHANNEL	TB103B TERM. USED				P204/J104 TERM. USED							
	1	2	3	1	5	9	13	17	25	29		
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

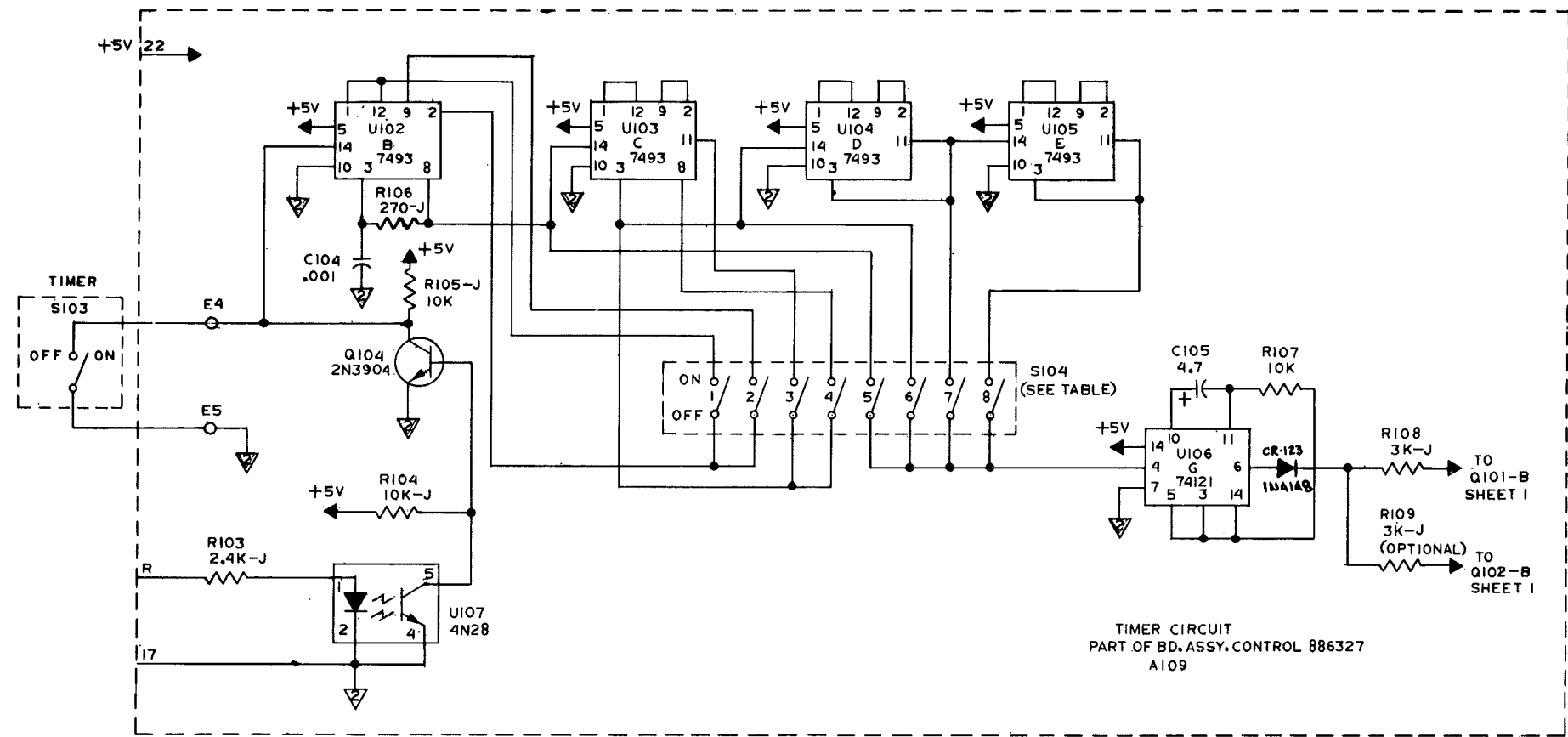
CHANNEL	TB103A TERM. USED				P203/J103 TERM. USED							
	4	5	6	1	4	7	10	13	11	14		
1	4	5	6	1	4	7	10	13	11	14		
2	7	8	9	3	6	9	12	15	2	5		

(JUMPERING REPEATED FOR CHANNELS 2 THRU 8)

RECORDER ASS'Y.

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BY	DATE	NAME	SCHMATIC	Gould Inc.
D.B. CZECH	9-10-74		2000 SERIES	Instrument Systems Division
APP				Cleveland, Ohio 44114 U.S.A.
McNeill				DWG. NO. 285851
		CODE IDENT.	ISSUE	PG. 2 OF 4
		96795	6	



S104 SW. SETTINGS FOR VARIOUS REPETITION RATES						
LINE FREQ.	50 HZ		60 HZ		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		

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BY OTHER GOULD DIVISIONS
AND/OR LOCATIONS. A F

BY		DATE	NAME	RECORDED ASS'Y.
D. CZECH		9-10-74	SCHEMATIC	Gould Inc.
CH. <i>Senario</i>		9/14/74	2000 SERIES	Instrument Systems Division
APP. <i>McNeill</i>		9/12/74	CODE IDENT. 96795	Cleveland, Ohio 44114 U.S.A.
			ISSUE G	DWG. NO. 285851
			CODE	PG 4 OF 4