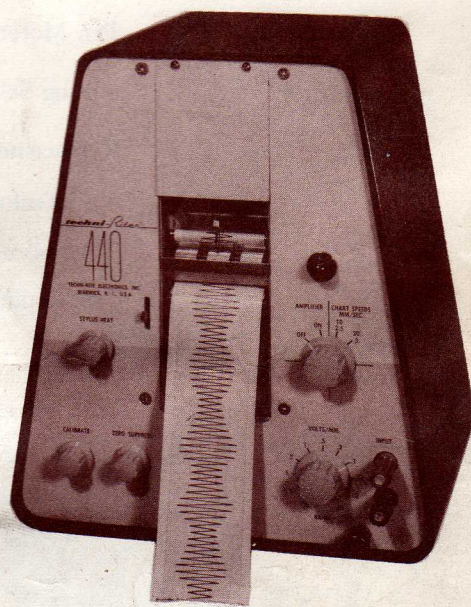


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TR-440
operations
and
service manual



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ELECTRONICS
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65 CENTERVILLE ROAD · WARWICK, R. I.

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YOUR TR-440

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Techni-Rite Electronics designed the TR-440 for long, trouble-free life. There is no section in this manual devoted to "trouble shooting". There is no "spare parts" section nor a section concerning "preparation or installation".

None is needed.



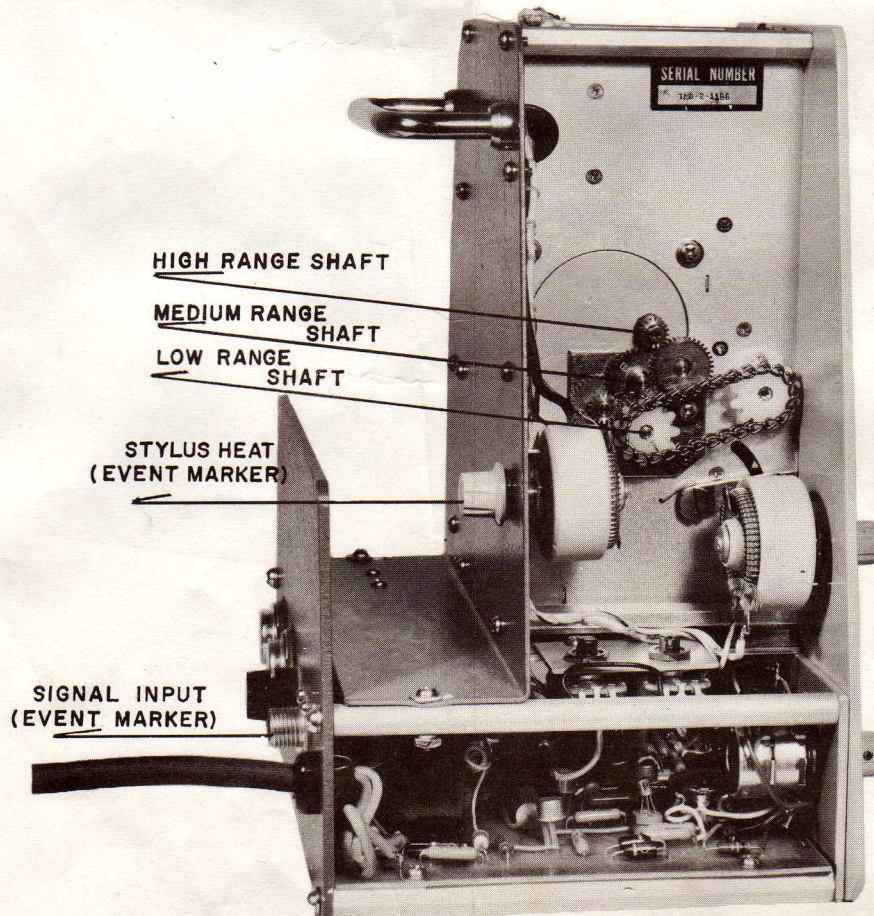
Fig. 1, TR-440 Quality Control at Techni-Rite Electronics

TR 440 OPERATIONS MANUAL
SUPPLEMENT NO. 1

CHART SPEEDS - SIX SPEED MODELS

The six chart speeds of the TR 440 are divided into three Ranges: High, Medium, and Low. Within each Range, the two speeds are changed electrically from the rotary switch located on the front panel. To change Ranges, proceed as follows:

1. Remove the two steel knurled Thumb Screws from the bottom of the case. Remove the instrument from the front.
2. With a screwdriver, loosen the set screw on the Sprocket located on the Motor Shaft at the gear train (see fig. below).
NOTE: There are three Motor Shafts at the gear train: the lowest Shaft is for the Low speed range, the middle Shaft is for the Medium range, the uppermost Shaft is for the High range (see fig. below).
3. Next, simply raise the Sprocket (with drive chain attached) off the Low Range shaft and place on the shaft of the desired chart speed range. Tighten the set screw.
4. Replace the unit in the case, tighten Thumb Screws.



HOW IT WORKS

Your TR-440 is a portable, single channel analog recording system complete with amplifier. The TR-440 uses a fully transistorized d.c. amplifier and records data in the frequency range of d.c. to 100 cps with a heated stylus and a heat sensitive chart. It has a calibrated measurement range from 50 millivolts to 400 volts; uncalibrated, the range is 10 millivolts/mm to 50 millivolts/mm.

The TR-440 may be used to record physical data — weight, force, pressure, temperature, rotation, light intensity — as well as countless electrical signals. These electrical or physical ‘variables’ may be either varying or constant.

A physical phenomenon may be measured by a pressure transducer, for example. The pressure transducer converts the physical change into proportional voltage which is an “analog” to the change in pressure. This change is amplified and is then permanently recorded on a moving, precision-engineered chart. The TR-440 accepts, in lieu of a physical change, an *electrical* value which represents the physical change.

SPECIFICATIONS

Number of Channels.....	One
Frequency Response.....	d.c. to 100 cps
Writing Method.....	Heat sensitive paper, true rectilinear coordinates
Measurement Range.....	Calibrated: 50 millivolts to 400 volts peak-to-peak Uncalibrated: 10 millivolts/mm to 50 millivolts/mm
Range Steps.....	Ten: 10, 5, 2, 1, .5, .2, .1, .05, .02, and .010 volts per line
Calibration.....	<i>Internal Voltage:</i> Range Steps: 10, 5, 2, 1, .5, .2, .1, and .05 volts per chart line <i>External Voltage:</i> Range Steps: .02 and .01 volts per chart line
Linearity.....	d.c.: 1% of full scale; a.c.: better than 2% of full scale
Maximum Amplitudes.....	40mm peak-to-peak to 20 cps, 30mm peak-to-peak to 25 cps, 20mm peak-to-peak to 45 cps, 10mm peak-to-peak to 80 cps, 8mm peak-to-peak to 100 cps, 6 mm peak-to-peak to 120 cps
Zero Suppression.....	Full Scale
Input.....	50K ohms fixed, single ended
Amplifier Design.....	Fully transistorized; no warm-up
Stability.....	Better than $\pm 1/3$ chart line in 8 hours
Chart Paper.....	Printed width 40mm wide, 40 lines, 60 feet long
Chart Speeds.....	Four: High Range: 10mm/sec and 20mm/sec Low Range: 2.5mm/sec and 5mm/sec
Input Terminals.....	Front binding posts
Power Requirements.....	105-125V, 60 cps, 20 watts; 3 wire power cord
Weight.....	Net: 14 pounds; Shipping: 17 pounds
Color.....	Case: Dark gray; Panel: Two tone gray
Dimensions.....	Portable Model: Height: 10", Width: 9", Depth: 6 $\frac{3}{4}$ " Rack Mounting Model: (Standard EIA) Height: 12 $\frac{1}{4}$ ", Width: 19", Depth: 6 $\frac{3}{4}$ "

DIMENSIONS

Height: 10", Width: 9", Depth: 6 $\frac{3}{4}$ "

Height: 12 $\frac{1}{4}$ ", Width: 19", Depth: 6 $\frac{3}{4}$ "

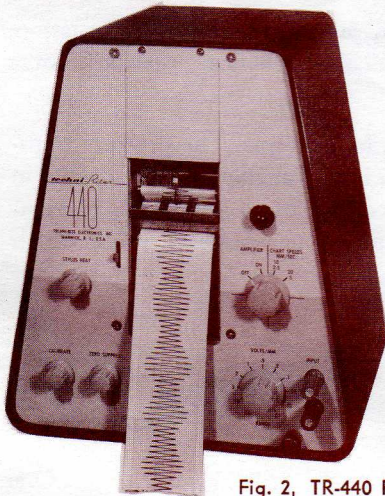


Fig. 2, TR-440 Front Panel

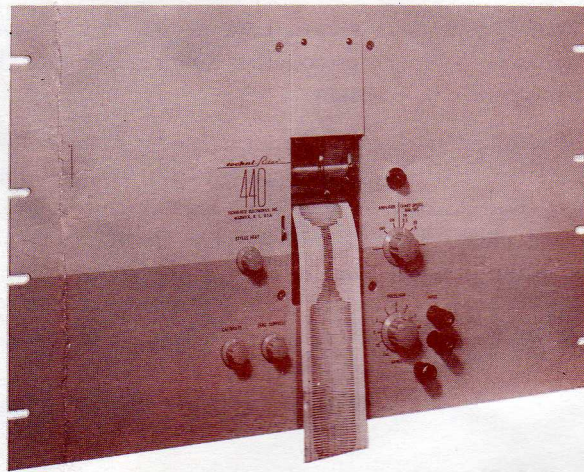


Fig. 3, Showing Rack Mounting TR-440

OPERATION

Your TR-440 is permanently calibrated at the factory. Hence, the calibration potentiometers located on the printed circuit board are sealed in place with Glyptol cement and they should not be disturbed at any time.

To obtain best results, check calibration before each use as follows:

Internal Calibration:

1. Turn the Chart Speed Selector to the 2.5mm/sec position. Fig. 4.
2. Adjust Stylus Heat for the optimum trace on the chart as shown in Fig. 4.
3. Set the Range to the 10 v/mm position.
4. Next, using the Zero Suppress, center the Stylus on the center line.
5. Now turn the Range to the CAL position.
6. Turn the Calibrate Control until the Stylus is exactly set to the right hand margin of the chart (full scale).

Your TR-440 is now calibrated with an *internal reference voltage* over the range of 50mv/mm to 10v/mm. However, when using the .010 or the .020v/mm scales *external calibration* must be used for *best results*.

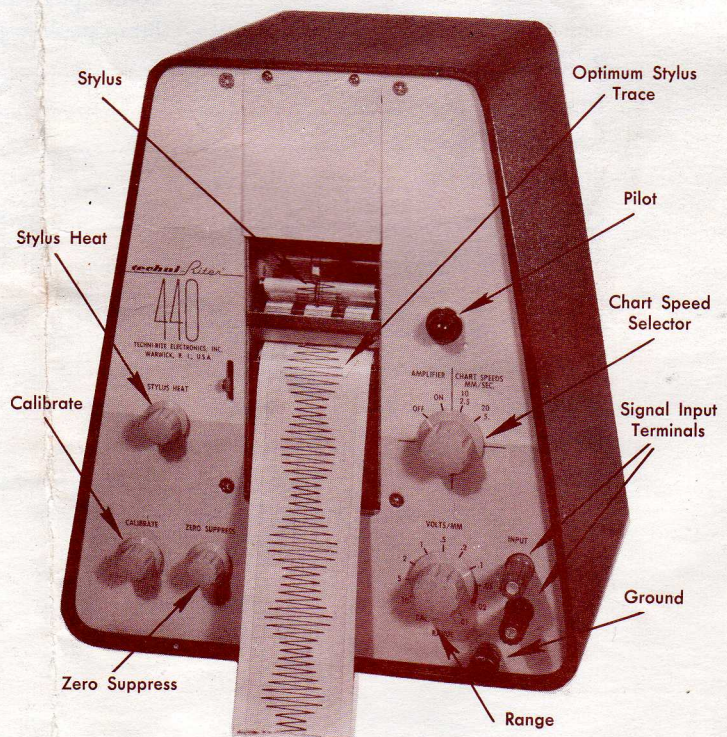


Fig. 4

For operation with *External Calibration* proceed as follows:

When using the .010 and .020v/mm range, your TR-440 should be calibrated with an *external* reference voltage. However, with external calibration any range may be used. After plugging in your TR-440:

1. Turn the Chart Speed Selector to the 2.5mm/sec position shown in Fig. 4.
2. Adjust Stylus Heat for optimum trace on the chart. Fig. 4.
3. Set the Range in the desired position. Fig. 4.
4. Center the Stylus with the Zero Suppress Control.
5. Connect your external reference signal to Signal Input Terminals. Fig. 4.
6. Next, adjust the Calibrate Control for the desired stylus deflection and the TR-440 is ready for use.

Figure 5 shows the TR-440 with the Minicom, a transistorized, compact dimensional gaging comparator. The TR-440 amplifier in this instance is calibrated to agree with the meter of the Minicom.



Fig. 5, TR-440 used to record readings from Techni-Rite Minicom

CHART SPEEDS

The proper chart speed is one that is fast enough to permit clear resolution on the moving chart, yet not so fast as to waste paper. The two *speeds* in each range are changed electrically. The *ranges* are changed manually.

The standard TR-440 is shipped to you with the chart speeds set in Low Range. However, if the High Range is preferable, the change can be accomplished in a matter of minutes. Proceed as follows:

1. Remove the two steel knurled Thumb Screws from the bottom of the case. See Fig. 10. Remove the instrument from the front.
2. With a screw driver, remove the Nylon Sprocket Gears. See Fig. 6.
3. Next, simply reverse the positions of the Nylon Sprockets. The large Sprocket is now on the Motor Shaft and the small Sprocket is on the Drive Roll Shaft. Tighten the Screws.
4. Replace the unit in the case, tighten Thumb Screws.

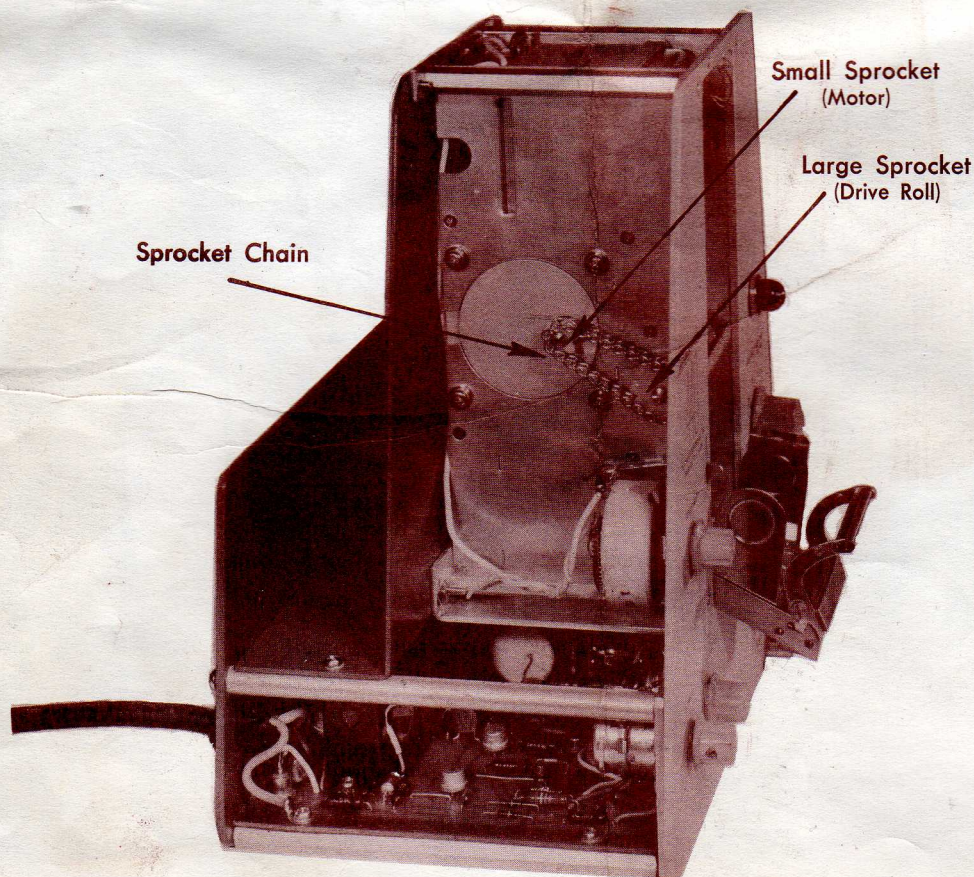
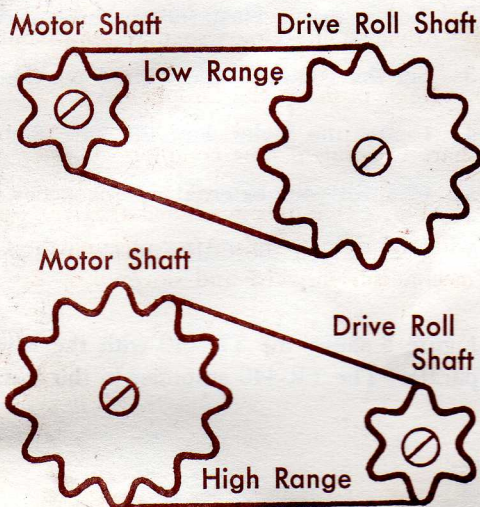


Fig. 6, TR-440 Side View, Case Removed

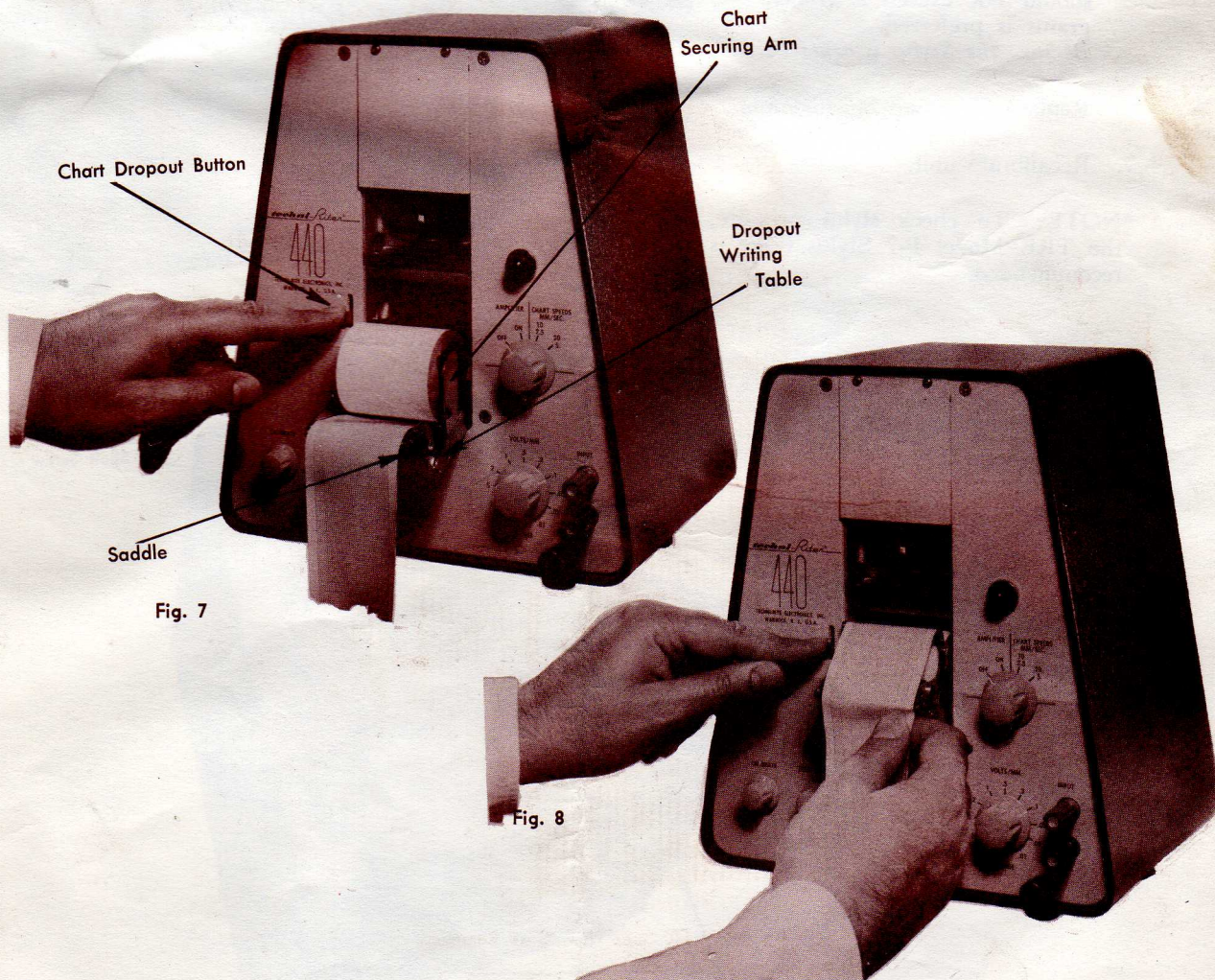
CHART LOADING

A black star appears 10 feet from the end of the chart to signal End of Chart. Chart loading is fast and easy with the newly designed push button TR-440. Loading the chart is as follows:

1. Push the Chart Dropout Button, remove the empty core.*
2. Place a fresh roll of A-1 Chart into the Saddle. Be sure that the Chart is secure, held on each side of the core by the Chart Securing Arms.
3. Advance the Chart so that approximately 10 inches "hangs" free as in Fig. 7.
4. Next, push up the Dropout Writing Table until it is snapped back into place.

Chart Loading is now complete. It is as simple as that.

***NOTE:** It is recommended that the operator first apply pressure to the Dropout Writing Table with the right thumb. After pushing the Chart Dropout Button with the left index finger, ease the mechanism forward and down. Fig. 8.



THE WRITING STYLUS

The SA-40 Heat Stylus is designed for many hours of use; but should a Stylus fail, replacement is easy. Proceed as follows.

1. With a Phillips screw driver, remove the Stylus Shield Panel.
2. Next, place the instrument on its back.
3. Pull out the Stylus Plug from the Pen Motor. Next, loosen the Stylus Pivot Screw. Remove the inoperative Stylus.
4. Place a new SA-40 Heat Stylus into the Pen Motor Shaft and center the Stylus on the Chart *very carefully*.
5. Tighten the Pen Motor Shaft Screw lightly to test stylus pressure. Once a pressure of approximately 1 to 2 grams is set, tighten the Screw firmly.* Stylus pressure should not exceed 2 grams; 1½ grams is preferred.
Be sure the Stylus is centered.
6. Replace the Stylus Shield Panel.
7. Recalibrate unit.

*NOTE: To check stylus pressure, the TRE Model P-7 Stylus Gage is recommended.

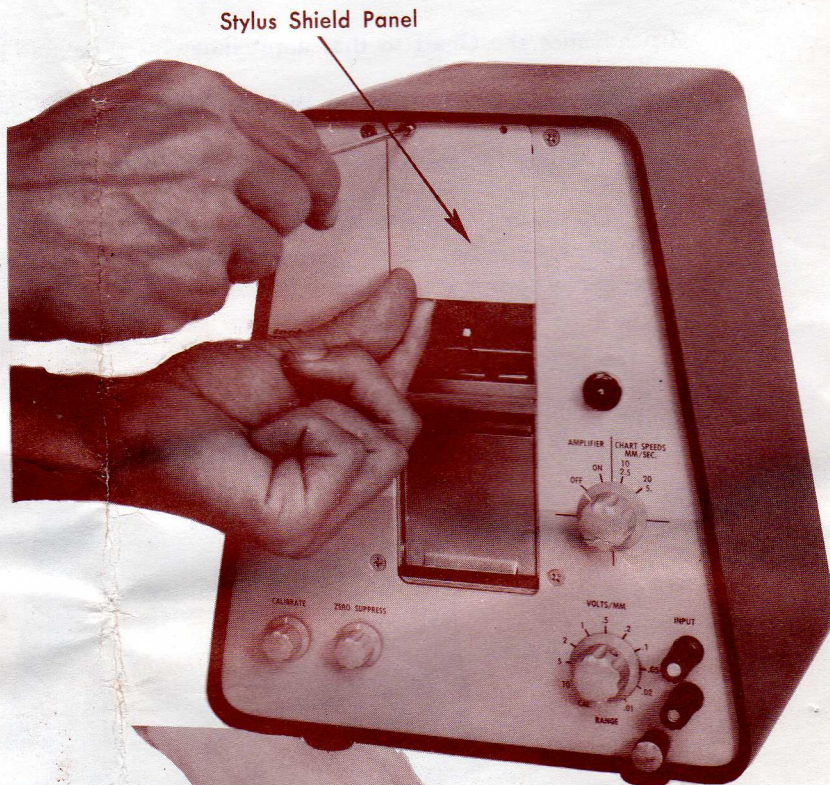


Fig. 9

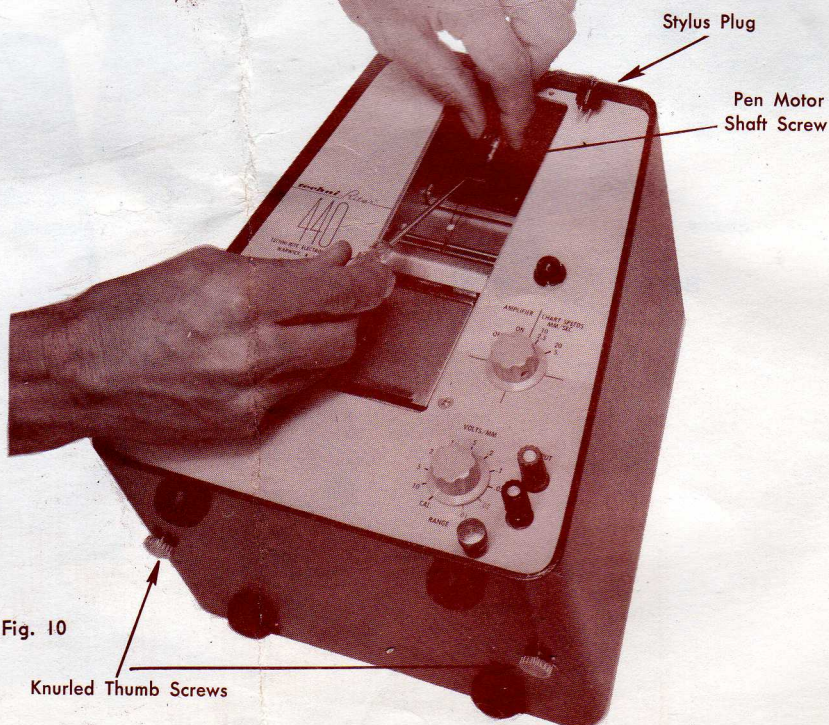


Fig. 10

Knurled Thumb Screws

PEN MOTOR

The TRE Pen Motor is a compact, highly accurate D'Arsenval-type galvanometer featuring a fully shielded magnetic structure. Although the motor is very stiff, it requires low power due to its unique design. The "stiffer" the galvanometer movement, the higher the torque — and the greater the recording accuracy.

The TRE Pen Motor has a resonant frequency of 42 cps but is compensated to operate beyond 100 cps.

Zener diodes protect the Pen Motor coil against accidental overload.

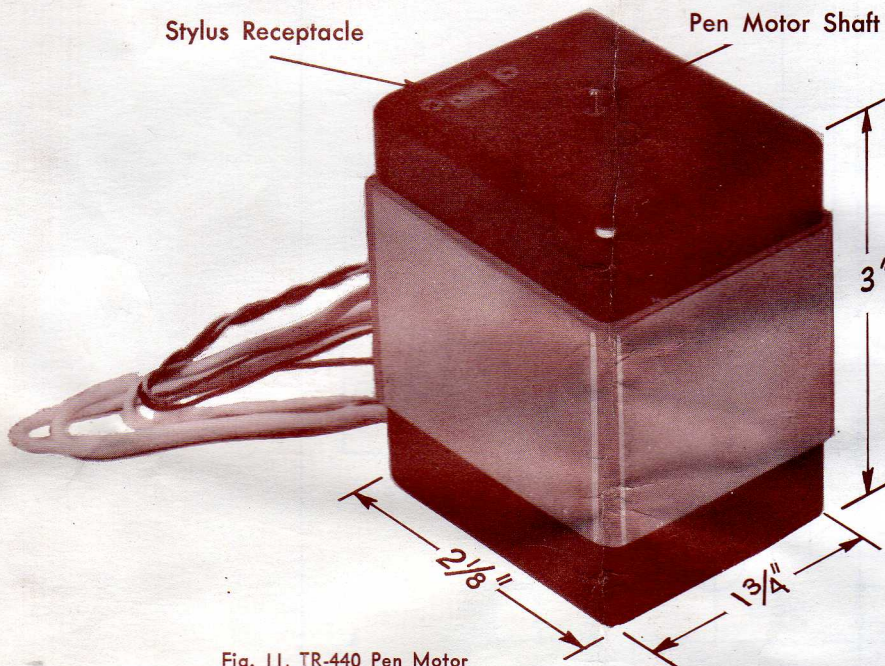
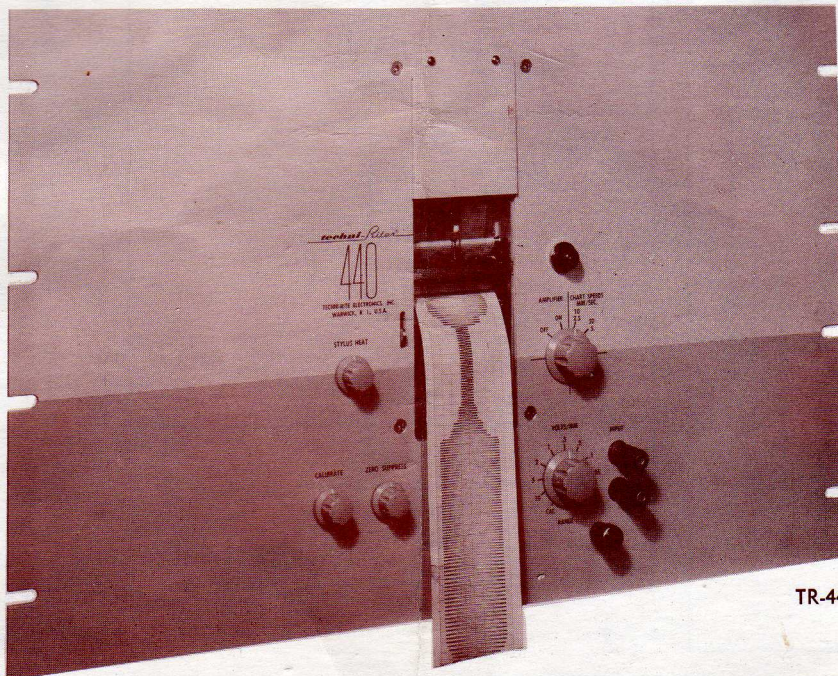
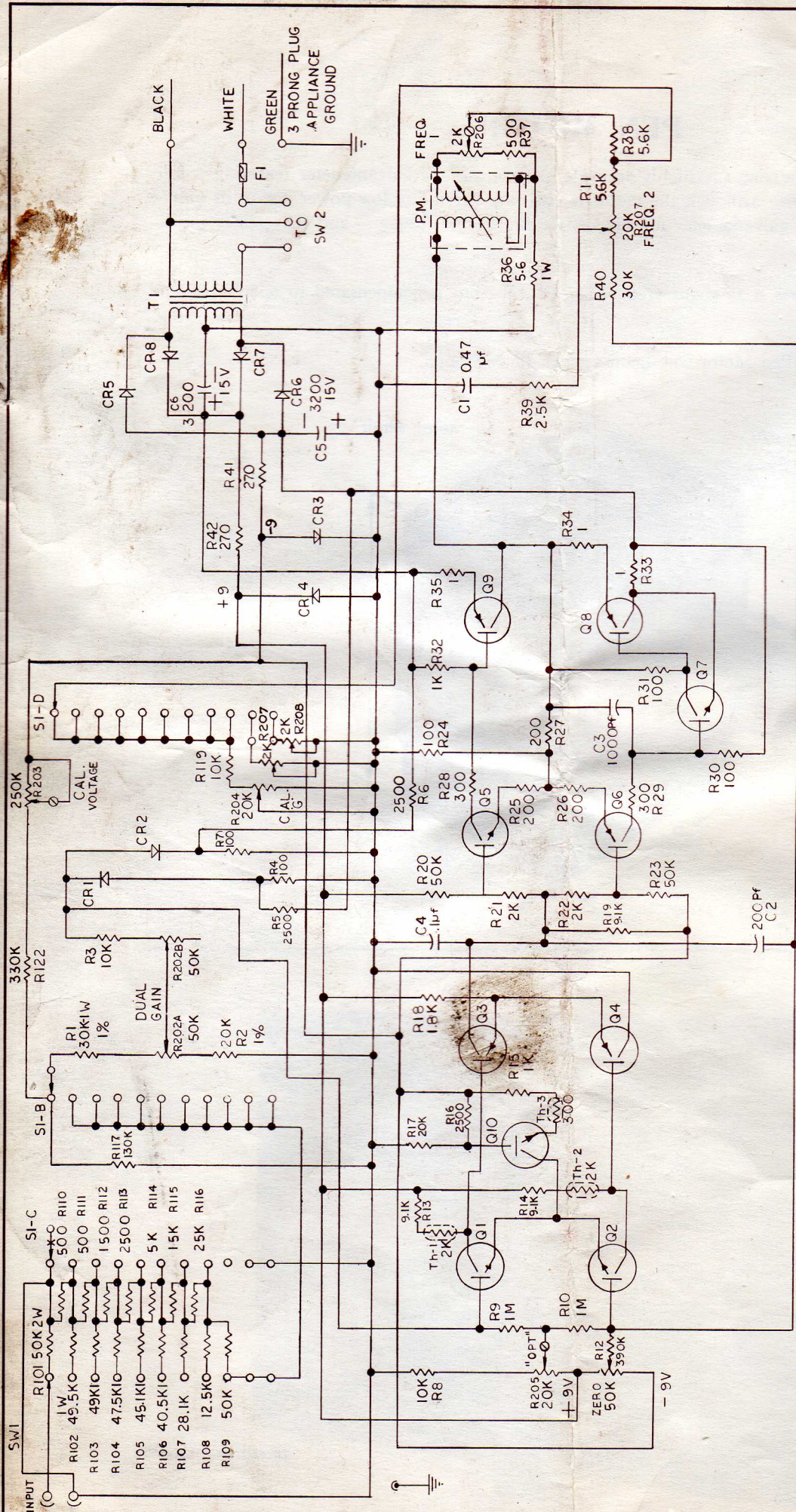


Fig. 11, TR-440 Pen Motor



TR-440 Rack Mounted



RESISTORS NOT MARKED OTHERWISE ARE 1/2 W-5% TOLERANCE.
 RESISTORS R101 THRU R116 ARE 1%, METAL FILM.
 RESISTORS R120 AND R121 ARE SELECTED.
 ATT: (SW1) IN CAL. POSITION (CCW)
 Ø POTS MARKED THUS ARE ACCESSIBLE UNDER CHASSIS

*

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 REGENT 7-2000 • TWX WRWK 266

APPROVED BY: SKOWRON
 DATE: 6-7-62
 DRAWN BY: SKOWRON
 TR-440 AMPLIFIER SCHEMATIC AND CONTROL DIAGRAM
 DRAWING NUMBER: 400031

REPLACEMENT PARTS LIST

<u>TRE Part No.</u>	<u>Description</u>	<u>TRE Part No.</u>	<u>Description</u>
100324	Potentiometer, stylus heat	100550-1252	Res. 12.5K 1% 1/2W; R108
100525	Heat Transformer	100550-5002	Res. 50K 1% 1/2W; R109
100294	Rotary Switch, power	100550-5000	Res. 500 1% 1/2W; R110, R111
100684	Pilot Light (amber)	100550-1501	Res. 1500 1% 1/2W; R112
100531	Transistor CQT 842; Q8, Q9	100550-5001	Res. 5000 1% 1/2W; R114
100554-511	Res. 510 ohms 5% 1/2W, R37	100550-1502	Res. 15K 1% 1/2W; R115
100554-562	Res. 5.6K ohms 5% 1/2W, R11, R38	100550-2502	Res. 25K 1% 1/2W; R116
100554-394	Res. 390K ohms 5% 1/2W; R12	100554-103	Res. 10K 5% 1/2W; R3, R8, R119
100696-474	Cap. .47uf, Mylar 200V; C1	100554-101	Res. 100 ohms 5% 1/2W; R4, R7, R24, R30, R31
100477	Tran. (Germ.) (N)2N404; Q3, Q4, Q6	100554-201	Res. 200 ohms 5% 1/2W; R27, R26, R25
100478	Tran. (Germ.) (P)2N1605; Q10, Q5, Q7	100554-301	Res. 300 ohms 5% 1/2W; R28, R29, R41, R42
100441-2	Terminal Post, red	100554-1R0	Res. 1 ohm 5% 1/2W; R33, R34, R35
100441-0	Terminal Post, black	100554-912	Res. 9100 ohms 5% 1/2W; R13, R14, R19
100537-202	Therm. 2K; Th1, Th2	100554-102	Res. 1000 ohms 5% 1/2W; R15, R32, R120
100538-301	Therm. 300; Th3	100554-105	Res. 1 meg 5% 1/2W; R9, R10
100553-254	Pot. 250K; R203	100550-2501	Res. 2500 1% 1/2W; R113
100553-203	Pot. 20K; R205, R207, R204	100554-303	Res. 30K 5% 1/2W; R1, R40
100560-503	Pot. 50K; R201	100554-503	Res. 50K 5% 1/2W; R20, R23
100554-182	Res. 1.8K 5% 1/2W; R18	100554-202	Res. 2000 5% 1/2W; R21, R22
100554-185	Res. 1.8 meg 5% 1/2W; R9X, R10X	100554-501	Res. 500 5% 1/2W; R121
100550-3002	Res. 30K, 1% 1/2W; R1	100554-252	Res. 2500 5% 1/2W; R5, R6, R16, R39
100554-203	Res. 20K 5% 1/2W; R2, R17	100555-5R6	Res. 5K 1% 1/2W; R114
100554-134	Res. 130K 5% 1/2W; R117	100554-334	Res. 5.6 ohms 5% 1W; R36
100484-201-020	Cap. 200pf. cer.; C2	100481	Power Transformer BTC 4924
100484-102-020	Cap. 1000pf. cer.; C3	100480-3215	Cap. 3200uf 15V
100484-104-012	Cap. .1uf cer.; C4	100479	Tran. Q1, Q2; Si-F
100553-202	Pot. 2K; R206, R208, R209	100471-503	Dual Control Pot.; R202
100551-5002	Res. 50K 1% 1W; R101	100511-9V0	Zener Diode; CR3, CR4
100551-4952	Res. 49.5K 1% 1W; R102	100512	Rotary Switch, attenuator
100551-4912	Res. 49.1K 1% 1W; R103	100609-050	Diode; CR5, CR6, CR7, CR8
100551-4752	Res. 47.5K 1% 1W; R104	100536	Diode; CR1, CR2
100551-4512	Res. 45.1K 1% 1W; R105	-----	SA-40 Stylus
100551-4052	Res. 40.5K 1% 1W; R106	-----	A-1 Chart Paper
100550-2812	Res. 28.1K 1% 1/2W; R107		



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