TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, MAINTENANCE MANUAL

RECORDERS, WIND DIRECTION

AND SPEED RO-2/GMQ, RO-2A/GMQ,

RO-2B/GMQ, AND RO-2C/GMQ

This copy is a reprint which includes current pages from Change 1.

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

8 MARCH 1974

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *17 November 1978*

Operator's and Organizational Maintenance Manual
RECORDERS, WIND DIRECTION AND SPEED
RO-2/GMQ (NSN 6660-00-663-8075),
RO-2A/GMQ (NSN 6660-00-932-8311),
RO-2B/GMQ, AND RO-2C/GMQ

TM 11-6660-231-12, 8 March 1974, is changed as follows:

1. Title of the manual is changed as shown above.
2. A vertical bar appears opposite changed material.
3. Remove and insert pages as indicated in the page list below:

Remove	*Insert*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
A-1	A-1
B-1 through B-6	B-1 through B-5

4. File this change sheet in front of the manual for reference purposes.

By Order of the Secretary of the Army:

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Units org under fol TOE:
29-207 (2)
29-610 (2)
11-96 (1)
11-117 (1)
11-127 (1)
11-500 (AA-AC) (1)
29134 (1)
29-136 (1)

ARNG: State AG (1); to the following states: AZ, AR, CT, IN, IA, MS, MO, NY, NC, OH, OR, PA, TX, VA, WV, PR.
USAR: None
For explanation of abbreviations used; see AR 310-50.

WARNING

Be careful when working on the 15 volt ac line connections. Serious injury or death may result from contact with these terminals.

DO NOT TAKE CHANCES!

TECHNICAL MANUAL
No. 11-6660-231-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
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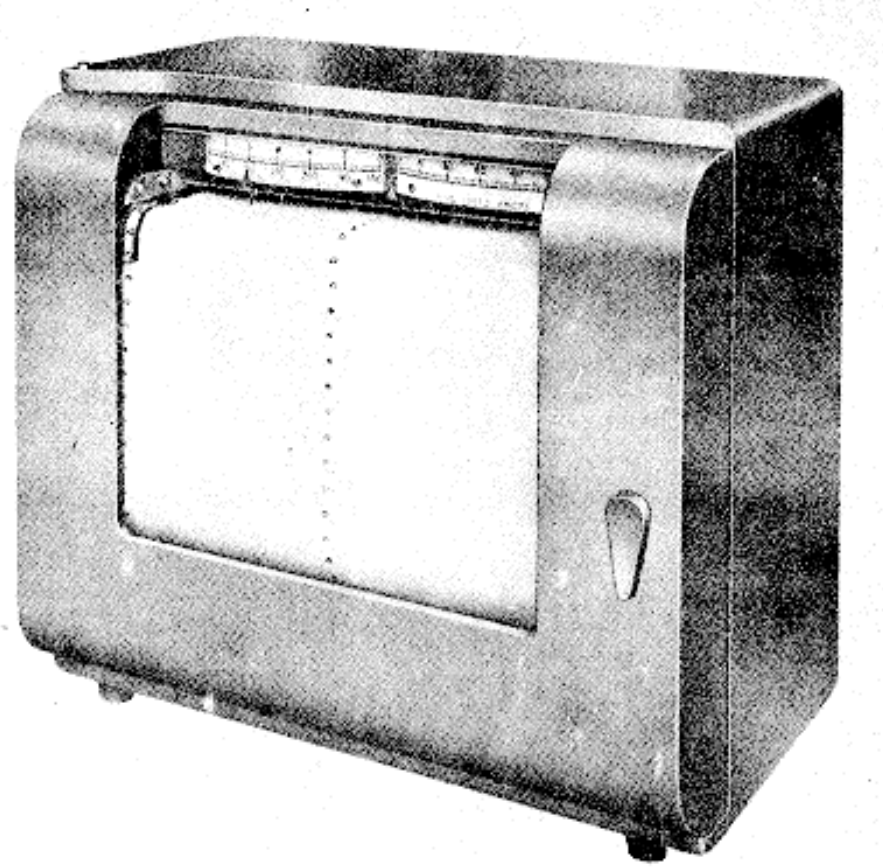
OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

RECORDERS, WIND DIRECTION AND SPEED RO-2/GMQ (NSN 6660-00-663-8075), RO-2A/GMQ (NSN 6660-00-932-8311), RO-2B/GMQ, AND RO-2C/GMQ

***This manual supersedes so much of TM 11-2444, 12 July 1955, including all changes as pertains to operator's and organizational maintenance.**

LIST OF ILLUSTRATIONS



EL6660 231-21-TM-1

Figure 1-1. Recorder, Wind Direction and Speed RO-2(*)/GMQ.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Recorders, Wind Direction and Speed RO-2/GMQ, RO-2A/GMQ, RO-2B/GMQ, and RO-2C/GMQ (fig. 1-1) (hereafter called recorder) and provides instructions for installation, operation, and operator's and organizational maintenance. It includes instructions for operation under usual and unusual conditions, cleaning and inspection of the equipment, and replacement of parts available to the operator and organizational maintenance technician.

b. The maintenance allocation chart (MAC) is contained in appendix B.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-181 MCO P4610.19C and DLAR 4500.15.

1-4. Administrative Storage

a. General. Equipment that is placed in administrative storage should be capable of being ready for use within a 24-hour period. Select the best available site for storage. Separate stored equipment from equipment in use. Conspicuously mark the area "Administrative Storage."

b. Maintenance Services. Before the equipment is placed in administrative storage, perform the operational checks (para 3-6). Faulty equipment should not be placed in storage. If equipment fails to operate, troubleshoot using procedures in section III. Further, empty and clean the ink tanks and clean the equipment so that it is free of dirt, grease, and other contaminants using the procedures in chapter 4 of this manual.

c. Removal From Storage. When the wind direction and speed recorder is removed from storage, it must be tested to insure that it is operating satisfactorily. Test it by using the procedures in chapter 3 of this manual.

1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics material to prevent enemy use shall be in accordance with-TM 750-244-2.

1-6. Reporting of Errors

You can help improve this manual by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your. letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

1-6.1. Reporting of Equipment Improvement Recommendations (EIR)

EIR's will be prepared using SF 368 (Quality Deficiency Report). Instructions for preparing EIR's are provided in TM 38-750 (The Army Maintenance Management System). EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

a. The recorders are two-element recorders that simultaneously produce, in separate channels, inked traces of wind direction and speed values on

a continuous strip paper chart. The mechanism is housed in a cast-aluminum case for mounting on either a vertical or horizontal surface.

b. The recorders are used with Wind Measuring Set AN/GMQ-11 (TM 11-6660-200-10). The AN/GMQ11 is not supplied as part of the recorder but is required for operation.

1-8. Items Comprising an Operable Recorder

The recorder consists of an 8-foot long power cable and a recorder unit that is 13-15/16 inches high, 10-1/16 inches deep, 15 5/8 inches wide, has a volume of 1-1/3 cubic feet and weighs 44 pounds.

1-9. Description

a. Recorder Unit. Each recorder unit (fig. 1-2) consists of a wind direction mechanism, a windspeed mechanism, chart drive mechanism, chart guide-pen lift r-mechanism, chart, and case. A description of each is given in (1) through (6) below.

(1) *Wind direction mechanism.* This mechanism consists of the pen-positioning mechanism, the pen-repositioning mechanism, and the inking system.

(2) *Wind speed mechanism.* The major parts of this mechanism are a permanent-magnet, moving-coil voltmeter, and a removable pen.

(3) *Chart drive mechanism.* The chart drive mechanism is a removable, self-contained assembly. The assembly consists of a frame which holds the sprocket-type drive roll, the chart, the take-up reel, the two motors (drive and take-up), the chart movement switch, and a set of change gears.

(4) Chart guide-pen lift mechanism. This mechanism consists primarily of chart guides, pen lift bar, and direction and speed scales.

(5) *Charts.* Two strip-type charts may be used with the recorder. Each chart is divided into two channels: one for recording wind direction, and the other for recording windspeed. The wind direction channel (identical in both charts) is graduated every 10° over a 540° range and is 4.513 inches wide. Direction letters representing the cardinal compass points (NESWNES) are printed above the appropriate numerical direction values. The windspeed channel of one chart is graduated every 2 knots from 0 to 120 knots and is 4.500 inches wide. The windspeed channel of the other chart is graduated every 2 miles per hour from 0 to 140 miles per hour and is 4.562 inches wide. Both types of charts are 10 3/4 inches wide, with time lines graduated to 10 minutes and numbered every hour. The KNOTS chart furnished with the RO-2/GMQ and RO-2A/GMQ is 93 feet long. The KNOTS and MILES PER HOUR charts furnished with the RO-2B/GMQ are 100 feet long and have footage remaining designations starting with 99 feet down to zero. All charts are interchangeable for use with the RO-WGMQ, RO-2GMQ, RO2B/GMQ, and RO2CVGMQ.

(6) *Case.* The case has a hinged door with a rubber gasket which contains a plastic window large enough for viewing the indication scales, pens, and 7 inches of the record. A recess at the bottom rear of the case has connections for the power and transmitter cables.

b. Power Cable. The power cable is 8 feet long and has a two-contact connector on one end which plugs into the receptacle at the rear of the case. At the other end is a connector that fits into the alternating-current (ac) power source receptacle.

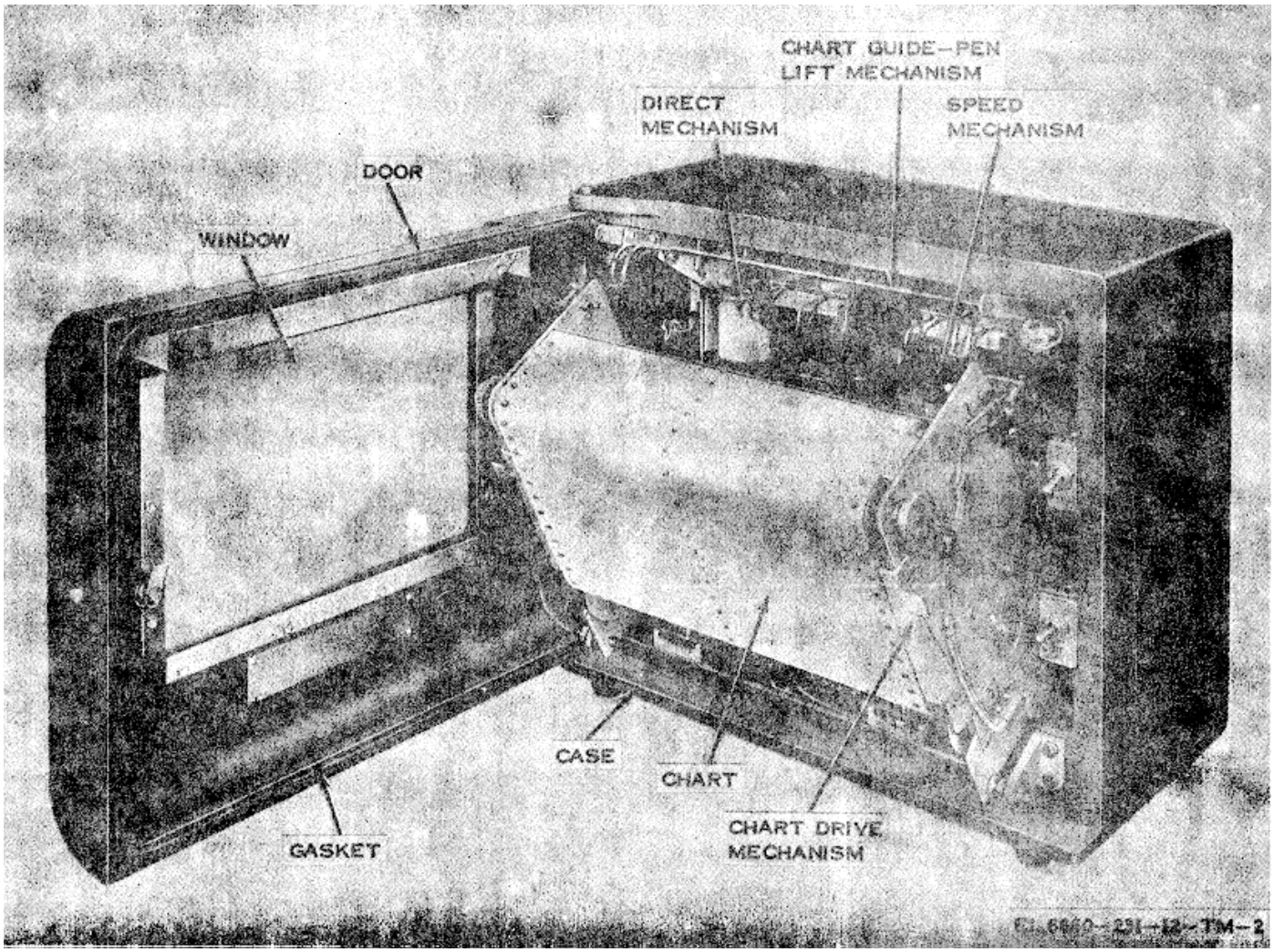


Figure 1-2. Recorder unit, door open, chart drive mechanism tilted.

1-10. Technical Characteristics

Power supply:

RO-2/GMQ).....	105 to 125 vac, 60 cycles,
RO-2C/GMQ).....	single phase, 80 watts.
RO-2A/GMQ).....	105 to 125 vac, 50 to 65 cycles,
RO-2B/GMQ).....	single phase, 80 watts.

Range of recorder measurements:

Wind direction.....	360°
Windspeed.....	0 to 120 knots or 0 to 240 knots (0-140 mph or 0-280 mph on the RO-2B / GMQ).

Recorder accuracy:

Wind direction.....	±4 (pen follows transmitter within ±4°).
Windspeed.....	±1 per cent of full scale on 0 to 120 and 0 to 240 knots (0-140 mph or 0-280 mph on the RO-2B/GMQ).

Atmospheric conditions:

Temperature.....	-I0°to + 125° F.
Relative humidity ...	0 to 95 percent.
Elevation.....	0 to 10,000 ft.
Running time.....	15 days (chart speed of 3 in. per hr) or 71/2 days (chart speed of 6 in. per hr)

Signal input:

Wind direction.....	Input from remote synchro (transmitter) representing a wind direction.
Windspeed.....	0 to 14.6± 0.1 vdc represents 0 to 120 knots windspeed. 0 to 29.2± .02 represents 0 to 240 knots windspeed. On the RO-2B/GMQ, 0-14.78 vdc ± 0.01 v represents 0-280 mph windspeed.

1-11. Differences Among Models

The differences in models are listed below.

ITEM	RO-2/GMQ	RO-2A/GMQ	RO-2B/ GMQ	RO-2C/ GMQ
Voltage requirements.	105 to 125 volts, 60 cycles per second, single-phase.	105 to 125 volts, 50 to 65 cycles per second, single-phase.	105 to 125 volts, 50 to 65 cycles per second, single-phase.	105 to 125 volts, 60 cycles per second, single-phase.
Chart drive motor type	Ac	Dc	Dc	Ac
Windspeed indication.	Knots	Knots	Knots or miles per hour.	Knots or miles per hour.
Windspeed range.	0 to 120 knots or 0 to 240 knots	0 to 120 knots or 0 to 240 knots	0 to 120 knots, or 0 to 240 knots, 0 to 140 miles per hour, and 0 to 280 miles per hour	0 to 120 knots, 0 to 240 knots, 0 to 140 miles per hour, and 0 to 280 miles per hour.
Wind direction scale markings.	Number at 90° intervals.	Numbered at 90° intervals.	Numbered at 30° intervals.	Numbered at 30° intervals.
Pen stop assembly.	Not included	Not included	Not Included.	Included.
Contact and sector assembly mounting.	Secured at top to top movement assembly by clamp.	Secured at top to top movement assembly by clamp.	Secured at top to top movement assembly by clamp.	Secured at top to top movement assembly by clamp; base seats in sleeve bearing on relay bracket.
Synchro type	If	If	If	23TR6a.
Wire code	Numbered	Numbered	Colored	Colored.

CHAPTER 2

SERVICE UPON RECEIPT OF EQUIPMENT AND INSTALLATION

2-1. Site

Choose a location in an area that is protected from bad weather conditions. Allow enough room for the connection of external cables, the opening of the door, removal of the chart take-up reel, and examination of the record. When choosing the location, the distance between the transmitter and the recorder is an important factor; therefore, the following should be considered:

a. To be sure of accuracy of the speed record, the direct-current (dc) resistance of the two conductors for the speed circuit in the cable connecting the recorder and the transmitter should not exceed 3.2 ohms per conductor.

Cable length (ft)	*No. of cond*
5,000	2
	3
	3
3,000	3
	2
	2
2,000	2
	6
1,200	2
	6
750	2
	6
500	2
	6
300	7
300	8
300	4
	4

NOTE

Each installation of the equipment will be provided with cable in such quantities as may be necessary to meet the requirements of the particular installation, and with 24 terminal lugs .

2-2. Unpacking and Checking Equipment

(figs. 2-1 and 2-2)

a. Cut the metal straps that bind the wooden case, and remove the straps.

b. Use a nailpuller to remove nails from the top of the case. Remove the top.

b. The following chart may be used as a guide in determining these distances. This chart lists the minimum wire sizes for these two speed conductors in various lengths of cable. It also gives the percent of error introduced into the speed circuit by these various wire sizes per 1,000 feet of cable.

NOTE

The 5,000-foot cable with the 8 conductors as indicated in the chart is furnished with the AN/GMQ-11 and is the cable used in the installation. The other cables listed in the chart are for emergency use only.

Cable	*Wire size AWG*	*Percent of error a t25° C. or 77° F.*
	10	-0.753
	14	
	16	
	12	-0.753
	16	
	20	
	14	-0.822
	20	
	14	-0.47
	20	
	14	-0.273
	20	
	16	-0.273
	20	
	20	-0.47
	16	0.205
	16	0.205
	20	

c. lift out the sealed envelope that contains the technical literature and lift out the two fiberboard boxes.

d. If packaged for export, remove the barrier box and the barrier bag from the large package, to expose the fiberboard box.

e. open the box and lift out the recorder and the fiberboard box containing the chart drive mechanism for the recorder.

f. Remove the metal strap from around the recorder.

g. Take the chart drive mechanism out of the fiberboard box.

h. Open the fiberboard box containing the spare parts and accessories and remove the contents.

I. Open all packages except the packages that contain the charts. Open only one chart package at this time. The remaining 25 packages that contain the spare charts are to be opened as needed.

j. Remove the tapes used to hold components rigid inside the recorder during shipment.

k. Examine each item of the equipment carefully to be sure that it has not been bent, broken, or otherwise damaged in shipment.

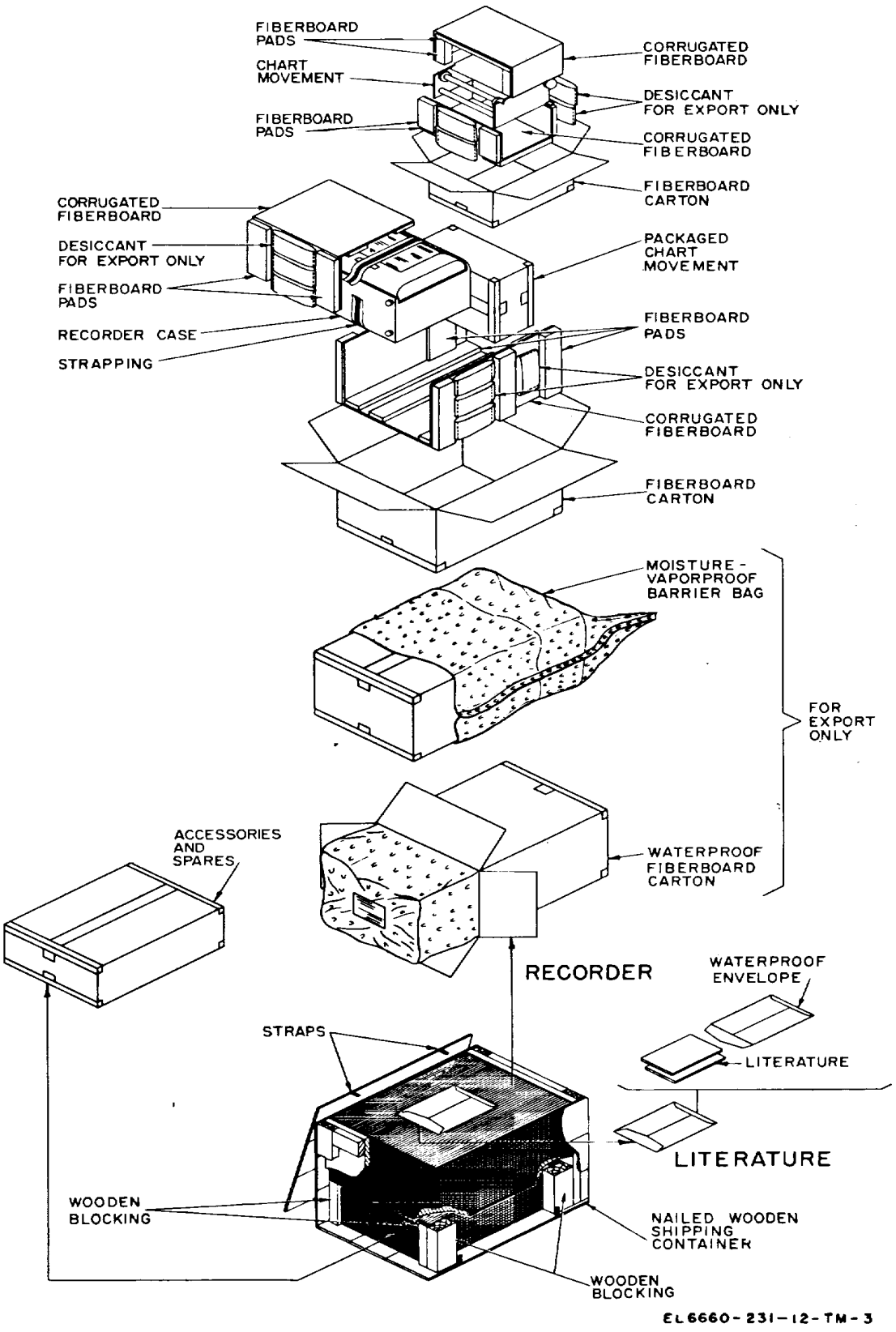


Figure 2-1. Recorder, packing diagram.

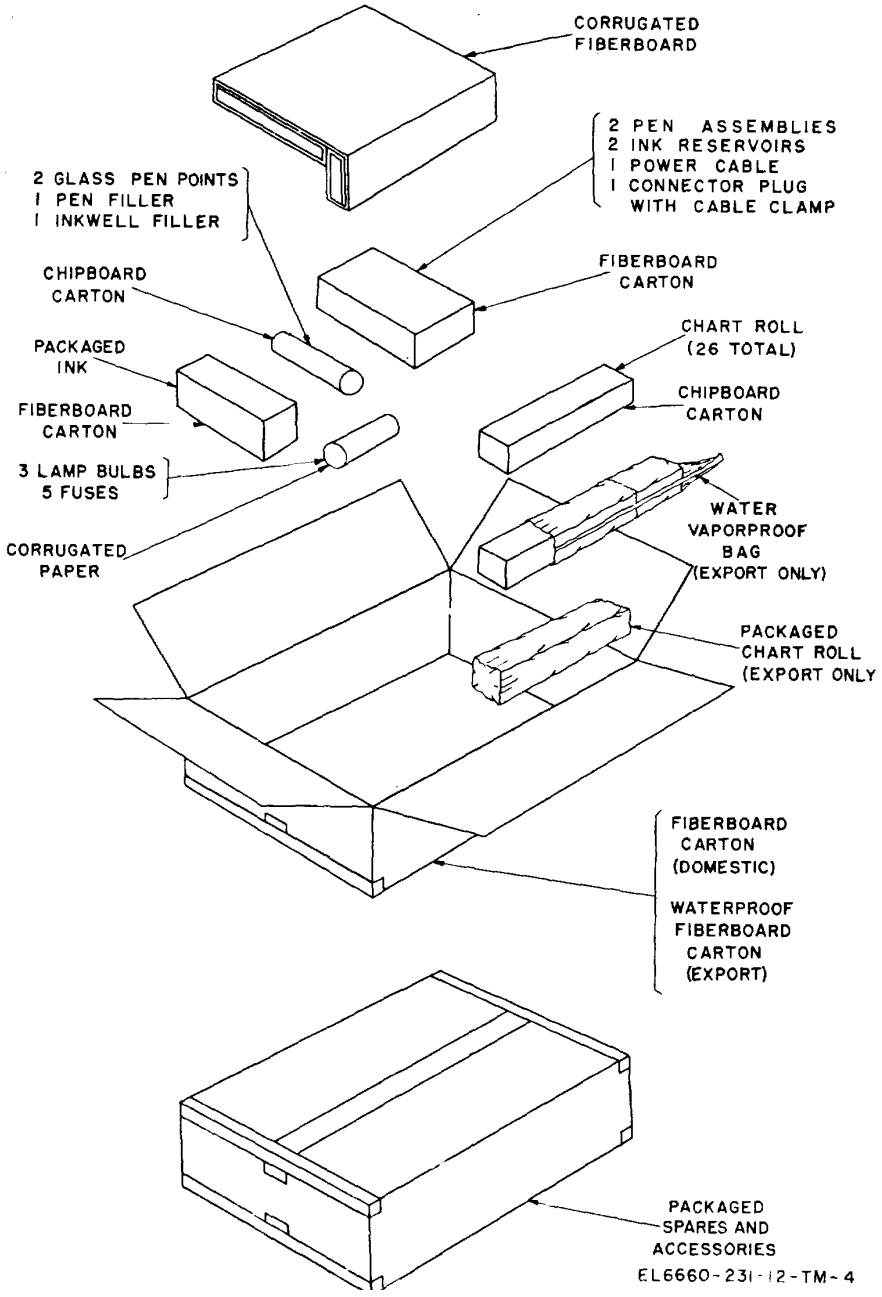


Figure 2-2. Recorder accessories and spare packing diagram.

2-3. Installation Instructions

The recorder may be mounted on a table or vertically on a panel.

a. Panel Mounting. Mount the recorder on any vertical surface as follows:

NOTE

This is a typical mounting. The installation determines the type of mounting.

(1) Use boards nailed together or plywood to form the panel. The thickness of the wood depends on the material available but it should be strong enough to support the recorder.

(2) Make the panel approximately 3 by 3 feet in size.

(3) Refer to figure 5 and drill three holes 5/16 inch in diameter through the panel wood in accordance with the measurements given. Drill the holes so that the recorder is centered on the panel.

(4) Insert 5/ 16-18 screws (length will depend on the thickness of the material used for the panel through the drilled holes into the threaded mounting holes of the recorder (fig. 2-3).

(5) Mount the panel (with the recorder attached) on a vertical surface, such as a wall or posts, with nails or screws (this procedure will be determined by the type of installation). It must be mounted high enough for the operator to read the recordings easily and also to have ready access to the chart drive mechanism and controls.

b. Table Mounting. When the recorder is table mounted, it need not be fastened down. It is provided with rubber feet to prevent slipping and also to help eliminate shocks and jars. Place it on a level surface that is as free as possible from vibration and that is sturdy enough to insure against tipping over or tilting. Be sure enough room is provided for the connection of the cables to the recess in the rear bottom of the case (fig. 2-4).

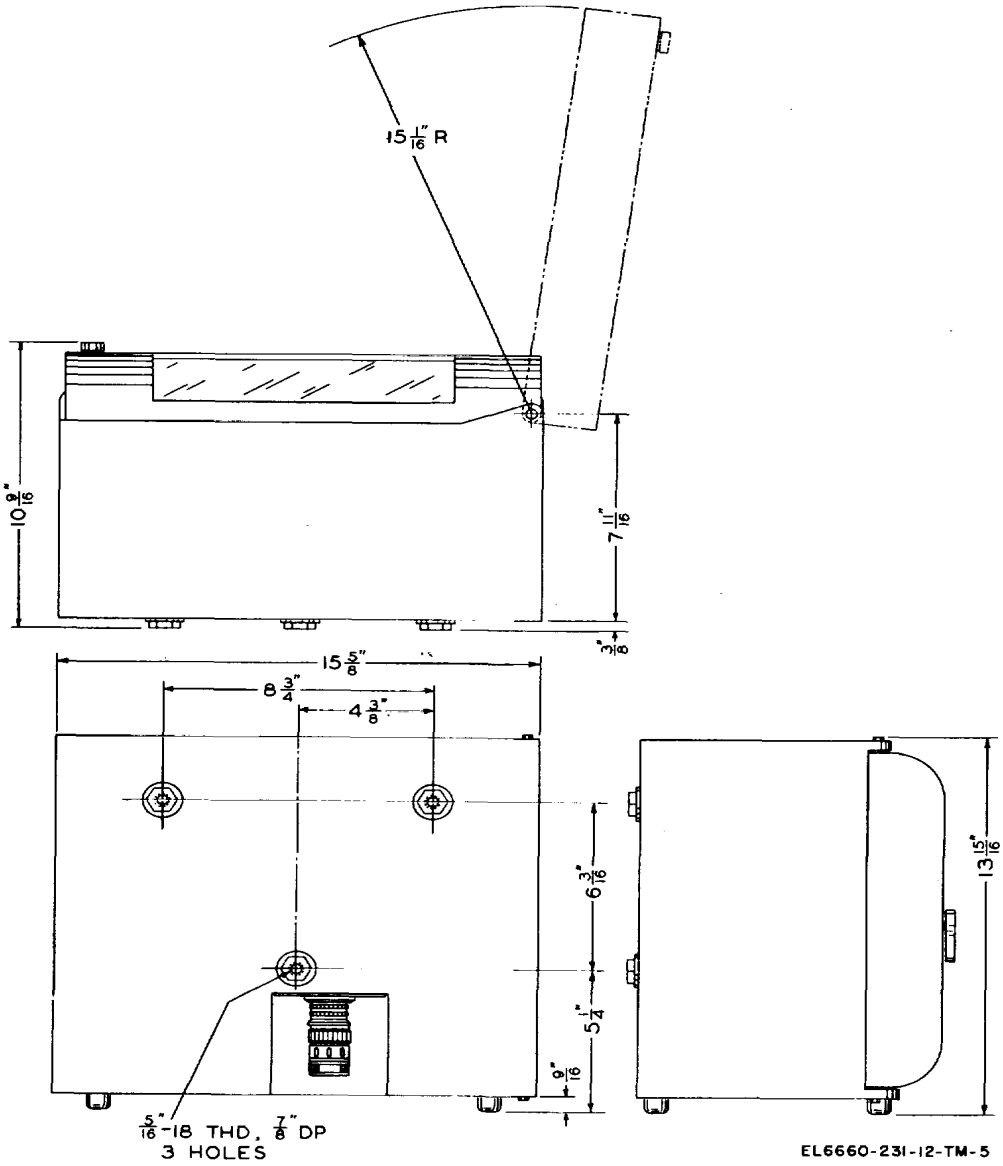


Figure 2-3. Mounting dimensions

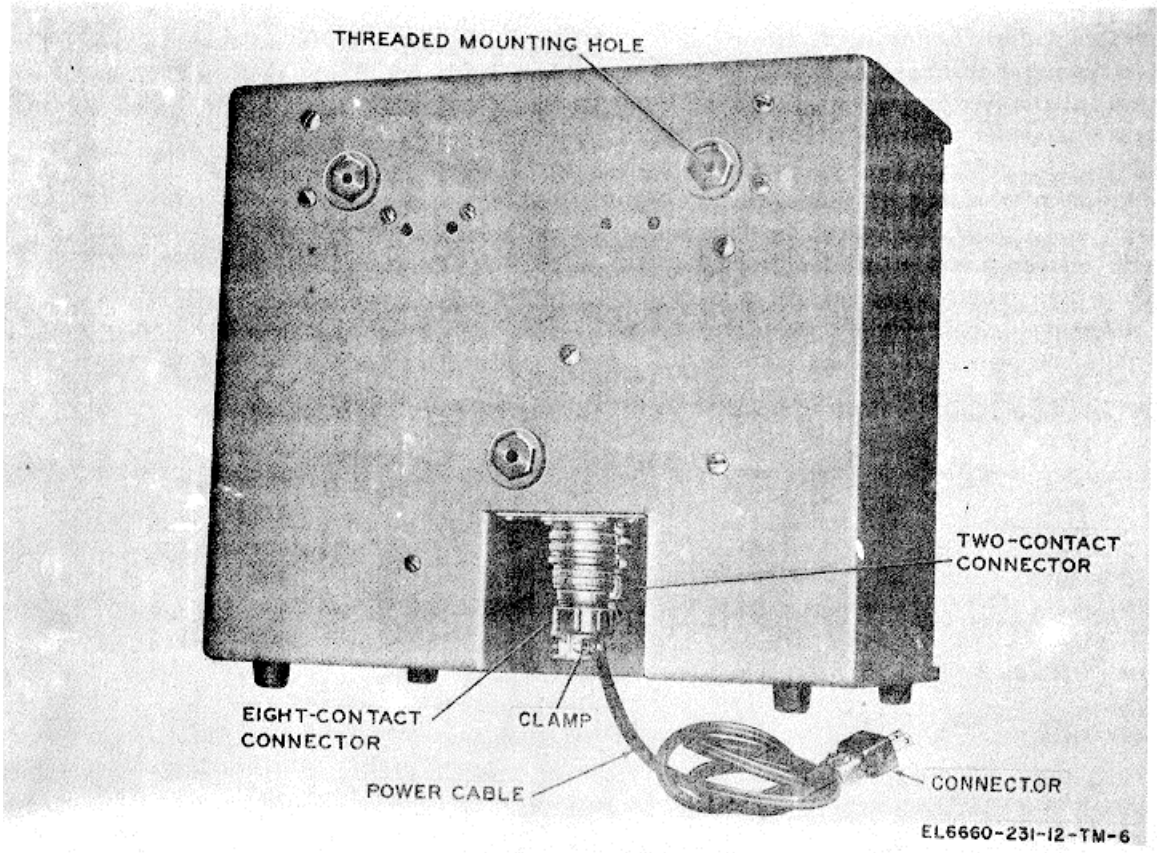


Figure 2-4. Recorder, rear view showing threaded mounting holes and cable connectors.

2-4. Connection Instructions

The recorder may be connected to a transmitter (fig. 2-5) or it may be connected to a transmitter and an indicator (fig. 2-6). The installation dictates the type of hookup. If a remote station is on a hill or the side of a hill (somewhat distant from the regular meteorological station) where readings are taken only at periodic intervals, the recorder and transmitter hookup is used. In other meteorological installations, the recorder can be connected to both the indicator and the transmitter. The procedure for connecting the recorder to the transmitter is described in *b* below.

NOTE

Refer to TM 11-6660-10 Wind Measuring Set AN/GMQ-11, for information regarding description, installation and operation of the wind measuring set.

a. Connecting Recorder to Transmitter (fig. 2-5). If only a recorder and transmitter are used, connect them as follows:

(1) If the recorder is to replace a properly functioning indicator (part of Wind Measuring Set AN/GMQ-11) tag each conductor at the indicator end of the transmitter cable with the corresponding terminal numeral on terminal board TB201 (fig. 2-6) before removing the cable. from the indicator. The tag number on each conductor is the same as the pin number of connector J1 to which that particular conductor is connected in the transmitter.

(2) If the recorder is to be connected to the free end of the transmitter cable, remove connector J1 from the transmitter and, by color code or continuity check, tag the free end conductors of the cable with the pin numbers to which they are connected. Reassemble connector J1 to the transmitter.

(3) Unscrew the cable clamp (fig. 2-4) from the eight-contact connector.

(4) Solder the cable to eight-contact connector P403 (fig. 2-5). Connect the conductors in rotation with the pin letters; that is. A of P403 is connected to conductor tagged 1; B is connected to 2, etc.

(5) If the cable is color-coded, note the color code on the wiring diagram (fig 2-5) for future reference.

(6) Plug eight-contact connector P403 into connector J403 in the recorder.

(7) Be sure that shunt resistor R403 (fig. 2-7) is installed as shown in figure 2-5.

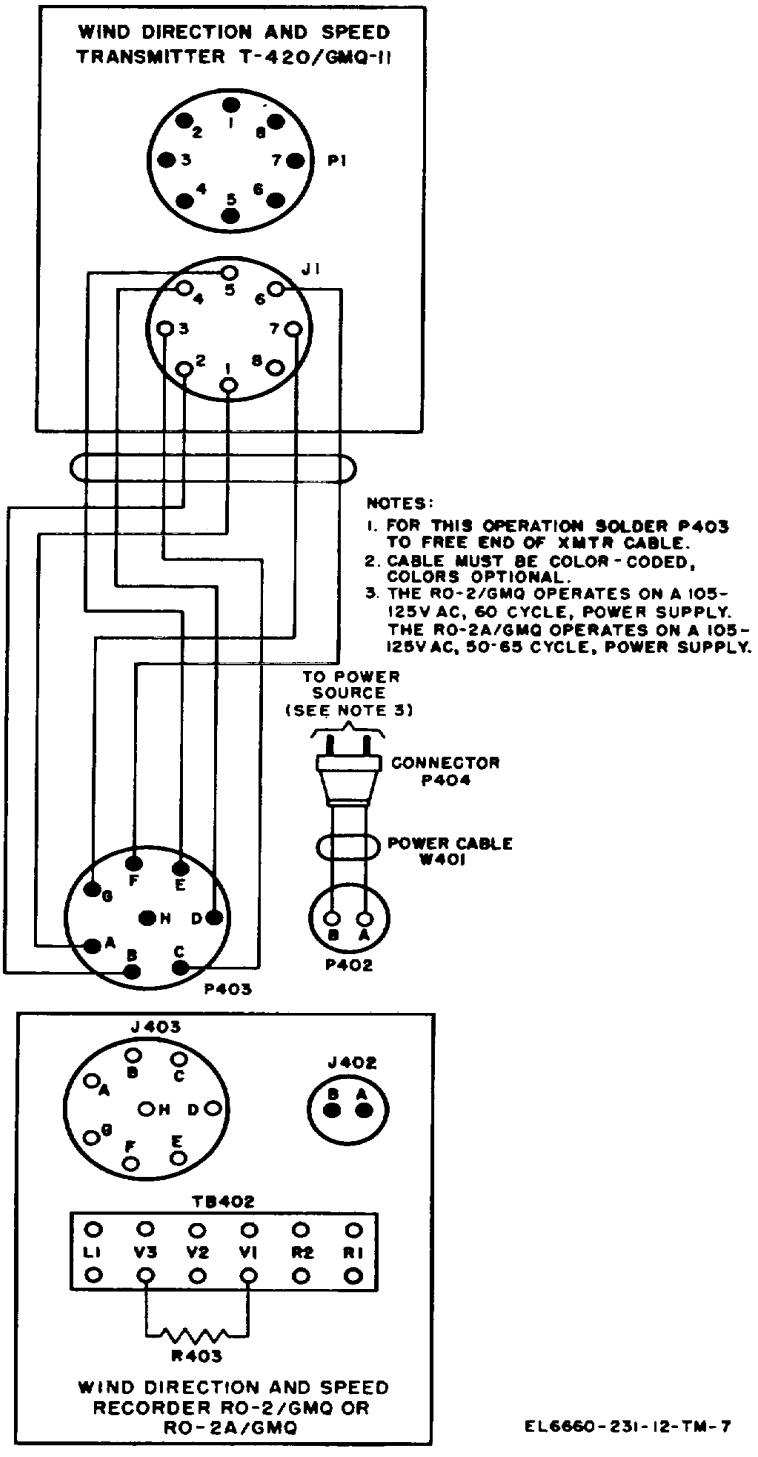


Figure 2-5. Connection diagram, recorder and transmitter.

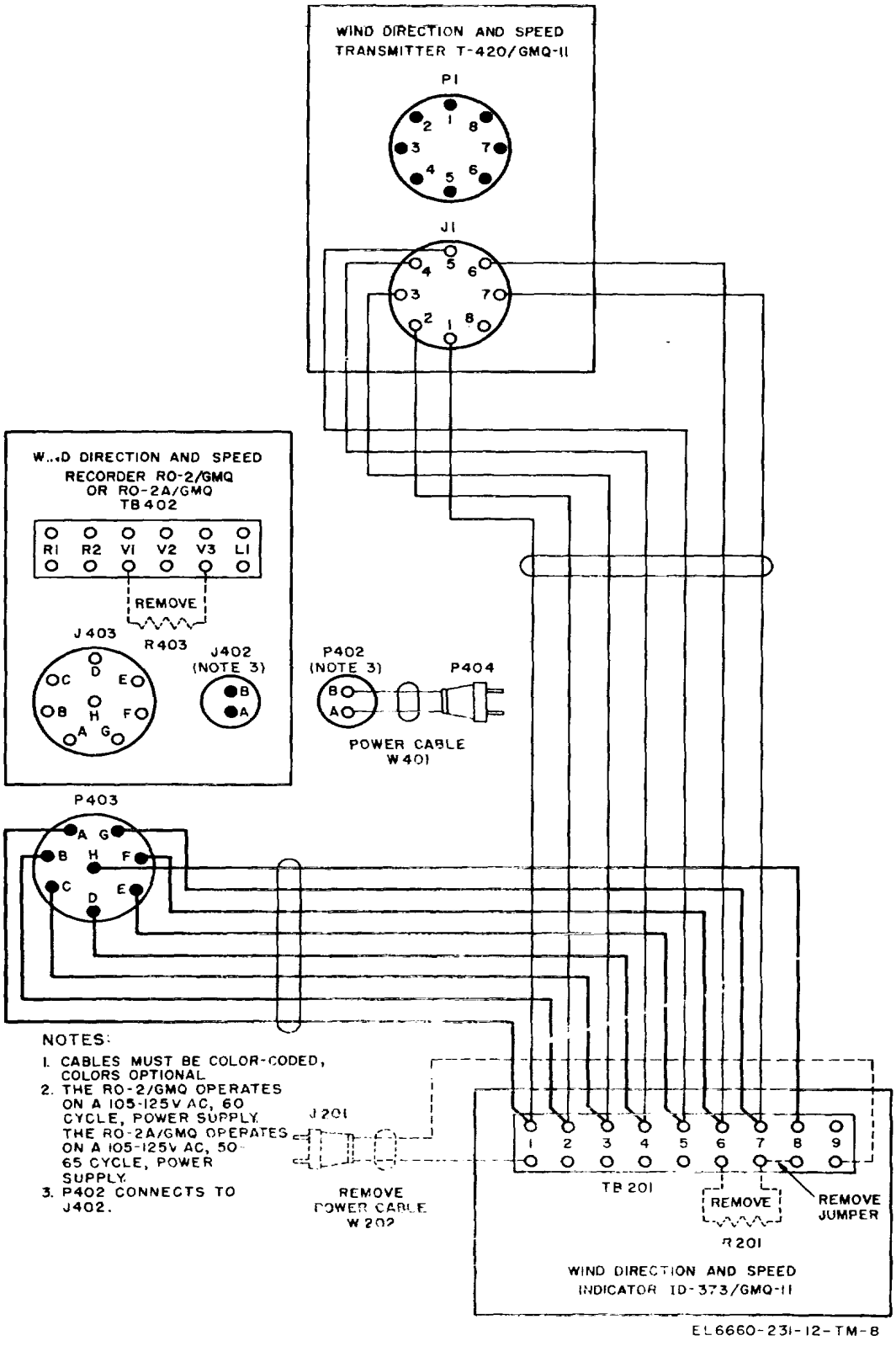


Figure 2-6. Connection diagram, recorder, indicator, and transmitter.

b. Connecting Recorder to Transmitter and Indicator. If a transmitter and indicator are to be used with the recorder, connect them as follows:

(1) Remove power cable W202 from terminal board TB201 of the indicator.

(2) Coil power cable W202 and store it inside the indicator case for future use.

(3) Remove the jumper across terminals 7 and 8 on terminal board TB201 in the indicator. Store the jumper inside the indicator case.

(4) Remove one lead on resistor R201 from terminal 6 or 7 of terminal board TB201 in the indicator. Tape the removed lead to electrically insulate it; leave the other lead attached to the terminal board to prevent loss of the resistor.

(5) Remove one lead on resistor R403 from terminal V1 or V3 of terminal board TB402 (shows below the shunt resistor on fig. 3-1) in the recorder. Tape the removed lead to electrically insulate it; leave the other lead attached to the terminal board to prevent loss of the resistor.

(6) Attach an eight-conductor cable to terminal board TB201 in the indicator. Be sure the two No. 10 speed conductors are attached (one each) to terminals 6 and 7.

(7) By continuity check or color code, tag each conductor at the free end of the cable with the number of the terminal to which it is connected in the indicator.

(8) Remove the eight-contact connector (fig. 2-4) from the recorder and unscrew the cable clamp.

(9) Solder the free ends of the eight-conductor cable to the eight-contact connector. Solder the two No. 10 speed conductor leads (one each) to pins G and F of the eight-contact connector. (These are the two dc (plus and minus) speed conductors.) Connect the remaining conductors in rotation with the pin letters; that is, A of the eight-contact connector to the conductor tagged 1; B to 2, etc. Color coding of the conductors will assist in this procedure.

(10) Plug in the eight-contact connector (P403 plugs into J403, fig. 2-6).

CAUTION

Avoid using two power cables (indicator and recorder) to prevent possible short circuit and damage to equipment and injury to personnel.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS

3-1. Controls and Indicators

The following is a list of recorder controls and indicators.

Control	*Fig. ref*	*Function*
POWER WITH LIGHTS OFF-POWER WITHOUT LIGHTS switch (power and lights switch).	3-1	Turns the equipment on with lights, on without lights, or off.
ON-OFF switch (chart movement)	3-7	Supplies power to the chart drive motors.
0-240K-MULTIPLY KNOTS X2-0-120K switch (dual range switch).	3-1	Selects windspeed recording range, also disconnects windspeed meter.
Direction pen adjustment lever.	3-1	Adjusts direction pen position (zeroing).
Speed pen adjustment lever.	3-1	Adjusts speed pen position (zeroing).
Operations levers	3-5	Raise or lower chart guide-pen lift mechanism.
Chart set knob.	3-5	Sets correct time line on the chart (pars 3-4 *b).*

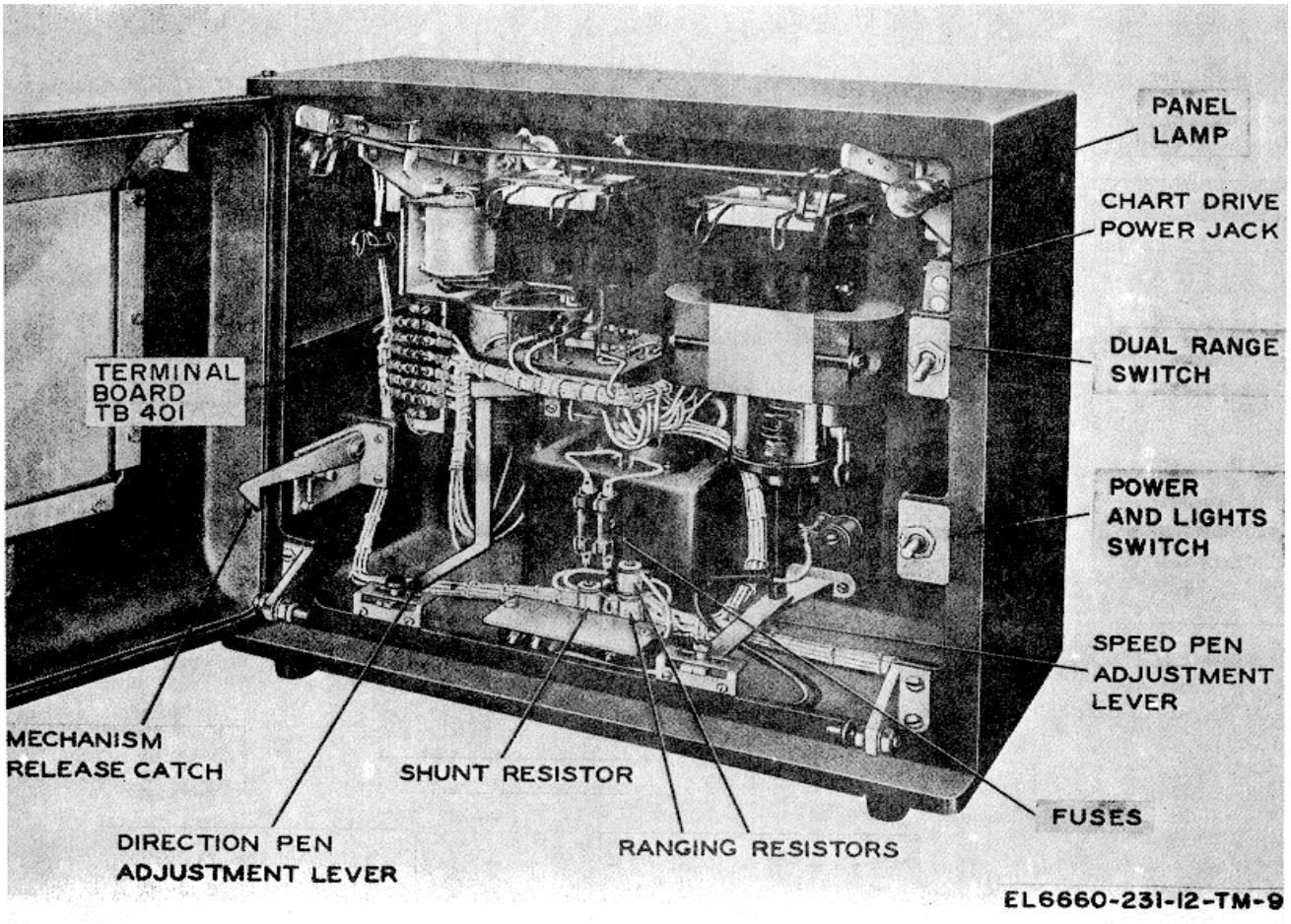


Figure 3-1. Case interior, chart drive mechanism removed, showing control location.

3-2. Ink Tanks

a. Fill both ink tanks (fig. 3-2) about three-quarters fill through the pen opening: use the ink and ink tank filler furnished with the recorder. Do not use standard writing inks. Keep the bottle tightly capped to prevent dirt from getting into the ink.

b. Raise the scale plates and insert the ink tanks in the receptors on top of the speed and direction mechanism assemblies (fig. 1-2), and see that they are tender the spring clips that hold them in place.

c. Set the pen elements in the pen element forks (penholder) by seating the knife edges (fig. 3-2) of the pens into the slots of the fork.

NOTE

The ink tanks and pens may be installed or removed for servicing when the chart drive mechanism is removed, tilted forward. or is in its operating position.

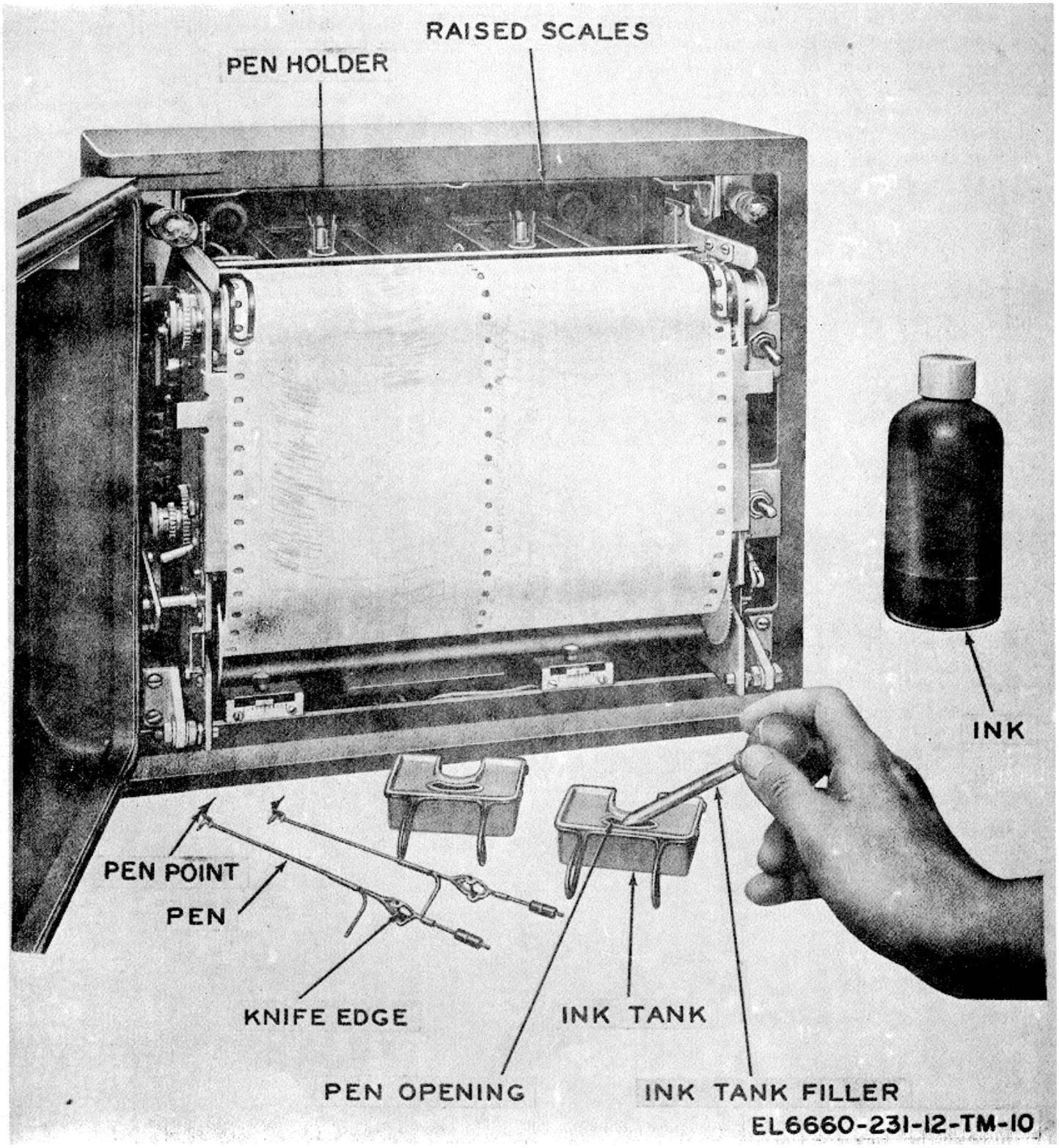


Figure 3-2. Filling ink tanks.

3-3. Preliminary Adjustments, Charts and Pens

a. Changing Chart Speeds (fig. 3-3, 3-4). The recorder is equipped with chart drive gears to give a chart speed of 3 inches per hour, which matches the time graduations of the chart supplied. Change gears (20), to provide a chart speed of 6 inches per hour, are mounted on a stud (19) on the left side plate of the chart drive mechanism. The change gear arrangements below show the combination of gears to obtain the different rate of chart speed. Change the rate of chart speed as follows:

(1) Unscrew the change gear nuts (28 and 29) from their shafts and pull off the existing gears (21).

(2) Remove the stud (19) and remove the gears (20).

(3) Slide the desired gears on (20) and replace the nuts (28 and 29); be careful to engage the slots in the gear hubs with the keys on the shafts.

(4) Be sure that the change gear nuts (28 and 29) are screwed on tightly and that the removed gears are placed securely on the storage stud (19). The change gear arrangements are as follows:

Chart speed (in. per hr)	*On drive roll shaft (3. fig. 3-3) use gear marked*	*On intermediate gear stud (31, fig. 3-3) use gear marked*	*Approximate running time (days)*
2.....	36T	36T.....	15
6.....	24T	48T.....	71/2

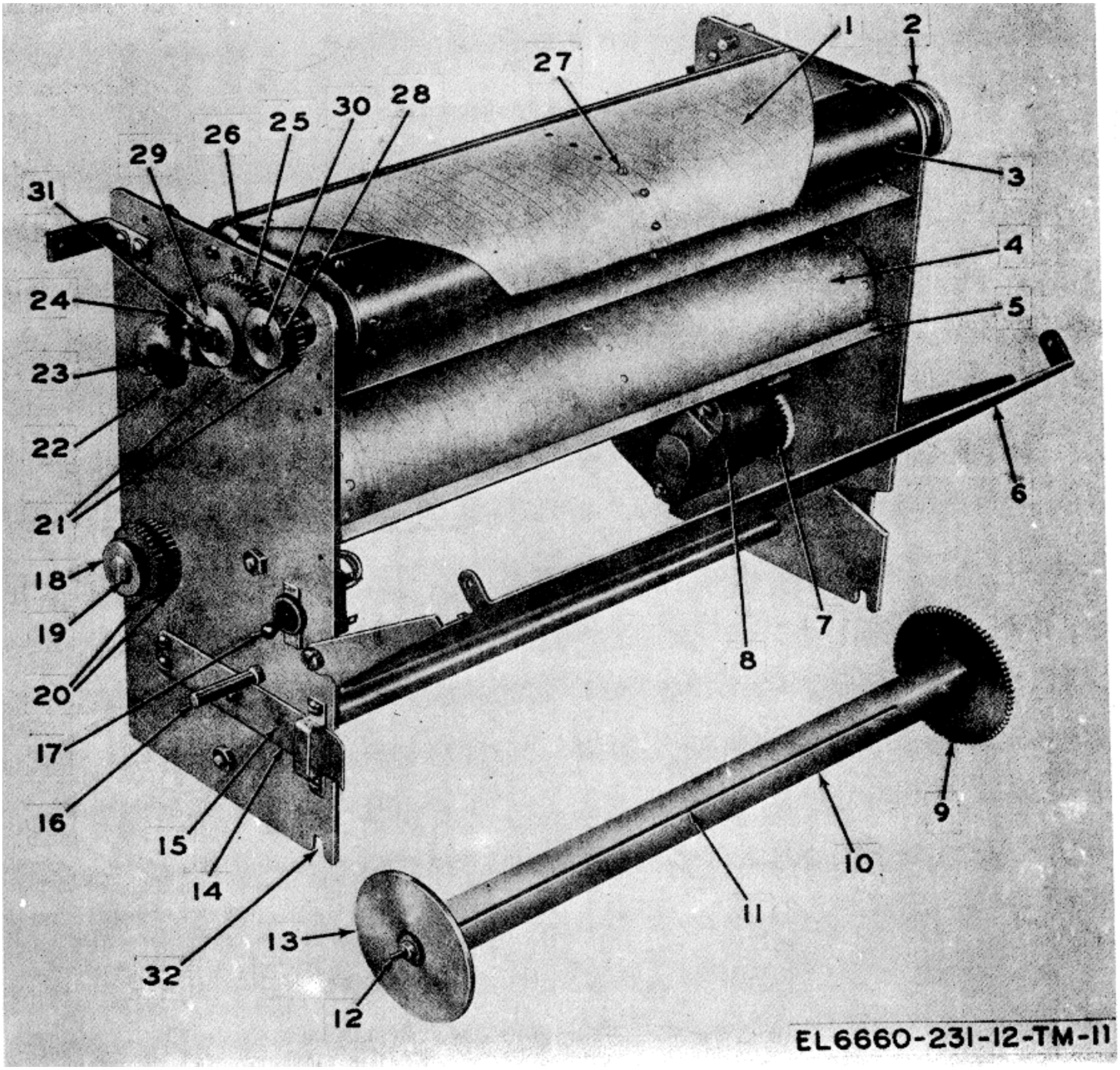


Figure 3-3. Chart drive mechanism, left view.

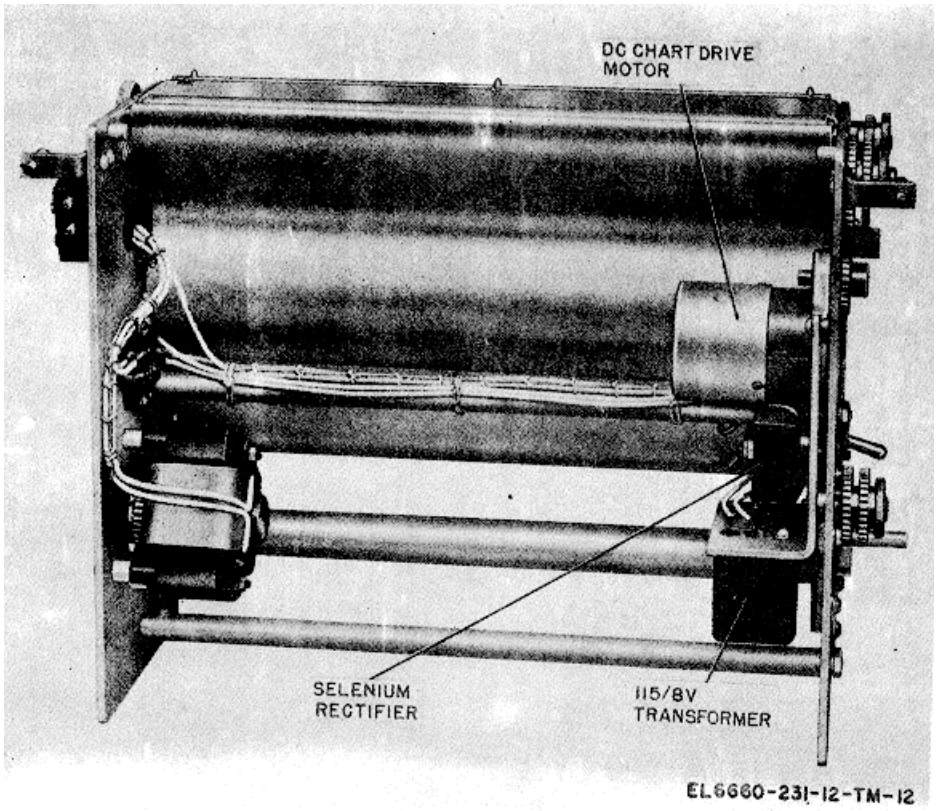


Figure 3-4. Chart drive mechanism, rear view.

b. Installing Chart Drive Mechanism.

(1) Lift up the operations levers.

(2) Place the chart drive mechanism in the recorder (fig. 3-5) so that the pivot slots 132, (fig. 3-3) in the mechanism sideplates are seated on the pivots (fig. 3-8).

(3) Place the mechanism in its normal operating position.

(4) Lower the operations levers over the chart drive roll.

c. Chart Installation. Install the chart as follows:

(1) Lift the operations levers and pull the chart drive mechanism forward (fig. 3-5).

(2) Open the front panel (6, fig. 3-3).

(3) Cut the corners from the end of the chart (fig. 3-5).

(4) Before installing the supply roll, thread the chart upward (fig. 3-6) through the space between the trough and the idler roller and then over the sprocket pins of the drive roll.

(5) Place the chart supply roll in the trough; wind tip the slack of the chart at the same time.

(6) Close the front panel (fig. 3-5).

(7) Pull the chart over the drive roll.

(8) Insert the tapered end of the chart into the slot of the take-up reel; wind several turns of the chart on the reel, printing on the outside (fig. 3-7).

(9) Insert the pivot on the gear end of the reel into its bearing hole. insert the left pivot in the bearing hole of the flat spring catch. If the reel does not install easily, the gears may not be meshing properly; turn slightly to remedy.

(I0) After the chart has been installed, return the chart drive mechanism to its normal operating position and lower the operation levers (fig. 3-8).

(11) Pull the indication scales down so that they are in position for viewing (fig. 1-1).

d. Filling Pen (fig. 3-8). Fill the pen with the pen filler furnished with the recorder; proceed as follows:

(1) Squeeze the bulb of the pen filler; lay the flat side of the soft rubber tip on the chart. Insert the glass pen into the hole in the rubber tip and let the filler suck in ink from the ink tank through the pen until no bubbles are visible in the glass pen.

(the pen feeds from the ink tank by capillary action once it is filled.)

(2) Remove the pen element from the filler. The pen should rest lightly on the chart.

(3) Swing the pen across the chart a few times. If it does not write properly, the pen probably has an air bubble in it, in which case the pen- filling operation must be repeated.

NOTE

Do not apply power to the recorder when swinging the direction pen.

(4) Be sure the pen is seated properly and that it does not rub on the ink tank. Also check to see that it does not rub on the indication' scales and the pen lift bar when they are in their operating positions. The indicating flag above the glass pen must not touch the scale plate.

NOTE

The pen element is balanced correctly at the factory when full of ink and will stay off the chart until the pen is filled.

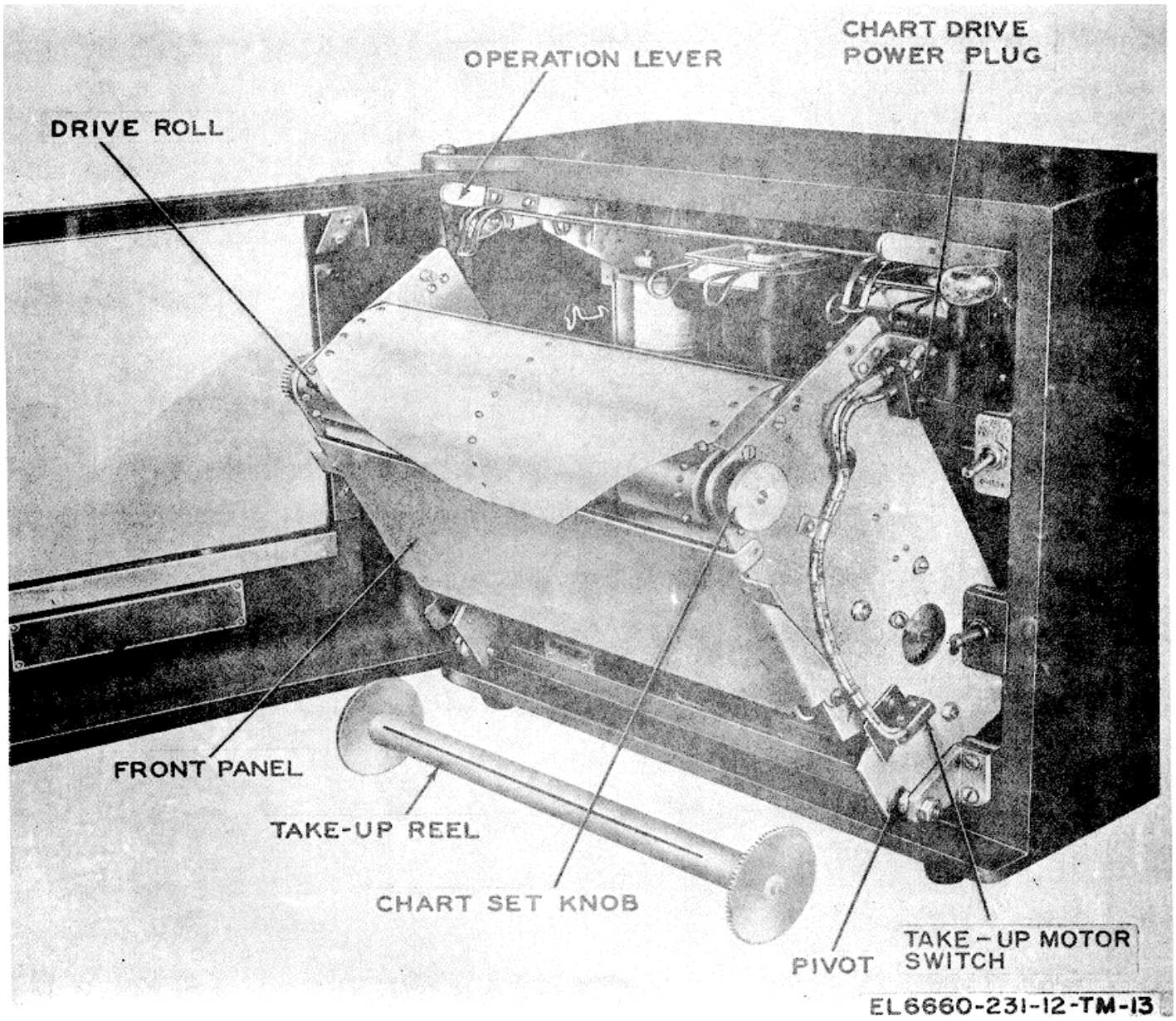


Figure 3-5. Installation of chart drive mechanism and chart.

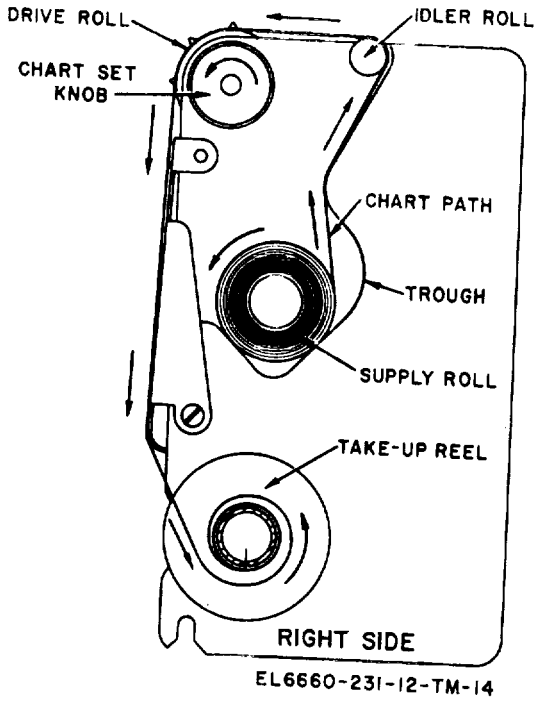


Figure 3-6. Chart threading diagram.

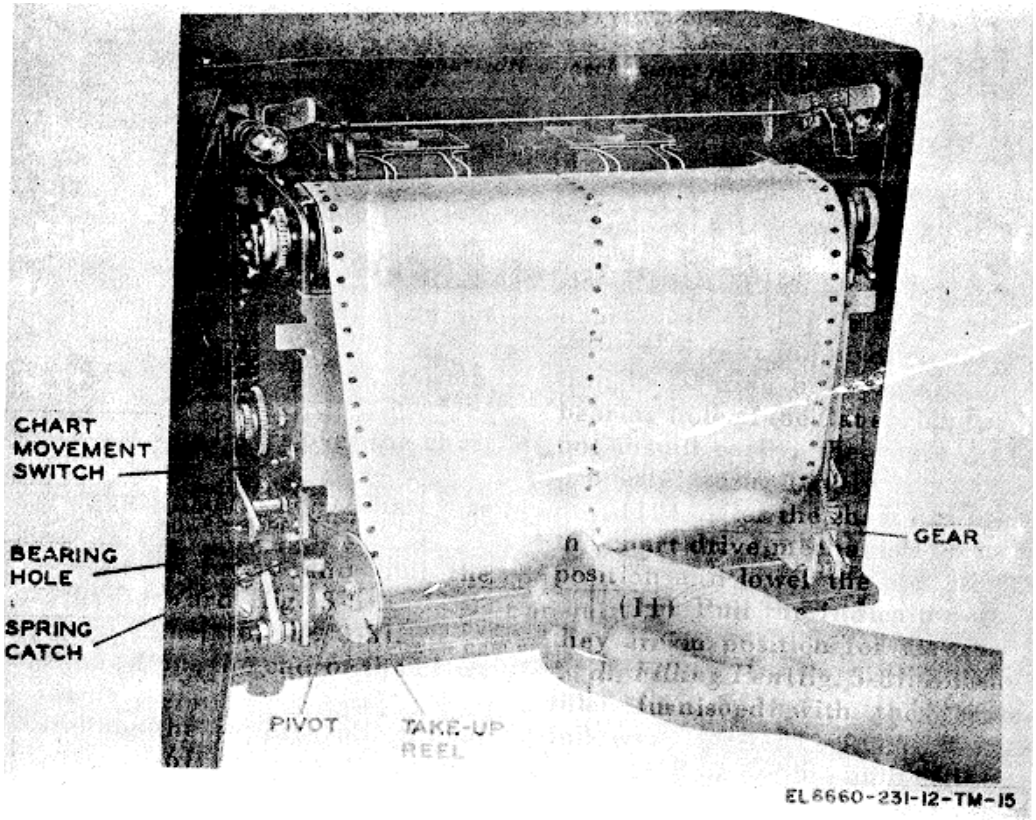


Figure 3-7. Installation of take-up reel.

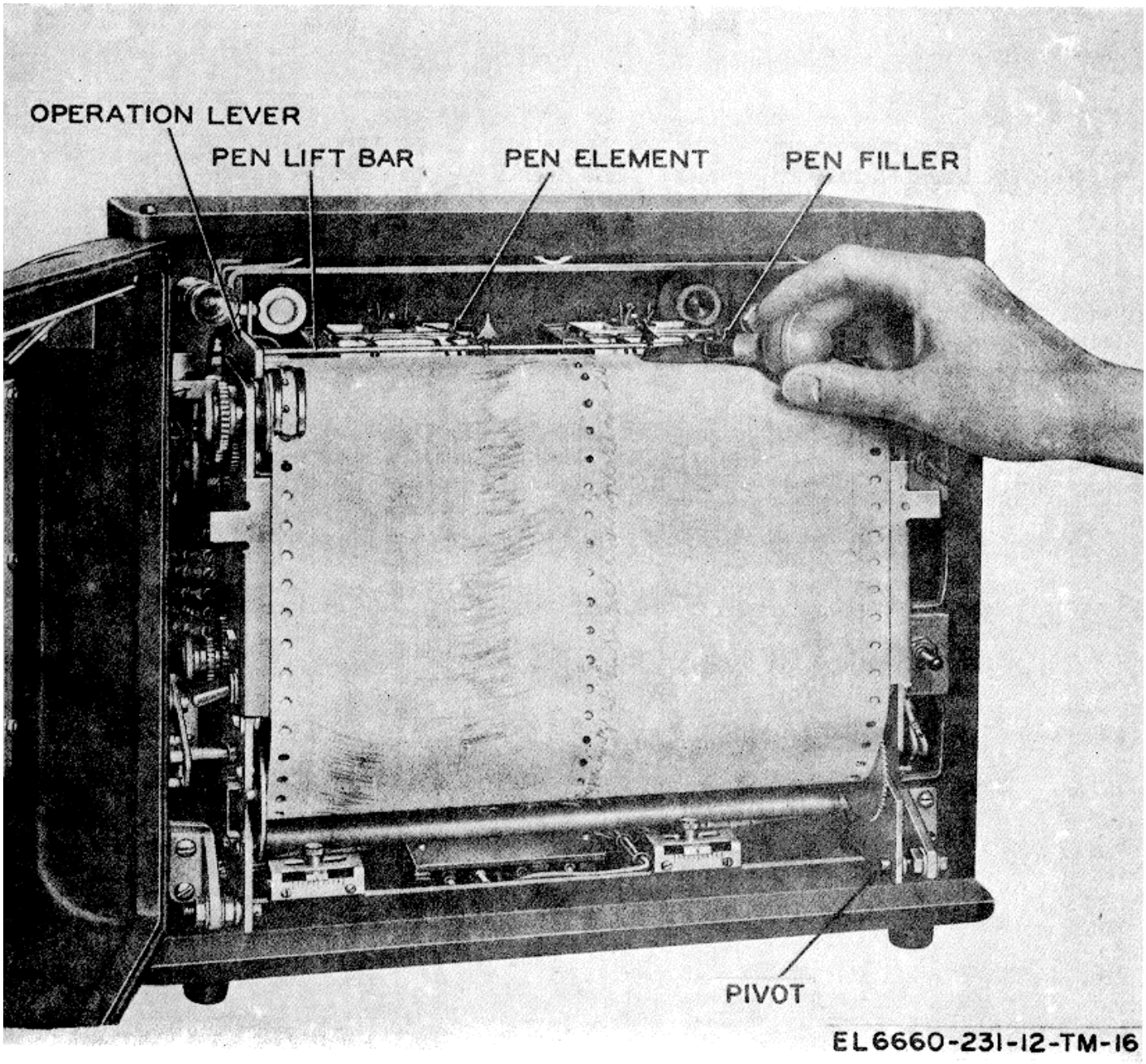


Figure 3-8. Filling pens.

3-4. Time Setting Chart

a. Before setting the chart with reference to time, make the following checks:

(1) See that the desired change gears are installed correctly, and that the spare gears are fastened securely on the storage stud (para 3-3 and fig. 3-3).

(2) See that the chart is installed properly (para 3-3*c)*.

(3) See that the chart drive mechanism is returned to its normal operating position with the chart guides down over the chart guide sprockets, the pens resting on the chart, and the indication scales pulled down so that they are in position for viewing.

(4) Install the power cable (fig. 2-4) in the recorder and plug it in the power source.

(5) Place the chart movement ON-OFF switch (fig. 3-7) in the ON position.

(6) Turn the power and light switch (fig. 3-1) to the desired position.

b. Turn the chart set knob (fig. 3-5) until the correct time line on the chart is under the pens.

NOTE

After time setting the chart, do not tilt the chart drive mechanism forward; power supplied to the chart drive motors will be interrupted, thus losing the time setting.

Section II. OPERATION UNDER USUAL AND UNUSUAL CONDITIONS

3-5. Preoperational Check

Be sure the switches are turned on (para 3-4*a* (5) and (6)); then follow the procedures outlined in *a* and *b* below before using the procedures described in paragraph 3-6.

a. Wind Direction Mechanism.

(1) Position the vane of the transmitter to the northerly direction.

(2) Check to see that the direction pen indicates 360y (not 0°).

(3) Slowly turn the vane through at least 540° ; first in one direction, then in the other.

(4) Check to see that the pen follows in the correct direction at all times.

b. Windspeed Mechanism.

(1) While the impeller of the transmitter is turning counterclockwise (facing the impeller), check to see that the speed pen moves to a speed indication.

(2) When the impeller is stationary, check to see that the speed pen indicates zero.

3-6. Operation

To operate the recorder, be sure the switches are turned on in accordance with the instructions in paragraph 3-4a(5) and (6); then proceed as follows:

a. Examine the chart according to the instructions listed in paragraph 3-3 c. Replace the chart when necessary.

b. Inspect the ink tanks (para 3-3 a), Add fresh ink weekly.

c. Operate the pens (para 3-3 *e*). Draw a small amount of ink through the pens with the pen filler weekly. This will loosen any clogged or stiffened ink.

d. Operate the dual range switch (fig. 3-1) on the 0-1 20K range position unless high wind intensities (over 90 knots) are being experienced or are expected. When the 0-240K range position is used, the indicator speed meter (if used) is removed automatically from the circuit.

e. The chart may be used with the 3-inch or 6-inch per hour chart speed and the time lines are graduated to 10 minutes and numbered every hour. Use the chart drive mechanism on the 3-inch per hour chart speed except to secure more detailed wind and gust data. The chart has a running time of approximately 15 days when used on the 3-inch per hour chart speed and 71/2 days when used on the 6-inch per hour chart speed. The time lines do not correspond with the 6-inch per hour chart speed. Therefore, the time must be divided by 2 to compensate when this speed is used.

f. To unroll the chart record from the take-up reel while the chart mechanism is operating. grasp the chart on either side, near the take-up reel, and pull it from the reel. See that the chart is kept straight and taut as it is allowed to rewind on the reel.

g. Observe the chart and scale.

h. Remove the chart from the take-up reel (figs. 3-3 and 3-5) by first removing the reel from the recorder. Then pull the plain flanged end from the core of the reel. Slide the chart off the core.

I. To install - new chart, slide it on the core of the reel; replace the plain flanged end of the reel and follow directions in paragraphs 3-3 *d* and 3-4.

j. Stop the equipment from operating by moving the power and lights switch (fig. 3-1) to the OFF position.

k. Remove the connector (fig. 2-4) of the power cable from the power source receptacle.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3-7. Unusual Conditions

It may be necessary to operate the recorder in regions where extreme cold, heat, humidity, moisture, or sand conditions prevail. The recorder will operate in a temperature range from -10° F to +125°F in a relative humidity range from 0 to 95 percent, and in an elevation range from 0 to 10.000 feet. Instructions for minimizing the effect of unusual operating conditions are contained in *a, b*. and *c* below.

a. Arctic Climates. Subzero temperatures and climatic conditions associated with cold weather affect the operation of the recorder. Observe the following instructions and precautions:

(1) Handle the equipment carefully.

(2) Keep the equipment as warm and dry as possible.

(3) Locate the equipment inside a heated enclosure, if possible.

(4) Keep the illuminating lamps of the recorder lighted to prevent the ink from stiffening.

(5) Keep moisture from the equipment. Dry thoroughly if moisture appears.

b. Tropical Climates. When operating in tropical climates, observe the following:

(1) Locate the recorder inside a shelter which will keep out the rain.

(2) Keep the shelter well ventilated.

(3) Keep moisture (caused by condensations from the equipment by lighting the recorder illuminating lamps.

(4) When possible, light other electric lamps near the equipment. These lamps will help to keep the equipment dry.

c. Desert Climates. The main problem that arises with equipment operation in desert areas is the amount of sand, dust, and dirt that enters moving parts of the recorder. To minimize these problems, observe the following:

(1)When possible, house the equipment in a dustproof shelter.

(2) When a dustproof shelter is not available, make the shelter as dustproof as possible by hanging wet sacking over the windows and doors and by covering the inside walls with heavy paper.

(3) When the recorder is housed in a tent, use sand to secure the outside walls to prevent their flapping in the wind.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S MAINTENANCE

4-1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of the recorder are listed below with references to the paragraphs for the particular maintenance function.

a. Daily preventive maintenance checks and services (para 4-4).

b. Weekly preventive maintenance checks and services (para 4-4).

c. Cleaning (para 4-5)

d. Visual inspection (para 4-12).

4-2. Materials Required for Operator's Maintenance

a. Alcohol for cleaning ink tanks and pens.

b. Lint-free cloth (FSN 8305-170-5062).

c. Trichloroethane (FSN 6810-664-0273).

d. Wire, 0.008 to 0.01-inch (2 feet).

4-3. Operator's Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to prevent downtime, and to insure that the equipment is serviceable.

a. Systematic Care. The procedures given in tables 4-1 and 4-2 cover routine systematic care and cleaning essential to proper upkeep and operation of the recorder.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services (tables 4-1 and 4-2) outline functions to be performed at specific intervals. These checks and services are to maintain the recording equipment in good general (physical and operating condition. If a defect cannot be corrected by the operator. higher category maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements of TM 38-750.

c. Preventive Maintenance Checks and Services Periods. Preventive maintenance checks and services on the recorder are required daily and weekly. Table 4-1 specifies the checks and services that must be accomplished daily. The first column lists the interval and sequence that a particular check or service is required. This column is subdivided into three columns: B (Before Operation), D (During Operation), and A (After Operation). The second column lists the item to be inspected and the procedure. The third column (Work Time (,M/H)) lists the man-hours it should take the operator to perform the check or service. This time is expressed in tenths of hours. Table 4-2 specifies the checks and services that must be accomplished weekly.

4-4. 0perator's Preventive Maintenance Checks and Services

a. Daily. Perform the preventive maintenance checks and services listed in table 4-1. If the equipment is not used daily, make sure these checks and services are performed prior to use.

b. Weekly. Perform the preventive maintenance checks and services listed in table 4-2. Equipment in *limited storage* (requires service before operation) does not require weekly maintenance.

Table 4-1. Operator/Crew Daily Preventive Maintenance Checks and Services

B - Before Operation Time required: 0.2 | D - During Operation Time required: 0.1 | A - After Operation Time required: 0.1

interval and sequence No			Item to be inspected procedure	Work time (M/ H)
B	D	A		
			NOTE Perform the following checks and services daily only if the equipment is being used. If the equipment is not used daily, perform these checks and services only When used. Do not allow the equipment to go beyond 1 week without performing both the daily and weekly preventive maintenance checks and services.	
1			EXPOSED SURFACES OF CASES AND ATTACHING HARDWARE Remove dirt and moisture from exposed surface of the case, interconnecting plug, and cable (para 4-5).	0.1
2			EXTERIOR ITEMS (KNOBS, SWITCHES, CONNECTORS, AND IN. DICATOR ASSEMBLIES): Visually inspect exterior items for damage. Inspect each control and switch for tightness. Replace setscrews that require frequent tightening (para 4-6).	0.05
	4		OPERATION: Perform equipment preliminary operating procedures given in paragraph 3-5. Be alert for any unusual performance or conditions.	0.1
		5	COMPLETENESS: See that all components and accessories are accounted for.	0.1

Table 4-2. Operator/Crew Weekly Preventive Maintenance Checks and Services

W-Weekly
Time required: 41.5

Sequence number	*Item to be inspected procedure*	*Work time (M/H)*
1	INKING SYSTEM: Inspect pens for clogging. Check ink tanks for thick ink or dried ink on sides (para 4-5).	0.25
2	INTERIOR CASE: Inspect for accumulation of dust or corrosion (para 4-5).	0.25

4-5. Cleaning

a. Exterior Surfaces. Inspect the exterior surfaces of the recorder. The exterior surfaces should be clean, and free of dust, dirt. grease, and fungus.

(1) Remove dust and loose dirt with a clean soft, cloth.

CAUTION

Do-not clean the window with any type of cleaning solvent; minute cracks may result.

(2) Clean the window with a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; milk soap may be used for more effective cleaning.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic, dangerous gases.

(8) Remove grease, fungus, and ground-in dirt from the recorder case; use a cloth dampened (not wet) with cleaning compound.

b. Pen Element. Use the pen filler to clean the pen element as follows:

(1) Lift the pen element from the pen element fork and remove the pen element from the recorder.

(2) Clean the pen element by blowing water or alcohol through It with the pen element.

(3) If the pen element is clogged, run a fine wire (0.0008 inch to).01 inch) through the penpoint and out the metal tube to loosen ink particles that block the pen. Then, rinse the pen ((2) above).

(4) Install the pen element in recorder (par. 3-2*c)* and fill the pen (para 3-3).

c. Ink Tanks. Clean the ink tanks as follows:

(1) Remove, the ink tanks from their receptacle.

(2) Carefully pry off the cover; make sure that it does not bend.

(3) Wash the ink tank and the cover in warm water; rinse and dry thoroughly).

(4) If washing does not remove all the dried ink, loosen the remainder by soaking the ink tank and cover in alcohol; then, wash the ink tank and cover again ((3) above).

(5) Before reassembling the ink tank, check to flake sure that the vent holes in the cover are open.

(6) Carefully press the cover onto) the ink tank.

(7) Fill the ink tanks and install them in the recorder (para 3-2).

4-6. Replacement of Panel Lamps and Fuses

a. Panel Lamps. Replace a panel lamp (fig. 3-1) as follows:

(1) Open the recorder door.

(2) Remove the defective panel lamp from its socket and replace it with a new one.

(3) Close the recorder door.

b. Fuses. Replace a fuse as follows:

(1) Open the recorder door.

(2) Lift the operation lever (fig. 3-5) to raise the pens from the chart.

(3) Lift the mechanism release catch (fig. 3-1) and pull the chart drive mechanism forward.

(4) Lift the chart drive mechanism off the pivots to remove it from the recorder.

(5) Remove the defective fuse from the fuseholder and replace it with a new one. (If the new fuse blows, higher category of maintenance is required.)

(6) Install the chart drive mechanism (para 3-3*c*.

(7) Close the recorder door.

4-7. Scope of Organizational Maintenance

Organizational maintenance of the shutter test set consists of the following:

a. Monthly preventive maintenance checks and services (table 4-3).

b. Quarterly preventive maintenance checks and services (table 4-4).

c. Visual inspection (para 4-12).

d. Troubleshooting (para 4-12 through 4-15).

4-8. Tools, Materials, and Test Equipment Required for Organizational Maintenance

The tools. materials, and test equipment required for organizational maintenance are listed below.

a. Tools. Tool Kit Electronic Equipment TK-101/G is required for organizational maintenance of the recorder.

b. Materials. The materials required for organizational maintenance are the same as those for operator's maintenance (para 4-2).

c. Test Equipment. The only test equipment required is Multimeter AN/URM-105.

4-9. Organizational Preventive Maintenance Preventive

Preventive maintenance checks at the organizational category are made monthly and quarterly unless directed otherwise by the commanding officer. Table 4-3 specified the monthly preventive maintenance checks and services. Table 4-4 specifies the quarterly preventive maintenance checks and services. Additional preventive maintenance information is contained in paragraph 4-4.

Table 4-3. Organizational Monthly Preventive Maintenance Checks and Services

M.- Monthly
Total man-hours required: 0.3

Sequence number (M/H)	*Item to be inspected procedure*	*Work Time*
1	HANDLES, LATCHES, AND HINGES:	
	Check handles, latches, and hinges for signs of damage. See that all attaching hardware is secured to its fittings. Items not readily repairable with tools allocated to the organizational repairman s hould be referred to higher category of maintenance.	0.1
2	GASKET:	
	Check gasket case for worn or loose edges. Secure or replace worn or loose gasket.	0.05
3	CONNECTORS:	
	Check connectors for signs of damage such as bent pins and dented or deformed casings. Refer damaged connectors to higher category of maintenance.	0.5
4	PENS AND INK TANKS:	
	Inspect and clean pens and ink tanks (para 4-5).	0.05

Table 4-4. Organizational Quarterly Preventive Maintenance Checks and Services
Q - Quarterly
Time Required: O.7

Sequence number M/H)	*Item to be inspected procedure*	*Work time*
1	INTERIOR OF CHASSIS AND COMBINATION CASE:	
	Clean interior of chassis and combination case (para 4-5.)	0.1
2	PLUCKOUT ITEMS:	
	Inspect seating of readily accessible items of a pluckout nature connectors, lamps, plug-in relays, etc. Do not twist to inspect. Use only direct pressure to insure item is fully seated.	0.1
3	RESISTORS:	
	Inspect resistors for cracks, blistering, or other obvious defects.	0.05
4	LUBRICATION:	
	Lubricate the recorder (para 4-11).	0.05
5	SWITCHES AND CONTROLS:	
	Inspect switches and controls for smooth operation and alignment of positions.	0.05
6	PRESERVATION:	
	Check all surfaces for evidence of fungus. Remove rust and corrosion and touchup-paint bare spots (para 4-10).	0.1
7	CHART:	
	Check chart for proper feed and alignment (para 4-14).	0.5
8	PUBLICATIONS.	
	DA Pam :310-4 Check to see that all publications are current. complete. and serviceable.	0.1
9	MODIFICATIONS:	
	Check DA Pam 310-7, to determine if new applicable MWO's have been published. ALL URGENT MWO's must be applied immediately. ALL NORMAL MWO's must be scheduled.	0.1

4-10. Touchup painting instructions

Remove rust and corrosion from metal surfaces by lightly sanding with fine sand paper. Brush two thin coats of paint on bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB 746-10.

4-11. LUBRICATION

The lubrication interval is contained in the preventive maintenance checklist (para 4-9), and in the chart below. This interval is established for operation on a 24-hour basis under moderate climatic conditions. Whenever climatic conditions

necessitate more frequent interval-s for general -servicing, the lubrication interval should be shortened accordingly. Avoid over lubrication; over lubrication is injurious to the recorder. Inspect the equipment after lubricating and remove all excess oil that will tend to collect dust. Oil may be properly applied by dipping a toothpick in the oil and applying it to the surface to be lubricated. Figures 4-1, 4-2, and 4-3 show the parts on the recorder that require lubrication. Follow the instructions above and the information in the chart below when lubricating the equipment.

Parts to be lubricated	*Lubricant*	*Interval*	*Fig. ref*	*Remarks*
Door hinge. latch pivot, and pivot hinge.	Oil, Lubricating, Preservative, Special (PLS Special).	Quarterly 4-1		Clean part with trichloro-ethane. Remove all sand, grease, and lint. Dry before lubricating.
Idler roll bearing. idler gear bearing. drive roll bearing, take-up reel pivots, and motor oil hole.	Oil PLS Special)	Quarterly) 4-2		Clean (as above) only the take-up reel pivots at organizational level.
Idler roll bearing. drive roll bearing. take-up motor hole.	Oil (PL Special)	Quarterly	4.3	Cleaning with trichloroethane at organizational level not authorized.

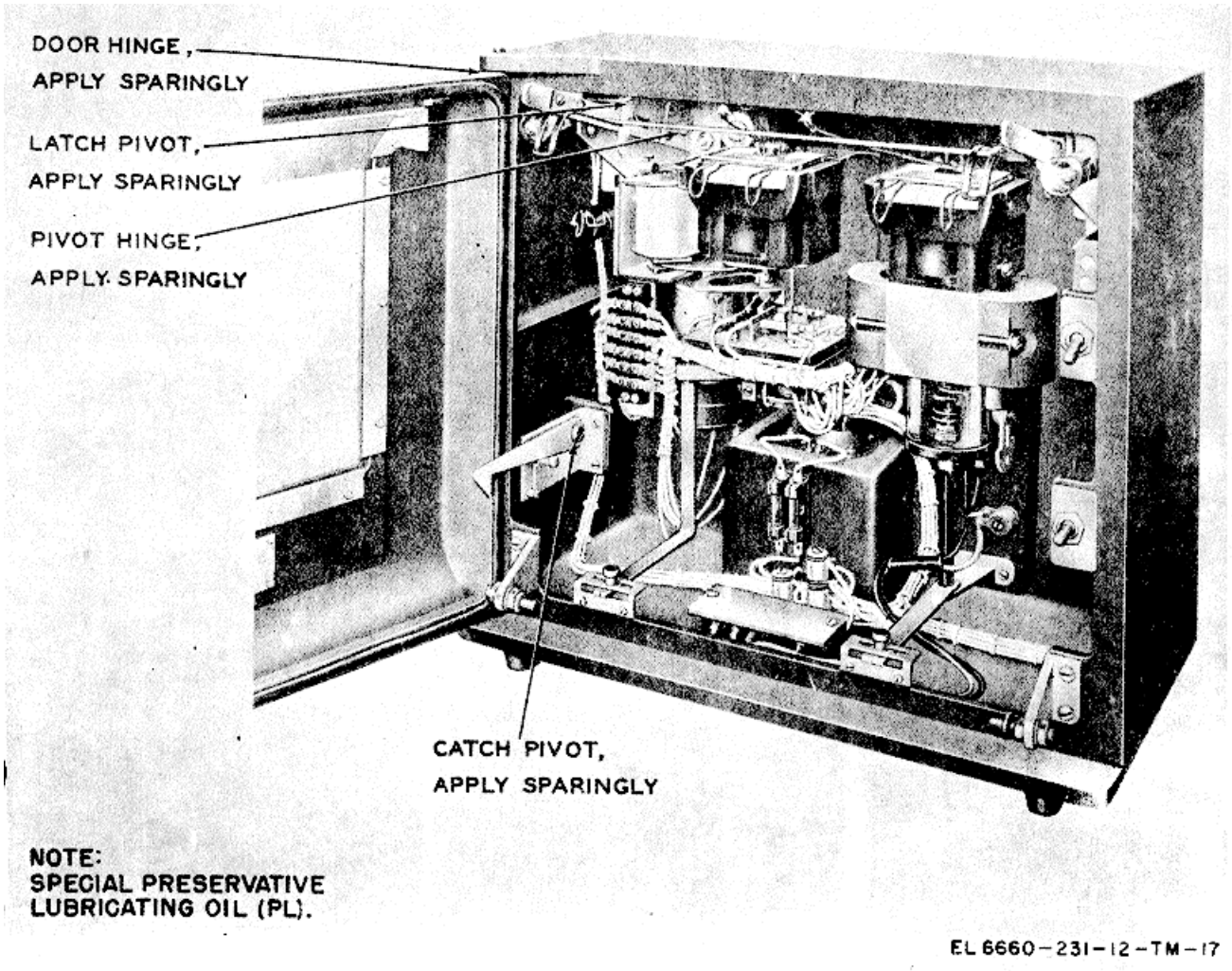


Figure 4-1. Lubrication, case interior.

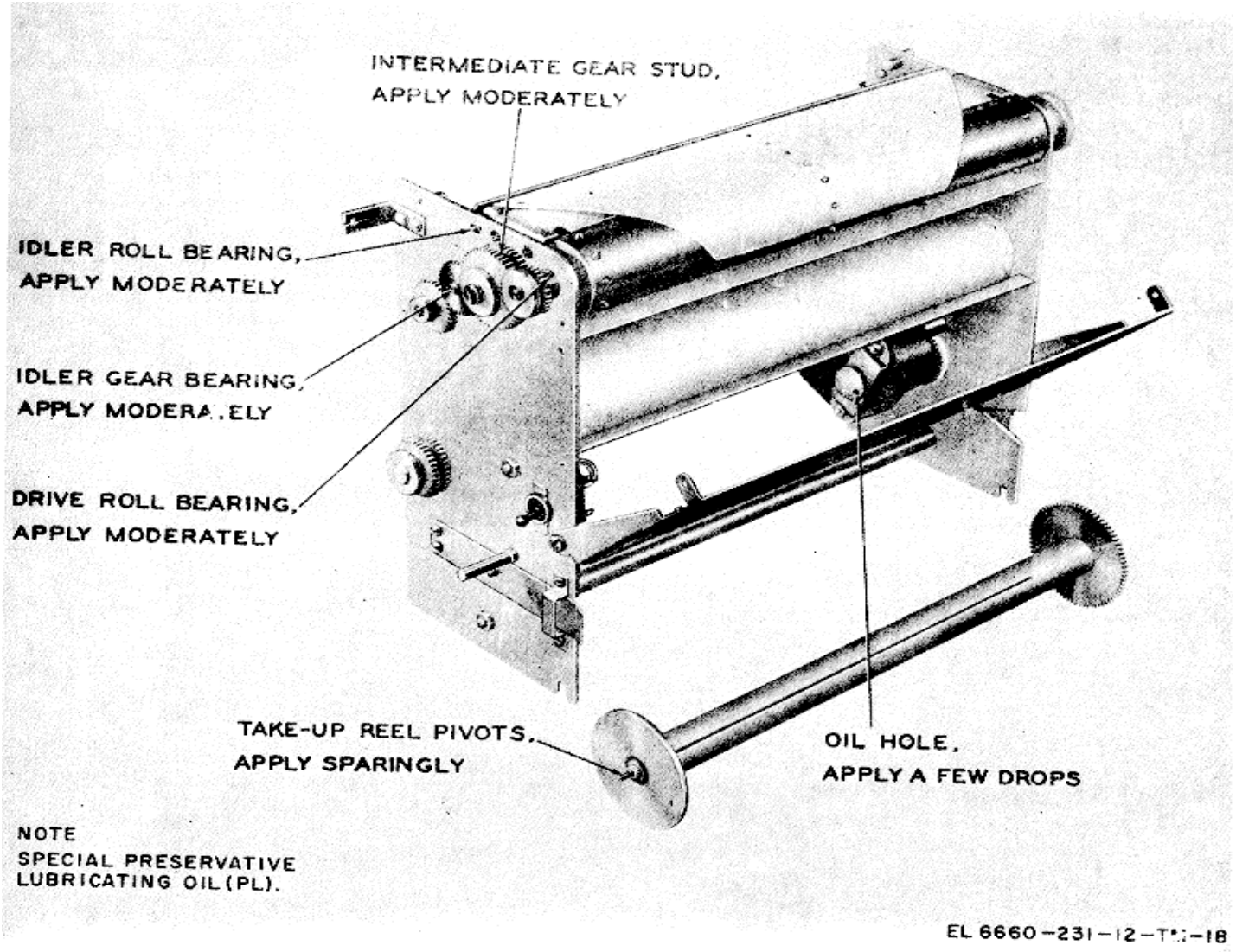


Figure 4-2. Lubrication, chart drive mechanism, left side.

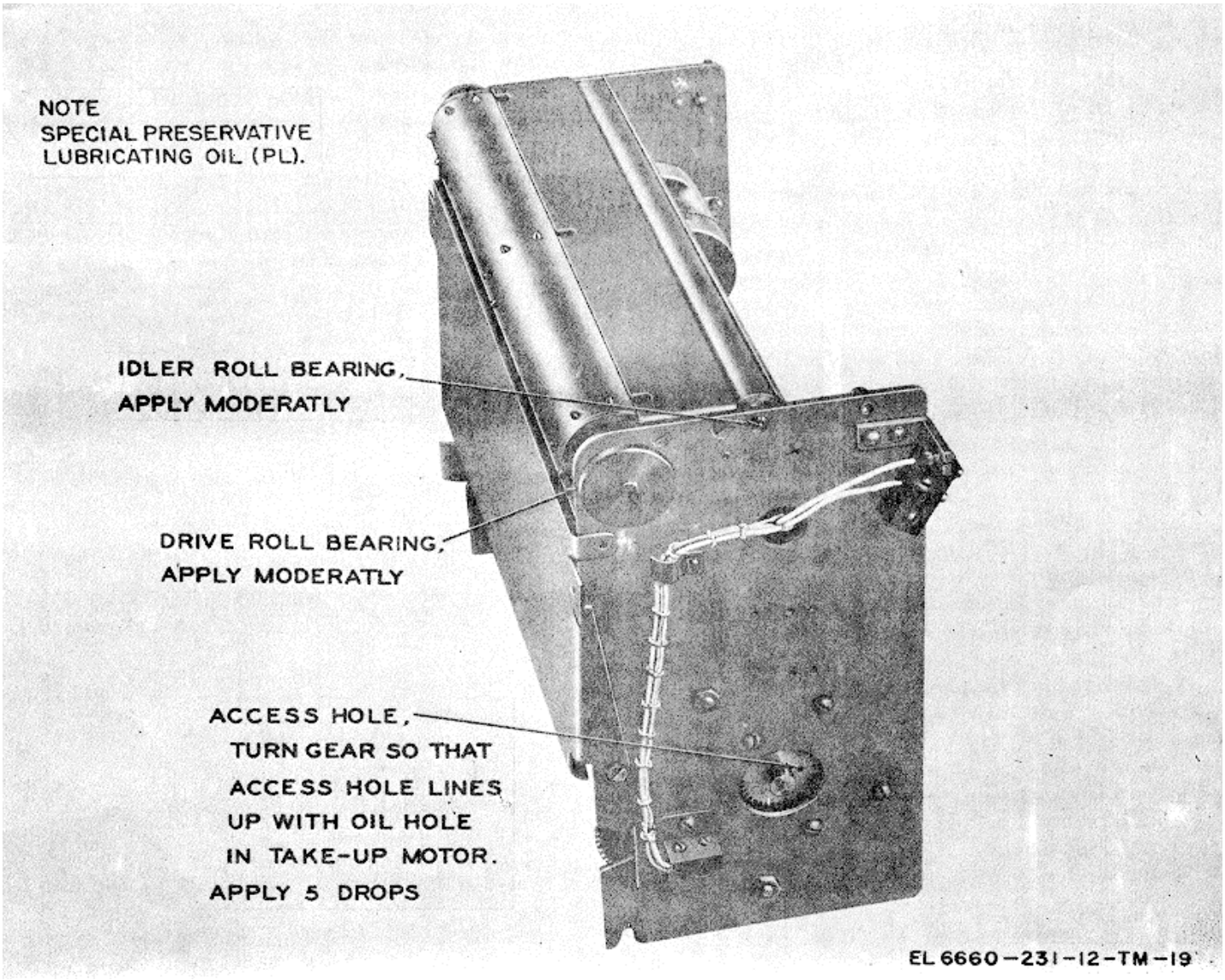


Figure 4-3. Lubrication, chart drive mechanism, right side.

Section III. TROUBLESHOOTING

4-12. Visual Inspection

Before operating the recorder. inspect it. Inspection will save repair time and may also avoid further damage. Inspect the recorder for the following defects:

a. Observe whether the power cable (fig. 2-4) is installed properly and check to see that it is not frayed, broken. or otherwise damaged.

b. Observe whether the eight-contact connector is installed properly and check to see that the eight-conductor cable is not frayed. broken. or otherwise damaged.

c. Operate the power and lights switch (fig. 3-1) to the POWER WITH LIGHTS position. Check to see that the two illuminating lamps are lighted and that the direction pen is in a position that corresponds to the transmitter vane position. If the lights do not light. check the fuses and bulbs.

d. Refer to paragraph 4-13 if an indicator and a recorder are used in the same circuit.

e. Check to see that the chart drive mechanism is seated firmly in its operating position and that the chart is being driven at the proper rate. Check to see that the chart is being taken up on the taken up reel. If the chart drive motors do not operate when the following conditions exist, refer the equipment to higher category of maintenance.

(1) Mechanism is seated properly.

(2) Chart movement ON-OFF switch is in the ON position.

(3) Power cable is connected to the power source.

(4) Fuses are good.

(5) Power and lights switch is in either on position (POWER WITH LIGHTS or POWER WITHOUT LIGHTS).

f. Disconnect the light-contact connector (fig. 2- 4) from the rear of tile case, remove the power cable from the ac power source, and proceed as follows:

(1) Manually move the direction pen across the chart. If the pen does not move easily and smoothly. friction may be present in the synchro, gears, or upper movement assembly. Refer the equipment to higher category of maintenance.

(2) Manually move the speed pen across the chart. If the pen does not move easily and smoothly. friction may be present in the voltmeter. Refer the equipment to higher category of maintenance.

(3) Visually inspect the interior of the case for evidence of arcing or pitting on the relay contacts. sliprings. commutator. or switch contacts. See that the relay coils. repositioning motor coils, or resistors do not show evidence of overheating. Refer the recorder to higher category of maintenance if evidence of the above conditions exists.

4-13. System Sectionalization

(figs. 4-4 and 4-5)

The windspeed and wind direction systems are isolated electrically and troubles in one should not become apparent in the other system.

a. If an indicator and a recorder are used in the same system, compare the indicator of each with the other. If the indications are the same, the fault does not lie in either the recorder or indicator, but elsewhere in the system.

b. Errors or failures in the wind direction system may be caused by excessive friction in the synchro bearings, loose or reversed cable connections, loose synchro clamp, defective thermal-delay relay, or defective synchros.

c. If the synchro in the indicator or recorder is not free to rotate, it may cause the other synchros in the direction system to overheat and may even cause them to burn out. Refer the equipment to highest category of maintenance for repair or replacement off synchros.

d. Errors or failures in the windspeed section may be caused by dirty or worn sliprings, defects in the magneto of the transmitter, loose cable connections, excessive friction in the recorder volt-meter, or defects in the recorder range switch, range resistors, shunt resistors, and internal wiring.

NOTE

Do not attempt to replace recorder parts at this level unless specifically outlined in this chapter.

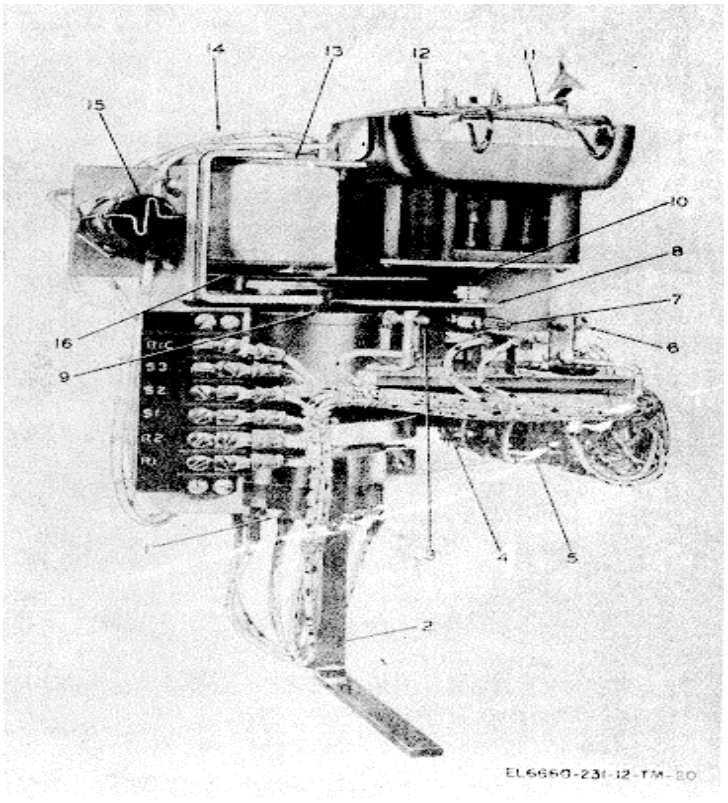


Figure 4-4. Wind direction mechanism.

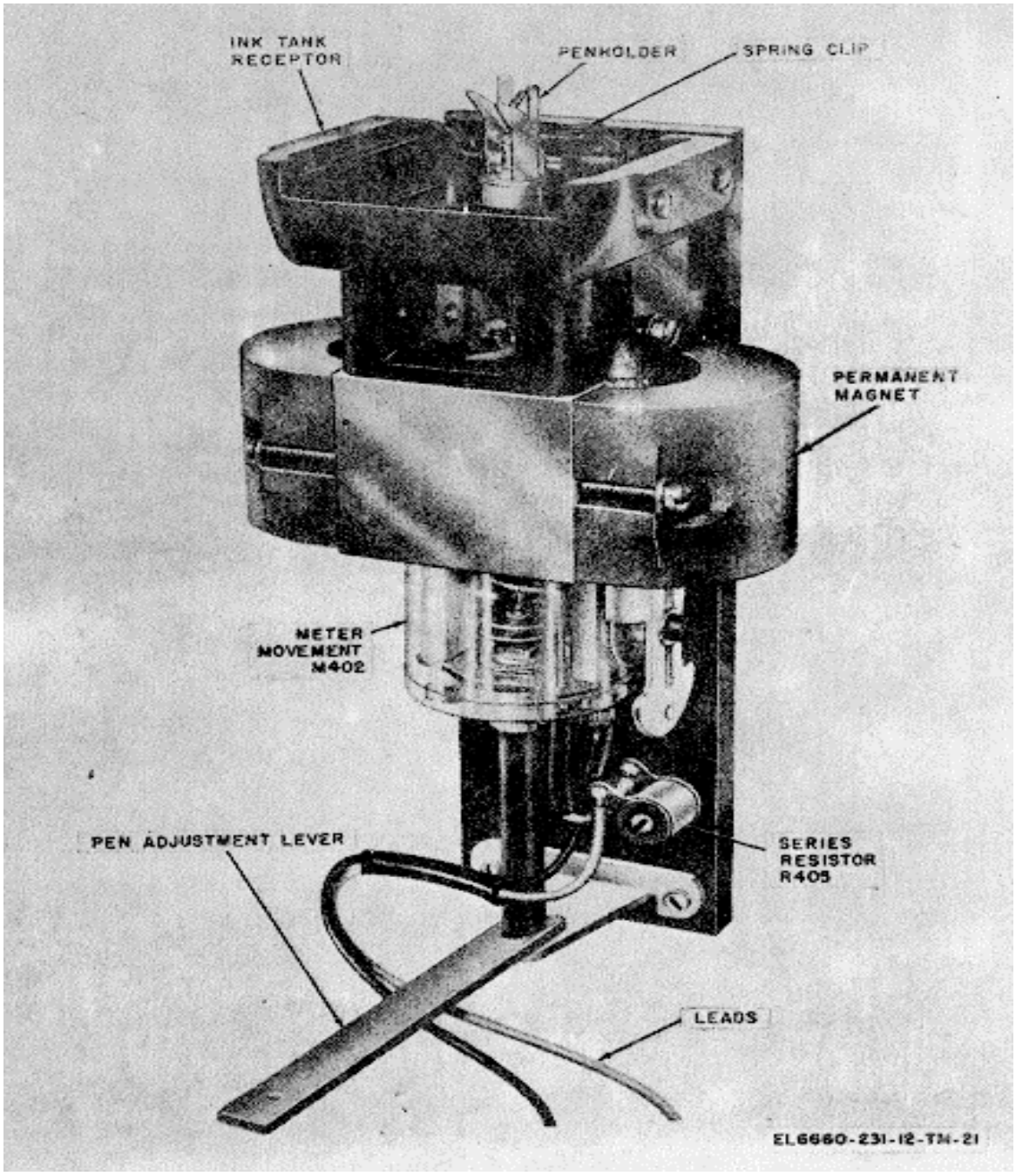


Figure 4-5. Speed mechanism.

4-14. Troubleshooting Procedures

Troubleshooting procedures (table 4-5) provides a procedure for systematically checking equipment performance. All corrective measures that the organizational repairman can perform are given in the *Corrective action* column. When using table 4-5, start at the beginning and follow each step in order. If the corrective action indicated do not correct the defect, troubleshooting is required by higher category of maintenance personnel. Note on the repair tag how the equipment performed and the corrective actions that were taken.

Table 4-5. Troubleshooting

Malfunction	*Probable trouble*	*Corrective action*
Pens do not swing across chart smoothly and easily.	Loose connections.	Clean and tighten connections.
	Damaged or dirty jewels and pivots in meter movement.	Refer to higher category of main tenance.
Scale lamps do not light when switch is in power with light position.	Burned-out lamps	Replace burned-out lamps.
	Blown fuses	Clean contacts of lamp sockets.
	.....	Replace blown fuses.
Recorder does not operate with wind under 90 knots per hour with dual range switch in the 0-120K position.	Synchro malfunction	Refer to higher category of main-
	.....	tenance.
Pen direction does not rotate to the same compass points and in the same direction as the transmitter vane.	Synchro not properly connected.	Refer to higher category of main-
	.....	tenance.
Pen produces unclear trace.	Dirty ink system	Clean ink system (para 4-5).
Chart drive does not take up chart while recorder operates.	Chart paper not aligned.	Reset the chart.
	Defective motor.	Refer to higher category of maintenance.

4-15. Adjusting Direction and Speed Pens

a. Adjusting Direction Pen. Adjust the direction pen as follows:

(1) Turn the power and lights switch (fig. 3-1) to OFF.

(2) Remove the eight-contact connector from the well in the rear of the case (fig. 2-4).

(3) Take out the chart drive mechanism (para 3-3).

(4) Connect three jumpers (test leads) to TB401 (fig. 3-1).

(5) Replace the chart drive mechanism and operate the power and lights switch to the POWER WITH LIGHTS position. The recorder pen should move to the 360° position on the chart.

(6) Correct small positioning errors by loosening the thumbscrew and moving the arm of the direction pen adjustment lever until the pen indicates 360°.

(7) Retighten the thumbscrew, turn the power and lights switch to OFF, and remove the jumpers.

(8) If the adjustment of the pen adjustment lever does not return the pen to the 360° position, refer the equipment to higher category of maintenance.

CAUTION

Do not allow the synchro to be connected to the 115-volt (ac) power source for more than 30 seconds, as serious damage to the synchro may occur because of overheating.

b. Adjusting Speed Pen. With the eight-contact connector removed, loosen the thumbscrew of the speed pen adjustment lever and adjust the arm so that the windspeed indication is zero. The chart drive mechanism should be turned on for this adjustment. Tap the case lightly, to remove residual friction.

APPENDIX A

REFERENCES

Following is a list of references applicable and available to the operator and organizational technician of the recorders.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Equipment Index of Modification Work Orders.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 11-6625-203-12	Operator and Organizational Maintenance Manual: Multimeter AN / URM-105, Including Multimeter ME-77 / U.
TM 11-6625-366-15	Operator's, Organizational DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 11-6660-200-10	Operator's Manual: Wind Measuring Set AN/GMQ-11.
TM 11-6660-200-20	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Wind Measuring Set AN/GMQ-11.
TM 38-750	The Army Maintenance Management Systems (TAMMS).
TM 50-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

B-1. General

This appendix provides a summary of the maintenance operations for RO-2( )/GMQ. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

5-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to lean (decontaminate), to preserve. to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/ action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column a, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The

number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
0 - Organizational
F - Direct Support
H - General Support
D - Depot

e. *Column 5, Tools and Equipment*. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. *Column 6, Remarks*. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

B-4. Tool and Test Equipment Requirements (sec III)

a. *Tool or Test Equipment Reference Code*. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. *Maintenance Category*. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. *Nomenclature*. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. *National/NATO Stock Number*. This column lists the National/NATO stock number of the specific tool or test equipment.

e. *Tool Number*. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (digit) in parentheses.

B-5. Remarks (sec IV)

a. *Reference Code*. This code refers to the appropriate item in section II, column 6.

b. *Remarks*. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART

FOR

RECORDERS, WIND DIRECTION AND SPEED RO-2/GMQ, RO-2A/GMQ, RO-2B/GMQ, RO-2C/GMQ

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	RECORDERS, WIND DIRECTION AND SPEED RO-2/GMQ, RO-2A/GMQ, RO-2B/GMQ, RO-2C/GMQ	INSPECT	0.2						A
		INSPECT		0.3					B
		TEST	0.2						C
		TEST		0.2				1,5	D
		TEST			0.3			2,3,4,7	E
		TEST				1.0		2,3,4, 6,7	F
		SERVICE	0.2						G
		SERVICE		0.3				5	H
		SERVICE			0.5			4	r
		ADJUST	0.2						J
		ADJUST		0.2				5	K
		ADJUST			0.5			4	L
		INSTALL	0.2						M
		INSTALL		0.2				5	N
		INSTALL				1.0		4	0
		REPLACE	0.2						P
		REPLACE		0.3				5	°
		REPLACE			0.5			4	R
		REPAIR		0.3				1,5	S
		REPAIR			0.3			2,4	T
		REPAIR				1.0		2,4	U
		OVERHAUL				1.0		2,3,4, 6,7	
01	CABLE ASSEMBLY, POWER ELECTRICAL W 401	INSPECT	0.1						A
		TEST		0.1				1,5	D
		REPLACE		0.1				5	
		REPAIR		0.2				5	S

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR RECORDERS, WIND DIRECTION AND SPEED RO-2/GMQ, RO-2A/GMQ, RO-2C/GMQ

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/NATO STOCK NUMBER	(5) TOOL NUMBER
1	0	MULTIMETER AN/URM-105	6625-00-581-2036	
2	F, H	MULTIMETER TS-352/U	6625-00-242-5023	
3	F, H	RESISTANCE BRIDGE ZM-4/U	6625-00-500-0937	
4	F, H	TOOL KIT TK-100/G	5180-00-605-0079	
5	0	TOOL KIT TK-101/G	518O-00-064-5170	
6	H	VOLTMETER AN/USM-98A	6625-00-753-2115	
7	F, H	TIMEPIECE (ANY ACCEPTABLE CLOCK OR WATCH WITH MINIMUM 12 HOUR TIME SPAN)		

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	VISUAL INSPECTION OF EXPOSED SURFACES AND EXTERIOR ITEMS.
B	VISUAL INSPECTION OF GASKETS, CONNECTORS AND INTERIOR OF CHASSIS AND COMBINATION CASE.
C	PRE-OPERATIONAL TESTS.
D	OPERATIONAL TESTS AND ELECTRICAL CONTINUITY.
E	CHART DRIVE MOVEMENT, RESISTANCE TESTS, COILS, RESISTORS, RELAYS, MOTORS, TRANSFORMERS, INDICATORS, AND SYNCHROS.
F	WIND SPEED MECHANISM, WIND DIRECTION MECHANISM, DRIVE CHART MOVEMENT, SYNCHROS, AND FINAL TESTING.
G	PREVENTIVE MAINTENANCE CLEANING TO REMOVE DUST, DIRT, GREASE, AND FUNGUS FROM EXTERNAL SURFACES.
H	PREVENTIVE MAINTENANCE INCLUDING TOUCH UP PAINTING, LUBRICATION, CLEANING PEN ELEMENTS, AND INK TANKS.
I	DISASSEMBLE TO CLEAN AND LUBRICATE PARTS EXCEPT MOTORS.
J	CHART SPEED AND START TIME SETTING.
K	PEN ELEMENTS TO ZERO POSITION.
L	POSITION OF CHART DRIVE MECHANISM, CHART GUIDE CLEARANCE, WIND DIRECTION AND SPEED SCALES, PEN REVERSAL CONTACTS, ALIGN AND BALANCE PEN DIRECTION.
M	CHART DRIVE MECHANISM GEARS.
N	RECORDER AND CHART DRIVE MECHANISM.
O	ALL MODULES AND PARTS.
P	CHART, INK, FUSE, AND PANEL LAMPS.
Q	PEN POINTS, PEN ARMS, CABLE CONNECTORS, CABLE ASSEMBLIES, TAKE-UP REELS AND INK TANKS.
R	WIND DIRECTION AND WIND SPEED MECHANISMS, SWITCHES, RESISTORS, CONNECTORS, RELAYS CHART TAKE-UP MOTOR, TRANSFORMERS, RECTIFIERS, AND CHART DRIVE MOTOR.
S	CABLE ASSEMBLIES AND OTHER ITEMS BY REPLACEMENT OF PARTS WHICH DO NOT REQUIRE SPECIAL TOOLS AND EQUIPMENT.
T	CHART DRIVE AND WIND SPEED MECHANISM, CASE ASSEMBLY, AND ELECTRICAL CIRCUITRY.
U	COMPLETE REPAIR BY REPLACEMENT OF PARTS.

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USAERDAA (1)
USAERDAW (1)
MAAG (1)
USARMIS (1)
Units org under fol TOE:
- (I cy ea unit)
- 11-96
- 11-117
- 11-127
- 11-158
- 11-500 (AA-AC)
- 29-134
- 29-136

NG: State AG (2) To the following State AG:
AZ. AR. CT. IN. IA. MS. MO. NY. NC. OH, OR, PA, TX, WV. PR.
USAR: None
For explanation of abbreviations used. see AR 310-50.

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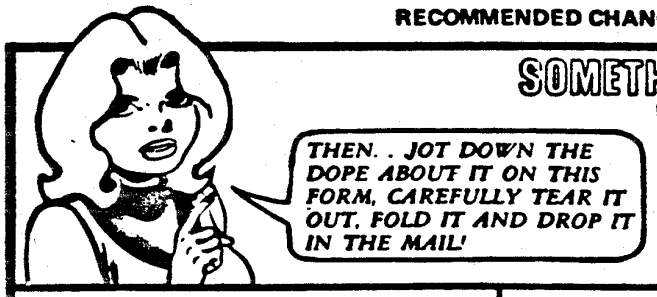

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

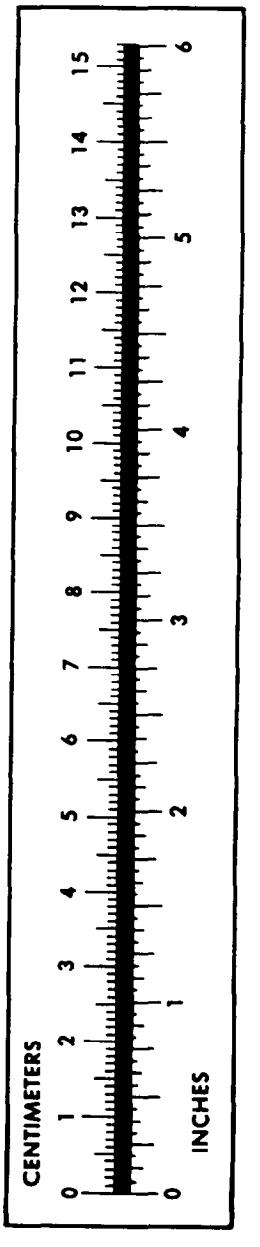
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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