

TYPE F RECORDER

**INSTRUCTION 37027
MARCH 1999**

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Safety and Equipment Protection

WARNING

ELECTRICAL POWER CAN RESULT IN PERSONNEL INJURY/DEATH OR CAN CAUSE DAMAGE TO EQUIPMENT.

If the instrument is driven by an external power source, disconnect the instrument from its power source before attempting any repairs.

WARNING

BATTERIES ARE DANGEROUS. IF HANDLED IMPROPERLY, THEY CAN RESULT IN PERSONNEL INJURY/DEATH OR CAN CAUSE DAMAGE TO EQUIPMENT.

Batteries can be hazardous when misused, mishandled, or disposed of improperly. They may explode or emit poisonous substances. Batteries contain potential energy, even when partially discharged.

WARNING

ELECTRICAL SHOCK CAN RESULT IN PERSONNEL INJURY OR DEATH.

Use extreme caution when handling cables, connectors, or terminals; they may yield hazardous currents if inadvertently brought into contact with conductive materials, including water and the human body.

CAUTION

Be aware of protective measures against environmentally caused electric-current surges.

In addition to the previous warnings and cautions, the following safety activities should be carefully observed.

Children-Adolescents

NEVER give batteries to young people who may not be aware of the hazards associated with batteries and their improper

Jewelry, Watches, Metal Tags

To avoid severe burns, NEVER wear rings, necklaces, metal watch bands, bracelets, or metal identification tags near exposed battery terminals.

Heat Fire

NEVER dispose of batteries in fire or locate them in excessively heated spaces. Observe the temperature limit listed in the Instrument specifications.

Charging

NEVER charge 'dry' cells or lithium batteries that are not designed to be charged.

NEVER charge rechargeable batteries at currents higher than recommended ratings.

NEVER recharge a frozen battery. Thaw it completely at room temperature before connecting charger.

Unvented Container

NEVER store or charge batteries in a gas-tight container. Doing so may lead to pressure buildup and explosive concentrations of hydrogen.

Short Circuits

NEVER short circuit batteries. High current flow may cause internal battery heating and/or explosion.

Damaged Batteries

Personnel injury may result from contact with hazardous materials from a damaged or open battery. NEVER attempt to open a battery enclosure. Wear appropriate protective clothing, and handle damaged batteries carefully.

Disposal

ALWAYS dispose of batteries in a responsible manner. Observe all applicable federal, state, and local regulations for disposal of the specific type of battery involved.

NOTICE

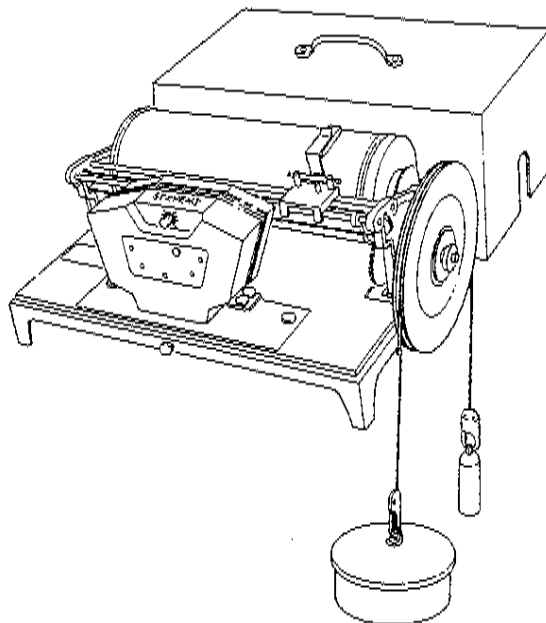
Stevens makes NO claims as to the immunity of its equipment against lightning strikes, either direct or nearby. The following statement is required by the Federal Communications Commission.

WARNING - This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

USER INFORMATION

Stevens makes no warranty as to the information furnished in these instructions and the reader assumes all risk in the use thereof. No liability is assumed for damages resulting from the use of these instructions. We reserve the right to make changes to products and/or publications without prior notice.

1 Introduction



1.1 NOTES FOR THE USER OF THIS MANUAL

If the reader is somewhat inexperienced in the use of this instrument, he should first read the overview in the next subsection (1.2). Then he should study the rest of this introduction to see how the resolution of the chart, the gage scale, and the time scale are related to produce useful chart tracings.

Note that the installation of the F68 itself and the installation of the Timers are covered in separate sections of this manual; Timer installation is part of Options and Accessories (Section 5).

1.2 OVERVIEW

The Stevens Type F Water Level Recorder is an instrument that is both float-driven and time-driven. This instrument records varying levels of any liquid surface in relation to time. Among other uses, flow data may be obtained by use with weirs, Parshall flumes, or other rated measuring structures in which heights (or differences in heights) are an index of flow.

The rise and fall of the float with changing water levels turns the drum proportionally, as the Timer-controlled marker moves across the chart at a constant speed. The resulting graph shows the water level against the record of time. The range in stage is limited only by the length of the float line and float size, since the chart drum may make any number of revolutions.

1.3 RESOLUTION

A ball bearing-mounted charted drum responds to 0.01 foot (3 mm) change at 1:1 scale, using a 5-inch float. The instrument is actually sensitive to 0.002 foot (0.6 mm), and can record to this degree of accuracy if a large enough float is employed.

1.4 GAGE SCALE

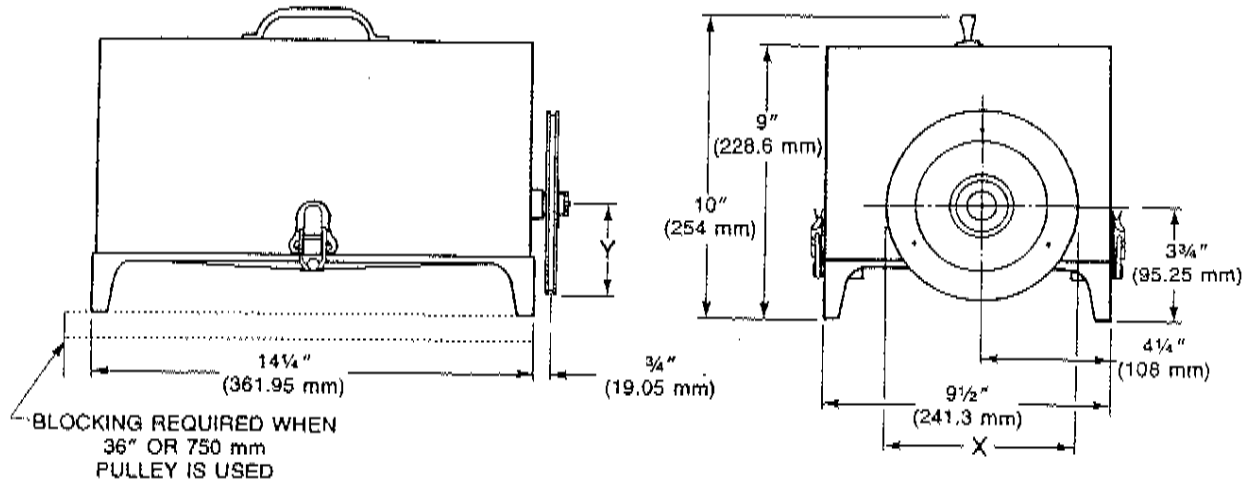
The relationship between the rotation of the float pulley and the rotation of the chart drum is set by gearing. Changes in gearing or the pulley circumference affect the ratio between the change in the position of the chart trace and water level changes. This ratio is known as gage scale. Table 6 shows gage scale selection.

1.5 TIME SCALE

Time scales determine the speed with which the marker travels across the chart and are expressed either as "inches per day" or as "days that the chart will last." There are three types of timers currently available to drive the marker across the chart: Quartz Multispeed Timer (QMT), Alternating Current (AC) Timer, and Weight-Driven Timer.

Table 7 shows the choices for time scale in inches-per-day of marker travel and also in number-of-days to cross the chart from left to right.

2 Installation



PULLEY CIRC.	X FLOAT LINE SPACING	Y PULLEY RADIUS
18"	5.73" (145.5 mm)	3.06" (77.72 mm)
36"	11.46" (291 mm)	5.93" (150.62 mm)
375 mm	4.70" (119.4 mm)	2.56" (65.02 mm)
750 mm	9.40" (238.8 mm)	4.86" (123.44 mm)

Figure 1. Installing the F68

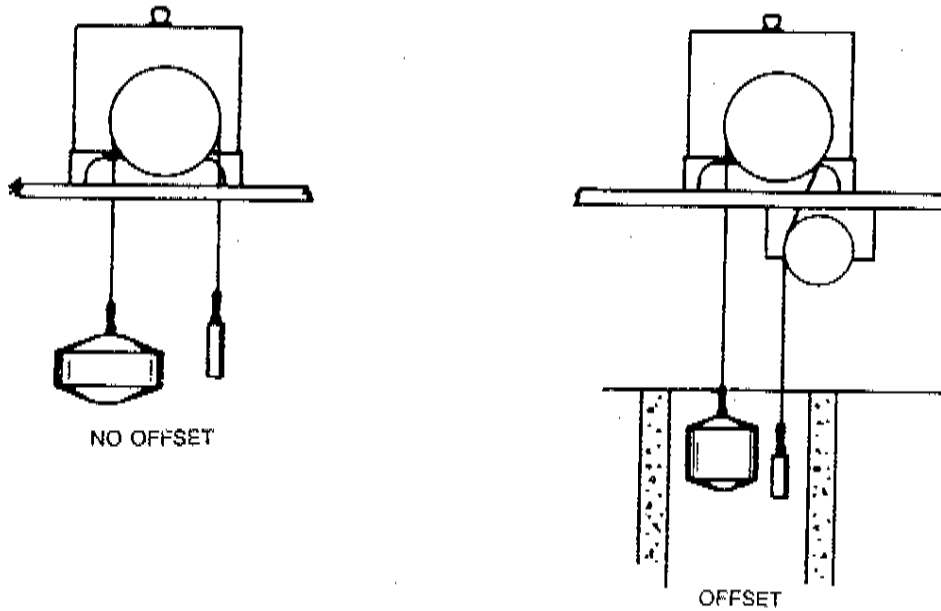


Figure 2. Positioning with Round Float

2 Installation

2.1 INSTALLATION

Refer to Figure 6 for items listed.

- Step 1. Remove all shipping tie-down straps, cardboard packing pieces, etc. Note that the parts kit is packed under the instrument.
- Step 2. Locate gage gear.
- Step 3. Release the clamp screw (item 6, at left end of the chart drum). Pull out the left center pin (item 5).
- Step 4. Lift the chart drum out of its standards and remove the two screws which hold the gage gear (item 14).
- Step 5. Remove the nut from the float pulley shaft (item 26).
- Step 6. Position the gears; replace the nuts, screws, and chart drum.
- Step 7. Place the float pulley (item 17) on the float pulley flange (item 16) with the concave face of the pulley towards the instrument. Reassemble the washer (item 18), with cupped side facing pulley, and the nut (item 19).
- Step 8. To obtain a 1:20 or a 1:24 English gage scale, attach the 3.0-foot circumference ring on the float pulley of the Recorder geared for 1:10 or 1:12 English scales, respectively. (See Figure 1 for extra height requirement/pulley clearance when ring is installed.)
- To obtain a 1:20 metric gage scale, double the circumference of the 37.5 centimeter annular ring on a Recorder geared for 1:10 metric scale and operate with the float line or the tape over the 75.0 centimeter ring.
- Step 9. For the QMT, follow instructions in Section 5.1.1.3 (POWER). Then continue with step 10.
- If the Timer used is not the QMT, proceed directly with step 10.

- Step 10. Prepare the shelf for the instrument. The shelf must support at least 20 pounds and provide sufficient room for the instrument and its attachments. Refer to Figure 1.

Note that the platform must allow for the cutting of the float line holes after the instrument is positioned in the next steps. For specifications, see Figure 2. Also notice in Figure 1 that blocking is required if the ring is installed.

- Step 11. If your setup will include the round float and no Weight-Driven Timer, refer to Figure 2 to position the instrument and its float. If not, proceed with step 12.
- Step 12. If your setup includes the round float and the Weight-Driven Timer, refer to Figure 3 to do the positioning. If not, proceed with step 13.

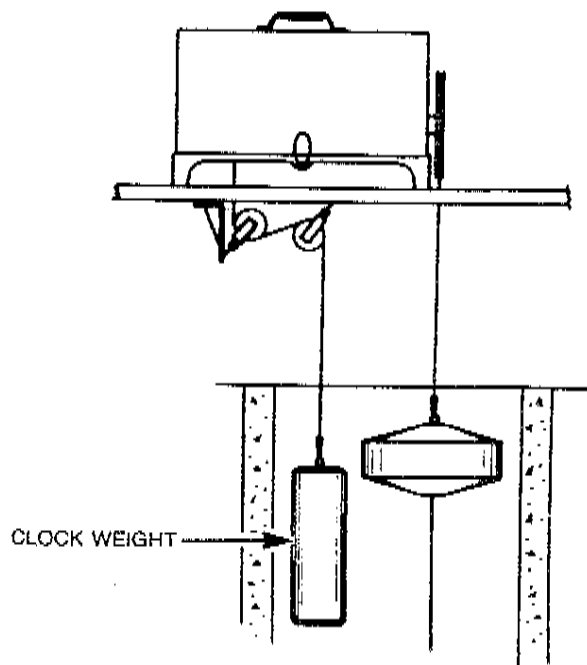


Figure 3. Positioning to Accommodate Weight Drive

2 Installation

Step 13. If your setup includes a scow float, refer to Figure 4.

As illustrated, the Stevens Type F Recorder may be operated with a scow float in a stream of flowing liquid. The Recorder is shown mounted temporarily in a manhole. Such an installation is essential when a stilling well is not available or where floating solids or siltation prevent use of wells.

The anchor rod is attached with swivel connections both to the anchor base and to the scow float. This supports the float on the surface, prevents weaving, and assures an accurate record of the fluctuating liquid level.

The float must be hung from the left side (facing pulley) to ensure proper chart tracing (see Figure 2).

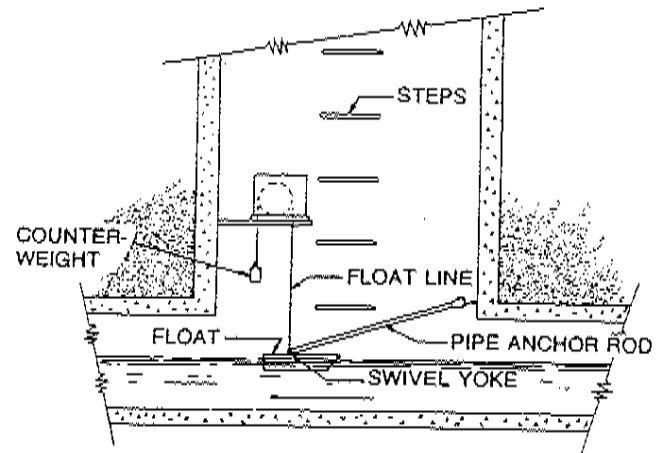


Figure 4. Installation with a Scow Float

3 Operation

3.1 GENERAL

The term "operation" as used in this section consists of the following in the order given:

- Installing the chart.
- Reading the chart.
- Preparing the marker.
- Positioning the marker at its starting point.
- Writing station name, time, date, reference level, gage scale, and time scale for the starting point on the chart.
- Setting time scale if QMT is used, when the AC Timer is connected to power, or when the weight is connected to its cable if the Weight-Driven Timer is used.

Operation begins the moment the last event in the above list occurs.

The following procedures are covered elsewhere as noted:

- Installing or repairing the Timers: Section 5.1.
- Installing the Recorder: Section 2.
- Installing the gage scale: Section 2.

3.2 PREPARING THE MARKER

3.2.1 INSTALLATION OF DISPOSABLE CARTRIDGE PEN

Remove the plastic cap from the pen's nib. Insert the pen into the black plastic holder. Verify that the pen's tip has snapped into the holder's detent and that the nib protrudes past the ramped paper guide on the bottom of the pen holder.

The entire assembly should be free to pivot and track the chart, but it should not have excessive free play. Tighten or loosen the adjusting screw (Figure 6, item 12), as necessary.

3.2.2 CAPILLARY PEN WITH ACRYLIC RESERVOIR

Fill the pen's reservoir about 3/4 full, using the chart ink provided. Prime the pen by inserting the filler end of the bottle's cap into the reservoir port and, without using excessive pressure, squeezing the bottle while holding a finger over the reservoir's air vent. This will force ink through the capillary tube into the pen's tip.

Cap the pen or retract it from the chart. This protects the chart and the pen's tip until the following steps are completed.

3.2.3 INSTALLING THE PENCIL

Refer to Figure 6. The position of the marker's carriage for pen recording is with the pen mounting adjusting screws (item 12) located over the carriage rod (item 22) nearest the chart drum. When using the pencil (optional accessory), the carriage is reversed on the carriage rods so that the pivot screws are farthest from the chart drum. To reverse, lift the carriage so that the lugs on the carriage clear the rods and then rotate the carriage 180°. It is not necessary to detach the spring connections. The pencil holder can then be mounted in the pivot screws. Retract the pencil from the chart.

3.3 INSTALLING CHARTS

See Table 8, Chart Selection, for types of charts.

- Step 1. Retract the marker.
- Step 2. Refer to Figure 6. Roll both of the chart holder springs (item 8) to the gear end of the chart drum (item 13). Remove the used chart.
- Step 3. Slip a new chart from the far side and underneath the chart drum, pulling the edges together and lapping the trimmed edge over the margin. See that the slot in the left chart margin engages the pin (Figure 6, item 7) in the chart drum. Match the lines and push the chart against the left flange of the chart drum. Replace the spring chart-bands at the left end and at the right end of the chart.

Charts should be rolled tightly and kept in the same carton in which they were shipped. If a chart has become flattened, the proper roll can be re-established. Roll it tightly, starting at the trimmed edge, print side out, and hold it in this position for a minute before placing it in position on the drum. The marker will not catch if the seam of the chart has not been properly rolled and placed. Mark start time as before.

3 Operation

3.4 READING THE CHARTS

Below are two samples of sections of charts: the F1 and the F4.

The float (see Figure 2) must be hung from the left side of the pulley (the point of view being facing the pulley from the pulley's side of the instrument). Notice that the drum must rotate down (from the point of view of the marker) for an increase in the level in the well. This means that an increase in level shows up as a rise in the trace on the chart (to the right of point A in Figure 5). Confirm this by manually rotating the pulley and observing the relationship between the marker and the chart.

3.4.1 F1 CHART (ENGLISH MEASUREMENT UNITS)

Two points, A and B, have been superimposed on the marker's trace to illustrate reading the chart.

Point A

If we assume that point A is the starting point for the marker, record the following data as shown:

Station 14
Start:
April 1, 1986
11:00 A.M.
9.015 feet
1:1 gage scale
1.2 inches per day

The horizontal movement of the marker represents changes in time; the effective "vertical" movement of the marker (caused by drum rotation) represents level change of the float.

With the F1 chart and a gage scale of 1:1, the space between heavy horizontal lines represents 0.1 foot. This record indicates that the heavy horizontal line immediately below point A represents a level of 9 feet (you might want to write 9 feet at the left end of this line).

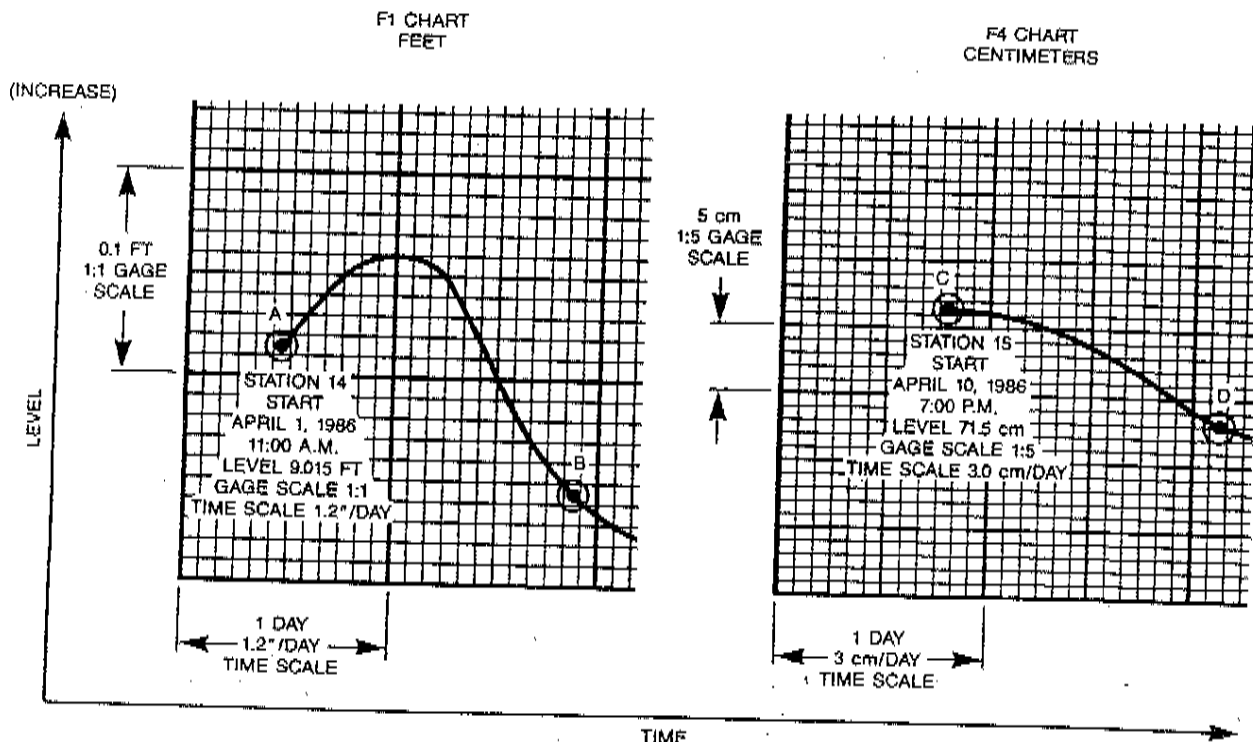


Figure 5. Reading the Charts

3 Operation

The nine lighter horizontal lines between the heavy horizontal lines then represent 0.01 foot. Interpolating, we get 9.015 feet for point A.

Since each vertical line represents 2 hours, the marker was set at point A at 11:00 A.M. Notice that there are heavy vertical lines to represent noon and midnight.

Point B

Because we know that the reference level line represents 9 feet, point B represents 8.945 feet at 9:00 P.M. on April 2, 1986. If this is not immediately clear to you, read the preceding section on deriving the value of point A. Then use the same methods to derive point B.

1:1 Gage Scale Ratio

The gage scale ratio (see Section 1.4) of 1:1 that has been assumed for this F1 example determines that each small horizontal division of the chart represents 0.01 foot. (A 1:10 ratio would determine a value of 0.1 foot for each small division.) Refer to Table 6, Gage Scales for Stevens Type F Recorders; note that the ratio is drum rotation (hence chart movement or effective vertical movement of the marker, "M") to float movement, "F." Learn to read it as M:F.

3.4.2 F4 CHART (METRIC MEASUREMENT UNITS)

Two points, C and D (Figure 1), have been superimposed in this sample to illustrate reading a metric chart.

Point C

By looking at Table 6, we know that for an F4 chart at a 1:5 gage scale ratio the smallest chart division represents 10 mm. If we assume that the heavy line immediately below point C represents a reference level of 70 cm (established at setup time), then point C represents a value of 71 cm plus 5 mm (715 mm).

Because each vertical line represents 2 hours, with heavy vertical lines at noon and midnight, then by interpolating the time for point C is 7:00 P.M. If the date of the setup for this chart was April 10, 1986, then somewhere on the chart, preferably near point C, should be noted the following:

Station 15
Start:
April 10, 1986
7:00 P.M.
71.5 cm
1:5 gage scale
3 cm per day

Point D

By referring to the same reference level as used for point C, the value represented by point D is 63 cm. The time for point D is then 3:00 A.M. on April 12, 1986. Note that the information given above for point C allows the chart reader to derive the data for point D.

3.5 TESTING THE TIMER

For the following tests, ensure that the marker is capped or retracted to prevent false traces on the chart.

3.5.1 QMT

To test for proper operation, set the speed selection (CHART DAYS) switch to the fastest position. You should hear a slight click (one click for each 15/16 second) coming from inside the QMT box. After you have verified this repeating click several times, reset the switch to the OFF position.

3.5.2 AC TIMER

Connect the AC Timer to its power source and listen for the hum. Then disconnect it from its power source. It will be connected again when regular operation begins.

3.5.3 WEIGHT-DRIVEN TIMER

Connect the weight to its cable, then look into the glass window of the Timer and note the approximately 270° of movement of the balance wheel. Disconnect the weight. It will be connected again when regular operation begins.

3.6 SELECTING TIME SCALE

Refer to the time scale selection table (Table 7) and choose a time scale. Note that for the Weight-Driven Timer there is only one choice—32 days. (If necessary, review Section 1.)

3 Operation

3.7 STARTING POSITION FOR THE MARKER

3.7.1 ADJUSTING MARKER FOR TIME

Note the time of day on the chart for starting the record and locate the corresponding timeline with respect to the time scale with which the Recorder is equipped. (If necessary, review Section 3.4, Reading the Charts.)

Set the marker to its approximate position by slowly pushing the marker's carriage (Figure 6, item 10) to the right.

3.7.2 ADJUSTING MARKER FOR GAGE HEIGHT

Note the gage reading on the chart for the beginning recording period and mark the corresponding position on the chart in accordance with the gage scale ratio. (If necessary, read Section 1, Gage Scale, and examine how it affects the reading of the charts.)

Refer to Figure 6. Set the marker to the starting point, without changing the time scale position (Section 3.7.1), by releasing the float pulley nut (item 19) and rotating the chart drum (item 13) while holding the float pulley (item 17) stationary. Tighten the clamp nut when adjustment has been made. Note that during this adjustment the carriage should not be moved.

3.8 LABEL STARTING POINT

See Section 3.4 for format and theory of the starting label.

3.9 APPLY MARKER TO STARTING POINT

When you are sure that the starting point is properly selected, uncap the marker (if capped) and lower it to the chart.

3.10 START TIMER

Ensure that all of the setup is complete because this step begins the trace on the chart and, therefore, the operation of the recorder.

3.10.1 QMT

Set the QMT's switch to the selected CHART DAYS (0.5, 1, 2, 4, 8, 16, or 32).

3.10.2 AC TIMER

Connect the Timer to its power source as specified on its identification label (see Figure 13).

3.10.3 WEIGHT-DRIVEN TIMER

Start by attaching the weight to the Timer's weight cable. Wind up the Timer's weight cable by turning the cable drum with the capstan bar provided. The 18-pound weight drops 2.8 feet in 30 days.

CAUTION!

Before removing the Timer, insert the capstan bar in the cable drum to act as a brake against a sudden damaging drop of the Timer's weight.

4 Maintenance

4.1 TIMERS

4.1.1 QUARTZ MULTISPEED TIMER

CAUTION!

No periodic lubrication is required for the QMT. All bearings and gears have been permanently lubricated at the factory or are designed to operate dry.

CAUTION!

No electronic circuit adjustment is needed. The output frequency has been set at the factory.

Do NOT ship instrument with batteries in place. Remove batteries when the QMT is to be stored or halted for an extended period.

4.1.1.1 Internal Batteries

If the QMT uses internal batteries, cells should be replaced when their open-circuit voltage falls below 1.3 volts. Battery replacement is also recommended before extended periods of cold temperatures and/or long periods of recording.

To inspect or replace batteries, slide the metal plate (located below the speed control knob) to the right. This will disengage five latch pins that hold the QMT's case together. The cover should now be free of the back section of the QMT. Inspect and clean the battery contacts. (If the QMT is to be shipped, stored, or halted for an extended period of time, remove the batteries from the case.)

4.1.1.2 Troubleshooting the QMT

For troubleshooting the QMT, see Table 3 in Section 5, Options and Accessories.

4.1.2 FACTORY SERVICE

Leupold & Stevens, Inc. maintains a Timer repair department in Beaverton, Oregon, U.S.A. (address on last page of this manual) where your Timer will receive prompt and competent handling.

4.2 CLEANING PENS

Use only water when cleaning both the reservoir and capillary tube in pen assemblies. Water for cleaning the capillary tube can normally be forced through the tube in the same manner as in priming the pen with ink. However, if the capillary tube is completely plugged with dry ink, use the pen cleaning wires furnished with each Recorder.

4 Maintenance

HOLE SCHEDULE

- A Clock mounting hole.
- C For Weight-Driven Timer cable.
- D Capstan bar storage, cable drum wind.
- E Mounting for carriage drive drum standard, used with AC and Weight-Driven Timers.
- F Three tapped holes for mounting float-pulley ring attachment, 36-in. or 75-cm circumference.

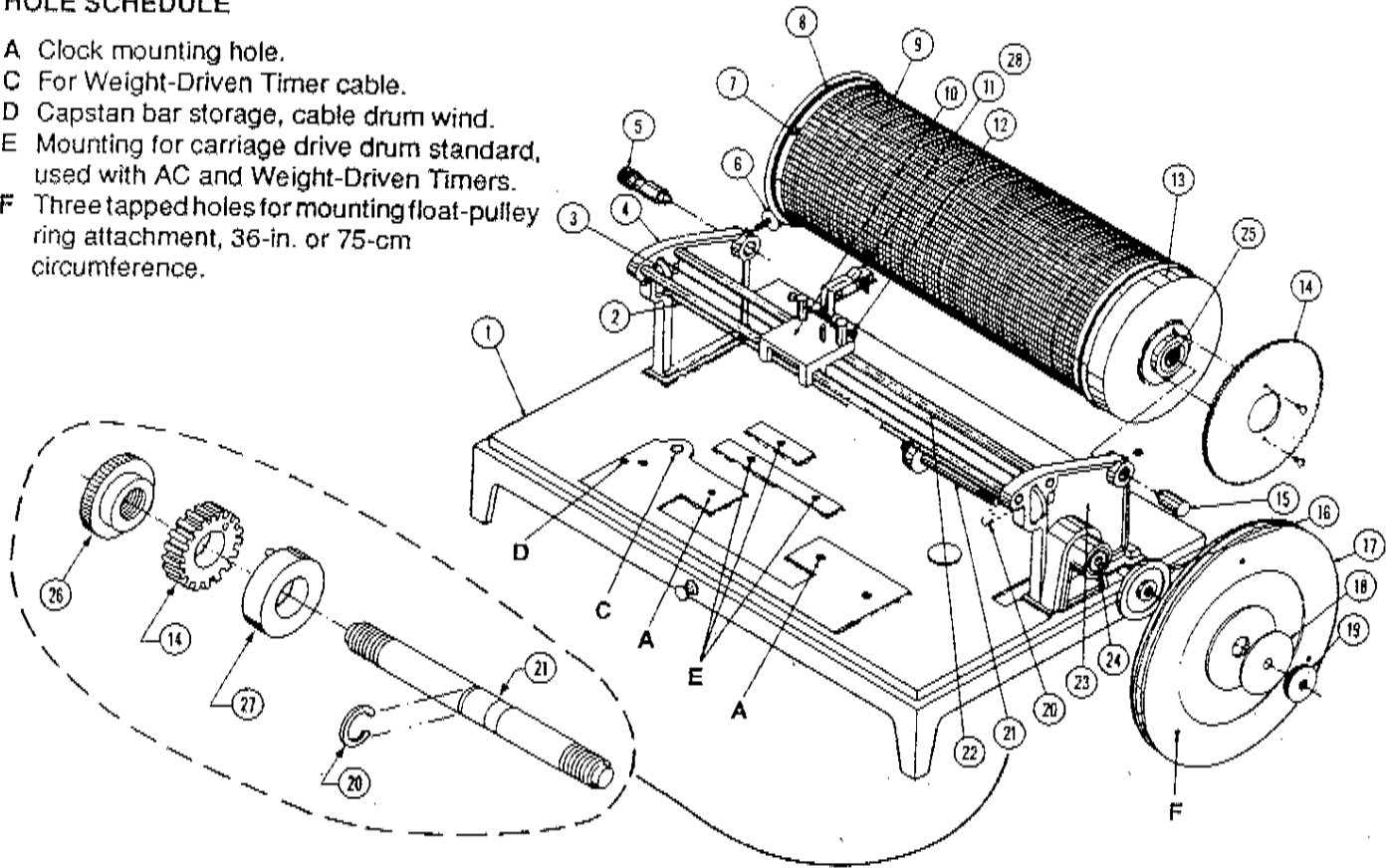


Figure 6. Exploded View of F68

Table 1. F68 Parts List

Item No.	Description	Part No.	Item No.	Description	Part No.
1	Base and standard assembly	12159	17	Pulley, float:	
2	Cable, carriage drive (QMT only)	37399		for beaded float line (18' circ.)	10160
2	Cable, carriage drive (AC and Weight-Driven Time. only)	12079		for beaded float line (37.5 cm circ.)	10318
3	Pulley, guide	12048		for tape (18" circ.)	10165
4	Standard, left	12039		for tape (37.5 cm circ.)	10322
5	Pin, center, chart drum adjustment	12133		Ring attachment, for float pulley (see Fig. 6):	
6	Screw, clamp	12134		for beaded float line (36" circ.)	10164
7	Pin, chart guide	12062		for beaded float line (75 cm circ.)	10320
8	Spring, chart holder (2 required)	12063		for tape (36" circ.)	10167
9	Chart (for available charts, see table B)	-		for tape (75 cm circ.)	10326
10	Carriage assembly (without marker)	12044	18	Washer, cup, float pulley	12118
11	Pen, disposable	34893	19	Nut, 1/4-32, float pulley	18945
12	Screw, adjusting (2 required)	10177	20	Retaining ring	20638
13	Drum, chart, with bearings, English	12057	21	Shaft, float pulley	12068
	Drum, chart, with bearings, metric	12064	22	Rod, carriage (2 required)	12047
14	Gear, gage (for gear numbers, see gage scale table)	-	23	Standard, float pulley, right (without bearings)	12038
15	Pin, center, stationary, chart drum	12132	24	Bearing, ball, float pulley standard (2 required)	20505
16	Flange, float pulley	12069	25	Bearing, ball, chart drum (2 required)	20518
			26	Nut	12749
			27	Flange, gage gear	12119
			28	Holder, disposable pen	34797

5 Options and Accessories

5.1 TIMERS

There are three kinds of Timers: QMT, AC Timer, and Weight-Driven Timer. All three are interchangeable in the field without special tools. The mounting holes are already present (see Figure 6, item A).

5.1.1 QUARTZ MULTISPEED TIMER (QMT)

The QMT is a battery-powered marker drive with seven switch-selectable speeds (CHART DAYS) (see Figure 7a). The QMT is powered by six D-size, 1.5 volt, dry cell batteries, which are generally available worldwide. An external rechargeable battery (14 VDC maximum) may be used if a different power source is desired. The QMT is offered in kit form for retrofitting to Recorders already in the field.

Newer models of the QMT have been equipped with coil-spring battery contacts (see Figure 7b). These contacts have been proven to be more reliable in harsh environments with high humidity. A field installation kit is available for converting QMTs in the field to the new spring contacts. Consult the factory for further information.

5.1.1.1 Specifications

Timer speeds: 19.2, 9.6, 4.8, 2.4, 1.2, 0.6, and 0.3 inches per day (English cylinder) or 48.0, 24.4, 12.2, 6.1, 3.1, 1.5, and 0.8 cm per day (metric cylinder). 1/2, 1, 2, 4, 8, 16, and 32 days per chart (CHART DAYS).

Output torque: 6 in-oz (432 cm-gm) minimum.

Frequency stability: +0.02% maximum variation.

Operating temperatures: The electronics and stepper motor will operate under ambient temperatures ranging from -30° to +50° C (-22° to +122° F). Alkaline cells will operate for short period under an ambient temperature of -20° C (-4° F), but low temperatures decrease the battery's capacity and reduce the circuit voltage available to the stepper motor. Capacity and voltage are regained once the temperature increases to normal range. For continued cold temperature operation, use an external rechargeable battery (14 VDC maximum).

Battery life: In moderate ambient temperature ranges (0° to 40° C (+32° to +104° F)) and at the lower three speed settings, a set of batteries should last 4-6 months.

Voltage Requirements: 6.5 - 14 VDC

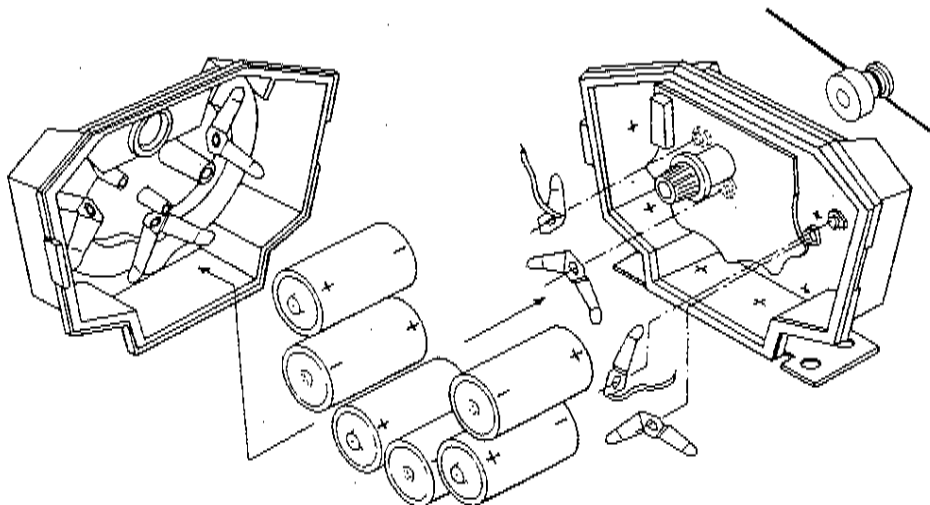


Figure 7a. QMT

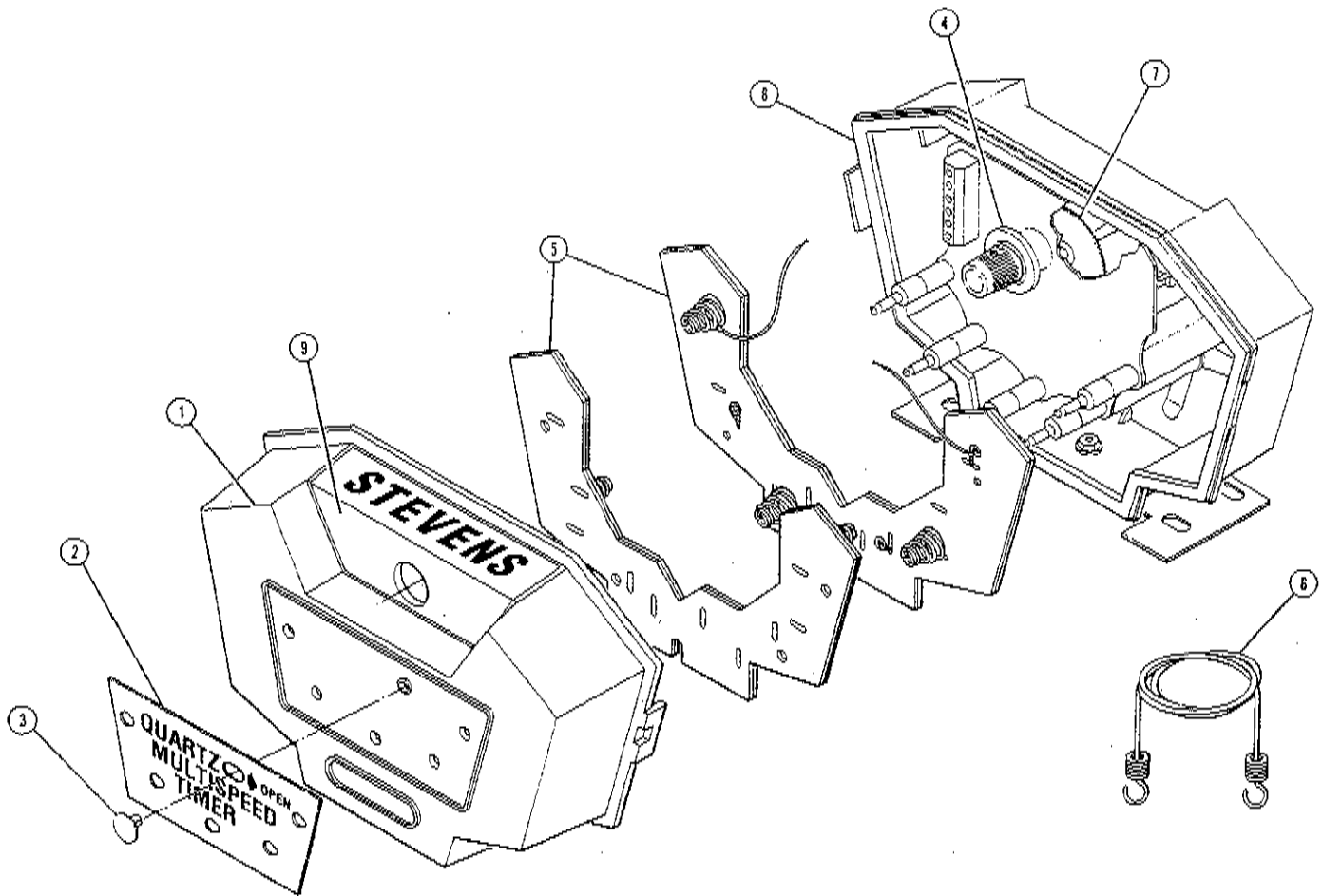


Figure 7b. QMT

Table 2. QMT Parts List

Item No.	Description	Part No.
1	Cover, Front — QMT	39775
2	Latching Plate — QMT	39750
3	Rivet, Snap — Plastic	40237
4	Gasket, Switch — QMT	37857
5	QMT Battery Contact Kit	45762
6	Cable with Springs	37399
7	Drum Drive	37051
8	Gasket, Housing	37866
9	Label, Time Scale Speed	39751

5 Options and Accessories

5.1.1.2 Procedure for Replacing the Spring-Driven Timer with a QMT

Step 1. Remove the Spring-Driven Timer.

- 1a. Without overstressing the cable springs, slip the carriage drive cable off of its guide pulleys, allowing the cable to lie on the pulley axles.
- 1b. Without overstressing the cable springs, slip the cable off of the Timer's drive drum.
- 1c. Remove the two knurled (and slotted) mounting screws and remove the Timer.

Step 2. Position the QMT:

- 2a. Install two 1/4-20 x 3/4 setscrews into the threaded holes (Figure 6, "A"). Leave approximately 3/8" (1 cm) of screw extending above the base plate of the F68.
- 2b. Position the QMT over the 1/4-20 studs on the F Recorder's base. Align these studs with the holes in the Timer's base that are closest to the Timer's gasket. If the studs are placed in the wrong set of holes, you will not be able to close the cover of the F68.

Step 3. Secure the QMT with the two 1/4-inch flat washers and nuts.

CAUTION!

Prevent damage to the cable's springs. When performing the following steps, do NOT overstretch the cable's springs, making the cable inoperative.

Step 4. Begin the installation of the QMT's cable. Unless you are replacing one QMT with another you must use the cable that came with the QMT; the old one will not fit.

Remove marker cartridge and holder. String cable as in Figure 8, with cable NOT over pulleys nor Timer's drum.

Step 5. Wrap cable around Timer's drum as shown in Figure 9.

Step 6. Connect cable to carriage. Invert carriage and lay it on the guide rods. Using a flatbladed screwdriver (or a strong fingernail), connect the cable's eyehooks to the carriage post as shown in Figure 10.

Step 7. Slip the cable over the right-hand pulley.

Step 8. Start cable into left pulley's groove as shown in Figure 11.

Note: It is important that you pull on the cable only enough to hold it in the position that is illustrated in Figure 11. This will protect the springs from being overextended.

Step 9. While holding the cable firmly against side of pulley as shown, rotate the pulley clockwise so that the pulley "pulls" the cable over its own lip into the cable groove.

The cable is now in position to move the carriage and its marking device. Proceed to Section 5.1.1.3.

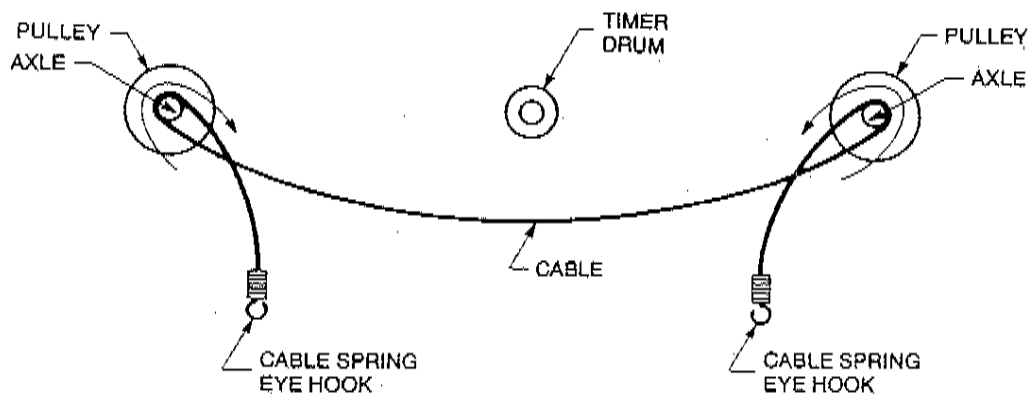


Figure 8. Laying Cable Over the Axles

5 Options and Accessories

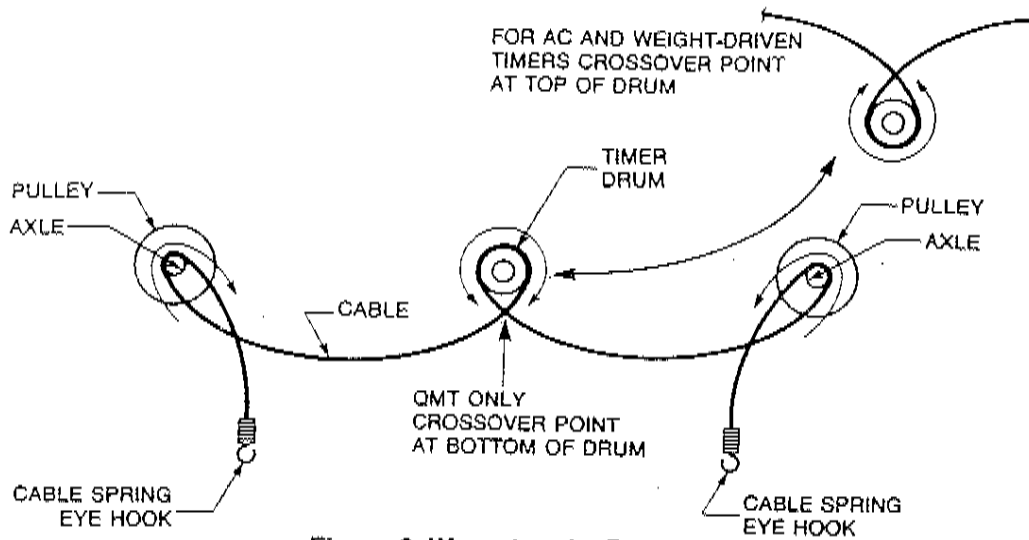


Figure 9. Wrapping the Drum

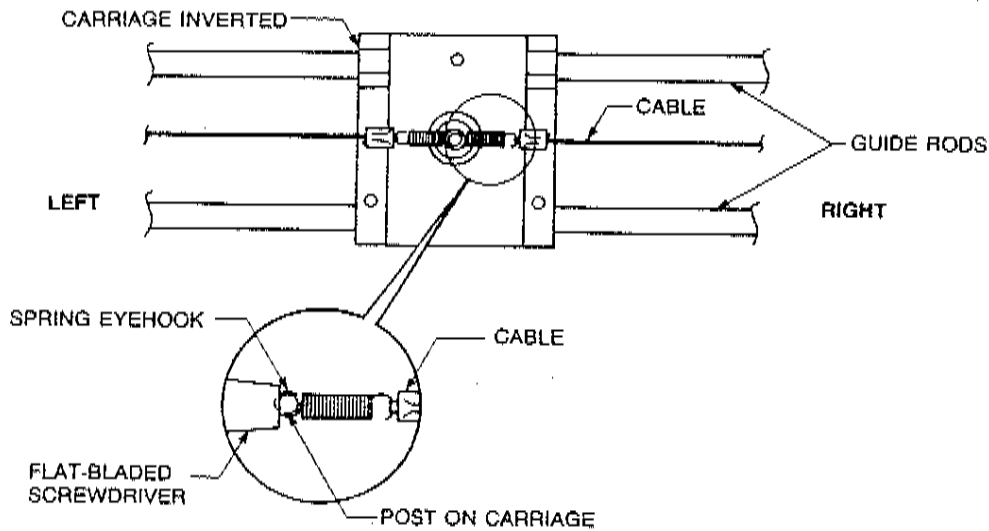


Figure 10. Connection to Post

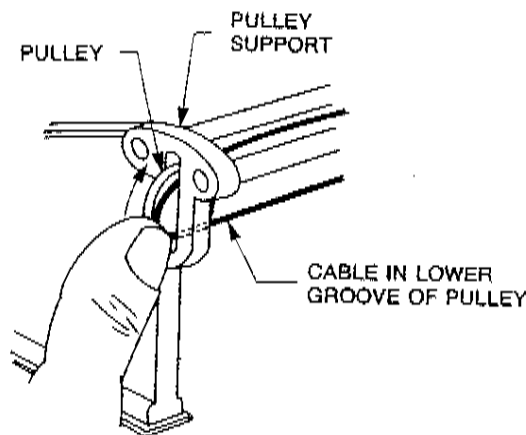


Figure 11. Guiding Cable Over Pully Lip

5 Options and Accessories

The Type F Recorder requires little maintenance. This section consists of changing the charts, preventive measures in caring for the instrument, and an exploded drawing of the instrument. See the Options and Accessories section for troubleshooting the QMT.

Timers should be returned to the factory for servicing (see Section 4.1.2).

It is a good practice to keep a spare Timer on hand. Timers and other parts and supplies may be ordered directly from the factory or through our representative network. Be sure to include the serial number of the Recorder. See the information at the end of this manual if you are contacting the factory.

5.1.1.3 Power

Power can vary from 6.5 - 14 VDC. The power source can be external or internal (six 1.5 V dry cells).

For internal power, carefully complete the following instructions:

Note: For use under maximum temperature range and for maximum service life, replacement batteries should be high-quality alkaline cells. In general, cells should be replaced when their open-circuit voltage falls below 1.3 volts. Battery replacement is also recommended before extended periods of cold temperatures and/or lengthy recording periods.

Step 1. Set the QMT switch (located on the front of the cover) to OFF.

Step 2. Remove the QMT cover by sliding the latching plate on the front cover to the right.

CAUTION!

Prevent loss of power. Be certain the polarity is correct during battery installation.

Step 3. Inspect the polarity markings in both the cover and the main enclosure of the QMT. (Refer to figure 7.) Properly position the six batteries between the contacts in the main enclosure and the cover. Note that the batteries alternate in orientation.

Step 4. Replace the QMT cover and re-latch.

For external power, carefully complete the following instructions:

WARNING!

NEVER attempt to connect the QMT to an external power source with the internal batteries installed.

Step 1. Set the CHART DAYS switch to OFF.

Step 2. Remove the QMT cover by sliding the latching plate on the front cover to the right.

Step 3. Refer to Figure 12. Remove knockout.

Step 4. Select a two-wire cable (NOT connected to power) that fits the connectors. Prepare the cable ends by stripping the wires approximately 1/2 inch.

Step 5. String the cable through the QMT knockout. Connect the negative (-) wire to terminal 1 and the positive (+) wire to terminal 4, then tighten the terminal screws.

Step 6. Connect the cable to the external power source.

Step 7. Replace the QMT cover and re-latch.

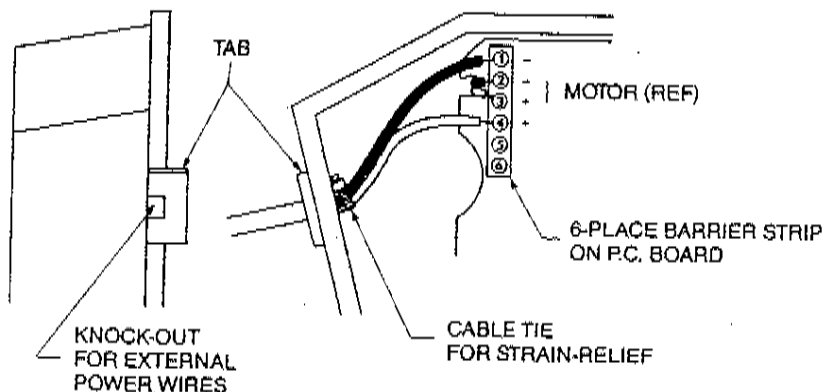


Figure 12. QMT External Power

5 Options and Accessories

5.1.1.4 Operation Test

See Section 3.5 for operation test. If there is a problem, refer to Table 3, Troubleshooting the QMT.

5.1.1.5 Procedure for Replacing a QMT with a QMT

With an external power supply, perform the following:

- Step 1. Set the QMT's CHART DAYS switch to OFF.
- Step 2. If the power supply is driven by an AC source, power it to OFF. Then disconnect the QMT from the AC source.
- Step 3. If the power supply is driven by a DC source, disconnect the DC cable which supplies power to the QMT.
- Step 4. Unlatch and remove the cover from the Timer.
- Step 5. Note the color and positions of the wires at the terminal block (Figure 12).
- Step 6. Disconnect the DC supply wires and the strain relief, then remove the supply wires from the QMT.

If an internal power supply is used, perform the following:

- Step 1. Unlatch and remove the cover of the old QMT. Remove the batteries.
- Step 2. Refer to Section 5.1.1.2; perform steps 1a and 1b.
- Step 3. Remove the two mounting nuts and remove the old QMT.
- Step 4. Refer to Section 5.1.1.2; perform steps 2b through 9.
- Step 5. Follow the instructions in Section 5.1.1.3.
- Step 6. Follow the instructions in Section 5.1.1.4.

5.1.2 AC TIMER

To replace parts in the AC Timer, refer to Figure 13.

WARNING!

Before working on the AC Timer, disconnect it from its power source to prevent possible bodily injury or damage to equipment.

5.1.3 WEIGHT-DRIVEN TIMER

To install the Weight-Driven Timer, refer to Figure 14.

Table 3. Troubleshooting the QMT

Symptom	Action
1. Timer stops; no audible clicks can be heard at any switch position.	1. Remove the batteries and check their open-circuit voltage. Batteries should have approximately equal voltage. Replace when voltage is below 1.3 volts. Clean and inspect contacts before re-installing the batteries. If this does not correct the problem, install a new set of batteries.
2. Timer stops.	2. Tighten the setscrews on the output shaft. Check to verify that the marker's carriage, drive cable, and pulleys are free to work.
3. After actions 1 and 2 are performed, the Timer still does not work.	3. Return the Timer to the Factory for service. Enclose note describing the problem. Include the name and phone number of the person that the factory should contact.

5 Options and Accessories

Table 4. AC Timer Parts

Item No.	Description	Part No.
	Cramer Motor Assembly	
1A	115V, 60 Hz, 1/8 revolutions per hour	19498
1B	230V, 50 Hz, 1/8 rph	25904
1C	115V, 60 Hz, 1 rph	25905
1D	230V, 50 Hz, 1 rph	25906
2A	Barrier strip	20372
2B	Cover, barrier strip	18992
3A	Bushing, strain relief	20707
3B	Electrical cable, 6-ft, w/plug	20040
4	Gear, drum shaft (B)	See Table 7
5	Cable, carriage drive w/springs	12079
6	Standard, carriage drive assembly	12161
7	Gear, clock shaft (A) w/drive-hub	See Table 7

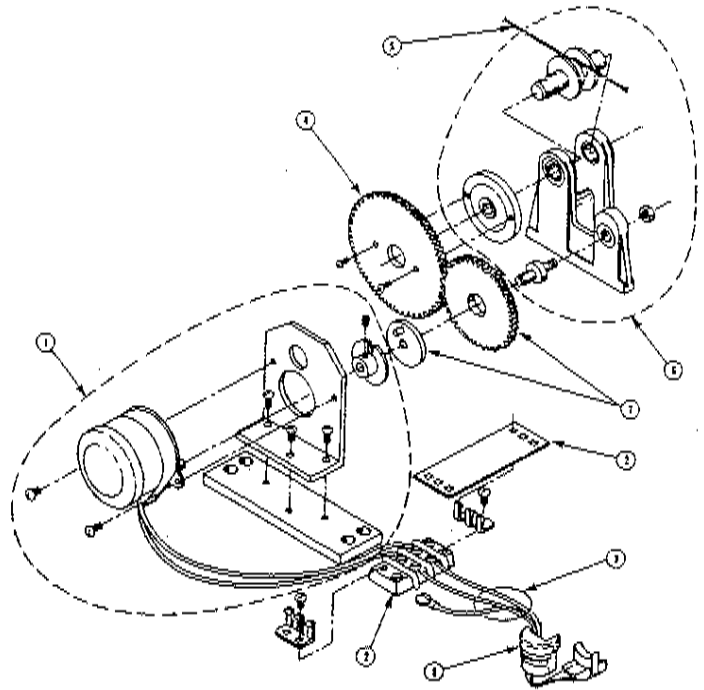


Figure 13. AC Timer

Table 5. Weight-Driven Timer Parts

Item No.	Description	Part No.
1	Timer, Weight-Driven, mounted	18975
2	Cable, Timer weight, 48 inches	34266
3	Capstan bar, cable drum wind	12246
4	Cable, carriage drive w/springs	12079
5	Standard, carriage drive assembly	18975
6	Hooks, end (set of 2)	15147

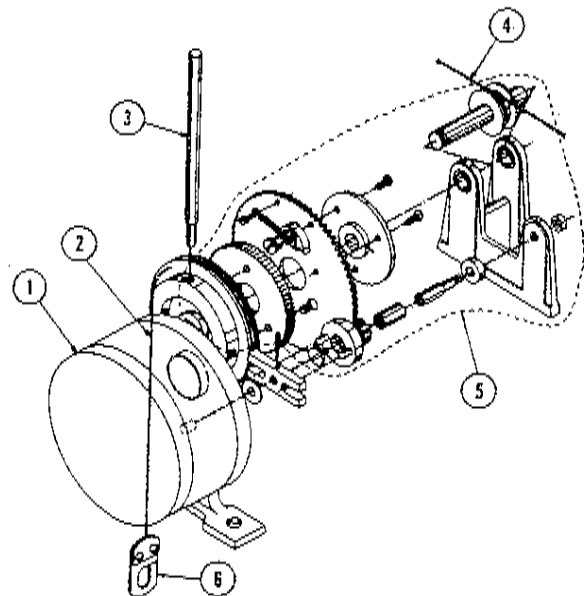


Figure 14. Weight Driven Timer

5.2 GAGE SCALE SELECTION

Table 6. Gage Scales for Stevens Type F Recorders

Gage Scale	Water Level Change*	Smallest Chart Division	Pitch-Circumference**	Pulley Shaft Gear "C"		Drum Shaft Gear "D"		Gear Kit Part No.	
				Teeth	Part No.	Teeth	Part No.		
English Decimal System									
	(feet)	F1/F2† (feet)	F3† (in)	(feet)					
1:1	1.0	0.01	0.1	1.5	84	12086	56	12095	30474
1:2	2.0	0.02	0.2	1.5	60	12088	80	12096	30475
1:5	5.0	0.05	0.5	1.5	33	12090	110	12097	30476
1:10	10.0	0.10	1.0	1.5	18	21838	120	12098	30477
1:20	20.0	0.20	2.0	3.0	18	21838	120	12098	30477
English Duo-Decimal System									
	(feet)	F3† (feet)	(feet)						
10:12	1.2	0.01	1.5	80	12091	64	12099	30470	
5:12	2.4	0.02	1.5	55	12093	88	12100	30471	
1:6	6.0	0.05	1.5	28	22145	112	12101	30472	
1:12	12.0	0.10	1.5	16	21758	128	12102	30473	
1:24	24.0	0.20	3.0	16	21758	128	12102	30473	
Metric System									
	(m)	F4† (mm)	(cm)						
1:1	0.3	2	37.5	80	12091	64	12099	30470	
1:2	0.6	4	37.5	55	12093	88	12100	30471	
1:5	1.5	10	37.5	28	22145	112	12101	30472	
1:10	3.0	20	37.5	16	21758	128	12102	30473	
1:20	6.0	40	75.0	16	21758	128	12102	30473	

* For one revolution of the drum

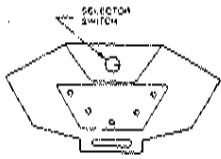
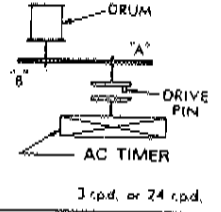
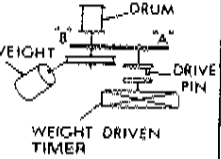
** Of the float pulley

† Chart type (printed on chart)

5 Options and Accessories

5.3 TIME SCALE SELECTION

Table 7. Time Scale Selection

Timer	Marker-Travel		Clock Shaft Gear "A"		Drum Shaft Gear "B"		Gear Kit Part No.
	Inches Per Day	Days Per 9.6 inches	Teeth	Part No.	Teeth	Part No.	
QUARTZ MULTISPEED TIMER 	0.3 0.6 1.2 2.4 4.8 9.6 19.2	32 Days 16 Days 8 Days 4 Days 2 Days 1 Day 12 Hours	ALL TIME SCALES SWITCH SELECTABLE				
AC TIMER  <small>3 r.p.d. or 24 r.p.d.</small>	1.2** 2.4** 4.8** 9.6† 19.2† 28.8† 57.6†	8 Days 4 Days 2 Days 1 Day 12 Hours 8 Hours 4 Hours	21 36 58 21 36 48 72	12124 12125 12127 12124 12125 12108 12110	126 108 87 126 108 96 72	12129 12130 12131 12129 12130 12115 12116	30443 30444 30445 30443 30444 30448 30449
WEIGHT-DRIVEN TIMER 	0.3	32 Days	ONE-TIME SCALE ONLY				

** 3 RPD
† 24 RPD

5 Options and Accessories

5-4 CHART SELECTION

Table 8. Chart Selection

Chart	Units	Major Chart Division	Req'd. Gage Scale Ratio	Time	Length
F1	English	0.10 ft.		(8 hr.) (4 or 8 day)	1 ft.
F2	English	0.10 ft.		(4 or 12 hr.) (1 or 2 day)	1 ft.
F3	English	See Table 6 Centimeters		All Scales	1 ft.
F4	Metric		All Scales	30 cm.	
F7	m.g.d. and g.p.m. through Parshall flumes		1:2	All Scales	1 ft.
F8	m.g.d. and g.p.m. over 90° V-notch weir		1:1	All Scales	1 ft.

5.5 OTHER OPTIONS

Table 9. Part Numbers for Options and Accessories

Description	Part No.
Assembly, pencil and arm	12055
Assembly, reservoir pen	12049
Pen cleaners for reservoir pen	10917
Charts (box of 54)	
(Chart type printed on edge of chart):	
F1	14984
F2	19985
F3	14986
F4	14987
Cover, with window	12082
Holder, pen (cartridge)	34797
Ink, black	10865
Pen, cartridge	34893

Notes
