

# **TYPE A RECORDER**

Model 71, 2004

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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.

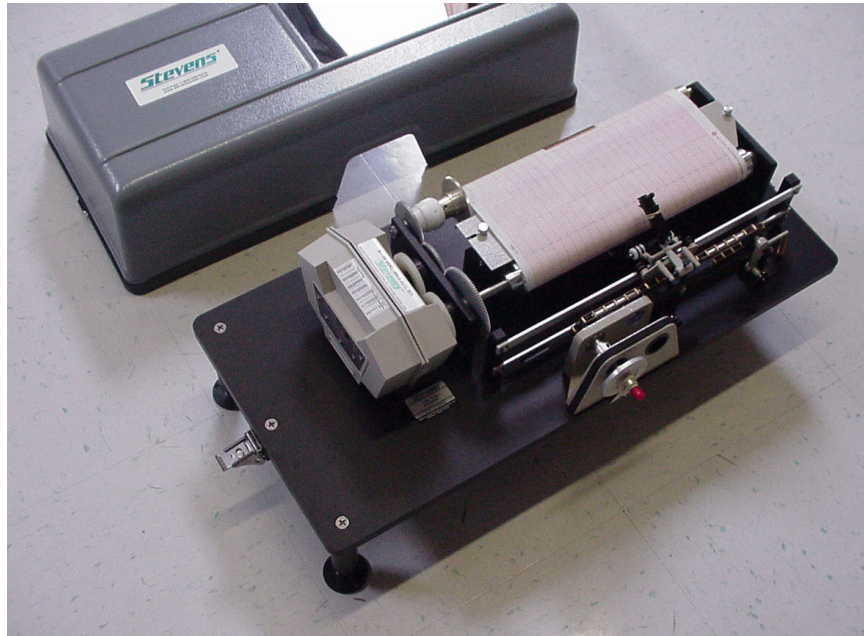
**WARNING** - This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart 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

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## 1.1 General Description

The Stevens Type A is a float-operated recorder that provides a permanent, continuous, long-term graphic record of water level fluctuations. A precision clock movement controls the rate at which the strip chart is advanced. The rise and fall in of the float moves a marking stylus laterally across the chart. The stylus or pen will reverse at each margin so that any range of water level stage change can be accommodated.

The water level recording ratio, called "gage scale", is also selectable. One traverse across the chart width can represent anywhere from .25 meters to 12.5 meters of water level change for Metric models, and 1 foot to 50 feet for English models (reference Table 5 & 6).

Chart drive is normally accomplished by use of a battery-operated Quartz Multispeed Timer unit, using an electronic control circuit. A wide range of chart speeds, called "time scales", may be selected (reference Table 1).

## 1.2 Safety Information

Before performing any procedure in this manual, read all applicable warnings and cautions.

# 1 Introduction

## 1.3 Basic Instrument Specifications

### Chart Drive (options)

- . Quartz Multispeed Timer (QMT)

### Time Scale

- . Refer to Table 1

### Gage Scale

- . Refer to Tables 5 and 6

### Float Pulley

- . 375 mm or 18 in. circumference for beaded float line or perforated tape
- . Optional 750 mm or 36 in. circumference pulley ring for beaded float line or perforated float tape

### Operating Temperature

- . QMT clock drive (alkaline batteries)
  - 0 to +40 degrees Celsius
  - (+32 to +104 degrees Fahrenheit)
- . QMT clock drive (lead-acid battery)
  - 30 to +50 degrees Celsius
  - (-22 to +122 degrees Fahrenheit)

### Shipping Weight

- . 20.5 Kg (45 pounds)

### Float Line/Tape

- . Stainless steel cable, 125mm or 6 in. bead spacing
- . Stainless steel tape, 125mm or 6 in. perforation spacing

### Recommended Float Size (Diameter)

203 mm (8 in), 254 mm (10 in)

### Instrument Size (HxWxD, Cover open)

42 x 64 x 44 cm  
(16.5 x 25.1 x 17 in)

### Chart

- . A-25 (Metric)
- . A-10 (English)

### Accessories (optional)

- . Guide Pulley for float line or tape

**Table 1** Time Scales, Quartz Multispeed Timer (switch selectable)

Scale cm/day (in/day)	Major Division 3.0 cm (1.2 in.)	Minor Division .25 cm (.1 in.)	Chart Life
1.5 (0.6)	48 hrs.	4 hrs.	4 yrs.
3.0 (1.2)	24 hrs.	2 hrs.	2 yrs.
6.1 (2.4)	12 hrs.	1 hr.	1 yr.
12.2 (4.8)	6 hrs.	30 min.	6 mos.
24.4 (9.6)	3 hrs.	15 min.	3 mos.
48.8 (19.2)	1.5 hrs.	7.5 min.	1.5 mos.
97.5 (38.4)	45 min.	3.75 min.	22.5 days

# 1 Introduction

**Table II.** *Gage Scale, Metric*

<b>METRIC GAGE SCALE</b>	<b>WATER LEVEL CHANGE, ONE TRAVERSE OF CHART</b>	<b>PEN CHG. PER METER OF WATER</b>	<b>VALUE OF MINOR DIVISION</b>	<b>FLOAT PULLEY SIZE</b>
1:1	.25 m	100 cm	.2 cm	375 mm
1:2	.50 m	50 cm	.4 cm	750 mm
1:5	1.25 m	20 cm	1.0 cm	375 mm
1:10	2.50 m	10 cm	2.0 cm	750 mm
1:10	2.50 m	10 cm	2.0 cm	375 mm
1:20	5.00 m	5 cm	4.0 cm	750 mm
1:25	6.25 m	4 cm	5.0 cm	375 mm
1:50	12.5 m	2 cm	10.0 cm	750 mm

**Table III.** *Gage Scale, English*

<b>ENGLISH GAGE SCALE</b>	<b>WATER LEVEL CHANGE, ONE TRAVERSE OF CHART</b>	<b>PEN CHG. PER FOOT OF WATER</b>	<b>VALUE OF MINOR DIVISION</b>	<b>FLOAT PULLEY SIZE</b>
10:12	1 ft.	10 in.	.01 ft.	18 in.
5:12	2 ft.	5 in.	.02 ft.	36 in.
1:6	5 ft.	2 in.	.05 ft.	18 in.
1:12	10 ft.	1 in.	.1 ft.	36 in.
1:12	10 ft.	1 in.	.1 ft.	18 in.
1:24	20 ft.	.5 in.	.2 ft.	36 in.
1:30	25 ft.	.4 in.	.25 ft.	18 in.
1:60	50 ft.	.2 in.	.5 ft.	36 in.

# 2 Installation

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## 2.1 Unpacking

Remove all shipping tie-downs, packing pieces, etc. Several parts and accessories are individually wrapped. Check the Sales Order to insure that all items are accounted for before disposing of the packing materials.

## 2.2 Equipment and tools required

The following equipment and tools are usually required for proper installation of the Type A Recorder:

- Float, float pulley, counterweight, float line or tape, and a set of end hooks.

- Guide pulley (if required) and mounting hardware.

- Necessary mounting hardware and tools (screw drivers, screws, drill, combination pliers, etc.) as required.

## 2.3 Mounting

The surface on which the recorder is to be mounted should be reasonably level. The recorder's feet are adjustable to compensate for minor variations. The recorder can be positioned so that the input pulley will hang over the edge of the surface, or holes can be drilled in the surface to allow for the float line or tape to pass through. Because the carriage reverses at each margin, the float pulley can rotate in either direction for rising water levels; thus the float can hang off of either side of the pulley. Position the recorder in its approximate final position. Final positioning and securing will be done after float and counterweight clearance is checked.

Install the float pulley on the recorder input shaft. Install the cupped washer with the recessed side toward the pulley. Thread the clamping disk onto the pulley shaft. Thread the hex nut onto the shaft, and tighten it against the pulley clamp. Loosely tighten the right- and left-hand screws down onto the washer, clamping the pulley in place.

Attach the float line or tape to the two adjustable end hooks. Adjust the length so the counterweight does not touch bottom when the float is at its highest point. Also verify that the length is great enough so the counterweight does not run into the support shelf when the float is at its lowest position.

A guide pulley can be used to route the float line or tape for a vertical drop different than just straight off the float pulley. It is normally mounted on the underside of the shelf, and used to shift the counterweight drop. This is typically done to route the counterweight out, so it does not hit a large diameter float, or in closer, for small diameter stilling wells.

If necessary, extra float line or tape may be removed. Tape may be broken by sharply bending it. Beaded float line should be cut 6mm (1/4 in.) beyond a bead to reduce raveling. Non-beaded cable should be heated until red hot at the desired point for annealing, and then cut.

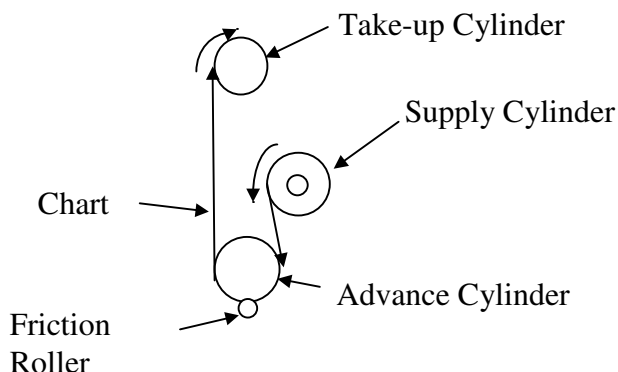
Attach the float and counterweight to opposite ends of the float line or tape using the end hooks. Lower the float into the well. Pass the float line or tape over the float pulley, engaging the beads or perforations into their proper position on the pulley. Lower the counterweight down the opposite side.

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Check the final position of the recorder to be sure the float and counterweight can move up and down freely, without interference from the side of the well or any protuberances. Secure the recorder to the mounting surface with screws, using the holes in the recorder feet.

## 2.4 Installing the Chart

Rotate the pen off the chart. Pull the friction roller assembly away from the chart cylinder. Lock it in place by sliding it in the direction of the "lock" arrow. Remove the two thumb screw from the sides of the writing plate and lift the plate out. Remove the take-up cylinder from the recorder. Remove the supply cylinder (middle cylinder) from the recorder, and remove the large knurled nut from the end. Observe that the core of the new chart is flush at one end and protrudes at the other. Slip the chart onto the supply cylinder, flush end toward the flange, and tighten the knurled nut firmly in place. Place the supply cylinder in its bearings, with the flange to the left so the chart comes off of the top of the cylinder. Replace the take-up cylinder.



**Figure 3.** *Chart Routing*

Pass the chart behind the drive cylinder (bottom drum) and out between the cylinder and the friction rollers. Pull the chart upward about 1 1/2 inches beyond the take-up cylinder with the right edge square to the flange. Reinstall the writing plate. Pass the chart over the writing plate and around the front of the take-up cylinder. Install the half-round paper clamp from the bottom, pressing downward. Take the slack out of the chart by winding the take-up cylinder upward, using the white knurled flange. Rotate the take-up cylinder until the chart and pen are properly positioned for the desired start point for recording. Unlock the friction roller assembly and allow it to hold the paper in place.

## 2.5 Removing the Chart

Lift the pen from the chart drive cylinder by simply tilting it back. Pull the friction roller away from the chart and slide it in the direction of the "Lock" arrow. Manually advance the chart by turning the large, white knurled disk on the left end of the take-up cylinder. Do this until the graphic record is just beyond the edge of the writing plate. Using the edge of the writing plate as a guide, cut the chart with a knife. Lift the take-up cylinder out of the instrument and slip off the chart. This may require a firm twisting motion if the chart is tightly wound. Pull or shake the chart clamp out of the chart roll. Re-attach the remaining chart, or install a new chart as described in section 1.6, above. The A-10 (English) charts have a diagonal blue line marked at the end of the chart fastened to the core. When this line appears during use, the remaining days of supply can be calculated. On the A-10 chart, count the number of small divisions (0.1 in) between the left margin and the blue line. At a chart speed of 2.4 inches per day, the number of

# 3 Operation

days of chart remaining is equal to the number of divisions counted.

The pen is a replaceable cartridge pen, which should be replaced periodically, as the chart line begins to dim. Simply slide the pen out of its holder and replace it with a new unit.

## 2.6 Positioning the Pen

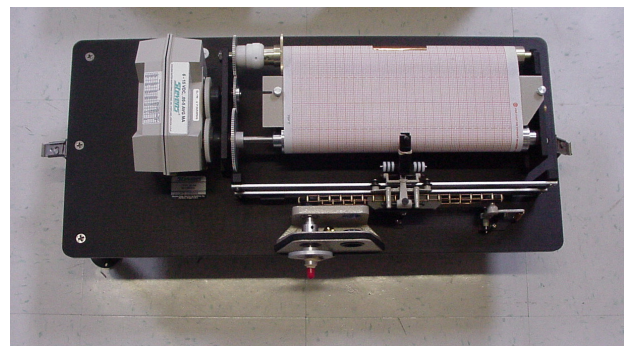
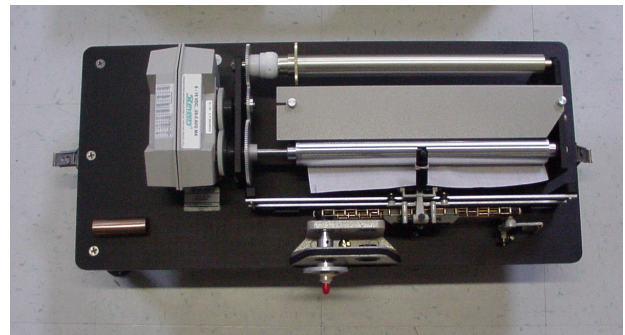
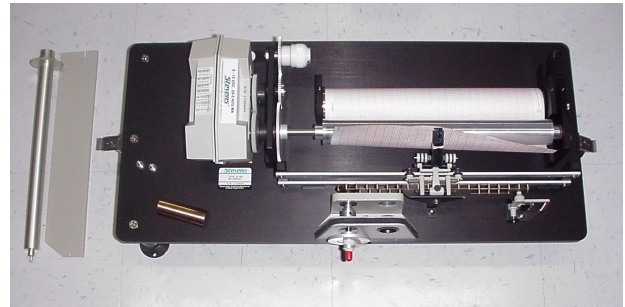
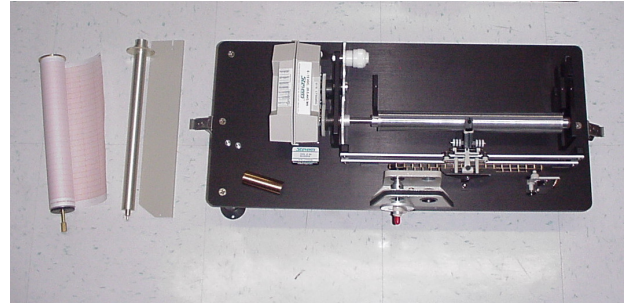
Turn the float pulley shaft to raise the float a short distance. Check that the pen is moving in the desired direction. If it does not, disengage the float line or tape from the pulley, and rotate the pulley until the pen is moving in the desired direction. Then re-engage the float line or tape.

Loosen the right- and left-hand threaded pulley clamp screws. Move the pen carriage until the pen indicates the correct water level, or head (do not go through a reversal). This should be determined from a staff gage water level reading, or by use of a contact meter to determine well depth at the time of installation. Retighten the float pulley clamp screws and re-check that nothing has slipped during tightening. Because this sets the starting point for the instrument, any error would affect the complete recording.

It is good practice to write on the chart the location, date, time scale and any other pertinent data. These notations become invaluable later when it comes time to "read" the chart record.

Your recorder is now properly set up, and recording can begin. All that is needed is to start the clock and, if appropriate, set the desired chart speed. Quartz Multispeed Timer-drive units have switch selectable chart speeds.

## *Sequence for chart installation*



# 3 Operation

## 3.1 Quartz Multispeed Timer Drive (QMT)

The Quartz Multispeed Timer unit (QMT) is designed to operate from 6 alkaline "D" cell batteries, which were included with the recorder when shipped. To install the batteries, first be sure the timer switch is set to the "OFF" position. Remove the QMT cover by sliding the latching plate on the front cover to the right. Check that the battery contacts are clean.

Observing the polarity markings in the case (see guide, Figure 5) place the six batteries in the main body of the timer. Note the batteries should alternate polarity direction. Replace the QMT cover and re-latch.

**NOTE:** BE SURE THAT THE BATTERIES ARE INSTALLED PROPERLY (ALTERNATING POLARITY). IF ALL BATTERIES ARE REVERSED, THE TIMER WILL NOT RUN. HOWEVER, IF ONLY ONE BATTERY IS REVERSED, THE TIMER WILL RUN, BUT OVERALL BATTERY LIFE WILL BE GREATLY REDUCED.

Set the speed select switches to the fastest chart speed. At this speed, the timer motor will be pulsed approximately once a second. By listening closely, you should be able to hear a short, "clicking" sound each time the motor is pulsed. If you hear this sound, the clock is operating properly. Set the timer to the desired chart speed to begin recording.

If desired, the QMT can be powered from an external source, such as a lead-acid battery or AC power converter. Any power source supplying 8 to 14 VDC with a peak current capability of 300 mA can be used to power the timer.

**NOTE:** THE TIMER SHOULD NEVER BE CONNECTED TO AN EXTERNAL POWER SOURCE WHILE SIMULTANEOUSLY USING INTERNAL BATTERIES.

Remove the QMT cover by sliding the latching plate on the front cover to the right and remove all batteries. Referring to Figure 6, remove the knock-out from the main body, using a small screwdriver or awl. Select an appropriate 2-wire cable (or two individual wires) for the power connection. Note: the wires should NOT be connected to a power source while doing this installation. Prepare the cable end for connection to the QMT by stripping back each wire about 6mm (1/4 in.). Thread the cable through the knock-out as shown in Figure 6. Loosen terminal connection 1 and 4 on the QMT terminal strip. Insert the negative (-) wire into terminal 1 and the positive (+) into terminal 4. The existing wires need not be removed. Tighten the terminal screws back down.

If the external power source is to be located outside the Type A Recorder, remove the 6mm (1/4 in.) hole plug and run the cable through the recorder base to the external source.

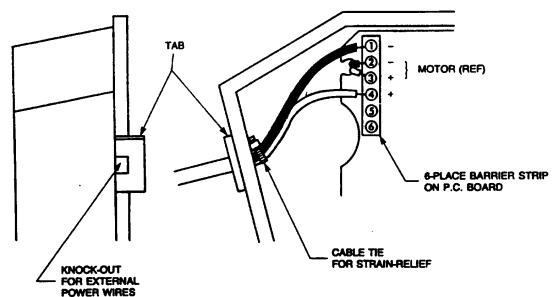
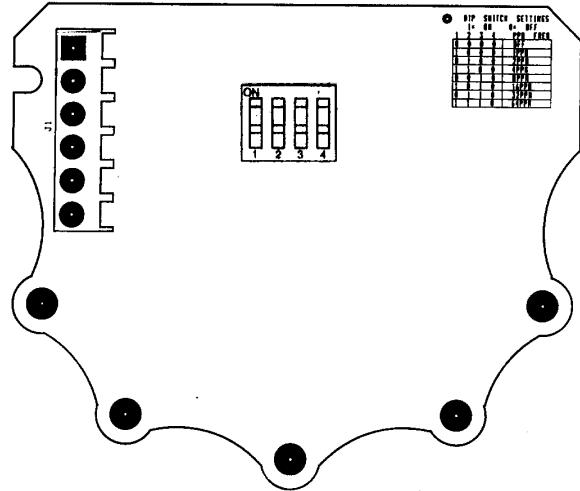


Figure 6. Quartz Timer, External Power Connections

# 3 Operation

## NEW STEVENS QMT

Stevens has redesigned the Quartz Multispeed Timer to allow for a more efficient switch configuration for setting of chart speeds. Below is a layout of the new switch, located on the timer circuit board. The switch is accessed by removing the cover of the QMT. The chart speed switch selections are listed on the table below.



### Quartz Multispeed Timer Switch Settings

Switch Number				Type A inches/day	Type A cm/day
1	2	3	4		
ON	ON	ON	OFF	38.4	97.5
OFF	ON	ON	OFF	19.2	48.8
ON	OFF	ON	OFF	9.6	24.4
OFF	OFF	ON	OFF	4.8	12.2
ON	ON	OFF	OFF	2.4	6.1
OFF	ON	OFF	OFF	1.2	3
ON	OFF	OFF	OFF	0.06	1.5

**NOTE:** A 1 AMP, IN-LINE FUSE IS RECOMMENDED FOR SAFETY AND CIRCUIT PROTECTION WHEN POWERING THE TIMER EXTERNALLY.

Connect the cable to the external source, with the wire coming from QMT terminal 1 connected to the negative (-) terminal of the source. Similarly, connect the wire from QMT terminal 4 to the positive (+) terminal of the source.

Replace the cover on the QMT. Set the timer to the fastest chart speed and listen for the "clicking" as described previously. If operating properly, set the timer to the desired chart speed to begin recording.

### 3.2 The Pen

A simple, disposable cartridge pen, which uses a felt tip is used with the Type A recorder. This disposable pen uses an adapting arm to mount

# 3 Operation

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between the adjustable arm's pivot screws. Be careful not to tighten the pivot screws too tight so as to bind the stylus arm.

The disposable cartridge pen clips into the pen holder on the stylus arm. It is protected by a plastic cover over the pen tip. Place the pen in the clip, making sure it locks firmly into place. Check for proper pen position with reference to time and stage level. Then remove the cover from the tip to begin recording.

The stylus can be adjusted to insure that reversals occur at the margin of the chart. Loosen the adjusting arm clamp screw. Reposition the arm and tighten the clamp screw. It is best to align the stylus for reversal on the left margin line, as chart expansion due to humidity changes will occur at the right side (the left edge of the chart is against the flange on the take-up and supply cylinders).

## 3.3 Gage Scales

Gage scales may be reconfigured by changing either the float pulley size or the float pulley standard, or both (see Table 2 & 3). Standard pulleys are either 375 mm (metric) or 18 inches (English) in circumference. These can be doubled by the addition of a pulley ring, thereby doubling the amount of stage change for one traverse of the pen across the chart.

Several gage standards are also available. The most common is a direct drive standard, which provides a moderate stage range of 1.25 meters (5 ft.) of stage recording for each traverse of the pen. Gearing of the gage standard makes it possible to make the recorder more sensitive (.25 meter or 1 ft. per pen traverse) for greater resolution, or less sensitive (6.25 meters or 25 ft. per pen traverse) for greater range. Standards can be easily interchanged in the field for varying conditions. However, accurate information needs to be recorded on the chart indicating which gage scale was used during a particular recording cycle. Otherwise, data will be confusing and possibly misinterpreted.

# 4 Maintenance

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## 4.1 Care of clocks

### 4.1.1 Quartz Clocks.

Stevens Quartz Multispeed Timers are designed for reliable operation with very little maintenance required. Batteries should be replaced on a regular basis (typically every time the chart is changed). Battery contacts should be kept clean. No oil or other lubricant should be used on any of the clock's moving parts.

## 4.2 Lubrication

The Type A Recorder is designed for long term operation with minimal maintenance. Oil or other lubricants should NOT be used on any of the recorders mechanical parts. Sealed ball bearings and precision engineered plastic bearings do not require lubrication. Oiling can cause unwanted dust to collect.

## 4.3 Spare Parts

Spare parts can be ordered from the factory. Be sure to include the recorder serial number with any order for parts.

# 5 Technical Notes

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## 5.1 Instrument Accuracy

Standard float systems are subject to small errors due to float lag and line shift. These errors can be minimized by selecting proper floats and counterweights. Table 8 through 13 show the line shift errors and float lag where standard float systems are used. Line shift errors can be eliminated by using special loop line float configurations if higher accuracy is required.

Further discussion on errors in float operated systems can be found in the *Stevens Water Resources Data Book*, available from the factory at a nominal cost.

## 5.1.1 Beaded Float Line

Standard beaded float line supplied by Stevens is 1 mm (0.040 in.) in diameter, and is beaded to match the recessed grooves in the float pulley. This stainless steel line is slip proof, exceptionally strong, and light weight to minimize errors.

## 5.1.2 Float Tape

Stainless steel float tapes are perforated to match pulley spines at regular intervals. Tapes are available plain, or they may be graduated in either English or metric scaling (feet, tenths and hundredths for English; meters, decimeters and centimeters for metric). Also available is a separate mounting bracket with adjustable index pointer to indicate a water level reading on graduated tapes.