Model HE-356 Series

INSTRUCTION MANUAL
INSTALLATION - OPERATION

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SECTION 1

INTRODUCTION

1-1 General Information

This instruction manual provides details for installing, operating and maintaining the HE-356 Depth Recorder and how to use it for depth finding and fish locating.

Now you can check out all of the fishing HOT SPOTS and even find some new ones. Use it from shoreline to deep water, running slow or fast; your HE-356 will give you a constant update of changing depth conditions and more information than you ever expected from a depth finder.

The HE-356 is small and light weight and is suitable for use on any size boat. The rugged construction permits using the HE-356 in almost any reasonable location on the boat. The design, using all solid state electronic circuits, provides high reliability and assurance of trouble-free operation.

Installation is made simple and easy. You can install it yourself. The universal mounting bracket allows recorder operation and viewing in almost any mounting location.

Careful examination of the application and inter-relationship of the controls, their function, and use are most important. This fundamental knoeledge of the HE-356 operation will help you obtain the maximum information and underwater definition from your HE-356 chart recordings.

1-2 Equipment Supplied

HE-356 Depth Recorder/Fish Finder
HE-356 Recorder mounting bracket/4 screws
HE-356 Recorder clamping knobs and rubber washers (2)
Transducer, 30 feet of cable (25 feet on thru-hull type)
Transducer transom mounting brackets (2 pieces)/4 screws, (if transducer mount and transducer is supplied)
Chart paper, 1 roll, 4 inch x 50 feet
HE-356 Installation/Operation Manual
Spare fuse, 2 ampere
Spare stylus
Power cable, 6 feet

1-3 Specifications

Characteristics of transducer models.

ITEM	MODEL	
Transducer	HE-356A	HE-356B
Frequency	200 KHz	50 KHz
Cone Beam	10°	50°
Power Output	100 watts	100 watts

Specifications that follow apply to both models of depth finder/recorder.

Sounding Rate:	300 per minute
Pulse Length:	0.2 ms for Depth Ranges 1,2,3 0.8 ms for Depth Ranges 4,5,6

	STANDERD SCALE	OPTIONAL SCALE
Depth Ranges	Feet	Fathoms
1	0 - 12	0 - 2
2	0 - 30	0 - 5
3	0 - 60	0 - 12
4	0 - 120	0 - 20
5	0 - 300	0 - 50
6	0 - 600	0 -100

Recording Type:	Straight Line with WHITE LINE and CLEAN ECHO
Operating Voltage:	12 Volts DC (10.5 to 14.0V)
Chart Paper Size:	4 inches (101 mm) x 50 feet (15 m) roll
Chart Paper Feed:	5/16" to 2-1/2" per minute CONTINUOUSLY VARIABLE
Event Marker:	Press to MARK switch
Night Light:	ON/OFF switch
Power Consumption:	6 Watts
Weight:	Approximately 4.4 lbs (Include Bracket)
Dimensions:	See outline drawing

Specifications are subject to change without prior notice.

1-4 Principles of Operation

Depth finder/recorder operation is based, primarily, on the measurement of the time required for sound waves to travel a specific distance through water. It is the time/depth (distance) relationship that is applied in depth measurement.

It has been determined from scientific tests, that sound waves transmitted into water will travel through the water at a speed of approximately 4800 feet per second. It is also known that objects underwater within the path of the sound waves will reflect part of the sound waves back toward the source. These reflected sound waves - called echoes - travel at the same speed as the transmitted sound waves. Using these principles, and by measuring the time - from transmission of the sound waves until return of the echoes - the depth to underwater objects can be measured.

The HE-356 is designed to measure the time/depth (distance) relationship to underwater objects, such as the lake bottom, sea bottom, a fish, schools of fish, etc., and record the depth measurements on a graph-type, straight line chart recording.

1-5 Description of a Depth Finder/Recorder

The basic functions of the depth finder/recorder are illustrated in Figure 1-1.

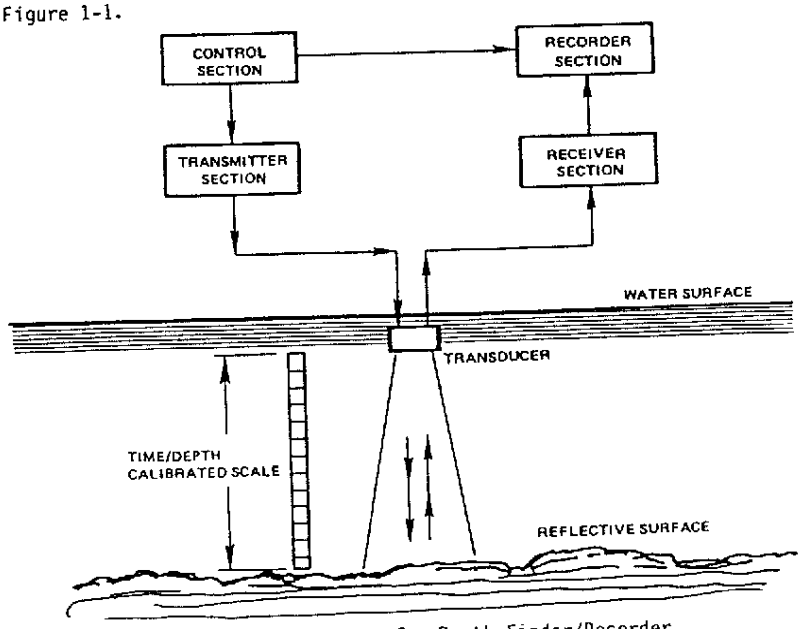


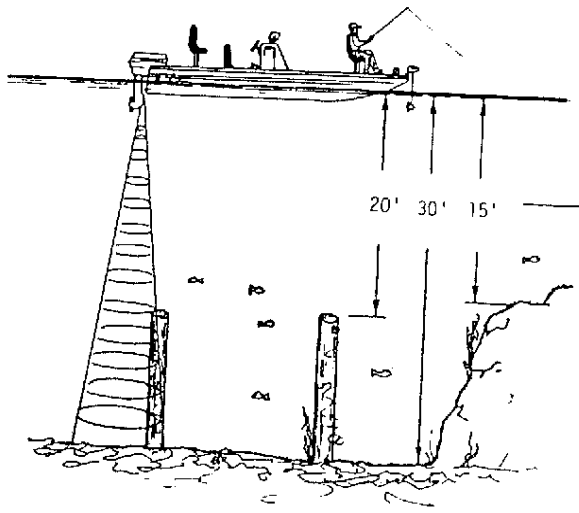
Figure 1-1. Functions of a Depth Finder/Recorder

The control section of the depth finder/recorder initiates (triggers) the function commands for the transmitter and recorder sections. The transmitter section generates ultra-sonic sound waves which drives the transducer. The ultra-sonic sound waves are converted from electrical energy to mechanical energy by the transducer. The mechanical energy, in the form of ultra-sonic vibrations, is radiated into the water in a cone-shaped pattern. At the instant of transmission, the recorder section marks a transmission line at the top of the chart. See Figure 1-2. At the same time, the control section begins to measure the time between time of transmission and the return of each echo. Many echoes from the bottom, fish, schools of fish, debris, etc., are reflected back to the transducer where they are converted from mechanical energy, back to electrical energy. Each echo returned to the transducer is amplified in the receiver section and transferred to the recorder section, which records each echo return as marks on the chart. Echoes from close objects arrive at the transducer in a shorter period of time than echoes from objects at deeper depths. Thus, the depth finder/recorder measures the TIME, from transmission line until the return of shallow or deep depth echoes, and records each echo at its representative depth location on the chart. A calibrated scale is provided to reference depth to recorded marks.
Example: Since the speed at which sound waves travel through water is approximately 4800 feet per second, a time interval measurement of one second (from time of transmission until return of an echo) will be recorded on the chart as 2400 feet depth. This is equivalent to a round-trip distance of 4800 feet, 2400 feet distance to the object (fish or bottom) and 2400 back from the object. NOTE: This is an example; your HE-356 is not designed to record 2400 feet.

1-6 Description of Chart Recordings

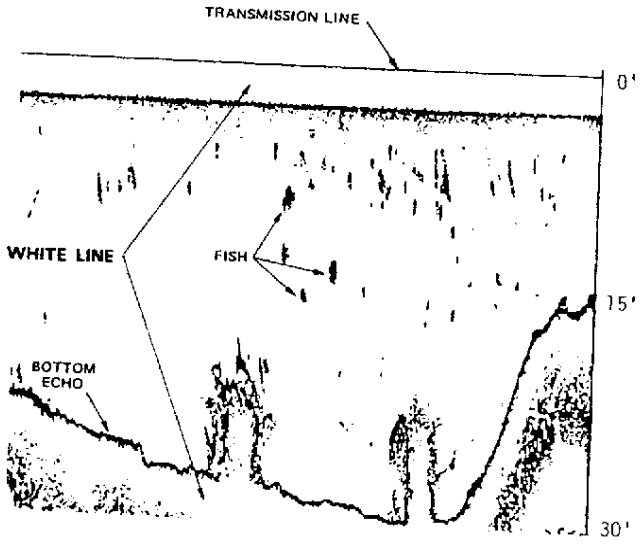
Figure 1-2 illustrates a typical chart recording.

The complete recorded image consists of an accumulation of many transmissions and the echoes returned from the bottom and intermediate objects, such as fish, to produce the recorded image. Note that one single echo will not produce the complete recorded image outline of fish nor any other object, but will produce single marks on the chart for each echo received. The accumulation of echoes will produce a wide variety of marks and image shapes on the recording, depending the strength of the echo, the depth, and the angle at which the transducer beam strikes the object. The movement of the boat through the water and the movement of a fish swimming through the water will have varying effects on the recorded images. Soft textured objects, such as a muddy bottom, sea weed, surface noise, air bubbles, etc., will absorb much of the ultra-sonic sound, and cause the reflected echo to be recorded as smaller, lighter marks on the chart. On the other hand, hard objects, such as rock or gravel bottom, will produce strong echoes, which will be recorded as heavy and dark marks on the chart. Fish and schools of fish will produce a variety of dark and light recordings on the chart. It has long been known that ultra-sonic sound will produce a strong echo from the gas blatter of a fish, however, as stated previously, the size of the fish, the depth location and the angle at which the transmitted pulse strikes the fish, are the factors which most effect the recorded image.



AFTER BOAT COMPLETES MOVEMENT FROM LEFT TO RIGHT OVER TYPICAL SUBSURFACE OBJECTS SHOWN, THE CHART BELOW COULD BE RECORDED.

SIMULATED CONDITIONS



A COMPLETE RECORDING CONSISTS OF MANY ECHOES ACCUMULATED TO PRODUCE THE RECORDED IMAGES. ACCUMULATION OF ECHOES FROM THE SAME OBJECT WILL PRODUCE A VARIETY OF SHAPES ON THE CHART DEPENDING ON THE DEPTH TO THE OBJECT, THE RELATIVE MOVEMENT BETWEEN THE OBJECT AND THE BOAT AND THE STRENGTH OF THE ECHO.

Figure 1-2. Typical Chart Recording

SECTION 2
INSTALLATION

See Figure 2-1 for Recorder unit dimensions and clearances.

See Figure 2-2 for Mounting Bracket dimensions and drilling.

See Figure 2-3 for Power Connection and External Cabling.

See Figure 2-4 through 2-11 for Transducer Installation.

2-1 Recorder Unit Mounting Location

The HE-356 is designed for easy installation, however, these recommendations are important and should be followed to obtain the best results.

1. Select a convenient location for the recorder unit. This location should provide access for operation and for observing the chart recordings.

2. The recorder unit should be installed in a location that will provide protection from extreme weather conditions, such as direct sea spray, rain and extreme temperatures.

3. If the recorder unit is installed in an open boat, some type of transparent plastic cover should be provided to protect the unit from extreme weather conditions.

4. Route the transducer cable a minimum of 12 inches from all other electrical cables and equipment.

5. Route the power cable away from the transducer cable and if possible, away from other electrical equipment that may radiate electrical interference (noise).

6. Provide a separation of at least three-to-four feet between the recorder and the boat's compass. Magnetic fields and other radiated interference may have adverse effects on the compass readings.

7. Before finalizing the recorder or transducer mounting locations, operate the depth recorder for a brief period. Observe any interference interaction that may occur between the recorder and all other equipments.

2-2 Recorder Unit Installation (See Figures 2-1 and 2-2)

After selecting the mounting location and position for the recorder unit, prepare the mounting foundation as follows:

1. Be sure to allow adequate clearance all around the unit.

   a. Provide for installation and removal of recorder unit from mounting bracket.

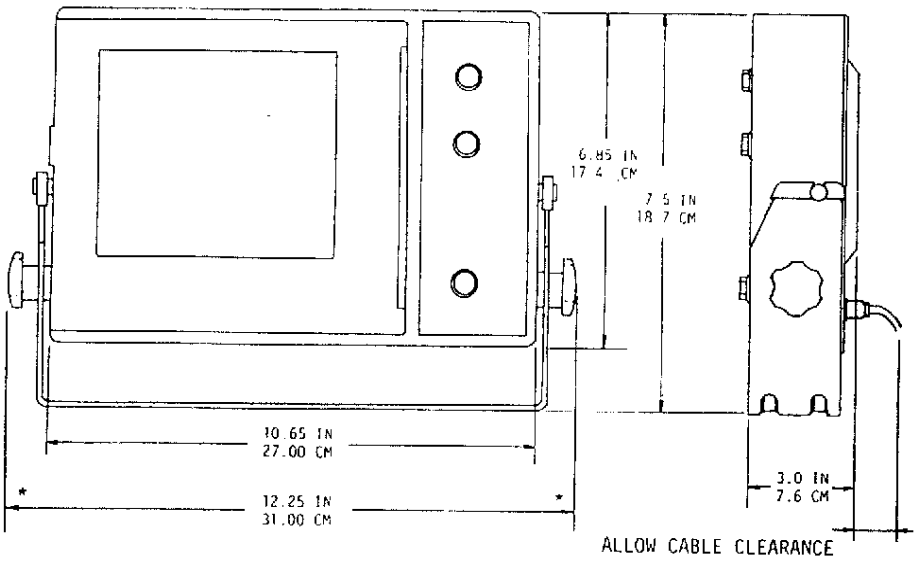


Figure 2-1. Recorder Dimensions

b. Allow for tilting the unit to front or back.

c. Allow for opening front cover to install chart paper.

d. Provide clearance for connecting and disconnecting the transducer cable.

2. Drill the proper size holes in the hole locations shown in Figure 2-2.

3. Install the two universal mounting brackets using the mounting screws provided. Tighten all screws securely.

4. Install the recorder unit onto the mounting brackets using the two clamping knobs and rubber friction washers provided. Install the rubber washers between the recorder unit and the brackets to prevent undesirable pivoting of the recorder unit when operating and when under way. Tighten clamping knobs securely.

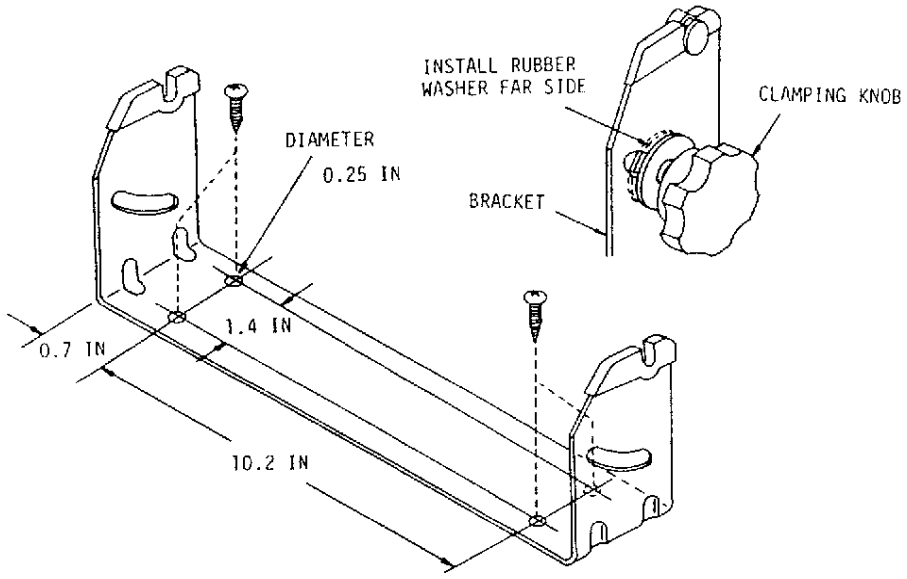


Figure 2-2. Installing the Recorder Mounting Brackets

2-3 Power Requirements and Fuses

1. Operating Voltage: 12 Volts D.C. nominal (10.5 to 14.0 volts).

2. Power Source: Battery or power converter capable of 1.0 amp average current at 12 Volts D.C.

3. Fuse/Fuseholder: Located inside in back of paper transport assembly.

4. Fuse Replacement: Install only a 2 amp fuse. The fuse is installed to protect the recorder unit from overload conditions. A blown fuse usually indicates a trouble condition in the equipment. If fuses blow continuously, have the equipment checked and repaired by a qualified technician.

CAUTION

DO NOT INSTALL A HIGHER RATED FUSE.
EXCESSIVE DAMAGE MAY RESULT AND
YOUR WARRANTY WILL BECOME INVALID.

2-4 Power Connection (See Figure 2-3)

1. Check the voltage and polarity of the battery or power source before connecting the recorder unit.
2. Set the unit power switch to OFF by rotating the GAIN control fully counterclockwise (CCW) to OFF.
3. If possible, do not route the power cable parallel to or within one foot of the transducer cable.
4. Power cable wires should be connected directly to the battery terminals, if possible. If not possible, provide heavy wire (No. 12 AWG) between the battery and the power distribution terminals.
5. Connect the BLACK wire to the NEGATIVE (-) battery terminal.
6. Connect the RED wire to the POSITIVE (+) battery terminal.
7. Tighten connections securely.

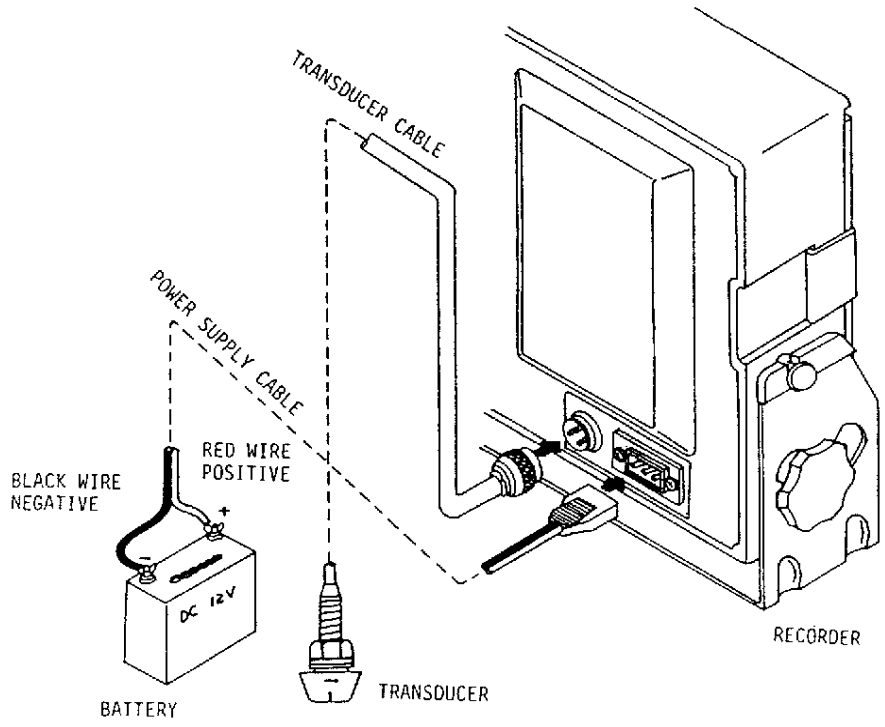


Figure 2-3. Power Connection/External Cabling

2-5 Transducer Mounting Location (See Figure 2-4)

The transducer mounting location must be selected carefully to obtain the proper performance from your depth recorder. Some primary considerations are:

1. The transducer should be mounted in a location that is relatively free of white water, that is, the turbulence and air bubbles, called cavitation, created by the movement of the boat as it travels through the water. Air bubbles greatly reduce the efficiency (transmit and receive sensitivity) of the transducer.

2. The transducer should be mounted so that the working face (surface for transmitting and receiving) is parallel to the waterline when the boat is floating in a normal position.

3. The transducer face should remain below the water at all times when the boat is under way; even when heeled or when it rolls and pitches in the sea swells.

4. Other factors that must be considered are:

   a. The type of boat, the shape of the hull (flat bottom, contoured or V-hull) and the dead rise angle of the hull and transom.

   b. The location and spacing of the lifting strakes.

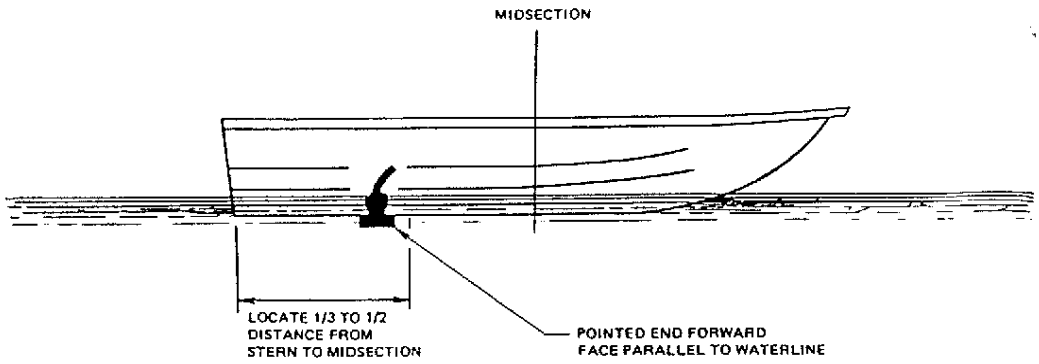
   c. The style and shape of the transducer, i.e., for thru-hull or transom mounting.

To determine the best mounting location, operate the boat in the water at several different speeds and observe the water as it passes under the transom. Study the turbulence created by the hull structure, the keel and the lifting strakes.

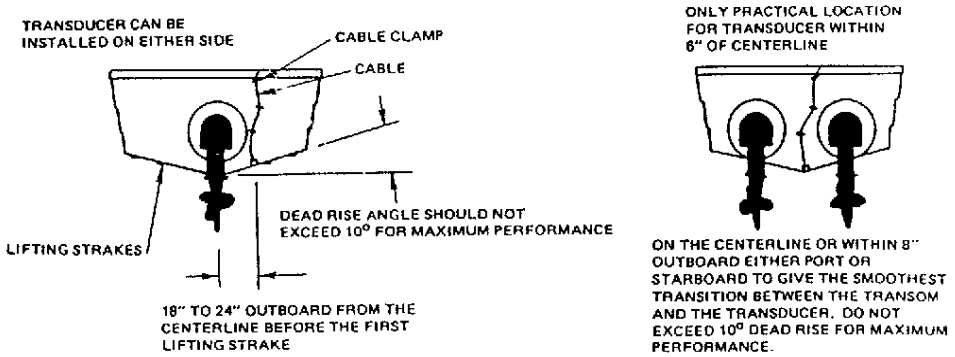
Before mounting the transducer, determine the location that will provide the smoothest transition of the water under the transducer working face.

NOTE

When preparing the transducer for mounting, do not assemble the connector to the cable before mounting. This will permit routing the cable through smaller holes and duct ways in bulkheads and panels.



THRU-HULL MOUNTING LOCATION



TRANSOM MOUNTING LOCATION

Figure 2-4. Transducer Mounting Locations

2-6 Thru-Hull Transducer Mounting (See Figure 2-5)

The bronze threaded, stem-type transducer is used for thru-hull mounting. This type of mounting is recommended for optimum performance on any type boat.

NOTE

Since the installation is below the waterline, the boat must be removed from the water to accommodate installation.

Thru-hull installation is accomplished as follows:

1. First, determine the best location for the transducer. See paragraph 2-5.

2. Select a location in the aft section of the boat, approximately 1/3 to 1/2 of the distance from the stern to the midsection. Allow approximately 12 inches lateral offset from the keel, such as the hull design will permit.

3. Mount the transducer as illustrated in Figure 2-5, with the pointed end forward and with the working face aligned parallel to the waterline.

4. If the hull is not level within 10 degrees in any direction, fairing blocks (leveling blocks) must be used between the transducer and hull, both inside and out, to ensure the transducer face is parallel to the waterline.

5. Fabricate the outer fairing block into a shape similar to the pointed transducer profile, to prevent creating any excessive turbulence around the transducer face. The shape of the inner fairing block may be limited by the inner hull structure.

6. Measure the transducer mounting stem diameter before drilling any holes in the hull or fairing blocks. Then drill the hole sized so that excessive force is not required to install the transducer stem through the hole. Oversize holes are not recommended.

7. After the drilling operation is completed, loosely assemble the transducer (and fairing blocks if used) against the hull. Check to be sure the transducer working face is level and observe the relative position of each part for location during final installation.

8. During the final installation, clean each mounting surface, then apply sealing or bedding compound to the inside and outside mounting surfaces of the hull, the fairing block mounting surfaces and the top surface of the transducer. This will maintain the water-tight integrity of the hull.

NOTE

Follow the manufacturer's recommendations for use of sealing and bedding compounds.

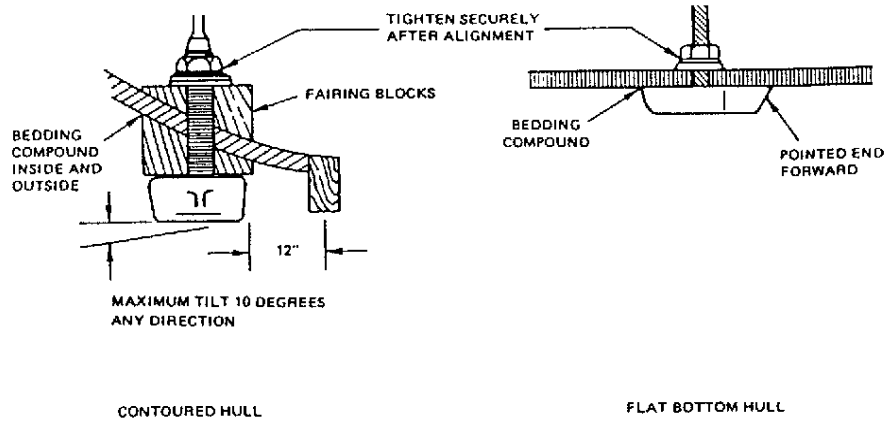


Figure 2-5. Thru-Hull Mounting

9. Assemble the transducer and fairing blocks to the hull and tighten the mounting nut securely to prevent loosening from vibration and other outside forces. On wood hull boats, allow normal wetting and swelling time before the mounting nut is tightened completely.

CAUTION

DO NOT OVER-STRESS THE THREADED STEM AND MOUNTING NUT BY EXCESSIVE TIGHTENING.

2-7 Transom Installation Requirements

NOTE

The plastic housing type transducer is used for transom mounting. This type of mounting provides excellent recorder operation and good operation at high speed when mounted flush with the transom bottom.

1. First, determine the best location on the transom for the transducer. Select the location as illustrated in Figure 2-4, such as the hull and transom design will permit.

2. Particular attention should be given to the location of the lifting strakes and the dead rise angle of the transom. For best results, the dead rise angle must not exceed 10 degrees.

3. If the dead rise angle of the transom is greater than 10 degrees, an alternate location should be selected. If this is not possible, the transducer should be mounted parallel to the waterline for best results.

4. Select the location where the transducer will not interfere with the operation of other devices such as, the rudder, trim tabs, etc., and where it will not be subject to damage from trailer loading or normal docking procedures.

2-8 Transducer Mounting On Brackets

1. Assemble the transducer to the two mounting brackets as illustrated in Figure 2-6. Tighten the screws sufficiently to hold the assembly together, yet loose enough to allow adjusting the transducer position.

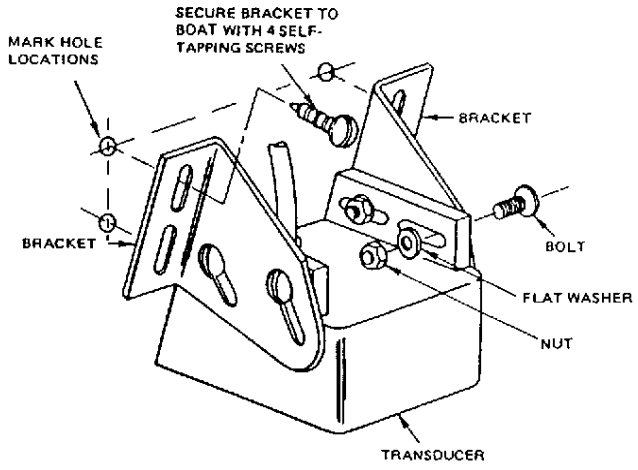


Figure 2-6. Transom Mounting Detail

2. Place the assembled parts against the transom in the selected location.

   a. If the dead rise angle is 10° or less and the transducer is to be mounted flush to transom bottom, locate the transducer as illustrated in Figure 2-7.

   b. If the transducer is to be mounted parallel to the waterline, locate the transducer as illustrated in Figure 2-8.

   c. Adjust the brackets and transducer to the desired position for mounting. Do not mount.

3. Using the slotted holes in the transom mounting bracket as a guide, mark the transom where the mounting screws will be located. See Figure 2-6.

4. Determine the proper hole size for the self-tapping screws provided, then drill the required 4 holes in the locations marked on the transom in step 3.

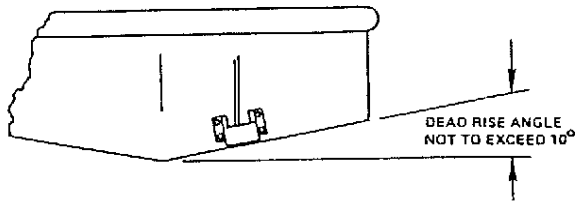


Figure 2-7. Mounting Flush to Transom Bottom

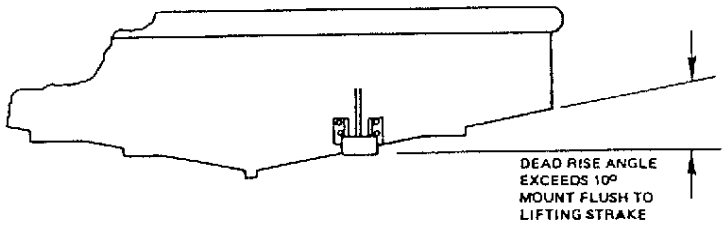


Figure 2-8. Mounting on Transom Parallel to Waterline

5. Mount the transducer and brackets to the transom using the 4 self-tapping screws provided. Tighten the screws securely. A small amount of sealing compound under the head of each screw will preserve the watertight integrity of the transom.

6. Adjust the transducer into the position selected in step 3 as illustrated in Figure 2-9. Be sure that the leading edge is flush and parallel with the transom bottom edge and the dead rise angle does not exceed 10 degrees. Tighten the mounting screws securely.

7. Minor adjustment of the transducer position may be required to obtain optimum performance. This can be determined by operating the boat in the water at several different speeds, while operating the recorder and observing the results.

8. After adjustments have been made, fill any gaps between the transom and transducer with sealer or caulking compound. Be sure the gap sealer is sanded smooth to avoid causing cavitation.

CAUTION

DO NOT SAND THE FACE OF THE
TRANSDUCER. DAMAGE WILL RESULT

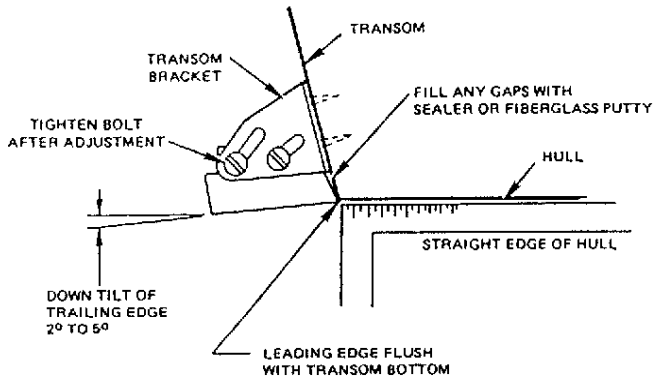


Figure 2-9. Positioning Transom Mounted Transducer

2-9 Inside Hull Transducer Mounting (See Figure 2-10)

In many cases, good results can be obtained by mounting the transducer inside the hull, generally in the bilge area. It is important to ensure that the transducer is placed in an area that has a single-hull thickness. This type of transducer mounting works best on fiberglass and aluminum boats. In many cases, good-to-fair results can be obtained in wood boats providing the hull is not too thick and it is void of air. There must not be any air or flotation material, other than solid fiberglass, between the transducer's face and the water. Also, the transducer should not be placed over hull struts or ribs which generally run under the hull.

1. To determine the best position for the transducer, put some water in the bilge, wash the transducer face with a mild detergent and place the transducer in the bilge so that the transducer face is flush with the hull. Run the boat at various speeds and move the transducer to different locations to determine the best location for permanent installation.

2. To ensure a good transducer installation, drain all the water from the bilge, thoroughly clean the inside hull where the transducer is to be mounted, and clean the transducer face with mild detergent. Allow both to dry completely, then use a good two-part epoxy or fiberglass resin to bond the transducer face to the hull. (Coat the transducer face and hull with epoxy). Press the transducer firmly to the hull and gently twist back and forth to remove any air which may be trapped in the epoxy. Allow to dry per epoxy instructions.

3. The depth sounder will now operate with no water in the bilge. This type of mounting is preferred over wet well mounting, because oily bilge water will tend to make sounding through the hull more difficult, and the transducer could move around if it were not secured in place.

4. On fiberglass flotation hulls, Figure 2-10, the inner hull can be removed and a reservoir made for transducer placement. After the reservoir is made, check depth-sounder operation before securing the transducer to the hull as described in step 2.

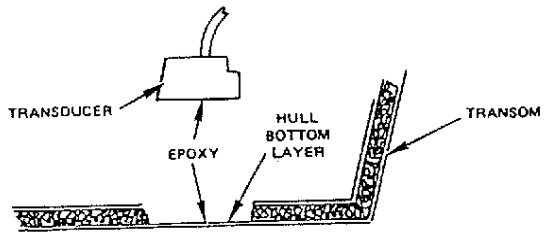


Figure 2-10. Transducer Mounted Inside Hull

2-10 Attaching Transducer Cable Connector

When installation of the transducer is completed, the connector can be attached to the transducer cable. See Figure 2-11 and proceed as follows:

NOTE

Do not cut off excess transducer cable. Coil excess and stow away. The connector is provided fully assembled and must be disassembled before connecting to the cable.

1. Remove two small screws from the cable clamp.
2. Remove one small flathead screw from the connector body.
3. Separate the connector shell/coupling ring from the plug body using a slight CCW twisting motion while pulling on the plug body.
4. Prepare the end of the cable for assembly using the proper wire-stripping tool.
   a. Strip the cable jacket approximately 1/2 inch from the end.
   b. Strip the insulation from each wire approximately 3/16 inch from the end.
5. Slide the connector shell/coupling ring onto the cable (cable clamp end first).

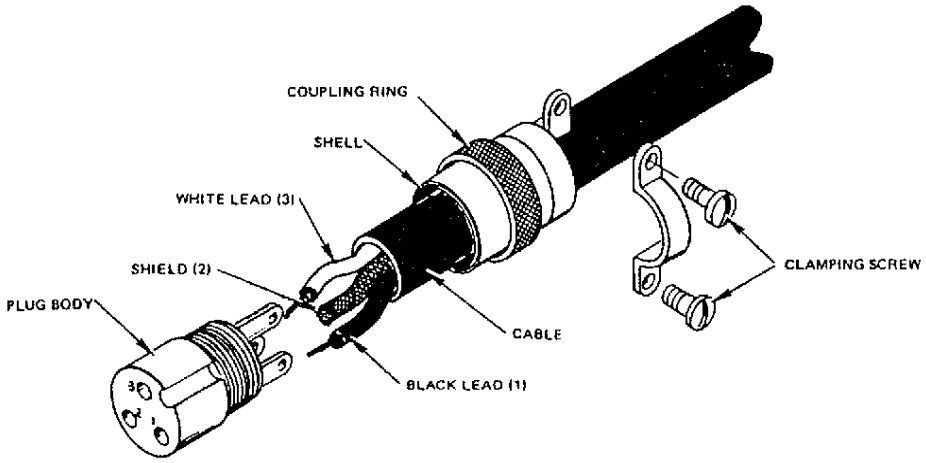


Figure 2-11. Transducer Cable Connection

6. Observe the terminal numbers on the plug body. Connect the cable wires to the plug body as follows.

   a. Solder the BLACK wire to terminal number 1.

   b. Solder the SHIELD wire to terminal number 2.

   c. Solder the WHITE wire to terminal number 3.

7. Be sure to remove excess solder to prevent shorting between terminals, wires or the connector shell.

8. Slide the connector shell over the plug body. Observe the keyway, and position shell to locate the screw hole properly.

9. Insert the flathead screw and tighten securely.

10. Assemble the cable clamp to the shell using the two screws removed in step 1. Tighten the clamping screws securely.

11. Connect the transducer cable to the recorder unit.

SECTION 3
OPERATION

3-1 Functional Operation and Chart Recordings

Each Operating Control on the HE-356 is used to control a specific section of the internal circuitry so that echoes recorded on the chart are clearly defined relative to depth and to the characteristics of the reflecting objects.

Before operating the HE-356, the operator should become thoroughly familiar with the functional operation of the unit, the operation of the controls and the loading of the chart recording paper.

Inside the HE-356

Internally, a small motor drives a recording belt. Mounted on the recording belt are a trigger device to initiate the transmit pulse, and a recording stylus to mark the chart paper.

Each rotation of the recording belt triggers the transmission of ultrasonic pulses from the transducer into the water. This transmit pulse, called transmission line, is recorded on the chart paper and establishes the zero-depth location on the chart - zero depth is the actual location of the transducer under the boat.

When echoes return to the transducer, they are amplified and recorded on the chart paper at the proper depth location depending on the DEPTH range selected.

With each rotation of the recording belt and stylus, the chart paper (driven by another small motor) is advanced a small amount, so that each succeeding transmission pulse and echo can be recorded separately. Thus, with each successive transmission, the chart records echoes which show the shape or contour of the reflecting objects.

The HE-356 is designed to distinguish between strong and weak echoes. Strong and moderately strong echoes are recorded as dark, black marks on the chart. Weaker echoes are recorded as gray tone marks. The length of the marks recorded on the chart indicate the duration of the echoes, which is sometimes one single echo or, more likely, an accumulation of echoes. Each echo returned has its own special characteristics, depending on the physical make-up of the reflecting object, whether it is a fish, school of fish, weeds, bottom echoes from hard or soft bottom, etc.

3-2 Operator Controls, Function and Use

Front Panel Controls. Three controls for normal operation are located on the front panel. See Figure 3-1.

* GAIN/Power ON-OFF
* DEPTH (depth ranges)
* WHITE LINE
* CLEAN ECHO

Internal Controls - Three controls are located behind the front plastic window below the paper transport assembly. See Figure 3-2.

* PAPER SPEED
* MARK
* LAMP SWITCH

CAUTION

THE UNIT HAS BEEN FACTORY CALIBRATED FOR OPTIMUM PERFORMANCE. INTERNAL ADJUSTMENTS, EXCEPT AS NOTED ABOVE, SHOULD NOT BE CHANGED BY THE OPERATOR.

Calibrated Depth Scale. See Figure 3-1. A calibrated depth scale is located behind the clear plastic window. It provides the operator with a means to determine the depth of the marks which are recorded on the chart. The depth scale can be positioned to either of two locations for the operators convenience. Refer to paragraph 4-3 for procedures.

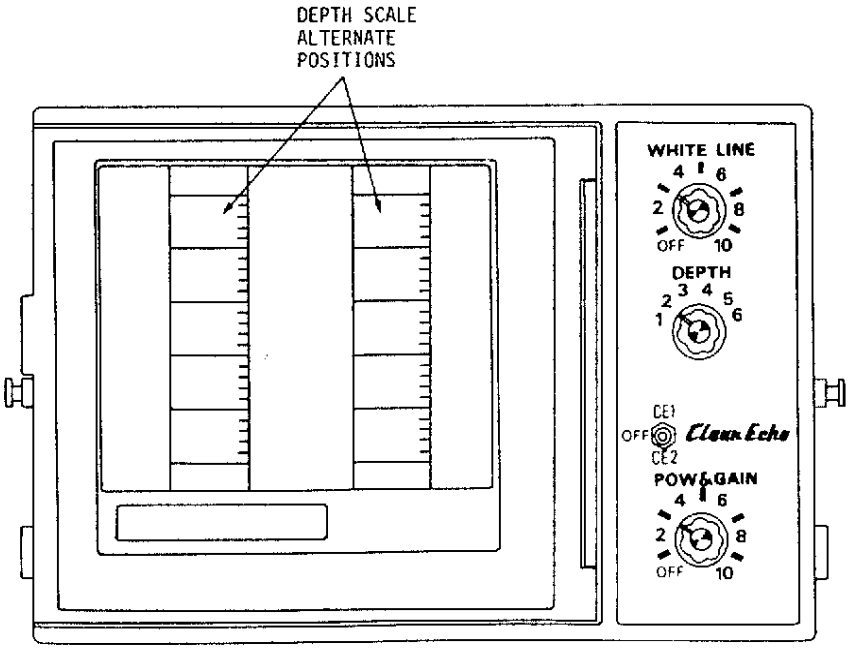


Figure 3-1 Front Panel Controls

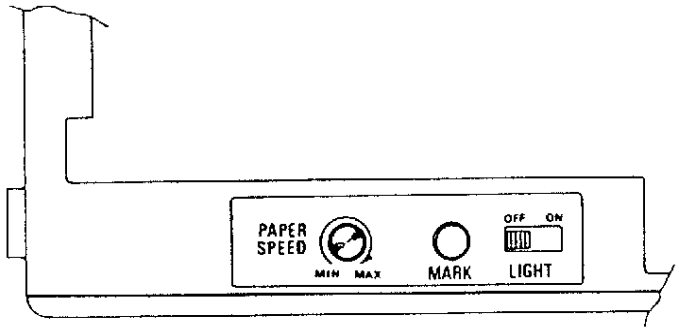


Figure 3-2. Internal Controls

Front Panel Controls (See Figure 3-1)

a. POW/GAIN - A variable control combined with a Power ON/OFF switch. Clockwise rotation of the control operates the Power switch to ON which applies 12 volt power to the unit.

The GAIN control is used to adjust the sensitivity of the unit to suit the depth recording conditions. Clockwise rotation, 1 to 10, increases the sensitivity.

Optimum setting for the GAIN control will vary depending on many factors and experience. In normal operation, the GAIN control should be set to record both the first and second bottom echoes, as shown in Figure 3-3. This provides the best results when using the recorder to locate fish.

The water depth and other local conditions will also influence the setting of the GAIN control.

Fixed STC is applied (in the P.C.Board) to eliminate surface noise, etc.

b. WHITE LINE - A variable control combined with an ON/OFF switch. Clockwise rotation operates the switch which activates the WHITE LINE control. When activated, the WHITE LINE control produces a gap - a blank white area - in the recorded images. The blank white area is interpreted as WHITE LINE. Further CW rotation of the control will increase the white line gap. The white line effect on

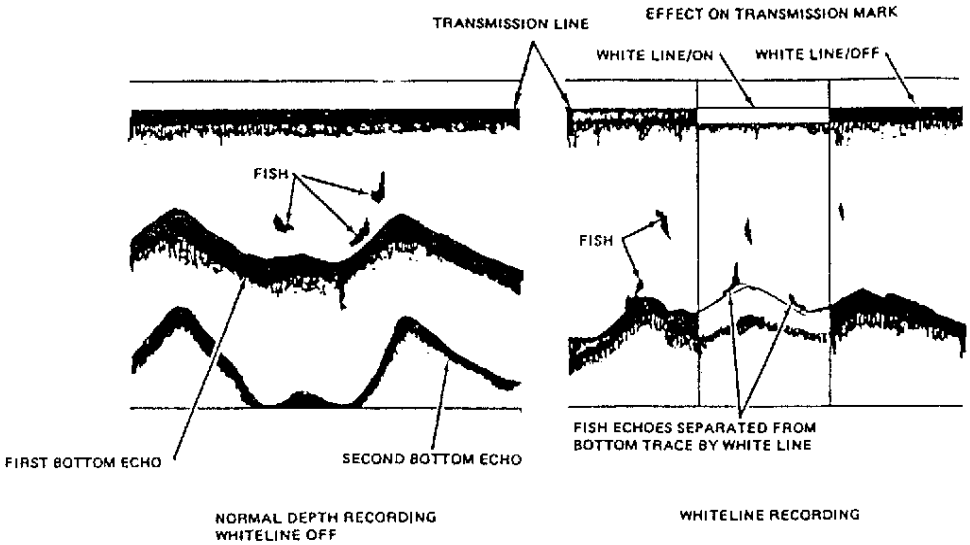


Figure 3-3. Examples of Recordings

the definition of recorded objects close to the surface or bottom may be realized by comparing the two types of recordings shown in Figure 3-3. Observe the difference between normal recordings and white line recordings.

To locate fish in normal operation, the operator should always use the WHITE LINE control. The white line will greatly enhance the depth recordings and aid in bottom discrimination for separation of fish echoes from bottom echoes.

(1) First note the effect on the recordings of bottom echo. With WHITE LINE off, the bottom echoes are recorded as a thick black line.

(2) With WHITE LINE on, the bottom echoes are recorded as a thin black line, over the blank white area (WHITE LINE), which is over the trailing edges called bottom tails.

(3) Note the effect on the echoes from fish near the bottom. With WHITE LINE on, fish at or near the bottom will be recorded as a thickening (enlarging) of the thin black line portion of the bottom echoes, thus making it easy to distinguish the fish from the bottom. It should be obvious that WHITE LINE is one of the most desirable features when looking for fish at or near the bottom, where a fish may be mistaken for part of the bottom echo.

(4) Note the effect on echoes from fish at intermediate depth. The recordings, in this case, are the same because echoes from fish are not strong enough to activate the white line circuitry. Large fish and schools of fish may, however, cause the white line to operate when the control is set too high.

(5) Note the effect on the recording of the transmission line. With WHITE LINE on, the transmission line recordings also appear as a thin black line separated by the blank white area (WHITE LINE) from the recording of the bottom tails. For this reason, white line function should not be used when operating in very shallow water, so that the recordings will show the bottom echoes merging toward the transmission line, indicating very little water depth under the transducer.

(6) The effect of the white line will be greater when operating over a very hard bottom. The white line area becomes larger and the bottom tails become longer.

(7) When operating over a soft muddy bottom, the WHITE LINE control setting may require increasing to achieve the desired effect.

(8) The white line effect is also useful when the recordings are near the bottom edge of the recording paper. The bottom echoes are clearly defined as a thin black line without resorting to DEPTH control range change.

(9) Use of the white line also reduces the amount of recording dust accumulated inside the unit and reduces wear of the recording stylus.

c. DEPTH - A six-position rotary switch used to select any of the six depth ranges. Depth ranges are indicated on the transparent Depth Range Scale located within the front panel window. Depth scale ranges, 1 through 6, correspond to the DEPTH switch position 1 through 6. Transmission pulse length is, also, automatically selected with the Depth range setting.

DEPTH RANGES ARE:

DEPTH SWITCH POSITION	DEPTH SCALE	DEPTH RANGE (Feet)	PULSE LENGTH (Millisec)
1	1	0-12	0.2
2	2	0-30	0.2
3	3	0-60	0.2
4	4	0-120	0.8
5	5	0-300	0.8
6	6	0-600	0.8

CLEAN ECHO - A three-position Toggle switch control with positions OFF, CE1 and CE2 marked on the panel. This control is used to reduce or eliminate electrical interference caused by other depth-finders operating nearby or from other types of electrical interference. Electrical interference from other depth finders can be easily distinguished because it results in a repetitious pattern of identical marks at random locations on the recording chart. The switch position selected depends on the strength of the interference. Use only when necessary - CE1 for low-level interference, CE2 for high-level interference.

NOTE

CLEAN ECHO will not affect echo recording from fish or other intermediate objects. However, it will affect the ability to determine the seabed or bottom characteristics. If bottom discrimination is important - do not use CLEAN ECHO. If intermediate objects are important, use the CLEAN ECHO switch in the most effective position.

Return this switch to OFF when not in use.

2. Internal Controls (See Figure 3-2)

SPEED - A variable control used to adjust the speed of the recording chart paper. In the counter-clockwise position, the paper speed is approximately 5/16 inches per minute. Clockwise rotation of the control increases the paper speed to a maximum of 2-1/2 inches per minute. Increase the paper speed when searching for fish at high speed. Decrease the paper speed for normal depth recording and to conserve recording paper at lower speeds.

MARK - A pushbutton switch used to produce a continuous black mark or line, from top to bottom on the recording chart. The switch is used to mark the chart when noting special information such as the boat's location, course and speed, location and depth of shoals, where fishing gear is set, etc. The switch is also useful to check the operation and recording of the stylus. Operation of the switch should produce a continuous black line without any skip or interruption. The proper stylus adjustment is when the stylus touches the paper with the least pressure that will provide continuous solid lines.

c. LAMP DIMMER - A two position slide switch used to turn the lamp on for night time viewing of the chart and depth scales.

3.3 Loading the Recording Paper

Before operating the unit, be sure that the recording paper is installed and properly loaded: See Figure 3-4.

1. Set the Power and Gain switch to OFF.
2. Open the front panel by pulling gently on the panel release latch at the left side of the unit. The panel is hinged on the right side.
3. Rotate the stylus belt downward to position the recording stylus at the bottom and rear of the transport cartridge. This will prevent damage to the stylus.
4. Hold the paper transport cartridge with one hand so that it will not fall out when the transport cartridge latch is released. See Figure 3-4.
5. Press firmly on the paper transport latch to release the paper transport cartridge. Remove the transport cartridge from the unit.
6. Loosen the screw at the bottom of the Depth Scale and remove the Depth Scale from the cartridge.
7. To install a new roll of chart paper (See Figure 3-4),

   a. Lift the paper take up spool retainer and remove the used recording paper. Remove the plastic take up spool from the used paper roll and retain it for use with the next roll of paper. Discard the used chart paper. Remove any used chart paper scraps from the slot in the plastic spool.

   b. Lift the paper feed spool retainer and remove the used paper spool. Discard the used paper spool.

   c. Open the new roll of recording paper and unwrap the loose end approximately 12 inches. Position the new roll of paper so that the direction of feed from the new roll will be counter clockwise as shown in Figure 3-4.

      NOTE

      The recording paper must be loaded properly. One side of the recording paper is coated with an electrically activated substance that permits the stylus to mark (or burn) the recordings onto the recording paper. Install the recording paper with the electrically coated surface facing the front of the recorder. Otherwise, the depth marks will not be recorded on the paper.

   d. Install the new roll of paper by mounting it between the paper feed notch key and the feed spool retainer. Be sure the paper spool notch is engaged into the notch key and that the paper will unroll counterclockwise as shown in Figure 3-4.

   e. Prepare the loose end of the chart paper for insertion into the slot of the paper take-up spool by tearing off approximately one inch from each corner, so that a 1/2 inch paper tab is formed which will be small enough to fit into the slot.

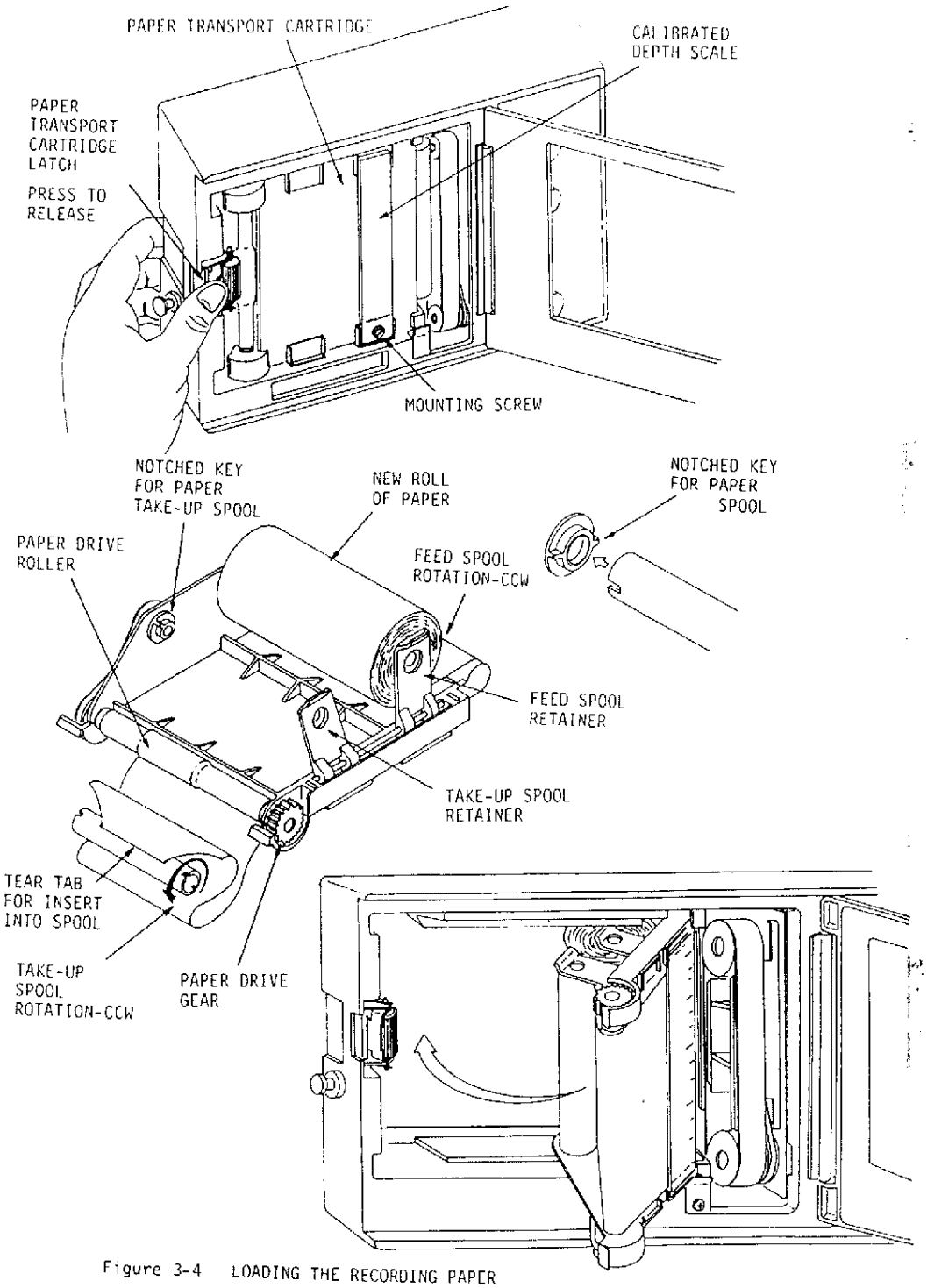


Figure 3-4 LOADING THE RECORDING PAPER

f. Insert the tab into paper take-up spool, rotate spool counter-clockwise and wrap approximately two turns of paper onto the spool.

g. Install the paper take-up spool by mounting it between the paper take-up notch key and the take-up spool retainer. Be sure that the spool notch is engaged into the notch key.

h. Remove all of the slack from the chart paper by reverse winding it back onto the new roll of paper.

i. Replace the Depth Scale and tighten the screw.

8. Position the paper transport cartridge in the recorder unit by inserting it from left to right at a small angle until it is properly seated near the stylus belt. When it is properly seated, press firmly on the left side of the cartridge until it snaps into place. If any slack remains in the chart paper, remove the slack.

9. Rotate the stylus belt slowly several times in the direction of the arrow, to be sure that the stylus does not hang-up on the recording paper.

10. Close the front panel securely.

11. Turn the POWER/GAIN control ON and operate the unit. Press the Mark switch to verify that the stylus is making contact across the entire face of the paper. If the Mark switch does not draw a continuous line across the recording paper, check to be sure that the recording paper is not installed backeard. The paper must be installed with the coated surface facing the front of the unit. See paragraph 3-3.

12. If the MARK switch produces an intermittent black line on the recording paper, the stylus may not be making good contact with the paper. Refer to paragraph 4-2 for stylus adjustment procedures.

13. Adjust the Depth Scale inside the front panel so that the zero (0) depth line coincides with the transmission mark on the recording paper.

3-4 HE-356 Operation

1. Before operating your HE-356 the following checks should be made.

   a. Check all external cable connections to be sure they are properly connected. See paragraph 2-4.

   b. Check the power supply voltage. Be sure the voltage and polarity are correct. See paragraphs 2-3 and 2-4.

   c. Be sure the Chart Recording Paper is properly loaded. See paragraph 3-3.

2. Rotate the GAIN control clockwise to apply power to the unit.

3. Set the DEPTH switch to a position (1 through 6) that will produce a recording of the sea bed or bottom and a second echo.

4. Adjust the GAIN control to produce a black recorde image of the first bottom echoes and a light recorded image of the second bottom echoes. Reset the DEPTH switch as necessary to produce the first bottom echo recordings.

5. Adjust the SPEED control for the desired paper feed rate; clockwise rotation of the control increases the paper speed.

6. Further adjustment of the GAIN and DEPTH controls is a matter of experience and will depend on the water depth and other local conditions.

7. Rotate the WHITE LINE control clockwise to obtain the white line operation. The WHITE LINE control should be used in conjunction with the GAIN control to produce the best results. The operator will observe an inter-related action between the two controls, and the difference in recordings will be obvious. Adjust these two controls to produce the best bottom discrimination effect on the recordings. Refer to paragraph 3-2 and to the chart recording examples for a more thorough description.

8. Operate the event MARKER by pressing the MARK pushbutton switch. Use this control any time - to test the operation of the recording stylus or to note some particular event recorded on the chart. Straight-line marks will appear across the chart from top to bottom.

9. Operate the CLEAN ECHO switch to eliminate interference from other fish finder units operating in the same area. Set the CLEAN ECHO switch to CE1 or CE2 as required.

10. Adjustment of the DENSITY control by the operator is not recommended.

3-5 Interpreting Chart Recordings

Figure 3-5 illustrates two actual recordings made at the same time, in the same location. The two recordings illustrate the differences between recordings made with the HE-356A (200KHz) and the HE-356B (50KHz) units. Recordings were made simultaneously, with the operating controls set at approximately the same position.

Note the differences between the two recordings. Recordings made with the 200KHz unit present greater definition and clarity. The recordings made with the 50KHz unit appear larger and slightly different in shape, except for the bottom contour.

The differences occur primarily because of the difference in the transducer beam angle - 10 degrees for the 200KHz transducer and 50 degrees for the 50KHz transducer. See Figure 3-6. The 10 degree beam covers a smaller area under the boat. Objects outside the 10 degree beam area are not detected with the 200KHz unit, whereas the same objects can be detected within the area covered by a 50KHz unit.

Fish moving under the boat will appear in the 50 degree beam long before they appear in the 10 degree beam; thus, the recorded image of the fish will be larger simply because it is within the transducer beam for a longer period of time. The same applies, when the fish is still and the boat is moving.

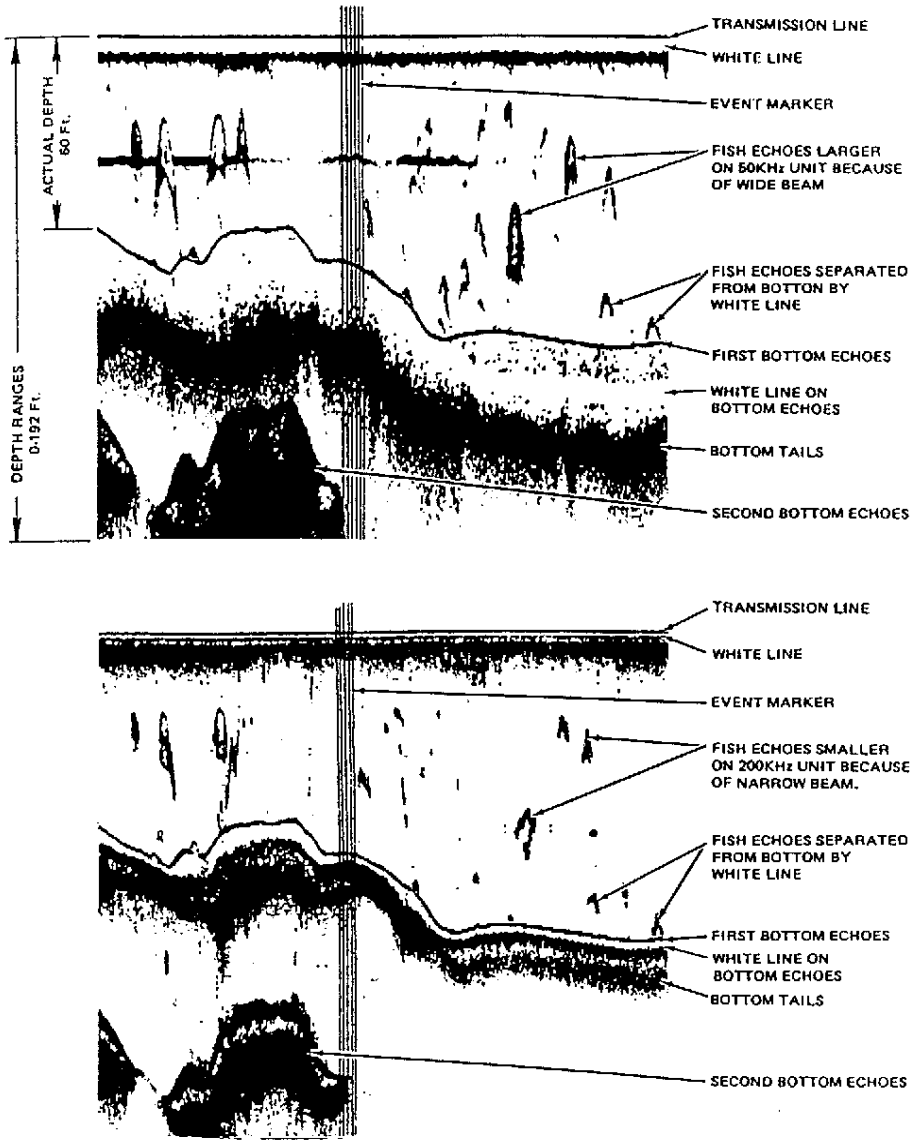


Figure 3-5. Interpreting Chart Recordings

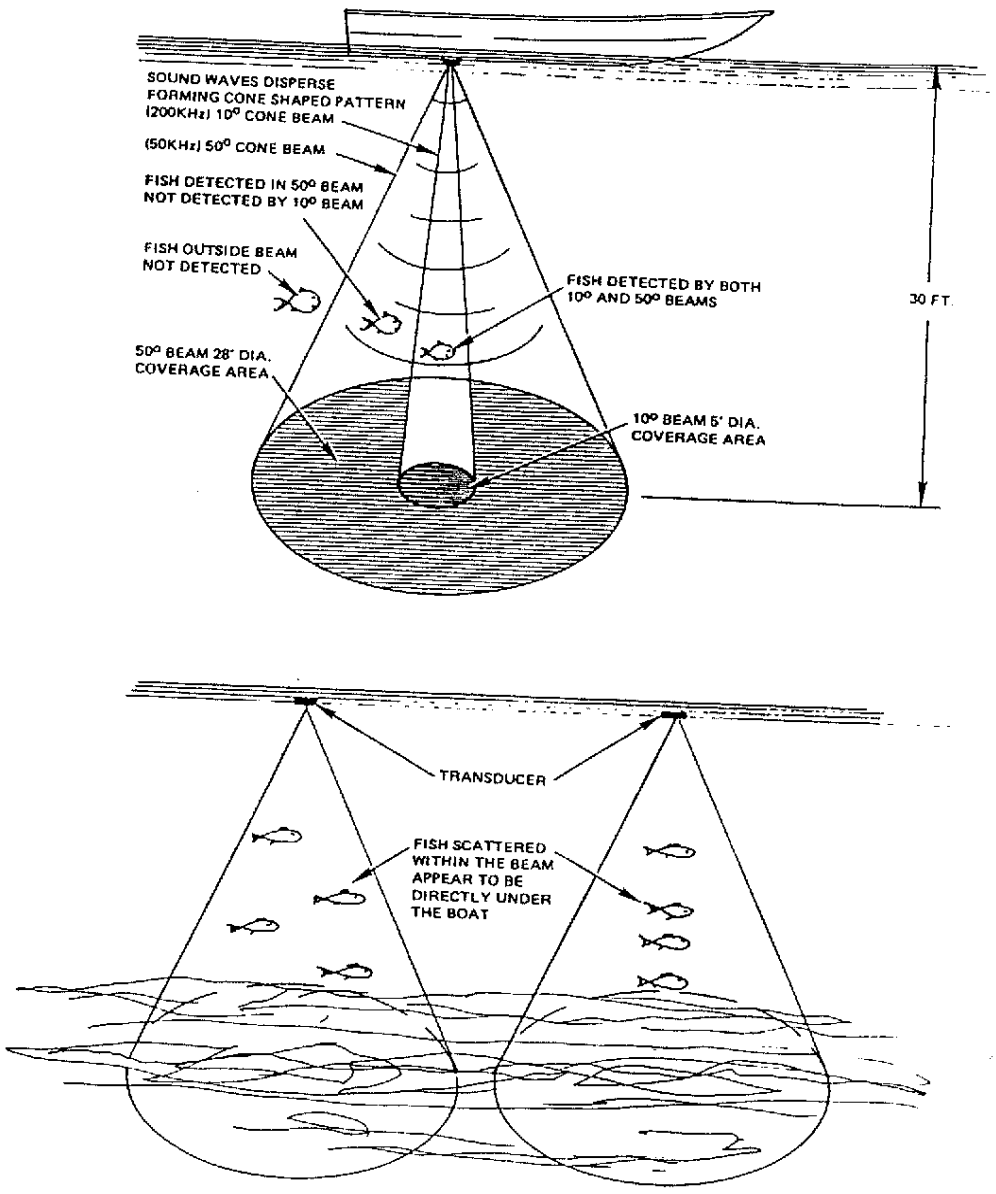


Figure 3-6. Transducer Beam Characteristics

Transducer Characteristics. See Figures 3-6 and 3-7.

In order to interpret and understand the chart recordings, some knowledge of the characteristics of the transducer is helpful. The primary function of the transducer is to transform electrical energy into sound energy during the transmitting period and to convert sound energy into electrical energy during the receive period, when echoes are returned to the transducer. In addition, the transducer must concentrate the sound energy in a specific direction so that, when echoes are returned, it is possible to know generally, from which direction they came.

A well designed transducer will concentrate the sound energy into a specific pattern called a beam. This beam of sound energy travels through the water forming a cone shaped pattern, which tends to spread wider as the distance of travel increases. Good manufacturing techniques permit the transducer to be designed so that the angle of the cone and the spread of the beam can be controlled and predicted.

Actual and Theoretical Beam Angle Characteristics.

Generally, the size of the transducer and the frequency of operation are the controlling factors which determine the beam angle and the spread of the beam. The illustrations provided in Figure 3-7 describe the true characteristics of transducers. Measurements are made at various angles to determine the intensity or strength of the sound energy transmitted into the water. The results are then plotted on a circular graph and the true transducer beam angle is determined from the graph.

As illustrated in Figure 3-7, the maximum power is concentrated at the center of the main beam. The theoretical beam angle is determined where the transmitted sound energy level has decreased to one-half of the power measured at center of the main beam. It can be readily seen that this particular area of coverage, where most of the power is concentrated, will provide the best results when measuring depth and detecting fish.

However, the true characteristics of the main beam (as plotted on the graph) indicate that, in the mid-water depth range, the sound energy spreads outward, forming a true beam angle that is wider than the theoretical beam angle. In reality, the true beam characteristics provide a useable beam angle that is twice as wide as the theoretical beam angle measured at the one-half power point and it provides a coverage area that is twice as large as would be expected from the theoretical beam angle coverage area. The true beam characteristics can be referred to as the Effective beam angle.

Effective Beam Angle.

Since most of the sound energy is concentrated within the directivity pattern of the theoretical beam angle, it is normal to expect strong echoes from directly under the transducer. The sound energy at the outer edges of the effective beam angle will be less and the resulting echoes from each transmission will be weak. These strong and weak echoes can be detected or rejected at the receiver section by increasing or decreasing the sensitivity of the receiver using the GAIN control.
The operator can make use of the characteristics of the effective beam angle to obtain better recordings and more information from the recordings.

1. By increasing the GAIN setting, the beam angle and the coverage area of the beam are "effectively" increased and the weak echoes in the fringe area of the effective beam can be detected and recorded.
2. By decreasing the GAIN setting, the beam angle and the coverage area of the beam is "ellectively" decreased and weak echoes in the fringe area of the effective beam can be rejected (not recorded). The strong schoes within the theoretical beam angle can be recorded.

Thus, by increasing and decreasing the GAIN control setting, the operator can control the

recording of echoes anywhere within the "Effective beam angle and the true coverage area. Fish and other objects within the effective beam coverage area can be detected and recorded on the chart or they can be rejected to obtain a recording with better definition of the objects close to the center of maximum power point.

Narrow Beam and Wide Beam Angles.

By using a high operating frequency, 200 kilohertz (KHz), the sound energy can be concentrated into a narrow cone beam with angles of 10 to 20 degrees. By using a low operating frequency, 50 KHz, the sound energy can be spread into a wider cone beam with angles of 50 to 60 degrees.

There are many advantages to both the narrow and wide beam transducers. Because the narrow cone beam is concentrated into a small area, only the echoes from the small area are returned to the transducer. This results in a much better definition of the underwater objects. Smaller objects can be pinpointed and detected, without them being buried among a large accumulation of echoes from every direction under the water. The narrow cone beam also provides a means to detect a sharp rise or drop-off in the bottom contour, thereby providing a better recording of underwater structure, fish near the structure, old river beds, tree stumps and the like. The usefullness of the wide beam becomes apparent when the user wants to cover a large area and doesn't necessarily need the sharp definition which results from the narrow beam. Because the wide cone beam spreads out over a large area, much more can be detected within the wide beam. Objects which would not normally be detected in the narrow beam are easily detected in the wide beam. Fish and other objects in the water will be indicated by larger marks on the recordings because they are within the wide beam for a longer period of time. Additionally, the 50 KHz frequency provides greater penetration into the bottom and subsurface of the bottom. This enables the user to determine the bottom characteristics, whether mud, sand, rock or gravel or combinations of each material.

All the characteristics described will provide useful knowledge about the habitat of the fish. By applying the knowledge of local conditions and the seasonal habits of the various species of fish, and then by comparing the chart recordings with this knowledge, the user can develop a technique for interpreting the chart recordings.

The typical standart 200 KHz operating frequency transducer has a crystal diameter of 2 inches and produces a cone beam angle of approximately 10 degrees at the 1/2 power point. It should be noted here, that the cone beam angle is a function of the diameter of the transducer crystal element.

Some transducer manufacturers have determined that, by reducing the transducer crystal diameter to 1 inch (using the same 200 KHz operating frequency), they can produce a cone beam angle of about 26 degrees. It may seem to be effective, in many cases, to have this wider cone beam angle. However, to achieve this wide angle, something must be sacrificed. Reducing the diameter of the crystal element results in a great loss in the transmit and receive sensitivity of the transducer.

When the transmitted sound waves are spread into a wider cone beam, much of the power is taken away from the center of the beam directivity pattern to achieve the wide angle. This results in a reduced depth range capability for the same applied transmit power. In addition, the reduced transmit power in the directivity pattern results in weaker echoes returned to the transducer, thus requiring additional receiver sensitivity to overcome the loss of power.

The total effect of achieving a wide cone beam angle with a 1 inch diameter crystal element will result in a loss of transducer sensitivity that is 4 times less than the sensitivity of the standard 2 inch diameter crystal element in a 200 KHz transducer.

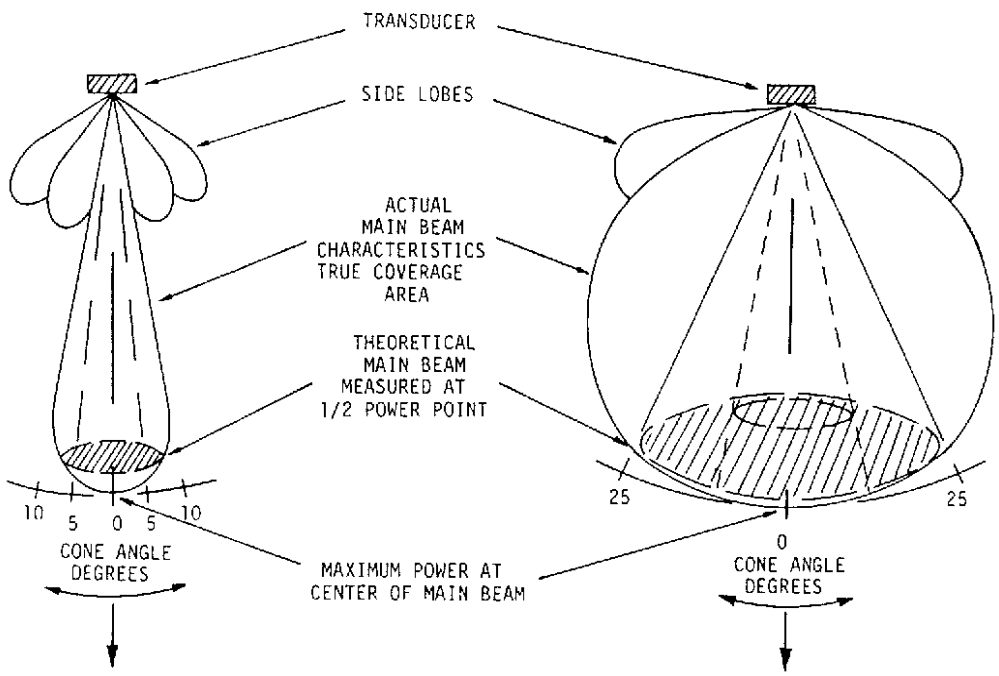


Figure 3-7 TRANSDUCER BEAM-ACTUAL AND THEORETICAL COVERAGE

3-7 Interference Suppression

Interference in sufficient magnitude will cause erratic performance of the depth finder.

Check installation for interference by stopping the engine in medium depth water and observing the depth finder. Then start the engine with the propeller disengaged; increase engine RPM and observe the indicator for interference.

If interference is present, one or more of the following remedies may affect a cure:

1. Operate the unit at ninimum required GAIN setting for satisfactory performance.

2. Install a suppressor on the center lead of the distributor. Install a coaxial condenser between the ignition coil and the ignition switch.

3. Install coaxial condencers on the electrical power line and the control leads which leave the engine compartment.

4. Bond engine, electrical accessories, propeller shaft, and rudder to each other and to the ground plate, if installed, with heavy copper grounding straps.

5. Resistor type spark plugs and/or copper screening on the inside of the engine compartment may be required in extreme cases.

On some engines, Champion "U" type spark plugs (such as UJ6) are specified. It is virtually impossible to eliminate noise caused by these plugs as they have an extra spark gap near the top of the plug which causes the leads to radiate noise. Replace these plugs with a resistor type plug such as the Champion XJ6, XJ8, etc. Check all high tension wires for continuity.

Ignition coil should be mounted on the engine. Clean away paint to ensure a good ground. Plastic-encased coils radiate excessive noise and should be replaced with a standard metal-cased unit.

Older types of voltage regulators contain a vibrating set of contacts to control voltage. If the usual capacitors do not eliminate the noise, replace with a solid-state regulator which has no moving parts.

Some electrical tachometers cause considerable radiation of spark noise. This type of tach connects to the points of the distributor. Disconnect the tach wire at the distributor, and note the noise reduction. This lead could be shielded or a special tach filter installed. If SUN tach are used, all wires must be shielded and the plastic-cased sender unit, which contains a vibrating set of contacts, should be completely shielded in a metal enclosure.

Your authorized marine electronic dealer will be familiar with the methods of reducing electrical interference and is qualified to assist you should a problem exist.

SECTION 4

MAINTENANCE

4-1 Owner/Operator Maintenance

Proper maintenance of your unit will help you obtain peak performance and may well extend the operating life.

CAUTION

DISCONNECT POWER BEFORE PERFORMING ANY MAINTENANCE PROCEDURES.

The following maintenance requirements can be accomplished by the owner/operator.

1. Cleaning the Unit

Carbon dust from the recording paper will accumulate throughout the unit, on the viewing window and on the mechanical parts. The carbon dust is abrasive and will absorb and retain moisture. The electrical parts are protected, however, the unit must be kept clean. Clean and remove all carbon dust deposits from the unit - inside and outside - at regular intervals, at the least, before each replacement of the recording paper.

Use the following methods:

a. Set power switch to OFF.

b. Use low-pressure compressed air to blow away the dust accumulation from all locations inside the unit, or

c. Use a soft bristle brush to clean away the dust.

d. Clean the clear plastic viewing window using a mild detergent solution and a soft cloth. Rinse with clear water. Do not remove carbon dust with a dry cloth. This will cause scratching and, eventually, degradation of the clear window.

2. Lubrication

Lubrication should be accomplished every 300 hours of operation, sooner if required.

Before lubrication, clean the unit per previous instruction.

CAUTION

USE LUBRICANT SPARINGLY. WIPE OFF ANY EXCESS THAT MAY FLOW AWAY FROM THE POINTS REQUIRING LUBE. BE SURE THAT OIL OR GREASE DOES NOT GET ON THE RECORDING STYLUS, THE RECORDING BELT OR PULLEYS OR THE TAKE-UP BELTS AND ROLLERS. IF ACCIDENTAL SPILL OCCURS, CLEAN PARTS WITH MILD DETERGENT SOLUTION, RINSE AND DRY THOROUGHLY BEFORE OPERATING.

a. Apply one very small drop of instrument oil on the following.

(1) The paper-drive gear assembly.

(2) The bearings for the recording belt drive pulley and idler pulley.

(3) The takeup roller metal shaft bearings.

b. Sparingly apply light grade at these locations.

(1) The takeup roller worm gear assembly.

(2) The paper-drive assembly - metal shafts only.

4-2 Operator Replaceable Parts

1. Fuse Replacement

The fuse is located inside the unit in the back of the case. See Figure 4-1.

a. Disconnect power or set power switch to OFF.

b. Remove the defective fuse from the fuse holder and replace with new fuse. Use only a 2.0 amp fuse.

CAUTION

OVER FUSING WILL VOID WARRANTY

C. If fuse continues to burn out, a circuit defect is indicated. Have the unit checked and repaired by a qualified technician before operating.

2. Stylus Replacement and Stylus Adjustment (See Figure 4-2)

In normal operation, the stylus life will be approximately 150 hours to 200 hours. Replacement is required when recording marks become intermittent or otherwise erratic. Operate the unit and press the MARK switch and observe the recording marks. This should produce a continuous black line recording from top to bottom on the chart, with no interruptions or skip. If this does not happen, the stylus should be replaced. Proceed as follows.

a. Set power switch to OFF.

b. Open the front cover of the cabinet.

c. Observe the arrow mark on the recording belt. Rotate the belt in the direction of the arrow until the stylus is on top of the belt drive pulley. Do not rotate the belt in opposite direction.

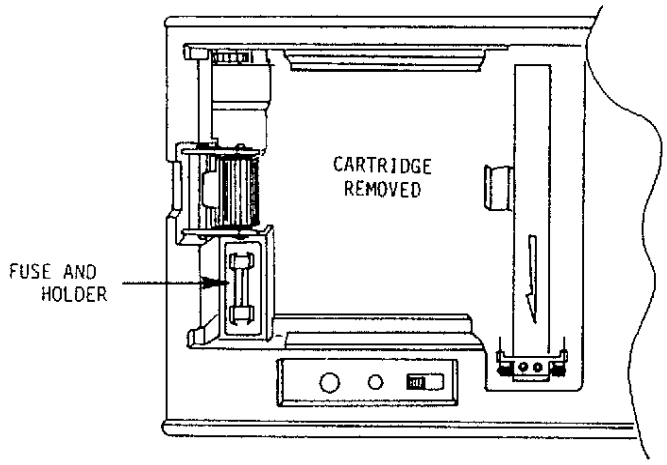


Figure 4-1 Fuse Replacement

d. Remove the defectve stylus from the holder.

(1) Use right hand to prevent the belt from rotating.

(2) Use left hand to disengage the stylus retaining spring from the groove on the stylus holder. Rotate spring CCW from notch. Move stylus assembly toward the left to remove from holder. (or move to right to remove from opposite side.)

e. Install new stylus

(1) Position the stylus assembly as shown in Figure 4-2.

(2) Insert the coiled stylus over the straight pin on the stylus holder - left side or right side.

(3) Engage the stylus spring into the notch on the stylus holder. Be sure it is secure and aligned.

f. Close the front cover and operate the unit.

g. Press the MARK switch and observe the recording marks. This should produce a continuous black line as previously described. If line is not continuous, the stylus may need adjustment.

h. Stylus Adjustment

(1) First, be sure the recording paper is not wrinkled or warped, causing the skip.

(2) Using a tweezer or long nose pliers, carefully bend the stylus a small amount. The lightest pressure on the paper that will produce a black continuous mark is the proper adjustment.

(3) Retest the unit with MARK switch.

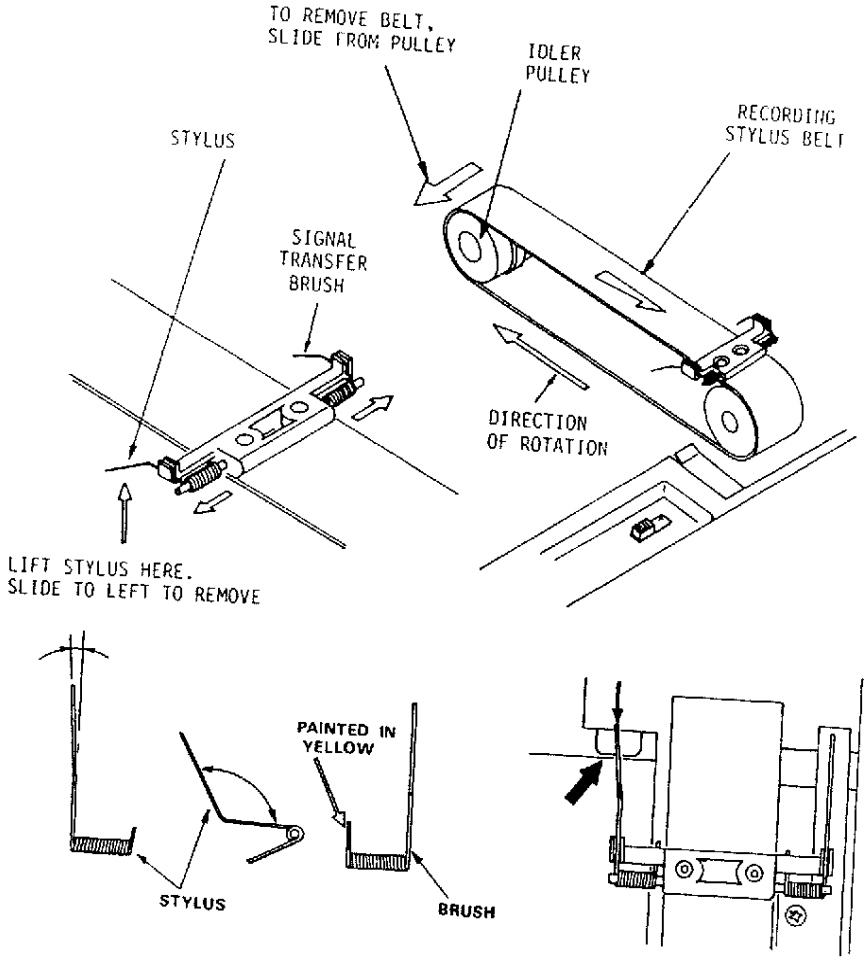


Figure 4-2 Stylus Replacement and Stylus Belt Replacement

3. Replacement of Recording Stylus Belt

   a. Set power switch to OFF.

   b. Remove recording belt.

      (1) Remove the paper transport cartridge.

      (2) Remove the stylus assembly as directed in Paragraph 2 and position the stylus belt as shown in Figure 4-2.

      (3) Remove the belt from the idler pulley by sliding it to the left and off the pulley.

(4) Carefully manipulate the belt into the gap between the idler pulley and remove the belt from the unit.

c. Install new recorder belt.

NOTE

When installing new recording belt, do not stretch the belt any more than necessary to wrap over pulleys.

(1) Manipulate the belt over the drive pulley and into the gap between the recording plate and the pulleys. Exercise cartion to avoid damage to the belt, the magnet and stylus holder.

(2) Install the belt over the idler pulley and rotate the belt several times to be sure the belt and rollers turn freely.

(3) Install stylus assembly as directed in paragraph 2.

(4) Operate and test the unit as directed in paragraph 2.

4-3 Alignment of Transmission Line Zero

1. Operate the unit and observe the recording of the transmission line. The recording line should begin at the zero (0) line on the Range scale.

If alignment is required.

a. Open the front panel.

b. Observe - the Range Scale is retained at the bottom by a slotted screw.

c. Loosen the screw, adjust the scale to the zero transmission line, then tighten the screw.

4-3 Transducer Maintenance

If boating in salt water, protect the transducer with thin coat of antifouling paint. Allow time for the face of the transducer to become wet (coupled intimately to the water) after installation or after returning to the water from storage.

Clearn the face of the transducer with a mild detergent or soap pad if the transducer's "vision" becomes obstructed, which may happen through constant exposure to the oily waters of a marina. Oil will act as an insulator and cause the face to become decoupled from the water or unwetted. Cleaning will restore the signal transmitting and receiving characteristics.

If the instrument fails to function, check all transducer electrical connections before calling a serviceman.

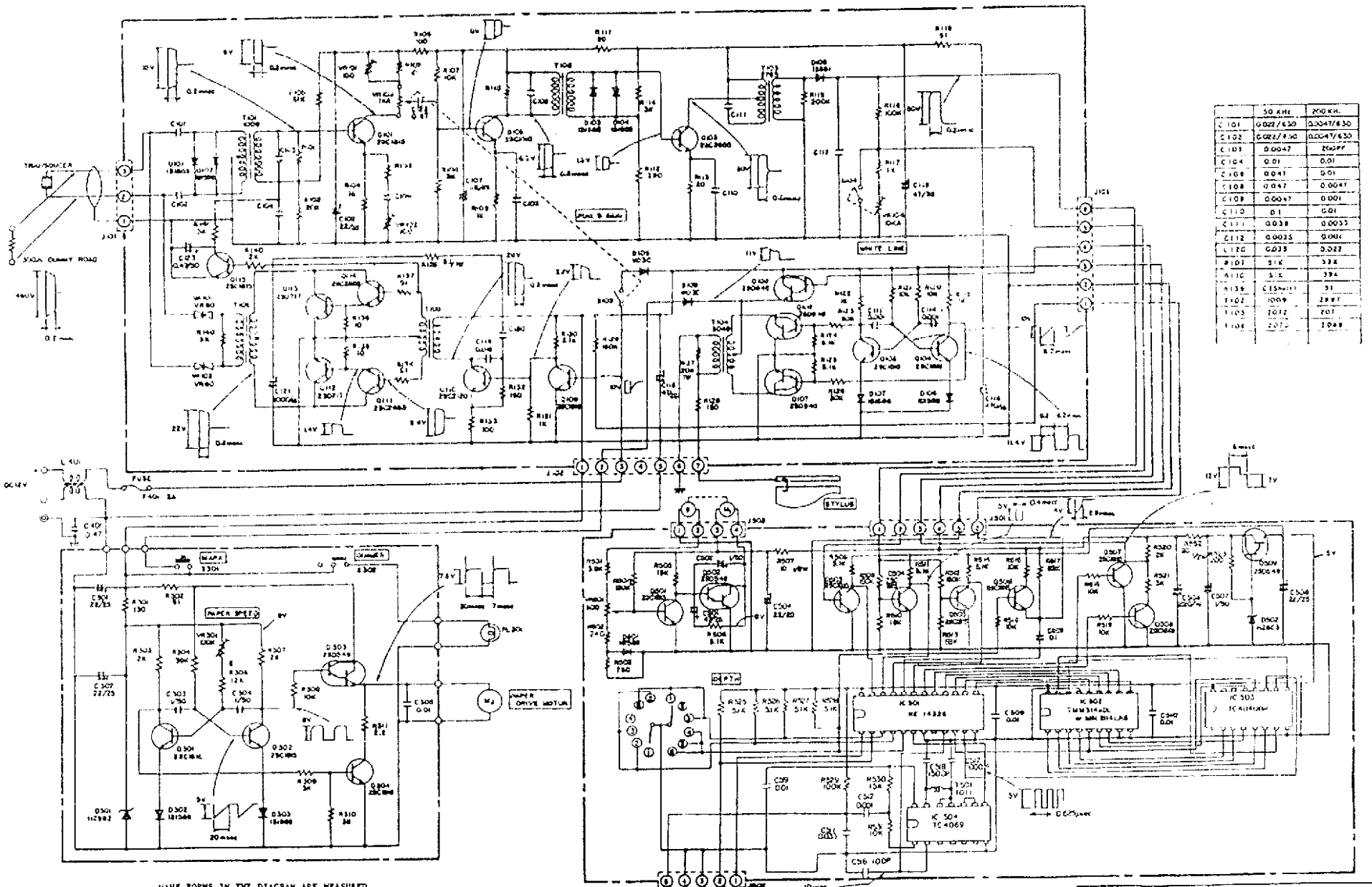
Do not coat the face of the transducer with heavily-pigmented antifouling paints, especially those filled with cuprous oxide, because they reduce the sensitivity or "vision" of the transducer.

TROUBLE SHOOTING CHART

CONDITION	TROUBLE SYMPTOMS	POSSIBLE CAUSES	REMEDY PROCEDURE
Power ON	Stylus belt does not turn Stylus motor does not run Paper drive motor does not run	Defective power source Defective power cable Defective fuse	Correct power supply Repair or replace cable Replace fuse
	Stylus motor runs, belt turns but recording paper does not move	Recording paper improperly installed Broken wires Defective drive motor Defective motor speed control circuit Defective gear assembly	Follow paper installation procedures Repair as required Shop service required
	Paper drive works properly Stylus motor does not run	Defective motor Broken wires	Shop service required Repair as required
Power ON Both motors run, paper moves, stylus belt rotates	No recordings on chart Test recording with MARK switch. Observe results 1. No marks on paper	Defective stylus assembly Grounding roller assembly not contacting chart paper Broken ground wire Defective Recording circuits	Replace stylus assembly Front cover not closed. Adjust roller assembly Repair wire Shop service required
	2. Good marks on paper	Density or Receiving circuits	Shop service required
	No recordings on chart MARK switch produces good recording	No transmission pulses Magnet missing from recording belt, defective reed switch	Replace magnet or reed switch if required
		Defective transmission circuits or trigger circuits	Shop service required
		Defective Receiver or control circuits	Shop service required

TROUBLE SHOOTING CHART (cont)			
CONDITION	TROUBLE SYMPTOMS	POSSIBLE CAUSES	REMEDY PROCEDURE
Power ON Both motors run, paper moves, stylus belt rotates	Transmission line marks but no echo recordings	Transducer not in contact with water. Defective transducer or transducer connection Defective Receiver circuits or control circuits Gain control not set properly	Adjust position of transducer Repair or replace as required Shop service required Increase GAIN
	Transmission line marks but all echoes are Black line markings	Density control not set properly for Gray tone or defective components in Receiver or Density circuits	Shop service required
	Transmission line marks but no WHITE LINE control 1. Control set maximum 2. No WHITE LINE control for bottom echoes	Defective switch or WHITE LINE control circuits. WHITE LINE control not set. Defective WHITE LINE control circuits	Shop service required Adjust as required Shop service required
Unit operates normally when engine is OFF	When engine is running, Black and Gray marks are recorded at random locations or over the length of the chart	Clean Echo switch is not ON Defective C.E. Circuit Interference too great to surpress with C.E.	Operate switch ON Shop service required Refer to section on interference surpression

TROUBLE SHOOTING CHART (cont)			
CONDITION	TROUBLE SYMPTOMS	POSSIBLE CAUSES	REMEDY PROCEDURE
Unit operates normally when boat is still, engine running	Echoes and/or bottom lines are not recorded when boat is moving and when boat is in reverse	Insufficient GAIN setting Transducer is not in contact with water Excessive turbulence, white water under transducer	Adjust as required Adjust position of transducer or relocate transducer out of turbulence
	Echoes and/or bottom lines are recorded when boat is moving over waves, over the wake of another boat or at faster speed	Transducer looses contact with the water or too much turbulence and white water under the transducer.	Readjust position of transducer to remain in water and out of the turbulence and white water
Unit operates normally	MARK switch operated, no mark recorded	Defective MARK switch or Mark control circuits	Shop service required
	SPEED control set or varied, paper does not change speed	Defective SPEED control or speed control circuits	Shop service required



	50 KHz	200 KHz
C101	0.022/630	0.0047/630
C102	0.022/630	0.0047/630
C103	0.0047	2200PF
C104	0.01	0.01
C105	0.01	0.01
C106	0.047	0.0047
C109	0.0047	0.001
C110	0.1	0.01
C111	0.039	0.0033
C112	0.0035	0.001
C120	0.033	0.022
R101	51K	33K
R110	5.1K	39K
R134	0.15K/1/2	51
T102	1009	2881
T105	T072	207
T106	2072	2068

WAVE FORMS IN THE DIAGRAM ARE MEASURED THE FOLLOWING CONDITIONS;

- GAIN = 10
- DEPTH = 1
- WHITE LINE = OFF
- PAPER SPEED = MAX.

NOTE: 300Ω DUMMY ROAD IS REQUIRED.

NOTE: Unless otherwise specified, resistance values are in ohms, ¼w and capacitance values are in microfarads.
Part of circuit or semiconductors is subject to change as a result of improvement in design and techniques.

DRAWN		HE-356 FISH FINDER
CHECKED		RECORDER SCHEMATIC DIAGRAM
OBSERVED		DATE July 1 1982 DRAWING NO. HF-1472905
APPROVED		