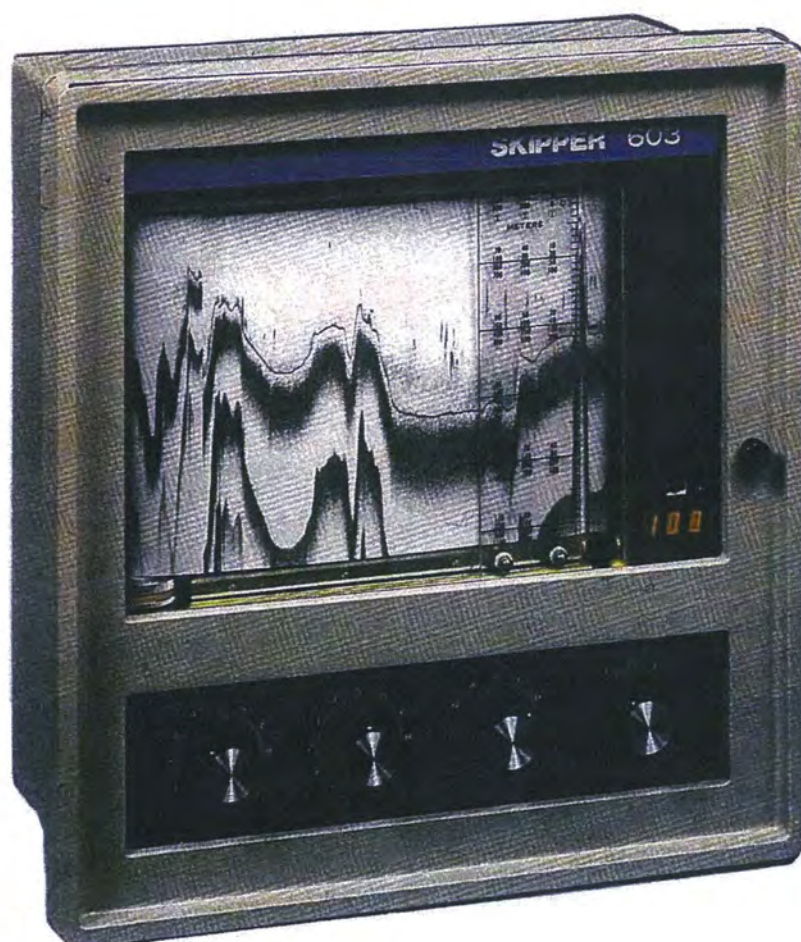


SKIPPER 603 Echosounder

OPERATORS MANUAL INSTALLATION OPERATION MAINTENANCE

EDITION T 5045 E



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SKIPPER

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1. Transducer Installation

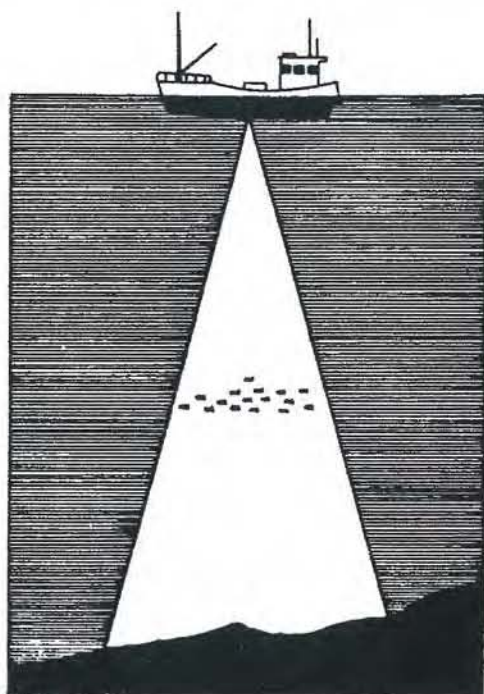
The SKIPPER 603 is supplied with either a wide beam ceramic transducer (Model TMM-60-50-10LA) or a narrow beam ferrite transducer (Model XGM-PI-50X4/2). This part of the manual shows the transducers equipped with housings for through-wooden hull installation. For steel-hulled vessels, special steel blisters are available, and drawings suggesting typical installations will be furnished upon request.

The installation should be planned in advance, taking into consideration the standard cable lengths supplied with each transducer. The wide beam ceramic transducer has a cable length of 10 meters (32 feet); the narrow beam ferrite unit 12 meters (39 feet). In cases where the standard cable length is not long enough, an additional 10 meters (32 feet) may be connected without it being necessary to re-tune the transmitter. The cable used should be of the same type as the standard cable.

Fig. 1 - 1
TRANSDUCER BEAM WIDTHS

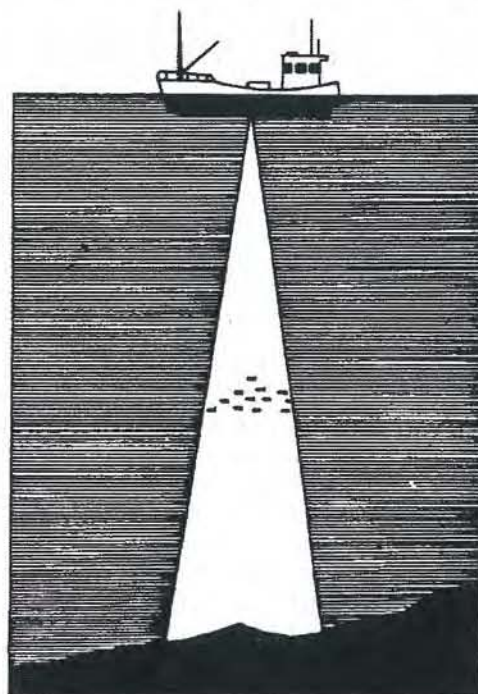
WIDE BEAM CERAMIC TRANSDUCER

33° CONICAL



NARROW BEAM FERRITE TRANSDUCER

19° ATHWARTSHIPS X 19° ALONGSHIPS

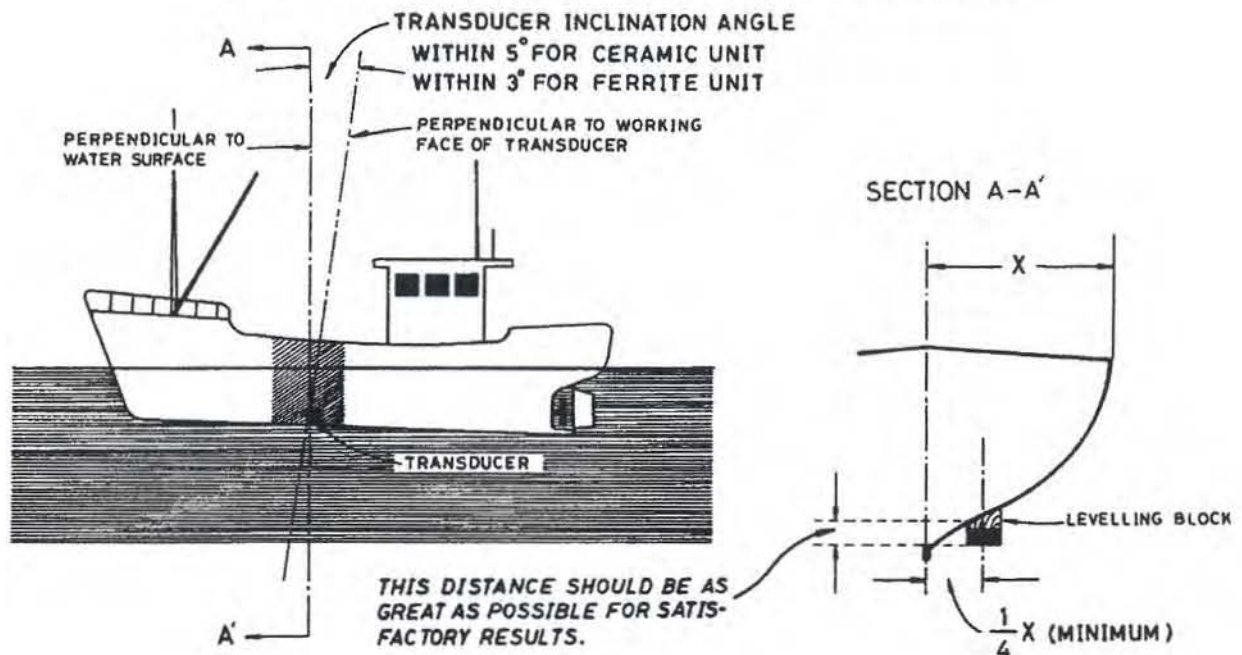


Location

Air bubbles and turbulence caused by the vessel's movement will seriously degrade the sounding capability of the transducer. The transducer should, therefore, be located well clear of any water intake or discharge line and also any projection along the hull that might disturb the smooth flow of water in the vicinity. Noise from the propellers will also adversely affect the performance, and it should not be mounted near the stern. On deep-keeled vessels, care must be taken to ensure that the transducer beam will not be blocked by a part of the keel.

Although the appropriate mounting location which meets the above requirements depends on the type of vessel and operating speeds, a practical choice will be somewhere between $\frac{1}{3}$ and $\frac{1}{2}$ of the vessel's length from the bow. In order to minimize the propeller noise, it is recommended that the transducer be mounted so that its working face is inclined towards the fore within 5 degrees of vertical for the wide beam unit or 3 degrees of vertical for the narrow beam unit. Levelling blocks should be designed to meet this requirement.

Fig. 1-2
RECOMMENDED TRANSDUCER MOUNTING LOCATION



NOTE : The more the transducer protrudes from the hull, the better the results will be.

WARNING : The transducer must always remain submerged, even when the vessel is heeled in one particular way. Operation with the transducer exposed to air will result serious damage to it.

A typical through-hull installation is illustrated in the following pages for each type. The levelling blocks are to be supplied by the dockyard. Any gaps between the block and the housing should be filled up with mastic, and the entire surface be made as smooth as possible to provide an undisturbed flow of water over the transducer working face.

Before mounting the transducer or the stuffing tube, apply a sufficient amount of high quality sealing compound inside the mounting holes and around the threads of the tube and bolts to ensure water-tight installation.

Fig. 1 - 3
TYPICAL THROUGH-WOODEN HULL INSTALLATION
FOR MODEL TMM-60-50-10LA

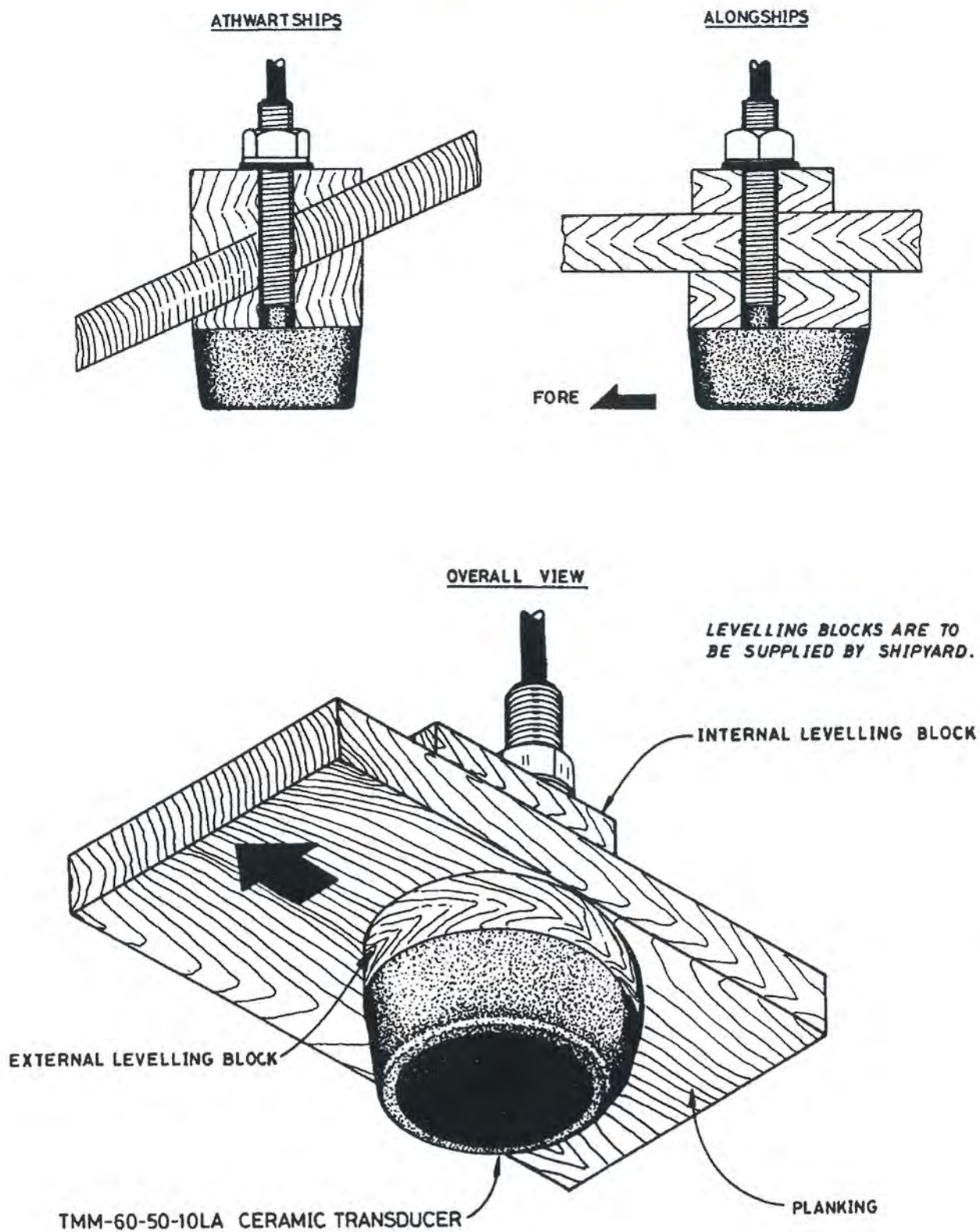
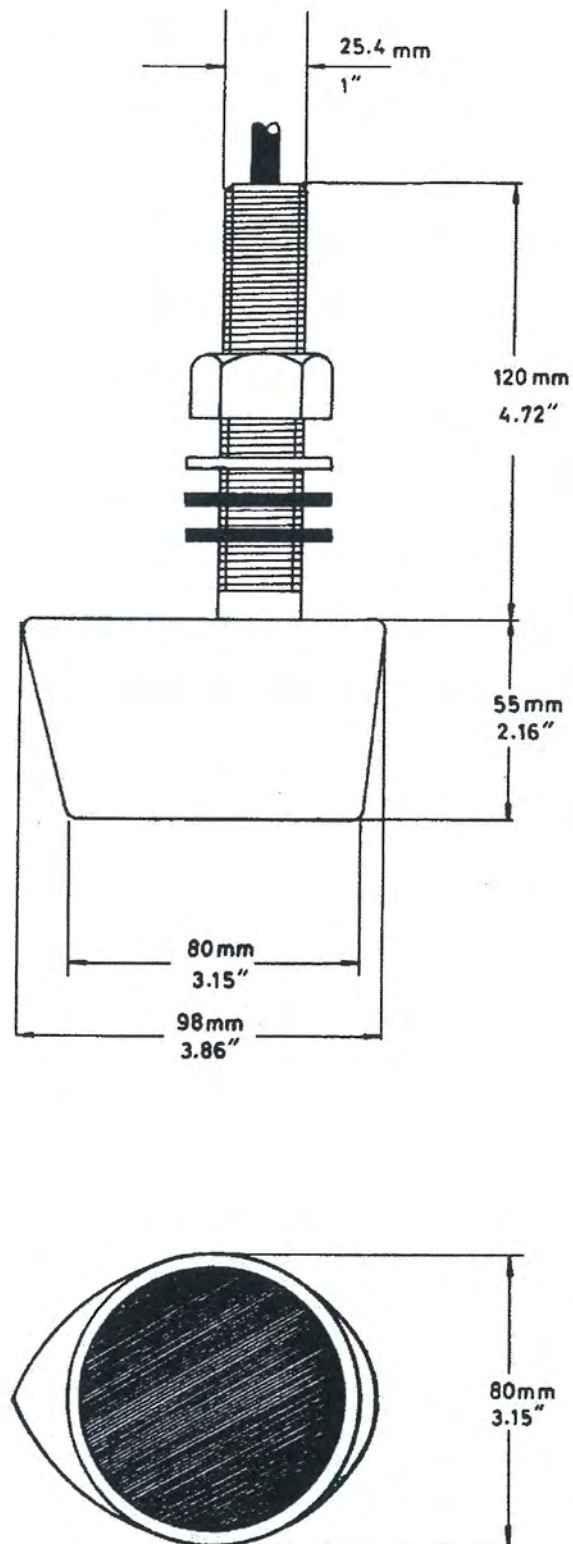
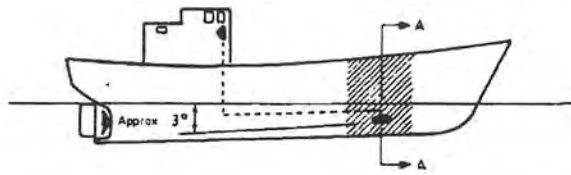


Fig. 1-4
CERAMIC TRANSDUCER DIMENSIONS

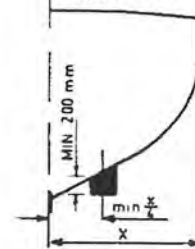
MODEL TMM-60-50-10LA



RECOMMENDED LOCATION OF
TRANSDUCER.
ANBEFALT PLASSERING AV
SVINGER.



SECTION A-A
SNITT A-A



NB! DO NOT LIFT THE TRANSDUCER
BY ITS CABLE

NB! SVINGEREN MÅ IKKE LØFTES
I KABLEN.

AIR OUTLET
LUFTEHULL

STEEL FAIRING, TO BE
MADE BY SHIPYARD.
STÅLFORING, LAGES
AV VERFT.

CERAMIC TRANSDUCER
KERAMISK SVINGER

PLUG

SAND FILLING
PÅFYLLING AV SAND

ABOVE WATER LINE
OVER VANNLINJE

FUEL OIL TANK, LUB. OIL TANK OR
WATER BALLAST TANK.
BRENNOLJETANK, SMØREOLJE-
TANK ELLER VANNBALLASTTANK.

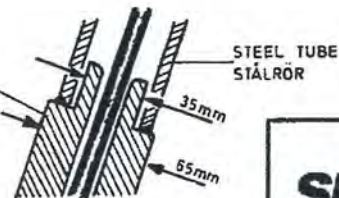
STEEL TUBE, MIN. 35 mm INSIDE DIAM.
WALL THICKNESS, MIN. 6mm (IF GALVANIZED 4,5mm)
TO BE FILLED WITH SAND AFTER HAVING PULLED THE CABLE AND TIGHTENED
THE PACKING NIPPLE.

STÅLRÖR, MIN. 35mm INNVENDIG DIAM.
MIN VEGGTYKKELSE 6mm (HVIS GALVANISERT 4,5mm)
RÖRET FYLLES MED SAND ETTER AT KABLEN ER TRUKKET OG PAKKNIPPELEN
ER TILSTRAMMET

* STUFFING TUBE
KABELGJENNOMFØRING

* WASHERS
SKIVER
* PACKING NIPPLE
PAKKNIPPEL

* RUBBER GASKET
GUMMIPAKNING



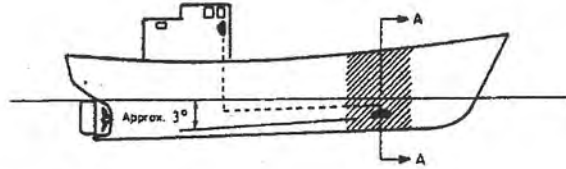
SKIPPER

* INST. KIT NO. 499-037763.0

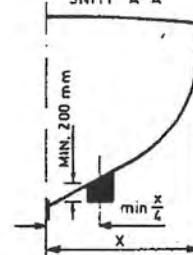
MOUNTING OF CERAMIC TRANSDUCERS ON STEEL VESSELS.
TRANSDUCER TYPES: 38 E-9-18 S1, 50 E-8-18 S1,
38-22 F, 38-22 F(T), 49-24 F, 49-24 F(T).

RECOMMENDED LOCATION OF
TRANSDUCER.

ANBEFALT PLASSERING AV
SVINGER.



SECTION A-A
SNITT A-A



NB! DO NOT LIFT THE TRANSDUCER
BY IT'S CABLE

NB! SVINGEREN MÅ IKKE LÖFTES I KABELN.

TARRED FELT
TJÆREFILT

WOODEN FAIRING, TO BE MADE BY SHIPYARD
TREFORING, LAGES AV VERFT

CHISEL A GROOVE IN THE FAIRING TO PREVENT THE CABLE FROM
BEING JAMMED BETWEEN THE TRANSDUCER AND THE FAIRING.

LAG ET SPOR I FORINGEN SLIK AT KABELN IKKE KOMMER I KLEM
MELLOM SVINGEREN OG FORINGEN.

WASHER
SKIVE

CERAMIC TRANSDUCER
KERAMISK SVINGER

ISOPORE PLUG
ISOPOR PLUGG

PACKING NIPPLE
PAKKNIPPEL

RUBBER GASKET
GUMMIPAKNING

CABLE PROTECTING PIPE
IF REQUIRED.
BESKYTTELSESRØR FOR
SVINGERKABEL HVIS
NÖDVENDIG.

WASHERS
SKIVER

RUBBER
GASKET
GUMMI
PAKNING

WASHER
SKIVE

STUFFING TUBE, TO BE
CUT TO REQUIRED LENGTH.
GJENNOMFØRINGSFLENS,
KUTTES TIL PASSENDE
LENGDE.

LONG STUFFING TUBE 119-040564 7

LANG GJENNOMFØRINGSFLENS 119-040564 7

SKIPPER

MOUNTING OF CERAMIC TRANSDUCERS ON WOODEN VESSELS.
TRANSDUCER TYPES: 38 E-9-18 S1, 50 E-8-18 S1,
38-22 F, 38-22 F(T), 49-24 F, 49-24 F(T).

Fig. 1 - 5
ASSEMBLING MODEL XGM-PI-50-4/2 FERRITE TRANSDUCER
FOR THROUGH-WOODEN HULL INSTALLATION

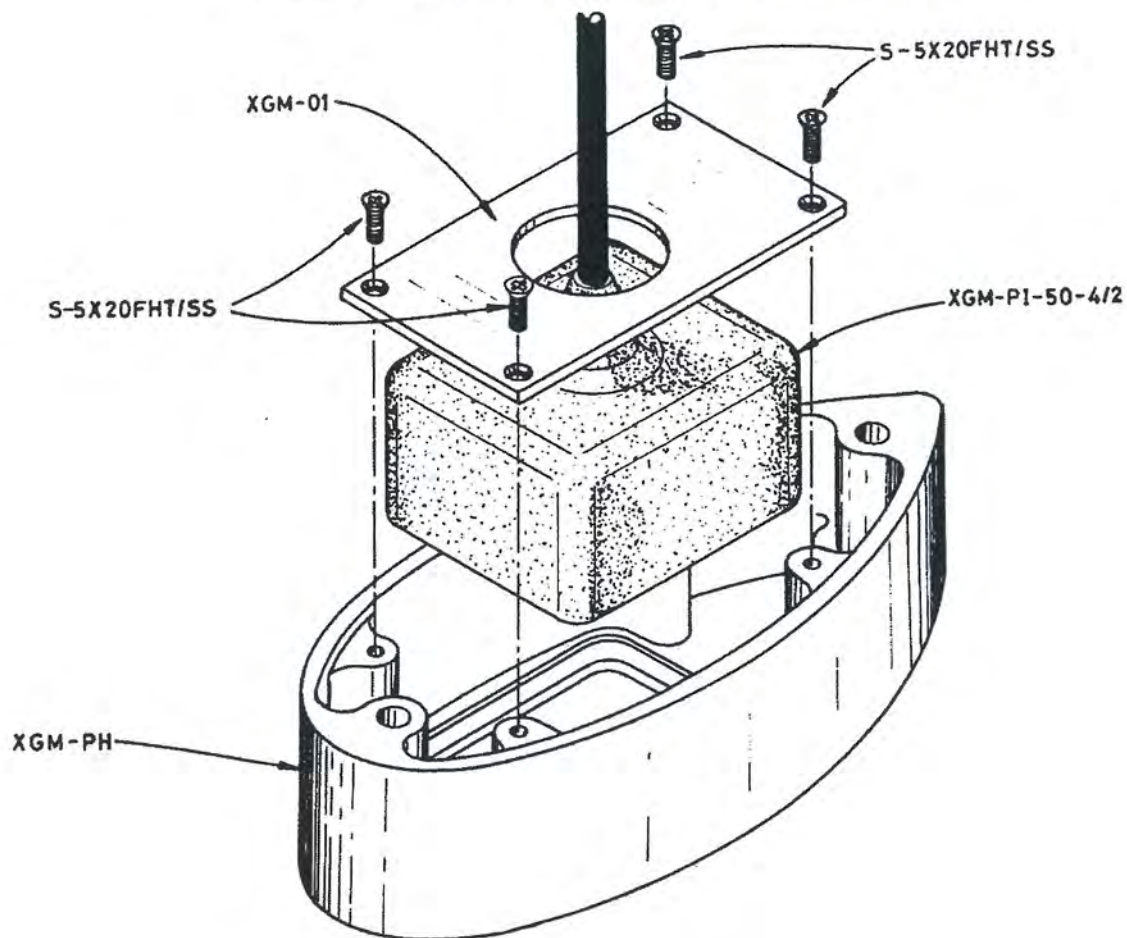


Fig. 1 - 6
TYPICAL THROUGH-WOODEN HULL INSTALLATION
FOR MODEL XGM-PI-50X4/2

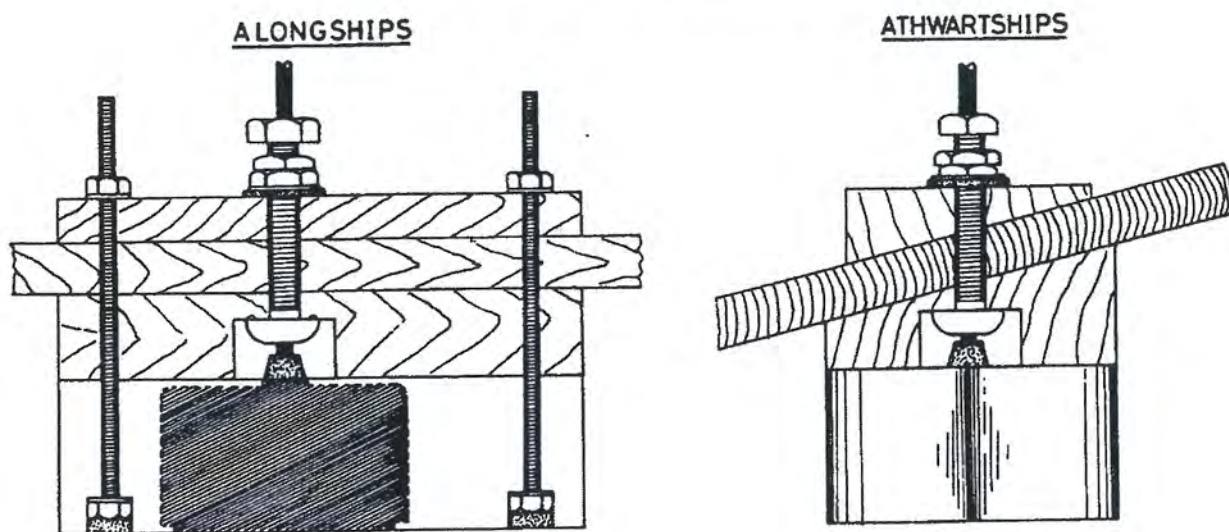


Fig. 1-7
THROUGH-WOODEN HULL INSTALLATION - DETAIL
FOR MODEL XGM-PI-50X4/2

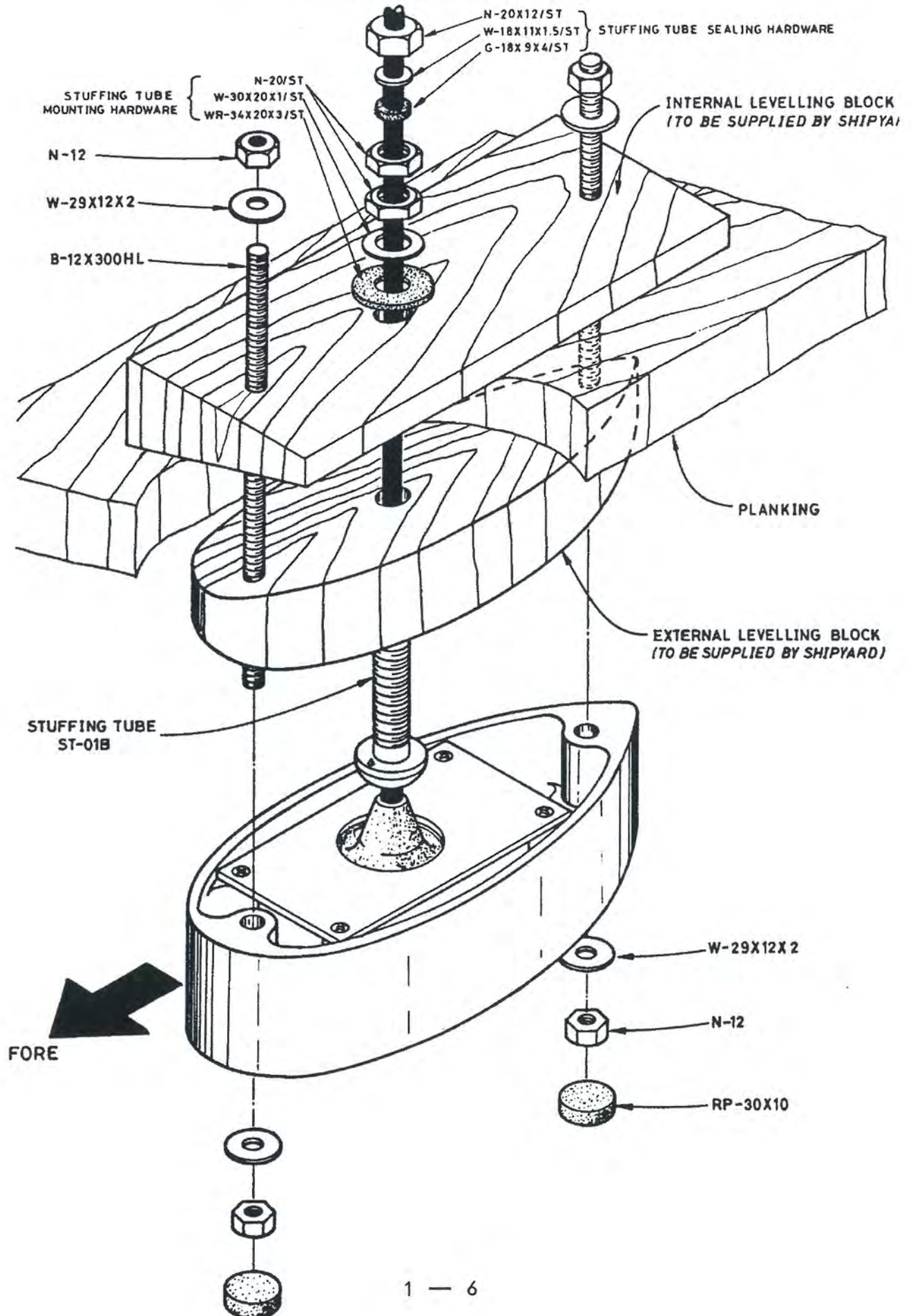


Fig. 1 - 8
ST-01B STUFFING TUBE DIMENSIONS

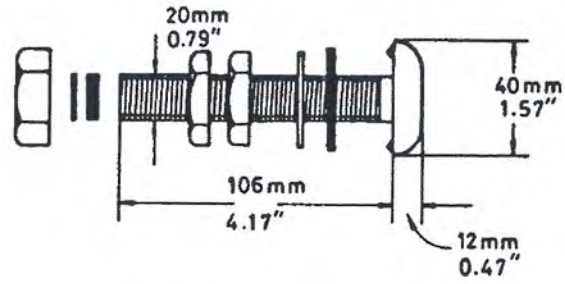


Fig. 1 - 9
XGM-PH PLASTIC HOUSING MOUNTING BOLT DIMENSIONS

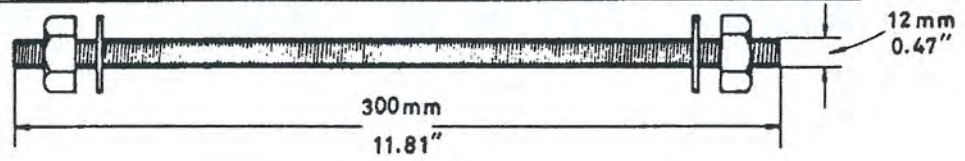
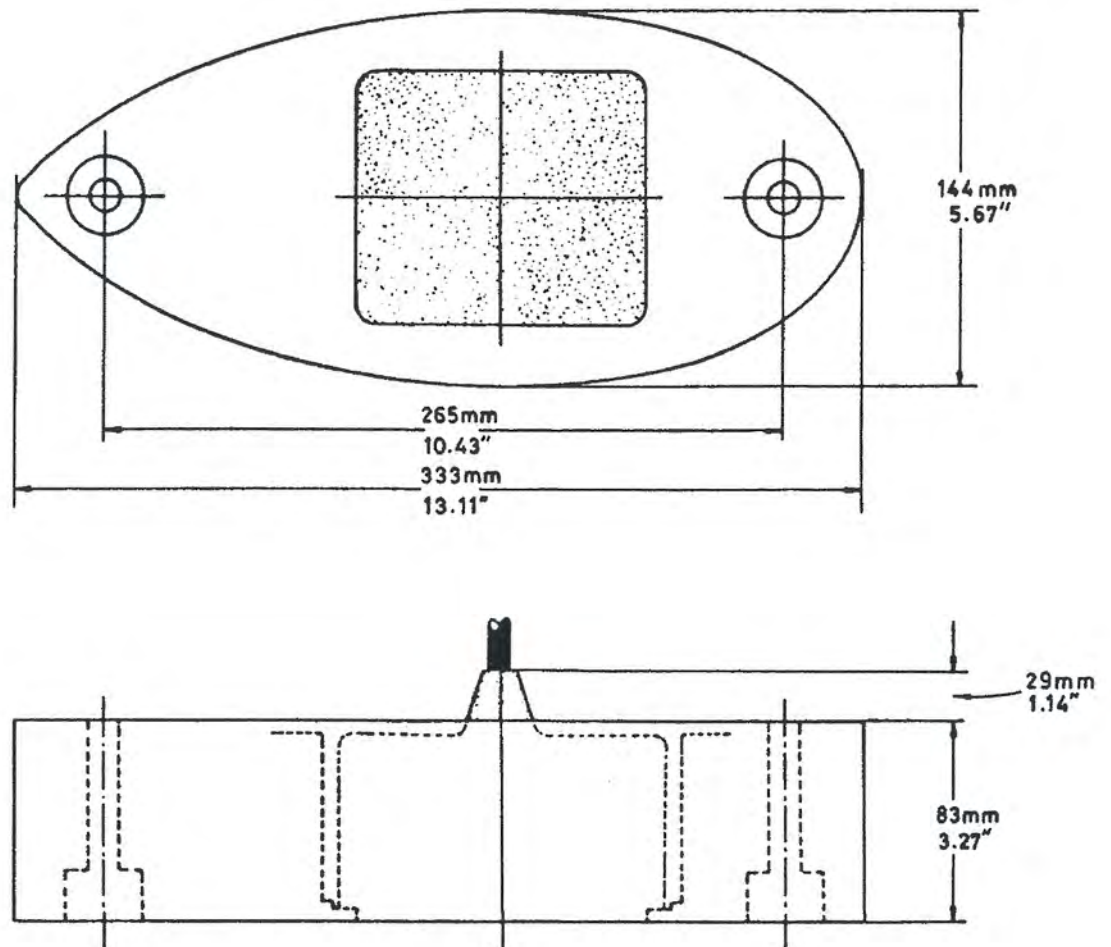


Fig. 1 - 10
MODEL XGM-PH PLASTIC HOUSING DIMENSIONS



2. Gaining Access to The Interior

In order to install the SKIPPER 603 recorder and make connections it is necessary to open the recorder cabinet and gain access to the mounting holes, terminal board and selector switches. This can be accomplished easily by following the procedures illustrated in Figs. 2-1 through 2-6.

WARNING : In Fig. 2-2, the front cabinet must be fully opened, and the scanning belt be manually turned in the downward direction till the recording stylus disappears into the inside of the main (rear) cabinet, before swinging down the recording platform. DAMAGE TO THE STYLUS WILL RESULT IF THE RECORDING PLATFORM IS OPENED WITH THE STYLUS OVER IT. This precaution must be observed whenever opening the recording platform for chart loading, routine maintenance, or servicing.

In Fig. 2-4, care should be taken not to lose the main chassis locking screw and spring washer after removal.

Refer to Fig. 2-6, before lowering the main chassis, the recording platform must be pushed back into the main chassis and locked in place so as to avoid possible damage to the platform by hitting against the bulkhead, floor or other nearby objects.

Fig. 2-1
GAINING ACCESS TO INTERIOR - STEP 1

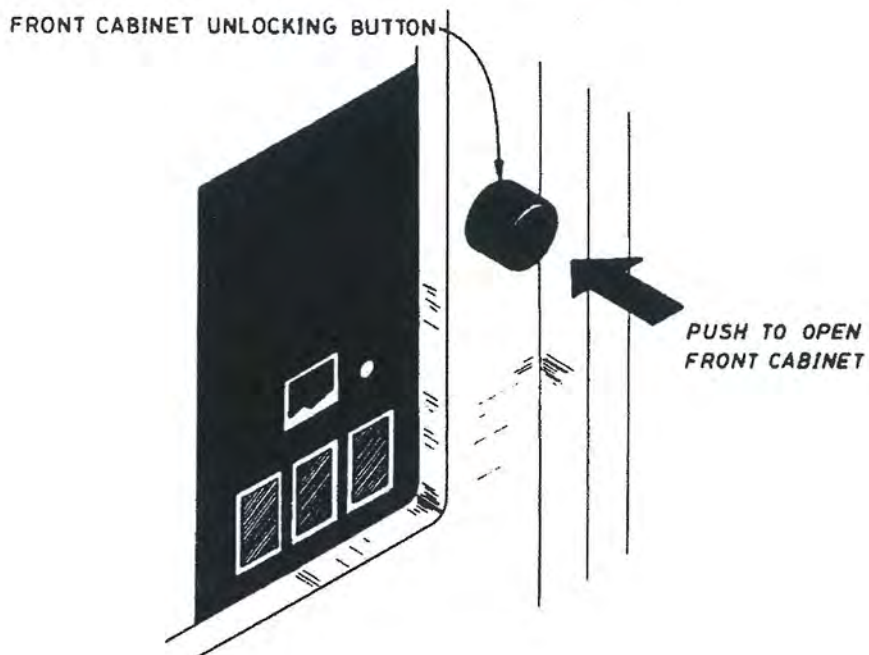


Fig. 2-2
GAINING ACCESS TO INTERIOR - STEP 2

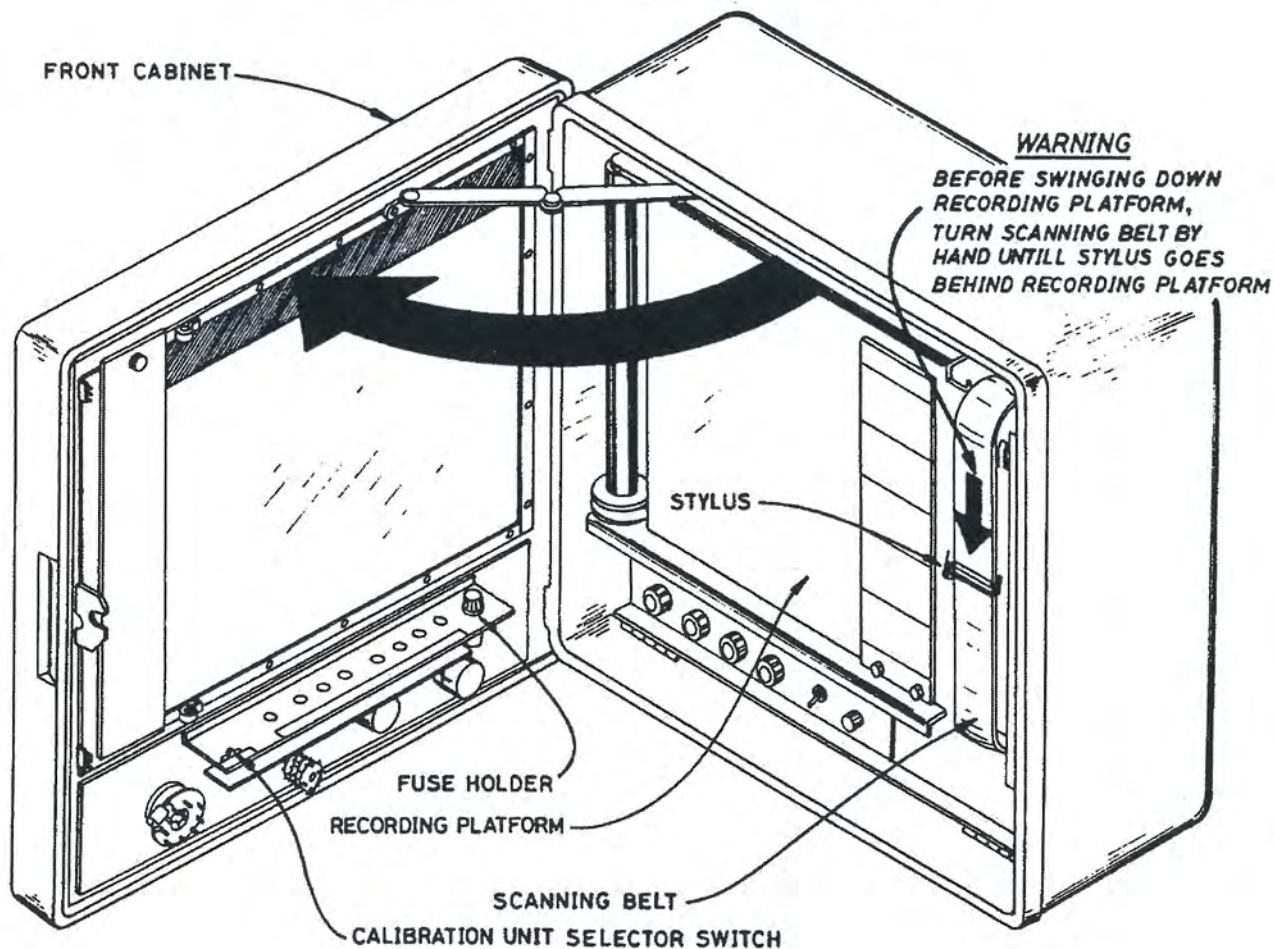


Fig. 2-3
GAINING ACCESS TO INTERIOR - STEP 3

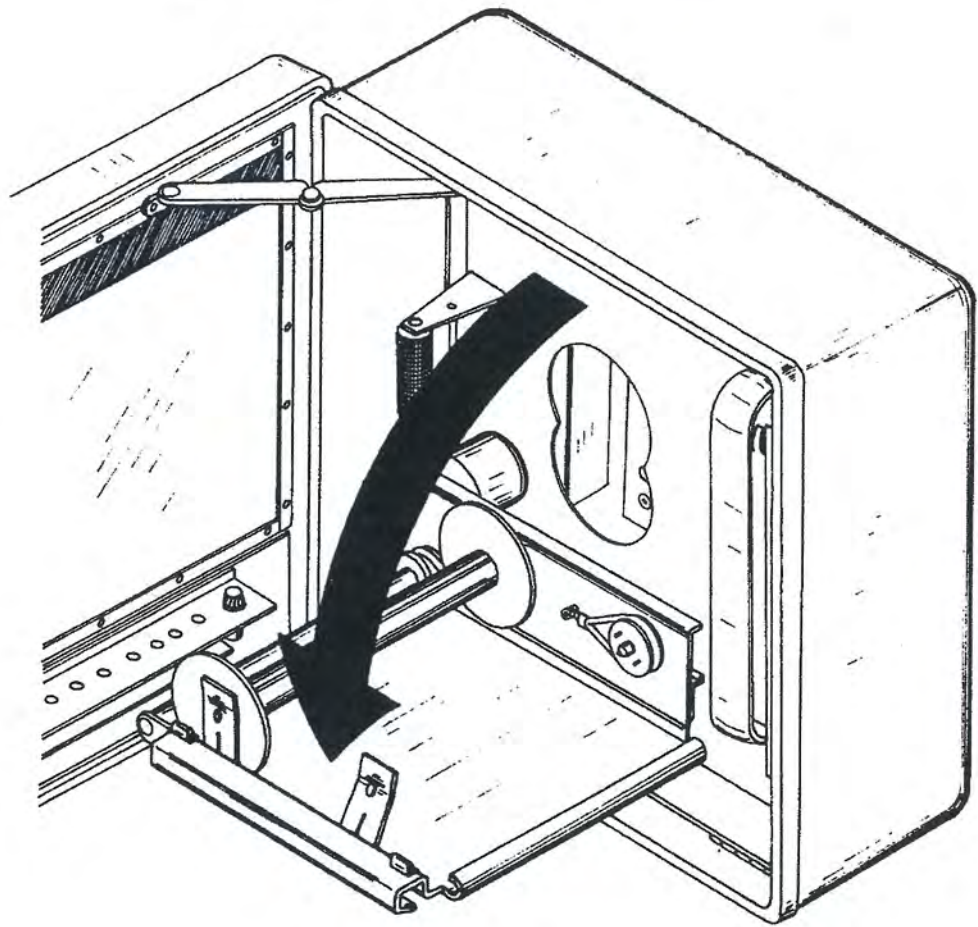


Fig. 2-4
GAINING ACCESS TO INTERIOR - STEP 4

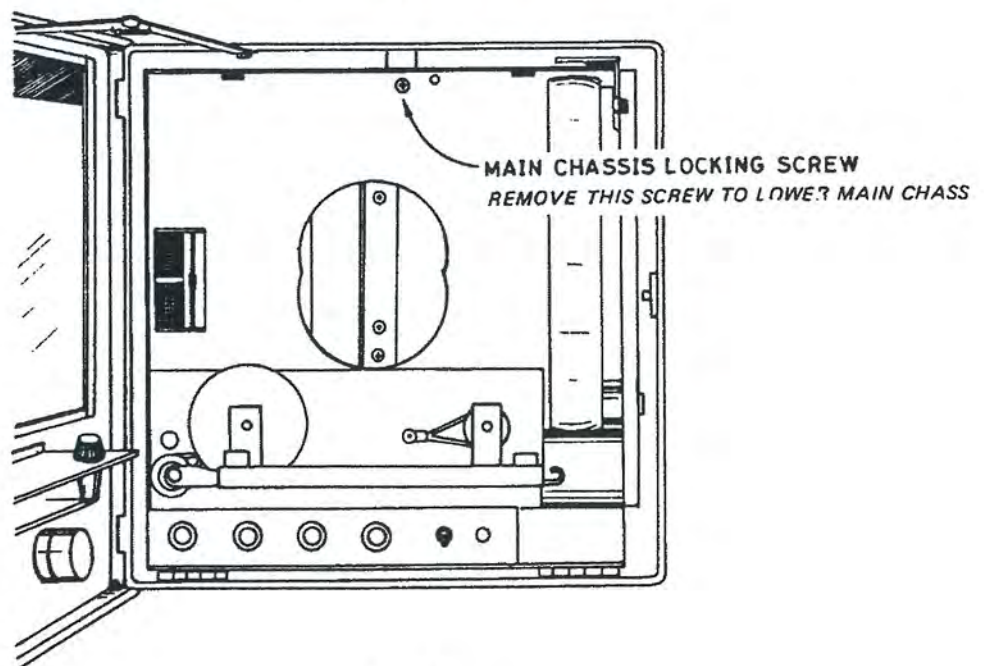


Fig. 2 - 5
GAINING ACCESS TO INTERIOR - STEP 5

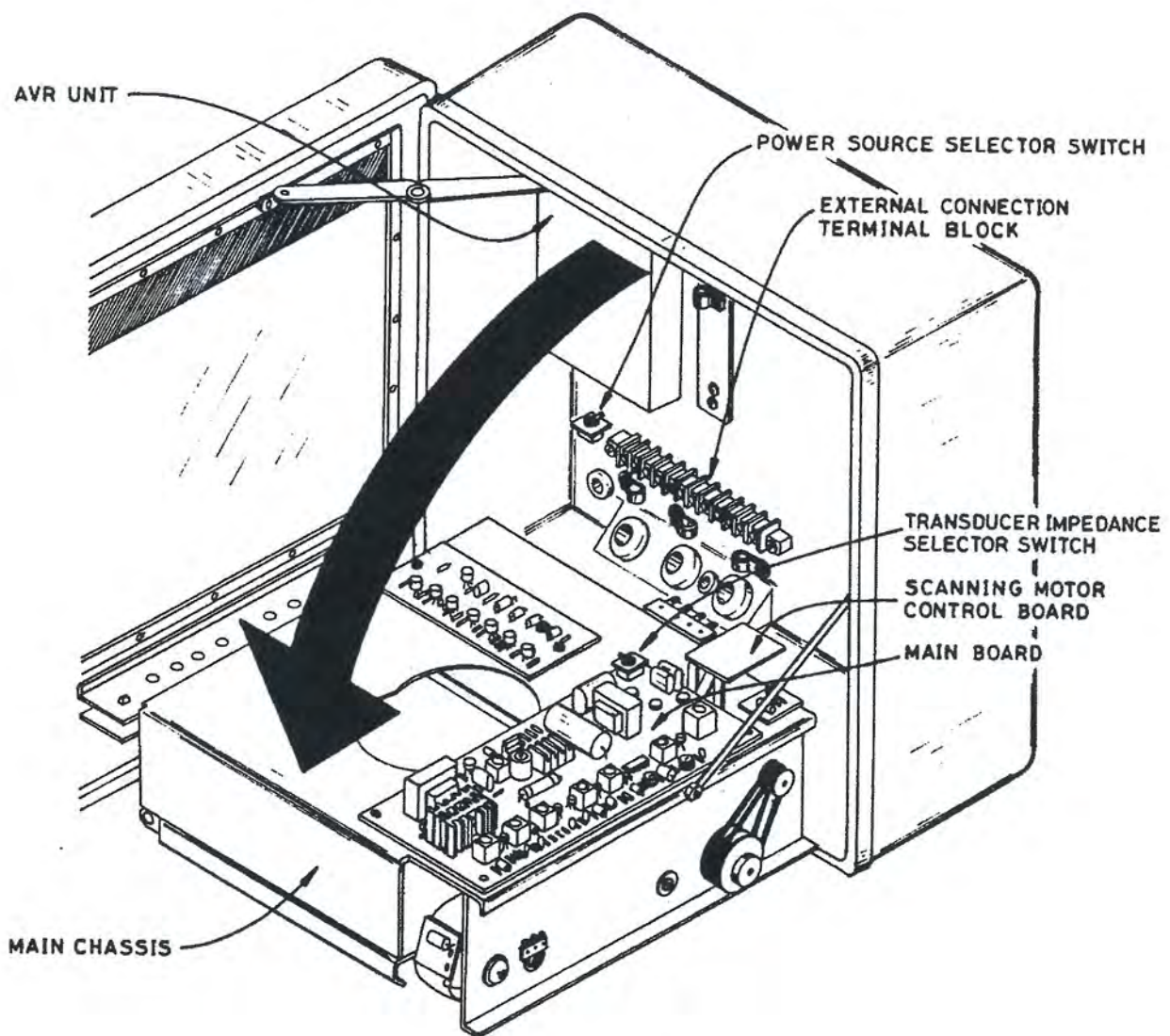
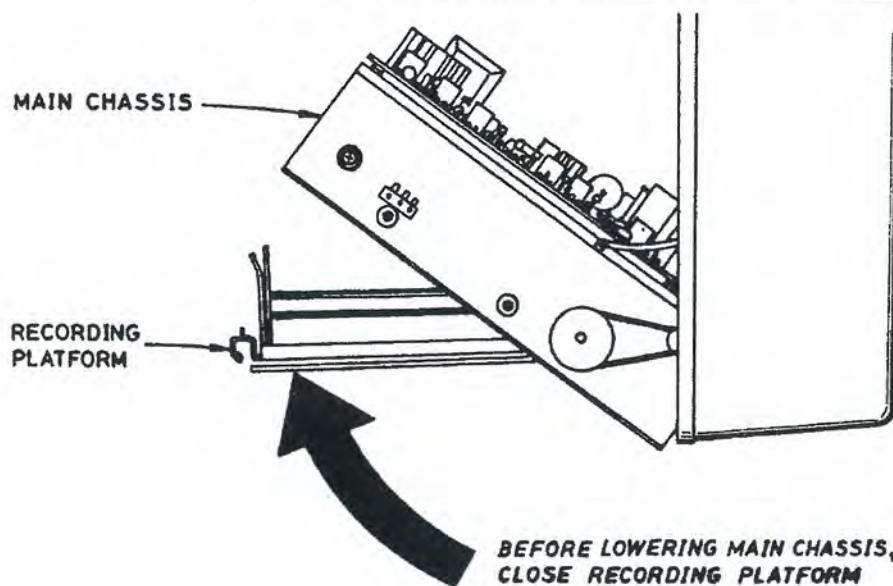


Fig. 2 - 6
GAINING ACCESS TO INTERIOR - STEP 6



3. Recorder Installation

Location

The SKIPPER 603 recorder is designed to operate normally on a continuous basis in the exacting marine environment. Nevertheless it is a sophisticated piece of electronic equipment, and should, therefore, be mounted in a dry and ventilated location in the interest of long term equipment reliability. For the same reason, areas where heavy shocks or vibrations are present or where extremely high temperatures prevail must be avoided.

The standard length of the transducer cable and power cable (6 meters or 19.7 feet) must, of course, be taken into consideration when choosing the site.

Bulkhead Mounting

The SKIPPER 603 is supplied with a bulkhead mounting kit as standard equipment. The kit consists of three threaded studs (B-8X80HL), six nuts and flat washers. The stud dimensions are 8 millimeters (0.31") in diameter, and 80 millimeters (3.1") in length. Fig. 3-1 shows the dimensions necessary for this type of installation. Using the mounting kit, install the recorder as illustrated.

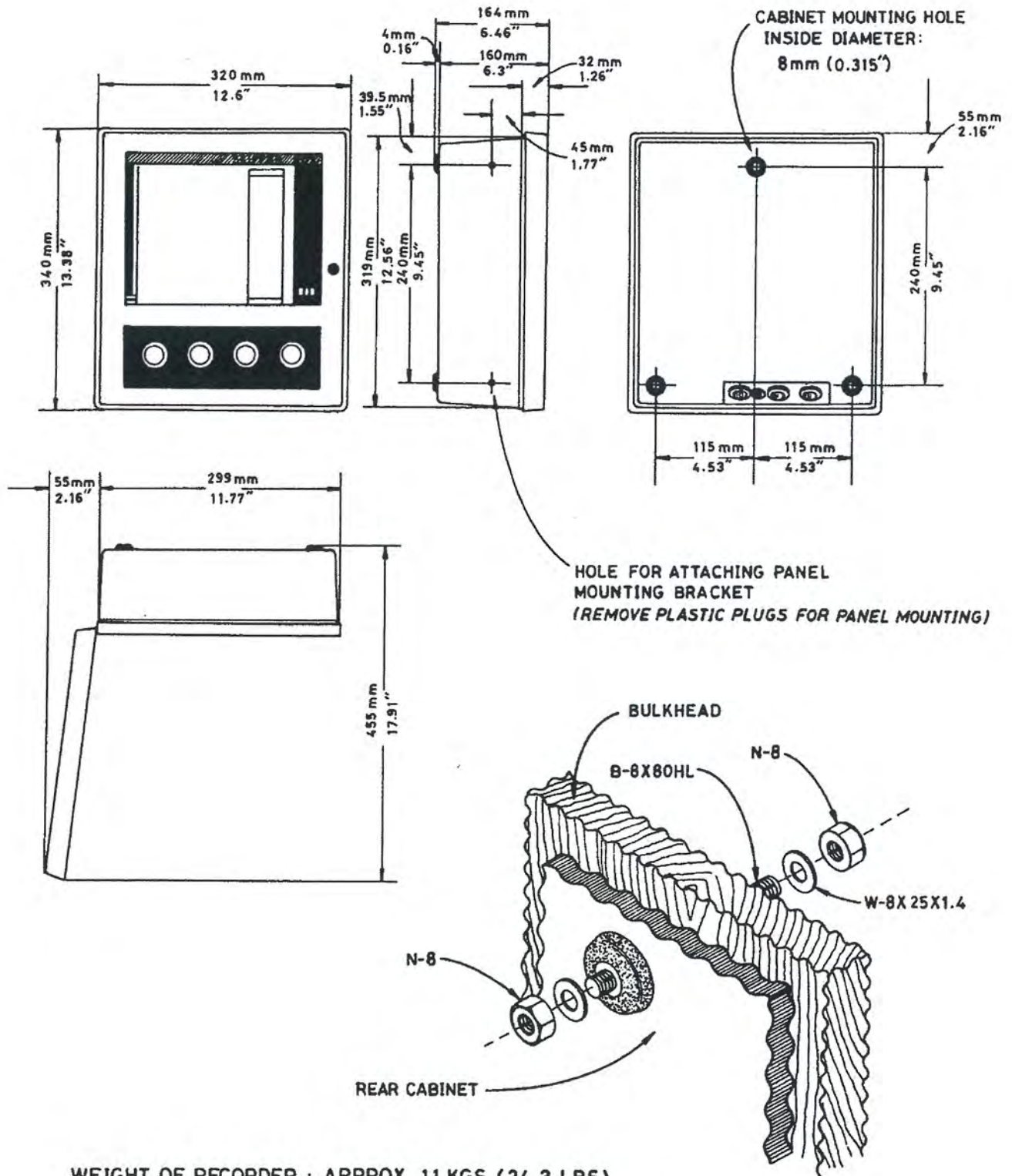
Panel Mounting (Optional)

It is possible to panel-mount the SKIPPER 603 recorder, and a kit of mounting hardware is available. It consists of two brackets, four bolts, flat washers, spring washers and nuts. Fig. 3-2 shows the panel opening dimensions, the method of attaching the brackets to the cabinet and securing the unit to the panel. The wood screws shown in the figure are not furnished. The screw size should be determined on the basis of the panel thickness and the bracket's mounting hole diameter (6.2 millimeters or 0.24").

The bracket is designed to accept a panel thickness of 15 to 30 millimeters (0.59" to 1.18"). However, before attempting to install, make sure that the panel is strong enough to support the cabinet (approx. 11 kilograms or 24.3 pounds with a standard chart roll fitted) under the conditions of continued vibration or shock which will be normally encountered on the vessel. If necessary, appropriate reinforcement measures should be taken.

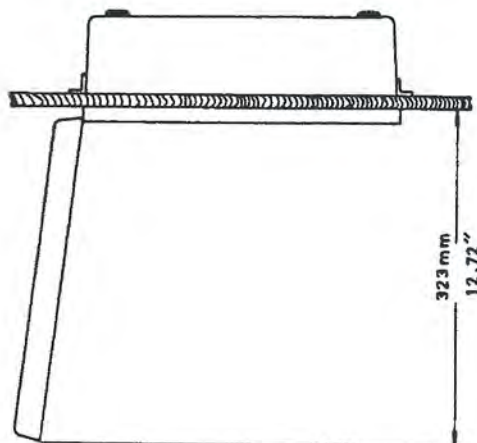
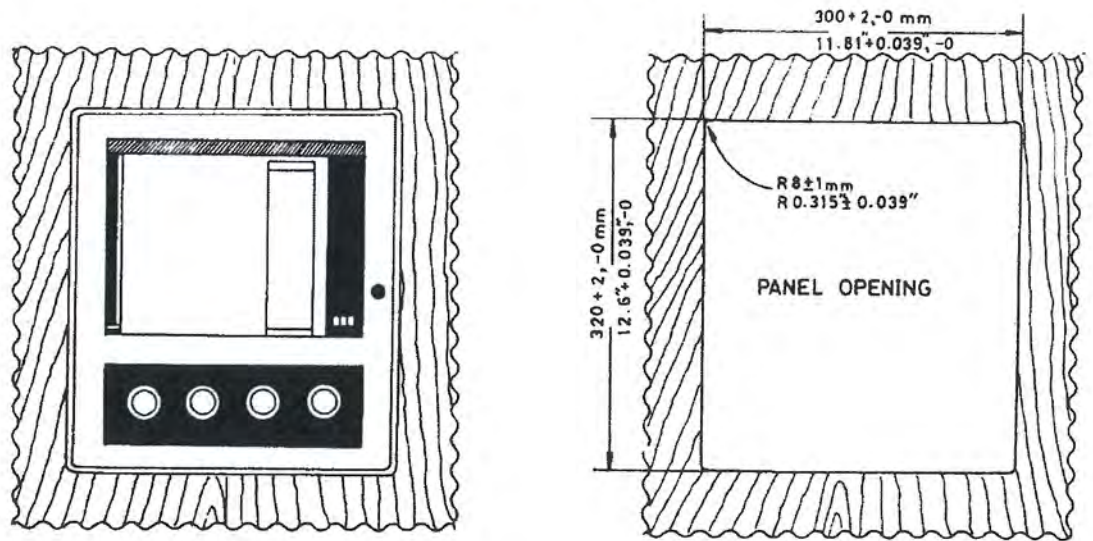
Fig. 3-3 shows the panel mounting bracket dimensions.

Fig. 3 - 1
RECORDER INSTALLATION
BULKHEAD MOUNTING

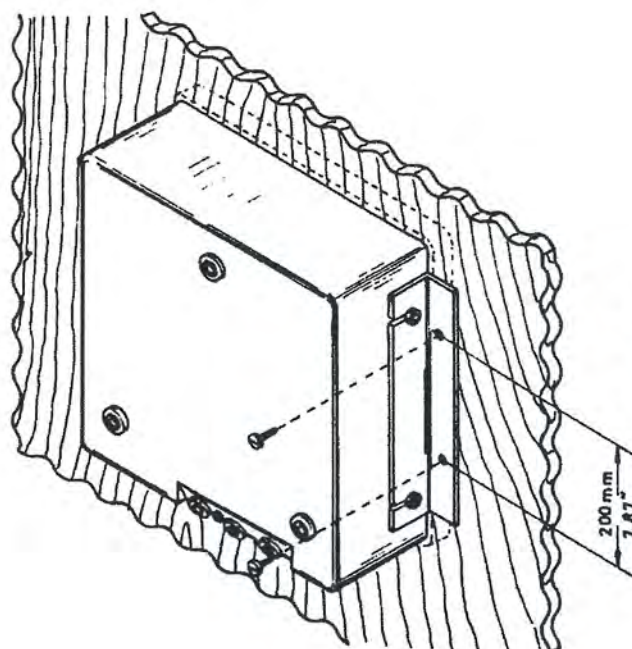
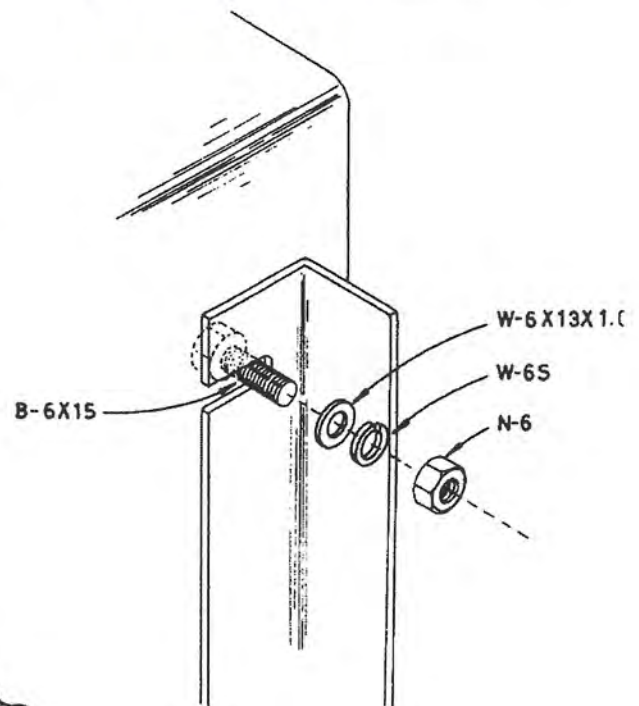


WEIGHT OF RECORDER : APPROX. 11 KGS (24.3 LBS)
WITH STANDARD ROLL INSTALLED

Fig. 3 - 2
RECORDER INSTALLATION
PANEL MOUNTING



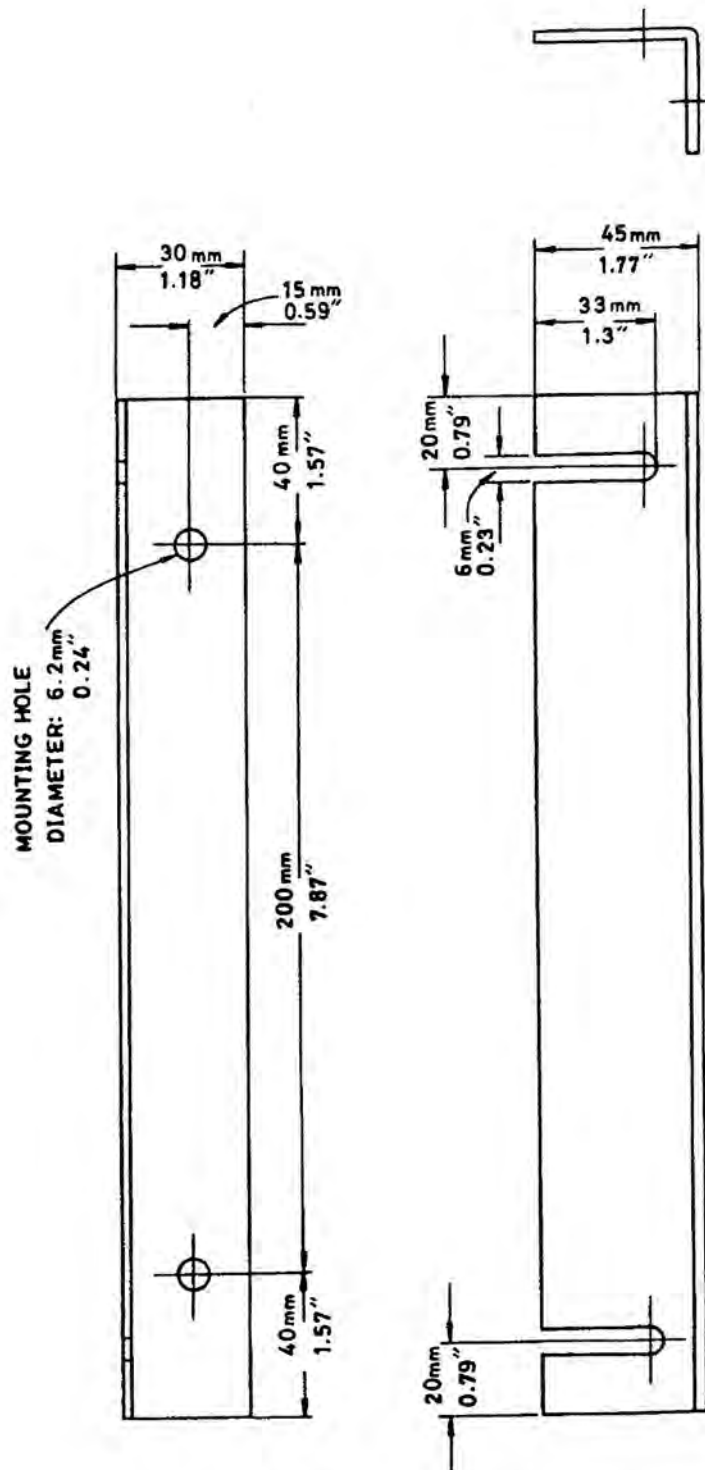
MOUNTING BRACKET INSTALLATION



NOTE:
 PANEL MOUNTING KIT IS OPTIONAL.
 WOOD SCREWS ARE NOT INCLUDED.

Fig. 3-3
DIMENSIONS OF PANEL MOUNTING BRACKET

PART NO.: 603PM



BRACKET THICKNESS: 3 mm (0.12")

4. Electrical Connections

Electrical connections to the SKIPPER 603 recorder are to be made at the external connection terminal block located just above the cable entry grommets. The transducer cable enters through the right-hand grommet, and the power cable through the left-hand grommet. The center grommet is to be used for connections to optional accessory equipment. Fig. 4-1 shows the SKIPPER 603 wiring instructions for the DC power supply system. For connections to the 220VAC system, refer to Fig. 4-2.

Transducer Connections to The Recorder

The transducer connections use three terminals at No. 10, 11 and 12 on the terminal block. Using the screws provided, securely connect the cable leads and shield to the terminals as follows :

White (or pink) lead	to No. 11
Black lead	to No. 12
Shield	to No. 10

The black and the white (or pink) leads may be reversed without affecting the system performance.

In order to minimize the chance of picking up extraneous electrical interference, avoid, where possible, routing the transducer cable near other on-board electrical equipment, particularly generators, d-c motors and electrical pumps. Also avoid running the cable in parallel with the vessel's power line. Any excess cable should be coiled up and secured by clamps. It should not be located close to the recorder.

Transducer Impedance Selection

The wide beam ceramic transducer (TMM-60-50-10LA) and the narrow beam ferrite transducer (XGM-PI-50X4/2) are different also in electrical characteristics. It will, therefore, be necessary to electrically match the transmitter and the transducer used. The small toggle switch marked CERAMIC-FERRITE on the mainboard (refer to Fig.4-3) is provided for this transmitter-transducer matching purpose.

When the wide beam ceramic transducer is connected, set the switch to the CERAMIC side as in Fig. 4-4. When the ferrite transducer is used, it should be set to the FERRITE side, as in Fig. 4-5. Setting the switch to the wrong position will result in a considerable decrease in depth sounding capability (and receiver sensitivity).

NOTES :

- 1) The equipment is usually supplied with the switch in the CERAMIC position.
- 2) Both 38 kHz and 200 kHz models do not have this impedance selector switch.

Fig. 4-1
CONNECTIONS FOR DC POWER SUPPLY SYSTEM

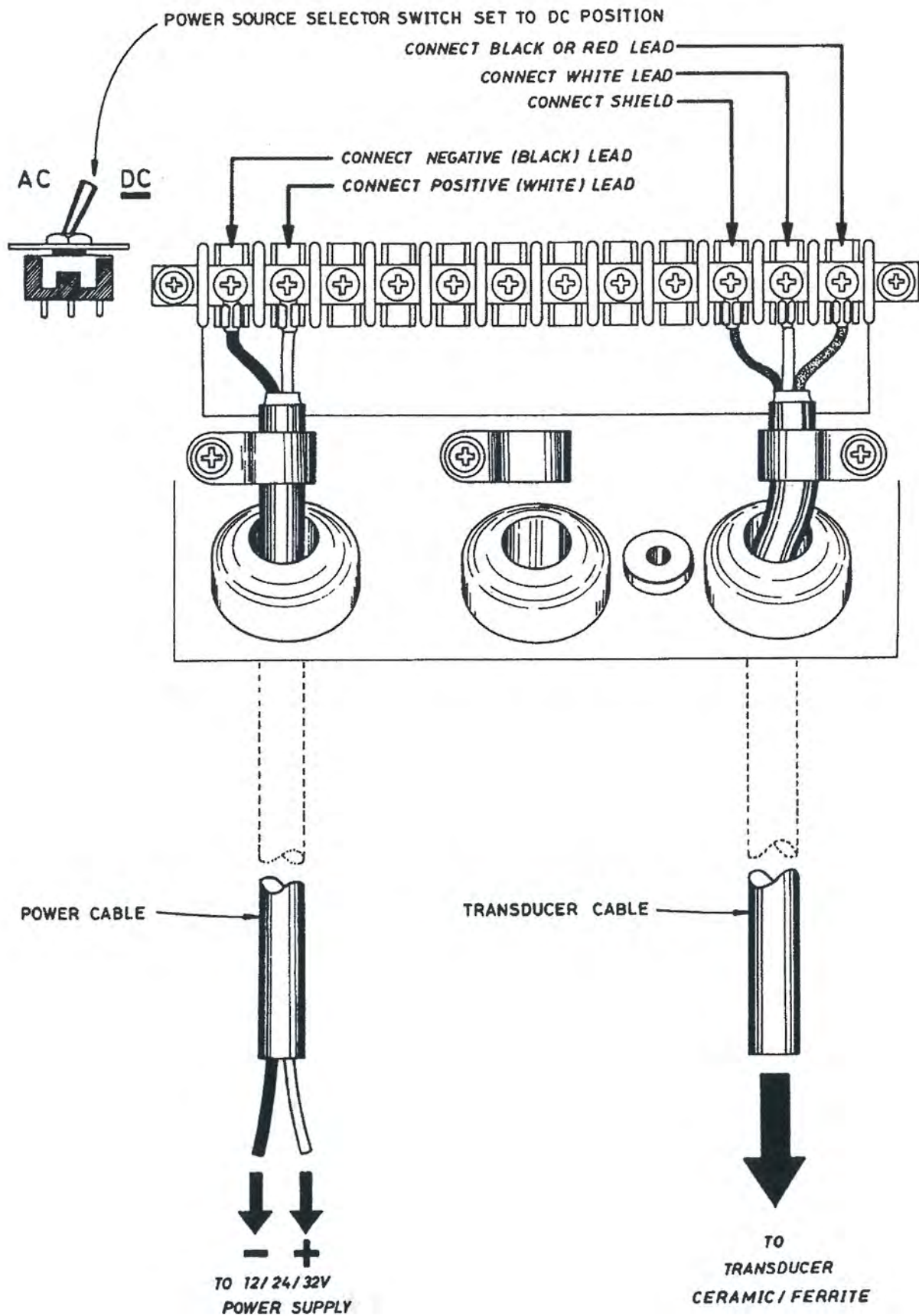


Fig. 4-2
CONNECTIONS FOR 220VAC POWER SUPPLY SYSTEM

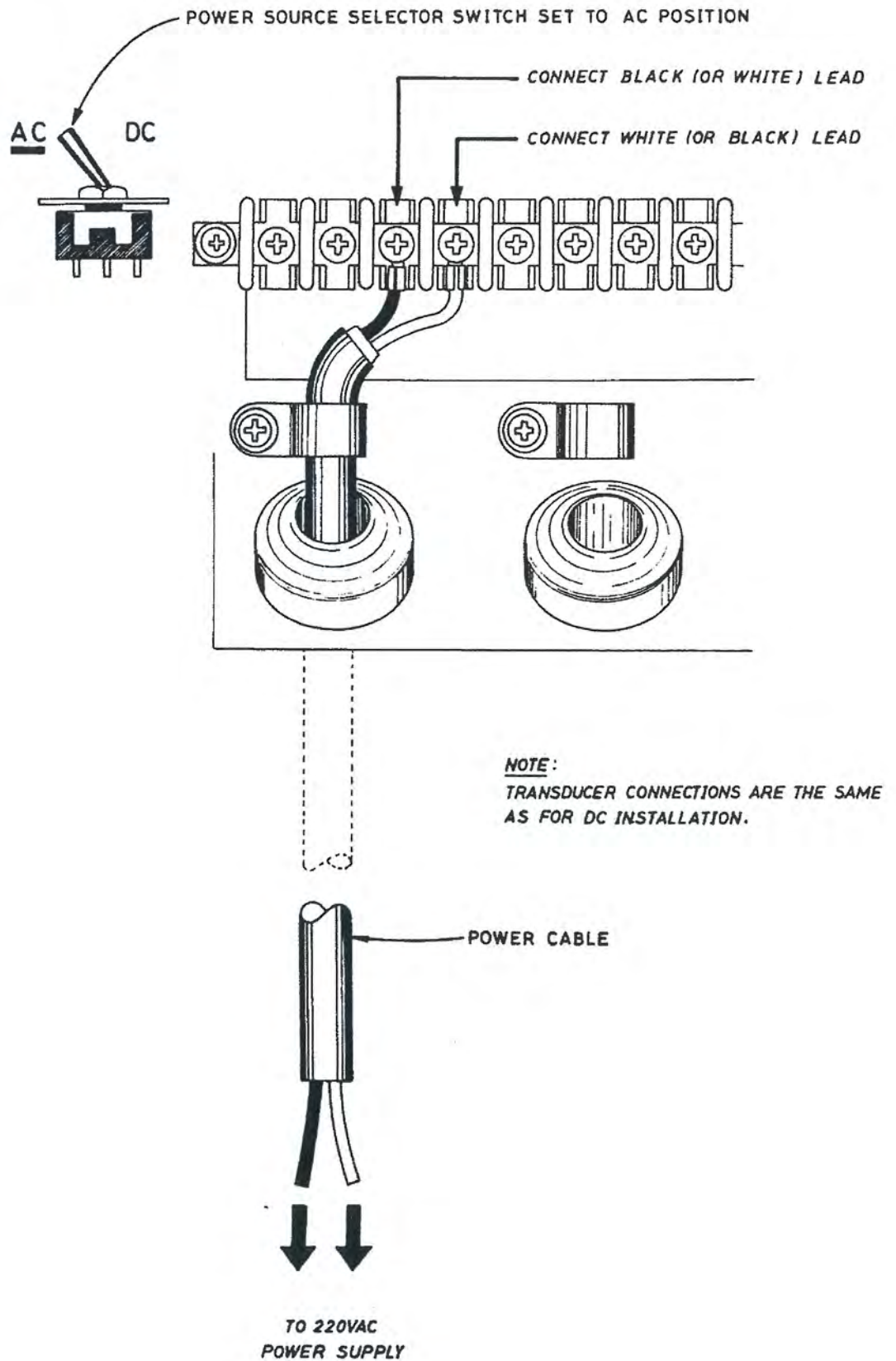


Fig. 4-3
TRANSDUCER IMPEDANCE SELECTOR SWITCH

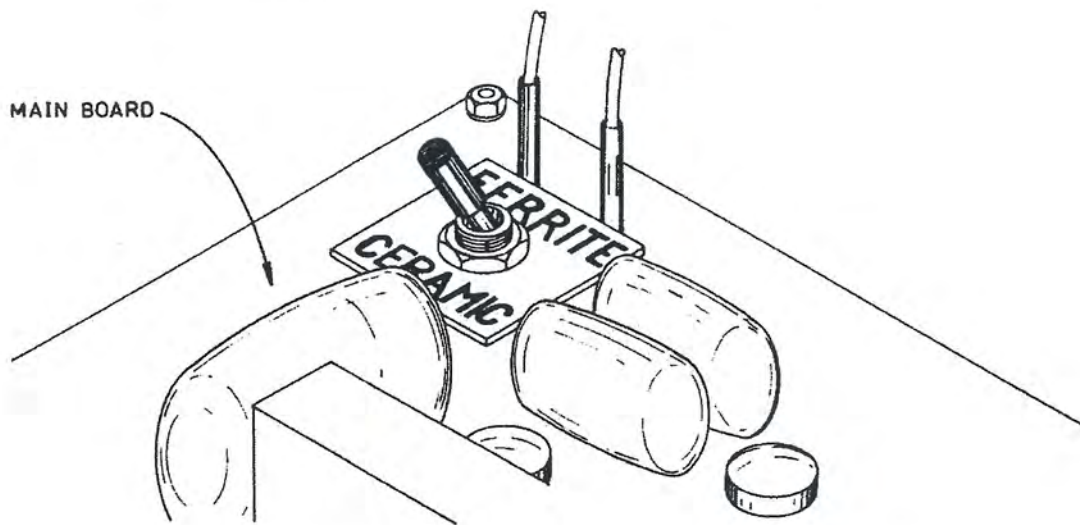


Fig. 4-4
SWITCH POSITION FOR CERAMIC TRANSDUCER

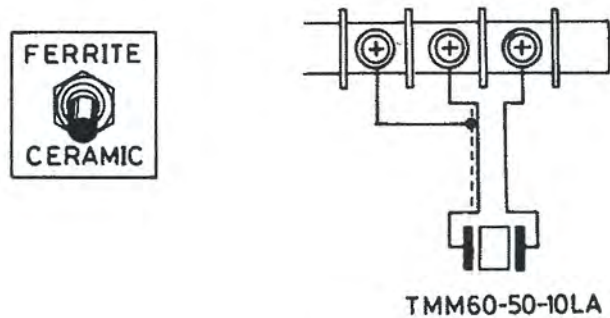
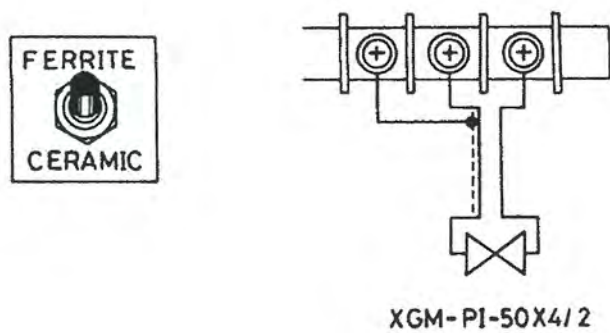


Fig. 4-5
SWITCH POSITION FOR FERRITE TRANSDUCER



DC Power Supply Connections to The Recorder

The SKIPPER 603 echo sounder is designed to function normally at any voltage between 11 and 40 volts d-c. The power cable to the recorder should be taken directly from the battery terminals, and not from the vessel's power distribution board or other source, so as to further reduce the interference pick-up possibility.

Using the two-lead power cable furnished, connect between the terminal block and the battery as follows :

Negative (-) to terminal No. 1 (use black lead)

Positive (+) to terminal No. 2 (use white lead)

WARNING : Reversing the polarity will result in blowing the fuse even when the equipment is switched off.

The ground line of the electronics circuitry in the recorder is d-c isolated from the recorder cabinet so that the set may be powered by both positive and negative ground supply systems.

AC Power Supply Connections to The Recorder

When the optional 220VAC rectifier unit is installed, it is possible to operate the SKIPPER 603 from a 220VAC (+10%) source. The 220VAC operation requires connection to terminal No. 3 and No.4, as in Fig. 4-2. No polarity consideration is necessary.

WARNING : An a-c voltage as high as 220 volts can be fatal. Be sure to switch off the vessel's mains before attempting to make connections.

Power Source Selection

The small toggle switch located on the left side of the terminal block selects the AC or DC power source. Refer to Fig.4-6. When the equipment is connected to the DC supply, set the switch to the DC 12/24/32V side. When it is connected for AC operation, the switch should be set to the AC220V position.

Fig. 4 - 6
SELECTING POWER SOURCE

FOR DC OPERATION



*FOR 220VAC OPERATION



*WITH OPTIONAL RECTIFIER INSTALLED

Ground Requirements

The SKIPPER 603 is designed to operate normally without grounding the cabinet, provided that those cable routing precautions are taken. However, in some exceptional cases, interference may show up at high gain settings, and it may become necessary to ground the cabinet to the vessel's ground line to correct the problem. In such cases, connect from terminal No. 10 on the terminal block to the nearest grounding point in the vessel, using as heavy and short a wire as possible.

NOTE: Terminal No. 10 is directly connected to the cabinet, and is isolated from the equipment's negative line.

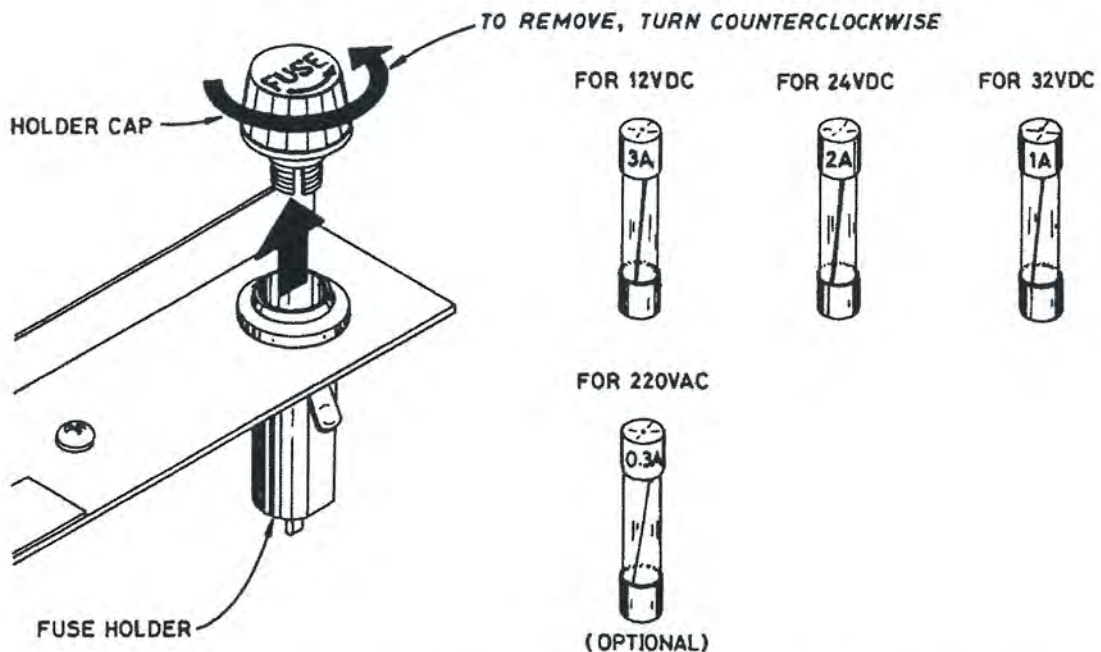
Fuse Installation

The SKIPPER 603 requires a fuse of the following rating :

3 amperes	(marked 3A)	for 12 volt d-c operation
2 amperes	(marked 2A)	for 24 volt d-c operation
1 ampere	(marked 1A)	for 32 volt d-c operation
*0.3 ampere	(marked 0.3A)	for 220 volt a-c operation
*optional		

When the equipment is delivered, the fuse is normally not installed in the fuse holder. After connecting up the set as per the previous wiring instructions, remove the fuse holder cap, insert the properly rated fuse and replace the cap.

Fig. 4-7
FUSE INSTALLATION



Two fuses are supplied for each supply voltage and are enclosed in the plastic bag which contains other spare parts. The fuses should be easily identified by referring to Fig. 4-7. If an improperly rated fuse is inserted, it will blow the instant the set has been switched on or the line marker switch has been depressed, or will not protect the electronic circuitry in the event of a trouble.

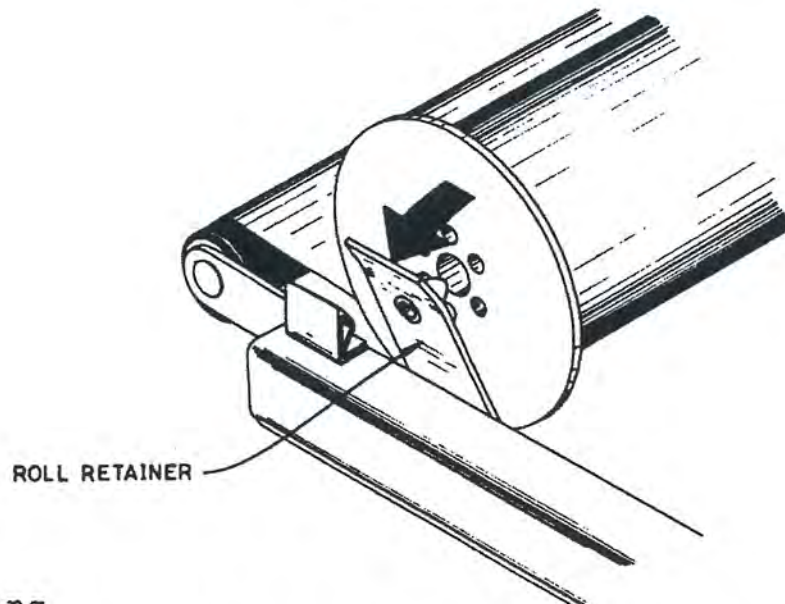
5. Operating Instructions

The SKIPPER 603 is usually delivered with a standard TP-6 roll of recording chart properly installed so that it is ready for operation after completing the wiring. However, before bringing the equipment into operation, make sure that there is no paper slack along the recording platform, and if necessary, swing down the platform and turn the roll backwards as in Fig. 5-4 to take up the slack. The chart is 153 millimeters (6 inches) wide and 20 meters (65.6 feet) long.

Unloading

When the complete roll has been used up, all the paper will have been wound onto the rewind cylinder. It can be removed by pulling the roll retainer as in Fig. 5-1, disengaging the roll from the platform. Unroll and retain the rewind cylinder for use with a new roll. The top and bottom spool rims need not be detached from the cylinder. The set can then be fitted with a new roll of paper.

Fig. 5-1
REMOVING USED ROLL



Reloading

To reload, proceed as follows, with the aid of the illustrations Figs. 5-2 through 5-7 :

- 1) Open the front cabinet, and turn the scanning belt until the stylus is off the recording platform. Swing down the platform, as shown in Fig. 5-2.
- 2) Attach the spool rim to both sides of the new roll in such a way that the rewind cylinder driver key on the rim engages with one of the end notches of the cylinder, as in Fig. 5-3.
- 3) Install the roll between the spool retainer and the roll support disc, making sure that the driver pins on the disc engages with the bottom rim's guide holes as in Fig. 5-5.

Fig. 5-2
CHART LOADING SEQUENCE - 1

GAINING ACCESS TO CHART LOADING SYSTEM

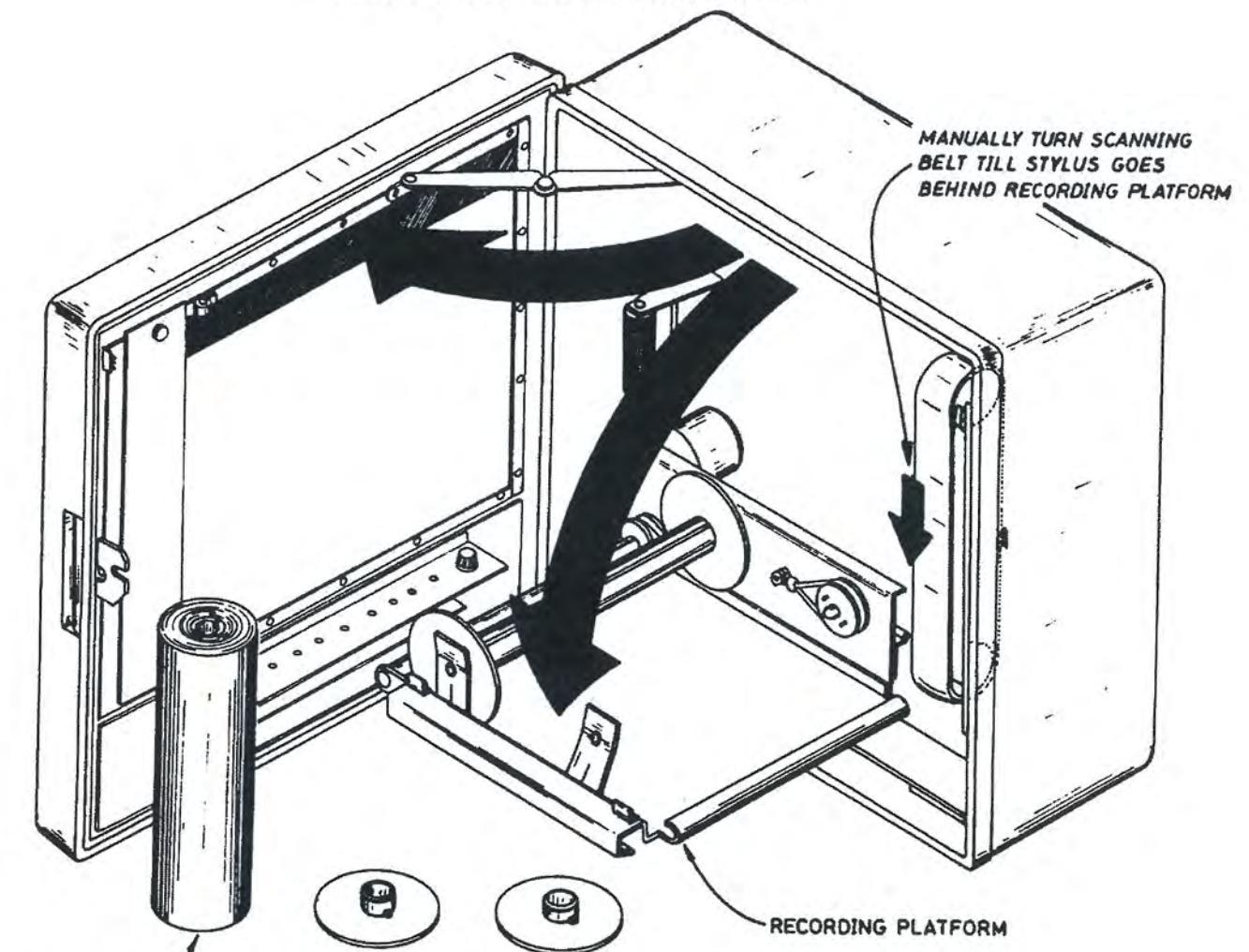
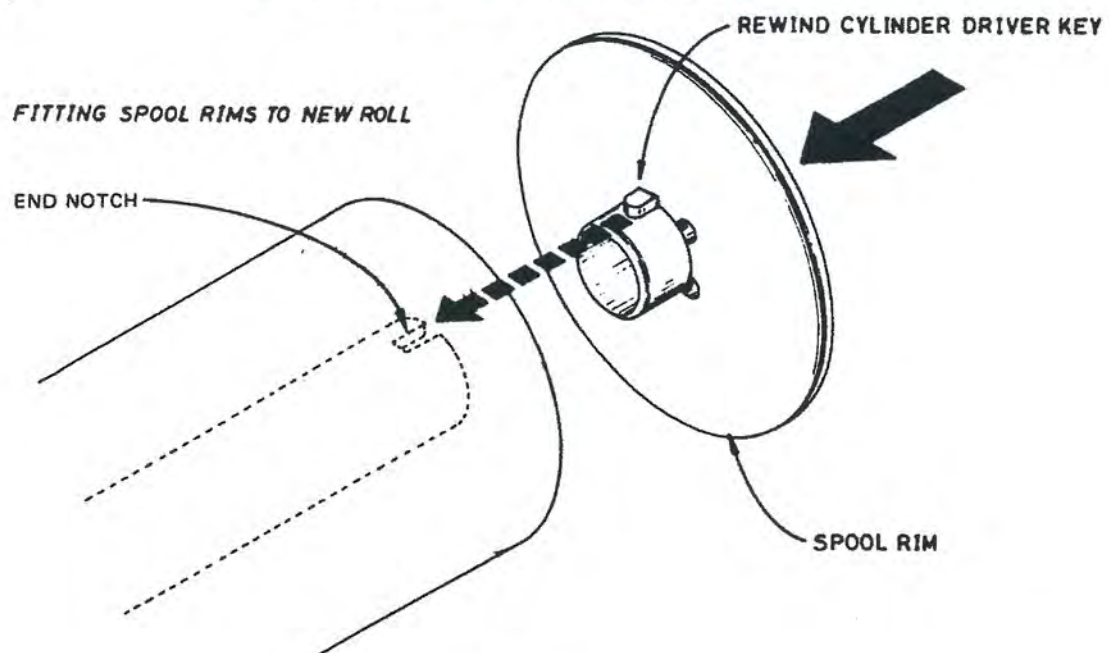


Fig. 5-3
CHART LOADING SEQUENCE - 2

NEW ROLL
 TP-6



- 4) Pull out approximately 40 centimeters (1.3') of paper and pass it between the scale plate and the platform. Guide it up to the rewind cylinder along the platform and around the chart transport roller as in Fig. 5-4.
- 5) Insert the chart end into the rewind cylinder slit, and turn the cylinder counterclockwise several turns to wind the chart onto it, as in Fig. 5-6. Also, at the same time, turn the new roll backwards to remove any slack along the platform.
- 6) Close the platform by pushing it back into the main chassis until it is locked in place.

WARNING : Before closing the platform, make sure once again that the stylus is inside the rear cabinet.
- 7) Advance the knurled pulley at the bottom of the transport roller with your finger or thumb, and check to be sure that the chart is being rewound correctly.

This completes chart reloading.

Fig. 5-4
CHART LOADING SEQUENCE - 3

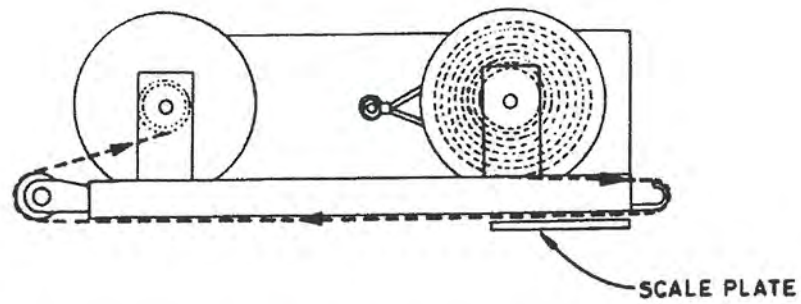


Fig. 5-5
PLACING ROLL IN LOADING SYSTEM - DETAIL

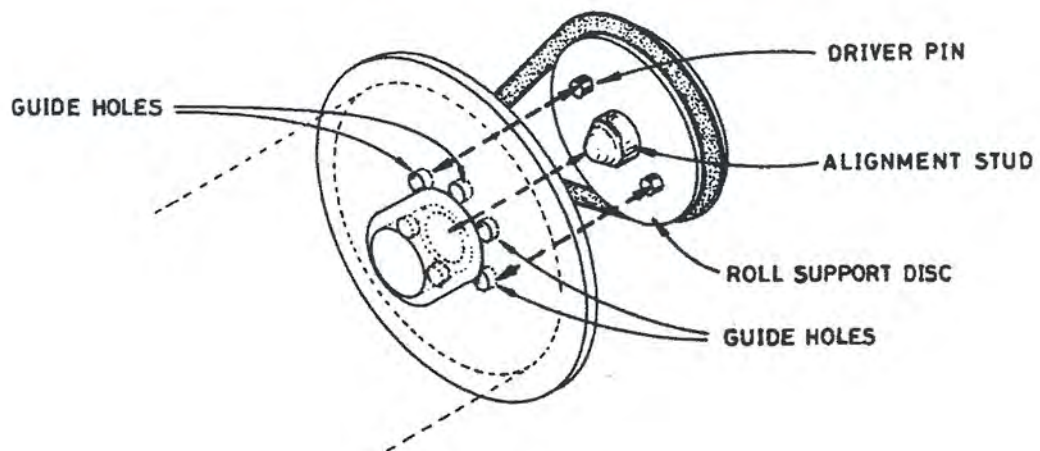


Fig. 5-6
CHART LOADING SEQUENCE - 4

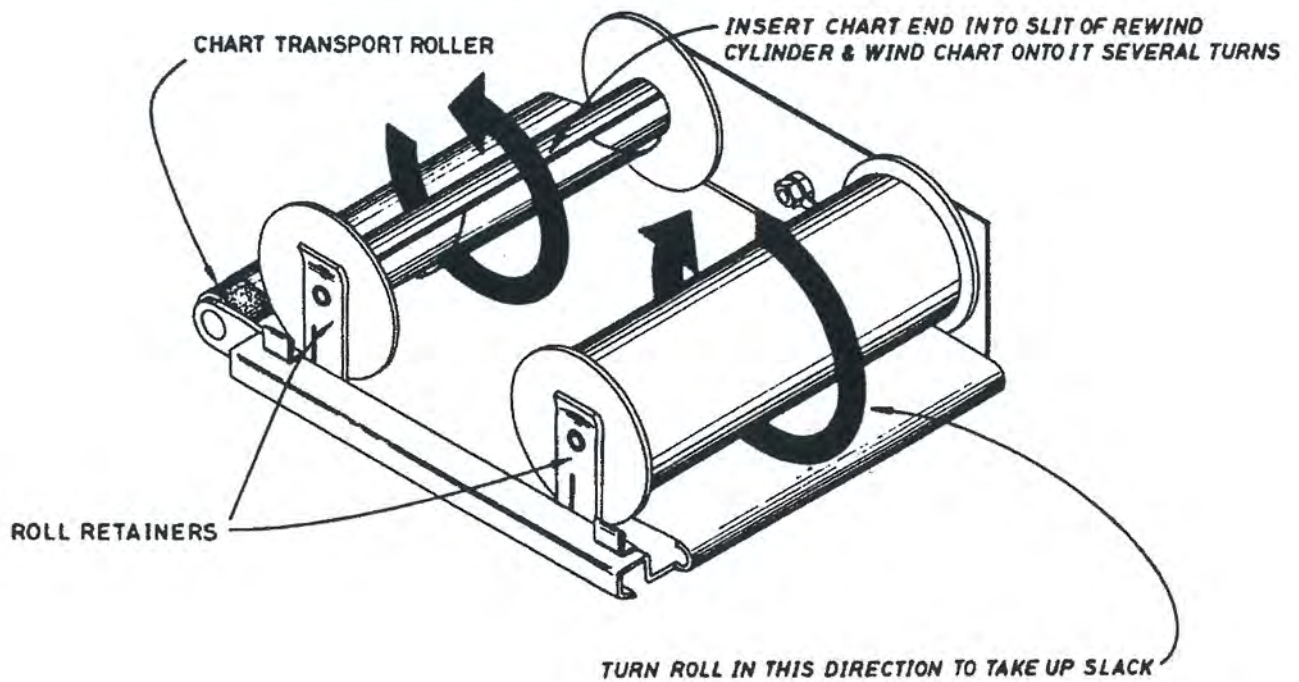
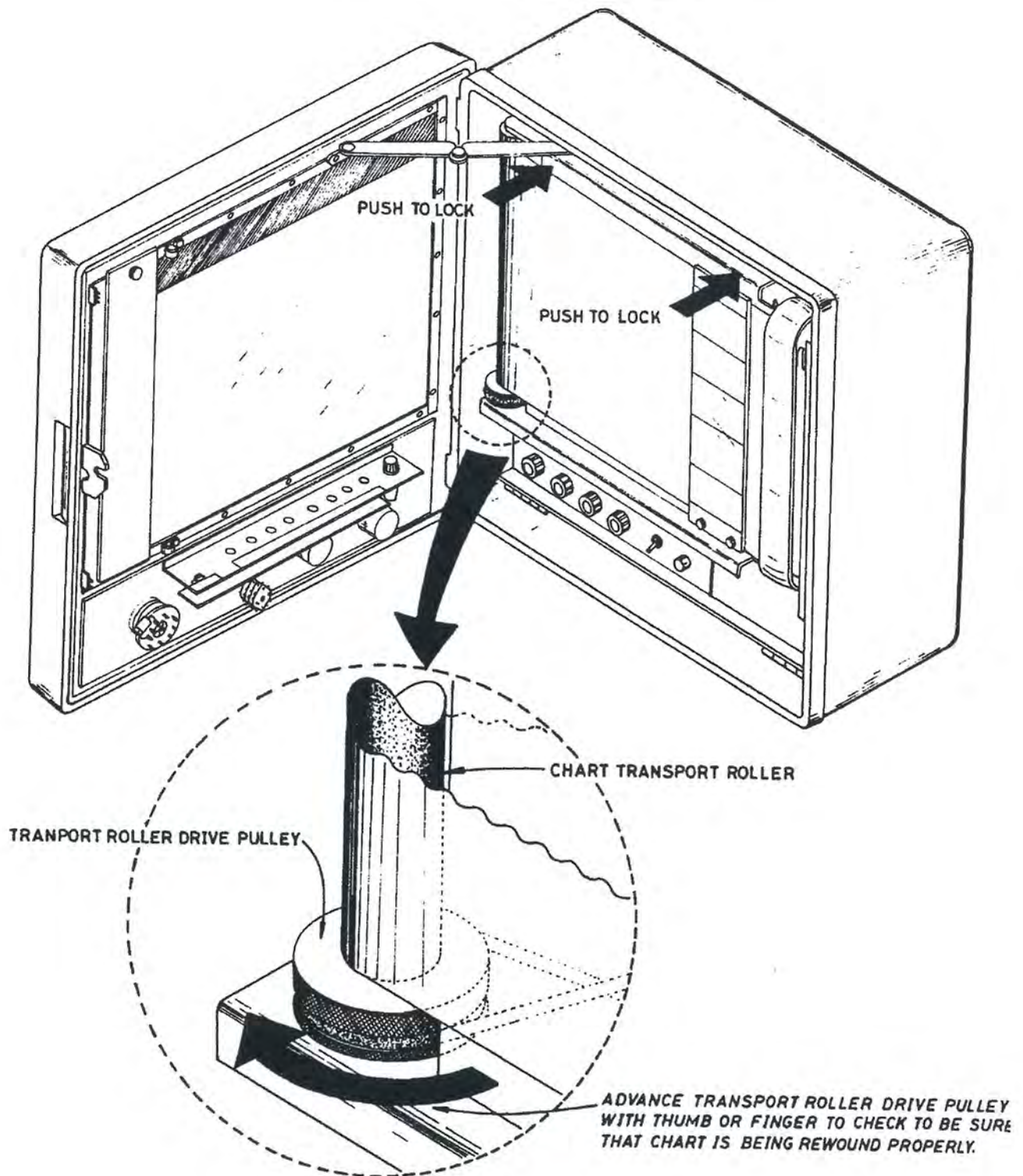


Fig. 5-7
CHART LOADING SEQUENCE - 5



Selecting Units of Depth Measurements

The SKIPPER 603 is designed to measure depths in meters, fathoms or feet without requiring internal adjustments. The equipment is normally delivered with the metric scale installed, and is switched to read depths in meters. If depth measurements are to be made in fathom or feet, the following procedure should be followed:

- 1) Locate the calibration unit selector switch on the rear side of the front cabinet (Location shown in Fig. 2-2)
- 2) Refer to Fig. 6-1 below. Loosen the screw securing the switch position keeper. The switch should be set to the METERS position, as in Fig. 6-2.

Fig. 6 - 1
CALIBRATION UNIT SELECTOR SWITCH

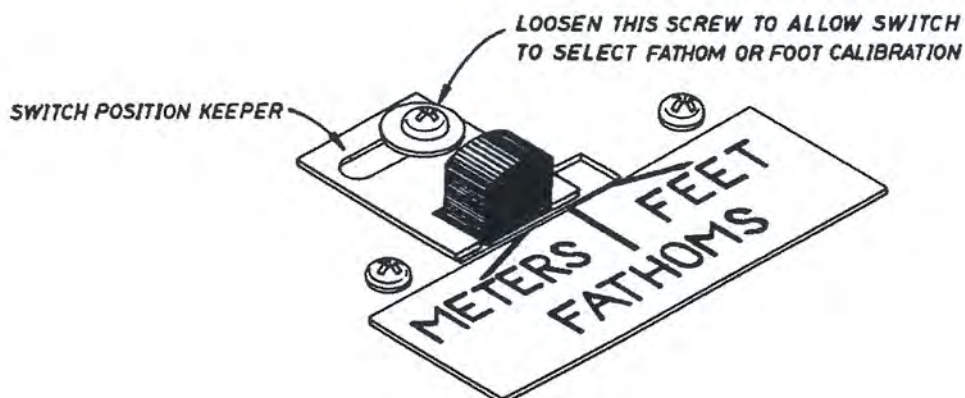


Fig. 6 - 2
SWITCH POSITION FOR DEPTH READING IN METERS



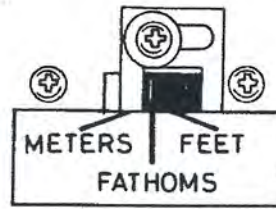
- 3) To read depths in fathoms, set the switch to the FATHOMS position as in Fig. 6-3. Tighten the screw.

Fig. 6 - 3
SWITCH POSITION FOR DEPTH READING IN FATHOMS



- 4) To read depths in feet, set the switch to the FEET position as in Fig. 6-4, and tighten the screw.

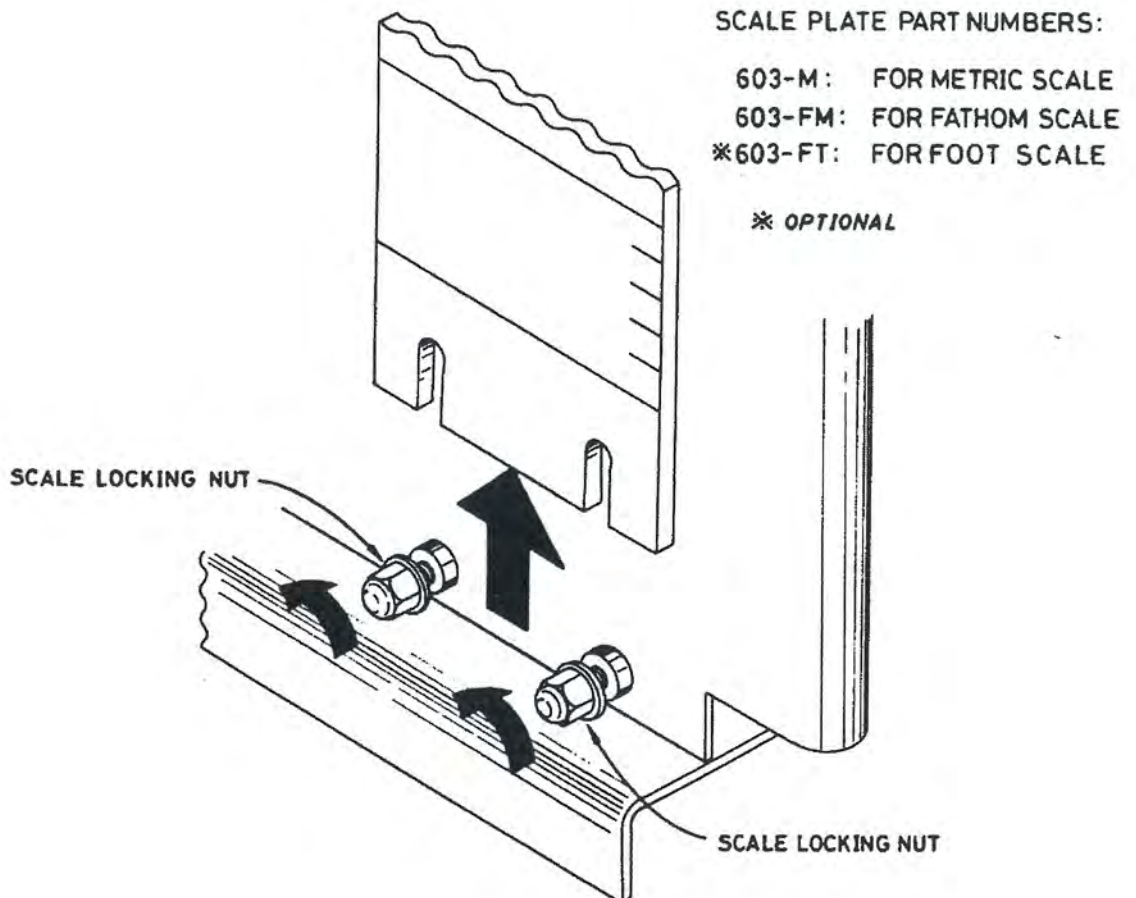
Fig. 6-4
SWITCH POSITION FOR DEPTH READING IN FEET



Replacing Scale Plate

After selecting the desired unit of calibration, it will be necessary to replace the metric scale with the appropriate scale plate. The FATHOM scale plate (part No. 603-FM) is normally supplied as standard equipment. The FOOT scale plate (part No. 603-FT) is optional and will be available from SKIPPER or its authorized dealers. The scale plate can be removed by loosening the two lock nuts at the bottom of the plate, as in Fig. 6-5.

Fig. 6-5
REPLACING SCALE PLATE



NOTE: It is possible to record depths in fathoms with the switch in the FEET position without affecting the accuracy. If, for example, an approximate depth indication is desired in feet for navigation but accurate depth information is needed for fishing, set the switch to the FEET position as in Fig.6-4 and install the FATHOM scale. The digital depth indicator will show approximate depths in feet, while accurate depth readings will be obtained in fathoms from the scale.

Switching The SKIPPER 603 on

The SKIPPER 603 is switched on by advancing the gain control/power switch clockwise past a "click" from 0. This will cause the scanning belt to start moving, enabling depth measuring operation to begin.

Further clockwise rotation will increase the receiver gain, allowing echoes from the bottom, fish, plankton, etc. to show up on the chart.

NOTE: When the basic range selector is in position "0", the scanning belt remains stationary with the equipment switched on.

Fig. 7-1
GAIN CONTROL / POWER SWITCH

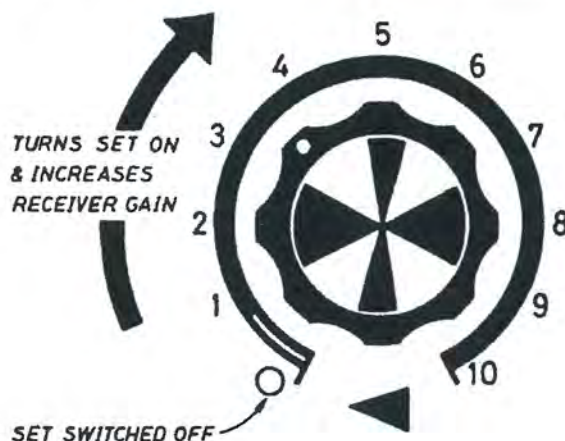
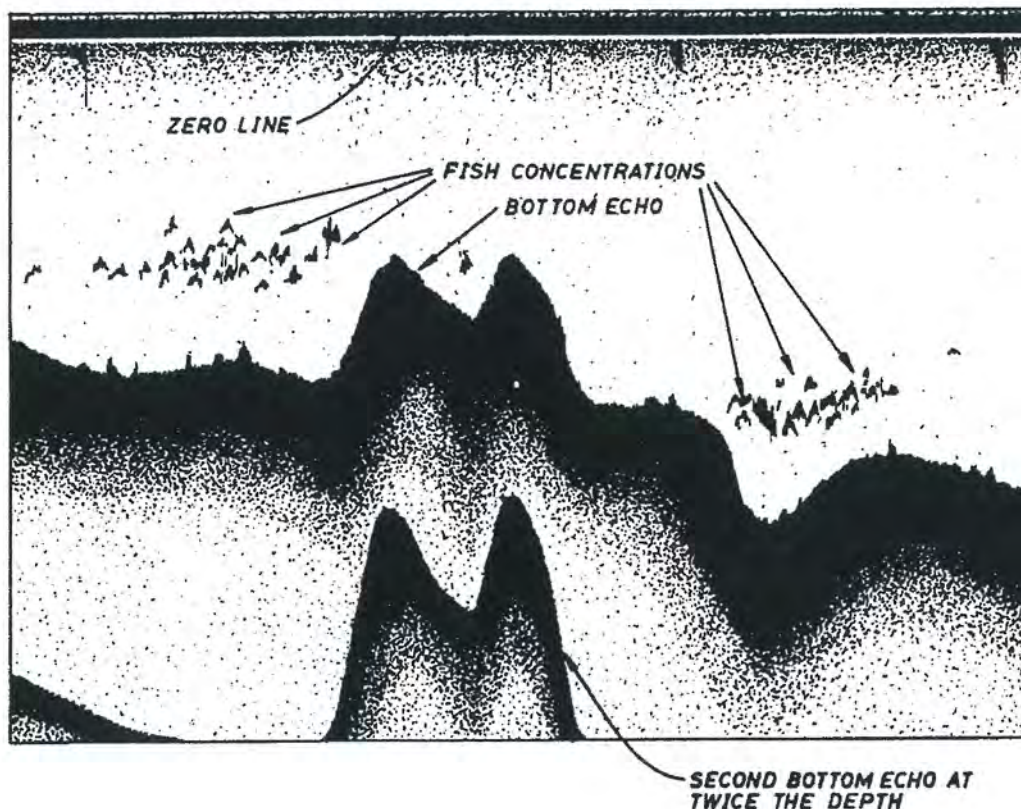


Fig. 7-2
TYPICAL SHALLOW WATER RECORDING



Basic Recording Range Selection

The basic range selector selects the following four basic recording ranges to be covered by the SKIPPER 603 :

SKIPPER 603 Basic Recording Ranges

Selector Position	Metric Scale	Fathom Scale	Foot Scale
A	0 - 110 meters	0 - 55 fathoms	0 - 330 feet
B	0 - 220 meters	0 - 110 fathoms	0 - 660 feet
C	0 - 550 meters	0 - 275 fathoms	0 - 1650 feet
D	0 - 1100 meters	0 - 550 fathoms	0 - 3300 feet

NOTE : Setting the selector to position 0 will cause the scanning belt to stop, and will bring the digital depth indicator into operation.

Fig. 7-3
BASIC RANGE SELECTOR

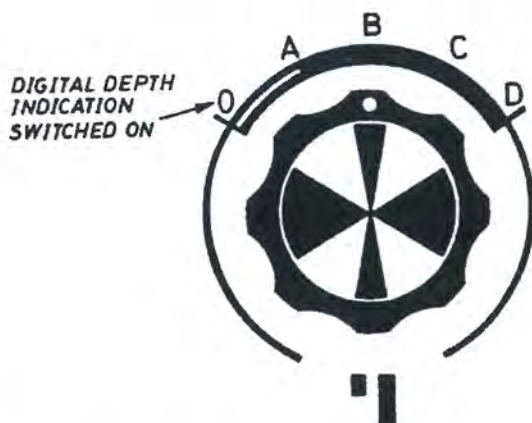


Fig. 7-4
PHASED RANGE SELECTOR



Phased Range Selection

Each basic recording range is divided into three phased ranges as in Fig.7-5, and these ranges are selected by the phased range selector.

In position 1, the range to be covered is always from the transducer face, with the zero line representing the transducer position relative to the water line. The zero line is produced by a portion of the transmitted energy leaking into the receiver, and its presence, in addition to identifying phased range 1, indicates that both the transmitter and the receiver are working consistently.

A certain amount of overlap exists between the phased ranges for each basic recording range, as is seen from Fig.7-5. This range overlapping is provided to eliminate the need of continually changing the phased range selector position to keep the bottom contour under surveillance when the depth is varying around the maximum mark of the scale selected.

Fig. 7-3
SKIPPER 603 DEPTH RANGE ARRANGEMENT

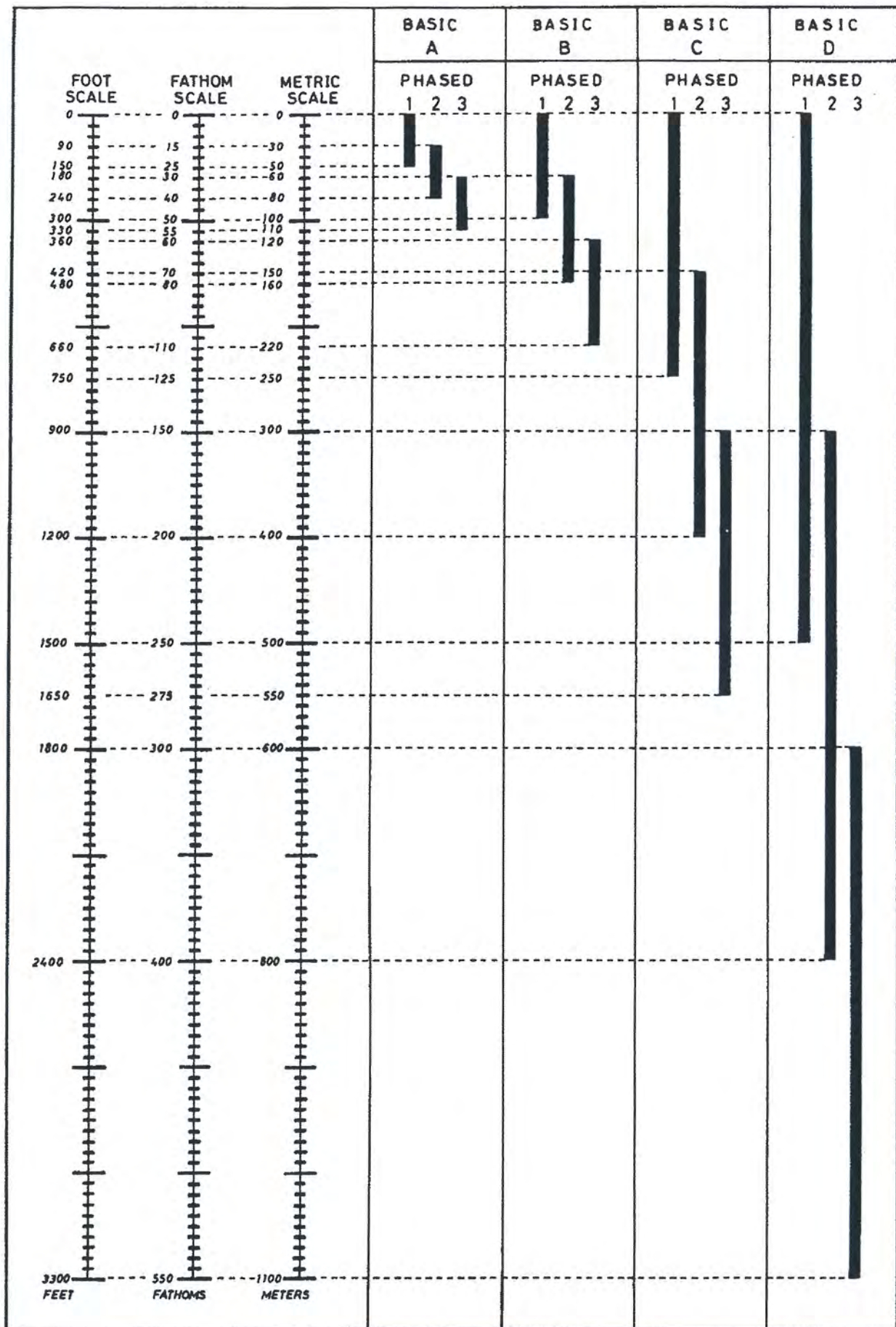
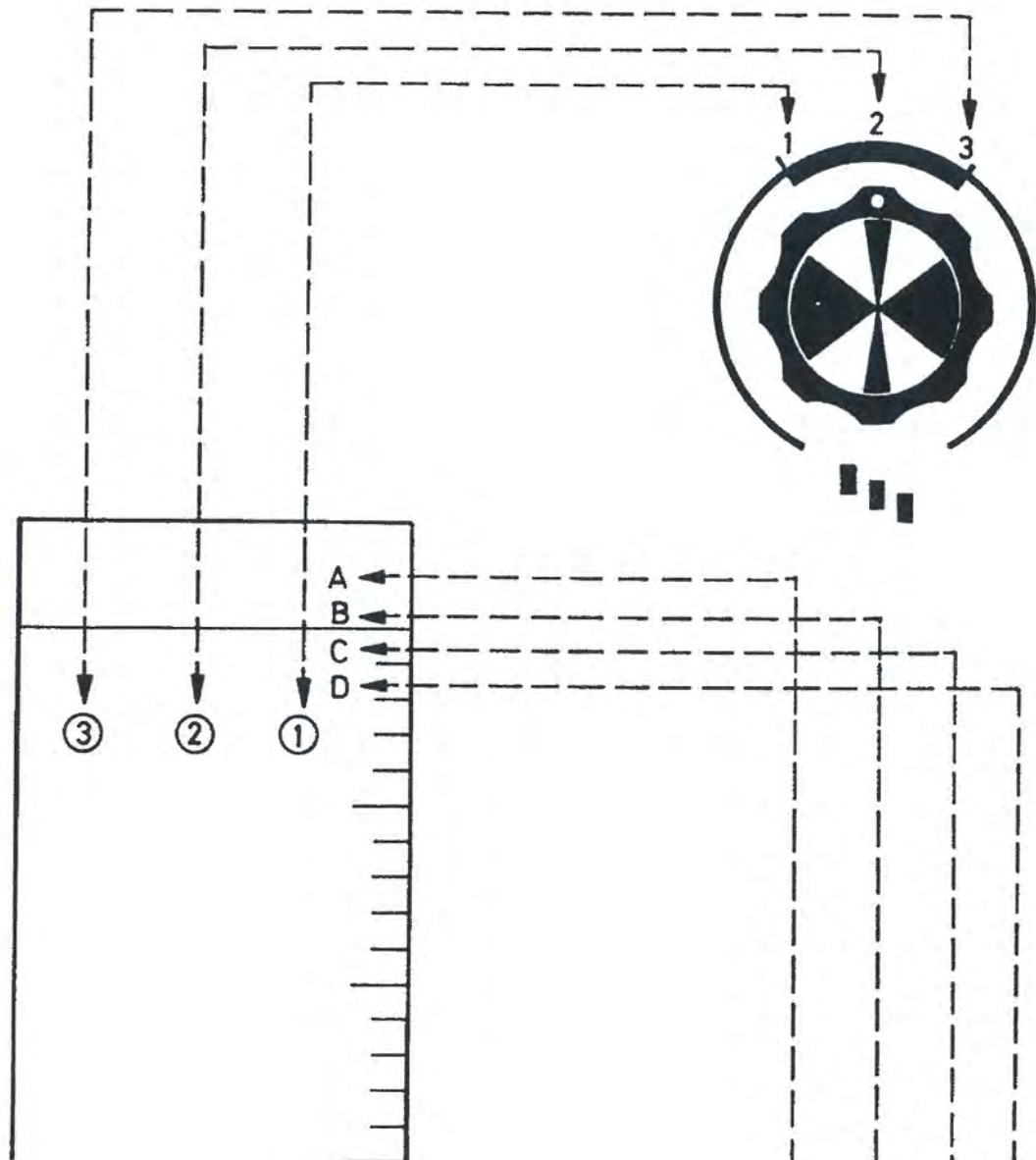


Fig. 7-6
SCALE SELECTION



*DIGITAL DEPTH INDICATION
SWITCHED ON & RECORDING
STOPPED IN THIS POSITION*



Scale Selection

Fig.7-6 shows which section of the scale should be used to read depths when a particular depth range is selected by the basic and phased range selectors. In this example, the depth range selected is phased range 2 on basic recording range B. Therefore, section 2 of scale calibration B is used, which reads :

60 to 160 meters (Metric Scale), or
30 to 80 fathoms (Fathom Scale), or
180 to 480 feet (Foot Scale)

Zero Line Alignment

Before bringing the SKIPPER 603 into actual depth recording operation, it will be necessary to determine from where the depth is to be read. This is because the depth is always measured from the face of the transducer which is at some distance from the water surface.

On the recording chart, the upper edge of the zero line corresponds to the transducer face. The zero line alignment is to set the position of the zero line on the scale. The following instructions will enable the zero line to be set properly in two typical situations.

- 1) Select phased range 1 on basic recording range A, as in Fig.8-1.

Fig. 8 - 1
CONTROL SETTINGS FOR ZERO LINE ALIGNMENT



BASIC RANGE SELECTOR



PHASED RANGE SELECTOR

- 2) Refer to Fig. 8-2, locating the zero line alignment lever.
- 3) Turn the SKIPPER 603 on by rotating the gain control/power switch clockwise past a "click". The zero line should appear near the scale zero.
- 4) To read depths from the face of the transducer, push the alignment lever in either direction whichever is necessary to make the upper edge of the zero line coincide with the scale zero, as in Fig. 8-3.
- 5) To read depths from the water surface, push the alignment lever in either direction whichever is necessary for the upper edge of the zero line to coincide with the position on the scale corresponding to the depth to the transducer, as in Fig. 8-4.

As an example, assume that the transducer is 1 meter (0.5 fathom or 3 feet) below the water surface. The zero line should be set so that its upper edge reads 1 meter (0.5 fathom or 3 feet) on the scale.

NOTE : When the other basic recording ranges are selected, the same procedure should be followed except when the depth is to be read from the transducer face.

Fig. 8-2
SETTING ZERO LINE

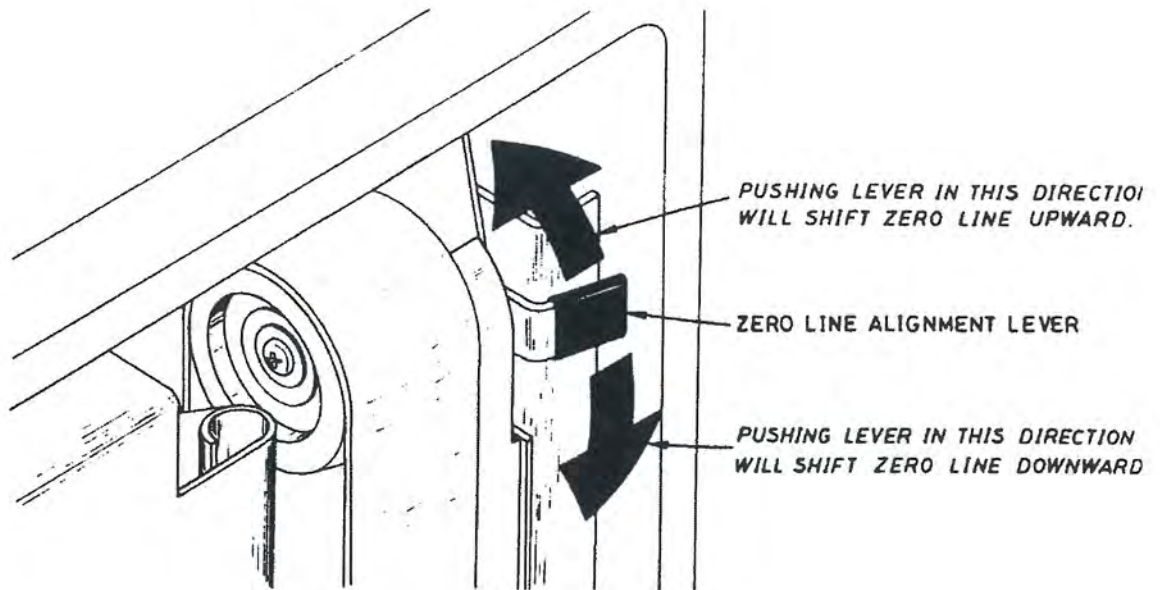


Fig. 8-3
ZERO LINE POSITION FOR DEPTH MEASUREMENT
FROM FACE OF TRANSDUCER

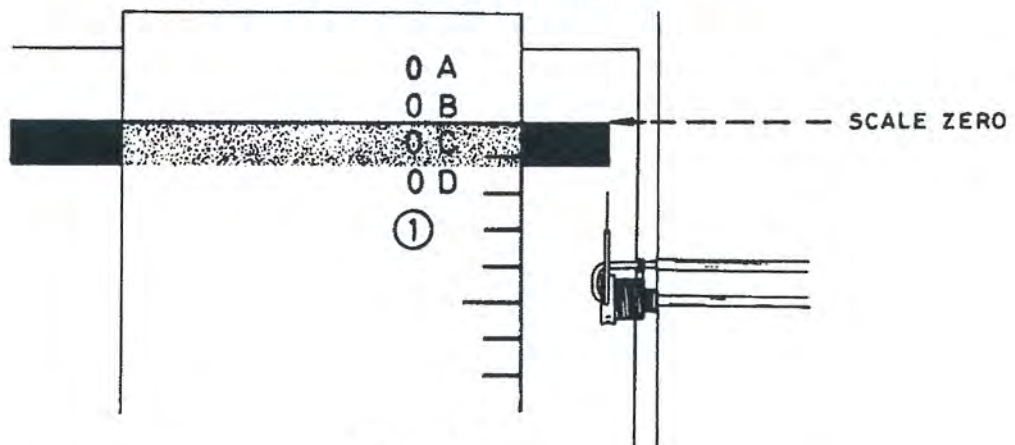
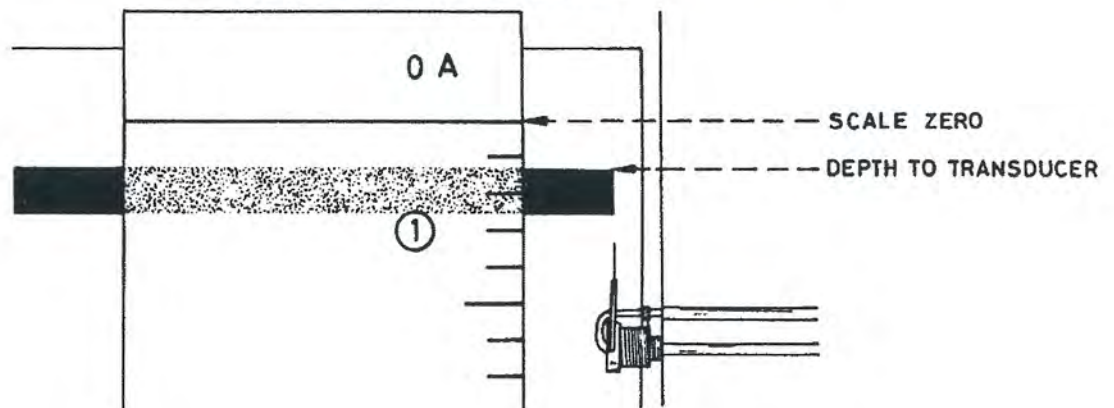


Fig. 8-4
ZERO LINE POSITION FOR DEPTH MEASUREMENT
FROM WATER SURFACE



Fish Finding with The SKIPPER 603

In order to take full advantage of the capabilities built into the SKIPPER 603 for efficient fish finding operation, the operator must become familiar with the functions of the operating controls and their effect on recording. The following explanation will help determine appropriate control settings in locating the presence of fish under various operating conditions.

1) Effect of Gain on Recording

To locate fish schools, the gain control must be kept fairly high even in shallow waters. The background will then become darkened as a result of numerous reflections from plankton concentrations, air bubbles, temperature layers, etc. A solid echo, similar to the bottom echo, may appear at twice the depth. This is the transmitted signal's being reflected from the bottom to the surface, back again from the surface to the bottom, and back again to the transducer. This kind of multiple reflection can occur several times over a hard bottom. Fish will show up in various forms, depending on the size, type and quantity. Fig. 7-2 on page 7-1 illustrates a typical example of how fish concentrations will show up in shallow water operation. Large single fish will sometimes appear in a slightly inverted "V" shape.

2) Bottom Line Control

The function of this control is to help in discriminating between the bottom and fish or other objects lying on or close to the bottom which, because of the extremely great strength of the bottom echo, may appear as a part of the bottom contour. To utilize this function, the bottom line/contour line selector switch must be set to its lower side (bottom line position) as in Fig. 9-2.

Fig. 9-1
BOTTOM LINE CONTROL

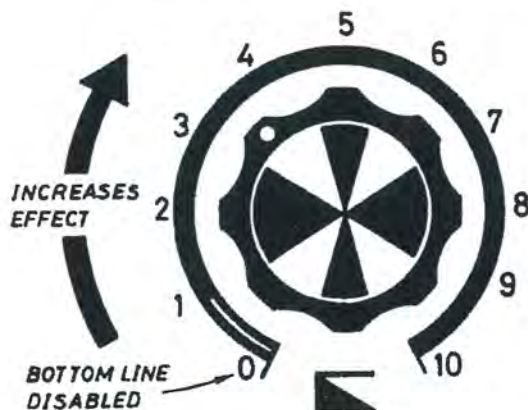


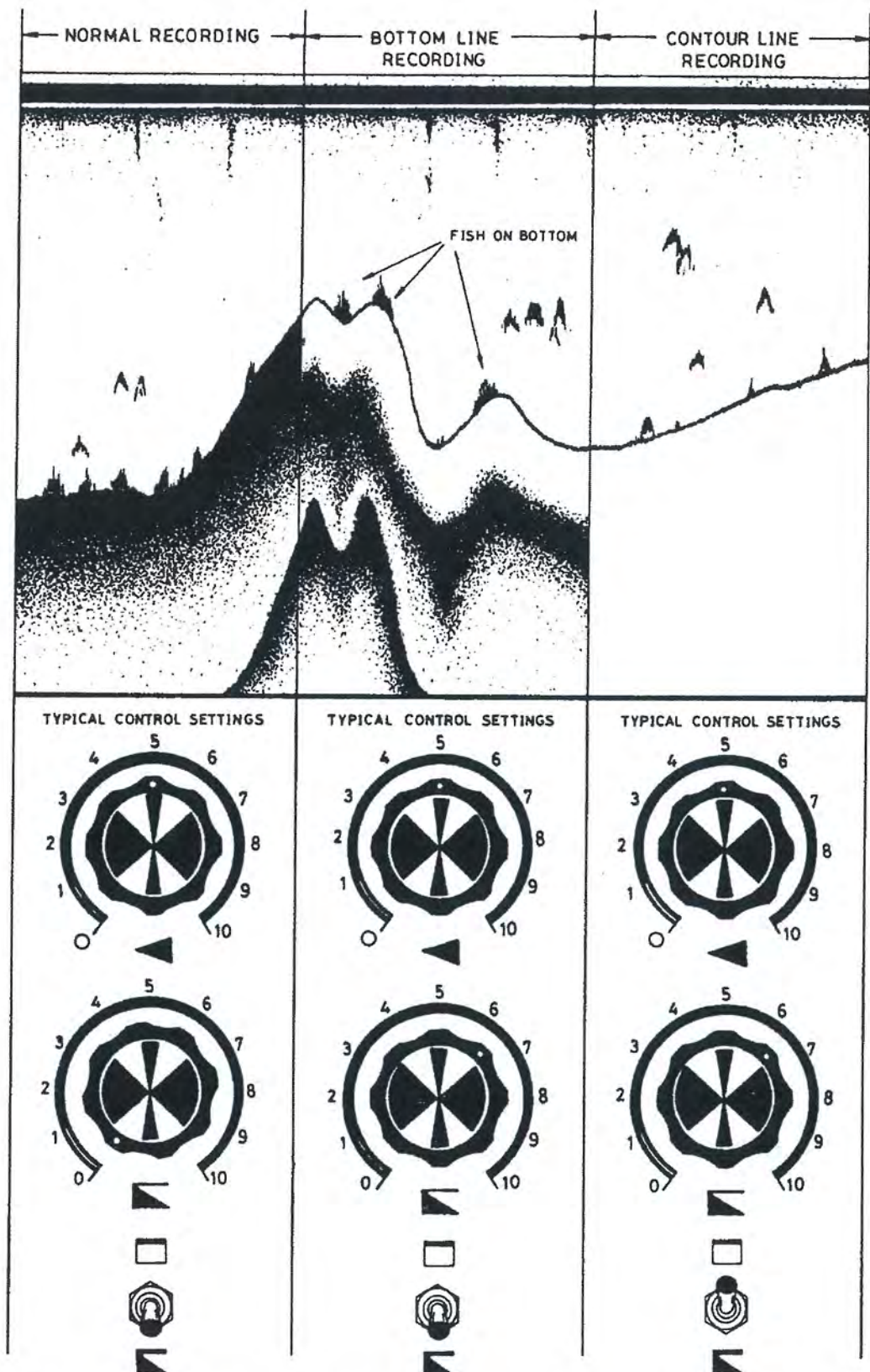
Fig. 9-2
BOTTOM LINE/CONTOUR LINE
SELECTOR SWITCH



In its fully counterclockwise position (0), the bottom line control is disabled, having no effect on recording. Advancing the control clockwise will turn the bottom marking into a thin

line with a white space immediately following it. Fish or other objects near or on the bottom will show up in the form of shady patches just above the line, as shown in Fig. 9-3. The optimum control setting depends on the depth, the gain control setting and bottom conditions. Good results will be usually obtained by first increasing the gain control until fish-like echoes become visible above the bottom line, whereupon advancing the bottom line control until such echoes become separated from the bottom contour and stand out clearly as in Fig. 9-3.

Fig. 9-3
CHANGING MODE OF RECORDING & ITS EFFECT



NOTE: Since the bottom line operation is activated by any strong signal returning from the bottom, it is possible to obtain some information on the bottom conditions from the way this bottom line effect appears on the chart. A very soft bottom will absorb much

of the transmitted energy so that the bottom echo will most often not be strong enough to produce the effect, even under high gain and bottom line control settings. On the other hand, if huge rocks or other hard objects are on the bottom, the effect will sometimes be noticeable even on the second echo.

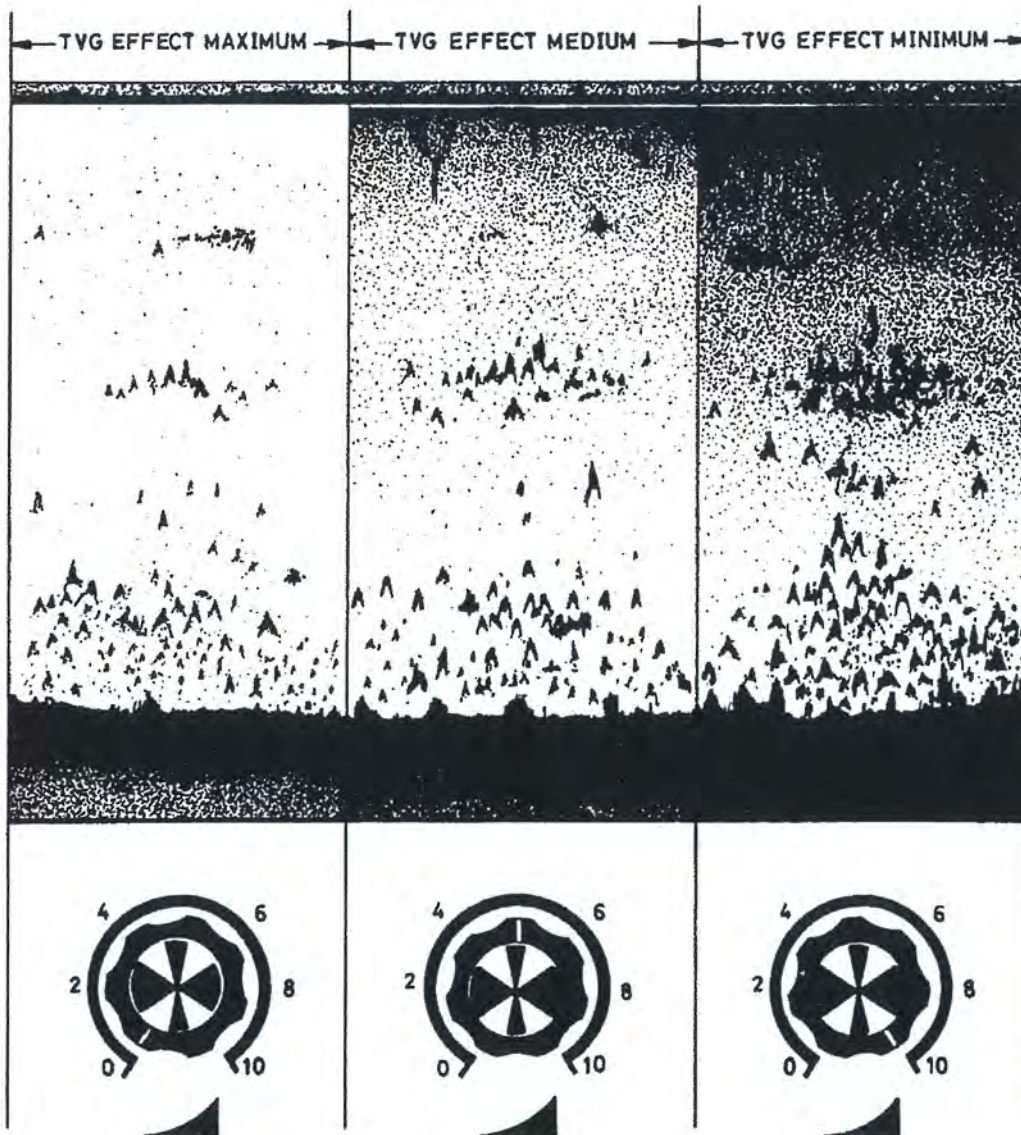
3) TVG Control

The TVG control will suppress the receiver gain for echoes from shallower depths and gradually increase it with depth. The greatest gain suppression will occur at the zero line. In its fully counterclockwise position, both the gain suppressing effect and the range of its effectiveness are maximum; at this control setting, the receiver will restore its normal gain level at a distance of approximately 150 meters (80 fathoms or 490 feet) from the transducer.

Fig. 9-4
TVG CONTROL



Fig. 9-5
TVG ADJUSTMENT & ITS EFFECT ON
SHALLOW WATER RECORDING



The main purpose of using the TVG control is to equalize the echoes from fish of the same size at different depths in strength on the chart within a range of 150 meters (80 fathoms or 490 feet) from the surface. Fig.9-5 shows a typical example of how the TVG settings affect the recording. A proper combination of the TVG and gain control settings will make it possible to avoid the shallow water background noise without sacrificing the sensitivity for fish finding at greater depths.

NOTE : The SKIPPER 603 is usually delivered with the TVG control turned fully counterclockwise. Under this condition, the bottom may not be recorded or may be very weak even if it is well within the depth range selected, if the gain control is at a low setting.

Fig.9-6
PULSE LENGTH CONTROL



4) Pulse Length Control

Fig.9-7
PULSE LENGTH ADJUSTMENT & ITS EFFECT ON SHALLOW WATER RECORDING

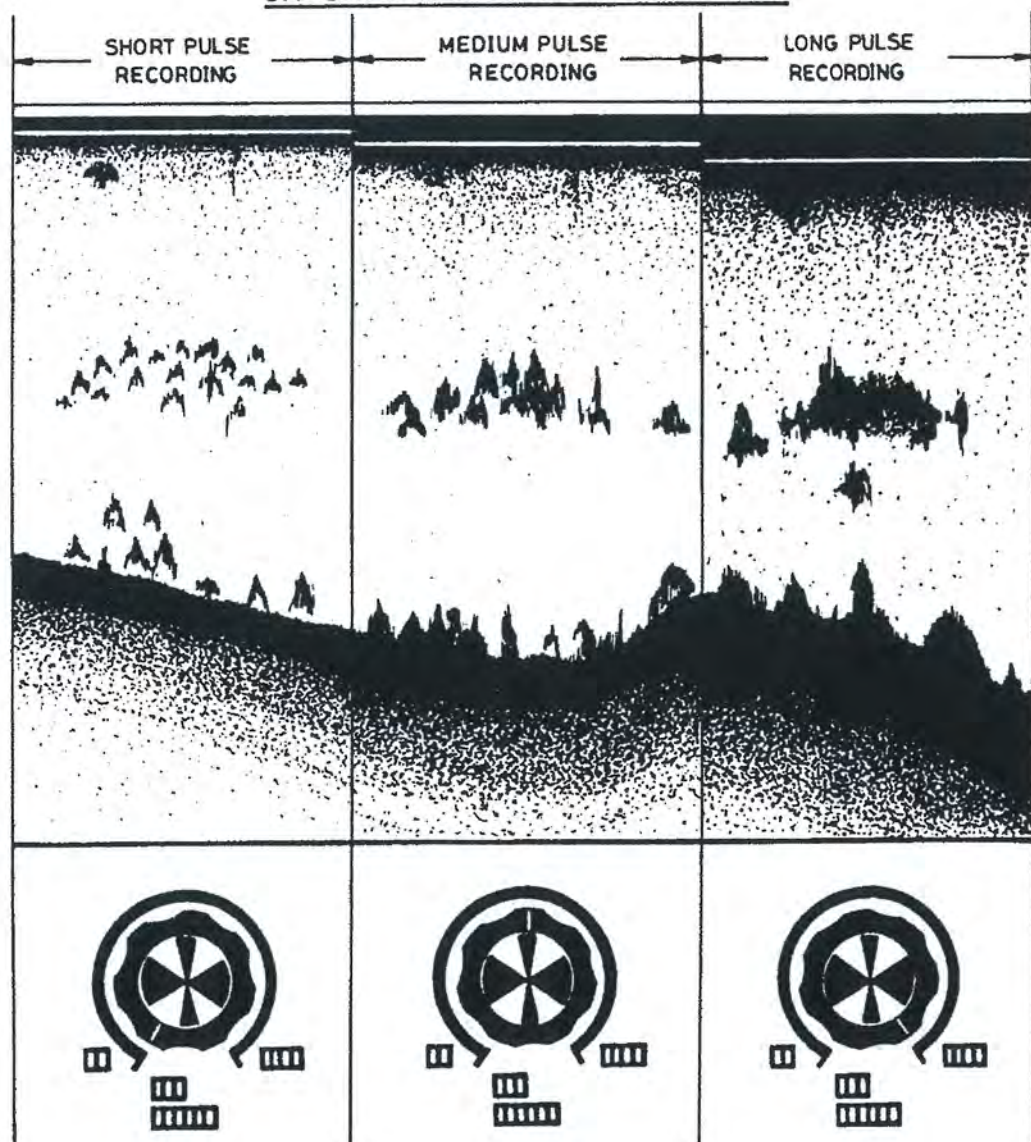
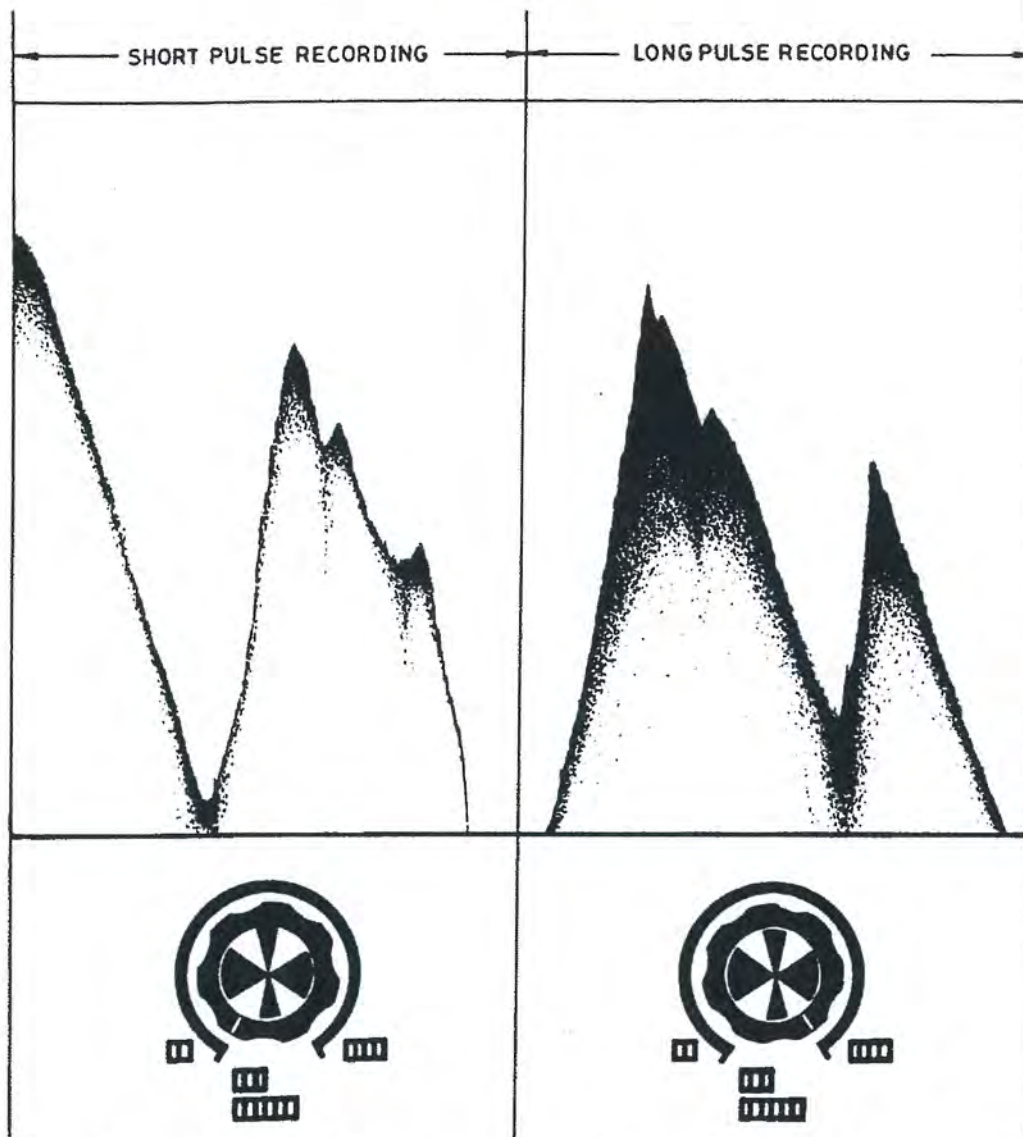


Fig. 9-8
PULSE LENGTH ADJUSTMENT & ITS EFFECT
ON DEEP WATER RECORDING



The pulse length control will adjust the length of the pulse to be transmitted into water. Clockwise rotation will increase the length. The pulse length adjustment will affect the ability of the sounder to discriminate between closely spaced objects in the vertical direction, and also affect the strength of the echoes to be received.

Fig. 9-7 shows how the discriminating ability changes with the control settings. Obviously, shorter pulse lengths will be more advantageous when fishing at shallow depths.

Longer pulses will provide more "hitting power" to the objects, and result in the echoes returning more strongly, as illustrated in Fig. 9-8. Long pulse operation will, therefore, be suitable where the ability to detect the presence of fish or the bottom is of greater importance.

5) Chart Speed Control

The chart speed control will adjust the chart feed speed from approximately 7.2 centimeters (2.8 inches) to approximately 72 centimeters (2.4 feet) per hour. At the lowest speed, available with the control turned fully counterclockwise, a standard TP-6 will last approximately 27 hours. Lower speeds will be adequate when using the SKIPPER 603 as a navigation sounder to record depths only, and will save chart consumption. Higher speeds will be preferable when detailed information on the echoes under close observation is required.

For fish finding purposes, low to medium speeds will be used, particularly on basic recording ranges "C" and "D", where, due to greater depth ranges to be covered, the rate of receiving the under-water information is relatively slow. High speeds on those deep ranges will cause the recording to become coarse horizontally, making it rather difficult to read the information.

Fig. 9-9
CHART SPEED CONTROL



6) Chart Illumination Control

This control will adjust the intensity of illumination over the chart and scale plate for operation in darkness.

Clockwise rotation past a "click" will turn illumination on and increase the intensity. If it is not needed, turn the control counterclockwise until it "clicks".

Fig. 9-10
CHART ILLUMINATION CONTROL



7) Line Marker Switch

Depressing this switch will cause the stylus to draw a continuous straight line across the chart. Such marker lines may be used for such purposes as to identify, for future reference, the spot where depth range was changed, where a particular combination of the operating controls was employed, where the fishing gear was introduced into water, etc.

Fig. 9-11
LINE MARKER SWITCH



The switch may also be used to check if the recording stylus, after being adjusted or replaced, is making proper contact with the chart over its entire width.

When operating the SKIPPER 603 for navigational purposes, all that is required is usually the depth to the bottom. Two modes of operation are available to meet this requirement in an economical way: Digital Depth Indication & Contour Line Recording.

1) Digital Depth Indication

In case where an approximate depth indication is adequate, this mode of operation is the most economical. The built-in digital depth indicator (numerical display on the front panel) will show the depth in three digits in meters, fathoms or feet as selected by the calibration unit selector switch. Refer to Figs. 6-1 through 6-4 on pages 6-1 and 6-2 for the unit of measurements selection.

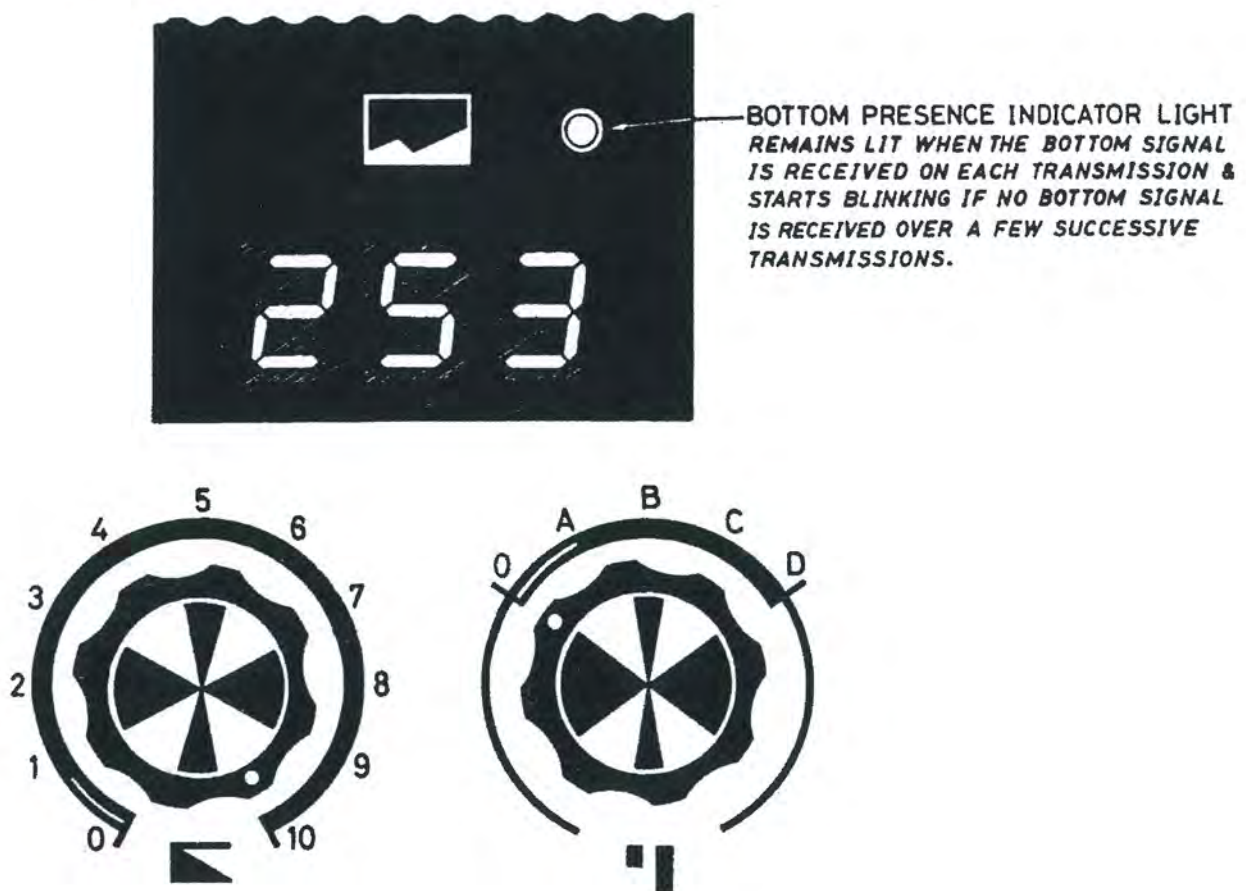
To bring the digital depth indicator into operation, the basic range selector must be set to position 0 and the bottom line control rotated fully clockwise, as in Fig. 10-1. The following controls will affect the ability of the indicator to show the depth correctly :

Gain Control
TVG Control
Pulse Length Control

The optimum setting positions of these controls depend on the depth and bottom conditions. Normally they should be adjusted

Fig. 10-1

TYPICAL DIGITAL DEPTH INDICATION AND
CONTROL SETTINGS TO OBTAIN READOUTS



so that the bottom presence indicator light (the small red light located just above the right digit) remains lit.

In shallow waters, there is a possibility that the digital indicator may show a false depth by reacting to the echoes from fish, or noise-producing particles, such as plankton concentrations or air bubbles. To minimize such a possibility, when using the indicator in less than 10 meters (5 fathoms or 30 feet) of water, both the TVG and the pulse length controls should be rotated fully counterclockwise, thus allowing only the gain control to be adjusted to keep the light lit.

It is good practice to switch back to the recording function whenever a sudden change in digital readout has taken place, to see if such a change was a result of an actual change in depth.

If the bottom echo is not received over a few consecutive scanning belt rotations either through incorrect control settings or due to the depth exceeding the maximum detectable depth of the equipment, the bottom presence indicator light will start blinking, and at the same time the readout indicator will be shut off. This condition will continue until the bottom is received again.

NOTES :

A) The digital depth readout will have an error of up to :

0.9 feet for FOOT depth indication
0.9 fathoms for FATHOM depth indication
0.9 meters for METRIC depth indication

If, for instance, a readout of 20 is obtained, the actual depth indication will be :

from 20 to 20.9 feet for FOOT indication
from 20 to 20.9 fathoms for FATHOM indication
from 20 to 20.9 meters for METRIC indication

The operator should, therefore, take this readout error into consideration, especially when working at shallow depths.

B) The digital depth indicator is designed to show the depth up to 600 meters (333 fathoms or 999 feet) correctly, despite of the maximum recording scale mark being greater than that. If depths greater than this limit are to be measured, it must be by means of recording.

2) Contour Line Recording

Where only an indication of the bottom is needed, this mode of operation will serve the purpose. Refer to Fig. 9-3, noting the type of recording this will provide.

Set the bottom line/contour line selector switch to the contour line position, and advance the bottom line control clockwise till the bottom echo is turned into a thin line showing only the contour of the bottom. The gain control should also be adjusted, as required, to produce this effect. No recording will be made below the bottom line, and this will help avoid causing excessive build-up of carbon dust and increasing the stylus wear. The chart feed speed should also be kept as low as possible to conserve the paper.

Basic Operational Notes

The following information is provided to help the operator in interpreting the recordings and understanding the performance limitations of the SKIPPER 603, so that he may locate the presence of fish more efficiently and estimate the quantity more accurately.

1) Horizontal Coverage & Discrimination

The sound energy is transmitted into water in a cone-shaped beam, and therefore the horizontal area to be covered by the beam increases with depth. Since all objects inside the beam produce echoes, there is a tendency to presume that all echo-producing fish are directly below the vessel; this is not always true.

Refer to Figs. 11-1A and 11-1B, which show how much area is to be covered at a particular depth. For example, at a depth of 150 meters (75 fathoms or 450 feet), the area to be covered horizontally is 91 meters (275 feet) in all directions by the wide beam transducer, or 50.2 meters (150 feet) both athwartships and alongships by the narrow beam transducer.

This also means that theoretically at 150 meters (75 fathoms or 450 feet) from the transducer, two schools of fish must be more than :

91 meters (275 feet) apart when the wide beam transducer is used, or

50.2 meters (150 feet) apart when the narrow beam transducer is used,

in order to provide separate echoes.

Fig. 11-1A
HORIZONTAL BEAM COVERAGE ON METRIC SCALE

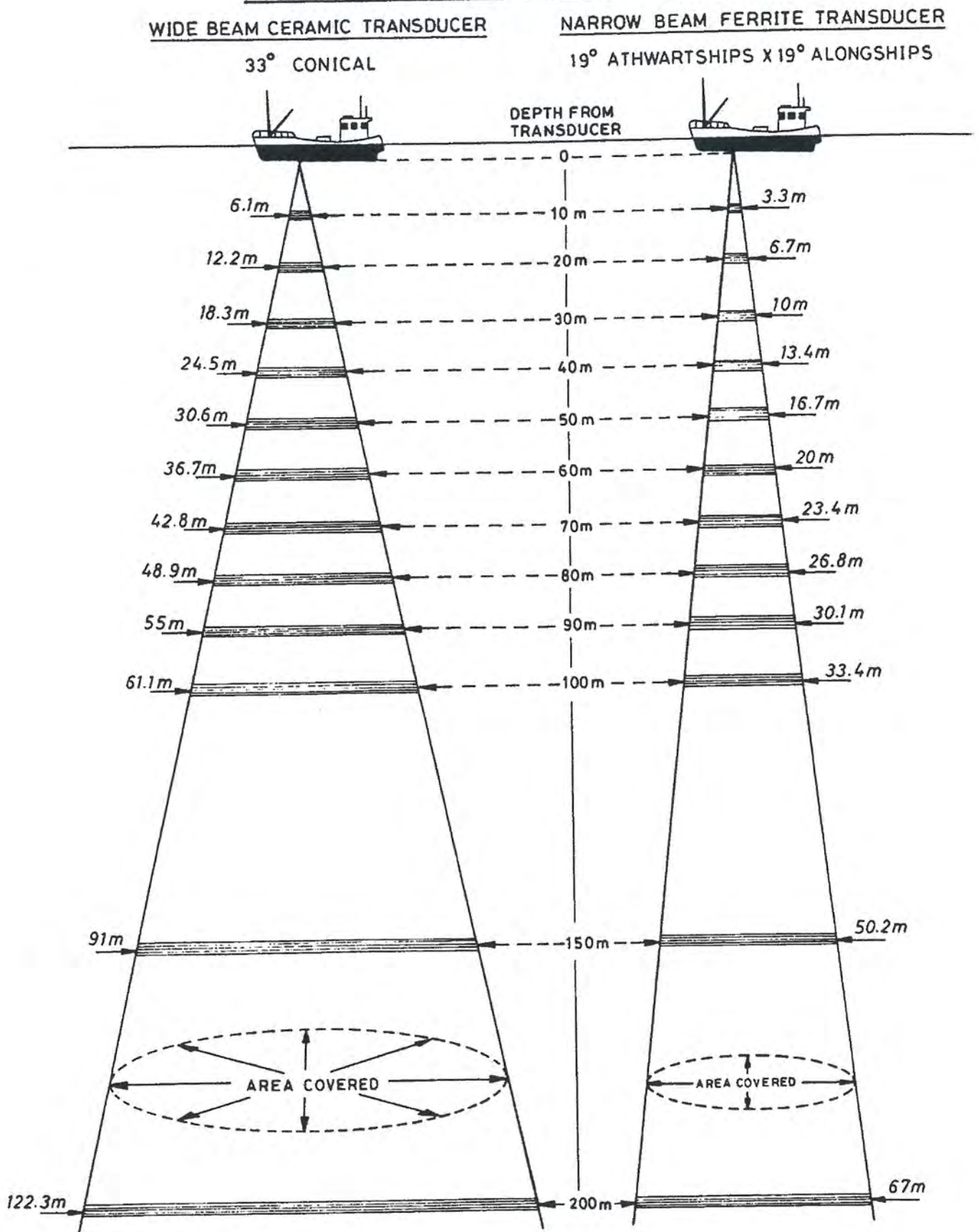


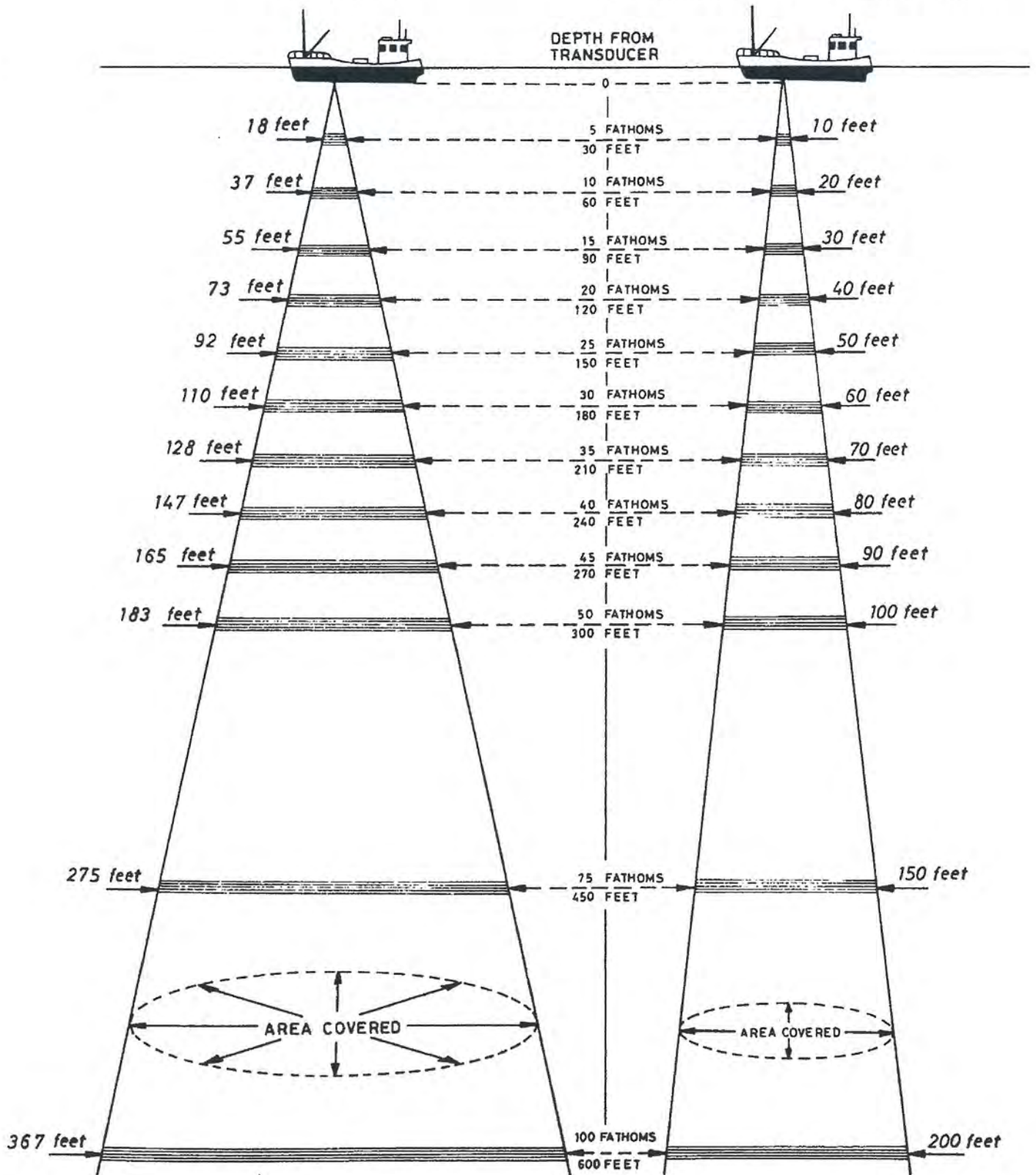
Fig. 11-1B
HORIZONTAL BEAM COVERAGE ON FATHOM/FOOT SCALE

WIDE BEAM CERAMIC TRANSDUCER

NARROW BEAM FERRITE TRANSDUCER

33° CONICAL

19° ATHWARTSHIPS X 19° ALONGSHIPS



2) Effect of Transducer Beam on Depth Recording to Fish

Another important factor to be born in mind during fish finding operation is that fish near the rim of the beam will be recorded slightly deeper than they actually are, and that those near the beam center will show up at the correct depth.

Refer to Fig.11-2. The echo from the fish school near the beam rim will take more time to reach the transducer than that from fish directly below the transducer. This will result in the former being recorded deeper than the latter. Table 11-1 shows how much fish may be recorded deeper than they actually are at some particular working depths.

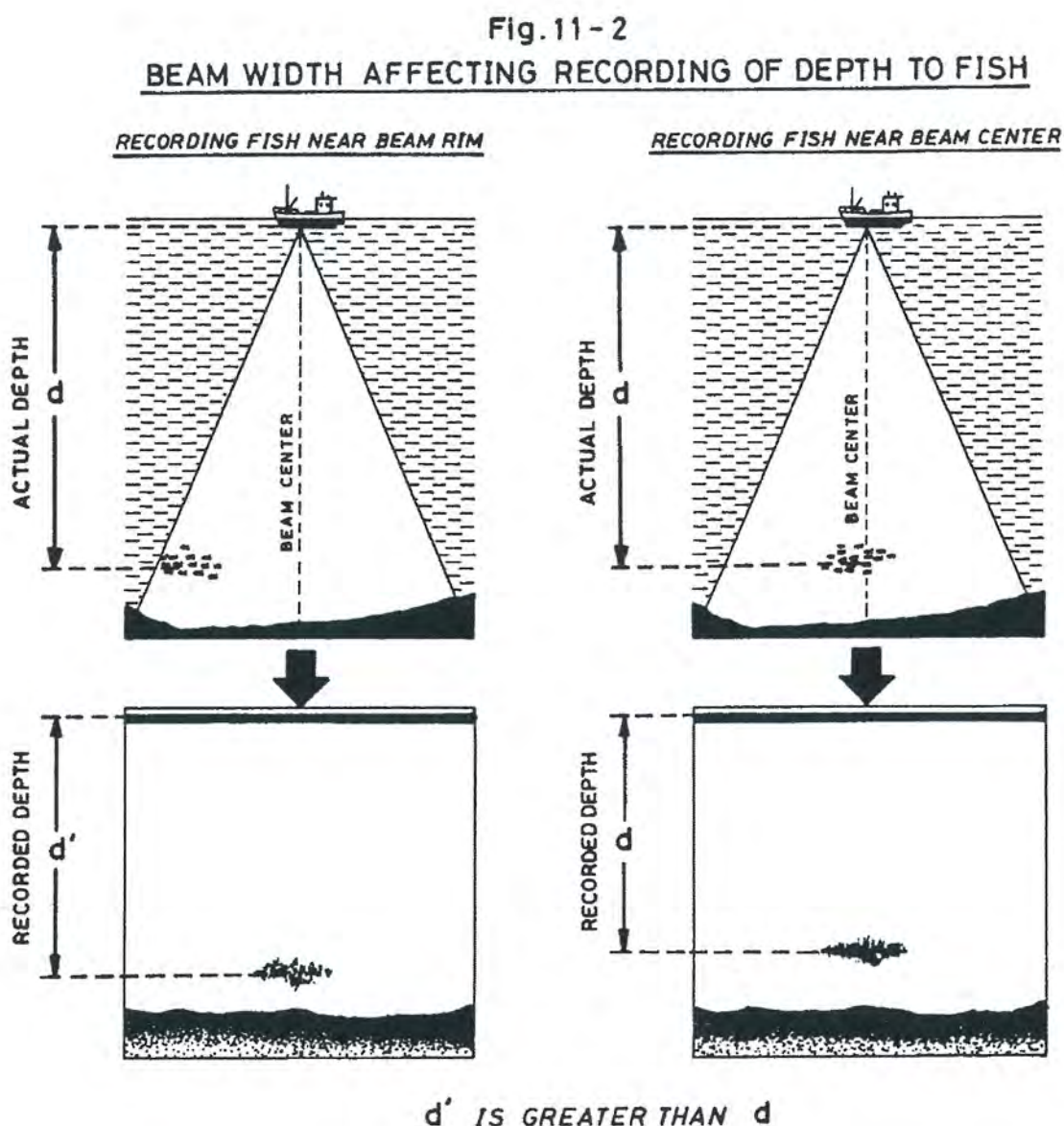


Table 11-1
RECORDED DEPTH TO FISH & ACTUAL DEPTH

RECORDED DEPTH TO FISH IN METERS	WIDE BEAM TRANSDUCER	NARROW BEAM TRANSDUCER
	ACTUAL DEPTH	ACTUAL DEPTH
50	48 — 50	49 — 50
100	96 — 100	98 — 100
150	143 — 150	148 — 150
200	191 — 200	197 — 200
250	239 — 250	246 — 250
300	287 — 300	296 — 300

RECORDED DEPTH TO FISH IN FATHOMS	WIDE BEAM TRANSDUCER	NARROW BEAM TRANSDUCER
	ACTUAL DEPTH	ACTUAL DEPTH
20	19 — 20	19.7 — 20
40	38 — 40	39.4 — 20
60	57 — 60	59 — 60
80	76 — 80	78.9 — 80
100	95 — 100	98.6 — 100
150	143 — 150	148 — 150

RECORDED DEPTH TO FISH IN FEET	WIDE BEAM TRANSDUCER	NARROW BEAM TRANSDUCER
	ACTUAL DEPTH	ACTUAL DEPTH
100	96 — 100	99 — 100
200	191 — 200	197 — 200
400	383 — 400	395 — 400
600	574 — 600	592 — 600
800	765 — 800	789 — 800
1000	956 — 1000	986 — 1000

3) Effect of Transducer Beam on Bottom Fish Finding

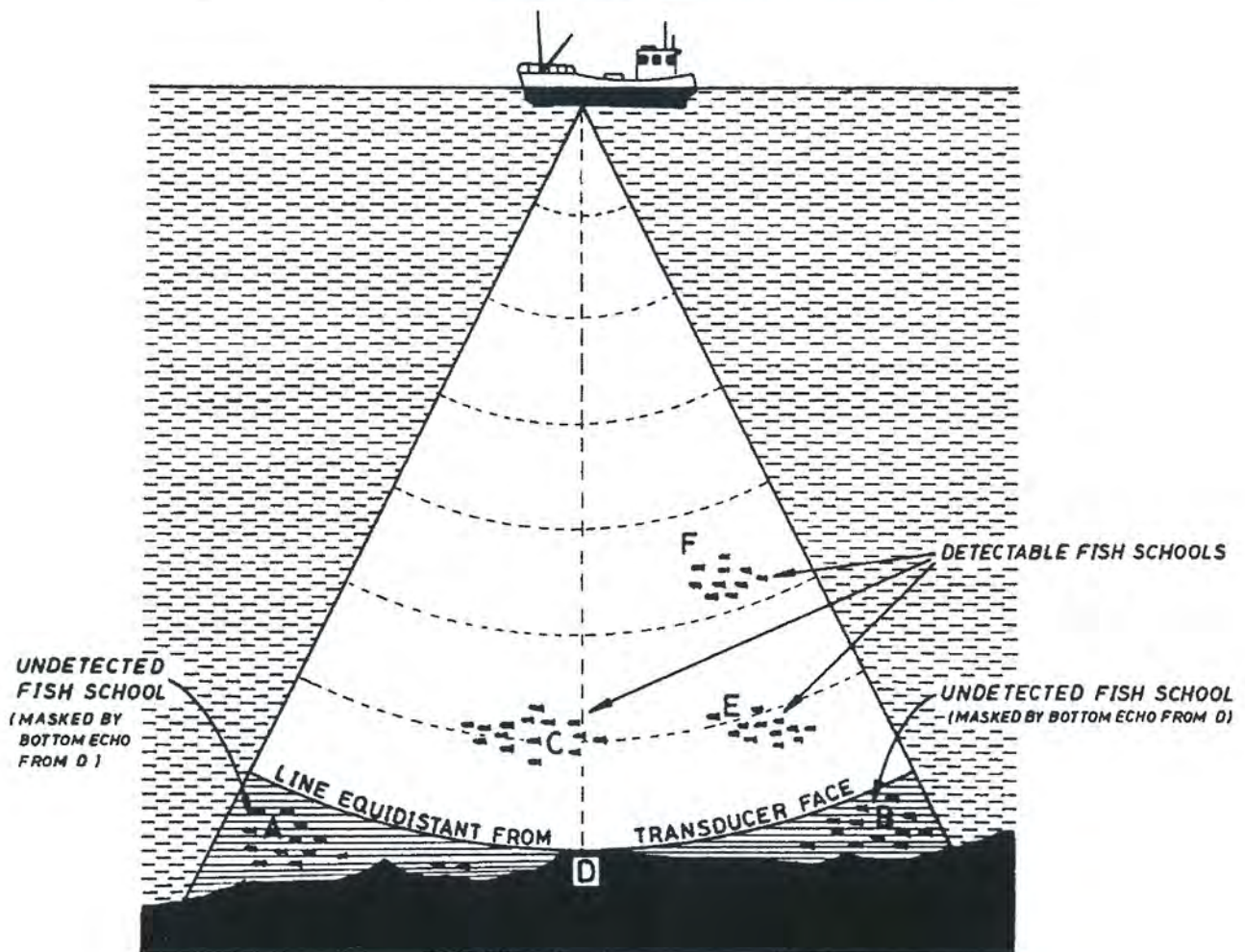
Undetected Bottom Fish

The effect of the beam will also limit the ability of the bottom line control to discriminate between the bottom and fish lying on or close to the bottom.

When locating the presence of fish, the operator should keep in mind the fact that only those near the beam center will be recorded as fish echoes on the chart, and that fish distant from the beam center will be left undetected, even by the use of the bottom line control.

Fig. 11-3 illustrates how this occurs. Fish schools "C", "E" and "F" will be recorded earlier than the bottom and show up separated from the bottom echo on the chart. It must be understood that objects on the same line equidistant from the transducer will be recorded at the same depth. When the transmitted pulse has reached point "D" on the bottom, fish schools "A" and "B" are still below the equidistant line on which point "D" is located. Therefore the echoes from "A" and "B" will be masked by the strong bottom echo from "D" on the chart, and this will make it impossible to detect those fish schools inside the beam.

Fig. 11 - 3
UNDETECTED FISH INSIDE TRANSDUCER BEAM



4) Vertical Discrimination

The length of the sound pulse will affect the ability of the SKIPPER 603 to discriminate between vertically spaced schools of fish. The minimum pulse length, available with the pulse length control turned fully counterclockwise, is approximately 0.4 millisecond which corresponds to approximately 60 centimeters (approximately 2 feet) in terms of vertical distance. In other words, the shortest pulse has a "thickness" of 60 centimeters (2 feet). If, therefore, two schools of fish are less than 60 centimeters (2 feet) apart, their echoes will merge and appear as a single echo on the chart.

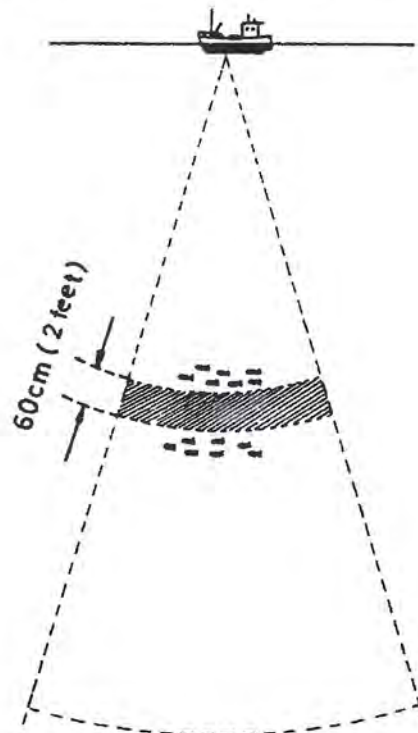
Likewise, if a school of fish is at less than that distance from the bottom, the fish echo will merge with the bottom echo. In this case, however, the proper use of the bottom line control will make it possible to separate them, as has been discussed under "Bottom Line Control" on page 9-1.

The longest pulse obtained by turning the pulse length control fully clockwise is approximately 2.4 milliseconds in length which corresponds to a vertical distance of approximately 3.5 meters (11.5 feet). In the 12 o'clock position, the length is approximately 1.5 milliseconds (2.2 meters or 7.2 feet).

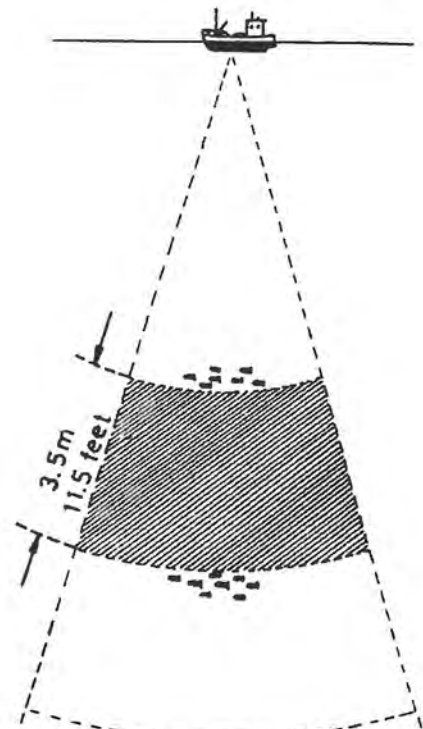
Obviously the shorter the pulse, the better the vertical discrimination. However, the longest pulse will provide the greatest transmitting power, and while sacrificing the discriminating ability, will be most effective for recording at maximum depths and especially under rough operating conditions such as when the vessel is heavily pitching or rolling.

Fig. 11 - 4
PULSE LENGTH AFFECTING VERTICAL DISCRIMINATION

DISCRIMINATION WITH SHORTEST PULSE



DISCRIMINATION WITH LONGEST PULSE



5) Typical Bottom Characteristics As Shown on The Chart

It will be possible to know some of the bottom characteristics from the way the bottom echo appears on the chart.

A soft bottom or thick silt-covered bottom will be registered as a relatively narrow line because of much of the transmitted energy being absorbed in the bottom sediment. On the other hand, a hard or rocky bottom will appear as a much wider marking under the same gain control setting due to the fact that most of the area covered by the beam width will reflect the sound energy back to the transducer. Also for the same reason, a sloping bank will show up in the form of a very wide line.

When using the bottom line control, if a white space appears just below the contour of the second echo as well as just below the first bottom line, that particular part of the bottom may be assumed to be very hard (in some cases heavy rocks are present).

6) Echo Disappearance

Under some operating conditions, fish echoes and even the bottom echo may disappear even if they are well within the depth range selected. This phenomenon will be caused mainly by air bubbles, turbulent streams and strong undercurrents.

When, for instance, the vessel is going astern, air bubbles in the propeller stream are driven over the transducer face, thereby preventing the transmitted power from getting through into water and furthermore preventing the echoes from reaching the transducer. A similar situation will occur when the vessel is passing through the wake of another travelling vessel, or in area where traffic is very heavy. The bottom echo may be recorded very weak or may not be recorded at high gain settings because of the presence of air bubbles, turbulence or agitated water, even if the surface looks calm.

6. User's Maintenance

In order to keep the SKIPPER 603 in proper working conditions, the following maintenance instructions should be carried out by the user at regular intervals.

1) Cleaning The Recorder Unit

After hours of use, there will be a certain amount of carbon dust inside the cabinet. It can become a source of trouble, if not removed on a regular basis. A small, soft paint may be used.

To remove carbon accumulated on the printed boards, it will be necessary to open the recording platform and lower the main chassis as per the instructions on pages 2-2 through 2-4. A vacuum cleaner or air compressor will be an ideal instrument for removal of carbon powder on the boards and in the switches.

Like all electronics equipment, the SKIPPER 603 must be kept dry in the interest of long term equipment reliability. If the 603 will not be used for several months, it should be removed from the vessel and placed in dry storage.

2) Maintenance on The Transducer

Marine growth on the working face of the transducer will result in a gradual decrease in the sensitivity. Each time the vessel is dry-docked, check the face of the transducer. If any growth of barnacles or weed is found, it should be removed very carefully with a piece of wood or sand paper, taking care not to damage the face.

The metallic housing of the ceramic transducer (TMM-60-50-10LA) may be painted with anti-fouling paint. The plastic housing of the ferrite transducer (XGM-PI-50X4/2) does not require painting.

The steel blister may be sand-papered and repainted with anti-fouling paint. Always remove old paint before repainting.

3) Checking Electrical Connections

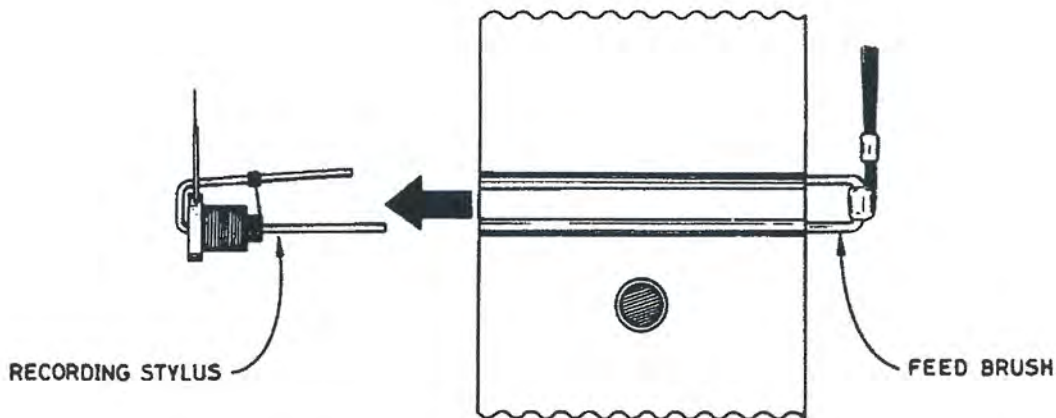
The most common source of trouble is usually the connections to the recorder unit. At least once a year, check the external connection terminal block to be sure that all the leads are securely fastened to their respective terminals and there is no sign of corrosion on them. The connections at the battery terminals should also be inspected.

4) Adjusting The Recording Stylus

After prolonged use, the stylus wire may wear down to such an extent that it is not contacting the chart properly, and it may need adjusting.

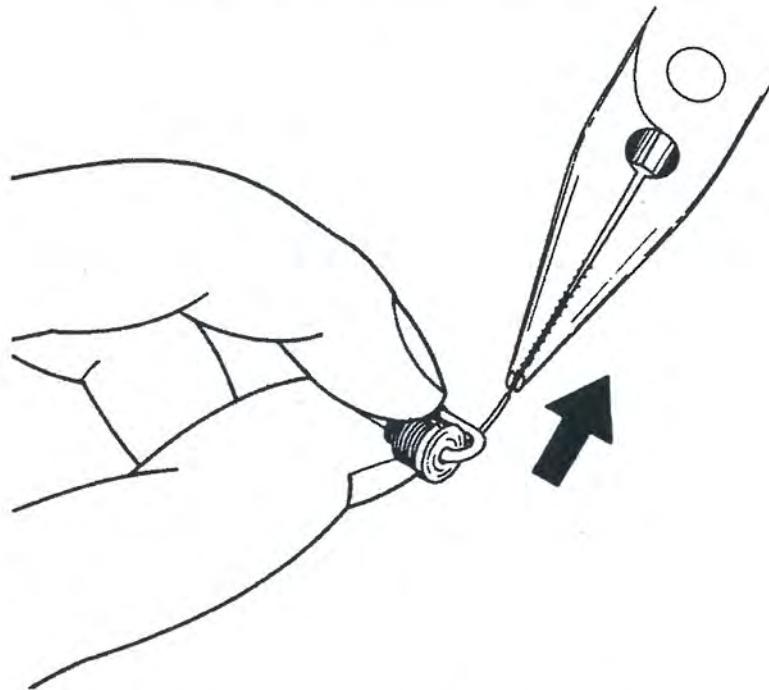
To remove the stylus, turn the belt downwards by hand until it is brought to an easily accessible point. While pressing the belt against the feed plate (the metallic plate behind the belt), remove the stylus as shown in Fig. 12-1.

Fig. 12-1
REMOVING RECORDING STYLUS



The spare stylus wire is coiled around the frame, and can be pulled out with a pair of pliers as in Fig. 12-2. Carefully pull the wire out to a length of 10 to 12 millimeters (0.39" to 0.47"), and push the stylus back into the holder on the belt.

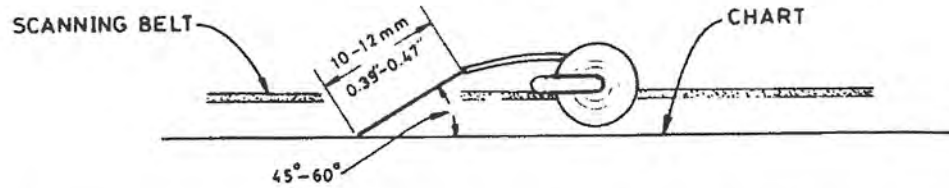
Fig. 12-2
PULLING OUT STYLUS TIP



Make sure that the wire is contacting the chart at an angle of 45 to 60 degrees, as shown in Fig. 12-3. If necessary, gently bend the wire so that the contact angle is between 45 and 60 degrees.

Fig. 12-3
STYLUS PRESSURE ADJUSTMENT-1

CORRECT TIP LENGTH AND CONTACT ANGLE TO CHART

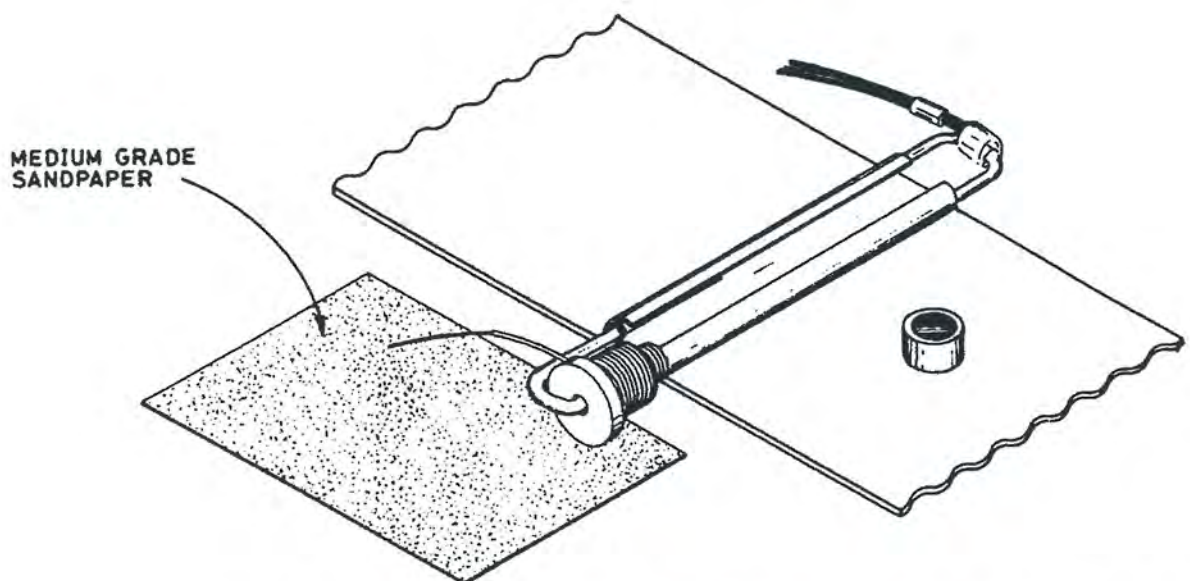


When the stylus is adjusted as above, or when a new stylus is installed, it is highly recommended that a piece of medium grade sand paper be placed over the chart and the stylus be allowed to travel over it for 10 to 20 seconds with the basic range selector in position "A". This will ensure proper stylus pressure against the chart, thus helping obtain satisfactory markings.

Finally, depress the line marker switch to make it sure that a continuous straight line is being drawn across the chart.

Fig. 12-4
STYLUS PRESSURE ADJUSTMENT-2

SMOOTHING TIP



ALLOW STYLUS TIP TO RUN OVER MEDIUM GRADE SANDPAPER FOR 10 TO 15 SECONDS WITH BASIC RANGE SELECTOR IN POSITION "A".

NOTE : The stylus adjustment will make it necessary to readjust the zero line position. Refer to "Zero Line Alignment" on page 8-1 for the instructions.

5) Adjusting The Feed Brush

The feed brush also requires maintenance at regular intervals for satisfactory recordings. It performs the function of feeding the receiver output to the recording stylus by making contact with the receiver output feed plate just behind the scanning belt. Faulty contact with the feed plate will result in intermittent recordings, especially on the shallow ranges, and/or in a failure to show weak signals.

Check, by rotating the belt downwards by hand, if most of the brush wires are contacting the feed plate while the stylus is on the chart. If the wires have been worn out to the extent that only a few are in contact with the plate, the feed brush must be adjusted.

Adjustment for Old Type Feed Brush

Early models have the feed brush as shown in Fig.13-1A. Remove the brush carefully from the belt. Hold the binder with your thumb and fingers, bend only the wires repeatedly until they are formed as shown.

Fig.13-1A
FEED BRUSH ADJUSTMENT



DO NOT BEND THE WIRES AT THE SOLDERED JOINT, or the joint may be broken, causing the brush and its frame to be out of joint. The wires may also be broken off. If, after this adjustment, most of the wires are still not able to maintain proper contact with the feed plate, the brush must be replaced. A spare feed brush is furnished along with other spare parts. It is pre-formed so that it should not normally require adjustment. If, however, only a few wires are found to be in contact with the plate after the brush is inserted into the holder, bend the wires, following the same precaution as stated above to avoid breaking the wires or the soldered joint.

Adjustment for New Type Feed Brush

When the new type feed brush as shown in Fig.13-1B is used, carefully bend the wire binding metal with a pair of pliers until most of the wires come into contact with the feed plate as shown. If this still does not allow the wires to contact with the plate properly, the feed brush should be replaced. Adjust the spare feed brush as above, if necessary.

Fig. 13-1B
FEED BRUSH ADJUSTMENT
FOR NEW TYPE



6) Lubricating Moving Parts

In order to ensure trouble-free recorder performance, some of the moving mechanical parts should be lubricated at regular intervals. Figs. 14-1 through 14-4 show the parts to be lubricated. Use high quality oil specified for use in precision machines.

Fig. 14-1 : Chart Transport Roller Support Arm

A single drop of oil every 3 to 4 months will be sufficient. Any oil overflow over the rubber roller must be wiped off.

Fig. 14-2 : Chart Pressure Roller & Its Mounting Bracket

Apply two to three drops to the top of the roller shaft every six months. The oil will permeate through the shaft to the lower part. Wipe off any oil overflow on the roller.

Fig. 14-3 : Alignment Studs of Roll Support Discs

Apply two to three drops of oil to each stud every six months, taking care not to spill onto the roll brake cord or roll drive belt. Excess oil should be wiped off.

Fig. 14-4 : Front Door Lock Assembly

These parts should be lubricated at least once every six months with either grease or oil, so as to prevent possible corrosion as well as to ensure smooth action.

Fig. 14-1
MOVING PARTS REQUIRING LUBRICATION - 1

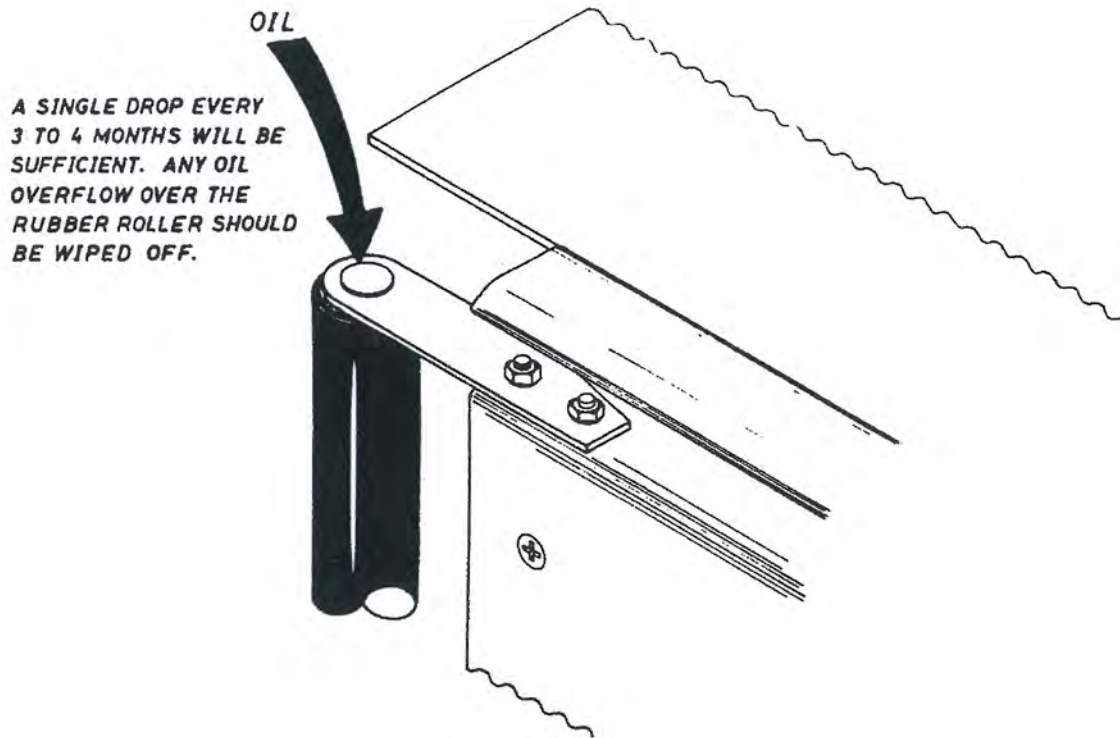


Fig. 14-2
MOVING PARTS REQUIRING LUBRICATION - 2

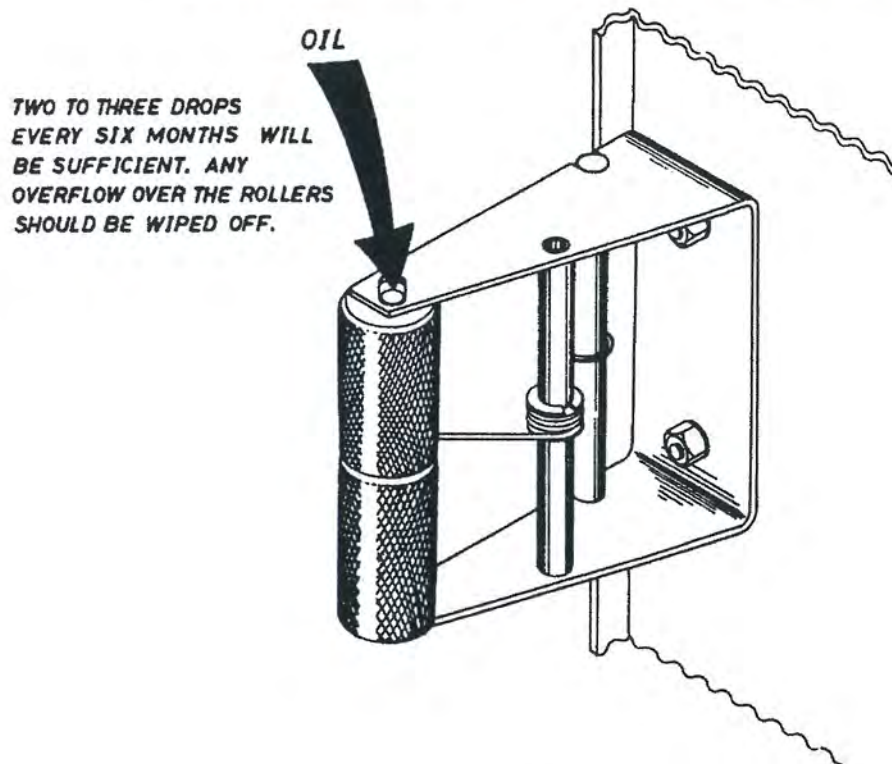


Fig.14-3
MOVING PARTS REQUIRING LUBRICATION - 3

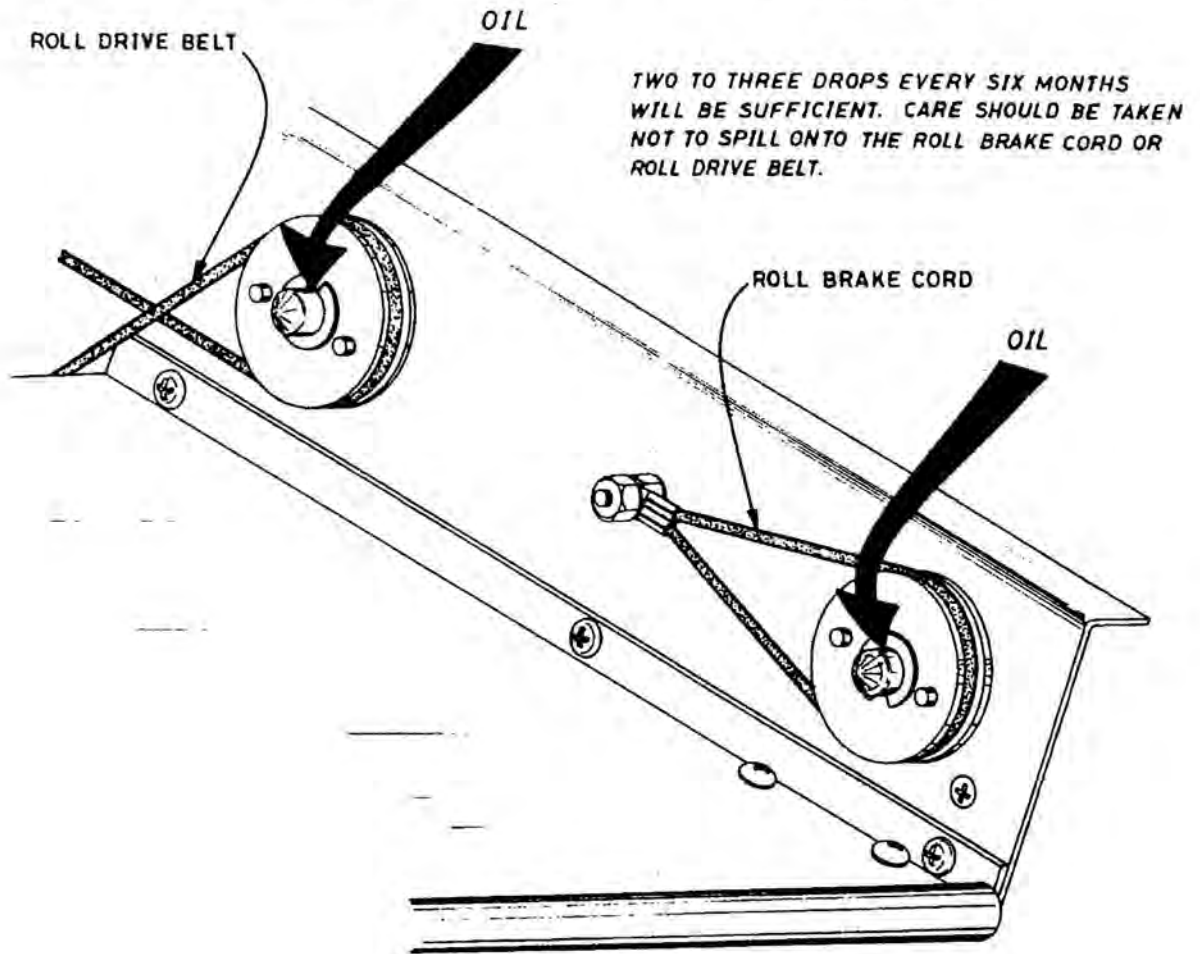
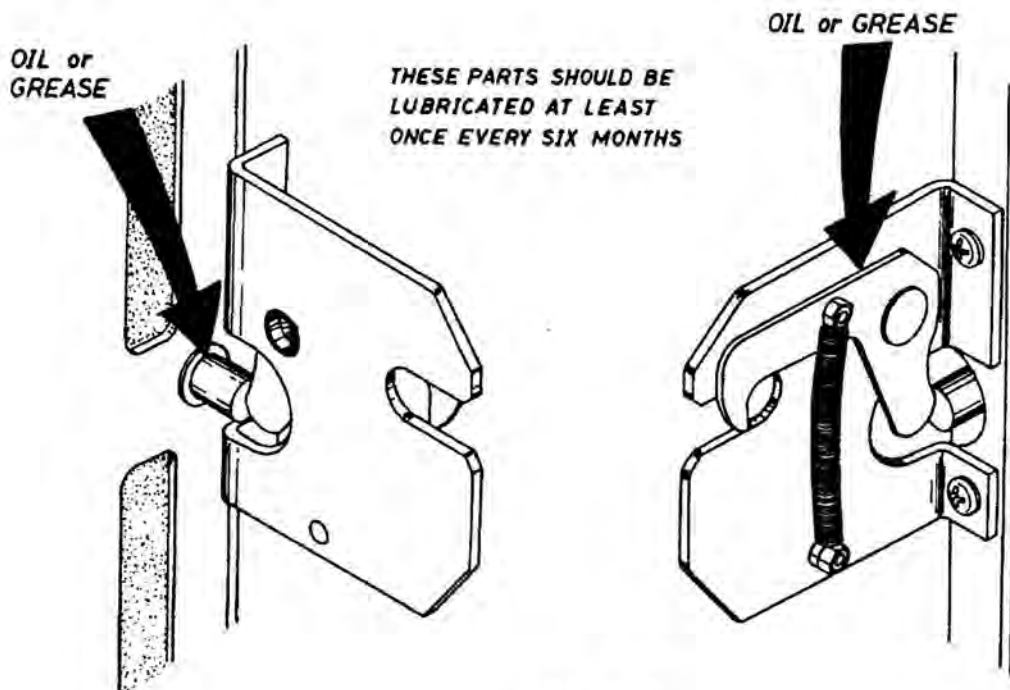
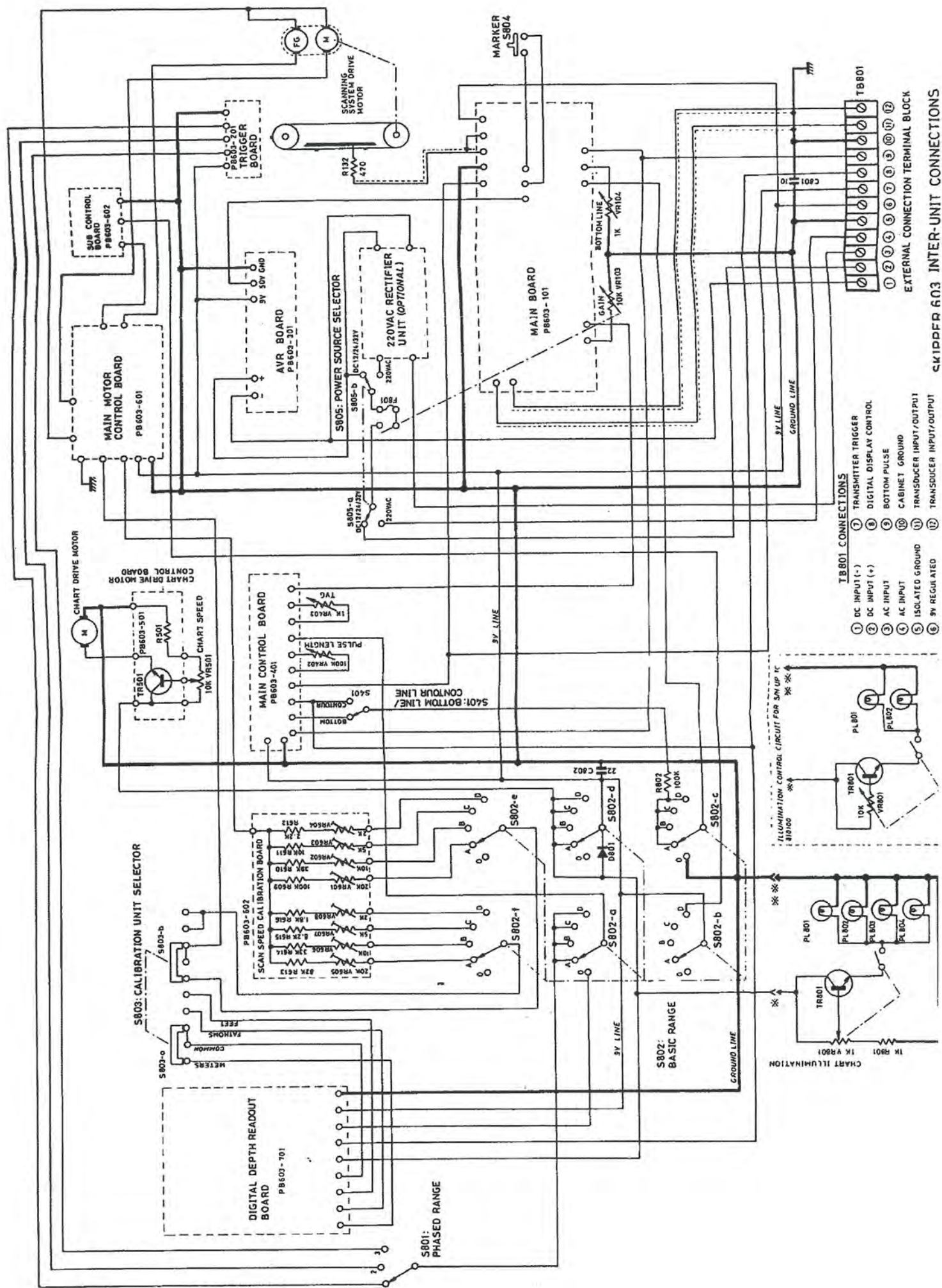


Fig.14-4
MOVING PARTS REQUIRING LUBRICATION- 4





EXTERNAL CONNECTION TERMINAL BLOCK

④ AC INPUT
⑤ ISOLATED GROUND
⑥ 9V REGULATED
⑩ CABINET GROUND
⑪ TRANSDUCER INPUT/OUTPUT
⑫ TRANSDUCER INPUT/OUTPUT