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FURUNO

OPERATOR'S MANUAL

DOPPLER SPEED LOG

MODEL DS-70

TYPE APPROVED BY MINISTRY OF TRANSPORT JAPAN

Model :	DS-70
Approval No. :	2627
Approval Date :	January 24, 1986

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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(TATA)

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SAFETY INFORMATION

"**WARNING**", "**CAUTION**" and "**NOTICE**" signs appear throughout this manual. It is the responsibility of the installer and operator of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

Safety information for both the installer and operator begins on the next page.

WARNING	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or property damage.
NOTICE	This notice indicates an unsafe practice which, if not avoided, could result in property damage or equipment malfunction.

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SAFETY INFORMATION FOR THE INSTALLER

WARNING



Only qualified personnel should work inside the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death.

Turn off the power at the ship's mains switchboard before beginning the installation. Post a warning sign near the switchboard to ensure that the power will not be applied while the equipment is being installed.

Serious injury or death can result if the power is not turned off, or is applied while the equipment is being installed.

CAUTION



Ground the equipment.

Ungrounded equipment can give off or receive electro-magnetic interference or cause electrical shock.

Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or equipment damage. The voltage rating appears on the label at the rear of the equipment.

NOTICE

The mounting location must satisfy the following conditions:

- Away from rain and water splash
- Out of direct sunlight
- Away from air conditioner vents
- Away from magnets and magnetic fields
- Moderate and stable in temperature and humidity

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SAFETY INFORMATION FOR THE OPERATOR

WARNING



Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

Do not dissasemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire, electrical shock or serious injury.

CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not place heater near the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

Do not operate the unit with wet hands.

Electrical shock can result.

Use the correct fuse.

Use of the wrong fuse can cause fire or equipment damage.

(Continued on next page)

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NOTICE

Do not use the equipment for other than its intended purpose.

Use of the equipment as a chair or a shelf, for example, can cause equipment damage.

Immediately turn off the power whenever you feel the equipment is abnormal.

Continued use can cause equipment damage.

The useable temperature range is -15°C to 55°C.

Use out of the range can cause equipment damage.

Keep magnets and magnetic fields (speaker, transformer, etc.) away from the equipment.

Magnets and magnetic fields can cause equipment malfunction.

Do not place objects near the equipment.

Objects near the equipment can cause overheating.

Handle the equipment carefully.

Rough handling can cause corrosion.

Do not use chemical cleaners to clean the equipment.

Chemical cleaners can remove paint and markings.

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Declaration of conformity to type

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1. PREFACE

The FURUNO DS-70 Doppler Speed Log measures ship's speed relative to the water. Its operating principle is based on the Doppler Effect; readout of the ship's speed is made by detecting the doppler shift frequency from the signal reflected by the water mass.

The major features of the DS-70 are as follows.

* **Pair-Beam System**

  To compensate for errors due to ship's pitch and roll the transducer assemblies symmetrically emit two sonic beams. This pair-beam system indicates an average doppler shift in both directions, thus providing accurate information under rough sea conditions.

* **Durability**

  Because the unit has no moving mechanism, and is composed of only electrical parts, very little maintenance is required.

* **Ease of Operation**

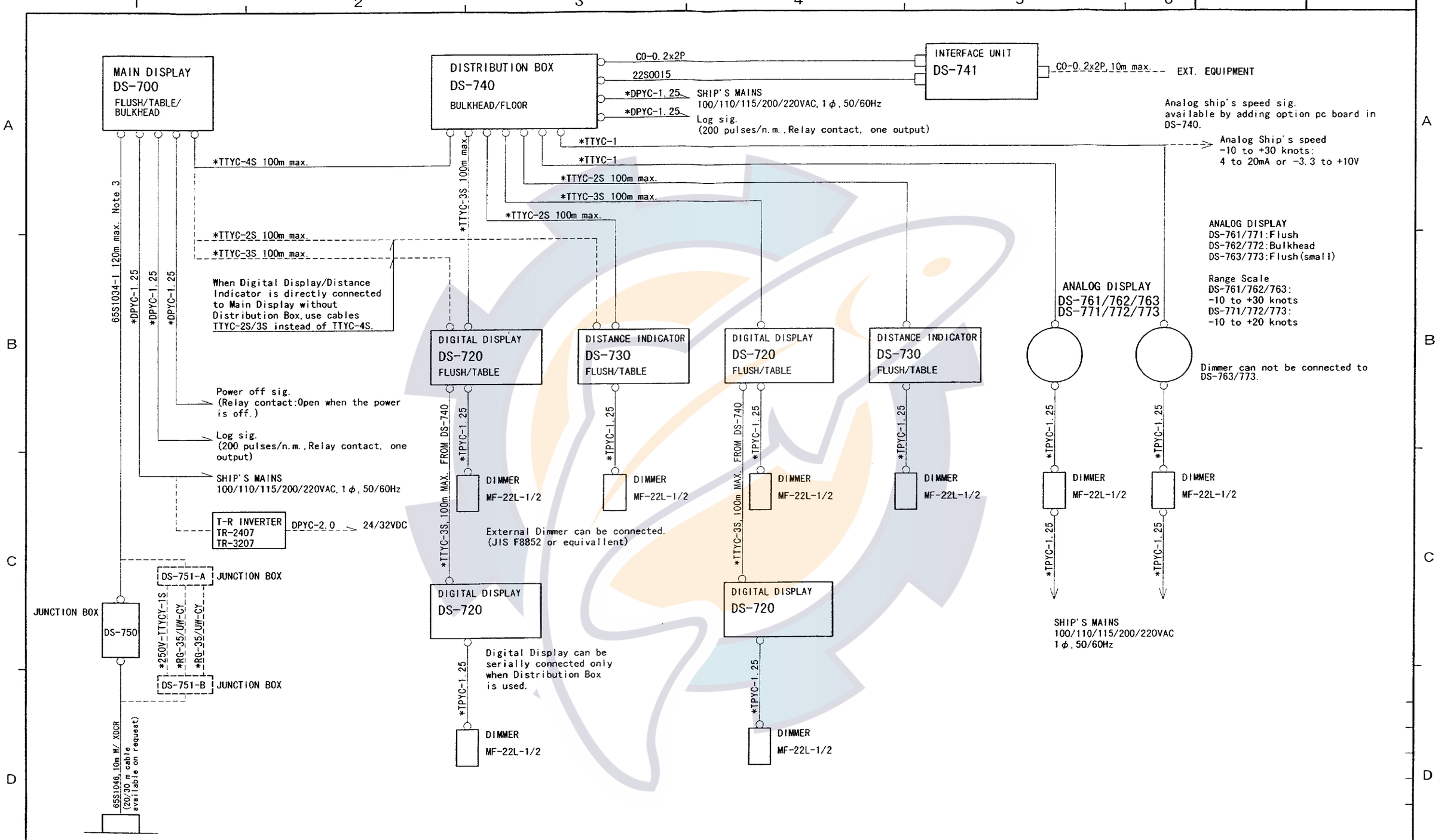
  In most cases, all that is needed is a simple push of the power switch.

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TRANSDUCER
DS-785-10:with 10m cable
DS-785-20:with 20m cable
DS-785-30:with 30m cable
SEACHEST
DS-781:Projection
DS-782:Gate Valve Type P
DS-783:Flush Type P
DS-784:Flush
DS-786:Gate Valve Type F

Note 1. *: SHIPYARD SUPPLY.

2. Units except Main Display, Junction Box and Transducer/Seachest are optional supply.

Note 3:
When cable length is extended more than 120m, use two junction boxes instead of DS-750. If so, maximum cable length between DS-700 and transducer is 400m.
(Note that cable length of 65S1034-1 should be 30m at maximum.)

DRAWN Jan 7'99 T.TAKASAKI			TITLE DS-70
CHECKED Jan 7 '99 K.Kusunoki			NAME DOPPLER SPEED LOG
APPROVED Jan 7 '99 K.Kusunoki			SYSTEM DIAGRAM
SCALE	MASS kg		
DWG No. E7222-026- H			

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2. OPERATION

2.1 Function of Controls

MAIN DISPLAY

- Front Panel -

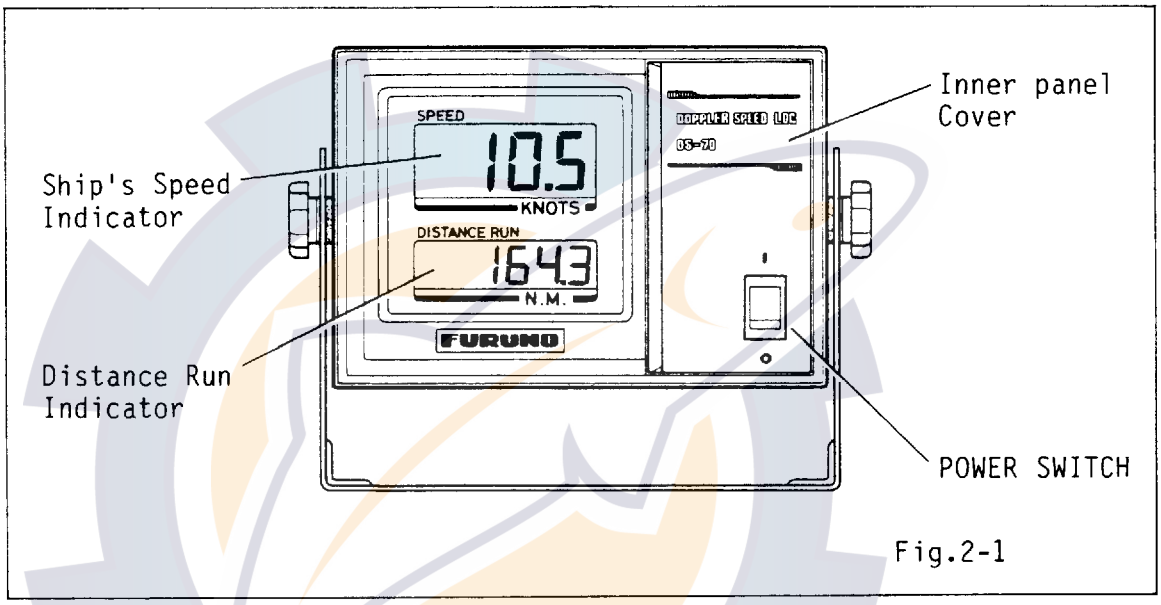


Fig.2-1

POWER SWITCH

This switch provides power to the display unit. (▮: ON, ⊙: OFF)

Ship's Speed Indicator

This indicator displays the ship's speed. The display is updated every second, and the following indicators appear to alert the operator of the present status of the ship's speed reading.

a) 0:0 (figure with colon) appears shortly after power is turned on and this indicates that the system is now calculating the ship's speed.

b) A flashing decimal point indicates that the echo level is low; no signal is being received.

c) When moving astern a "-" (minus sign) is displayed.

Distance Run Indicator

Both forward and astern speeds are measured, and displayed as the distance run. When the power is turned off the present distance run

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figure is memorized for about a one week period. When power is reapplied the previous figure is displayed.

- Inner Panel -

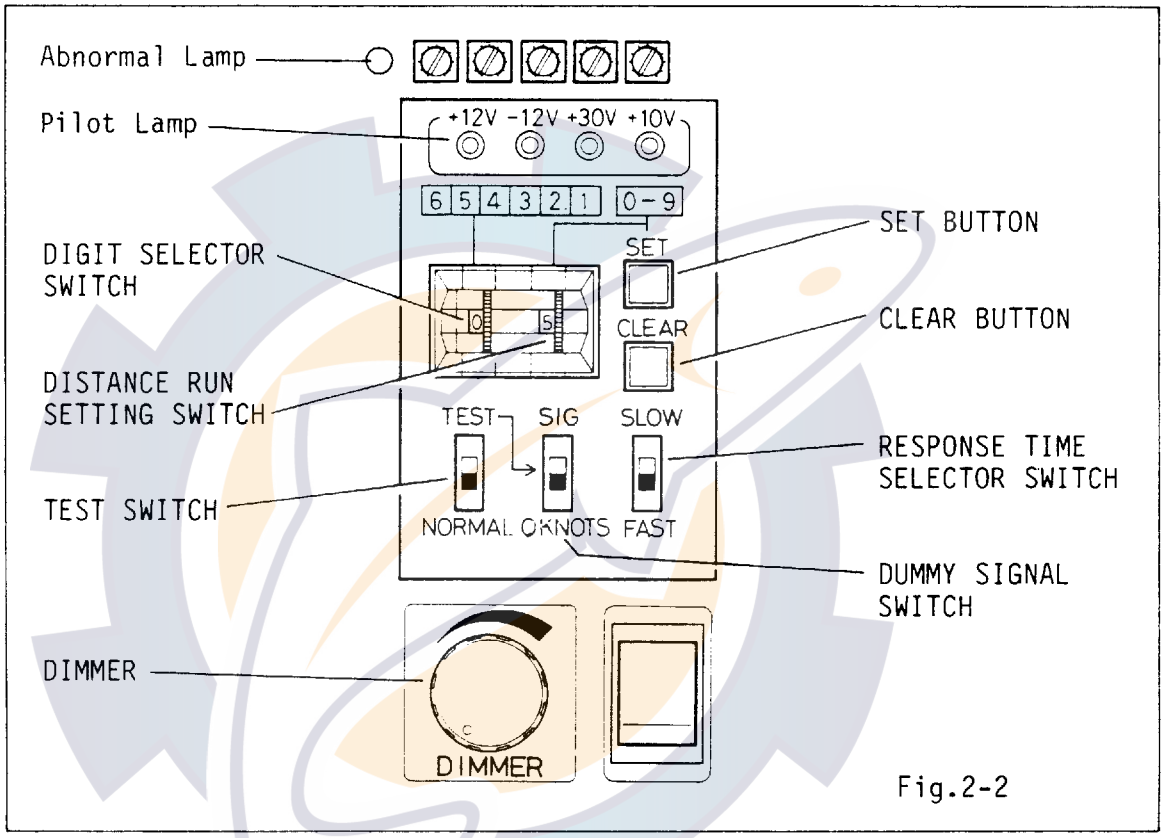


Fig.2-2

DIMMER

This control adjusts the illumination of the display.

TEST SWITCH

NORMAL: Set to this position for normal use.

TEST: When the system appears faulty, place the switch in this position; and the dummy signal can be used in conjunction with this switch to check the system. (Refer to "4. SELF TEST" for detailed application of this switch.)

DUMMY SIGNAL SWITCH

The switch is effective only when the test switch is set to the TEST mode.

0 KNOTS: A 0.00 or 0.01 knot reading indicates the system is operating properly when the switch is placed in this position.

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S I G : 24 thru 30 knot reading indicates the system is operating properly when the switch is set to this position.

RESPONSE TIME SWITCH

FAST: With the switch in this position, it takes approx. a half minute to track 90% of the ship's speed.

SLOW: In this position the response time is three times the speed of the FAST position. Use this position when the reading of the ship's speed is unsteady due to rough sea conditions.

NOTE

When the ship's speed is changed in abrupt steps, the true ship's speed reading will be delayed slightly at the SLOW position.

DIGIT SELECTOR SWITCH

This switch is used for presetting the distance run. When set to other than 0, the display will flush, signalling the unit is being preset. Numerals 1 thru 6 are for setting the distance run from tenths of a n.m. to ten thousands of nautical miles, respectively. Numerals 7 thru 9 are not used for setting the distance run. The distance run can be set to a maximum of 99,999.9 n.m.

DISTANCE RUN SETTING SWITCH

The desired value for the distance run is set with this switch.

CLEAR BUTTON

Pressing this button resets the distance run display to 0.0 n.m. The button may be pressed at any time when a reset of the distance run is desired. The button may also be pressed to erase previously memorized data.

SET BUTTON

This button sets the desired value of the selected digit according to the digit selector and distance run setting switch.

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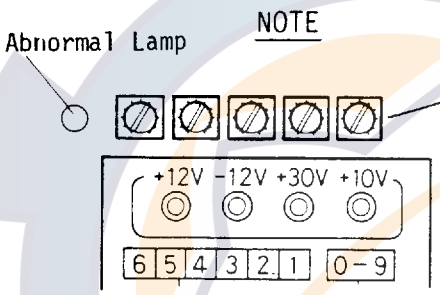
Abnormal Lamp

An abnormal lamp lights when the speed data abruptly changes from the ship's present speed due to noise. If the lamp flashes more than about 1 or 2 times within 5 seconds, the speed indication may be unreliable.

Pilot Lamp

A pilot lamp lights when each voltage is correct.

+12V, -12V : All other controls except transmission block
+30V : Transmission block and output transistor
+10V : Remote display



NOTE

The potentiometers located above and behind the inner panel are factory set, and should be adjusted by a qualified service technician only.

Fig.2-3

DIGITAL DISPLAY

DIMMER

Adjusts the illumination of the display.

Ship's Speed Indicator

This indicator displays the ship's speed. The arrow marks at the left of the digital display show the ship's moving direction; when moving fore the upper arrow mark (⇧) lights up, and when moving astern the lower one (⇩) lights up.

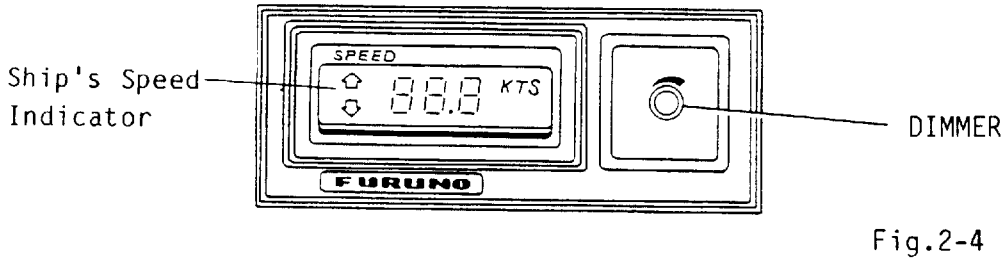


Fig.2-4

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DISTANCE INDICATOR

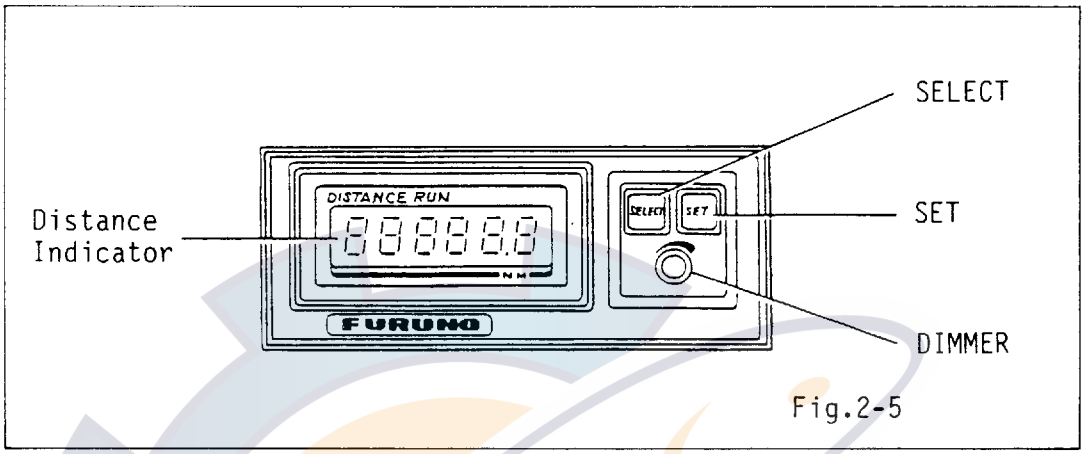


Fig.2-5

DIMMER

This control adjusts the illumination of the display.

Distance Indicator

This indicator displays the distance run. When the power is turned off, the previous distance run figure is preserved for about a one week period by the incorporated keep-alive battery. If the unit is off for more than one week, all digits indicate zero for about 30 seconds. Then the upper four digits go off, resulting in normal indication.

Note: Indication can be changed to four-digit integral numbers and two-digit decimal numbers with a jumper wire on the pc board. Consult with your dealer or agent if desired.

SELECT

This button is used for presetting the distance run. When this button is pressed succeedingly, a flashing unit for indicating that it is being preset is switched one by one from left to right. When the SELECT button is pressed while the decimal figure is flashing, all digits will flush; signalling the distance run figure is being reset to zero. Further pressing of this button will return to normal indication.

SET

This button sets the desired value of the selected digit according to the SELECT button. Every pressing of the SET button decrements the value at the flashing figure from 9 to 0. Press it until the desired value is obtained. When the SET button is pressed at the moment all digits are flashing, the distance run indication is reset to zero.

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ANALOG DISPLAY

The ship's speed is indicated in range scale of -10 to +30 knots (DS-761/762/763) or -10 to +20 knots (DS-771/772/773).

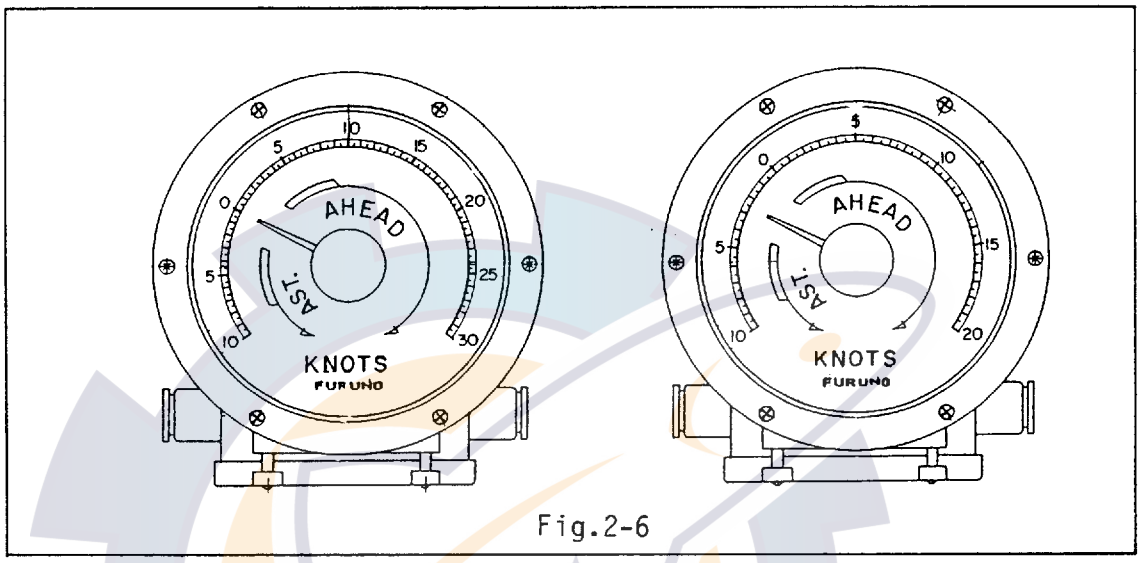


Fig.2-6

DIMMER

DIMMER

Adjusts the illumination of the display at a remote place.

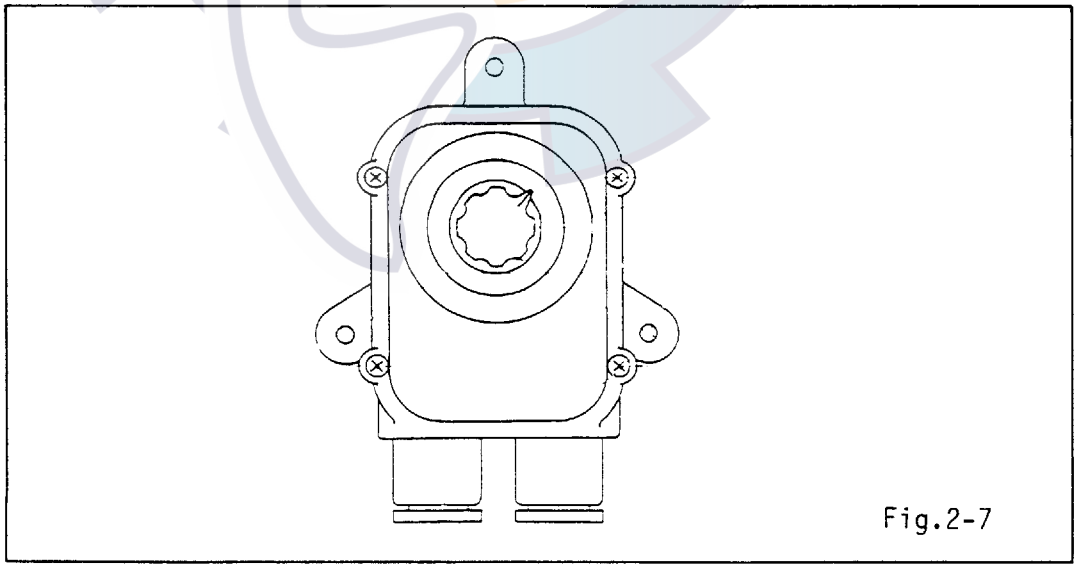


Fig.2-7

INTERFACE UNIT

The Interface Unit DS-741 converts serial digital data (current loop) to VDVBN (IEC61102-1) format to enable to connect radar, ARPA, etc.

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2.2 Operating Procedure

MAIN DISPLAY

Basic Operating Procedure

1. Apply power to ship's switchboard (if applicable).

2. Set the inner panel controls to the following positions.

   a) TEST switch is at NORMAL position.
   b) DIGIT SELECTOR switch to 0.
   c) Confirm that RESPONSE TIME SELECTOR switch is set to "FAST".

3. Turn DS-70 POWER switch on.

4. Adjust DIMMER control.

After power is applied, the following is displayed for 2-3 minutes while the ship's speed is being measured.

[: 0.0] or [-:0.0]

The colon in the ship's speed display indicates the system is now calculating the ship's speed. After the colon has extinguished, the figures change to the actual speed gradually thereafter. Anytime the reading does not steady, refer to SELF TEST on page 4-1.

Using RESPONSE TIME switch

Normally the switch should be set to the "FAST" position, however, the "SLOW" position should be used under the following conditions.

a) When sea conditions are rough and a steady readout can not be obtained.

b) When sailing for an extended period at a constant speed.

Setting Distance Run

To set 12.3 n.m., for example, use the following procedure.

1. Push CLEAR button to reset display to 0.0 n.m.

2. Set left switch (DIGIT SELECTOR switch) to 1 (display begins to flash).

3. Set right switch (DISTANCE RUN SETTING switch) to 3, push SET button, and display should now read 0.3.

4. Set left switch to 2.

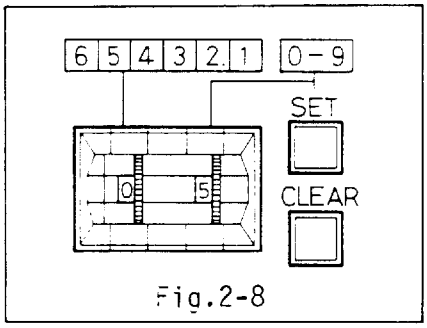


Fig.2-8

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5. Set right switch to 2, push SET button, and display should now read 2.3.

6. Set left and right switch to 3 and 1, respectively. Then, press SET button, and 12.3 will be displayed.

7. Turn the left switch to 0 for normal use, and the display stops flickering. Setting is now complete.

DISTANCE INDICATOR

Clearing Distance Run

1. Press the SELECT button until all digits are flashing.



2. Press the SET button, and the distance run figure is reset to "0.0".



3. Press the SELECT button again for normal use, and the display stops flickering.



Amending Distance Run

ex. Amend 1123.5 to 1134.7

1. Press the SELECT button four times, and the tens digit will be flashing.



2. Press the SET button until the flashing figure changes to "3".



3. Ones digit will flash with the next pressing of the SELECT button.



4. Press the SET button until the figure changes to "4".



5. Next, pressing the SELECT button causes the one tenths to flash.



6. Press the SET button until the figure changes to "7".



7. Press the SELECT button two times to return to normal operation.



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3. INSTALLATION

3.1 Mounting

MAIN DISPLAY

In deciding an installation site keep in mind the following factors.

1) Choose a place not vulnerable to rain, sea spray or other extreme weather conditions.
2) Select a site free from high temperatures and high humidity.
3) A place where vibration from other machinery is minimal.
4) Install the unit in a place where it will not become soiled easily.
5) Mount the unit distant from other electrical sources; esp., radio transceivers operating at 2MHz or harmonic frequencies of 2MHz.

Tabletop or Bulkhead Mount

1. Allowing maintenance space (according to the figure shown below), fix hanger with the four M6 bolts or wood screws. If necessary, stick the rubber cushion supplied as the installation materials onto both inner-sides of the hanger to escape the unit from severe vibration.

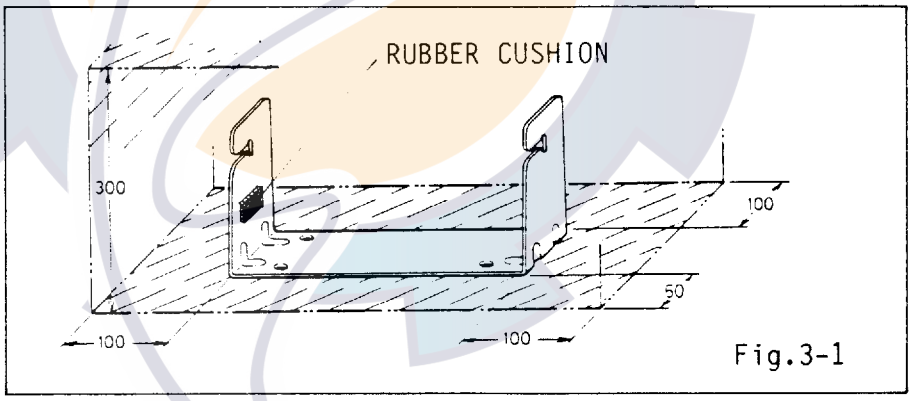


Fig.3-1

2. Attach rubber washers and knob washers to both sides of the unit, and loosely tighten the adjusting knobs.

3. Insert Main Display into hanger, and tighten both knobs.

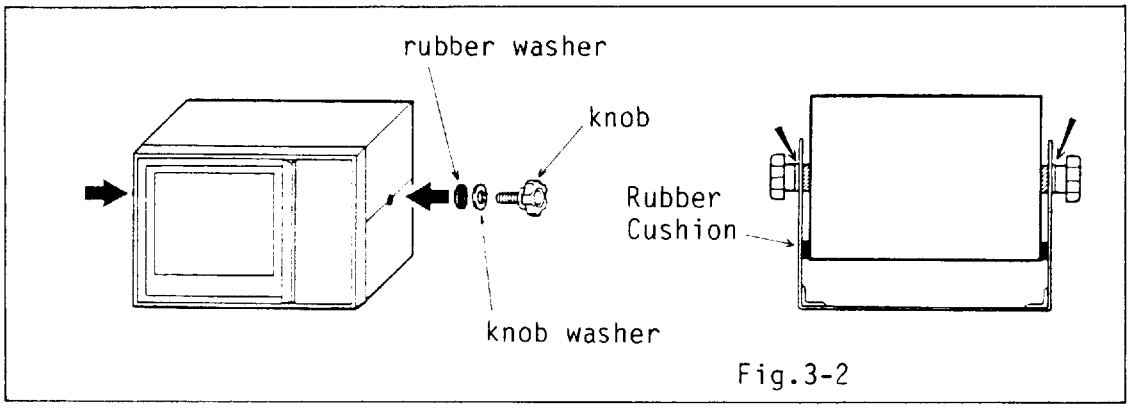


Fig.3-2

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When mounting the Main Display on the bulkhead, rotate the hanger 90 degrees as illustrated.

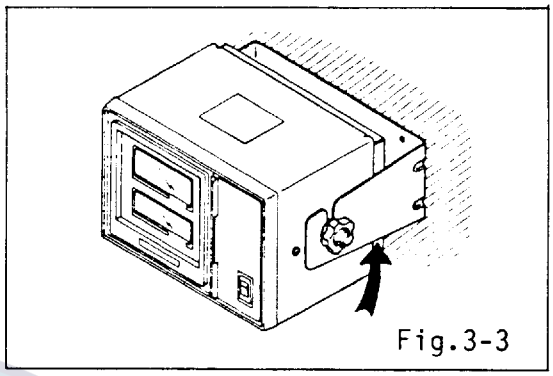


Fig.3-3

Flush mount

1. Cut out the planking by a dimension of 260mm wide by 172mm high.
2. Loosen four screws at both sides of the Main display and fix the hanger for flush mount type to the Main Display together with the cosmetic cover fixing plate as shown at right.
3. Put the Main display into the hole and fix it with four wood screws.
4. Fit the cosmetic cover onto the cosmetic cover fixing plate.

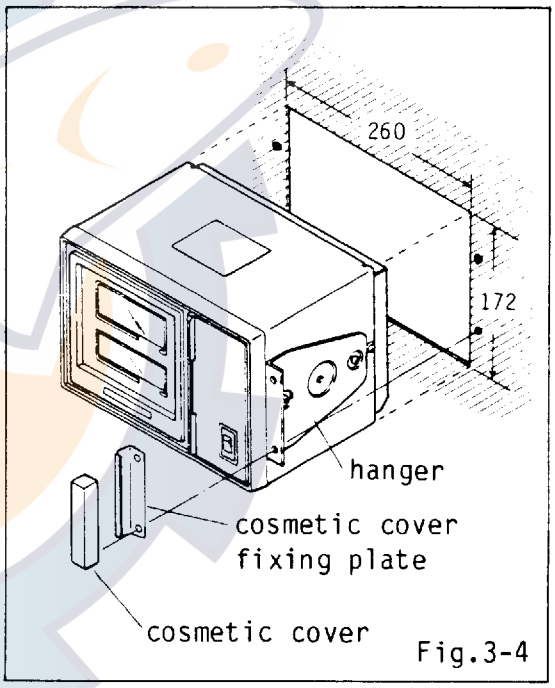


Fig.3-4

DIGITAL DISPLAY/DISTANCE INDICATOR

Select an installation site in the same manner as that of the Main Display;

1) Choose a place not vulnerable to rain, sea spray or other extreme weather conditions.
2) Select a site free from high temperatures and high humidity.
3) A place where vibration from other machinery is minimal.
4) Install the unit in a place where it will not become soiled easily.

These units can be installed on either a table top or flush mounted. Since the mounting method of these units are also the same as that of the Main Display except the dimensions, install them referring to the outline drawings on pages 6-10 thru 6-13 and the description on the installation method of the Main Display. Note that these units can not be mounted on the bulkhead, as the hanger will not rotate 90 degrees.

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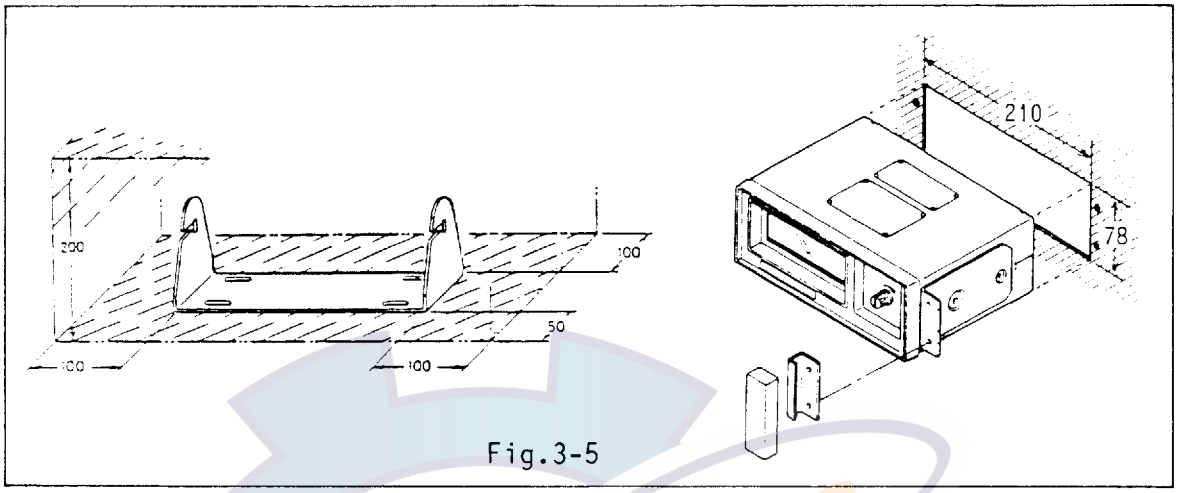


Fig.3-5

ANALOG DISPLAY

Since the Analog Display is a kind of current meter, it should be kept away from magnetic generating devices such as a transformer, generator, etc., so as to avoid erroneous ship's speed readings. Also choose a place free from sea spray, high temperature, high humidity and severe vibration. Either bulkhead or flush mount is available.

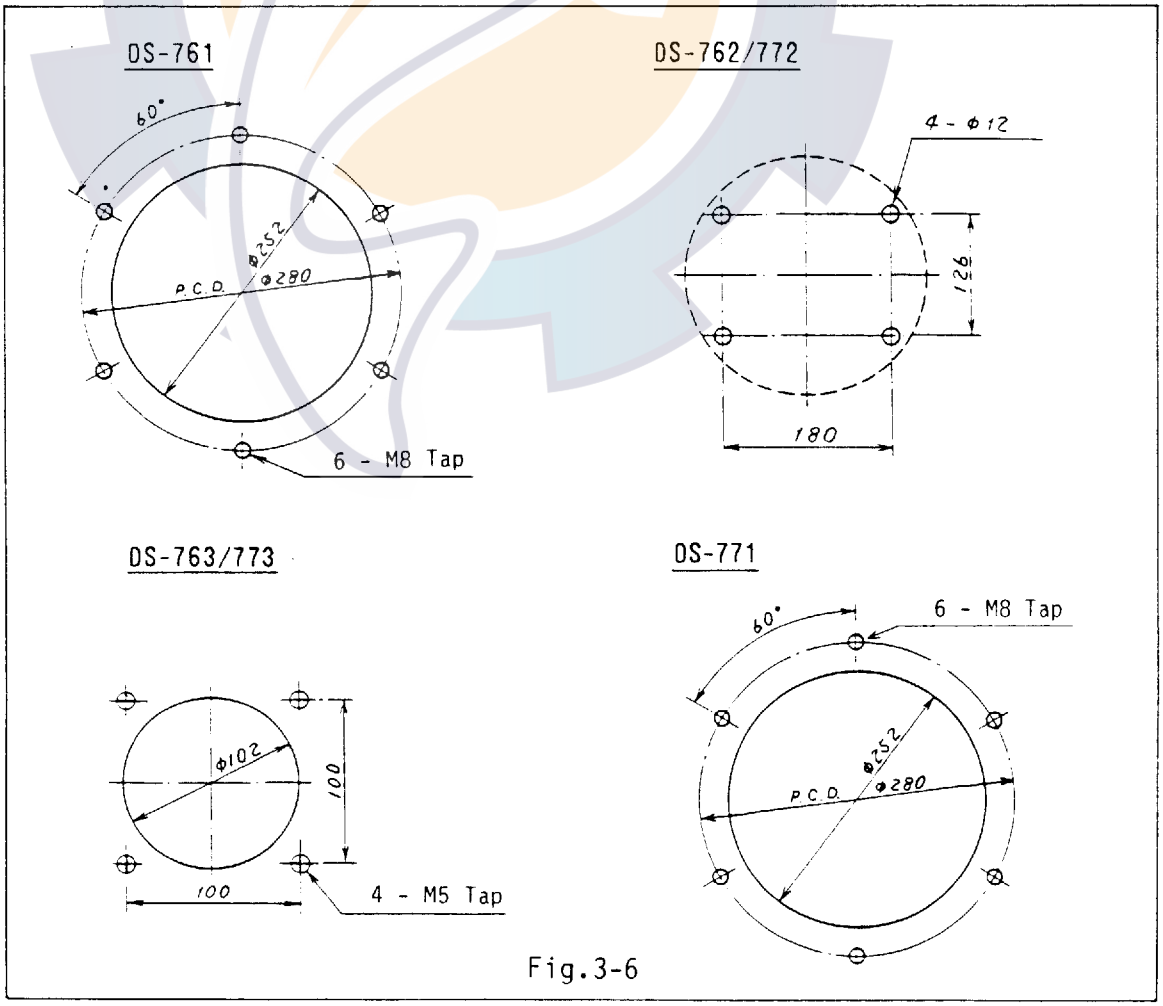


Fig.3-6

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DIMMER

The Dimmer, which is designed to comply with the Japan Industrial Standards (JIS F8852), is used for externally controlling the illumination of the display of the Digital/Analog Displays. When the Dimmer is supplied locally, refer to the Interconnection Diagrams on pages 6-26 and 6-27 for the values of the resistors since they are different on the connecting Display (Digital or Analog) and power supply (100V or 220VAC).

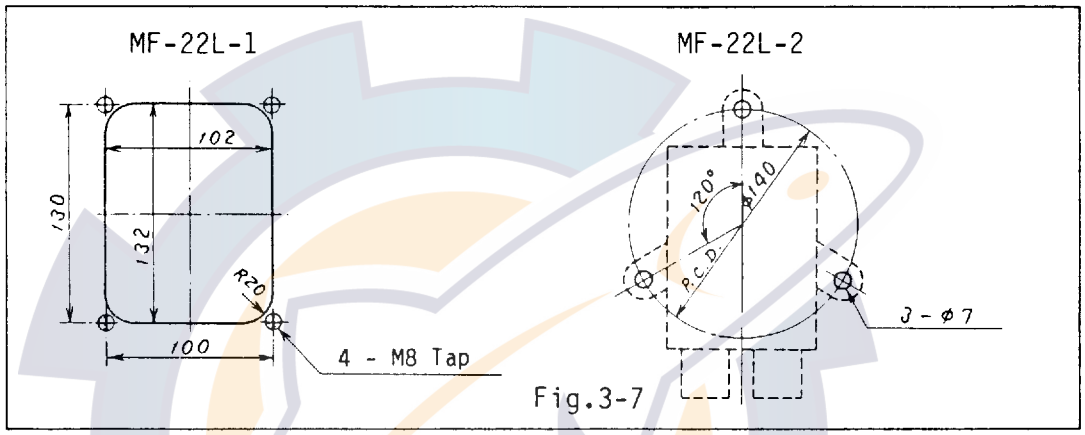


Fig.3-7

DISTRIBUTION BOX

Since the Distribution Box is combined with several units such as the Main Display, Digital Indicator, Distance Indicator, etc., determine the installation site with the wirings to these units taken into account. Refer to the outline drawings on page 6-21 for the mounting dimensions.

JUNCTION BOX

Recommended installation site for the Junction Box is;

1) Although the unit is splashproof, do not install it in places of high humidity.
2) Keep it away from noise emitting electrical machinery.
3) Install in a place where maintenance and checking are optimal.
4) Avoid installing the box where strong vibrations occur.
5) Choose a place where the junction box will not become soiled easily.
6) Install in close proximity to the transducer. (Do not connect the transducer directly to the Main Display Unit without the Junction Box.)

The mounting plate should be well grounded to the ship's body. To prevent breakage of the inner core, do not bend the transducer cables at small angles (more than 300 mm).

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TRANSDUCER

The performance of this equipment is directly related to the installation of the seachest; i.e, for the ship's speed sensor to operate properly the transmission signal should not be affected by either air bubbles or noise.

1) Separate as far as possible from other equipment and especially those operating at 2MHz or harmonic frequencies of 2MHz.

2) Locate the unit at least 2.5m from the transducer of an echo sounder. (This distance has been calculated using an echo sounder having a maximum sounding depth of 500m.) Also, to escape cavitation caused by uneveness of the hull plate, the doppler speed log's seachest should be mounted as below. Be especially careful not to install it on the same line as the echo sounder.

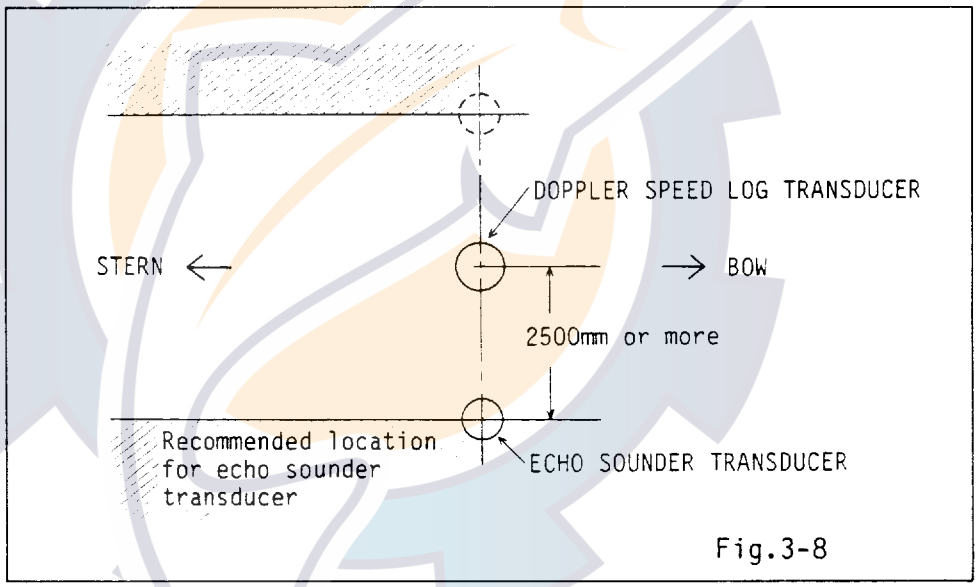


Fig.3-8

3) Separate as far as possible from air bubble sources; i.e., side thruster and water disposal pipes.

4) Install in close proximity to the keel line, because water flows parallel to the keel line; more accurate speed readings can be obtained.

5) Generally, best performance is obtained when mounting on the bow side; the stern side is influenced more easily by air bubbles and propeller cavitation.

6) Never apply ordinary paint to the transducer face. Whenever the ship is in dry dock, the transducer face should be kept clean by removing barnacle from the surface.

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Mounting of Flush Type Seachest DS-784 (ref. Dwg. C7222-T06 on page 6-26)

1. Loosen lock nut ⑤ with a wrench (hex. size: 50mm) and take off cap nut ④ from transducer flange ③ together with gasket ⑥ and flat washer ⑦. (It is not necessary to draw the cap nut completely out from the cable.)

2. Unscrew hex. socket head bolts ⑨ (M12 x 25, 4 pcs.) by using a socket screw wrench (size: 10mm). Separate hull flange ② and transducer ① from transducer flange ③. Handle O-ring ⑧ carefully.

3. Weld hull flange ② to the hull plate. Confirm that the "FORE" mark alignment line on the side of the hull flange faces the fore-aft line of the ship within ±1 degree. The hull flange should also be horizontal within ±1 degree at ship's normal trim.

4. Finish the outside hull plate with a grinder to ensure smooth water-flow.

5. Apply "Kinoruster (Anti-crevice corrosive sealant)" to face A of hull flange ②, O-ring groove on the hull flange, O-ring ⑧ and face A of the transducer flange ③.

6. Fit O-ring ⑧ onto the O-ring groove.

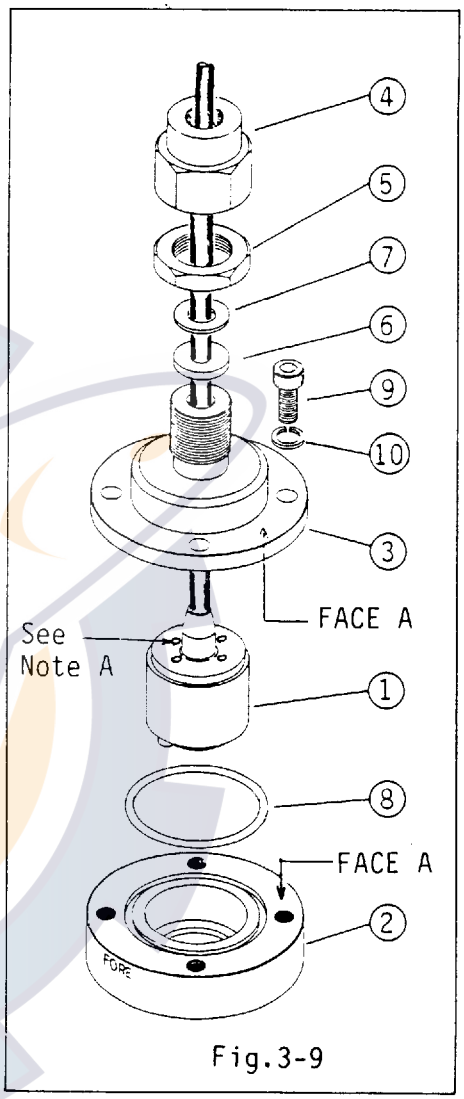


Fig.3-9

7. Place transducer ① into hull flange ② so that the alignment nipple on the transducer face fits into the notch on the hull flange.

8. Clean the hull flange face and settle transducer flange ③ on the hull flange.

9. Tighten hex. socket bolts ⑨ with a socket screw wrench.

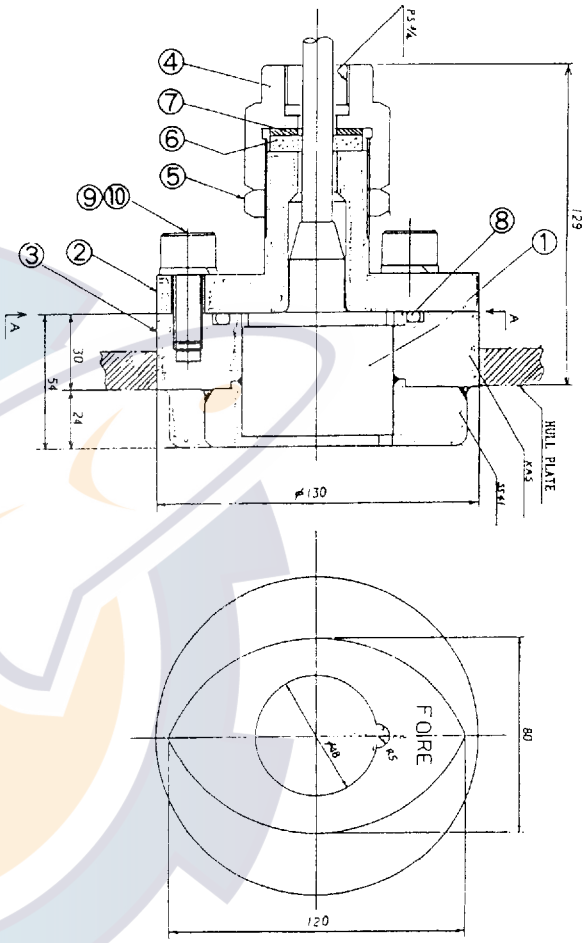
10. Put gasket ⑥ and flat washer ⑦ on top of the transducer flange and tighten cap nut ④ securely with a wrench (hex. size: 50mm). Screw lock nut ⑤.

11. When running the transducer cable inside the conduit pipe, screw the pipe end onto the cap nut (PS3/4) for watertightness.

NOTE A: NEVER REMOVE THE FOUR FLAT HEAD SCREWS WHICH SEAL SCREW HOLES, OTHERWISE WATERTIGHT INTEGRITY CANNOT BE PRESERVED.

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Flush mount, projection type Seachest DS-783
(ref. Dwg. E7222-T03-A on page 6-24)



1. Loosen lock nut ⑤ with a wrench (hex. size: 50mm) and take off cap nut ④ from hull flange ③ together with gasket ⑥ and flat washer ⑦. (It is not necessary to draw the cap nut completely out from the cable.)

2. Unscrew hex. socket head bolts ⑩ (M12 x 32, 4 pcs.) by using a socket screw wrench (size: 10mm). Separate flange ② and transducer ① from hull flange ③. Handle O-ring ⑧ carefully.

3. Weld hull flange ③ to the hull plate. Confirm that the "FORE" mark alignment line on the side of the hull flange faces the fore-aft line of the ship within +1 degree. The hull flange should also be horizontal within +1 degree at ship's normal trim.

4. Finish the outside hull flange with a grinder to ensure smooth water-flow.

5. Apply "Kinoruster (Anti-crevice corrosive sealant)" to face A of hull flange ③, O-ring groove on the hull flange, O-ring ⑧ and face A of the flange.

6. Fit O-ring ⑧ onto the O-ring groove.

7. Place transducer ① into hull flange ③ so that the alignment nipple on the transducer face fits into the notch on the hull flange.

8. Clean the hull flange face and settle flange ② on the hull flange.

9. Tighten hex. socket bolts ⑩ with a socket screw wrench.

10. Put gasket ⑥ and flat washer ⑦ on top of the transducer flange and tighten cap nut ④ securely with a wrench (hex. size: 50mm). Screw lock nut ⑤.

11. When running the transducer cable inside the conduit pipe, screw the pipe end onto the cap nut (PS3/4) for watertightness.

NOTE A: NEVER REMOVE THE FOUR FLAT HEAD SCREWS WHICH SEAL SCREW HOLES, OTHERWISE WATERTIGHT INTEGRITY CANNOT BE PRESERVED.

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Mounting of Projection type Seachest DS-781
(ref. Dwg. C7222-T05 on page 6-27)

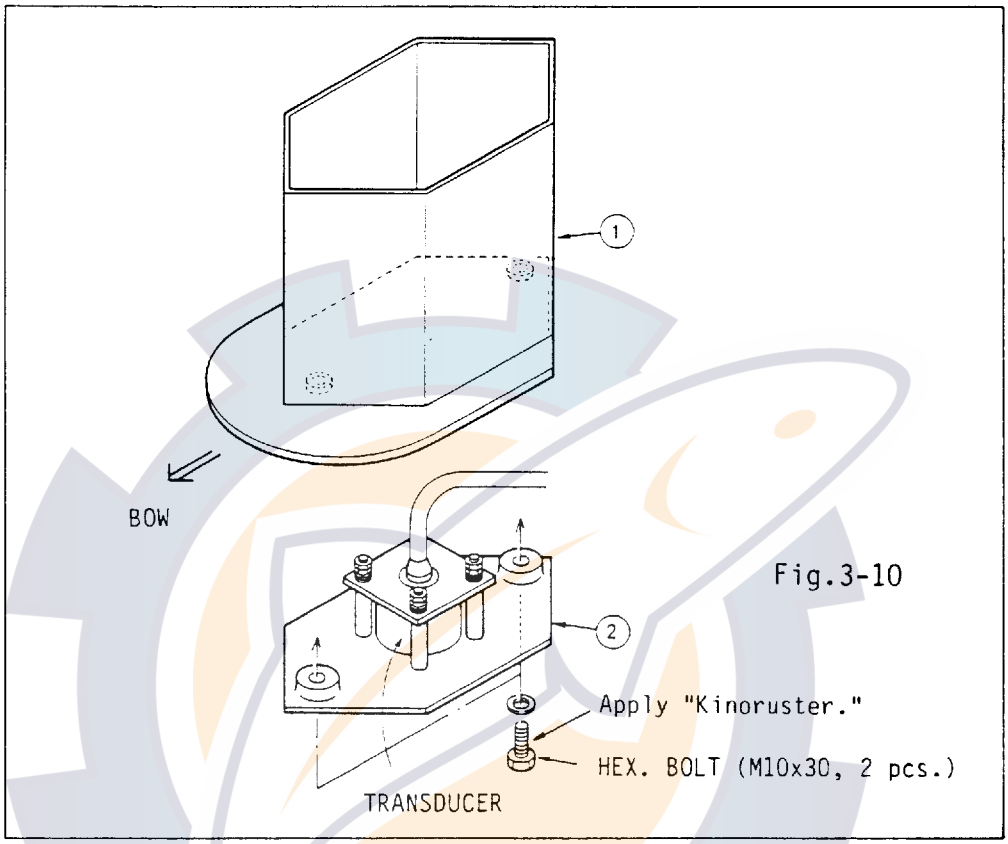


Fig.3-10

1. Weld doubling plate (supplied by shipyard) to hull plate.
2. Remove the two M10 bolts, and take out transducer fixing flange ② (including transducer) from transducer housing ①.
3. Determine the projection distance, and cut transducer housing ①. The horizontal error should be within 1°.
4. Before beginning this step, remove the rubber gasket inside the thru-hull pipe ⑤ to prevent it from melting. After cutting a hole through the hull plate for thru-hull pipe (ø 36), weld the thru-hull pipe to the hull plate.
5. Weld transducer housing ① to doubling plate. Direction error from fore-aft line should be within 1°. At stern side of transducer housing, make air exhaust holes (ø 10-20).
6. Through the thru-hull pipe ⑤ , pull up the transducer cable into the ship. Be careful not to jam the cable between the flange and housing. Next, using the two M10 x 30 bolts("Kinoruster" applied), fasten the transducer fixing flange to the transducer housing.

NOTE: ALSO IN THE TYPE, NEVER REMOVE THE FOUR FLAT HEAD SCREWS.

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Mounting of Gate Valve Type Seachest DS-786
(ref. Dwg. E7222-T04 on page 6-28)

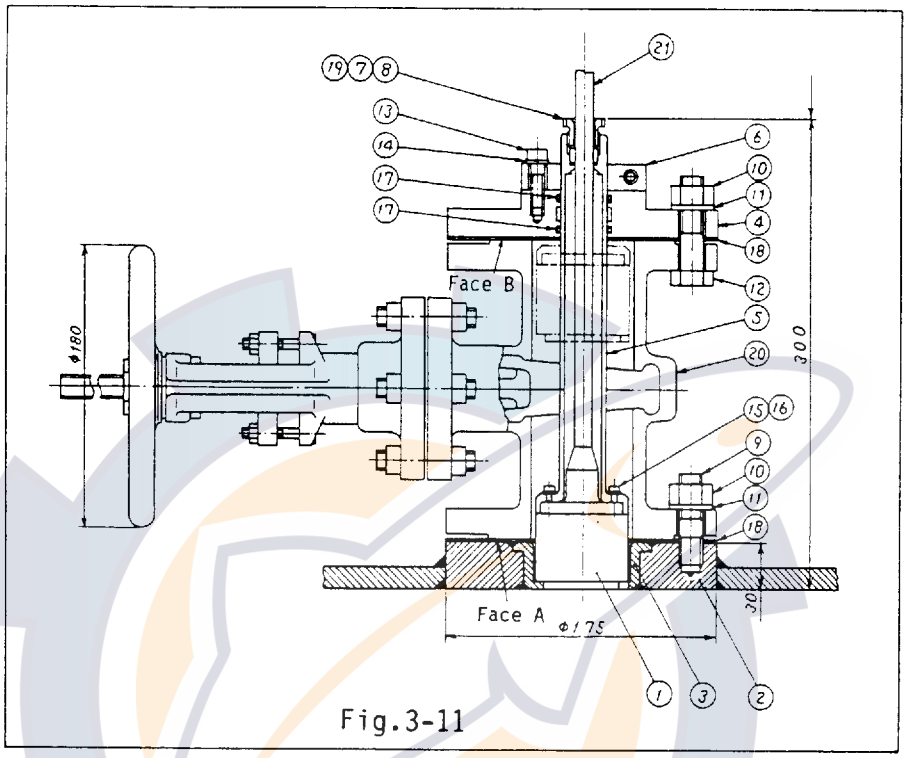


Fig.3-11

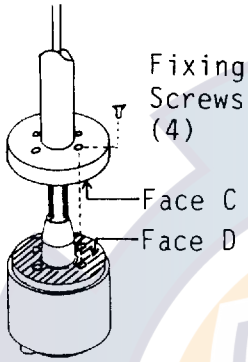
1. Separate hull flange ② and flange ④ (with transducer ① and shaft ⑤) from gate valve ⑳ by removing hex. nut ⑩.
2. Weld hull flange ② to the hull plate. Confirm that the "FORE" and align marks on the side of the hull flange face the fore-aft line of the ship within +1 degree. The hull flange should also be horizontal within +1 degree at ship's normal trim. Finish the outside hull plate flat with a grinder.
3. Apply "Kinoruster (Anti-crevice corrosive sealant)" to face A of hull flange ②, both faces of gasket ⑱ and flange of gate valve ⑳.
4. Put gasket ⑱ onto hull flange ②.
5. Mount gate valve ⑳, considering the direction of the handle (aft direction normally) so as to allow enough space for operation.
6. Apply "Kinoruster" to face B of flange ④, both faces of gasket ⑱ and the flange of gate valve ⑳.
7. Put gasket ⑱ onto the flange of gate valve ⑳.
8. Mount flange ④ (with transducer and shaft) to gate valve ⑳. Make sure the fore marks on flange ④ and hull flange ② are aligned.
9. Loosen the hex. socket head bolt, then check that shaft ⑤ moves upward and downward smoothly by hand.
10. Lower shaft ⑤ at its extreme and fasten hex. socket bolt ⑬.

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11. Confirm that the hull plate is flush with the transducer face.

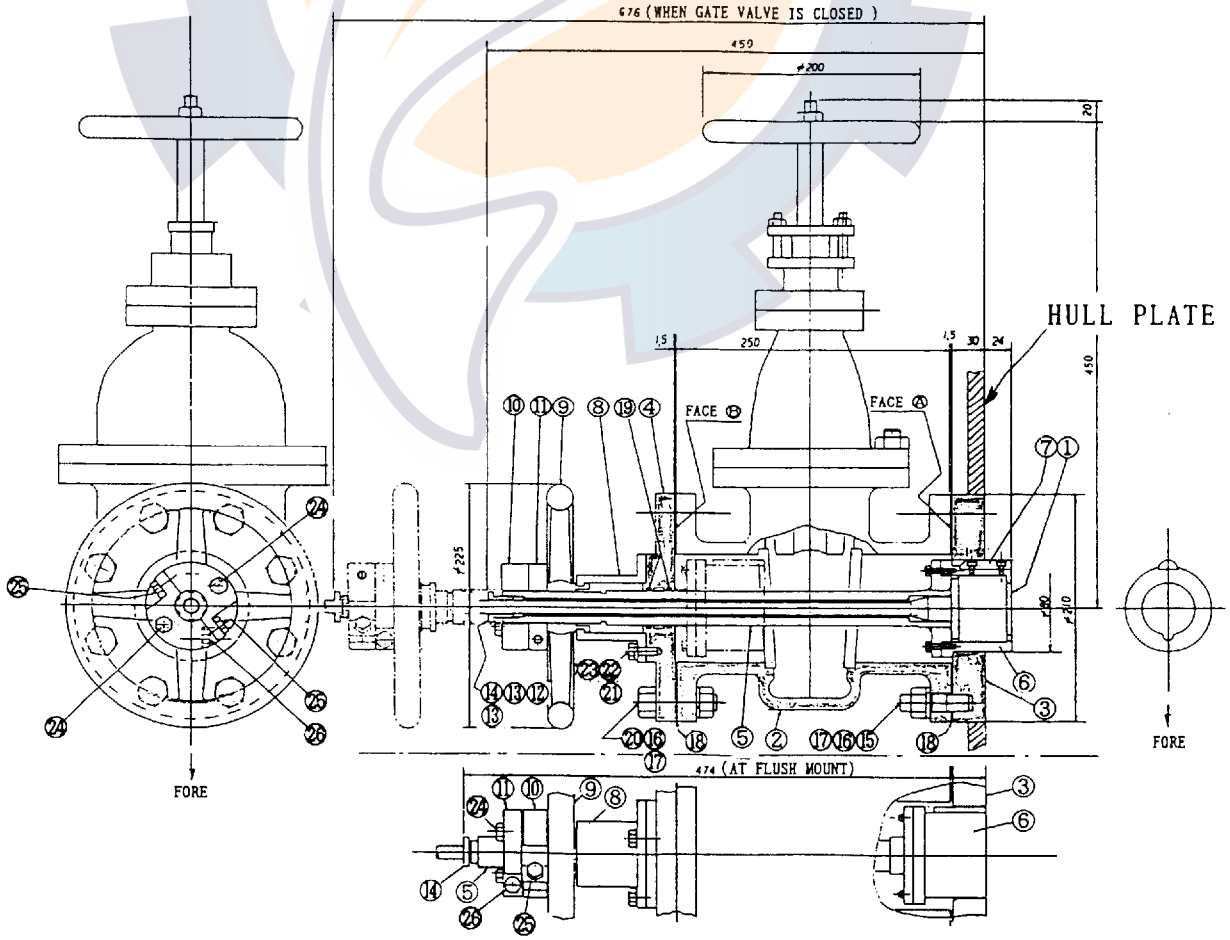
Note: Neither weld the hull flange or transducer tank when the transducer is being fitted, nor weld near the transducer of other equipment.

When the transducer ① is replaced, or separated from the shaft ⑤, re-assemble as follows;



1. Remove sealant from face C and/or face D.
2. Apply adhesive #1104 (Three Bond) to face D and four fixing screw.
3. Re-assemble them.

Gate valve, projection type Transducer DS-782
(ref. Dwg. E7222-T02-A on page 6-25)



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1. Separate hull flange ③ and flange ④ (with transducer ① and shaft ⑤) from gate valve ② by removing hex. nut ⑰.

2. Weld hull flange ③ to the hull plate. Confirm that the "FORE" and align marks on the side of the hull flange face the fore-aft line of the ship within +1 degree. The hull flange should also be horizontal within +1 degree at ship's normal trim. Finish the outside hull plate flat with a grinder.

3. Apply "Kinoruster (Anti-crevice corrosive sealant)" to face A of hull flange ③, both faces of gasket ⑱ and flange of gate valve ②.

4. Put gasket ⑱ onto hull flange ③.

5. Mount gate valve ②, considering the direction of the handle (aft direction normally or selectable every 45 degrees) so as to allow enough space for operation.

6. Apply "Kinoruster" to face B of flange ④, both faces of gasket ⑱ and the flange of gate valve ②.

7. Put gasket ⑱ onto the flange of gate valve ②.

8. Mount flange ④ (with transducer and shaft) to gate valve ②.

9. Loosen the hex. socket head bolts ㉓ & ㉖, then check that shaft ⑤ moves upward and downward smoothly by hand.

10. Lower shaft ⑤ at its extreme and fasten hex. socket bolt ㉓ and ㉖.

11. Lower the transducer by turning the handle until the transducer case ⑥ touches the hull flange ③.

12. Confirm that the hull plate is projected by 24mm.

Note: Neither weld the hull flange or transducer tank when the transducer is being fitted, nor weld near the transducer of other equipment.

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3.2 Wiring

Take the following points into account when planning the cable path.

Transducer Cable

* Run the cable as short as possible to minimize the affect of interference and noise from other equipments. Run the cable inside the conduit pipe to avoid such noise induction.
* For perfect grounding, do not damage or cut the armor. The armor should be firmly grounded thru the cable gland of the Junction Box.

Other Cables

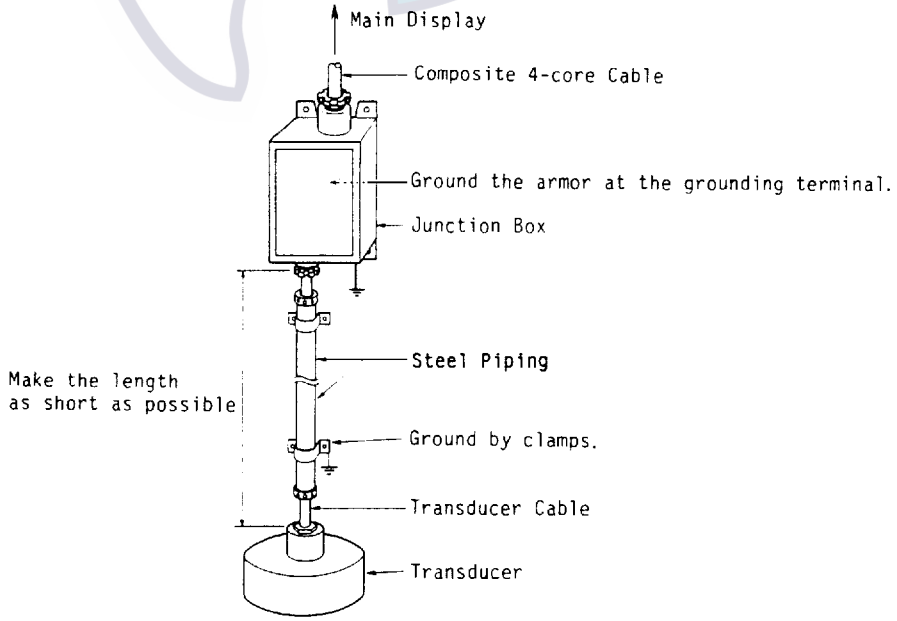
* Do not run the cable along other noise generating devices or cables such as Radar, Radio transmitter, Winch cables, etc.

CAUTION

Ground the armor with a cable clamp after scraping off the paint, otherwise, unexpected noise may be induced into the cable, resulting in malfunction of the equipment.

Piping

The transducer cable should be layed in piping (steel, etc.) extending from the transducer to the Junction Box to shield the cable from external noise. The transducer cable has an outer braided shield, however the composite 4-core cable is superior in keeping out external noise. For this reason, make the length of the transducer cable as short as possible, and use the composite 4-core cable to make the connection from the Junction Box to the Main Display. If the path from the transducer to the Junction Box is electrically isolated by a steel bulkhead, piping is unnecessary.



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MAIN DISPLAY

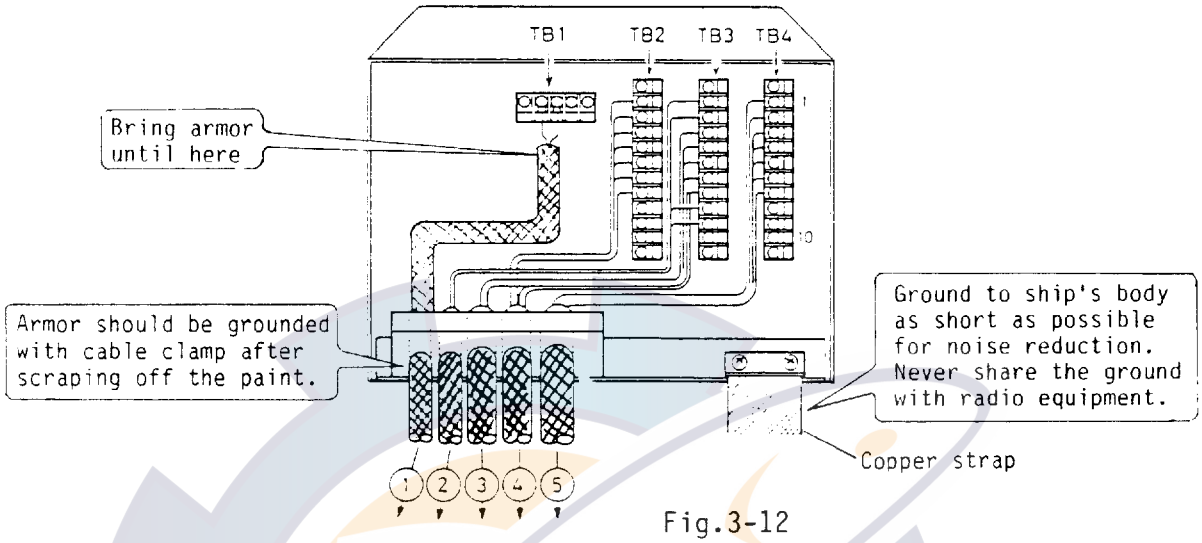
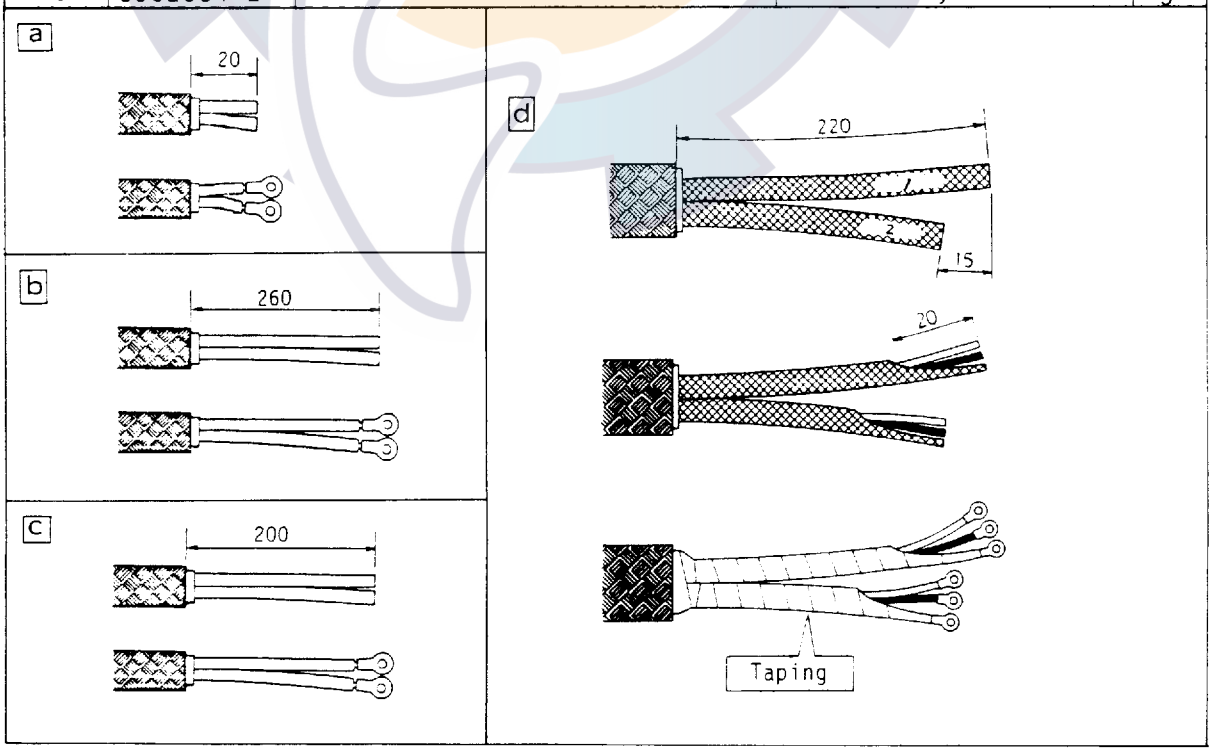
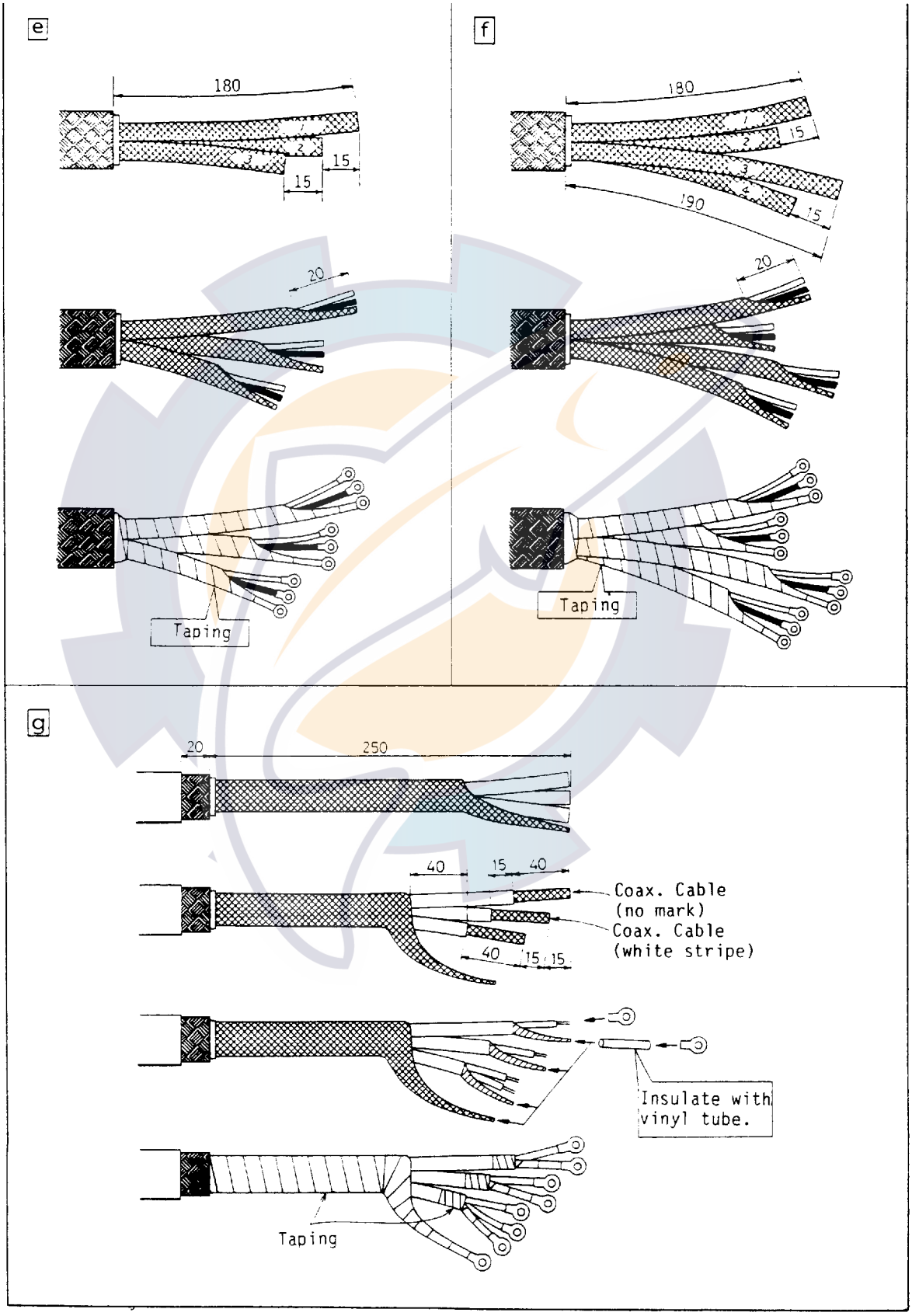


Fig.3-12

Cable No.	Name	To	Terminal No.	Dwg. No.
1	DPYC-1.25	Ship's Mains	TB1 1 - 2	a
2	DPYC-1.25	Log Signal	TB3 1 - 2	b
		Alarm Signal	TB3 8 - 9	c
3	TTYC-2S	Distance Indicator	TB3 3 - 7	d
4	TTYC-3S	Digital Display	TB2 1 - 7	e
	TTYC-4S	Distribution Box	TB2 1 - 4, TB3 3 - 7	f
5	65S1034-1	Junction Box	TB4 1 - 7, 10	g



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JUNCTION BOX

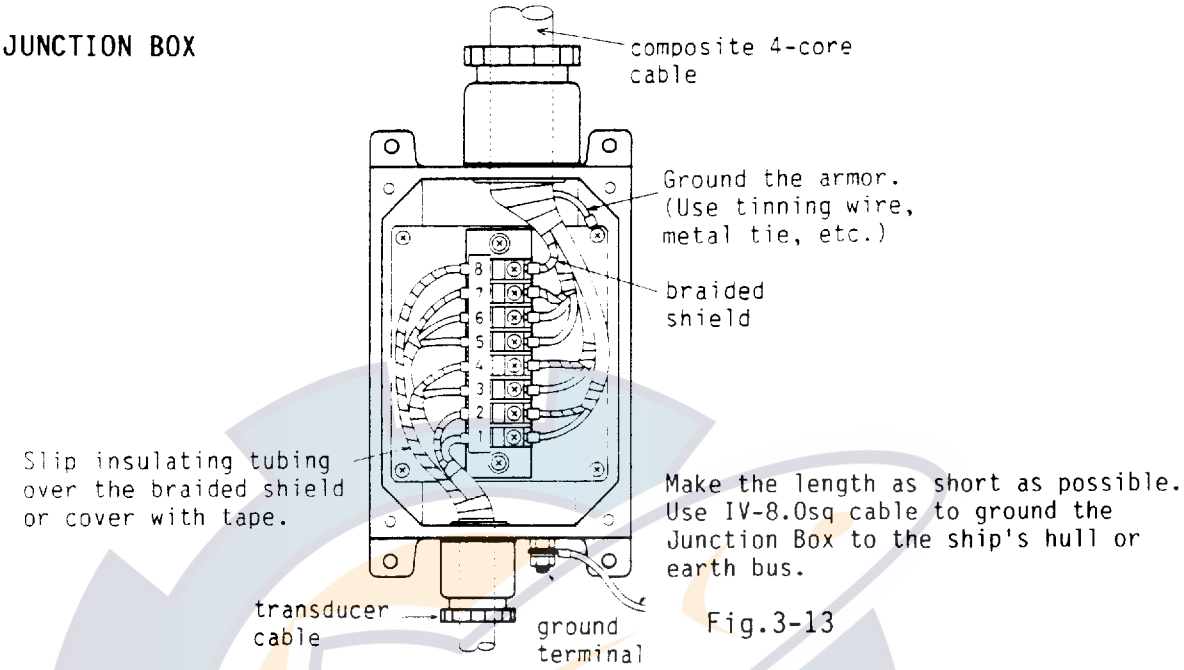
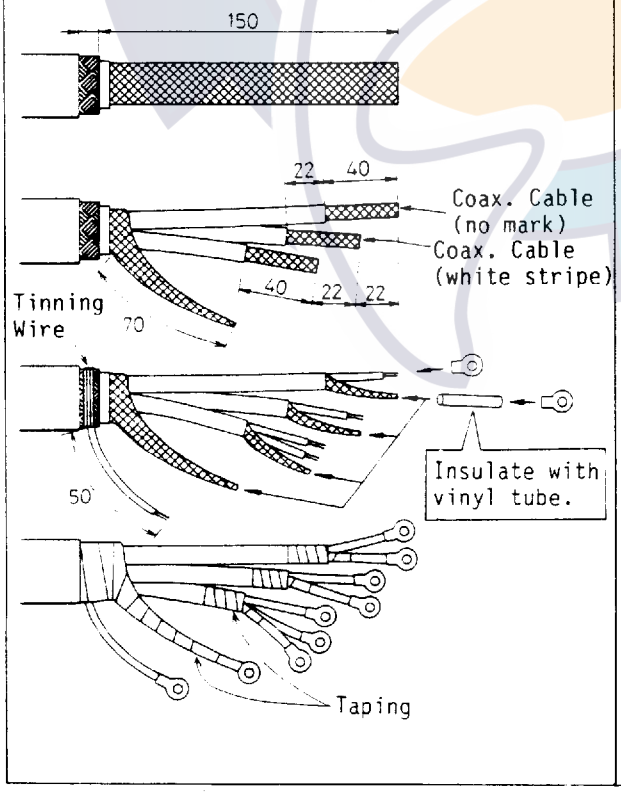


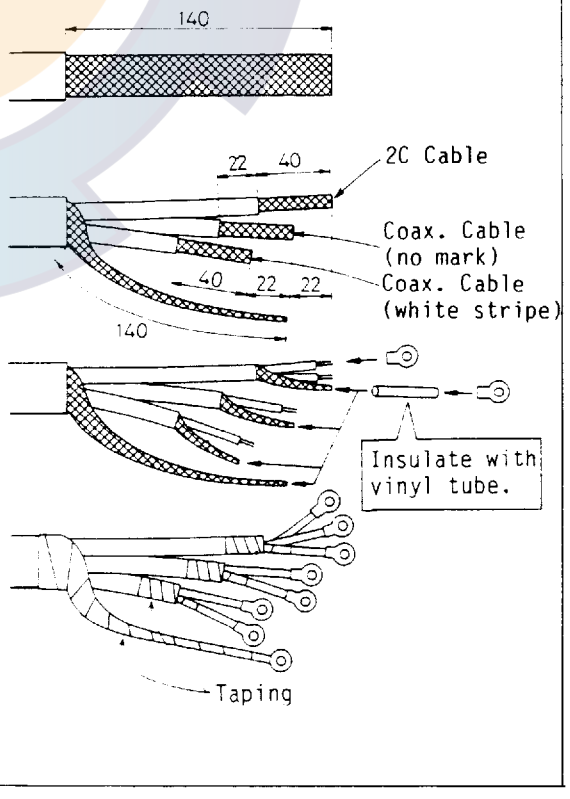
Fig.3-13

Cable No.	Name	To	Terminal No	Dwg. No.
1	65S1034-1	Main Display	TB1 1 - 8	h
2	65S1046	Transducer	TB1 1 - 8	i

h Conposite 4-core Cable



i Transducer Cable



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DIGITAL DISPLAY/DISTANCE INDICATOR

A special terminal board is used in the Digital Display, Distance Indicator and Distribution Box. The following describes how to connect a wire to the terminal.

1. Strip the vinyl sheath of the wire to expose the core by 5mm thru 6mm.

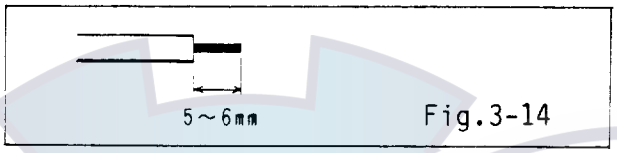


Fig.3-14

2. Hook the wire inserting tool (supplied as installation materials, type: 236-332) into the terminal board as shown in Fig.3-15(a) and press it in direction A (opposite to the wire inserting side) to lower the spring. With the wire inserted into the slit, release the tool from the terminal. Pull the wire to make sure that the wire does not come off the terminal.

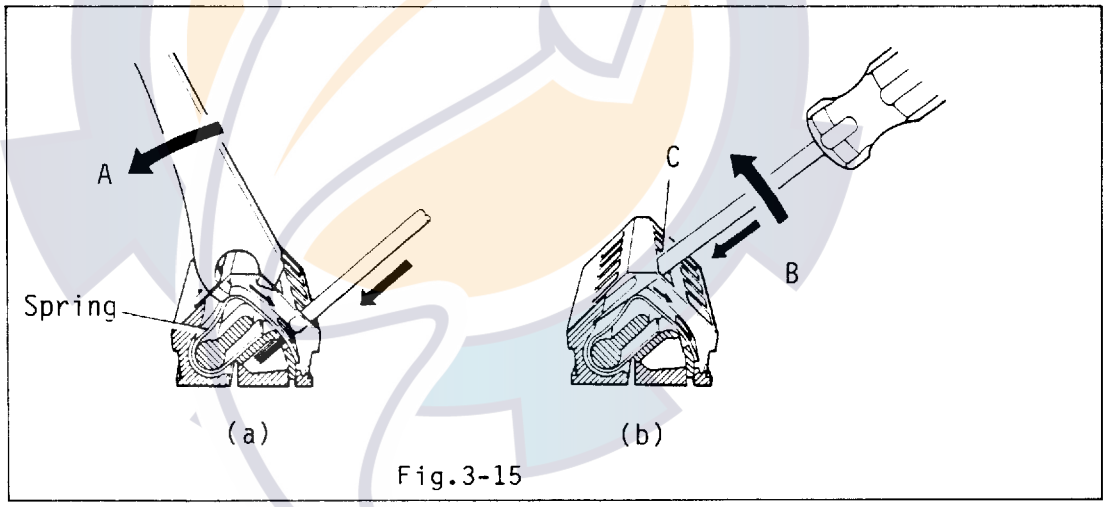


Fig.3-15

3. If the wire inserting tool is not available, insert a small screwdriver (-) into hole C and press it upward as shown in Fig.3-15(b).

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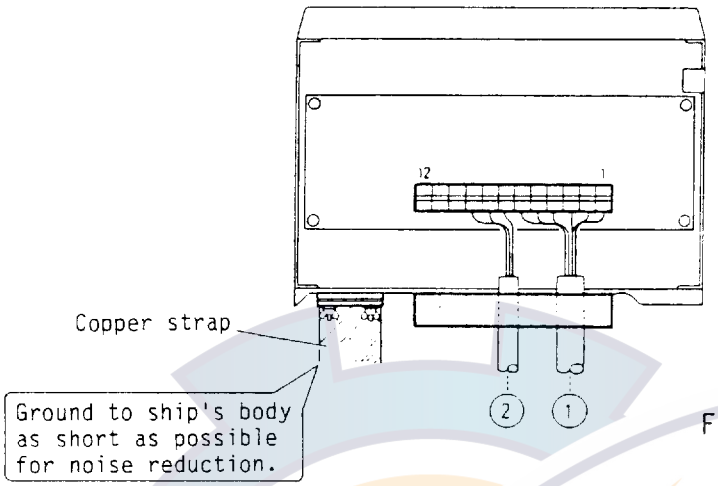
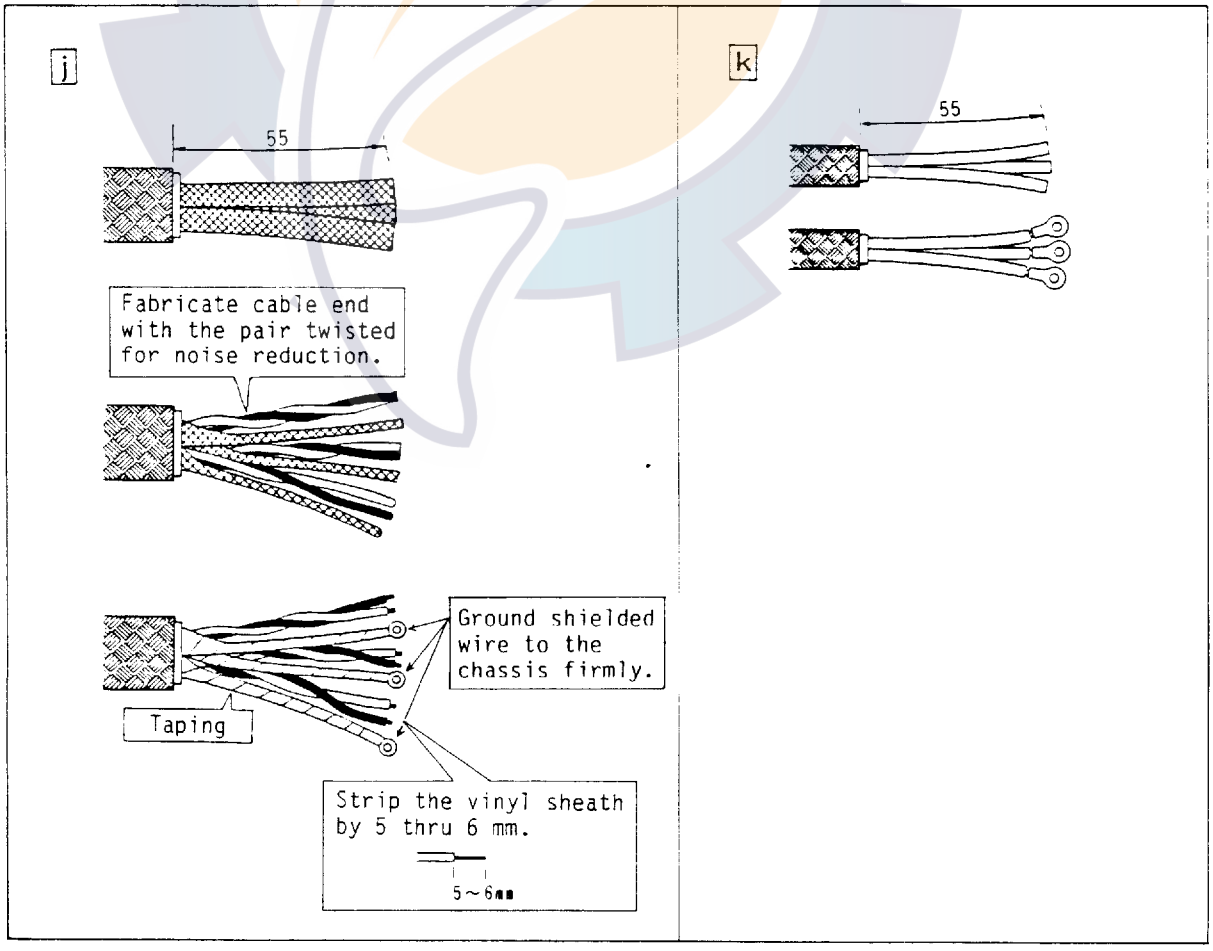


Fig.3-16

Cable No.	Name	To	Terminal No.	Dwg. No.
1	TTYC-3S *1	Main Display	TB1 1 - 6	j
	TTYC-2S *2	(or Distribution Box)	TB1 3 - 6	
2	TTYC-1.25	Dimmer	TB1 7 - 9	k

*1 : Digital Display *2 : Distance Indicator



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DISTRIBUTION BOX

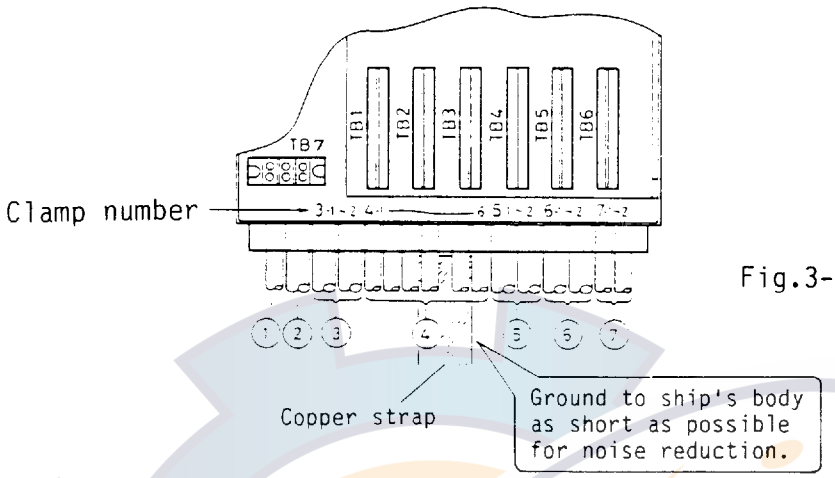
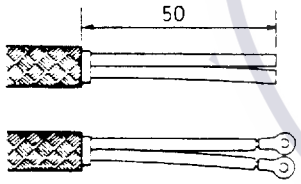


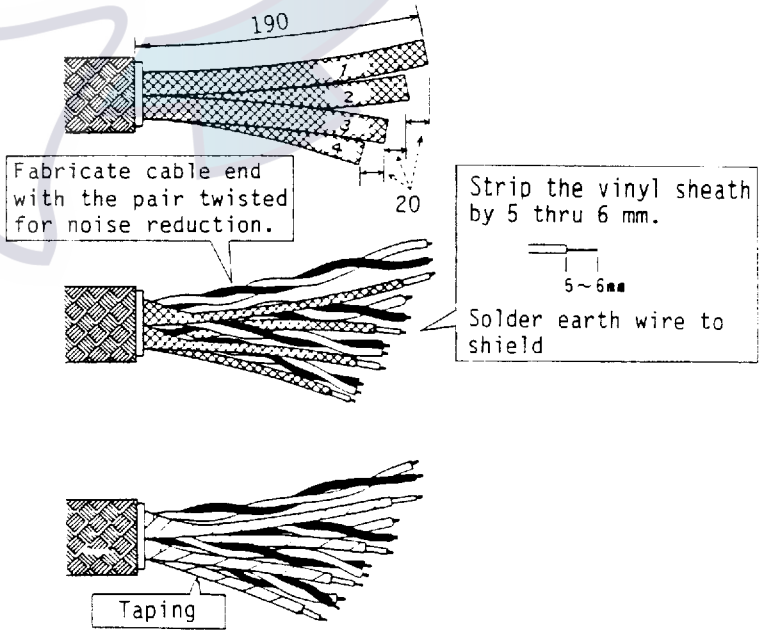
Fig.3-17

Cable No.	Name	To	Terminal No.	Dwg. No.
1	DPYC-1.25	Ship's Mains	TB7 1 - 2	l
2	TTYC-4S	Main Display	TB1 1 - 12	m
3	TTYC-3S	Digital Display	TB2/TB3 1 - 9	n
4	DPYC-1.25	Log Signal	TB4 1 - 12	o
5	TTYC-2S	Distance Indicator	TB5 1 - 12	p
6	TTYCS-1	Analog Display	TB6 1 - 3 , 7 - 9	q
7	DPYC-1.25	Fore-Aft Relay Signal	TB6 4 - 5 , 10 - 11	r

l

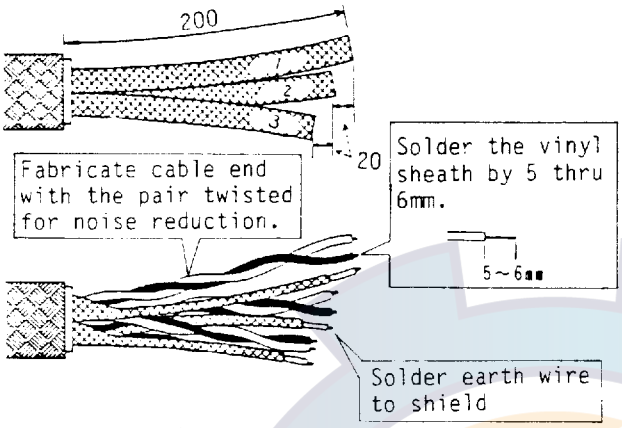


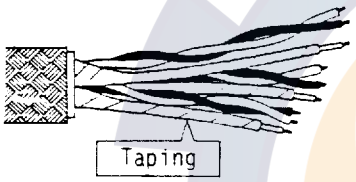
m



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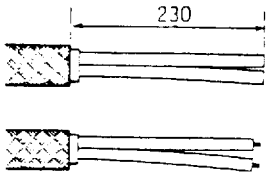
n When clamp No.3-1 is used





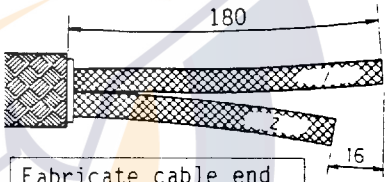
Length of twisted pair wires should be 220mm(NO.1),200mm(No.2) and 180mm(No.3) when clamp No.3-2 is used.

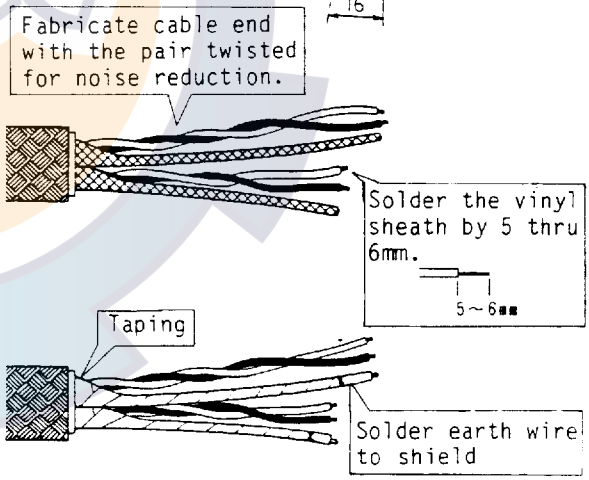
o When clamp No.4-1 is used



Length of wire should be 200mm, 180mm, 150mm, 110mm or 80mm when clamp No.4-2 thru 4-6 is used.

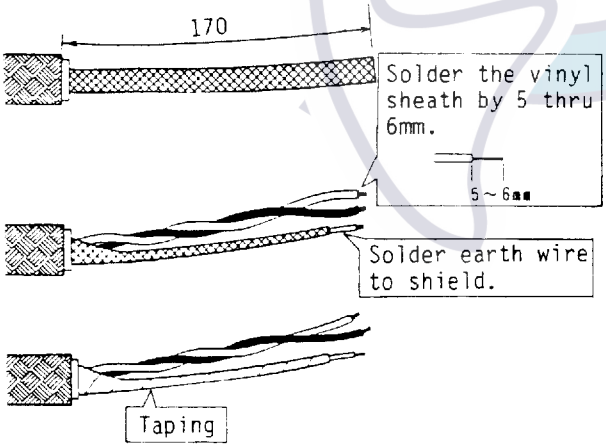
p When clamp No.5-1 is used





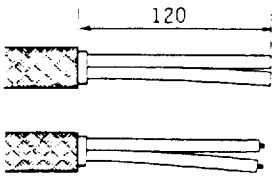
Length of twisted pair wires should be 110mm(No.1) and 90mm(No.2) when clamp No.5-2 is used.

q When clamp No.6-1 is used



Length of twisted pair wires should be 110mm when clamp No.6-2 is used.

r When clamp No.7-1 is used



Length of wire should be 70mm when clamp No.7-2 is used.

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3.3 After Installation Check and Adjustment

ALTERATION OF POWER SUPPLY

The equipment can be operated from any one of 100, 110, 115, 200 and 220 VAC (Transistor Inverter TR-2407/3207 is available for DC power supply). If the ship's mains is different from the power supply labeled on the equipment, change the tap connection of the power transformer in the Main Display and Distribution Box (if provided) as shown below.

- Main Display -

1. Separate the rear panel from the Main Display by loosening four screws (M3 x 6). Be careful not to swing the rear panel upward or downward when removing the panel, because it is directly plugged into the pc boards.

2. Unplug the ML connectors (J33 and P33) located at the bottom corner of the Main Display, then change the connection of the red wire coming from the POWER switch to an appropriate pin number as illustrated.

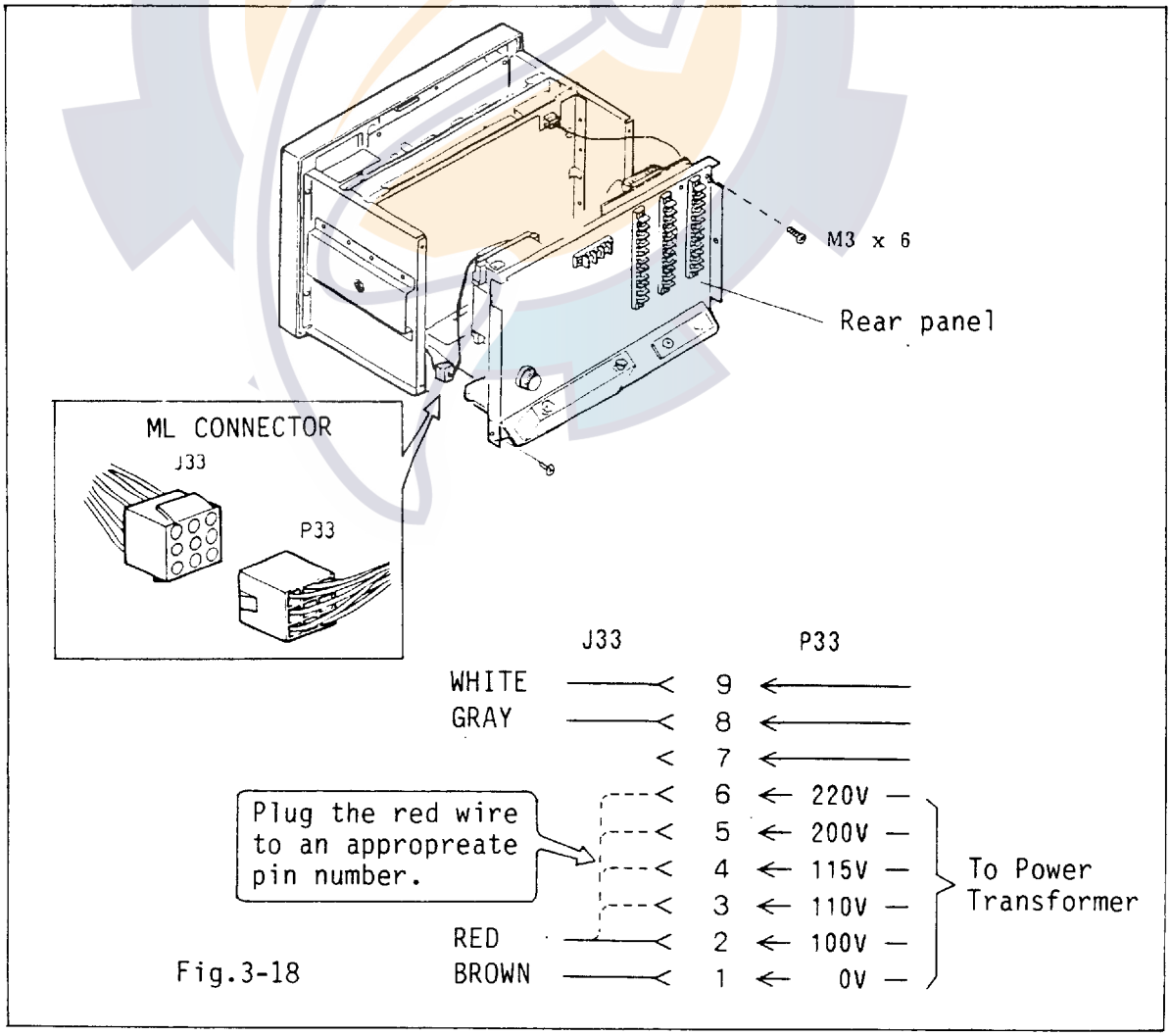


Fig.3-18

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How to extract the contact pin

Insert the pin extractor(LEJ-13) into the pin hole from the side opposite to the wire inserting side. Pull the wire, and the contact pin can be removed.

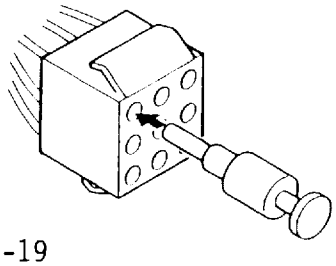


Fig.3-19

Distribution Box

Change the tap connection of the power transformer inside the Distribution Box to an appropriate power supply.

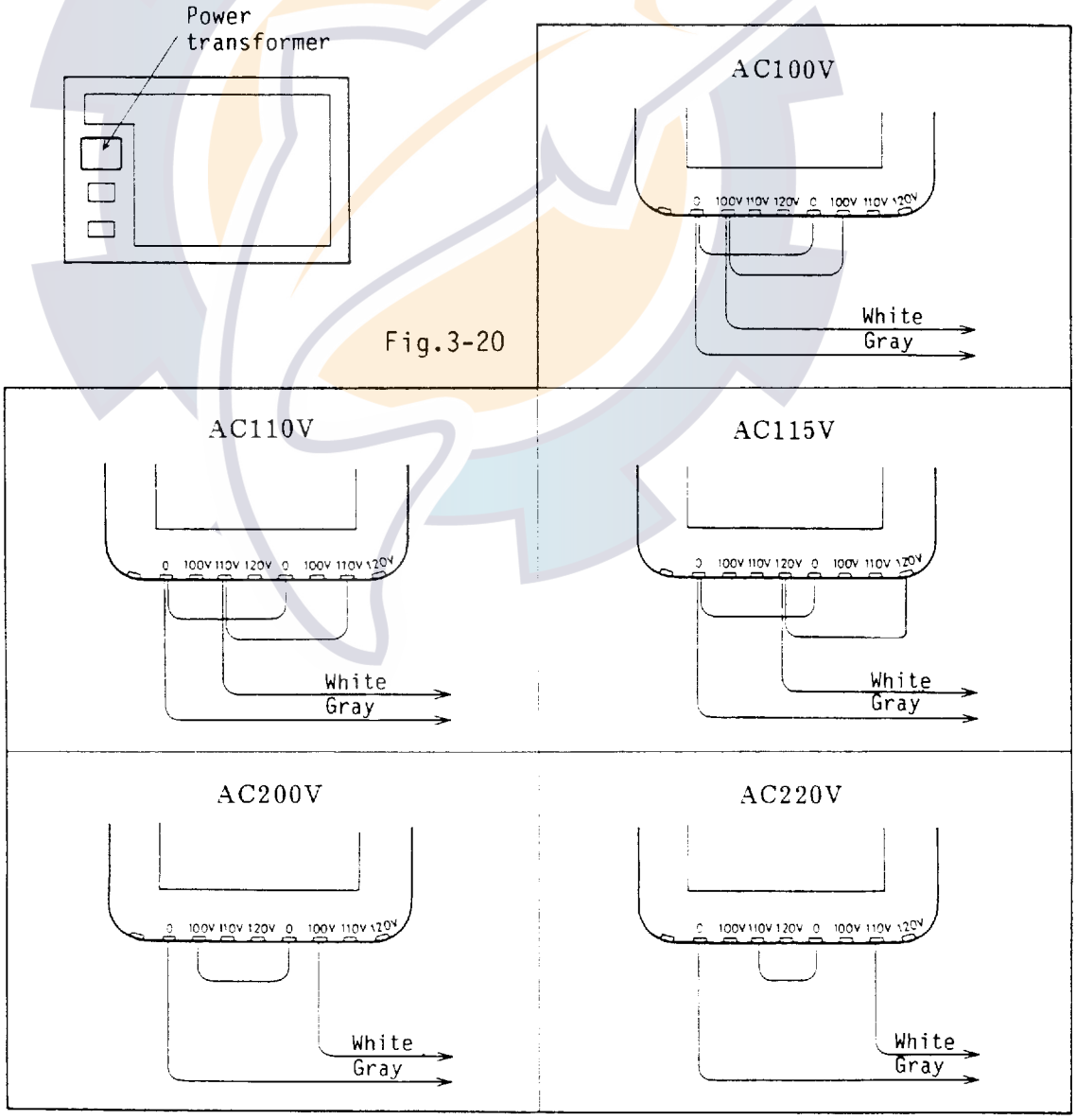


Fig.3-20

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ADJUSTMENT OF RESPONSE TIME/CORRECTION OF SPEED INDICATION

As the equipment is fully tested and adjusted at the factory, no further adjustment is required in the field after installation. If desired, however, the following items can be readjusted locally on user's demand.

Open the inner panel cover and the five preset potentiometers are located at the top of the inner panel as illustrated. Potentiometer Ⓐ is for adjusting the response time and Ⓑ, for correcting speed indication. Other potentiometers are for factory adjustment only and thus should not be touched in the field.

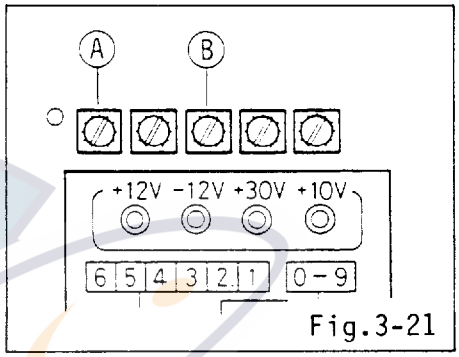


Fig.3-21

Response Time

The response time in the "SLOW" position can be continuously changed with potentiometer Ⓐ; the response time is three times the speed of "FAST" position at the counter-clockwise point (factory set) and is the same as the "FAST" position at the fully clockwise point.

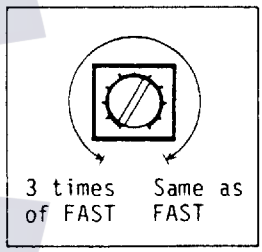


Fig.3-22

Correction of speed indication

If an erroneous speed is indicated during the speed test (mile post test), it can be corrected by ±10 % of the present indication by adjusting potentiometer Ⓑ.

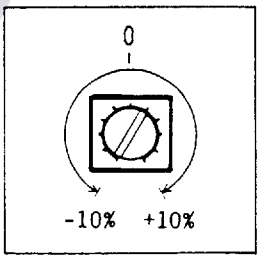


Fig.3-23

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4. POST INSTALLATION TEST

4.1 Self-test of Main Display

To check the performance of the unit, a built-in test circuit is available. Through the procedure below, the following checks can be made.

CHECK ITEM	TEST SWITCH	
	"SIG"	"0 KNOTS"
Ship's Speed Reading	The reading should gradually reach 24 thru 30 knots if the equipment is operating normally.	Ship's speed should read 0.0 or + 0.1 knots.
Distance Run Reading	Use the following equation to confirm the calculating time required for the increment of the distance run reading by 0.3 n.m. $\frac{1080}{\text{ship's speed reading taken from the above check item}}$ sec. ex. If the ship's speed reading is 27.0 knots, the time is; $\frac{1080}{27.0}$ = 40 sec.	Distance run cannot be incremented.
Log Signal Output Check using a Multimeter	On the rear panel, connect a multimeter to TB3 (1 and 2), and measure the pulse count (*).	There should be no signal output.

(*) This relay contact signal is equivalent to 200 pulses/n.m. Therefore, 60 pulse are equal to 0.3 n.m.

NOTE

Just after changing the dummy signal switch from either SIG to 0 or 0 to SIG (with test switch in TEST position), it takes a while for the ship's speed reading to reach the value of the particular test setting.

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4.2 Self-test of Distance Indicator

Remove the top cover of the Distance Indicator and the TEST switch is located on the DSP board (65P3010) as shown below.

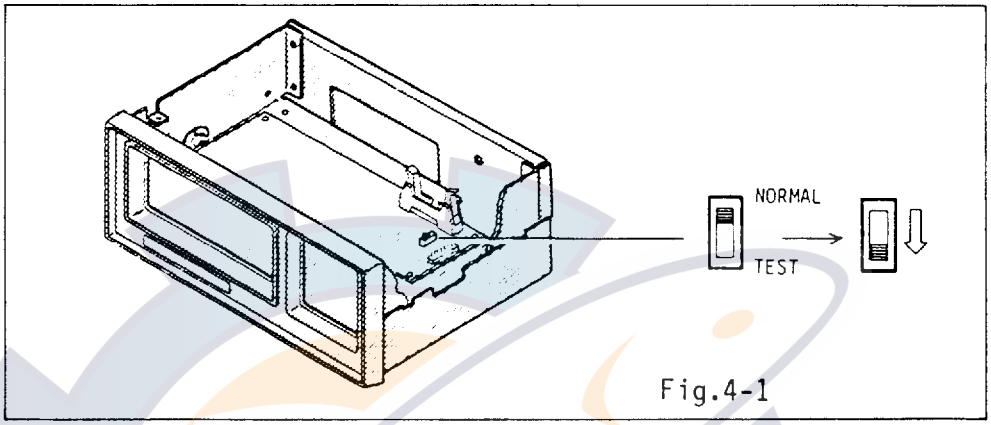


Fig.4-1

Distance Indication check

When the TEST switch is set to "TEST" position, the distance run figure increments by 5.0 miles every 10 seconds.

Figure check

After presetting the distance run figure to 99995.0 with the SELECT and SET button, set the TEST switch to "TEST". If the indication changes to 0.0 in 5 seconds, the unit operates normally.

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4.3 Noise Test

After completing the installation, make sure the DS-70 is not picking up noise by following in order the test procedure below.

1. Stop the ship where the distance between the hull bottom and seabed is greater than 3m. Turn off the power to radio equipment, fish finding gear (such as echo sounder, sonar, etc.) and all other electronic equipment.

2. Apply the power to the DS-70, and perform the self-check with the test switch and dummy signal switch inside the inner panel. Set the test switch and dummy signal switch to "TEST" and "SIG" positions, respectively. If the display shows 24 to 30 kts within 30 seconds, return the test switch to the normal position. Approximately 0 kts will be displayed within a few minutes if the unit is operating normally.

3. Make sure the abnormal echo lamp is not blinking excessively. (If the lamp blinks within 1 and 2 times every five seconds, the equipment is operating normally.) Also, confirm that no decimal point is blinking.

4. Turn on one by one the equipment turned off in step 1, and observe the abnormal echo lamp. If the lamp blinks excessively when the power is applied to a piece of equipment, then noise is being picked up from that equipment. Check the installation method of the offending equipment. Likewise, check the ground of noise generating equipment.

5. Run the ship at both cruising and maximum speeds and confirm that the abnormal echo lamp does not blink excessively in either case.

NOTE

Propeller shaft noise may be picked up through the cables of the DS-70. This type of noise (from the brushes, etc.) may be reduced by grounding the shaft to the ship's body.

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4.4 Sea Test Procedure

1. Purpose

To ensure the accuracy of the DS-70, the following test should be carried out at sea, during anchoring and cruising of the vessel.

2. Testing Method

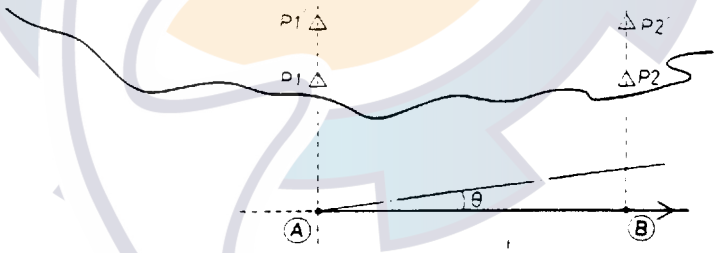
Static Data

With the vessel stationary in the dock, read the speed indication of the DS-70 every 10 seconds. The average value and the deviation of indication should be examined.

Speed Test

While running on the mile post, or measuring the vessel's speed by a radio log, record the indication of the DS-70 every 10 seconds. The resultant average value should then be compared with the data obtained by running on the mile posts or by the radio log. The accuracy of the doppler speed log is found out by measuring the time elapsed over one mile of the distance meter.

In practice, the vessel's speed is evaluated as follows.



The data taken by speed test should be recorded on page 4-7 of the TEST SHEET.

1. Measurement of vessel's speed by means of the mile post.

Run the vessel at a constant speed along the test course given by mile posts (P1/P1' and P2/P2') and measure the time (TOG: unit in seconds) elapsed between points (A) and (B). The vessel's speed is obtained from the following equation.

$$\text{Vessel's speed (VMP)} = \frac{3600}{TOG} \times \frac{d \times \frac{1}{\cos\theta}}{1852} \text{ [KTS]} \quad \cdots 1$$

Where d is the distance between points (A) and (B), and θ, drifting angle.

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2. Measurement of vessel's speed by using the distance run indication of the DS-70.

   While performing the test in step 1, measure the exact time (T/mile) elapsed over a one-mile counting of the distance run indication.

$$VDS = \frac{3600}{T/mile} \quad [KTS] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 2$$

3. Obtain the average value of VMP and VDS in going and returning over the test course.

$$VMP' = \frac{VMP(going) + VMP(returning)}{2} \quad \ldots\ldots\ldots\ldots \quad 1$$

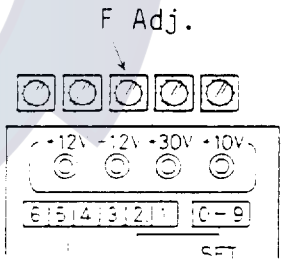
$$VDS' = \frac{VDS(going) + VDS(returning)}{2} \quad \ldots\ldots\ldots\ldots \quad 2$$

   Therefore, the measurement error of the DS-70 is given as follows.

$$\Delta V = \frac{VDS' - VMP'}{VMP'} \times 100\%$$

4. The error ΔV can be corrected with potentiometer F Adj., accessible through the clearance above the top of the inner panel as illustrated.

   In order to perform the correction precisely, adjust the F Adj. potentiometer by using the built-in test signal as follows.



   a. Set the TEST and DUMMY SIGNAL switches to TEST and SIG, respectively.

   b. Wait for a while until the speed indication becomes stable (27 ±3 knots).

   c. Adjust the potentiometer so that the ship's speed reading shows the value given by the following equation.

$$\text{Ship's speed reading} = \frac{VSIG}{1 + \frac{\Delta V}{100}} \qquad \Delta V: \text{percent}$$

   Where VSIG is the speed reading by the test signal before adjusting the potentiometer.

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Ref: The scale around the potentiometer is graduated in about 2% increments and can be calibrated by ±10% of the present indication.

Ex.

If the ⊿V and VSIG is 2% and 27.0 knots, respectively:

$$VADJ = \frac{27.0}{1 + \frac{2}{100}}$$

$$\fallingdotseq 26.5 \text{ knots.}$$

Therefore, adjust the potentiometer for a ship's speed reading of 26.5 knots.

TEST SHEET FOR DS-70 DOPPLER SPEED LOG

DATE_____ TEST SITE_____ SHIP'S LENGTH _____ (M) DRAFT Fore_____ Aft_____ Mean_____ (M)

SHIP'S NAME _____ SNo. _____ DOCKYARD_____ TRIM_____ (M)

RUN NO.	ENGINE			TRUE SPEED		DOPPLER SPEED LOG			EM-LOG (kts)	DEPTH (m)	COURSE (deg)	WIND (m/s)	SEA COND.	REMARKS
	LOAD	OUT	RPM	RADIO LOG/ *1 MILE POST		DISTANCE RUN (n.m.)		ERROR						
				KTS	TIME (sec.)	*2SPEED (kts)	TIME (sec.)	*3 (%)						
MEAN														
MEAN														
MEAN														
MEAN														

*1 : MILE POST = [ ] (miles)

$$*2 : \text{D.L. SPEED} = \frac{\text{DISTANCE RUN (n.m.)}}{\text{TIME (sec.)}} \times 3600 \text{ (kts)}$$

$$*3 : \text{ERROR} = \frac{\text{D.L. SPEED} - \text{TRUE SPEED}}{\text{TRUE SPEED}} \times 100 (\%)$$

Note. Use mean error on both ways. (going and returning)

Formula for Correction Value

$$V_{ADJ} = \left(1 + \frac{\text{ACTUAL SPEED} - \text{D.L. SPEED}}{\text{D.L. SPEED}}\right) \times V_{SIG}$$

V_{ADJ} : Speed indication on DS-70 after speed correction.

V_{SIG} : Speed indication at "TEST-SIG" before speed correction.

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5. OPERATING PRECAUTIONS AND REMARKS ON DOCKING THE SHIP

5.1 Abnormal Indication in a Specific Area

The DS-70 measures ship's speed by detecting the doppler shift frequency of the return echo which is reflected by plankton or other micro organisms between 2 and 3m deep. There are rare occurrences, however, that no signal is received due to a lack of the plankton. It was reported that this phenomenon was observed in the Ohotsuku Sea during the spring season. The probable reason is that the plankton are lying in deep water because the ice-melted cold water mass covers over the sea surface. Similar cases have also been seen in a fresh water lake. Under such circumstances, the DS-70 will not indicate the correct ship's speed even if the equipment works normally.

5.2 Countermeasure to protect Transducer from being damaged by Dry Dock Blocks

The transducer may be damaged if the transducer touches the block at grounding. Take the following countermeasure to prevent this from occuring.

1. Before delivery, draw up a docking plan referring to the dimensions and location of the transducer. The plan should be kept onboard ship.

2. Plan the placing of the blocks referring to the above plan.

3. Prior to pumping out the water, have a diver check the position between the transducer and the blocks. Confirm that the transducer will not touch the blocks.

Consult with the dockyard personnel over items 2 and 3 above before dry docking.

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6. SPECIFICATIONS

GENERAL

1. Speed Range:	-10.0 to 30.0 knots
2. Tracking Mode:	Water tracking
3. Depth Range:	Over 3 m
4. Accuracy:	± 1% or ± 0.1 kt (excluding effect of tide current)
5. Transmission Frequency:	2MHz (Pair-beam system)
6. Ambient Conditions:	Temperature: -15 to 55°C Relative humidity: 80% (at 45°C)
7. Power Supply/Consumption:	100/110/115/200/220/230 VAC, 1 ϕ , 50/60 Hz Max. 25VA (except optional units)

MAIN DISPLAY UNIT: DS-700

1. Indication	-Ship's speed- Fore: □□.□ knot Aft : -□□.□ knot -Distance run- □□□□□.□ n. mile
2. Output Signal	1) Digital speed signal (TTL level: one output) 2) Log signal of 200 pulses/n/m., forward data only (Relay contact: one output, Contact capacity: 30V max./0.5A max.) 3) Log signal of 400 pulses/n.m., forward data only (TTL Level: one output)
3. Others	1) Illumination of green EL board and dimmer 2) Manual set of each digit and reset of all digits for distance run 3) Function checks by internal reference signal

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DIGITAL DISPLAY: DS-720

1. Indication	Fore: □□.□ knot, Aft : □□.□ knot (LCD display with dimmer)
2. Power Consumption	2.5VA approx.

ANALOG DISPLAY: DS-761/762/763/771/772/773

1. Indication	-10 to 30 knot (for DS-761/762/763) -10 to 20 knot (for DS-771/772/773) Illumination of orange EL board (except DS-763/773)
2. Power Consumption	2.5VA approx.
3. Others	External Dimmer Box (JIS F8852 or equivallent) can be connected.

DISTANCE INDICATOR: DS-730

1. Indication	□□□□□.□ n. mile . LCD display with dimmer . Manual set of each digit and reset of all digits
2. Accuracy	± 1% or ± 0.1 kt
3. Power Consumption	2.5VA approx.
4. Others	1)Function Checks 2)Keep – alive battery to preserve the distance run figure

DISTRIBUTION BOX: DS-740

1. Output Signal	1) Ship's speed for Digital Display (TTL level: two outputs) 2) Analog ship's speed signals

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output i

* for Analog Display
* anplog current signal
  (-10 to 30 knots: 4 to 20mA)
* analog current signal
  (-10 to 30 knots: -3.3 to 10V)

output ii

* for Analog Display
* analog current signal
  (-10 to 30 knots: -3.3 to 10V)

3) Log signal of 400 pulse/n. miles, forward data only (TTL level: 2 outputs)

4) Log signal of 200 pulse/n. miles, forward data only (Relay contact: six output, Contact capacity: 30V/0.5A)

2. Power Consumption Max. 50VA,

INTERFACE UNIT : DS-741

(1) Input Port 1 port

(2) Output Port 2 ports

(3) I/O Sentences

Input Serial digital data(current loop)

Output (IEC61162-1) VDVBW-water speed

$VDVBW, x, x, x, x, A, x, x, x, x, A<CR><LF>

- Status: Ground speed, A= Data valid, V= Data invalid
- Transverse ground speed, knots
- Longitudinal ground speed, knots
- Status: Water speed, A= Data valid, V= Data Invalid
- Transverse water speed, knots
- Longitudinal water speed, knots
- Formatter
- Talker, "VD"

Note 1: Longitudinal speed: "-" = astern

Note 2: Transverse/longitudinal ground speed and transverse water speed signals are Null.

(4) Power Supply 8-18/18-42 VDC, unstabilized. 0.2 A max.
Value is selected by changing receptacle on internal board.

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EQUIPMENT LIST (STANDARD)

No.	Name	Type	Wgt.(kg)	Q'ty	Remarks
1	Main Display	DS-700	6	1	Flush mount
			6.2		Table/Bulkhead mount
2	Transducer	DS-785-10	2.5	1	w/10m cable
		DS-785-20	4.8		w/20m cable
		DS-785-30	7		w/30m cable
3	Seachest	DS-781	11	1	Projection
		DS-782	75		Gate Valve type P
		DS-783	5.6		Flush type P
		DS-784	9.5		Flush
		DS-786	44		Gate Valve type F
4	Junction Box	DS-750	2.6	1	
5	Installation Materials			1 set	
6	Accessories			1 set	
7	Spare Parts			1 set	
8	Interface Unit	DS-741	0.8	1	for SOLAS type ship only

EQUIPMENT LIST (OPTION)

No.	Name	Type	Wgt.(kg)	Remarks
1	Digital Display	DS-720	1.6	Flush/Table mount
2	Analog Display *	DS-761/771	6	Flush mount
		DS-762/772	6	Bulkhead mount
		DS-763/773	1.3	Flush(small) mount
3	Distance Indicator	DS-730	1.7	Flush/Table mount
4	Dimmer	MF-22L-1	1.2	Flush mount
		MF-22L-2	1.3	Bulkhead mount
5	Distribution Box	DS-740		
6	Junction Box	DS-750	1.3	
7	Accessories			
8	Installation Materials			
9	Spare Parts			

* Meter scales are different between DS-76X series and DS-77X series as follows.

DS-761/762/763 : -10 to 30 knot
DS-771/772/773 : -10 to 20 knot

ACCESSORIES

No.	Name	Type	Code No.	Q'ty	Remarks
1	Knob Bolt	KG-B2 M8x20	000-861-934	2	For DS-700 (Table top/Wall mount)
2	Rubber Washer	02-019-0003	201-900-031	2	
3	Knob Washer	02-043-1112	204-311-120	2	
4	Hanger	02-043-1501	204-315-011	1	
5	Cosmetic Cover Fixing Plate	65-003-0141	100-022-940	2	For DS-700 (Flush mount)
6	Hanger	65-003-0142	100-022-950	2	
7	Cosmetic Cover	65-003-0143	100-022-960	2	

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8	Hanger	65-003-0318-0	100-033-670	2	For DS-720/730 (Flush mount)
9	Cosmetic Cover Fixing Plate	65-003-0319-0	100-033-680	2	
10	Cosmetic Cover	65-003-0321-0	100-033-690	2	
11	Slotted Hex. Bolt	M6 x 25 SUS304	000-862-133	4	
12	Hex. Nut	M6 SUS304	000-863-109	4	
13	Spring Washer	M6 SUS304	000-864-260	4	
14	Hanger	01-011-1015	006-261-890	1	For DS-720/730 (Table mount)
15	Knob Bolt	KG-B2 M8x15	000-861-937	2	
16	Fiber Washer	M8 FIBER	000-864-936	2	

INSTALLATION MATERIALS

No.	Name	Type	Code No.	Q'ty	Remarks
1	Copper Strap	WEA-1004	500-310-040	1	For DS-700
2	Crimp-on Lug	FV1.25-3 Red	000-538-113	35	
3	Rubber Cushion	65-003-0211-0	100-044-380	2	
4	Copper Strap	WEA-1004-0	500-310-040	1	For DS-720/730
5	Crimp-on Lug	FV2-S3.3	000-538-117	6	
6	Hook Spanner	236-332	000-104-345	1	
7	Crimp-on Lug	FV2-S3.3	000-538-117	5	For DS-76X/77X *
8	Copper Strap	WEA-1004-0	500-310-040	1	For DS-740
9	Crimp-on Lug	FV1.25-3 Red	000-538-113	3	
10	Hook Spanner	236-332	000-104-345	1	
11	Crimp-on Lug	FVD2-4 Blue	000-104-950	10	For DS-750
12	Crimp-on Lug	FVD2-MS3 Blue	000-104-951	10	
13	Crimp-on Lug	V1.25-4 Red	000-538-102	10	
14	Compound 4C Cable	65S1034	000-104-949	□m	
15	Kinoruster (Anti-crevice corrosion sealant)	855 50g	000-801-328	1	For Transducer seachest

* DS-761/762/763 , DS-771/772/773

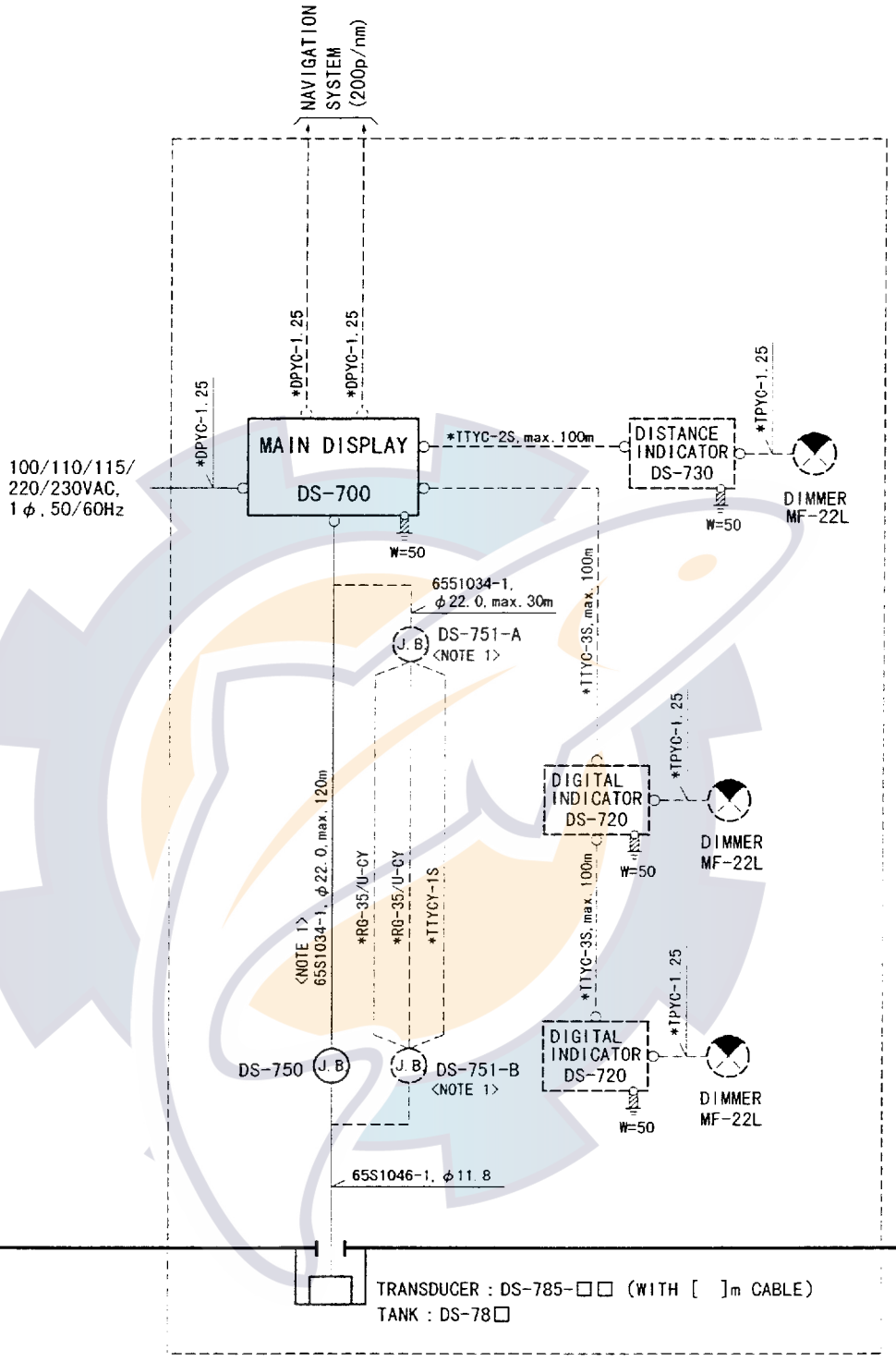
SPARE PARTS

No.	Name	Type	Code No.	Q'ty	Remarks
1	Glass Tube Fuse	FGBO 1A AC250V	000-549-019	4	For DS-700
2	Glass Tube Fuse	FGBO 2A AC125V	000-549-062	2	
3	Glass Tube Fuse	FGBO 0.5A AC125V	000-549-060	3	For DS-720/730
4	Glass Tube Fuse	FGBO 0.5A AC250V	000-549-018	3	*1 For DS-740
		FGBO-A 1A AC125V	000-549-061	3	*2 For DS-740

*1: For 200 to 220VAC, *2: For 100 to 115VAC

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DS-70 DOPPLER SPEED LOG

NOTE

* : SHIPYARD SUPPLY

: CONNECTOR (: FACTORY-FITTED)

: CRIMP-ON LUG (: FACTORY-FITTED)

: GROUNDING COPPER STRAP

: GROUNDING WIRE IV-8sq.

: CABLE SUPPLY SIDE

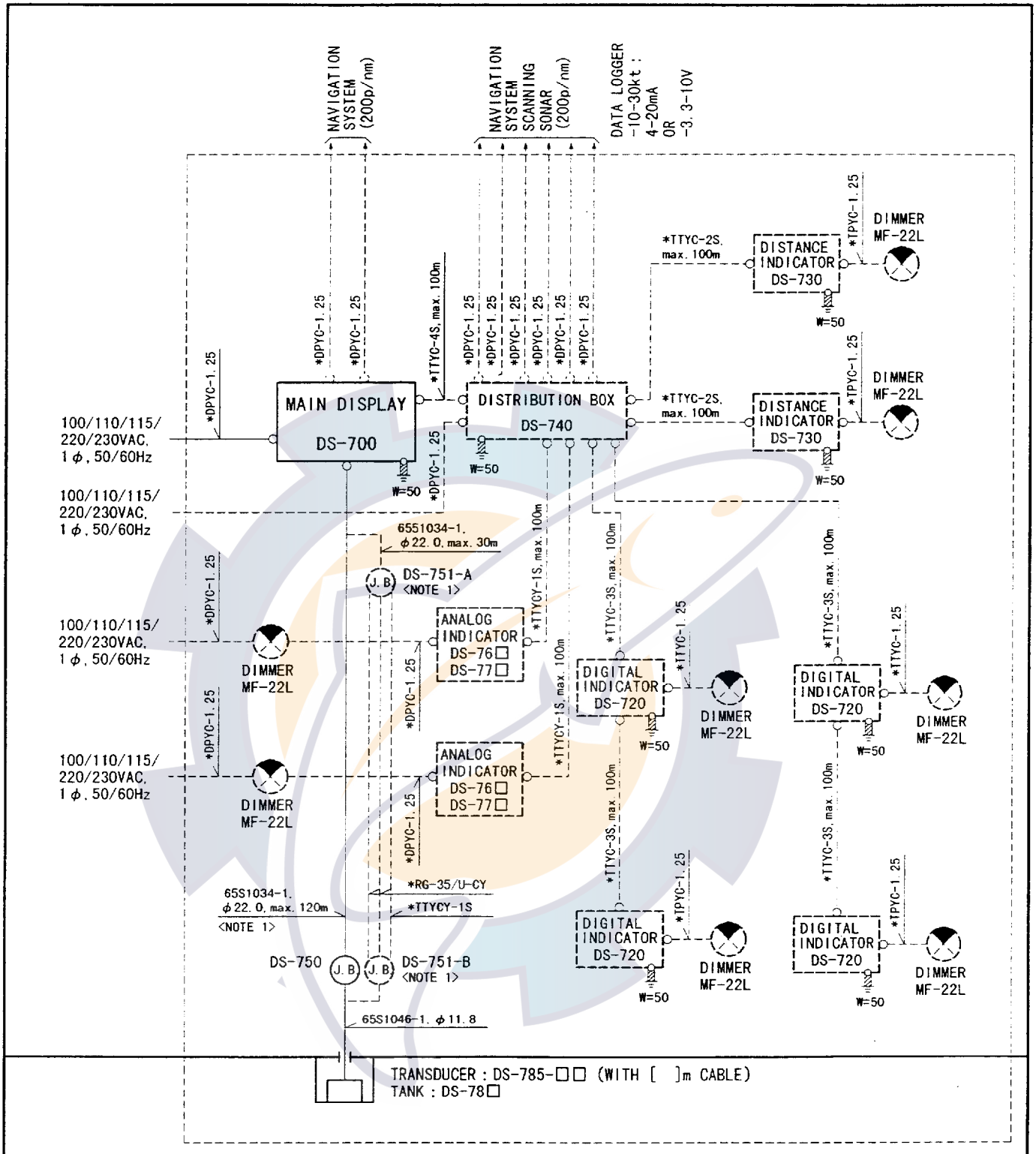
-- : OPTIONAL SUPPLY

<NOTE 1> :
WHEN CABLE LENGTH IS EXTENDED MORE THAN 120m, USE TWO JUNCTION BOXES INSTEAD OF DS-750.
IF SO, MAXIMUM CABLE LENGTH BETWEEN DS-700 AND TRANSDUCER IS 400m.
(NOTE THAT CABLE LENGTH OF 65S1034-1 SHOULD BE 30m AT MAXIMUM.)

DRAWN	Dec 15 '98 T.TAMASAKI	TYPE	DS-70
CHECKED	Dec 16 '98 K.KUSUKI	NAME	DOPPLER SPEED LOG
APPROVED	Dec 16 '98 K.KUSUKI		SYSTEM DIAGRAM
		REMARKS	CONNECTION W/ DS-720/730
DWG. No.	E7222D02F000		

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DS-70 DOPPLER SPEED LOG

NOTE

* : SHIPYARD SUPPLY

: CONNECTOR (: FACTORY-FITTED)

: CRIMP-ON LUG (: FACTORY-FITTED)

: GROUNDING COPPER STRAP

: GROUNDING WIRE IV-8sq.

: CABLE SUPPLY SIDE

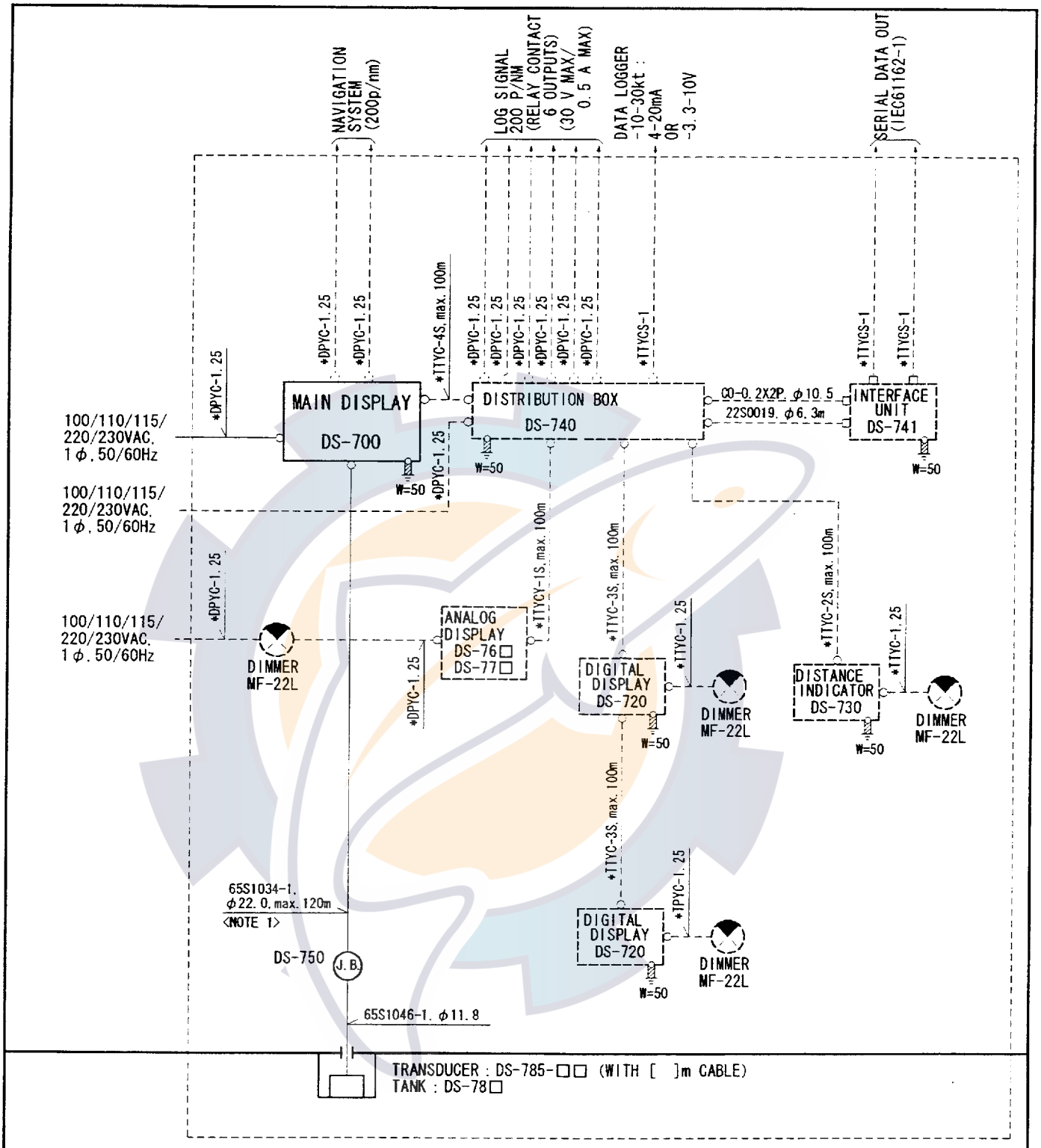
: OPTIONAL SUPPLY

<NOTE 1> :
WHEN CABLE LENGTH IS EXTENDED MORE THAN 120m, USE TWO JUNCTION BOXES INSTEAD OF DS-750.
IF SO, MAXIMUM CABLE LENGTH BETWEEN DS-700 AND TRANSDUCER IS 400m.
(NOTE THAT CABLE LENGTH OF 65S1034-1 SHOULD BE 30m AT MAXIMUM.)

DRAWN Dec15'98 T.YAMASAKI		TYPE DS-70
CHECKED Dec16'98 K.Kusunoki		NAME DOPPLER SPEED LOG
APPROVED Dec16'98 K.Kusunoki		SYSTEM DIAGRAM
		REMARKS
DWG. No E7222D01F000		

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DS-70 DOPPLER SPEED LOG

NOTE

* : SHIPYARD SUPPLY

: CONNECTOR (: FACTORY-FITTED)

: CRIMP-ON LUG (: FACTORY-FITTED)

: GROUNDING COPPER STRAP

: GROUNDING WIRE IV-8sq.

: CABLE SUPPLY SIDE

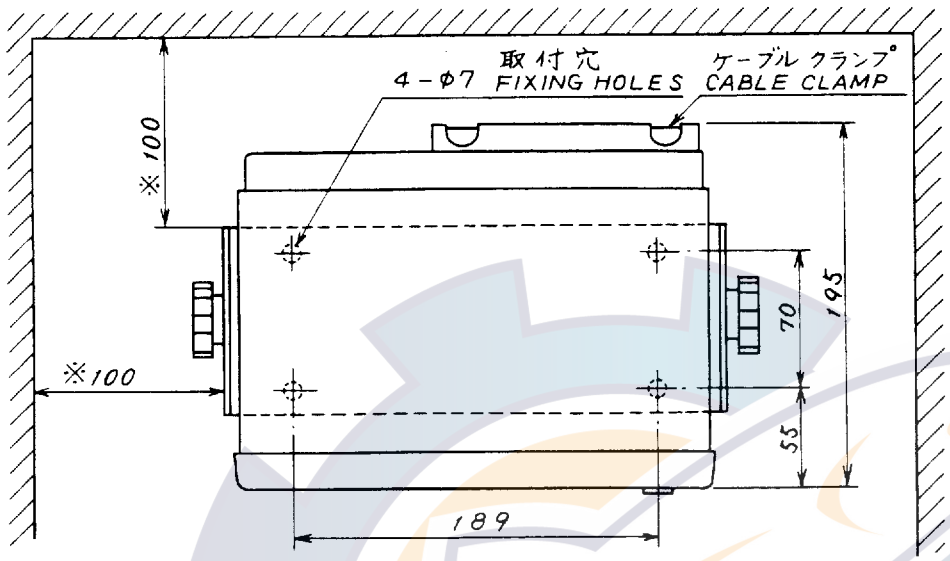
- - : OPTIONAL SUPPLY

<NOTE 1>:
WHEN CABLE LENGTH IS EXTENDED MORE THAN 120m, USE TWO JUNCTION BOXES INSTEAD OF DS-750.
IF SO, MAXIMUM CABLE LENGTH BETWEEN DS-700 AND TRANSDUCER IS 400m.
(NOTE THAT CABLE LENGTH OF 65S1034-1 SHOULD BE 30m AT MAXIMUM.)

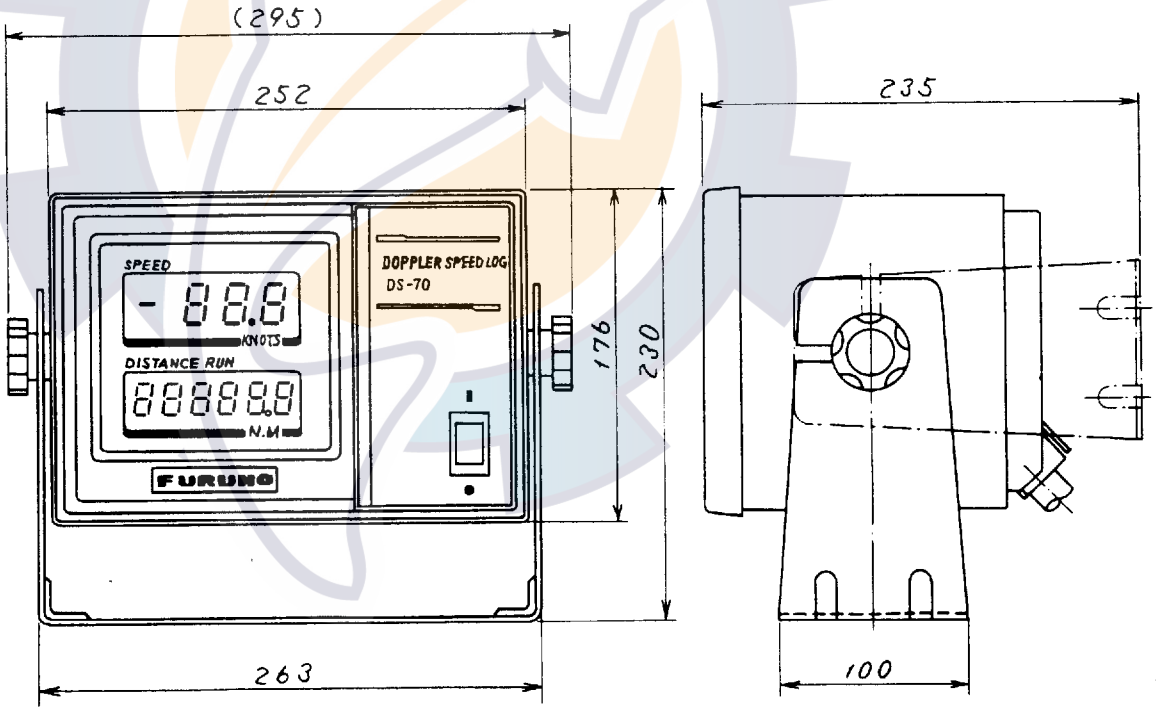
DRAWN Oct 8'98 K.Kusuoki		TYPE DS-70
CHECKED Oct 8'98 T.YAMASAKI		NAME DOPPLER SPEED LOG
APPROVED Oct 8'98 K.Kusuoki		
		REMARKS
DWG. No. E7222D03A000		SYSTEM DIAGRAM

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※ 推奨サービス空間
RECOMMENDED SERVICE CLEARANCE.



COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.5m
STEERING····· 0.9m

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

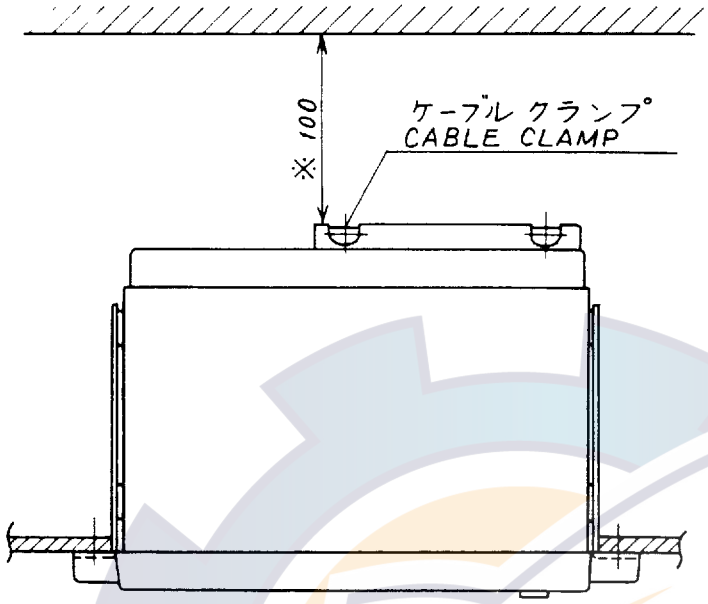
承認 APPROVED	JUL.11.'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-700 主指示器（卓上/壁掛型） MAIN DISPLAY(TABLE TOP/WALL MOUNT)
検図 CHECKED	July.10.'85	尺度 SCALE 1/4	
製図 DRAWN	JUL.8.'85	重量 WEIGHT 6.2 kg	図番 DWG.NO. C7222-005-C

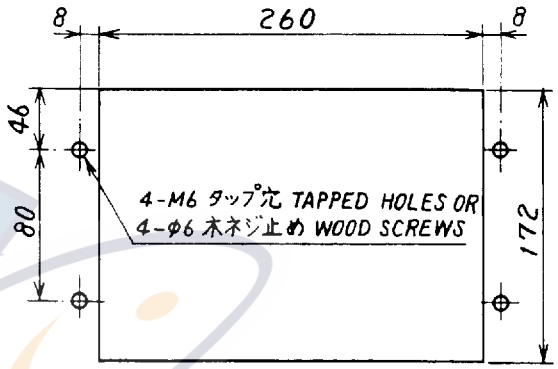
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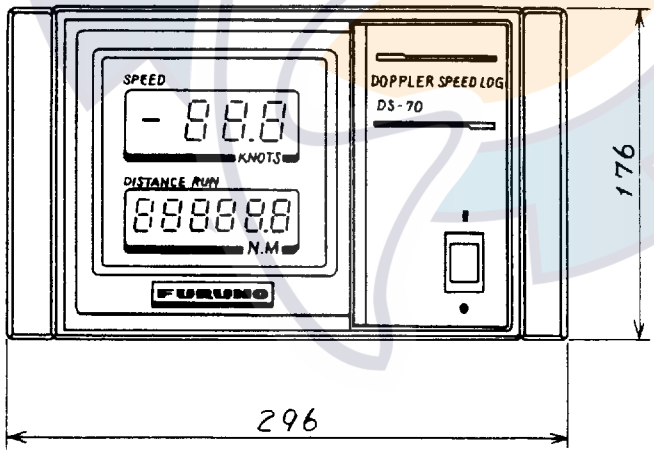
FURUNO

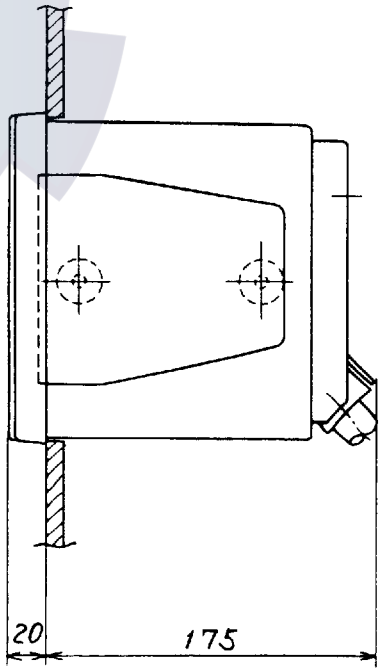
※ 推奨サービス空間
RECOMMENDED SERVICE CLEARANCE.





取 付 寸 法 図
MOUNTING DIMENSIONS





COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.5m
STEERING····· 0.9m

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

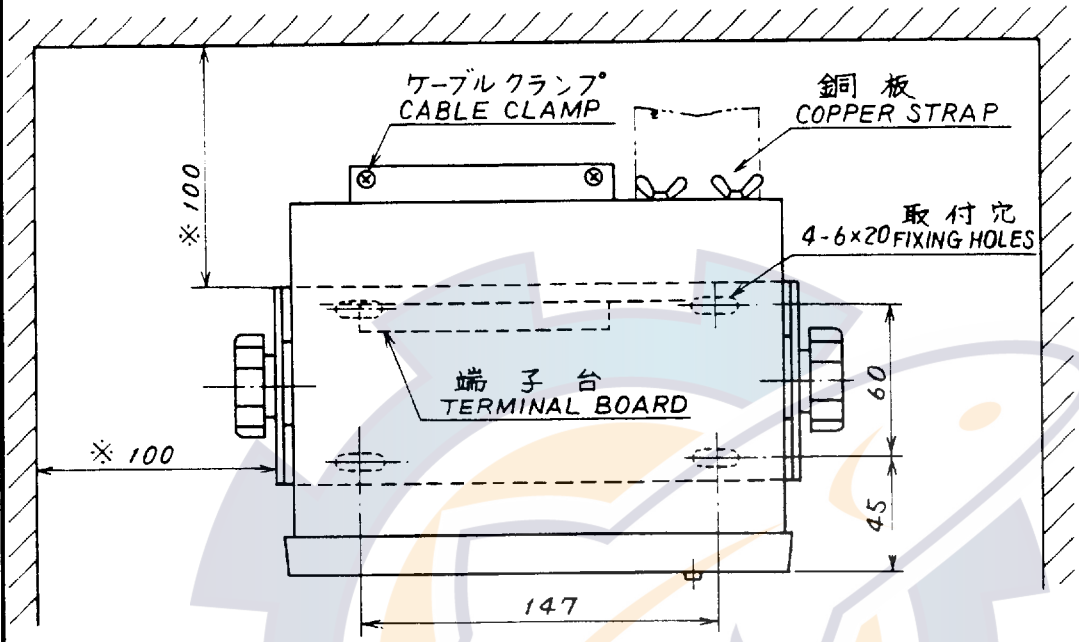
承認 APPROVED	AUG 7 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-700 主指示器（埋込型） MAIN DISPLAY (FLUSH MOUNT)
検図 CHECKED	AUG. 7 '85	尺度 SCALE 1/4	
製図 DRAWN	AUG. 7. '85	重量 WEIGHT 6 kg	図番 DWG.NO. C7222-012-B

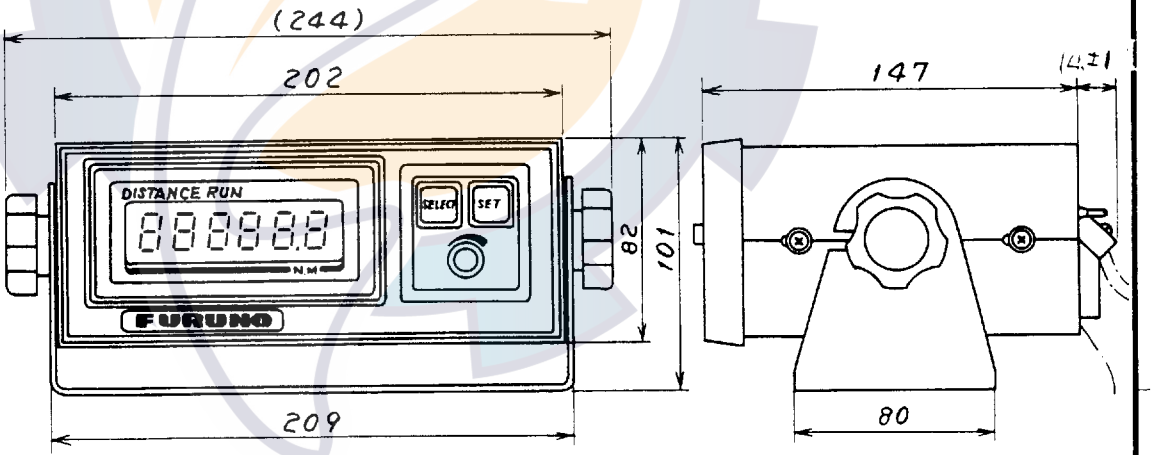
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RECOMMENDED SERVICE CLEARANCE.





COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.0m
STEERING····· 0.6m

注：指定なき公差は1.5%
TOLERANCE IS 1.5% UNLESS OTHERWISE SPECIFIED.

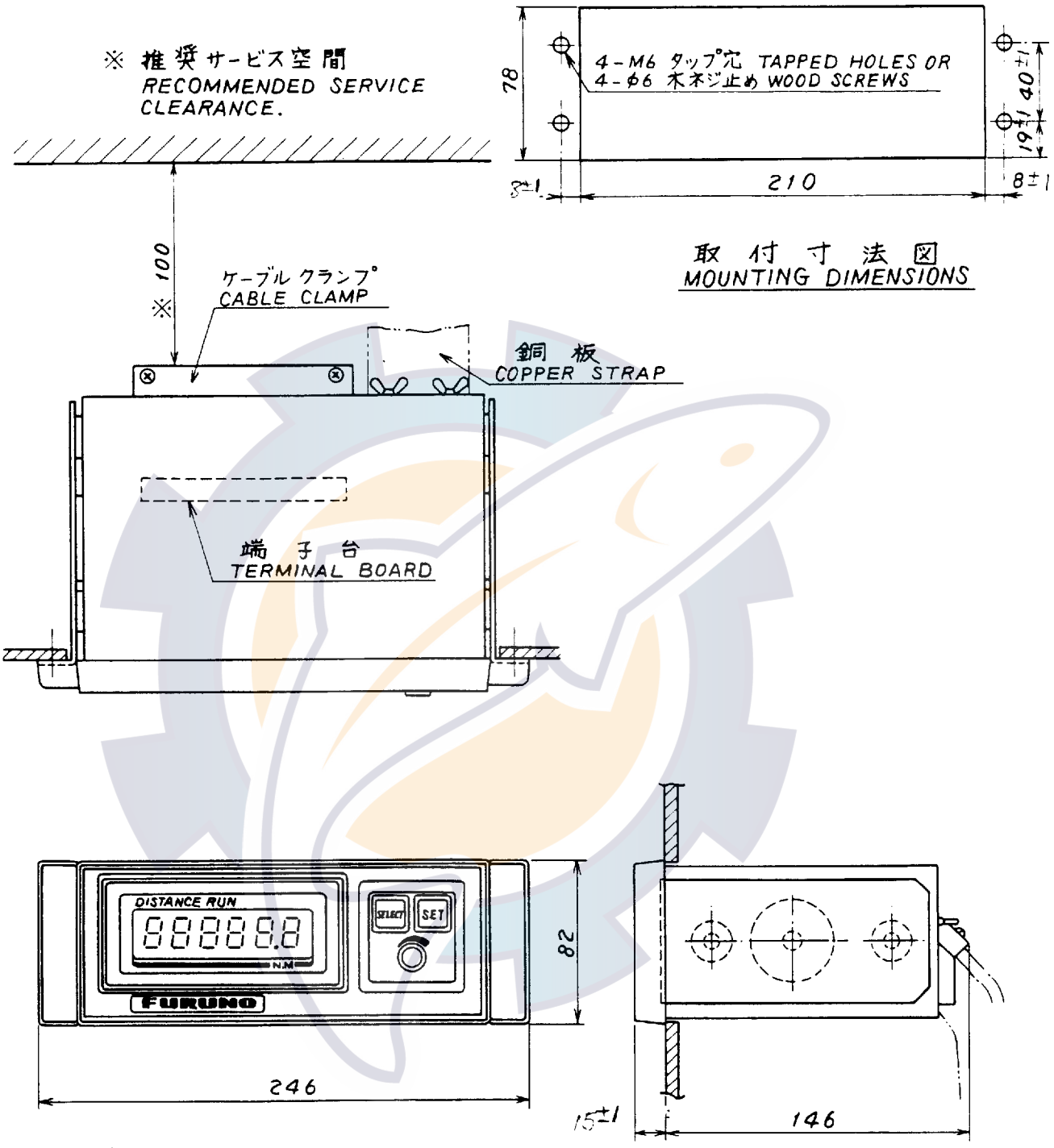
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	AUG. 7 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-730 航程計（卓上型） DISTANCE INDICATOR (TABLE TOP MOUNT)
検図 CHECKED	AUG. 7 '85	尺度 SCALE 1/3	
製図 DRAWN	AUG. 7 '85	質量 MASS 1.7 kg	図番 DWG.NO. C7222-016-C

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取 付 寸 法 図
MOUNTING DIMENSIONS

COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.0m
STEERING····· 0.6m

注：指定なき公差は1.5%
TOLERANCE IS 1.5% UNLESS OTHERWISE SPECIFIED.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

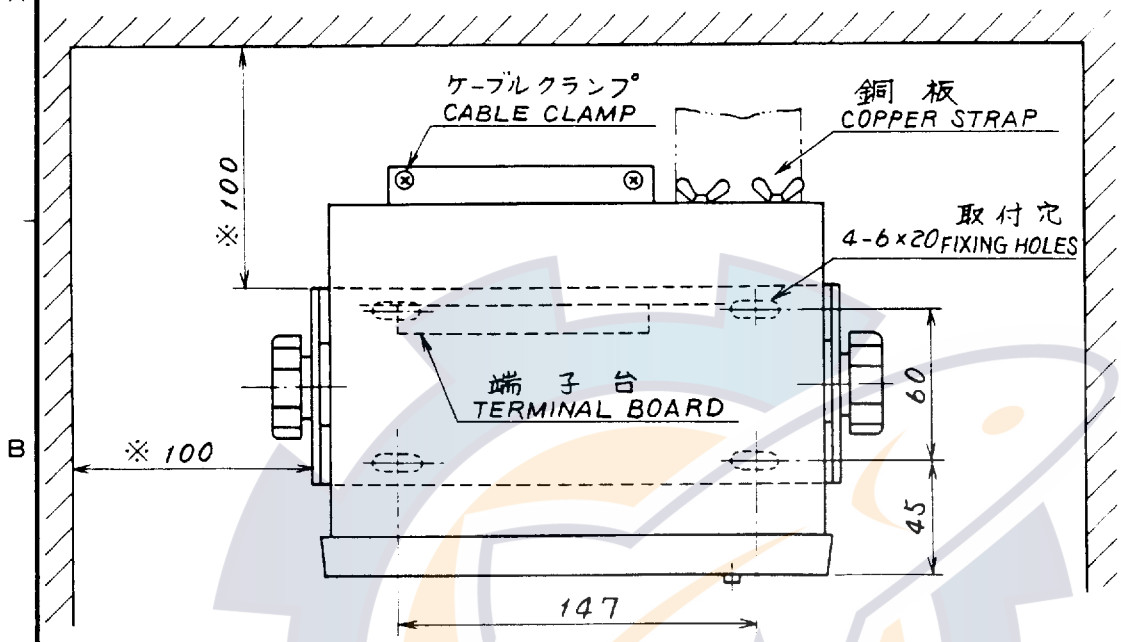
承認 APPROVED	AUG. 7 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-730 航程計 (埋込型) DISTANCE INDICATOR (FLUSH MOUNT)
検図 CHECKED	Aug. 7 '85	尺度 SCALE 1/3	
製図 DRAWN	AUG. 7 '85	質量 MASS 1.7 kg	図番 DWG.NO. C7222-015-C

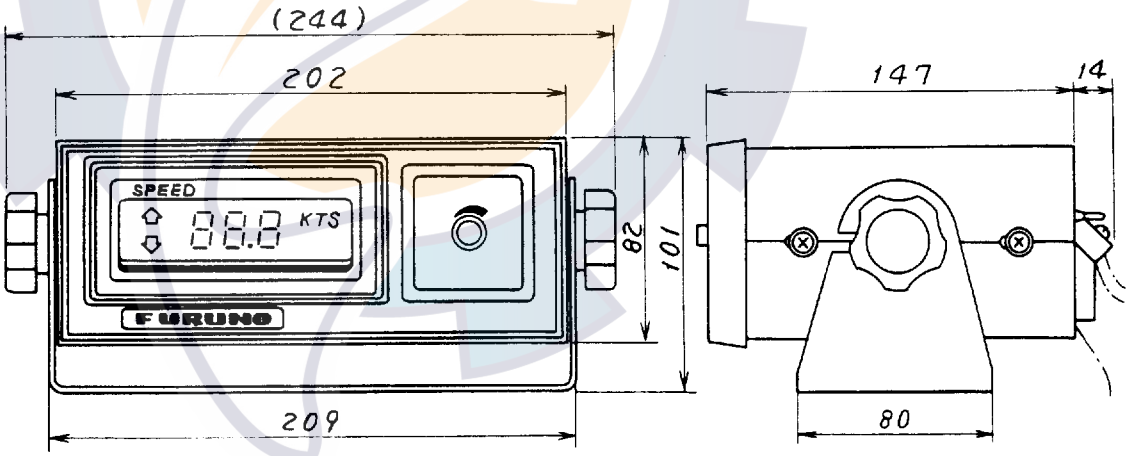
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RECOMMENDED SERVICE CLEARANCE.





COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.0m
STEERING····· 0.6m

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

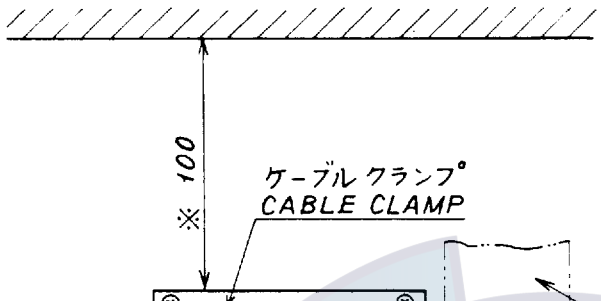
承認 APPROVED	Aug. 7 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-720 デジタル指示器(卓上型) DIGITAL DISPLAY (TABLE TOP MOUNT)
検図 CHECKED	Aug. 7 '85	尺度 SCALE 1/3	
製図 DRAWN	AUG. 7 '85	重量 WEIGHT 1.6 kg	図番 DWG.NO. C7222-013-B

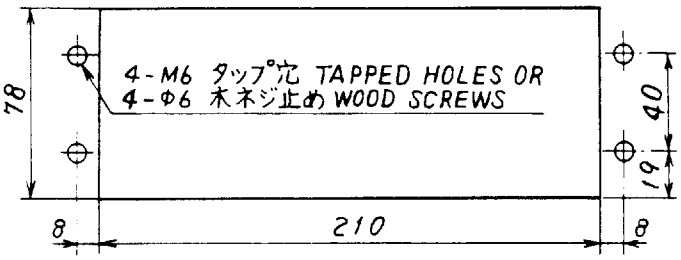
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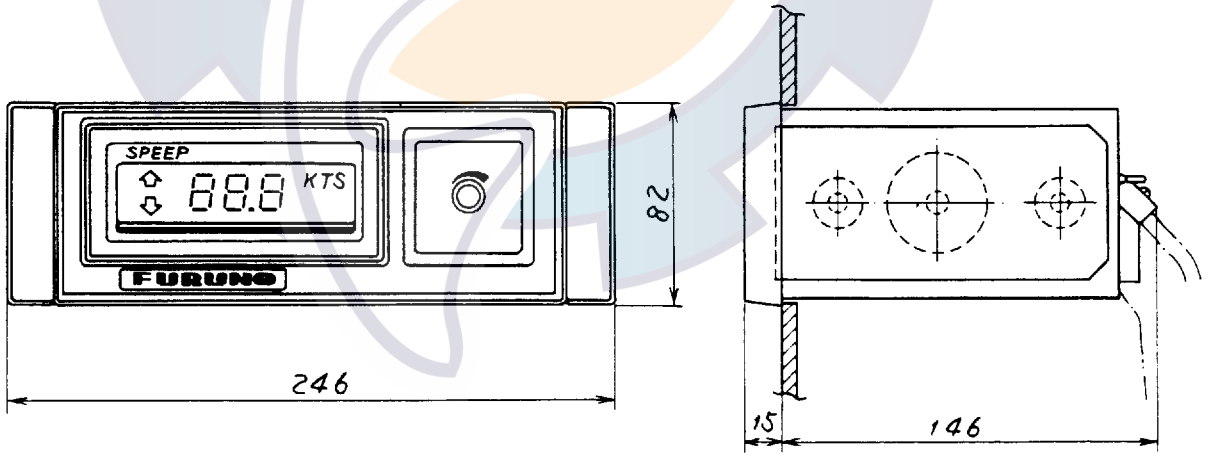
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取付寸法図
MOUNTING DIMENSIONS



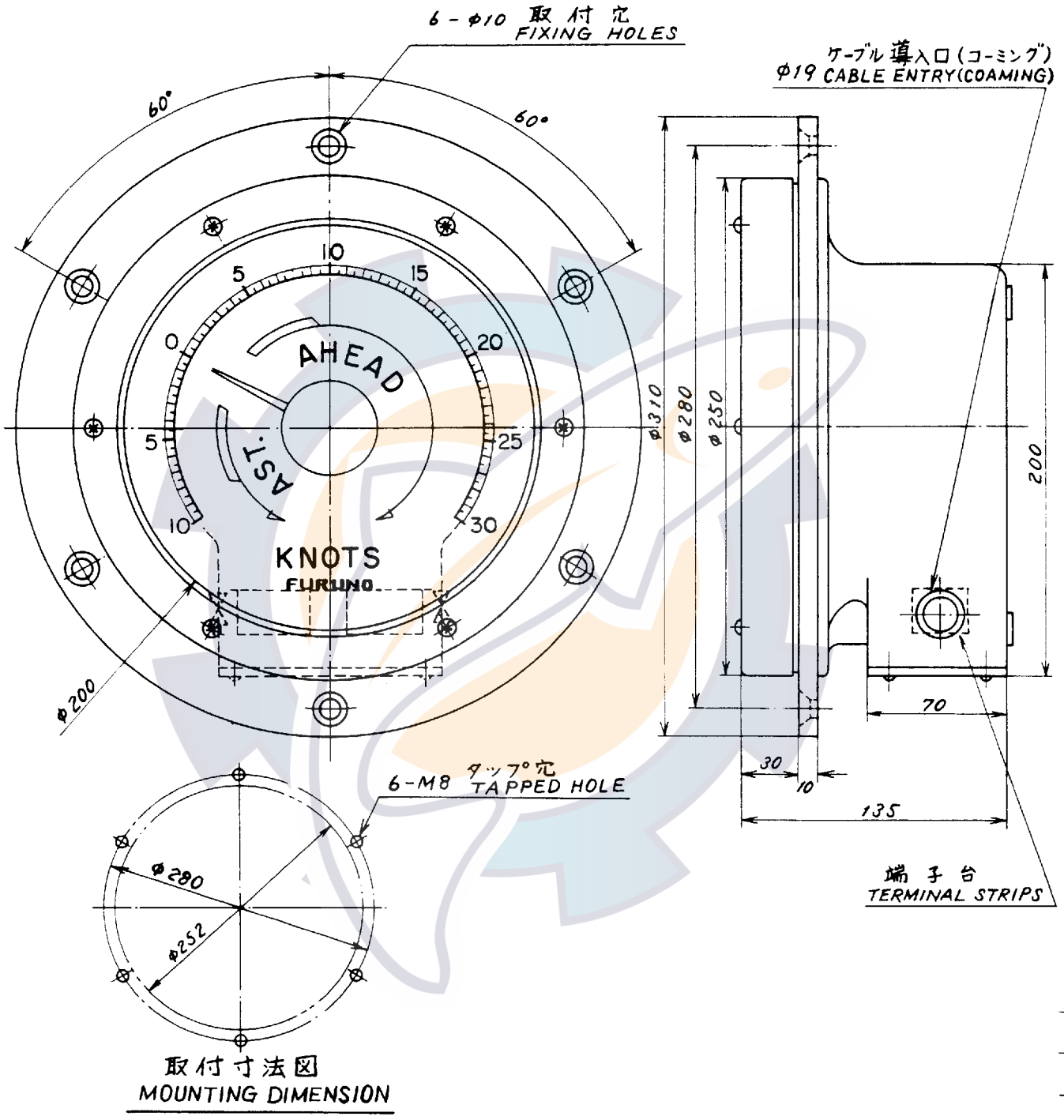
COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.0m
STEERING····· 0.6m

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	Aug. 7 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-720 デジタル指示器（埋込型） DIGITAL DISPLAY (FLUSH MOUNT)
検図 CHECKED	Aug. 7 '85	尺度 SCALE 1/3	
製図 DRAWN	AUG. 7 '85	重量 WEIGHT 1.6 kg	図番 DWG.NO. C7222-014-B

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取付寸法図
MOUNTING DIMENSION

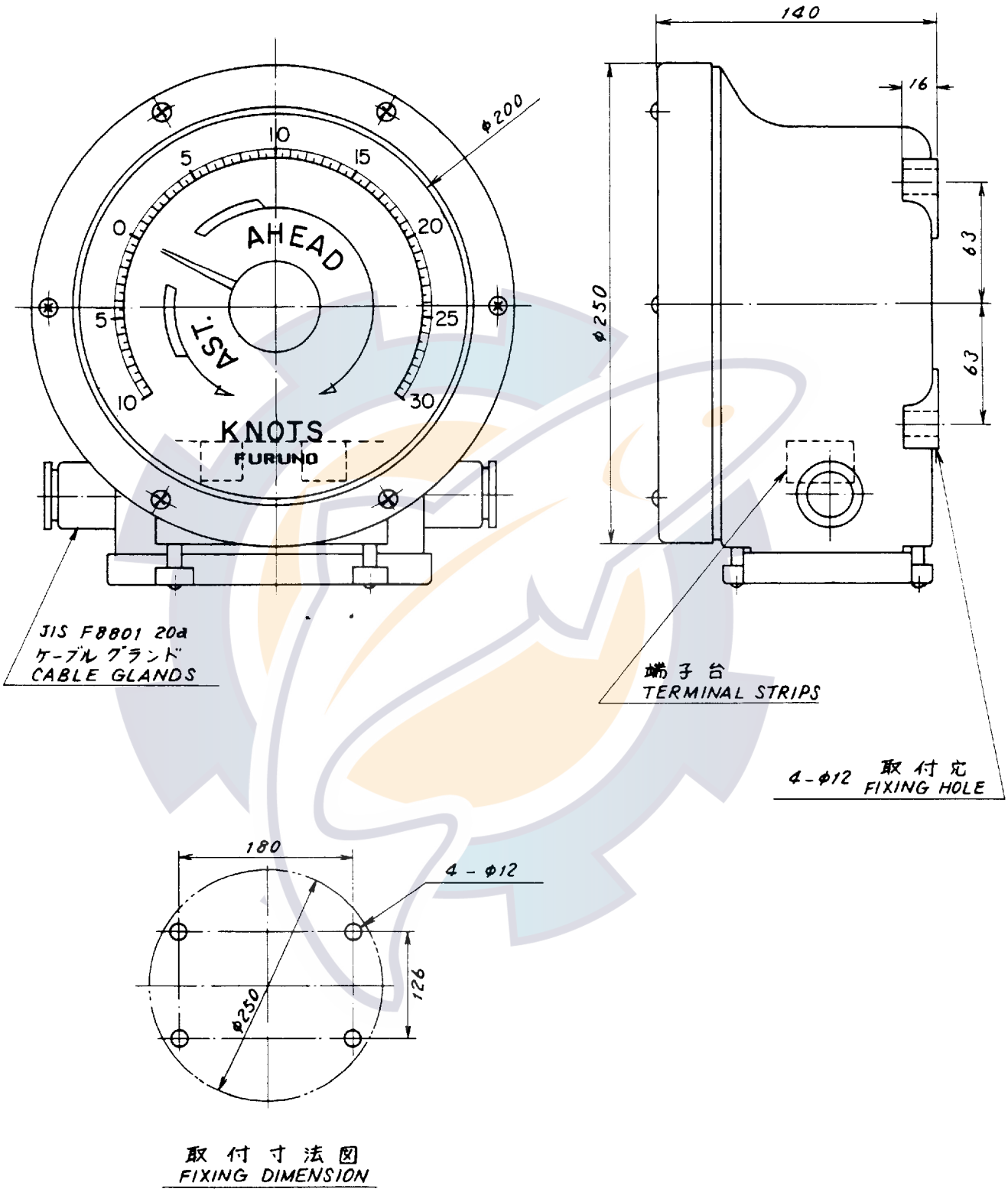
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	SEP.17.'85	三角法 THIRD ANGLE PROJECTION		名称 TITLE	DS-761 アナログ指示器(埋込型) ANALOG DISPLAY (FLUSH MOUNT)
検図 CHECKED	Sep.17.'85	尺度 SCALE	1/3		
製図 DRAWN	SEP.17.'85	重量 WEIGHT	6.0 kg	図番 DWG.NO.	C7222-024-A

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取付寸法図
FIXING DIMENSION

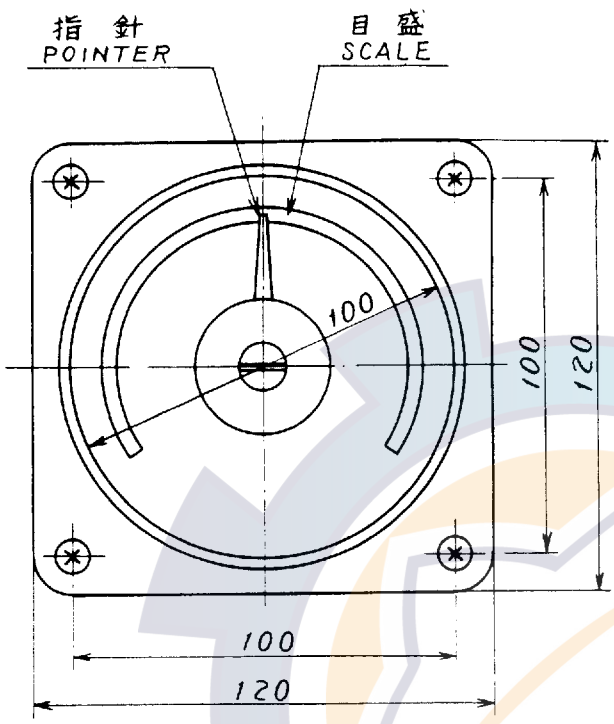
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

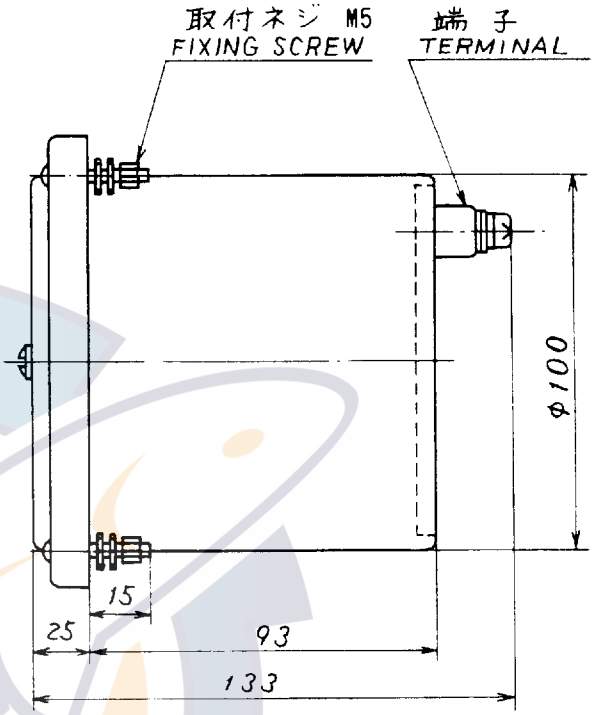
承認 APPROVED	SEP・17・'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-762 アナログ指示器(壁掛型) ANALOG DISPLAY (BULKHEAD MOUNT)
検図 CHECKED	Sep・17・'85	尺度 SCALE: 1/3	
製図 DRAWN	SEP・17・'85	重量 WEIGHT: 6.0 kg	図番 DWG.NO.: C7222-023-A

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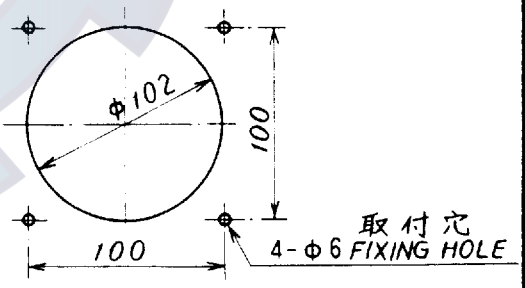
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指示範囲 RANGE	DS-763	-10 ～ 30 ノット KNOT
	DS-773	-10 ～ 20 ノット KNOT



取付寸法図 MOUNTING DIMENSION (S=1/4)

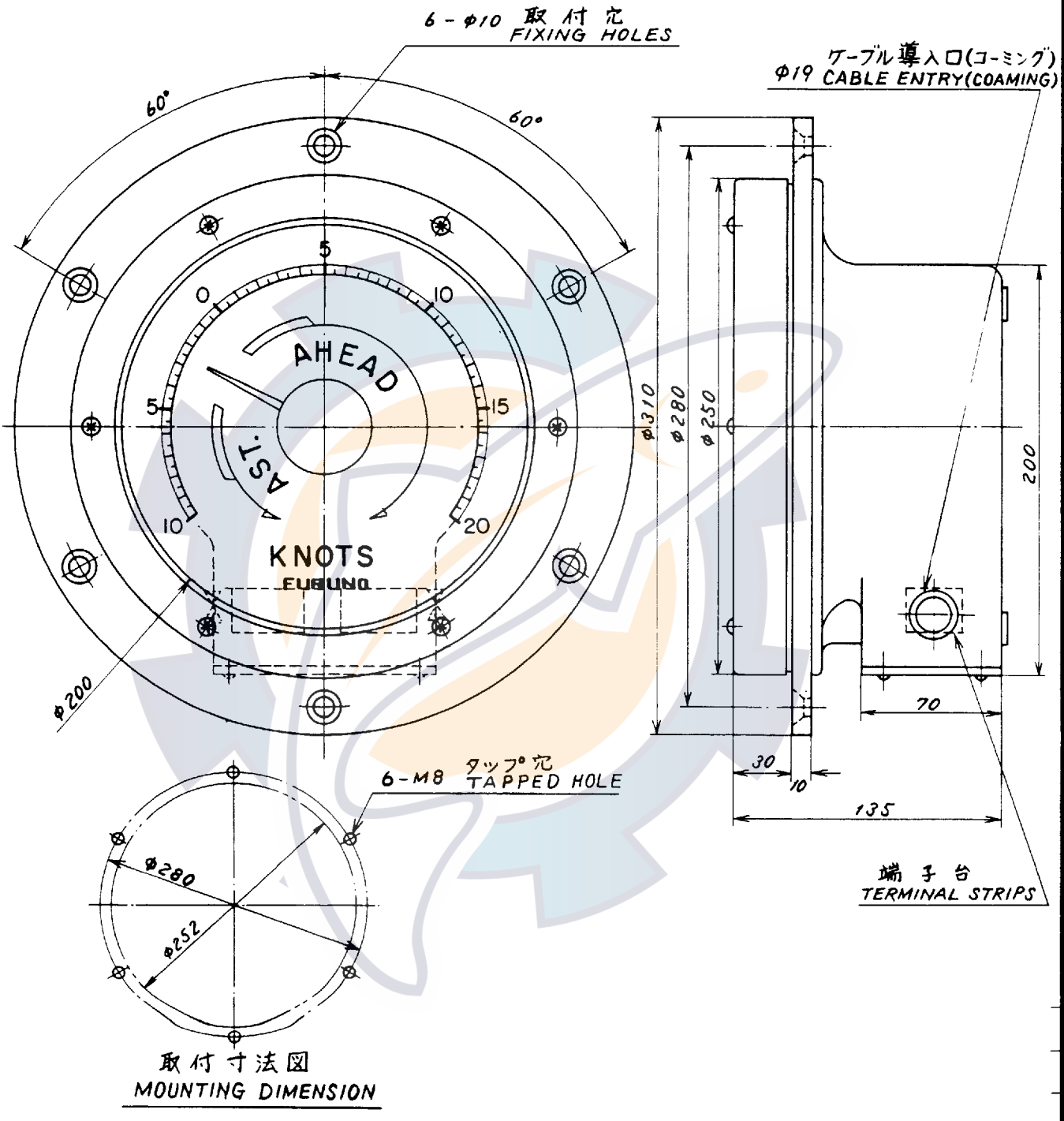
DS-70

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	SEP・17・'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-763/773 アナログ指示器 ANALOG DISPLAY
検図 CHECKED	SEP・17・'85	尺度 SCALE: 1/2	
製図 DRAWN	SEP・17・'85	重量 WEIGHT: 1.3 kg	図番 DWG.NO.: C7222-021-B

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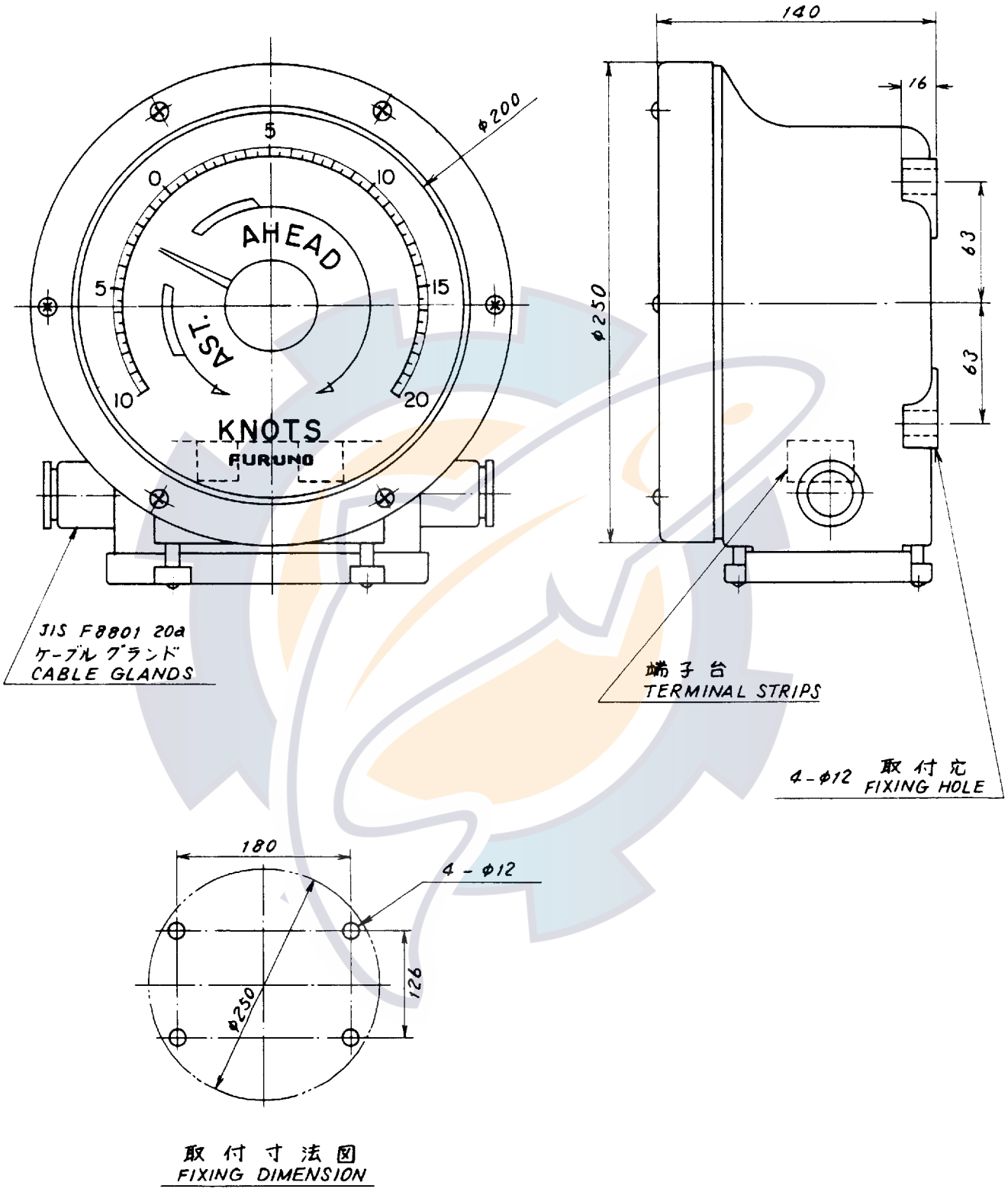
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	SEP・17・'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-771 アナログ指示器(埋込型) ANALOG DISPLAY (FLUSH MOUNT)
検図 CHECKED	Sep・17・'85	尺度 SCALE: 1/3	
製図 DRAWN	SEP・17・'85	重量 WEIGHT: 6.0 kg	図番 DWG.NO. C7222-025-A

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取付寸法図
FIXING DIMENSION

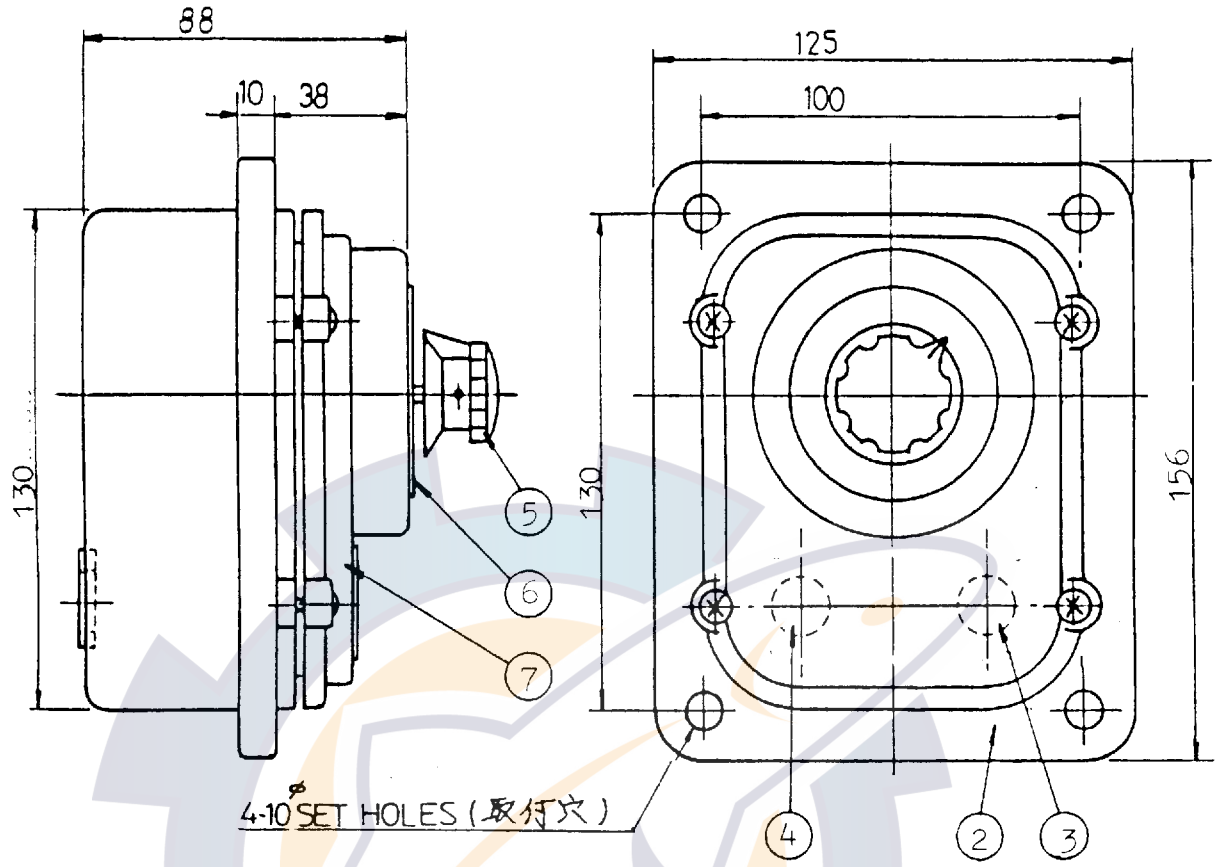
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	SEP.12.'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-772 アナログ指示器(壁掛型) ANALOG DISPLAY (BULKHEAD MOUNT)
検図 CHECKED	SEP.17.'85	尺度 SCALE: 1/3	
製図 DRAWN	SEP.17.'85	重量 WEIGHT: 6.0 kg	図番 DWG.NO. C7222-022-A

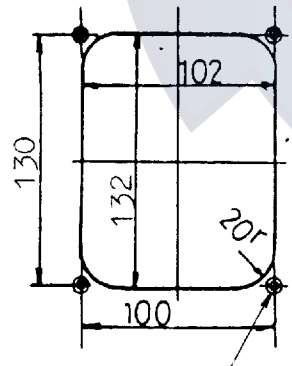
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PANEL CUT (パネル取付寸法図)



⑥ DETAILS OF NAME PLATE (銘板詳細)



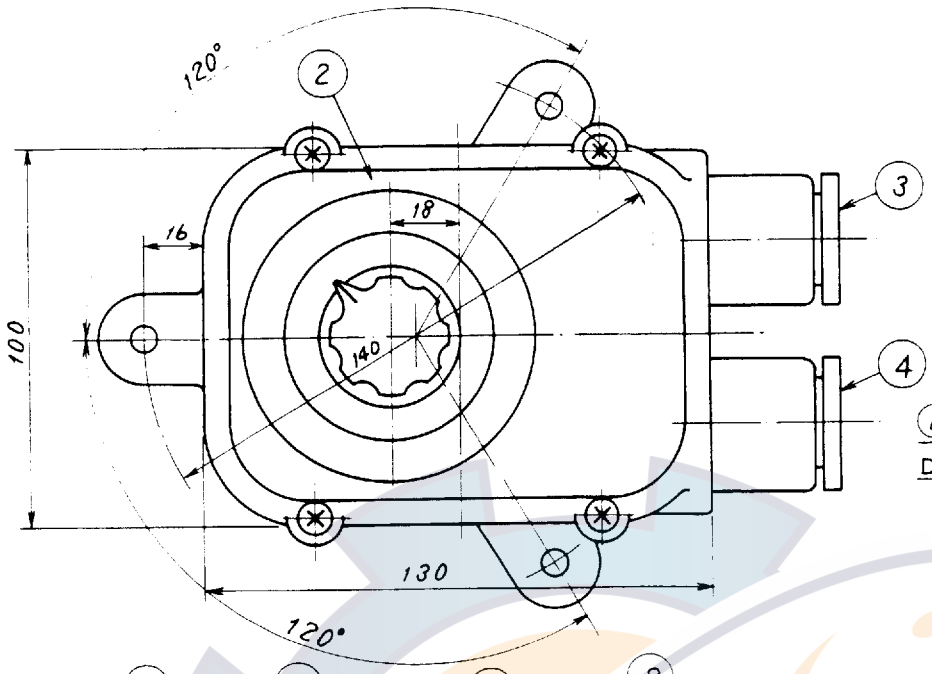
ITEM 品番	NAME 品名	MATERIAL 材質	Q'TY 数量	DWG.NO. 図番	REMARKS 摘要
7	COVER フタ	AC7AF	1		
6	NAME PLATE 銘板	SUS	1		
5	KNOB 把手		1		
4	BUSHING ブッシング	RUBBER	1		φ15
3	BUSHING ブッシング	RUBBER	1		φ15
2	BODY 本体	AC7AF	1		
1					

承認 APPROVED		三角法 THIRD ANGLE PROJECTION	名称 TITLE 調光器外観図
検図 CHECKED		尺度 SCALE 1/2	MF-22L-1 OUTLINE OF DIMMER BOX 埋込型 (FLUSH MOUNT)
製図 DRAWN	Sep. 20. '79 K. Kobayashi	重量 WEIGHT 1.2 kg	図番 DWG.NO C7213-027-E

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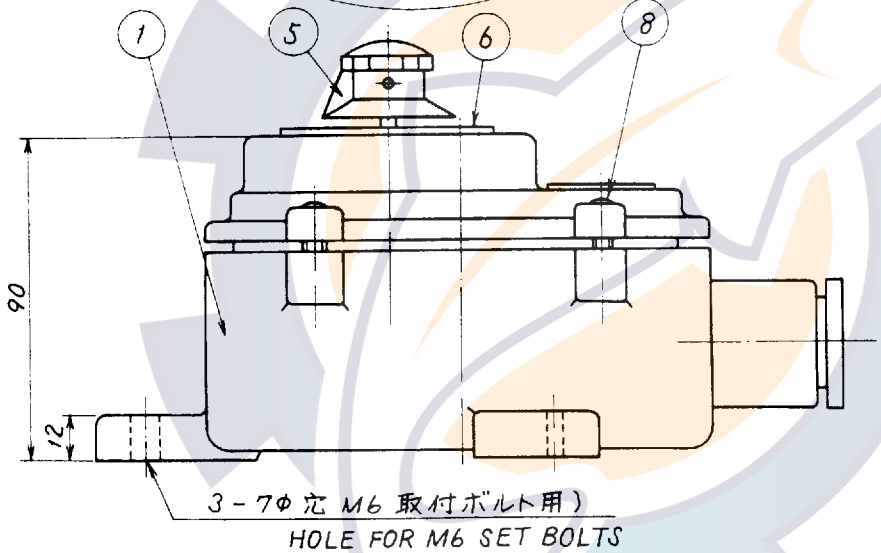
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⑥ 銘板詳細
DETAIL OF NAME PLATE





3-7Φ穴 M6 取付ボルト用)
HOLE FOR M6 SET BOLTS

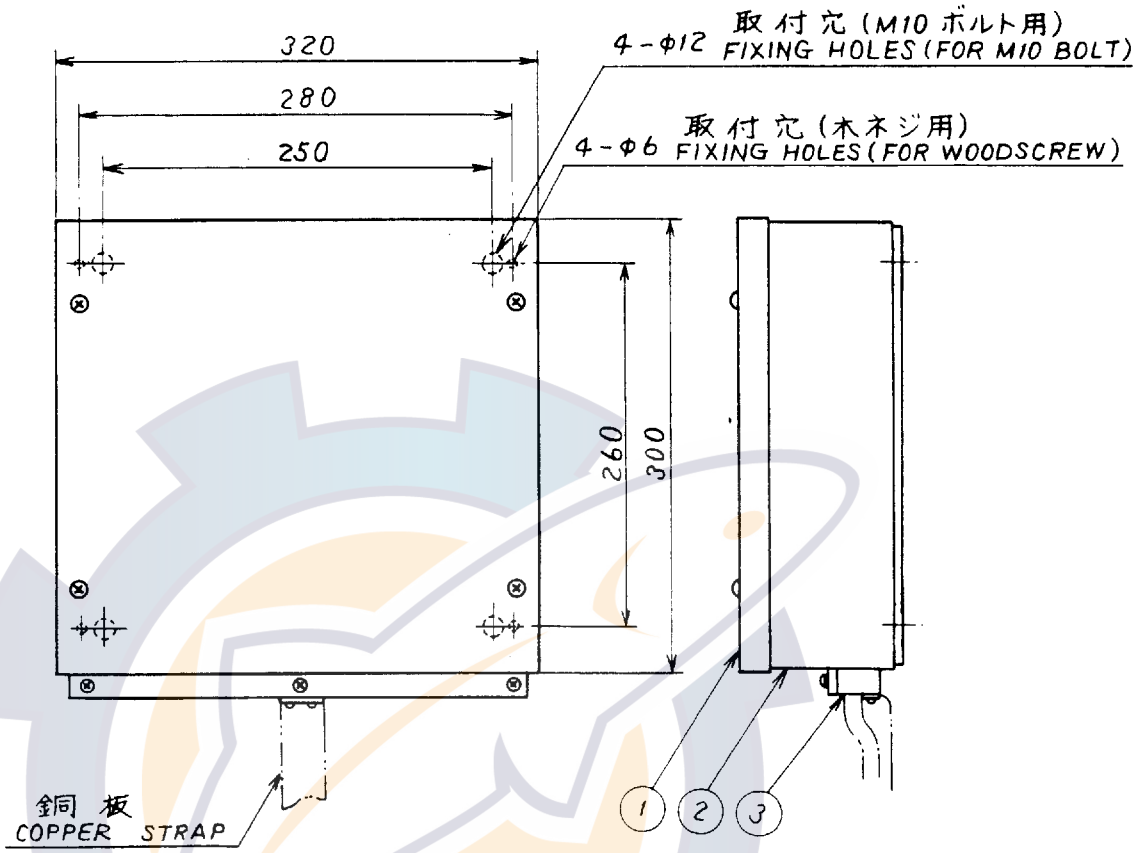
ITEM 品番	NAME 品名	MATERIAL 材質	Q'TY 数量	DWG.NO. 図番	REMARKS 摘要
8	取付ネジ SET SCREW	BSBM2	1		
7					
6	銘板 NAME PLATE	SUS	1		
5	把手 KNOB	AC7AF	1		
4	グランド GLAND	AC7AF	1		
3	グランド GLAND	AC7AF	1		
2	フタ COVER	AC7AF	1		
1	体 BODY	AC7AF	1		

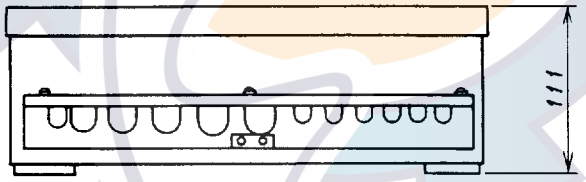
承認 APPROVED	三角法 THIRD ANGLE PROJECTION	名称 TITLE	調光器 外観図 OUTLINE OF DIMMER BOX 壁掛型(BULKHEAD MOUNT)
検図 CHECKED	尺度 SCALE 1/2	MF-22L-2	
製図 DRAWN	重量 WEIGHT 1.3 kg	図番 DWG.NO.	C7213-033-F

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COMPASS SAFE DISTANCE
(DOT: UK)
STANDARD····· 1.5m
STEERING····· 0.9m

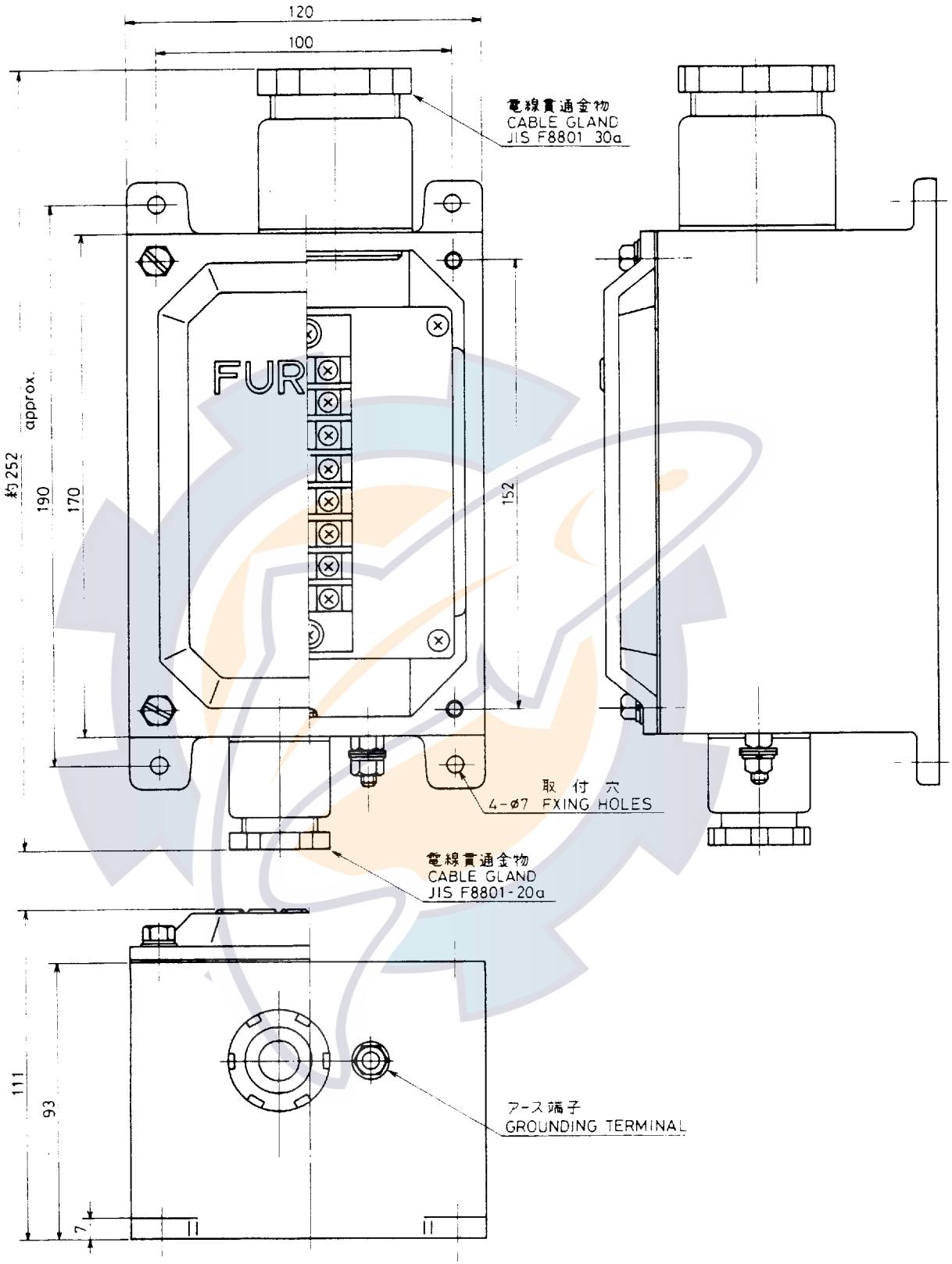
ITEM 品番	NAME 品名	MATERIAL 材質	Q'TY 数量	DWG.NO. 図番	REMARKS 摘要
3	ケーブル固定金具 CABLE CLAMP	A5052B	1		
2	ケース HOUSING	SPCC	1		
1	蓋 COVER	SPCC	1		

承認 APPROVED	AUG. 20 '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-740 信号分配器(壁掛型) DISTRIBUTION BOX(BULKHEAD MOUNT)
検図 CHECKED	Aug. 20 '85	尺度 SCALE 1/5	
製図 DRAWN	AUG. 20 '85	重量 WEIGHT 6.0 kg	図番 DWG.NO. C7222-017-D

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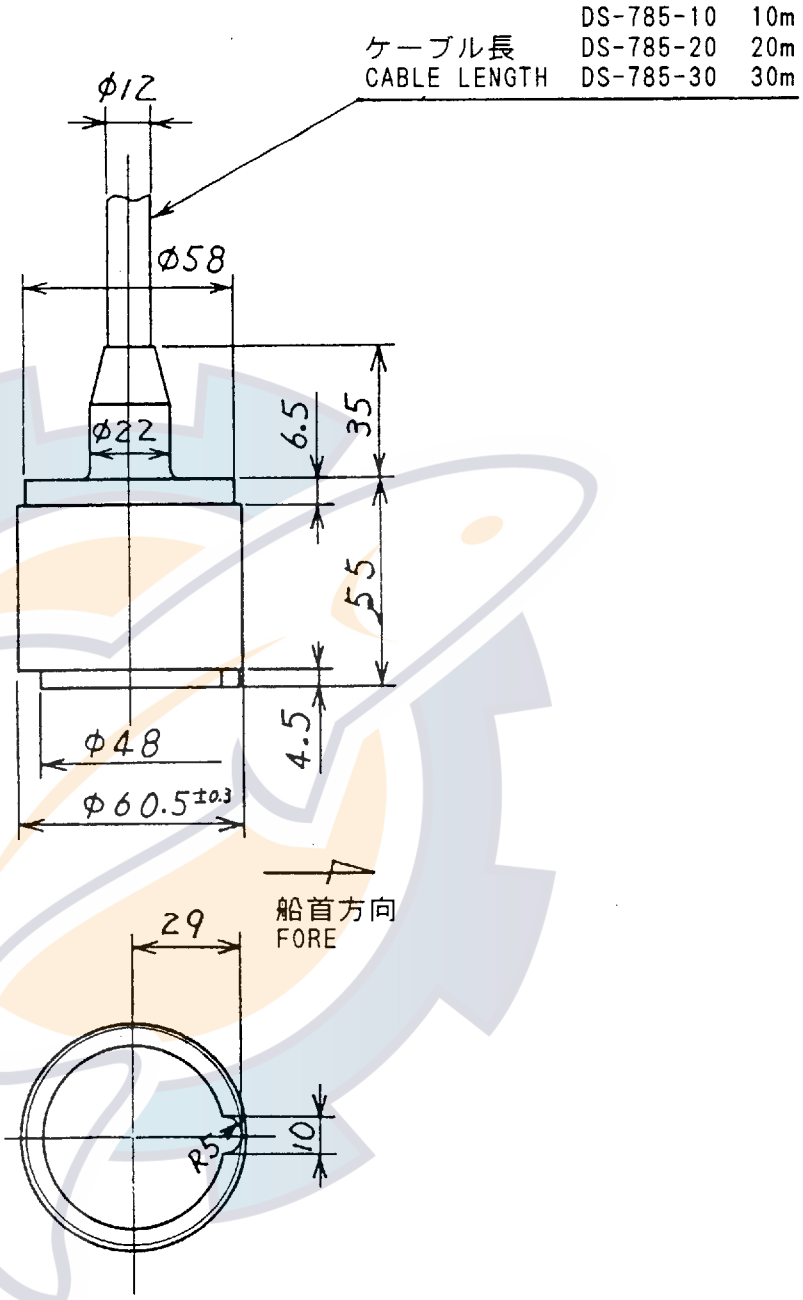
(DS-70)

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	MAR. 3 '87 T.NAKANO	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-750 接続箱 JUNCTION BOX
検図 CHECKED	Mar. 3 '87 M. IKEDA	尺度 SCALE 1/2	
製図 DRAWN	Feb. 26 '87 H. MORI	重量 WEIGHT 2.6 kg	図番 DWG.NO. C7222-057-A

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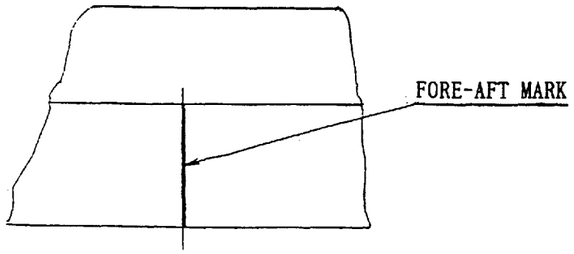
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

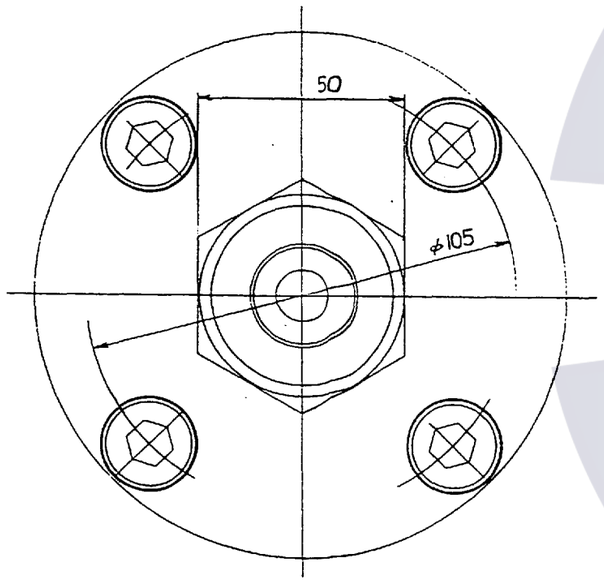
承認 APPROVED	APR・26・'91 T.UAKAJO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	送受波器 DS-785 TRANSDUCER
検図 CHECKED	APR・26・'91 M. IKEDA	尺度 SCALE	1/2		
製図 DRAWN	APR・26・'91 C. TANAKA	重量 WEIGHT	2.5 kg w/10m CABLE	図番 DWG.NO.	C7222-G02-A

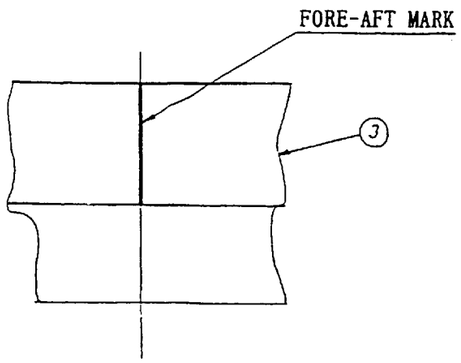
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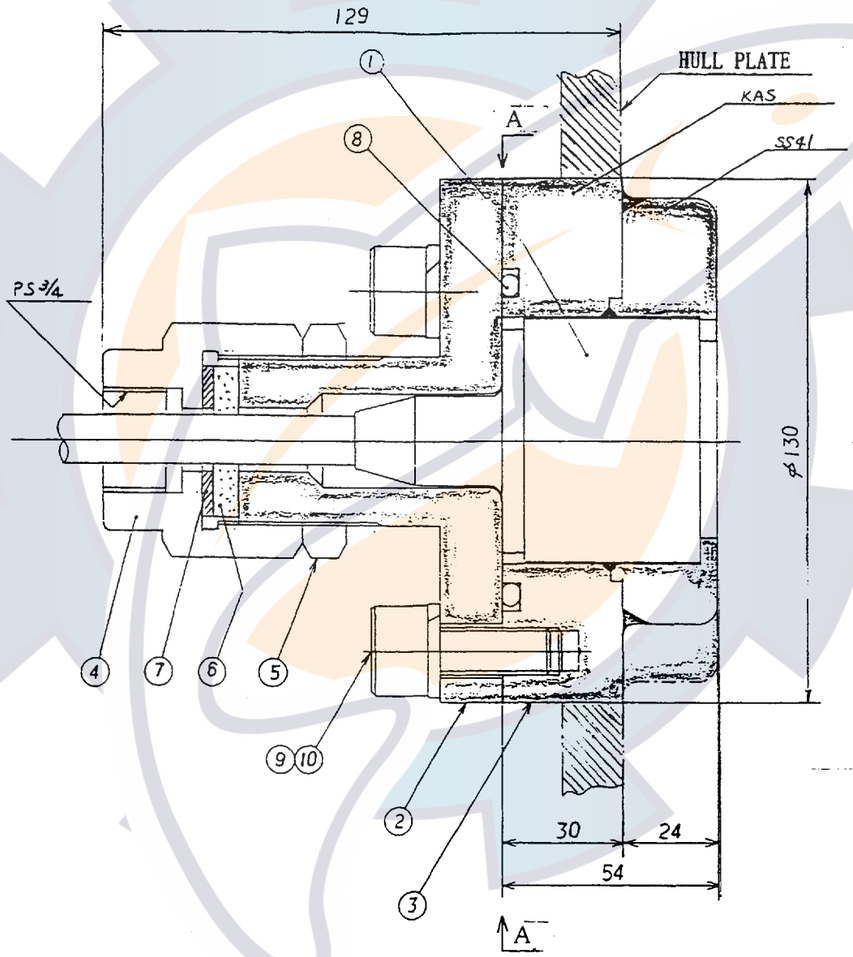


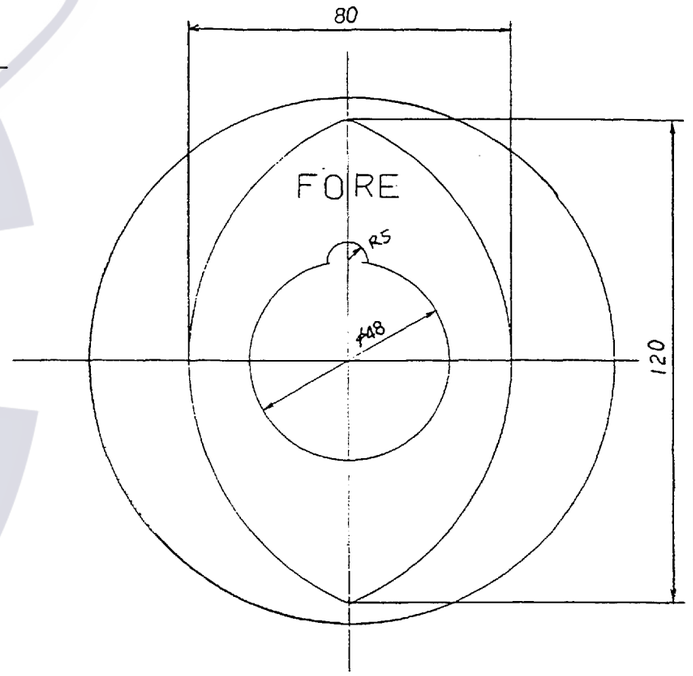




Mounting Procedure

1 Loosen lock nut ⑤ with a wrench (hex. size: 50mm) and take off cap nut ④ from hull flange ③ together with gasket ⑥ and flat washer⑦. (It is not necessary to draw the cap nut completely out from the cable.)
2 Unscrew hex. socket head bolts⑩ (M12 x 32, 4 pcs.) by using a socket screw wrench (size: 10mm). Separate flange ② and transducer ① from hull flange ③. Handle O-ring⑧ carefully so as not to damage it.
3 Weld hull flange③ to the hull plate. Confirm that the "FORE" mark is orientated to fore and alignment lines on the side of hull flange are in parallel with the fore-aft line of the ship within ±1degree. The hull flange③ should also be horizontal within ±1 degree at ship's normal trim.
4 Finish the outside of hull flange with a grinder to ensure smooth water-flow.
5 Apply kinoruster (Anti-crevice corrosion sealant) to face A of hull flange③, O-ring groove on the hull flange, O-ring⑧ and face A of the flange.
6 Fit O-ring⑧ onto the O-ring groove.
7 Place transducer① into hull flange ③ so that the alignment nipple on the transducer face fits into the notch on the hull flange.
8 Settle flange ② on the hull flange.
9 Tighten hex. socket holts ⑩ with a socket screw wrench.
10 Put gasket⑥ and flat washer⑦ on the top of the flange and tighten cap nut ④ securely with a wrench (hex. size: 50mm). Screw lock nut⑤.
11 When running the transducer cable inside the conduit pipe, screw the pipe end onto the cap nut (PS3/4) for watertightness.



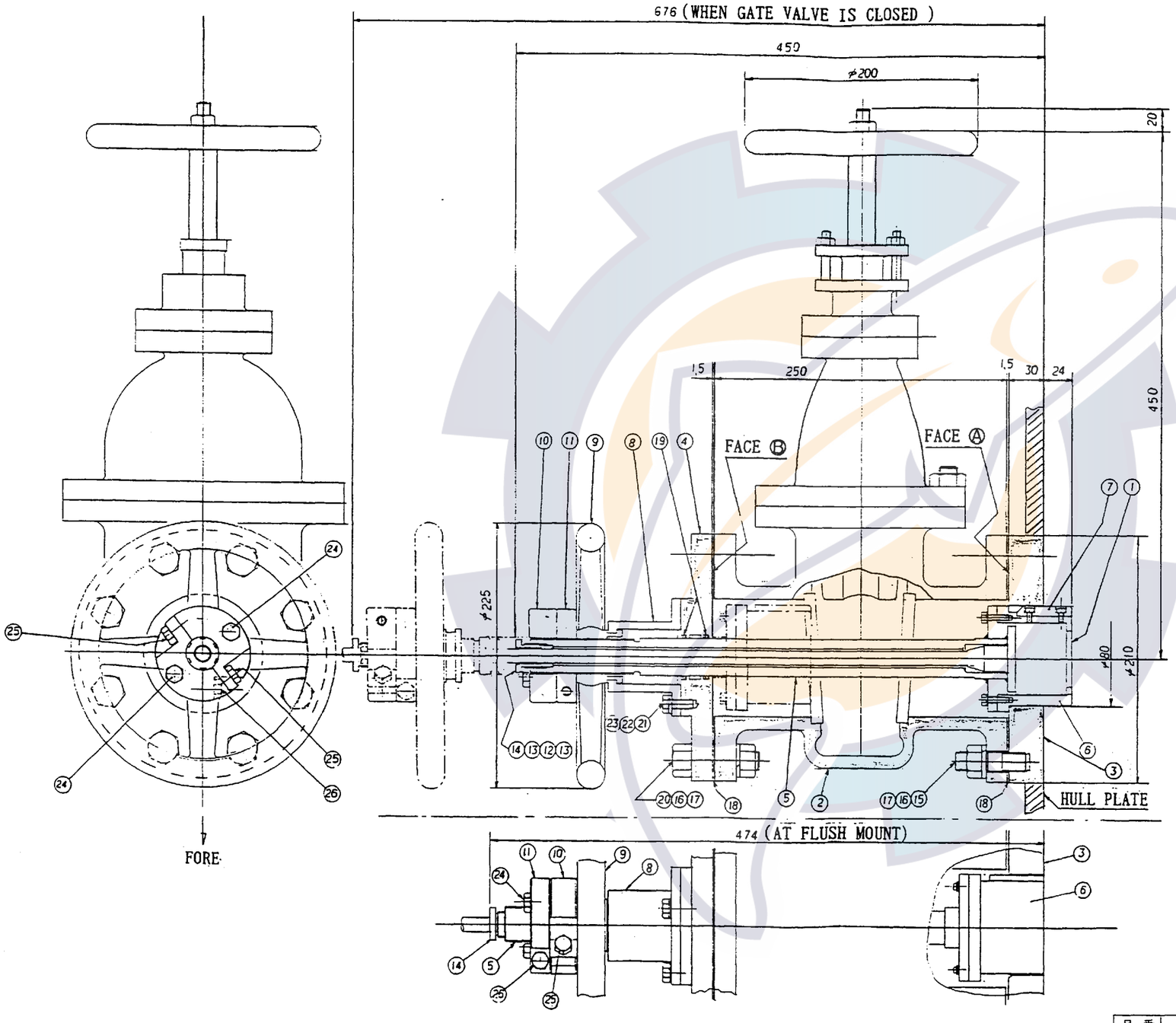


ITEM	NAME	MATERIAL	Q'TY	REMARKS
10	SOCKET-HEAD SCREW	SUS304	4	M12 x 32
9	SPRING WASHER	SUS304	4	12
8	O-RING	NBR	1	JISB2401-1A-P75
7	FLAT WASHER	SPC	1	9106
6	GASKET	CR	1	9105
5	NUT	SS41	1	9104
4	CAP NUT	SS41	1	9103
3	HULL FLANGE	KAS/SS41	1	9502
2	FLANGE	SS41	1	65-003-9501
1	TRANSDUCER			DS-785

承認 APPROVED	APR·26·'91 T.NAKAJO	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-783 TRANSDUCER SEACHEST (FLUSH MOUNT, PROJECTION TYPE)
検図 CHECKED	APR·26·'91 M. IKEDA	尺度 SCALE: ≈	
製図 DRAWN	APR·26·'91 C.TANAKA	重量 WEIGHT: 5.6 kg	図番 DWG. NO.: E7222-T03-A

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NOTE/INSTALLATION PROCEDURE

1 SEPARATE ③ HULL FLANGE AND ④ FLANGE (WITH ① TRANSDUCER/⑤ SHAFT) FROM ② GATE VALVE BY REMOVING ⑰ HEX. NUT.
2 WELD ③ HULL FLANGE TO HULL PLATE. CONFIRM "FORE" AND REFERENTIAL MARKS SO THAT FORE-AFT INSTALLATION ERROR IS WITHIN ±1 DEGREE. ALSO THE FACE OF ③ HULL FLANGE SHOULD BE ALIGNED IN PARALLEL WITH THE DRAFT LINE (WITHIN ±1 DEGREE). USING A GRINDER OR SIMILAR TOOL, FINISH THE OUTSIDE HULL FLANGE SO THAT IT IS SMOOTH.
3 APPLY KINORUSTER (ANTI-CREVICE CORROSIVE SEALANT) TO FACE A OF ③ HULL FLANGE AND TO BOTH FACES OF ⑱ GASKET AND FLANGE OF ② GATE VALVE.
4 PUT ⑱ GASKET ONTO ③ HULL FLANGE.
5 FASTEN ② GATE VALVE TO ③ HULL FLANGE. THE DIRECTION OF ② GATE VALVE CAN BE SELECTED EVERY 45 DEGREES. (STANDARD DIRECTION OF HANDLE: AFT)
6 APPLY KINORUSTER TO FACE B OF ④ FLANGE AND TO BOTH FACES OF ⑱ GASKET AND FLANGE OF ② GATE VALVE.
7 PUT ⑱ GASKET ONTO FLANGE OF ② GATE VALVE.
8 FASTEN ④ FLANGE (WITH ① TRANSDUCER/⑤ SHAFT) TO ② GATE VALVE.
9 FOR TESTING THE MOVE OF ⑤ SHAFT, RAISE AND LOWER IT AFTER LOOSENING ㉔ ㉓ HEX. BOLTS AND HEX. BOLT OF ⑧ LOCK RING.
10 FASTEN THE ㉔ HEX. BOLT OF ⑧ LOCK RING.
11 LOWER THE TRANSDUCER BY TURNING THE HANDLE UNTIL THE ⑥ TRANSDUCER CASE TOUCH THE ③ HULL FLANGE .
12 CONFIRM THAT FACES OF TRANSDUCER IS PROJECTED BY 24mm.

FOR FLUSH MOUNT OF TRANSDUCER

1 FOR STEPS 1) TO 12), FOLLOW ABOVE PROCEDURE.
2 RAISE THE SHAFT BY TURNING THE ⑨ HANDLE UNTIL THE ⑩ SPACER (24mm) IS INSERTED BETWEEN TOP OF ⑨ HANDLE AND ⑪ LOCK RING.
3 PUT THE ⑩ SPACER BETWEEN ⑨ HANDLE AND ⑪ LOCK RING, AND LOWER THE SHAFT.
4 CONFIRM THAT FACES OF HULL PLATE AND TRANSDUCER ARE EVEN.

ITEM	NAME	MATERIAL	Q'TY	REMARKS
26	HEX. BOLT	SUS304	1	M8x30
25	HEX. BOLT	SUS304	2	M8x30
24	HEX. BOLT	SUS304	2	M8x30
23	HEX. BOLT	SUS304	4	M8x20
22	SPRING WASHER	SUS304	4	M8
21	FLAT WASHER	SUS304	4	M8
20	HEX. BOLT	SUS304	8	M16x60
19	O-RING	NBR	2	JISB2401-1A-P32
18	GASKET	T/#1000-S	2	JIS-10K 100A-1.5
17	HEX. NUT	SUS304	16	M16 CLASS 1
16	SPRING WASHER	SUS304	16	M16
15	STUD BOLT	SUS304	8	M16x40
14	CABLE GLAND	C3604	1	JISF8801 FOR 15
13	SECURE RING	SPC	2	
12	GASKET	CR	1	
11	LOCK RING	SS41	1	
10	SPACER	RESIN	2	
9	HANDLE	FC20	1	
8	LOCK RING	C3604B	2	
7	TURNING STOPPER	SUS304	1	
6	TRANSDUCER CASE	SUS304	1	
5	RETRACTION SHAFT	SUS304	1	
4	UPPER FLANGE	SS41	1	
3	HULL FLANGE	KAS	1	
2	GATE VALVE		1	
1	TRANSDUCER			

承認 APPROVED	APR·26·'91 T.NAKAJO	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-782 TRANSDUCER SEACHEST (GATE VALVE, PROJECTION TYPE)
検図 CHECKED	APR·26·'91 M. IKEDA	尺度 SCALE ~	
製図 DRAWN	APR·26·'91 C. TANAKA	重量 WEIGHT Approx. 75 kg	図番 DWG. NO. E7222-T02-A

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取付要領

1 ⑤止めナットを緩め（仮締めなので手で回る。堅い時は対辺50㎜スパナを使用のこと）、④キャップナットを③振動子フランジから外す（ケーブルから抜き取る必要はない）。⑥ガスケット、⑦座金も④キャップナットの方へ移しておくこと。

2 ⑨M12 六角穴付きボルト４本を外し（対辺10㎜六角棒スパナを使用）、③振動子フランジと①振動子を②船底フランジから分離する。（⑨ボルト、⑩ばね座金、⑧Ｏリングは保管しておく。）

3 ②船底フランジを船底に溶接する。この時以下の点に注意のこと。
・側面に刻印されている“FORE”の文字と船首、船尾の２本の基準線を船の船首－船尾方向に合せて溶接する。（取付誤差は±１°以内）
・水平方向も吃水線と平行になるように溶接する。（取付誤差は±１°以内）

4 船底溶接部はグラインダー等で面一に仕上げる。

5 付属のキノラスタ（金属スキマ腐食防止剤）を②船底フランジのフランジ面（Ａ面）、リング溝内及び振動子フランジ面（Ａ面）に塗布する。

6 ⑧Ｏリングを②船底フランジに装着する。

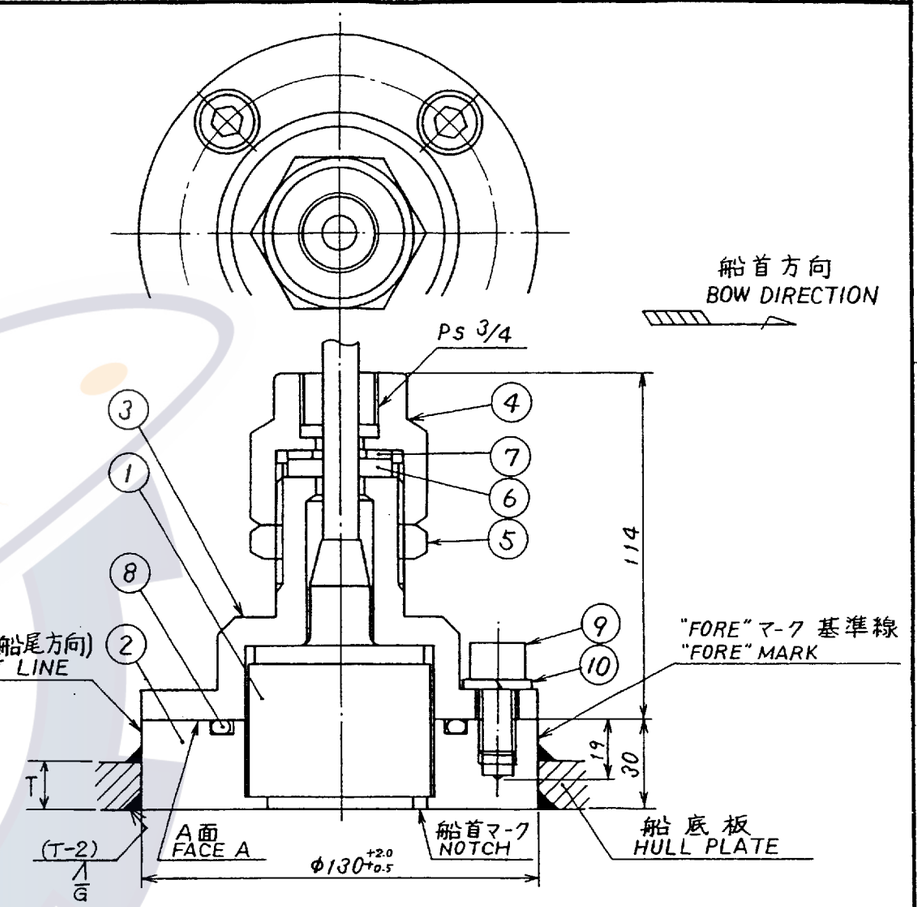
7 ①振動子を②船底フランジにはめ込む。（船首マークである②船底フランジの切欠と①振動子の突起を合せること。）

8 ③振動子フランジを②船底フランジに乗せる。

9 ⑨六角穴付きボルトを締め付ける。（③振動子フランジは船首方向に関係なく任意方向でよい）

10 ⑥ガスケット、⑦座金を③振動子フランジ上に移し④キャップナットを締める（対辺50㎜スパナ使用）。それから⑤止めナットを緩み止めとして④キャップナットにかける。

11 振動子ケーブルに配管する時は、④キャップナット上部のPS 3/4ねじを利用すること。



Mounting of Flush Type Transducer

1. Loosen lock nut ⑤ with a wrench (hex. size: 50mm) and take off cap nut ④ from transducer flange ③ together with gasket ⑥ and flat washer ⑦. (It is not necessary to draw the cap nut completely out from the cable.)
2. Unscrew hex. socket head bolts ⑨ (M12 x 25, 4 pcs.) by using a socket screw wrench (size: 10mm). Separate hull flange ② and transducer ① from transducer flange ③. Handle O-ring ⑧ carefully so as not to damage it.
3. Weld hull flange ② to the hull plate. Confirm that the "FORE" mark alignment line on the side of the hull flange faces the fore-aft line of the ship within ±1 degree. The hull flange ② should also be horizontal within ±1 degree at ship's normal trim.
4. Finish the outside hull plate with a grinder to ensure smooth water-flow.
5. Apply kinoruster (Anti-Crevice corrosion sealant) to face A of hull flange ② , O-ring groove on the hull flange, O-ring ⑧ and face A of the transducer flange.
6. Fit O-ring ⑧ onto the O-ring groove.
7. Place transducer ① into hull flange ② so that the alignment nipple on the transducer face fits into the notch on the hull flange.
8. Settle transducer flange ③ on the hull flange.
9. Tighten hex. socket bolts ⑨ with a socket screw wrench.
10. Put gasket ⑥ and flat washer ⑦ on top of the transducer flange and tighten cap nut ④ securely with a wrench (hex. size: 50 mm). Screw lock nut ⑤
11. When running the transducer cable inside the conduit pipe, screw the pipe end onto the cap nut (PS3/4) for watertightness.

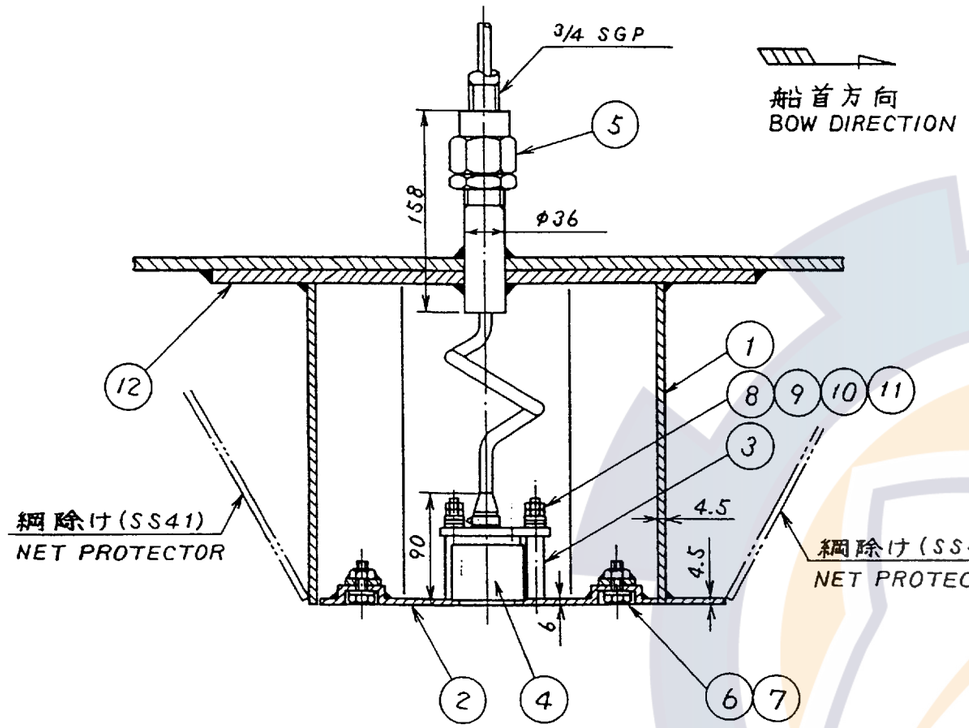
ITEM	NAME	MATERIAL	Q'TY	DWG.NO.	REMARKS
10	バネ座金 SPRING WASHER	SUS304	4		M12
9	六角穴付きボルト HEX. SOCKET HEAD BOLT	SUS304	4		M12 x 25
8	Ｏリング O RING	NBR	1		JIS B2401 P75
7	平座金 FLAT WASHER	SPC	1		5/8
6	(電線貫通金物用)ガスケット GASKET	CR	1		
5	(電線貫通金物用)止メナット NUT	SS41	1		
4	(電線貫通金物用)キャップナット CAP NUT	SS41	1		
3	振動子フランジ TRANSDUCER FLANGE	SS41	1		
2	船底フランジ FLANGE	KA	1		
1	振動子 TRANSDUCER			DS-785-10/20/30	

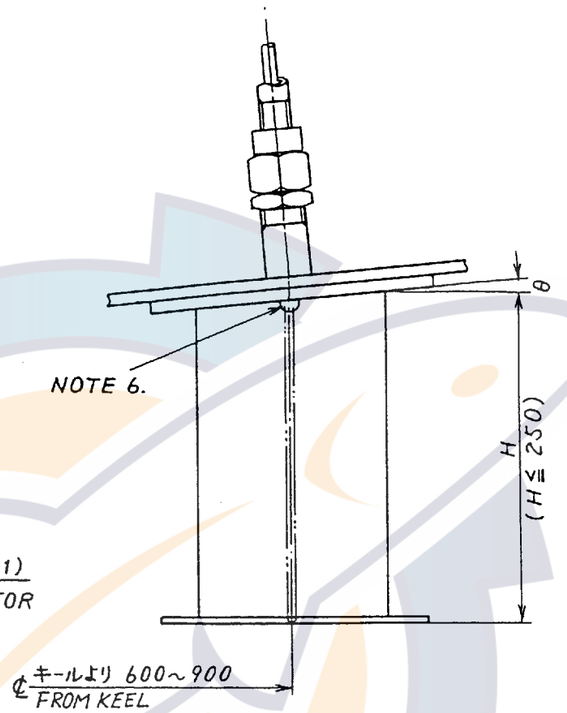
DRAWN: Mar.25'98 T.YAMASAKI			TYPE: DS-784
CHECKED: Mar.25'98 K.Kusunoki			名称: 船底タンク（埋込型）
APPROVED: Mar.25'98 K.Kusunoki			送受波器装備図
SCALE: 1/2	MASS: 9.5 kg	APPLICABLE TO; (MODEL) / BLOCK NO.	NAME: TRANSDUCER SEACHEST(FLUSH TYPE TRANSDUCER INSTALLATION
DWG NO.: C7222-T06- C			

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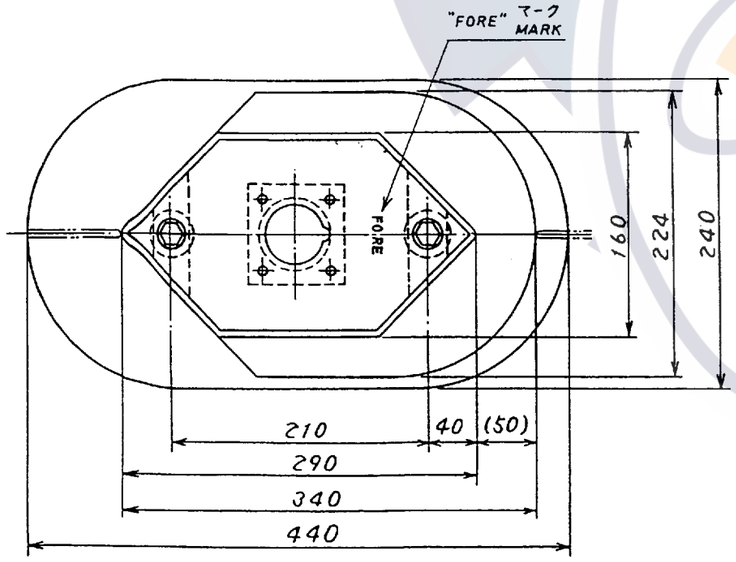




NOTE

1. θは船底傾斜角。
2. 要目表は船主又は造船所と協議の上記入すること。
3. 網除け、保護タンクは必要に応じて造船所にて製作のこと。
4. 電線貫通金物はフレーム等のじゃまにならない所で振動子に当らず、キャップナットが容易に締付けられる位置に取付けること。
5. 船尾側上端に空気抜き用穴(φ10~φ20程度)を明けて下さい。
6. 振動子ケースを船底に溶接する際 "FORE" マークを確認して、船首ー船尾方向の取付誤差は±1°以内とすること。
7. 振動子面と水平面との平行取付誤差は±1°以内になるよう振動子ケースを切断すること。

1. θ : RISING ANGLE OF SHIP'S HULL.
2. DECIDE PRINCIPAL ITEMS UPON DISCUSSING WITH SHIP'S OWNER OR SHIPYARD.
3. IF NECESSARY, NET PROTECTOR AND PROTECTION TANK TO BE MADE BY SHIPYARD.
4. ALLOW ENOUGH CLEARANCE AROUND THRU-HULL PIPE FOR EASY TIGHTENING AND SERVICING.
5. MAKE A HOLE OF 10 TO 20 MM IN DIA. ON STERN SIDE TO ALLOW AIR TO ESCAPE FROM TANK.
   WHEN WELDING THE TRANSDUCER HOUSING TO HULL, CONFIRM "FORE" MARK.
6. FORE-AFT INSTALLATION ERROR SHOULD BE WITHIN ±1 DEGREE.
7. CUT THE TRANSDUCER HOUSING SO THAT THE FACE OF TRANSDUCER IS ALIGNED IN PARALLEL WITH THE DRAFT LINE. (WITH IN ±1 DEGREE)



要目表 PRINCIPAL ITEM		
位置 POSITION	船首から FROM BOW	m
	キールから FROM KEEL	mm
突出量 H PROJECTING		mm
取付状態 FIXING CONDITION	走行時水平 HORIZONTAL AT RUNNING	
保護タンク PROTECTION TANK		

ITEM	NAME	MATERIAL	Q'TY	DWG.NO.	REMARKS
12	補強板 DOUBLING PLATE	SM41	1		造船所手配 DOCKYARD SUPPLY
11	六角ナット (M8) HEX. NUT	SUS304	8		
10	バネ座金 SPRING WASHER (M8)	SUS304	4		
9	平座金 FLAT WASHER (M8)	SUS304	4		
8	平ワッシャ (呼び8) FLAT WASHER (NOMI. 8)	P.C.	4		
7	バネ座金 SPRING WASHER (M10)	SUS304	2		
6	六角ボルト (M10×30) HEX. BOLT	SUS304	2		
5	5号電線貫通金物 THRU HULL PIPE NO.5		1	TFB-5000	
4	振動子 TRANSDUCER			DS-785-10/20/30	
3	スペーサ SPACER	SGP40A	4	T-606-03	
2	振動子取付フランジ TRANSDUCER FIXING FLANGE	SS41	1	65-003-9201	
1	振動子ケース TRANSDUCER HOUSING	SS41	1	T-604-01	

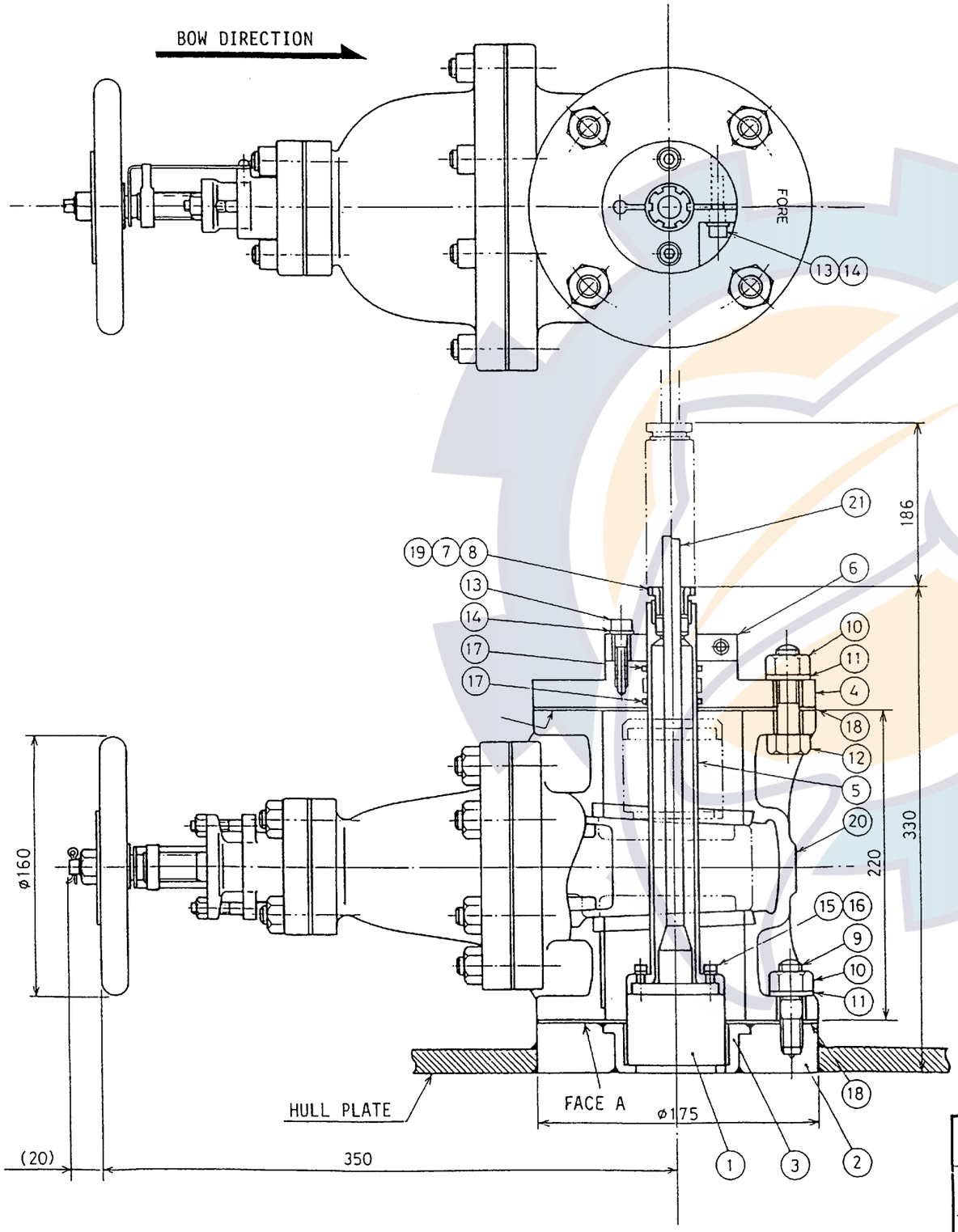
承認 APPROVED	JUL.12.'85	三角法 THIRD ANGLE PROJECTION	名称 TITLE DS-781 船底タンク(突出型) SEACHEST (PROJECTION TYPE)
検図 CHECKED	July.10.'85	尺度 SCALE 1/5	
製図 DRAWN	JUL.10.'85	重量 WEIGHT 11 kg	図番 DWG.NO. C7222-T05-B

DS-70

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NOTE/INSTALLATION PROCEDURE

1. SEPARATE ②HULL FLANGE AND ④FLANGE (WITH ①TRANSDUCER/ ⑤SHAFT) FROM ⑳ GATE VALVE BY REMOVING ⑩ HEX. NUT.
2. WELD ②HULL FLANGE TO HULL PLATE. CONFIRM "FORE" AND REFERENTIAL MARKS SO THAT FORE-AFT INSTALLATION ERROR IS WITHIN ±1 DEGREE. ALSO THE FACE OF ② HULL FLANGE SHOULD BE ALIGNED IN PARALLEL WITH THE DRAFT LINE (WITHIN ±1 DEGREE). USING A GRINDER OR SIMILAR TOOL, FINISH THE OUTSIDE HULL PLATE SO THAT IT IS SMOOTH AND FLAT.
3. APPLY KINORUSTER (ANTI-CREVICE CORROSIVE SEALANT) TO FACE A OF ②HULL FLANGE AND TO BOTH FACES OF ⑱ GASKET AND FLANGE OF ⑳ GATE VALVE.
4. PUT ⑱ GASKET ONTO ②HULL FLANGE.
5. FASTEN ⑳ GATE VALVE TO ②HULL FLANGE. THE DIRECTION OF ⑳ GATE VALVE CAN BE SELECTED EVERY 90 DEGREES. (STANDARD DIRECTION OF HANDLE: AFT)
6. APPLY KINORUSTER TO FACE B OF ④FLANGE AND TO BOTH FACES OF ⑱ GASKET AND FLANGE OF ⑳ GATE VALVE.
7. PUT ⑱ GASKET ONTO FLANGE OF ⑳ GATE VALVE.
8. FASTEN ④FLANGE (WITH ①TRANSDUCER/ ⑤SHAFT) TO ⑳ GATE VALVE. ALIGN THE "FORE" MARK OF ④FLANGE WITH THE "FORE" MARK OF ②HULL FLANGE AT THIS TIME.
9. FOR TESTING THE MOVE OF ⑤SHAFT, RAISE AND LOWER IT AFTER LOOSENING ⑬ HEX. SOCKET HEAD BOLT OF ⑥LOCK RING.
10. FASTEN THE ⑬ HEX. SOCKET HEAD BOLT OF ⑥LOCK RING AT THE LOWEST POSITION ON THE ⑤SHAFT. ALIGN THE BOW DIRECTION MARK AT THE UPPER SIDE OF ⑤SHAFT WITH "FORE" MARK OF ④FLANGE.
11. CONFIRM THAT FACES OF HULL PLATE AND TRANSDUCER ARE EVEN.

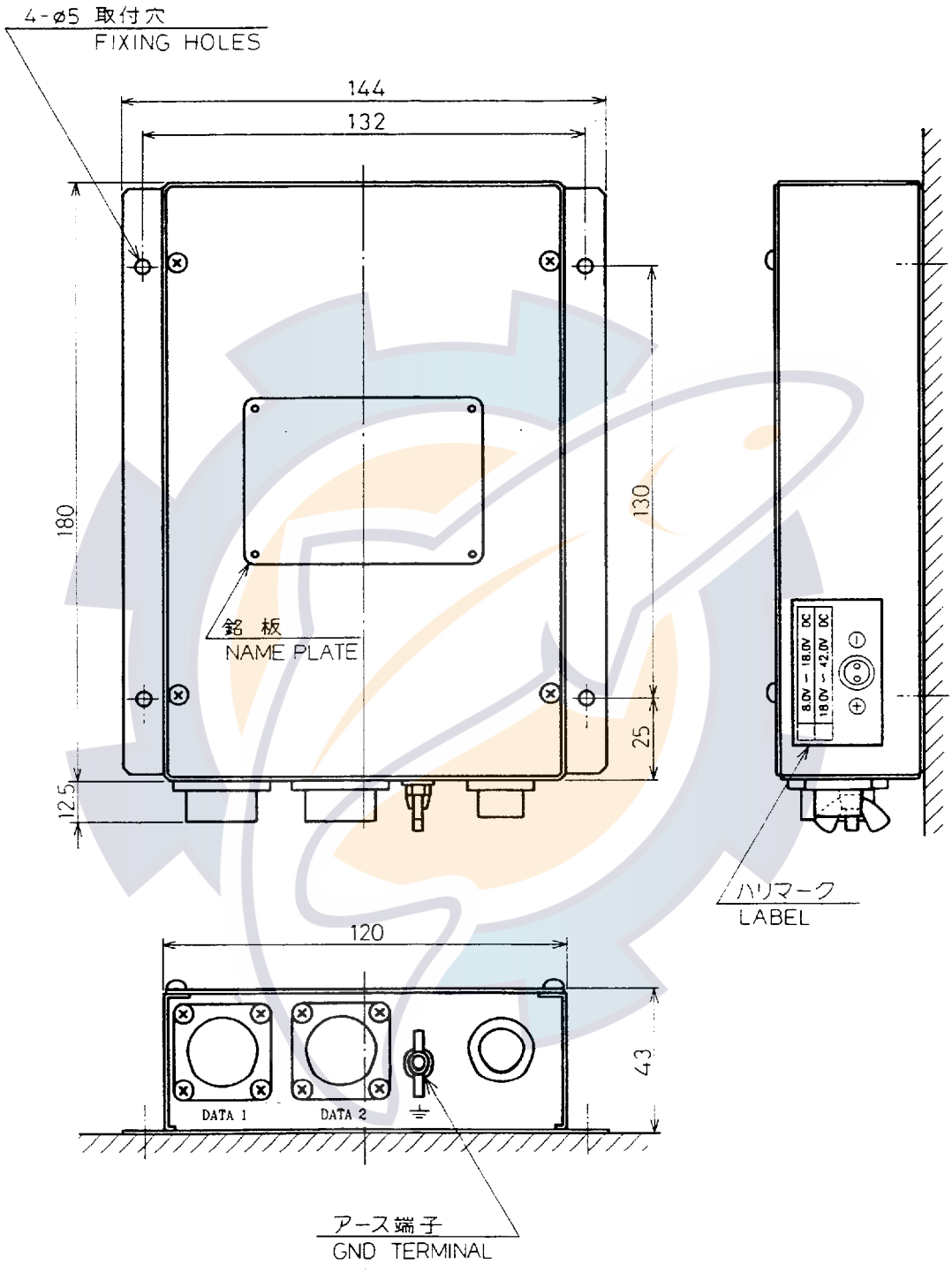
ITEM	NAME	MATERIAL	Q'TY	REMARKS
21	CONNECTION CABLE			ø11.8
20	GATE VALVE	SC	1	10kg/cm²x65
19	FIXING GLAND	BRASS	1	
18	GASKET		2	10kg/cm²x65
17	O RING	NBR	2	JIS B2401 P30
16	SEAL WASHER	SUS NBR	4	M4
15	HEX. SOCKET HEAD BOLT	SUS304	4	M4x16
14	SPRING WASHER	SUS304	3	M8
13	HEX. SOCKET HEAD BOLT	SUS304	3	M8x30
12	HEX. BOLT	SUS304	4	M16x60
11	SPRING WASHER	SUS304	8	M16
10	HEX. NUT	SUS304	8	M16
9	TAP-END STUD BOLT	SUS304	4	M16x40
8	WASHER	SPC	2	
7	GASKET	CR	1	
6	LOCK RING	SS41	1	
5	SHAFT	SUS304	1	
4	FLANGE	SUS304	1	
3	BUSHING	SUS304	1	
2	HULL FLANGE	KA	1	
1	TRANSDUCER			DS-785-10/20/30

承認 APPROVED	AUG. 20. '85	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-786 TRANSDUCER/SEACHEST (GATE VALVE TYPE)
検図 CHECKED	Aug. 20. '85	尺度 SCALE: 1/3	
製図 DRAWN	AUG. 20. '85	重量 WEIGHT: 44 kg	図番 DWG. NO.: E7222-T04-B

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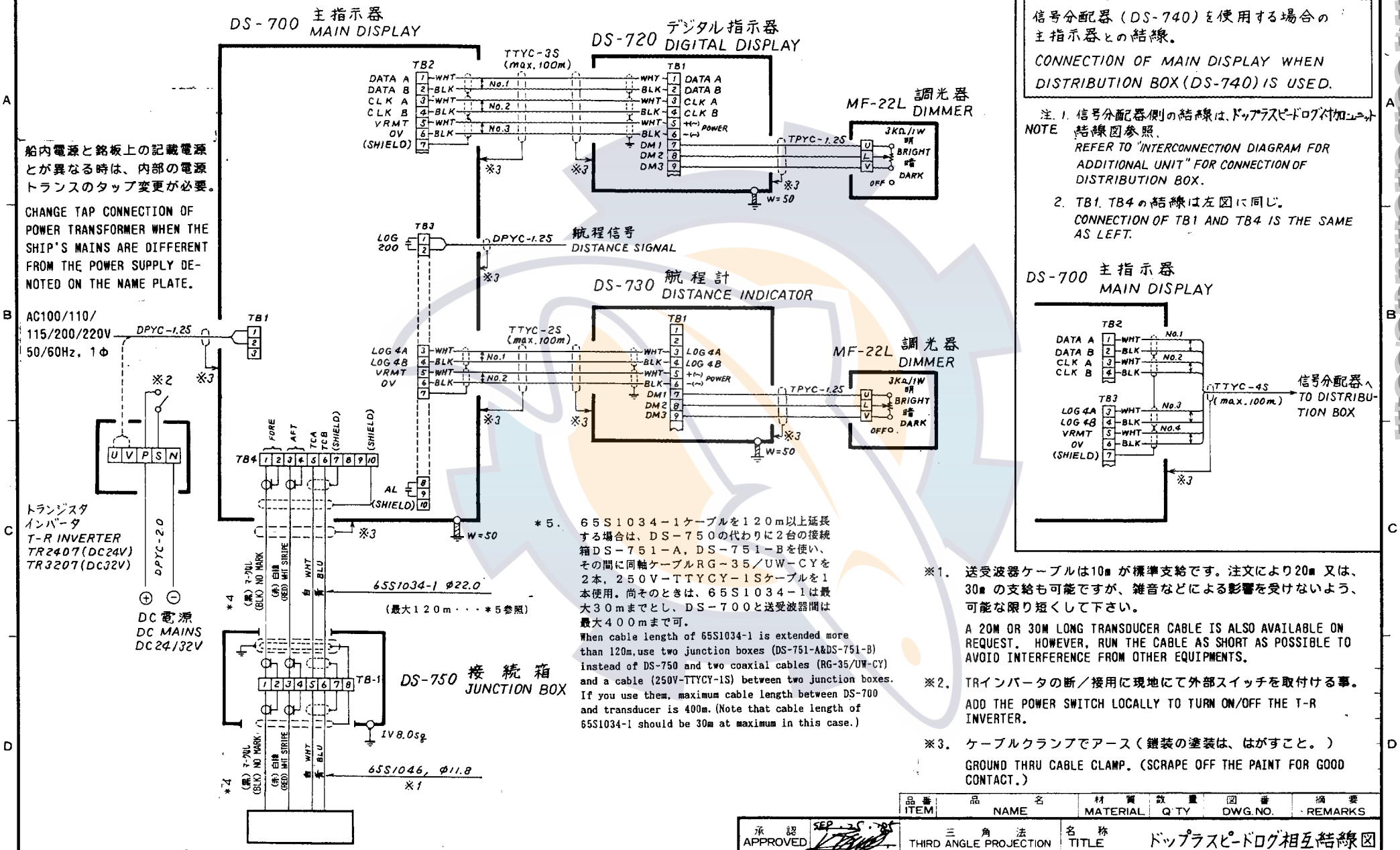
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DRAWN Sep 24 '98 T.YAMASAKI			TYPE IF-1001/1002,DS741
CHECKED Sep 24 '98 K.KISHIKI			名称 インターフェイスユニット
APPROVED Sep 24 '98 K.KUSUNOKI			外寸図
SCALE 1/2	MASS 0.8 kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME INTERFACE UNIT
DWG NO. C4341-G01- B				OUTLINE DRAWING

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船内電源と銘板上の記載電源とが異なる時は、内部の電源トランスのタップ変更が必要。

CHANGE TAP CONNECTION OF POWER TRANSFORMER WHEN THE SHIP'S MAINS ARE DIFFERENT FROM THE POWER SUPPLY DENOTED ON THE NAME PLATE.

信号分配器（DS-740）を使用する場合の主指示器との結線。

CONNECTION OF MAIN DISPLAY WHEN DISTRIBUTION BOX (DS-740) IS USED.

NOTE
注. 1. 信号分配器側の結線は、ドップラスピードログ付加ユニット結線図参照。
REFER TO "INTERCONNECTION DIAGRAM FOR ADDITIONAL UNIT" FOR CONNECTION OF DISTRIBUTION BOX.
2. TB1, TB4の結線は左図に同じ。
CONNECTION OF TB1 AND TB4 IS THE SAME AS LEFT.

*4. ( )内の線色は1992年6 月生産以降
COLORS IN PARENTHESIS APPLY TO TRANSDUCER PRODUCED FROM JUNE 1992.

*5. ６５Ｓ１０３４－１ケーブルを１２０m以上延長する場合は、ＤＳ－７５０の代わりに２台の接続箱ＤＳ－７５１－Ａ，ＤＳ－７５１－Ｂを使い、その間に同軸ケーブルＲＧ－３５／ＵＷ－ＣＹを２本，２５０Ｖ－ＴＴＹＣＹ－１Ｓケーブルを１本使用。尚そのときは、６５Ｓ１０３４－１は最大３０mまでとし、ＤＳ－７００と送受波器間は最大４００mまで可。
When cable length of 65S1034-1 is extended more than 120m, use two junction boxes (DS-751-A&DS-751-B) instead of DS-750 and two coaxial cables (RG-35/UW-CY) and a cable (250V-TTYCY-1S) between two junction boxes. If you use them, maximum cable length between DS-700 and transducer is 400m. (Note that cable length of 65S1034-1 should be 30m at maximum in this case.)

※1. 送受波器ケーブルは10m が標準支給です。注文により20m 又は、30m の支給も可能ですが、雑音などによる影響を受けないよう、可能な限り短くして下さい。
A 20M OR 30M LONG TRANSDUCER CABLE IS ALSO AVAILABLE ON REQUEST. HOWEVER, RUN THE CABLE AS SHORT AS POSSIBLE TO AVOID INTERFERENCE FROM OTHER EQUIPMENTS.

※2. TRインバータの断／接用に現地にて外部スイッチを取付ける事。
ADD THE POWER SWITCH LOCALLY TO TURN ON/OFF THE T-R INVERTER.

※3. ケーブルクランプでアース（鎧装の塗装は、はがすこと。）
GROUND THRU CABLE CLAMP. (SCRAPE OFF THE PAINT FOR GOOD CONTACT.)

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

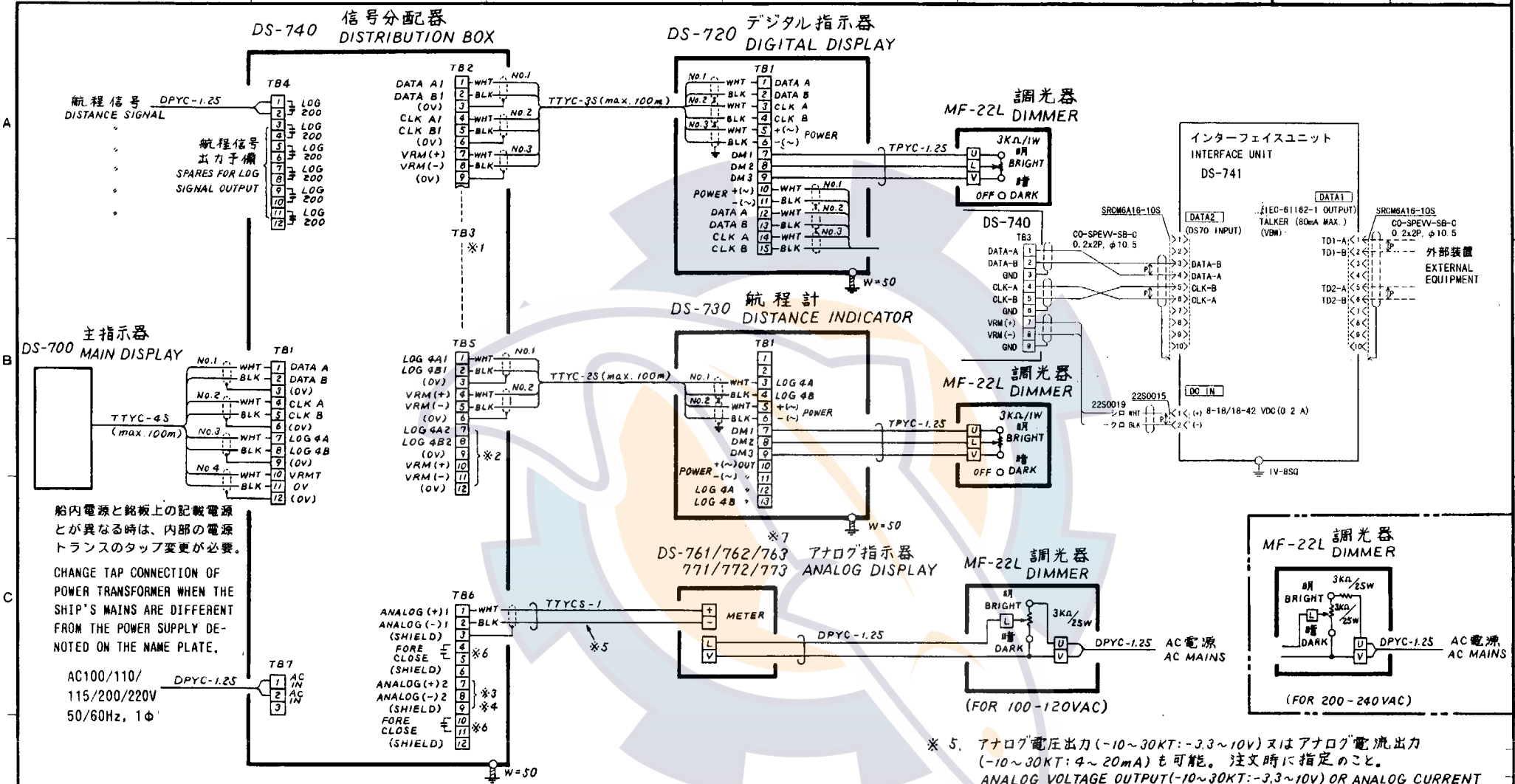
承認 APPROVED		三角法 THIRD ANGLE PROJECTION	名称 TITLE: ドップラスピードログ相互結線図 DS-70 INTERCONNECTION DIAGRAM
検図 CHECKED	Sep.25.'95	尺度 SCALE	
製図 DRAWN	Sep.25.'95	重量 WEIGHT kg	図番 DWG.NO. C7222-028-H

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※1. デジタル指示器を2台装備の時は、TB3を使用。結線はTB2と同じ。
USE TB3 WHEN EQUIPPING ANOTHER DIGITAL DISPLAY.
CONNECTION IS THE SAME AS TB2.

※2. 航程計を2台装備の時は、TB5の7番から12番を使用。結線はTB5の1番から6番迄と同じ。
USE No.7 THRU No.12 OF TB5 WHEN EQUIPPING ANOTHER DISTANCE INDICATOR.
CONNECTION IS THE SAME AS TERMINAL NO.1 THRU 6 OF TB5.

※3. アナログ指示器を2台装備の時はTB6の7番から9番を使用。結線はTB6の1番から3番迄と同じ。
USE NO.7 THRU NO.9 OF TB6 WHEN EQUIPPING ANOTHER ANALOG DISPLAY.
CONNECTION IS THE SAME AS NO.1 THRU NO.3 OF TB6.

※4. アナログ電圧出力(-10～30KT:-3.3～10V)も可能。注文時に指定のこと。
ANALOG VOLTAGE OUTPUT (-10～30KT:-3.3～10V) IS ALSO AVAILABLE. SPECIFY WHEN ORDERING.

※5. アナログ電圧出力(-10～30KT:-3.3～10V)又はアナログ電流出力(-10～30KT:4～20mA)も可能。注文時に指定のこと。
ANALOG VOLTAGE OUTPUT(-10～30KT:-3.3～10V) OR ANALOG CURRENT OUTPUT(-10～30KT:4～20mA) IS ALSO AVAILABLE. SPECIFY WHEN ORDERING.

※6. 前後進リレー接点信号(FORE:接, AFT:断)
FORE-AFT RELAY CONTACT SIGNAL (FORE:CONTACT, AFT:OPEN)

※7. DS-763/DS-773には調光器を接続できない。
NO DIMMER CAN BE CONNECTED TO DS-763/DS-773.

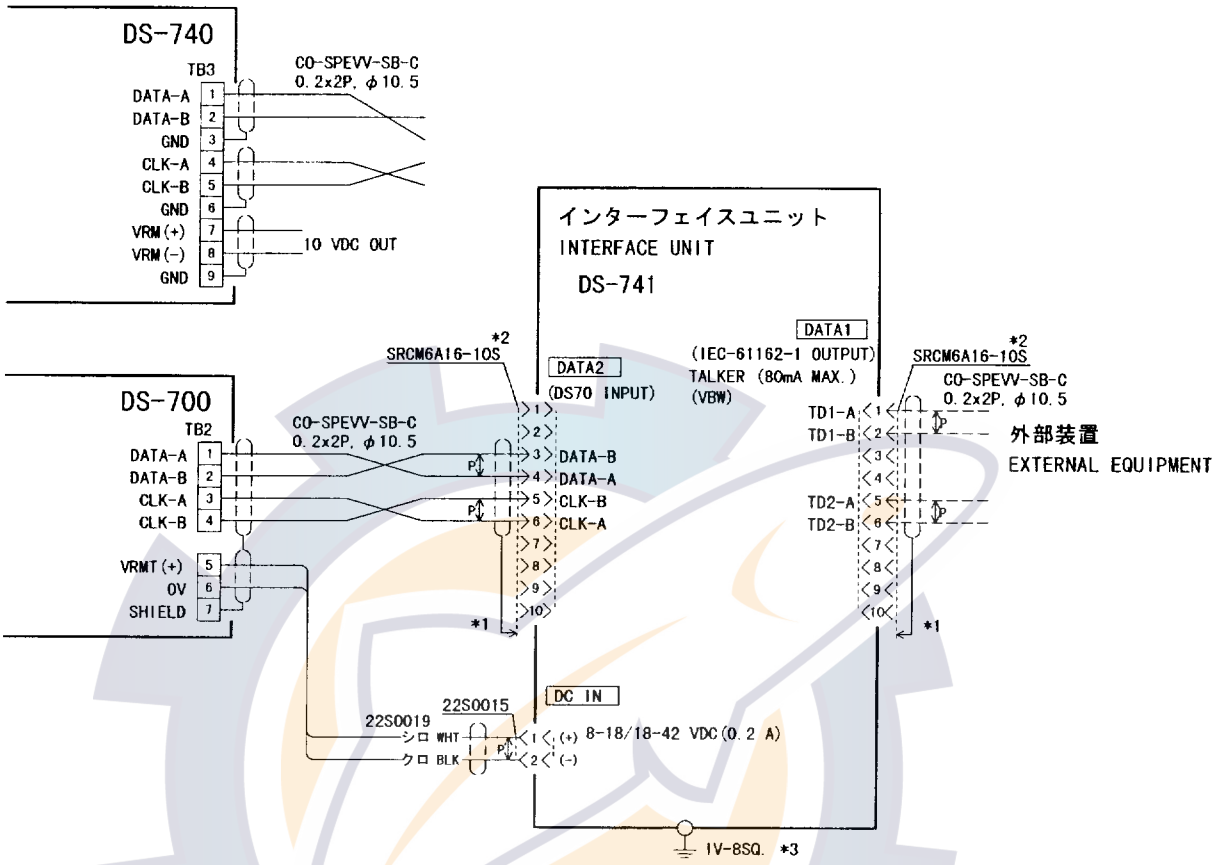
DRAWN Jan20'99 T.YAMAMOTO			TYPE DS-720/730/740
CHECKED Jan20'99 K.Kusunoki			名称 付加ユニット用
APPROVED Jan20'99 K.Kusunoki	DS-70		相互結線図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME FOR ADDITIONAL UNITS
DWG NO. C7222-027- D			INTERCONNECTION DIAGRAM

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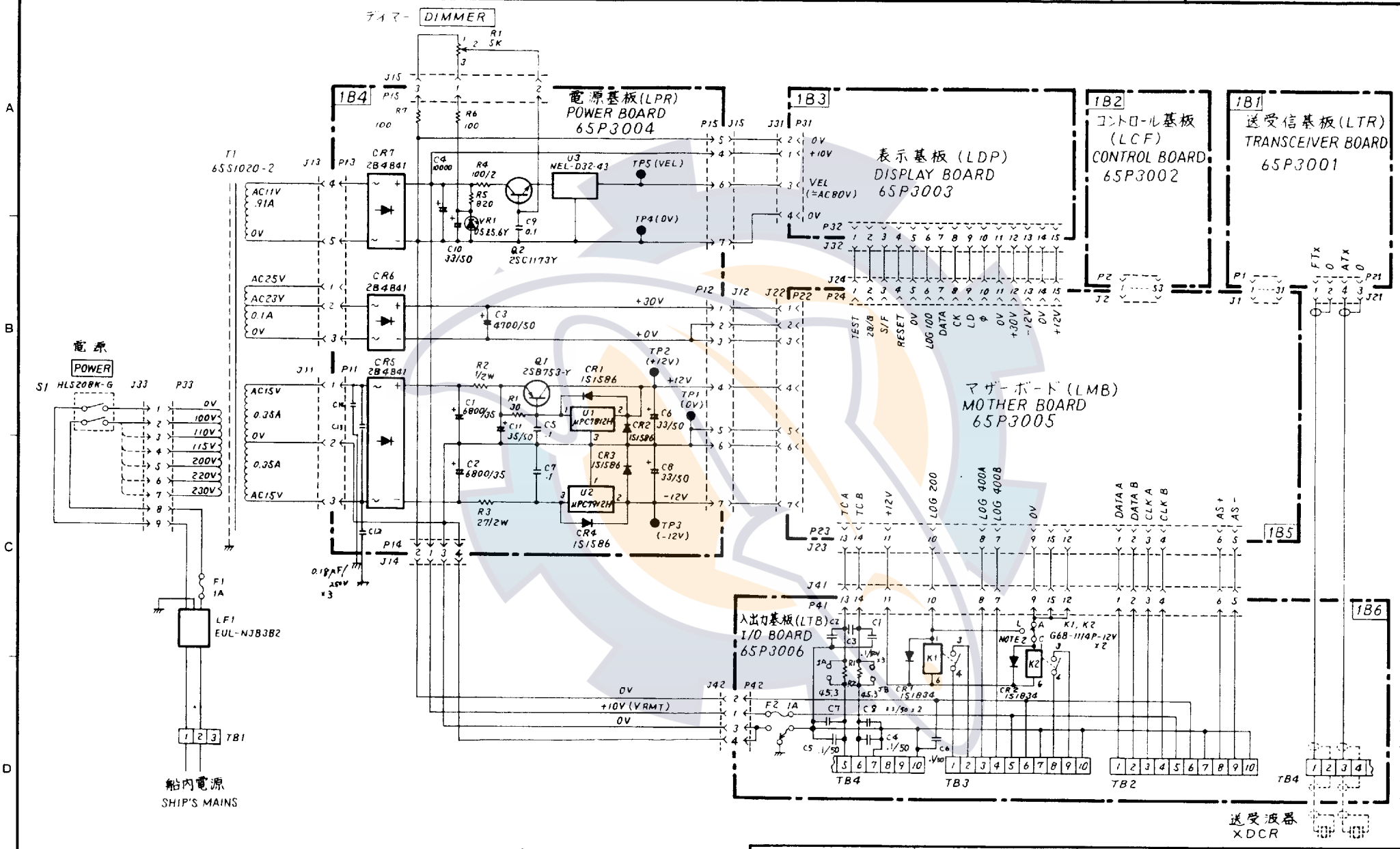


注記
＊１）コネクタのクランプでアースに落とす。
＊２）信号名の無記入端子はオープンにする。
＊３）造船所手配。

NOTE
*1: GROUND THRU CONNECTOR CLAMP.
*2: PINS W/O NAME ARE NOT CONNECTED WITH CABLE.
*3: SHIPYARD SUPPLY.

DRAWN Jan 20'99 T.YAMASAKI			TITLE DS-741
CHECKED Jan 20'99 K.Kusunoki			名称 インターフェイスユニット
APPROVED Jan 20'99 K.Kusunoki	DS-70		相互結線図
SCALE	MASS kg		NAME INTERFACE UNIT
DWG. No. C7222-C02- C			INTERCONNECTION DIAGRAM

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NOTE 1. 特記なき抵抗の単位はΩ, 1/4W, コンデンサの容量はμF.
ALL RESISTANCE IN OHMS, 1/4W, AND ALL CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

2 TB3の8.9番よりログ信号(200パルス)を取りだす時はA-C間をカットし, L-C間をジャンパー接続.
TO TAKE OUT LOG SIGNAL (200 P/n.mi.) FROM PIN NO.8 AND 9 OF TB-3, CUT JUMPER WIRE BETWEEN A AND C. THEN MAKE JUMPER WIRE BETWEEN L AND C.

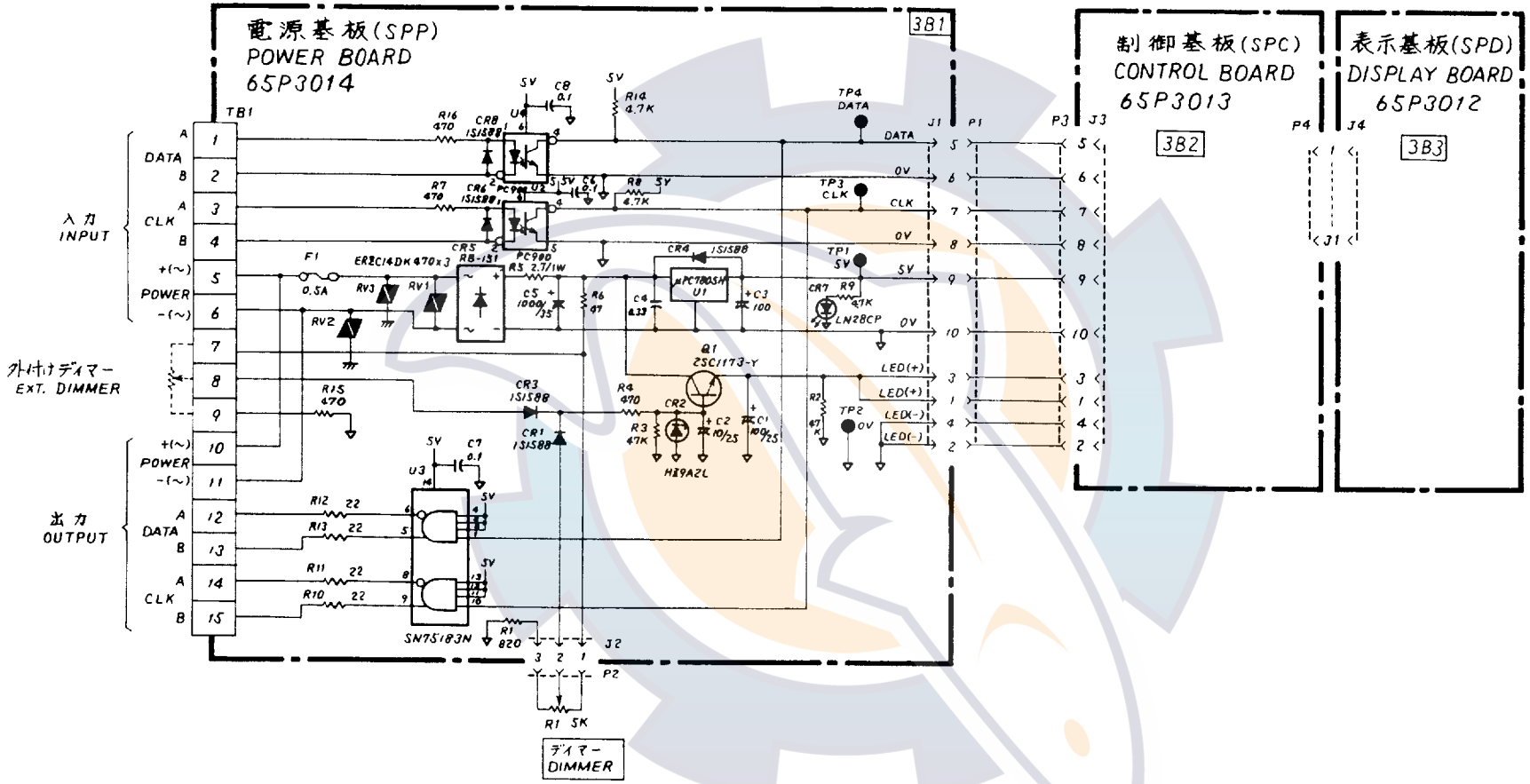
承認 APPROVED	JAN.-8-'86	三角法 THIRD ANGLE PROJECTION	名称 TITLE: DS-70 主指示器総合回路図 MAIN DISPLAY
作図 CHECKED	Jan.-8-'86	尺度 SCALE	
製図 DRAWN		重量 WEIGHT	kg 図番 DWG NO: C7222-044-F

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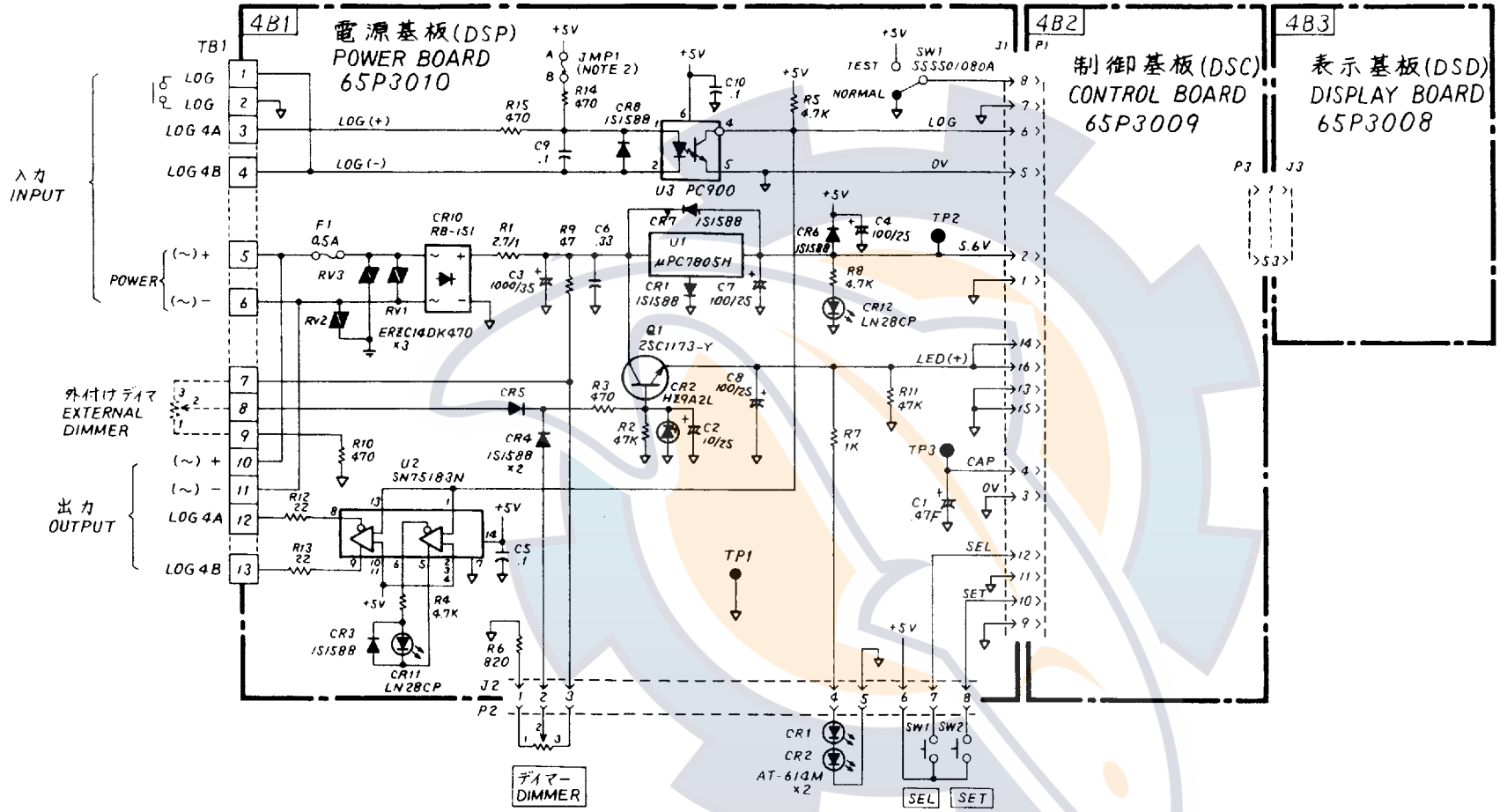


注. 特記なき抵抗の単位は Ω, 1/4W, コンデンサの容量は μF.
ALL RESISTANCE IN OHMS, 1/4W, AND ALL CAPACITANCE IN MICROFARADS UNLESS NOTED OTHERWISE.

ITEM	NAME	MATERIAL	Q TY	DWG.NO	REMARKS
APPROVED	JAN. 16. '86	THIRD ANGLE PROJECTION	TITLE	デジタル指示器総合回路図 DIGITAL DISPLAY	
CHECKED	Jan. 8. '86	SCALE	DS-720		
DRAWN	Jan. 7. '86	WEIGHT kg	DWG.NO.	C7222-045-A	

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NOTE 1 特記なき抵抗の単位はΩ, 1/4W, コンデンサの容量はμF。
ALL RESISTANCE IN OHMS, 1/4W, AND ALL CAPACITANCE IN MICRO FARADS UNLESS NOTED OTHERWISE.

2. 入力が接点信号の時はJMP1をジャンパー接続のこと。
FOR RELAY CONTACT LOG SIGNAL, MAKE JUMPER WIRE JMP1 BETWEEN A AND B.

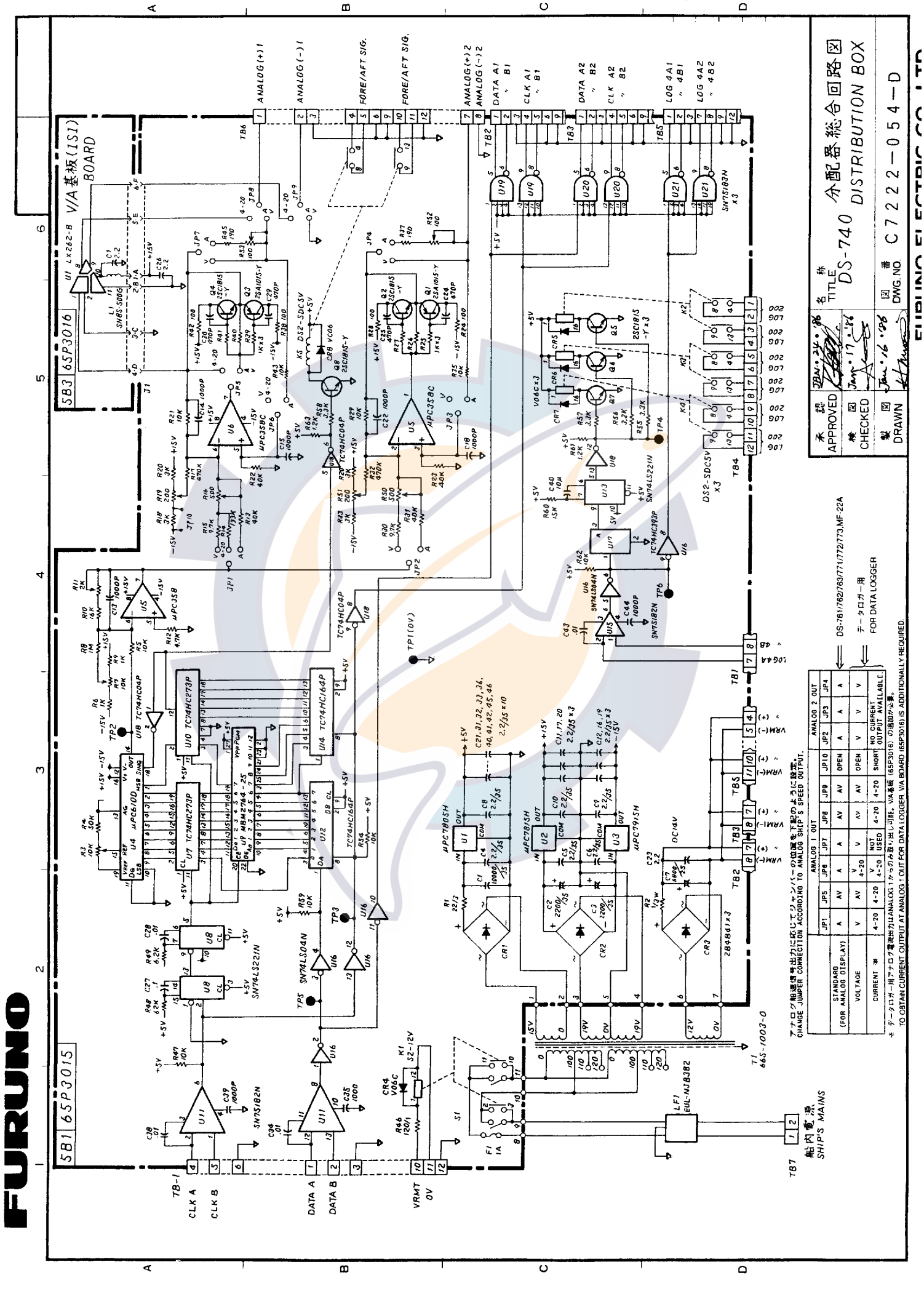
ITEM	NAME	MATERIAL	Q TY	DWG.NO	REMARKS

APPROVED	JAN-16-'86	THIRD ANGLE PROJECTION	TITLE: 航程計総合回路図 DISTANCE INDICATOR
CHECKED	Jan-8-'86	SCALE	DS-730
DRAWN	Jan-7-'86	WEIGHT kg	DWG.NO C7222-046-A

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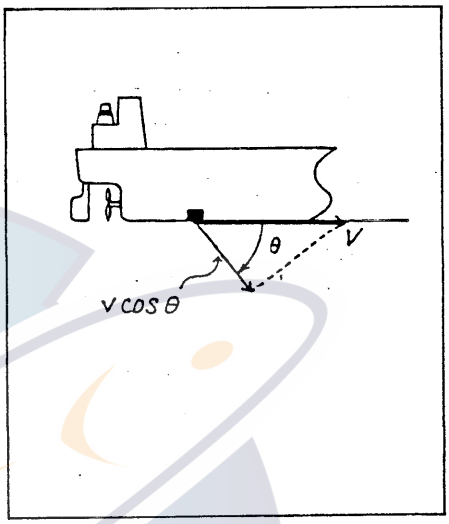


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Principle of Doppler Effect

Operation of the Doppler Speed Log is based on the Doppler Effect principle. The Doppler Effect is a phenomenon in which ultrasonic sound emitted from an object in motion is received with slight frequency shifts by an observer at a stationary place.

In the figure at right, ultrasonic sound is emitted below the horizontal plane with an inclination of θ degrees. Assume that the ship's speed is V, the emitting source is approaching the seabed at a speed of V cos θ.



The frequency of the return signal from the water mass becomes higher in proportion to the ship's speed; the amount of shifting (fd) caused by the Doppler Effect is given in the following equation.

$$fd = fo\ 2V\cos\theta\ / C$$

fo: Transmission frequency

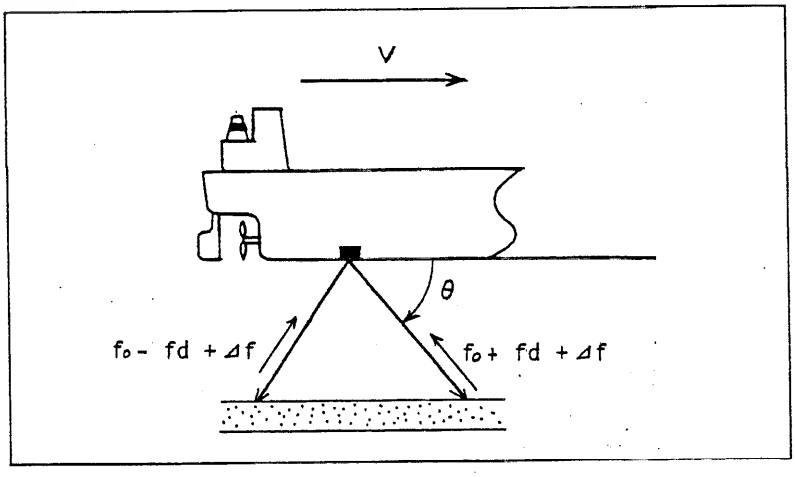
C : Propagation speed of ultrasonic wave under the water

Since the transmission frequency fo , and propagation speed C and inclination θ are known parameters, the ship's speed can be obtained by measuring the doppler shift frequency fd.

Note : Although the propagation speed C changes slightly, largely depending on water temperature, a temperature sensor in the transducer automatically cancels the measuring error caused by this factor.

In practice, the erroneous frequency shift Δf, caused by rolling and pitching, is involved in the fd. The advanced pair-beam system provides features to cancel this Δf by subtracting the frequency obtained by the beam in the aft direction from the one in the fore direction.

$(fo + fd + \Delta f) (fo - fd + \Delta f) = 2fd$



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Pub NO. DOC-272

Declaration of conformity to type

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

hereby declare under our sole responsibility that the product

Doppler speed log model DS-70 consisting of Main display unit DS-700, Transducer assembly DS-785*, Junction box DS-750 and Interface unit DS-741, and optional Distribution box DS-740, Digital display unit DS-720, Distance indicator DS-730 and Analog display unit DS-762

(Model names, type numbers)

to which this declaration relates conforms to the following standard(s) or normative document(s)

IMO Resolution A.824 (19): 1995, EN 61023, EN-61162-1, EN 60945: 1997 (IEC 60945 Third edition: 1996-11)

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see EC – type approval certificate Nr. 6299/059/00 of 17 February 2000 issued by Federal Maritime and Hydrographic Agency, the Federal Republic of Germany
(Item marked with asterisk is designated as DS-710 in the certificate, but it has been renamed as DS-785.)

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 98/85/EC.

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu
Manager,
International Rules and Regulations

Nishinomiya City, Japan
April 14, 2000

(Place and date of issue)

(name and signature or equivalent marking of authorized person)