FURUNO®

DOPPLER SPEEDLOG DS-50 INSTALLATION MANUAL

This manual provides the information necessary for the installation of the FURUNO DS-50 Doppler Speedlog. For best performance please follow the recommended procedures.

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PUB.No. IME-72410-P

(TENI) DS-50

Your Local Agent/Dealer

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00080757000

IME72410P00

⚠ SAFETY INSTRUCTIONS

"NOTIICE", "CAUTION" and **"WARNING"** notices appear throughout this manual. It is the responsibility of the installer 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.

⚠ 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.

⚠ 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 warnig 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 electromagnetic 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:

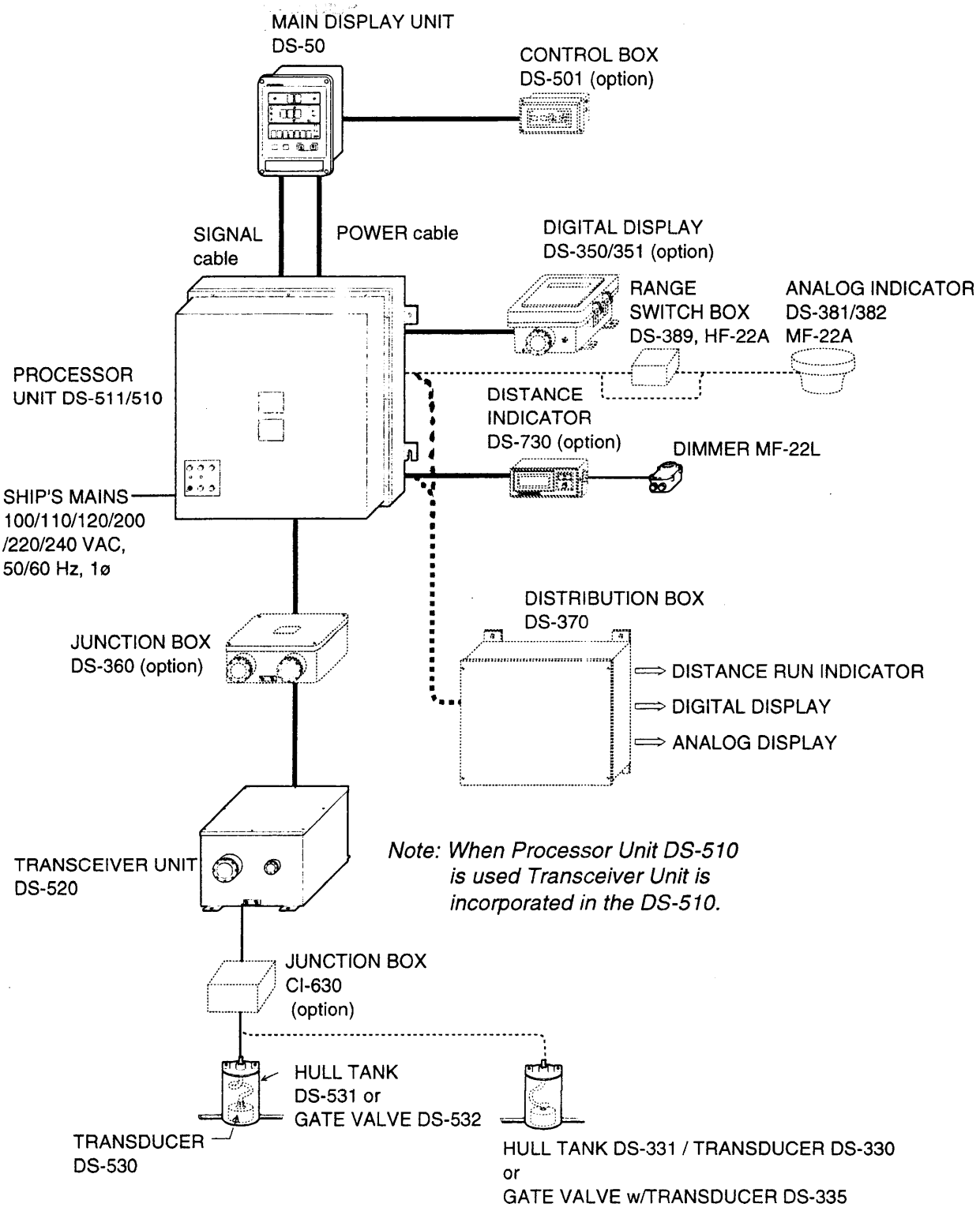
- Away from rain and water splash
- Out of direct sunlight
- Away from air conditionaer vents
- Moderate and stable in temperature and humidity

Observe the compass safe distances to prevent deviation of a magnetic compass.

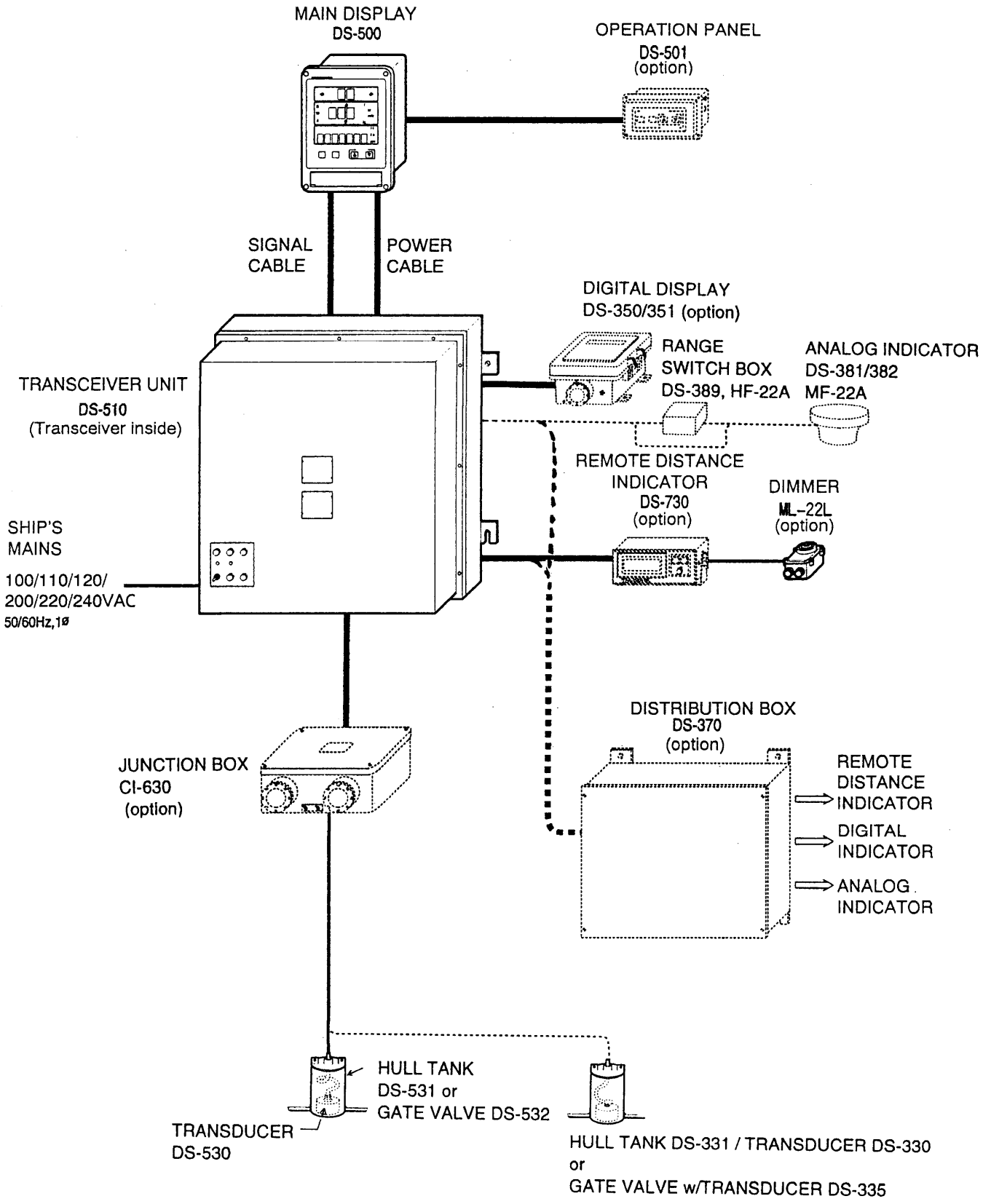
	Standard compass	Steering compass
Main Display	0.8 m	0.6 m
Processor Unit	2.1 m	1.6 m

1. SYSTEM CONFIGURATION

Separate processor and transceiver units



Transceiver unit incorporated in processor unit



2. EQUIPMENT LISTS

Standard Supply

No.	Name	Type	Qty	Remarks
1	Main Display	DS-500	1	Flush mount/Bulkhead mount
2	Processor Unit	DS-510/511	1	Blukhead mount/Deck mount, DS-510 incorporates DS-520
3	Transceiver Unit	DS-520	1	Blukhead mount/Deck mount, required only with DS-511
4	Transducer	DS-530	1	
5	Tank	DS-531	1	
6	Spare Parts	SP65-00400	1 set	For DS-510
		SP65-00410		For DS-511
7	Installation Matetials	CP65-00700	1 set	For DS-510
		CP65-00710		For DS-511

Optional Supply

No.	Name	Type	Code No.	Remarks
1	Installation materials for bulkhead mount	CP65-00704	002-886-970	For main display unit
2	Gate Valve	DS-532	000-028-993	Including installation materials
3	Gate Valve Inst. Materials	MF-220-C-6	000-069-367	For gate valve, option
4	Operation Panel	DS-501		Including installation materials
5	Junction Box	CI-630		Including installation materials CP66-00703: 006-927-330
		DS-360	000-027-994	
6	Distribution Box	DS-370		Bulkhead mount/Deck mount
7	Digital Indicator	DS-350		Waterproof construction
		DS-351		Indoor use
8	Remote Distance Indicator	DS-730		
9	Analog Indicator	DS-381		Flush mount
		DS-382		Bulkhead mount
		MF-22A		
		FE-90		Flush mount
		FL-90		Flush mount
10	Range Switch Box	DS-389		
		MF-22R		

Optional Supply

No.	Name	Type	Code No.	Remarks
11	Dimmer	MF-22L		
12	4 Pairs Cable	66S-1067-1 *20m*	000-120-228	
		66S-1067-1 *30m*	000-120-229	
		66S-1067-1 *100m*	000-138-041	
13	VAE Board	66P3613	002-886-210	For DS-510/511. Current output
14	VDE Board	66P3614	002-886-220	For DS-510/511. To connect CI-370/377 or DS-720
15	Spare Parts Box	SP65-00402	002-887-500	
16	Transducer/Tank	DS-330/DS-331		Installation materials page 9b and 9c.
	Gate valve w/ Transducer	DS-335		

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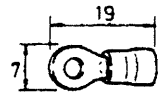
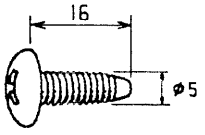
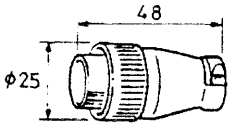
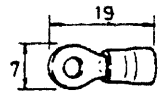
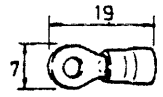
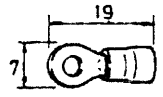
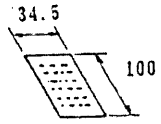
CODE NO.	000-028-991	65AC-X-9401-1
TYPE	CP65-00700	

工事材料表 INSTALLATION MATERIALS

DS-50 トランスデューサ DOPPLER SPEEDLOG (DS-510用)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	圧着端子 CRIMP-ON LUG		FV1.25-M3 アカ RED CODE NO. 000-538-110	18	DS-500用 FOR DS-500
2	+トラスタッピングネジ +TAPPING SCREW		5×16 SUS304 CODE NO. 000-805-494	4	DS-500用 FOR DS-500
3	コネクタ CONNECTOR		SRCN6A16-10P CODE NO. 000-508-663	2	DS-510用 FOR DS-510
4	圧着端子 CRIMP-ON LUG		FV1.25-M4 アカ RED CODE NO. 000-536-715	18	DS-510用 FOR DS-510
5	圧着端子 CRIMP-ON LUG		FV2-M4 アオ BLUE CODE NO. 000-536-716	3	DS-510用 FOR DS-510
6	圧着端子 CRIMP-ON LUG		FV1.25-M3 アカ RED CODE NO. 000-538-110	100	DS-510用 FOR DS-510
7	ハリマーク TB5 STICKER		66-022-2102-0 CODE NO. 100-237-960	1	DS-510用 分配箱使用時 FOR DS-510
			CODE NO.		
			CODE NO.		
			CODE NO.		

002-885-350 CP65-00701

002 885 360 CP65-00711

(略図の寸法は、参考値です。)

図番 DWG. NO. C7241-M01-C (1/1)

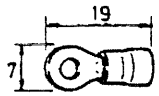
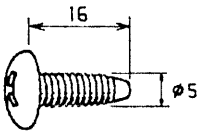
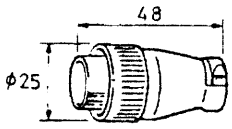
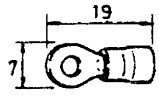
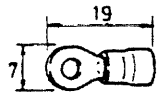
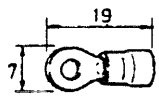
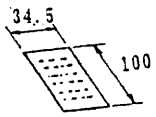
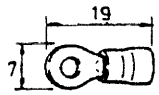
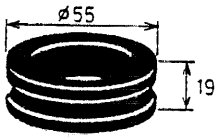
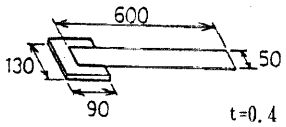
FURUNO ELECTRIC CO., LTD

FURUNO

CODE NO.	000-028-992	65AC-X-9402-1
TYPE	CP65-00710	

工事材料表 INSTALLATION MATERIALS

DS-50 トランプラストピートログ DOPPLER SPEEDLOG (DS-511用)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
	圧着端子		FV1.25-M3 アカ RED	18	DS-500用
1	CRIMP-ON LUG		CODE NO. 000-538-110		FOR DS-500
002 885 350 CP65-00701	+トラスタッピングネジ		5×16 SUS304	4	DS-500用
2	+TAPPING SCREW		CODE NO. 000-805-494		FOR DS-500
	コネクタ		SRCN6A16-10P	2	DS-511用
3	CONNECTOR		CODE NO. 000-508-663		FOR DS-511
	圧着端子		FV1.25-M4 アカ RED	18	DS-511用
4	CRIMP-ON LUG		CODE NO. 000-536-715		FOR DS-511
	圧着端子		FV2-M4 アオ BLUE	3	DS-511用
5	CRIMP-ON LUG		CODE NO. 000-536-716		FOR DS-511
	圧着端子		FV1.25-M3 アカ RED	100	DS-511用
002 885 360 CP65-00711 6	CRIMP-ON LUG		CODE NO. 000-538-110		FOR DS-511
	ハリマーク TB5		66-022-2102-0	1	DS-511用
7	STICKER		CODE NO. 100-237-960		FOR DS-511
	圧着端子		FV1.25-M4 アカ RED	50	DS-520用
8	CRIMP-ON LUG		CODE NO. 000-536-715		FOR DS-520
	クランドパッキン		66-019-4201-0 CR	1	DS-520用
002 876 350 CP66-00804 9	CABLE GLAND PACKING		CODE NO. 100-176-510		FOR DS-520
	アース銅板 *鉄付*		0.4X50X600MM	1	DS-520用
10	COPPER STRAP W/STEEL PLATE		CODE NO. 000-810-253		FOR DS-520

(略図の寸法は、参考値です。)

図番 DWG. NO. C7241-M02-C (1/1)

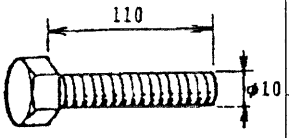
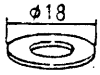
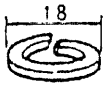
FURUNO ELECTRIC CO., LTD

FURUNO

CODE NO.	002-885-670	65AC-X-9405-1
TYPE	CP65-00702	

工事材料表
INSTALLATION MATERIALS

DS-50 トップラースピードログ
DOPPLER SPEEDLOG
(DS-530用)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	六角ボルト HEX.BOLT		M10X110 SUS 304 CODE NO. 000-807-523	3	
2	小型丸平座金 FIBER WASHER		M10 SUS 304 CODE NO. 000-864-031	3	
3	バネ座金 SPRING WASHER		M10 SUS304 CODE NO. 000-864-261	3	
			CODE NO.		
			CODE NO.		
			CODE NO.		
			CODE NO.		
			CODE NO.		
			CODE NO.		
			CODE NO.		

(略図の寸法は、参考値です。)

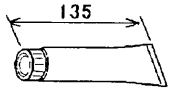
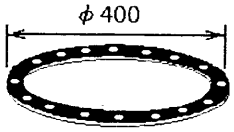
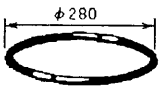
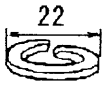
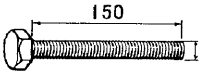
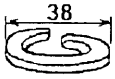
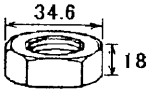
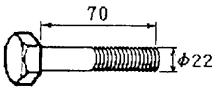
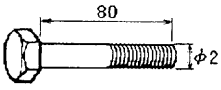
図番 (1/1)
DWG. NO. C7241-M04-C

FURUNO

CODE NO.	000-028-995	65AC-X-9403 -5
TYPE	CP65-00720	1/1

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ﾘﾏｯｸｽ GREASE		1-T 45G TUBU CODE NO. 000-824-056	2	
2	ﾊﾟｯｷﾝ. 2. PACKING		65-002-1004-0 CODE NO. 850-210-040	1	
3	Oﾘﾝｸﾞ O-RING		JISB2401-1A-G280 CODE NO. 000-851-348	1	
4	ﾊﾞﾈ座金 SPRING WASHER		M12 SUS304 CODE NO. 000-864-263	12	
5	六角ﾎﾞﾙﾄ HEX. BOLT		M12X150 SUS304 CODE NO. 000-808-821	12	
6	ﾊﾞﾈ座金 SPRING WASHER		M22 SUS304 CODE NO. 000-864-271	24	
7	六角ﾅｯﾄ 1種 HEX. NUT		M22 SUS304 CODE NO. 000-863-117	24	
8	六角ﾎﾞﾙﾄ HEX. BOLT		M22X70LX50S SUS304 CODE NO. 000-809-382	12	
9	六角ﾎﾞﾙﾄ HEX. BOLT		M22X80LX50S SUS304 CODE NO. 000-800-079	12	

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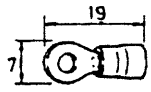
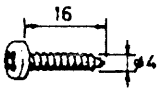
（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

C7241-M03-C

CODE NO.	002-885-370	65AC-X-9404-1
TYPE	CP65-00703	

工事材料表 INSTALLATION MATERIALS	DS-50 ﾄﾞｯﾌﾟﾗ ｽﾋﾟｰﾄﾞﾛｸﾞ DOPPLER SPEEDLOG (DS-501用)	オプション OPTION

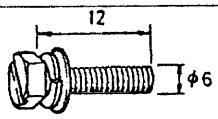
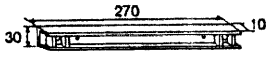
番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	圧着端子 CRIMP-ON LUG		FV1.25-M4 ｱｶ RED CODE NO. 000-536-715	7	
2	+ﾊﾞｲﾝﾄﾞﾀｯﾋﾟﾝﾈｼﾞ +TAPPING SCREW		4X16 SUS304ｼｭ CODE NO. 000-802-955	4	

FURUNO

C7241-M06-B

CODE NO.	002-886-970	65AC-X-9406-1
TYPE	CP65-00704	

工事材料表 INSTALLATION MATERIALS	DS-50 ﾄﾞｯﾌﾟﾗ ｽﾋﾟｰﾄﾞﾛｸﾞ DOPPLER SPEED LOG 主指示部壁掛用工材（オプション）	OPTION

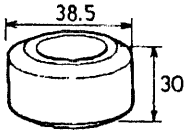
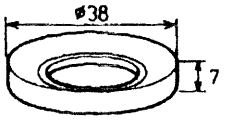
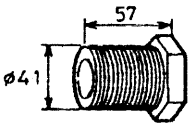
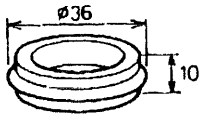
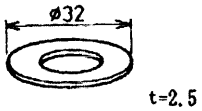
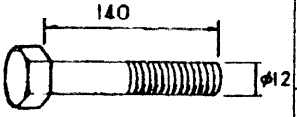
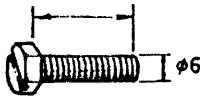
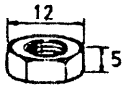
番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	六角ｾﾑｽBｽﾘ割付 HEX.BOLT(SLOTTED WASHER HEAD)		M6X12 SUS 304 CODE NO. 000-882-060	4	
2	取付足 MOUNTING PLATE		66-019-5571-0 CODE NO. 100-178-670	2	

FURUNO

CODE NO.	002-876-310	66AM-X-9415-2
TYPE	CP66-00840	

工事材料表 INSTALLATION MATERIALS

DS-30 トップラソナー
DOPPLER SONAR DOCKING SYSTEM
(DS-330用 FOR DS-330)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	防水ゴム RUBBER PACKING		66-019-1202-0 CR CODE NO. 100-178-550	1	
2	座金 COUNTERSUNK WASHER		66-019-1203-0 SUS316 CODE NO. 100-178-560	1	
3	ケーブルグランド CABLE GLAND		66-019-1204-0 SUS316 CODE NO. 100-178-570	1	
4	キャップ LID		66-019-1983-0 ウレタン CODE NO. 100-176-520	3	
5	平座金 FLAT WASHER		66-019-1205-0 SUS304 CODE NO. 100-176-530	3	
6	六角ボルト HEX. BOLT		66-019-1984-0 SUS304 CODE NO. 100-214-530	3	
7	六角ボルトスリ割付 HEX. BOLT (SLOTTED HEAD)		M6X30 SUS304 CODE NO. 000-862-135	1	
8	六角ナット 1種 HEX. NUT		M6 SUS304 CODE NO. 000-863-109	2	
9	ミカキ平座金 FLAT WASHER		M6 SUS304 CODE NO. 000-864-129	2	
10	バネ座金 SPRING WASHER		M6 SUS304 CODE NO. 000-864-260	2	

図番 (1/2)
DWG. NO. C7236-M24-D

FURUNO ELECTRIC CO., LTD

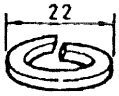
FURUNO

DWG. NO. C7236-M31-C

CODE NO.	002-876-310	66AM-X-9416-2
TYPE	CP66-00840	

工事材料表
INSTALLATION MATERIALS

DS-30 トップラソナー
DOPPLER SONAR DOCKING SYSTEM
(DS-330用 FOR DS-330)

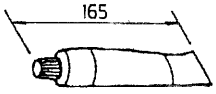
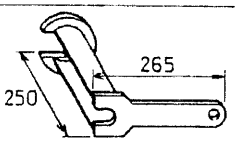
番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
11	ﾊﾞﾈ座金 SPRING WASHER		M12 SUS304 CODE NO. 000-864-263	6	3個は予備 3 PCS. FOR SPARE

FURUNO

CODE NO.	002-884-990	
TYPE	SP66-00512	

工事材料表
INSTALLATION MATERIALS

DS-30 トップラソナー
DOPPLER SONER DOCKING SYSTEM
(DS-331 船底部 FOR DS-331 HULL UNIT)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ｼﾘｺﾝｺﾞﾑ SILICONE SEALANT		G30M CODE NO. 000-824-012	1	工事用工具 INSTALLATION TOOL
2	締付ハンドル CABLE GLAND SPANNER		66-019-1253-0 CODE NO. 100-176-500	1	工事用工具 INSTALLATION TOOL

工事使用後、船上備品として保管してください。

TO BE KEPT IN VESSEL AS MAINTENANCE TOOL AFTER INSTALLATION.

（略図の寸法は、参考値です。）

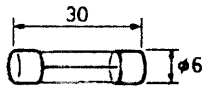
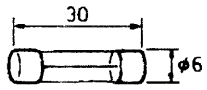
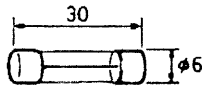
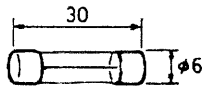
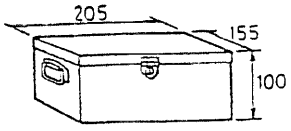
図番 (1/1)
DWG. NO. C7236-M33-B

FURUNO ELECTRIC CO., LTD

FURUNO

CODE NO.	000-028-989	65AC-X-9301-1
TYPE	SP65-00400	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	DS-50 ﾄﾞｯﾌﾟﾗｰｽﾋﾟｰﾄﾞﾛｸﾞ DOPPLER SPEED LOG	D S － 5 1 0 用	

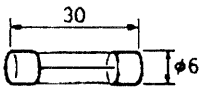
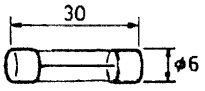
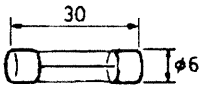
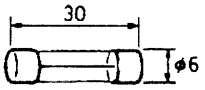
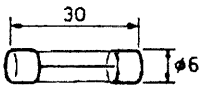
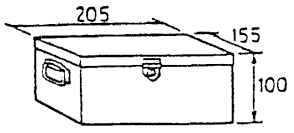
ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES.	QUANTITY SPARE	REMARKS/CODE NO.
1	管入りヒューズ GLASS TUBE FUSE		FGBO 3A AC250V	2		2	DS－510用 FOR DS-510 000-549-021
2	管入りヒューズ GLASS TUBE FUSE		FGBO-A 2A AC125V	1		1	DS－510用 FOR DS-510 000-549-062
3	管入りヒューズ GLASS TUBE FUSE		FGBO-A 3A AC125V	1		3	DS－510用 FOR DS-510 000-549-063
4	管入りヒューズ GLASS TUBE FUSE		FGBO-A 5A AC125V	3		3	DS－510用 FOR DS-510 000-549-064
10	予備品箱 SPARE PARTS BOX		JISF0902-12-10		1		000-831-626

MFR'S NAME	FURUNO ELECTRIC CO., LTD	DWG. NO.	C7241-P01-C	1/1

FURUNO

CODE NO.	000-028-990	65AC-X-9302-1
TYPE	SP65-00410	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	DS-50 ﾄﾞｯﾌﾟﾗｰｽﾋﾟｰﾄﾞﾛｸﾞ DOPPLER SPEED LOG	D S － 5 1 1 用	

ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES.	QUANTITY SPARE	REMARKS/CODE NO.
1	管入りヒューズ GLASS TUBE FUSE		FGBO 3A AC250V	2		2	DS－511用 FOR DS-511 000-549-021
2	管入りヒューズ GLASS TUBE FUSE		FGBO-A 2A AC125V	1		1	DS－511用 FOR DS-511 000-549-062
3	管入りヒューズ GLASS TUBE FUSE		FGBO-A 3A AC125V	1		3	DS－511用 FOR DS-511 000-549-063
4	管入りヒューズ GLASS TUBE FUSE		FGBO-A 5A AC125V	3		3	DS－511用 FOR DS-511 000-549-064
5	管入りヒューズ GLASS TUBE FUSE		FGBO-A 3A AC125V	1		3	DS－520用 FOR DS-520 000-549-063
10	予備品箱 SPARE PARTS BOX		JISF0902-12-10		1		000-831-626

MFR'S NAME	FURUNO ELECTRIC CO., LTD	DWG. NO.	C7241-P02-C	1/1

3. OVERVIEW

The FURUNO DS-50 Doppler Speedlog mainly consists of the main display, processor unit, junction box, transceiver unit and transducer.

To obtain full performance from the system, proper installation is very important, especially the transducer. Poor siting or poor cable layout may cause mutual interference or sub par performance. This chapter presents an overview of how to install the system.

3.1. Selection of Mounting Location

Transducer

The performance of the system largely depends on the installation of the transducer and an important consideration is the mounting location. It should meet the requirements mentioned below.

Location from the bow
The location from the bow should be at the distance 1/4 of the ship's length.

Location from the keel
The transducer is installed flush with the ship's hull bottom, therefore it is susceptible to air bubbles which flow below the hull bottom. Select a location where air bubbles will not gather at the mounting location. For the ship having a bulbous bow, air bubbles gather on the hull when the draft line is lower than the bulbous part on the bow.
Generally a location along the keel line provides the best performance.

Projecting distance from hull
The effects of air bubbles are most pronounced near the hull. Therefore, install the transducer along the keel or just below it.

Interference of other ultrasonic equipment
Interference may occur when integer multiple of the transmission frequency of other ultrasonic equipment is within 440 ± 8 kHz. To avoid interference, select a location at least one meter away from the transducer of ultrasonic equipment.

Engine noise

Engine noise resonates through the hull and may interfere with the transducer. Be sure to locate the transducer well away from the engine.

Installation site

The transducer is made of waterproof rubber molding, thus the hull tank, etc. may be installed almost anywhere which meets the requirements noted earlier. However, it is recommended to provide a housing for the transducer inside the ship to keep water out of the transducer.
The transducer cable should be laid in steel conduit tubing, lined with vibration-absorbing materials such as sand to prevent cable vibration.

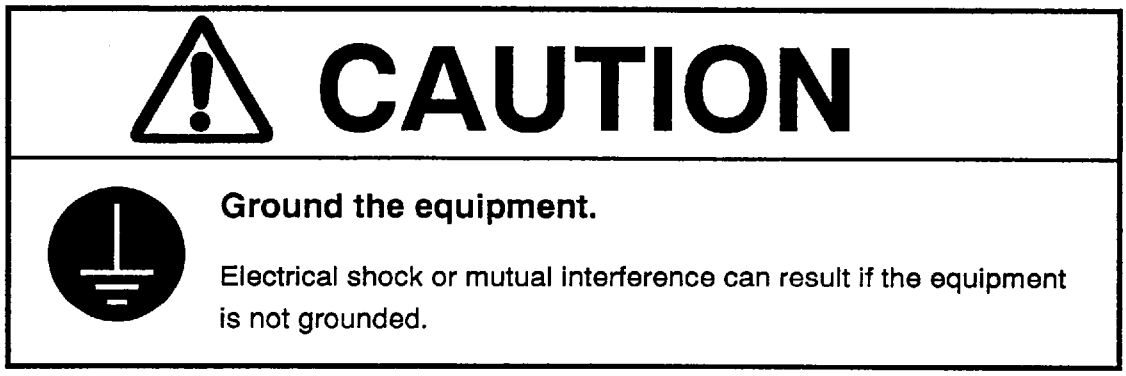
> The material of the transducer tank must meet the requirements of relevant ship classification society. The material of the tank supplied standard by FURUNO is type KSTPG370, approved by the Ship Classification Society of Japan. Consult with relevant classification society to determine suitable material.

Mounting considerations for indoor units

All equipment in the DS-50 system is designed and constructed to withstand the humidity and corrosive atmosphere found in the marine environment. However, certain guidelines must be observed to ensure continued operation. When selecting a mounting location for indoor units, keep the following points in mind.

- Locate the units out of direct sunlight because of heat which can build up inside the cabinet.
- Locate the units away from heaters and air conditioners.
- Avoid places subject to water splash.
- The mounting location should be well ventilated.
- The mounting location should be clean.
- Select a place where vibration is minimal.

3.2 Grounding



The DS-50 system use pulse signals. Thus, insufficient grounding of the equipment may cause mutual interference, especially to radio equipment. To minimize unwanted radiation, considering the following.

- Do not run cables near radio equipment.
- Do not bind cables with cables of radio equipment.
- Cables should be as short as possible, laid along the shortest route.
- Ground all units of the system with a copper strap.
- Lay cables on top of copper plate and fix them every 30 cm with a brass band.
- To connect a copper strap to a copper plate, use silver solder or solder cream to ensure solid connection.

4. MOUNTING

4.1 Mounting the Main Display

The main display can be mounted in a panel (flush mount) or on a bulkhead. Consider the following points when selecting a mounting.

- Select a location where the display can be easily viewed and operated.
- Select a location out of direct sunlight and free of water splash.
- The unit weighs 4.5 kg. Be sure the mounting location is strong enough to support the weight of the unit.

Flush mounting

Refer to the outline drawing on page D-1 for mounting dimensions.

1. Prepare a cutout in the mounting location referring to Figure 2-1 on the next page.
2. Unfasten four bolts on the front panel to separate the front panel from the chassis. Save the bolts for later use.
3. Set the chassis to the mounting location and fasten it with four tapping screws (5 x 16).
   Note: Leave sufficient slack in cabling so the unit can be drawn out for maintenance and servicing.
4. Connect wires to the terminal strip referring to the next chapter.
5. Fasten the front panel to the chassis with four bolts removed at step 2.

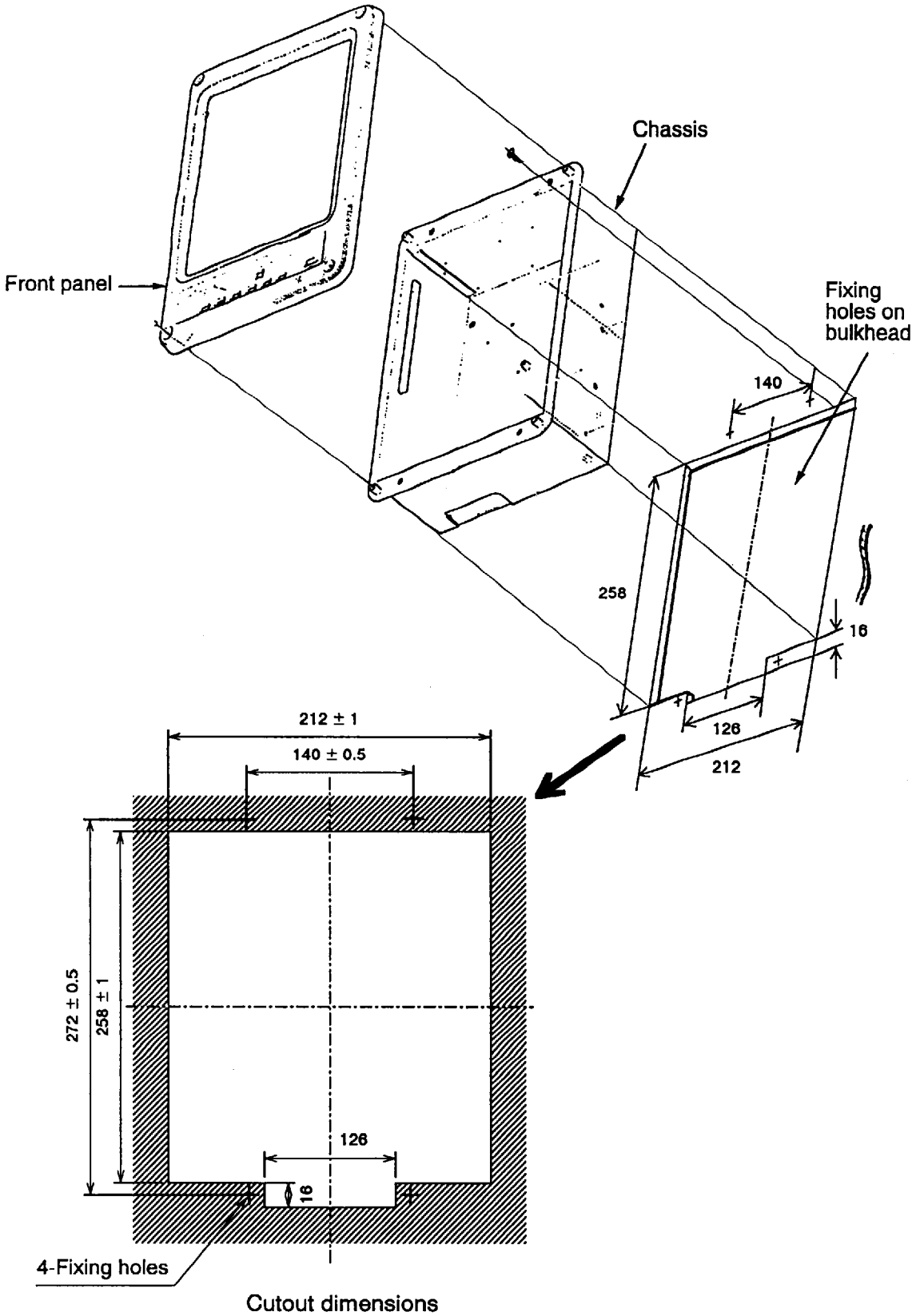


Figure 4-1 Mounting dimensions for flush mounting main display

Bulkhead mounting
Fix the unit to the mounting location with M10 bolts or coach screws. Refer to the outline drawing on page D-2.

4.2 Mounting the Processor Unit

The processor unit can be mounted on the deck or on a bulkhead. Consider the following points when selecting a mounting location.

- Select a location which is both well ventilated and low in humidity to keep the unit cool.
- The unit weighs 40 kg. For bulkhead mounting, be sure the mounting location is strong enough to support the weight of the unit under continued vibration normally encountered on the vessel.

Refer to the outline drawing on page D-3 for mounting dimensions.

1. Set four stud bolts to the mounting location at the intervals shown in the outline drawing on page D-3. The bolts should protrude from the mounting location by about 20 mm.
2. Set the unit to the stud bolts and fasten it with four M10 nuts.

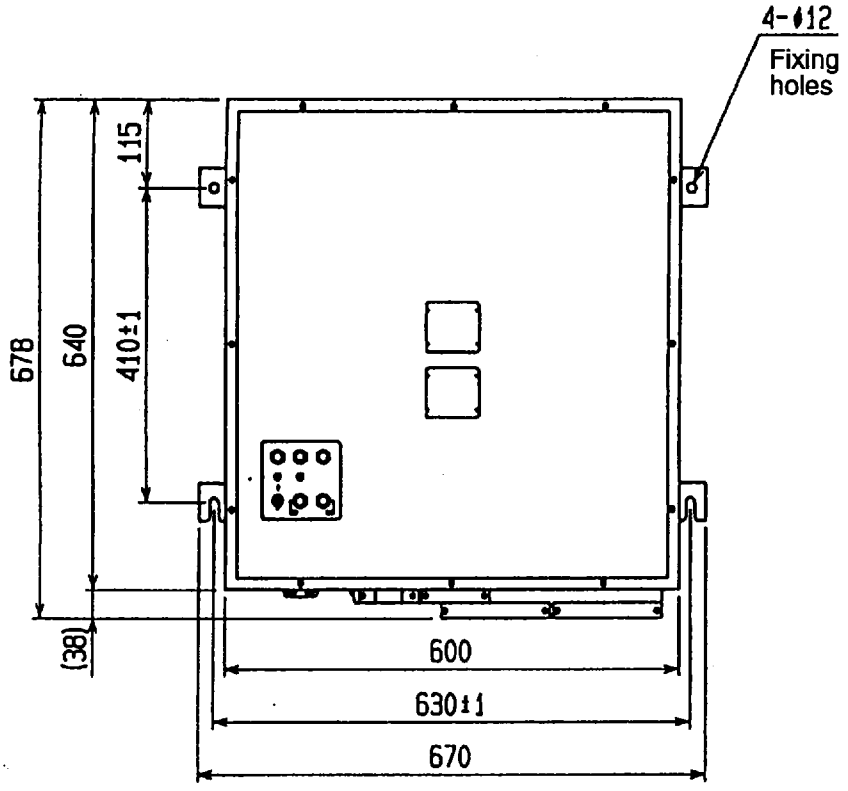


Figure 4-2 Mounting dimensions for processor unit

4.3 Mounting the Transceiver Unit

The transceiver unit can be mounted on the deck or on a bulkhead. Consider the following points when selecting a mounting location.

- Select a location which is both well ventilated and low in humidity to keep the unit cool.
- The unit weighs 14 kg. For bulkhead mounting, be sure the mounting location is strong enough to support the weight of the unit under continued vibration normally encountered on the vessel.

Refer to the outline drawing on page D-4 for mounting dimensions.

1. Set four stud bolts to the mounting location at the intervals shown in the outline drawing on page D-4. The bolts should protrude from the mounting location by about 20 mm.
2. Set the unit to the stud bolts and fasten it with four M10 nuts.

4.4 Mounting the Junction Boxes (option)

Junction box DS-360 (between processor and transceiver units)

The DS-360 can be mounted on the deck or on a bulkhead. For bulkhead mounting be sure the mounting location is strong enough to support the weight of the unit (6 kg). Refer to page D-10 for mounting dimensions.

1. Determine mounting location.
2. Remove cover of junction box.
3. From inside the junction box, fasten it to the mounting location with tapping screws (5 mm dia.) or bolts, nuts and washers (5 mm dia.)
4. Replace the cover.

Junction box CI-630 (between transceiver and transducer)

The mounting procedure is the same as that for the DS-360. Refer to the outline drawing on page D-11 for mounting dimensions.

Consider the following points when selecting a mounting location.

- The CI-630 handles pulse signals. Locate it well away from generators, radio equipment, televisions and other noise-emitting equipment.
- The unit is waterproof; however, select a location which is low in humidity.
- Locate the unit away from heaters and air conditioners. The temperature should be moderate and stable to prevent moisture build up inside the unit.

- The CI-630 is usually installed above the draft line and the transducer cable is run through steel conduit tubing. This permits replacement of the transducer without having to dry dock the vessel.

If the junction box is installed below the draft line, pass the transducer cable through steel conduit tubing laid between the cable gland on the transducer and the junction box, to prevent noise interference. If steel conduit tubing is not used, shorten the transducer cable as much as possible and install the junction box close to the hull.

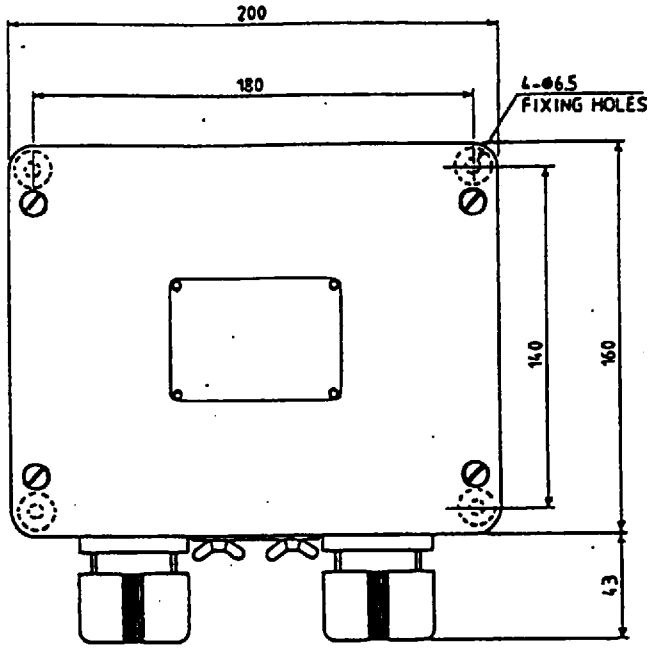


Figure 4-3 Mounting dimensions for junction box CI-630

4.5 Mounting the Hull Unit

For steel hull vessels

1. Confirming transducer tank material, hull plate thickness

Before installing the hull unit, check that the transducer tank is of material approved by relevant ship classification society and is with a thickness not thinner than the hull plate. The type of material used for the casing of the hull tank supplied standard by FURUNO is type KSTPG370 (formerly KSTPG38, KST138), approved by the Ship Classification Society of Japan, with a thickness of 25 mm.

2. Determining installation site

Select the installation site referring to page 11. For ships which are prone to collect air bubbles at the hull bottom, consult local FURUNO agent or dealer for advice.

3. Constructing housing for transducer tank

Housing for the transducer is not required by classification societies since the transducer tank is waterproof. However it is recommended to do so for safety. Dimensions shown in the hull unit outline drawing are for reference; shipyard may change as required. No maintenance space is required inside the housing since the transducer is detachable/replaceable in the water from outside the ship.

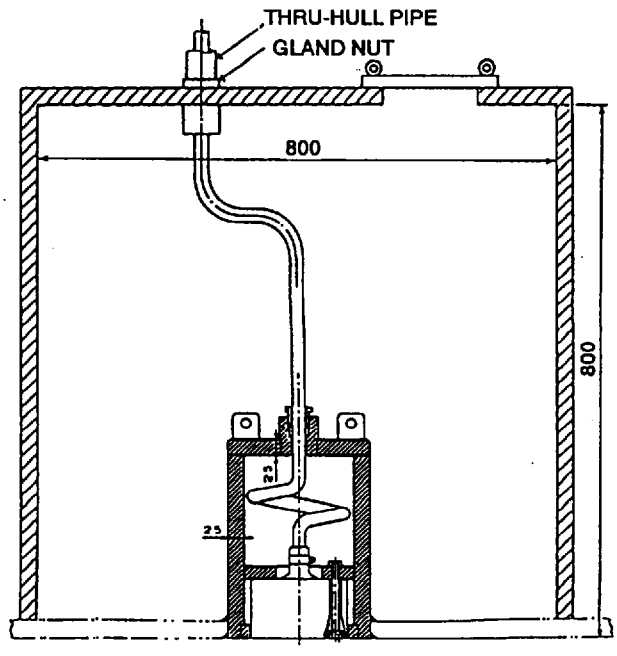


Figure 4-4 Eample of housing for transducer tank

4. Welding tank

a) Fore/aft direction
"Fore" mark is engraved on the tank. Align them with the ship's fore-aft line within accuracy of 1 ° . After the tank has been welded, measure both ship's fore-aft direction and tank fore-aft direction with a magnetic compass. Calculate the difference between the readings and enter it on the system settings menu after completion of installation as follows:

1) Turn off the main display.
2) While pressing and holding down the [Kt/ m/s] key, turn on the power.
3) Press the DOWN arrow key to select system setting no. 3, transducer installation error.
4) Press RIGHT or LEFT arrow key to set offset.
5) Turn off the power.

b) Leveling: Install the tank so that its top face is horizontal while the ship is running. Measure leveling accuracy with a level meter, after the ship is launched.

c) Detach transducer, transducer cable, cable gland and gasket before welding the tank.
d) Welding method for tank and hull should be determined by the shipyard. Weld reinforcement ribs to the tank if the shipyard considers them necessary.
e) Remove welding build up between the tank and the ship's hull with a grinder, for a flat finish.

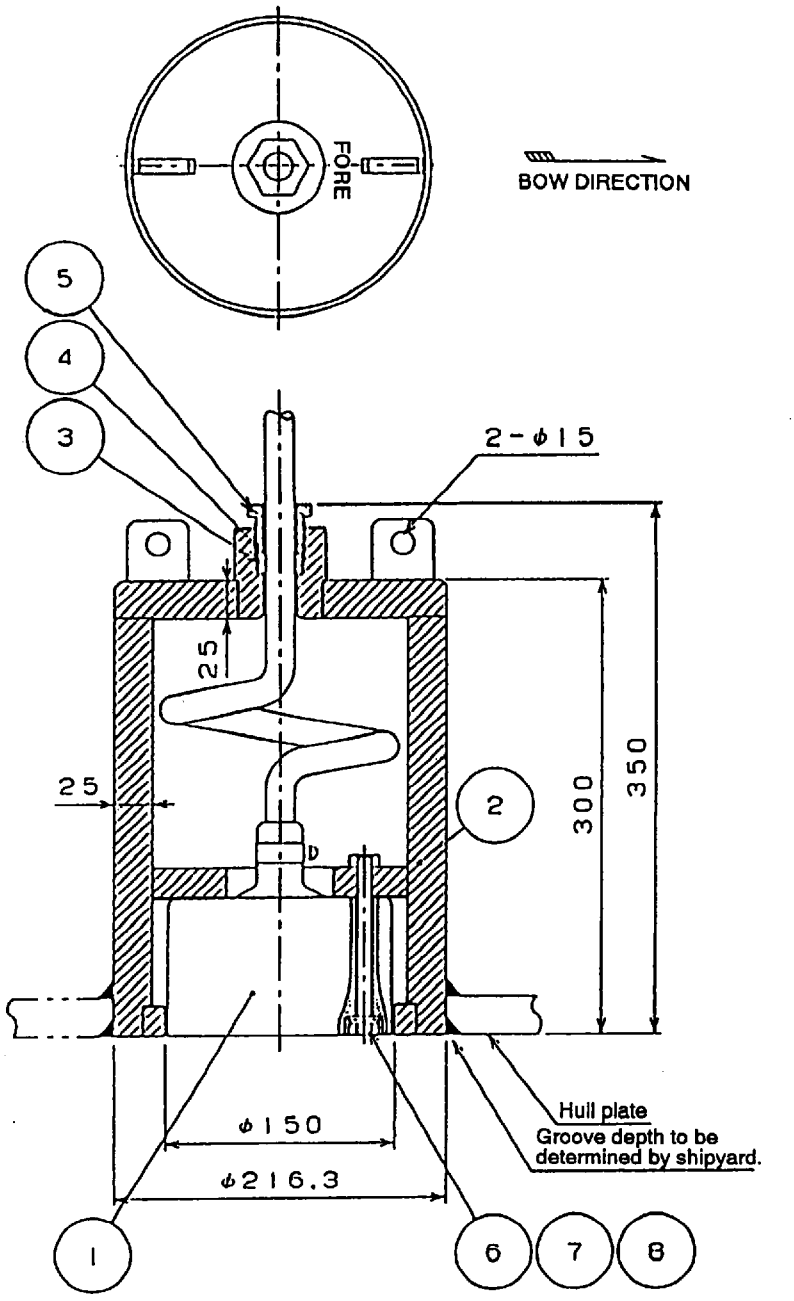
5. Fixing/connecting the transducer cable

The transducer cable should be laid in steel conduit tubing, lined with vibration absorbing material to prevent cable vibration.

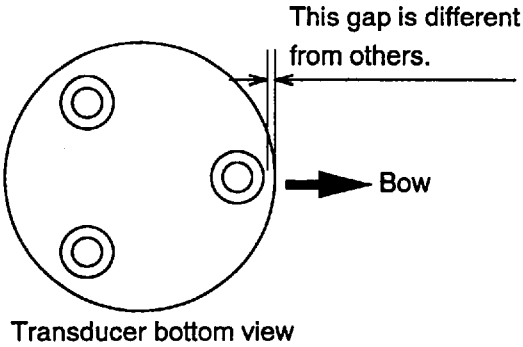
6. Painting

After welding the tank, paint both inner and outer surfaces of the tank with paint used for top coating of hull bottom.

Note: The bottom face of the transducer has been coated with Marine Star 20 Antifouling Paint. Do not coat it with paint for the hull.



① Transducer
② Tank
③ Gasket
④ Washer
⑤ Cable Gland
⑥ Hex Head Bolt
⑦ Spring Washer
⑧ Flat Washer



Transducer bottom view

Figure 4-5 Tank installation example

Note: Refer to page D-12 for installion of DS-330 (option).

4.6 Mounting the Operation Panel (option)

The operation panel is designed for flush mounting. Consider the following points when selecting a mounting location.

- Locate the unit where it can be easily operated.
- The mounting location should be free of water splash.

Procedure
Refer to the outline drawing on page D-7 for mounting instructions.

1. Prepare a cutout in the mounting location.

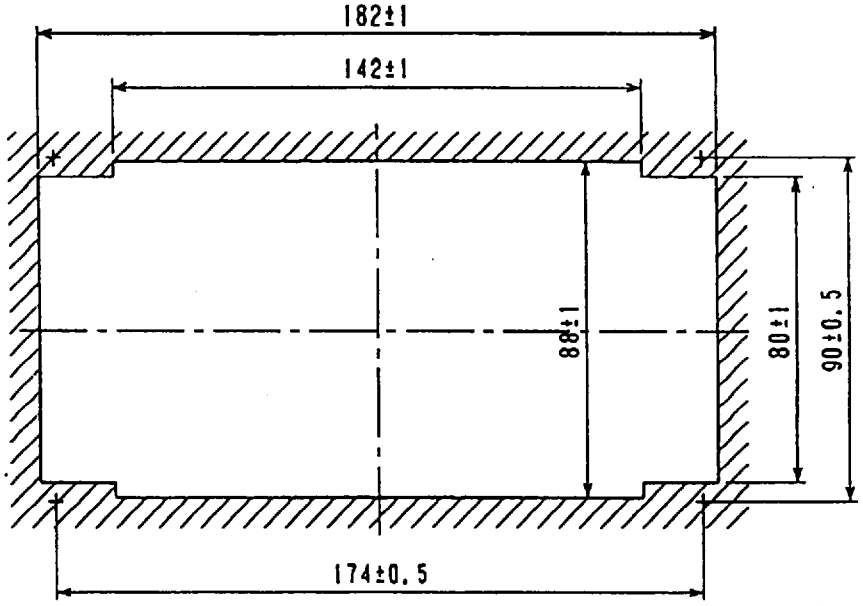


Figure 4-6 Mounting dimensions for control box

2. Open the lid of the control box. Connect the unit referring to the next chapter.
3. Set the control box to the mounting location and fix it with four tapping screws.

Note: Leave sufficient extra cabling so the unit can be drawn out for maintenance and servicing.

5. WIRING

5.1 Remarks on Cabling

1. Cable between transducer and transceiver unit

This cable carries very weak signals having amplitude of less than 0.1 μV, which are easily interfered by noise. Therefore, dedicate steel conduit tubing exclusively for this cable. For the conduit which runs vertically, line it with vibration absorbing material prevent cable vibration.

Cable to use

Cable Name	FEP-4P
Outer diameter	18.7 ± 0.5 mm
Weight	480 kg/km
Outer sheath	Rubber
Armor	None

2. Cables between transceiver unit and processor unit (via junction box DS-360)

These cable carries echoes signal having amplitude of greater than 0.1 mV, which can be interfered by noise from high power electrical power cables. Therefore, do not run these cables through steel conduit tubing with the following cables:

- Cable carrying more than a few kilowatts of power to fluctuating loads.
- Cable carrying switching waves generated by thyristor, etc.
- Transmission antenna cable of radio equipment.

Observe also the guidelines given for "3. Other cables."

Cable to use

Cable Name	TTYCY-16S
Outer diameter	39.2 ± 1.6 mm
Weight	2100 kg/km

3. Other cables

Observe the guidelines which follow to prevent noise and interference.

- When cables run parallel with power cables, separate them 40 cm minimum.
- For cables run in non-metallic conduit tubing or duct behind a bulkhead, use cable with armor and no protective covering and ground it every 50 cm.

5.2 Cable Fabrication

1. Transducer cable

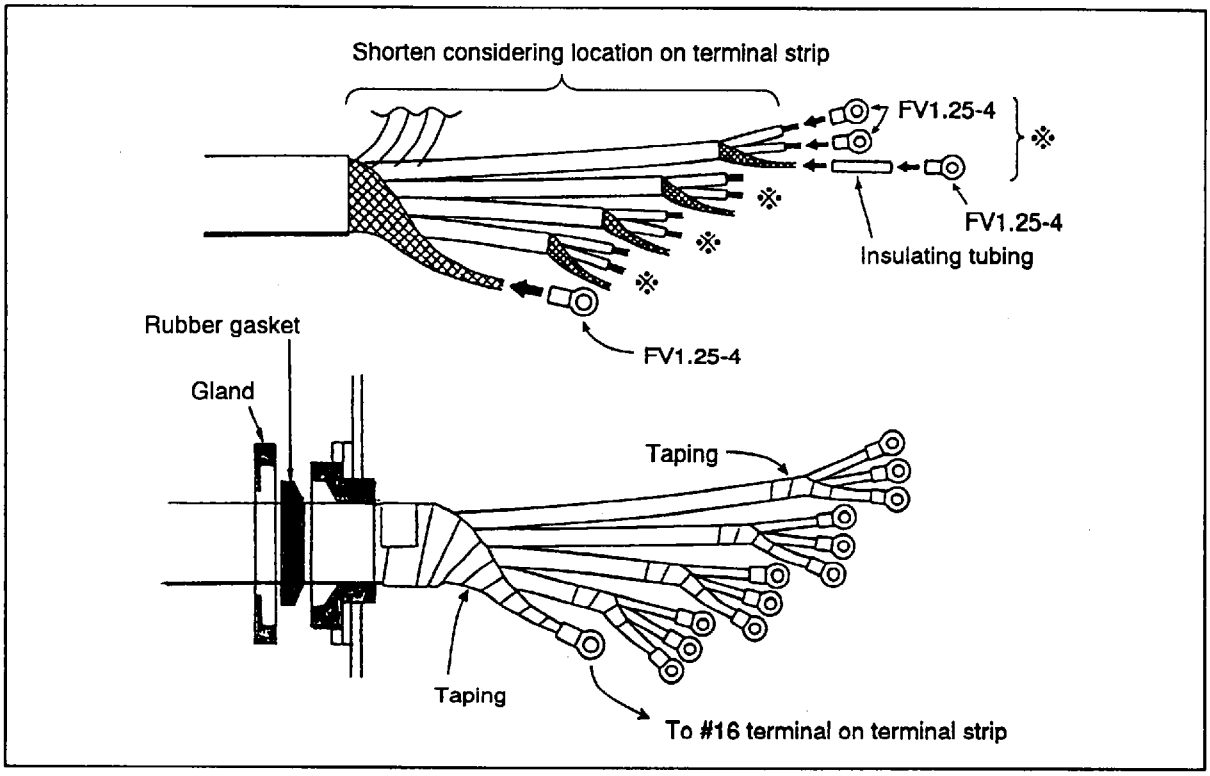


Figure 5-1 Fabrication of transducer cable

2. Cable between transceiver unit, junction box and processor unit (TTYCY-16S)

1) Transceiver unit/junction box

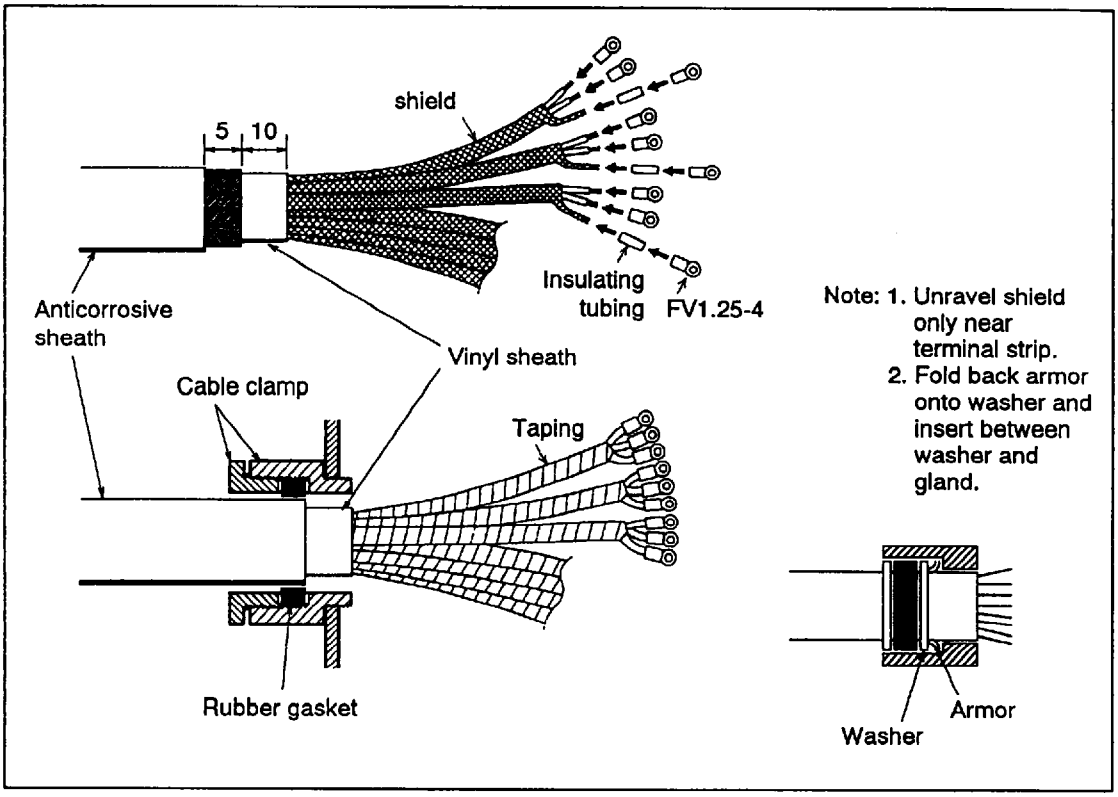


Figure 5-2 Cable fabrication

2) Processor unit

Cores and shields are fabricated the same as on transceiver unit/junction box side. To ground the cable, remove paint from the armor and set the armor in the cable clamp.

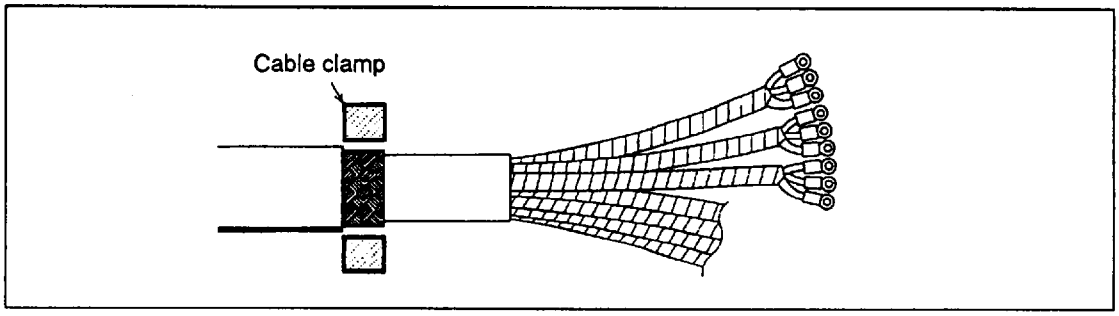


Figure 5-3 Cable fabrication

3. CIF/NMEA data signal cable (CO-SPEVV-SB-C 0.2 x 5P)

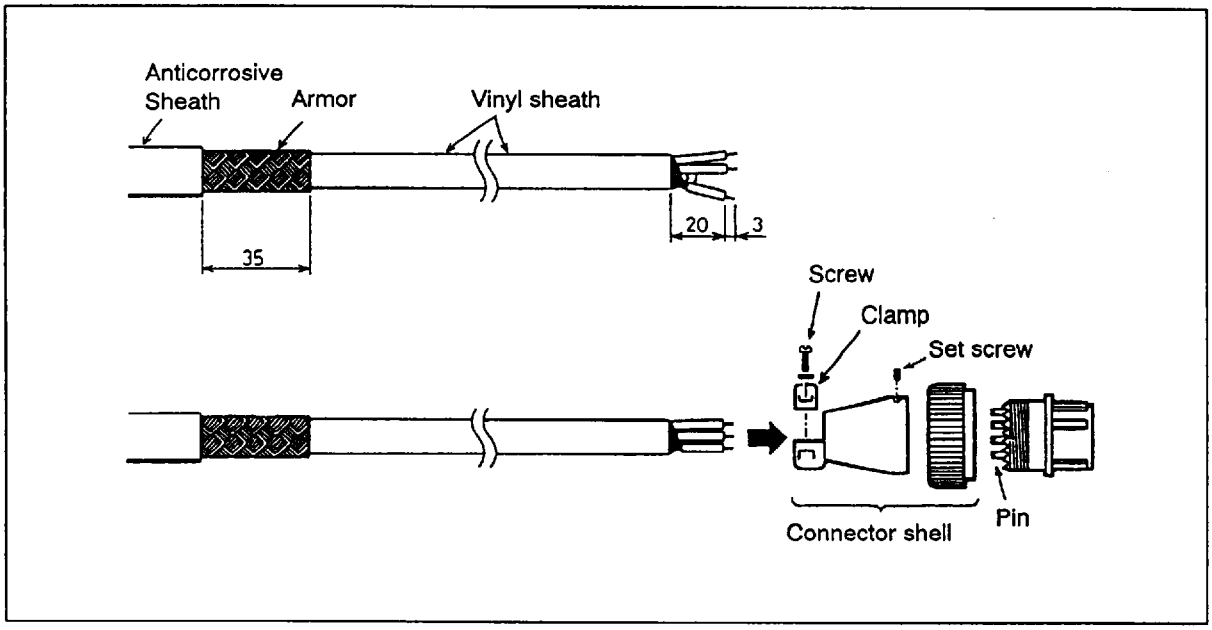


Figure 5-4 Cable fabrication

4. Other cables

All other cables are terminated at a terminal strip.

1) Processing the armor

- **Cable passed through cable clamp**

  Locate the armor in the cable clamp.

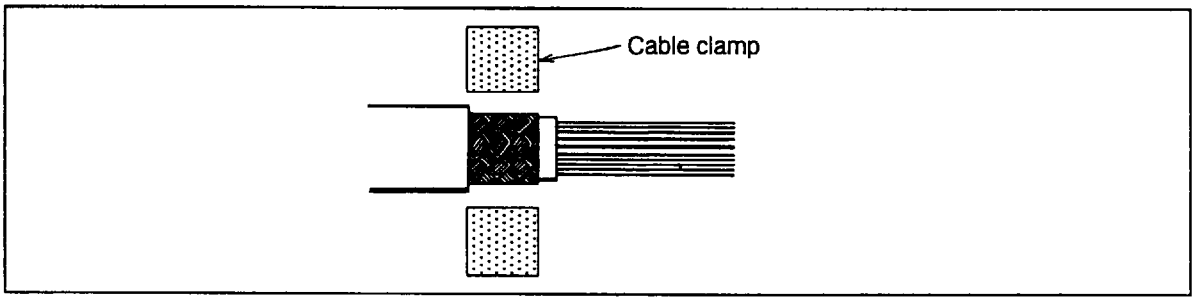


Figure 5-5 Cable fabrication

• **Cable passed through cable gland**
Solder a vinyl wire w/crimp-on lug to the armor and fasten it to the earth terminal.

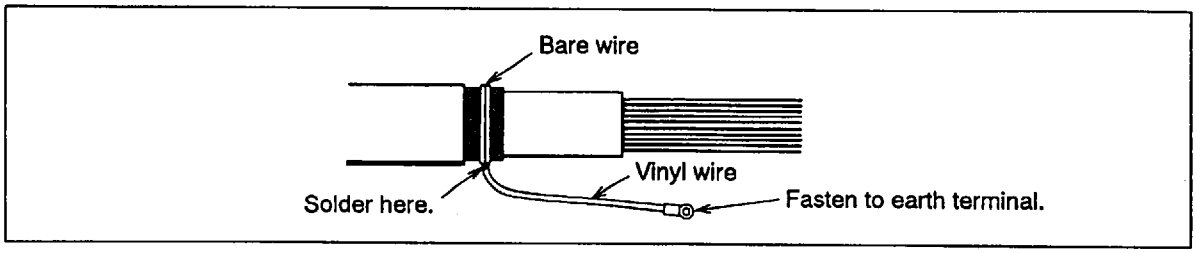


Figure 5-6 Cable fabrication

2) Processing the shield

• **Individual shields**
Undo individual shields only near the terminal strip to which its wire is connected. Tape shields for insulation.

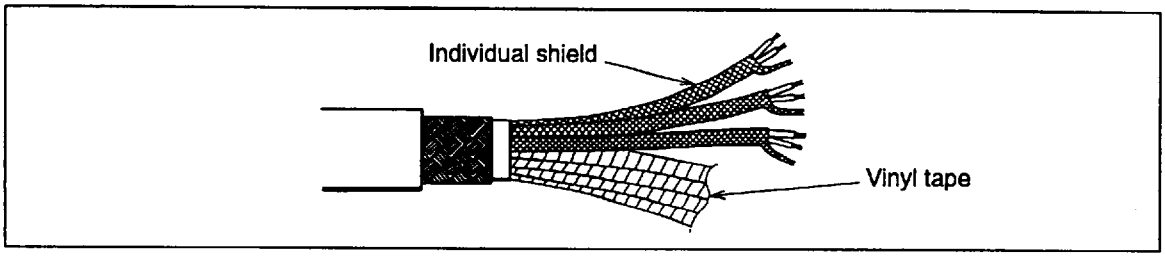


Figure 5-7 Cable fabrication

• **Common shield**
Undo common shield at the cable gland of equipment and tape it for insulation.

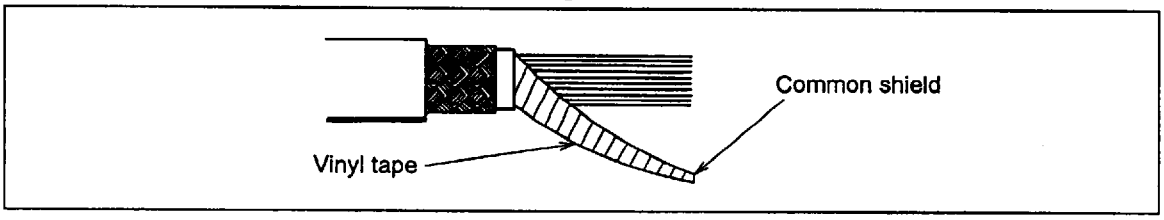


Figure 5-8 Cable fabrication

5.3 Remarks on Connection of Other Equipment

1. KP input signal to reject interference

When a Tx trigger pulse (KP) input to the system is giving off interference, note the following:

1) Interference rejection signal input circuit
Two input ports are provided in the processor unit for connection of KP for interference rejection. Use either port.

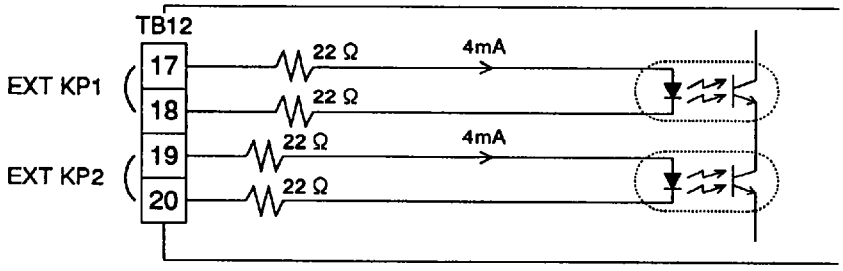


Figure 5-9 KP inout circuit

2) Current requirement
Recommended current is 4 mA while the circuit operates normally at 2 mA to 20 mA. Adjust resistance of output circuit in equipment connected to obtain recommended current.

3) Signal logic
Use signal logic equivalent to electric current flow when the system is transmitting.

2. NMEA I/O circuit

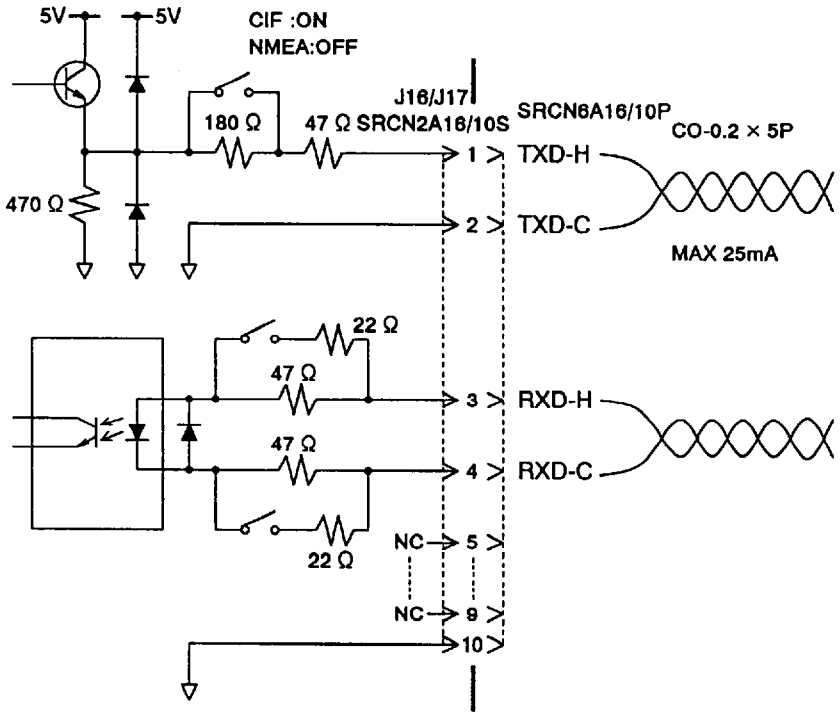


Figure 5-10 NMEA I/O circuit

The maximum allowable current in the NMEA output line is 25 mA and recommended current is 10 mA. When terminating the line by a photo coupler for current loop configuration, take suitable means at the signal receive side to limit the current. If, for example, forward voltage drop in the photo coupler is 2.2 V;
[4.8 - 2.2 (V)]/[10 (mA)] - 227 (Ω) = 33 (Ω)
therefore, insert a 33 ohm resistor in series in the line.

6. INITIAL SETTINGS

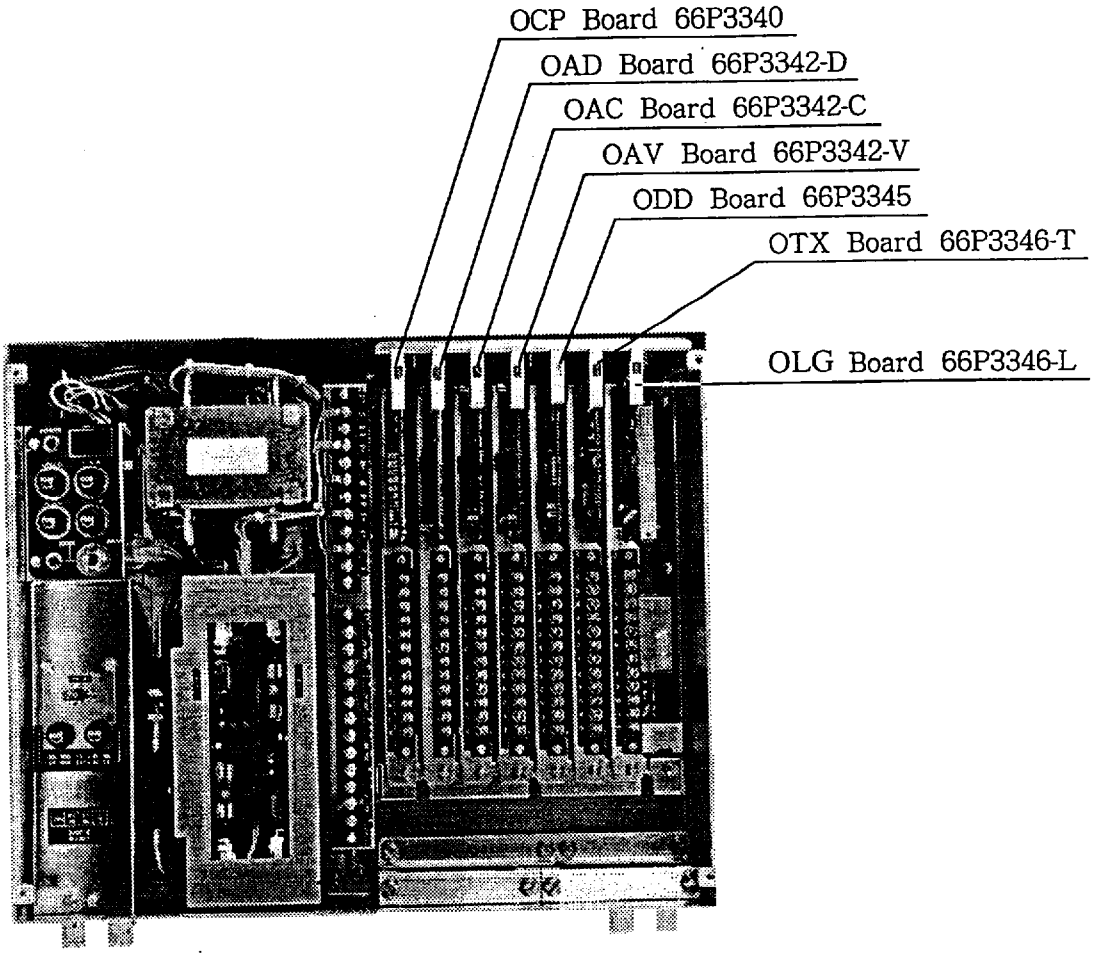
6.1 Processor Unit

When a KP is input to the system, turn on appropriate DIP switch as follows.

<table>
<tr><th>Board</th><th colspan="2">DIP switch</th><th>Function</th><th>Setting</th></tr>
<tr><td rowspan="2">MCP Board 66P3310</td><td rowspan="2">S3</td><td>7</td><td>Interference rejector 1</td><td>Turn ON when a KP signal is conneted to TB12-#17 and #18 in the Processor unit to reject interference from other ultrasonic equipment.
OFF: Int. Rej.1 OFF(Default setting) ON : Int. Rej.1 ON</td></tr>
<tr><td>8</td><td>Interference rejector 2</td><td>Turn ON when a KP signal is connected to TB12-#19 and #20 to reject interference from other ultrasonic equipment.
OFF: Int. Rej.2 OFF(Default setting) ON : Int. Rej.2 ON</td></tr>
<tr><td rowspan="2">VOC Board 66P3612</td><td>S2</td><td>678</td><td>Speed output dummy</td><td>
<table>
<tr><th colspan="3">S2 dip switch No.</th><th rowspan="2">Output format</th></tr>
<tr><th>6</th><th>7</th><th>8</th></tr>
<tr><td>OFF</td><td>–</td><td>–</td><td>Normal Condition (Not output dummy sig.)</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>Min. value (-10kt for almost case)</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Changable between -10 to 30/40kt</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Output 0 kt</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Max. speed 30kt or 40kt</td></tr>
</table>
</td></tr>
<tr><td>S3</td><td>1</td><td>Analogmeter Range</td><td>
<table>
<tr><th>1</th><th>Range</th></tr>
<tr><td>OFF</td><td>30 kt</td></tr>
<tr><td>ON</td><td>40 kt</td></tr>
</table>
</td></tr>
</table>

Board	Jumper	Function	Setting	
VMT Board 66P3611	JP4 JP5 JP6 JP7 JP8	Analog indicator selection	JP4:1,3 JP7:1,3 JP5:1,3 JP8:1 JP6:1,3	Remove VOC Board(66P3612) and MCNA Board(66P3616) to access the Jumpers under the MCNA board.
		Distributor selection	JP4:2,4 JP7:2,4 JP5:2,4 JP8:2 JP6:2,4	

6.2 Distributor



Quantity and type of boards to be incorprated change with equipment specifications.

Figure 6-1 Distributor

Set DIP switches on circuit boards incorporated in accordance with specifications of equipment connected.

Board	DIP switch		Function	Setting
OCP Board 66P3340	S1	1 2 3	Speed dummy output	1 / 2 / 3 / Specification – / – / OFF / Normal OFF / OFF / ON / 0 knot output ON / OFF / ON / Max. (30 or 40 knot) ON / ON / ON / Variable(-10 to 30/40 knot) OFF / ON / ON / Min. (almost case: -10 knot)

<table>
<tr><th>Board</th><th colspan="2">DIP switch</th><th>Function</th><th>Setting</th></tr>
<tr><td rowspan="2">OAV Board 66P3342 -V</td><td rowspan="2">S1</td><td>1
2</td><td>Ship's speed voltage output selection</td><td>Selct ship's speed versus voltage characteristics according to specifications of equipment connected to the OAV Board.
<table><tr><th>Specification</th><th>1</th><th>2</th></tr><tr><td>-10~40 knot = -2.50~10.0V</td><td>OFF</td><td>OFF</td></tr><tr><td>-10~30 knot = -3.33~10.0V</td><td>ON</td><td>OFF</td></tr><tr><td>-10~25 knot = -4.00~10.0V</td><td>OFF</td><td>ON</td></tr><tr><td>-10~20 knot = -5.00~10.0V</td><td>ON</td><td>ON</td></tr></table></td></tr>
<tr><td>3
4</td><td>Speed output selection</td><td>Select type of ship's speed to output from OAV Board.
<table><tr><th>Output speed</th><th>3</th><th>4</th></tr><tr><td>Fore-aft speed</td><td>OFF</td><td>OFF</td></tr><tr><td>Port-stbd speed</td><td>ON</td><td>OFF</td></tr><tr><td>Vector Speed</td><td>OFF</td><td>ON</td></tr></table></td></tr>
<tr><td rowspan="2">OAC Board 66P3342 -C</td><td rowspan="2">S1</td><td>1
2</td><td>Ship's speed current output selection</td><td>Select ship's speed versus current output characteristics according to specifications of equipment connected to the OAC Board.
<table><tr><th>Specification</th><th>1</th><th>2</th></tr><tr><td>-10~40 knot = 4.0~20.0mA
0 knot = 7.2mA</td><td>OFF</td><td>OFF</td></tr><tr><td>-10~30 knot = 4.0~20.0mA
0 knot = 8.0mA</td><td>ON</td><td>OFF</td></tr><tr><td>-10~25 knot = 4.0~20.0mA
0 knot = 8.57mA</td><td>OFF</td><td>ON</td></tr><tr><td>-10~20 knot = 4.0~20.0mA
0 knot = 9.33mA</td><td>ON</td><td>ON</td></tr></table></td></tr>
<tr><td>3
4</td><td>Speed output selection</td><td>Select type of ship's speed to output from the OAC Board.
<table><tr><th>Output speed</th><th>3</th><th>4</th></tr><tr><td>Fore-aft speed</td><td>OFF</td><td>OFF</td></tr><tr><td>Port-stbd speed</td><td>ON</td><td>OFF</td></tr><tr><td>Vector speed</td><td>OFF</td><td>ON</td></tr></table></td></tr>
</table>

Board	DIP switch		Function	Setting
OAD Board 66P3342 -D	S1	1	Analog indicator selection	Set according to analog indicator connected to the OAD Board. Analog indicator: 1 MF-22A: OFF DS-381/382: ON Note: Speed current output to analog indicator: ON: -10~40 kont = -2.50~10.0 mA OFF : -10~30 knot = -3.33~10.0 mA

6.3 Digital Indicator

Set the DIP switch S1 on PCP board at installation.

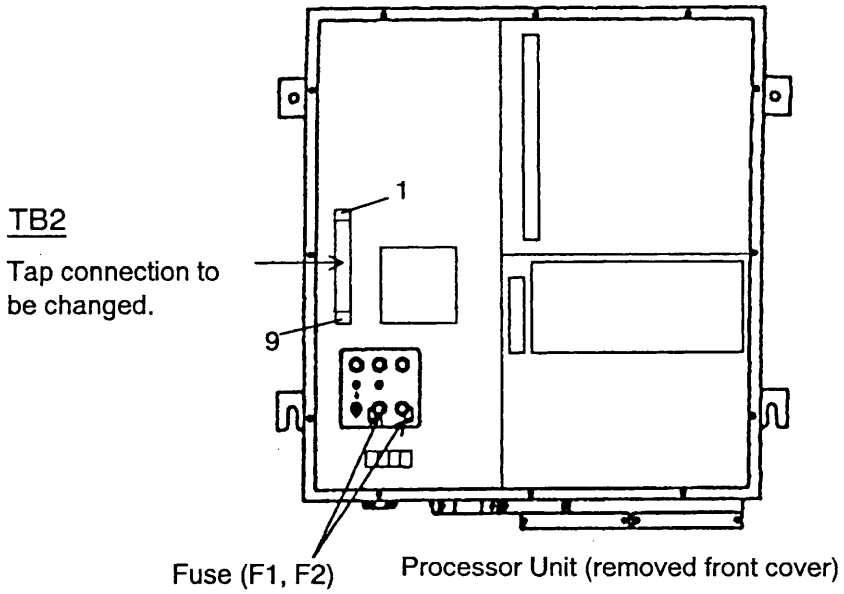
Board	DIP switch		Function	Setting
PCP Board 66P3355	S1	1 2	Depth Unit Selection	Depth Unit: 1: –, 2: OFF m: – / OFF ft: OFF / ON fm: ON / ON DS-350/351 only
		3	Display Mode Selection	OFF: Type A ON: Type B DS-350 only
	※	4	Rate Gyro Connection	OFF: Yes ON: No DS-351 only
	※	5	Gyrocompass Connection	OFF: Yes ON: No DS-350/351 only
		6	Depth Selection	OFF: Internal Depth ON: External Depth DS-350/351 only
		7 8	Model Selection	Model: 7 / 8 DS-350: OFF / OFF DS-351: OFF / ON No use: ON / OFF No use: ON / ON

Note: ※ When DS-350/351 is connected to DS-50, dip switches S1 #4 and #5 on PCP board (60P3355) should be set to ON.

7. CHANGING POWER SUPPLY SPECIFICATIONS

This equipment can be powered by 100, 110, 200 or 220 VAC, and its power specification is set at the factory in accordance with customers order. If the specification is different from ship's power supply, change jumper wires and fuses in the processor unit as follows.

Changing tap connection



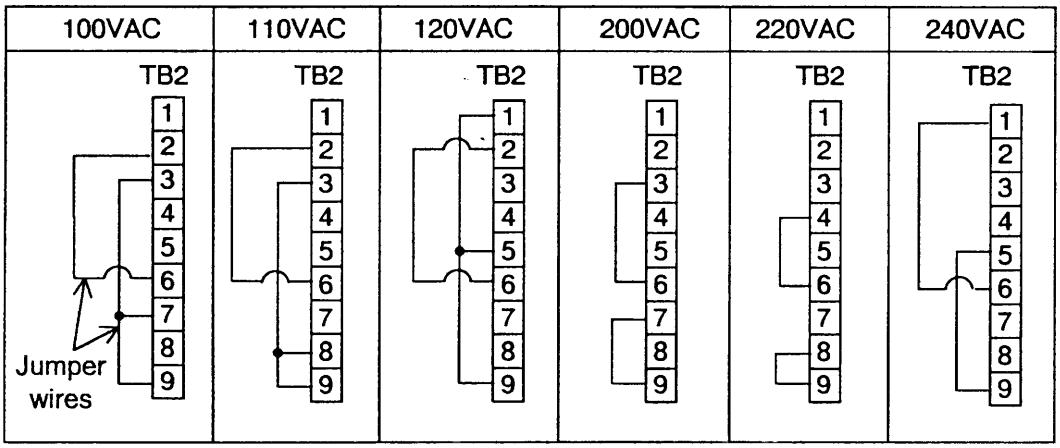


Figure 7-1 Changing tap connection

Changing fuses

Change fuse F1 and F2 by according to ship's mains.

SHIP'S MAINS	FUSE(F1, F2)
100/110/120VAC	5A(125V)
200/220/240VAC	3A(125V)

8. LIST OF DIP SWITCH SETTINGS

DIP Switch Location

The DIP switches are located on the boards shown in the table below.

Unit	Board	DIP Switch
Display Unit DS-500	VCP Board	S1 (all off)
Processor Unit DS-510/511	MCP Board	S1, S2, S3, S4
	MFT Board	S1
	MIF Board	S1, S3, S4, (S2, S5 and S6: no use)

Setting and Function of DIP Switch

○ : Do not change setting.
● : Change setting as required.

1) Processor Unit

Board	Switch Setting			Function	Factory Setting
MCP Board	S1	0		Monitor signal: Fore beam GEL	○
		1		Ditto: Fore beam EL	
		2		Ditto: Starboard beam GEL	
		3		Ditto: Starboard beam EL	
		4		Ditto: Port beam GEL	
		5		Ditto: Port beam EL	
		6		Ditto: TVG + external KP	
		7		Ditto: External KP	
		8 to F		Unused	
		GEL: Echo signal with TVG effected EL: Echo signal without TVG effected			
	S2	#1	#2	Bottom tracking beam selection	
		OFF	OFF	Fore beam	○
		ON	OFF	Starboard beam	
		ON	OFF	Port beam	
		ON	ON	All beams	
		#3	OFF	TX pulselength in water tracking mode: Standard	●
			ON	Ditto: Long	
		#4	OFF	Automatic sound speed correction: On	●
			ON	Ditto: Off	
		#5	OFF	Angular speed latitude error correction: On	●
			ON	Ditto: Off	
		#6	OFF	Exponential smoothing: On	●
			ON	Ditto : Off	
		#7		Unused	
		#8	OFF	Ship's speed smoothing: Yes (without MKL pcb)	
			ON	Ditto: No (without MKL pcb)	●

Board	Switch Setting			Function	Factory Setting
MCP Board	S3	#7	OFF	Interference rejector 1: Off	o
			ON	Ditto: On	
		#8	OFF	Interference rejector 2: Off	o
			ON	Ditto: On	
		#1 to #6		Unused	
	S4	0		TVG curve selection: Auto (TVG curve is automatically adjusted based on water temperature measured by DS-30 transducer.)	●
		1		Ditto: Water temp 20°C or less	
		2		Ditto: Water temp 20°C to 25C	
		3		Ditto: Water temp 25°C to 30°C	
		4 to F		Ditto: Water temp 30°C or above	
MFT Board	S1	#8	OFF	Continuous self-test (for factory use): Off	o
			ON	Ditto: On	
		#1 to #7		Unused	

Board	Switch Setting			Function	
MIF Board	S1	#1	OFF	IEC/NMEA Format, Baud rate: 4800bps (Related switch: S1-#8, S4-#7 and S1-#3)	For Port1 J16
			ON	CIF Format, Baud rate: 4800bps	
		#2	OFF	-	
			ON	-	
		#3	OFF	NMEA ver1.5	
			ON	NMEA ver2.0	
		#4	OFF	Logpulse out at forward and backward	
			ON	Logpulse out at forward only	●
		#5	Same as #1 (Related switch: S3-#8, S4-#8 and S1-#7)		For Port2 J17
		#6	-		
		#7	Same as #3		
		#8	OFF	Port 1 IEC: Effective when S1-#1 is OFF (Related switch: S4-#7)	●
			ON	Port 1 NMEA: Effective when S1-#1 is OFF (Related switch: S4-#7)	

Board	Switch Setting			Function	Factory Setting
MIF Board	S4	#1	#2	Ship's speed for distance run pulse selection	
		OFF	OFF	Speed over-the-ground & speed through-water & speed fed from nav sensor	™
		OFF	ON	Speed over-the-ground & speed through-water	
		ON	-	Speed over-the-ground	
		#3 to #6		Unused	
		#7	OFF	Port 1: NMEA Ver 1.5 or 2.0 (Related switch: S1-#3.)	
			ON	Port 1: NMEA Ver. 3.0 (S1-#8: ON) Port 1: IEC 61162-1 Ed2 (S1-#8: OFF)	●
		#8	OFF	Port 2: NMEA Ver 1.5 or 2.0 (Related switch: S1-#7.)	
			ON	Port 2: NMEA Ver. 3.0 (S3-#8: ON) Port 2: IEC 61162-1 Ed2 (S3-#8: OFF)	●
	S3	#8	OFF	Port 2 IEC: Effective when S1-#5 is OFF (Related switch: S4-#8)	●
			ON	Port 2 NMEA: Effective when S1-#5 is OFF (Related switch: S4-#8)	

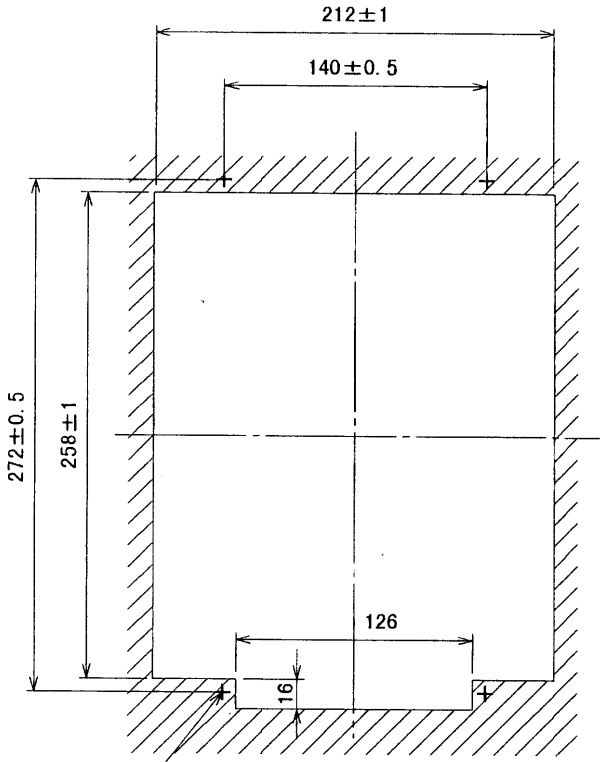
Setting of CIF/NMEA(1) and CIF/NMEA(2) ports

You can choose output data format among IEC, NMEA and CIF.

Setting	Port1 Select output format for CIF, IEC or NMEA.			
	CIF/IEC(NMEA)	IEC/NMEA	IEC(NEMA) Ver	IEC(NMEA) Ver
	S1-#1	S1-#8	S4-#7	S1-#3
CIF	ON	-	-	-
IEC61162-1 Ed2	OFF	OFF	ON	-
NMEA Ver 3.0	OFF	ON	ON	-
NMEA Ver 2.0	OFF	ON	OFF	ON
NMEA Ver 1.5	OFF	ON	OFF	OFF

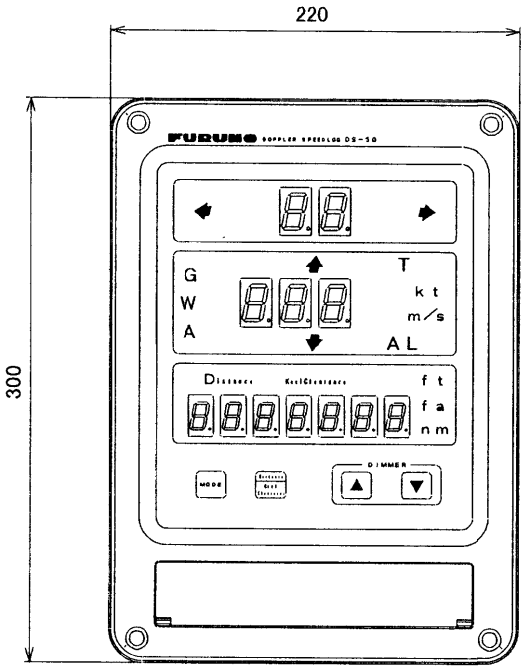
Setting	Port2 Select output format for CIF, IEC or NMEA.			
	CIF/IEC(NMEA)	IEC/NMEA	IEC(NEMA) Ver	IEC(NMEA) Ver
	S1-#5	S3-#8	S4-#8	S1-#7
CIF	ON	-	-	-
IEC61162-1 Ed2	OFF	OFF	ON	-
NMEA Ver 3.0	OFF	ON	ON	-
NMEA Ver 2.0	OFF	ON	OFF	ON
NMEA Ver 1.5	OFF	ON	OFF	OFF

FURUNO



4－取付穴
FIXING HOLES

取付穴寸法（参考図）
CUTTING DIMENSIONS



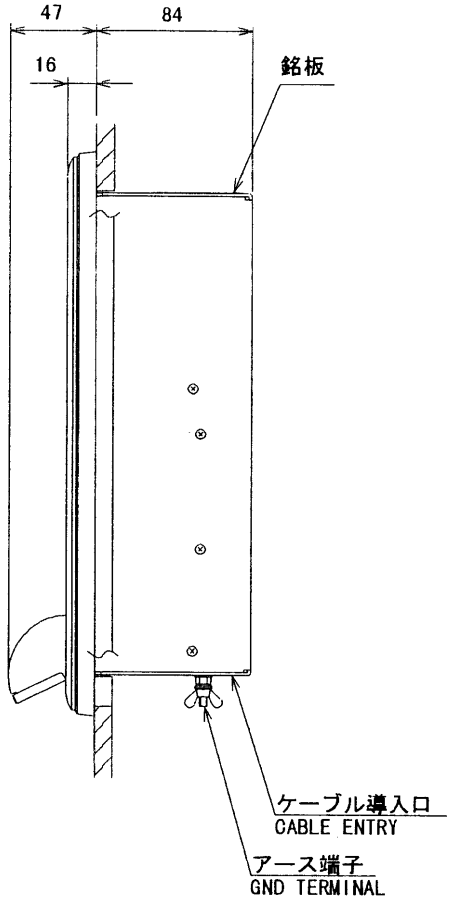


表１　TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 ＜ L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3

注　記

１）装備ケーブルはサービス時、本体を十分に引き出せるよう余裕を持たせること。

２）取付用ネジは、トラスタッピングネジ　呼び径５×１６を使用のこと。

３）指定外の寸法公差は表１による。

NOTE

1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
2. USE TAPPING SCREWS 5x16 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

DRAWN June26 '00 T.YAMASAKI			TITLE DS-500
CHECKED June26 '00 Y.Kimura			名称 主指示器（埋込装備）
APPROVED June26 '00 Y.Kimura		DS-50	外寸図
SCALE 1/4	MASS ±10% 4.4 kg		NAME DISPLAY UNIT (FLUSH MOUNT)
DWG. No. C7241-G01- D		66-022-1000-G3	OUTLINE DRAWING

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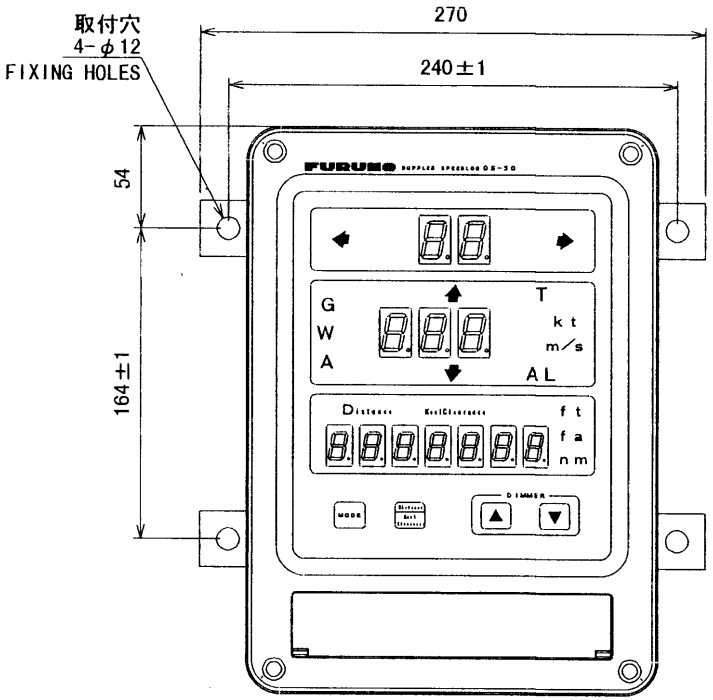
D-1

FURUNO



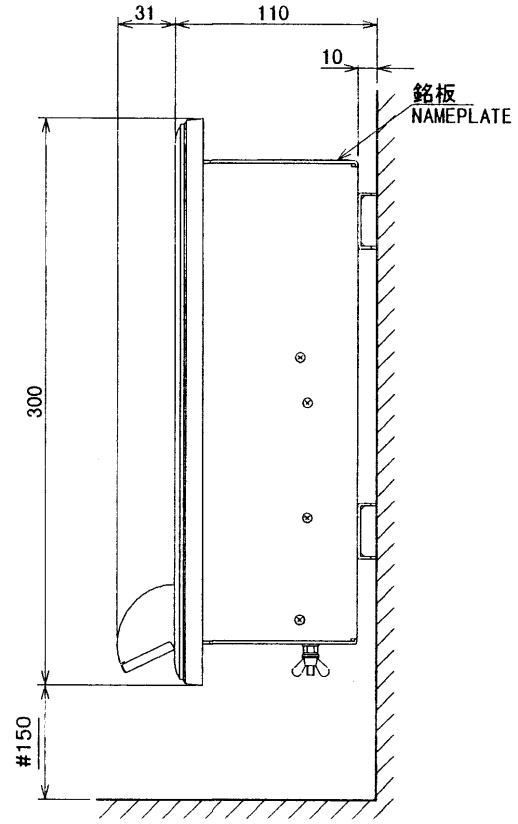
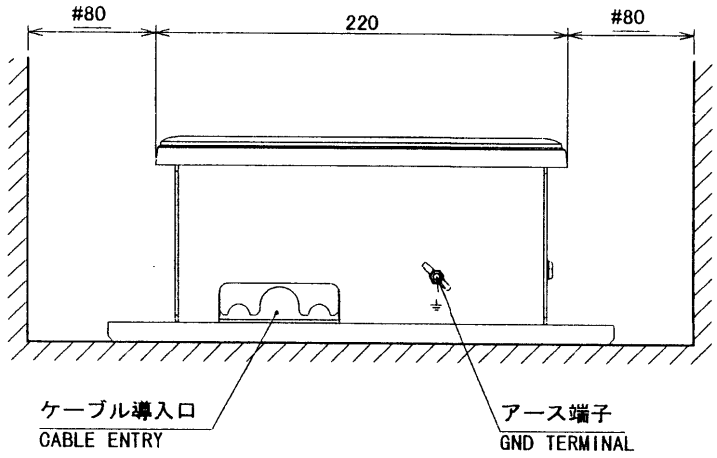


表1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 < L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3



注 記
1）装備ケーブルはサービス時、本体を十分に引き出せるよう余裕を持たせること。
2）取付用ネジは、M10ボルトまたはコーチボルト呼び径９を使用のこと。
3）指定外の寸法公差は表１による。
4）＃：推奨する最小サービス空間寸法。

NOTE
1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
2. USE M10 BOLTS OR CARCH BOLTS φ9 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
4. #: RECOMMENDED SERVICE CLEARANCE.

DRAWN June 26 '00 TYAMASAKI			TITLE DS-500
CHECKED June 26 '00 T.Kuni			名称 主指示器（壁掛装備）
APPROVED June 26 '00 T.Kuni		DS-50	外寸図
SCALE 1/4	MASS ±10% 4.7 kg		NAME DISPLAY UNIT (BULKHEAD MOUNT)
DWG. No. C7241-G02- D		66-022-1100-G1	OUTLINE DRAWING

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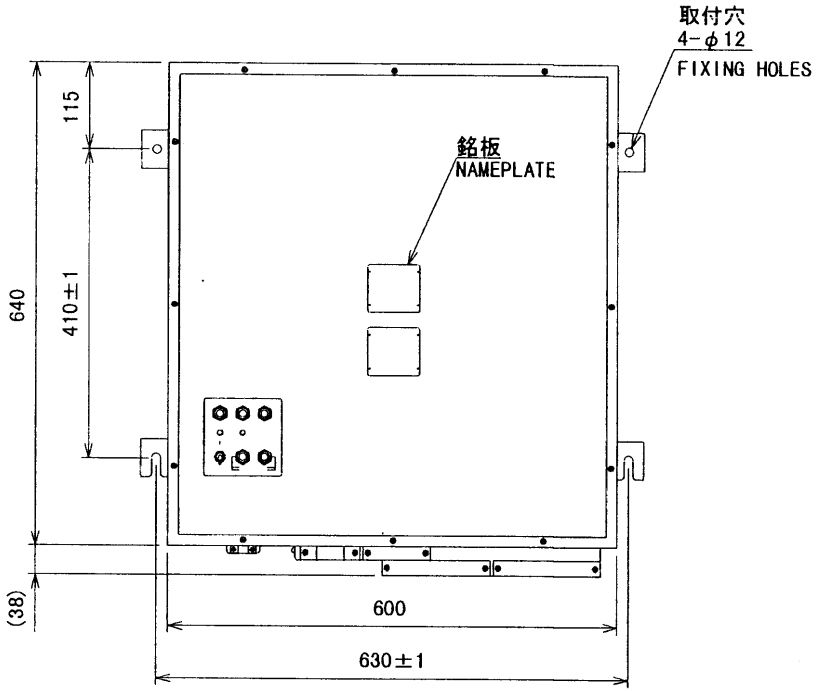
FURUNO



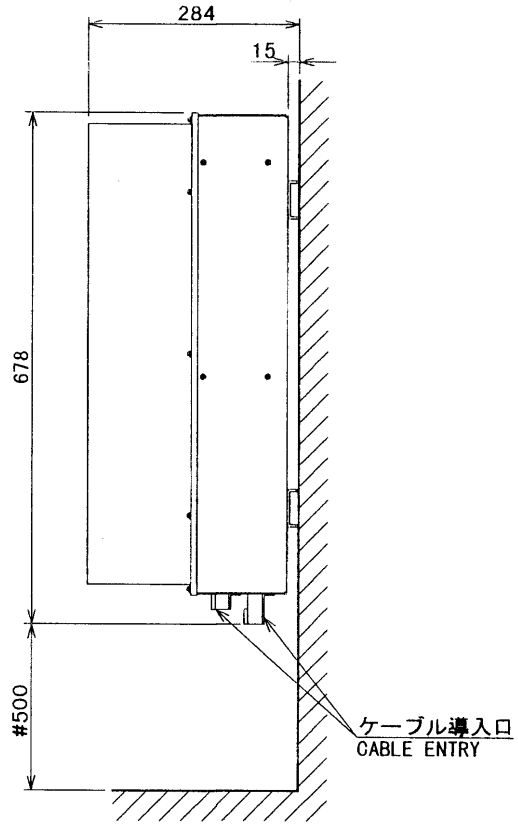
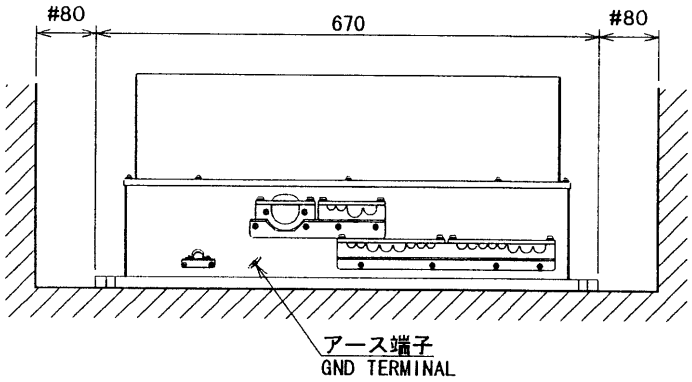


表１　TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 ＜ L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3
500 ＜ L ≦ 1000	±4

表２　TABLE 2

型式 TYPE	質量(kg±10%) MASS
DS-510	38.5
DS-511	36.7



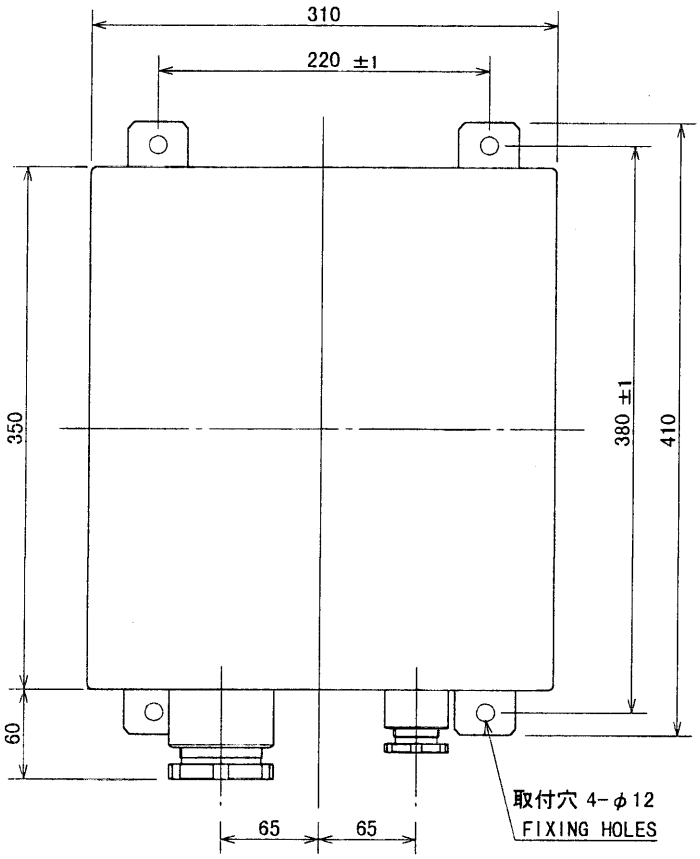
注　記　１）取付用ネジはＭ１０ボルトまたはコーチボルト呼び径９を使用のこと。
２）#印寸法は最小サービス空間寸法とする。
３）指定なき寸法公差は表１による。
４）装備ケーブルの端末処理は装備要領書参照のこと。

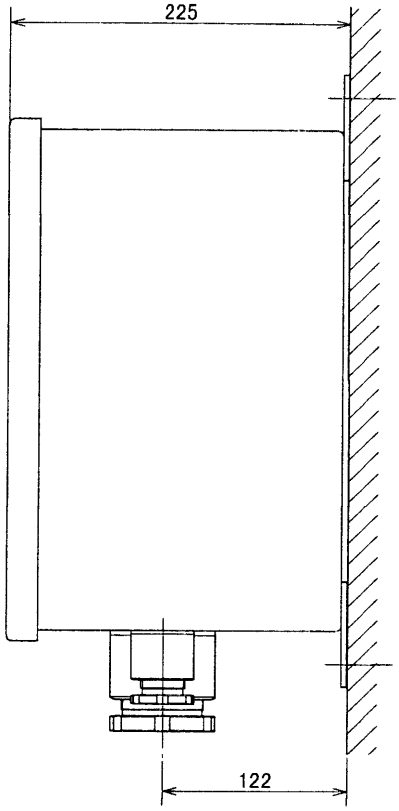
NOTE　1. USE M10 BOLTS OR CORCH BOTLS φ9 FOR FIXING THE UNIT.
2. #: RECOMMENDED SERVICE CLEARANCE.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
4. REFER TO INSTALLATION MANUAL FOR FABRICATION OF CABLE ENDS.

DRAWN June 26 '00 T.YAMASAKI			TITLE DS-510/511
CHECKED June 26 '00 Y.K			名称 演算部
APPROVED June 26 '00 Y.K		DS-50	外寸図
SCALE 1/10	MASS 表２参照 SEE TABLE 2		NAME PROCESSOR UNIT
DWG. No. C7241-G03- D		66-022-2000-G2	OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO





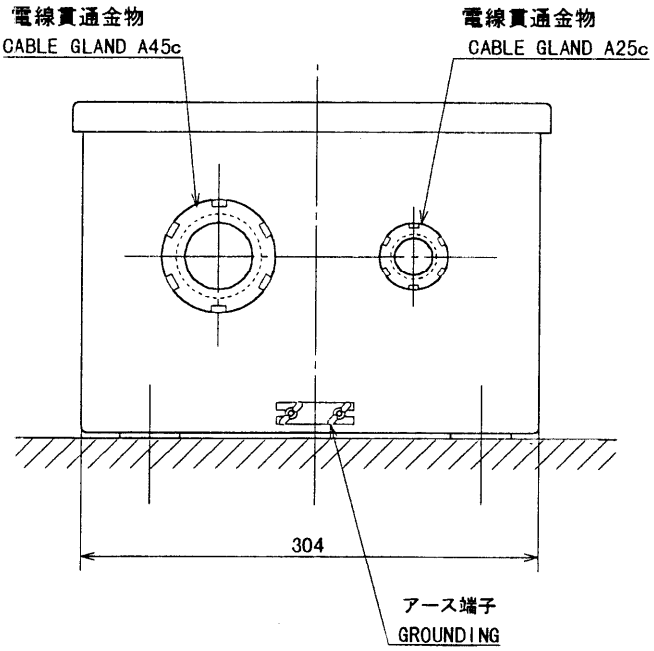
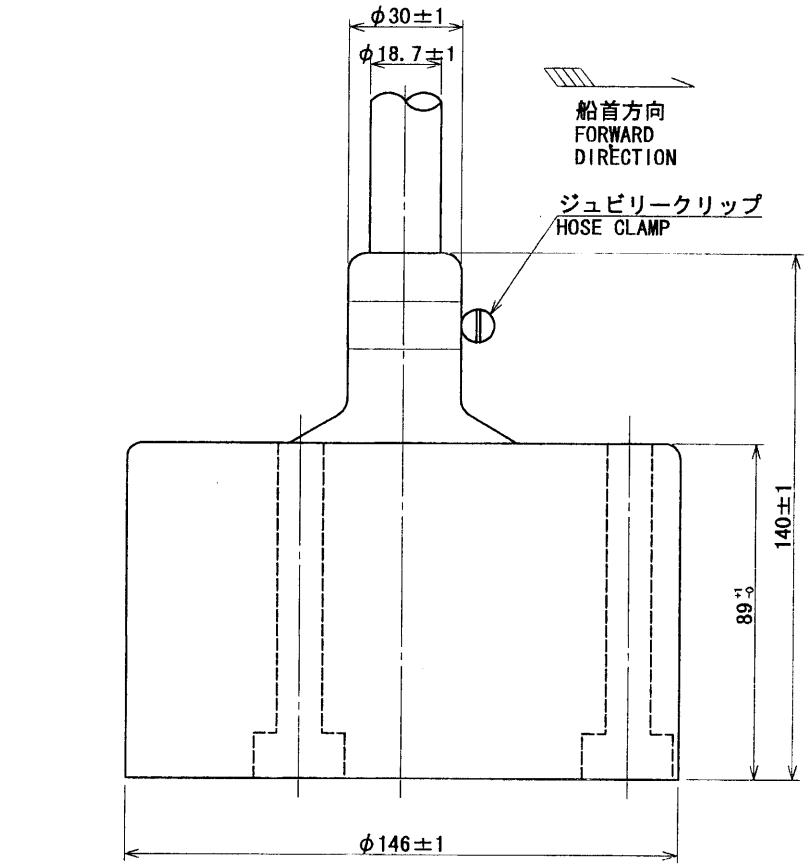


表1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 < L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3

DRAWN June 27'00 T.YAMASAKI		TITLE	DS-520
CHECKED June 28'00 Y.Kimura		名称	送受信器
APPROVED June 28'00 Y.Kimura			外寸図
SCALE 1/5 MASS kg		NAME	TRANSCEIVER
DWG. No. C7241-G08-E	66-022-3000-G0		OUTLINE DRAWING

FURUNO



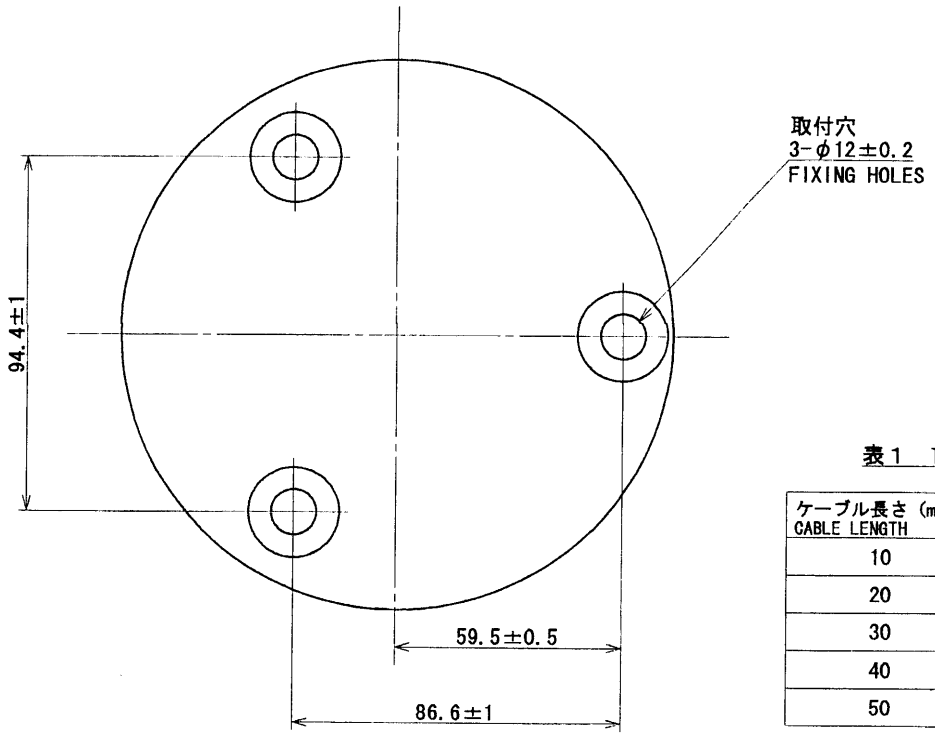


表1　TABLE 1

ケーブル長さ (m) CABLE LENGTH	質量 (kg) MASS
10	7.6±1
20	12.6±2
30	17.6±2
40	22.6±3
50	27.6±3

DRAWN Nov.26'99 T.YAMASAKI			TITLE DS-530
CHECKED Nov.26'99 K.Kusunoki			名称 送受波器
APPROVED Nov.26'99 K.Kusunoki		DS-50	外寸図
SCALE 1/2	MASS TABLE 1		NAME TRANSDUCER
DWG. No. C7241-G04- E		66-022-6000-G2	OUTLINE DRAWING

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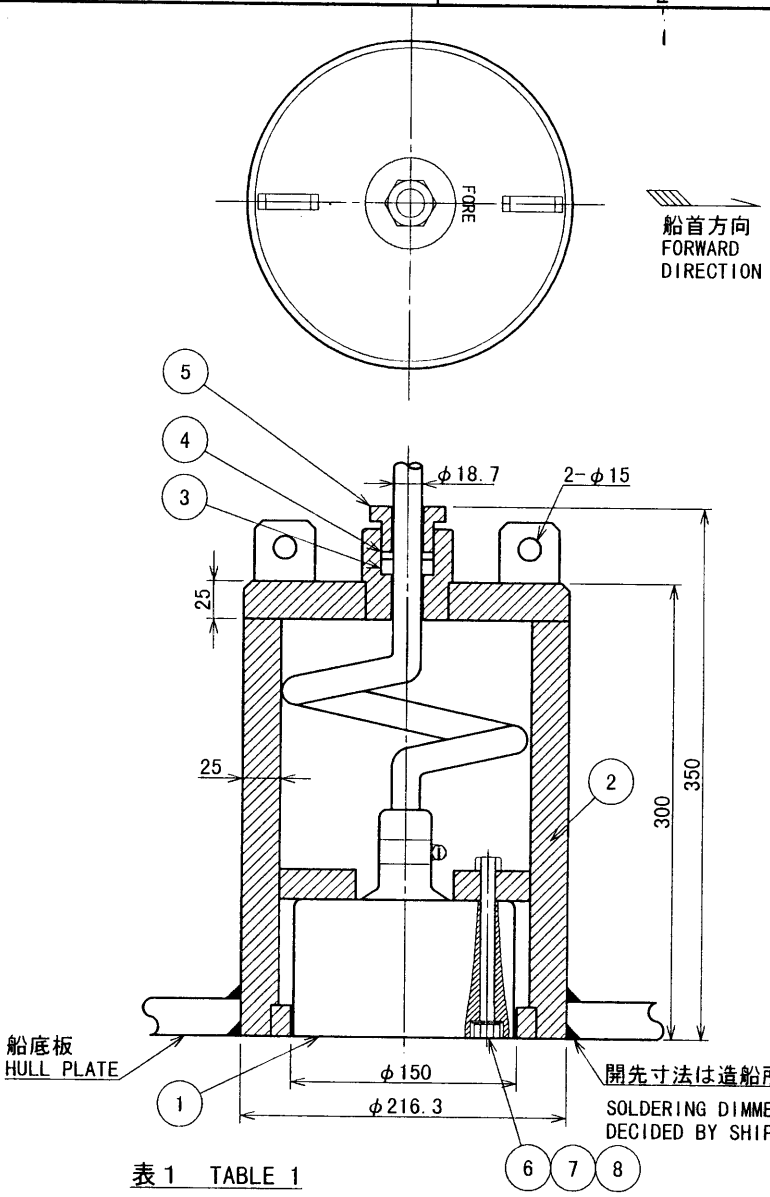

表1 TABLE 1

寸法範囲 (mm) DIMENSION	公差 (mm) TOLERANCE
0 ＜ L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3

注記

1. 指定なき寸法公差は表1による。
2. 船底タンク板厚は標準25mmです。これ以上の厚さが必要な場合は別途打合せ願います。
3. 船底タンク材質はKSTPG370です。その化学成分を表2に示します。
4. 船底タンクを船底に溶接する際、船首船尾方向の据付誤差は±1°以内とする。また、水平方向の取付はタンクの上面が吃水線と±1°以内の誤差で平行になるようにしてください。
5. 送受波器面にはマリンスター20を塗布しています。その他の船底用塗料を塗布しないでください。

NOTES

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
2. NOMINAL THICKNESS OF THE CASING IS 25 mm. TO BE DISCUSSED FOR THICKER ONE.
3. CHEMICAL COMPOSITION OF THE CASING MATERIAL KSTPG370 IS AS TABLE 2.
4. ORIENT BOW MARK OF THE CASING IN PARALLEL WITH SHIP'S FORE-AFT LINE AND THE TOP OF THE CASING IN PARALLEL WITH WATER-LINE TO AN ACCURACY OF 1 DEGREE OR BETTER.
5. THE TRANSDUCER BOTTOM FACE IS COATED WITH MARINE STAR 20. DO NOT APPLY OTHER TYPE OF PAINT.

表2 TABLE 2

化学成分 CHEMICAL COMPOSITION	C	Si	Mn	P	S	Cr	Mo
含有量 (%) CONTENT	0.25以下 OR LESS	0.35以下 OR LESS	0.30-0.90	0.040以下 OR LESS	0.040以下 OR LESS	なし NIL	なし NIL

ITEM	NAME		MATERIAL	Q'TY	DWG NO	REMARKS
8	平座金 FLAT WASHER	M10	SUS304	3		
7	バネ座金 SPRING WASHER	M10	SUS304	3		
6	六角ボルト HEX. BOLT	M10×110	SUS304	3		
5	締付グランド CABLE GRAND		SUS304	1	66-017-1404	
4	座金 WASHER		SUS304	1	66-017-1402	
3	VAパッキン RUBBER GASKET		CR	1	VA-25	
2	船底タンク CASING		KSTPG370	1	66-022-7001	
1	送受波器 TRANSDUCER			1	DS-530	

DRAWN Nov 4 '99 T.YAMASAKI			TITLE DS-531-B
CHECKED Nov 4 '99 K.Kusunoki			名称 送受波器タンク
APPROVED Nov 4 '99 K.Kusunoki	DS-50		外寸図
SCALE 1/5	MASS 45±5 kg		NAME HULL BOTTOM UNIT
DWG No. C7241-G05- E	66-022-7000- 01		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

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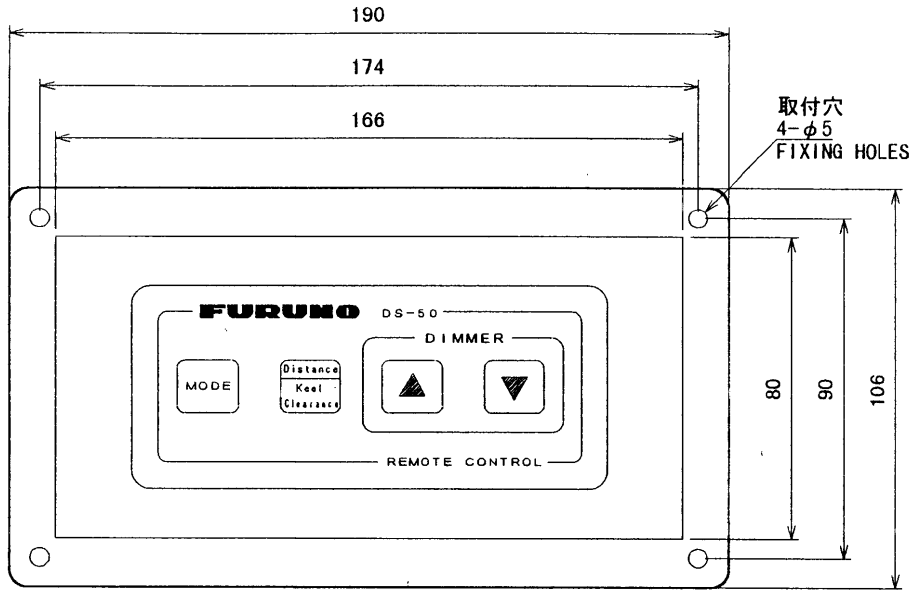


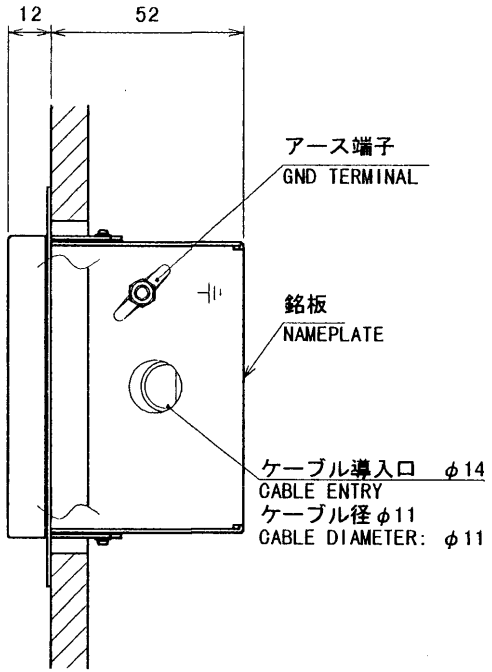
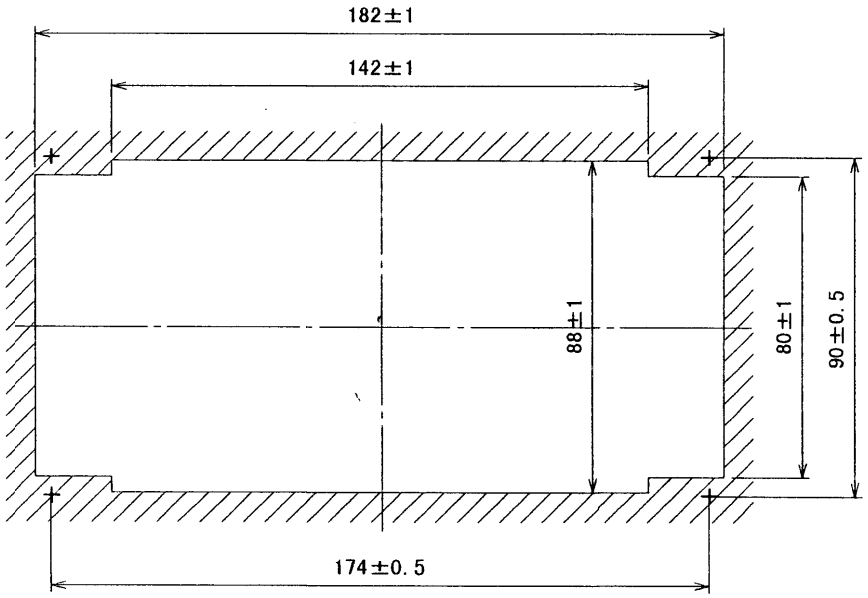


表1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 < L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3



取付穴寸法（参考図）
CUTTING DIMENSIONS

注 記

1）装備ケーブルはサービス時、本体を十分に引き出せるよう余裕を持たせること。

2）取付用ネジは、トラスタッピンネジ呼び径４×１６を使用のこと。

3）指定外の寸法公差は表１による。

NOTE

1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
2. USE TAPPING SCREWS 4x16 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.

DRAWN June 26'00 T.YAMASAKI			TITLE DS-501
CHECKED June 26'00 Y.Kimura			名称 操作箱
APPROVED June 26'00 Y.Kimura	DS-50		外寸図
SCALE 1/2	MASS ±10% 0.6 kg		NAME OPERATION PANEL
DWG. No. C7241-G07- D	66-022-4000-G2		OUTLINE DRAWING

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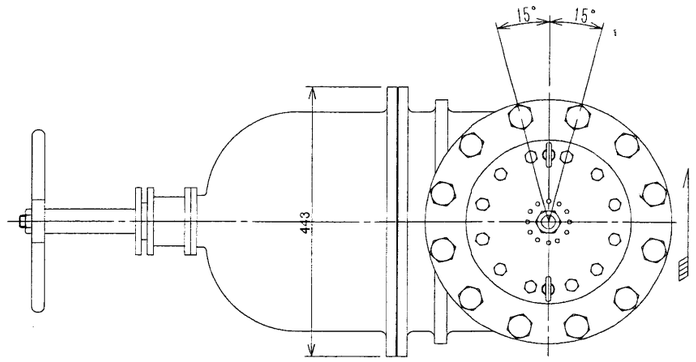
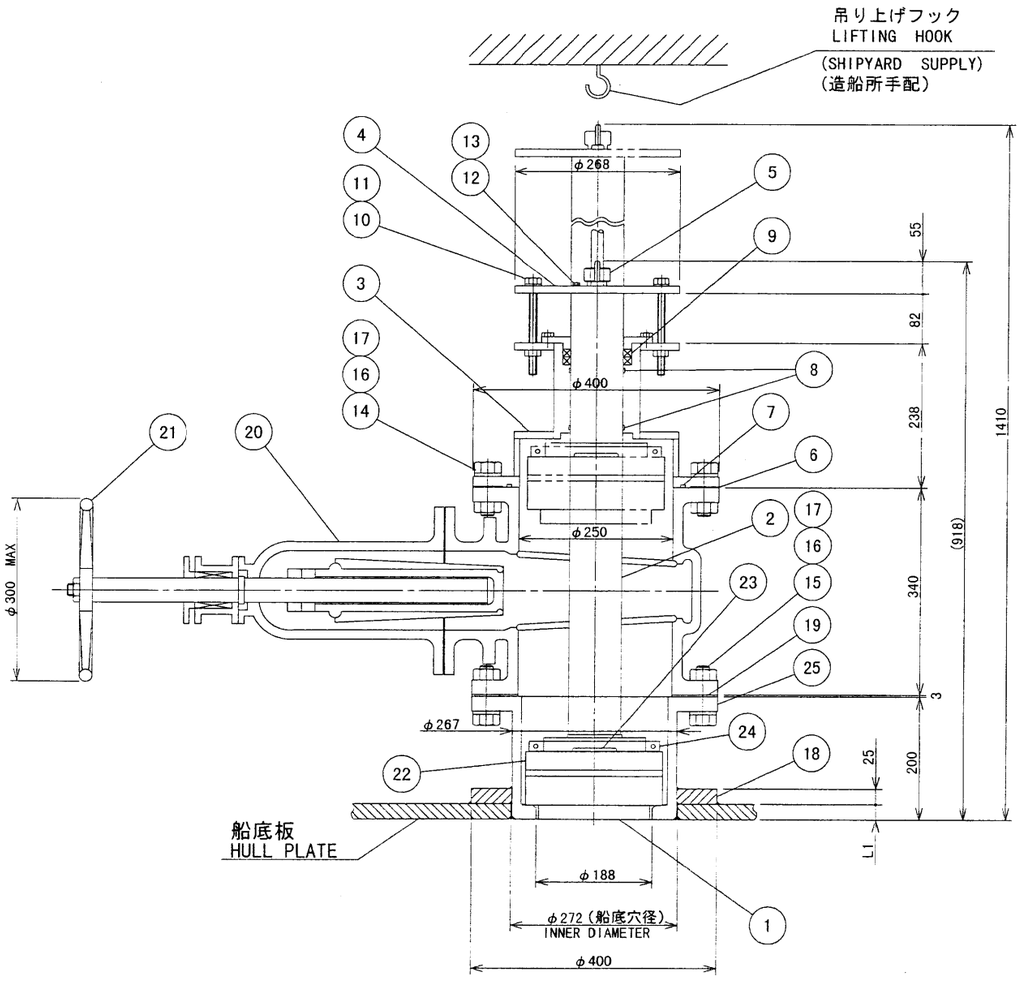
D - 8



船 首 方 向

FORWARD
DIRECTION



注記 NOTES

1. (20) (21) ゲートバルブは原則として造船所殿支給とします。
   (20) (21) GATE VALVE SHOULD BE PREPARED BY DOCKYARD .
2. 船底厚(L1)と船底補強板厚(25mm)の和が60mm以下になるようにして下さい。
   L1寸法を御連絡下さい。
   TOTAL THICKNESS OF HULL PLATE(L1) AND DOUBLING PLATE(L2) MUST BE LESS THAN 60mm. FOR FINISH OF TRANSDUCER FLANGE.
   SPECIFY L1 IN THE TABLE BELOW.

船底板板厚	THICKNESS OF HULL PLATE : L1	mm
船底補強板厚	THICKNESS OF DOUBLING PLATE	25 mm
計	TOTAL * (L1+25) * : MAX. 60mm	mm

3. 船首、船尾方向の取付誤差は±1° 以内にして下さい。
   DIRECTIONAL FITING ERROR IN FORE-AFT LINE SHOULD BE WITHIN ±1° .
4. ゲートバルブ(20)を取付ける際はナット(17)の回り止め対策として、ボルト(14),(15)及びナット(17)を脱脂後、#601(日本ロックタイト)を塗布して完全に締めて下さい。
   PRIOR TO SECURE NUTS (17), CLEAN BOLTS(14),(15)AND NUTS(17)WITH SOLVENT AND APPLY LOCKTIGHT #601 TO THREADS OF THEM.
5. ゲートバルブ部以外の部分は4.9×10^5 Paの水圧試験がされています。
   SEACHEST EXCEPT GATE VALVE IS TESTED UNDER 4.9×10^5 Pa PRESSURE.
6. 指定外の寸法公差は表1による。
   TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
7. 送受波器面にはマリンスター20を塗布しています。その他の船体用塗料を塗布しないでください。
   THE TRANSDUCER BOTTOM FACE IS COATED WITH MARINE STAR 20. DO NOT APPLY OTHER TYPE OF PAINT.

表1 TABLE 1

寸法範囲 (mm) DIMENSION	公差 (mm) TOLERANCE
0 < L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3
500 < L ≦ 1000	±4
1000 < L ≦ 2000	±5
2000 < L ≦ 4000	±7
4000 < L ≦ 8000	±10
8000 < L	±15

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG NO.	摘要 REMARKS
25	スペーサ SPACER	STPG370	1		
24	クランプ CLAMP BAND	SUS304	2		
23	クランプピン CLAMP PIN	SUS304	2		
22	防蝕亜鉛 ANTI-CORROSIVE ZINC	ZAP	2		
21	ハンドル HANDLE	FC20	1		造船所手配 SHIPYARD SUPPLY
20	ゲートバルブ GATE VALVE 9.8×10^5 Pa	SC46	1	JIS F7366-250B	造船所手配 SHIPYARD SUPPLY
19	ガスケット GASKET	アスベスト複合シート ASBESTOS JOINT SHEET	1	t=3 mm	
18	船底補強板 DOUBLING PLATE	KA	1		
17	ナット NUT M22	SUS304	12		
16	バネ座金 SPRING WASHER M22	SUS304	12		
15	六角ボルト BOLT M22×80	SUS304	12		
14	六角ボルト BOLT M22×65	SUS304	12		
13	バネ座金 SPRING WASHER M6	SUS304	12		
12	六角ボルト BOLT M6×12	SUS304	12		
11	バネ座金 SPRING WASHER M12	SUS304	12		
10	六角ボルト BOLT M12×150	SUS304	12		
9	グリース綿 GREASE COTTON				
8	O-リング O-RING	NBR	2		
7	O-リング O-RING	NBR	1		
6	ガスケット GASKET	CR	1	t=2 mm	
5	取付金具 FIXING GRAND	SUS304	1		
4	押さえ板 UPPER PLATE	SS400	1		
3	蓋 SEACHEST CAP	SS400	1		
2	シャフト SHAFT	SUS304	1		
1	送受波器 TRANSDUCER		1		

DRAWN Oct 28 '99 T.YAMASAKI		TITLE	DS-532
CHECKED Oct 28 '99 K.KUSUNOKI		名称	ゲートバルブ式送受波器タンク（スペーサ付）
APPROVED Oct 28 '99 K.KUSUNOKI	DS-50		船底装備図
SCALE 1/10 MASS 400±50 kg		NAME	SEACHEST WITH GATE VALVE (W/ SPACER)
DWG No. C7241-G10- D	65-005-8100-G2		HULL UNIT INSTALLATION

FURUNO ELECTRIC CO., LTD.

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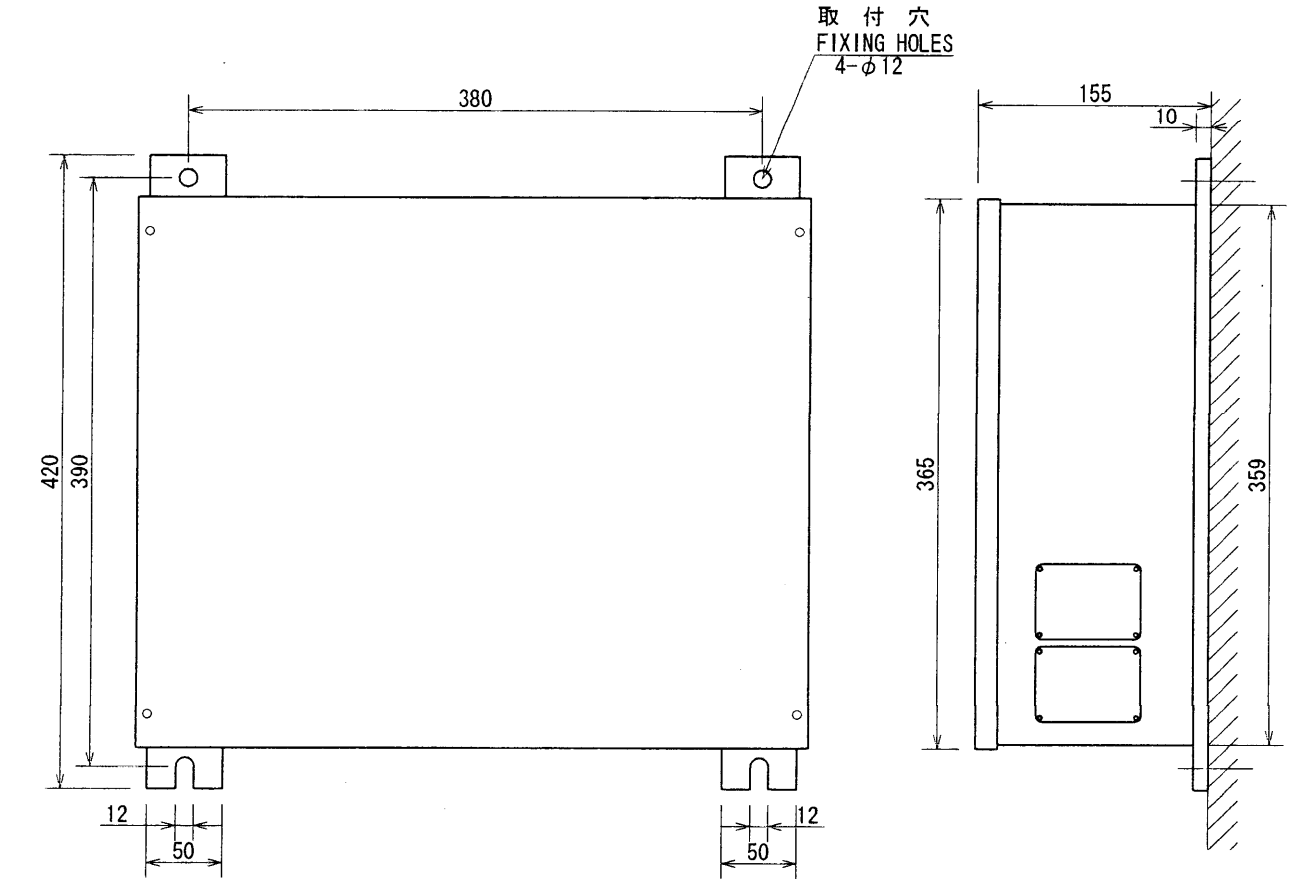

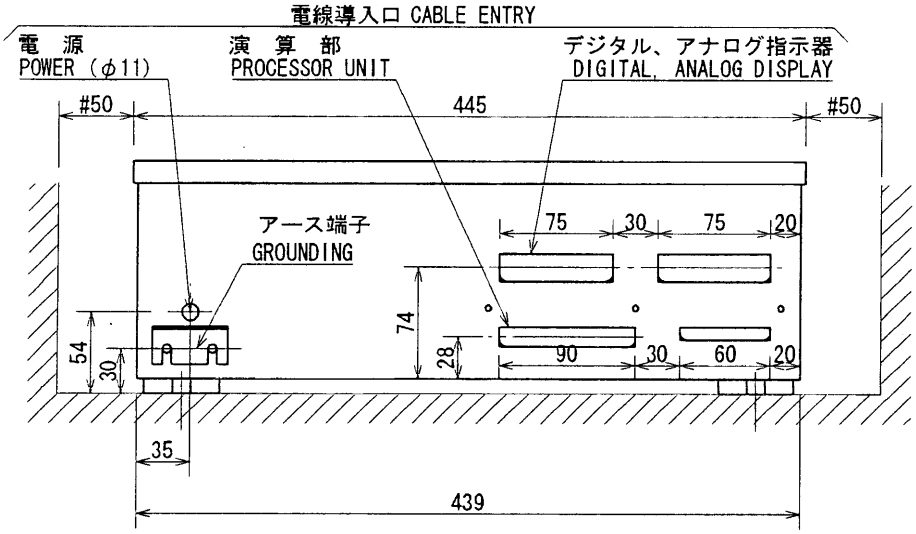

表1 TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 ＜ L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3
500 ＜ L ≦ 1000	±4

注記
1）指定なき寸法公差は表1による。
2）＃：推奨する最小サービス空間寸法。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
2. #: RECOMMENDED SERVICE CLEARANCE DIMENSION.

DRAWN July 26'00 T.YAMASAKI		TITLE DS-370
CHECKED July 27 '00 T.K		名称 分配器
APPROVED July 27 '00 T.K		外寸図
SCALE 1/5 MASS 19 kg		NAME DISTRIBUTION UNIT
DWG. No. C7236-G10-G		OUTLINE DRAWING

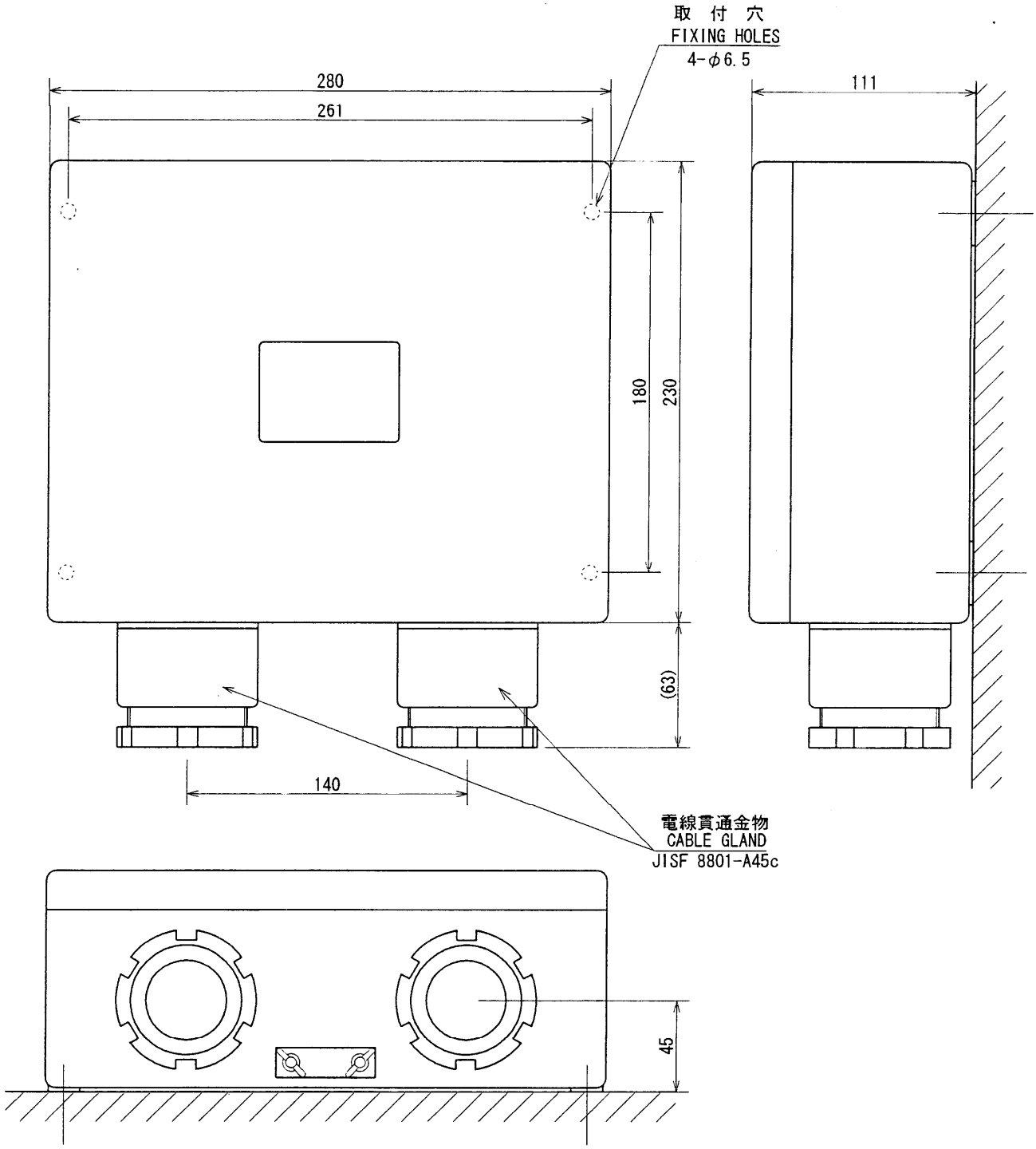

表1　TABLE 1

寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 ＜ L ≦ 50	±1.5
50 ＜ L ≦ 100	±2.5
100 ＜ L ≦ 500	±3

注記
1）指定なき寸法公差は表1による。
2）#：推奨する最小サービス空間寸法。

NOTE
1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
2. #: RECOMMENDED SERVICE CLEARANCE DIMENSION.

DRAWN Jul.26'00 T.YAMASAKI		TITLE DS-360
CHECKED Jul.27'00 T.K		名称 接続箱
APPROVED Jul.27'00 T.K		外寸図
SCALE 1/3 MASS kg		NAME JUNCTION BOX
DWG. No. C7236-G06-E		OUTLINE DRAWING

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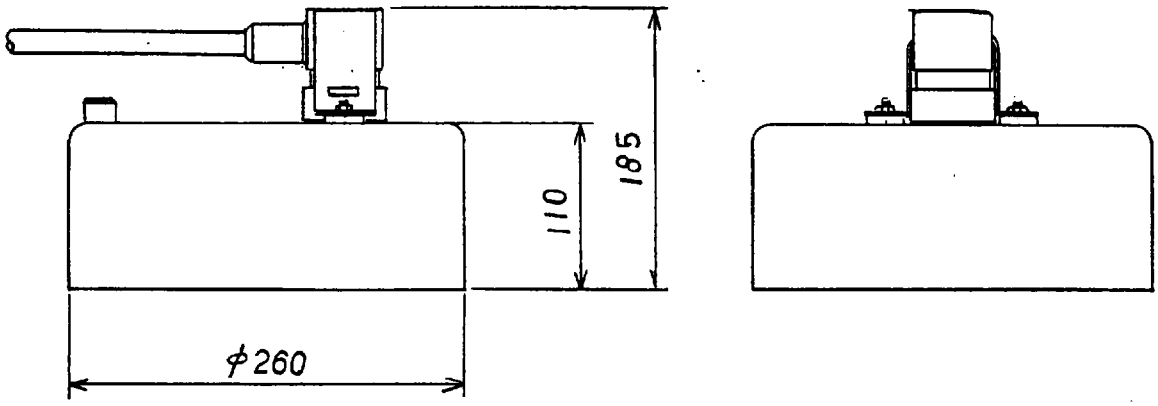

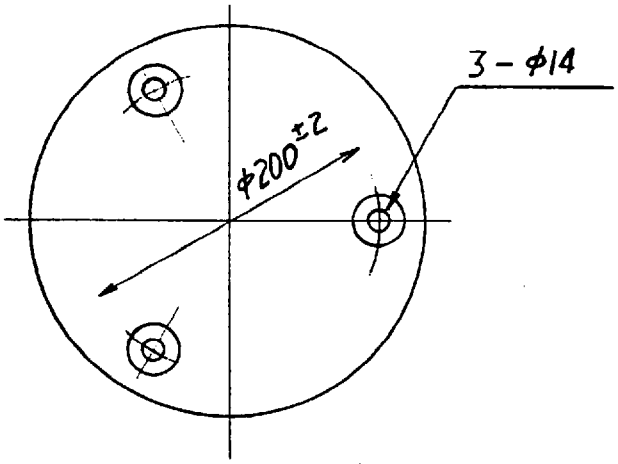

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	APR. 8 '92 TSUKADO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	DS-330 送受波器 TRANSDUCER
検図 CHECKED	APR. 8 '92 M. USUDA	尺度 SCALE	1/5		
製図 DRAWN	APR. 8 '92 TOMITA	重量 WEIGHT	9 kg (ケーブル含まず)	図番 DWG.NO.	C7236-G14-A

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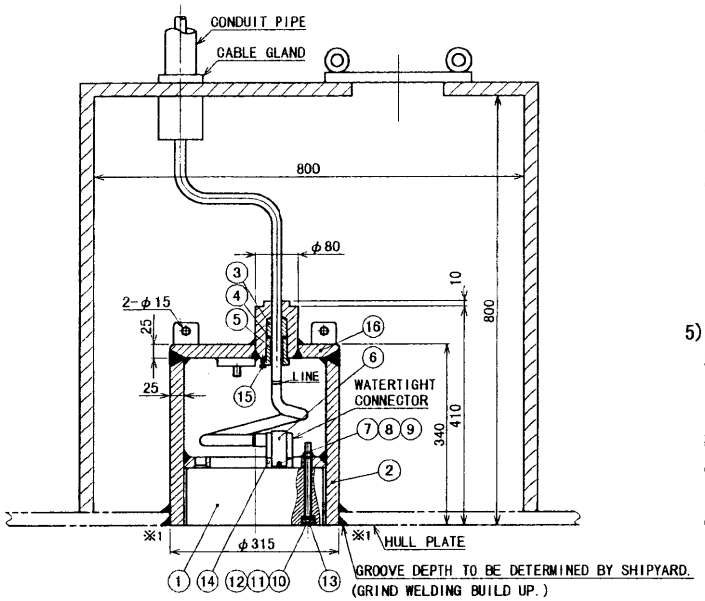
HULL UNIT INSTALLATION



1) CHECKING MATERIAL AND THICKNESS OF TRANSDUCER CASING

Before starting the installation work, check that the transducer casing is of a material approved by ship classification society concerned and with a thickness not thinner than the hull plate. The standard tank supplied by FURUNO is of material KSTPG370 (KSTPG38, KST138) , approved by ship Classification Society of Japan, with a thickness of 25 mm.

2) DETERMINING INSTALLATION SITE

Select the installation site reffering to the recommended sites described in the installation instructions.

For ships prone to collect air bubbles under the hull bottom, consult your local FURUNO office or agent for advice.

3) CONSTRUCTING WATERPROOF COMPARTMENT FOR TRANSDUCER CASING

The compartment for the transducer casing is not compulsory required by law because the transducer casing is waterproof. However it is recommended to construct it for safety. Dimensions shown above are only for reference; shipyard may change as required. Since the transducer is detachable/replaceable in water from outside the ship, maintenance space is not required inside the compartment.

4) WELDING CASING

a) Fore/aft marks are engroved on the casing. Align them with ship's fore-aft line.

b) Orientation and leveling errors can be offset on the data offset menu in the display unit. Install the casing as follows.

Fore-aft orientation: Align the bow mark on the casing with ship's fore-aft line to an accuracy within 1 degree.

Leveling: Install the casing so that the top face of the casing is horizontal during navigation. Measure leveling accuracy with a level meter, after the ship is launched.

c) Detach transducer (1), cable, cable gland (5) and gasket (3) before welding the casing.

d) Welding method for casing and ship's hull should be determined by the shipyard. Weld reinforcement ribs to the casing if the shipyard considers them necessary.

e) Remove welding build up between the casing and the ship's hull (part marked ※1 in the drawing) with a grinder, for a flat finish.

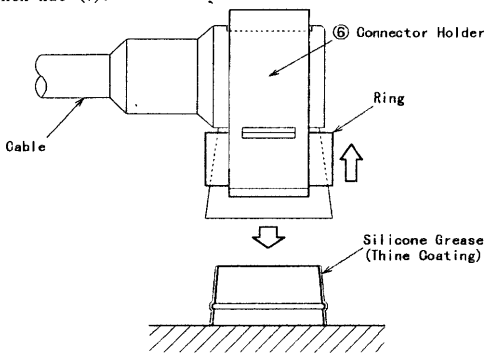
5) FIXING/CONNECTING TRANSDUCER CABLE

a) Lead the transducer cable into the casing up to the white line mark on the cable and tighten the cable gland with the cable gland spanner supplied.

b) Install locking bolt (15) after the cable gland is tightened.

c) Remove dirt and apply silicone grease onto the side of receptacle on the transducer before plugging the watertight connector.

d) To plug in the watertight connector, pull up the ring and insert the connector into the receptacle, and then fix the connector holder (6) with hex nut (7).



6) FIXING TRANSDUCER

Twisting the cable (namely, rotating the transducer by about one turn), align the bow mark on the transducer with ship's bow and fix the transducer by using hex bolt (10) and bolt cap (13).

7) CABLING

Lay the cable from the casing to the transceiver unit inside a conduit pipe and fill the conduit pipe with sand or other appropriate materials to prevent cable vibration.

8) PAINTING

Shop primer coating (Epcom Zinc Rich Primer B) has been applied to the casing. Paint both inner and outer surfaces on the casing with the paint used for top coating of the ship's hull bottom.

Note: The transducer surface is coated with antifouling paint Marine Star 20. Do not coat it by other type of paint.

9) TESTING AFTER INSTALLATION

Comfirm the ohm value of terminals on the transducer.

A digital ohmmeter is recommended.

Do not use a megohmmeter.

TYPE OF SIGNAL	TEST POINT	STANDARD(Ω)
BEAM 1 (BLK)	TB #1(RED) - #2(BLK)	0.5~3.0
BEAM 2 (RED)	TB #4(RED) - #5(BLK)	0.5~3.0
BEAM 3 (GRN)	TB #7(RED) - #8(BLK)	0.5~3.0
TEMP SENSOR 1	TB #10(YEL) - #11(WHT)	450~550
TEMP SENSOR 2	TB #13(BLU) - #14(GRY)	450~550

DRAWN Apr 13'00 T.YAMASAKI			TITLE DS-330/331
CHECKED Apr 13'00 Y.K			NAME HULL UNIT
APPROVED APR 13'00 S.Y	DS-30		INSTALLATION PROCEDURE
SCALE	MASS kg		REMARKS
DWG No. E7236-Y10- F			

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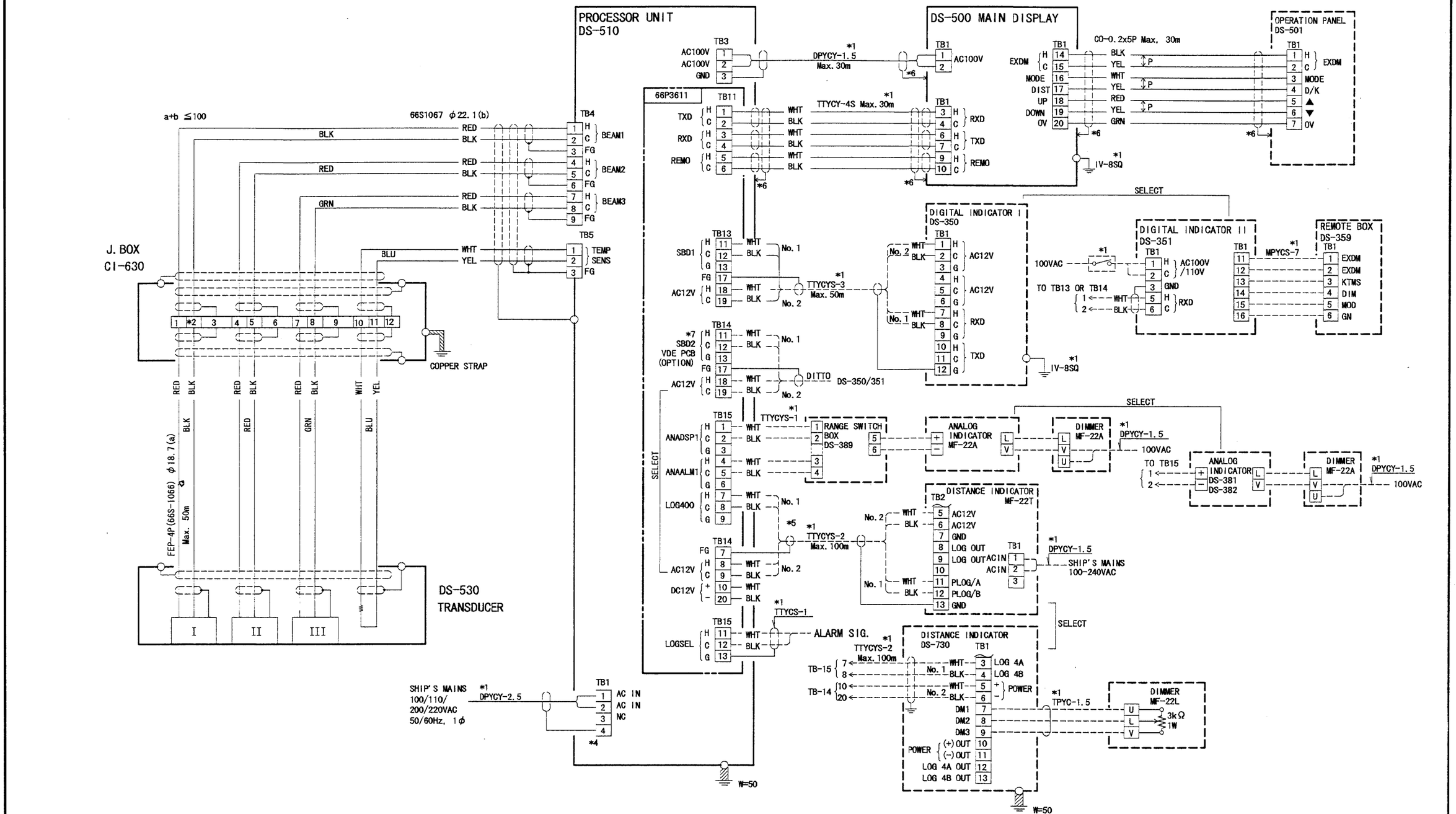

NOTE

*1. *: SHIPYARD SUPPLY

*2. CABLE ARMOR SHOULD BE CLAMPED TIGHTLY AFTER REMOVING PAINT FOR COMPLETE GROUNDING.

*3. ALL UNITS SHOULD BE GROUNDED TO SHIP'S BODY.

*4. CHANGE CONNECTION ON TRANSFORMER TAP ACCORDING TO SHIP'S MAINS.

*5. ONE OF MF-22T OR DS-730 CAN BE CONNECTED.

*6. GROUND THROUGH CABLE CLAMP.

*7. CURRENT SIGNAL OF SPEED DATA REQUIRES VAE PCB (OPTION). CO-0.2x5P: CO-SPEVV-SB-C, 0.2x5P, φ13.5

DRAWN Dec. 13 '01 T. YAMASAKI			TITLE DS-50
CHECKED Dec.13'01 Y.K.			NAME DOPPLER SPEEDLOG (1/4)
APPROVED Dec.13'01 Y.K.		DS-50	INTERCONNECTION DIAGRAM
SCALE	MASS	APPLICABLE TO: kg (MODEL)	BLOCK NO. / REMARKS
DWG NO. E7241-C02-E		66-022-0001-0	

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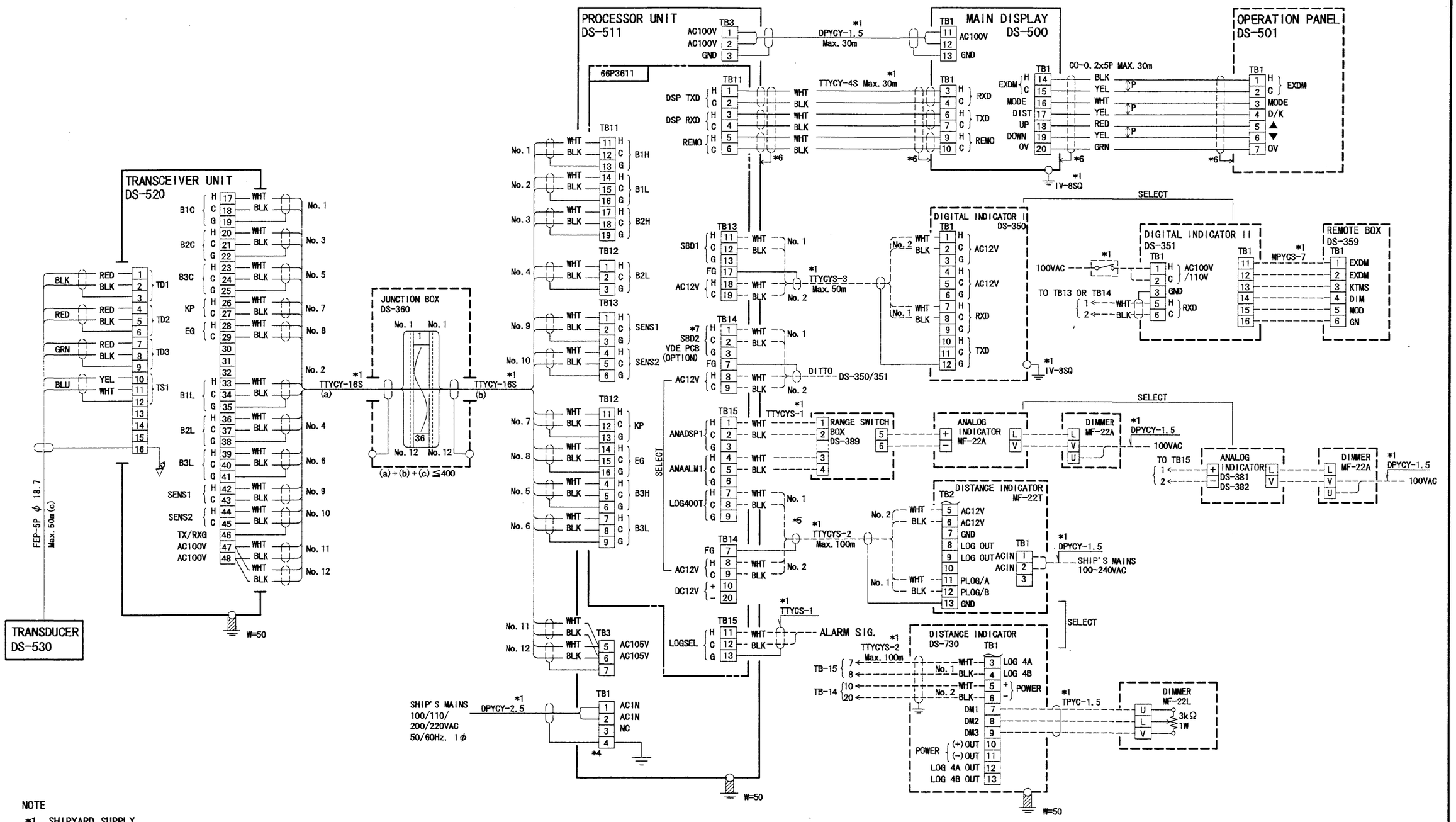


NOTE

*1. SHIPYARD SUPPLY

*2. CABLE ARMOR SHOULD BE CLAMPED TIGHTLY AFTER REMOVING PAINT FOR COMPLETE GROUNDING.

*3. ALL UNITS SHOULD BE GROUNDED TO SHIP'S BODY.

*4. CHANGE CONNECTION ON TRANSFORMER TAP ACCORDING TO SHIP'S MAINS.

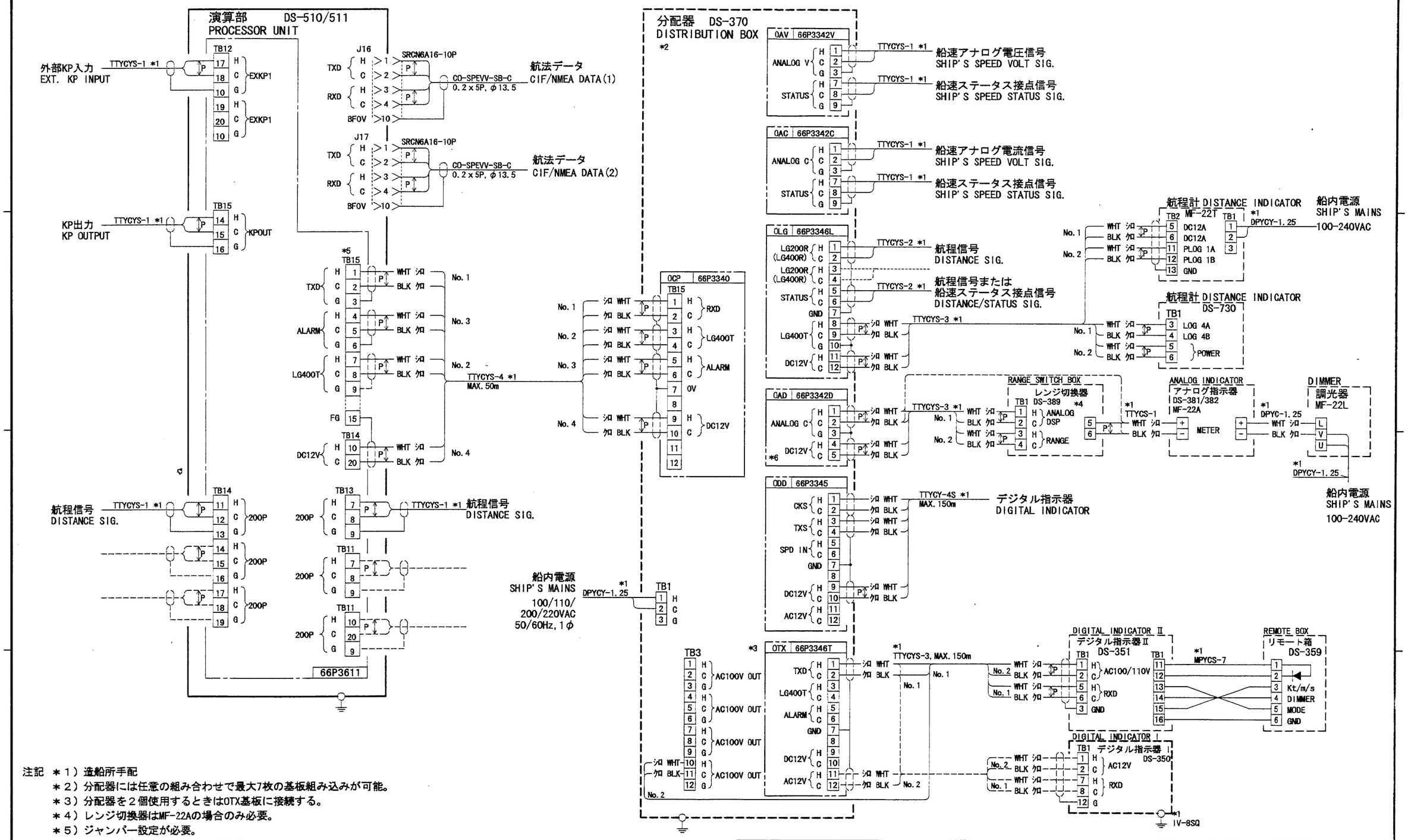
*5. ONE OF MF-22T OR DS-730 CAN BE CONNECTED.

*6. GROUND THROUGH CABLE CLAMP.

*7. CURRENT SIGNAL OF SPEED DATA REQUIRES VAE PCB (OPTION).

CO-0.2x5P: CO-SPEVV-SB-C, 0.2x5P, φ13.5

DRAWN Dec. 13 '01 T. YAMASAKI				TITLE DS-50
CHECKED Dec.13'01 Y.K				NAME DOPPLER SPEEDLOG (2/4)
APPROVED Dec.13'01 Y.K		DS-50		INTERCONNECTION DIAGRAM
SCALE	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	REMARKS
DWG NO. E7241-C03- F		66-022-0003-0		



注記 ＊１）造船所手配
＊２）分配器には任意の組み合わせで最大7枚の基板組み込みが可能。
＊３）分配器を２個使用するときはOTX基板に接続する。
＊４）レンジ切換器はMF-22Aの場合のみ必要。
＊５）ジャンパー設定が必要。
＊６）２台目の指示器は#6～#8に接続する。

NOTE *1. SHIPYARD SUPPLY.
*2. DISTRIBUTION BOX CAN INCORPORATE SEVEN BOARDS IN ANY COMBINATION.
*3. WHEN TWO DISTRIBUTION BOXES ARE USED, CONNECT ONE DIST. BOX TO "OTX" BOARD.
*4. RANGE SWITCH BOX IS ONLY REQUIRED FOR MF-22A.
*5. JUMPER CONNECTION SETTING REQUIRED.
*6. USE #6 TO #8 FOR No.2 INDICATOR.

DRAWN Dec. 13 '01 T. YAMASAKI		TITLE	DS-50
CHECKED		名称	ドップラスピードログ(3/4)
APPROVED			相互結線図
SCALE	MASS kg	NAME	DOPPLER SPEED LOG (3/4)
DWG No. C7241-C04- C	66-022-0002- 0		INTERCONNECTION DIAGRAM

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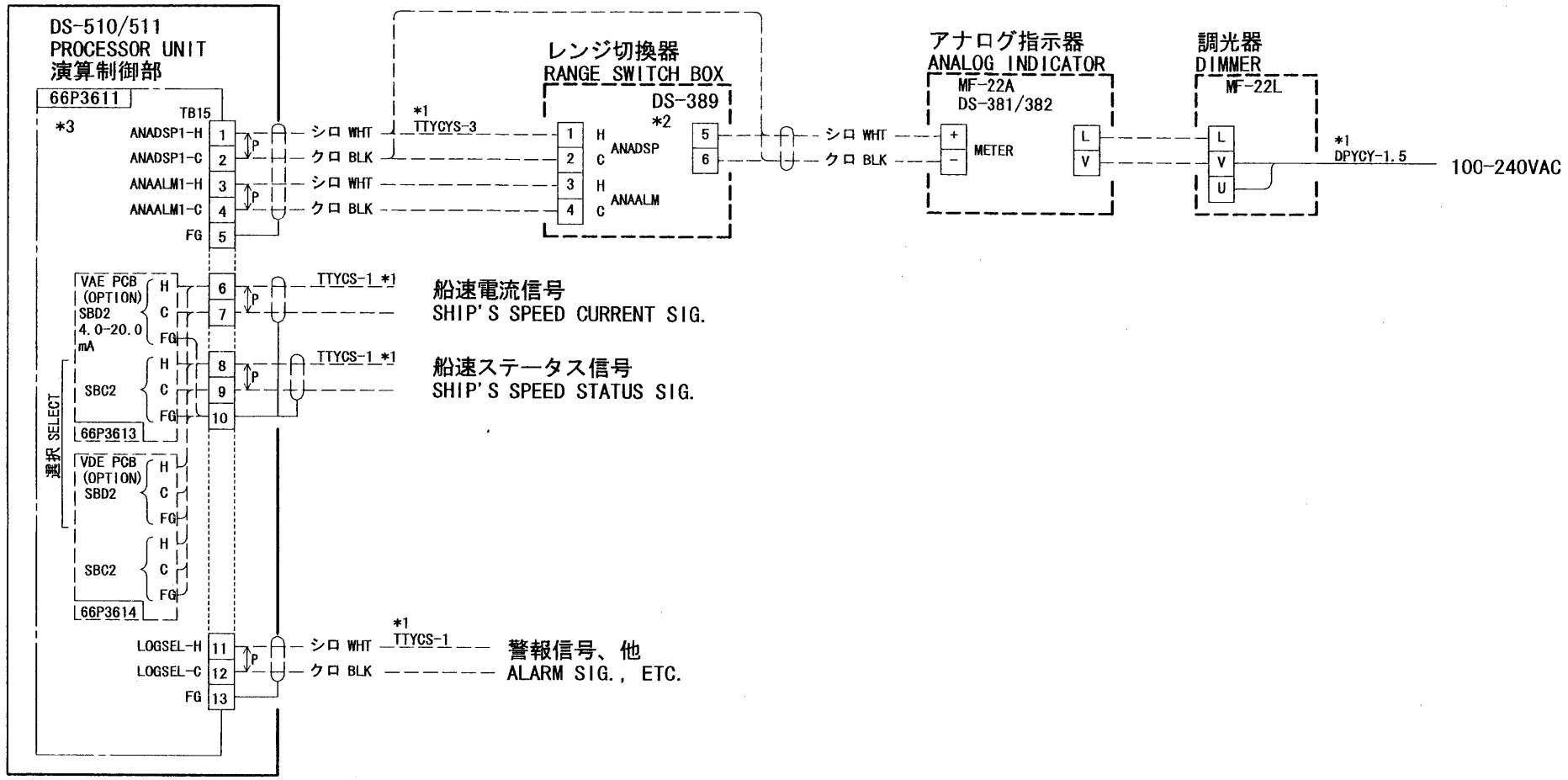

注記
＊1）造船所支給
＊2）レンジ切換器はMF-22Aの場合のみ必要。
＊3）信号出力には内部設定変更が必要。

NOTE
*1: SHIPYARD SUPPLY.
*2. RANGE SWITCH BOX IS ONLY REQUIRED FOR MF-22A.
*3. SIGNAL OUTPUT REQUIRES MODIFICATION OF PCB SETTING.

DRAWN Oct. 19 '01 T. YAMASAKI			TITLE DS-50
CHECKED 0822 '01 T.K.			名 称 ドップラスピードログ(4/4)
APPROVED 0822 '01 T.K.		DS-50	相互結線図
SCALE	MASS kg		NAME DOPPLER SPEED LOG(4/4)
DWG. No. C7241-C05- C		66-022-0004- 0	INTERCONNECTION DIAGRAM

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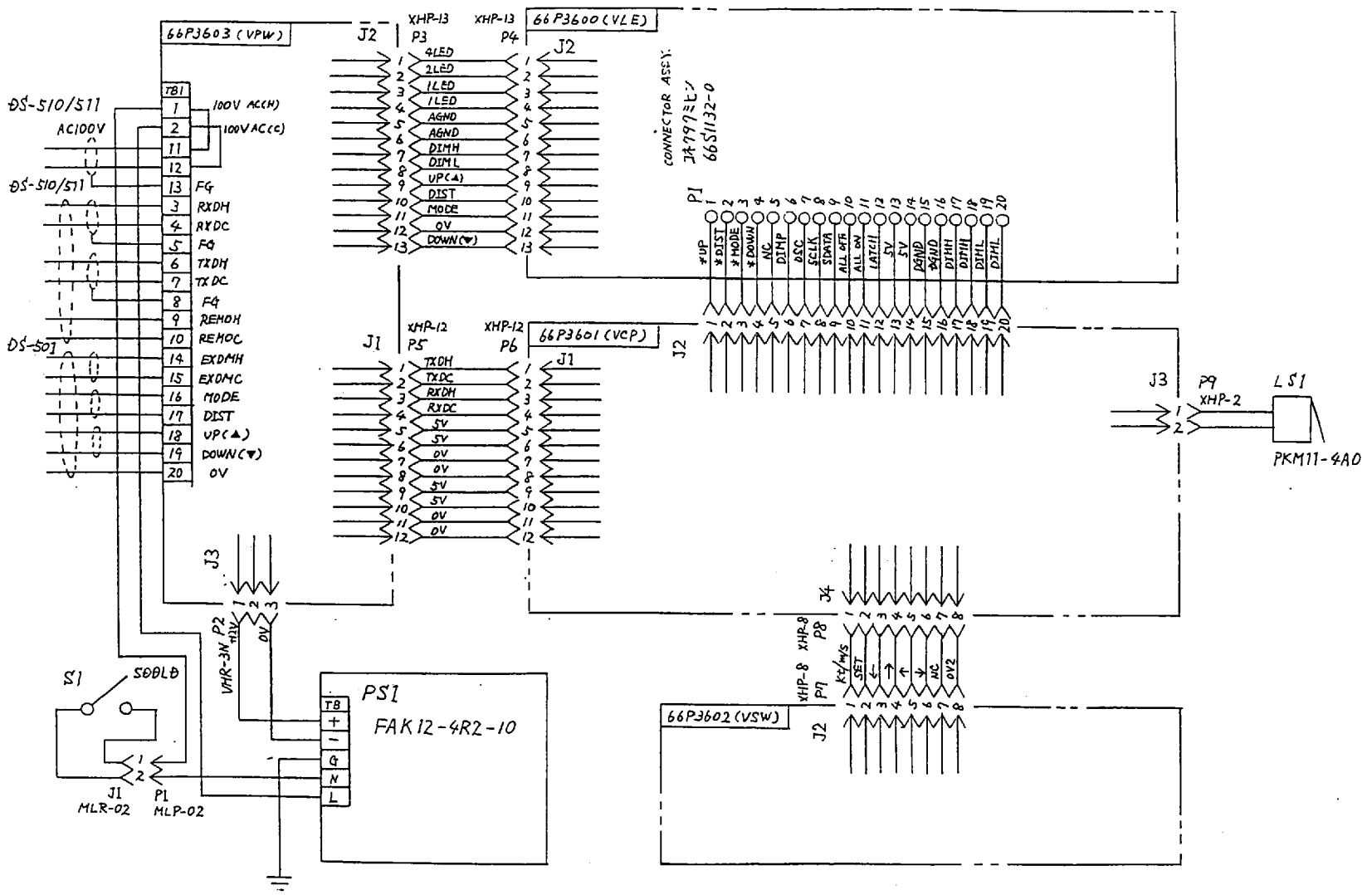
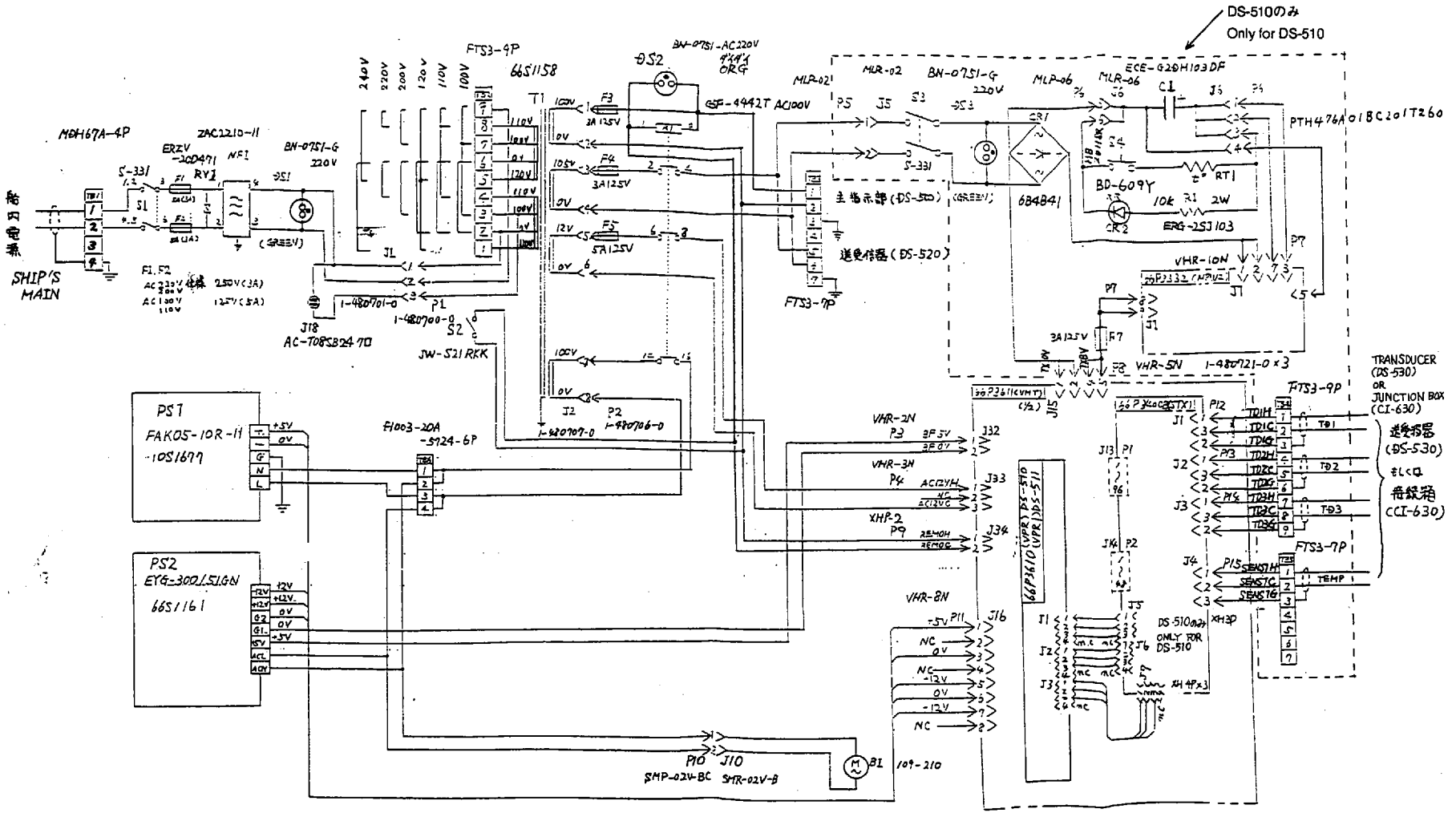


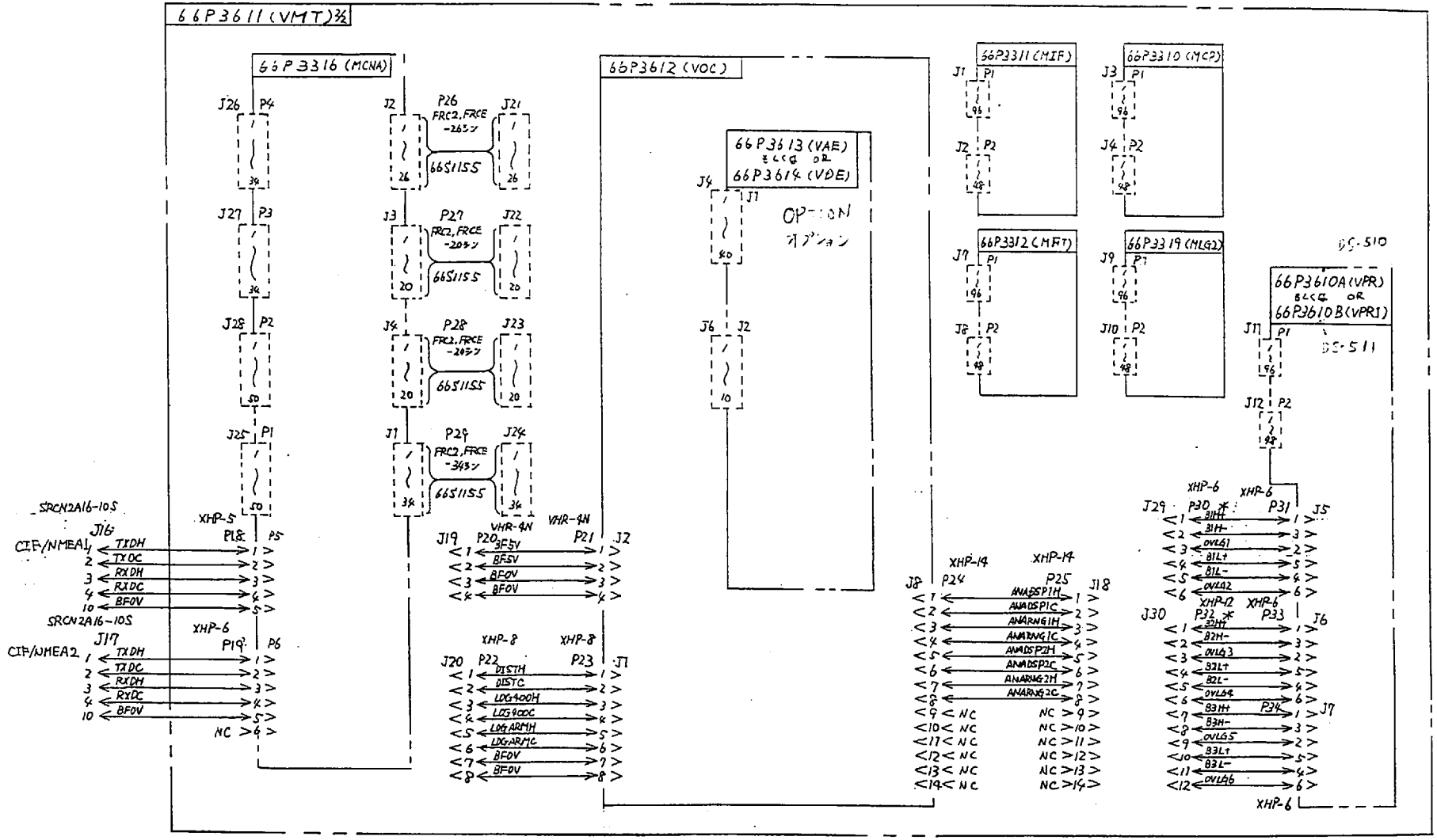
DRAWN MAY 13 '96 T.YAMASAKI				TYPE DS-500
CHECKED MAY 13 '96 TAKAMATSU				名称 主指示器 総合
APPROVED MAY 13 '96 K.OKAMOTO	DS-50			回路図
SCALE ∝	MASS — kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME MAIN DISPLAY GENERAL
DWG NO. C7241-K01- A		66-022-1101- 0		SCHEMATIC DIAGRAM

FURUNO



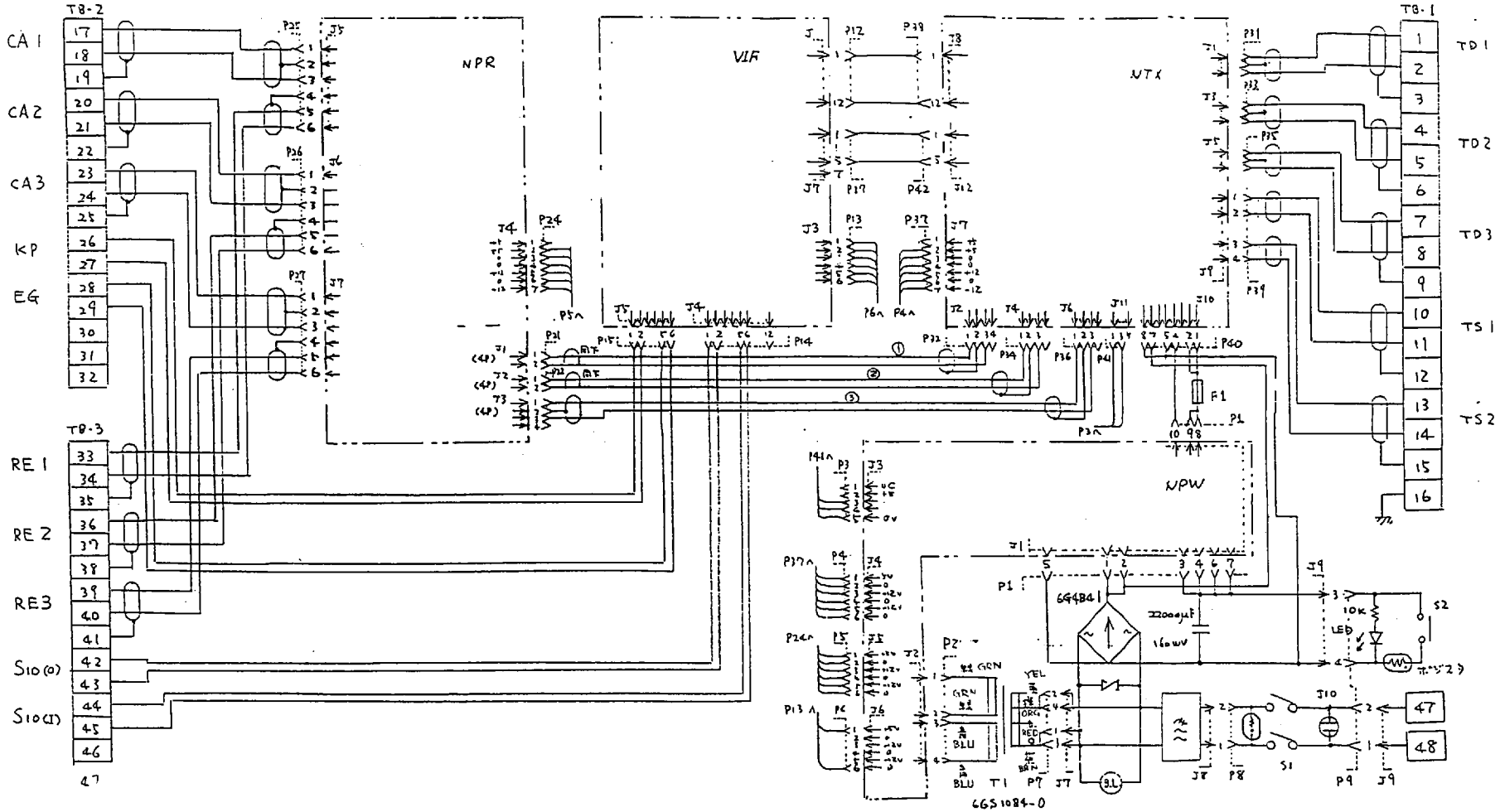
DRAWN June 2 '97 T. YAMASAKI			TYPE DS-510/511
CHECKED June 2'97 K. KUSUNOKI			名称 演算部 総合 (1/2)
APPROVED June 2 '97 T. Yamanaka		DS-50	回路図
SCALE 1/1	MASS — kg	APPLICABLE TO: (MODEL)	BLOCK NO. NAME PROCESSOR UNIT GENERAL(1/2)
DWG NO. C7241-K02- B		66-022-2101- 4	SCHEMATIC DIAGRAM

FURUNO

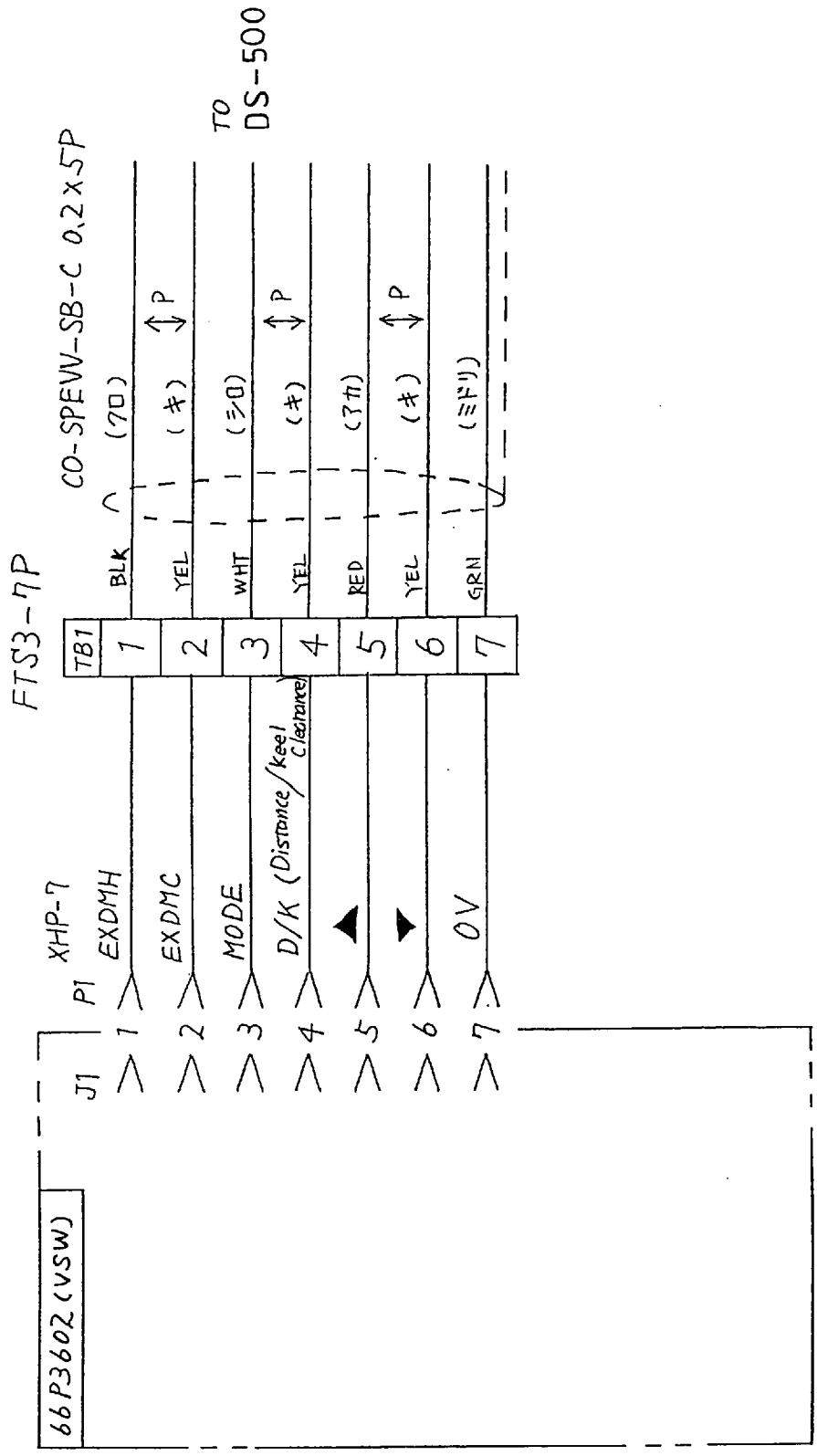


DRAWN MAY 13 '96 T. YAMASAKI			TYPE DS-510/511
CHECKED MAY 13 '96 TAKAHASHI			名称 演算部 総合 (2/2)
APPROVED MAY 13 '96 K. OKAMOTO	DS-50		回路図
SCALE — MASS — kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME PROCESSOR UNIT GENERAL (2/2)
DWG NO. C7241-K03- A	66-022-2102- 0		SCHEMATIC DIAGRAM

FURUNO



DRAWN MAY 13 '96 T. YAMASAKI				TYPE DS-520
CHECKED MAY 13 '96 TAKAHASHI				名称 送受信機
APPROVED MAY 13 '96 HOKAMOTO		DS-50		回路図
SCALE ―	MASS — kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME TRANSCEIVER UNIT
DWG NO. C7241-K04- A		66-019-3304- 1		SCHEMATIC DIAGRAM



DRAWN: MAY 13 '96 T.YAMASAKI			TYPE: DS-501
CHECKED: MAY 13 '96 TAKAHASHI			名称: 操作箱
APPROVED: MAY 13 '96 K.OKAMOTO	DS-50		回路図
SCALE: / MASS: kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME: OPERATIONAL PANEL
DWG NO.: C7241-K05- A	66-022-4101- 0		SCHEMATIC DIAGRAM