

SERVICE

WA

FURUNO

OPERATOR'S MANUAL

A-D CONVERTER

MODEL AD-10S



FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

SPECIFICATIONS OF AD-10S A-D CONVERTER

General

The A-D converter is a kind of gyrocompass repeater which indicates gyrocompass reading (i.e. ship's bearing) on 4 digit LED display, and converts gyro repeater signal into digital coded bearing data. The digital bearing data are used for navigation equipment such as satellite navigator, radar and so on.

Specifications

1. Input Signal : Gyro repeater signal (Synchro or Step-by-step)
(With simple change of jumper connection, various types of gyrocompass can be connected.)
2. Input Voltage : Synchro type --- AC28V to 135V (rotor)
AC20V to 135V (stator)
50/60Hz or 400/500Hz
Power failure protector for instantaneous power-off. (Synchro type repeater only)
Memory hold: approx. 5 sec.
Step-by-step --- DC20 to 100V (For DC20 to 30V input, an external power supply of DC30 to 100V or AC60 to 125V is required.)

3. Power Consumption : Less than 14W

4. Tracking Speed :

		360X	90X/180X	36X	180X
SYNCHRO	50Hz	13°/sec	32°/sec	80°/sec	/
	60Hz	16°/sec	40°/sec	100°/sec	
	400Hz	130°/sec	260°/sec	660°/sec	
	500Hz	160°/sec	320°/sec	800°/sec	
STEP-BY-STEP					30°/sec

5. Bearing Display : 4 digit LED display
6. Data Output : Photo-coupler driver type (open collector),
4 digit BCD (16 bit serial) code, MSB transmission order.
7. Output Lines : Two output lines for radar north-up unit (RG-2/2A) and two other lines for satellite navigation system, doppler sonar current indicator or color scanning sonar, etc.
8. Data Transmission Interval : Approx. 25msec for radar north-up unit
Approx. 200msec for other equipments
9. Coating Color : Cabinet Cover --- 2.5GY5/1.5 Newtone No.5
Front Panel ----- N3.0 Dark gray mat

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Complete Set

<u>No.</u>	<u>Name</u>	<u>Type</u>	<u>Code No.</u>	<u>Q'ty</u>	<u>Weight</u>	<u>Remarks</u>
1	A-D Converter	AD-10S	000-044-115	1	2.5Kg	With mounting bracket
2	Installation Materials	AD-10S-C	000-044-116	1 set		
3	Spare Parts	AD-10S-S	000-044-117	1 set		

Installation Materials

<u>No.</u>	<u>Name</u>	<u>Type</u>	<u>Code No.</u>	<u>Q'ty</u>	<u>Remarks</u>
1	Crimp-on Lug	FV1.25 M3	000-538-110	24	
2	Woodscrew	4.8x25 C2700W MBNI2	000-861-717	4	
3	Flat Washer	M5 C2600P MBNI2	000-864-108	4	
4	CAPACITOR	ECQ-M1H104KV	000-260-401	3	

Spare Parts

<u>No.</u>	<u>Name</u>	<u>Type</u>	<u>Code No.</u>	<u>Q'ty</u>	<u>Remarks</u>
1	Fuse	FGBO-A 1A	000-549-061	4	

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MAINTENANCE

Replacement of Fuse

- 1) Take off the top cover by loosening six screws.
- 2) Disconnect two connectors connected to A-D converter board.
- 3) Remove the shield plate (with A-D converter board) by loosening six screws and replace blown fuse with new one.

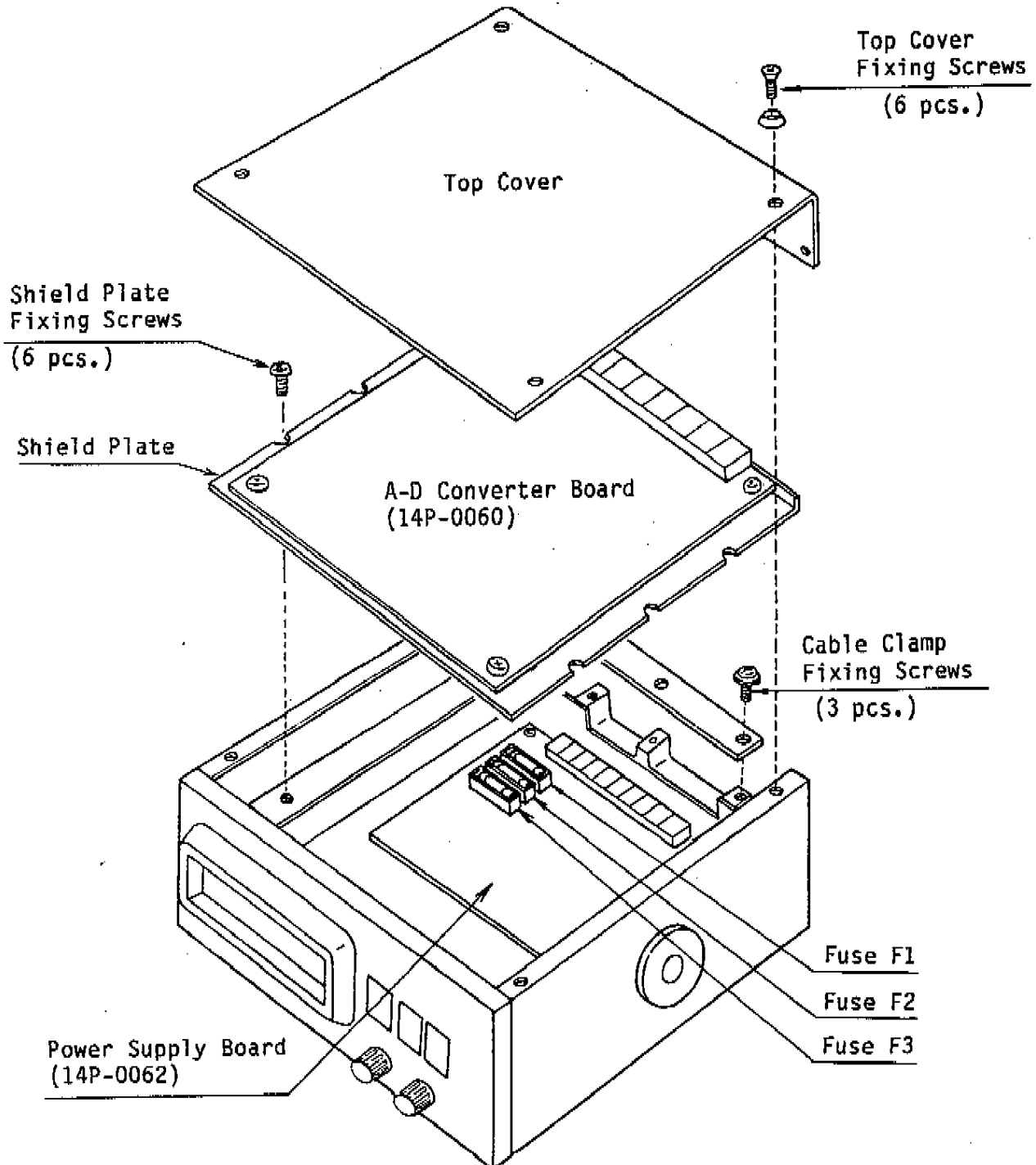


Fig.2 A-D Converter Exploded View

APPENDIX 1. INSTALLATION INSTRUCTIONS

1. Modifications at Installation

Some modifications are required for A-D converter so as to be combined with different types of gyrocompass repeater signal. Check the following items for gyrocompass.

- 1) Type of repeater signal : AC synchro signal or DC step-by-step pulse?
- 2) If it is synchro type;
 - Primary voltage (rotor) : AC _____ V
 - Secondary voltage (stator) : AC _____ V
 - Frequency : 50/60Hz or 400/500Hz?
 - Gear ratio : 360X, 180X, 90X or 36X?
- 3) If it is step-by-step type;
 - Repeater driving circuit : DC on-off pulse with 4 output lines or open collector transistor drive system with 5 output lines?
 - Operating voltage : DC _____ V
 - Gear ratio : 180X?
 - Common line level with respect to other terminal's level : Positive or negative?

The A-D converter is previously set up at the factory for the following specifications. If different specifications are required, reset the DIP switch on A-D converter board 14P-0060 and change jumper connection on that board and power supply board 14P-0062 referring to the instruction affixed on the inner face of the top cover and one mentioned below.

Setting at Factory

- 1) Synchro type repeater signal
- 2) Primary and secondary voltages are higher than 60V
- 3) Frequency is 50Hz/60Hz
- 4) Gear ratio is 90X

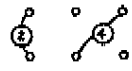


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**MODIFICATION ON POWER SUPPLY/A-D CONVERTER BOARDS
DEPENDING ON TYPE OF GYROCOMPASS. (SEE PAGE AP1-4.)**

(When combining with gyrocompass other than listed below, refer to page AP1-3.)

AC Synchro Type


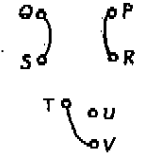





- *1: Mod. depending on input voltage.
- *2: Mod. depending on gyro repeater signal.
- *3: Mod. depending on gyro repeater signal and frequency.
- *4: Mod. depending on gyro repeater signal, frequency and gyro ratio.

Gyrocompass and Manufacturer	Gyro signal (Gyro ratio)	Modification on POWER SUPPLY board (14P-0062)		Modification on A-D CONVERTER board (14P-0060)									
		Jumper wire connection (*1)	Jumper wire terminal (*2)	Jumper wire connection (*3)	DIP switch setting (*4)								
ANSCHUTS: STANDARD 1 to 6 HOKUSHIN-PLATH: A,B-55, C-1, C-1A, C-2, C-3 PLATH: NAVIGAT II and III MICROTECNICA LK-2, MB-12, MV-58	50/60VAC 50/60Hz (x 360)	 (Jumper wire (1) not connected, Factory setting)	$\begin{matrix} 60 & 0P \\ 50 & 0R \\ & \text{to } U \\ & \text{or } V \end{matrix}$ (Factory setting)	 (Factory set.)	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr></table>	1	2	3	4	ON	OFF	ON	OFF
1	2	3	4										
ON	OFF	ON	OFF										
HOKUSHIN PLATH: CMZ-100, CMZ-200, C-Jr, D-1Z	100VAC 50/60Hz (x 360)				<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr></table>	1	2	3	4	OFF	OFF	OFF	OFF
1	2					3	4						
OFF	OFF					OFF	OFF						
MICROTECNICA: SIRIUS	115VAC (x 360)												
TOKYO KEIKI-SPERRY: ES-1, ES-2, ES-11 GLT-101/102/103/ 106K	110VAC 60Hz (x 36)				<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr></table>	1	2	3	4	OFF	OFF	OFF	OFF
1	2				3	4							
OFF	OFF				OFF	OFF							
TOKYO KEIKI-SPERRY: ES-11A, TG-200, PR222R, PR237L,H	110VAC 60Hz (x 90)	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr></table> (Factory set.)	1	2	3	4	ON	OFF	OFF	OFF			
1	2	3	4										
ON	OFF	OFF	OFF										
USSR MAKE: BEGA, KURS-4, AMUR-3	110VAC 50Hz (x 360)	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr></table>	1	2	3	4	ON	OFF	ON	OFF			
1	2	3	4										
ON	OFF	ON	OFF										
USSR MAKE: AMUR-M	110VAC 500Hz (x 360)	 (Factory set.)	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr></table>	1	2	3	4	ON	ON	ON	OFF		
1	2	3	4										
ON	ON	ON	OFF										

Note: 1. For the synchro repeater signal of 50/60Hz, 180X, cut the copper foil and connect jumper wires on A-D CONVERTER board (14P0060) as shown on the page AP1-5.

DC Step-by-step Type

- *1: Mod. depending on input voltage.
- *2: Mod. depending on gyro repeater signal.
- *3: Mod. depending on gyro repeater signal and frequency.
- *4: Mod. depending on gyro repeater signal, frequency and gyro ratio.

Gyrocompass and Manufacturer	Gyro signal (Gyro ratio)	Modification on POWER SUPPLY board (14P-0062)		Modification on A-D CONVERTER board (14P-0060)									
		Jumper wire connection (*1)	Jumper wire terminal (*2)	Jumper wire connection (*3)	Dip switch setting (*4)								
TOKYO KEIKI-SPERRY: MK-14 MOD-1, MK-14 MOD-2, MK-14 MOD-T, MK-EN, MK-EI	70VDC, 3 wires (+) and common line (x 180)			 (Jumper wires (1) & (3) not connected.)	<table border="1" data-bbox="1218 551 1380 633"> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> </table>	1	2	3	4	ON	ON	ON	ON
1	2	3	4										
ON	ON	ON	ON										
TOKYO KEIKI-SPERRY: SR-130	70VDC 5 wires open collector coupling (x 180)	(Jumper wire (1) not connected. Factory set.)											
TOKYO KEIKI: TG-100, TG-5000	70VDC 3 wires (-) and common line (x 180)												
TOKYO KEIKI-SPERRY: SR-120, ES-16, MK-20 ROBERTSON: SKR-80	35VDC 3 wires (-) and common line (x 180)												
SPERRY (Note 2): MK-37, MOD-1	35V pulsating voltage, with 5 wires of open collec- tor coupling (x 180)												
SPERRY (Note 2): MK-120	70V pulsating voltage, with 5 wires of open collec- tor coupling (x 180)	 (Jumper wire (1) not connected. Factory set.)											
ARMABROWN: MK-10	50VDC 3 wires (-) and common line (x 180)												

Note: 1. When the step voltage is too low to make A-D converter operative, use external power supply for AD-10S and remove all jumper wires, that is, between (U)-(V), (P)-(R), (Q)-(S) and (T)-(V).


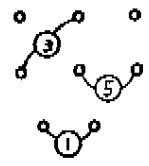
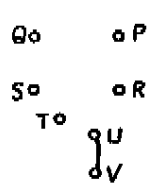
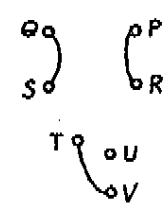
2. When combining with step-by-step gyrocompass whose repeater signal employs a pulsating current rectified in half-wave or full wave, put three capacitors (0.1uF, 50V) supplied as installation materials in parallel with C10, C11 and C12 respectively on POWER board (14P-0062). See page AP1-4. Use 0.33uF instead of 0.1uF if not enough.

3. The capacitors C1 to C3 and C7 to C12 are not used for combining with GY-700.

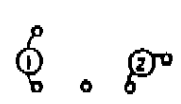
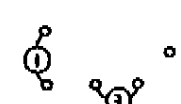

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When combining with gyrocompass other than listed on pages AP1-2/1-3, refer to the following.

Modification of POWER SUPPLY board (14P-0062)

	Input Voltage	
	Higher than AC45V (DC50V)	AC45V (DC50V) or lower than that
Jumper wire connections (1) to (5)	 <p>(Factory setting.)</p>	
	AC synchro repeater signal	DC step-by-step repeater signal
Jumper wire terminals		

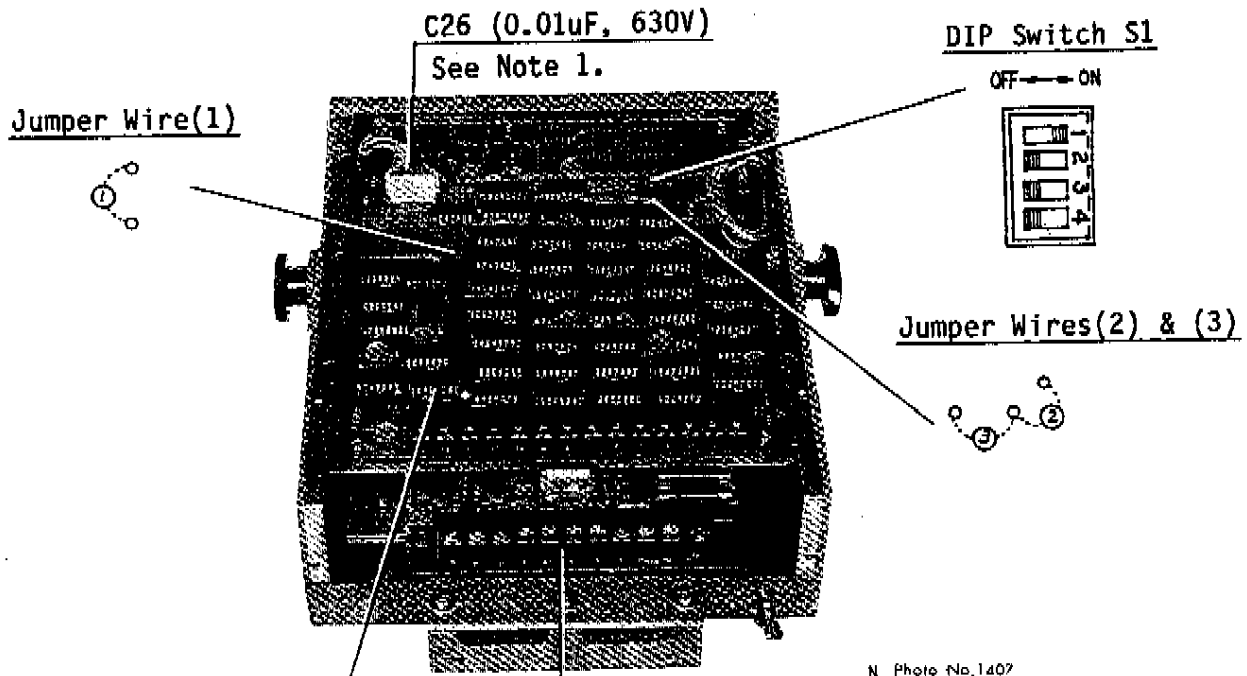
Modification of A-D CONVERTER board (14P-0060)

	AC synchro repeater signal		DC step-by-step repeater signal
	50/60Hz	400/500Hz	
Jumper wire connections (1) to (3)	 <p>(Factory setting.)</p>		 <p>(Cut the jumper wire (1).)</p>

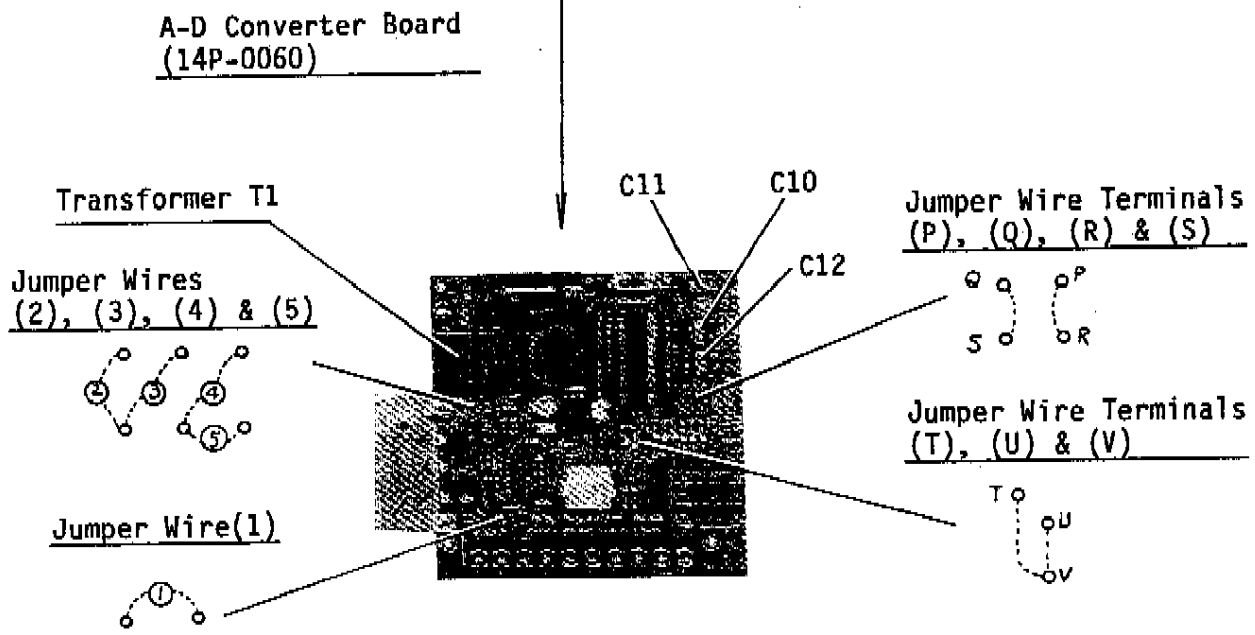
Note: Change DIP switch setting depending on the type of gyro repeater signal, frequency and gyro ratio.

SETTING OF DIP SWITCH S1		SYNCHRO 50/60Hz			SYNCHRO 400/500Hz			STEP-BY-STEP
		360X	70X/180X	36X	360X	70X/180X	36X	180X
	1	ON	ON	OFF	ON	ON	OFF	ON
	2	OFF	OFF	OFF	ON	ON	ON	ON
	3	ON	OFF	OFF	ON	OFF	OFF	ON
	4	OFF	OFF	OFF	OFF	OFF	OFF	ON

↑
Factory setting



N Photo No.1407



N Photo No.1408

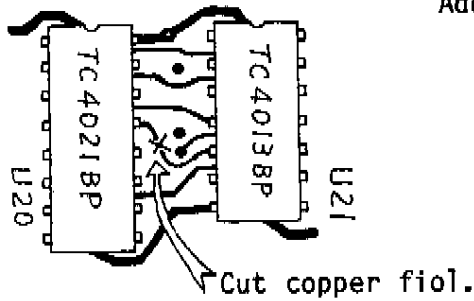
Note: 1. When A-D converter is combined with some kinds of gyrocompass, the capacitance of C26 (0.01uF, 630V) on the A-D converter board used as a noise filter may not be enough to operate the converter in good order. To solve this problem, change the capacitance of C26. (Minimum value is 0.001uF/400V.)

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For the synchro repeater signal of 50/60Hz, 180X,
modify the A-D converter board as below.

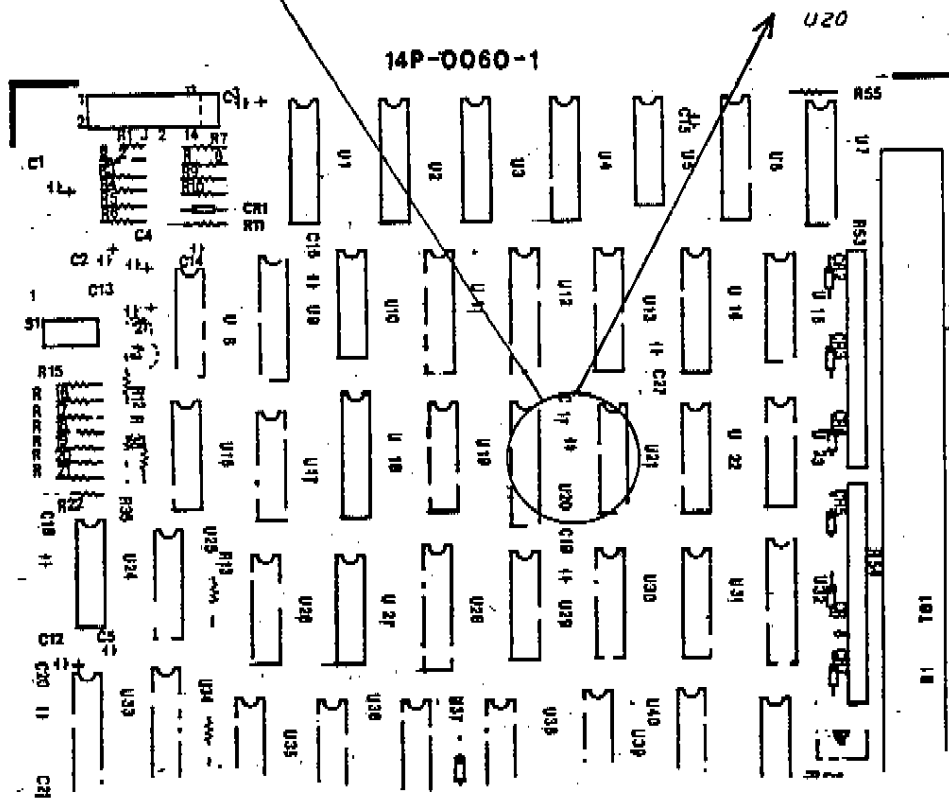
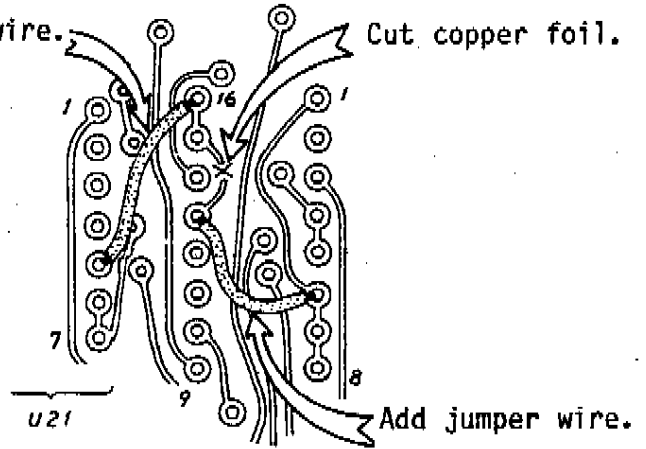
(Parts Side)

(Soldering Side)



Add jumper wire.

Cut copper foil.



A-D Converter Board (14P-0060)

2. Mounting

When siting the A-D converter, select a well ventilated waterproof place where the initial setting of the bearing can be made with observing gyrocompass reading. The bearing display of the A-D converter should not be in the direct path of bright sunshine or overhead lighting.

Cable length to the radar north-up unit, satellite navigation system, doppler sonar current indicator or scanning sonar steady picture display, etc.(max. 10m) must be taken into account.

The A-D converter is supplied with a bracket for tabletop or overhead mounting. See outline drawing C4280-001 on page D-1.

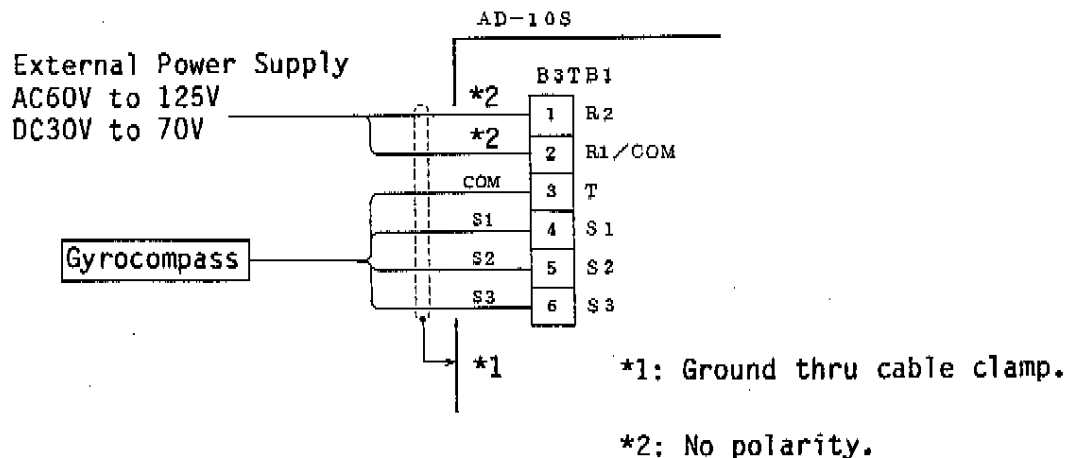
- 1) Separate the bracket from the main body by loosening two bracket fixing knobs.
- 2) Install the bracket on the selected place by fixing it with four woodscrews ($\phi 4.8 \times 25$) and washers supplied. For the overhead mounting, use hex. bolts, nuts and washers instead of woodscrews.
- 3) Mount the main body on the bracket.

3. Wiring

For the connection between A-D converter and gyrocompass, 5C cable (250V-MPYCS-5 or equivalent) is required. For the connection between A-D converter and radar north-up unit, satellite navigation system, doppler sonar current indicator or scanning sonar steady picture display, etc. CO-SPEVV-SB-C 0.2sq, 5P cable is optionally supplied together with the latter equipment.

Connect the A-D converter to the gyrocompass and the navigational equipments referring to interconnection diagram C4248-007 on page S-1.

Note: When the step voltage is less than 30V, connect A-D converter to the external power supply as below.

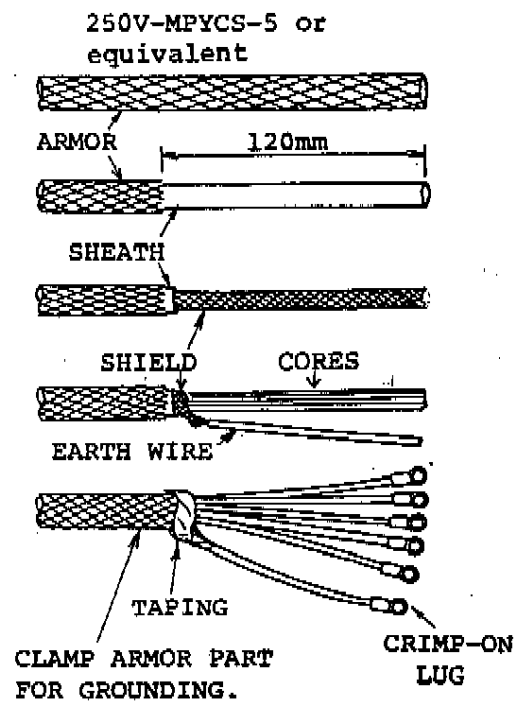


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- Fabrication of 5C Cable -

- 1) Cut the cable to the appropriate length.
- 2) Cut off the armor and sheath for approx. 120mm from the end of the cable.
- 3) Comb out the cores from the braided shield.
- 4) Cut the shield leaving 10mm and solder it with earth wire.
- 5) Dress the end of armor, sheath and shield with vinyl tape.
- 6) Fit crimp-on lugs on each end of the core and earth wire.

Note: Ground the armor thru the cable clamp.



- Fabrication of CO-SPEVV-SB-C, 0.2sq. 5P Cable -

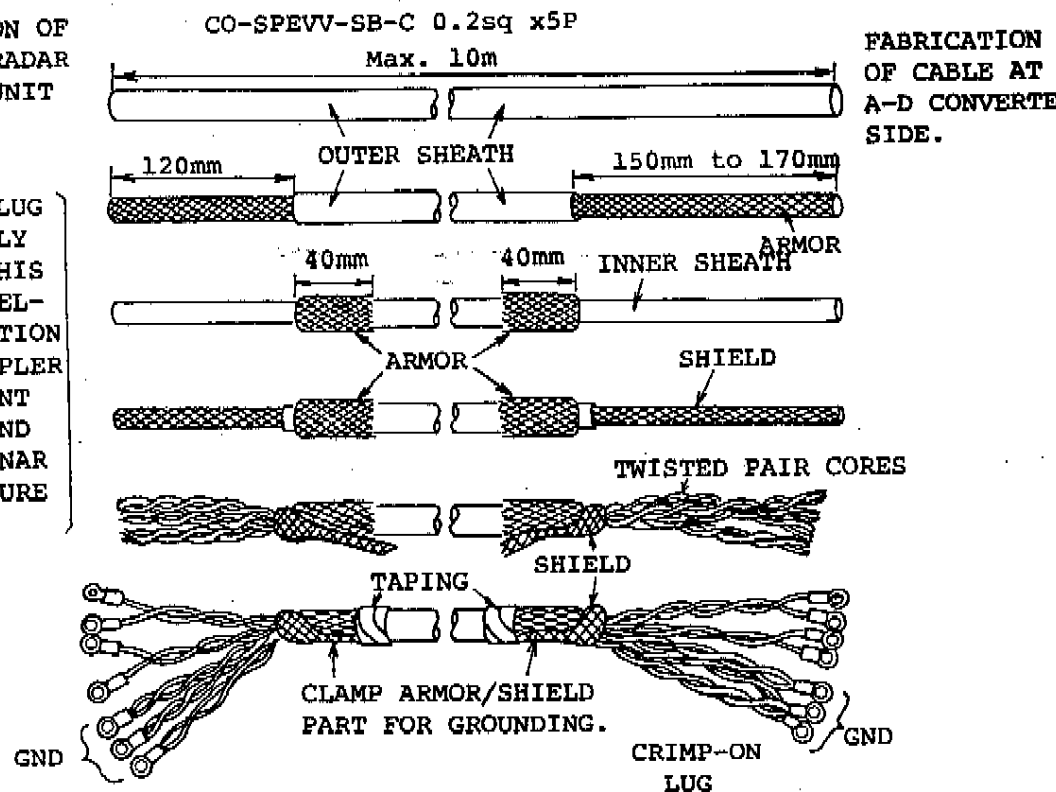
- 1) Cut the cable to the appropriate length.
- 2) Remove vinyl sheath for the length shown in the drawing with care not to cut armor.
- 3) Cut the armor leaving 40mm long and fold back it over the sheath.
- 4) Remove inner sheath with care not to cut braided shield.
- 5) Comb out cores from the shield with care not to untwist each pair of cores.
- 6) Fold back the braided shield over the armor and cut it for the same length as armor remaining.
- 7) Dress the ends of armor and braided shield with vinyl tape.
- 8) Fit the crimp-on lugs on each end of cores as shown below.

Note: Ground the armor and shield through cable clamp.

FABRICATION OF CABLE AT RADAR NORTH-UP UNIT SIDE.

FABRICATION OF CABLE AT A-D CONVERTER SIDE.

CONNECTOR PLUG IS PREVIOUSLY FITTED AT THIS END FOR SATELLITE NAVIGATION SYSTEM, DOPPLER SONAR CURRENT INDICATOR AND SCANNING SONAR STEADY PICTURE DISPLAY



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APPENDIX 2. INTERCHANGEABILITY BETWEEN PCBs OF AD-10S AND AD-10

1. A-D Converter Board (Ref. to page AP2-2.)

<u>AD-10S</u>	<u>AD-10</u>
14P-0060	13P-5019

The A-D converter board (14P-0060) of AD-10S can be used in AD-10 as well if the following modification is made on 14P-0060 board. (It is also possible to use the A-D converter board of AD-10 in AD-10S by reversing the following modification.)

- (1) Remove jumper wires connected at the positions of R37, R40 and R43, and put the carbon resistors (150K ohms, 1/4W) at these positions.

2. Power Supply Board (Ref. to page AP2-2.)

<u>AD-10S</u>	<u>AD-10</u>
14P-0062	13P-5020

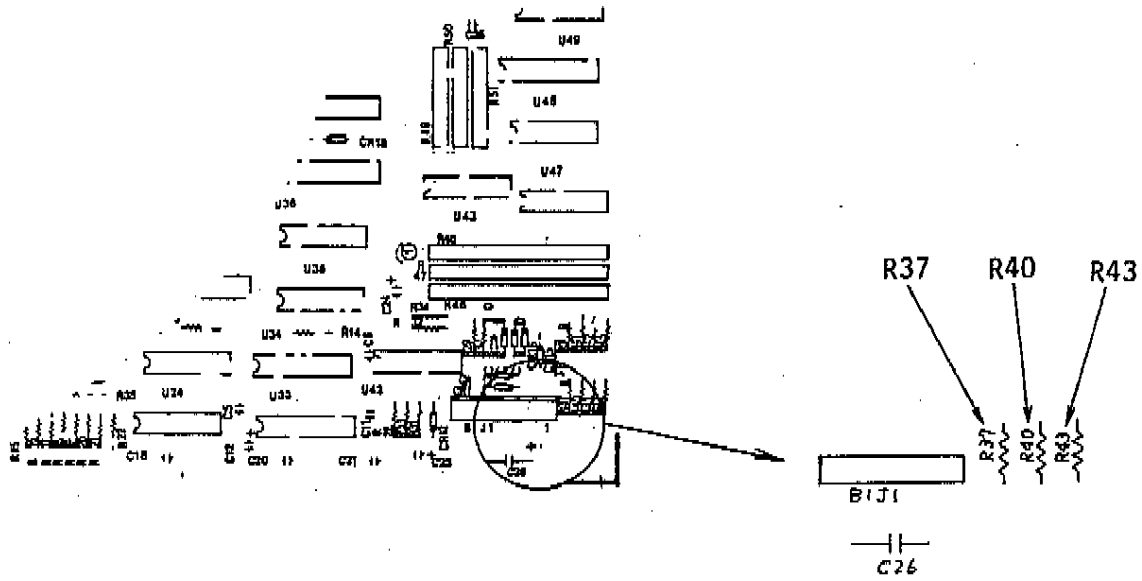
The power supply board (14P-0062) of AD-10S can be used in AD-10 as well if the following modification is made on 14P-0062 board. (It is also possible to use the power supply board of AD-10 in AD-10S by reversing the following modification.)

- (1) Remove the resistors R4, R5 and R6 (150K ohms x 3) and connect jumper wires at the respective positions.
- (2) Remove the resistors R7, R8 and R9 (22K ohms x 3).

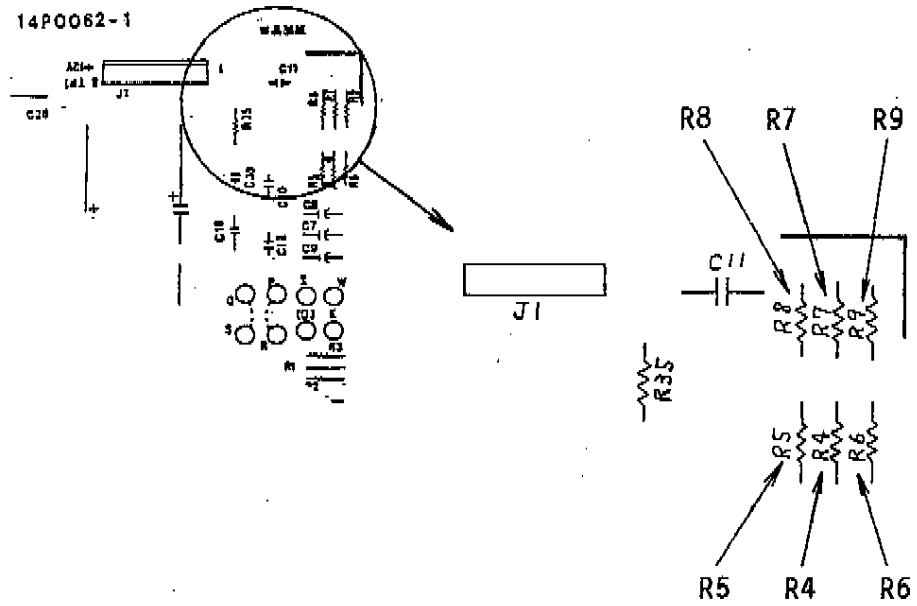
3. Display Board (AD-10S: 14P-0061, AD-10: 13P-5021)

The display board is not interchangeable each other.

Note: When both the A-D converter and power supply boards are changed at the same time (AD-10S ↔ AD-10), the above modification is not required.



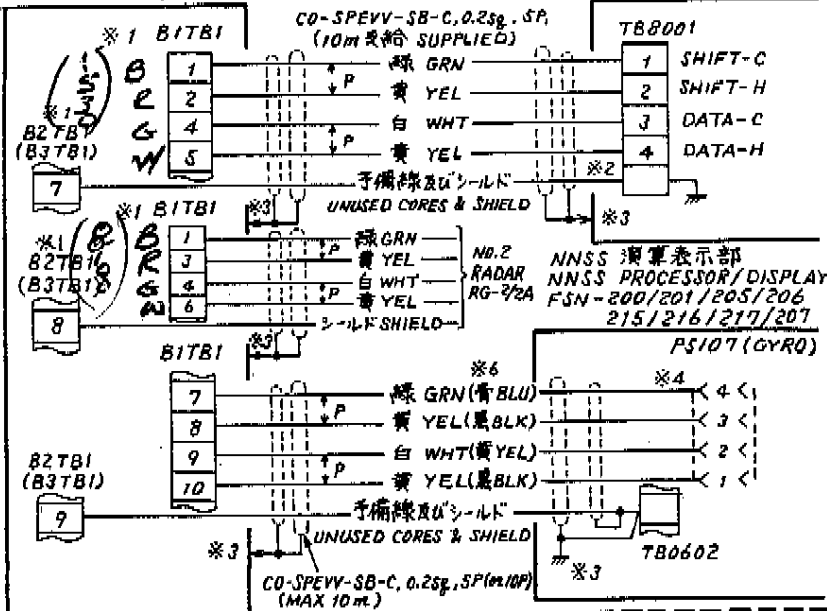
A-D Converter Board



Power Supply Board

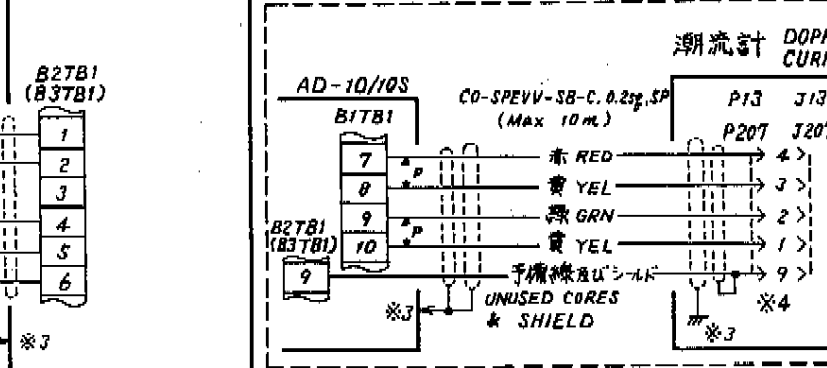
A-D コンバータ (ツイストペア) No.1 レーダー真方位表示装置
 A-D CONVERTER (TWISTED PAIR) NO.1 RADAR NORTH-UP UNIT
 AD-10/10S RG-2/2A

NOTE: ()内の端子台番号はAD-10S用, TERMINAL BOARD NUMBER IN () FOR AD-10S.
 J20
 CC 1-BK
 CH 2-R
 DC 3-GK
 DH 4-White

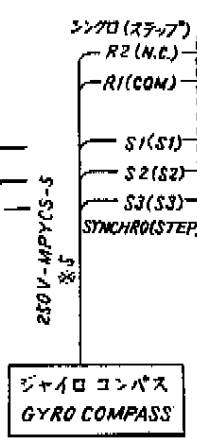


下記機種にも接続可能な相互結線図参照。CAN ALSO BE COMBINED WITH THE FOLLOWING EQUIPMENTS. REFER TO INDIVIDUAL INTERCONNECTION DIAGRAM.

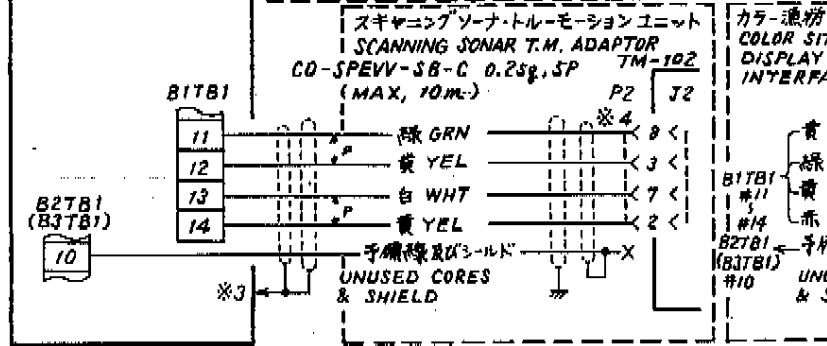
- BITBI #1, #2, #6 ← FR-800D, FCR-1400 SERIES, CD-140/CD-141
- BITBI #7, #8, #10 ← FSN-70



潮流計 DOPPLER SONAR CURRENT INDICATOR



ジャイロコンパス GYRO COMPASS

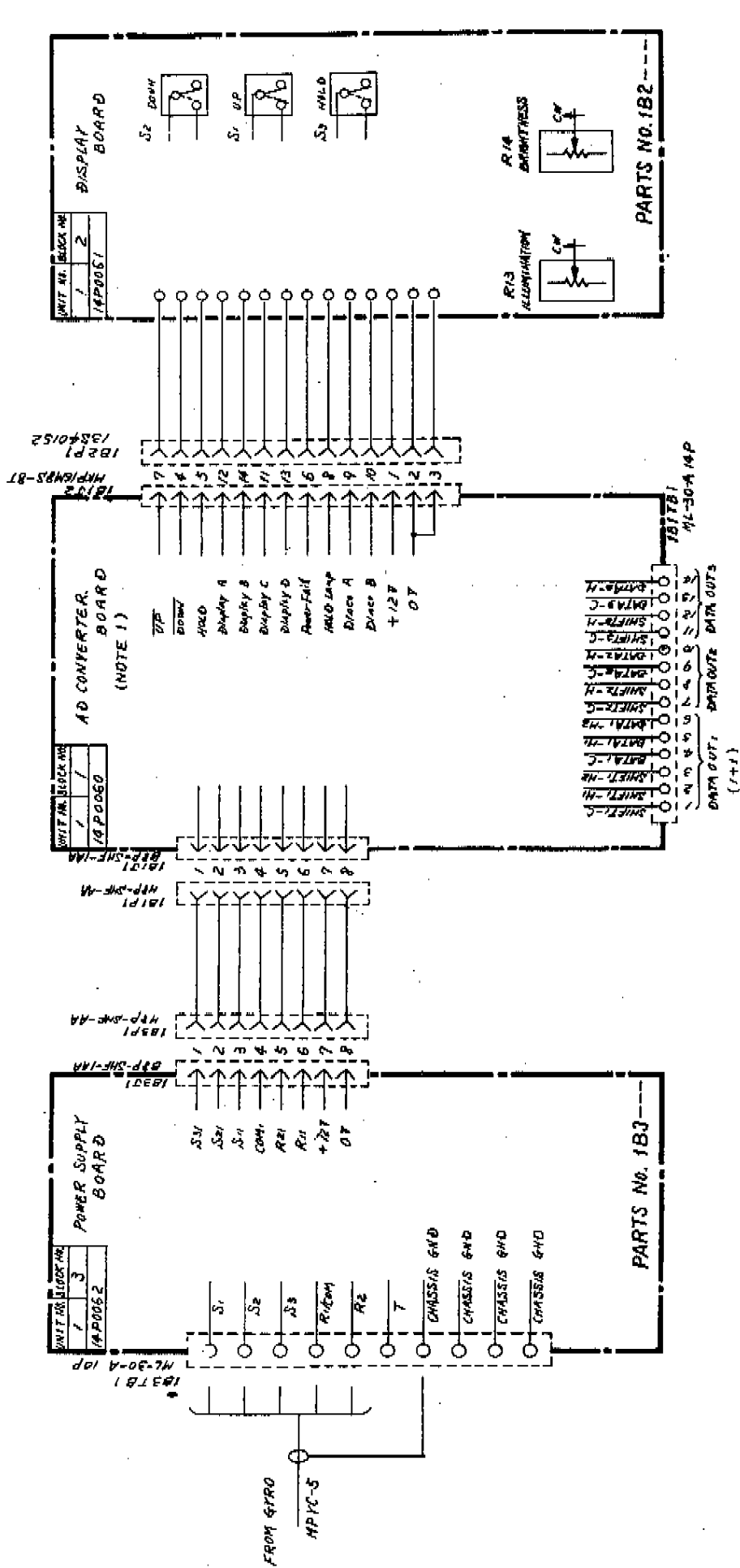


スキャニングソナートルモーションユニット SCANNING SONAR T.M. ADAPTOR TM-102

カラー濃弱ディスプレイ、外部インターフェイス COLOR SITUATION DISPLAY EXT. INTERFACE (CS-120A) P205, J205

- NOTE: *1. No.1 レーダーは、#1, #2, #4, #5, #7 に、No.2 レーダーは #1, #3, #4, #6, #8 にそれぞれ接続。
 NO.1 RADAR IS CONNECTED TO #1, #2, #4, #5, #7, AND NO.2 RADAR TO #1, #3, #4, #6, #8 RESPECTIVELY.
 *2. 端子台をメネジでアースに落とす。GROUND THRU TERMINAL BOARD FIXING SCREWS.
 *3. ケーブルクランプをアースに落とす。GROUND THRU CABLE CLAMP.
 *4. 出荷時ケーブルにはコネクター取付済。CONNECTOR PLUG PREVIOUSLY FITTED TO CABLE AT FACTORY.
 *5. 造船所支給。SHIPYARD SUPPLY.
 *6. ()内のカラーコードは10Pケーブル使用の場合、COLOR CODES IN () ARE THOSE FOR 10P CABLE.

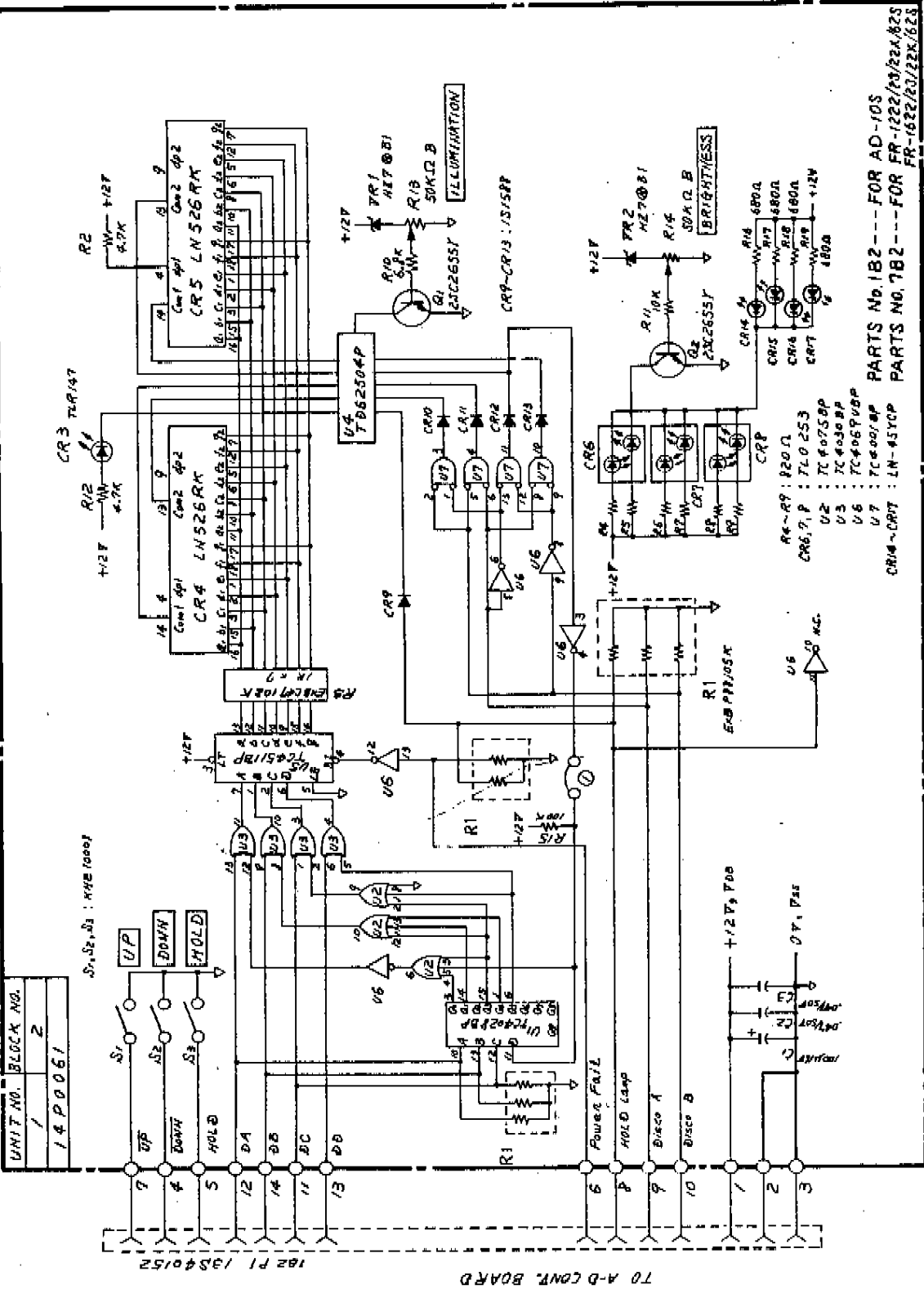
承認 APPROVED	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘要 REMARKS
FEB. 10. '83 K...		三角法 THIRD ANGLE PROJECTION				
検図 CHECKED	FEB. 10. '83	尺度 SCALE				
製図 DRAWN	107.26.80 K...	重量 WEIGHT				
						名称 TITLE AD-10 A-D CONVERTER AD-10S A-D CONVERTER
						図番 DWG. NO. C4248-007-H



NOTE 1. A-D コンバータ-基板の回路図は非公開。
SCHEMATIC DIAGRAM FOR A-D CONVERTER
BOARD IS NOT PUBLISHED.

承認 APPROVED	検査 CHECKED	製図 DRAWN	品名 ITEM	品名 NAME	数量 QTY.	材料 MATERIAL	数量 QTY.	図番 DWG. NO.	備考 REMARK
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	DEC-15-03	DEC-15-03	19	ML-30-A 14P	19		
			第三角法 THIRD ANGLE PROJECTION	比例尺 SCALE	重量 WEIGHT				
			名称 TITLE	AD-10S A-D CONVERTER					
			製図 DRAWN	製図 DWG. NO.	C4280-005-A				

総合回路図
AD-10S A-D CONVERTER
C4280-005-A
FURUNO ELECTRIC CO., LTD.



NOTE 1. 特記なき抵抗値は全て 1/4W スコンデンサは 12uF.
ALL RESISTANCE IN OHMS, 1/4W AND CAPACITANCE
IN MICROFARADS UNLESS NOTED OTHERWISE.

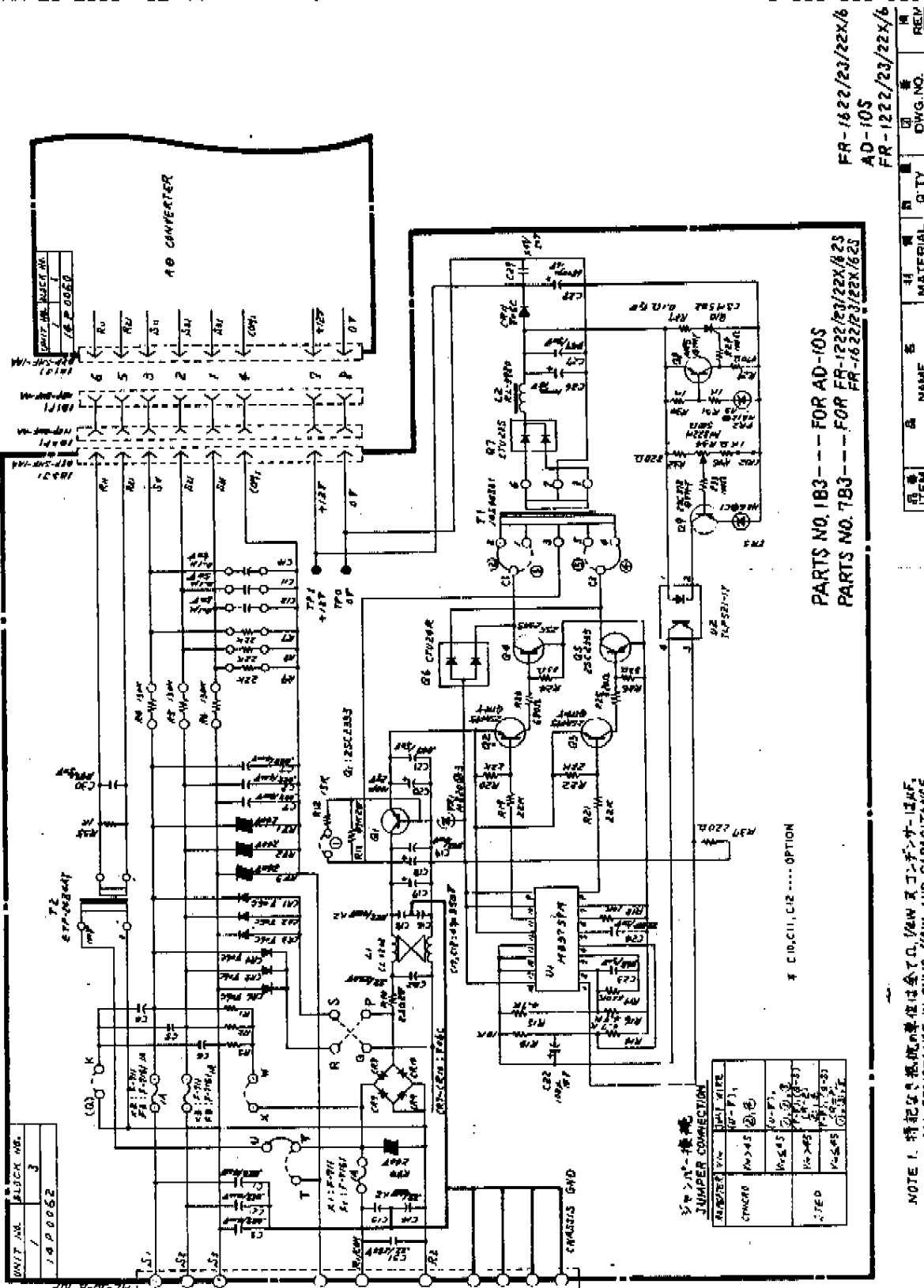
APPROVED	THIRD ANGLE PROJECTION	品名	数量	材料	数量	図番	REMARKS
CHECKED	SCALE	品名	数量	材料	数量	図番	
DRAWN	WEIGHT	品名	数量	材料	数量	図番	

表示基板回路図 14P0061
DISPLAY BOARD

AD-105
FR-1222/23/22X/62S, FR-1622/23/22X/62S

C4280-007-D

FURUNO ELECTRONIC CO., LTD.



PARTS NO. 1B3 --- FOR AD-103
 PARTS NO. 7B3 --- FOR FR-1222/23/22X/623
 FR-1622/23/22X/6
 AD-103
 FR-1222/23/22X/6

UNIT NO.	BLICK NO.	REV
1000052	3	

ITEM	NAME	QTY	MATERIAL	REV

APPROVED	THIRD ANGLE PROJECTION	TITLE
CHECKED	R. SCALE	電源基板回路図
DRAWN	WEIGHT	POWER SUPPLY BOARD
		14P
		DWG. NO. C4280-006-

NOTE 1. 特記なき抵抗値は全てΩ、1/4W又は1/2W、容量は全てμF
 ALL RESISTANCE IN OHMS, 1/4W AND CAPACITANCE
 IN MICROFARADS UNLESS NOTED OTHERWISE.

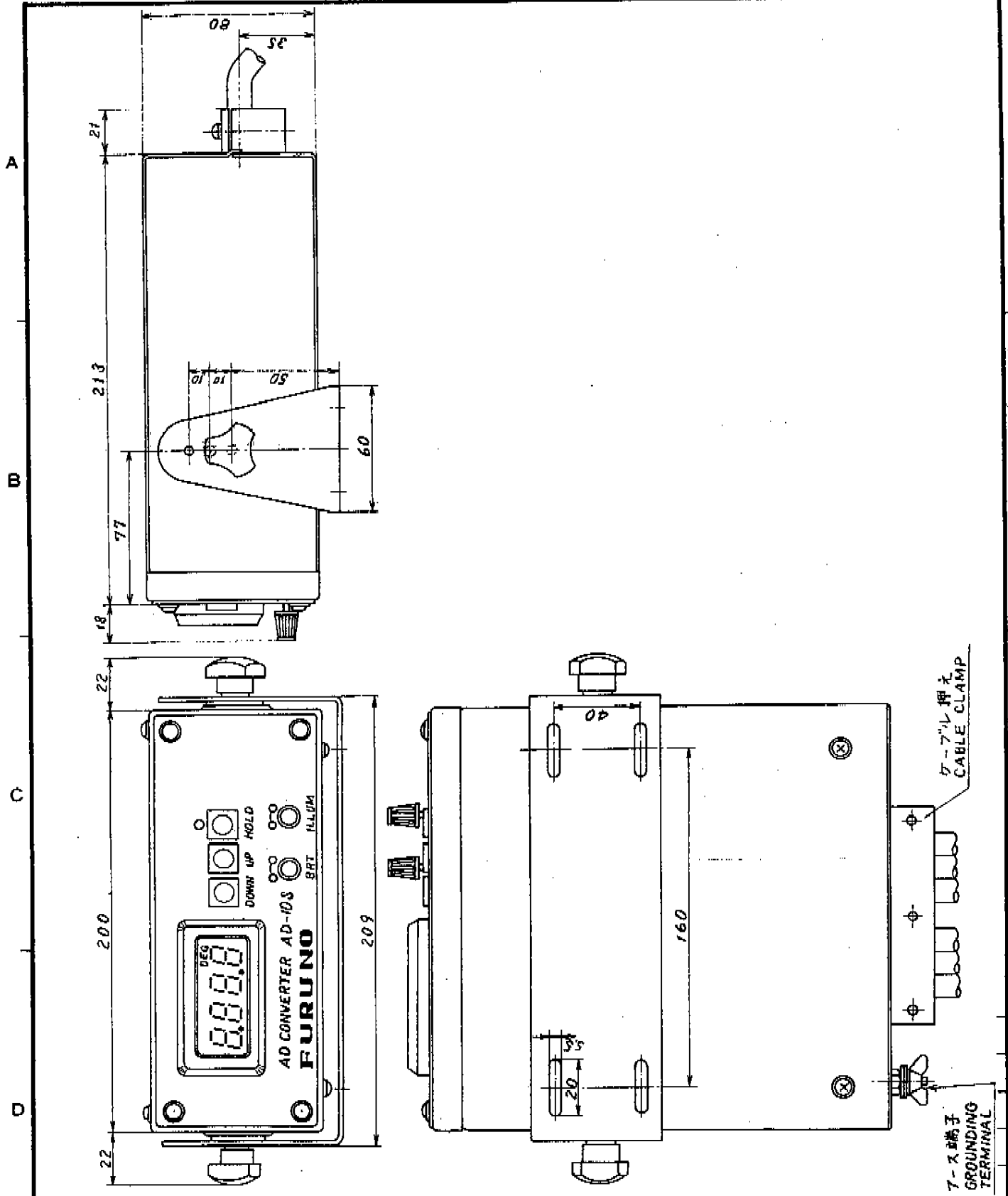
FURUNO ELECTRIC CO., LT

FURUNO

2

3

D 1



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	備考 REMARKS
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承認 APPROVED	MAY. 16. 2000	三角法 THIRD ANGLE PROJECTION		名称 TITLE	
検 CHECKED	MAY. 16. 2000	尺 SCALE	1/2.5	AD-10S A-D コンバータ寸法図 A-D CONVERTER	

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