

FURUNO

OPERATOR'S MANUAL

COLOR GPS PLOTTER SOUNDER

MODEL GP-1610CF



FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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SAFETY INSTRUCTIONS

Safety Instructions for the Operator



WARNING



Do not open the equipment.

Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Turn off the power immediately if water leaks into the equipment or the equipment is emitting smoke or fire.

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

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

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

Do not operate the equipment with wet hands.

Electrical shock can result.

Keep heater away from equipment.

Heat can alter equipment shape and melt the power cord, which can cause fire or electrical shock.



CAUTION

Use the proper fuse.

Use of a wrong fuse can result in fire or permanent equipment damage.

GPS position and velocity accuracies are controlled by the U.S. Department of Defense. Position may be degraded up to 100 meters.

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

Personal injury can result if the equipment is used as a chair or stepping stool, for example.

Do not place objects on the top of the equipment.

The equipment can overheat or personal injury can result if the object falls.

About the TFT LCD

The TFT LCD is constructed using the latest LCD techniques, and displays 99.99% of its pixels. The remaining 0.01% of the pixels may drop out or blink, however this is not an indication of malfunction.

Safety Instructions for the Installer



WARNING



Do not work inside the equipment unless totally familiar with electrical circuits.

Hazardous voltage which can shock, burn or cause serious injury exists inside the equipment.



Turn off the power at the mains switchboard before beginning the installation. Post a sign near the switch to indicate it should not be turned on while the equipment is being installed.

Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.



CAUTION



Ground the equipment to prevent electrical shock and mutual interference.

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 display unit.

Use the correct fuse.

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

Keep the following compass safe distance.

	Standard	Steering
Display Unit	0.7 m	0.6 m

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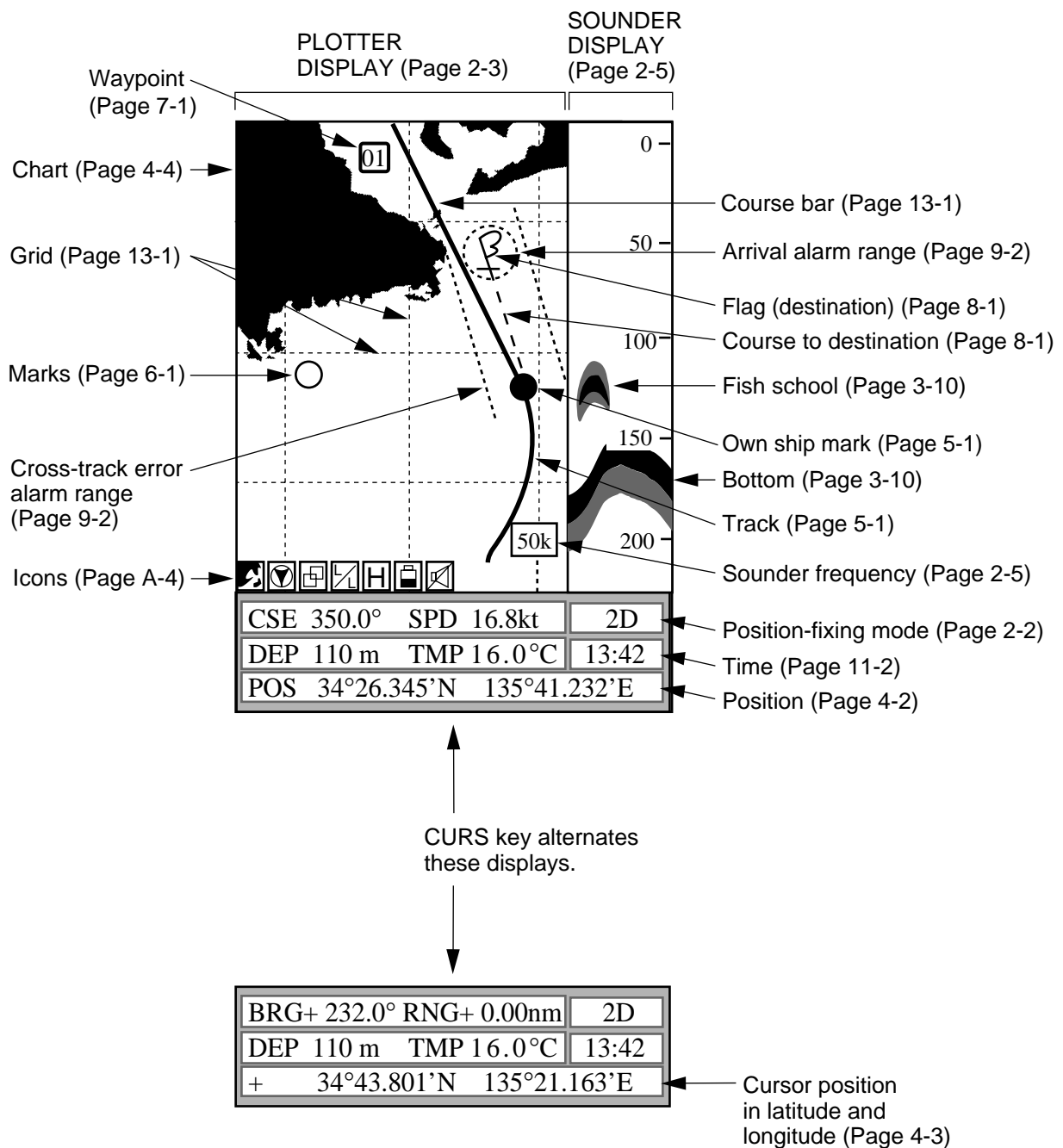
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FOREWORD

A Word to GP-1610CF Owners

Congratulations on your choice of the FURUNO GP-1610CF COLOR GPS PLOTTER SOUNDER. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 40 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

This equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless installed, operated and maintained properly. Please carefully read and follow the recommended procedures for installation, operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

Features

The GP-1610CF is a totally integrated GPS receiver, color video plotter and color video sounder. It mainly consists of a display unit and a GPS antenna.

Navigation information is displayed on a bright 5.6-inch color TFT LCD. On-screen information shown are position, range and bearing to cursor position, range, bearing, ETA and TTG to waypoint, etc.

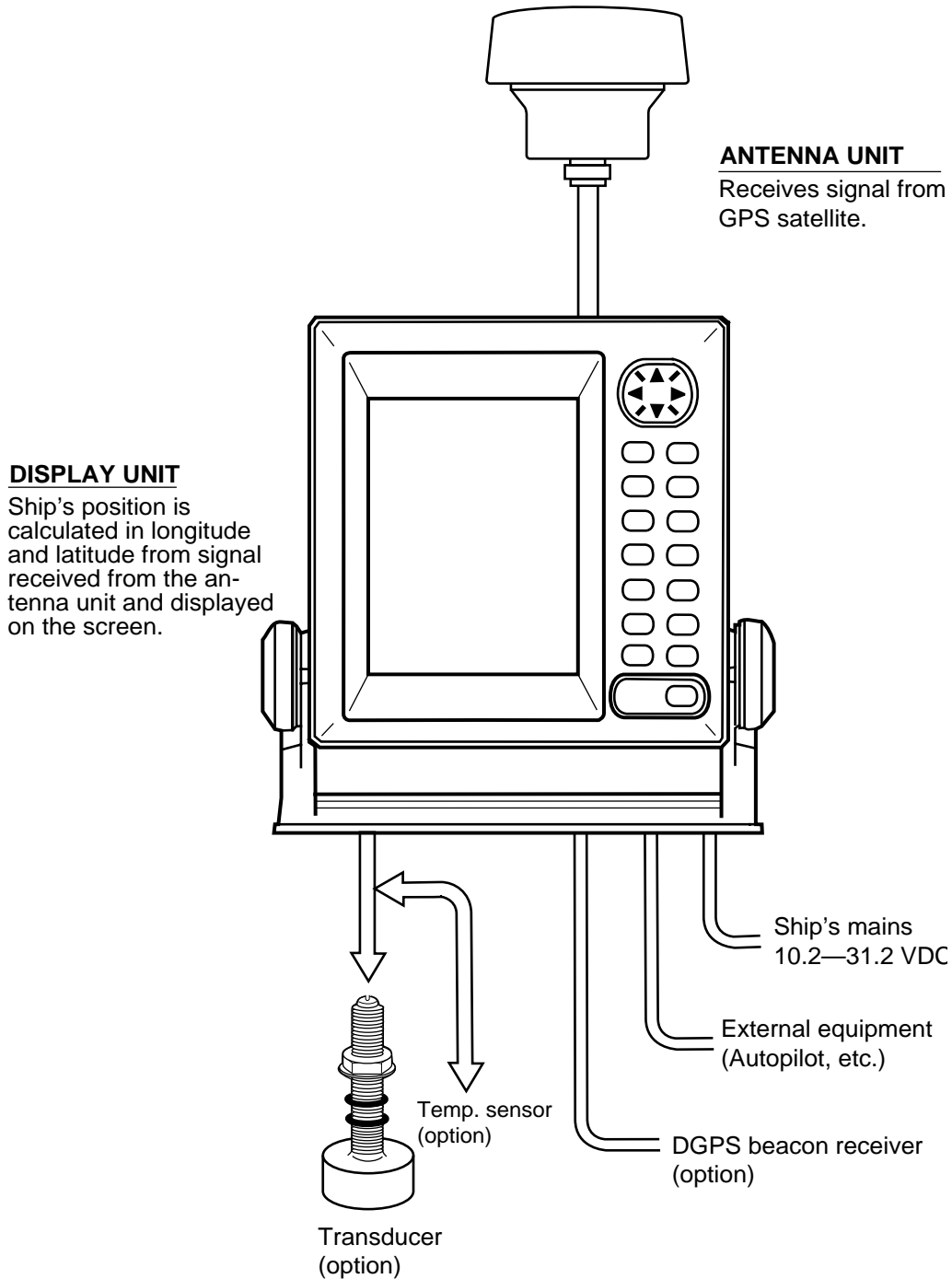
A high sensitivity receiver tracks up to eight satellites simultaneously. An 8-state Kalman filter ensures optimum accuracy in determination of vessel position, course and speed.

The main features of the GP-1610CF are

- Comprehensive navigation data displays.
- Bright 5.6-inch color LCD with temperature compensated tone and brilliance control.
- Automatic coastline chart loading.
- Position display in latitude and longitude, Loran C LOPs or Decca LOPs.
- Outputs steering information to FURUNO autopilots (FAP-50/55/300/330).
- Improved position accuracy with connection of DGPS beacon receiver (option).
- FURUNO and NAVIONICS chart cards.
- Memory capacity: 2,000 points of track, 100 marks, 100 event marks, 200 waypoints and 20 routes.
- Alarms: Arrival, Anchor Watch, Cross-track Error, Depth, Fish, Speed, Trip, and Water Temperature.
- Man overboard feature records latitude and longitude coordinates at time of man overboard and provides continuous updates of range and bearing to that point.
- "Highway" display provides graphic presentation of ship's track and is useful for monitoring cross track error.
- Automatic or manual video sounder operation.

System Configuration

The GP-1610CF mainly consists of a display unit and a GPS antenna. A dual frequency transducer is optionally available. The chart card drive in the display unit loads electronic charts. External equipment which can be connected include water temperature and speed sensors, autopilot, and DGPS beacon receiver.



INSTALLATION

1.1 Equipment Lists

Standard supply

No.	Name	Type	Code No.	Qty	Remarks
1	Display Unit	GP-1610CF-E		1	
2	Antenna Unit	GPA-016		1	
3	Installation Materials	CP86-00300	000-041-038	1 set	
4	Spare Parts	SP86-00300	004-394-640	1 set	

Optional equipment

No.	Name	Type	Code No.	Remarks
1	Antenna cable set	CP20-01700	004-372-110	30 m, for antenna cable extension
		CP20-01710	004-372-120	50 m, for antenna cable extension
2	Right-angle antenna base	No.13-QA330	000-803-239	For mounting antenna unit
3	L-angle antenna base	No.13-QA310	000-803-240	
4	Antenna base for rail mounting	No.13-RC5160	000-806-114	
5	Mast mount fixture	CP20-01111	000-040-722	
6	ST sensor	ST-02MSB	000-137-986	Thru-hull type
		ST-02PSB	000-137-987	
7	Temperature sensor	T-02MTB	000-040-026	With 8 m cable, transom mount
		T-03MSB	000-040-027	With 8 m cable, thru-hull type

Optional equipment (con't)

No.	Name	Type	Code No.	Remarks
8	Transducer	520-5PSD	000-015-125	
		520-5PWD	000-015-126	With 8 m cable, transom mount
		520-5MSD	000-015-127	With 8 m cable and waterproof connector
9	Dual frequency transducer	524ST-MSD	000-015-224	
		520ST-PWD	000-015-128	
10	Cable assy.	MJ-A6SPF0011-100	000-132-336	6P-4P, 10m
		MJ-A6SPF0011-050	000-132-244	6P-4P, 5m
		MJ-A6SPF0012-100	000-133-817	6P-6P, 10m
		MJ-A6SPF0012-050	000-134-424	6P-6P, 5m
		MJ-A7SPF0003-050	000-136-730-01	7P-6P, 5m for DGPS
11	Inner hull kit S	22S0191-0	000-802-598	
12	Converter connector set	CP86-00310	004-395-280	

1.2 Installation of Standard Equipment

Installing the display unit

Mounting considerations

The display unit can be installed on a tabletop or on the overhead.

When selecting a mounting location for the display unit keep the following in mind:

- Keep the display unit out of direct sunlight.
- The temperature and humidity should be moderate and stable.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.
- Keep the unit away electromagnetic field generating equipment such as motor, generator.
- For maintenance and checking purposes, leave sufficient space at the sides and rear of the unit and leave slack in cables.
- A gyrocompass will be affected if placed too close to the display unit. Observe the following compass safe distances to prevent disturbance to the gyrocompass:

Standard compass: 0.7 meters

Steering compass: 0.6 meters

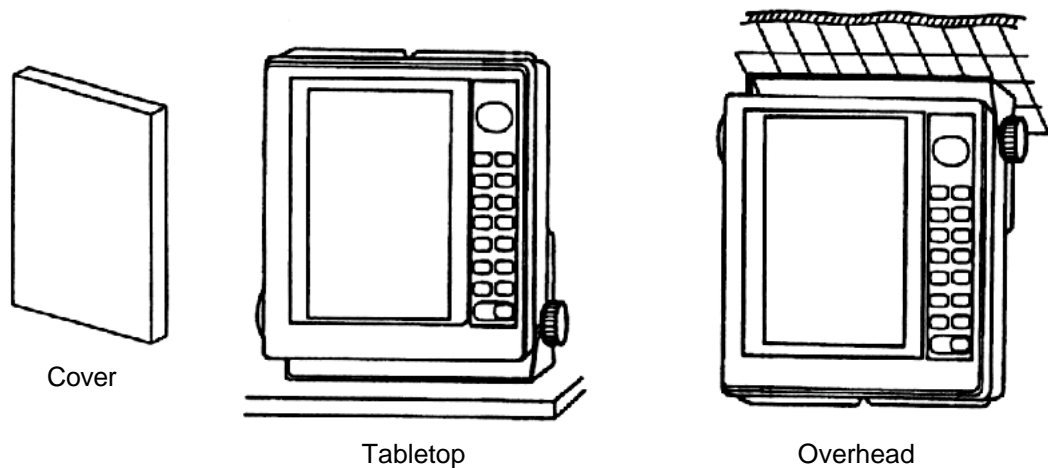


Figure 1-1 Display unit mounting methods

Tabletop mounting

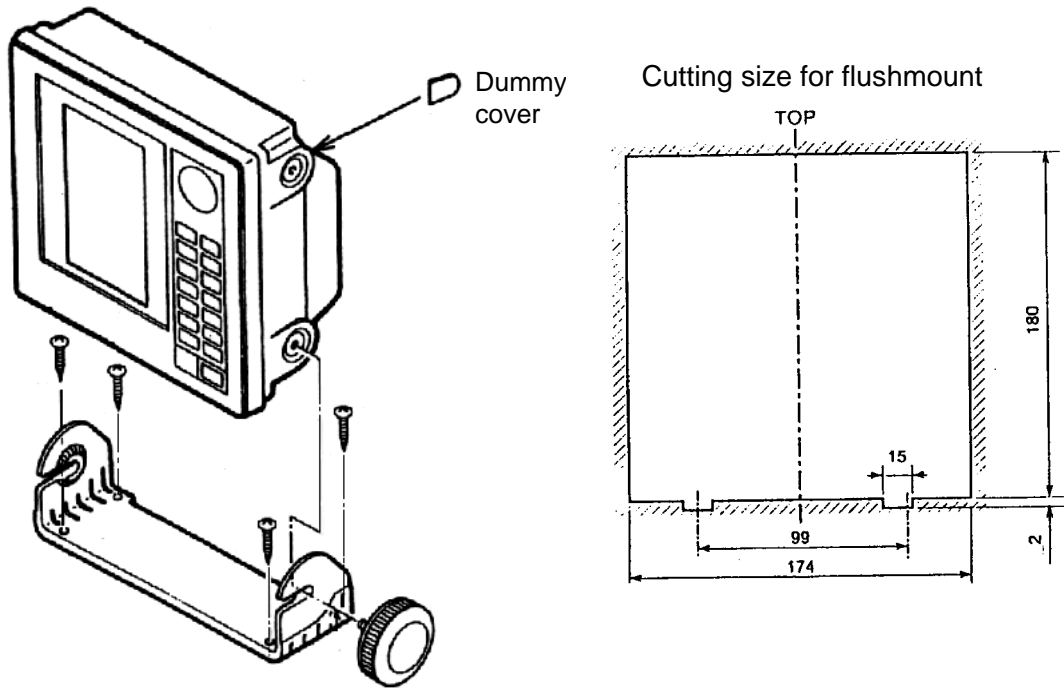


Figure 1-2 Display unit mounting methods

Installing the antenna unit

Mounting considerations

When selecting a mounting location for the antenna unit, keep in mind the following points:

- Select a location out of the radar beam. The radar beam will obstruct or prevent reception of the GPS satellite signal.
- Be sure the location offers a clean line-of-sight to satellite. Objects within line-of-sight to a satellite, for example, a mast or funnel, block reception and cause prolonged acquiring time or interruption of position fix.
- Mount the unit as high as possible. This will keep the unit free of water spray, which can interrupt reception of GPS satellite signal if frozen.
- Separate the unit well away from the antenna of radio equipment.

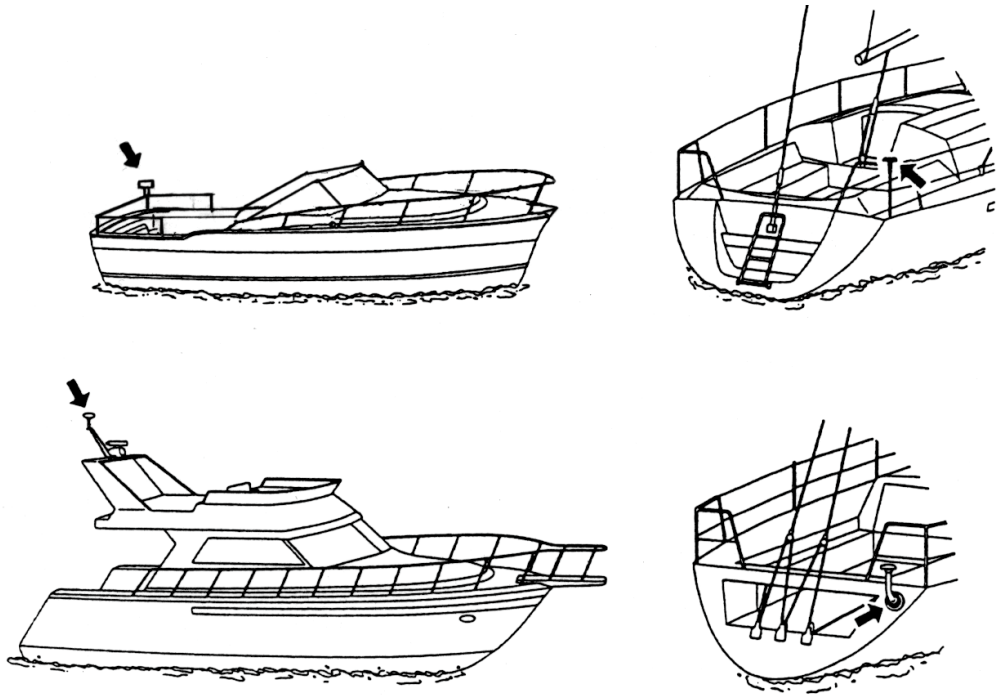


Figure 1-3 Typical antenna unit mounting locations

Antenna unit mounting procedure

You will need a medium size slotted-head screwdriver and vinyl tape.

The standard antenna is usually fastened to a length of pipe and fastened to a mast. (A mast mount fixture is optionally available for this.) The threaded antenna base accepts a standard antenna mount with a 1"-14 straight thread. Mount the antenna on a length of pipe with a 1"-14 threaded end.

1. Pass the antenna cable through the pipe. Fasten the connector on the cable to the antenna.

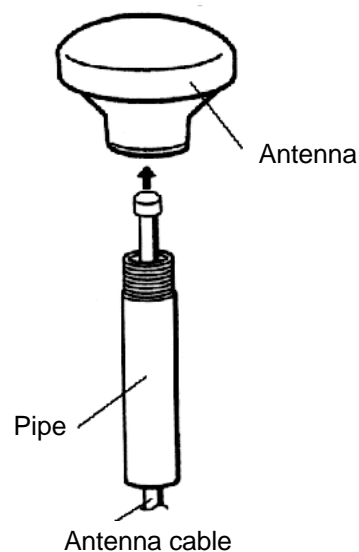


Figure 1-4 Passing antenna cable through pipe

2. Screw the pipe into the antenna. DO NOT USE TOOLS TO FASTEN THE ANTENNA TO ITS MOUNTING; ONLY HAND TIGHTEN.

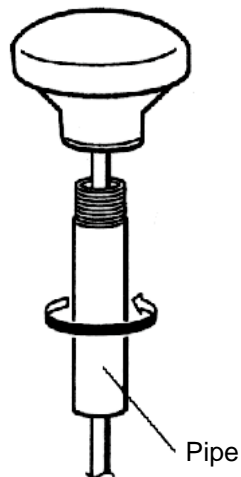


Figure 1-5 Fastening pipe to antenna

3. Tape the junction between the pipe and antenna unit with vinyl tape.

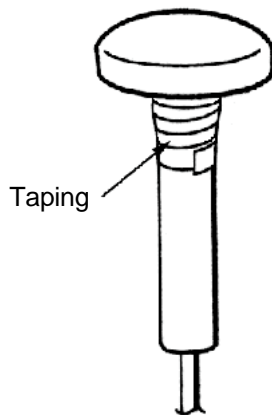


Figure 1-6 Taping the antenna

4. Attach the mounting fixture to the mast and set the pipe with antenna to the mounting fixture.

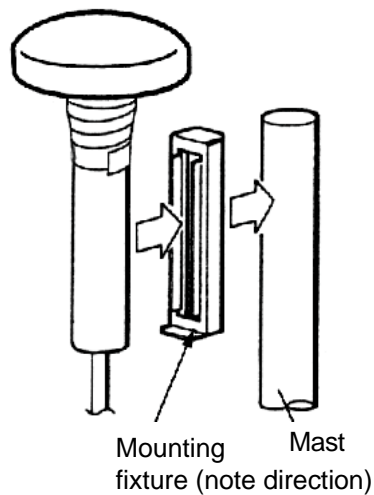


Figure 1-7 Attaching antenna to mounting fixture

5. Tape the antenna unit, mounting fixture and mast with vinyl tape.

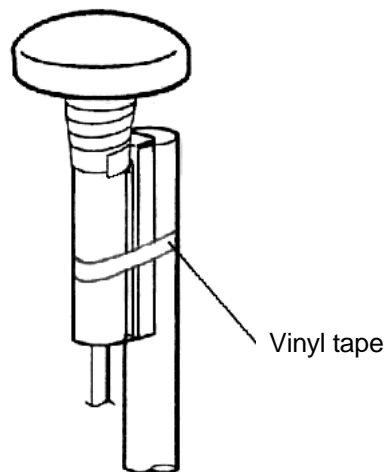


Figure 1-8 Securing antenna to mast with vinyl tape

6. Attach a clamp to the antenna unit and tighten. Leaving some slack in the antenna cable as shown, fix it with vinyl tape.

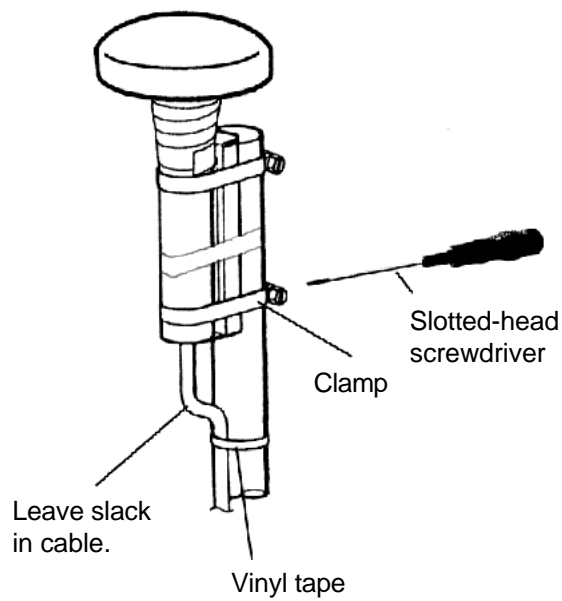


Figure 1-9 Fixing the antenna cable with vinyl tape

Wiring

All wiring are terminated at the rear of the display unit.

Power cable

Connect the power cable to the power connector. Connect the leads to the battery (12 or 24 VDC); white to plus(+) terminal and black to minus(-) terminal.

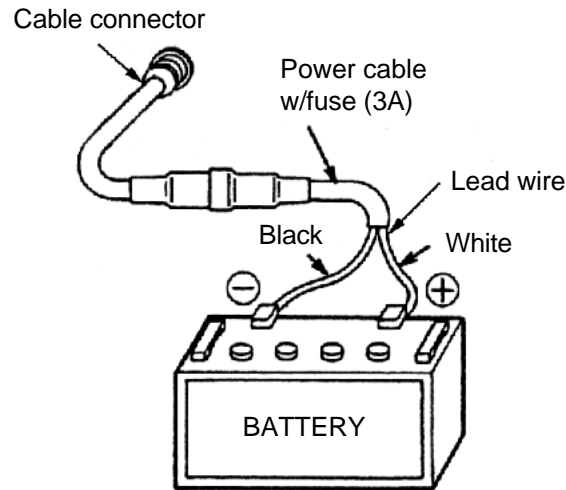


Figure 1-10 Connecting the power cable to the battery

Antenna unit

Connect the antenna unit cable to the GPS ANT connector.

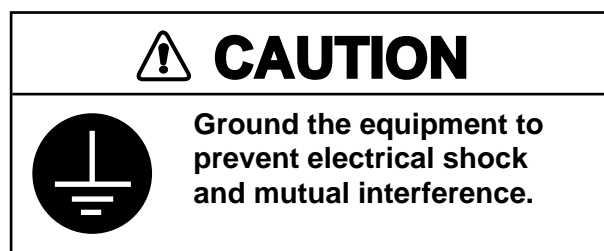
Transducer

Connect the transducer cable to the XDR connector.

Ground

The display unit contains several CPUs. While they are operating, they radiate noise, which can interfere with radio equipment. Ground the

unit to prevent interference. The grounding wire should be 1.25 sq or larger and as short as possible. Connect the grounding wire to ship's ground by silver-alloy brazing. On a fiberglass boat, it is best to install a ground plate that measures about 20 cm by 30 cm on the outside of the hull bottom to provide a ground point. If this is not practical, the engine block can be used.



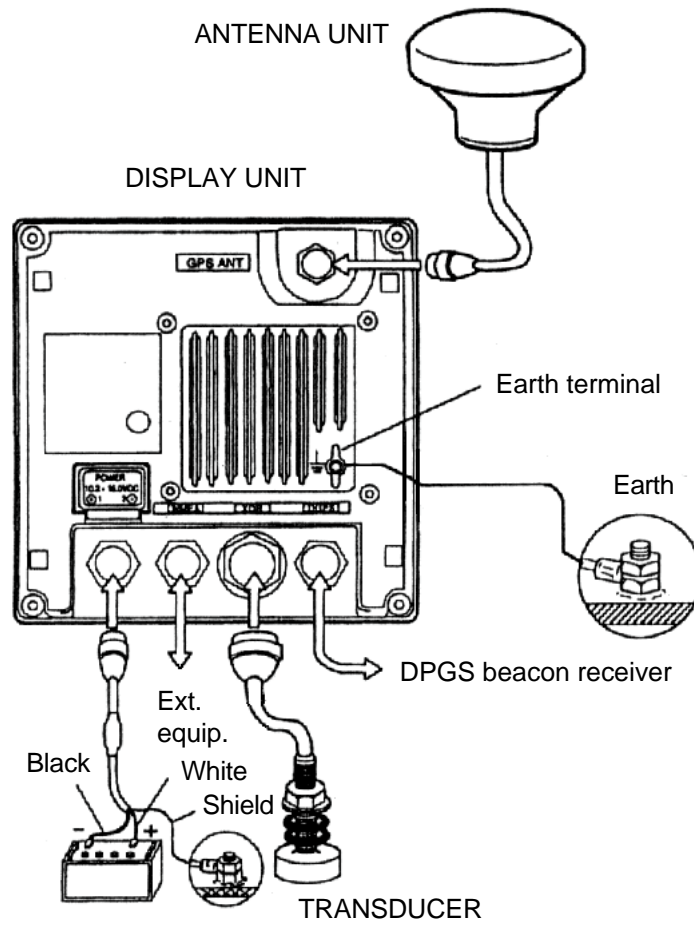


Figure 1-11 Display unit, rear view

1.3 Installation of Transducers

Installing the inside-hull mount transducer

Necessary tools

You will need the following tools:

- Sandpaper (#100)
- Silicone sealant
- Silicone grease

Remarks on installation

- Do the installation with the boat hauled out of the water.
- Turn off the engine while installing the equipment.
- Install the transducer in the engine room.

Selecting the mounting location

Keep the following points in mind when selecting a mounting location:

- The mounting location should be where the hull is of single-hull thickness and is void of air or flotation materials other than solid fiberglass between the transducer face and the water.
- Do not place the transducer over hull struts or ribs which run under the hull.
- Avoid a location where the rising angle of the hull exceeds 15°, to minimize the effect of the boat's rolling.
- You will finalize the mounting location through some trial and error. The procedure for this is shown later.

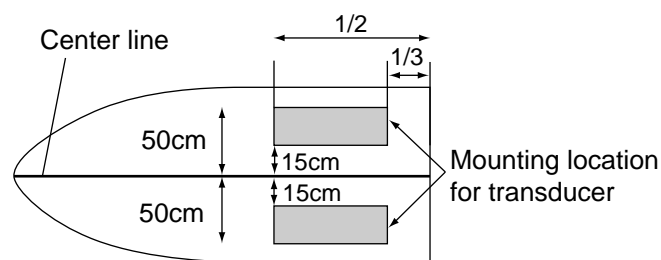


Figure 1-12 Inside-hull transducer mounting location

Attaching the transducer

1. Clean the transducer face to remove any foreign material. Lightly roughen the transducer face with #100 sandpaper. Also, roughen the inside of the hull where the transducer is to be mounted.
2. Warm the silicone sealant to 40°C before usage to soften it. Coat the transducer face and mounting location with silicone sealant.

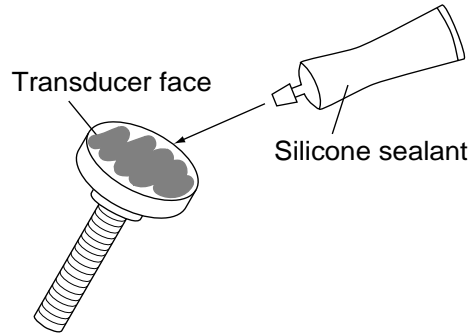


Figure 1-13 Coating the transducer face with silicone sealant

3. Press the transducer firmly down on the hull and gently twist it back and forth to remove any air which may be trapped in the silicone sealant.

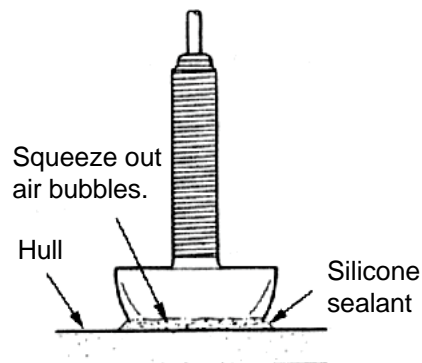


Figure 1-14 Attaching transducer to hull with silicone sealant

Observing the picture

1. Press the POWER key to turn on the display unit.
2. Press the PLTR key.
3. Press the AUTO key.

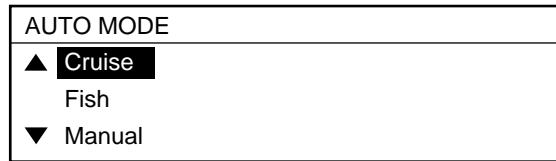


Figure 1-15 Auto mode selection screen

4. Press ▼ twice to select Manual.

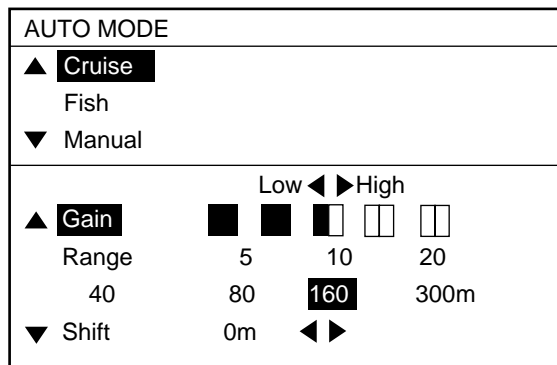


Figure 1-16 Auto mode adjustment screen

5. Confirm that Gain is set at 5 (midpoint).
6. Press ▼ once to select Range.
7. Press ◀ four times to select 10.
8. Note the depth to the seabed.

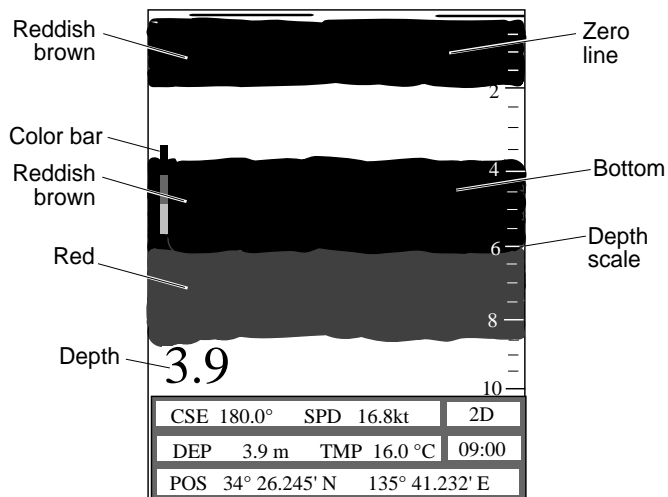


Figure 1-17 Video sounder picture

If the bottom is displayed in red and the light-blue color appears the mounting location is suitable. You can leave the transducer in position.

If the bottom is not displayed in reddish brown, the mounting location is unsuitable. Relocate the transducer and do the following.

1. Press the POWER key to turn off the power.
2. Gently dismount the transducer with piece of wood.
3. Do steps 1 through 5 in the previous procedure. Repeat until a suitable location is found.

Final preparation

Support the transducer with a piece of wood to keep it in place while it is drying. Let the transducer dry 24–72 hours.

Installing the thru-hull mount transducer

Transducer mounting location

This type of mounting provides the best performance of all, since the transducer protrudes from the hull and the effect of air bubbles and turbulence near the hull skin is reduced. When the boat has a keel, the transducer should be at least 30 cm away from it. Typical through hull mountings are shown in the figure on the next page.

The performance of the video sounder is directly related to the mounting location of the transducer, especially for high-speed cruising. The installation should be planned in advance, keeping the standard cable length (8 m) and the following factors in mind:

- Air bubbles and turbulence caused by movement of the boat seriously degrade the sounding capability of the transducer. The transducer should, therefore, be located in a position where water flow is the smoothest. Noise from the propellers also adversely affects performance and the transducer should not be mounted nearby. The lifting strakes are notorious for creating acoustic noise, and these must be avoided by keeping the transducer inboard of them.
- The transducer must always remain submerged, even when the boat is rolling, pitching or up on a plane at high speed.
- A practical choice would be somewhere between 1/3 and 1/2 of the boat's length from the stern. For planing hulls, a practical location is generally rather far astern, so that the transducer is always in water regardless of the planing attitude.

Transducer outline drawings

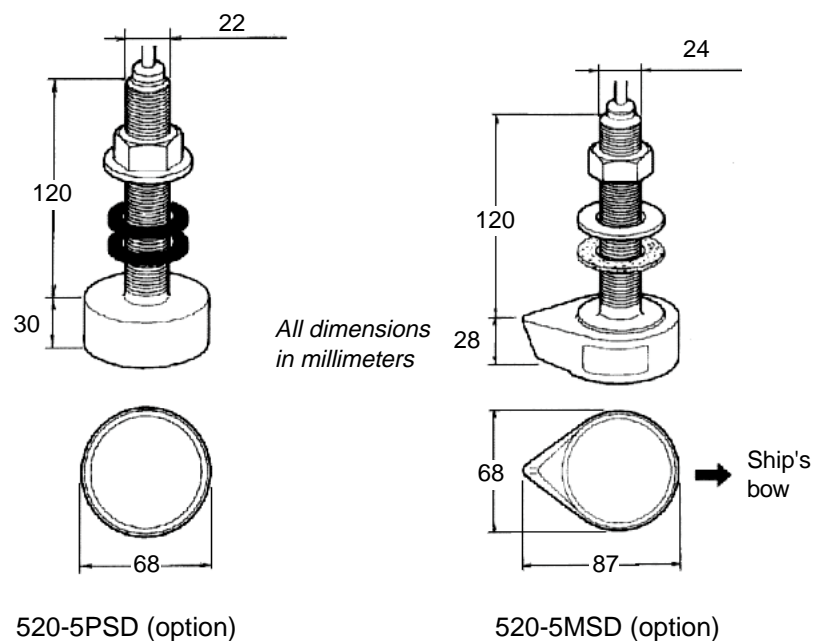
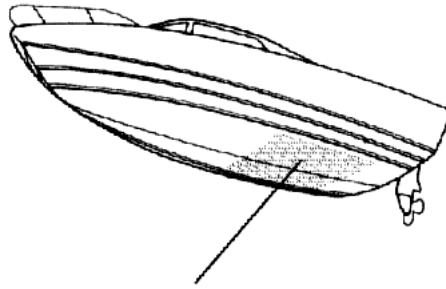


Figure 1-18 Transducer outline drawings

Acceptable transducer mounting locations

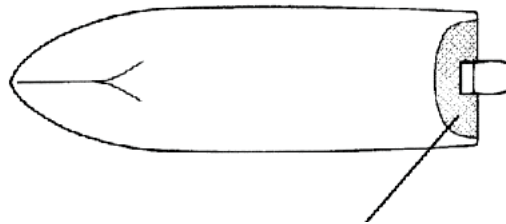
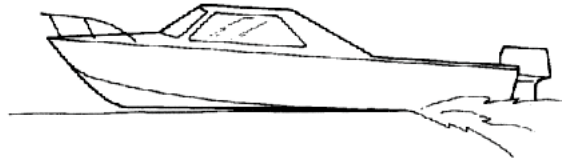
Deep-V hull



- Position 1/2 to 1/3 length of the hull from stern
- 15 to 30 cm off center line (inside first lifting strakes).

Figure 1-19 Transducer mounting location on deep-V hull

High speed V-planing hull



- Within the wetted bottom area
- Deadrise angle within 15°

Figure 1-20 Transducer mounting location on high speed V-planing hull

Typical through-hull mount transducer installations

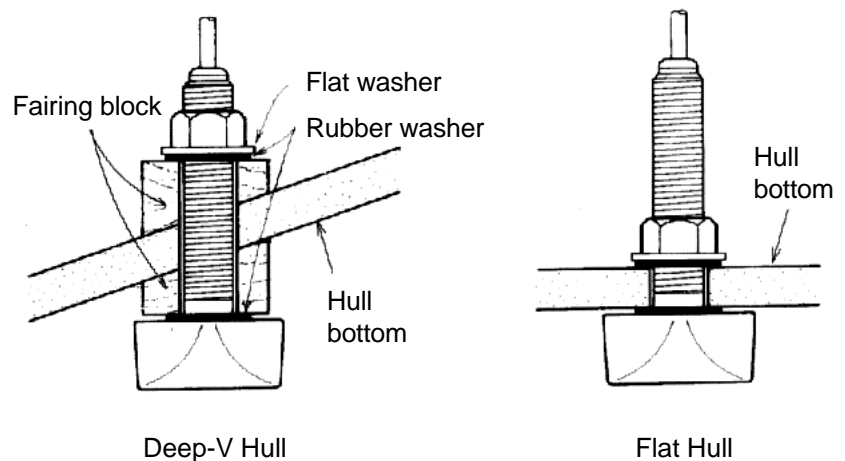


Figure 1-21 Typical through-hull mount transducer installations

Procedure for installing the thru-hull mount transducer

1. With the boat hauled out of the water, mark the location selected for mounting the transducer on the bottom of the hull.
2. If the hull is not level within 15° in any direction, fairing blocks made out of teak should be used between the transducer and hull, both inside and outside, to keep the transducer face parallel with the water line. Fabricate the fairing block as shown below and make the entire surface as smooth as possible to provide an undisturbed flow of water around the transducer. The fairing block should be smaller than the transducer itself to provide a channel to divert turbulent water around the sides of the transducer rather than over its face.

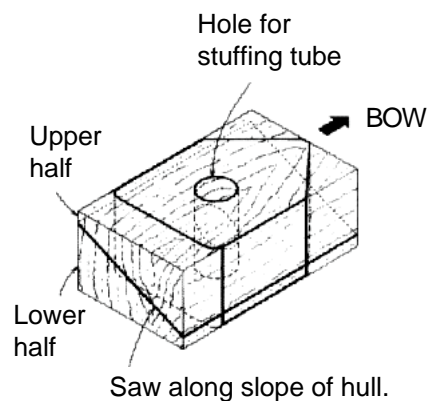


Figure 1-22 Construction of fairing block

3. Drill a hole just large enough to pass the threaded stuffing tube of the transducer through the hull, making sure it is drilled vertically.
4. Apply a sufficient amount of high quality caulking compound to the top surface of the transducer, around the threads of the stuffing tube and inside the mounting hole (and fairing blocks if used) to ensure watertight mounting.
5. Mount the transducer and fairing blocks and tighten the locking nuts. Be sure that the transducer is properly oriented and its working face is parallel to the waterline.

Note: Do not over-stress the stuffing tube and locking nuts through excessive tightening, since the wood block will swell when the boat is placed in the water. It is suggested that the nut be tightened lightly at installation and retightened several days after the boat has been launched.

Installing the transom mount transducer

This type of mounting is very commonly employed, usually on relatively small I/O or outboard boats. Do not use this method on an inboard motor boat because turbulence is created by the propeller ahead of the transducer.

There are two methods of installation: flush with hull (for flat hulls) and projecting from hull (for deep V-hulls).

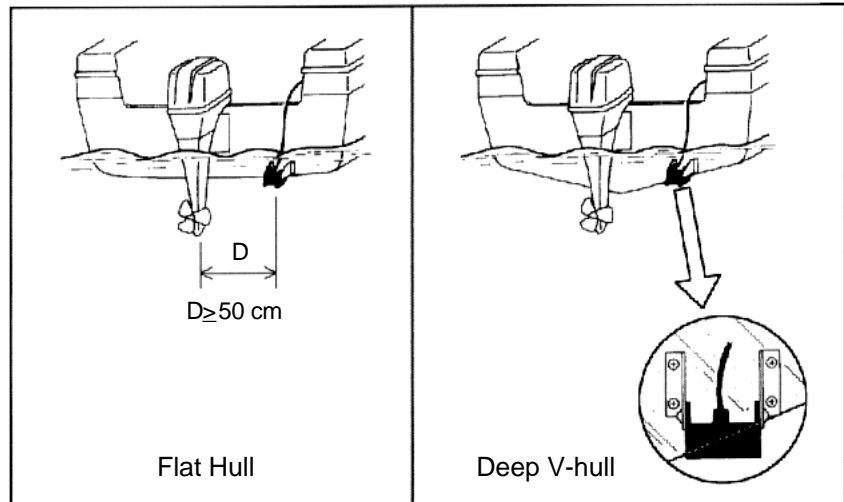


Figure 1-23 Transom mount transducer mounting locations

Installing the transom mount transducer flush with hull (for flat hulls)

A suitable mounting location is at least 50 cm away from the engine and where the water flow is smooth.

1. Drill four pilot holes in the mounting location.
2. Attach the transducer to the bracket with tapping screws (supplied).
3. Adjust the transducer position so the transducer faces right to the seabed.

Note: If necessary, to improve water flow and minimize air bubbles staying on the transducer face, incline the transducer about 5° at the rear. This may require a certain amount of experimentation for fine tuning at high cruising speeds.

4. Fill the gap between the wedge front of the transducer and transom with epoxy material to eliminate any air spaces.

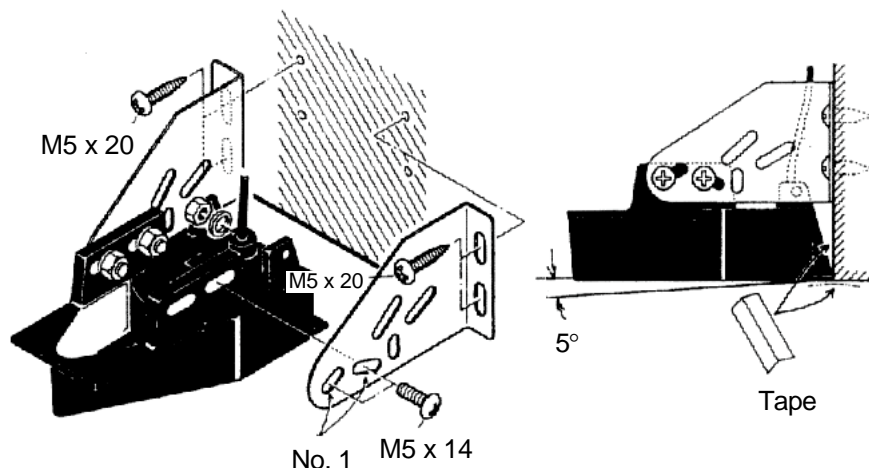


Figure 1-24 Transom mount transducer, mounting flush with hull

Installing the transom mount transducer projecting from hull (for deep-V hulls)

This method is employed on deep-V hulls and provides good performance because the effects of air bubbles are minimal. Install the transducer parallel with water surface; not flush with hull. If the boat is placed on a trailer care must be taken not to damage the transducer when the boat is hauled out of the water and put on the trailer.

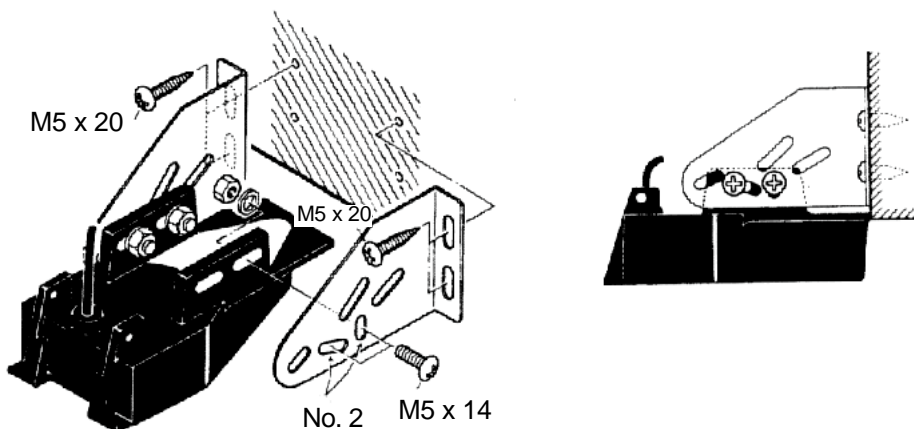


Figure 1-25 Transom mount transducer, projecting from hull

Transducer preparation

Before putting the boat in water, wipe the face of the transducer thoroughly with a detergent liquid soap. This will lessen the time necessary for the transducer to have good contact with the water. Otherwise the time required for complete "saturation" will be lengthened and performance will be reduced.

Do not paint the transducer. Performance will be affected.

1.4 Installation of Optional Sensors

Through-hull mount water temperature/speed sensor (ST-02MSB, ST-02PSB)

Select a suitable mounting location considering the following:

- Select a mid-boat flat position. The sensor does not have to be installed perfectly perpendicular. The sensor must not be damaged in dry-docking operation.
- Select a place apart from equipment generating heat.
- Select a place in forward direction viewing from the drain hole for cooling water.
- Select a place free from vibration.

1. Dry-dock the boat.
2. Make a hole of approx. 51 mm diameter.
3. Unfasten locknut and remove the sensor section.
4. Apply high grade sealant to the flange of the sensor.
5. Pass the sensor casing through the hole.
6. Face the notch on the sensor toward boat's bow and tighten the flange.
7. Set the sensor section to the sensor casing and tighten the locknut.
8. Launch the boat and check for water leakage around the sensor.

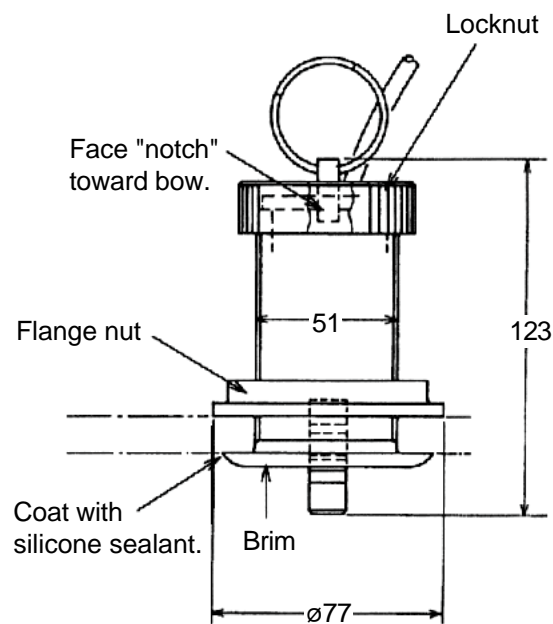


Figure 1-26 Water temperature/speed sensor ST-02MSB, ST02PSB

Transom mount water temperature sensor T-02MTB

- Fix the cable at a convenient location with cable clamp.
- When the cable is led in through the transom board, make a hole of approx. 17 mm diameter to pass the connector. After passing the cable, fill the hole with a sealing compound.

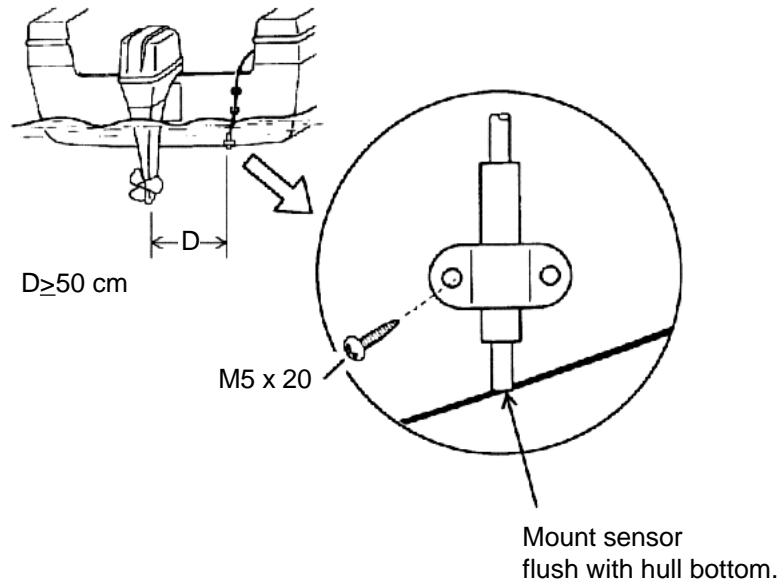


Figure 1-27 How to install transom mount water temperature sensor T-02MTB

Thru-hull mount water temperature sensor T-03MSB

- Select a mid-boat flat position. The sensor does not have to be installed perfectly perpendicular. The sensor must not be damaged in dry-docking operation.
 - Select a place apart from equipment generating heat.
 - Select a place in forward direction viewing from the drain hole for cooling water.
 - Select a place free from vibration.
1. Dry-dock the boat.
 2. Drill a hole of 25 mm in the hull.
 3. Pass the sensor cable through the hull.
 4. Pass the rubber washer, washer and locknut onto the cable in that order.
 5. Apply high grade sealant to the sensor flange, sensor and locknut. Tighten the locknut. Do not overtighten it.
 6. Launch the boat and check for water leakage around the sensor.

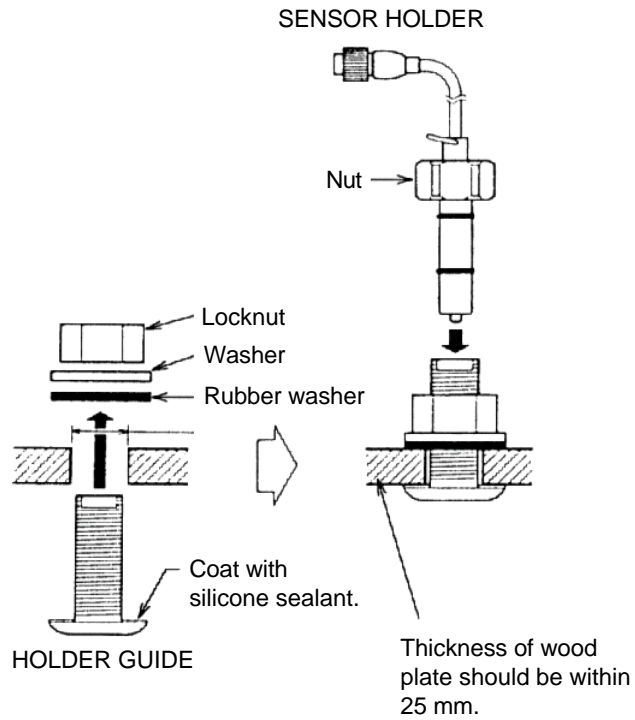


Figure 1-28 Thru-hull mount water temperature sensor T-03MSB

1.5 Connection of Optional Equipment

Connecting a DGPS beacon receiver

Most any DGPS beacon receiver having RS-422 or RS-232C output level can be connected. (Connection of the FURUNO FR-80 requires no modification.) For RS-232C, a level converter (local supply) is required. Connect the receiver to the DGPS connector at the rear of the display unit.

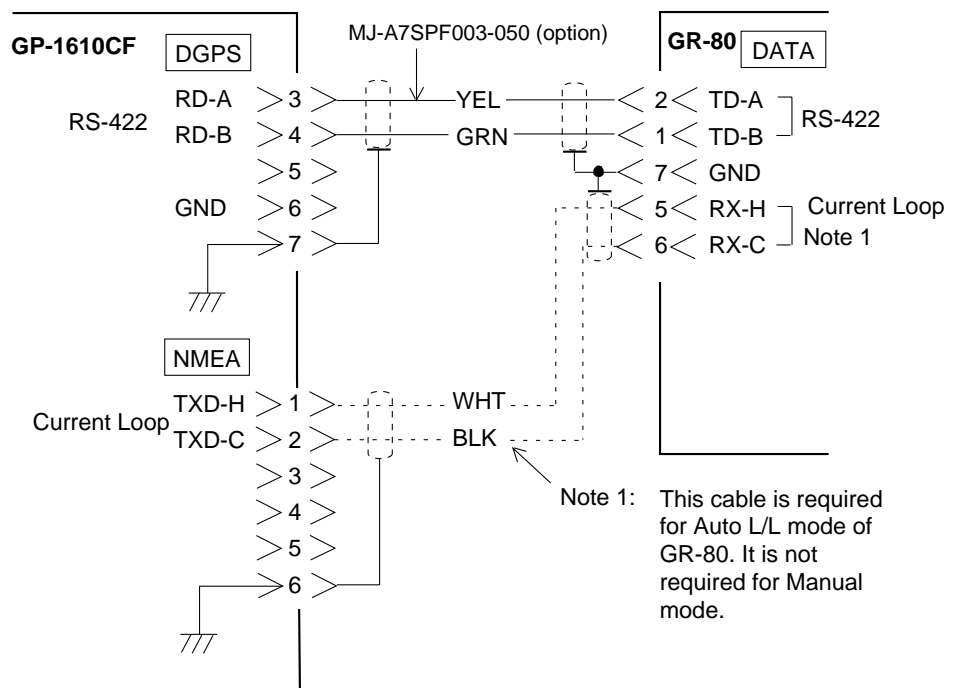
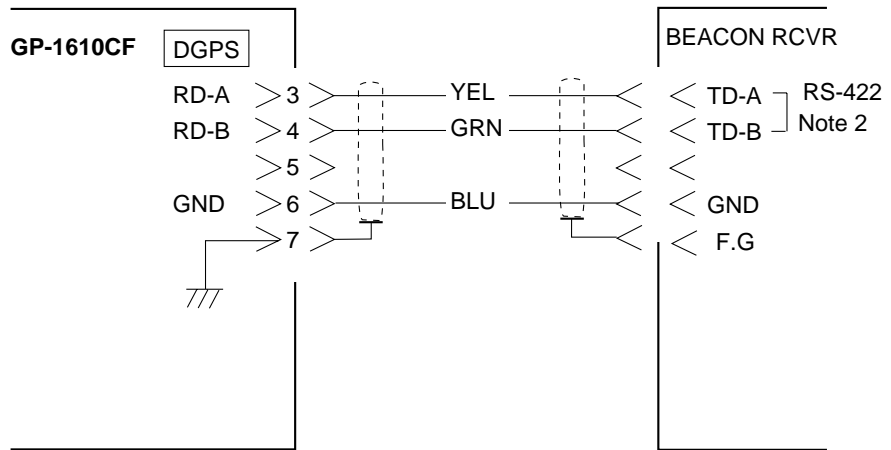


Figure 1-29 Connection of the FURUNO GR-80 DGPS receiver



Note 2: The signal names depend on equipment connected. If data is not input to the GP-1610CF, change connection between TD-A and TD-B.

Figure 1-30 Connection of other DGPS beacon receivers

Connecting a sensor

Connect the water temperature sensor or water temperature/speed sensor to the XDR connector with the converter connector kit (option). This kit contains only a connector; a cable is required.

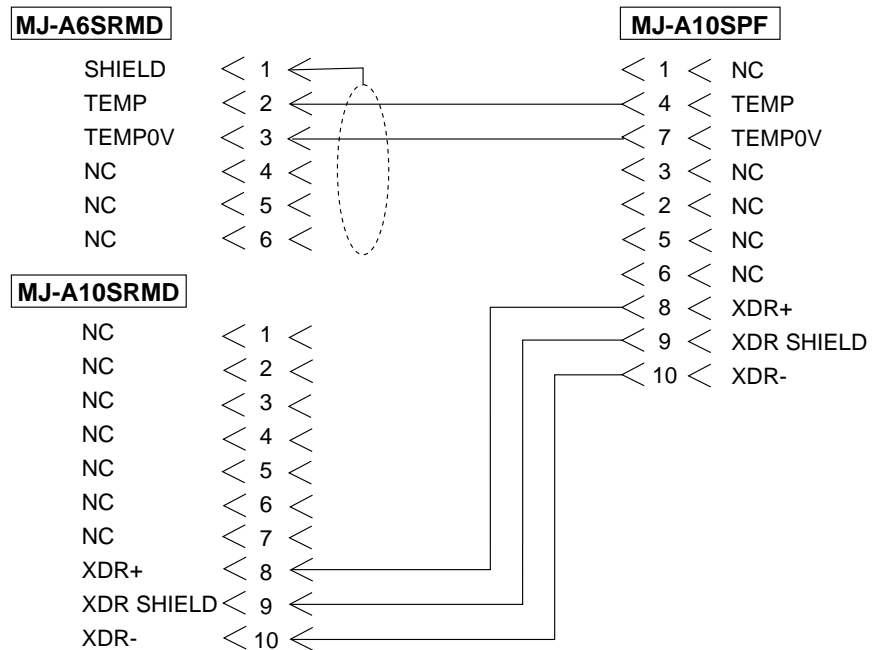


Figure 1-31 Wiring of converter connector for water temperature sensor

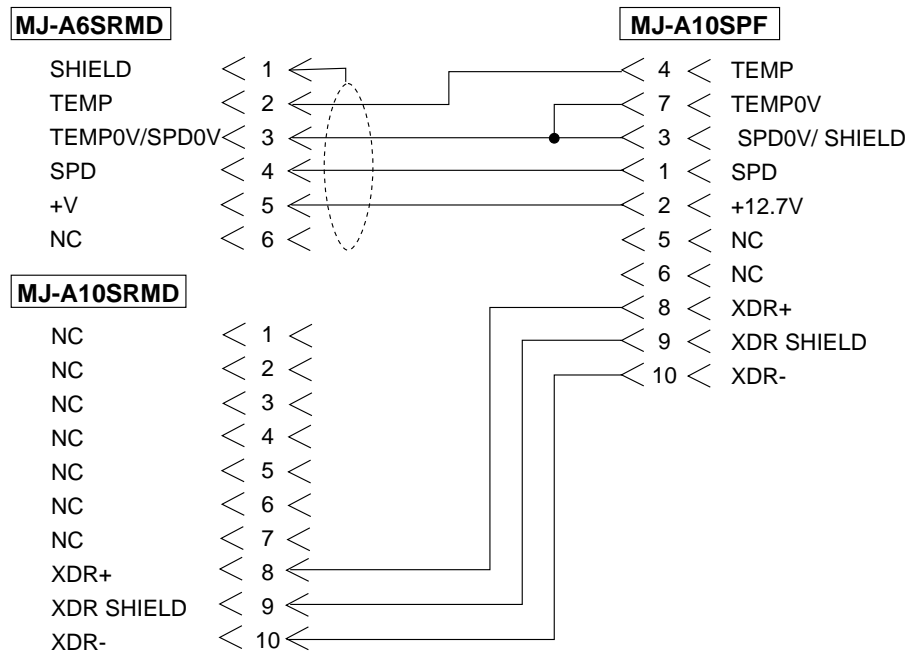


Figure 1-32 Wiring of converter connector for water temperature/speed sensor

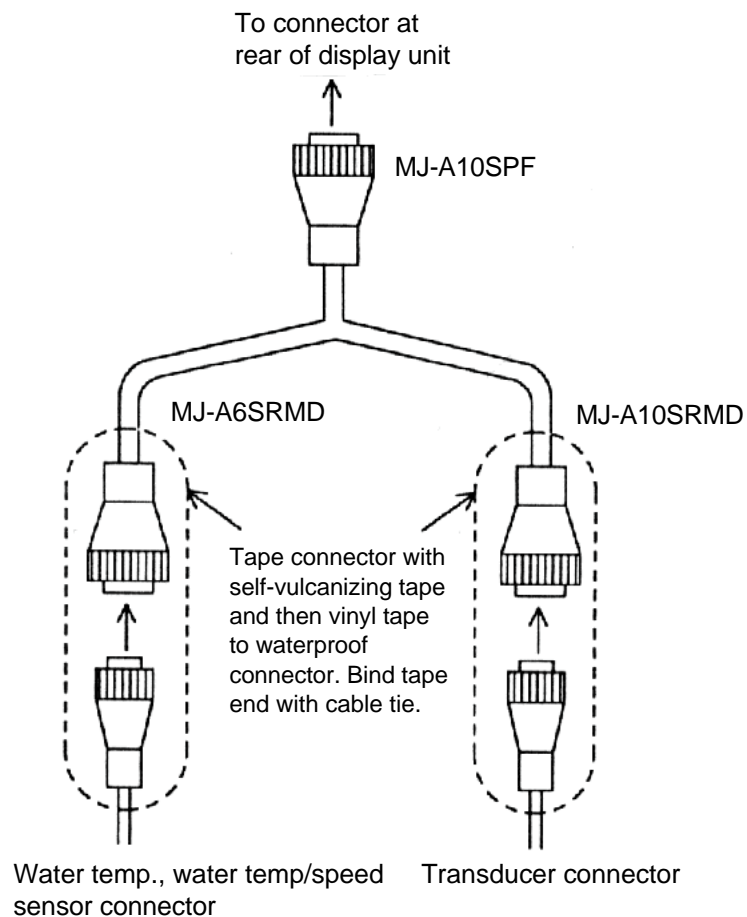


Figure 1-33 Connection of transducer, water temperature sensor, water temperature/speed sensor

1.6 Initial Settings



Sensor connection

This section should be done with the boat in water.

1. Turn on the power and press the MENU key.
2. Press the [0] key.
3. Press the [5] key to select SENSOR SETUP.

SENSOR SETUP		
SPD SENSOR	STW	SOG
TEMP SENSOR	OWN	NMEA
SPD CALIB	-00%(-50~+50)	
TEMP CALIB	+000°C	
DEPTH CALIB	+0.0m	
▲▼ : Cursor		↻ : +/-
ESC : Esc		

Figure 1-34 Sensor setup menu

4. Select source of ship's speed; STW (Speed-Through-Water): local sensor, SOG (Speed-Over-Ground): GPS.
5. Press ▲ twice to select SPD CALIB.
6. If speed reading is higher or lower than actual speed you may apply an offset to compensate for this. Enter offset with plus or minus sign. The  key alternately displays plus and minus.
7. If a water temperature sensor is installed, press ▼ to select TEMP SENSOR.
8. Press ◀ to select OWN. (NMEA is for water temperature data from external source.)
9. Press ▼ twice to select TEMP CALIB.
10. If temperature reading is higher or lower than actual temperature you may apply an offset to compensate for this. Enter offset with plus or minus sign. The  key alternately displays plus and minus.
11. Press ▼ to select DEPTH CALIB.
12. Enter ship's draft, if applicable. Normally, depth is measured from the transducer so enter positive figure.
13. Press the MENU key.

Autopilot or remote display connection

1. Press the MENU key.
2. Press the [0] key.
3. Press the [6] key.

NMEA SETUP		
FORMAT	183V1.5	183V2.0
EXT DEVICE	REM	PILOT
▲▼◀▶: Cursor		ESC: Esc

Figure 1-35 NMEA setup menu

4. Press ◀ or ▶ to select data format of connected external equipment. If you are not sure, try both and select the one which successfully receives data.
5. Press ▼ to select EXT DEVICE.
6. Press ◀ or ▶ to select type of external equipment (input and output data); REMote display or AutoPILOT.

Table 1-1 Output data

Equipment	Talker	Sentences
Autopilot	GP	AAM, APB, BOD, GLL, VTG, XTE
Remote display	GP	BWR, DBT (version 1.5), DPT (version 2.0), GLL, MTW, RMB, RMC, VTG, ZDA

Table 1-2 Input data

Talker	Sentences
LC, DE, or all talkers	GLL, GGA, RMC, RMA, TLL, VTG
None	MTW, TLL

7. Press the MENU key.

DGPS beacon receiver connection

1. Press the MENU key.
2. Press the [0] key.
3. Press the [8] key.

DGPS SETUP			
DGPS	ON	OFF	
RTCM VER	1.0	<input type="text" value="2.0"/>	
BYTE FORM	<input type="text" value="8-6"/>	8-8	
FIRST BIT	MSB	<input type="text" value="LSB"/>	
PARITY BIT	EVEN	ODD	<input type="text" value="NONE"/>
STOP BIT	<input type="text" value="1"/>	2	
BIT RATES	7	<input type="text" value="8"/>	
BAUD RATES	300	600	1200
	2400	<input type="text" value="4800"/>	9600
▲▼◀▶ : Cursor			
ENT : Sel		ESC : Esc	

Figure 1-36 DGPS setup menu

4. Press ◀ to select ON in the DGPS line.
5. Change settings referring to the operator's manual of the DGPS beacon receiver. Circumscribed options are standard settings.
6. Press the MENU key.

OPERATIONAL OVERVIEW

2.1 Control Description

All operations of the GP-1610CF are carried out with the controls on the front panel of the display unit. All controls respond immediately to your command and the unit emits a beep to signify correct key sequence. (Invalid key input emits several beeps.)

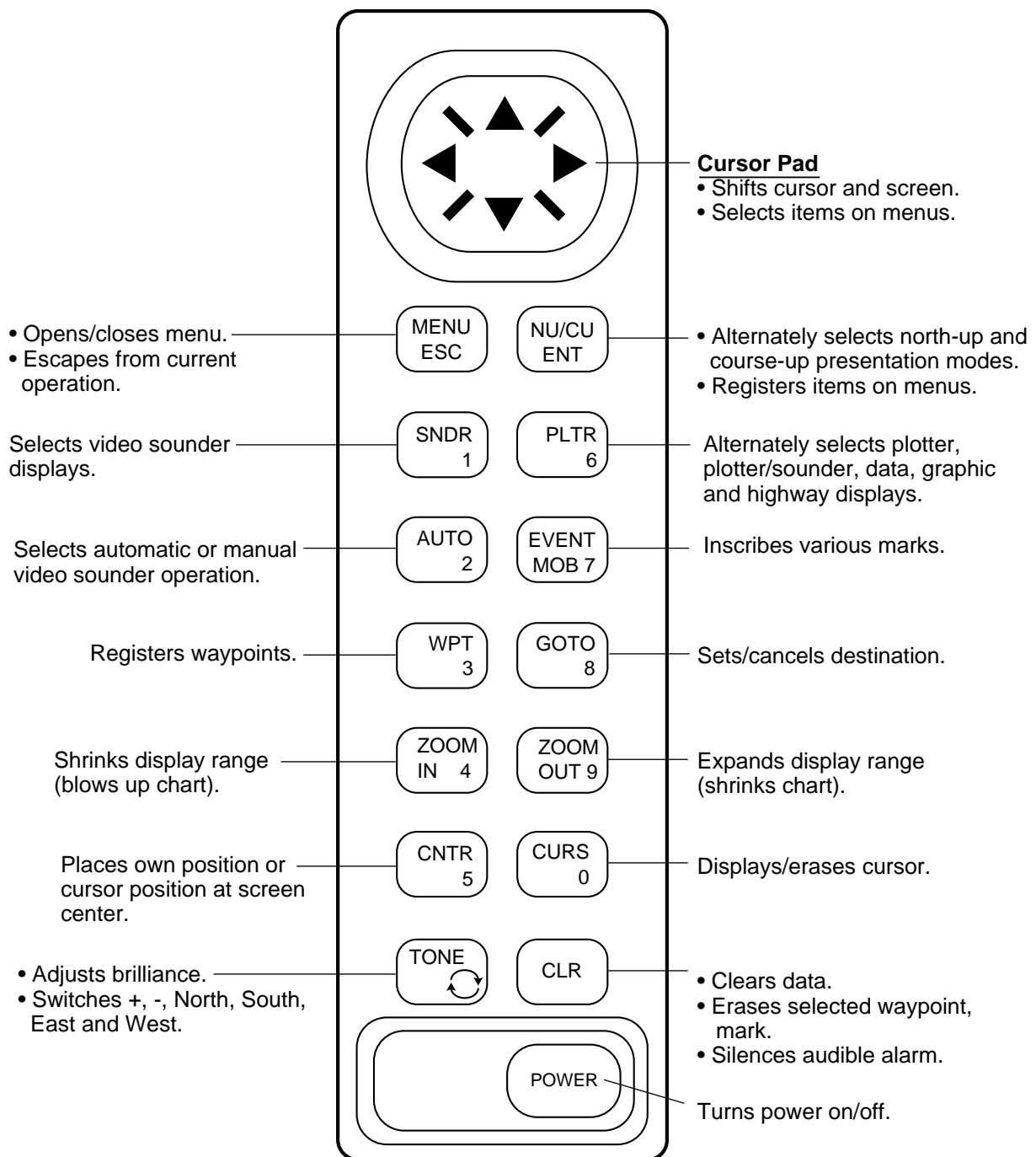


Figure 2-1 Controls

2.2 Inserting Chart Cards

Note: Insert chart card before turning on the power. This enables automatic loading of chart.

1. Open the memory card slot cover at the bottom of the display unit by unfastening two screws.

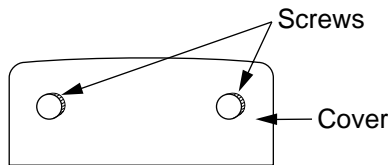


Figure 2-2 Display unit, bottom

2. Insert the chart card label side up, arrow forward.

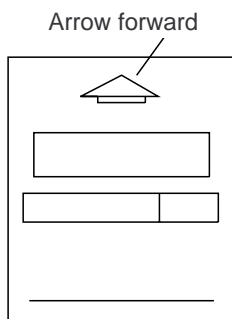
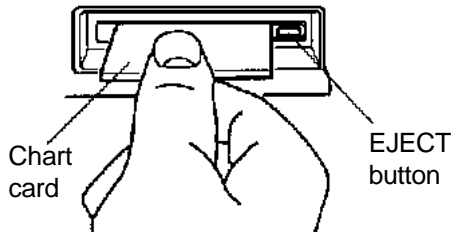


Figure 2-3 How to insert chart card

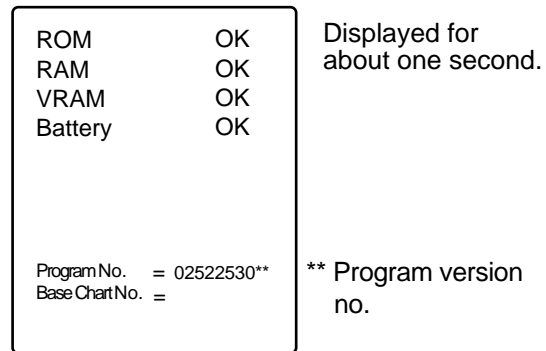
3. Close the cover and fix it.

Note: Always keep the cover closed to keep foreign material out of the chart card drive.

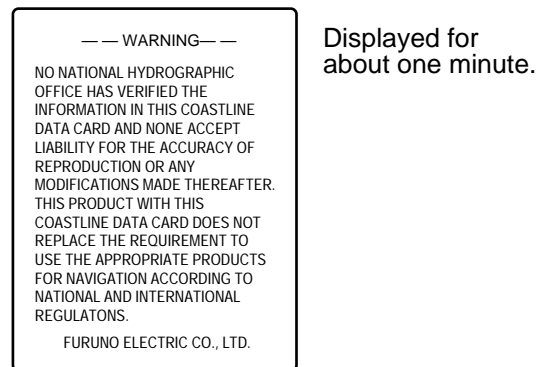
2.3 Turning On/Off the Power

Press the POWER key to turn the power on/off. When the unit is turned on, it proceeds in the sequence shown in Figure 2-4. About 20 seconds after the start-up sequence is com-

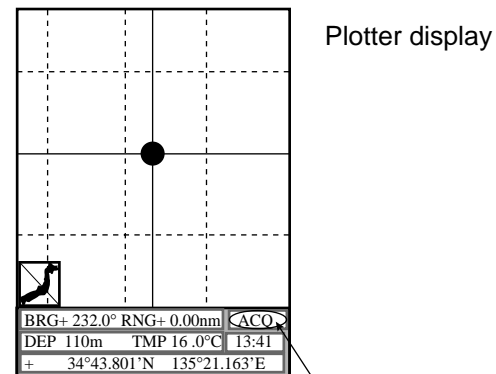
pleted, the GPS receiver status indication "ACQ" (at the bottom right-hand corner) changes to 2D (or 3D). ACQ means the receiver is acquiring the GPS signal, and 2D (or 3D) means the position data is reliable.



Displayed for about one second.



Displayed for about one minute.



Plotter display

GPS Fixing Status
ACQ (Acquiring) is replaced by 2D or 3D when position becomes reliable.

Figure 2-4 Start-up sequence

2D: Ship's position is calculated by using data from 3 satellites.

3D: Ship's position is calculated by using data from 4 satellites.

2.4 Adjusting Tone and Brilliance

1. Press the TONE key. The tone and brilliance setting display appears.



Figure 2-5 Tone and display brilliance setting display

2. Operate ◀ or ▶ to adjust display tone.
3. Press ▲ or ▼ to adjust display brilliance.

Note: Tone or brilliance must be adjusted within about 10 seconds after pressing the TONE key or the display will be erased.

2.5 Plotter Displays

There are five types of plotter displays: plotter, plotter/sounder, data, graphic and highway.

Selecting a plotter display

1. Press the PLTR key. The SELECT PLOTTER MODE screen appears.

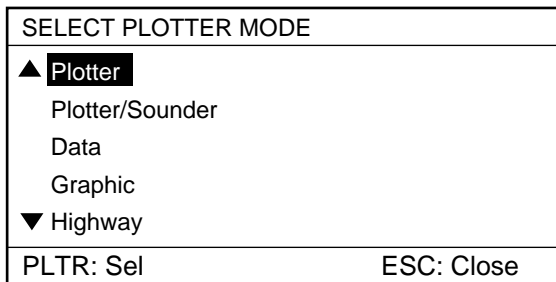
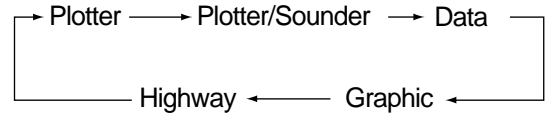


Figure 2-6 Select plotter mode screen

2. Press the PLTR key again to select a plotter mode. Each time the key is pressed the mode changes in the following sequence:



You may also select a mode by pressing ▲ or ▼ and the ENT key.

3. Press the ESC key to conclude your selection.

Sample plotter displays

Plotter display

The plotter display mainly shows chart, ship's track, waypoints, marks and various data.

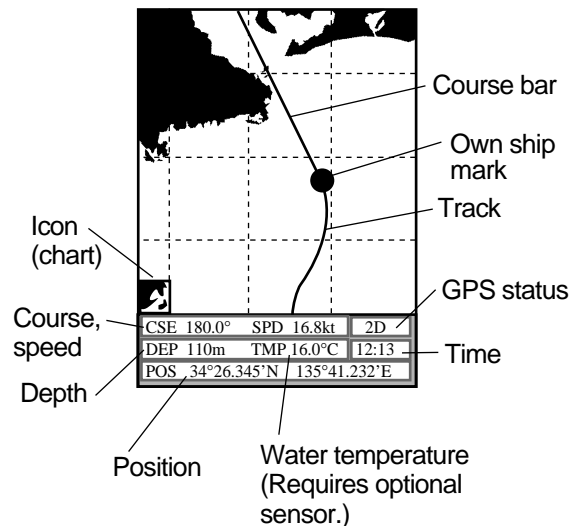


Figure 2-7 Plotter display

Plotter/sounder display

This display provides a plotter display on the left 2/3 of the screen and the normal sounder display on the right 1/3. It is useful for searching fish schools at cruising speed.

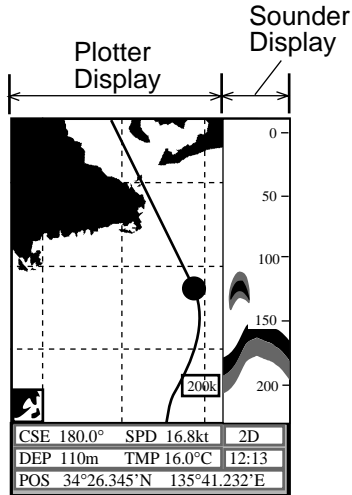


Figure 2-8 Plotter/sounder display

Data display

This display provides various navigation data, such as position, course and speed, in digital form.

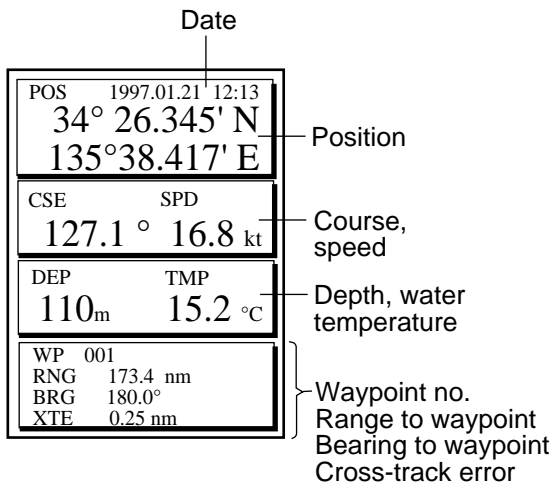


Figure 2-9 Data display

Graphic display

This display provides analog and digital displays of cross track error (XTE), course, etc. It is useful for monitoring progress when steering by autopilot. The XTE scale shows direction and amount to steer to return to course.

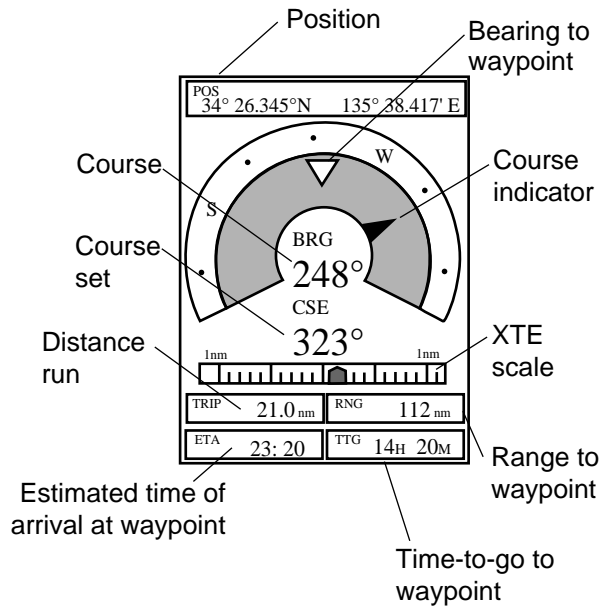


Figure 2-10 Graphic display

Highway display

The highway display provides a graphic presentation of ship's track along a course. It is useful for monitoring XTE-the XTE scale shows direction and amount in nautical miles to steer to return to course.

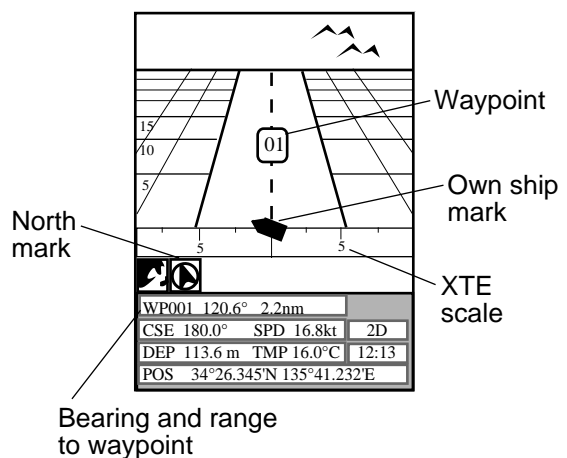


Figure 2-11 Highway display

2.6 Sounder Displays

Five sounder displays are available: normal, marker zoom, bottom zoom, bottom-lock and A-scope display. You may select a sounder display with the SNDR key.

Selecting a sounder display

1. Press the SNDR key. The SELECT SOUNDER MODE screen appears.

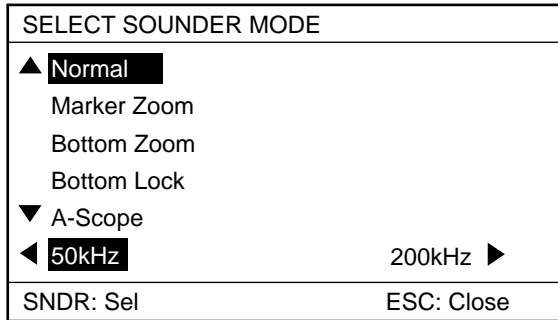
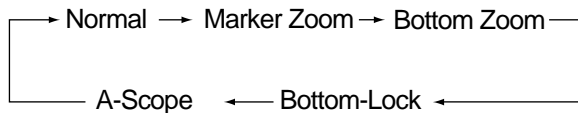


Figure 2-12 Select sounder mode screen

2. Press the SNDR key again to select a sounder mode. Each time the key is pressed the sounder mode changes in the following sequence:



You may also select a sounder mode by pressing ▲ or ▼ and the ENT key.

3. Press the ESC key to conclude your selection.

Normal sounder display

50 kHz

The sounder uses ultrasonic pulses to detect seabed conditions. The lower the frequency of the pulse, the wider the detection area. Therefore, the 50 kHz frequency is useful for general detection and judging seabed condition.

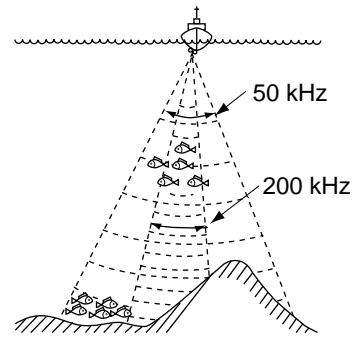


Figure 2-13 Detection area

200 kHz

The higher the frequency of the ultrasonic pulse the better the resolution. Therefore, the 200 kHz frequency is ideal for detailed observation of fish schools.

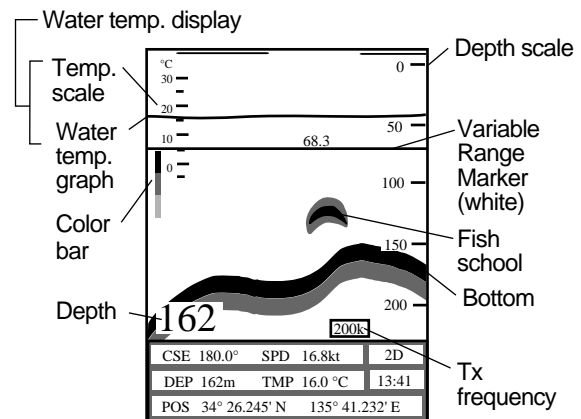


Figure 2-14 Typical 200 kHz normal sounder display

Marker zoom display

This mode expands anywhere of the normal picture to full vertical size of the screen on the left-half window. You may specify the portion to expand by operating the VRM (Variable Range Marker), which you can shift with ▲ or ▼. The segment between the VRM and zoom range markers are expanded. The length of the segment is equal to one division of the depth scale.

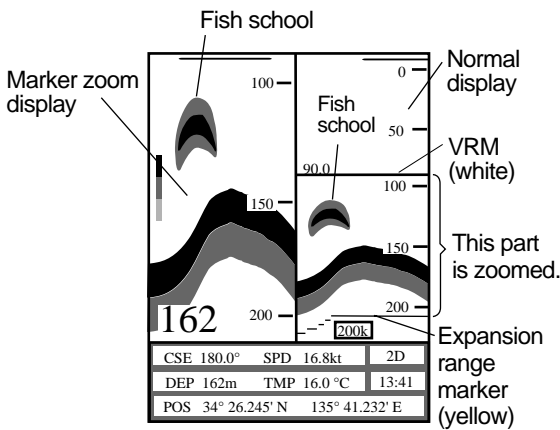


Figure 2-15 Marker zoom display plus normal display

Bottom zoom display

This mode expands bottom and bottom fish echoes two to five times to vertical size of the screen. This mode is useful for determining bottom hardness. A bottom displayed with a short echo tail usually means it is a soft, sandy bottom. A long echo tail means a hard bottom.

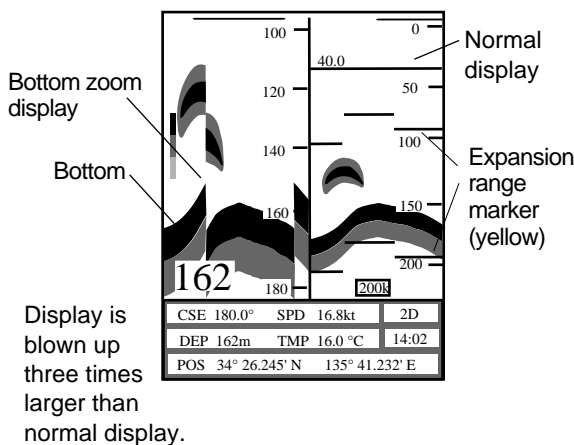


Figure 2-16 Bottom zoom display plus normal display

Bottom-lock display

The bottom-lock display provides a compressed normal picture on the right half of the screen and a 5 or 10 meter wide layer in contact with the seabed is expanded onto the left half of the screen. (You may select layer width on the SOUNDER SETUP menu in the SYSTEM menu.) This mode useful for bottom discrimination.

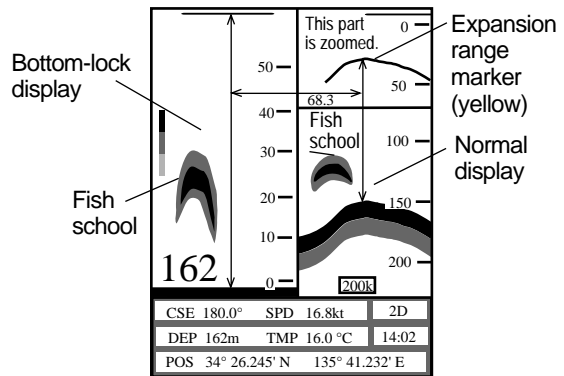


Figure 2-17 Bottom-lock display plus normal display

Note: The expansion marker is not displayed in the default setting. It may be turned on in the SDR SETUP menu in the SYSTEM menu.

A-scope display

This display shows echoes at each transmission with amplitudes and tone proportional to their intensities, on the right 1/3 of the screen. It is useful for estimating the kind of fish school and seabed composition.

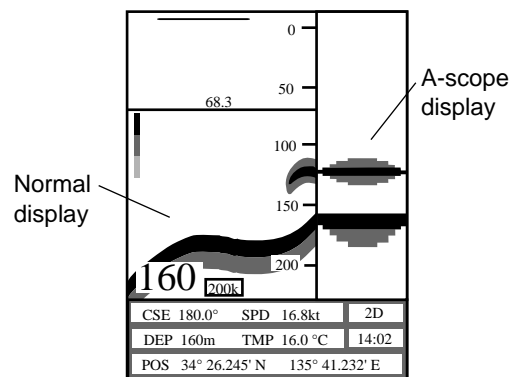


Figure 2-18 A-scope display (right side)

2.7 Basic Menu Operation

1. Press the MENU key to display the MAIN menu.

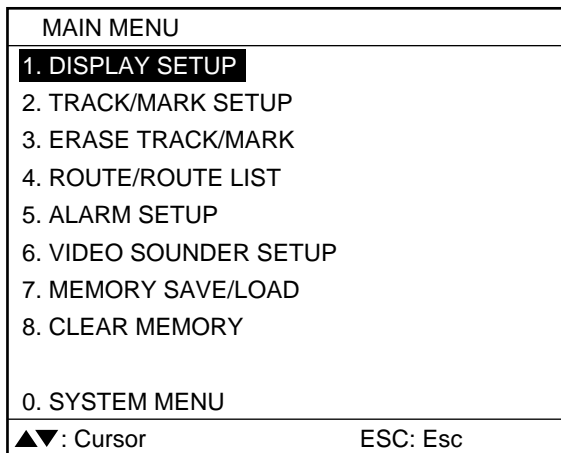


Figure 2-19 Main menu

2. Press appropriate numeric key or ▲ or ▼ and ENT key to select menu desired. The highlighted cursor shifts with numeric key or Cursor Pad operation. For example, press the [1] key to display the DISPLAY SETUP menu.

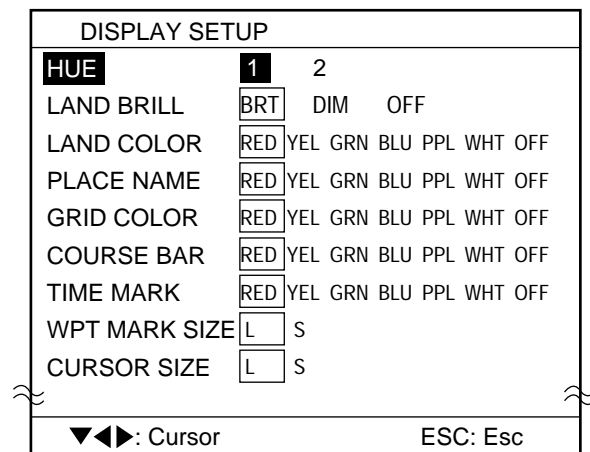


Figure 2-20 Display setup menu

3. Press ▲ or ▼ to select menu item.
4. Press ◀ or ▶ to select option.
5. To enter numeric data use the numeric keys. The entry of leading zero is necessary; trailing zero is optional. For example, to enter 050, press [0] [5]. Wrong numeric data can be cleared with the CLR key.
6. After entering numeric data, press the ENT key. (It is not necessary to press the ENT key after selecting an option which does not require entry of numeric data.)
7. Press the MENU key to escape.

VIDEO SOUNDER OPERATION

3.1 Principle of Operation

The video sounder of the GP-1610CF determines the distance between its transducer and underwater objects such as fish, lake bottom or seabed and displays the results on screen. It does this by utilizing the fact that an ultrasonic wave transmitted through water travels at a nearly constant speed of 4800 feet (1500 meters) per second. When a sound wave strikes an underwater object such as fish or sea bottom, part of the sound wave is reflected back toward source. Thus by calculating time difference between the transmission of a sound wave and the reception of the reflected sound wave, the depth to the object can be determined.

The entire process begins in the display unit. Transmitter power is sent to transducer as a short pulse of electrical energy. The electrical signal produced by the transmitter is converted into an ultrasonic signal by the transducer and transmitted into the water. Any returning signals from intervening objects (such as a fish school) are received by the transducer and converted into an electrical signal. The signals are then amplified in the amplifier section, and finally, displayed on screen.

The picture displayed is made up of a series of vertical scan lines, one for each transmission. Each line represents a snapshot of what has occurred beneath the boat. Series of snapshots are accumulated side by side across screen, and the resulting contours of the bottom and fish between the bottom and surface are displayed.

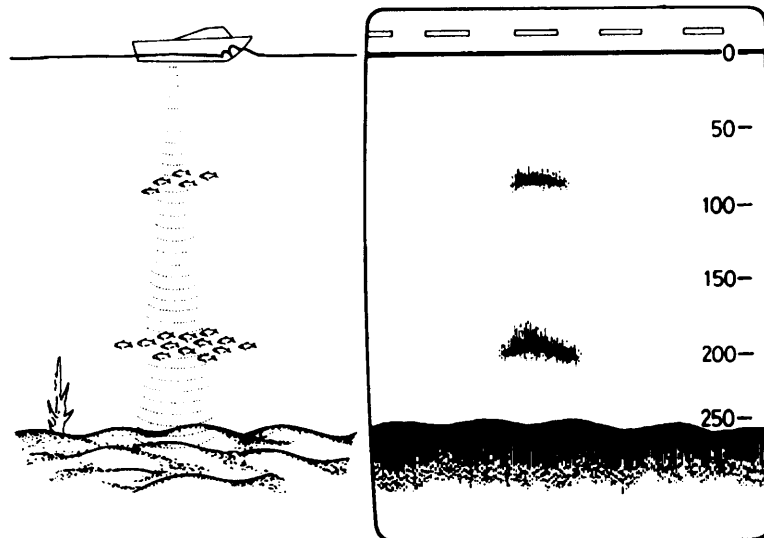


Figure 3-1 Underwater conditions and video sounder display

3.2 Automatic Sounder Operation

Automatic operation is useful when you are preoccupied with other tasks and do not have time to adjust the display.

How it works

The automatic function automatically selects the proper gain and range scale according to depth. It works as follows:

- Range changes automatically to locate the bottom on the lower half of screen. It jumps to one step shallower range when bottom echoes reach a half way point of the full scale from top and to one step deeper range when they come to the lower edge of scale.
- The gain is automatically adjusted to display the bottom echo in reddish brown (default color arrangement).
- Clutter level, (on the VIDEO SOUNDER SETUP menu), which suppresses low level noise, is automatically adjusted.

Two types of automatic modes

Two types of automatic modes are available: cruise and fish. Cruise is for tracking the bottom, and fish is for searching fish schools. Since "Cruise" uses a higher clutter rejection setting than "Fish," it is not recommended for fish detection – weak fish echoes may be deleted by clutter rejection.

How to enable automatic sounder operation

1. Press the AUTO key.

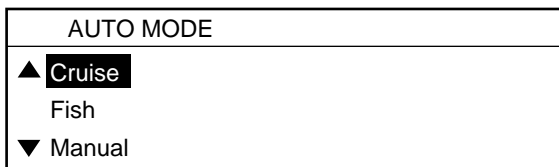


Figure 3-2 Auto mode display

2. Press the AUTO key again to select Cruise or Fish.
3. Press the ENT or MENU key.

3.3 Manual Sounder Operation

Manual operation is useful for observing fish schools and bottom using fixed gain setting.

The gain, range and range shifting functions used together give you the means to select the depth you can see on screen. The basic range can be thought of as providing a "window" into the water column and the range shifting as moving the "window" to the desired depth.

Manually adjusting the sounder picture

1. Press the AUTO key to display the AUTO MODE menu.
2. Press ▼ to select Manual.

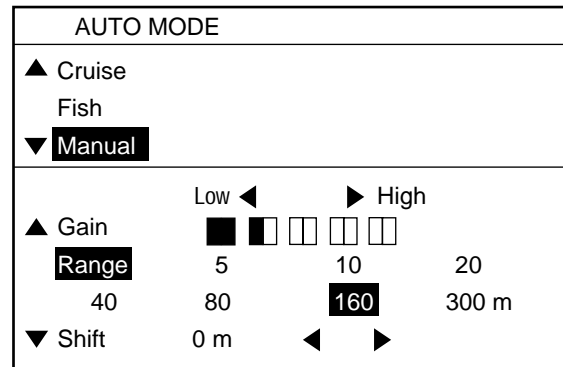


Figure 3-3 Gain, range and shift adjustment display

3. Press ▼ to select Gain.

Normally, set the gain to the point where excessive noise does not appear on screen. Use a higher gain setting for greater depths and a lower setting for shallower waters.

4. Press ◀ or ▶ to set level.

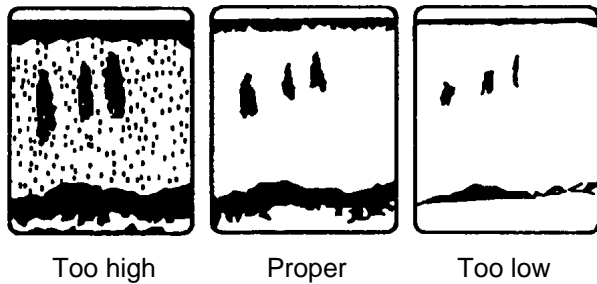


Figure 3-4 Examples of proper and improper gain

5. Press ▲ to select Range.
6. Press ◀ or ▶ to select basic range desired.
7. Press ▼ to select Shift.

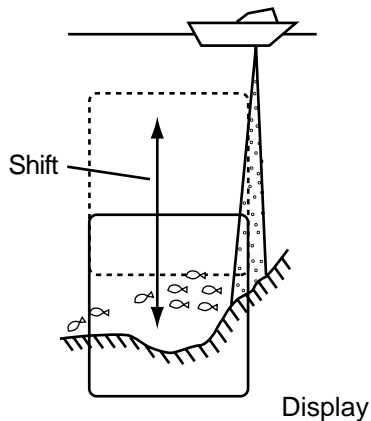


Figure 3-5 Shift concept

8. Press ◀ or ▶ to shift the basic range, if desired.
9. Press the MENU key.

3.4 Suppressing Low Level Noise

Light-blue dots may appear over most of screen. This is mainly due to dirty water or noise. This noise can be suppressed by adjusting CLUTTER on the VIDEO SOUNDER SETUP menu.

When the sounder mode is Auto, the clutter suppression setting is fixed at AUTO. To suppress low level noise in manual sounder operation do the following:

1. Press the MENU key.

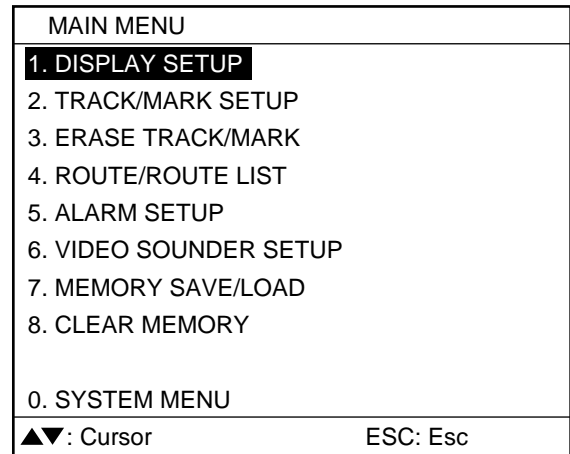


Figure 3-6 Main menu

2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.

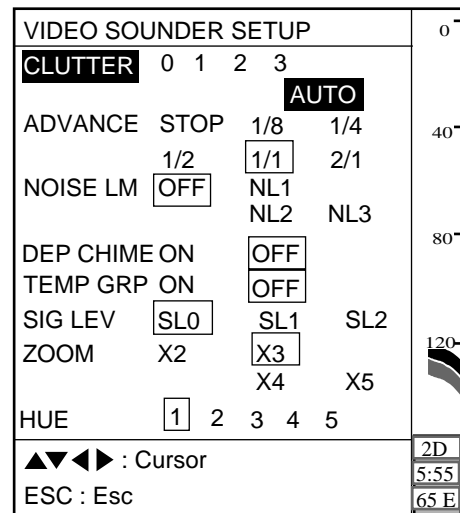


Figure 3-7 Video sounder setup menu

3. Press ▲ to select CLUTTER.
4. Press ◀ or ▶ to select clutter rejection level desired; 0 (OFF), 1, 2, 3 or AUTO. The higher the number the higher the degree of suppression. Note that weak echoes may not be displayed when the clutter circuit is on.
5. Press the MENU key.

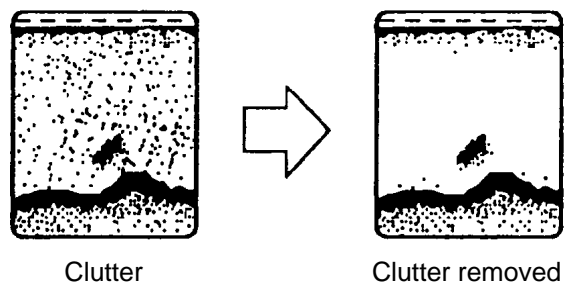


Figure 3-8 How the clutter function works

3.5 Selecting Picture Advance Speed

When selecting a picture advance speed, keep in mind that a fast advance speed will expand the size of the fish school horizontally on the screen and a slow advance speed will contract it.

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.
3. Press ▲ or ▼ to select ADVANCE.
4. Press ◀ or ▶ to select advance speed (a "fraction") desired, or STOP to suspend advancement of the picture.

The fractions in the menu denote number of scan lines produced per transmission. For example, 1/8 means one scan line is produced every 8 transmissions.

5. Press the MENU key.

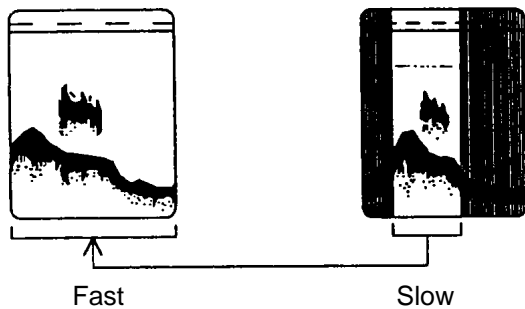


Figure 3-9 Comparison of picture advance speeds

3.6 Suppressing Interference

Interference from other acoustic equipment operating nearby or other electronic equipment on your boat may show itself on the display as shown in Figure 3-10.

To suppress interference, do the following:

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.
3. Press ▲ or ▼ to select NOISE LM.

4. Press ◀ or ▶ to select degree of suppression desired; OFF, NL1, NL2 or NL3. The higher the number the greater the degree of suppression.
5. Press the MENU key.

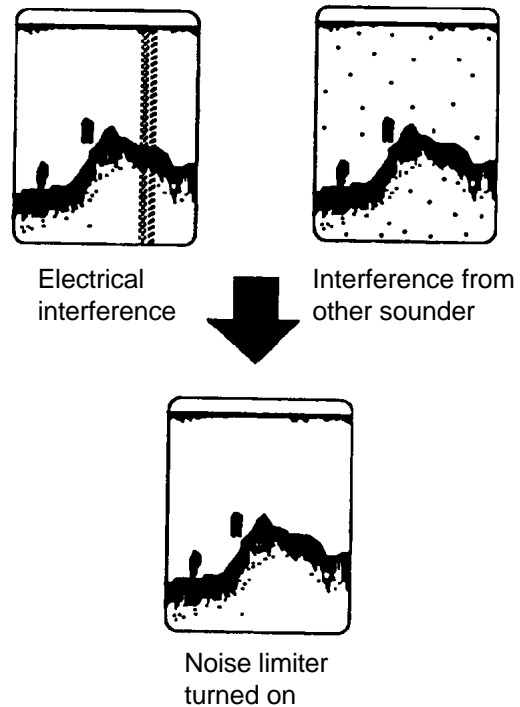


Figure 3-10 How the noise limiter works

Turn the noise limiter circuit off when no interference exists, otherwise weak echoes may be missed.

3.7 Erasing Weak Echoes

Dirty water or reflections from plankton may be painted on the display in green or light blue. These weak echoes may be erased as follows:

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.
3. Press ▲ or ▼ to select SIG LEV.
4. Press ◀ or ▶ to select level of erasure; SL0 (OFF), SL1 or SL2. The higher the number the stronger the echo will be erased.
5. Press the MENU key.

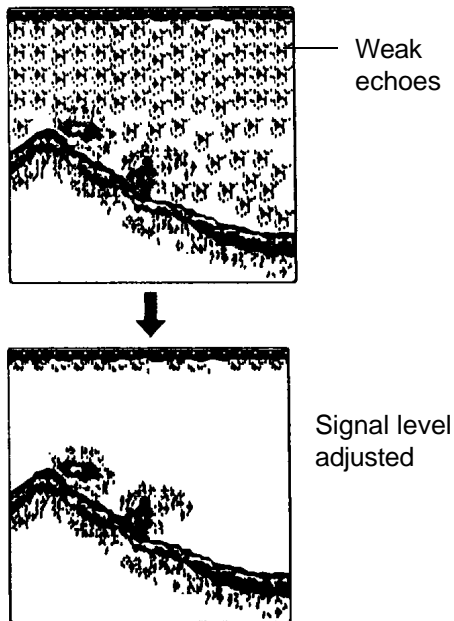


Figure 3-11 How SIG LEV works

3.8 Changing Zoom Magnification Factor

You may select the zoom magnification factor for the marker and bottom zoom modes. This is the amount the zoomed picture is magnified in relation to the normal picture.

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.
3. Press ▲ or ▼ to select ZOOM.
4. Press ◀ or ▶ to select zoom factor desired; x2, x3, x4 or x5.
5. Press the MENU key.

3.9 Selecting Hue (color arrangement)

The GP-1610CF provides several color arrangements to match lighting conditions.

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.

3. Press ▲ or ▼ to select HUE.
4. Press ◀ or ▶ to select hue arrangement number. (A portion of the sounder display appears so you may see the result of your selection.)

Hue	1	2	3	4	5
Bkgd color	Blue	Light blue	Black	Green	Black

5. Press the MENU key.

3.10 Measuring Depth

The VRM (Variable Range Marker) functions to measure the depth to fish schools, etc.

1. Press ▲ or ▼ to place the VRM on an echo.
2. Read the VRM range just above the VRM.

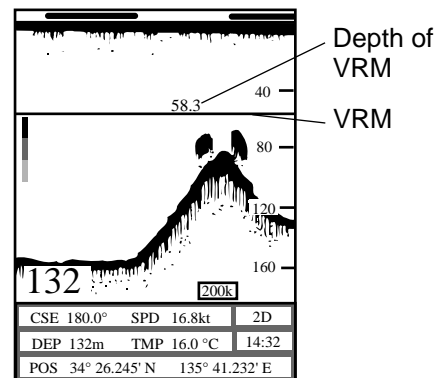


Figure 3-12 How to measure depth with the VRM

3.11 Knowing Depth Change by Audible Chime

The depth chime function alerts you to change in depth by audible chime. Depth change direction is given by chime interval; the longer the interval the greater the change in depth.

To turn on or off the depth chime function, do the following:

1. Press the MENU key.

2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.
3. Press ▲ or ▼ to select DEP CHIME.
4. Press ◀ or ▶ to select ON or OFF.
5. Press the MENU key.

3.12 Selecting Unit of Depth Measurement

You may display the depth in meters, feet or fathoms as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [4] key to display the UNIT SETUP menu.

UNIT SETUP			
DISTANCE	nm	km	sm
DEPTH	m	ft	fa
TEMP	°C	°F	
▲▼◀▶ : Cursor ESC: Esc			

Figure 3-13 Unit setup menu

4. Operate the Cursor Pad to select Depth.
5. Operate the Cursor Pad to select m, ft, or fa.
6. Press the MENU key.

3.13 Offsetting the Depth Readout

If the depth displayed is not correct you may offset to it to correct the correct value as follows:

1. Press the MENU key.
2. Press the [0] key to select the SYSTEM SETUP menu.

SYSTEM MENU	
1. SELF TEST	
2. PLTR SETUP	
3. SOUNDER SETUP	
4. UNIT SETUP	
5. SENSOR SETUP	
6. NMEA SETUP	
7. GPS SETUP	
8. DGPS SETUP	
9. CHART POSN CALIB	
▲▼ : Cursor	
ENT: Sel	ESC: Esc

Figure 3-14 System menu

3. Press the [5] key to select SENSOR SETUP.

SENSOR SETUP		
SPD SENSOR	STW	SOG
TEMP SENSOR	OWN	NMEA
SPD CALIB	+00%(-50~+50)	
TEMP CALIB	+00.0 °C	
DEPTH CALIB	+0.0 m	
▲▼ : Cursor ↻ : +/-		
ESC: Esc		

Figure 3-15 Sensor setup menu

4. Press ▲ or ▼ to select DEPTH CALIB.
5. Enter correction with numeric keys.
6. Press the ENT key.
7. Press the MENU key.

3.14 Displaying the Water Temperature Graph

A water temperature graph can be displayed. This function requires a water temperature sensor.

To turn on/off the water temperature graph:

1. Press the MENU key.
2. Press the [6] key to display the VIDEO SOUNDER SETUP menu.

3. Press ▲ or ▼ to select TEMP GRP.
4. Press ◀ or ▶ to select ON or OFF.
5. Press the MENU key.

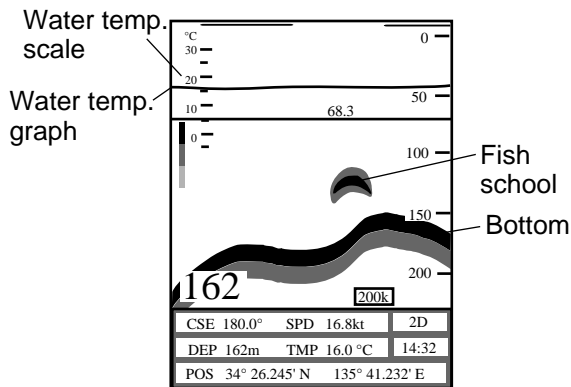


Figure 3-16 Water temperature graph

3.15 Selecting Unit of Water Temperature Measurement

You may display temperature in degrees Centigrade or Fahrenheit as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [4] key to display the UNIT SETUP menu.
4. Operate the Cursor Pad to select Temp.
5. Operate the Cursor Pad to select °C or °F.
6. Press the MENU key.


3.16 Offsetting Water Temperature Readout

In some instances the water temperature readout may be off by a few degrees. You can offset it to the correct temperature as follows:

1. Press the MENU key.
2. Press the [0] key to select the SYSTEM SETUP menu.
3. Press the [5] key to select SENSOR SETUP.

4. Press ▲ or ▼ to select TEMP CALIB.
5. Enter correction with numeric keys.
6. Press the ENT key.
7. Press the MENU key.

3.17 Fish Alarm

The fish alarm sounds when a fish school is detected within the selected range. When a fish school comes within the range set the audible alarm sounds and the alarm icon  and the indication FISH appear. You may silence the alarm with the CLR key. The indication remains on the screen until the fish echo is out of the alarm range.

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.

ALARM SETUP		1/2
ARRIVAL	ARRIVAL ANCHOR OFF	
	Range 00.500nm	
XTE	ON OFF	
	Range 00.250nm	
SPEED	WITHIN OVER OFF	
	Speed 11.0~15.0kt	
TEMP	WITHIN OVER OFF	
	Temp +11.0~+15.0°C	
TRIP	ON OFF	
	Range 0005.00nm	
▲▼◀▶: Cursor		
		ESC: Esc

Figure 3-17 Alarm setup menu

3. Press ▼ to select FISH on page 2.

ALARM SETUP		2/2
FISH	NORM B/L OFF	
	B/L 003.4~004.6m	
BOTTOM	ON OFF	
	Range 003.4~004.6m	
▲▼◀▶: Cursor		
		ESC: Esc

Figure 3-18 Alarm setup menu, page 2

4. Press ► or ◀ to select NORMAL or B/L (Bottom Lock).
5. Press ▼ to send the cursor to the second line (Range or B/L).
6. Key in the depth desired.
7. Press the ENT key.
8. Press the MENU key.

3.18 Bottom Alarm

The bottom alarm sounds when the seabed depth is narrower than the alarm range set. When the bottom echo enters the alarm range set the audible alarm sounds and the alarm icon ☒ and the indication DEPTH appears. You can silence the audible alarm with the CLR key. The DEPTH indication remains on the screen until the bottom echo goes out of the alarm range.

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.
3. Press ▼ to select BOTTOM on page 2.
4. Press ◀ to select ON.
5. Press ▼ to send the cursor to the fourth line (Range).
6. Key in the range desired.
7. Press the ENT key.
8. Press the MENU key.

3.19 Water Temperature Alarm

The water temperature alarm sounds when the water temperature is within (or over) the pre-set temperature range. This alarm is useful for searching for specific species of fish, since each species of fish has its own habitable water temperature. (This alarm requires connection of a water temperature sensor.)

When the water temperature becomes within (or over) the alarm range the audible alarm

sounds and the alarm icon ☒ and the indication TEMP appears on the display. The indication remains on the display until the temperature is no longer in the alarm range.

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.
3. Press ▲ or ▼ to select TEMP.
4. Press ► or ◀ to select WITHIN or OVER.
5. Press ▼ to send the cursor to the eighth line (Temp).
6. Key in the temperature desired.
7. Press the ENT key.
8. Press the MENU key.

3.20 Turning On/Off the Expansion Range Marker

The expansion range marker appears in the normal display picture in the bottom marker and bottom zoom displays and marks the area which is expanded in the bottom marker and bottom zoom pictures. You may turn the marker on or off as follows:

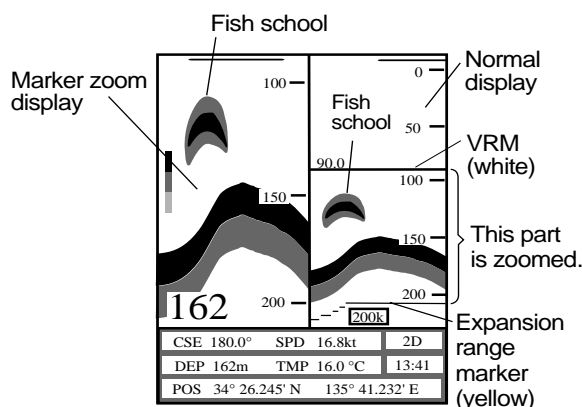


Figure 3-19 Marker zoom display

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [3] key to display the SOUNDER SETUP menu.

SNDR SETUP		
EXP MARKER	ON	OFF
GAIN ADJ	(-20~+20)	
50k	+00	
200k	+00	
BTM-LOCK	NARROW	WIDE
TRANSMIT	ON	OFF
▲▼◀▶ : Cursor		
ESC: Esc		

Figure 3-20 Sounder setup menu

4. Operate the Cursor Pad to select EXP MARKER.
5. Operate the Cursor Pad to select ON or OFF.
6. Press the MENU key.

3.21 Receiver Sensitivity (gain) Adjustment

If the gain effect is too low or too high, it may be offset as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [3] key to display the SOUNDER SETUP menu.
4. Operate the Cursor Pad to select 50k.
5. Press ◀ or ▶ to adjust level.
6. Operate the Cursor Pad to select 200k.
7. Press ◀ or ▶ to adjust level.
8. Press the MENU key.

3.22 Selecting Bottom-Lock Expansion Width

The expansion width for the bottom-lock display can be selected to narrow (5 meters) or wide (10 meters) as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [3] key to display the SOUNDER SETUP menu.
4. Operate the Cursor Pad to select BTM-LOCK.
5. Operate the Cursor Pad to select NARROW or WIDE.
6. Press the MENU key.

3.23 Stopping Transmission

You may disable transmission as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [3] key to display the SOUNDER SETUP menu.
4. Operate the Cursor Pad to select TRANSMIT.
5. Operate the Cursor Pad to select OFF.
6. Press the MENU key.

3.24 Interpreting the Display

Zero line

The zero line (sometimes referred to as the transmission line) represents the transducer's position, and moves off the screen when a deep phased range is used.

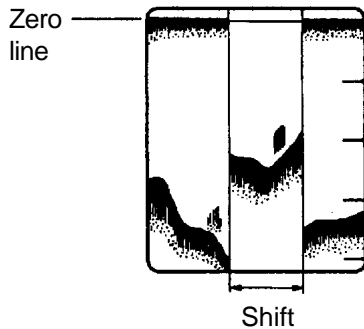


Figure 3-21 Zero line

Fish school echoes

Fish school echoes will generally be plotted between the zero line and the bottom. Usually the fish school/fish echo is weaker than the bottom echo because its reflection property is much smaller compared to the bottom. The size of the fish school can be ascertained from the density of the display.

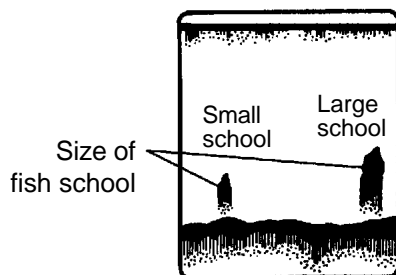


Figure 3-22 Fish school echoes

Bottom echo

Echoes from the bottom are normally the strongest and are displayed in reddish brown color (in default color arrangement) but the color and width will vary with bottom composition, water depth, frequency, sensitivity, etc.

In a comparatively shallow depth, a high gain setting will cause a second or sometimes a third or a fourth echo to be displayed at the same interval between them below the first echo trace. This is because the echo travels between the bottom and the surface twice or more in shallow depths.

The color of the bottom echo can be used to help determine the density of the bottom materials (soft or hard). The harder the bottom, the wider the trace. If the gain is set to show only a single bottom echo on mud, rocky bottom will show a second or third bottom return. The range should be chosen so the first and second bottom echoes are displayed when bottom hardness is being determined.

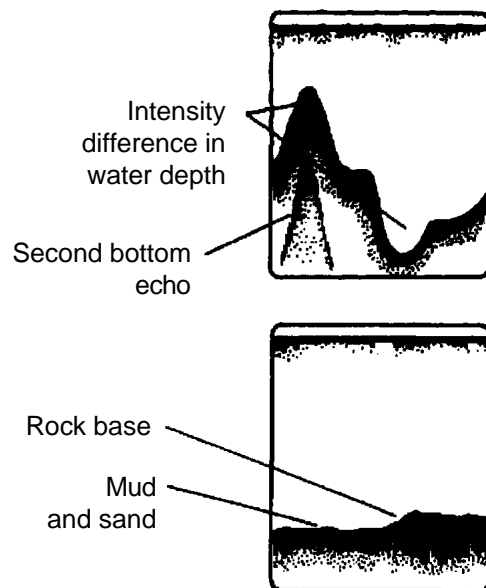


Figure 3-23 Bottom echoes

Surface noise/aeration

When the waters are rough or the boat passes over a wake, surface noise may appear near the zero line. As surface turbulence is acoustically equivalent to running into a brick wall, the bottom echo will be displayed intermittently. Similar noise sometimes appears when a water temperature difference (thermocline) exists. Different species of fish tend to prefer different temperature zone, so the thermocline may be useful to help identify target fish. 200 kHz tends to show shallow thermoclines better than 50 kHz.

In rough waters the display is occasionally interrupted due to below-the-ship air bubbles obstructing the sound path. This also occurs when the boat makes a quick turn or reverses movement. Lowering the picture advance speed may reduce the interruption. However, reconsideration of the transducer installation may be necessary if the interruption occurs frequently.

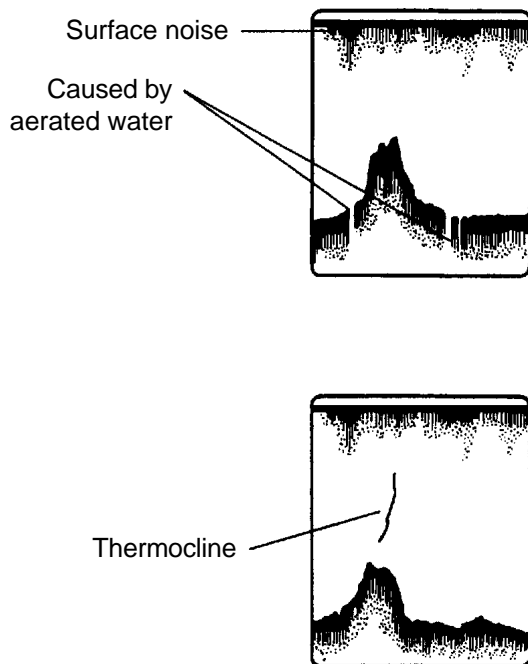


Figure 3-24 Surface noise/aeration

GPS, CHART OVERVIEW

4.1 Principle of GPS

What is GPS?

GPS is an acronym meaning Global Positioning System. GPS (sometimes referred to as NAVSTAR) is a highly precise satellite navigation system developed by the U.S. Department of Defense.

A constellation of 24 satellites emplaced in nearly 20,000-kilometer high 12-hour circular orbits provides highly precise, continuous, worldwide, all-weather position plus time and velocity information to GPS receiver-equipped vehicles, vessels and aircraft.

How the GPS receiver calculates position

The GPS receiver's position is continuously fixed by receiving 3 (or 4) satellites in line-of-sight of the GPS receiver. The basic steps in position fixing are as below:

- 1) GPS satellites continually transmit their own precise orbital data called ephemeris. The GPS receiver computes satellites' position by this data.
- 2) The GPS receiver measures very accurate distance to the satellites.
- 3) Satellite positions and their distances from the GPS receiver are known. The point of intersection of the satellites used in fixing position.

- ① Satellite locations are calculated.
- ② Distances are measured.
- ③ The GPS fix is the point of intersection of three spheres which are drawn around the three satellites with diameter d_1 , d_2 , and d_3 .

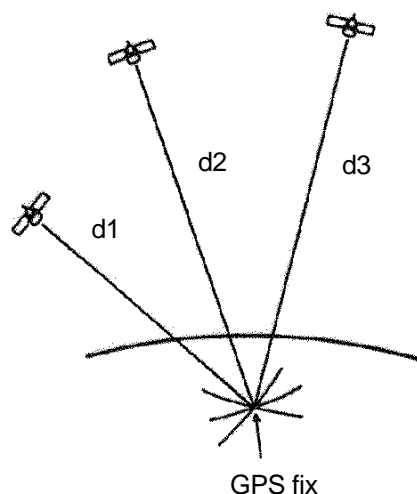
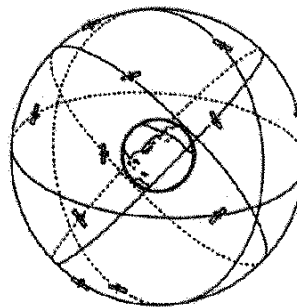
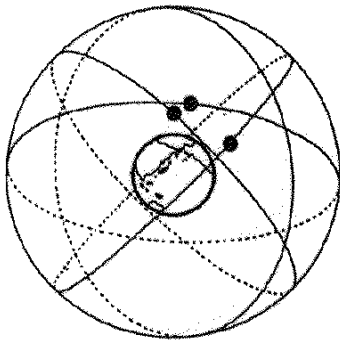


Figure 4-1 How GPS determines position

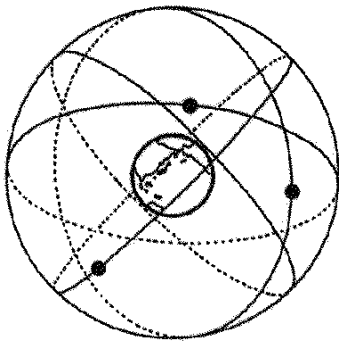
Position-fixing accuracy (HDOP)

In radar position-fixing, most accurate position fixes are obtained when the targets used are spaced nearly 90° from each other. Similarly, GPS position fixing accuracy is subject to satellite location. Generally, the further apart the satellites are from one another, the greater the position-fixing accuracy.

For example, take a look at Figure 4-2. In both situations a fix is obtainable in the Northern Pacific region because three satellites are in line-of-sight. However, accuracy will be higher in the bottom figure since the satellites are spread farther apart than the satellites in the top figure.



Low accuracy



High accuracy

Figure 4-2 Satellite positions and accuracy of position fix

The index for position-fixing accuracy is known as HDOP (Horizontal Dilution of Precision). In simpler terms it is the geometrical relationship among 3 (or 4) satellites. The higher the HDOP value the less accurate the position fix. The error in distance is proportional to the HDOP value as shown in Figure 4-3.

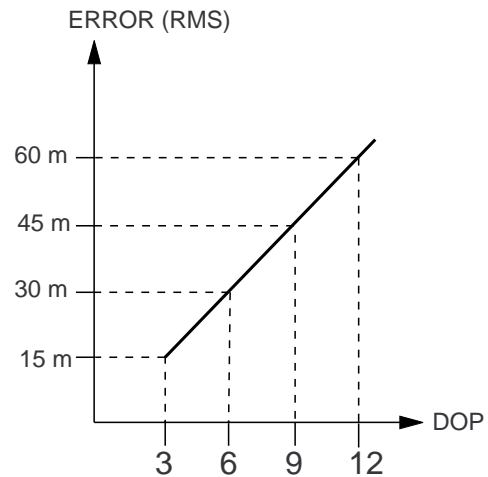


Figure 4-3 HDOP rate and position error

In this manual HDOP is referred to as DOP.

4.2 Presentation Mode

Two types of display presentations are provided for the plotter display and plotter/sounder display: north-up and course-up. You can select one with the NU/CU key.

North-up

North (zero degrees) is at the top of the display and own ship is at the center of the screen. This mode is useful for long-range navigation.

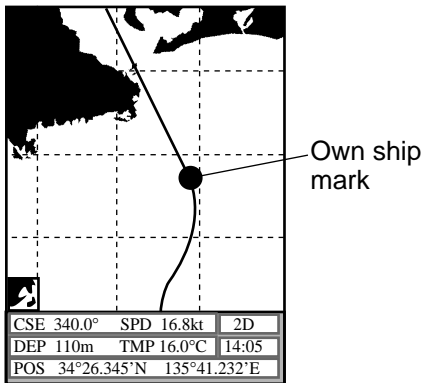


Figure 4-4 North-up display

Course-up

When destination is set it is at the top of the screen, the north mark appears at the lower left side of the screen and points to north. A triangle marks own ship's position.

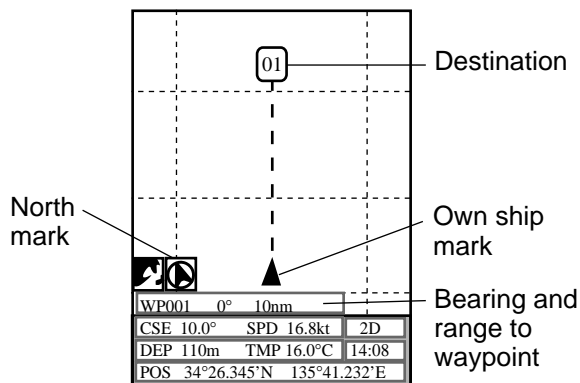


Figure 4-5 Course-up display

4.3 Shifting the Cursor

1. Press the CURS key to turn the cursor on.
2. Operate the Cursor Pad. The cursor moves in the direction the Cursor Pad is pressed. When the cursor reaches an edge of the screen, the display is scrolled.

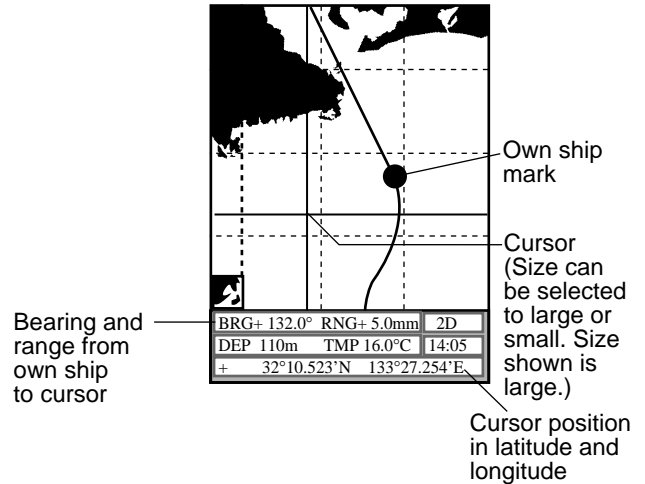


Figure 4-6 Plotter display, showing location of cursor data

When the cursor is turned off, own ship data is shown instead of cursor data.

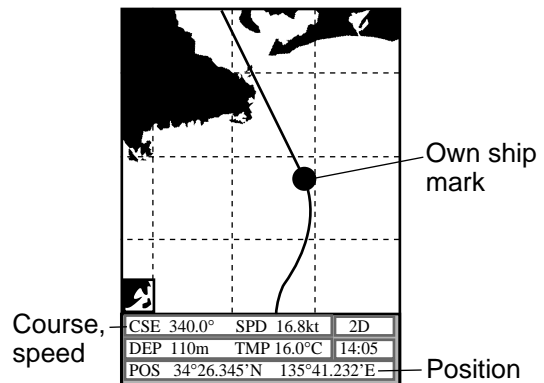


Figure 4-7 Plotter display, showing location of own ship's data

4.4 Selecting Screen Center by Cursor

1. Press the CURS key to display the cursor.
2. Operate the Cursor Pad to place the cursor where desired.
3. Press the CNTR key.

4.5 Shifting the Display

1. Press the CURS key to turn off the cursor.
2. Operate the Cursor Pad to shift the display.

4.6 Centering Position

1. Press the CURS key to turn off the cursor.
2. Press the CNTR key.

4.7 Changing Chart Scale/Range

Chart scale (range) may be selected with the ZOOM IN and ZOOM OUT keys. The ZOOM IN key blows up the chart; the ZOOM OUT key shrinks it.




Note: When the display is blown up or shrunk beyond the range of the chart card in use the message NO CHART appears to alert you.

4.8 Chart Cards

The chart cards contain nautical charts. When you insert a suitable chart card in the drive and your boat is near land, a chart appears with the land portion arranged according to the "land settings" in the DISPLAY SETUP menu.

When a wrong card is inserted or a wrong chart scale is selected, the land will be hollow. Insert the proper card and select a suitable chart scale. Chart icons appear to help you select suitable chart scale. Table 4-1 explains the chart icons and their meanings.

Table 4-1 Chart icons and their meanings

Icon	Meaning
	Proper card is not inserted or chart scale is too small. Press the ZOOM OUT key to adjust chart scale.
	Chart scale is too large. Press the ZOOM IN key to adjust chart scale.
	Suitable chart scale is selected.

Indices and chart enlargement

When the ZOOM OUT key is pressed you will see several frames. These frames are called indices and they show you what parts of the chart can be enlarged in the current picture range. The areas circumscribed with smaller frames can be enlarged, but the area enclosed by the largest frame cannot.

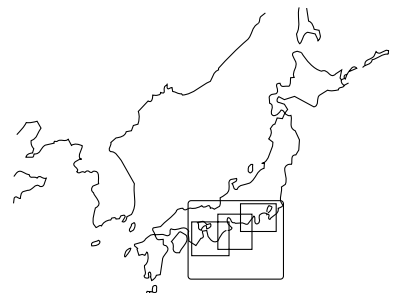


Figure 4-8 Sample chart (Japan and South Korea) showing indices

Remarks on chart display

A chart will not be displayed in the following conditions:

- When the chart scale is too large or too small.
- When scrolling the chart outside the indices.

When this happens, the message NO CHART appears for a couple of seconds. The icon also appears.

FURUNO chart symbols

The table below shows FURUNO charts symbols and their meanings.

Table 4-2 FURUNO chart symbols






















Symbol	Description
	Summit
	Wreck
	Lighthouse
	Lighted Buoy
	Buoy
	Radio Station
	Position of Sounding
	Obstruction
	Fishing Reef
	Platform
	Anchorage

Table 4-3 NAVIONICS chart symbols

Type	Color	Symbol																
Lighthouse	Red																	
	Green																	
	White																	
	Others																	
Lighted-buoy	Red																	
	Green																	
	White																	
	Others																	
Foghorn																		
Lighthouse		 The arc is viewable range and alphabet is lighting color. <table border="1" data-bbox="1169 902 1393 1037"> <tbody> <tr> <td>Red</td> <td>R</td> <td>Cyan</td> <td>C</td> </tr> <tr> <td>Green</td> <td>G</td> <td>Yellow</td> <td>Y</td> </tr> <tr> <td>White</td> <td>W</td> <td>Blue</td> <td>B</td> </tr> <tr> <td>Orange</td> <td>O</td> <td></td> <td></td> </tr> </tbody> </table>  For multiple colors	Red	R	Cyan	C	Green	G	Yellow	Y	White	W	Blue	B	Orange	O		
Red	R	Cyan	C															
Green	G	Yellow	Y															
White	W	Blue	B															
Orange	O																	

Difference between FURUNO and NAVIONICS charts

Table 4-4 Comparison of chart systems

Item	FURUNO	NAVIONICS
Dot scrolling capability	YES	YES
Course-up display	YES	NO
Lighthouse data presentation	YES *3	YES
Zoom at cursor position	YES	*1
Range at Equator	1, 1.5, 2, 3, 4, 5, 6, 8, 12...8192 nm	0.125, 0.25, 0.5, 1, 2, 3, 4, 8...1024 nm
Chart offset data entry	YES	NO
Centering	YES	*2

*1 NAVIONICS chart may not center cursor perfectly.

*2 NAVIONICS chart may not center own ship's position perfectly.

*3 Newly designed chart cards containing lighthouse data. Chart cards for North America area are completed, and others are in production.

Lighthouse and buoy data display

You can find data of lighthouses and buoys by placing the cursor on them. Lighthouse and buoy data are displayed as shown in Figure 4-9.

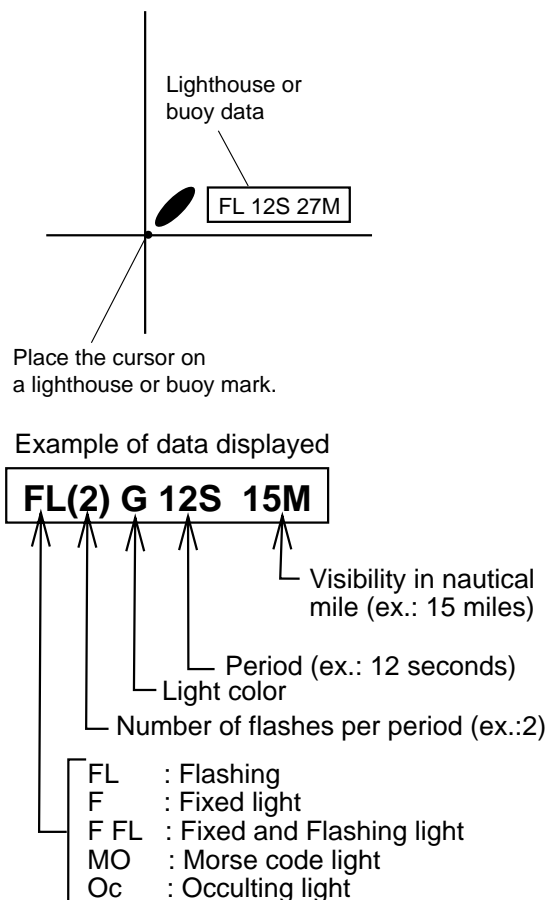


Figure 4-9 Lighthouse and buoy data

TRACK

5.1 Stopping/Restarting Plotting of Track

When your boat is at anchor or returning to port you probably won't need to record its track. You can stop recording the track, to conserve the track memory, as follows:

1. Press the MENU key.
2. Press the [2] key to select TRACK/MARK SETUP. The track/mark setup menu appears.

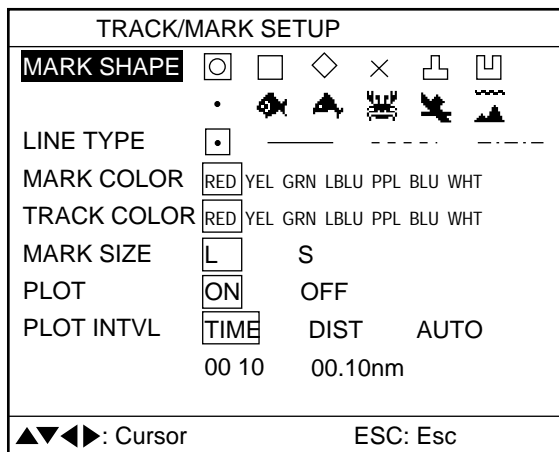


Figure 5-1 Track/mark setup menu

3. Operate the Cursor Pad to select PLOT.
4. Press ▶ to select OFF.
5. Press the MENU key to close the menu.

H appears on the screen, and own ship mark becomes hollow. (Note that the "H" icon does not appear on the sounder, data, graphic or highway display.) To resume recording and plotting, display "PLOT ON" at step 4 in the above procedure.

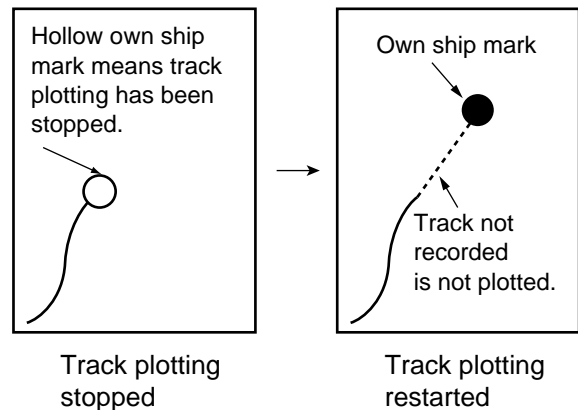


Figure 5-2 Own ship mark appearance when track is not being recorded/track is being recorded

5.2 Changing Track Color

Track can be displayed in red, yellow green, light blue, purple, blue or white. It can be useful to change track color on a regular basis to discriminate between previous day's track, past track, etc.

1. Press the MENU key.
2. Press the [2] key.
3. Operate the Cursor Pad to select TRACK COLOR.
4. Press ◀ or ▶ to select color desired.
5. Press the MENU key to close the menu.

5.3 Erasing All Track

You can erase all track. Be absolutely sure you want to erase all track; erased track cannot be restored.

1. Press the MENU key.
2. Press the [3] key to select ERASE TRACK/MARK.

ERASE TRACK/MARK		
MARK ERASE	<input checked="" type="checkbox"/> NO	YES
TRACK ERASE	<input type="checkbox"/> NO	YES
MARK USED	15/100	PT
TRACK USED	1200/2000	PT
▲▼ : Cursor	▶ : Go	ESC: Esc

Figure 5-3 Erase track/mark menu

- Operate the Cursor Pad to select TRACK ERASE.
- Press ▶ to select YES. You are asked if you are sure you want to erase all track.

Are you sure?
ENT: YES
ESC: NO

- Press the ENT key.
- Press the MENU key.

5.4 Changing Track Plotting Interval

In drawing the track, first the ship's position (fed from the GPS plotter) is stored into this unit's memory at an interval of time, distance or automatic recording. (The default setting is 10 minutes.) A shorter interval provides better reconstruction of the track, but the storage time of the track is reduced. When the track memory becomes full, the oldest track is erased to make room for the latest.

- Press the MENU key.
- Press the [2] key to select TRACK/MARK SETUP.
- Operate the Cursor Pad to select PLOT INTVL.
- Operate the Cursor Pad to select interval desired; AUTO, TIME or DIST on the PLOT INTVL line.

TIME: Plots ship's track at desired time interval, from 0 to 99 min 59 sec.

DIST: Plots ship's track only when the boat is moving, thus no track is saved to the memory when your boat is dead in water.

AUTO: Changes with chart scale automatically.

- For time or distance, enter interval desired.
- Press the MENU key to close the menu.

5.5 Smoothing Track

Even when the vessel is sailing a straight line the track shown on the display looks crooked. This is due to signal variation. To smooth out this irregularity, change the smoothing factor.

- Press the MENU key.
- Press the [0] key.
- Press the [2] key.

PLTR SETUP			
NAVAID	<input type="checkbox"/> OWN	LC	DE ALL
SCALE	SCALE		<input type="checkbox"/> RANGE
SMOOTHING	00 (00~15)		
SPD AVERAG	00 min		
BEARING	TRUE		<input type="checkbox"/> MAG
MAG CALIB	<input type="checkbox"/> AUTO		MAN
	06.3°W		00.0°E
EVNT METHOD	EVENT		<input type="checkbox"/> MARK
<input checked="" type="checkbox"/> POSITION	<input checked="" type="checkbox"/> L/L		LOP
DISP	<input type="checkbox"/> LC		DE
Chain: Sec	7970: 11-26		
LOP CALIB	+000.0 μs		
	+000.0 μs		
▲▼◀▶ : Cursor		↻ : E/W, +/- ESC: Esc	

Figure 5-4 Plotter setup menu

- Operate the Cursor Pad to select Smoothing.
- Enter smoothing with numeric keys.
- Press the ENT and MENU keys to register selections.

MARKS

6.1 Entering Marks

You can inscribe marks on the plotter display to denote important locations; for example, buoy, fishing point, wreck, etc. Further, marks can be connected with lines to depict an area such as a hot fishing spot.

100 marks may be entered. When the mark memory is full the oldest mark is deleted to make room for the latest.

Entering a mark at ship's position

1. Press the CURS key to turn off the cursor.
2. Press the EVENT MOB key. The mark currently selected on the TRACK/MARK SETUP menu appears at own ship's position.

Entering a mark at cursor intersection

1. Press the CURS key to turn on the cursor.
2. Press the EVENT MOB key. The mark currently selected on the TRACK/MARK SETUP menu appears at the cursor intersection.

6.2 Entering Event Marks

The event mark denotes a point of interest at own ship's position.

100 event marks may be entered. When the event mark memory is full the oldest event mark is deleted to make room for the latest.

Enabling entry of an event mark

To enable entry of an event mark do the following:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.

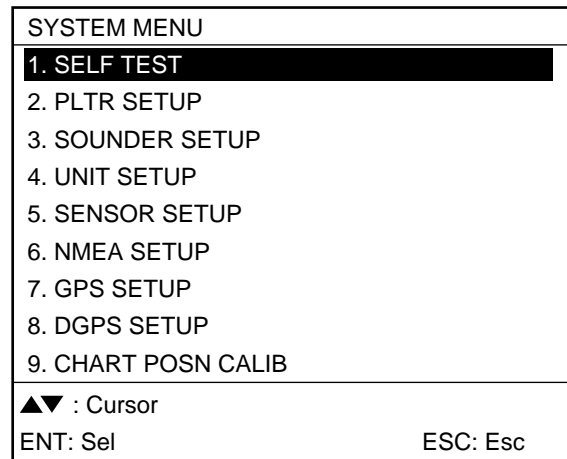


Figure 6-1 System menu

3. Press the [2] key to select PLTR SETUP.

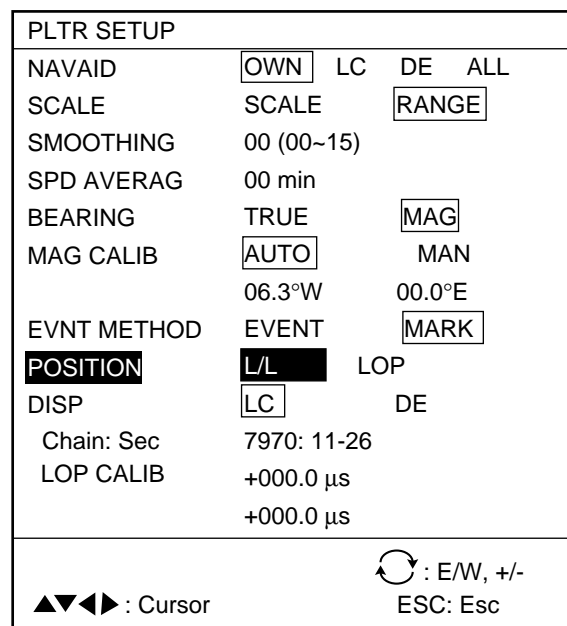


Figure 6-2 Plotter setup menu

4. Press ▼ or ▲ to select EVNT METHOD.
5. Press ◀ to select EVENT.
6. Press the MENU key.

Entering an event mark

Press the EVENT MOB key. An event mark is entered at own ship's position.

6.3 Erasing Individual Marks

Marks can be erased individually or collectively. How to erase marks collectively will be discussed later.

1. Press the CURS key to turn on the cursor.
2. Operate the Cursor Pad to place the cursor on the mark to erase.
3. Press the CLR key.

6.4 Changing Mark Attributes

Changing mark shape

1. Press the MENU key.
2. Press the [2] key to select TRACK/MARK SETUP.

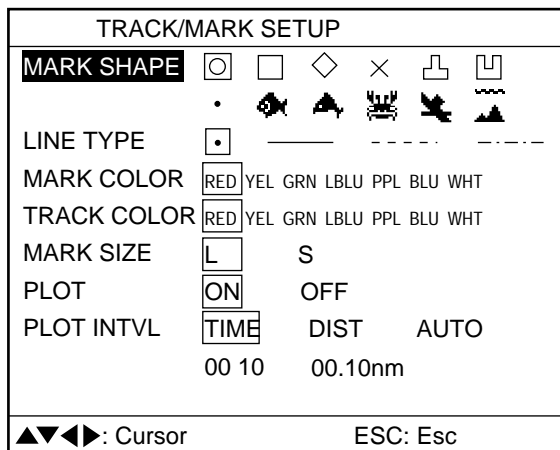


Figure 6-3 Track/mark setup menu

3. Press ▲ to select MARK SHAPE.
4. Press ◀ or ▶ to select shape desired.
5. Press the MENU key.

Changing line type

Marks can be connected with solid or dashed lines. This is useful for denoting an important area such as a good fishing spot. To select line type and connect marks do the following:

1. Press the MENU key.
2. Press the [2] key to select TRACK/MARK SETUP.
3. Press ▲ or ▼ to select LINE TYPE.
4. Press ◀ or ▶ to select any line type other than "single dot," the default setting, which provides for no connection of marks.
5. Press the MENU key.

To enter marks without connecting them, select "single dot" in step 4 in the above procedure.

Changing mark color

Marks can be displayed in red, yellow, green, light blue, purple, blue or white.

1. Press the MENU key.
2. Press the [2] key to select TRACK/MARK SETUP.
3. Press ▲ or ▼ to select MARK COLOR.
4. Press ◀ or ▶ to select color desired.
5. Press the MENU key.

Changing mark size

You may change the size of marks to small or large.

1. Press the MENU key.
2. Press the [2] key to select TRACK/MARK SETUP.
3. Press ▲ or ▼ to select MARK SIZE.
4. Press ◀ or ▶ to select Large or Small.
5. Press the MENU key.

6.5 Entering the MOB Mark

The MOB mark functions to mark man overboard position. The range and bearing to the MOB position are continuously updated on the display, to help you navigate to the MOB position.

Entering the MOB mark

1. Press the EVENT MOB key over 3 seconds. The MOB mark appears at own ship's position along with a flag. The MOB position is automatically selected as destination and the range and bearing from own ship to the MOB position are displayed.

Saved MOB position !!	
32° 59.660°N	
130° 00.066°E	
Begin navigation to the MOB waypoint	
Are you sure?	
ENT: Yes	ESC: No

Figure 6-4 MOB position display

2. Press the MENU key. (If an autopilot is connected press the ENT key.)

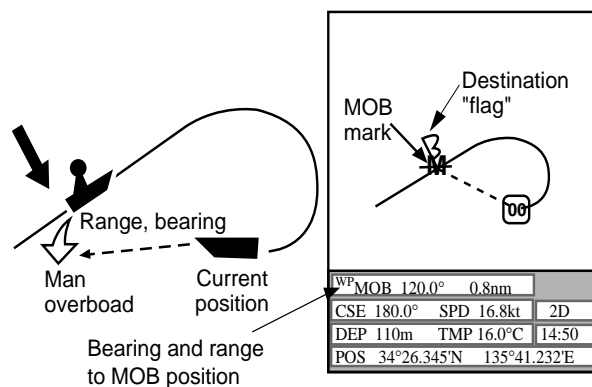


Figure 6-5 MOB concept

To erase the MOB mark, clear the memory as shown in paragraph 14.9 Clearing the Memory on page 14-7.

Cancelling MOB position as destination

1. Press the GOTO key.

SELECT GOTO MODE	
▲ WPT List	
EVENT List	
ROUTE List	
▼ Cursor/Route plan	
ENT: Sel	CLR: Release
ESC: Cancel	

Figure 6-6 GOTO selection screen

2. Press the CLR key. You are asked if you want to cancel MOB position as GOTO.

RELEASE GOTO	
ENT: Yes	
ESC: No	

3. Press the ENT key.
4. Press the MENU key.

6.6 Erasing All Marks

All marks can be erased collectively. Be absolutely sure you want to erase all marks; they cannot be restored once erased.

1. Press the MENU key.
2. Press the [3] key to select ERASE TRACK/MARK.

ERASE TRACK/MARK		
MARK ERASE	<input type="checkbox"/> NO	<input type="checkbox"/> YES
TRACK ERASE	<input type="checkbox"/> NO	<input type="checkbox"/> YES
MARK USED	0/100	PT
TRACK USED	0/2000	PT

Figure 6-7 Erase track/mark menu

3. Operate the Cursor Pad to select MARK ERASE.

3. Operate the Cursor Pad to select MARK ERASE.
4. Press ► to select YES. You are asked if you are sure to erase all marks.

Are you sure?
 ENT: YES
 ESC: NO

5. Press the ENT key.
6. Press the MENU key.

6.7 Radar Target Mark

If a radar which has the radar target position output function is connected to the GP-1610CF, radar target position can be output by the radar and marked on the screen of the GP-1610CF with the radar target mark ⊗ .

The following FURUNO radars can output target position data:

Model	Cable	Connection procedure	Operation on radar
MODEL 821/841/841MARK-2	MJ-A6SPF0012-050 (6P-6P, 5m) or MJ-A6SPF0012-100 (6P-6P, 10m)	Make the connection between NAV and radar.	Press the [HM OFF] key.
MODEL 851/861			
FMD-811			
MODEL 1831/1941 MARK-2			Press the [HM OFF] key.
MODEL 1832/1932/1942			Press the [TLL] key.
FR-7041/7041R/7061			Press and hold down the [ENTER] key about two seconds.
FR-1505/1510/1525 MARK-2	Select one of the following cables: MJ-A6SPF0011-050 (6P-4P, 5m) MJ-A6SPF0011-100 (6P-4P, 10m) MJ-A6SPF0012-050 (6P-6P, 5m) MJ-A6SPF0012-100 (6P-6P, 10m)	1. Connect the cable to the navigation. 2. Shorten the other end of the cable as necessary. 3. Solder the XH connector assy. 03-1796 (supplied with radar) to the cable.	Press the [TRGT PLT] control.
FR-8051/8111/8251			Press the [VRM (TLL)] control.
FMD-8010			

This function requires gyrocompass or bearing sensor connection at the radar.

WAYPOINTS, ROUTES

7.1 Entering Waypoints

In navigation terminology, a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination point. A waypoint is the simplest piece of information the GP-1610CF requires to get you to a destination, in the shortest distance possible.

This unit has 200 waypoints into which you can enter position information. There are four methods by which you can enter a waypoint:

- By ship's position
- Through the waypoint list (manual input of latitude and longitude)
- By event position or MOB position
- By the cursor

Entering a waypoint at own ship's position

1. Press the WPT key. The menu for selection of waypoint entry method appears.

SELECT WPT MODE	
▲ Own Position	
Cursor	
WPT List	
▼ Event to WPT	
ENT: Sel	ESC: Cancel

Figure 7-1 Display for selection of waypoint entry method

2. Press ▲ or ▼ to select Own Position.
3. Press the ENT key. The following display appears.

WPT at Own Position	
LAT:	32°59.685'N
LONG:	130°00.177'E
No:	001
MARK:	--
CMNT:	970125 12
◀▶: Cursor	▼: Column
ENT: Enter	MENU: Sel Mode

Figure 7-2 Display for entry of waypoint at own ship's position

The waypoint number shown is the youngest empty waypoint. If you want to enter the waypoint under that number go to step 5. To change the number go to step 4.

4. Enter waypoint number with numeric keys.
5. To select mark shape, press ▼. (If not selected the waypoint will be marked by a yellow octagon with waypoint number in its center. Waypoint color cannot be changed.)

					SP
					SP
▲▼◀▶: Cursor					
ENT: Enter			ESC: Escape		

Figure 7-3 Display for selection of waypoint symbol

6. Operate the Cursor Pad to select mark desired.
7. Press the ENT key.

ABCDE	FGHIJ	KLMNO	PQRST	UVWXY
Z, - !?	/&=#	12345	67890	
a b c d e	f g h i j	k l m n o	p q r s t	u v w x y
z				
ENTER				
COMMENT: 970125 12				
▲▼◀▶: Cursor				
ENT: Enter		ESC: Escape		

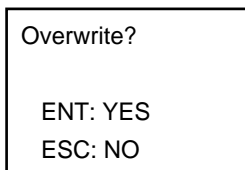
Figure 7-4 Display for entry of waypoint comment

8. Enter a comment as follows:
 - a) Operate the Cursor Pad to select desired character. (You may enter numeric data with the numeric keys. The CLR key deletes last-entered character.)

- b) Press the ENT key.
- c) Repeat a) and b) to complete the comment. A comment may contain 10 characters.
- d) Select ENTER.
- e) Press the ENT key.

9. Press the ENT key.

Note 1: If you manually entered a waypoint number which already exists the following message will appear on the display:



In this case you may overwrite the waypoint by pressing the ENT key or press the ESC key to escape.

Note 2: If you do not need to change mark shape or enter a comment, simply press the ENT key at the "WPT at Own Position" display to enter the waypoint in the default waypoint mark shape and youngest empty waypoint number.

Entering a waypoint by the cursor

1. Press the WPT key. The menu for selection of waypoint entry method appears.
2. Press ▲ or ▼ to select Cursor.
3. Press ENT key. The display prompts you to select position.

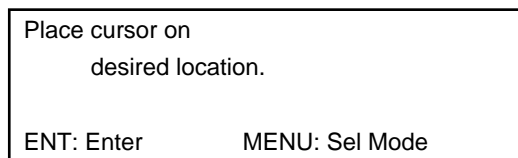


Figure 7-5

4. Operate the Cursor Pad to place the cursor on position desired.
5. Press the ENT key.
6. Follow steps 4 through 9 in "Entering a waypoint at own ship's position."

Entering waypoints by latitude and longitude

1. Press the WPT key.
2. Press the WPT key to select WPT List.
3. Press the ENT key. The waypoint list appears.

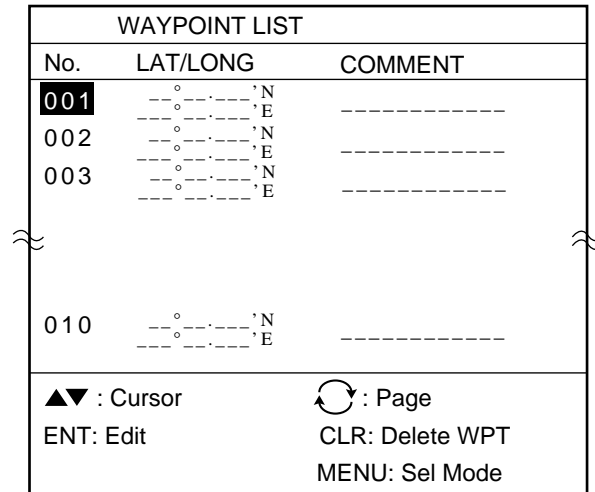


Figure 7-6 Sample waypoint list

4. Press ▲ or ▼ to select vacant waypoint number. To scroll the list, press ↻.
5. Press the ENT key. The waypoint edit screen appears.

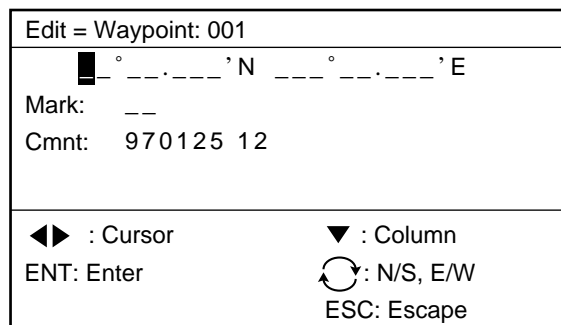


Figure 7-7 Waypoint edit screen

6. Enter latitude and longitude. (To switch latitude or longitude polarity, press ↻ before entering position data.)
7. Press ▼.
8. Select mark shape, if desired.
9. Press the ENT key.
10. Enter comment, if desired.

11. Press the ENT key.
12. Press the MENU key twice.

Entering waypoints by event position or MOB position

1. Press the WPT key.
2. Press the WPT key to select Evnt to WPT.
3. Press the ENT key. The event list appears.

EVENT LIST		
No.	LAT	LONG
MOB	32°59.892'N	129°59.893'E
001	32°59.954'N	130°00.236'E

⏏ : Cursor ↻ : Page change
MENU: Sel Mode

Figure 7-8 Event list

4. Press ▲ or ▼ to selection position to enter as a waypoint.
5. Press the ENT key.
6. Follow steps 4 through 9 in "Entering a waypoint at own ship's position."

7.2 Erasing Individual Waypoints

Waypoints can be erased by the cursor or through the waypoint list.

Erasing waypoints by the cursor

1. Press the CURS key to turn on the cursor.
2. Operate the Cursor Pad to place the cursor on the waypoint you want to erase.
3. Press the CLR key. The waypoint is erased from both the screen and the waypoint list.

Erasing waypoints through the waypoint list

1. Press the WPT key.
2. Press the WPT key again to select WPT List.
3. Press the ENT key. The waypoint list appears.
4. Press ▲ or ▼ to select waypoint.
5. Press the CLR key. You are asked if you want to erase the waypoint.

Are you sure?
ENT: YES
ESC: NO

6. Press the ENT key.
7. Press the MENU key twice.

7.3 Changing Waypoint Position

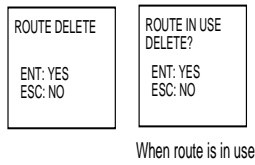
You may change the latitude and longitude position, waypoint shape and comments of waypoints you have entered, through the waypoint list.

1. Press the WPT key.
2. Press the WPT key again to display the WPT List.
3. Press the ENT key.
4. Press ▲ or ▼ to select waypoint.
5. Press the ENT key. You are asked if it is alright to overwrite the contents of the waypoint.

Overwrite?
ENT: YES
ESC: NO

6. Press the ENT key. The edit display appears. Change data as necessary, following "Entering waypoints by latitude and longitude."

Note: If the waypoint selected is part of a route you are asked whether it is alright to edit the waypoint.



7. Press the ENT key to register changes.
8. Press the MENU key to escape.

7.4 Changing Waypoint Mark Size

Waypoint mark size can be selected to large or small.

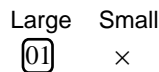


Figure 7-9 Waypoint mark size

1. Press the MENU key.
2. Press the [1] key to show the DISPLAY SETUP menu.

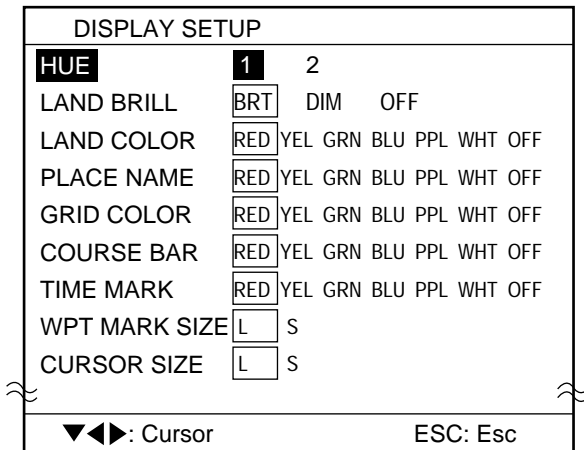


Figure 7-10 Display setup menu

3. Operate the Cursor Pad to select WPT MARK SIZE.
4. Operate the Cursor Pad to Large or Small.
5. Press the MENU key to register selection.

7.5 Entering Routes

Often a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. The GP-1610CF can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

You can store up to 20 routes. A route may consist of 30 points.

A route is constructed using waypoints, therefore enter waypoints beforehand.

1. Press the MENU key.
2. Press the [4] key to display the route/route list.

ROUTE LIST			
No.	PTS	TOTAL	TTG
01	6	302.11nm	41:36
02	4	201.27nm	35:52
⋮			
▲▼ : Cursor		ENT: Sel	
CLR : Delete Route		ESC: Esc	
* : In Use			

Figure 7-11 Route list

3. Press ▲ or ▼ to select route number.

4. Press the ENT key.

ROUTE LIST 01 LEG: ____ . ____ nm				
----	----	----	----	----
----	----	----	----	----
----	----	----	----	----
----	----	----	----	----
----	----	----	----	----
WAYPOINT LIST				
No.	LAT/LONG	COMMENT		
001	23°00.000'N 123°00.000'E	10MAR97 01__		
004	32°21.154'N 135°27.321'E	10MAR97 01__		
007	30°19.721'N 132°21.321'E	10MAR97 01__		
◀▶: Cursor		ENT: Sel		
↻: Page		ESC: Esc		

Figure 7-12 Route entry screen

5. Press the ENT key to enable entry of waypoints.
6. Press ▲ or ▼ to select waypoint number.
7. Press the ENT key. The waypoint number selected appears at the top of the screen and the cursor shifts to the next column.
8. Repeat steps 6 and 7 to complete the route and press the MENU key twice.
9. To set trial speed, the default setting of which is 10 kts, press ▼ until TRIAL TIME appears (after 20th route).
10. Enter speed with numeric keys.
11. Press the ENT key.
12. Press the MENU key.

7.6 Editing Routes

1. Press the MENU key.
2. Press the [4] key.
3. Press ▲ or ▼ to select route number.
4. Press the ENT key. You are asked if it is alright to overwrite the contents of the route.

Overwrite? ENT: YES ESC: NO

5. Press the ENT key.
6. Press ◀ or ▶ to select waypoint.
7. Press the ENT key.
8. Press ▲ or ▼ to select new waypoint.
9. Press the ENT key.
10. Press the ESC key three times to escape.

Note: If the waypoint is currently the destination, the following alert appears.

ROUTE IN USE OVERWRITE? ENT: YES ESC: NO

7.7 Erasing Routes

1. Press the MENU key.
2. Press the [4] key. The route/route list appears.
3. Press ▲ or ▼ to select route number.
4. Press the CLR key.

ROUTE DELETE ENT: YES ESC: NO

ROUTE IN USE DELETE? ENT: YES ESC: NO
--

When route is in use

5. Press the ENT key.
6. Press the MENU key.

SETTING DESTINATION

8.1 Setting Destination

The GP-1610CF offers four methods by which you can set destination:

- Previously entered waypoint
- Cursor position
- Event position/MOB position
- Route

Setting destination by waypoint

1. Press the GOTO key. The following menu appears.

SELECT GOTO MODE	
▲ WPT List	
EVENT List	
ROUTE List	
▼ Cursor/Route plan	
ENT: Sel	CLR: Release
	ESC: Cancel

Figure 8-1 Destination waypoint selection menu

2. Press the GOTO key again to select WPT List.
3. Press the ENT key. The waypoint list appears.

WAYPOINT LIST		
No.	LAT/LONG	COMMENT
001	23°00.000'N 123°00.000'E	10MAR97 01__
002	32°21.128'N 135°27.923'E	10MAR97 01__
005	30°12.345'N 127°21.293'E	10MAR97 01__

▲▼ : Cursor	↻ : Page change
ENT: Set	CLR: Release
	MENU: Sel Mode
*: In Use	

Figure 8-2 Waypoint list

4. Operate ▲ or ▼ to select a waypoint.
5. Press the ENT key.
 - A dashed light-blue line runs between destination selected and own ship's position.
 - The range and bearing to the destination appear at the bottom of the display.

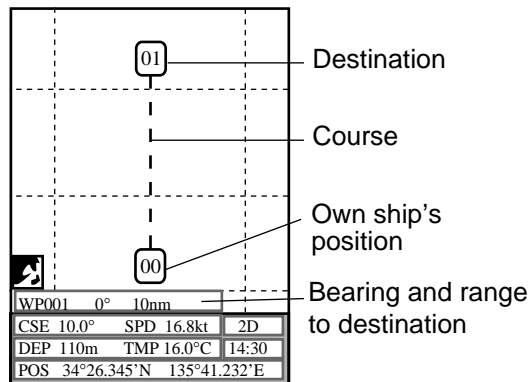


Figure 8-3 Appearance of display when destination is selected by waypoint

Setting destination by cursor

1. Press the GOTO key.
2. Press the GOTO key to select Cursor/Route plan.
3. Press the ENT key.

▲▼◀▶ : Cursor
ENT: Set
ENT twice: complete
MENU: SEL Mode

4. Place cursor on position desired for destination.
5. Press the ENT key. To set a single destination, go to step 7. To set more than one destination, go to step 6.
6. Repeat steps 4 and 5 to enter other destinations.
7. Press the ENT key.

Own ship's position is marked as "00." A light-blue line connects own ship with destination, marked with a flag, and it shows the shortest course to the destination. Range and bearing from own ship to the destination appears at the bottom of the screen.

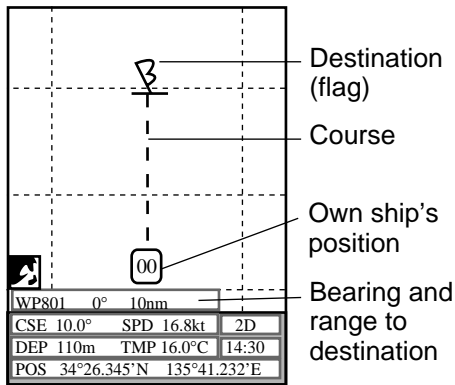


Figure 8-4 Destination selected by cursor

Setting destination by event position/ MOB position

1. Press the GOTO key.
2. Press the GOTO key to select EVENT List.
3. Press the ENT key. The event list appears.

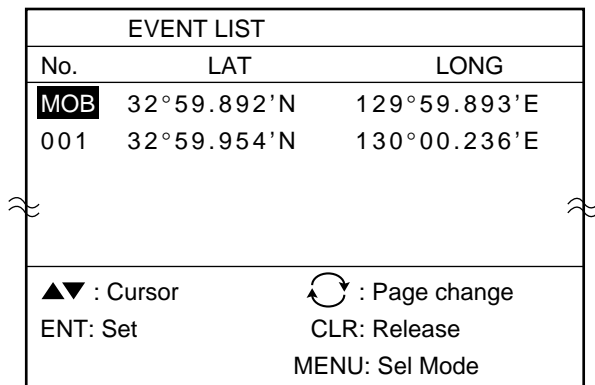


Figure 8-5 Event list

4. Press ▼ or ▲ to select event position.
5. Press the ENT key.

Own ship's position is marked as "00." A light-blue line connects own ship with destination, marked with a flag, and it shows the shortest course to the destination. Range and bearing from own ship to the destination appears at the bottom of the screen.

Setting a route as destination

1. Press the GOTO key.
2. Press the GOTO to select ROUTE List.
3. Press the ENT key. The route list appears.

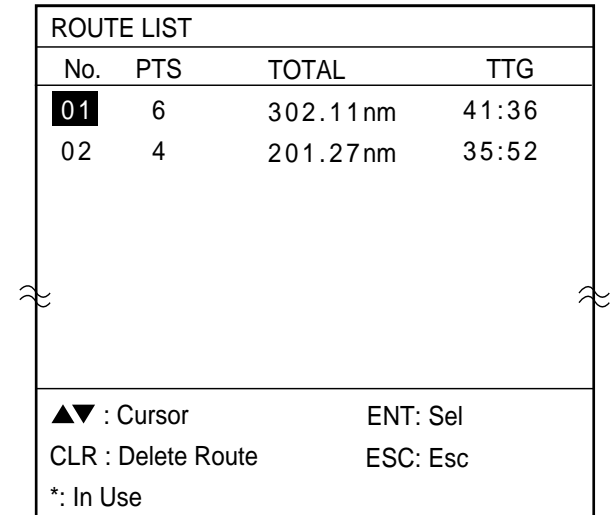


Figure 8-6 Route list

4. Press ▼ or ▲ to select a route.
5. If you want to navigate the waypoints of the route in the order reverse of which they were entered, press the ↻ key. Direction selected appears at the top of the display.
6. Press the ENT key.

Own ship's position is marked as "00." Light-blue lines run between route waypoints. Range and bearing from own ship to the next destination waypoint appears at the bottom of the screen.

8.2 Skipping Route Waypoints

There are times when you won't need to follow all waypoints in a route. In Figure 8-7, for example, the ship has skipped waypoint 04.

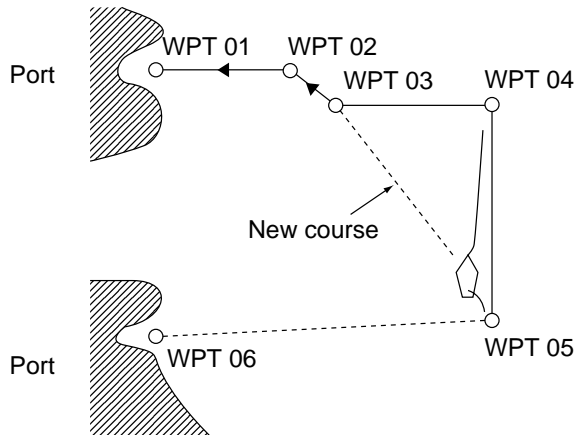




Figure 8-7 How a waypoint is skipped

1. Press the MENU key.
2. Press the [4] key. The route/route list appears.
3. Press ▲ or ▼ to select route number.
4. Press the ENT key. You are asked if it is alright to overwrite route contents.

Overwrite? ENT: Yes MENU: No

5. Press the ENT key.
6. Operate the Cursor Pad to select waypoint to skip.
7. Press the  key to skip that point temporarily. The route waypoint is displayed in light blue.
8. Press the MENU key twice to escape.

To restore a waypoint, select it and press the  key to display it in white.

8.3 Cancelling Destination

1. Press the GOTO key.
2. Press the CLR key.

RELEASE GOTO


ENT: Yes ESC: No

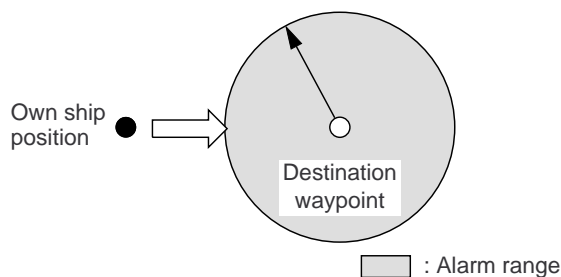
3. Press the ENT key.
4. Press the MENU key.

PLOTTER-RELATED ALARMS

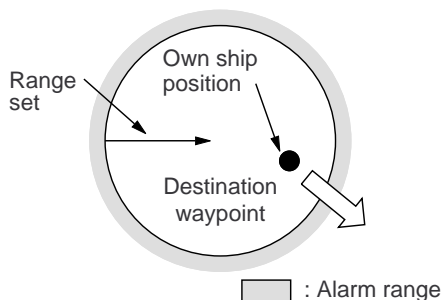
9.1 Arrival/Anchor Watch Alarm

The **arrival alarm** informs you that your boat is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if your boat enters the circle. The **anchor watch alarm** sounds to warn you that your boat is moving when it should be at rest.

When the arrival or anchor watch alarm is violated, the audible alarm sounds and the alarm icon  and the indication ARR or ANCHR appear. You may silence the alarm with the CLR key. The indication remains on the screen until the cause of the alarm is corrected.



Arrival alarm



Anchor watch alarm

Figure 9-1 How the arrival and anchor watch alarms work

The arrival and anchor watch alarms cannot be activated together. You may activate one as follows:

1. Press the MENU key.

2. Press the [5] key to select ALARM SETUP.

ALARM SETUP		1/2
ARRIVAL	ARRIVAL ANCHOR	OFF
	Range	00.500nm
XTE	ON	OFF
	Range	00.250nm
SPEED	WITHIN OVER	OFF
	Speed	11.0~15.0kt
TEMP	WITHIN OVER	OFF
	Temp	+11.0~+15.0°C
TRIP	ON	OFF
	Range	0005.00nm
▲▼◀▶: Cursor		
		ESC: Esc

Figure 9-2 Alarm setup menu

3. Press ▲ to select ARRIVAL.
4. Press ▶ or ◀ to select ARRIVAL or ANCHOR.
5. Press ▼ to send the cursor to the second line (Range).
6. Key in the alarm range desired. The available range is 00.001 to 99.999 miles.
7. Press the ENT key.
8. Press the MENU key.

When a destination is set and the arrival alarm is activated a red dashed circle circumscribes the destination waypoint and it denotes arrival alarm range.

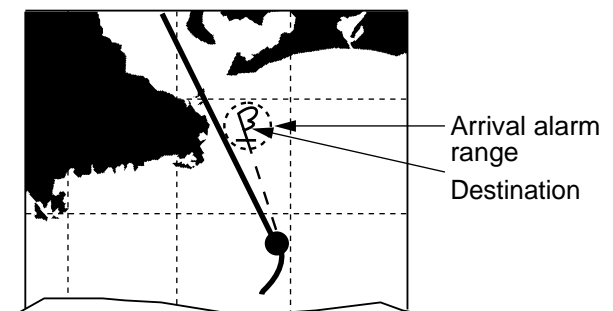



Figure 9-3 Arrival alarm range

9.2 XTE (Cross Track Error) Alarm

The XTE alarm warns you when your boat is off its intended course.

When your boat goes off course by the alarm range set, the audible alarm sounds and the alarm icon  and the indication XTE appears. You may silence the alarm with the CLR key. The indication remains on the screen until the boat is put back on course.

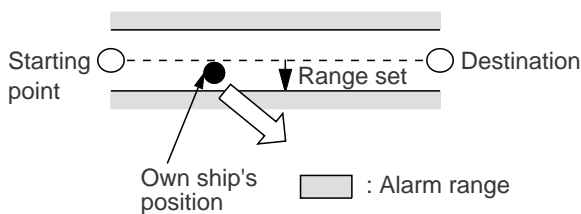


Figure 9-4 How the XTE alarm works

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.
3. Press ▲ or ▼ to select XTE.
4. Press ◀ to select ON.
5. Press ▼ to send the cursor to the fourth line (Range).
6. Key in alarm range desired. The available range is 00.001 to 99.999 miles.
7. Press the ENT key.
8. Press the MENU key.

When a destination is set and the XTE alarm is activated, a pair of dashed red lines denote the XTE alarm range.

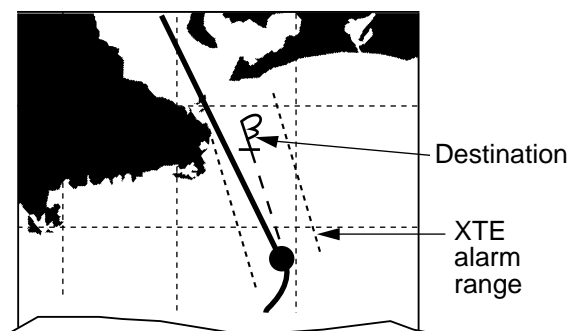



Figure 9-5 XTE alarm range

9.3 Speed Alarm


The speed alarm sounds when your boat's speed is within (or over) the alarm range set.

When the alarm setting is violated, the audible alarm sounds and the alarm icon  and the indication SPEED appears. You may silence the alarm with the CLR key. The indication remains on the screen until the cause of the alarm is corrected.

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.
3. Press ▲ or ▼ to select SPEED.
4. Press ▶ or ◀ to select WITHIN or OVER.
5. Press ▼ to send the cursor to next line (Speed).
6. Key in speed desired.
7. Press the ENT key.
8. Press the MENU key.

9.4 Trip Alarm

The trip alarm sounds when distance travelled exceeds the trip alarm setting.

When the alarm setting is violated, the audible alarm sounds and the alarm icon  and the indication TRIP appears. You may silence the alarm with the CLR key. The indication remains on the screen until the cause of the alarm is corrected.

1. Press the MENU key.
2. Press the [5] key to select ALARM SETUP.
3. Press ▲ or ▼ to select TRIP.
4. Press ◀ to select ON.
5. Press ▼ to send the cursor to the last line (Range).
6. Key in the range desired.
7. Press the ENT key.
8. Press the MENU key.

POSITION-RELATED OPERATIONS

10.1 Displaying Position in LOPs

Position can be displayed in latitude and longitude, Loran C LOPs or Decca LOPs.

Displaying position in Loran C LOPs

1. Press the MENU key.
2. Press the [0] key to select the SYSTEM menu.
3. Press the [2] key to select PLTR SETUP.

PLTR SETUP			
NAVAID	<input type="text" value="OWN"/>	LC	DE ALL
SCALE	SCALE	<input type="text" value="RANGE"/>	
SMOOTHING	00 (00~15)		
SPD AVERAG	00 min		
BEARING	TRUE	<input type="text" value="MAG"/>	
MAG CALIB	<input type="text" value="AUTO"/>	MAN	
	06.3°W	00.0°E	
EVNT METHOD	EVENT	<input type="text" value="MARK"/>	
POSITION	<input type="text" value="L/L"/>	LOP	
DISP	<input type="text" value="LC"/>	DE	
Chain: Sec	7970: 11-26		
LOP CALIB	+000.0 μs		
	+000.0 μs		
		↻ : E/W, +/-	
▲▼◀▶ : Cursor		ESC: Esc	

Figure 10-1 Pltr setup menu

4. Press ▲ or ▼ to select POSITION.
5. Press ▶ to select LOP.
6. Press ▼ to select DISP.
7. Select LC.
8. Press ▼ to select Chain: Sec.
9. Key in Loran C GRI.
10. Key in Loran C slave code.
11. Key in other Loran C slave code.
12. If necessary, press ▼ to select LOP CALIB.

13. Press the key to display plus(+) or minus(-).
14. Key in offset(s).
15. Press the ENT key.
16. Press the MENU key.

Displaying position in Decca LOPs

Follow the procedure in "Displaying position in Loran C LOPs." At step 7 select DE instead of LC. Key in chain number and station pair: 1 for R, 2 for G, 3 for P. See Decca Chains in the Appendix for chain number.

10.2 Offsetting GPS Position

You may wish to offset the GPS position to refine position accuracy. First, moor boat at a pier and plot position shown by GP-1610CF on a nautical chart. Then, enter offset.


1. Press the MENU key.
2. Press the [0] key to select the SYSTEM SETUP menu.
3. Press the [7] key. The GPS SETUP menu appears.

GPS SETUP			
GPS SMOOTHING			
Posn	000 (000~999)		
Speed	000 (000~999)		
GEODETTIC	<input type="text" value="WGS-84"/>	OTHER (002)	
POS CALIB	<input type="text" value="00.000'N"/>	<input type="text" value="00.000'E"/>	
UNHEALTH	RSTR	<input type="text" value="DISABLED"/> (_ _)	
		- - - - -	
		- - - - -	
TIME DIFF	+09: 00		
▲▼ : Cursor		↻ : N/S, E/W, +/-	
		ESC: Esc	

Figure 10-2 GPS setup menu

4. Select POS CALIB.

5. Consulting a nautical chart, enter offset with numeric keys.
6. Press the ENT key.
7. Press the MENU key.

 appears on the display. To remove the offset, enter zeroes at step 5 in the above the procedure.

10.3 Selecting Navaid

If your boat is equipped with other position-fixing equipment you may wish to use its position fixes instead.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [2] key.
4. Operate the Cursor Pad to select NAVAID.
5. Operate the Cursor Pad to select OWN (internal GPS), LC (Loran C), DE (Decca), or ALL. (Select ALL for multiple navaid connection. In this case position data is read in the order of GPS, Loran C, Decca, etc.)
6. Press the MENU key.

10.4 Displaying True or Magnetic Bearings

You may display bearing relative to true North (true bearing) or relative to magnetic North (magnetic bearing).

1. Press the MENU key.
2. Press the [0] key.
3. Press the [2] key.
4. Operate the Cursor Pad to select BEARING.
5. Operate the Cursor Pad to select TRUE or MAG.
6. Press the MENU key.

10.5 Magnetic Variation

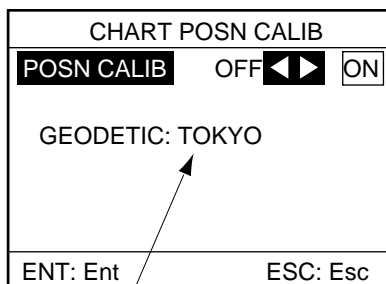
The location of the magnetic pole is different from the geographical North pole. This causes a difference between the true and magnetic North direction. The difference is called magnetic variation, and varies by the observation point on the earth. This unit is programmed with the earth's magnetic variations. However, you may wish to further refine variation for a particular area by entering them manually. If you enter compensation manually, be sure to change it when magnetic variation changes.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [2] key.
4. Operate the Cursor Pad to select MAG CALIB.
5. Operate the Cursor Pad to select AUTO or MAN.
6. If you selected MAN in step 5, enter magnetic variation with the numeric keys.
7. Press the ENT key followed by the MENU key.

10.6 Offsetting Chart Position

In some instances chart position may be off by a few minutes. For example, the position of the ship is shown to be at sea while it is in fact moored at a pier. You can compensate for this error as follows:

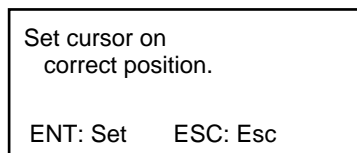
1. Press the MENU key.
2. Press the [0] key to select SYSTEM SETUP.
3. Press the [9] key to select CHART POSN CALIB.




Datum of FURUNO chart card inserted.
Does not appear when using NAVIONICS chart card.

Figure 10-3 Chart position calibration menu

4. Press ► to select ON.



5. Set the cursor on correct position.
6. Press the ENT key. The calibration values appear.
7. Press the MENU key.

The chart offset icon  appears on the display. To remove the correction, select OFF in step 4 of the above procedure.

GPS OPERATIONS

11.1 GPS Setup Menu

The GPS setup menu provides for the setting up of GPS-related operations.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [7] key.

GPS SETUP	
GPS SMOOTHING	
Posn	000 (000~999)
Speed	000 (000~999)
GEODETIC	WGS-84 OTHER (002)
POS CALIB	00.000'N 00.000'E
UNHEALTH	RSTR DISABLED (_ _)
	--- --
	--- --
TIME DIFF	+09: 00
▲▼: Cursor	↻: N/S, E/W, +/-
	ESC: Esc

Figure 11-1 GPS setup menu

GPS SETUP menu description

GPS POSITION SMOOTHING: When the DOP or receiving condition is unfavorable, the GPS fix may change greatly, even if the vessel is dead in water. This change can be reduced by smoothing the raw GPS fixes. A setting between 0 and 9 is available. The higher the setting the more smoothed the raw data. Note however that too high a setting slows response time to change in latitude and longitude. This is especially noticeable at high ship's speeds. "000" is the default setting; increase the setting if the GPS fix changes greatly.

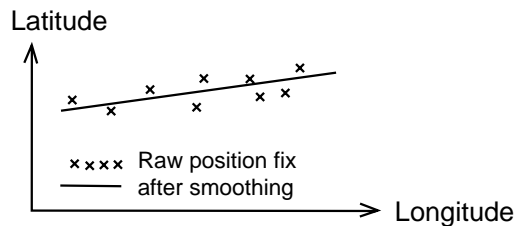


Figure 11-2 GPS position smoothing

GPS SPEED SMOOTHING: During position fixing, ship's velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may change randomly depending on receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. Like with latitude and longitude smoothing, the higher the speed and course smoothing the more smoothed the raw data. If the setting is too high, however, the response to speed and course change slows. "000" is the default setting; increase the setting if the GPS speed changes greatly.

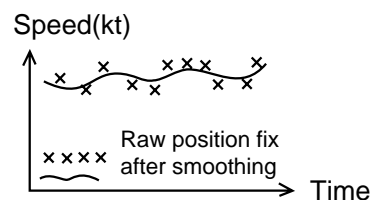



Figure 11-3 GPS speed smoothing

GEODETIC: Select the geodetic chart system you are using. WGS-84 (standard GPS chart system) can be directly selected. For other charts, select OTHER and enter chart number referring to Geodetic Chart List in the Appendix. For sake of accuracy, the chart system selected here should be the same as that of the cart card used. (See page 10-3.)

POS CALIB: You may apply an offset to position generated by the internal GPS receiver, to further refine position accuracy. For further details, see "10.2 Offsetting GPS Position."

UNHEALTH: Every GPS satellite is broadcasting abnormal satellite number(s) in the Almanac. Using this information, the GPS receiver eliminates any malfunctioning satellite from the GPS satellite schedule. Once the malfunctioning satellite is returned to on-line status it is automatically restored to the satellite schedule when the Almanac is received. In some instances however the Almanac may not contain information which announces that a satellite is now back on line. If you hear of this through another source, you can manually restore the satellite to the satellite schedule. Conversely, you can manually disable a healthy satellite if you hear it is unhealthy.

To restore or disable a satellite, select RSTR or DISABLED on the UNHEALTH line and then enter satellite number.

TIME DIFF (using local time): GPS uses UTC time. If you want to use local time, enter time difference between local time and UTC time here. The  key serves to designate plus or minus time. See the World Time Standards chart on page A-3 for time differences.

11.2 Speed Averaging

Calculation of ETA and TTG is based on an average ship's speed over a given period. If the period is too long and the ship's speed is changed suddenly, calculation error will result. Speed averaging may be increased or decreased to offset calculation error. The default setting is 00.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [2] key to display the PLOTTER SETUP menu.



PLTR SETUP			
NAVAID	<input type="text" value="OWN"/>	LC	DE ALL
SCALE	SCALE		<input type="text" value="RANGE"/>
SMOOTHING	00 (00~15)		
SPD AVERAG	00 min		
BEARING	TRUE		<input type="text" value="MAG"/>
MAG CALIB	<input type="text" value="AUTO"/>		MAN
	06.3°W		00.0°E
EVNT METHOD	EVENT		<input type="text" value="MARK"/>
POSITION	<input type="text" value="L/L"/>		LOP
DISP	<input type="text" value="LC"/>		DE
Chain: Sec	7970: 11-26		
LOP CALIB	+000.0 μs		
	+000.0 μs		
		 : E/W, +/-	
 : Cursor		ESC: Esc	

Figure 11-4 Pltr setup menu

4. Operate the Cursor Pad to select SPD AVERAG.
5. Enter averaging with numeric keys.
6. Press the ENT and MENU keys to register selection.

OPTIONAL EQUIPMENT SETUP

12.1 Selecting Sensors

The sensor setup menu provides for selection and calibration of speed and temperature sensors (optional equipment).

1. Press the MENU key.
2. Press the [0] key.
3. Press the [5] key.

SENSOR SETUP		
SPD SENSOR	STW	SOG
TEMP SENSOR	OWN	NMEA
SPD CALIB	+00% (-50~+50)	
TEMP CALIB	+00.0 °C	
DEPTH CALIB	+0.0 m	
▲▼: Cursor ↻: +/-		
ESC: Esc		

Figure 12-1 Sensor setup menu

SENSOR SETUP menu description

SPD SENSOR: Select speed input source; navaid or internal.

TEMP SENSOR: Select device (option) which feeds temperature data; external or internal.

SPD CALIB: Enter offset to correct speed data.

TEMP CALIB: Enter offset to correct water temperature data.

DEPTH CALIB: Enter offset to correct depth.

12.2 Selecting Autopilot, Remote Display

The NMEA menu provides for selection of autopilot or remote display and its format.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [6] key.

NMEA SETUP		
FORMAT	183V1.5	183V2.0
EXT DEVICE	REM	PILOT
▲▼◀▶: Cursor ESC: Esc		

Figure 12-2 NMEA setup menu

4. Select format of connected external device; NMEA format 0183V1.5 or 0183V2.0.
5. Select type of external device connected; REMote display or autoPILOT.
6. Press the MENU key to register selections.

12.3 Setting up DGPS Beacon Receiver

With connection of an external DGPS beacon receiver (option), GPS position accuracy becomes within 5 to 10 meters.

The specifications of the DGPS beacon receiver should be set on the DGPS setup menu.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [8] key.

DGPS SETUP			
DGPS	ON	OFF	
RTCM VER	1.0	<input type="text" value="2.0"/>	
BYTE FORM	<input type="text" value="8-6"/>	8-8	
FIRST BIT	MSB	<input type="text" value="LSB"/>	
PARITY BIT	EVEN	ODD	<input type="text" value="NONE"/>
STOP BIT	<input type="text" value="1"/>	2	
BIT RATES	7	<input type="text" value="8"/>	
BAUD RATES	300	600	1200
	2400	<input type="text" value="4800"/>	9600
▲▼◀▶: Cursor			
ENT: Sel		ESC: Esc	

Figure 12-3 DGPS setup menu

4. Display DGPS ON and set other items according to specifications of beacon receiver.
5. Press the MENU key to register selections.

CUSTOMIZING THE DISPLAY

13.1 Plotter Display Marker Attributes

The various markers and items shown on the plotter display can be turned on/off and their color changed on the DISPLAY SETUP menu. The markers which can be changed are as follows:

- Background color (light-blue or black)
- Grid color and grid on/off
- Course bar color and course bar on/off
- Time mark color and time mark on/off

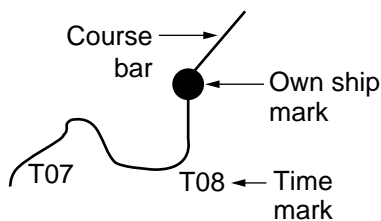


Figure 13-1 Time mark and course bar

- Waypoint mark size
- Cursor size

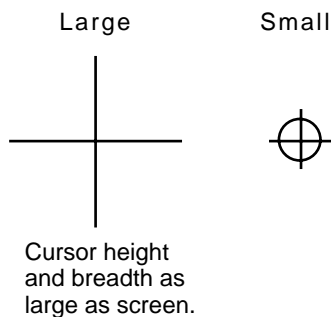


Figure 13-2 Cursor size

1. Press the MENU key.
2. Press the [I] key to show the DISPLAY SETUP menu.

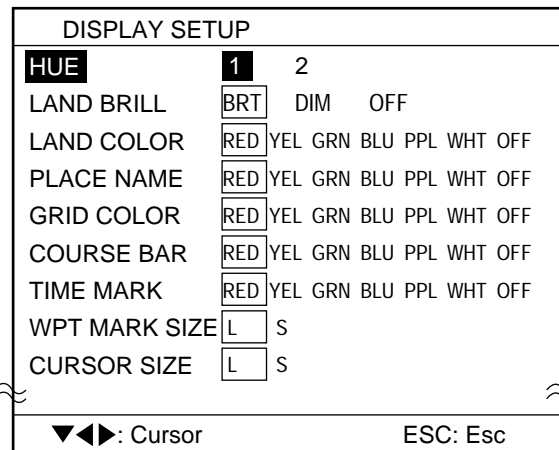


Figure 13-3 Display setup menu

3. Operate the Cursor Pad to select item among HUE, GRID COLOR, COURSE BAR, TIME MARK, WAYPOINT SIZE or CURSOR SIZE.
4. Operate the Cursor Pad to select option desired.
5. Press the MENU key to register selections.

13.2 Chart Attributes

You may select the color and brightness of the land on a chart and turn/off place-name display as follows:

1. Press the MENU key.
2. Press the [I] key to show the DISPLAY SETUP menu.
3. Operate the Cursor Pad to select item among LAND BRIGHT, LAND COLOR, or PLACE NAME.
4. Operate the Cursor Pad to select option desired.
5. Press the MENU key to register selections.

13.3 Unit of Distance Measurement

You may display range in nautical miles, kilometers or statute miles as follows:

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [4] key to display the UNIT SETUP menu.

UNIT SETUP			
DISTANCE	nm	km	sm
DEPTH	m	ft	fa
TEMP	°C	°F	
▲▼◀▶ : Cursor		ESC: Esc	

Figure 13-4 Unit setup menu

4. Operate the Cursor Pad to select Distance.
5. Operate the Cursor Pad to select nm, km, or sm.
6. Press the MENU key.

13.4 Chart Range or Scale Indication

This unit can show either nautical miles or scale whenever the ZOOM IN or ZOOM OUT key is pressed.

1. Press the MENU key.
2. Press the [0] key.
3. Press the [2] key.

PLTR SETUP			
NAVAID	OWN	LC	DE ALL
SCALE	SCALE		RANGE
SMOOTHING	00 (00~15)		
SPD AVERAG	00 min		
BEARING	TRUE		MAG
MAG CALIB	AUTO		MAN
	06.3°W		00.0°E
EVNT METHOD	EVENT		MARK
POSITION	L/L		LOP
DISP	LC		DE
Chain: Sec	7970: 11-26		
LOP CALIB	+000.0 μs		
	+000.0 μs		
▲▼◀▶ : Cursor		↻ : E/W, +/- ESC: Esc	

Figure 13-5 Plotter setup menu

4. Operate the Cursor Pad to select SCALE.
5. Operate the Cursor Pad to select SCALE or RANGE.
6. Press the MENU key.

MAINTENANCE & TROUBLESHOOTING

14.1 Maintenance

Regular maintenance is essential for good performance. A maintenance program should be established and should at least include the items listed in Table 14-1.

WARNING

Do not open the equipment.


Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

14-1 Recommended maintenance program

Item	Check point	Remedy
Antenna	Check for loosened and corroded bolts.	Tighten loosened bolts. Replace heavily corroded bolts.
Antenna cable	Check connection point for watertightness.	Replace damaged parts.
	Check connector for tightness and corrosion.	
	Check cables for damage.	
Display unit connectors	Check for tight connection.	Tighten loosened connectors.
Ground terminal	Check for tight connection and corrosion.	Clean or replace as necessary.
Display unit	Dust and foreign material on the display unit and screen.	Dust on the display dims the picture. Dust may be removed with a soft cloth. If necessary anti-static cleaner may be used. Never use chemical solvents to clean the display; they can remove paint and markings.
Transducer	Check for marine life on transducer face, each time the boat is docked.	Carefully remove any marine life with a piece of wood or sandpaper.

14.2 Replacement of Fuse, Battery

The fuse on the power cable of the display unit protects the system from reverse polarity of the ship's mains and equipment fault. If the fuse blows, find the cause before replacing the fuse. Use only a 3A fuse. Using the wrong fuse will damage the unit and void the warranty.

A battery installed on a circuit board inside display unit preserves data when the power is turned off. The life of the battery is about three years. When the battery voltage is low the battery icon  appears on the display. When this happens, contact your dealer to request replacement of the battery.

	Type	Code number
Lithium Battery	CR2450-F2 ST2	000-133-495

Note: Before replacing a battery, save data into a memory card. (See page 14-6.)

14.3 Simple Troubleshooting

Below are simple troubleshooting procedures which the user can follow to restore normal operation.

Table 14-2 Simple troubleshooting

If...	Then...
General	
you cannot turn on the power	check for blown fuse.
	check that the power connector is firmly tightened.
	check for corrosion on power cable connector.
	check for damaged power cable.
	check battery for proper voltage output (10.2 to 31.2 V).
power is on but nothing appears	press the TONE key and Cursor Pad to adjust display brilliance and tone.
there is no response when a key is pressed	turn on the power again.
Plotter	
position is not fixed within 3 minutes	check for loosened antenna connector.
	check for frequency deviation of GPS receiver on GPS monitor display.
	check GPS receiver status indication.
position is wrong	check that the correct geodetic chart system is selected on the GPS SETUP menu.
	enter GPS position offset on the GPS SETUP menu.
track is not plotted	plotting is stopped. ("H" appears on the plotter display.)
bearing is wrong	check that correct magnetic compensation is entered on the PLOTTER SETUP menu.
Loran or Decca LOPs do not appear	check that proper Loran or Decca chain codes are entered on the PLOTTER SETUP menu.
Loran LOPs are wrong	enter LOP offset on the PLOTTER SETUP menu.
ship's speed display is not zero after ship is stopped	try to decrease GPS speed smoothing setting on the GPS SETUP menu.

Table 14-2 Simple troubleshooting (con't)

If...	Then...
Video Sounder	
no picture but marks and characters appear	check if picture advance speed is set to "0" on the VIDEO SOUNDER SETUP menu.
	check for loosened transducer connector.
picture appears but no zero line	If using manual video sounder operation, range is shifted; set shifting to zero to correct.
picture sensitivity is too low	check gain setting, if using manual operation.
	marine life or air bubbles may be clinging to transducer face.
	water may be dirty.
	bottom may be too soft to return a suitable echo.
depth is not displayed	adjust gain to display bottom echo in dark tone.
noise or interference obstructs the display	check if transducer cable is near ship's engine. If it is, relocate it.
	check ground.
	other video sounders may be operating nearby and on same frequency.
water temperature graph appears but no or wrong readout	check for loosened sensor cable.

14.4 Error Messages

The GP-1610CF displays the following error messages to alert you to possible trouble:

Table 14-3 Error messages

Error Message	Reason	Remedy
GPS connector not connected.	Connection between MAIN board and GPS MODULE board has loosened. Have a technician check the set.	Have a technician check the set.
Backup error	Almanac data on the GPS MODULE board is corrupted.	In either case turn off the power, wait two minutes and reapply power.

14.5 Diagnostic Tests

Memory, I/O port test

This test conduct a general check of the display unit and the antenna unit. The unit displays the check results for each device or component checked as OK or NG (No Good).

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [1] key to select SELF TEST.
4. Press the [2] key to select MEMORY, I/O PORT TEST.

MEMORY, I/O PORT TEST	
ROM	OK
RAM	OK
VRAM	OK
Battery	OK
SIO (GPS)	OK
SIO (NMEA)	OK*
SIO (DGPS)	OK*
MEMORY CARD	OK*
SPEED	0.0kt
TEMP	+100.0°C
: ESC: Esc	

* If applicable; NG for no connection or error.

Figure 14-1 Sample memory, I/O port test results

5. The test runs continuously. To return to the self test menu, press the MENU key.

Panel test

This test checks the keys for proper operation.

1. Press the MENU key.
2. Press the [0] key to select SYSTEM MENU.
3. Press the [1] key to select SELF TEST.
4. Press the [3] key to select PANEL TEST. The following display appears.

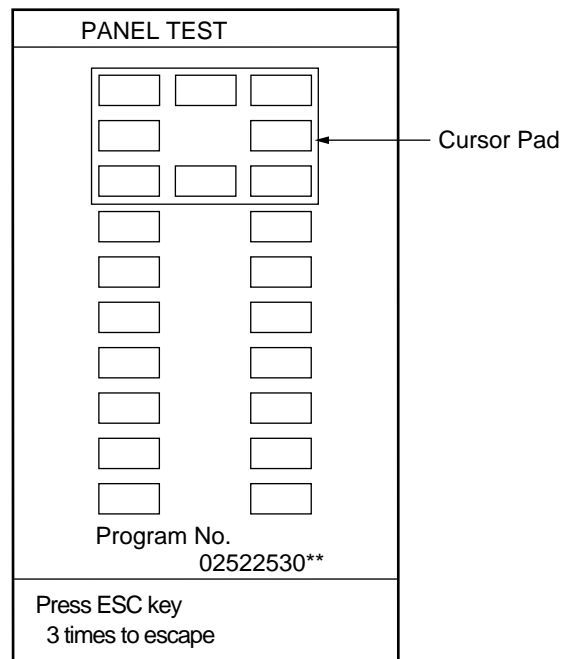


Figure 14-2 Panel test

5. Press any key except the POWER key. The key's location on the display lights in white if the key is functioning properly. (The POWER key cannot be tested.)
6. To escape, press the ESC key three times.

Display test

1. Press the MENU key to display the main menu.
2. Press the [0] key to select SYSTEM MENU. The system menu appears.
3. Press the [1] key to select SELF TEST.
4. Press the [4] key to select DISPLAY TEST.

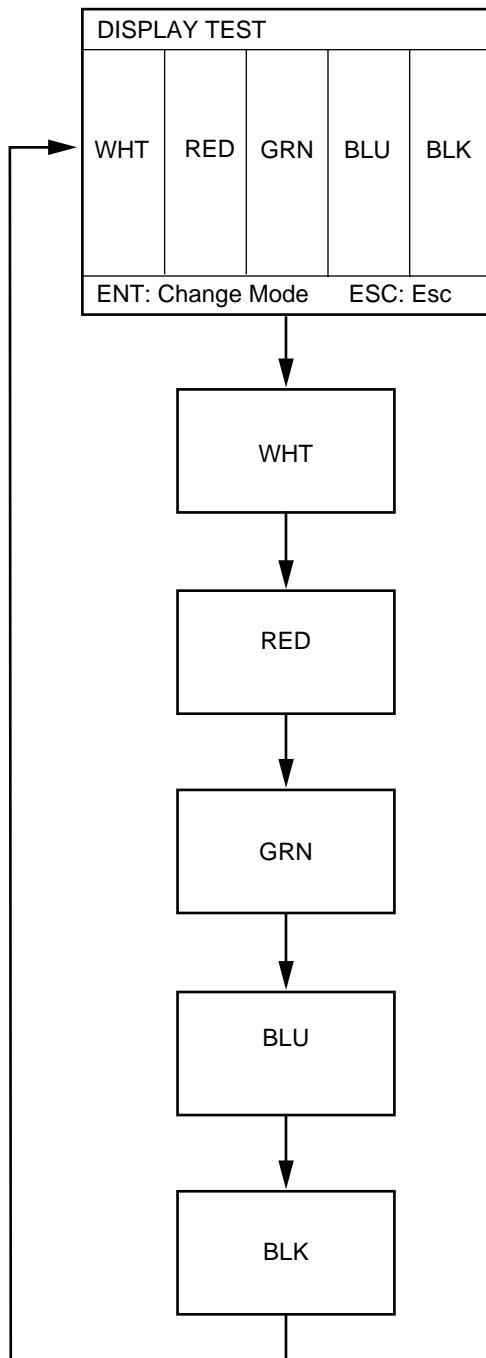


Figure 14-3 Display test pattern

5. Check that colors are properly displayed. Press the ENT key to change test pattern.
6. To escape, press the ESC key three times.

14.6 GPS Monitor Display

The GPS monitor display provides information on all GPS satellites.

1. Press the MENU key.
2. Press the [0] to select SYSTEM MENU.
3. Press the [1] key twice to display the GPS monitor display.

GPS MONITOR DISPLAY				Indicated at 3D mode
Fix Mode	2D	Alt	m	Status of DGPS Rx data
DOP	1			
Data Rx	: --			Status of DGPS REF station
Ref Sta	: --			
Program No.	48501030**			GPS Program no.
Rx Status				
No.	ELV	AZM	SNR	
23	77	278	40	
12	16	042	70	
29	30	100	40	
27	50	050	60	
1	21	303	30	
17	18	220	50	
26	27	095	35	
5	52	142	60	
				ESC: Esc

** : Version no.

Figure 14-4 Sample GPS monitor display

GPS monitor display description

Fix Mode: This shows current position-fixing mode; 2D or 3D (D2D or D3D appears in DPGS mode).

Alt: Shows present altitude of GPS receiver when position fixing mode is set to 3D.

DOP: This is the index for position-fixing accuracy. The lower the value the higher the accuracy. If the index exceeds 20, position fixing may not be possible.

Data Rx: Shows DGPS beacon receiver is normal or abnormal. Two dashes appear when no DPGS beacon receiver is connected.

Ref Sta: Shows status of DPGS transmitting station. Two dashes appear when no DPGS beacon receiver is connected.

Program No.: Shows the program version number of the unit.

Rx Status: This section shows elevation angle, azimuth and signal levels of GPS satellites.

14.7 Demonstration Display

The demonstration display provides simulated operation of this unit. Own ship tracks, at the speed selected, a figure eight course, starting from position entered. All controls are operative; you may set destination, enter marks, operate the video sounder, etc.

1. Turn on the power while pressing and holding down the ENT key. Release hold of the keys when the following display appears.

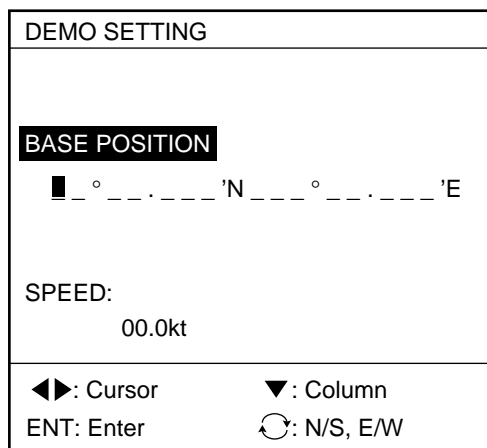



Figure 14-5 Demo setting screen

2. Key in latitude and longitude for base position. If necessary, press  to switch from North latitude to South latitude or vice versa, or from West longitude to East longitude or vice versa.
3. Press ▼.

4. Enter ship's speed to use for the demonstration.
5. Press the ENT key to start the demonstration display. The unit checks itself for proper operation and then the plotter display appears. DEMO and 3D (or 2D) are alternately displayed in the data window at the bottom of the screen when the unit is in the demonstration mode.
6. To return to the normal mode, turn off the power and then turn it on while pressing and holding down the ENT key.

Note: When the memory is cleared while in the demonstration mode, the unit starts up in the normal mode.

14.8 Memory Card Operations (for technicians)

Before changing the internal battery, save the contents of the memory (waypoint, event, mark, track, route data and menu setting data) to a memory card (256 K bytes).

Saving data

1. Press the MENU key.
2. Press the [7] key to select MEMORY SAVE/LOAD.
3. Press ▲ to select SAVE MEMORY.

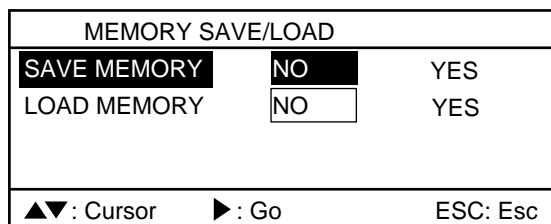
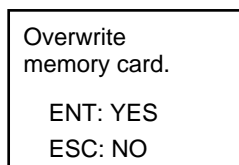


Figure 14-6 Memory save/load menu

4. Press ▶ to select YES.



5. Press the ENT key. The card is formatted and data are saved. When saving is completed, the cursor moves to NO at the SAVE MEMORY line.
6. Press the MENU key.

Note: "Memory card err" appears in the following cases:

- No card is set
- Card is write protected
- Card error

Loading data

Data stored on a memory card can be loaded as follows:

1. Press the MENU key.
2. Press the [7] key.
3. Press ▼ to select LOAD MEMORY.
4. Press ► to select YES. The message window appears.

Overwrite
memory.

ENT: YES
ESC: NO

5. Press the ENT key. After the plotter data is loaded, the system is reset and the initial display appears.

14.9 Clearing the Memory

The memory, which stores marks, tracks and settings, can be cleared to start afresh. When this done all default settings are restored.

1. Press the MENU key.
2. Press the [8] key. The following prompt appears.

CLEAR MEMORY

ENT: YES
ESC: NO

3. Press the ENT key.

Specifications

Video Sounder

Frequency	50 kHz and 200 kHz
Display range	5, 10, 20, 40, 80, 160, 300 meter (feet, fathoms, and passi/braza also available)
Shift	0 to 300 m
Display mode	Normal, marker zoom, bottom zoom, bottom-lock zoom, A-scope
Alarms	Bottom, Fish

GPS Receiver

Receiver format	8 channels all in view
Tracking system	Parallel
Position accuracy	Approx. 50 m, 95% of the time, Horizontal dilution of position (HDOP) ≤ 4 DGPS (option): Approx. 5 m, 95% of the time. <i>All GPS receivers are subject to degradation of position and velocity accuracies under the U.S. Department of Defense.</i>

Plotter Section

Chart projection	Mercator (85° latitude or below) Land filled in Arrival, anchor watch, bottom, fish, speed, trip, water temperature, XTE (cross track error)
Display range	0.14 to 6144 nm (above Equator)
Chart display	Land filled in
Memory capacity	Track, 2000 pts; Mark, 100 pts; Event, 100 pts; Waypoint, 200 pts, Route, 20 routes (30 waypoints/route)
Alarms	Arrival, Anchor Watch, Speed, Trip, Water Temperature, XTE

I/O Data Format

Input format	NMEA 0183, Ver. 1.5 or 2.0
Output format	NMEA 0183, Ver. 1.5 or 2.0

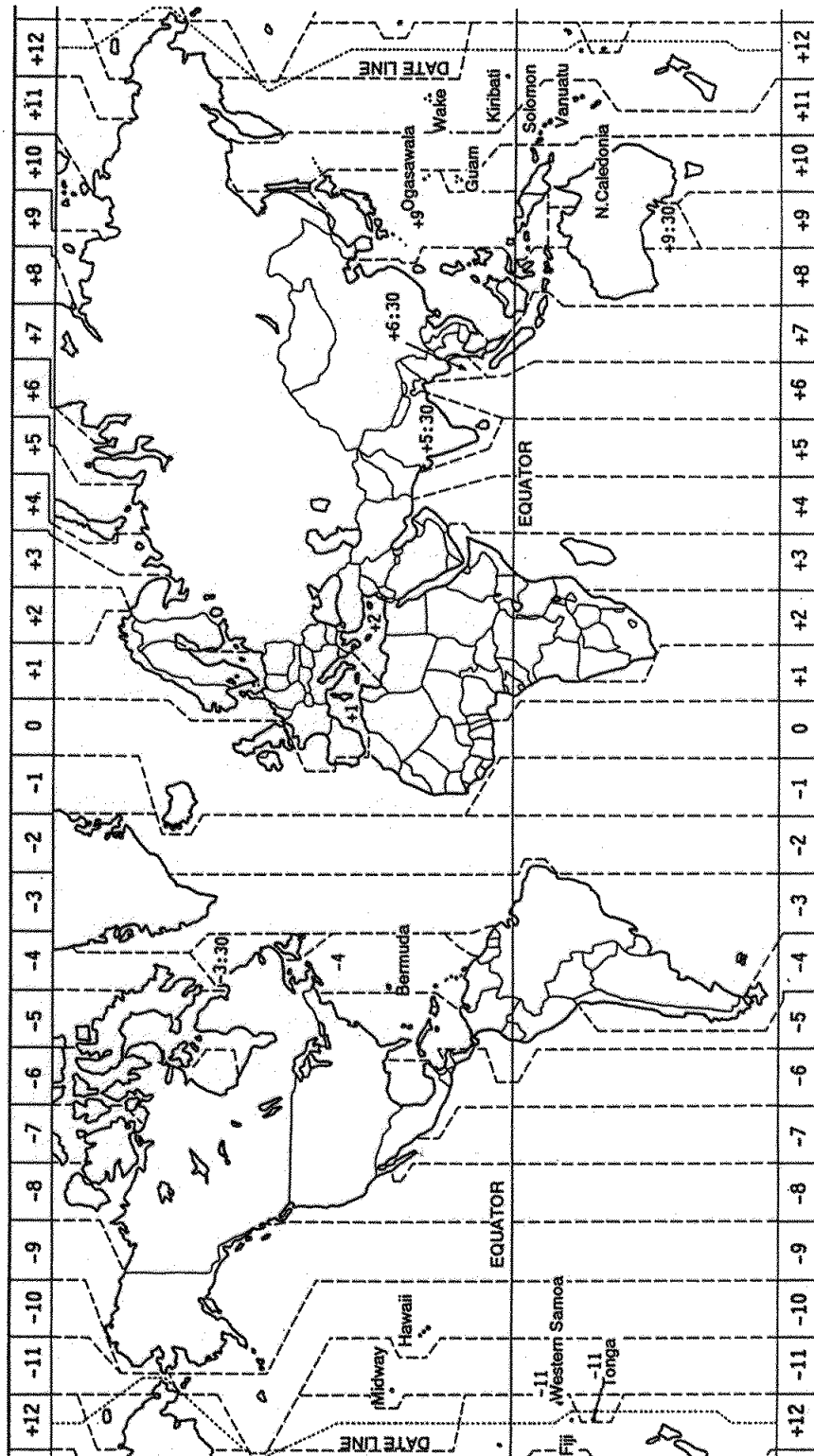
Power and Environmental Conditions

Power	10.2 to 31.2 VDC, less than 20 W
Useable temperature	Display unit: -15°C to +55°C Antenna unit: -25°C to +70°C
Waterproofing standard	Display unit: IEC529 IPX5 Antenna unit: IEC529 IPX6

Dimensions and Weight

Display unit	5.6-inch color TFT LCD, 234 x 320 dots
Dimensions and weight	Display unit: 182(W) x 188(H) x 102.5(D) mm, 2.0 kg Antenna unit: 062 x 67(H) mm, 0.1 kg

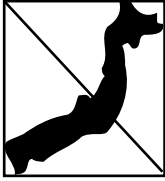
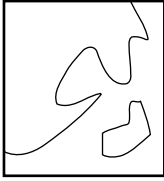
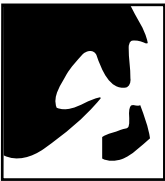
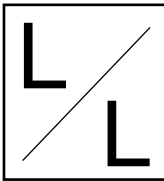
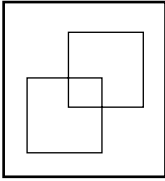
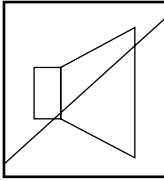
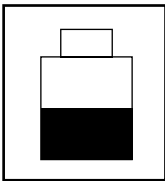
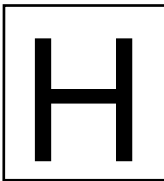
World Time Standards



Geodetic Chart List

001: WGS84			
002: WGS72			
003: TOKYO			
004: NORTH AMERICAN 1927	: Mean Value (Japan, Korea & Okinawa)		
005: EUROPEAN 1950	: Mean Value (CONUS)		
006: AUSTRALIAN GEODETIC 1984	: Mean Value		
007: ADINDAN	: Australia & Tasmania		
008:	: Mean Value (Ethiopia & Sudan)		
009:	: Ethiopia		
010:	: Mali		
011:	: Senegal		
012: AFG	: Sudan		
013: AIN EL ABD 1970	: Somalia		
014: ANNA 1 ASTRO 1965	: Bahrain Is.		
015: ARC 1950	: Cocos Is.		
016:	: Mean Value		
017:	: Botswana		
018:	: Lesotho		
019:	: Malawi		
020:	: Swaziland		
021:	: Zaire		
022:	: Zambia		
023: ARC 1960	: Zimbabwe		
024:	: Mean Value (Kenya & Tanzania)		
025:	: Kenya		
026: ASCENSION IS. 1958	: Tanzania		
027: ASTRO BEACON "E"	: Ascension Is.		
028: ASTRO B4 SOR. ATOLL	: Iwo Jima Is.		
029: ASTRO POS 71/4	: Tern Is.		
030: ASTRONOMIC STATION 1952	: St. Helena Is.		
031: AUSTRALIAN GEODETIC 1966	: Marcus Is.		
032: BELLEVUE (IGN)	: Australia & Tasmania		
033: BERMUDA 1957	: Efate & Erromango Islands		
034: BOGOTA OBSERVATORY	: Bermuda Islands		
035: GAUPO INCHAUSPE	: Columbia		
036: CANTON IS. 1966	: Argentina		
037: CAPE	: Phoenix Islands		
038: CAPE CANAVERAL	: South Africa		
039: CARTHAGE	: Mean Value (Florida & Bahama Islands)		
040: CHATHAM 1971	: Tunisia		
041: CHUA ASTRO	: Chatham Is. (New Zealand)		
042: CORREGO ALEGRE	: Paraguay		
043: DJAKARTA (BATAVIA)	: Brazil		
044: DOS 1968	: Sumatra Is. (Indonesia)		
045: EASTER IS. 1967	: Gizo Is. (New Georgia Is.)		
046: EUROPEAN 1950 (Cont'd)	: Easter Is.		
047:	: Western Europe		
048:	: Cyprus		
049:	: Egypt		
050:	: England, Scotland, Channel & Shetland Islands		
051:	: England, Ireland, Scotland, & Shetland Islands		
052:	: Greece		
053:	: Iran		
054:	: Italy, Sardinia		
055:	: Italy, Sicily		
056:	: Norway & Finland		
057: EUROPEAN 1979	: Portugal & Spain		
058: GANDAJIKA BASE	: Mean Value		
059: GEODETIC DATUM 1949	: Republic of Maldives		
060: GUAM 1963	: New Zealand		
061: GUX 1 ASTRO	: Guam Is.		
062: HJORSEY 1955	: Guadalcanal Is.		
063: HONG KONG 1363	: Iceland		
064: INDIAN	: Hong Kong		
065:	: Thailand & Vietnam		
066: IRELAND 1965	: Bangladesh, India & Nepal		
067: ISTS 073 ASTRO 1969	: Ireland		
068: JOHNSTON IS. 1961	: Diego Garcia		
069: KANDAWALA	: Johnston Is.		
070: KERGUELEN IS.	: Sri Lanka		
071: KERTAUI 1948	: Kerguelen Is.		
072: LA REUNION	: West Malaysia & Singapore		
073: L. C. 5 ASTRO	: Mascarene Is.		
074: LIBERIA 1964	: Cayman Brac Is.		
075: LUZON	: Liberia		
076:	: Philippines (excl. Mindanao Is.)		
077: MAHE 1971	: Mindanao Is.		
078: MARCO ASTRO	: Mahe Is.		
079: MASSAWA	: Salvage Islands		
080: MERCHICH	: Eritrea (Ethiopia)		
081: MIDWAY ASTRO 1961	: Morocco		
082: MINNA	: Midway Is.		
083: NAHRWAN	: Nigeria		
084:	: Masirah Is. (Oman)		
085:	: United Arab Emirates		
086: NAMIBIA	: Saudi Arabia		
087: MAPARIMA, BWI	: Namibia		
088: NORTH AMERICAN 1927	: Trinidad & Tobago		
089:	: Western United States		
090:	: Eastern United States		
091:	: Alaska		
092:	: Bahamas (excl. San Salvador Is.)		
093:	: Bahamas, San Salvador Is.		
	: Canada (incl. Newfoundland Is.)		
094:			: Alberta & British Columbia
095:			: East Canada
096:			: Manitoba & Ontario
097:			: Northwest Territories & Saskatchewan
098:			: Yukon
099:			: Canal Zone
100:			: Caribbean
101:			: Central America
102:			: Cuba
103:			: Greenland
104:			: Mexico
105: NORTH AMERICAN 1983			: Alaska
106:			: Canada
107:			: CONUS
108:			: Mexico, Central America
109: OBSERVATORIO 1966			: Corvo & Flores Islands (Azores)
110: OLD EGYPTIAN 1930			: Egypt
111: OLD HAWAIIAN			: Mean Value
112:			: Hawaii
113:			: Kauai
114:			: Maui
115:			: Oahu
116: OMAN			: Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936: Mean Value			
118:			: England
119:			: England, Isle of Man & Wales
120:			: Scotland, & Shetland Islands
121:			: Wales
122: PICO DE LAS NIVIES			: Canary Islands
123: PITCAIRN ASTRO 1967			: Pitcairn Is.
124: PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53° S)			
125: PROVISIONAL SOUTH AMERICAN 1956: Mean Value			
126:			: Bolivia
127:			: Chile-Northern Chile (near 19° S)
128:			: Chile-Southern Chile (near 43° S)
129:			: Columbia
130:			: Ecuador
131:			: Guyana
132:			: Peru
133:			: Venezuela
134: PUERTO RICO			: Puerto Rico & Virgin Islands
135: QATAR NATIONAL			: Qatar
136: QORNOQ			: South Greenland
137: ROME 1940			: Sardinia Islands
138: SANTA BRAZ			: Sao Maguel, Santa Maria Islands (Azores)
139: SANTO (DOS)			: Espirito Santo Is.
140: SAPPER HILL 1943			: East Falkland Is.
141: SOUTH AMERICAN 1969			: Mean Value
142:			: Argentina
143:			: Bolivia
144:			: Brazil
145:			: Chile
146:			: Columbia
147:			: Ecuador
148:			: Guyana
149:			: Paraguay
150:			: Peru
151:			: Trinidad & Tobago
152:			: Venezuela
153: SOUTH ASIA			: Singapore
154: SOUTHEAST BASE			: Porto Santo & Madeira Islands
155: SOUTHWEST BASE			: Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
156: TIMBALAI 1948			: Brunei & East Malaysia (Sarawak & Sadah)
157: TOKYO			: Japan
158:			: Korea
159:			: Okinawa
160: TRISTAN ASTRO 1968			: Tristan da Cunha
161: VITI LEVU 1916			: Viti Levu Is. (Fiji Islands)
162: WAKE-ENIWETOK 1960			: Marshall Islands
163: ZANDERIJ			: Surinam
164: BUKIT RIMPAH			: Bangka & Belitung Islands (Indonesia)
165: CAMP AREA ASTRO			: Camp Mcmurdo Area, Antarctica
166: G. SEGARA			: Kalimantan Is. (Indonesia)
167: HERAT NORTH			: Afghanistan
168: HU-TZU-SHAN			: Taiwan
169: TANANARIVE OBSERVATORY 1925:			: Madagascar
170: YACARE			: Uruguay
171: RT-90			: Sweden

Icons

 <ul style="list-style-type: none"> • Unsuitable chart/chart card not inserted. • Chart scale/range is too small. (Page 4-4) 	 <ul style="list-style-type: none"> • Chart scale/range is too large. • Chart data is unreliable. (Page 4-4)
 <ul style="list-style-type: none"> • Suitable chart scale is selected. (Page 4-4) 	 <ul style="list-style-type: none"> • L/L position is offset. (Page 10-1)
 <ul style="list-style-type: none"> • Chart position is offset. (Page 10-3) 	 <ul style="list-style-type: none"> • Alarm setting violated. • Disappears when reason for alarm is cleared. (Page 3-7—3-8, 9-1—9-2)
 <ul style="list-style-type: none"> • Battery voltage (on pcb) is low. (Page 14-1) 	 <ul style="list-style-type: none"> • Track is not being recorded. (Page 5-1)

Glossary

GPS Plotter

Almanac

Each GPS satellite broadcasts its own orbital data as well as general orbital data of all other GPS satellites. This general orbital data is called the Almanac. The GPS receiver receives the Almanac and decodes it to calculate the quantity and elevation angle of satellites in view, to know when it can receive the GPS signal. If there is no Almanac in the receiver it cannot fix its position. The receiver is shipped with no Almanac, thus when it is turned on for the first time it starts receiving the Almanac. Each time the unit is turned on the previous Almanac is erased and the latest received.

Beacon receiver

The DGPS (Differential GPS) station transmits a beacon signal which contains information about GPS error. The device which receives the beacon signal is called a beacon receiver.

Cold start

When the GPS receiver is turned on for the very first time, it starts receiving the Almanac. This condition is called cold start. In this condition it takes about two minutes to find position. Once the Almanac is stored in the GPS navigator, it takes only about 20 seconds to find position. (The normal start-up condition is called warm start.)

Destination

A destination can be either a single destination waypoint or a series of waypoints leading to the ultimate destination. When you set a destination, the GPS receiver provides range and bearing data to the destination, to help you steer to the destination along the shortest past possible.

Differential GPS (DGPS)

The differential GPS system, consisting of DGPS land stations and DGPS beacon receiver equipped marine vessels, further refines the accuracy of the GPS measured position.

A DGPS land station knows its exact position. If there is a difference between GPS position and DGPS land stations position this is called GPS error. The DGPS station transmits GPS error data to a beacon receiver which relays the data to the GPS receiver. The GPS receiver uses this data to refine the accuracy of the GPS position (within about 10 meters under ideal conditions).

DGPS stations are strategically located throughout America (including Hawaii and Alaska), Europe, Canada, Bermuda and Brazil.

Estimated time of arrival (ETA)

The time at which you arrive at a destination.

Geodetic chart

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country where it is used. The GPS standard chart system is WGS-84.

Thus if you are using a chart different from WGS-84, there will be error between GPS position and nautical chart position. To get correct position, the GPS receiver must know what chart system you are using, to apply an offset to GPS position.

Magnetic bearing

Bearing relative to magnetic north, with the compass bearing corrected for deviation.

Magnetic variation offset

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. This difference is called magnetic variation, and varies with respect to the observation point on the earth. This variation may be entered automatically or manually.

Navigation calculation

The GPS receiver calculates the range, bearing and cross-track error to next waypoint when you select a destination. The calculation of that data is called navigation calculation.

NMEA 0183

The National Marine Electronics Association's signal format which enables connection of electronic equipment of different marine electronics manufacturers.

Plotting interval

The plotting interval determines both how the track will be reconstructed on the display and track storage time. The shorter the interval the more accurate the reconstruction of track line, however total storage time is reduced. The plotting interval can be selected to time or distance. Plotting by distance offers the advantage that the track is not stored when the vessel is anchored.

S/A

GPS was developed by the US Department of Defense mainly for use by its marine vessels and aircraft. For civil users the accuracy of the system is purposely downgraded for national security reasons. This intentional accuracy reduction is called S/A. Because GPS position error may be greater than 100 meters any GPS position should be double checked against other sources to confirm position.

Time-to-go (TTG)

The amount of time necessary to get to a destination, maintaining current speed and course.

Time differences

Time differences (or TDs) are the position information generated by the Loran C and Decca position-fixing systems. TDs are the time in microseconds between the transmission of pulsed signals in the Loran C and Decca systems.

Total distance

This is the number of miles from starting point to end point in a route.

Trip distance

The distance run from a position.

Trip elapsed time

The amount of time passed since departing a starting point.

True bearing

Bearing relative to North; compass bearing corrected for magnetic deviation. The GPS receiver can display true or magnetic bearing.

Velocity to destination

The amount of speed in the direction (course) of the desired destination.

Waypoint

A waypoint is a particular location on a voyage whether it be a starting, intermediate or destination waypoint.

Video Sounder

Clutter

Cruising noise, polluted water or plankton can clutter the screen with low signal level echoes. This situation can be improved by adjusting the CLUTTER function.

Detecting area

The detecting area varies with the main beamwidth of the transducer. Objects out of the main beam but close to the beam will be presented less densely, smaller in size and at a lower intensity.

Generally, beamwidth depends on Tx frequency; a narrower beamwidth is usually obtained at a higher frequency. The beamwidth of the 200 kHz is narrow, thus it has the advantage of higher resolution. On the negative side, fish at the sides of the boat can be overlooked because of the narrow beamwidth.

Display color

A color video sounder displays an echo in a color corresponding to its strength. The GP-1610CF displays echoes in eight colors: reddish brown, red, orange, yellow, green, light-blue, blue and black.

Frequency

The frequency of the ultrasonic pulse used in video sounders is between 15 and 200 kHz, and the GP-1610CF provides both 50 kHz and 200 kHz. The 200 kHz frequency offers a sharp, clear-cut picture since its beamwidth is narrow. However its use should be limited to shallow waters since its pulse is easily attenuated in water. The 50 kHz frequency provides a longer sounding range since its pulse it is not as easily attenuated.

Gain

Gain adjusts the sensitivity of the receiver. It should be set at the point where excessive noise does not appear on the screen. Usually, use a high gain setting for deep water; a low one for shallow water.

Interference, noise

Interference can result from other acoustic equipment which operates on the same frequency as your own or electrical equipment on your boat which disturbs the video sounder. In most cases interference can be suppressed with the noise limiter.

Picture advance speed

Picture advance speed defines how fast the video sounder picture moves across the display screen. Several speeds are available including freeze, which lets you stop advancement to observe the picture more closely.

Pulselength

Pulselength is the length of time the transmitter in the transducer is turned on each transmitted ultrasonic signal. Pulselength is linked with range and thus cannot be selected. The higher the range selected the longer the pulselength.

Pulse repetition rate

The pulse repetition rate defines the number of pulses transmitted within a certain period. The more pulses transmitted the greater the detection accuracy. The pulse repetition rate is automatically changed with range.

Resolution

Resolution is the ability of the video sounder transducer to discriminate returning signals. The higher the transducer frequency the better the resolution.

Returning signal

The ultrasonic pulse transmitted by the transducer "strikes" intervening objects such as the bottom and fish schools and returns to the transducer. The signal received at the transducer is called the returning signal.

Sounding range

Sounding range refers to the maximum depth observable in the range in use. For example, if the range selected is 0-100 meters, the maximum depth which you can observe is 100 meters. Of course, factors such as bottom composition and water conditions may affect the sounding range.

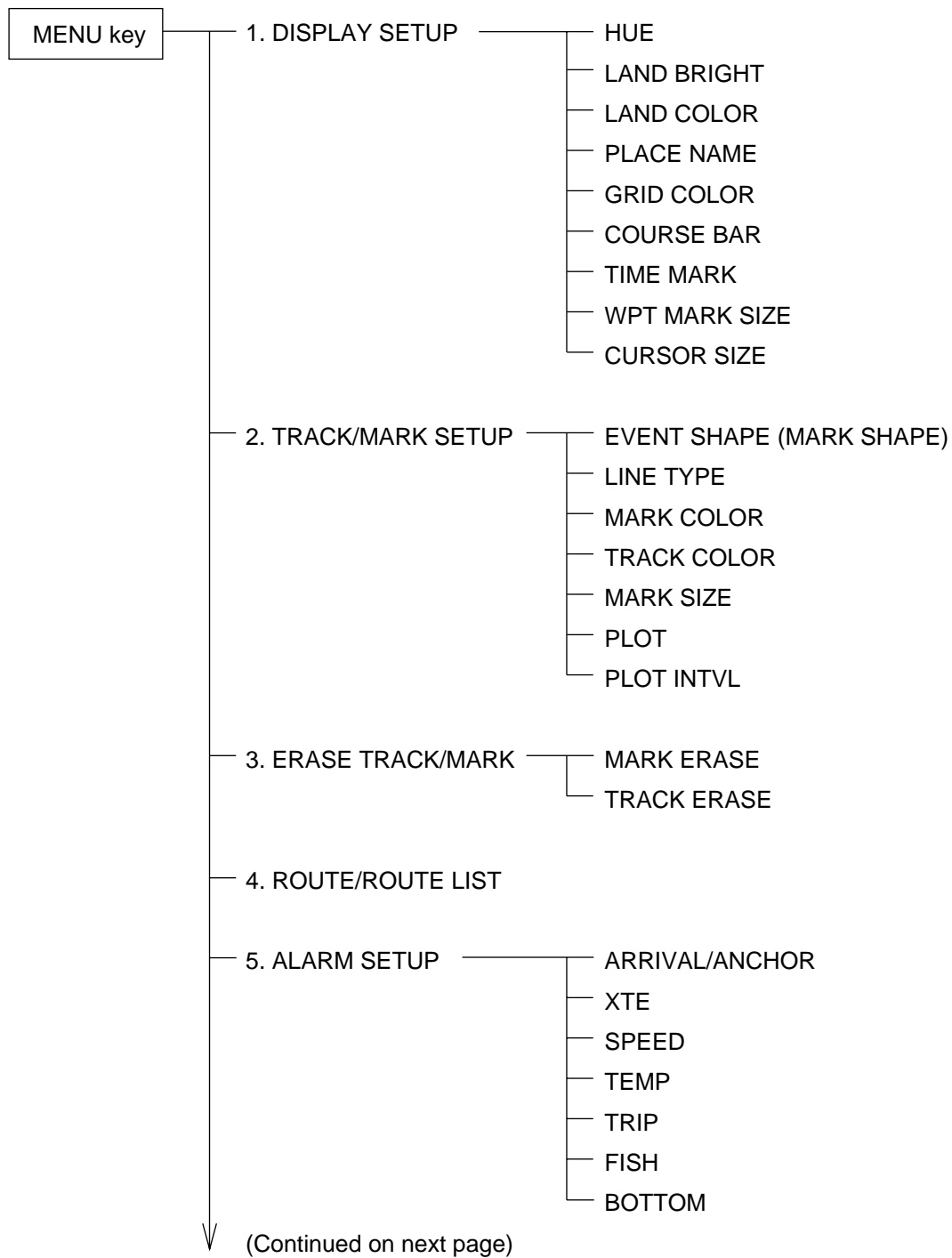
Transducer

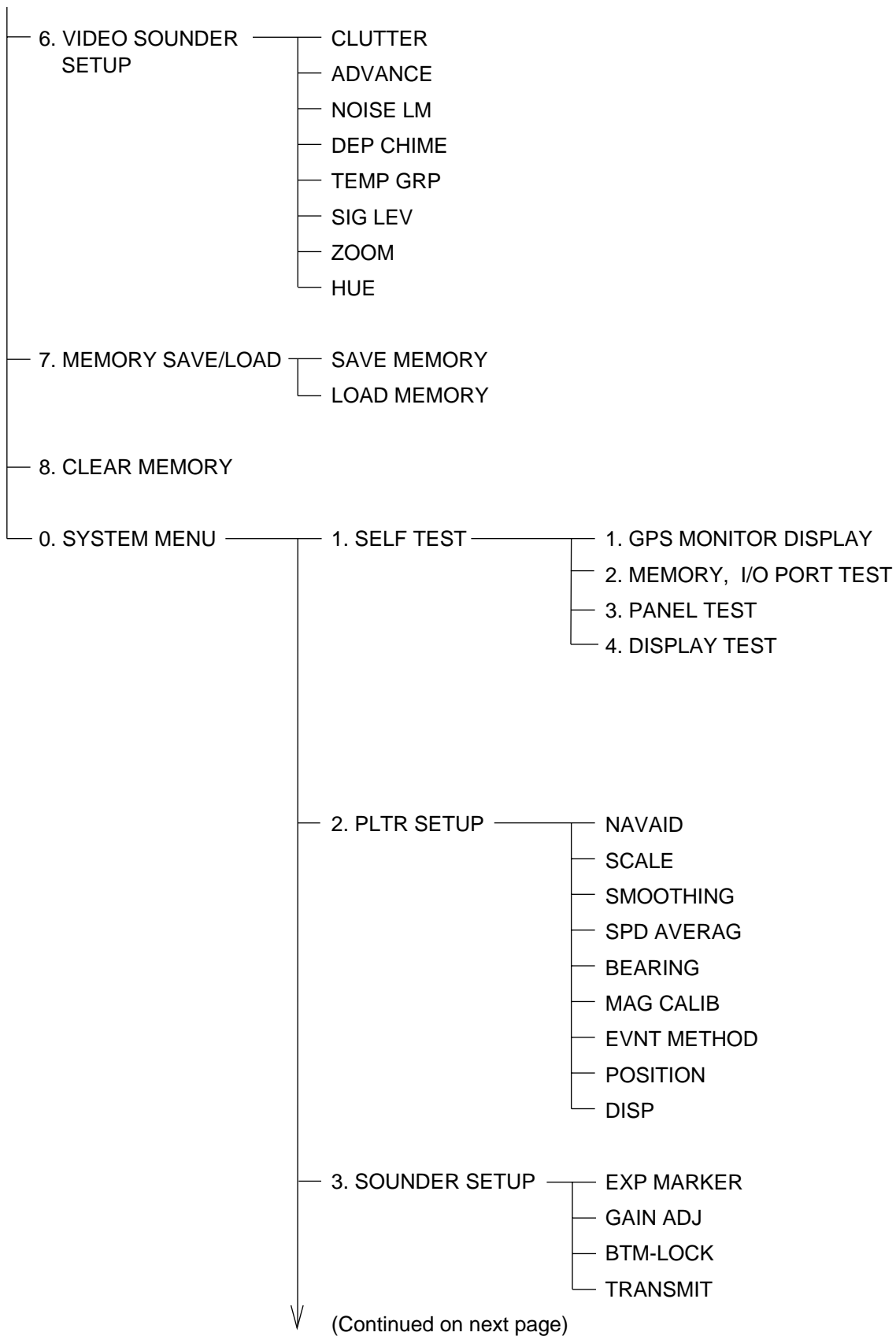
A transducer converts an electrical signal into an ultrasonic signal, transmits it in the water and receives any returning signals from intervening objects. The higher the frequency of the transducer the sharper its beamwidth. Transducers are generally classified according to their method of installation. There are three general classes: thru-hull, transom mount or inside hull. The thru-hull type provides the best performance since the transducer protrudes from the hull and the effects of air bubbles and turbulences are minimal.

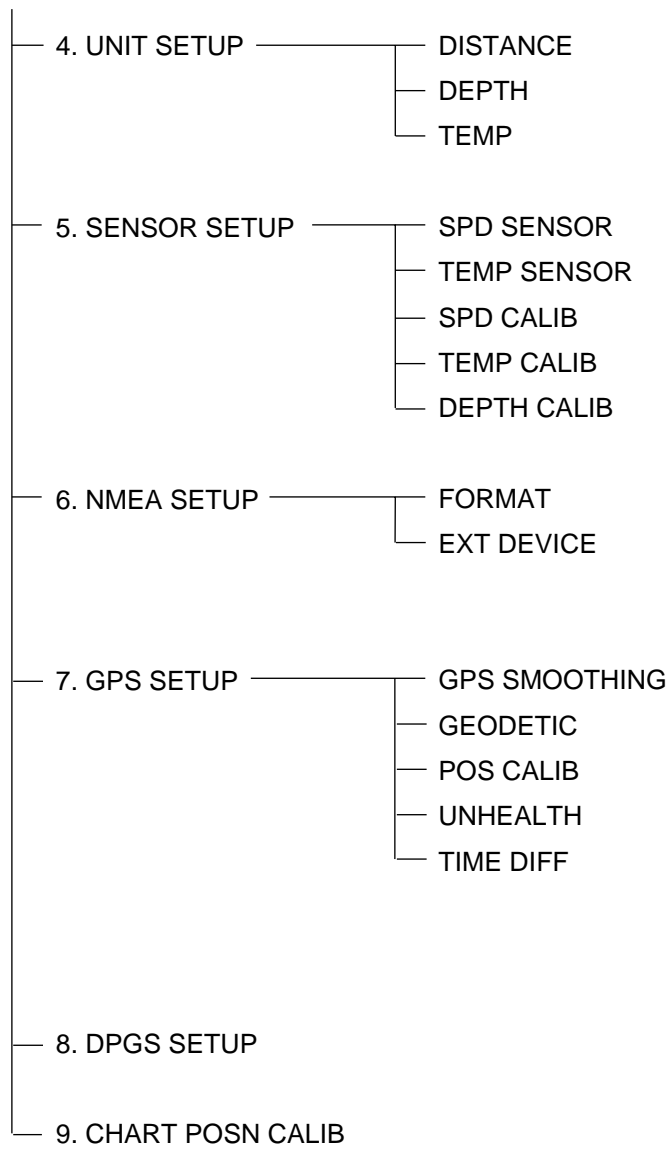
Water temperature sensor

The water temperature sensor (option) measures water temperature near the transducer. A combination water temperature and speed sensor is also available.

Menu Tree



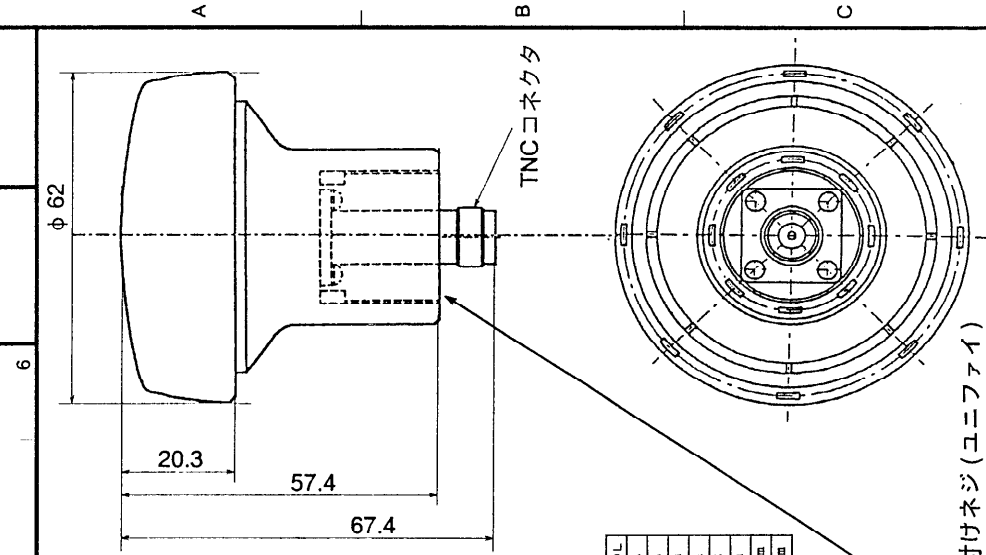




Decca Chains

Chain no.	Chain	Chain code	Location
01	South Baltic	0A	Europe
02	Vestlandet	0E	"
03	Southwest British	1B	"
04	Northumbrian	2A	"
05	Holland	2E	"
06	North British	3B	"
07	Lofoten	3E	"
08		3F	"
09	North Baltic	4B	"
10	North West	4C	"
11	Trondelag	4E	"
12	English	5B	"
13	North Bothnian	5F	"
14	Southern Spanish	6A	"
15	North Scottish	6C	"
16	Gulf of Finland	6E	"
17	Danish	7B	"
18	Irish	7D	"
19	Finnmark	7E	"
20	French	8B	"
21	South Bothnian	8C	"
22	Hebridean	8E	"
23	Frisian Islands	9B	"
24	Helgeland	9E	"
25	Skagerrak	10B	"
26	North Persian Gulf	5C	Persian Gulf & India
27	South Persian Gulf	1C	"
28	Bombay	7B	"
29	Calcutta	8B	"
30	Bangladesh	6C	"
31	Saliyah	2F	"
32	Hokkaido	9C	Japan
33	Tohoku	6C	"

Chain no.	Chain	Chain code	Location
34	Kanto	8C	Japan
35	Shikoku	4C	"
36	Hokuriku	2C	"
37	Kita Kyushu	7C	"
38	Namaqualand	4A	Southern Africa
39	Cape	6A	"
40	Eastern Province	8A	"
41	South West Africa	9C	"
42	Natal	10C	"
43	Dampier	8E	Australia
44	Port Headland	4A	"
45	Anticosti	9C	Northern Africa
46	East Newfoundland	2C	"
47	Cabot Strait	6B	"
48	Nova Scotia	7C	"



ネジの呼び	ねじ山数 (25.4mmにつき)	ピッチ	オネジ有効径	オネジ有効長さ
1 × 14UNS1B	14	1.8143	24.17	15.17

単位
Unit=mm

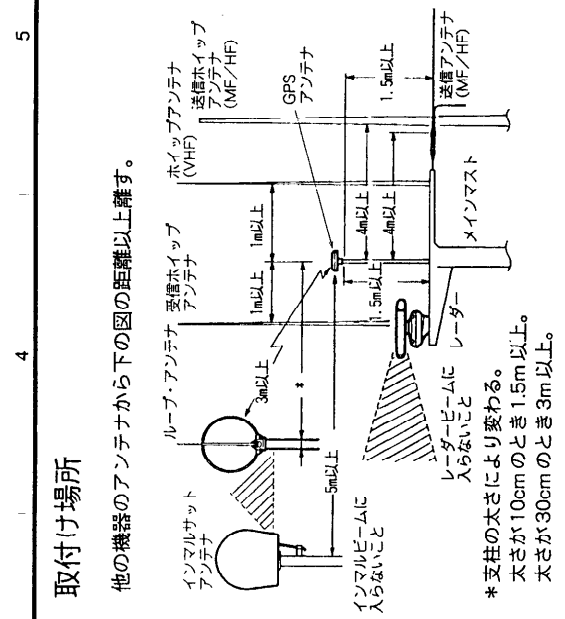
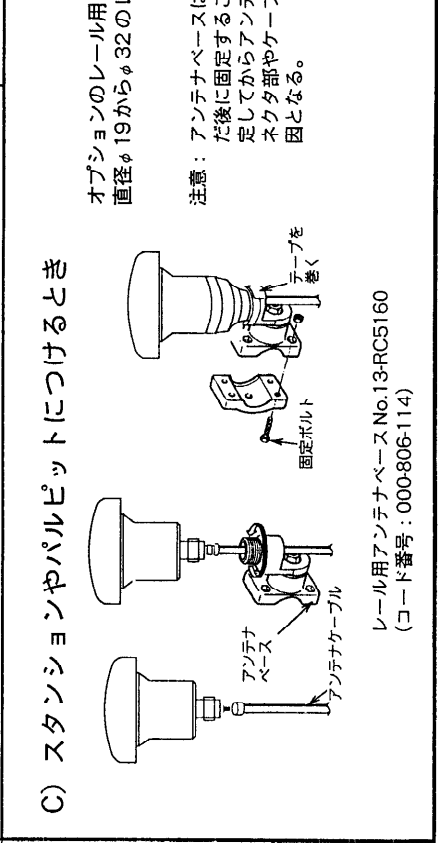
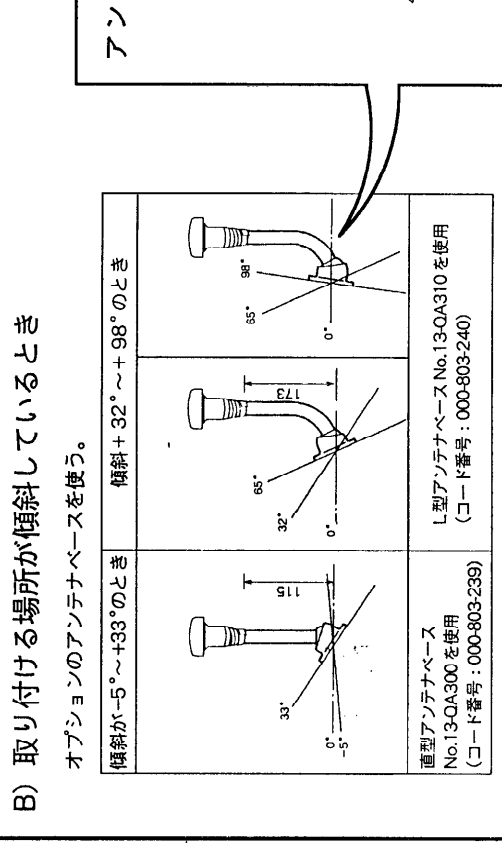
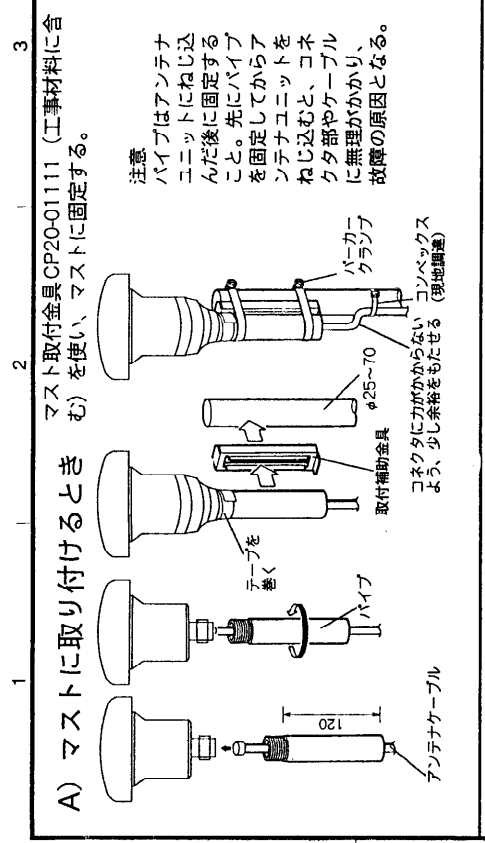


表 1 TABLE 1

範囲 DIMENSIONS	公差 TOL
150 < L ≤ 100	± 1.0mm
100 < L ≤ 50	± 3.0mm
50 < L ≤ 10.0	± 4.0mm
10.0 < L ≤ 2.0	± 5.0mm
2.0 < L ≤ 4.0	± 7.0mm
4.0 < L ≤ 8.0	± 1.0mm
8.0 < L ≤ 1.5	± 1.5mm

アンテナユニット取付けネジ (ユニファイ)



取付け場所

他の機器のアンテナから下の距離以上離す。

注意
パイプはアンテナユニットにねじ込んだ後に固定すること。先にパイプを固定してからアンテナユニットをねじ込むと、コネクタ部やケーブルに無理がかかり、故障の原因となる。

* 支柱の太さにより変わる。太さが10cmのとき1.5m以上。太さが30cmのとき3m以上。

アンテナベース基部

オプションのレール用アンテナベースを使う。直径φ19からφ32のレールに取付け可能。

注意: アンテナベースはアンテナユニットにねじ込んだ後に固定すること。先にアンテナベースを固定してからアンテナユニットをねじ込むと、コネクタ部やケーブルに無理がかかり、故障の原因となる。

DRAWN	May 20 1977	TYPE	GPA-016
CHECKED	T. Yamaguchi	名称	空芯線部
APPROVED	May 21 1977	GP-8000M2	
	K. Kusuzuki	GP-50M3	
		GP-8000M2	
		GP-3100M2	
		GP-80	
SCALE	1/1	APPLICABLE TO:	ANTENNA UNIT
DWG. NO.	J4.374-G04-E	BLOCK NO.	

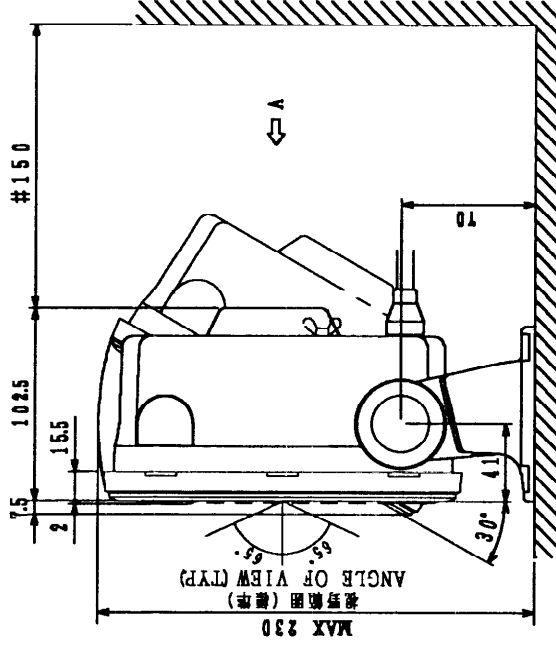
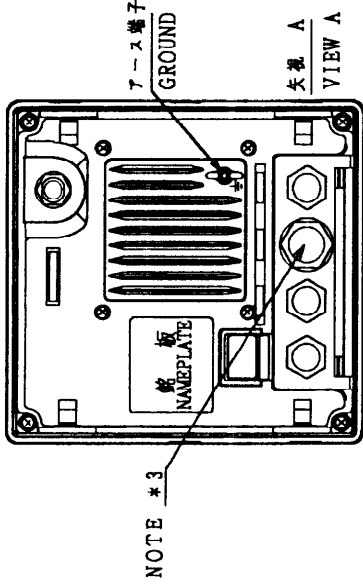
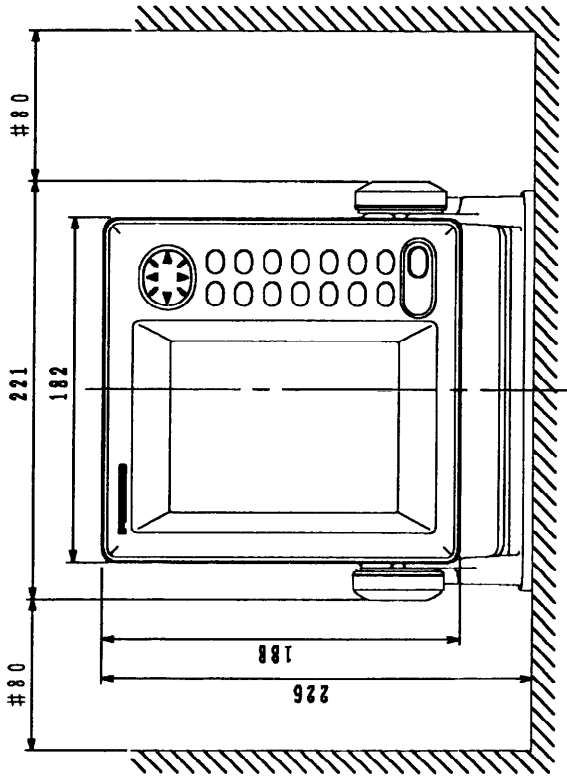
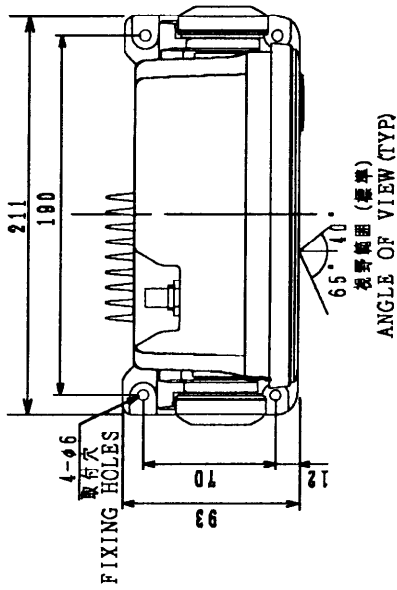


表 1 TABLE 1

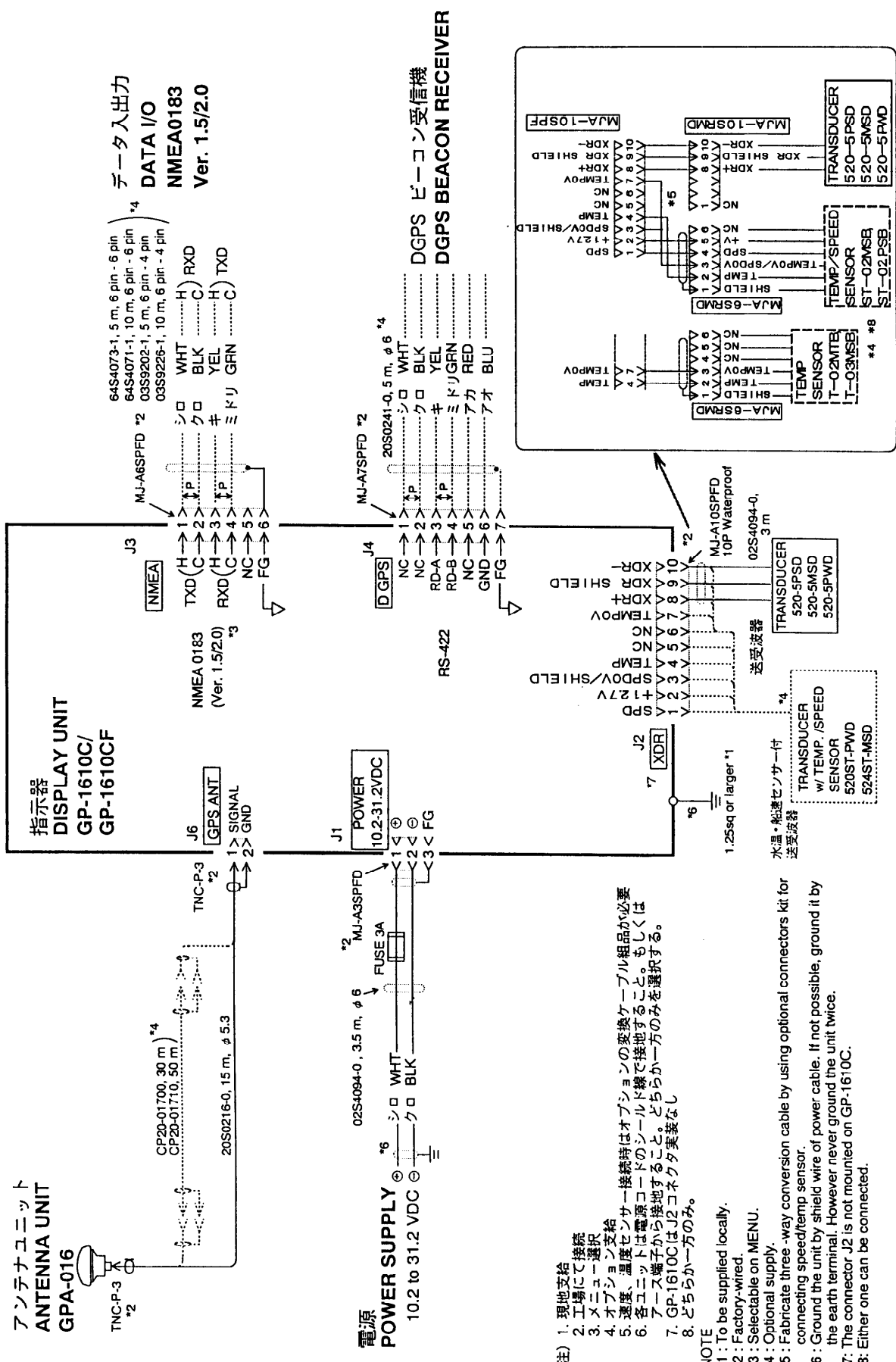
面図 DIMENSIONS	公差 TOL
L ≤ 50	± 1mm
50 < L ≤ 100	± 2mm
100 < L ≤ 500	± 3mm

- 注 記
- 1) 井: 推奨するサービス空間寸法。
 - 2) 表記なき寸法公差は表 1 による。
 - 3) 使用なきコネクタはブラインド。

NOTE

1. #: RECOMMENDED SERVICE CLEARANCE
2. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS
3. BLIND CONNECTOR IS NOT USED

DRAWN Feb. 10, 98 T. TAKASAKI	TITLE
CHECKED Feb 10, 98 K. Kusumoto	名称 指示器
APPROVED Feb 12, 98 F. Deminguchi	外寸図
SCALE 1/4 MASS 2.0 kg	NAME DISPLAY UNIT
DWG. No. C4377-G01-D	86-009-1000-GO
	OUTLINE DRAWING



TYPE	GP-1610C/GP-1610CF
名称	GPSプロッタ/GPSプロッタ魚探
相互接続図	
GPS/PLOTTER / SOUNDER/GPS/PLOT	
INTERCONNECTION DIAGRAM	
DRW. NO.	C4386-C01-G
SCALE	1/80
APPLICABLE TU: (MODEL)	kg
CHECKED	Jan. 19 '98 T. Yamashita
APPROVED	Jan. 19 '98 K. Kusunoki
DATE	Jan. 19 '98 T. Yamashita

注) 1. 現地支給
 2. 工場で接続
 3. メニュー選択
 4. オプション支給
 5. 速度、温度センサー接続時はオプションの変換ケーブル組品が必要
 6. 各ユニットは電源コードのシールド線で接地すること。もしくは、アース端子から接地すること。どちらか一方のみを選択する。
 7. GP-1610CはJ2コネクタ実装なし
 8. どちらか一方のみ。

NOTE
 *1: To be supplied locally.
 *2: Factory-wired.
 *3: Selectable on MENU.
 *4: Optional supply.
 *5: Fabricate three-way conversion cable by using optional connectors kit for connecting speed/temp sensor.
 *6: Ground the unit by shield wire of power cable. If not possible, ground it by the earth terminal. However never ground the unit twice.
 *7: The connector J2 is not mounted on GP-1610C.
 *8: Either one can be connected.

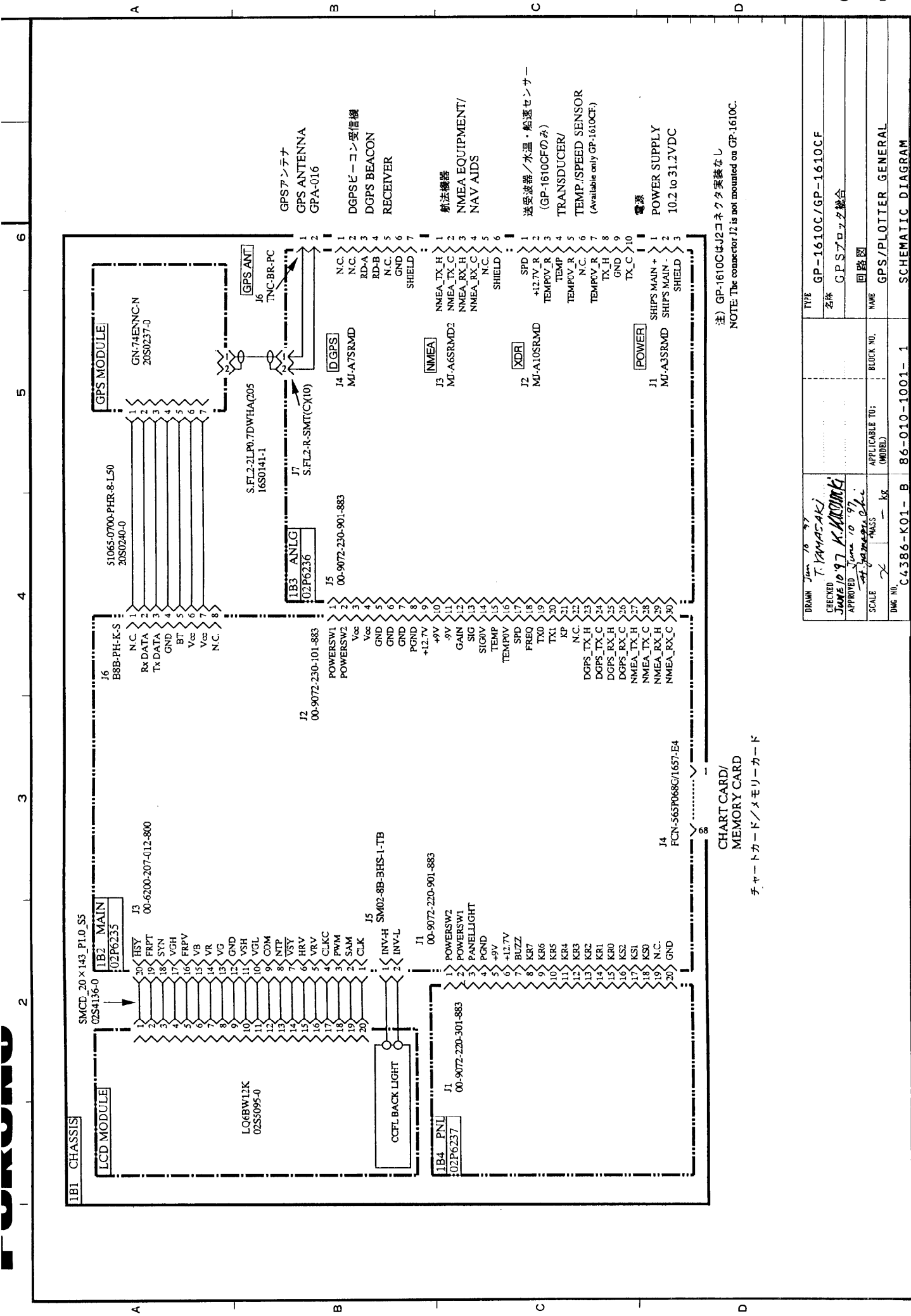
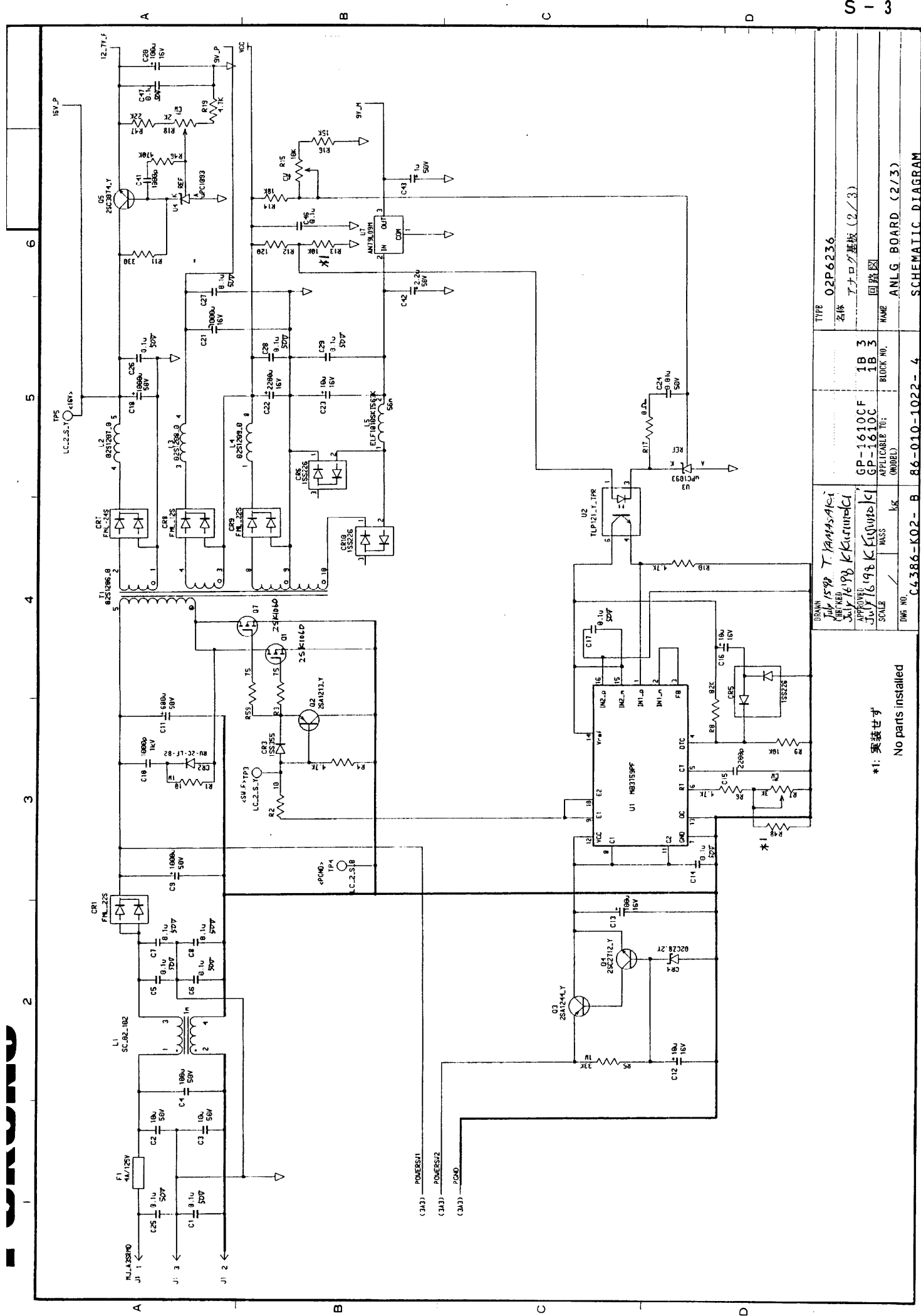


CHART CARD/
MEMORY CARD
チャートカード/メモリーカード

DRAWN June 16 97 T. YAMASAKI	CHECKED June 19 97 K. KAWABUCHI	APPROVED June 19 97 H. YAMASAKI	SCALE 1/100	NAME Y. KAWABUCHI	TYPE GP-1610CF/GP-1610CF
DATE June 16 97	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME 回路図	SHIP'S MAIN +	GP-1610CF/GP-1610CF
DWG. NO. C4386-K01-B	86-010-1001-1	1	GPS/PLOTTER GENERAL	SHIP'S MAIN -	GPSプロセッサ総合
SCHEMATIC DIAGRAM					



TYPE	02P6236
名称	アナログ基板 (2/3)
回路図	回路図
NAME	ANLG. BOARD (2/3)
SCHEMATIC DIAGRAM	SCHEMATIC DIAGRAM
DRAWN	T. YAMASAKI
CHECKED	July 16/1988 K. KURUMICHI
APPROVED	July 16/1988 K. KURUMICHI
SCALE	1/1
MASS	kg
DWG. NO.	C4386-K02-B
BLOCK NO.	1B 3
APPLICABLE TO:	GP-1610CF
(MODEL)	GP-1610C
86-010-1022-4	

*1: 実装せず
No parts installed

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