# FURUNO

# OPERATOR'S MANUAL

## DOPPLER SONAR CURRENT INDICATOR

MODEL CI-80

**FURUNO ELECTRIC CO., LTD.**
NISHINOMIYA, JAPAN

·Your Local Agent/Dealer

FIRST EDITION : FEB 1995
E        : JAN. 31, 1997

*000807361 00*

# Table of Contents

## Principle of Measurement

When a moving vessel emits an acoustical pulse into the water at a an angle, a portion of that emitted energy is reflected from the seabed and microscopic objects (plankton, etc.) in the sound path. The frequency of the received signal is shifted from the transmitted frequency in proportion to the relative velocity between the vessel and underwater reflecting objects. This is called the doppler effect.

The CI-80 calculates and displays movements of ship and currents (tides) at specific depths by measuring doppler shifts obtained from three separate directions.
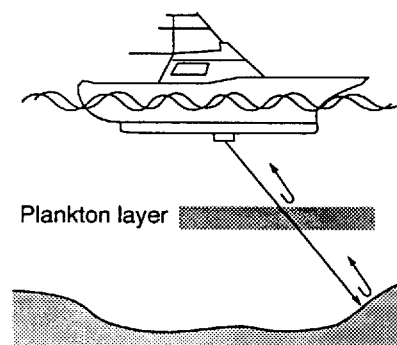
*Figure 1 Principle of measurement*

### How ship's speed is expressed

Ship's speed is expressed two ways: **ground tracking speed** and **water tracking speed**. Ground tracking speed is ship's speed and course relative to the seabed, and water tracking speed is ship's speed and course relative to water layer just below the vessel.

| | Absolute speed (ground tracking mode) | Relative speed (water tracking mode) |
|---|---|---|
| **S H I P  S P E E D** | Ground tracking speed<br>Absolute speed<br>Observation point  Seabed | Water tracking speed<br>Relative speed<br>Observation point  Layer |
| **T I D E / T I D E  D I F** | Tide (absolute tide)<br>① Ground tracking speed<br>② Water tracking speed<br>③ Tide (absolute tide)<br>③ = ① - ②<br>Layer A<br>Seabed<br>O = Observation point | Tide differential<br>① Water tracking speed (ref. layer A)<br>② Water tracking speed (ref. layer B)<br>③ Tide difference<br>③ = ① - ②<br>Layer A<br>Layer B<br>O = Observation point |

*Figure 2 How the CI-80 measures ship's speed and calculates tide differential*

## Tide differential calculation

Tide differential is a relative movement of tides at different depths, layer A, and layer B. To calculate tide differential, the following two data are necessary: ① ship's speed and course based on layer A, and ② ship's speed and course based on layer B.

When the direction and speed of layers A and B are expressed as vectors $V_A$ and $V_B$ respectively, tide differential can be calculated. For example, if layer A is the reference layer, the tide differential can be found by the following equation;



*Figure 3 Tide differential*

$$\overrightarrow{AB} = V_B - V_A$$
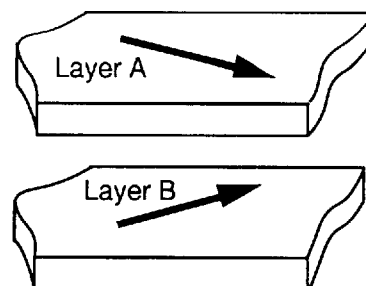
(Movement of layer B as viewed from layer A. White arrow in Figure 4.)

And to know movement of layer A as viewed from layer B;

$$\overrightarrow{BA} = V_A - V_B$$

(In this case, the white arrow in Figure 4 would be pointing in the opposite direction.)
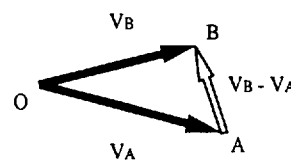


*Figure 4 Tide differential vector*

If we express the calculated tide differential as new vector $V_C$, shifting vector starting point to origin, the tide speed and direction would be displayed as shown in Figure 5.

In Figure 5, the tide differential is between reference layer A and layer B is expressed (movement of layer B as viewed from layer A).
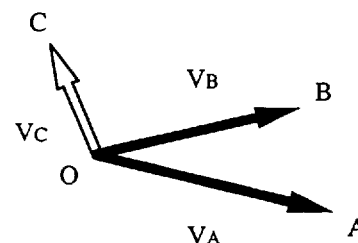


*Figure 5 Vector from origin point*

Using the above calculations, the CI-80 displays tide differential. For example, the tide differential between layer A and layer B, where layer A is the reference layer, is shown on the display as follows;

```
1-2  0.5kt  NW
```

The relative tide speed is 0.5kt and the movement is northwest.

2

# Features

The CI-80 mainly consists of three units: a display unit, a transceiver unit, and a transducer, each compact enough to fit on small boats.

The main features of the CI-80 are;

- Triple-beam system for automatic compensation against pitching and rolling of vessel.

- Single mold transducer for excellent mechanical beaming accuracy.

- DC powered for economic operation.

- Alphanumeric information display on high resolution 10 inch color CRT.

- Simultaneous display of tide vectors and ship's track. Indispensable for maneuvering and docking.

- Echo level display constantly displays underwater conditions of three sounding beams.

- Target point feature predicts flow of objects (for example, fishing tackle) against tide.

- Easy-to-follow menu operation for control of various settings and measuring conditions.

# Control Description

## Display unit (CI-800)



BRILL control

POWER switch

Not used. (Cannot be opened.)

*A viewing hood can be optionally supplied.*

*Figure 6 Display unit*

DISP MODE key

MODE key

Menu selection keys

Arrrow keys

CURSOR ON/OFF key

EVENT key

TRIP key

TARGET POINT key
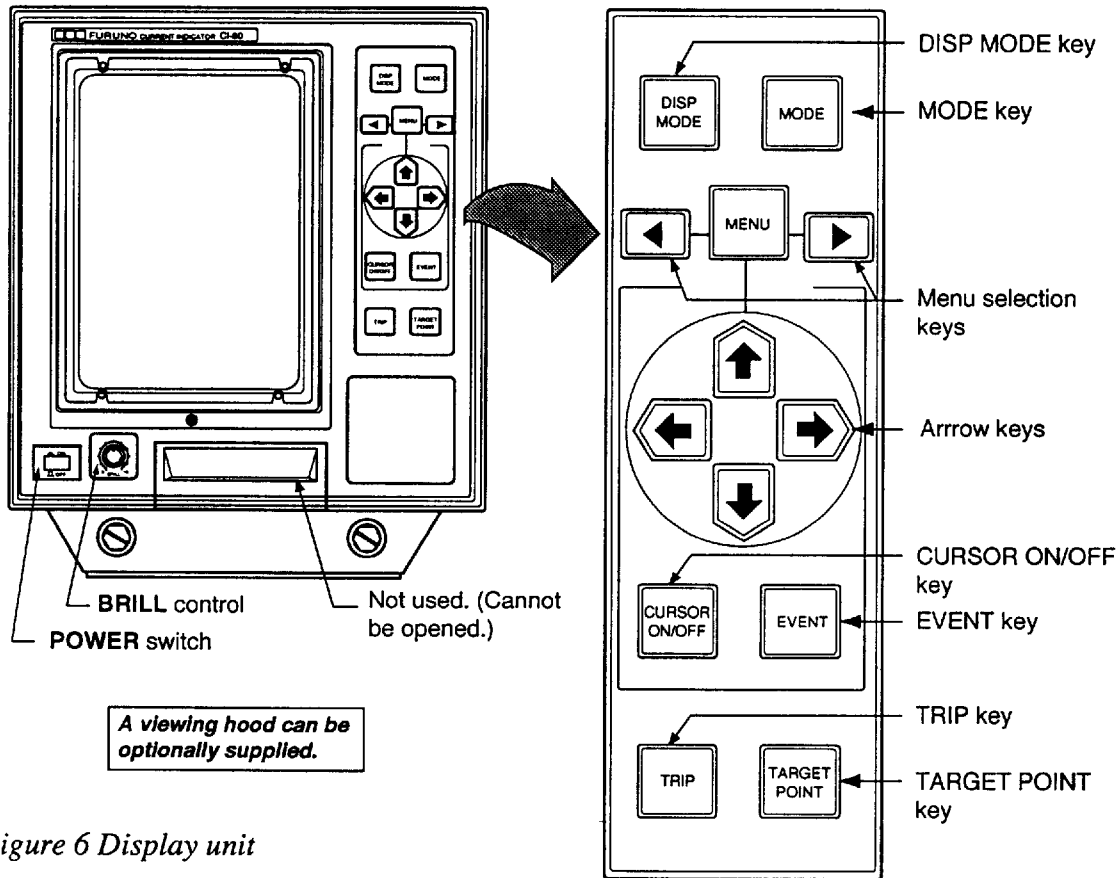
## Transceiver unit (CI-810)



POWER switch

Fuse
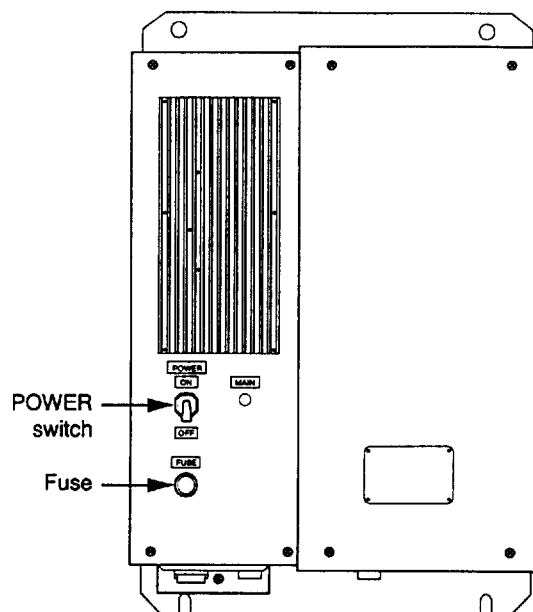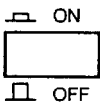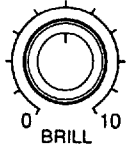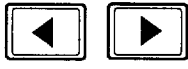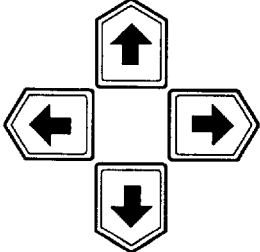
*Figure 7
Transceiver unit*

**4**

*Table 1 Control description*

| Control | Description |
|---|---|
| ___ ON <br> [ ] <br> ___ OFF | Turns the system on/off. |
| ⊙ <br> 0 10 <br> BRILL | Adjusts brilliance of display. Setting can be locked by pushing in control. |
| DISP MODE | Alternately selects echo display and course plot display. |
| MODE | Selects tracking mode among ground tracking, water tracking, and automatic selection. |
| MENU | Opens/closes the menu. |
| ◀ ▶ | Select menu. |
| ↑ ← → ↓ | In menu operation, select menu items; change settings; enter data. On the course plot display, shift cursor. |
| CURSOR ON/OFF | Turns cursor on/off. |
| EVENT | Enters event mark. Also activates self tests and demonstration display and register calibrations. |
| TRIP | Calculates trip distance. Also enables system menu, when pressed and held down while pressing the **MENU** key. |
| TARGET POINT | Inscribes target point mark, to predict flow of object (for example, fishing tackle) against tide. |

# How to Read the Displays

The CI-80 has two display modes: echo display and course plot display. A display may be selected with the **DISP MODE** key.

## Echo display
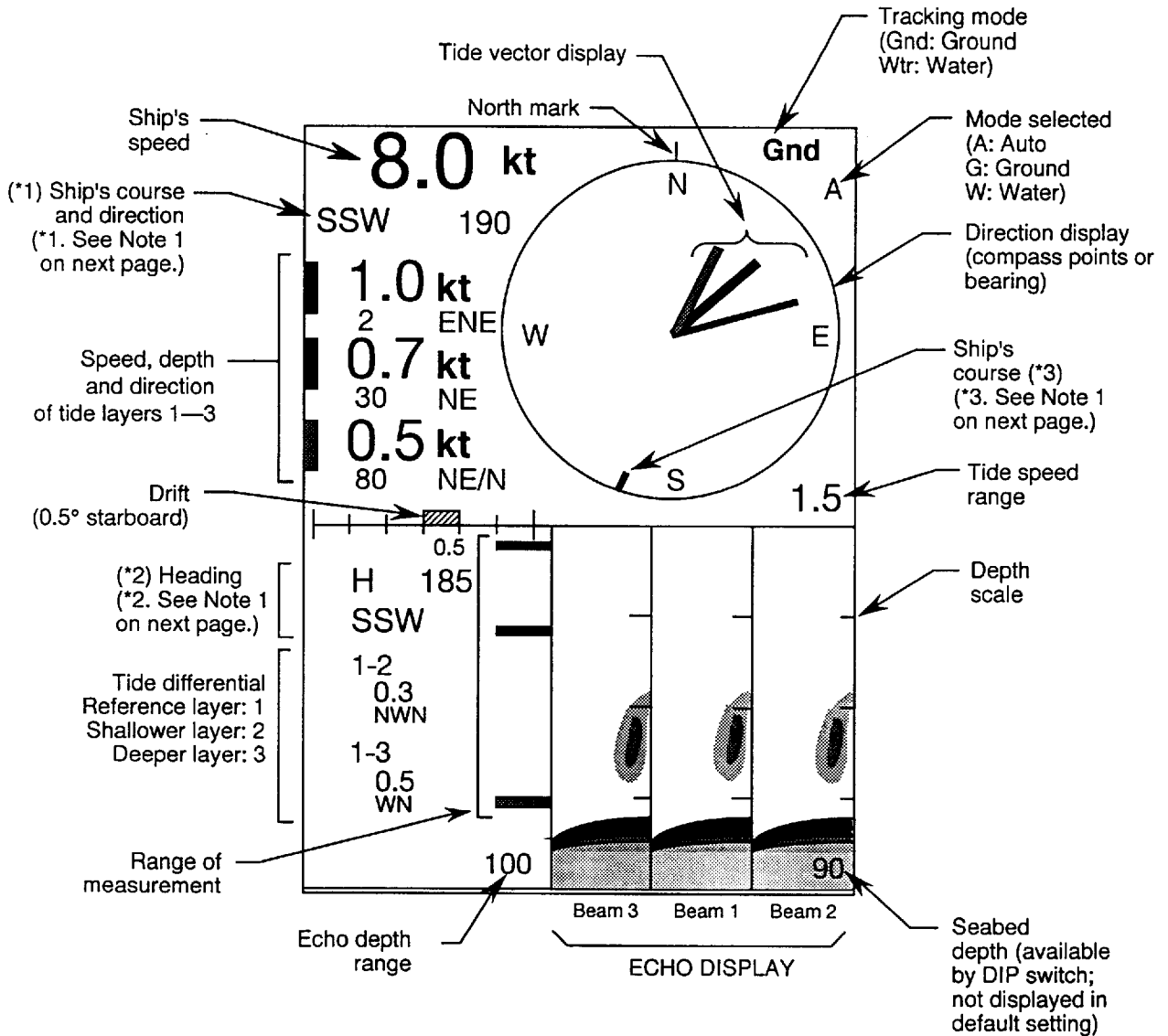


*Figure 8 Sample echo display*

---

**When speed or depth data appears in red...**

Speed or depth data containing error appears in red.

| | |
|---|---|
| **Ships speed** | Cannot find reference echo in respective tracking mode. |
| **Tide speed** | Cannot find echo in given layer. |
| **Set depth** | Depth set is invalid. In ground tracking mode, depth should be shallower than 7 m, or in the water tracking mode no more 3/4 of seabed depth. |
| **Measured speed** | When measured speed (tide or ship's) is unreliable. |

# Course plot display
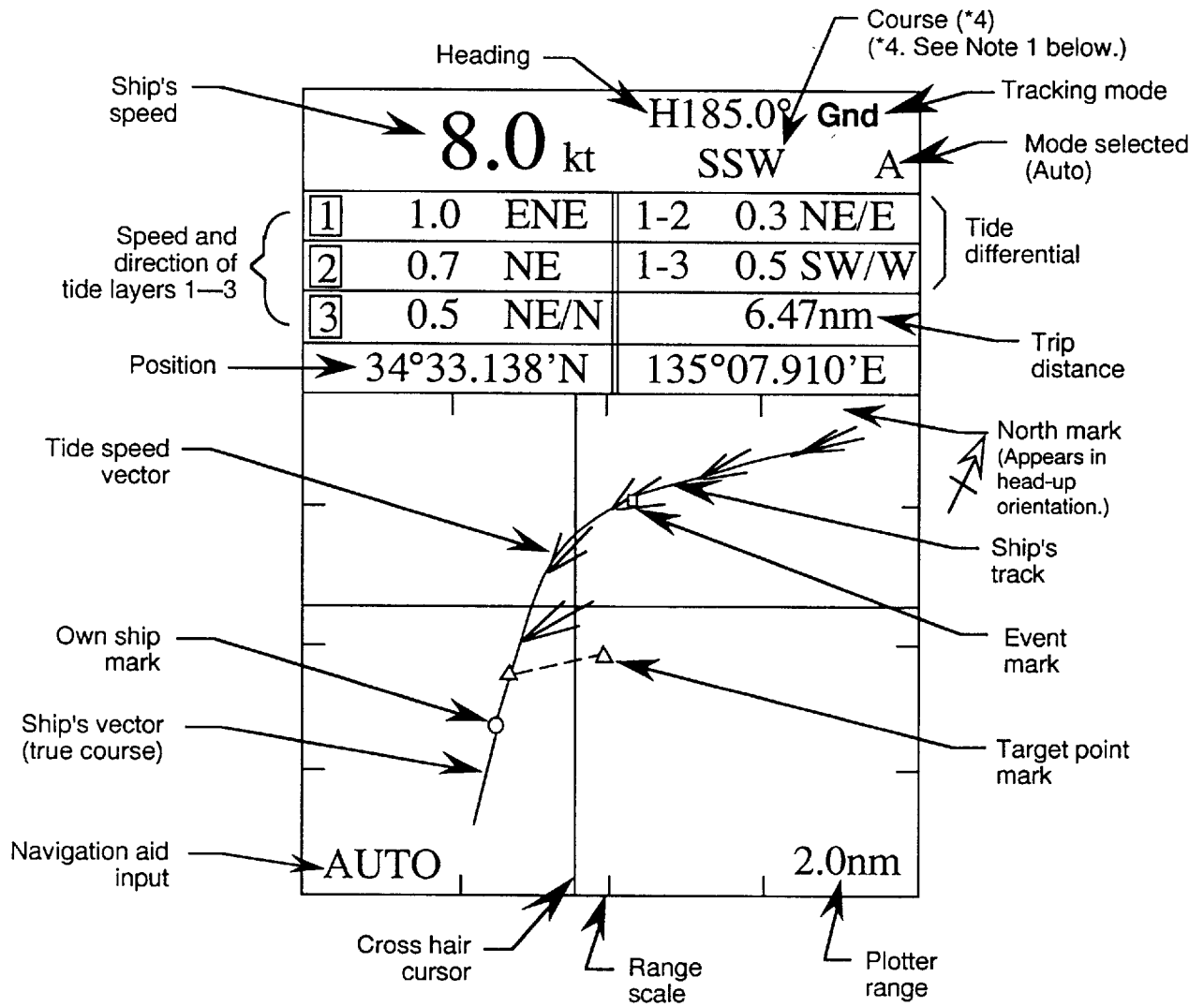


Figure 9 Sample course plot display

**Note 1:** *Ship's course and heading displays can be switched with display mode as follows, by a DIP switch in the display unit.*

|  |  | Course mode | Heading mode |
|---|---|---|---|
| Echo display | Ship's course (*1) | COURSE | HEADING |
|  | Heading (*2) | HEADING | COURSE |
|  | Ship's course mark (*3) | COURSE | HEADING |
| Course plot display | Ship's course (*4) | COURSE | HEADING |

**Note 2:** *Ship's speed and course displays are updated every three seconds, in the default setting. They can be updated every second. For details, consult your dealer.*

7

Most major functions of the CI-80 are carried out through an easy-to-follow menu system. The menu system consists of two main groups of menus: main (operation) and system (testing, calibration). This chapter covers the main menu. For complete menu tree, see page 24.

## *Basic Menu Operation*

Most major functions of the CI-80 are carried out through an easy-to-follow menu system. Two general types of menus are used: main (operation) and system (testing).

**Opening/closing the menu:** Press the MENU key.

**Selecting menus:** Press ◀ / ▶.

**Selecting menu items:** Press ↑ / ↓.

**Selecting menu options, changing settings:** Press ← / →.

## DEP Menu



This menu sets both the measuring depths for three layers and the reference layer for tide differential calculation.

LAYER 1, LAYER 2, LAYER 3: Depth for measuring layers 1, 2 and 3 can be set between 2 and 250 meters, in resolution of one meter.

REF TIDE DIFFERENCE: Selects tide layer to be used reference layer in tide differential calculation.

**NOTE:** *The depth of each layer may be set as you like; layer number does not necessarily correspond to depth in ascending order.*

*Figure 10 DEP menu*

# ECHO Menu

```
              ↓
 /DEP \/ECHO\/ TRK \/MARK\/ AVR \
┌─────────────────────────────┐
│  ┌───────────────────────┐  │
│  │  SPEED RANGE          │  │
│  ├───────────────────────┤  │
│  │ ┌─────┐               │  │
│  │ │ 1.0 │ kt   [0.1~15.0]│ │
│  │ └─────┘               │  │
│  │  ECHO DEPTH RANGE     │  │
│  ├───────────────────────┤  │
│  │ ┌────┐                │  │
│  │ │AUTO│ m    [50~300]  │  │
│  │ └────┘                │  │
│  │  ECHO LEVEL SHIFT     │  │
│  ├───────────────────────┤  │
│  │ ┌────┐                │  │
│  │ │ 30 │      [1~100]   │  │
│  │ └────┘                │  │
│  │                       │  │
│  │  <   >: MENU SELECT   │  │
│  └───────────────────────┘  │
└─────────────────────────────┘
```

*Figure 11 ECHO menu*

Sets up the echo display.

SPEED RANGE: Sets length of tide speed vector between 0.1 and 15.0 knots, in resolution of 0.1 knots.

ECHO DEPTH RANGE: Sets echo depth range. Depth can be set either manually between 50 and 300 meters in resolution of 50 meters or automatically. In AUTO, seabed depth is automatically selected as depth range.

ECHO LEVEL SHIFT: Sets echo intensity level, between 1 and 100 in resolution of 1. The higher the figure the stronger the echo level.

**NOTE:** *ECHO LEVEL SHIFT is not related to amplifier gain; it does not affect detection of tide speed or ship's speed.*

# TRK Menu

```
              ↓
 /DEP \/ECHO\/ TRK \/MARK\/ AVR \
┌─────────────────────────────┐
│  ┌───────────────────────┐  │
│  │  PLOT RANGE           │  │
│  ├───────────────────────┤  │
│  │ ┌─────┐               │  │
│  │ │ 1.0 │ nm   [0.1~5.0]│  │
│  │ └─────┘               │  │
│  │  PLOT MODE            │  │
│  ├───────────────────────┤  │
│  │ ┌────┐                │  │
│  │ │ HU │   NU            │  │
│  │ └────┘                │  │
│  │  TRACK DISPLAY        │  │
│  ├───────────────────────┤  │
│  │        ┌────┐         │  │
│  │  OFF   │ ON │         │  │
│  │        └────┘         │  │
│  │                       │  │
│  │  <   >: MENU SELECT   │  │
│  └───────────────────────┘  │
└─────────────────────────────┘
```

*Figure 12 TRK menu*

Sets up the course plot display.

PLOT RANGE: Sets latitude and longitude range of course plot, between 0.1 and 5.0 miles in resolution of 0.1 mile.

PLOT MODE: You may select either Head-up (bow at top of display) or North-up (North at top of display) orientation.

TRACK DISPLAY: Turn on/off trackline display.

# MARK Menu



Figure 13 MARK menu

This menu sets measuring conditions for tide vector and target point mark.

PRESET REFERENCE VALUE: Sets the effect of tide on the target point mark. The higher the figure, the greater the effect of tide.

TIDE HISTORY: Sets tide vector plotting interval, among 0 (turns off tide vector display), 15 sec.(1/4 min.), 1 min., 5 min., 10 min., 30 min., and 60 min.

# AVR Menu



Figure 14 AVR menu

The AVR (Averaging) sets averaging time for measuring raw speed, tide and water tracking data, to smooth out random variation of data.

SHIP SPD AVR: Raw speed data (from connected sensor) may change randomly due to receiving conditions, etc. If speed data varies greatly increase speed averaging. Speed averaging is available in times of 15 sec., 30 sec., 60 sec., and 90 sec. The default setting is 15 sec., which is suitable for most conditions.

TIDE AVERAGE: Direction and speed of a tide changes with time, place and depth. Therefore it is important that the current indicator not respond to quickly or too slowly to tide movement. Tide averaging time is available between 0 and 5 minutes in the nearest minute. ("0" is for use of raw tide data.) In most cases "2 min." provides excellent results. Too high a setting may prevent detection of rapid changes in tide movement, such as a current rip.

WT SPD DEPTH: Sets measuring depth of water speed in the water tracking mode. The default setting is two meters, and it is suitable for most conditions. Change the setting when water tracking speed display becomes unstable (due to air bubbles, etc.), or to measure water tracking speed at a given depth.

## Basic Operating Procedure

### Turning on the system

1. Turn on the transceiver unit.

2. Turn on the display unit.

3. Adjust brilliance of display.

The display unit conducts a check of the system, displaying the results about 40 seconds after turning on the power.
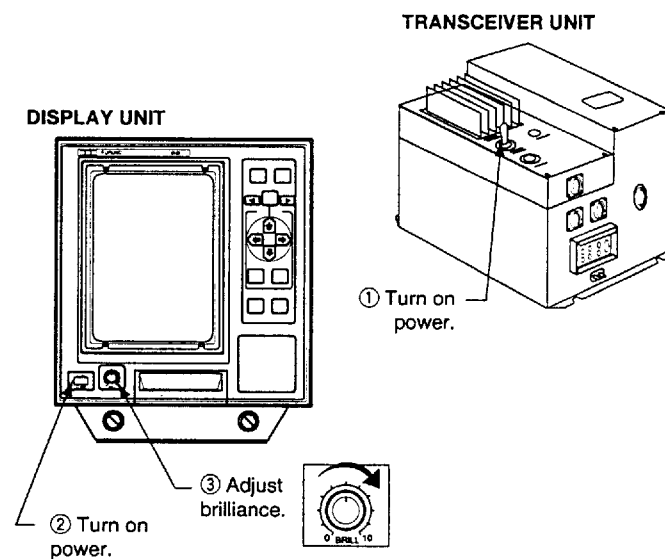


*Figure 15 Display unit and transceiver unit*

### Selecting operating mode

Press the **MODE** key to select operating mode among water tracking, ground tracking, or automatic selection. Selected mode appears at top right corner on the display.
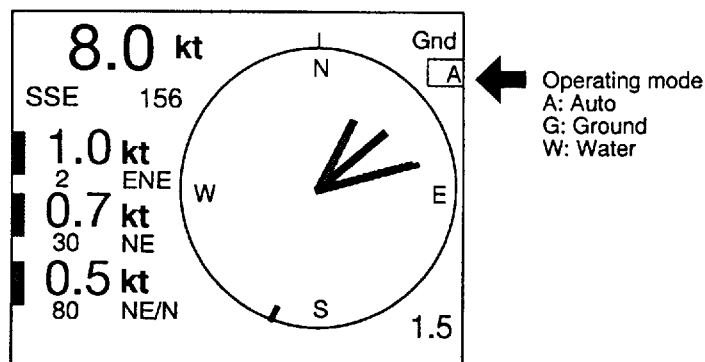


*Figure 16 Location of operating mode indication on echo display*

## Setting measuring depths

1. Press the **MENU** key.

2. Press ◀/▶ to select DEP menu.

3. Press ↑/↓ to select layer.

4. Press ←/→ to set depth.

5. Repeat steps 1—4 to set other layers.

Note that measuring depth can also be set on the echo display. See next page for further details.

## Setting tide differential layer

1. On the DEP menu, press ↑/↓ to select REF TIDE DIFFERENCE.

2. Press ←/→ to set layer.
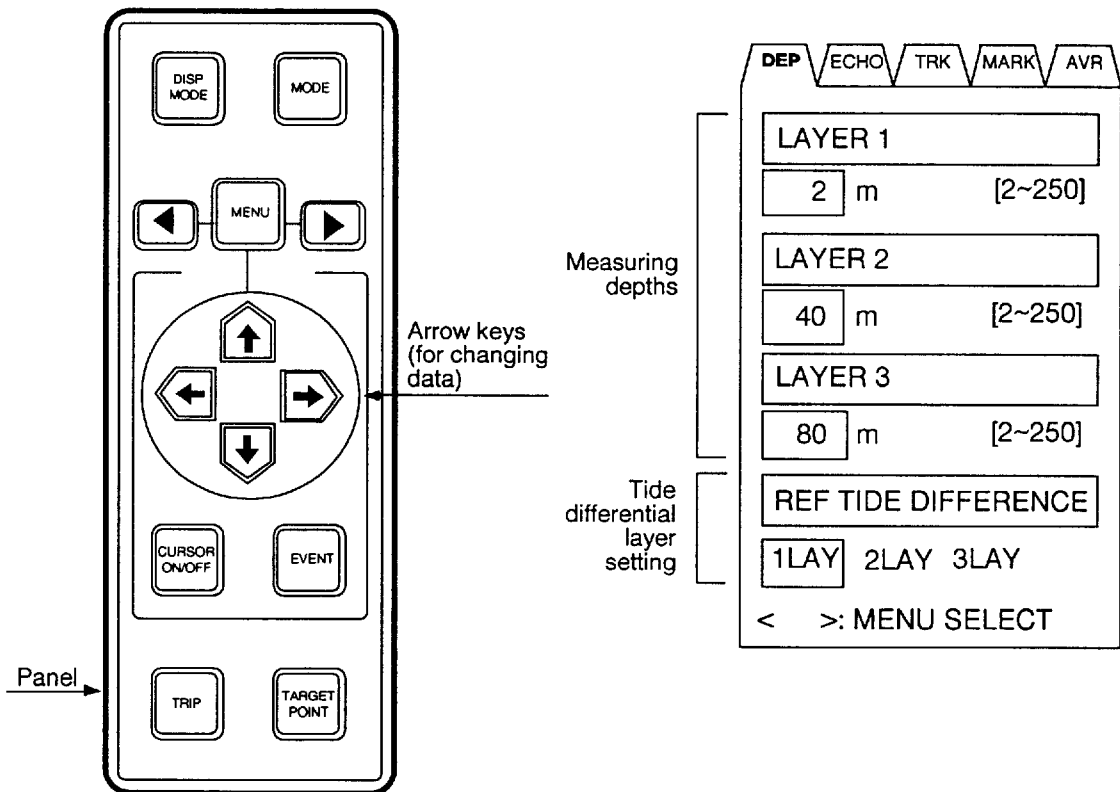


*Figure 17 How to set tide differential*

## Turning off the power

Press the power switch on the display unit.

**12**

# Setting Tide Measuring Depths on the Echo Display

Earlier you learned how to set tide measuring depths on the DEP menu. Measuring depths can also be set directly on the echo display.

## Selecting a layer, setting depth

1. On the echo display, press ↑/↓ to select layer desired. Selected layer's depth indication changes from white to orange .
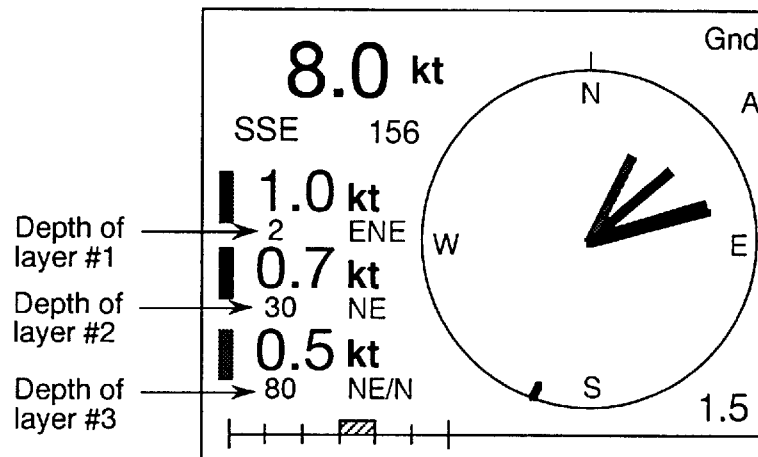


*Figure 18 Echo display*

2. Press ←/→ to set depth. "DEPTH SETTING" appears while setting depth.

3. Press ↓ to finish. Depth indications change from orange to white.

# Setting up the Echo Display

## Setting tide speed vector range

1. Press the **MENU** key.

2. Press ◀/▶ to select the ECHO menu.

3. Press ↑/↓ to select SPEED RANGE.

4. Press ←/→ to set speed. (Default setting: 1.0 knot)

## Setting echo depth range

1. Press ↑/↓ to select ECHO DEPTH RANGE.

2. Press ←/→ to set depth. (Default setting: 100 meters)

## Setting echo intensity

1. Press ↑/↓ to select ECHO LEVEL SHIFT.

2. Press ←/→ to set echo intensity.

## Registering settings, closing the menu

Press the **MENU** key.
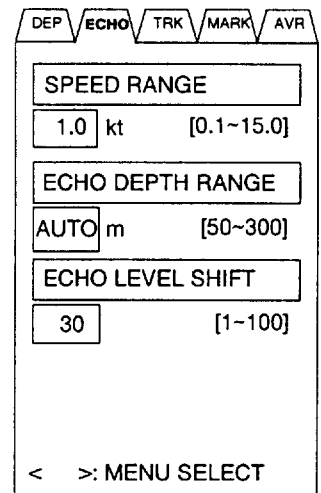


*Figure 19 ECHO menu*

# Setting up the Course Plot Display

The course plot display mainly plots ship's track. It can be displayed by pressing the **DISP MODE** key.
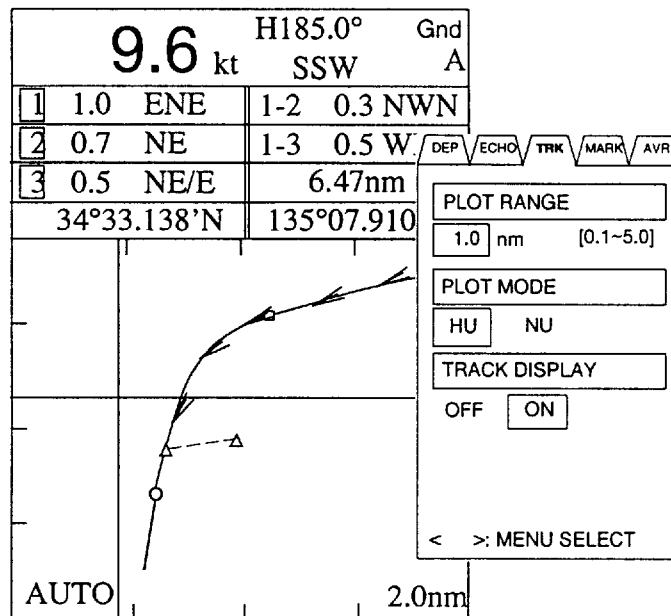


*Figure 20 Sample course plot display, TRK menu*

## Setting the plot range

1. Press the **MENU** key.

2. Press ◀/▶ to select the TRK menu.

3. Press ↑/↓ to select PLOT RANGE.

4. Press ←/→ to set plot range.

## Setting plot orientation

1. Press ↑/↓ to select PLOT MODE.

2. Press ←/→ to select HU (Head-up) or NU (North-up).

## Setting tide vector plotting interval

1. Press ◀/▶ to select the MARK menu.

2. Press ↑/↓ to select TIDE HIS-TORY.

3. Press ←/→ to set plotting inter-val.
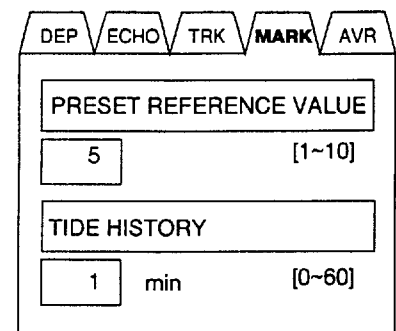


*Figure 21 MARK menu*

# Marks

The CI-80 has two types of marks which can be inscribed on the display: event mark and target point mark.
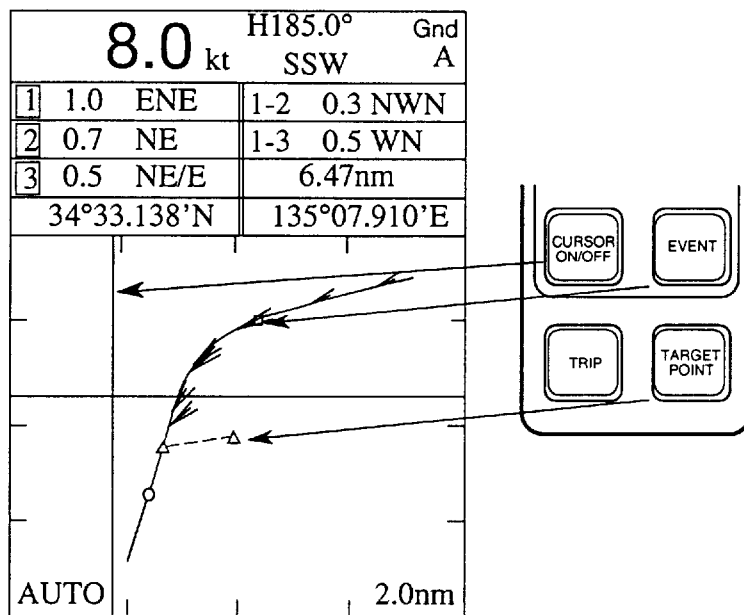


Figure 22 Appearance of event mark and target point mark

## Event mark

The **EVENT** key inscribes present position on the display. It is useful for marking important locations, etc. 25 event marks may be entered. When the event mark memory is full the oldest event mark is erased to make room for the latest.

## Target point mark

The **TARGET POINT** key inscribes a target point mark on the display. The target point mark is useful for estimating 3-D deformation of fishing tackle (net, etc.) by the effect of tides at different depths. 25 target point marks can be entered. When the target point mark memory is full the oldest target point mark is erased to make room for the latest.

Tide effect can be set on the MARK menu.

## Erasing marks

1. Press the **CURSOR ON/OFF** key.

2. Operate the four arrow keys to place cursor on mark to erase.

3. Press the **EVENT** key (or **TARGET POINT** key).
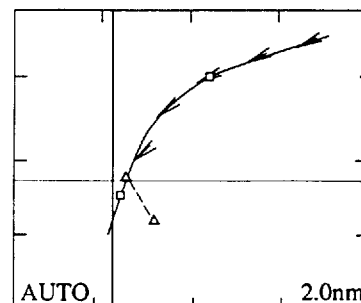


Figure 23 How to erase marks

# Calculating Trip Distance

Press the **TRIP** key to start calculation of trip distance from present position. The trip distance indication is automatically reset to zero.



*Figure 24 Course plot display, showing location of trip distance indication*

# Calibrations (offsets)

Offsets can be applied to measured values to further refine accuracy. This can be done on the CALB menu.

## Opening the system menu

1. Press the **DISP MODE** key to display the echo display.

**Displaying the CALB menu**

2. While pressing and holding down the **TRIP** key, press the **MENU** key.

## Displaying the CALB menu



*Figure 25 CALB menu*

1. Press ◄/► to select the CALB menu.

2. Press ↑/↓ to select menu item.

3. Press ←/→ to set offset.

### Menu items

| | |
|---|---|
| GT SPD CALIB: | Raise setting when ground tracking speed is slower than ship's speed. |
| WT SPD CALIB: | Raise setting when water tracking speed is slower than ship's speed. |
| DRAFT LEVEL: | Enter depth of transducer from sea surface. |
| BEARING CALIB: | Compensate for bearing error in relation to ship's bow. |

4. Press the **MENU** key to register settings and close the menu.

# MAINTENANCE & TROUBLESHOOTING

## Preventative Maintenance

### Regular checks

Regular maintenance is important for continued performance. Check the following on a monthly basis.

- Check that all connectors and cables are securely tightened.
- Check grounding systems of units for corrosion.

Also regularly measure voltage to confirm that it is within prescribed rating.

### Cleaning of units

#### Display unit/transceiver unit

Accumulated dirt can be wiped off with a soft cloth. If necessary, a mild detergent diluted in water may be used. Chemical cleaners should not be used to clean any unit; they can remove paint and markings.

#### Transducer unit

Barnacles and other marine life adhering to the transducer face can cause a considerable drop in performance. Check the transducer face regularly for marine life and clean if necessary. The transducer should never be painted.

# Troubleshooting

The troubleshooting table which follows provides simple troubleshooting procedures which the user may use to restore normal operation. If normal operation cannot be restored, do not attempt to check inside any unit. Any repair is best left to a qualified technician.

*Table 2 Troubleshooting table*

| If... | Then... |
|---|---|
| power is on but nothing appears on the display | • adjust BRILL control.<br>• check power cable.<br>• check for loosened power connector.<br>• check for blown fuse. |
| nothing appears on the echo display | • check that transceiver unit is turned on.<br>• check power cable and connector on transceiver unit for tight connection.<br>• check fuse on transceiver unit. |
| echo display is normal but echo or tide is not displayed | • check interconnection cable between transceiver unit and display unit. |
| color is distorted or display is too bright/ dark | • adjust BRILL control. |
| certain colors are abnormal or picture jumps | • check for magnets near display unit.<br>• try turning off and on the power to restore normal picture. |
| tide vector is not displayed | • "TIDE HISTORY" on the MARK menu may be set to "0". |
| no echoes are displayed | • "ECHO LEVEL SHIFT" on the ECHO menu may be set too narrow. |
| if ship's track is not displayed | • "TRACK DISPLAY" on the TRK menu may be turned off. |
| seabed does not appear on the echo display | • "ECHO DEPTH RANGE" on the ECHO menu is set too shallow. Set to suitable depth, or select AUTO.<br>• depth is beyond measurable depth (300 meters). |
| echo display is interuppted | • vessel is in heavy seas or passing over wake of another vessel.<br>• marine life may be adhering to the transducer. |
| tide data is unstable | • "TIDE AVERAGE" on the AVR menu may be set to "0". |
| interference is present on the display | • check ground for corrosion.<br>• cables of other equipment may be too near transducer cable. |

# Self Tests, Demonstration Display

The CI-80 has four self tests and a demonstration display which check the system for proper operation.

## Displaying the system menu

1. Press the **DISP MODE** key to select the echo display.

2. While pressing and holding down the **TRIP** key, press the **MENU** key.

## Conducting self tests

1. Press ◀/▶ to select the MODE menu.

2. Press ↑/↓ to select SELF TEST.

3. Press ←/→ to select test.

### Self test menu description

SYS: Conducts general check of all circuit boards.
ECHO: Checks receiver and transmitter.
PNL: Checks keys and switches of display unit.

4. Press the **EVENT** key to start test.

5. Press the **MENU** key when test is completed.

**To quit the self test,** Select "SELF TEST-OFF" on the MODE menu and press the **EVENT** key.
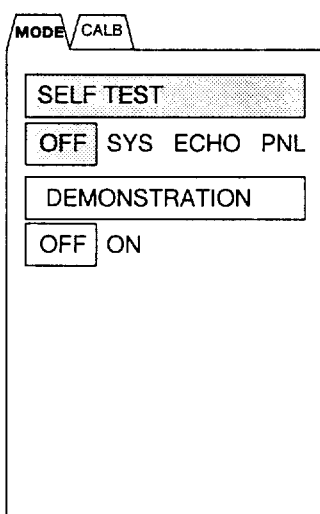
*Figure 26 MODE menu*

## Starting the demonstration display

The demonstration display checks the controls on the display unit and conducts a loopback test between the display unit and the transceiver unit.

1. Press ↑/↓ to select DEMONSTRATION.

2. Press → to select ON.

3. Press the **EVENT** key.

The echo display appears and the demonstration begins. "DEMO DATA OUTPUTTING" appears while the demonstration display is on. All data shown is for purpose of demonstration; it is not actual data.

**To quit the demonstration display,** select "DEMONSTRATION-OFF" on the MODE menu and press the **EVENT** key.
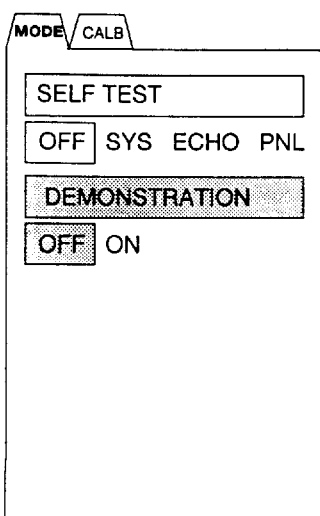
*Figure 27 MODE menu*

# Self Test Results

## System test

The system test check results appear at each power on or whenever the system check is conducted through the self test.

SYSTEM CHECK

---------CI-800---------

| | | |
|---|---|---|
| IP VOL | 66503001** | ICP Board ROM prog. no. |
| IP DSW | "00 00" | IPU Board's DIP switch setting in hexadecimal notation |
| IP MEM | 1 2 3 4 5 6 OK | ICP Board memory test |
| IP MEM | 7 8 9 | |

---------CI-810---------

| | | |
|---|---|---|
| CP VOL | 66503101** | JCPA Board ROM prog no. |
| CP TBL | 66503110** | |
| CP MEM | 1 2 3 4 5 6 7 8 OK | JCPA Board memory test |
| CP DSW | "00 00 00 00" | JCPA Board's DIP switch setting in hexadecimal notation |
| FT VOL | 66503201** | JFTA Board ROM prog. no. |
| FT NEM | 1 2 3 4 5 6 7 OK | JFTA Board memory test |
| TX DEV | 1      OK | Tx device test |
| IF VOL | 66500401** | JIFA Board ROM prog no. |
| IF MEM | 1 2 3 | JIFA Board memory test |
| IF DSW | "00 00 00" | JIFA Board's DIP switch setting in hexadecimal notation |
| IF DEV | 1 | JIFA Board device test |
| IF AN1 | RU3 00V RL2.00V OK | AD Converter reference voltage test |
| IF AN2 | MLD 2.50V | Temperature sensor signal test |
| IF AN3 | PWR 1.01V | Power check |
| IF AN4 | PTH...RLL...V | Inclinometer signal test |
| IF AN5 | IS1 1.01V IS2 1.01V | |
| ERR No. | Error Number | *NOTE: ** indicates version no.* |

| Test | ICP | JCPA | JFTA | JIFA |
|---|---|---|---|---|
| Prog. ROM test | 5 | 6 | 1 | 1 |
| Data ROM test | 6 | | | |
| Memory test | 1—4, 7—9 | 1—5, 7—8 | 2—7 | 2—3 |

## Error display

"OK" appears for normal memory IC test. For fault NG (No Good) and asterisk (*) appear next to ROM/RAM number.

*Table 3 Error number display and meaning*

| Error number | Reason | Circuit board to check |
|---|---|---|
| 000 | Input voltage | JCPA, JIFA |
| 001 | Overheated transducer element | JLGA, JCPA, JIFA* |
| 002 | abnormal Tx B voltage | STXA, UPW, JCPA |
| 003 | Tx voltage of beam 1 | JCPA, STXA |
| 004 | Tx voltage of beam 2 | JCPA, STXA |
| 005 | Tx voltage of beam 3 | JCPA, STXA |
| 006 | Tx current of beam 1 | JCPA, STXA |
| 007 | Tx current of beam 2 | JCPA, STXA |
| 008 | Tx current of beam 3 | JCPA, STXA |
| 100 | External position data | JCPA, JIFA |
| 101 | External speed data | JCPA, JIFA |
| 102 | External time data | JCPA, JIFA |
| 103 | External depth data | JCPA, JIFA |
| 104 | Heading data | JCPA, JIFA |
| 105 | Heading error angle | JCPA, JIFA |
| 106 | Water temperature data | JCPA, JIFA |
| 200 | External KP input interval | JCPA, JIFA, abnormal external KP interval |
| 201 | Depth sensor input | JLGA, JCPA, JIFA, faulty temperature sensor |
| 202 | Inclinometer roll signal | JCPA, JIFA, no inclinometer data |
| 203 | Inclinometer pitch signal | JCPA, JIFA, no inclinometer data |

*\* Abnormally high Tx voltage, abnormally low transducer impedance, too high Tx duty, faulty temperature sensor (faulty element), high water temperature, and other factors may also cause this error display.*

## Echo test

### Checking echo display intensity

Press the right and left arrow keys. The SHIFT indication should change with key operation, between 0 and 100.

### Checking echo display range

Press the up and down arrow keys. The echo display range should in steps of 50 between 0 and 300.

```
ECHO   CHECK      MENU : END
TVG  SET    : [MODE  KEY]
     OFF        [ON]
ECHO  DEPTH  :  [ UP ] [ DOWN ]
ECHO  SHIFT : [ LEFT ] [ RIGHT ]
    SHIFT   :    2 3
TX POWER
    BEAM1  : [100]
    BEAM2  : [100]
    BEAM3  : [100]
+B  volt    : [100]
           BEAM3  BEAM1  BEAM2
    0 m

    100 m
```
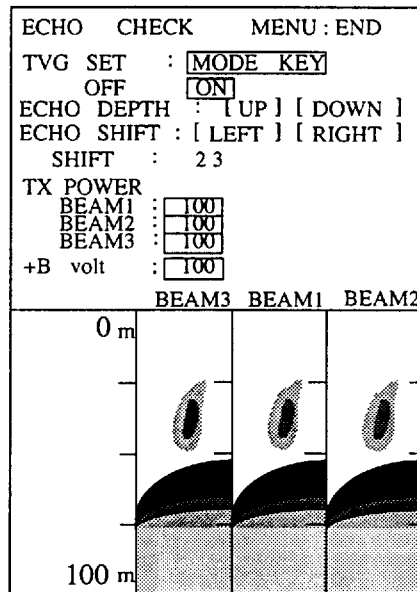
*Figure 28 Sample echo test display*

## Panel test

Press each key on the control panel one by one. The pressed key's corresponding "0" on the display should change to "1".

```
PANEL  TEST      MENU : END

 DISP MODE          MODE
     0                0
          MENU
            0
 <=SELECT      SELECT=>
        0      0
          UP
           0
    LEFT 0      0 RIGHT
          0
         DOWN

  CURSOR 0      0 EVENT
   TRIP  0      0 POINT
```
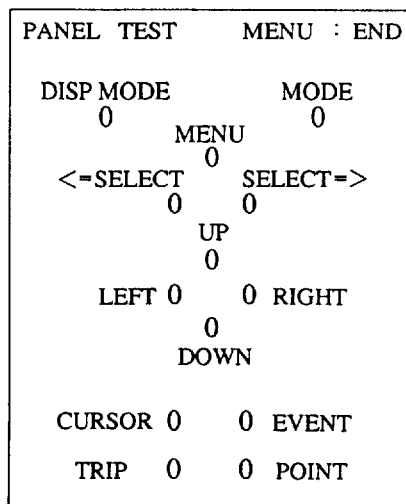
*Figure 29 Panel test display*

**23**

```
MAIN MENU ──┬── DEP ──┬── LAYER1
            │         ├── LAYER2
            │         ├── LAYER3
            │         └── REF TIDE DIFFERENCE
            │
            ├── ECHO ──┬── SPEED RANGE
            │          ├── ECHO DEPTH RANGE
            │          └── ECHO LEVEL SHIFT
            │
            ├── TRK ──┬── PLOT RANGE
            │         ├── PLOT MODE
            │         └── TRACK DISPLAY
            │
            ├── MARK ──┬── PRESET REFERENCE VALUE
            │          └── TIDE HISTORY
            │
            └── AVR ──┬── SHIP SPD AVR
                      ├── TIDE AVERAGE
                      └── WT SPD DEPTH


SYSTEM MENU ──┬── MODE ──┬── SELF TEST ──┬── OFF
              │          │               ├── SYS
              │          │               ├── ECHO
              │          │               └── PANEL
              │          │
              │          └── DEMONSTRATION ──┬── OFF
              │                              └── ON
              │
              └── CALB ──┬── GT SPD CALIB
                         ├── WT SPD CALIB
                         ├── DRAFT LEVEL
                         └── BEARING CALIB
```
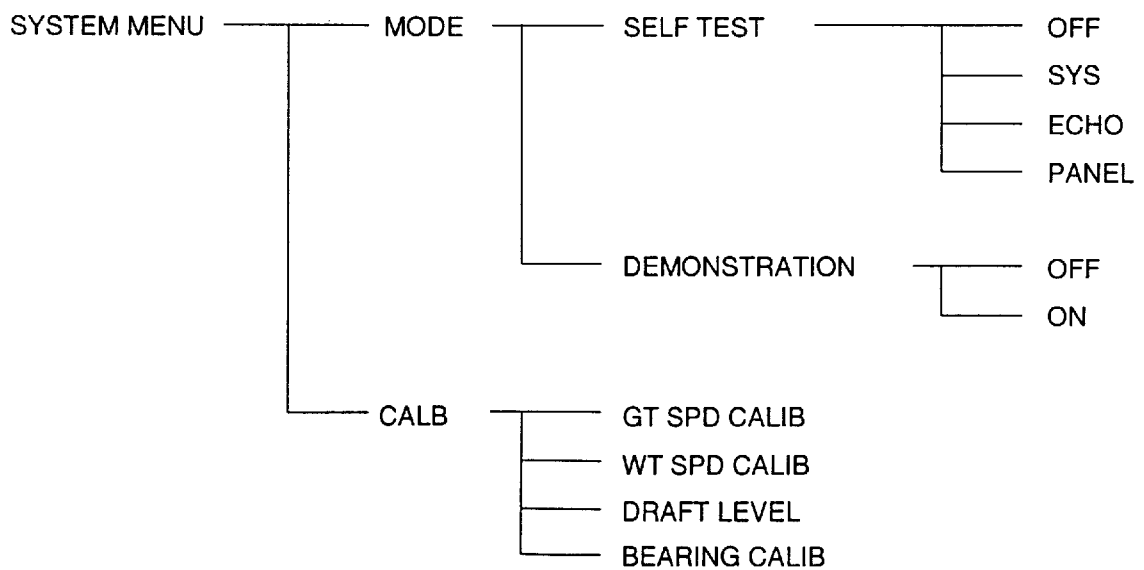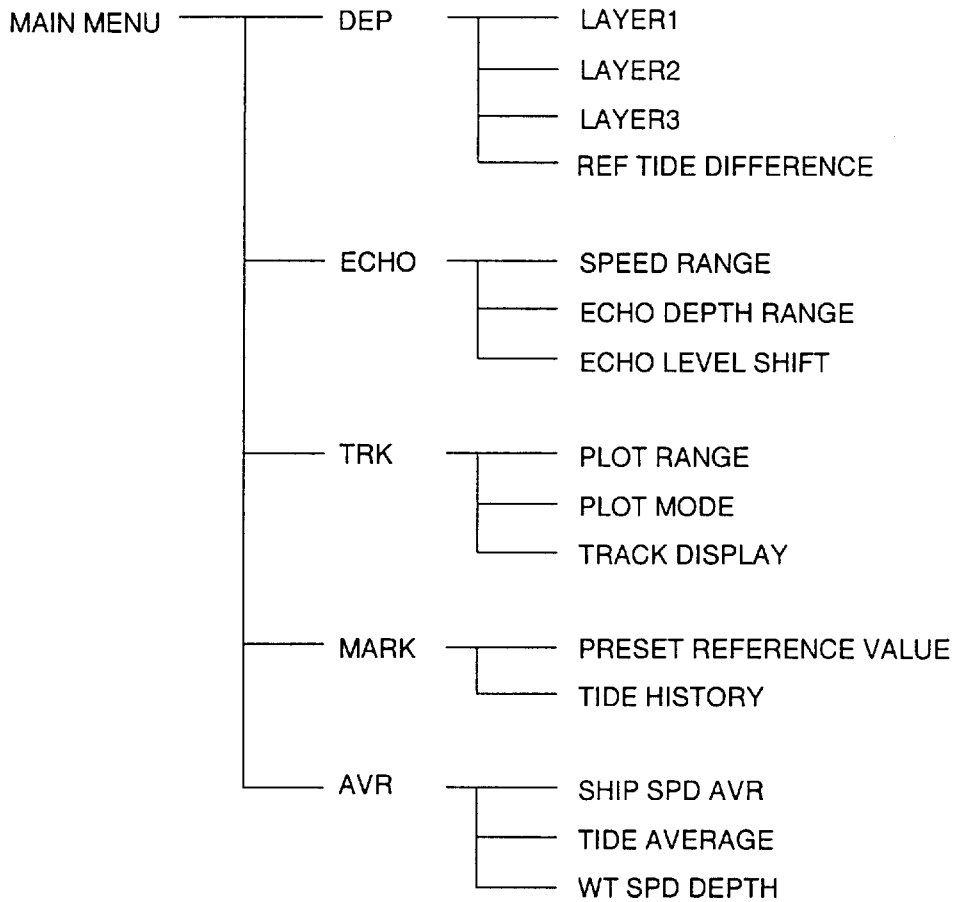
## General

| | |
|---|---|
| Ground tracking acquirable depth | 3 m—200m (measureable range 300m) |
| Measurable tide range | 2m—100m, or 2m to 75% of depth, whichever is shallower |
| Measurable tide depth | 10m (measurable from 7m) |
| Measurable ship's speed | Fore/aft: +30kts to -10 kts, Port/starboard: +9.9kts to -9.9kts |
| Measurable tide speed | 0kts to 9.9kts |
| Tide differential range | -9.9kts to +9.9kts |
| Measuring accuracy | Ship's speed: ±1(1% + 0.1kt), Tide speed: ±(2% + 0.1kt) |
| Number of beams | Three (tilt angle 60° each beam) |
| Transmitting frequency | 288kHz |
| Display type | 10-inch color CRT |

## Display

| | | |
|---|---|---|
| Common displays | Speed, heading:<br>Tide speed, direction: | 360 degree or 32 compass points<br>Three layers |
| Course plot display | Track display:<br>Tide vector:<br>Target point mark:<br>Event mark:<br>Ship's position:<br>Orientation:<br>Trip distance indication: | DR, max. 1000 pts.<br>Three layers, max. 1000 pts.<br>25 pts.<br>25 pts.<br>Latitude, longitude<br>Head-up (true motion), North-up<br>Provided |
| Echo display | Tide vector:<br>Tide differential:<br>Video sounder: | Three layers, circular graph<br>Three layers, measurement between two layers<br>Three directions |
| Other | Self test:<br>Demonstration:<br>Calibration facilities<br>Range selection<br>Object flow prediction | All circuit boards, controls<br>With internal data |

## Input/Output Signal

| | | |
|---|---|---|
| Input signal | Compass signal (heading):<br>KP (2 circuits):<br>CIF/NMEA 0183: | AD-100 format<br>Photo isolation (current loop)<br>Position data |
| Output signal | Log signal:<br>KP signal:<br>CIF/NMEA 0183:<br>CI-7000 format signal | 200/400 pulses, contact signal<br>TTL<br>Speed, tide |

## Environmental Conditions

| | |
|---|---|
| Useable temperature | 0°C to 45°C |
| Relative humidity | 85% |

## Power Supply & Power Consumption

| | |
|---|---|
| Main's input | 11—40VDC, less than 120W avg., or 100/110/115/220/230VAC, 1ø, 50/60Hz (rectifier required) |