LORAN C RECEIVER

XJ - 1

OPERATION MANUAL

SI-TEX

IMPORTANT NOTICE ON XJ-1

1. ANTENNA COUPLER INSTALLATION

IF A LAYDOWN BASE MOUNT IS USED, CAULKING OR SEALING COMPOUND MUST BE APPLIED AROUND THE BASE OF THE COUPLER AND THE CABLE ENTRANCE TO PREVENT WATERLEAKAGE WHEN COUPLER IS IN HORIZONTAL POSITION.

2. GRI ENTRY PROCEDURE

WHEN ALL 9'S APPEAR ON THE DISPLAY WITHOUT THE BAR (-) INDICATOR, SIMPLY PRESS THE 4 DIGIT GRI NUMBER OF YOUR AREA AND THEN THE ENT KEY.

ENTRY PROCEDURE

PRESS	ON (OFF)			FOR POWER ON OBSERVE 9'S
PRESS	(#)	(#)	(#) (#)	GRI NUMBER FOR YOUR AREA
PRESS	(ENT)			TO ENTER GRI

OBSERVE NORMAL OPERATION

NOTE: 9'S MAY APPEAR FROM STARTING ENGINE WITH EQUIPMENT ON.

3. REVERSE POLARITY

REVERSE POLARITY WILL CAUSE INTERNAL DAMAGE NOT COVERED UNDER WARRANTY. THE FOLLOWING PROCEDURE WILL GIVE ADDITIONAL REVERSE POLARITY PROTECTION.

INSTALL A 5 AMP SLO BLO FUSE IN THE NEGATIVE SIDE OF THE POWER CABLE.

ATTACH THE POWER CABLE TO THE LORAN AND OPERATE THE UNIT PRIOR TO ATTACHING THE CASE (R.F.) GROUND.

4. CAUTION

WHEN HANDLING THE LORAN RECEIVER, TAKE CARE NOT TO GRASP BY THE DISPLAY PORTION (TOP HALF) OF THE FACE PLATE. DISCOLORATION OF THE LCD DISPLAY CAN OCCUR. THIS IS USUALLY TEMPORARY, BUT THE LONG TERM EFFECTS OF MISHANDLING COULD BE PERMANENT AND NOT COVERED UNDER YOUR WARRANTY.

5. INSTALLATION NOTICE

THIS UNIT CONTAINS LIQUID CRYSTAL DISPLAYS. PROLONGED EXPOSURE TO DIRECT SUNLIGHT CAN CAUSE THE DISPLAY TO WASH OUT. PERMANENT DAMAGE COULD RESULT. PRECAUTIONS SOULD BE OBSERVED TO PROVIDE ADEQUATE PROTECTION FROM DIRECT SUN EXPOSURE.

XJ-1 LORAN C BRIEF OPERATING INSTRUCTIONS

Cycle Select   Signal/Noise

Operating Modes

Mode Indicator Bar

Upper or S1 Display Area

Lower or S2 Display Area

CPN-Course Computer Functions

Numeric Keyboard

Function and Mode Select Keys

OPERATING MODES

GRI-Group Repetition Interval	TTG-Time To Go
LOP-Lines of Position	STG-Steering (or Bearing)
L/L-Latitude/Longitude	HDG-Heading
TST-Test Mode	DIST-Distance To Waypoint
CMP-Compensation Mode	SPD-Speed
SET-Set Mode	V/CMG-Velocity Mode Good
WP-Waypoint	and Course Mode Good

LORAN C CHAINS

4990-CENTRAL PACIFIC	8290-NORTH CENTRAL U.S.
5930-CANADIAN EAST COAST	8970-GREAT LAKES
5970-COMMAND LION	8990-NORTH SAUDI ARABIA
5990-CANADIAN EAST COAST	9610-SOUTH CENTRAL U.S.
7170-SOUTH SAUDI ARABIA	9940-U.S. WEST COAST
7930-LABRADOR SEA	9960-NORTHEAST U.S.
7960-GULF OF ALASKA	9970-NORTHWEST U.S.
7970-NORWEGIAN SEA	9980-NORTH ATLANTIC
7980-SOUTHEAST U.S	9990-NORTH PACIFIC
7990-MEDITERRANEAN SEA	

OPERATION	MODE	KEY PRESS SEQUENCE	TYPICAL DISPLAY
POWER ON AND GRI ENTRY	GRI	ALL 9'S OR PONT 9AM TO GRI	
TURNING XJ-1 OFF	LOP OR L/L	HOLD 5 SECONDS	
SELECT LOPs	GRI	LOP DISPLAY SELECT	
LOP DISPLAY	LOP	PRESS — POSITION BAR UNDER LOP	
LAT/LON DISPLAY	L/L	PRESS — POSITION BAR UNDER L/L	
SPEED & HEADING DISPLAY	HDG & SPD	POSITION BAR OVER SPD / POSITION BAR OVER HDG	
V/CMG DISPLAY	V/CMG	PRESS — POSITION BAR OVER V/CMG	
BASIC NAVIGATION PROGRAMMING			
DIRECT ENTRY LOP WAYPOINT	WP	SELECT LOP MODE / SELECT WP	
DIRECT ENTRY LAT/LON WAYPOINT	WP	SELECT L/L MODE / SELECT WP	
DISPLAY BEARING & DISTANCE	SIG & DIST	POSITION BAR OVER SIG / POSITION BAR OVER DIST	
DISPLAY TIME-TO-GO (TTG)	TTG	AFTER WP ENTRY / POSITION BAR OVER TTG	
DISPLAY SIGNAL QUALITY MONITOR	TST	POSITION BAR UNDER TST	
RESET OF POINT OF ORIGIN FOR THE COURSE	LOP, L/L	PRESS / POSITION BAR OVER WP	

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OPERATION	MODE	KEY PRESS SEQUENCE	TYPICAL DISPLAY
IMAGINARY COURSE DISPLAY	CMP 05	FROM LOP OR L/L ↑ POSITION BAR UNDER CMP [S1] OR [S2] TO GET 05 PAGE. [-/R] [FIRST MEMO] NUMBER [SECOND MEMO] NUMBER [ENT]	
LAT/LON MANUAL COMPENSATION	CMP	FROM LOP OR L/L ↑ POSITION BAR UNDER L/L. PRESS [S1] OR [S2] UNTIL 01 IS DISPLAYED UNDER L/L MPU. ENTER CORRECTED PRESENT L/L... UNTIL BAR IS UNDER L/L	CORRECTED POSITION INFORMATION
LOP COMPENSATION	GRI	PRESS... POSITION BAR UNDER GRI [↑/N]... TO ADD OR SUBTRACT [ENT]... TO PLACE BAR UNDER GRI FOR 32 COMPENSATION AND REPEAT	CORRECTED POSITION INFORMATION
COMPLIMENTARY L/L	L/L	POSITION BAR UNDER L/L PRESS [S2] TO RETURN TO THE PRIMARY SOLUTION	BLANK
HEADING & BEARING COMPENSATION	CMP	FROM LOP OR L/L ↑ POSITION BAR UNDER CMP [S1] OR [S2] UNTIL 02 IS UNDER MEMO PRESS... TO ADD OR SUBTRACT	
AUTOMATIC ASF CORRECTION	CMP	FROM LOP OR L/L ↑ POSITION BAR UNDER CMP PRESS [S1] OR [S2] UNTIL 04 IS UNDER MEMO THEN ENTER 1 TO ACTIVATE AUTO ASF OR 0 TO DEACTIVATE THEN PRESS [ENT] ↑ TO RETURN TO L/L, LOP	BLANK
CHANGING SET MODE LIMITS	SET	FROM LOP OR L/L ↑ POSITION BAR UNDER SET [S1] OR [-/R] TO SELECT THE SET MODE NUMBER UNDER MEMO. TO CHANGE THE LIMITS MODE 01 ARRIVAL ALARM ENTER 2 DIGITS [ENT] 02 ANCHOR WATCH ENTER 2 DIGITS [ENT] 03 XTE ALARM ENTER 2 DIGITS [ENT] 04 SPEED AVERAGING 1 DIGIT [ENT] PRESS ↑ TO RETURN TO L/L, LOP NOTE: ENTER 0 0 TO INHIBIT ANY ALARM	MEMO 01 02 03 04
ENGAGE ANCHOR WATCH	WP	FROM LOP OR L/L ↑ POSITION BAR OVER WP PRESS [0] [ENT] TO CLEAR POSITION BAR OVER WP THEN PRESS [ENT]	MEMO

OPERATION	MODE	KEY PRESS SEQUENCE	TYPICAL DISPLAY
LOP WAYPOINT STORAGE IN MEMORY	WP FROM LOP MODE	POSITION BAR OVER WP [←] [1/N] [4/N] [2/S]... AFTER NUMBER ENTRY PRESS MEMORY NUMBER [0] [1/N] [CLR]	
L/L WAYPOINT STORAGE IN MEMORY	WP FROM L/L MODE	POSITION BAR OVER WP [←]... MEMORY NUMBER AFTER NUMBER ENTRY PRESS [0] [CLR]	
WAYPOINT RECALL	WP	FROM L/L OR LOP [←] POSITION BAR OVER WP MEMO No. THEN PRESS [-/R]	WAYPOINT MAY BE L/L OR LOP
ENTER RECALLED WAYPOINT	WP	FROM L/L OR LOP [←] MEMO No. POSITION BAR OVER WP PRESS [-/R]	
TRANSFER MEMORY WAYPOINTS	WP	FROM L/L OR LOP POSITION BAR OVER WP [0] [1/N] [2/S] THEN [←]	
INSTANT MEMORY STORAGE	LOP OR L/L	WHILE THE BAR IS UNDER L/L OR LOP PRESS [-/R] TO RETURN TO NORMAL TRACK	
INSTANT MEMORY RECALL	LOP. L/L	WHILE THE BAR IS UNDER L/L OR LOP PRESS [-/R] TO RETURN TO NORMAL TRACK	
AUTOMATIC WAYPOINT SEQUENCE	WP	FROM L/L OR LOP [←] MEMO NUMBER [-/R] [ENT] MEMO NUMBER [-/R] [ENT] REPEAT FOR UP TO TEN MEMO NUMBERS [←]	BLANK
TO SKIP A WAYPOINT IN AUTO SEQUENCE	LOP. L/L	[0] [ENT] STEPS AUTOMATIC WAYPOINT SEQUENCING TO THE NEXT ENTERED WAYPOINT	L/L EXAMPLE
MANUAL LOP TO L/L CONVERSION	CMP 05 PAGE	FROM LOP OR L/L POSITION BAR UNDER CMP PRESS [S1] OR [S2] TO GET 05 ENTER PRESS [1/N] LOPs [4/N] [4/N] [2/S]... [ENT]	ENTERED LOPs L/L RESULT

CONTENTS

"PRECAUTIONS"

1. Before operating Loran C Navigator XJ-1 read through the manual carefully.

2. If it does not operate properly even with correct handling, repeat the initial setting operating.

3. The Loran C XJ-1 navigator contains an internal lithium battery for memory storage of programmed information. Replacement may be required once every 3 to 5 years. There is no recharging necessary.

4. The Loran C signal may be distorted and a location error may be produced depending on its transmission passage. As a corrective measure, Loran charts where location errors are corrected, and Loran C error correction tables where errors are enumerated, are available commercially.

5. If the unit cannot be energized, the fuse may have blown. The fuse is located on the back panel, however, before replacing the fuse, the cause of the trouble must be located. Contact the nearest agent.

6. If you encounter difficulty with your Loran C settling out or maintaining cycle lock, the problem can often time be traced to R.F. interference. Refer to your operators manual and use the TEST function provided in your Loran C receiver to locate the sources of R.F. interference. The following is a list of known possible interference sources:

    > Television sets
    > Color video sounders
    > Alternators
    > Improperly grounded radar
    > Electronic Tachometers
    > Microprocessor based instruments
    > D. C. powered fluorescent lights

7. If a lay down mount is used to mount the antenna coupler, do not allow the coupler to be lowered to a horizontal position. The coupler should be kept elevated so that water does not lay against the cable entrance.

8. Reverse polarity, improper ground wiring, will cause internal damage not covered under warranty. The following procedure will give additional reverse polarity protection.

    a. Install a 5 Amp Slo Blo fuse in the negative side of the power cable.

    b. Attach the power cable to the Loran and operate the unit prior to attaching the case (R.F.) ground.

9. When handling the loran receiver, take care not to grasp by the display portion (top half) of the face plate. Discoloration of the LCD display can occur. This is usually temporary, but the long term effects of mishandling could be permanent and not covered under your warranty.

10. This unit contains liquid crystal displays. Prolonged exposure to direct sun light can cause the display to wash out. Permanent damage could result. Precautions should be observed to provide adequate protection from direct sun exposure.

Specifications For Loran C Navigator XJ-1

SPECIFICATIONS

Frequency   : 100kHz
Tracking stations   : Master and 4 slave stations
GRI selection   : Manual
Secondary selection   : Manual
Acquisition   : Automatic
Tracking   : Automatic
ASF correction   : Automatic (only in the area with compensation table)
                                     or manual
Magnetic compass
  compensation   : Automatic or manual
Settling time   : Approx. 3 min. at 0 dB (nominal)
Max. tracking speed   : 80 knots
Max. signal level   : 110 dBuV/m
Notch filter   : Built-in preset: 4
Display element   : One LCD backlighted (3 lines)
Display unit   : LOP: 0.1 usec, Lat/Long: 0.01 min.
                                     Bearing: 0.1 degree, Time: 1 min.
                                     Speed: 0.1 knot, Distance: 0.01 n.m.
Output data format   : KODEN-717, NMEA-0180 (simple and complex),
                                     NMEA-0182, and NMEA-0183 (LOP or L/L)
Ambient temperature   : 0 to 50° C
Power supply   : 11-15 VDC
Power consumption   : 8 VA at 12 VDC

DISPLAY CONTENTS AND MAJOR FUNCTIONS

Position display   : 2 LOPs or Lat/Long
Navigational display   : Speed, heading, steering to go, distance to go,
                                     time to go, cross track error, velocity made good,
                                     course made good, elapsed time, distance between 2
                                     imaginary points and its bearing
Signal condition   : Displayed
Frequency deviation   : Displayed
Instant memory   : 10 points
Waypoint memory   : 89 points
Route setting   : 1 route (10 waypoints are settable)
Visual alarm   : CS, S/N, station blink
Audible alarm   : Waypoint proximity, anchor watch, cross track error
Compensation   : Position of acquisition (±10 usec),
                                     Lat/Long position, magnetic compass variation,
                                     additional secondary factor (ASF)

Specifications subject to change without notice.

1. NAMES AND FUNCTIONS OF OPERATING CONTROLS
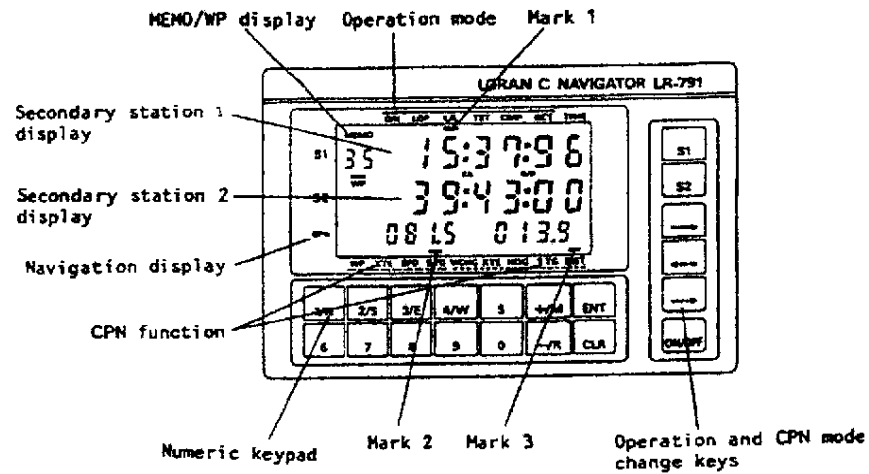
1.1 Names and Functions of Keys

1.1.1 [ON/OFF] (DIM) Key

(1) Pressing it turns on power and starts the acquisition of Loran signal.

(2) Pressing it again, briefly, dims the Display and Keyboard. An additional brief press will return the Display and Keyboard to their original brightness.

(3) Pressing the [ON/OFF] Key and holding it for a moment will power-down (turn-off) the unit.

1.1.2 Operation and CPN mode change key

(4) [→] key

The mark 1 moves to the right (upper stage) to select the operation mode.

(5) [←] key

When the mark 1 is at LOP or L/L position, the mark 2 moves to the left, thereby selecting the navigation display.

(6) [→] key

When the mark 1 is at LOP or L/L position, the mark 3 moves to the right, thereby selecting the navigation display.

1.1.3 Numeric keypad

(8) [S1] Key. This key is used in several different modes of operation to select and display various data.

GRI, and LOP modes	The time difference of the secondary station to be indicated on the Secondary 1 Display is selected.
L/L mode	The Latitude and Longitude within normal operation range is displayed. (Note 1)
CMP mode (Conversion)	When a desired time difference is converted into latitude and longitude, the location within a normal operation range is displayed. (Note 1)
TST mode	The signal quality of the selected secondary stations is sequentially displayed in the S1 Display Area.
CMP and SET mode	Page is advanced.

NOTE 1: Refer to Special Computation of Latitude and Longitude.

(9) $\boxed{S2}$ Key. This key is used in several different modes of operation to select and display various data.

GRI and LOP modes   The time difference of the secondary station indicated on the secondary 2 display is selected.

L/L mode   The latitude and longitude within a <u>special</u> operation range are displayed. (Note 1)

CMP mode
(Conversion)   When a desired time difference is converted into latitude and longitude, the location within a <u>special</u> operation range is displayed. (Note 1)

TST mode   The signal quality of the selected secondary stations is sequentially displayed in the S1 Display Area.

(10) $\boxed{+M}$ Key

    GRI mode
    (Master)   The tracking point of the master station signal is adjusted by plus ten microseconds. Thus, the time difference displayed for both secondary stations is reduced by ten microseconds.

    (Secondary 1)   The tracking point of the signal from secondary station 1 is adjusted by plus ten microseconds. Thus, the time difference displayed for secondary station 1 is increased by ten microseconds.

    (Secondary 2)   The tracking point of the signal from secondary station 2 is adjusted by plus ten microseconds. Thus, the time difference displayed for secondary station 2 is increased by ten microseconds.

    LOP mode   The current location (time difference) is stored in the instant memory. Each press of the key increases the instant memory number by one. The instant memory numbers are 90 to 99. After memory number 99 has been used, instant memory numbers restart from 90. Location information stored at number 90 will be replaced with new TD's.

    L/L mode   The current location (latitude/longitude) is stored in instant memory. Each press of the key increased the instant memory number by one. The instant memory numbers are 90 to 99. After memory number 99 has been used, instant memory numbers restart from 90. Location information stored at number 90 will be replaced with new lat/lon's.

NOTE 1: Refer to Special Computation of Latitude/Longitude.

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| CMP mode (Conversion) | When the stored location (time difference) is converted into latitude/longitude, the designated two-digit memory number (01 to 89) must be entered using the numeric keypad. |
| WP mode | The memory location (two-digit memory number from 01 to 89) for a waypoint, is stored in this mode. |

(11) $\boxed{\text{-/R}}$ Key

GRI mode (Master)	The tracking point of a Loran C signal from the master station is adjusted by minus ten microseconds. The time difference displayed for both secondary stations is thus increased by ten microseconds.
(Secondary 1)	The tracking point of the signal from the S1 secondary station is adjusted by minus ten microseconds. The displayed time difference for the S1 secondary station is thus decreased by ten microseconds.
(Secondary 2)	The tracking point of the signal from the S2 secondary station is adjusted by minus ten microseconds. The displayed time difference for the S2 secondary station is thus decreased by ten microseconds.
LOP mode	The locations stored in the instant memory (memory numbers 90 to 99) are recalled. Each key press decreases the instant memory number by one.
L/L mode	The locations stored in the instant memory (memory numbers 90 to 99) are recalled. Each key press decreases the instant memory number by one.
CMP mode (Conversion)	The stored time difference (TD) is recalled and is converted into latitude and longitude. To designate the stored TD, use a two-digit memory number from 01 to 99.
SET mode	When correcting the bearing of a waypoint by function 02, a negative correction value can be entered. The entered correction value is deducted from the current waypoint bearing. The SET mode function is indicated on the location/navigation display area. By pressing $\boxed{\text{+/M}}$ or $\boxed{\text{-/R}}$ key, the two-digit function codes will be circled through within the range of 01 to 09.
WP mode	By designating a two-digit memory number from 01 to 99, a stored location is recalled as a waypoint.

(12) |CLR| key

GRI mode

The audible alarm for off-course, waypoint arrival, or anchor watch is silenced. Loran C signal acquisition and tracking processes are restarted. An error, if any, during GRI entry is corrected.

LOP mode
and L/L mode

The audible alarm for off course, waypoint arrival, or anchor watch is silenced. Pressing this key after storing the current location into the instant memory resumes normal display of the Loran C signal. The location (waypoint) information entered into the instant memory is recalled, and the Loran C receiver is returned to normal display.

CMP mode
(Conversion)

After converting from time difference (TD) to latitide/longitude, the location/navigation display is cleared. Errors, if any, produced during the entry of TD for conversion is cleared.

SET mode

The latitude/longitude correction manually added to the latitude/longitude reading is cancelled. The correction of heading and bearing information is cancelled. Key-in error produced during correction entry is cleared. Key-in error produced during entry of latitude/longitude correction is cleared. The alarm limit of off-course, arrival, and anchor watch is set to zero (0), thereby inhibiting the audible alarm.

WP mode

A recalled destination is cleared and the location/navigation display is returned to the current designation data. Key-in error is cleared.

(13) |ENT| key

GRI mode

Pressing the |ENT| key completes GRI entry. By pressing the |ENT| key without pressing the numeric keys for a chain code, all 9's will be displayed.

CMP mode
(Conversion)

A time difference (TD) to be converted into latitude/longitude coordinates is entered. The conversion to latitude/longitude is initiated. Two waypoints are entered for computing the distance and bearing of an imaginary course. When the |ENT| key is pressed, a value is entered, and a correction is applied.

SET mode

Limit values and data are entered into each of six setting mode functions. When current position is known, lat/lon correction is entered.

WP mode	Completes the entry of a waypoint into the navigation course computer.
LOP mode or L/L mode	Pressing the ⌷1/N⌷ key, followed by pressing the ⌷ENT⌷ key resets the point of origin for navigation computation. Pressing the ⌷0⌷ key, followed by pressing the ⌷ENT⌷ key skips the waypoints to the next one.

(14) ⌷1/N⌷ key
The numeric value 1 is entered for waypoint data, SET mode, GRI correction, and memory number entry. Pressing the ⌷1/N⌷ key, followed by pressing the ⌷ENT⌷ key resets the point of origin for the computed course. Additionally, northern hemisphere is designated when entering latitude information.

(15) ⌷2/S⌷ key
The numeric value 2 is entered for waypoint data, SET mode, GRI correction, and memory number entry. Additionally, southern hemisphere is designated when entering latitude information.

(16) ⌷3/E⌷ key
The numeric value 3 is entered for waypoint data, SET mode, GRI correction, and memory number entry. Additionally, eastern hemisphere (easterly from Greenwich, England, from 0 degrees to 180 degrees) is designated when entering longitude information.

(17) ⌷4/W⌷ key
The numeric value 4 is entered for waypoint data, SET mode, GRI correction, and memory number entry. Additionally, western hemisphere (westerly from Greenwich, England, from 0 degrees to 180 degrees) is designated when entering longitude information.

(18) ⌷5⌷, ⌷6⌷, ⌷7⌷, ⌷8⌷, ⌷9⌷, and ⌷0⌷, keys
Numeric information corresponding to the respective keys is entered when entering navigation method computing, SET mode, GRI, corrections, and memory numbers.

(19) ⌷0⌷ key
In LOP or L/L mode, pressing the ⌷0⌋ key, followed by pressing the ⌷ENT⌷ key skips to the next waypoint.

1.2 Mark Display Position and Functions

1.2.1 MEMO and WP

a. MEMO

(1) The storage mark displayed under MEMO indicates whether the location/navigation display information is stored or recalled from memory.

(2)   The number under MEMO is the memory number for a destination
which is stored or recalled.

b.   WP

(1)   There are two marks (-) active in the WP mode.

(2)   The destination mark indicated above WP for a memory number
display denotes the memory display number has been entered as a
waypoint.

(3)   Mark 1, if any, above WP mode indicates that the WP mode is
selected.

(4)   The WP mode is used for memory entry, recall, and transfer of
memory information.

(5)   The waypoint is entered to compute navigation information.

(6)   Pressing the $\boxed{0}$ key, followed by pressing the $\boxed{\text{ENT}}$ key initiates
the anchor watch alarm.

(7)   The line of position (LOP) or latitude/longitude position of the
waypoint is displayed.

c.   MEMORY/WAYPOINT NUMBER

(1)   When a memory mark is displayed under MEMO, the memory number of
the waypoint being recalled, or being stored is indicated.

(2)   When a waypoint mark is displayed below MEMO, it indicates the
number of the current waypoint (waypoint in use).

(3)   When several waypoints are set, the waypoint which is currently
in use is indicated.

(4)   In SET mode, the SET function number is displayed.

(5)   In LOP or L/L mode, the instant memory number to be stored
appears when the $\boxed{\text{+/M}}$ key is presssed.

(6)   In LOP or L/L mode, pressing the $\boxed{\text{-/R}}$ key displays an instant
memory number which has already been stored.

1.2.2 Operation modes: Mark 1 set to particular mode

a.   GRI

(1)   A GRI (chain code) can be entered.

(2)   The secondary station is initially selected for TD display
between the secondary stations 1 and 2.

(3) Pressing the ⌷CLR⌷ key will restart Loran C signal acquisition.

(4) Cycle selection is active in this mode for all stations.

b. GRI (Master)

(1) The tracking point of the master station can be changed.

(2) The tracking point of the master station signal can be changed in ten microsecond step by pressing the ⌷0⌷ and ⌷+/M⌷ keys or the ⌷0⌷ and ⌷-/R⌷ keys.

(3) the secondary station is changeable using ⌷S1⌷ or ⌷S2⌷ keys.

c. GRI (Secondary 1)

(1) The secondary station 1 is selected, or its tracking point is changed.

(2) The secondary station can be changed by pressing ⌷S1⌷ key.

(3) The tracking point of the signal from secondary station 1 is changed in ten microsecond step by pressing the ⌷1/N⌷ and ⌷+/M⌷ keys or the ⌷1/N⌷ and ⌷-/R⌷ keys.

d. GRI (Secondary 2)

(1) The secondary station 2 is selected, or its tracking point is changed.

(2) The secondary station can be changed by pressing ⌷S2⌷ key.

(3) The tracking point of the signal from secondary station 2 is changed in ten microsecond step by pressing the ⌷2/S⌷ and ⌷+/M⌷ keys or the ⌷2/S⌷ and ⌷-/R⌷ keys.

e. LOP

(1) The current position is displayed in TD (time difference).

(2) Pressing the ⌷+/M⌷ key will store the current location LOP in the instant memory.

(3) Pressing the ⌷-/R⌷ key will recall the instant memory contents.

(4) Pressing the ⌷CLR⌷ key resumes normal display.

(5) The CPN function becomes active for entering LOP waypoints.

(6) The point of origin for navigation computing in the CPN mode can be read by pressing the ⌷1/N⌷ key followed by pressing the ENT key.

(7) The waypoint in use during navigation is changed to the next waypoint by pressing the $\boxed{0}$ key followed by the $\boxed{\text{ENT}}$ key.

f. L/L

(1) The current location is displayed in terms of latitude and longitude (degrees, minutes, and 1/100th minute).

(2) Pressing the $\boxed{+/M}$ key stores the curent location in instant memory.

(3) Pressing the $\boxed{-/R}$ key recalls the instant memory contents.

(4) Pressing the $\boxed{\text{CLR}}$ key resumes normal latitude/longitude mode display.

(5) The navigation computing (CPN) function becomes active for entering Lat/Lon waypoints.

(6) The point of origin for navigation computing can be renewed by pressing the $\boxed{1/N}$ key followed by pressing the $\boxed{\text{ENT}}$ key.

(7) The waypoint in use can be cycled sequentially to the next waypoint entered during a navigation by pressing the $\boxed{0}$ key followed by pressing the $\boxed{\text{ENT}}$ key.

g. WP

(1) The waypoint can be entered, and stored location data can be transferred in this mode.

(2) The waypoint can be entered in terms of time difference (TD) or latitude/longitude.

(3) A stored location can be entered as a waypoint.

(4) Information stored in the instant memory can be transferred to permanent memory.

h. SET

(1) Six functions are available.

(2) The function number is indicated in the memory number display area.

(3) Any of the six functions is selectable sequentially by pressing the $\boxed{+/M}$ or $\boxed{-/R}$ key.

(4) SET: 01.....setting of waypoint arrival alarm range.
The waypoint arrival alarm, and waypoint changeover distance when several waypoints have been entered, is set. Setting is available up to 9.9 nautical miles. Setting 0.0 nautical miles inhibits the waypoint arrival alarm and waypoint changeover action.

(5) SET: 02.....setting of anchor watch alarm range
The alarm range (radius) around the alarm point is set. **The**
anchor watch alarm sounds as soon as the vessel goes beyond the
alarm range. This function is activated by pressing the ⍿0⍰ key
and ⍿ENT⍰ key in this mode. Up to 9.9 nautical miles can be set.
Setting 0.0 nautical miles inhibits the anchor watch alarm.

(6) SET: 03.....setting of off-course alarm range (XTE Alarm).
When the vessel goes off-course by a specified distance, the
alarm will sound. Setting is available up to 9.9 nautical miles.
By setting 0.0 nautical miles, the off-course alarm (cross-track
error alarm) is inhibited.

(7) SET: 04.....speed averaging consant
The range of averaging constant values is from 1 to 5. The
default value is 2. The slower the vessel speed, the higher the
value required. It takes several minutes to obtain a correct
speed reading after the vessel speed has steadied.
Vessel course information is computed from the same information
that is used to compute vessel speed.

(8) SET: 05.....data output format
An output format for serial data is settable by entering one of
the following five numbers: 1 sets KODEN-717 format; 2 sets NMEA-
0182 format; 3 sets NMEA-0183 Number 1 type format; 8 sets
NMEA-0180 format; 9 sets NMEA-0183 Number 2 type format.

(9) SET: 06.....validating complementary lat/lon solution
Because of the hyperbolic (curving) nature of Loran lines plotted
on a chart, it is possible in some cases for one LOP to cross
another LOP at two different locations. Normally, the Loran unit
automatically selects the primary correct crossing point of the
two LOP's. The resulting conversion to Lat/Lon will provide a
correct, primary Lat/Lon position display. The user/operator
may, however, choose to display the second, or complementary,
solution. Pressing the ⍿1/N⍰ key followed by pressing the ⍿ENT⍰
key selects the automatic (default) computation. By pressing the
⍿0⍰ key followed by pressing the ⍿ENT⍰ key, the complementary
solution is displayed.

1. TST

(1) The signal status of the secondary stations S1 and S2 is dis-
played. The frequency deviation of the oscillator is indicated
for the navigation display (left). The S1 display is selected by the
S1 key -- the S2 display by the S2 key.

(2) For information on the interpretation of the display, refer to
"2.11 Displaying Signal Status and Frequency Deviation."

j. CMP

(1) Any of the five functions is selectable sequentially by pressing the
[SI] key.

01: The amount of compensation currently being applied to
LOP's is displayed in this mode. Compensation factors
may be added to, or subtracted from LOP's or
Latitude/Longitude conversions. Refer to "2.3
Correcting Current Location."

02: Bearing (heading STG) compensation is accomplished in
this mode. Refer to "2.9.5 a, Correcting Heading."

03: Compass auto/manual compensation is selected in this
mode. Pressing the [0] key, followed by pressing the [ENT]
key selects manual compensation. Pressing the [1] key
followed by pressing the [ENT] key selects automatic
compensation. When left-most digit is 1, correction
data is in memory. When left-most digit is 0, no
correction data has been entered into memory.

04: ASF (Additional Secondary Factors) auto/manual
correction is selected in this mode. By pressing the
[0] key, followed by pressing the [ENT] key, manual
correction is selected. Pressing the [1/N] key,
followed by pressing the [ENT] key selects automatic
correction. When the left-most digit is 1, correction
data has been entered into memory. When the left-most
digit is 0, no correction data has been entered. Refer
to section "2.4, Correction of Radio Wave Propagation."

05: CNV the time difference (TD) is converted to LAT/LONG.

k. CS ALARM

(1) Indicated by a blinking colon (:) in the CS column of displays of S1
display and S2 display, and navigation display in GRI, or TST modes.

(2) It is an indication that the cycle selection of the secondary
station signal is erroneous, and that the displayed time
difference (TD) is unreliable.

(3) The CS alarm can be cleared by moving the mode display bar over
TST, and back again to the tracking mode. Unless the signal
quality is then correct, the CS alarm will be displayed again.

(4) If the CS alarm persists, the fault may be signal interference
from the generator/alternator, poor antenna installation,
improper grounding of the system, or signal interference from the
TV set, fluorescent lamps, or wireless transmitter.

1.   S/N ALARM

(1)   An S/N alarm condition is indicated by a blinking colon (:) in the
      S/N column of S1 and S2 displays, and the navigation display in GRI,
      or TST modes.

(2)   An S/N alarm condition indicates that the Loran signal-to-noise
      ratio is not within a receivable range, and that the displayed
      time difference (TD) is unreliable.

(3)   An S/N alarm may persist when there is signal interference from
      an alternator/generator, poor system grounding, improper
      installation of the antenna, interference from a TV set, fluor-
      escent lamps, or wireless transmitter.

1.2.3 Navigation computing Function

a.   XTE

(1)   Cross track error indicates a deviation, either left or right,
      to get back to the computed course.

(2)   Course deviation, either right or left, is indicated, and
      distance off-course is displayed in tenths or hundredths of
      nautical miles.   Tenths of nautical miles are automatically
      selected when the alarm range is one nautical mile or more.
      Hundredths of nautical miles are automatically selected when the
      alarm range is 0.9 nautical miles, or less.

b.   SPD

(1)   The vessel speed is indicated by the four left-most digits of the
      navigation display.

(2)   The speed reading is not quick to respond.   At least three or
      four minutes are required after vessel speed has stabilized to
      get an accurate reading.

(3)   After changes in vessel speed, either faster or slower, about
      three or four minutes are required for an accurate speed reading.

(4)   The accuracy of the SPD reading is seriously affected by the
      lines of position (LOP) crossing angles, the lines of position
      (LOP) intervals, and any vessel speed or course changes.

(5)   As a general rule, the more rapidly the vessel intersects the
      lines of position (LOP), the greater the accuracy and stability
      of the SPD reading.

(6) SET mode number 04 displays the speed averaging factor value. The normal value is 2, but it may be set from 1 to 5.

(7) An increase in the speed averaging factor value means an increase in lag time.

(8) A decrease in the speed averaging factor value means a decrease in lag time.

(9) To stabilize the SPD reading, the speed averaging factor value must be increased.

c. STG

(1) The bearing, or steering direction, to the entered waypoint is indicated.

(2) Unless corrected in CMP mode (function 02), the bearing is displayed in terms of a true bearing.

(3) When the vessel is on the course, set it between the point of origin and the waypoint, the course deviation is displayed as 0:0. The navigation computing is always carried out with respect to the vessel's current location.

d. TIME

(1) The time elapsed since turning on the power is displayed on S2 display.

(2) It is reset by pressing the CLR key.

(3) In the CPN mode, TIME function becomes independent and is initiated by pressing ⬚ key to move mark 1 to Lop or L/L, and then by ⬚ key to move mark 3 to V/CMG position.
TIME is set in twenty-four hour format using the numeric keypad to enter the necessary six digits for: days; hours; minutes; folowed by pressing the ⬚ key.

e. HDG

(1) An average heading is displayed in degrees, on the right side of the navigation display area.

(2) The heading display is unstable when the cross angle of lines of position (LOP) is small, the lines of position are widely separated or the vessel speed is slow.

(3) When the vessel stops, the fluctuation of heading display increases. During a navigation, it takes two to four minutes for the heading display to stabilize.

(4) The same as the speed, the heading is computed from the location data.

(5) The same as the average speed, the velocity averaging factors affect the heading information.

(6) For heading, the destination cannot be entered.

f. TTG

(1) Indicates the time required for arriving at the predetermined destination when navigation at the current vessel speed and heading.

(2) The reading is in hours and minutes.

(3) The reading appears on the four digits of the navigation display.

(4) It takes about four minutes for the reading of required time to stabilize and be usable.

(5) When the vessel moors, the reading of TTG is 99:99 or maximum required time.

(6) When several waypoints are set, pressing the $\boxed{1/N}$ and $\boxed{ENT}$ keys changes over the required time to the next waypoint into the required time to the final waypoint.

g. DIST

(1) The distance between two points is displayed.

(2) The distance from the current location to a waypoint entered as a desired waypoint is displayed.

(3) With DIST function, reading appears on the four right digits of the navigation display area.

(4) At one nautical mile or less, the minimum resolution of reading is 0.01 nautical mile.
Example: three tenths of a nautical mile is indicated as 0.30.

(5) When several waypoints are set, pressing the $\boxed{1/N}$ and $\boxed{ENT}$ keys changes over the distance to the next waypoint into the distance to the final waypoint.

1.3 Alarm Types

1.3.1 Audible alarms

a. Waypoint arrival alarm

Intermittent audible sound is heard when getting near the way-
point set as a desired waypoint for navigation computing. The
alarm stops as soon as the vessel leaves the limit of predeter-
mined area.
The audible sound is stopped by pressing ⃞CLR⃞ key.
The alarm area radius is changeable by SET mode function 01 and
entering a value out of 0.1 to 9.9 nautical miles. Entering 0.0
inhibits the arrival alarm, thereby overriding the sound.

b. Anchor watch alarm

When an anchored vessel leaves a predetermined area, and inter-
mittent "pip" sound is developed. The anchor watch alarm is activated
by pressing ⃞0⃞ and ⃞ENT⃞ keys in this order in WP mode. Press
⃞CLR⃞ to silence the alarm. The alarm area radius is set at SET
mode function number 05. The radius of anchor watch alarm area
is settable between 0.1 and 9.9 nautical miles. To inhibit the
anchor watch alarm, select SET mode function 02, set the alarm
area radius to 0.0 nautical mile, and press the ⃞ENT⃞ key.

c. Cross track error alarm

A continuous sound is developed as soon as the cross track error
exceeds a predetermined value. This function warns the operator
of an abnormal off course status.
The limit of cross track error alarm is set at SET mode function
03.
The limit of cross track error alarm is set by keying in a value
within the range of 0.1 to 9.9 nautical miles and then ⃞ENT⃞ . An
alarm is stopped buy pressing ⃞CLR⃞ key. To override the cross
track error alarm, key in 0.0 as an alarm limit value.

Note: Once waypoints are entered, the waypoint alarm sounds for
        any entered waypoint. If such is undesirable, override
        this function.

1.3.2 Visible alarms

a. CS alarm CAUTION

The colon (:) visible under CS of location/navigation display indicates the current location computed and indicated according to Loran signal may not be correct.
When CS alarm is indicated for the master station or a secondary station, the tracking point of Loran C signal may be dubious. CS alarm can forcibly be reset by moving the mark 1 onto TST mode via [→] key and then resuming the tracking mode. Note that it does not remedy the problem but just stops the alarm display.

b. S/N alarm CAUTION

The colon under S/N on location/navigation method display is a signal-to-noise alarm notifying a faulty status of Loran signal. It show the received Loran signal is not intense enough to carry out tracking properly.
It is caused by operation beyond the receivable range, poor grounding, improper antenna position, alternator noise, wireless noise on band or many others.
S/N alarm cannot be reset manually. Its cause must be corrected or the secondary stations or GRI must be replaced with wave of higher intensity.
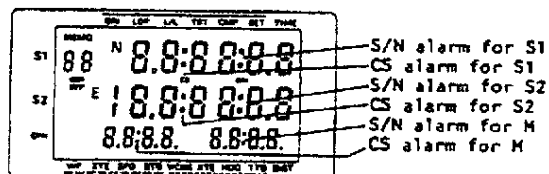
c. When colon decimal points blink (correction display)

Decimal points blink when current position correction, bearing correction, or compass correction has been entered (about every 12 seconds), and when automatic correction has been activated. It is indicated when lat/long is displayed.

d.   When middle digits (2 digits) blink on time difference display
      (blink signal display)

   Indicates an alarm (blink signal) is sent from the transmitting
   station of Loran C chain used.
   This alarm is usually sent when the transmission status of at
   least one station in the employed chain is problematic.
   When the received signal is not intense enough or because of
   noise, this alarm may be displayed erratically.
   When the time difference is indicated on the display, the third
   and fourth digits blink. When the latitude/longitude is dis-
   played, mark 1 blinks.
   When a blink signal is displayed, the alarm is reset by moving the
   mode display bar to TST position via either ⟶ key and then resuming
   LOP or L/L.

Colon (:) blinks indicating correction in progress.

Point blinks indicating correction
in progress.

Middle digits blink indicating blink
signal from transmitting station.
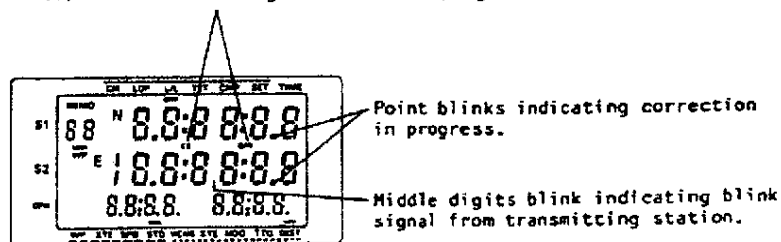
e.   When WP mark blinks

   Indicates the automatic waypoint changeover function is active
   with a schedule course entered. The automatic waypoint
   changeover is cancelled by entering a new waypoint.

f.   When MEMO mark blinks

   Indicates the information recalled from the memory is displayed.
   Immediately below MEMO, the destination memory number of displayed
   information is indicated by two digits.

g.   When MEMO mark is displayed

   The stored location is displayed and not the current location of
   your own vessel.

2. OPERATION PROCEDURE

2-1 Initial Setting

Loran C station chain and S1 and S2 secondaries are selected for acquiring Loran signal.

(1) Press the ON/OFF key to turn on the power.

(2) Press ⟶ key to move the mark 1 to Press the GRI.

(3) Press the ENT key to display the figure below.

Mark 1

(4) Press the numeric keys (0 – 9) to display a chain number (4 digits) to be used.

(5) If a number key is pressed incorrectly, press CLR key.

(6) Make sure the employed chain number is indicated on the navigation display, and then press the ENT key.

(7) When the desired time difference is indicated on the S1 display, press the S1 key.

(8) When the desired time difference is indicated on the S2 display, press S2 key.

CS mark for S1
Mark 1   S/N mark for S1

Time difference of S1

Time difference of S2

CS mark for S2
CS mark for M

GRI number

S/N mark for M
S/N mark for S2

Notes: 1. When the initial setting has been completed, make sure the displayed time difference is correct. If not correct, carry out an operation in "2.3.3 Correction in ten microsecond steps in terms of time difference".

2. Do not proceed to the next operation before CS mark disappears. Otherwise, a correct location may not be displayed.

a. To display current location LOP

(1) Press [→] key to move the mark 1 to LOP.

Mark 1

Time difference of S1

Time difference of S2

b.   To display current location L/L

(1)   Press [→] key to move the mark 1 to L/L.

Mark 1

N 35:38:32 — Latitude

E 139:06:52 — Longitude

99.9   999.9
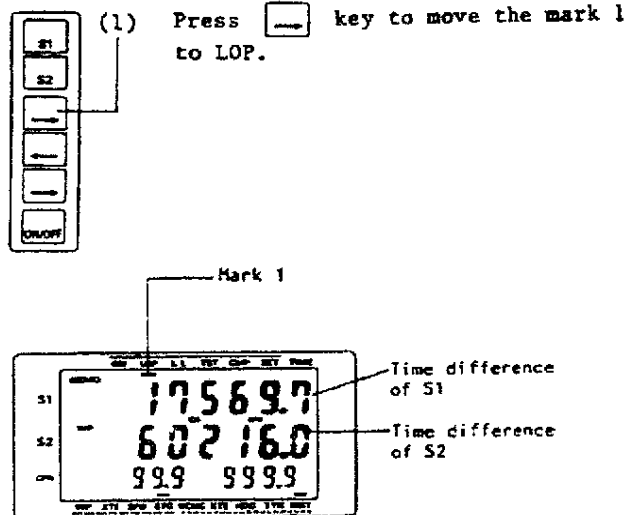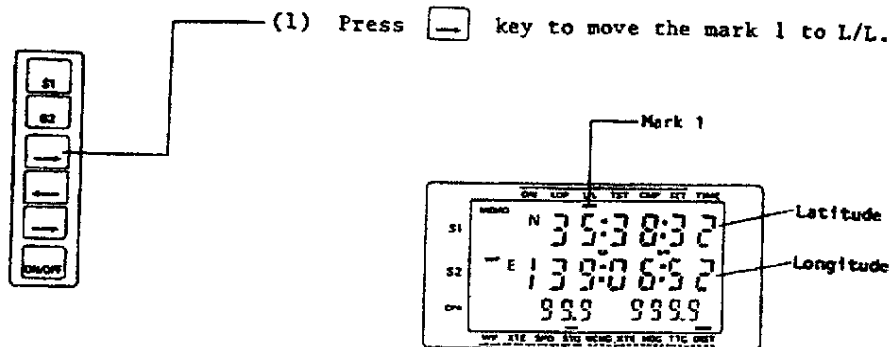
c.   Precautions when turning off power

(1)   Make sure the mark 1 is at LOP or L/L.

(2)   If not at said position, press [→]
key to move the mark 1 to the above location.

Mark 1

N 35:38:32 — Latitude

E 139:06:52 — Longitude

99.9   999.9

(3)   Pressing [ON/OFF] key for about 5 seconds
turns off the power.

Display disappears
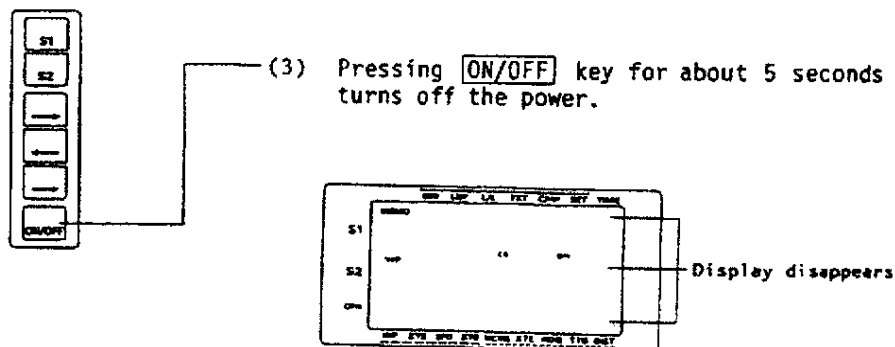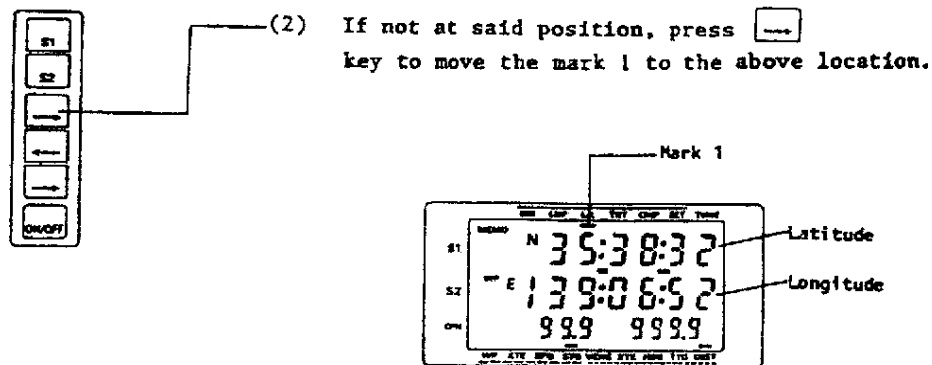
2.2 Usual Operation

This is for routine, day-to-day operation after once completing
"2.1 Initial Setting."

2.2.1 Precautions and operations when power is turned on

(1) Press the [ON/OFF] key to turn on the power.

(2) Make sure the mark 1 is at LOP or L/L as depicted below.
After the mark 1 stops blinking, a correct position is displayed.
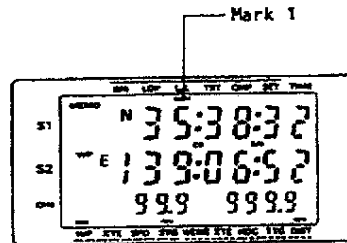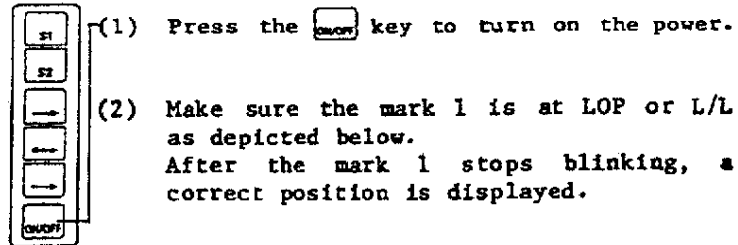
Mark 1

Note: 1. If the mark 1 is located at other than the position of
GRI neither CS mark nor S/N mark is dis-played and,
instead, mark 1 will blink.
Even if mark 1 blinks from time to time during
operation, the current location display remains cor-
rect. If blinking continues, an error may be produced.
Turning power off and then on may correct this
situation, however, if this occurs often, the cause
must be located and corrected.

Mark 1   CS mark   S/N mark
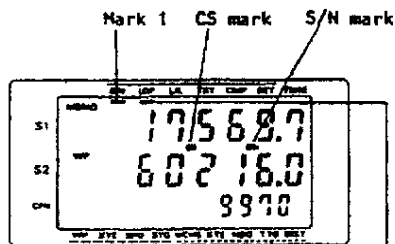
When mark 1 is displayed
within this range, CS
mark and S/N mark are
indicated.
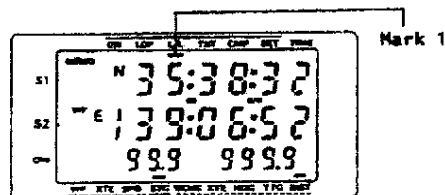
Mark 1

When mark 1 is within this
range, mark 1 blinks.

a.   Power-ON when mark 1 is not at LOP or L/L

(1) Press [—] key to move the mark 1 to GRI.

(2) Press the [CLR] key.

CS mark for S1

S/N mark for S1
CS mark for S2
S/N mark for S2

S/N mark for M
CS mark for M

(3) Make sure CS mark and S/N mark for master station and secondary stations 1 and 2 have gone off.

(4) Press [—] key to move the mark 1 to LOP or L/L.
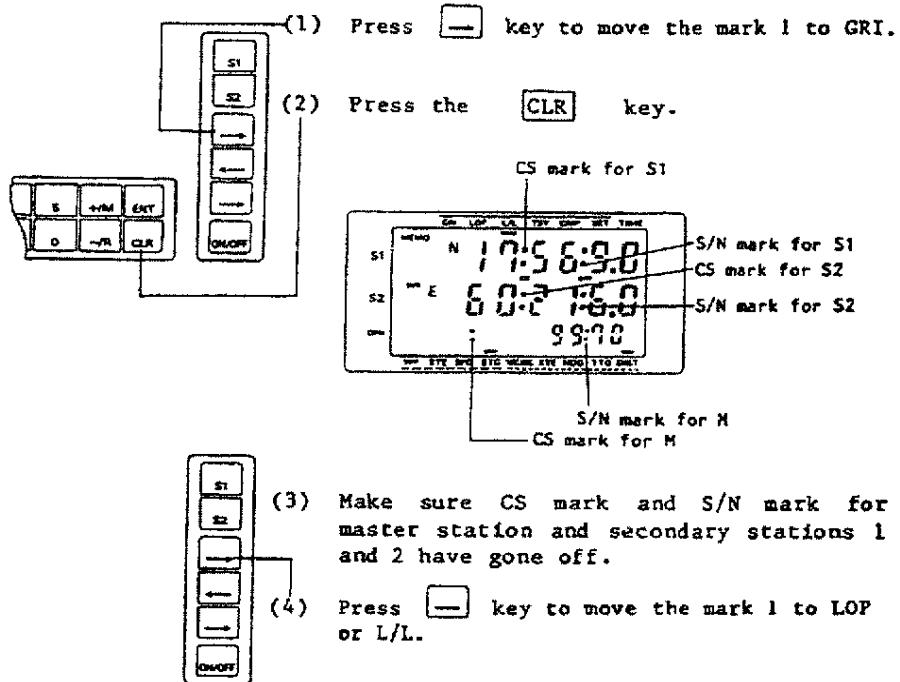
2.2.2 Changing display brightness

(1) Pressing [ON/OFF] key changes the display and keyboard brightness to bright or dark alternately.
When the surrounding is dark, the keyboard characters and marks are seen outstandingly. Thus, the operation in a dark place is easy.

Display and keyboard brightness is changed over.
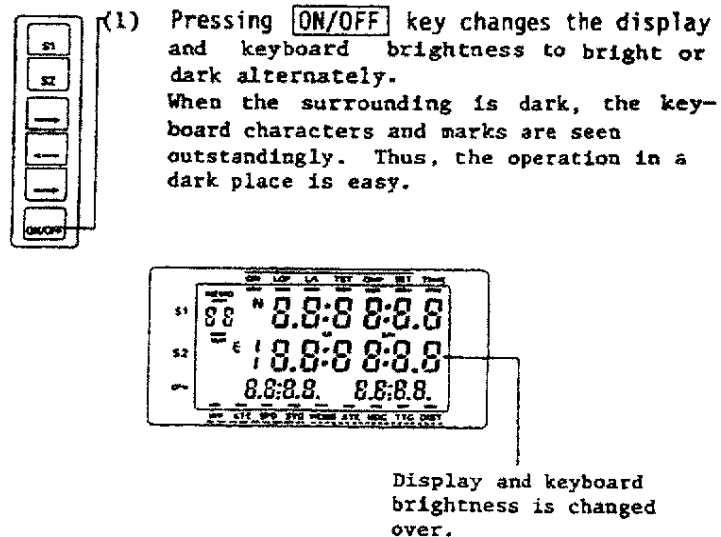
2.2.3 Precautions and operation when turning off power

Before turning off power, make sure the mark 1 is at LOP or L/L.

(1) Making sure the mark 1 is not at LOP nor L/L, press ⟨→⟩ key to move the mark 1 to LOP or L/L.

(2) Pressing the ⟨ON/OFF⟩ key for about 5 seconds turns off the power.
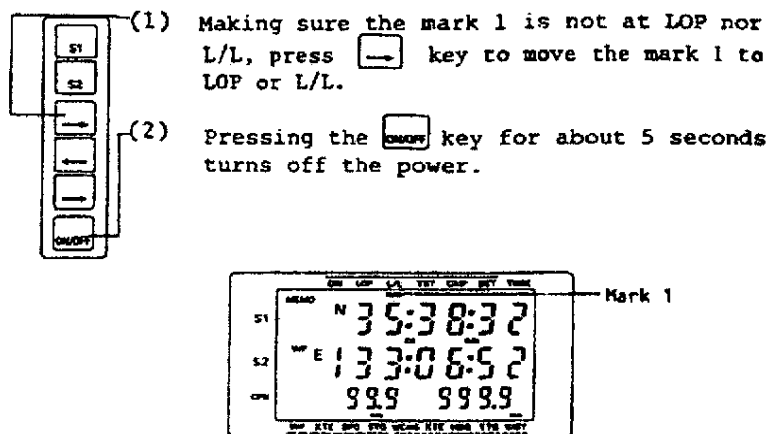
2.2.4 Changing secondary station

(1) Press ⟨→⟩ key to move the mark 1 to GRI.

(2) To change the secondary station 1, press the ⟨S1⟩ key and, as soon as the desired time difference of secondary station is displayed, press the ⟨S1⟩ key again.

(3) To change the secondary station 2, press the ⟨S2⟩ key and, as soon as the desired time difference of secondary station is displayed, press the ⟨S2⟩ key again.

Mark 1 CS mark S/H mark

Time difference of S1
Time difference of S2
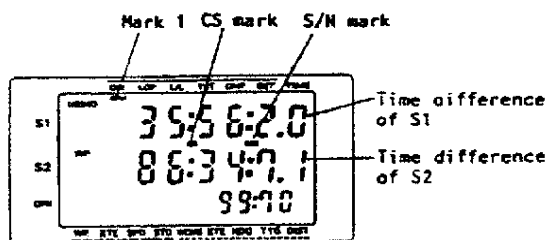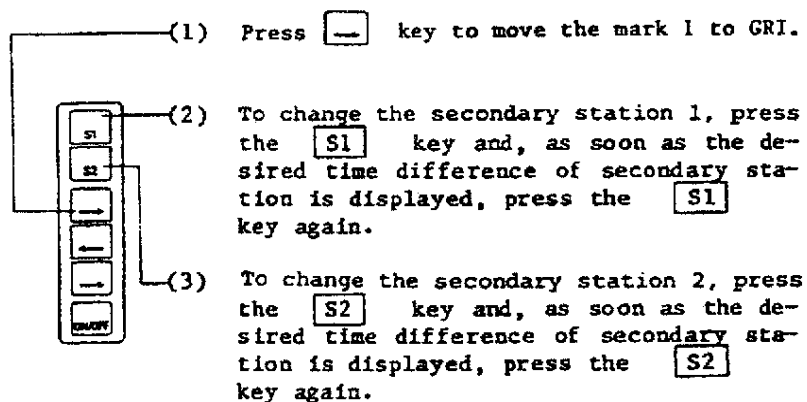
(4) Press ⬅ key to move the mark 1 to LOP or L/L.
The current location is displayed.

2.2.5 Changing the Loran C chain

During navigation, the vessel may enter another Loran C chain, and the location data may be incorrect. In such a case, Loran C chain must be altered by the following operation.

(1) Press ⬅ key to move the mark 1 to GRI.

(2) Press the [ENT] key to develop the display depicted below.

Mark 1

(3) Press numeric keys (0 - 9) to display a new Loran C chain number (4 digits).

(4) If a numeric key is pressed erratically, press the [CLR] key.

(5) After making sure of the displayed numerics, press the [ENT] key.
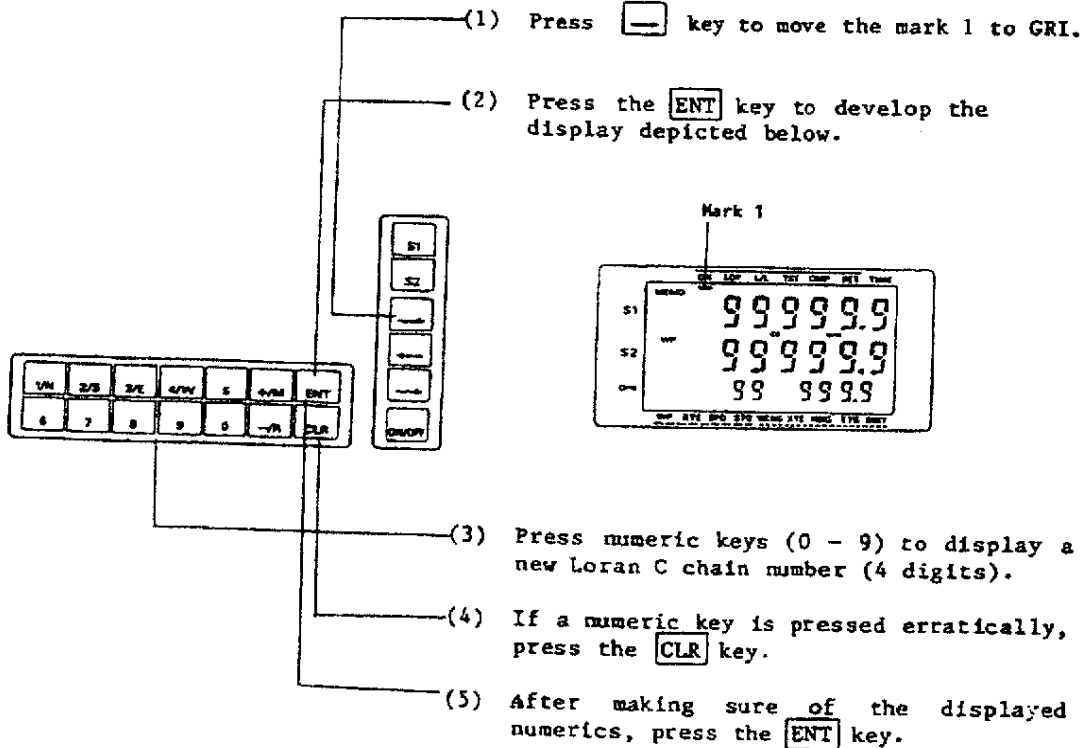
(6) Press the [S1] key when the desired time difference of secondary station 1 is displayed.

(7) Press the [S2] key when the desired time difference of secondary station 2 is displayed.
Settling ends when CS mark and S/N mark for master station and secondary stations 1 and 2 go off.

Mark 1   CS mark   S/N mark

Time difference of S1
Time difference of S2
Altered number
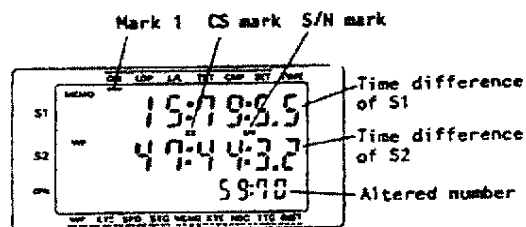
(8) Press [←] key to move the mark 1 to LOP or L/L.
The current location is displayed.

2.3 Correcting Current Location

2.3.1 Correction in terms of latitude and longitude

When the exact latitude and longitude of the current location are known, a correction is available by the following operation.

(1) Press ⟨→⟩ key to move the mark 1 to CMP.

(2) Press ⟨S1⟩ key continuously until 01 is displayed on the memory number column.

Develop <01>

Mark 1

(3) Press ⟨1/N⟩ or ⟨2/S⟩ key followed by numeric keys (0 – 9) to set a correct latitude (6 digits).

(4) Press ⟨3/E⟩ or ⟨4/W⟩ key followed by numeric keys (0 – 9) to set a correct longitude (6 or 7 digits).

(5) If a wrong number is keyed in, press the ⟨CLR⟩ key.

(6) After making sure of the displayed figures, press the ⟨ENT⟩ key. The correction is entered.

(7) Press ⟨→⟩ key to move the mark 1 to LOP or L/L. The current location is displayed.

a. How to interpret correction amount

Move the mark 1 to CMP and develop 01 on the memory number column.
The correction amount will be displayed as illustrated below.

Develop <01>

Corrected latitude
Corrected longitude

Correction amount (+0.32 min) of latitude (display when correction amount is positive)

Correction amount (+0.53 min) of longitude

Correction amount (-0.31 min) of longitude (display when correction amount is negative)

Correction amount (-0.53 min) of longitude

b. Clearing correction

(1) Press ⟶ key to move the mark 1 to CMP.

(2) Press S1 key continuously until 01 is displayed on the memory number column.

(3) By pressing the CLR key, the navigation display indicates as illustrated below, whereby the location correction is cleared.

Display <01>

Mark 1

Note: 1. The location correction is cleared also by "2.1 Initial setting".

2.3.2   Correction in terms of time difference
        (when correction range is 0.1 - +9.9 microseconds)
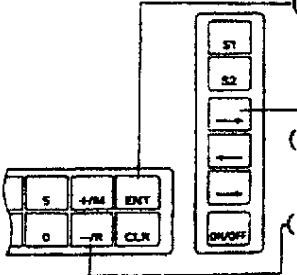
The following operation is for when the exact time difference of
the current location is known and the difference from the dis-
played time difference is 0.1 - 9.9 microseconds.
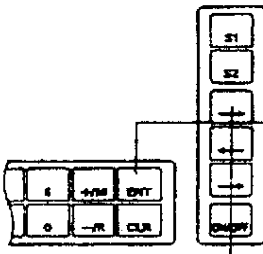
a. Correction of S1 time difference.

(1) Press [→] key to move the mark 1 to GRI.

(2) Press [1/N] and numeric keys (0-9) followed
     by [+/M] key when the correction amount is
     positive or [-/R] key when negative, to set
     the correction amount (2 digits) of time
     difference for secondary station 1.

(3) If a numeric key, [+/M] key or [-/R]
     key is pressed mistakenly, press the
     [CLR] key.

Mark 1

Time difference of S1

Correction amount (-0.2) of S1
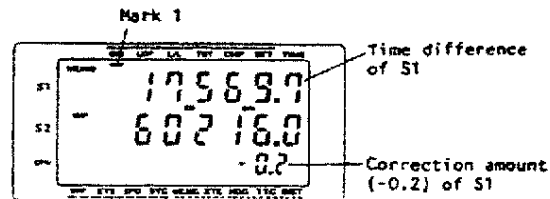
b. Correction of S2 time difference.

(4) After making sure of the correction amount for secondary station 1 indicated on the navigation display, press the ENT key.

(5) Press → key to move the mark 1 to GRI.

(6) Press 2/S and numeric keys (0 - 9) followed by +/M or -/R key to set the correction amount (2 digits) of time difference for secondary station.

(7) If a numeric key, +/M key or -/R key is pressed mistakenly, press the CLR key.

Mark 1
—Time difference of S2
—Correction amount (+0.3) of S2

(8) After making sure of the correction amount for secondary station 2 indicated on the navigation method display, press the ENT key.

(9) Press → key to move the mark 1 to LOP or L/L.

a. Clearing correction

(1) Press ⟨→⟩ key to move the mark 1 to GRI
    Press ⟨1/N⟩ key to clear secondary station 1.
    Press ⟨2/S⟩ key to clear secondary station 2.

(2) Press ⟨0⟩ key.

(3) Press the ⟨ENT⟩ key.

Mark 1
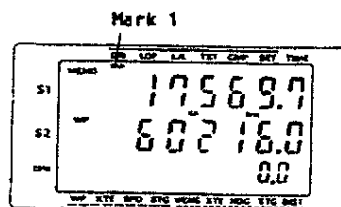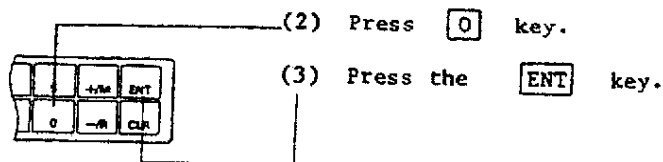
NOTE: ALL CORRECTION IS CLEARED WHENEVER THE GRI IS ENTERED BY
THE INITIAL SETTING PROCEDURE.

2.3.3   Manual assist for cycle selection   (See Note B).

On the border of the service area or when affected by surrounding
noise, the time difference displayed may be off in increments of
ten microseconds. It tends to occur when the transmitting sta-
tion is distant.
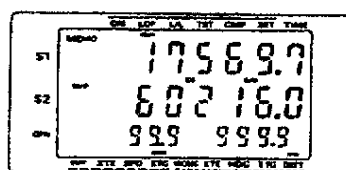
Typical time difference display

Time difference
(17569.7 µsec) of S1

Time difference
(60216.0 µsec) of S2
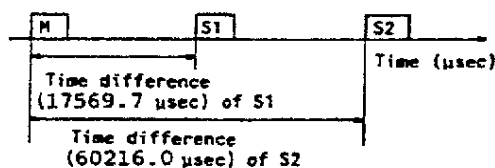
Time difference of master station and
secondary stations and acquiring position

The LOP display is different between acquisition errors of the master station and secondarys. A skill is required for judging which acquisition position to correct.
Generally, when receiving three stations, the master station and secondary stations 1 and 2, at least one station has a strong signal and is acquired correctly.
With this assumption, a station having an acquisition error is judged in the following manner.

a.   When either secondary station 1 or 2 has acquisition error:

The secondary station having an acquisition error gives a wrong time difference.

b.   When both secondary stations 1 and 2 have acquisition error

Both secondary stations give a wrong time difference

c.   When master station has acquisition error

The time difference displayed for both secondary stations is off by the acquisition error of the master station.

d.   When master station and secondary stations 1 or 2 have acquisition error:

The time difference is displayed as if the secondary station suffering from an acquisition error were normal or have less error. The time difference is displayed as if the secondary station free from error had an acquisition error.

Carry out the following correcting operation after judging which of the four conditions is causing the error.

(1)   As illustrated below, the acquisition position of master or secondary station is moved rightward in ten microsecond steps.

(2)   As illustrated below, the acquisition position of master or secondary station is moved leftward in ten microsecond steps.

(3)   The mark 1 display position is moved.

CS mark for S1

Set Mark 1 to GRI

CS mark for M

Time difference of S1

Time difference of S2

Note: 1. To move acquisition position of master station
................Set mark 1 to GRI, and then press ⎣0⎦ and
⎣+/M⎦ or ⎣-/R⎦ key
To move acquisition position of secondary station 1
................Set mark 1 to GRI, and then press ⎣1/N⎦ and
⎣+/M⎦ or ⎣-/R⎦ key
To move acquisition position of secondary station 2
................Set mark 1 to GRI, and then press ⎣2/S⎦ and
⎣+/M⎦ or ⎣-/R⎦ key

a.   When either seondary station 1 or 2 has acquisition error:

(1)   Press ⎣→⎦ key to align the mark 1 to GRI erroneous secondary the station.
S1 .... when secondary station 1 has
acquisition error, press ⎣1/N⎦ key.
S2 .... when secondary station 2 has
acquisition error, press ⎣2/S⎦ key.

(2)   Press ⎣+/M⎦ or ⎣-/R⎦ key repeatedly until the displayed. time difference is correct. Every pressing moves ten micro-seconds.

(3)   Press ⎣→⎦ key to move the mark 1 to LOP or L/L.

Note: 2. Under a receiving status where this correction is required, the column may continue to blink. Disregard it and pursue the operation.

b. When both secondary stations 1 and 2 have acquisition error

(1) Press ⟦—⟧ key to move the mark 1 to GRI.

(2) Press ⟦1/N⟧ and ⟦+/M⟧ or ⟦-/R⟧ key repeatedly until the displayed time difference for secondary station 1 is correct. Every pressing moves ten microseconds.

(3) Press ⟦S1⟧ or ⟦S2⟧ key to return to original GRI display.

(4) Press ⟦1/N⟧ and then ⟦+/M⟧ or ⟦-/R⟧ key repeatedly until the displayed time difference for secondary station 1 is correct. Every pressing moves ten microseconds.

> Note 3: Under a receiving status where this correction is required, the CS and S/N marks may continue to blink. Disregard it and pursue the operation.

c. When master station has acquisition error

(1) Press ⟦—⟧ key to move the mark 1 to GRI.

(2) Press ⟦1/N⟧ and then ⟦+/M⟧ or ⟦-/R⟧ key repeatedly until the displayed time difference for master station is correct. Every pressing moves ten microseconds.

> Note: 4. ⟦+/M⟧ key ... when displayed time difference is greater than correct value.
> ⟦-/R⟧ key ... when displayed time difference is smaller than correct value.

(3) Press ⟦—⟧ key to move the mark 1 to LOP or L/L.

> Note: 5. Under a receiving status where this correction is required, the CS and S/N marks may continue to blink. Disregard it and pursue the operation.

d. When both master station and secondary station 1 (or 2) have acquisition error

(1) Press ⟦—⟧ key to move the mark 1 to GRI.

(2) Press ⟦1/N⟧ and then ⟦+/M⟧ or ⟦-/R⟧ key repeatedly until the displayed time difference for secondary station not suffering the acquisition error is correct. Every pressing moves ten microseconds.

Note: 6. $\boxed{\text{+/M}}$ key ... when displayed time difference is greater then correct value.

   $\boxed{\text{-/R}}$ key ... when displayed time difference is smaller than correct value.

(3) Press $\boxed{\text{1/N}}$ for secondary station 1 or $\boxed{\text{2/S}}$ for secondary station 2 and $\boxed{\text{+/M}}$ or $\boxed{\text{-/R}}$ key repeatedly until the displayed time difference for secondary station set in (3) is correct. Every pressing moves ten microseconds.

(4) Press $\boxed{\rightarrow}$ key to move the mark 1 to LOP or L/L.

   Note: 7. Under receiving status where this correction is required, the mark 1 may continue to blink. Disregard it and pursue the operation.

   Note: 8. CAUTION IS REQUIRED WHEN USING MANUAL ASSISTED CYCLE SELECTION.
   Under certain conditions of high level noise and very weak loran signals, the unit may never obtain complete cycle selection and setting. However, when the TIME DIFFERENCE numbers become very stable and not fluctuating, move the Mode Mark 1 to the TST position and observe the signal strength. Refer to Section 2.11 for signal status display.

   Note: 9. When multiple correction among master, $\boxed{\text{S1}}$ and $\boxed{\text{S2}}$ are required, press S1 key between corrective operation to return to normal GRI display status.

2.4 Correction of Radio Wave Propagation (ASF)

Some error may be produced between the time difference on the chart and that displayed on the receiver.
One reason for it is that the time difference displayed on the receiver is slightly longer than the time difference on the chart by the amount corresponding to the propagation on land from the terrestrial transmitting station. The correction for the delay in time difference due to this propagation on land is referred to as a radio wave propagation correction (ASF).
This correction is either automatic or manual ("2.3.2 Correction in terms of time difference").

The operation procedure for automatic correction is as follows.

(1) Press ⬜→ key to move the mark 1 to CMP.

(2) Press ⬜S1 or ⬜S2 key repeatedly until 04 is displayed on the memory number column.

(3) Press ⬜0 key.

(4) Press the ⬜ENT key.
Automatic correction is actuated
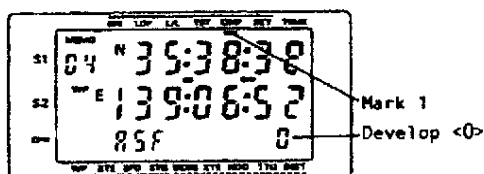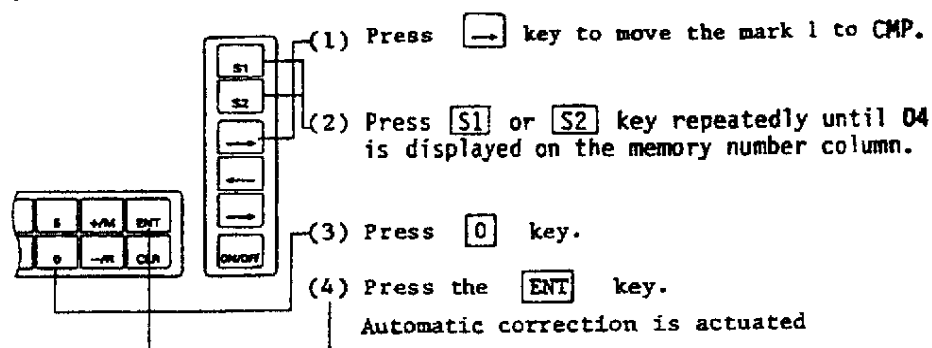
(5) Press ⬜— key to move the mark 1 to LOP or L/L. The corrected position is displayed.

Note: 1   In this correction mode, ASF is displayed in the left side navigation display.

a. Display during automatic ASF correction mode.

When mark 1 is at <LOP>
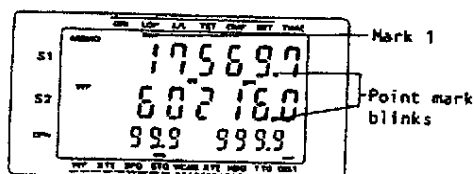
When mark 1 is at <L/L>
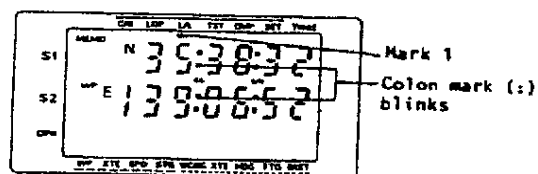
Note: 1. About one minute thirty seconds after the step (3) of automatic correction, blinking starts and, every twelve seconds, the point or colon (:) blinks.

b. Operation procedure for manual ASF operation

(1) Press [→] key to move the mark 1 to CMP.

(2) Press [S1] or [S2] key repeatedly until 04 is displayed on the memory number column.

(3) Enter ASF correction value (-9.9 to +9.9) through numeral keys.

(4) If the value is negative, press [-/R] and then [ENT] keys.
If positive, press [ENT] key.

Display <04>

(5) Press [→] key to move the mark 1 to LOP or L/L.
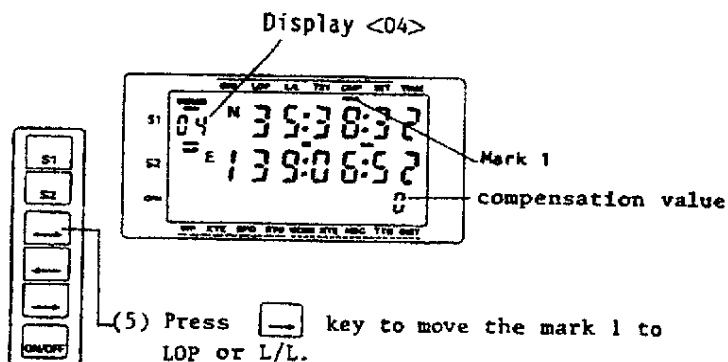
Note: 2. The correction is also cleared by "2.1 Initial setting".

2.5 Complementary Latitude/Longitude Solution

Each group of loran C stations is located geographically to provide the best coverage within a certain area. When the loran C unit is used outside of the normal coverage area, a special computation is required. This is named a "COMPLEMENTARY SOLUTION". This special computation can be selected either manually or automatically using the following procedure.
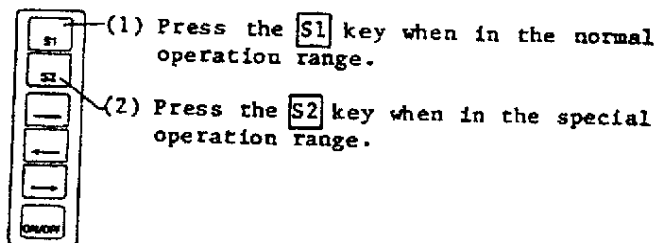

Latitude and longitude display
in special operation range
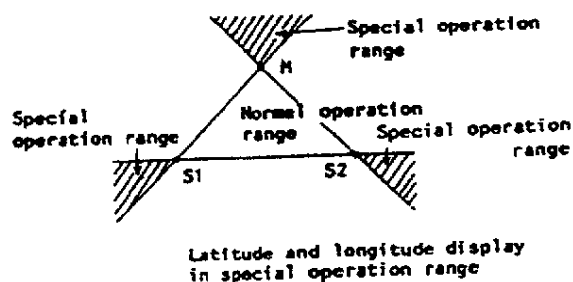
a. Manual selection and automatic selection

(1) Press ⟶ key to move the mark 1 to SET.

(2) Press +/M or -/R key repeatedly until 04 is displayed on the memory number column.

(3) For manual selection ..... press 0 key.
For automatic selection ... press 1/N key.

Display <06>

0 or 1 digit indicates the selected mode.

(4) After making sure of the number in-
dicated on the navigation display,
press the [ENT] key.

(5) Press [—] key to move the mark 1 to LOP
or L/L.
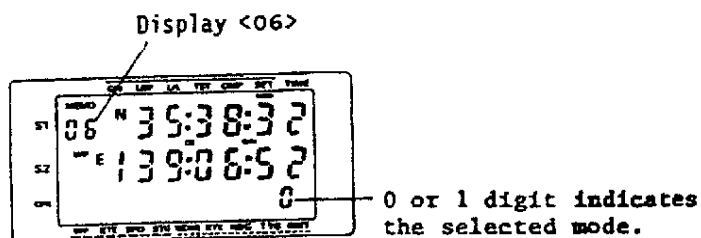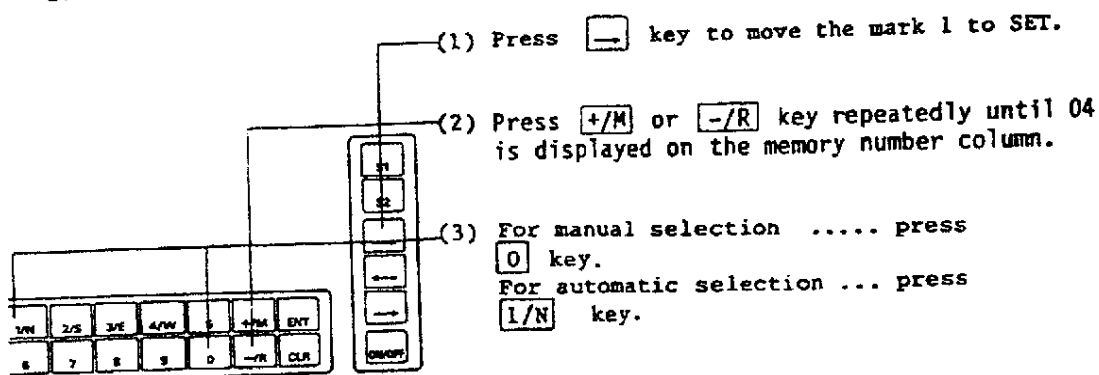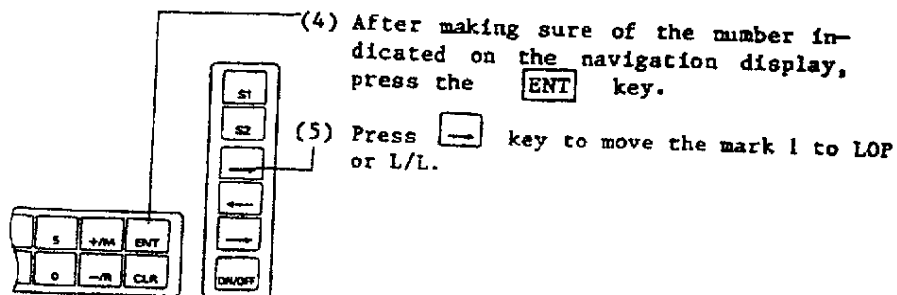
b. Typical display of manually selected position.

(1) Press the [S1] key when in the normal
operation range.

(2) Press the [S2] key when in the special
operation range.

Mark 1
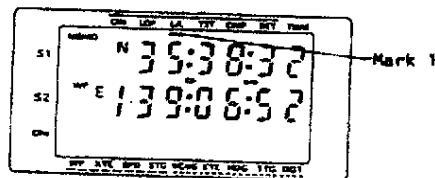
NOTE: Using this operation is not normally required except when the
loran C unit is used in or near the area requiring special
computation. Some knowledge of the local area of operation
is helpful to determine this selection and the true Latitude/
Longitude position. When the displayed Lat-Lon is obviously
not correct, press [S1] or [S2] key to obtain the correct readout.

2.6 Instant Memory and Recall

The current position can be stored, and the stored position can be recalled.

Notes: 1. When it is attempted to store eleven or more points, the oldest points are erased so that the ten most recently entered points are stored at all times. Store a position to be saved by transferring it to the permanent memory. (See "2.7.3 Changing number from instant memory to permanent memory."

2. The ten locations stored in instant memory are retained even when the power is turned off.

2.6.1 Operation of instant memory

As current location data, any time difference and latitude/longitude can be stored in the instant memory.

(1) Press [→] key to move the mark 1 to LOP or L/L. (See Note 3.)

(2) Pressing [+/M] key displays an instant memory number (90 — 99) and memory mark. (See Note 3.)

Memory mark
Instant memory number

Mark 1

(3) Pressing the [CLR] key stores the current location and resumes the normal navigation display.

See note 4.
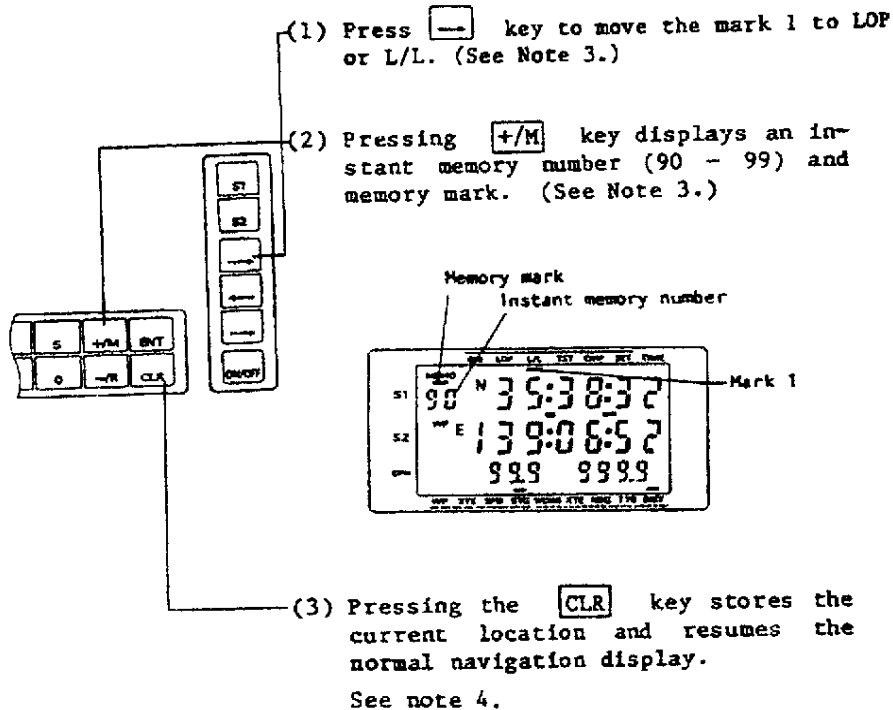
Notes: 1. To store the current location again, repeat the steps (2) and (3).

2. The time difference is stored when the time difference is being displayed, or the latitude and longitude are stored when the latitude and longitude are being displayed.

3. The instant memory number starts at 90, which is increased to 91 and 92 at every storage. 99 is followed by 90, whereby the contents of previous 90 are lost.

4, Repeating the step (2) only does not renew the instant memory number.
A renewal is made sequentially by repeating (2) and (3).

2.6.2 Recalling location stored in instant memory

a. Sequentially recalling instant memory numbers

(1) Press [—] key to move the mark 1 to LOP or L/L.

(2) Press [-/R] key repeatedly until a desired instant memory number is displayed.
The memory mark blinks.
Every pressing of [-/R] key sequentially recalls the numbers.

Memory mark blinks
Instant memory number

Mark 1

(3) Pressing the [CLR] key resumes the normal navigation display.

— 40 —
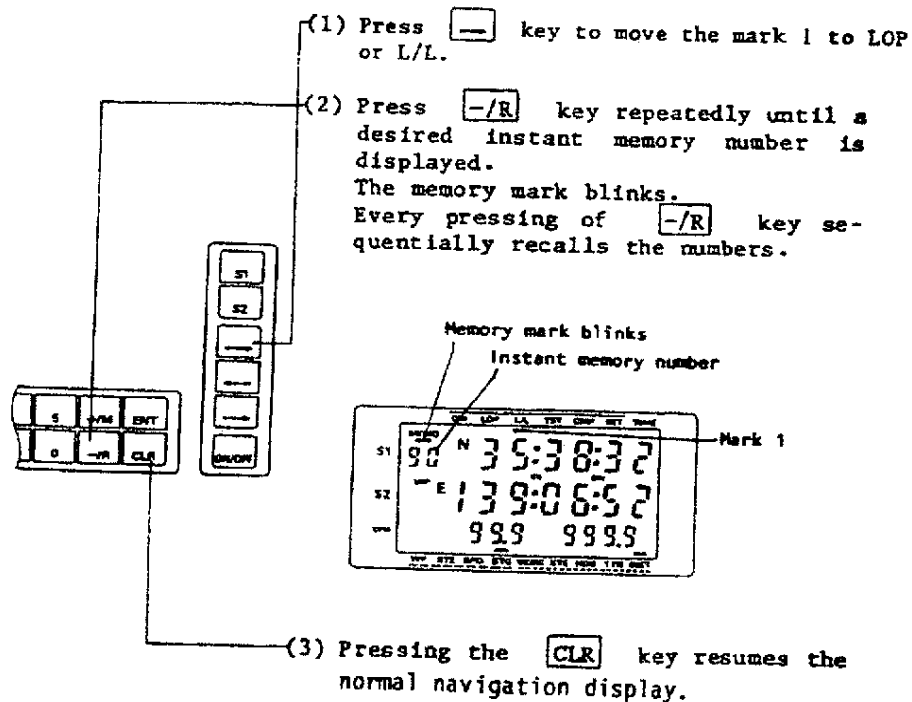
b. Recalling designated instant memory number

(1) Press [→] key to move the mark 2 to WP. (See left figure.)

(2) Press [-/R] key.

(3) Press numeric keys (0-9) to select the instant memory number (90-99) to be recalled. The memory mark will blink. (See right figure.)

(4) Pressing the [CLR] key resumes the destination display.

Memory mark blinks

Instant memory number

Mark 2
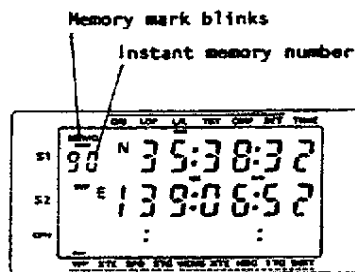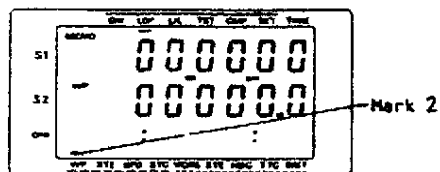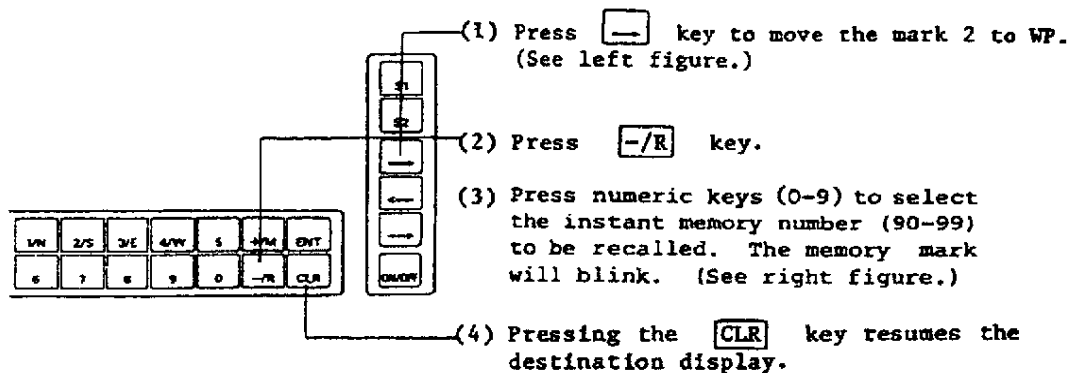
2.7 Storing and Recalling Location or Waypoints

A desired location can be stored, and the stored location can be recalled. Up to eighty-nine destinations or other locations can be stored.

NOTE: The stored 89 locations are retained in memory even when the power is turned off.

2.7.1 Storing location

a. Storing in terms of time difference

(1) Press ⌊—⌋ key to move the mark 1 to LOP.

Mark 1

Mark 2

(2) Press ⌊—⌋ key to move the mark 2 to WP.

(3) Press the numeric keys (0 – 9) to set the time difference (6 digits each for secondary stations 1 and 2).

(4) If a numeric key is pressed incorrectly, press the [CLR] key.

(5) After making sure of the number in-
dicated on the navigation display,
press +/M key.

(6) Press two numeric keys (0 - 9) to
set the memory number (01 - 89).
The memory mark is displayed.

Memory mark
Memory number

Mark 1

Mark 2

(7) Press the CLR key. The display
at (2) is resumed. To store add-
itional waypoints, repeat steps
(3) through (7).

b. Storing in terms of latitude and longitude

(1) Press → key to move the mark 1 to L/L.

Mark 1

(2) Press [←] key to move the mark 2 to WP.

(3) Following [1/N] or [2/S] key, press the numeric keys (0 - 9) to set the latitude (6 digits).

(4) Following [3/E] or [4/W] key, press the numeric keys (0 - 9) to set the longitude (up to 7 digits).

(5) If a key is pressed erroneously, press the [CLR] key.

(6) After making sure of the number indicated on the navigation display, press [+/M] key.

(7) Press two numeric keys (0 - 9) to set the memory number (01 - 89). The memory mark is displayed.

Memory mark
Memory number

Mark 2

(8) Press the [CLR] key. The display at (2) is resumed. To store additional waypoints, repeat steps (3) through (8).

2.7.2 Recalling stored location

(1) Press [←] key to move the mark 2 to WP.

(2) Press [−/R] key.

(3) Press two numeric keys to set a memory number (01 − 89) to be recalled.
The memory mark is displayed.
To recall another memory number successively, repeat setting of the memory number.

Memory mark blinks
Memory number
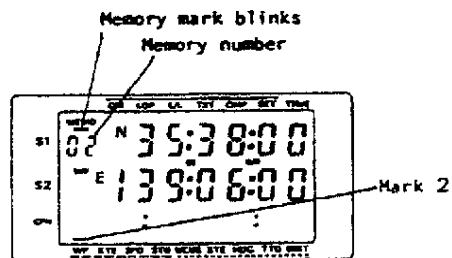
Mark 2

(4) Press [—] key to move the mark 1 to LOP or L/L. Then the usual navigation display is resumed.

a. Using recalled location as destination waypoint

Press ⊡ key to move the mark 2 to WP.

(1) Press the $\boxed{-/R}$ key. Press two
numeric keys to set the memory
numbers (01 to 89)

(2) Press the $\boxed{ENT}$ key.
The memory mark goes off, and the
destination mark and destination
memory number are displayed.

(3) Press $\boxed{-}$ key to move the mark 1 to LOP
or L/L.

(4) Press $\boxed{-}$ or $\boxed{-}$ key to select the
navigation display to be used.

Waypoint mark

Waypoint memory number

Navigation Display

Mark 2   Mark 3
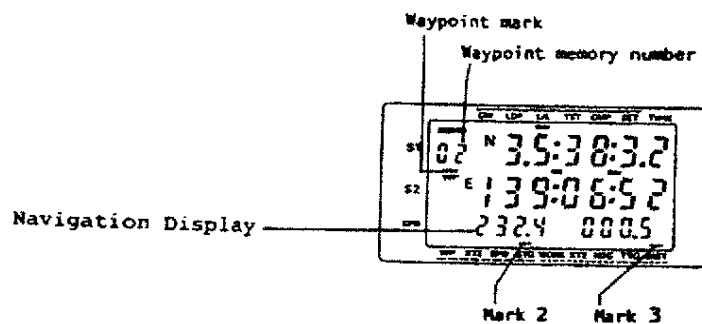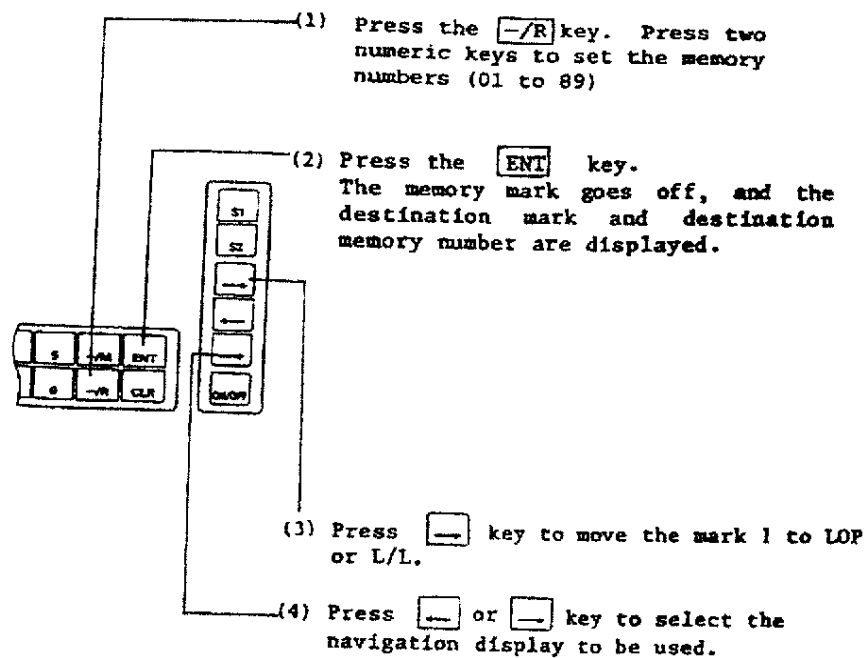
b. Transferring a recalled location into another memory number

Press [←] key to move the mark 2 to WP.

(1) Press the [-/R] key
Press two numeric keys to set
the memory number

(3) Press [+/M] key.
The memory number and memory mark go
off.

(4) Press the numeric keys (0 - 9) to
set a new memory number (01 - 99).
The memory number and memory mark
are displayed.

Memory mark

New memory number

(5) Press [→] key to align with LOP or L/L.
Then the usual navigation display is
resumed.
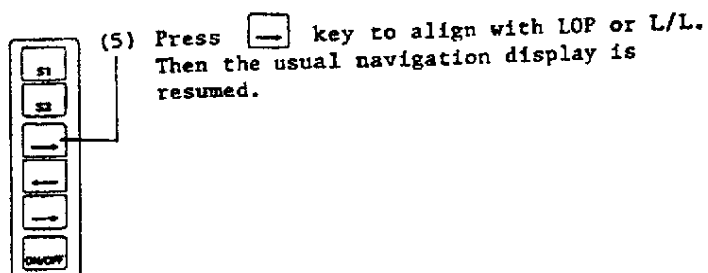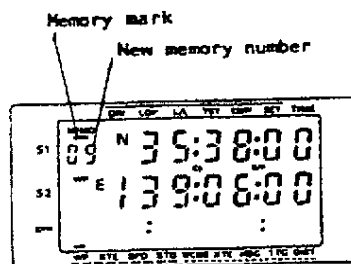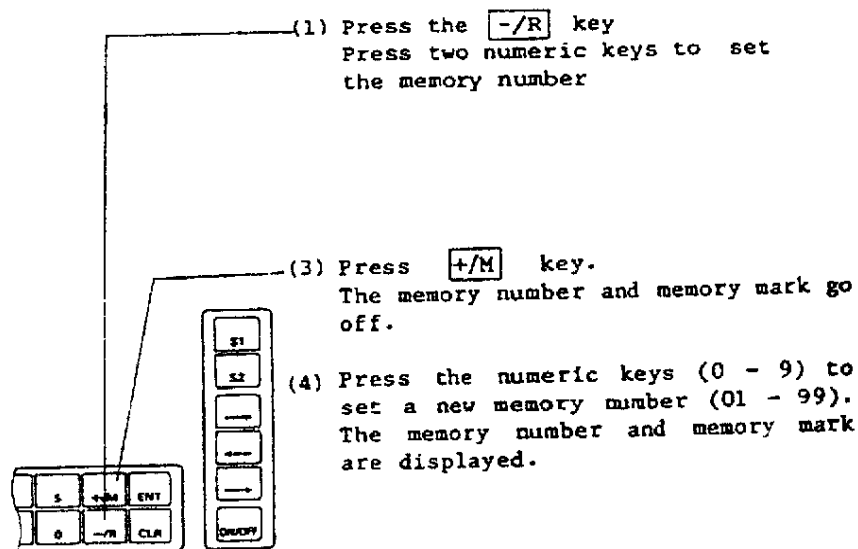
2.8 Setting Waypoint

A destination is set for navigation display. Either a desired waypoint is set, or a stored location is recalled and set.

2.8.1 Setting waypoint of desired location

a. Direct entry of LOP Waypoint

(1) Press ⟨—⟩ key to move the mark 1 to LOP.

(2) Press ⟨←⟩ key to move the mark 2 to WP.

(3) Press the numeric keys (0 - 9) to set the time difference (6 digits each for secondary S1 and S2) of waypoint.

(4) If a wrong numeric key is pressed, press the [CLR] key.

(5) After making sure of the number indicated on the display, press the [ENT] key.
The waypoint mark is displayed.

Waypint mark

Waypoint number is not displayed unless waypoint is recalled from memory.

Align mark 1 with <LOP>, and then mark 2 with <WP>

(6) Press [—] key to move the mark 1 to LOP or L/L.

(7) Press [←] or [→] key to select the navigation display to be used.

Mark 1
Mark 2   Mark 3

b.   Direct entry of Latitude/Longitude Waypoint

(1) Press [→] key to move the mark 1 to L/L.

(2) Press [←] key to move the mark 2 to WP.

(3) Press [1/N] or [2/S] key followed by numeric keys (0 - 9) to set the latitude (6 digits) of waypoint.

(4) Press [3/E] or [4/W] key followed by numeric keys (0 - 9) to set the longitude (7 digits) of waypoint.

(5) If a key is pressed incorrectly, press the [CLR] key.

(6) After making sure of the number indicated on the display, press the [ENT] key.
The waypoint mark is displayed.

NOTE: LATITUDE IS DESIGNATED 1/N NORTH OF THE EQUATOR, 2/S SOUTH OF THE EQUATOR.   LONGITUDE IS DESIGNATED 3/E EAST FOR ALL LONGITUDE 0-180 DEGREES EAST OF GREENWICH, ENGLAND, AND 4/W WEST FOR ALL LONGITUDE 0-180 DEGREES WEST OF GREENWICH, ENGLAND.

Waypoint mark

Align mark 1
with <L/L>,
and then mark 2
with <WP>

(7) Press [→] key to move the mark 1 to L/L.

(8) Press [←] or [→] key to select the navigation display to be used.

Mark 1

Mark 2   Mark 3
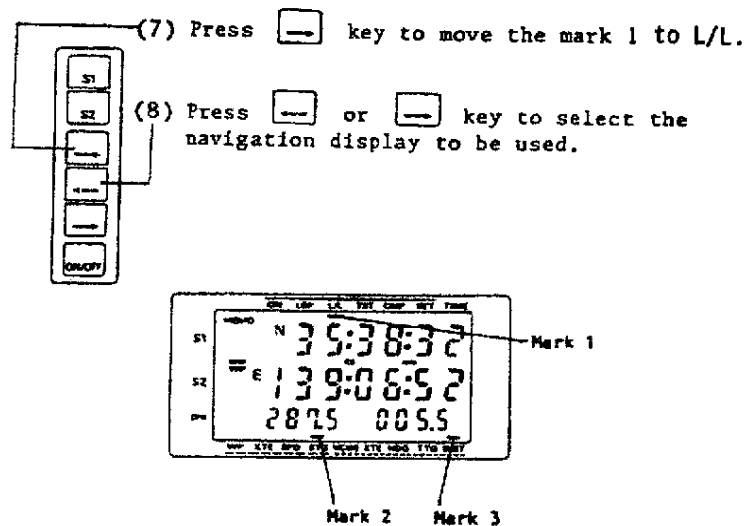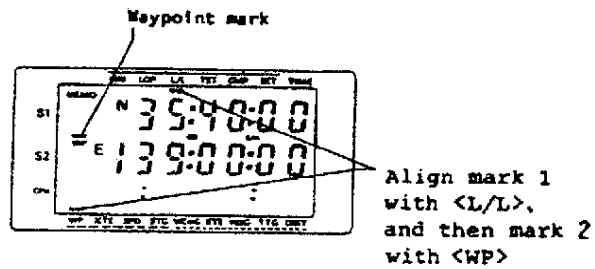
c. Clearing waypoint setting

Pressing the [CLR] key after the steps (1) and (2) above clears the waypoint and indicates all 0's on the display.

2.8.2 Enter Waypoints stored in instant memory

(1) Press [←] key to move the mark 2 to WP.

(2) Press [-/R] key.

(3) Press the numeric keys (0 –9) to set a memory number (91 – 99) to be re-called.
The memory mark is displayed.

The memory mark blinks
Memory number

Entered waypoint
number is displayed

Mark 2
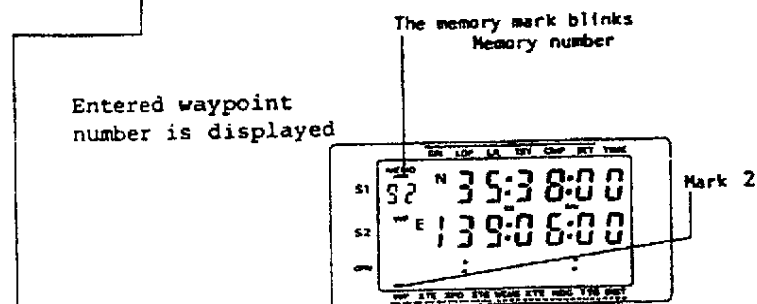
(4) Press [ENT] key.
The memory mark goes off. The mark and memory mark of the waypoint are displayed.

(5) Press the [—] key to move the mark 1 to LOP or L/L position.

(6) Press [←] or [→] key to select the navigation display to be used.
used.

WP mark

Mark 1

Mark 2   Mark 3
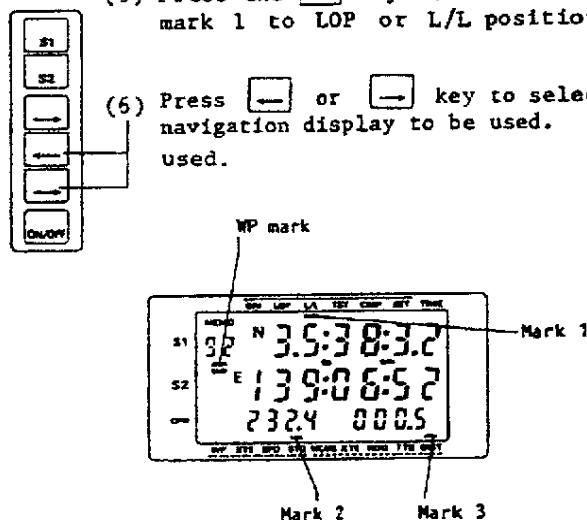
Steering and Distance
are selected.

2.8.3 Setting of two or more waypoints

Up to 10 waypoints can be preset. If two or more points are preset, changeover from one waypoint to another is automatically accomplished, and the total navigation distance to the final waypoint can be displayed.

(1) Press [→] key to move the mark 1 to LOP or L/L.

(2) Press [←] key to move the mark 2 to WP.

(3) Press the [-/R] key.

(4) Press the numeral keys (0 – 9) for the memory number (01 – 99) of the first waypoint.
The "MEMO" indicator bar blinks.
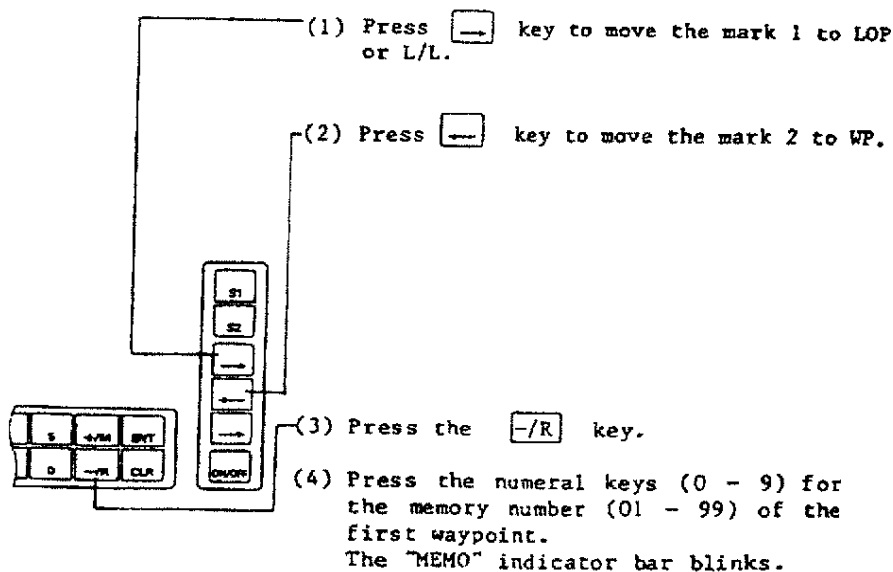
Note: 1. In case a wrong key is pressed, press the correct number immediately after the wrong one.

"MEMO" indicator bar blinks.

Memory number
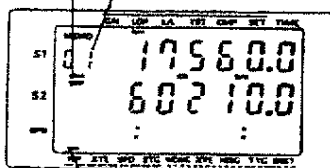
Set the mark 1 in the <LOP> or <L/L> position, and then the mark 2 in the <WP> position

(5) Verify the displayed position and memory number of waypoint and press the $\boxed{\text{ENT}}$ key.
The "MEMO" indicator mark is turned OFF, and the WP indicator bar blinks periodically.
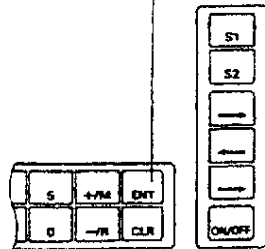
Note: 2. If depression of a wrong key is detected after pressing the $\boxed{\text{ENT}}$ key, press the $\boxed{\text{CLR}}$ key and repeat the subsequent steps again.

"WP" indicator bar
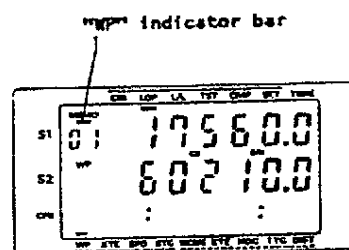
(6) Set the second and third waypoints by going through the steps (3), (4) and (5).
Up to 10 waypoints can be set.

Note: 3. The memory number and position of the waypoint set first are displayed when the $\boxed{\text{ENT}}$ key is pressed.

When the vessel arrives at the each waypoint, the WP number will advance to the next waypoint number.

First waypoint

<02> <03>

<01>

<04>

Current position <05>

Fifth waypoint

Fourth waypoint

Third waypoint

Second waypoint
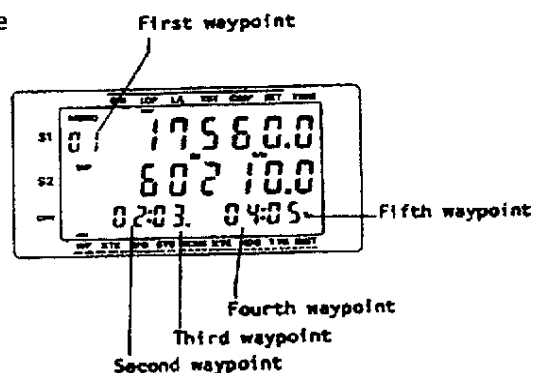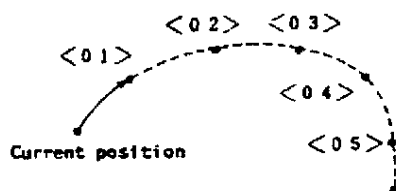
(7) Press ⬅ key to shift the mark 2 to a position other than WP. Setting of waypoints is completed by this step.

"WP" indicator bar blinks
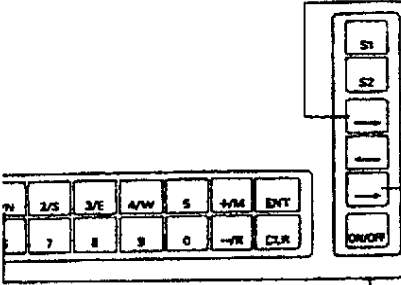
S1 `17569.7`

S2 `60216.0`

`0.0   5910`

Shift mark 1 to position other than <WP>.
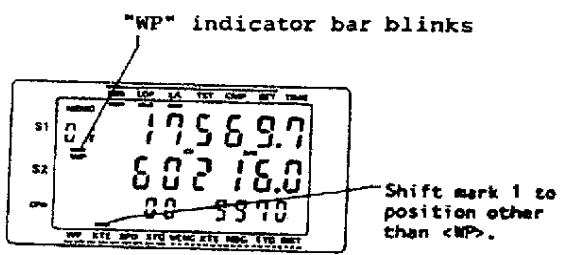
a. To clear display of waypoint settings

The display can be cleared of the waypoint settings by pressing the CLR key after going through the steps (1) and (2).

S1 `00000.0`

S2 `00000.0`
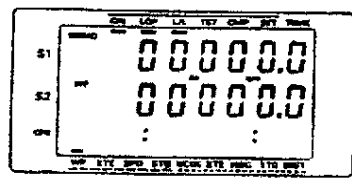
b. To determine total distance to final waypoint

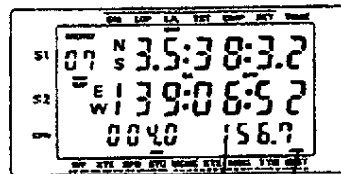After entering a sequence of waypoints, perform the following:

(8) Press ⌐→ key to move the mark 1 to LOP or L/L.

(9) Press ⌐→ key to set the mark 3 to the DIST position.
If the mark 3 is not blinking, the distance from the current position to the current waypoint is displayed.

(10) When the 1/N key is pressed, the navigation distance from the current position to the final waypoint is displayed.

(11) The data displayed at (9) can be recovered by pressing the 1/N key again.

(Distance to current waypout <01>)   (Distance to final waypoint <07>)
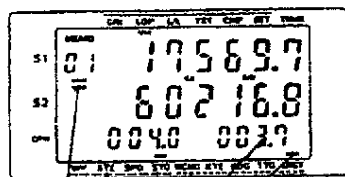
Mark 3 lights up
3.7 miles (NM)

Current waypoint

Mark 3 blinks
156.7 miles (NM)

c. To determine navigation time needed to reach final waypoint.

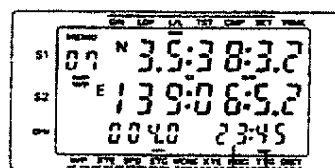After entering a sequence of waypoints, perform the following:

(8) Press [—] key to move the mark 1 to LOP or L/L.

(9) Press [—] key to set the mark 3 to the TTG position.
If the mark 3 is not blinking, the navigation time needed to go from the current position to the current waypoint is displayed.

(10) Pressing the [1/N] key starts the blinking of the mark 3, and the navigation time needed to go from the current position to the final waypoint is displayed.

(11) The data displayed at (9) can be recovered by pressing the [1/N] key.
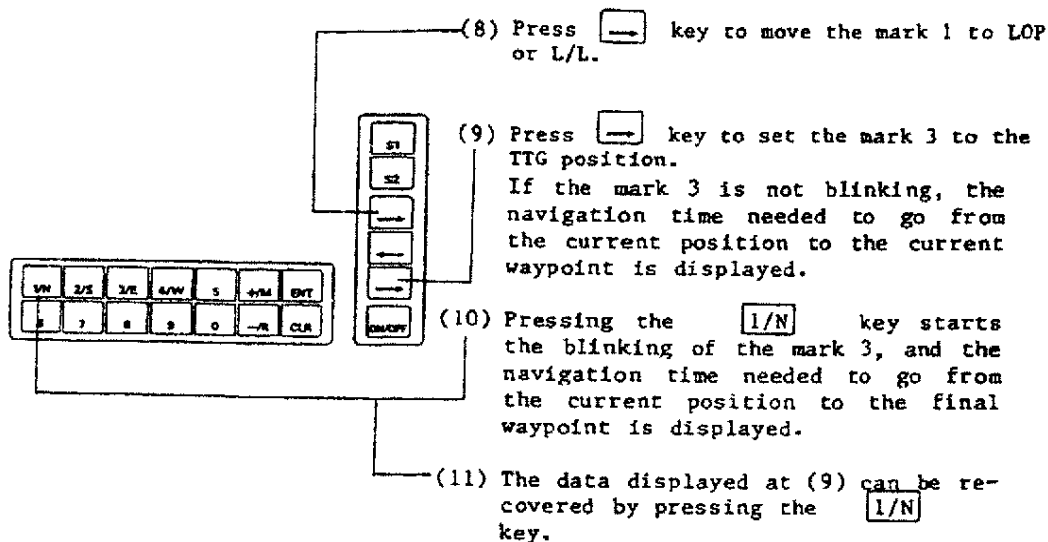
(Navigation time needed to reach current waypoint <01>)

(Navigation time needed to reach final waypoint <07>)
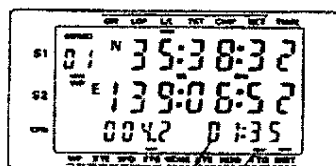
Mark 3 lights up.
Navigation time needed
(hours : minutes)

Mark 3 blinks
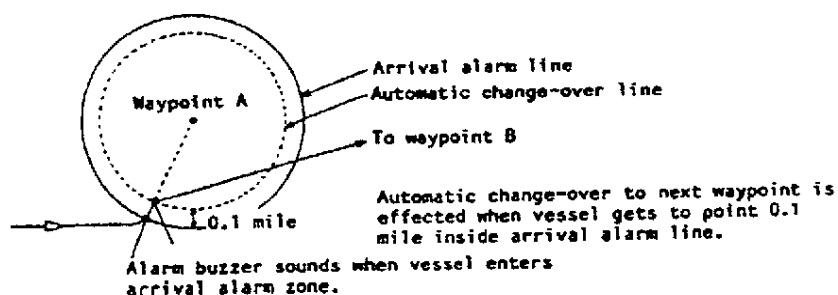Navigation time needed
(hours : minutes)

Notes: 4. As shown in these examples, 99:99 is displayed while the vessel is stopped.

5. Upon the lapse of approximately 4 minutes after the vessel starts moving again, the navigation time (TTG) will be displayed.
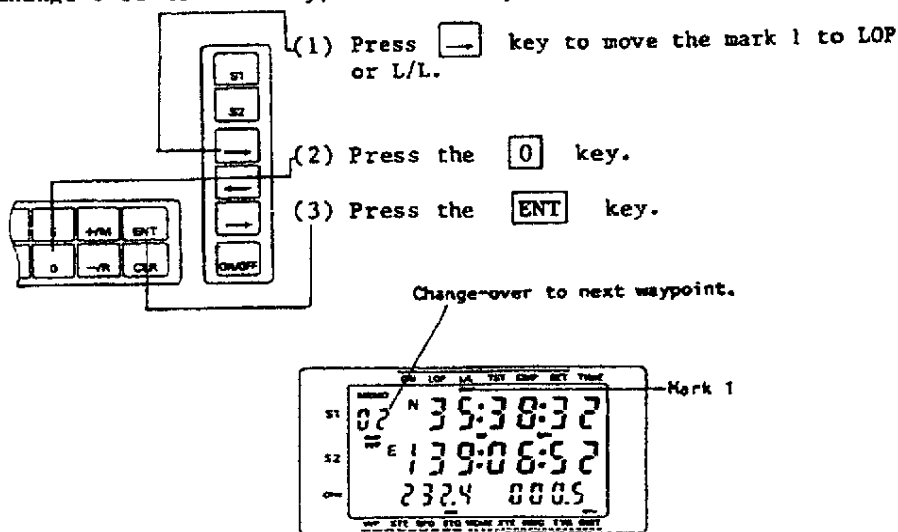
d. Actions after waypoint setting

After the vessel approaches a waypoint, changeover from that waypoint
to the next one is automatically made. That change over is made, the
moment the vessel gets to a point 0.1 mile inside the arrival alarm
line. If the course is to be changed before arrival at the waypoint
changeover point, follow the procedure described below to change the
next waypoint manually.

Notes: 6. Automatic changeover is not effected while the mark
            1 is blinking. In that case, follow the procedure
            described below to change over to the next waypoint
            manually.

Arrival alarm line
Automatic change-over line
To waypoint B

Automatic change-over to next waypoint is
effected when vessel gets to point 0.1
mile inside arrival alarm line.

Alarm buzzer sounds when vessel enters
arrival alarm zone.

e. To change over to next waypoint manually

(1) Press ⟶ key to move the mark 1 to LOP
    or L/L.

(2) Press the 0 key.

(3) Press the ENT key.

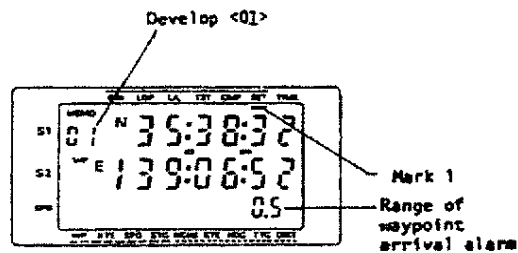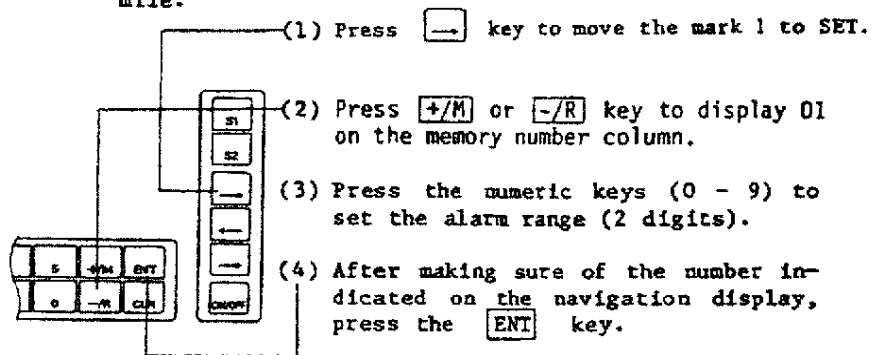Change-over to next waypoint.

Mark 1

2.8.4 Waypoint arrival alarm (intermittent sound)

When the waypoint gets near, an intermittent pip-pip sound is emitted, thereby notifying the vessel is arriving at the waypoint. The alarm sounds when the predetermined waypoint arrival alarm range is reached but the mark 1 does not blink.

a. Setting alarm range

Notes: 1. The settable range is 0.1 - 9.9 nautical miles. When 0.0 nautical mile is set, the waypoint arrival alarm does not work. Performing "2.1 Initial setting" sets 0.5 nautical mile.

(1) Press [→] key to move the mark 1 to SET.

(2) Press [+/M] or [-/R] key to display 01 on the memory number column.

(3) Press the numeric keys (0 - 9) to set the alarm range (2 digits).

(4) After making sure of the number indicated on the navigation display, press the [ENT] key.

Develop <01>

Mark 1

Range of waypoint arrival alarm

b. Automatic changeover of alarm range and waypoint

When several waypoints are set, the waypoint is automatically changed over to the next at a location of 0.1 nautical miles inside of the limit of arrival alarm.

— 58 —

c. Stopping audible alarm

Pressing the [CLR] key stops the audible alarm.

NOTE: THE AUDIBLE ALARM WILL SOUND AGAIN AFTER LEAVING AND
RE-ENTERING THE PRESET RANGE.

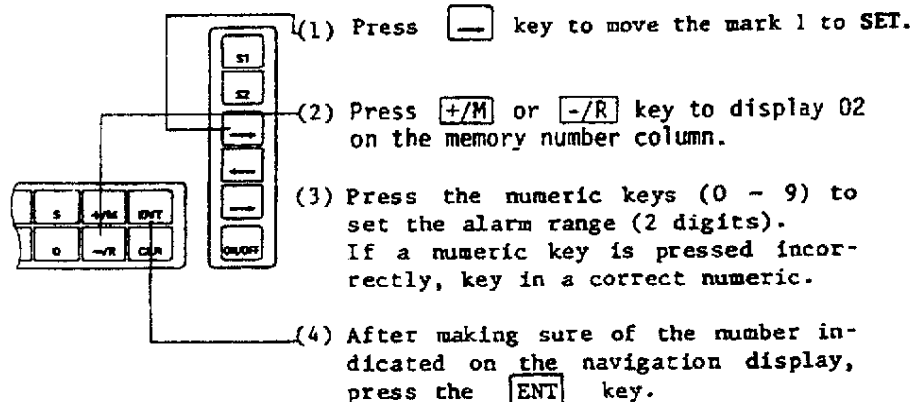## 2.8.5   Anchor watch alarm (intermittent sound)

When the vessel leaves an anchor site and goes beyond the
predetermined anchor watch alarm range, and provided the
mark 1 is not blinking, an intermittent audible alarm will
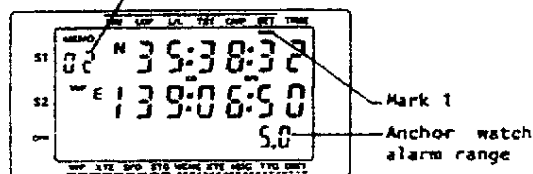sound.

a. Setting alarm range

Notes: 1. The settable range is 0.1 - 9.9 nautical miles.

2. When 0.0 nautical mile is set, the anchor watch
alarm does not work.

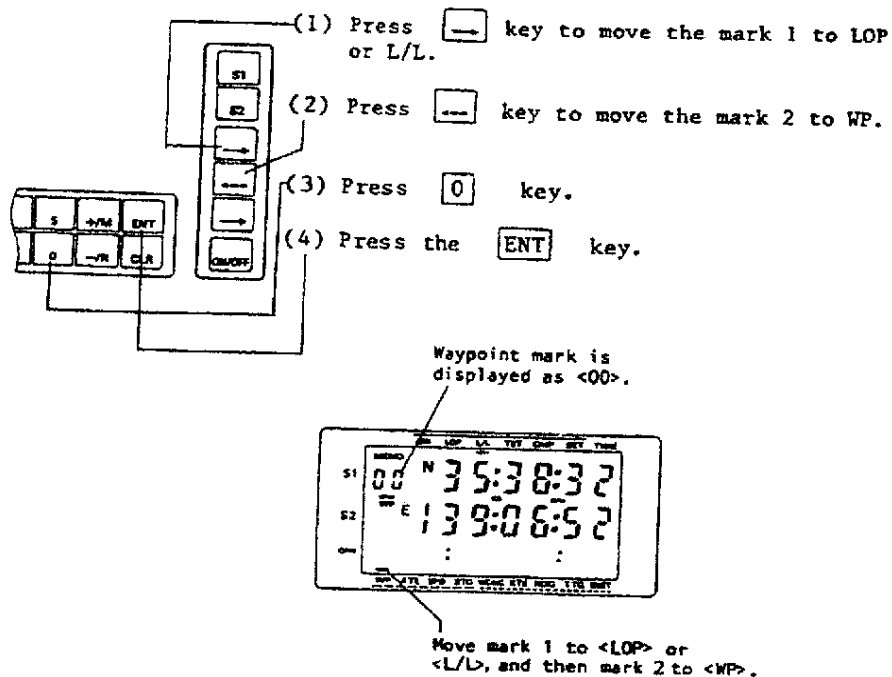3. Performing "2.1 Initial setting" sets 5.0 nautical
miles.

(1) Press [—] key to move the mark 1 to SET.

(2) Press [+/M] or [-/R] key to display 02
on the memory number column.

(3) Press the numeric keys (0 ~ 9) to
set the alarm range (2 digits).
If a numeric key is pressed incor-
rectly, key in a correct numeric.

(4) After making sure of the number in-
dicated on the navigation display,
press the [ENT] key.

Develope <02>

Mark 1

Anchor watch
alarm range

b. Setting anchorage site

The following operation sets the current location as an anchorage point and initiates the alarm function.

Notes: 4. Setting an anchorage point deletes the already set destination.

(1) Press [—] key to move the mark 1 to LOP or L/L.

(2) Press [—] key to move the mark 2 to WP.

(3) Press [0] key.

(4) Press the [ENT] key.

Waypoint mark is displayed as <00>.

Move mark 1 to <LOP> or <L/L>, and then mark 2 to <WP>.

c. Stopping audible alarm

Pressing the [CLR] key stops the audible alarm.

Re-entering the alarm range automatically stops the audible alarm.

d. Clearing anchor watch alarm

It is necessary to set a different waypoint to deactivate and totally clear the Anchor Watch alarm.
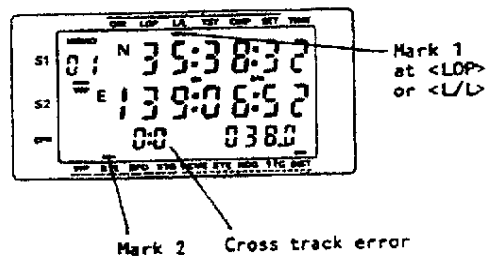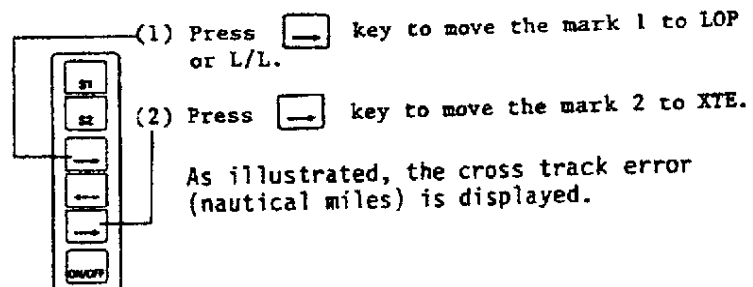
2.9 Navigation Display

The Loran displays the navigating information: Cross Track Error, Distance, Speed, Heading, Steer to Go, Time to Go, Timer and Route.

In order to display the navigating information except the vessel speed and heading, a waypoint must be set beforehand. (See 2.8 Setting Waypoint".)
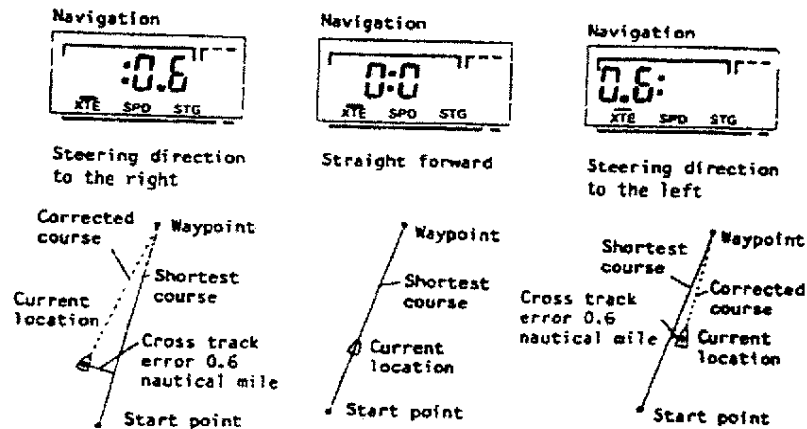
2.9.1 Displaying cross track error

The deviation of the actual vessel course with respect to a straight course to the waypoint is called Cross Track Error (XTE).

> Note: The display range of cross track error is 0.01 – 9.9 nautical miles.

(1) Press [→] key to move the mark 1 to LOP or L/L.

(2) Press [→] key to move the mark 2 to XTE.

As illustrated, the cross track error (nautical miles) is displayed.

Mark 1 at <LOP> or <L/L>

Mark 2   Cross track error

a. How to interpret XTE cross track error display.

Navigation

```
 :0.6
XTE  SPD  STG
```

Steering direction
to the right

Navigation

```
 0·0
XTE  SPD  STG
```

Straight forward

Navigation

```
 0.6·
XTE  SPD  STG
```

Steering direction
to the left

Corrected course — Waypoint
Shortest course
Current location
Cross track error 0.6 nautical mile
Start point

Waypoint
Shortest course
Current location
Start point

Shortest course — Waypoint
Cross track error 0.6 nautical mile — Corrected course
Current location
Start point

Perform steering slowly so the cross track error is reduced.

Notes: 1. The cross track error is displayed (a) in one hundredth nautical mile steps when its alarm range is set to below one nautical mile, or (b) in one tenth nautical mile steps when alarm range is one nautical mile or more.

2. The start point of course is the position where the waypoint is set or changed over.

3. The current location can be set as a new start point (new point of origin). Move mark 2 to WP and press 1/N ENT keys.

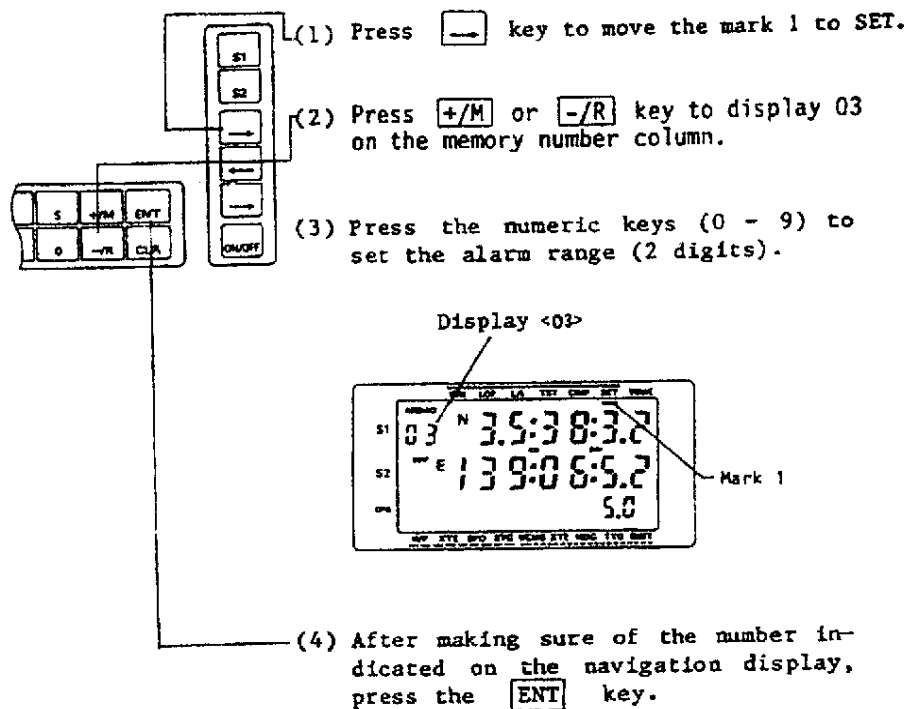   The cross track error will be reset to 00 and the new course to steer is computed.

4. When the course deviation is displayed in one hundredth nautical mile steps, a deviation of 0.99 nautical mile or more, if any, gives a display of "99". In case of one tenth nautical mile steps, a cross track error of 9.9 nautical miles or more, if any, gives a display of "9.9".

5. When the anchor watch alarm function is valid, the cross track error is not displayed and remains blank.

6. In addition, there is an off course alarm function which sounds an audible alarm if the cross track error becomes excessive. This function is valid even in an operation mode where off course is not displayed.

2.9.2 Cross track error alarm (continuous sound)

A continuous sound is emitted as soon as the cross track error is
beyond the predetermined off course alarm range.

a. Setting alarm range

Notes: 1. The settable range is 0.1 - 9.8 nautical miles.

2. Setting 0.0 or 9.9 nautical miles invalidates the
cross track error.

3. Executing "2.1 Initial setting" sets 5.0 nautical
miles automatically.

4. The cross track error is displayed in one hundredth
nautical mile steps when the setting is below one
nautical mile, or in one tenth nautical mile steps
when one nautical mile or more.

(1) Press ⬜ key to move the mark 1 to SET.

(2) Press +/M or -/R key to display 03
on the memory number column.

(3) Press the numeric keys (0 - 9) to
set the alarm range (2 digits).

Display <03>

Mark 1

(4) After making sure of the number in-
dicated on the navigation display,
press the ENT key.

b. Stopping audible alarm
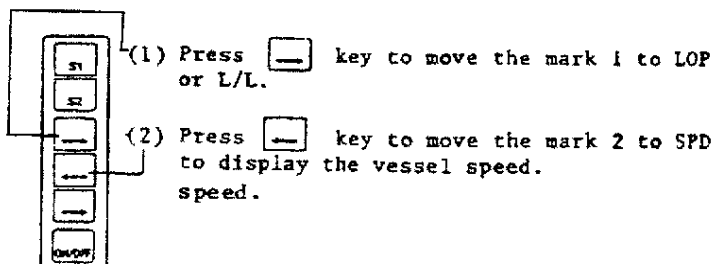
Pressing the CLR key stops the audible alarm.

2.9.3 Indicating distance to go

The great circle route (0.01 - 999.9 nautical miles) from the current location to the waypoint is displayed.
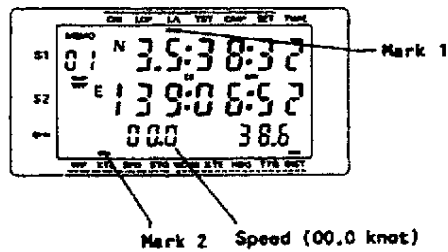
(1) Press [→] key to move the mark 1 to LOP or L/L.

(2) Press [→] key to move the mark 3 to DIST.

The navigation display indicates the distance (nautical miles) up to the waypoint.

The displayed distance is up to the next waypoint when the mark 3 is not blinking, or the total route when it is blinking.

(3) Pressing [1/N] key selects the distance to the final or next waypoint alternately.

Mark 1

Distance (38.6 nautical miles)

Mark 3

Notes: 1. When the distance is below 0.1 nautical mile, two digits below decimal point are displayed.
0.01 nautical mile is displayed as 0:01.

2.9.4 Display of vessel speed and repeated setting of average vessel speed.

The current vessel speed (0.1 knot steps) with respect to land is displayed.

(1) Press [→] key to move the mark 1 to LOP or L/L.

(2) Press [→] key to move the mark 2 to SPD to display the vessel speed.
speed.

Mark 2   Speed (00.0 knot)

Note : 1.   When the speed is below one knot, 00.0 is displayed
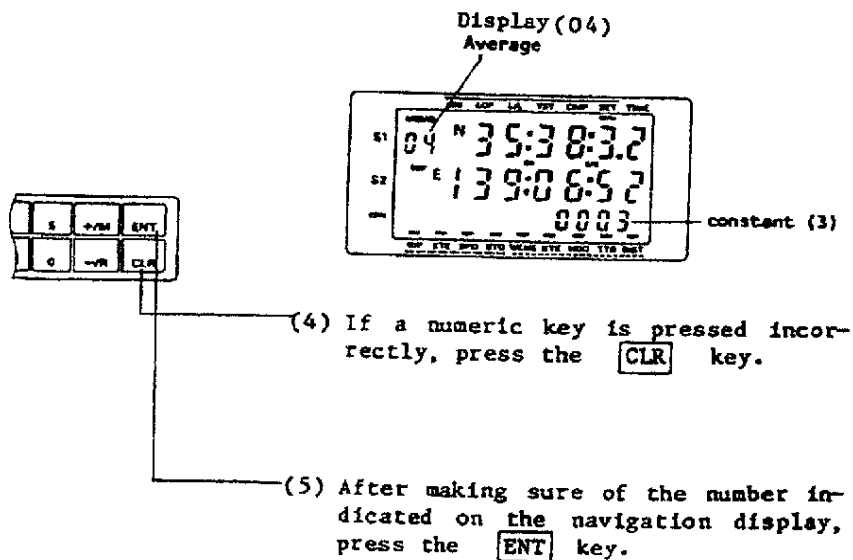   as illustrated above.

a. Repeated setting of average speed

When the speed display fluctuates excessively while the vessel is
navigating at a constant speed, the fluctuating display can be de-
creased to an approximate speed.

(1) Press [→] key to move the mark 1 to SET.

(2) Press [+/M] or [-/R] key to display 04
    on the memory number column.
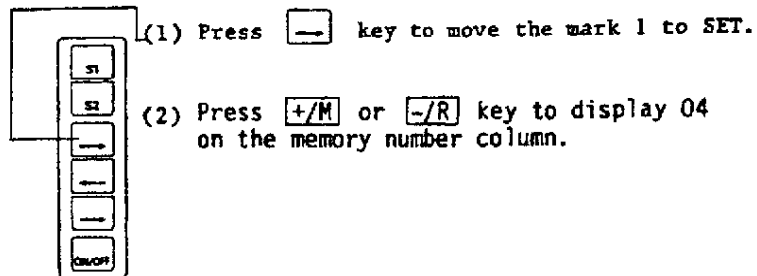
(3) Set a number (1 digit) greater than
    2 by numeric keys (3 - 5).

    Note: 2. When the speed response
                is expected to be faster,
                set a number smaller than
                2 by the numeric key 1.
                1 through 5 are average
                constants.

Display (04)
Average

constant (3)

(4) If a numeric key is pressed incorrectly, press the [CLR] key.

(5) After making sure of the number indicated on the navigation display, press the [ENT] key.

Note: 3. Carrying out "2.1 Initial setting" sets a constant 2 automatically.

2.9.5 Display and correction of heading

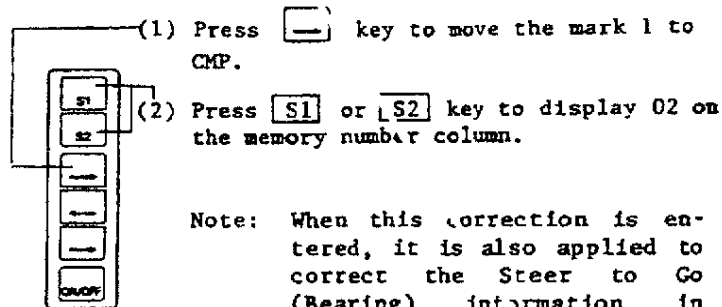The vessels forward 'HEADING' direction is displayed in the true bearing (0.1 degree steps).

(1) Press [▬] key to move the mark 1 to LOP or L/L.

(2) Press [▬] key to move the mark 3 to HDG.
Then the navigation display indicates the heading (deg).

Mark 1

(301.2°)

Mark 3
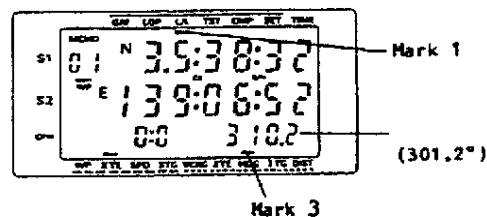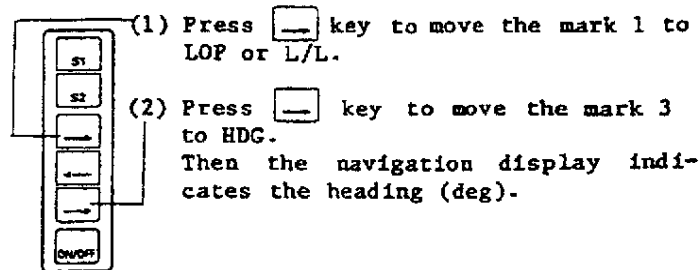
a. Correcting heading

The displayed heading can be corrected to match with the compass when the heading on the navigation display differs from the heading indicated by a gyro or magnetic compass.

Notes: 1. Carry out this correction when the heading display is stable during navigation.

2. The correctable range is +0.1 to +30°.

(1) Press [▬] key to move the mark 1 to CMP.

(2) Press [S1] or [S2] key to display 02 on the memory number column.

Note: When this correction is entered, it is also applied to correct the Steer to Go (Bearing) information in 2.9.7.

(4) Press $\boxed{+/M}$ key when the correction amount is positive, or $\boxed{-/R}$ key when negative.

Mark 1

Correction amount (-00.5 deg)

Indicated when correction amount is negative.

(5) After making sure of the correction amount indicated on the display, press the $\boxed{ENT}$ key.

(6) In about ten seconds, the corrected heading is indicated on the right of the navigation display.
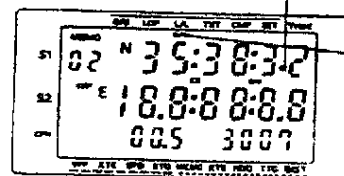
Corrected heading (300.7°)

Correction amount (-00.5 deg)
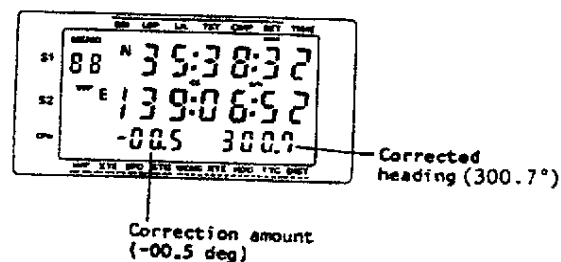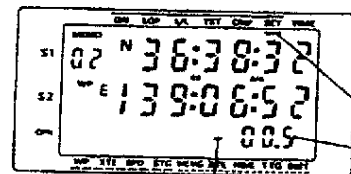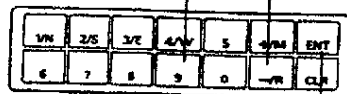
b. Display after correcting heading
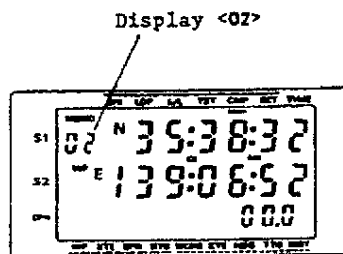
LOP Displays

Point goes off about every twelve seconds.
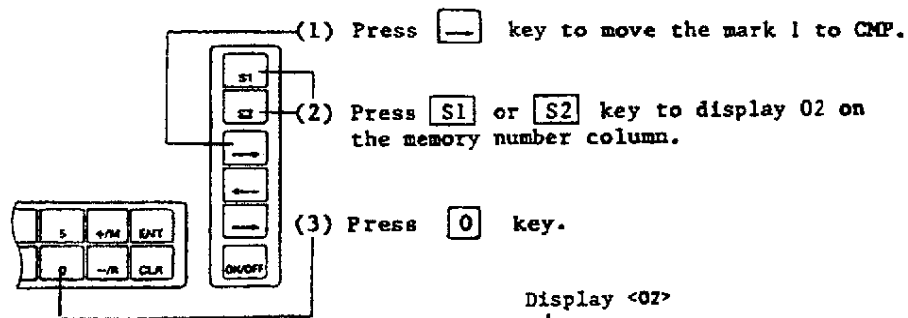
Mark 1
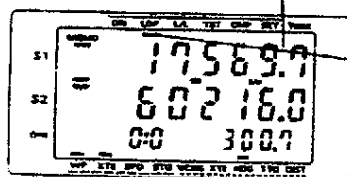
Latitude/Longitude Displays

Point (.) goes on about every twelve seconds.

Mark 1

c. **Clearing heading correction**

(1) Press ⊡ key to move the mark 1 to CMP.

(2) Press ⌊S1⌋ or ⌊S2⌋ key to display 02 on the memory number column.

(3) Press ⌊0⌋ key.

Display <02>

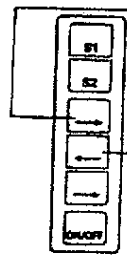(4) Pressing the ⌊ENT⌋ key clears the correction.
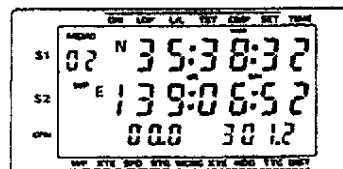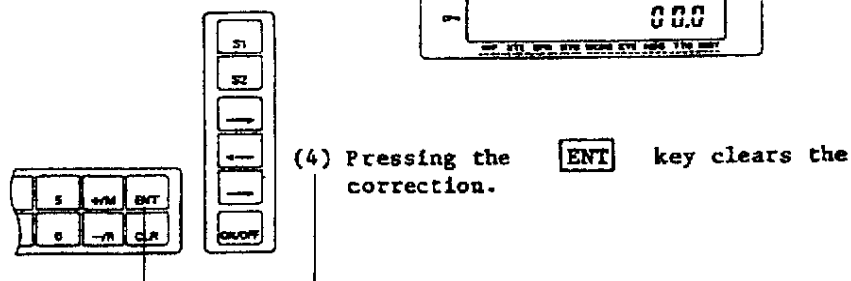
Note: The correction is also cleared by "2.1 Initial setting".

2.9.6 Display of route

When several waypoints are set, the distance and required time to the final waypoints are displayed. For the display procedure, refer to "2.8.2 Setting of two or more waypoints."

2.9.7 Display of steer to go

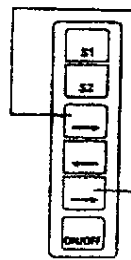The direction to the waypoint is indicated in the angle with respect to north (either true or magnetic).

(1) Press [→] key to move the mark 1 to LOP or L/L.

(2) Press [←] key to move the mark 2 to STG.

The steer to go with respect to true north is displayed.
Magnetic correction can be applied.
See 2.9.5a.

Waypoint memory number

North

92.1 degrees
Waypoint

Steer to go
(92.1 deg)

Mark 1

Mark 2
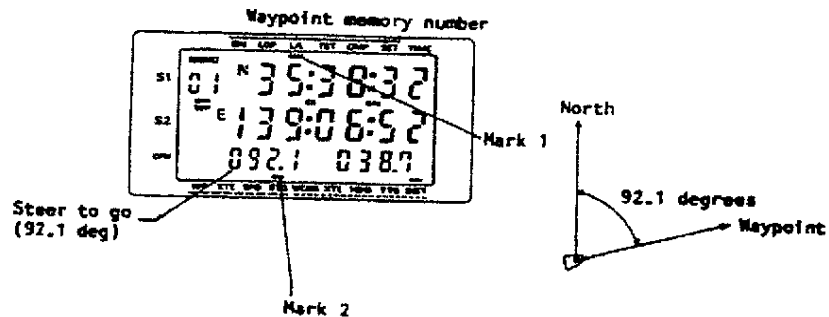
2.9.8 Display of time to go
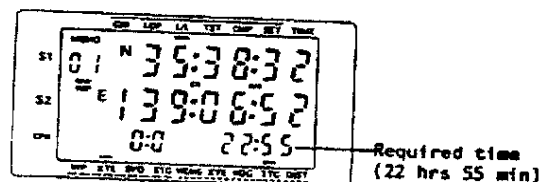
Estimated time to go to the waypoint is displayed.

Note: When the speed display is unstable, a correct time to go is not displayed.

(1) Press [←] key to move the mark 1 to LOP or L/L.

(2) Press [→] key to move the mark 3 to TTG.

The time to go to the next waypoint is displayed when the mark 3 is not blinking, or to the final waypoint when blinking.

Required time
(22 hrs 55 min)

(3) Pressing $\boxed{1/N}$ key displays the time to go to the final or next waypoint alternately.
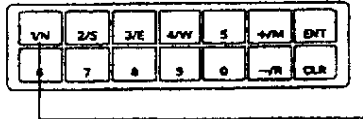
a. How to interpret display

While mooring ...... 99:99 is displayed as shown below.

While navigating ... hours and minutes are displayed at the positions illustrated below.
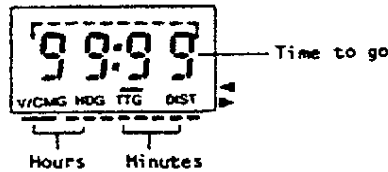
2.9.9 Display of timer

The time elapsed since turning on power or from manual reset is displayed. The time can be set by numeric keys (0 - 9).

(1) Press $\boxed{\leftarrow}$ key to move the mark 1 to LOP or L/L.

(2) Press $\boxed{\rightarrow}$ key to move the mark 3 to V/CMG.
At the position illustrated, the time elapsing since turning on the power or from a resulting is displayed.

(3) Pressing the [CLR] key displays 00:00:00 whereby the elapsed time is reset to "0 " and the elapsed time counter begins to count again.
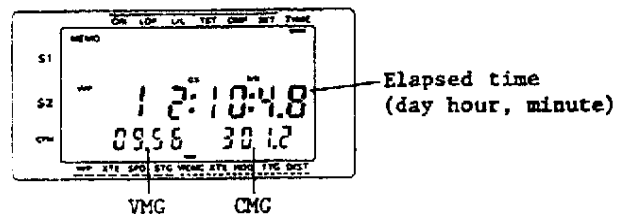
(4) In this mode, it shows TIME in S2 display area, and velocity and heading in CPN display area. Using the numeric keyboard to enter six digits--two for days, two for hours in 24-hour format, and two for minutes, followed by pressing ENT key sets the TIME function.
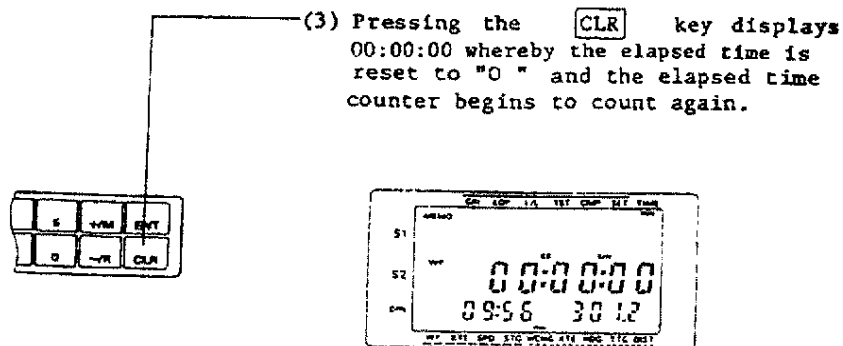
2.9.10 Display of imaginary course distance and bearing

An imaginary course interconnecting two stored points with a straight line is set, and the great circle distance and bearing of that course are displayed.

Note: The distance range which can be displayed is 0.1 - 999.9 nautical miles.

(1) Press [—] key to move the mark 1 to CMP.

(2) Press [-/R] key.

(3) Press the numeric keys (0 - 9) to set the memory number (01 - 99) of a location to start at. The location and memory number of the start point are displayed, and the memory mark blinks.
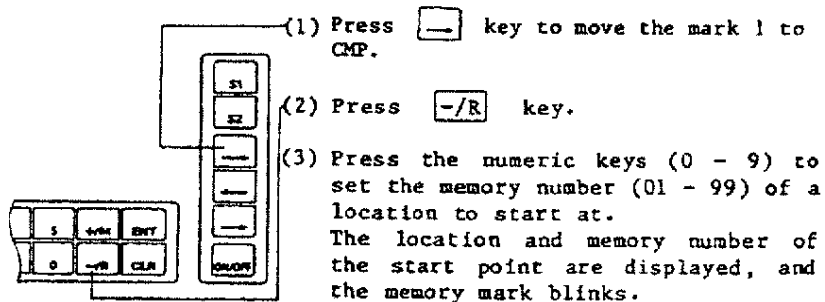
(4) Press the numeric keys (0 - 9) to set the memory number (01 - 99) of an end point.
The location and memory number of the end point are displayed, and the memory mark blinks.

Memory mark blinks
Memory number of end point
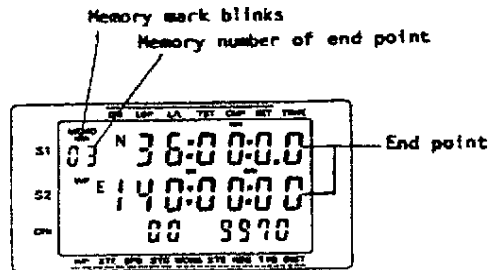
End point

(5) Press the [ENT] key.
The distance and bearing from the start point to end point are displayed.

Distance (nautical miles) from start point to end

Bearing (deg) from start point to end point
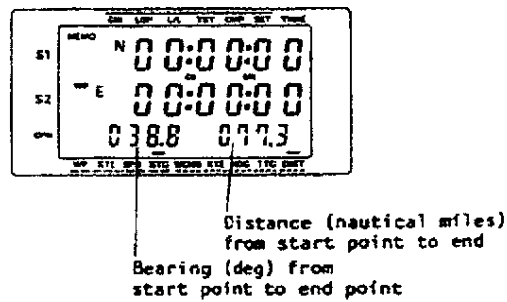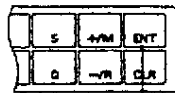
Start point <05>

imaginary course

End point <06>

2.10 Converting from Time Difference to Latitude/Longitude

To convert a time difference (TD) into Latitude/Longitude (L/L).

a. Converting time difference in same chain by numeric keys

(1) Press [___] key to move the mark 1 to CMP.

(2) Press [S1] or [S2] key to get 05 page.

(3) Press the numeric keys (0 - 9) to set the time difference (6 digits each) for TD-1 and TD-2

Set time difference

Mark 1

(4) If a numeric key is pressed incorrectly, press the [CLR] key.

(5) After making sure of the time difference indicated on the display, press the [ENT] key.

(6) To pursue converting another time difference, press the [CLR] key and then repeat the steps (2), (3) and (4).

Converted latitude/longitude

b. Converting time difference stored memory

(1) Press [—] key to move the mark 1 to CMP.

(2) Press [S1] or [S2] key to display 05 on the memory number column.

(3) Press [-/R] key.

(4) Press the numeric keys (0 – 9) to set a memory number (2 digits) to be recalled.
If numeric keys are pressed incorrectly, key in correct numerics.

Memory mark is displayed
Set memory number

Recalled time difference
Mark 1

(5) After making sure of the recalled time difference, press the [ENT] key.

(6) To convert another time difference successively, press the [CLR] key and then repeat the steps (2), (3) and (4).

Converted latitude/longitude

c. Converting time difference of other Loran C chain

   Note: Altering the GRI does not affect Loran signal tracking.

(1) Press [—] key to move the mark 1 to CMP.

(2) Press [S1] or [S2] key to display 05 on the memory number column.

(3) Press the numeric keys (0 - 9) to set a Loran C chain (4 digits) to be converted.

(4) After making sure of the number indicated on the S1 display, press the [ENT] key.
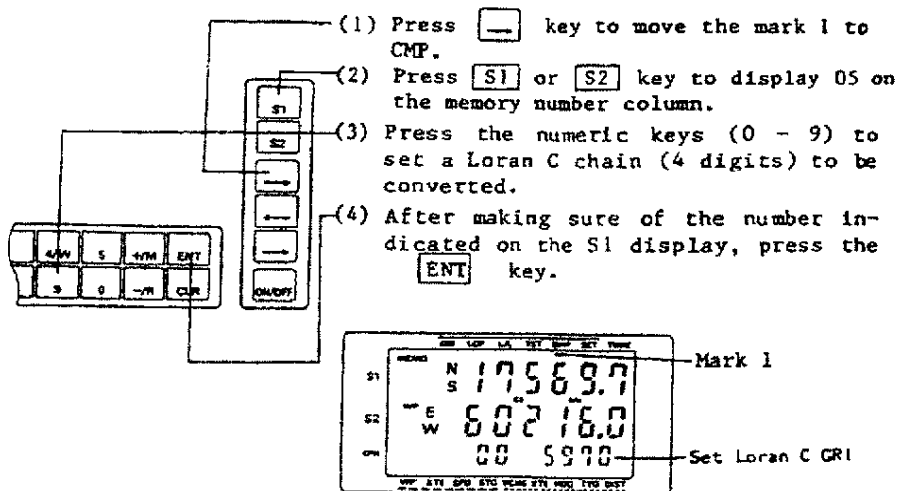
— Mark 1

— Set Loran C GRI

(5) Enter the TD's to be converted by using the keyboard, or by recalling the TD's from memory.

(6) Press the [CLR] key.
To pursue the operation, press the [CLR] key, and repeat the procedure.

d. Storing converted latitude/longitude

   Following the steps in a, b or c above, carry out the steps below.

(7) Press [+/M] key.

(8) Press the numeric keys (0 - 9) to set a number (2 digits) to be stored. (See typical display.)

(9) Press the [CLR] key.
To pursue a conversion, press the [CLR] key and follow the procedure outlined above.
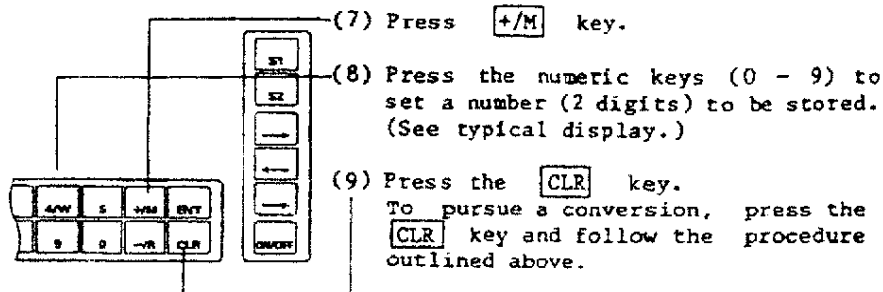
Latitude/Longitude Conversion Table
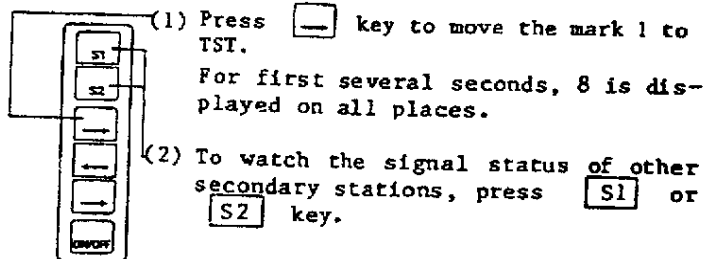
GRI Number	GRI Designation
4990	CENTRAL PACIFIC
5930	CANADIAN EAST COAST
5970	COMMANDO LION
5990	CANADIAN WEST COAST
7170	SOUTH SAUDI ARABIA
7.30	LABRADOR SEA
796L	GULF OF ALASKA
7970	NORWEGIAN SEA
7980	SOUTHEAST U.S.
7990	MEDITERRANEAN SEA
8290	NORTH CENTRAL U.S.
8970	GREAT LAKES
8990	NORTH SAUDI ARABIA
9610	SOUTH CENTRAL U.S.
9940	U.S. WEST COAST
9960	NORTHEAST U.S.
9970	NORTHWEST U.S.
9980	NORTH ATLANTIC
9990	NORTH PACIFIC

2.11 Displaying Signal Status and Frequency Deviation

The status of Loran C signal while acquiring and tracking and oscillator frequency deviation can be monitored.

(1) Press [—] key to move the mark 1 to TST.

For first several seconds, 8 is displayed on all places.

(2) To watch the signal status of other secondary stations, press [S1] or [S2] key.

a. How to read display

Numbers at ten thousand place of secondary station and thousand place of GRI number are displayed.

Numbers at thousand place of secondary station and hundred place of chain number blink

0 or 1 must be displayed.

Any of 1 to 9 must be displayed. Greater number is desirable.

Must be greater than left number.

4 must be displayed.

Signal status of S1

Signal status of S2

Mark 1

Signal status of M

Oscillator frequency deviation

Allowable range of frequency deviation is -20 to +20.
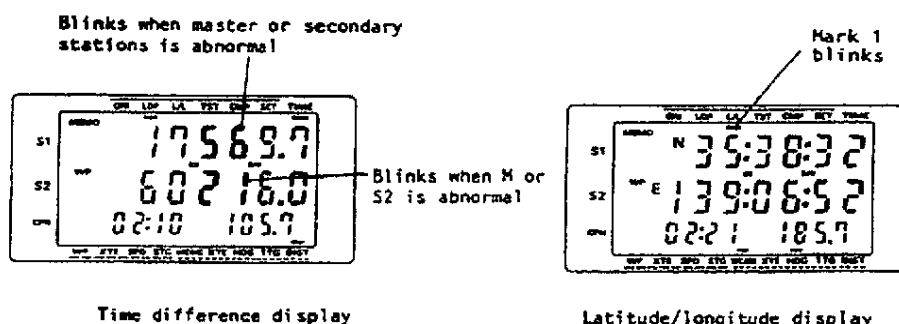
Display of +20: [20]

Display of 0 : [00] or [-00]
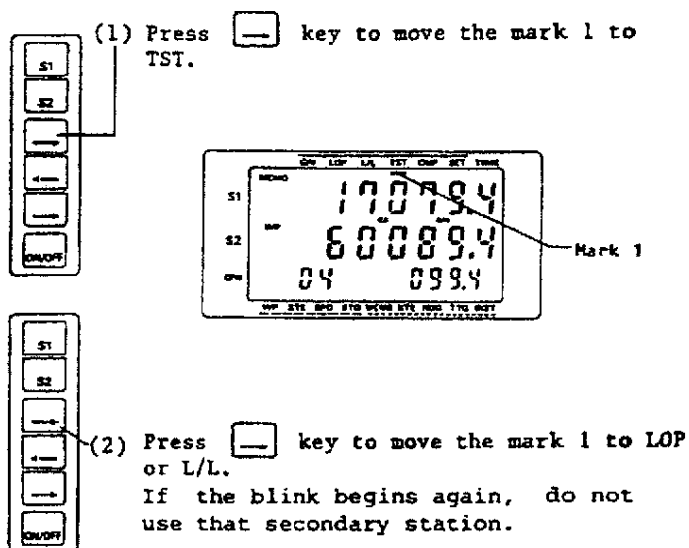
Display of -20: [-20]

2.12 Displaying Error Signal

A display appears on the Loran when an error signal is sent from a transmitting station (master station or secondary station 1 or 2).

a. How to read display

Time difference display

Latitude/longitude display

b. Clearing error signal display

(1) Press [→] key to move the mark 1 to TST.

(2) Press [←] key to move the mark 1 to LOP or L/L.
If the blink begins again, do not use that secondary station.

The station blink is usually transmitted to indicate that the Loran C station is not operating properly. Select a different station or, if necessary, a different chain.
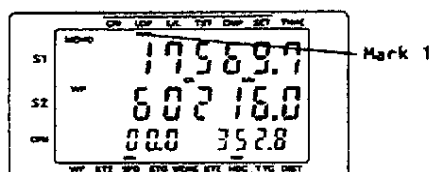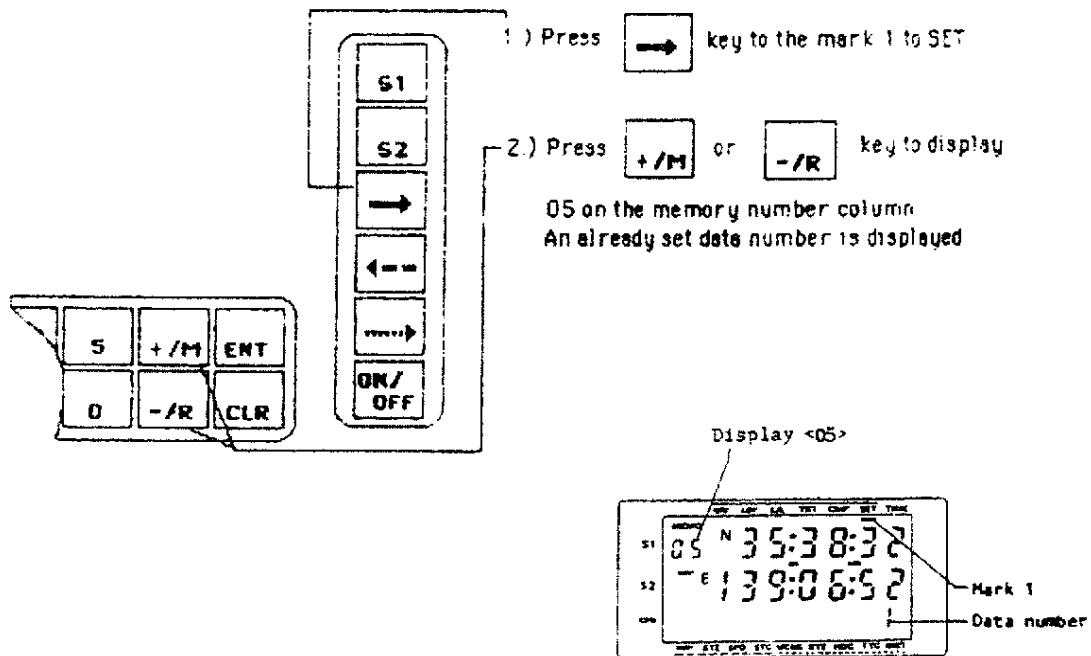
2.13 Selecting Connected Devices

There are five types of output data for LR-791. Each is selectable according to the particular connected device.

OUTPUT FORMAT	DATA NUMBER	DEVICE NAME
KODEN-717	1	KODEN-717 COMPATIBLE DEVICE, UR-7
NMEA-0182	2	NMEA-0182 COMPATIBLE DEVICE, UR-7
NMEA-0183(LOP) SELECTED DATA	9	NMEA-0183 COMPATIBLE DEVICE
NMEA-0180	8	AUTOPILOT (NMEA-0180 TYPE)
NMEA-0183(L/L)	3	NMEA-0183 COMPATIBLE DEVICE

a. Checking output format

1) Press [→] key to the mark 1 to SET

2) Press [+/M] or [-/R] key to display

05 on the memory number column
An already set data number is displayed

Display <05>

Mark 1
Data number

b. Changing number for data output format

(3) Press a numeric key(1, 2, 3, 8, 9)to
set a new data number (1 digit).
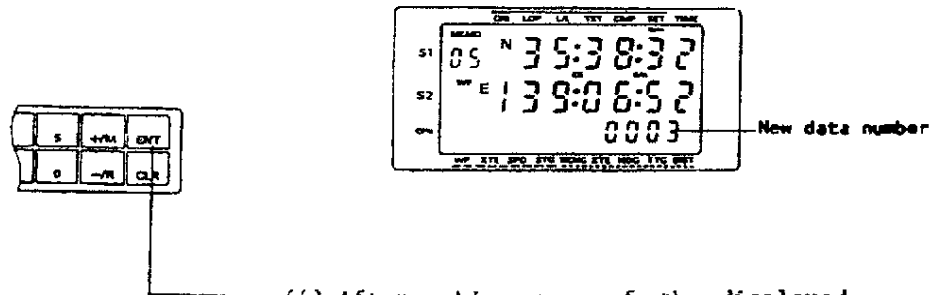
New data number

(4) After making sure of the displayed
data number, press the ENT key.

Note: The data number is not changed by "2.1 Initial setting".

3. MAINTENANCE

## 3.1 Replacing Fuse

Major circuits are protected by a fuse. If they are faulty, the fuse will blow.

a. Precautions

(1) If the fuse has blown, locate its cause, repair it and then re-place the fuse.

(2) Turn off power and then replace with a new rated fuse.

b. How to replace

(1) Press the [ON/OFF] Key to turn off power.

(2) Locate the fuse holder on the back panel. Remove the fuse holder by turning it in a counter-clockwise fashion.

(3) Replace the blown fuse with same value replacement fuse (1 Amp, 125 Volt).
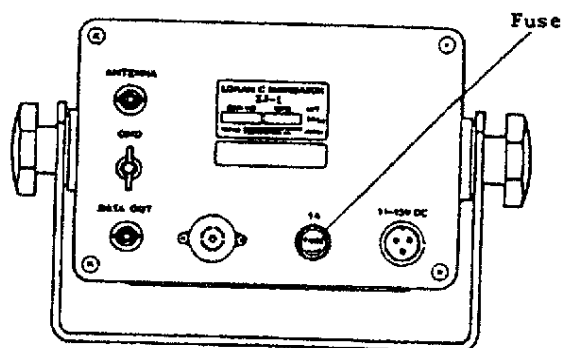
Rear panel

3.2 When Trouble is Suspected

a.   All displayed digits are 7's when a lat/lon display is
     expected.

     The secondary station selection has not been completed.
     Return the mark 1 to GRI mode position, press |S1| or |S2|
     key, select the secondary stations 1 and 2, and perform a
     fixed display. Then select L/L mode. The latitude and
     longitude of the current location will be displayed.

          NOTE: IN AN AREA HAVING ONLY TWO SECONDARY STATIONS,
          FIXING ON STATION 1 AUTOMATICALLY FIXES ON STATION 2.

B.   All displayed digits are 9's.

     When the chain is not set, 9's are displayed for all
     digits. In such a case, pressing the |CLR| key does not
     change the display. return the mark 1 to GRI mode and key in
     the correct four-digit GRI chain code.

c.   Display is frozen.

     A frozen display may result from any or all of the
     following:

          (1) Excessive RF noise from external causes

          (2) Signal is lost (Loran signal is not transmitted)

          (3) Operation mode is incorrect (example: WP).

d.   CS alarm and S/N alarm is displayed at all times

     CS alarm and/or S/N alarm is displayed because of one of the
     following external factors:

          (1) Signal is lost

          (2) Interferring RF noise (AC, electric motor, TV,
               etc.)

          (3) Antenna or receiver grounding is poor

          (4) Noise from other wireless equipment has invaded
               power line

          (5) Poor installation of antenna

e. Displayed cross track error is erroneous

When Loran position measurement is working properly, no internal error of cross track error is conceivable usually. Therefore, one of the causes enumerated below may cause this kind of trouble.

(1) Antenna or receiver ground is poor

(2) Interferring radio wave noise or alternator/generator noise.

(3) Poor handling of cross track error function

(4) Comparison difference between cross track error information and visual criterion

(5) Comparison difference between cross track error information and compass

(6) Keying error for waypoint

(7) Lines of position (LOP) are widely spaced, or lines of position are intersected at small angle

NOTE: DO NOT USE THE CROSS TRACK ERROR WHEN THE LORAN UNIT IS NOT OPERATING PROPERLY.

f. Displayed speed or heading is erroneous

The displayed speed or heading does not quickly respond to an abrupt change of the vessel speed or heading. Therefore, it may differ from reading on the speedometer or compass.
Note that the speed and heading display tends to be affected by:

(1) Dispersion or intersection angle of lines of position

(2) Poor Ground

(3) Improper mounted position of antenna

(4) Poor setting of averaging speed in SET mode (average setting increases as vessel speed increases)

(5) Interferring radio wave noise

(6) Unstable route variation

g. Time difference display is faulty

The time difference display becomes faulty as a result of:

(1)   Poor ground

(2)   Interferring radio wave noise

(3)   Improper mounted position of antenna

(4)   Correction not cleared

(5)   Wrong operation mode

h. Latitude/longitude display is erroneous

The latitude and longitude are computed from the time difference. Therefore, a faulty display may be attributed to:

(1)   Correction of position is not cleared

(2)   Position is corrected by secondary propagation correction

(3)   Selection of normal or special operation range for conversion of time difference to latitude/longitude is wrong.

(4)   Secondary station is not selected properly

i. Power cannot be turned on

(1)   Poor connection of power cable

(2)   Fuse has blown out.

If neither of the two points above is the cause, contact the nearest agent.

4. EQUIPMENT INSTALLATION

4.1 Locations of Antenna and Its Coupler

Install the antenna and its coupler at a highest position on the vessel. Even if it has inevitably to be installed at a low position, do not mount them under or inside a place where metals are collected. A metallic object which intervenes between the transmitting station and antenna might not allow a reception even within the service area.

(1) As an installation site, select a place free from any metallic objects.

(2) Install the antenna coupler at least one meter away from the receiver or remote display.

(3) A correct installing location for the antenna and coupler is as follows according to different types of vessels.

On a yacht, an insulated aft stay is usable as an antenna.

In case of central cabin vessel, perform an installation on a side or top of the cabin.

On a motor boat, install the equipment on a bridge passage, on the top or side of the cabin.

(4) Select a place where the antenna can be mounted vertical.

(5) Install the Loran receiver antenna as far away from other antennas, particularly transmitting antennas of intermediate or high frequency as possible.

(6) To select an optimum antenna mounting position, change the locations to test the signal conditions. (See "2.11 Displaying signal status and frequency deviations".)

(7) Keep away from TV set and receiving antenna. While using Loran receiver, do not turn on a TV set.

4.1.1   Reference diagrams for receiving antenna mounting position

a. For small vessel
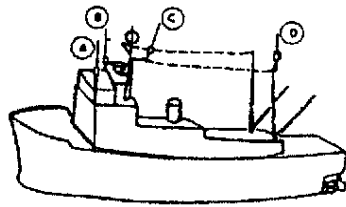
Select an optimum location from A, B and C below.
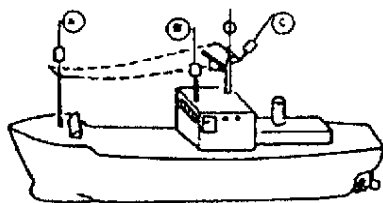
(1) Location C (above radar mast)
A short receiving cable suffices.
The installation is available at an
elevated place.

(2) Location A (on mast)
Installation is possible at an ele-
vated position, but the receiving
cable length may fall short.

(3) Location B (bridge)
A short receiving cable suffices.
However, installation at an ele-
vated place is impossible.

b. For medium to large sized fishing boats
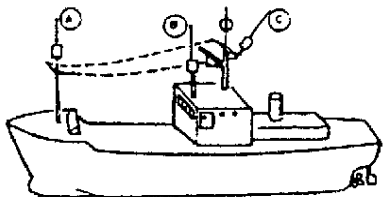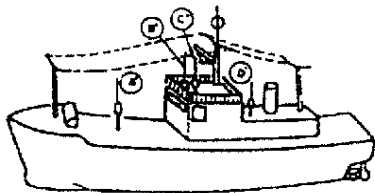
(1) Location Ⓐ
Mount the antenna at least one
meter above the yard and as away
from the transmitting antenna as
possible.

(2) Location Ⓑ
Mount the antenna on the end of the
bridge and as away from the trans-
mitting antenna as possible. Mount
the antenna coupler so the horizon-
tal antenna element will be posi-
tioned below the middle of the whip
antenna.

Good example for medium to
large sized fishing boats (1)

(3) Location Ⓒ
Tilt the antenna outward at least
two meters away from the loop
antenna. Even this may slightly
affect the bearing measurement.

(1) Locations Ⓐ and Ⓑ
Mount on the bridge end as far away from the transmitting antenna as possible.

(2) Location Ⓒ
Mount at least one meter above the yard and as far away from the transmitting antenna as possible.
Tilt outward at least two meters away from the loop antenna.
Even this may slightly affect the bearing measurement.

(3) Location Ⓓ
Mount at least one meter above the yard and away from the transmitting antenna as possible.

Good example for medium to large sized fishing boats (2)

If no location is available matching the above conditions and when the operation is made only on the sea area where Loran C signal is intense enough, refer to the following.

(1) Location Ⓐ
Absolutely avoid a place immediately below the transmitting antenna.

(2) Locations Ⓑ' and Ⓒ'
Separate as far away from the transmitting antenna. Mount the receiving antenna so its top end is located above the transmitting antenna.
Separate as far away from the radar mast and other obstacles as possible.

(3) Location Ⓓ'
Absolutely avoid a place surrounded by obstacles.

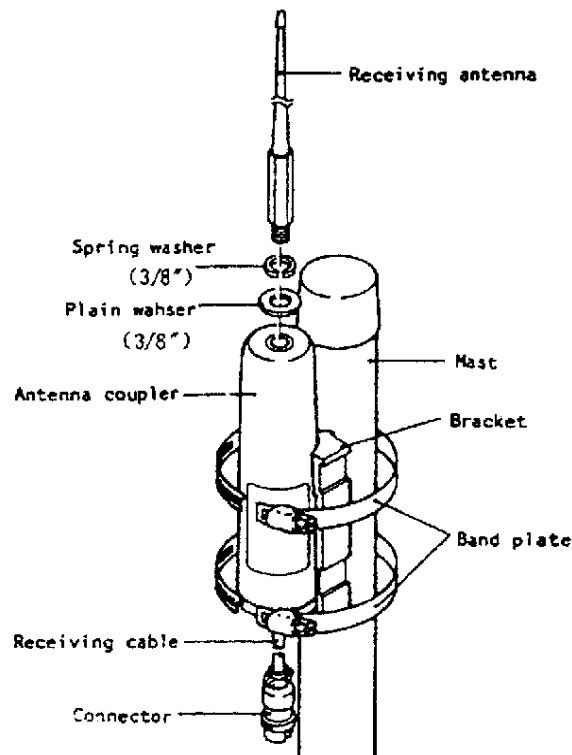No good example for medium to large sized fishing boats (1)
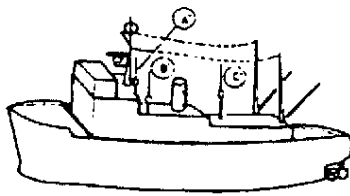
No good example for medium to
large sized fishing boats (2)

(1) Locations (A)' and (B)'
Separate as far away from the
transmitting antenna as possible,
and mount the receiving antenna so
its tops end is located above the
transmitting antenna.
Separate as far away from the radar
mast and other obstacles.

(2) Location (C)'
Absolutely avoid a place immediate-
ly below the transmitting antenna.

4.2 Typical Installation of Receiving Antenna

Receiving antenna

Spring washer
(3/8")

Plain wahser'
(3/8")

Antenna coupler

Mast

Bracket

Band plate

Receiving cable

Connector

4.3 Power Supply and RF Ground

4.3.1 Source voltage

The employed voltage range is 11 - 15 VDC. Within this voltage range, a connection is available as it is without modification or readjustment.
A battery or power supply capable of supplying 11 - 28 VDC, 1.0 amperes is required.
Since the power consumption is low, the power capacity need not be considered too strictly.

4.3.2 Connecting power

Before connecting power to the receiver, check the power voltage and polarities.
As shown in Figure 2.6, connect the positive side to the power connector pin 1, and negative side to the pin 2.


Pin 3   Pin 2 (⊖ side)   Wind PVC tape

Pin 1 (⊕ side)
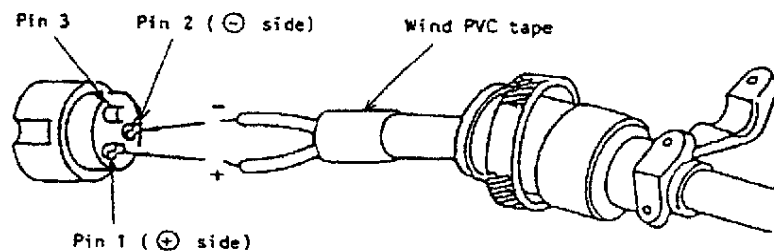
WARNING

Notes:
1. If the polarity is reversed, the receiver might be destroyed. Damage caused by a reversed polarity is excluded from the warranty clause.
2. Do not use external switch or circuit breaker as a power switch for Loran navigator.
3. Before connecting power to the receiving indicator, connect between the negative side of power supply and ground a circuit tester set at DC range, and make sure the reading is 0 V. Otherwise, change the power connection to obtain 0 V.
4. If the same power source is used for another electrical appliance, turning it on or off may generate a voltage. Make sure 0 V remains unchanged even after turning on the other appliance.
5. On the Loran C navigator, the negative side of power circuit is isolated from the ground terminal of the case.

4.3.3 RF ground

In order that Loran receiver operates properly, correct RF ground is required. If the grounding status is wrong, an erratic or no operation might occur.
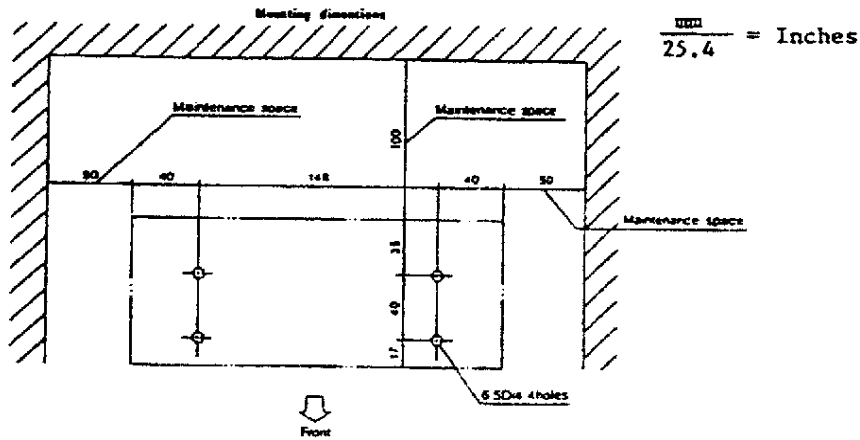
The equipment conditions differs from one vessel to another. In case of an engine ship, extend the ground wire direct to the engine block or engine outer case.

4.4 External Dimensions

Front view

Right-side view
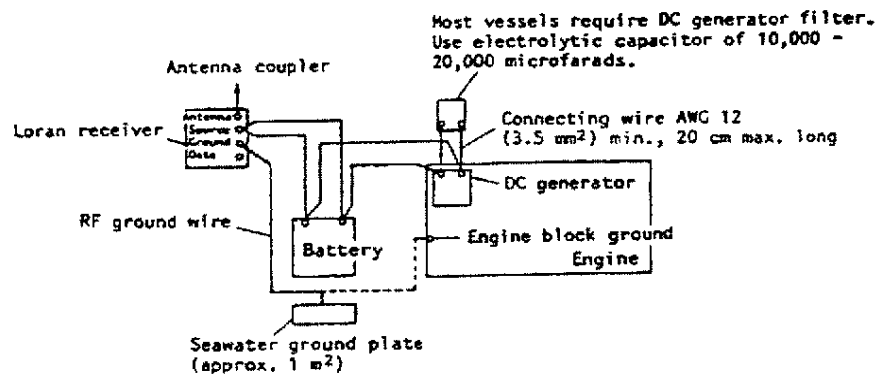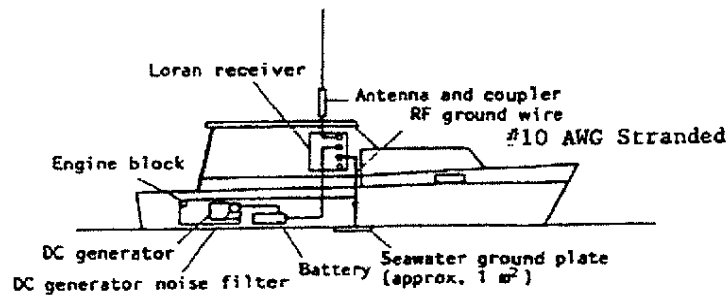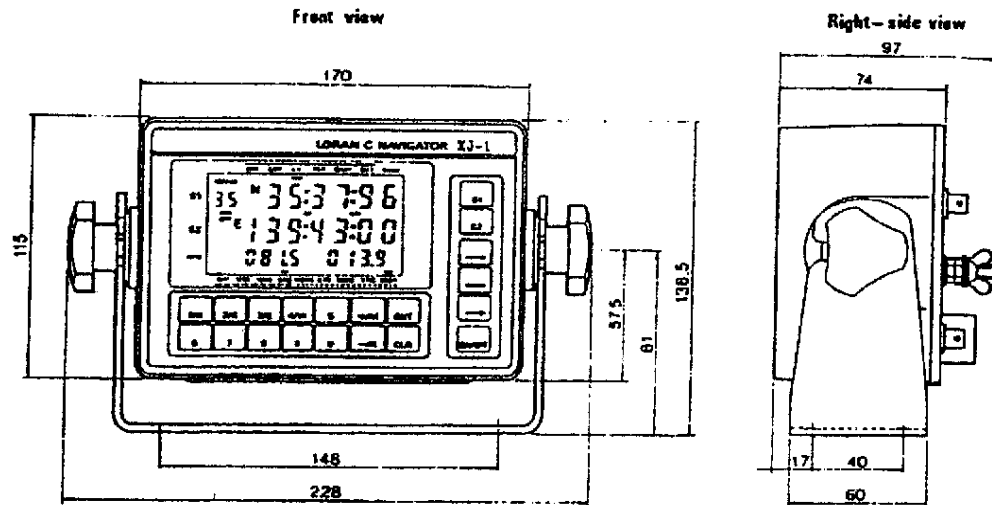
Dimensions are in millimeters.
To convert to inches, divide
mm by 25.4

$$\frac{mm}{25.4} = Inches$$

Mounting dimensions

6 SD×4 4holes

Front

CERTIFICATE OF LIMITED WARRANTY

Providing you present a valid proof of purchase, SI-TEX Marine Electronics Inc. warrants all parts of each new product against defect in material and workmanship under normal use and will repair or exchange any parts proven to be defective at no charge for a period of two years for parts and one year for labor from the date of purchase, except as provided below under Limited Warranty Exceptions.

Defects will be corrected during normal working hours by an authorized SI-TEX Marine Electronics Inc. dealer, service center, or at the SI-TEX office in St. Petersburg, Florida. There will be no charge for labor for a period of one year from the date of purchase, except as provided below under Limited Warranty Exceptions.

This Warranty and Proof of Purchase must be made available to the authorized SI-TEX Marine Electronics Inc. service location or dealer at the time of service.

LIMITED WARRANTY EXCEPTIONS

SI-TEX Marine Electronics Inc. will not be responsible for equipment which has been subjected to water or lightning damage, accident, abuse, or misuse nor any equipment on which the serial number label has been removed, altered or mutilated.

SI-TEX Marine Electronics Inc. assumes no responsibility for damage incurred during installation.

This Limited Warranty is effective only with respect to the original purchaser.

Any cost associated with transducer replacement, other than the cost of the transducer itself, is specifically excluded from this Limited Warranty. Travel cost incurred will not be accepted for SI-TEX Marine Electronics Inc. products.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.

SPECIFIC EXCLUSIONS

Charges for overtime, stand-by, holiday, and per diem are specifically excluded from the Limited Warranty.

Chart paper, stylus, stylus belt, lamps, and fuses are consumable items and are not covered by this Limited Warranty.

Installation workmanship or materials except as provided directly by SI-TEX Marine Electronics Inc. are not covered by this Limited Warranty.

SI-TEX Marine Electronics Inc. equipment or parts thereof which have been repaired or altered except by an authorized SI-TEX Marine Electronics Inc. dealer or service center are not warranted in any respect.

Transducer, software update, battery, microphone, magnetron, and microwave components and water damage on water resistant VHF radio are items excluded from the two-year warranty and are covered by warranty for a period of one year for both parts and labor.

SI-TEX Marine Electronics Inc. will not, at any time, assume any costs or labor charges for checkout or external line fuse replacement or problems not found to be at fault in equipment itself.

THERE ARE NO WARRANTIES OR GUARANTEES EXPRESSED OR IMPLIED WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY SI-TEX MARINE ELECTRONICS INC. HAS NO OTHER LIABILITY TO PURCHASE FOR DIRECT OR CONSEQUENTIAL DAMAGE OR ANY THEORY INCLUDING ABSOLUTE LIABILITY, TORT, OR CONTRACT. THIS LIMITED WARRANTY CANNOT BE ALTERED OR MODIFIED IN ANY WAY AND SHALL BE INTERPRETED IN ACCORDANCE WITH THE LAWS OF THE STATE OF FLORIDA. THIS WARRANTY IS LIMITED TO THE CONTINENTAL U.S.A , ALASKA, HAWAII, AND CANADA.

HOW TO OBTAIN SERVICE UNDER THIS WARRANTY

To provide better flexibility, SI-TEX Marine Electronics Inc. gives you the option of obtaining service under this warranty by either:

a) Contacting an authorized SI-TEX Marine Electronics Inc. service station (The closest service station may be found by contacting your dealer of purchase.)
or
b) Shipping your equipment prepaid via UPS or truck with insurance prepaid to SI-TEX Marine Electronics Inc. at the address provided below. SI-TEX Marine Electronics Inc. will, whenever possible, make all repairs covered by Limited Warranty within two weeks of receiving the equipment in Florida and return same to you, freight prepaid.

c) You must present a copy of your Purchase Sales Slip at the time you request warranty service.

Shipping/Mailing Address:
SI-TEX Marine Electronics Inc.
11001 Roosevelt Blvd., Suite 800
St. Petersburg, FL 33716
727-576-5734

SI-TEX Marine Electronics Inc. offers a complete line of quality marine electronics including fishfinders, electronic charting systems, radars, autopilots, GPS/WAAS/Loran receivers, SSB receivers, direction finders, VHF radios, VHF marine & TV antennas, and integrated systems. For more information, contact your SI-TEX dealer or the main office, located in St. Petersburg, Florida.

4.5 Connecting Antenna Coupler

Receiving antenna (2m)

Antenna coupler

Core wire

Shield

connector

Copper plate or tress

3P connector for DC power

11 - 15 VDC