Chapter 1. Introduction of Radar

1. Introduction

SMR-3600 type radar is a small size raster scanning Radar, which composes Radom type transceiver with 4 KW Transmitting power and 10.4 inch color TFT LCD monitor. Completely sealed case offers one-step higher stability, and it is designed to protect from damaging out of heat, salt water and heavy impact. In addition, it adopts color LCD monitor that can offer faster recognition of all the floating information on screen.

1-1. Usage of manual

Manual for SMR-3600 is composed of the following contents.

- Chapter 1 Introduction of Radar
- Chapter 2 How to operate on unit
- Chapter 3 How to control the unit
- Chapter 4 Installation
- Chapter 5 Maintenance
- Chapter 6 Circuit diagram and installation drawing

2. Composition

2-1. General

SMR-3600 is composed two units, transceiver and monitor as follows.

Power	DC 12V ~ DC 32V
Model Name	SMR - 3600
Transceiver Model	RSU - 3600
Monitor Model	SMR - 3600

1) Transceiver (Scanner)

Transceiver emits the micro wave towards target and receives the reflecting signal and transmtts to Monitor.

- Transmittin power : 4KW
- Maximum range : 36NM(apprx. 65Km)

2) Monitor

SMR-3600 Monitor receives input signal coming from transceiver, displayes on the screen and offers a various functions for user's convenience.

In addition, it is designed for perfect waterproof that allow you to install any places onboard.

Major features are as follows.

- 10.4 inch colour TFT LCD Display
- 640 × 480 pixel high resolution
- One touch dedication button for many fuctions available
- Bracket for fixing the unit

Display part has a switch illuminating, which is adjusted with 8 steps and the brightness of LCD screen is adjusted in 10 steps.

Gyro Comapss and NMEA0183 input is available for the convenience of navigation, which enales to display current ship's position and destination.

3. Specification

3-1. General

- Display type : Raster scan type
- Display screen : 10.4" Color TFT LCD, Vertical display
- Displaying Color : Green, Yellow, Red, White color
- Distance Range : 0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 36 NM
- Distance resolution: within 30m
- Minumum detacting Range : within 25m
- Bearing accuracy : Within ±1°
- Bearing resolution : 4.2°
- Bearing input : Real Bearing/Relative Bearing
- Environmetal condition
  - 1) Temperature : Transceiver -25℃ ~ +55℃
    : Monitor -15℃ ~ +55℃
  - 2) Relative humidity : Transceiver 35℃ -- Below 95%
    : Monitor 35℃ --- Below 95%
  - 3) Relative wind speed : 51.5m/sec (100knots)
- Power consumption : 60W
- DC Power : DC 12V ~ 32V
- Preheating time : 90 seconds
- Preaction time : Within 3 seconds

3-2. Transceiver

- Diemension
  1) Dia : 590mm
  2) Height : 290mm
- Weight : 10Kg
- Plane of polarization : Horizontarget polarized wave
- Polar pattern
  1) Horizontal Beam Width : 4.0°
  2) Vertical Beam Width : 25°
  3) Sidelobe Level : Below -21dB
- Revolution : Approx. 24r/min
- Tx Frequency : 9410±30MHZ
- Emission Type : P0N
- Peal Power : 4KW
- Transmission Bulb : Magnetron EEV MG5388
- Tx Pulse width/Repetition frequency
  1) Pulse with set-up : Short
     0.08 μsec/1640Hz - 0.125, 0.25, 0.5, 0.75,1.5NM RANGE
     0.25 μsec/1160Hz - 3NM RANGE
     0.5 μsec/580Hz - 6NM RANGE
     1 μsec/580Hz - 12, 24, 36NM RANGE
  2) Pulse with set-up : Long
     0.08 μsec/1640Hz - 0.125, 0.25, 0.5, 0.75NM RANGE
     0.25 μsec/1160Hz - 1.5NM RANGE
     0.5 μsec/580Hz - 3NM RANGE
     1 μsec/580Hz - 6, 12, 24, 36NM RANGE

3-3. Monitor

- Dimension
  1) Width : 290mm
  2) Height : 300mm
  3) Depth : 142mm
- Construction : Desk Type
- Weight : 5.8kg
- Monitor Screen : 10.4” Colour TFT LCD
- Scale Zoom-in : Of 1 % of using RANGE or 70m, below whichever it is bigger
- VRM : .000 ~ 64.0 NM – Digital display
- EBL : .000° ~ 359° --- Digital display
- Synchonizing Method : Manual/Automatic switchable

- Bearing scale : 1° scale, 360°
- Bearing display : Electronic type
  - Operating point
  - Front Panel button

1) Tune : Knob
2) Gain : Knob
3) Rain, Snow Clutter removal : Knob
4) Sea Clutter Removal : Knob
5) Guard : Switch
6) Distance Circle : Swich
7) Interference Rejection : Swich
8) Heading Line : Swich
9) Parallel Line : Swich
10) Center movement : Swich
11) 1 EBL/VRM : Swicth
12) 2 EBL/VRM : Swicth
13) F EBL/VRM : Swicth
14) Cursor : Swicth
15) Range ◀ : Swicth
15) Range ▶ : Swicth
16) ESC : Swicth
17) Menu : Swicth
18) Conversion : Swicth
19) Enter : Swicth
20) Center : Swicth
21) Direction button (8 direction) : Swicth
22) Brightness ▲ : Swicth
23) Brightness ▼ : Swicth
24) Power : Swicth
25) Transmit : Swicth

- Menu type : POP-UP Type

3-4. Connection Cable

- Antenna Cable Length : 15m
- Power Cable Length : 3m
- Data Cable Maximum Length : 3m

Chapter 2. How to operate

1. Introduction

It offers to display a wide range of information in monitor by using control buttons.

- 4 numbers dedicated volume
- 8 directional button and center button for moving to center screen
- 20 numbers of dedicated button.
- Wide range of choice for function in Menu

2. How to use the front button and volume

2-1. How to use direction button

- Moving cursor in Radar screen
- Selection of items in Menu
- To increase or decrease setting value

When pressed the direction button, cursor or selected bar is shifted to the same direction as the display on the button. The longer pressing time is, the moving speed is increase.

2-2. How to use the dedicate button

These buttons have their endowed function as follows.

- GUARD : Set up desired monitoring area on screen and alarm function.
- RING : Display a concentric ceircle referring to measuring the distance.
- IR : Elimination of interference on Radar plotting
- SHM : Display of heading line
- PLINE : Display a parallel line with heading direction
- OFF CENT : To move Radar plotting to the center position
- 1 EBL VRM : Setting up and display NO.1 EBL and VRM
- 2 EBL VRM : Setting up and display NO.2 EBL and VRM
- F EBL VRM : Setting up and display flexile EBL and VRM

- 

: Display of cursor
- 

: Distance adjustment
- 

: To return or move the previous screen in menu
- 

: Call for Menu screen
- 
: To convert or alter the setting value
- 

: Confirm the setting value or selection of menu
- 

: To adjust dimmer on screen and switch
- 

: Function to turn ON/OFF
- 

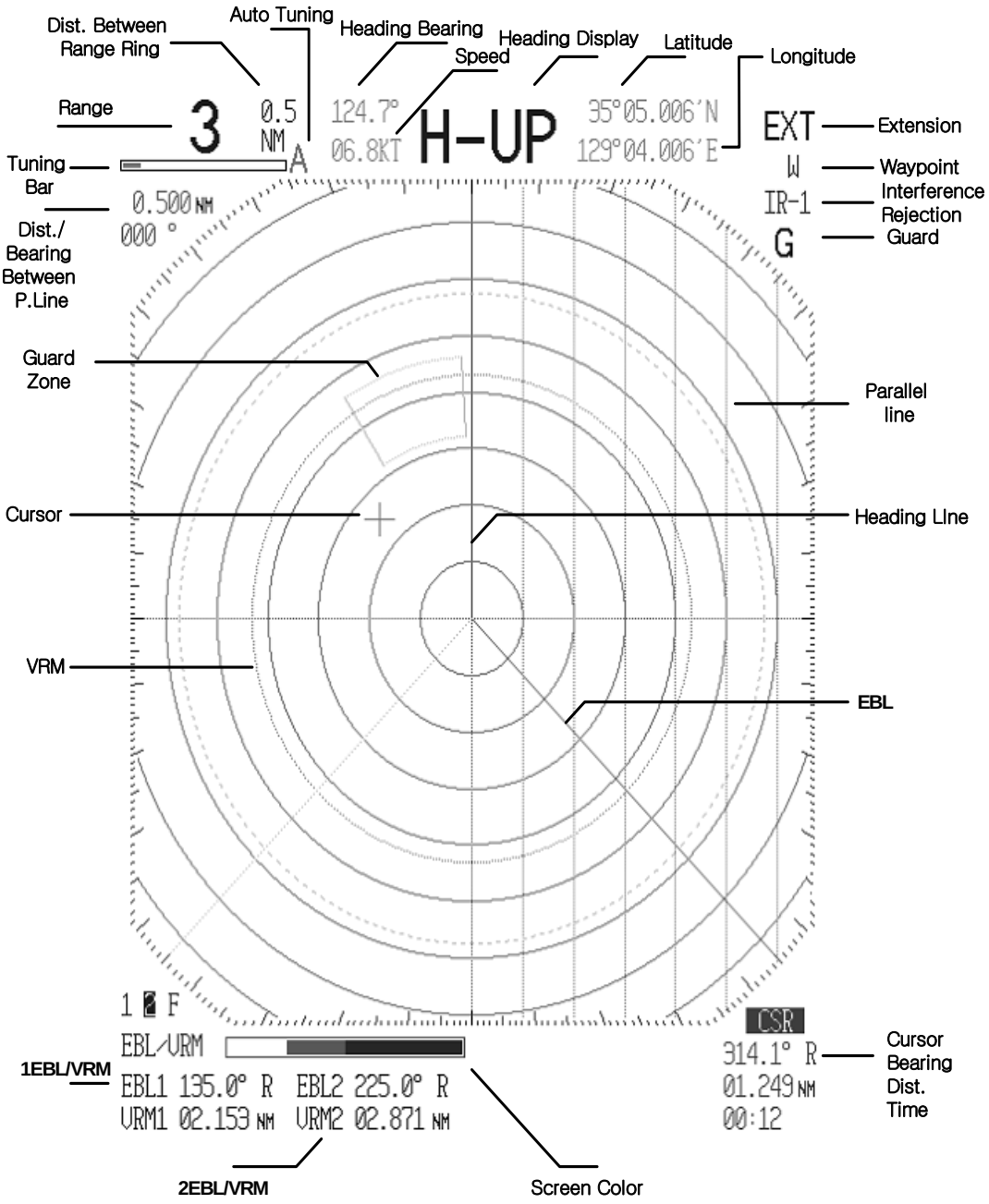
: Function to ready for transmitting or changing the states of it

2-3. Volume adjustment

4 numbes dedicated volume has a function below and it can be adjusted in the night as dimmer is in rear side.

- Tune : Adjust synchronized frequencies at receiver
- Gain : Adjust gain of receiving signal
- Snow, Rain Clutter elimination : Eliminating the reflected wave due to snow and rain in a heavy weather
- Sea Clutter elimination : Eliminating the reflected wave due to sea surface.

2-4. Screen Description



• Display on top of the screen regarding bearing, speed, latitude and longitude and set-up on right bottom of the screen for destination is only available when the singanl from Gyro Compass and GPS is nput to DATA port.

3. Turn ON/OFF

3-1. Turn ON

1) Press POWER button.

2) I t will be ready after preheating time of 1’ 30” (90 seconds) is passed.

3) Press TX button and Radar starts transmitting.

3-2. Turn OFF

1) Press POWER button for 2-3 seconds.

2) Radar will be in state of stoppage and all functions stopped.

3-3. Using time in total

In the state of preheating, the time shown in screen (**** time) is the total time in using Radar. It is determined to replace or maintain Magnetron referring to total time used.

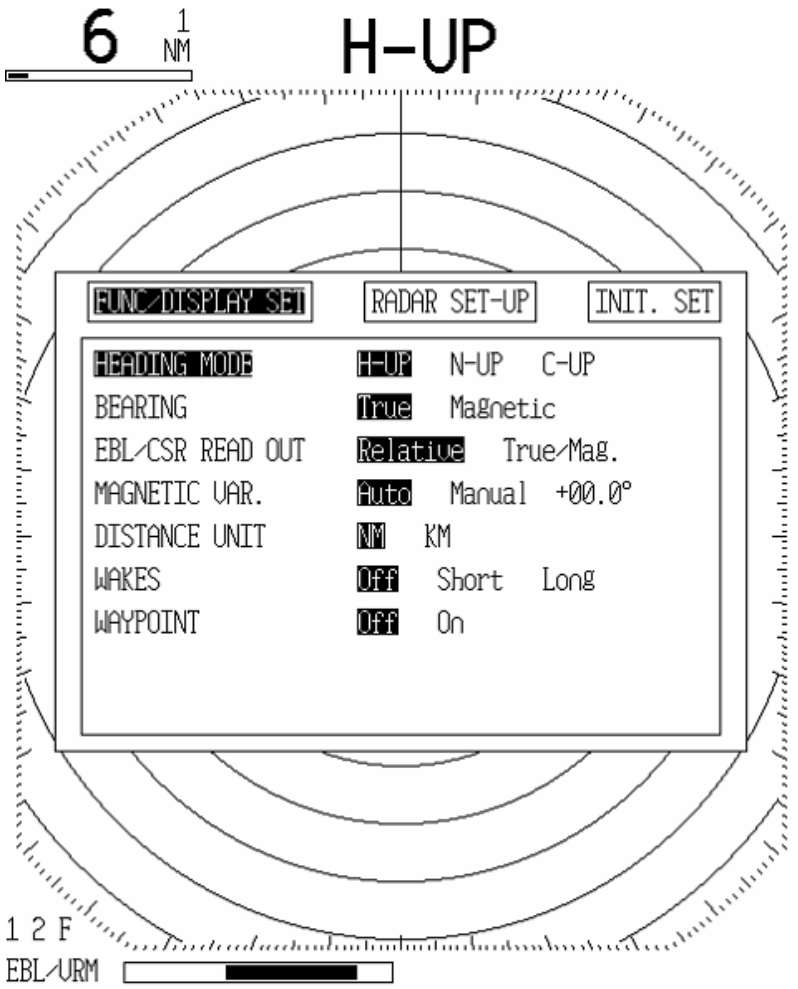
3-4. How to control power during repair/maintenance

Even power is OFF, unt inside still exited especially in Monitor that cause eletric shock while in repair or maintenance. Therefore you are requested to stop the power provided by rectifer (in case of using rectifier), or separate power cable from the rear side of Monitor.

4. How to use menu

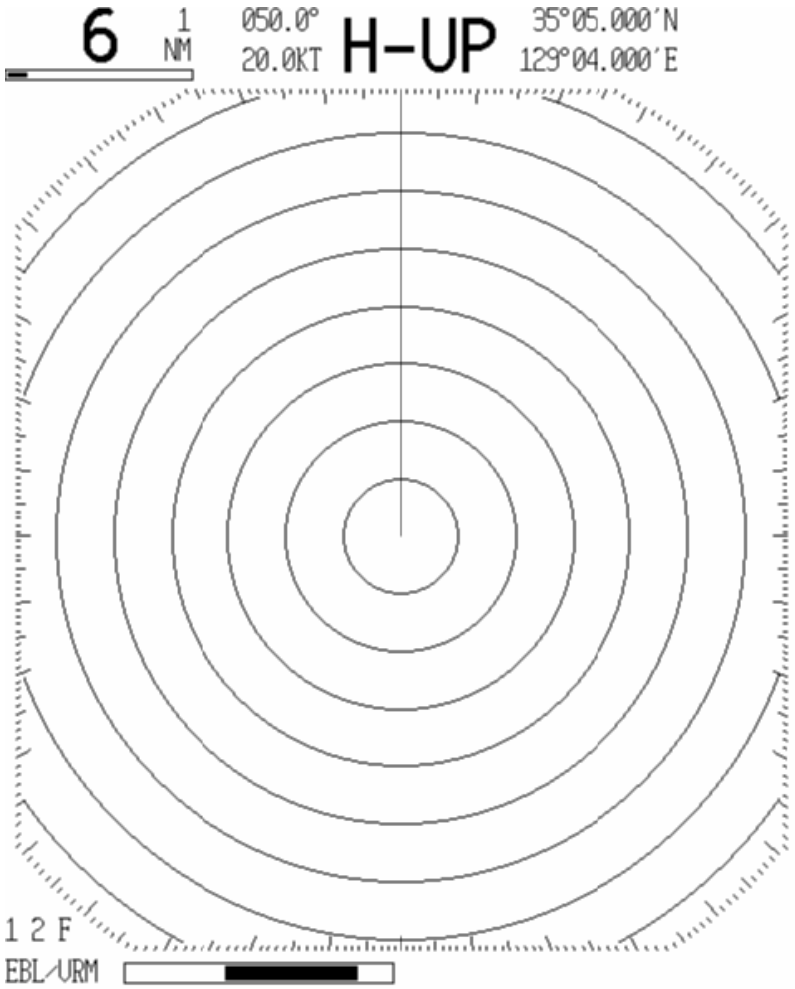
4-1. Screen display

1) MENU ->[◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [HEADING MODE]
   -> Press ENT button and then there will be a blue line on screen.
2) Select one of [H-UP, N-UP, C-UP] [◀][▶].
3) Press ESC button after ENT button for the return to screen.



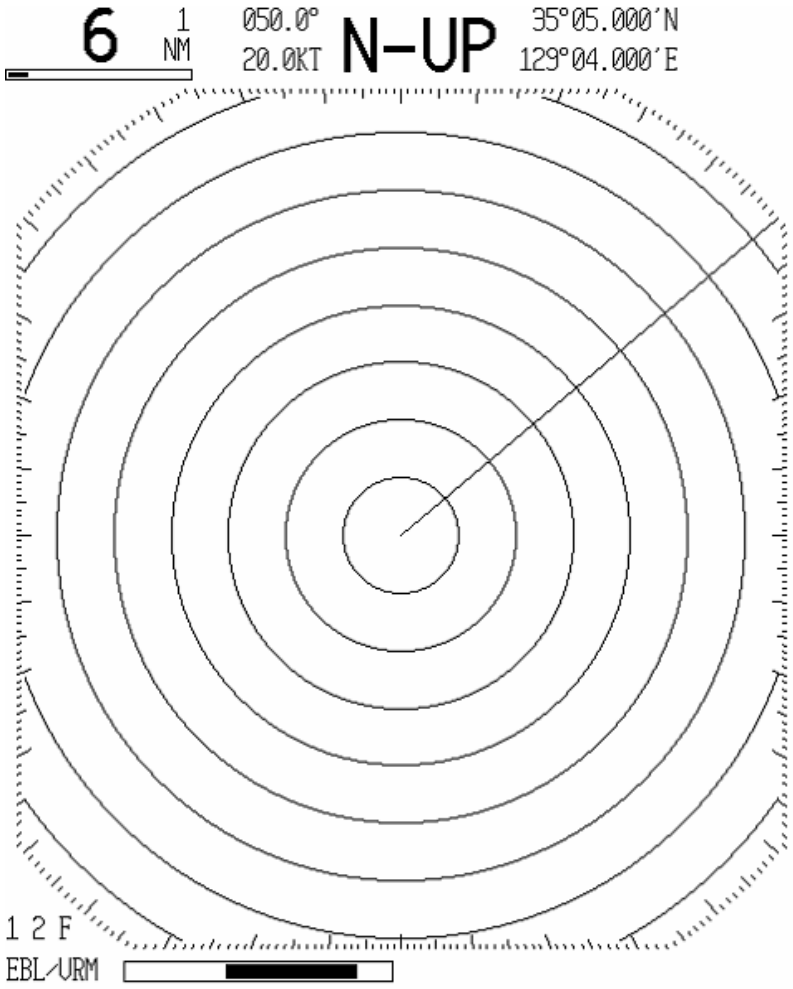
4-1-1. H-UP (Heading Up, Display the other's bearing)

- Make the stem display on the screen (Bearing 0°).
- If stem's bearing is changed, it changes the bearing of echo image on screen.
- Display the other's bearing in case there's no connected with Gyro Compass such as the equipment that is able to get bearing information.
- Following display is for the screen that there's GPS or Gyro Compass signal input through data port.



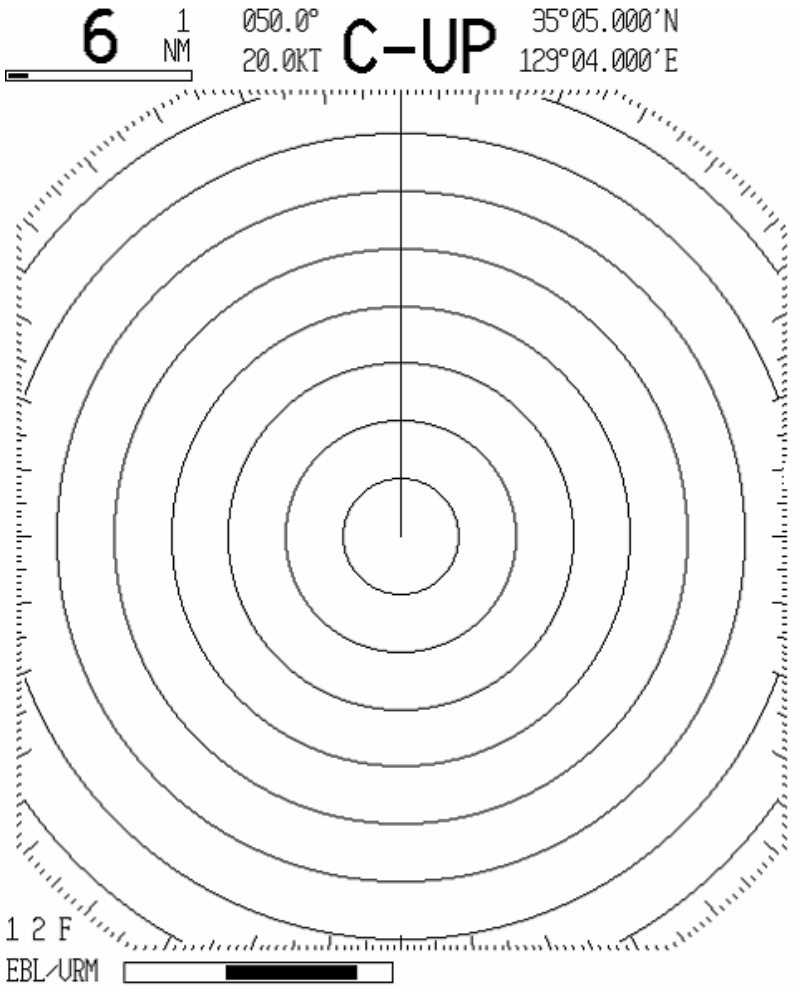
4-1-2. N-UP (Norse Up, True bearing display)

- The north displays as a true image on the screen.
- Even the vessel's stem changed, the image range does not change.
- Need the equipment that is able to get bearing information such as Gyro Compass.
- Displays stem bearing, speed, longitude and latitude as an option.



4-1-3. C-UP (Course Up)

- When press course-up switch for course setup, vessel's bearing should be a true imageon screen.
- Even the vessel's stem is changed, the echo image bearing does not change and vessel stem line is rotated as the change of vessel stem direction.
- It needs the equipment that is able to get bearing information such as Gyro Compass.
- Display vessel's stem bearing, speed, longitude and latitude on screen as option



(Notice) It is available to display a data of Gyro Compass and GPS on the screen as above and this is only available for the option.
The below shows a screen which is no data input.

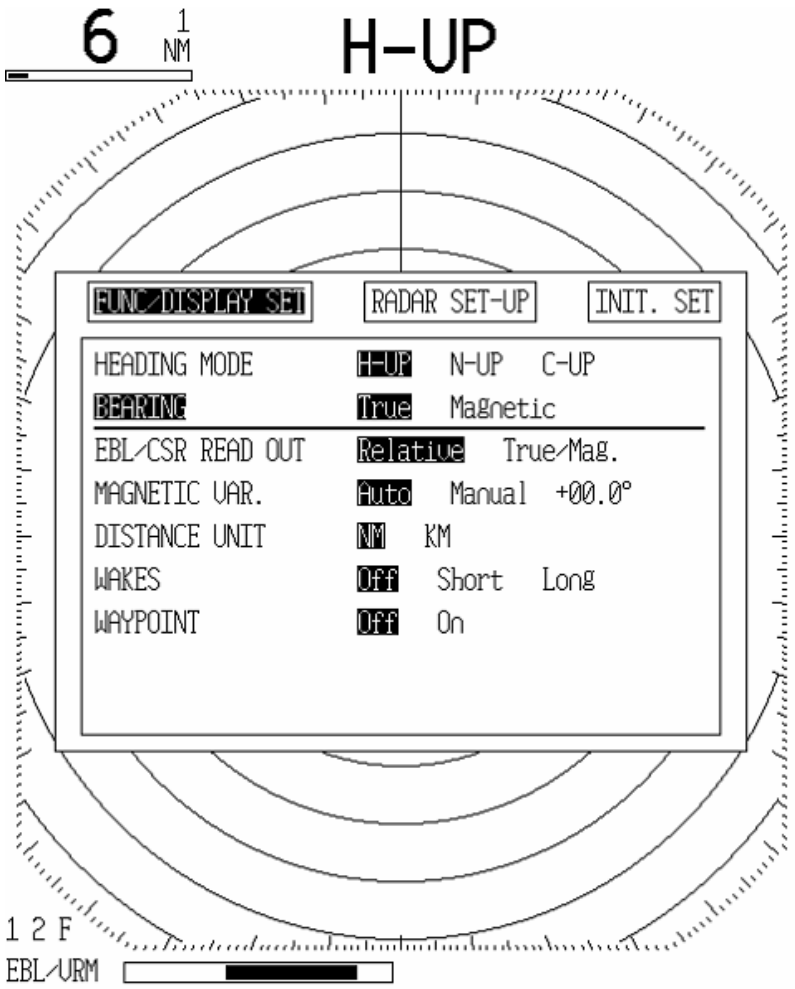
4-2. Bearing

1) MENU -> [◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [BEARING] -> Press ENT button and then there's a blue line on [BEARING].

2) Select true bearing or magenetic bearing by using [◀][▶] button.

3) Press ENT button and ESC button for the return to screen.

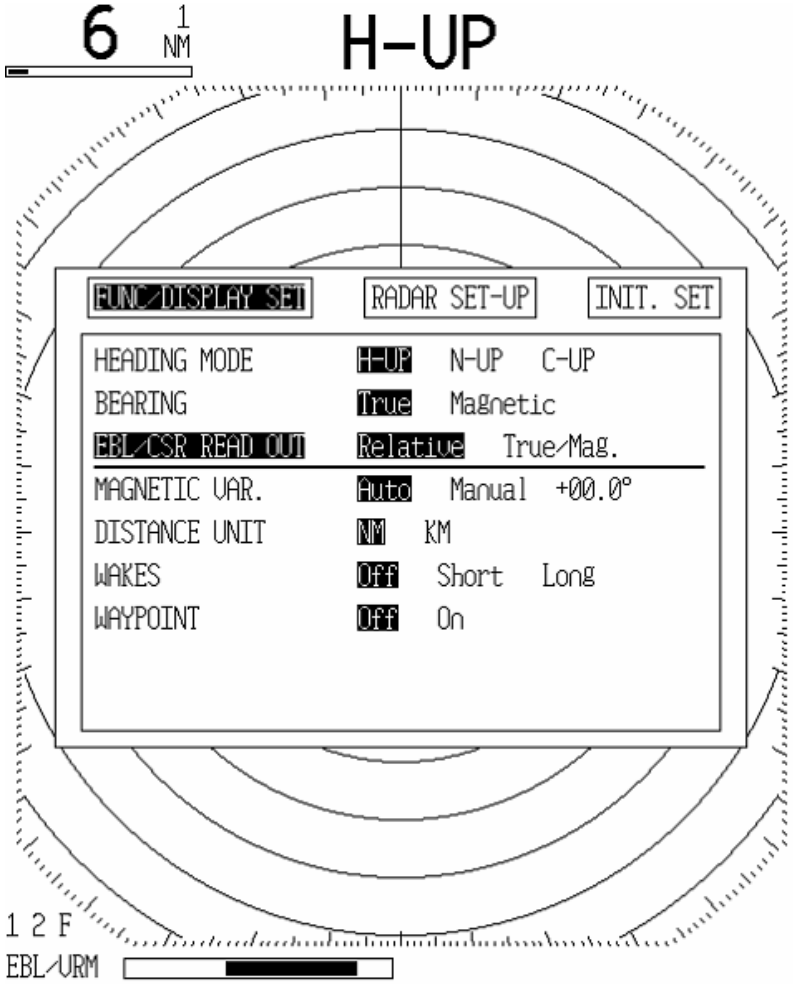
• It needs the equipment that is able to get bearing information such as Gyro Compass.



4-3. EBL/CSR Read out (Display bearing line/cursor)

1) MENU -> [◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [EBL/CSR READ OUT]
   -> Press ENT and then there's a blue line on [EBL/CSR READ OUT].
2) Select the others or true north] by [◀][▶].
3) Press ENT and ESC for the return to screen.

• It needs the equipment that is able to get bearing information such as Gyro Compass.



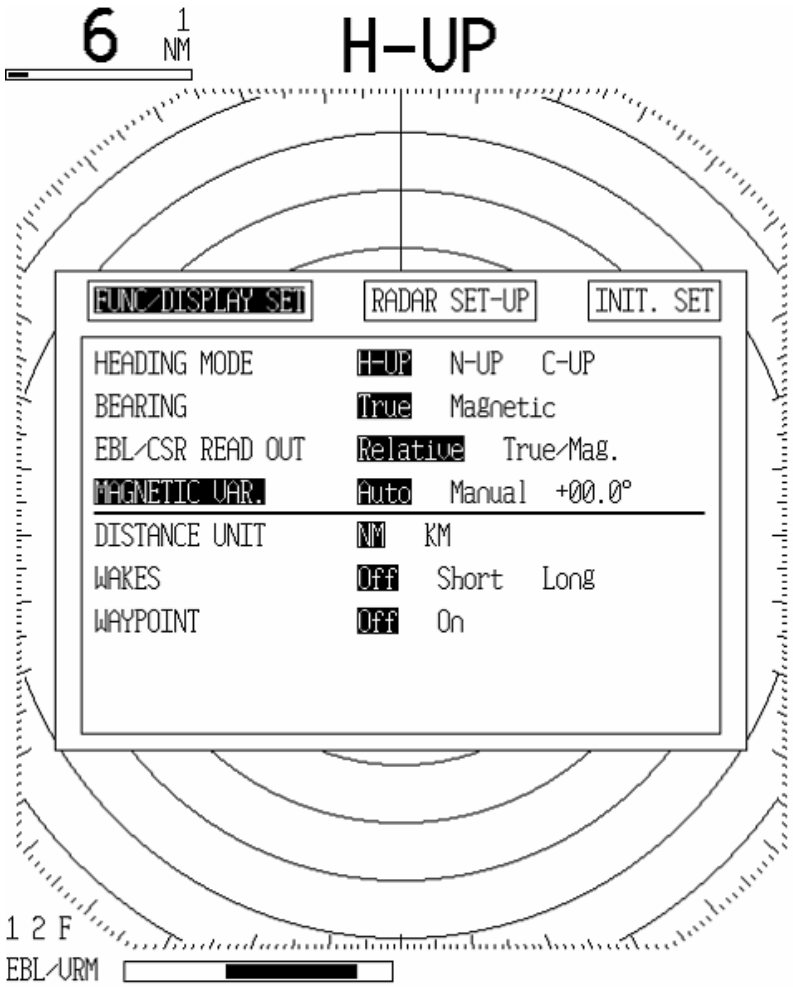
4-4. Magenetic Var.

1) MENU -> [◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [MAGNETIC VAR.]
-> Press ENT and there's a blue line on [MAGNETIC VAR.].

2) Select [Auto, Manual, +00.0°] by [◀][▶] and press ENT.
Auto : Display a true bearing on External input GPS DATA.
Manual : Display a bearing with adding bearing correctiong value to a true bearing on External input GPS DATA.
+00.0°: Bearing bearing correction, Input the wanted correction value(-99.9° ~ +99.9°).

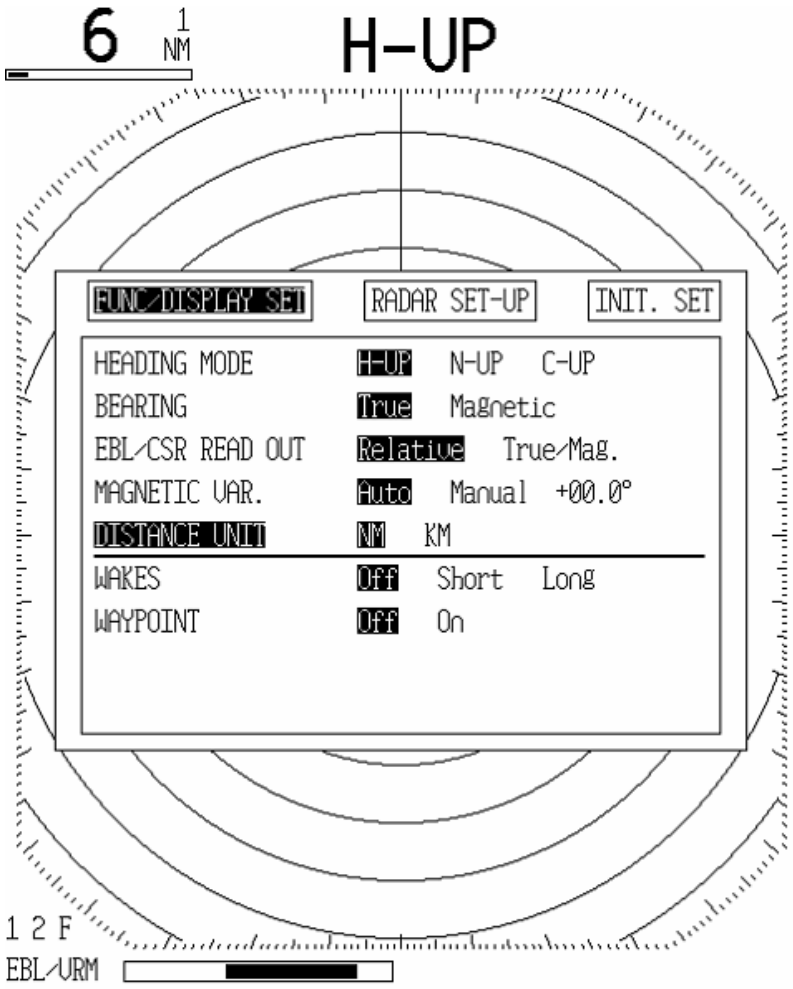
3) Press ENT and ESC for the return to screen.

• It needs the equipment that is able to get bearing information such as Gyro Compass.



4-5. Distance Unit

1) MENU -> [◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [DISTANCE UNIT]
   -> Press ENT and then there's a blue line on [DISTANCE UNIT].
2) Select [NM, KM] by using [◀][▶] button.
   NM : Display a distance as Mile.
   KM : Display a distance as Km.
3) Press ENT and ESC for the return to screen.



4-6. Wake Point

• Display a trace that is passed a target.

1) MENU -> [◄][►] -> [Func/DISPLAY SET] -> [▲][▼] -> [WAKES] -> Press ESC and then there will be a blue line on [WAKES].

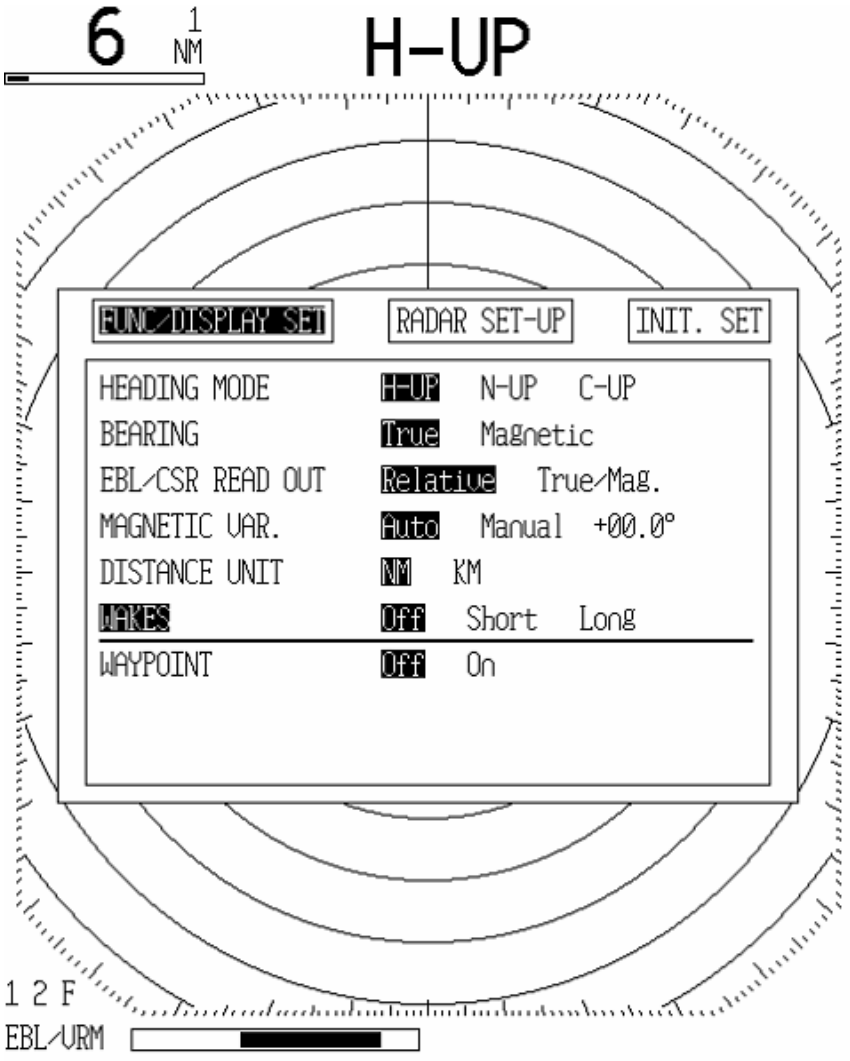
2) Select [Off, Short, Long] by using [◄][►] button.

Off : No display a target trace.

Short : Display a target trace shortly.

Long : Display a target trace long.

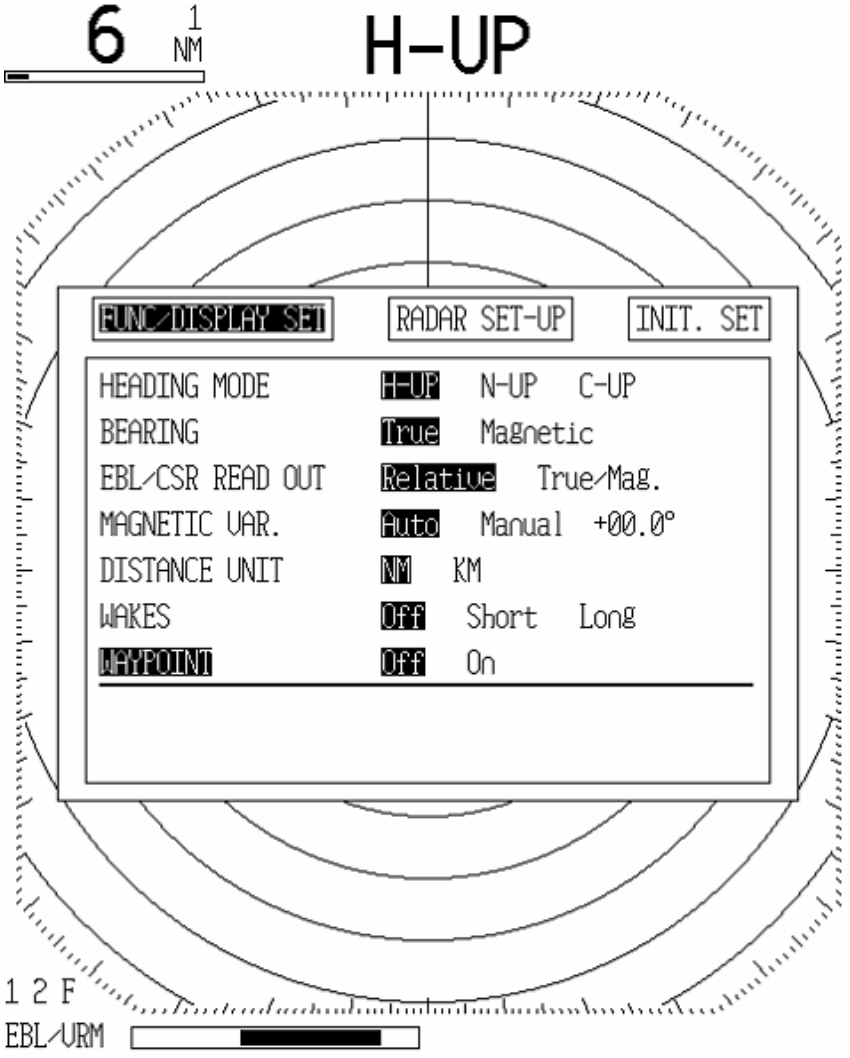
3) Press ENT and ESC button for the return to screen.



4-7. Waypoint

1) MENU -> [◀][▶] -> [FUNC/DISPLAY SET] -> [▲][▼] -> [WAYPOINT]
   -> Press ESC and then there's a blue line on [WAYPOINT].
2) Select [Off, On] by using [◀][▶].
   OFF : No display a destination sign on the screen.
   ON : Display destination sign on the screen.
3) Press ENT and ESC button for the return to screen.
4) It is necessary GPS bearing information and speed input.

• This is only for sending a destination setup data (*BWC signal) from GPS which is available for destination setup to Radar



4-8. Tuning Mode

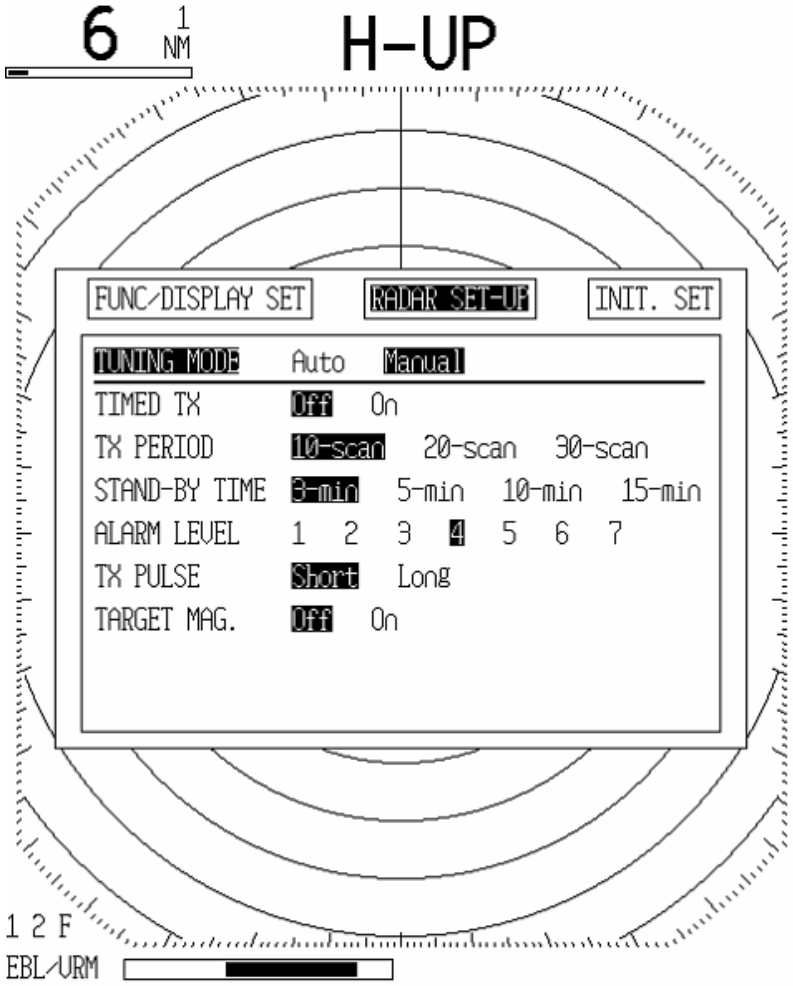
1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [TUNING MODE] -> Press ENT and then there will be a blue line in tuning.
2) Select [Auto, Manual] by using [◀][▶] button.
3) Press ENT after ESC for the return to screen.

• Manual tuning adjustment

1) Rotate tuning volumn.
2) When there is an echo image by sign on a screen, adjust the image bigger.
3) When there is no echo image by sign on a screen, adjust the tuning maximum with the distance range which is 6 mile over.

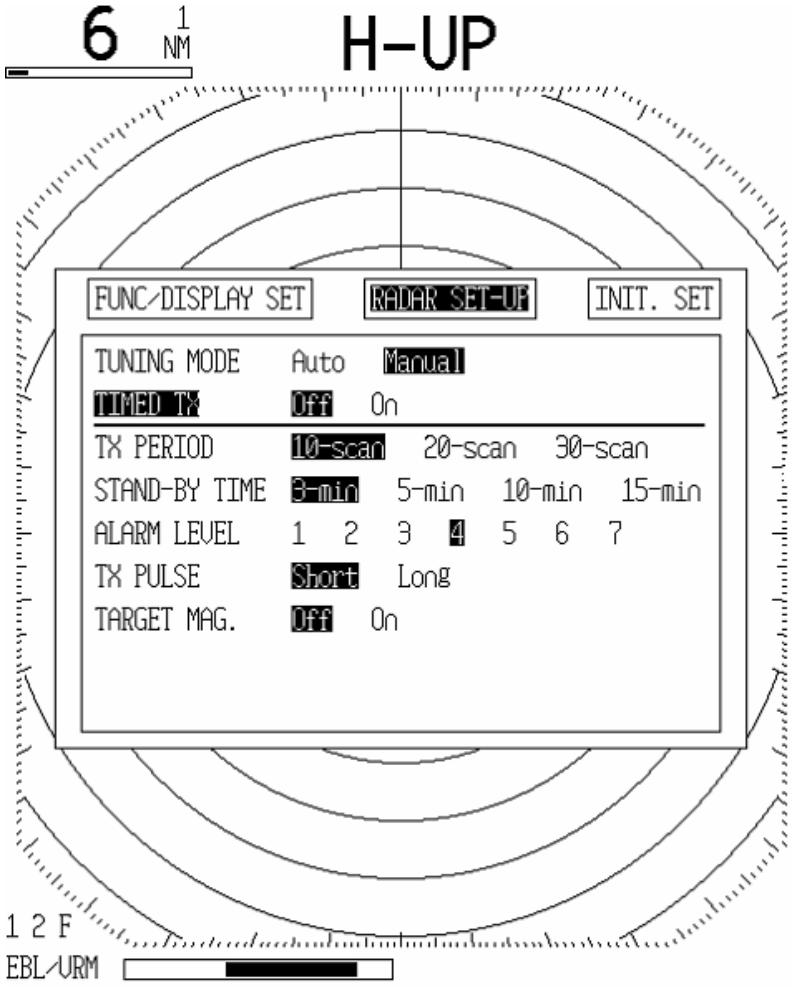
• Auto tuning adjustment

1) After check on tuning volume is on center, do not rotate a tuning volume.
2) If tuning volume is rotated, it doesn't rotate a tuning temporary but rerotate after a couple of scanning. If tuning volume is out of center, it cannot be tuned.



4-9. Timed TX

1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [TIMED TX]
   -> Press ENT and then there's a blue line on Intermittent Transmitting.
2) Select [ON, OFF] by using [◀][▶] button.
   ON : Be TX status from Ready status.
   OFF : Be Ready status from TX.
3) Press ENT after ESC for the return to screen.



(Notice) Due to Radar's standby during intermittent transmitting, it needs to be controlled with upmost attention. Otherwise there could be a crash with a vessel with high speed.

4-10. TX Period

1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [TX Period] -> Press ENT to see blue line drawing in TX Period.

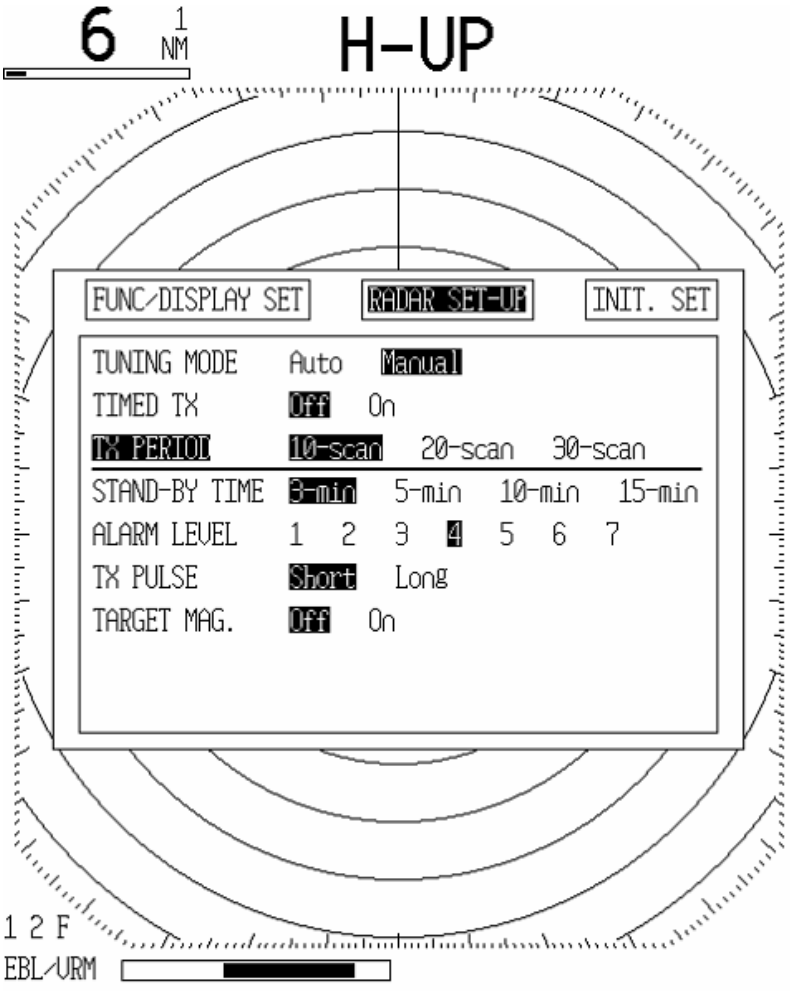
2) By using [◀][▶] to select 10, 20, 30-scan.

10-scan : Be in use of 10-scan TX period.

20-scan : Be in use of 20-scan TX period.

30-scan : Be in use of 30-scan TX period.

3) After pressing ENT , press ESC to return back to screen.



4-11. Stand-by Time

1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [STAND-BY TIME] -> Press ENT to see blue line drawing in STAND-BY TIME.

2) By using [◀][▶] button to select among [3-minutes, 5-minutes, 10-minutes, 15-minutes]

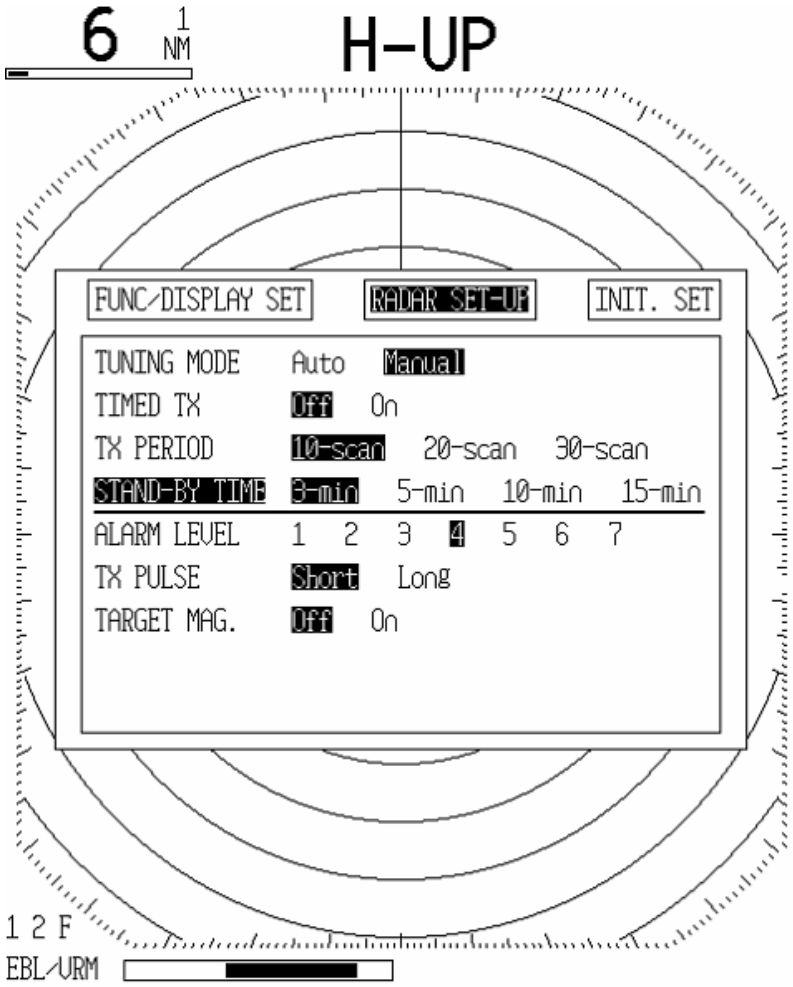
3-minutes : STAND-BY TIME is 3 minutes

5-minutes : STAND-BY TIME is 5 minutes

10-minutes : STAND-BY TIME is 10 minutes

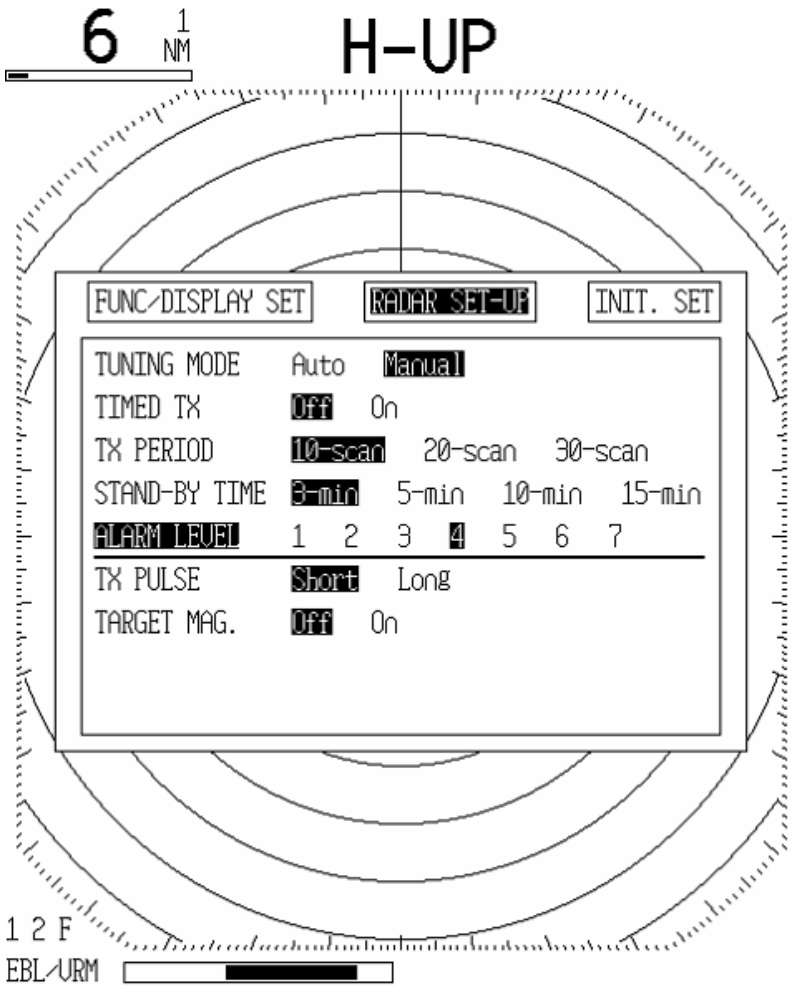
15-minutes : STAND-BY TIME is 15 minutes

3) After pressing ENT, press ESC to return back to screen.



4-12. Alarm Level

1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [ALARM LEVEL] -> Press ENT to see blue line drawing in alarm level.
2) By using [◀][▶] button to select among [1, 2, 3, 4, 5, 6, 7]
3) After pressing ENT, press ESC to return back to screen.



4-13. TX Pulse

• Set up the transmission pulse width.

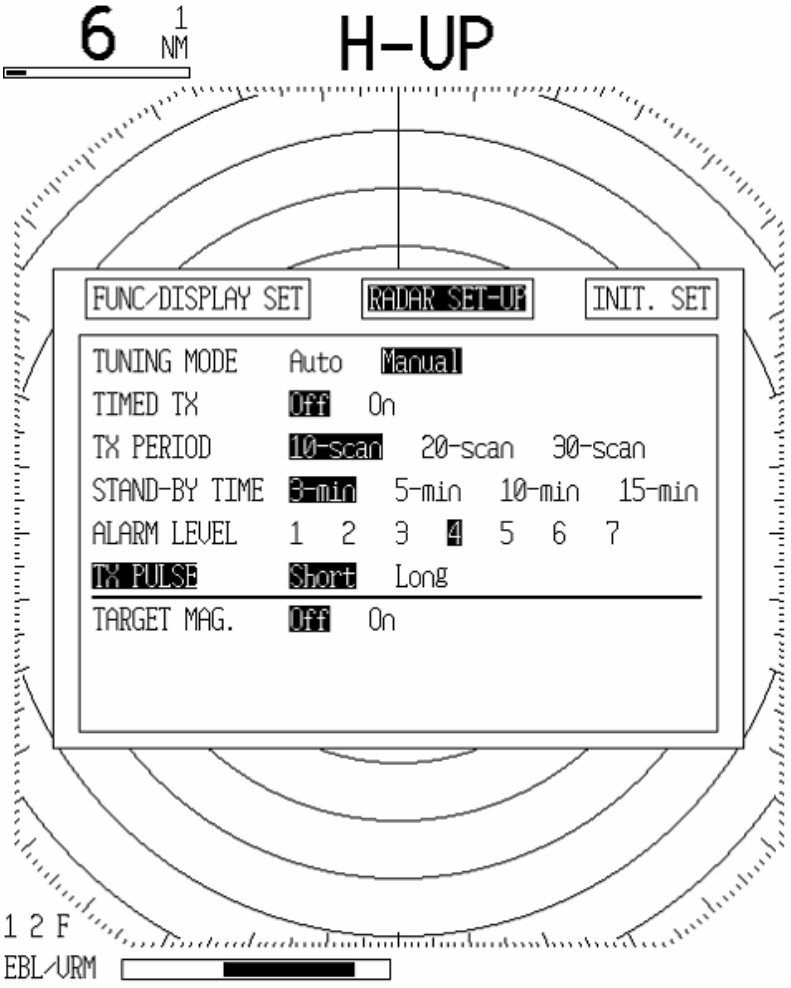
1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [TX PULSE] -> Press ENT to see blue line in TX pulse.

2) By using [◀][▶] button to select between [Short] or [Long]

Short : The more the transmission pulse is narrow the more distance resolving power is sufficient

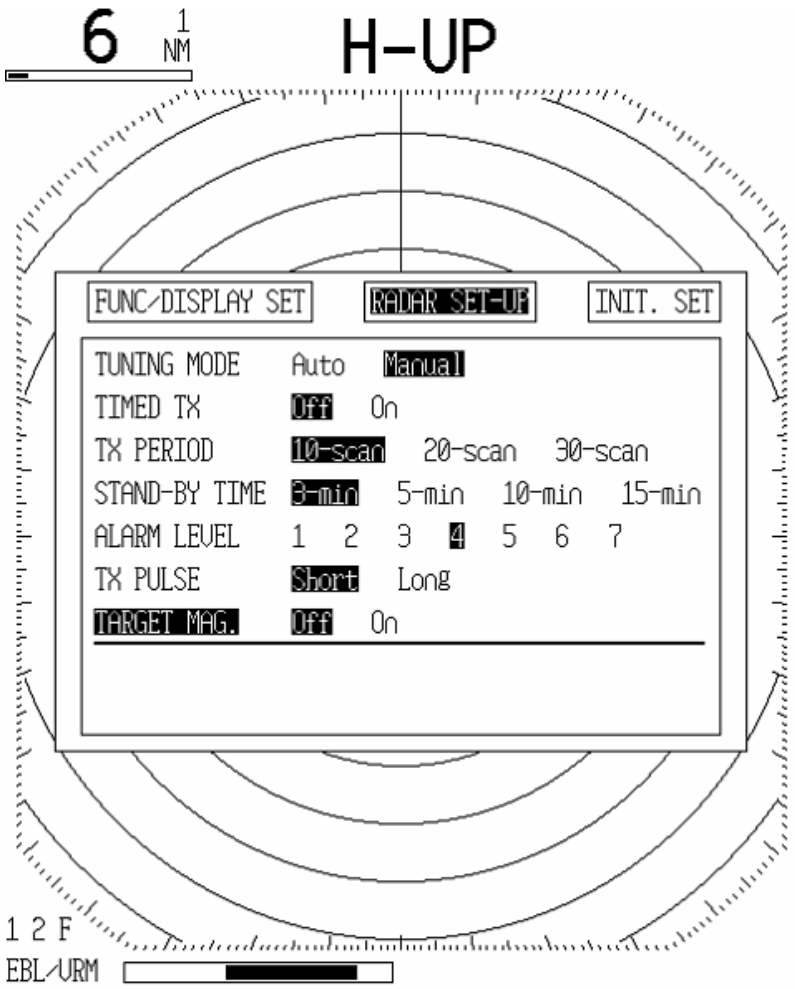
Long : The more the transmission pulse is broad the more sensitivity is sufficient.

3) After pressing ENT, press ESC to return back to screen.



4-14. Target Mag.

1) MENU -> [◀][▶] -> [RADAR SET-UP] -> [▲][▼] -> [Target Mag.] -> Press ENT to see blue line drawing in target mag..
2) By using [◀][▶] button to select between [Off] and [On].
3) After pressing ENT, press ESC to return back to screen.



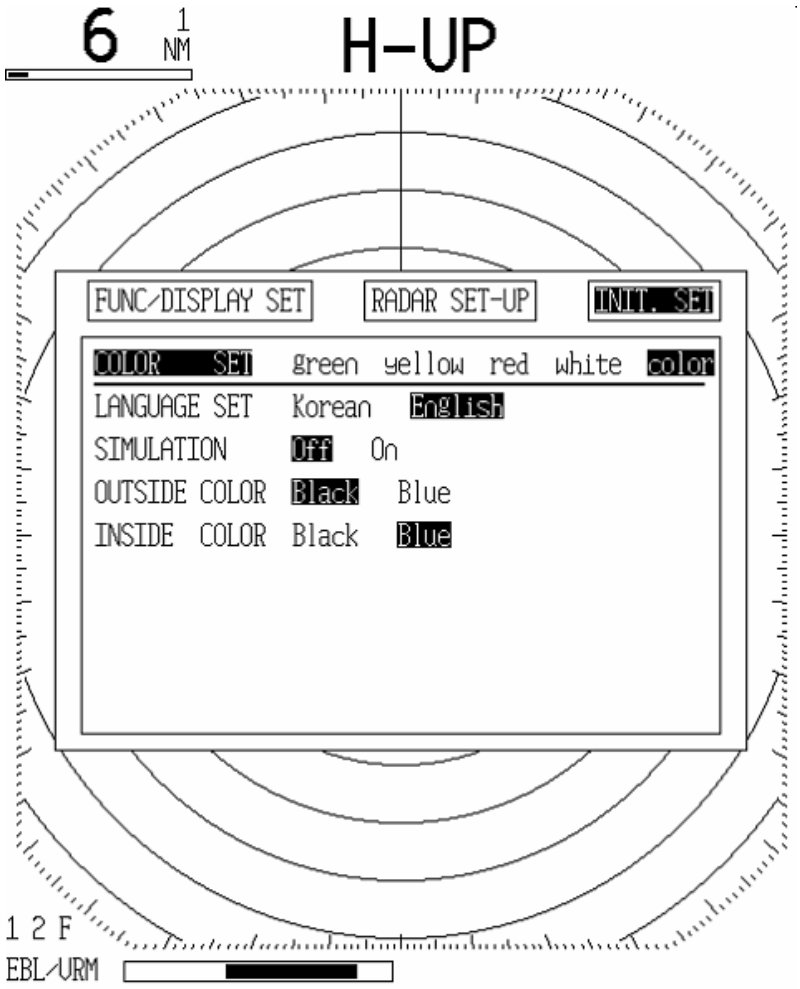
4-15. Color Set

• Function to change from screen color into wanted color

1) MENU -> [◀][▶] -> [INIT. SET] -> [▲][▼] -> [COLOR SET] -> Press ENT to see blue line drawing in the color set.

2) By using [◀][▶] button to select among green, yellow, red, white colors and press ENT.

3) After pressing ENT, press ESC to return back to screen.



4-16. Language Set

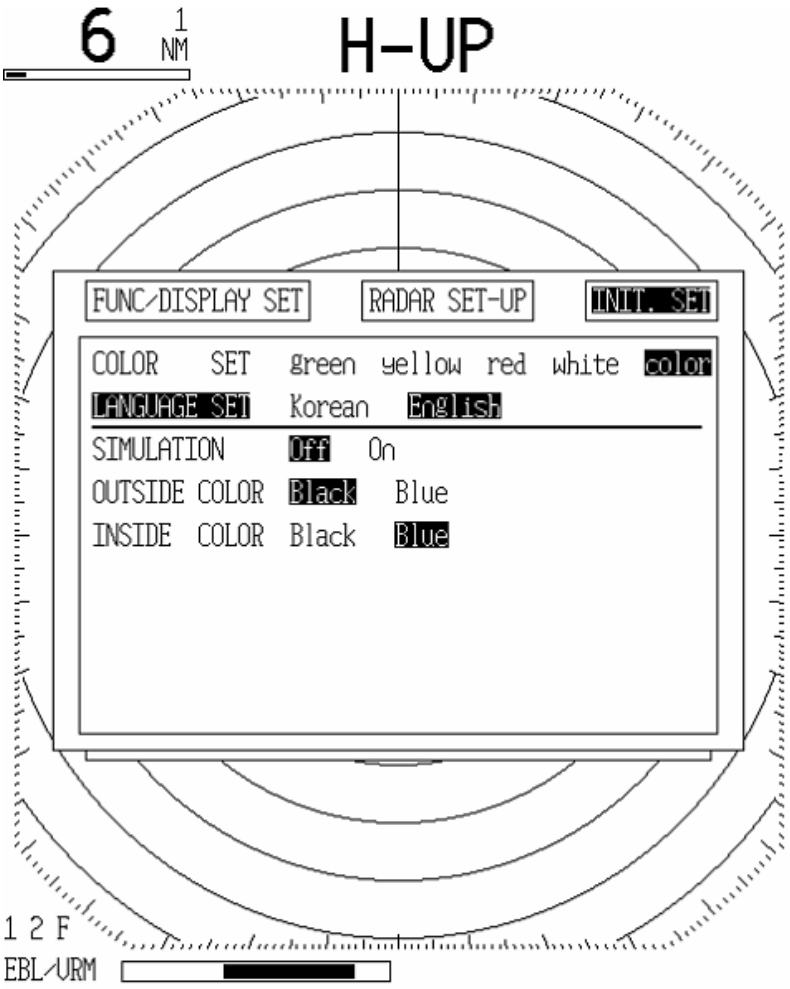
1) MENU -> [◀][▶] -> [INIT. SET] -> [▲][▼] -> [LANGUAGE SET] -> Press ENT to see bule line drawing in language set.

2) By using [◀][▶] button to select between Korean, English.

Korean : Korean coming up

English : English coming up

3) After pressing ENT, press ESC to return back to screen.

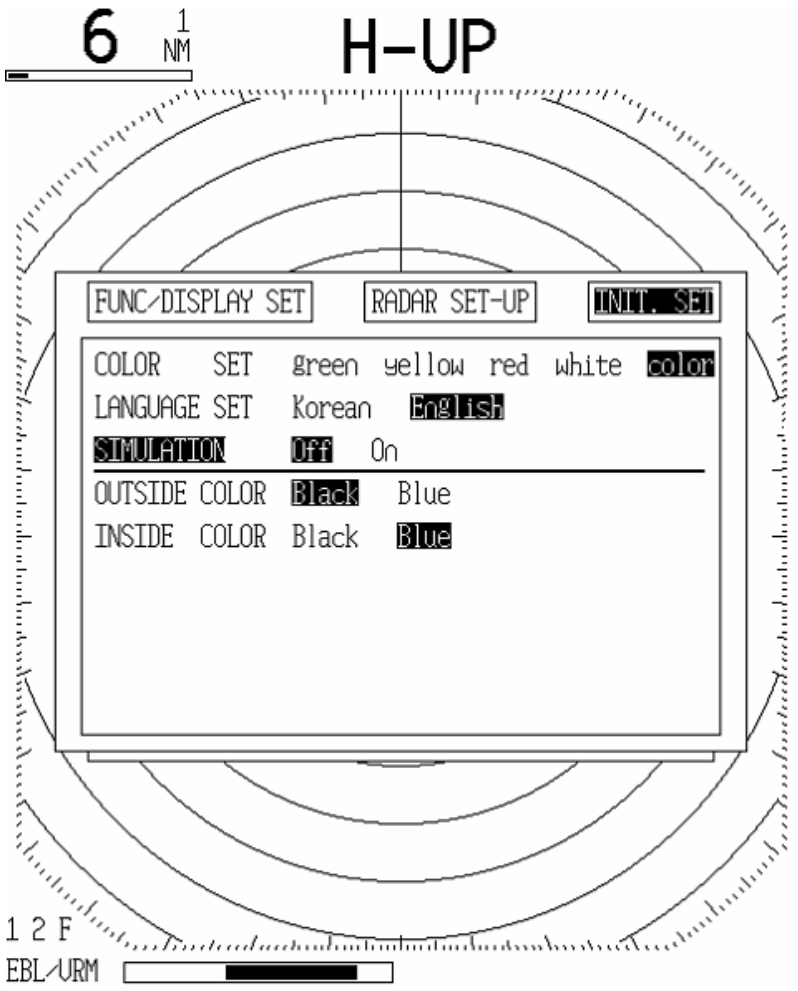


4-17. Simulation

1) MENU -> [◀][▶] -> [INIT. SET] -> [▲][▼] -> [SIMULATION] -> Press ENT to see blue line drawing in simulation.

2) By using [◀][▶] button to select between Off, On.

3) After pressing ENT, press ESC to return back to screen.

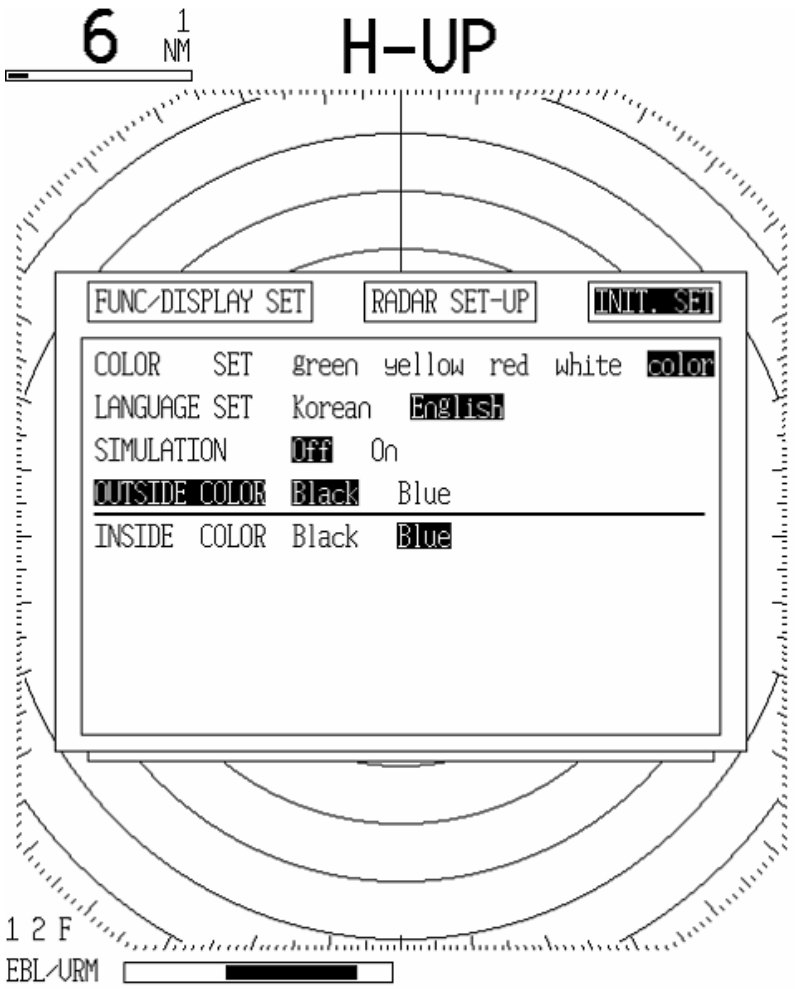


4-18. Outside Color

1) MENU -> [◀][▶] -> [INIT. SET] -> [▲][▼] -> [OUTSIDE COLOR] -> Press ENT to see blue line drawing in outside color.

2) By using [◀][▶] button to select between Black, Blue.

3) After pressing ENT, press ESC to return back to screen.

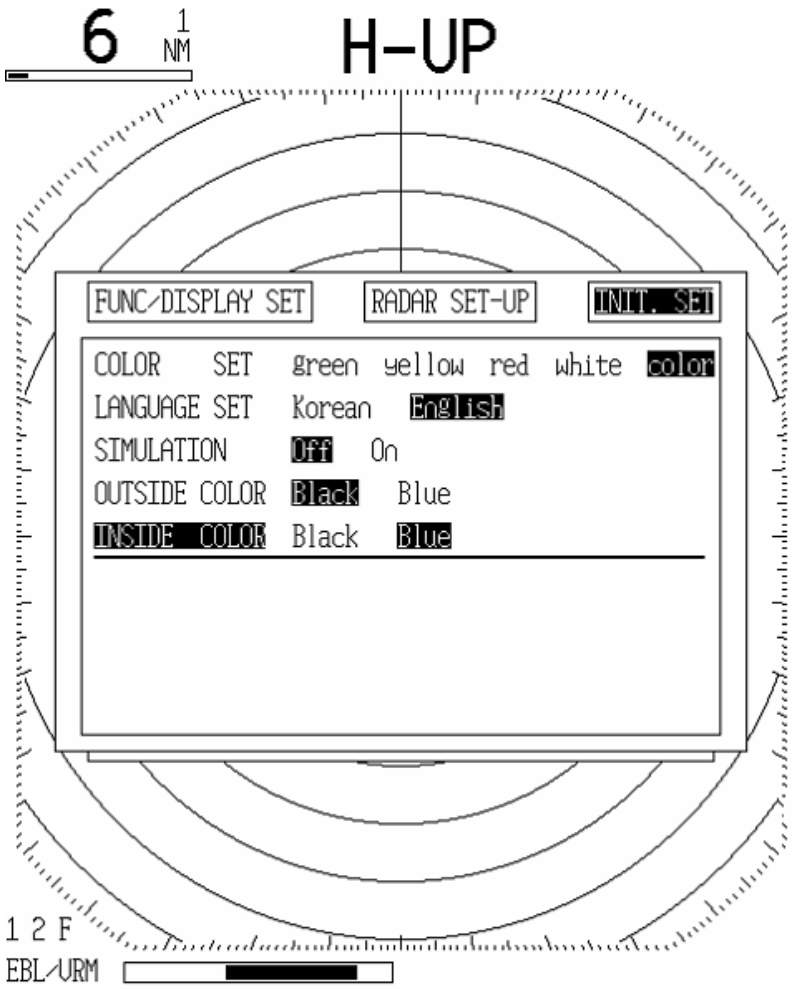


4-19. Inside Color

1) MENU -> [◀][▶] -> [INIT. SET] -> [▲][▼] -> [INSIDE COLOR] -> Press ENT to see blue line in inside color.

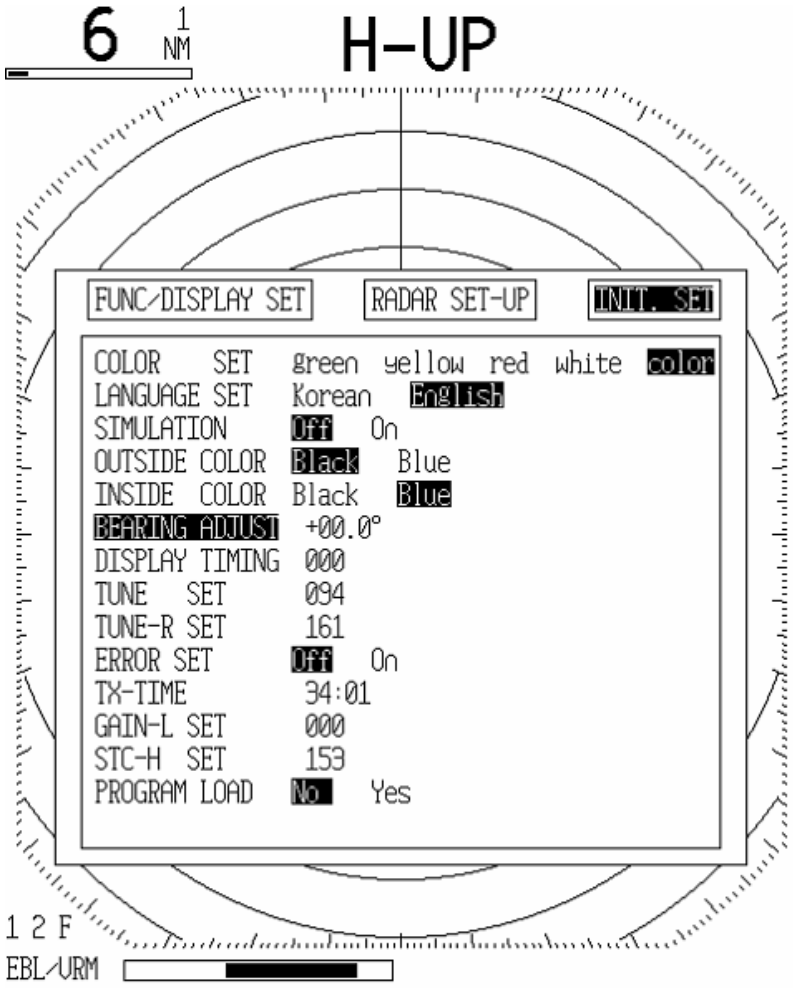
2) By using [◀][▶] button to select between Black, Blue.

3) After pressing ENT, press ESC to return back to screen.



[How to use Radar internal set menu.]

1) MENU -> [◀][▶] -> [INIT. SET] -> On front panel, press IR PLINE IR PLINE following menu is shown up.



2) BEARING ADJUST, DISPLAY TIMING, TUNE set, TURN-R set, ERROR SET, TX-TIME, GAIN-L SET, STC-H SET and PROGRAM LOAD are radar's internal set menu, therefore in case of control, following instruction is recommendable.

(Notice) Radar internal set menu is value when taking goods out of the warehouse, therefore if user modifies the value, radar capability could be affected.

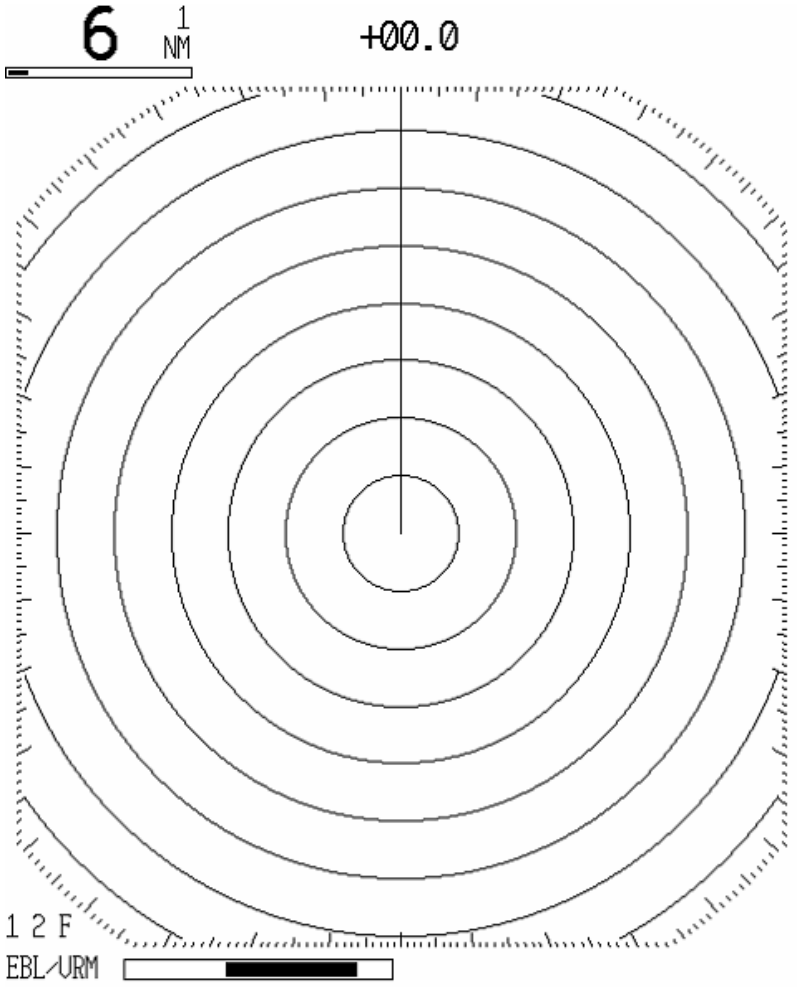
4-20. Bearing Adjust

• Function to control direction of screen.

1)On [INIT. SET], [▲][▼] -> [BEARING ADJUST] -> Press ENT to return back to screen and show BEARING ADJUST value in the middle of upside.

2) By using [▲][▼] [◄][►], to select BEARING ADJUST value (-90.0 ~ +90.0)

3) After pressing ENT, press ESC to return back to screen.



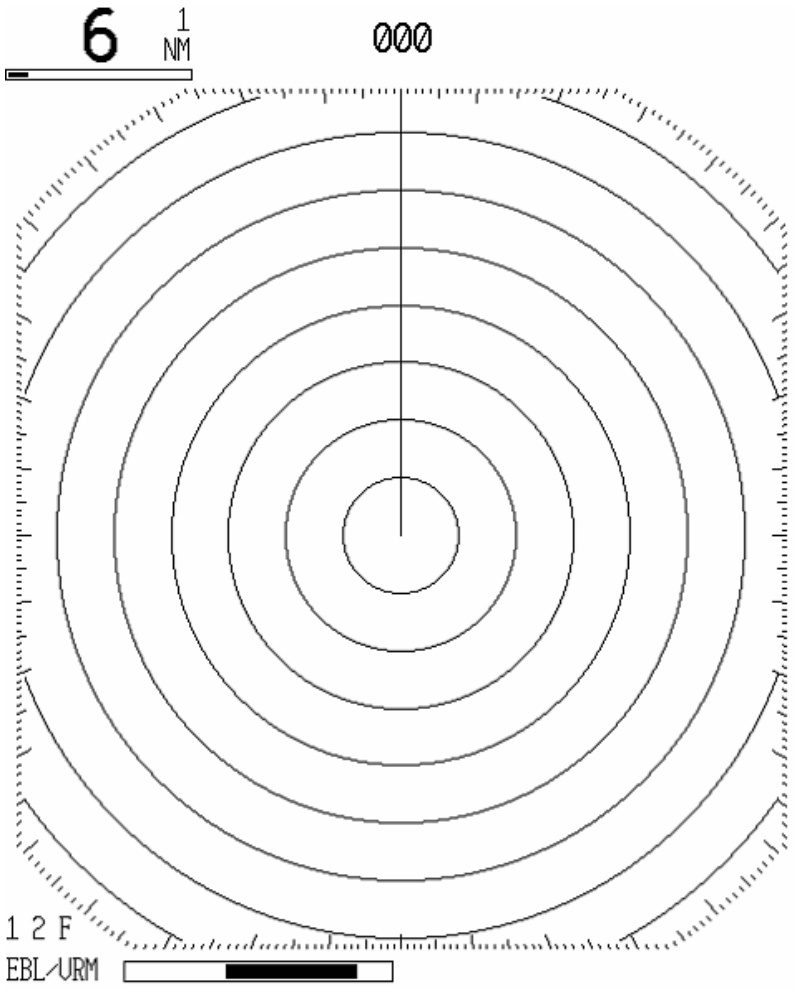
4-21. Display Timing

• Functin to adjust the distance on screen.

1) [INIT. SET]-> [▲][▼] -> [DISPLAY TIMING] -> Press ENT to return back to screen and DISPLAY TIMING is shown in the middle of upside.

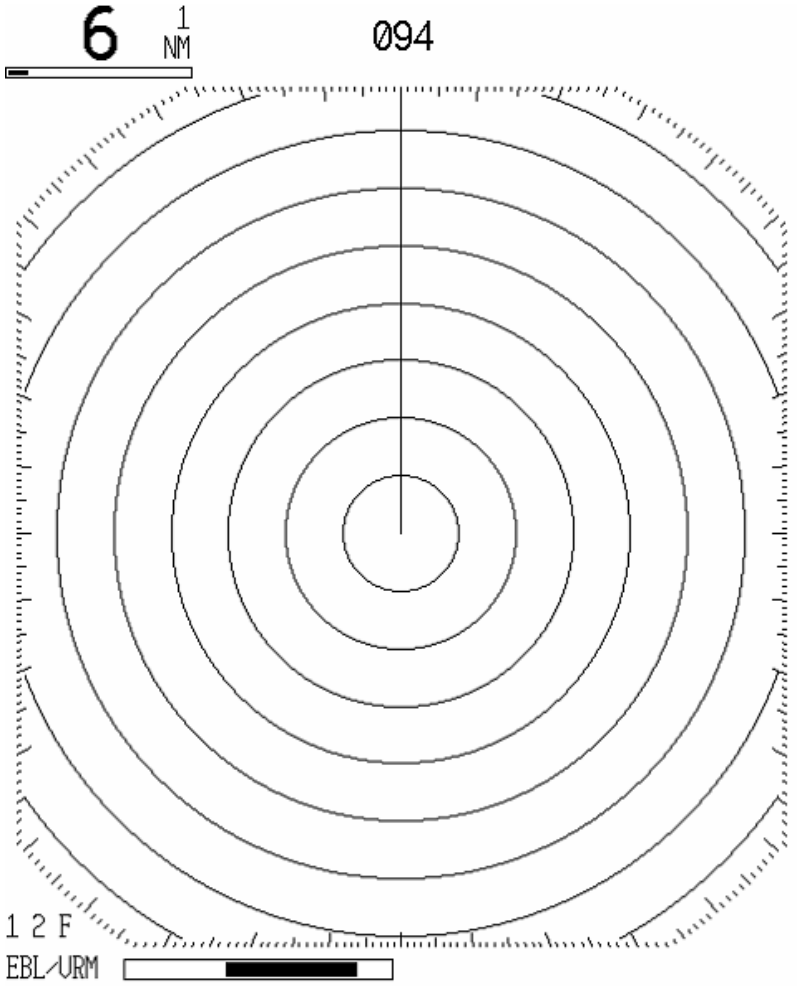
2) By using [▲][▼] [◄][►] to select DISPLAY TIMING. (000 ~ 255)

3) After pressing ENT, press ESC to return back to screen.



4-22. Tune Set

1) [INIT. SET] [▲][▼] -> [TUNE SET] -> press ENT to return back to screen and Tune value is shown in the middle of upside.
2) By using [◄][►] [▲][▼] to select TUNE value. (0 ~ 255)
3) After pressing ENT, press ESC to return back to screen.



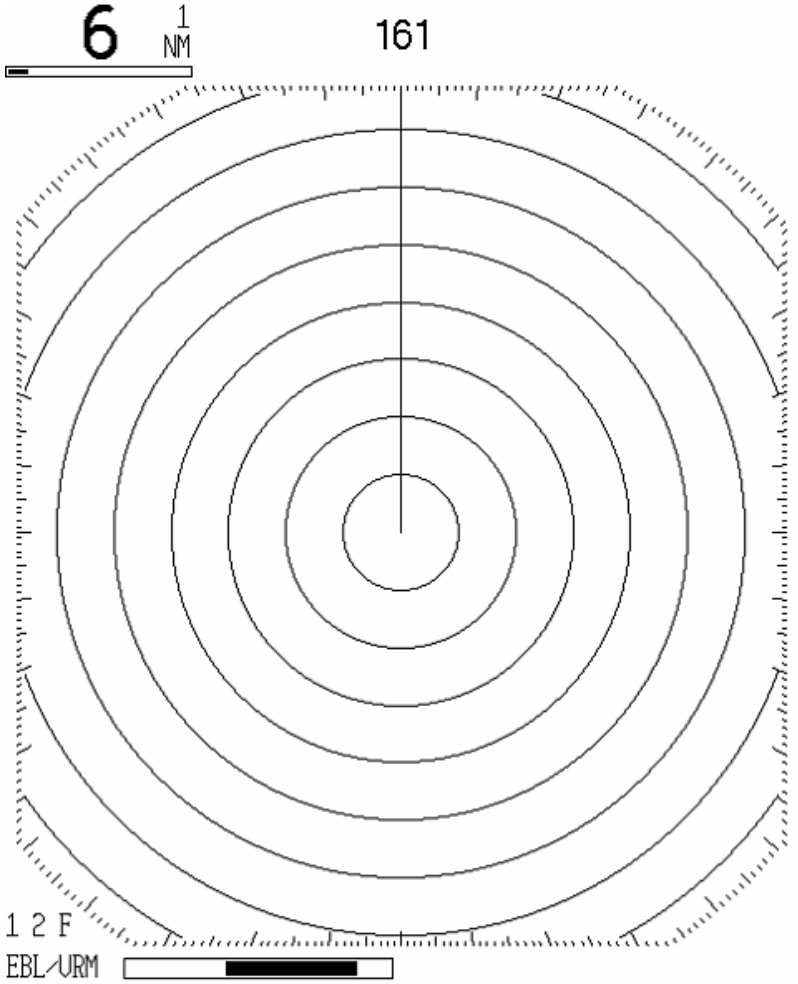
4-23. TURN-R Set

- Function to set the tune voltage range.

1) [INIT. SET] -> [▲][▼] -> [TURN-R SET] -> Press ENT to return back to screen and Tune-R value is shown in the middle of upside.

2) By using [◀][▶] [▲][▼] to select Tune-R value. (0 ~ 255)

3) After pressing ENT, press ESC to return back to screen.



4-24. Error Set

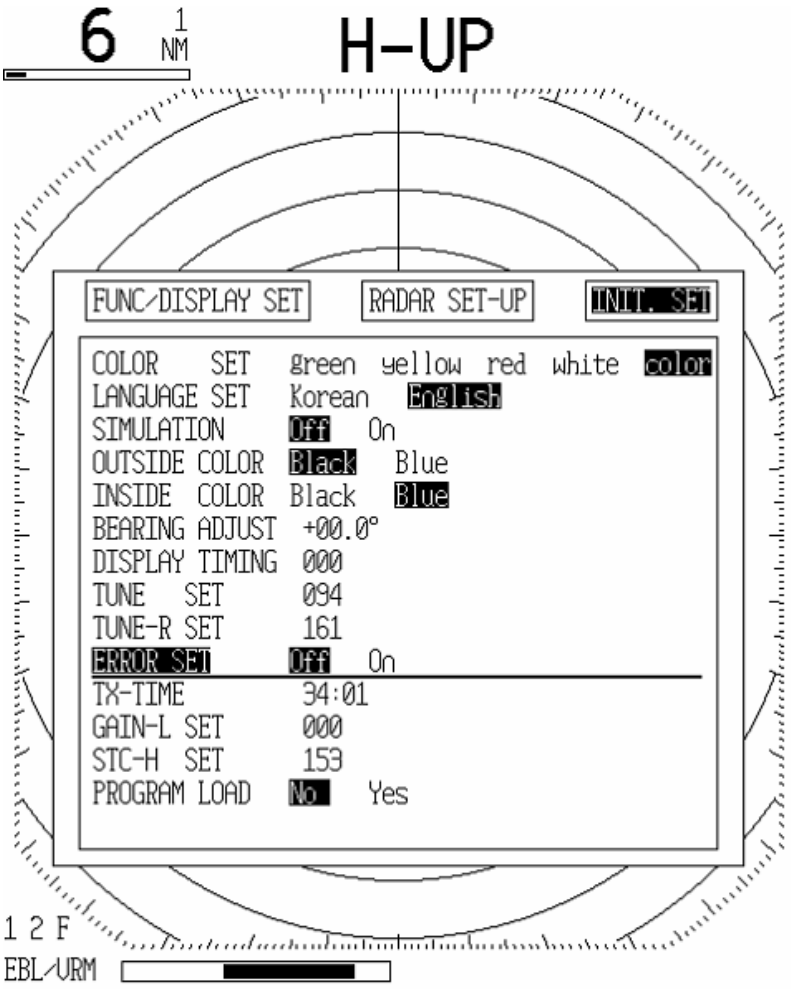
• Function to test at the moment of pausing error when error is occurred.

1) [INIT. SET] -> [▲][▼] -> [ERROR SET] -> ENT.

2) By using [▶] to select [Off, On].

3) After pressing ENT, press ESC to return back to screen.

(Notice) It should be [ON] status all the time in order to remove ERROR SET.

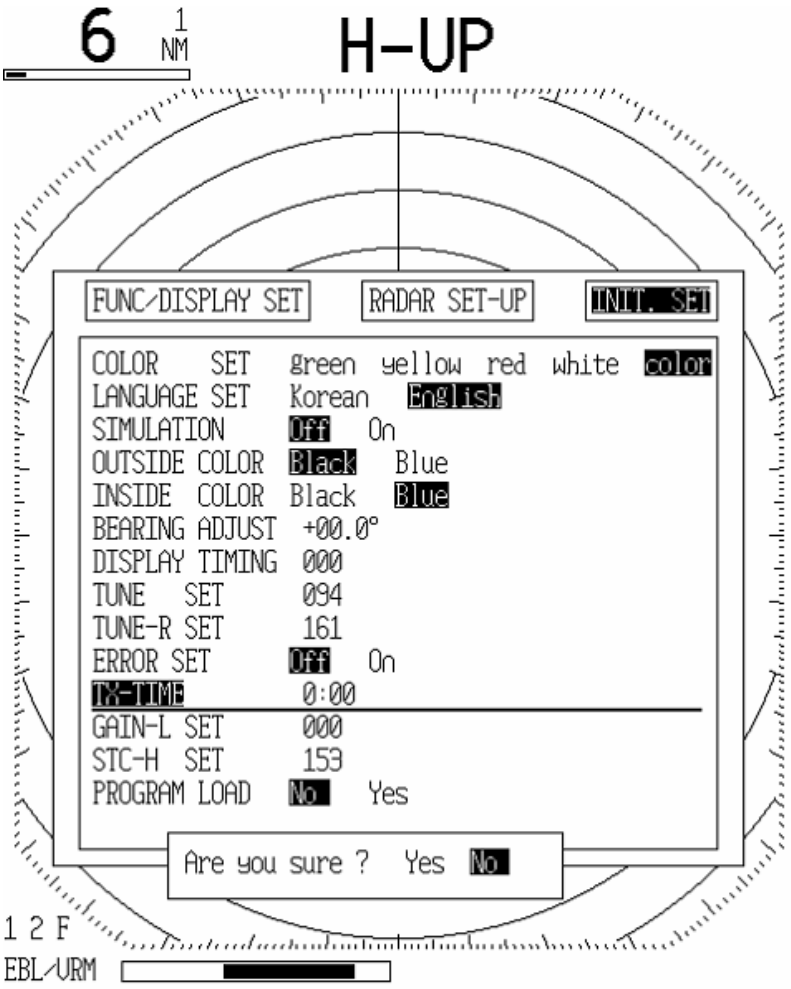


4-25. TX-Time

• Function to control TX-TIME.

1) [INIT. SET] -> [▲][▼] -> [TX-TIME] -> ENT

(Notice) User access to select is prohibited since it is linked with using time of magnetron.



4-26. GAIN-L Setup

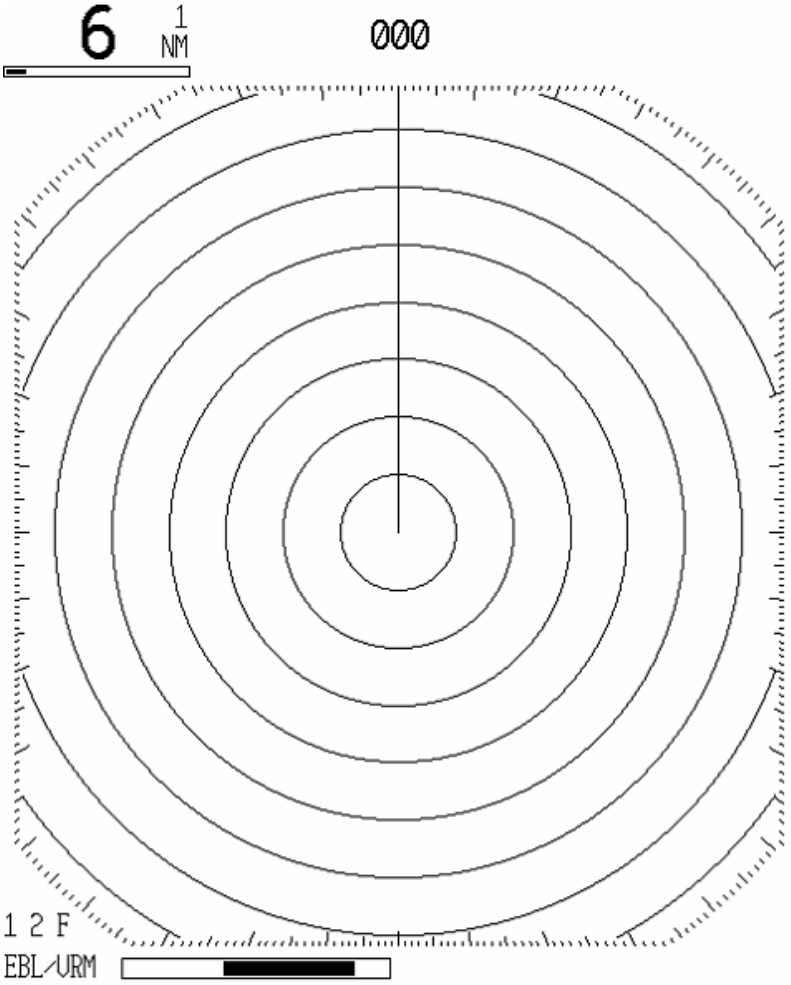
• Setup of GAIN voltage range

1) [INIT. SET] -> [▲][▼] -> [GAIN-L SET] -> Press ENT button to return to screen that will show GAIN-L value in the middle of top.

2) Use [◄][►] [▲][▼] buttons to select GAIN-L value. (0 ~ 255)

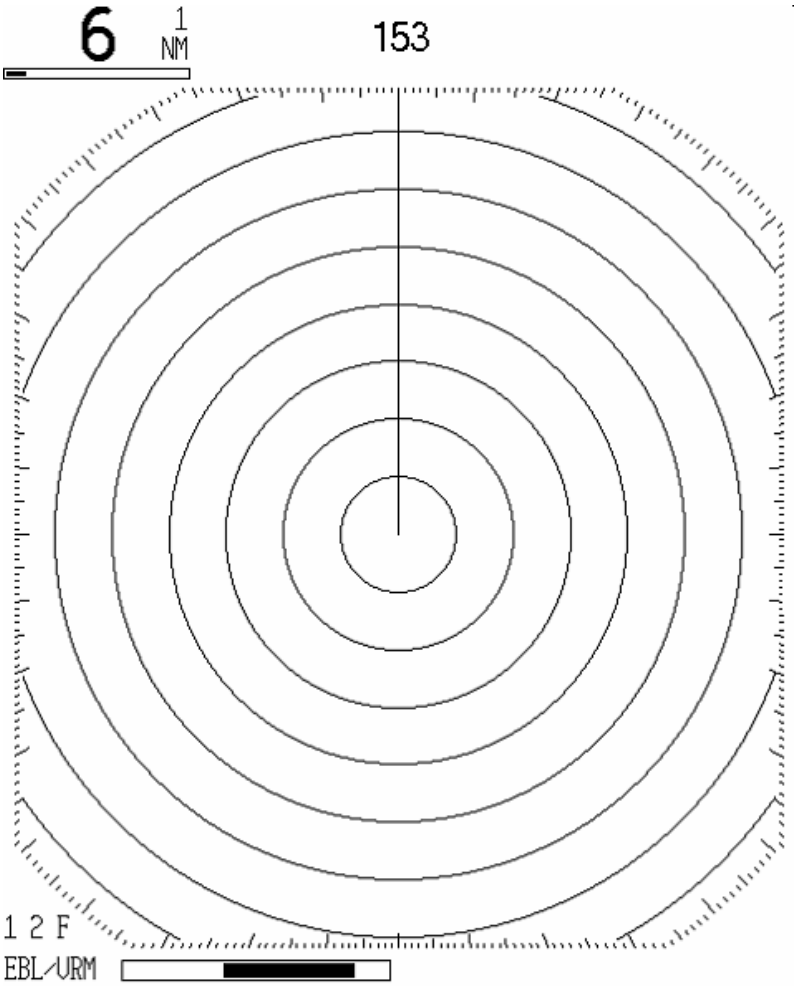
3) After pressing ENT button, press ESC button.

(Notice) When controlling GAIN-L, don't change the set value because there are some cases of excessive pressure given to the receiver unit.



4-27. STC-H Setup

1) [RADAR SET-UP Menu] -> [▲][▼] -> [STC-H SET] -> Press ENT button to return to screen that will show STC-H value in the middle of top.
2) Use [◄][►] [▲][▼] buttons to select STC-H value. (0 ~ 255)
3) After pressing ENT button, press ESC button.
(Notice) If STC-H SETUP value is high, targets may disappear at short distance.



4-28. Program Load
(Notice) Users must not make any setup for the purpose of program upgrade.

Chapter 3. How to operate

1.Control of display screen

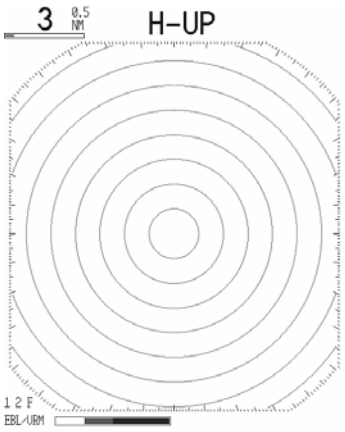
1-1.Control of distance range

1) Press RANGE button.
Distance range ▶ : For expanding.
Distance range ◀ : For diminishing.

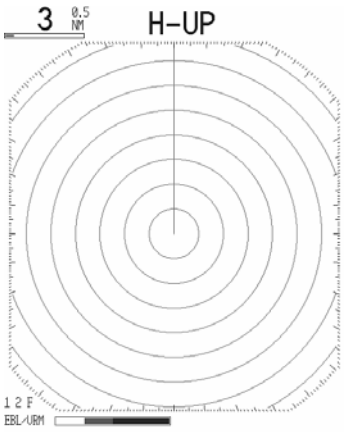
2) Distance range as follows ;
It is available to adjust up to 0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 36NM.

1-2. Elemination of heading line

1) Heading line indicates the heading direction of the own ship.
2) Press and hold down SHM button to eliminate it. Release the button to have it.



• In case of no heading line



• In case of heading line

1-3. Gain control

1) By turning the gain volume, the gain adjustment can be made.
2) Generally as the biggest size of any searched echo reflection, the best gain is the degree that is not contacted echo image by another target.
(Notice) If the gain increases too high, noises of the receiver can occur in the display that will normally disturb the search.

1-4. Radar Interference Removal

• Radar interference means the phenomenon that the microwave launched from other radars runs into the radar antenna of the own ship and is displayed on the PPI screen.

• Use IR button of the front panel to get rid of the radar interference.

1) Press the interference removal button.

Every time the button is pressed, the function of interference removal(IR) becomes IR1, IR2, IR3, OFF.

(Notice) What can be eliminated by IR function as follows ;

• Radar interference

• Receiver interference (It appears when the gain is increased.)

• Much attention should be paid, as there are some cases that some echo images that have a low degree of such targets as small-sized vessels are removed.

1-5. Snow, rain and interference removal

• In case that it rains or snows, it is difficult to see echo reflection of ships because rain or snow clutters are shown in PPI screen.

• By using the function of rain/snow removal volume, rain clutter is controlled to make a search of targets easier.

• The more the volume is turned to right side, the stronger the function of rain/snow removal gets. (Notice) The function of rain/snow removal is for the purpose of controlling the echo reflection by rain and snow but much attention should be paid because the echo from targets such as ships may be repressed.

1-6. Removal of Sea Level Wave

• When the wave becomes high, it is difficult to see the echo image of ships as the sea clutter is displayed in PPI screen. The shorter the distance is, the stronger the sea clutter is displayed.

• Through the removal function of sea level wave, the sea clutter is controlled to make the search easier.

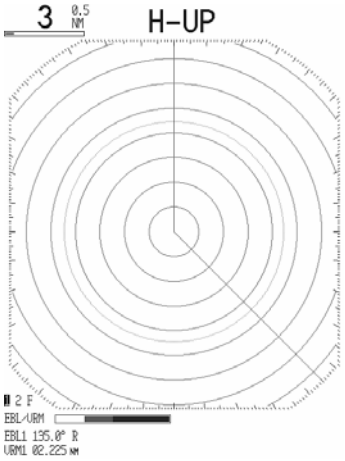
• The more the volume is turned to right side, the stronger the removal function becomes.

(Notice) This function is for the purpose of controlling the echo image by wave but much attention should be paid as the echo images of ships can be repressed at the same time. User can expect a good effect through properly using the gain control function together.

1-7. How to measure distance & bearing to target

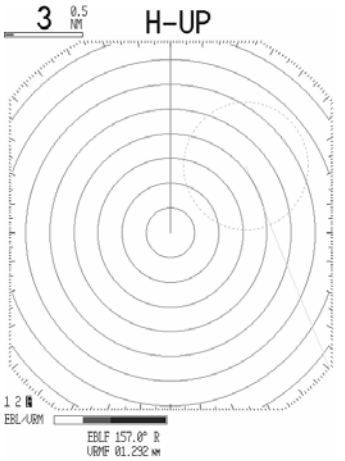
- To measure the distance and bearing to target, the following methods can be chosen.

1) Use of 1 EBL/VRM
2) Use of 2 EBL/VRM
3) Use of F EBL/VRM
4) In case of1 EBL/VRM - 2 EBL/VRM
5) In case of 1 EBL/VRM - F EBL/VRM
6) In case of cursor indication



- 1 EBL/VRM

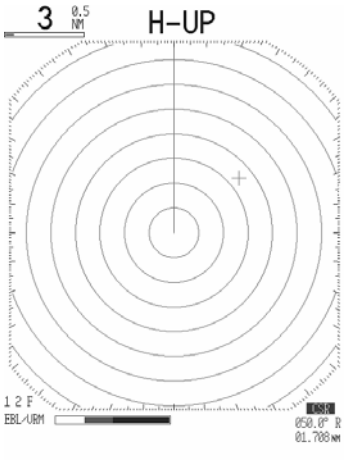
- 2 EBL/VRM



- F EBL/VRM

- 1 EBL/VRM - 2 EBL/VRM

- 1 EBL/VRM - F EBL/VRM



- Cursor indication

1-8. How to use VRM (Variable Range Maker)

- VRM is a circle that is displayed on the screen.
- As it is available to freely vary the size of a circle with ▲(Expand), ▼(Diminish) buttons, user can precisely measure the distance in comparison with the scale of fixed distance.
- This radar is capable of indicating 2(two) VRM at the same time.
  (1 VRM - 2 VRM, 1 VRM - F VRM, but 2 VRM - F VRM cannot be used.)
- For selection of VRM, users have only to press the wanted button in the front panel.
  For move, use [▲(Expand), ▼(Diminish)] buttons.
- For removal of VRM, press simply the selected VRM once again.

1-9. How to use EBL (Electronic Bearing Line)

- EBL is a straight line that is displayed on the screen.
- As it is available to freely vary the EBL straight line with ◀(Counterclockwise), ▶(Clockwise) buttons, the bearing can be precisely meansured.
- This radar can indicate 2(two) EBL at the same time.
  (1 EBL - 2 EBL, 1 EBL - F EBL, but 2 EBL - F EBL cannot be used.)
- For selection of EBL, users have only to press the wanted button in the front panel.
- For move, use [◀(Counterclockwise), ▶(Clockwise) buttons.
- For removal of EBL, press simply the selected EBL once again.

1-10. How to F EBL/VRM

- Not based on the center, but based on any specific island or vessel, the radar is designed to indicate EBL/VRM.
- For position move, press OFF CENT button and use [▲▼◀▶] button to move to any wanted position. Then press ENT button.

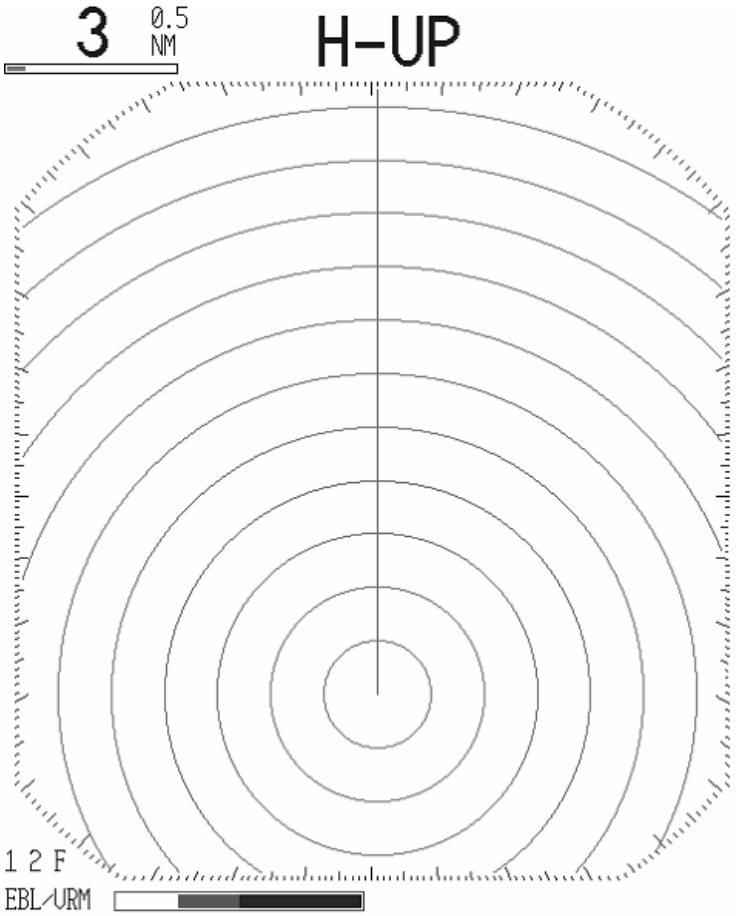
1-11. How to measure distance and bearing by cursor

- Press CURSOR button in the front panel.
- “+” will be indicated.
- Use [▲▼◀▶] button to move and then the distance and bearing will be indicated in the right bottom
- Press simply the removal button to eliminate the cursor.

1-12. How to move the center position on the screen

• By moving the center, it is available to expand the distance range of a temporary direction.

• After pressing OFF CENT button, use [▲▼◀▶] button to locate “+” to the screen center and then press ENT button.



※ There are three ways of indicating the bearing of EBL and the cursor,

○ Relative bearing indication : It indicates the bearing which EBL is heading for in case of 0° heading line : **R**

○ True north bearing indication : It indicates the bearing which EBL is heading for in case of 0° true north (North Pole) : **T**

○ Magnetic bearing indication : It indicates the bearing which EBL is heading for in case of 0° north in magnetic compass : **M**

2. How to operate SAMYUNG radar

2-1. A fixed target on PPI screen

- In case that user wants to fix any fixed target on PPI screen of radar when the own ship is under way, move the own ship and then the PPI image will move together.
- This indication way is called 'RM (Relative Motion)'.
- TM (True Motion) is an another indication way that the echo image does not move in the course of PPI image for any fixed targets such as land, the own ship's position (the center of PPI) moves along the own ship's course and speed.
- In indicating TM, it is required to input the data on bearing and speed.
- If the mode is changed into TM indication at H-UP mode, it will automatically turn into N-UP mode. But at TM mode, it does not turn into H-UP mode.

2-2. In monitoring any move of other ships (targets).

- To monitor the move of other ships (targets), use following function depends on the case.
  1) Indication function of radar track
  2) Alarm function

2-2-1. Track indication function

- It is designed to indicate radar track.

As all the PPI images are reconstructed every scan, the movement course of any object can be figured out.

As the radar displays the low brightness of past images every five or ten scans, the last scan is even capable of showing the movement course of any object.

But when the radar track indication gets start, the images of low brightness may not stay even at the 5^{th} or 10^{th} scan.

- In the [Short] mode, it is the track 10 to 13 sec. and 25 to 30 sec. in [Long] mode.
- Select [Short], the brightness will decrease by 1(one) level at every five scans.
- Select [Long], the brightness will decrease by 1(one) level at every 10 scans.

2-2-2. Alarm function

- Use the alarm function to set up the guard zone.
  Guard zone refers to the zones that are set up on PPI screen.
- When any target comes in, or gets out of this zone, an alarm may ring.
- In the alarm levels from (1) to (7), the numbers indicate the image levels (echo gain) that ring an alarm.

  The higher the number is, only the brighter images react, the lower the number is, the darker images also react.

(Notice) If the gain is very good, an alarm may ring through reacting to noise etc..

3. Other convenient functions

3-1. To display the own ship speed in the indicator

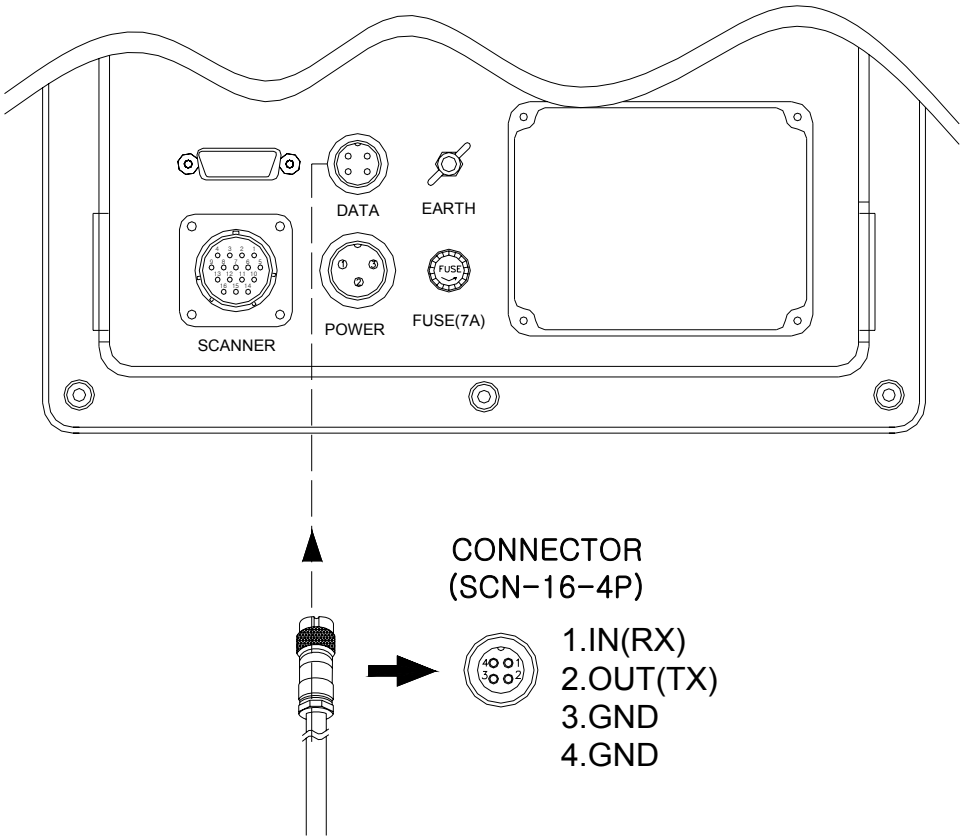
- When the data on the own ship speed is input to the indicator, it will be automatically indicated.
- To use this function, it is necessary to have the data on the own ship speed in the indicator.

3-2. To display the heading in the indicator

- When the data on the heading is input to the indicator, it will be automatically indicated.
- To use this function, it is necessary to input the data on the heading in the indicator.

4. How to connect to external navigation equipment

- This radar is designed to connect to the data terminal at the back panel of the indicator.



5. Basic knowledge in observation

5-1. Scanning range and target

• The maximum range to targets that can be scanned by radar is influenced by the transmission output power, antenna beam width, receiving sensitivity and its performance as well as by other factors as follows;

• The height of targets, the distance to targets and the height of radar antenna have an influence on the maximum scanning ranges, too.

This is because the electric wave that is launched from radar goes straight without almost zero influence by the curve of the earth.

For example, if the antenna is 3 meters high away from the sea surface, 10 meters high-islands that are located 10 miles away from the position are displayed on the screen but 5 meters high islands are not displayed at the same distance. These values are the theoretical values, not consistent depending on the conditions such as weather.

Theoretically, more than 7.6 meters' height is required for targets that are 10 miles away but targets that are lower than that are not displayed on the screen. So pay sufficient attention.

The actual maximum scanning range of radar is related to straight sight.

The following formular shows the limitations of scanning distance, depending on the height of radar antenna and the height of targets.

R_{max} (Max.Scan Range)= $2.23(\sqrt{h} + \sqrt{H})$

h = Antenna height

H = Target height

• Reflection from targets

As the strength of reflection from targets are related to the sizes of targets and to the elements and images of the targets, we cannot say that only the reflection from big targets is strong. If the coastal lines are flat, only the mountains or bays of the inland may be seen on the image screen, depending on the geographical conditions of the coastal lines. Therefore, the image should be used to measure the distance to the coastal lines.

• Wave route status

Sometimes it is impossible to scan the targets behind as the wave is blocked by mountain, rain and snow being on the wave route.

5-2. Navigational reflection wave

• Reflection of sea level

On the sea surface where are made, white and broad images are displayed on the screen center. This is a reflection created from the sea level and occurs as a different image mainly depending on the size of save, range and the direction of wind.

• False Image

There is a possibility that non-existing targets may be shown or any existing targets may not be shown through the image. This image is called 'virtual image'.

What mainly causes such false image as follows;

1) Shadow

Depending on the installation position of antenna, the reflection may come back after colliding against the funnel or mast, which may create 'shadow' causing the virtual image on PPI screen. In this case, the targets that are located at the shodow direction may not be shown on the screen.

The existence of such a 'shadow' can be figured out by checking if there is any dim image or any unseen part, based on the reflection of sea level.

If the 'shadow' occurs, the user needs to memorize the direction in order to observe the targets with care.

2) Side echo

There may be an image of arc wave line in the same distance from target image on the screen. This is caused by the side lobe of which beam is radiated from the antenna.

For this phase, it is easy to make a judgment when targets are fixed.

3) Secondary reflection

Fake images may be displayed as their directions are changed through being reflected against the funnel or mast, which create shadow.

In this case, the images of targets are located at the mast direction that reflects the radar wave.

4) Multi-reflection image

Where there are any structures or big-sized vessels that are hidden behind gigantic vertical line, multiple images by multi-reflection appear.

These images come out at intervals of every lamp line and among the lines, the closest line to the own ship is the actual image of target.

5) Radar interference

If there is any radars closely located that uses the same frequency, the interference image by the radar appears on PPI screen. This interference turns into various spots and appear in forms of many images but as the interference does not appear in the same place, it can be distinguished from target image. For the radar interference, select 『ON』 in the function to diminish or get rid of it.

Chapter 4. Installation

1. Summary

* RADAR equipment must be installed with careful Notice, according to the following method for installation, in order to get sufficient efficiency and mend easily.
* Transmitter / Receiver should be set up at high point based on the weight normally.
* Instruction-equipment is set up to easy-observe at ship's bridge.
* 15 meter standard cable of the unit is used between transmitter / receiver and instruction-equipment.

2. Transmitter / Receiver set up

2-1. Select of set-up location

* Decided in accordance with following points.

1) Set up at the front location of transmitter / receiver has no big obstacles on the ship head-back line.
2) Set up at far funnel exit to avoid dropping off in efficiency by smoke and getting out of order by heat.
3) The service wires of Antenna should be set up far away one another when Antenna for direction detection and VHF Antenna are set up at a close location of transmitter / receiver. (Must avoid tying radar's wires to those)
4) Pay attention to rope's twisting might be taken place out of order in a round type of air cable.

2-2. How to set-up

* Generally, the head of High-Speed boat is going up on the navigation with high speed. Because of this heading up, in case of making a surface level on the radar's air cable set-up at anchor, the forwarder echo may not be shown by weak electric waves touched onto the surface of water owing to making the surface of water out of the beam if TRIM (Both angle of head on navigation) is more than half of vertical beam width.

On the contrary, the reflection of the surface of sea is made strong by strong electronic waves touched onto the surface of water in backward.

However, there is little reflection on starboard / port side of vessels nearly. Accordingly, recommended setting up the transmitter / receiver with a condition slopping toward forward in vessels if the such TRIM is more than half of vertical beam width.

* Notice in time of setting up air cables to yachts

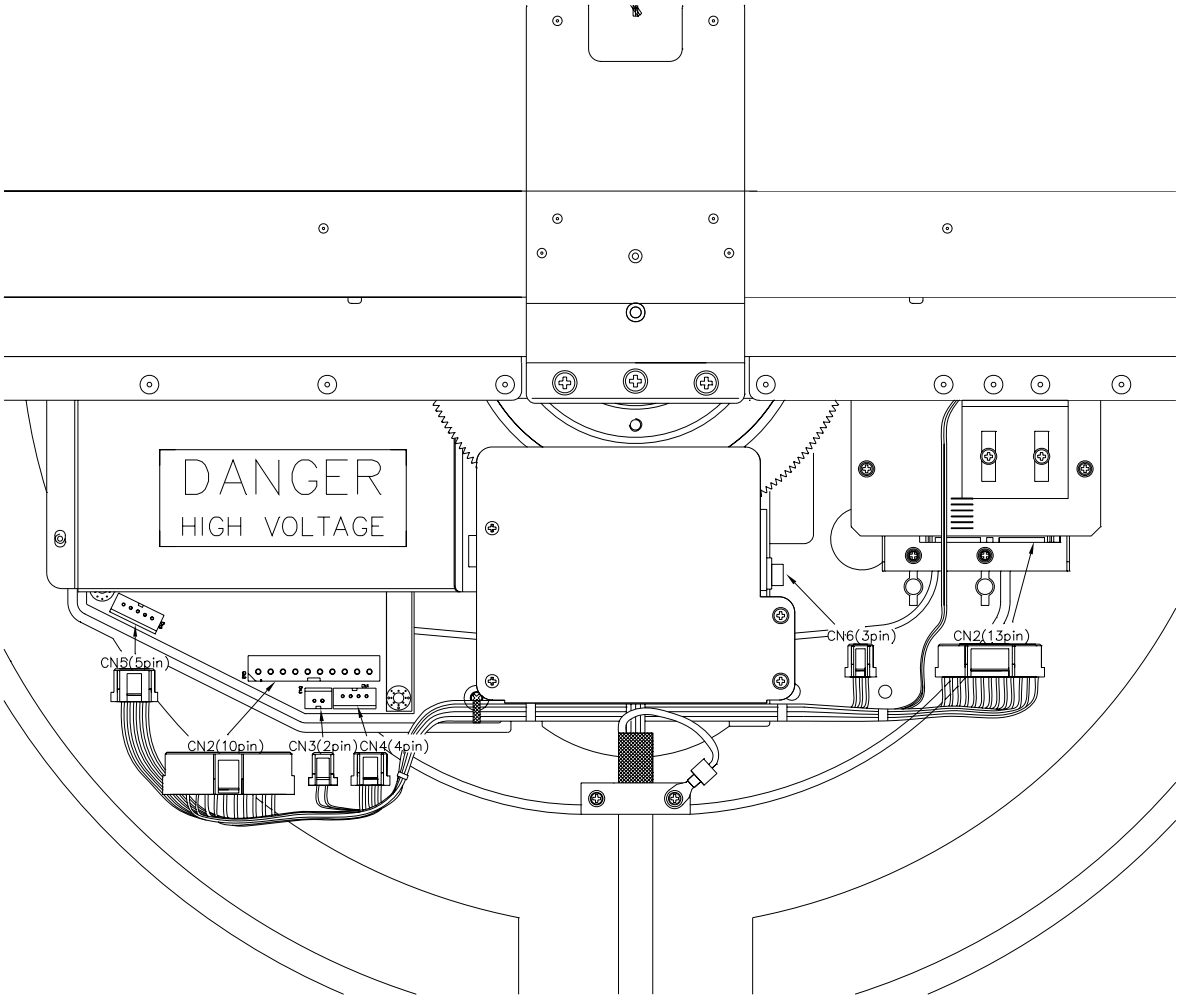
Yachts navigate on the opposite side of windy direction with condition of inclining a little. If

the inclining angle is more than half of the beam width, in windy direction, the echo by the surface of water may not be shown by weak electric waves touched onto the surface of water owing to making the surface of water out of the beam. On the contrary, the reflection of the surface of sea is made strong by strong electronic waves touched onto the surface of water on the opposite side of windy direction.
However, there is little reflection on forward / backward side of vessels nearly. Accordingly, recommended setting up something to make air cable right / left inclining in accordance with an appropriate slope in yachts having more than half of vertical beam width of a slope.

* In setting up, make a hole for sibling-tube. Water can't be protected because of bending sibling-tube if the transmitter / receiver is set up without the hole.

* Make installation beam in case of not having enough height for set-up on top of bridge.

2-3. Inside wire connection



→ Make hold it with a cable-tie in order to tie-up cables.

→ Don't bend a connector too strong on putting a cable with a radome.

3. Installation for instruction-equipment

3-1. Installation point select

* Decided to the point for instruction-equipment installation considering of the following facts.

1) Sep up in order to easy observe and mend.
2) Sep up at the location of 1 meter more far away Magnet Compass.

3-2. How to set up

* Refer to the drawings of installation.

3-3 power cable connect

* Connect a power cable to the [POWER] on backside of instruction-equipment.
* Connect a cable of transmitter / receiver to the [SCANNER] on backside of instruction-equipment.

(NOTICE) Connected a connection terminal of instruction-equipment to the body of vessel with enough thick cables.

4. Installation check

* Check all installation has been done correctly by instruction, especially, for instance, if problems on cable connection, all equipments, leakage of water in air cable and a connection of cable shield.

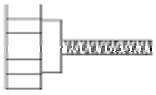
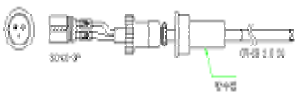
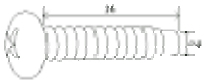
4-1. Operation check

* Check if vessel voltage is in a permitted limit before operation check.
* Start radar on first and then check if operated all equips. of the radar, correctly.
* Readjustment should be according to the manual even though operation check is O.K.

4-2. All sorts of adjustment

* A compass direction of radar must be adjusted.
* The tuning is readjusted with [TUNE-R SETUP] on the Menu List in case volume location with tuning on is far away around center or without tuning on.
* The distance is readjusted with [0 MILE ADJUST] on the Menu List in case the distance displayed on a PPI screen of the radar is different with the actual distance.

4-3. Packing list

SMR-3600 36 NMile Radar							
No.	Item	External Drawing	Dimension		Q'ty	CH	Remark
1	Monitor		SMR-3600		1		
			CODE NO.	SMR-3600			
2	Bracket				1		
			CODE NO.	ACC-RADAR-001			
3	Knob		Ø6 × 20		2		
			CODE NO.	ACC-6X18MM-002			
4	Antenna (Inch cable)	 L=15m	RSU-3600-15M		1		Cap SRCN2A 25-16P
			CODE NO.	RSU-3600-15M			
5	Power Cable	 L=3m	CVV-SB2.0 SQ X 2C		1		Cap SCN20-3P
			CODE NO.	ACC-CAB-010			
6	Earth Cable	 L=3m	KIV 5.5mm^2		1		
			CODE NO.	STR -595			
7	Steel piece		Ø4 X 16		5		
			CODE NO.	SPR-1407			
Scanner installation material			CODE NO.	ACC-PAK-001			
8	6 angle bolt		Ø10 X 20		4		
			CODE NO.	ACC-SC-001			
9	Spring washer		Ø10		4		
			CODE NO.	ACC-WA-001			
10	Plain washer		Ø10		4		
			CODE NO.	ACC-WA-001			
11	Fuze		7A		2		
			CODE NO.	ACC-FUSE-001			
12	Manual				1		
			CODE NO.	SMR-3600-MK			
13	Antenna Dwg. Install'n		A3		1		
			CODE NO.	RSU-3600-DK			

Chapter 5. Maintenance

1. General

• In order to get Radar performed in good order, a periodical maintenance should be done properly.
• The unexpected troubles would be less by paying proper attention to timely maintenance.
• A common maintenance for each component is as follows.

1-1. Cleaning

• Do cleaning out the dust, salt water adhered to the unit.
• Cleaning with dry cloth.

1-2. Check out the tightness of screw, bolt

• Check out the tightness of screw or bolts, which attached on the Unit.

1-3. Check the cabling

• Do checking and maintaining the cabling between Units periodically (Between transceiver with Monitor, Between Monitor with Power supply, Between Monitor with optional equipment).

* Notice : When checked the Units, please be sure to turn off the power to protect from electric shocking. In case using Rectifire, cut off the power on Monitor because it is still excited even Radar stopped**.**

2. Transceiver

When maintained a transceiver, please be sure to cut off the power of Monitor.
Don't place watch or electronic card close to the area of modulation, which equips with Magnetron.

2-1. Radar Dome

• In case Raydom surface being contaminated by dust, paint, it may arise the attenuation or reflection of electric wave and cause to lower the performance of Radar, it should be cleaned out by a soft cloth with alcohol to keep it cleaned at all times.

Notice : Don't use Benzene, Gasoline, Tricrene, Ketone and any solvents other than Alcohol.

- Check periodically the tightness of attached bolts.

2-2. Bracket

- Check the mounting of scanner and do painting every half-year to prevent from being rusted.

3. Monitor

3-1. Cleaning of a Monitor LCD Screen

- In case a stain adhered to LCD screen, it deteriorates the transparency of LCD screen.
- Do cleaning with a soft cloth.

Chapter 6. Installation drawing and circuit diagram