FURUNO

OPERATOR'S MANUAL

AUTOMATIC TRACKING AID

MODEL   ARP-17

FURUNO ELECTRIC CO., LTD.

NISHINOMIYA, JAPAN

© **FURUNO ELECTRIC CO., LTD.**

9-52, Ashihara-cho,
Nishinomiya, Japan

Telephone:　0798-65-2111
Telefax:　　0798-65-4200

PUB. No. OME-30460
(DAMI)　　ARP-17

·Your Local Agent/Dealer

FIRST EDITION : NOV 1998
D　　　　　 : JUN. 2, 1999

00080857500

⚠ **SAFETY INSTRUCTIONS**

⚠ **WARNING**

No one navigational aid should be relied upon for the safety of vessel and crew. The navigator has the responsibility to check all aids available to confirm position. Electronic aids are not a substitute for basic navigational principles and common sense.

- This auto plotter automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data generated by the auto plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.

- A target does not always mean a landmass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the A/C SEA, A/C RAIN and GAIN controls to be sure target echoes are not eliminated from the radar screen.

⚠ **CAUTION**

The plotting accuracy and response of this auto plotter meets IMO standards. Tracking accuracy is affected by the following:

- Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15-30 seconds for high relative speed; 30-60 seconds for low relative speed.

Display accuracy is affected by the following:

- Echo intensity
- Radar transmission pulsewidth
- Radar bearing error
- Gyrocompass error
- Course change (own ship or target)

TABLE OF CONTENTS

FOREWORD

A Word to FURUNO ARP-17 Owners

FURUNO Electric Company thanks you for considering and purchasing the FURUNO Automatic Tracking Aid (ATA) ARP-17. We are confident you will discover why FURUNO has become synonymous with quality and reliability.

For nearly 50 years FURUNO Electric Company has enjoyed an enviable reputation for efficient and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your unit is designed and manufactured to meet the rigorous demands of the marine environment. However, no machine can perform to the utmost of its ability unless properly operated and maintained. Please carefully read and follow the recommended procedures for operation and maintenance.

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

Thank you for considering and purchasing FURUNO.

Features

The ATA ARP-17 is an optional circuit board which is accommodated in the display unit of the FR-1500 MARK-3 Series Radars and the FR-1710/1725/1760DS radars.

The ATA permits manual acquisition and automatic tracking of up to 10 radar targets. An internal microprocessor calculates target data such as speeds and courses and displays the results in alphanumeric and by vectors.

When the ARP-17 is installed (whether or not in use), EPA (manual acquisition, manual tracking with 10 selected symbols) is disabled.

- Manual acquisition of up to 10 targets between 0.2 and 32 nm
- Automatic tracking of up to 10 manually acquired targets between 0.1 and 32 nm
- Vector length adjustable and vector reference in true or relative
- Motion trend displayed within 1 min., full accuracy within 3 min. after acquisition
- Past position display shows last ten positions.
- Visual and audible alarms against targets violating CPA/TCPA limits; visual alarms against lost targets.

1. Introduction

The FR-1500 MARK-3 series radar and the FR-1710/1725/1760DS can accommodate an optional ATA (Automatic Tracking Aid) module complying with IMO MSC.64(67) Annex 4 and IEC 60872-2. With the optional ATA circuit board (ARP-17) Fitted in the display unit, the radar will automatically acquire 10 targets coming into the acquisition area. Once a target is acquired automatically or manually it is automatically tracked within 0.1 to 32 nm, whether inside or outside the acquisition area.

2. Criteria of Tracking

A target measuring 800 m or more in the radial or circumferential direction is regarded as a landmass and not acquired or tracked. Echoes smaller than 800 m are regarded as targets to be tracked.

The FURUNO ARPA ATA video processor detects targets in midst of noise and discriminates radar echoes on the basis of their size. Target whose echo measurements are greater than those of the largest ship in range or tangential extent are usually land and are displayed only as normal radar video. All smaller ship-sized echoes which are less than this dimension are further analyzed and regarded as ships and displayed as small circles superimposed over the video echo.

When a target is first displayed, it is shown as having zero true speed but develops a course vector as more information is collected. In accordance with the International Marine Organization Automatic Radar Plotting Aid (IMO ARPA) requirements, an indication of the motion trend should be available within 20 scans of antenna and full vector accuracy within 60 scans. The FURUNO ARPAs/ATAs comply with these requirements.

Acquisition and tracking

A target which is hit by 5 consecutive radar pulses is detected as a radar echo.

Auto acquisition is not defined in paints but in time, which should be less than 3 s of initial stage.

Manual acquisition is done by designating a detected echo with the trackball. Automatic acquisition is done in the acquisition areas when a target is detected 5-7 times continuously depending upon the congestion. Tracking is achieved when the target is clearly distinguishable on the display for 5 consecutive or alternate paints out of 10 consecutive scans whether acquired automatically or manually.

Targets not detected in 5 consecutive scans become "lost targets."

Quantization

The entire picture is converted to a digital from called "Quantified Video." A sweep range is divided into small segments and each range element is "1" if there is radar echo return above a threshold level, or "0" if there is no return.

The digital radar signal is then analyzed by a ship-sized echo discriminator. As the antenna scans, if there are 5 consecutive radar pulses with 1's indicating an echo presence at the exact same range, a target "start" is initiated. Since receiver noise is random, it is not three bang correlated, and it is filtered out and not classified as an echo.

The same is true of radar interference. Electronic circuits track both the closet and most distant edges of the echo. At the end of the scanning of the echo, the discriminator indicates the measured maximum range extent and total angular extent subtended by the echo. If the echo is larger than a ship-sized echo in range extent and/or angular width, adjusted as a function of range, it is declared

to be a coastline and the closet edge is put into memory as a map of the area.

This land outline is used to inhibit further acquisition and tracking of ship sized echoes beyond the closest coast outline. 5 consecutive scans of coastal outline are retained in memory to allow for signal variation. All smaller echoes are declared to be ship sized and the middle of the leading edge is used to provide precise range and bearing coordinates of each echo on every scan. This range/bearing data is matched to previous data and analyzed from scan-to-scan for consistency. When it is determined to be as consistent as a real target, automatic acquisition occurs and tracking is initiated.

Continued tracking and subsequent calculation develop the relative course and speed of the target just as a man would do when plotting the relative course and speed of the target on the scope with a grease pencil.

The true course and speed of own ship are computed from own ship's gyro and speed inputs, and the resulting course and speed of each tracked target is easily computed by vector summing of the relative motion with own ship's course and speed. The resulting true or relative vector is displayed for each of the tracked targets. This process is updated continually for each target on every scan of the radar.

Automatic acquisition areas and suppression lines

Performance of auto-acquisition is enhanced by controlling the limit lines (suppression lines) in the former series of FURUNO ARPAs. In the ATA, the automatic acquisition rings are used instead of the limit lines.

Auto acquisition rings work as suppression lines when viewed from the opposite direction. The should be placed clear of a landmass or shoreline. The acquisition areas may be a full 360 degree circle or sector of any angles. They are gyro stabilized.

Qualitative description of tracking error

The FURUNO ATA accuracy complies with or exceed IMO standards.
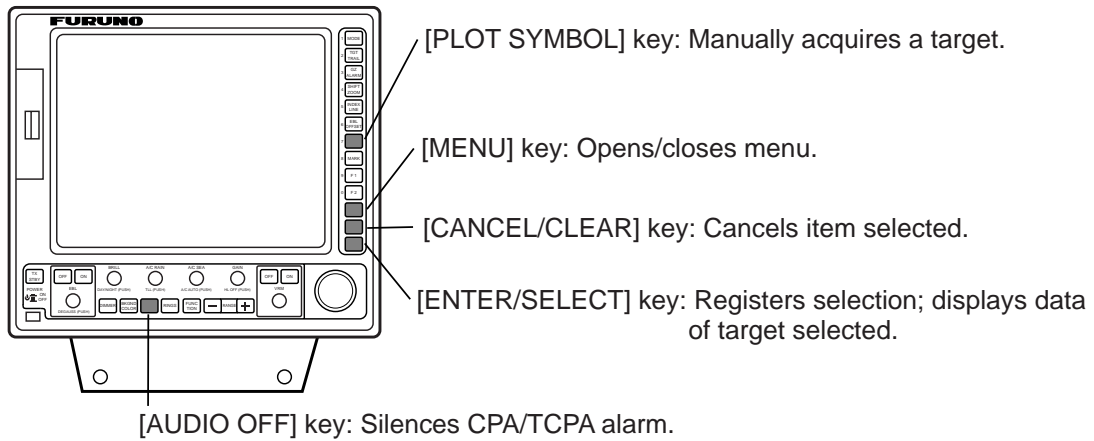
Own ship maneuvers

For slow turns there is no effect. For very high turning rates (greater than 150°/minute, depending on gyro), there is some influence on all tracked targets which last for a minute or two and then all tracked targets revert to full accuracy.
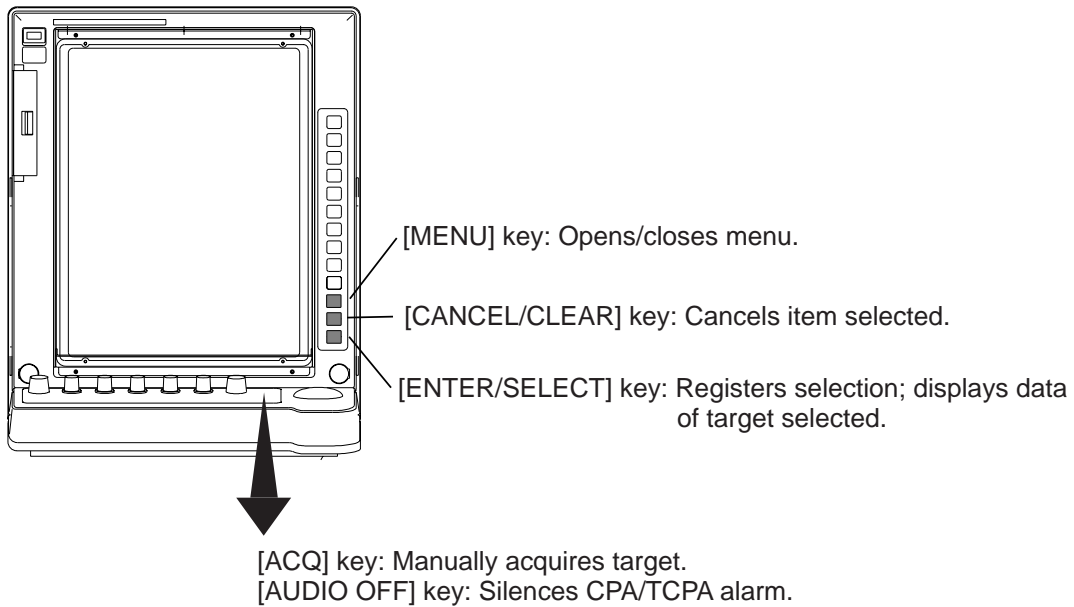
Other ship maneuvers

Target ship courses, lag 15 to 30 seconds at high relative speed, or 3 to 6 seconds at low (near 0) relative speed. It is less accurate during a turn due to lag, but accuracy recovers quickly.

3. Controls, Menu Description

Controls

[PLOT SYMBOL] key: Manually acquires a target.

[MENU] key: Opens/closes menu.

[CANCEL/CLEAR] key: Cancels item selected.

[ENTER/SELECT] key: Registers selection; displays data of target selected.

[AUDIO OFF] key: Silences CPA/TCPA alarm.

FR-1500 MARK-3 SERIES DISPLAY UNIT

[MENU] key: Opens/closes menu.

[CANCEL/CLEAR] key: Cancels item selected.

[ENTER/SELECT] key: Registers selection; displays data of target selected.

[ACQ] key: Manually acquires target.
[AUDIO OFF] key: Silences CPA/TCPA alarm.

FR-1710/1725/1760DS DISPLAY UNIT

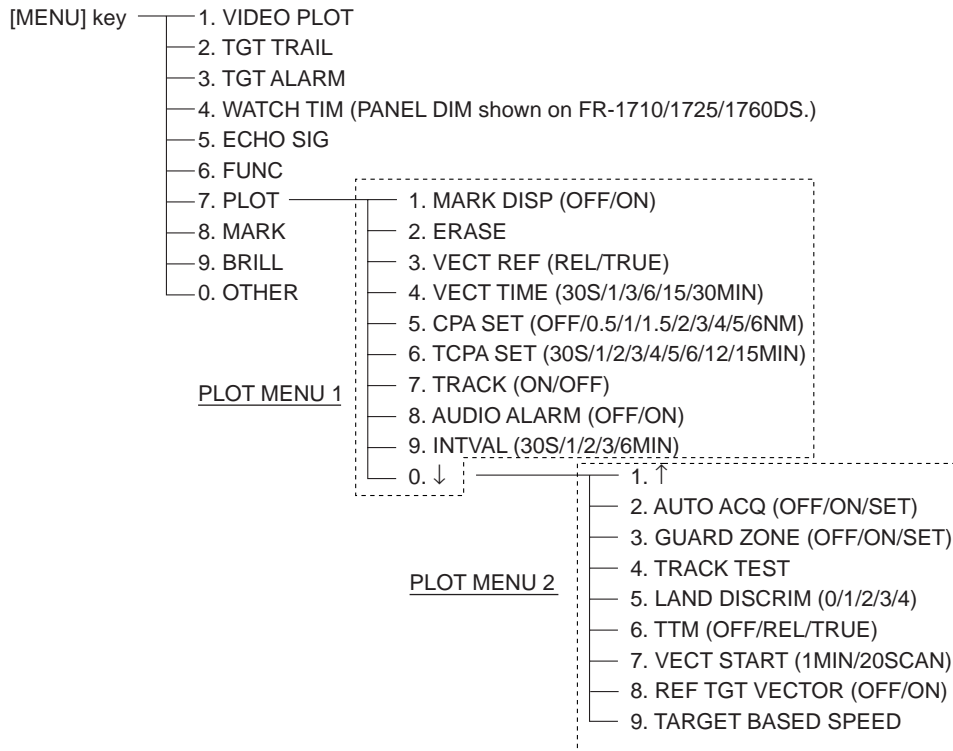*Figure 1 Display unit of the FR-1500 MARK-3 series, FR-1710/1725/1760DS*

Menu tree

```
[MENU] key ── 1. VIDEO PLOT
            ── 2. TGT TRAIL
            ── 3. TGT ALARM
            ── 4. WATCH TIM (PANEL DIM shown on FR-1710/1725/1760DS.)
            ── 5. ECHO SIG
            ── 6. FUNC
            ── 7. PLOT ── 1. MARK DISP (OFF/ON)
            ── 8. MARK    ── 2. ERASE
            ── 9. BRILL   ── 3. VECT REF (REL/TRUE)
            ── 0. OTHER   ── 4. VECT TIME (30S/1/3/6/15/30MIN)
                          ── 5. CPA SET (OFF/0.5/1/1.5/2/3/4/5/6NM)
                          ── 6. TCPA SET (30S/1/2/3/4/5/6/12/15MIN)
            PLOT MENU 1   ── 7. TRACK (ON/OFF)
                          ── 8. AUDIO ALARM (OFF/ON)
                          ── 9. INTVAL (30S/1/2/3/6MIN)
                          ── 0. ↓ ── 1. ↑
                                    ── 2. AUTO ACQ (OFF/ON/SET)
                                    ── 3. GUARD ZONE (OFF/ON/SET)
                                    ── 4. TRACK TEST
                    PLOT MENU 2     ── 5. LAND DISCRIM (0/1/2/3/4)
                                    ── 6. TTM (OFF/REL/TRUE)
                                    ── 7. VECT START (1MIN/20SCAN)
                                    ── 8. REF TGT VECTOR (OFF/ON)
                                    ── 9. TARGET BASED SPEED
```

Figure 2 Menu tree

Menu description

Table 1 Menu description

Menu Item	Function
PLOT MENU 1	
1. MARK DISP	Turns target data display on/off.
2. ERASE	Erases all plot symbols.
3. VECT REF	Selects vector reference; true or relative.
4. VECT TIME	Sets vector time.
5. CPA SET	Sets CPA alarm range.
6. TCPA SET	Sets TCPA alarm range.
7. TRACK	Turns past position display on/off.
8. AUDIO ALARM	Turns audio alarm on/off.
9. INTVAL	Selects past position display plotting interval.
0. ↓	Go to PLOT MENU 2.
PLOT MENU 2	
1. ↑	Go to PLOT MENU 1.
2. AUTO ACQ	Sets an automatic acquisition area.
3. GUARD ZONE	Sets a guard zone.
4. TRACK TEST	Tests ATA processor for proper operation.
5. LAND DISCRIM	Sets size of echo to be recognized as landmass. The larger the figure the larger the landmass. Default setting is "2".
6. TTM	Turns target data output on/off.
7. VECT START	Start displaying a vector after 20 scans.
8. REF TGT VECTOR	Turns vector display on/off for reference target.
9. TARGET BASED SPEED	Selects reference target(s).

4

4. Activating, Deactivating the ATA

The ATA is activated/deactivated through the menu. Acquired targets are tracked internally when the ATA is deactivated.

1. Adjust the A/C RAIN, A/C SEA and GAIN controls for proper radar picture.

2. Press [MENU], [7], [7] to show PLOT MENU 1.

```
              PLOT MENU 1
1. MARK DISP      OFF  [ON]
2. ERASE
3. VECT REF      [REL]   TRUE
4. VECT TIME     [30S]   1     3     6
   (min)          15    30
5. CPA SET       [OFF]  0.5NM    1NM   1.5NM
                  2NM    3NM    4NM
                  5NM    6NM
6. TCPA SET      [30S]   1     2     3
   (min)          4     5     6    12    15
7. TRACK         [OFF]  ON
8. AUDIO ALARM   [OFF]  ON
9. INTVAL        [30S]   1     2     3     6
   (min)
0. ↓
```

Figure 3 PLOT MENU 1

3. Press the [1] key to select ON or OFF from the MARK DISP field.

4. Press the [ENTER/SELECT] key.

5. Press the [MENU] key to close the menu.

Note: The ATA plot is automatically turned on whenever the automatic acquisition area or guard ring is activated or a target is selected for target-based speed input.

5. Entering Own Ship's Speed

The ATA requires own ship's speed and heading data. Of these, the speed data can be entered automatically from a speed log, navaid or manually through the menu.

Note: It is customary to use a speed relative to water for collision avoidance and a speed over the ground for navigation purpose.

Automatic speed input

1. Press [MENU], [0], [0] to display the OTHER menu.

```
              OTHERS
1. HDG SET
2. SPD MODE     [MAN]  LOG  NAV*
                        LOG (S-BT)
                        LOG (S-WT)
3. MAN SPD
4. SET & DRIFT
5. DISPLAY
6. MARK/LINE
7. TUNE
8. NAV DATA
9. EBL/VRM/+
0. ↓
```

* NAV shown on R-type only.

Figure 4 OTHER menu

2. Press the [2] key to select a LOG option or NAV from the SPD MODE field.

   LOG: Pulse input from speed log

   NAV: Speed data from nav equipment

   LOG(S-BT): Speed over ground, serial data from speed log

   LOG(S-WT): Speed relative to water, serial data from speed log

3. Press the [ENTER/SELECT] key.

4. Press the [MENU] key to close the menu.

Notes:

1) IMO Resolution A.823(19) for ARPA recommends that a speed log to be interfaced with an ARPA should be capable of providing through-the-water speed. This shall apply to the ATA operation as well.

2) Be sure not to select LOG when a speed log is not connected. If the log signal is not provided, the ship's speed readout at the screen top will be blank.

3) SPEED xx.x and "SIGNAL MISSING LOG" appear if no log signal is present for 30 seconds.

5

Manual speed input

Select MAN at step 2 above, press the [3] key twice, and enter speed with the ten keys.

Target-based speed input

This mode is used when the ship's SDME (log) is not operating properly, ship's speed is changed minutely (in case of no log), or the vessel has no device which detects ship's leeward movement (doppler sonar 2-axis speed log, etc.) and leeward movement is not disregarded. You may select up to three targets, and they are marked as R1, R2, R3. They appear as tracked targets, each shown in a small circle, but without a vector. When a plural number of objects is selected, the mean value is used for stabilization and speed.

Note 1: The ATA calculates own ship's speed relative to a fixed target. Therefore, when selecting a target, a larger ground mass or a long coast line is not suitable as a reference target because of obscure reference point.

Note 2: A vector can be displayed for the reference target. This can be done with TARGET BASED SPEED on PLOT MENU 1.

Note 3: If a tracked target is acquired as a reference target it will become a lost target and cannot be reacquired. Therefore, when acquiring a reference target, select a target which is not being tracked. To select a tracked target as a reference target, cancel tracking and then acquire it as a reference target.

1. Select a small ground mass target (small island, lighthouse) 0.2 to 24 nautical miles from own ship.

2. Place the cursor on the target.

3. Press [MENU], [7], [7], [0], [0], [9], [9].

4. Place the cursor on the target and press the [PLOT SYMBOL] key ([ACQ] key on the FR-1710/1725/1760DS).

5. Press the [MENU] key.

The reference target mark (dashed square) appears at the cursor position and the own ship data label changes from LOG, NAV or MAN to REF. Note that it takes 60 scan before a new speed is displayed, indicated by the target mark changing to a circle. If tracking has failed for a reference target, the target is marked with a lost target mark (symbol formed with two triangles).

6. Acquiring Targets

The ATA permits automatic acquisition (10 targets) plus manual acquisition (10 targets), or fully manual acquisition (20 targets) within a range of 0.2 to 32 miles. The targets are automatically numbered and the same numbers are not used more than once until the maximum capacity is reached.

Before starting the ATA, check that heading and speed readouts at the top of the screen are correct.

Manual acquisition

1. Place the cursor (+) on a target of interest by operating the trackball.

2. Press the [PLOT SYMBOL] key ([ACQ] key on the FR-1710/1725/1760DS).

The plot symbol changes its shape according to the status as below, with plot number to the right of the plot symbol. A vector appears in about 20 antenna scans after acquisition indicating the target's motion trend. If the target is consistently detected for three minutes, the plot symbol changes to a solid mark. If acquisition fails, the target symbol blinks and disappears shortly.

Figure 5 Plot symbols

Figure 6 Automatic acquisition area

Note: If you wish to create an auto acquisition area having a 360 degree coverage around own ship, set point B in almost the same direction (approx. ±5°) as point A and press the [ENTER/SELECT] key.

⚠ CAUTION

TARGET SWAP

When a tracked target near another tracked target, the targets may be "swapped." When two targets come close to each other, one of the two can become a "lost target." Should this happen, reacquisition of the "lost target" is required after the two targets have separated.

Automatic acquisition

1. Press [MENU], [7], [7] to display PLOT MENU 1.

2. Press the [0] key twice.

3. Press the [2] key to select SET from the AUTO ACQ field.

4. Press the [ENTER/SELECT] key.

5. Place the cursor at upper (lower) left edge of area and press the [ENTER/SELECT] key.

6. Place the cursor at the lower (upper) right edge of the area and press the [ENTER/SELECT] key.
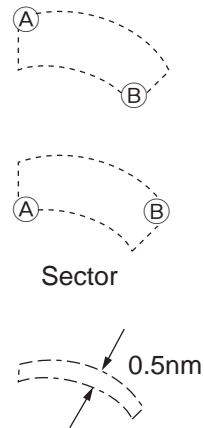
7. Terminating Tracking of Targets

When the ATA has acquired 10 targets, no more acquisition occurs unless targets are lost. Should this happen, cancel tracking of individual targets or all targets by the procedure described below.

Individual targets

Place the cursor (+) on a target which you do not want to be tracked any longer by operating the trackball and press the [CANCEL/CLEAR] key.

All targets

All targets can be canceled from PLOT menu as follows.

1. Press [MENU], [7], [7] to show PLOT MENU 1.

2. Press the [2] key twice to select ERASE.

3. Press the [ENTER/SELECT] key.

4. Press the [MENU] key.

7

8. Vectors

True or relative vector

Target vectors are displayed in relative or true mode. Own ship does not have a vector in relative mode. You may select true or relative vector with VECT REF on PLOT MENU 1 menu.

Note: The indication TRUE VECTOR appears in red characters when the true vector is selected on relative motion displays.

Vector time

From PLOT MENU 1, VECT TIME (or the length of vectors) can be set to 30 seconds, 1, 3, 6, 15 or 30 minutes and the selected vector time is indicated on the screen.

The vector tip shows an estimated position of the target after the selected vector time elapses. It can be valuable to extend the vector length to evaluate the risk of collision with any target.

Vector start time

Whenever the range is changed the vectors for tracked targets is reestablished. You can select when to start reestablishment of the vectors with VECT START on the PLOT MENU 2 menu. The operator has the choices of 1 min or 20 scans.

9. Displaying Target Data

The ATA calculates motion trends (range, bearing, course, speed, CPA and TCPA) of all targets under tracking, and displays data of selected target at the top right corner of the screen.

Note: At a speed under 5 kt the target data is displayed with a delay due to filtration processing.
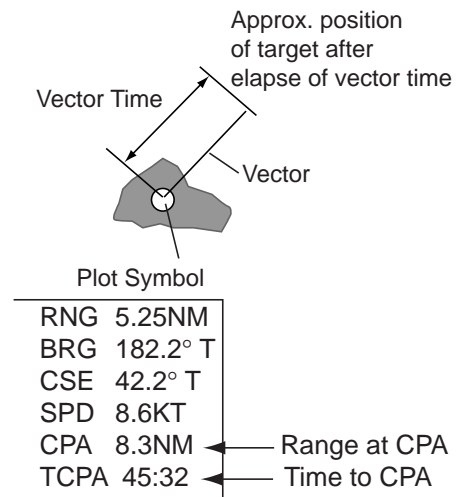

Figure 7 Target data example

Displaying data

Place the cursor on a wanted target and press the [ENTER/SELECT] key. Data on the selected target is displayed on the screen. The data includes the follows;

BRG/RNG (Bearing/Range)**: RNG/BRG** (Range/Bearing)**:** Range and bearing from own ship to the selected target with suffix "T" (True) or "R" (Relative).

CSE/SPD (Course/Speed)**:** Course and speed are displayed for the selected target with suffix "T" (True) or "R" (relative).

CPA (Closest Point of Approach) is the closest range a target will approach to own ship. Do not mix it with the operator preset CPA alarm limit.

TCPA is the time to CPA measured with present speeds of own ship and the targets. Both CPA and TCPA are automatically calculated. When a target ship has passed clear of own ship, the CPA is displayed and the TCPA appears as "xx.x". TCPA is counted up to 99.59 min. and beyond this it is indicated as TCPA>99.59 min.

Note 1: MARK DISP on PLOT MENU 1 must be turned on to display target data.

10. Past Position Display

The ATA displays equally time-spaced dots (maximum 10 dots at intervals of 30 s, 1, 2, 3 or 6 min) marking the past positions of any targets being tracked.

If a target changes its speed, the spacing will be uneven. If it changes the course, its plotted course will not be a straight line in TM mode. In TM, the past position display is produced relative to North (True Trails). In RM, it is relative to North or Heading as selected.

To turn the past position display on/off:

1. Press [MENU], [7], [7] to display PLOT MENU 1.

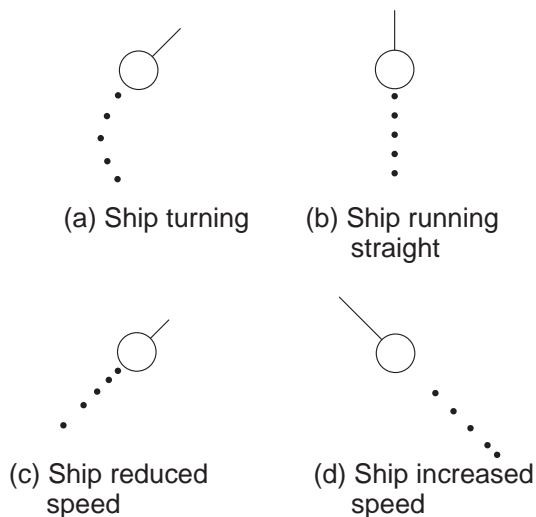2. Press the [7] key to select ON or OFF from the TRACK field.

(a) Ship turning　　(b) Ship running straight

(c) Ship reduced speed　　(d) Ship increased speed

Figure 8 Past position display examples
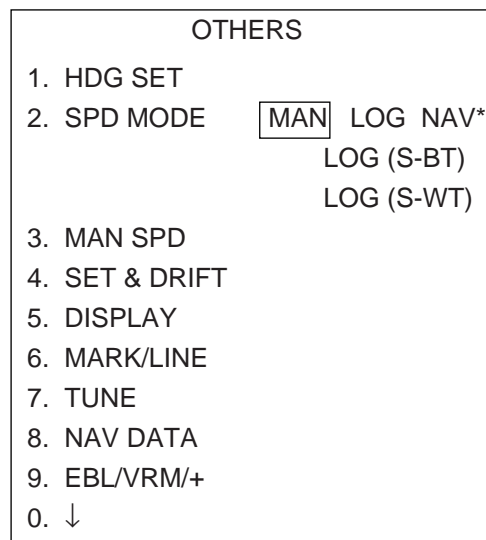
Selecting plotting interval

On PLOT MENU 1, select desired past position display plotting interval among 30 sec, 1 min, 2 min, 3 min or 6 min from 9. INTVAL.

11. Set and Drift

Set, the direction of ocean current, can be manually entered in the nearest degree. Drift, the speed of current, can also be entered manually, in 0.1 knot increments. Set and drift corrections are beneficial for increasing the accuracy of the vector data. The correction is best made on relative motion with true vector, watching landmasses, buoys, or stationary targets. Thus, the speed and course of own ship over the ground are reciprocally calculated and compared with the relative bearing and range to the reference target to produce a Set and Drift. These values are applied to all targets. If stationary objects have vectors, the set and drift should be corrected until they lose their vectors.

If own ship is equipped with a device to indicate ocean current movements, the values shown on it may be used.

1. Press [MENU], [0], [0] to display the OTHER menu.

```
              OTHERS

   1.  HDG SET
   2.  SPD MODE     MAN  LOG NAV*
                         LOG (S-BT)
                         LOG (S-WT)
   3.  MAN SPD
   4.  SET & DRIFT
   5.  DISPLAY
   6.  MARK/LINE
   7.  TUNE
   8.  NAV DATA
   9.  EBL/VRM/+
   0.  ↓
```

* NAV shown on R-type only.

Figure 9 OTHER menu

2. Press the [4] key twice to select SET/DRIFT.

```
          SET & DRIFT
   1.  ↑
   2.  SET/DRIFT    OFF  ON
   3.  SET          000.0
   4.  DRIFT        0-19.9 KT
```
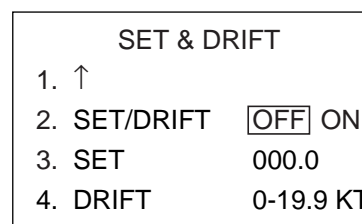
Figure 10 SET/DRIFT menu

9

4. Press the [2] key to select ON from the SET DRIFT field, and then press the [ENTER/SELECT] key.

5. Press the [3] key twice, enter SET value, and then press the [ENTER/SELECT] key.

6. Press the [4] key twice, enter DRIFT value, and then press the [ENTER/SELECT] key.

7. Press the [MENU] key.

12. Alarms

CPA/TCPA alarm

Visual and audible alarms are generated when the predicted CPA and TCPA of any target become less than their preset limits. Press the [AUDIO OFF] key to acknowledge and silence the CPA/TCPA audible alarm.

The ATA continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each tracked target to own ship.

When the predicted CPA of any target becomes smaller than a preset CPA alarm range and its predicted TCPA less than a preset TCPA alarm limit, the ATA releases an audible alarm. In addition, the target plot symbol changes to a triangle and flashes together with its vector.

Provided that this feature is used correctly, it will help prevent the risk of collision by alerting you to threatening targets. It is important that GAIN, A/C SEA, A/C RAIN and other radar controls are properly adjusted and the ATA is set up so that it can track targets effectively.

CPA/TCPA alarm ranges must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

The CPA/TCPA alarm feature should never be relied upon as a sole means for detecting the risk of collision. The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

Follow the steps shown below to set the CPA/TCPA alarm ranges:

1. Press [MENU], [7], [7] to display PLOT MENU 1.

2. Press [5] (CPA SET) to select CPA limit desired from the CPA SET line.

3. Press the [ENTER/SELECT] key.

4. Press [6] (TCPA SET) to select a TCPA limit desired.

5. Press the [ENTER/SELECT] key.

6. Press the [MENU] key to close the menu.

Silencing CPA/TCPA audible alarm

Press the [AUDIO OFF] key to acknowledge and silence the CPA/TCPA audible alarm.

The flashing of the triangle plot symbol and vector remain on the screen until the dangerous situation is no longer present or you intentionally terminate tracking of the target by using the [CANCEL/CLEAR] key.

Lost target alarm

When the system detects a lost target, tracking on the target is discontinued and the target symbol becomes a flashing diamond ($\ominus$). The normal plotting symbol is restored to the target when the target is manually acquired. If the target is not reacquired the flashing diamond will be erased from the screen.

Confirming lost target

1. Place cursor on target.

2. Press the [CANCEL/CLEAR] key.

Guard zone alarm

When a target comes in the guard zone, the buzzer sounds and the indication "GUARD ZONE" appears. The intruding target is denoted by an inverted triangle mark. The mark disappears when the target exits the zone.

You can set the guard zone as follows:

1. Press the [MENU], [7], [7] to display PLOT MENU 1.

2. Press the [0] key twice.

3. Press the [3] key to select GUARD ZONE.

4. Press the [3] key again to select SET and press the [ENTER/SELECT] key.

5. Set the cursor on one boundary of the guard ring and press the [ENTER/SE-LECT] key. Set the cursor on the other boundary and press the [ENTER/SE-LECT] key.

To disable the guard ring, select OFF at step 4 in the above procedure and press the [EN-TER/SELECT] key.
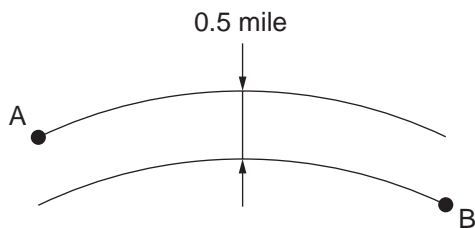
Figure 11 Guard zone

13. Track Test (Simulation Display)

The simulation display tests the ATA processor for proper operation. The figure below shows the starting picture of the simulation display. Each mark moves as time passes. Check that each target's data is reasonable. **Do this test when the radar is not being used.**
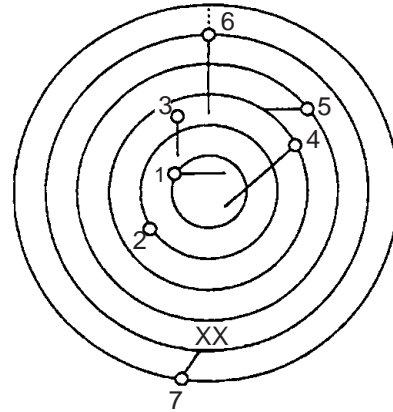
Figure 12 Track test display

1. Press [MENU], [7], [7], [0], [0], [4], [4].

2. Press the [ENTER/SELECT] key to start the test.

3. It takes approximately three minutes for all vectors to be displayed completely on the screen. The simulation display does not need radar, gyrocompass nor speed log input; seven targets on various courses and speeds are provided.

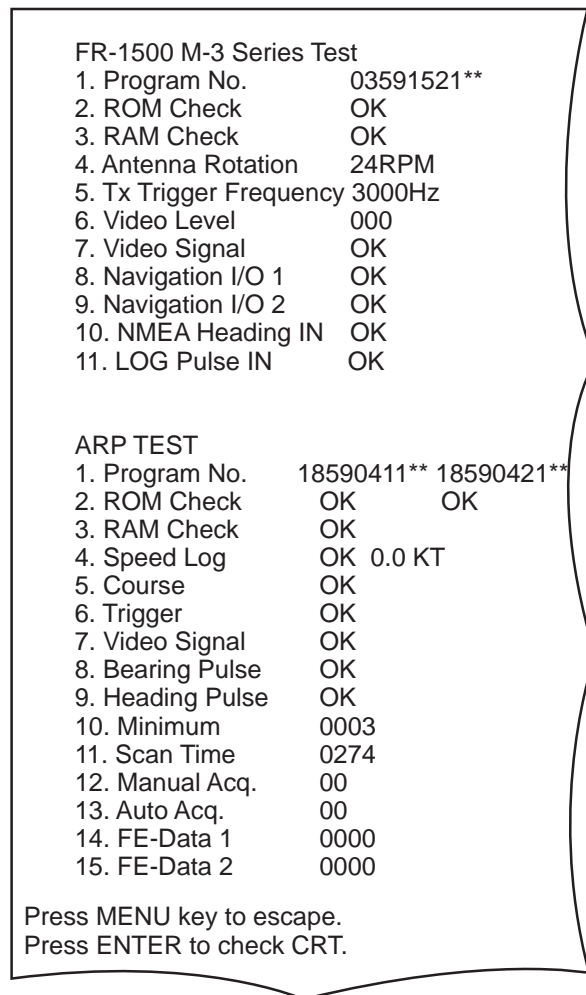| Target	Course	Speed	CPA*	TCPA*
Target 1	90.0° R	10.0 kt	1.0 nm	10.4 min
Target 2	0.0° R	0.0 kt	4.0 nm	—
Target 3	180.0° R	10.0 kt	1.7 nm	28.2 min
Target 4	216.5° R	23.8 kt	0.9 nm	15.0 min
Target 5	273.5° R	14.2 kt	6.0 nm	22.5 min
Target 6	180.0° R	20.0 kt	0.0 nm	30.0 min
Target 7	24.6° R	15.6 lkt	4.0 nm	43.6 min

* Initial data

4. The simulation continues for five minutes and then repeats. To quit the test sequence, turn the TRACK TEST off on the PLOT MENU2.

11

14. Diagnostic Sequence

You can check the ATA Board for proper operation as follows. The self test does not require operator intervention. It runs automatically when the power is placed on at regular intervals or on operator demand.

1. Press [MENU], [0], [0], [0], [0].

2. Press the [2] key twice to start the diagnosis sequence. The results of the test appear as shown below.

```
FR-1500 M-3 Series Test
1. Program No.          03591521**
2. ROM Check            OK
3. RAM Check            OK
4. Antenna Rotation     24RPM
5. Tx Trigger Frequency 3000Hz
6. Video Level          000
7. Video Signal         OK
8. Navigation I/O 1      OK
9. Navigation I/O 2      OK
10. NMEA Heading IN      OK
11. LOG Pulse IN         OK


ARP TEST
1. Program No.      18590411** 18590421**
2. ROM Check        OK         OK
3. RAM Check        OK
4. Speed Log        OK  0.0 KT
5. Course           OK
6. Trigger          OK
7. Video Signal     OK
8. Bearing Pulse    OK
9. Heading Pulse    OK
10. Minimum         0003
11. Scan Time       0274
12. Manual Acq.     00
13. Auto Acq.       00
14. FE-Data 1       0000
15. FE-Data 2       0000

Press MENU key to escape.
Press ENTER to check CRT.
```

** Program No.

*Figure 13 Diagnostics test results
(FR-1500 MARK-3 series)*

3. If NG appears for any ATA-related item, call for service.

4. To escape, press the [MENU] key.

15. Outputting Target Data

Target data may be output to external equipment as follows:

1. Press [MENU], [7], [7], [0], [0].

2. Press the [6] key to select OFF, REL or TRUE from the TTM field as appropriate.

3. Press the [ENTER/SELECT] key followed by the [MENU] key.

Target data contain as follows;

*   Target number

*   Target distance from own ship

*   Bearing from own ship, True or relative

*   Target speed

*   Target course, true or relative

*   CPA and TCPA

*   etc.

SPECIFICATIONS OF AUTO PLOTTER
ARP-17

1. GENERAL

(1) Functions

- Calculation/indication of own ship speed relative to a fixed target
- Manual target acquisition, automatic tracking
- Target information:

    Distance and bearing from own ship to target

    Moving direction and speed
- History presentation

(2) Acquisition and Tracking

- Manual acquisition by trackball and cursor
- Maximum number of targets: 10
- Acquisition range: 0.2 to 32 nm
- Tracking range: 0.1 to 32 nm

(3) Vector

- Vector length: 30 sec; 1, 2, 3, 6, 15, 30 min
- Mode: true velocity or relative velocity

(4) History

- plotting interval: 30 sec; 1,2,3,6 min
- Number of plotting points: 10 per target

(5) Alarms

- Visual and audible alarm against target violating CPA/TCPA limits
- Visual and audible alarm against guard-zone limits (5 targets max.)
- Visual alarm against lost target, target full and system failure

(6) Compatible Radar   FR-1700 series, FR-1500 Mark-3 series

INDEX