FURUNO

OPERATOR'S MANUAL

CLASS B AIS TRANSPONDER

Model **FA-70**

FURUNO ELECTRIC CO., LTD.

www.furuno.com

(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

FURUNO ELECTRIC CO., LTD.

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・FURUNO Authorized Distributor/Dealer

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（YOTA） FA-70

IMPORTANT NOTICES

General

- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the descriptions in this manual. Wrong operation or maintenance can cancel the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
- The following concern acts as our importer in Europe, as defined in DECISION No 768/2008/EC.
  - Name: FURUNO EUROPE B.V.
  - Address: Ridderhaven 19B, 2984 BT Ridderkerk, The Netherlands
- Microsoft and Windows are registered trademarks or trademarks of the Microsoft Corporation of the USA and other countries.
- All brand and product names are trademarks, registered trademarks or service marks of their respective holders.

How to discard this product

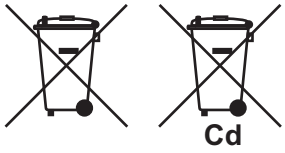
Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. If a battery is used, tape the + and - terminals of the battery before disposal to prevent fire, heat generation caused by short circuit.

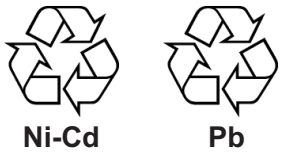
In the European Union

The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.



In the USA

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.



In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.

SAFETY INSTRUCTIONS

The operator and installer must read the applicable safety instructions before attempting to install or operate the equipment.

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Warning, Caution Prohibitive Action Mandatory Action

Safety Instructions for the Operator

WARNING

Do not open the equipment.

This equipment uses high voltage that can cause electrical shock. Only qualified personnel can work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can occur. If the equipment does not work properly, contact your dealer.

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

Fire or electrical shock can result.

Use the correct fuse.

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

Do not operate the equipment with wet hands.

Electrical shock can result.

CAUTION

Make sure no rain or water splash leaks into the equipment.

Fire or electrical shock can result if water leaks into the equipment.

Do not place liquid-filled containers on or near the equipment.

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

Do not disconnect the power cable while the system is powered.

Damage to the equipment can result.

Safety Instructions for the Installer

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel can work inside the equipment.

Turn off the power at the switchboard before beginning the installation.

Fire or electrical shock can result if the power is left on.

Do not install the equipment where it may get wet from rain or water splash.

Water in the equipment can result in fire, electrical shock or damage to the equipment.

Be sure that the power supply is compatible with the voltage rating of the equipment.

Connection of an incorrect power supply can cause fire or damage the equipment.

⚠ CAUTION

Observe the following compass safe distances to prevent interference to a magnetic compass:

	Type	Standard compass	Steering compass
Antenna Unit	GPA-017S	0.3 m	0.3 m
	GPA-017	0.3 m	0.3 m
	GPA-C01	0.3 m	0.3 m
AIS Transponder	FA-70	0.3 m	0.3 m
Power Supply Unit	PR-240	0.9 m	0.6 m

Radiation Hazard

⚠ WARNING

Do not approach the antenna closer than x.x m when it is transmitting.

The antenna emits radio waves which can be harmful to the human body, particularly the eyes.

Radiation level	Distance
100 W/m^2	N/A
10 W/m^2	N/A
2 W/m^2	0.2 m

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FOREWORD

A Word to the Owner of the FA-70

Congratulations on your choice of the FURUNO FA-70 Class B AIS Transponder. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

Since 1948, FURUNO Electric Company has enjoyed an enviable reputation for quality marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

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

Thank you for considering and purchasing FURUNO equipment.

Features

The FA-70 is a Class B AIS (Automatic Identification System) capable of exchanging navigation and ship data between own ship and other ships or coastal stations.

The main features are:

- Fully meets the following regulations: IEC 62287-1, IEC 62287-2
- Switchable communication system; SOTDMA and CSTDMA
- Capable of initial setting from the TZTL12F/15F (software version: 07.01 or later) or TZT12F/16F/19F
- Built in VHF splitter
  The VHF splitter enables the AIS tansponder and VHF transceiver to share a single VHF antenna.
- Capable of easy uploading the latest FA-70
- Fulfill the NMEA2000
- Static data
  - MMSI (Maritime Mobile Service Identity), ship’s name, call sign
  - Types of ship and cargo
  - Location of position-fixing antenna on the ship
- Dynamic data
  - Ship's position with accuracy indication and integrity status
  - Universal Time Coordinated (UTC)
  - Course over ground (COG)
  - Speed over ground (SOG)

Usage notes

MMSI

Obtain own ship's MMSI (9 digit number) before the installation. Depending on your location, it may be illegal to input the MMSI and static data by the user (EG: United States of America, FCC regulations). Incorrect or inaccurate input of static data may also be deemed illegal. For users in the U.S.A, have your local FURUNO dealer or qualified FURUNO technician input the MMSI and static data. For other locations, check your local regulations for details regarding MMSI and static data input.

Note: You can enter the MMSI only once. When changing the MMSI, contact your dealer.

VHF splitter in the FA-70

- AIS transmission and reception can not be done during the VHF radio transmission.
- A pop noise may be generated from the VHF radio during the AIS transmission, however this is not abnormal as it is the sound by AIS transmission.
- Supported VHF radio: 155 MHz to 164 MHz, Power < 25 W

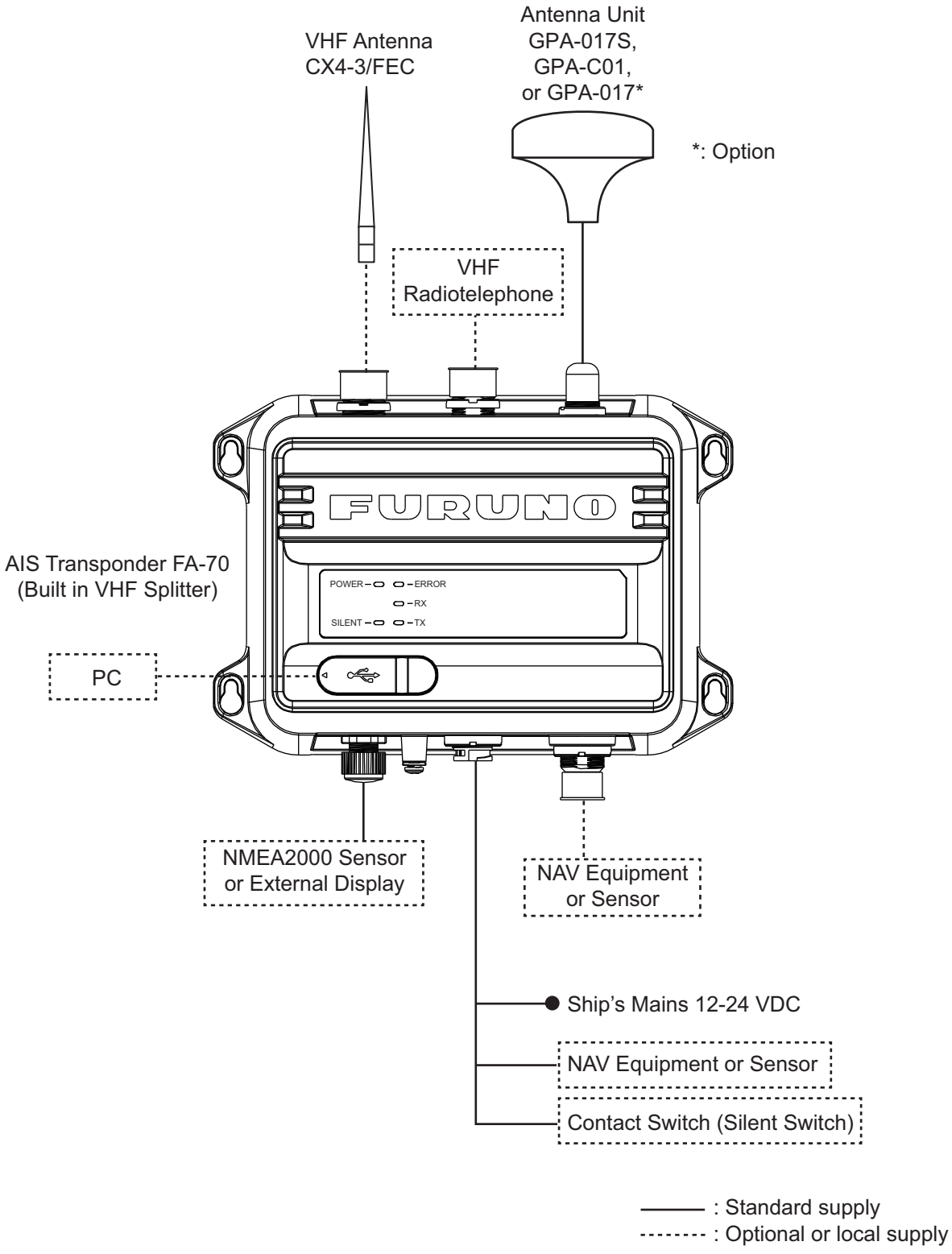
Software used in this product

This product includes software to be licensed under the Apache and BSD.

Program No.

0550263-01.** (** denotes minor modifications.)

SYSTEM CONFIGURATIONS



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1. INSTALLATION

1.1 Equipment List

Standard supply

Name	Type	Qty	Remarks
AIS Transponder	FA-70	1	Built in VHF Splitter
Antenna Unit	GPA-017S	Select one	GPS Antenna
	GPA-C01		
Installation Materials	61110000000101	1	PWR/NMEA1/SILENT Cable
	NPD-MM1MF1000G02M	1	NMEA2000 Cable
	PA4×25	4	Self Tapping Screws
Spare Parts	250VAC 5A	2	5A Glass Tube Fuses
Accessories	FA70/60/40 SW *CD*	1	AIS Setting Tool (CD-ROM for PC software*)

*: The CD-ROM for PC software and USB driver is supplied as standard. The folder structure of the CD-ROM is shown in the table below.

Folder		Filel	Remarks
AIS_Setting_ Tool	DotNetFX40	dotNetFx40_Full_ x86_x64.exe	
	Windows Installer4_5	Windows6.0-KB958655-v2-x64.MSU, etc.	
	–	AIS_Setting_Tool_ Installer.msi	
	–	setup.exe	Install file of AIS setting tool
	USBDriver ForWindows7	cdc.cat	Install file of USB driver required to connect the FA-70 with USB CDC
		FURUNO_AIS.inf	

PC requirements

OS	Microsoft® Windows® 7 (32 bit / 64 bit), Microsoft® Windows® 10 (64 bit)
CPU	Min. 1 GHz
Main memory	32 bit: min. 1 GB, 64 bit: min. 2 GB
Resolution	1280 × 720 or better
Language pack	English
USB communication	USB CDC (Communication Device Class) USB2.0 / Type A-Micro B cable

Optional supply

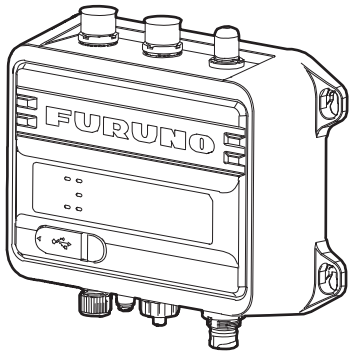
Name	Type	Code No.	Remarks
Antenna Unit	GPA-017	-	GPS antenna
	GPA-017S	-	
	GPA-C01	-	
AC/DC Power Supply Unit	PR-240	-	
Antenna Cable Assembly	CP20-02700 (30M)	004-381-160	For GPA-017S (30 m), 8D-FB-CV*30M*
	CP20-02710 (50M)	004-381-170	For GPA-017S (50 m), 8D-FB-CV*50M*
	CP20-02720 (40M)	001-207-990	For GPA-017S (40 m), 8D-FB-CV*40M*
Mast Mounting Kit	CP20-01111	004-365-780	For GPS antenna
Antenna	CX4-3/FEC	001-474-340	
Antenna Fixing Bracket	N173F/FEC	001-474-350	For CX4-3/FEC (ϕ49-90)
	N174F/FEC	001-494-890	For CX4-3/FEC (ϕ30-61)
Right Angle Mounting Base	NO.13-QA330	001-111-910-10	For GPS antenna
L-Angle Mounting Base	NO.13-QA310	001-111-900-10	For GPS antenna
Handrail Mounting Base	NO.13-RC5160	001-111-920-10	For GPS antenna
Cable Assembly	TNC-PS/PS-3D-L15M-R	001-173-110-10	For GPA-017S, TNC-TNC (15 m)
	FRU-NMEA-PMMFF-010	001-533-060	Max. 6 m
	FRU-NMEA-PMMFF-020	001-533-070	
	FRU-NMEA-PMMFF-060	001-533-080	
	FRU-NMEA-PFF-010	001-507-010	
	FRU-NMEA-PFF-020	001-507-030	
	FRU-NMEA-PFF-060	001-507-040	

Name	Type	Code No.	Remarks
Cable Assembly	MJ-A6SPF0003-020C	000-154-029-10	Max. 15 m
	MJ-A6SPF0003-050C	000-154-054-10	
	MJ-A6SPF0003-100C	000-168-924-10	
	MJ-A6SPF0003-150C	000-159-643-10	
Micro T-Connector	FRU-MM1MF1MF1001	001-507-050	
Termination Resistor (Micro)	FRU-MM1000000001	001-507-070	
	FRU-MF000000001	001-507-060	
In-Line Terminator	FRU-0505-FF-IS	001-077-830-10	

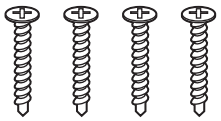
1.2 Included Items and Local Supplies

AIS Transponder

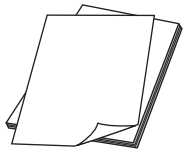
• AIS Transponder (1 pcs)



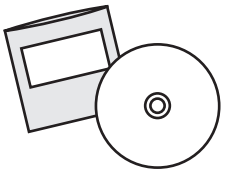
• Self-tapping screw (4 pcs)



• Documents (1 set)

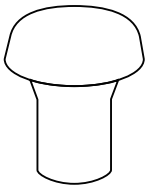


• AIS Setting Tool (1 pcs)

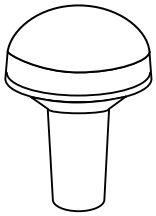


Antenna Unit

• Antenna Unit (1 pcs)



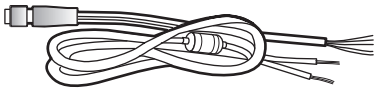
GPA-017/017S



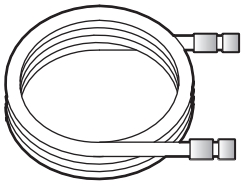
GPA-C01

Cable assembly

• PWR/NMEA1/SILENT cable (1 pcs): 2 m



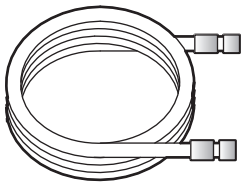
• NMEA2000 cable (1 pcs): 2 m



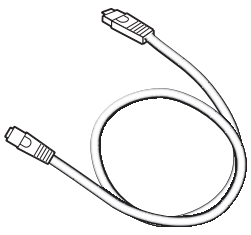
• Spare fuse (5A, 2 pcs)

Local supplies

• 5D-2V cable

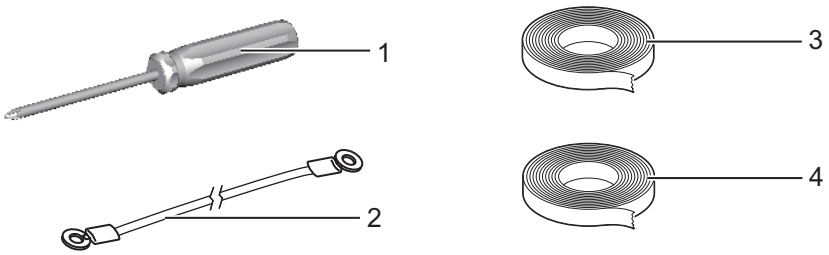


• USB cable: max. 2 m



1.3 Required Tools and Materials

The following tools should be prepared in advance for this installation.



No.	Name	Remarks
1	Phillips-head screw driver	#3, for securing the cable cover
2	Ground wire	IV-1.25sq
3	Self-vulcanizing tape	For waterproofing the junction of connectors
4	Vinyl tape*	

*: For cosmetic purposes, black color vinyl tape (cable color) is recommended.

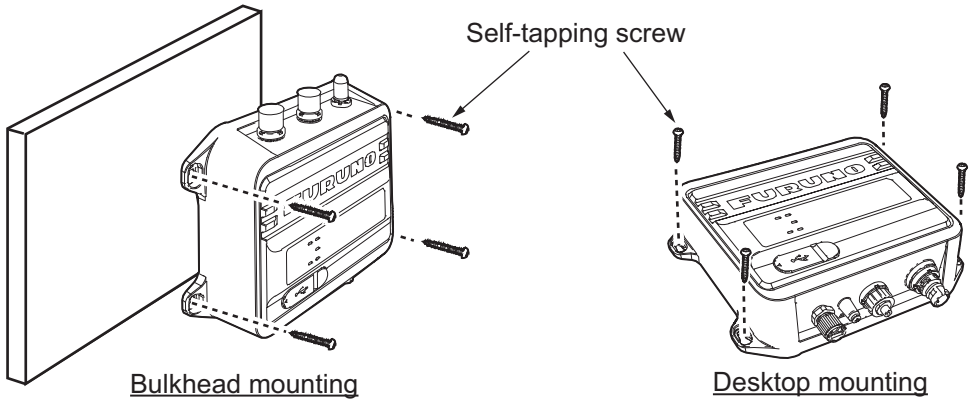
1.4 AIS Transponder FA-70

Mounting considerations, mounting

The FA-70 can be mounted on a desktop or on a bulkhead. When selecting a mounting location, keep in mind the following points:

- Keep the unit out of direct sunlight.
- The temperature and humidity should be moderate and stable.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.
- Keep the unit away from electromagnetic field-generating equipment such as motors and generators.
- A magnetic compass will be affected if the FA-70 is placed too close to it. Observe the compass safe distances noted in the safety instructions to prevent disturbance to the magnetic compass.

Fix the unit to the mounting location with four self-tapping screws (supplied).



1.5 GPS Antenna

> **⚠ CAUTION**
>
> **Do not connect the GPS antenna connector to ground.**
>
> Short circuit can result.

Install the GPS antenna unit referring to the outline drawing at the back of this manual. When selecting a mounting location for the antenna, keep the following in mind:

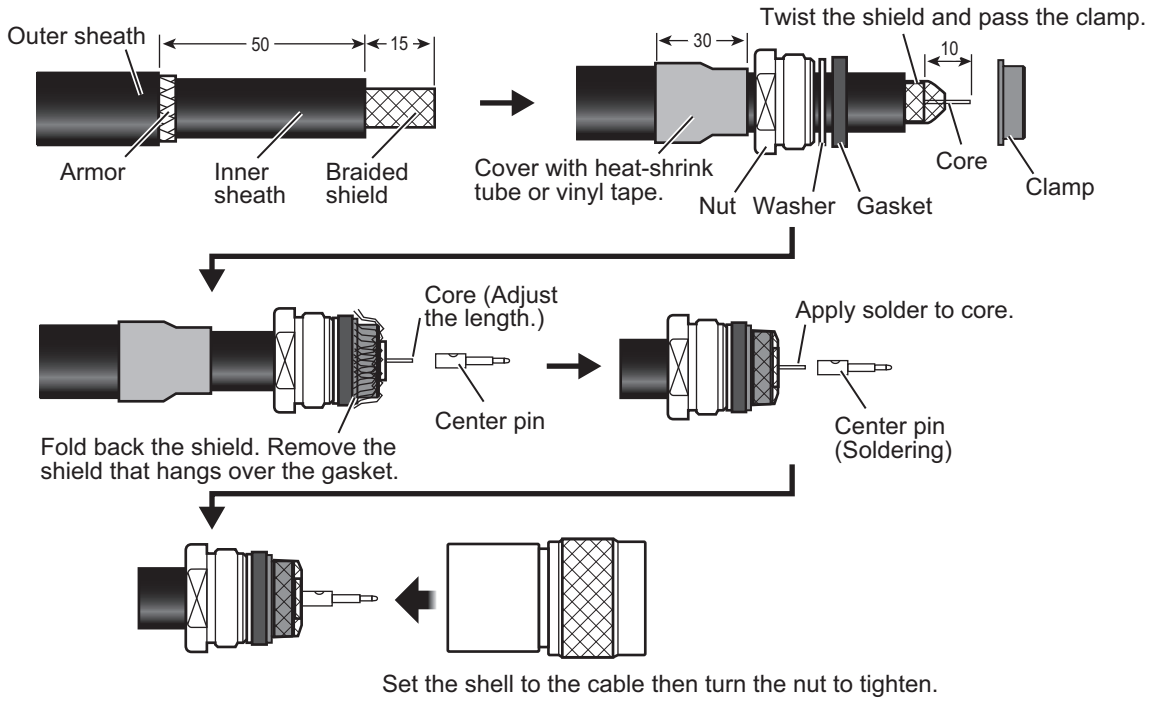
- Select a location out of the radar and inmarsat beams. The radar beam will obstruct or prevent reception of the GPS satellite signal.
- There should be no interfering object within the line-of-sight to the satellites. Objects within line-of-sight to a satellite, for example, a mast, may block reception or prolong acquisition time.
- Mount the antenna unit as high as possible to keep it free of interfering objects and water spray, which can interrupt reception of GPS satellite signal if the water freezes.
- The location should be well away from a VHF antenna. VHF antenna emits harmonic waves which can interfere with the GPS receiver.

How to extend the antenna cable

Use the cable type RG-10/UY (shipyard supply) to extend the antenna cable.

Note: The length of this cable should be less than 20 m to prevent signal loss. The coax. coupling cable assy.(type: NJ-TP-3DXV-1, code no. 000-123-809), coaxial connector (N-P-8DFB; supplied), vulcanizing tape and vinyl tape are required. Fabricate both ends of the cable as shown in the figure below.

How to attach the connector N-P-8DSFA for cable 8D-FB-CV

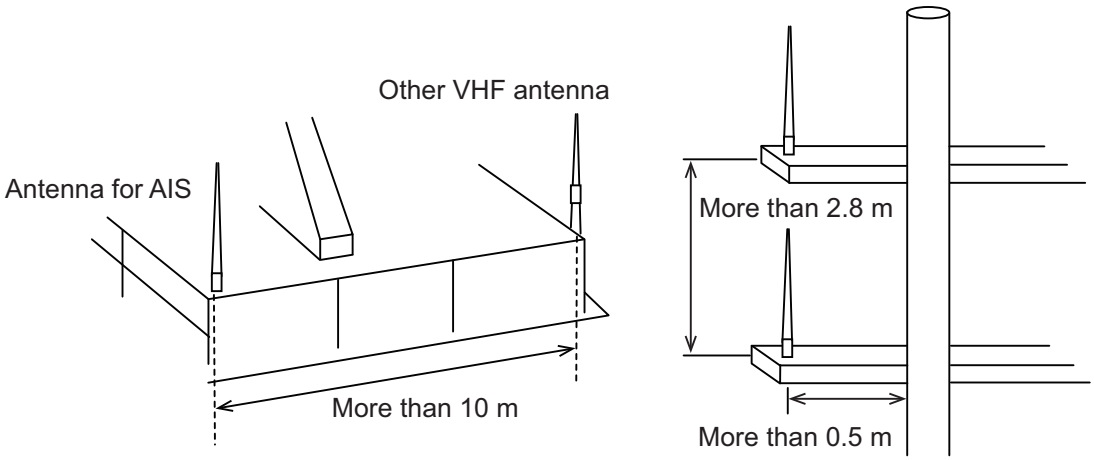


1.6 VHF Antenna (option)

Location

The location of the VHF antenna should be carefully considered. It may be necessary to relocate the VHF radiotelephone antenna to minimize interference effects. To minimize interference effects, the following guidelines apply:

- Select a location out of the radar and inmarsat beams. Those beams will obstruct or prevent reception of the GPS satellite signal.
- The VHF antenna should be placed in an elevated position that is as free as possible with a minimum of 0.5 meters in the horizontal direction from constructions made of conductive materials. The antenna should not be installed close to any large vertical obstruction. The objective for the VHF antenna is to see the horizon freely through 360 degrees.
- There should not be more than one antenna on the same plane. The VHF antenna should be mounted directly above or below the ship's primary VHF radiotelephone antenna, with no horizontal separation and with a minimum of 2.8 meters vertical separation. If it is located on the same plane as other antennas, the distance apart should be at least 10 meters.



Horizontal separation distance　　Vertical separation distance

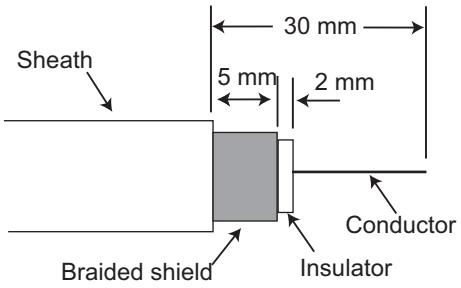
Cabling

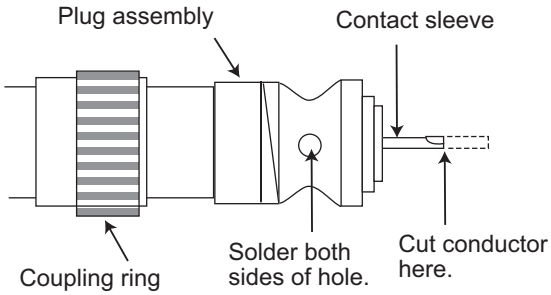
- The cable should be kept as short as possible to minimize signal attenuation. Coaxial cables equal to or better than 5D-2V are recommended.
- All outdoor-installed connectors on coaxial cables should be fitted with preventive isolation such as vulcanizing tape to protect against water penetration into the antenna cable. Also, apply marine sealant at the antenna base to prevent water intrusion from the screw part of antenna base.
- Coaxial cables should be installed in separate signal cable channels/tubes and at least 10 cm away from power supply cables. Crossing of cables should be done at right angles (90 degrees). The minimum bend radius of the coaxial cable should be 5 times the cable's outer diameter.

When coaxial cable 5D-2V (shipyard supply) is used, attach the coaxial plug M-P-5 (shipyard supply) as shown on the following page.

How to attach the plug M-P-5

Lay the coaxial cable and attach an M-type plug to the cable as follows.

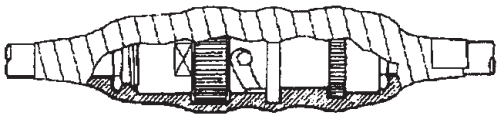




1. Remove the sheath by 30 mm.
2. Bare 23 mm of the center conductor. Trim braided shield by 5 mm and tin.
3. Slide coupling ring onto cable.
4. Screw the plug assembly on the cable.
5. Solder plug assembly to braided shield through solder holes. Solder contact sleeve to conductor.
6. Screw coupling ring into plug assembly.

Waterproofing connector

Wrap connector with vulcanizing tape and then vinyl tape. Bind the tape end with a cable-tie.



1.7 AC-DC Power Supply (option)

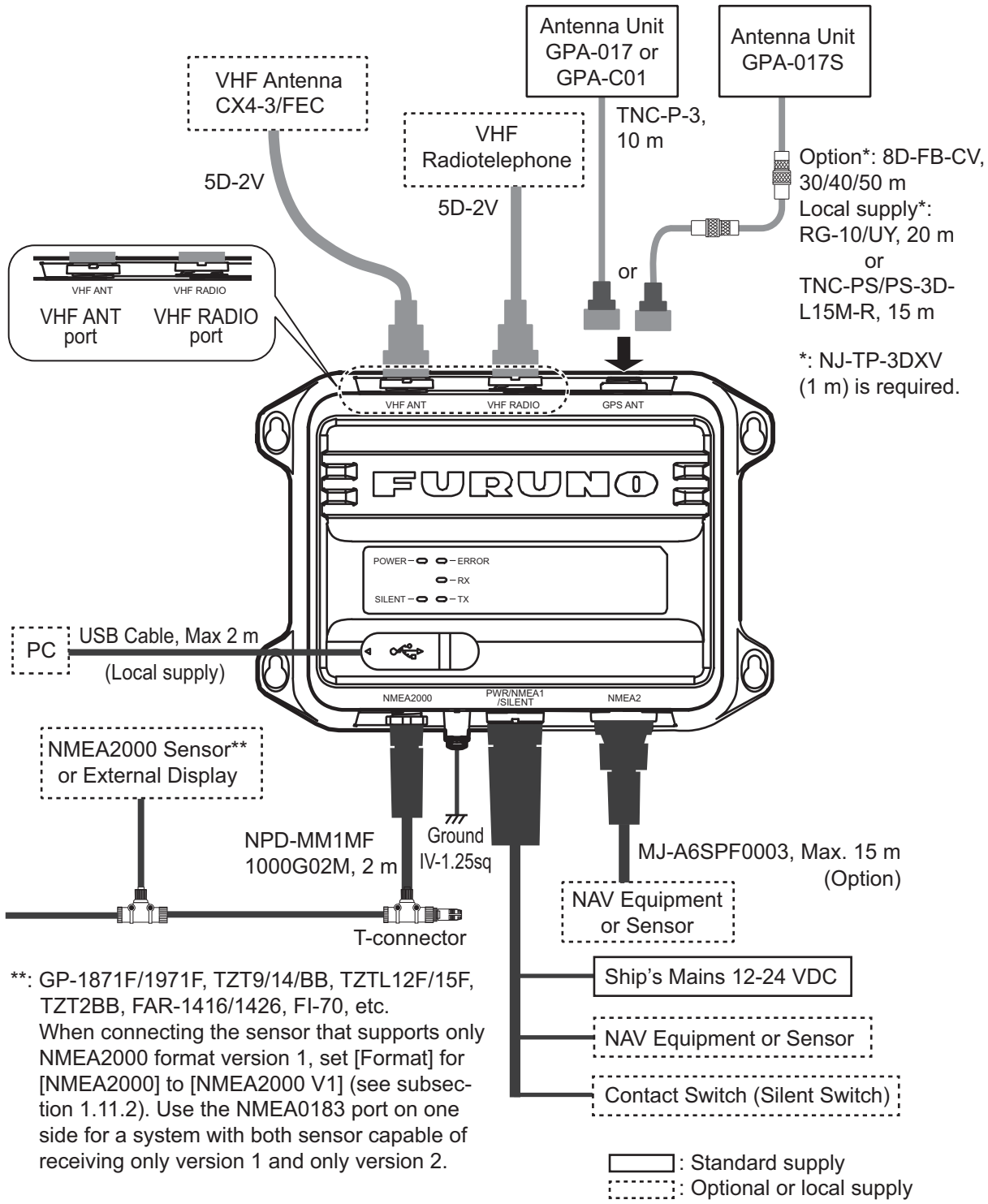
When selecting a mounting location for the unit, keep the following in mind:

- Keep the unit away from areas subject to water splash.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.
- A magnetic compass will be affected if the unit is placed too close to it. Observe the compass safe distances noted in the safety instructions to prevent disturbance to the magnetic compass.

Fix the unit with four self tapping screws (4×16) to a desktop or the deck. It is not necessary to open the cover.

1.8 Wiring

Connect the equipment, referring to the figure below and the interconnection diagram at the back of this manual.



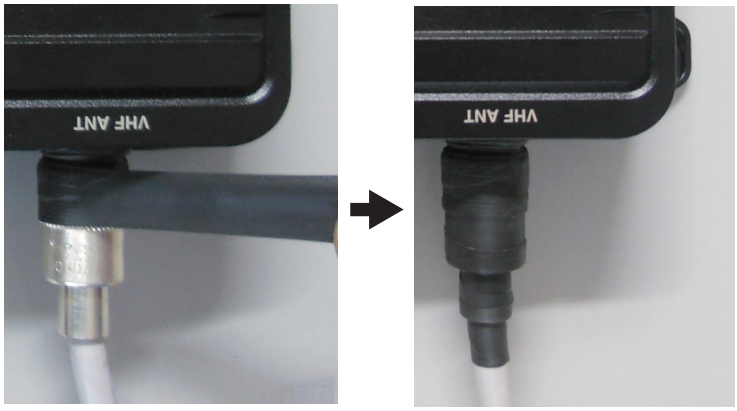
**: GP-1871F/1971F, TZT9/14/BB, TZTL12F/15F, TZT2BB, FAR-1416/1426, FI-70, etc.
When connecting the sensor that supports only NMEA2000 format version 1, set [Format] for [NMEA2000] to [NMEA2000 V1] (see subsection 1.11.2). Use the NMEA0183 port on one side for a system with both sensor capable of receiving only version 1 and only version 2.

Note 1: The FA-70 is the permanently connected equipment. Install the external disconnecting device (e.g. power switchboard).

Note 2: Connect the VHF antenna to the "VHF ANT" port, and the VHF radiotelephone to the "VHF RADIO" port. If the VHF radiotelephone is connected to the "VHF ANT" port, the VHF radiotelephone and the FA-70 may be damaged.

How to waterproof the connector for VHF antenna and VHF radiotelephone

Wrap the connector for VHF antenna and VHF radiotelephone with the self-bonding tape.



Connection with the PC and NavNet TZtouch2/3

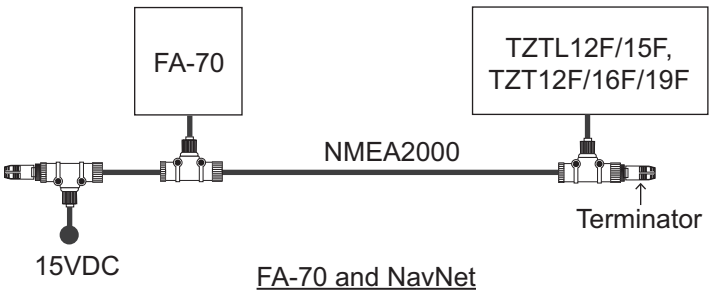
The FA-70 may be connected to a PC or TZTL12F/TZTL15F/TZT12F/TZT16F/ TZT19F. See the figure below for connection examples.

⚠ CAUTION

PC connected by USB is only powered by a battery.

Short circuit can result if the PC is connected to ground.

FA-70 and PC



FA-70 and NavNet

2. SHIP INFORMATION INPUT

You must set the ship static information after the installation of the equipment. The FA-70 is set up from the PC or external display (TZTL12F*/15F* or TZT12F/16F/19F). When setting from the PC, install the USB driver and PC software (see sections 2.1 and 2.2).

*: The software version 07.01 or later is required.

2.1 How to Install the Driver

The CD-ROM for PC software and USB driver is supplied as standard.

Note 1: Install the driver with administration rights.

Note 2: In the case of Microsoft® Windows® 10, the “Driver” file is already installed. If you need to re-install this file, install this file in [Device Manager].

Note 3: “Microsoft.NET Framework 4(×86 or ×64)” is installed at the time of the AIS Setting Tool installation.

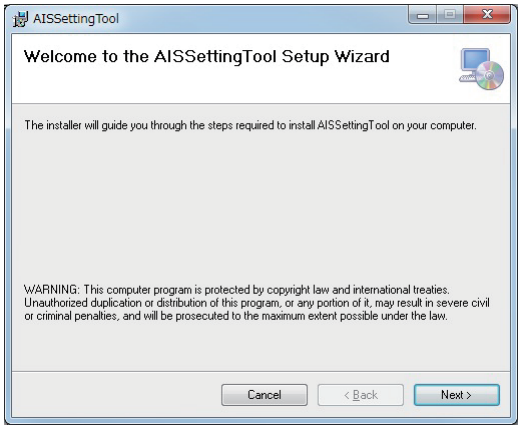
The following instructions are for Windows® 7.

1. Turn the FA-70 on.
2. Connect the USB cable between the FA-70 and the PC.
3. Set the supplied CD-ROM in the CD drive.
4. Click the [Start] button and then click [Control Panel].
5. Click [Device Manager].
6. Enter the installuser password and then click [Yes].
7. Double-click [Other devices] – [VIRTUAL COM PORT] in order.
8. Click the [General] tab and then click [Update Driver…].
9. Click [Browse my computer for driver software].
10. Select the [usb_driver] folder in the CD-ROM.
11. Click [Install this driver software anyway] to install the driver. After the installation, [FURUNO AIS (COMxx)] is displayed in [Ports (COM & LPT)] of [Device Manager].

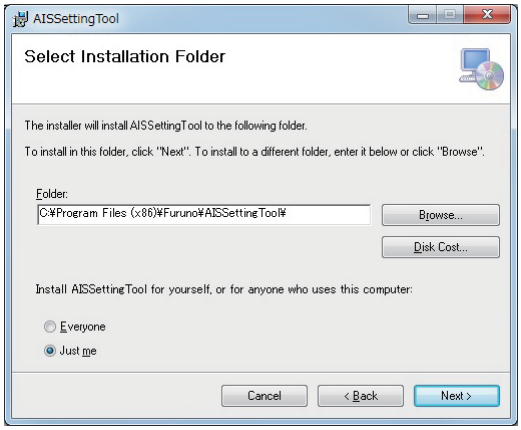
2.2 How to Install the AIS Setting Tool

Note: Install the AIS setting tool with administration rights.

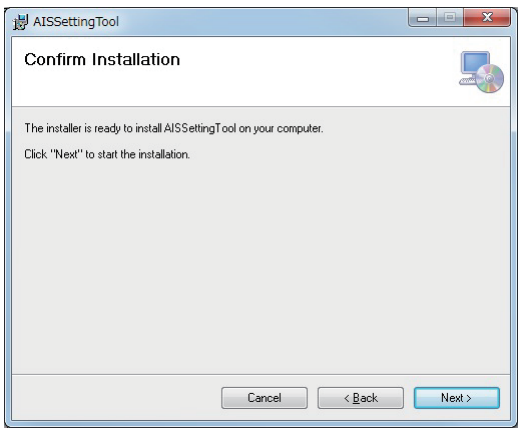
1. Set the supplied CD-ROM in the CD drive.
2. Click [AIS_Setting_Tool].
3. Click [setup.exe].



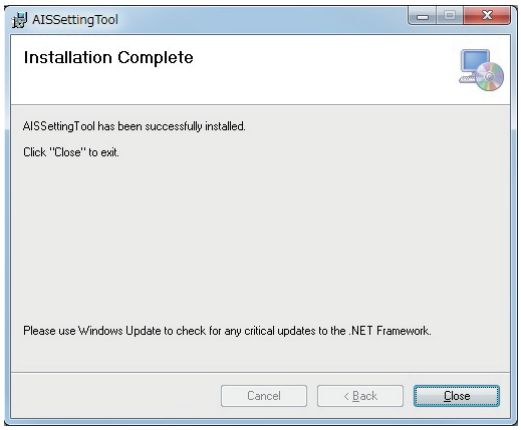
4. Click [Next].



5. Click [Next]. To change the installation folder, click [Browse] and select the folder before clicking [Next].



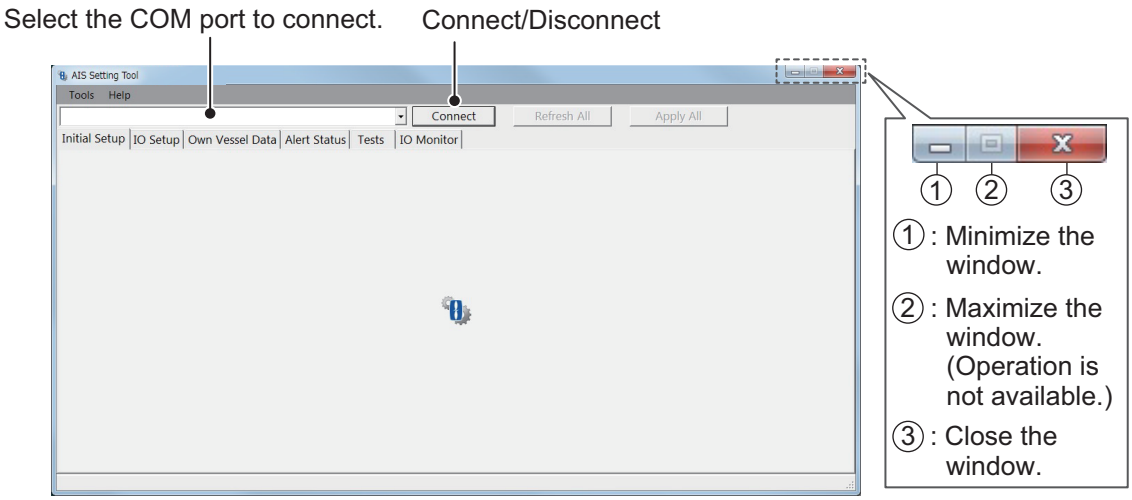
6. Click [Next] to start the installation. When the installation is completed, the dialog box shown below appears.



7. Click [Close] to finish. The shortcut icon for [AIS_Setting_Tool.exe] is created on your desktop.

2.3 How to Start and Quit the AIS Setting Tool

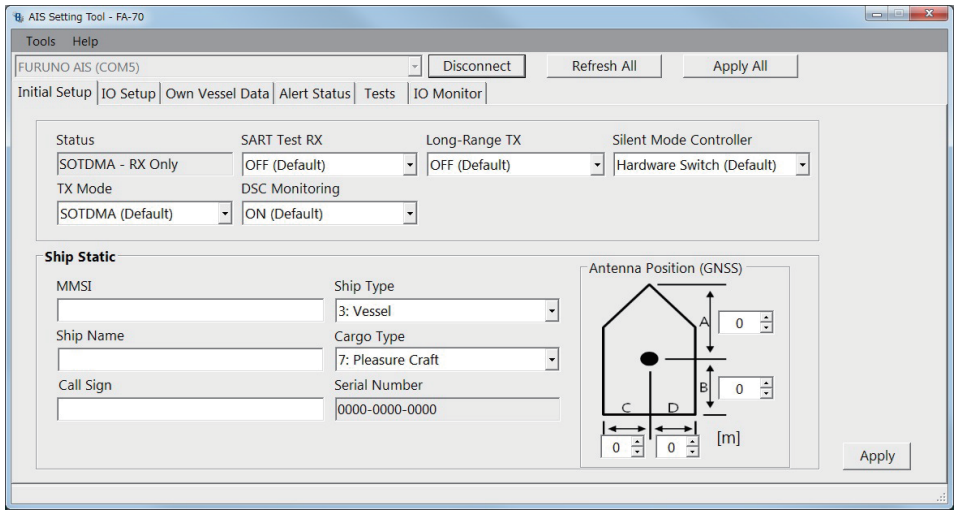
1. Double-click the shortcut icon for [AIS_Setting_Tool.exe].



2. Click the down-allow button at the top left of the screen, and then select the COM port to connect.
3. Click [Connect].
4. To quit the software, click [Disconnect], and then click the close button (x) at the upper right-hand corner of the screen.

2.4 Initial Setup

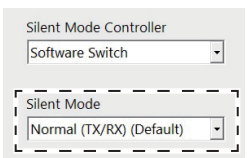
You can set up the the TX/RX mode, own ship's static information (MMSI, ship's name, call sign, antenna position and type of ship), and silent mode from the [Initial Setup] menu. You must set the ship static information.

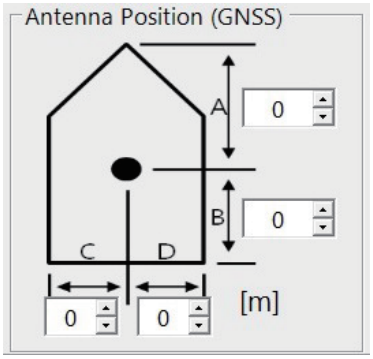


[Status] ([AIS Status] on the external display), [Serial Number]: Display only.

[Initial Setup] menu for PC

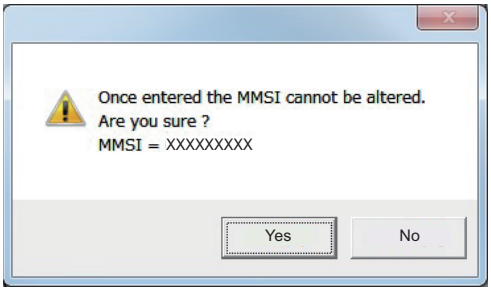
Most of the menu items are same between the PC and external display. For details, see "MENU TREE" on page AP-1.

Menu item	Description
[AIS Status] (for the external display)	Shows the status for transmission and reception of AIS.
[Status] (for the PC)	
[TX Mode]	Select the transmission mode from [SOTDMA] or [CSTDMA]. [SOTDMA]: Self organized time division multiple access (This mode is default setting.) [CSTDMA]: Carrier sense time division multiple access (Transmission information volume for CSTDMA is smaller than SOTDMA.) When changing the transmission mode, the confirmation message appears. Click [Yes], and then click [Apply] to restart the FA-70.
[SART Test RX]	Select whether to receive an AIS SART test message.
[DSC Monitoring]	Select whether to receive a DSC message.
[Long-Range TX]	Select whether to transmit an AIS message of long range. This menu is displayed when [TX Mode] is set to [SOTDMA].
[Silent Mode Controller]	Select the silent mode controller from hardware or software.
[Silent Mode]	When selecting [Software Switch] in the [Silent Mode Controller] menu, the [Silent Mode] menu as shown the right figure appears on the screen. Select the FA-70 function from [Normal (TX/RX)] or [RX Only]. [Normal (TX/RX)]: Sets the FA-70 for normal (transmission and reception) function. [RX Only]: Sets the FA-70 for receiving function only. 

Menu item	Description
[Ship Static]	
[MMSI]	Enter the ship's MMSI (nine digits). The available MMSI numbers are displayed at the bottom of the screen. **Note 1:** When the ship's MMSI has already set, the numer is displayed. **Note 2:** You can enter the MMSI only once. When changing the MMSI, contact your dealer. **Note 3:** When the MMSI is not set, you can not transmit the data.
[Ship Name]	Enter the ship's name, using up to 20 alphanumeric characters.
[Call Sign]	Enter the call sign, using seven alphanumeric characters.
[Ship Type]	Select the ship type.
[Cargo Type]	Select the cargo type. Available options depend on the setting of [Ship Type].
[Serial Number]	Shows the serial number for the equipment.
[Antenna Position]	Set the antenna position referring to the following figure.  A: Distance from bow to GPS antenna position (setting range: 0 to 511 m) B: Distance from stern to GPS antenna position (setting range: 0 to 511 m) C: Distance from port to GPS antenna position (setting range: 0 to 63 m) D: Distance from starboard to GPS antenna position (setting range: 0 to 63 m)

For the PC, click [Apply] or [Apply All] to confirm the settings.

Note: If you enter the MMSI, the following message appears when clicking [Apply] or [Aplly All].



Click [Yes] to save the settings, [No] to cancel the settings.
For the external display, the same message appears when entering the MMSI. Select [Yes] to save the settings, [No] to cancel the settings. When selecting [Yes], the same message appears again. Select [Yes] again.

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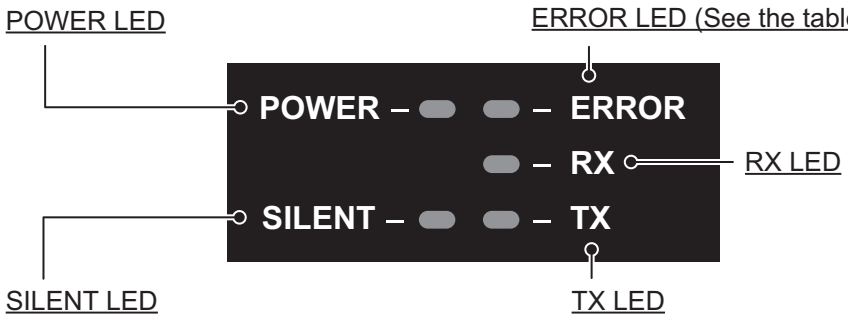
3. SETTINGS AND STATUS

3.1 AIS Transponder FA-70

The FA-70 has no power switch. Power is fed from the ship's switchboard, and a power switch on the switchboard turns the FA-70 on or off.

The table below shows the function for each LED.

LED	Color	Meaning
POWER	Green	When the power is on, the POWER LED lights in green for CSTDMA mode.
	Blue	When the power is on, the POWER LED lights in blue for SOTDMA mode.
SILENT	Blue	The SILENT LED lights in blue when the silent mode is set to on.
ERROR	Red	The ERROR LED lights in red when the equipment error (TX, RX, ROM, or RAM) is found.
	Orange	The ERROR LED lights in orange when the equipment is not installed correctly.
RX	Green	The RX LED lights in green for 50 msec when receiving.
TX	Green	The TX LED lights in green for 200 msec when transmitting.
	Orange	• The TX LED blinks in orange when the continuous transmission is not possible (TX time out). • The TX LED lights in orange when the MMSI is not set.



Red	Orange
• RAM error • CPU built-in ROM error • External ROM error • RX1/2 PLL unlock error • TX PLL unlock error • TX power error	• GPS antenna short • Lost position • VSWR error • Temperature error • Power amplifier voltage error • MMSI not registered • Noise level error (CS)