

FURUNO

OPERATOR'S MANUAL

KU-BAND ANTENNA

Model **FV-110**

ECF

(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

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KU-BAND ANTENNA FV-110

Quick guide

Introduction

This quick guide aims at experienced service personnel who have installed the FV-110 system and connected power. It lists the minimum configuration tasks you have to make before the system can be used on-air on a satellite.

Prerequisites

1. Connect a PC to the front LAN connector or the LAN3 connector at the rear of the Antenna Control Unit.
2. Open an Internet Browser and type the default IP address of the FV-110: <http://192.168.0.1> to access the web interface.

Configuration tasks (minimum)

Configuration task	What to do and where to find more information
Heading input	Configure the heading input to External under SERVICE > Calibration . For more information see <i>Select the desired heading input, see table below</i> . on page 5-6. Connect the ship's heading (RS-422, NMEA0183) to the NMEA 0183 multi-connector. Pin 8 Ship Ground/Shield (connect only one end), Pin 9 Line B +, and Pin 10 Line A-. For more information see <i>NMEA 0183 connector</i> on page 3-4.
Azimuth calibration	Make an azimuth calibration under SERVICE > Calibration to ensure that the FV-110 can point and receive satellite signal. For more information see <i>Azimuth calibration</i> on page 5-8.
TX cable calibration	Make a Tx cable calibration under SERVICE > Calibration to ensure that Tx power is calibrated at all frequencies. For more information see <i>Cable calibration</i> on page 5-10. See Appendix E or http://www.lyngsat.com for DVB-S transponder information.
VSAT modem connection	Connect cables between the modem and the ACU. For more information see <i>VMU settings</i> on page C-1.
Modem profile	Configure the modem profile under SETTINGS > Satellite profiles > VSAT modem profiles . For more information see <i>VSAT modem profile – New entry and Edit</i> on page 5-25.
Network settings	Configure the network settings under SETTINGS > Network if the modem communicates with IP to the ACU. For more information see <i>To configure the LAN network</i> on page 5-29.
Satellite profile	Configure the satellite profile under SETTINGS > Satellite profiles and then activate the satellite profile and wait for the system to acquire the satellite and start tracking. For more information see <i>Satellite profiles – New entry and Edit</i> on page 5-23 and <i>Satellite profiles</i> on page 5-22.

You find a flow chart for the calibration procedure on page 5-12.

Important notice

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.
- 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. Follow the instructions below if a battery is used. Tape the + and - terminals of battery before disposal to prevent fire, heat generation caused by short circuit.

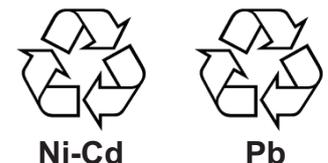
In the European Union

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

Read these safety instructions before you operate the equipment.

 WARNING	Indicates a condition that can cause death or serious injury if not avoided.
 CAUTION	Indicates a condition that can cause minor or moderate injury if not avoided.

 Warning, Caution	 Prohibitive Action	 Mandatory Action
--	--	--

 WARNING	
	Do not open the equipment. The equipment uses high voltage that can cause electrical shock. Refer any repair work to a qualified technician.
	If water leaks into the equipment or something is dropped into the equipment, immediately turn off the power at the switchboard. Fire or electrical shock can result.
	If the equipment is giving off smoke or fire, immediately turn off the power at the switchboard. Fire or electrical shock can result.

 WARNING	
	If you feel the equipment is acting abnormally or giving off strange noises, immediately turn off the power at the switchboard and contact a FURUNO service technician.
	Do not disassemble or modify the equipment. Fire, electrical shock or serious injury can result.
	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 operate the equipment in an explosive environment. Fire or electrical shock can result.

WARNING

 **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 operate the equipment with wet hands.**

Electrical shock can result.

 **Use the proper fuse.**

Use of the wrong fuse can cause fire or electrical shock.

 **Turn off the power at the mains switchboard before beginning the installation. Post a sign near the switch to indicate it should not be turned on while the equipment is being installed.**

Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.

 **Ensure the unit is properly grounded.**

Improper grounding can cause electrical shock or interference from/with other devices.

 **Use equipment with a suitable voltage rating for ship's mains.**

Rated voltage is directed at each unit, and out of range voltage may cause damage to the equipment.

WARNING

 **Do not approach the FV-110 antenna unit when it is transmitting.**

The radome emits radio waves that can be harmful to the human body, particularly the eyes.

RF power density on antenna aperture	Distance
100W/m ²	—
50W/m ²	—
10W/m ²	30 m

CAUTION

 **Observe the compass safety distances shown in the table to prevent interference to a magnetic compass.**

Unit	Standard	Steering
Antenna Unit	1.70 m	1.00 m
Antenna Control Unit	0.15 m	0.10 m
AC/DC Power Supply Unit	0.30 m	0.20 m

 **Do not manually turn the polarisation unit of the antenna.**

The antenna can be damaged.

VSAT restrictions

There are restrictions in use of the frequency band 13.75 to 14 GHz in the following countries:

Belgium, Hungary, Latvia, Malta, Slovakia

Connect the VSAT modem provider for local setups.

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Foreword

A word to the owner of the FV-110

Congratulations on your choice of the FURUNO FV-110. 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 innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual.

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

Thank you for considering and purchasing FURUNO equipment.

Features

The main features of the FV-110 are as shown below.

- Single 50 Ohm coax cable for the ADU
- Support of several VSAT modems
- Gyro-free operation
- Ku-to-Ka-band conversion
- Dual antenna mode
- SNMP support
- Remote or local simultaneous software update of ADU and ACU via PC and Internet browser
- Global RF configuration
- Full remote control and troubleshooting with built-in test equipment (BITE)
- ACU with 4 x LAN, NMEA 0183, NMEA 2000, RS-232 and RS-422
- All interfaces at the ACU, no additional units required
- DC powered. Start up voltage: 22VDC guaranteed, operating range: 20 - 32VDC
- No scheduled maintenance

Software version

This manual is intended for FV-110 with software version 1.50.

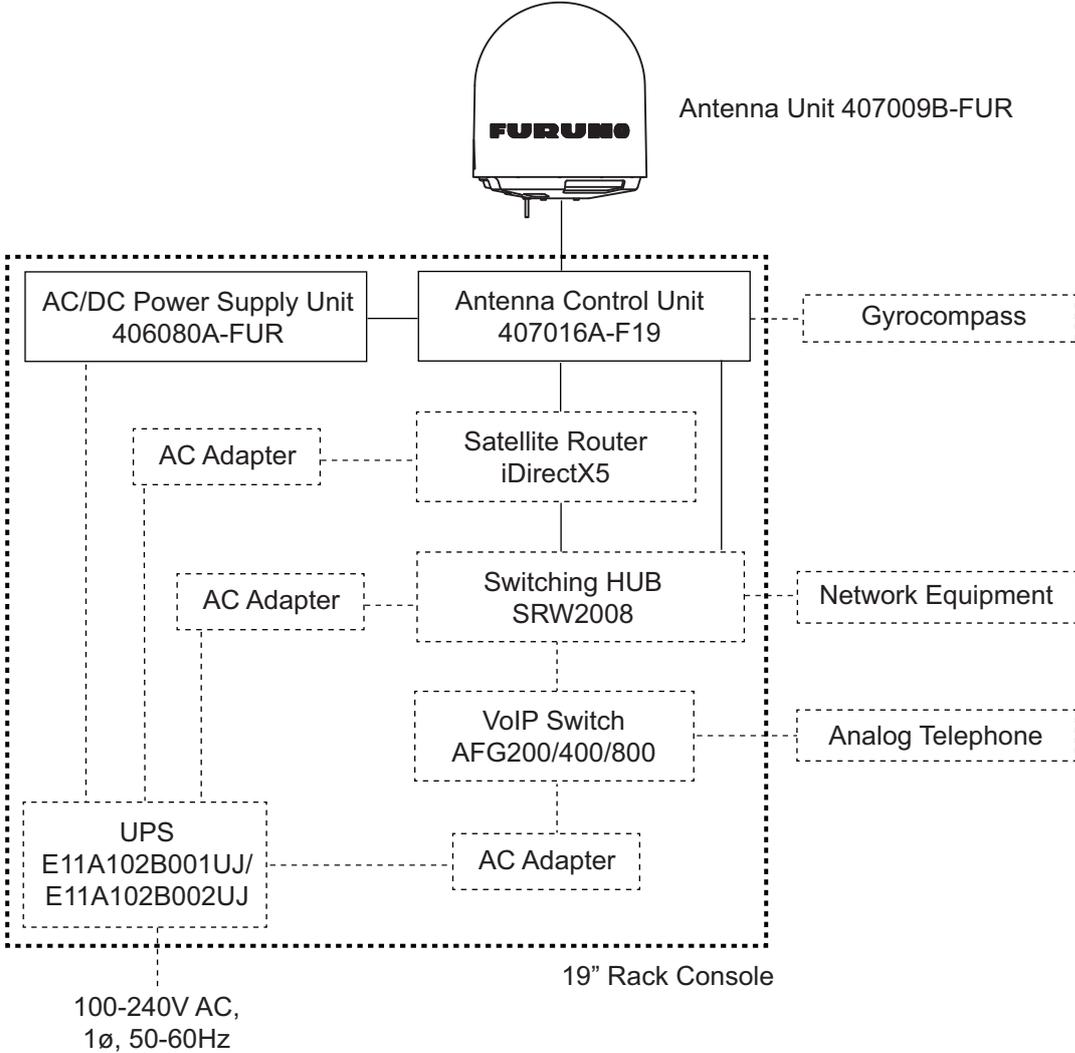
Software information

This product includes software to be licensed under the GNU General Public License (GPL), GNU Lesser General Public License (LGPL), BSD, Apache, MIT and others. The program(s) is/are free software(s), and you can copy it and/or redistribute it and/or modify it under the terms of the GPL or LGPL as published by the Free Software Foundation. Please access to the following URL if you need source codes.

https://www.furuno.co.jp/contact/cnt_oss.html

System configuration

The figure below shows an example system configuration.



Equipment category

Unit	Category
Antenna	Exposed to the weather
Other units	Protected from the weather

—— : Standard supply
 - - - - : Optional or local supply

Equipment list

Standard supply

Name	Model	Code No.	Qty	Remarks
Antenna Unit (ADU: Above Deck Unit)	407009B-FUR	-	1	Installation materials included (See PL-1.)
Antenna Control Unit (ACU)	407016A-F19	-	1	Installation materials included (See PL-2.)
AC/DC Power Supply Unit (PSU)	406080A-FUR	-	1	Installation materials and accessories included (See PL-3.)
Rack Mount Kit	406080A-275	-	1	(See PL-4.)
Installation Materials	CP16-04200	000-015-931	Select one	30 m 8D-FB-CV cable, single connector
	CP16-04120	000-015-865		40 m 8D-FB-CV cable, single connector
	CP16-04210	000-015-932		50 m 8D-FB-CV cable, single connector
	CP16-04220	000-029-109		60 m 8D-FB-CV cable, single connector
	CP16-06100	000-029-111	Select one	For 100 ACV (See PL-5.)
	CP16-06110	000-029-197		For 200 ACV (See PL-6.)

Optional supply

Name	Model	Code No.	Remarks
UPS	E11A102B001UJ	-	For 100/110/115/120 VAC
	E11A102B002UJ	-	For 200/220/230/240 VAC
Dual Antenna Mode Kit	407090-010	001-423-880	
Jumper Cable	407090A-925	001-423-890	

Introduction

This chapter is organised in the following sections:

- *FV-110 system*
- *Part numbers and options*

1.1 FV-110 system

The FV-110 is a unique stabilized maritime VSAT antenna system operating in the Ku-band (10.7 to 14.5 GHz). It provides bi-directional IP data connections both on regional satellite beams and quasi-global Ku-band satellite networks. The system only requires a single 50 Ohm cable to provide the Above Deck Unit with both DC power, data and control information. The radome does not have to be removed neither before nor after the installation. To protect the Above Deck Unit the built-in DC motors act as brakes during transport and when the Above Deck Unit is not powered. The ADU system can be accessed remotely and in-depth performance analysis can be done using the built-in web interface.

The FV-110 system consists of the following units:

- Above Deck Unit (ADU)
- Antenna Control Unit (ACU)

The following figure shows the FV-110 system.



Figure 1-1: Above Deck Unit and Antenna Control Unit (ACU)

1.1.1 Above Deck Unit (ADU)

The FV-110 ADU is a 103 cm VSAT stabilised tracking antenna, consisting of a suspended antenna with a standard global RF configuration. The ADU's weight is 126,5 kg. It is stabilized by heavy duty vibration dampers in 3-axis (plus skew) and can be used in environments with elevations of -25° to $+125^{\circ}$. The ADU is powered by the ACU and protected by a radome.



Figure 1-2: Above Deck Unit (ADU)

Modules in the FV-110 ADU

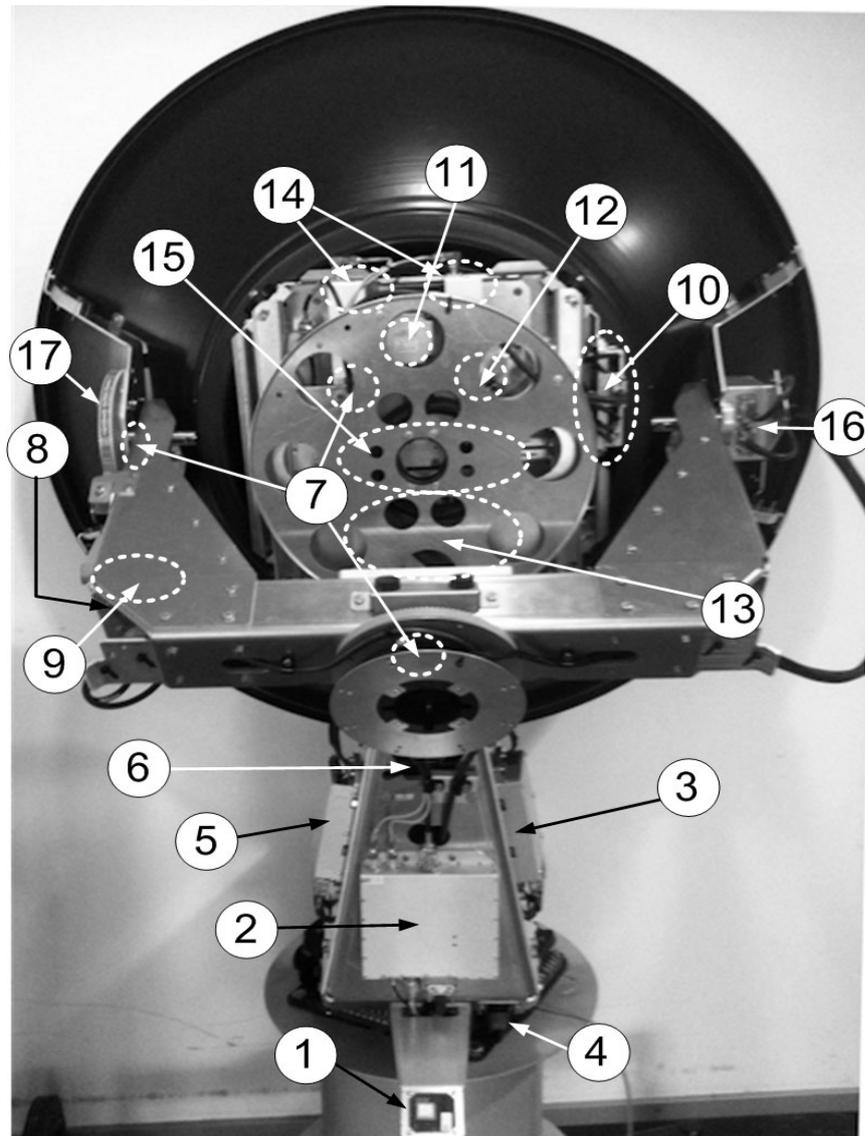


Figure 1-3: FV-110: Above Deck Unit modules 1/2

1. GPS module.
2. VSAT Interface Module (VIM).
3. Pedestal Control Module (PCM).
4. Service switch.
5. DC-Motor Driver Module for cross elevation (DDM).
6. Cross elevation motor and encoder.
7. Zero Reference Module (x4) (ZRM) (not visible on photo). (3 on this figure)
8. DC-Motor Driver Module for elevation (on the bottom) (DDM).
9. Elevation motor and encoder (not visible).
10. Polarisation Motor Module (PMM).

11. Polarisation motor.
12. Polarisation encoder.
13. Block Up Converter (BUC).
14. Low Noise Block downconverter (x2), (LNB).
15. Ortho Mode Transducer (OMT) (not visible on photo).
16. Inertial Sensor Module (ISM).
17. Elevation locking pin to lock the antenna dish in a fixed position.
In switch-off position the DC Motor Driver modules and the BUC are turned off for safe conditions during service and repair. The switch must be in on position for normal ADU operation.

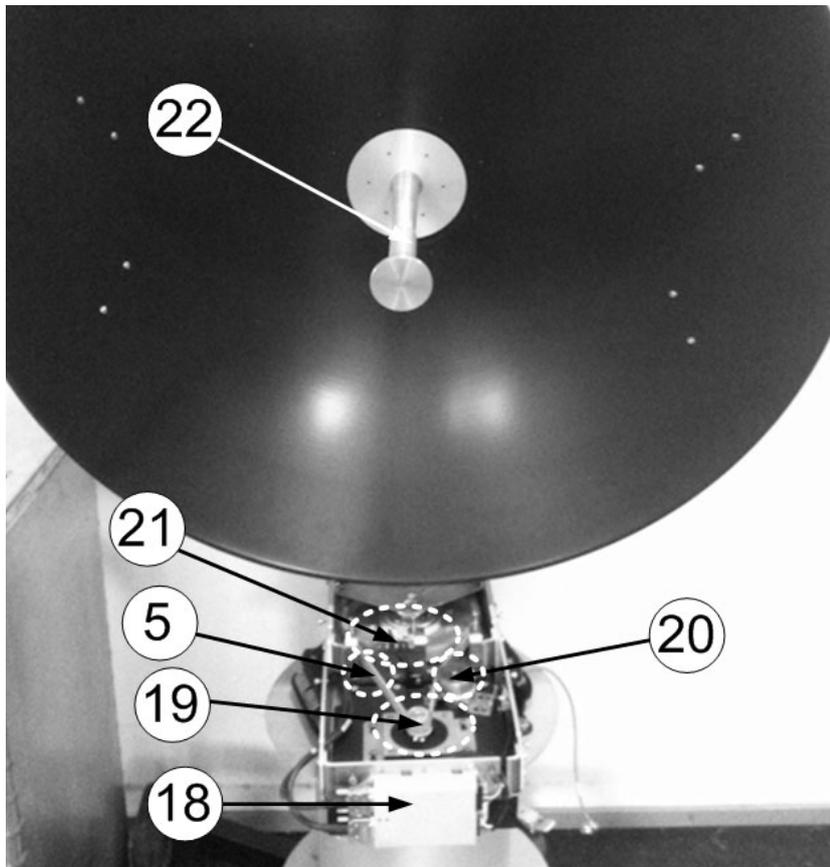


Figure 1-4: FV-110: Above Deck Unit modules 2/2

18. DC-Motor Driver Module for Azimuth (DDM).
19. Azimuth motor.
20. Azimuth encoder.
21. Rotary joint.
22. Feed horn.

FV-110 ADU interface

All communication between the ADU and the ACU passes through a single standard 50 Ohm cable (with N connector) through the rotary joint. No cable work is required inside the radome.

Installation friendly

Four lifting brackets (included in the delivery) and reuse of packing material help getting the ADU safely into place. Satellite profile parameters are entered using the built-in web server of the ACU, using a PC.

Service friendly

The system configuration is saved in two modules, there is no loss of data at repair. The large service hatch of the radome gives easy access to the ADU on site. The service switch in the ADU stops the DC Motor Driver modules and turns the BUC off. The service tools for replacing modules are placed on a tool holder inside the radome.

All modules have a service and power LED status indicator. Each module is encapsulated in a metal box with self-contained mounting bolts.

If necessary, belts and modules can be exchanged through the service hatch on site.

You can do remote diagnostics and service with the ADU. Its built-in test equipment checks constantly the ADU's modules for proper functioning, it monitors and logs information for all modules. The ADU performs a POST (Power On Self Test) and you can request a self test (PAST, Person Activated Self Test) and Continuous Monitoring (CM). Error codes can be read out in the web interface and in the display of the ACU.

ADU software is updated automatically when making a software update of the ACU.

1.1.2 Antenna Control Unit (ACU)

The ACU is the central unit in the system. It contains all user interfaces and manages all communication between the ADU and the connected VMU, a connected PC and an optional FleetBroadband service communication line. The ACU has a display, status LEDs and a keypad. It provides a DHCP client. During configuration you can configure heading offset, save satellite and VMU setups and enter *No Transmit Zones* (blocking zones in which the ADU does not transmit).

The ACU provides DC power to the ADU through a single coaxial cable. You can use the 406080A-FUR Power Supply to provide the DC power for the ACU.

ACU interfaces

The ACU has the following interfaces and switch:

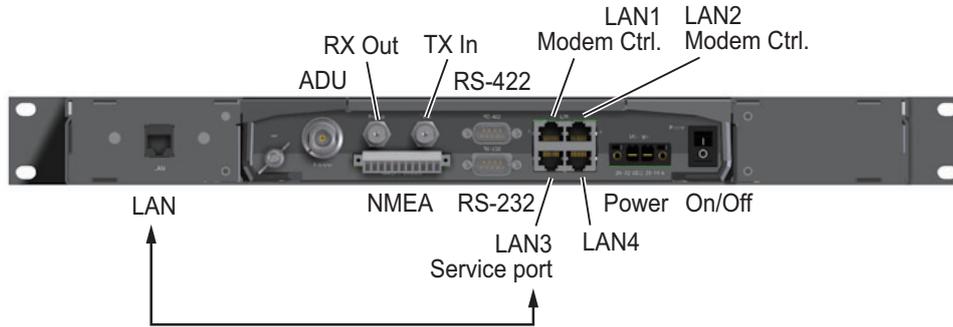


Figure 1-5: FV-110 ACU, connector overview

- N-connector for ADU cable (50 Ohm).
- 2 x F connectors for Rx and Tx cables (75 Ohm) to VSAT modem.
- Multi connector for NMEA interfaces (for input from GPS compass or Gyro compass).
- RS-422 interface for modem control.
- RS-232 interface for modem control.
- 4 x LAN ports for VSAT modem control and user equipment.
- Power connector.
- On/Off power switch

The ACU has additionally a LAN connector at the front for accessing the service port from the ACU front panel.



Figure 1-6: FV-110 ACU, 19'' rack version

Installation friendly

The ACU comes in a 19'' rack version.



Figure 1-7: Antenna Control Unit for 19'' rack installation

Service friendly

You can do remote diagnostics and service with the ACU. Its built-in test equipment checks constantly the device for proper functioning. It performs POST (Power On Self Test) and you can request a PAST (Person Activated Self Test). Continuous Monitoring (CM) is also available. BITE error codes can be read out in the web interface and in the display of the ACU.

Software update is done via a connected PC and the built-in web interface of the ACU.

1.1.3 VSAT Modem Unit (VMU)

FV-110 is designed to be operated with third-party VSAT modems. For a list of supported VSAT modems see SP-2.

1.1.4 Satellite type approvals

For a list of satellite type approvals see *Eutelsat S.A – ESV Summary Sheet* on page H-4, *Russian Maritime Register of Shipping* on page H-5, and *ANATEL Certificado de Homologação* on page H-8.

1.1.5 Power supply

Use the 406080A-FUR Power Supply to provide DC power to the FV-110.

1.1.6 Service activation

Before you can start using the FV-110, you need to activate the system for VSAT service. Contact your service provider for activation.

1.2 Part numbers and options

1.2.1 Applicable FURUNO model and part numbers

The following model and part numbers are available for the FV-110 system:

Part number	Model number	Description
407009B-27000	407009B-FUR	FV-110 Above Deck Unit (ADU) Variant B
407016A-27020	407016A-F19	FV-110 Antenna Control Unit (19 inch rack)
406080A-27000	406080A-FUR	FV-110 AC/DC Power Supply
406080A-275	406080A-275	FV-110 Rack Mount Kit

Table 1-1: Model and part numbers for the FV-110 system

1.2.2 Options for FV-110

The following options are available for the FV-110 system:

Part number	Description
407090A-925	Pigtail Cable 1.25 m, N-Conn, female/male
407090-010	Accessory kit for dual antenna mode

Table 1-2: Model and part numbers for options of the FV-110 system

Installation

This chapter is organised in the following sections:

- *Unpacking*
- *Site preparation*
- *Installation of the ADU*
- *Installation of the ACU*
- *Installation of the VMU*

2.1 Unpacking

2.1.1 What's in the box

ADU

Unpack your FV-110 ADU and check that the following items are present:

- ADU with 4 lifting brackets (already mounted)
- Package with bolts, washers and cable glands (2 sizes)

ACU

Unpack your FV-110 ACU and check that the following items are present:

- 1 x Ethernet cable (2 m)
- 1 x Ethernet cable (short)
- Power connector
- 2 x 75 Ohm coax cables F-F (1m), for Rx and Tx
- NMEA multi-connector
- Installation manual

2.1.2 Initial inspection

Inspect the shipping cartons and wooden box immediately upon receipt for evidence of damage during transport. If the shipping material is severely damaged or water stained, request that the carrier's agent be present when opening the cartons and wooden box. Save all box packing material for future use.



WARNING! To avoid electric shock, do not apply power to the system if there is any sign of shipping damage to any part of the front or rear panel or the outer cover. Read the safety summary at the front of this manual before installing or operating the system.

After unpacking the system, i.e. removing the top and sides of the wooden box and opening the cartons, inspect it thoroughly for hidden damage and loose components or fittings. If the contents are incomplete, if there is mechanical damage or defect, or if the system does not work properly, notify your dealer.

2.1.3 Tools needed

- Unbraco key (5 mm), included, mounted on a tool holder inside the radome.

Other tools that may be needed during the installation:

- Torx TX 20 to open the locks of the service hatch
- Wrench to fasten the mounting bolts for the ADU
- Wrench to fasten the N connector at the ADU
- PC and Internet browser
- Crimping tools

2.2 Site preparation

The following topics have to be considered when installing the ADU:

- *General site considerations*
- *Obstructions (ADU shadowing)*
- *Blocking zones – azimuth and elevation*
- *Safe access to the ADU: Radiation hazard*
- *Ship motion and offset from the ship's motion centre*
- *ADU mast design: Foundation and height*
- *Interference*
- *Other precautions*

2.2.1 General site considerations

For optimum system performance, some guidelines on where to install or mount the different components of the FV-110 System must be followed.

It is recommended to mount the ADU in a location with as much **360° free line of sight to the satellite** as possible while making sure that the support structure fulfills the requirements for the mast foundation. The ADU must be mounted on stiffened structures with a minimum of exposure to vibrations.

2.2.2 Obstructions (ADU shadowing)

Place the ADU so that it has as much free line-of-sight as possible without any structures in the beam through one full 360 degrees turn of the vessel. Do not place the ADU close to large objects that may block the signal. To avoid obstruction elevate the ADU by mounting it on a mast or on a mounting pedestal on a deck or deck house top.

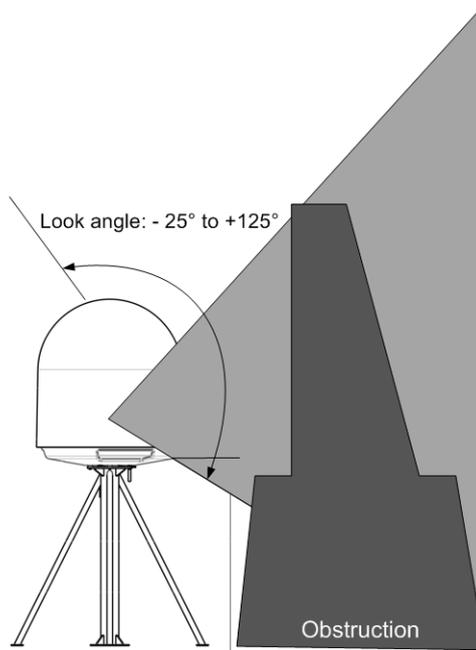


Figure 2-1: Signal degradation because of obstructing objects

The ADU is stabilized in 3-axis (plus skew) and can be used in environments with elevations of -25° to $+125^{\circ}$ to allow for continuous pointing even in heavy sea conditions.

The ADU beam is approximately 1 m in diameter for the first 30 m from the ADU. Beyond 30 m the beam gradually widens so that it is approximately 5 m in diameter at 100 m distance. This beam expansion continues with increasing distance.

Any obstructions, such as masts, funnels, bridge house etc. within this field can cause signal degradation or signal loss.

Note Please note that due to the short wavelength at Ku band and the narrow beam width of the ADU even a **6 mm steel wire placed within 50 m** inside the beam can causes signal degradation.

2.2.3 Blocking zones – azimuth and elevation

Your installation may require that you set up blocking zones for the ADU, i.e. areas where the ADU will not transmit and areas where transmit power is potentially dangerous for persons frequently being in these zones. You can set up 8 blocking zones. Each blocking zone is set up with azimuth start and stop, and elevation angle.

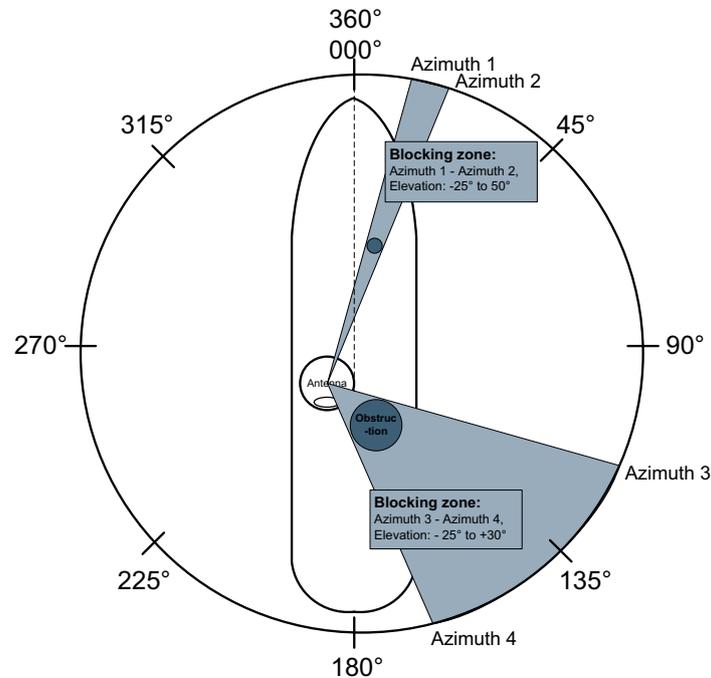


Figure 2-2: 2 blocking zones with no-transmit zones, azimuth (example)

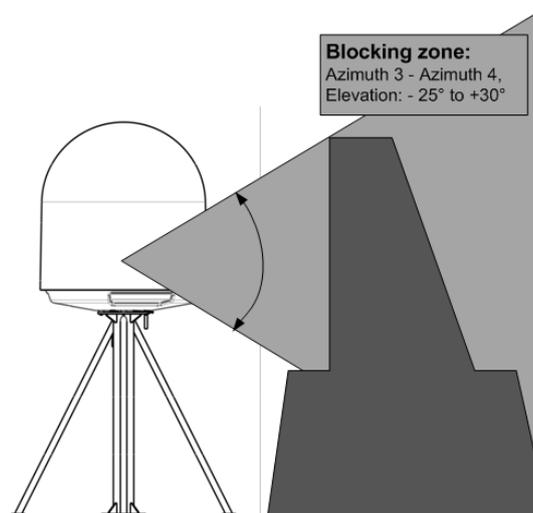


Figure 2-3: Blocking zone with no-transmit zones, elevation angle (example)

The blocking zones are set up in the built-in web interface of the ACU. For further information see *To set up blocking zones (RX and TX)* on page 5-27.

2.2.4 Safe access to the ADU: Radiation hazard

The FV-110 ADU radiates up to 49 dBW EIRP. This translates to a minimum safety distance of 30 m from the ADU while it is transmitting, based on a radiation level of 10 W/m².



Figure 2-4: FV-110: Radiation hazard, safety distance 30 m

2.2.5 Ship motion and offset from the ship's motion centre

Even though it is recommended to mount the ADU high, keep the distance between the ADU and the ship's motion centre as short as possible. The higher up the ADU is mounted, the higher is the linear g force applied to the ADU. The g force also depends on the roll period of the ship, see Table 2-1. If the g force applied is too high, performance and ADU signal stabilization may be reduced and eventually the ADU may be damaged. Refer to the following table for allowed mounting heights above the ship's motion centre.

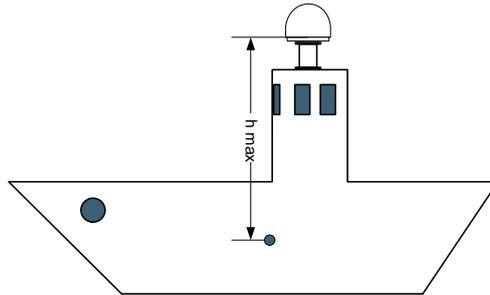


Figure 2-5: Maximum distance from the ship's motion centre (h max)

Min. roll period	Max. ADU mounting height (h max)	
	Full performance	Potential risk of damage
4 s	12 m	16 m
6 s	27 m	35 m
8 s	48 m	62 m
10 s	75 m	98 m

Table 2-1: Maximum distance from the ship's motion center versus ship's roll period

2.2.6 ADU mast design: Foundation and height

The ADU mast must be designed to carry the weight of the ADU unit, which is 126,5 kg (FV-110). The mast must also be able to withstand on-board vibrations and wind speeds up to 110 knots on the radome, even in icing conditions.

ADU mast flange

Fit the top of the ADU mast with a flange with clearance holes matching the bushings in the radome and with minimum 4 gusset plates. No center hole is necessary in the flange.

- **Flange thickness:** Minimum 15 mm.
- **4 gusset plates:** Minimum 15 mm thick, must be placed close to the holes in the mounting plate and evenly distributed.

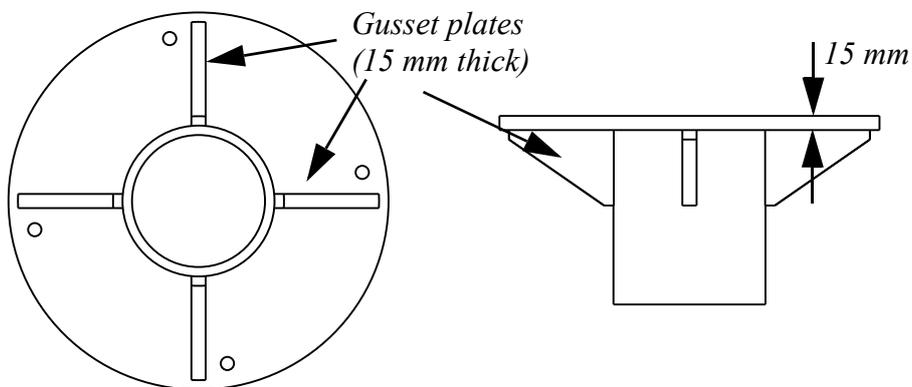


Figure 2-6: FV-110: ADU mast flange, top and side view

Recommended flatness on the mast mount plateau is below 3,0 mm.

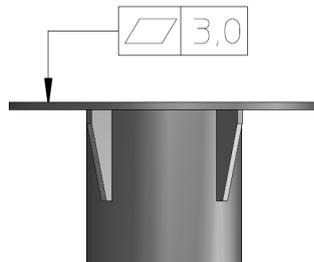


Figure 2-7: ADU mast flange, recommended flatness on the mast mount plateau

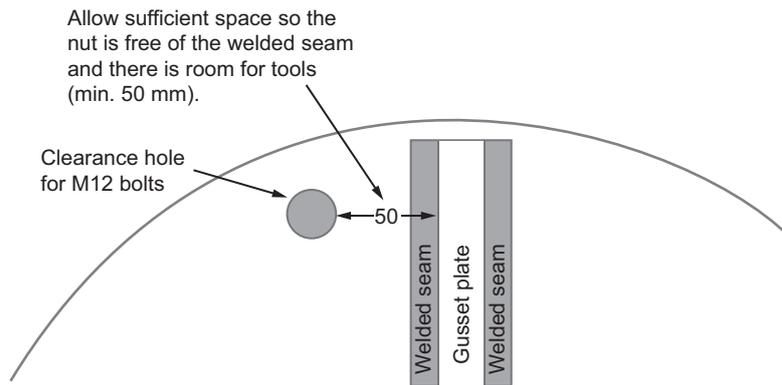


Figure 2-8: ADU mast flange, distance to the welded seam



CAUTION! Avoid sharp edges where the flange is in direct contact with the radome. Round all edges as much as possible to avoid damaging the surface of the radome.

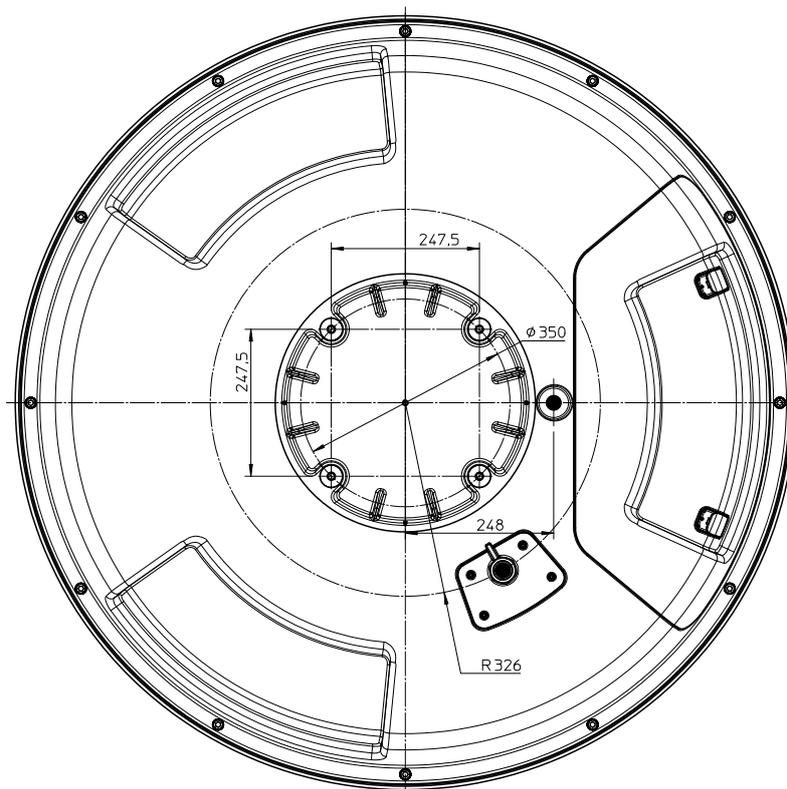


Figure 2-9: FV-110: ADU, bottom view

Mast length and diameter

The placement of the ADU must ensure a rigid structural connection to the hull or structure of the ship. Parts of the ship with heavy resonant vibrations are not suitable places for the ADU. A small platform or short mast shall provide rigid support for the ADU fastening bolts and a rigid interface to the ship.

If it is necessary to use a tall mast, you must stabilise the mast with bracing. Note that the design values given below depend on rigid ADU-ship interfaces. The cross-sectional properties and the corresponding maximum free length give a natural frequency close to 30 Hz. It is recommended to shorten the mast length as much as possible to obtain higher frequencies. Preferably, mount stays or wires to stabilize the mast further.

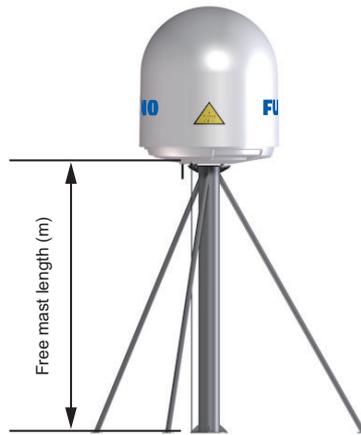


Figure 2-10: Free mast length and bracing for a tall mast

Note Make sure that there is free space below the drain tube. Read also *Condensation and water intrusion* on page 2-17.

The tables in the next sections give some suggested design values for the free mast length.

Note The tables list the values for **steel masts**. For **aluminium masts**, the free mast length is reduced to 75% of the values for steel.

Note Bracing and rigid masts can still not prevent vertical vibration if the mast is attached to a deck plate that is not rigid. Make every effort to mount the mast on a surface that is well supported by ribs. If this is not possible, provide extra deck plate propping.

FV-110 ADU mast length

The below tables show the minimum dimensions for a FV-110 ADU mast with and without stays or wires. Note that the values are only guidelines - always consider the environment and characteristics of the ship before deciding on the mast dimensions.

Mast without braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Weight (kg/m)
	0.4 ^a	200	5	24.0
	0.6	220	5	26.5
	0.8	250	5	30.2
	1	270	5	32.7

Table 2-2: FV-110: Mast dimensions without braces

- a. The height of 0.4 m is not recommended to be used as it will make access through the ADU's service hatch difficult.

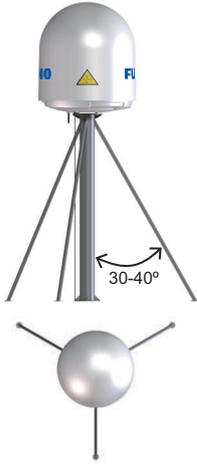
Mast with 3 braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Outer Diameter for brace (mm)	Thickness for brace (mm)
	1.2	140	10	50	5.0
	1.2	200	5	50	5.0
	1.6	140	10	70	5.0
	1.6	200	5	70	5.0
	2	160	10	70	5.0
	2	220	5	70	5.0
	2.5	180	10	80	5.0
	2.5	220	5	80	5.0

Table 2-3: FV-110: Mast dimensions with 3 braces

Mast with 2 braces	Max. free mast length (steel), (m)	Outer Diameter (mm)	Wall Thickness (mm)	Outer Diameter for brace (mm)	Thickness for brace (mm)
	1.2	160	10	80	5.0
	1.2	200	5	80	5.0
	1.6	180	10	80	5.0
	1.6	220	5	80	5.0
	2	180	10	80	5.0
	2	240	5	80	5.0
	2.5	200	10	80	5.0
	2.5	260	5	80	5.0

Table 2-4: FV-110: Mast dimensions with 2 braces

2.2.7 Interference

Note Do not place the ADU close to interfering signal sources or receivers. For allowed distances to other transmitters see Figure 2-12: *Recommended distance to transmitters (m) for frequencies below 1000 MHz* on page 2-16. We recommend testing the total system by operating all equipment simultaneously and verifying that there is no interference.

The ADU must be mounted as far away as possible from the ship's radar and high power radio transmitters, because they may compromise the ADU performance. RF emission from radars might actually damage the ADU.

The FV-110 ADU itself may also interfere with other radio systems.

Radar

It is difficult to give exact guidelines for the minimum distance between a radar and the ADU because radar power, radiation pattern, frequency and pulse length/shape vary from radar to radar. Further, the ADU is typically placed in the near field of the radar ADU and reflections from masts, decks and other items in the vicinity of the radar are different from ship to ship.

However, it is possible to give a few guidelines. Since a radar radiates a fan beam with a horizontal beam width of a few degrees and a vertical beam width of up to +/- 15°, the worst interference can be avoided by mounting the ADU at a different level – meaning that the ADU is installed minimum 15° above or below the radar antenna. Due to near field effects the benefit of this vertical separation could be reduced at short distances between radar antenna and the FV-110 ADU. Therefore it is recommended to ensure as much vertical separation as possible when the FV-110 ADU has to be placed close to a radar antenna.

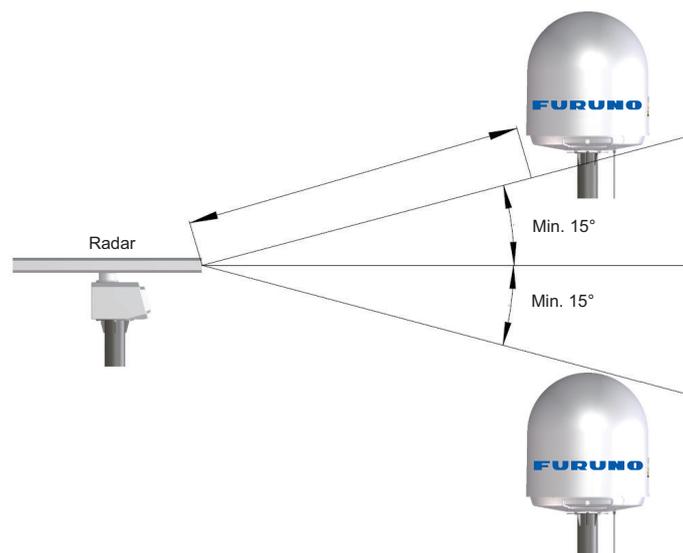


Figure 2-11: Interference with the vessel's radar

Radar distance

The minimum acceptable separation ($d_{min.}$) between a radar and the ADU is determined by the radar wavelength/frequency and the power emitted by the radar. The tables below show some “rule of thumb” minimum separation distances as a function of radar power at X and S band. If the $d_{min.}$ separation listed below is applied, antenna damage is normally avoided.

“ $d_{min.}$ ” is defined as the shortest distance between the radar antenna (in any position) and the surface of the FV-110 ADU.

X-band (~ 3 cm / 10 GHz) damage distance		
Radar power	FV-110 ADU	
	d min. at 15° vertical separation	d min. at 60° vertical separation
0 – 10 kW	1.0 m	1.0 m
30 kW	2.0 m	1.0 m
50 kW	3.3 m	1.7 m

Table 2-5: Minimum radar separation, X-band

S-band (~ 10 cm / 3 GHz) damage distance		
Radar power	FV-110 ADU	
	d min. at 15° vertical separation	d min. at 60° vertical separation
0 – 10 kW	2.0 m	1.0 m
30 kW	3.0 m	1.5 m
50 kW	5.0 m	2.5 m

Table 2-6: Minimum radar separation, S-band

The separation distance for C-band (4-8 GHz) radars should generally be the same as for SX-band radars.

Radar interference

Even at distances greater than “d min.” in the previous section the radar might still be able to degrade the performance of the FV-110 system.

The presence of one or more S or X-band radars within a radius up to 100 m may cause a minor degradation of the Ku-band connection. The degradation will be most significant at high radar pulse repetition rates.

As long as receiving conditions are favourable, this limited degradation is without importance. However, if receiving conditions are poor – e.g. due to objects blocking the signal path, heavy rainfall or icing, low satellite elevation and violent ship movements – the small extra degradation due to the radar(s) could cause poor connection quality.

The presence of S-band radar(s) is unlikely to cause any performance degradation – as long as the minimum distances (d min.) listed in the previous section are applied.

It is strongly recommended that interference free operation is verified experimentally before the installation is finalized.



CAUTION! The ADU must never be installed closer to a radar than “d min.” - even if experiments show that interference free operation can be obtained at shorter distances than “d min.” in the previous section.

GPS receivers

Good quality GPS receivers will work properly very close to the ADU - typically down to one meter outside the main beam.

Other transmitters

See the following figure for minimum recommended distance to transmitters in the frequency range below 1000 MHz.

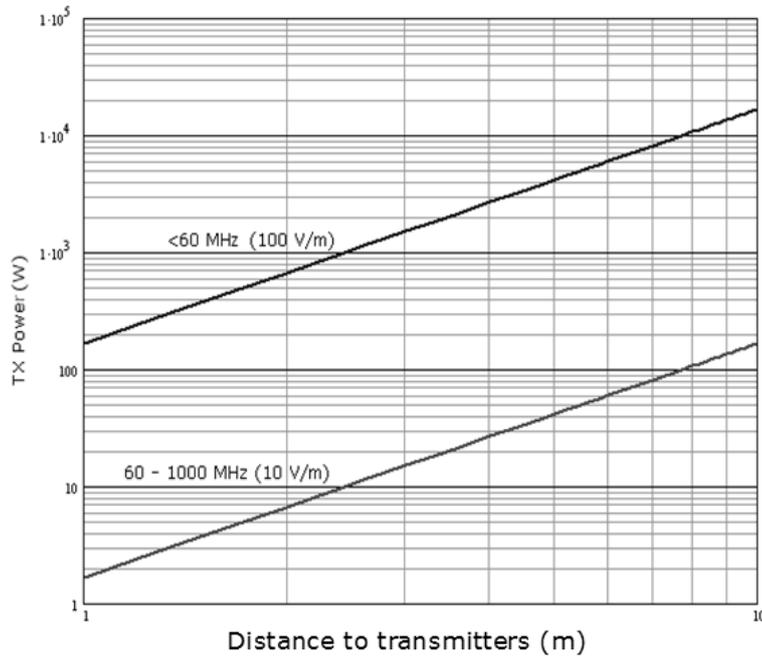


Figure 2-12: Recommended distance to transmitters (m) for frequencies below 1000 MHz

2.2.8 Other precautions

Condensation and water intrusion

If possible, install the radome such that direct spray of seawater is avoided. In some weather conditions there may occur condensation inside the radome. The drain tube is designed to lead any water away from inside the radome. Make sure the ADU's drain tube is open and that there is free space between the drain tube and the mounting surface so water can escape and there is ventilation for the ADU.



Figure 2-13: FV-110: Drain pipe with free space

It is recommended not to use pneumatic tools for cleaning the radome, especially at a short distance and directly at the split between top and bottom.

Deposits

Do not place the ADU close to a funnel, as smoke deposits are corrosive. Furthermore, deposits on the radome can degrade performance.

2.3 Installation of the ADU

The ADU is shipped fully assembled. You have to install it on the mast and attach the ADU cable.



WARNING! Use a strong webbed sling with a belt to lift the ADU without damaging the radome. Make sure that the sling can carry the ADU's weight 126,5 kg (FV-110).



WARNING! The ADU may be subject to swaying motions in windy conditions. Always use tag lines to stabilise the ADU during hoisting.

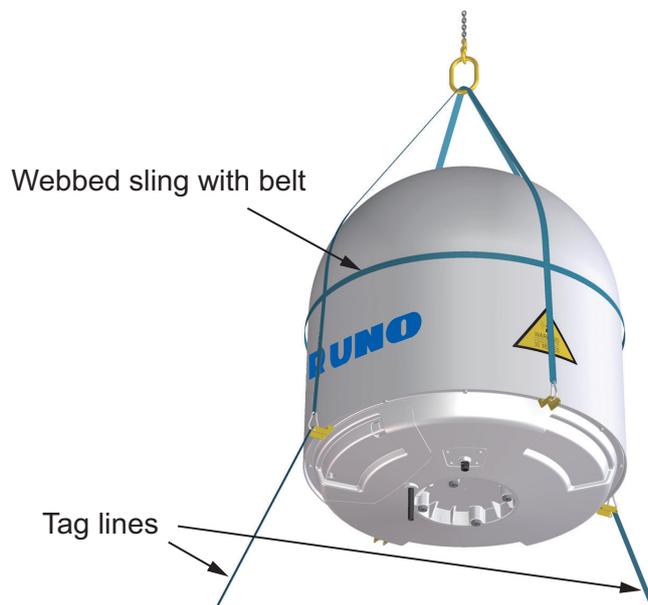


Figure 2-14: FV-110: Use of strong sling with a belt and tag lines for safe hoisting

Before installing the ADU read the following guidelines.

2.3.1 To install the ADU

Make sure that there is sufficient space underneath the ADU to open the service hatch. Through this hatch you access the ADU modules for service and maintenance.



Figure 2-15: FV-110: Free space for access to the service hatch

The ADU does not have to be aligned with the bow-to-stern line of the ship. When configuring the FV-110 you make an azimuth calibration to obtain the correct azimuth of the ADU.

- It is important to maintain **vertical orientation of the ADU center line**.
- Consider the aspect of interference, read more about this in *Interference* on page 2-13.
- Install the ADU where **vibrations are limited to a minimum**.
- Always use **all 4 bolts** when installing the ADU.

To install the ADU, do as follows:

1. Install the mast with the mast flange and have the 4 M12 bolts ready.
2. Undo all shipping buckles, take off the wooden top and remove the casing.
3. Unscrew the 4 bolts holding the ADU on the wooden platform.
4. Attach a webbed, four-part sling with a belt to all 4 lifting brackets.



Figure 2-16: FV-110: ADU installation, webbed sling attached to the 4 lifting brackets

5. Attach 2 tag lines of suitable length to 2 lifting brackets and man them.
6. With a crane lift the ADU off the wooden platform and move it on top of the ADU mast.
7. Install the ADU on the mast flange with 4 M12 bolts and washers. Read carefully and follow instructions given in *To ground the ADU* on page F-2. Tightening torque value: 30 Nm.
8. Remove the 4 lifting brackets. For safekeeping fasten the lifting brackets inside the bottom of the radome.



Figure 2-17: Mounting the ADU on the mast flange

9. Put the coaxial ADU cable through the protection plate as shown in the following figure (FV-110), and connect the N connector of the ADU cable to the ADU.

Select a suitable size for the cable gland: 16—20 mm diameter or 19—23 mm diameter. See also *N-connector interface on the ADU* on page 2-22 for a more detailed drawing how to connect the N-connector on the ADU.

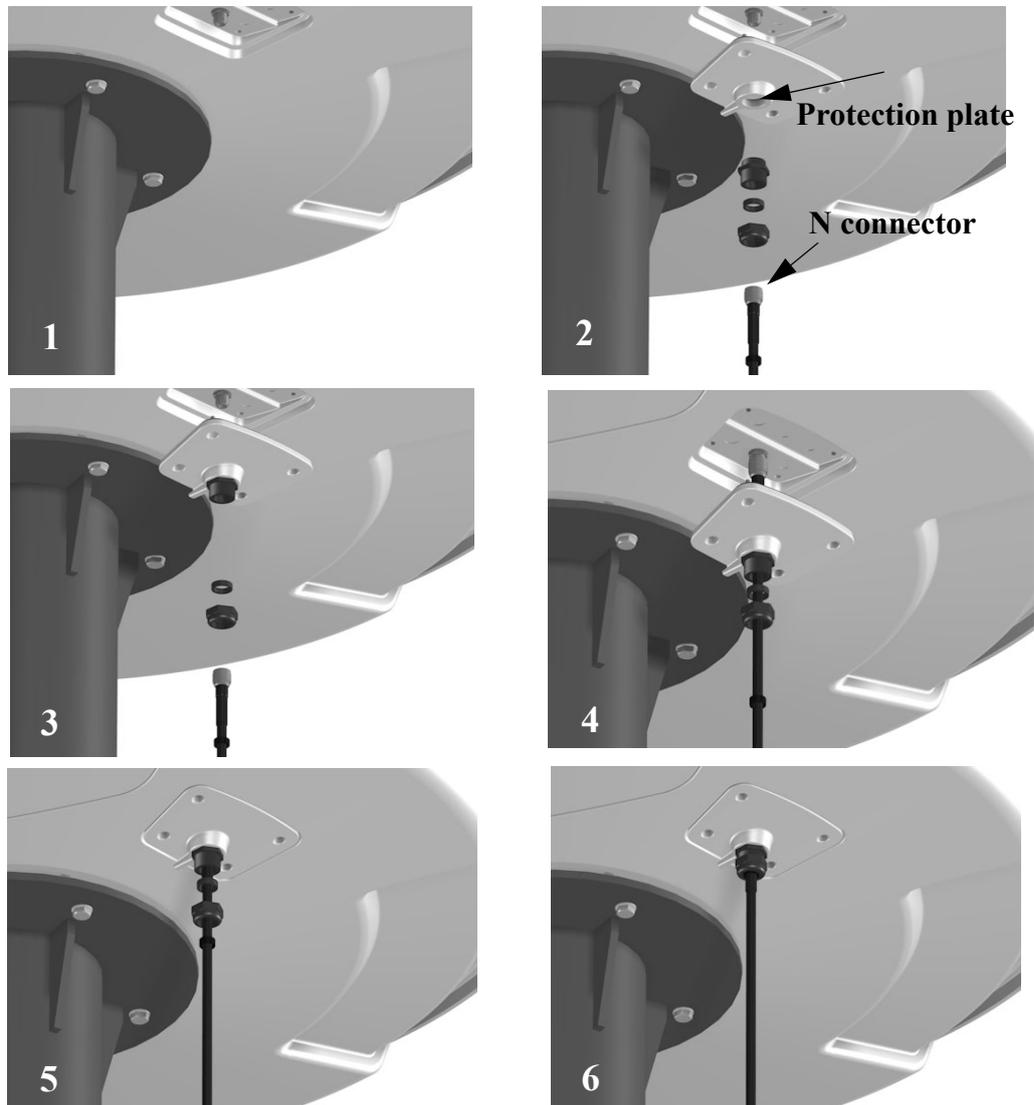


Figure 2-18: FV-110: Connecting the ADU cable

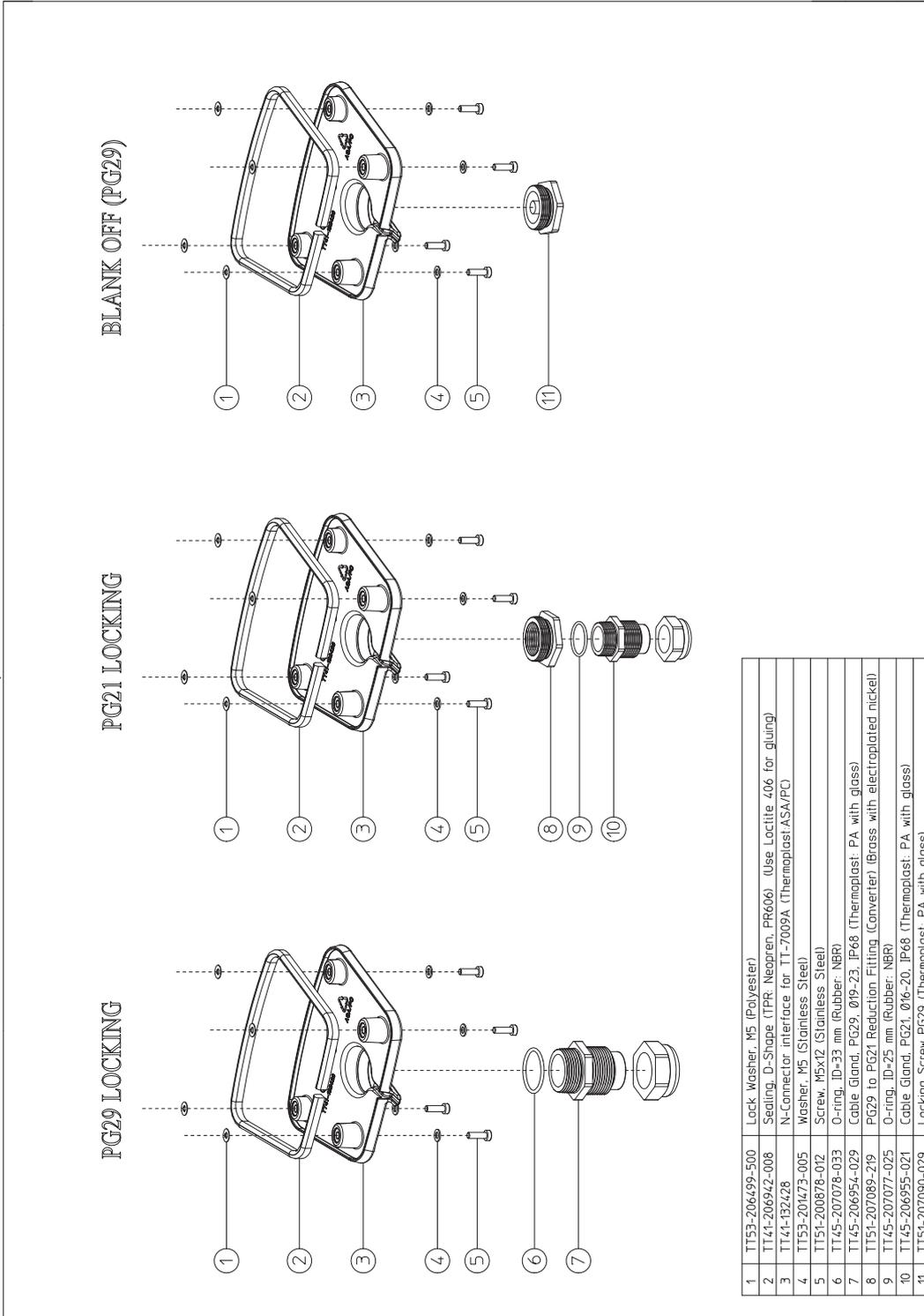
Ensure that the connector assembly is properly protected against seawater and corrosion. As a minimum, wrap it with self-amalgamating rubber.

10. Put the protection plate in place and fasten the 4 bolts (picture 5).

11. Fasten the nut.

Where the cables are exposed to mechanical wear — on deck, through bulkheads, etc. — protect the cables with steel pipes. Otherwise, follow standard procedures for cabling in ship installations.

N-connector interface on the ADU



Maximum allowed RF loss in the ADU cable

Maximum allowed cable loss ≤ 20 dB at 1700 MHz. This is to ensure optimum performance of the system.

2.3.2 To open and remove the service hatch

Open the hatch to access the antenna modules. The two latches of the service hatch must be locked by fastening the two screws in the latches with a Torx TX20 screw driver to protect the ADU modules against unauthorised access.

You can remove the hatch for better mobility when servicing the antenna. Do as follows to open and remove the service hatch:

1. With a Torx TX20 screw driver, remove the two screws locking the latches.
2. Pull open the two latches and let the lid fall open.



Figure 2-19: FV-110: Opening the service hatch

3. Remove the 2 split pins and park them.



Figure 2-20: Removing the 2 split pins

4. Pull the service hatch free.

2.3.3 To ground the ADU

The ADU must be grounded using the mounting bolts. If the ADU cannot or should not be electrically connected directly to the mounting surface, you can use a separate grounding cable to make the connection between the ADU and the common ground to which the ACU is also connected. If grounding to the ship ground is impossible, for example if you have a fibre glass hull, see *Alternative grounding for fibre glass hulls* on page F-6.

To obtain a good ground connection, the metal underneath the head of **at least** one bolt must be clean of insulating protective coating and a serrated washer should be used. After tightening the bolts we recommend that you seal the area suitably in order to avoid corrosion of the grounding point. Use stainless steel bolts and washers.

Optimum grounding is achieved by connecting the ground wire to the bolt marked in the figure below.

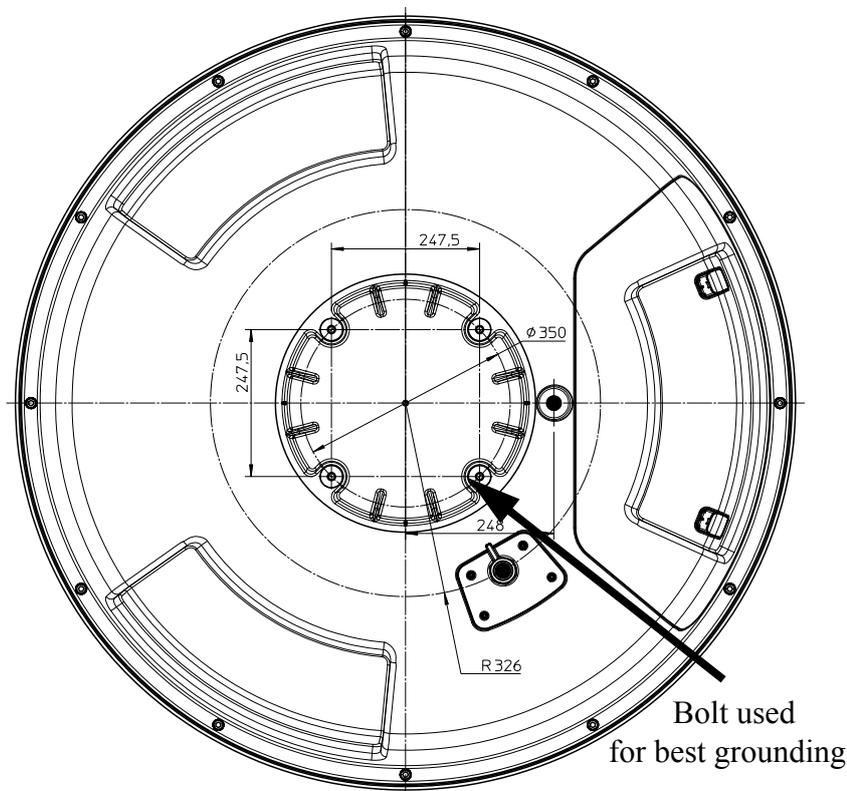


Figure 2-21: FV-110: ADU, bolt for optimum grounding

For further information on grounding and RF protection see *Grounding and RF protection* on page F-1.

2.3.4 Alternative ADU cable

The allowed RF loss in the antenna cable is determined by the attenuators of the PSM and VIM modules. The electronic design guarantees that minimum 20 dB RF loss @ 1700 MHz in the antenna cable will work, but typically an RF loss of about 25 dB will be within the limits of the cable calibration. You can verify the cable attenuation margin with the cable calibration. See *Cable calibration* on page 5-10 for more details.

The DC-resistance loop of the antenna cable must be maximum 0.9 Ohm. This is to ensure the power requirements from ACU to the antenna and to ensure the performance of the system. Preferably choose one of the cable types listed in the table below.

Cable Type	Absolute maximum length (m)	Absolute maximum length (ft)
RG223-D	25 m	80 ft
RG214/U	50 m	160 ft
S 07272B-05	95 m	310 ft
LMR-600-50	135 m	440 ft
LDF4.5-50 Andrew	300 m	980 ft

Table 2-7: ADU cable types and maximum lengths

Check the data sheet from the cable supplier that both the RF- attenuation and the DC-resistance are kept within the maximum specified values:

- ADU cable RF-attenuation at 1700 MHz: max. 20-25 dB including connector.
- ADU cable modem-attenuation at 10 MHz: Max. 2 dB
ADU cable modem-attenuation at 36 and 54 MHz: Max. 4 dB
- ADU cable loop DC-resistance max: 0.9 Ohm.

Also ensure that the specified minimum bending radius is respected. If this is not the case, the loss in the cable will increase. Check the documentation from the cable supplier.

2.4 Installation of the ACU

The following sections describe the installation and grounding of the ACU.

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

- Locate the 19" rack where maintenance can easily be done.
- Separate the 19" rack 30 to 50 cm from a bulkhead.

2.4.1 To install the ACU

A cable relief bracket is already mounted when receiving the ACU. The cable relief is a simple system to secure cables with cable strips. It offers a number of holders to which you can secure the cables from the ACU. To install the 19" rack version of the ACU, do as follows:

1. Slide the ACU into a 1U space in a 19" rack.
2. Mount the screws in each side through the holes in the front and fasten the screws to the rack. Make sure that the unit is mounted securely using the optional support bracket according to the requirements for your 19" rack.
3. Connect all cables. See *Interfaces of the FV-110 ACU* on page 3-1 for a description of the ACU connectors.



Figure 2-22: ACU, On/off switch at the back

4. Set the On/Off switch at the back of the ACU to On. Then you can use the On/Off switch at the front panel.

For a description of the connectors see *ACU connector panel — overview* on page 3-1. The ACU has additionally a LAN connector at the front for accessing the service port from the ACU front panel.



Figure 2-23: ACU, LAN connector at the front: Service port

For information on wiring 24 VDC power see *DC Input connector* on page 3-2. For information about power supply and power requirements see *Connecting power* on page 4-1.

2.4.2 To ground the ACU

Make sure that the grounding requirements are met. See the appendix *Grounding and RF protection* on page F-1 for details about grounding.

ADU cable

The ADU is connected to the ACU with the ADU cable (coax cable) with an N connector at both ends. For information on ADU grounding, see *To ground the ADU* on page 2-24.

At the ACU end, it is strongly recommended to ground the ADU cable. Use a short cable from the ACU to a grounding point in the rack and connect the short cable to the ADU cable at this grounding point, making sure the shield of the connector is properly connected to the rack.

Ground stud at the ACU

To ensure that the ACU is grounded – also if the ADU cable is disconnected from the ACU, connect an extra ground wire from the rack to the ground stud on the ACU. This ground wire must be a heavy wire or braid cable with a larger diameter than the coax cable.



Figure 2-24: ACU, 19'' rack version, ground stud

2.5 Installation of the VMU

For a list of supported VSAT modems see Figure 5-19: *Web interface: SETTINGS, VSAT modem profile – supported modems*.

2.5.1 General mounting considerations — VMU

1. Mount the VMU close to the ACU, preferably at a distance < 1 m.
2. Connect all cables. See *Interfaces of the VMU* on page 3-6 for a description of the connectors for supported VSAT modems.
For cable specifications see *VMU cables* on page B-1.

Connectors and pin-out of the VMU

For connectors and pin-out see the user documentation of the VMU and *Interfaces of the VMU* on page 3-6.

Wiring Power

Provide power to the VMU, see the user documentation of the unit.

2.6 To install the dual-antenna mode (optional)

You can use the FV-110 in dual antenna mode with 2 ADUs, 2 ACUs and the dual-antenna accessories kit. The kit consists of two 75 Ohm RF cables, an RF splitter and an RF combiner. In case one antenna enters a blocking zone, the other antenna of the dual-antenna system takes over and the system continues working.

There is a Master ACU and a Slave ACU. The VSAT modem is connected to and configured in the Master ACU. The Slave ACU is configured as a slave unit. It is connected with an Ethernet cable to the Master ACU from which it gets all satellite information.

The switching from one antenna to the other is done based on the programmed blocking zones in the two antennas and takes effect whenever signal blockages occur from cranes etc.

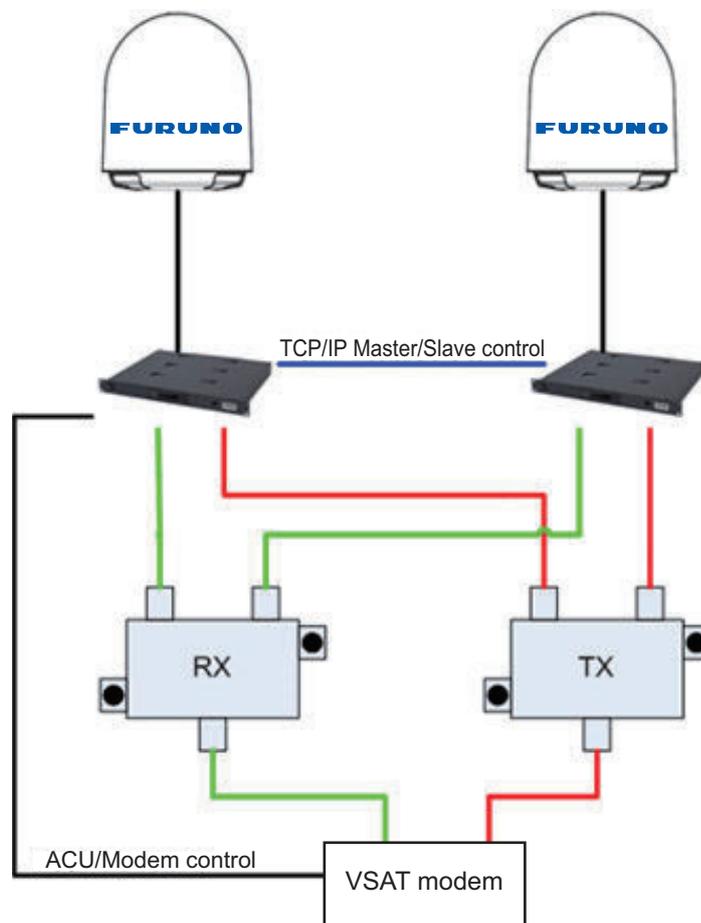


Figure 2-25: Dual mode antenna, overview

To install the dual antennas, do as follows:

1. Install the master ADU, ACU, the RX combiner and the VSAT modem as shown in figure 2-25.
2. Install the slave ADU, ACU, the TX splitter as shown below.
3. Provide vessel heading input to the master ACU and slave ACU, see *NMEA 0183 connector* on page 3-4.

4. Connect the cables as shown below and in the table below.

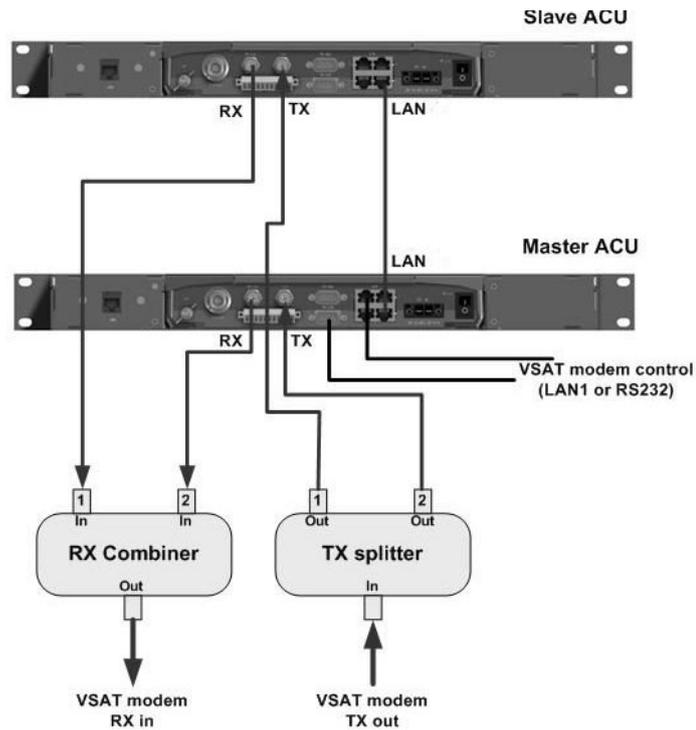


Figure 2-26: Dual mode antenna, connecting cables (example)

Connect cables	Purpose
Master ACU LAN to Slave ACU LAN	Master/Slave control
Master ACU LAN port 1 or RS 232 to VSAT modem control	VSAT modem control
Master ACU Rx Out to the Rx combiner input 1	Rx when Master active
Slave ACU Rx Out to the Rx combiner input 2	Rx when Slave active
Rx combiner output to VSAT modem Rx	Rx to VSAT modem
Master ACU Tx In to the Tx splitter output 1	Enabled when Master active
Slave ACU Tx In to the Tx splitter output 2	Enabled when Slave active
Tx splitter input to VSAT modem Tx	Tx from VSAT modem

Table 2-8: Dual mode antenna, cabling

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Interfaces

This chapter is organised in the following sections:

- *Interfaces of the FV-110 ACU*
- *Interfaces of the VMU*

3.1 Interfaces of the FV-110 ACU

3.1.1 LEDs, display and keypad



Figure 3-1: ACU — LEDs, display and keypad



Figure 3-2: ACU: LEDs, display and keypad (detailed)

3.1.2 ACU connector panel — overview

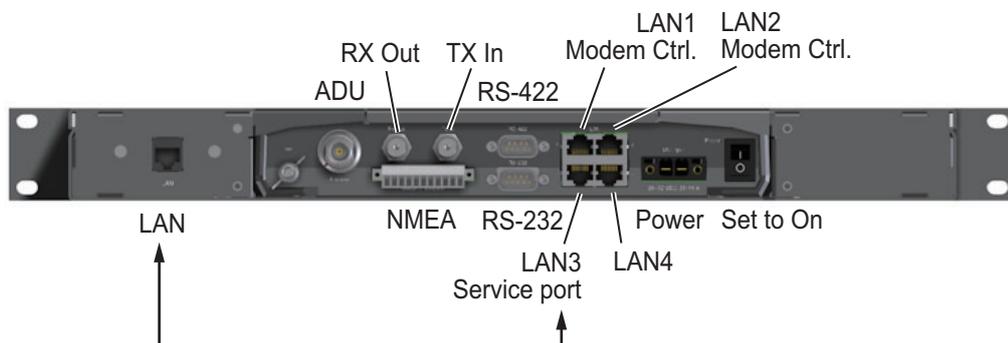


Figure 3-3: ACU rack version, connector panel overview

The connector LAN on the front panel is typically connected to the service port at LAN3 with a straight Ethernet cable. Then you can access the service port from the front of the ACU rack version.

Important

Set the On/Off switch at the back of the ACU to On. Then you can use the On/Off switch at the front panel of the ACU.

Connect the Ethernet cable to provide connection to the service port on the front of the ACU.

3.1.3 DC Input connector

Provide DC power to the ACU, for example by using the 406080A-FUR Power Supply or 24 VDC from the vessel’s power supply. The connector for DC input is included in the delivery.

DC input: Female plug (Weidmuller, Part number 1930050000) for wires up to AWG10/6 mm².

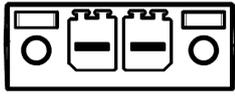
Outline (on the ACU)	Pin	Pin function	Wire color
 V_{in+} V_{in-}	Left	Vin+	Red
	Right	Vin-	Black

Table 3-1: DC Input plug, outline and pin assignment

1. Insert the power cable as shown below.

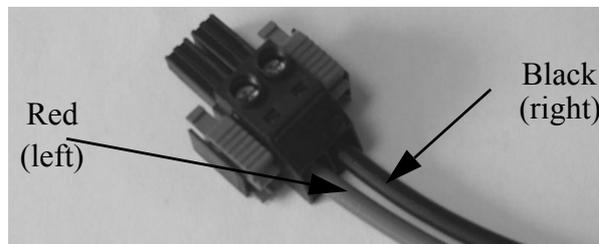


Figure 3-4: DC Input connector with power cable

2. Plug in the connector.
3. Fasten the connector with the two red clamps.

For more information about power supply and power requirements see the chapter *Connecting power* on page 4-1.

3.1.4 ADU connector

There is just one cable from the ACU to the ADU. This is used to power the ADU, supply 10 MHz clock, handle all communication between ACU and ADU, and deliver the VSAT Rx and Tx signals.

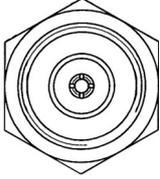
Outline (on the ACU)	Conductor	Pin function
	Inner	DC to ADU 10 MHz clock to ADU ACU to ADU internal communication VSAT Rx/Tx
	Outer	GND (Shield)

Table 3-2: N connector, outline and pin assignment

Important

Do not use TNC connectors on the ADU antenna cable or on pigtails. TNC connectors cannot carry the DC current for operating the ADU.

3.1.5 Rx/Tx connectors for VMU

Connect the Rx and Tx channels of the VMU to the Rx and Tx connectors of the ACU with the 2 supplied Rx/Tx cables (75 Ohm coax, F-F, 1 m).

Outline (on the ACU)	Pin number	Pin function
	1	Inner conductor: 10 MHz clock, VSAT Rx/Tx
	2	Outer conductor: GND (Shield)

Table 3-3: F connector, Rx and Tx, outline and pin assignment

For step-by-step guidelines how to set up the VSAT modem see *VMU settings* on page C-1.

3.1.6 NMEA 0183 connector

Connect the ship's gyro to this connector.

Outline (on the ACU)	Pin	Pin function	Wire color
	1	Not connected	–
	2	NET-H (NMEA 2000)	White
	3	NET-L (NMEA 2000)	Blue
	4	NET-S (NMEA 2000)	Red
	5	NET-C (NMEA 2000)	Black
	6	Not connected	–
	7	Not connected / RS-232 RX NMEA 0183 ^a	–
	8	RS-232 GND RS-422 shield, connect only one end.	
	9	RS-422 RX Line B (+) NMEA 0183	
	10	RS-422 RX Line A (-) NMEA 0183	
	11	Not connected	–

Table 3-4: NMEA 0183/2000 connector, outline and pin assignment

- a. The Power Supply Module (PSM) module must be hardware ID 2 or higher. To check your system download a diagnostics report and search for PSM.

Example for version 2 PSM: psm 2 0A.02 0406210014 1.47-0096 1.00-0001

Example for version 1 PSM: psm 1 0B.01 0389420009 1.47-0096 1.00-0001.

(Hardware prepared for NMEA 2000, for future use)

NMEA 2000 power: 9-16 VDC. NMEA 2000 LEN (Load Equivalency Number): 2 (100mA)

NMEA 0183

The NMEA 0183 connection supports IEC 61162-1 and IEC 61162-2.

- IEC 61162-1, baud rate 4800, format 8N1.
- IEC 61162-2, baud rate 38400, format 8N1.

The baud rate is auto detected by the ACU, the user cannot configure this interface.

Supported NMEA string:

1. HEHDT (North seeking Gyro compass)
2. GPHDT (GPS compass)
3. HNHDT (Non-North seeking gyro compass)
4. IIHDT (Integrated Instrument)
5. HCHDT (Magnetic compass)

Recommended NMEA 0183 cable:

Two-wire constructed with one enclosed shield

Network signal pair:

- Size: No. 24 AWG (0.24 sq. mm) or heavier
- Characteristic impedance: 95 - 140 Ohm
- Propagation delay: 5 nanoseconds per meter, maximum
- 15 Twists (minimum) per meter

3.1.7 RS-232 and RS-422 connectors

Use these connectors to connect the ACU to the VSAT modems with serial interfaces. See *Interfaces of the VMU* on page 3-6 for further details about the RS-232 or RS-422 connector.

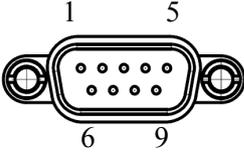
Outline (on the ACU)	Pin	Pin function
	1	Not connected
	2	RXD
	3	TXD
	4	DTR
	5	Ground
	6	DSR
	7	RTS
	8	CTS
	9	Receive Signal Strength Indicator

Table 3-5: RS-232 connector, male, outline and pin assignment

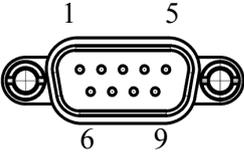
Outline (on the ACU)	Pin	Pin function
	1	Ground
	2	Line A RXD (+)
	3	Line B TXD (-)
	4	Ground
	5	Ground
	6	Not connected
	7	Line A RXD (-)
	8	Line B TXD (+)
	9	Not connected

Table 3-6: RS-422 connector, male, outline and pin assignment

3.1.8 LAN1, LAN2, LAN3 and LAN4 connectors

Four Ethernet connectors (type RJ45) for PC/lap tops, routers, wireless access points. The maximum cable length per connection is 100 m. Depending on the VMU connected, a LAN connector may be used for modem control.

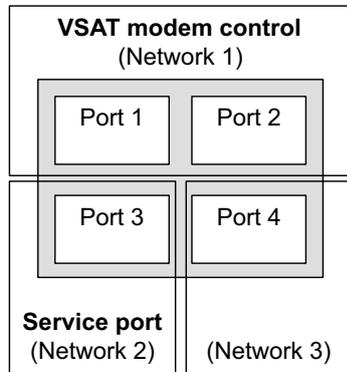


Figure 3-5: LAN connectors

Cable type: CAT5, shielded.

For information how to configure the LAN network see *To configure the LAN network* on page 5-29.

Outline	Pin	Pin function	Wire color
	1	Tx+	White/orange
	2	Tx-	Orange
	3	Rx+	White/green
	4	Not connected	Blue
	5	Not connected	White/blue
	6	Rx-	Green
	7	Not connected	White/brown
	8	Not connected	Brown

Table 3-7: Ethernet connector, outline and pin assignment

3.2 Interfaces of the VMU

For interfaces of the VMU and how to connect a VMU correctly to the ACU the user documentation of the VMU. For step-by-step guidelines how to set up the VSAT modem see Appendix C, *VMU settings*.

Connecting power

This chapter is organised in the following sections:

- *Power source*
- *Power cable selection*
- *Connecting power*
- *Power up*

4.1 Power source

There are different options for the power supply:

- The 24 VDC ship supply provides power for the ACU.
- An AC line provides power through an AC/DC power supply. The 406080A-FUR Power Supply is recommended.

Note | Be aware of high start-up peak current: 35 A at 24 VDC, 5 ms.

In order to protect against short circuit in the power cable/connector, the ship's DC outlet must be protected by a 30 A fuse or circuit breaker.

4.2 Power cable selection

4.2.1 Source impedance

The maximum length of the power cable depends on the type of cable used and the source impedance of the DC power installation in the ship.

The maximum allowed source impedance depends on the usage of the power range of the terminal DC input (Start up voltage: 22 VDC guaranteed, operating range: 20 – 32 VDC; 23 A – 14 A).

Select a power outlet from the DC system and measure the source impedance of the ship installation as described in the next section.

Note | If the total impedance is higher than the limits stated in section 4.2.3, the terminal may become unstable and start to on/off oscillate.

The total impedance is made up of the source impedance of the ship power supply plus the impedance of connected cables including connectors and joints where cables are extended.

For further recommendations on power cable selection, see *Power cable recommendations* on page 4-2.

4.2.2 Measuring the ship source impedance

Select a power outlet from the ship 24 VDC system and measure the source impedance of the ship installation as described below.

1. Measure the voltage without load (R.var disconnected).
2. Set the current to e.g. 1 A by adjusting R.var.
3. Measure the corresponding voltage change.

Example: 1 A and 50 mV. Source impedance: $50 \text{ mV}/1 \text{ Amp} = 50 \text{ mOhm}$.

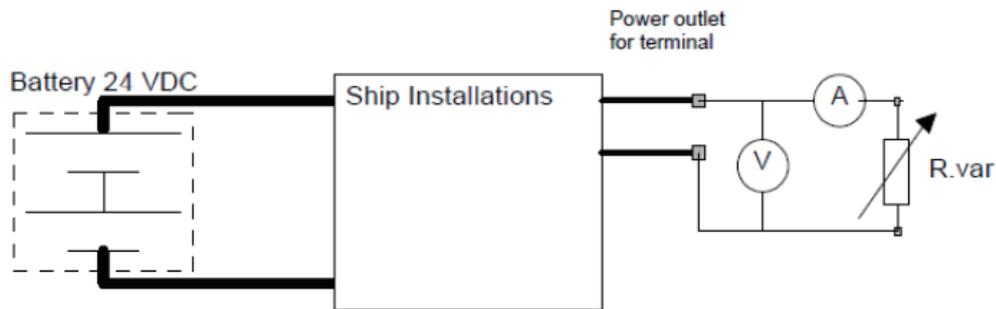


Figure 4-1: Measuring the ship source impedance

4.2.3 Power cable recommendations

Overview

The ACU is delivered with a power connector (PCB plug-in connector, female plug, Weidmuller, Part number 1930050000), which accepts wires up to AWG10/6 mm².

- When installing the power cable, install positive and negative supply wires closely together side by side to keep cable inductance low.
- Ensure that cable inductance for the selected cable at the desired length is less than 50 uH. Approximately 50 m maximum length.

Calculating the maximum power cable length

For 24 VDC operation, the total impedance must be max. 60 mOhm (R_{max}), including the source impedance in the ship installation (R_{source}).

The total impedance is made up of the following:

- Source impedance in the ship installation
- Impedance of the selected power cable

To calculate the maximum cable extension, do as follows:

1. First measure the source impedance in the ship installation as shown in *Measuring the ship source impedance* on page 4-2.
2. Find the resistance per meter (R_{wire}) for the cable type you are going to use.

For 4 mm²/AWG 11, the value is 4.8 mOhm/m at 55°C
 For 6 mm²/AWG 10, the value is 3.8 mOhm/m at 55°C
 For other cable types, refer to the data sheet for the cable.

$$\text{Maximum length} = 0,5 \times (R_{\text{max}} - R_{\text{source}}) / (R_{\text{wire}})$$

The length is multiplied by 0.5 above because there are two conductors in the cable.

If the 406080A-FUR Power Supply is used, use $R_{\text{source}} = 0$ mOhm.

Examples for using the 406080A-FUR Power Supply:

$$\text{AWG11}_{\text{max}} = 0.5 \times (60 \text{ mOhm} - 0) / 4.8 \text{ mOhm/m} = 6.2 \text{ m}$$

$$\text{AWG10}_{\text{max}} = 0.5 \times (60 \text{ mOhm} - 0) / 3.8 \text{ mOhm/m} = 7.9 \text{ m}$$

4.3 Connecting power

To connect the power cable to the ACU

1. Connect the positive and negative input terminals to the ship's DC supply according to *DC Input connector* on page 3-2.
2. Connect the power plug to DC Input.



Figure 4-2: Connecting power to DC Input

4.4 Power up

4.4.1 Procedure

1. Connect power to the VMU.
2. Switch on the ACU. The unit starts up and goes through an initialization procedure:
 - ACU POST
 - ADU Initializing
 - ADU POST
 - READY

This may take some time (up to a couple of minutes).

3. The FV-110 is ready to be calibrated (for first time power up) or receive data from the VSAT modem (when in normal operation). The ACU display shows the following message:



Figure 4-3: ACU display after first power on (example with LAN ports 1 and 4 used)

The LEDs **Power** and **Fail/Pass** are **steady green**, the LED **Logon** is off. For further information on status indicators see *Status signalling with LEDs and status messages* on page 7-6.

Make sure there are no hardware failures or error codes present, check the display of the ACU for events. For more information on error codes and events see *Troubleshooting* on page 7-12 and *System messages* on page G-1.

4. Continue to get the FV-110 system operational, do the following:
- Make a cable loss and an azimuth calibration.
 - Create VSAT modem profiles.
 - Create one or more satellite profiles.

For step-by-step instructions, see *Introduction to the built-in web interface* on page 5-1. For installation check lists see, *Installation check* on page 6-1.

4.4.2 Initialisation steps in daily use

Once the system is configured and a satellite profile is active, the startup sequence is as follows:

- ACU POST
- ADU Initializing
- ADU SW upload (If the software versions in the ADU and ACU are not the same, a software update is done during startup.)
- ADU POST
- READY
- POINTING ANTENNA
- ACQUIRING SIGNAL
- TRACKING

4.4.3 FV-110 operational

When the display shows **TRACKING** and the LED **Logon** is steady green, the system is operational.

Configuration

This chapter is organised in the following sections:

- *Introduction to the built-in web interface*
- *Calibration*
- *Configuration with the web interface*
- *Keypad and menus of the ACU*
- *SNMP support*

5.1 Introduction to the built-in web interface

5.1.1 Overview

Use the built-in web interface (installation of software is not necessary) of the FV-110 ACU to make a full configuration of the FV-110 with the correct VMU, the satellite positions you intend to use and other parameters. You can use a standard Internet browser.

For quick start instructions see *Calibration* on page 5-3.

5.1.2 Connecting to the web interface

To connect to the web interface of the ACU do as follows:

1. Power up the FV-110 system, i.e. switch on the ACU. Wait until the LEDs on the front plate of the ACU show that the system is ready to be configured.
 - Power LED: Green
 - Logon LED: Off
 - Fail/Pass LED: Flashing green, during power-on self test, after that steady green.
2. Connect a PC to LAN interface 3 (Service port, standard Ethernet) of the ACU or to the front LAN connector of the ACU.



Figure 5-1: LAN connector used for configuring the SAILOR 900 VSAT

3. Open your Internet browser and enter the IP address of the ACU. The default IP address is **http://192.168.0.1**.
4. The web interface shows the **DASHBOARD** page.

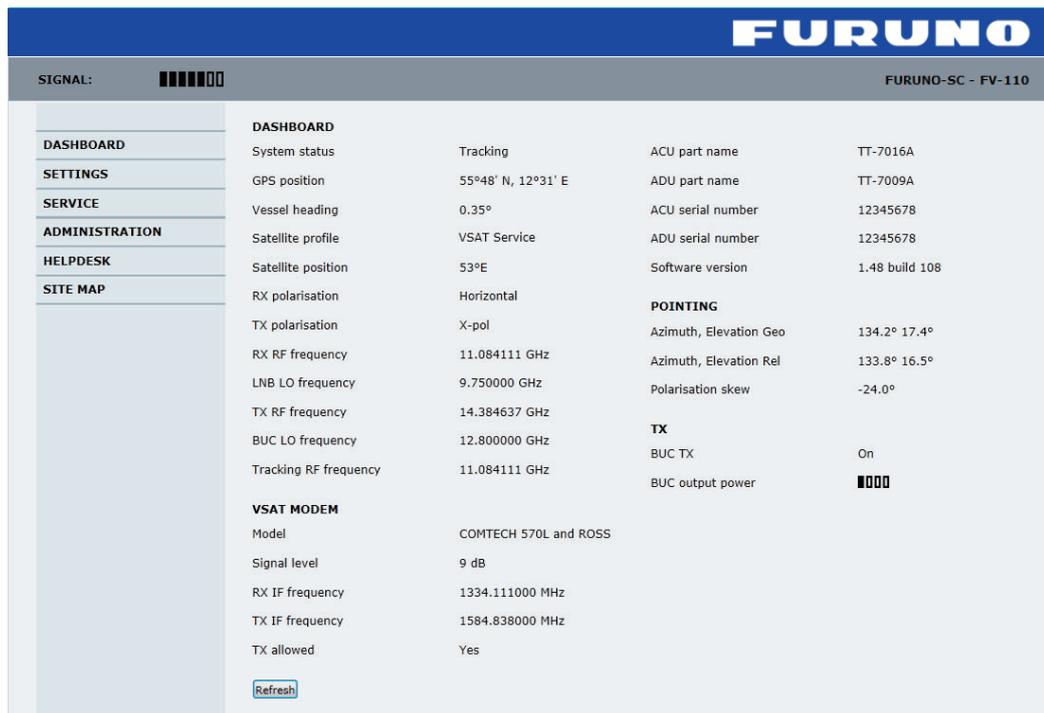


Figure 5-2: FV-110 Dashboard

When the Dashboard is displayed you have verified that the connection to the FV-110 can be established. The web interface is ready for use. You can continue to configure the system.

If you cannot establish a connection there might be problems with the Proxy server settings of your PC. See *Proxy server settings in your browser* on page 5-18 for further information. For a detailed introduction to the web interface see *Overview and dashboard* on page 5-16. If you want to use another LAN port you must configure it according to your network requirements. For information how to configure the LAN connectors see *To configure the LAN network* on page 5-29.

For a detailed introduction to the web interface see *Overview and dashboard* on page 5-16.

5.2 Calibration

Before the FV-110 can be used you must select a heading input setting in order to make an azimuth and cable calibration. The azimuth calibration is required in order for the FV-110 to determine the offset of the ADU zero direction to the bow-to-stern line of the ship. This procedure is fully automatic. The satellite data for calibration can be entered directly on the calibration page or you can define a Service profile to be used for the azimuth calibration. A cable calibration is required in order to record the cable characteristics of the antenna cable which is used in the FV-110 fixed gain feature. See *FV-110 fixed TX gain principle* on page 5-15 for more information.

After the calibration you create the satellite and VSAT modem profiles you want to use during normal operation, and you can set up blocking zones for the specific installation.

Important | You must logon as an administrator to do a calibration.
See *Administration* on page 5-40.

The following sections describe the steps for a successful calibration:

- *To set up a service profile for calibration*
- *Heading input*
- *Azimuth calibration*
- *Cable calibration*
- *Operation in gyro-free mode*
- *Flow chart for calibration*
- *To make a line up procedure*
- *FV-110 fixed TX gain principle*

5.2.1 To set up a service profile for calibration

To prepare for calibration you can set up a service profile for calibration. Use this approach if you do not want to enter the satellite parameters directly on the calibration page.

To setup a service profile do as follows:

1. Open your Internet browser and enter the IP address of the ACU. The default IP address is **http://192.168.0.1**.
2. Select **SETTINGS > Satellite profiles > New entry**. Enter the name of the satellite profile for calibration (a name of your own choice).
3. Select the VSAT modem profile **Service** from the drop-down list.

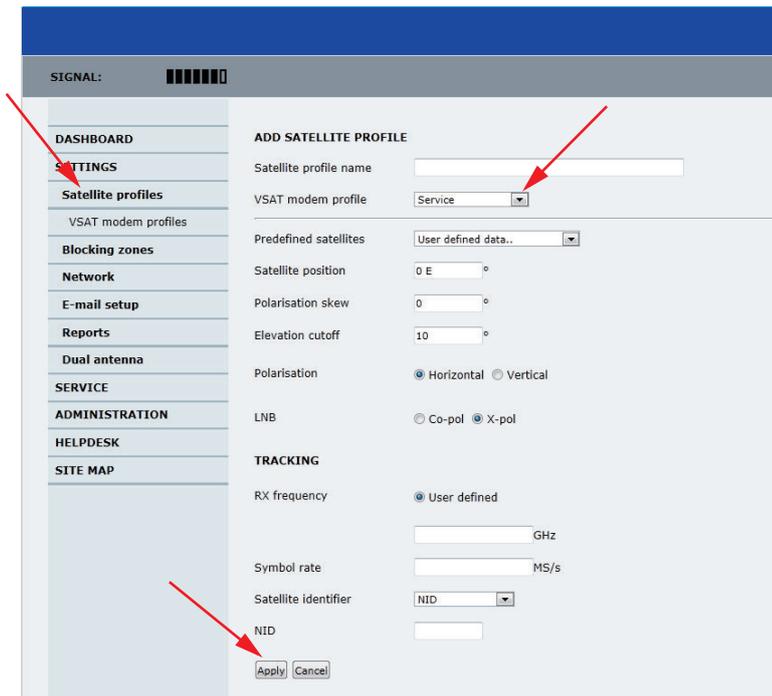


Figure 5-3: Service profile for calibration

4. Enter the data for the satellite that you want to use as a calibration reference. You can enter the satellite data manually or select a satellite from the list of predefined satellites (Eutelsat). For satellite information see *DVB-S satellites* on page E-1 or www.lyngsat.com.

Note the following calibration requirements:

Satellite requirements for successful calibration	
Elevation	Elevation angle: 5 – 70 degrees Not allowed for calibration: Inclined orbit.
System encryption	DVB-S or DVB-S2
Polarisation	Horizontal or vertical polarisation. Not allowed: Left-hand circular (L) or right-hand circular (R).
Symbol rate	The DVB symbol rate must be >5 Ms/s.
NID	Preferably a unique NID (ONID). An azimuth calibration without NID can be useful in regions where the satellite operators do not broadcast NID (US, China, Australia etc.). For NID=0 the NID is not used when checking the satellite link.

Table 5-1: Satellite requirements for elevation and carrier

Elevation cutoff: Not relevant for calibration.

LNB: Co-pol or X-pol, use this for test if both the LNBs and RX cables function properly in case of issues with the reception of a signal. The polarisation must remain the same as stated for the transponder used for the azimuth calibration. The antenna will just turn the polarisation motor 90 degrees to use the other LNB to receive the same signal.

5. Click **Apply** to save the settings for the service profile for calibration. The system is ready for the azimuth and cable calibration.

5.2.2 Heading input

Access the page for heading and calibration through **SERVICE > Calibration**.

Figure 5-4: Web interface: SERVICE, Calibration

Note

If you do not want to enter the satellite data on the calibration page you can set up a dedicated service profile for calibration, see 5.2.1.

Check that the satellite transponder is visible from the location of the installation and that it is at an elevation angle between 10 and 70 degrees.

1. Select the desired heading input, see table below.
2. For **Fixed**, enter the vessel heading in degrees.
3. Click **Apply**.

Note | If you change the heading settings from external to fixed or vice versa you must make a new azimuth calibration.

Heading input	Description
External	Heading input from the vessel’s gyro compass (default). If there is no heading input due to failure, alarms are raised and the antenna continues in gyro-free mode. When heading input is available again and a new acquisition is made, alarms are cleared. See also <i>Operation in gyro-free mode</i> on page 5-10.
Fixed	Use this setting for making an azimuth and cable calibration if there is no input from the vessel’s gyro compass and for permanent installations like remote areas or oil rigs, or during training and test. <u>Important: Fixed heading is not allowed for sailing vessels!</u>
None	<u>Important: You must make an azimuth and cable calibration with Fixed before you can use this setting. This is required in order to be able to use blocking zones. After a successful azimuth and cable calibration you must change the heading input setting from Fixed to None.</u> Select this setting after a successful azimuth calibration with Fixed heading if the system does not have input from the vessel’s gyro compass. See also <i>Operation in gyro-free mode</i> on page 5-10.

Table 5-2: Heading input options

Acquisition process and search pattern

With heading input or fixed heading

1. The FV-110 starts the acquisition, searches for 10 seconds at the expected position. If RX lock is detected the FV-110 goes to Tracking.
2. If no RX lock is detected, a box search pattern is started and the positions where RF power can be received are stored.

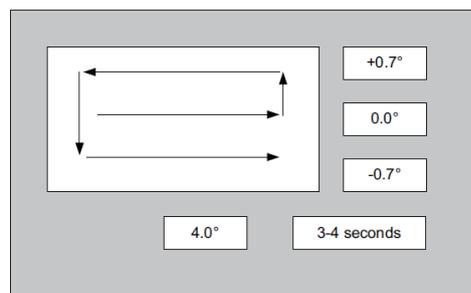


Figure 5-5: Acquisition, search pattern

3. The FV-110 checks each stored position for up to 10 seconds. If RX lock is detected for more than 20% of the time, the FV-110 goes to Tracking.

With heading input or fixed heading, Inclined Orbit Satellite

1. The FV-110 starts the acquisition, searches for 10 seconds at the expected position. If RX lock is detected the FV-110 goes to Tracking.
2. If no RX lock is detected, a box search pattern is started and the positions where RF power can be received are stored.

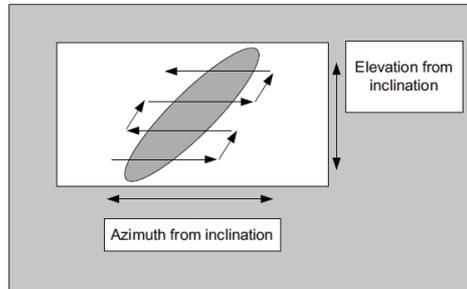


Figure 5-6: Acquisition, search pattern for inclined orbit

3. The FV-110 checks each stored position for up to 10 seconds. If RX lock is detected for more than 20% of the time, the FV-110 goes to Tracking.

Without heading input and not fixed heading (Gyro-free)

1. A box search pattern is started and the positions with reception of RF power are checked for up to 10 seconds. If RX lock is detected for more than 20% of the time, the FV-110 goes to Tracking.

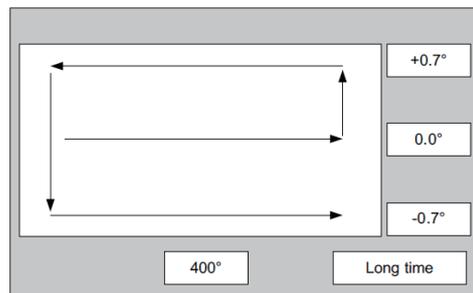


Figure 5-7: Acquisition, search pattern in gyro-free mode

FV-110 acquisition times

Activity	Inclination 0°	Inclination 1°	Inclination 2°	Inclination 3°	Inclination 4°
Initial search	10 s				
Scan box pattern	5 s	10 s	15 s	25 s	30 s
Validate result (10 s per result)	10 - 30 s				
Max. total time	25 - 45 s	30 - 50 s	35 - 55 s	45 - 65 s	50 - 70 s

Table 5-3: FV-110 acquisition time

Azimuth calibration

Note | If the target satellite is in inclined orbit, the elevation range is extended accordingly.

Azimuth calibration is done toward a satellite of a known position. After finding the satellite, the system can calculate the azimuth offset of the ADU installation. The satellite and transponder properties for the calibration can be selected from a list of service profiles or supplied manually.

There are two ways to make an azimuth calibration:

- *Azimuth calibration with a service profile*
- *Azimuth calibration with user defined input*

Azimuth calibration with a service profile

1. Click **SERVICE > Calibration**.
2. Select the service profile in the drop down list **Satellite**. All profiles with the VSAT modem **Service & Calibration** are displayed in the list. If there is no profile in the list see *To set up a service profile for calibration* on page 5-3.
3. Click **Start** in the section **Azimuth calibration** and wait typically 5 minutes for the calibration to finish. After finished calibration a message with the result of the calibration is displayed.

Azimuth calibration with user defined input

1. On the page **SERVICE > Calibration**, select **User defined** in the Satellite drop down list.
2. Type in the longitude and polarisation skew of the satellite. The polarisation skew is provided by the satellite operator, it is typically 0 degrees. For satellite data see *DVB-S satellites* on page E-1, www.lyngsat.com.

Important | The calibration function is not able to verify the correctness or precision of the supplied longitude. It is therefore important to supply the correct longitude including the first decimal.

3. Select the polarisation of a transponder and type in its frequency and symbol rate.
4. Select which satellite identifier to use for identification of the signal.

Satellite identifier	NID value	Description
NID	0	Satellite identifier is not used.
NID	1–65535	Supplied NID is matched against Network ID broadcast by the satellite.

Table 5-4: Satellite identifier and NID values

Satellite identifier	NID value	Description
Orbital position	n.a.	Supplied longitude is matched with orbital position broadcast by satellite. Not all service providers broadcast the orbital position.

Table 5-4: Satellite identifier and NID values

5. Click **Start** and wait typically 5 minutes for the calibration to finish. A progress bar is shown during calibration and a message is displayed when the calibration has completed. In case of failure, see the table in the following section for a description of error codes during calibration.

Important

It is strongly recommended to verify the result of a calibration performed with user defined data. This can be done by making a new calibration on a different satellite and verify that the resulting Azimuth calibration value differs less than one degree.

The following table shows the error codes that might be displayed during a calibration.

Error code	Explanation
1	The elevation of the selected satellite is too low. Select another satellite.
2	The elevation of the selected satellite is too high. Select another satellite.
4	The calibration values could not be saved. Possibly due to defective hardware.
5	The antenna could not point with sufficient precision. Check that the antenna is mounted in a stable way. Other possible causes might be electrical or mechanical faults.
6	No signal received. Check that there is free line of sight. Try again or try with another satellite.
7	RF setup error, e.g. missing or invalid TX frequency.
8	Invalid satellite, e.g. satellite not visible.

Table 5-5: Possible error codes during calibration

5.2.3 Cable calibration

1. On the page **SERVICE > Calibration** click **Start** in the section **Cable calibration**.

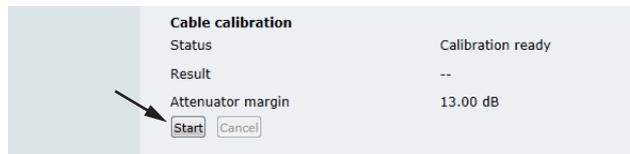


Figure 5-8: Web interface: SERVICE, Calibration, cable attenuator margin

Wait typically for 2 minutes for the calibration to finish. A message is displayed when the calibration has been completed successfully. This screen shows how much attenuation margin is left for the antenna cable. This indicates whether the antenna cable and connectors are in good condition and well crimped.

It is recommended to make a cable calibration when servicing the system to check if the antenna cable is still in good order. If the attenuator margin changes by 2 dB or more after a cable calibration, it is recommended to do a P1dB compression measurement to verify that the VSAT modem configuration is correct.

The FV-110 is calibrated now. If the calibration failed there will be a message on the calibration screen.

Important For operation when input from the vessel’s gyro compass is not available: Change the heading input setting from **Fixed** to **None** at **Heading – Input**. **Fixed heading is not allowed for sailing vessels!**

5.2.4 Operation in gyro-free mode

Heading input: none

If input from a gyro compass is not available, information from the GPS position is used when searching for a satellite.

When the VSAT antenna does not have ship heading input from the vessel's gyro compass, the azimuth direction of the satellite is not known. In this case the antenna will start a 360 degrees sky scan and scan until it finds a satellite. The satellite search time to find the satellite and start tracking is therefore raised considerably. If the ship is on a steady course and sails at a speed over ground above 5 kn, the system can use an estimated heading from the current GPS position. This will reduce the search time, but it will still be a longer search time than with heading input.

This mode can be difficult for inclined orbit satellites and elevations <5 and >70 degrees, see the following sections for details.

If a VSAT system loses the signal from the satellite, i.e. due to blockage, and the duration of signal loss is longer than approximately 1 minute, a system without heading input must do a new sky scan to find the satellite when the antenna is out of blockage.

Inclined orbit satellites

If the wanted satellite is an inclined orbit satellite, the VSAT system does not have any information of the satellite latitude position but only information about inclination. This means longer search times, depending on the maximum inclination. With the increased search time for a system without heading input the search time can be so long that it will be more or less useless in practice.

Tracking for satellite elevation between 5 and 75 degrees

When the VSAT system has found the satellite and is in pointing mode, the performance of a system with heading input and a system without heading input will be very similar. Note that this is only the case for a satellite elevation range from 5 to 75 degrees.

If the satellite is an inclined orbit satellite, the missing heading information introduces a polarization error depending on the satellite elevation and the inclination. Normally it is required that the polarization is controlled within 1 degree towards the satellite. This gives the following limit for use of inclined orbit satellites (a purely physical limit), and all systems without heading input have this limit.

Satellite elevation	Max allowed inclination
<20	2.5
<50	0.7
<70	0.3
≤75	0

Table 5-6: Satellite elevation and max. allowed inclination

Tracking for satellite elevation above 75 degrees

It is not possible to use a system without heading input from the vessel's gyro compass with satellites at an elevation of higher than 75 degrees because the system will not have the required polarization accuracy of the transmitted signal.

5.2.5 Flow chart for calibration

The following flow chart gives an example of the steps in a calibration.

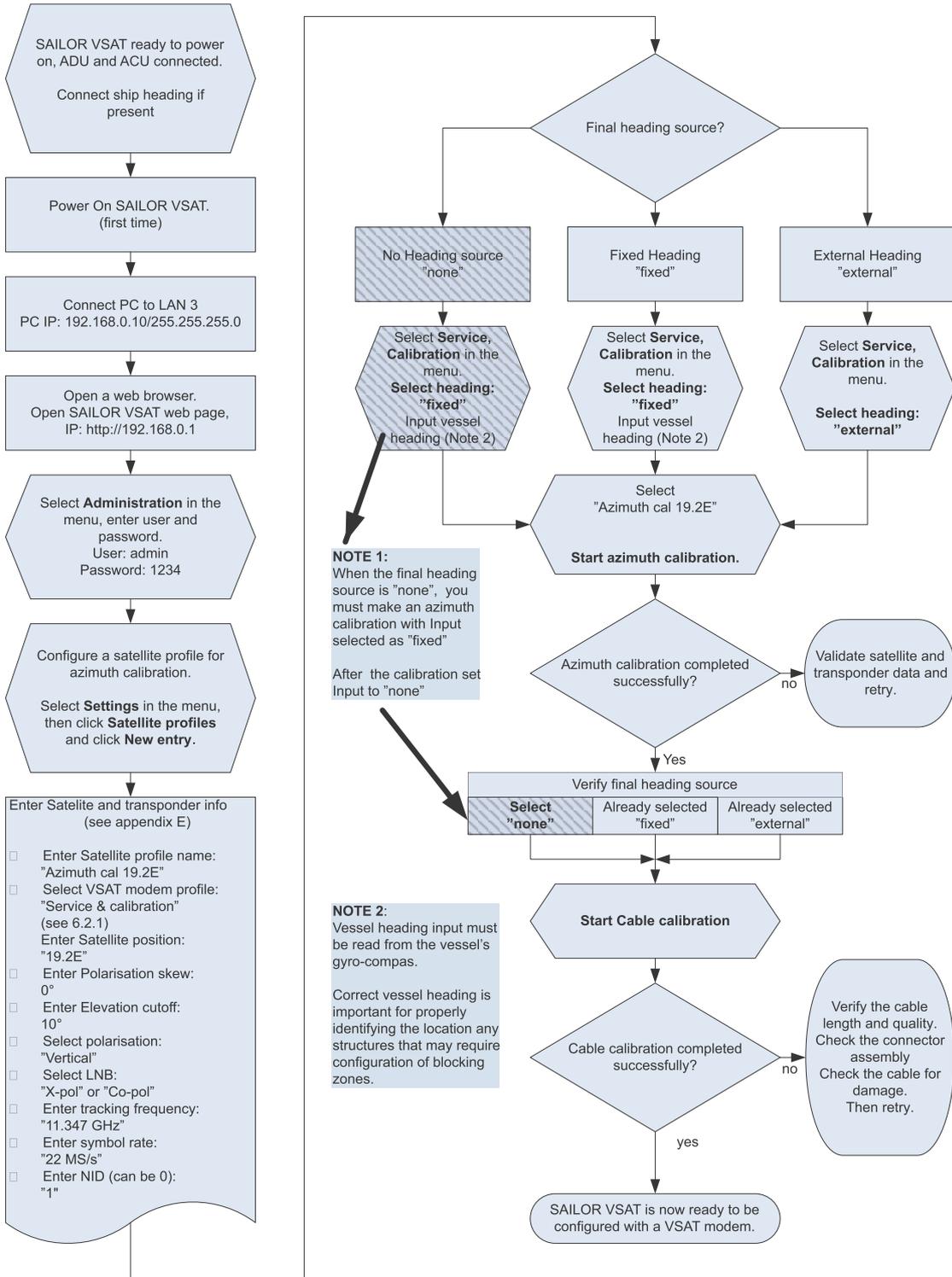


Figure 5-9: Example for a calibration – step by step

5.2.6 To make a line up procedure

Note

The ship must not move during the calibration procedure.

The FV-110 has been tested at the factory and online on a live satellite link to calibrate the TX polarisation unit. You can fine-tune the TX polarization by doing a line up as described below. To do the line up, do as follows:

1. Open your Internet browser and enter the IP address of the ACU. The default IP address is **http://192.168.0.1**.
2. Create a VSAT modem profile and a satellite profile using the previously created VSAT modem profile (See *To set up a service profile for calibration* on page 5-3).
3. Go to the page **SERVICE > Line up**. As soon as the antenna is in tracking mode and points to the satellite, the text next to **Status** shows:

Please wait. Improving tracking.

This may take up to 2 minutes. Wait until the text shows:

Ready for activation.

Figure 5-10: Web interface: SERVICE, Line up: Ready for activation

- Click the button **Activate** and wait until the status field shows **Antenna ready**. Follow the instructions from your service provider.

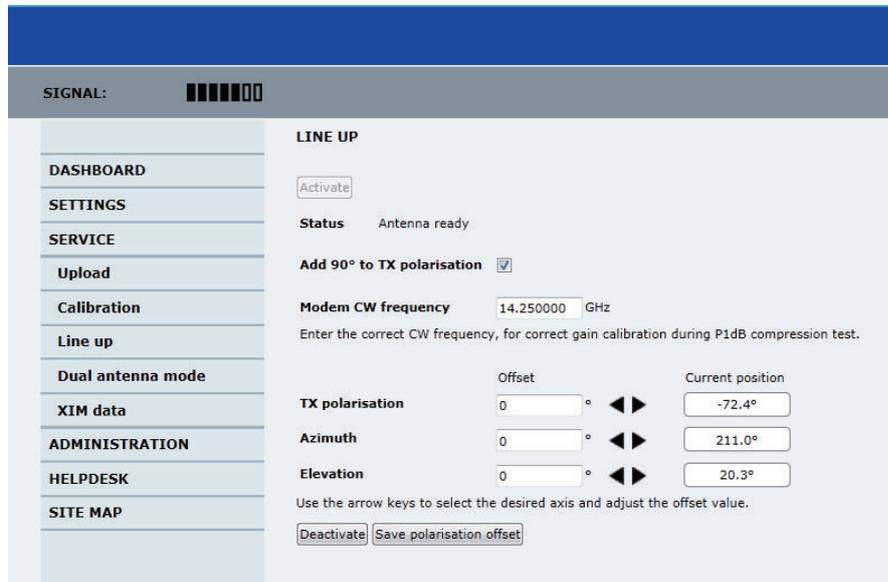


Figure 5-11: Web interface: SERVICE, Line up: Antenna ready

- Enter the Modem CW frequency (Continuous Wave) in GHz. This is provided by the satellite operator, typically when talking to the satellite operator on the phone before starting the line up.
- Adjust the TX polarisation as instructed by the service provider. If needed, add 90 degrees to the TX polarisation by selecting the field.
- Set the values as advised by the service provider:
 - TX polarisation
 - Azimuth
 - Elevation
- To save the TX polarisation offset value, click the button **Save polarisation offset**.
- Follow the instructions from the service provider to make a P1dB compression test (VSAT modem).
- Click the button **Deactivate** to finish the line up procedure.

When finished, the saved value for TX polarisation is visible the next time the line up procedure is selected.

5.2.7 FV-110 fixed TX gain principle

The FV-110 uses a new transmitter chain concept. After calibration it provides a fixed gain of 44 dB from the Tx-port of the ACU to the output of the BUC. Advantages of the fixed TX gain principle are:

- Fixed TX gain over frequency and cable length
- TX gain independent of antenna cable length
- Utilization of the full 8W BUC power over frequency
- P1dB compression point the same over frequency

When installing the FV-110 you make a cable calibration. At that point every installation finds the same P1dB compression setting regardless of cable length. The P1dB compression point is approximately -5 dBm at the ACU Tx-port. Additionally the FV-110 system monitors the TX gain in real time.

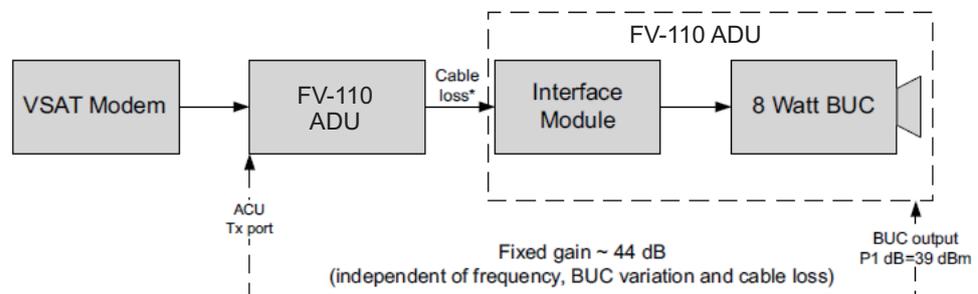


Figure 5-12: Fixed TX gain principle (FV-110)

- * You find the maximum cable loss at *Maximum allowed RF loss in the ADU cable* on page 2-22.

Example: ACU Tx-port power: -5 dBm > BUC output = +39 dBm (compression)

5.3 Configuration with the web interface

5.3.1 Overview and dashboard

Topics in the web interface

Use the site map to get an overview over the existing menus, submenus and topics. You can click on each menu in the site map to go directly to the page or display the respective submenu.

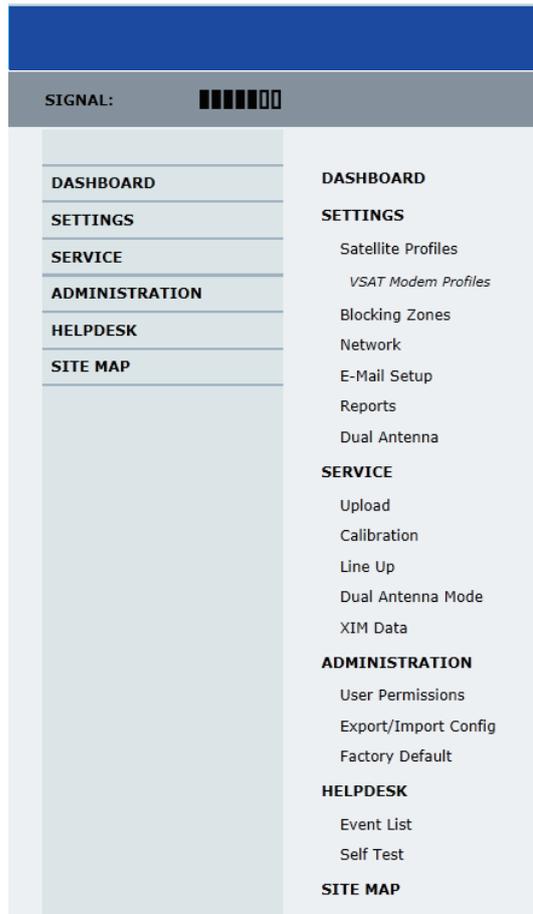


Figure 5-13: Topics in the web interface (SITE MAP)

Dashboard and navigation

The Dashboard is the first screen that is displayed when the user or administrator enters the IP address of the web interface of the ACU. The Dashboard is used for viewing properties and status of the ACU and ADU.

The web interface consists of the following sections:

Section	Item	Value
DASHBOARD	System status	Tracking
	GPS position	55°48' N, 12°31' E
	Vessel heading	0.35°
	Satellite profile	VSAT Service
	Satellite position	53°E
	RX polarisation	Horizontal
	TX polarisation	X-pol
	RX RF frequency	11.084111 GHz
	LNB LO frequency	9.750000 GHz
	TX RF frequency	14.384637 GHz
VSAT MODEM	Model	COMTECH 570L and ROSS
	Signal level	9 dB
	RX IF frequency	1334.111000 MHz
TX	BUC TX	On
	BUC output power	■■■■

Figure 5-14: Web interface: DASHBOARD of FV-110

1. The navigation pane holds the main menu. Clicking an item in the menu opens a submenu in the navigation pane or a new page in the contents section.
2. The signal status field shows the tracking signal strength of the antenna. The signal strength can vary during operation, depending on the current position relative to the satellite. The signal strength of the VSAT modem is shown at VSAT MODEM, Signal level.
3. The icon bar shows icons for active events, when relevant.
4. The host name is shown on every page of the web interface. The host name is useful for identifying the system at remote login and when requesting reports from the system. The host name is recommended to contain the name of the vessel. To change the host name see *To configure the LAN network* on page 5-29.
5. The contents section shows the page selected in the navigation pane. This section is used for viewing or changing settings, or for performing actions. For a description of the individual items in the contents section see *Information fields on the Dashboard* on page 5-20.

The following icons may appear in the icon bar in the web interface:

Icon	Explanation
	<p>An event is active. Click the icon to see a list of active events. For explanations of the event messages, see <i>Event list</i> on page 7-2 and <i>Event messages – overview</i> on page G-1. Note that this icon will remain in the icon bar as long as the event is active.</p>

Table 5-7: Web interface: Event icon

To navigate the web interface

- **To expand a menu**, click the menu in the navigation pane.
- **To access status and settings**, click the relevant subject in the navigation pane or click the relevant icon in the icon bar. The status or settings are displayed in the contents section.
- **To get an overview over the submenus available**, click **SITE MAP** in the navigation pane. Click on items in the site map to go directly to the relevant location.

Note | You can give access to some configuration settings for users that are not administrators. For information see *To set up user permissions* on page 5-42.

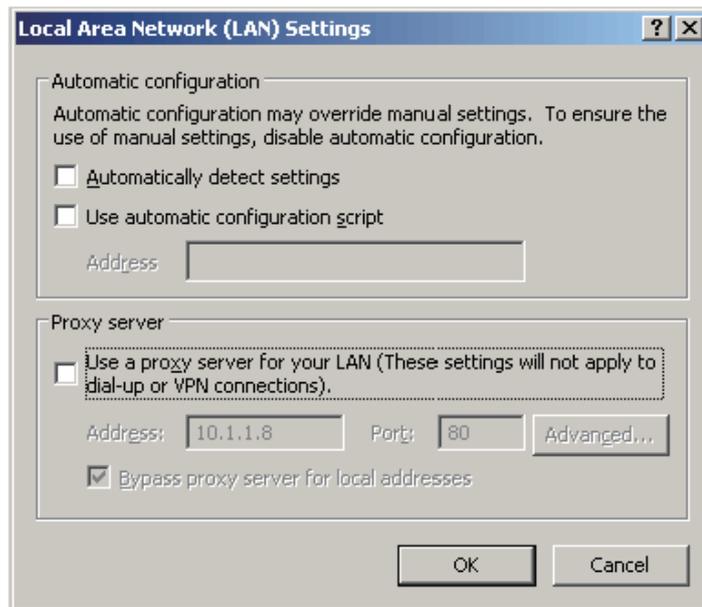
Proxy server settings in your browser

If you are connecting your computer using a LAN or WLAN interface, the **Proxy server** settings in your browser must be disabled before accessing the web interface. Most browsers support disabling of the Proxy server settings for one specific IP address, so you can disable Proxy server settings for the web interface only, if you wish. Consult your browser help for information.

To disable the use of a Proxy server completely, do as follows:

Note | The following description is for **Microsoft Internet Explorer**. If you are using a different browser, the procedure may be different.

1. In Microsoft Internet Explorer, select **Tools > Internet Options > Connections > LAN Settings**.



2. Clear the box labeled **Use a proxy server for your LAN**.
3. Click **OK**.

When the proxy server settings are disabled, close and restart your browser.

You may need to change this setting back on return to your Internet connection.

To connect a PC

To connect your PC to the ACU do as follows:

1. Connect a PC to LAN interface 3 (Service port, standard Ethernet) of the ACU or to the front LAN connector of the ACU.
If you want to use another LAN port than LAN 3 you must configure it according to your network requirements. For information how to configure the LAN connectors see *To configure the LAN network* on page 5-29.
2. Open your Internet browser and enter the IP address of the ACU. The default IP address is **http://192.168.0.1**.

Information fields on the Dashboard

FV-110 parameter	Description
System status	Current status of the FV-110. Examples: Not ready (waiting for input from GNSS, e.g. GPS) Ready (waiting for data from the VSAT modem or no satellite profile selected) Pointing antenna (locating the satellite) Acquiring signal (acquiring the satellite signal) Tracking (tracks the current satellite) No Tx zone (antenna is pointing in a no TX zone; TX is off) Blocking zone (antenna is pointing into a blocking zone) Service switch (service switch in ADU activated) Safe mode (error, followed by an error description)
GPS position	Current position of the vessel, reported by the GPS module
Vessel heading	Ship's heading in degrees with reference to North, provided by the ship's gyro.
Satellite profile	Name of the currently active satellite profile.
Satellite position	Position of the satellite selected in Satellite profile.
RX polarisation	Horizontal or vertical.
TX polarisation ^a	Co-pol or X-pol, auto-selected by VSAT modem
RX RF frequency ^a	Ku band receiving frequency, auto-selected by VSAT modem
LNB Lo frequency ^a	Auto-selected by VSAT modem
TX RF frequency ^a	Auto-selected by VSAT modem
BUC Lo frequency	12.8 GHz (system parameter)
Tracking RF frequency	Current RF tracking frequency.
ACU part name, ADU part name, ACU serial number, ADU serial number, Software version	Part names, serial numbers for ACU and ADU, software version of the FV-110.

Table 5-8: Web interface, DASHBOARD, FV-110 parameters

a. Can be altered when using a generic modem profile.

VSAT MODEM parameter	Description
Model	VSAT modem name, entered in SETTINGS > VSAT modem profiles .
Signal level	Current input signal level from VSAT modem. iDirect openAMIP modem: (PWR) 0-500, delivered by the connected modem. For values <250 the antenna searches after a new signal. Other modem: Signal level in dB.
RX IF frequency	Read out from VMU.
TX IF frequency	Read out from VMU.
TX allowed	On or Off. Indicates if the VSAT modem supplies the 10 MHz reference signal on its TX connector (On) and if an iDirect OpenAMIP modem indicates modem Locked and Tx ON in the OpenAMIP message L (L 1 1).

Table 5-9: Web interface, DASHBOARD, VSAT MODEM parameter

POINTING parameter	Description
Azimuth relative	Current value for azimuth, relative to the vessel heading.
Elevation relative	Current value for elevation, relative to the vessel.
Polarisation skew	Current value for polarisation skew.

Table 5-10: Web interface, DASHBOARD, POINTING parameter

TX parameter	Description
BUC TX	On or Off. Shows if the FV-110 has enabled the BUC or not. It is the same TX ON/TX OFF as shown in the display of the ACU, see <i>ACU display and keypad</i> on page 5-46.
BUC output power	See sections below this table.

Table 5-11: Web interface, DASHBOARD, TX parameter

TX BUC output power information

The BUC TX information is displayed on the DASHBOARD. The BUC TX indicates if the FV-110 has enabled the BUC or not. It can show BUC Tx On or Off. This information is also shown in the display of the ACU as TX ON or TX OFF.

The FV-110 shows BUC TX On when the following conditions are met:

- The FV-110 must sense the 10 MHz Tx reference signal from the connected VSAT modem.
- The VSAT modem must have Rx lock.
- The antenna must point correctly to the satellite.
- The antenna must be in tracking mode.

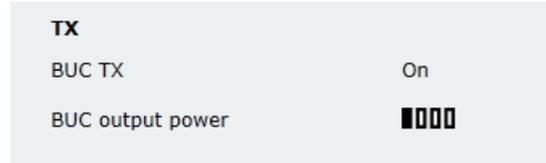


Figure 5-15: Web interface: DASHBOARD, TX - BUC output power (example)

The BUC output power indicates if the BUC is transmitting or not. This is a unique feature of the FV-110 antenna. A built-in power detector in the OMT makes it possible to measure the power within a time window to be able to catch short TX bursts. The power within the window is averaged and shown in the BUC output power bar graph on the DASHBOARD. Not that this indicator is an averaged signal, it is not a real-time indicator. After measuring a signal burst the bar graph falls slowly in order for the user to be able to see short TX bursts.

The BUC output power indicator is very useful during installation as the service engineer knows whether the antenna is transmitting or not and that the hub should be able to monitor the transmission. It is also very useful when doing line up with the hub as the service engineer can monitor the TX BUC output power level on the DASHBOARD and watch when the output power approaches the P1dB compression point which is at 4 bars.

5.3.2 Satellite profiles and VSAT modem profiles

Satellite profiles

On the page **Satellite profiles** you add, edit and delete satellite profiles. A satellite profile contains all settings that are necessary for a successful connection to the satellite, including a VSAT modem profile. Most of the data you have to fill in are provided by your VSAT service provider.

You must activate one satellite profile.

Note You must add at least one VSAT modem profile before you can add a satellite profile. See *VSAT modem profile – New entry and Edit* on page 5-25.

Satellite profiles – New entry and Edit

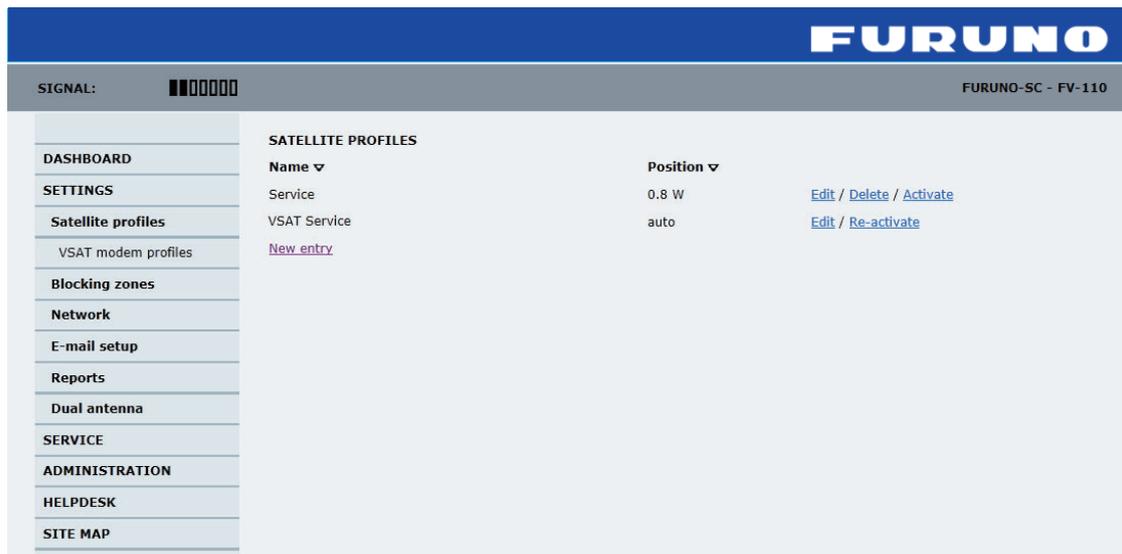


Figure 5-16: Web interface: SETTINGS - list of satellite profiles (example)

Each satellite profile has one assigned VSAT modem profile.

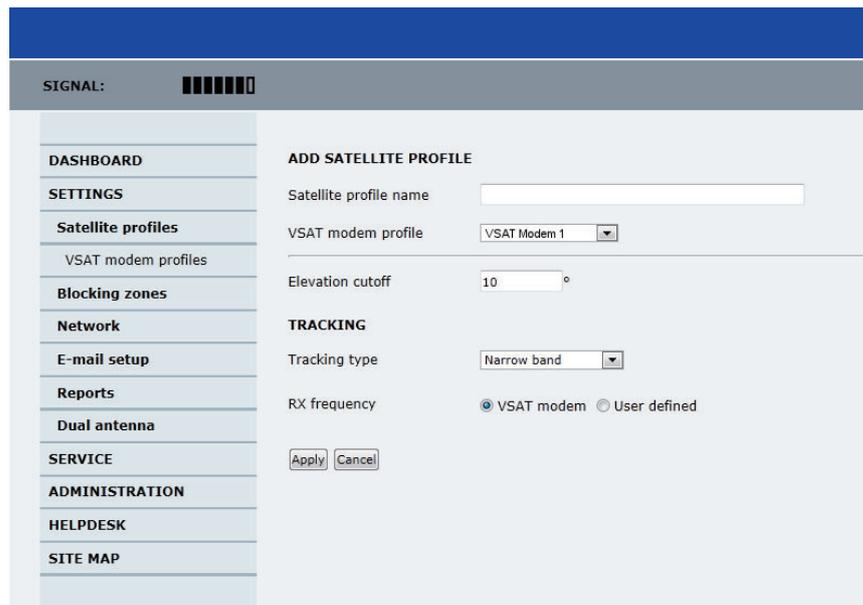


Figure 5-17: Web interface: SETTINGS, Satellite profiles — new entry (example)

To add or edit a satellite profile, do as follows:

1. Go to **SETTINGS** or **Satellite profiles** and click **Edit** or **New entry**.
2. Enter or edit the Satellite profile name.

Note It is helpful to assign a name containing the location where the Satellite profile is to be used (e.g. *Gulf of Mexico* or *North Sea*) and possibly the provider.

3. Select a VSAT modem profile. The page automatically displays the parameters available for the selected VSAT modem profile.
For instruction how to add a VSAT modem profile see *VSAT modem profile – New entry and Edit* on page 5-25.
4. Enter the data for the satellite that you want to use. For satellite data see *DVB-S satellites* on page E-1 or www.lyngsat.com.
5. Polarisation skew: See documents from VSAT provider.
6. At Elevation cutoff enter the minimum elevation angle for the antenna to function in accordance with ETSI (ETSI EN 302 340) and FCC (FCC §25.205) regulations.
 - **ETSI (ETSI EN 302 340):** The minimum elevation angle depends on the Tx bandwidth and the nominal power of the VSAT modem, see the table below.

Bandwidth	Nominal VSAT modem power								
	-22 dBm	-20 dBm	-18 dBm	-16 dBm	-14 dBm	-12 dBm	-10 dBm	-8 dBm	-6 dBm
Eirp@14.25 GHz ^a	63.4 dBm	65.4 dBm	67.4 dBm	69.4 dBm	71.4 dBm	73.4 dBm	75.4 dBm	77.4 dBm	79.4 dBm
64 kHz	3°	4°	4°	5°	6°	7°	8°	10°	12°
128 kHz	3°	4°	4°	5°	6°	7°	8°	10°	12°
256 kHz	3°	4°	4°	5°	6°	7°	8°	10°	12°
512 kHz	3°	4°	4°	5°	6°	7°	8°	10°	12°
1024 kHz	3°	4°	4°	5°	6°	7°	8°	10°	12°
2048 kHz	3°	3°	3°	4°	5°	5°	6°	8°	9°
4096 kHz	3°	3°	3°	3°	4°	4°	5°	6°	7°
8192 kHz	3°	3°	3°	3°	3°	3°	4°	5°	5°
16384 kHz	3°	3°	3°	3°	3°	3°	3°	4°	4°
32768 kHz	3°	3°	3°	3°	3°	3°	3°	3°	3°

Table 5-12: FV-110: Elevation cutoff (in degrees) versus VSAT modem bandwidth and power

a. Eirp = Fixed system gain 44 dB + antenna gain @ 14.25 GHz 41.4 dB + modem power

- **FCC (FCC §25.205):** 5 degrees

7. Click **Apply** to save the settings for the satellite profile.

VSAT modem profiles

A VSAT modem profile contains all VSAT modem settings that are necessary for a successful connection to the satellite. The data you have to fill in are provided by your VSAT service and modem provider. You must add at least one VSAT modem profile.



Figure 5-18: Web interface: SETTINGS, VSAT modem profiles — list (example)

To create a new VSAT modem satellite profile, click **New entry**. To edit or delete a VSAT modem profile, click **Edit** or **Delete**.

VSAT modem profile – New entry and Edit

On the page **VSAT modem profiles** you create, edit or delete VSAT modem profiles. The supported VSAT modem profiles are listed in the drop-down list **VSAT modem profile**.

To add or edit a VSAT modem profile, do as follows:

1. Go to **SETTINGS > VSAT modem profiles** and click **New entry** or **Edit**.

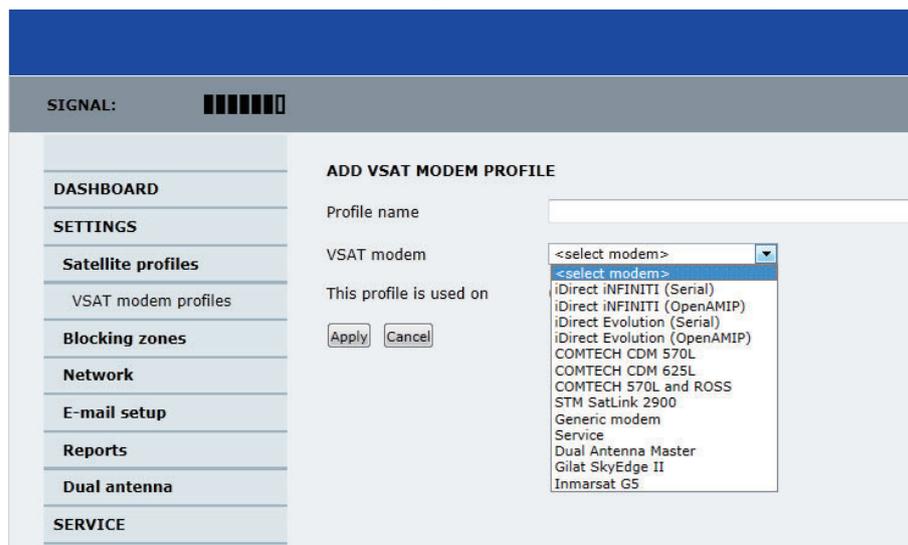


Figure 5-19: Web interface: SETTINGS, VSAT modem profile – supported modems

2. Fill in a VSAT modem profile name of your own choice.

3. Select one of the supported VSAT modems from the drop down list. Once you have selected a VSAT modem, entry fields required for this VSAT modem are displayed.
Generic modem: If you have a modem that is not included in the list, select the generic modem. This is mainly used for troubleshooting purposes.
4. Fill in or edit the data provided by your VSAT service provider.
Enter the passwords, if needed.
Select the VSAT modem baud rate and whether you want to use the 10 MHz reference from the ACU or the VSAT modem.

Important

The FV-110 can work either using the Rx or Tx 10 MHz reference signals provided by the modem or using its own built-in 10 MHz reference signal. It is recommended to use the Tx 10 MHz reference signal from the modem.

For OpenAMIP IP address: Make sure that you have entered this IP address also for the LAN connector that is used for the OpenAMIP modem, see *To configure the LAN network* on page 5-29.

5. Click **Apply** to add the new profile to the list of VSAT modem profiles or to accept the edits.

For a generic modem you enter all parameters in the satellite profile.

Figure 5-20: Satellite profile for generic modem

5.3.3 To set up blocking zones (RX and TX)

On this page you define blocking zones, i.e. NO TX and RX zones, enter azimuth values and elevation angles for each blocking zone.

You must select **Active** to enable a blocking zone.

The screenshot shows the 'Blocking zones' configuration page. The table below represents the data shown in the interface:

Active	Azimuth	Elevation	No TX
<input checked="" type="checkbox"/>	264 ° - 297 °	-25 ° - 12 °	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	264 ° - 281 °	-25 ° - 22 °	<input checked="" type="checkbox"/>
<input type="checkbox"/>	0 ° - 360 °	-25 ° - 90 °	<input checked="" type="checkbox"/>
<input type="checkbox"/>	0 ° - 10 °	0 ° - 10 °	<input type="checkbox"/>
<input type="checkbox"/>	0 ° - 0 °	0 ° - 0 °	<input type="checkbox"/>
<input type="checkbox"/>	0 ° - 0 °	0 ° - 0 °	<input type="checkbox"/>
<input type="checkbox"/>	0 ° - 0 °	0 ° - 0 °	<input type="checkbox"/>
<input type="checkbox"/>	0 ° - 0 °	0 ° - 0 °	<input type="checkbox"/>

Below the table are 'Apply' and 'Cancel' buttons. A circular diagram below the buttons shows an antenna at the center with a vertical oval blocking zone. The diagram is marked with azimuth angles: 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°.

Figure 5-21: Web interface: SETTINGS, Blocking zones — azimuth and elevation

To define and set a blocking zone, do as follows:

1. Select **SETTINGS > Blocking zones**.
2. Select **Active** to enable the blocking zone.

- Azimuth:** Enter start and stop azimuth value in degrees for the blocking zone. Values allowed: 0 to 360 degrees. Enter clockwise.

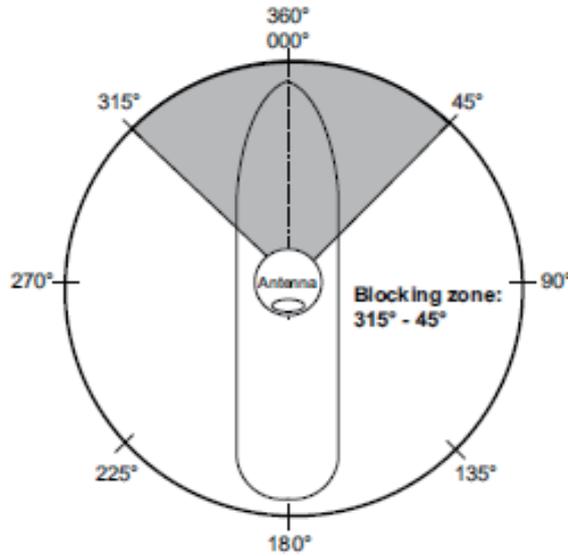


Figure 5-22: Blocking zone, example: 315 - 45 degrees

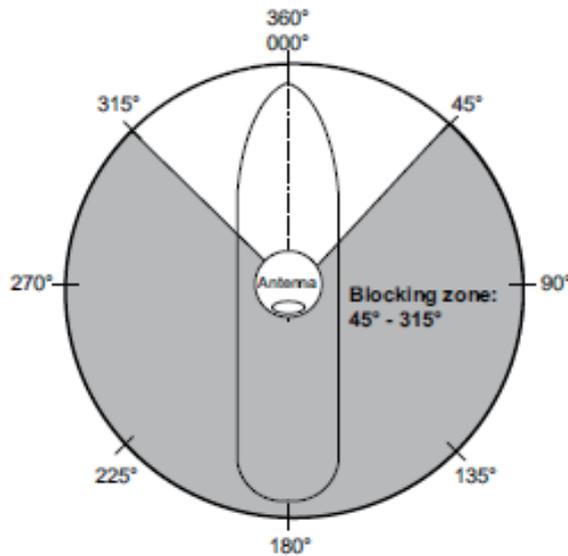


Figure 5-23: Blocking zone, example: 45 - 315 degrees

- Elevation:** Enter the start and stop elevation angle for the blocking zone. If you enter nothing, there will be no blocking zone. Values allowed: -30 to 90 degrees.

Important

You must enter 2 different elevation angles to have an active blocking zone.

- Select **No TX** for zones if you don't want the system to transmit. If not selected, the system also transmits when pointing through areas with blocking objects. The VSAT modem will shut off for TX if no signal is received.
- Click **Apply** to save the blocking zones.

5.3.4 To configure the LAN network

You can enter a host name. The host name helps identifying the FV-110 system when sending e-mail reports. The ACU has four 10/100 Mbit Ethernet ports labelled LAN port 1, 2, 3 and 4. The ports are divided in three groups, each group operating in its own network. You can setup DNS and Gateway.

To configure the LAN network go to **SETTINGS > Network**.

The screenshot shows the 'NETWORK' configuration page. At the top, the 'Host name' is 'SHIP-VSAT1'. Below this are three sections for LAN ports:

- LAN Port 1: VSAT Modem Unit**: Mode is 'Static IP'. IP address is 203.88.69.106, Netmask is 255.255.255.0. DHCP Server is checked. DHCP Server Start is 203.88.69.107, and DHCP Server End is 203.88.69.254.
- LAN Port 2: LAN**: Note: Switched with Port 1.
- LAN Port 3: Service**: Mode is 'Static IP'. IP address is 192.168.2.111, Netmask is 255.255.255.0. DHCP Server is unchecked. DHCP Server Start is 192.168.1.100, and DHCP Server End is 192.168.1.200.
- LAN Port 4: LAN**: Mode is 'DHCP client'. IP address is 10.196.17.27, Netmask is 255.255.255.0.

Below the LAN ports are three sections:

- DNS setup**: DNS source is 'Static'. Primary DNS is 10.196.9.3, Secondary DNS is 10.196.9.7.
- Gateway setup**: Default gateway source is 'Static'. Default gateway is 192.168.1.1.
- Zeroconf setup**: Zeroconf source is 'Disabled'.

At the bottom are 'Apply' and 'Cancel' buttons.

Figure 5-24: Web interface: SETTINGS, Network (default settings)

Important

Make sure that the 3 networks do not use IP address ranges that overlap.

Sections	Preferred use
NETWORK Host name	The host name is used for identifying the ACU in local networks and in e-mail reports. The default host name is acu. You can change the name. Letters (a-z), digits (0-9) and hyphen (-) are allowed as legal characters. Note: The host name must start with a letter.
LAN Port 1 + 2	LAN port 1 and 2 are switched, i.e. they share the same IP address and operate on the same network. This network is usually connected to the VSAT Modem Unit. LAN port 1 can be set to static IP (default), DHCP client or DHCP server.
LAN Port 3	LAN port 3 is dedicated as the service port. By default this port has the IP address 192.168.0.1; the current value can be displayed in the ACU display. In a 19" rack mount it is recommended to connect LAN port 3 to the front port (via rear connector, see the figure <i>ACU rack version, connector panel overview</i> on page 3-1), for access to the service port from the rack front. LAN port 3 can be set to static IP, DHCP client or DHCP server (default).
LAN Port 4	LAN port 4 can be used for connection to the LAN of the vessel or other general purpose. LAN port 4 can be set to static IP, DHCP client (default) or DHCP server.

Table 5-13: Setup of LAN connectors

Static IP or DHCP Client

If you select **DHCP client** the network IP address and sub-net mask must be provided by a DHCP server on that network.

If you select **Static IP** address you must specify a unique IP address and a sub-net mask.

DHCP Server Settings.

On LAN ports 1,3 and 4 you can choose to run a DHCP server. Select the check box **DHCP Server**. The DHCP server settings are only displayed and can be selected when the port mode is set to **Static IP**, otherwise the DHCP server settings are not shown.

The DHCP start and end addresses must be on the same network as the port's static IP.

DNS setup

If you have access to a Domain Name Server (DNS) you can specify the address of the e-mail server by using the server name instead of its IP address. This can be used in **Outgoing mail server** in *E-mail setup* on page 5-31.

You may statically specify the address of one or two DNS. Select the DNS source as static and fill in IP address or addresses.

Alternatively, if your DHCP server can provide a DNS address and you have selected DHCP client above, then select the same LAN as your DNS source.

Gateway setup

If the ACU needs to communicate with network units outside the specified sub-nets, you must specify a default gateway (typically a router).

The default gateway can be set as a static IP address. Then set the default gateway source to static and enter the IP address of the default gateway. To remove the default gateway set it to 0.0.0.0.

Alternatively, if your DHCP server is able to provide a default gateway address and you have selected DHCP client above, then select the same LAN as your default gateway source.

Zeroconf Settings

On LAN ports 1,3 and 4 you can choose to add a zeroconf address in the network (169.254.0.0).This zeroconf address will be in addition to the existing static or DHCP IP address. One port at a time can be enabled.

Zeroconf allows devices to connect to a network automatically.

5.3.5 E-mail setup

To be able to send diagnostics and statistics reports using e-mail you must set up a couple of parameters. Contact your IT department for the specific data.

To configure the e-mail setup, do the following:

1. Go to **SETTINGS > E-mail setup**.



Figure 5-25: Web interface: SETTINGS, E-mail setup (example)

2. Enter the data for Outgoing mail server (SMTP), SMTP port number, SMTP authentication, User name and password. This data is typically provided by your IT department.

Note You must set **Outgoing mail server** to an IP address if DNS has not been set up in **DNS setup** in *To configure the LAN network* on page 5-29.

5.3.6 To send statistics reports

FV-110 can send a statistics report at fixed intervals. This report contains historical information from the FV-110 of up to 1 month. It is sent as a zipped attachment to an e-mail. The file format is a comma separated value file (csv). The report can then be processed in spreadsheet applications, e.g. Microsoft Excel.

Figure 5-26: Web interface: SETTINGS, Reports (example)

To set up sending a statistics report, do as follows:

1. Configure e-mail first, see *E-mail setup* on page 5-31.
2. Go to **SETTINGS > Reports**.
3. In the section **STATISTICS REPORT** enter the following:
 - Email sender.
 - Email recipients (comma separated).
 - Send interval: Select disabled, day (default) with 2-minute samples, week with hourly samples or month with hourly samples. The report contains statistics data for the selected intervals.
4. Click **Apply**.

You can also send the report at any time by clicking **Send now**. Use **Send now** to validate the e-mail setup. See also *Download of a diagnostic report or a statistics report* on page 7-2.

The following parameters are recorded in the statistics report:

Parameter recorded	Description
Hostname	Host name, entered in the web interface on the page SETTINGS > Network.
ACU SN	ACU serial number
ADU SN	ADU serial number
SW ver.	Software version
System type	FV-110

Table 5-14: Statistics report, header record

Parameter recorded	Description
UTC. (s) UTC (YYYY-MM-DD hh:mm)	UTC in seconds and date format for the data set.
RSSI.Av RSSI.Max RSSI.Min	Received signal strength (average, maximum and minimum value) for the sampling interval.
POS.Lat (degree) POS.Long (degree) POS.Valid	Latitude value of position. Longitude value of position. Fix = valid position, No Fix = invalid position.
Heading.Samp (degree) Heading.Max (degree) Heading.Min (degree) Heading.Range (+/-degree)	Ship's heading (sample, maximum and minimum value, range) for the sampling interval. See Figure 5-27: <i>Statistics — how to read data for a range.</i>
Antenna.Azi (degree) Antenna.Azi Max (degree) Antenna.Azi Min (degree) Antenna.Azi Range (+/-degree)	Current antenna azimuth (sample, maximum and minimum value, range) for the sampling interval. See Figure 5-27: <i>Statistics — how to read data for a range.</i>
Antenna.Ele (+/-degree) Antenna.Ele Max (+/-degree) Antenna.Ele Min (+/-degree)	Current antenna elevation (sample, maximum and minimum value) for the sampling interval.
Vsat.rx_lo_freq (GHz) Vsat.tx_lo_freq (GHz)	Rx frequency of VSAT modem for this record. Tx frequency of VSAT modem for this record.
Tracking.rf_freq (GHz) Tracking.type	Tracking RF frequency for this record. Narrow filter, DVB-S2 decoder and VSAT modem RSSI.
Sat.long (degree)	Longitude position of the satellite.

Table 5-15: Parameters recorded in a statistics report

Parameter recorded	Description
Carrier rf.rx (GHz) Carrier rf.tx (GHz)	Rx frequency of carrier for this record. Tx frequency of carrier for this record.
Pol.rx Pol.tx	Current Rx and Tx polarisation modes
Rx Lock (%) Logon (%)	Rx locked and logon time, in percent, for the sampling interval.
Pos Ok (%)	Valid position, in percent of the sampling interval.
VMU Connection (%)	Link with VSAT modem, in percent of the sampling interval.
Blocking (%)	Ship in blocking zone, in percent of the sampling interval.
DualAntenna.mode DualAntenna.logon_remote (%) DualAntenna.active (%)	Shows the current mode and the time active and remote logon.

Table 5-15: Parameters recorded in a statistics report (Continued)

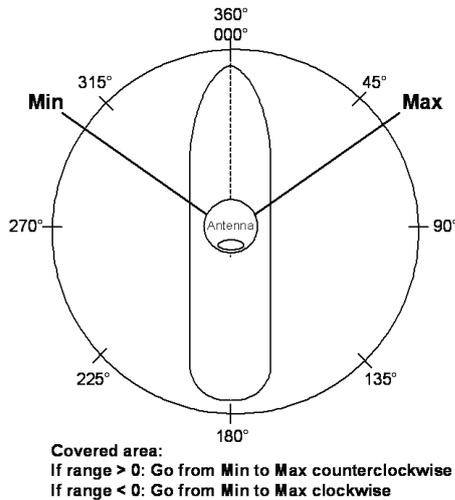


Figure 5-27: Statistics — how to read data for a range

Processing the statistics report in a spreadsheet application

The statistics report is in a data format that can be imported into spreadsheet applications, e.g. Microsoft Excel, for further processing.

1. Save the zipped file to your computer and extract the text file. The file name contains the identification of the system (example: adu-acu3_stat_20111021110901_day.csv).

- Open the spreadsheet application, for example Microsoft Excel. On the tab Data click the tab Import from text. Import the unzipped text file and follow the instructions in the wizard. When asked about the delimiter, select 'comma'.

The following figure shows an example of a statistics report in MS Excel 2007.

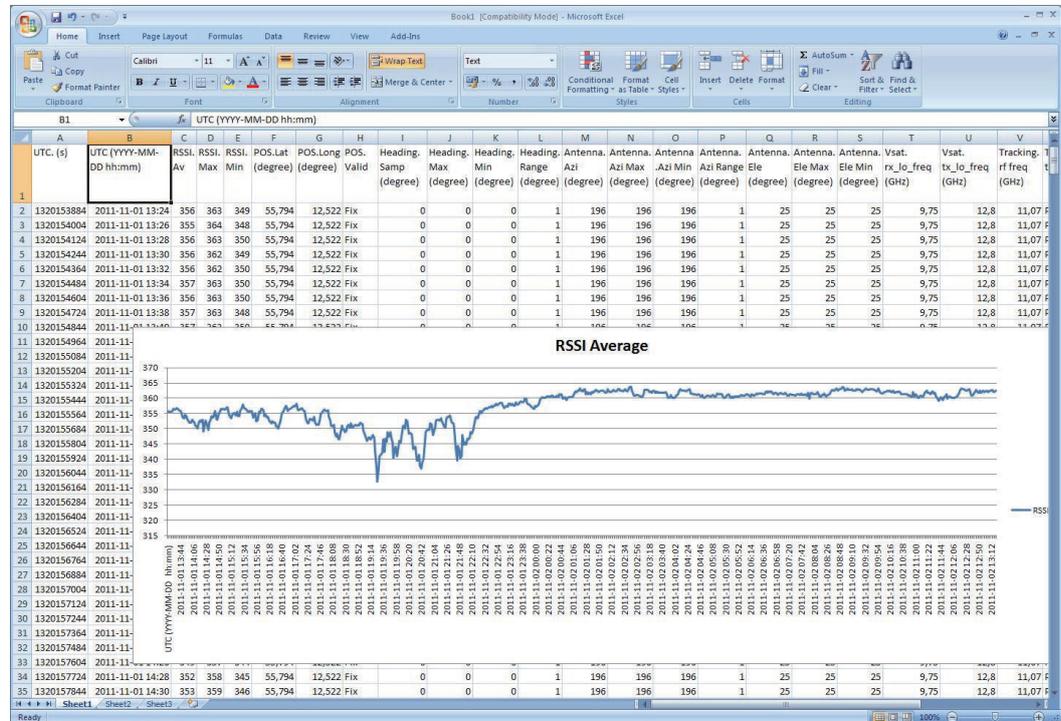


Figure 5-28: Statistics report (example)

5.3.7 To send a diagnostics report

You can send automatically generated diagnostic reports at fixed intervals. The diagnostic report contains information relevant for the service personnel during troubleshooting.

To set up sending a statistics report, do as follows:

- Go to **SETTINGS > Reports**.
- In the section **DIAGNOSTICS REPORT** enter the following:
 - Email sender.
 - Email recipients (comma separated).
 - Send interval: Select disabled, day (default) with 2-minute samples, week with hourly samples or month with hourly samples. The report contains statistics data for the selected intervals.
- Click **Apply**.

To generate a diagnostic report, click **Send now** or go to the page **HELPDESK** and click **Download** to download it directly to your computer. See also *Download of a diagnostic report or a statistics report* on page 7-2.

5.3.8 Dual antenna mode (optional)

The following tasks must be taken care of when setting up a dual-antenna system:

- *To configure the Master ACU*
- *To configure the Slave ACU*
- *Blocking zone setup*
- *Line up and commissioning*

At the bottom of the DASHBOARD of the web interface there is a section where you can switch over to the other ACU dashboard. Next to **Status** you can see whether the current ACU is active or not.

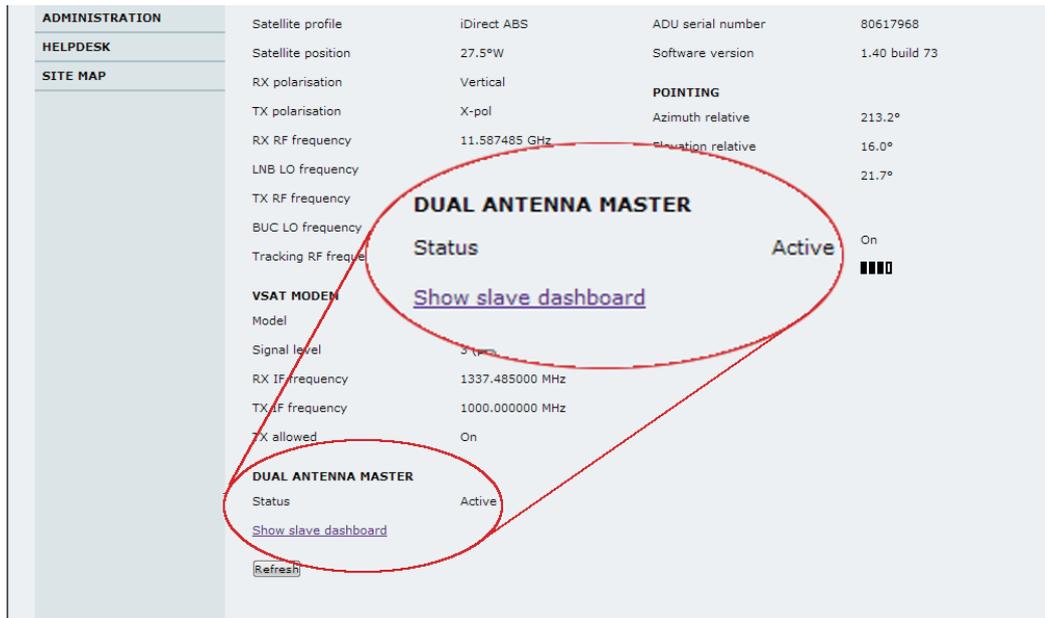


Figure 5-29: Dual-antenna mode, link on DASHBOARD

The dual-antenna system switches between the 2 antennas in the following scenarios:

- When in a programmed blocking zone.
- When the signal is blocked for more than 2 minutes.
- ADU is malfunctioning.

In the statistics report you can get more detailed information on the dual-antenna mode, see also Table 5-15 on page 5-33.

To configure the Master ACU

The Master ACU is configured exactly the same way as a stand-alone FV-110 system with satellite profiles and VSAT modem profiles. Do as follows:

1. Go to **SETTINGS > Dual antenna**.

2. Select **Enable** and click **Apply**.

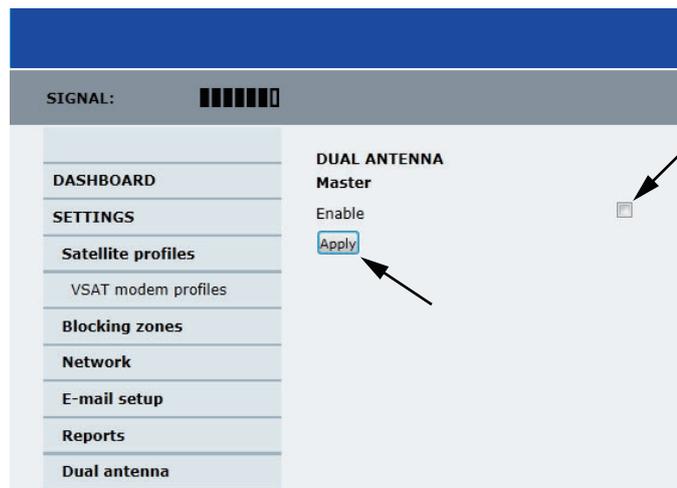


Figure 5-30: Enabling dual-antenna mode in Master ACU

The FV-110 is now ready to act as Master ACU.

To configure the Slave ACU

The Slave ACU is configured to use the Master ACU as VSAT modem profile. The VSAT modem profile must point to the IP address of the Master ACU, that is the IP address of the LAN port at which the Master/Slave communication cable is connected.

1. Add a specific VSAT modem profile for dual-antenna mode, go to **SETTINGS > Satellite profiles > VSAT modem profiles > New entry**.

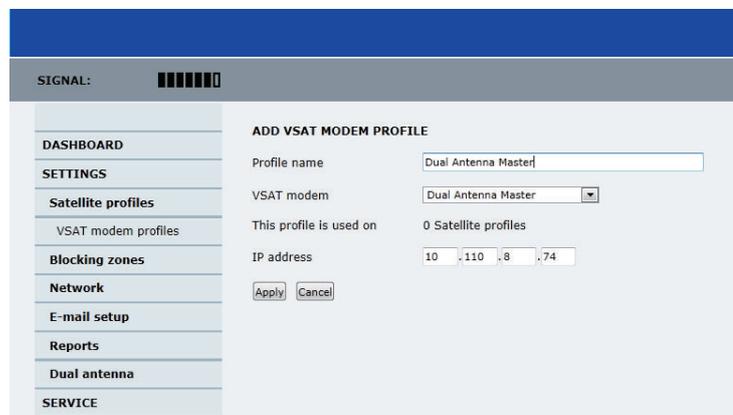


Figure 5-31: Dual-antenna mode, add Slave modem profile

2. Enter the profile name, for example Dual Antenna Master.
3. As VSAT modem select **Dual Antenna Master**.
4. IP address: this is the IP address of the LAN connector at the Master ACU. See *To configure the LAN network* on page 5-29.
5. Click **Apply**.

6. Add a satellite profile that uses the VSAT modem **Dual Antenna Master**, go to **SETTINGS > Satellite profiles > New entry**.

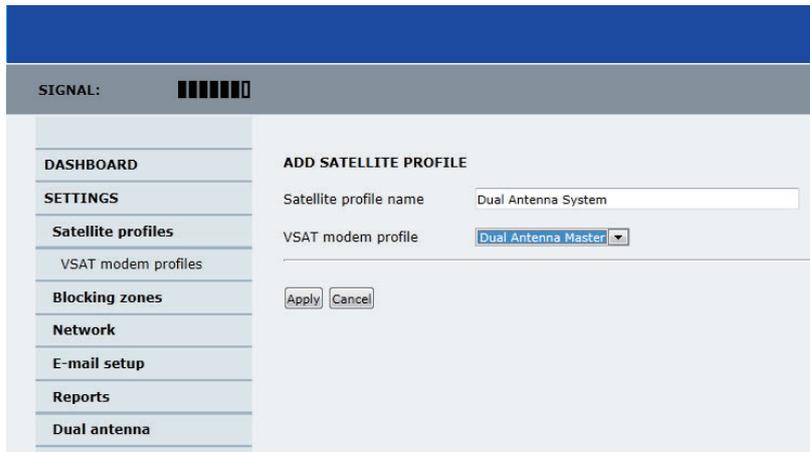


Figure 5-32: Dual-antenna mode, add Slave satellite profile

7. Enter the satellite profile name, for example: **Dual Antenna Master**.
8. As VSAT modem profile select **Dual Antenna Master**.
9. Click **Apply**.
10. Go to **SETTINGS > Satellite profiles** and activate the satellite profile **Dual Antenna Master**.



Figure 5-33: Dual-antenna mode, Activate

Blocking zone setup

It is recommended to define the following 3 blocking zones in each FV-110 system:

1. Actual blocking zones on the vessel (No TX)
2. Switching blocking zones (TX allowed).
3. Personnel safety zones (No TX)

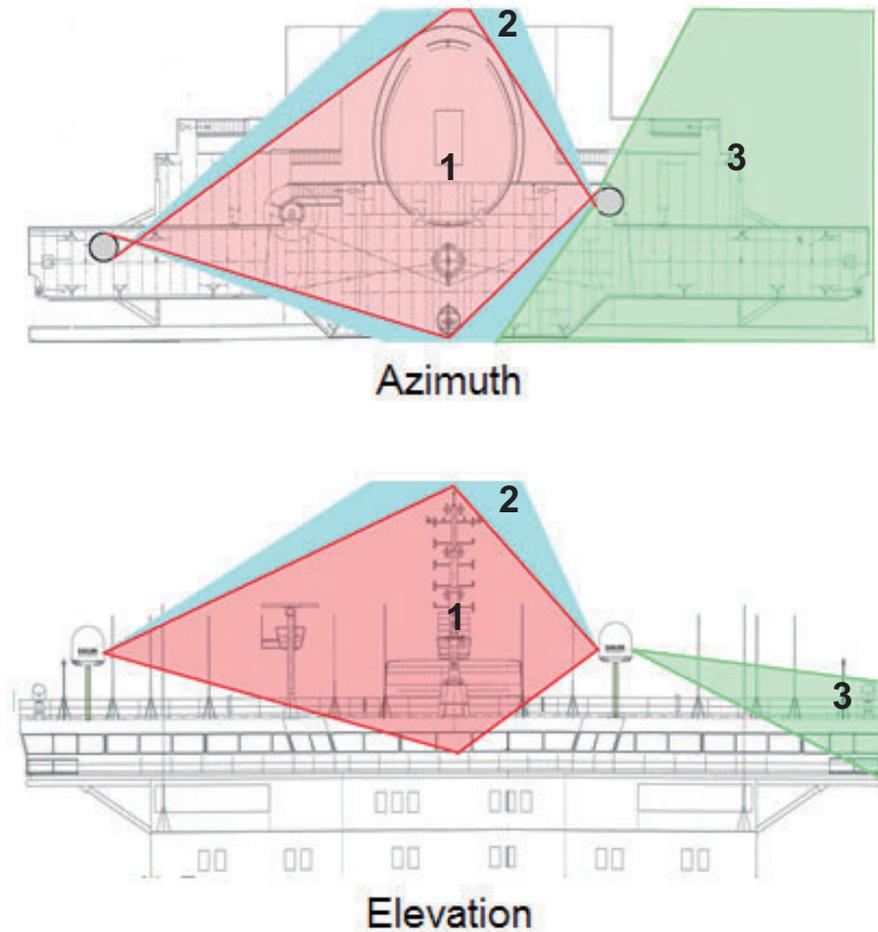


Figure 5-34: Dual-antenna mode, blocking zones — azimuth and elevation

For instructions how to set up blocking zones see *To set up blocking zones (RX and TX)* on page 5-27.

Line up and commissioning

The FV-110 antenna systems must be lined up and commissioned one by one. The lineup procedure is done for each antenna as it would have been done for a single antenna system. In order to be able to do the lineup for each antenna you must force the dual system to use one or the other antenna at a time. Do as follows:

1. Enter the web interface of the Master ACU, go to the page **SERVICE > Dual antenna mode**.

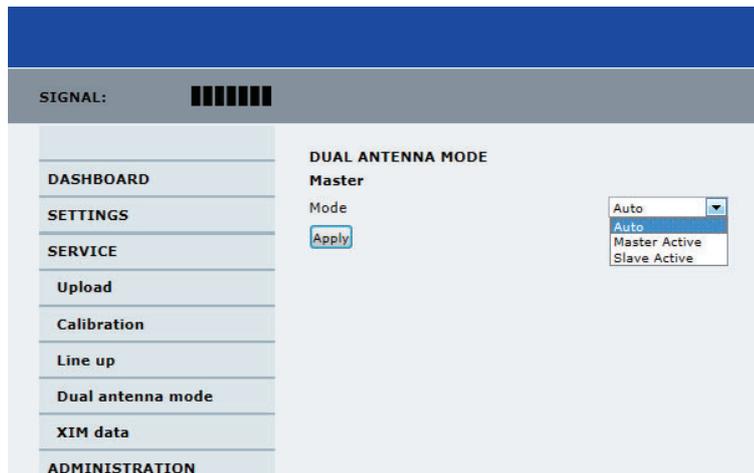


Figure 5-35: Dual-antenna mode, line up

2. Set the mode to either **Master active** or **Slave active** to force the system to use that antenna until it is changed again or the Master system is rebooted. After reboot the dual antenna mode will be set to Auto (default).

5.3.9 Upload

For uploading new software to the FV-110 see *Software update* on page 7-3.

5.3.10 Administration

In this section of the web interface you can configure the following administrative settings:

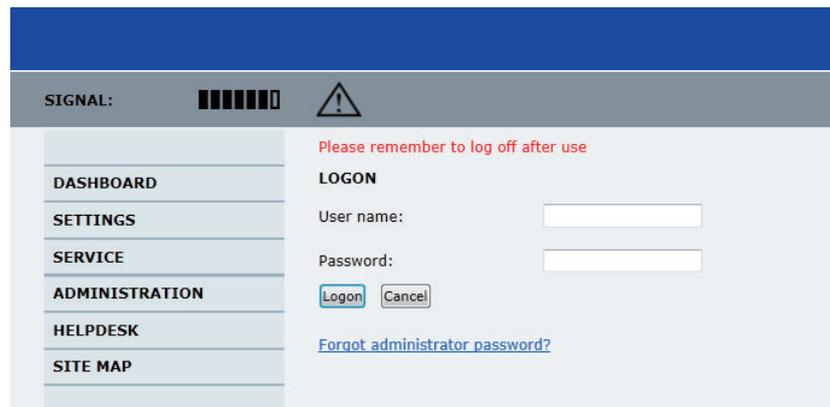
- *To access the administration settings (user name, password)*
- *To set up user permissions*
- *To import and export a system configuration*
- *To reset to factory default*

To access the administration settings (user name, password)

The Administration settings require an Administration user name and password. To log on as administrator, do as follows:

1. Select **ADMINISTRATION** from the left navigation pane.
2. Enter the Administration user name and password.

The default user name is **admin** and the default password is **1234**.



The screenshot shows the Administration page of a web interface. At the top, there is a blue header bar. Below it, a grey bar contains a 'SIGNAL:' indicator with a signal strength icon and a warning triangle. The main content area is divided into a left sidebar and a right main panel. The sidebar lists menu items: DASHBOARD, SETTINGS, SERVICE, ADMINISTRATION (highlighted), HELPDESK, and SITE MAP. The main panel features a red warning message: 'Please remember to log off after use'. Below this is the 'LOGON' section, which includes 'User name:' and 'Password:' input fields, a 'Logon' button, a 'Cancel' button, and a blue link for 'Forgot administrator password?'.

Figure 5-36: Web interface: Administration

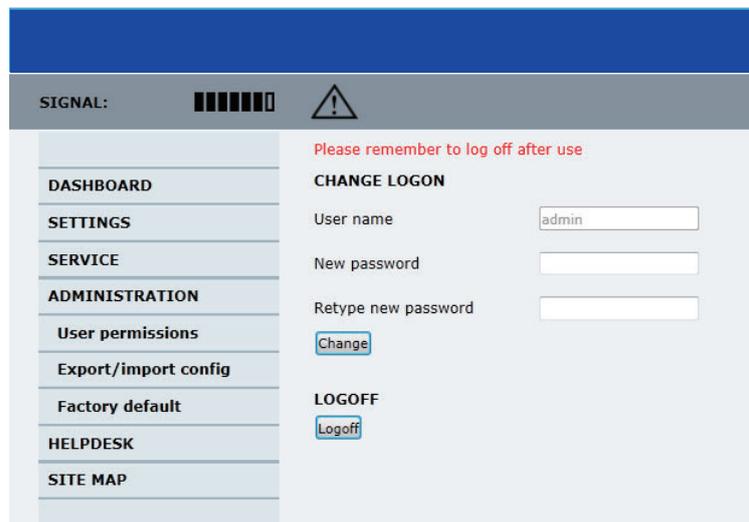
If you have forgotten the administrator password, you can reset the password. For further information, see the next section.

3. Click **Logon**.

The Administration page is now updated to let you change the user name and password or log off Administration.

To change the administrator password, do as follows:

1. After entering the administrator user name and password in the **ADMINISTRATION** page, locate the section **Change administrator logon**.



The screenshot shows the Administration page with the 'CHANGE LOGON' section active. The sidebar menu is updated to include 'User permissions', 'Export/import config', and 'Factory default'. The main panel displays the 'CHANGE LOGON' section with 'User name' (pre-filled with 'admin'), 'New password', and 'Retype new password' input fields, and a 'Change' button. Below this is the 'LOGOFF' section with a 'Logoff' button. The red warning message 'Please remember to log off after use' is still present.

Figure 5-37: Web interface: Administration, change administrator logon and password

2. Type in the new password and retype it on the next line.
3. Click **Change**. At the next logon the new password is required.

To reset the administrator password, do as follows:

1. Contact your service partner for a reset code. Report the serial number of the ACU. You find it in the **Dashboard, ACU serial number**.
2. Click the link **Forgot administrator password?** at the bottom of the **ADMINISTRATOR LOGON** page (see Figure 5-36: *Web interface: Administration*).

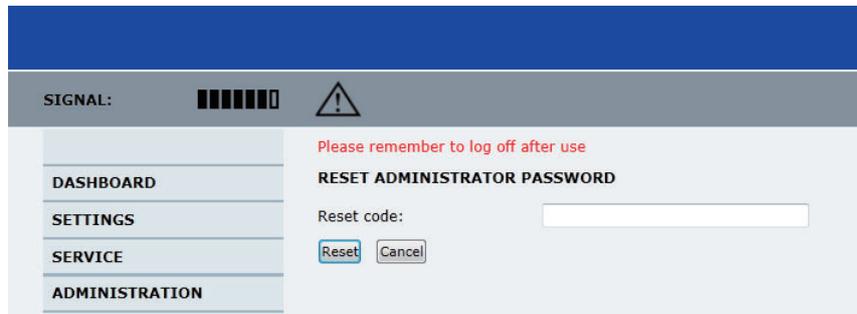


Figure 5-38: Web interface: ADMINISTRATION, Reset administrator password

3. Type in the reset code obtained from your service partner and click **Reset**.
4. Type in the user name **admin**, the default password **1234** and click **Logon**.

To log off administration

If you have not entered anything for 30 minutes under **ADMINISTRATION**, you are logged off automatically. To log off manually, click **Logoff** under administrator logoff in the **ADMINISTRATION** page.

To set up user permissions

You can manage user access to certain functions of the FV-110 system. You can allow or deny users that are not administrators access to certain functions and make these pages read-only. This is useful if you want to protect the system against unintended changes or tampering of the system.

Important Study this screen thoroughly and decide which areas of the FV-110 system you want to give non-administrator users access to.

To set up the user permissions, do as follows:

1. From the left navigation pane, select **ADMINISTRATION > User permissions**.

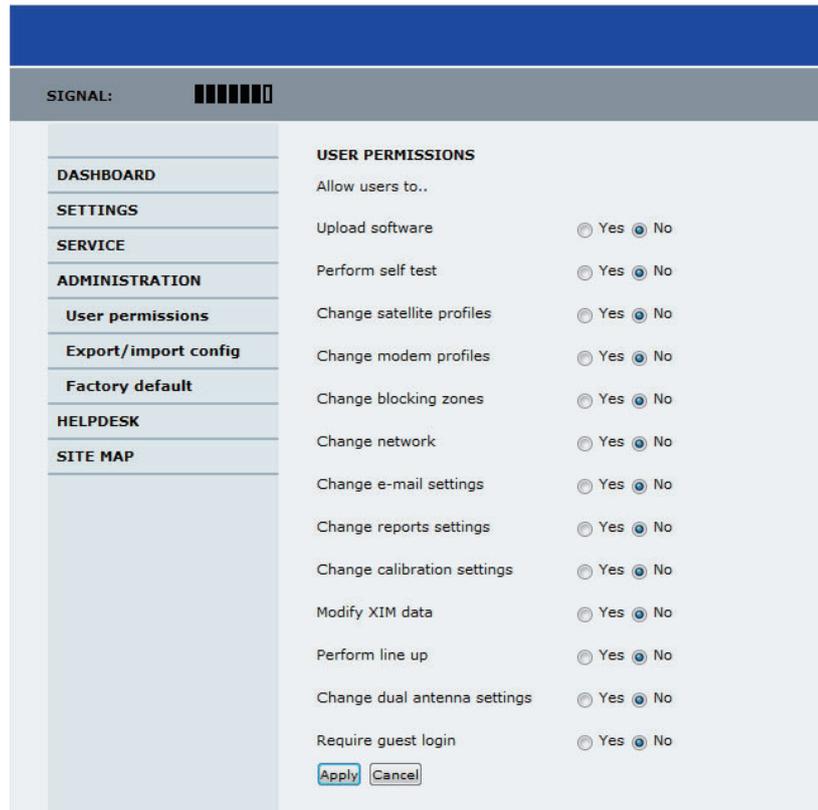


Figure 5-39: Web interface: ADMINISTRATION, User permissions

2. For each item under **ALLOW USERS TO:** select
 - **Yes** to allow access
 - **No** to block access to the settings. Then the pages are read-only, changes cannot be made by non-administrator users.

Change network: Change IP configuration of the LAN connectors. For further information see *To configure the LAN network* on page 5-29.

Change email settings: Change e-mail addresses for sending reports. For further information see *E-mail setup* on page 5-31.

Modify XIM data: Only used during service and maintenance.

3. Click **Apply**.

The settings to which access is denied are now greyed out for the non-administrator user.

To import and export a system configuration

If you need to reuse a configuration in another FV-110 system, you can save the current configuration to a file, which can then be loaded into another FV-110. You can also use this feature for backup purposes.

The configuration file contains all the settings you have entered during system setup: satellite profiles, modem profiles, LAN setup, blocking zones, etc.

To save a configuration to a file, do as follows:

1. Select **ADMINISTRATION > Export/import config**.
2. Click the button **Export**. Follow the download instructions on the screen. You can use this configuration file for upload into another FV-110,

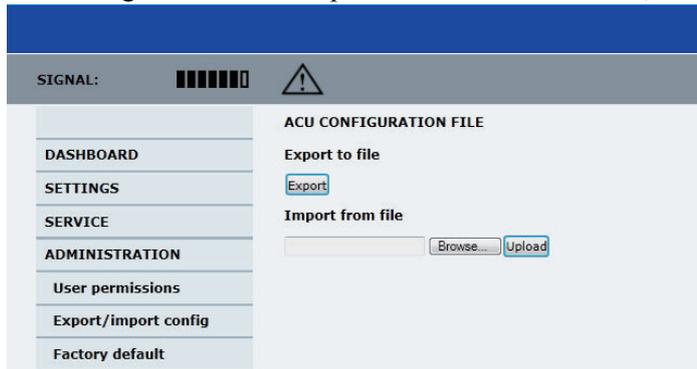


Figure 5-40: Web interface: Administration, Export/import configuration

To load a configuration from a file, do as follows:

1. Select **ADMINISTRATION > Export/import config**.
2. Click the button **Browse** and locate the configuration file (.cfg file) you want to upload. Then click the button **Open**.
3. In the web interface click the button **Upload**.

To clone a system configuration, do as follows:

1. Reset to factory default, see the following section for details.
2. Import a configuration from file, see section above.

To reset to factory default

When resetting FV-110 to factory default, the following settings are deleted:

- All satellite profiles
- All VSAT modem profiles
- Blocking zones
- Heading settings
- Network setup
- User permissions
- ACU display: brightness setting

To reset to factory default settings, do as follows:

1. From the left navigation pane, select **ADMINISTRATION > Factory default**.

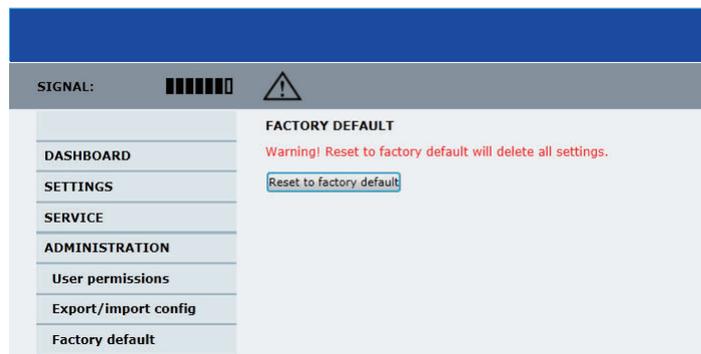


Figure 5-41: Web interface: ADMINISTRATION, Factory default

2. Click **Reset to factory default**.

Note | Calibration data for azimuth and cable calibration are not reset during factory default.

5.4 Keypad and menus of the ACU

5.4.1 ACU display and keypad

In the ACU display you can see the current state of the system. You can also see events (warnings, errors and information) and how the system has been configured. Use the keypad to navigate through the menu tree.

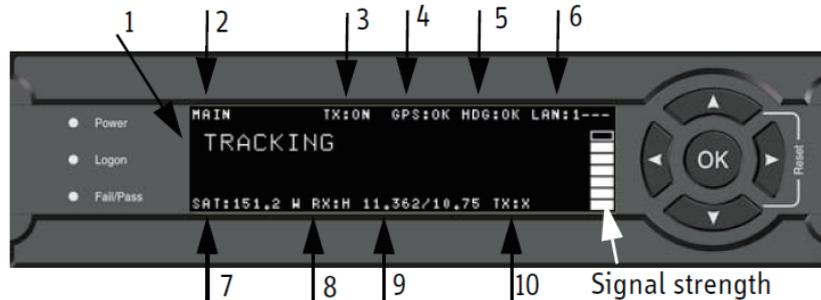


Figure 5-42: Display (example) and keypad of the ACU

1. Current status of the FV-110:
 - NOT READY** (Waiting for input from GNSS, e.g. GPS)
 - READY** (no satellite profile selected)
 - POINTING ANTENNA** (Locating the satellite)
 - ACQUIRING SIGNAL** (Acquiring the satellite signal)
 - TRACKING** (Tracks the current satellite)
 - BLOCKING ZONE** (Antenna is pointing into a blocking zone)
2. Current menu.
3. TX: Current transmission state, ON or OFF (off when in blocking zone).
4. GPS: GPS signal is received from the GPS module, OK or ---.
5. HDG: Ship heading data received from the ship's gyro, OK or ---.
6. LAN: LAN connectors used, 1, 2, 3, 4, ---.
7. SAT: Satellite position of currently active satellite profile.
8. RX: RX polarisation of currently active satellite profile. H (horizontal), V (vertical), L (left-hand) R (right-hand).
9. RF tracking frequency in GHz and LNB LO Frequency.
10. TX:XTX polarisation of currently active satellite profile. X (Cross polarisation) or Co (Co-pol).

After 1 hour the display is dimmed to lowest intensity. Press any key to light up the display.

5.4.2 Navigating the menus

Use the keypad to navigate the menus.

- Press **OK** or **▶** to select a menu item.
- Use the arrow keys **▲** and **▼** to go through the menu items or enter a number, digit by digit.
- Use the arrow keys **◀** and **▶** to go through the settings and move from one digit to the next.
- Press **OK** to select a setting.
- Press **◀** again to move one level up. If applicable, confirm to store the new setting by pressing **OK**.



5.4.3 The menu tree

In the menu tree you can see how the system has been configured. To enter satellite information directly, use a connected PC and the web interface.

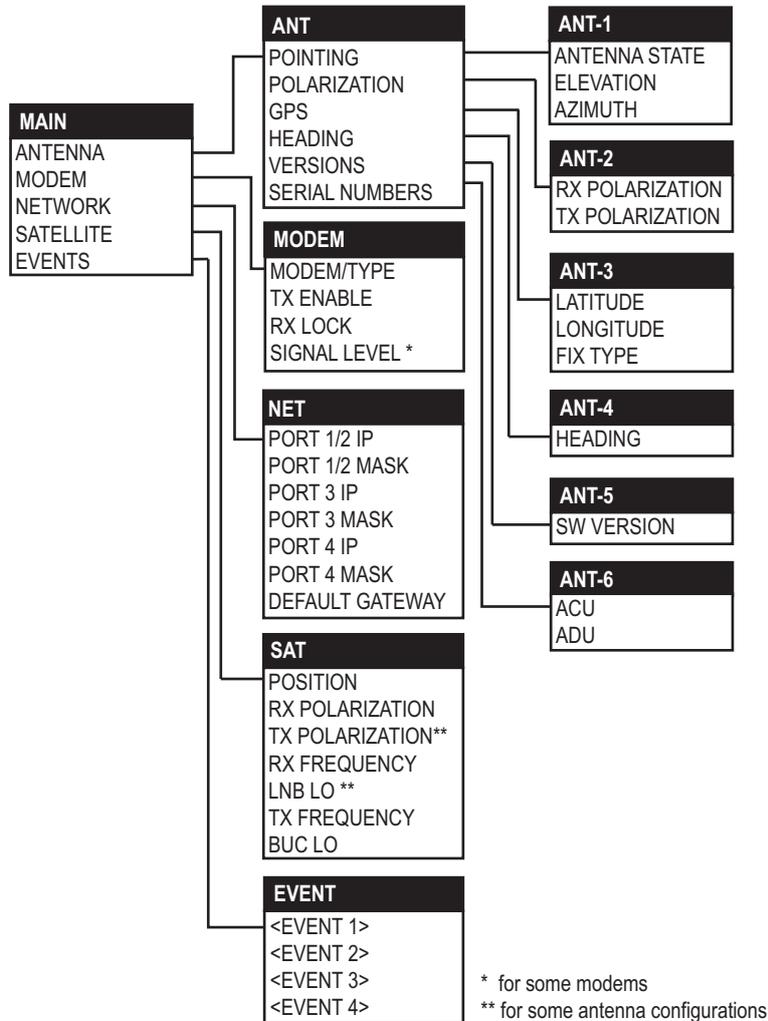


Figure 5-43: Antenna Control Unit, menu tree

Top-level menu

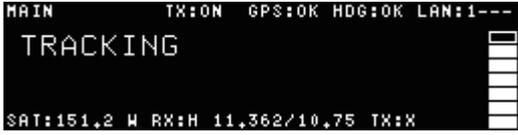
Top-level menu	Description
MAIN	<p>View with current status of the FV-110. Example when logged on to the satellite:</p>  <p> This view is displayed after a time out of 10 minutes. Press any key (except left arrow) to enter the menu at MAIN. New events are shown in this display. If an event is displayed, press OK to jump directly to the menu EVENTS for viewing the currently active events. </p>
ANTENNA	Shows the current ADU parameters, position, software version and serial numbers of the ADU and ACU.
MODEM	Selected VMU type and setup, including signal level.
NETWORK	Shows the IP addresses and netmasks of the LAN connectors of the ACU and the management mask.
SATELLITE	Current satellite information. This information is entered using the web interface.
EVENTS	View system events. Active events are shown as: X ACTIVE EVENTS in the MAIN display. Press OK to update the list.

Table 5-16: Top-level menus of the ACU

Menu descriptions

ANTENNA menu	Description
POINTING	<p>ANTENNA STATE: Current state of the antenna, e.g. TRACKING ELEVATION: Current elevation angle of the antenna AZIMUTH: Current azimuth of the antenna, with reference to North</p>
POLARISATION	<p>RX POLARISATION: HORIZONTAL or VERTICAL, read from connected VSAT modem. TX POLARIZATION: X-POL or Co-POL, read from connected VSAT modem.</p>

Table 5-17: ANTENNA menu of the ACU

ANTENNA menu	Description
GPS	LATITUDE: current latitude, read from GPS module. LONGITUDE: current longitude, read from GPS module. FIX TYPE: 2D or 3D
HEADING	Ship's heading in degrees with reference to North, provided by the ship's gyro.
VERSIONS	Current software version.
SERIAL NUMBERS	ACU: ACU serial number; ADU: Serial number of the antenna

Table 5-17: ANTENNA menu of the ACU (Continued)

MODEM menu	Description
MODEM TYPE	Connected modem type.
TX ENABLE	On or off, information delivered by the connected VSAT modem.
RX LOCK	On or off, information delivered by the connected VSAT modem.
SIGNAL LEVEL	Current input signal level from VSAT modem. iDirect openAMIP modem: (PWR) 0-500, delivered by the connected modem. For values <250 the antenna searches after a new signal. Other modem: Signal level in dB.

Table 5-18: MODEM menu of the ACU

NETWORK menu	Description
PORT 1/2 IP	Current IP address for LAN 1 and LAN 2.
MASK 1/2	Current netmask for LAN 1 and LAN 2.
PORT 3 IP	(LAN 3) Current IP address of the FV-110 web interface (default: 192.168.0.1).
MASK 3	(LAN 3) Current netmask of the FV-110 web interface (default: 255.255.255.0).
PORT 4 IP	Current IP address for LAN 4.
MASK 4	Current netmask for LAN 4.
DEFAULT GATEWAY	Current default gateway.

Table 5-19: NETWORK menu of the ACU

SATELLITE menu	Description
POSITION	Position of the current satellite.
RX POLARISATION	HORIZONTAL, VERTICAL.
TX POLARIZATION	X-polarisation or Co-polarisation, auto-selected by VSAT modem
RX FREQUENCY	Ku band receiving frequency of the active satellite, auto-selected by VSAT modem.
LNB LO	Auto selected by VSAT modem.
TX FREQUENCY	Transmission frequency, auto-selected by VSAT modem
BUC LO	12.8 GHz, system parameter

Table 5-20: SATELLITE menu of the ACU

EVENT menu	Description
<EVENT>	<p>In this menu all active events are listed. Use ▼ and ▲ to go through the active events.</p> <p>Events can be of the type WARNING or ERROR.</p> <p>If a new event occurs or there is a change in the event list while you are in the EVENTS menu, a * is shown in the upper left corner of the display, next to the menu name. Press OK to update the EVENTS list, the * will be removed.</p> <p>A > means the event text is longer than the display. Press to > to see the remaining text.</p>

Table 5-21: EVENTS menu of the ACU

Example: **EVENT 1/4***: This is the first event out of a list of 4 and there has been a change in the list. EVENT 1/4 will always be shown, the * indicates that there has been a change.

5.4.4 Adjusting brightness of the display

To adjust the brightness do the following:

1. Press and hold **OK** for a short moment until BRIGHTNESS XXX% is displayed (XXX is the current brightness value).
2. Hold OK pressed + press ▲ for lighter or ▼ for darker display.
3. Release OK to leave the brightness menu.

5.4.5 Resetting the system

To reset the system do the following:

1. Press and hold ▲ and ▼ until the ACU display shuts down and the ACU reboots.



Figure 5-44: Reset the system

2. Wait until the system has rebooted and is operational again. The last active satellite profile will be used.

5.5 SNMP support

The FV-110 supports SNMP v2 requests to retrieve configuration and present settings. SNMP is always enabled on all Ethernet interfaces. The SNMP community string is **public**.

The FV-110 offers via SNMP most of the data that are available from the DASHBOARD web pages. Detailed documentation about supported OIDs can be found in the FV-110 MIB file.

The MIB entries are grouped as shown below:

- System configuration
- Navigation coordinates
- Antenna pointing
- Dashboard and profile
- Tracking receiver

Note | None of the SNMP values need to be polled more often than once a minute. Polling SNMP values more frequently will impact the performance of the ACU.

You can acquire the MIB file as follows:

Download the ACU MIB file directly from the ACU from the **HELPDESK** page.

Click the link **Download MIB file** and save the file on your computer.

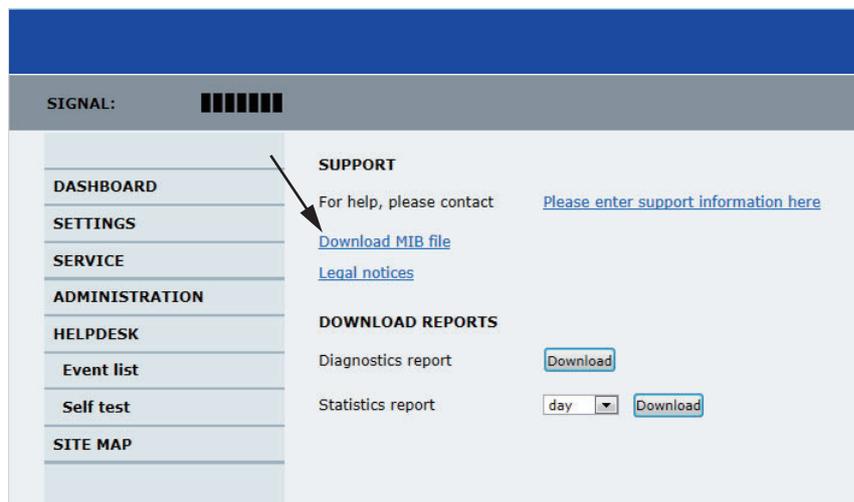


Figure 5-45: Download of MIB file

Installation check

Now that you have installed the system, you can test it to verify it is ready for customer delivery. Follow the check lists below to test the system for proper operation.

- *Installation check list: Antenna*
- *Installation check list: ACU, connectors and wiring*
- *Installation check list: Functional test in harbor*

6.1 Installation check list: Antenna

Step	Task	Further information	Done
1.	Check that the antenna is free of obstructions.	See <i>Obstructions (ADU shadowing)</i> on page 2-4.	
2.	Make sure there is sufficient space for access through the service hatch.	See <i>To install the ADU</i> on page 2-19.	
3.	Make sure to maintain the vertical orientation of the ADU center line.		
4.	Check that the ADU is installed where vibrations are limited to a minimum.		
5.	Check that you programmed the blocking zones correctly.	See <i>Blocking zones – azimuth and elevation</i> on page 2-5 and <i>To set up blocking zones (RX and TX)</i> on page 5-27.	
6.	Make sure that the safety distance for radiation hazard of 30 metres is kept.	See <i>Safe access to the ADU: Radiation hazard</i> on page 2-6.	
7.	Check that the mounting height of the antenna is in accordance with the ship's min. roll period.	See <i>Ship motion and offset from the ship's motion centre</i> on page 2-7.	

Table 6-1: Installation check list: Antenna

Step	Task	Further information	Done
8.	Make sure that the requirements for mast foundation and height, including flatness, gusset plates and distance from welding seams are met.	See <i>ADU mast design: Foundation and height</i> on page 2-8.	
9.	Make sure that the distances to radar, Inmarsat systems, GPS receivers and other transmitters are as required.	See <i>Interference</i> on page 2-13.	
10.	Make sure that the drain tube is open and risk for water intrusion is at a minimum.	See <i>Other precautions</i> on page 2-17.	
11.	Check that the ADU is grounded correctly, using the mounting bolts.	See <i>To ground the ADU</i> on page 2-24 and <i>Grounding and RF protection</i> on page F-1.	

Table 6-1: Installation check list: Antenna (Continued)

6.2 Installation check list: ACU, connectors and wiring

Step	Task	Verification and further information	Done
1.	Check that the ACU is grounded correctly, using the mounting bolts and washers.	See <i>To ground the ACU</i> on page 2-27 and <i>Grounding and RF protection</i> on page F-1.	
2.	Make sure you strain relieved the cables.	See <i>To install the ACU</i> on page 2-26.	
3.	Make sure that the VSAT modem is mounted close to the ACU.	See <i>General mounting considerations — VMU</i> on page 2-27.	
4.	Check that the ADU antenna N-connector is properly connected with the 50 Ohm RF cable.	Visual inspection of the cover plate at the bottom of the ADU.	
5.	Check that the ACU antenna N-connector is properly connected with the 50 ohm RF cable.	Visual inspection of the connector panel of the ACU.	
6.	Check that the ACU's Rx Out is connected to the VSAT modem's Rx in using the included 1 m F-F 75 ohm cable.	Visual inspection of the connector panel of the ACU and the VSAT modem.	
7.	Check that the ACU's Tx In is connected to the VSAT modem's Tx out using the included 1 m F-F 75 ohm cable.	Visual inspection of the connector panel of the ACU and the VSAT modem.	

Table 6-2: Installation check list: ACU, connectors and wiring

Step	Task	Verification and further information	Done
8.	<p>Check connection of the VSAT modem:</p> <p>COMTECH only!: Check that the ACU RS-232 port is connected to the Remote Control port and Alarm port of the VMU using the serial cable (specifications in <i>Modem Cable COMTECH Serial & RSSI TT7016A</i> on page B-2).</p> <p>iDirect iNFINITI Series/ Evolution only!: Check that the ACU RS-232 port is connected to the Console port of the VMU using the included serial cable.</p> <p>iDirect iNFINITY Series only!: Check that the ACU LAN port 1 is connected to the LAN B of the VMU using the included CAT5 Ethernet cable.</p> <p>iDirect Evolution only!: Check that the ACU LAN port 1 is connected to the LAN of the VMU using the included CAT5 Ethernet cable.</p> <p>STM SatLink 2900: Check that the ACU LAN port 1 is connected to the LAN of the VMU using the included CAT5 Ethernet cable.</p> <p>Gilat SkyEdge II VSAT modem: Check that the ACU RS-232 port is connected to the SERIAL port of the VMU using the included serial cable.</p>	<p>Visual inspection of the connector panel of the ACU and the VSAT modem. See also:</p> <p><i>COMTECH 570L and ROSS box</i> on page C-17</p> <p><i>OpenAMIP setup for iDirect iNFINITI & Evolution</i> on page C-3</p> <p><i>OpenAMIP setup for iDirect iNFINITI & Evolution</i> on page C-3</p> <p><i>STM SatLink 2900 VSAT modem</i> on page C-22</p> <p><i>Gilat SkyEdge II VSAT modem</i> on page C-25</p>	
9.	<p>Check that the ADU's NMEA 0183 connector is connected to the NMEA 0183 bus of the vessel using the included multi-connector</p>	<p>Visual inspection of the connector panel of the ACU connector.</p>	
10.	<p>Measure that the power has the correct polarity in the power connector, before connecting it to the ACU power input. (V_{in+}: left, V_{in-}: right).</p>	<p>Use a volt meter. See Table 3-1: <i>DC Input plug, outline and pin assignment</i> on page 3-2.</p>	

Table 6-2: Installation check list: ACU, connectors and wiring (Continued)

6.3 Installation check list: Functional test in harbor

Step	Task	Further information	Done
1.	Check that the antenna is tracking the satellite	The logon LED in the ACU display must be steady green and the display shows: TRACKING . In the web interface check: DASHBOARD: System status: Tracking	
2.	Check that the VMU is in lock and ready for Tx.	In the web interface check: DASHBOARD > VSAT MODEM > Signal level and RX frequency show values.	
3.	Connect a user PC LAN (not the service PC) to the Internet LAN connector, either on the LAN port 2 of the ACU (only X5 VSAT modem) or to the User LAN connector on the VMU.	Check the VSAT modem documentation for details.	
4.	Open a DOS window and type: ping 4.2.2.2.	Check that you get a response.	
5.	Open a web browser and browse to www.google.com.	Check that the web page is downloaded.	
6.	If step 4 is successful and step 5 is not then it seems like the DNS is not configured correctly.	Check the VSAT modem documentation how to set up the DNS server, "Obtain DNS server address automatically" or enter specific DNS server addresses.	

Table 6-3: Installation check list: Functional test in harbour

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Service

In this chapter you find the following sections:

- *Getting support: Helpdesk*
- *Software update*
- *Status signalling with LEDs and status messages*
- *Removal and replacement of the ACU*
- *Removal and replacement of ADU modules*
- *Troubleshooting*

7.1 Getting support: Helpdesk

If this manual does not provide the remedies to solve your problem, contact your service provider.

7.1.1 Help desk and diagnostic report

During the installation you can enter the support contact for this installation.

To access the Help desk, select **HELPDESK** from the left navigation pane.

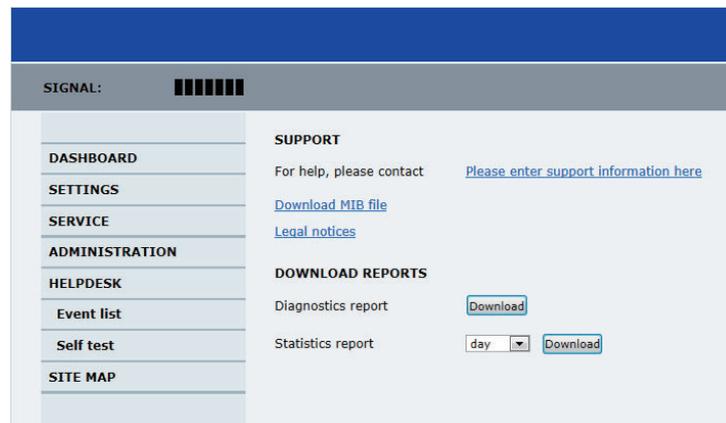


Figure 7-1: Web interface: HELPDESK

Click the link, enter support contact information and click **Apply**.

You can download the MIB file.

At Legal notice the licence text for the source code of the parts of the FV-110 software that falls under free and open source software can be displayed.

If you need help **with ACU or ADU related issues** call your service provider.

Download reports

You can download a diagnostic report. This report contains information relevant for the service personnel during troubleshooting. To generate a diagnostics report click **HELPDESK > Download** and save the file to your computer.

You can download a statistics report. This report contains information relevant for the service personnel during troubleshooting. To generate a statistics report select the period for the statistics from the drop down list and click **Download**.

You can also configure the system to send statistics reports at defined time intervals. For further details on this see *To send a diagnostics report* on page 5-35.

Event list

When an event is registered, the web interface shows an event icon  in the icon bar as long as the event is active. The ACU display shows also active events. To view the event list with active events, click the event icon from the icon bar at the top of the web interface, or select **HELPDESK > Event list** from the left navigation pane.

ACTIVE EVENTS	
Time UTC	ID Unit Severity Text
13:06:32 10 Sep 2012	09010-0 Terminal ERROR KDM link/SW version (00000003)
13:06:27 10 Sep 2012	08108-0 Terminal ERROR TX Power Detector calibration (00000000)
NOTIFICATIONS	
Notification list empty	

Figure 7-2: Web interface: HELPDESK, Event list

The **Event list** page shows a detailed list of active events and notifications including the time of the first occurrence, ID and severity of the event message, and a short text describing the error. Active events are cleared from the event list when the error is cleared. They are moved to the section **Notifications** and are displayed for 24 hours. All entries in the section **Notifications** are cleared automatically after 24 hours and after restart of the system.

For a list of all events with description, error code (ID), explanation and remedy see *List of events with explanation and remedy* on page G-1.

Self test

You can start a self test of the FV-110 ADU and ACU.

1. Click **Self test** in the **HELPDESK** page.
2. Click the menu item **Self test**.

Important

Warning! The FV-110 will reboot to perform the self test. Rebooting the ACU will terminate all existing connections.

Reset to factory defaults

You can reset the FV-110 ADU and ACU to factory defaults. See *To reset to factory default* on page 5-44.

Important

Warning! Reset to factory default will delete all settings, including satellite and VSAT modem profiles, blocking zones, network setup, user permissions and ACU display brightness settings.

7.2 Software update

7.2.1 Hardware and software requirements

The following items are required before the software can be updated:

- One computer with a standard Ethernet port available.
- A standard Internet browser.
- 1024×768 pixels or higher display resolution. The program is best viewed using small fonts.
- One straight LAN cable.
- The file containing the new software.

7.2.2 Software update (ADU and ACU)

Note

Software update should only be done by qualified service personnel.

You can update the software in the following way:

- *Software update using the web interface of the ACU*

Software update using the web interface of the ACU

1. Power up the FV-110 system, i.e. switch on the ACU. Wait until the message “Initializing” has disappeared from the ACU display.
2. Connect a PC to LAN interface 3 (Service port, standard Ethernet) or the front LAN connector of the ACU.

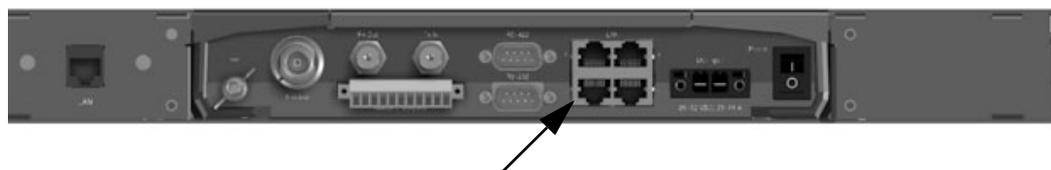


Figure 7-3: LAN connector used for software update (web interface)

3. Open your Internet browser and enter the IP address of the ACU. The IP address is **http://192.168.0.1** (default). For further details on network setup see *To configure the LAN network* on page 5-29.
4. The web interface opens directly with the **DASHBOARD** page.
5. Click **SERVICE** from the left navigation pane. The **Upload** page is displayed.

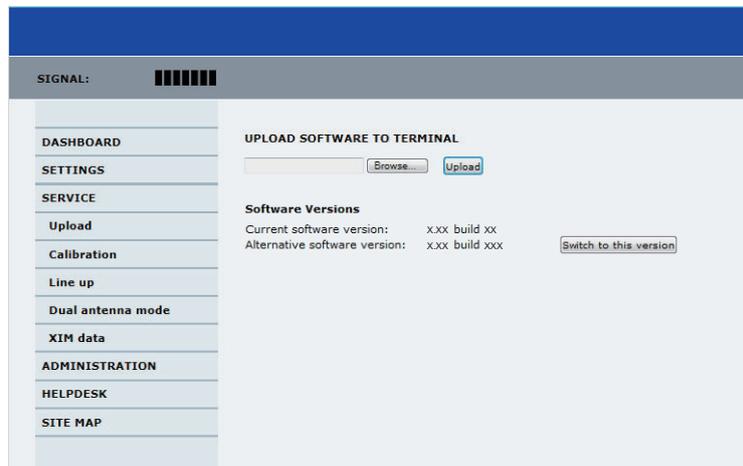


Figure 7-4: Software update with the web interface

6. Click **Browse...** and locate the new software file.
7. Click **Upload**.
Note that the upload procedure takes a couple of minutes. When done, the ACU automatically restarts with the new software version.

Important

Do not browse away from the upload page. This will terminate the upload process. Wait for the browser to reload automatically.

The start-up procedure after a software upload takes longer than the usual start-up time, as the software in the ADU must also be updated. The ACU display shows: **ADU SW UPLOAD**.

If software upload fails - how to recover

To recover from a failed software upload, turn off the ACU and turn it on again. Then repeat the upload procedure as described in *Software update* on page 7-3.

7.2.3 To verify the software update

1. The software version can be viewed in the **DASHBOARD** window of the web interface.
2. After completing the software update procedure, the ACU will perform a POST (Power On Self Test).
3. When the POST has finished, the green Pass/Fail LED on the front of the ACU must become steadily green. Verify that the Pass/Fail LED is not red nor flashing orange once every 2 seconds. Wait until the Pass/Fail LED is green.

4. Verify that the software update has been completed successfully. You find the software version number in the **DASHBOARD** window of the web interface.

The screenshot displays the FURUNO web interface dashboard. The top navigation bar includes the FURUNO logo and the text 'FURUNO-SC - FV-110'. Below the navigation bar, there is a 'SIGNAL:' indicator with a bar graph. The main content area is divided into several sections: 'DASHBOARD', 'SETTINGS', 'SERVICE', 'ADMINISTRATION', 'HELPDESK', and 'SITE MAP'. The 'DASHBOARD' section is active and contains the following data:

DASHBOARD	
System status	Tracking
GPS position	55°48' N, 12°31' E
Vessel heading	0.35°
Satellite profile	VSAT Service
Satellite position	53°E
RX polarisation	Horizontal
TX polarisation	X-pol
RX RF frequency	11.084111 GHz
LNB LO frequency	9.750000 GHz
TX RF frequency	14.384637 GHz
BUC LO frequency	12.800000 GHz
Tracking RF frequency	11.084111 GHz
ACU part name	TT-7016A
ADU part name	TT-7009A
ACU serial number	12345678
ADU serial number	12345678
Software version	1.48 build 108
POINTING	
Azimuth, Elevation Geo	134.2° 17.4°
Azimuth, Elevation Rel	133.8° 16.5°
Polarisation skew	-24.0°
TX	
BUC TX	On
BUC output power	■■■■
VSAT MODEM	
Model	COMTECH 570L and ROSS
Signal level	9 dB
RX IF frequency	1334.111000 MHz
TX IF frequency	1584.838000 MHz
TX allowed	Yes

A red circle highlights the 'Software version' entry, which is '1.48 build 108'. A 'Refresh' button is located at the bottom of the dashboard section.

Figure 7-5: Verifying software update, FV-110

7.3 Status signalling with LEDs and status messages

Built-In Test Equipment

The ADU and the ACU have a Built-In Test Equipment (BITE) function in order to make fault diagnostics easy during service and installation. The BITE test is performed during:

- Power On Self Test (POST), which is automatically performed each time the system is powered on.
- Person Activated Self Test (PAST), which is initiated by starting a self test in the web interface **HELPDESK > Self test**.

For details on error messages after a POST or a self test see *Event list* on page 7-2.

Means of signalling

The FV-110 provides various methods for signalling the system status. **LEDs** on the front panel of the ACU are used to signal:

- Power on/off
- Logon
- Fail/Pass

The built-in web interface of the ACU shows any events (BITE error codes) with a short message describing each error. This is also displayed in the ACU.

In an error situation, one of the following system status messages may be shown:

- ACU POST error
- ADU POST error
- SAFE MODE (plus information about the specific error, see *System messages* on page G-1).

7.3.1 LEDs of the ADU modules

Each ADU module has a Power and a Service LED.

LED	Behaviour	Description
Power	Steady green	Power supply OK
	Off	No power
Service	Steady green	Module ok, application running.
	Flashing green	Waiting for upload
	Flashing red/green	Uploading application
	Steady red	Module error or loading error

Table 7-1: LEDs of the ADU modules

For a list of modules see *Removal and replacement of ADU modules* on page 7-9.

7.3.2 LEDs in the ACU

The ACU has 3 LEDs: Power, Logon and Fail/Pass LED.



Figure 7-6: LEDs on the ACU

LED	Behaviour	Description
Power	Steady green	Power supply OK
	Steady red	Power supply failure
	Off	No power
Logon	Flashing green	Current status is displayed: <ul style="list-style-type: none"> • Searching satellite • Identifying satellite • Carrier lock & TX enabled from modem
	Steady green	Satellite link established
	Off	No satellite link acquired
Fail/Pass LED	Steady red	A fault which prevents operation is present in the system (ACU, ADU, MODEM).
	Flashing green	A Power On Self Test (POST) or Person Activated Self Test (PAST) in progress. The current status is displayed.
	Flashing red	Active BITE failure or warning. The event is shown in the ACU display.
	Steady green	No faults.

Table 7-2: LEDs on the ACU

7.4 Removal and replacement of the ACU

There are no parts in the ACU that you can remove or replace.

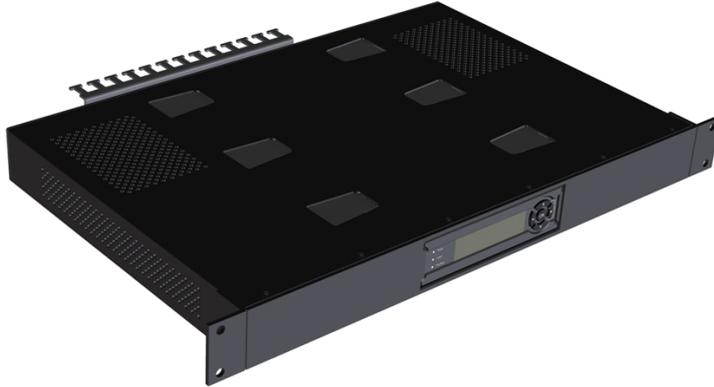


Figure 7-7: Removal and replacement of the ACU

7.5 Removal and replacement of ADU modules

All replacement of modules must be carried out by FURUNO. The figure below shows the modules and their position. Some modules are equipped with LEDs for status information and troubleshooting.

For instructions on how to open and remove the service hatch see *To open and remove the service hatch* on page 2-23.

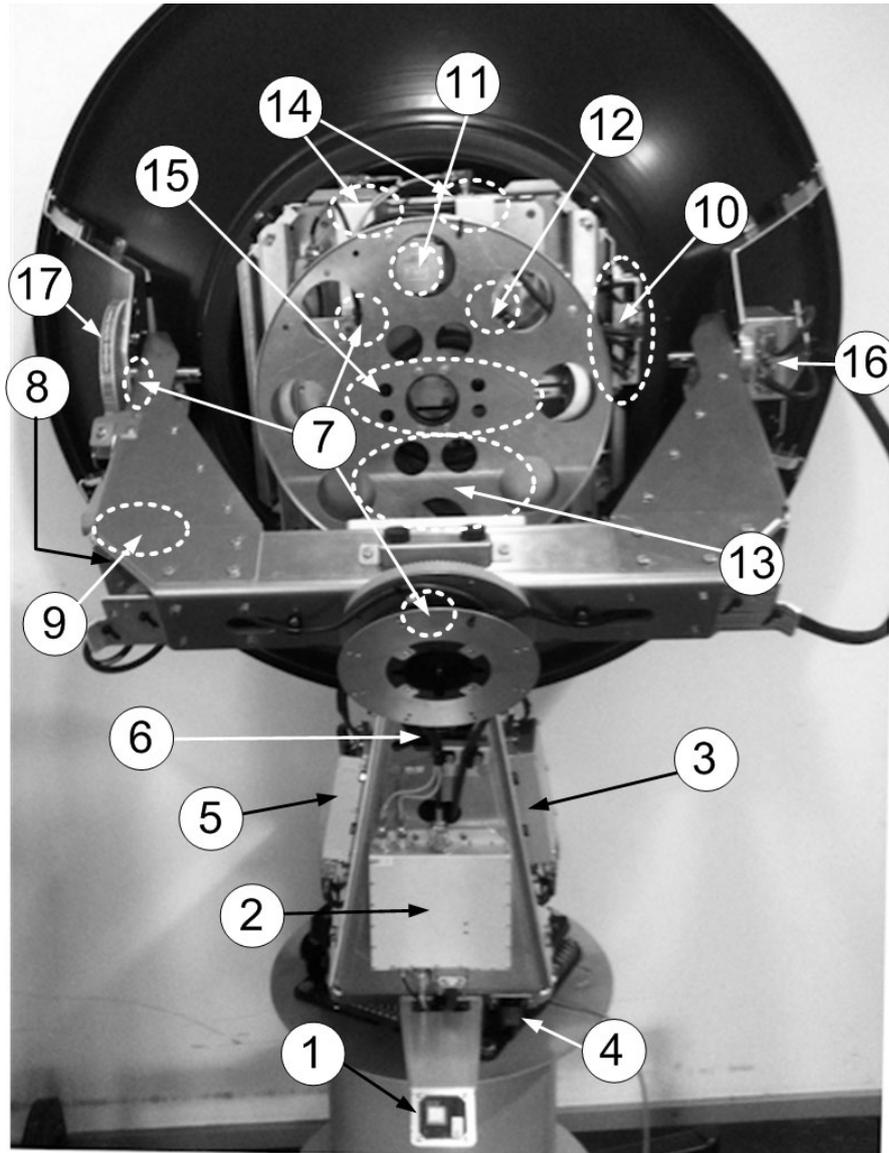


Figure 7-8: FV-110: ADU modules and motor stop switch

1. GPS module.
2. VSAT Interface Module (VIM).
3. Pedestal Control Module (PCM).

4. Service switch.
In switch-off position the DC Motor Driver modules (DDM), the Polarisation Motor Module (PMM) and the BUC are turned off for safe conditions during service and repair. The switch must be in on position for normal ADU operation.
5. DC-Motor Driver Module for cross elevation (DDM).
6. Cross elevation motor and encoder.
7. Zero Reference Module (x4, 3 in the previous figure, 1 in the next figure) (ZRM) (not visible on photo).
8. DC-Motor Driver Module for elevation (on the bottom side) (DDM).
9. Elevation motor and encoder (not visible on photo).
10. Polarisation Motor Module (PMM).
11. Polarisation motor.
12. Polarisation encoder (not visible on photo).
13. Block Up Converter (BUC). (behind cable screen, not visible on photo)
14. Low Noise Block down converter (x2) (LNB).
15. Ortho Mode Transducer (OMT) (behind cable screen, not visible on photo).
16. Inertial Sensor Module (ISM).
17. Elevation locking pin to lock the antenna dish in a fixed position (for safety during service) (not visible on photo).

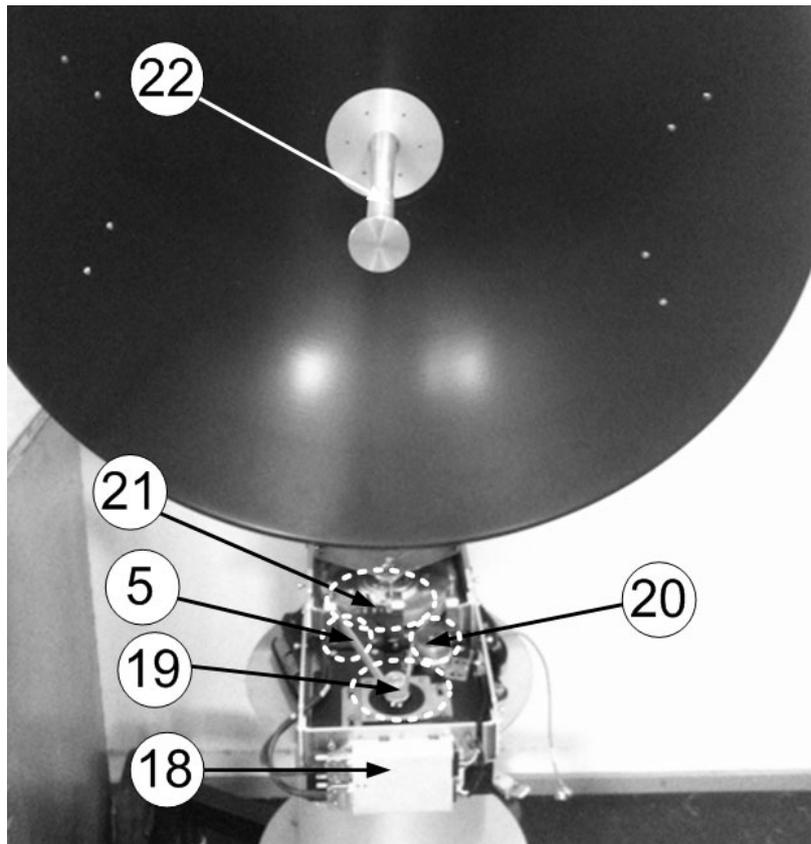


Figure 7-9: FV-110: Above Deck Unit modules (continued)

18. DC-Motor Driver Module for Azimuth (DDM).

19. Azimuth motor.

20. Azimuth encoder.

21. Rotary joint.

22. Feed horn.

Before contacting your service partner check the LEDs on all modules (VIM, DDMs, PCM, PMM and ISM). See *LEDs of the ADU modules* on page 7-6 and *LEDs in the ACU* on page 7-7.

7.6 Troubleshooting

7.6.1 Overview

This section describes an initial check of the primary functions of the FV-110 system, and provides some guidelines for troubleshooting.

Generally, if a fault occurs without any obvious reason, it is always recommended to observe the LEDs and the ACU display showing the active events. Possible failure states are shown in the web interface and the display of the ACU:

- SAFE MODE (e.g. hardware error, missing communication link between the ADU and ACU, excessive ship motion)
- XIM error (after exchange of modules)
- ADU POST error (hardware error)
- ACU POST error (hardware error)

For information on the function of the LEDs, see *Status signalling with LEDs and status messages* on page 7-6.

For a list of all the error messages and warnings, see *Event messages – overview* on page G-1.

7.6.2 Event list for troubleshooting

You can use the event list for troubleshooting. It is described in detail at *Help desk and diagnostic report* on page 7-1.

You can download the event list as part of a diagnostic report.

7.6.3 Diagnostics report for troubleshooting

You can generate a diagnostic report containing results from the POST, all events and system log information since the last reset to factory default. For more information see *To send a diagnostics report* on page 5-35.

7.6.4 To verify that the VSAT antenna can go into tracking mode

In case there is no RX lock on the connected VSAT modem you can activate a service profile to verify that the transponder data used during calibration are received correctly. If the FV-110 can go into tracking mode it not likely that it is defective.

1. Go to **SETTINGS** or **Satellite profiles**.
2. Activate a satellite profile that is used for azimuth calibration. This is a satellite profile that uses the VSAT modem profile **Service & Calibration**.
3. Go to **DASHBOARD** and monitor the field System status. If the field ends up showing Tracking, the FV-110 can track the satellite and is most likely not the reason why the VSAT modem is not in RX lock.

Data sheets

A.1 VSAT LNB Data Sheet (physical LNB)

The following table shows the data of the LNBs which are fitted in the ADU.

The FV-110 is designed to make any Ku Band frequency in the range of 10.7 GHz to 12.75 GHz available to a VSAT modem by allowing the user to select the LNB LO of his choice – without having to exchange the physical LNBs in the ADU. This is achieved by the sophisticated single-cable solution of the FV-110.

Please see A.1.1 for configuration information.

Interface	Model	Spec.
Input, Ku-band	2-band	WR75 waveguide
Output, IF	2-band	F (50 Ohm)
LO type	2-band	Locked to 10 MHz external reference over IF interface or ACU internal
LO frequencies	2-band	9.75, 10.75 GHz

Table A-1: Technical specifications for VSAT LNB 1/2

Parameter	Condition/remark	Unit	Min.	Typical	Max.
Input frequency range	VSAT	GHz	10.7		12,75
Output (IF) frequency range	2-band	MHz	950		2150
VSWR	Input	-			2.0 : 1
	Output	-			1.7 : 1
Noise Figure	At 25 °C	dB		0,8	
LO stability	Over temp. range	kHz	-10	0	10
Gain		dB		60	
Gain (relative)	Over 500 MHz BW	dB	-2.0	0	2.0
Gain (relative)	Over 36 MHz BW	dB	-0.5	0	0.5
External ref. freq. (input)	Nominal	MHz		10	
Power supply voltage	DC	V	11.0		19.0
Supply current	DC	mA			350

Table A-2: Technical specifications for VSAT LNB 2/2

Parameter	Condition/remark	Unit	Min.	Typical	Max.
LO selection voltage	Voltage, low (L) (input)	V	11.0		14.0
	Voltage, high (H) (input)	V	16.0		19.0
Temperature range (ambient)	Operation	°C	-30		75
	Storage	°C	-40		85
Dimensions (incl. connector) over all	L	mm			140
	W	mm			58
	H	mm			50
Weight	Total	g			350

Table A-2: Technical specifications for VSAT LNB 2/2 (Continued)

A.1.1 VSAT LNB user installation and configuration information

The FV-110 can interpret 4-band LNB switching signals as well as exact LO information acquired directly from the attached VSAT modem by means of a data connection.

When using a VSAT modem which is integrated to use LO information transferred via a data connection, the LO must be in the range of 9.6 GHz to 11.3 GHz (Optimum values are 9.75 GHz and 10.75 GHz as these match the physical LNB values).

All VSAT modems that can be used with FV-110 use this approach for selecting the LO frequency, except a COMTECH modem with ROSS server. A COMTECH modem with ROSS server reads switching signals by means of a data connection instead of using voltage and tone signals.

Example configuration for an iDirect i5100 (L-Band range 950 - 1700 MHz)

Ku-Band frequency: 11.7389 GHz
 L-Band frequency: 1638.9 MHz
 LO: 10.1 GHz

Since the LO frequency of 10.1 GHz is in the range of 9.6 GHz to 11.3 GHz, this is a valid set of data. The FV-110 will tune to 11.7389 GHz and provide the carrier on the L-Band frequency 1638.9 MHz.

Example configuration for a special VSAT modem (L-Band range 950 - 1450 MHz)

Ku-Band frequency: 12.750 GHz
 L-Band frequency: 1450 MHz
 LO: 11.3 GHz

Since the LO frequency of 11.3 GHz is in the range of 9.6 GHz to 11.3 GHz, this is a valid set of data. The FV-110 will tune to 12.750 GHz and provide the carrier on the L-Band frequency 1450 MHz.

4-band switching

When using 4-band switching and a VSAT modem which is integrated with FV-110 to use voltage and tone for switching, the switching is done according to the following table:

LO frequency	Voltage 11-19 V	Tone 22 kHz	Ku band frequency (L-band 950-2150 MHz)
9.75 GHz	11-14 V	Tone off	10.7-11.9 GHz
10.25 GHz	11-14 V	Tone on	11.2-12.4 GHz
10.75 GHz	16-19 V	Tone off	11.7-12.75 GHz
11.25 GHz	16-19 V	Tone on	12.2-12.75 GHz

Table A-3: 4-band switching

Currently none of the VSAT modems which are integrated with the FV-110 use voltage and tone switching.

A.2 VSAT 8 W BUC Data Sheet (Extended)

Interface	Model	Spec.
Input, IF	-	N (50 Ohm)
Output, Ku-band	8 W	WR75 waveguide (39.0 dBm min.)
Spectrum	-	Non inverting
LO type	-	Locked to 10 MHz external reference over IF interface or ACU internal
LO frequency	Extended	12.80 GHz
TX ON/OFF	-	10 MHz reference ON/OFF
Cooling	-	External temperature controlled fan - not incl. BUC

Table A-4: Technical specifications for VSAT 8 W BUC 1/3

Parameter	Condition/remark	Unit	Min.	Typical	Max.
Output frequency range	VSAT Ext. TX	GHz	13.75		14.50
Input (IF) frequency range	Extended	MHz	950		1700
VSWR	Input (10, 950 - 1700 MHz)	-			2.0 : 1
	Output (13.75 - 14.50 GHz)	-			2.0 : 1

Table A-5: Technical specifications for VSAT 8 W BUC 2/3

Parameter	Condition/remark	Unit	Min.	Typical	Max.
Output power at P1dB	Worst case	dBm	39.0		
Output power 10 MHz ref OFF	TX band, at -35 dBm ref.	dBm			-60
Gain (absolute linear)	Over output freq. range	dB	61	65	69
Gain (relative)	Over 500 MHz BW	dB	-2.5	0,0	2.5
Gain (relative)	Over 36 MHz BW	dB	-1.0	0,0	1.0
Spurious	RX band	dBc			-60
	TX band	dBc			-15
Phase noise	10 Hz	dBc/Hz			-50
	100 Hz	dBc/Hz			-60
	1 kHz	dBc/Hz			-70
	10 kHz	dBc/Hz			-80
	100 kHz	dBc/Hz			-90
	1 MHz	dBc/Hz			-110
IMD3	At 2 x +33 dBm carriers	dBc			-26
External ref. freq. (input)	Nominal	MHz		10,000000	
External reference freq. (input)	Deviation	Hz	-100	0	100
Power supply voltage	DC	V	20.0		50.0
Supply power	DC	W			85

Table A-5: Technical specifications for VSAT 8 W BUC 2/3 (Continued)

Parameter	Condition/remark	Unit	Min.	Typical	Max.
Temperature range	Operation w. external forced cooling				
		°C	-30		75
	Storage	°C	-40		85
Dimensions	L	mm			176
	W	mm			170
	H	mm			102
Weight	Total	g			2790

Table A-6: Technical specifications for VSAT 8 W BUC 3/3

VMU cables

This appendix contains cable specifications for cables between the ACU and a VSAT modem.

- *Modem Cable COMTECH Serial & RSSI TT7016A*
- *Modem Cable iNFINITI iDirect VSAT modem*

B.1 Modem Cable COMTECH Serial & RSSI TT7016A

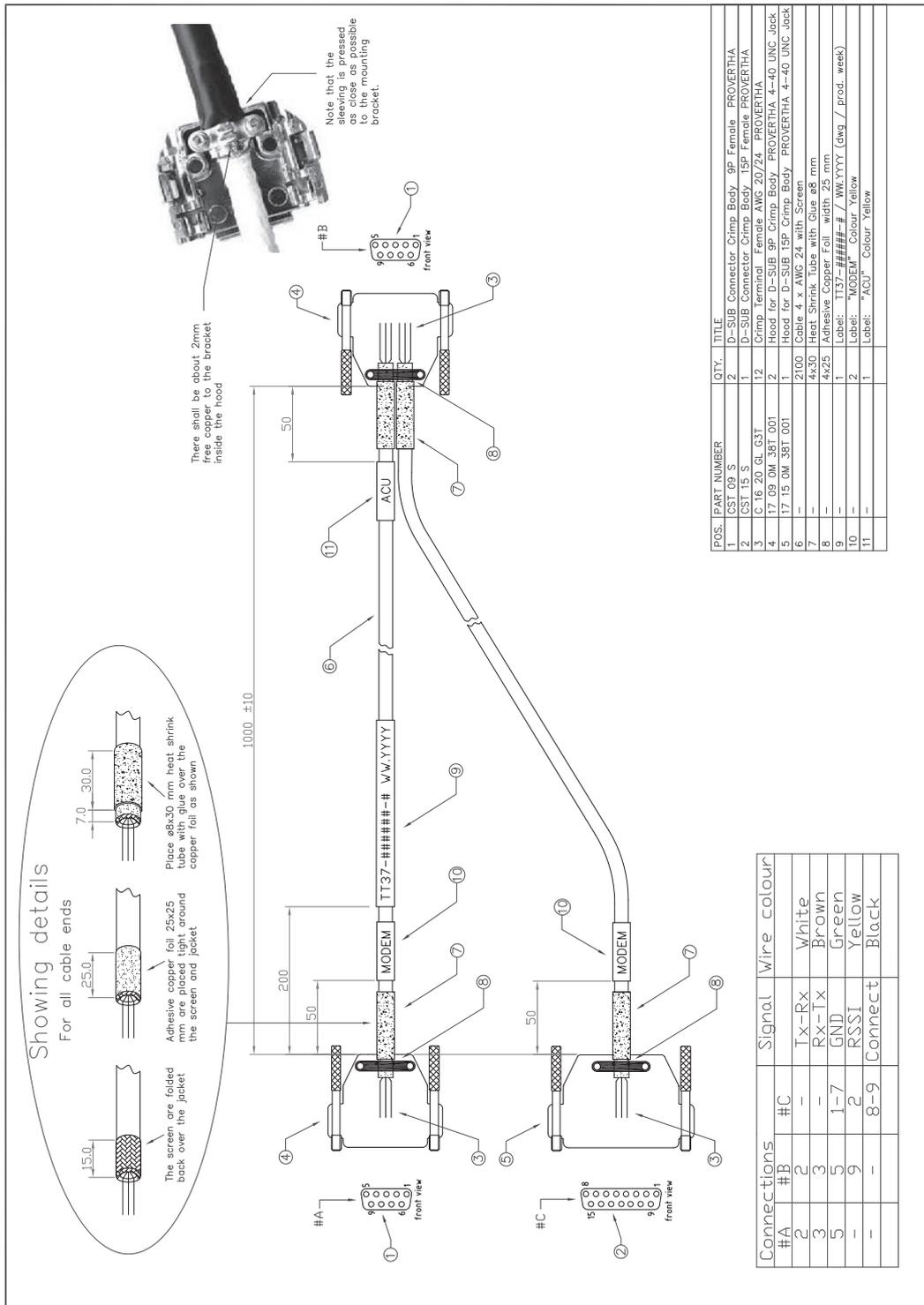


Figure B-1: Modem Cable COMTECH Serial & RSSI TT7016A

B.2 Modem Cable iNFINITI iDirect VSAT modem

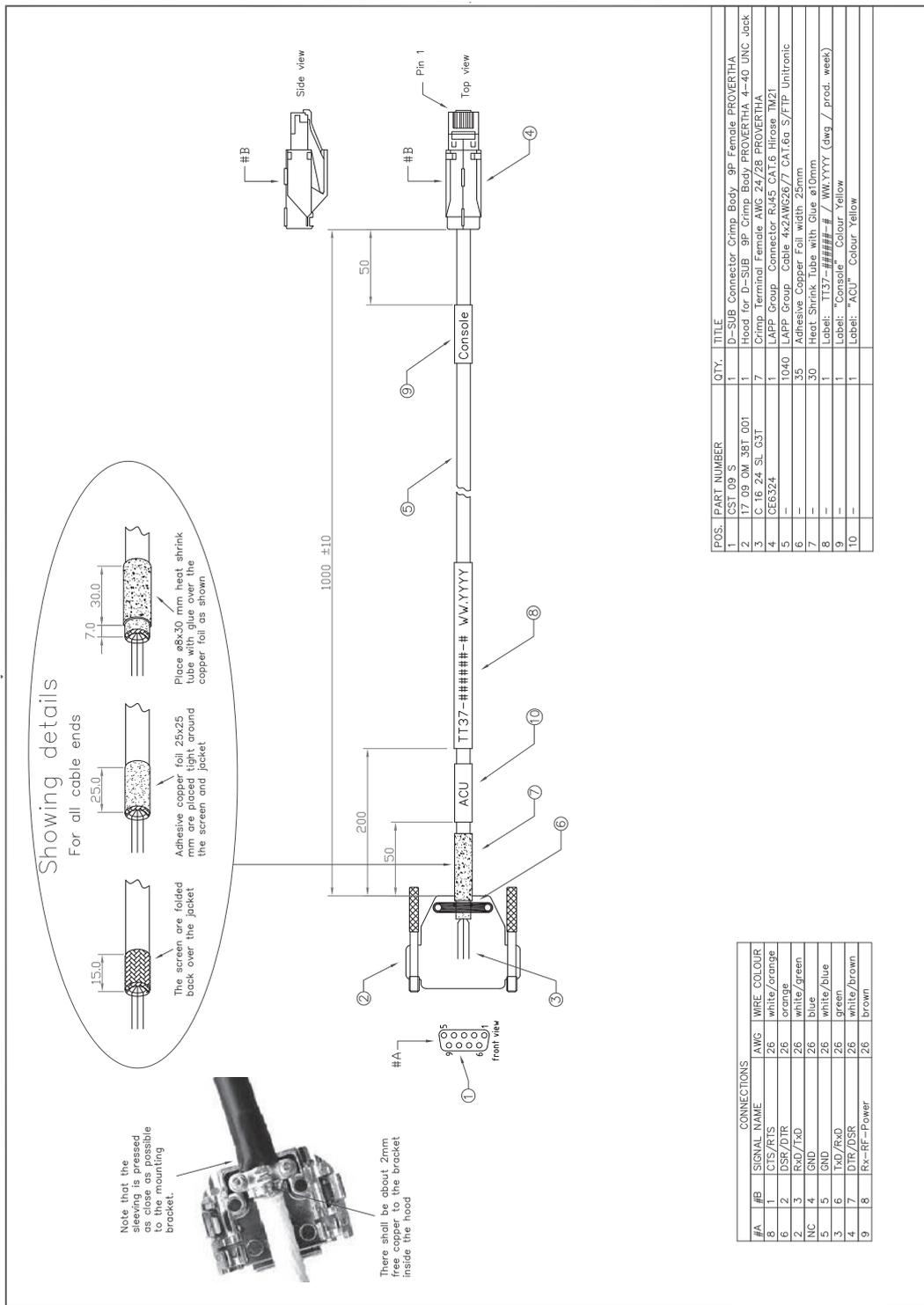


Figure B-2: Modem Cable iNFINITI iDirect VSAT modem

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VMU settings

In this appendix you find detailed information how to optimise performance in blockage situations and how to set up supported VSAT modems. The appendix has the following sections:

- *Performance optimization for blockage*
- *OpenAMIP setup for iDirect iNFINITI & Evolution*
- *Serial setup for iDirect iNFINITI & Evolution*
- *COMTECH 570L and ROSS box*
- *COMTECH 570L*
- *STM SatLink 2900 VSAT modem*
- *Gilat SkyEdge II VSAT modem*
- *Inmarsat G5 modem*

C.1 Performance optimization for blockage

C.1.1 Performance of VSAT systems encountering blockage, configured with multiple satellites.

Blockage definition

In most VSAT installations the VSAT antenna is installed in a position with areas of blockage. Blockage is often caused by the vessel's masts, stacks and other equipment installed on board. During installation the blockage areas should be entered in the web interface, see *To set up blocking zones (RX and TX)* on page 5-27.

When blockage occurs, the ACU can inform the VSAT modem (if the blocking zones have been typed correctly into the ACU web interface). It is often seen that by not informing the VSAT modem of blockage the VSAT system gains a higher uptime, although the quality of the extra gained uptime is not good enough to give the user a stable data connection. Therefore it is not of any value to the user. Another disadvantage of not informing the VSAT modem of blockage is that the VSAT modem does not have the option to switch to a different satellite to avoid the blockage.

VSAT modems can typically¹ only receive one signal from the ACU, which is "TX-mute" / "modem must not transmit", they are therefore not able to perform fast switching, but are limited to use a simple time-out, which is configured as a fixed value in the modem configuration.

1. There are VSAT modems that can interpret more detailed information about blockage from the ACU. This allows for increased performance in the event of blockage.

The simple time-out means that there is a fixed delay, plus the time needed to acquire another satellite, before there is a chance of regaining good link performance.

If the signal is not sent to the modem, the system can in some cases remain linked and have a higher uptime, but not provide a stable data connection. Such a link is of no value to the subscriber. Not sending the blockage (TX-Mute) signal also extends the period of the poor-quality link, as the VSAT modem is still relying on a time-out before switching to another satellite, and the time-out may be constantly reset by the link coming and going.

Better blockage communication

A major disadvantage of this single signal is that if the VSAT modem has multiple satellites to choose from, then, when selecting a new satellite, the VSAT modem is again relying on the simple time-out. This continues until a satellite with no obstruction in the view from the satellite terminal is selected. If the VSAT modem was able to receive information from the ACU that the view towards the current satellite is blocked, it would be able to choose a visible satellite much faster without the need to wait for multiple time-outs.

Minimum elevation angle

One safe way of getting optimum performance under the current conditions is to switch to a satellite in view as fast as possible. This is done by having well defined satellite parameters in the VSAT modem configuration. It is the VSAT modem that has the task of selecting the correct satellite, and since the VSAT modem is only concerned about the satellite visibility at the current geographic position, it is very important to enter the minimum elevation of a satellite at which a stable link can be established.

It is often seen that the minimum elevation is set to 0 (zero). A setting of 0 is not only in many cases below the usable limit of the satellite, but also a violation against ETSI EN 302 340, where a calculated minimum elevation ranges from 12° to 3° depending on power and bandwidth must be ensured or FCC §25.205 which states the minimum elevation to be 5°. See also Table 5-12 on page 5-24.

Unless the vessel is operating in international waters with no other options, a minimum elevation of 10° or higher is recommended.

Conclusion

Fewer but well-functioning satellites to choose from give better user performance than having many satellites, which may have a longer uptime but do not provide a stable data connection. In the end it is not the actual uptime the subscriber is concerned about, but it is the uptime where the link gives a stable data connection.

C.2 OpenAMIP setup for iDirect iNFINITI & Evolution

C.2.1 Protocol and interfaces

Introduction

The following sections describe the protocol and interface between the FV-110 ACU and an iDirect OpenAMIP VSAT modem. OpenAMIP operation is normally used by service providers offering global VSAT service as the protocol supports roaming between satellites (Automatic Beam Switching).

OpenAMIP, an ASCII message based protocol invented and Trademarked by iDirect is a specification for the interchange of information between an antenna controller (ACU) and a VSAT modem (VMU). This protocol allows the VSAT modem to command the ACU to search and lock to a particular satellite as well as allowing exchange of information necessary to permit the VSAT modem to initiate and maintain communication via the antenna and the satellite. In general, OpenAMIP is not intended for any purpose except to permit a modem and the ACU to perform synchronized automatic beam switching.

Connections

Connect the ACU and iDirect modem with the following cables:

- Ethernet cable for TCP/IP data communication
- RS-232 console cable for signal strength indication (part number: 407090A-020)

Important

It is important to connect this cable to achieve satisfactory acquisition of the satellite. This is due to missing information in the iDirect OpenAMIP software before version 3.1.1.2/13.0.1.2. RSSI information on the dashboard will only be available with this cable connected.

- 75 Ohm RF cables F-F connectors for rx and tx frequencies.

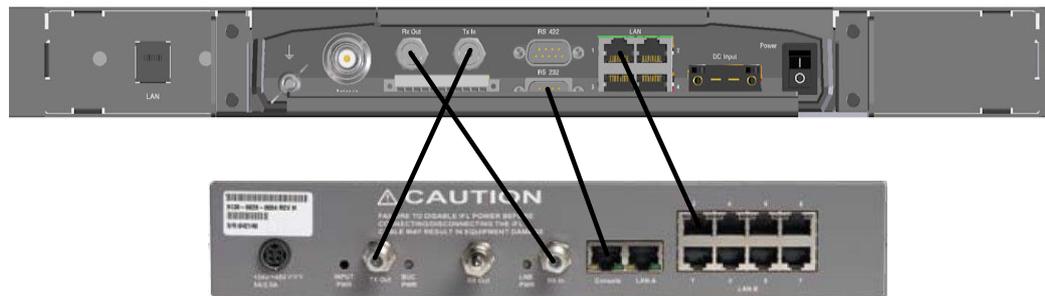


Figure C-1: Connecting iDirect iNFINITI 5000 series to the ACU (OpenAMIP)



Figure C-2: Connecting iDirect Evolution X5 to the ACU (OpenAMIP)

The pin allocation for the RS-232 Console cable is shown below. See also Appendix B for a cable drawing.

Console port (DTE)	RJ-45 pin	Color code	RJ-45 to DB-9 adapter pin	Console device
RTS	1	Blue	8	CTS
DTR	2	Orange	6	DSR
TxD	3	Black	2	RxD
GND	4	Red	NC	GND
GND	5	Green	5	GND
RxD	6	Yellow	3	TxD
DSC	7	Brown	4	DTR
Rx-RF Power	8	White/Grey	9	--

Table C-1: RS-232 Console cable for iDirect VSAT modem

Protocol

The FV-110 ACU supports all OpenAMIP commands except the X command which is optional. All the supported OpenAMIP commands are shown in the following figure.

iDS/iDX Release	Messages Sent from Remote		Mapped to Options File Keys	Options File Group	Messages Sent from Antenna	
	Message	# Parameters			Message	# Parameters
iDX 2.0.x	A		keepalive_interval Default value of 15 seconds. Will not appear in Options file unless overwritten.	[ANTENNA]	a	
	B	2	rx_lcl_osc, tx_lcl_osc	[SATELLITE]		
	H	2	hunt_frequency, hunt_bandwidth	[SATELLITE]		
	K	1	max_skew Maximum skew of the beam short axis to the geosynchronous arc.	[SATELLITE]		
	P	2	polarity, tx_polarity	[SATELLITE]		
	S	3	longitude, max_lat, pol_skew	[SATELLITE]	s	2
	T	2	tx_frequency, tx_bandwidth	[SATELLITE]		
	W	1	latlong_interval Message contains single value in seconds. Does not generate Options file key.	[MOBILE]	w	4

Figure C-3: Supported OpenAMIP commands

Messages sent from VSAT modem	Explanation
S -15.000000 0.000000 0.000000	Longitude, Max_lat, Pol_skew
H 1451.815000 1.905000	Hunt_frequency, Hunt_bandwidth
P H V	Rx_polarity, Tx_polarity
B 11250.000000 12800.000000	Rx-lcl_osc, Tx_lcl_osc
T 1403.290000 0.618000	Tx_frequency, Tx_bandwidth
A 15	Keepalive_interval in mS [ACU: s message]
W 300	latlong_interval in seconds [ACU: w message]
L 1 1	Rx lock, Tx allowed
K 90.000000	Max_skew

Table C-2: Messages sent from the VSAT modem to the ACU (examples)

Messages sent from the ACU to the VSAT modem	Explanation
s 1 1	Functional, Tx OK
w 1 55.794010 12.52272 985523005	GPS valid, Latitude, Longitude, Time

Table C-3: Messages sent from the ACU to the VSAT modem (examples)

Note The iDirect modems only sends the satellite information once when booting. If the ACU has not received the information for some reason, the system cannot point. In that case the modem will automatically boot after 5 minutes and send the satellite information again.

The signal strength from the modem is measured on RS-232 pin 9. It is a DC voltage in the range of 0 - 5 VDC.

Ranges for signal strength	
VDC	Antenna status
0-2.5	RF energy is detected, but from the wrong satellite.
2.6-5.0	Carrier lock, correct satellite.

Table C-4: Ranges for signal strength for iDirect OpenAMIP VSAT modem

The signal strength displayed web interface on the Dashboard as 0 – 500. The minimum value for an Internet connection is 250 - 260.

C.2.2 Sample options file

The following section presents a portion of a sample iDX 2.0.x Options file with OpenAMIP messages and parameters defined. OpenAMIP keys appear highlighted in bold.

```
[OPTIONS_FILE]
product_mode = idirect_scpc
modem_sn = 40170
generated_by = NMS-10.0.0
did = 12885226
modem_type = Remote
modem_hardware = 5000
is_mesh = 0
disable_options_flash_command = 0
carrier_type = 0
...
[MOBILE]
is_mobile = 1
```

```
tx_handshake_enabled = 0
gps_input = 2
latlong_interval = 300
latlong_fail_interval = 10
init_tx_power_offset = 0.000000
[MAPSERVER_0]
hostname = 172.20.130.3
port = 5003
[BEAMS]
beam_21 = PPS_Perf_Eval
maxbeam = 21
[ANTENNA]
manufacturer = OpenAMIP
model = OpenAMIP
addr = 172.26.81.34
port = 2000
connect_timeout = 30
dedicated_interface = ixp1
[SATELLITE]
min_look_angle = 0.000000
tx_frequency = 1300.000000
tx_bandwidth = 36.000000
hunt_bandwidth = 36.000000
rx_lcl_osc = 11250.000000
tx_lcl_osc = 12800.000000
max_skew = 90.000000
name = T12
channelname = T12_EMEA
longitude = -15.000000
max_lat = 0.000000
pol_skew = 0.000000
hunt_frequency = 1075.000000
polarity = H
tx_polarity = X
noise_reference_frequency = 0.000000
```

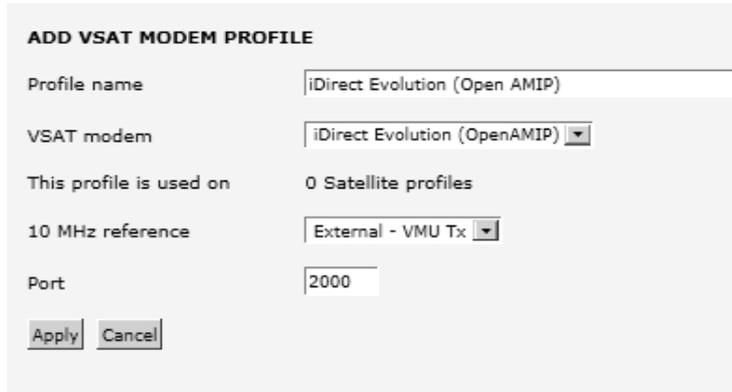
The option file must use following information:

Section in the option file	Requirements
[SATELLITE]	<p>The modem provides RX and TX frequency information via a data connection to the FV-110.</p> <p>The single-cable solution makes it possible to configure the VSAT modem to use any LO frequency in the range from 9.6 GHz to 11.3 GHz. The FV-110 will tune to the correct Ku-Band frequency and provide the correct L-Band frequency to the VSAT modem.</p> <p>Example: “rx_lcl_osc = 11250.000000”</p> <p>FV-110 has an extended 8 Watt BUC with LO up conversion frequency of 12.8 GHz.</p> <p>— Example: “tx_lcl_osc = 12800.000000”</p> <p>Note: FV-110 supports any LNB frequency due to the 1-cable design.</p>
[MOBILE]	<p>The iDirect modem must be set to mobile unit and receive the GPS information from the ACU with the command “w <Valid> <Lat> <Lon> <Time>”.</p> <p>Example: “is_mobile = 1”</p> <p>Tx handshake must not be enabled in the iDirect modem.</p> <p>Example: “tx_handshake_enabled = 0”</p>
[ODU]	<p>The FV-110 can work either using the Rx or Tx 10 MHz reference signals provided by the modem or using its own built-in 10 MHz reference signal. It is recommended to use the Tx 10 MHz reference signal from the modem. See also <i>VSAT modem profile – New entry and Edit</i> on page 5-25.</p> <p>Example: “odu_rx_10_mhz = 1”</p> <p>The FV-110 needs the Tx 10 MHz reference signal in order to allow TX ON.</p> <p>Example: “odu_tx_10_mhz = 1”</p>

Table C-5: Information in the VSAT modem option file

C.2.3 Configuration example (OpenAMIP)

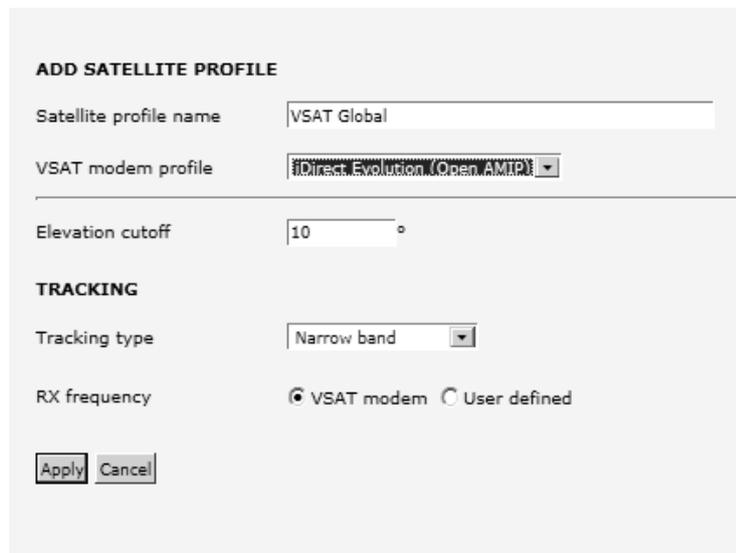
Examples of modem profile and satellite configuration from the ACU web interface are shown in the figures below.



The screenshot shows a web form titled "ADD VSAT MODEM PROFILE". It contains the following fields and values:

- Profile name: iDirect Evolution (Open AMIP)
- VSAT modem: iDirect Evolution (OpenAMIP) (dropdown menu)
- This profile is used on: 0 Satellite profiles
- 10 MHz reference: External - VMU Tx (dropdown menu)
- Port: 2000
- Buttons: Apply, Cancel

Figure C-4: VSAT modem profile, OpenAMIP (example)



The screenshot shows a web form titled "ADD SATELLITE PROFILE". It contains the following fields and values:

- Satellite profile name: VSAT Global
- VSAT modem profile: iDirect Evolution (OpenAMIP) (dropdown menu)
- Elevation cutoff: 10 °
- TRACKING section:
 - Tracking type: Narrow band (dropdown menu)
 - RX frequency: VSAT modem User defined
- Buttons: Apply, Cancel

Figure C-5: Satellite profile, OpenAMIP (example)

Simple OpenAMIP protocol in iDS 8.0.2.7 is **NOT** supported by the FV-110.
Full OpenAMIP protocol from iDX 2.0 and up is supported by the FV-110.

C.2.4 Troubleshooting

It is expected that the modem has been connected with cables to the ACU and that an iDirect OpenAMIP modem profile and satellite profile have been configured in the web server of the FV-110 and has been activated. For further details see *Configuration example (OpenAMIP)* on page C-9.

It is recommended to connect the service PC to LAN port 2 of the ACU in order to have access to the web server of the FV-110 and IP connection to the attached iDirect OpenAMIP modem.

A telnet or ssh client and Internet browser is needed in order to go through the troubleshooting guidelines. It is recommended to use the telnet/ssh client program called PuTTY, which is available for free on the Internet (<http://www.putty.org/>).

1. Default login to iDirect modems are: User name: admin, Password: P@55w0rd!
2. Every time a setting is changed in the iDirect modem, it must be stored in flash using the following command line command:

```
options flash
```

3. After changing a setting and storing the new setting the modem has to boot its application in order to read and use the new setting. This is done with the command line command:

```
reset application
```

The iDirect options file is divided into sections; the section name is always CAPITAL letters. Each section has several parameters, and each parameter has a value. See the following example:

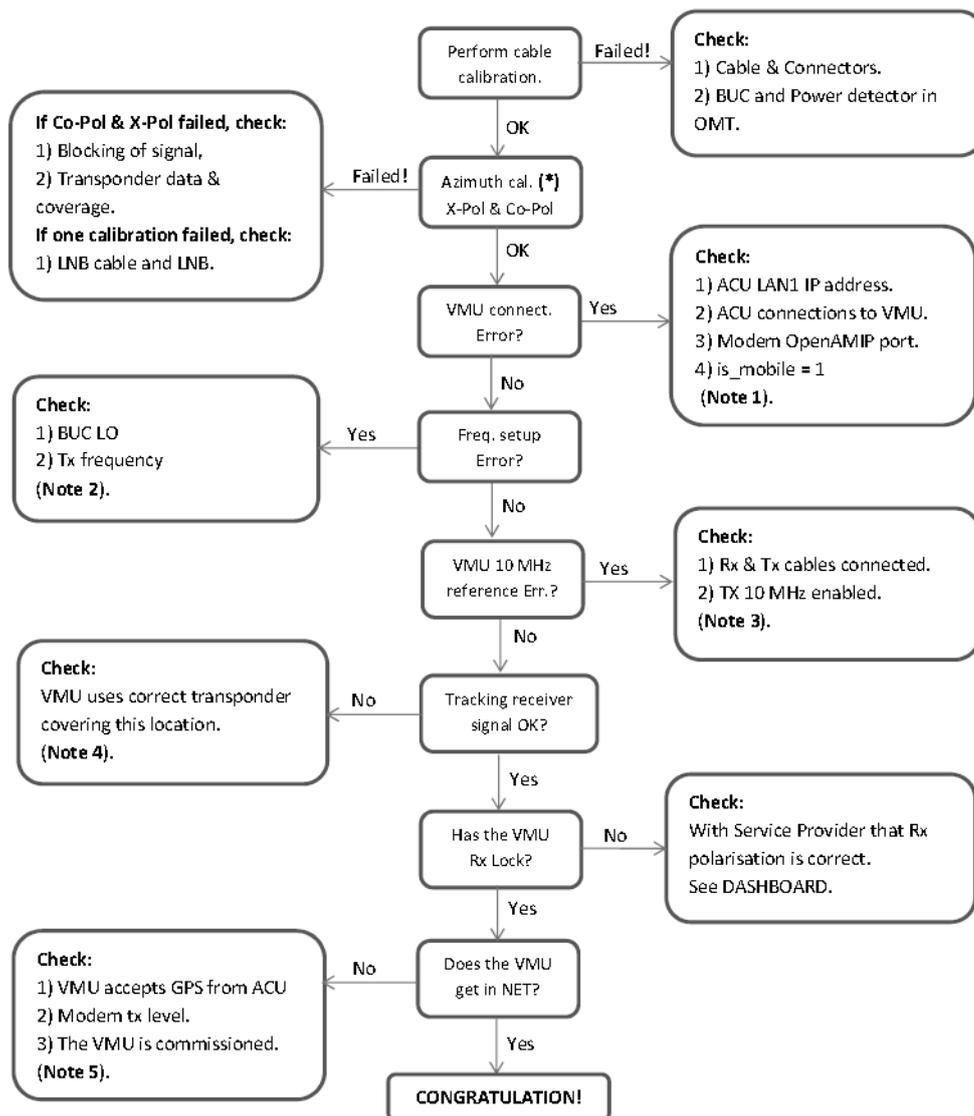
```
[MOBILE]
  gps_input = 2
  init_tx_power_offset = 0.000000
  is_mobile = 1
  latlong_interval = 60
  tx_handshake_enabled = 0
```

To change a setting in the MOBILE section use the `options set` command. See example of command here:

```
options set MOBILE gps_input 2
```

Note that setting the `gps_input` parameter to value 2 is written without an equal sign but only with a space character between parameter name and the value.

You can use the following flow chart and the instructions in the notes later in this appendix.



* Use same transponder polarity with both calibrations.

Figure C-6: iDirect OpenAMIP troubleshooting

Note 1: Connect to modem with Telnet or serial and issue following commands:

```

options show ANTENNA
Check: IP address, port # and manufacturer = OpenAMIP.
options show MOBILE
Check: is_mobile = 1
  
```

Note 2: Connect to modem with telnet and issue command:

```

options show SATELLITE
Check: tx_lcl_osc = 12800.000000,
Check: tx_frequency is between: 950.000000 to 1700.000000
Check: rx_lcl_osc + hunt_frequency is between: 10.7 GHz to 12.75 GHz
  
```

Note 3: Connect to the modem with Telnet and issue commands:

```
options show ODU
Check: odu_tx_10_mhz = 1
options show MOBILE
Check: tx_handshake_enabled = 0
```

Note 4: Connect to the modem with Telnet and issue command:

```
beamselector list
Write down the transponder number for one of the beams that has line of sight.
Use the command: beamselector switch <number> -f to force the VMU to use this
transponder. E.g:
beamselector switch 323 -f
Use the command: beamselector lock to lock the VMU to this transponder and stay
there (until power cycle or reset application).
```

Note 5: Connect to the modem with Telnet and issue commands:

```
options show MOBILE
Check: gps_input = 2
tx power
Try to increase the tx power step by step up to max. -5 dBm, which is around FV-110
P1dB level. E.g. tx power -10
```

Examples of commands

```
options set SATELLITE tx_frequency 1450
options set MOBILE gps_input 2
options set MOBILE is_mobile 1
options set MOBILE tx_handshake_enabled 0
options set ODU odu_tx_10_mhz 1
options flash
If this fails then the options file is write protected!
Change disable_options_flash_command = 0 first!
options set OPTIONS_FILE disable_options_flash_command 0
reset application
Starts the VMU application (soft boot)
```

- Notice that changing options file locally can help determine wrong settings. The settings will probably be changed back to original settings when the VMU get synchronized with the hub.
- Tell the NOC about the faulty settings so they can correct configuration.

C.3 Serial setup for iDirect iNFINITI & Evolution

C.3.1 Protocol and interfaces

Introduction

The following sections describe the protocol and interface between the ACU and an iDirect Serial modem. Serial operation is normally used by service providers offering regional VSAT service.

Connections

Connect the ACU and iDirect modem with the following cables:

- RS-232 console cable for control communication
- 75 Ohm RF cables F-F connectors for rx and tx frequencies.

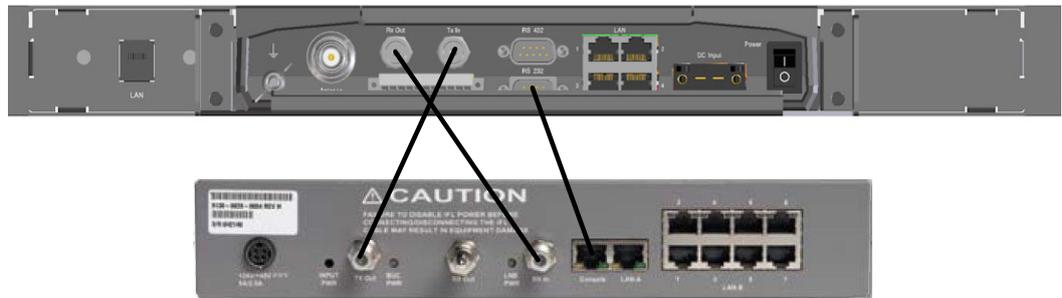


Figure C-7: Connecting iDirect iNFINITI 5000 series to the ACU (Serial)

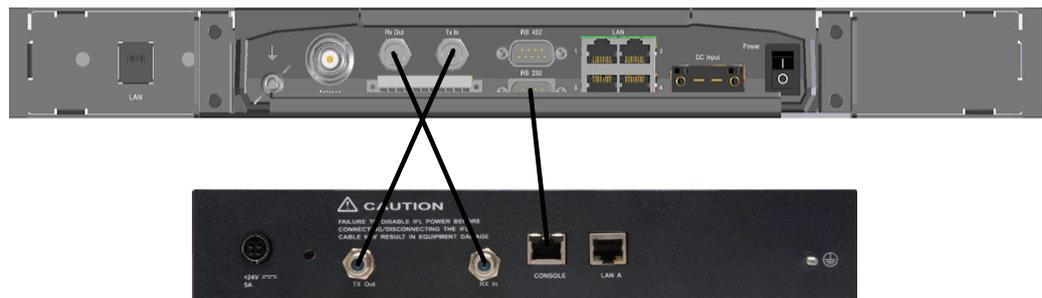


Figure C-8: Connecting iDirect Evolution X5 to the ACU (Serial)

The pin allocation for the RS-232 Console cable is shown in Table C-1 on page C-4. See also Appendix B for a cable drawing.

C.3.2 Console port settings

The iDirect modem must be configured to use following console port settings:

- Baud rate: 4800 or 9600
- Data bits: 8

- Parity: None
- Stop bit: 1

Passwords

The FV-110 ACU will log in to the modem using root and user passwords. The default passwords are:

- Root: P@55w0rd!
- User: iDirect

Supported commands

After login to the modem the ACU will issue commands to the modem every second. The following commands are supported by the FV-110 ACU:

- rx snr
- options show FREQ_TRANS
- rx freq
- tx freq
- latlong <lat> <long>

The signal strength command: rx snr is issued every 2 seconds. The rest of the commands are issued one by one every 2 seconds between each signal strength command. Meaning each of the other commands is issued every 8 seconds.

The signal strength in the ACU display and web interface is shown as dB., e.g: 8.5 dB. The minimum value for Internet connection is around 2-3 dB.

VSAT modem option file

The option file of the VSAT modem must also include the following information:

Section in option file	Description
Satellite information	Receive frequency of the transponder. Used with “rx freq” command Transmit frequency if known otherwise just a dummy tx frequency (e.g. 1.450 MHz). Used with “tx freq” command.
FV-110 information	The modem provides RX and TX frequency information via a data connection to the FV-110. The single-cable solution makes it possible to configure the VSAT modem to use any LO frequency in the range from 9.6 GHz to 11.3 GHz. The FV-110 will tune to the correct Ku-Band frequency and provide the correct L-Band frequency to the VSAT modem. The FV-110 has an extended 8 Watt BUC with LO up conversion frequency of 12.8 GHz.

Table C-6: Requirements for VSAT modem option file, Serial

Section in option file	Description
GPS	The iDirect modem must be set to mobile unit and receive the GPS information from the ACU with the command “latlong <lat> <long>”. Tx handshake must be disabled in the iDirect modem.
Rx 10 MHz	The FV-110 can work either using the Rx or Tx 10 MHz reference signals provided by the modem or using its own built-in 10 MHz reference signal. It is recommended to use the Tx 10 MHz reference signal from the modem. See also <i>VSAT modem profile – New entry and Edit</i> on page 5-25.
Tx 10 MHz	The FV-110 needs the Tx 10 MHz reference signal in order to allow TX ON.

Table C-6: Requirements for VSAT modem option file, Serial (Continued)

C.3.3 Configuration example (Serial)

Examples of modem profile and satellite configuration from the ACU web interface are shown in the figures below.

The screenshot shows a web form titled "ADD VSAT MODEM PROFILE" with the following fields and values:

- Profile name: iDirect Evolution (Serial)
- VSAT modem: iDirect Evolution (Serial) (dropdown menu)
- This profile is used on: 0 Satellite profiles
- VSAT modem root password: P@55w0rd!
- VSAT modem user password: iDirect
- Baud rate: 4800 baud (dropdown menu)
- 10 MHz reference: External - VMU Tx (dropdown menu)

At the bottom of the form are "Apply" and "Cancel" buttons.

Figure C-9: VSAT modem profile, Serial (example)

ADD SATELLITE PROFILE

Satellite profile name

VSAT modem profile

Predefined satellites

Satellite position °

Polarisation skew °

Maximum inclination °

Elevation cutoff °

RX polarisation Horizontal Vertical

TX polarisation Co-pol X-pol

TRACKING

Tracking type

RX frequency VSAT modem User defined

Figure C-10: Satellite profile, Serial (example)

C.4 COMTECH 570L and ROSS box

C.4.1 Protocols and interfaces

The following sections describe how to connect an ACU, a COMTECH570L VSAT modem, a ROSS box and an Ethernet switch.

From software version 1.30 or higher the FV-110 supports COMTECH ROSS ROAM protocol 1+ which includes the satellite longitude in the responses from the ACU to the ROSS box. 1.30 also supports setting inclined orbit by entering user defined data.

Connections

Connect the ACU and COMTECH 570L, ROSS box and Ethernet switch with the following cables:

- Ethernet cables for TCP/IP data communication (x3)
- RS-232 console cable
- 75 Ohm RF cables F-F connectors for rx and tx frequencies.

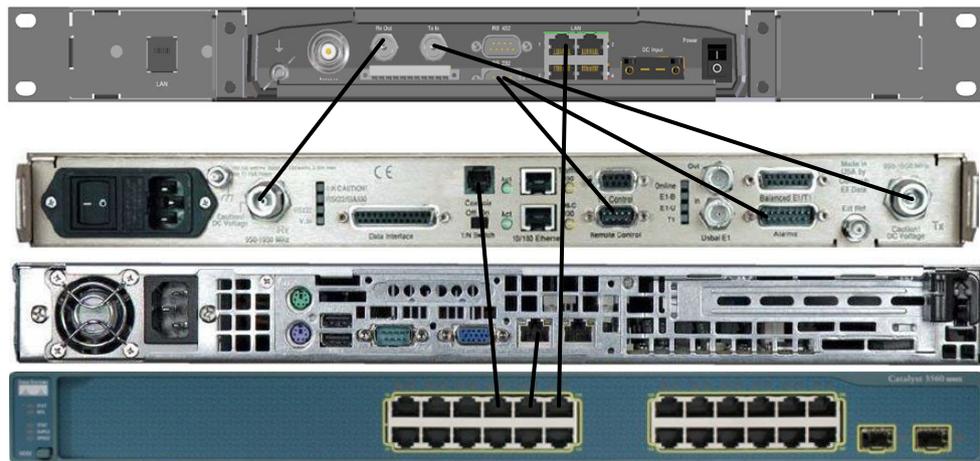
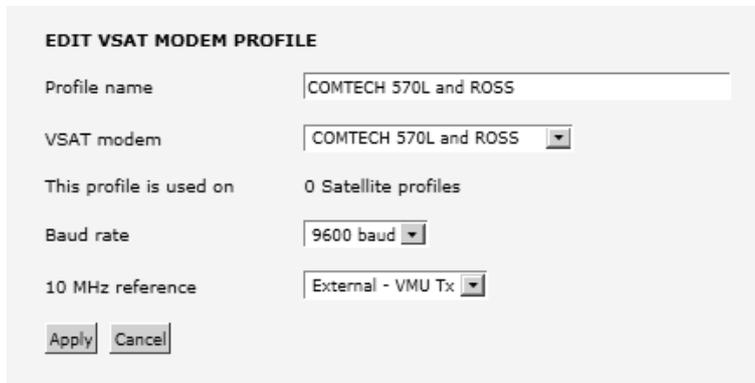


Figure C-11: Connecting COMTECH 570L and ROSS box to the ACU (example)

See also cable specifications at *Modem Cable COMTECH Serial & RSSI TT7016A* on page B-2.

C.4.2 Configuration example (COMTECH 570L and ROSS)

Examples of modem profile and satellite configuration from the ACU web interface are shown in the figures below.



EDIT VSAT MODEM PROFILE

Profile name: COMTECH 570L and ROSS

VSAT modem: COMTECH 570L and ROSS

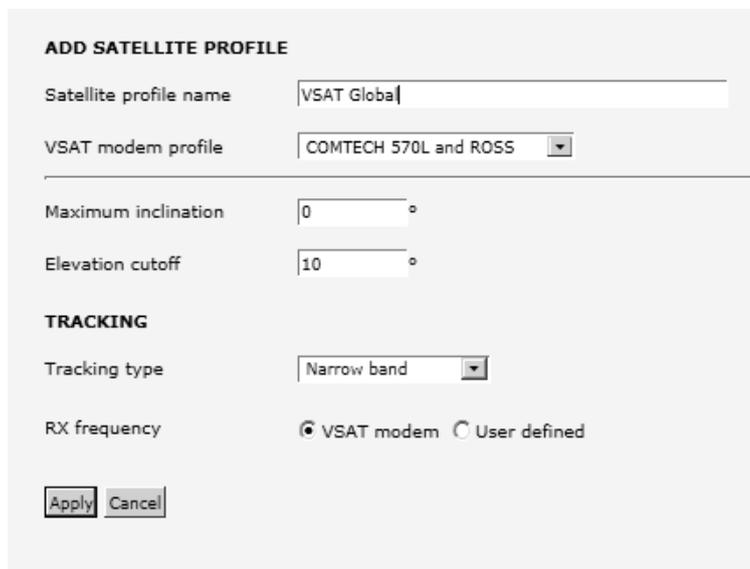
This profile is used on: 0 Satellite profiles

Baud rate: 9600 baud

10 MHz reference: External - VMU Tx

Apply Cancel

Figure C-12: VSAT modem profile, COMTECH 570L and ROSS (example)



ADD SATELLITE PROFILE

Satellite profile name: VSAT Globa

VSAT modem profile: COMTECH 570L and ROSS

Maximum inclination: 0 °

Elevation cutoff: 10 °

TRACKING

Tracking type: Narrow band

RX frequency: VSAT modem User defined

Apply Cancel

Figure C-13: Satellite profile, COMTECH 570L and ROSS (example)

C.5 COMTECH 570L

C.5.1 Protocol and interfaces

The following sections describe how to connect the ACU to a COMTECH 570L VSAT modem.

Protocol

The ACU supports 4800 or 9600 baud on the serial port. You can set the baud rate of the COMTECH 570L at its front MMI.

The ACU issues the following commands on the serial interface to the COMTECH 570L modem:

- 0000/EBN?
- 0000/TFQ?
- 0000/LLO?
- 0000/BLO?
- 0000/RFQ?

An example of the serial communication between the ACU and the COMTECH 570L modem is shown below:

```
0000/EBN?  
0000EBN=11.8  
0000/TFQ?  
0000/TFQ=1310.7956  
0000/EBN?  
0000/EBN=11.8  
0000/LLO?  
0000/LLO=10000+  
0000/EBN?  
0000/EBN=11.9  
0000/BLO?  
0000/BLO=12800-  
0000/EBN?  
0000/EBN=11.8  
0000/RFQ?  
0000/RFQ=1367.5500
```

Command	Description
EBN?	This command is used to show the signal strength in the web interface and on the display of the FV-110 to determine if the COMTECH 570L modem is in Rx Lock. The signal strength goes from 0dB - 16dB, +16dB indicates a signal greater than 16dB, 99.9dB indicates no Rx Lock.
TFQ?	TFQ (Transmit Frequency) is used to calibrate the Tx chain in real time, in order to have same output power independent of frequency, temperature and antenna cable length.
LLO?	LLO (LNB LO) is used to set up the LNB LO frequency for the system. All LNB LO frequencies are supported by FV-110.
BLO?	BLO (BUC LO) is used to read the BUC LO. This makes the ADU compatible with future FV-110 products using a different BUC LO.
RFQ?	RFQ (Receive Frequency) is used as tracking frequency for FV-110.

Table C-7:

Note | The BUC LO (BLO) must always be 12800 MHz for FV-110.

Connections

Connect the ACU and the COMTECH 570L with the following cables:

- Standard RS-232 serial cable (using 300KHz Narrow Band tracking receiver)
- Or COMTECH Serial & RSSI cable (using Modem RSSI tracking)
- 2 pcs. 75 Ohm RF cables F-F connectors for rx and tx frequencies.

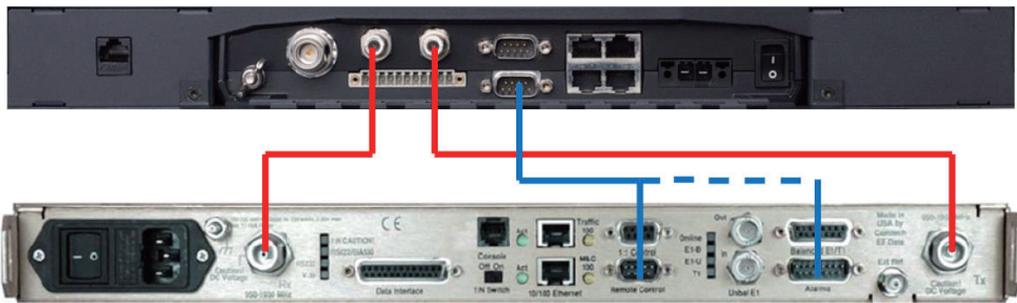


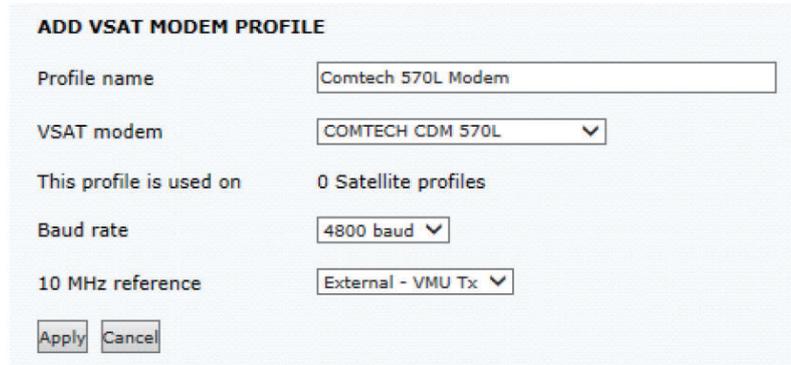
Figure C-14: Connecting COMTECH 570L to the ACU (example)

In most cases it is recommended to use the antenna that is built-in in the 300 KHz narrow band tracking receiver to track the satellite, and you can connect the ACU to the VSAT modem with a standard RS-232 serial cable.

For Modem RSSI tracking use a cable according to the specifications at *Modem Cable COMTECH Serial & RSSI TT7016A* on page B-2 (Cobham part number: 407090A-021).

C.5.2 Configuration example (COMTECH 570L)

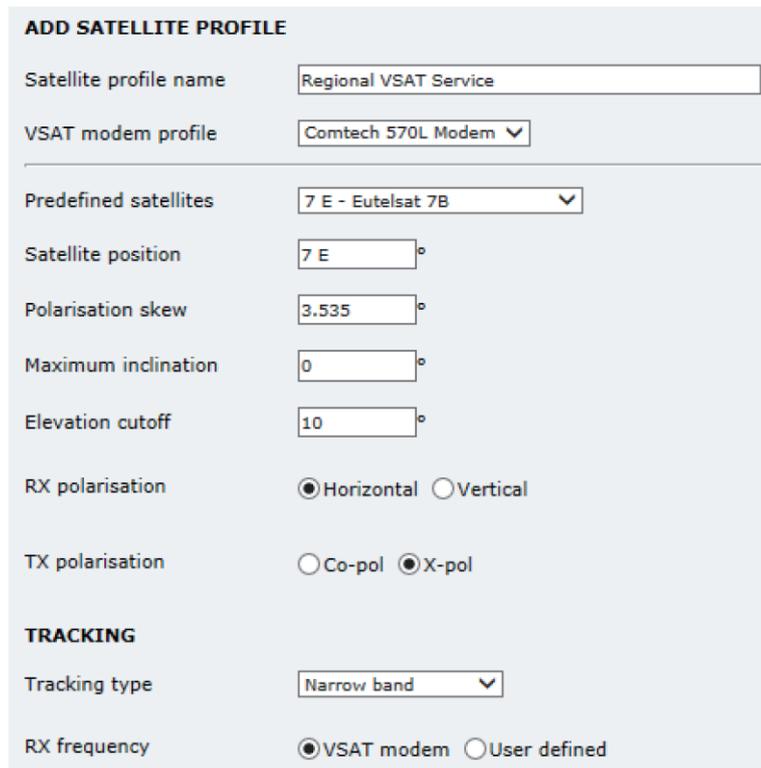
Examples of the modem profile and satellite configuration from the ACU web interface are shown in the figures below.



ADD VSAT MODEM PROFILE

Profile name	<input type="text" value="Comtech 570L Modem"/>
VSAT modem	<input type="text" value="COMTECH CDM 570L"/>
This profile is used on	0 Satellite profiles
Baud rate	<input type="text" value="4800 baud"/>
10 MHz reference	<input type="text" value="External - VMU Tx"/>
<input type="button" value="Apply"/> <input type="button" value="Cancel"/>	

Figure C-15: VSAT modem profile, COMTECH 570L (example)



ADD SATELLITE PROFILE

Satellite profile name	<input type="text" value="Regional VSAT Service"/>
VSAT modem profile	<input type="text" value="Comtech 570L Modem"/>
Predefined satellites	<input type="text" value="7 E - Eutelsat 7B"/>
Satellite position	<input type="text" value="7 E"/> °
Polarisation skew	<input type="text" value="3.535"/> °
Maximum inclination	<input type="text" value="0"/> °
Elevation cutoff	<input type="text" value="10"/> °
RX polarisation	<input checked="" type="radio"/> Horizontal <input type="radio"/> Vertical
TX polarisation	<input type="radio"/> Co-pol <input checked="" type="radio"/> X-pol
TRACKING	
Tracking type	<input type="text" value="Narrow band"/>
RX frequency	<input checked="" type="radio"/> VSAT modem <input type="radio"/> User defined

Figure C-16: Satellite profile, COMTECH 570L (example)

C.6 STM SatLink 2900 VSAT modem

C.6.1 Interfaces and VSAT modem configuration

The following sections describe how to connect an ACU to an STM SatLink 2900 VSAT modem. The STM SatLink 2900 and the FV-110 are fully integrated and require almost no user setup.

STM SatLink 2900 software version required: 14.2.0 or higher.

Connections

Connect the ACU and STM SatLink 2900 with the following cables:

- Ethernet cable for TCP/IP data communication. Connect LAN A on the VSAT modem to LAN 1 on the ACU.
- 75 Ohm RF cables F-F connectors for RX and TX frequencies

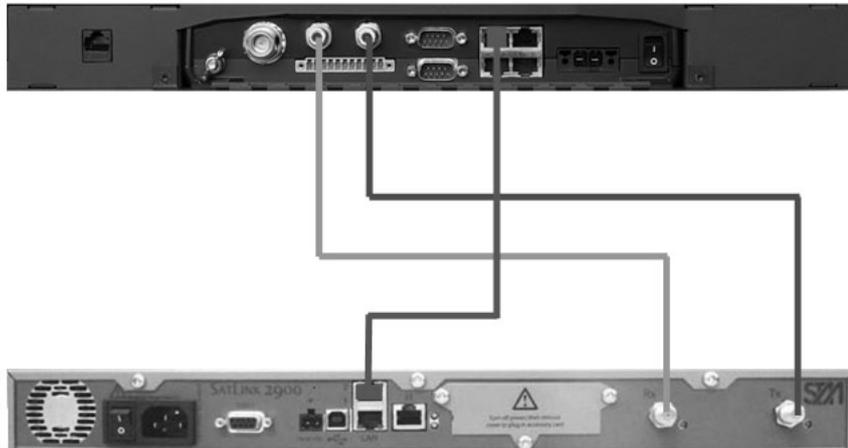


Figure C-17: Connecting STM SatLink 2900 VSAT modem to the ACU

Modem configuration requirements

Type the following command in a modem console to set up the STM Satlink 2900 modem to use the FV-110:

```
odu antenna 30
odu txtype 62
odu lnb 62
```

To display the antenna setup for the STM Satlink 2900 modem, type:

```
odu antctrl show
```

Example:

```
odu antctrl show
Antenna Controller Configuration
-----
Type                               : FURUNO FV-110
```

```
Enabled                : All
IP address             : 10.110.2.226
Polling frequency     : 5 sec
Antenna Stability Tries : 300
```

Antenna Controller Status

```
-----
Controller detected   : no
Packets sent         : 0
Packets received     : 0
```

C.6.2 ACU configuration

To set up the ACU to work with an STM Satlink 2900 VSAT modem, do as follows:

1. Add a modem profile with the STM Satlink 2900 modem. See *VSAT modem profile – New entry and Edit* on page 5-25.
2. Add a satellite profile using the STM Satlink modem profile just created. See *Satellite profiles – New entry and Edit* on page 5-23.
3. Edit the network settings and input the IP information supplied with the modem. See *To configure the LAN network* on page 5-29.
4. Activate the satellite profile.

C.6.3 Configuration example (STM Satlink 2900)

Examples of modem profile and satellite configuration from the ACU web interface are shown in the figures below.

EDIT VSAT MODEM PROFILE

Profile name

VSAT modem

This profile is used on

10 MHz reference

Figure C-18: VSAT modem profile, STM SatLink 2900 (example)

ADD SATELLITE PROFILE

Satellite profile name

VSAT modem profile

Elevation cutoff °

TRACKING

Tracking type

RX frequency VSAT modem User defined

Figure C-19: Satellite profile, STM SatLink 2900 (example)

C.7 Gilat SkyEdge II VSAT modem

C.7.1 Interfaces and VSAT modem configuration

The following sections describe how to connect an ACU to a Gilat SkyEdgeII VSAT modem. The Gilat SkyEdge II and the FV-110 are fully integrated and require only little user setup.

Connections

Connect the ACU and Gilat SkyEdge II with the following cables:

- 75 Ohm RF cables F-F connectors for RX and TX frequencies
- Serial cable for communication with the modem. Connect SERIAL on the VSAT modem to RS-232 on the ACU.

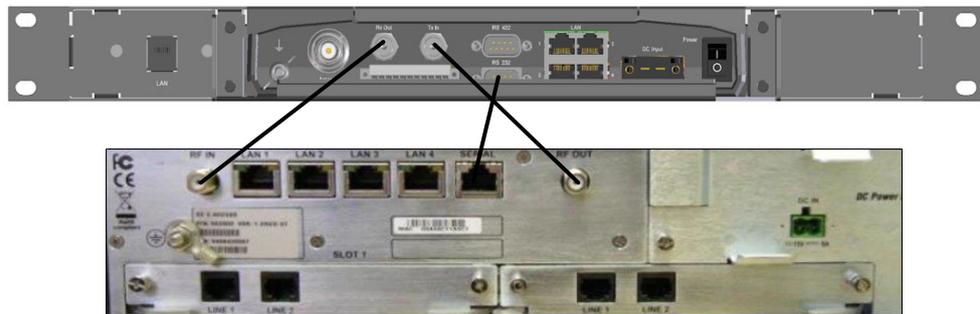


Figure C-20: Connecting Gilat SkyEdge II VSAT modem to the ACU

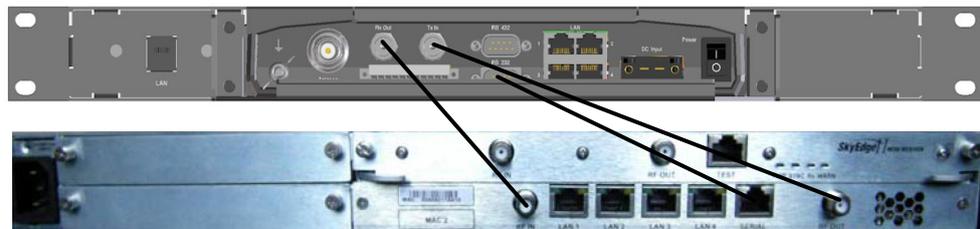


Figure C-21: Connecting Gilat SkyEdge II VSAT modem (rack) to the ACU

Modem configuration requirements

1. Connect a PC with an Ethernet cable to LAN port 1 of the VSAT modem.
2. Set the PC to static IP address: 192.168.1.2
3. Start an Internet browser (e.g. Internet Explorer) and go to URL://192.168.1.1 in order to get access to the web server of the VSAT modem.
4. Login with: User name: inst and Password: \$Sat2598\$
5. Go to the menu **Installer**.

Parameter	Settings
RF Downlink frequency	In the section General the RF Downlink frequency is shown. Write it down as it is going to be used for the selection of LNB LO. Further down on the page you find the BUC and LNB LO frequencies.
LNB LO	Depending on the RF Downlink frequency select an appropriate LNB LO of 9.75, 10.25, 10.75 or 11.25 GHz which will result in an L-band frequency between 950 and 1650 MHz which is the operating frequency band of the SkyEdge II Access modem.
BUC LO	Select the BUC to be 12.8 GHz as this is the BUC LO of the FV-110. Remember to inform the hub operator about this when doing line up and commissioning.
BUC 10MHz Reference Signal	The BUC 10MHz Reference Signal must be configured to ON, otherwise the FV-110 will never allow TX. Scroll further down to enable GPS for the Location Coordinates. This enables the serial protocol of the modem so it can communicate with the ACU.

Table C-8: Configuration of Gilat SkyEdge II VSAT modem

6. Go to the top of the page and press the **Submit** button and **OK** to save the new settings.

The VSAT modem is now configured to be used with the FV-110.

C.7.2 ACU configuration

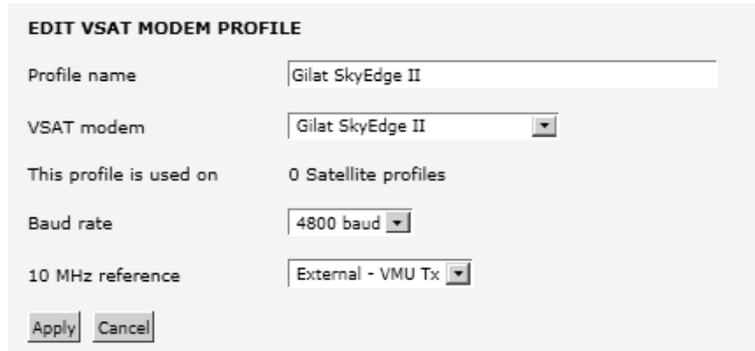
To set-up the ACU to work with a Gilat SkyEdge II VSAT modem, do as follows:

1. Add a modem profile with the Gilat SkyEdge II modem. See *VSAT modem profile – New entry and Edit* on page 5-25.
2. Add a satellite profile using the Gilat SkyEdge II modem profile just created. See *Satellite profiles – New entry and Edit* on page 5-23.
3. Edit the network settings and input the IP information supplied with the modem. See *To configure the LAN network* on page 5-29.
4. Activate the satellite profile.

See also the configuration example in the following section.

C.7.3 Configuration example (Gilat SkyEdge II)

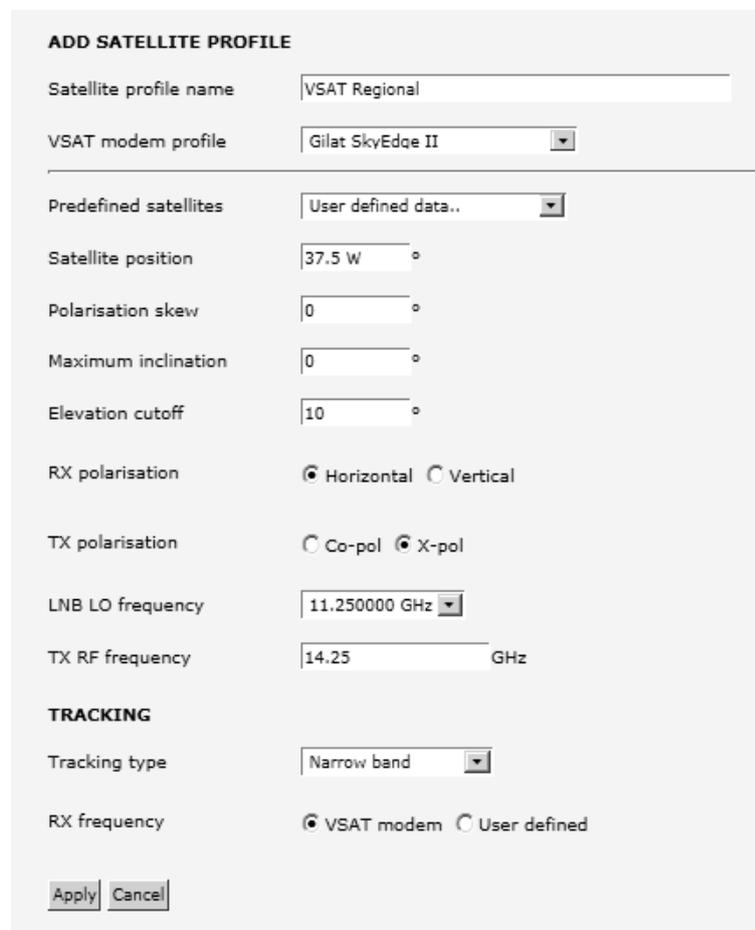
Examples of modem profile and satellite configuration from the ACU web MMI are shown in the figures below.



EDIT VSAT MODEM PROFILE

Profile name	<input type="text" value="Gilat SkyEdge II"/>
VSAT modem	<input type="text" value="Gilat SkyEdge II"/>
This profile is used on	0 Satellite profiles
Baud rate	<input type="text" value="4800 baud"/>
10 MHz reference	<input type="text" value="External - VMU Tx"/>

Figure C-22: VSAT modem profile, Gilat Sky Edge II (example)



ADD SATELLITE PROFILE

Satellite profile name	<input type="text" value="VSAT Regional"/>
VSAT modem profile	<input type="text" value="Gilat SkyEdge II"/>

Predefined satellites	<input type="text" value="User defined data.."/>
Satellite position	<input type="text" value="37.5 W"/> °
Polarisation skew	<input type="text" value="0"/> °
Maximum inclination	<input type="text" value="0"/> °
Elevation cutoff	<input type="text" value="10"/> °
RX polarisation	<input checked="" type="radio"/> Horizontal <input type="radio"/> Vertical
TX polarisation	<input type="radio"/> Co-pol <input checked="" type="radio"/> X-pol
LNB LO frequency	<input type="text" value="11.250000 GHz"/>
TX RF frequency	<input type="text" value="14.25"/> GHz

TRACKING

Tracking type	<input type="text" value="Narrow band"/>
RX frequency	<input checked="" type="radio"/> VSAT modem <input type="radio"/> User defined

Figure C-23: Satellite profile, Gilat Sky Edge II (example)

C.8 Inmarsat G5 modem

C.8.1 Interfaces and VSAT modem configuration

Inmarsat G5 is delivered in a pre-wired and fully configured 19" rack by Inmarsat.

C.8.2 Connecting a Inmarsat G5 modem

Inmarsat G5 is delivered in a pre-wired and fully configured 19" rack by Inmarsat.

C.8.3 Configuration example (Inmarsat G5)

Examples of modem profile and satellite configuration from the ACU web MMI are shown in the figures below.

EDIT VSAT MODEM PROFILE

Profile name

VSAT modem

This profile is used on

10 MHz reference

Port

Figure C-24: VSAT modem profile, Inmarsat G5 (example)

ADD SATELLITE PROFILE

Satellite profile name

VSAT modem profile

Elevation cutoff °

TRACKING

Tracking type

RX frequency VSAT modem User defined

Figure C-25: Satellite profile, Inmarsat G5 (example)

Command line interface

D.1 Introduction

After you have done the initial configuration and connected the FV-110 to your network, you can use Telnet to configure the FV-110. You can also setup VSAT modem parameters.

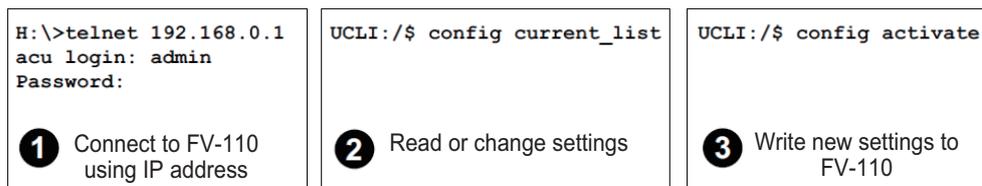


Figure D-1: How to use the command line interface (example for telnet)

After successful login you can read and change settings. Use the command **config activate** to activate the new settings in the ACU.

You will need to refresh the browser window before the changed settings become visible.

Note Every change is performed on the active satellite profile or the active VSAT modem profile.
Parameter identifiers are case sensitive.

D.1.1 Telnet connection

You can access the command line interface via Telnet.

User name and password

Access to the FV-110 system is protected by a user name and password. This is the same user name and password that is used in the web interface under **ADMINISTRATION**, for further details see *To access the administration settings (user name, password)* on page 5-40.

Telnet

The interface is on the standard Telnet port 23. Use any LAN port and corresponding IP address of the ACU.

To start telnet session do as follows:

1. Open a Telnet client of your choice.
2. At the prompt, enter the IP address of the ACU, user name (admin) and password (1234).

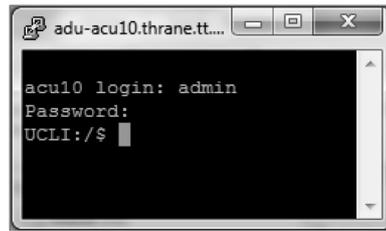


Figure D-2: Command line interface, login

D.1.2 Help

If you enter **help** directly at the prompt **UCLI:/\$** all available commands are listed. Additionally any command will take **help** as first argument and display detailed information of the specific command.

D.1.3 Conventions

The command description below uses the following special typography:

Convention	Description
Courier font	Information that is displayed on the screen.
Bold Courier font	Text the user must enter.
<argument>	Required argument
[argument]	Optional argument

Table D-1: Command typography

Example: satellite lon [longitude]
zone <id> active <yes | no>

D.2 Supported commands

The following commands are described in detail. They are listed in alphabetical order.

- *config*
- *demo*
- *dual_antenna*
- *exit*
- *help*
- *modem*
- *satellite*
- *status*
- *system*
- *track*
- *zone*

D.2.1 config

Command	Description
config	Shows the sub commands available, including a short description.
config pending_list	Shows the number of pending changes.
config current_list	Shows the values for the current satellite profile, antenna and some tracking information.
config activate	Use this command to save and activate the pending changes in the FV-110.

Table D-2: UCLI command: config

D.2.2 demo

Command	Description
demo start	Starts a demo pattern where the antenna will turn azimuth, elevation and cross elevation until it receives the command demo stop .
demo stop	Stops the antenna demo pattern.
demo reset	Resets the antenna to angle 0.

Table D-3: UCLI command: demo

D.2.3 dual_antenna

Command	Description
dual_antenna mode	Shows the current dual antenna mode <ul style="list-style-type: none">• single• master• slave
dual_antenna status	<ul style="list-style-type: none">• Shows the current dual-antenna mode status• active• inactive

Table D-4: UCLI command: dual_antenna

D.2.4 exit

Command	Description
exit	Exits the connection to the FV-110.

Table D-5: UCLI command: exit

D.2.5 help

Command	Description
help	Shows a list of commands available, including a short description.
help satellite	Shows the sub commands and description for the command satellite.
help modem	Shows the sub commands and a short description for the command modem.
help track	Shows the sub commands and description for the command track.
help status	Shows the sub commands and description for the command status.
help system	Shows the sub commands and a short description for the command system.
help config	Shows the sub commands, unit and description for the command config.
help zone	Shows the sub commands, unit and description for the command zone.

Table D-6: UCLI command: help

D.2.6 modem

Command	Description
<code>modem</code>	Shows a list of sub commands available, including a short description.
<code>modem name</code>	Shows the VSAT modem name of the currently active satellite profile (entered in the web interface).
<code>modem model</code>	Shows the currently active VSAT modem model (selected in the web interface).

Table D-7: UCLI command: `modem`

D.2.7 satellite

Command	Description
<code>satellite name</code>	Shows the name of the currently active satellite profile.
<code>satellite lon</code> <code>satellite lon 1W</code>	Shows or sets the longitude position of the satellite, in degrees. <ul style="list-style-type: none"> • 1.0W or 1.0E or -1.0 for west and 1.0 for east
<code>satellite skew</code> <code>satellite skew 3.7</code>	Shows or sets an additional skew offset of the satellite. Some satellite has additional skew because they have been placed different in the orbit. E.g. Optus satellites in Australia are offset -45 degrees. Most satellites have 0 degree skew offset. <ul style="list-style-type: none"> • Skew of the satellite: -90° to $+90^{\circ}$.
<code>satellite max_inc</code> <code>satellite max_inc 2.5</code>	Shows or sets the maximum inclination of the used satellite. Some satellites are old and are therefore moving in larger circles in space. Setting the maximum inclination will add this to the FV-110 acquisition window size used to find the satellite. <ul style="list-style-type: none"> • Maximum inclination of satellite 0.0° to 90°
<code>satellite rx_pol</code> <code>satellite rx_pol v</code>	Shows or sets the current RX polarisation: <ul style="list-style-type: none"> • v (vertical) • h (horizontal)

Table D-8: UCLI command: `satellite`

Command	Description
<pre>satellite tx_pol</pre> <pre>satellite tx_pol v</pre>	<p>Shows or sets the current RX polarisation:</p> <ul style="list-style-type: none"> v (vertical) h (horizontal)
<pre>satellite ele_cut_off</pre> <pre>satellite ele_cut_off 5</pre>	<p>Shows or sets the elevation referenced to earth where the FV-110 must shut off for transmission. This is an FCC requirement. The elevation cut off depends on how much power is transmitted and which coding is used.</p> <ul style="list-style-type: none"> Valid range: 0° to 90° <p>For further information see <i>FV-110: Elevation cutoff (in degrees) versus VSAT modem bandwidth and power</i> on page 5-24.</p>
<pre>satellite rx_lo</pre>	<p>Shows the Rx LO / LNB LO. Range: 9.6 GHz to 11.3 GHz.</p>
<pre>satellite rx_rf_freq</pre> <pre>satellite rx_rf_freq 12.123456 9.75</pre>	<p>Shows or sets the Ku-band rx frequency and LNB Lo frequency.</p> <ul style="list-style-type: none"> RF frequency: 10.7 — 12.75 GHz. LNB Lo frequency: 9.6 GHz — 11.3 GHz. <p>The FV-110 supports any LNB Lo!</p> <p>Note: Setting the Ku-band rx frequency and LNB Lo automatically configures the L-band rx frequency: Rx L-band freq = rx_rf_freq – LNB Lo</p> <p>Example: 1567.890 MHz = 11.567890 GHz – 10 GHz</p>

Table D-8: UCLI command: **satellite** (Continued)

Command	Description
<pre>satellite rx_if_freq satellite rx_if_freq 1200.123 9.75</pre>	<p>Shows or sets the IF rx frequency together with the LNB Lo frequency.</p> <ul style="list-style-type: none"> IF frequency within 950 MHz – 2150 MHz. LNB Lo frequency within 9.6 GHz – 11.3 GHz. <p>The FV-110 supports any LNB Lo!</p> <p>Note: Setting the L-band rx frequency and LNB Lo automatically configures the Ku-band rx frequency: Rx Ku-band frequency = LNB Lo + rx_if_frequency</p> <p>Example: 11.567890 GHz = 10 GHz + 1567.890000 MHz</p>
<pre>satellite tx_lo</pre>	<p>Shows the current TX LO frequency, fixed at 12.8 GHz.</p>
<pre>satellite tx_rf_freq satellite tx_rf_freq 14.123456</pre>	<p>Shows or sets the Set the RF frequency used for tx.</p> <ul style="list-style-type: none"> Valid range: 13.75 GHz to 14.5 GHz. <p>Note: Configuring the Ku-band tx frequency automatically configures the L-band frequency: L-band frequency = Ku-band tx frequency – 12.8 GHz (BUC Lo)</p> <p>Example: 1308.300000 MHz = 14.108300 GHz – 12.8 GHz</p>
<pre>satellite tx_if_freq satellite tx_if_freq 1200.123</pre>	<p>Shows or sets the Set the IF frequency for tx.</p> <ul style="list-style-type: none"> Valid range: 950 MHz to 1700 MHz. <p>Note: Configuring the L-band tx frequency automatically configures the Ku-band frequency: Ku-band frequency = 12.8 GHz (BUC Lo) + L-band frequency</p> <p>Example: 14.108300 GHz = 12.8 GHz + 1308.300000 MHz</p>

Table D-8: UCLI command: **satellite** (Continued)

D.2.8 status

Command	Description
status	Shows the sub commands available, including a short description.
status system	Shows the current status of the FV-110. For further information on status values see <i>Information fields on the Dashboard</i> on page 5-20.
status track_all	Shows the current values for all tracking parameters: <ul style="list-style-type: none">• vessel heading• azimuth relative• elevation relative• polarisation skew• GPS latitude and longitude
status event_list	Shows a list of active events. For further information on events see <i>System messages</i> on page G-1.

Table D-9: UCLI command: **status**

D.2.9 system

Command	Description
system	Shows the sub commands available, including a short description.
system restart	Sends a command to the ACU to restart the system instantaneously. It makes a power-on self test and then points to the last used satellite.
system info	Shows the software version, part names and serial numbers of the FV-110.

Table D-10: UCLI command: **system**

D.2.10 track

Command	Description
<code>track</code>	Shows the sub commands available, including a short description.
<code>track mode</code> <code>track mode dvb</code>	Shows or sets the receiver bandwidth or mode, the way the FV-110 tracks the satellite: <ul style="list-style-type: none"> • narrow (recommended, uses the built-in 300 kHz filter of the FV-110) • rssi (uses the RSSI signal from the VSAT modem) • wide (uses the wide-band filter to track the satellite) • dvb (uses the built-in DVB-S2 receiver of the FV-110 to track the satellite. You must configure <code>dvb_sym</code> and <code>dvb_nid</code>.)
<code>track dvb_sym</code> <code>track dvb_sym 22</code>	Shows or sets the current mega symbols rate for the DVB-S2 receiver when in dvb mode. The symbol rate used to verify and track a transponder. <ul style="list-style-type: none"> • Valid range: 0.1 — 99
<code>track dvb_nid</code> <code>track dvb_nid 0</code>	Shows or sets the DVB NID to be verified by the built-in DVB-S2 tracking receiver, when using tracking mode DVB. It configures the NID used to verify and track a transponder. <ul style="list-style-type: none"> • Valid range: 0 — 65535 A NID of '0' disables the NID check. Then the NID will be omitted in the verification of the transponder.
<code>track rx_rf_freq</code>	The frequency for the receiver to tune to. Verify that the frequency is in the same range as the modem <code>rx_rf_frequency</code> , above or below 11.7 GHz. If <code>rx_rf_freq</code> is set to 0, the tracking frequency is the same as the RX frequency provided by the modem <ul style="list-style-type: none"> • Valid range: 10.7 GHz to 12.75 GHz.

Table D-11: UCLI command: `track`

D.2.11 zone

Command	Description
zone	Shows the sub commands, unit and description for the command <code>zone</code> .
zone <id> azimuth <start angle> <end angle>	Sets the azimuth angles of the blocking zone for one zone. <ul style="list-style-type: none">• Valid zones: 0 to 7• Valid angles: 0 to 360
zone <id> elevation <start angle> <end angle>	Sets the elevation angles for a blocking zone. <ul style="list-style-type: none">• Valid zones: 0 to 7• Valid angles: 0 to 360
zone <id> tx_off <yes no>	Enables or disables TX inside the blocking zone.
zone <id> active <yes no>	Enables or disables the blocking zone.
zone <id>	Shows the setting for the blocking zone.

Table D-12: UCLI command: `zone`

DVB-S satellites

This appendix contains examples of DVB-S satellite data for azimuth calibration of the FV-110.

VSAT coverage	Satellite name	Satellite position	RX polarisation	RX frequency	Symbol rate	NID
Americas 	SatMex6 Transponder Backup	113°W	Horizontal —	12.080 GHz —	25.635 MS/s —	0 —
USA 	Echostar9 Transponder Backup	121°W	Horizontal Vertical	11.943 GHz 12.016 GHz	20.000 MS/s 20.000 MS/s	0 0
South East Asia 	NSS6 Transponder Backup	95°E	Horizontal Horizontal	11.676 GHz 12.729 GHz	27.500 MS/s 26.400 MS/s	65535 100
Europe 	Thor 5 T2 Transponder Backup	0.8°W	Horizontal Vertical	11.785 GHz 12.418 GHz	30.000 MS/s 28.000 MS/s	70 70
Europe 	Astra2 Transponder Backup	28.2°E	Horizontal Horizontal	11.623 GHz 12.032 GHz	27.500 MS/s 27.500 MS/s	32 2
China 	Apstar6 Transponder Backup	134°E	Horizontal Vertical	12.435 GHz 12.675 GHz	27.500 MS/s 27.500 MS/s	65 65

Table E-1: Examples of DVB-S satellites for azimuth calibration

VSAT coverage	Satellite name	Satellite position	RX polarisation	RX frequency	Symbol rate	NID
Australia 	Optus D1 Transponder Backup	160°E	Horizontal	12.391 GHz	12.600 MS/s	0
		-45°skew	Horizontal	12.407 GHz	12.600 MS/s	0
Singapore	Thaicom 5	78.5°E	Horizontal Vertical	12.272 GHz 12.313 GHz	30.000 MS/s 30.000 MS/s	88 1
Singapore	Apstar 2R (Telstar 10) / Apstar 7	76.5°E	Vertical	11.167 GHz	45.000 MS/s	0
Osaka, Japan 	KT 5	113°E	Vertical	12.430 GHz	25.6 Ms/s	0

Table E-1: Examples of DVB-S satellites for azimuth calibration (Continued)

For satellite data of other regions or transponders see www.lyngsat.com.

Example:

Freq. Tp	Provider Name Channel Name	System Encryption	SR-FEC SID-VPID	ONID-TID APID Lang.	Beam EIRP (dBW) C/N lock	Source Updated
11038 V tp 38	 Canal +		DVB-S Mediaguard 2 Nagravision 3	22000-5/6	1-1038	Europe 51 6.5 D Shimoni 111119

Figure E-1: Satellite data, example from www.lyngsat.com

The above transponder has following parameters:

- Frequency: 11.038 GHz
- Polarisation: V-Vertical
- Symbol Rate: 22.000 MS/s
- NID: 1
- Coverage: Europe.

Grounding and RF protection

F.1 Why is grounding required?

F.1.1 Reasons for grounding

Grounding the FV-110 system is required for at least two reasons:

- Safety: Lightning protection of persons and equipment.
- Protection: ESD (ElectroStatic Discharge) protection of equipment.

F.1.2 Safety

First of all grounding of the system is required for safety reasons. In the event of a lightning strike at the ADU a proper grounding of the system will provide a low resistance path to divert the strike discharge to seawater.

F.1.3 ESD Protection

The ESD protection circuits in the ACU rely on proper grounding of the system in order to work properly. Otherwise sensitive circuits within the ACU might be damaged due to ESD when you are handling the equipment.

F.2 Grounding Recommendations

F.2.1 To ground the ACU

The ACU should be grounded to the ship/hull. For this purpose you may use a short ADU cable and a grounding kit. Further, the ACU must be grounded at its grounding stud in order to ensure proper grounding if the short ADU cable is disconnected. For further information, see *To ground the ACU* on page 2-27.

If you use the Extended cable support, make the ground connections through the cable support. You may need to extend the ground plane using copper foil, see the following section.

To extend the ground plane

In some cases it may not be possible to access the hull and at the same time place the ACU in a suitable place. A way to insure good grounding and at the same time make it possible to ground the coax cable - is to extend the ship ground plane by means of copper foil. The maximum length of the foil is determined by the width of the foil:

- Copper foil 5 cm wide: Max 50 cm
- Copper foil 10 cm wide: Max 100 cm
- Copper foil 20 cm wide: Max 200 cm

Note | The foil must be at least 0.1 mm thick.

Connect the foil to the hull by plenty of screws or hard-soldering. Run the foil past the place where the short ADU cable is to be grounded and mount a grounding kit on top of the foil. For details on the jumper cable see *Jumper cable for grounding* on page F-10.

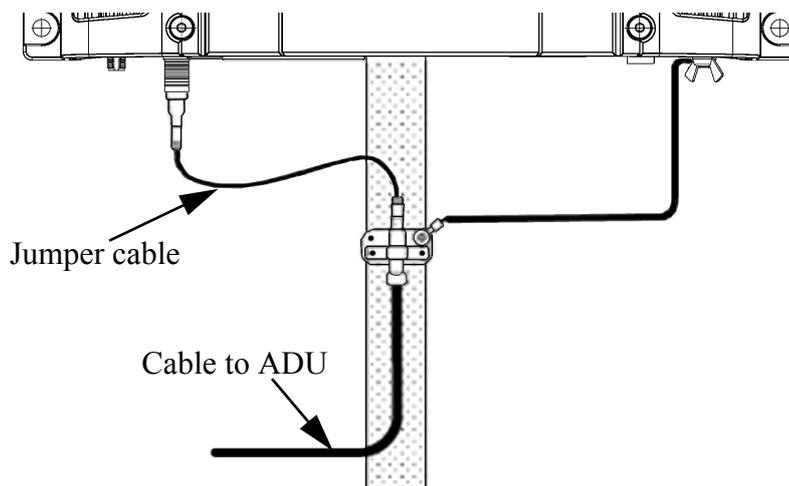


Figure F-1: Extending the ground plane

F.2.2 To ground the ADU

You can ground the ADU to the ship/hull via one or more of its mounting bolts. Make sure to remove painting, dirt, grease etc. at the mounting holes in order to make good

electrical contact to the hull. Use serrated washers when securing the mounting bolts and seal the joint with protective coating to avoid corrosion.

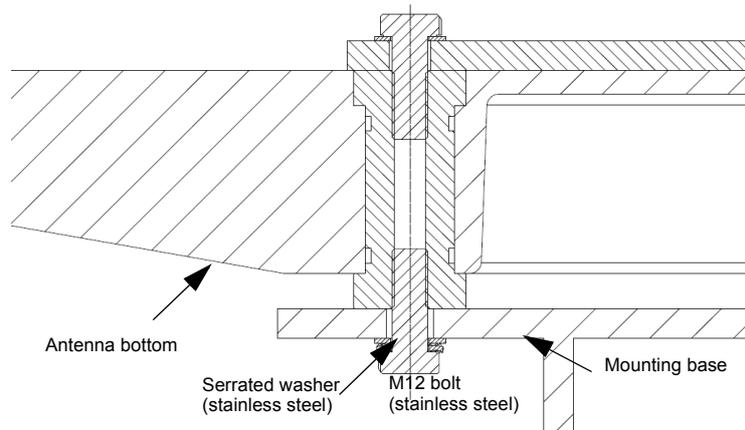


Figure F-2: Grounding the ADU

Note For optimum grounding use the mounting bolt located closest to the ADU cable plate, see *To ground the ADU* on page 2-24.

It is always recommended to establish the shortest possible grounding path e.g. on steel hulls the ADU should be grounded directly to the hull². However, due to the fact that this is not possible on e.g. fibreglass hulls (nor is it preferable on aluminium hulls) a number of alternative grounding methods are suggested in the following paragraphs.

F.3 Alternative grounding for steel hulls

The following guidelines assume a two-wire, isolated grounding arrangement; that is no part of the circuit, in particular the battery negative, is connected to any ground potential or equipment.

F.3.1 To ground the ACU

The ACU should preferably be grounded to the ship with the short cable. Further, the ACU must be grounded at its grounding stud in order to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection can be established either at the hull (recommended) or at a dedicated RF ground if available (alternative).

Important However, bear in mind that the ADU ground connection is to be made at the **same electrical ground potential as the ACU** (see *To ground the ADU*).

2. Please note that the ADU ground connection is made at the same electrical ground potential as the ACU.

The ACU provides galvanic isolation (as required) from its input power terminals to the chassis/grounding stud. This way the isolated grounding arrangement is maintained.

F.3.2 To ground the ADU

Note For optimum grounding use the mounting bolt located closest to the ADU cable plate, see *To ground the ADU* on page 2-24.

Terminal grounded at the hull (recommended)

In this case the ADU is grounded to the ship via one (or more) of its mounting bolts. Make sure to remove painting, dirt, grease etc. at the mounting holes in order to make good electrical contact to the hull. Use serrated washers when securing the mounting bolts and seal the joint with protective coating to avoid corrosion.

Terminal grounded at a dedicated RF ground (alternative)

In this case the ADU is grounded with a separate ground cable. The ground cable must be routed parallel and close to the shielded coax cable connecting the ADU to the ACU grounding kit. A heavy gauge wire with tinned strands (min. 6 mm²) can be used for this purpose.

Note The ADU must be electrically isolated at its mounting bolts by means of shoulder bushings and washers ensuring the isolated RF ground - see *Isolation of the ADU from the mounting base* on page F-8.

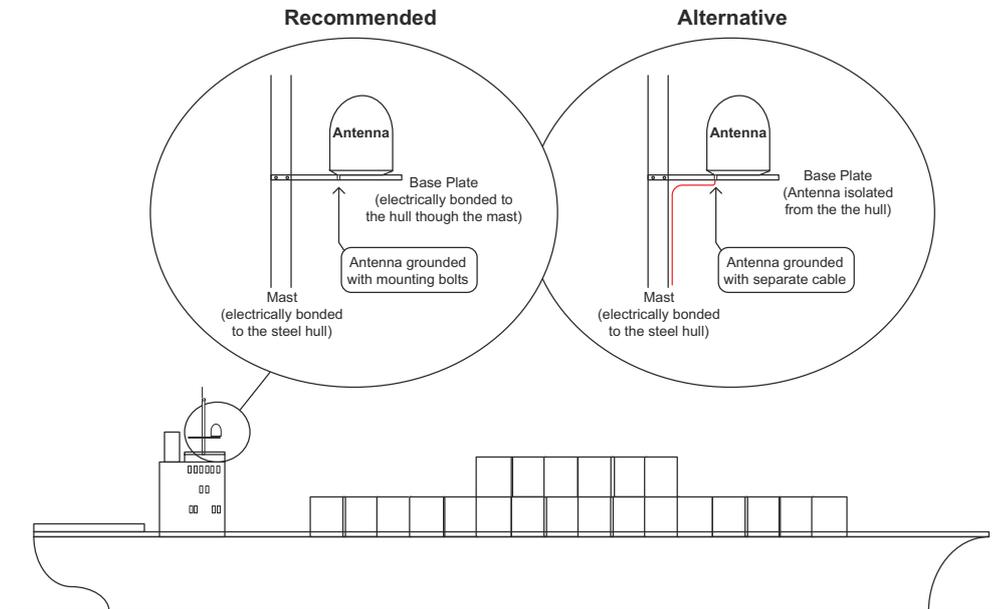


Figure F-3: Grounding at a dedicated RF ground (alternative)

F.4 Alternative grounding for aluminum hulls

The following guidelines assume a two-wire, isolated grounding arrangement; that is no part of the circuit, in particular the battery negative, is connected to any ground potential or equipment.

F.4.1 To ground the ACU

The ACU should preferably be grounded with the short cable. Further, the ACU must be grounded at its grounding stud to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection must be established at a dedicated RF ground (either capacitively or electrically coupled).

Important Remember to make the ADU ground connection at the **same electrical ground potential** as the ACU (see *To ground the ADU*).

The ACU provides galvanic isolation (as required) from its input power terminals to the chassis/grounding stud. This way the isolated grounding arrangement is maintained.

F.4.2 To ground the ADU

If the mounting base of the ADU is electrically connected to the hull (or any other ground potential than the ACU), the ADU must be isolated at its mounting bolts by means of shoulder bushings and washers, see F.6.3. This is done in order to prevent DC currents flowing in the hull thus causing electrolytic corrosion.

However, a ground connection must be established via one of the mounting bolts using a separate ground cable. The ground cable must be routed parallel and in close proximity to the shielded coax cable hence connecting the ADU to the ACU Grounding kit. A heavy gauge wire with tinned strands (min. 6 mm²) can be used for this purpose.

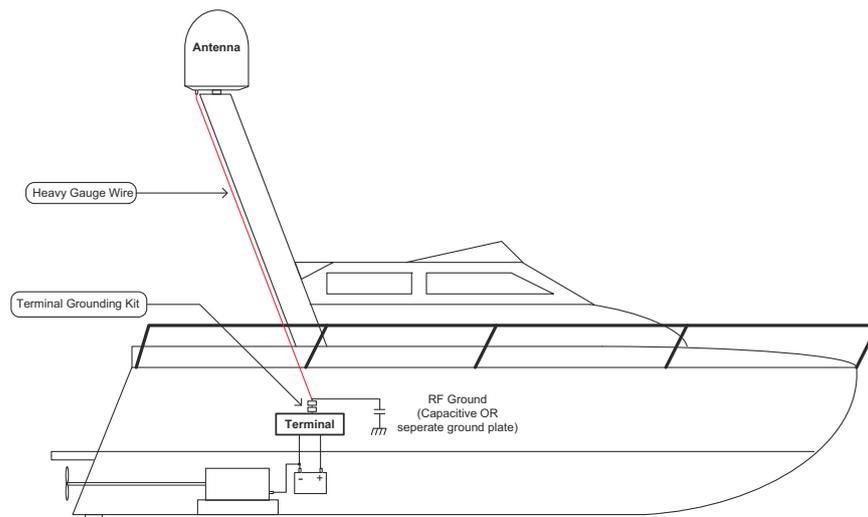


Figure F-4: Alternative grounding for aluminium hulls

F.5 Alternative grounding for fibre glass hulls

F.5.1 To ground the ACU

The ACU should be grounded as shown in this section. Further, the ACU must be grounded at its grounding stud in order to ensure a proper grounding if the short ADU cable is disconnected.

The ground connection must be established at a dedicated RF ground (either capacitive or electrical coupled).

Important

Bear in mind that the ADU ground connection is to be made at the **same electrical ground potential** as the ACU (see *To ground the ADU*).

F.5.2 To ground the ADU

If the mounting base of the ADU is electrically connected to any other ground potential than the ACU (e.g. Lightning Ground), the ADU must be isolated at its mounting bolts by means of shoulder bushings and washers - see section F.6.3.

However, a ground connection must be established via one of the mounting bolts using a separate ground cable. The ground cable must be routed parallel and in close proximity to the shielded coax cable hence connecting the ADU to the ACU Grounding kit. A heavy gauge wire with tinned strands (min. 6 mm²) can be used for this purpose.

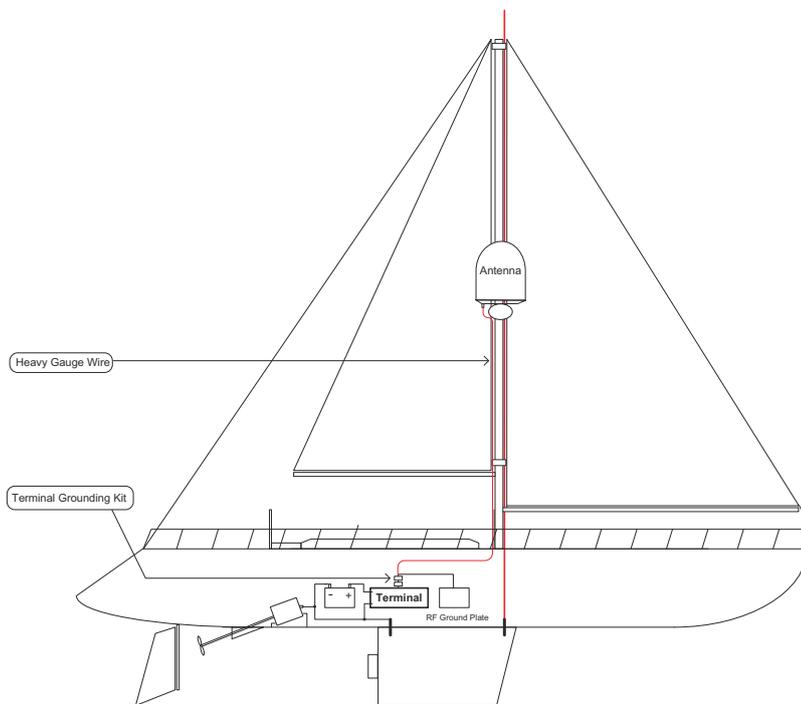


Figure F-5: Alternative grounding for fibreglass hulls

F.6 Separate ground cable

F.6.1 Ground cable - construction

When dealing with electrical installations in a marine environment, all wiring must be done with double insulated, tinned strands, high quality and if exposed also UV resistant cables. This shall also apply to the separate ground cable mentioned in the previous paragraphs.

The ground cable is constructed using an appropriate cable with a cross section area of at least 6 mm^2 (AWG10) and terminated with insulated ring crimp terminals – see illustration below. The crimp terminals must be a marine approved type e.g. the DuraSeal series from Raychem.

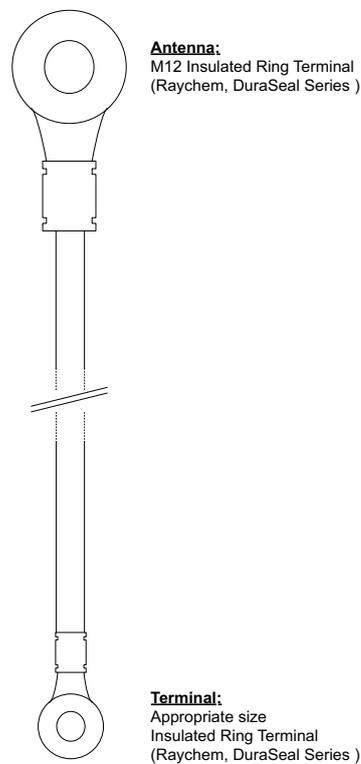


Figure F-6: Separate ground cable

F.6.2 Ground cable - connection

Mount the ground cable close to and parallel to the shielded coax cable thus minimizing ground loop problems. If possible, route the coax cable and the ground cable in metal conduits bonded to the hull or within a mast (depending on the actual installation).

The ground cable must be connected at one of the mounting/grounding bolts on the ADU. Use bolts and washers of stainless steel and seal the joint with protective coating to avoid corrosion. If the ADU is to be isolated from the mounting base, shoulder bushings and washers must be used — see figure F-7, *Isolation of the ADU from the mounting base* on page F-8.

At the other end, connect the ground cable as described in *To ground the ACU* on page F-2.

F.6.3 Isolation of the ADU from the mounting base

In cases where the ADU is to be isolated from the mounting base, shoulder bushings and washers (accessories) must be used as illustrated below. Please note that the isolation has to be implemented on all four mounting bolts (including the bolt securing the ground cable).

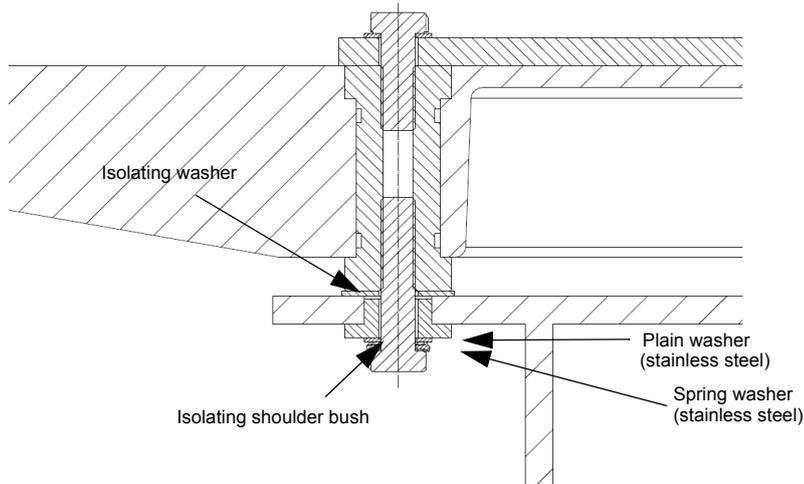


Figure F-7: Isolation of the ADU from the mounting base

The ground cable must be connected at one of the mounting/grounding bolts on the ADU as illustrated below. Remember to seal the joint with protective coating to avoid corrosion.

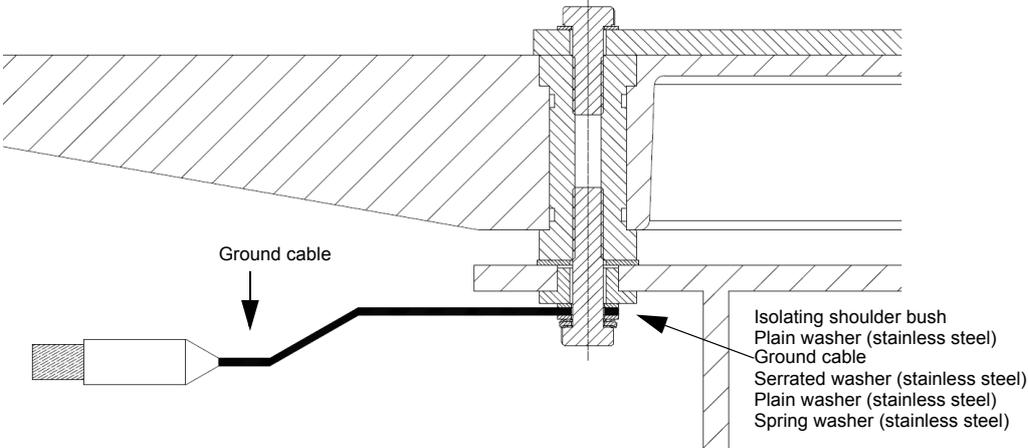


Figure F-8: ADU isolation and grounding cable

F.7 Jumper cable for grounding

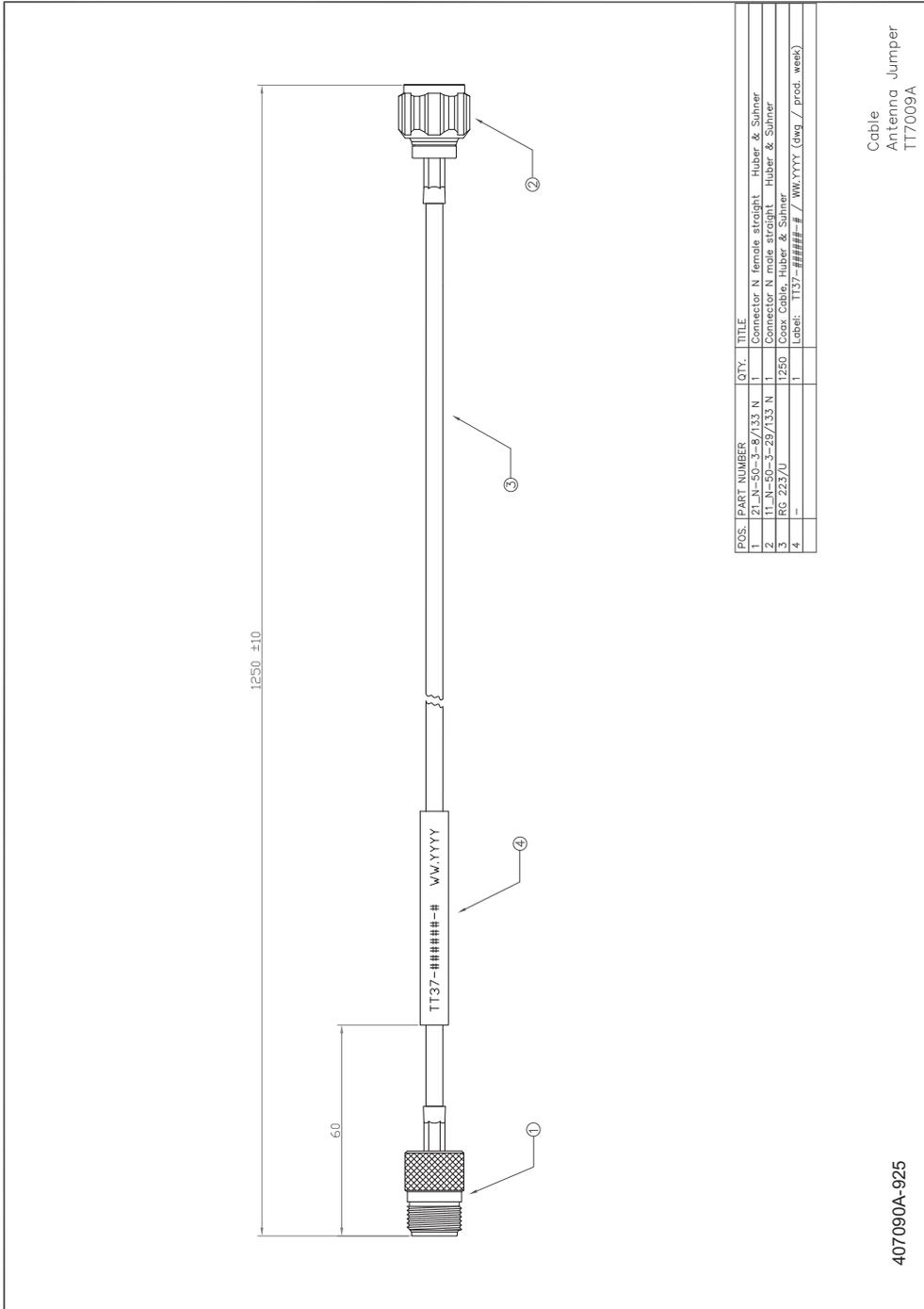


Figure F-9: Jumper cable for grounding (specifications)

F.8 RF interference

Interference induced from nearby high-power RF transmitters might cause system failures and in extreme cases permanent damage to the FV-110 equipment. If there are problems with interference from HF transmitters, it is advisable to mount ferrite clamps on the coax cable in order to provide suppression of induced RF. The ferrites will have no effect on the differential-mode signals but increases the impedance in relation to common-mode RFI.

F.8.1 Recommendations

Use 1-5 pcs. hinged clamp cores (e.g. the RFC or SFC series from Kitagawa) mounted on the ADU cable near the ADU.

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System messages

G.1 Event messages – overview

The FV-110 detects events during

- POST (Power On Self Test) – a self test performed at every power-up.
- PAST (Person Activated Self test) – started in the web interface
- CM (Continuous Monitoring) – automatically performed while the system is in operation.

When the FV-110 detects an event that requires your action, it issues an event message and the red Fail/Pass LED in the LED panel of the ACU is lit. As long as an event is active, it is shown in the ACU display and the web interface (in HELPDESK > Event list or click the event icon on the DASHBOARD).

Note

Active events and notifications are shown. As soon as the event is cleared, it is not displayed any longer. It is then moved to the Notifications section. Notifications are cleared after 24 hours.

State the Event ID when contacting your service partner.

The event description might contain a number of digits in brackets, e.g. (00000005). This is supplemental information and used for service and diagnostics purposes.

G.2 List of ADU events

Error code (ID)	Unit	Severity	Description	Explanation
0A001-0	Antenna	ERROR	Production data	Production data is invalid.
0A002-0	Antenna	ERROR	XIM internal	Antenna configuration data stored in the PCM module is invalid.
0A003-0	Antenna	ERROR	XIM external	Antenna configuration data stored in the VIM/TIM module is invalid.
0A004-0	Antenna	ERROR	XIM I/X match	Antenna configuration data stored in the PCM module does not match the configuration data stored in the VIM/TIM module.
0A005-0	Antenna	ERROR	Antenna type	The configured antenna type is not supported or unknown.
0A006-0	Antenna	ERROR	PCM FPGA load	The PCM FPGA cannot be initialised and loaded correctly.
0A007-0	Antenna	ERROR	XIM FPGA load	The VIM/TIM FPGA cannot be initialised and loaded correctly.
0A008-0	Antenna	ERROR	XIM production	Production/calibration data stored in the VIM/TIM module is invalid.
0A00A-0	Antenna	ERROR	GPS initialisation	The GNSS device cannot be initialised. Check cable and GNSS device.
0A014-0	Antenna	ERROR	AMB device discovery	Missing one or more of the following devices: ISM, DDM and PMM. Check cables.
0A015-0	Antenna	ERROR	Azi DDM ABS device	Cannot initialise the azimuth DDM. Info: 0x00000000: Device not found (possible cabling problem) 0x0000bbaa: Device internal error (replace device) aa=status, bb=state.
0A016-0	Antenna	ERROR	Xel DDM ABS device	Cannot initialise the cross-elevation DDM. Info: See 0A015-0.
0A017-0	Antenna	ERROR	Ele DDM ABS device	Cannot initialise the elevation DDM. Info: See 0A015-0.

Table G-1: ADU event messages

Error code (ID)	Unit	Severity	Description	Explanation
0A018-0	Antenna	ERROR	ISM ABS device	Cannot initialise the ISM Info: 0x00000000: Device not found (possible cabling problem) 0x000cbbaa: Device internal error (replace device) aa=status, bb=state, c=calibration data error.
0A019-0	Antenna	ERROR	PMM ABS device	Cannot initialise the PMM. Info: See 0A015-0.
0A01A-0	Antenna	ERROR	BCM ABS device	Cannot initialise the BCM. Info: See 0A015-0.
0A01E-0	Antenna	ERROR	Sensor sanity	Too many invalid values measured by the ISM during initialisation. Check for vibrations or malfunctioning ISM.
0A021-0	Antenna	ERROR	Azi axis calibration	Azimuth axis zero reference not found. Check belt and zero reference module. Info: 0x00000001: Timeout (operation did not complete in time) 0x00000010: Encoder or mechanical problem 0x00000020: Zero reference not found 0x00000040: End stop not found.
0A022-0	Antenna	ERROR	Xel axis calibration	Cross-elevation axis zero reference or end stops not found at expected locations. Check belt, zero reference module, and end stops. Info: See 0A021-0.
0A023-0	Antenna	ERROR	Ele axis calibration	Elevation axis zero reference or end stops not found at expected locations. Check belt, zero reference module, and end stops. Info: See 0A021-0.
0A024-0	Antenna	ERROR	Pol axis calibration	Polarisation axis zero reference or end stops not found at expected locations. Check movement of the polarisation unit and the zero reference module. Info: See 0A021-0.
0A025-0	Antenna	ERROR	Antenna calibration	One or more errors occurred during antenna start-up Info: 0x00000001: Timeout (calibration did not complete in time) 0x00000010: Azimuth axis 0x00000020: Cross-elevation axis 0x00000040: Elevation axis 0x00000080: Polarisation axis

Table G-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0A028-0	Antenna	ERROR	Demodulator load	The second receiver demodulator cannot be initialised and loaded correctly.
0A029-0	Antenna	ERROR	XIM PLL lock	The PLL on the VIM/TIM does not lock.
0A02B-0	Antenna	ERROR	ABS software version	The ABS software version in the antenna is too old to match the hardware requirements. Upgrade the software.
0A034-0	Antenna	WARNING	ACU communication	The communication link between ACU and antenna is down.
0A035-0	Antenna	WARNING	ISM data valid	Sensor measurements from the ISM are invalid. This indicates a malfunctioning ISM.
0A036-0	Antenna	WARNING	ISM data range	Sensor measurements from the ISM are out of range.
0A037-0	Antenna	WARNING	GNSS communication	Lost connection to the GNSS device.
0A038-0	Antenna	WARNING	GNSS data range	Received information from the GNSS device which is out of range.
0A039-0	Antenna	WARNING	GNSS device warning	Local GNSS device warning.
0A03A-0	Antenna	WARNING	GNSS device error	Local GNSS device error.
0A03B-0	Antenna	ERROR	Azi DDM shutdown	The azimuth motor control has detected one of the following situations: Extreme temperature, voltage, current or velocity. The motor was then shut down. This is usually a temporary situation and is probably fixed by a restart of the system.
0A03C-0	Antenna	ERROR	Xel DDM shutdown	As Azi DDM shutdown but detected by the cross-elevation motor control.
0A03D-0	Antenna	ERROR	Ele DDM shutdown	As Azi DDM shutdown but detected by the elevation motor control.
0A03E-0	Antenna	ERROR	PMM shutdown	As Azi DDM shutdown but detected by the polarisation motor control.
0A03F-0	Antenna	WARNING	AMB timing	This indicates a busy situation. It may occur during installation procedures. No user interaction is required.
0A040-0	Antenna	WARNING	VIM cable attn	The output power cannot be controlled correctly. Check the Tx chain.

Table G-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0A041-0	Antenna	WARNING	BUC voltage low	The voltage for the BUC is too low, probably caused by a malfunctioning VIM or BUC.
0A042-0	Antenna	WARNING	BUC voltage high	The voltage for the BUC is too high probably caused by a malfunctioning VIM.
0A043-0	Antenna	WARNING	LNB voltage low	The voltage for the LNB is too low probably caused by a malfunctioning VIM/TIM or LNB.
0A044-0	Antenna	WARNING	LNB voltage high	The voltage for the LNB is too high probably caused by a malfunctioning VIM/TIM.
0A045-0	Antenna	WARNING	PMM fan	The fan is not working or the tacho input from the fan is not connected. Check fan cable and fan.
0A046-0	Antenna	WARNING	OMT temperature	The temperature of the BUC is too high. Check if the fan is working.
0A047-0	Antenna	ERROR	VIM PLL lock	The PLL of the VIM/TIM is out of lock. Check the 10 MHz reference signal.
0A048-0	Antenna	WARNING	VIM tuner lock	The PLL of the second receiver (DVB) is out of lock. Check the 10 MHz reference signal.
0A049-0	Antenna	WARNING	Azi encoder slip	A slip of the azimuth encoder has been detected. No user interaction is required unless this is a permanent situation. In this case the belt and encoder of the azimuth axis must be checked.
0A04A-0	Antenna	WARNING	Xel encoder slip	A slip of the cross-elevation encoder has been detected. No user interaction is required unless this is a permanent situation. In this case the belt and encoder of the cross-elevation axis must be checked.
0A04B-0	Antenna	WARNING	Ele encoder slip	A slip of the elevation encoder has been detected. No user interaction is required unless this is a permanent situation. In this case the belt and encoder of the elevation axis must be checked.
0A04C-0	Antenna	WARNING	Pol encoder slip	A slip of the polarisation encoder has been detected. No user interaction is required unless this is a permanent situation in which case the encoder of the polarisation axis must be checked.
0A04D-0	Antenna	WARNING	GNSS position	No position available from the GNSS device or position too old.
0A04E-0	Antenna	WARNING	GNSS velocity	No velocity available from the GNSS device.

Table G-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0A04F-0	Antenna	WARNING	Heading data	Heading information is missing in the antenna.
0A050-0	Antenna	ERROR	Azi DDM communication	Communication error between PCM and azimuth DDM. Check SUB-D connectors and cables.
0A051-0	Antenna	ERROR	Xel DDM communication	Communication error between PCM and cross-elevation DDM. Check SUB-D connectors and cables.
0A052-0	Antenna	ERROR	Ele DDM communication	Communication error between PCM and elevation DDM. Check SUB-D connectors and cables.
0A053-0	Antenna	ERROR	ISM communication	Communication error between PCM and ISM. Check SUB-D connectors and cables.
0A054-0	Antenna	ERROR	PMM communication	Communication error between PCM and PMM. Check SUB-D connectors and cables.
0A055-0	Antenna	WARNING	Azi DDM warning	The azimuth motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0A056-0	Antenna	WARNING	Xel DDM warning	The cross-elevation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0A057-0	Antenna	WARNING	Ele DDM warning	The elevation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.
0A058-0	Antenna	WARNING	PMM warning	The polarisation motor controller has temporarily observed an unusual situation with regards to temperature, voltage, current or velocity. No user interaction required.

Table G-1: ADU event messages (Continued)

Error code (ID)	Unit	Severity	Description	Explanation
0A059-0	Antenna	WARNING	Azi cal. limits	Azimuth axis calibration result check limits exceeded. Pointing performance may be degraded. Info: 0x00000040: End stop detected before expected limit 0x00000100: Zero width is low 0x00000200: Zero width is high 0x00000400: Zero slack is high 0x00001000: Friction average is high 0x00002000: Friction peak is high 0x00004000: Friction asymmetry is high Zero width low/high: Zero reference module placement may be incorrect. Zero slack high: Mechanical slack may be too high. Friction average/peak high: Mechanical friction is higher than expected. Friction asymmetry high: Mechanical imbalance may be too high.
0A05A-0	Antenna	WARNING	Xel cal. limits	Cross-elevation axis calibration result check limits exceeded. Pointing performance may be degraded. Info: See 0A059-0.
0A05B-0	Antenna	WARNING	Ele cal. limits	Elevation axis calibration result check limits exceeded. Pointing performance may be degraded. Info: See 0A059-0.
0A05C-0	Antenna	WARNING	Pol cal. limits	Polarisation axis calibration result check limits exceeded. Pointing performance may be degraded. Info: See 0A059-0.
0A05D-0	Antenna	WARNING	ISM warning	The ISM has temporarily observed an unusual situation with regards to temperature or voltage. No user interaction required. If repeated after cooldown and reboot, the ISM or cables around it may be defective.
0A05E-0	Antenna	WARNING	Low elevation	The antenna is not allowed to transmit because the elevation is too low.
0A05F-0	Antenna	WARNING	Heading range	Heading data range error. External heading unit supplies unreliable data.
0A062-0	Antenna	WARNING	High elevation	The antenna cannot perform acquisition in mode without heading input because the elevation is too high.

Table G-1: ADU event messages (Continued)

G.3 List of ACU events

Error code (ID)	ACU PCB	Severity	Description	Explanation
08060-0	ADM	WARNING	ADU modem	ACU/ADU communication error detected (framing and parity). If the situation is persistent, check if cable specifications comply (length and attenuation).
08061-0	ADM	WARNING	VMU linux shell password	The specified password (root) for the VSAT modem is not accepted by the modem.
08062-0	ADM	WARNING	VMU debug shell password	The specified password (user) for the VSAT modem is not accepted by the modem.
08063-0	ADM	ERROR	ADU connection	The ACU has lost connection with the antenna.
08064-0	ADM	ERROR	ADM PLL lock	The intermediate frequency PLL is not in lock. Check the 10 MHz reference signal.
08065-0	ADM	WARNING	GNSS data	Missing GPS data (fix).
08066-0	ADM	WARNING	Heading data	Missing heading information. Check cable and heading provider device.
08067-0	ADM	ERROR	PCB temperature	ADM temperature too high. The ACU is not equipped with a fan, so make sure there is compliance with the environmental specifications.
08068-0	ADM	ERROR	PSM power	The PSM fails to provide the requested supply voltage.
08069-0	ADM	WARNING	Blocking Zone	The antenna has entered a blocking zone.
0806A-0	ADM	WARNING	VMU connection	The ACU has lost connection with the sat modem.
0806B-0	ADM	WARNING	ROSS connection	The ACU has lost connection with the ROSS device.
0806C-0	ADM	ERROR	VMU frequency setup	There is a mismatch in the frequency setup. Probably the sat modem is not configured correctly to match the requirements of the ACU and antenna. A common mismatch is the absence of Rx or Tx LO parameter in the VSAT modem.

Table G-2: ACU event messages

Error code (ID)	ACU PCB	Severity	Description	Explanation
0806D-0	ADM	ERROR	ADU power	The ADU supply voltage is outside the allowed limits. This could happen if the PSM fails to provide the requested supply voltage or if the voltage difference across the hotswap is unacceptable high.
0806E-0	ADM	ERROR	VMU 10 MHz reference	The VMU Rx or Tx reference signal is not present. Whether this error Rx or Tx reference, depends on the users selection on the modem profile page. Make sure VMU Rx/Tx cable is connected and that the VMU is configured to output the RX/TX reference signal.
0806F-0	ADM	WARNING	ROSS synchronization	The ACU has become out of sync with the ROSS device, most likely because the ACU has been replaced, or the ROSS satellite profile is new. A manual (forced) handoff sequence must be initiated from the ROSS, refer to the ROSS manual for the procedure.
08073-0	ADM	WARNING	Slave connection	The system is configured as a dual antenna master, but no dual antenna slave is connected to it. Either disable the dual antenna master in the web interface or configure a another system as a dual antenna slave.
08074-0	ADM	WARNING	Master connection	The system is configured as a dual antenna slave, but it was not possible to connect to the dual antenna master. Check that the IP address entered in the modem profile is correct and check that the master and slave systems are physically connected as described in the manual.
08076-0	ADM	WARNING	Incompatible message version	The system is configured as a dual antenna system, but the software versions on master and slave system are different. Ensure that both master and slave have identical software.
08078-0	ADM	WARNING	VMU TX frequency invalid	VSAT modem unit provided a TX frequency of zero. This may degrade tx performance. To remove this warning re-configure the modem to provide the correct tx frequency.
08100-0	ADM	ERROR	PSM low voltage (22 V)	The ADM measures a different ADU voltage than expected. If the problem is not solved by a restart, and the PSM is not reporting any errors, the ADM is probably defective.

Table G-2: ACU event messages (Continued)

Error code (ID)	ACU PCB	Severity	Description	Explanation
08101-0	ADM	ERROR	PSM high voltage (48 V)	The ADM measures a different ADU voltage than expected. Check for short circuit of the antenna coax connector. If the problem is not solved by a restart, and the PSM is not reporting any errors, the ADM is probably defective.
08102-0	ADM	ERROR	PSM 5 V power	Internal voltage supply error of the ADM.
08103-0	ADM	ERROR	ADM hotswap	The ACU is not able to supply the correct voltage to the antenna. Check for short circuits in coax cable and the antenna
08104-0	ADM	ERROR	ADU communication	The ACU cannot communicate with the antenna. Check cable and antenna.
08107-0	ADM	ERROR	ADM FPGA load	The ADM FPGA cannot be initialised and loaded.
08108-0	ADM	ERROR	TX Power Detector calibration	The power detector calibration is not valid.
08109-0	ADM	ERROR	ADU XIM data	There is a mismatch with the antenna configuration data. Either the PCM or the VIM in the antenna are malfunctioning or one of them has been replaced. In the latter case, select which is the original device in the web interface and restart the system.
0810A-0	ADM	ERROR	ADM production data	Production data has been corrupted.
0810B-0	ADM	ERROR	ADU software version	Some error occurred during upload of software to the ADU, which means that the ADU software version is not as expected. Either the software in the ACU, does not meet the minimum version required by the ADU, the software image in the ACU is corrupted or the upload procedure failed because of a communication error.
0810C-0	ADM	ERROR	File system integrity	One or more file system partitions are corrupt. You may have lost your settings and collected statistics. If restarting the system does not help, contact your service partner.

Table G-2: ACU event messages (Continued)

Error code (ID)	ACU PCB	Severity	Description	Explanation
0810D-0	ADM	ERROR	ACU software upload	Some error occurred during upload of software to the ACU, which means that the ACU software version is not as expected. Either the software in the ACU, does not meet the minimum version required by the ACU, the software image in the ACU is corrupted or the upload procedure failed because of a communication error.
08840-0	ADM	WARNING	Master PLL lock	The master PLL has lost lock. Check the input reference signal.
09000-0	KDM	ERROR	KDM 3V3 supply	Internal 3V3 voltage supply error in the KDM.
09001-0	KDM	ERROR	KDM 12V supply	Internal 12V voltage supply error in the KDM.
09002-0	KDM	ERROR	KDM display	Display hardware error in the KDM.
09010-0	KDM	ERROR	KDM link/SW version	Link to the KDM module could not be established. Either the KDM board is malfunctioning, or - if the system software has just been updated - the software is too old and is not compatible with the KDM hardware.
0B000-0	PSM	ERROR	PSM production data	Missing or invalid production data in the PSM. It should be replaced.
0B001-0	PSM	ERROR	NMEA 2000 identifier	Missing or invalid production data in the PSM. It should be replaced.
0B010-0	PSM	ERROR	PSM link/SW version	Link to the PSM module could not be established. Either the PSM board is malfunctioning, or - if the system software has just been updated - the software is too old and is not compatible with the PSM hardware.
0B060-0	PSM	WARNING	NMEA 0183 parse error	Parse errors detected on the NMEA 0183 interface. Check NMEA 0183 cable, signal levels etc.

Table G-2: ACU event messages (Continued)

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Approvals

H.1 Overview

This appendix lists the approvals for FV-110:

- *OEM declaration*
- *CE (R&TTE)*
- *Eutelsat S.A – ESV Summary Sheet*
- *Russian Maritime Register of Shipping*
- *ANATEL Certificado de Homologação*

H.2 OEM declaration



Cobham SATCOM
Lundtoftegaardsvej 93 D
2800 Kgs. Lyngby
Denmark
T: +45 39 55 88 00
F: +45 39 55 88 88

Declaration of Thrane & Thrane A/S

1. This declaration refers to the following Thrane & Thrane antenna model:
407090B FV-110, Maritime Ku-Band Antenna System consisting of:
407016A FV-110 Antenna Control Unit (ACU) FUR PN = 407016A-F19
407009B FV-110 VSAT Above Deck Unit (ADU) FUR PN = 407009B-FUR
2. Thrane and Thrane A/S hereby declare that the antenna units referenced in 1, are electrical and hardware identical to the units of Maritime Ku-Band Antenna System referenced in 4. The only difference of the two systems is labels and a different user interface in the software.
3. Thrane and Thrane A/S hereby declare that all Declaration of Conformity concerning for the Maritime Ku-Band Antenna System referenced in 4 also apply for the Maritime Ku-Band Antenna System referenced in 1.
4. TT-7090B SAILOR 900 VSAT, Maritime Ku-Band Antenna System consisting of:
TT-7016A Antenna Control Unit (ACU) PN = 407016A-T19
TT-7009B Above Deck Unit (ADU) PN = 407009B-THR

Date: 17/6-2015

Vibeke Fink
R&D Director
Thrane & Thrane A/S

H.3 CE (R&TTE)

The FV-110 is CE certified (R&TTE directive) as stated in the “Declaration of Conformity with R&TTE Directive”.



Thrane & Thrane A/S

Declaration of Conformity with R&TTE Directive

The undersigned of this letter declares that the following equipment complies with the specifications of EC directive 1999/5/EC concerning Radio & Telecommunications Terminal Equipment.

Equipment included in this declaration

TT-7090B SAILOR 900 VSAT, Maritime Ku-Band Antenna System consisting of:

TT-7016A	SAILOR 900 Antenna Control Unit (ACU) T19"	PN = 407016A-T19 or
	SAILOR 900 Antenna Control Unit (ACU) TBH	PN = 407016A-TBH or
	S900 Antenna Control Unit (ACU) N19"	PN = 407016A-N19 or
	S900 Antenna Control Unit (ACU) NBH	PN = 407016A-NBH

And:

TT-7009B	SAILOR 900 Above Deck Unit (ADU) THR	PN = 407009B-THR or
	S900 Above Deck Unit (ADU) EDK	PN = 407009B-EDK or
	S900 Above Deck Unit (ADU) NEU	PN = 407009B-NEU

Equipment Applicability

TT-7090B SAILOR 900 VSAT System consists of an antenna unit (ADU – Above Deck Unit) and an ACU (Antenna Control Unit). The system includes either one of the ACUs (TT-7016A 19" Rack or TT-7016A Bulkhead). VSAT=Very Small Aperture Terminal. It is a system that provides two-way satellite voice/data broadband communication while in movement on a vessel at sea (stabilized). The system can transmit to and receive from any desired Ku-band satellite, which has adequate signal coverage in the current geographic area.

Declaration

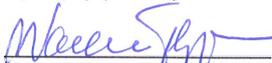
The requirement with respect to the LVD directive 2006/95/EC is met by conforming to the harmonized EU standard EN 60950. The protection requirement with respect to the EMC directive 2004/108/EC is met by conforming to the harmonized EU standard EN 60945. Effective use of frequency spectrum is met by conforming to harmonized EU standard EN 302 340. Confirmed by Nemko, Notified Body No. 0470.

Manufacturer

Thrane & Thrane A/S
Lundtoftegårdsvej 93D, DK-2800 Kgs. Lyngby, Denmark
Porsvej 2, DK-9200 Aalborg SV, Denmark

Place and Date

Kgs. Lyngby, 17. April 2013



Walther Thygesen, CEO
Thrane & Thrane A/S

Doc. no. 99-139020-A



Page: 1 of 1

H.4 Eutelsat S.A – ESV Summary Sheet

Eutelsat s.a.

ESV Summary Sheet



Manufacturer:

Thrane & Thrane A/S
Lundtoftegaardsvej 93 D
DK-2800 Kgs. Lyngby
DENMARK

Tel: + 45 39 55 88 00
Fax: + 45 39 55 88 88
<mailto:info@thrane.com>

Antenna model:

SAILOR 900 VSAT 407009B-00500

Antenna aperture dimensions:

1.03 m

Standard:

M

Characterization date:

30-04-2013

System Description:

Stabilised maritime antenna – ring focus Gregorian configuration – Sandwich foam pre-preg layers radome. Three axis stabilization platform with conical RF tracking.
BUC NextGenWave 8W rating
LNB Philtech .
OMT Thrane & Thrane TT 60-131011.

Models Characterized:

Standard configuration: linear orthogonal polarization with co-polarized or cross-polarized signal reception option.

Maximum Allowed EIRP:

For digital carriers transmitted at the satellite receive contour of 0 dB/K (EESS 502 refers):
39.8 dBW / 40 kHz for an orbital separation of the adjacent satellite $\geq 2.5^\circ$
39.6 dBW / 40 kHz for an orbital separation of the adjacent satellite $\geq 2.0^\circ$
35.6 dBW / 40 kHz for an orbital separation of the adjacent satellite $\geq 1.5^\circ$

Tx Frequency:

13.75 – 14.50 GHz

Rx Frequency:

10.70-12.75 GHz

Tx Gain:

41.1dBi (typical at 14.25 GHz)

Rx Gain:

40.2 dBi (typical at 11.7 GHz)

Tx XPD:

>30 dB within -1 dB contour

Rx XPD:

>30 dB within -1 dB contour

G/T (measured with radome)

19.9 dB/K @ 12.75 GHz 30 ° Elevation

Remarks:

- 1-The manufacturer states that the RMS pointing error is less than 0.20° for the following ship motions:
Roll = 30° in a period of 6 sec
Pitch = 15° in a period of 4 sec
Yaw = 10° in a period of 10 sec
- 2-The RF performance characterization was performed on one antenna unit with radome, at the France Telecom test range of La Turbie, France on the 18-20 April 2013.
- 3-Thrane & Thrane has inserted in the ACU software a look-up table with the polarization skew of the Eutelsat satellites, to protect against the mishandling of polarization skew values by installers.
- 4-The characterization's validity is subject to regular submission of patterns to confirm that the system remains compliant with the Eutelsat standards.

Restrictions:

The use of Rx band 10.7 to 10.95 GHz may be subject to impairments because the isolation of the sidelobes at 3° from the boresight is less than 20 dB at 10.70 GHz (17.8 dB). Nevertheless these operations may be exceptionally authorized according to a valid Eutelsat transmission plan.

H.5 Russian Maritime Register of Shipping

РОССИЙСКИЙ МОРСКОЙ РЕГИСТР СУДОХОДСТВА RUSSIAN MARITIME REGISTER OF SHIPPING		MODTAGET 6.8.3 AALBORG 10 DEC. 2013
		
СВИДЕТЕЛЬСТВО О ТИПОВОМ ОДОБРЕНИИ TYPE APPROVAL CERTIFICATE		
Изготовитель Manufacturer	Thrane & Thrane A/S	
Адрес Address	Lundtoftegaardsvej 93 D, DK-2800 Kgs., Lyngby, Denmark Тел. / Tel.: +45 39 55 88 00, Факс. / Fax.: +45 39 55 88 88, Эл. почта / e-mail: info@thrane.com, www.thrane.com	
Изделие* Product*	Судовая земная станция (СЗС) спутниковой связи VSAT, типы "SAILOR 800 VSAT / SAILOR 900 VSAT" VSAT Ship Earth Station (SES) of satellite communication, types "SAILOR 800 VSAT / SAILOR 900 VSAT"	
Код номенклатуры Code of nomenclature	04090000	
<p>На основании освидетельствования и проведенных испытаний удостоверяется, что вышеупомянутое(ые) изделие(я) удовлетворяет(ют) требованиям Российского морского регистра судоходства. This is to certify that on the basis of the survey and tests carried out the above mentioned item(s) complies(ly) with the requirements of Russian Maritime Register of Shipping.</p>		
<p><i>Изделие соответствует применимым требованиям части IV "Радиооборудование" Правил РС по оборудованию морских судов, изд. 2013 г., требованиям Резолюции ИМО А.694(17).</i></p>		
<p><i>Product meets the applicable requirements of the Part IV "Radioequipment" of the RS Rules for the Equipment of Sea-Going Ships, edition 2013, requirements of IMO Resolutions A.694(17).</i></p>		
<p>Настоящее Свидетельство о типовом одобрении действительно до 15.11.2018 This Type Approval Certificate is valid until</p>		
<p>Настоящее Свидетельство о типовом одобрении теряет силу в случаях, установленных в Правилах технического наблюдения за постройкой судов и изготовлением материалов и изделий для судов. This Type Approval Certificate becomes invalid in cases stipulated in Rules for the Technical Supervision during Construction of Ships and Manufacture of Shipboard Materials and Products.</p>		
Дата выдачи Date of issue	№	13.03831.315
Российский морской регистр судоходства Russian Maritime Register of Shipping	М.П. L.S.	В.И.Евенко / V.Evenko (фамилия, инициалы) name
<p>*Дополнительную информацию смотри на обороте. Additional information see overleaf.</p>		

Технические данные
Technical data

Рабочие частоты:

- SAILOR 800 VSAT: 10.7 - 12.75 ГГц (Ku-Band) - режим приема, 13.75 - 14.5 ГГц (Ku-Band) - режим передачи;
- SAILOR 900 VSAT: 10.7 - 12.75 ГГц (Ku/Ka-Band) - режим приема, 13.75 - 14.5 ГГц (Ku/Ka-Band) - режим передачи.

Режимы работы: доступ в Интернет, телефония IP, телефонная связь с судами.

Источник питания: - постоянный ток - 20.0 - 32.0 В;

- переменный ток - 110 или 220 В ± 10%, 50/60 Гц ± 5% (с использованием блока питания SAILOR 6080).

Диапазон рабочих температур: -15°C - +55°C (для блоков, устанавливаемых во внутренних помещениях судна);

-25°C - +55°C (для блоков, устанавливаемых на открытой палубе).

Версия программного обеспечения: 1.xx.

Frequencies of operation:

- SAILOR 800 VSAT: 10.7 - 12.75 GHz (Ku-Band) - receiving mode, 13.75 - 14.5 GHz (Ku-Band) - transmitting mode;

- SAILOR 900 VSAT: 10.7 - 12.75 GHz (Ku/Ka-Band) - receiving mode, 13.75 - 14.5 GHz (Ku/Ka-Band) - transmitting mode.

Modes of operation: Internet access, IP telephone, telephone calls between ships.

Power Source: - DC - 20.0 - 32. V;

- AC - 110 or 220 V ± 10%, 50/60 Hz ± 5% (using Power Supply Unit SAILOR 6080).

Operating temperature range: -15°C - +55°C (for protected units);

-25°C - +55°C (for exposed units).

Software version: 1.xx.

Судовая земная станция (СЗС) спутниковой связи VSAT, типы "SAILOR 800 VSAT / SAILOR 900 VSAT", состоит из блоков, перечисленных в Приложении к настоящему Свидетельству о типовом одобрении. VSAT Ship Earth Station (SES) of satellite communication, types "SAILOR 800 VSAT / SAILOR 900 VSAT", consists of units which are listed in the Annex to this Type Approval Certificate.

Техническая документация и дата ее одобрения Российским морским регистром судоходства
Technical documentation and the date of its approval by Russian Maritime Register of Shipping

Техническая документация одобрена Главным управлением Российского морского регистра судоходства (исх. No. 315-58-218878 от 29.10.2013 г.):

The technical documentation is approved by the Head Office of the Russian Maritime Register of Shipping (Ref. No. 315-58-218878 of 29.10.2013):

- SAILOR 800 VSAT, Installation Manual, Document number: 98-139995-A;

- SAILOR 900 VSAT, Installation and Maintenance Manual, Document number: 98-138976-B.

Образец изделия испытан под техническим наблюдением Российского морского регистра судоходства.
Product's specimen has been tested under the technical supervision of Russian Maritime Register of Shipping.

Акт № 13.03550.315 от 30.10.2013
Report No. of

Область применения и ограничения
Application and limitations

Судовая земная станция спутниковой связи VSAT, типы "SAILOR 800 VSAT / SAILOR 900 VSAT", не отвечает требованиям ГМССБ и предназначена для использования на морских судах в качестве дополнительного радиооборудования.

VSAT Ship Earth Station, types "SAILOR 800 VSAT / SAILOR 900 VSAT", does not meet the GMDSS requirements and it is intended for use onboard the sea-going ships as an additional radioequipment.

Вид документа, выдаваемого на изделие
Type of document issued for product

Изделие должно поставляться со Свидетельством Российского морского регистра судоходства по форме 6.5.31.

The product shall be delivered with the Certificates of the Russian Maritime Register of Shipping in accordance with form 6.5.31.

02/2012

13.03831.315

Приложение

к Свидетельству о типовом одобрении № 13.03831.315 от 15.11.2013 г.

Аппенд

to Type Approval Certificate No. 13.03831.315 of 15.11.2013

**Судовая земная станция (СЗС) спутниковой связи VSAT,
тип "SAILOR 800 VSAT / SAILOR 900 VSAT", состоит из следующих блоков:
VSAT Ship Earth Station (SES) of satellite communication,
type "SAILOR 800 VSAT / SAILOR 900 VSAT", consists of the following units:**

No	Наименование блока Name of Unit	Тип блока Type of Unit	Примечания Remarks
1. Блоки, устанавливаемые на открытой палубе: 1. Above Deck Equipment:			
1.1 Морские антенные системы SAILOR: SAILOR Maritime Antennas:			
1.1.1	Антенный блок / Antenna Unit,	TT-7009 (SAILOR 900 VSAT)	Диаметр рефлектора – 1.03 м. Diameter of Reflector – 1.03 m.
		TT-7008 (SAILOR 800 VSAT)	Диаметр рефлектора – 0.83 м. Diameter of Reflector – 0.83 m.
1.2 Передатчики: Transmitters:			
1.2.1	Block Up Converter (BUC)	BUC 8W (SAILOR 900 VSAT)	Встроен в антенный блок. Built-in Antenna Unit.
		BUC 6W (SAILOR 800 VSAT)	Встроен в антенный блок. Built-in Antenna Unit.
1.3 Приемники-усилители: Receiver-amplifier:			
1.3.1	Low Noise Block (LNB)	VSAT LNB	Встроен в антенный блок. Built-in Antenna Unit.
2. Блоки, устанавливаемые во внутренних помещениях судна: 2. Below Deck Equipment:			
2.1 Блок управления антенной: SAILOR Antenna Control Unit:			
2.1.1	Antenna Control Unit (ACU)	TT-7016A	Для / For SAILOR 800 VSAT / SAILOR 900 VSAT
2.2 Спутниковые модемы – маршрутизаторы: Satellite modems / routers:			
2.2.1	iDirect Technologies (США) iDirect Technologies (USA)	iINFINITY Series	iDirect 3000, 5000, 7000
		EVOLUTION Series	iDirect X3, X5, 8000
2.2.2	COMTECH (США) COMTECH (USA)	CDM Series	CDM570L, 625
2.2.3	STM (США) STM (USA)	STM Satlink Series	SatLink 2900
2.2.4	GILAT (Израиль) GILAT (Israel)	Gilat SkyEdge Series	SkyEdge I, SkyEdge II
3. Дополнительные блоки: 3. Optional Units:			
3.1	Блок питания Power Supply Unit	SAILOR 6080	Переменный ток – пост. ток. AC - DC.

Российский морской регистр судоходства
Russian Maritime Register of Shipping

М.П. / L.S

В.И.Евенко / V. Evenko



H.6 ANATEL Certificado de Homologação



REPÚBLICA FEDERATIVA DO BRASIL
AGÊNCIA NACIONAL DE TELECOMUNICAÇÕES.

Certificado de Homologação
(Intransferível)
Nº **1530-13-8350**
Validade: **Indeterminada**
Emissão: **31/05/2013**

Solicitante:
ULSTEIN BELGA MARINE SERVIÇOS DE ELETRÔNICA NAVAL
RUA CURUZU 58 SÃO CRISTÓVÃO
20920440 RIO DE JANEIRO RJ

Fabricante:
THRANE & THRANE A/S
LUNDTOTTEGARDSVEJ 93 D DK-2800 KGS.
LYNGBY

Este documento homologa, nos termos do Regulamento para Certificação e Homologação de Produtos para Telecomunicações, aprovado pela Resolução Anatel nº 242, de 30 de novembro de 2000, o Certificado de Conformidade nº 3055, emitido pelo **OCD - Fundação CPqD**. Esta homologação é expedida em nome do solicitante aqui identificado e é válida somente para o produto a seguir discriminado, cuja utilização deve observar as condições estabelecidas na regulamentação do(s) serviço(s) ou aplicação(ões) a que se destina.

Tipo:
Transceptor do SMM por Satélite - Categoria II

Modelo(s):
Sailor 900 Vsat

Serviço/Aplicação:
Serviço Móvel Marítimo - SMM
Sistemas de Comunicação por Satélite
Comunicação por Satélite

Características técnicas básicas:

Faixa de Frequências Tx (MHz)	Potência Máxima de Saída (W)	Designação de Emissões
14000,0 a 14500,0	7,9799	-

Ensaio de SAR não aplicável.

Observações:
Na sua utilização, o(s) produto(s) deve(m) estar em conformidade com as condições e frequência(s) autorizada(s) pelo órgão técnico competente da Agência Nacional de Telecomunicações – Anatel.

Constitui obrigação do fabricante do produto no Brasil providenciar a identificação do produto homologado, nos termos do art. 39 do Regulamento anexo à Resolução Anatel nº 242, em todas as unidades comercializadas, antes de sua efetiva distribuição ao mercado, assim como observar e manter as características técnicas que fundamentaram a certificação original.

As informações constantes deste certificado de homologação podem ser confirmadas no SGCH - Sistema de Gestão de Certificação e Homologação, disponível no portal da Anatel. (www.anatel.gov.br).



Marcos de Souza Oliveira
Gerente de Certificação e Numeração



**SPECIFICATIONS OF KU-BAND ANTENNA
FV-110**

1 ANTENNA UNIT (ADU)

- 1.1 Antenna type
 - Pedestal 3-axis (plus skew) stabilized tracking ADU with integrated GPS
 - Reflector system Reflector/sub-reflector, ring focus
- 1.2 Frequency
 - Transmit 13.75 to 14.50 GHz (extended)
 - Receive 10.70 to 12.75 GHz
- 1.3 Reflector size 103 cm
- 1.4 Gain (excluding radome)
 - Transmit 41.6 dBi typical at 14.25 GHz
 - Receive 40.6 dBi typical at 11.70 GHz
- 1.5 System G/T 19.9 dB/K at 12.75 GHz, at 30° elevation and clear sky w/radome
- 1.6 BUC output power 8 W
- 1.7 Tracking receiver Internal all band/modulation type and VSAT modem RSSI
- 1.8 Polarization Linear cross or Co-Pol (selected by ACU)
- 1.9 Elevation range -25° to +125°
- 1.10 Azimuth range Unlimited (rotary joint)
- 1.11 Ship's motion Roll: ±30° (6 s), Pitch: ±15° (4 s), Yaw: ±10° (10 s), ROT: ±10°/s
- 1.12 Certification (approval) Compliant with CE (Maritime), ETSI EN 302 340, CEI/IEC 60950-1, CEI/IEC 60945, CEI/IEC 60950-22

2 ANTENNA CONTROL UNIT (ACU)

- 2.1 Modem protocols
 - iDirect openAMIP protocol & custom protocol
 - Comtech ROSS Open Antenna Management (ROAM)
 - ESS Satroaming
 - STM SatLink
- 2.2 Antenna interface Single 50 ohm coax. for RX/TX, modem and DC power

3 INTERFACE (ACU)

- 3.1 Number of port
 - Antenna RF 1 port, N-connector (50 ohm)
 - VSAT modem 2 ports, F-connectors (75 ohm) for RX/TX
 - NMEA0183 (RS-422) 1 port for Gyro/GPS compass input, 4800/38400 bps auto detect
 - LAN 4 ports, Ethernet 100Base-T, RJ45
- 3.2 Data sentence (NMEA0183)
 - Input HDT

4 POWER SUPPLY

- 4.1 Antenna control unit 20-32 VDC: 8.8-5.5 A, 370 W_{peak}, 175 W typical
- 4.2 AC/DC power supply unit 100-230 VAC, 1 phase, 50/60Hz

4.3 UPS (option)

E11A102B001UJ	Input: 100/110/115/120 VAC: 50/60Hz, Output: 700W/1000VA
E11A102B002UJ	Input: 200/220/230/240 VAC: 50/60Hz, Output: 700W/1000VA

Output voltage are same as input voltage
Back-up period: 5 min (700W), Charge time: 12 hr typical

5 ENVIRONMENTAL CONDITIONS**5.1 Ambient temperature**

Antenna unit	-25°C to +55°C (storage: -40°C to +85°C)
ACU	-25°C to +55°C
AC/DC power supply unit	-15°C to +55°C
UPS (option)	0°C to +40°C

5.2 Relative humidity

Antenna unit	100% condensing
ACU	95% or less at +40°C (non-condensing)
UPS	20% to 90%

5.3 Degree of protection

Antenna unit	IPX6
ACU	IP20
UPS	IPX0

5.4 Vibration IEC 60945 Ed.4**6 SUPPORTED VSAT MODEMS**

iDirect iNFINITI 5000 (Serial/OpenAMIP),
iDirect Evolution (Serial/OpenAMIP),
COMTECH CDM 570L/625L, COMTECH 570L with ROSS (ROAM),
Genetic VSAT modem, STM SatLink 2900, Gilat SkyEdge II (Pro),
Inmarsat G5, Shiron InterSKY iRG-4G-Pro
Newtec MDM3100 IP Satellite modem

PACKING LIST

407009B-FUR

16AX-X-9851 -1

1/1

PL-1

NAME	UNIT	OUTLINE	DESCRIPTION/CODE No.	QTY
ユニット アンテナユニット	UNIT		407009B-FUR 000-028-885-00	1
工事材料 INSTALLATION MATERIALS				
N-コネクタ/ケーブル			TT-7009A 999-999-222-00 (*)	1
N-CONNECTOR INTERFACE				
ハネ座金			M12 SUS304 000-167-397-10	4
SPRING WASHER				
シガキル平座金			M12 SUS304 000-167-446-10	4
FLAT WASHER				
重ね歯付座金			M12 SUS304 999-999-209-00 (*)	1
SERRATED WASHER				
六角ネジ			M12X40 SUS304 000-162-810-10	4
HEXAGONAL HEAD BOLT				
図書 DOCUMENT				
N-コネクタ/ケーブル説明図			97-147148 999-999-236-00 (*)	1
ASSEMBLY DRAWING N-CONNECTOR INTERFACE				
検査合格証			99-146641-A 999-999-234-00 (*)	1
PRODUCTION CERTIFICATE				

(*)は、タミコードに付き、注文できません。
(*) THIS CODE CANNOT BE ORDERED.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

16AX-X-9851

PACKING LIST

407016A-F19

16AX-X-9852 -1

1/1

PL-2

NAME	UNIT	OUTLINE	DESCRIPTION/CODE No.	QTY
ユニット アンテナコントロールユニット	UNIT		407016A-F19 000-028-886-00	1
工事材料 INSTALLATION MATERIALS				
750MHz同軸ケーブル MF-F			37-138211-A 999-999-212-00 (*)	2
750MHz COAX CABLE F-F				
NMEAマルチコネクタ			31-206391-011 999-999-214-00 (*)	1
NMEA MULTI CONNECTOR				
イーサネットケーブル			37-133251-A 999-999-211-00 (*)	1
ETHERNET CABLE (SHORT)				
イーサネットケーブル			37-203213-A 999-999-210-00 (*)	1
ETHERNET CABLE (2M)				
パワーコネクタ			31-206446-002 999-999-213-00 (*)	1
POWER CONNECTOR				
図書 DOCUMENT				
検査合格証			99-146642-A 999-999-223-00 (*)	1
PRODUCTION CERTIFICATE				
取扱説明書			01M*-50990-* 000-191-006-1**	1
OPERATOR'S MANUAL				

1.(*)は、タミコードに付き、注文できません。
1.CODE NUMBER ENDING WITH "*" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL
2.コード番号末尾の[**]は、選択品の代表コードを表します。
2.CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

16AX-X-9852

PACKING LIST

406080A-FUR

16AX-X-9853 -2 1/1

PL-3

NAME	OUTLINE	DESCRIPTION/CODE No.	QTY
ユニット			
AC/DC電源ユニット		406080A-FUR	1
工率材料			
インストール材料			
平頭ネジ		3X10 SUS304	4
セルフタッピングネジ		4X25 SUS304	4
セルフタッピングネジ		5X50 SUS304	4
ケーブル固定板		82-125350	1
ケーブルリリフブラケット		TT41-128535	4
プラスチックキャップ		M6X55 SUS304	4
六角穴付ネジ		999-999-218-00 (*)	4
図書			
検査合格証		99-147229-A	1
取扱説明書		0M-50991-*	1
取扱説明書		000-191-007-1* **	

1.(*)は、タミコードに付き、注文できません。
 1.(*) THIS CODE CANNOT BE ORDERED.
 2.コード番号末尾の[**]は、選択品の代替コードを表します。
 2.CODE NUMBER ENDING WITH "**" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

(略図の寸法は、参考値です。DIMENSIONS IN DRAWING FOR REFERENCE ONLY.) 16AX-X-9853

PACKING LIST

PSU RACKMOUNT KIT

16AX-X-9854 -1 1/1

PL-4

NAME	OUTLINE	DESCRIPTION/CODE No.	QTY
キット内容			
前カバー		87-146132	1
19インチ用シャーシ		999-999-227-00 (*)	1
組立図		97-147189	1
六角穴付ネジ M6X55		*51-204708-055	4
六角穴付ネジ M3X8		999-999-230-00 (*)	7
六角穴付ネジ M4X8		*51-205286-408	1
重ね歯付座金		999-999-232-00 (*)	1
ワシヤ		*53-200166-004	1
		999-999-233-00 (*)	

(*)は、タミコードに付き、注文できません。
 (*) THIS CODE CANNOT BE ORDERED.

(略図の寸法は、参考値です。DIMENSIONS IN DRAWING FOR REFERENCE ONLY.) 16AX-X-9854

CODE NO.		000-029-111-00		16AX-X-9402-4		1/1	
TYPE		CPI16-06100					
AC100V							
工事材料表							
INSTALLATION MATERIALS							
番号 NO.	名称 NAME	略図 OUTLINE	型名/規格 DESCRIPTIONS	数量 QTY	用途/備考 REMARKS		
1	UL1015ワイヤ EQUIPMENT WIRE UL-1015		2. USG GRN/TEL 1.5M CODE NO. 000-191-124-10	2			
2	コネクタ CABLE TIE		CY-150N CODE NO. 000-162-186-10	10			
3	シリコングル SILICONE SEALANT		KE-45-W-100 CODE NO. 000-166-578-10	1			
4	ワイヤ組立 WIRE ASSEMBLY		MT2.500MM CODE NO. 000-132-825-10	1			
5	コネクタ(N) COAXIAL CONNECTOR *N TYPE*		N-F-8DFB-CF CODE NO. 000-156-918-10	1			
6	ケーブル組品 CABLE		NR-VM0302-1.5M-NONPB CODE NO. 000-173-322-11	1			
7	ケーブルバンド CABLE BAND		PLF1M-M CODE NO. 000-116-921-10	10			
8	ビニル平型コード EQUIPMENT WIRE		VFF3.5SQ RED/BLK1.5M CODE NO. 000-191-123-10	1			
9	工事材料ガイド INSTALLATION MATERIAL GUIDE		G52-01503-* CODE NO. 000-191-334-1*	1			

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

CODE NO.		000-029-197-00		16AX-X-9403-3		1/1	
TYPE		CPI16-06110					
AC200V							
工事材料表							
INSTALLATION MATERIALS							
番号 NO.	名称 NAME	略図 OUTLINE	型名/規格 DESCRIPTIONS	数量 QTY	用途/備考 REMARKS		
1	UL1015ワイヤ EQUIPMENT WIRE UL-1015		2. USG GRN/TEL 1.5M CODE NO. 000-191-124-10	2			
2	コネクタ CABLE TIE		CY-150N CODE NO. 000-162-186-10	10			
3	シリコングル SILICONE SEALANT		KE-45-W-100 CODE NO. 000-166-578-10	1			
4	ワイヤ組立 WIRE ASSEMBLY		MT2.500MM CODE NO. 000-132-825-10	1			
5	コネクタ(N) COAXIAL CONNECTOR *N TYPE*		N-F-8DFB-CF CODE NO. 000-156-918-10	1			
6	ケーブル組品 CABLE		NR-VM0302-1.5M-NONPB CODE NO. 000-173-322-10	1			
7	ケーブルバンド CABLE BAND		PLF1M-M CODE NO. 000-116-921-10	10			
8	ビニル平型コード EQUIPMENT WIRE		VFF3.5SQ RED/BLK1.5M CODE NO. 000-191-123-10	1			
9	工事材料ガイド INSTALLATION MATERIAL GUIDE		G52-01503-* CODE NO. 000-191-334-1*	1			

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

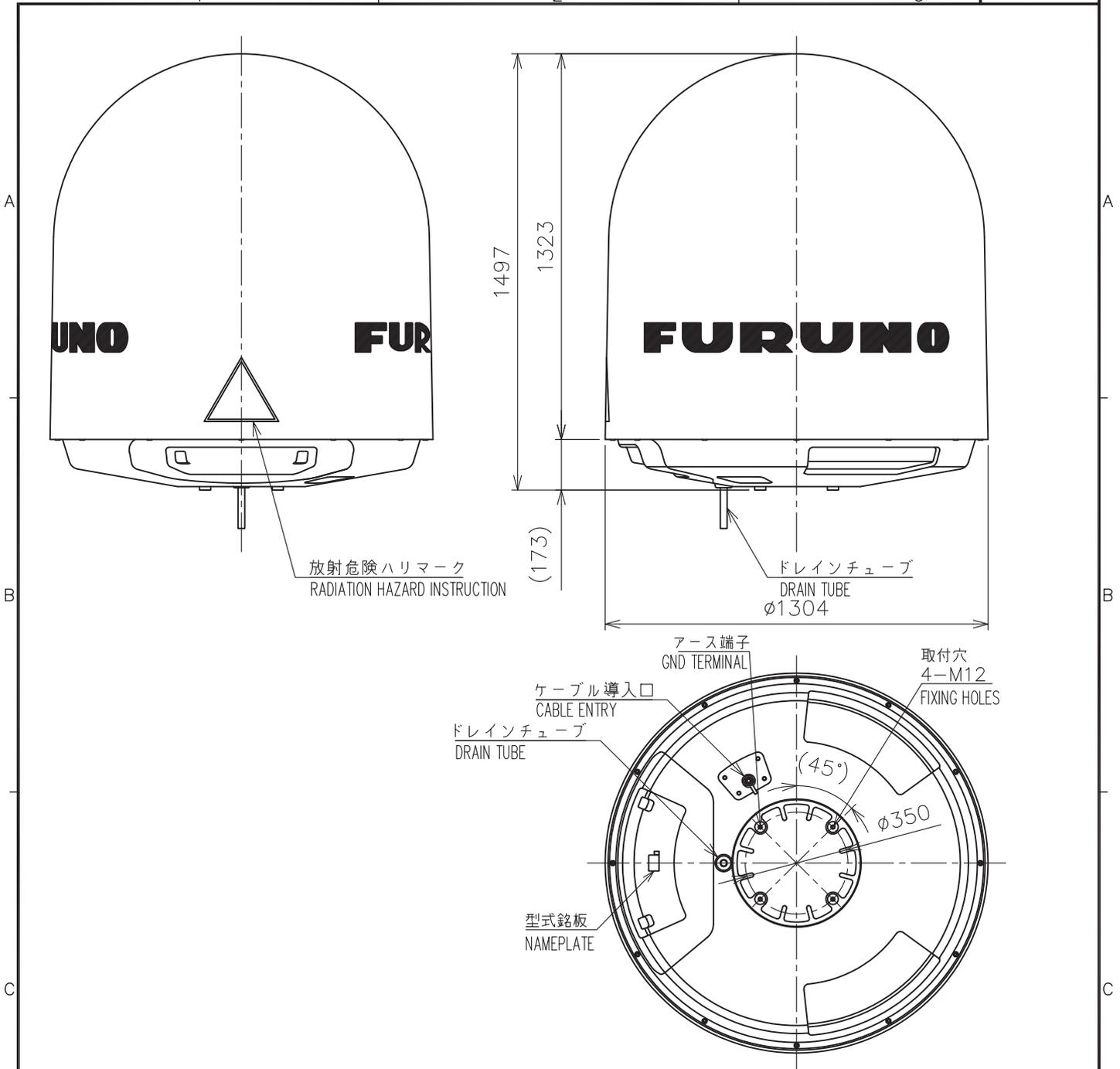


表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3
$500 < L \leq 1000$	± 4
$1000 < L \leq 2000$	± 5

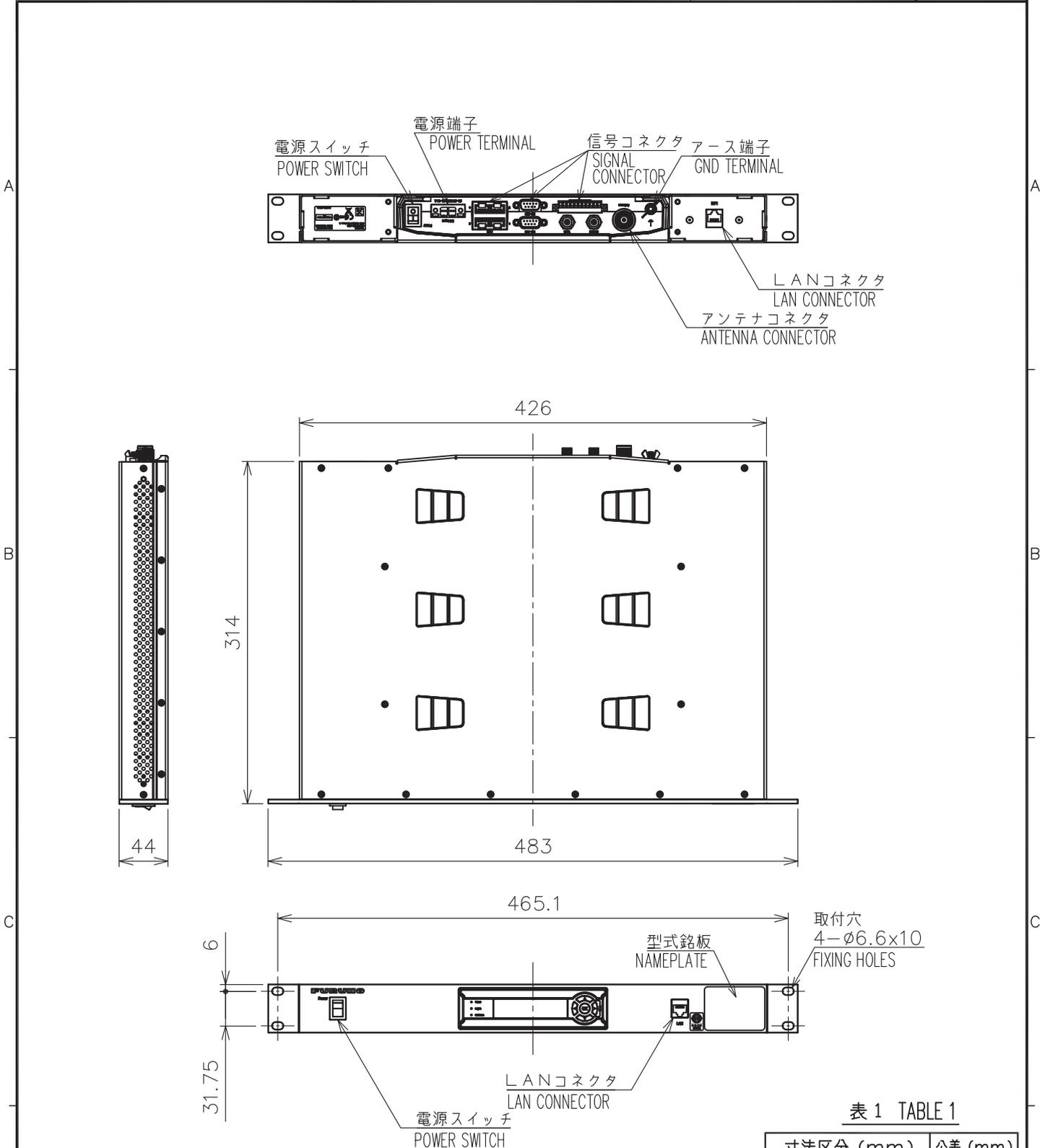
注 記

1) 指定なき寸法公差は表 1 による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

DRAWN 19/May/2015 T.YAMASAKI		TITLE 407009B-FUR
CHECKED 19/May/2015 H.MAKI		名称 アンテナユニット
APPROVED 25/May/2015 H.MAKI	FV-110	外寸図
SCALE 1/20	MASS 126.5 $\pm 10\%$ kg	NAME ANTENNA UNIT
DWG. No. C5099-G01-A	REF. No. 16-024-150G-0	OUTLINE DRAWING



注記

1) 指定なき寸法公差は表 1 による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

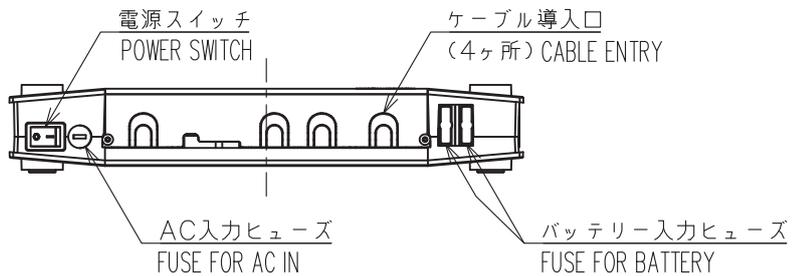
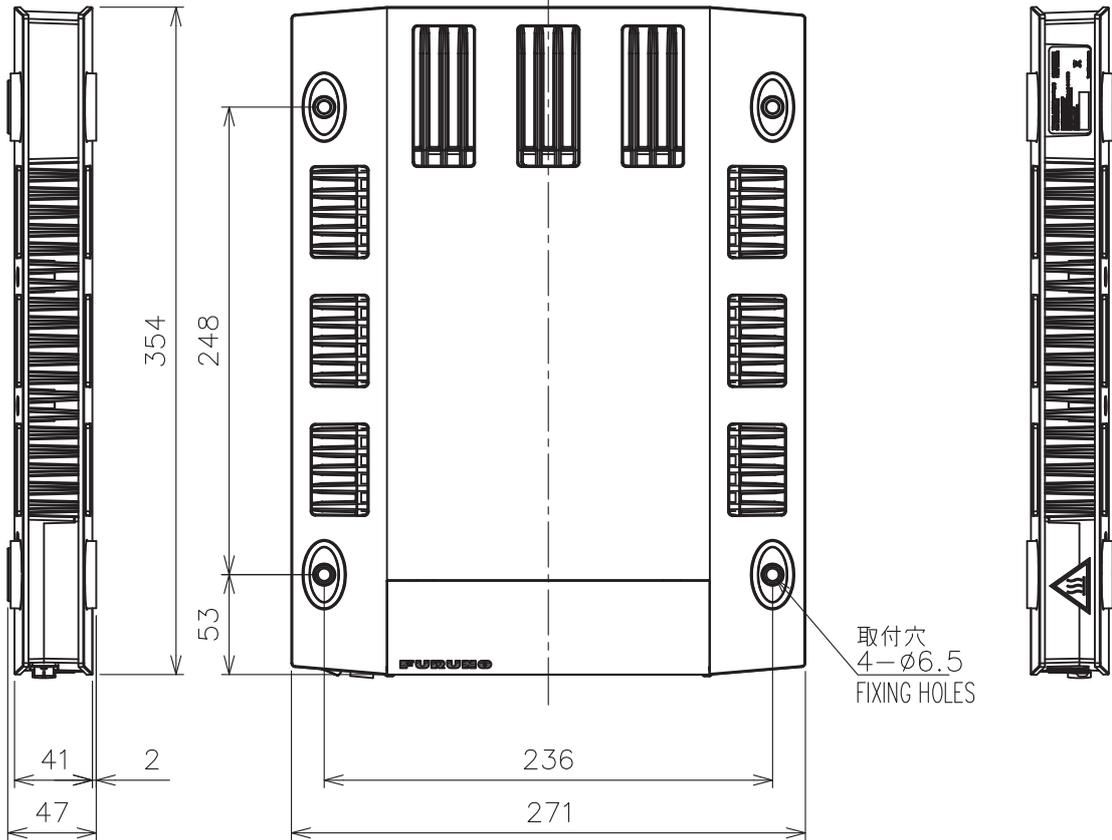
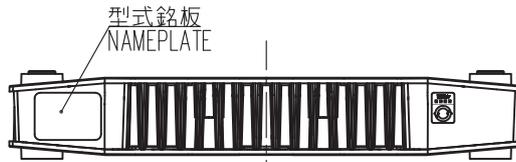
表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN 19/May/2015 T.YAMASAKI	TITLE 407016A-F19
CHECKED 19/May/2015 H.MAKI	名称 アンテナコントロールユニット
APPROVED 25/May/2015 H.MAKI	外寸図
SCALE 1/5	NAME ANTENNA CONTROL UNIT
MASS 4.5 $\pm 10\%$ kg	OUTLINE DRAWING
DWG. No. C5099-G02-A	REF. No. 16-024-250G-0

表 1 TABLE 1

寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
$L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3



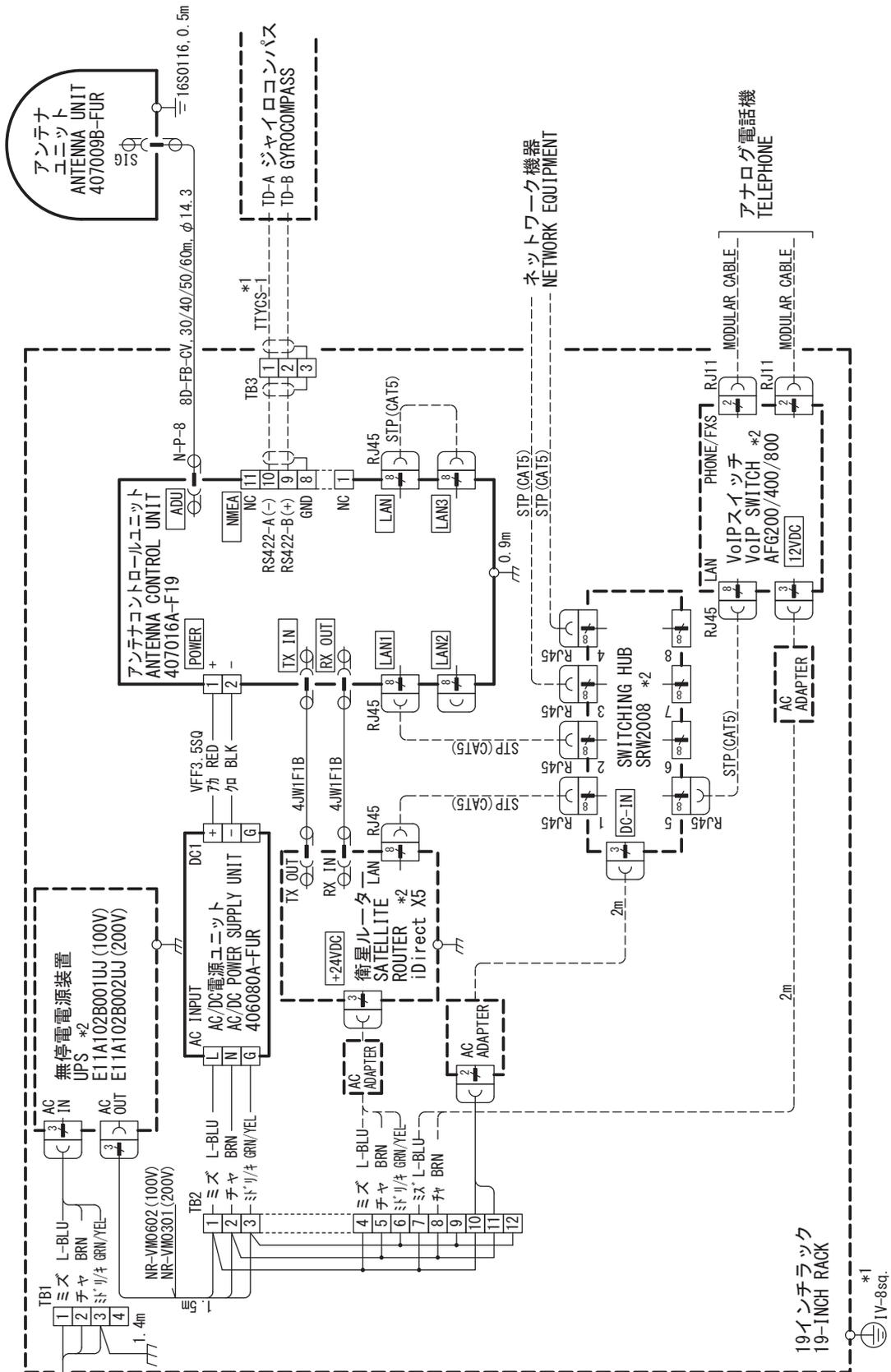
注記

1) 指定なき寸法公差は表 1 による。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

DRAWN 19/May/2015 T.YAMASAKI		TITLE 406080A-FUR
CHECKED 19/May/2015 H.MAKI		名称 AC/DC電源ユニット
APPROVED 25/May/2015 H.MAKI	FV-110	外寸図
SCALE 1/4	MASS 3.7 ±10% kg	NAME AC/DC POWER SUPPLY UNIT
DWG. No. C5099-G03-A	REF. No. 16-024-350G-0	OUTLINE DRAWING



注記

- * 1) 造船所手配。
- * 2) オプション。

NOTE

- *1: SHIPYARD SUPPLY.
- *2: OPTION.

DRAWN	19/May/2015	T. YAMASAKI	TITLE	FV-110 (SpeedCast)
CHECKED	19/May/2015	H. MAKI	名称	KUバンドアンテナ
APPROVED	25/May/2015	H. MAKI	相互結線図	
SCALE	1/ASS	kg	NAME	KU-BAND ANTENNA
DWG. No.	C5099-C01-A	REF. No.	INTERCONNECTION DIAGRAM	

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