EXPLORER® 727

INSTALLATION MANUAL

EXPLORER™ 727

inmarsat

Thrane & Thrane

Thrane & Thrane A/S

EXPLORER®727

Installation manual

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Company addresses
www.thrane.com

Denmark Company headquarters	**Denmark**
Thrane & Thrane A/S Lundtoftegårdsvej 93 D DK-2800 Kgs. Lyngby Denmark	**Thrane & Thrane Aalborg A/S** Porsvej 2 DK-9200 Aalborg SV Denmark
USA	**China**
Thrane & Thrane, Inc. 509 Viking Drive, Suites K, L and M Virginia Beach, VA 23452 USA	**Thrane & Thrane Shanghai** Unit 602 - Building 4, 289 Bisheng Rd. Zhangjiang High-tech Park, Pudong 201204 Shanghai P. R. China

Safety summary

The following general safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the equipment. Thrane & Thrane A/S assumes no liability for the customer's failure to comply with these requirements.

Observe marked areas
Under extreme heat conditions do not touch areas of the terminal or antenna that are marked with this symbol, as it may result in injury.

Microwave radiation hazards
During transmission the antenna in this system radiates microwave power. This radiation may be hazardous to humans close to the antenna. When the system is powered, make sure that nobody gets closer than the recommended minimum safety distance.

The minimum safety distance is 1 m to the side and above the antenna when the EXPLORER 727 is powered. The safety distance of 1 m does not apply directly below the antenna, as the radiation forms a hemisphere above the antenna.

Service
User access to the interior of the system units is prohibited. Only a technician authorized by Thrane & Thrane A/S may perform service – failure to comply with this rule will void the warranty.

Do not service or adjust alone
Do not attempt internal service or adjustments unless another person, capable of rendering first aid resuscitation, is present.

Power supply
The voltage range is 10.5 - 32 V DC; 14 A - 5.5 A. Be aware of high start-up peak current: 20 A at 24 V, 5 ms.

Do not operate in an explosive atmosphere
Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep away from live circuits
Operating personnel must not remove equipment covers. Component replacement and internal adjustment must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Install and use the antenna with care
Thrane & Thrane A/S assumes no liability for any damage caused by the antenna falling off the vehicle or stressing the mounting base. It is the responsibility of the customer to ensure a safe and correct installation of the antenna. The instructions in this manual are only guidelines.

Failure to comply with the rules above will void the warranty!

About the manual

Intended readers

This is an installation manual for the EXPLORER 727 system. The readers of the manual include installers of the system and service personnel. Personnel installing or servicing the system must be properly trained and authorized by Thrane & Thrane. It is important that you observe all safety requirements listed in the beginning of this manual, and install the system according to the guidelines in this manual.

Manual overview

Note that this manual does not cover general use of the system nor does it cover how to use the IP handset that comes with the system. For this information, refer to the user manual for this system and the user manual for the IP handset, both listed in the next section.

This manual has the following chapters:

- *System units* contains a short description of each main unit in the system.

- *Installing the system* describes where to place the system units, how to mount them, distance to other equipment etc.

- *Connecting power* explains how to connect the terminal to power and gives recommendations for cables.

- *Hardware interfaces* describes each interface on the terminal and shows pin-out for the connectors.

- *Starting up the system* explains how to insert the SIM card, power up the system and enter the PIN. It also gives a short overview of how to use the system.

- *Troubleshooting* describes the function of the Reset button and the light indicators on the terminal. It also describes event messages that may appear in the web interface.

This manual may not always reflect the latest software functionality of your EXPLORER system. To obtain the latest version of the manual, please enter the Thrane & Thrane web site www.thrane.com and download the latest version, or acquire it from your distributor.

Related documents

The below list shows the documents related to this manual and to the EXPLORER 727 system.

Title and description	Document number
EXPLORER 727 User Manual Explains how to set up and use the EXPLORER system.	TT98-126882
EXPLORER 727 Quick Guide A short guide to the most important functions of the EXPLORER systems.	TT98-126881
EXPLORER 727 Getting Started Explains how to start up your EXPLORER 727 system and make the first call or data session.	TT98-126880
Thrane & Thrane IP Handset, User Manual Explains the features and functions of the Thrane & Thrane IP handset. The IP handset works as a standard IP handset, but also serves as a user interface for the EXPLORER systems.	TT98-126059

Typography

In this manual, typography is used as indicated below:

Bold is used for the following purposes:

- To emphasize words.
  Example: "Do **not** touch the antenna".

- To indicate what the user should select in the user interface.
  Example: "Select **Settings** > **LAN**".

Italic is used to emphasize the paragraph title in cross-references.

  Example: "For further information, see *Connecting Cables* on page...".

Table of contents

System units

1.1 Introduction

The basic system consists of three units: The terminal, the antenna and the IP handset with cradle.

1.2 EXPLORER® terminal

The terminal, which contains the primary electronic parts, is designed for wall or desktop installation.

The terminal supplies 23.0 – 30.0 V DC to the antenna through a single coaxial cable.

The DC input for the terminal is designed for both 24 V DC and 12 V DC power supply.

1.3 EXPLORER®727 antenna

The EXPLORER 727 antenna is a mechanical tracking antenna, consisting of a 2-axis stabilized antenna with RF-unit, antenna control unit and GPS antenna. The antenna is dedicated to the Inmarsat BGAN (Broadband Global Area Network) system and is designed for roof mounting on a vehicle. All communication between the antenna and terminal passes through a single coaxial cable.

1.4 IP handset and cradle

1.4.1 Thrane & Thrane IP handset

Besides the normal functions of an IP handset, the Thrane & Thrane IP handset also provides a user interface for the EXPLORER system. The IP handset connects to the LAN interface of the terminal, and is power supplied with Power over Ethernet (PoE) through the LAN interface.

For further information on the IP handset, refer to the user manual for the Thrane & Thrane IP handset.

1.4.2 Thrane & Thrane IP cradle

The IP cradle serves as a holder for the IP handset. It is power supplied from the terminal using Power over Ethernet (PoE). The cradle connects to the handset with a coil cord and to the terminal with a standard LAN cable.
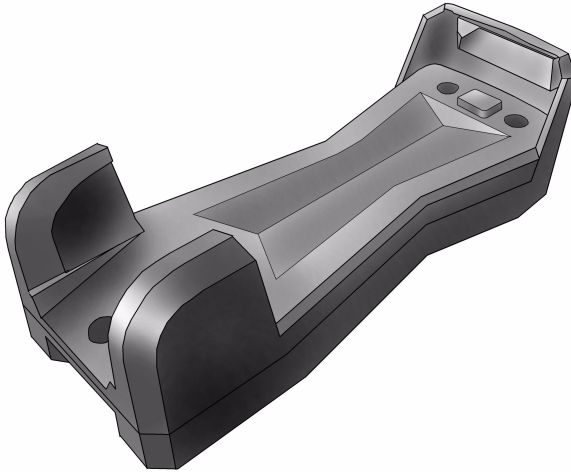
Installing the system

2.1   Unpacking

Unpack your EXPLORER system and check that the following items are present:

- TT-3736A EXPLORER terminal
- TT-3053B EXPLORER 727 antenna
- TT-3670A IP handset and cradle
- Basic cable support kit including an I/O connector
- Power cable
- Antenna cable
- LAN cable
- Installation manual (this manual)
- Getting Started kit including:
    - Getting Started leaflet
    - Quick Guide
    - EXPLORER 727 CD including electronic versions of User manual, Installation manual, Quick Guide and Getting Started guide.

Inspect all units and parts for possible transport damage.

| Note | For information on how to install the IP handset and cradle, refer to the user manual for the handset. |

2.2 Placing the antenna

2.2.1 Obstructions

Obstructions can cause signal degradation.

The amount of degradation depends on the size of the obstruction and the distance from the antenna. As a rule of thumb any obstruction that subtends an angle of less than 3° at the antenna has limited effect. The table below gives a guideline for obstruction sizes that will cause limited degradation.

Distance of Obstruction	Size of Obstruction
3 m	16 cm
5 m	26 cm
10 m	52 cm
20 m	104 cm

2.2.2 Radiation hazard

The EXPLORER 727 antenna radiates up to 18 dBW EIRP. This translates to a minimum safety distance of 1 m from the antenna while it is transmitting. Note that the safety distance applies to a hemisphere above the antenna. The antenna does not radiate power directly below the antenna.

2.2.3 Interference

Do not place the antenna close to interfering signal sources or receivers. We recommend that no other antennas are located within three meters of the antenna. If other equipment is installed near the EXPLORER 727 we recommend testing the total system by operating all equipment simultaneously and verifying that there is no interference.

2.3 Installing the antenna

2.3.1 Antenna cables

Guidelines

A coaxial cable for connection between the antenna and terminal is delivered with the system. If you need a different cable, make sure that the cable meets the requirements. Preferably choose one of the cable types in *Recommended antenna cables* on page 7.

The maximum allowed RF-loss in the antenna cable is 20 dB at 1660 MHz. This is to ensure the performance of the system.

Recommended antenna cables

The table below shows recommended cable types and maximum cable lengths for EXPLORER 727.

Cable Type	Absolute maximum length
RG-223_U-01	14 m
RG-214_U-01	50 m
S-10162-B-11	92 m

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

• Antenna cable RF-attenuation at 1660 MHz: max. 20 dB incl. connector.

• Antenna cable modem-attenuation at 54 MHz: max. 4 dB.
 Antenna cable modem-attenuation at 36 MHz: max. 3 dB.

• Antenna cable loop DC-resistance max: 0.6 Ω.

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 instruction from the cable supplier. The bending radius for the coax cable delivered with the system is min. 110 mm.

2.3.2 Important mounting notes

Line of sight

Place the antenna with free line of sight in all directions to ensure proper reception of the satellite signal. Do not place the antenna close to large objects that may block the signal.

After installing and starting up the EXPLORER 727, we recommend checking the signal strength while driving the vehicle in a 360° circle to ensure a clear line of sight in all directions.

Condensation

In some cases there will be condensation inside the antenna. Gaskets in the bottom of the EXPLORER 727 antenna are designed to lead any water away from the antenna.

Make sure these draining gaskets are not blocked.

> **Important** Make sure there is always a distance of min. 10 mm between any part of the antenna bottom and the mounting surface. Use 10 mm spacers (or higher if necessary) at each bolt.

See the drawing in *Mounting the antenna directly on the vehicle roof* on page 15.

Safety

> ⚠️ **Caution!** It is the responsibility of the customer to ensure a safe installation! See guidelines below.

Under normal driving circumstances the magnetic force of the magnetic mount kit for the antenna should be sufficient to hold the antenna. However, the magnets may not be able to hold the antenna in place, if:

- the vehicle is involved in an accident,
- the magnets are not mounted properly,
- the roof is not plain or made of a material that will not stick properly to the magnets,
- the speed of the vehicle is too high and/or
- the road is very bumpy.

We recommend mounting the antenna on the roof rails or directly on the roof instead of using the magnetic mount kit. Make sure that all mounting bolts and nuts are secured properly, and that the material of the mounting surface is strong enough to hold the antenna during the intended use.

2.3.3 Mounting the antenna

The antenna can now be installed on the roof of the vehicle with three stainless steel bolts. You may choose between three methods:

- Attach the antenna to the roof rails on your vehicle using the dedicated mounting brackets delivered with your EXPLORER 727 system.

- Attach the antenna using the magnetic mount kit from Thrane & Thrane. Mount the magnetic feet on the antenna and the magnetic force will keep the antenna fixed to the vehicle roof. Note that this method requires a vehicle roof made of magnetizable material.

- Mount the antenna directly on the roof of the vehicle. This method requires that you drill holes in the roof of the car. Remember to leave min. 10 mm space between the antenna and the roof.

Refer to the previous section, *Safety* on page 9!

2.3.4 Mounting the antenna on the roof rails on the vehicle

Overview

Using dedicated brackets you can attach the antenna to the roof rails on your vehicle. For ordering information, see *Roof rail mount kit* on page 60.
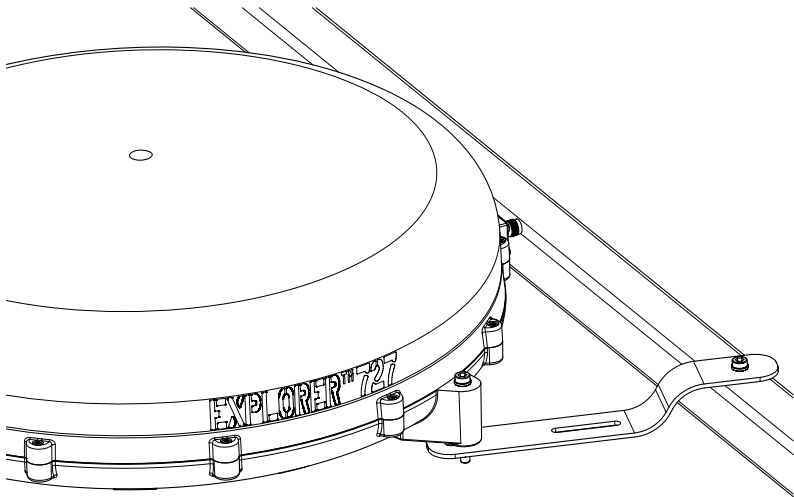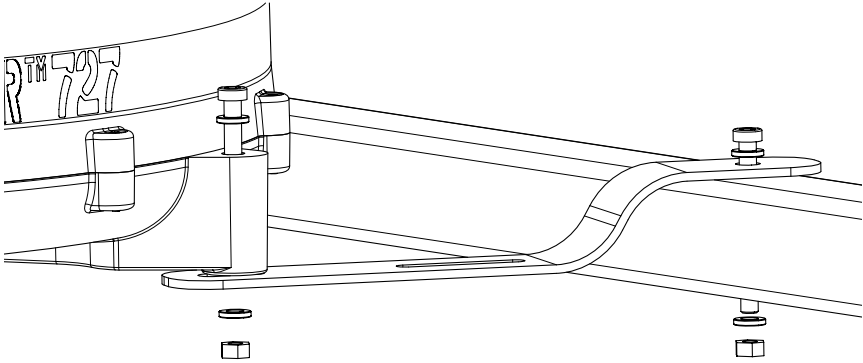
Installing the antenna on the roof rails

Do as follows:

1. Mount the brackets from the roof rail mount kit on the 3 "legs" of the antenna, using the bolts, nuts and washers from the kit.

2. Drill 3 holes in the roof rails, matching the position of the 3 brackets.

3. Mount the antenna with the brackets onto the roof rails of the vehicle, placing the bolts, nuts and washers from the kit as shown on the drawing.

4. Tighten all bolts and nuts firmly to secure the antenna to the roof rails.

2.3.5 Magnetic mount

Overview

For temporary use – or to avoid drilling holes – you may use a magnetic mount installation kit. For ordering information, see *Magnetic mount kit* on page 61.

The Magnet Mount kit consists of 3 individual high intensity magnets with rubber coating. Each magnet has an adhesive force of at least 420 N and is mounted with a stainless steel M5 center bolt.

Installing the magnetic mount kit

> **Note** Make sure the roof of the vehicle is made of a magnetizable material. Wipe the surface clean before placing the antenna on the roof, in order to make a better connection between the magnets and the roof and to avoid scratches in the surface.
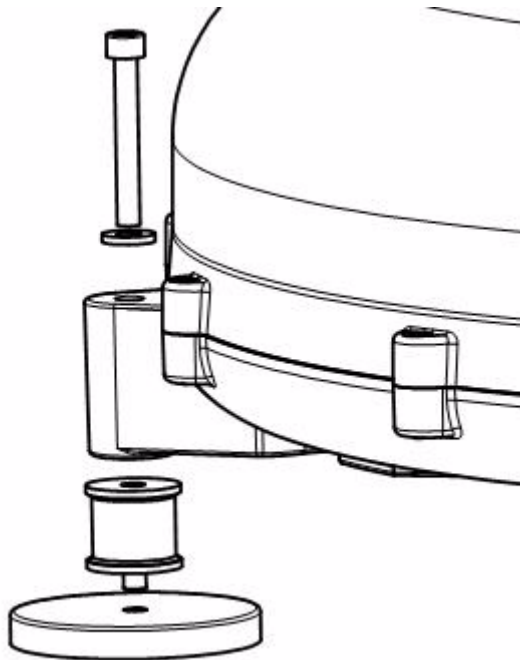
To use the magnetic mounts, do as follows:

1. First attach the magnets to the antenna.

    > **Important** The antenna must have a clearance of 10 mm above the base plane. If the base plane is curved, it may be necessary to place extra spacers to ensure the clearance of 10 mm.

    There are 3 "legs" on the antenna. Place one magnet under each leg as shown on the drawing on the next page.

2. Place the antenna with magnets on the roof of the car. Remember that the magnets only work on a roof made of magnetizable material!

Detaching the antenna

Grab the antenna near one of the magnets and lift it. When one magnet is loose, the other two are easy to "break off". In some situations the magnetic force may be so great that it is necessary to unscrew the antenna first and remove the magnets separately.

2.3.6 Mounting the antenna directly on the vehicle roof

The antenna may be mounted directly on the roof of your car, using three M5 bolts, spacers and rubber washers. This solution requires that you drill three holes in the roof of the car.

Important There must always be a clearance of min. 10 mm between the bottom of the antenna and the mounting surface.

Mounting accessories are included with the antenna.

Note the individual position of washers and spacers.

Installing the system

M5 bolt

M5 washer

Rubber washer

Rubber washer

Spacer - min. 10 mm

M5 nut
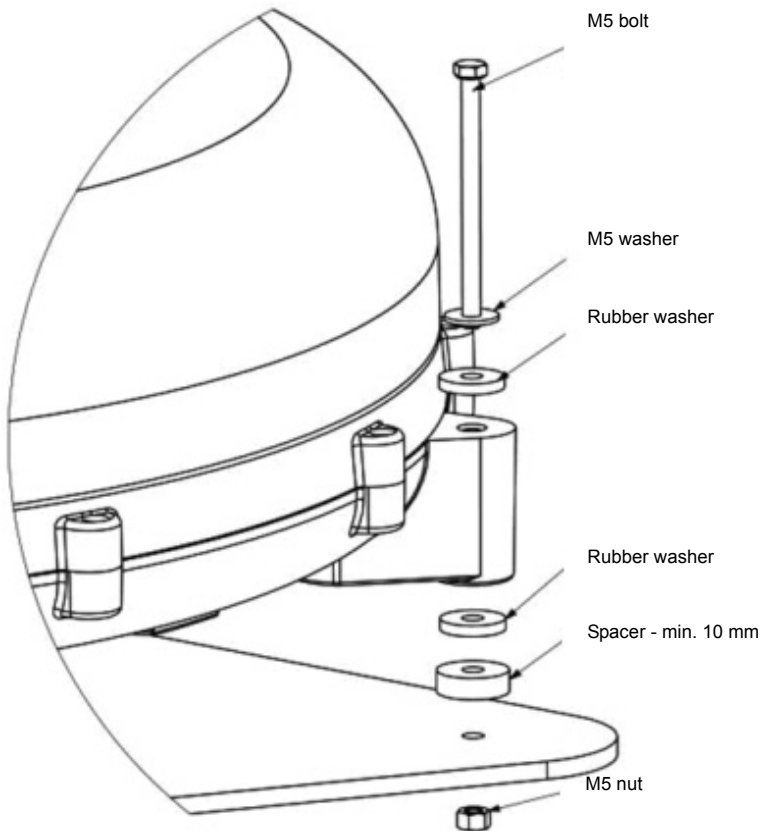
2.4   Placing the terminal

2.4.1   Where to place the terminal

General

The terminal is designed for installation inside a vehicle. It is not suited for outdoor installation.

Temperature conditions

The terminal must be placed in a ventilated area with free space around all sides of the unit, except the bottom side.

Ambient temperature range is −25° to +55°C.

If the terminal is installed in a location where the ambient temperature may exceed 50°C, we recommend placing the terminal where unintentional contact is avoided. If the maximum ambient temperature does not exceed 50°C, the terminal can be placed in a public area.

2.5 Installing the terminal

2.5.1 Mounting the Basic cable support

The Basic cable support comes with the terminal as part of the delivery.

When mounted on the terminal the Basic cable support offers a number of holders to which you can secure the cables from the terminal, using cable strips.
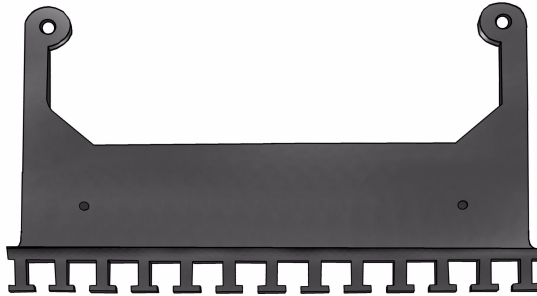
To mount the Basic cable support, do as follows:

1. Remove the two rubber feet from the bottom of the terminal at the connector panel end. The mounting bushes are underneath the rubber feet.

2. Fasten the Basic cable support to the two mounting bushes close to the connector panel on the terminal, using two M4 x 6 mm countersunk screws.
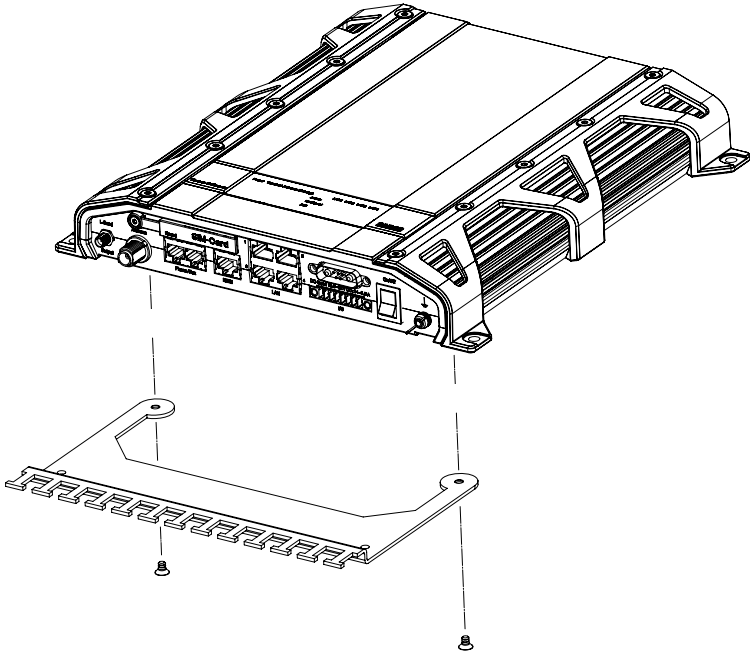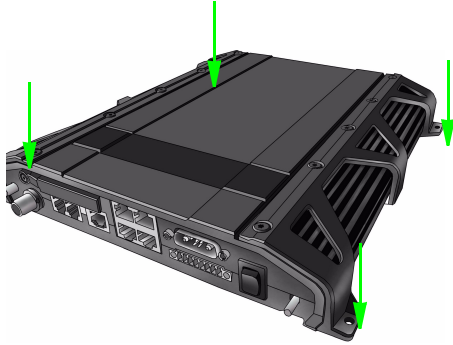

3. Install the terminal as described in *Mounting the terminal* on page 19.

2.5.2 Mounting the terminal

Do as follows to mount the terminal:

1. Insert four screws through the holes in the mounting bracket and into the mounting surface.

2. Connect all cables.
    If you are using the cable support, secure the cables to the cable support using cable strips.

Connecting power

3.1 Power source

The 12 or 24 V DC supply of the vehicle provides power for the terminal.

Note Do not use the cigarette lighter socket in the vehicle to supply power for the EXPLORER 727. Connect directly to the 12 or 24 V supply instead.

Note that the maximum allowed source impedance is much lower for a 12 V DC supply than for a 24 V DC supply. Also, the total output power available for PoE is limited when the power supply is 12 V DC.

Be aware of high start-up peak current: 20 A at 24 V, 5 ms.

The terminal is equipped with an internal 20 A Fuse, so no external fuse is necessary in order to protect the terminal. However, in order to avoid short circuit in the power cable/connector, the DC outlet of the vehicle should be protected by a 30 A fuse or circuit breaker.

3.2 Power cable selection

3.2.1 Source impedance

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

The maximum allowed source impedance depends on the utilization of the power range of the terminal DC input (10.5 – 32 V DC; 14 – 5.5 A).

Select a power outlet from the DC system and measure the source impedance of the installation as described in *Measuring the source impedance* on page 74 in Appendix B.

Note	If the total source impedance is higher than the limits stated in this section, the terminal may start to on/off oscillate.

For further recommendations on power cable selection, see the next section.

3.2.2 Power cable recommendations

Overview

The terminal is delivered with a power cable, which can be extended according to the recommendations below:

Red: +

Black: -

When extending the power cable, positive and negative supply wires must be installed closely together side by side to keep cable inductance low.

Ensure that cable inductance for the selected cable at the desired length is below the 50 μH requirement.

If you are going to use the Remote on/off function, also extend the two wires (green and orange) used for this function. For further information, see *Connecting a Remote on/off switch* on page 27.

Calculating the maximum power cable extension

For 24 V DC operation, the total impedance must be max. 500 mΩ, including the source impedance in the vehicle installation.

For 12 V DC operation, the total impedance must be max. 85 mΩ, including the source impedance in the vehicle installation.

The total impedance is made up of the following:

- the source impedance in the vehicle installation
- the cable impedance of the supplied power cable, including the impedance in the joint of the two cables. In the following example, the impedance of the cable and joint is set to 50 mΩ (6 m power cable). Note that if the cable length or type is changed, the impedance will change accordingly.
- the extension cable impedance.

To calculate the maximum cable extension, do as follows:

1. First measure the source impedance in the vehicle installation as shown in *Measuring the source impedance* on page 74.

2. Then find the resistance per meter for the cable type you are going to use.
   For 4 mm^2/AWG 11, the value is 4 mΩ/m at 20°C
   For 1.5 mm^2/AWG 15, the value is 10 mΩ/m at 20°C
   For other cable types, refer to the data sheet for the cable.

3. Calculate the maximum allowed impedance in the extension cable as follows:
   Max. allowed impedance in extension cable = max. total impedance – (measured source impedance + impedance of the supplied cable).

4. Then calculate the max. extension cable length as follows:

   $$\text{Max. length} = 0.5 \times \frac{\text{Max. impedance in extension cable (from step 3)}}{\text{impedance/meter (from step 2)}}$$

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

Example:

| Note | The following example may not be applicable to your installation! For example, the source impedance of the vehicle power supply varies depending on the type of battery and the temperature.

Vehicle supply voltage: 12 V DC

Vehicle source impedance (measured): 15 mΩ

Extension cable type: 4 mm^2 (AWG 11)

$$\text{Max. cable extension} = 0.5 \times \frac{85\ \text{m}\Omega - (15\ \text{m}\Omega + 50\ \text{m}\Omega)}{4\ \text{m}\Omega/\text{m}} = \underline{\underline{2.5\ \text{m}}}$$

In this case, the power cable can be extended with up to 2.5 m.

If you need more length, you can double the maximum allowed length by connecting two cables in stead of one, or you can use a cable with a larger diameter.

Connecting power

3.3 To connect power

3.3.1 Connecting the power cable

Do as follows:

1. Connect the power cable to the DC supply according to the recommendations in the previous section.

   | Note | If you need a **remote on/off** function, connect the wires from pin 2 (green wire) and 5 (orange wire) in the power connector to a switch or similar which can connect/disconnect these two pins. See *Connecting a Remote on/off switch* on page 27 for details. |

2. Connect the D-sub connector on the power cable to the DC input connector on the terminal.
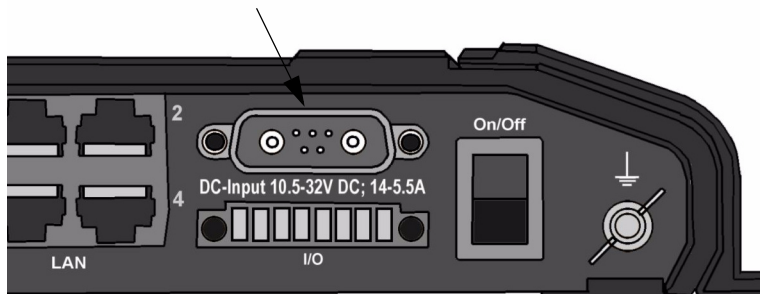
For information on pin-out, see *DC power input* on page 31.

For specifications of the DC input on the terminal, see *EXPLORER®* *terminal* on page 68.

3.3.2 Connecting to the ignition

The terminal has an ignition function. When this function is used, the EXPLORER 727 switch on/off when you start/stop the engine of your vehicle (provided the power switch on the terminal is on).

Use the **SETTINGS > Discrete I/O** page in the web interface to configure the ignition function according to your needs. Select if the Ignition pin should be active high or low and set up a delay determining how long the terminal will stay on after switching the ignition off. For further information on the web interface, see the EXPLORER 727 user manual.

To implement the ignition function, connect the appropriate pin in the I/O connector to the ignition key switch:

*   If the ignition signal is active high, connect pin 8 to the ignition input and pin 5 to ground.

*   If the ignition signal is active low, connect pin 5 to the ignition input and pin 8 to DC.

Pin-out and default functions: *Discrete I/O interface* on page 38.

Standby current when the ignition power is off: *Standby current* on page 70 .

3.3.3 Connecting a Remote on/off switch

The terminal has a remote on/off function. When the terminal power switch is in the "on" position you can remote-control the power function.

By installing a switch that can short-circuit the "Remote on/off" pins (2 and 5) in the power connector you can power the terminal on or off with this remote switch.

When pins 2 and 5 are not short-circuited and valid input power is present, the terminal is powered on, provided the Power switch is in the "on" position.

For pin-out for the power connector and a description of the wire colors in the power cable, see *Pin-out* on page 32.

For information on the standby current when the remote on/off switch is off, refer to *Standby current* on page 70 in the *General specifications.*

Connecting power

Hardware interfaces

4.1   The connector panel

The connector panel is placed at one end of the terminal and has the following connectors:

Port 1   Port 2
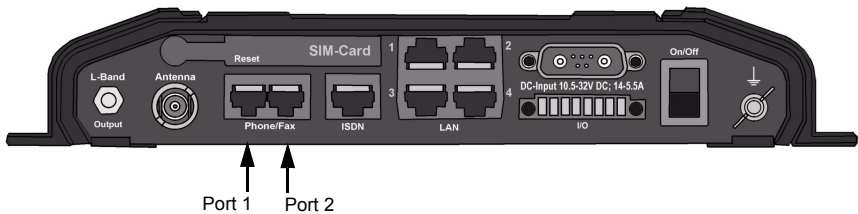
- 1 L-Band connector (not currently used)
- 1 Antenna connector (TNC)
- 2 Phone/Fax connectors (Port 1 is closest to the antenna connector)
- 1 ISDN connector
- 4 LAN connectors with Power over Ethernet (PoE)
- 1 DC power input connector for connection to 10.5-32 V DC, with optional remote on/off
- 1 Input/Output connector with 5 inputs/outputs for external control or signaling
- 1 ground stud with wing nut

For information on how to connect to a specific interface, see the next sections.

4.2 Antenna interface on terminal

4.2.1 Overview

The antenna interface on the terminal connects to the TT-3053B antenna in the EXPLORER 727 system.

The antenna connector on the terminal is a TNC female connector placed in the connector panel.
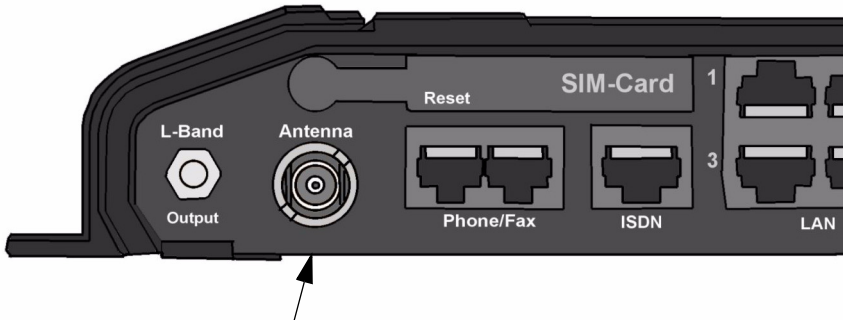
For information on cables and how to install and connect the antenna, see *Installing the antenna* on page 7.
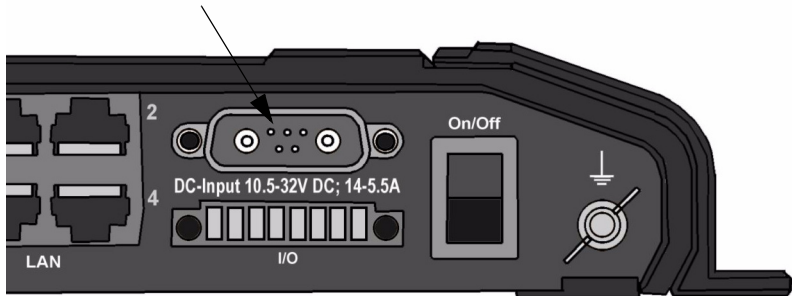
4.2.2 Pin-out

The below drawing shows the TNC female connector in the terminal.
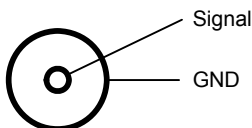
4.3   DC power input

4.3.1   Overview

The DC power input for the terminal is a 10.5 - 32 V DC; 14 - 5.5 A input with a remote on/off function. The input is protected against reverse polarity. For information on power recommendations and how to connect, see *Connecting power* on page 21. The power connector is a D-sub connector placed in the connector panel.
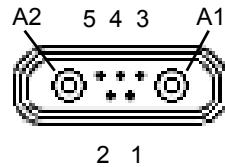
4.3.2 Pin-out

The power connector is a Mixed D-Sub connector 7W2, control pin male / power pin male. The below table shows the pin-out for the connector and the colors of the corresponding wires.

| Pin number	Pin function	Color of wire in power cable
A1	Vin+	Red
A2	Vin-	Black
1	not connected	(Black)
2	Remote on/off	Green
3	not connected	(Brown)
4	not connected	(Red)
5	Remote on/off	Orange

Mixed D-Sub connector, 7W2, male

A2   5 4 3   A1

2   1

DC power input

4.4   Analog Phone/Fax interface

4.4.1   Overview

The terminal has two RJ-11 ports, which can be used for connection of analog phones, fax machines or analog modems.
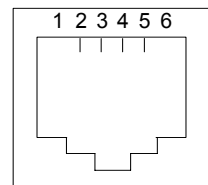

Phone/Fax 1   Phone/Fax 2
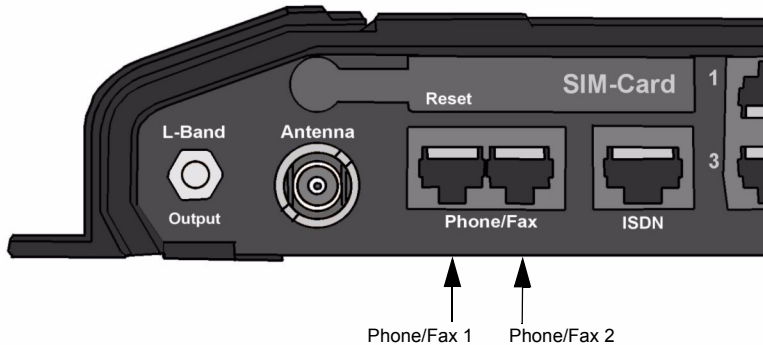
4.4.2   Pin-out

The Phone/Fax connectors are RJ-11, 6/4 female connectors. The table and figure below show the pin-out for the connectors.

Pin number	Pin function
1	-
2	not connected
3	Tip
4	Ring
5	not connected
6	-

RJ-11 female connector
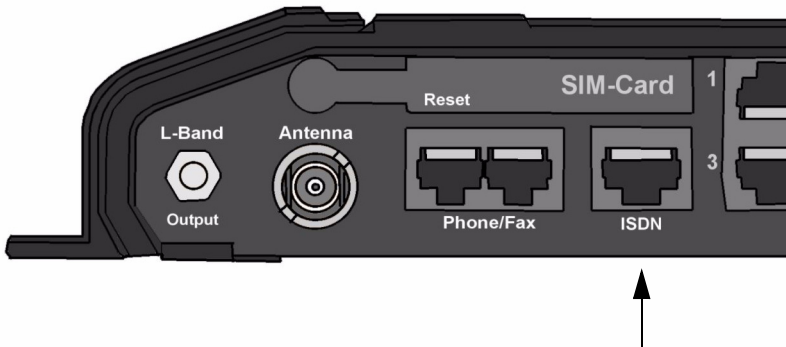
Hardware interfaces

4.5 ISDN interface

4.5.1 Overview

The terminal has one ISDN connector for connecting an ISDN phone or an ISDN modem. The ISDN interface supports 56/64 kbps data rate. It is configured as the network side, i.e. Rx is an input and Tx is an output.
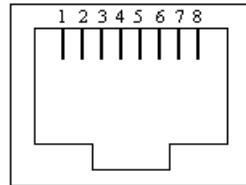
4.5.2 Pin-out

The figure and table below show the connector outline and pin assignments.

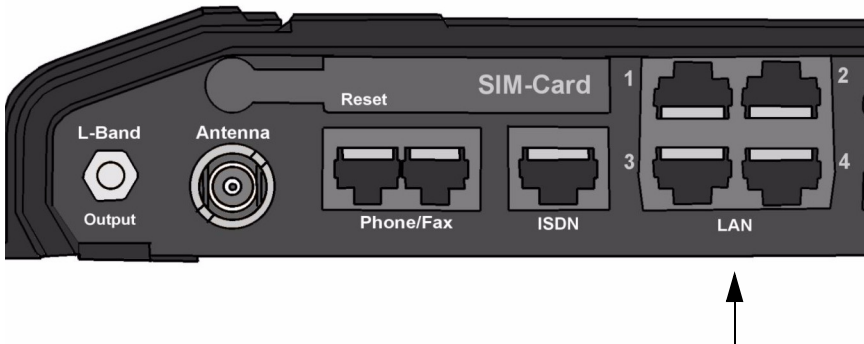| Pin number	Pin function
1	not connected
2	not connected
3	Rx+ (c) input
4	Tx+ (d) output
5	Tx- (e) output
6	Rx- (f) input
7	not connected
8	not connected

RJ-45 female connector

4.6 LAN interface

4.6.1 Overview

The terminal has four Ethernet LAN ports with Power over Ethernet (PoE). The Ethernet ports are standard IEEE 802.3 af ports using RJ-45 connectors.

4.6.2 Power over Ethernet (PoE)

One power supply powers all four interfaces with a floating 48 V DC supply (44 - 57 V DC). Therefore, the interfaces are not galvanically separated from each other. All Tx signals are DC connected to the Positive PoE Voltage and all Rx signals to the Negative PoE Voltage.

The total output power from all 4 interfaces is 64 W at 24 V DC power supply, so all interfaces can support devices of power class 1, 2 and 3 (4, 7 and 15.4 Watt). At 12 V DC power supply the total output power for PoE is 32 W. This means you cannot use power class 3 devices on all four LAN interfaces.
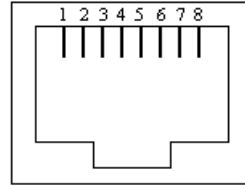
In case of power hold-up (failure on input power), PoE will be turned off.

4.6.3 Pin-out

The figure and table below show the connector outline and pin assignments.

Pin number	Pin function
1	TxD+ input (positive PoE)
2	TxD-input (positive PoE)
3	RxD+ output (negative PoE)
4	not connected
5	not connected
6	RxD- output (negative PoE)
7	not connected
8	not connected

RJ-45 female connector

4.6.4 Connecting an IP handset

To connect the Thrane & Thrane IP handset to the terminal, do as follows:

Connect the cable from the IP cradle to one of the LAN connectors on the terminal. For information on how to install the IP handset, refer to the user manual for the handset.

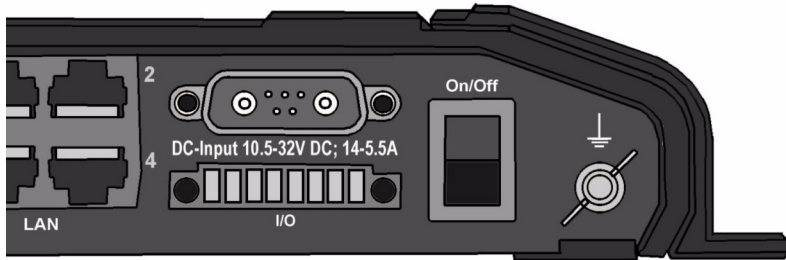The cable between IP cradle and terminal must be maximum 80 m.

Note   If you insert a switch or similar between the cradle and the terminal, make sure that it conforms to the industry standard **IEEE 802.3 af (using data pairs)**.

4.7 Discrete I/O interface

4.7.1 Overview

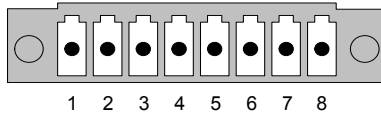The terminal has an I/O connector with 5 configurable inputs/outputs.

The connector is a WieCon Type 8513S connector.

A mating I/O connector is included in the delivery.

4.7.2 Pin-out

The figure and table below show the connector outline and pin assignments.

WieCon Type 8513S connector

Pin number	Connection	Default configuration[a]
1	GPIO 1	Ringer output, active high
2	GPIO 2	Warning/Error output
3	GPIO 3	Mute output
4	GPIO 4	Radio silence input
5	GPIO 5	Ignition input
6	Chassis GND	Chassis GND
7	DC out	9-15 V DC, 50 mA
8	DC in	(ignition input)

a. The default functions of the I/O pins are described in the next section.

4.7.3   Default configuration of I/O pins

The built-in web interface of the terminal offers a page for configuring the I/O pins.

The default configuration of the I/O pins is as follows:

- **Pin 1: Ringer output.**
  This pin changes state from low to high when the terminal is notified of an incoming call from the satellite interface. When the call is answered, or the caller gives up and releases the call, the pin changes back to low.

- **Pin 2: Warning/Error output**
  This pin provides an external signal that indicates active warning/error condition(s). The signal stays active until all warnings/errors are cleared.

- **Pin 3: Mute output.**
  The mute output pin provides an external signal that is active during a phone call. The signal can be used to mute external equipment, such as a car-radio.

- **Pin 4: Radio silence input.**
  When active the terminal observes Radio Silence. The terminal gracefully closes all open connections, and deregisters from the BGAN network. No transmission is allowed until the pin is deactivated.

- **Pin 5/8: Ignition input.**
  The ignition function uses pin 5 together with pin 8 (DC in). Connect the appropriate pin to the ignition key switch of the vehicle.
  If the input should be **active high**, connect pin 5 to Ground, and use pin 8 to switch on the terminal by pulling it high (10-32 V DC).
  If the input should be **active low**, connect pin 8 to positive DC voltage, and use pin 5 to switch on the terminal by pulling it low (< 1.2 V DC).

Pin 7 (non-configurable)**:** Apart from the 5 configurable inputs/outputs, the DC connector has an additional output pin, pin 7 DC output, which can be connected to a ringer, relay or similar. The output voltage is 9-15 V, 50 mA.

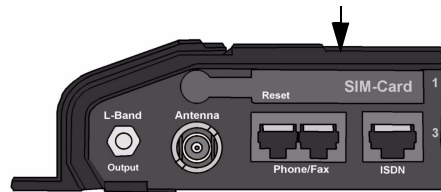For information on how to configure the I/O pins, see the user manual for the EXPLORER 727 system.

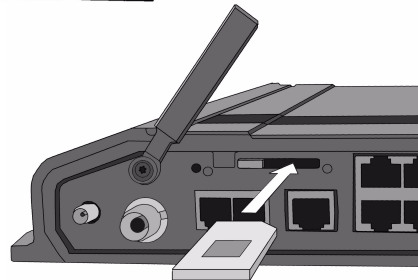# Starting up the system

5.1 Using the SIM card

5.1.1 Inserting the SIM card

The SIM card is provided by your Airtime Provider. Insert the SIM card as follows:
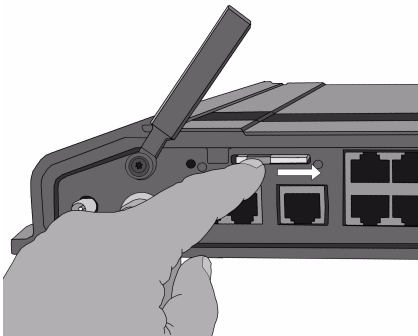
1. Open the SIM cover in the left side of the connector panel.

2. Insert the SIM card into the SIM slot.
   Place the card with the chip side facing up as shown.

3. Press gently until it clicks.

4. Slide the lock in front of the SIM card.

5. Close the cover for the SIM slot.
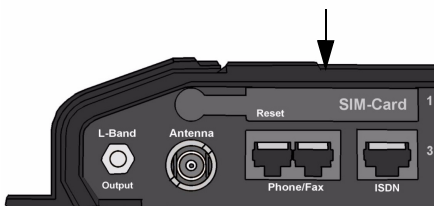
Removing the SIM card

Note When the SIM card is removed, you cannot use the BGAN menu of the IP handset nor make calls or start data sessions.
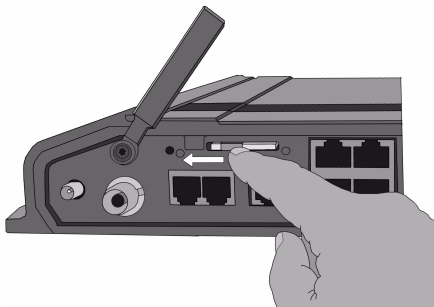Only emergency calls are allowed, and only if permitted by the network.

However, if you have an administrator user name and password, you can upload software using the web interface without having a SIM card. For further information, see the user manual.
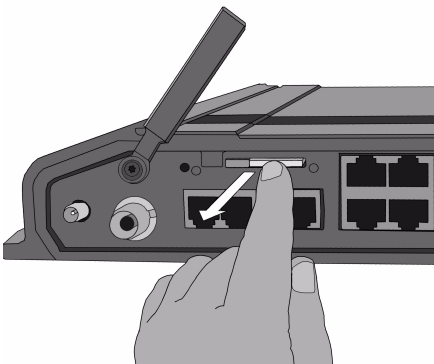
Remove the SIM card as follows:

1. Open the SIM cover in the left side of the connector panel.

2. Slide the lock aside.

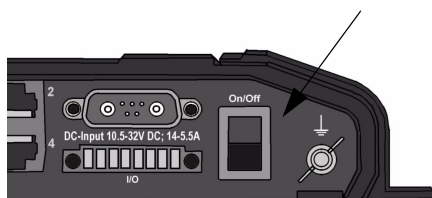3. Gently push the SIM card and let it pop out.

4. Remove the SIM card and close the cover for the SIM slot.

5.2 Powering the system

5.2.1 Switching the terminal on

To switch on the terminal, use the Power switch in the connector panel It normally takes one or two seconds for the terminal to switch on.

> ⚠️ **Caution!** When the system is powered on, stay clear of the antenna! The antenna emits radio frequency energy, **not only** when the system is used. Always keep a minimum distance of 1 m from the EXPLORER 727 antenna.

5.2.2 Switching the terminal off

To switch off the terminal, change the position of the Power switch again.

> Note | Wait at least 5 seconds after power off, before trying to power on the system again.

5.2.3 Ignition

You may use the ignition system of your vehicle to power the EXPLORER 727 system. When the ignition function is used, the EXPLORER 727 will start up when you turn the ignition key of the vehicle.

> Note | In some cases, the system may reboot after power-on because of the high start-up current.

For further information, see *Connecting to the ignition* on page 27.

Starting up the system

5.2.4 Remote on/off

Alternatively, you may use the Remote on/off function. In this case, leave the power switch in the On position and switch off the terminal remotely using a switch or similar connected to the Remote on/off pins in the DC power interface. For further information, see *Connecting a Remote on/off switch* on page 27.

5.3 Entering the SIM PIN for the terminal

5.3.1 Overview

If your SIM card requires a PIN, you have to enter a PIN to use the system. You can enter the PIN using a standard or ISDN phone, the IP handset or the web interface.

For information on how to connect the handset or computer you are going to use, refer to the user manual.

5.3.2 Entering the PIN using a phone or IP handset

To enter the PIN

If you have a phone connected to the terminal, you can use it to enter the PIN at start up.

Do as follows:

- **For an analog or ISDN phone**:
  Pick up the phone. When the terminal is waiting for a PIN, you will hear 2 beeps – pause – 2 beeps – etc.
  Dial <**PIN**> followed by **#**.

  When you hear a "busy" tone or a dialing tone, the PIN has been accepted and you can hang up or dial a number.

- **For an IP handset:**
  Select the **BGAN** menu, select **ENTER PIN** and enter the user name and password for the terminal. Then enter the PIN for the terminal.

  Note The ENTER PIN menu item is only available if your SIM card requires a PIN, and the PIN has not yet been entered and accepted in the terminal.

Wrong PIN

Analog phone or ISDN phone:
If, instead of the busy tone or dialing tone, you continue to hear 2 beeps -
pause - 2 beeps - etc., it means the PIN was not accepted. Check that you have
the correct PIN and try again.

If a wrong PIN has been entered three times, you will hear 3 beeps - pause - 3
beeps - etc. This means you have to enter the PUK (PIN Unblocking Key)
provided with your SIM card.
After entering the PUK, you must enter a new PIN of your own choice (4 to 8
digits long).

Dial the following:

<PUK> * <New PIN> * <New PIN>   followed by **#** or off-hook key.

Example: If the PUK is 87654321 and the new PIN is 1234, dial
          87654321 * 1234 * 1234   followed by # or off-hook key.

If you enter 10 wrong PUKs, the SIM card will no longer be functional. Contact
your Airtime Provider for a new SIM card.

IP handset:
After having entered the user name and password for the terminal You have 3
attempts to enter the terminal PIN, before you are asked to enter the PUK (Pin
Unblocking Key). The PUK is supplied with your terminal SIM card.

Enter the PUK followed by a new PIN of your own choice. The PIN must be
from 4 to 8 digits long.

If you enter a wrong PUK 10 times, the SIM card will no longer be functional,
and you have to contact your BGAN Airtime Provider for a new SIM card.

5.3.3 Entering the PIN using the web interface

If yoru SIM card requires a PIN and the PIN has not yet been entered when
you start up the web interface, the start-up page will be the PIN page. Enter
the PIN and click **OK**.

For further information on web interface, see the user manual.

5.4 Operating the system

5.4.1 General use

The user manual for the EXPLORER 727 system describes general use of the system and goes through all the functions of the web interface. It also contains a brief description of how to use the Thrane & Thrane IP handset with the terminal.

5.4.2 User interfaces

Overview

The main user interfaces for operation of the system are

- the built-in web interface
- the Thrane & Thrane IP handset

Built-in web interface

The built-in web interface is used for easy configuration and daily use. You access the web interface from a computer connected to the terminal, using an Internet browser. No installation of software is needed.

An Administrator password is required to access advanced configuration of the system.

For further information on the web interface, refer to the user manual for the EXPLORER 727 system.

IP handset

Apart from the standard functions of an IP handset, the Thrane & Thrane IP handset contains a display menu for the EXPLORER 727 system. For further information on the Thrane & Thrane IP handset, refer to the user manual for the IP handset.

Starting up the system

Troubleshooting

6.1   Reset button

6.1.1   How to access the Reset button

The terminal has a Reset button placed next to the SIM slot behind the SIM cover. The functions of this button is described in the next section.
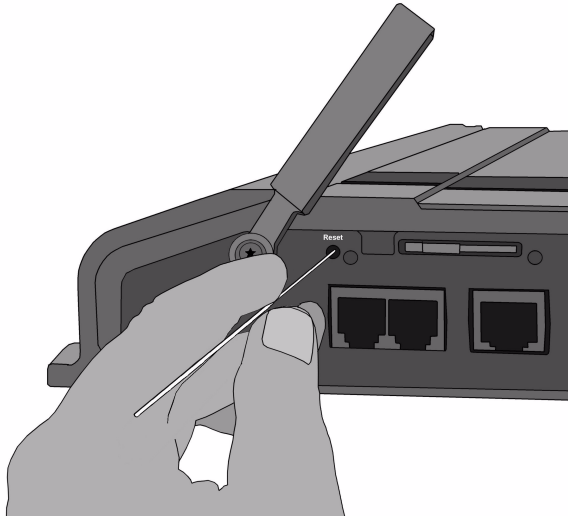
To press the Reset button, use a pointed device.

6.1.2 Function of the Reset button

The Reset button on the terminal has the following functions:

Action	Function
With the terminal running, press the Reset button normally.	The terminal IP address and IP netmask are temporarily set to the default value (default IP address: 192.168.0.1). With this function, even if the IP address has been changed and you do not remember the new IP address, you can still access the web interface and see your current configuration. The default value is not saved in the configuration, but is only valid until next reboot.
With the terminal running, press and hold the Reset button for 30 seconds, until the Power indicator on the terminal is flashing orange.	The terminal restores factory settings and reboots the system.

Action	Function
While the terminal is booting, press and hold the Reset button.	**For service use only!** The bootloader initiates software upload. This firmware upload procedure is only to be used if the other procedures fail due to missing or corrupted firmware. This setup uploads software to the terminal from a TFTP server via the LAN connection. The procedure is as follows: 1. Activate or install a TFTP server on a PC. 2. Locate the correct software image (xxx.dl) for the terminal and place it in the TFTP server directory. 3. Rename the image to **ttexp.dl**. 4. Reconfigure the PC LAN interface to use the static address **192.168.0.2/255.255.255.0**. 5. Power off the terminal. 6. Connect the PC LAN Interface to the terminal. 7. Press and hold down the Reset button. 8. Keep the Reset button pressed while powering on the terminal, and through the next step. 9. Monitor the TFTP server window. When the upload starts you can release the Reset button. 10. When the TFTP upload finishes the terminal boots up using the new image.

Troubleshooting

# 6.2 Status signaling

6.2.1 Overview

The EXPLORER 727 system uses event messages and light indicators to display the status of the system.

6.2.2 Light indicators

Overview

The terminal has a number of light indicators, placed in the panel at the top of the terminal:

- a green/orange Power indicator,
- a green/red/orange Terminal indicator,
- a green/red/orange Antenna indicator,
- a green Message indicator and
- 3 LAN indicators for each LAN interface, showing Activity (Green), Link/Speed (Green/Yellow) and PoE (Green/Red).
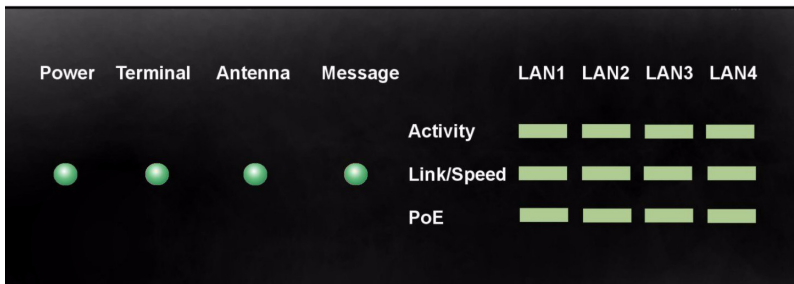
General status indicator functions
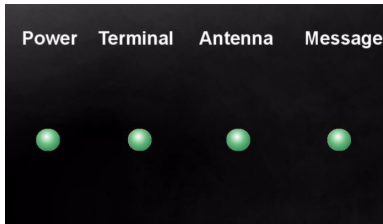
Power indicator

Behavior	Meaning
Steady green	Power OK.
Flashing green	The terminal is powering up.
Flashing orange	The terminal is closing down.
Off	No power.

Terminal indicator

Behavior	Meaning
Steady green	Ready. BGAN registration completed.
Flashing green	Please wait – process in progress. BGAN registration ongoing.
Orange	Warning – temporary malfunction. User action is required.

Behavior	Meaning
Red	Critical error. Check the event log. If the problem is in the EXPLORER system and you cannot solve it, contact your distributor and return the unit for repair if necessary.

Antenna indicator

Behavior	Meaning
Steady green	Tracking. The antenna is ready for use.
Flashing green	Please wait - process in progress. Slow flashing: The antenna is starting up Rapid flashing: Sky scan
Orange	Warning - temporary malfunction. User action is required.
Red	Critical error. Check the event log. If the problem is in the EXPLORER system and you cannot solve it, contact your distributor and return the unit for repair if necessary.

Message indicator

Behavior	Meaning
Flashing green	A new SMS message has arrived.
Off	No new messages, or the unit is off.

Troubleshooting

LAN indicator functions

Activity indicator

Behavior	Meaning
Flashing green	The LAN port is active.

Link/Speed indicator

| Behavior	Meaning
Green	Link speed is 100 Mbps.
Yellow	Link speed is 10 Mbps.
Off	The link is down.

PoE indicator

Behavior	Meaning
Green	The terminal is supplying power to the LAN port.
Red	The connected device requires more power than the terminal can supply to the LAN port.
Off	The terminal is not supplying power to the port.

6.2.3 Event messages

Display of event messages

The terminal can detect events during POST (Power On Self Test), PAST (Person Activated Self Test) or CM (Continuous Monitoring). When the terminal detects an event that requires your action, it issues an event message.

When your terminal issues an event message, the Terminal indicator or the Antenna indicator in the LED panel on top of the terminal signals the event, according to the tables *Terminal indicator* and *Antenna indicator* in the previous section.
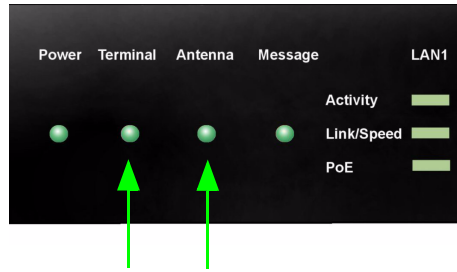
You can see the active event messages in the web interface by clicking the warning symbol in the icon bar at the top in the web interface.

All events are logged in the event log. For information on the event log, see *Event log* on page 58.

Troubleshooting

6.3   Logging of events

6.3.1   Diagnostic report

When contacting Thrane & Thrane for support, please include a diagnostic report.
The diagnostic report contains information relevant for the service personnel during troubleshooting.

To generate the diagnostic report, access the web interface and select **Help Desk**. Then click **Generate report**.

6.3.2   Event log

The event log holds information of all registered events in the terminal or antenna that are also shown in the Antenna and Terminal LEDs on the terminal.

The log includes the time of the occurrence, a short description, location of the error etc. This information can help troubleshooting errors in the system. You can see the event log in the web interface. For further information on the web interface, see the user manual.

Part numbers

A.1   System units

A.1.1   TT-3722A EXPLORER®727 system

Item	Part number
EXPLORER 727 antenna	403053B
EXPLORER terminal	403736A

A.1.2   TT-3670A IP handset and cradle

Item	Part number
Thrane & Thrane IP Handset	403672A
Thrane & Thrane IP Cradle	403674A

A.2 Spare parts, EXPLORER®727

A.2.1 Antenna spare parts

Item	Part number
HPA module	S-62-124671
GPS module	S-60-124765

A.2.2 Roof rail mount kit

Item	Part number
Roof rail mount kit	S-41-127102-A

A.2.3 Cables

Item	Part number
Antenna cable, 2.7 m	S-37-123410-A
Antenna cable, 8 m	S-37-126878-A
Power cable	S-37-125999
LAN cable	S-37-204649-005

A.2.4 Other spare parts

Item	Part number
Getting Started kit	S-673736A

A.3 Options and accessories

A.3.1 Cables

Item	Part number
Antenna cable RG214/U, 50 m.	403722A – option 947
Antenna cable RG223/U, 14 m.	403722A – option 943
Antenna cable S-10162-B-11, 92 m	403722A – option 955
DC cable, 6 m.	403722A – option 009

A.3.2 Magnetic mount kit

Item	Part number
Magnetic mount kit	403722A-920

Technical specifications

B.1   Overview

This chapter contains specifications for the EXPLORER 727 system including the terminal and antenna.

Note   For specifications and outline drawings for the Thrane & Thrane IP handset, refer to the manual for the IP handset.

B.2   EXPLORER®727 antenna

B.2.1   General specifications

Item	Specification
Type	BGAN Class 10, land-vehicular mechanical tracking antenna
Polarization	RHCP
Rx Freq. Band Tx Freq. Band GPS	1525.0 - 1559.0 MHz 1626.5 - 1660.5 MHz 1575.42 MHz
Channel Spacing	1.25 kHz

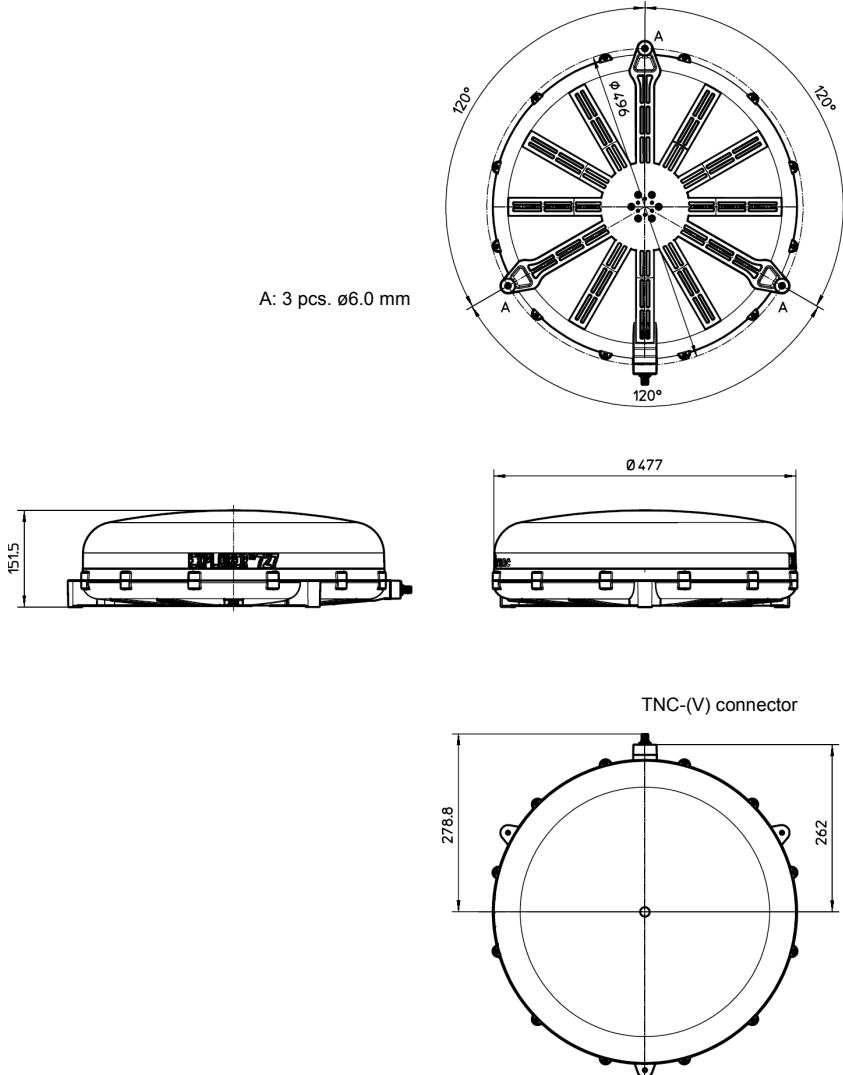| Item	Specification
Antenna element	Gain (RX-band, min.): 12.7 dBi Gain (TX-band, min.): 13.26 dBi
G/T	G/T ≥ -12.5 dBK
EIRP	Min. EIRP: 8 dBW Max. EIRP: 18 dBW
Return loss	Better than -10 dB/50 Ω
Cable losses	RF attenuation: at 1660 MHz: max. 20 dB at 54 MHz: max. 4 dB at 36 MHz: max. 3 dB DC resistance (loop): max. 0.6 Ω Max. cable length between terminal and antenna: • RG-223_U-01: 14 meter • RG-214_U-01: 50 meter • S-07262-BD: 70 meter • S-10162-B-11: 92 meter
Antenna power supply	23.0 - 30.0 V DC, 47 W max. continuous (without cable loss). Measured at ATB input.
Total antenna weight	6 kg

B.2.2 Environmental specifications

Item	Specification
Water and dust	IP-56 dust and water jet proof.
Ambient Temperature	Operational: -25° to +55°C Storage: -40° to +80°C
Operating humidity	100%, condensing
Rain	Up to 100 mm/h, 0.5-4.5 droplets at 200 km/h
Ice, survival	Up to 25 mm of ice (non-operational)
Wind	Normal operation with relative average wind velocity up to 200 km/h (56 m/s, 108 knots).
Vibration, operational	Random spectrum 1.05 g rms x 3 axes: 5 to 20 Hz: 0.02 g^2/Hz 20 to 150 Hz: -3 dB/octave
Vibration, non-operational	Random spectrum 1.7 g rms 2 h x 3 axes 6 h total): 5 to 20 Hz: 0.05 g^2/Hz 20 to 150 Hz: -3 dB/octave
Vehicle motion[a]	Turning rate: 60°/s Turning acceleration: 50°/s^2 Induced acceleration: 0.5 g Velocity: Max. 200 km/h (see note below!)
Shock	Half sine, 20 g/11 ms

Technical specifications

Item	Specification
Solar radiation	1120 W/m^2 according to MIL-STD-810F 505.4
Air Pressure, transport	4572 m AMSL MIL-SPEC 810E 500.4

a. Note that these specifications only apply for the antenna alone. The values will differ depending on the mounting method. Especially the max. velocity is lower when the antenna is mounted with brackets or magnetic mount.

B.2.3 Antenna outline dimensions

EXPLORER®727 antenna

A: 3 pcs. ø6.0 mm

TNC-(V) connector

B.3 EXPLORER® terminal

B.3.1 General specifications

Item	Specification
Global services Voice Data Standard IP Streaming IP SMS	 4 kbps AMBE+2 or 3.1 KHz Audio 64 kbps UDI 432/432 kbps 32, 64, 128, 256 kbps Up to 160 characters
Antenna interface	One connector, TNC-female 1525 to 1559 MHz: -94 dBm to -64 dBm 1626.5 to 1660.5 MHz: -9 dBm to +11 dBm Power supply: 23.0 - 30.0 V DC,
2-wire telephone interface	Two connectors: RJ-11 female. 600 Ω ITU-T Rec. G. 473, standard DTMF telephone. Supported cable length: up to 100 meters.
ISDN interface	One connector: RJ-45 female. Conforms with CCITT I.430, ETSI ETS300012, ANSI T1.605.

Item	Specification
LAN interface	Four connectors: RJ-45 female. Conforms with IEEE 802.3 af, 10/100 Mbps. Supported cable length: up to 100 m PoE (max. 15.4 W) on each port, Total PoE power: 64 W at 24 V operation, 32 W at 12 V.
I/O interface **Output:** Open switch hold-off voltage Open circuit resistance Closed switch voltage **Input:** Input resistance Voltage Voltage High Voltage Low	One connector with 5 configurable inputs/outputs. Open collector, Short circuit protected at 1.5 A and reverse polarization protected. max. 32 V min. 130 KΩ max. 1 V DC at 50 mA min. 130 KΩ Max. 32 V Min. 2.2 V Max. 1.2 V
L-Band output	Not currently used One connector: SMA female. Rx output, 1525 - 1559 MHz: -105 dBm to -80 dBm

Item	Specification
Power Input	Connector: Mixed D-Sub 7W2 Nominal 12/24 VDC (10.5 - 32 V DC; 14 A - 5.5 A) Max. source impedance: 85 mΩ at 12 V, 500 mΩ at 24 V Maximum 20 A at 24 V, 5 ms (start up)
Standby current	Ignition function, off: max. 15 mA Remote on/off in DC connector, off: max. 2 mA
Ambient temperature:	Operational: -25° to +55°C Storage: -40° to +80°C
Relative Humidity	95% non-condensing at +40°C

B.3.2 Outline dimensions, terminal

Connector panel and bottom view, including Basic cable support.

Technical specifications

Side view and top view, including Basic cable support.
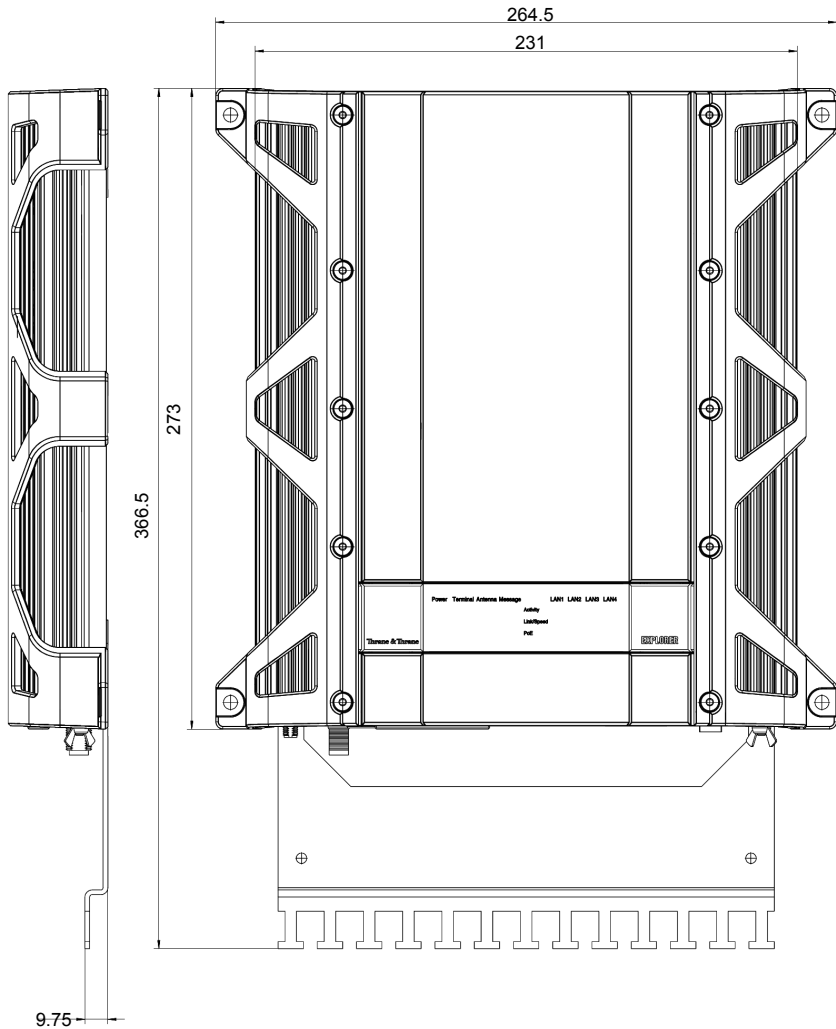
End view with serial number label and heat label.

Weight: 2.5 kg.

Dimensions are in mm.

B.3.3 Measuring the source impedance

Select a power outlet from the 24 V DC or 12 V DC system, and measure the source impedance of the installation as described below.

Measure the voltage without load (R.var disconnected).

Set the current to e.g. 1 A by adjusting R.var – and measure the corresponding voltage change.

Example:

1 A and 50 mV. Source impedance: 50 mV/1 Amp = 50 mΩ.
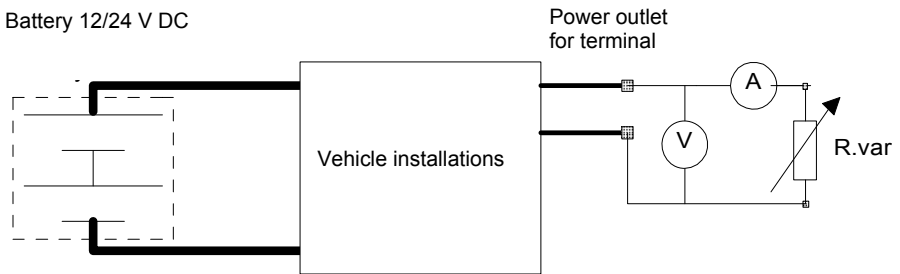
A

AMSL   Above Mean Sea Level

ATB   Antenna Tracking Board

AWG   American Wire Gauge. A means of specifying wire diameters.

B

BGAN   Broadband Global Area Network. A mobile satellite service that offers high-speed data up to 492 kbps and voice telephony. BGAN enables users to access e-mail, corporate networks and the Internet, transfer files and make telephone calls.

C

CD   Compact Disc

CM   Continuous Monitoring

D

DC   Direct Current (or Continuous current). In direct current, the electric charges flow in the same direction, distinguishing it from alternating current (AC).

DTMF   Dual Tone Multi Frequency. The keypad signaling technology that generates two distinct tones when each key is pressed. This system allows navigation of voice menus and other advanced calling services. All wireless phones use DTMF dialing.

E

EIRP	Effective Isotropically-Radiated Power. The amount of power that would have to be emitted by an isotropic antenna (that evenly distributes power in all directions) to produce the peak power density observed in the direction of maximum antenna gain.

G

G/T	A figure of merit of an antenna and low noise amplifier combination expressed in dB. "G" is the net gain of the system and "T" is the noise temperature of the system. The higher the number, the better the system.
GPIO	General Purpose Input/Output
GPS	Global Positioning System. A system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.

H

HPA	High Power Amplifier

I

I/O	Input/Output
IMSO	International Maritime Satellite Organisation. An intergovernmental body established to ensure that Inmarsat continues to meet its public service obligations, including obligations relating to the GMDSS.
IP	Internet Protocol. The method or protocol by which data is sent from one computer to another on the Internet.

ISDN   Integrated Services Digital Network. A circuit-switched telephone
                network system, designed to allow digital transmission of voice
                and data over ordinary telephone copper wires, resulting in
                higher quality and speed than are available with analog.

K

kbps   kilobits per second

L

LAN   Local Area Network

M

Mbps   Megabit per second

P

PAST   Person Activated Self Test. A test similar to the POST test, but
                activated by the user. The PAST causes the system to reset.

PC   Personal Computer

PIN   Personal Identification Number. A secret numeric password
                shared between a user and a system, used to authenticate the
                user to the system.

PoE   Power over Ethernet. A standard for combining power supply with
                transmission of data over the Ethernet. The source unit "injects"
                power into the Ethernet cable and the power is "picked up" at the
                connected device.

POST   Power On Self Test. A test sequence that runs every time the
                system is powered up or reset.

PUK   Pin Unblocking Key

R

RF   Radio Frequency. Electromagnetic wave frequencies between about 3 kilohertz and about 300 gigahertz including the frequencies used for communications signals (radio, television, cell-phone and satellite transmissions) or radar signals.

RHCP   Right-Hand Circular Polarization.

S

SIM   Subscriber Identity Module.The SIM provides secure storing of the key identifying a mobile phone service subscriber but also subscription information, preferences and storage of text messages.

SMA   SubMiniature version A. A coaxial RF connector developed as a minimal connector interface for coaxial cable with a screw type coupling mechanism. The connector has a 50 Ohm impedance.

SMS   Short Message Service

T

TFTP   Trivial File Transfer Protocol. A very simple file transfer protocol, with the functionality of a very basic form of FTP. Since it is so simple, it is easy to implement in a very small amount of memory.

TNC   Threaded Neill-Concelman. A type of RF connector used for terminating coaxial cables. The TNC connector is a threaded version of the BNC connector. The connector has a 50 Ohm

U

UDI   Unrestricted Digital Information. A transparent 64 kbps data channel.

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U

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