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Includes RSA BSAFE cryptographic or security protocol software from RSA Security.
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1. INTRODUCTION

- General
This document describes the TW1m TETRA Voice and Data Modem, including the key technical data, hardware, installation, and features of the device.
The TW1m modem described in this manual is approved for use in the TETRA network. Contact your service provider for more information about networks.
When using the features in the TW1m modem, obey all laws and respect the privacy and legitimate rights of others.

Note:
GPS was replaced with GNSS in deliveries in 04/2023.

Company policy
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- Typographic conventions
Notes (including cautions, tips, warnings and general notes) call your attention to information.
The following symbols are used in the notes:

⚠️ WARNING:
Warnings alert to dangers which may cause loss of life, physical injury or ill health in any form.

⚠️ CAUTION:
Cautions indicate possible damage to equipment or a possibility of loss of data.

✉ Note:
Notes indicate additional information such as recommendations or tips.

1.
Task sequence symbol. Indicates the start of a procedure.
2. IMPORTANT SAFETY INFORMATION

- Operating environment
  Remember to follow any special regulations in force in any area, and always switch off your radio when its use is prohibited or when it may cause interference or danger. Use the radio only in its normal operating positions.
  To maintain compliance with radio frequency exposure guidelines, only use enhancements approved by Airbus Defence and Space for use with this radio.
  Using two TETRA devices in close proximity (in the same vehicle, for example) may cause them to interfere with each other. If you experience such interference, separate the two devices until the interference stops.

- Medical devices
  Operation of any radio transmitting equipment may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device to determine if they are adequately shielded from external RF energy or if you have any questions.
  Switch off your radio in health care facilities or near medical devices when any regulations posted in these areas instruct you to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

  Active implanted medical devices (AIMD)
  To avoid potential interference with persons carrying active implanted medical devices (AIMD), it is important to follow and respect the AIMD manufacturers’ safety recommendations.
  In general, persons with AIMD should keep the radio at least 20 cm (7.9 in) away from the AIMD device. If you have any reason to suspect that interference is taking place, switch off your radio immediately and contact the nearest medical service supporting the interference AIMD.

  Hearing aids
  Some digital wireless terminals may interfere with some hearing aids. If interference occurs, consult your service provider.

- Vehicles
  RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles. These systems include, for example, electronic fuel injection systems, electronic antiskid (antilock) braking systems, electronic speed control systems, and air bag systems. For more information, check with the vehicle or additional-equipment manufacturer or its representative.
  Only qualified personnel should service the radio or install the radio in a vehicle. Faulty installation or service may be dangerous and may invalidate any warranty that may apply to the radio.
  Check regularly that all radio equipment in your vehicle is mounted and operating properly.
  Do not store or carry flammable liquids, gases, or explosive materials in the same compartment as the radio or its parts and enhancements.
  For vehicles equipped with an air bag, remember that air bags inflate with great force. Do not place objects, including installed or portable wireless equipment, in the area over the air bag or in the air bag deployment area. If in-vehicle wireless equipment is improperly installed and the air bag inflates, serious injury could result.

- Aircrafts
  Using or installing this radio in an aircraft is prohibited. Switch off your radio before boarding an aircraft. The use of wireless teledevices in an aircraft may be dangerous to the operation of the aircraft or disrupt the wireless telephone network, and may also be illegal.
**IMPORTANT SAFETY INFORMATION**

- **Potentially explosive environments**
  Using or installing this radio in an area with a potentially explosive atmosphere is prohibited. Switch off the radio when in any area with a potentially explosive atmosphere and obey all signs and instructions. Potentially explosive atmospheres include areas where you would normally be advised to turn off your vehicle engine. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death. Switch off the radio near refueling points such as gas pumps at service stations. Observe restrictions on the use of radio equipment in fuel depots, storage and distribution areas, chemical plants, or where blasting operations are in progress. Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include below-deck on boats, chemical transfer or storage facilities, vehicles using liquefied petroleum gas (such as propane or butane), and areas where the air contains chemicals or particles such as grain, dust, or metal powders.

- **Care and maintenance**
  The TW1m modem is a product of superior design and craftsmanship and should be treated with care. The suggestions below will help you fulfil any warranty obligations and enjoy this product for many years.
  - Keep the TW1m modem and all its parts and accessories out of reach of small children.
  - Keep the TW1m modem dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
  - Do not use or store the TW1m modem in dusty, dirty areas. Its moving parts can be damaged.
  - Do not store the TW1m modem in hot areas. High temperatures can shorten the life of electronic devices, damage batteries and warp or melt certain plastics.
  - Do not store the TW1m modem in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
  - Do not drop, knock or shake the TW1m modem. Rough handling can break internal circuit boards.
  - Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the TW1m modem. Use only detergents meant for electronic devices and printed circuit boards.
  - Do not paint the TW1m modem. Paint can clog the moving parts and prevent proper operation.
  - Use only the accessory antennas or other approved antennas. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, charger or any accessory.
3. DEVICE OVERVIEW

The TW1m modem has the following specific characteristics:

- Compact size
- Voice and data capability
- Integrator friendly - simple to connect interfaces using commercial connectors
- RF performance with power class 3L
- Location service GNSS
- Programming interface

The TW1m modem is designed to be a TETRA modem solution that is compact in size yet provides a full TETRA feature set required by typical data and voice applications. It has been made integrator- and service friendly with commercial off-the-shelf connectors and a standard programming interface.

The TW1m modem is used as a TETRA radio, which allows applications to send and receive SDS messages as well as use IP data services via a PEI-based serial interface. It can also transmit TETRA voice communication.

The device is available with the following features:

- Diplexer for GNSS support
- SIM card reader (E2EE / BSI)
- USB or RS-232C data interface

**Note:** TW1m's USB interface is working as a USB device. It means that the application USB entity should work as the USB host.

Note that the integrator must develop their own adapter to fit for mechanics and IP class.

### Feature summary

The current feature combinations are listed below.

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter</td>
<td>AB1: RS-232/USB data, Audio, GNSS, SIM card reader, Smart interface license included</td>
</tr>
<tr>
<td>TH1n radio board</td>
<td>RC-47: 380-400MHz, 406-430MHz</td>
</tr>
</tbody>
</table>

**Note:**

Activating the Tx power class and DMO repeater license at the factory is optional. By default, the customer can activate the feature using Taqto. The smart interface is activated at the factory in the case of the AB1 adapters by default.

### Device structure

The TW1m modem consists of an adapter board, MAB-1, and the Airbus TH1n TETRA radio's radio board. Both the TH1n board and the software are the same as used in the TH1n radio. Note that the software license of the smart accessory, which enables the simultaneous use of voice and data, must be activated because the TH1n board detects the adapter as a smart device. This is preconfigured at the factory for new orders; otherwise it can be configured in the Taqto tools as a maintenance activity.

MAB-1 is an adapter board that routes the RF-, audio- and digital I/O interfaces from the TH1n main PCB to the external ports for modem use.

MAB-1 is specified to be connected to the following TH1n types: RC-36 (HWID 07xx only) and RC-47 main PCB's. MAB-1 must be integrated into an enclosure for environmental protection. Interfaces are provided as commercial connectors and external cabling must be customized by the user.
4. TECHNICAL DATA

The technical specifications of the TW1m modem are listed in Table 2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQUENCY</td>
<td>Band 3: TX 380-390 MHz, RX 390-400 MHz</td>
</tr>
<tr>
<td></td>
<td>Band 4: TX 410-420 MHz, RX 420-430 MHz</td>
</tr>
<tr>
<td>RF OUTPUT POWER</td>
<td>EN 300392-2 compliant, power class 3L (1.8W)</td>
</tr>
<tr>
<td>DIMENSIONS (W X H X D) MM</td>
<td>84 mm x 64 mm x 24.7 mm</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>66 g</td>
</tr>
<tr>
<td>POWER SUPPLY REQUIREMENTS</td>
<td>+Regulated 3.9V +/- 0.2V DC / max 2.5A</td>
</tr>
<tr>
<td>GNSS ANTENNA POWER SUPPLY</td>
<td>Feed for the active GNSS antenna: 35mA (max) / + 3.9V DC</td>
</tr>
<tr>
<td>POWER CONSUMPTION</td>
<td>Note that all figures are subject to change. TETRA Call: 8 W (maximum TX slot consumption in 50Ω antenna load.) GNSS: 180 mW (typical average, in addition to other power consumption when on) and 280mW maximum peak consumption</td>
</tr>
<tr>
<td>OPERATING TEMPERATURE</td>
<td>-20 to +55°C</td>
</tr>
</tbody>
</table>

Table 2  Technical data

The mounting of the screw positions is shown in Figure 1.

Figure 1  Mounting of screw positions

- Interfaces
  The TW1m modem uses commercial connectors (Molex) available from electronic connector resellers. Molex cable kits are available to simplify the setup. The integrating requires that the cables are tailored to the optimum length. Airbus does not provide the tailored cables.

  The RF antennas should be installed a minimum of 50cm from the TW1m boards to avoid TETRA interferences.

  Note:
  Simultaneous use of AT commands and IP data is not supported.

  The PCB connector has a 3-wire serial port with 2.78 V voltage levels for data communication. The RS-232 voltage levels and HW flow control are provided with accessories.
The TW1m modem features a GNSS receiver for positioning applications. An external active GNSS antenna is required for the receiver. Do not use a passive GNSS antenna!

The TW1m modem does not have an integrated TETRA antenna. Therefore, a connector for an external antenna is provided. A combined TETRA/GNSS antenna can also be used.

Audio and the majority of the control signals are routed straight from the system connectors to the TH1n side connector flex.

These may be connected to external devices in all cases regardless of the MAB-1 operation mode. Operations on these signals are determined by TH1n.

Data signals are routed to the RS-232 transceiver by default. Connecting the USB_VBUS voltage of 5V routes these signals via USB. These ports may not be used simultaneously.

For data signals, the MAB-1 operation may be split into three operating modes. These are described in chapter Operating modes.

- Device layout

![TW1m modem](image)

**Figure 2** TW1m modem
Table 3  Operation mode truth table (X = Any value)

<table>
<thead>
<tr>
<th>OPT_SEL2</th>
<th>DTR</th>
<th>MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>X</td>
<td>Data mode</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>FBUS parametering</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>MBUS parametering</td>
</tr>
</tbody>
</table>

Figure 3  TW1m modem’s top side view

Figure 4  Overview of the TW1m modem’s connectors
**Operating modes**

**Data mode**
In the data mode, the device may be controlled with AT commands from the terminal software and transfer data packets as with DLR-8U Data Cable. AT tiny MCU handles conversion from MBUS to UART handshake signals for flow control.
The USB or RS-232 interfaces are used for communication to MAB-1. RS-232 is used as default and MAB-1 enables USB connection when USB_VBUS voltage of 5V is detected. USB and RS-232 cannot be used simultaneously.
The data mode is toggled by pulling the OPT_SEL2 I/O signal to low. After 6 seconds the data mode is ready to use.

**Parametering mode**
In the parametering mode, the device communicates with the Taqto TETRA programming tool using MBUS or FBUS signals. Taqto selects the data bus by using the DTR handshake signal.
The USB or RS-232 interfaces are used for communication to MAB-1. RS-232 is used as default and MAB-1 enables USB connection when USB_VBUS voltage of 5V is detected. USB and RS-232 cannot be used simultaneously.
The parametering mode is the default mode that is enabled when the OPT_SEL2 signal is left floating.

**RF interface**
The MAB-1 RF path is connected to the TH1n antenna springs. The TETRA- and GNSS antenna paths are separated by a diplexer.
An assembly option without diplexer is possible when only the TETRA functionality is desired.

![Figure 5 RF interface](image)

**Audio**
Microphone and speaker signals are routed directly from the TH1n side connector to System Connector 1.
5. INTERFACES

- **Power Connector**

A regulated VBAT supply voltage is fed to the power connector X105. The Power Connector’s pinout is shown in Table 4.

The connector type is JST B8B-PH-SM4-TB(LF)(SN) and the mating connector is JST PHR-8.

**Figure 6  MAB-1 Adapter board block diagram**

**Figure 7 Power connector**
Table 4  Power Connector’s pinout

**System Connector 1**

System Connector 1 is used for data/audio user applications.
The connector type is Molex Picoblade 53398-1571 and the mating connector is Molex 51021-1500.

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>IN/OUT</th>
<th>LEVEL</th>
<th>CURRENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VBAT</td>
<td>IN</td>
<td>3.7 V - 4.1 V DC</td>
<td>2.5A</td>
<td>Total current between pins 1-3</td>
</tr>
<tr>
<td>2</td>
<td>VBAT</td>
<td>IN</td>
<td>3.7 V - 4.1 V DC</td>
<td>2.5A</td>
<td>Total current between pins 6-8</td>
</tr>
<tr>
<td>3</td>
<td>VBAT</td>
<td>IN</td>
<td>3.7 V - 4.1 V DC</td>
<td>2.5A</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>n.c. *)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>n.c. *)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>IN</td>
<td>0V</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>IN</td>
<td>0V</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>IN</td>
<td>0V</td>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

*) not connected

---

**Figure 8  System connector 1**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>IN/OUT</th>
<th>LOW LEVEL</th>
<th>HIGH LEVEL</th>
<th>CURRENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USB_GND</td>
<td>IN</td>
<td>0 - 0.3 V</td>
<td>2.8 - 3.6 V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>USB_DP</td>
<td>IN/OUT</td>
<td>0 - 0.3 V</td>
<td>2.8 - 3.6 V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>USB_DM</td>
<td>IN/OUT</td>
<td>0 - 0.3 V</td>
<td>2.8 - 3.6 V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>USB_GND</td>
<td>IN</td>
<td>0V</td>
<td>0V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>USB_VBUS</td>
<td>IN</td>
<td>0 - 0.8 V</td>
<td>5.0V ±5%</td>
<td>500mA</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>IN</td>
<td>0V</td>
<td>2.78V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>OPT_SEL2</td>
<td>IN</td>
<td>0 - 0.54 V</td>
<td>1.26 - 1.8 V</td>
<td>10mA</td>
<td>Data/Parametering toggle (Internal pull-up)</td>
</tr>
<tr>
<td>8</td>
<td>OPT_SEL1</td>
<td>IN</td>
<td>0 - 0.54 V</td>
<td>1.26 - 1.8 V</td>
<td>10mA</td>
<td>(Internal pull-up)</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>IN</td>
<td>0V</td>
<td>2.78V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ALARM</td>
<td>IN</td>
<td>0 - 0.54 V</td>
<td>1.26 - 1.8 V</td>
<td>10mA</td>
<td>(Internal pull-up)</td>
</tr>
<tr>
<td>11</td>
<td>PTT</td>
<td>IN</td>
<td>0 - 0.54 V</td>
<td>1.26 - 1.8 V</td>
<td>10mA</td>
<td>(Internal pull-up)</td>
</tr>
<tr>
<td>12</td>
<td>SGND</td>
<td>IN</td>
<td>0V</td>
<td>2.78V</td>
<td>MIC- / Accessory supply</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>XMIC</td>
<td>IN</td>
<td>0V</td>
<td>2.78V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

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### System Connector 2

System Connector 2 is used for power on/off and as a service interface for parametering and updating the terminal SW.

The PIN header for connections to parametering cable (e.g. CA-119) and flash box interface.

The connector type is Molex Picoblade 53398-1271 and the mating connector is Molex 51021-1200.

#### Table 5  System Connector 1’s pinout

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>IN/OUT</th>
<th>LOW LEVEL</th>
<th>HIGH LEVEL</th>
<th>CURRENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>XEAR</td>
<td>OUT</td>
<td>0V</td>
<td>2.1V_p-p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td>SPK-</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 6  System Connector 2’s pinout

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>IN/OUT</th>
<th>LOW LEVEL</th>
<th>HIGH LEVEL</th>
<th>CURRENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>n.c. *)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>n.c. *)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>POWER_ON_OFF</td>
<td>IN</td>
<td>0 - 1.3V</td>
<td>3.0 - VBAT</td>
<td>10mA</td>
<td>Power button (Internal pull-up)</td>
</tr>
<tr>
<td>5</td>
<td>Reserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reserved for R&amp;D use. Do not connect.</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>n.c. *)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>FBUS_RX</td>
<td>IN</td>
<td>0 - 0.83V</td>
<td>1.95 - 2.78V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>FBUS_TX</td>
<td>OUT</td>
<td>0 - 0.83V</td>
<td>1.95 - 2.78V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>MBUS</td>
<td>IN/OUT</td>
<td>0 - 0.83V</td>
<td>1.95 - 3.0V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>BSI</td>
<td>IN</td>
<td>0</td>
<td>2.70V</td>
<td>10mA</td>
<td>10-bit ADC input</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) not connected

---

Figure 9  System Connector 2
### RS-232 Connector

The RS-232 Connector X103 signals are described in Table 7. The connector type is Molex Picoblade 53398-1271 and the mating connector is Molex 51021-1200.

![Figure 10 RS-232 connector](image)

**Table 7 RS-232 Connector’s pinout**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>IN/OUT</th>
<th>MAX LEVEL</th>
<th>CURRENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DCD</td>
<td>OUT</td>
<td>± 5.4V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
<td>OUT</td>
<td>± 5.4V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
<td>IN</td>
<td>± 25V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DTR</td>
<td>IN</td>
<td>± 25V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>OUT</td>
<td>± 5.4V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>IN</td>
<td>± 25V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>OUT</td>
<td>± 5.4V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>RI</td>
<td>OUT</td>
<td>± 5.4V</td>
<td>10mA</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**INTERFACES**

- **U.FL connectors**
  The TETRA- and GNSS antenna connectors are standard U.FL connectors.

![U.FL connectors](image)

**Figure 11 U.FL connectors**

- **SIM card holder**
  The SIM card holder is a plastic guide to support the SIM card on the TH1n SIM connector.
6. TOOLS AND ACCESSORIES

The accessories and connectors are not provided by Airbus. The connectors are globally commercially available connectors which enable using optimized cables at a reasonable cost. The overall device cabling is typically specific made to fit for purpose by the integrator.
7. INSTALLATION

- Safety warnings and cautions

**WARNINGS:**

1. If the device is installed in a vehicle, care must be taken on installation in vehicles fitted with electronic engine management systems and anti-lock braking systems. Under certain fault conditions, emitted RF energy may affect to operation of these systems. If necessary, consult the vehicle dealer/manufacturer to determine the immunity of vehicle electronic systems to RF energy.

2. The radio must not be operated in areas likely to contain potentially explosive atmospheres, for example petrol stations (service stations), blasting areas etc.

3. Operation of any transmitting radio equipment may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device if you have any questions. Other electronic equipment may also be subject to interference.

**CAUTIONS:**

1. Servicing and alignment must be undertaken by qualified personnel only.

2. Ensure that all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.

3. Ensure that solder, wire or foreign matter do not enter into mechanics of the radio, as damage may result.

4. Use only approved components as specified in the parts list.

5. Ensure all components, modems screws and insulators are correctly re-fitted after servicing and alignment. Ensure all cables and wires are repositioned correctly.

6. It is recommended that the radio is powered down before disconnecting or switching off the radio's battery or other input power supply. This method ensures the integrity of the file system. Make sure that the power is really switched off (the powering down takes about 3 seconds after which the Power On LED goes off).

**ESD protection**

Airbus Defence and Space requires that the TW1m modem’s service points have sufficient ESD protection against static electricity when servicing the product. Any product which has its covers removed must be handled with ESD protection. To replace the covers, ESD protection must be applied. All electronic parts of the product are susceptible to ESD.

All ESD-sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD-protected spare part packages MUST NOT be opened/closed outside of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Airbus Defence and Space After Market Services representative.
Environmental conditions

The TW1m modem can be installed in an environment meeting the specifications shown in Table 8.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-20…+55°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Up to 95%, non-condensing</td>
</tr>
<tr>
<td>Vibrations and shocks</td>
<td>According to ETSI EN 300 019-2-5 V3.0.0 (5M3), installations only inside vehicles. According to ETSI EN 300 019-2-6 V2.1.2 (6M3)</td>
</tr>
<tr>
<td>IP Classification</td>
<td>Not applicable</td>
</tr>
<tr>
<td>EMC &amp; SAR</td>
<td>EMC approved according to EU regulations. SAR is not evaluated as the device is not a handheld device.</td>
</tr>
</tbody>
</table>

Table 8  TW1m modem’s environmental conditions

⚠️ WARNING:
Do not install the TW1m modem in a dusty environment. If the modem and the heat sink are dusty, they can overheat.

Tools and installation materials

The TW1m modem is to be mounted on mechanics using ø (M3) screws suitable for a printed circuit board. The recommended torque is 80 - 100 Ncm. The screw type depends on the material (metal/wood/plastic). For the detailed dimensions of the TW1m modem, see chapter 4.

Cable types, making of cables

Depending on your application and its environmental conditions, you should consider the requirements relevant to your cables, for example:

- Direct exposure to sunlight
- Common chemicals such as:
  - alcohol
  - isopropanol
  - petrol
  - sun lotion and hand creams
  - insecticides.

All the cables and other materials must be selected so that they tolerate the conditions in your application and its environment.

⚠️ WARNING:
When cutting and joining cables, take care not to drop pieces of cables and thin copper wires on the TW1m modem, because they can cause short-circuits in the modem.

Installation procedure

It is recommended that the radio’s parameter and network configuration is done before its installation.

1. Check and clean the surface the TW1m modem is to be installed on. Also make sure that the mechanics is suitable for the TW1m modem. If you are uncertain what the installation procedure is or if the mechanics selected can be used with the TW1m modem, consult the retail dealer.

   - The components on the TW1m board are not mechanically protected. Therefore, ensure that the board does not come into contact with any external equipment, cables or surfaces when mounted to avoid damaging the TW1m modem or causing short circuits.
   - Always ensure that there is sufficient space around the heat sink for ventilation, and that the enclosure, if any, is sufficiently cooled and/or ventilated. In certain conditions and usage forced air-cooling may be necessary.
2. Check that you have the tools and mounting screws that are suitable for the material the TW1m modem is to be installed on, and the accessories needed for the installation and operation of the TW1m modem.

3. Remove the TW1m modem from the package and dispose the packing materials according to the local instructions.

⚠️ WARNING:
Keep in mind that the TW1m modem is ESD sensitive.

4. Place the TW1m modem on the mechanics as recommended. Also ensure that all the mounting holes of the printed circuit board are on the same level. This reduces mechanical stress of components and connectors on the board, and guarantees a longer product lifetime. Never mount the board in a manner that the mounting arrangement causes twisting or bending to it.

5. Fasten the TW1m modem using mounting screws and procedures suitable for the surface material. Do not tighten the screws too much.

6. If the optional GNSS antenna is going to be used, connect it.

7. Connect the TETRA antenna.

8. Connect the serial/AT cable.

9. Ensure that all the cables which are connected to the TW1m modem are fastened in a manner that does not cause bending, twisting, pushing, pulling, or vibrating in the connectors of the TW1m modem.

10. Connect the power cable.

### Powering up considerations

#### Connecting the power supply

The prerequisites to power up the TW1m modem are the following:

1. Connect the TW1m to a main DC supply (3.9V) in the power connector before you power it up.

2. Power up the board by pulling down the **System Connector 2**'s Pin4 PWR_ON_OFF to GND at least for 3 seconds.

   Pin4 can also be permanently left to GND (that is, automatic start-up and shut down by power supply).

   Note that if you have the automatic start-up function in use, the rise time between 2.0Vdc to 3.9Vdc must be less than 15ms.

   ▶️ Note: The PWR_ON_OFF signal must be released during the programming operation in Taqto. The flashing fails if the PWR_ON_OFF is pulled low during the flashing.

3. Select the mode and set the PIN code.
   - Pull **System Connector 1**'s Pin7 OPTSEL2 to GND permanently to get the DATA mode selected.
   - Connect to the USB or RS-232C interface.
     - USB data is always primary compared to RC-232 when the USB supply voltage 5V is detected by the USB interface.
   - Set the PIN code 1234 by using the AT commands. For example, AT+CPIN="1234"
     - The pin code query can be set OFF by using Parameters or AT command.

Now the TW1m modem is started up and running.

#### Special considerations for vehicles, vessels and so on

Mount the device and all the cables securely to the installation base to avoid product damage because of shocks and vibrations. Sharp bending of cables, especially RF cables, must be avoided.

The positive voltage must be taken directly from the battery to the 3.9V regulator, unless the mains voltage of the vehicle differs from 12V. This minimizes the risk of disturbances from or to the TW1m modem, as well as guarantees a loss-free power distribution. The grounding cable is connected to the car chassis with a lead as short as possible (NOT directly from the negative pole of the battery).
If the vehicle has a +24 V electrical system (trucks, all-terrain vehicles, etc), an external voltage converter must be used. The converter must be well protected against transients produced by the vehicle's electrical system. It must also be capable of maintaining a stable output during the rapid changes in the load current. Some vehicles have a main switch (for instance the gas trucks) that separates the chassis of the vehicle from the negative lead of the battery. Never pass this switch, that is, the grounding of the reducer must be taken from the body of the vehicle, NOT directly from the battery.

**Lightning protection**

Protect the antennas in particular from lightning by using lightning rods, surge arrestors, gas discharge tubes and/or other methods. As the installation and climatic conditions vary, the customer is always responsible for the lightning protection of the final installation.

**Grounding**

The TW1m modem has been designed for negative ground systems. If you install the TW1m modem in a system with positive ground, take a special care to ensure that the grounding and supply voltages are correctly connected. All the input and output signal voltages in this document are always referred to the GND pins of the connector. Always connect the power connector GND first and last. Antenna GND needs to be always galvanically connected to the power GND.
8. PROGRAMMING

- **PC Software**
The parametering is based on the TETRA Terminal management tool Taqto Rel. 2.6 or newer version. Taqto identifies the product as a TH1n radio, type RC-36 or -47 depending on which modem is used. The modem name is available in the type plate on the radio board.

- **Programming cable**
The model of the programming cable depends on the TW1m variant:
  - AB1 supports USB cable for programming and flashing in the USB device mode.

  **System connector 1.** Connection example for using a standard USB cable to TW1m AB1 parameterization is shown in Figure 12.

  ![USB Parameterization cable connection](image)

  **Figure 12 AB1 variant USB Parameterization cable connection**

  **Note:** The PWR_ON_OFF signal must be released during the programming operation in Taqto. The flashing fails if the PWR_ON_OFF is pulled low during the flashing.

- **Configuring TW1m**
In some cases it is possible that Transmit Inhibit is active after the terminal has been programmed by using Taqto. This can be avoided by not using the NORMAL_NO_SERVICE mode in the Terminal mode settings. Note that there is one set of settings that is common for Taqto, and it is possible to override them for each connection.
It is recommended to keep the default values for the common settings (see Figure 13) and then adjust the settings for the connection to which TW1m is configured (see Figure 14 for an example).
Figure 14 Device configuration: Example of adjusting the connection specific settings
It is recommended that you set the terminal parameter **Accessory Detection** to the value **TW1m** in **User interface settings > Enhancement settings > Accessories**.

![Accessory detection](image1.png)

**Figure 15 Accessory detection**

Activate the smart accessory interface by selecting it in the **Applications > AT commands settings**.

![Activating the smart accessory interface](image2.png)

**Figure 16 Activating the smart accessory interface**
If the Power class 3L (1.8 W) TX power feature is used, activate the option 1.8 W TX power in Subscriber settings > RF parameters in trunked mode (TMO). Select also an appropriate value for the Max TX power level. For direct mode (DMO), define these settings in Direct Mode (DMO) > Channels: TX power level.

Figure 17 Power class 3L (1.8 W) TX power

- Updating TW1m

When updating TW1m from an earlier release, features that are already enabled, remain enabled. Note, however, that if the SW update is done using the Force flash option in Taqto, the enabled features are not enabled automatically.
9. FEATURE GUIDE

**AT commands**
AT commands can be used to manage and control the functionality of the TW1m modem.
For a complete list of the AT commands, refer to the latest version of the document *AT Command set for Airbus DS TETRA products*, which is available in the My Contents and smarTWISP customer portals.

**Note:**
AT passwords cannot contain quotation marks (" ... ").

**Note:**
The data connection must be disconnected before removing the data cable.
If the data cable is removed before the data connection is disconnected, the connection will stay reserved and new connection attempts will fail.
This section explains the abbreviations that are used in this document.

<table>
<thead>
<tr>
<th>TERM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIMD</td>
<td>Active implanted medical device</td>
</tr>
<tr>
<td>AT</td>
<td>Attention command language</td>
</tr>
<tr>
<td>DLR-8U</td>
<td>Airbus data cable name and type</td>
</tr>
<tr>
<td>DTR</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>EPA</td>
<td>ESD protected Area</td>
</tr>
<tr>
<td>ESD</td>
<td>Electrostatic discharge</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>FBUS</td>
<td>Fast bus</td>
</tr>
<tr>
<td>FPS</td>
<td>Frames per second</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>GNSS</td>
<td>Global Navigation Satellite System</td>
</tr>
<tr>
<td>HW</td>
<td>Hardware</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/output</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>MAB</td>
<td>Module adapter board</td>
</tr>
<tr>
<td>MBUS</td>
<td>Meter-bus</td>
</tr>
<tr>
<td>MCU</td>
<td>MicroController</td>
</tr>
<tr>
<td>Ncm</td>
<td>Newton centimeters</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed circuit board</td>
</tr>
<tr>
<td>PEI</td>
<td>Peripheral equipment interface</td>
</tr>
<tr>
<td>RC</td>
<td>Airbus Terminal ID type</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
</tr>
<tr>
<td>SAR</td>
<td>Specific absorption rate</td>
</tr>
<tr>
<td>SDS</td>
<td>Short data service</td>
</tr>
<tr>
<td>SIM</td>
<td>Subscriber identity module</td>
</tr>
<tr>
<td>TETRA</td>
<td>Terrestrial trunked radio</td>
</tr>
<tr>
<td>TX</td>
<td>Radio transmitter</td>
</tr>
<tr>
<td>UART</td>
<td>Universal asynchronous receiver-transmitter</td>
</tr>
<tr>
<td>USB</td>
<td>Universal serial bus</td>
</tr>
<tr>
<td>USB_VBUS</td>
<td>USB voltage line</td>
</tr>
<tr>
<td>VBAT</td>
<td>Voltage battery line</td>
</tr>
</tbody>
</table>