

RADius 1000

Installation Manual

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31438-MA-010	RADius Processing Unit, dimensions	4	1
3840-MD-041	RADius Controller Unit, dimensions	2	1
3840-MA-011	Interrogator, dimensions	3	1
3840-MA-020	Transponder, dimensions	1	1
3840-MA-026	Transponder dimensions, 600 High Gain	1	1

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1. INTRODUCTION

1.1 About this manual

This manual contains the information necessary to install the RADius 1000 on a vessel. For all other product information, please consult the *RADius 1000 User's Manual*, reference [2].

This manual is organised into the following chapters:

Chapter 1 **Introduction** - A brief presentation of the *RADius 1000 Installation Manual* with references and abbreviations.

Chapter 2 **Specifications** - Describes the physical dimensions, required power, environmental and cable specifications.

Chapter 3 **Installation** - Presents procedures to be followed for a typical ship installation with recommendations on location of the different parts, mechanical and electrical installation and how to set up the product.

Chapter 4 **Installation drawings** - Contains outline drawings showing the mechanical dimensions of the different parts of the RADius 1000.

Chapter 5 **Parts list** - Lists the parts in the RADius 1000 system.

In this manual the following notations are used:

WARNING! *Used when it is necessary to warn personnel that a risk of injury or death exists if care is not exercised.*

Caution! *Used to warn the reader that a risk of damage to the equipment exists if care is not exercised.*

Note! *Used to draw the reader's attention to a comment or some important information.*

1.2 FCC part 15 statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a marine and/or commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. The equipment is not intended for operation in

a residential area. Operation in such an area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Additional information to the user:

Changes or modifications not expressly approved by Kongsberg Seatex AS will void the user's authority to operate the equipment.

1.3 FCC RF exposure compliance

This device conforms with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

WARNING! The RADius must be mounted with a separation distance of at least 20 cm from any humans.

1.4 References

- [1] *NMEA 0183 Standard for interfacing marine electronic devices*, Version 2.3
- [2] *RADius 1000 User's Manual*
- [3] *Man_inst_RADius_600X*
- [4] *Man_inst_RADius_500X*

1.5 Definitions, abbreviations and acronyms

1.5.1 Definitions

host system	In this manual defined as Navigation computers, Dynamic Positioning Systems, etc, receiving data from RADius.
Interrogator	The Interrogator transmits signals and receives the reflected signals from the Transponder(s). Based on this, it calculates the distance and bearing to one or more transponders. Mounted on the DP vessel.
Transponder	The Transponder reflects the signals transmitted from the Interrogator. Mounted on the remote object/vessel.
Latency	The time it takes from the actual measurement is made until the telegram is transmitted on the serial port.

1.5.2 Abbreviations and acronyms

AC	Alternating Current
BCD	Binary Coded Decimal
CU	Controller Unit
DP	Dynamic Positioning
DGPS	Differential Global Positioning System
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
EN	European Norm
FBEAM	Fanbeam telegram format
FM-CW	Frequency Modulated Continuous Wave
FPGA	Field Programmable Gate Array
GND	Ground
GPS	Global Positioning System
GUI	Graphical User Interface
IEC	International Electrotechnical Committee
IP	Ingress Protection
IU	Interrogator Unit
LAN	Local Area Network
LED	Light Emitting Diode
NC	Not connected
NMEA	National Marine Electronics Association
RF	Radio Frequency
RMS	Root Mean Square
RX	Receive
TX	Transmit
UPS	Uninterruptible power supply used to ensure power in case of mains interrupt
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
VDU	Video Display Unit
VGA	Video Graphic Adapter

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2. SPECIFICATIONS

2.1 Physical dimensions

RADius 1000 Controller Unit

See drawing 3840-MD-041, rev. 2, page 33, for physical description.

RADius 1000 Processing Unit

Width: 482 mm (19-inch rack)
 Height: 132 mm (3 U)
 Depth: 430 mm
 Weight: 12 kg
 Colour: Front anodised black

Video Display Unit, 15" LCD

Width: 343 mm
 Height: 310 mm
 Depth: 170 mm
 Weight: 3.7 kg
 Colour: Black

RADius 1000 Interrogator Unit

Width: 562 mm
 Height: 412 mm
 Depth: 184 mm
 Weight: 7 kg
 Colour: White - front
 Colour: Grey - rear

RADius 500 Transponder

Width: 220 mm
 Height: 228 mm
 Depth: 72 mm
 Weight: 1.6 kg
 Colour: White - front
 Colour: Grey - rear

RADius 600 Transponder

Width: 220 mm
 Height: 228 mm
 Depth: 72 mm
 Weight: 1.4 kg
 Colour: White - front
 Colour: Grey - rear

RADius Transponder Power Supply

Width:	126 mm
Height:	226 mm
Depth:	90 mm
Weight:	2.5 kg
Colour:	Grey

2.2 Input power supply**RADius 1000 Processing Unit**

Voltage:	85 to 135 and 180 to 265V AC
Power consumption:	100 W (max.)
Batteries:	None, connection to UPS recommended

Video Display Unit, 15"

Voltage:	100 to 240V AC (50/60 Hz)
Power consumption:	23 W (typical)

RADius 1000 Interrogator Unit

Voltage:	Provided from Power/Connection Shelf (48V DC \pm 10%)
Power consumption:	70 W (max.)
Batteries:	None, connection to UPS recommended

RADius 500 Transponder

Voltage:	3.6 V battery ¹
Power consumption:	7 mW

RADius 600 Transponder

Voltage:	Supplied from Transponder Power Supply
Power consumption:	700 mW (max.)

RADius Transponder Power Supply

Input voltage (universal):	85 to 265 V AC
----------------------------------	----------------

2.3 Interrogator radiated power

Peak radiated output power (EIRP):	1.43 W
Mean radiated output power (EIRP):	1.05 W

¹ The RADius 500 contains a lithium battery. International regulations on shipment of lithium require special warning labels. See Appendix E - Transportation in this manual for information on equipment containing lithium batteries.

2.4 Environmental specification

Products are compliant with relevant requirements in IEC/EN60945 and IEC/EN60950, except for the listed Video Display which is not compliant to IEC/EN60945. Please contact Kongsberg Seatex AS for a compliant version if required.

Processing Unit

Enclosure material:..... Aluminium
 Enclosure protection: IP-30
 Operating temperature range:..... -15 to +55°C/5 to 131 F
 Operating humidity: 20 to 80% relative
 Storage temperature range: -20 to +60°C/-4 to 140 F
 Storage humidity: Less than 55%

Video Display Unit, 15"

Operating temperature range:..... 5 to +40°C/41 to 104 F
 Relative humidity:..... 20 to 80%

RADius 1000 Interrogator Unit

Enclosure material:..... Anodised aluminium - rear
 Enclosure material:..... Plastic - front cover
 Enclosure protection: IP-66
 Operating temperature range:..... -30 to +55°C/-22 to 131 F
 Operating humidity (max.):..... 100%
 Storage temperature range: -25 to +70°C/-13 to 158 F
 Storage humidity (max.):..... 60%

RADius 500 Transponder

Enclosure material:..... Anodised aluminium - rear
 Enclosure material:..... Plastic - front cover
 Enclosure protection: IP-66
 Operating temperature range:..... -30 to +55°C/-22 to 131 F
 Operating humidity (max.):..... 100%
 Storage temperature range: -25 to +70°C/-13 to 158 F
 Storage humidity (max.):..... 60%

RADius 600 Transponder

Enclosure material:..... Anodised aluminium - rear
 Enclosure material:..... Plastic - front cover
 Enclosure protection: IP-66
 Operating temperature range:..... -30 to +55°C/-22 to 131 F
 Operating humidity (max.):..... 100%
 Storage temperature range: -25 to +70°C/-13 to 158 F
 Storage humidity (max.):..... 60%

RADius Transponder Power Supply

Enclosure material:	Aluminium
Enclosure protection:	IP-65
Operating temperature range:	-15 to +55°C/5 to 131 F
Operating humidity (max.):	100%
Storage temperature range:	-25 to +70°C/-13 to 158 F
Storage humidity (max.):	60%

2.5 Cables

Possible cable types:

Interrogator to Processing Unit Data Cable

Type 1:	Draka type TI (C) 60 V, shipline, 2x2x0.5 mm ² (Halogen free) ¹
Draka part number:	839202, El-number 1045881
Type 2:	Draka type TI (C) 250 V, shipline, 2x2x0.5 mm ² (Halogen free)
Draka part number:	832002,
Cable resistance, Type1 and Type 2:	40 Ohm/km
Diameter overall, Type 1:	6.5 ± 0.5
Diameter overall, Type 2:	6 ± 0.5
Maximum length:	60 m
Flame retardation:	IEC 60332-1/3

Interrogator Power Cable

Type:	As above
Maximum length:	60 m

Transponder Power Cable

Type:	As above
Maximum length:	200 m

Note! *The data cable must be twisted pair cable! If other cable types are used the maximum diameter should not exceed 7.5 ± 0.5 mm.*

¹ This type is likely to be obsolete in 2006

3. INSTALLATION

3.1 General information

This chapter describes a typical ship installation of the RADius system (EX approved transponders are described in separate manuals). The standard system is supplied with the following parts:

- A 19-inch rack (6U) (resiliently mounted)
- RADius 1000 Processing Unit (mounted in the rack)
- RADius 1000 Interrogator Unit
- RADius 500 Transponder
- VDU monitor for desktop mounting
- Keyboard with integrated mouse (1U)
- A power and connection shelf (2U) (mounted in the rack)
- Power and data cables between the Processing Unit and the Interrogator Unit
- Documentation
- Power supply - Transponder

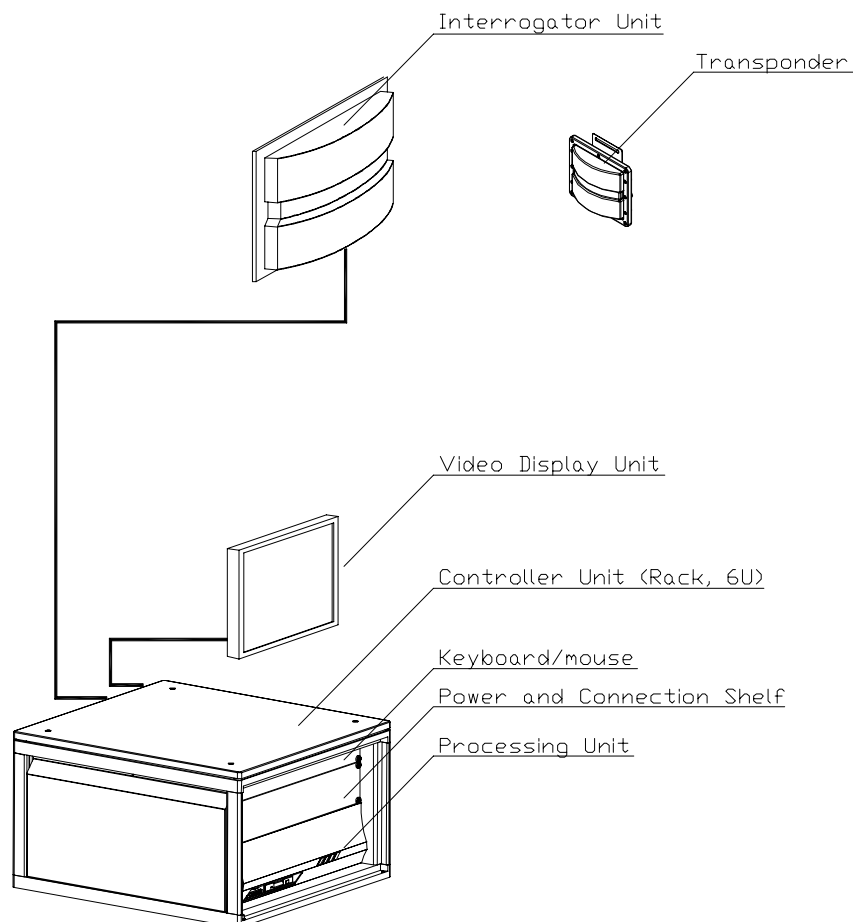


Figure 1 RADius 1000 system, single Interrogator

If a dual Interrogator system is needed, another RADIUS 1000 Interrogator Unit is added as shown in Figure 2.

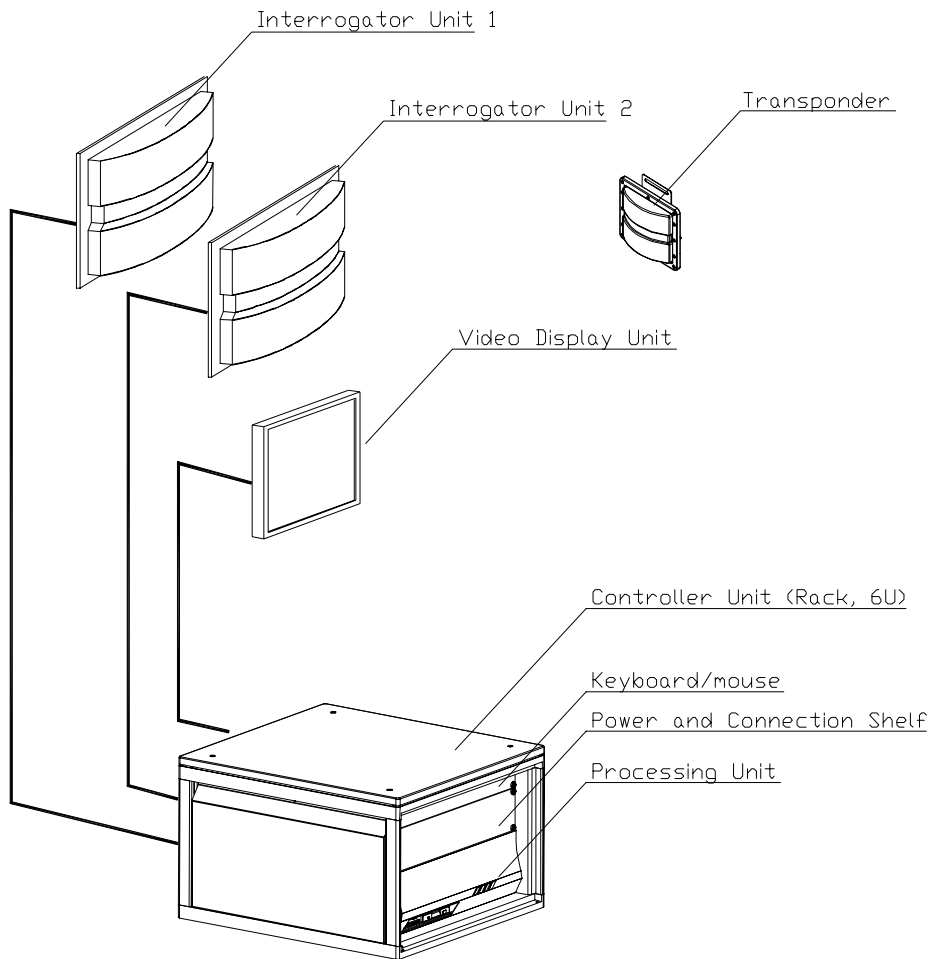


Figure 2 RADIUS 1000 system, dual Interrogator

In addition to the above delivered parts, the following is needed:

- Additional cables for output lines to external equipment
- Power cable to the Transponder

For external interfaces, electrical characteristics and data formats must be decided, and the necessary cables and connectors made available. Mains cables for the Power/ Connection Shelf and Processing Unit are also needed.

3.2 Logistics

WARNING! The RADius 500 contains a lithium battery inside the equipment housing. The battery is completely covered by the transponder housing and is watertight. Unless severe damage is made to the housing there is no risk of explosion or fire. See Appendix E - Transportation for labels and symbols on equipment package.

To avoid possible fire, explosion, leakage or burn hazard do not open the sealed unit. Do not attempt to recharge, disassemble, heat above +75° C / 167 F or incinerate.

Caution! *The RADius 500 battery cannot be recharged and an attempt to do so could result in a hazard. (Battery terminals are not accessible unless the cover is destroyed or removed).*

Inspect equipment for possible physical damage before installation. Make sure that no damage is made to the cover of the RADius 1000 Interrogator unit, the RADius 600 Transponder and the RADius 500 low power.

WARNING! Defective cover, exposing battery, on RADius 500 may be hazardous.

Safety: General safety guidelines to be followed when working in mast and on deck. See note on battery in Appendix E - Transportation in this manual.

Personnel qualifications: Trained electrical workers.

Minimum number of personnel: 2, especially when mounting the Interrogator Unit to rail or mast.

Ship location: None.

Special tools required: None.

Note! *Keep the original packaging (at least) for RADius 500. The package is equipped with transport labels specific to content (lithium battery).*

3.3 Location of the system parts

The following sections describe various procedures regarding mounting of the different system parts:

3.3.1 The Interrogator Unit

For location of the Interrogator Unit, consider the following:

- The sector which the Interrogator is supposed to cover. The Interrogator has an operating sector of 90 degrees in both vertical and horizontal direction.
- The longest Interrogator axis must be horizontally oriented.
- The Interrogator should be located high above sea level.
- The Interrogator should not be mounted close to the ship side, or other large metal surfaces. This is to avoid multi path effects.
- The Interrogator needs free line of sight to the Transponders.
- The Interrogator should be mounted to a stiff mast, rail or wall to limit the risk of mechanical resonances caused by vibration. Excessive (> 1 g rms) vibrations could affect the quality of the measurements.
- During dual Interrogator installations, the two Interrogators should ideally be mounted with a 90 degree difference as shown in Figure 8. This will make it possible to cover 180 degrees.

Note! *The longest Interrogator axis must be horizontally oriented, or else the RADius system will not be able to track any transponders.*

A typical operational scenario for a single Interrogator solution is shown in Figure 3. The system will typically operate against several Transponders simultaneously and the Interrogator should be installed in the direction where the vessel will see one or more Transponders in the operational environment. For a supply vessel a good location for installation can be outside railing on top of bridge roof, pointing aft. To avoid multi path effects during operation, it is important not to locate the transponders close to the ship/rig side.

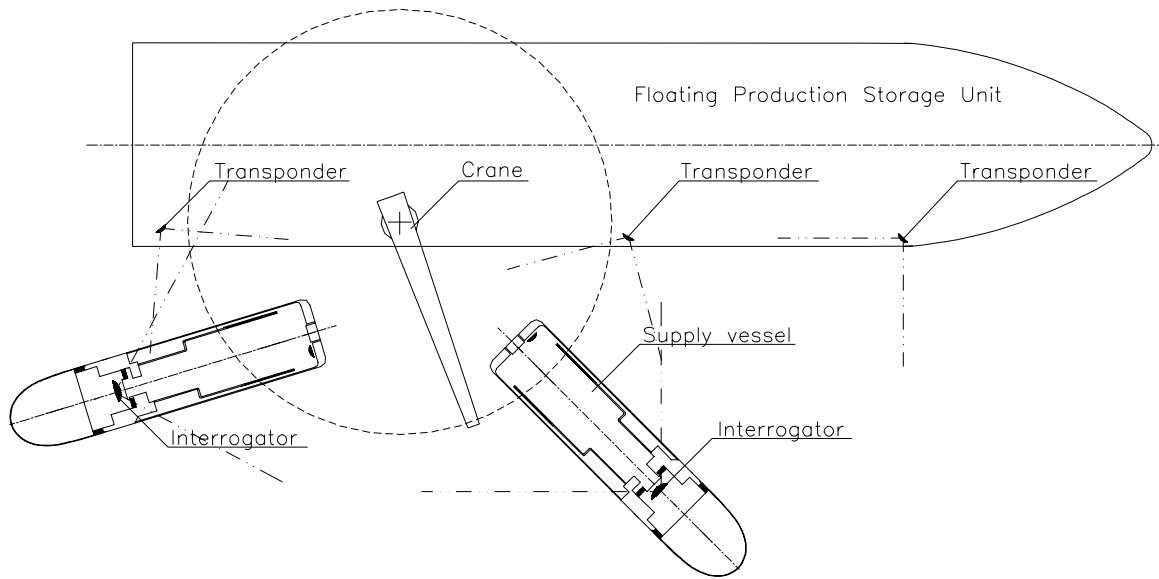


Figure 3 Typical operational scenario for a supply vessel operation, single Interrogator

For supply vessels operating with different sides against an installation, it is highly recommended to use a dual Interrogator system. A typical operational scenario for a dual Interrogator solution is shown in Figure 3.

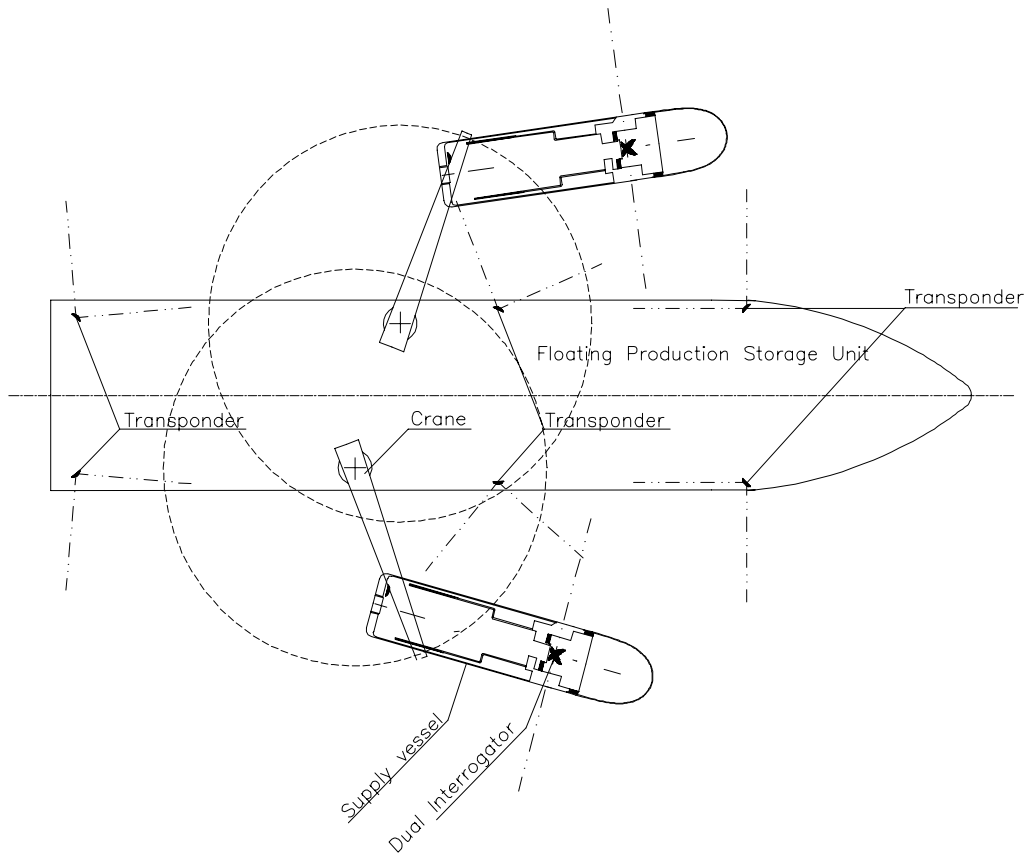


Figure 4 Typical operational scenario for a supply vessel operation, dual Interrogator

3.3.2 The Transponders

Please note that Transponders located at the same side of the vessel **MUST** have different identification numbers (ID).

For location of the Transponders, consider the following:

- The Transponder is placed on a reference location, e.g. rail of rig, which is to be positioned by an Interrogator.
- The orientation of the Transponder is optimised according to its 90-degree operating sector (both vertical and horizontal) and to the operational location for the vessel(s) containing the Interrogators.
- The longest Transponder axis must be horizontally oriented.
- The Transponder requires free line of sight to the Interrogators.
- The Transponder should be mounted to a stiff mast, rail or wall to limit the risk of mechanical resonances caused by vibration.
- The RADius 600 High Gain Transponder shall preferably be mounted in a location not too distant from its power supply (< 200 metres) in order to minimize cable resistance.
- The Transponder should not be mounted close to large metal surfaces (e.g. rig side) to avoid multi path effects that could decrease accuracy.

Caution! *The longest Transponder axis must be horizontally oriented or else the RADius system will not be able to track the transponders.*

3.3.3 Transponder Power Supply

Indoor mounting is recommended. Outdoor mounting may be allowed as the equipment is ingress protected to IP65. The Transponder Power Supply shall preferably be mounted not too distant from the Transponder (< 200 metres) in order to minimize cable resistance.

3.3.4 The Controller Unit

For location of the Controller Unit, consider the following:

- The Controller Unit must be resiliently mounted.
- The warranty will be void if the Processing Unit is removed from the cabinet.
- The unit is designed for indoor installation (protected environment) and should not be exposed to heavy vibrations (exceeding 0,7 g RMS), transformers or similar.

- It is recommended that ventilation or air conditioning is provided in order to keep the ambient operating temperature around +20°C. The best location is typically in the instrument room or on the bridge, where good ventilation for the 19-inch rack can be provided.
- It is recommended that the area around the unit is kept free from dust and static electricity.
- The air inlet and outlet on the unit must not be blocked. The unit has an internal fan and requires free airflow from the rear and out to the sides of the unit.
- All connections to the unit are at the rear side and available space for cable connections and service must be provided.

3.3.5 The Video Display Unit

For location of the table mounted Video Display Unit, consider the following:

- The unit is designed for installation in an indoor environment and for operation within the temperature range. The best location is typically on a table in the instrument room or on the bridge.
- The unit should be mounted close to the Controller Unit.
- The unit must be located and oriented in such a way that it is easy to see for the vessel operator.
- It is recommended that the area around the unit is kept free from dust and static electricity.

3.4 Installation procedures

3.4.1 Mechanical installation

The mechanical installation consists of:

- Mounting the Interrogator(s) in a mast or to the rail.
- Mounting the Transponder at a suitable reference point.
- Mounting the Transponder Power Supply.
- Mounting the Controller Unit in the instrument room or bridge of the vessel.
- Mounting the VDU in a location easy to monitor for the vessel operator.

3.4.1.1 Interrogator installation procedure

The mechanical installation of the various parts is performed in the following steps:

1. Dismantle the mounting bracket shown in Figure 5 from the rear of the Interrogator Unit if not already done.

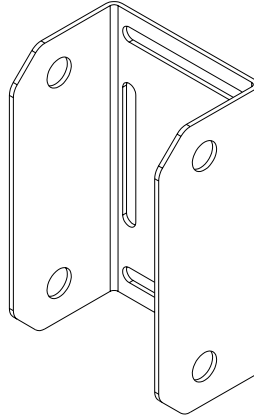


Figure 5 Interrogator mounting bracket

2. When the best mounting location for the Interrogator Unit has been identified, mount the bracket to a mast, pole or rail with clamps as shown in Figure 6 and Figure 7. The mounting plate is designed for 2-inch mast, pole or rail mounting and clamps are enclosed with the delivery. The bracket can also be mounted on a wall. If wall mounted, remember to make holes in the wall for entering the power and data cables to the connector at the rear of the Interrogator Unit.

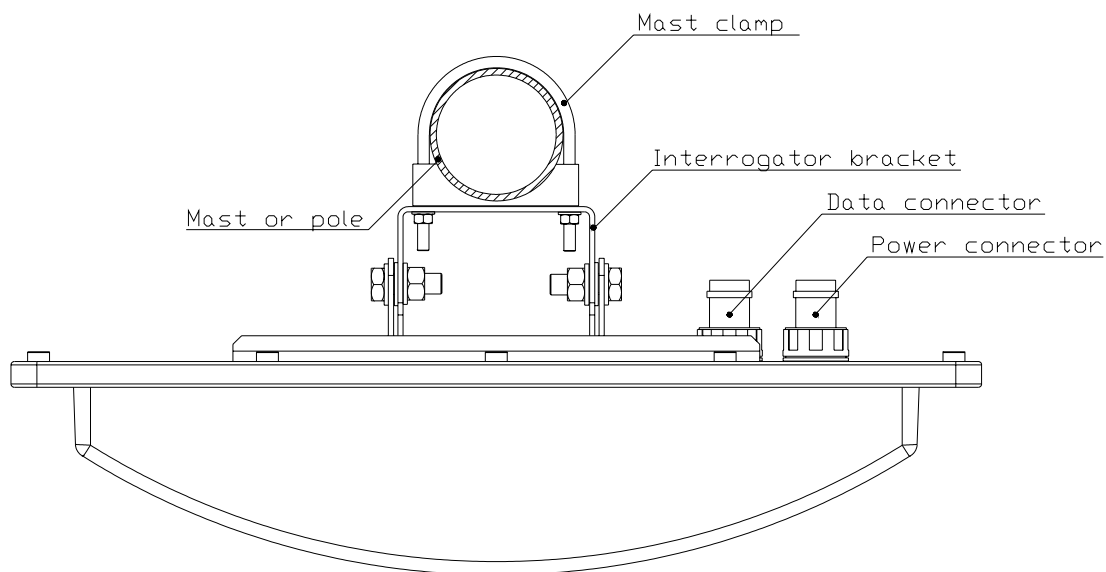


Figure 6 Interrogator Unit mounted to mast or pole, top view

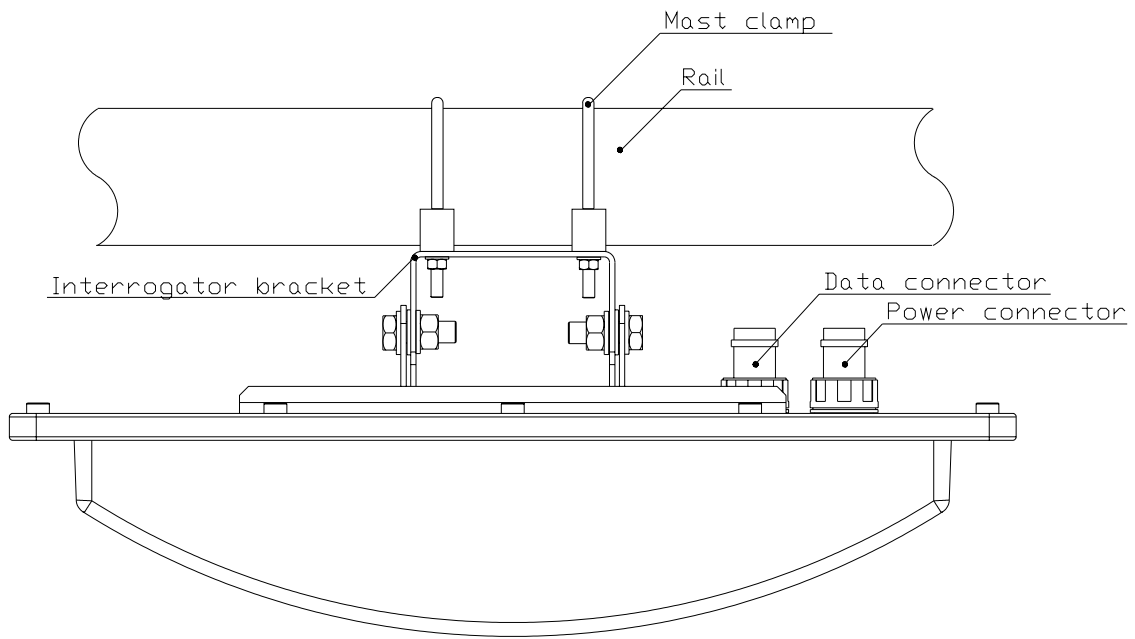


Figure 7 Interrogator Unit mounted to rail, top view

3. A typical dual Interrogator solution that will cover a 180 degree sector, is shown in Figure 8. Dual Interrogator mounting is done similar to single Interrogator solutions.

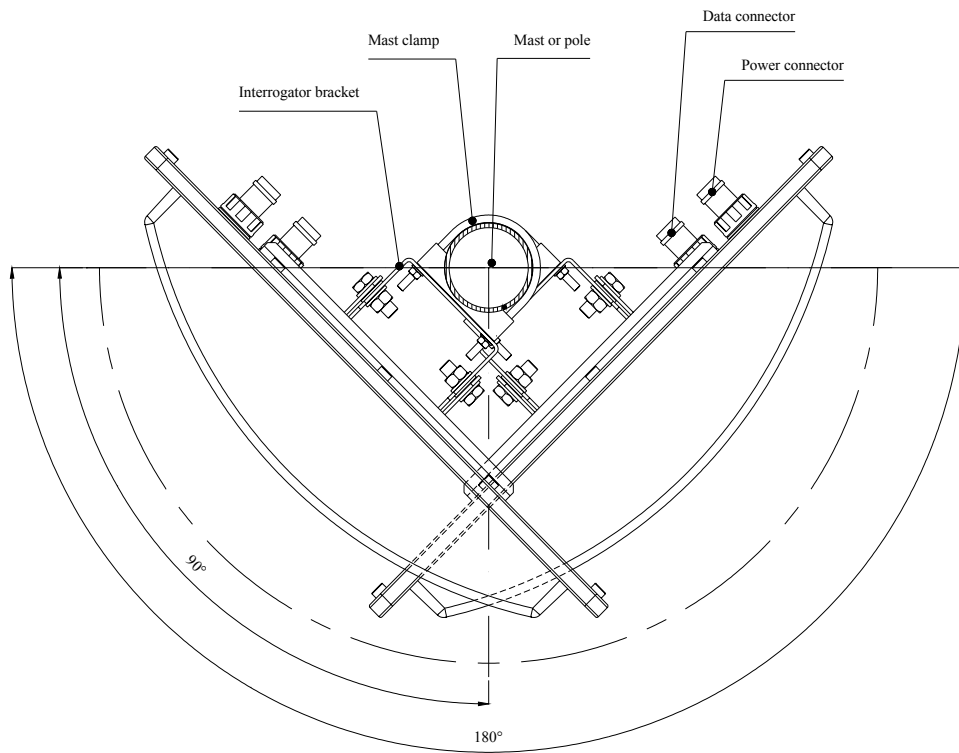


Figure 8 Dual Interrogator Unit mounted to mast or pole, top view

Note! *Interrogators do not have to be mounted at the same location, but could be displaced from each other.*

4. Mount the base plate bracket at the rear of the Interrogator Unit to the mounting bracket and insert the four screws. Secure the screws with the provided washers and self-locking nuts.

Note! *The longest Interrogator axis must be horizontally oriented, or else the RADius system will not be able to track any transponders.*

3.4.1.2 Transponder installation procedure

The Transponder is delivered with a mounting plate for mast, pole or rail installation. The mounting plate is designed for 2-inch mast, pole or rail mounting and clamps are enclosed with the delivery. The Transponder mounting plate can also be mounted directly on a wall or on another foundation. The installation of the Transponder is performed in the following steps:

1. For installation of the Transponder in a mast, pole or to a rail use the enclosed clamps as shown in Figure 9. Fasten the unit to a mast, pole or rail using the enclosed 2-inch clamps. If wall mounted, remember to make a hole in the wall for entering the power cable to the connector at the rear of the Transponder.

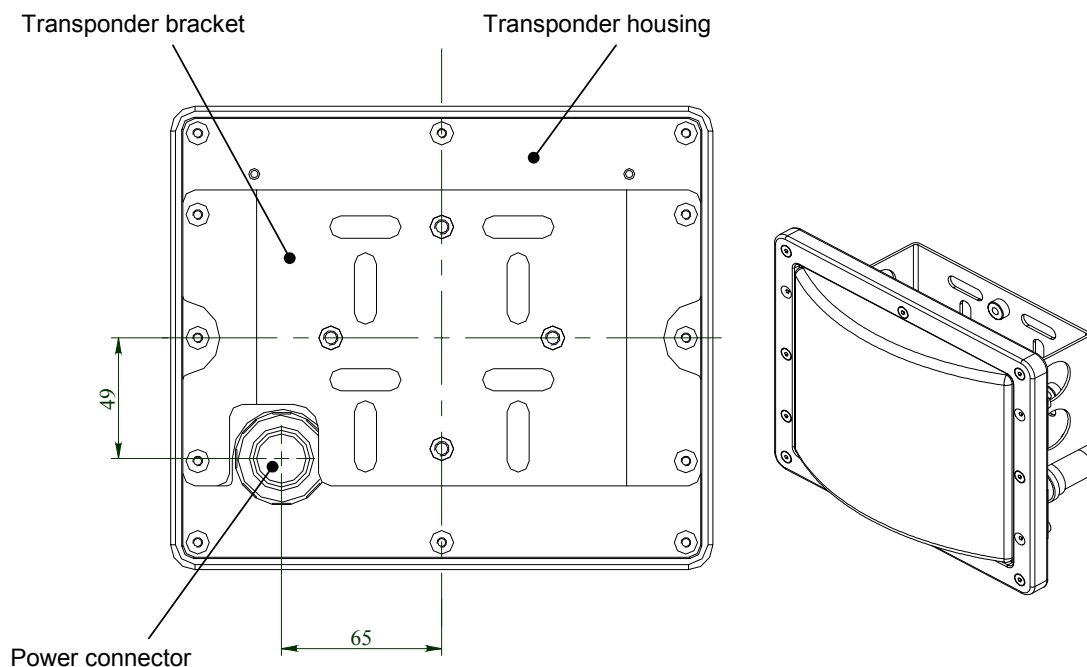


Figure 9 Transponder, rear and side view

Caution! *The longest Transponder axis must be horizontally oriented, or else the RADius system will not be able to track the transponders.*

3.4.1.3 Transponder Power Supply installation procedure

The Transponder Power Supply must be securely mounted.

Note! *See References [3] and [4] for the installation of EX approved transponders.*

3.4.1.4 Controller Unit installation procedure

The cabinet must be securely mounted. Drilling plan for the resilient mounting is included in the attached drawing 3840-MD-041 on page 33.

Caution! *The power to the cabinet must be connected to a grounded mains outlet. This applies to both the Processing Unit and Power Connection Shelf.*

3.4.1.5 VDU installation procedure

Connect the VDU to the location labelled VGA at the rear panel of the Processing Unit.

3.4.2 Electrical installation

The electrical installation consists of:

- Connecting a power cable between the Interrogator Unit and the 48 VDC power located on the Power/Connection Shelf.
- Connecting the data cable between the Interrogator Unit and Data/LAN connector on the Power/Connection Shelf.
- Connecting cables with output data between the Processing Unit and external equipment (optional).
- Connecting the Video Display Unit and the keyboard to the Processing Unit (optional).
- Supplying 110/230 VAC power to the Processing Unit and the Video Display Unit.
- Connecting 110/230VAC to the Power/Connection Shelf.
- Connecting a power cable between the Transponder and the Transponder power supply.

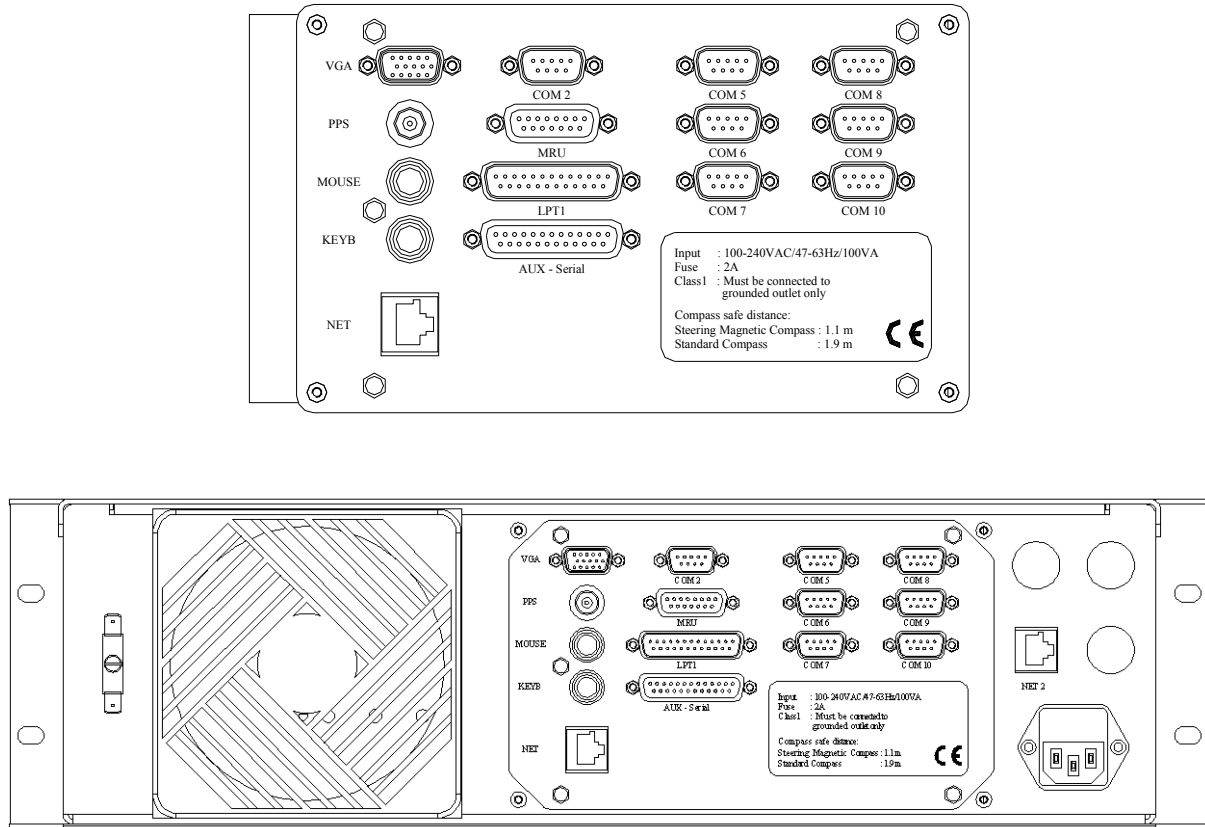


Figure 10 Rear panel of the Processing Unit

3.4.2.1 External output serial lines

RADius communicates with external equipment through RS-232 and RS-422 serial lines. Output data are distance and bearing to dynamic positioning systems etc., hereafter called *host* systems. No hardware or software handshake is used on the serial lines.

The configuration of serial lines and their default settings are:

Line	Type	Data
com5	RS-232	User configurable output
com6	RS-232	User configurable output
com7	RS-422	User configurable output
com8	RS-422	User configurable output
com9	RS-422	User configurable output
com10	RS-422	User configurable output

The connectors on the Processing Unit for the serial lines are of DB-9 male type. Pin layout:

RS-232		RS-422	
Pin no.	Signal	Pin no.	Signal
1	N/C	1	N/C
2	RXD	2	RX+
3	TXD	3	TX+
4	N/C	4	N/C
5	REF	5	REF
6	N/C	6	N/C
7	RTS	7	TX-
8	CTS	8	RX-
9	N/C	9	N/C

3.4.2.2 Power/Connection Shelf

Figure 11 shows the rear panel of the Power/Connection Shelf indicating the terminal rail for power connection and for Data/LAN.

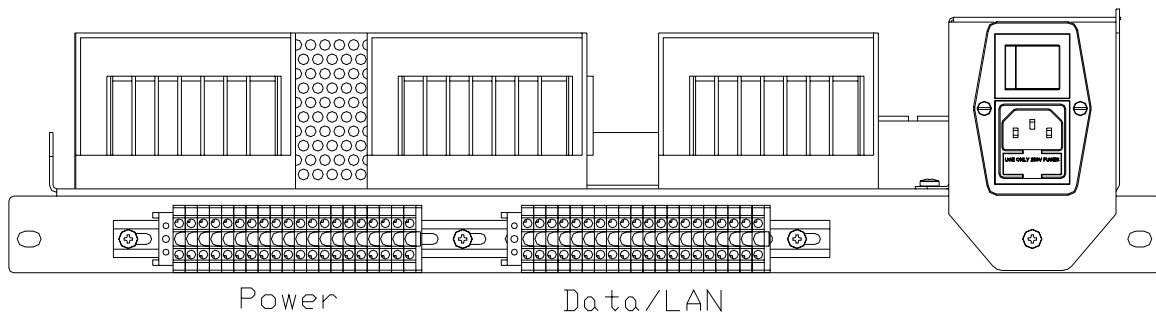


Figure 11 Power and Data/LAN terminal rails for the Interrogator cables

Figure 12 and Figure 13 illustrate the pin-out for the terminal rail Power and Data/LAN. In the terminal rail connections for up to four Interrogator Units are included. Connection of more than one Interrogator Unit is a future optional feature.

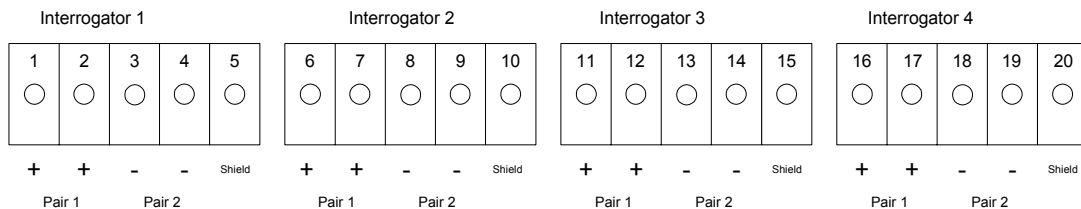


Figure 12 Pin numbers on Power terminal rail

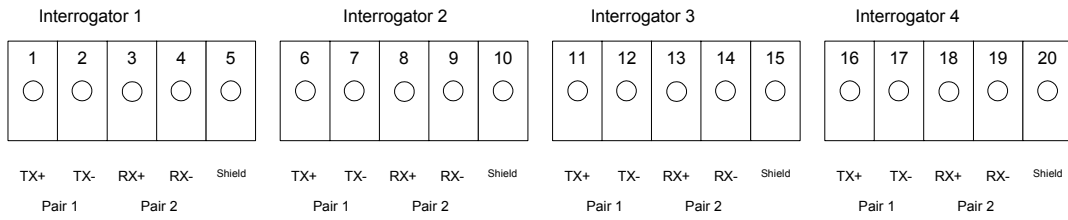


Figure 13 Pin numbers on Data/LAN terminal rail

3.4.2.3 Interrogator data cable wiring

The data cable from the Interrogator Unit to the terminal rail on the Power/Connection Shelf has the following cable wiring:

Signal Description	Interrogator connector Pin no.	Data/LAN Pin no.
Shield wire	1	(5)
Data TX+	2	1
Data TX-	3	2
NC	4	
Data RX+	5	3
Data RX-	6	4

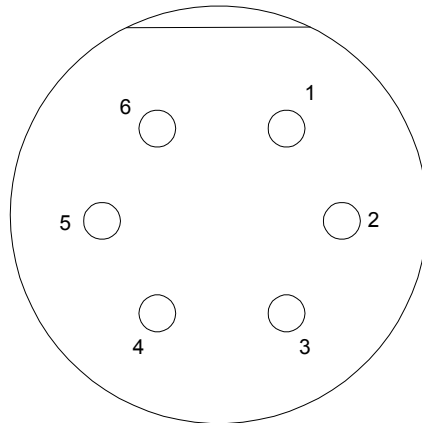


Figure 14 Inside view of data communication connector on the Interrogator Unit cable

The connector used on the Interrogator Unit for data communication is of type Bulgin Buccaneer standard 6-pole. The part number for the connector on the cable is PX0739/S. This connector is a screw terminal type. For a description of the connector assembling, see APPENDIX C - Bulgin connector assembly.

Note! *After fastening the wires in the connector, use Loctite on the screw terminals to avoid loosening of wires due to vibration. Also make sure that no Loctite is spilled on the wires or in the wire mounting holes!*

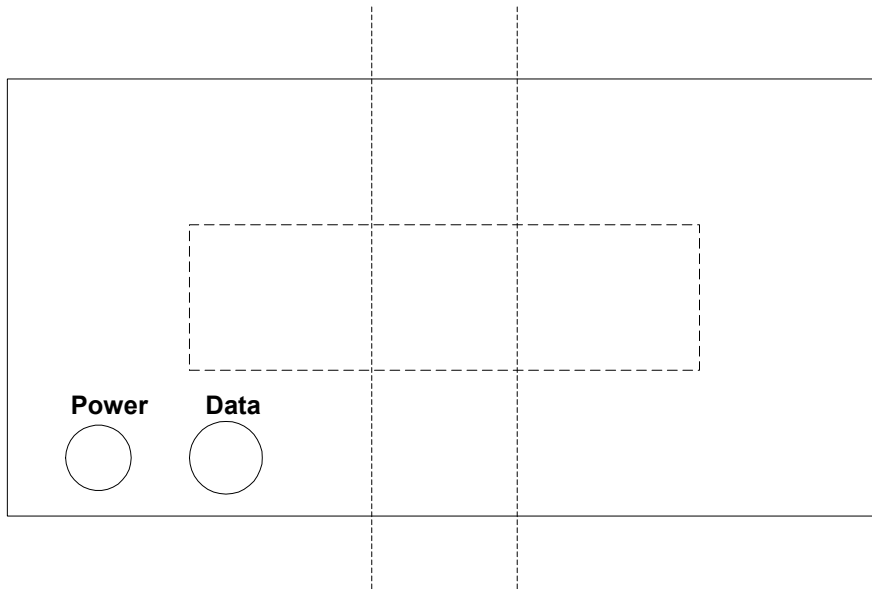


Figure 15 Location of the data and power connectors on the Interrogator rear panel

3.4.2.4 Interrogator power cable wiring

The power cable from the Interrogator Unit to the terminal rail on the Power/Connection Shelf has the following cable wiring:

Signal Description	Interrogator connector Pin no.	Power/Connection shelf Pin no.
Shield wire	1	
GND (pair 1)	2	3
GND (pair 1)	3	4
+48 VDC (pair 2)	4	1
NC	5	
NC	6	
+48 VDC (pair 2)	7	2

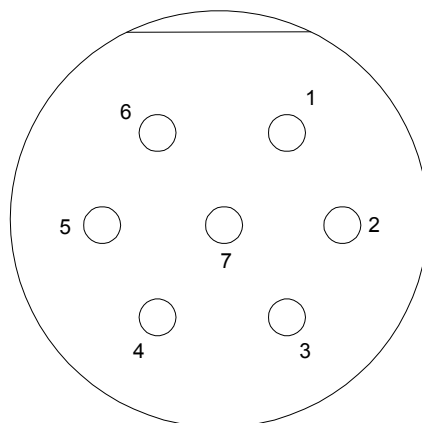


Figure 16 Inside view of power connector used on the Interrogator Unit cable

The power connector used on the Interrogator is of type Bulgin Buccaneer standard 7-pole. The part number for the connector on the cable is PX0745/S. This connector is a screw terminal type. For a description of the connector assembling, see APPENDIX C - Bulgin connector assembly.

Note! *After fastening the wires in the connector, use Loctite on the screw terminals to avoid loosening of wires due to vibration. Also make sure that no Loctite is spilled on the wires or in the wire mounting holes!*

3.4.2.5 High Gain Transponder power cable wiring and installation

The cable wiring for the Transponder power cable is as follows:

Signal Description	Connector Pin no.
Shield	1
+ 6 VDC (pair 1)	2
+ 6 VDC (pair 1)	3
NC	4
GND (pair 2)	5
GND (pair 2)	6

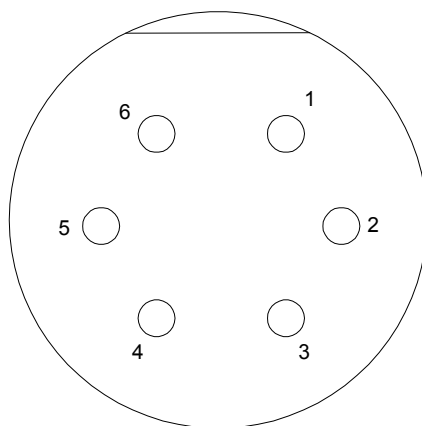


Figure 17 Inside view of power connector on the Transponder cable

The power connector on the high gain Transponder is Bulgin 6-pole Buccaneer standard. The part number for the connector on the cable is PX0739/S. This connector is a screw terminal type. For a description of the connector assembling, see APPENDIX C - Bulgin connector assembly.

Note! *After fastening the wires in the connector, use Loctite on the screw terminals to avoid loosening of wires due to vibration. Also make sure that no Loctite is spilled on the wires or in the wire mounting holes!*

For the cable connections in the Transponder Power Supply, see the figure below. The cable marked DC is the cable to the Transponder and the cable marked AC is the VAC input. The shield wire to the Transponder is not connected in the Transponder Power Supply.

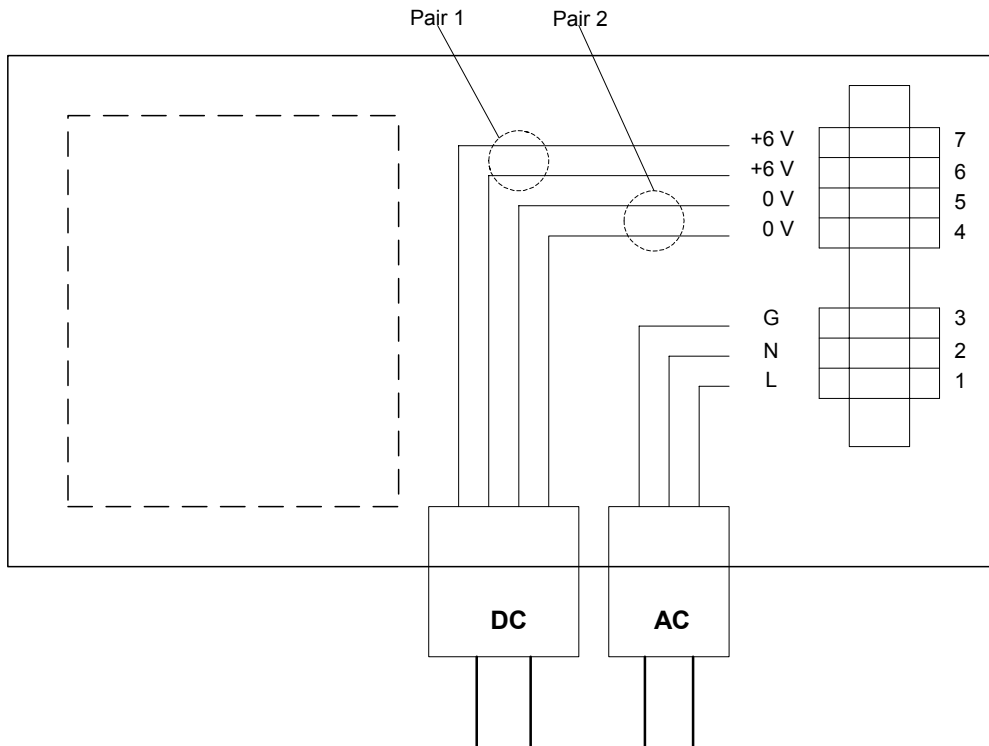


Figure 18 Transponder Power Supply cable connections

WARNING! The power to the Transponder Power Supply is Class 1 equipment and must be properly connected to a grounded mains outlet!

3.4.2.6 Low Power Transponder battery switch

Please note that the RADius 500 Transponder needs an LP-Transponder activate switch installed in the connector position on the rear side for applying the battery power.

WARNING! NEVER connect other equipment than the supplied battery switch to the rear connector. An attempt to connect other sources to the connector pins may cause a hazard.

3.4.2.7 Interrogator Cable installation procedure

1. Connect the power cable connector to the rear of the Interrogator Unit and the other end of the cable to the Power terminal list on the Power/Connection Shelf. Shields shall be connected in the provided terminals. The shield terminals on the connection shelf are floating. Shields are terminated inside the Interrogator Unit.

Use the required number of clips to fasten the cable to the mast, pole, rail or wall.

2. Connect the data cable connector to the rear of the Interrogator Unit and the other end of the cable to the Data/LAN terminal list on the Power/Connection Shelf. Shields shall be connected in the provided terminals. The shield terminals on the connection shelf are floating. Shields are terminated inside the Interrogator Unit.

Use the required number of clips to fasten the cable to the mast, pole, rail or wall.

3. Connect the cables for output data from the Processing Unit to external equipment to the ports com5, 6, 7 or com8 for serial communication. These are located on the rear panel of the Processing Unit. An Ethernet connector (NET 2) is also available for future use.
4. Connect the 110/230V AC ship's power supply to the power connector at the rear of the Power/Connection Shelf.
5. Connect the cable from the Video Display Unit and the keyboard to the corresponding connectors at the rear of the Processing Unit.
6. Connect the Video Display Unit to 110/230V AC ship's power.
7. Connect the power cable connector to the rear of the Transponder and the other end of the cable to the Transponder power supply. Use the required number of clips to fasten the cable to the mast, pole, rail or wall.
8. When all cables are connected, power on the Processing Unit. The four LED indicators located on the front panel of the Processing Unit blink red shortly before the left LED turns green, indicating that the Processing Unit is powered and operational.

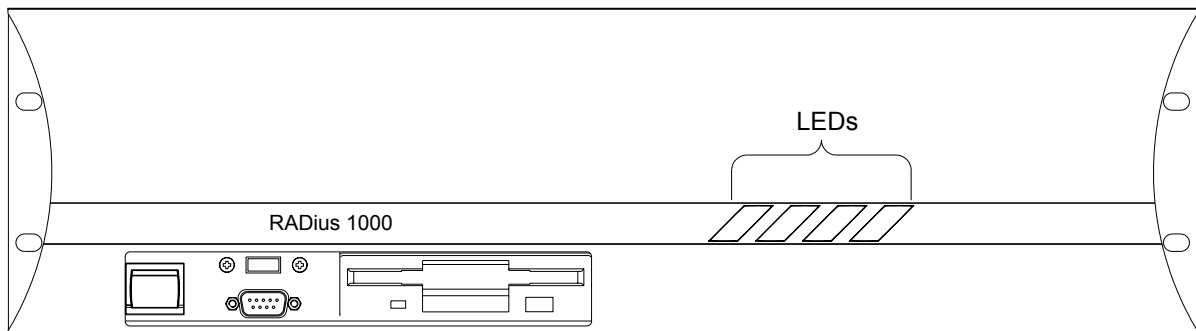


Figure 19 Processing Unit front view showing status LEDs

3.4.3 Setup of configuration parameters

Configuration parameter setup consists of:

- Select Interrogator Unit (see chapter 3.4.3.1)
- Entering the mounting angle for the Interrogator Unit (see chapter 3.4.3.2)
- Entering output data interface (see chapter 3.4.3.3)

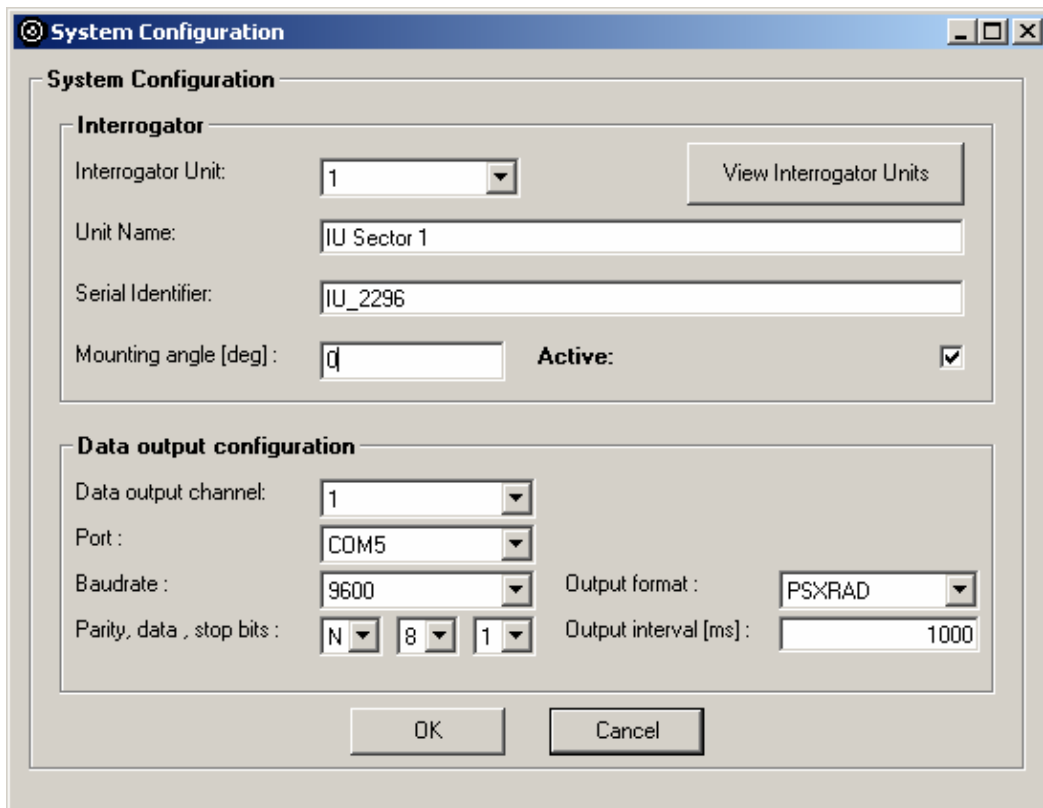



Figure 20 System Configuration dialog box

Always fill in the setup parameters for the specific installation in the Installation Worksheet before entering the setup software. Fill in the parameters directly in the worksheet found in the *Appendix A - Installation worksheet* in the manual. In this way, the parameters for the actual installation will be easier to find when requested later.

3.4.3.1 Select Interrogator Unit

During first boot after installation, it is necessary to select which Interrogator Unit to use.

This is done by selecting the  button in the Radius GUI. This will open the window shown in Figure 20. By selecting **View Interrogator Units**, a list of current Interrogators appears (as in Figure 21).

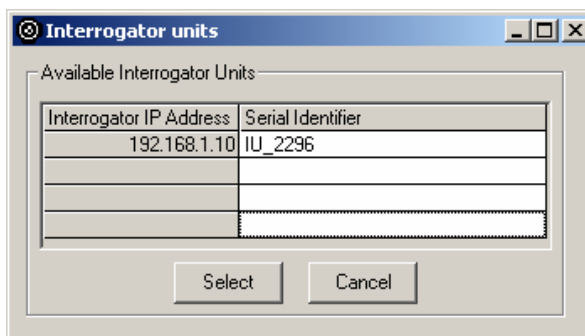


Figure 21 View Interrogator Units menu

For each Interrogator Unit edit the Unit Name, shown in Figure 20, to identify the Interrogators after installation (e.g. IU 1 Port side). When choosing between different Interrogators at the installation, select the Interrogator Unit drop down menu. Then choose which Interrogator to use, and make sure that the Active check box is checked (as shown in Figure 20).

3.4.3.2 Interrogator mounting angle

The Interrogator's mounting angle has to be calibrated after installation. RADius outputs direction to the Transponder relative to the vessel's centre line (0 forward, positive to starboard). The Interrogator is typically pointing backwards on the vessel. If the mounting angle had been 180 degrees, then the mounting angle in the system configuration box above should have been 180 degrees. However, the actual installation angle is seldom met exactly and a procedure to measure the actual angle is shown in Figure 22.

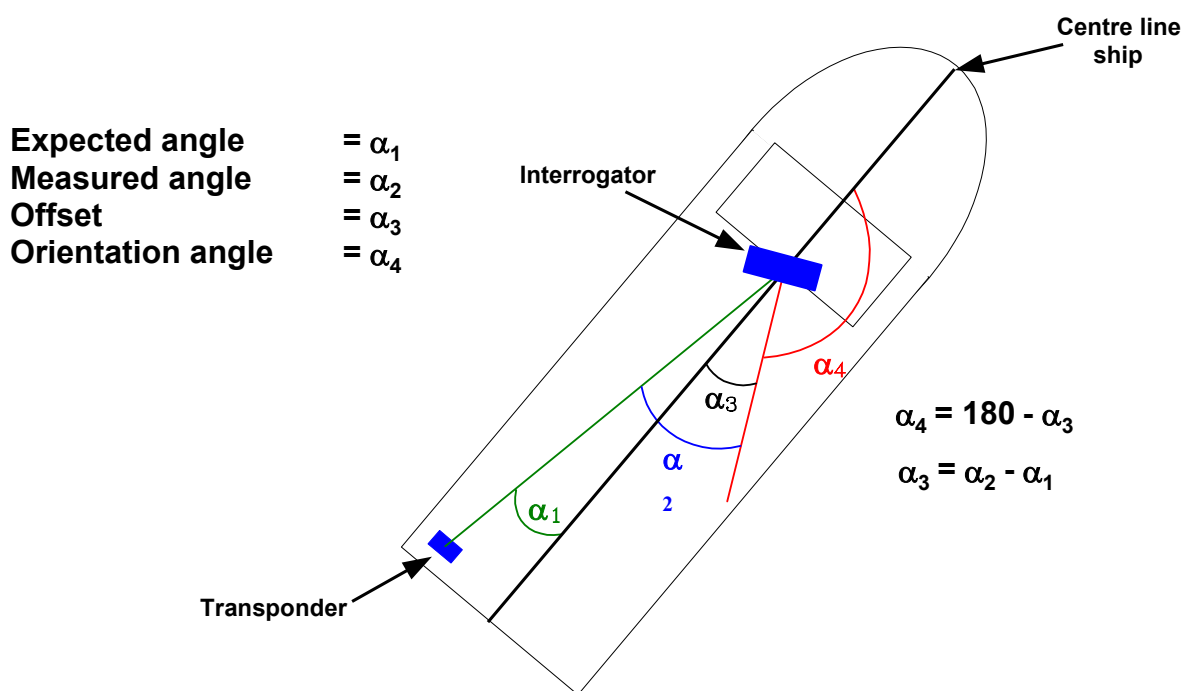


Figure 22 Measuring the mounting angle for the Interrogator

In this example the Transponder is mounted at the stern of the vessel.

1. The location of the Transponder is measured relative to the centre line of the vessel and the **Expected angle** , α_1 , is calculated.
2. The system measures the angle to the Transponder, **Measured angle**: α_2 , and the offset from the expected angle, **Offset angle**: α_3 , is computed.
3. Then the **Mounting angle** , α_4 , can be computed based on the expected mounting angle (180° in the example above) and the computed installation Offset angle, α_3 .



Figure 23 Interrogator mounting angle

3.4.3.3 Data output

The Processing Unit has to be set up to output data to a DP system, following the procedure below:

1. Select which data output channel that is to be configured. This is usually channel 1.
2. Select which port that is going to be used.
3. Configure the port settings according to the settings on the host system.
4. Select the wanted output format. PSXRAD, FBEAM, ARTEMIS and ABB DP are available. For a description of the different formats, see *Appendix B - Output Protocols*.
5. Set the wanted output interval [ms]. The default value is 1000. This gives an output frequency of 1 Hz (one telegram per second).

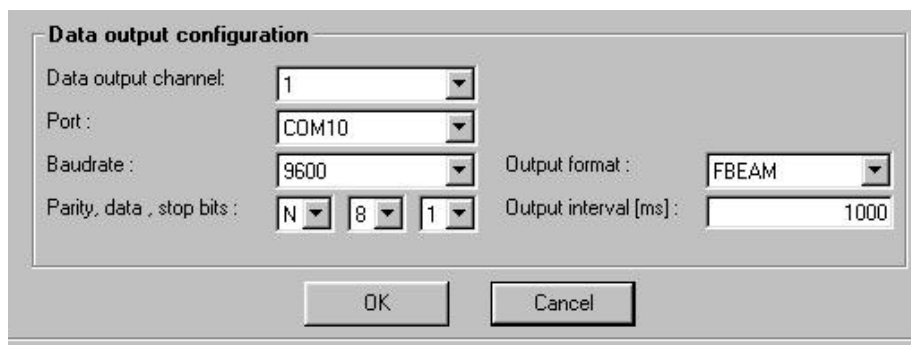


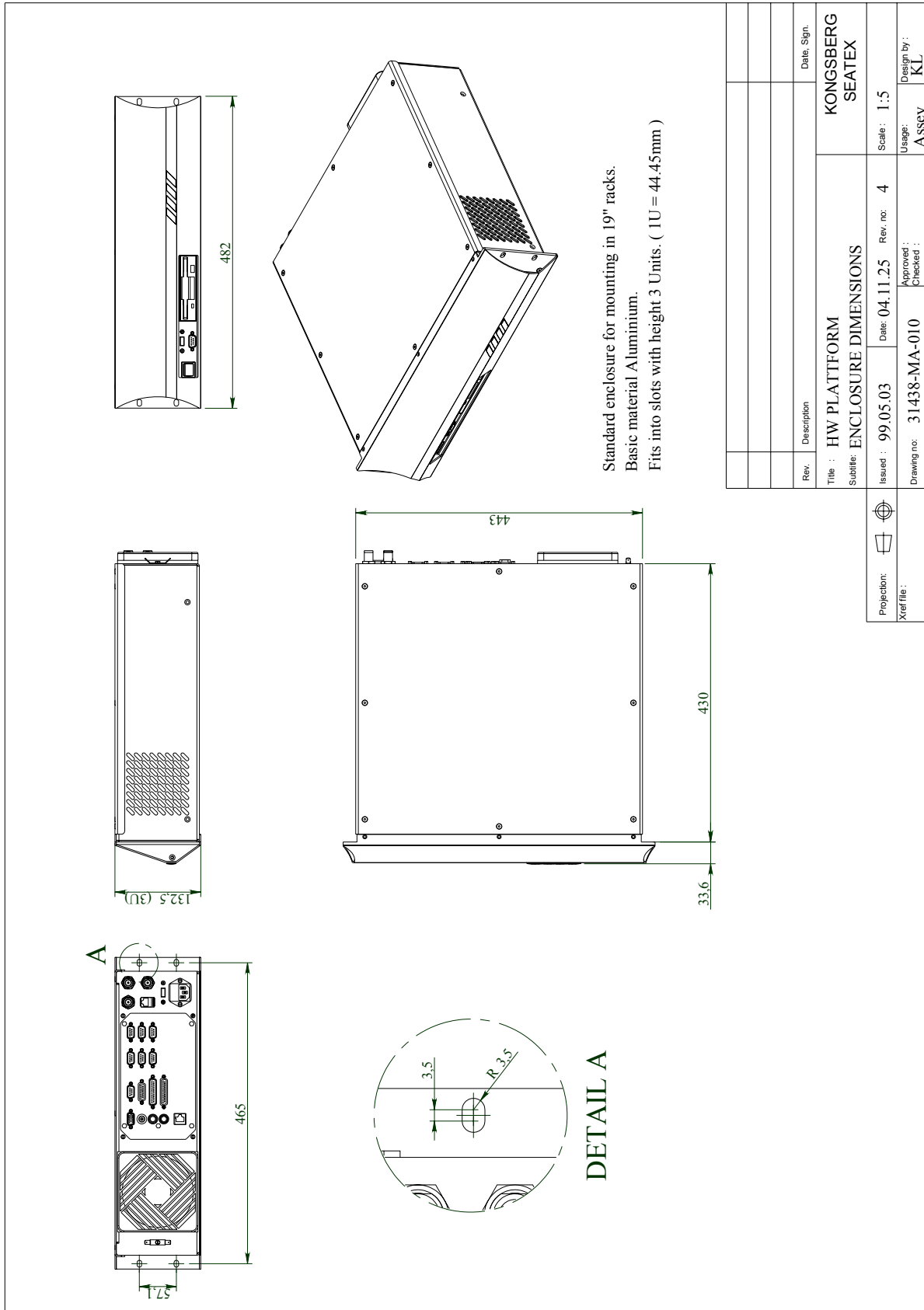
Figure 24 Data output configuration

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4. INSTALLATION DRAWINGS

This chapter contains the outline drawings showing the mechanical dimensions of the Processing Unit, the Interrogator Unit and the Transponder.

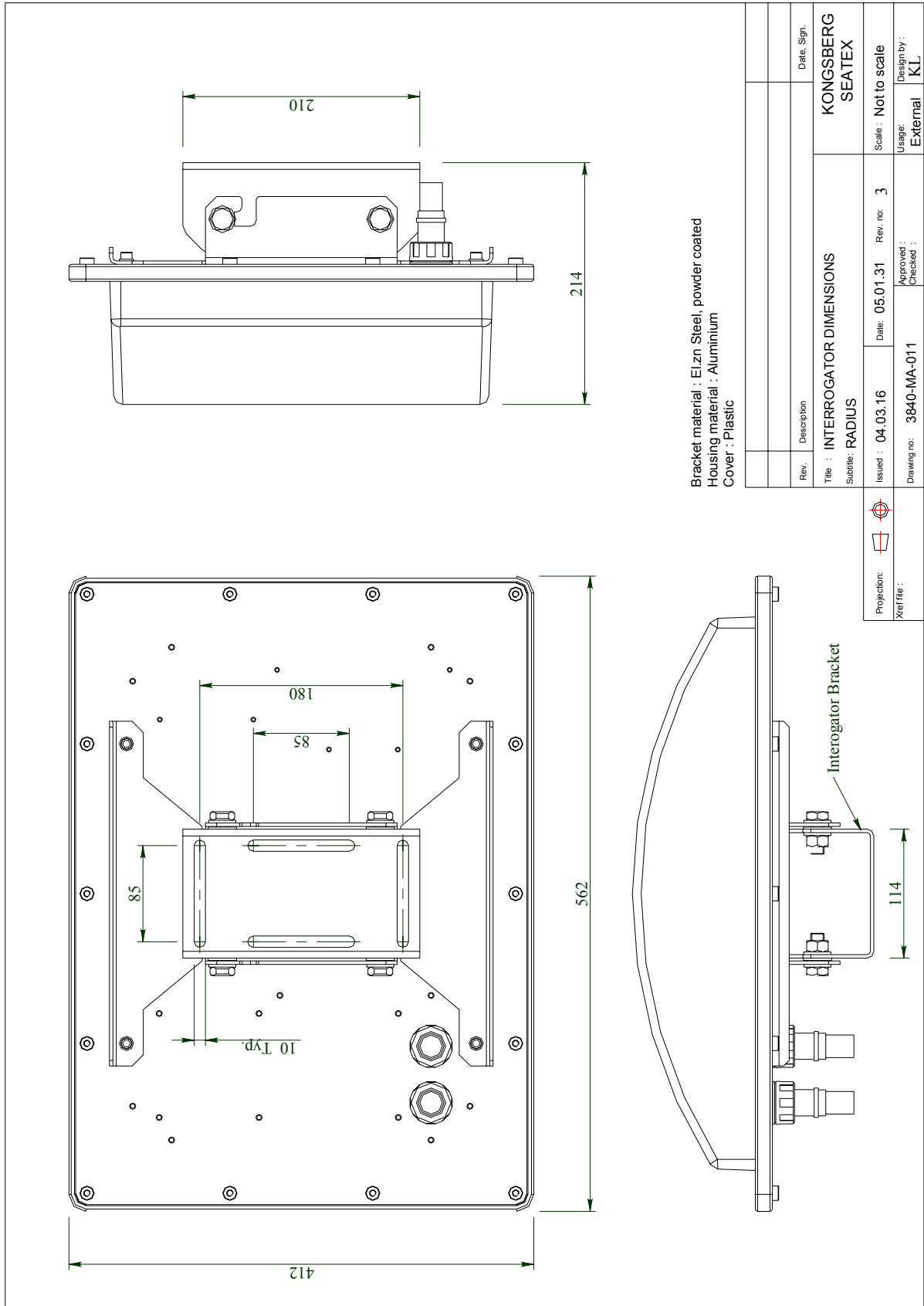
4.1 RADius Processing Unit, dimensions



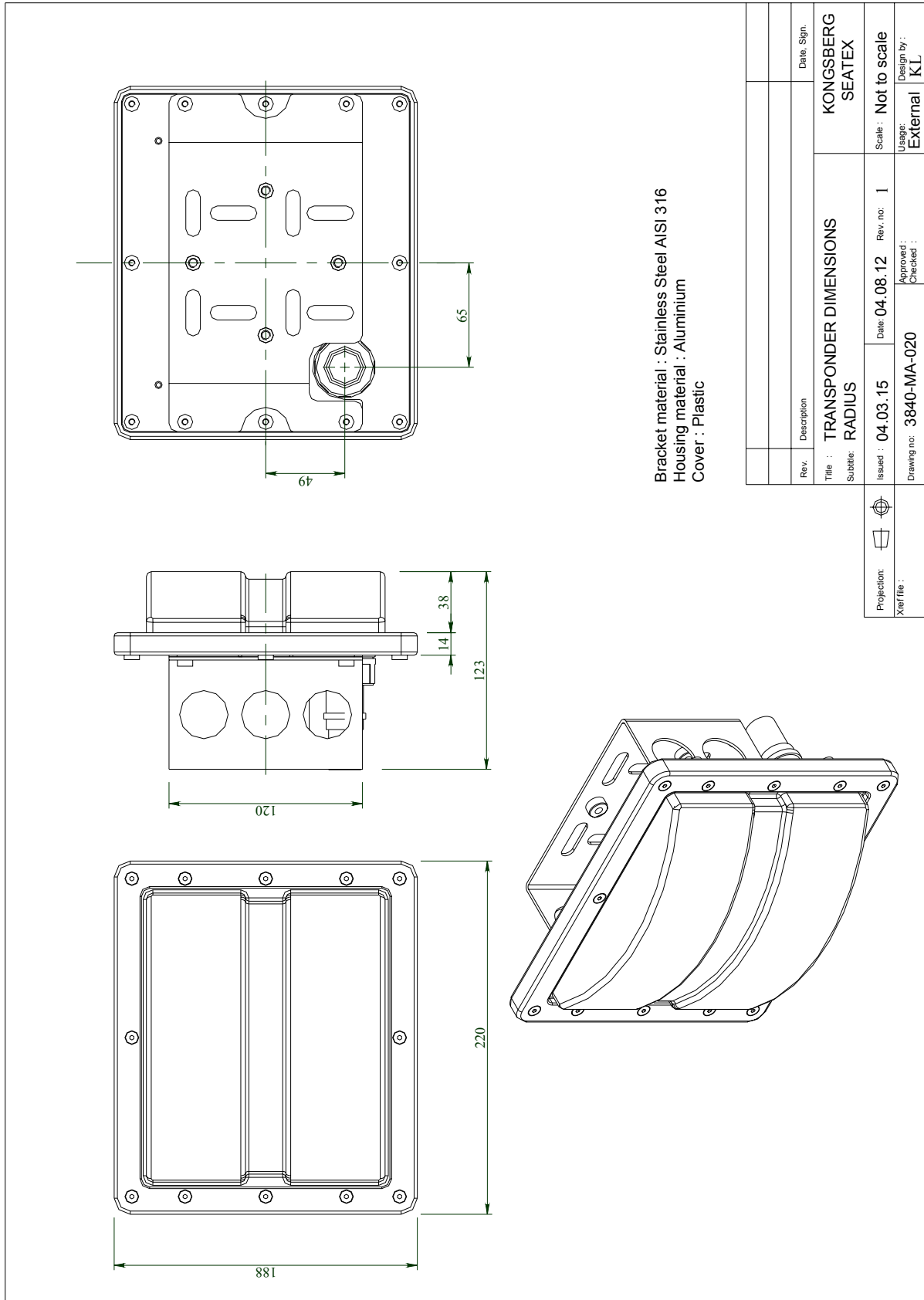
Rev.	Description	Date, Sign.
Title : HW PLATTFORM		
Subtitle: ENCLOSURE DIMENSIONS		
Issued : 99.05.03	Date: 04.11.25	Rev. no: 4
Drawing no: 31438-MA-010	Approved : Checked :	Scale: 1:5 Usage: Assey
KONGSBERG SEATEX		Design by: KL

Projection:	
Xref file:	

4.3 RADius Interrogator, dimensions



4.4 RADius Transponder 500 Low Power, dimensions



5. PARTS LIST

The RADius 1000 system consists of:

Part no.	No.	Description
RAD-S-SIN_00		
RADius 1000 Single Interrogator		
RAD-E-IU_00	1	RADius 1000 Interrogator Unit
RAD-E-PU_00	1	RADius 1000 Processing Unit
RAD-M-IUB_00	1	RADius Mounting Bracket Interrogator
RAD-E-PS1_00	1	RADius Power/Connection Shelf Single Interrogator
RAD-C-CAB_00	1	RADius IU & Transp. Cable
RAD-C-IUP_00	1	RADius Power Connector Interrogator 7 pole
RAD-C-IUN_00	1	RADius Net Connector Interrogator 6 pole
RAD-S-LPT_00	1	RADius 500 Low Power Transponder, including LP-transponder activate switch
G071-21	1	Cabinet, Height 6U
G060-31	1	VGA monitor, LCD, office type, 15", including G071-28 power cable 1.5 m
G071-27	1	Keyboard with rollerball, 19" rack mounted
RAD-D-USR_00	1	RADius User Manual
RAD-D-IST_00	1	RADius Installation Manual
RAD-S-HGT_00		
RADius 600 High Gain Transponder		
RAD-C-CAB_00	1	RADius IU & Transp. Cable
RAD-E-HGT_00	1	RADius 600 High Gain Transponder
RAD-E-TPS_00	1	RADius Power Supply Transponder
RAD-C-TRP_00	1	RADius Power Conn. High Gain Transponder
RAD-M-TBW_00	1	RADius Mounting Bracket Wall Transponder
RAD-M-TBM_00	1	RADius Mounting Kit Mast Transponder
RAD-S-LPT_00		
RADius 500 Low Power Transponder		
RAD-E-LPT_00	1	RADius 500 Low Power Transponder
RAD-M-TBM_00	1	RADius Mounting Kit Mast Transponder
RAD-M-TBW_00	1	RADius Mounting Bracket Wall Transponder

RAD-S-DIN_00		RADius 1000 Dual Interrogator
RAD-E-IU_00	2	RADius 1000 Interrogator Unit
RAD-E-PU_00	1	RADius 1000 Processing Unit
RAD-M-IUB_00	2	RADius Mounting Bracket Interrogator
RAD-E-PS2_00	1	RADius Power/Connection Shelf Dual Interrogator
RAD-C-CAB_00	2	RADius IU & Transp. Cable
RAD-C-IUP_00	2	RADius Power Connector Interrogator 7 pole
RAD-C-IUN_00	2	RADius Net Connector Interrogator 6 pole
RAD-S-LPT_00	1	RADius 500 Low Power Transponder, including LP-transponder activate switch
G071-21	1	Cabinet, Height 6U
RAD-M-ITB_00	1	RADius Mounting Bracket Twin Interrogator
RAD-M-TBW_00	1	RADius Mounting Bracket Wall Transponder
G060-31	1	VGA monitor, LCD, office type, 15", including G071-28 power cable 1.5 m
G071-27	1	Keyboard with rollerball, 19" rack mounted
RAD-D-USR_00	1	RADius User Manual
RAD-D-IST_00	1	RADius Installation Manual

APPENDIX A - INSTALLATION WORKSHEET

Vessel			
RADius serial no.		IU serial no.	
Place		Date	
Installed by		Signature	

Vessel Geometry		
Vessel Dimension:		
Length [m]	Width [m]	Height [m]
Centre of Gravity (CG) Location:		
From CG to AP (Aft Point) [m] (positive forward of CG)	From CG to CL (Centre Line) [m] (positive to starboard of CG)	From CG to the Keel [m] (positive below CG)

Vessel Description		
Vessel Data:		
Vessel Type and Name	Vessel Owner	Country of Origin
Management:		
Manager	Phone Number	
RADius:		
RADius Owner	RADius Manager	

Interrogator Mounting Angle		
Heading offset (Reference - Interrogator reading) [deg]	Reference [deg]	Interrogator [deg]

Data Output – Digital RS-232/422 Output Configuration								
Device	Line (com)	Electric 232/422	Baud rate	Parity (st. n)	Data bits (st. 8)	Stop bits (st.1)	Interval [s]	Format
Out Port #1								

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APPENDIX B - OUTPUT PROTOCOLS

The available output data formats are as follows:

Name	Format no.	Description
PSXRAD	1	NMEA proprietary messages
Fanbeam BCD telegram	2	Fanbeam binary format
ARTEMIS	3	Pseudo Artemis, ASCII 17 bytes format
ABB DP	4	Pseudo Fanbeam, ASCII 333 bytes adapted for ABB DP.

5.1 PSXRAD, NMEA proprietary format

The NMEA format is an ASCII text format based on the NMEA 0183 standard defined in [1]. RADius utilises the proprietary PSXRAD format described below.

Format:

Note that this telegram is repeated for every Transponder tracked. The field marked *ss* is a sequence number indicating what telegram this is of a total of the number of transponders initiated for tracking (indicated by field *nn*).

```
$PSXRAD,I,hhmmss.ss,nn,ss,tid,rrrr.rr,aa.a,bbb.bb,ss.s,±vv.vv,ff.f,±dd.dd,sn,S*cc<cr><lf>
```

I	ID for Interrogator, range 0-9
hhmmss.ss	Time of position hour, minutes, seconds
nn	Number of transponders set up for tracking, range 0 – 99
ss	Sequence number (multiple transponders), range 0 – (nn-1)
tid	Transponder ID, the number is the transponder frequency in 10KHz resolution. 150 is then 1.5 MHz transponder
rrrr.rr	Range in meters, decimal centimetres
aa.a	Range accuracy estimate (1 σ level in m)
bbb.bb	Bearing to transponder 0.00 to 360.00 degrees
ss.s	Bearing accuracy estimate (1 σ level in deg)
±vv.vv	Vertical angle to transponder (-90.0 - +90.0), the + sign is omitted when positive.
ff.f	Vertical angle accuracy estimate (1 σ level in deg)
±dd.dd	Velocity relative to transponder (doppler) m/s, the + sign is omitted when positive.
sn	Signal to noise in DB 0 – 90, less than 10 is not good, 10 – 15 is week, > 15 is good
S	Status 0 – 9 (0 – No reply (not tracking transponder), 1 – Other error, do not use, 2 – Range only, 3 – 8 TBD, 9 – Valid Status)
*cc	Computed checksum
<cr>	Carriage Return
<lf>	Line Feed

The telegram above is repeated for all Interrogators installed in the RADius system

5.2 Fanbeam BCD telegram

This telegram supports one Transponder only. This Transponder output can be selected from the RADius GUI.

BBBRRR00T

where:

BBB	is the bearing in packed BCD format.
RRR	is the range in packed BCD format.
00	are two ASCII zero bytes.
T	is the ASCII character 255 acting as the terminator.

Byte 1 : ab bearing = abc.def deg.

Byte 2 : cd

Byte 3 : ef

Byte 4 : gh range = ghijk.l meter

Byte 5 : ij

Byte 6 : kl

Byte 7 : 0

Byte 8 : 0

Byte 9 : 0xFF

5.3 Pseudo Artemis telegram

This telegram supports one Transponder only. This Transponder output can be selected from the RADius GUI.

```
ABCDEF GHIJKL S [CR] [LF]
```

Where:

ABCDEF	is the range in decimeter, ASCII, ABCDE.F (m)
GHIJKL	is the bearing in degrees, ASCII, GHI.JKL (deg).
S	Status, '0' (0x30) is invalid data. '1' (0x31) is valid data

Byte 1-6 : abcdef, Range in decimeter (abcde.f m).
 Byte 7 : Space
 Byte 8-13 : ghijkl, Bearing in degrees (ghi.jkl deg).
 Byte 14 : Space
 Byte 15 : s, Status flag, '0' (0x30) is invalid data, '1' (0x31) is valid data.
 Byte 16 : [CR], Carriage Return
 Byte 17 : [LF], Line Feed

Note that this telegram differs from Artemis When it comes to bearing. Bearing in Artemis is relative to North. Bearing from RADius is relative to vessels heading.

5.4 ABB DP telegram

This telegram supports one Transponder only. This Transponder output can be selected from the RADius GUI.

SN,RRRR.R,BBB.BB,TTT,S,HH:MM:SS[CR][LF]

Where:

SN	Signal to Noise Ratio (dBm), ASCII
RRR.R	Is the range in meters, ASCII
BBB.BB	Bearing in degrees, ASCII
TTT	Transponder ID, ASCII
S	Status, ASCII, 0 – 9 (0 – No reply (not tracking transponder), 1 – Other error, do not use, 2 – Range only, 3 – 8 TBD, 9 – Valid Status)
HH:MM:SS	Time, ASCII, Hour : Minutes : Seconds from system time.

Byte 1-2 : SN.
 Byte 3 : Comma Character
 Byte 4-9 : RRR.R, Range (meters)
 Byte 10 : Comma Character
 Byte 11-16 : BBB.BB, Bearing (degrees)
 Byte 17 : Comma Character
 Byte 18-20 : TTT, Transponder ID (range 150 – 300)
 Byte 21 : Comma Character
 Byte 22 : Status, See above
 Byte 23 : Comma Character
 Byte 24-31 : Time
 Byte 32 : [CR], Carriage Return
 Byte 33 : [LF], Line Feed

APPENDIX C - BULGIN CONNECTOR ASSEMBLY

It is very important that the Bulgin connector is correctly assembled to ensure that the connectors are watertight. Follow the instructions below carefully.

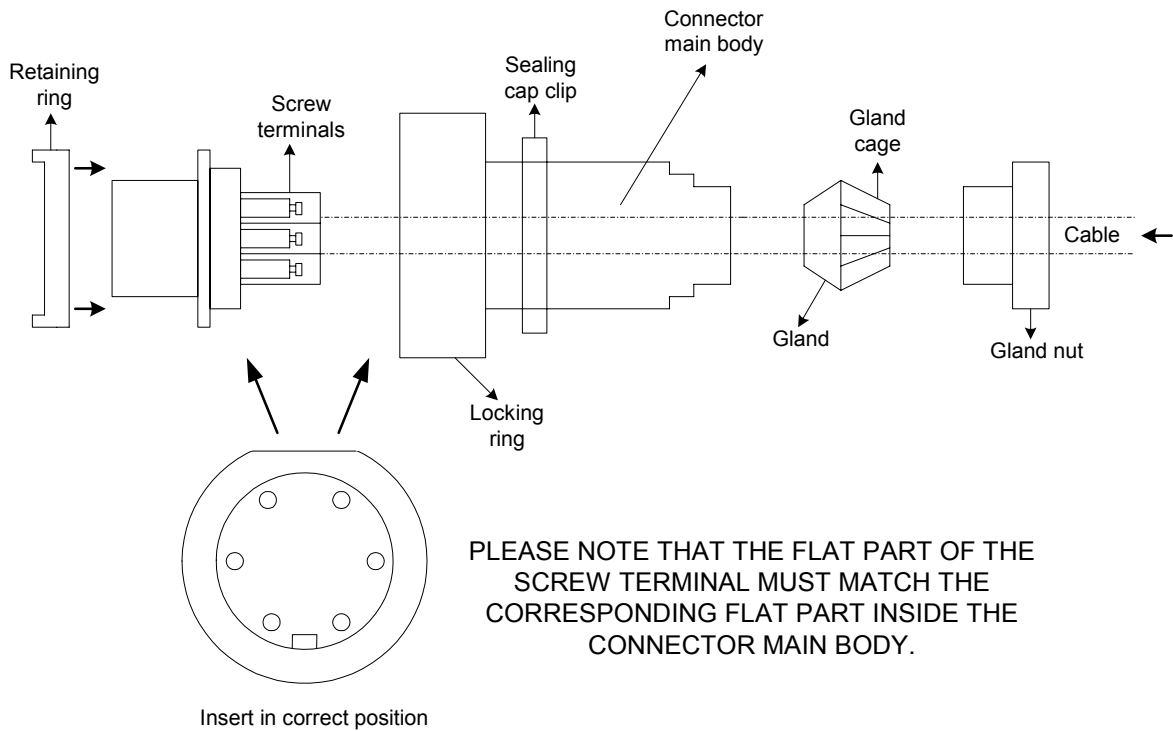


Figure 25 Bulgin connector assembly

- The gland nut shown in the figure above should be replaced with the supplied gland nut with strain relief.
- Insert the cable through the glands and the connector main body before connecting the wires to the screw terminals.

Note! *After fastening the wires in the connector, use Loctite on the screw terminals to avoid loosening of wires due to vibration.*

When inserting the screw terminal part into the connector main body, be sure to rotate the part until it is locked before installing the retaining ring. The flat part of the screw terminal must match the corresponding flat part inside the connector main body. A good way to ensure a correct installation is to rotate the screw terminal body inside the connector main body until it locks and can not be rotated more.

It is in addition recommended to vulcanize all outdoor connectors with self vulcanizing tape.

Caution! *If the screw terminal body is not correctly mounted in the connector main body, the assembled connector will not be waterproof.*

It is recommended to use self vulcanizing tape on the assembled connector.

APPENDIX D - TRANSPONDER ID SETTINGS

The table below shows the possible DIP switch settings for setting the TID on the RADius Transponders. Standard settings are 150, 160, 170 ... up to 300. Note that the battery powered RADius 500 Low Power Transponders has two jumpers close to the middle of the card that has to be shifted from lower to upper position when the frequency identities is 210 or higher (marked with different colour in the table).

Switch Setting							TID
MSB			LSB				
0	0	0	0	0	0	0	150
0	0	0	0	0	0	1	152
0	0	0	0	0	1	0	154
0	0	0	0	0	1	1	156
0	0	0	0	1	0	0	158
0	0	0	0	1	0	1	160
0	0	0	0	1	1	0	162
0	0	0	0	1	1	1	164
0	0	0	1	0	0	0	166
0	0	0	1	0	0	1	168
0	0	0	1	0	1	0	170
0	0	0	1	0	1	1	172
0	0	0	1	1	0	0	174
0	0	0	1	1	0	1	176
0	0	0	1	1	1	0	178
0	0	0	1	1	1	1	180
0	0	1	0	0	0	0	182
0	0	1	0	0	0	1	184
0	0	1	0	0	1	0	186
0	0	1	0	0	1	1	188
0	0	1	0	1	0	0	190
0	0	1	0	1	0	1	192
0	0	1	0	1	1	0	194
0	0	1	0	1	1	1	196
0	0	1	1	0	0	0	198
0	0	1	1	0	0	1	200
0	0	1	1	0	1	0	202
0	0	1	1	0	1	1	204
0	0	1	1	1	0	0	206
0	0	1	1	1	0	1	208
0	0	1	1	1	1	0	210
0	0	1	1	1	1	1	212
0	1	0	0	0	0	0	214
0	1	0	0	0	0	1	216
0	1	0	0	0	1	0	218
0	1	0	0	0	1	1	220
0	1	0	0	1	0	0	222
0	1	0	0	1	0	1	224
0	1	0	0	1	1	0	226

Switch Setting							TID
MSB			LSB				
0	1	0	0	1	1	1	228
0	1	0	1	0	0	0	230
0	1	0	1	0	0	1	232
0	1	0	1	0	1	0	234
0	1	0	1	0	1	1	236
0	1	0	1	1	0	0	238
0	1	0	1	1	0	1	240
0	1	0	1	1	1	0	242
0	1	0	1	1	1	1	244
0	1	1	0	0	0	0	246
0	1	1	0	0	0	1	248
0	1	1	0	0	1	0	250
0	1	1	0	0	1	1	252
0	1	1	0	1	0	0	254
0	1	1	0	1	0	1	256
0	1	1	0	1	1	0	258
0	1	1	0	1	1	1	260
0	1	1	1	0	0	0	262
0	1	1	1	0	0	1	264
0	1	1	1	0	1	0	266
0	1	1	1	0	1	1	268
0	1	1	1	1	0	0	270
0	1	1	1	1	0	1	272
0	1	1	1	1	1	0	274
0	1	1	1	1	1	1	276
1	0	0	0	0	0	0	278
1	0	0	0	0	0	1	280
1	0	0	0	0	1	0	282
1	0	0	0	0	1	1	284
1	0	0	0	1	0	0	286
1	0	0	0	1	0	1	288
1	0	0	0	1	1	0	290
1	0	0	0	1	1	1	292
1	0	0	1	0	0	0	294
1	0	0	1	0	0	1	296
1	0	0	1	0	1	0	298
1	0	0	1	0	1	1	300

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APPENDIX E - TRANSPORTATION

Information on transportation for RADius 500 containing lithium battery

The RADius 500 packaging is labelled with the following:

LITHIUM BATTERIES CONTAINED IN EQUIPMENT			
CLASS 9	UN 3091	NET WT OF LITHIUM	5 GRAMS
PACKING INSTRUCTIONS			912, II

In addition the symbol below is used:

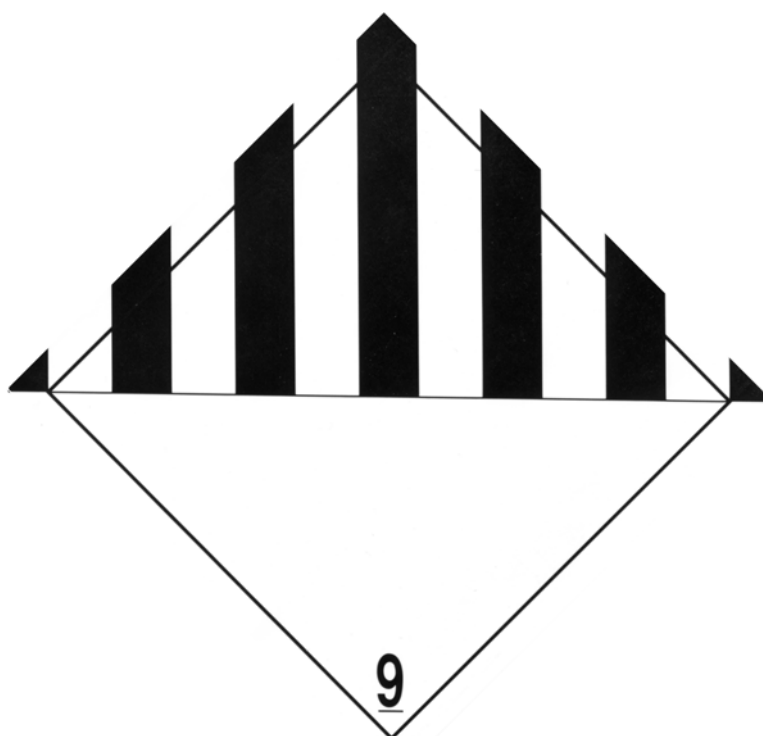


Figure 26 Dangerous goods class 9 UN-3091

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