MOONRAKER

Marine Lightning Protection System

PROTECT YOUR VESSEL, CREW AND ELECTRONICS

Lightning at sea is fast, powerful, and unpredictable. A single strike can carry up to 30 million volts and 100,000 amperes, reaching temperatures five times hotter than the surface of the sun. Even nearby strikes can induce destructive transient currents into antennas, power systems, and onboard electronics. Vessels with masts and antennas are natural targets. Moonraker Marine Lightning Protection Systems are engineered to safely capture, conduct, and dissipate lightning energy minimizing damage and ensuring operational continuity.

► LPS Lightning Rods

- Low-impedance marine-grade aluminium air terminals that create an effective 45° protection zone
- Available from 1–8m with optional laydown mounts
- Corrosion-resistant epoxy coating ensures durability in salt environments.

► LPU Horn Gap Protection

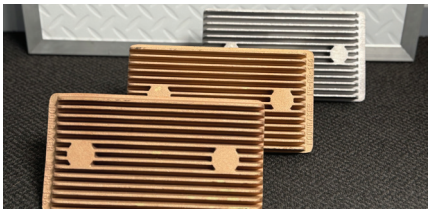
- Designed for MF/HF open-wire antenna feeders
- Provides a low-impedance discharge path for high-voltage static buildup and lightning-induced surges
- Low capacitance ensures minimal impact on antenna tuning.

► CSS Coaxial Surge Suppressors

- High-frequency protection for coaxial cable systems
- Fast-response gas-filled arrestors clamp voltage while maintaining 50Ω impedance
- Less than 0.2dB insertion loss up to 3GHz
- Protects transmitters, receivers, and HF systems up to 1 kW PEP.

► DCL / ACL Line Protectors

- Solid-state surge protection for DC (12–32 V) and AC (110–240 V) systems
- Up to 50 kA surge handling capability
- Protects navigation lights, computers, instruments, radios, and onboard electronics.



► E Plates – Marine Grounding Solutions

- Efficient low-resistance sea grounding plates for wooden and fibreglass vessels
- Large surface area ensures effective lightning energy dissipation.
- Constructed from low-corrosion copper or aluminium to prevent electrolysis.

CBG Systems
9 Bender Drive, Derwent Park
Tasmania, AUSTRALIA 7009
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Moonraker Marine Lightning Protection Systems deliver professional-grade protection trusted for marine communication systems, commercial vessels, and offshore operations.

Ask us to size the correct LPS rod and earthing solution for your vessel.

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LPU

MF TO HF LIGHTNING PROTECTION UNIT FOR MARINE AND LAND BASED ANTENNA SYSTEMS

The Moonraker LPU is a horn gap overvoltage lightning protection system designed to be placed in MF/HF open wire antenna feeders. It gives an easy path to earth for high voltage static charges, such as those induced in the antenna system by lightning induction and other electromagnetic disturbances. When used with the CSS Coaxial Surge Suppressor, the range is extended to cover all frequencies from MF to 2 GHz.

The solid copper horns are mounted upon special ribbed high voltage insulators which facilitate easy horn gap adjustment. The device is completely enclosed in an IP56 rated (weatherproof) cast aluminium housing, finished with a high durability epoxy based coating, highly resistant to chemical attack, abrasion and the effects of ozone and ultra violet radiation. It is designed to be back mounted externally; close to the antenna feed point. The LPU metal housing ensures it is intrinsically safe from fire and explosion.

The unit exhibits low capacitance to earth in order to cause minimal effect upon antenna tuning. As most antenna tuning units (ATUs) provide little resistance to high reverse voltages, we also recommend that a Coaxial Surge Suppressor be fitted in the 50Ω coaxial cable between the ATU and the transmitter for HF installations.

The unit is designed to be placed in the open wire feeder between the antenna and antenna tuning unit (ATU). A close by, low resistance earth point is essential for optimum protection.

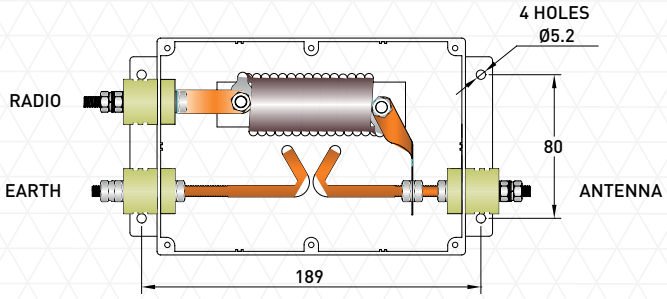
SPECIFICATIONS ▼

LPU	Tested in accordance with ANSI C6241 Category B, ie 45kV 1.2/50 micro second (rise/fall times) voltage pulse, 5kA 8/20 microsecond current pulse; observed breakdown with continuous RF at 3.3 MHz 1.5mm gap, 3.5kV rms (refer to installation instructions)
Housing Dimensions	106 x 122 x 172mm (260mm including insulators)
Maximum RF Power	1.2kW PEP
Adjustment	Adjust horns using spanner and feeler (thickness) gauges (refer to installation instructions)
Connection	HV silicone insulated antenna cable required at each end for connection to antenna feed stud, ATU and to earth
Weight	1.25Kgs
Packed Weight	2.0 Kgs

LPU INSTALATION INSTRUCTIONS ▼

Mounting:

The LPU may be mounted on either a horizontal or vertical surface utilising the mounting holes in the bottom panel.



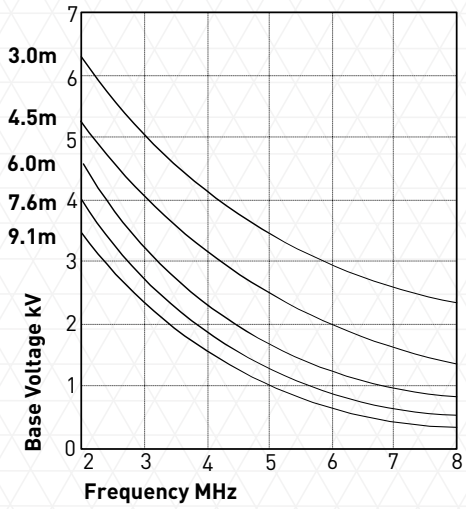
Connection:

Utilising the nuts, lugs and washers on the threaded ends of the horn gap rods, connect one horn to the antenna feed (preferably at or near the base of the antenna) and the other horn directly to a low resistance earth (ground). The antenna connection must be made to the horn connected internally to the coil. The earth lead should be as short and as direct (no sharp bends) to earth (ground) as possible. The ATU should be connected to the other end of the coil. Seal up all cable entries and unused mounting holes with silicone sealant to prevent moisture and insect ingress to housing.

Adjustment:

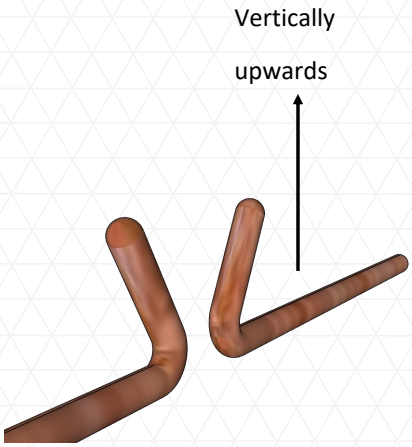
The horn gap must now be adjusted to suit the particular installation.

1. Slacken the horn clamp screws at the top of the standoff insulators. The horns can now be oriented so that they are both in the same plane (exactly).
2. Tighten the clamping nuts on one of the horns. The other horn can now be slid in its clamp to facilitate gap adjustment relative to the other horn.
3. Using the graph as a guide and from the approximate length of your antenna (including the length of feeder from the ATU) and the lowest frequency used, determine the likely maximum base voltage.



Typical antenna base voltage at 100w using an ATU for various lengths of antenna/feedwire

4. Preset the horn gap to approximately 0.5mm per kV of calculated base voltage. The use of feeler gauges will assist here.
5. Tune the system (transmitter and ATU) to the lowest frequency used. This ensures maximum transmit voltage is being applied across the horn gap. Use low power if possible. Increase transmitter power to maximum whilst observing the horn gap and the VSWR.
6. If arcing effects are visible or tuning (ATU) needs to be varied, turn off the transmitter and increase the gap. Repeat until no arcing effects are observed at maximum power. (Arcing effects will show as a sudden change in VSWR as the horn gap is ionised and breakdown occurs.)
7. Replace the cover after ensuring that the sealing gasket is seated correctly. It is recommended that anti-seize be applied to the cover screw threads to prevent locking.



Depending on installation position, the horns may need to be rotated so that they are facing vertically upwards

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LPS

LIGHTNING PROTECTION GROUNDING ROD

Moonraker LPS Rods provide a low impedance path for lightning strikes to ground. They are equally suitable for protecting a large rooftop area of a building or for shipboard use when strategically placed around the upper perimeter of the area to be protected.

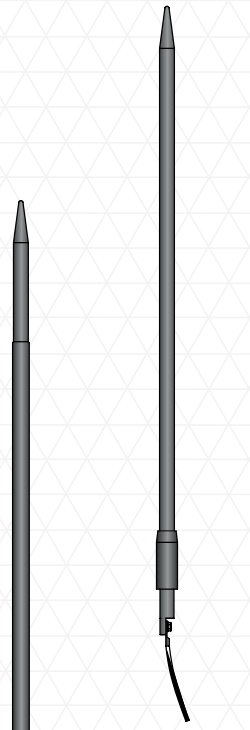
Lightning tends to take the path of least impedance (resistance and inductance). The LPS keeps this impedance to a minimum using tempered marine grade aluminium tube which provides a large low loss surface area minimising the skin effect. Combined with this lowering of inductance from skin effect is the inherent low resistance of aluminium to provide an overall low impedance path. This type of construction keeps the overall weight low, important in modern ship design. The LPS also features a stainless steel tip sharpened to increase the intercept capability of the lightning leader in the charged field below a thunderstorm.

Mounting is via a cast aluminium alloy base flange and support tube integrally connected to the LPS Rod. A stainless steel stud provides direct electrical connection to the earth system or to the metal deck or superstructure of a ship. The base and the rod are fully protected by a high durability epoxy based coating resistant to chemical attack, abrasion and the effects of ozone and ultra-violet radiation.

For ease of transport, the LPS rods longer then 4m are supplied in two slip together sections, complete with special jointing shroud and conducting grease sealing kit. The LPS is also available in laydown mounting option.

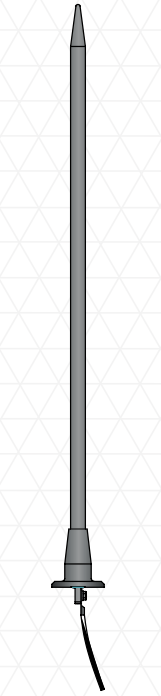
SPECIFICATIONS ▼

Colour	APO Grey (Low reflecting)	
Current Capability	Multiple lightning strikes of 250,000 Amperes	
Inductance (total)	3.2 micro henries	
Resistance (total)	0.7 milli ohms	
Overall Height	1m – 8m versions	
Diameter	Base element: 32mm	
Construction	Aluminium alloy A6060 Temper T81 with stainless steel 316 rod tip.	
Wind Survival	250km/h	
Shock	Capable of operation after three successive shocks applied in each direction of three mutually perpendicular axes at: 981m/s for 6mS duration upwards, downwards and horizontally	
Vibration	Designed for 10 hours in any of three perpendicular directions: 1.25mm 5-14Hz; 0.45mm 14-23Hz; 0.125mm 23-33Hz	
Connection	Stainless steel stud and lock nuts at side	
Mounting	Base flange, 152mm diameter with 4 x 9mm diameter holes located equidistant on a 127mm PCD	
Nett Weight	1m: 2.0kg	2m: 3.0kg
	3m: 6.5kg	4m: 7.5kg
	5m: 7.8kg	6m: 8.8kg
	7m: 10.0kg	8m: 11.0kg



LPS1 - LPS2
TUBE MOUNT

LPS3 - LPS5



LPS1 - LPS2
FLANGE MOUNT

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JOINT SEALING KIT (not required for LPS-3 or shorter

The kit will consist of the following:

1 x Joint Shroud (made from Silastic 3481).
1 x Container of special grease (Penetrox "A") for antenna joint
1 x Roll of special tape (3M Vinyl Mastic) for antenna joint
Antenna Assembly Instructions

Other items required but not supplied:

1 x pair scissors
1 x Philips head screw driver
Rags - lint free
Cleaning fluid (general purpose)
Lubricant (detergent and water)

Section joining:

The object of this procedure is to exclude moisture from the joints of the antenna. Strict adherence to the instructions will prolong service life and ease disassembly of the lightning rod in years to come.

> **Note:** When handling the lightning rod ensure that hands and tools are clean. Wipe any dirt, grease etcetera from antenna using clean rag soaked in cleaning fluid.
>
> Ensure sections are adequately supported and are not knocked or scraped against any hard surfaces. If necessary, place protective wrapping around antenna to prevent damage to surface finish.

Preliminary Joint Shroud Installation:

1. Roll the joint shroud back over itself as far as possible.
2. Lightly lubricate the internal surface of the shroud with detergent and water.
3. Carefully slide the joint shroud over the top of the base section of the antenna until you are below the four screw holes.

Joint Sealing:

1. Thoroughly clean mating surfaces of the joint using rag and cleaning fluid and allow drying. Ensure no dust or residue is left on the surfaces.
2. Apply the special conductive grease supplied to both surfaces of the joint.
3. Insert top section into base section and gently rotate the top section to ensure even distribution of the jointing grease.
4. Align the joint fixing holes, insert and tighten the four Philips head screws.
5. Thoroughly clean any excess grease from the external surface of the antenna, using rag and cleaning fluid. Allow to dry.
6. Wind special tape supplied firmly (without stretching) once around antenna immediately below the fixing screws, and then spirally wind tape towards antenna joint, keeping tape firm. Each winding to step up by half the tape width until a position just above the joint is reached. Proper adherence to this procedure will ensure that the screws and joint are properly sealed.

Joint Shroud Installation:

1. Unroll the joint shroud and manipulate it until it covers the tape.
2. Thoroughly clean all excess lubricant from antenna with a clean rag.

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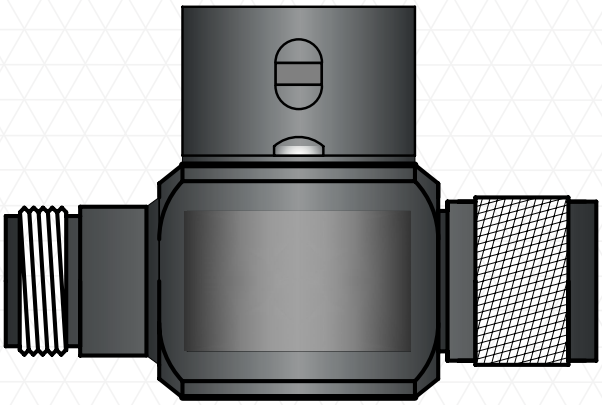
CSS

RF COAXIAL SURGE SUPPRESSOR



Radio transmitters, receivers, high frequency LANs and all high frequency cable systems require protection from transient over voltage due to lightning strikes causing direct induction or potential differences due to earth potential rise caused by spikes to buildings and towers.

Transient over voltage appearing between the inner conductor of the coaxial cable and its screen can directly damage receiver and line driver chips of communications equipment connected via coaxial cables.

The coaxial cable surge protectors contain fast response gas filled arrestors to provide low let through voltage for fast rise time transients. The use of low capacitance gas filled arrestors ensures operation at high frequencies with low insertion loss.
The coaxial cable protector consists of a fast acting gas filled arrestor enclosed in an in line mounting with coaxial connectors on either end. The device is configured to minimise circuit capacitance and present a 50Ωcharacteristic impedance so that performance up to 3GHz is assured. Standard models provide protection for receivers and transmitters up to a 1kW power level. Models for higher power levels are readily available. A range of connectors is available

Installation is easily effected by connecting the protector in the coaxial line as close to the equipment to be protected as is practical. The essential aim of these protectors is to provide electrical clamping between the inner and outer conductors of coaxial cables. Normal precautions such as earthing coaxial cable sheaths at building points of entry are still vitally important. The N bulkhead models are specifically designed to be mounted at cable entry points. Surge protectors are supplied with a mounting bracket as standard allowing a secure earth connection.

SPECIFICATIONS ▼

Description	Gas arrestor over voltage surge protector for coaxial cable systems
Clamping Voltage	1000V line to screen (DC)
Impulse Clamping	<1400v (1kV/us)
RF Power Level	Up to 1kW PEP Please specify (higher power versions available)
Protection Stages	Gas filled surge arrester
Insulation Resistance	$>10^{10}\,\Omega$
Surge Withstand	20KA (8/20us)
Insertion Loss	<0.2dB at 3 GHz
VSWR	1.07:1 to 1GHz; 1.1:1 to 3GHz
Cable Impedance	Suitable for 50Ω systems; F connector types 75Ω
Dimensions	70mm (max) x 25mm x 25mm
Connectors	50Ωand 75Ωtypes available. Please specify

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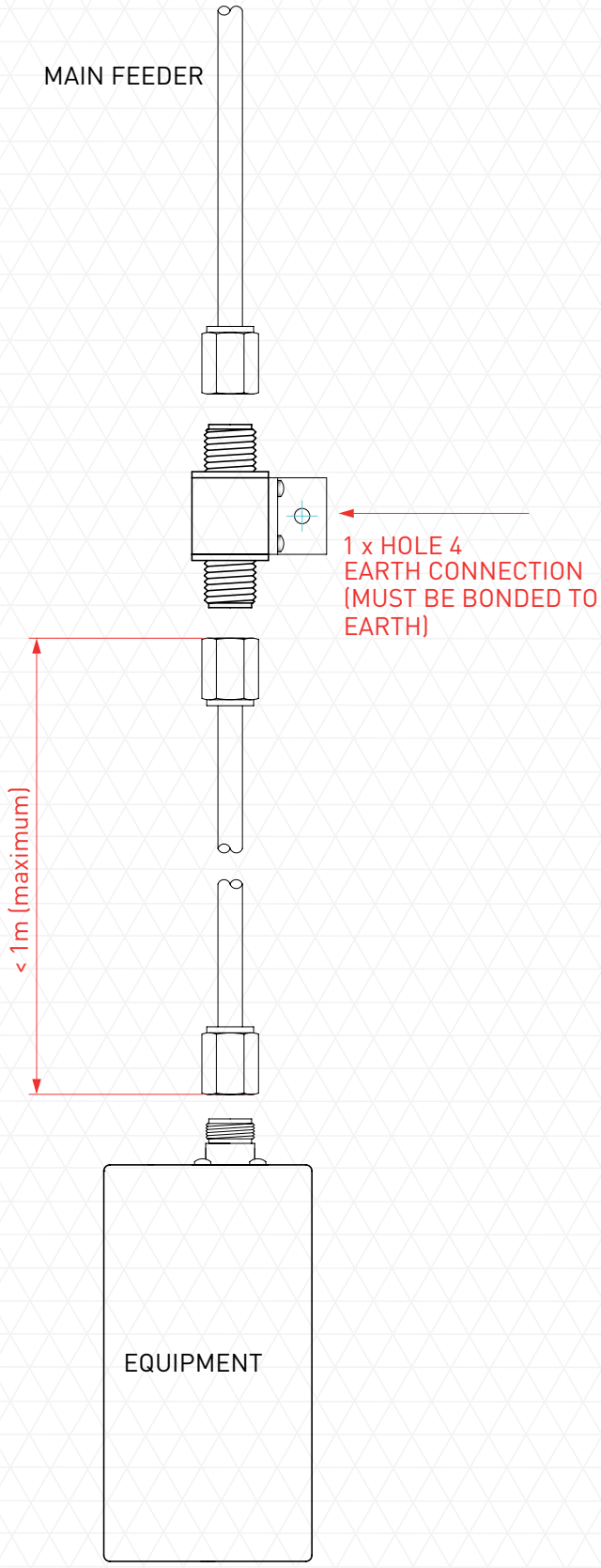

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LIGHTNING PROTECTION SYSTEMS

www.cbgsystems.com

DCL/ACL

DC AND AC LINE LIGHTNING PROTECTION FOR VESSELS AT SEA

Lightning generated transients or overvoltages appearing across DC or AC cables and between them and earth are likely to be damaging to connected equipment. DC and AC external cables feeding navigation lights, wind speed and direction indicators, etc., can also carry these transient over voltages via the ships DC or AC wiring to other instruments and electronic devices such as chart plotters, computers, radios and the like, to cause damage.

Moonraker DCL/ACL line protectors provide high quality protection from these potentially damaging transients by clamping the voltage and conducting surges safely to ground. The use of solid-state transient clamping devices connected between each cable and earth, ensures virtually instantaneous protection is achieved. For higher current drain two units should be used.

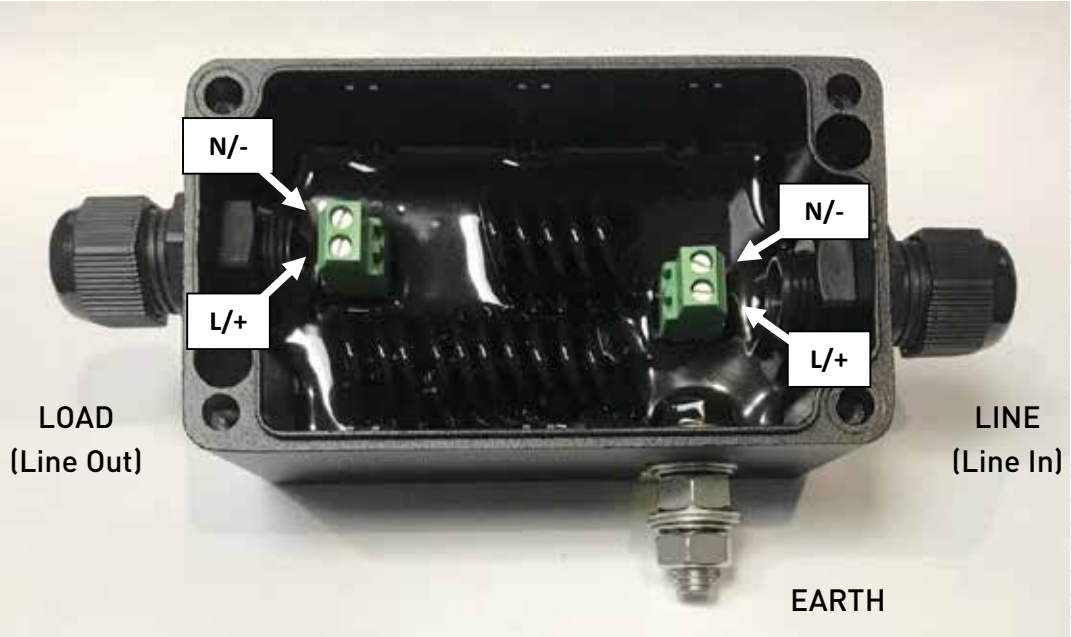
The protectors should be fitted at the point of entry of the cables to the interior of the vessel. Connection in the type DC or type AC cable is via sealed cable glands and internal screw terminals. The lid of the housing is fitted with an O ring seal. The housing is mounted via two bolts (not supplied) through the mounting plate.

The protectors are housed in safe all metal enclosures so that they are intrinsically safe. In the event of a prolonged overvoltage they will not catch fire or explode. The housing is constructed from cast aluminium, being finished with a high durability epoxy based coating, highly resistant to chemical attack, abrasion and the effects of ozone and ultra-violet radiation, and sealed to IP65 rating for waterproofing.

SPECIFICATIONS ▼

Operating Voltage	**DCL** suitable for 12, 24 and 32 volts DC; **ACL** suitable for 110 and 240 volts AC, 50 or 60 Hz
Operating Current	10 Amps maximum (split the system and use extra units for higher currents)
Earth Leakage Current	less than 500µA (micro amp)
Operating Temperature	-40°C to +80°C
Housing Dimensions	66W x 58H x 114mm long (163 including cable glands)
Earth Terminal	M8 stainless steel stud on side of housing
Maximum Surge Current	**DCL** 10kA **ACL** 50kA
Response Time	<5NS
Connection	via cable glands to screw terminals (16mm OD maximum cable)
Mounting	via 2 bolts (not supplied) through base plate 6.5mm holes
Weight	550g
Packed Weight	1 kg

DCL/ACL WIRING INSTRUCTIONS ▼



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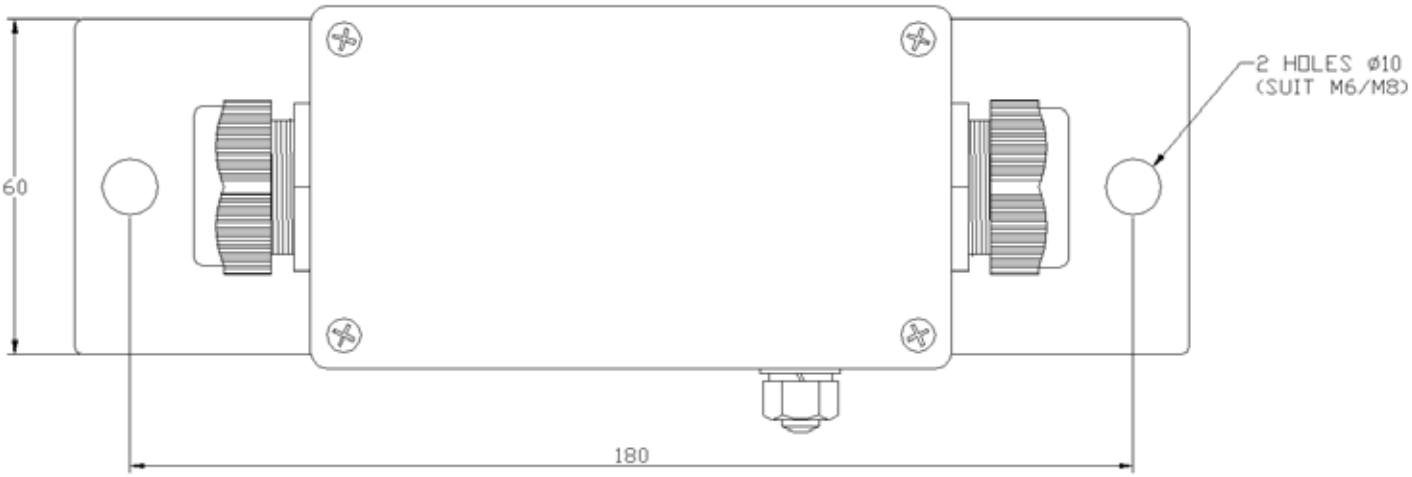

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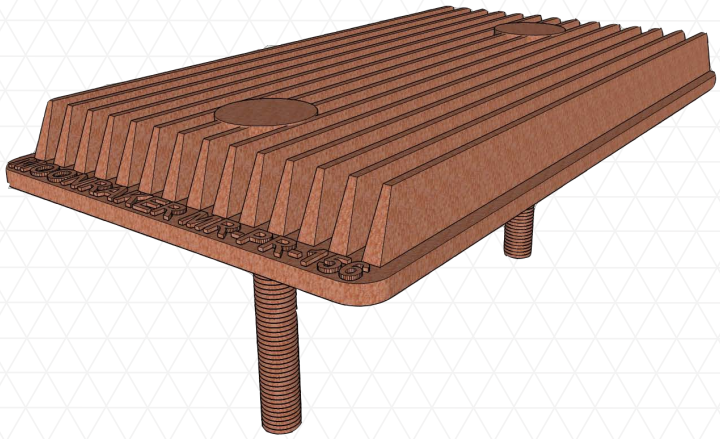
E PLATE

RADIO/ELECTRICAL EARTH SYSTEM FOR WOODEN OR FIBREGLASS VESSELS



A compact radio or electrical earth plate designed to provide an efficient low resistance earth connection in wooden or fibreglass vessels for the professional and non professional user.

The Moonraker E Plate has an effective surface area of approximately 1265 sq cm and is not appreciably affected by marine growth fouling.

Normally constructed of 94% low corrosion copper alloy, designed especially for tropical waters, it is also available in low corrosion aluminium for boats fitted with aluminium outboard legs or under conditions where bronze fittings should not be used, to prevent electrolysis.

Two threaded studs are integrally connected with the E Plate for mounting. No pre assembly is necessary and there are no bolted joints to corrode and cause problems.

The performance of any HF radio circuit is limited by the efficiency of the antenna / earth system used. Moonraker products are designed to give the high standard of efficiency demanded by the professional user.

SPECIFICATIONS ▼

Area	Effective surface area of approximately 1265 sq cm	
Length	240 mm	
Width	130 mm	
Thickness	20 mm (min plate thickness 5mm)	
Impedance	Less than 1Ω (measured) at 5 MHz in sea water; also suitable for use in fresh water	
Mountings	**Copper Type:**	**Aluminium Type:**
	2 x M12 x 75mm studs	2 x M10 x 75mm studs
Weight	2.9kg	900g
Packed Weight	3 kg	1 kg

E PLATE INSTALLATION INSTRUCTIONS ▼

Mounting:

1. Mount the E Plate in a position which will allow minimum lead length from the radio equipment and located so that the E Plate will not be out of water under any sea conditions.
2. Drill two 13mm holes (10.5mm for aluminium plate) spaced 152mm apart, so that the E-Plate fins run fore and aft. An internal backing plate should be used to strengthen thin hulls.

   Important Note:

   DO NOT OVERTIGHTEN THE NUTS as this may fracture the studs.
3. Copper strip should be used for connection between radio equipment and COPPER E-PLATE. The strip should follow the shortest possible path clear of power wiring and free from contact with other metal objects.

   Note:

   Do not use flexible copper braid for connecting strap as it has a relatively high radio frequency resistance and may corrode rapidly.

   Copper strip should not be used with aluminium E Plates. Use marine grade aluminium strip. Continuous length copper strip is available from Moonraker.

It is recommended that a silicone rubber sealant be used to bed in the E-Plate and bolts, also smeared over the connection between the strap and E-Plate. Use only neutral cure silicone sealant, others may corrode the metal.

Maintenance:

1. The E Plate requires no maintenance other than regular inspection. Moderate marine growth does not appreciably affect operation. Any growth should be cleaned off when the vessel is slipped
2. Aluminium plates require more frequent inspection than copper plates to guard against possible plate and bolt corrosion due to the possible presence of copper lead or mercury, etc., in paints, timber, etc. E Plates should not be treated with anti - fouling paints. Copper base anti -fouling paints should be kept clear of aluminium E Plates.

The performance of any HF radio circuit is limited by the efficiency of the antenna/earth system used. Moonraker products are designed to give the high standard of efficiency demanded by the professional user.

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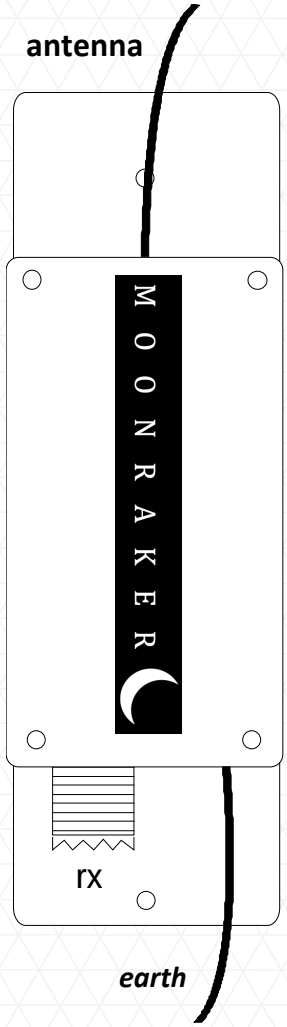
MRA RX Transformer

MATCHING TRANSFORMER FOR RECEIVING ANTENNAS



The MRA RX-Transformer is a wideband (0.3-30 MHz) impedance transformer, designed for matching either whip or long wire antennas to the coaxial cable and receiver. It is ideally suited for 7 metre (23ft) whips (types 23B/3, 23B/3C and 23H/S) and long wire antennas.

The transformer converts the widely varying antenna impedance to a constant 50ohms, permitting long or variable lengths of coaxial cable to be used between the antenna and the receiver. Low loss cable is recommended for lengths exceeding 40 metres.

It is designed primarily for shipboard use, but is equally suitable for land based systems, to allow location of receiving antennas to be situated as far as practically possible from transmitting antennas or other high noise areas, such as power lines.

The antenna is DC grounded via the transformer to prevent static build-up and the connecting cable is DC isolated to prevent electrolysis. In addition a gas discharge device is also provided to allow for nearby lightning strikes.

Electrical connection to the antenna is by way of insulated cable to the antenna feedpoint and an earth cable connected to ground. Mechanical mounting is by way of two screws or small bolts through the holes in the PVC mounting plate. The unit should be fixed near to the feedpoint of the antenna. The transformer components are housed in an insulated fully marinised PVC box designed to withstand the harsh marine conditions. As a further guard against water ingress, the components are completely encapsulated in a silicone material.

Units are also available to meet military specifications, being housed in additional zinc anneal box, NATA tested to IP66 standard, and finished in pebble grey. Single outlet (type RXT1N) and dual outlet (type RXT2N) models with cable glands to internal coaxial connectors.

SPECIFICATIONS ▼

	STANDARD	OPTIONAL
Colour	Grey	N/A
Dimensions	Transformer Housing: 112 x 62 x 31 mm Military types (RXT1N & RXT2N): 300 x 150 x 120 mm Mounting Plate: 182 x 57 mm	
Frequency Range	0.28-30 MHz	
Bandwidth	Full	
Impedance	50Ω nominal	
Antenna Types	7 metre (23ft) whips or long wire antennas	
Mountings	Via a PVC plate and screws (not provided); distance between mounting holes 143mm, hole diameter 5mm	
Connection	UHF SO239 (in base of unit), allowing direct 50 ohm coaxial feed to receiver; military types: N type connector	
Packed Gross Wt	1.0kg	
Nett Wt	.50 grams	

MRA RX TRANSFORMER INSTALLATION INSTRUCTIONS

For best results the MRA RX should be mounted close to the feed point of the antenna.

For ease of mounting the unit is fitted with a mounting plate at each end.

1. Select a suitable mounting position on a rail or other structure close to the antenna feedpoint.

2. Using the unit and mounting plate as a template, mark the position of the two bolt/screw holes.

3. Drill the two holes to suit your bolts or screws.

4. Fasten the unit securely with the bolts or screws.

5. Connect the earth cable which is near the coaxial connector at the bottom of the unit, directly to earth or a nearby steel rail. Ensure this is a good electrical connection. It may be possible to utilise one of the unit's mounting bolts or screws for this.

6. Using good quality low loss coaxial cable and connector, connect the unit to the radio receiver directly via the coaxial socket. Waterproof the joint using a sealing compound or tape.

7. Ensure the coaxial cable is secured to prevent strain on the connector.

8. Connect the wire antenna cable at the top of the unit directly to the antenna feed point. Waterproof this connection using a sealing compound and tape.

9. The unit is completely sealed internally to prevent water and insect ingress.

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