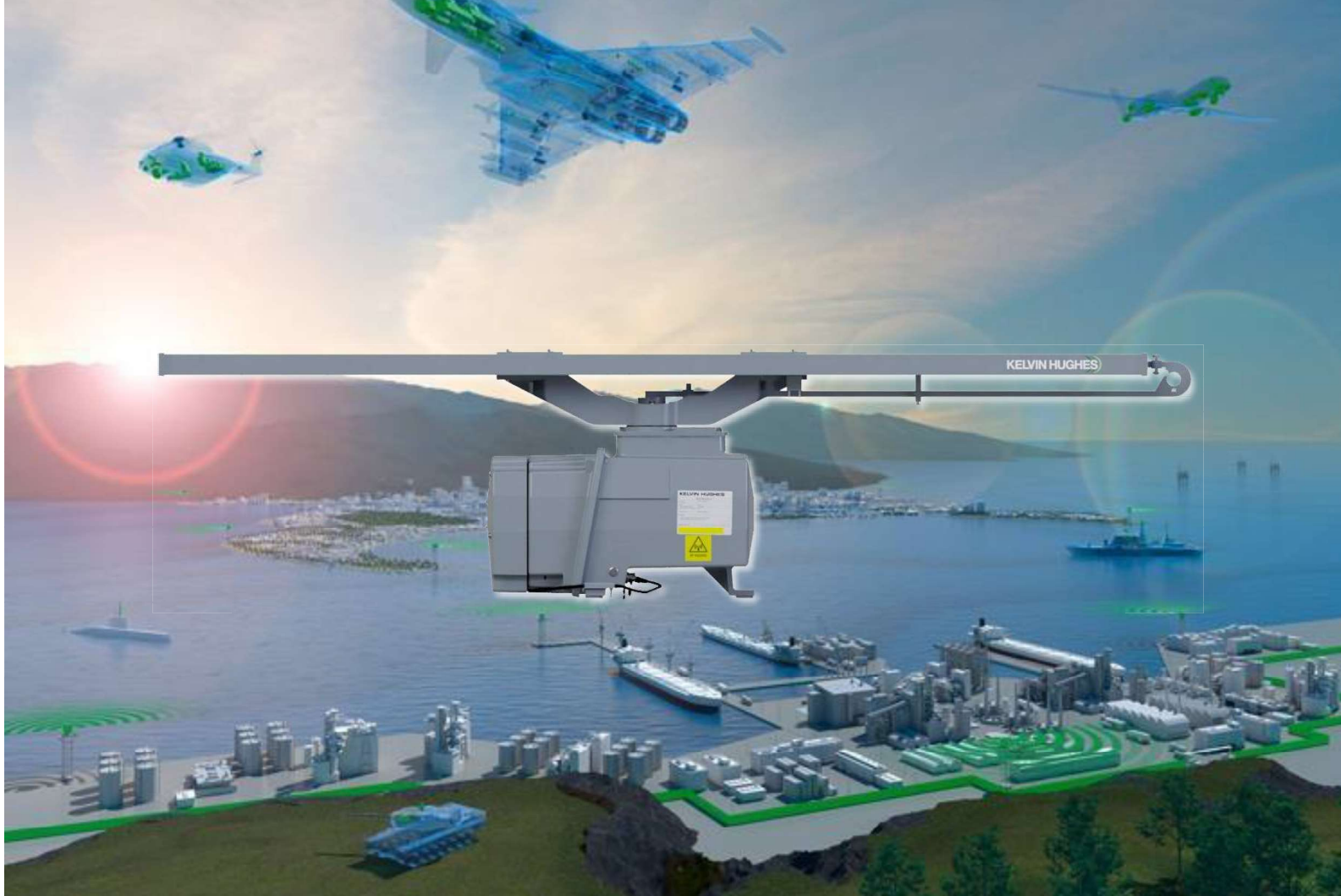




HENSOLDT
Detect and Protect.

**Kelvin Hughes MK5 SharpEye™
Upmast X-band transceiver**

**INSTALLATION, COMMISSIONING,
OPERATION & MAINTENANCE**

DOCUMENT HISTORY

ISSUE	RELEASE DATE	DETAILS
1	November 2019	First release.
2	February 2020	• Addition of Corrective Maintenance section, • Service Access Panel safety rope and carabiner added to fitting kit and assembly instructions, • Minor corrections, amendments and drawings updated to latest revision(s).
3	July 2021	• Section 4.1.6: Fitting kit contents revised. • Section 4.5: Update to transceiver mounting arrangement • Section 5.2: Connector location drawing updated (PLA & PLB). • Drawings updated to latest revision(s) as appropriate. • Minor corrections and amendments.
4	February 2024	• FCC Warnings added.



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When planning any aspect of the installation, commissioning, operation, maintenance or risk analysis (RADHAZ) of the system(s) described in this handbook, it is the responsibility of the individual carrying out the required task to ensure they are working from the latest issue/ revision of this document.

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Where translated, the original English version of this document will remain the definitive document and should be referred to in any situation of doubt, confusion or conflict.

Specifications are subject to change without notice.

Printed copies of this document are unmaintained.

This publication supersedes all previous versions.

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2 Safety notices

KEY TO SAFETY NOTICES

NOTICE	CAUTION	WARNING
A notice on a condition or setting that may affect the operation of the equipment but has no safety implications.	A condition or setting that if incorrectly used or applied could present a potentially hazardous situation, condition or setting.	A condition or setting that if incorrectly used or applied would lead to a hazardous situation or condition.

HEALTH & SAFETY

When working on HENSOLDT UK equipment, operators, engineers and agents must be trained by HENSOLDT UK to work on their equipment and must work within the health and safety guidelines noted in this handbook and as issued by their respective employer or as stated by site regulations, shipyard and/ or vessel owner.

RISK ASSESSMENT

In line with an employer's, shipyards or vessel owners requirements, risk assessments of a working area must be undertaken prior to commencement of any work and must be regularly reviewed.

AID TO NAVIGATION

Kelvin Hughes navigation systems and equipment supplied by HENSOLDT UK comply with the relevant SOLAS regulations. The equipment is provided as an aid to navigation and should be used in accordance with the SOLAS regulations.

HANDBOOK INSTRUCTIONS

This publication is designed to be used by trained engineers and assumes prior knowledge and training in the use of computing equipment and navigation systems.

MICROWAVE RADIATION LEVELS (RADHAZ)

WARNING: RADHAZ (NON-IONISING)

Avoid exposure to the main beam of a stationary radar antenna. Avoid standing closer to the central front face of the antenna than the distances specified in the RADHAZ ranges detailed in this handbook. Users of cardiac pacemakers should be aware of the possibility that radio frequency transmissions can damage some devices or cause irregularities in their operation. Anyone using such devices should understand the risks present before exposure.

WARNING: RF LEAKAGE

Radiation risks are greater from an unterminated, leaky or damaged waveguide. Do not operate the transceiver with the antenna disconnection or partially fitted.

NOTICE: RADHAZ FIGURES

It is the responsibility of the end user to ensure they are working from the latest released handbook when planning an installation or carrying out any form of risk or hazard assessment.

RADHAZ (continued)

Kelvin Hughes Mk5 SharpEye™ fitted with Low Profile Antenna (rotation)	RADHAZ RANGE WITHIN WHICH THE POWER DENSITY EXCEEDS THE FOLLOWING:		
	10W/m ²	50W/m ²	100W/m ²
X-band LPA-A13 1.3m antenna	1.1	0.43	0.35
X-band LPA-A19 1.9m antenna	1.1	0.5	0.35

The range at which specified RF exposure limits can be exceeded is far greater for a non-rotating antenna. For that reason, RF transmission without antenna rotation is not a permitted operational mode for this equipment: In all SharpEye™ systems, the fault condition following the loss of Heading Line and Azimuth data (e.g. the antenna has stopped rotating) will be recognised and trigger the transceiver OFF condition within a few seconds.

The basic restriction level for the operating frequency of this product, as set out in 1999/519/EC (Annex III table 2) and calculated in accordance with EN50385:2002, is 10W/m² averaged over a six minute period. For normal operation, the EU basic restriction level for public exposure is only exceeded within the minimum RADHAZ range of the antenna centre as specified above.

ANTENNA ROTATION WARNING

WARNING: ANTENNA ROTATION

When power is connected to the system and switched ON, the antenna may rotate *immediately* depending on the RUN command status of the system. Refer to the operator's section for details on stopping the antenna and isolating a system.

ELECTRICAL HAZARDS

All HENSOLDT UK designed equipment is constructed so that access to high voltages may only be gained after having used a tool, such as a spanner or screwdriver. Warning labels are prominently displayed both within the equipment and on protective covers.

All HENSOLDT UK designed equipment is designed to meet the requirements of IEC 60950, safety of information technology equipment.

WARNING: ELECTRICAL HAZARDS

The MK5 SharpEye™ assembly and optional PCV-A2 AC/DC power supply must not be opened or dismantled. Neither unit contain safety interlocks. When opened, DC voltages and lethal AC voltages (PCV-A2 only) are exposed on uninsulated terminals.

WARNING: SYSTEM ISOLATION

The system must be fully isolated from all sources of power and locked into the OFF position prior to the commencement of any installation or maintenance work.

WARNING: RESIDUAL VOLTAGES

Residual voltages may be present on large capacitors within the system. When accessing the internal parts of the system, fully isolate all sources of power before removing access panels. This will allow time for the voltages to discharge whilst panels are removed.

GROUNDING/ EARTH POINTS

All parts of the system must be fully and correctly connected to a proven & tested earth point before connecting any source of AC power. Fully isolate and mechanically disconnect all sources of AC before attaching ESD protective wrist straps to the various points in the system.

WARNING: SYSTEM EARTH

The system must NOT be operated or have power switched ON with an earth/ grounding point disconnected.

GENERAL PRECAUTIONS**WARNING: EQUIPMENT SURFACE TEMPERATURES**

The equipment housing, antenna and internal assembly surfaces will be hot during normal operation, in strong sunlight or when operating at elevated temperatures.

At ambient temperatures exceeding +50°C, surface temperatures may exceed +70°. The unit should be allowed to cool prior to carrying out any maintenance procedure.

WARNING: SharpEye™ PROCESSOR

The factory sealed SharpEye™ processor within the system must not be dismantled as components within the factory sealed processor contain Beryllium which can represent a risk if the processor is dismantled.

WARNING: FIRE RISKS

Some equipment contains materials which may produce toxic fumes if burnt.

GENERAL PRECAUTIONS (continued)**WARNING: ACCESS TO EQUIPMENT**

To meet with electrical safety recommendations, all equipment should be situated in a restricted area where access is only available to authorised personnel. Persons entering the restricted area should be aware of the dangers that are present when the system is operational which can include rotating equipment, radiation hazards and where applicable, working at heights.

SAFETY ALOFT**WARNING: WEATHER CONDITIONS**

When weather conditions are poor, a full risk assessment must be carried prior to working aloft. Poor weather conditions can include but are not restricted to high winds, heavy rain, snow, ice or if access is required at sea, risk of vessel pitch and roll.

- When working aloft or near radar scanners, moving or RF radiating equipment, ALL power to the platform and equipment including Anti-Condensation Heaters (ACH) and UPS supported supplies must be switched OFF, be electrically and mechanically isolated and locked into the OFF position.
- Ensure someone in authority at ground level knows of your intentions and ensure that suitable clear warnings are in place.
- Ensure all means of access are secure and beware of wet or slippery ladder rungs and working areas.
- All working at height health & safety requirements and procedures, including risk assessments, inspection and use of personal protective equipment (PPE) must be adhered to at all times.
- A safety cordon must be established and managed below the working area(s).
- All tools, Line Replacement Units and loose items must be safely stowed or secured so that they cannot present a drop hazard.

MK5 SHARPEYE LIFTING

See section 4.4 (Lifting) for specific lifting instructions for the MK5 SharpEye/ antenna assembly.

The Mk5 SharpEye™ assembly should be lifted using two (2) suitably rated 3m long strops with loops at both ends.

LIFTING EQUIPMENT**WARNING: LIFTING**

Equipment must be hoisted to the fixing position using suitable lifting equipment and must be supported at all times to prevent any risk of falling or slipping.

- Local health and safety requirements must be observed at all times when lifting any equipment.
- All appropriate Personal Protective Equipment (PPE) must be worn.
- Where special equipment such as cranes hoists and jigs is required, consideration must be given to the authority to use such equipment.
- During lifting, a safety zone shall be established beneath the lifting area around any cranes or platforms. Safety personnel must ensure that persons do not encroach on the area of work.
- Consult with the lifting operator to obtain the best and safest method of securing lifting strops or ropes to the equipment and advise lifting operators of the areas of a system that are susceptible to damage such as antenna fascia's, swing castings etc. Check that the centre of gravity of the equipment cannot cause the lifting strops or ropes to slip or move.
- All straps, lifting cables or ropes must be thoroughly checked to ensure that there is no risk of the unit slipping or falling from the lifting strap or lifting equipment and that there is no damage to the lifting straps.
- Gearboxes must never be lifted by the antenna or swing casting/ yoke.
- Where spare parts are required for equipment located on a platform or access is via a ladder, heavy items must be lifted to the platform using a suitably rated lifting bag or lifting strop. Heavy items must not be manually carried up ladders.
- HENSOLDT UK cannot be held responsible for any damage that occurs to supplied or 3rd party equipment as a result of incorrect lifting procedures or handling of equipment.

ANTENNA LIFTING

- Care should be taken when unpacking and lifting antennas to ensure that the waveguide is not bent, crushed or damaged during handling. Do not lift, handle or support the antenna by the waveguide.
- If lifting a gearbox with the antenna pre-assembled, the lifting equipment, ropes or straps must not place any pressure on any part of the antenna or the swing casting.
- The antenna and antenna fascia must never be painted or have non-approved labels attached.

SERVICING AND REPAIR

Service and equipment repair must only be undertaken by HENSOLDT UK or HENSOLDT UK authorised service agents/ engineers. Un-authorised repair or servicing of equipment during the warranty period may invalidate the warranty status of the equipment. Repair of the MK5 SharpEye™ system is limited to replacing predefined line replaceable units.

ANTI-STATIC HANDLING**CAUTION: ELECTROSTATIC DISCHARGE (ESD)**

When handling Line Replacement Units (LRUs) or spares, an ESD wrist strap must be connected to the ESD point provided on or within the equipment.

- Fully isolate and mechanically disconnect all sources of power before attaching ESD protective wrist strap,
- Outer clothing must not be able to generate static charges,
- Line Replacement Units/ spares must be stored and transported in anti-static containers,
- Fit new devices in a special antistatic safe handling area.

SOFTWARE LICENSING

Only approved software may be used on HENSOLDT UK equipment. The use of unapproved or unlicensed software on any HENSOLDT UK equipment is strictly prohibited. The use of such software voids the warranty status of the unit.

Any HENSOLDT UK designed software supplied whether pre-installed, supplied on CD/ DVD or other removable media, is the copyright of HENSOLDT UK, which will not accept any responsibility for any damage or loss caused in whatever way by the use or misuse of the software. This copyright applies to software supply in various formats including but not restricted to CD, DVD, USB memory device, email or obtained via the HENSOLDT UK agents download area.

Software supplied with HENSOLDT UK equipment may not be resold or re-distributed without the express permission of HENSOLDT UK. 3rd party software supplied with the system remains the copyright of the original manufacturer.

VIRUS PRECAUTIONS

HENSOLDT UK PC based systems do not have anti-virus protection installed. It is the responsibility of installation engineers, service engineers, maintainers and system users to ensure that virus threats are not transferred to the system.

WARNING

Prior to use, ALL removable media used with HENSOLDT UK products MUST be fully scanned for viruses on a computer installed with up to date anti-virus software. Media containing potential virus infections must not be used. Charges relating to systems found to be infected with a virus will be passed onto the company found to be using media that has not been suitably scanned. HENSOLDT UK cannot be held responsible for damage caused to systems by virus infections.

RoHS STATEMENT

For details on RoHS (Restriction of Hazardous Substances) statements please contact HENSOLDT UK; contact details can be found in at the end of this handbook.

FCC PART 15.19 WARNING STATEMENT

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION

FCC PART 15.21 WARNING STATEMENT

NOTE: THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

FCC PART 15.105(B) WARNING STATEMENT

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

DISPOSAL OF MATERIALS/ EQUIPMENT

HENSOLDT UK is committed to recycling and reducing landfill waste. It has been globally recognised that the incorrect disposal of some materials including plastics can have a harmful and negative impact on the environment. HENSOLDT UK request that waste material is not discarded as general waste or by a method that could lead to the equipment being disposed of in a landfill site.

Please contact your local regulatory body for current waste recycling and disposal instructions or contact HENSOLDT UK for a list of any potentially hazardous material contained within the system.

PACKING: Unless specifically required for repacking, storage, transport or return, all equipment packaging and any waste material generated during equipment installation should be recycled or disposed of in accordance with ships requirements and/ or current local waste disposal regulations.

IN-LIFE CONSUMABLES: When any item is replaced and the removed item(s)/ assemblies are not being returned to the manufacturer, they should be recycled or disposed of in accordance with ships requirements and/ or current local waste disposal regulations.

END OF LIFE: When any HENSOLDT UK supplied equipment has reached the end of its serviceable life, the various parts that make up the system should be recycled or disposed of in accordance with all current local industrial waste disposal and recycling regulations.

SHARPEYE™ TRANSCEIVER DISPOSAL: Kelvin Hughes SharpEye™ transceivers are factory sealed units that contains no field serviceable parts or lifed components. Components within the processor contain traces of Beryllium and Trivalent Chromium. For details on the end of life recycling and disposal, please contact HENSOLDT UK quoting the Kelvin Hughes SharpEye™ processor part number and MOD state.

3 Introduction

3.1 Overview

The Kelvin Hughes Mk5 SharpEye™ consists of an X Band SharpEye™ transceiver fitted inside a sealed cast aluminium enclosure that can be fitted with either a 1.3m or 1.9m low profile open array antenna (LPA).

The maintenance free, state-of-the-art solid state SharpEye™ transceiver is a highly reliable, high performance X-band Doppler radar system ideally suited to marine navigation, collision avoidance and situational awareness.



KEY FEATURES

- Enhanced Doppler processing to optimize target detection in clutter,
- Radar video & control via Gigabit LAN (1000 Base-T),
- Open architecture interfaces providing ease of Integration.
- Waterproof to IPx6,
- Designed to withstand shock & vibration levels found on patrol craft,
- Low maintenance and high reliability solid state transceiver,
- Designed/ approved to Marine Equipment Directive requirements, ^{Note 1}
- Ease of installation with three fixing points and two rugged, waterproof connectors,
- Inherently corrosion resistant materials used throughout, Supports Tactical features such as selectable transmit frequency, low power mode and sector transmission (optional Naval display software is required to utilise these features).

CONNECTIONS

Interfacing is via the following externally mounted waterproof connectors:

POWER: Operation is from a +24VDC supply. AC operation (110/ 220VAC) is available using a separate optional AC/DC converter PCV-A2. ^{Note 2}

DIGITAL COMMUNICATIONS: Radar Video, Status & Control are via a single 1000 Base-T Gigabit Ethernet connection.

EXTERNAL FANS: An internally generated DC supply connects to the PCV-A125 Fan Assembly.

APPLICATIONS

The Mk5 SharpEye is intended for installation on a range of small to medium sized craft, typically 15m+ including patrol craft etc.

HENSOLDT DISPLAY SOLUTION

The Kelvin Hughes Mk5 SharpEye™ radar sensor can be integrated with a range of Kelvin Hughes displays that offer Type Approved functionality and ARPA tracking. Additional tactical features may also be specified providing additional functionality suited to naval and surveillance applications. All required Navigation sensors are inputted via the serial to Ethernet converter (IEC 61162-1) or directly to the display over Ethernet, within UDP datagrams.

3.2 Part numbers

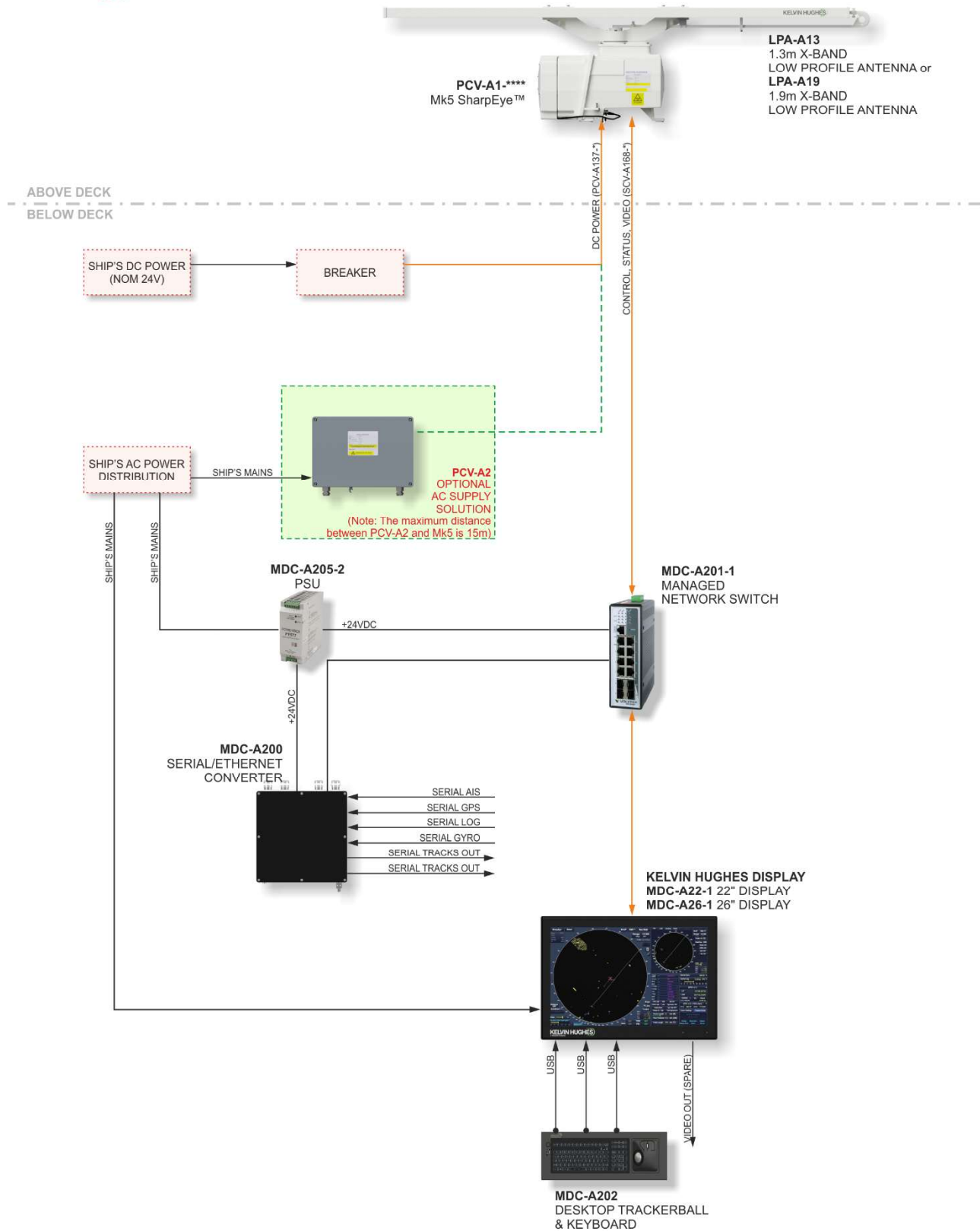
DESCRIPTION	WHITE RAL 9003	GREY RAL 7001
Mk5 SharpEye™ upmast transceiver assembly.	PCV-A1-AAAA	PCV-A1-BAAA
1.3m X-band Low Profile Antenna (LPA).	LPA-A13-ABAA	LPA-A13-BAAA
1.9m X-band Low Profile Antenna (LPA).	LPA-A19	LPA-A19-BAAA
Optional AC/DC Power Supply. ^{Note}	PCV-A2	PCV-A2-BAAA

Note 1: Approval pending at time of handbook release.

Note 2: Early versions of the PCV-A2 carried the part number **PCV-A157** which is identical in all respects.

3.3 Typical system

HENSOLDT



Mk5 SharpEye™ X-BAND TRANSCEIVER

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Drawing for indication purposes only.
Serial inputs from third party equipment shall comply with IEC-61162-2.
Where such signal feed connects to HENSOLDT UK equipment, suitable buffering / amplification units shall have been incorporated should multiple sources be connected, so as to not adversely impact the performance of the HENSOLDT UK sensor.
Unless specifically listed in the scope of supply, serial buffers / amplifiers are not supplied.

4 Mechanical installation

4.1 Installation considerations & requirements

4.1.1 Storage conditions & shelf life

PACKING

Equipment being stored prior to installation or delivery must be kept in its original packing. When opened or after any inspection, all equipment must be repacked using the original packing material. Shipping clearance and Special Packing Instructions are void if the equipment is unpacked.

CAUTION: SEALED PACKING

The MK5 SharpEye is shipped in a sealed bag within a transit / storage case. The sealed bag surrounding the transceiver **MUST NOT BE OPENED** until the equipment is ready to be mounted.

See section 4.2 for additional details.

STORAGE ENVIRONMENT

Equipment must be stored in its original packing in a well-ventilated, dry building or warehouse that provides protection from extremes of temperature, the weather, contamination, rodent and insect infestation.

STORAGE TEMPERATURE RANGE

-40°C to +70°C with a relative humidity of up to 95% at +40°C.

WARRANTY

No provision is allowed to extend the warranty on equipment which will be in storage.

SHELF-LIFE

If no DC power is supplied to the equipment for a long period there is a risk that the performance of large capacity electrolytic capacitors can decline.

When leaving equipment unused for a long time, it is recommended that the system is powered up once every two years and is left switched ON in a standby state for a minimum of 5 hours. Where possible and whilst switched ON, the basic functions of the system should be checked to ensure that the system is operational.

When applying power after 2-years of static storage, it is strongly recommended that the power is applied gradually using a suitably rated variable power supply. The test procedures for equipment held in long term storage are not defined in this document. Please contact [HENSOLDT UK](#) for specific instructions on packing, powering, testing and re-packing of a system.

4.1.2 Handbook: Radar installation guidelines

A separate publication that is available that provides detailed instructions on the positioning and installation of Kelvin Hughes radar equipment. This should be read when considering the mounting and positioning of any HENSOLDT UK supplied radar equipment. [Copies of this handbook are available upon request.](#)

- **HBK-1000: RADAR INSTALLATION GUIDELINES & INTERPRETING THE RADAR DISPLAY.**

4.1.3 General position requirements

Due care should be taken with regard to the location of radar antennas relative to other radiating antennas which may cause interference to either equipment. The location of a transceiver, turning unit & antenna should comply with the following:

- Radar antennas should be installed safely away from magnetic compasses, high-power interfering energy sources and other transmitting and receiving radio antennas.
- The lower edge of a radar antenna should be a minimum of 500mm above any safety rail and 914mm above any flat surface greater than the diameter swept by the antenna.
- Radar antennas in close proximity should have a minimum vertical elevation separation angle of 20° and a minimum vertical separation of 1.0m where possible.
- The unit must not be mounted in a recess or position where accumulation of water can occur.
- Consideration should be given to the proximity of other antennas such as GNSS, AIS, VHF etc.
- Posts or structures of more than 0.6m diameter can cause blind sectors. Increasing the distance between the antenna and these objects will reduce the blind sectors that inhibit good radar returns. Some close objects may require the radar to be blanked in that sector.
- All installations should facilitate protection of equipment, including cabling, from damage.
- To meet with electrical safety recommendations, the transmission system must be situated in a restricted area where access is only available to authorised personnel in an area which can be RADHAZ controlled.
- Consideration should be given to the location of cable runs.
- The position of earth studs on the mounting plate should be designed so that the earth cables or straps are as short as possible.

SERVICE ACCESS PLATFORMS & RAILINGS

Equipment must be mounted in a position where service access panels can be safely and easily accessed for installation, maintenance and service work. Safe installation/ service access should be provided using platforms where necessary having a minimum size of 1m² at a suitable height and with a safety rail of suitable height. For turning mechanisms mounted in excess of 1.8m above deck, a working platform should be provided for installing and servicing the assembly. This should be positioned approximately a metre below the base of the turning mechanism housing with a guard rail surrounding it giving unrestricted access to the service access panel(s) and mounting fasteners.

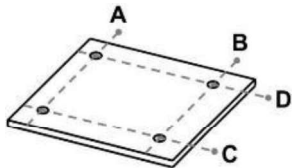
MOUNTING STRUCTURE

The design of the mounting platform for the antenna and antenna pedestal should take into account the vibration requirements of resolution A.694 (17) and furthermore defined by IEC 60945. In addition to vibration, the design of the mounting platform should consider shock and torque due to operational conditions. The structure must also be capable of withstanding the high starting and stopping torques generated by an antenna motor. The mast is to be torsionally strong to avoid twisting due to the motor torque. Any deflection in azimuth will compromise bearing accuracy. For example, a 0.1° alignment error will result in a target at a range of 11 nautical miles being displaced in azimuth by approximately 35 metres.

The mounting surface, platform or mast must be able to fully support the weight of the transceiver/ antenna assembly and should be designed to minimise vibration, shock and movement.

MOUNTING PLATE TOLERANCE

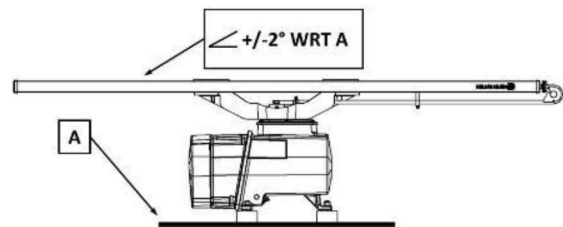
The mounting plate should be a 15mm (minimum) flat steel plate pre-drilled to accommodate the transceiver, the grounding point, cable access and cable restraint. The proposed mounting plate and location must be inspected and accepted as being suitable. All four planes shown (A, B, C and D) should be checked to ensure the surface is flat and that there is no curvature of the plate. The maximum deviation should not exceed 1.0mm.



Example of mounting plate (not to scale).

HORIZONTAL TOLERANCE

Once installed the radar antenna should be parallel to the horizon, the horizontal tolerance of the transceiver assembly with respect to the mounting plate/ surface is ± 2.0 degrees.



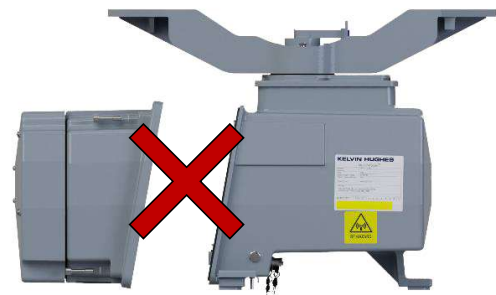
CAUTION: DO NOT OPEN THE TRANSCEIVER

DO NOT REMOVE THE COVER FROM THE TRANSCEIVER

The Mk5 SharpEye™ contains no user adjustable or configurable components, parts or assemblies.

Access to components or sub-assemblies within the system is NOT required during installation, commissioning or operation.

Unauthorised opening of the unit breaks tamper and waterproof seals and voids the warranty status of the unit.



4.1.4 Recommended orientation

The MK5 SharpEye™ should be positioned with the **fans/ access panels pointing aft**. As noted in the previous sections, provision must be made for safe service access platforms for planned and corrective maintenance work.



4.1.5 Inspection & installation notes

Prior to installation, all equipment should be inspected for any signs of damage that may have occurred during storage or transit.

- Equipment should only be installed and operated when all welding, grinding, sanding etc. within the installation area has been completed. All equipment is to be installed in a clean environment that is free from grinding dust, welding spatter, shot blast, moisture, excessive dust etc. Where this is not possible, then the equipment is to be protected to prevent dirt and contamination from work being carried out around the equipment. HENSOLDT UK will not be held liable for damage to equipment as a result of poor environmental conditions encountered pre-commissioning.
- Within the warranty period or prior to commissioning, the warranty will be void if the equipment is not correctly installed, operated, stored or is installed or operated in an unsuitable environment. This includes any damage caused by improper transport and storage.
- Any damage including accidental dropping of the unit, must be reported prior to installation or equipment operation. Damaged equipment must only be repaired when authorised by HENSOLDT UK.
- The Kelvin Hughes Mk5 SharpEye™ has protective coatings and finishes to allow it to withstand demanding environments around the world. If the unit sustains mechanical damage, such as scores or scratches that is sufficient enough to damage the coatings and expose underlying metal, the unit's ability to withstand salt corrosion may be reduced. Damage to finishes or metalwork should be made good immediately.
- Connectors, straps and fixings should be protected against corrosion using the Moly grease provided in the fitting kit, a suitable Denso products (or equivalent) or suitably specified halogen free, non-silicone based self-amalgamating tape that is intended for a marine environment (UV & Ozone stabilized). Manufacturer's instructions and safety data should be reviewed for suitability prior to use and application.

4.1.6 Fitting kits, cables & tools

FITTING KITS

KIT	KIT CONTENTS			
	PART NO.	QTY	DESCRIPTION/ APPLICATION	
LPA-A159 Low Profile Antenna (LPA) fitting kit	ASD-1573-1	4	Fasteners for fixing the antenna waveguide to the MK5 SharpEye™ rotating joint.	
	20-282-5008-25	4		
	LPA-A1351	1	Waveguide window	
	30-756-713	1	Waveguide 'O' ring	
	DMR-4216	1		
	25-263-0151-001	2	Waveguide clamp and M5x30 fasteners.	
	20-282-5009-25	2		
	45-280-0029-001	4		
	25-238-0035-001	4	M8x75 bolt, washers and Nyloc nuts for fastening the antenna to the MK5 SharpEye™ swing casting.	
	25-281-3076-27	4		
	25-272-1152-01	4		
PCV-A154 MK5 SharpEye™ fitting kit	PCV-A156	1	Earth strap	
	55-100-0575-001	1	Moly grease tube 80ml	
	55-100-0338-003	3	Anti-vibration mounts	
	25-281-3077-27	6	Plain Washer M12	
	25-273-0023-001	6	M12 Nut Nyloc	
	25-263-0071-001	3	M12X60	
	55-100-0590-001	1	Carabiner	
	55-100-0589-001	1	Wire rope	
	25-252-1304-27	1	M6 x 30 bolt	
	25-281-3072-27	2	M6 plain washer	
	PCV-1116	1	Spacer	
	25-273-0020-004	1	M6 Nyloc nut	

CABLES

PART NUMBER	DESCRIPTION
PCV-A137-*	DC power connection available in 5, 10 & 15 metre lengths.
SCV-A168-*	LAN connection available in 5, 10, 15, 20, 25 & 30 metre lengths.

4.1.7 Recommended tools

In addition to the normal tools required for installation and service work, the following will be required:

DESCRIPTION	WHERE USED
8mm spanner	M5 fasteners including the waveguide clamps
10mm spanner	M6 fasteners including earth connections.
19mm spanners (two required)	M12 fasteners including the main transceiver/ turning mechanism mounting fasteners.
4mm Hex socket key	M5 hex fasteners including the main transceiver retaining fasteners.
5mm Hex socket key	M6 hex fasteners.
6mm Hex socket key	M8 hex fasteners including the service access panel removal NOTE: Only required for corrective maintenance tasks.
4BA spanners (two recommended)	Waveguide coupling fasteners.
Pozi drivers	PZ1: M2.5 and M3 pozidrive fasteners. PZ2: M3.5, M4, M4.5 and M5 pozidrive fasteners. PZ3: M6 pozidrive fasteners.
Philips	General selection.
Torque wrench	Torque settings are detailed below and in the relevant installation sections.
Multimeter/ safety ohmmeter or bridge megger	Earth bonding tests.
Loctite 222	A small amount of Loctite 222 should be applied to fasteners that are NOT fitted with Nyloc fasteners or spring washers.
Greased plastic compound such as Henley's compound or Denso-Tape	Waterproofing the waveguide couplings.

4.1.8 Torque settings

Unless otherwise stated, the following recommended dry torque values should be used for general fixings. A small amount of Loctite 222 should be applied to fasteners that are NOT fitted with Nyloc bolts or spring washers.

Fixing size/ Type	Torque number (Nm)	Notes
M3 STN ST	1	M3 to M8: incompressible parts to metal. The M12 fasteners for the main turning unit mounting are installed using the anti-vibration mounts supplied in the fitting kit.
M4 STN ST	2.2	
M5 STN ST	4.2	
M6 STN ST	5.6	
M8 STN ST	20	
M12 STN ST (see note)	50	
Semi-rigid RF cables	0.9	

4.2 Unpacking & lifting

SAFETY NOTICES

When unpacking, handling or planning the lifting of equipment, refer to the Safety Notices shown in section 2 with specific reference to the sections detailing **General Lifting of Equipment**, **Antenna Lifting** and **Correct & Incorrect Lifting Procedures**.

TRANSCEIVER UNPACKING

The Kelvin Hughes MK5 SharpEye™ is shipped in a **sealed packing bag** within a wooden transit / storage case.

CAUTION: SEALED PACKING

The sealed bag surrounding the transceiver within the transit/ storage case **MUST NOT BE OPENED** until the equipment is ready to be mounted.

UNPACKING NOTES & PRECAUTIONS

SEALED PACKING: When opening the sealed packing, ensure any cutting edges, blades etc. do not touch, scratch or score the MK5 SharpEye™ paintwork.

LIFTING: Observe all lifting precautions when handling and opening the transit/ storage case.

PACKING CASE MOUNTING BOLTS: The fasteners used to secure the transceiver to the transit/ storage case must never be used to fix the transceiver onto the operational platform. The fasteners from the PCV-A154 fitting kit must be used for this purpose.

EXTERNAL FAN CABLE REMAINS UNPLUGGED THE CABLE CONNECTING THE MAIN TRANSCEIVER HOUSING TO THE EXTERNAL FAN ASSEMBLY IS SUPPLIED DISCONNECTED.

- Do not connect the cable until the transceiver has been lifted and secured onto its operational platform.
- During the lifting and installation process, ensure that the cable and connector cannot be damaged or crushed.
- See section 5.7 for termination details

RETAIN THE TRANSIT / STORAGE CASE

The transit / storage case should be retained for future use and should not be discarded.



Example of packing case



Example of a MK5 SharpEye within the packing case



Example of fan cable location
Leave DISCONNECTED until lifting is complete

4.3 X-band LPA antenna installation

The following procedure is identical for both the **1.9m** and **1.3m** antennas.

- a) Locate the **LPA-A159 Fitting Kit** and ensure the contents are correct.
 - The kit is provided with a drawing that gives additional installation information.
 - A copy of the drawing can be found on the following page.

- b) Remove the transit bracket, fastener and cable tie that supports the waveguide to the antenna. The bracket and its fastenings are not required and may be discarded.

Remove all protective caps and ensure that all surfaces are clean, dry and free from grease and dirt.



- c) Observing the lifting notices shown in section 2, place the antenna on the swing casting/ yoke and fasten it into place using all four fasteners that are supplied in the LPA-A159 fitting kit.

WASHER LOCATION

- The self-centring bonded seal washers (**25-238-0035-001**) from the fitting kit are placed on the **TOP SURFACE**.
- The M8 Plain Washers (**25-281-3076-26**) are placed **UNDERNEATH THE SWING CASTING**.

ADDITIONAL NOTES

- Do not lubricate the main fasteners as this can lead to overtightening.
- During installation, the antenna fasteners should be tightened to ensure that the antenna is fully and safely supported whilst allowing the antenna to be moved slightly to assist in aligning the waveguide couplings. Lifting equipment/ supports should remain in place until the fasteners have been fully tightened.

- d) Ensure the 'o' ring (**30-756-713**) is in place on the rotating joint as shown opposite.

Ensuring correct orientation, ensure the waveguide window (**LPA-1351**) is in place between the antenna waveguide and the rotating joint.

The Antenna waveguide is fitted with a threaded bracket.

Using the fasteners supplied in the fitting kit, connect the antenna waveguide to the rotating joint and tighten to a torque of **2.5Nm**.



- e) Fit the waveguide support bracket (**DMR-5326**) using the M5 fasteners from the fitting kit and tighten to a torque of **2.5Nm**.



- f) The fasteners securing the antenna to the swing casting/ yoke must now be tightened to a torque of **20 Nm**. To prevent damage to the antenna surface, place a spanner on the top bolt and the torque wrench on the lower bolt head.

- g) The waveguide joint must be waterproofed by sealing with a layer of greased plastic compound such as Henley's compound or Denso-Tape.

Note: It is only necessary to apply enough sealing tape to seal the waveguide coupling and the fasteners. Multiple layers of tape are not required and can add to the overall weight of the antenna assembly.

- h) After installation, the antenna should be checked to ensure that it can freely rotate without obstruction.

END OF ANTENNA INSTALLATION PROCEDURE

4.4 Lifting

HEALTH & SAFETY

PRIOR TO LIFTING ANY EQUIPMENT, REFER TO THE SAFETY NOTICES SHOWN IN SECTION 2.

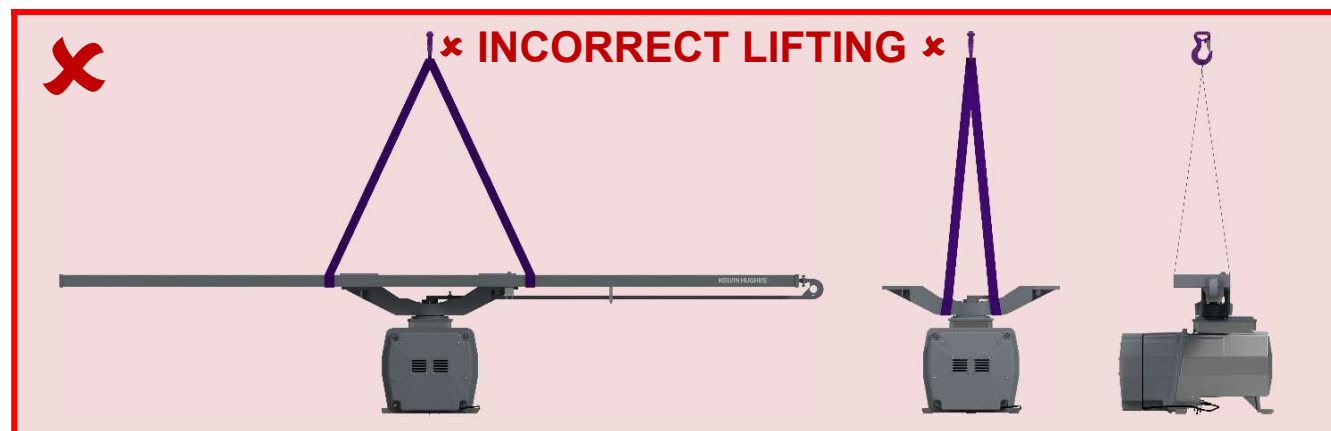
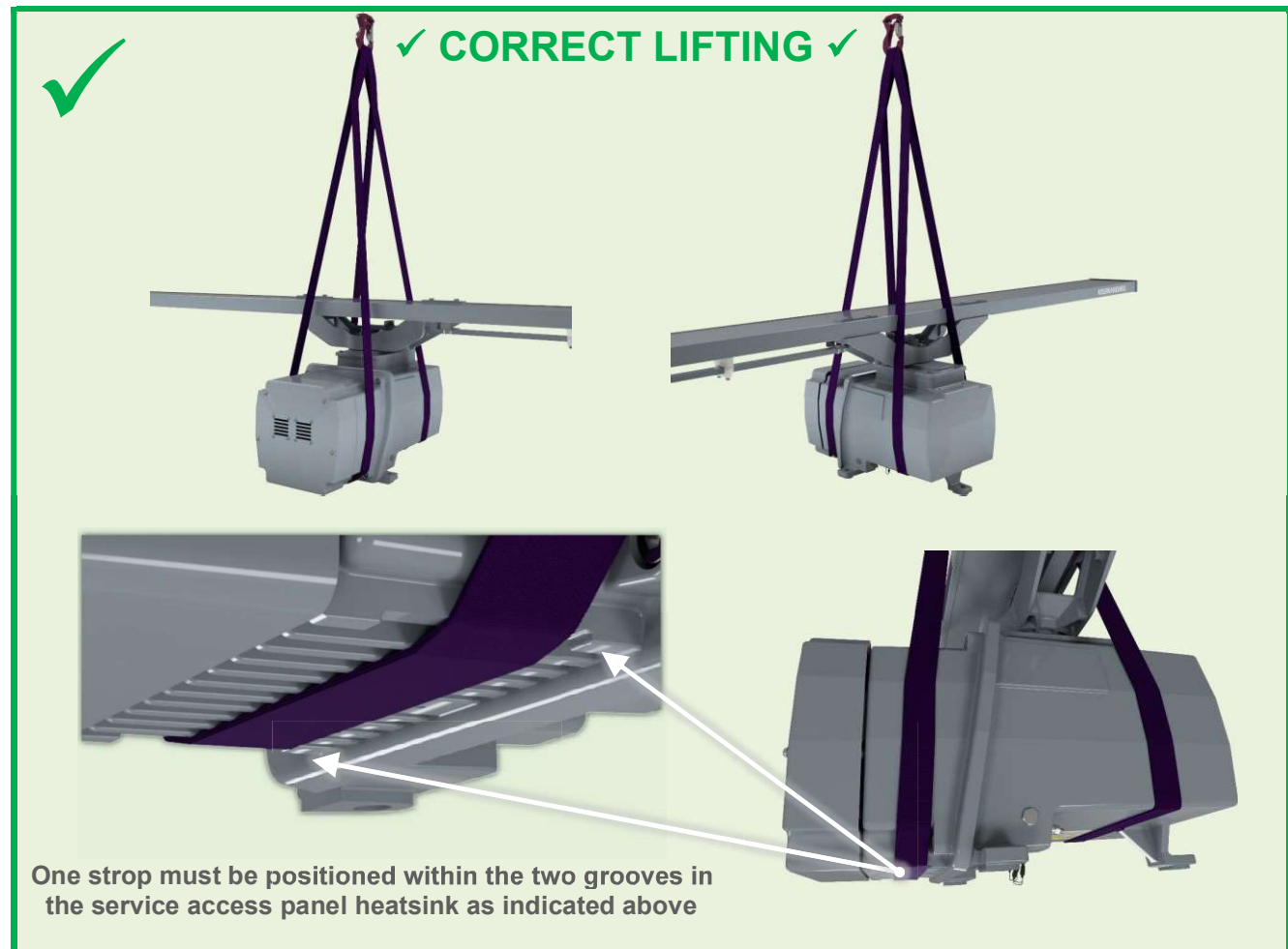
FAN ASSEMBLY CABLE

The cable connecting the main transceiver housing to the external Fan Assembly is supplied **DISCONNECTED**. **Do not connect the cable until the transceiver has been lifted and secured onto its operational platform.** During the lifting and installation process, ensure that the cable and connector cannot be damaged or crushed.

LIFTING/ LIFTING STROPS

The Kelvin Hughes MK5 SharpEye™ may be lifted with the Low Profile Antenna **FITTED** as illustrated below.

- Two (2) suitably rated 3m long strops with loops at both ends should be used.



4.5 Turning unit/ transceiver installation

MOUNTING FASTENERS

The M12 mounting fasteners supplied in the **PCV-A154** fitting kit **MUST** be used to secure the transceiver to the mounting platform and should be tightened to a torque of **50Nm**.

- Alternative or locally sourced fasteners must not be used,
- A small coating of the Molybdenum Disulphide grease provided in the fitting kit should be applied to threads prior to assembly,
- The top and bottom M12 nuts must be tightened simultaneously.

ANTI-VIBRATION MOUNTS

Regardless of the application, the Anti-vibration mounts **MUST BE FITTED** as detailed below and in the dimension drawings shown in the following pages.



Mounting arrangement showing anti vibration mounts.

SAFETY ROPE & CARABINER

The safety carabiner wraps around the mounting foot and must not interfere with the mounting fasteners.

Install the safety rope, carabiner and fasteners from the fitting kit as detailed below.

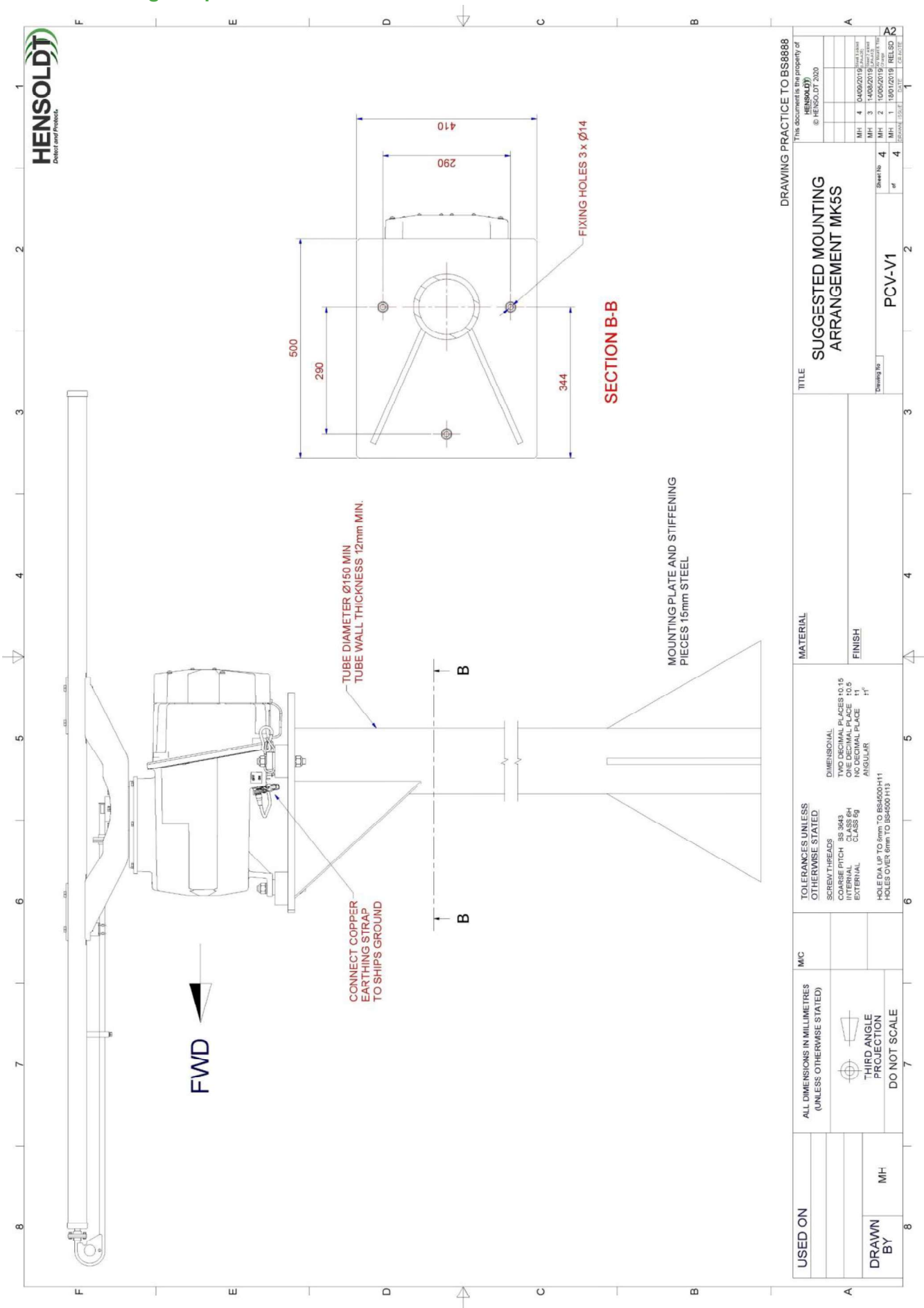


Safety rope & Carabiner

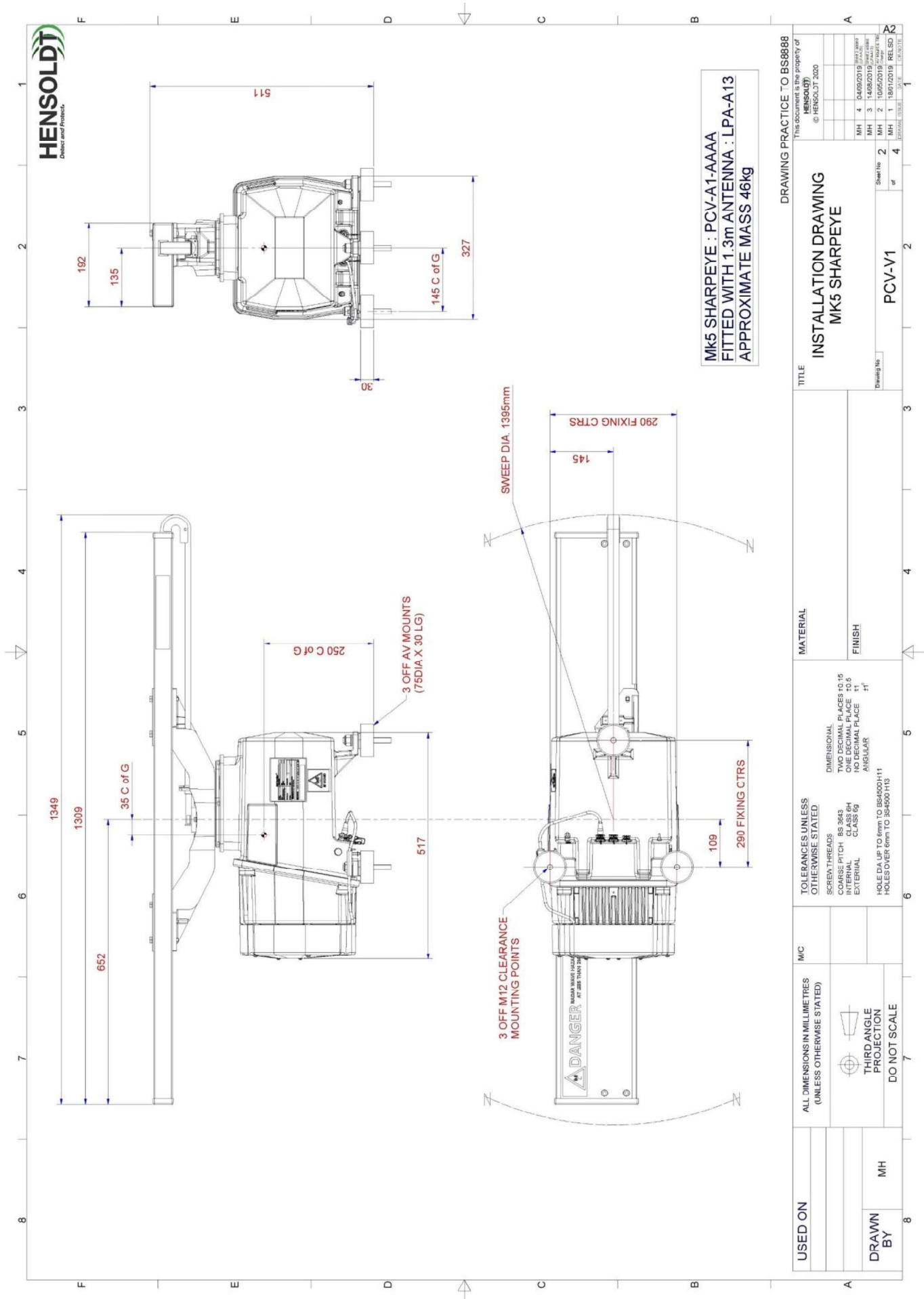
Detail of Safety rope & Carabiner fastener arrangement

4.6 Dimensions

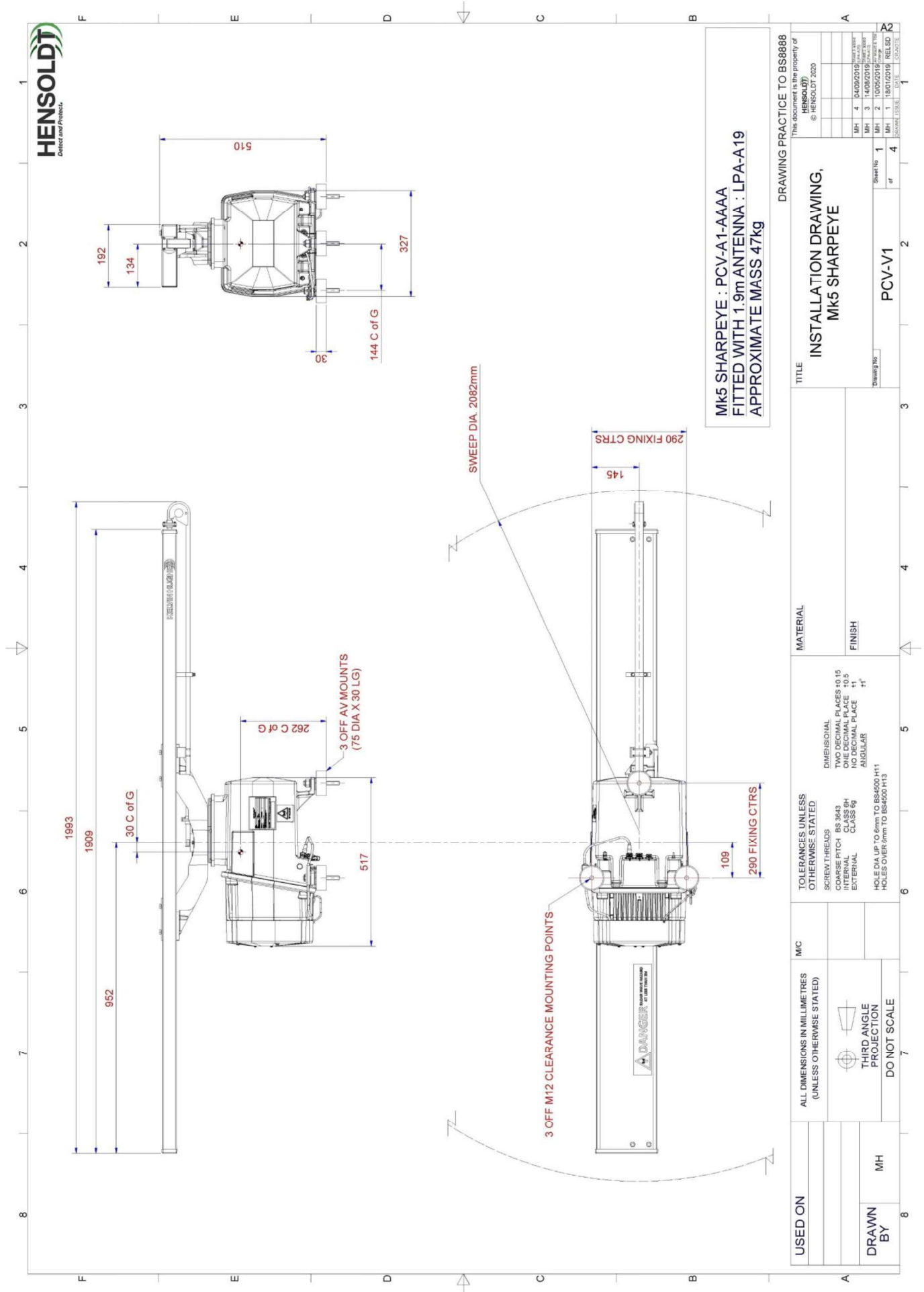
4.6.1 Mounting footprint



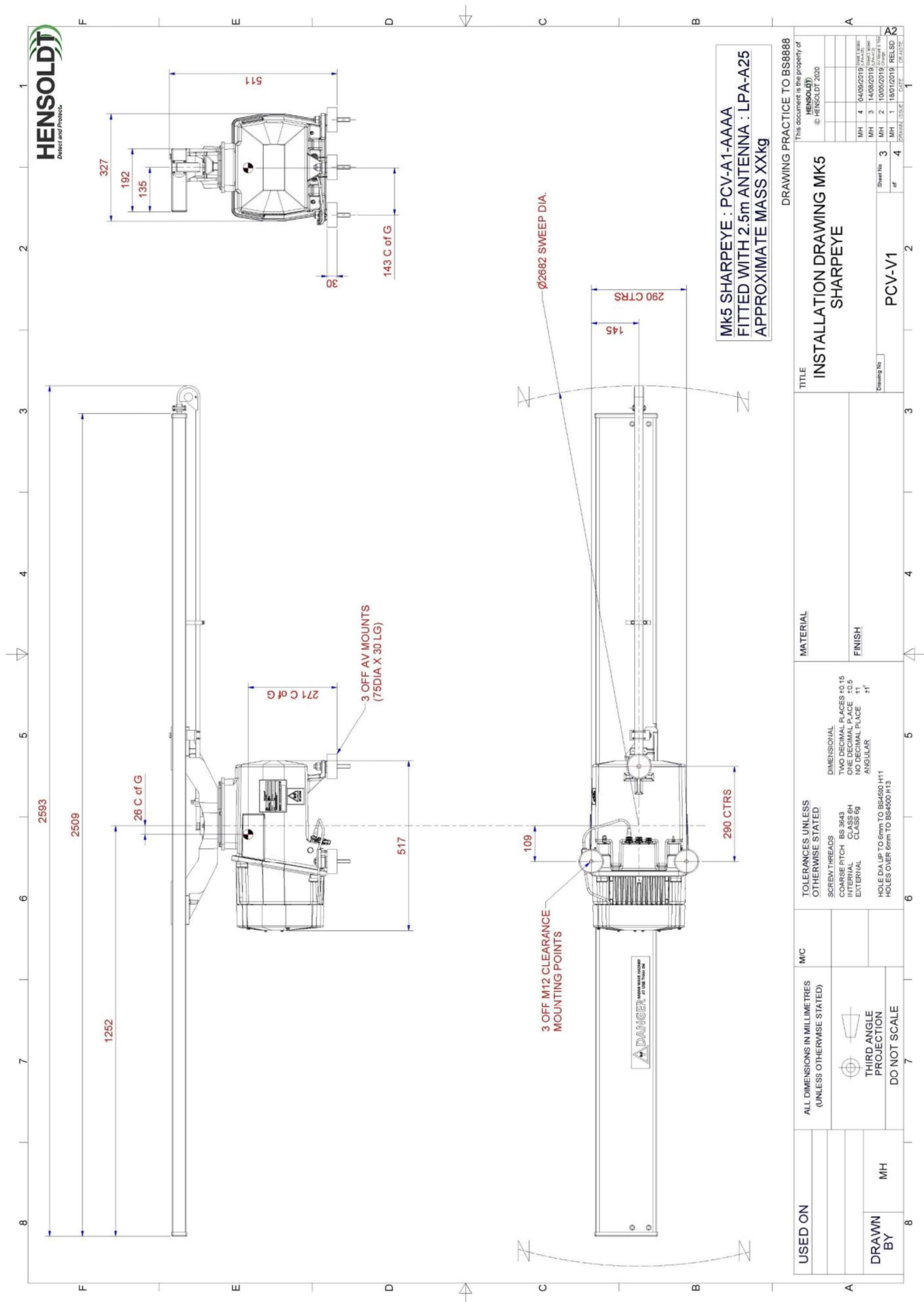
4.6.2 1.3m Antenna



4.6.3 1.9m antenna



4.6.4 2.5m antenna



5 Termination

5.1 Cabling, termination and general notes

CHASSIS MOUNTED ON/ OFF SWITCH

Ensure the system is switched OFF and is fully isolated before making any connections or using the external chassis mounted ON/OFF switch. Refer to the [Operator Instructions](#) section for isolation details.

BULKHEAD AND DECK PENETRATION

Any bulkhead penetrations which are opened must be closed and sealed using appropriate materials thus maintaining existing water or fire proofing precautions.

DC/ AC BREAKER/ SWITCH (not supplied)

AC and/ or DC supplies to the system must be connected via clearly labelled, suitable rated, user accessible lockable breakers/ overcurrent protective devices with a protective earth (AC only).

The MK5 SharpEye™ and/ or optional PCV-A2 must not be connected directly to an unprotected/ un-switched DC power source.

EARTH CABLE CONNECTION

Regardless of the connection point, the earth/ ground wire in a cable must be longer than the supply voltage cables. This ensures the earth is the last to disconnect in the event of the cable being accidentally pulled away from the equipment or the supply connection. Equipment should not be switched ON or connected to a power source when an earth connection point is disconnected.

MINIMUM BEND RADIUS

The minimum bend radius of the cable must be observed when laying the cable. Where a bend radius is not stated, a minimum bend radius of 12 x the cable diameter should be assumed for HENSOLDT UK supplied cable.

CABLING

- Cabling, terminations and connections should be made to the applicable standards and regulations for the specific application.
- Cable ferrules should be used as appropriate.
- Cables are to be of correct specification and rating and should be run in suitable cable trays or guides. They should be laid in positions that cannot cause an obstruction or hazard.
- Cable runs must allow for service loops.
- All cables should be secured in position using cable ties placed at regular intervals.
- In order to reduce electromagnetic interference effects, all cables should be routed as directly as possible, consistent with consideration for other equipment.
- Always route data cables as far away as possible from other equipment, cables, high current carrying AC and DC power lines and radio-transmitter lines.
- Crossing of cables should be done at right angles (90°) to minimize magnetic field coupling.
- Cables must be laid and secured in a fashion that does not place undue stress or strain on the cable or the connector(s). Ensure excessive strain is not applied to the cable or the connectors when connecting and disconnecting the main DC power and LAN cables.
- Provision must be made on the mounting platform for securing of the cables.

CABLING (continued)

- Secure cables in such a way to prevent gradual abrasion against a platform. If this is unavoidable measures should be taken to protect the cable at the point where abrasion occurs and regular inspections undertaken.

CONNECTION/ CONNECTOR NOTES

- Fully isolate all sources of power to the system before mating or de-mating any connection.
- Installation of external connectors should only be undertaken in dry conditions.
- Connectors should be inspected prior to installation to ensure that pins are not bent, corroded or otherwise damaged and that no contamination, pollution or moisture has entered either mating half. Where required, cleaning should be undertaken in such a way as not to damage the contacts or insulation.
- Where fitted, protective connector caps should be retained or be left attached to the system for future use.
- External connectors should never be left disconnected and exposed to the elements.
- Ensure the cable restraining method does not strain the connector as this could cause the connector to become damaged.

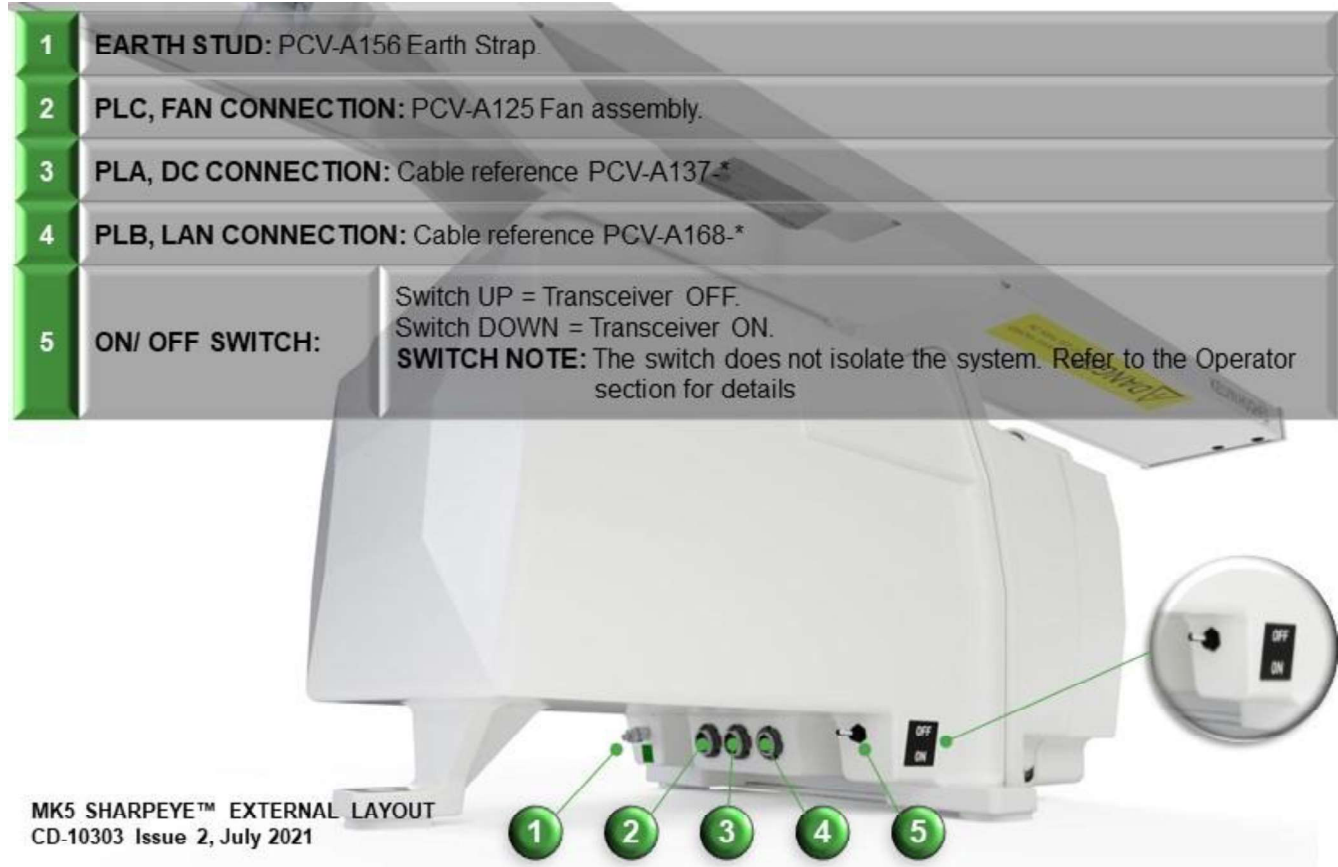
MATING/ DE-MATING CONNECTORS

- The external connectors are keyed, push-pull latching that can only be inserted in one orientation.
- Correct mating and de-mating of the connector requires very little force. To remove the connectors pull the collar back then pull with minimal force. If effort is required when connecting or disconnecting, the wrong technique is being employed.
- Care should be taken when mating and de-mating connectors so that the connector shell finish is not damaged.
- When fitted ensure each connector is fully inserted and makes a full waterproof seal.

SHIELDING

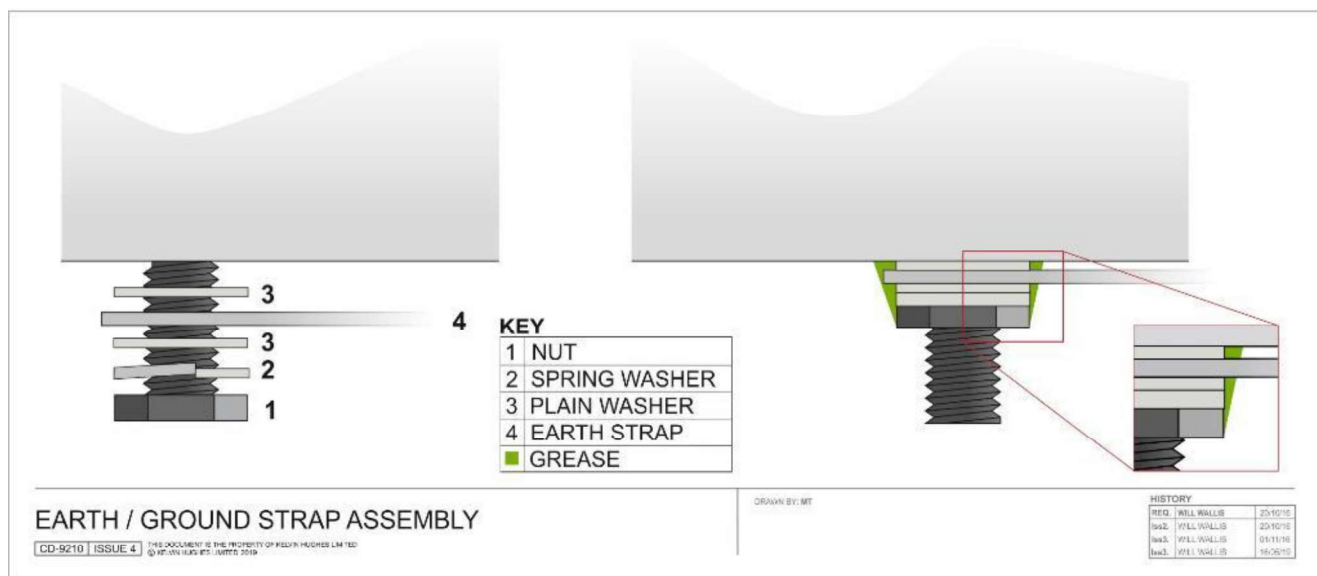
- Ensure that all cables are properly shielded (screened) and that the cable shielding is intact.
- In order to achieve the best EMC performance, shielding should be terminated 360° around the both ends of the cable.
- The product power cable shielding and earth conductor should be connected to a common proven ground.
- When batteries are used to power the equipment, typically the common ground point is a bonded ground, i.e. with the ground point connected to battery negative, and situated as close as possible to the battery negative terminal. If a bonded ground system is not possible, a non-bonded RF ground may be used.
- When grounding any system, always keep the length of connecting braid, wires or straps as short as possible.

5.2 Connector & Switch locations

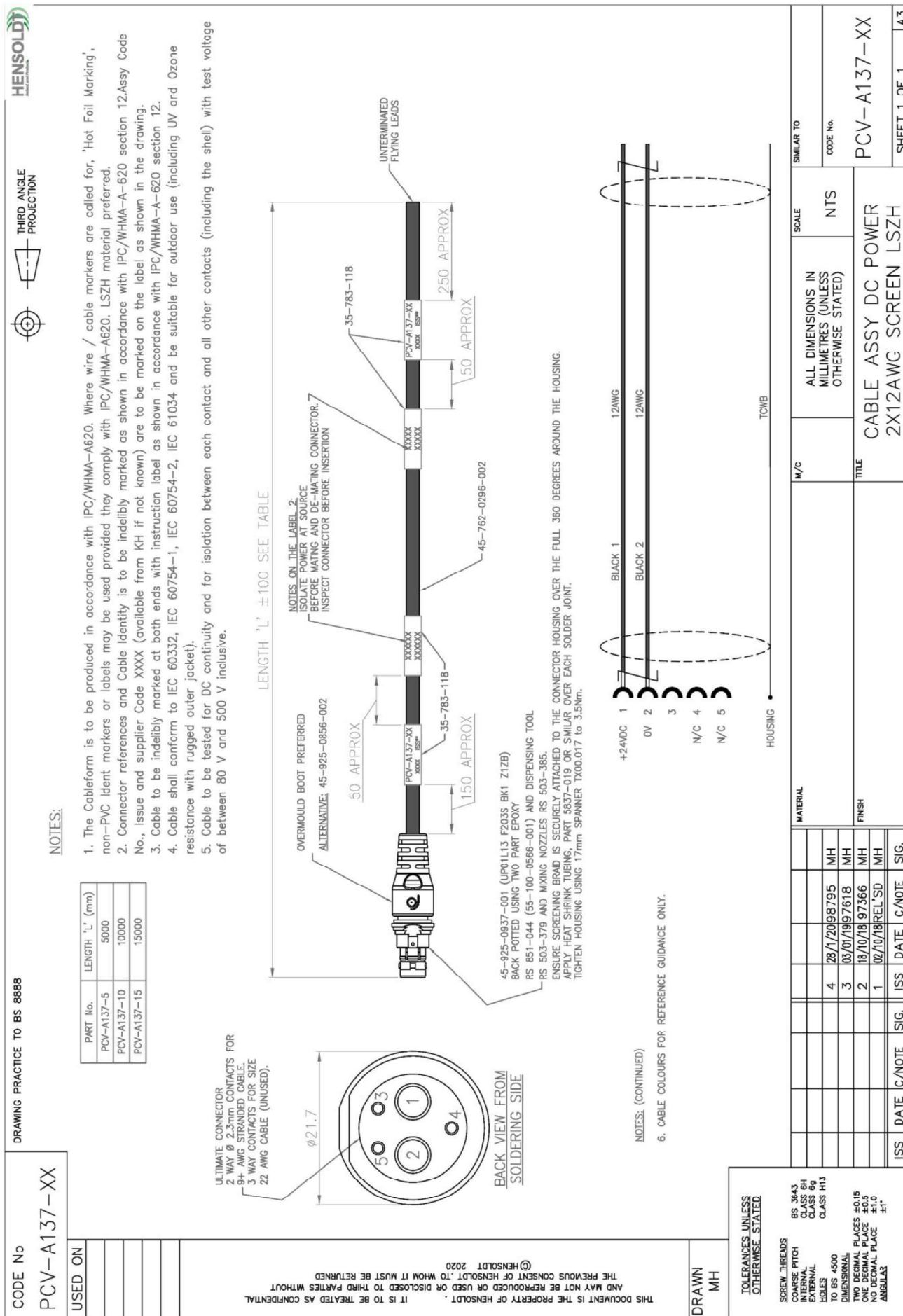


5.3 Earth stud

- The main casing earth stud must be connected to a proven and tested earth point using the PCV-A156 earth strap supplied in the fitting kit. Alternative grounding cables, braids or arrangements must not be used.
- The earth connection must be tested for conductivity using a high current impedance meter such as a Megger or similar.
- To ensure the earth bonding cannot deteriorate over time, the terminals should be protected using the Moly grease provided in the fitting kit or in line with local working practices.



5.4 PCV-A137-* DC cable



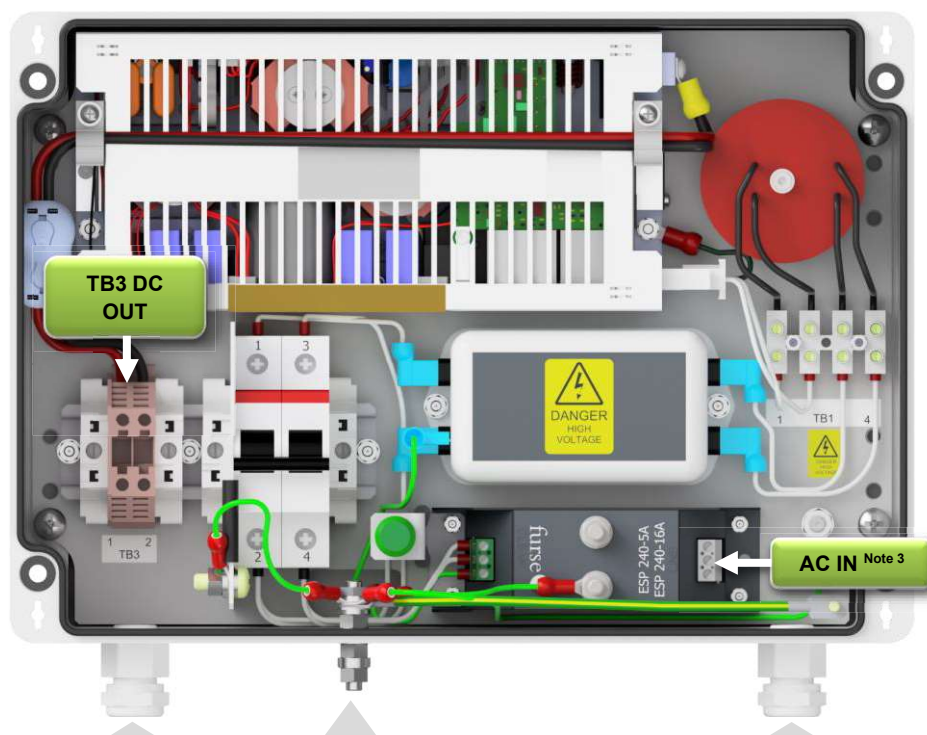
5.6 PCV-A2 AC/DC supply (optional)

WARNING: HAZARDOUS VOLTAGES

The PCV-A2 ^{Note} must never be operated or switched ON with the lid removed. Hazardous AC and DC voltages are present on exposed components and terminals within the unit when it is switched ON.

TERMINATION

The optional PCV-A2 must be terminated in accordance with the instructions shown in section 5.1. ^{Note 1 & 2}



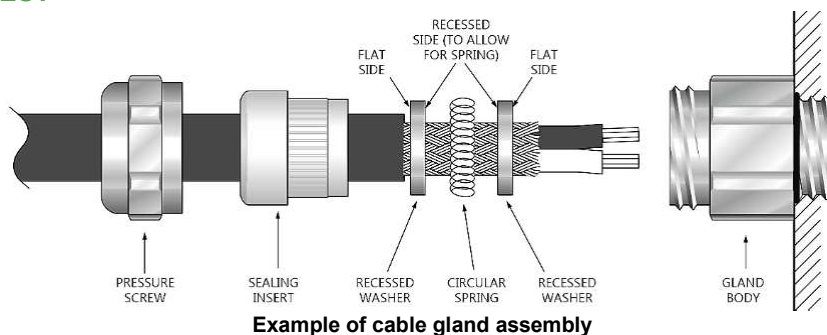
GL2 CABLE GLAND FOR DC OUTPUT		M6 EARTH STUD Prior to connecting any source of power, the unit must be connected to a tested and proven earth point.	GL1 CABLE GLAND FOR AC INPUT ^{Note 2 & 3}	
TB3-1	+Ve DC OUT		E	Earth
TB3-2	-Ve DC OUT		N	L2 (Neutral)
			L	L1 (live)

Internal layout of the PCV-A2 for reference use only

CABLE GLAND ASSEMBLY & PULL TEST

When a cable has been installed and the gland tightened, pull and push the cable ensuring that no movement of the cable is possible in the gland.

Carry out conductivity tests to ensure the cable screen is connected to ground/ chassis.



Example of cable gland assembly

3RD PARTY POWER SUPPLIES

Where a third party AC/ DC Power supply is to be used that is not a HENSOLDT UK supplied item, the unit must be designed in accordance with the requirements of IEC 60950-1:2005. The power supply should be designed in such a way that under single fault conditions, mains/ AC voltages cannot be applied to the DC output.

Note 1: Early versions of the PCV-A2 carried the part number **PCV-A157** which is identical in all respects.

Note 2: AC inputs to the PCV-A2 must be suitably protected as detailed in section 5.1.

Note 3: Check the labels on the AC input terminal block for correct pin identification.

5.7 External fan connection

Once the unit has been mechanically installed onto its mounting position, the DC cable for the external fans should be connected. ^{Note}

CABLE LOCATION

The fan cable is supplied taped to the chassis and should NOT be removed until ready for connection.

CABLE CLAMP

The cable should be passed through the clamp located on one of the mounting feet. Once fitted, tighten the **8mm (M5)** bolt retaining the cable clamp to a torque of **4.2Nm**.

CONNECTOR

The power cable connects to **PLC** on the unit housing (see section 5.2 for connector location).



Mk5 SharpEye™ shown with the external DC fan cable connected



Example of fan power cable location



Detail of fan power cable clamp

Note: The fan cable is supplied DISCONNECTED. Do not connect the cable until the transceiver has been lifted and secured onto its operational platform. During the lifting and installation process, ensure that the cable and connector cannot be damaged or crushed.