Document history

<table>
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<tr>
<th>Issue number</th>
<th>Release date</th>
<th>Details</th>
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<tr>
<td>1</td>
<td>24th March 2016</td>
<td>1st Release</td>
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<tr>
<td>2</td>
<td>15th June 2016</td>
<td>Updates to specifications. General amendments and changes in formatting. Cable details changed.</td>
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Amendment record

When an amendment is incorporated into this handbook, the details should be recorded below. Any equipment modifications should also be shown.

<table>
<thead>
<tr>
<th>Amendment number</th>
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<th>Initials</th>
<th>Equipment modification number</th>
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When working on Kelvin Hughes Ltd equipment, operators, engineers and agents 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 or vessel owner.

Risk assessments of a working area must be undertaken prior to commencement of any work and must be regularly reviewed.

HAZARDS
The 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.

**WARNING: ELECTRICAL HAZARDS**
Some equipment does not have safety interlocks fitted. Lethal single phase AC and DC voltages may be present when units are open and exposed. Before accessing any internal parts, ALL power sources to the equipment must be fully isolated; this must include the isolation of any UPS supported supplies to the system.

**WARNING: HIGH VOLTAGES**
This product contains high voltages. Do NOT remove any covers or otherwise attempt to access internal components, unless specifically instructed in this document.

**WARNING: SWITCH OFF POWER SUPPLY**
Ensure all power supplies are switched OFF before starting to install this product. Do NOT connect or disconnect the equipment with the power switched ON, unless instructed in this document.

**ANTENNA ROTATION WARNING**
Before rotating the radar scanner, ensure all personnel are clear.

**EQUIPMENT ACCESS**
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 include rotating equipment, radiation hazards and where applicable, working at heights.

**RADIATION HAZARDS**
Avoid exposure to the main beam of a stationary radar antenna. Avoid standing closer than 2 metres from the central front face of the antenna.

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.

The radar scanner transmits electromagnetic energy at microwave frequencies which can be harmful, particularly to the eyes. Do NOT look at the scanner from close range. Ensure personnel are clear of the scanner when it is powered on.

<table>
<thead>
<tr>
<th>Antenna</th>
<th>Range Within Which the Power Density Exceeds the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10W/m²</td>
</tr>
<tr>
<td>Rotating</td>
<td>34 cm or less from the radar scanner</td>
</tr>
</tbody>
</table>
WORKING ALOFT

CAUTION: SAFETY ALOFT
When working aloft or near any radar scanners, moving or RF radiating equipment, ALL power sources to the platform and equipment must be fully isolated.

Prior to working aloft, all AC supply breakers supplying power to the system must be switched OFF and locked. Ensure someone in authority or at ground level knows of your intentions and ensure that suitable clear warnings are in place.

Ensure all means of access aloft are secure and beware of wet or slippery ladder rungs and working areas.

All working at height health & safety requirements and procedures including the inspection and use of personal protective equipment (PPE) such as approved safety harnesses and gloves, must be adhered to at all times as required by your employer, site regulations, shipyard and / or vessel.

CAUTION: SAFETY CORDON
When working aloft a safety cordon must be established and managed below the working area(s).

CAUTION: DROP HAZARDS
When working aloft, all tools, Line Replacement Units (LRU’s) and any loose items must be safely stowed or secured so that they cannot present a drop hazard.

CAUTION: WEATHER HAZARDS
When weather conditions are poor, a full risk assessment must be carried prior to working aloft as defined by an individual’s employer or shipborne safety procedures. 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.

ANTI-STATIC HANDLING
Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Persons removing sub-units from equipment containing these devices must be earthed by a wrist strap and a resistor at the labelled point provided on/within the equipment.

Observe the following precautions when handling these devices in their un-terminated state, or sub-units containing these devices:

- Soldering irons used during authorised repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer.
- Outer clothing worn must be unable to generate static charges.
- Printed circuit boards fitted with these devices must be stored and transported in anti-static containers.
- Fit new devices in a special antistatic safe handling area.

Fully isolate and mechanically disconnect all sources of AC before attaching ESD protective wrist straps to the various points in the system.

RoHS STATEMENT
For details on RoHS statements please contact Kelvin Hughes Ltd; contact details can be found at the end of this handbook.

END OF LIFE DISPOSAL
When the equipment detailed in this handbook has reached the end of its serviceable life, the various parts that make up the system must be disposed of in accordance with the WEEE Directive.

The Waste Electrical and Electronic Equipment (WEEE) Directive requires the recycling of waste electrical and electronic equipment. Whilst the WEEE Directive does not apply to some Kelvin Hughes Ltd products, we support its policy and ask you to be aware of how to dispose of this product.
GROUNDING/ EARTH POINTS
All parts of the system must be fully and correctly connected to a proven earth point prior to connecting any source of AC or DC power.

The system must never be switched ON or operated with an earthing point disconnected.

Connection point: The equipment is fitted with a single protective earth connection point which is indicated on the mechanical installation drawings.

Conductivity tests: During installation and maintenance, the earth connections must be tested for conductivity using a high current impedance meter such as a Megger or similar.

Wrist Straps: Fully isolate and mechanically disconnect all sources of AC or DC supply before attaching ESD protective wrist straps to the various points in the system.

WARNING
The system must NOT be operated or have power switched ON with Earth/ Grounding points disconnected.

SERVICING AND REPAIR
Service and equipment repair must only be undertaken by an authorised service agent/ engineer. Un-authorised repair or servicing of equipment during the warranty period may invalidate the warranty status of the equipment.

LIFTING EQUIPMENT
- All health and safety requirements must be checked and 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.

WARNING
The transceiver and antenna are heavy items that must be hoisted to the fixing position using suitable lifting equipment, a secured block and tackle or by rope strops.

During installation, the equipment being lifted must be secured and supported at all times to prevent any risk of falling or slipping.

Gearboxes must never be lifted by the antenna or swing casting.

The system must NOT be lifted with the antenna assembled onto the unit.

Kelvin Hughes cannot be held responsible for any damage that occurs to supplied or 3rd party equipment as a result of incorrect lifting procedures or handling or equipment.
### 3 General Notices

#### 3.1 Suggested tools

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power drill</td>
</tr>
<tr>
<td>2</td>
<td>13 mm socket</td>
</tr>
<tr>
<td>3</td>
<td>17 mm socket</td>
</tr>
<tr>
<td>4</td>
<td>Screwdriver (&quot;Pozidrive&quot; head)</td>
</tr>
<tr>
<td>5</td>
<td>Adhesive tape</td>
</tr>
<tr>
<td>6</td>
<td>11 mm drill bit</td>
</tr>
<tr>
<td>7</td>
<td>3 mm drill bit</td>
</tr>
<tr>
<td>8</td>
<td>17 mm spanner</td>
</tr>
<tr>
<td>9</td>
<td>13 mm spanner</td>
</tr>
<tr>
<td>10</td>
<td>Torque wrench</td>
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#### 3.2 Fitting kit contents

<table>
<thead>
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<th>Item</th>
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<tbody>
<tr>
<td>1</td>
<td>Pedestal</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Mounting template</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Denso paste</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>E70352 Voltage Converter</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>E70352 cable clamp</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Lifting eye</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Stud</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Plain Washer</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Spring washer</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Nut</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>E70352 mounting screw</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>E70352 cable clamp mounting screw</td>
<td>3</td>
</tr>
</tbody>
</table>
3.3 Disclaimers

WATER INGRESS
Although the waterproof rating capacity of this product exceeds that called for by the IPX6 standard, water intrusion and subsequent equipment failure may occur if the transceiver enclosure is subjected to commercial high pressure washing. Kelvin Hughes Ltd will not warrant equipment subjected to high pressure washing.

EMC INSTALLATION GUIDELINES
The X-band 12kW transceiver system conforms to the appropriate Electromagnetic Compatibility (EMC) regulations, to minimize electromagnetic interference between equipment and minimize the effect such interference could have on the performance of your system.

Correct installation is required to ensure that EMC performance is not compromised.

For optimum EMC performance we recommend that wherever possible the equipment and cables connected to it are:
- At least 1m from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 2m.
- More than 2 m from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The cables supplied and specified for the equipment are correctly fitted and used.
- Cables are not cut or extended, unless doing so is detailed in the installation manual.

NOTICE
Where constraints on the installation prevent any of the above recommendations, always ensure the maximum possible separation between different items of electrical equipment, to provide the best conditions for EMC performance throughout the installation

SUPPRESSION FERRITES
Cables supplied with the equipment may be fitted with suppression ferrites. These are important for correct EMC performance. If a ferrite has to be removed for any purpose (e.g. installation or maintenance), it must be replaced in the original position before the product is used.

Use only ferrites of the correct type as supplied with the cables.

3.4 Declaration of conformity

The X-band 12kW transceiver and open Array radar scanners are in compliance with the essential requirements of R & TTE directive 1999/5EC.
4 Typical system
5 Mechanical installation

5.1 Location requirements

When selecting a location for the scanner/transceiver it is important to consider a number of factors. Additional information on the sighting and position of a radar system is available from Kelvin Hughes Ltd on request.

HORIZONTAL POSITION
The radar scanner should be positioned as near as possible to your vessel’s centreline.

HEIGHT
The radar scanner should normally be mounted as high as practical above the waterline.
- Mount the scanner above head height out of range of personnel, to avoid mechanical danger and minimize exposure to electromagnetic radiation.
- Radar operates at the line-of-sight, so a high mounting position gives better long range performance.
- Surrounding large objects, in the same horizontal plane, can interfere with the radar signal and can cause blind areas or shadow sectors and false targets on the radar display (see below).

SHADOW AREAS AND FALSE ECHOES
Mount the radar scanner away from large structures or equipment, such as engine stacks, searchlights, horns, or masts. These objects may cause shadow areas and false echoes. For example, if you mount the radar scanner on a mast, echoes from other targets may be reflected from the mast. It is particularly important to avoid shadow areas near the bow. Raising or even lowering the radar scanner may help to reduce these effects.

In shadow areas beyond the obstruction there will be a reduction of the beam intensity. There may be a blind sector if the beam intensity is not sufficient to obtain an echo from an object. This may occur even at close range. For this reason the angular width and relative bearing of any shadow area must be determined at installation. You may be able to detect shadow areas or false echoes on your multifunction display. For example, sea clutter can be used as a good indicator of blind arcs. Dark sectors on the radar display indicate possible shadowed areas. This information should be posted near the display unit and operators must be alert for targets in these blind areas.

ACCESS
The radar scanner should be easily accessible to allow maintenance to be carried out safely. Sufficient clearance must be allowed to fully open the scanner unit for maintenance and service.

MULTIPLE RADAR SCANNERS
If two radar scanners are installed at different locations in a dual radar system, care should be taken to allow for the difference in position of the radars when switching between the transceivers. This is especially noticeable at short ranges on larger vessels.

CABLES
All cables should be adequately clamped and protected from physical damage and exposure to heat. Avoid running cables through bilges or doorways, or close to moving or hot objects. Where a cable passes through an exposed bulkhead or deck head, use a watertight feed-through.

MOUNTING PLATFORM
The radar scanner must be mounted on a rigid and stable platform. The platform must be capable of supporting the mass and inertia of the radar scanner under seagoing conditions. The platform should not twist (causing bearing errors) or be subjected to excessive vibration.
5.2 Transceiver installation

Before mounting the unit, ensure that you have:

- Selected a suitable location.
- Identified the cable connections and route that the cables will take.
- Prepared suitable lifting equipment for fixing the pedestal to the mounting platform.
- The transceiver assembly with the antenna fitted weighs 29 kg

For safety reasons it is recommended that the unit is not fitted by one person. The unit is supplied with lifting eyes (maximum Safe Working Load (SWL) = 40kg) to facilitate the use of standard lifting accessories, such as a rope, chain or strop. The SWL of the lifting accessories should be a minimum of 150kg. Suitable lifting equipment could include a crane, hoist, or an appropriate rigid overhead structure.

**WARNING**

DO NOT LIFT THE TRANSCEIVER WITH THE ANTENNA FITTED

**NOTICE**

DO NOT connect any cables until the following steps have been completed.

1. Check the selected location.
   
   A clear, flat platform is required for mounting the pedestal unit.

2. Fix the supplied mounting template to the platform, using masking or self-adhesive tape.

3. Using a 3mm drill bit, drill the 4 holes, as indicated on the mounting template.
   
   Check that the holes have been drilled in the correct position.

4. Using an 11 mm drill bit, drill through the 4 holes.

5. Remove the mounting template.

6. Fit the lifting eyes by removing the existing bolts.
   
   The lifting eyes should be tightened to 7.0Nm torque.

7. The pedestal unit has a cap fitted over the open array mounting shaft to protect the protruding coaxial pin.
   
   This cap must be left in place until the open array antenna is fitted to the pedestal.

8. Grease the 4 metal studs with the supplied Denso paste.
9. Insert the studs no more than 18 mm into the holes in the pedestal base, and hand-tighten. 4 spare nuts are provided which may be used as a temporary locking nut to aid insertion of the studs into the pedestal. If the supplied studs are not long enough for the mounting surface thickness, use M10 stainless steel, grade A4-70 studding of a suitable length.

10. Using suitable lifting equipment (such as a rope or chain) attached to the lifting eyes; raise the pedestal over the mounting surface. Carefully lower into position, taking care that the studs pass through the holes without damaging the threads. Ensure that the front of the pedestal is pointing towards the bow of the vessel.

11. Grease the studs with the supplied Denso paste.

12. Use the 4 nuts and associated washers to secure the pedestal to the platform. Ensure all 4 sets of nuts and washers are used to secure the pedestal to the mounting platform.

   Tighten each nut to 30Nm torque.

13. There should be no more than 6 mm of excess stud below the nut. Cut-off any excess stud.

REMOVING THE RADAR PEDESTAL LIFTING EYES

1. Loosen the first lifting eye securing bolt, enough to remove the lifting eye.

2. Once the lifting eye is removed, re-tighten the bolt to 7Nm torque.

3. Repeat Steps 1 to 2 to remove all lifting eyes.
5.3 Antenna installation

**CAUTION**

Ensure that the antenna does not come into contact with the delicate protruding coaxial pin, this is a critical component and should be treated with caution. Follow all the instructions provided on the following page and ensure that the alignment guides are used.

Before attaching the antenna to the pedestal unit, ensure that:

- The pedestal base is securely fixed to the platform.
- The power/data cable is NOT attached.
- The pedestal unit has a cap fitted over the open array mounting shaft to protect the protruding co-axial pin. This cap must remain in place until you are ready to fit antenna to the pedestal unit.
- The pedestal power switch is in the OFF position.

1. Fit the 4 threaded alignment guides to the studs on the underside of the antenna.

2. Ensure a close fit. The alignment guides are essential to help prevent damage to the coaxial pin.

3. Remove the protective cap from the antenna shaft. Retain the cap for future use.

4. Position the antenna mounting bracket on the Port to Starboard axis of the pedestal.

5. Lift the antenna into position, ensuring it is in the correct orientation and that the threaded alignment guides are fitted. Carefully align and slowly lower the antenna.

6. Once the antenna is in position, remove the alignment guides.

7. Grease the 4 securing studs with the supplied Denso paste.

8. Use the 4 nuts and associated washers to secure the antenna to the pedestal, as shown in the following diagram.

9. Tighten each nut to 10 Nm torque.
5.4 E70352 Power supply

**CAUTION**
This product is NOT approved for use in hazardous/ flammable atmospheres such as in an engine room or near fuel tanks.

**POWER SUPPLY LOCATION REQUIREMENTS**
The E70352 is designed to be internally bulkhead mounted on a flat vertical surface.

**VENTILATION**
- Ensure that equipment is mounted in a compartment of suitable size.
- Ensure that ventilation holes are not obstructed.
- Allow adequate separation between equipment.

**CABLES**
Ensure the unit is mounted in a location which allows proper routing and connection of cables:
- Minimum bend radius of 100 mm (3.94 in) unless otherwise stated.
- Use cable supports to prevent stress on connectors.
- The maximum length of cable between the DC power source and the E70352 should not normally exceed 6m.
  - All power cable lengths should be kept as short as possible.
  - See section 7.3 for additional details.

**WATER INGRESS**
The E70352 is splash proof and suitable for internal mounting below decks only.

**ELECTRICAL INTERFACE**
Select a location that is far enough away from devices that may cause interference, such as motors, generators and radio transmitters/ receivers.

**POWER SUPPLY**
Select a location that is as close as possible to the vessels DC power source. This will help to keep cable runs to a minimum.
POWER SUPPLY INSTALLATION

Before mounting the unit, ensure that you have:

- Selected a suitable location. The unit is designed to be internally mounted in a vertical position.
- Identified the cable connections and route that the cables will take.

**NOTICE**

Do NOT connect any cables to the power supply until the following steps have been completed.

1. Check the selected location for the unit. The E70352 requires a clear, flat area with suitable space for routing the cables below the unit.
2. Hold the E70352 in place in the required mounting location.
3. Using a pencil, mark the drilling area inside the mounting lug on each side of the E70352 unit.
4. Using a 3 mm drill bit, drill a hole through the pencil marks.
5. Align the E70352 mounting lugs with the drill holes.
6. Hold the E70352 in place.
7. Using a suitable screwdriver, screw the self-tapping mounting screws through the mounting lug holes, into the drilled holes.
8. Connect the cables, according to the instructions provided in this handbook.
9. Hold the cable clamp in place over the cables, approximately 50 mm below the mounted E70352 unit.
10. Using a pencil, mark the drilling area inside each mounting bracket hole. **ENSURE THE CABLES DO NOT COVER THE HOLES.**
11. Using a 3mm drill bit, drill a hole through the pencil marks.
12. Hold the cable clamp in place, each hole aligned with the drill holes.
13. Using a suitable screwdriver, screw the self-tapping mounting screws through the bracket holes, into the drilled holes.
5.5.2 Mounting hole dimensions

Note: A drilling template is provided as part of the fitting kit.
5.5.3 E70352 DC Power Unit

5.6 Compass safe distances

**E70352 Power supply:** Mount at least 1.0m away from a magnetic compass.

**Transceiver/ scanner unit:** Mount at least 1.0m away from a magnetic compass.
6 Cabling guidance

6.1 General advice

CABLE TYPES & LENGTH
It is important to use cables of the appropriate type and length.
- Unless otherwise stated use only standard cables of the correct type as supplied with the equipment.
- Ensure that any additional cable that are not supplied are of the correct quality and gauge. For example, longer power cable runs may require larger wire gauges to minimize voltage drop along the run.

ROUTING CABLES
Cables must be routed correctly to maximise performance and prolong cable life.
- Do NOT bend cables excessively. Wherever possible, ensure a minimum bend radius of 100 mm.

![Minimum bend radius diagram]

- Protect all cables from physical damage and exposure to heat. Use trunking or conduit where possible. Do NOT run cables through bilges or doorways, or close to moving or hot objects.
- Secure cables in place using tie-wraps or lacing twine. Coil any extra cable and tie it out of the way.
- Where a cable passes through an exposed bulkhead or deckhead, use a suitable watertight feed-through.
- Do NOT run cables near to engines or fluorescent lights.

Always route data cables as far away as possible from:
- Other equipment and cables,
- High current carrying AC and DC power lines,
- Antennae.

STRAIN RELIEF
Ensure adequate strain relief is provided. Protect connectors from strain and ensure they will not pull out under extreme sea conditions.
6.2 Grounding

All parts of the system MUST be fully and correctly connected to a proven earth point prior to connecting any source of AC power.

**CONNECTION POINT**
All Kelvin Hughes equipment is fitted with a single protective earth connection point which is indicated on the mechanical installation drawings.

The preferred minimum requirement for the path to the ground (bonded or non-bonded) is via a flat tinned copper braid, with a 30 A rating (1/4 inch or greater).

In any grounding system, always keep the length of connecting braid or wires as short as possible.

**CONDUCTIVITY TESTS**
During installation and maintenance, the earth connections must be tested for conductivity using a high current impedance meter such as a Megger or similar.

**WRIST STRAPS**
Fully isolate and mechanically disconnect all sources of AC before attaching ESD protective wrist straps to the various points in the system.

**CABLE SCREENS**
Unless otherwise specified, cable screens should be connected to a proven and tested earth point by use of connectors or cable glands.

**WARNING**
The system must NOT be operated or have AC power switched ON with Earth/ Grounding points disconnected
7 CONNECTION DETAILS

7.1 Transceiver

STANDARD CABLE
Cable part number A55079 (25m length) connects the transceiver to the managed network switch and the DC power supply. The cable contains both DC power and the LAN data wires.

- All power connections must be made via the E70352 power supply as this controls and monitors the DC supply to the system. The transceiver must not be directly connected to a separate DC supply.
- Each system requires a dedicated E70352 unit.
- The power connection between the transceiver and the E70352 must be via the specified power and cable (purchased separately).
- The transceiver must be connected to the POWER OUT terminals of the E70352.
- The screen (drain) strands of the cable must be connected to one of the E70352 SCREEN terminals.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>RED WIRE</td>
</tr>
<tr>
<td></td>
<td>Connect to the positive POWER OUT terminal of the E70352.</td>
</tr>
<tr>
<td>2</td>
<td>BLACK WIRE</td>
</tr>
<tr>
<td></td>
<td>Connect to the negative POWER OUT terminal of the E70352.</td>
</tr>
<tr>
<td>3</td>
<td>SCREEN STRANDS</td>
</tr>
<tr>
<td></td>
<td>Connect to one of the SCREEN terminals of the E70352.</td>
</tr>
</tbody>
</table>

CAUTION
The standard cable must not be cut, shortened or lengthened.

TRANSCEIVER CONNECTOR
The power and data connector is at the rear of the radar scanner unit.

Ensuring that the arrow on the power and data cable connector is aligned with the red triangular mark on the radar scanner connector, connect the cable to the scanners’ connector, and fully hand-tighten. Do NOT use a wrench or any other tool.

NOTICE
If the antenna connector is disconnected after initial installation, it is recommended that before reconnecting, you lightly coat the connector thread with Renolit Aqua 2 Calcium grease.

7.2 Longer LAN cable

Where the distance between the network switch and the display sub-system exceeds 25m, a screened CAT5e LAN cable must be used and connected to the existing cable. Where cables are joined a screened coupler must be used and the joint should be secured to ensure that the connection cannot work loose.
### 7.3 Power Supply

The E70352 power supply is intended for use on ships DC power systems operating from 12 to 24 Volts DC.

**OPTIONAL AC/DC POWER SUPPLY**

Where no ships +24VDC is available an optional AC/DC power supply can be supplied. See section 10 for details.

**DC INPUT CABLE**

The power cable can be extended for longer cable runs between the E70352 and the ships DC supply or optional AC/DC power supply.

If you need to extend the power cable, use a waterproof junction box for external connections. The junction box should provide a terminal strip with sufficient space for power connections. The terminal strip should be a minimum of 30 Amp rating for power cores. It is essential that both power cores and the screen (drain) are connected and that the connection is of a very low resistance as considerable power passes through this connection.

The following table provides recommended total power cable lengths and gauges. These figures relate to the maximum distance of power cables from the ships DC supply or optional AC/DC power supply to the E70352.

<table>
<thead>
<tr>
<th>AWG American Wire gauge</th>
<th>mm²</th>
<th>Maximum distance 12 volt supply</th>
<th>Maximum distance 24 volt supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>10.55</td>
<td>15m</td>
<td>55m</td>
</tr>
<tr>
<td>8</td>
<td>8.36</td>
<td>10m</td>
<td>40m</td>
</tr>
<tr>
<td>10</td>
<td>5.26</td>
<td>8m</td>
<td>32m</td>
</tr>
<tr>
<td>11</td>
<td>4.17</td>
<td>6m</td>
<td>24m</td>
</tr>
</tbody>
</table>

**CAUTION**

Exceeding the following cable lengths may cause unreliable operation.

**NOTICE**

If the required extensions result in unacceptably large diameter cables, use two or even smaller gauge wires to achieve the required copper wire cross-section. For example, using two pairs of 2mm² cables is equivalent to using two single 4 mm² cables.

**EARTH / SCREEN WIRE EXTENSION**

The earth wire can be extended for longer cable runs between the E70352 and your vessels RF ground system.

Extensions to the screen (drain) wire should use an 8 mm braid or AWG 10 (5.26 mm²) multi stranded cable.
POWER SUPPLY CONNECTIONS

- The power supply must be connected to a dedicated breaker or a DC distribution panel.
- The DC input must be connected to the POWER IN terminals.
- Do NOT connect additional power switches to the cable providing the power feed to the power supply.
- All power connections between the E70352 and the power source must have appropriate fuse or breaker protection (see below).
- The SCREEN terminals must be connected to a tested and proven ground/earth.
- The system must NOT be connected to a positively-grounded power system.

1. POWER OUT (Positive) – connect to the RED wire of the cable.
2. POWER OUT (Negative) – connect to the BLACK wire of the cable.
3. SCREEN – connect to the bare screen (drain) strands of the cable.
4. SCREEN – connect to your vessel’s RF ground system.
5. POWER IN (positive) – connect to the positive terminal of the DC distribution panel or battery isolator switch.
6. POWER IN (negative) – connect to the negative battery terminal.
7. Not used in this application
8. Not used in this application
9. Not used in this application

7.4 Breaker and fuse ratings

All power connections between the E70352 and its power source must be protected by a thermal circuit breaker or fuse, fitted close to the power connection. The connection from the output of the E70352 to the transceiver does not require a fuse or circuit breaker.

If you do not have a thermal circuit breaker or fuse in your power circuit (fitted to the DC distribution panel, for example) you MUST fit an in-line breaker or fuse to the positive wire of the power cable.

The following table provides suitable ratings for battery isolator switches, circuit breakers and fuses.

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Device</th>
<th>12 kW scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 volt</td>
<td>Isolator switch</td>
<td>30 amps (minimum rating)</td>
</tr>
<tr>
<td></td>
<td>Thermal breaker</td>
<td>15 amps</td>
</tr>
<tr>
<td></td>
<td>Fuse</td>
<td>20 amps</td>
</tr>
<tr>
<td>24 volt</td>
<td>Isolator switch</td>
<td>15 amps (minimum rating)</td>
</tr>
<tr>
<td></td>
<td>Thermal breaker</td>
<td>8 amps</td>
</tr>
<tr>
<td></td>
<td>Fuse</td>
<td>10 amps</td>
</tr>
</tbody>
</table>
8 Setting to work

8.1 Radar scanner initial power on test

With all cables correctly and securely connected, ensure the transceiver power switch is set to ON.

DISPLAY SUB-SYSTEM
The display sub-system must be switched on and commissioned to control the transceiver.

At switch ON, the magnetron warm-up sequence should start, after which the transceiver should enter Standby mode.

8.2 Radar checks

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RADAR SCANNER SAFETY</td>
</tr>
<tr>
<td>Before rotating the radar scanner, ensure all personnel are clear.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RADAR TRANSMISSION SAFETY</td>
</tr>
<tr>
<td>The radar scanner transmits electromagnetic energy; ensure all personnel are clear of the scanner when the radar is transmitting.</td>
</tr>
</tbody>
</table>

1. From the display sub-system, select the transceiver and place it into run.
2. Ensure that the system runs and that the antenna rotates.
3. Test the transceiver functionality across all available ranges.
8.3 Check and adjust bearing alignment

The radar bearing alignment ensures that radar objects appear at the correct bearing relative to ownship.

You should check the bearing alignment of any new installation.

1: Target object (such as a buoy) dead ahead

2: Target displayed on the radar display is not aligned with the Ship’s Heading Marker (SHM). Bearing alignment is required.

CONFIGURATION APP
The bearing and antenna parking alignment is configured using a stand-alone application.

The APP is delivered as a software bundle with the Kelvin Hughes Navigation Display.

The configuration is carried out on the installation engineer’s laptop when it is connected to the MDC-A201-1 Managed network Switch.

The setup is carried out as part of the display to transceiver commissioning.

COMMISSIONING DETAILS
The use and configuration of the Setup App is detailed in the Navigation Display commissioning handbook:

8.4 Troubleshooting

The troubleshooting information provides possible causes and corrective action required for common problems associated with marine electronics installations.

Prior to packing and shipping, the equipment is subjected to comprehensive test and quality assurance programmes. However, if you experience problems with the operation of the system, this section will help you to diagnose and correct problems in order to restore normal operation.

If after referring to this section you are still having problems with your unit, please contact Kelvin Hughes Ltd Technical Support for further advice.

POWER UP TROUBLESHOOTING
Problems at power and their possible causes and solutions are described here.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Possible solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The transceiver does not start up or operate</td>
<td>Problem with the power supply</td>
<td>Check relevant fuses/ breakers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check that the power supply cable is sound and that all connections are tight and free from corrosion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check that the power source is of the correct voltage and sufficient current.</td>
</tr>
</tbody>
</table>

RADAR TROUBLESHOOTING
Problems with the radar and their possible causes and solutions are described here.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
<th>Possible solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Data or No scanner message</td>
<td>Radar scanner power supply</td>
<td>Check that the scanner power supply cable is sound and that all connections are tight and free from corrosion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the relevant fuses and breakers.</td>
</tr>
<tr>
<td>The bearing of a target on the radar screen is incorrect.</td>
<td>The radar bearing alignment requires correcting</td>
<td>Check power source is of the correct voltage and sufficient current (using voltage booster if appropriate).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and adjust radar bearing alignment.</td>
</tr>
</tbody>
</table>

POWER SUPPLY LED INDICATIONS

<table>
<thead>
<tr>
<th>LED name</th>
<th>LED color/ state</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Green/ solid</td>
<td>Radar operating normally</td>
</tr>
<tr>
<td>Fault</td>
<td>Red/ solid</td>
<td>Fault condition</td>
</tr>
<tr>
<td>Sleep</td>
<td>Yellow/ flashing</td>
<td>Radar scanner in standby</td>
</tr>
<tr>
<td></td>
<td>Yellow/ solid</td>
<td>Fault condition, unit self-recoverts after 20 seconds</td>
</tr>
</tbody>
</table>
## 9 Specification

<table>
<thead>
<tr>
<th><strong>General</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions</strong></td>
<td>Pedestal: 412 mm x 402 mm (to top of antenna)</td>
</tr>
<tr>
<td></td>
<td>Antenna length: 1918 mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>29 kg (with antenna)</td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>10.8 to 32 volts (using E70352)</td>
</tr>
<tr>
<td><strong>Power consumption (typical)</strong></td>
<td>&lt; 110 watts</td>
</tr>
<tr>
<td><strong>Power consumption (Standby)</strong></td>
<td>&lt; 30 watts</td>
</tr>
<tr>
<td><strong>Power consumption (sleep)</strong></td>
<td>&lt; 1.2 watts</td>
</tr>
<tr>
<td><strong>Warm up time</strong></td>
<td>75 seconds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environmental</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waterproof rating</strong></td>
<td>IPX6</td>
</tr>
<tr>
<td><strong>Operating temperature range</strong></td>
<td>-25°C to +55°C</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>Up to 40°C at 95% relative humidity.</td>
</tr>
<tr>
<td><strong>Maximum wind speed</strong></td>
<td>Starts in winds up to 100Kn</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Transmitter</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>9405 MHz ±20 MHz</td>
</tr>
<tr>
<td><strong>Peak output power</strong></td>
<td>12kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Receiver</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intermediate frequency:</strong></td>
<td>75MHz</td>
</tr>
<tr>
<td><strong>Receiver characteristics:</strong></td>
<td>Linear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Antenna</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beamwidth (vertical)</strong></td>
<td>25° nominal</td>
</tr>
<tr>
<td><strong>Beamwidth (horizontal)</strong></td>
<td>1.15° nominal</td>
</tr>
<tr>
<td><strong>Polarisation</strong></td>
<td>Horizontal</td>
</tr>
<tr>
<td><strong>Rotation speed</strong></td>
<td>24RPM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Approvals</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC60945</td>
<td></td>
</tr>
<tr>
<td>IEC62388</td>
<td></td>
</tr>
</tbody>
</table>
Page Intentionally blank
10 Optional AC/DC power supply

Kelvin Hughes part number: 80119460

The optional AC to DC power supply can be used where no ships DC power is available to power the E70352 transceiver power supply.

10.1 Installation

DIMENSIONS

SUITEABLE LOCATIONS
- Ensure the unit is mounted in a location that allows proper routing and connection of cables.
- Ensure that the unit is mounted in a compartment of suitable size.
- It is important to check the unit’s location to ensure it is correctly mounted and that all fastenings are secure and tightened.
- Make sure that the device will not be affected by electromagnetic field generators.
- The chosen location should not be an area of high vibration.
- The area should be free of dust.
- The device should not be left in direct sunlight.

10.2 Grounding

The unit must be grounded to a tested and proven ground point. The earth connections must be tested for conductivity using a high conductivity impedance meter such as a Megger or similar.

CAUTION
The system must NOT be operated or have AC power switched ON with Earth/ Grounding points disconnected.
10.3 Termination

<table>
<thead>
<tr>
<th>Function</th>
<th>Terminal Number</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Alarm</td>
<td>X2-1</td>
<td>N/C</td>
</tr>
<tr>
<td></td>
<td>X2-2</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>X2-3</td>
<td>N/O</td>
</tr>
<tr>
<td>+24VDC OUT</td>
<td>X4-1</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td>X4-2</td>
<td>OV</td>
</tr>
<tr>
<td></td>
<td>X4-3</td>
<td>+24VDC OUT</td>
</tr>
<tr>
<td>+24V Battery input</td>
<td>X5-1</td>
<td>Ground</td>
</tr>
<tr>
<td>(not used in this application)</td>
<td>X5-2</td>
<td>OV</td>
</tr>
<tr>
<td></td>
<td>X5-3</td>
<td>+24VDC IN</td>
</tr>
<tr>
<td>230 VAC INPUT</td>
<td>X1-1</td>
<td>Chassis/ Ground</td>
</tr>
<tr>
<td></td>
<td>X1-2</td>
<td>Natural</td>
</tr>
<tr>
<td></td>
<td>X1-3</td>
<td>Live</td>
</tr>
</tbody>
</table>

10.4 Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum input voltage</td>
<td>110/127V AC or 220/ 237V AC</td>
</tr>
<tr>
<td></td>
<td>160VA 50/60HZ</td>
</tr>
<tr>
<td>Maximum output voltage</td>
<td>24V DC @ 170W</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-15°C to +55°C, 93% relative humidity</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20°C to +70°C, 93% relative humidity</td>
</tr>
<tr>
<td>Power supply wires</td>
<td>110V AC - 2 X 1.5mm²</td>
</tr>
<tr>
<td></td>
<td>220V AC - 2 X 0.7mm²</td>
</tr>
<tr>
<td></td>
<td>24V AC - 2 X 6.0mm²</td>
</tr>
<tr>
<td>Note: Absolute maximum voltage on</td>
<td></td>
</tr>
<tr>
<td>battery input is 32V.</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>5kg</td>
</tr>
</tbody>
</table>

10.5 Operation

There are no operator functions or controls apart from the ON/OFF switch on the outside of the device.

**WARNING**

**ELECTRICAL HAZARDS**

Lethal single phase AC and DC voltages are present within the unit.
The unit must be fully isolate from the AC mains supply before removing the cover.

10.6 Maintenance

The power supply cannot be repaired in the field.

**Input Fuses:**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Fuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>110/127V AC</td>
<td>T2A</td>
</tr>
<tr>
<td>220/ 237V AC</td>
<td>T1A</td>
</tr>
</tbody>
</table>
# 11 Contacting Kelvin Hughes

<table>
<thead>
<tr>
<th></th>
<th>Kelvin Hughes Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>6 Mollison Avenue</td>
</tr>
<tr>
<td><strong>Enfield</strong></td>
<td>EN3 7XQ</td>
</tr>
<tr>
<td><strong>United Kingdom</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Phone</strong>:</td>
<td>+44 (0)1992 805 200</td>
</tr>
<tr>
<td><strong>Fax</strong></td>
<td>+44 (0) 1992 805 310</td>
</tr>
</tbody>
</table>

**Service**
- **Email**: service@kelvinhughes.co.uk
- **Phone**: +44 (0)1992 805 301

**Technical Advice**
- **Email**: technical.advice@kelvinhughes.co.uk
- **Phone**: +44 (0)1992 805 302

**Spares**
- **Email**: spares@kelvinhughes.co.uk
- **Phone**: +44 (0)1992 805 301

**Internet**
- **Website**: www.kelvinhughes.com

**KELVIN HUGHES REGIONAL OFFICES**
A full list of regional offices and authorised service agents is also available on the Kelvin Hughes website.

<table>
<thead>
<tr>
<th>Region</th>
<th>Contact Information</th>
<th>Phone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelvin Hughes Rotterdam, Netherlands BV</td>
<td><a href="mailto:service@kelvinhughes.nl">service@kelvinhughes.nl</a></td>
<td>+31 10 472 4050</td>
<td>+31 10 472 4051</td>
</tr>
<tr>
<td>Kelvin Hughes A/S Bergen, Norway</td>
<td><a href="mailto:service@kelvinhughes.dk">service@kelvinhughes.dk</a></td>
<td>+45 8611 2888</td>
<td>+45 8611 2260</td>
</tr>
<tr>
<td>Kelvin Hughes A/S Arhus, Denmark</td>
<td><a href="mailto:service@kelvinhughes.dk">service@kelvinhughes.dk</a></td>
<td>+45 8611 2888</td>
<td>+45 8611 2260</td>
</tr>
<tr>
<td>Kelvin Hughes PTE Ltd Singapore</td>
<td><a href="mailto:service@khsing.com">service@khsing.com</a></td>
<td>+65 6545 9880</td>
<td>+65 6545 8892</td>
</tr>
</tbody>
</table>