SHIP'S TECHNICAL MANUAL

INSTALLATION, COMMISSIONING
and
MAINTENANCE INFORMATION
for
SharpEye™ X-BAND UPMAST TRANSCEIVER
fitted with ANTENNA LPA-A25

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AMENDMENT RECORD

When an amendment is incorporated into this publication, the details should be recorded below. Where the equipment has been modified, the modification number shown on the Amendment Instruction Sheet is also to be recorded.

Amdt. No.	Date Inserted	Initials	Mod. No.

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CONTENTS

PRELIMINARY PAGES

CHAPTERS

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FOREWORD

This Ship's Manual provides installation, commissioning and maintenance information for the ***SharpEye™*** X-band Transceiver and Antenna.

Maintenance must only be undertaken by qualified service engineers or by Kelvin Hughes and their approved agents. Unauthorised repair of equipment during the Warranty period will invalidate the Warranty. If you wish to undertake the maintenance of the equipment, then you need to ensure that the service engineers have undertaken a training course approved by Kelvin Hughes.

A general description of the equipment and the specification is given in Chapters 1 and 2 respectively. A full technical description to unit level is given in Chapter 3, including block diagrams and interconnection diagrams.

The Installation Information in Chapter 4 includes all physical installation information, including coaxial cable installation, and generic cabling data. For detailed cabling information to the display, refer to your System Manual.

The Commissioning Information in Chapter 5 includes generic information on commissioning from the master display and information specific to this equipment. For detailed information on commissioning from the display, refer to your System Manual.

The Maintenance Information in Chapter 6 covers routine maintenance procedures and fault diagnosis and repair to unit level.

A Parts List to unit level is given in Chapter 7.

A section is provided at the end of the manual for inclusion of customer information relating to the specific equipment supplied to your ship, including installation and service reports, and software information.

When operating, installing or maintaining your system, this manual should be used in conjunction with the following:

System Manuals provided for the particular installation, which provide Operating Installation and System Commissioning Information

Manuals for the other equipment supplied as part of the System.

Refer overleaf for contact details for the Kelvin Hughes Customer Service Group.

If a unit exhibits a fault, and you are unable to fix it, and therefore require a service engineer to attend your vessel, please contact our Service Control Centre, giving full details of the following:

1. Name of vessel (Phone or Fax number if fitted)
2. Equipment type
3. Software status (version number) (if applicable)
4. Next port of call, ETA/ETD and ship's agents
5. Fault description (with as much detail as possible)
6. Purchase order number with invoicing details
7. Contact Name

You may contact our direct line, send a fax or send an email.

Kelvin Hughes, Customer Services Group, New North Road, Hainault, Essex IG6 2UR (UK)

Phone: Main UK Switchboard: 44 (0)20 8502 6887
Direct Service Line & Out of Hours Emergency Technical Support: 44 (0)20 498 1761

email: service@kelvin hughes.co.uk

If you have any technical queries or require any technical information regarding your Kelvin Hughes bridge equipment you may phone our direct Service Line. You may also contact our direct line, send or fax an email to:

technical.advice@kelvinhughes.co.uk

If you require information on our training facilities or would like to have a quote for training, please give as much detail as possible. You may contact our direct line, send a fax or send an email to:

training@kelvinhughes.co.uk

For quotation of spares, or if you require any information regarding availability, lead times etc, you may contact our direct line, send a fax or send an email to:

spares@kelvinhughes.co.uk

Please Note. All quote requests must have full contact details. Our preferred method of contact is email, but Fax or Post may be used. We normally supply the quotation by email.

For more information regarding our contract services or to arrange a meeting with a member of our team you may email us at the following address. Those customers already holding an agreement with us may also use this email address to request a service, providing the same information as mentioned for service (no purchase order number required). You may contact our direct line, send a fax or send an email to:

contract.support@kelvinhughes.co.uk

IMPORTANT NOTICES
HEALTH AND SAFETY

1 All personnel are required to study these notices and familiarise themselves with all applicable safety precautions and bring them to the attention of others in the vicinity.

HIGH VOLTAGE WARNING

LETHAL HIGH VOLTAGES ARE PRESENT IN THE TRANSCEIVER

2 A current of 100 mA passing through the human body for one second can kill. This can occur at voltages as low as 35 V AC or 50 V DC. Some equipment in the system uses electrical power that can be lethal. Whenever practical, before carrying out installation, maintenance or repair, personnel involved must:

(1) Isolate the equipment from the electrical supply.

(2) Make tests to verify that the isolation is complete.

(3) Ensure that power cannot be accidentally reconnected.

DO NOT OPEN ANY OF THE UNITS WHEN THE RADAR IS OPERATIONAL - UNLESS FULLY QUALIFIED TO DO SO.

3 If it is essential to work on the equipment with power connected, work must only be undertaken by qualified personnel who are fully aware of the danger involved and who have taken adequate safety precautions to avoid contact with dangerous voltages.

HEALTH HAZARD

4 This equipment contains materials which produce toxic fumes when ignited.

5 The inhalation of dust and fumes or any contact with lubricants when cleaning the equipment may be temporarily harmful to health, depending on individual allergic reactions. Components which are broken or overheated may release toxic fumes or dust and must be treated with caution. Do not inhale the fumes and ensure that the dust and debris do not enter open cuts or abrasions. It is prudent to regard all damaged components as being potentially toxic, requiring careful handling and appropriate disposal.

RADIATION HAZARD: NON-IONISING

AERIAL RADIATION HAZARD: INJURY CAN RESULT FROM EXPOSURE TO THE MAIN BEAM OF A STATIONARY RADAR AERIAL. DO NOT STAND LESS THAN 2 m FROM THE CENTRAL FRONT FACE OF THE AERIAL.

6 It is accepted in most countries that no significant hazard is presented by radio frequency mean power density levels up to 10mW/cm. RF power levels in excess of this may cause harmful effects, particularly to the eyes.

7 Users of cardiac pacemakers should be aware that radio frequency transmissions, can damage some such devices or cause irregularities in their operation. Persons using a pacemaker should ascertain whether their device is likely to be affected before exposing themselves to the risk of malfunction.

SAFETY ALOFT

AERIAL ROTATION: BEFORE MAINTENANCE TO THE TURNING MECHANISM TAKES PLACE, DISABLE AERIAL ROTATION.

8 When working aloft, ensure that it is brought to the attention of someone in authority at deck or at ground level and that suitably placed warning notices are posted warning that work aloft is in progress. Ensure that the means of access aloft is secure and beware of wet or slippery ladder rungs and working areas.

9 When working on or near a radar scanner and other moving or r.f. radiating equipment, ensure that it is switched off and that the fuses have been removed and retained.

PERSONAL PROTECTION

10 Personal protection must be used whenever the possibility of an uncontrolled hazard exists. For example, a suitable face visor, gloves and a body apron should be worn when handling cathode ray tubes, as a precaution against injury in the event of breakage.

EQUIPMENT SAFETY

11 Do not run the radar with the rotating joint output disconnected.

12 Removal of printed circuit boards with power connected can damage FETs and Integrated Circuits.

13 The circuitry used on the equipment PCBs utilises CMOS Integrated Circuits. All the relevant CMOS precautions must be taken to avoid damage to CMOS circuitry when any board is removed.

14 The equipment should be serviced by qualified agents only.

ELECTRIC SHOCK RESUSCITATION

1 **SHOUT FOR HELP.**
SWITCH OFF ELECTRICITY IF POSSIBLE.

SWITCH OFF ELECTRICITY IMMEDIATELY. IF NOT POSSIBLE, DON'T WASTE TIME SEARCHING FOR A SWITCH

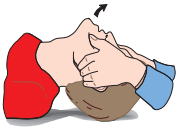
2 **REMOVE CASUALTY FROM DANGER.**

SAFEGUARD YOURSELF WHEN REMOVING CASUALTY FROM HAZARD.
IF CASUALTY IS STILL IN CONTACT WITH ELECTRICITY AND THE SUPPLY CANNOT BE ISOLATED, STAND ON A DRY NON-CONDUCTING MATERIAL (RUBBER MAT, WOOD, LINOLEUM). USE RUBBER GLOVES, DRY CLOTHING WOODEN BROOM, STOOL, CHAIR, LENGTH OF DRY ROPE OR WOOD TO PULL OR PUSH CASUALTY AWAY FROM THE HAZARD.

3 **REMOVE ANY OBVIOUS OBSTRUCTION TO BREATHING.**

IF CASUALTY IS NOT BREATHING, START RESUSCITATION AT ONCE.
GET HELP.

SHOUT & SHAKE CASUALTY (FOR RESPONSE)
LOOSEN NECKWARE,
TILT HEAD BACKWARDS & PUSH CHIN UPWARDS



CHECK FOR SIGNS OF CIRCULATION,
SIGNS OF LIFE (< 10 SECONDS).

SIGNS OF LIFE/CIRCULATION PRESENT

WHEN NORMAL BREATHING COMMENCES,
PLACE CASUALTY IN RECOVERY POSITION

KEEP CASUALTY AT REST.
MOVE USING A STRETCHER.
WATCH CLOSELY, PARTICULARLY FOR DIFFICULTY IN BREATHING. LIGHTLY COVER WITH BLANKETS OR OTHER MATERIALS

SIGNS OF LIFE/CIRCULATION ABSENT

HEART HAS STOPPED BEATING, LAY CASUALTY
ON THEIR BACK ON FIRM SURFACE eg. FLOOR

PERFORM CPR:
HEEL OF HAND IN CENTRE OF BREASTBONE
WITH OTHER HAND ON TOP (FINGERS OFF CHEST)
WRISTS & ELBOWS LOCKED COMPRESS DOWN 5cm.
REPEAT 30 TIMES IN TOTAL (SPEED 100 PER MINUTE)

OPEN AIRWAY, PINCH THE NOSE & HOLD THE CHIN.
TAKE NORMAL BREATH, SEAL MOUTH,
BLOW STEADILY (WATCHING CHEST RISE).
REMOVE MOUTH, CHECK THAT CHEST FALLS,
REPEAT RESCUE BREATH.

CONTINUE CPR WITH **30 CHEST COMPRESSIONS,**
THEN **2 BREATHS** UNTIL CASUALTY REVIVES &
COLOUR IMPROVES, OR HELP ARRIVES
OR YOU ARE EXHAUSTED.

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MEDICAL ASSISTANCE MAY BE OBTAINED ON / AT .....

CAUTION
Handling of Electrostatic-Sensitive Semiconductor Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

(1) Persons removing sub-units from an equipment using these devices must be earthed by a wrist strap and a resistor at the point provided on the equipment.

(2) Soldering irons used during the repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer.

(3) Outer clothing worn must be unable to generate static charges.

(4) Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

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CODE OF SAFE WORKING PRACTICES FOR THE INSTALLATION AND COMMISSIONING OF KELVIN HUGHES LIMITED MANUFACTURED EQUIPMENT

This code must be followed when installing or commissioning any Kelvin Hughes Limited product.
Failure to follow this code invalidates the equipment warranty.

SAFETY

Reference must be made to the Safety Warnings located at the beginning of each Kelvin Hughes Limited Manual and must be read and understood. These include but are not limited to, the knowledge and understanding of: 'Electric Shock Resuscitation', the safety interlock system, all lethal voltages present, source of supply to all equipment, any hazardous material in the equipment or area of work, radiation hazard from the beam of a Radar Antenna and any antenna rotation hazard.

Before working on antennas the following conditions must be met:

- A responsible person (such as the officer of the watch) must be informed that there will be an engineer working on the system.
- The system interlock must be activated.
- The source of power to the system must be isolated.
- Warning notices must be posted at the system power source and at all displays showing 'MAN WORKING ALOFT DO NOT SWITCH ON'. Local language considerations must be taken into account and included with the English statement above.
- When working above a height of 1.5 metres safety harnesses must be worn and must be clipped in to the superstructure.
- All tools must be securely lashed to ensure that they can not present a drop hazard.

INSPECTION

Before commencing work, the proposed installation locations must be inspected and accepted as being suitable for the equipment to be mounted securely following the installation procedures which can be found in the relevant Kelvin Hughes Limited manual under 'installations'. All characteristics of the equipment must be taken into account when inspecting the proposed location such as weight and torque of turning mechanisms, regulation height of Radar display units and type, length and specification of cables or waveguide.
All equipment must be inspected and checked off against the indent on unpacking, if practicable, for completeness and damage. Any discrepancies against the indent or damage to equipment must be reported to Kelvin Hughes Limited as soon as possible but in any case within 24 hours.

TECHNICAL CONSIDERATIONS

Earthing:
Earthing is to be completed by following the appropriate installation instructions, ensuring that all screws and bolts are tightened sufficiently and that any cable or braid is routed correctly.

Cabling:
Cables are to be of correct specification and rating and are to be run in suitable cable trays or guides. Any bulkhead penetrations, which are opened, must be closed thus maintaining existing fire proofing precautions. Metal cable ties must be used when running cable in any deckhead or bulkhead areas. Cables are to be terminated as per current IEEE regulations thus ensuring correct practices are followed.

Siting and Mounting of Equipment:
The equipment must be mounted following the relevant Kelvin Hughes Limited installation manual. Particular attention must be paid to the tightening of bolts and the use of 'Nylon' locking nuts in areas of vibration such as on antennas and turning mechanisms. Stainless steel nuts, washers and bolts must be used for all outdoor installations. No modifications are to be made to any Kelvin Hughes Limited equipment unless previously authorised in writing by Kelvin Hughes Limited and a copy of such authorisation kept with the equipment manual(s).

Maintenance and Care of Equipment:
Kelvin Hughes Ltd recommends inspection on a three monthly basis of all equipment. Particular attention is to be paid to turning mechanisms and scanners, which must be kept clean using only a soft cloth and soap and water - **No chemical agents or corrosive cleaning agents are to be used**. Any excessive end-to-end play, or excessive noise in scanners should be reported to Kelvin Hughes Limited within 24 hours of discovery.

PLEASE COMPLETE ONE CARD FOR EACH PIECE OF EQUIPMENT

KELVIN HUGHES LIMITED

EQUIPMENT REGISTRATION CERTIFICATE

FORM 050
ISSUE 3

(TO BE RETAINED ON VESSEL)

Equipment	Serial Number.	Voltage	Installed By	Date

ALL SERVICE COMMUNICATIONS TO BE DIRECTED TO:

KELVIN HUGHES LIMITED
CUSTOMER SERVICES
New North Road
Hainault
Ilford, Essex, IG6 2UR

Tel: 0208 501 6123
Fax: 0208 559 8526

e-mail: technical.advice@kelvinhughes.co.uk
service@kelvinhughes.co.uk

Name of Vessel	KELVIN HUGHES LIMITED EQUIPMENT REGISTRATION CERTIFICATE			Indent/Invoice number
Type of Equipment	Serial No. of Unit	Software Issue	Voltage	IMO No.
Display/Data Acquisition Unit				Tx 25 kW X ☐
Transmitter/Crash Survival Module				Tx 25 kW S UP ☐
Array				Tx 25 kW S Down ☐
Turning Mech.				Tx 10 kW UP ☐

Name and Address of Owner	Compass Type	Tx 10 kW Down ☐
	Log Type	Interswitched ☐
	GPS Type	Interfaced ☐
Telephone: Fax:	RADAR TO WHICH INTERFACED	

Agent's Name (Printed)	**ENGINEER** Print Name : Signature :	1. 2.

This Certificate Must be Returned to:-

Kelvin Hughes Limited,
Customer Services
New North Road,
Hainault,
Ilford, Essex, IG6 2UR

N.B. GUARANTEE CHARGES WILL NOT BE ACCEPTED UNTIL EQUIPMENT HAS BEEN OFFICIALLY REGISTERED.

Signature / Ship's Master (**MANDATORY**)

Date of Installation

Date of Expiry

Installed By

Agent's Name (Printed) :

Engineer's Name (Printed) :

Engineer's Name (Signature) :

Training Certificate Number :

Check List

- ☐ Earthing
- ☐ Bolts Torqued correctly
- ☐ Washers Fitted
- ☐ System Tested
- ☐ Waveguide Clamped & Watertight
- ☐ Health and Safety Requirements met
- ☐ Wiring Electrically Correct
- ☐ Voltage Rating Set Correctly
- ☐ Cable Runs Secured
- ☐ Latest Software Version Loaded
- ☐ Through Decks & Cable Glands Sealed

The Units have been installed in accordance with Kelvin Hughes Limited Code of Practices CP 225 and commissioned by a Kelvin Hughes Limited Authorised Engineer

The Authorised Engineer must print, sign and date below for Guarantee to be officially registered.

Signature .....

Print Name .....

Training Certificate Number .....

Date.....

CHAPTER 1

GENERAL DESCRIPTION

CONTENTS

ILLUSTRATIONS

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CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1 The ***SharpEye™*** Radar combines the latest concepts, technologies and state of the art performance in surface search capability into a high reliability product for the maritime industry. Comprising an antenna, gearbox and compact transceiver, ***SharpEye™*** Radar provides the mariner with a range of highly sophisticated and flexible operating modes and an unsurpassed ability to detect small targets such as buoys, yachts and personal water craft, in moderate to severe clutter environments. ***SharpEye™*** radically departs from conventional marine navigation radar practice through the transmission of low power RF pulses and application of pulse compression and coherent pulse Doppler techniques to provide sub-clutter visibility of targets.

2 The ***SharpEye™*** Radar is available as an X-band Transceiver in upmast configuration (DTX-A3) and is used with the Low Profile Antenna (LPA-A25).

3 The ***SharpEye™*** Transceiver operates at fixed antenna rotation speeds of 22 RPM or 44 RPM for optimum update rate. The antenna rotation speed is preset during installation and is not selectable by the operator.

4 The ***SharpEye™*** Transceiver has a range cell size of between 15 m and 30 m, depending on the range selected from the display.

5 Radar control is via a CAN bus to the display system with discrete analogue video, sync, azimuth and heading line signals to the display.

6 The ***SharpEye™*** Transceiver requires 110 V/220 V single phase AC for the transceiver electronics and 3-phase AC from a Drive Control Unit (GTX-A24) for the antenna turning motor. The Drive Control Unit uses the 220 V ship's single phase mains to generate a variable frequency 3-phase output for the antenna turning motor. The frequency of the 3-phase output determines the antenna rotation speed, and is set by links on installation to provide a 25 Hz output for 22 RPM operation or a 50 Hz output for 44 RPM operation, provided the input frequency is 50 Hz. If a 60 Hz input frequency is used the Drive Control Unit must also be reprogrammed as described in Chapter 5 to provide the correct output frequency.

7 A transformer can be supplied to allow the Drive Control Unit to be used with 110 V mains supplies.

8 The Upmast configuration is shown in Figure 1, and a typical implementation in Figure 2.

SYSTEM DESCRIPTION

Transceiver

9 The transceiver electronics and the transceiver power supply are mounted in a cast enclosure with one removable side cover, secured by seven captive bolts. The transceiver electronics are contained in a unit mounted on the side of the enclosure and the power supply is mounted on the base of the enclosure. The gearbox and motor are mounted on top of the enclosure with the antenna secured to the top of the gearbox on a swing casting.

WARNING

THERE IS NO SAFETY SWITCH ON THE UPMAST TRANSCEIVER/TURNING MECHANISM.
MAN ALOFT SAFETY IS PROVIDED BY AN ON/OFF KEYSWITCH ON THE ASSOCIATED DRIVE CONTROL UNIT (FOR DETAILS SEE BELOW).
THE ON/OFF KEYSWITCH MUST BE SET TO OFF AND THE KEY REMOVED BEFORE WORKING ON THE UPMAST TRANSCEIVER/TURNING MECHANISM.
THE INVERTER IN THE DRIVE CONTROL UNIT MUST BE SET TO REMOTE OPERATION DURING COMMISSIONING, OTHERWISE THE KEYSWITCH FUNCTION WILL BE OVERRIDDEN.

10 The gearbox has a hollow output shaft through which the rotating joint (rojo) passes. The output shaft also incorporates the mounting for the azimuth encoder, which provides angular position information in the form of azimuth and heading line pulses.

11 The azimuth encoder provides azimuth and heading line pulses to the transceiver, which uses the data internally. The azimuth and heading line pulses are also opto-isolated to provide outputs to the display system. There are two sets of azimuth pulses in quadrature (each set providing normal and inverse outputs with 1024 pulses per antenna revolution) and two heading line pulses (normal and inverse outputs).

12 The motor and gearbox operate in conjunction with the Drive Control Unit to rotate the antenna at speeds of up to 45 RPM in winds of up to 100 knots. The motor uses a variable frequency 3-phase supply of 220 V between phases from the Drive Control Unit.

13 The Drive Control Unit uses the ship's single phase mains, which is fed via an inverter to generate the 3-phase output. The frequency of the 3-phase output determines the antenna rotation speed. The Drive Control Unit provides a 'soft start' by controlling the supply frequency from 0 Hz to the operating frequency over a period of nominally 2 seconds.

14 The transceiver electronics comprise radar control and timing, waveform generator, solid state transmitter, duplexer, low noise RF receiver, digital receiver, signal processor and communications interface.

15 The waveform generator provides frequency modulated pulses at an intermediate frequency (IF), whose characteristics are determined by the range modes. The IF pulses are mixed with a local oscillator to provide an RF frequency signal to the solid state transmitter, which provides an RF output at 170 W peak power to a duplexer located within the transceiver. The signals from the duplexer are fed via a coaxial cable to the rotating joint and then to the antenna.

16 Return signals from the antenna are fed through the rotating joint to the transceiver, which routes the received signal via the duplexer to an internal low noise RF receiver, digital receiver and signal processor. Sensitivity time control (STC) is applied to the RF receiver to increase the dynamic range. The transceiver provides one analogue SYNC and one analogue VIDEO coaxial output to the display system.

17 Internal monitoring of the transmitter and receiver performance is provided, therefore no external components are required to ensure operation is satisfactory.

18 The power supply, located in the cast enclosure, provides the DC supplies for the transceiver from the 110 V/220 V single phase mains input. The power supply is autoranging, so no setting up is required for the input voltage.

Drive Control Unit

19 The Drive Control Unit provides a variable frequency 3 phase supply for the antenna turning motor. The Drive Control Unit accepts a 220 V single phase mains supply. It generates a 3 phase supply at either 25 Hz (for low speed antenna operation (22 RPM)) or 50 Hz (for high speed antenna operation (44 RPM)), set up by links made on installation. The default input frequency is 50 Hz to provide these output frequencies. If a different input frequency or output frequency are used, the Drive Control Unit must be reprogrammed as described in Chapter 5. The Drive Control Unit provides a 'soft start' of nominally 2 seconds, and a 'soft stop' of nominally 10 seconds for the antenna. This reduces torque when the antenna is started and stopped. If required, a transformer can be fitted to the mains input to enable the unit to be used with 110 V mains.

20 The Drive Control Unit has two indicators and a switch on the top of the unit. The indicators are MAINS ON, which is lit when the single phase mains input is present and MOTOR ON, which is lit when the 3 phase output to the motor is present. The switch provides a man aloft safety function, and is key operated. The key can only be removed when the switch is set to OFF. When set to OFF, the 3 phase output is inhibited, thus preventing the antenna from rotating. When set to ON the key is captive in the switch and the 3 phase power to the antenna motor is enabled. Note that when the switch is set to OFF the MOTOR ON indicator will always be unlit.

WARNING

ALWAYS SET THE KEYSWITCH TO OFF AND REMOVE THE KEY WHEN WORKING ON THE UPMAST TRANSCEIVER. THIS PREVENTS THE ANTENNA FROM ROTATING.
THE INVERTER MUST BE SET TO REMOTE OPERATION DURING COMMISSIONING, OTHERWISE THE KEYSWITCH FUNCTION WILL BE OVERRIDDEN.

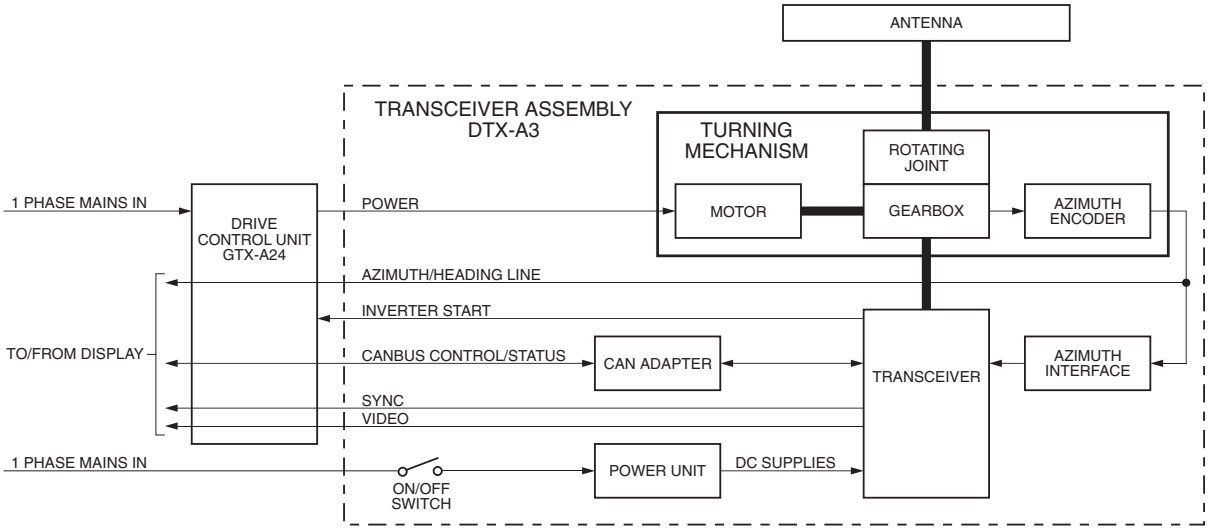

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Figure 1 - *SharpEye*™ Transceiver: Block Diagram

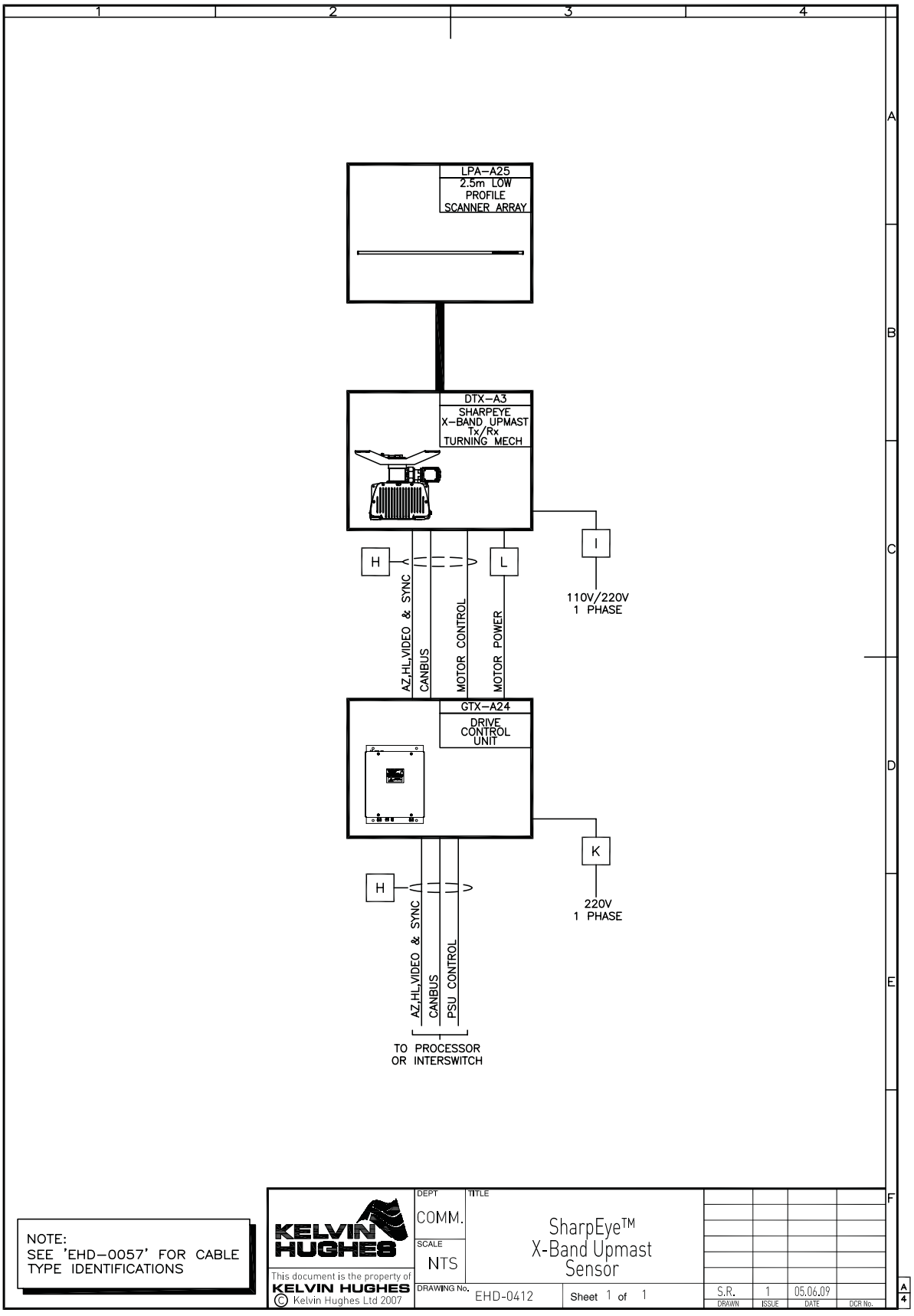

Figure 2 - *SharpEye™* Transceiver: Typical Configuration

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CHAPTER 2

SPECIFICATION

CONTENTS

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CHAPTER 2

SPECIFICATION

TECHNICAL SPECIFICATIONS

1 The technical specifications for the ***SharpEye***™ X-band Upmast Transceiver is as follows:

Features

Range resolution:	40 m
Dynamic range:	100 dB (including Sensitivity Time Constant (STC)) ensures simultaneous detection of large and small targets
Radar control:	CANbus
System Type:	Fully coherent

Transmitter

Frequency:	1 of 14 frequencies, each 20 MHz wide, selectable in the band 9.22 GHz to 9.48 GHz
Type:	Solid state power amplifier
RF Peak output power:	170 W minimum
Pulse width:	0.1 s to 40 s

Receiver

Type:	Single channel, linear
Noise figure:	5 dB
Dynamic range:	65 dB at Analogue-to-Digital output, excluding STC 96 dB at Analogue-to-Digital output, with STC
Output:	Analogue radar video and sync

Signal Processor

Digital Phase Sensitive Detector

Digital Pulse Compression

Maximum instrumented range:	48 nm
Compressed pulse lengths:	0.1 s or 0.2 s

Antenna

Antenna Type:	End fed slotted array
Polarisation:	Horizontal
Turning Circle:	2.6 m
Horizontal beamwidth:	0.95
Vertical beamwidth:	26
Sidelobes:	-30 dB, 1st sidelobe -26 dB typical
	>10 sidelobes -33 dB typical
Antenna gain:	30 dB
Frequency range:	9.22 GHz to 9.48 GHz (centre frequencies)

Turning Mechanism

Azimuth Data:	4096 pulses per antenna revolution
Heading Data:	1 pulse per revolution
Antenna rotation rates:	22 or 44 RPM for optimum update rate

Operating Temperature Ranges

Ambient Range	Operational:	-25°C to +55°C
	Storage:	-25 C to +70 C
Humidity	95% at +40°C	

Input Power

Input Power Single Phase:	110 V/220 V 50/60 Hz AC input
(Transceiver)	440 VA max
Input Power Single Phase:	220 V 50/60 Hz AC input
(Drive Control Unit):	(or 110 V via a transformer)
	2200 VA max

CHAPTER 3

TECHNICAL DESCRIPTION

CONTENTS

ILLUSTRATIONS

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CHAPTER 3

TECHNICAL DESCRIPTION

PHYSICAL DESCRIPTION

TRANSCEIVER

1 The transceiver is mounted in a cast enclosure with one removable side cover that allows access to the transceiver electronics (refer to Figure 1). The cover is fitted with a seal to prevent the ingress of moisture, and is secured to the cast enclosure by seven bolts. A strap attached to the cover and enclosure prevents the cover from being dropped when removed from the enclosure.

2 The main units are:

(1) Antenna Motor and Gearbox, 55-100-0273-001

(2) Azimuth/Heading Line Encoder, GTX-A188

(3) RF Rotating Joint, 45-750-0034-001

(4) Swing Mount for the antenna, LPA-1129

(5) Transceiver, DTX-A115

(6) Power Supply, 45-690-0062-002

(7) Switch and CAN Adapter PCA Assembly, DTX-A150 comprising:

(a) CAN Adapter PCB, NNR-A981

(b) ***SharpEye***™ Azimuth Interface PCA, DTX-A151

3 The Antenna Motor and Gearbox (55-100-0273-001) is mounted on top of the cast enclosure with the antenna turning motor facing the rear of the enclosure. The antenna is mounted on a swing casting (LPA-1129) fitted to the top of the gearbox. The gearbox has a hollow output shaft through which the RF Rotating Joint (rojo) passes. The output shaft also incorporates the mounting for the Azimuth Encoder (GTX-A188), which provides angular position information in the form of azimuth and heading line pulses.

4 The Transceiver (DTX-A115) is mounted on the side wall of the enclosure, the Power Supply (DTX-A111) is mounted on the base of the enclosure, and the Switch and CAN Adapter PCA Assembly (DTX-A150) is mounted on the rear end of the enclosure.

DRIVE CONTROL UNIT

5 The Drive Control Unit comprises a sheet metal rear plate which is formed to include the top and bottom of the unit and also provides the bulkhead fixing points (refer to Figure 2). The main sub-units, including the inverter, are bolted to the rear plate. A sheet metal wrap-around cover is secured in position by four screws.

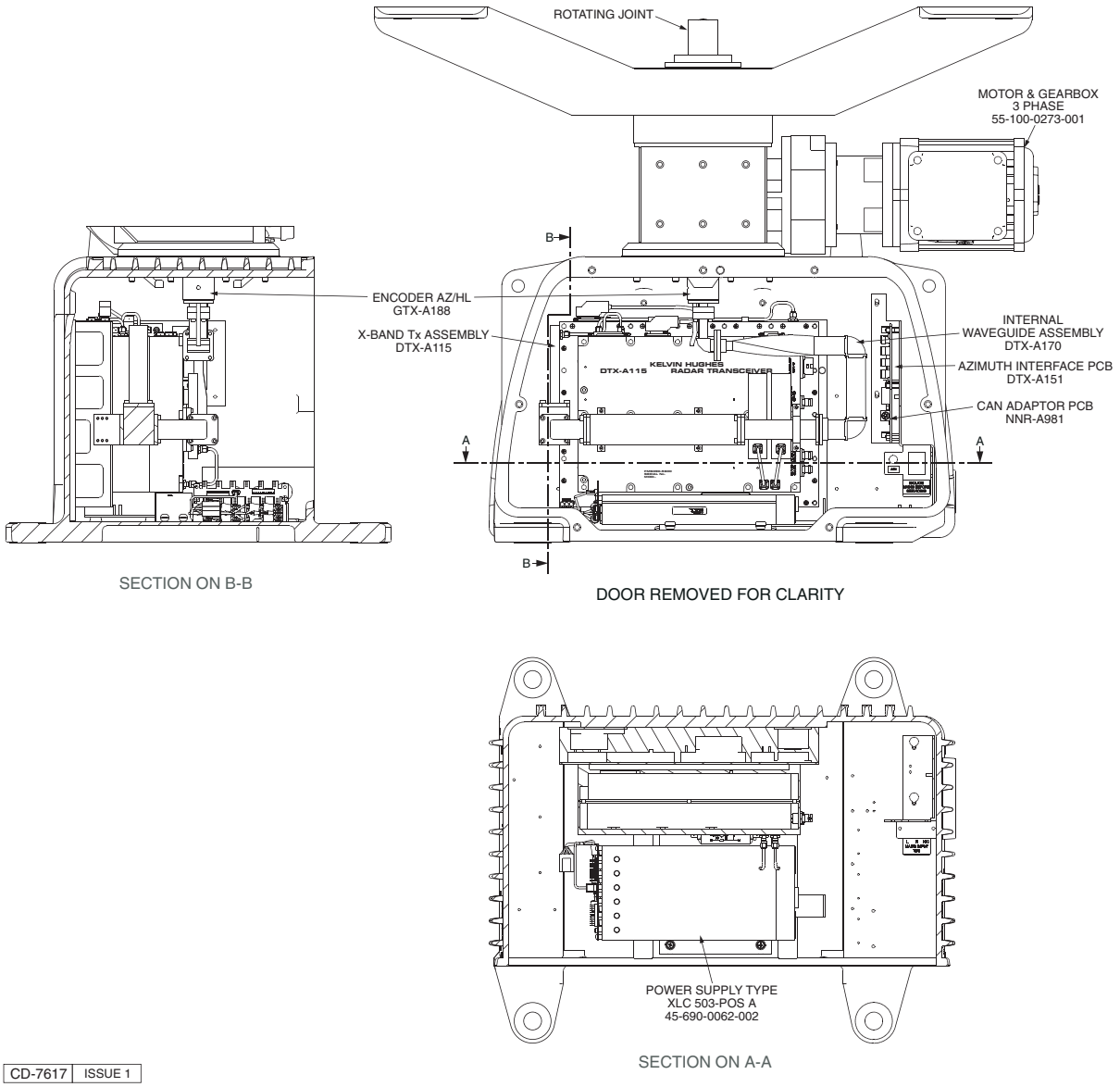


Figure 1 - Transceiver (DTX-A3): Module Locations

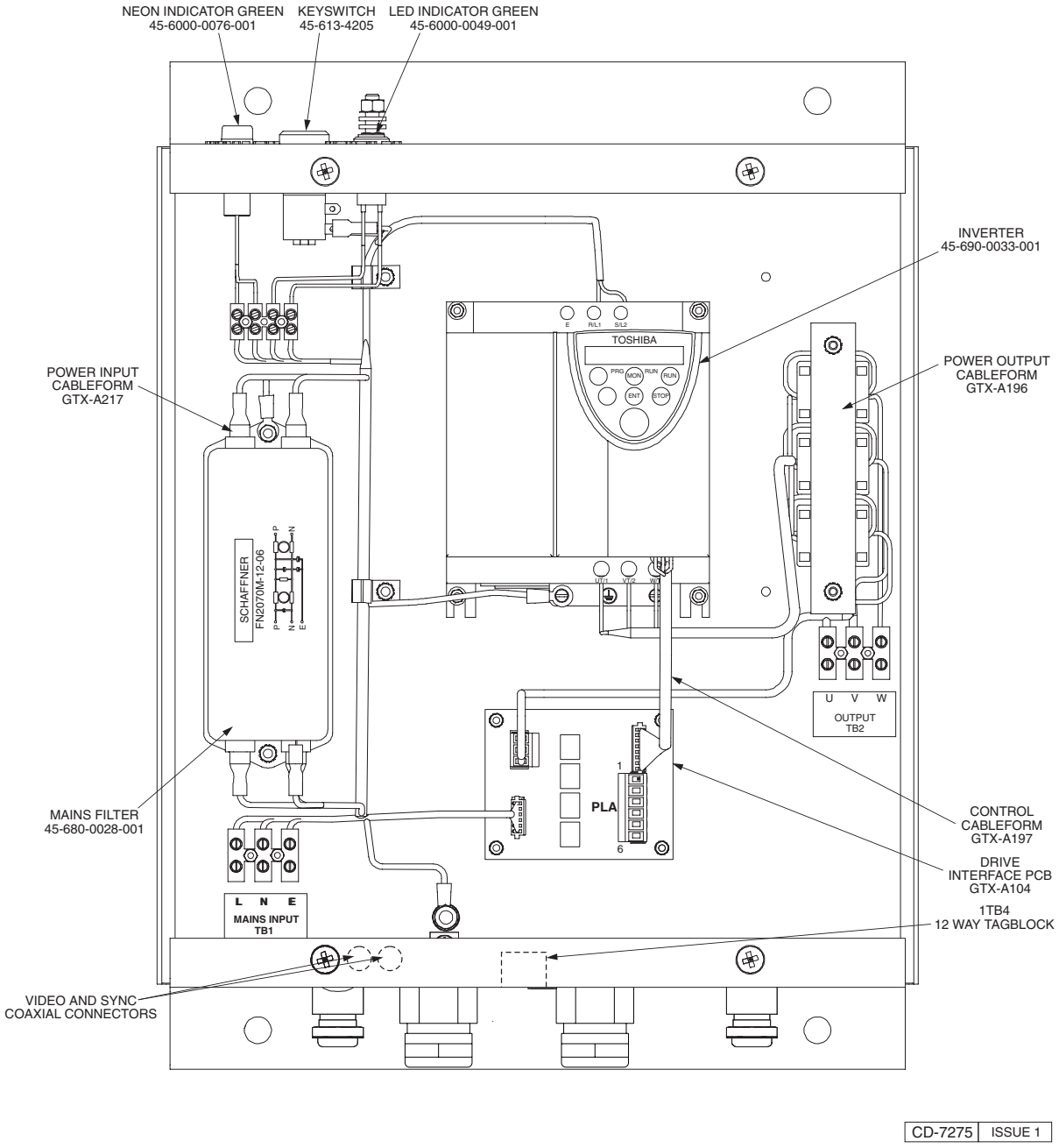


Figure 2 - Drive Control Unit (GTX-A24): Module Locations

FUNCTIONAL DESCRIPTION

6 Functional diagrams of the transceiver and antenna are shown in Figure 3 and the interconnections in Figure 4.

TRANSCEIVER

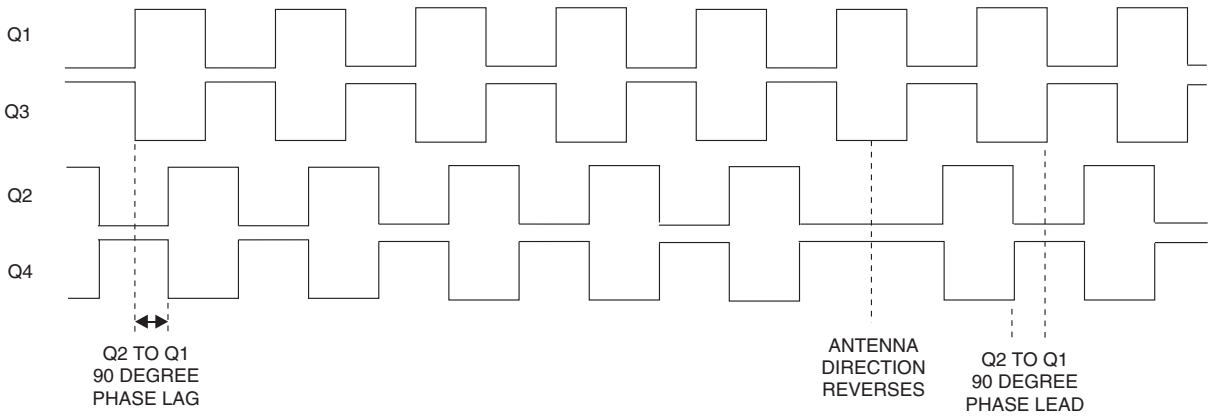
Motor and Gearbox

7 The antenna motor is driven by a 3 phase supply from the inverter in the Drive Control Unit. The Drive Control Unit is configured to provide a soft start and a soft stop for the motor, so that the motor takes a few seconds to reach normal antenna rotation speed and a few seconds to slow down when stopped. This reduces the start up and stopping torque on the motor. The motor is connected to the antenna by the gearbox which provides the drive to the antenna.

8 The Azimuth and Heading Line pulses are generated by the Azimuth Encoder, which is mounted on the output shaft of the gearbox. Part of the Azimuth Encoder rotates with the gearbox and part remains stationary with the enclosure. The Azimuth Encoder uses an optical disc with sensors.

9 Two heading line pulses (heading line and inverse heading line) and two sets of 1024 pulses per revolution azimuth pulses (each set comprising azimuth and inverse azimuth) are produced for each rotation of the antenna. The two sets of azimuth pulses are produced in quadrature (called Q1 and Q2 pulses), with Q2 **lagging** Q1 pulses by 90 when the antenna rotates in the normal direction. This allows the azimuth data to be used to detect reverse rotation of the antenna (which may occur due to windage when the motor is switched off) as Q2 pulses **lead** Q1 pulses by 90 when the antenna starts to rotate in the reverse direction. The Azimuth Encoder is supplied with +15 V, which is used to generate azimuth and heading line output pulses of +15 V. The pulses are passed directly to the display system via TB1 and also to the ***SharpEye***™ Azimuth Interface PCA (DTX-A151), which opto-isolates the signals before they are routed to the Transceiver (DTX-A115).

10 The phase of the azimuth inputs for normal and reverse rotation is shown below.



Transceiver (DTX-A115)

11 The transceiver uses solid state components and provides a signal generator and frequency synthesiser, up-converter, solid state RF power amplifier, duplexer, low noise RF receiver, down-converter, digital receiver, digital signal processor and a LAN interface. The transceiver produces a peak power output of 170 W. The solid state design provides excellent reliability and has no lifed items. Note that the unit is not repairable in the field and must be returned to the manufacturer for repair. The following description is for information only.

12 The transceiver is capable of transmitting and receiving pulses of RF energy whose centre frequency is contained in the band 9.22 to 9.48 GHz and is capable of inhibiting the transmission of pulses of RF energy over an azimuth sector defined by the display system.

Timing Circuits and Azimuth Data Processing

13 There are two reference clock outputs, which output squarewaves with a frequency of 80 MHz 80 Hz. The local oscillator is phase locked to the reference clock. All the clock and timing circuits are derived as multiples of this reference clock.

14 The local oscillator produces a sinusoidal output with a frequency of 640 MHz 1.3 kHz. This is used with the transmit and receive circuits for up- and down-conversion.

Transmitter Circuits

15 The signal generation and frequency synthesis circuits use a waveform generator that provides frequency modulated pulses at an intermediate frequency. The characteristics of the pulses are determined by the range and rotation modes, i.e. the instrumented range selected and the antenna rotation speed selected. The waveform generator employs digital synthesis techniques and outputs frequency modulated pulses with a centre frequency of 60 MHz 200 Hz. The within pulse frequency modulation is phase contiguous.

16 The up-converter converts the IF signals from the waveform generator to RF frequency in three stages. The bandwidth of the first intermediate frequencies within the up converter are 60 MHz 12 MHz and 140 MHz 12 MHz. The bandwidth of the second intermediate frequencies within the up converter are 500 MHz 20 MHz and 580 MHz 20 MHz. The bandwidth of the third intermediate frequencies within the up converter are 1140 MHz 20 MHz and 1220 MHz 20 MHz.

17 The RF frequency signal is fed to the solid state power amplifier, which provides an RF output at 170 W peak power to a duplexer located within the transceiver. Note that the power amplifier stage is switched off between sending each of the pulses in order to maximise receiver sensitivity. The signals from the duplexer are fed via a coaxial cable to the rotating joint and then to the antenna.

Receiver Circuits

18 Return signals from the antenna are fed through the rotating joint to the transceiver, which routes the received signal via the duplexer to an internal low noise RF receiver, digital receiver and signal processor.

19 Sensitivity Time Control (STC) is applied to the low noise RF receiver to increase the dynamic range of the receiver. The noise figure of the receiver is 4 dB, measured at the output of the analogue to digital converter. The low noise receiver contains the capability to adjust the mean noise level prior to analogue to digital conversion.

20 The output from the low noise RF receiver is converted to a third intermediate frequency in three stages. The bandwidth of the first intermediate frequency is 1220 MHz 20 MHz. The bandwidth of the second intermediate frequency is 580 MHz 20 MHz. The bandwidth of the third intermediate frequency is 60 MHz 12 MHz.

21 The intermediate frequency is applied to an analogue-to-digital converter which outputs 14 bit two's complement digitised samples to the digital receiver. The centre frequency of the digitised samples is 20 MHz 80 Hz and the instantaneous bandwidth is 20 MHz.

22 The digital receiver translates the signals to the baseband frequency and provides In-phase and Quadrature (I and Q) outputs to the digital signal processor. The in-phase and quadrature phase outputs of the digital receiver are both rounded to 18 bits, and the format of the output is two's complement.

23 The digital signal processor uses digital pulse compression before applying the signals to the limiting and compensation function. Motion compensation removes the effect of own ship motion from the received signal vector. The limiting and motion compensation function has a Doppler output channel and a Logarithmic output channel.

24 The Doppler channel is currently not implemented.

25 The input to the Logarithmic channel is used for video processing. The video processing function aligns the amplitude data into a contiguous range ordered data stream, aligns the single bit detection video into a contiguous range ordered data stream and aligns the logarithmic amplitude data into a contiguous range ordered data stream.

26 The video is converted to analogue video for output to conventional display systems, e.g. Nucleus 3, Manta and MantaDigital. In the future digital video will also be output from the LAN link.

27 Due to the characteristics of RACON systems, the processing applied to targets and objects within the digital signal processor is not suitable for the detection of a RACON. To solve this, a specific RACON processing channel is included. This enables RACON signals to be processed and integrated into the surface picture processed video output.

Operating States

28 The transceiver has the following six operating states:

(1) **Off**. In this state power is not applied to the transceiver and it is switched off.

(2) **Initialise**. When power is applied to the transceiver it enters initialise state. The transceiver automatically loads any software or configuration files and supplies DC power to the azimuth encoder. On completion of initialisation the transceiver switches to Standby state.

(3) **Standby**. In this state the transceiver establishes communication with the display system and reports its status to the display system. The transceiver receives and acts on commands from the display system and provides azimuth and heading line data from the encoder to the display system. The transceiver does not radiate RF in this state.

(4) **Transmit**. On receipt of a Run command from the display system, provided the display system has defined all the operating conditions, the transceiver switches from Standby to Run state. The transceiver initially outputs an RF signal into the antenna at low power. This enables the VSWR to be checked without the risk of damage to the transceiver, e.g. from an open circuit into the antenna. If the VSWR is within limits then the transceiver automatically switches to full power. If the VSWR is high, indicating an antenna fault, a warning message is sent to the display system and the transceiver does not radiate on full power. The radar returns are then processed to provide radar video to the display system. Note that the time from switch on to being ready to enter the run state is less than 2 minutes.

(5) **Degraded**. The transceiver continuously runs background performance checks on forward power, reverse power and receiver sensitivity. If any of these parameters is outside predetermined levels a warning message is sent to the display system indicating the nature of the fault. The transceiver continues to operate, but with reduced performance and functionality. The fault should be investigated at the earliest opportunity.

(6) **Fault**. If the performance or functionality is degraded such that the transceiver cannot operate it enters the fault state and a fault message is sent to the display system. The transceiver stops radiating RF and there is no video to the display.

Operating Range

29 In either the Transmit or Degraded states the radar operates in one surface picture mode with a range of interest of 48 nm. The operating range is determined by the Range Scales selected on the display. 24 nm mode is applied when a range scale of 24 nm or less is selected. 48 nm operating range is selected for range scales greater than 24 nm.

Installation and Setting to Work Parameters

30 The ***SharpEye™*** Transceiver contains a number of operational settings that are set up during system installation and setting to work. These operational settings are:

(1) Rotation Rate. The transceiver supports 2 nominal antenna rotation rates, 22 rpm and 44 rpm. System behaviour and performance varies depending upon which rotation rate is selected as the system parameters are adjusted for the different rotation rates.

(2) Operating Frequency. The transceiver contains 14 pre-set transmission frequencies within the operating frequency band. The frequency used for a particular system is set during system installation and setting to work. The centre frequencies of each RF band are:

(a) 9.22GHz 15 kHz.

(b) 9.24GHz 15 kHz.

(c) 9.26GHz 15 kHz.

(d) 9.28GHz 15 kHz.

(e) 9.30GHz 15 kHz.

(f) 9.32GHz 15 kHz.

(g) 9.34GHz 15 kHz.

(h) 9.36GHz 15 kHz.

(i) 9.38GHz 15 kHz.

(j) 9.40GHz 15 kHz.

(k) 9.42GHz 15 kHz.

(l) 9.44GHz 15 kHz.

(m) 9.46GHz 15 kHz.

(n) 9.48GHz 15 kHz.

(3) Transmit Inhibit Sector. The transceiver provides one blanking sector that is configured via the display system. The radar does not transmit RF energy within the blanking sector.

Monitoring

31 If the RF output power falls below 100 W the transceiver sends an RF Power warning message to the display system and switches to the Degraded state of operation.

32 If the VSWR on the RF output is above 2.0:1 the transceiver sends an Antenna VSWR warning message to the display system and switches to the Degraded state of operation.

33 If the minimum detectable signal rises above a preset level the transceiver sends a Receiver Sensitivity warning message to the display system and switches to the Degraded state of operation.

34 If the transceiver detects hardware faults (frequency synthesis or phase locked oscillator failure), it sends a warning message to the display system and switches to the Degraded state of operation.

35 If communication between the transceiver and the display system is lost for > 5 seconds the transceiver switches to the fault state.

36 If the temperature of the RF power transistors in the transceiver exceeds a predetermined limit, the transceiver sends an Overtemperature warning to the display system and switches to the Degraded state. If the temperature exceeds a further preset limit the transceiver switches to the Fault state. As the temperature drops below the predetermined limits the transceiver returns to the Degraded state and then to normal Transmit operation.

CAN Bus Interface

37 The CAN bus signals to and from the display system are routed via the CAN Adapter PCB (NNR-A981), which interfaces the CAN bus to the RS232 interface on the Transceiver (DTX-A115). The CAN Adapter PCB converts the RS232 signals from the Transceiver into CAN bus signals for routing to the display, and converts the CAN bus signals from the display to RS232 signals for application to the transceiver.

+15 V Supplies

38 +15 V from the transceiver is routed to the ***SharpEye™*** Azimuth Interface PCB (DTX-A151). The ***SharpEye™*** Azimuth Interface PCB routes the +15 V to the Encoder and the CAN Adapter PCB (NNR-A981).

Power Supply (45-690-0062-002)

39 The transceiver uses 110 V or 220 V single phase mains, which is passed through a mains filter before application to the Switched Mode Power Supply. The Power Supply provides the following DC supplies for the transceiver module:

(1) +3.3 V at 5.0 A for the digital processing circuits.

(2) +15 V at 5.0 A for the digital processing and amplifier circuits.

(3) +13 V at 6.0 A for the amplifier circuits.

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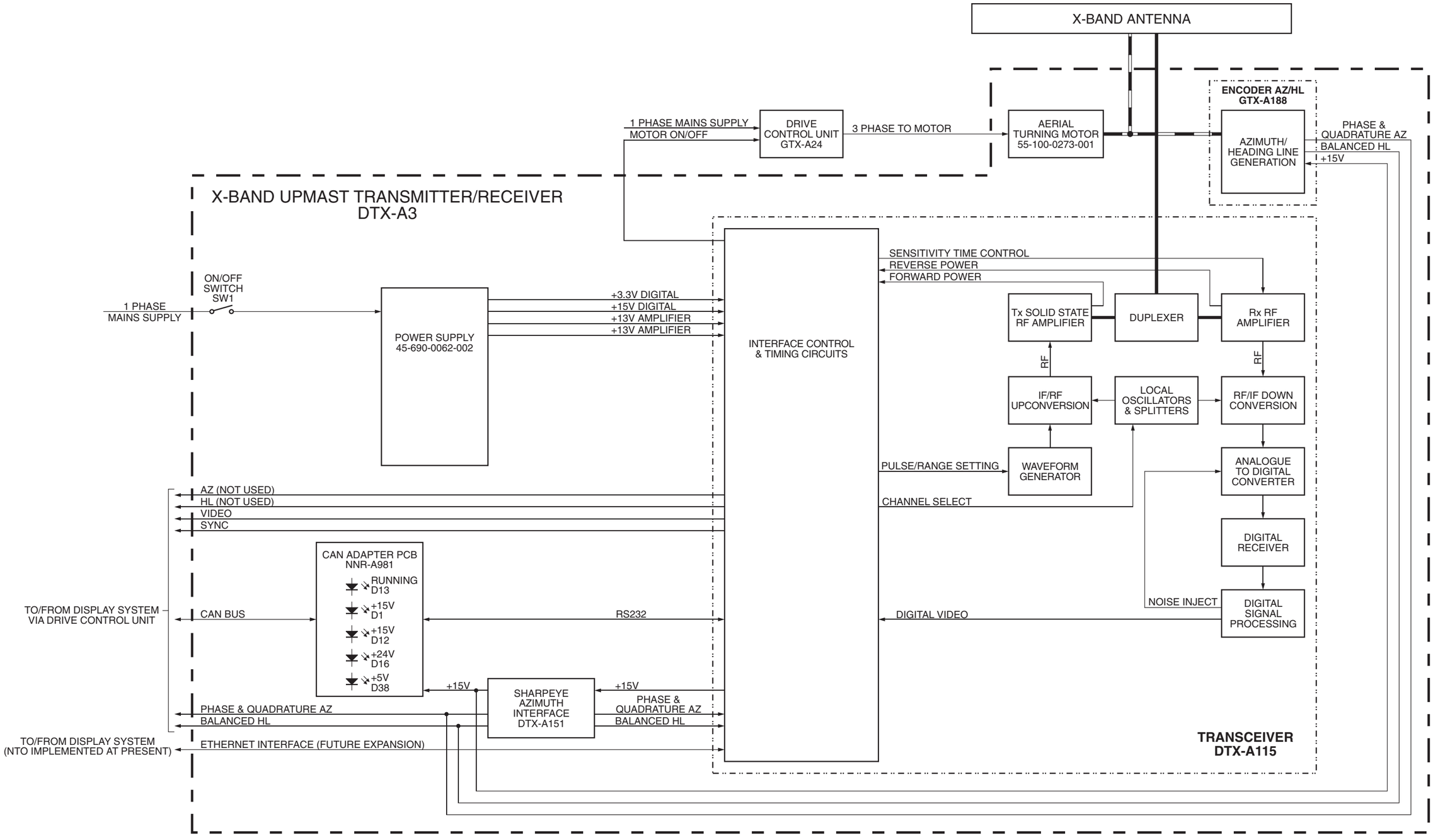

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Figure 3 **X-band Upmast Transceiver (DTX-A3): Functional Diagram** **Figure 3**

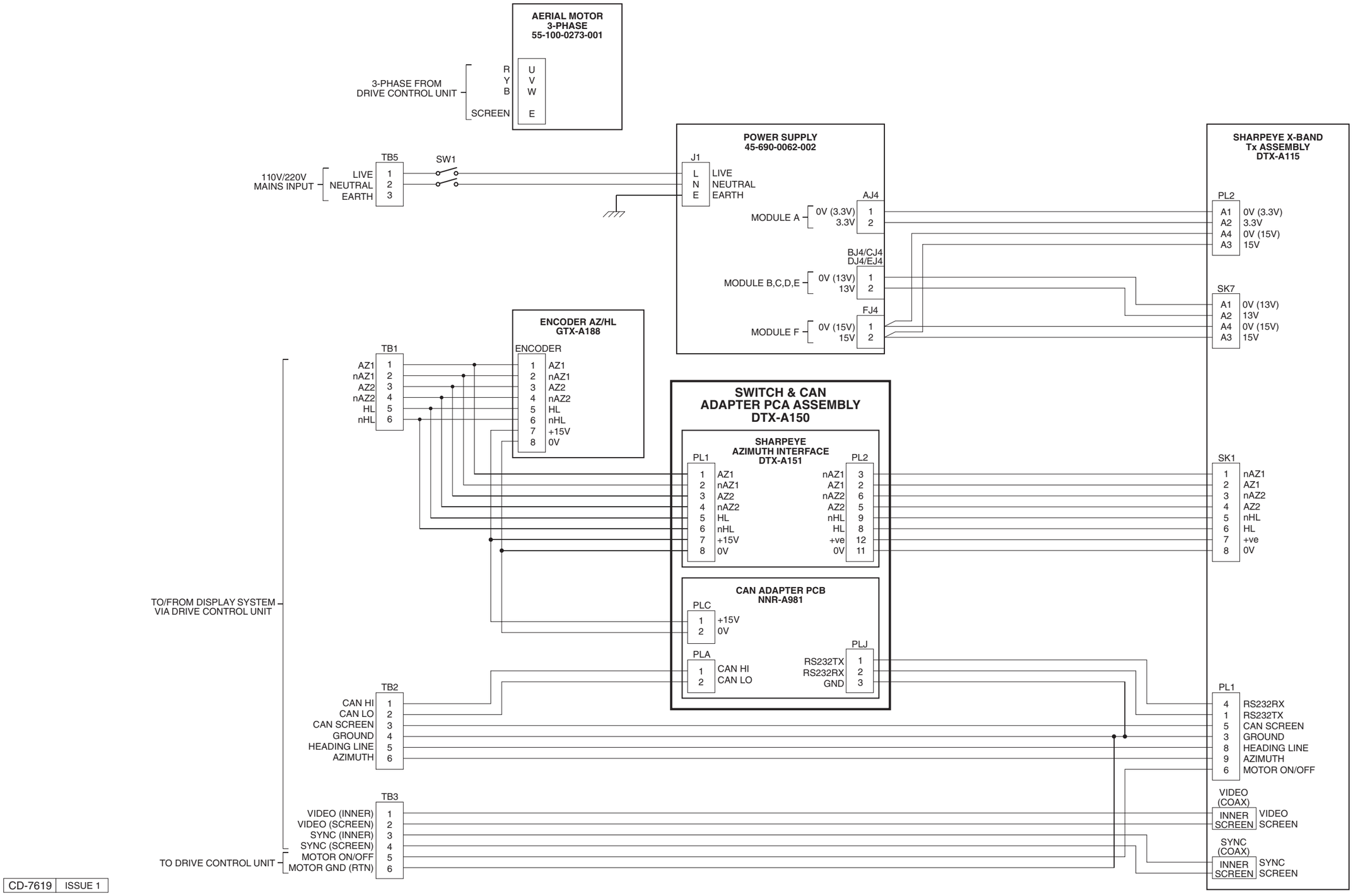


Figure 4 **X-band Upmast Transceiver (DTX-A3): Interconnection Diagram** **Figure 4**

DRIVE CONTROL UNIT (GTX-A24)

40 The drive control unit provides 3 phase supplies for the antenna turning motor in the ***SharpEye***™ Upmast Transceiver. It accepts a 220 V single phase mains supply and generates a 3 phase supply at either 25 Hz or 50 Hz with the frequency set internally, either of which may be selected from the display, or by physical wire links on the Drive Control Unit. 25 Hz is used to provide an antenna speed of 22 rpm and 50 Hz is used to provide an antenna speed of 44 rpm. If required, a transformer can be fitted to the mains input to enable the unit to be used with 110 V mains.

41 Figure 5 shows the interconnections within the Drive Control Unit. The Drive Control Unit comprises:

(1) Inverter (45-690-0033-001)

(2) Drive Interface PCB (GTX-A104)

(3) Mains input filter (part of Power Input Cableform GTX-A217)

(4) Man Aloft Keyswitch (45-613-4205)

(5) Output filters (ferrite cores - part of Power Output Cableform GTX-A196)

42 The presence of the mains input is indicated by the MAINS ON neon indicator (LP1) on the top of the unit being lit.

43 The mains input is passed through the input filter, which slows down the rate of rise of current input pulses to reduce the generation of interference. The mains is then applied to the inverter, which converts the single-phase input at 50/60 Hz into 3-phase at 0 Hz to 120 Hz (variable). The 3-phase output is generated as switched mode power pulses. These pulses are at the peak output voltage, which is approximately 320 V with 5 kHz switching frequency. The effective rms voltage at the output varies from 130 V to 230 V AC depending on the antenna motor load.

44 The output frequency sets the speed of antenna rotation. The output frequency is set to 25 Hz for 22 rpm and 50 Hz for 44 rpm antenna rotation speed. The speed is set at the inverter on installation and if the inverter is replaced, the new inverter must be correctly set after repair. Note that the inverter is set on installation to provide a 25 Hz or 50 Hz output using wire links. The output frequency is also dependent on the input frequency, so that the new inverter must be programmed for 50 Hz or 60 Hz input as described in Chapter 5. Most of the settings are the manufacturer's defaults, but others must be set up as specified.

45 The inverter is set to provide an acceleration time of 2 seconds before reaching full speed, this provides a soft-start function for the antenna on start up. When the power is switched off, the inverter provides a deceleration time of 10 seconds to slow the antenna rotation. These functions reduce the torque on the antenna during starting and stopping.

46 The Drive Interface PCB (GTX-A104) provides the control interface to the inverter. It also provides the interface to external control lines to allow one of the antenna speeds to be selected by wire links on installation. It uses opto-isolators to allow the control signals to the inverter to be compatible with the inverter.

47 The inverter is switched on by applying +12 V to +28 V across PLA pins 1 and 2 on the Drive Control PCB. The positive voltage is routed via PLC pin 5 to the Man Aloft Keyswitch (SW1), which is located on the top of the unit. This switch disables the +12 V to +28 V to the inverter when set to the OFF position, thus switching the inverter off, regardless of the input condition, provided the inverter has been set for remote operation. The key is removable in the OFF position only and is captive in the ON position. This enables antenna rotation to be inhibited to allow safe man aloft working.

WARNING

THE INVERTER MUST BE SET TO REMOTE OPERATION TO ENABLE THE KEYSWITCH TO SWITCH THE INVERTER ON AND OFF. UNDER NO CIRCUMSTANCES SET THE INVERTER TO LOCAL OPERATION AS THIS WILL OVERRIDE THE SAFETY FUNCTION.

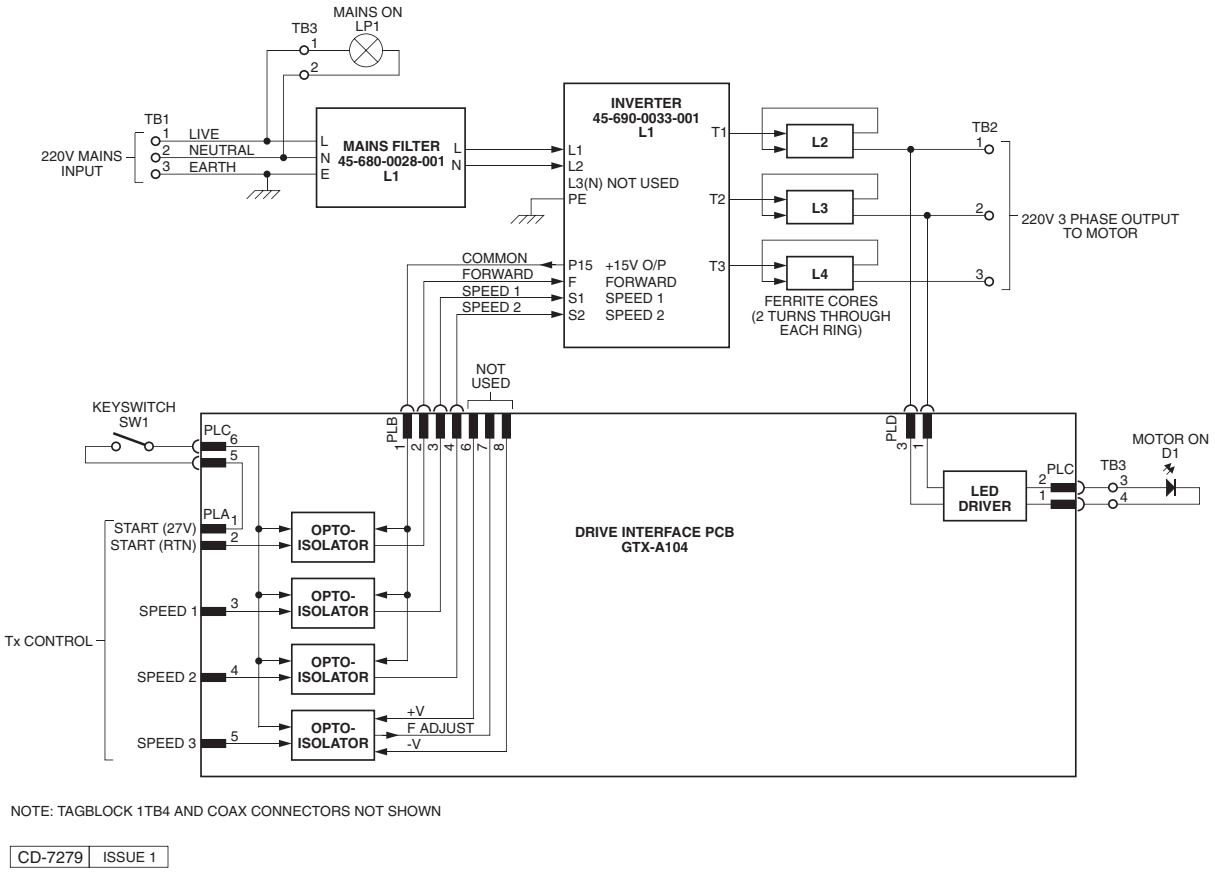
48 The voltage from the keyswitch is routed to PLC pin 6 on the Drive Control PCB. When the +12 V to +28 V is present at PLC pin 6, an opto-isolator on the Drive Control PCB is switched on, linking PLB pins 1 and 2 to switch the inverter on. When the +12 V to +28 V is not present at PLC pin 6, either by the absence of the input on PLA pin 1 or by the keyswitch being set to OFF, the opto-isolator is switched off and PLB pins 1 and 2 are open circuit, thus switching the inverter off.

49 A MOTOR ON LED (D1) on top of the unit is lit when 3-phase power is available to the motor from the inverter. Two of the phases from the inverter are passed to the Drive Control PCB, which converts the signal to a DC level suitable for the LED.

50 Each output wire passes through a ferrite core to reduce the rate of rise of current, which reduces the generation of interference. The ferrite cores form part of the output cable.

51 The inverter is used with Speed 1 and Speed 2 inputs, which operate in the same way, so only Speed 1 input is described. Speed 1 switches on an opto-isolator when PLA pin 3 is connected to the negative side of the start input (PLA pin 2) and +12 V to +28 V is present at PLC pin 6. The output is used to link the appropriate inverter speed selector terminals. Using Speed 1 input gives a two speed selection, depending on whether PLA pin 3 is connected to PLA pin 2 or is open circuit. In this application PLA pin 3 is linked to PLA pin 2 for low speed and is open circuit for high speed. Speed 2 (PLA pin 4) is always linked to PLA pin 2.

52 Future enhancements will allow the Drive Control Unit to provide the facility to select up to four antenna speeds, by controlling Speed 1 and Speed 2 inputs from an external source. This will allow one of up to four preset speeds to be selected to meet the operational requirements of the system.



NOTE: TAGBLOCK 1TB4 AND COAX CONNECTORS NOT SHOWN

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Figure 5 - Drive Control Unit (GTX-A24): Block Diagram

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CHAPTER 4

INSTALLATION

CONTENTS

TABLES

CONTENTS (continued)

LIST OF ILLUSTRATIONS

CHAPTER 4

INSTALLATION

GENERAL

1 This section provides installation information for ***SharpEye***™ X-band Upmast Transceiver.

2 Kelvin Hughes, or appointed agents, contracts only to supply the equipment, supervise the installation and final connection of the equipment. The installation must be made by a fully qualified Kelvin Hughes Radar Engineer.

3 Forward planning for positioning the various units of the Radar must be made before any installation work is carried out. A full survey is required in order to establish the ship's fitment. This may be arranged with the Technical Department of Kelvin Hughes or one of the approved agencies. Details of Agencies worldwide can be found in Publication KH 401.

COMPASS SAFE DISTANCES

4 Compass safe distances are stated on labels on all units and are as follows:

	Standard Compass Limit 5.4 /H Compass Safe Distance	**Steering Compass Limit 18 /H Compass Safe Distance**
SharpEye™ Transceiver:	120 cm	52 cm
Drive Control Unit:	246 cm	154 cm

TRANSCEIVER

5 One version of upmast transceiver is available, type DTX-A3, which is used with the Low Profile Antenna (LPA) (LPA-A25).

6 The transceiver is used with a bulkhead mounted Drive Control Unit (GTX-A24), which provides the 3-phase power for the antenna turning motor.

SAFETY NOTES

Observe the Health and Safety Notices at the front of this manual. In particular, the procedures given in the Code of Safe Working Practices CP225 MUST be followed. Failure to follow these procedures and to complete and return the Warranty card will invalidate the warranty on the equipment.

7 Safety personnel must ensure that persons do not encroach on the area of work.

8 Electrical supplies are to be isolated to any part of the platform when mounting an upmast transceiver/turning mechanism. A suitable safety platform or harness should be used to avoid personal injury when working aloft.

9 Electrical supplies in the vicinity of the transceiver are to be isolated during installation.

10 A working platform is to be provided for installing or servicing the assembly. This should be positioned approximately a metre below the base of the Upmast Transceiver housing with a guard rail surrounding it.

11 The Upmast Transceiver must be hoisted to the fixing position using a secured block and tackle or rope strops.

12 The Upmast Transceiver **MUST NOT** be lifted by the array, but the complete unit secured and hoisted evenly. The antenna must be installed after the upmast transceiver has been installed.

WARNING

WHEN WORKING ON THE UPMAST TRANSCEIVER ALWAYS ENSURE THE ON/OFF SWITCH ON THE DRIVE CONTROL UNIT IS SET TO OFF AND THE KEY IS WITHDRAWN. THE KEY SHOULD BE RETAINED BY THE INSTALLER WHEN WORKING ALOFT. REMOVAL OF THE KEY PREVENTS THE ANTENNA FROM ROTATING.

THE INVERTER MUST BE SET TO REMOTE OPERATION DURING COMMISSIONING, OTHERWISE THE KEYSWITCH FUNCTION WILL BE OVERRIDDEN.

THE UPMAST TRANSCEIVER USES A 110 V/220 V MAINS SUPPLY FOR THE TRANSCEIVER ELECTRONICS. THIS SUPPLY IS NOT ISOLATED BY THE KEYSWITCH IN THE DRIVE CONTROL UNIT, AND MUST BE ISOLATED AT THE MAINS ISOLATOR.

EQUIPMENT LOCATION

UPMAST TRANSCEIVER (DTX-A3)

13 The Upmast Transceiver should be installed in such a position where Blind Arcs, caused by obstructions, i.e. masts, funnels etc, are eliminated or minimised. Funnels, crosstrees and other large obstructions can also reflect energy and give rise to spurious echo returns especially in close proximity to land. Positioning the antenna close to funnels and exhaust gases can adversely affect antenna performance.

14 The Upmast Transceiver is to be mounted on a rigid platform, which is positioned so that the rotating antenna is clear of other structures.

15 The primary consideration must be the strength of the support for the Upmast Transceiver/Antenna assembly. Details of the requirement are described in the following sub-paragraphs:

(1) The antenna must be mounted more than 914 mm (3 ft) above any flat surface greater than the diameter swept by the antenna. It must not be positioned in close proximity of any magnetic compass or D/F aerial etc.

(2) Masts, sampsons, posts and rigging of more than 0.6 m (2 ft) diameter can cause blind sectors. Increasing the distance between the antenna unit and these objects will reduce the blind sectors that inhibit a good radar picture.

16 The Upmast Transceiver **must not** be mounted where the temperature exceeds 70^{o}C.

17 The Upmast Transceiver must be kept clear of ship's flexible communication aerials to avoid damage to both.

DRIVE CONTROL UNIT (GTX-A24)

18 The Drive Control Unit is designed for bulkhead mounting and must be sited as near the Transceiver as possible, the maximum cable run between the Drive Control Unit and Transceiver is 65 m.

19 The Drive Control Unit must be sited to allow removal of the front cover, access to the cable glands and removal of the key from the keyswitch, which is essential when working aloft.

OPTIONAL MAINS ISOLATOR (80-261-600)

20 The Mains Isolator must be sited adjacent to the display or in the area of the operators control room and connected in parallel with the main display.

INSTALLATION

UPMAST TRANSCEIVER (DTX-A3)

WARNING
ENSURE THAT ALL POWER SUPPLIES IN THE VICINITY OF THE TRANSCEIVER ARE ISOLATED BEFORE ANY INSTALLATION TAKES PLACE.

21 The ***SharpEye***™ Upmast Transceiver is supplied in two parts:

(1) Transceiver with Gearbox.

(2) Antenna.

22 The ***SharpEye***™ Upmast Transceiver is fitted with a Low Profile Antenna (LPA-A25).

23 The ship's mounting structure must be capable of withstanding the high starting and stopping torque generated by the motor fitted in the upmast transceiver.

24 When mounting the upmast transceiver observe the following:

(1) Use the fitting pack supplied with the equipment (refer to Figure 3). The fitting pack contains fixings that have been tested to withstand the stresses detailed in paragraph 24.

(2) Recommended tensile strengths and torque loadings for the fixings are stated on the installation diagram.

(3) For upmast transceivers mounted in excess of 1.8 m above the deck, it is recommended that a service platform and guard rail are fitted.

(4) Use a suitable jointing compound or sealant to prevent corrosion between the platform and upmast transceivers/turning mechanism.

CAUTION
The Antenna Window Must NOT Be Painted.

(5) Any chipped or damaged surfaces must be painted with polyurethane paint.

25 With reference to Figures 1, 2 and 3, install the upmast transceiver and antenna following the procedures below.

26 It is recommended that the antenna is fitted after installing the transceiver/turning mechanism to avoid damage to the antenna. Only fit the antenna prior to installing the transceiver/turning mechanism if absolutely necessary, in which case care must be taken to avoid damage to the antenna when lifting the combined assembly.

Fitting the Upmast Transceiver to the Ship

27 To install the upmast transceiver, proceed as follows:

(1) Mark out and drill four 17 mm gearbox mounting holes at the mounting position.

WARNING

THE UNIT MUST NOT BE LIFTED BY MEANS OF THE SWING CASTING. THE LIFTING SUPPORTS MUST GO UNDER THE CASTING.

IF IT IS NECESSARY TO FIT THE ANTENNA BEFORE INSTALLING THE TURNING MECHANISM, THE TURNING MECHANISM MUST NOT BE LIFTED BY THE ANTENNA. THE TURNING MECHANISM MUST BE HOISTED TO THE FIXING POSITION USING A SECURED BLOCK AND TACKLE, OR BY ROPE STROPS.

(2) Using the lifting gear, install the upmast transceiver/turning mechanism at the mounting position, ensuring correct orientation.

(3) Use the shim washers supplied to take up any distortion in the mounting platform. Failure to do so may cause the casting to crack when bolts are tightened to the correct torque.

(4) Secure the upmast turning mechanism using the noise reduction kit supplied in the Fitting Kit GTX-A144 (refer to Figure 3) and secure the fittings to a torque of 20 Nm, as specified on Figure 3.

Fitting the Low Profile Antenna

28 It is recommended that lifting slings are used in an arrangement similar to those shown in Figure 4 to position the low profile antenna on the transceiver/turning mechanism.

CAUTION

When unpacking the Antenna, ensure that the Waveguide is not kinked, crushed or bent. Support the Antenna near the ends when lifting it out of its packing and when fitting into position on the Turning Mechanism. Do Not handle the Antenna by the Waveguide input.

29 To install the antenna, proceed as follows (refer to Figure 1):

CAUTION
When rotating the Antenna do not apply excessive force.

Ensure the Waveguide, on the underside of the Antenna, is not crushed or damaged.

(1) Fit the antenna mounting bracket on top of the swing casting by inserting the 8 supplied M10 x 40 mm button head allen key screws through the aligning holes, and tightening the 8 supplied M10 barb nuts on the underside of the swing casting. Apply Loctite to all screws.

(2) Remove the protective caps, tapes, etc. from the antenna and waveguide. Ensure the waveguide faces are clean and free from grease.

(3) Carefully slide the antenna into the mounting bracket slot and align the four mounting holes. Insert the 4 supplied M8 x 75 mm bolts, each fitted with an M8 washer, through the holes to hold the antenna in place. Loosely fit another washer and 4 of the supplied M8 Nyloc nuts to each of the bolts. Apply Loctite to all screws.

(4) Position the waveguide by fitting its support tab onto the M8 stud on the front face of the mounting bracket, and ensuring the flanges at each end align with their respective components.

(5) Secure the waveguide to the antenna input with the 4 supplied bolts, nuts and washers, having fitted the round O-ring seal into the flange groove.

(6) Secure the waveguide to the rotating joint with the 4 supplied M4 x 12 mm cheese slot pan head screws and M4 crinkle washers, having fitted the rectangular O-ring seal into the flange groove.

(7) Fit the remaining M8 Nyloc nut and M8 washer to the M8 stud on the front face of the mounting bracket to secure the support tab.

(8) Tighten the M8 bolts fitted through the antenna and mounting bracket to a torque of 29 Nm.

(9) Waterproof the waveguide joint by sealing with a layer of greased plastic compound such as Henleys compound or Denso-Tape.

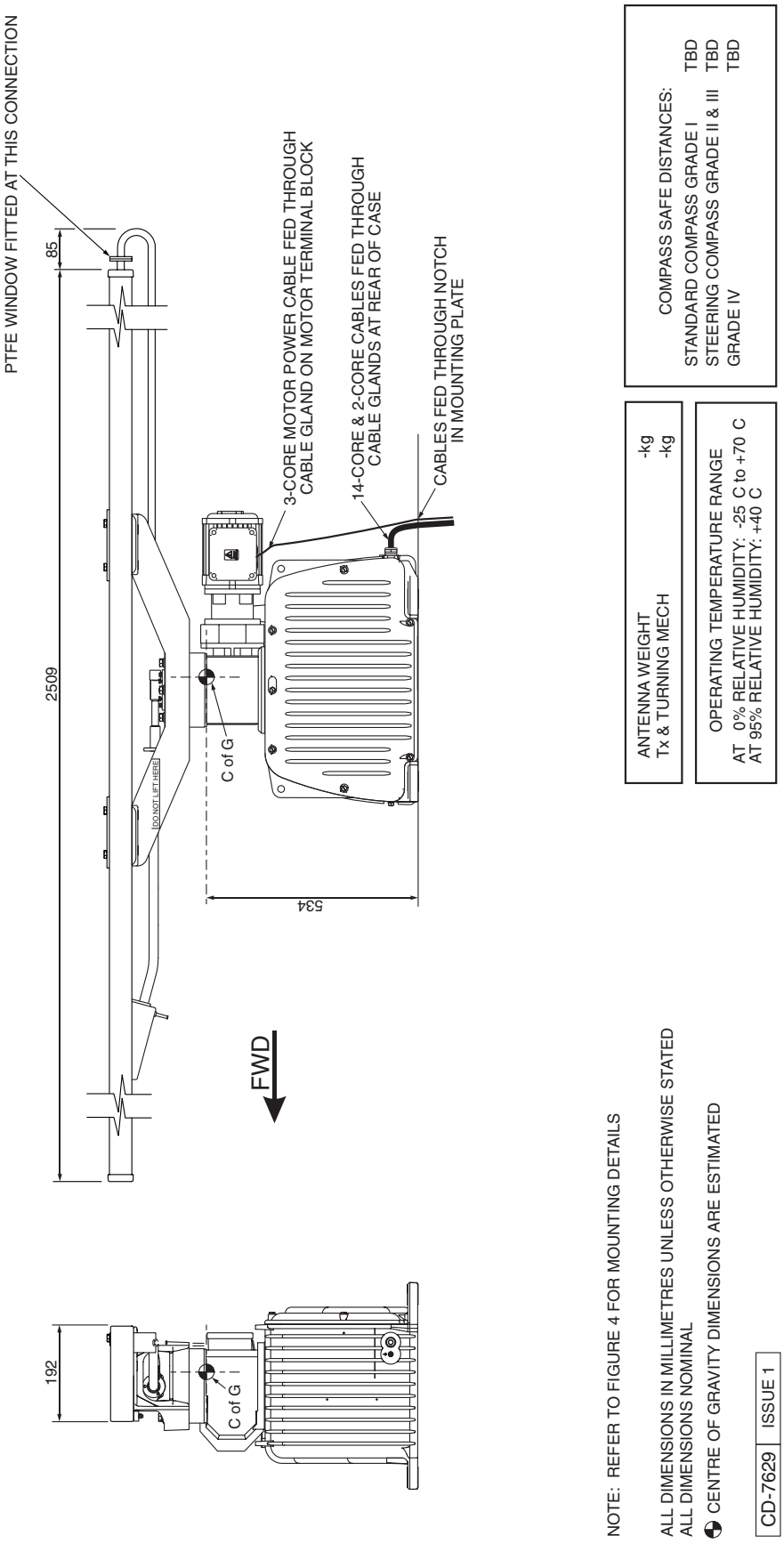

Figure 1 - Transceiver (DTX-A3): Installation Dimensions

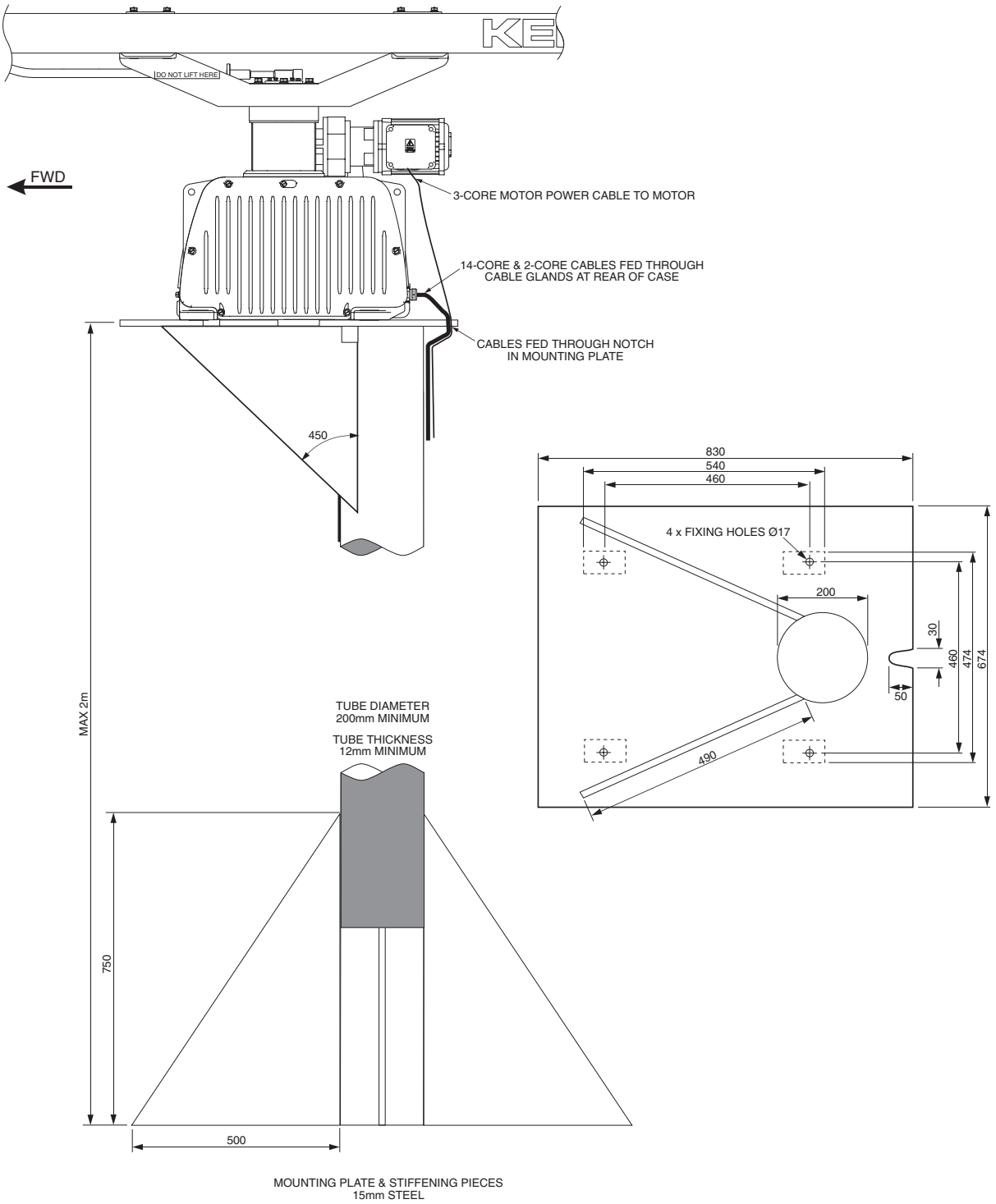

Figure 2 - Transceiver (DTX-A3): Mast Mounting

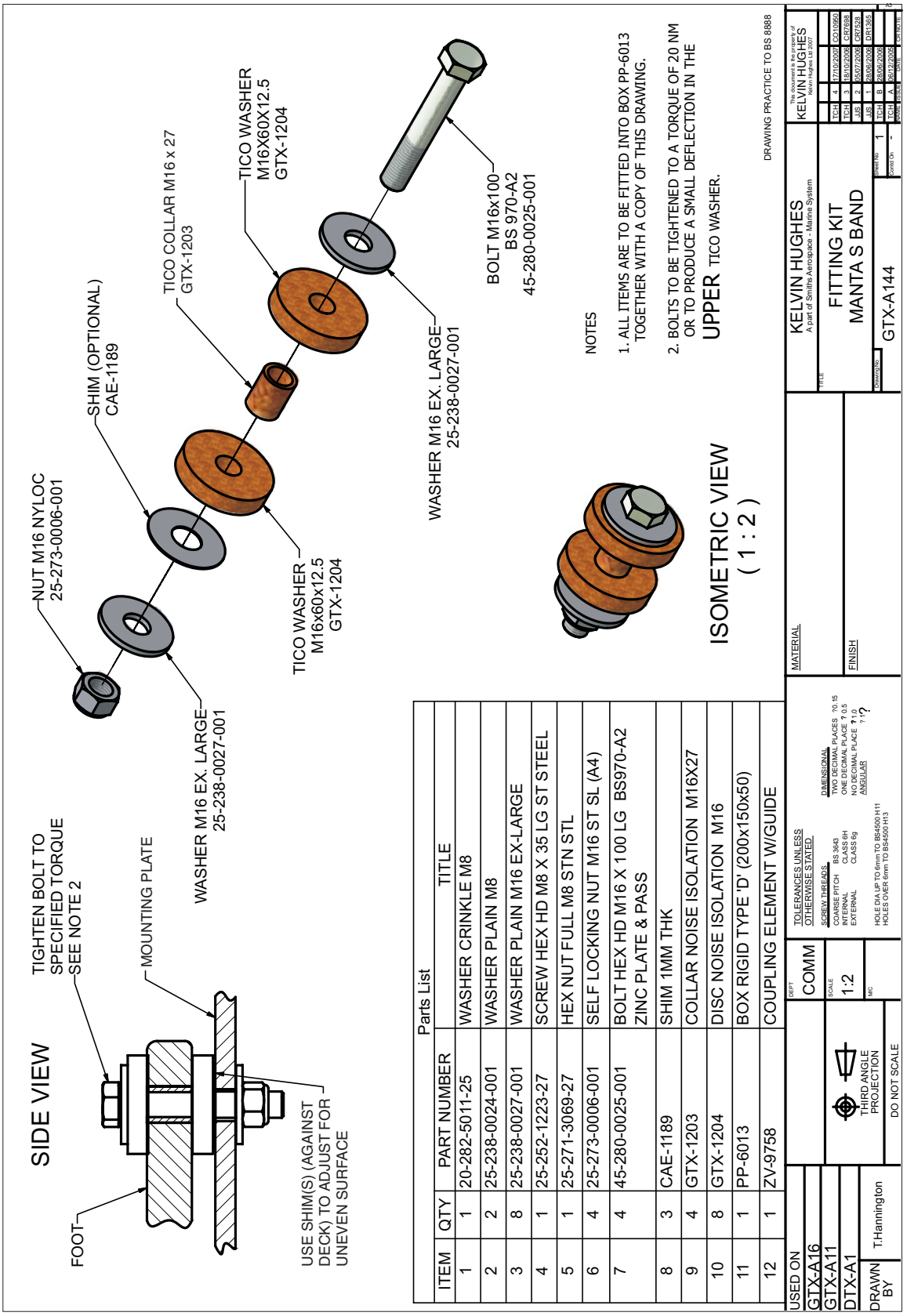

Figure 3 - Transceiver (DTX-A3): Fitting Kit

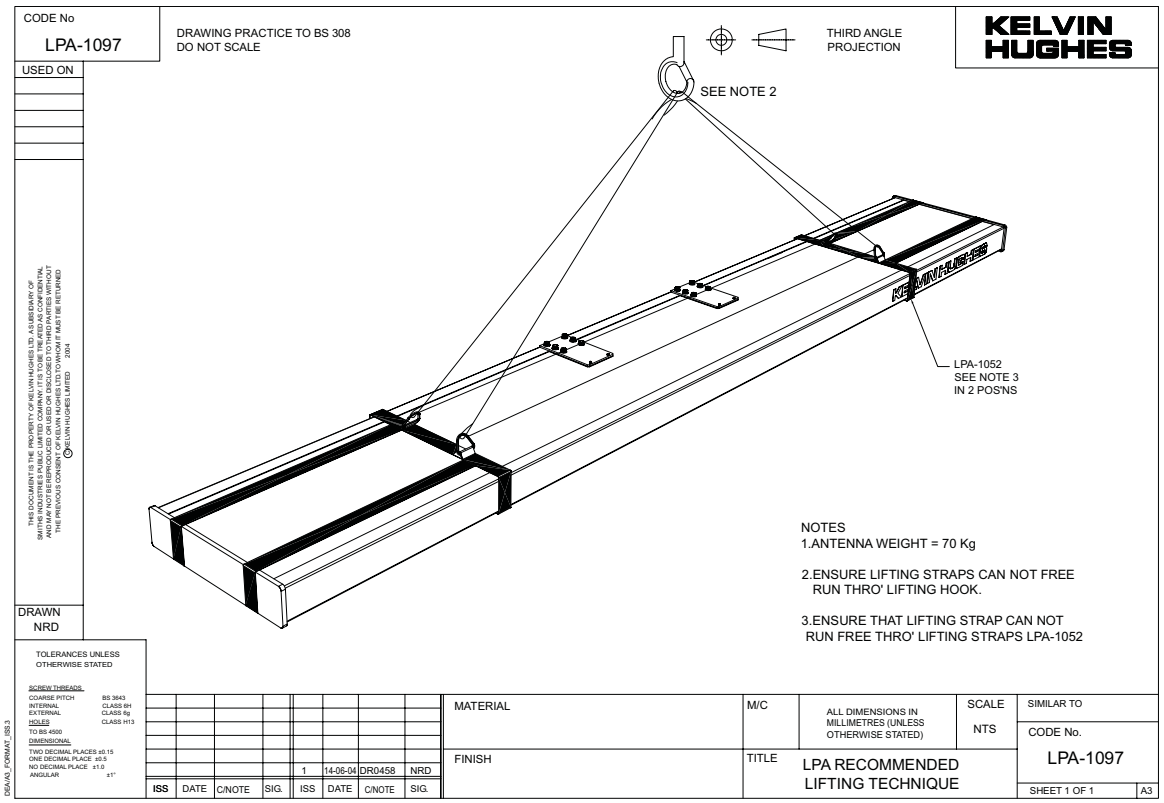

Figure 4 - Suggested Antenna Lifting Arrangement

DRIVE CONTROL UNIT (GTX-A24)

WARNING
ENSURE THAT ALL POWER SUPPLIES IN THE VICINITY OF THE DRIVE CONTROL UNIT ARE ISOLATED BEFORE ANY INSTALLATION TAKES PLACE.

30 Fit the drive control unit to the securing bulkhead using the installation bolts supplied with the fitting kit. Refer to Figure 5 for dimensions. Allow sufficient space at the base of the unit to allow the cables to be inserted through the cable glands and at the top of the unit for withdrawal of the key from the keyswitch.

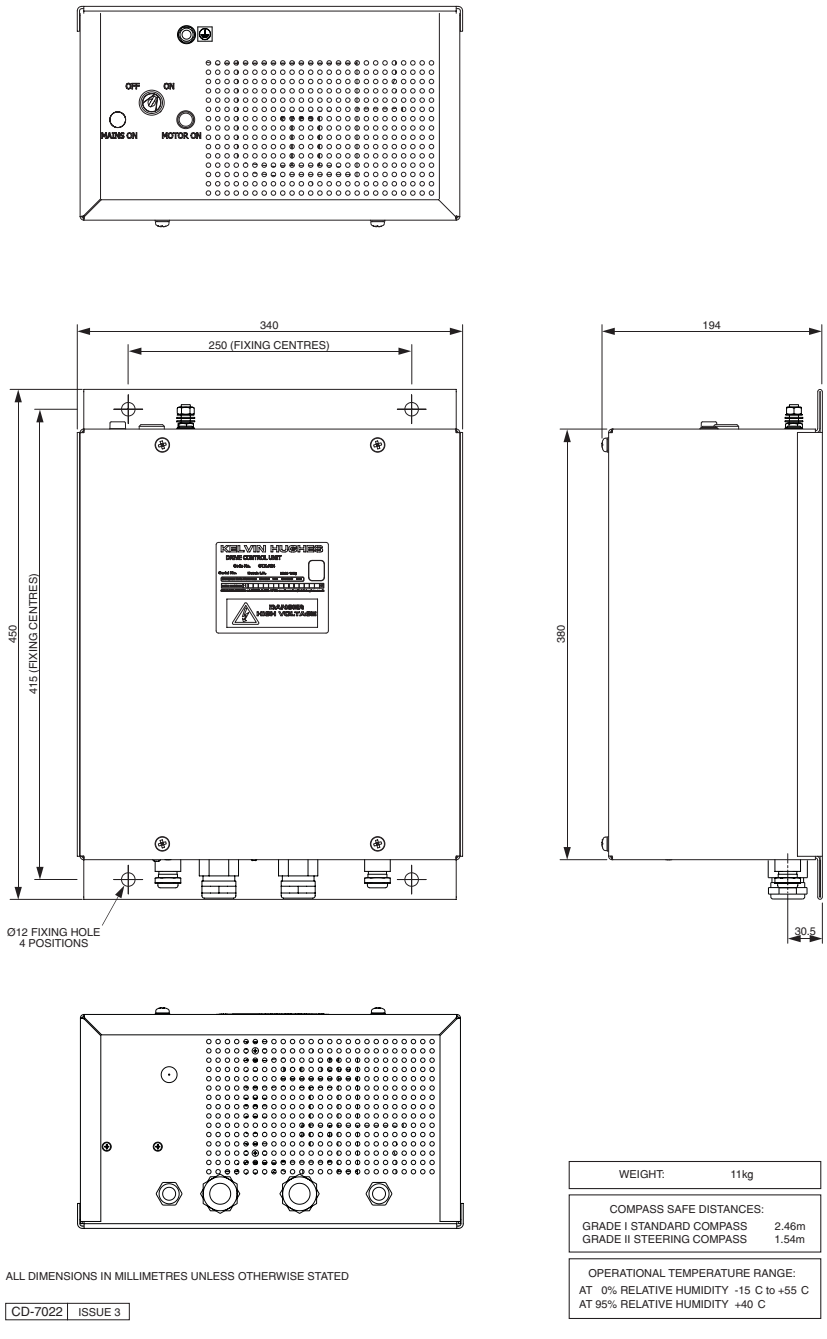

Figure 5 - Drive Control Unit (GTX-A24): Installation Dimensions

OPTIONAL MAINS ISOLATOR (80-261-600)

31 With reference to Figure 6, secure the Mains Isolator in the required position (no fittings are supplied).

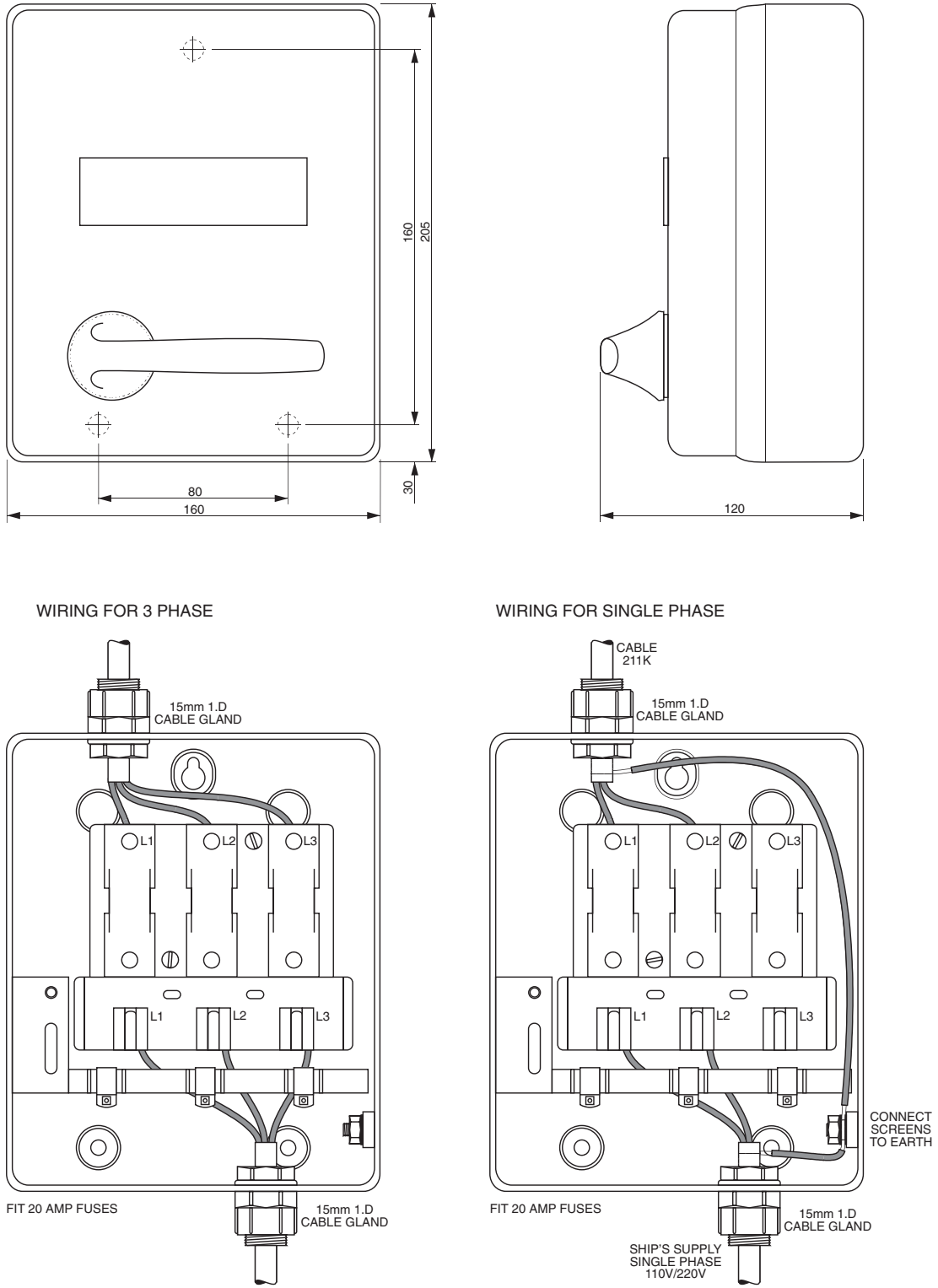

Figure 6 - Mains Isolator: Installation Dimensions

ELECTRICAL CONNECTION

CABLE SPECIFICATIONS

32 Each cable is identified by a letter code which defines the type of cable required, e.g. Cable code H is a 14-core cable. Table 1 provides specifications for each cable type. Table 2 provides 14-core cable, colour code abbreviations.

33 The cables used to connect Kelvin Hughes equipment are to be to the following specification. Failure to use the correct specification cables may result in impaired equipment performance.

TABLE 1: Cable Specification

CABLE	DESCRIPTION	CODE	CORE	DIAMETER
A	2-core small multi-core	1344-718	0.5 mm	6.1 mm 6.9 mm
B	3-core small multi-core	1344-719	0.5 mm	6.4 mm 7.2 mm
C	4-core small multi-core	1344-720	0.5 mm	6.9 mm 7.7 mm
D	6-core small multi-core	1344-721	0.5 mm	7.9 mm 8.7 mm
E	12-core small multi-core	1344-722	0.5 mm	10 mm 11 mm
F	Not used			
G	Not used			
H	14-core composite	45-762-0116-001	Mixed	18 mm
I	2 x 1.5 mm Power (low)	45-762-0173-001	1.5 mm	8 mm
J	Not used			
K	2-core Power	5344-787	2.5 mm	12 mm
L	3-core Power	5344-788	2.5 mm	13 mm
N	Not used			
R	Not used			

14 Core Composite Cable

34 The 14-core composite cable (KH code number 45-762-0116-001) is a Low Smoke and Fume cable, but not Zero Halogen, made for Kelvin Hughes and comprises the following:

(1) Core function:

4 cores of 32/0.2 mm (1.0 mm^2) copper wire.
1 screened twisted pair 16/0.2 mm (0.5 mm^2) copper wire for serial data links.
3 twisted pairs in 1 screen 16/0.2 mm (0.5 mm^2) copper wire for serial data links.
2 cores of co-axial cable 7/0.25 mm (0.35 mm^2).

(2) Overall Screen

The cable has an overall screen of close woven copper braid (tinned copper 91% minimum coverage) suitable for a high noise environment.

(3) Outer Sheath

The cable has a black outer sheath to withstand exposure to the outside environment, of salt air, rain, lubricating or diesel oil splashes, sun, snow, ice and some possible abrasion. The outer sheath is UV stable.

(4) Conductor rating:

	1.0 mm^2	0.5 mm^2	Coaxial
DC between conductors	100 V	30 V	15 V
DC current	100 mA	50 mA	
Impedance			75
Losses			<3 dB at 25 MHz up to 60 m

TABLE 2: 14-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
BN	BROWN
V	VIOLET
O	ORANGE
W	WHITE
S	SLATE (GREY)

Small Multi-Core Cables

35 These cables conform to DEF STAN 61-12 (part 5). Each cable consists of a number of insulated cores, collectively screened and clad in a PVC outer sheath.

36 Core Details

(1) The core details are as follows:

Conductors consist of 16 strands of 0.2 mm diameter tinned copper wire.
Nominal cross-section area of conductor = 0.5 mm^2.
Nominal diameter of conductor = 0.93 mm
Nominal thickness of insulation = 0.45 mm
Minimum thickness of insulation = 0.40 mm
Minimum diameter of core = 1.75 mm
Maximum diameter of core = 1.90 mm

(2) Braided Screen

The cores are laid-up, covered with binding tape over which is woven a braiding of 0.2 mm diameter tinned copper wire.

(3) Outer Sheath

A PVC outer sheath is applied by extrusion over the wire braiding.

(4) Maximum Current Rating

The maximum current ratings are as follows:
2.5 A at 1000 V DC
2.5 A at 440 V AC at 1600 Hz.

Power Cables

37 These cables are used for services requiring a moderate current carrying capacity, i.e. main supplies.

2-Core (Power):

Cable Code K:	KH Reference No. 5344-787
250/440 V grade:	7 x 0.67 mm (7 x 0.026") cores cross linked polythene insulation, braided with 0.2 mm (0.0078") diameter tinned copper wire, 79% coverage low smoke, zero halogen outer sheath.
Outer diameter:	12 mm (0.39 in.).

3-Core (Power):

Cable Code L:	KH Reference No. 5344-788
(250/440 V grade):	Specification as for 2-core cable.
Outer Diameter:	13 mm (0.44 in.)

GENERAL

38 Before starting electrical connection observe the following:

WARNING
ENSURE THAT ALL POWER SUPPLIES ARE ISOLATED BEFORE ANY ELECTRICAL CONNECTION TAKES PLACE.

39 Isolate power supplies as follows:

(1) Ensure that the associated display is turned off.

(2) Remove fuses from mains isolators.

40 The casing of the upmast transceiver must be securely earthed to the platform with braided copper wire.

41 Allow sufficient length on all cables to allow for routing through the transceiver. Make sure that there is sufficient slack to allow for extreme movements during sudden shock to the vessel.

42 Ensure that all cables are secured to their associated entry point and that screened cables are earthed to their respected units.

43 Fit cable through gland in accordance with the diagram shown on Figure 9.

COVER REMOVAL

44 Before any electrical connections can be made, covers have to be removed from the following equipment:

(1) Upmast Transceiver.

(2) Drive Control Unit.

(3) Optional Mains Isolator.

Upmast Transceiver (DTX-A3)

45 Using a 12 mm spanner, release the seven bolts securing the side cover to the Upmast Transceiver and remove the cover. Note that the cover is attached to the enclosure by a strap to prevent it from being dropped. Cable routing is shown in Figure 7.

Drive Control Unit (GTX-A24)

46 Remove the Drive Control Unit cover by releasing the four fixing screws. Cable routing is shown in Figure 8.

Optional Mains Isolator (80-261-600)

47 Open the Mains Isolator cover by releasing the captive screw.

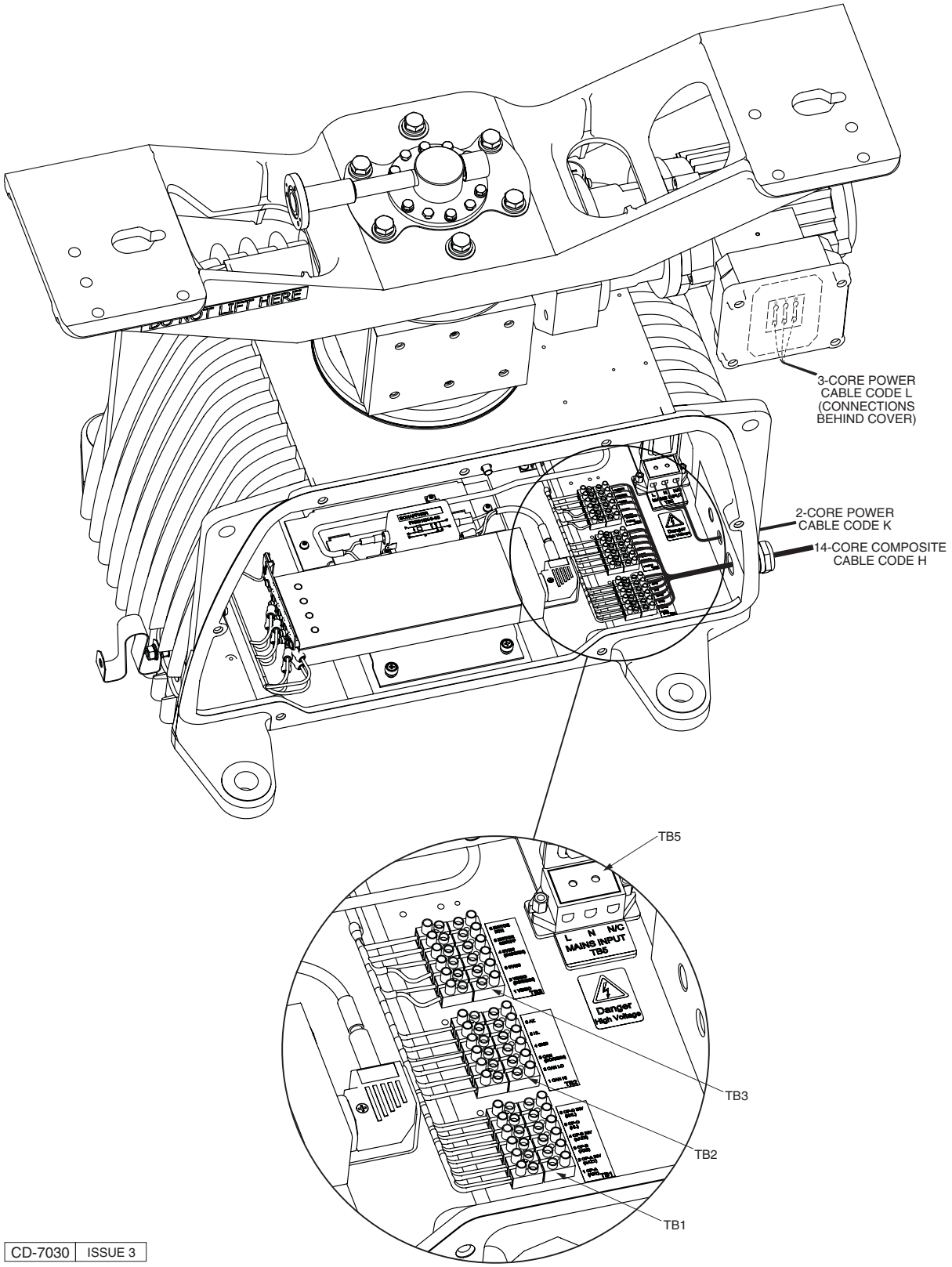

Figure 7 - Transceiver (DTX-A3): Cableform Routing

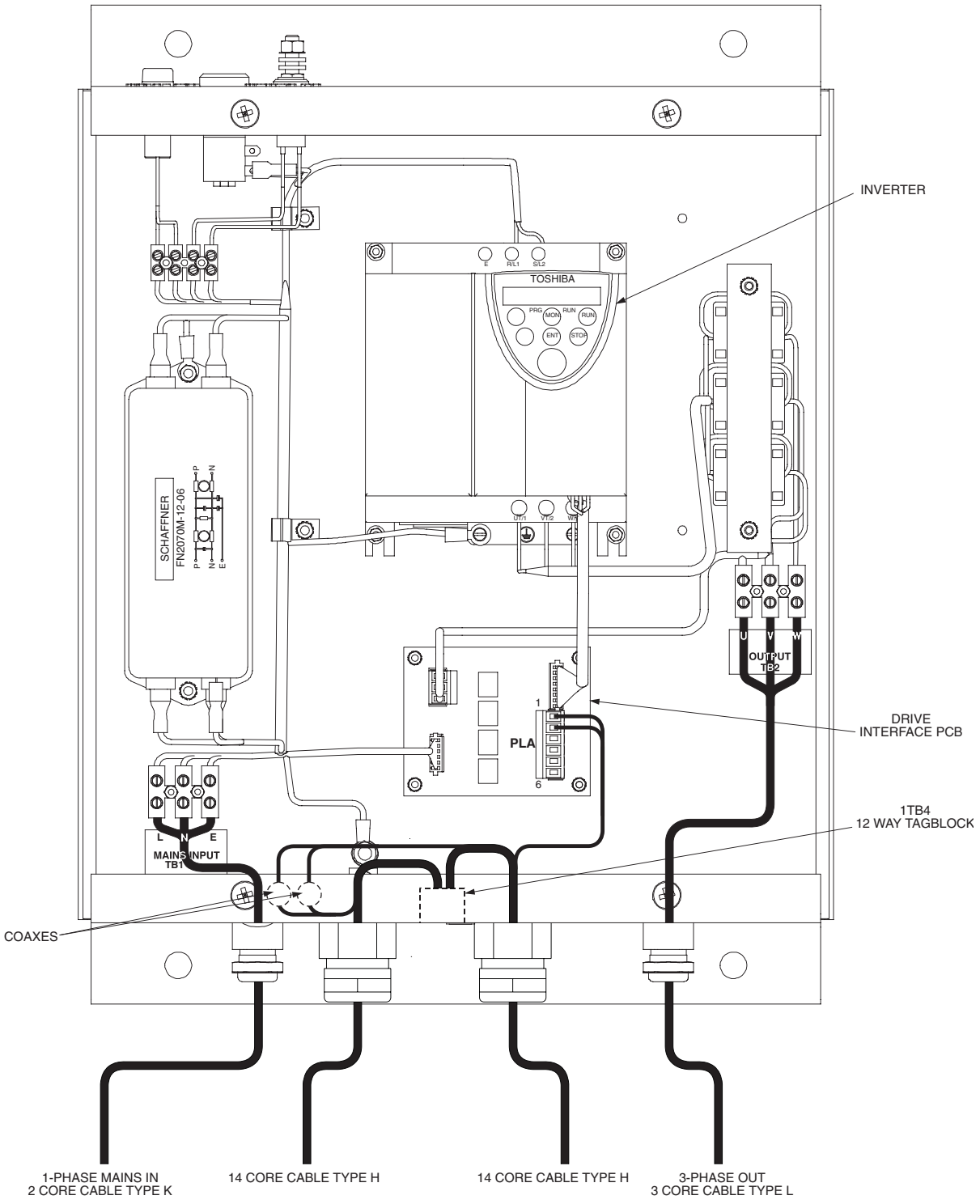

Figure 8 - Drive Control Unit (GTX-A24): Cableform Routing

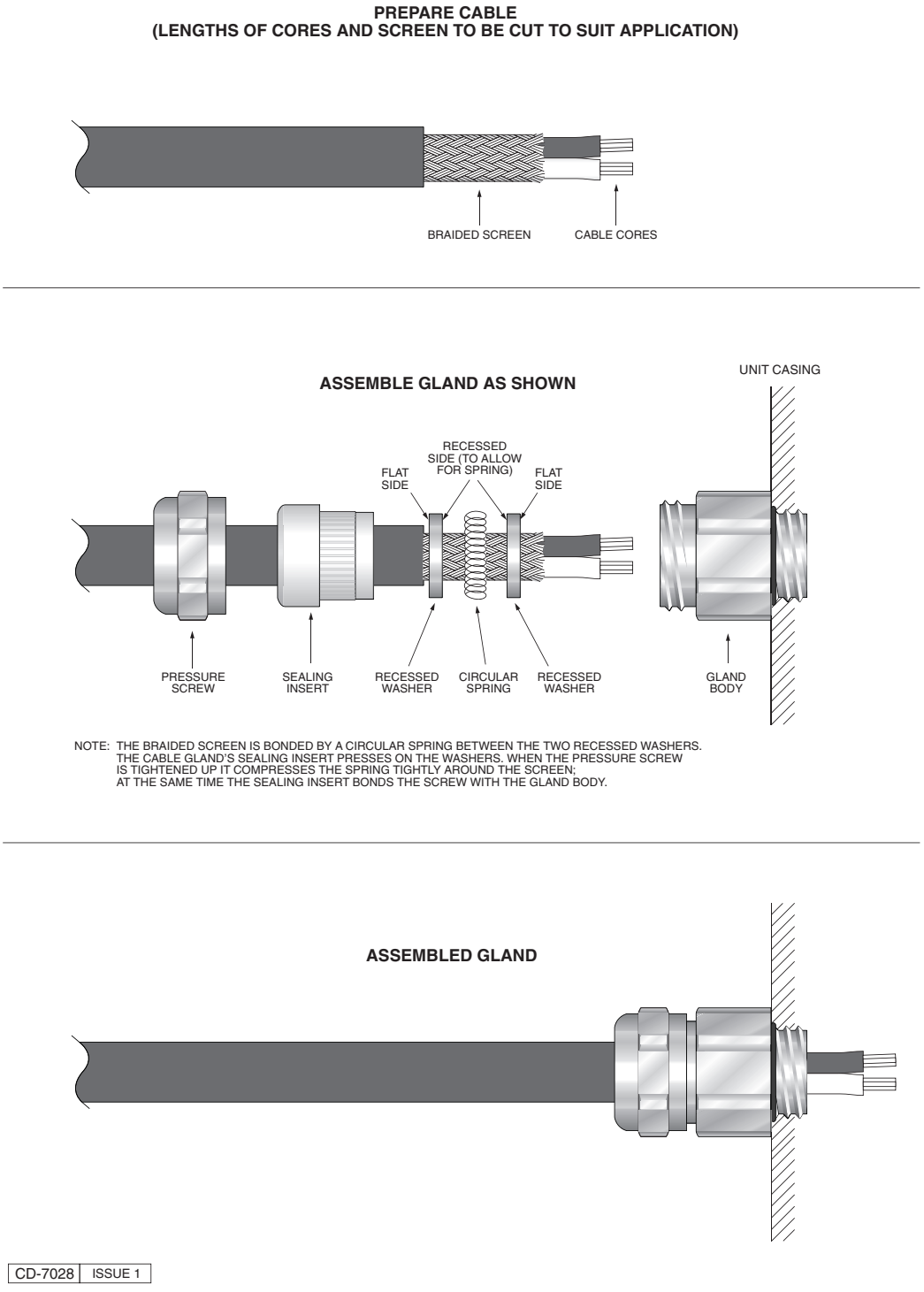

Figure 9 - Cable Gland: Assembly

WIRING DIAGRAMS

48 Electrical connections for upmast and downmast transceiver systems are detailed on the wiring diagram (Figure 10). For full details of connections to the display system refer to your system manual (KH2020, KH2026 and KH2061), as appropriate.

49 The inverter in the Drive Control Unit must be set to produce either low speed or high speed antenna rotation to meet the operational requirements of the system. To set the inverter to produce low speed or high speed antenna rotation, at the Drive Control Unit, Drive Control PCB (GTX-A104) PLA, make the following connections:

Low speed (22 RPM)	Link	PLA pins 2 and 4 only
High speed (44 RPM):	Link	PLA pins 2 and 4 and PLA pins 3 and 4

CHECKS AFTER FITTING

50 The upmast transceiver must be checked for security and freedom to rotate.

51 Ensure that all cables are secured to their associated entry point and that screened cables are earthed to their respective units.

52 All cable entries must be checked for signs of fretting, chafing or damage, and subsequently sealed with a mastic compound.

53 Commissioning instructions are provided in Chapter 5.

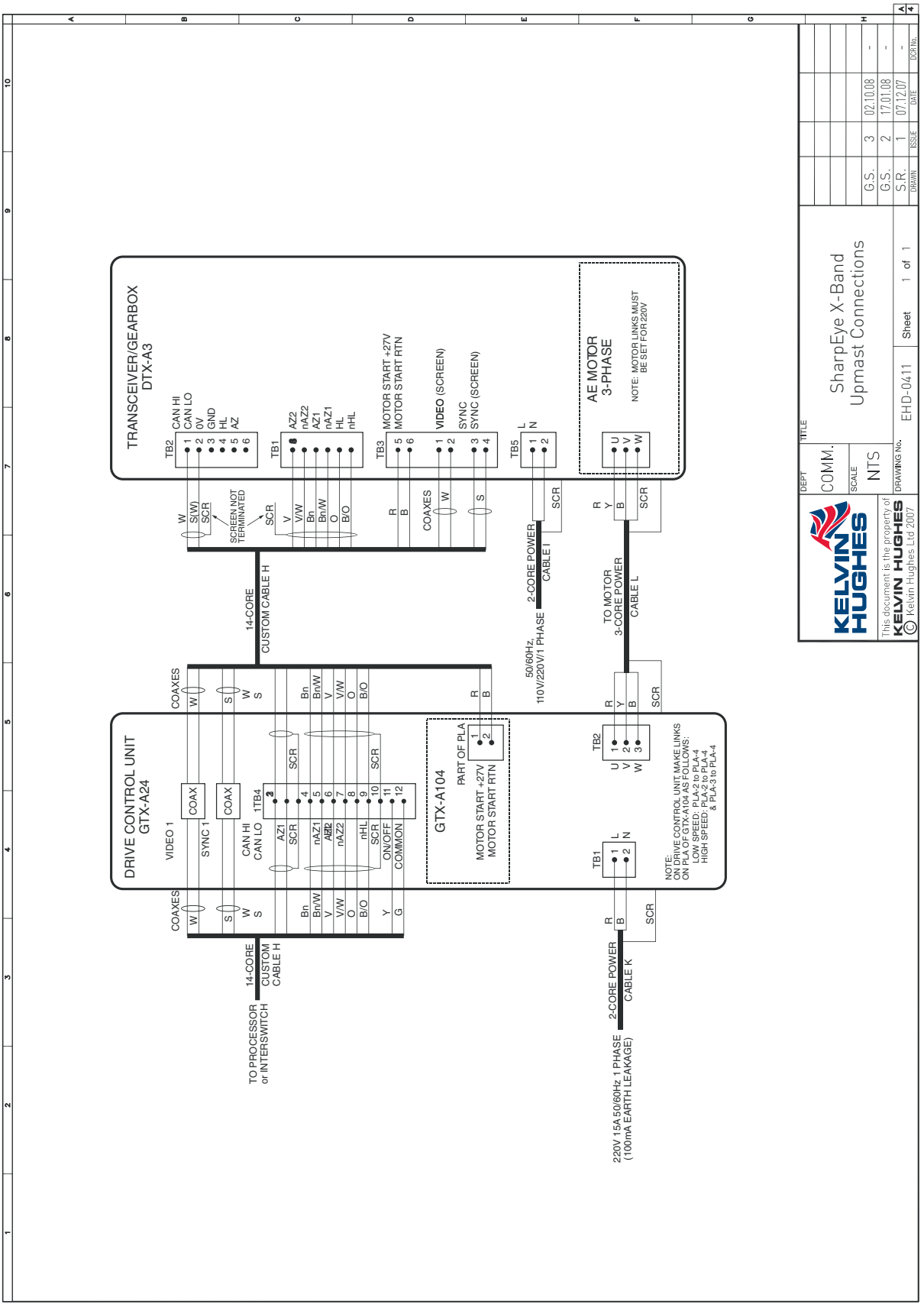

Figure 10 - Transceiver (DTX-A3): External Connections

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CHAPTER 5

COMMISSIONING

CONTENTS

ILLUSTRATIONS

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CHAPTER 5

COMMISSIONING

INTRODUCTION

1 Interswitched equipments, or equipments interfaced with other radar equipments, are described in their respective Handbooks.

POWER SUPPLIES

2 Check that all cables have been installed and connected.

SETTING TO WORK

WARNING

WHEN WORKING ON THE UPMAST TRANSCEIVER ALWAYS ENSURE THE ON/OFF SWITCH ON THE DRIVE CONTROL UNIT IS SET TO OFF AND THE KEY IS WITHDRAWN. THE KEY SHOULD BE RETAINED BY THE INSTALLER WHEN WORKING ALOFT. REMOVAL OF THE KEY PREVENTS THE ANTENNA FROM ROTATING.

3 Carry out the following:

(1) Switch on the single phase mains at the Isolators for the Display and Transceiver.

(2) Set the Drive Control Unit switch to OFF. Ensure the switch IS NOT set to ON.

(3) Set the display power switch to ON.

4 At the display ensure that the Transceiver is entered as ***SharpEye™*** in the installed equipment parameters. The following parameters are set up from the display system, refer to your system manual (KH2020, KH2026 and KH2061), as appropriate, for details of accessing these menus:

(1) Operating Frequency. ***SharpEye™*** contains 14 pre-set transmission frequencies within the operating frequency band.

(2) Reverse Sweep Mode. To minimise in-band asynchronous interference from other X-Band ***SharpEye™*** radars in the same locality, the operator is able to select a reverse sweep mode.

(3) Transmit Inhibit Sector. The ***SharpEye™*** radar provides one blanking sector that is configured via the Display. Within the blanking sector, the ***SharpEye™*** radar does not transmit RF energy.

Drive Control Unit

NOTE: The inverter is set up in the factory for operation with an input frequency of 50 Hz.

WARNING

**THE INVERTER MUST BE SET TO REMOTE OPERATION.
IF THE INVERTER IS SET TO LOCAL OPERATION IT WILL BE SWITCHED ON REGARDLESS OF THE POSITION OF THE ON/OFF KEYSWITCH, THUS OVERRIDING THE MAN ALOFT INTERLOCK FUNCTION.**

5 The Drive Control Unit contains an inverter that must be programmed to provide the correct frequency of rotation for the antenna. Refer to Figure 1 for the location of the inverter.

6 Remove the Drive Control Unit front cover by releasing the four screws. This allows access to the inverter.

7 The inverter in the Drive Control Unit is Factory set for 50 Hz input and provides a 25 Hz (low speed antenna) or 50 Hz (high speed antenna) depending on the link settings. If a different mains frequency is used or a system specific configuration is required, the inverter may require reconfiguring. To change a parameter proceed as follows:

NOTE: The inverter must be set up as specified in the table overleaf in order for it to function correctly for this system. The following procedure explains how to access the menu functions.

(1) Switch the mains ON and turn the keyswitch to the ON position. The inverter initialises and the readout goes to 0.00.

(2) Press the MON button. Whilst programming the PRG indicator is lit for the main function path, and flashes for F--- setting path.

(3) Press the button to scroll down through the function menu as listed below. Press the button to scroll up through the menu.

(4) At any function, pres ENT to read the Function Setting. Press or to change the setting and then press ENT to save the new setting and return to the function menu.

(5) When the menu reaches F---, press ENT to access F100, then press to scroll F101, F102 to F990. Pressing scrolls F100, F990, F880 to F100.

(6) At any F--- function press ENT to read the Function Setting and buttons to change the Setting.

(7) Press ENT to enter the new setting and return to the Function menu.

(8) To exit menus, press MON button until 00 is displayed.

(9) To change from 50 Hz to 60 Hz operation select function **typ** and select **2**.

(10) To set the antenna motor to high speed rotation select function **417** and set to **2820** for 50 Hz operation or **3384** for 60 Hz operation.

WARNING
IF OPERATION FROM THE INVERTER FRONT PANEL IS SELECTED, THE MAN ALOFT SAFETY KEYSWITCH IS OVERRIDDEN. NEVER SELECT OPERATION FROM THE INVERTER FRONT PANEL FOR NORMAL OPERATIONAL USE.

(11) To select operation from the inverter front panel set function **CN0d** to **1** (Start/Stop local control) and **FN0d** to **1** (Frequency set by). Set both functions to **0** to return to remote control (normal operation).

8 The parameters are set as follows (set for 50 Hz operation in the factory):

FUNCTION	DESCRIPTION	SET	OPERATION
AUH	HISTORY FUNCTION		
AUF	WIZARD FUNCTION		
CN0d	COMMAND MODE	0	TERMINAL BLOCK
FN0d	FREQUENCY SETTING MODE	0	TERMINAL BLOCK
FNSL	FM/OUT TERMINAL FUNCTION SELECTION	0	DEFAULT NOT USED
FN	METER ADJUSTMENT	0	
typ	STANDARD SETTING MODE	1--0 2--0 3--0	50 Hz, sets FH, UL, uL & F170 to 50 60 Hz, sets FH, UL, uL & F170 to 60 FACTORY DEFAULT
FR	FORWARD/REVERSE	0	FORWARD
ACC	ACCELERATION TIME	2	SECONDS
dEC	DECELERATION TIME	10	SECONDS
FH	MAXIMUM FREQUENCY	50/60	50 Hz or 60 Hz (set by typ)
UL	UPPER LIMIT FREQUENCY	50/60	50 Hz or 60 Hz (set by typ)
LL	LOWER LIMIT FREQUENCY	0	0 Hz
uL	BASE FREQUENCY (MOTOR)	50/60	50 Hz or 60 Hz (set by typ)
Pt	V/F CONTROL MODE SELECTION	0	VOLTAGE/FREQUENCY CONSTANT
ub	TORQUE BOOST	5	5% BOOST
tHr	MOTOR THERMAL PROTECTION LEVEL	80	80% (EQUIVALENT 1.5 kW MOTOR)
0LN	ELECTRONIC THERMAL PROTECTION LEVEL	0	OVERLOAD PROTECTION OFF OVERLOAD STALL ON
Sr-1	PRESET SPEED FREQUENCY 1	0	0 Hz
Sr-2	PRESET SPEED FREQUENCY 2	25	25 Hz
Sr-3	PRESET SPEED FREQUENCY 3	50	50 Hz
Sr-4	PRESET SPEED FREQUENCY 4	0	0 Hz
Sr-5	PRESET SPEED FREQUENCY 5	0	0 Hz
Sr-6	PRESET SPEED FREQUENCY 6	0	0 Hz
Sr-7	PRESET SPEED FREQUENCY 7	0	0 Hz
F—	EXTENDED PARAMETER	ENT	
F109	ANALOG/LOGIC INPUT FUNCTION SELECT	2	CONTACT INPUT
F127	SINK/SOURCE INPUT SELECTION	100	SOURCE
F170	BASE FREQUENCY 2	50/60	50 Hz or 60 Hz (set by typ)
F300	PWM CARRIER FREQUENCY	2	4 kHz
F301	AUTO RESTART	0	DISABLED
F302	REPETITIVE POWER RIDE-THROUGH	0	DISABLED
F303	RETRY SELECTION		
F417	MOTOR SPEED	2820 3384	For 50 Hz For 60 Hz
Gr..U	SEARCH FOR CHANGED SETTINGS THIS MENU ONLY SHOWS PARAMETERS THAT ARE NOT SET TO DEFAULT VALUE. GIVES FAST TRACK THROUGH MENUS.		

Transceiver Checks

NOTE: The following checks require the display to be configured for the transceiver/antenna combination.

9 Set any Mains Isolators to ON.

10 At the Drive Control Unit, insert the key into the ON/OFF keyswitch and set the switch to ON.

11 Configure the display for the transceiver/antenna combination installed.

12 Verify that the display indicates TX READY after the warm up period of approximately 30 seconds. Check that no fault indications are displayed.

13 Ensure that the antenna is rotating.

14 At the display set the transceiver to RUN.

15 Check that a radar picture is displayed on the screen, and no failure messages are displayed.

16 Confirm that known targets are being tracked on the display.

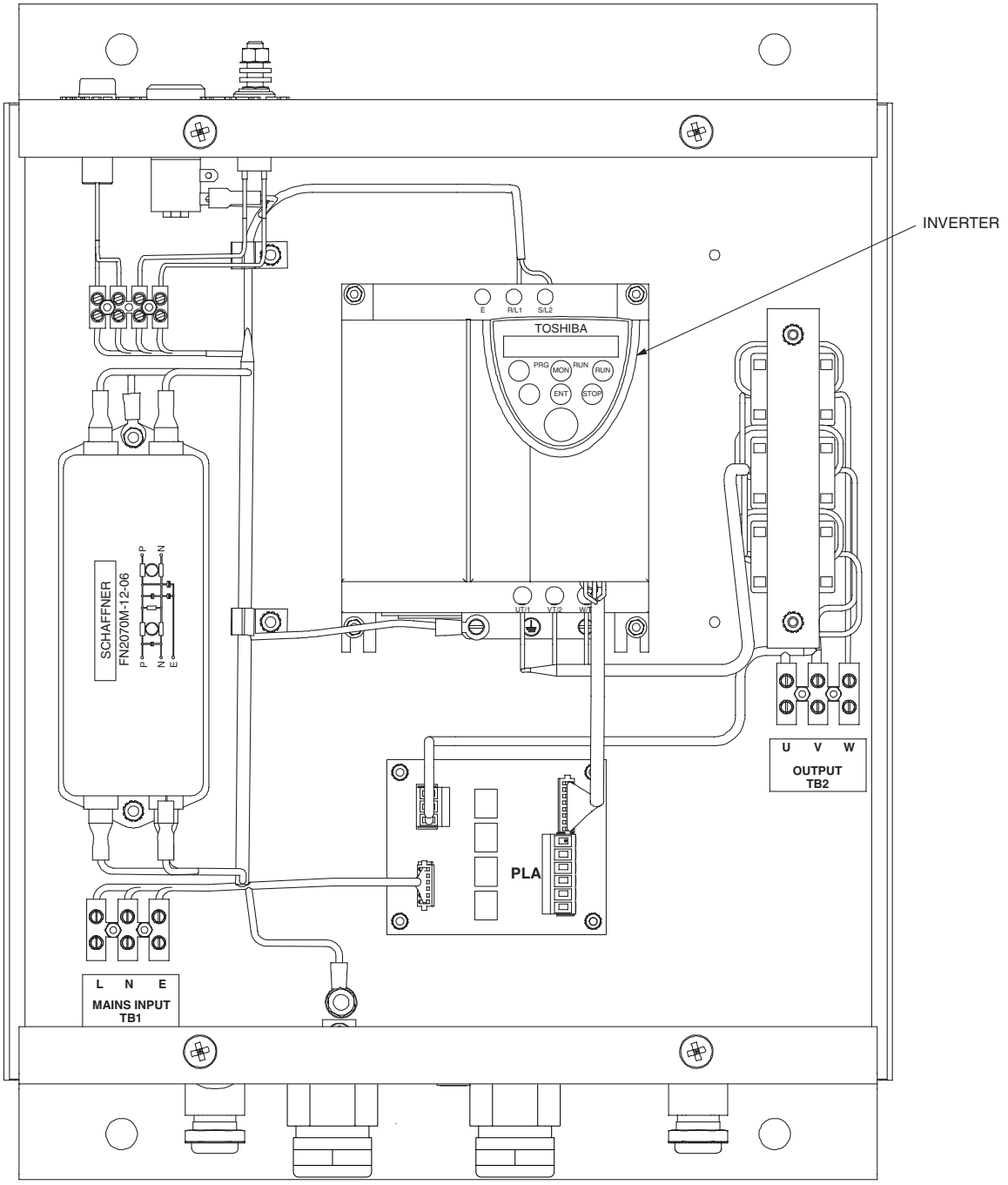

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Figure 1 - Drive Control Unit: Inverter Location

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CHAPTER 6

MAINTENANCE

CONTENTS

CONTENTS (CONT.)

ILLUSTRATIONS

CHAPTER 6

MAINTENANCE

INTRODUCTION

1 This Chapter is divided into three parts:

(1) Planned Maintenance.

(2) Diagnostic Maintenance.

(3) Corrective Maintenance.

PLANNED MAINTENANCE

NOTE: The transceiver runs continuously runs performance checks in the background, and any degradation in performance is reported as a warning message. There are no routine operator or maintainer performance checks required on the transceiver.

SIX MONTHLY CHECKS

NOTE: If you detect any problems when carrying out the following routine maintenance procedures contact the Kelvin Hughes Service Control Centre or your agent for advice.

CAUTION
Always switch the radar OFF, and as an additional precaution, switch OFF the antenna safety switches when working on the transceiver or antenna.

Antenna

2 Visually check the front radiating window for damage and soot or dirt. Note that even a thin layer of soot or dirt can cause serious loss of radar performance. If necessary, CAREFULLY wipe the antenna front radiating window using soap and water and a soft non-abrasive cloth. Ensure the window is not scratched or damaged when carrying out this procedure.

CAUTION
NEVER PAINT the front radiating window.

Transceiver Casing Inspection

3 Visually inspect that all screws, nuts and bolts are secure and free from corrosion.

DIAGNOSTIC MAINTENANCE

WARNING
THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS AND LETHAL VOLTAGES ARE PRESENT WITHIN THE UNIT. ACCESS TO THE INTERIOR OF THE UNIT IS ONLY TO BE CARRIED OUT BY A QUALIFIED TECHNICIAN.

4 The flowcharts in this chapter provide an aid to fault diagnosis in the transceiver. The algorithms enable fault diagnosis down to module level and also identify wiring faults. Entry to the algorithms is via Failure Messages generated by the display.

PRE-REQUISITES

5 The diagnostic routines in the flow charts assume that the radar has been working, and that the system is set up for normal operation at the time the fault occurred.

FAILURE MESSAGES

6 These failure messages appear in the data field of the display monitor if certain signals are missing. One or more of the following messages may be displayed on the display system:

(1) **No Sync**. Indicates that the display is not detecting sync pulses from the transceiver.

(2) **No Video**. Indicates that the display is not detecting video from the transceiver.

(3) **No Azimuth**. Indicates that the display is not detecting azimuth pulses from the transceiver.

(4) **No Heading Line**. Indicates that the display is not detecting heading line pulses from the transceiver.

7 The following messages are supplied from the transceiver via the CAN bus, which may switch to degraded mode of operation (low power output, low sensitivity etc) or fault mode:

(1) **Receiver Sensitivity Low**. This indicates that the minimum detectable signal is TBD dB, indicating a receiver fault. The transceiver continues operating in the degraded state. Should the minimum detectable signal be TBD dB, the transceiver will enter the fault state.

(2) **Antenna VSWR High**. The transceiver has detected a high reverse power and hence VSWR. This indicates that there is a mismatch in the transceiver output to the antenna, e.g. an antenna or rotating joint fault.

(3) **RF Power Low**. The transceiver has detected low power on the output. If the power is 3 dB below normal this indicates that one of the two RF output transistors in the transceiver has failed, i.e. a fault in the transceiver unit. The transceiver continues operating in a degraded state on half power. Should the second RF output transistor then fail, the transceiver will enter the fault state.

(4) **PLO Lock**. Indicates that the phase locked oscillator has developed a hardware fault.

(5) **Synth Lock**. Indicates that the frequency synthesiser has developed a hardware fault.

(6) **Transmitter Over-temperature**. This indicates that the temperature of the RF power transistors is high, indicating a fault in the transceiver.

8 Fault diagnosis algorithms covering these failures is provided in Figure 3.

TEST EQUIPMENT

9 Fault location is to module replacement level only. The only test equipment required for fault finding is a high impedance Multimeter.

PREPARATION FOR FAULT DIAGNOSIS

WARNING
THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS AND LETHAL VOLTAGES ARE PRESENT WITHIN THE UNIT. ACCESS TO THE INTERIOR OF THE TRANSCEIVER IS ONLY TO BE CARRIED OUT BY A QUALIFIED TECHNICIAN.

CAUTIONS

(1) Handling Of Electrostatic Sensitive Semiconductor Devices.

Semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or modules containing these devices.

Persons removing modules from an equipment using these devices should be earthed by a wrist strap and a resistor.

Soldering irons used during repair operations must be low voltage types with earth tips and isolated from the mains voltage by a double insulated transformer.

Outer clothing worn must be unable to generate static voltages.

Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

Fit new devices in a special handling area.

For detailed information, refer to British Standard BS 5783 or other equivalent standard.

10 To access the units inside the upmast transceiver, remove the side cover of the transceiver. This allows access to the transceiver and the power supply and allows the LEDs on the PSU Sense PCB and CAN Adapter PCB to be seen.

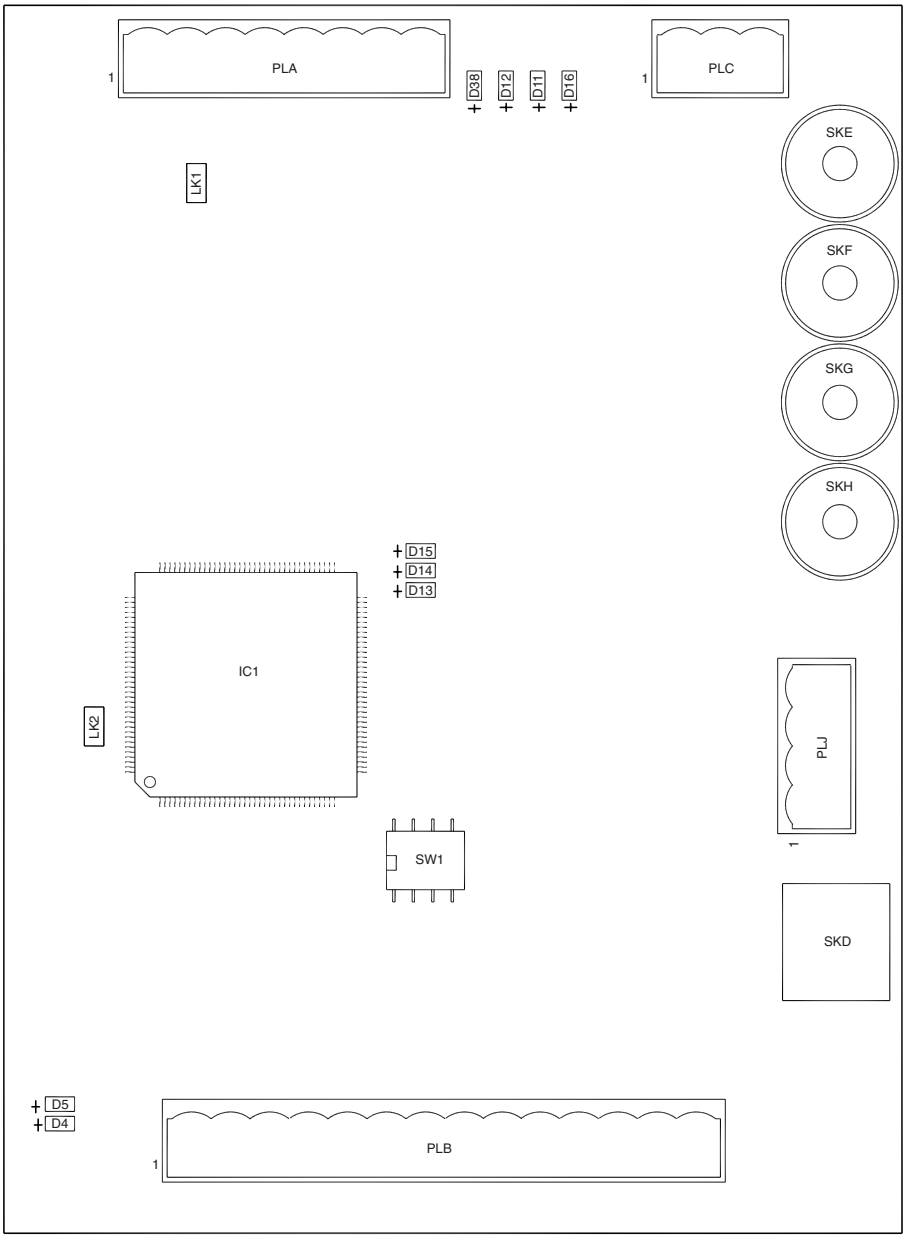
WARNING

IT IS DANGEROUS TO RUN THE TRANSCEIVER WHEN UPMAST AS THE ANTENNA IS ROTATING AND RF IS RADIATED. UNDER NO CIRCUMSTANCES SHOULD THE MAINTAINER BE UPMAST WHEN RF IS RADIATED AND/OR THE ANTENNA IS ROTATING. THEREFORE ALL CHECKS MUST BE MADE WITH THE TRANSCEIVER IN STANDBY MODE, THIS WILL LIMIT THE CHECKS THAT CAN BE MADE WHEN THE TRANSCEIVER IS SET TO RUN.

INDICATORS (Figure 1)

11 The indicators provided on the CAN Adapter PCB are as follows:

D4	MUTE. Unlit (not used) (Lit when mute active)
D5	RUN. Unlit (not used) (Lit when Run is active)
D11	+15 V. Lit when +15 V supply present
D12	-15 V. Lit when -15 V supply present
D13	RUNNING. Flashes when processor running
D14	LED 1. Lit when heartbeat received
D15	LED 2. Unlit (not used)
D16	+24 V. Lit when +24 V supply present
D38	+5 V. Lit when +5 V supply present



VIEW ON COMPONENT SIDE

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Figure 1 - CAN Adapter PCB (NNR-A981): LED Location

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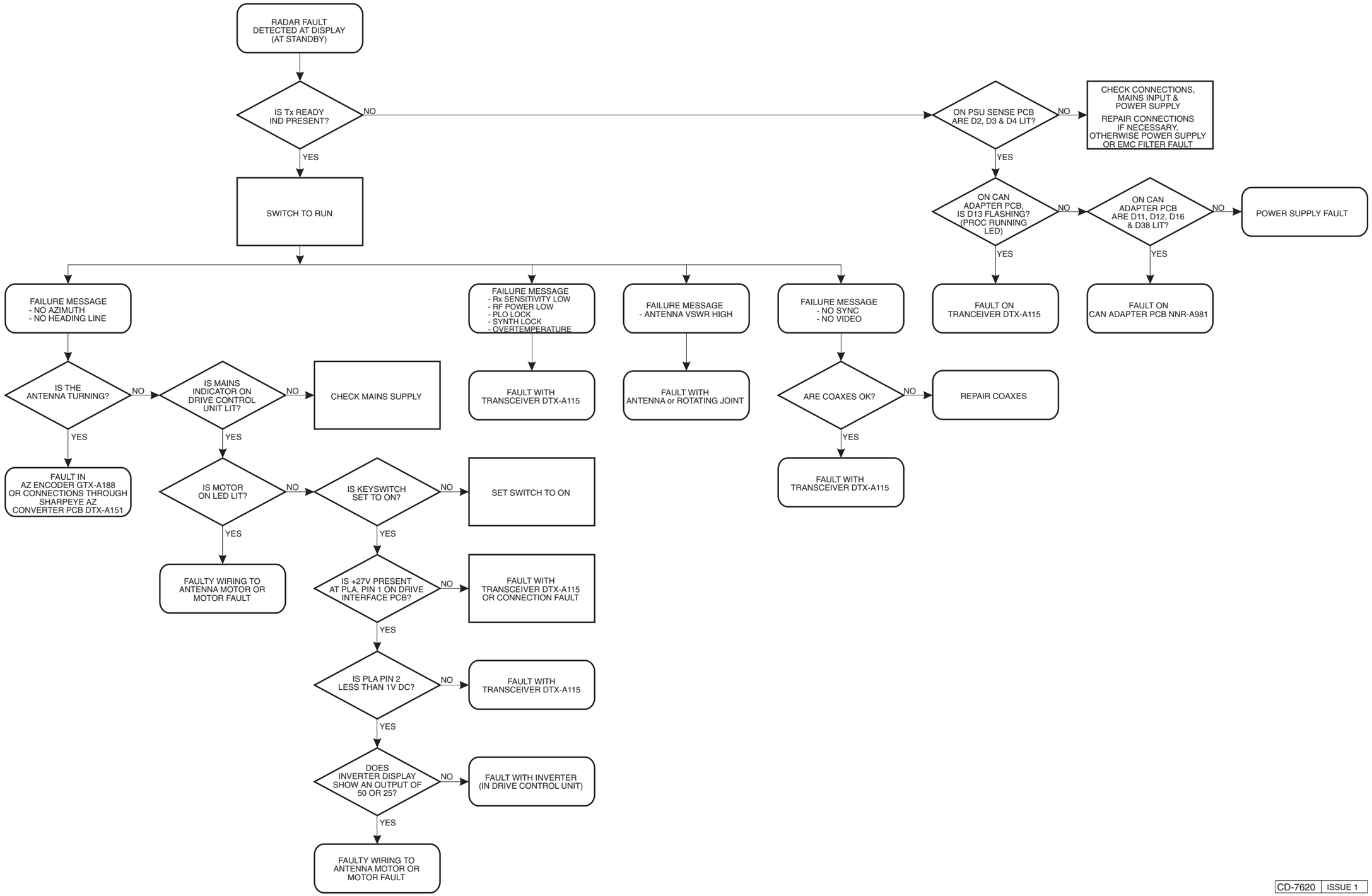

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Figure 2 **Transceiver: Fault Diagnosis** **Figure 2**

CORRECTIVE MAINTENANCE

WARNING
THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS AND LETHAL VOLTAGES ARE PRESENT WITHIN THE UNIT. ACCESS TO THE INTERIOR OF THE TRANSCEIVER IS ONLY TO BE CARRIED OUT BY A QUALIFIED TECHNICIAN.

CAUTIONS

(1) Handling Of Electrostatic Sensitive Semiconductor Devices.

Semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or modules containing these devices.

Persons removing modules from an equipment using these devices should be earthed by a wrist strap and a resistor.

Soldering irons used during repair operations must be low voltage types with earth tips and isolated from the mains voltage by a double insulated transformer.

Outer clothing worn must be unable to generate static voltages.

Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

Fit new devices in a special handling area.

For detailed information, refer to British Standard BS 5783 or other equivalent standard.

12 When a module is to be refitted, or a new one fitted, the refitting process is in the reverse order of the removal procedure unless stated otherwise.

TRANSCEIVER (DTX-A3)

13 The locations of the modules and assemblies in the upmast transceiver and turning mechanism are shown in Figure 3.

Access

14 Access to the modules and assemblies in the Upmast Transceiver, except the motor and gearbox, is attained by releasing the seven bolts securing the side cover in position and then removing the cover.

Removal of Rotating Joint (45-750-0034-001)

15 To remove the rotating joint, proceed as follows:

(1) Remove the antenna from the gearbox as follows:

CAUTION
When removing the antenna support it near its centre when lifting it from the gearbox. Do not handle the antenna by the waveguide input.
When removing and replacing the antenna ensure the waveguide input, on the end of the antenna, is not crushed or damaged.

(a) Slacken the 4 M8 x 75 mm bolts securing the antenna to the mounting bracket, allowing the antenna to be moved.

(b) Remove and retain all bolts, nuts, washers and screws securing the waveguide to the rotating joint, antenna waveguide input and mounting bracket. Carefully withdraw the waveguide from the assembly and store in a safe place.

(c) Remove and retain the 4 M8 x 75 mm bolts securing the antenna to the mounting bracket, and carefully withdraw the antenna from the mounting bracket.

(d) Remove and retain the 8 M10 x 40 mm bolts securing the mounting bracket to the swing casting.

(2) Inside the transceiver housing remove and retain the 4 allen key socket head screws that secure the bottom 90 degree bend of the rotating joint to the main shaft of the rotating joint.

(3) Before withdrawing the rotating joint, it will also be necessary to untie the unused coil of S-Band feed.

(4) Remove and retain the 6 M6 x 20 mm bolts and M6 washers that secure the top housing of the rotating joint to the swing casting, and carefully withdraw the rotating joint upwards out of the swing casting.

(5) If the bottom 90 degree bend of the rotating joint is also required, remove and retain the 4 bolts, nuts and washers that secure it to the internal waveguide.

Replacement of Rotating Joint (45-750-0034-001)

16 To replace the rotating joint, reverse the above procedure. Tighten and torque load the 12 antenna retaining bolts to 56 Nm and apply Loctite 222 on their threads during assembly. Waterproof the coaxial joint to the antenna by sealing with a layer of greased plastic compound such as Henleys compound or Denso-Tape.

Removal of Gearbox and Motor (55-100-0273-001)

17 To remove the gearbox, complete with motor, proceed as follows:

(1) Remove the antenna and rotating joint as described in paragraph 14.

(2) Remove and retain the six bolts securing the swing casting to the gearbox. Remove and retain the swing casting.

(3) Using an Allen Key, remove and retain the six bolts securing the Mounting Disc to the Gearbox and Motor. Remove and retain the Mounting Disc.

(4) Disconnect the electrical connections to the motor.

(5) Remove and retain the eight nuts securing the gearbox and motor to the enclosure (these are located inside the enclosure under the gearbox.

(6) Lift the gearbox, complete with motor, from the casting.

Replacement of Gearbox and Motor (55-100-0273-001)

18 To replace the gearbox, reverse the above procedure.

Removal of Azimuth Encoder (GTX-A188)

19 To remove the azimuth encoder, proceed as follows:

(1) Unplug the rigid RF Coaxial cable from the transceiver. Remove and retain the three bolts securing the rigid RF Coaxial cable to the rotating joint. Remove the coaxial cable and the coupling element and retain. This allows the encoder to be removed from the rotating joint.

(2) Unplug the Azimuth Encoder flying lead from the housing cableform (located in the top of the housing).

(3) Remove and retain the three bolts securing the rotating joint to the RF coaxial cable.

(4) Unscrew the flange from the base of the rotating joint.

(5) Remove and retain the two screws securing the Azimuth Encoder to the casting.

(6) Slacken the three grub screws securing the azimuth encoder to the gearbox and carefully remove the Azimuth Encoder, ensuring the cable is not damaged.

Replacement of Azimuth Encoder (GTX-A188)

20 To replace the azimuth encoder, reverse the above procedure.

Transceiver (DTX-A115) - Removal

21 To remove the Transceiver, proceed as follows:

(1) Remove all power supplies to the transceiver.

NOTE: The D -type connectors have a sliding metal retainer which must be moved fully one way before the connector can be removed. Note that the transceiver is removed in two sections.

(2) Disconnect the internal waveguide from the transceiver by removing the four sets of bolts and nuts. If necessary remove and retain the waveguide by releasing the four bolts securing it to the casing.

(3) Disconnect all the internal cableforms from the transceiver, including the coaxial cable to the rotating joint.

(4) Remove and retain the two semi-rigid cables on top of the transceiver (forward and reverse). Remove and retain the two semirigid cables at the side of the transceiver fitted between the upper and lower sections. Remove and retain the multiway cable at the side of the transceiver between the upper and lower sections. Note the position of each of the five cables.

(5) Remove the six small bolts securing the waveguide to the top of the upper section of the transceiver, and lift the waveguide up to access the securing bolts (a section of flexible waveguide is used to allow the waveguide to be hinged up).

(6) Remove the 15 large bolts (three rows of five bolts) securing the top section of the transceiver to the bottom section (DO NOT release the smaller bolts). Lift the top section clear of the unit. Note that the bolts do not go through the unit, but are screwed into studs on the bottom section of the unit, which align the two sections of the transceiver.

(7) Remove the 18 bolts securing the lower section of the transceiver to the side of the casing and remove the transceiver.

Transceiver (DTX-A115) - Replacement

22 To replace the Transceiver reverse the above procedure. There is no setting up for this unit.

Power Supply (45-690-0062-002) and PSU Sense PCB (DTX-A121) - Removal

23 To remove the Power Supply, proceed as follows:

(1) Remove the connectors from the Power Supply.

(2) Release the two captive screws securing the Power Supply to the base of the case.

(3) Pull the unit out, releasing the two securing flanges securing the power supply to the baseplate, and remove the power supply.

24 To remove the PSU Locating Plate, complete with mains filter, from the Power Supply (Modular) Xgen series (45-690-000062-002) remove and retain the four screws securing the PSU Locating Plate to the power supply and disconnect the cable from the mains filter. Retain the PSU Locating Plate.

Power Supply (45-690-0062-002) and PSU Sense PCB (DTX-A121) - Replacement

25 To replace the Power Supply Assembly reverse the above procedure. Ensure the two flanges are correctly inserted into baseplate.

CAN Adapter PCB (NNR-A981) - Removal

26 To remove the CAN Adapter PCB, proceed as follows:

(1) Remove the connectors from the CAN Adapter PCB.

(2) Remove and retain the six screws securing the CAN Adapter PCB and remove the PCB.

CAN Adapter PCB (NNR-A981) - Replacement

27 To replace the CAN Adapter PCB reverse the above procedure. Ensure SW1 on the replacement PCB is set as follows:

Position 1 OFF
Position 2 OFF
Position 3 OFF
Position 4 ON

SharpEye **Azimuth Interface PCB (DTX-A151) - Removal**

28 To remove the ***SharpEye™*** Azimuth Interface PCB, proceed as follows:

(1) Remove the connectors from the ***SharpEye™*** Azimuth Interface PCB.

(2) Remove and retain the two screws securing the ***SharpEye™*** Azimuth Interface PCB and remove the PCB.

SharpEye **Azimuth Interface PCB (DTX-A151) - Replacement**

29 To replace the ***SharpEye™*** Azimuth Interface PCB reverse the above procedure.

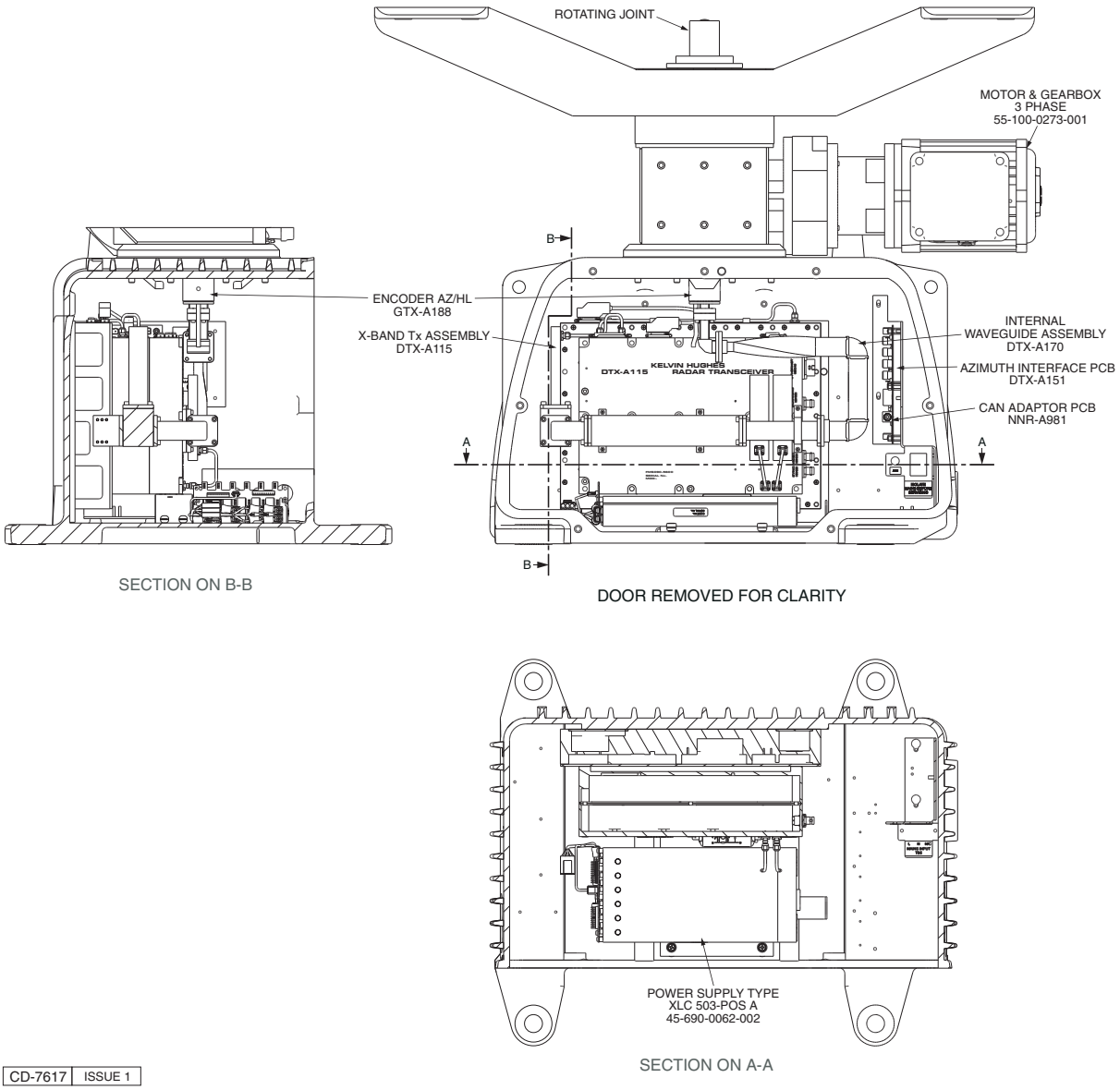

Figure 3 - Transceiver (DTX-A3): Module Locations

DRIVE CONTROL UNIT (GTX-A24)

30 The locations of the modules and assemblies in the Drive Control Unit are shown in Figure 4.

Access

31 Access to the modules and assemblies is attained by releasing the four screws securing the cover in position and then removing the cover.

Inverter Assembly - Removal

32 To remove the Inverter Assembly, proceed as follows:

(1) Remove power from the Drive Control Unit.

(2) Remove all electrical connections from the Inverter Assembly, ensuring each cable is identified.

(3) Remove and retain the four nuts securing the Inverter Assembly and remove.

Inverter Assembly - Replacement

33 To replace the inverter assembly reverse the above procedure. Ensure the cables are connected correctly to the new Inverter Assembly. The new inverter assembly must be programmed before use as described in Checks After Replacement.

Drive Interface PCB (GTX-A104) - Removal

34 To remove the Drive Interface PCB, proceed as follows:

(1) Remove power from the Drive Control Unit.

(2) Remove the internal and external connections to the Drive Interface PCB.

(3) Remove and retain the four nuts securing the Drive Interface PCB and remove.

Drive Interface PCB (GTX-A104) - Replacement

35 To replace the Drive Interface PCB reverse the above procedure.

Mains Filter (45-680-0028-01) - Removal

36 To remove the Mains Filter, proceed as follows:

(1) Remove power from the Drive Control Unit.

(2) Remove the four internal connections to the Mains Filter.

(3) Remove and retain the two nuts securing the Mains Filter and earth tag. Remove the Mains Filter.

Mains Filter (45-680-0028-01) - Replacement

37 To replace the Mains Filter reverse the above procedure, ensuring the earth tag is refitted and secured.

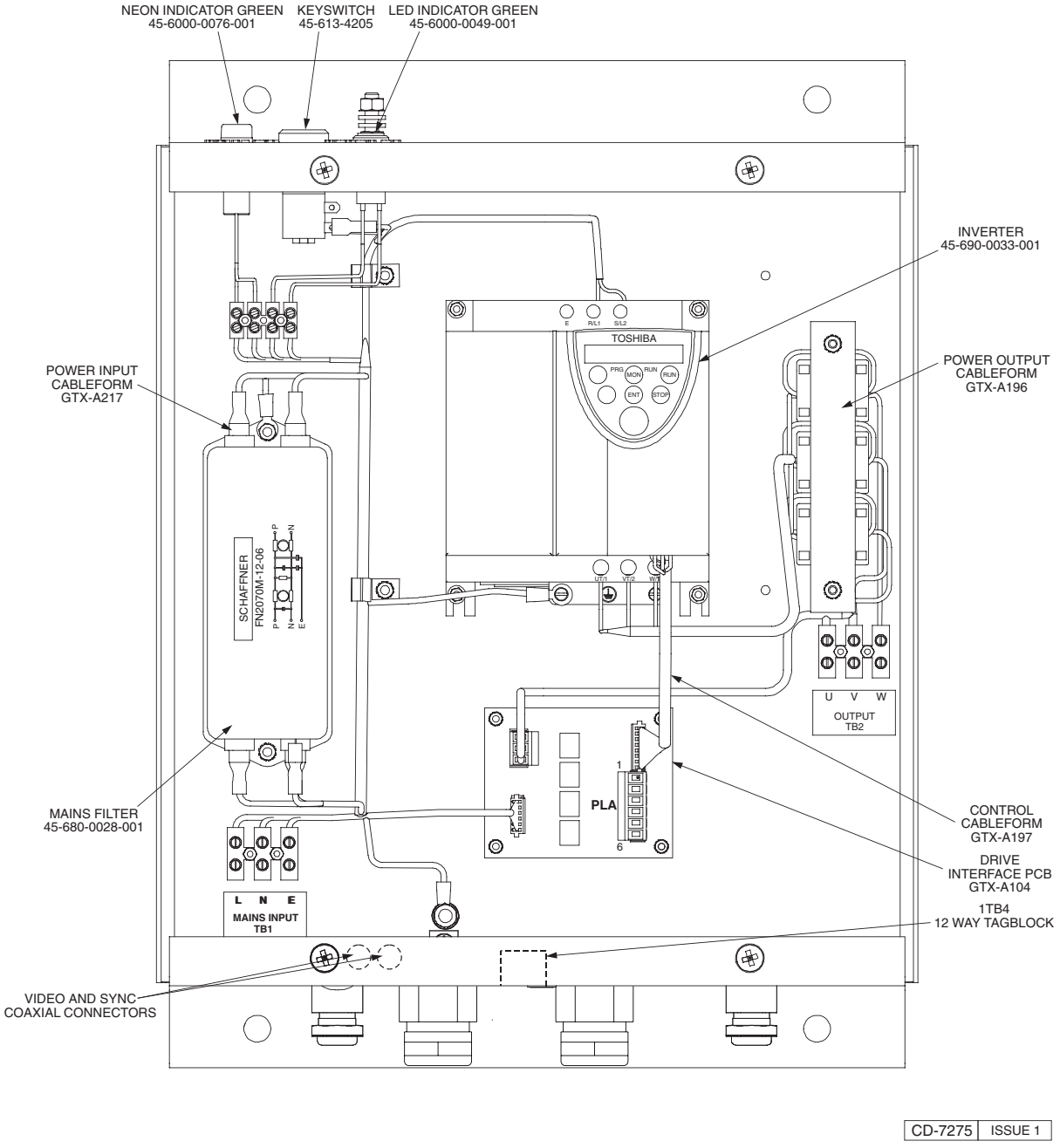

Figure 4 - Drive Control Unit (GTX-A24): Module Locations

CHECKS AFTER UNIT REPLACEMENT

38 Any maintenance, or rectification, involving the replacement of PCBs or Modules within the Transceiver involves certain procedures to bring the Transceiver up to full working order. The PCBs and Modules have been factory tested, and preset, and do not require any adjustment. Therefore, no setting up procedures are required for the transceiver. However, if the inverter in the Drive Control Unit is replaced the new inverter must be set up with the same parameters as the replaced unit.

39 The following paragraphs and sub-paragraphs are procedures that the maintainer or installer must follow to gain satisfactory performance of the equipment.

WARNING

DURING THESE PROCEDURES THE ANTENNA IS REQUIRED TO BE ROTATING, CARE IS TO BE TAKEN IF CHECKS ARE TO BE MADE AT THE TRANSCEIVER.

Transceiver

40 There are no setting up procedures required for the transceiver after a unit has been replaced.

Drive Control Unit

41 The inverter in the Drive Control Unit must be programmed to provide the correct frequency of rotation for the antenna. Refer to Chapter 5 for details of the commissioning procedure for the inverter.

CHAPTER 7

PARTS LIST

CONTENTS

PARTS LISTS

ILLUSTRATIONS

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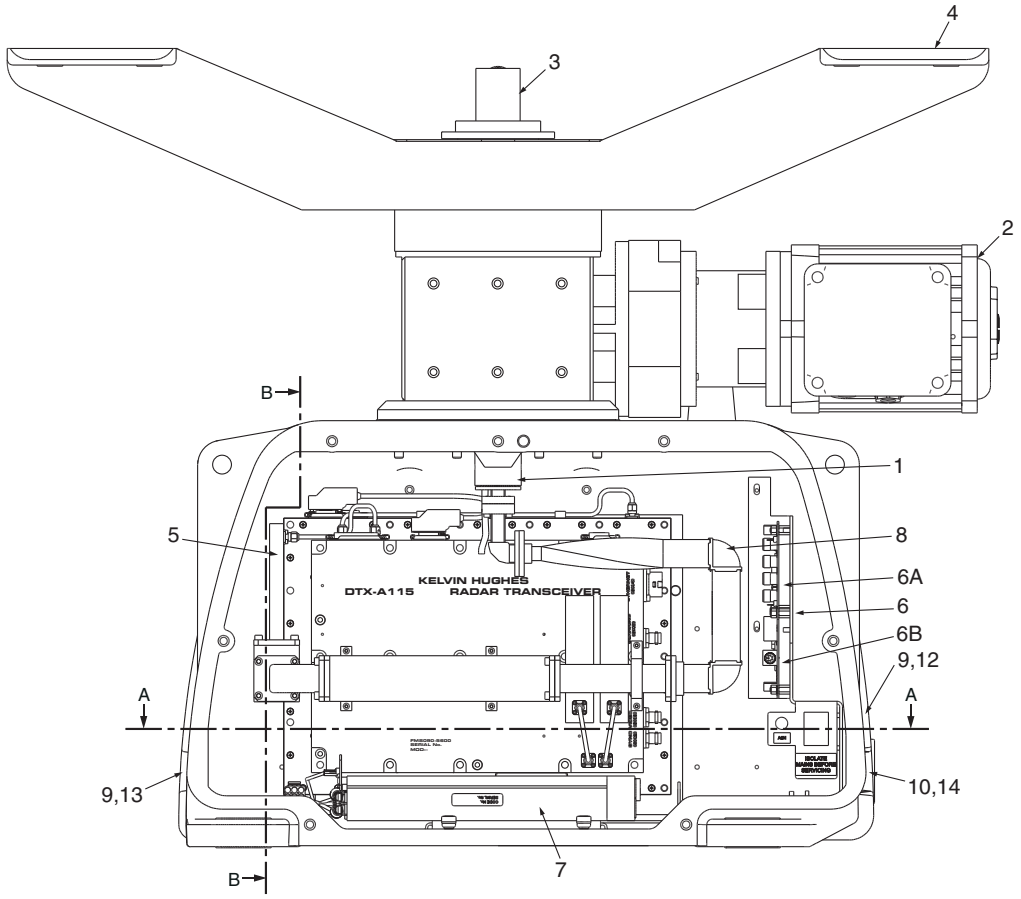
CHAPTER 7

PARTS LIST

INTRODUCTION

1 This Chapter provides a Parts Lists and drawing, showing layout and location information, to support the ***SharpEye™*** X-band Transceiver.

2 The Parts List is presented in tabular form and provides a description and Kelvin Hughes part number for each item labelled on the associated drawing. Items are cross referenced to the parts list by a number.



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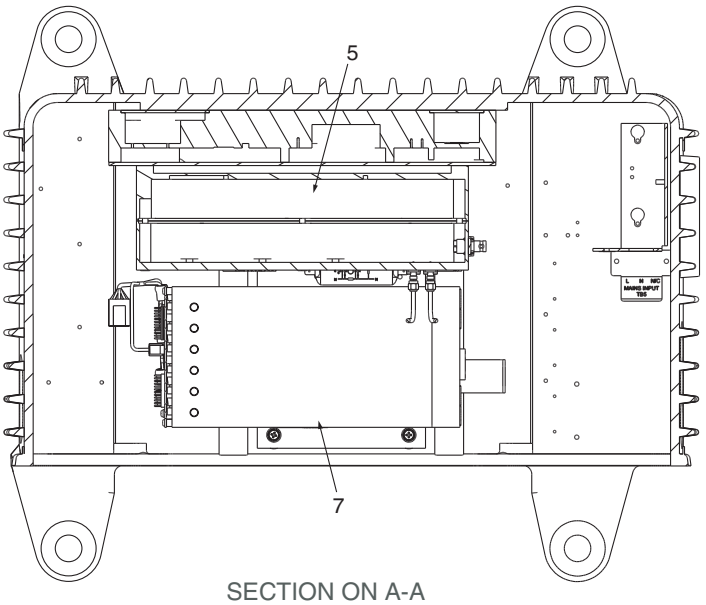

SECTION ON A-A

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Figure 1 - X-band Upmast Transceiver (DTX-A3): Main Assemblies

PL1 - X-band Upmast Transceiver (DTX-A3): Parts List

ITEM NUMBER	DESCRIPTION	KELVIN HUGHES Part No.
1	ENCODER AZ/HL	GTX-A188
2	MOTOR & GEARBOX 3 PHASE	55-100-0273-001
3	ROTATING JOINT	45-750-0034-001
4	ANTENNA SUPPORT CASTING	LPA-1129
5	***SharpEye***™ X BAND TX ASSY	DTX-A115
6	SWITCH AND CAN ADAPTER PCA ASSY	DTX-A150
6A	CAN ADAPTER PCB	NNR-A981
6B	***SharpEye***™ AZIMUTH INTERFACE PCB	DTX-A151
7	POWER SUPPLY TYPE XLC2503-P00A	45-690-0062-002
	DC POWER CABLE ASSY	DTX-A119
	INTERFACE CABLE ASSY	DTX-A149
	MAINS INPUT CABLE ASSY	DTX-A148
8	VTS INTERNAL WAVEGUIDE ASSEMBLY	DTX-A170
	TERMINAL SOCKET 12-WAY TYPE 302	45-925-0390-001
	NEON PANEL INDICATOR RED 220V	45-625-0005-001
9	EMC GLAND IP68 M16 FORM E	85-290-0071-006
10	GLAND, M25 CABLE DIA. 14-18MM	85-290-0071-003
	GLAND M20 CABLE DIA. 9 - 13MM	85-290-0071-002
11	BLANKING PLUG M16X1.5 BRASS	85-290-0081-001
12	GLAND BLANKING DISC	55-100-0210-003
13	GLAND BLANKING DISC	55-100-0210-002
14	GLAND BLANKING DISC	55-100-0210-001
	BLANKING PLUG M25	85-290-0080-001
	BLANKING PLUG M16X1.5 BRASS	85-290-0081-001
	FITTING KIT MANTA S BAND	GTX-A144

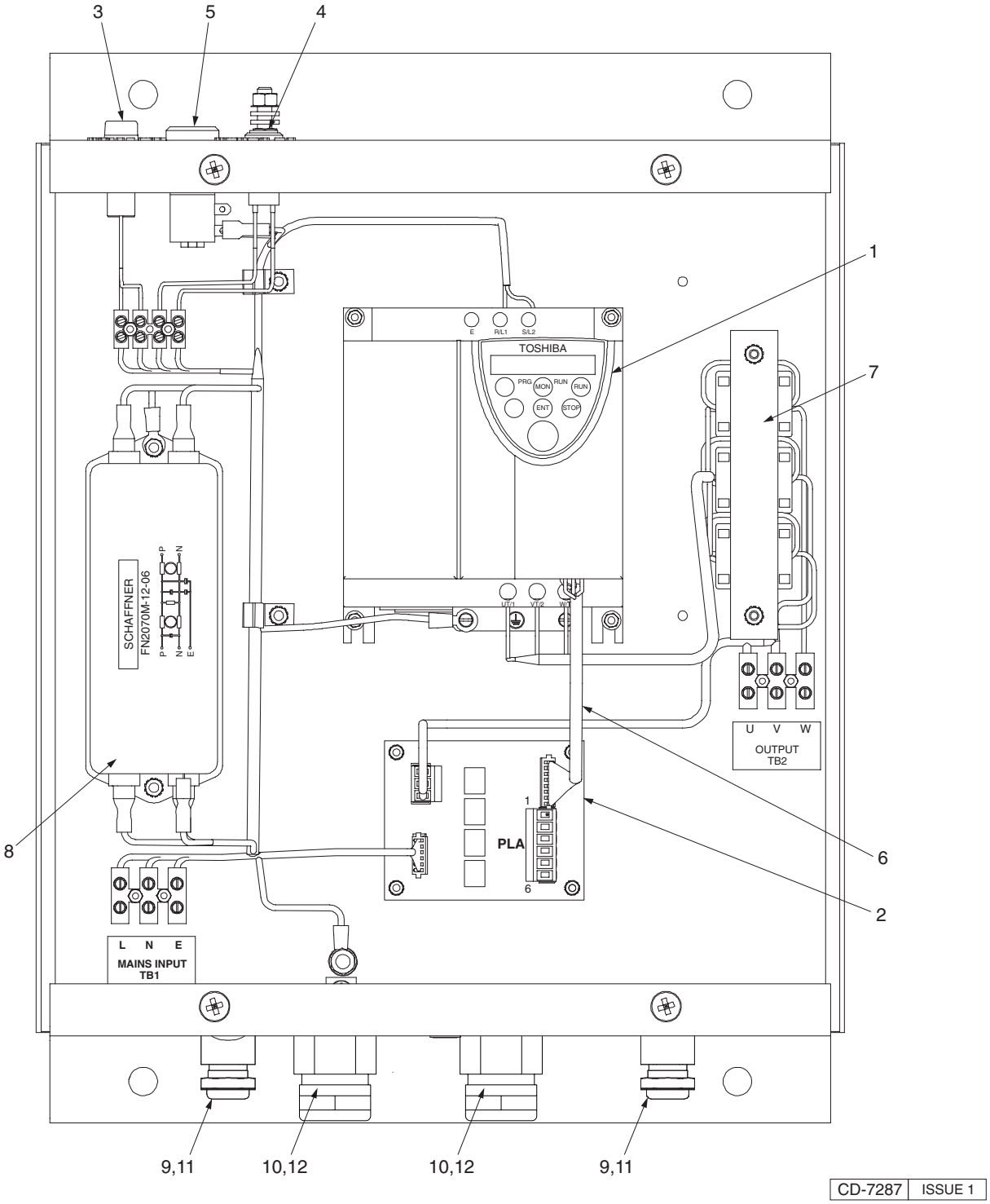

Figure 2 - Drive Control Unit (GTX-A24): Main Assemblies

PL2 - Drive Control Unit (GTX-A24): Parts List

ITEM NUMBER	DESCRIPTION	KELVIN HUGHES Part No.
1	INVERTER PT No.VFNC1S-2022PL-W (TOSHIBA)	45-690-0033-001
2	DRIVE INTERFACE PCB	GTX-A104
3	NEON INDICATOR GREEN 230V No L01770 (LP1)	45-6000-0076-001
4	LED INDICATOR GREEN 6340-305-505G (D1)	45-6000-0049-001
5	KEY SWITCH 2 POSITIONS 2A-250V	45-613-4205
6	CONTROL CABLEFORM	GTX-A197
7	POWER OUTPUT CABLEFORM	GTX-A196
8	POWER INPUT CABLEFORM	GTX-A217
	MAINS FILTER 12A FN2070M-12-06	45-680-0028-01
9	EMC GLAND IP68 M16 FORM E	85-290-0071-006
10	GLAND, M16 CABLE DIA. 6.5-9.5	85-290-0071-004
11	GLAND BLANKING DISC	55-100-0210-003
12	GLAND BLANKING DISC	55-100-0210-001

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INSTALLATION AND SERVICE REPORTS

This section is reserved for customer use and the following information should be inserted into the manual:

1 Installation Reports and Records

2 Service Reports and Records

3 Copy of Warranty Card

4 Other relevant documentation

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