SYSTEM HANDBOOK
for the
NUCLEUS 3 RADAR SYSTEMS

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Original

May 2001

Nucleus 3 Software Version 2.0x

ARPA 3 Software Version 4.x
RIU Software Version 1.0x
TIU Software Versiion 1.0x

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CONFORMITY STATEMENT

This system has been designed to comply with IMO regulations and IEC standards.

EQUIPMENT	IMO REGULATION(S)	IEC STANDARD(S)
Radar	IMO A.477(XII) MSC 64(67) Annex 4	IEC 936.1988 IEC 60936-1
HSC Radar	IMO A.820(19)	IEC 60936-2
ARPA	IMO A.422(XI) IMO A. 823(19)	IEC 872-1987 IEC 60872-1
ATA	MSC 64(67) Annex 4	IEC 60872-2
EPA	MSC 64(67) Annex 4	IEC 60872-3

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AMENDMENT RECORD

When an amendment is incorporated into this handbook, the details should be recorded below. If the equipment has been modified, the modification number is shown on the Amendment instruction page.

No.	Date Inserted	Initials	Mod No.	No.	Date Inserted	Initials	Mod No.
1	Sep 01	DFB	-	31			
2	Oct 01	DFB	-	32			
3	Nov 01	DFB	-	33			
4	Nov 02	GJS	-	34			
5	Jul 03	CRB	-	35			
6	Sep 03	CRB		36			
7				37			
8				38			
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30				60			

ELECTRIC SHOCK RESUSCITATION

1 SHOUT FOR HELP. SWITCH OFF ELECTRICITY IF POSSIBLE.

Do this immediately. If not possible, don't waste time searching for a switch.

2 REMOVE FROM DANGER.

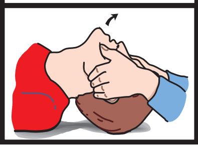
Safeguard yourself when removing casualty from hazard. If casualty is still in contact with electricity, and the supply cannot be isolated, stand on a dry non-conducting material (rubber mat, wood, linoleum).

Use rubber gloves, dry clothing, length of dry rope or wood to pull or push casualty away from the hazard.

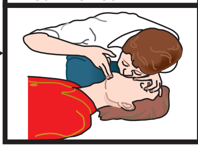
3 REMOVE OBVIOUS OBSTRUCTION TO BREATHING.

If casualty is not breathing start resuscitation at once.

LOOSEN NECKWARE
TILT HEAD BACKWARDS
AND PUSH CHIN UPWARDS



PINCH THE NOSE
COMMENCE VENTILATION
FOUR GOOD INFLATIONS
MOUTH TO MOUTH



IF CHEST DOES NOT RISE
RE-CHECK AIRWAY.
REMOVE OBSTRUCTION
AND RE-INFLATE

CHECK PULSE

POSITION OF PULSE

PULSE PRESENT

CONTINUE INFLATIONS
UNTIL RECOVERY OF
NORMAL BREATHING

PULSE ABSENT

HEART HAS STOPPED BEATING
LAY ON BACK ON FIRM SURFACE
eg FLOOR
COMMENCE EXTERNAL CHEST
COMPRESSION AND CONTINUE
MOUTH-TO-MOUTH VENTILATION

ONE FIRST AIDER

15 Compressions of 80 per minute followed by two inflations

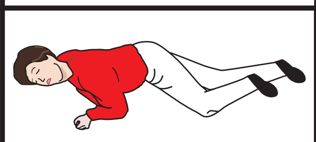
TWO FIRST AIDERS

One conducts chest compressions, without pause at 60 per minute. The other administers mouth-to-mouth ventilation - after each 5th compression

Check heart beat after first five mintutes and then after every three mintutes. Continue external chest compression and mouth-to-mouth ventilation until a normal pulse is felt and colour improves

CONTINUE INFLATIONS
UNTIL RECOVERY OF
NORMAL BREATHING

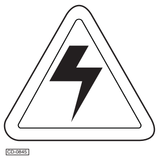
WHEN NORMAL BREATHING COMMENCES
PLACE CASUALTY IN RECOVERY POSITION



Keep casualty at rest. Remove on a stretcher. Watch closely, particularly for difficulty in breathing. Lightly cover with blankets or other materials.

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

SAFETY WARNINGS



WARNING

THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS. LETHAL VOLTAGES ARE PRESENT WHEN THE UNITS ARE OPEN AND EXPOSED. BEFORE REMOVING ANY SUB-UNIT OR PCB, ALL SUPPLIES MUST BE SWITCHED OFF.

WARNING

ENSURE THAT THE DISPLAY IS SWITCHED OFF PRIOR TO CLEANING THE SCREEN. OTHERWISE STATIC BUILD-UP MAY PRODUCE ELECTRICAL DISCHARGES WHICH, IN EXTREME CASES, COULD BE HAZARDOUS.

WARNING

THIS EQUIPMENT CONTAINS MATERIALS WHICH PRODUCE TOXIC FUMES WHEN BURNT.

SAFETY WARNINGS

ANTENNA RADIATION HAZARD

INJURY CAN RESULT FROM EXPOSURE TO THE MAIN BEAM OF A RADAR ANTENNA AT A DISTANCE FROM THE CENTRAL FRONT FACE, OF LESS THAN:

1.3m (X-Band) Antenna: 3.0 metres
1.8m (X-Band) Antenna: 2.3 metres
2.4m (X-Band) Antenna: 1.5 metres
2.9m (S-Band) Antenna: 1.1 metres
3.9m (S-Band) Antenna: 0.8 metres

WARNING

DO NOT OPEN ANY OF THE EQUIPMENT UNITS WHEN THE RADAR IS OPERATIONAL.

ANTENNA ROTATION

ANTENNA ROTATION CAN BE HALTED BY SWITCHING THE DISPLAY TO STANDBY OR OFF.

SERVICING

THE EQUIPMENT SHOULD BE SERVICED BY AUTHORISED AGENTS ONLY.

SAFETY WARNINGS

Mains Voltage

All Kelvin Hughes equipment is supplied with Mains Voltage set for 220V, unless stated otherwise on labels attached to the equipment.

S-Band Tuning

It may be necessary to re-tune the transmitter when changing the pulse length.

Picture Freeze

The rare event of Processor failure is indicated by non-operation of the trackerball, no update of screen data and a frozen tune bar indicator. The radar picture may be updated, but plotting is not possible.

The display is to be switched OFF and ON again to reset the Processor.

ARPA Failure

The ARPA computer is protected by a watchdog circuit, which monitors the ARPA for correct operation.

In the unlikely event of computer failure, the Operator observes vector footprints becoming detached from targets. If this occurs, reset the computer, by pressing the "Delete All Targets" pushbutton twice.

If the ARPA fails while running, an ARPA FAILURE message is indicated. If the ARPA fails to start, a TESTING ARPA message remains on the screen after the initial self-test period of 10 seconds.

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:

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

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.

Outer clothing worn must be unable to generate static charges.

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 IEC Standard IEC 61340-5-1:1998 or other equivalent standard.

LIST OF ABBREVIATIONS

ACQ	Acquire
ADS	Adjust
AFC	Automatic Frequency Control
ARPA	Automatic Radar Plotting Aid
AUD	Audible
BCR	Bow Crossing Range
BCT	Bow Crossing Time
BRG	Bearing
CPA	Closest Point of Approach
CSE	Course
DIU	Dual Interswitch Unit
EBL	Electronic Bearing Line
ENH	Enhanced
EPA	Electronic Plotting Aid
EPROM	Erasable Programmable Read Only Memory
ERBL	Electronic Range & Bearing Line
EXT	External
FTC	Fast Time Constant
GPS	Global Positioning System
HL	Heading Line
IR	Interference Rejection
LP	Long Pulse
MINIM	Minimum
MP	Medium Pulse
NMEA	National Maritime Electronics Association
PCB	Printed Circuit Board
PI	Parallel Index
PM	Performance Monitor
PPI	Plan Position Indicator
RADAR	Radio Detection And Ranging
RAM	Random Access Memory
RATS	Rate Aided Tracking System
RCGA	Radar Control Gate Array
RIU	Radar Interswitch Unit
RM(R)	Relative Motion, Relative Trails
RM(T)	Relative Motion, True Trails
Rx	Receiver
SATNAV	SATellite NAVigation
SC/SC	Scan to Scan (Correlation)
SP	Short Pulse
STC	Swept Time Constant
TCPA	Time to Closest Point of Approach
TIU	Transceiver Interface Unit
TM(T)	True Motion, True Trails
TTL	Transistor Transistor Logic
Tx	Transmitter
VDU	Video Display Unit
VRM	Variable Range Marker

CONTENTS

INTRODUCTION

Table of Contents

ILLUSTRATIONS

INTRODUCTION

1 This section provides an introduction to the Nucleus 3 Display systems.

2 The Nucleus 3 Radar systems can be configured to suit customer requirements, according to the quantity and types of display, transmitter/receiver and Interswitch unit used. Typical configurations are shown on the Figures at the end of this Introduction.

3 The comprehensive use of colour, provides an optimum display of radar picture, selectable functions, warnings, target information and Ownship navigation data.

4 The Nucleus 3 5000 series equipment is designed for use as a desk mounted display. It can also be mounted on a pedestal base, for deck-mounting, if required. All electronics including the display driver, system processor, interface and ARPA (if fitted) are accessed via a removable top panel.

5 The Nucleus 3 6000 series equipment is designed for use as either a deck mounted Console or a desk mounted Display with a separate Processor cabinet. Display driver electronics are accessed through a top panel, whilst all other electronics including the system processor, interface and ARPA (if fitted) are accessible via the front panel.

6 The Nucleus 3 7000 series equipment features a range of remote Flat Panel display options designed for either console or desktop mounting

OPERATION

7 Nucleus 3 colour Radar Displays utilise a unique method of operation. The entire operation of the radar (apart from power ON/OFF switching and degauss) is controlled by using the trackerball and the three pushbutton keys located on the specially designed ergonomic control unit, featuring a contoured hand rest.

8 The operation of the Nucleus 3 range of radars is designed to be simple and intuitive. A cursor is moved by the trackerball inside and outside the radar circle. When the cursor is moved to be within the confines of a 'Status Box' (located outside the radar circle) the box is automatically highlighted; pop-down boxes provide abbreviated pushbutton functionality. Simultaneously, function options are displayed as a labelled diagrammatic view of the three pushbuttons in the 'Pushbutton Selection Box'. The functions are accessed by pressing the appropriate pushbutton. The 'Status Box' changes to display the new status and the cursor can then be moved back to the radar circle or to another function box.

9 When the cursor is inside the radar circle, the three buttons are used for plotting targets, positioning markers and mapping graphics. A diagrammatic labelled view of the pushbutton functionality is displayed in the pushbutton selection box.

10 Detailed Operating Information is provided in Chapter 1.

PLOTTING AIDS

11 Three types of radar plotting are available throughout the Nucleus 3 range;

(1) Automatic Radar Plotting Aid (ARPA) - offering manual and automatic acquisition and automatic tracking.

(2) Automatic Tracking Aid (ATA) - providing manual acquisition and automatic tracking.

(3) Electronic Plotting Aid (EPA) System - for manual plotting.

12 Radar Plotting Aids are described in Chapter 2.

MAPPING

13 The mapping facility has a capacity of 350kbytes used in a flexible partition arrangement. Maps can be ground stabilised in any mode using a reference target, or by external position fixing systems (e.g. GPS).

14 The maps are stored on internal non-volatile Flash memory.

DISPLAY TYPES

15 The 5000, 6000 and 7000 series of displays provide the following operational facilities:

(1) 5/6/7000ARPA - Relative Motion RM(R) and True Motion TM(T) and Relative Motion RM(T) modes incorporate True Motion and ARPA (Automatic Radar Plotting Aid) facilities.

(2) 5/6/7000ATA - Relative Motion RM(R), True Motion TM(T) and Relative Motion RM(T) modes incorporate True Motion facilities and an ATA computer input (an Automatic Tracking Aid).

(3) 5/6/7000EPA - Relative Motion RM(R), True Motion TM(T) and Relative Motion RM(T) (True Trails) Presentation, incorporate True Motion facilities and Electronic Plotting facilities.

16 Day/night operation is optimised by colour and intensity.

DISPLAY FACILITIES

17 For information on how to select any facility on the display, refer to Chapter 1 - Operating Information.

Range Scales

18 The PPI range scales are: 0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm, 3nm, 6nm, 12nm, 24nm, 48nm and 96nm.

Screen Modes of Operation

19 The following modes of operation and presentation are available for selection, depending on the type of display installed:

(1) Relative Motion, Relative Trails RM(R) (2) True Motion, True Trails TM(T) (3) Relative Motion, True Trails RM(T)	**Motion Modes**
(4) Head Up. (5) North Up. (6) Course Up.	**Presentation Modes**

Options (True Motion and Relative Motion with True Trails)

20 True Motion (True Trails), TM(T) is available - where Ownship moves across the screen at a velocity equivalent to the Ownship's speed and heading.

21 Relative Motion (True Trails) mode offers relative motion, fixed centred or off-centred Ownship's position, with true trails.

Offcentre

22 The display can be offcentred by up to 70%, on all range scales, except 96nm.

Heading Line

23 The ship's heading line and all other computer generated graphics can be temporarily removed from the radar display, to present the operator with a clear radar only picture.

Variable Range Marker

24 The Variable Range Markers (VRM1 & VRM2) are shown on the radar display as dashed rings (colour coded; Green for VRM1 and Red for VRM2) and are available over the entire radar range. The VRMs ranges are displayed by an alphanumeric readout in a box (colour coded; Green for VRM1 and Red for VRM2), located in the lower left-hand side of the screen.

Electronic Bearing Line

25 The Electronic Bearing Lines (EBL1 & EBL2) are shown on the radar display as lines colour coded; (Green for EBL1 and Red for EBL2), emanating from Ownship. The EBLs are True in North Up display mode and Relative in Head Up mode. The bearings of the EBLs are displayed as an alphanumeric readout in a box (colour coded; Green for EBL1 and Red for EBL2), located beneath the VRM box.

26 The EBL can be off-centred and the origin set to the cursor position. This enables measurement of the bearing of a target from a point other than the Ownship.

Signal Controls - Gain, Sea, Rain

27 The Gain facility sets the basic threshold level of the radar video displayed on the screen. The Sea facility reduces sea clutter returns and features an "AUTO" (automatic) option. The Rain facility reduces clutter from rain, snow and hail precipitation.

Ownship and Plotting Parameters

28 Ownship and Plotting parameters are displayed in a box (located on the right-hand side of the screen) which contains Gyro, Heading, Speed, Set & Drift Input, Vector, Trails, CPA and TCPA.

Target Data

29 Target data is displayed on demand, for any selected tracked target, in a box located beneath the Ownship and Plotting parameter data box.

Parallel Index Lines

30 Four colour-coded Parallel Index Lines are provided to enable the operator to navigate in difficult areas (e.g. an estuary). Each line is independent.

OPTIONS

31 Refer to Chapter 8A for details of available Options.

RADAR PLOTTING AIDS

Electronic Plotting Aid (EPA)

32 The Electronic Plotting Aid (EPA) is a manual plotting system equivalent to, but superior than, a reflection plotter. Up to 20 targets can be plotted in all display modes. EPA is fitted to all Relative and True Motion display systems.

33 The operator manually selects and enters target plots, and at regular intervals updates the plots by entering the new position of the targets.

34 Refer to Chapter 2a for a full description of EPA facilities.

Automatic Tracking Aid (ATA)

35 The Automatic Tracking Aid (ATA) is based on the ARPA system and offers 20 target capacity. Trial manoeuvre, target history and automatic acquisition are **excluded** from the ATA facility. ATA performance is fully compliant with IMO requirements.

36 The ATA utilises a computer which employs advanced processing techniques to track targets automatically.

37 Refer to Chapter 2b for a full description of ATA facilities.

Automatic Radar Plotting Aid (ARPA)

38 The Automatic Radar Plotting Aid (ARPA) facility complies with and exceeds the IMO requirements for an Automatic Radar Plotting aid. Up to 50 targets can be acquired (automatically or manually) and tracked.

39 The ARPA includes Simulations and Trial Manoeuvres.

40 Refer to Chapter 2b for a full description of ARPA facilities.

SYSTEM CONFIGURATIONS

41 The Nucleus 3 Display System can be configured in a number of different ways.

42 Typical configurations include:

(1) Single Display unit with single Transmitter/Receiver and Antenna.

(2) Two Display units with a single Transmitter/Receiver and Antenna.

(3) Two Display units interswitched with two Transmitter/Receivers and Antennas.

43 Some typical system configurations are shown in Figures 1 to 10 on the following pages.

44 As an Option, multiple Display units can be interswitched with multiple Transmitter/Receivers and Antennas. Information on Options is provided in Chapter 8.

DISPLAY SYSTEM SPECIFICATION

The following table contains a Summary of Data for all Nucleus 3 Displays

		5000 Series	6000 Series	7000 Series
Display	**500mm rectangular colour CRT with B22 phosphor.** **660mm rectangular colour CRT with B22 phosphor.** **18-inch TFT LCD Colour Flat Panel** **20-inch TFT LCD Colour Flat Panel** Low flicker raster presentation 1024 line, 80Hz interlaced. **250mm radar diameter radar field** **340mm radar diameter radar field** **Zoned operational data/control fields.** **Active picture size: 1360x1024 pixels.** **Active picture size:1280x1024 pixels.** **Display controls minimised by use of a trackerball and three pushbuttons.** **Day/Night operation optimised by colour selection.** **Degauss facility.**			
Video Processing	**Re-timed processed multi-level video.** **Multi-plane recycled raster memory.** **Manual/Auto selectable STC, interference rejection, target enhancement and scan correlation.**			
Target Trails	**Relative and True Target Trails variable 0.75, 1.5, 3 and then 3 minute steps to 99 minutes.**			
Range Scales/Rings and Pulse Lengths	Range Scale (Nautical Miles) / Range Rings (Nautical Miles) / Pulse Length (PL Option) 0.125 / 0.025 / Short 0.25 / 0.05 / Short 0.5 / 0.1 / Short 0.75 / 0.25 / Short (medium) 1.5 / 0.25 / Short (medium) 3.0 / 0.5 / Medium (long/short) 6.0 / 1 / Medium (long/short) 12.0 / 2 / Medium (long/short) 24.0 / 4 / Medium (long/short) 48.0 / 8 / Long (medium) 96.0 / 16 / Long			
Motion Modes	**Relative Motion RM(R), True Motion TM(T) and Relative Motion RM(T),**			

		5000 Series	6000 Series	7000 Series
Presentation Modes	**Head Up / North Up/ Course Up.**			
Gyro Input	**All types stepper, synchro, "M" type with 90:1, 180:1 and 360:1 ratios.** **IEC 1162-2 High Speed Serial Gyro Interface.**			
Primary Speed Input **Secondary Speed Input**	**Single Axis 100, 200, 400, Pulses/nm, Manual, VHW** **Fixed Track Target** **VTG from GPS** **VBW from Doppler Log.**			
Drift Input	**Manual: 0-99.9kts, derived from VTG, VBW, ref target**			
Range Data	Minimum Range: Better than 30m on $10m^2$ target with short pulse, 4.5m aerial height and 4.5m waveguide. Range Discrimination: Better than 30m on 0.75 scale Range Ring Accuracy: 1% of range scale in use or 10m, whichever is greater.			
Lat/Lon	**Readout of Ownship's lat/lon and cursor range/bearing and lat/lon.**			
Range	Variable Range Markers (1 & 2): VRMs 1 & 2 variable from 0.01 to 96nm displayed on screen.			
Bearing Data	Bearing Scale: Electronically generated 1°, 5°, and 10° from 0° - 359.9°. Electronic Bearing Lines (EBL1& 2): (EBLs) Variable in 0.1° increments. Accuracy 0.5°. Centred or Offcentred. Parallel Index: Four Navigation Lines.			
Mapping Facilities	**350Kbytes internal memory** **4 user options of line and 16 symbol types.** **5 Map colours** **True Map positioning facility, via position fixing input from GPS.**			

		5000 Series	6000 Series	7000 Series
Power Supplies	**110V nominal, 220V nominal (50-60Hz) - Single Phase.** **115/380/440V 3 phase with optional transformer.** **Power corruption protected default parameters.**			
Interfacing	Standard: Diagnostic Output (RS232) 4 x NMEA Input (RS422/RS232) 1 x NMEA Output RS422 3 x NMEA Output RS232 Serial Trackerball Input PS/2 Trackerball Input Inputs NMEA 0183/IEC 61162-1 E2: DPT (depth) GGA, GLL (position) RNN, RTE (route) VHW (water speed) HDT (heading) RNN, RTE (route) VHW (water speed) VBW (ground/water speed) VTG (ground speed/heading) WPL (waypoints) ZDA, ZZU (UTC) Outputs: OSD (Ownship data) TTM (Target data) RSD (Radar System data) **Standard Azimuth Interface, 90:1, 180:1, 10V - 150V amplitude or 4096 TTL.** **Remote Monitor up to 20m separation (daisy chain).** **Transceiver - Full operation with Mk IV/V/VI/VII transceivers 5/10/25/30kW, “X” and “S” band.** **Display / Transceiver Separation - Up to 60 metres standard.**			

		5000 Series	6000 Series	7000 Series
	Power Supply - Capable of providing power for 5kW/10kW upmast transceivers and aerials. **VDR Video Output**			
Mechanical	Construction: Aluminium fabricated sheet metal. Mounting: Deck-Mount (Pedestal) Desk-Mount Split Display Custom Console Viewing Angle: 34 degrees to vertical 80 degrees (typical) to vertical and horizontal. Orientation: Landscape Display Size: Height: 399.5mm (18-inch) 480mm (20.1-inch) 465mm 1200mm Width: 482mm (18-inch) 533.8mm (20.1-inch) 520mm 682mm Depth: 77.47mm (18-inch) 76.8mm (20.1-inch) 776mm 820mm.			

			5000 Series	6000 Series	7000 Series
	Configuration:	Display Unit with Separate Processor Display Unit with Integral Processor.			
	Cooling:	Fan re-circulated cooling.			
	Electrostatic Damage:	Provision for wrist strap point.			
	Environmental:	To IEC 945-3 Ergonomic design to ISO recommendations			
	Paint:	Colour: two tone grey, with durable finish.			
	Cables:	Individually clamped at entry. Cable entries to allow for rear or bottom entry Provision for earthing bolt			

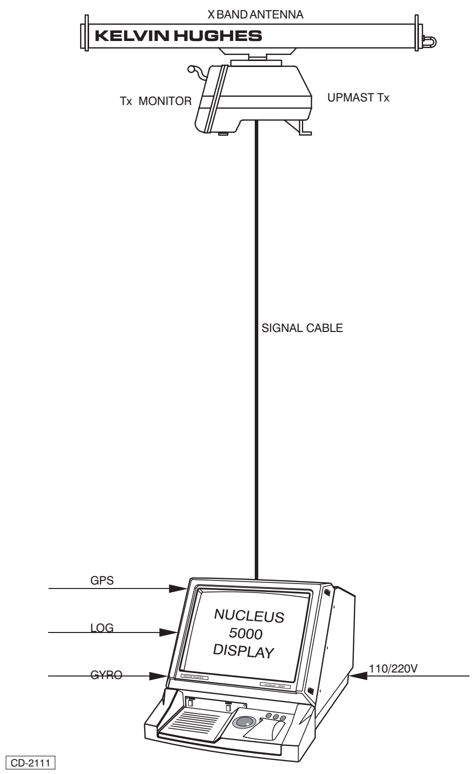


Figure 1 - Single Display with single Upmast Transmitter/Receiver and Antenna.

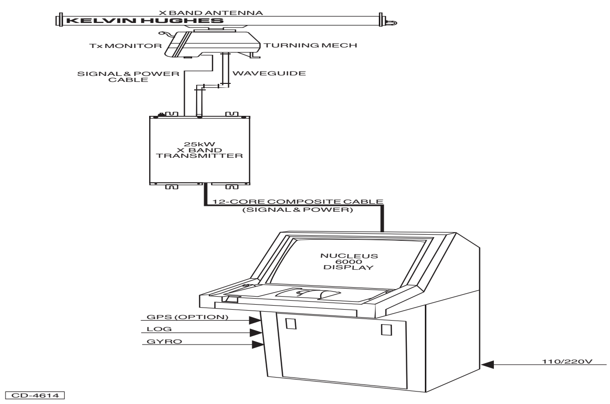


Figure 2 - Single Display with Single Downmast Transmitter/Receiver and Antenna

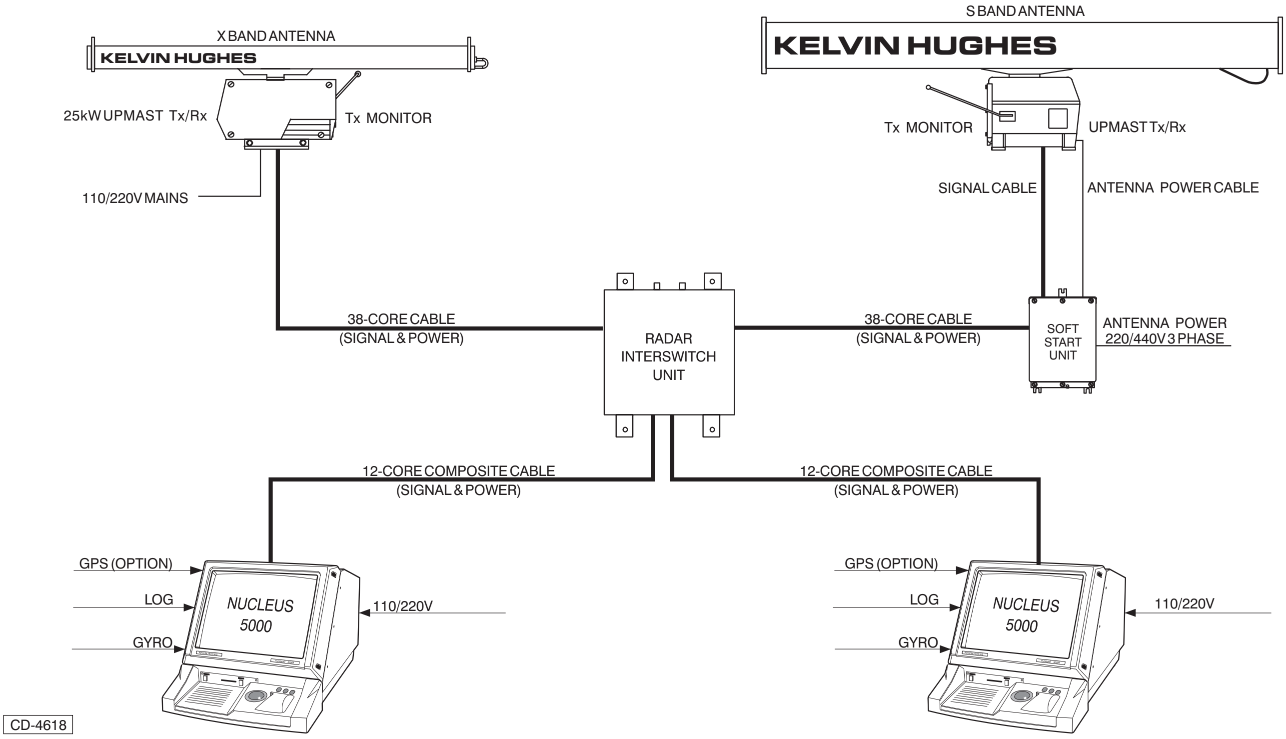


Figure 3- Two Displays interswitched (via RIU) with Two Upmast Transmitter/Receivers and Antenna

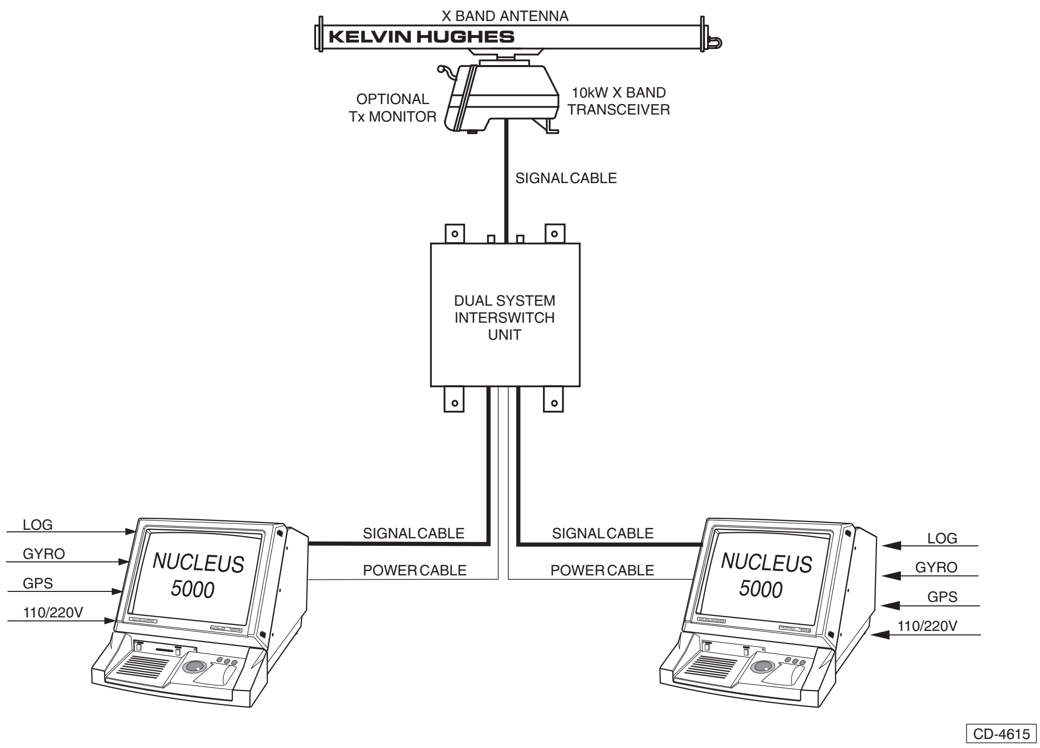


Figure 4 - Two Displays Interswitched (via a DIU) with a Single Transmitter/Receiver and Antenna

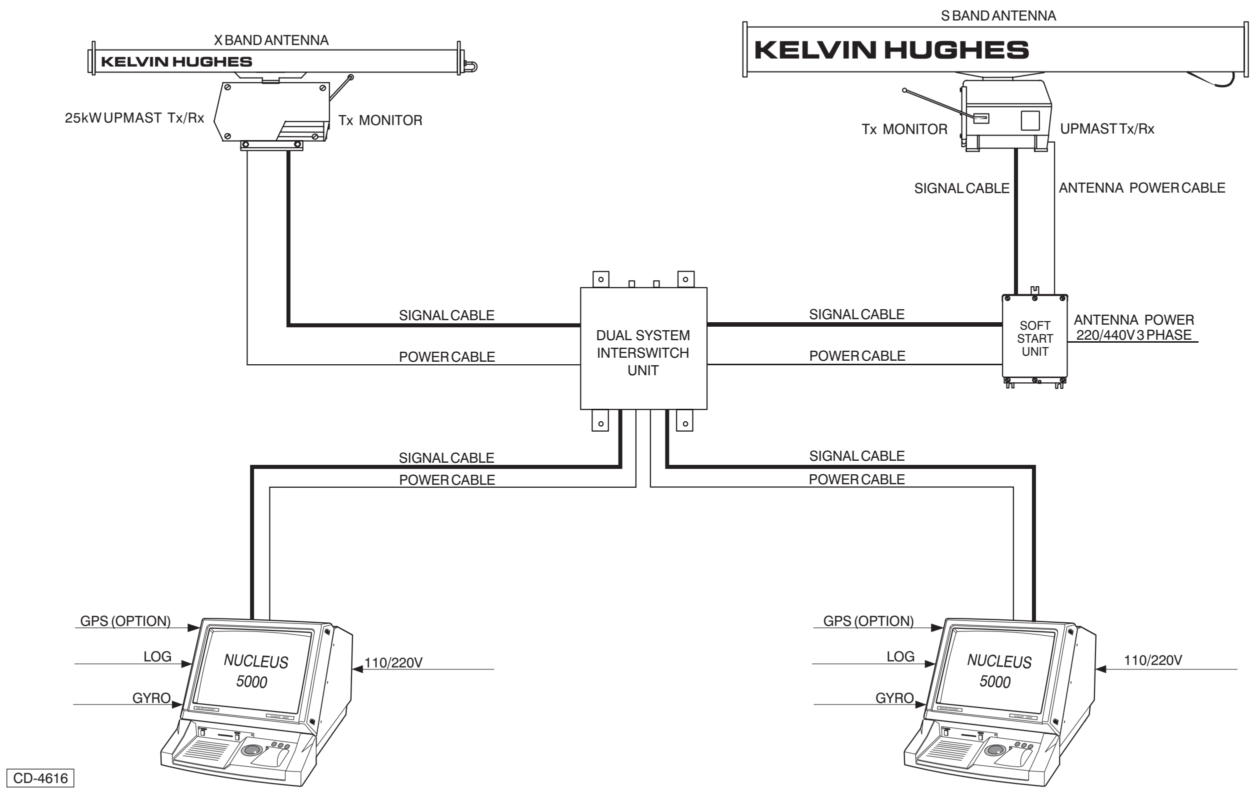


Figure 5 - Two Displays Interswitched (via a DIU) with two Upmast Transmitter/Receivers and Antenna

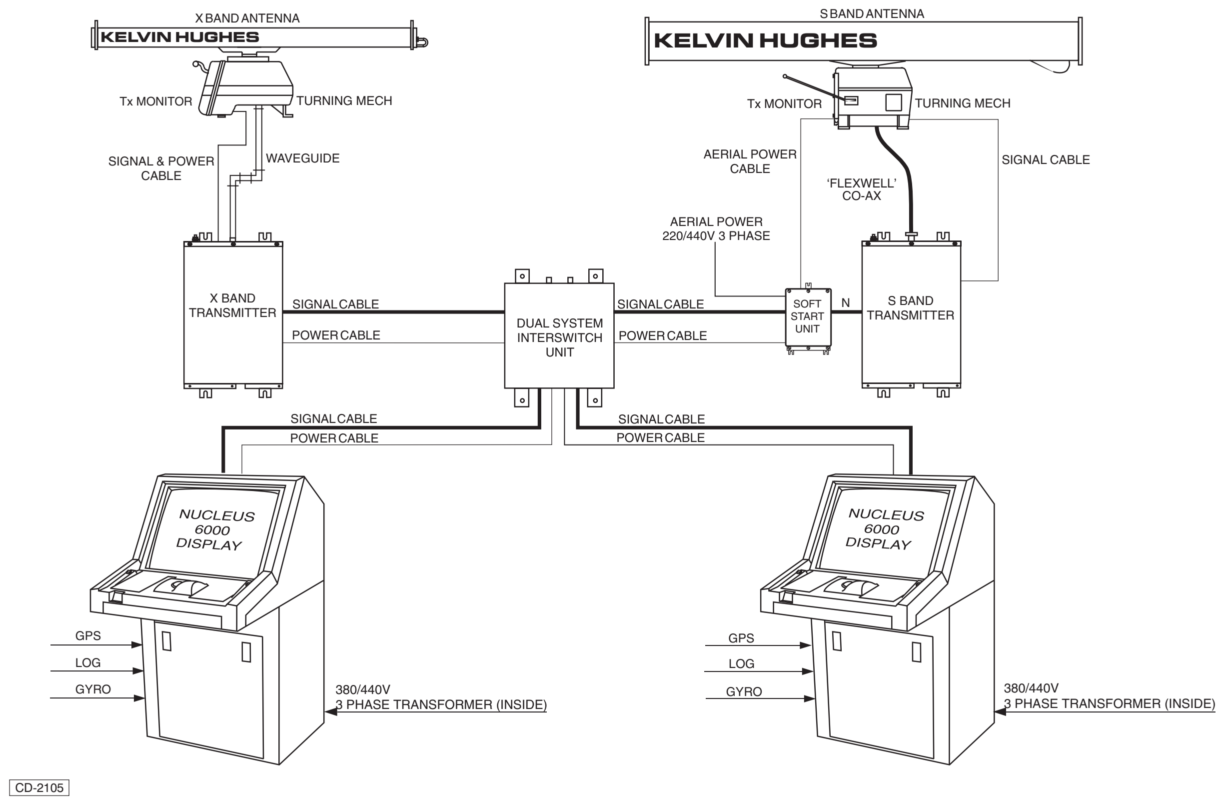


Figure 6 - Two Displays Interswitched (via DIU) with Two Downmast Transmitter/Receivers and Antenna

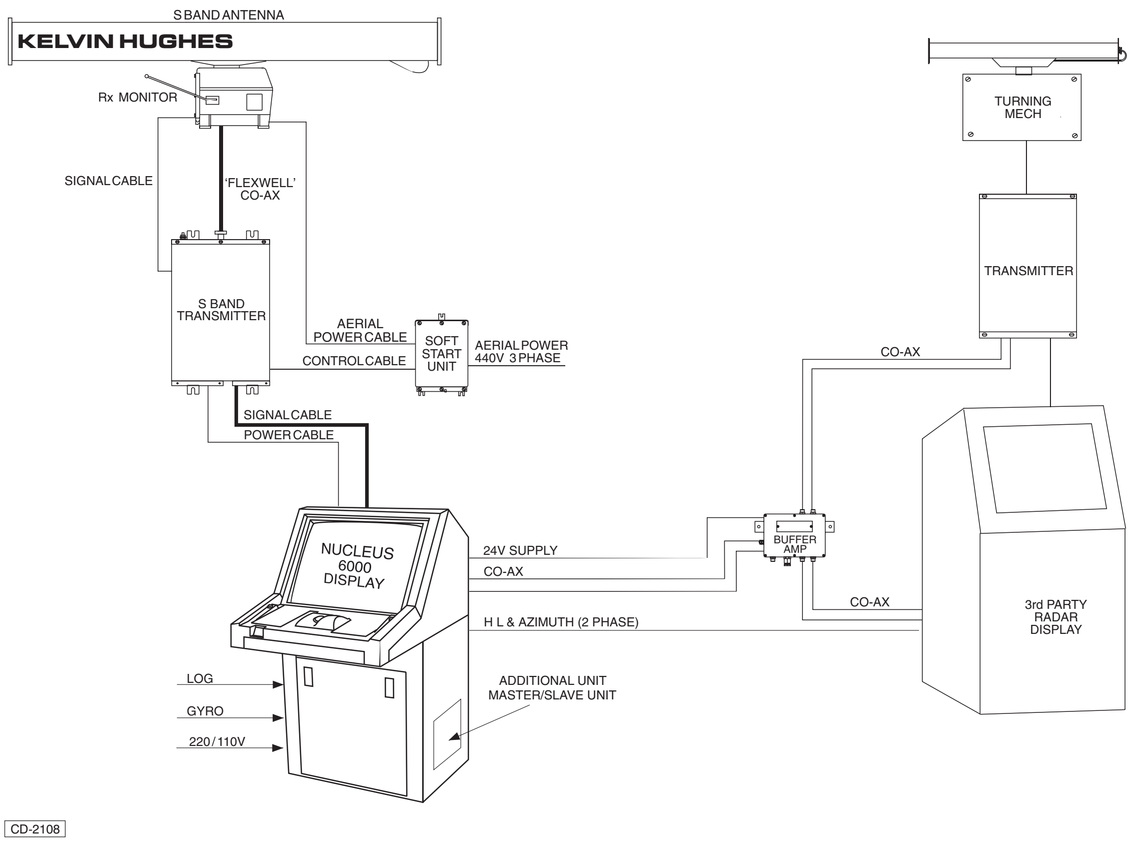


Figure 7 - Single Display with Single Transmitter/Receiver and Antenna, interfaced with Third Party Equipment

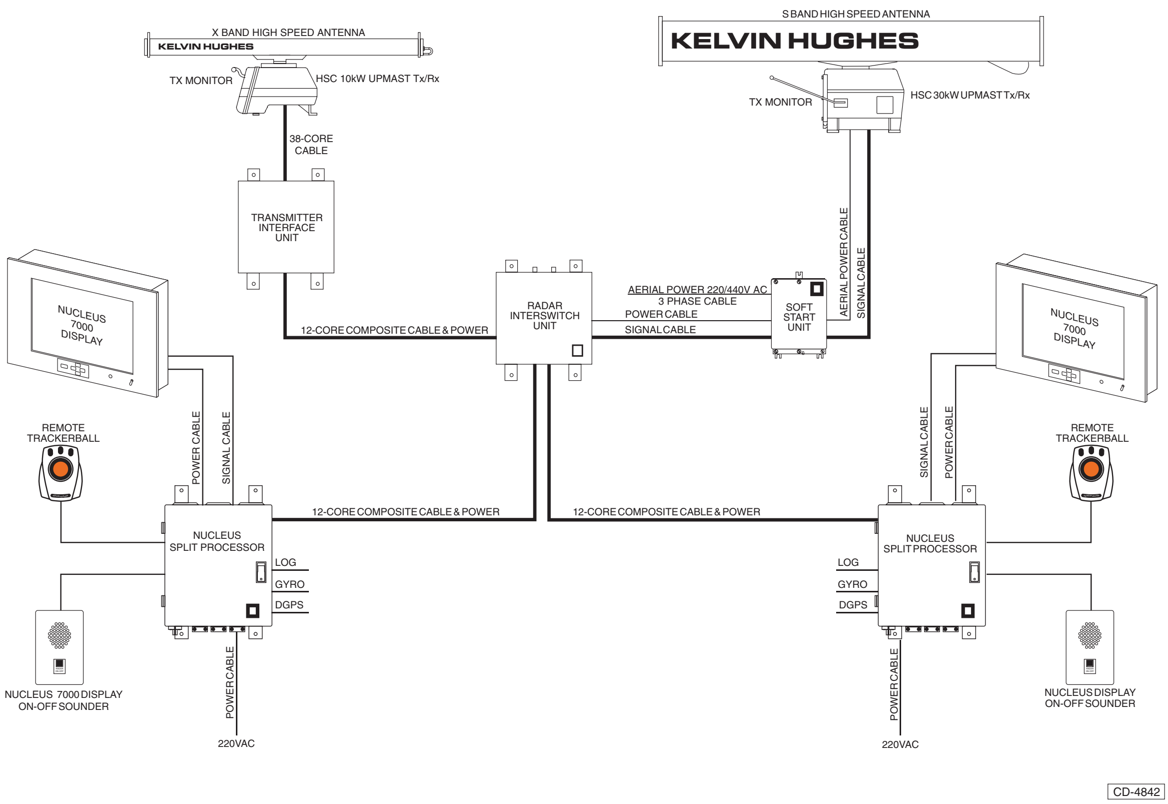


Figure 8 - Two Flat Panel Displays interswitched (via an RIU) with Two Upmast Transmitter/Receivers and Antenna

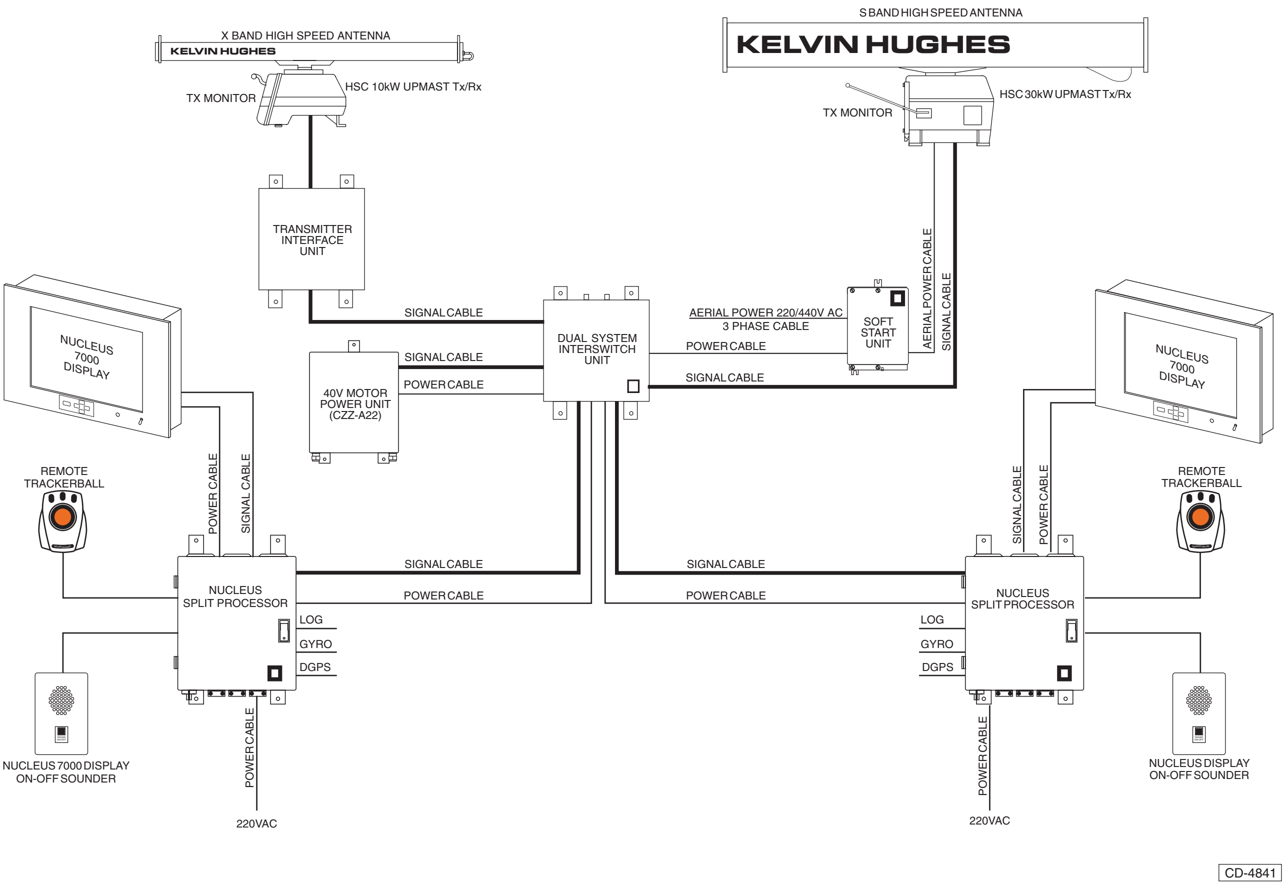


Figure 9 - Two Flat Panel Displays Interswitched (via a DIU) with Two Upmast Transmitter/Receivers and Antenna

Introduction Index

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INSTALLATION RECORD
TO BE COMPLETED ON INSTALLATION

NAME OF VESSEL:	....	
DISPLAY TYPE (1) :	Nucleus 3	SERIAL. NO. ....
DISPLAY TYPE (2) :	Nucleus 3	SERIAL. NO. ....
DISPLAY TYPE (3) :	Nucleus 3	SERIAL. NO. ....
DISPLAY TYPE (4) :	Nucleus 3	SERIAL. NO. ....
DISPLAY TYPE (5) :	Nucleus 3	SERIAL. NO. ....
DISPLAY TYPE (6) :	Nucleus 3	SERIAL. NO. ....
ANTENNA TYPE (1) :	....	SERIAL. NO. ....
ANTENNA TYPE (2) :	....	SERIAL. NO. ....
ANTENNA TYPE (3) :	....	SERIAL. NO. ....
ANTENNA TYPE (4) :	....	SERIAL. NO. ....
ANTENNA TYPE (5) :	....	SERIAL. NO. ....
ANTENNA TYPE (6) :	....	SERIAL. NO. ....
TX TYPE (1) :	....	SERIAL. NO. ....
TX TYPE (2) :	....	SERIAL. NO. ....
TX TYPE (3) :	....	SERIAL. NO. ....
TX TYPE (4) :	....	SERIAL. NO. ....
TX TYPE (5) :	....	SERIAL. NO. ....
TX TYPE (6) :	....	SERIAL. NO. ....
RAD 1 :	....	
RAD 2 :	....	
HL 1 SKEW :	....	

HL 2 SKEW :	....	
LOG TYPE :	....	
GYRO TYPE :	....	
MAINS SUPPLY : MONITOR	.... VOLTS :	PHASE : .... FREQ.
PERFORMANCE MONITOR:		
	TX : .... nm	
	RX : .... nm	
INSTALLATION ENGINEER :		
	DATE :	
	LOCATION :	

DEFAULT SETTINGS

	FACTORY SETTINGS	RANGE	CUSTOMER SETTINGS
RANGE	6nm	0.25 - 96nm	
RINGS (ON/OFF)	ON	ON/OFF	
EBL1/EBL2	OFF	ON/OFF	
VRM1/VRM2	OFF	ON/OFF	
VECTOR TIME	15min	1 - 30min	
VECTOR MODE	NORM	NORM/NORM REVERSED	
DAY/NIGHT	DAY	DAY/NIGHT	
TRAILS ON/OFF	ON	ON/OFF	
TRAILS TIME	3min	0.75 - 99min	
AZIMUTH MODE	N. UP	N. UP/C. UP/ HEAD UP	
MEDIUM PULSE	3nm	Not Adjustable	
LONG PULSE	48nm	Not Adjustable	
PULSE STATUS	Normal	Down/Normal/ Up	
HISTORY	OFF	ON/OFF	
STABILISATION	EXT	SEA/MANUAL/EXT	
MOTION MODE	RELATIVE	R, T or CD	
SEA CONTROL	0	0 - 9 or A	
RAIN CONTROL	0	0 - 9	

	FACTORY SETTINGS	RANGE	CUSTOMER SETTINGS
GAIN CONTROL	6.5	0 - 9	
CURSOR MODE	Range/Bearing	Range/Bearing or TCPA	
CURSOR PARKING	LOW	LOW/HIGH	
ENHANCE	NORM	NORM/ENH	
CORRELATION	IR	OFF, IR or SC/SC	
CPA	1nm	0.1 - 6nm	
TCPA	15min	1 - 60min	
CONTRAST	2/3 of Setting	0 to Maximum	
BRILLIANCE	1/3 of Setting	0 to Maximum	
LEVELS	Maximum	0 to Maximum	
SPEED INPUT	LOG	LOG, Man or Dop	

OPERATING INFORMATION

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CHAPTER 1

NUCLEUS 3 DISPLAYS - OPERATING INFORMATION

INTRODUCTION

1 This Chapter provides operating information for the Nucleus 3 Display.

2 There are three types of Nucleus 3 displays available; 5000 series, 6000 series and 7000 series. Both the 5000 and 6000 series displays are consoles including a CRT. The 7000 series displays comprise a Flat Panel LCD display, which is used in conjunction with a split processor unit, a Remote trackerball and a display ON/Off sounder unit. (For further information on the Flat Panel Displays, refer to Chapter 8c).

3 Nucleus 3 displays can be fitted in a single radar configuration, or interswitched in a dual/multiple system (X and S band) configuration and are available as standard or high speed variants. The displays are designed to be desk, console or deck mounted.

4 Comprehensive mapping and navigational facilities are provided. Extensive interfacing permits integration with multiple ship sensors and use as part of an integrated bridge or navigation system.

5 Nucleus 3 radar systems are fully compliant with IMO requirements.

6 The Nucleus 3 displays feature three radar plotting aid options:

(1) ARPA - Automatic Radar Plotting Aid.

(2) ATA - Automatic Tracking Aid.

(3) EPA - Manual Electronic Plotting Aid.

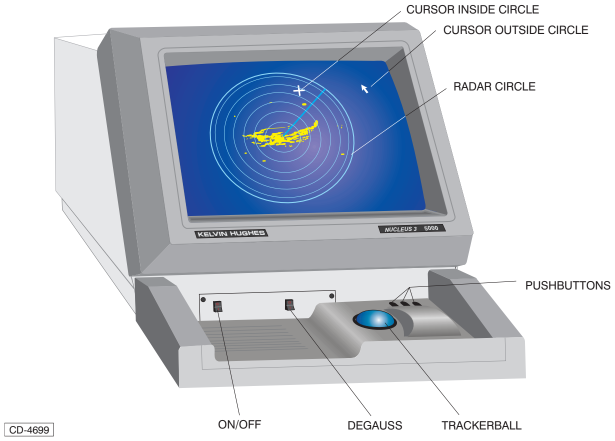


Figure 1a - 5000 Displays (Controls)

NUCLEUS 5000/6000 DISPLAYS

Controls

7 Nucleus 3 includes an ergonomically designed control unit, which features a contoured hand rest, trackerball and three pushbuttons.

NOTE:

The Nucleus 3 displays can also be controlled using an Ergopod (optional). For information on the Ergopod, refer to Chapter 8 - Options.

8 The facilities available on the radar display screen are selected by using the trackerball and pushbuttons, as described in the following paragraphs.

9 The location of controls on the 5000 and 6000 series display types are shown in Figures 1a and 1b below.

Trackerball

10 The **trackerball** is used to position the cursor on the screen, near to, or on the function to be activated and to change parameters once a function is activated.

Cursor

11 The **cursor** is shown on screen inside the radar display area as a marker (+) and is shown as an arrow ( ) outside the radar display area.

12 When a function is selected, the cursor is repositioned and is shown as a box (□) on the selected function inside the radar display area.

13 Positioning of the cursor is also displayed (in terms of range and bearing) on the lower, right-hand side of the screen. The operator can change the cursor mode to indicate TCPA, LAT/LON or RANGE-BEARING within the radar area.

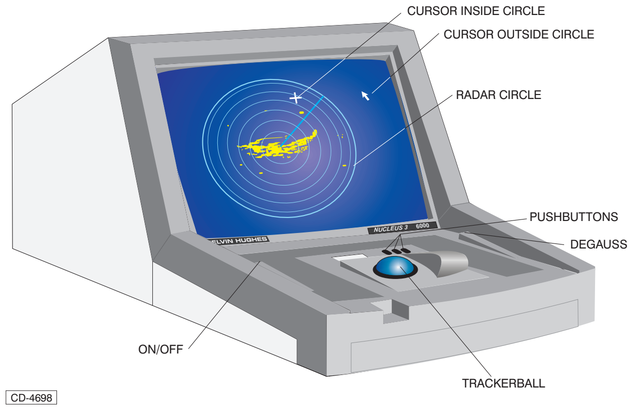
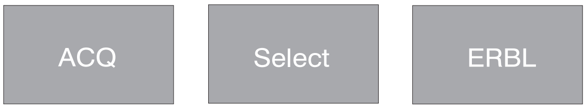


Figure 1b - 6000 Displays (Controls)

Pushbuttons

14 **Pushbuttons** are used to activate/select a particular function. On-screen guidance as to which button to press is given in the Information Boxes located in the lower centre portion of the display. The information boxes, when first displayed, after going to 'Run' from standby, show:



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15 When a function is selected (e.g. Range/Rings) the Information box displays similar data to that in the **pop-down** (information) boxes which appear below the selected function box. If all pushbutton activities are the same, a red box appears on the display containing the legend:

CD-1964

16 A facility which has been previously activated, such as EBL, is re-selected by positioning the cursor in close proximity to the required facility and pressing the centre pushbutton.

NUCLEUS 7000 DISPLAYS

17 Refer to Chapter 8c for Operating Information concerning the Flat Panel Displays.

Power ON/OFF

CAUTION

Before switching on, make sure that the radar scanner is clear and that no maintenance work is being implemented.

Nucleus 5000/6000 Displays

18 The 5000/6000 display is switched on using the ON/OFF switch, which is located on the left-hand side of the Screen Control Unit (SCU). Two short beeps sound, to indicate that all systems are functioning correctly. After a few seconds, the standby screen is displayed.

Nucleus 7000 Displays

19 The 7000 display is switched on using the RADAR ON/OFF switch, which is located on the front of the On/Off Sounder unit. (Refer to Chapter 8c for information on the On/Off Sounder Unit). The Power Indicator illuminates to indicate that power is present at the display and two short beeps sound, at the On/Off Sounder unit, to indicate that all systems are functioning correctly. After a few seconds, the standby screen is displayed.

Screen Illumination

20 The adjustment of Day/Night, brilliance and contrast levels and Audible (AUD) alarm on/off are available upon selection of the VDU box, displayed in the bottom right-hand of the screen.

21 At any time, pressing **all 3 pushbuttons** (on the SCU for 5000/6000 displays or on the Remote Trackerball for 7000 displays) simultaneously increases the VDU brilliance and contrast.

Degauss

22 Colour tones on raster type displays may be adversely affected by changing magnetic fields. If the colour is degrading, press the DEGAUSS pushbutton, located on the right-hand side of the SCU (5000/6000 displays), to restore the display to normal.

COLOURS

23 The display colours are divided into three main groups as follows:

(1) Inside and Outside the Radar circle.

(2) Inside the Radar circle only.

(3) The Radar colours.

Inside and Outside the Radar Circle

24 The colours used Inside and Outside the RADAR circle are:

(1) Grey/Blue — Screen Background.

(2) Red — Warnings, Electronic Bearing Line 2, Variable Range Marker 2, .

(3) Green — Cursor/Measure, Electronic Bearing Line 1, Variable Range Marker 1.

(4) Navy Blue — Box background (Functions).

(5) Grey — Pop-down box background, box background (Information).

(6) Cyan — Bearing scale, bottom/right box outline & pop-down box outline.

(7) Royal Blue — Highlight box.

(8) White — Text.

Inside the Radar Circle Only

25 The colours used Inside the Radar circle only are:

(1) Blue — Radar background (Day Mode).

(2) Red — WayPoints, Exclusive Sectors, Polyzones & Routes

(3) Green — Heading Line, Guard Zones.

(4) Dark Grey — Range Rings.

(5) Yellow — Radar Video.

(6) Cyan — Ownship Vector & Inclusive Sectors.

(7) Magenta — Plots, Plot Labels.

(8) White — Map Features.

The Radar Colours

26 The colours used for Radar returns are:

(1) Sepia — Dim (weak).

(2) Ochre — Medium.

(3) Yellow — Strong.

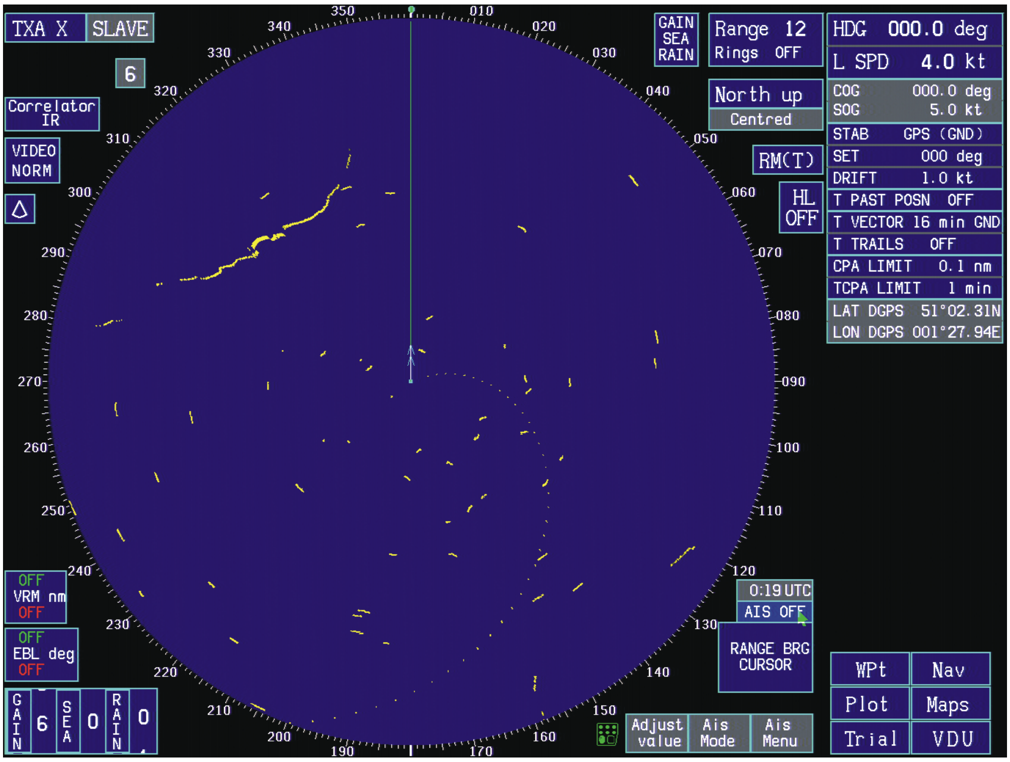
(4) Dark Grey — Old trails.

(5) Medium Grey — Medium trails.

(6) Light Grey — New trails.

Day/Night Operation

27 The Background colour of the Display Screen and Radar Circle change to Black when Night operation is selected. All other colours are darkened.



CD-6027

RADAR SYSTEM & STANDBY/RUN

Function

Run

28 The selected radar information is displayed on the screen and all functions are available for selection. (See Figure 2).

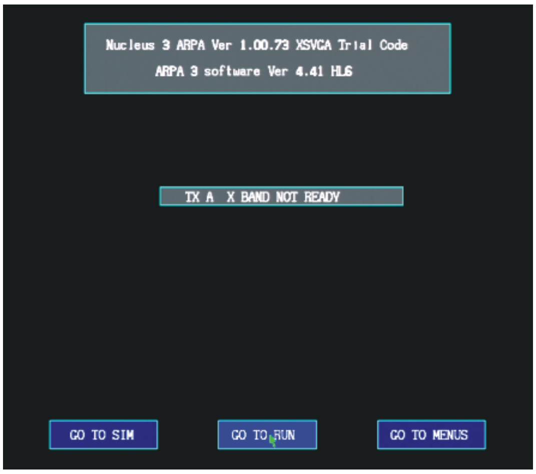
Standby

29 The display starts up in the standby condition. No radar is displayed. The ARPA screens contain a set of instruction boxes, as shown in Figure 3 below.

EPA screens contain [GO TO TEST] instead of [GO TO SIM].

NOTE:

The 'TX IS (NOT) READY' box, is only available if the Radar is Master.



CD-4726

Figure 2 - Standby Screen (No Interswitch, ARPA)

Selection

30 To change the operational state of the system to Run:

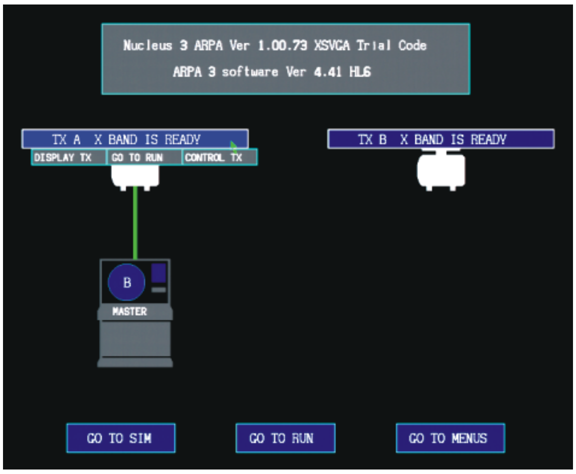
(1) Press any pushbutton (all pushbuttons turn the selected function on/off).

NOTE:

On switch-on, or when returning to Standby screen, the cursor is located in the RUN box.

31 To change the operational state of the system from Run to Standby, highlight the TX box and press the centre pushbutton.

32 To select the Radar System if more than one is installed, highlight the TX box, press the left-hand pushbutton.



CD-4727

Figure 3 - Standby Screen (with Interswitch & ARPA)

Cursor Positioning and Initial Pushbutton Facilities after selecting RUN

33 The cursor defaults to a particular (PARK) position and the initial Information Boxes are different depending upon whether GO TO RUN is selected after switching the system ON or selecting RUN, for the second time, via the standby screen.

34 After switching the system ON a dialogue box appears:

CD-1968

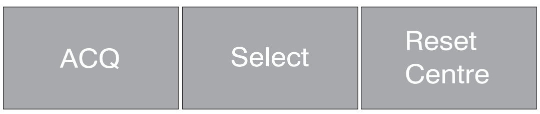
35 On entering RUN mode for the first time, if Land Mode is selected, the cursor is positioned over the GYRO box (top right of screen) ready for any amendment to the heading shown. If Sea Mode is selected, an **Align Heading to Ownship Heading** screen will be displayed.

36 If adjustment is required, press both left and right pushbuttons, and, whilst maintaining pressure on the buttons move the trackerball - the GYRO reading increases/decreases.

37 If the cursor is outside the radar circle, after 30 seconds of trackerball/pushbutton inactivity, the cursor defaults to the park position (set in the Default menu) and the pushbutton information boxes show

CD-1969

38 After selecting GO TO RUN from the standby screen, the cursor is positioned in the centre of the radar circle and the pushbutton information boxes show:

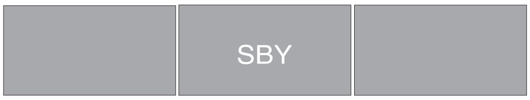


CD-2475

FUNCTIONS - STANDBY MENUS

39 The system setup menus can be displayed on screen as follows:

(1) If in RUN mode, place the cursor over the TXA box at the top-left of the screen. A pop-down information box appears, as below:



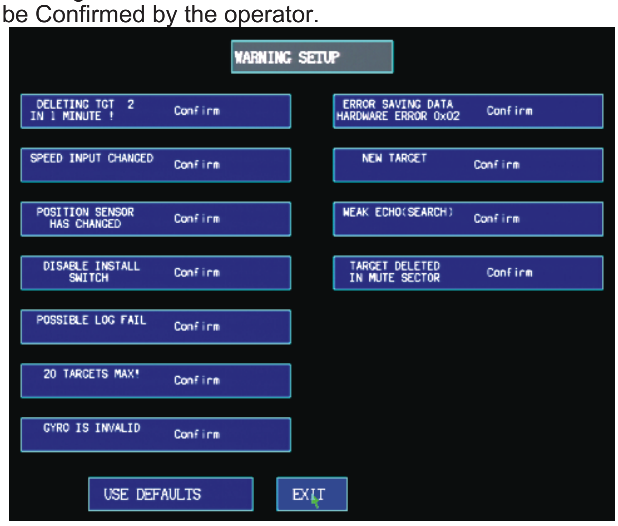
CD-2026

(2) Press the centre pushbutton to enter the standby mode, then place the cursor over the GO TO MENUS box and press any pushbutton, the following menu appears:

CD-4728

WARNING SET UP SCREEN

40 Allows the operator to change the settings for the warning alarm messages displayed. Warning messages can be Switched ON or OFF, set to Timeout or to be Confirmed by the operator.



CD-4729

NOTE:

Refer to Chapter 5 - Commissioning, for information on Levels and Default Settings.

SYSTEM WARNING ALARM

41 If the system develops a fault the System Warning alarm is displayed, as shown below, together with details of the fault condition.

CD-4730

GO TO TEST

42 This is a maintenance feature and is not available for operator use. Refer to Chapter 5 - Commissioning, for information.

TEST CARD 1

43 This is a maintenance feature and is not available for operator use. Refer to Chapter 5 - Commissioning, for information.

CRT TEST

44 This is a maintenance feature and is not available for operator use. Refer to Chapter 5 - Commissioning, for information.

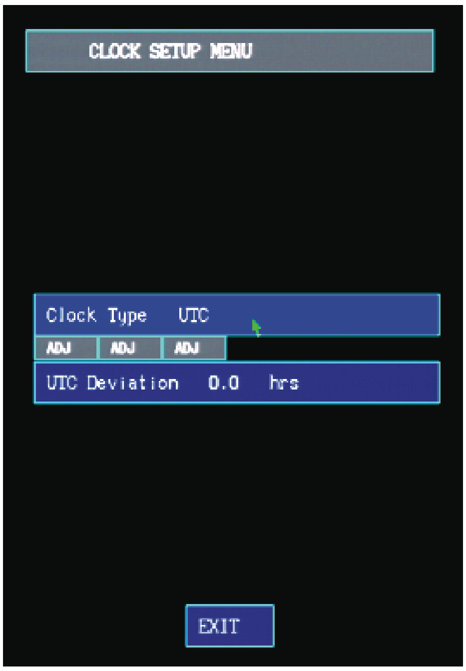
CLOCK SETUP

45 The clock is used for references to the time. This facility is only available if the radar system is receiving a ZDA message. To edit the clock setup:

(1) Place the cursor over the TXA box at the top-left of the screen. A pop-down information box appears, as for the Printer Setup, press the centre pushbutton to put the system into standby mode.

(2) In the standby mode, placing the cursor over the GO TO MENUS box and select by pressing any pushbutton.

(3) In the next menu placing the cursor over the CLOCK SETUP box and select by pressing any pushbutton, the following menu appears:



CD-4731

46 In the clock setup menu the method of time-keeping that the radar uses is defined and the time can also be offset to allow for different time zones.

47 There are three modes of time-keeping, UTC (Universal Time Constant), UTC Adjusted and Local Time. UTC Adjusted and standard UTC are modes which use the time transmitted by satellite. The UTC Adjusted time is the received UTC adjusted by the value set in the UTC Deviation box. For example, if the UTC Deviation is set to +1.00 hours then when the received UTC is 1300 hours, the time displayed by the radar system is shown as 1200 hours. The Local Time mode provides the local time which is automatically adjusted when passing through a time zone.

48 To change the selected time-keeping method:

(1) Place the cursor over the CLOCK TYPE box. A pop-down information box appears, as below:

CD-4732

(2) Press and hold down any pushbutton, you can flip through the options by moving the trackerball. When the required option is selected release the pushbutton.

(3) The same method of adjustment is applied with the 'UTC Deviation (n) hours' box, with a range from - 13 to +13 hours onto the given time.

(4) To exit from the menu, place the cursor over the EXIT box and press any pushbutton.

COMMS SETUP MENU SCREEN

49 Allows the operator to adjust the settings for the Four NMEA Serial Input Message Communications Ports.

50 Each of the following input message types can be received on one or more of the 4 serial input comms ports:

DPT, GGA, GLL, HDT, RNN, RTE, VBW, VHW, VTG, WPL, ZDA, ZZU.

CD-4812

NOTE:

To adjust the settings for the Serial NMEA Input messages, the Installation must first be "unlocked".

51 Provided that authorised access is possible, the following can be set for each Port:

(1) Priority

(2) Type Checking (i.e. Strict, or Relaxed)

(3) Timeout (for message failure detection)

(4) IBS / OS Data (allows IBS/Ownship's data to be exchanged with IBS devices or other equipment when enabled).

NOTE:

When the Port is disabled, no messages are transmitted on the selected COM port.

52 Messages can also be disabled. Refer to Chapter 5 - Commissioning, for information on Comms Port settings.

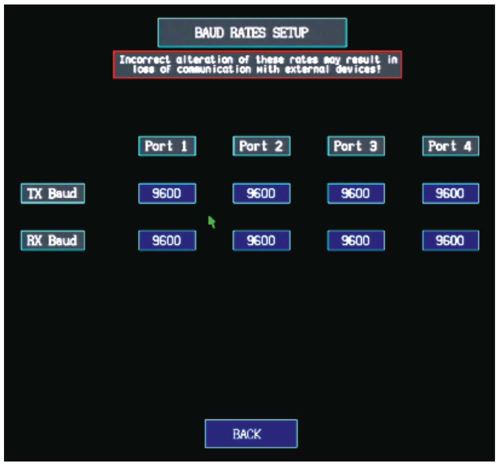
53 Selecting DEFAULTS from the COMMS SETUP MENU, resets the message comms port settings to the system Default values. Refer to Chapter 5 - Commissioning, for information on Default Settings.

54 The Baud Rate Setup Screen can be accessed from the Comms Setup Menu Screen, by selecting BAUDRATES. This displays the BAUD RATE SETUP Screen, as shown below.

Baud Rates Setup Screen

55 Allows the operator to set the transmit and receive baud rates for each of the comms ports.

56 Each port can be set to transmit and receive messages at a different Baud Rate, to allow for non-NMEA inputs. The Baud rates can be set within the range 1200 - 38400 baud. For information on setting Baud Rates, refer to Chapter 5 - Commissioning.

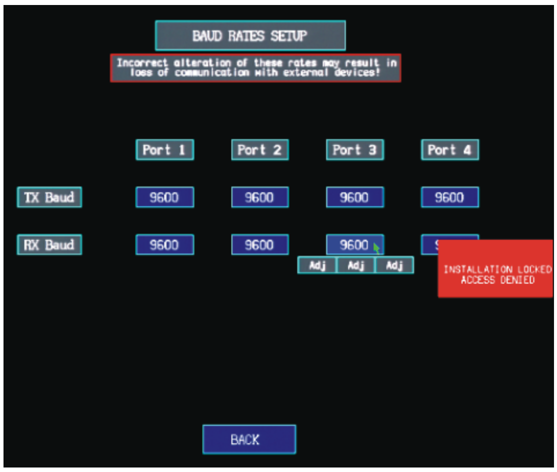


CD-4734

NOTES:

(1) Care should be taken to ensure that the correct baud rate settings are used, to avoid possible loss of communication with the external devices connected to the comms ports.

(2) Attempting to alter the settings, without first unlocking the Installation, results in the "Installation Locked" warning message being displayed, as shown below.



CD-4735

OWNSHIP SETUP

57 This facility allows Ownship to be shown on the radar display in the correct dimensions and the antenna correctly positioned in relation to the ship.

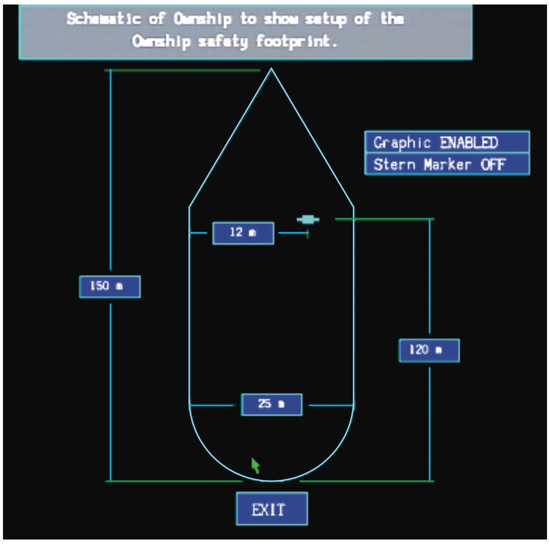
58 To edit the Ownship Graphics:

(1) Place the cursor over the TXA box at the top-left of the screen. A pop-down information box appears below. Press the centre pushbutton to put the system into Standby Mode.

(2) In the Standby Mode, place the cursor over the box GO TO MENUS box and press any pushbutton.

(3) From the new menu that appears place the cursor over the select the OWNSHIP SETUP box, and press any pushbutton.

(4) A plan view representative of Ownship is presented.



CD-4736

(5) To edit the length and the width of the ship, along with the positioning of the antenna:

(a) Set switch SW1 to ON, place the cursor over the dimension to be edited and press and hold down any pushbutton. Increase or decrease the measurement by the movement of the trackerball until the required measurement is obtained, then release the pushbutton. The length may be between 10 and 500 metres, with a width of 10 to 250 metres, switch SW1 OFF.

(6) The Ownship Graphics can be disabled by placing the cursor over the Graphic ENABLED box, and pressing any pushbutton. Pressing the pushbutton over the box once again turns the graphics back on.

(7) The Stern Marker can only be turned ON when the Ownship Graphic is ENABLED and is only displayed when the Range Scale in use is 3nm or less. Once the Ownship graphic is enabled, the Stern Marker can be turned ON by positioning the cursor over the Stern Marker box and pressing any pushbutton. Pressing the pushbutton over the box once again turns the stern Marker OFF.

(8) To exit from the menu, place the cursor over the EXIT box and press any pushbutton.

CURVED SETUP SCREEN

59 The Curved EBL is an Electronic Bearing Line that graphically displays the rate of turn or radius of turn that the vessel will take to effect a new course. The turn shown will include the ship's forwarding distance.

60 For information on setting-up the Curved EBL, refer to Chapter 5 -Commissioning.

GO TO INSTALL SCREEN

61 Selecting GO TO INSTALL from the Standby Menus, displays the Installation Screen. This facility allows the selection of the Transmitter Type, Display Type, etc. To define the system configuration.

NOTE:

This is not an operator function and is usually set during system commissioning.

62 For information on Installation settings, refer to Chapter 5 - Commissioning.

WATCH MONITOR

63 This is used to alert the Operator that the integrated bridge has not been used for a specified time period. However, for this utility a particular connection is required to the radar system. Refer to Chapter 5 for levels and default setting information.

64 When there is inactivity exceeding the time period specified in the setup, a **Red Warning** appears:

WATCH ALARM TRIGGERED MOVE TRACKERBALL

CD-2031

65 If the trackerball is not moved within another thirty seconds an additional **Red Warning** appears.

WATCH ALARM UNACKNOWLEDGED AFTER SPECIFIED TIME

CD-2032

NOTE:

This function requires the use of an optional watch alarm controller, alarms are reset on all displays if any activity is noticed.

FUNCTIONS

66 To assist in location of functions on the display screen, a pullout illustration of the display is provided at the end of this Chapter.

Zone 1 - Radar System

67 (1) Standby/Run.

(2) Selection of the Radar System.

(3) Short, Medium, Long Pulse.

(4) Tuning of the selected Radar & Performance Monitor.

(5) Correlation & Interference Rejection.

(6) Enhancement of Radar Signals & Sector Scan.

Zone 2 - Screen Mode of Operation

68 (1) Gain, Sea, Rain Settings.

(2) Range and Rings.

(3) North Up.

(4) Course Up.

(5) Head Up.

(6) Relative Motion, Relative Trails RM(R).

(7) True Motion, True Trails TM(T) (Optional).

(8) Relative Motion, True Trails RM(T) (Optional).

(9) Heading Line.

Zone 3 - Ownship and Plotting Parameters

69 (1) Ownship Parameters.

(2) Plotting Parameters.

(3) Trail Parameters.

Zone 4 - VRM, EBL and Signal Controls

70 (1) Variable Range Marker.

(2) Electronic Bearing Line.

(3) Gain Setting.

(4) Sea Setting.

(5) Rain Setting.

Zone 5 - Data and Menus

71 (1) Target Data Information.

(2) System and Function Warnings.

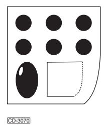
(3) Menus for VDU Facilities, WPt, NAV, PLOT, MAPS, TRAIL, VDU.

Zone 6 -Cursor Control and Mode

72 (1) Pushbutton Information Boxes.

(2) Cursor Readout Mode.

(3) MISC Icon (when an Ergopod is connected ONLY).



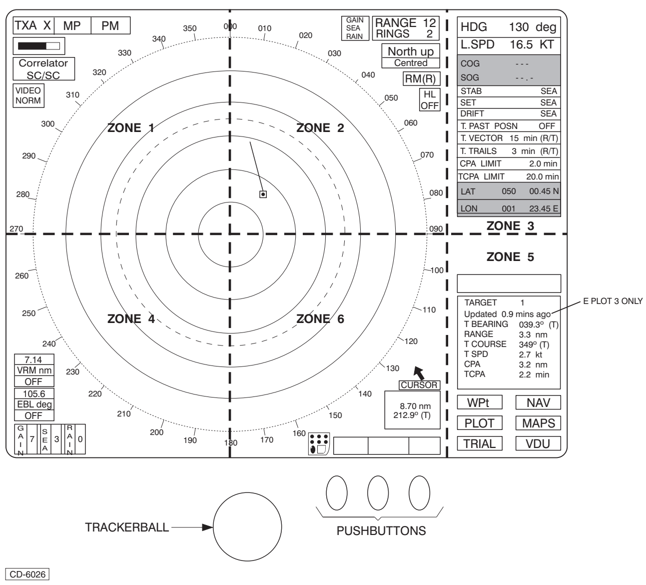


Figure 4 - Display Zones

FUNCTION - ZONE 1 TRANSMITTER INFORMATION

TX BOX - TRANSMITTER SELECTION

73 Shows the transmitter under control. With the cursor highlighting the TX box, the middle pushbutton puts the radar into STANDBY. Left and right pushbuttons change the displayed transmitter (optional).

PULSE LENGTH (MP/SP/LP) BOX- SELECTION

74 Shows the pulse length in use. With the cursor highlighting the box, a pop-down selection box appears as shown below. The middle pushbutton sets the pulse length to automatic (normal) setting. Left and right pushbuttons select a shorter (SP) or longer (LP) pulse length respectively, where allowed.

CD-4737

PM BOX – PERFORMANCE MONITOR (OPTIONAL)

75 Press and hold any pushbutton with the cursor highlighting the PM box to invoke the performance monitor.

76 To enable to monitor permanently:

(1) Highlight the PM Box.

(2) Press and hold down any pushbutton.

(3) Using the trackerball, move the cursor to highlight the TUNE box, and press either of the other two buttons.

(4) Release both pushbuttons.

77 While the performance monitor is enabled the PM box will outlined in red.

78 To de-activate the performance monitor once permanently enabled, with the cursor highlighting the PM box, press any pushbutton.

Using The Performance Monitor To Check Radar Performance

79 The radar plume and sun responses (see diagrams below) can be used to measure radar performance as follows:

Transmitter Performance:

80 Select the 12nm range scale and measure the extreme range of the plume using the cursor readout.

81 Compare the range measurement with the reference figure taken on installation: A fall of more than 20% indicates a need for transmitter maintenance.

Receiver Performance:

82 Select the 1.5nm range scale (X-Band receivers only, for S-Band select the12nm range scale) and measure the range of the sun using the cursor readout.

83 Compare the range measurement with the reference figure taken on installation: A fall of more than 20% on an X-Band, or 80% on an S-Band (due to the S-Band monitor being more sensitive to changes) indicates a need for maintenance.

NOTE

Refer to the Installation Record, for details of the reference figures.

Typical sun and plume responses

Rx 'SUN' (X-BAND) **Rx 'SUN' (S-BAND)** **Tx PLUME**

CD-1965

X-Band
Typical Figures: Tx=6 to 8nm (25kW)
Tx=1.5 to 2.5nm (10kW)
Rx=0.75 to 1nm

S-Band Typical sun and plume responses

Tx PM

Rx PM

Typical Figures: Tx=6 to 8nm
Rx=Sectors typically 8nm

TUNE BOX – BARGRAPH CONTROL (MASTER RADARS ONLY)

84 Allows manual tuning of the radar receiver. This has limited effect on systems with Automatic Frequency Control (AFC).

85 To manually tune the radar:

(1) Move the cursor using the trackerball so that the TUNE box is highlighted.

(2) Hold down any pushbutton. A red control bar will appear beneath the green tune indicator bar showing the current position of the control.

(3) The control bar can be lengthened or shortened by moving the trackerball through the east or west axis respectively. The length of the green bar indicates the level of tuning, which is longest when the radar is optimally tuned. When the desired tune level has been reached, release the pushbutton.

NOTES:

(1) On systems with AFC the red TUNE control bar should be set to approximately mid-position to allow the system to operate correctly.

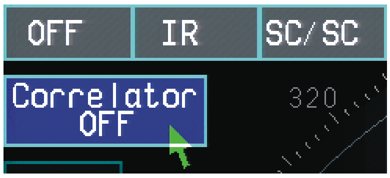
(2) In the event of the AFC failing to 'Lock On', manually tune the radar as described above.

Displaying SART Responses

86 To detune the receiver, for displaying clear SART responses, tune the radar as described above to achieve minimal radar targets. Ensure that the receiver is re-tuned for normal operation.

CORRELATOR BOX

87 Displays the video correlator in use. With the cursor highlighting the correlator box, a pop-up information box appears above the correlator box as shown below. The left pushbutton (OFF) turns correlation and interference rejection off. The middle pushbutton (IR) switches on interference rejection only. The right pushbutton (SC/SC) switches on scan to scan correlation (includes interference rejection).



CD-4738

NOTE:

*(1) If SC/SC is selected on short pulse and/or a low range scale, the CORRELATOR box outline flashes. This is to warn the user that **small targets with a fast relative speed may not correlate and therefore may be suppressed to a lower level paint.***

(2) High speed craft should only use SC/SC on 3nm range scale and above with target enhance switched on, (see Video box).

(3) Fast ships generate high relative target speeds that will reduce target correlation; therefore to improve the target update rate a faster scanner should be fitted.

VIDEO BOX

88 Displays the video mode – normal or enhanced. With the cursor highlighting the video box, press any pushbutton to toggle between NORM and ENH.

CD-4739

NOTE:

In excessive sea clutter or precipitation, the use of enhanced video mode may reduce target visibility. A combination of longer pulse length or video enhance, adjusting SEA/RAIN and CORRELATOR SC/SC produces better target visibility.

MUTE BOX (OPTIONAL)

89 Indicates the status of the non-secure mute sector; a red or white pie-slice indicates that the mute sector is enabled or disabled respectively. With the cursor highlighting the mute box, press any pushbutton to toggle the status of the mute sector.

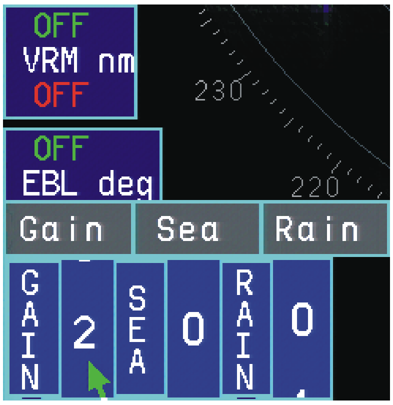
FUNCTIONS - ZONE 2
RADAR PRESENTATION INFORMATION

GAIN/SEA/RAIN BOX

90 Shortcut to the GAIN/SEA/RAIN control in zone 4.

CD-4740

91 With the Gain/sea/rain box highlighted, note that the GAIN/SEA/RAIN control in zone 4 is also highlighted, as shown below. Pushbutton functions are as detailed in the zone 4 description.



CD-4741

RANGE/RINGS BOX

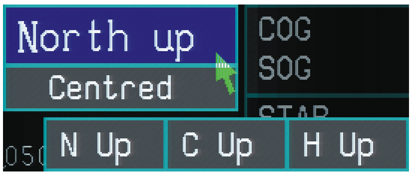
92 Displays the range scale in use and the distance (in nm) between the range rings displayed (or OFF). With the range/rings box highlighted, the left pushbutton changes range scale down. The right pushbutton changes range scale up. The middle pushbutton toggles the range rings on or off.

CD-4742

93 The Range can be set between 0.25 to 96nm. The Rings are set between 0.025 to 16nm, depending on the range scale in use.

AZIMUTH MODE (NORTH UP) BOX – PRESENTATION SELECTION

94 Displays the azimuth mode in use, and whether the display is centred or off centred. With the azimuth mode box highlighted, a pop-down information box appears. The left pushbutton sets the azimuth mode to North Up. The middle pushbutton sets the azimuth mode to Course Up. The right pushbutton sets the azimuth mode to Head Up.



CD-4743

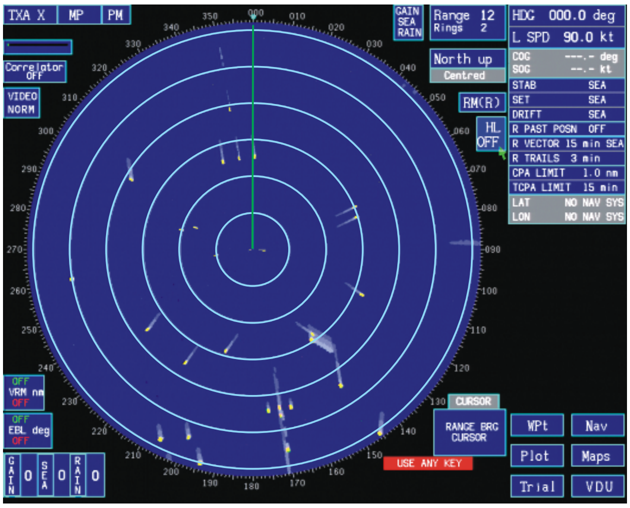
MOTION MODE (RM (R)) BOX

95 Displays the motion mode in use. With the motion mode box highlighted, the left pushbutton sets the motion mode to True Motion with True Trails (TM(T)). The middle pushbutton sets the motion mode to Relative Motion with Relative Trail (RM(R)). The right pushbutton sets the motion mode to Relative Motion with True Trails (RM(T)).

CD-4744

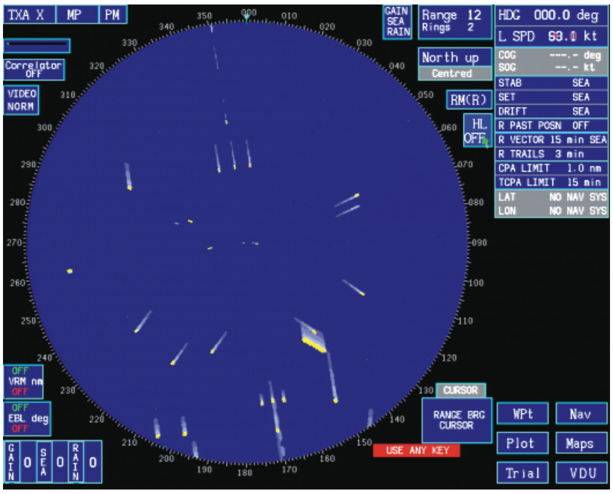
HL OFF BOX

96 Removes the heading line and all other graphics (EBLs, VRMs, footprints, sectors etc.) from the PPI. With the HL off box highlighted, press and hold any pushbutton. Release the pushbutton to restore the graphics to the screen. Figure 5 shows the screen with normal graphics, before HL OFF is activated and Figure 6 shows the screen when HL OFF is active.



CD-4745

Figure 5 - Display Screen PPI with normal graphics



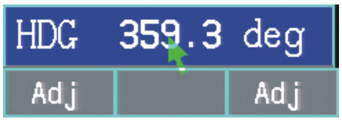
CD-4746

Figure 6 - Display Screen PPI with HL OFF Active

FUNCTIONS – ZONE 3
OWNSHIP INFORMATION

HDG BOX – MASTER GYRO HEADING

97 Displays Ownship heading. To adjust; with the HDG box highlighted, press and hold down both the left and right pushbuttons. Move the trackerball through the north/south axis to change the displayed heading.



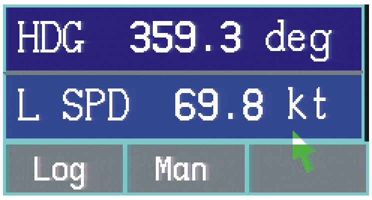
CD-4747

NOTE:

On initial switch on the master gyro heading may be incorrect. See glossary.

L SPD BOX – SPEED

98 Displays Ownship speed and its source. With the SPD box highlighted, the left pushbutton selects LOG speed (L SPD). The middle pushbutton selects manual speed (M SPD). The right pushbutton selects Doppler (W or G SPD) (optional) or VTG input (optional, non-EU mode only).



CD-4749

99 If manual speed is selected (see below), the middle pushbutton is then used to change the speed. With the SPD box highlighted press and hold the middle pushbutton (Adj). The speed may be increased/decreased by moving the trackerball in the north/south axis respectively.

CD-4748

STAB BOX – STABILISATION

100 With the stab box highlighted, the left pushbutton selects sea stabilisation, the middle pushbutton selects manual stabilisation, and the right pushbutton selects external stabilisation (non-EU mode only). When a Doppler log speed input is in use, stabilisation selection options are disabled.

CD-4750

SET BOX – TIDE DIRECTION

101 With the set box highlighted and the stabilisation mode set to manual, press and hold any pushbutton while moving the trackerball through the north/south axis to change the angle.

NOTE:

If an external stabilisation source is selected, the set value will be automatically updated (non-EU mode only).

DRIFT BOX – TIDE RATE

102 With the set box highlighted and the stabilisation mode set to manual, press and hold any pushbutton while moving the trackerball through the north/south axis to change the tide rate.

CD-4751

NOTE:

If an external stabilisation source is selected, the drift value will be automatically updated (non-EU mode only).

PAST POSN BOX – PAST POSITION

103 With the past posn box highlighted, press and hold any pushbutton while moving the trackerball through the north/south axis to increase/decrease the time setting respectively.

CD-4752

104 The Past position can be set to OFF or set to between 0.5 to 2.0 minutes, in 0.5 minute increments.

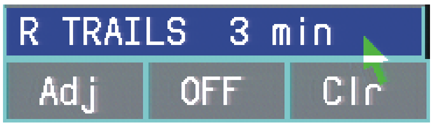
VECTOR BOX

105 With the vector box highlighted, pressing and holding the left pushbutton while moving the trackerball through the north/south axis increases/decreases the vector time respectively. The middle pushbutton overrides (changes) the vector mode while the pushbutton is held down. Holding down the pushbutton for more than two seconds will permanently change the vector mode. The right pushbutton changes the vector stabilisation mode.

CD-4753

TRAILS BOX

106 Displays the lifetime (in minutes) of the trails along with their motion mode. With the trails box highlighted and the trails turned on, pressing and holding the left pushbutton while moving the trackerball through the north/south axis will increase/decrease the trails lifetime between 0.75 minutes and 99 minutes. The middle pushbutton will turn off the trails. The right pushbutton will clear the trails. If the trails are turned off, pressing any pushbutton will turn them on.



CD-4754

CPA LIMIT BOX – CLOSEST POINT OF APPROACH LIMIT

107 Displays the current CPA limit. With the CPA limit box highlighted, pressing and holding the left pushbutton while moving the trackerball through the north/south axis will adjust the CPA limit value between 0.1nm and 6.0nm. The middle button selects the minimum CPA limit (0.1nm). The right pushbutton selects the maximum CPA limit (6.0nm).

CD-4755

TCPA LIMIT BOX – TIME TO CLOSEST POINT OF APPROACH LIMIT

108 Displays the current TCPA limit. With the TCPA limit box highlighted, pressing and holding the left pushbutton while moving the trackerball through the north/south axis will adjust the TCPA limit value between 1 minute and 60 minutes. The middle pushbutton selects the minimum TCPA limit (1 min). The right pushbutton selects the maximum TCPA limit (60 min).

CD-4756

LAT/LON BOX - OWNSHIP LATITUDE & LONGITUDE

109 Displays the current geographical location of Ownship, if location data is available.

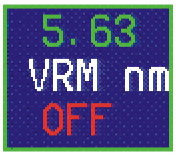
DEPTH BOX

110 Displays the current depth. The box is only visible when a valid depth reading is received.

FUNCTIONS – ZONE 4 NAVIGATION & CLUTTER INFORMATION

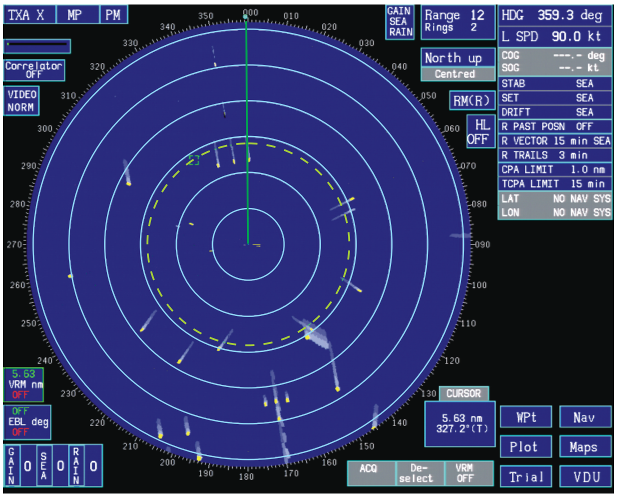
VRM BOX – VARIABLE RANGE MARKER

111 Displays the current range of the VRMs. With the VRM box highlighted, the left pushbutton toggles the green VRM on or off. The right pushbutton toggles the red VRM on or off.



CD-4757

112 As soon as a VRM has been activated the cursor moves to the PPI and controls the active VRM. VRM range is controlled by the trackerball. The left pushbutton acquires a target at the cursor position, the middle pushbutton deselects the VRM and the right pushbutton turns off the VRM. A typical VRM is shown below.



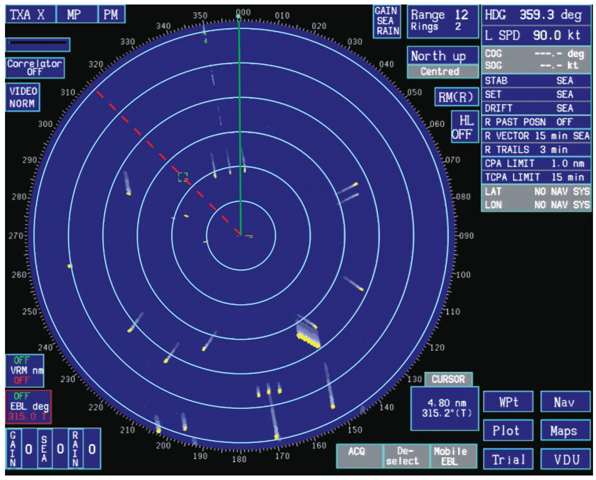
CD-4828

EBL BOX – ELECTRONIC BEARING LINE

113 Displays the current angle of the EBLs. With the EBL box highlighted, the left pushbutton toggles the green EBL on or off. The right pushbutton toggles the red EBL on or off.

CD-4758

114 As soon as an EBL has been activated the cursor moves to the PPI and controls the active EBL. EBL bearing is controlled by the trackerball. The left pushbutton acquires a target at the cursor position, the middle pushbutton deselects the EBL and the right pushbutton turns off the EBL. A typical EBL is shown below.



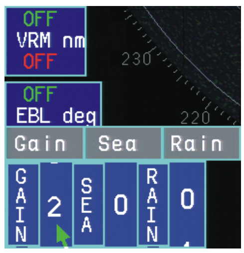
CD-4829

ERBL ACTIVATION

115 Pressing the right pushbutton anywhere inside the radar circle will activate both an EBL and a VRM and allow control of both via the trackerball. A displayed EBL and VRM can be selected simultaneously by positioning the cursor over the dot where the VRM and EBL intersect and pressing the middle pushbutton.

GAIN/SEA/RAIN BOX

116 Displays the current setting of the Gain, Sea and Rain controls. With the Gain/sea/rain box highlighted, holding down the left pushbutton and moving the trackerball through the north/south axis will increase/decrease the Gain setting respectively.



CD-4759

117 Similarly, holding down the middle pushbutton while moving the trackerball through the north/south axis will increase/decrease the sea clutter level respectively. Rapidly moving the trackerball in the south axis will enable Auto Sea mode. Auto Sea mode is disabled by rapidly moving the trackerball in the north axis.

118 Holding down the right pushbutton while moving the trackerball through the north/south axis will increase/decrease the rain setting respectively.

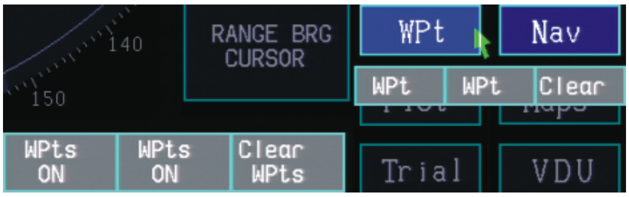
119 Settings for Gain, Sea and Rain are:

Gain - set between 0 - 9.
Sea - set to Auto or between 0 - 9.
Rain - set between 0 - 9.

FUNCTIONS – ZONE 5 – DATA AND MENUS

WPT BOX

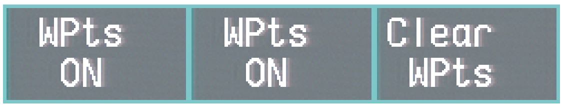
120 Allows the operator to display waypoints and routes if they have been received. When the WPt box is highlighted, a pop-down menu details the operation of the pushbuttons.



CD-4760

Activating Waypoints

121 With waypoints inactive, the pushbutton selection boxes are shown below:



CD-4761

122 To activate waypoint display, the radar must have a valid lat/lon position; otherwise, attempts are ignored. Press the left or the middle pushbutton; if any waypoints have been received, they will be displayed in the PPI whenever they are within the current radar range. If no waypoints have been received, the following warning box appears:

CD-2018

Clearing Waypoints

123 Waypoints are cleared with the right hand pushbutton option. To ensure that waypoints are not cleared accidentally, the operator is required to confirm his action. The following warning box is displayed:

CD-2020

124 The right pushbutton must be pressed again within five seconds to clear the waypoints.

Toggling Waypoint Labels

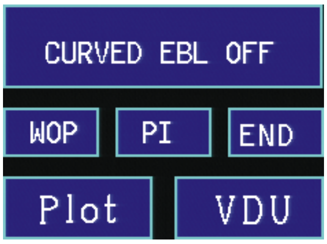
125 With waypoints active, pressing the right pushbutton toggles the state of the waypoint labels.

Toggling the Route

126 With waypoints active, and a route having been received, pressing the middle pushbutton will join up the received waypoints to show the proposed route. Any waypoint that is not part of the route will be hidden. With a route being displayed, pressing the middle pushbutton will remove the route from view and any hidden waypoints will again become visible.

NAV MENU

127 To access the navigation menu, with the NAV box highlighted, press any pushbutton. The following option boxes are displayed:



CD-4762

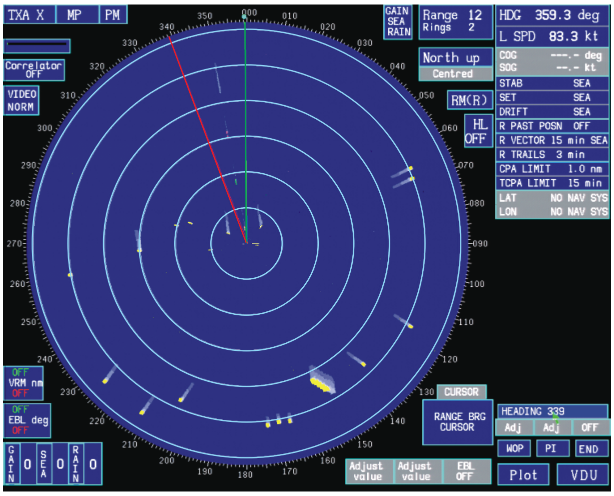
Curved EBL Box

128 With the curved EBL box highlighted, pressing any pushbutton activates the curved EBL. The following menu appears:

CD-2022

To Adjust The Heading:

129 With the heading box highlighted, holding down either the left or the middle pushbutton, while moving the trackerball through the north/south axis will change the heading of the EBL.



CD-4763

To Adjust The Turning Radius:

130 With the radius box highlighted, holding down either the left or the middle pushbutton, while moving the trackerball through the north/south axis will change the curve radius of the EBL.

131 To deactivate the curved EBL, with either the heading or the radius box highlighted, press the right pushbutton.

CD-4764

WOP Box – Wheel Over Point

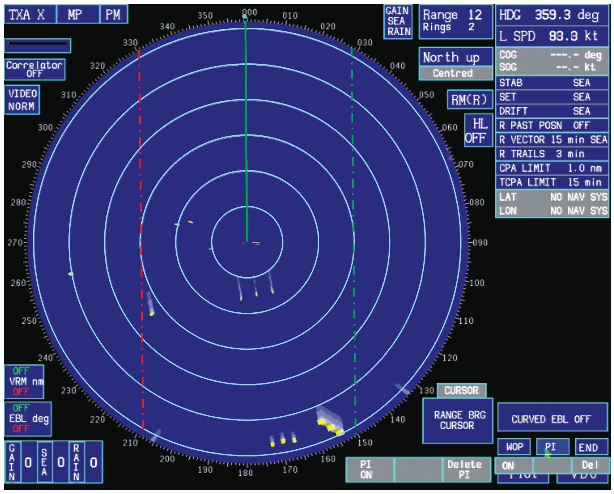
132 With the WOP box highlighted and the curved EBL active, press any pushbutton. Press again to deactivate.

PI Box – Parallel Index Line

133 To activate a parallel index line (up to a maximum of 4), with the PI box highlighted (see below), press the left pushbutton.

CD-4765

134 To delete an active parallel index line, with the PI box highlighted, press the right pushbutton.



CD-4766

135 To adjust the position of a parallel index line:

(1) Position the cursor over the PI line and press the middle pushbutton to select it.

(2) Move the trackerball to the desired position and press the middle pushbutton to deselect the PI line.

136 To adjust the angle of the parallel index line:

(1) Position the cursor over the PI line and press the middle pushbutton to select it.

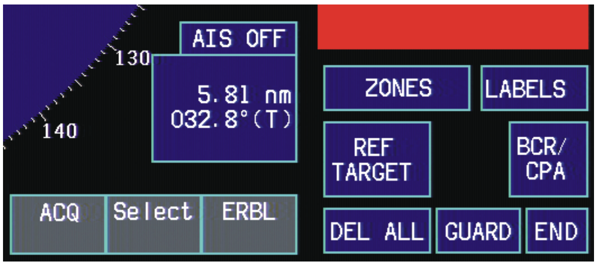
(2) Press and hold the left pushbutton while moving the trackerball through the north/south axis to adjust the PI line angle. The PI line is automatically deselected as soon as the left pushbutton is released.

END Box – Exit the NAV Menu

137 To exit the NAV menu, with the END box highlighted, press any pushbutton.

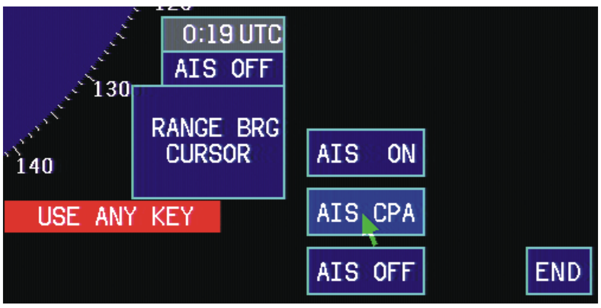
PLOT Box – Shortcut to PLOT Menu

138 To open the PLOT menu, with the PLOT box highlighted, press any pushbutton. The PLOT menus are then displayed, as shown below.



CD-4767

139 AIS functionality is available on ARPA and ATA systems. To open the AIS menu, with the AIS box highlighted, press right pushbutton. The AIS menu is then displayed. The AIS menu provides facilities to select any AIS mode, whether it is OFF, AISc, or AIS.



CD-6028

OFF - No AIS processing done, no AIS plot displayed.

AISc - AIS plots which have CPA and TCPA both within the limit displayed (i.e. dangerous plots).

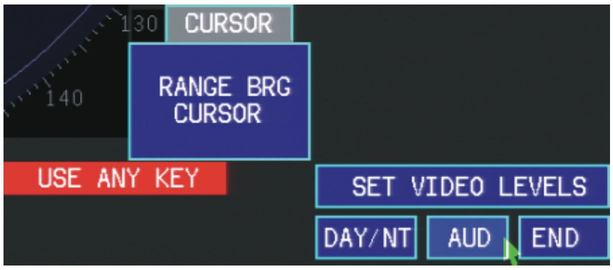
AIS - All available AIS plots are displayed.

140 When AIS plots are being displayed, a white dotted circle indicates the range of the AIS plot furthest from ownship. If only the ownship plot is being displayed, the circle will have zero radius, and will not be visible; if the plot being processed is at a range that exceeds the PPI, then the circle will only appear when the PPI range is increased to more than the range of the AIS plot that is furthest away.

141 The quantity of AIS plots processed can be from 00 to 50, controlled by adjusting with a left click on the AIS box. Each AIS plot being processed will be displayed depending on PPI image, and AIS mode. If the plot's range is near enough to be displayed then a dangerous plot will always be displayed; if in AISc mode then non-dangerous plots will not be displayed, in AIS mode any plot is displayed.

VDU Box – Shortcut to VDU Menu

142 To open the VDU menu, with the VDU box highlighted, press any pushbutton and the following menu appears.



CD-4771

PLOT MENU

143 The contents of the plot menu are dependent on the radar plotting aid fitted and are described in chapter 2.

AIS MENU

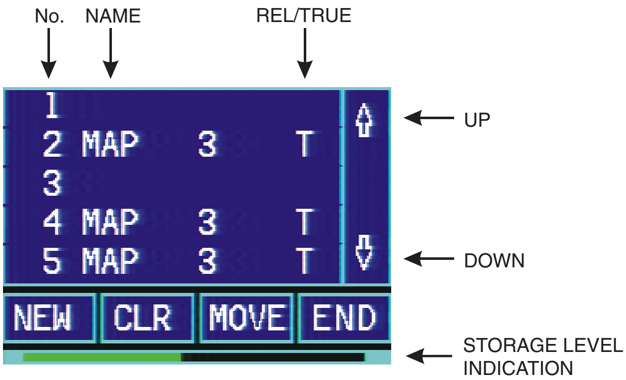
144 The contents of the AIS menu are described in Chapter 2.

MAPS MENU

Creating a New Map

145 With the NEW box highlighted, pressing the left pushbutton will create a new true map and open the edit map sub-menu. Pressing the middle pushbutton will create a new relative map and open the edit map sub-menu. The NEW box is only visible if no map is currently being displayed.

Loading a Map



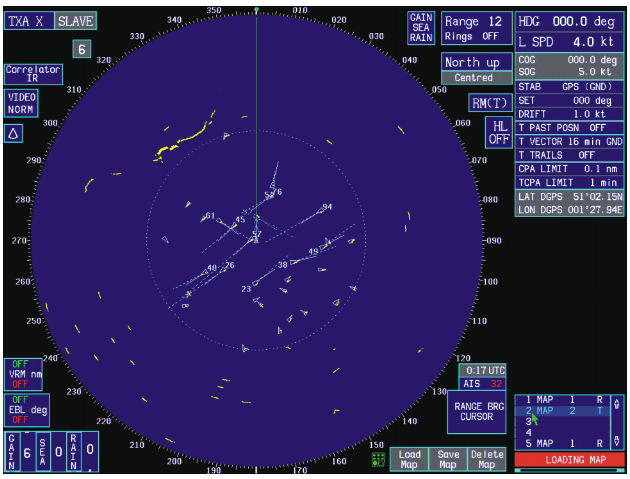
CD-4772

146 A Map Storage Level indication is provided along the bottom of the MAPS menu. If the Map storage becomes full a **MAP STORAGE FULL** warning message is displayed and some stored Maps may need to be removed to create space for new maps.

147 To load a map:

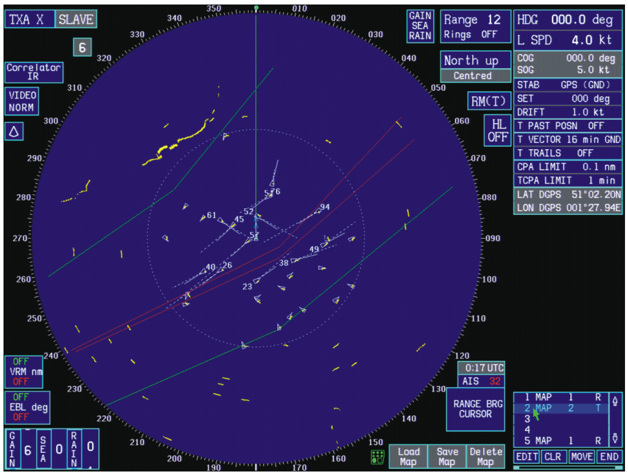
(1) Scroll the map selection by positioning the cursor on the Up or Down arrow (located on the right-hand side of the Map Directory box) and then press and hold down any pushbutton and rotate in the North/South axis until the required map appears.

(2) Position the cursor inside the Map Directory box on the map required, the map is now highlighted, and then press the left-hand pushbutton. The message "LOADING MAP" is displayed below the MAPS Menu, as shown below.



CD-5121

(3) The map is automatically loaded and displayed on screen and can be edited, if required. The highlighted map colour changes to indicate the selected map, as shown below.



CD-5122

(4) Maps can be loaded from or to another Nucleus display, provided that the I/O ports are setup to enable this facility. When a Map is loaded from another Nucleus Display, the "LOADING MAP" message will be displayed on both screens.

NOTE:

Setting up the I/O ports is done within the Maps Setup Menu, via the Comms Setup Menu screen. For further information, refer to Chapter 5 - Commissioning (see Serial Message Setup Screen) .

Saving a Map

148 Position the cursor, using the trackerball, on the MAP No. Under which the map is to be saved. Press the centre pushbutton to save the map, the following warning box is displayed:

CD-2011

NOTE:

If the Map is already in the Directory, the warning box displays the message 'CLICK AGAIN NOW TO CONFIRM ACTION'.

Clearing the Current Map

149 With the CLR box highlighted, pressing any pushbutton will clear the current map.

Deleting a Map

150 Position the cursor, using the trackerball, on the MAP No. to be deleted. Press the right-hand pushbutton the following warning box is displayed:

CD-2014

151 Press the pushbutton again, the map is now deleted.

Moving the Current Map (True Maps Only)

152 With the MOVE box highlighted, pressing and holding the left pushbutton while moving the trackerball will reposition the map. Pressing the middle pushbutton, as shown below, will reset the map to its original position.

CD-4773

Editing the Current Map

153 With a map displayed, and the EDIT box highlighted, pressing any key will open the edit map sub-menu.

Drawing Lines:

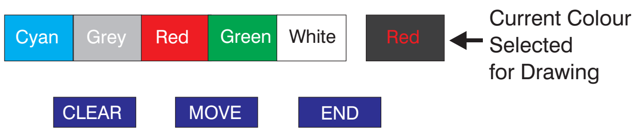
154 To draw a line:

(1) If the Current Feature selected is not the Type, Style or Colour required, position the cursor in the **Lines** box, pop-down boxes appear to allow selection of Change Style (centre pushbutton) and select colour (right pushbutton).

(2) Selection of the Change Style pushbutton produces the following menu, position the cursor on the required selection and press any pushbutton.

CD-2001

(3) Select the Lines/Select colour, by pressing the right-hand pushbutton, the following menu appears. Position the cursor on the required colour and press any pushbutton:



CD-2532

NOTE:

If a feature is to be placed at a designated Lat/Lon co-ordinate, place the feature at the required Radar display position using the Lat/Lon readout.

(4) Move the cursor into the Radar display drawing area and press the left-hand pushbutton to start the line, the cursor changes to • .

(5) Using the trackerball, draw the line in the direction required until the required distance is reached, press the right-hand pushbutton to complete the line.

NOTE:

If a series of connected lines is to be drawn, press the left-hand pushbutton to end the previous line and to start the new line.

(6) To change the line types and colours repeat Sub-paragraphs (1) to (5) above.

Drawing Circles:

155 To draw a circle:

(1) If the Current Feature selected is not the Type, Style or Colour required, position the cursor in the Circle box, pop-down boxes appear to allow selection of Change Style (centre pushbutton) and Select colour (right pushbutton).

(2) Selection of Change style produces the following menu. Position the cursor on the required selection and press any pushbutton.

CD-2006

(3) Colours of circle outlines are selected in the same way as for Line colours.

NOTE:

If a feature is to be placed at a designated Lat/Lon co-ordinate, place the feature at the required Radar display position using the Lat/Lon readout.

(4) Move the cursor into the Radar display drawing area and press the left-hand pushbutton to start the Circle, the cursor changes to .

(5) Using the trackerball, draw the circle to the required size, press the right-hand pushbutton to complete the circle.

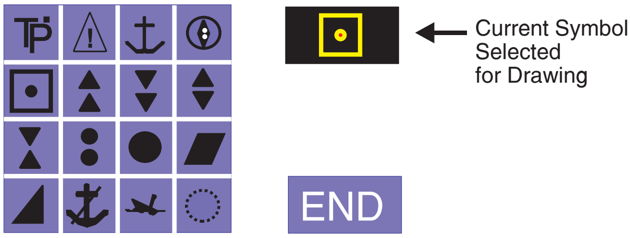
(6) To delete the circle, select by positioning the cursor on either the outside of the circle or the centre of the circle and press the centre pushbutton and then the right-hand pushbutton.

Placing Symbols:

156 To place a Symbol:

(1) If the Current Feature selected is not the Type, Style or Colour required, position the cursor in the Symbol box, pop-down boxes appear to allow selection of Change Style (centre pushbutton) and Select colour (right pushbutton).

(2) Selection of the Symbol style produces the following menu, position the cursor on the required selection and press any pushbutton.



CD-2636

(3) Colours of symbols are selected in the same way as for Line colours.

NOTE:

If a feature is to be placed at a designated Lat/Lon co-ordinate, place the feature at the required Radar display position using the Lat/Lon readout.

(4) Using the trackerball, position the Symbol in the required position and press the left-hand pushbutton.

(5) If the symbol is incorrectly positioned, reselect the symbol by positioning the cursor over the symbol and pressing the centre pushbutton. To delete the selected symbol press the right-hand pushbutton.

Exiting the Edit Map Sub-menu:

157 With the END box highlighted, pressing any pushbutton will return to the MAPS menu.

Exiting the Maps Menu

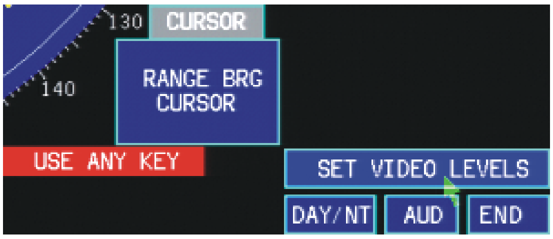
158 With the END box highlighted, pressing any key will exit from the maps menu.

TRIAL MENU – TRIAL MANOEUVRE

159 The TRIAL menu is described in chapter 2.

VDU MENU

160 Allows the operator to adjust the brightness, contrast and video levels for all screen information. With the VDU box highlighted, pressing any key opens the VDU menu.



CD-4775

Contrast & Brilliance Adjustment

161 To adjust either the contrast or brilliance: with the appropriate box highlighted, press and hold any pushbutton while moving the trackerball through the east/west axis.

NOTE:

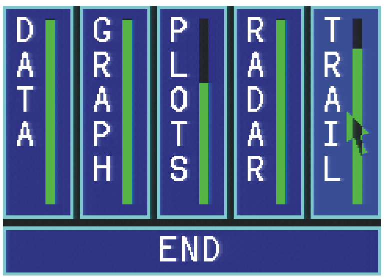
To increase contrast and brilliance levels without entering the VDU menu, simultaneously press and hold all three pushbuttons.

Video Levels Adjustment

162 With the SET VIDEO LEVELS box highlighted, press any pushbutton.

CD-4776

163 This causes the Video levels available for adjustment to be displayed, as shown below.



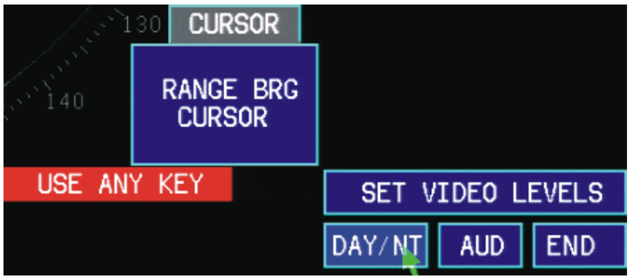
CD-4777

164 With the appropriate box highlighted, pressing and holding any pushbutton while moving the trackerball through the north/south axis will adjust that particular video level.

165 To return to the VDU menu, highlight the END box and press any pushbutton.

Day/Night Selection

166 To switch between Day and Night video levels, with the DAY/NT box highlighted, press any pushbutton.



CD-4778

Audible Alarms

167 To switch audible alarms on or off, with the AUD box highlighted, press any pushbutton. Signified ON by a red border around the AUD box, as shown below.

CD-4779

Exiting the VDU Menu

168 With the END box highlighted, pressing any key will exit the VDU menu.

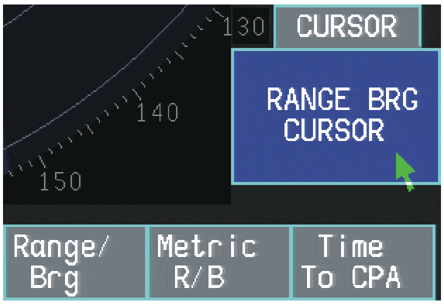
NOTE:

Moving the cursor inside the PPI will automatically close the VDU menu.

FUNCTIONS – ZONE 6 BUTTONS & TRACKERBALL INFORMATION

CURSOR BOX

169 Displays the current cursor position whenever it is within the PPI. With the cursor box highlighted, the left pushbutton sets the cursor readout to range/bearing. The middle pushbutton sets the cursor readout to metric range/bearing. The right pushbutton sets the cursor readout to TCPA. Lat/lon position is always displayed if available.



CD-4780

Electronic Tape Measure

170 Position the cursor over the location to be chosen as the first reference point in the PPI.

CD-4781

171 Select the specific location by pressing and holding the middle pushbutton. The cursor box becomes outlined in red, indicating that the range & bearing information shown is now relative to the chosen location.

172 Move the cursor to the desired location. The range and bearing is shown in the cursor box.

CD-4781

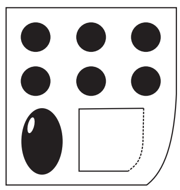
PUSHBUTTON MENU

173 Displays the current action assigned to each pushbutton.

CD-4783

ERGOPOD ICON

174 The Ergopod Icon is displayed at the bottom of the screen (below the 160 degree marker at the edge of the PPI, as shown in Figure 7). The icon shown below can be either red or green, denoting port or starboard Ergopod control (optional).



CD-3070

GLOSSARY OF TERMS

STANDBY

175 This is the default condition of the radar at switch-on. No radar information is displayed and the antenna is not rotating.

176 The STANDBY menu screen is displayed, showing the current status of the transceiver(s) (Master only). There are three selectable options available to the operator: GO TO MENUS, GO TO RUN and GO TO TEST (ATA and ARPA fitted equipment display GO TO SIM instead of GO TO TEST).

RUN

177 This is the active condition of the radar. The antenna is rotating and the received radar information is displayed on the screen. All functions are available for selection.

CURSOR POSITIONING

178 The cursor defaults to a particular (PARK) position whenever the cursor is inactive outside the PPI for a short time. The cursor parking position is an empty (black) area of the screen close to the PPI and can be set either high (35 position below GSR link box) or low (120 position, above the cursor box). The cursor parking position (either HIGH or LOW) can be set from the GO TO DEFAULT menu.

MASTER GYRO HEADING & GYRO WARNINGS

179 The master gyro heading is normally manually set to the reading taken from the Ownship gyro repeater.

180 While the radar is switched on, Ownship heading is tracked with the aid of a gyro compass. If the gyro heading changes while the radar is switched off the radar cannot keep track. Therefore when the radar is switched on the gyro heading may be incorrect.

Gyro Alarm ON (Sea Mode)

181 This is the normal mode of operation for a ship borne radar. On selecting GO TO RUN for the first time after switch-on, the operator is requested to align the gyro heading with Ownship heading before continuing to RUN mode. Should a gyro fault be detected, a GYRO IS INVALID warning box will immediately be displayed and the radar will switch automatically to HEAD UP. A system warning will also indicate that there is a gyro fault.

Gyro Alarm OFF (Land Mode)

182 This is the normal mode of operation for a land based or fixed position radar where the heading is known and will not change. On entering RUN mode for the first time after switch-on, the cursor is positioned over the HDG box. A warning box RADAR HAS BEEN OFF CHECK THE GYRO is displayed, but the operator is not required to align the gyro to Ownship heading. In the event of a gyro failure, or no gyro being connected, no warnings are displayed, and the radar will not switch automatically to HEAD UP.

SHORT/MEDIUM/LONG PULSE (MASTER ONLY)

183 A Master display controls the radar pulse length to be transmitted depending on the range scale selected. The operator may override the automatic settings shown below:

Short Pulse (SP)	- 0.25nm to 1.5nm ranges.
Medium Pulse (MP)	- 3nm to 24nm ranges.
Long Pulse (LP)	- 48nm and 96nm ranges.

184 The operator can select a pulse length either longer or shorter than the automatic setting. If a shorter pulse length is selected while using a range scale of 0.25nm to 1.5nm this will have no effect. However, the pulse length still remains overridden and should the operator increase the range scale to 3nm the automatic setting (MP) will be overridden and SP will be used. Similarly, if a longer pulse length is selected on 48nm or 96nm ranges, the pulse length displayed will still be LP. Should the range scale be reduced to 24nm then the automatic setting (MP) will be overridden and LP will be used. While the pulse length is being overridden the border of the pulse length box is red.

PERFORMANCE MONITOR

185 Checks the overall performance of the transmitter/receiver system by displaying the radar transmission **PLUME** and receiver response **SUN** at the centre of the display. During installation, the radar performance is measured to establish a performance reference level, and written into the installation record.

TUNING & RESPONSES

186 Tuning affects the signal received. A tuned receiver will receive strong radar returns from its own transmitter. Conversely a detuned receiver will receive very weak or no radar returns at all from its own transmitter. This feature is very useful for distinguishing between radar returns and SART transmissions. A detuned receiver will still receive SART transmissions even though its own transmitter's radar returns are not being received. This will have the effect of removing all radar from the display except SART responses.

VIDEO CORRELATION AND INTERFERENCE REJECTION

187 Signal correlation is used to reduce radar interference (interference rejection) and to reduce clutter (scan to scan correlation).

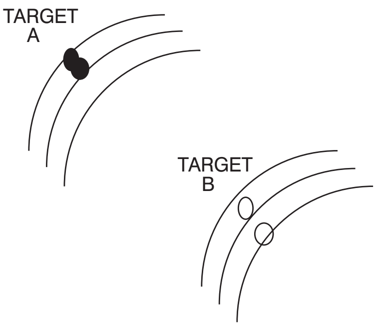
Interference Rejection (IR)

188 Consecutive transmissions are compared and only signals present on **both** transmissions are painted. Interference from other radars is suppressed and receiver noise reduced.

Scan to Scan Correlation (SC/SC)

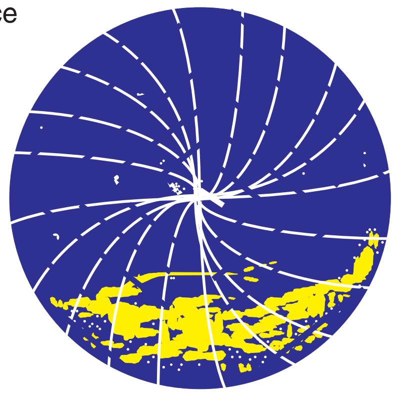
189 Signal correlation reduces random clutter returns and preserves radar signals that correlate (are present) for two successive scans of the antenna. Targets that do not paint consistently are displayed at the medium echo if one scan is missed, at the weak echo colour if two scans are missed and not at all if more than two scans are missed. Interference rejection, and receiver noise reduction are also used to further improve the radar image.

190 A target that stays in the same position, or overlaps on two consecutive scans correlates (Target A). A target with high relative speed on a low range scale that does not overlap on two consecutive scans paints at a lower intensity level (Target B). A longer pulse length improves correlation, but close targets moving at a high tangential speed may still not correlate.



CD-1976

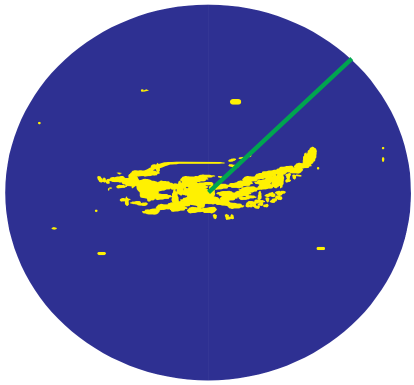
Interference



CD-1977

VIDEO ENHANCE

191 Enhances the radar signals by stretching the size of strong radar returns. Clutter should be reduced to a minimum before switching to ENH.



CD-1974

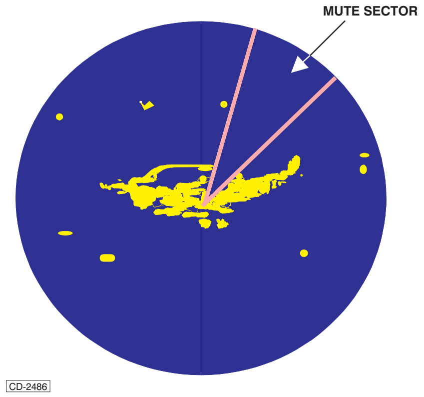
Video Normal

CD-1975

Video Enhance

MUTE SECTOR

192 A predefined arc (sector) of the radar antenna sweep, over which it does not transmit radar. The sector must be defined in the installation menu. An active mute sector is outlined in magenta on the PPI. This is commonly used to prevent the antenna from transmitting into a ship's superstructure or funnel to prevent radar reflections.



NOTE:

A Mute Sector Skew facility is provided as part of the GO TO TEST menu (Refer to Chapter 5 for details). This allows the Mute Sector's position to be adjusted, if required, to compensate for any slight error in positioning.

Targets Entering Mute Sector

193 When a tracked target enters the MUTE sector, it is automatically deleted and the warning TARGET DELETED IN MUTE SECTOR is displayed.

NOTE:

The WARNING message is set to be acknowledged by default, but can be configured within WARNINGS SETUP to timeout if required.

RANGE SCALE & RANGE RINGS

194 The displayed range scale is selectable from 0.25nm to 96nm as detailed in the table below. The number and separation of the range rings is dependent on the range scale in use:

Range Scale (nm)	Range Ring Separation (nm)	No. of Rings
0.25	0.05	5
0.5	0.1	5
0.75	0.25	3
1.5	0.25	6
3.0	0.5	6
6.0	1.0	6
12.0	2.0	6
24.0	4.0	6
48.0	8.0	6
96.0	16.0	6

PPI MODES AND PRESENTATION

195 The following PPI modes are available for selection:

Relative Motion RM(R) True Motion TM(T) Relative Motion RM(T)	**Motion Modes**
Head Up North Up Course Up	**Presentation Modes**

NOTE:

In all modes and presentations, the heading line (HL) indicates the heading of Ownship.

Relative Motion, Relative Trails RM(R)

196 Ownship position is user-definable (up to 70% off centre) but fixed to this point of the PPI. All target move relative to Ownship's course (CSE) and speed. Targets have relative past trails (afterglow), but Ownship has no trail.

STABILISATION MODE

Sea Stabilisation

197 Gives the correct course (HDG) and speed though the water. Set and Drift information is not used. Sea stabilisation provides an excellent display for **coastal navigation**, **pilotage** and **anti collision**. The true trails of targets give an indication of their apparent true motion.

198 A single axis log (or manual speed input) and gyro provide sensor data for sea stabilisation.

Ground Stabilisation

199 Ownship log speed and heading, and an input of tide/wind rate and direction can be used to calculate Ownship course and speed over the ground. Without this ground-referenced speed and course, stationary targets would appear to drift at a rate and direction opposite to the tide.

200 Ownship course over ground (COG) and speed over ground (SOG) will also be calculated from a dual axis log input. VTG input from a GPS will also provide COG and SOG (non-EU mode only).

201 The ground stabilised true motion display can be very useful for pilotage, when it is important to know Ownship and other ship's course and speed over ground in relation to land, buoys and beacons.

NOTES

(1) A known stationary target (Navigational Mark) should not show any movement providing there is no error in the ground stabilisation.

(2) Course Over Ground (COG) and Speed Over Ground (SOG) boxes are for information only.

(3) If the GPS no longer sends information or sends an error message, then the display will revert automatically to sea stabilisation (non-EU mode only).

Manual Stabilisation

202 Uses manually entered information for tide/wind direction (SET) and rate (DRIFT).

Other Stabilisation Sources

203 In addition to the three selectable stabilisation modes, other sources of stabilisation are available. Doppler log input will automatically set the stabilisation to either bottom track or water track Doppler. Reference targets (optional) can also be used to provide stabilisation.

PAST POSITION

204 Plots the past position of tracked targets by dropping a marker to indicate the target's position up to two minutes ago. One marker is dropped for each tracked target up to every two minutes. The markers shrink as they age, and only four markers are shown for each tracked target.

205 The past position can be either relative to Ownship or a true position and is indicated by a preceding T or R depending on the vector mode.

VECTORS

206 Indicates the projected direction and speed of a tracked target. The end of the target vector represents where that target will be in *n* minutes (where n represents the vector time) if the target holds current speed and course. Vectors are normally displayed in the current motion mode (true or relative), but it is possible to display relative vectors while in true motion and visa versa by changing the vector mode from the vector box. Changing from normal vectors will result in the borders of the vector and past posn boxes turning red.

RADAR TRAILS

207 Displays previous radar using three levels of trail video. Each video level represents one third of the trails lifetime. If the trails are set to 15 minutes then trails will be displayed in bright grey until they are 5 minutes old when they will be displayed in a darker grey. When the trails reach 10 minutes old they will be displayed in a still darker shade of grey. At 15 minutes old the trails will disappear.

CLOSEST POINT OF APPROACH

208 The minimum distance from Ownship that a target will achieve based on current speed and heading.

CPA Limit

209 Defines the minimum approach distance from Ownship of a target's projected course.

TCPA Limit

210 Defines the maximum time in which a target's projected course can bring it within the CPA limit before generating a collision warning.

LATITUDE/LONGITUDE

211 The lat/lon box displays the current position of Ownship and the source of the position information. Valid sources of position information are shown below along with the mnemonic that will be displayed in the lat/lon box:

Global Positioning System	GPS
Differential Global Positioning System	DGPS
DECCA	DECC
LORAN-C	LORA
Integrated Bridge System	IBS
Electronic Chart	CHAR
Electronic Chart Display & Information System	ECDIS

In addition the following mnemonics may be shown in the lat/lon box:

Dead Reckoning Mode	DR
Other External Position information source	EXT

NOTE:

The LAT/LON box is for information only.

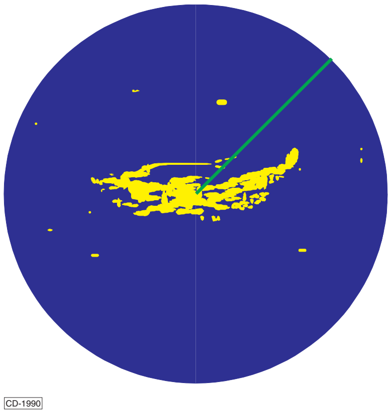
VARIABLE RANGE MARKER (VRM)

212 An Ownship stabilised ring centred on Ownship. The radius (representing distance from Ownship) is variable. The range of an active VRM is displayed in the VRM box.

ELECTRONIC BEARING LINE (EBL)

213 A movable line extending from Ownship position to the edge of the PPI. The bearing of an active EBL is shown in the EBL box; this is a relative bearing in head up presentation mode, and a true bearing in north up and course up.

GAIN, SEA & RAIN



Normal Picture

GAIN

214 The Gain control sets the signal threshold of the radar signals displayed on the screen. For a correct Gain setting, with the correlator switched OFF, the control should be adjusted until a 'speckled' background is just visible on the screen.

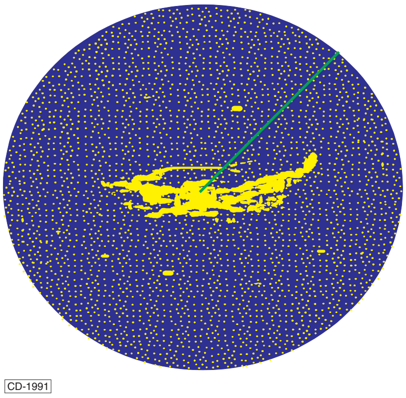
215 If the setting is too high, a poor quality picture masked by excessive noise results; if set too low, it may result in the loss of weak targets and a reduction in the detection range.

216 In conditions of high precipitation (rain, hail or snow) a reduction of the Gain level reduces clutter and produces a clearer picture.

217 The Gain level can be set from 0 (low) to 9 (high), with a typical operation level of between 6 and 8.

NOTE:

Do not set too high a level as excess noise on the screen degrades the picture quality.



Excess Gain

NOTE:

Fine adjustment of the Auto STC, Manual STC and Rain anti-clutter functions can be made using the Gain control.

SEA (STC)

218 The sea (STC) control is a manual adjustment that reduces the sea clutter returns. Maximum attenuation takes place at zero range, decreasing until no reduction of signals or clutter occurs up to a range of 6 miles or greater.

219 Advancing the sea setting progressively reduces the near range clutter. The sea level may be set from 0 (minimum) to 9 (maximum) with a typical operational level of between 3 and 5 (medium pulse). Less sea is to be applied on short pulse, more on long pulse. It is advisable to set the sea (STC) level with the correlator set to OFF or IR, since SC/SC causes a delay before the adjustment becomes visible.

220 The correct setting for the sea control under any given weather condition is only obtained by experience. If a setting is too high, it may result in the loss of close range targets. NEVER set the sea control to clear ALL clutter, but leave a light speckle of sea returns to indicate optimum sensitivity within the clutter field. Reduction of the remaining clutter can be achieved by setting the correlator to SC/SC mode.

NOTE:

When not in use the sea clutter control should always be set to 0.

Excess Sea

AUTO SEA

221 The auto facility provides automatic suppression of clutter. Further fine adjustment can be achieved using the Gain control.

222 The auto mode operates efficiently in open sea and in estuaries, though some land detail may be suppressed (leading edges are preserved). RACON responses may be reduced, but at least part of the response is normally visible.

223 The auto facility is effective against sea and close rain clutter.

224 On selecting the auto facility, target trails are cleared; this is to remove clutter build up in the trails.

NOTE:

The TUNE and Enhance (ENH) functions also affect the signals received (refer to TUNE and Enhance sections for more detail.

RAIN (FTC)

225 The rain control reduces clutter from rain, snow and hail. The rain facility also provides attenuation of sea clutter, though RACON responses are likely to be suppressed. The rain level can be set from 0 (minimum) to 9 (maximum) with a typical operational level of between 2 and 4.

226 The rain setting is adjusted to preserve small targets. It is often beneficial to reduce the Gain level to optimise target detection in high precipitation.

227 The use of S-Band radar is advantageous in very high precipitation conditions.

NOTE:

(1) The rain facility also improves short range discrimination.

(2) When not in use the rain control should always be set to 0.

MAPS, ROUTES & WAYPOINT POSITIONING

228 Maps, routes and waypoints can be positioned in one of two projections: Great Circle or Rhumb Line. The operator must ensure that the projection mode is set as required prior to using this facility. Map facilities are described in paragraphs 145 to 158.

229 Refer to Chapter 5 - Commissioning, for levels and default setting information.

Great Circle

230 Typically used for maps, as points of fixed Latitude and longitude remain coincident with the radar returns, but straight lines joining two points are only useful as a means of associating those points.

Rhumb Line

231 Typically used for routes between waypoints, as the straight line in this projection may represent the rhumb line that the ship is sailing, hence an indication of cross track error may be read directly from the radar return.

CURVED EBL

232 An electronic bearing line that graphically displays the rate of turn/radius of turn that the vessel will take to effect a new course. The turn shown will include the ship's forwarding distance. (Refer to paragraph 128).

WHEEL OVER POINT

233 Causes an active curved EBL to become sea stabilised. By activating the wheel over point as soon as the autopilot has been commanded to steer to a new course, it becomes possible to monitor the vessels progress around the turn by comparing it to the curved EBL. The WOP box is highlighted with a red border when active, and automatically deactivates when the gyro heading comes within 3 degrees of the curved EBL bearing. It can be deactivated at any time by pressing the WOP function again.

PARALLEL INDEX LINES

234 These are Ownship stabilised lines which extend across the width of the PPI. The angle to, and distance from Ownship is adjustable. By setting PI lines to channel boundaries, it is possible to get a view of Ownship position compared to the channel boundaries.

FUNCTIONS

Zone 1 - Radar System

(1) Standby, Run.

(2) Selection of the Radar System.

(3) Short, Medium, Long Pulse.

(4) Tuning of the selected Radar & Performance Monitor.

(5) Correlation & Interference Rejection.

(6) Enhancement of Radar Signals & Sector Scan.

Zone 2 - Screen Mode of Operation

(1) Range and Rings.

(2) Relative Motion, Relative Trails RM(R).

(3) True Motion, True Trails TM(T) (Optional).

(4) Relative Motion, True Trails RM(T) (Optional).

(5) North Up.

(6) Course Up.

(7) Head Up.

(8) Heading Line.

(9) Gain, Sea, Rain Settings.

Zone 3 - Ownship and Plotting Parameters

(1) Ownship Parameters.

(2) Plotting Parameters.

(3) Trail Parameters.

Zone 4 - VRM, EBL and Signal Controls

(1) Variable Range Marker.

(2) Electronic Bearing Line.

(3) Gain Setting.

(4) Sea Setting.

(5) Rain Setting.

Zone 5 - Data and Menus

Target Data Information.

(2) Menus for VDU Facilities, MAPS, TRAIL, PLOT,NAV and WPt.

(3) System and Function Warnings.

Zone 6 - Cursor Control and Mode

(1) Pushbutton Information Boxes.

(2) Cursor Readout Mode.

Figure 7 - Nucleus 3 Display and Screen Controls

CHAPTER 2A

RADAR PLOTTING AIDS

ELECTRONIC PLOTTING AID

INTRODUCTION

1 Manta displays are provided with one of three radar plotting aids:

(1) **EPA** - A Manual **E**lectronic **P**lotting **A**id.

(2) **ATA** - An **A**utomatic **T**racking **A**id with manual acquisition and a limited subset of ARPA functions.

(3) **ARPA** - A comprehensive **A**utomatic **R**adar **P**lotting **A**id with manual and automatic acquisition and including all ARPA functions.

2 This section covers the Electronic Plotting Aid (EPA).

3 The specification for the Electronic Plotting Aid (EPA) is provided at the end of this Chapter.

4 The EPA is a manual plotting system equivalent to, but superior than, a reflection plotter. Up to 20 targets may be plotted.

5 The operator enters an initial plot at a target position, followed by a second plot some minutes later (typically 3 to 6 minutes). The two plots are used to calculate the target true course (CRSE), speed, CPA and TCPA, and to generate a vector. The calculation and vector are ONLY based on the previous two plots.

6 The vector origin is RATE AIDED and therefore moves at the predicted course (CRSE) and speed of the target. Should the vector deviate from the target, it may be that the target has manoeuvred. If Ownship changes course or speed, relative vectors instantly indicate the changes in CPA and TCPA status. Whenever any target manoeuvres (vector leaves target) a plot update is required.

ELECTRONIC PLOTTING AID CONTROLS

NOTE: - APPLIES TO EU MODE ONLY

An operator warning is displayed if the target is not updated for 10.5 minutes. The target is automatically deleted and the warning cancelled if a new plot is not acquired within 11.5 minutes.

7 To plot a single target and obtain target data proceed as follows:

(1) Position the cursor over the target, press the ACQ (Acquire) pushbutton (left-hand) a plot symbol [•] appears over the target position. Release the ACQ pushbutton.

(2) Target data, other than Range and Bearing (BRG), is not available until the initial plot has been updated. The equipment accepts an update immediately after the entry of the next plot and target data is shown.

(3) To update the plot, position the cursor over the [•] symbol of the target, press the SELECT pushbutton (centre), the [•] symbol flashes to acknowledge selection. Now reposition the cursor over the present position of the target and press the ACQ (Acquire) pushbutton, a vector is generated representative of the target course (CRSE) and speed.

(4) Release the ACQ (Acquire) pushbutton. The vector origin will move at a course and speed predicted from the two previous plots. It is recommended that the LEADING EDGE of the target is used for a plot entry or update, to ensure consistent plotting.

NOTE:

Vectors are normally relative if in the Relative Motion RM(R) mode and true if in the True Motion TM(T) mode.

(5) Further plots on the target are made by repeating sub-paragraph (3) . The previous plot symbols and vector flash to acknowledge selection. Reposition the cursor over the present target position and press ACQ (Acquire), the previous vector disappears and a new vector is generated.

(6) If the vector deviates from the target track, reposition the cursor to select the target and press the ACQ (Acquire) pushbutton, the vector is recalculated using the new data.

(7) To display target data, position the cursor on or near to the vector origin and press the SELECT pushbutton. The plot symbols and vector flash, target data is displayed in the Target Data box on the right-hand side of the screen. The range and bearing of a target plot is displayed if selected and only the initial plot has been entered.

NOTE:

Following the selection of SELECT, the target vector and plot symbols will flash. Careful selection of the pushbutton functions is advised as the options are: CANCEL ENTRY, ACQ or DELETE PLOT.

(8) The vector presentation mode can be reversed by pressing and holding the VECTOR MODE pushbutton, to display true vectors when the equipment is in the Relative Motion RM(R) mode and relative vectors when the equipment is in the True Motion TM(T) or Relative Motion RM(T) mode.

NOTE:

Releasing the VECTOR MODE pushbutton within 4 seconds allows the vectors to return to the normal mode.

8 Changes in range scale, Off-centering, Relative or True Motion or stabilisation mode (NORTH UP, COURSE UP, HEAD UP) does not result in any loss of plots. Vectors correspond to the motion selected.

Plotting Additional Targets

9 Up to 20 targets can be plotted on the display at the same time. When selected and plotted, targets are allocated a number, in sequential order from 1 to 99. When 99 is reached numbers are allocated on the first free from 1 (refer to PLOT menu for labels on targets). To plot additional targets first ensure that no other target, map line or symbol are selected, then proceed as follows:

(1) Position the cursor over the initial target and press the ACQ (Acquire) pushbutton, a plot symbol [•] appears over the target position.

(2) Position the cursor over the 2nd target, press the ACQ (Acquire) pushbutton, a plot symbol [•] appears over the 2nd target position. Move the cursor to the next target.

NOTE:

(1) When two or more targets are close to one another, careful selection of the correct plot is required.

(2) If difficulty is experienced, and the wrong plot is selected, position the cursor over the symbol for the correct plot and press the SELECT pushbutton, the symbol/vector flashes. Now move the cursor over the new position of the target, press the ACQ (Acquire) pushbutton, the new vector is now generated.

Deleting Plots

10 To delete plots proceed as follows:

(1) Target Plots selected in error may be deselected provided the ACQ (Acquire) pushbutton has not been pressed. Press the SELECT pushbutton to correct the error.

(2) The vector of any one target can be deleted by positioning the cursor on the vector origin, pressing the SELECT pushbutton and then pressing the DELETE pushbutton.

Vector Time

11 The default or initial value of vectors is 15 minutes. The length of the vector is proportional to the speed of the target, e.g. target speed of 12 knots (KT) = vector length of three nautical miles.

12 The vector time may be changed between 1 and 30 minutes by selecting the VECTOR function and then operating the trackerball in the vertical plane to increase or decrease the time shown next to VECTOR in the pop-down box.

TARGET DATA

Function

13 Data concerning a selected target may be displayed in the Target Data box. The data for plotted targets using EPA is as follows:

(1) Target Number (automatically allocated).

(2) Bearing (True or Relative).

(3) Range.

(4) Course & Speed (True).

(5) Closest Point of Approach (CPA) & Time to Closest Point of Approach (TCPA) or Bow Crossing Range (BCR) & Bow Crossing Time (BCT).

14 EPA tracking is available on a radar visible target out to the maximum range of 96nm.

Selection

15 To display data in the Target Data box:

(1) Position the cursor over the selected target to be tracked and press the centre pushbutton (Select).

16 The elapsed time is calculated between successive target returns and a vector generated on the display to represent the predicted course and speed of the target.

17 Target information appears in the Target Data box as follows:

TARGET XX	Target Number
updated XX.X mins ago	Time since last update
T.BEARING 056.0°	Bearing (T) or (R)
RANGE 3.3 nm	Range in nautical miles
T. COURSE 349.0	Course in degrees
T. SPEED 2.7KT	Speed in knots (KT)
CPA or BCR 3.2nm	Closest Point of Approach (nautical miles) or Bow Crossing Range
TCPA or BCT 2.2min	Time of Closest Point of Approach (minutes) or Bow Crossing Time

18 To delete a target plot, position the cursor close to the selected target and press the select pushbutton, then press the delete pushbutton.

PLOT MENU

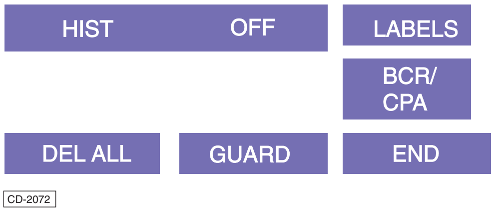
Function

19 Provides a selection of functions; Past Plot ON/OFF History (when 'ON' shows previous four plot positions) Guard ring functions (switching ON/OFF and setting Variable ring range and bearing) Deleting all plots and Selecting Bow Crossing Range (BCR) or Closest Point of Approach (CPA), and Labels allowing up to twenty targets to be labelled numerically. The menu also contains END to EXIT the PLOT menu.

Selection

20 To select the Plot menu:

(1) Highlight the PLOT box and press any pushbutton. The Plot menu boxes appear in the lower right-hand corner of the screen as shown below.



Plot Menu (EPA System)

(2) To change the ON/OFF state of the Plot History facility, highlight the [HIST] box and press any pushbutton.

(3) To delete **all** plots, Highlight the DEL ALL box. Press any pushbutton to delete all plots. A warning box is displayed; CLICK AGAIN NOW TO CONFIRM ACTION.

(4) To select Bow Crossing Range / Time (BCR/BCT), the displayed target information is changed. BCR/BCT data replaces CPA/TCPA.

(5) To change Target Data Function:

(a) Highlight the BCR/CPA box.

(b) Press any pushbutton to change the functions CPA/TCPA and BCR/BCT.

CPA/TCPA is replaced with . . .
BCR/BCT readings in the ranges of :
-99.9 to +99.9nm
—.- after +/-99.5min

(6) To enable the Labels facility: position the cursor over the LABELS box and operate any pushbutton. The box outline highlights in red - the LABELS facility is enabled. To disable this facility position the cursor over the LABELS box and operate any pushbutton.

(7) To leave the Plot menu, highlight the END box and press any pushbutton.

Guard Zones

21 Two Guard Zones are available, one Fixed and the other Variable, each zone is preset to 0.5nm wide. The guard zones operate by directly 'Searching' the screen for targets inside the zones. **When in use, the following points are to be remembered**:

(1) Radar Controls GAIN/SEA/RAIN, Correlation, Pulse Lengths and Video Enhance affect the amount of video on the screen and may be used to optimise the 'Searching ' of the zones (i.e. False alarm rate should be reduced).

(2) If the range in use is less than the guard zones range then the zones do not operate until the range scale is increased.

(3) The Operator must note that 'WHAT HE SEES ON THE SCREEN IS WHAT THE GUARD ZONES SEE'.

Fixed Guard Zone

22 The Fixed guard zone is preset between 5.5nm and 6nm (i.e. Outside the sea clutter field).

23 To activate the Fixed guard zone, select the [GUARD] function in the PLOT menu. Press any pushbutton and the Fixed and Variable guard zones appear on the screen at 5.5nm and 6nm respectively. Press the right-hand pushbutton (Vari OFF) to turn off the variable guard zone. Press the left-hand pushbutton (Zones Active) to activate the guard zones. The centre pushbutton (Guards OFF) deletes fixed and variable rings.

NOTE:

(1) Subsequent operation of the pushbutton turns the Fixed guard zone off, and the guard zone ring is cancelled.

(2) Targets are acquired and marked with a symbol when the Guard Zone is activated, further plotting is to be carried out manually by means of SELECT and ACQ (Acquire) for each target.

Variable Guard Zone

24 Activation of the Variable Ring guard zone is automatic when the Fixed guard ring is turned on. The Variable Ring guard zone appears on the screen at the default initialisation range of 7nm to 7.5nm.

25 The Variable Ring guard zone can be positioned at any range from 0.5nm out to 40nm.

26 To change the Variable guard ring range, move the trackerball to anywhere on the ring (not at the ends) and press the SELECT pushbutton. Movement of the trackerball then changes the range. Pressing SELECT again fixes the new range.

Bearing Limits

27 The port and starboard bearing limits of both the Fixed and Variable guard zones default to 45° relative to Ownship's heading line.

28 To change the bearing limits:

(1) Select the PLOT menu and Guard function.

(2) Move the trackerball to either end of the Variable guard zone (i.e. port or starboard) and press the SELECT pushbutton.

(3) Move the trackerball to increase or decrease the angle. Minimum port limit 10° Maximum starboard limit 180° from ship's head.

(4) Press SELECT pushbutton to enter the new value.

(5) To de-activate a guard zone move trackerball to position the cursor on the zone ring, press SELECT, then press the right-hand pushbutton.

NOTE:

The fixed ring may only be selected at its ends.

TRIAL MENU

Function

29 Provides a graphic display of the consequences of an intended change of course or speed of Ownship to be assessed in advance and allows avoiding action to be planned, when a potential collision scenario exists.

Selection

30 Before selecting the trial manoeuvre function, target vectors should be set to relative so that the results of an intended course/speed change can be assessed more accurately.

31 To select the Trial Manoeuvre menu:

(1) Highlight the TRIAL box and press any pushbutton.

(2) The CPA/TCPA boxes are replaced as shown below.

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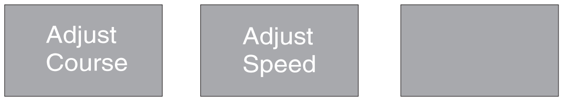
TRIAL MANOEUVRE

(3) The cursor is automatically placed in the TRIAL MANOEUVRE box and the pop-up boxes and the Pushbutton Selection box [3] contain the following:



CD-2071

(4) If the course/speed requires adjustment, the implications of the changes can be viewed quickly on the display as other target vectors are rotated to show their simulated direction relative to Ownship.

(5) To adjust the course or speed, press the appropriate pushbutton and move the trackerball until the required figure is obtained.

(6) To exit the Trial Manoeuvre facility, highlight the TRIAL box and press any pushbutton, or the Trial Manoeuvre facility can be exited by moving the cursor, using the trackerball, to the radar circle.

PLOTTING LIMITATIONS

32 Target plotting using the EPA is limited only by the Operator's skill and accuracy when manually plotting and updating target positions. The EPA is superior to a reflection plotter.

NOTE:

Whenever any target manoeuvres (vector leaves target) a plot update is required.

When two or more targets are close to one another, care must be taken to select the correct plot.

EPA PERFORMANCE SPECIFICATION

The following Table provides a list of EPA features and a description of each.

FEATURES	EPA DESCRIPTION
PLOTTING MODE	Relative Motion (After second plot it is possible to select either True or Relative vector).
GROUND REFERENCE	NOT APPLICABLE
VECTOR FACILITIES	Vector Mode: Target vectors displayed in Relative when True Motion selected and vice versa. Vector Length: 1-30 mins.
LOST TARGETS	NOT APPLICABLE
TRACKING	NOT APPLICABLE
TARGET DATA	Manual target data transmission for selected targets of interest.
ACQUISITION OPTIONS	NOT APPLICABLE
PLOTTING RANGE	On a radar visible target, up to 96 Nautical miles.
PLOTTING CAPACITY	Manual Plotting of up to 20 targets. Minimum lapsed time between any two plots: greater than 30 seconds.
PLOTTING ACCURACY	Course Tolerance: 5^0 Speed Tolerance: 1 kt. Closest Point of Approach Tolerance: 0.1nm Time to Closest Point of Approach Tolerance: 2 min.
TARGET SPEED	Targets plotted up to relative speed of 75 knots maximum.
OWNSHIP SPEED	99.9knots maximum.
OWNSHIP RATE OF TURN	12 degrees per second maximum.
TARGETS ON A BEARING	Up to maximum No. of target plots allowed.
PAST POSITION	Past plots may not be equally spaced, but vary according to the Operator controlled manual plotting interval
TARGET FADING/ PLOT LIMIT	After 10 minutes a warning is issued for any plots not updated. Any plot with a “time between plot updates” exceeding 15 minutes is removed.
RADAR ANTENNA RATE	Up to 60rpm (limited by system)
RADAR SIGNAL	From digitized video (set by operator for GAIN, RAIN, SEA CLUTTER)
TARGET CORRELATION	Correlation by target identification and predicted position.
TRIAL MANOEUVRE	Ownship’s manoeuvre simulation in speed and course
SIMULATION(S)	Single-scenario - Manually generated targets to assess the consequences of an intended change of course or speed of Ownship, enables avoiding action to be taken.
TEST DIAGNOSTICS	NOT APPLICABLE

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CHAPTER 2B

RADAR PLOTTING AIDS

INTRODUCTION

1 Manta displays are provided with one of three types of radar plotting aids:

(1) **EPA** - A manual **E**lectronic **P**lotting **A**id.

(2) **ATA** - An **A**utomatic **T**racking **A**id, with manual acquisition and limited subset of ARPA functions

(3) **ARPA** - A comprehensive **A**utomatic **R**adar **P**lotting **A**id, with manual and automatic acquisition and including all ARPA functions.

2 This section covers the Automatic Tracking Aid (ATA) and the Automatic Radar Plotting Aid (ARPA).

AUTOMATIC TRACKING AID

INTRODUCTION

3 The specification for the Automatic Tracking Aid (ATA) is provided at the end of this Chapter.

4 The Automatic Tracking Aid (ATA) is based on the ARPA System and offers a 20 target capacity. Trial Manoeuvre, Target History and Auto Acquisition facilities are excluded from the ATA. The ATA performance is fully compliant with the IMO requirements.

5 The ATA utilises a computer, which employs advance processing techniques to track targets automatically.

6 The ATA provides the following facilities:

(1) **Target Acquisition** - Target with relative speeds of up to 150 knots (KT) can be acquired out to a range of 80nm. Up to 20 targets can be acquired manually.

(2) **Guard Zones** - Two guard zones are available, one preset and one variable. When a target (which has not previously been acquired) enters a guard zone, an alarm is given and the ATA automatically acquires the target.

(3) **Tracking** - Acquired radar visible targets are automatically tracked to a range of 80nm and vectors are generated, which indicate the course (CRSE) and speed of the target. all acquired targets can be labelled and data on true target course (CRSE), true speed, range, bearing (BRG), BCR/BCT, CPA and TCPA can be displayed.

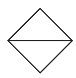
(4) **Vector Mode** - Provides the facility of true vectors when the display is in the RELATIVE motion mode, and relative vectors when the display is in the TRUE motion mode.

(5) **TCPA/CPA Limit** - The limits define the time and closest point of approach of a target that triggers the COLLISION WARNING alarm. The target must violate both parameters to trigger the alarm. TCPA limit may be varied between 1 and 60 min., in 1 minute increments. CPA limit may be varied between 0.1 and 6.0 nautical miles, in increments of 0.1 nautical miles. The default values are 15 minutes and 1 nautical mile.

(6) **BCR/BCT** - Once data is available on a target, the bow crossing range and time can be requested.

(7) **Simulation** - Provides both a training and test facility, the standard simulation is an off-line facility and is based on a known solution. The known solution is the basis for testing the integrity of the computer.

(8) **Lost Target** - When a target is lost, the red warning box produces a 'WEAK ECHO SEARCH' alarm message and a Lost Target symbol (see right) is placed on the display at the last known position of the target. If the Target is of interest, and after 10 sweeps the Target has not been found, the Alarm message 'LOST TARGET' is displayed. If the Target is not of interest, i.e. the range is greater than 3 nautical miles, has a negative TCPA and is outside the forward 45° either side of the Heading Line, it is deleted.



(9) **Tracking Overload** - An alarm indicates attempted acquisition of the 21st target and requires that one or more targets should be released from tracking.

(10) **Interfacing** - Target data (ATA tracked targets) outputs are available, in IEC 61162 TTM format and as a feed to a serial printer.

(11) **Automatic Identification System (AIS)** - Adjustable 50 plot capacity.

Options

7 As detailed in the Introduction section of this manual.

ATA PLOTTING CONTROLS

Acquire Target

8 To manually acquire a target, position the cursor over the target and press the **[ACQ]** Acquire pushbutton, the target is labelled with a symbol. Within 12 scans a target vector is generated and within 3 minutes the vector is stable.

Select

9 To select a target, position the cursor over the target and press and release the **[Select]** pushbutton. The target plot symbol and vector flash to acknowledge selection. Once the target is selected, full target information is available in the target data field provided that the target is being tracked.

NOTE:

When the SELECT pushbutton is pressed the target vector flashes.

Delete

10 Position the cursor on the target and press the **[Select]** pushbutton, press the **[Delete]** pushbutton and the tracking/plotting on the target ceases. Targets causing a collision warning cannot be deleted until acknowledged.

NOTE:

Ensure that the correct target, map or navigation line or symbol is selected before pressing the DELETE pushbutton.

Vector Mode

11 Change the vector presentation mode by positioning the cursor in the Vector menu; press and hold the **[T. or R. Mode]** pushbutton for 4 seconds. The Vector box is outlined in red to indicate that vectors are displayed in the opposite presentation mode to that of the display, plus a Red Warning box as below. To return the Vectors to the correct presentation mode repeat the procedure. This function is not available in Trial Manoeuvre mode.

VECTOR MODE
SET TO TRUE

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Vector Time (Vector Length)

12 The vector time can be changed between 1 and 30 minutes, in increments of 1 minute, by pressing and operating the trackerball in the vertical plane to increase or decrease the time shown next to VECTORS in the OWNSHIP DATA field.

13 The default or initial value of vectors is 15 minutes. The length of the vector is proportional to the speed of the target (e.g. target speed 12 knots (KT) then vector length is 3nm, which is the distance the target travels in 15 minutes).

Target Data

14 To display target data, position the cursor on or near the required target/vector and press the **[Select]** pushbutton. The target plot symbols and vector flash; data on the selected target is displayed/ updated in the TARGET DATA field every scan.

NOTE:

Between acquiring a target and the Computer generating a vector, the TARGET DATA shows Range and Bearing (BRG). Target course (CRSE) and speed are 'True'.

15 To vary either the **[CPA LIMIT]** or the **[TCPA LIMIT]** select the function and press and hold down the left pushbutton, operate the trackerball in the vertical plane to increase or decrease the limit value. Press the centre pushbutton to enter the minimum (MINIM) value and the right pushbutton to enter the maximum (MAX) value.

16 The default values are 15min (TCPA) and 1nm (CPA).

ATA ALARMS

17 ATA Alarms, listed below, are displayed in a RED highlighted box on the right-hand side of the screen. If the ATA computer is not available the following message is displayed:

THE ATA
COMPUTER HAS NOT
BEEN FITTED

CD-2077a

18 With the ATA functioning, warnings produce an audible alarm and the following alarm messages may be displayed in the highlighted box:

(1) **Collision Warning** When a target is within both CPA and TCPA, a flashing symbol is generated on the target plus TARGET DATA.

(2) **Weak echo Search** When a target is lost this message appears and is always shown until the target is deleted.

(3) **Lost Target** If a target is not seen for eight consecutive scans the target is counted as weak and the Lost Target symbol appears in the last vector position. If the target is of interest, after a further 10 sweeps the target is designated as 'Lost' and an Acknowledge box appears above the warning box.

(4) **Tracking Overload** Occurs when the computer is tracking to maximum capacity and any additional target is acquired.

(5) **ATA Failure** If the computer fails after initialisation.

Alarm De-selection /Operator Action

19 Unacknowledged alarms cause a flashing red outline box to be displayed in the alarm box. To acknowledge the alarms, position the cursor in this box and press any pushbutton. The box disappears when all alarms are acknowledged.

20 An exception to this is the 'Collision Warning' alarm, the Red box is not removed until the target is no longer a danger. The following action is permitted:

(1) **Collision** - The target vector and square symbol continue flashing until the parameter violation ceases. Any other target can be selected whilst a collision alarm exists. Target data for the selected target is displayed for 10 seconds; the display then reverts to the collision target data.

(2) **Lost Target** - The resetting of the alarm automatically removes the Lost Target symbol from the display.

(3) **Tracking Overload** - Alarm cancelled by reset action; one or more selected targets have to be deleted to allow for selection of new target.

(4) **ATA Fault** - Return to Standby and reselect **[GO TO RUN]**.

SIMULATION MODE

21 A simulation facility is provided for both a training and a test purpose. There is one Standard simulation available with ATA, which runs for about 60 minutes. The simulation is off-line (i.e. Radar Standby)

Standard Simulation Mode

22 Based on a known situation this scenario shows the targets moving within a 15 mile radius of the radar origin, refer to Figure 1 - Standard Simulation Mode - Known Scenario (At Start of Simulation).

Selection

23 Select [SIM] from the standby menu.

24 The Standard simulation begins after the message:

Testing ATA

disappears from the screen.

(1) Select the 24 mile range to see the simulated targets.

Terminating the Simulation

25 To terminate the simulation facility, from either mode, select the **[STANDBY]** function highlighting the TX box, then press the centre pushbutton.

ATA PARAMETERS

26 The ATA specification is defined at the rear of this Chapter.

PLOT MENU

Function

27 Provides a selection of functions: Deleting all plots and an Electronic ARPA computer reset facility; Selecting Bow Crossing Range (BCR) or Closest Point of Approach (CPA). The Labels function applies labels to the targets.

28 The menu also contains END which removes the PLOT menu.

Selection

29 To select the Plot menu, carry out the following:

(1) Highlight the PLOT box and press any pushbutton.

(2) The Plot menu boxes appear in the lower right-hand corner of the screen as shown below.

CD-2076

(3) To reset the computer and to delete **all** plots, position the cursor in the DEL ALL box, the box is now highlighted. Press any pushbutton to reset the computer and to delete all plots.

A highlighted box appears with the words:

CLICK AGAIN NOW TO CONFIRM ACTION

The words in the box change to:

Testing ATA

until the computer resets.

TARGET DATA

30 To change Target Data information:

CPA/TCPA is replaced with BCR/BCT readings in the ranges of : -99.9 to +99.9nm, after +/-99.9min.

(1) Highlight the BCR/CPA box, the box is now highlighted.

(2) Press any pushbutton to change the state of selection.

LABELS

31 To enable the LABELS facility:

(1) Highlight the LABELS box and operate any pushbutton. The box outline highlights in red - the LABELS facility is enabled. To disable this facility position the cursor over the LABELS box and operate any pushbutton. Target labels are numbered 1 to the maximum target capacity. The numbers of deleted or lost targets are not used until the maximum number is reached.

(2) Selection of Labels ON identifies the target labels.

(3) To leave the Plot menu, position the cursor in the END box and press any pushbutton.

TARGET TOTE

32 This shows varied information on multiple targets: Range/bearing (BRG), speed, course (CRSE), TCPA (Time to Closest Point of Approach) CPA (Closest Point of Approach) and BCT (Bow Crossing Time) BCR (Bow Crossing Range) and can be shown with six targets simultaneously.

33 To execute the facility:

(1) Select the target from the radar display, place the cursor over the target. Press the centre (Select) pushbutton, the target blinks to verify it has been chosen.

(2) An information display on the target selected then appears on the right side of the display. This shows target information, as does target tote, but can only display it in this way one target at a time.

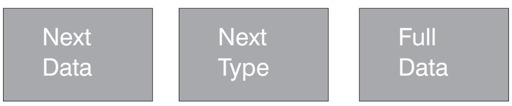
34 To execute the tote mode:

(1) Place the cursor in the TOTE box, located over to the top-right of the target information display, press any of the pushbuttons to activate.

(2) The initial target information display is replaced by the Target Tote display. This shows information on the speed/course (CRSE),range/bearing (BRG), TCPA/CPA and BCT/BCR of six independent targets.

(3) To switch between the different data types:

(a) Place the cursor over the bar at the top of the target information display. An information box appears below the radar display:



CD-1949

(b) Select until the data to be analysed appears.

(4) The ranking of the target information can be arranged. The order can be TCPA within CPA , closest CPA or shortest TCPA. To switch through the different ranking types:

(a) Place the cursor over the bar at the top of the Target Tote display.

(b) Press the centre pushbutton continuously until the ranking type you want to analyse appears.

(5) To return to the single target information display, place the cursor over the bar at the top of the target tote display then press the right-hand pushbutton.

PLOTTING LIMITATIONS

35 Target plotting limitations using the ATA include the following:

(1) Operator's skill and accuracy when manually entering the Ownship's speed.

NOTE:

When using the manual speed input method, the Operator MUST adjust the speed input manually every time that the Ownship changes speed.

For sea stabilised displays, the input speed MUST be Ownship's speed over the water NOT over the ground.

(2) A maximum of 20 targets can be tracked at any one time. Attempts to track more than 20 targets at once result in a TRACKING OVERLOAD alarm.

NOTE:

To track another target, when 20 are already selected, one of the currently tracked targets must first be removed from tracking.

(3) The tracking accuracy of the ATA is 2 deg. (or 3 deg., within 1 minute of a target manoeuvre).

(4) A maximum of 4 past positions only are displayed for each tracked target.

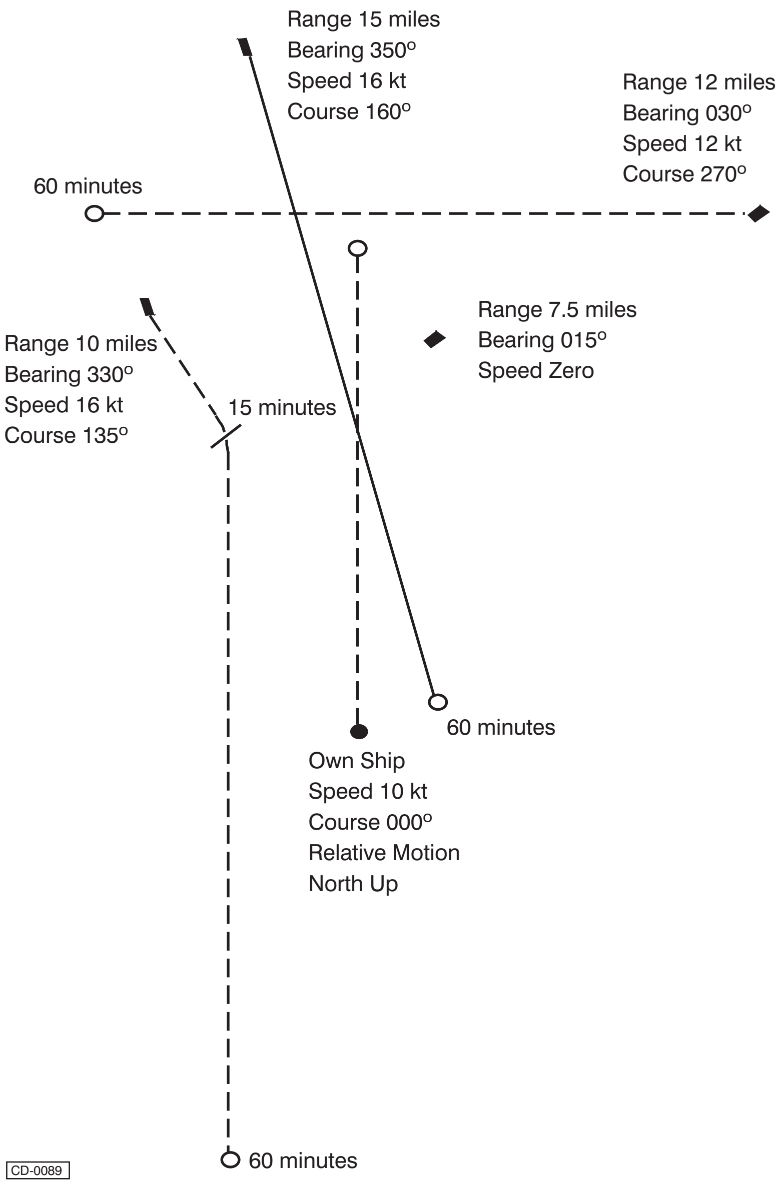


Figure 1 - Four Target Simulation Mode - Known Scenario (At Start of Simulation)

AUTOMATIC RADAR PLOTTING AID

INTRODUCTION

36 The specification for the Automatic Radar Plotting Aid (ARPA) is provided at the rear of this chapter.

37 The Automatic Radar Plotting Aid (ARPA) facility complies with and greatly exceeds the IMO requirements for an Automatic Radar Plotting aid. Up to 50 targets can be tracked and acquired, automatically or manually.

38 Automatic acquisition options include twin Guard Zones, Sectors (Not EU) and Footprint Acquisition Zones (FAZ). The **ARPA performance is fully compliant with the IMO resolutions A422 and A823 for ARPA.**

39 The ARPA computer employs advanced processing techniques to acquire and track targets automatically. Data on all tracked targets can be transmitted via an RS232 serial link to a navigation system, plotter or terminal. A second RS232 serial link provides an external diagnostic facility. Radar Operator controls are similar to those described in Chapter 1, any variations are described in this chapter.

40 The design of the ARPA computer includes software and hardware components that minimise the effects of error sources on tracking accuracy and also minimise target swap. However, as with all tracking systems, error sources, such as excessive clutter or poor signal to noise ratio, have a detrimental effect on accuracy. The following describes the effects of error sources on **ALL** ARPA tracking systems:

(1) **Low signal - to - noise** - Targets may appear to fade on the display. The ARPA may indicate a WEAK ECHO alarm and, in extreme cases, lose the target. Other echoes appearing in the track window during this period may be assumed to be the required echo.

(2) **Low signal - to - clutter** - Clutter returns and echoes may merge on the display. This may cause the ARPA to malfunction during this period, possibly by not detecting a manoeuvre, or by losing vector stability.

(3) **Side lobes/reflections** - Particular settings of the display, or poor siting of the antenna may cause the ARPA to lose accuracy, particularly in its ability to determine the true bearing of the echo, and hence the CPA.

41 The ARPA function provides the following facilities:

(1) **Target Acquisition** - Target with relative speeds of up to 150 knots (KT) can be acquired out to a range of 80 nm. Up to 50 targets may be acquired either manually, using the cursor, or automatically using guard zones. Auto acquisition is also possible by sectors or Footprint Acquisition Zones (FAZ).

(2) **Guard Zones** - Two guard zones are available, one preset, the other variable. When a target, which has not previously been acquired, enters a guard zone, an alarm is given, and the ARPA automatically acquires the target.

(3) **Zone Acquisition** - Fourteen sectors are available, either inclusion or exclusion, ship's head or north stabilised and can be stored.

(4) **Footprint Acquisition Zones** - Provided to allow automatic acquisition over a defined area around Ownship.

(5) **Tracking** - Acquired radar visible targets are automatically tracked to a range of 80nm, and vectors are generated which indicate the course (CRSE) and speed of the target. All acquired targets may be labelled, and data on true target course (CRSE), true speed, range, bearing (BRG), BCR/BCT, CPA and TCPA may be displayed.

(6) **Vector Mode** - Provides the facility of true vectors when the display is in the RELATIVE motion mode, and relative vectors when the display is in the TRUE motion mode.

(7) **Target History** - Displays a target track history, showing 4 past positions for each target, representing 2 minute intervals.

(8) **Reference Targets** - Tracked targets may be designated as Reference Targets and used for ground stabilisation.

(9) **Autodrift** - Drift is automatically calculated using the average movement of designated Reference Targets or using data from a navigation system (e.g. GPS).

(10) **Anchor Watch** - All designated Fixed Targets are monitored for movement relative to Ownship, and if any one target moves in excess of the Anchor Watch limit, the ANCHOR WATCH alarm is triggered.

(11) **TCPA/CPA LIMIT** - The limits define the time and closest point of approach of a target that triggers the COLLISION WARNING alarm. The target must violate both parameters to trigger the alarm. TCPA LIMIT may be varied between 1 and 60 min. in 1 minute increments, CPA LIMIT may be varied between 0.1 and 6.0 nautical miles in increments of 0.1 nautical miles. The default values are 15 minutes and 1 nautical mile.

(12) **BCR/BCT** - Once data is available on a target the bow crossing range and time may be requested.

(13) **Trial Manoeuvre** - Simulates the intended change of course (CRSE) or speed to assess planned action in advance either for navigational purposes or when a potential collision situation exists.

(14) **Simulation** - Provides both a training and test facility, the standard simulation is based on a known solution. The known solution is the basis for testing the integrity of the ARPA computer.

(15) **Lost Target** - When a target is lost, the red warning box produces a 'WEAK ECHO SEARCH' alarm message and a Lost Target symbol is placed on the display at the last known position of the target. If the Target is of interest, and after 10 sweeps the Target has not been found, the Alarm message 'LOST TARGET' is displayed. If the Target is not of interest, i.e. the range is greater than 3 nautical miles, has a negative TCPA and is outside the forward 45° either side of the Heading Line, it is deleted.

(16) **Tracking Overload** - An alarm indicates attempted acquisition of the 51st target. To track an another target, requires one or more currently tracked targets to be released from tracking.

(17) **Mapping** - External NAVCARD used for map storage and retrieval. Several cards can be used for multi-map storage. Each card can store approximately 64Kbytes of features. Flexible partitioning is arranged to store different maps. Maps can be land stabilised in any mode and can be stabilised by SATNAV or GPS. Auto map positioning facility, uses smoothed ship's position.

(18) **Drift Input** - Three modes of drift input; Manual - True motion models only 0-99.9KT, GPS - Ownship vector calculation (GPS Fitted) and Plot - Autodrift calculation using reference targets.

(19) **Interfacing** - Target data (ARPA tracked targets) outputs are available in IEC 61162 TTM format and as a feed to a serial printer.

(20) **Automatic Identification System (AIS)** - Adjustable 50 plot capacity.

Options

42 As detailed in the Introduction section of this manual, except that the Additional NAVCARD external Maps and Serial Comms Adapter Board are fitted to ARPA as Standard.

ARPA PLOTTING CONTROLS

Acquire Target

43 To manually acquire a target, position the cursor over the target and press the **[ACQ]** Acquire pushbutton, the target is labelled with a symbol. Within 12 scans a target vector is generated and within 3 minutes the vector is stable.

Select

44 To select a target, position the cursor over the target and press and release the **[Select]** pushbutton. The target plot symbol and vector flash to acknowledge selection. Once the target is selected, full target information is available in the target data field provided that the target is being tracked.

NOTE:

When the SELECT pushbutton is pressed the target vector flashes.

Delete

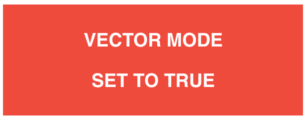
45 Position the cursor on the target and press the **[Select]** pushbutton, press the **[Delete]** pushbutton and the tracking/plotting on the target ceases. Targets causing a collision warning cannot be deleted until acknowledged.

NOTE:

Ensure that the correct target, map or navigation line or symbol is selected before pressing the DELETE pushbutton.

Vector Mode

46 Change the vector presentation mode by positioning the cursor in the Vector menu; press and hold the centre pushbutton **[Mode]** for 4 seconds. The Vector box is outlined in red to indicate that vectors are displayed in the opposite presentation mode to that of the display, plus a Red Warning box as below. To return the Vectors to the correct presentation mode repeat the procedure, but only pushing the button momentarily.



CD-2073

NOTE:

If the cursor is outside the radar area, the left pushbutton gives direct access to vector mode without moving the cursor into the vector box.

Vector Time

47 The vector time can be changed between 1 and 30 minutes, in increments of 1 minute, by pressing and operating the trackerball in the vertical plane to increase or decrease the time shown next to VECTORS in the OWNSHIP DATA field.

48 The default or initial value of vectors is 15 minutes. The length of the vector is proportional to the speed of the target (e.g. target speed 12 knots (KT) then vector length is 3nm, which is the distance the target travels in 15 minutes).

Target Data

49 To display target data, position the cursor on or near the required target/vector and press the **[Select]** pushbutton. The target plot symbols and vector flash; data on the selected target is displayed/ updated in the TARGET DATA field every scan.

NOTE:

Between acquiring a target and the ARPA generating a vector, the TARGET DATA shows Range and Bearing (BRG) only. Target course (CRSE) and speed are 'True'.

50 To vary either the **[CPA LIMIT]** or the **[TCPA LIMIT]** select the function and press and hold down the left pushbutton, operate the trackerball in the vertical plane to increase or decrease the limit value. Press the centre pushbutton to enter the minimum (MINIM) value and the right pushbutton to enter the maximum (MAX) value.

51 The default values are 15min (TCPA) and 1nm (CPA).

Past History

52 Target Past History can be displayed by selecting **[PAST POSn]** from the radar menus next to the radar display and pressing any pushbutton to select ON. From the selection time onwards, the four past positions, separated by a period of two minutes are displayed for every target which is being tracked.

NOTE:

A823 has variable history.

53 Past History information is True in True Motion TM(T) and Relative Motion RM(T) modes and Relative in Relative Motion RM(R) mode.

GUARD ZONES

54 Two Guard Zones are available, one Fixed and the other Variable, each zone is preset to 0.5nm wide.

Fixed Zone

55 The Fixed guard zone is preset at 5.5nm to 6.0nm.

56 To activate the Fixed and Variable guard zones, select **[GUARD]** in the **[PLOT]** menu and press any pushbutton, the Fixed guard zone appears on the screen at 5.5nm to 6.0nm. The Variable guard zone appears on the screen at 7 nm to 7.5 nm and can be adjusted from 1.25nm to 40nm. The pop-down box allows selection of the zones 'Active' or 'Switched Off'.

NOTE:

(1) Turning the Fixed Guard Zone off automatically removes the Variable Guard Zone.

(2) Targets acquired and tracked when the Guard Zone was activated, continue to be tracked when the Guard Zone is switched off.

Variable Zone

57 Activation of the Variable guard zone is automatic when the Fixed guard zone is turned on. The variable zone cannot be displayed alone without also displaying the fixed zone.

58 The Variable guard zone can be positioned to any range from 1.25nm out to 40nm.

59 To change the Variable guard zone range, move the trackerball to anywhere on the zone (not at the ends) and press the **[Select]** pushbutton. Movement of the trackerball then changes the range. Pressing **[Select]** again fixes the new range.

Bearing Limits

60 The port and starboard bearing limits of both the Fixed and Variable guard zones default to 45° relative to Ownship's.

61 To change the bearing limits select the **[PLOT]** menu and **[GUARD]** function. Move the trackerball to the either end of the guard ring that is to be adjusted (i.e. port or starboard) and press the **[Select]** pushbutton. Move the trackerball to increase or decrease the angle, Minimum port limit 15° Maximum starboard limit 180° from ship's head. Press **[Select]** pushbutton to enter the new value. To de-activate a guard ring press **[Select]**, position the trackerball anywhere on the ring and then press the right-hand pushbutton.

NOTE:

The fixed ring can only be selected at its ends.

ARPA ALARMS

62 ARPA Alarms, listed below, are displayed in a RED highlighted box on the right-hand side of the screen. If the ARPA computer is not available the following message is displayed:

THE ARPA

COMPUTER HAS NOT

BEEN FITTED

CD-2078

63 With the ARPA functioning, warnings produce an audible alarm and the following alarm messages may be displayed in the highlighted box:

(1) **Collision Warning** When a target is within both CPA and TCPA, a flashing symbol is generated on the target.

(2) **Weak echo Search** When a target is lost this message appears and is always shown until the target is deleted.

(3) **Lost Target** If a target is not seen for eight consecutive scans the target is counted as weak and the Lost Target symbol appears in the last vector position. If the target is of interest, after a further 10 sweeps the target is designated as 'Lost' and an Acknowledge box appears above the warning box.

(4) **TARGET DELETED IN MUTE SECTOR** When a target enters a Mute Sector it is automatically deleted and this message is displayed.

(5) **Anchor Watch** If anchor watch limits are in operation (anchor symbol over target) and the selected target moves more than the Anchor Watch limit, an anchor symbol is generated over the target.

(6) **Tracking Overload** Occurs when computer is tracking to maximum capacity and an additional target is acquired.

(7) **New Target** Targets automatically acquired by the guard rings, show an inverted triangle symbol.

(8) **ARPA Failure** If the computer fails after initialisation.

Alarm De-selection /Operator Action

64 Unacknowledged alarms cause a flashing red outlined box to be displayed in the alarm box. To acknowledge the alarms, position the cursor in this highlighted box and press any pushbutton. The box disappears when all alarms are acknowledged.

65 An exception to this is the 'Collision Warning' alarm, the Red box is not removed until the target is no longer a danger. The following action is permitted:

(1) **Collision** - The target vector and square symbol continue flashing until the parameter violation ceases. Any other target can be selected whilst a collision alarm exists. Target data for the selected target is displayed for 10 seconds; the display then reverts to the collision target data.

(2) **Lost Target** - The resetting of the alarm automatically removes the Lost Target symbol from the display.

(3) **Anchor Watch** - Alarm cancelled by reset action; the anchor symbol may be removed by reselecting the target.

(4) **Tracking Overload** - Alarm cancelled by reset action; one or more selected targets have to be deleted to allow for selection of new target.

(5) **New Target** - Reset by acknowledgment of the alarm.

(6) **ARPA fault** - Return to Standby and reselect **[GO TO RUN]**.

SIMULATION MODE

66 A simulation facility is provided for both a training and a test purpose. Three simulation modes are available and run for about 60 minutes. The following facilities are disabled while in Simulation Mode:

Changing the Heading
Changing the Speed Input
Changing the Stabilisation
Changing the Drift.

(1) Select the 24 mile range.

Scenario 1 - Four Target Simulation

67 Based on a known situation this scenario shows the targets moving within a 15 mile radius of the radar origin, refer to Figure 2 - Standard Simulation Mode - Known Scenario.

Selection

68 Select [SIM] from the standby menu then press the left-hand pushbutton.

Scenario 2 - Two Rings of Twenty-Five Simulation

69 This scenario is used for the testing of Sectors and Guard Zones and consists of 2 rings of 25 targets. The first ring at 6.0nm and the second ring at 10.0nm.

70 The targets circle Ownship's position at the starting point at an ever expanding radius. Ownship's course (CRSE) 000 degrees, Log Speed 10 knots (KT).

Selection

71 Select [SIM] from the standby menu then press the centre pushbutton.

Scenario 3 - Fifty Target Simulation

72 This scenario can be used for the testing of Polyzones. It consists of a grid of targets all of which are travelling away from Ownship. Refer to Annex A for a detailed description of targets course (CRSE), bearing (BRG), speed and initial range.

Selection

73 Select [SIM] from the standby menu then press the right-hand pushbutton.

Terminating the Simulation

74 To terminate the simulation facility, select the **[STANDBY]** function highlighting the TX box, then press the centre pushbutton.

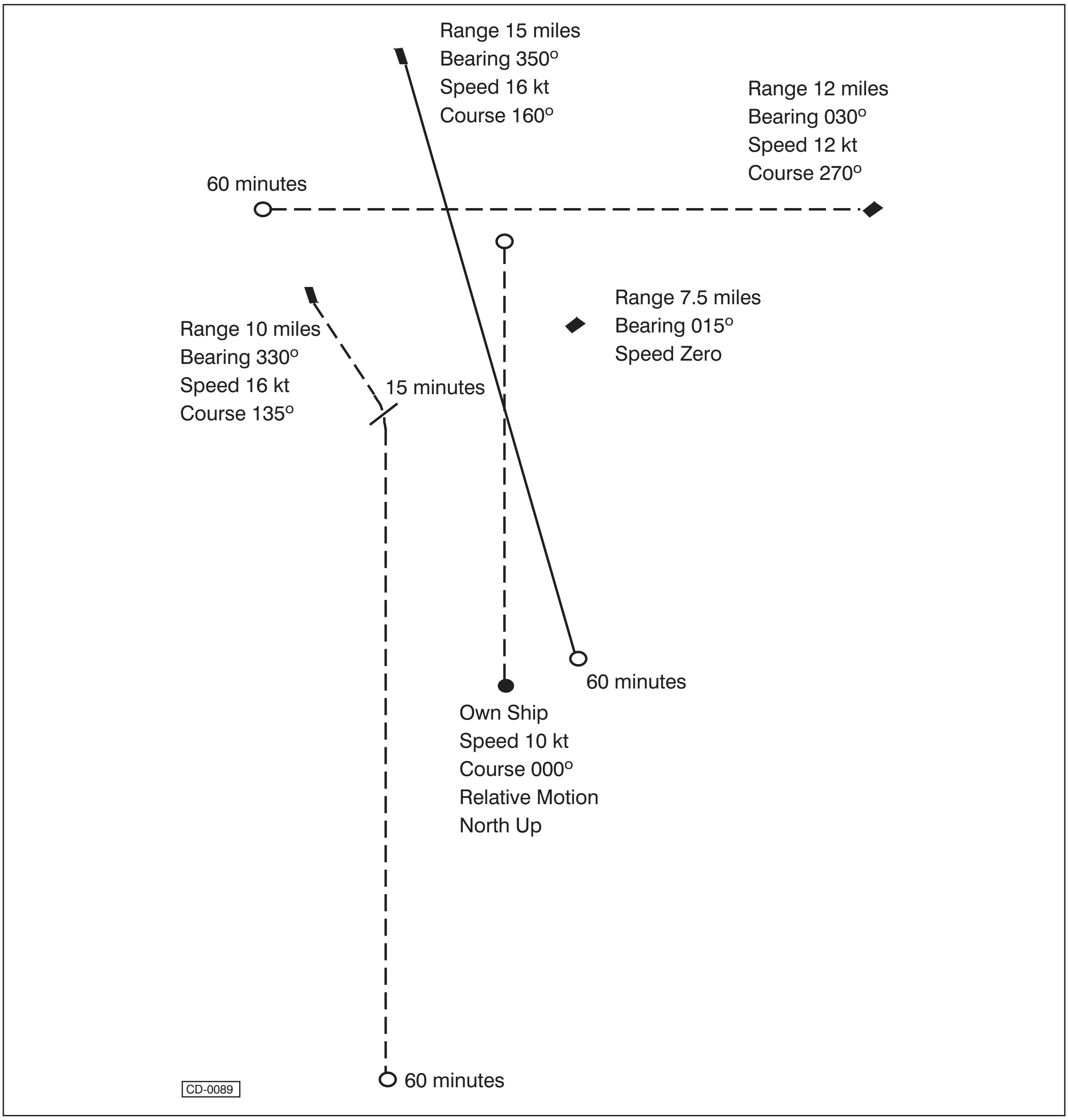


Figure 2 - Four Target Simulation Mode - Known Scenario

PLOT MENU

Function

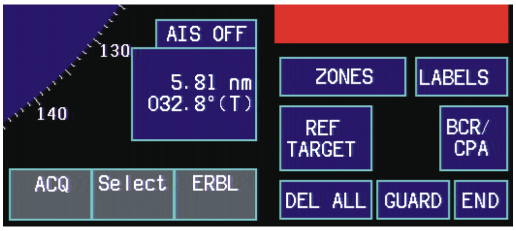
75 Provides a selection of functions: Guard zone activities, i.e. switching ON/OFF and setting Variable zone range and bearing (BRG); Deleting all plots and an Electronic ARPA computer reset facility; Selecting Bow Crossing Range (BCR) or Closest Point of Approach (CPA) also contains selection of Reference Targets and Sectors. The Labels function applies labels to the targets. The menu also contains END which exits the menu.

Selection

76 To select the Plot menu:

(1) Highlight the PLOT box and press any pushbutton.

(2) The Plot menu boxes appear in the lower right-hand corner of the screen as shown below.



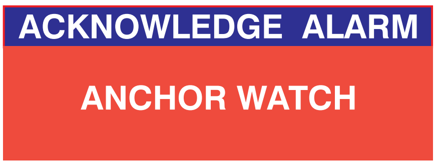
CD-4767

Ref. Target

77 To operate the Reference Target function:

(1) Select a target on the Radar screen, highlight the REF TGT box, the pop-down menu reads; Fix, Unfix, Anchor.

(2) Press the appropriate pushbutton to Fix (Unfix) the selected target. An 'R' appears on the selected target and the Drift Input changes to 'Fixed Target'. If 'Anchor Target' is selected the 'R' is replaced with an anchor in a box, and the Drift Input changes to Anchor Watch. When the limit is violated, the Red Alarm box contains the words:



CD-2081

NOTES:

(1) After the Anchor Alarm has been acknowledged, the target reverts to a reference target. If Anchor Watch is still required, it must be reactivated.

(2) When more than one target is annotated as 'Fixed' the ARPA may drop a reference target if that target's parameters vary considerably from those of other Reference Targets.

(3) To reset the ARPA computer and to delete **all** plots, position the cursor in the DEL ALL box, the box is now highlighted. Press any pushbutton to reset the computer and to delete all plots.

A highlighted box appears with the words:

Sector Selection (Not EU)

78 To include/exclude sectors:

(1) Ensure Footprint Acquisition Zones are turned off.

(2) Highlight the ZONES box, pop-down boxes appear with: Sect, Poly, FAZ. Press the left-hand pushbutton and the following menu appears:

CD-2075

(3) A Sector Storage Level indication is provided along the bottom of the Sector Selection menu. If the Sector storage becomes full a **SECTOR STORAGE FULL** warning message is displayed and some stored Sectors may need to be removed to create space for new sectors.

(4) To load previously saved sectors, scroll the selection box until required sector appears. Highlight the sector and press the left-hand pushbutton.

(5) To create a sector, highlight **[Create]** and press any pushbutton. A dotted inclusive/exclusive sector appears on the display, the information menu states: Plot, Select. Press the centre pushbutton to select that Sector. The following menu appears:

CD-1958

(6) Press the left-hand pushbutton to activate the sector.

(7) Place the cursor over the sector outline and press the centre pushbutton. Set the sector size by selecting and then moving each edge to the required position, when correct press the centre pushbutton.

(8) Any sector may be deleted by placing the cursor over the sector and pressing the right-hand pushbutton.

NOTE:

*The sector to be created can be selected to Ship or North Stabilised headings by highlighting SHIP/NORTH and pressing any pushbutton, the sector may also be set to inclusive/exclusive by highlighting INCLUSIVE/EXCLUSIVE and pressing any pushbutton. The sectors are colour coded, **Cyan** for Inclusive and **Red** for Exclusive.*

(9) When an unplotted target enters an active inclusion sector it is automatically acquired unless it is also in an active exclusion zone. Up to fourteen inclusion/exclusion sectors may be active at any one time. To save the created sectors, select an empty space on the menu and press the centre pushbutton.

(10) **[CLR]**, when highlighted and selected, clears the current sectors from the display.

(11) **[END]**, when highlighted and selected, returns to the PLOT menu.

Footprint Acquisition Zones Selection

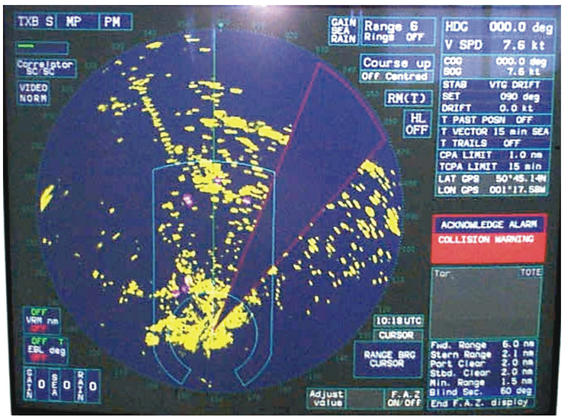
79 The Footprint Acquisition Zone (FAZ) allows an area around Ownship to be defined, in which all echoes are acquired and tracked. To operate the FAZ function:

(1) Ensure all sectors are deleted.

(2) Highlight the **[ZONES]** box, pop-down boxes appear with: Sect, Poly, FAZ. Press the **right-hand** pushbutton, the following menu appears:

CD-1960

(3) The FAZ appears as a dotted area, if Off and solid line if On (see below).



(4) To adjust the FAZ, move the cursor over the line or arc to be adjusted and press the centre 'Select' pushbutton. Move the cursor to the required position and press the 'Deselect' pushbutton.

(5) To activate the FAZ, once in the correct position, select a part of the menu box and press the right-hand pushbutton.

(6) To turn 'Off' the FAZ, if active, select the FAZ menu and press the right-hand pushbutton.

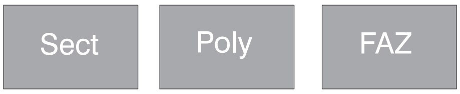
Polyzones (Not EU)

80 Polyzones are used to surround targets which are not required to be selected using the Auto target selection methods. Any target inside a polyzone during AUTO TARGET ACQUISITION is not selected.

Creating Polyzones

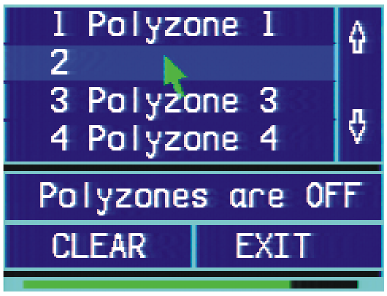
81 To create polyzones:

(1) Position the cursor over the ZONES box. Three pop-down information boxes appear below:



CD-1961

(2) Further detailed information is shown below the radar display. Press the centre pushbutton. The following Polyzone menu is displayed:



CD-4847

(3) A Polyzone Storage Level indication is provided along the bottom of the Polyzone Menu. If the polyzone storage becomes full, a POLYZONE STORAGE FULL warning message is displayed and some stored polyzones may need to be removed to create space for new polyzones.

(4) Before drawing the polyzones, first check that the polyzones are enabled. This information is shown in the new menu (see above). If the centre box reads POLYZONES ARE ON the polyzones function is enabled. To change between the polyzones on and off, position the cursor over the centre box below the radar display and press the pushbutton.

Drawing Polyzones

82 To draw the polyzones:

(1) Place the cursor over the desired starting point on the radar display. Three new information boxes appear below the radar display:

CD-1955

(2) To draw the first line of the polyzone press the left-hand pushbutton.

(3) Draw the line, the end of the first line “sticks” to the cursor. Position the cursor where the first line is to end and the second line is to start.

(4) Press the left-hand pushbutton, this locks the first line down, and allows the positioning of the end of the second line in the same way as the first line. Continue until enough “sides” of the polyzone have been created.

(5) To close the polyzone, so that both ends join up, press either the centre or the right-hand pushbutton.

(6) If another polyzone is to be created, repeat steps (1) to (5) above.

NOTE:

The limit to create the polyzones is fifty lines e.g. one polyzone may be drawn with fifty sides (lines), or ten polyzones each with five sides (lines) maximum.

Editing Polyzones

83 To edit the polyzones:

(1) Select the area for editing by positioning the cursor over the polyzone side that is to be changed, press the centre pushbutton.

(2) Then manipulate the shape of that polyzone side by moving the cursor, the polyzone side “sticks” to the cursor.

(3) While editing the side, the information display changes to show:

CD-1954

(4) When the shape of the side being edited is correct, press the centre pushbutton.

Deleting Polyzones

84 To delete a polyzone:

(1) Select the required polyzone and then press the right-hand pushbutton .

85 Three options exist when the polyzones have been created:

(1) To save the configuration of polyzones

(2) To clear the configuration of polyzones

(3) To exit and return to the previous menu area.

NOTE:

Save the configuration if possible, as creating the polyzones can be time consuming.

Saving Polyzones

86 To save a polyzone:

(1) Position the cursor over an empty file space in the file selection area. Three information boxes appear below the radar display:

CD-1951

(2) Press the centre pushbutton, the polyzones are then saved in the specific file space, with a given name for reference when retrieving.

Loading Polyzones

87 To load a file:

(1) Position the cursor over the required file name in the file selection area and press the left-hand pushbutton.

(2) If file spaces run out a **POLYZONE STORAGE FULL** warning message is displayed and a saved file will need to be deleted (by placing the cursor over the specified file and pressing the right-hand pushbutton) to allow a new polyzone file to be loaded.

88 To exit and return to the main menu area, first position the cursor over the EXIT box and press any pushbutton. Once out of that menu, position the cursor over the END box and press any pushbutton.

89 To clear all of the polyzones:

(1) Place the cursor over the CLEAR box. An information box appears:

(2) Pressing any pushbutton clears all of the polyzones displayed at that time.

Guard Zones

90 The operation of the Guard function is fully described in Paragraphs 75 to 82 - GUARD ZONES.

Target Data

91 To change Target Data information:

CPA/TCPA is replaced with BCR/BCT readings in the ranges of : -99.9 to +99.9nm
—.- after +/-99.5min.

(1) Highlight the BCR/CPA box, the box is now highlighted.

(2) Press any pushbutton to change the state of selection.

Labels

92 To enable the LABELS facility:

(1) Highlight the LABELS box and operate any pushbutton. The box outline highlights in red - the LABELS facility is enabled. To disable this facility position the cursor over the LABELS box and operate any pushbutton. Target labels are numbered 1 to the maximum target capacity. The numbers of deleted or lost targets are not used until the maximum number is reached.

(2) Selection of Labels ON identifies the target labels.

(3) To leave the Plot menu, position the cursor in the END box and press any pushbutton.

TRIAL MENU

Function

93 Provides a **graphical display** of an intended change of course (CRSE) or speed of Ownship which can then be assessed in advance, enabling avoiding action to be planned, when a potential collision exists.

NOTE:

Trial manoeuvre vectors are Relative only.

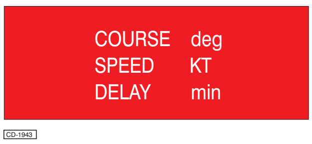
Selection

94 To select the Trial Manoeuvre menu, carry out the following:

(1) Highlight the **[TRIAL]** box and press any pushbutton.

(2) The LAT/LON boxes are replaced as shown below.

TRIAL MANOEUVRE

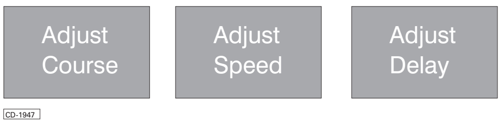


{For

{Information

{Only

(3) The cursor is automatically placed in the TRIAL MANOEUVRE box and the pop-up boxes and the Pushbutton Selection boxes [3] contain the following:



(4) If the course (CRSE)/speed/delay (ARPA) requires adjustment, the implications of the changes can be viewed quickly on the display as other target vectors show their new directions relative to Ownship.

NOTE:

The delay provides a means of delaying the result of the Trial Manoeuvre for the stipulated period.

(5) To adjust the speed, course or delay press the appropriate pushbutton and move the trackerball until the required figure is obtained.

(6) To exit the Trial Manoeuvre facility, position the cursor in the **[TRIAL]** box and press any pushbutton.

95 The course and speed defaults to Ownship's present course and speed (i.e. values at the instant 'trial' is activated). The delay (time before the manoeuvre is initiated) defaults to 10 minutes.

NOTE:

If a previous Trial has not finished, the defaults will not be used.

Delay

96 The delay may be set to any value, in 1 minute increments from 1 to 30 minutes. The delay counts down to zero, from the selected delay period.

97 The delay is adjusted using the trackerball in the vertical plane whilst pressing the DELAY pushbutton. At delay time 'zero', the trial is cancelled, menu area cleared, 'TRIAL' legend cancelled, and the display reverts to normal operation.

Trial Course/Speed/Time

98 The TRIAL COURSE operates in 5 deg steps, while the TRIAL SPEED operates in 1 knot increments (0-99 knots). For example, if default Ownship course is 118 deg true, starboard trial course adjustment selects 123, 128, 133, 138 etc.

99 The trial course and speed are varied by moving the trackerball in the vertical plane whilst pressing the COURSE or SPEED pushbutton, as appropriate.

100 The trial manoeuvre functions in True motion TM(T), Relative motion RM(T) and Relative motion RM(R) modes. In Relative motion, a TRIAL COURSE LINE radiates from Ownship to indicate the proposed heading.

101 In True motion TM(T), Ownship's vector is displayed along the heading line, then turns onto the TRIAL COURSE. The DELAY TIME is defined as the time from the initialisation of the delay period to the time that Ownship has completed the manoeuvre.

102 Collision targets in Trial mode are designated with a triangle symbol.

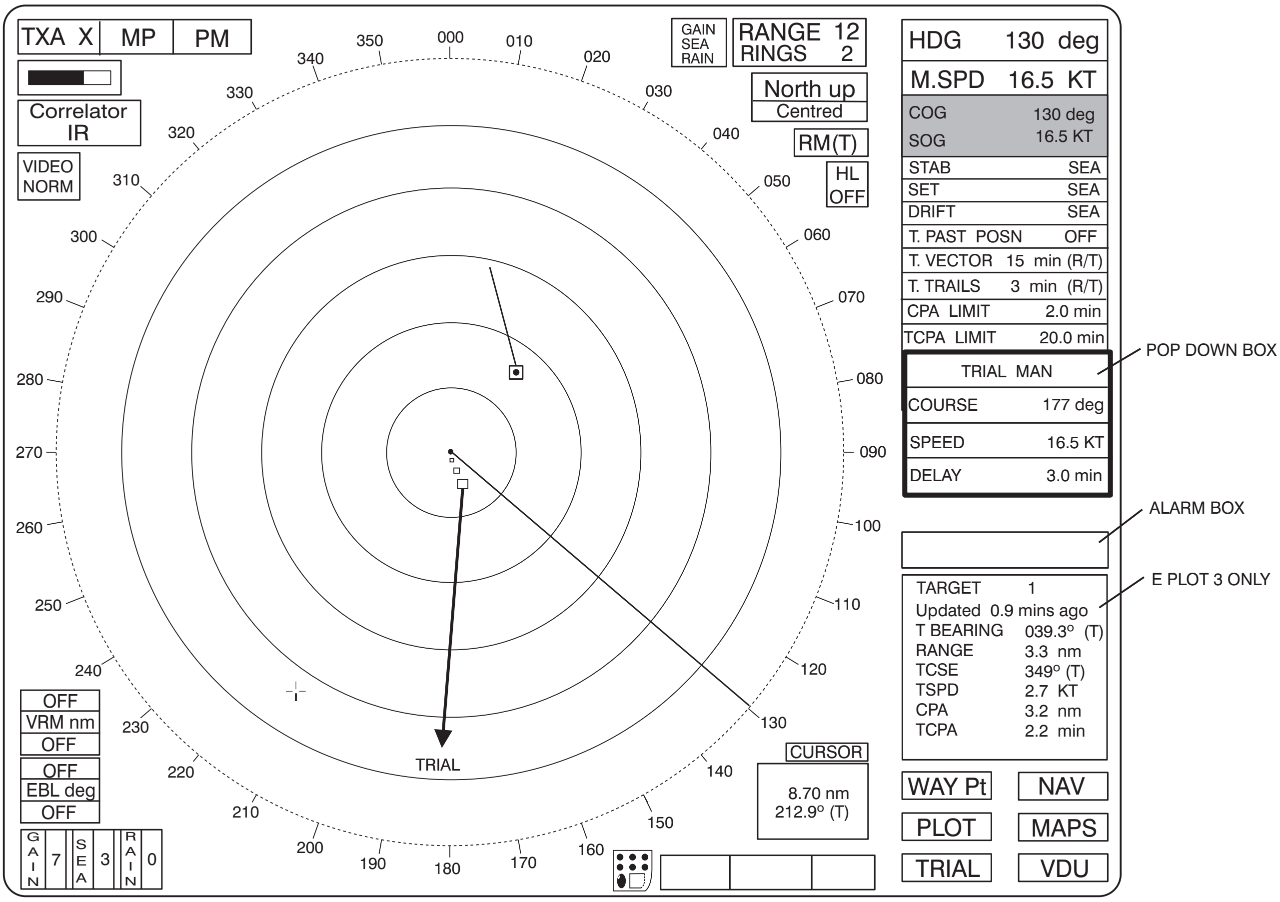


Figure 3 - Example of Trial Manoeuvre Screen

TARGET TOTE

103 This shows varied information on multiple targets: Range/bearing (BRG), speed/course (CRSE), TCPA (Time to Closest Point of Approach) CPA (Closest Point of Approach) and BCT (Bow Crossing Time) BCR (Bow Crossing Range) and can be shown with six targets simultaneously.

104 To execute the facility:

(1) Select a target from the radar display, place the cursor over the target, press the centre pushbutton (Select), the target blinks to verify it has been chosen.

(2) An information display on the target selected then appears on the right side of the display. This shows target information, as does target tote, but can only display it in this way one target at a time.

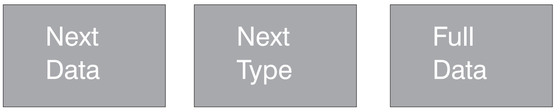
105 To execute the tote mode:

(1) Place the cursor in the TOTE box, located over to the top-right of the target information display, press any of the pushbuttons to activate.

(2) The initial target information display is replaced by the Target Tote display. This shows information on the speed/course (CRSE), range/bearing (BRG), TCPA/CPA and BCT/BCR of six independent targets.

(3) To switch between the different data types:

(a) Place the cursor over the bar at the top of the target information display. An information box appears below the radar display:



CD-1949

(b) Select until the data to be analysed appears.

(4) The ranking of the target information may be arranged. The order may be TCPA within CPA , closest CPA or shortest TCPA. To switch through the different ranking types:

(a) Place the cursor over the bar at the top of the Target Tote display.

(b) Press the centre pushbutton continuously until the ranking type you want to analyse appears.

(5) To return to the single target information display, place the cursor over the bar at the top of the target tote display then press the right-hand pushbutton.

NOTE:

The tote may be removed and replaced by full TARGET DATA should a warning situation develop (e.g. Collision Warning) or any other target selected using the cursor.

PLOTTING LIMITATIONS

106 Target plotting limitations using the ARPA include the following:

(1) Operator's skill and accuracy when manually entering the Ownship's speed.

NOTE:

When using the manual speed input method, the Operator MUST adjust the speed input manually every time that the Ownship changes speed.

For sea stabilised displays, the input speed MUST be Ownship's speed over the water NOT over the ground.

(2) A maximum of 50 targets can be tracked at any one time. Attempts to track more than 50 targets at once result in a TRACKING OVERLOAD alarm.

NOTE:

To track another target, when 50 are already selected, one of the currently tracked targets must first be removed from tracking.

(3) The tracking accuracy of the ARPA is 2 deg. (or 3 deg. for 1 minute duration, following target manoeuvre).

(4) A maximum of 4 past positions only are displayed for each tracked target.

50 TARGET SIMULATION - NUMBERING SYSTEM

107 Targets are in 5 rows of 10 columns, with Ownship in the centre of the 'grid'. Ownship has a heading of 000^0 and a log speed of 10KT.

108 Target 1 is specified as top left corner, i.e. row 1, column 1. Target 50 is bottom right (5, 10). Target numbering is sequential, returning to the beginning of the next row when at the end of the current row, i.e. target 11 is row 2, column 1.

109 This numbering system is arbitrary and is merely to allow identification of the target echoes used in the simulation. The ARPA may not necessarily adopt this numbering sequence.

110 All values in the following table are nominal, with no decimal precision given. Deviations may be up to + 1.0 indicated units, i.e. 10 may be in the range 9.0 to 11.0.

Target Number	True Bearing	True Course	True Speed	Range at Start
1	294	340	15	10
2	300	344	14	8
3	309	350	14	6
4	323	355	14	5
5	345	355	13	4
6	12	360	13	4
7	34	4	12	5
8	49	10	12	6
9	59	12	13	8
10	65	16	13	10
11	284	337	13	9
12	287	341	12	7
13	293	345	12	5
14	304	350	11	4
15	330	355	11	2
16	22	360	11	2
17	55	5	11	4
18	69	10	11	5
19	75	16	11	7
20	79	21	11	9
21	270	333	11	9
22	270	338	10	7
23	268	342	10	5
24	265	348	10	3
25	254	354	9	1
26	116	0	9	1
27	100	6	9	3
28	97	13	9	5
29	95	20	9	7
30	95	26	9	9
31	257	326	8	9
32	254	334	9	7
33	248	339	8	5
34	236	345	8	4
35	206	352	7	2
36	155	0	7	2
37	125	8	7	4
38	113	17	7	5
39	107	25	7	7
40	103	33	7	9
41	245	320	7	10
42	239	325	7	8
43	231	332	6	6
44	216	339	6	5
45	194	350	5	4
46	166	0	5	4
47	144	12	5	5
48	130	23	5	6
49	121	34	5	8
50	115	43	5	10

AUTOMATIC IDENTIFICATION SYSTEM

INTRODUCTION

111 The specification for the Automatic Identification System (AIS) is provided at the rear of this chapter.

112 The Automatic Identification System (AIS) facility complies with and greatly exceeds the IMO requirements for an Automatic Identification System aid. Up to 50 targets can be tracked and activated, automatically or manually.

113 Automatic activation options include twin Guard Zones, Sectors (Not EU) and Footprint Acquisition Zones (FAZ). The **ARPA performance is fully compliant with the IMO resolutions for AIS.**

114 AIS data is received from the Ownship's AIS receiver via a serial link. This data is filtered to allow processing to focus on data from the nearest vessels. These vessels are depicted on the PPI as triangular AIS plots. Further information is displayable in a similar manner to ARPA plots, but with more detail.

115 The AIS function provides the following facilities:

(1) **Target Acquisition** - Targets can be displayed out to a range of 99 nm. Up to 50 targets may be activated either manually, using the cursor, or automatically using guard zones. Auto activation is also possible by sectors or Footprint Acquisition Zones (FAZ).

(2) **Guard Zones** - Two guard zones are available. See ATA or ARPA.

(3) **Zone Acquisition** - Fourteen sectors are available in ARPA systems. See ARPA.

(4) **Footprint Acquisition Zones** - As provided in ARPA systems. See ARPA.

(5) **Plot Displaying** - Activated plots are displayed to a range of 99nm, and vectors are generated which indicate the course (CSE) and speed of the target. All activated targets may be labelled, and data on true target course (CSE), true speed, range, bearing (BRG), CPA and TCPA may be displayed.

(6) **Vector Mode** - Provides the facility of true vectors when the display is in the RELATIVE motion mode, and relative vectors when the display is in the TRUE motion mode.

(7) **TCPA/CPA LIMIT** - The limits define the time and closest point of approach of a target that triggers the COLLISION WARNING alarm. The target must violate both parameters to trigger the alarm. TCPA LIMIT may be varied between 1 and 60 min. in 1 minute increments, CPA LIMIT may be varied between 0.1 and 6.0 nautical miles in increments of 0.1 nautical miles. The default values are 15 minutes and 1 nautical mile.

(8) **Trial Manoeuvre** - Simulates the intended change of course (CSE) or speed to assess planned action in advance either for navigational purposes or when a potential collision situation exists.

(9) **Lost Dangerous Plot** - Where a dangerous plot is lost (no more messages being received), the red warning box produces a 'Lost Plot' alarm message and a Lost Plot symbol is placed on the display at the last known position of the plot. The plot may still be selected to display data on the vessel, but when the Lost Plot alarm is acknowledged, the plot will be lost.

(10) **AIS Capacity** - Quantity of AIS plots to display is adjustable up to 50. When zero (00) is selected, the digits will always be coloured red. Whenever 01 up to 50 is selected, the digits will be coloured white unless that amount is being received. The first AIS plot is always the ownship.

(11) **Drift Input** - Drift input is via GPS only to conform with the AIS standards.

ARPA PLOTTING CONTROLS

Activate Target

116 To manually activate a sleeping target (one without vectors) position the cursor over the target and press the **[ACQ]** Acquire pushbutton, the target is labelled with a symbol. Target vectors are generated for heading and course.

Select

117 To select a target, first activate it, then position the cursor over it and press and release the **[Select]** pushbutton. The target plot symbol and vector flash to acknowledge selection. Once the target is selected, full target information is available in the target data field.

NOTE:

When the SELECT pushbutton is pressed the whole plot flashes.

Deactivate

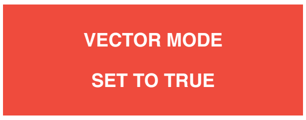
118 Position the cursor on the activated target and press the **[Select]** pushbutton, press the **[Delete]** pushbutton and the plot is put to sleep. Dangerous plots cannot be deleted.

NOTE:

Ensure that the correct target, map or navigation line or symbol is selected before pressing the DELETE pushbutton.

Vector Mode

119 Change the vector presentation mode by positioning the cursor in the Vector menu; press and hold the centre pushbutton **[Mode]** for 2 seconds. The Vector box is outlined in red to indicate that vectors are displayed in the opposite presentation mode to that of the display, plus a Red Warning box as below. To return the Vectors to the correct presentation mode repeat the procedure, but only pushing the button momentarily.



CD-2073

NOTE:

If the cursor is outside the radar area, the left pushbutton gives direct access to vector mode without moving the cursor into the vector box.

Vector Time

120 The vector time can be changed between 1 and 30 minutes, in increments of 1 minute, by pressing and operating the trackerball in the vertical axis to increase or decrease the time shown next to VECTORS in the OWNSHIP DATA field.

121 The default or initial value of vectors is 15 minutes. The length of the vector is proportional to the speed of the plot (e.g. target speed 12 knots (KT) then vector length is 3nm, which is the distance the target travels in 15 minutes).

Plot Data

122 To display plot data, position the cursor on or near the required activated target/vector and press the **[Select]** pushbutton. The target plot symbols and vector flash; data on the selected target is displayed/ updated in the TARGET DATA field every scan. The quantity of data available is dependent on the data being sent by the vessel and how often (e.g. Class B AIS vessels will not send ETA at all. Check Previous or Next Page buttons on the PAGE box of the target data to select other data.

123 To vary either the **[CPA LIMIT]** or the **[TCPA LIMIT]** select the function and press and hold down the left pushbutton, operate the trackerball in the vertical plane to increase or decrease the limit value. Press the centre pushbutton to enter the minimum (MINIM) value and the right pushbutton to enter the maximum (MAX) value.

124 The default values are 15min (TCPA) and 1nm (CPA).

GUARD ZONES

125 Two Guard Zones are available, one Fixed and the other Variable, each zone is preset to 0.5nm wide.

Fixed Zone

126 The Fixed guard zone is preset at 5.5nm to 6.0nm.

127 To activate the Fixed and Variable guard zones, select **[GUARD]** in the **[PLOT]** menu and press any pushbutton, the Fixed guard zone appears on the screen at 5.5nm to 6.0nm. The Variable guard zone appears on the screen at 7 nm to 7.5 nm and can be adjusted from 1.25nm to 40nm. The pop-down box allows selection of the zones 'Active' or 'Switched Off'.

NOTE:

(1) Turning the Fixed Guard Zone off automatically removes the Variable Guard Zone.

(2) Targets acquired and tracked when the Guard Zone was activated, continue to be tracked when the Guard Zone is switched off.

Variable Zone

128 Activation of the Variable guard zone is automatic when the Fixed guard zone is turned on. The variable zone cannot be displayed alone without also displaying the fixed zone.

129 The Variable guard zone can be positioned to any range from 1.25nm out to 40nm.

130 To change the Variable guard zone range, move the trackerball to anywhere on the zone (not at the ends) and press the **[Select]** pushbutton. Movement of the trackerball then changes the range. Pressing **[Select]** again fixes the new range.

Bearing Limits

131 The port and starboard bearing limits of both the Fixed and Variable guard zones default to 45° relative to Ownship's.

132 To change the bearing limits select the **[PLOT]** menu and **[GUARD]** function. Move the trackerball to the either end of the guard ring that is to be adjusted (i.e. port or starboard) and press the **[Select]** pushbutton. Move the trackerball to increase or decrease the angle, Minimum port limit 15° Maximum starboard limit 180° from ship's head. Press **[Select]** pushbutton to enter the new value. To de-activate a guard ring press **[Select]**, position the trackerball anywhere on the ring and then press the right-hand pushbutton.

NOTE:

The fixed ring can only be selected at its ends.

AIS ALARMS

133 AIS Alarms, listed below, are displayed in a RED highlighted box on the right-hand side of the screen.

134 Warnings produce an audible alarm and the following alarm messages may be displayed in the highlighted box:

(1) **Collision Warning** When a target is within both CPA and TCPA, the dangerous plot flashes in red.

(2) **Lost Target** If a dangerous plot is not seen for the stipulated time (see table) the Lost Plot symbol appears in the last vector position and an Acknowledge box appears above the warning box.

(3) **New Target** Targets automatically activated by the guard rings are shown as activated, and if dangerous (as red dangerous plots).

Alarm De-selection /Operator Action

135 Unacknowledged alarms cause a flashing red outlined box to be displayed in the alarm box. To acknowledge the alarms, position the cursor in this highlighted box and press any pushbutton. The box disappears when all alarms are acknowledged.

136 An exception to this is the 'Collision Warning' alarm, the Red box is not removed until the target is no longer a danger. The following action is permitted:

(1) **Collision** - The target vector and square symbol continue flashing until the parameter violation ceases. Any other target can be selected whilst a collision alarm exists. Target data for the selected target is displayed for 20 seconds; the display then reverts to the collision target data.

(2) **Lost Target** - The resetting of the alarm automatically removes the Lost Target symbol from the display.

(3) **New Target** - Reset by acknowledgment of the alarm.

PLOT MENU

137 AIS Plot Menu functions tend to shadow the ATA and ARPA functions depending on which type of system is in use. The differences are:

(1) ATA Systems only:

(a) DEL ALL - This does not apply to AIS plots, which cannot be termed as deletable. Deletion as such is done by reducing the number of plots allowed to be displayable (to delete the further away displayed plots), and turning AIS off (to reset AIS processing).

(b) BCR/CPA - Bow Crossing Range is not calculated for AIS plots.

(2) ATA and ARPA Systems:

(a) REF TARGET - The use of reference targets is not allowed when AIS processing is enabled. So this facility is not valid whenever AIS is not OFF. This restriction applies to ARPA as well as AIS plots in this situation.

TRIAL MENU

138 This shadows ARPA operation, but does not distinguish collision targets implied by the Trial Manoeuvre.

PLOTTING LIMITATIONS

139 Target plotting limitations using the AIS include the following:

NOTE:

For sea stabilised displays, the input speed MUST be Ownship's speed over the water NOT over the ground.

(1) A maximum of 50 targets can be plotted at any one time. The quantity is adjusted to the number in the AIS box by left click and moving the trackerball up/down.

NOTE:

The plots displayed will always be selected by the dominant filter in use, in this case the nearest.

(2) In order for AIS reception to be available the following services have to be supplied correctly:
- GPS position (preferably GGA)
- Valid Heading
- Non-Manual Log

ATA/ARPA/AIS PERFORMANCE SPECIFICATION

The following Table provides a list of ATA, ARPA and AIS features and a description of each.

FEATURES	ATA DESCRIPTION	ARPA DESCRIPTION	AIS DESCRIPTION
TRACKING MODE (ATA/ARPA)/	Relative Motion	Relative Motion	True Motion
GROUND REFERENCE	NOT APPLICABLE	Ownship SOG, COG data plus a number of fixed (reference) targets - average of which gives the Set and Drift.	Ownship, SOG, COG
VECTOR FACILITIES	Vector Mode: Target vectors displayed in Relative when True Motion selected and vice versa. Vector Length: 1-30 mins.	As ATA	As ATA
LOST TARGETS	Lost Target (searching) Warning given for targets not seen for 8 consecutive scans. After searching (last known course (CRSE) & speed) for 12 further scans Lost Target alarm given. Lost Target alarms only issued for targets: - within 3nm radius of Ownship. - with positive TCPA. - within the forward 90 degree sector, relative to ownship Lost Target alarm: 5 seconds. Visual alarm Audible alarm (optional) Indicate the last position in which the target was searched for.	As ATA	Lost Target (searching) Warning given for targets not seen for a specified time. Lost Target alarms only issued for targets: - that are dangerous Lost Target alarm: 5 seconds. Visual alarm Audible alarm (optional) Indicate the last position in which the target was searched for.
TRACKING WINDOWS	Placement resolution & data extraction resolution equal and dependent on maximum tracking range required. Maximum Resolution: 5 yards. Window Size : Variable & dependent on target status.	As ATA	NOT APPLICABLE
TRACKING ACCURACY	Within 2 degrees. Within ± degrees for 1 minute after a manoeuvre is completed. Turn Trend indication, dependent on speed of target & antenna rotation rate.	As ATA	AIS data resolution is to 1/10,000th of a minute. However, this may be reduced by the quality of GPS resolution at target or ownship.
TARGET DATA	Auto and Manual target data transmission for selected/all targets of interest.	As ATA	NONE
ACQUISITION OPTIONS (ATA/ARPA) ACTIVATION OPTIONS (AIS)	Manual acquisition of targets.	Manual acquisition of targets. Automatic acquisition in a radial defined area or FAZ.	Manual activation of targets. Auto activation in a radial defined area or FAZ.

FEATURES	ATA DESCRIPTION	ARPA DESCRIPTION	AIS DESCRIPTION
ACQUISITION RANGE (ATA/ARPA) ACTIVATION RANGE (AIS)	0.1 to 40 Nautical miles.	0.1 to 80 Nautical miles.	 0.1 to 99 nautical miles.
ACQUISITION SPEED	Vector for normally acquired target displayed after 11 scans.	As ATA.	Dependent on transmission rate from vessel (2 s up to 3 minutes)
TRACKING CAPACITY	Autotracking: up to 20 targets.	Autotracking: up to 50 targets.	Autotracking: up to 50 targets (adjustable).
TRACKING RESOLUTION	12 bit azimuth resolution (4096) Maximum 5 yards resolution	As ATA.	As ATA.
TARGET SWAP	Enhanced rejection of target swap.	As ATA.	NOT APPLICABLE
TARGET SPEED	Normal target's track, relative speed = 150knots maximum.	As ATA.	NOT APPLICABLE
OWNSHIP SPEED	99.9knots maximum.	As ATA.	As ATA.
OWNSHIP RATE OF TURN	20 degrees per second maximum.	As ATA	NOT APPLICABLE
TARGETS ON A BEARING	Up to maximum No. of targets tracks allowed.	As ATA	NOT APPLICABLE
TARGET HISTORY (ATA) PAST POSITION (ARPA)	Variable (can be scaled for range selected) 12 minutes. Four 3 minute history positions.	 Variable up to 2 minutes in 30 second intervals for each target tracked. A maximum of four past positions are available for each target.	NOT APPLICABLE
TARGET FADING	Up to 20 consecutive scans. Time dependent on scanner rate.	As ATA.	NOT APPLICABLE
RADAR AERIAL RATE	Up to 60rpm	As ATA.	NOT APPLICABLE
RADAR SIGNAL	From digitized video (set by operator for GAIN, RAIN, SEA CLUTTER)	As ATA.	NOT APPLICABLE
TARGET CORRELATION	Correlation by target identification and predicted position.	As ATA.	NOT APPLICABLE
TRIAL MANOEUVRE	NOT APPLICABLE	Ownship's manoeuvre simulation in speed, course (CRSE) and time delay.	Ownship manoeuvre simulation speed course (CRSE) and time delay
SIMULATION(S)	Single-scenario - ATA generated targets to test and demonstrate tracking ability.	Multi-scenario - ARPA generated targets to test and demonstrate acquisition and tracking ability.	NOT APPLICABLE
TEST DIAGNOSTICS	Computer self-test watchdog monitors system and indicates any failures. Test programs available to operate (requires an external PC to be connected).	As ATA.	NONE

CHAPTER 3

INTERPRETING THE PPI DISPLAY & SART OPERATION

INTRODUCTION

1 This Chapter contains information on interpreting the PPI display and operation of the SART (Search and Rescue Transponder).

INTERPRETING PPI PRESENTATION

2 If the operator is to have confidence in using the radar equipment, knowledge of interpretation of the PPI presentations is required to gain the best use of the display information.

3 Factors influencing the parameters on the display, in conjunction with variable atmospheric and natural conditions that may have an adverse effect on the overall performance of the radar equipment, are described in this chapter.

NOTE:

Reference publications on the use of Radar at Sea are available from the Royal Institute of Navigation.

PPI DISPLAY

4 The PPI picture displays signals sourced from the radar sensor (transmitter/receiver/aerial system). The PPI display uses a raster scan screen, therefore the picture has to be scan converted from polar form (i.e. rotating trace - the form produced by the transmitter/receiver/aerial system) into X and Y co-ordinates for display.

5 Range and bearing data of the echoes displayed are then used as the basis for the various calculations and data readouts.

6 The modes of operation and use of operator controls are described in Chapter 1.

FACTORS THAT AFFECT PPI PRESENTATION

Antenna Height, Range and Bearing Discrimination

7 The height of the Antenna above the waterline affects the maximum and minimum range performance of the equipment. The ability to discriminate between objects that are very close together depends on the range and bearing discrimination performance. Range discrimination is mainly dependent on the Pulse Length in use. Bearing discrimination is a factor of the size of target and Antenna parameters.

Blind Arcs

8 Where the path of the transmitted energy is interrupted by the superstructure, funnels, masts, etc., beam or energy scatter takes place. When the obstruction is narrow in relation to the transmission path, a sector of reduced sensitivity and increased beamwidth is formed behind the obstruction. For a large obstruction, such as a superstructure, a blind arc is formed in which there is no radar coverage, but in which false echoes may occur due to reflections from the obstruction.

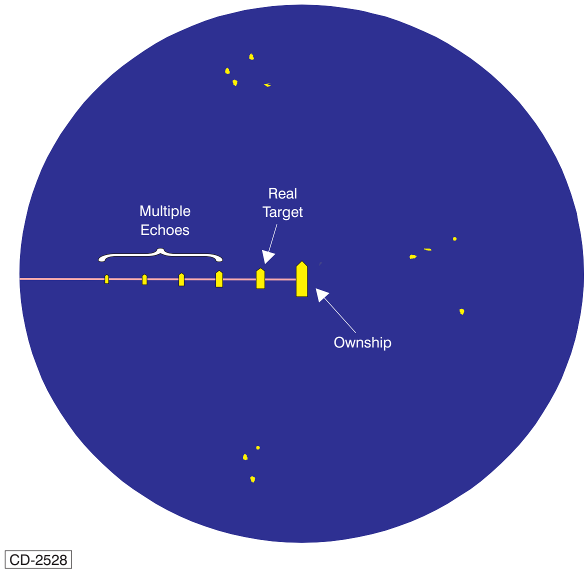
False Echoes

9 Any large obstruction may reflect energy, causing false echoes. The surface of the obstruction reflects a significant proportion of the transmitted energy at an angle creating a false echo on the display. Reflected signals from these objects reach the Antenna and paint on the display on the bearing at which the Antenna is pointing. The range of the false echo is the true distance (via the reflecting surface) of the object causing the false echo.

10 The operator must be acquainted with the bearings of obstructions from which false echoes may be obtained.

Multiple Echoes

11 Multiple echoes may be obtained when another ship or vessel is passing on a parallel course at close range. This effect occurs when return signals are sufficiently strong to be reflected backwards and forwards between the two vessels. Multiple echoes always occur on the same bearing as the true target and at exact multiples of the true target range. The echoes become weaker as the amount of energy reflected diminishes with each return. A simplified example of how multiple returns may appear on the display is shown below.



Spurious Echoes

12 In built up areas and in narrow congested waters, transmitted energy may be reflected along a number of paths producing confusing spurious echo patterns on the display. Spurious echoes may not always appear in the same location and may not correlate.

NOTE:

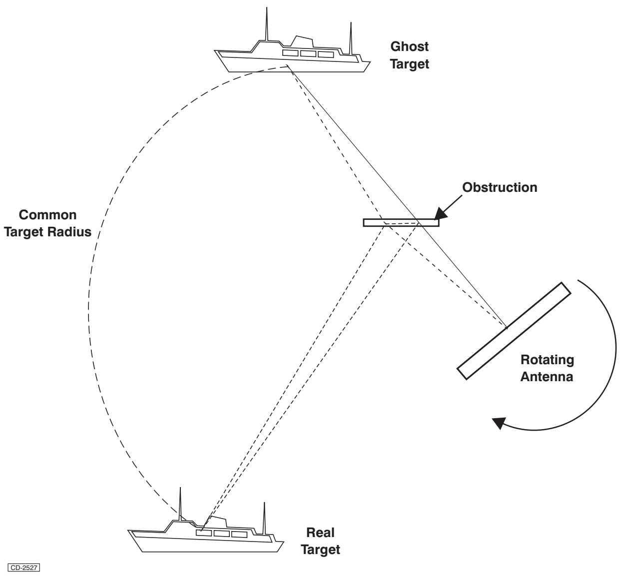
Adjustment of the GAIN control helps to minimise these spurious echoes.

Ghost Echoes

13 In a similar manner to false echoes, the proportion of transmitted energy reflected off obstructions may be directed towards a real target causing a **ghost echo** of the real target to appear on the bearing at which the antenna is pointing. The ghost echo will appear to be a real target and behave in the same way. However, because the antenna is not directed at the real target the returns from the ghost target will be weaker than those of the real target. The range of the ghost echo is the true distance of the real target.

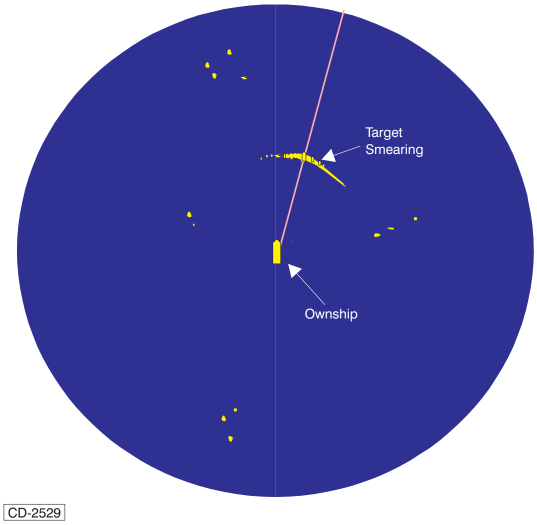
NOTE:

The suspected Ghost target echo will appear on the display at the same radius as the real target (see below). The VRM facility can be used to confirm this. However, there is no real way of determining whether the indicated target is a ghost or a real target.



14 Other types of ghosting include echoes of groups of targets (which appear to be real). When in the vicinity of land masses, these may be from large inland objects and may be caused by a combination of atmospheric conditions, unusual propagation conditions and reflection.

15 Where obstructions occur in close proximity to the antenna, the radar beam can be dispersed causing target smearing to occur. This is indicated by a number of weaker echoes appearing around a stronger target echo on the display. When the antenna points directly at the target the returns are at their strongest and these form the thickest part of the arc shaped pattern on the display (see below).



Radar Interference

16 Other radar equipment using the same frequency, on the same vessel or other vessels, may interfere with the PPI presentation. Such interference produces a spiral pattern emanating from the centre of the radar picture. Careful positioning of the Antenna arrangement helps to minimise interference from these radars. Cross pulse blanking and the use of interference rejector circuits, when selected, remove the spiral patterns from the display.

Atmospheric Conditions

17 The propagation of radar signals in acute atmospheric conditions may have an adverse effect on the PPI display. A transmitted beam of energy normally travels in a straight 'line of sight' path but certain conditions may contribute to the beam bending upwards or downwards.

18 The effect of this condition (known as anomalous propagation) is that when the beam is 'bent' upwards, distant targets appear below the beam and consequently the maximum detection range of the equipment is impaired.

19 When the transmitted beam is 'bent' downwards, the beam tends to follow the earth's surface and improves maximum range performance, with the detection of targets over the horizon.

20 Under specific atmospheric conditions the beam may be 'bent' to reflect from the earth's surface to the upper atmosphere where, due to the presence of a layer of dense air, the beam is reflected back to earth. This condition, known as 'ducting', may happen several times and echoes may be obtained over great distances. However, these echoes may return several transmissions later and are displayed as false ranges on the display.

21 Severe atmospheric conditions, such as thunderstorms or acute static build up during pre-storm situations, also have the affect of distorting the PPI presentation due to the contorting effect of the electrical disturbances in the atmosphere.

Sea Clutter

22 In adverse weather conditions considerable echo return may be obtained from the sea. Under these circumstances the sea clutter return may be greater than the reflections from buoys and other small targets and thus prejudice the detection of these echoes. The use of GAIN, SEA Anti-clutter and CORRELATOR functions to combat these varying conditions is described in Chapter 1.

23 High sea swell tends to produce random echoes and clutter on the display. Clutter returns from seas breaking on shoals and sand banks may help to show the position of these hazards.

Rain Clutter

24 This condition differs from sea clutter, as falling rain produces a continuous return, blanketing whole areas of the display. The use of RAIN Anti-clutter is described in Chapter 1.

NOTE:

S band (10cm) radar systems are generally less effected than X band (3cm) radar systems in heavy rain conditions.

25 The plotting of rain storms and torrential rain conditions may be easily determined due to the continual movement of the weather over an area.

Hail, Snow and Ice

26 Hail and snow produce effects similar to that of rain clutter. Dense snow has a greater effect than that of light flurries which, owing to the small reflecting surface, have minimal effect.

27 The echoes obtained from ice depend on the form and shape that the ice presents. The generalisation of the effects produced by various ice floes are as follows:

(1) Smooth Flat Ice: Most of the radar energy is reflected at the angle of incidence, providing little or no return signal. Sometimes an advantage is gained by setting up the controls to obtain sea clutter right up to the edge of the ice. Patches of water in a smooth ice field are often revealed by clutter return if sufficient wind disturbs the surface of the water.

(2) Pack Ice: Strong multiple echoes are obtained from pack ice, producing a pattern on the display not unlike excessive sea clutter. The ice left in the wake of a vessel passing through an ice field may be distinguished clearly on the display.

(3) Ice Walls: These objects give strong return echoes depending on the angle that the walls are to the sea surface to scatter the reflected energy.

(4) Icebergs: As the angle of iceberg faces is rarely normal to the surface of the sea, much of the reflected energy from the transmitted pulse does not reach the receiver aerial, giving a poor signal return. Also the surrounding dense air produces a higher than usual atmospheric attenuation.

(5) Growlers: The detection of growlers by radar is uncertain due to the small surface area above water and the mass that is submerged.

Fog

28 Although echoes may be obtained from rain bearing clouds, due to the clouds' density, fog does not greatly affect the radar return signals. A slight reduction in maximum detection range due to fog may be experienced. Mist makes little or no difference to the radar display.

Sea and Swell

29 The rolling and pitching of a vessel in adverse sea conditions causes the beam to swing about in azimuth. In severe conditions this may cause intermittent echoes on the display. Also, if the roll or pitch angle is much greater than the vertical beamwidth of the aerial, the detection probability is lowered.

THE RADAR PICTURE

Open Sea

30 At sea, out of sight of land, interpreting the PPI presents little difficulty. Echoes on the display depend on the size, range, shape and aspect of the targets. Wake echoes may sometimes be seen, particularly where a vessel is turning at high speed.

Land Echoes

31 Echo paints of a coastline require careful examination and translation since the presence or absence of return signals depend on parameters such as height, slope, composition, aspect and distance of the feature. When a radar beam strikes a high reflecting surface, including cliffs and large buildings at close range, a sharp echo with a blank area behind is presented on the display. Coastlines with flat areas return echoes depicting every small reflecting surface that the radar beam strikes for several miles inland. The variation of tide may also affect the presentation owing to the height at which the Antenna is relative to that of the coastlines.

32 At low tide the PPI presentation shows less of an area of coastline due to the reflected echo from cliffs or sand dunes etc. High tide gives the radar the ability to slightly 'look over' low lying objects.

RADAR REFLECTORS AND BEACONS

33 Reflectors are designed to give maximum return from radar transmissions and can be fitted to buoys to aid navigation, to sundry features such as dangerous outcrops of rocks, and to any hazard that would impair the navigation of a vessel. Small boats may also have reflectors fitted to increase the boat's detection range.

NOTE:

Some small buoys have a reduced cross-sectional area when healing over in high sea states.

34 Radar beacons produce a specific, coded signal response when the radar transmission interrogates the beacon. The reflected signal then gives a precise echo paint on the PPI presentation. This effect can be reduced when using a high Correlation level (RACONS are not normally affected by Correlator IR or SC/SC).

SEARCH AND RESCUE TRANSPONDER (SART)

35 The Search and Rescue Transponder (SART) is a 9GHz receiver/transmitter which provides a position indication by producing range and bearing information on any 9GHz radar screen (with no modification). The SART code displayed on the radar screen is a series of dots extending radially outwards from the location of the transponder. The series of dots represents a range of approximately 10 nautical miles. This indication is an internationally accepted signal for search and rescue operations. In addition, the SART gives confidence to survivors by giving a loud audible signal and/or visual indication of the approach of assistance.

OPERATION OF MARINE RADAR FOR SART DETECTION

Radar Range Scale

36 To look for a SART signal, select a range scale of 6 or 12 nautical miles. The spacing between the SART responses is about 0.6 nautical miles (1125 metres) and a number of returns are required to distinguish the SART from other responses.

SART Range Errors

37 Inherent delays occur in the SART responses due to the in-built trigger delay. Also SART may have to sweep through the whole radar band before reaching the frequency of the search radar. At medium ranges of about 6 nautical miles the range delay may be between about 150 metres and 0.6 nautical mile beyond the SART position.

38 As the SART is approached, the radar detects the initial fast sweep of the SART and double dots are displayed. The range delay of the first dot is no more than 150 metres beyond the SART position.

Radar Bandwidth

39 This is matched to the radar pulse length and is switched with the range scale and the associated pulse length. Narrow bandwidths of 3 - 5 MHz are used with long pulses on long range and wide bandwidths of 10 - 25 MHz with short pulses on short ranges.

40 Any radar bandwidth of less than 5 MHz attenuates the SART signal slightly, so a medium bandwidth is normally selected to ensure optimum detection of the SART. Operating Instructions are to be consulted about the particular radar parameters and bandwidth selections.

Radar Side Lobes

41 As the SART is approached side lobes from the radar antenna may show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the anti-clutter sea control. Operationally, observation of the side lobes can be used to confirm that the SART is near to the ship.

Detuning The Radar

42 To increase the visibility of the SART in clutter conditions, the radar can be detuned to reduce the clutter without reducing the SART response. Radar with automatic frequency control may not permit manual detuning of the equipment. Care is to be taken when operating the radar while detuned, as other wanted navigational and anti-collision information may be removed. The radar tuning must be returned to normal operation as soon as possible. (Refer to Chapter 1, for information on Tuning and Detuning of the radar).

Gain

43 For maximum range SART detection the normal maximum gain is to be used.

Anti-clutter Sea Control

44 For optimum range SART detection, this control is to be set to the minimum. Care must be exercised as targets in sea clutter may be obscured.

45 Automatic/manual anti-clutter sea control facilities are to be switched to manual.

Anti-clutter Rain Control

46 Rain control must not be used when trying to detect SARTs, as the SART responses may be removed.

SART OPERATION USING NUCLEUS 3 DISPLAY

47 In operation, the SART responds automatically using a 9.2GHz to 9.5GHz high-speed frequency sweeping signal with a pulse emission period of 100 s which is synchronous with any received scanning pulse. The SART response signal scans all frequencies in the 9GHz radar band (refer to Figure 1).

48 To select the SART code only on the radar screen, refer to Chapter 1 - “To Detune, To Display SART Responses Only”. This off-centred tuning erases all normal radar images caused by echoes with the same frequency as the radar transmission. However, the SART code is not erased because the SART response signal scans all frequencies in the 9GHz band.

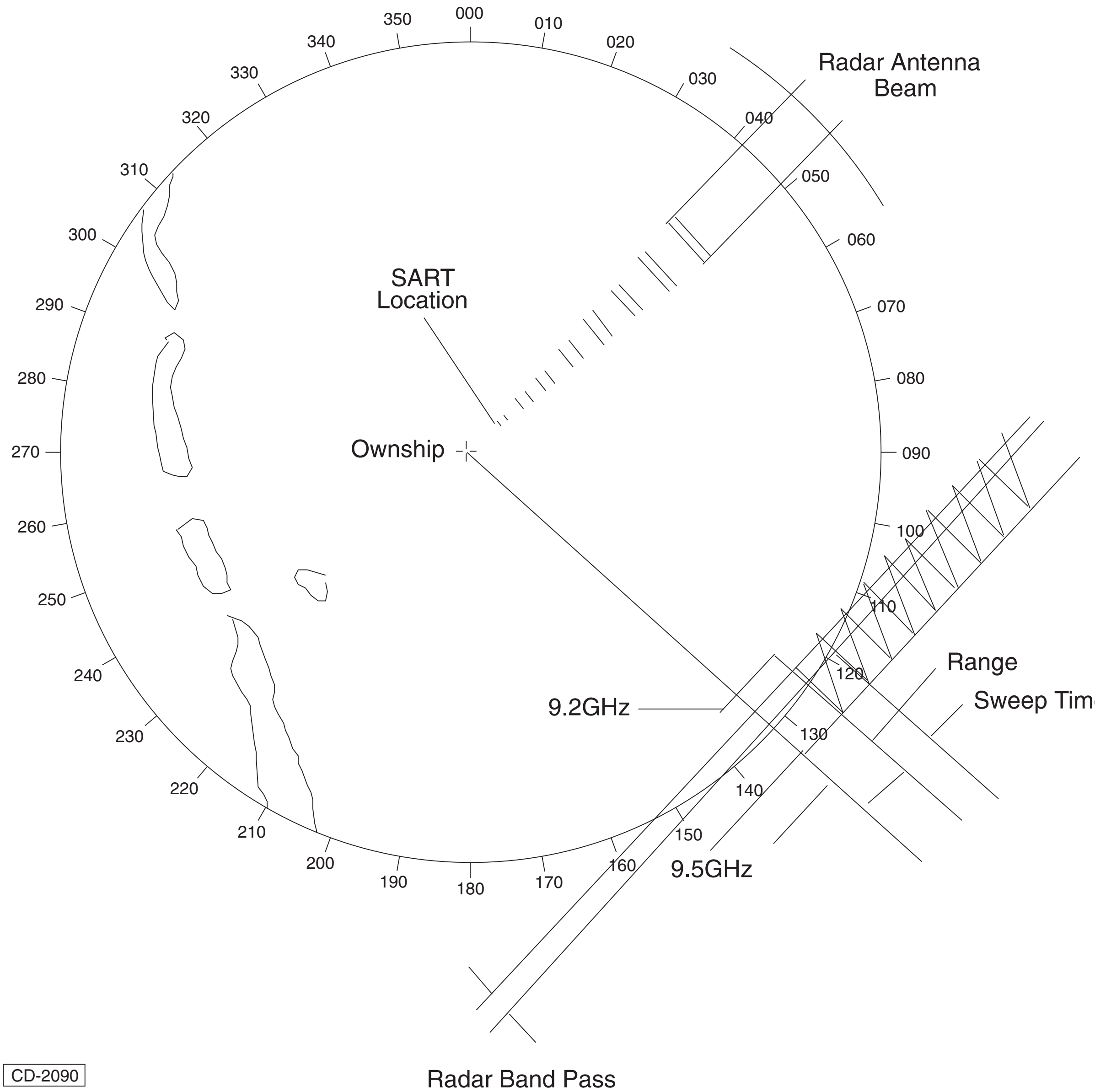


Figure 1 - SART Signal on Display

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CHAPTER 4A

INSTALLATION & INTERCONNECTIONS - DISPLAYS

INTRODUCTION

1 This Chapter provides information on installation of the system equipment. The overall chapter comprises a number of sections, each section covering the installation of the different equipment types that comprise the overall system.

2 Three types of Nucleus 3 displays are available, these are:

(1) Nucleus 5000

(2) Nucleus 6000

(3) Nucleus 7000

3 This section covers Installation of the Nucleus 5000 and 6000 series Displays. Refer to Chapter 8c for information on the Installation of Nucleus 7000 Displays.

4 The Nucleus 3 5000 display is a desk mounted console. The Nucleus 3 6000 display can be provided as either a Pedestal Display Console (with integral processor located in the lower half of the console), for deck mounting, or as a Split Display Desk Console, with the processor installed in a separate Processor Unit.

5 The Display systems comprise the following assemblies:

(1) Processor - containing Input/Output PCB, System PCB and Power Supply Unit.

(2) Monitor - containing Input PCB, Deflection PCB, Power Supply, Tube Base Board and Monitor CRT.

(3) Keyboard - containing Trackerball and Pushbutton PCB.

PRE-INSTALLATION REQUIREMENTS

6 Prior to installation of the Display System, implement the following:

(1) Ensure that there is adequate clearance for the Operator's position in front of the desk or pedestal display unit and at the rear of the unit to allow fitting of the power and other system cables.

(2) Lay in the ships cables to the required installation position.

NOTE:

Cables may enter the Nucleus 3 6000 Pedestal at either the rear or bottom of the unit.

INSTALLATION INSTRUCTIONS

NUCLEUS 5000 DISPLAY

Desk Top Display

7 Install the desk top display according to the instructions provided on the Installation Diagram (Figure 1a).

Cable Connections

8 Refer to the appropriate Connections Diagrams (see Table 4.1a for details) and ensure that all connections are correctly made.

NUCLEUS 6000 DISPLAY

Pedestal Display

9 Install the Pedestal Display according to the instructions given on the Installation Diagram (Figure 3a)

Split Display

10 Install the Split Display according to the instructions given on the Installation Diagram (Figure 4a).

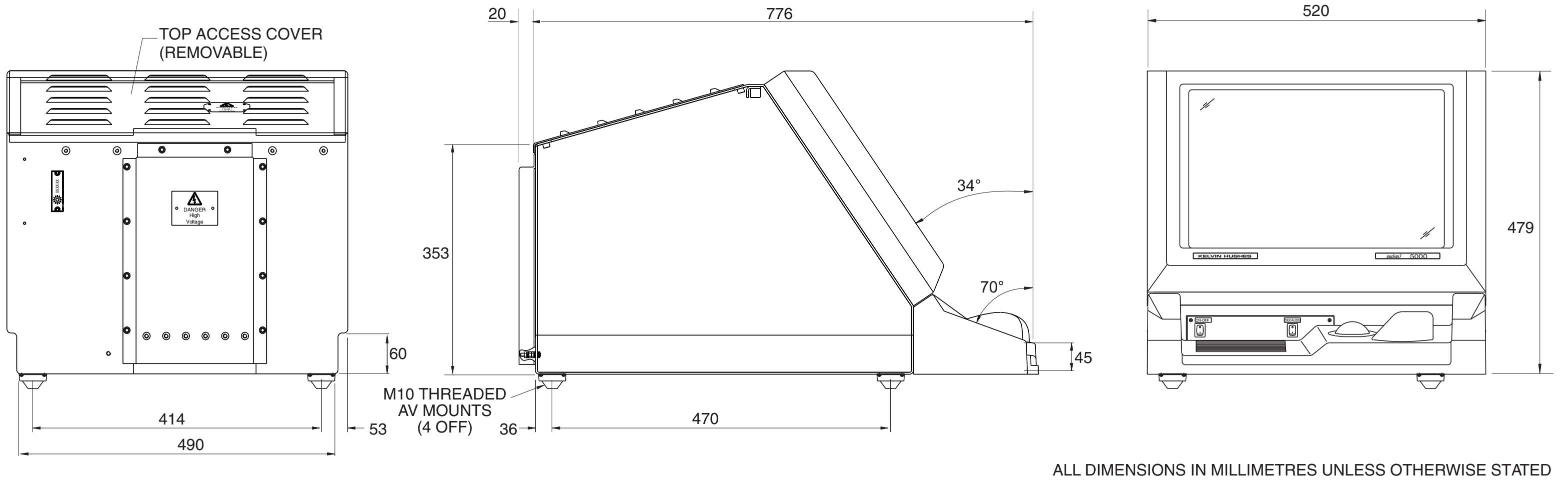
Cable Connections

11 Refer to the appropriate Connections Diagrams (see Table 4.1a for details) and ensure that all connections are correctly made.

12 The diagrams listed in Table 4.1a below, provide installation information for the Nucleus Displays:

Table 4.1a

Figure	Description
1a	Nucleus 3 5000 Display Installation Diagram (including: assembly, compass safe distances and unit weights).
2a	Nucleus 3 5000 Display Internal Connections.
3a	Nucleus 3 6000 Display (Pedestal) Installation Diagram (including: assembly, compass safe distances and unit weights).
4a	Nucleus 3 6000 Split Display Installation Diagram (including: assembly, compass safe distances and unit weights).
5a	Nucleus 3 6000 Display Internal Connections.
6a	Nucleus 3 Display to RIU to Transmitter (MkIV - Upmast) Interconnections.
7a	Nucleus 3 Display to RIU to Transmitter (MkV) Interconnections.
8a	Nucleus 3 Display to RIU to Transmitter (MkVII - S-Band) Interconnections.
9a	Nucleus 3 Display to RIU to Transmitter (MkVII - X-Band, Low Speed) Interconnections.
10a	Nucleus 3 Display to RIU to Transmitter (MkVII - X-Band, High Speed) Interconnections.
11a	Nucleus 3 Display To RIU to Soft Start Unit to Transmitter (MkVI - Upmast) Interconnections
12a	Nucleus 3 Display To Dual Interswitch Unit to Transmitter (MkVII -S-Band) Interconnections
13a	Nucleus 3 Display To Dual Interswitch Unit to Transmitters (MkVI & MkIV - Upmast) Interconnections
14a	Nucleus 3 Display To Dual Interswitch Unit to Soft Start Unit to Transmitter (MkVI - Upmast) Interconnections
15a	Nucleus 3 Display To Dual Interswitch Unit to Transmitter (MkVII - X-Band , Low Speed) Interconnections.
16a	Nucleus 3 Display To Dual Interswitch Unit to Transmitter (MkVII - X-Band, High Speed) Interconnections.
17a	Nucleus 3 Displays: Mains and Power Distribution.



NUCLEUS 3 5000 - OVERALL DIMENSIONS

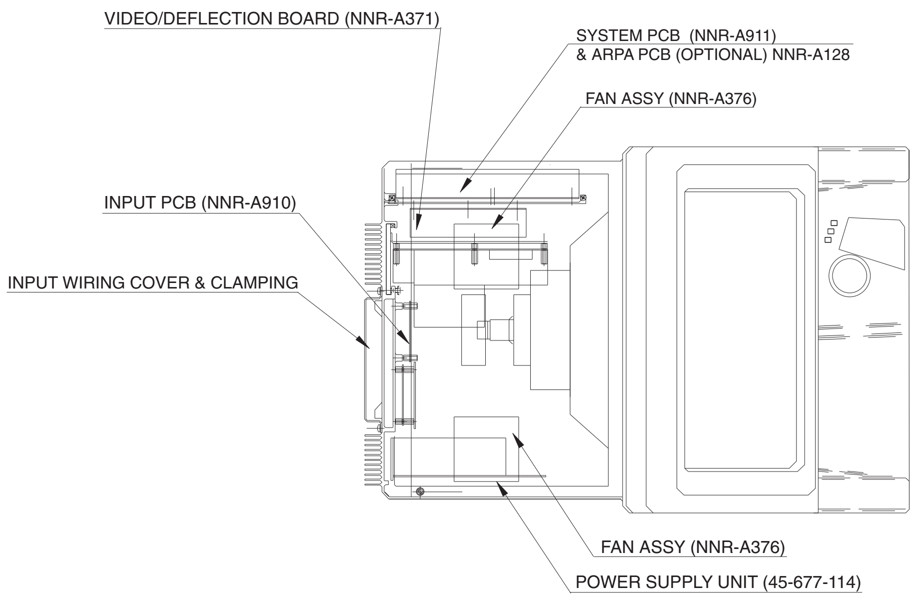
TO INSTALL NUCLEUS 3 5000 DISPLAY

1. Mark out the position of the 5000 Display Console, leaving sufficient clearance for the Operator, for ventilation & cable access.
2. Drill the required holes.
3. Feed the ship's cables (power, signal, compass & log) through the rear of the console.
4. Locate the console into position and secure with bolts as required.
5. Ensure that the console is correctly earthed to the ship's earth.
6. Connect the cables as shown on the appropriate Connections diagrams.

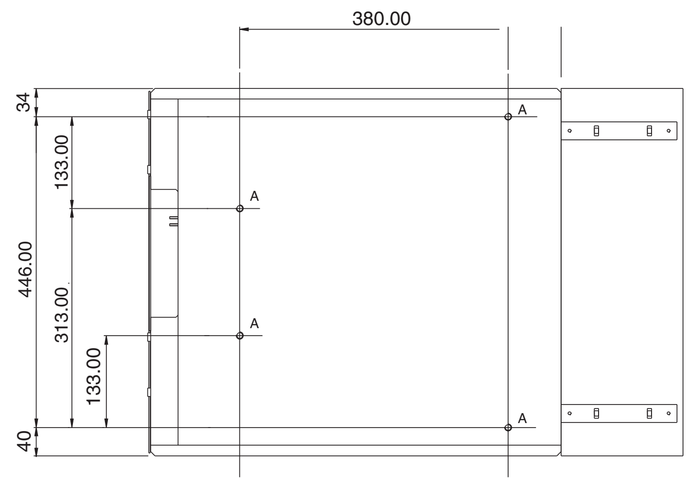
Display Console Weight: 41kg

COMPASS SAFE DISTANCES

	Grade 1 1/4°	Grade 2 & 3 1°	Grade 4 2°
ARPA TRUE RELATIVE ATA	1.4	0.7	0.5



TOP VIEW WITH ACCESS COVER REMOVED



DIMENSIONS FOR MOUNTING

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Figure 1a - Nucleus 5000 Display Installation Diagram

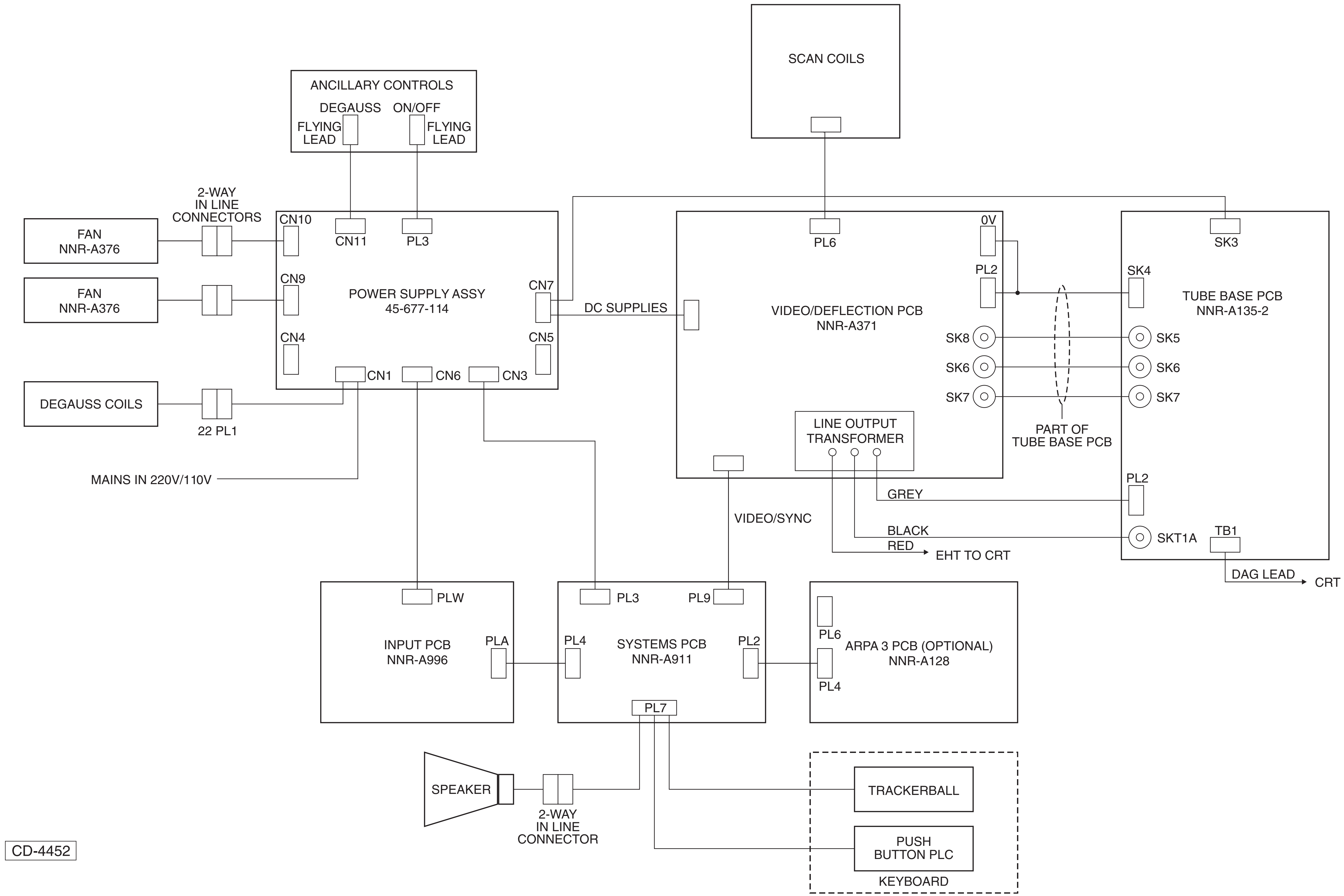
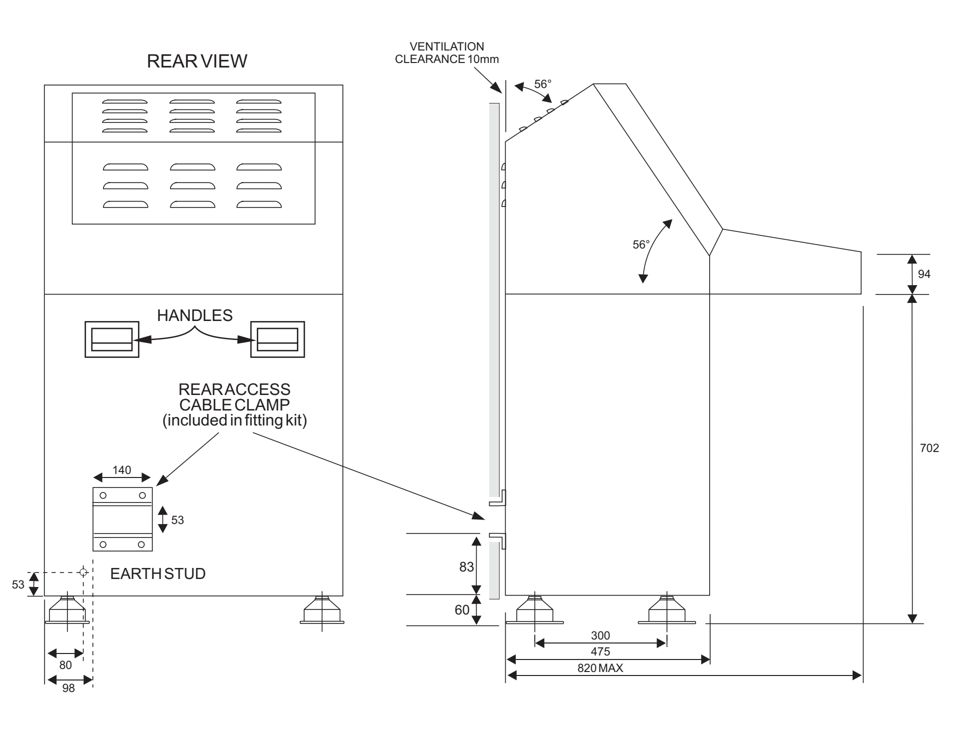


Figure 2a - Nucleus 3 5000 Display: Internal Connections



NUCLEUS 3 6000 - OVERALL DIMENSIONS

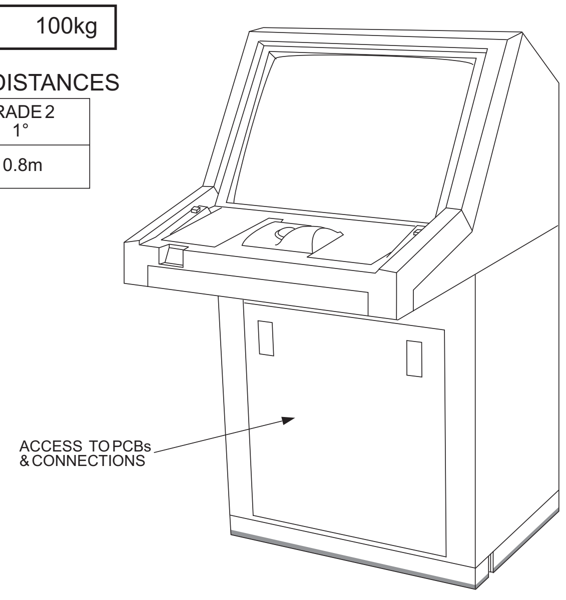
TO INSTALL THE NUCLEUS 3 6000 WORKSTATION

1. Mark out the position of the pedestal, leaving sufficient clearance for the operator, for ventilation, and for cable access.
2. Drill the required bolt holes for the Anti-vibration mounts.
3. Feed the ship's cables (power, signal, compass and log etc) through the rear or base of the pedestal.
4. Locate the pedestal into it's designated position and secure the Anti-vibration mounts in position.
5. Fit the skirts to the base of the pedestal, by fastening the "snap in" plastic rivets, through the holes in the skirt bracket, to underside of the pedestal base.
6. Ensure that the pedestal is correctly earthed to the ship's earth.
7. Connect the cables as shown on the appropriate Connections diagrams.

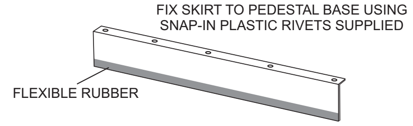
Display Weight: 100kg

COMPASS SAFE DISTANCES

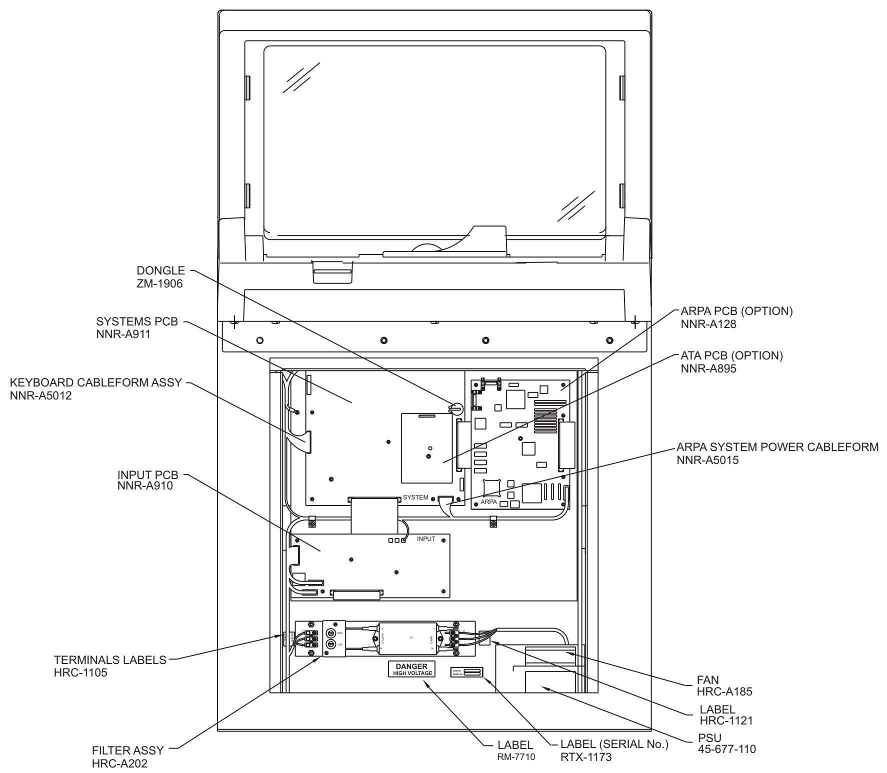
GRADE 1 1/4°	GRADE 2 1°
2.0m	0.8m



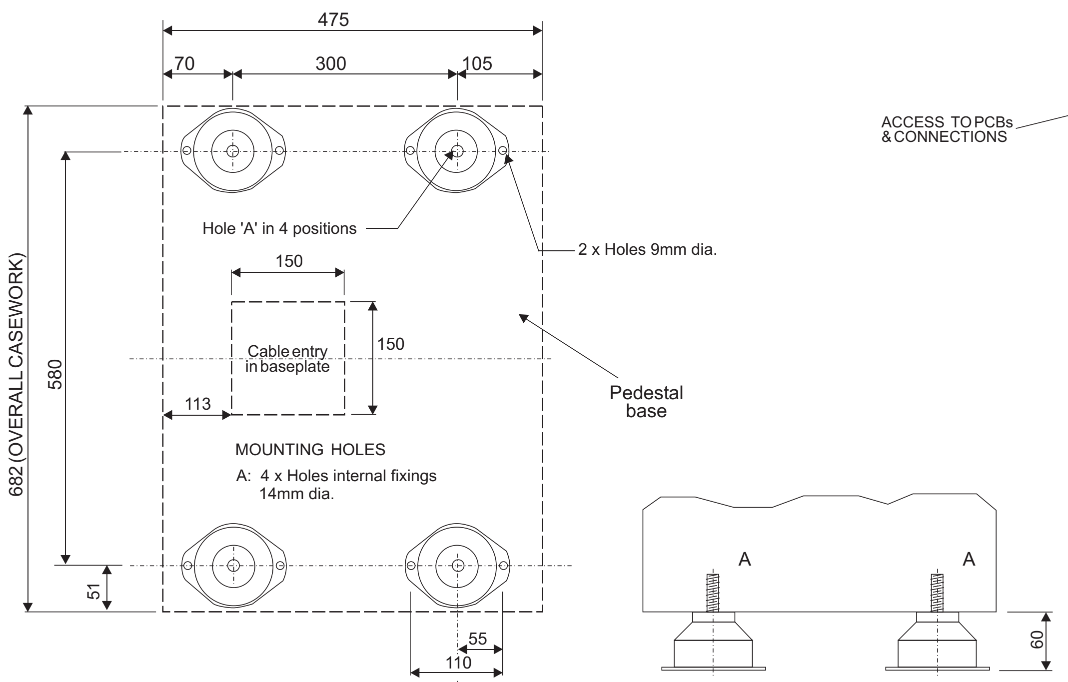
VIEW WITH SKIRTS FITTED



SKIRT (NNR-A5076) DETAIL



VIEW WITH OUTER DOOR REMOVED
(PCB & CONNECTOR LOCATIONS)



NOTE: ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

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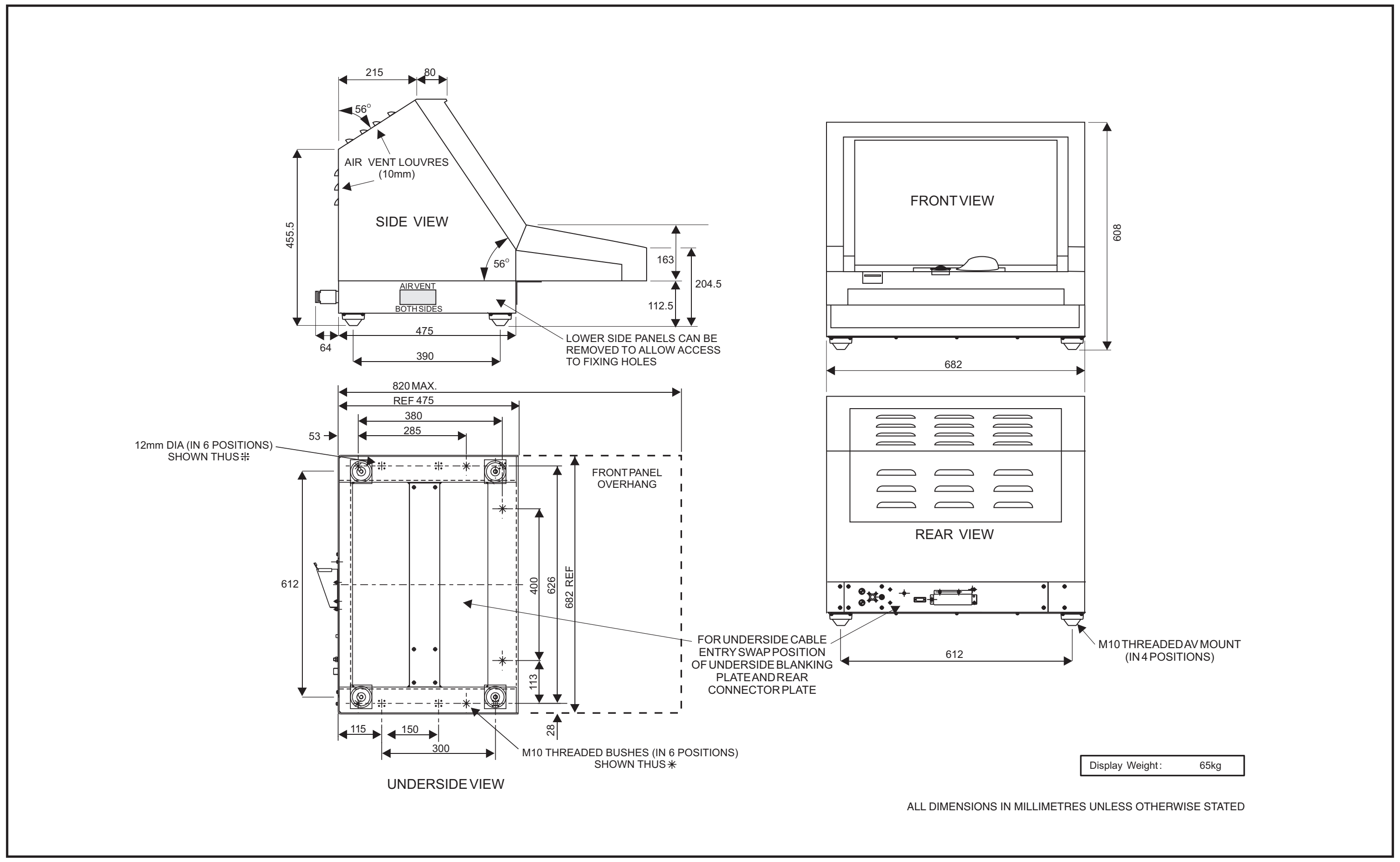
Figure 3a - Nucleus 6000 Display (Pedestal): Installation Diagram



TO INSTALL THE NUCLEUS 6000A SPLIT DISPLAY

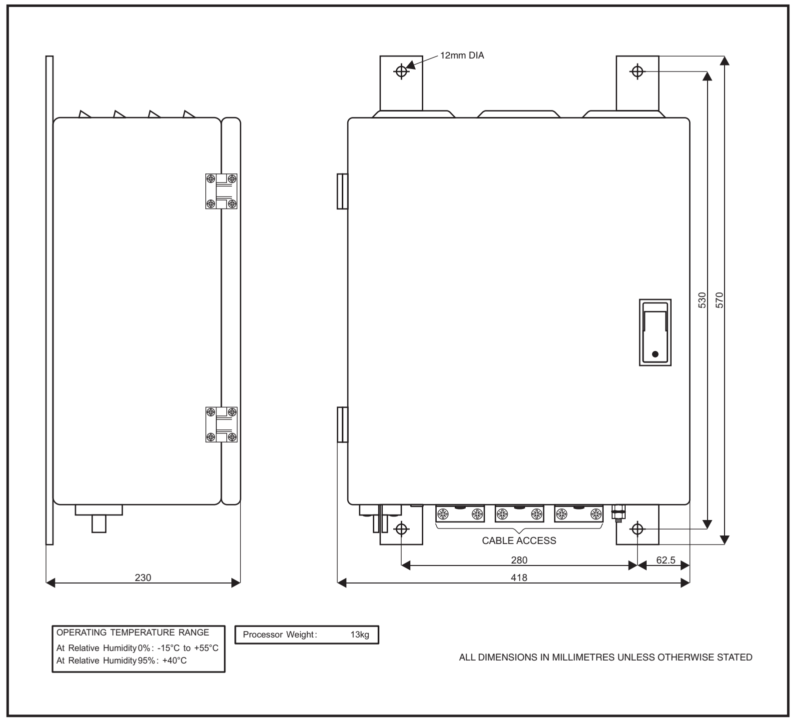
A) DISPLAY UNIT

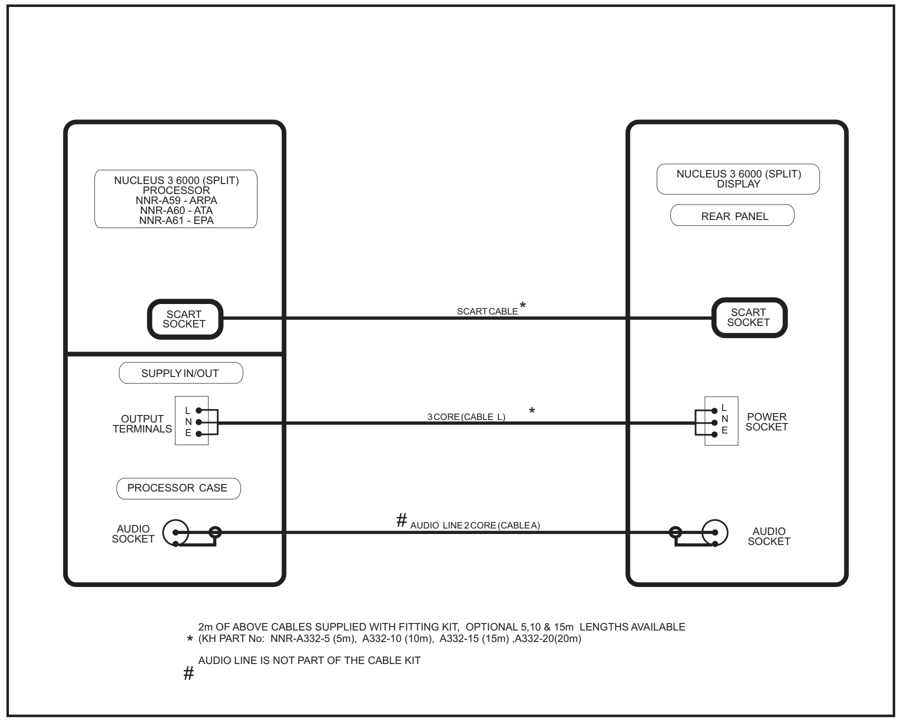
1. Refer to the dimensioned drawing opposite for hole locations. There is the option to either have Cable Connections to the rear of the unit or underneath (if underneath, cut out the hole as shown, swap the Connecting Plate and Blanking Plate over).
2. Fasten the Display Unit to the required location, using the fixings and anti-vibration mounts supplied.

B) PROCESSOR UNIT

NOTE: A 2m Cable Kit is supplied as standard with optional 5, 10, 15 & 20m kits also available.

1. Mark out the position of the Processor Unit, leaving sufficient clearance for ventilation, cable access and servicing; drill the bolt positions as shown in the diagram.
2. Secure the Processor Unit in position.
3. Feed the ship's cables through the base of the unit and make the connections as detailed on the appropriate Connections Diagram(s).
4. Ensure that the Processor Unit is directly earthed to the ship's earth, using the bolt provided.
5. See Monitor to Processor Connections Diagram





OPERATING TEMPERATURE RANGE
AT RELATIVE HUMIDITY 0%: -15°C TO +55°C
AT RELATIVE HUMIDITY 95%: +40°C

VIBRATION LEVELS
1 TO 12.5Hz WITH AN EXCURSION± 1.6mm
12.5 TO 25Hz WITH AN EXCURSION± 0.8mm
25 TO 50Hz WITH AN EXCURSION± 0.1mm

TO A CONSTANT MAXIMUM ACCELERATION OF 10m/s

POWER CONSUMPTION: 380VA

WEIGHTS
PROCESSOR UNIT: 13kg
DESK CONSOLE: 65kg

COMPASS SAFE DISTANCES

	GRADE 1 1/4°	GRADE 2 1°
DISPLAY	2.0m	0.8m
PROCESSOR	2.0m	0.8m

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Figure 4a - Nucleus 6000 Split Display: Installation Diagram

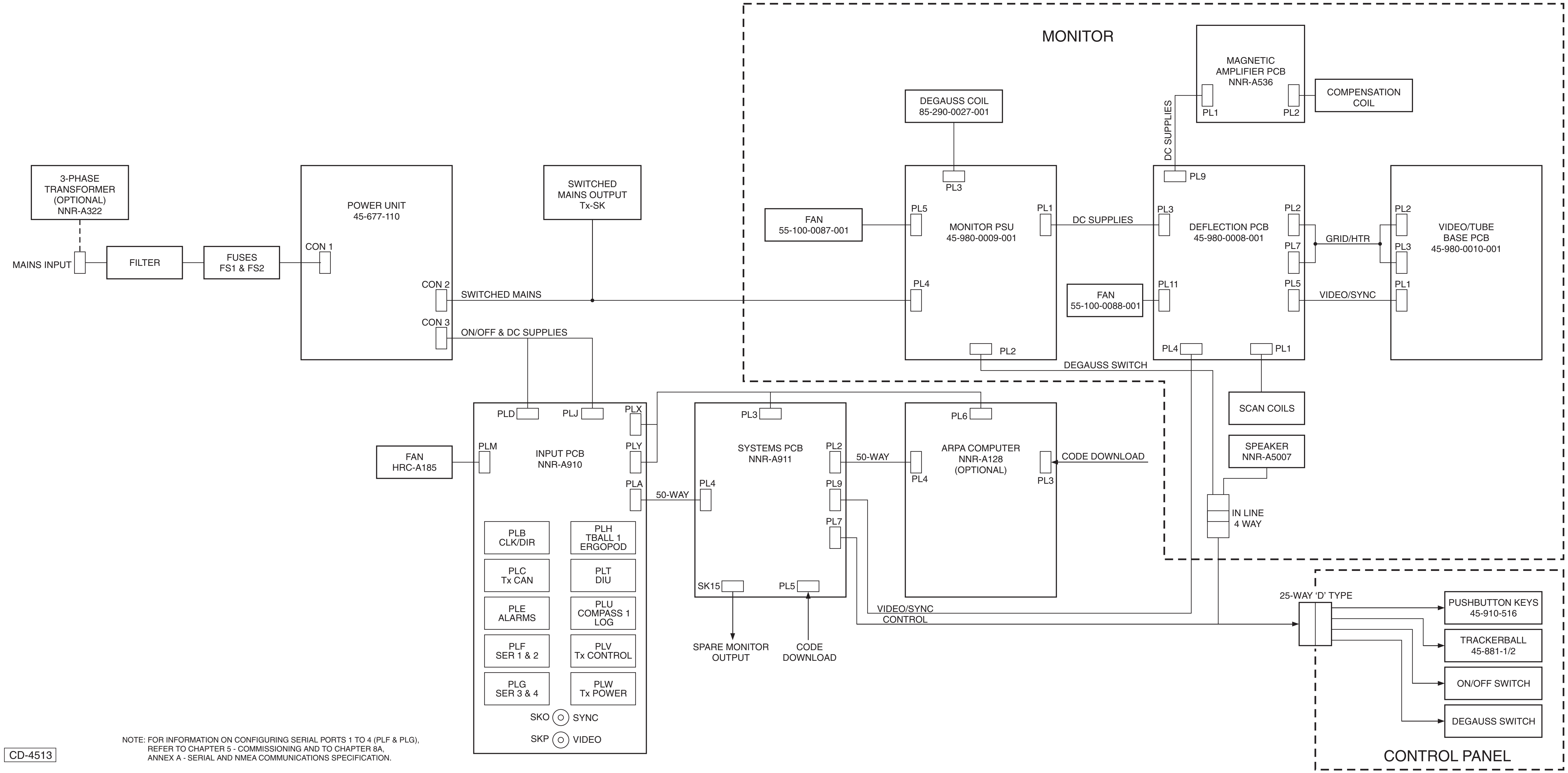


Figure 5a - Nucleus 3 6000 Display: Internal Connections

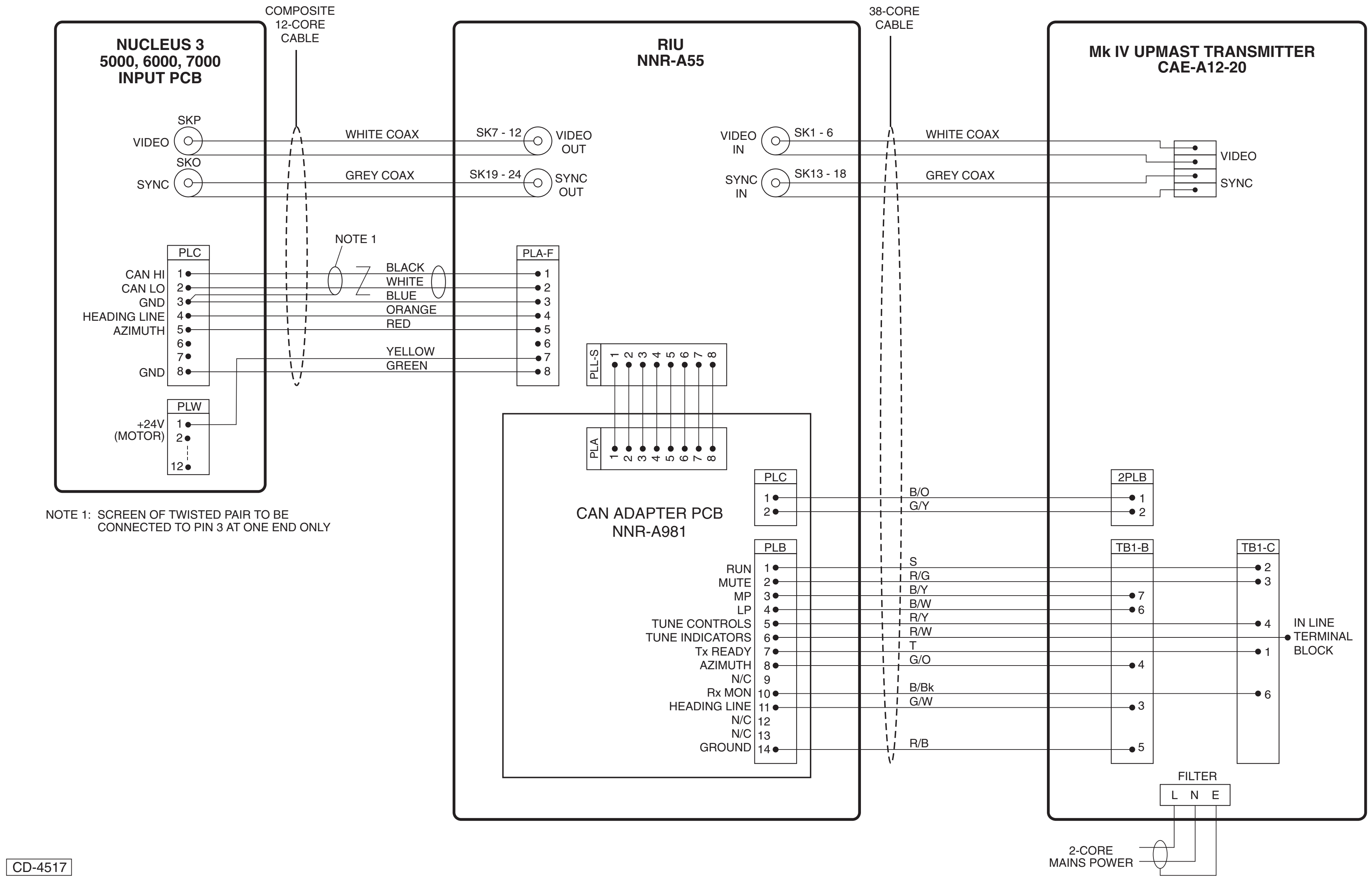


Figure 6a - Nucleus 3 Display to Transmitter (MkIV - Upmast) via RIU: Interconnections

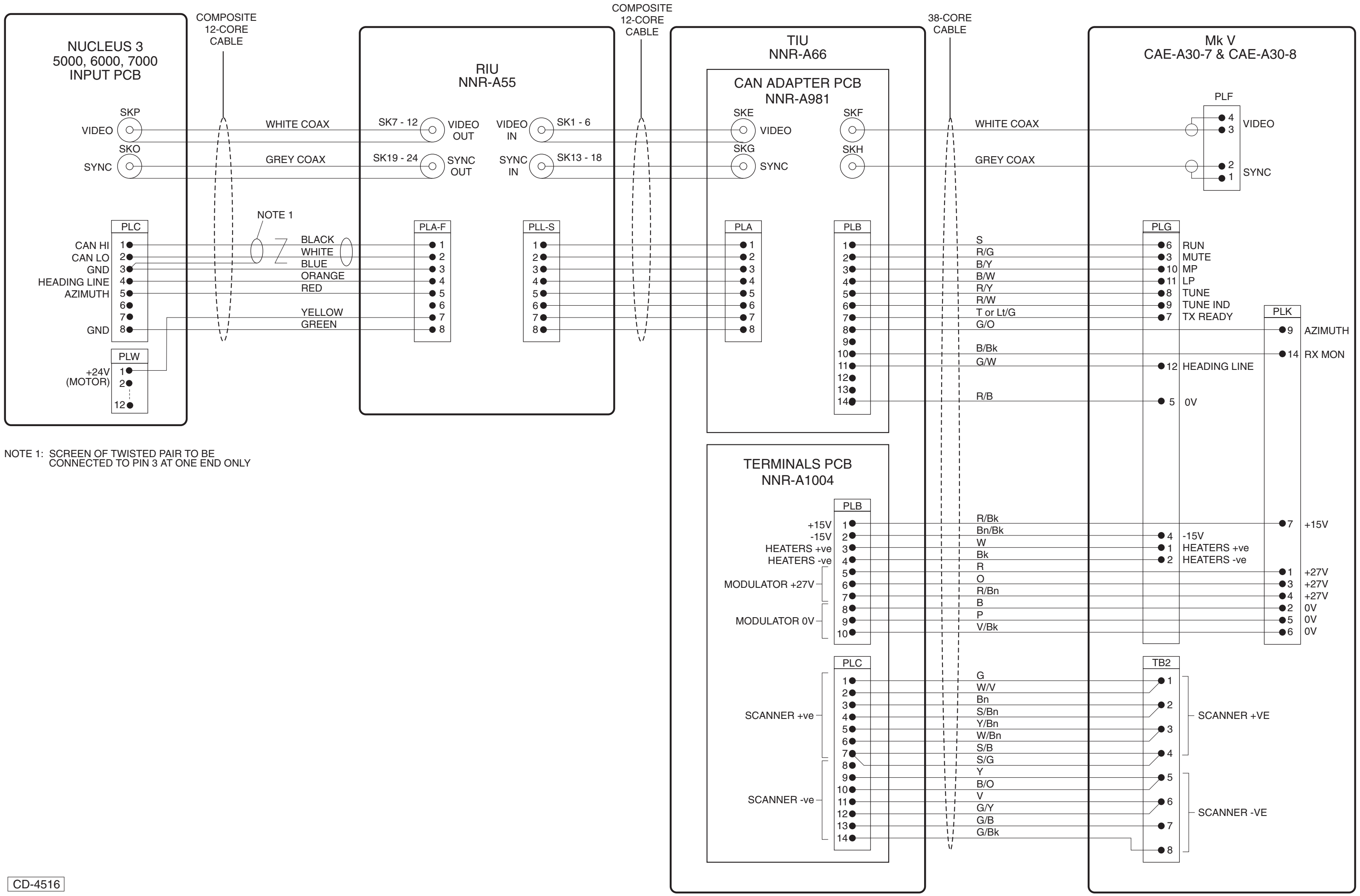


Figure 7a Nucleus 3 Display to Transmitter (Mk V) via RIU: Interconnections

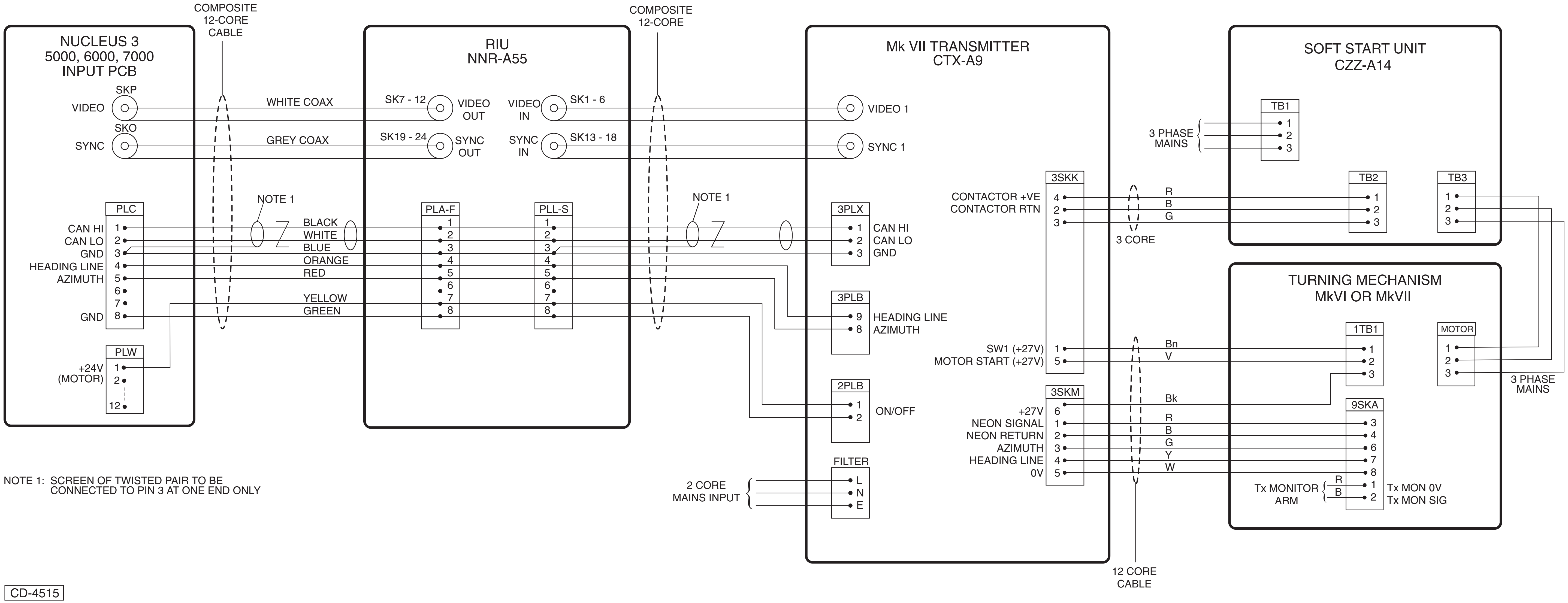


Figure 8a - Nucleus 3 Display to Transmitter (MkVII -S-Band) via RIU: Interconnections

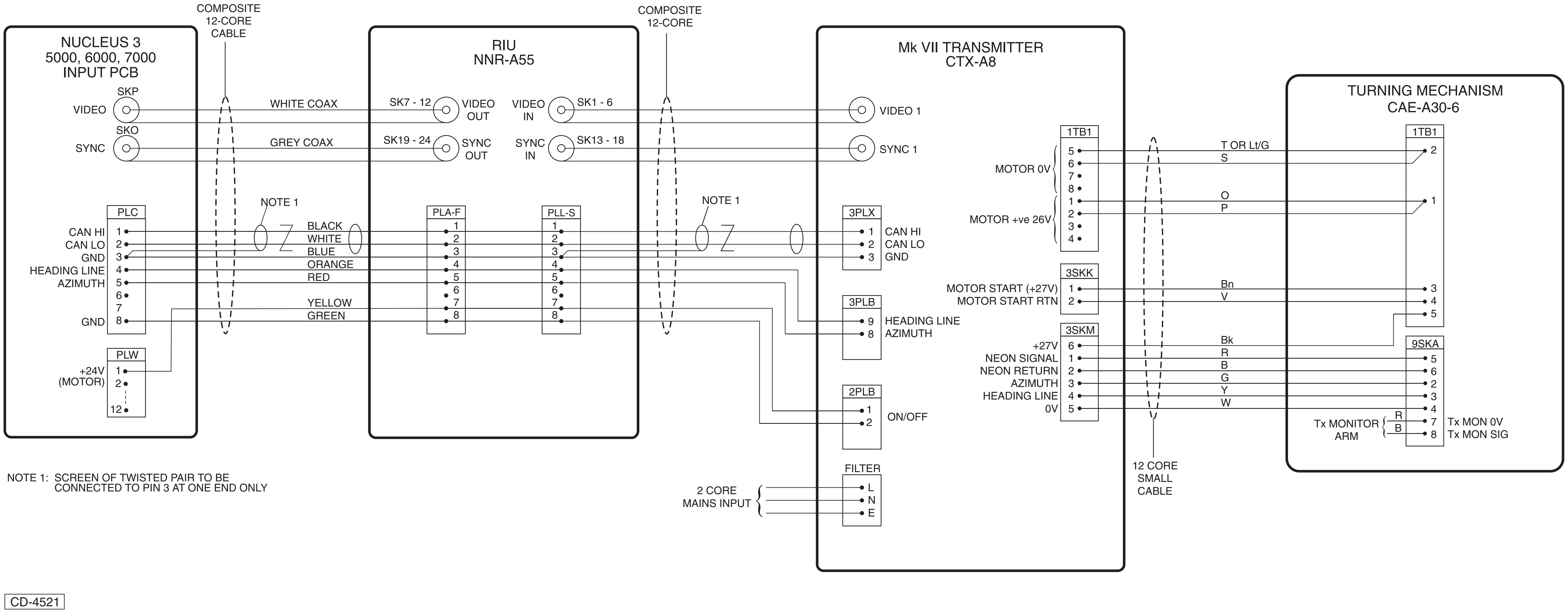
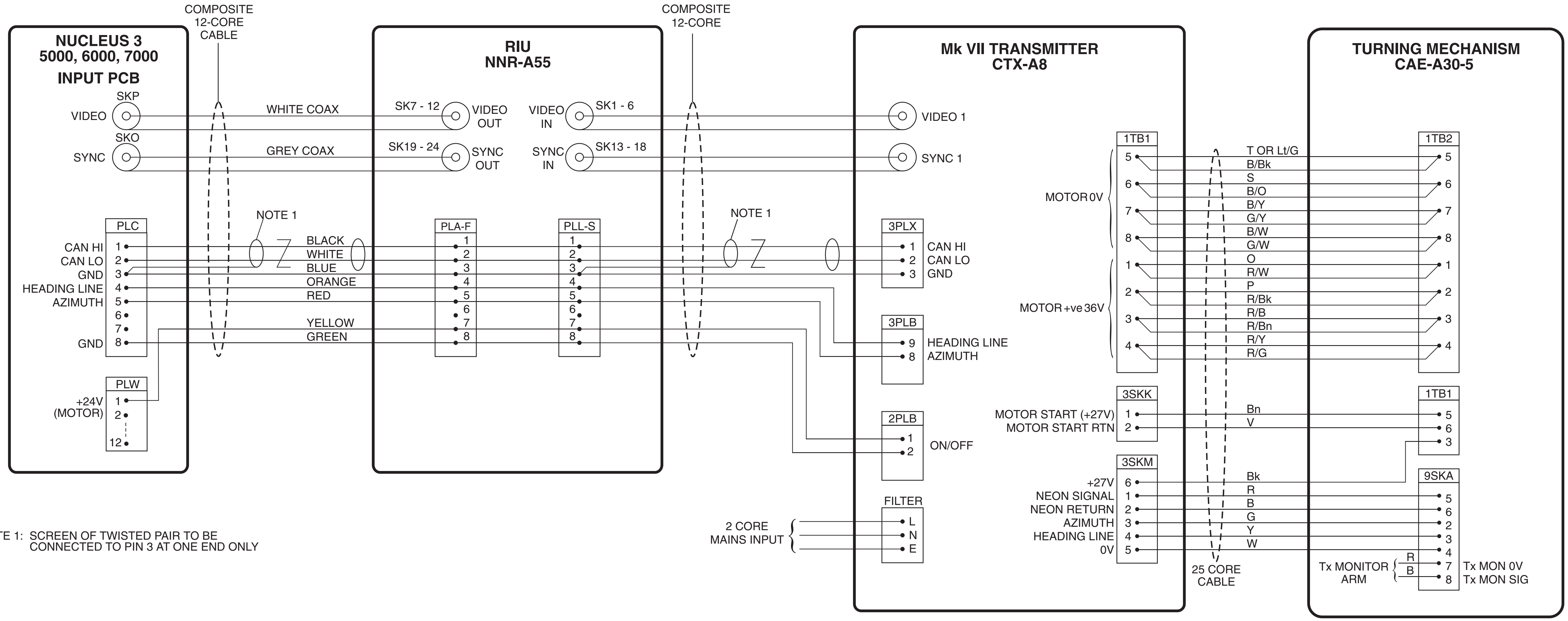


Figure 9a - Nucleus 3 Display to Transmitter (MkVII - X-Band, Low Speed) via RIU: Interconnections



NOTE 1: SCREEN OF TWISTED PAIR TO BE CONNECTED TO PIN 3 AT ONE END ONLY

CD-4522

Figure 10a - Nucleus 3 Display to Transmitter (MkVII, X-Band, High Speed), via RIU: Interconnections

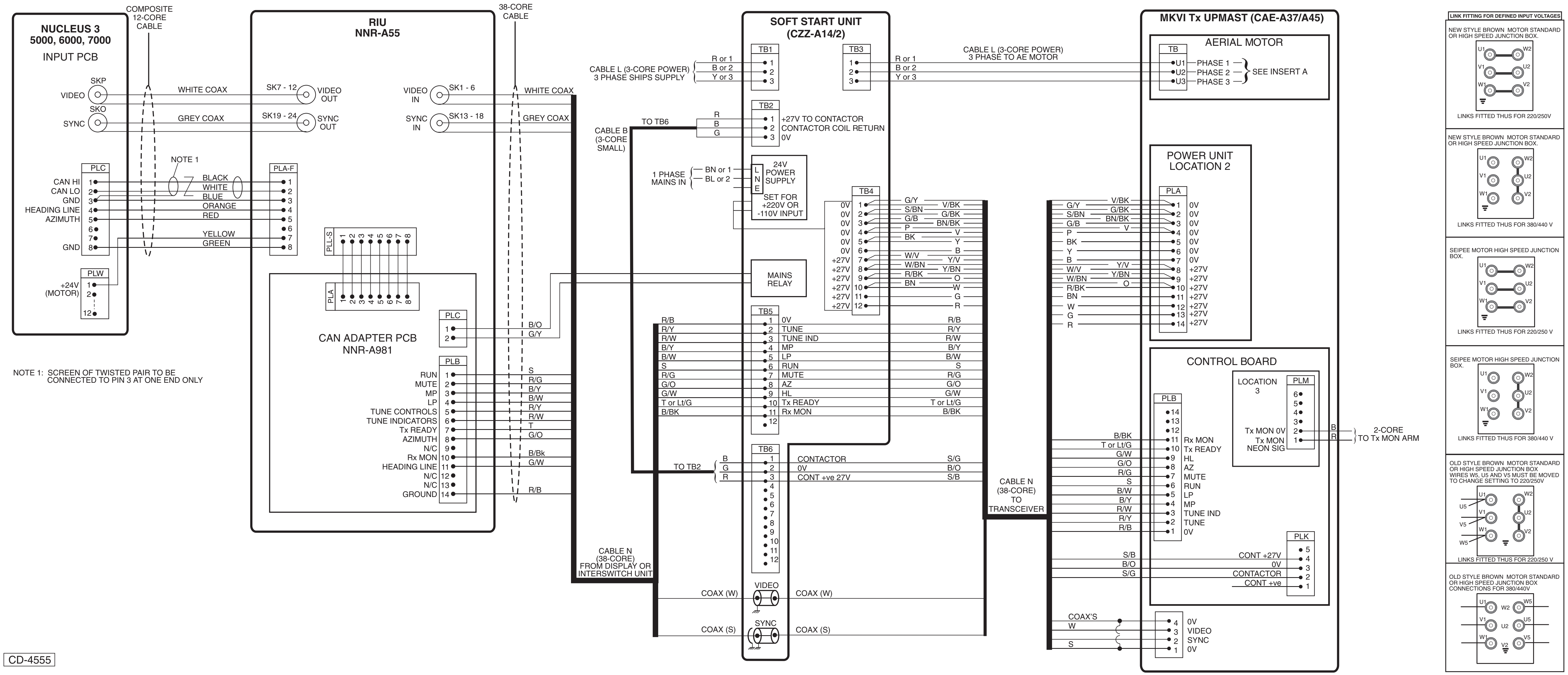


Figure 11a - Nucleus 3 Display to Transmitter (MkVI - Upmast), via RIU and Soft Start Unit: Interconnections

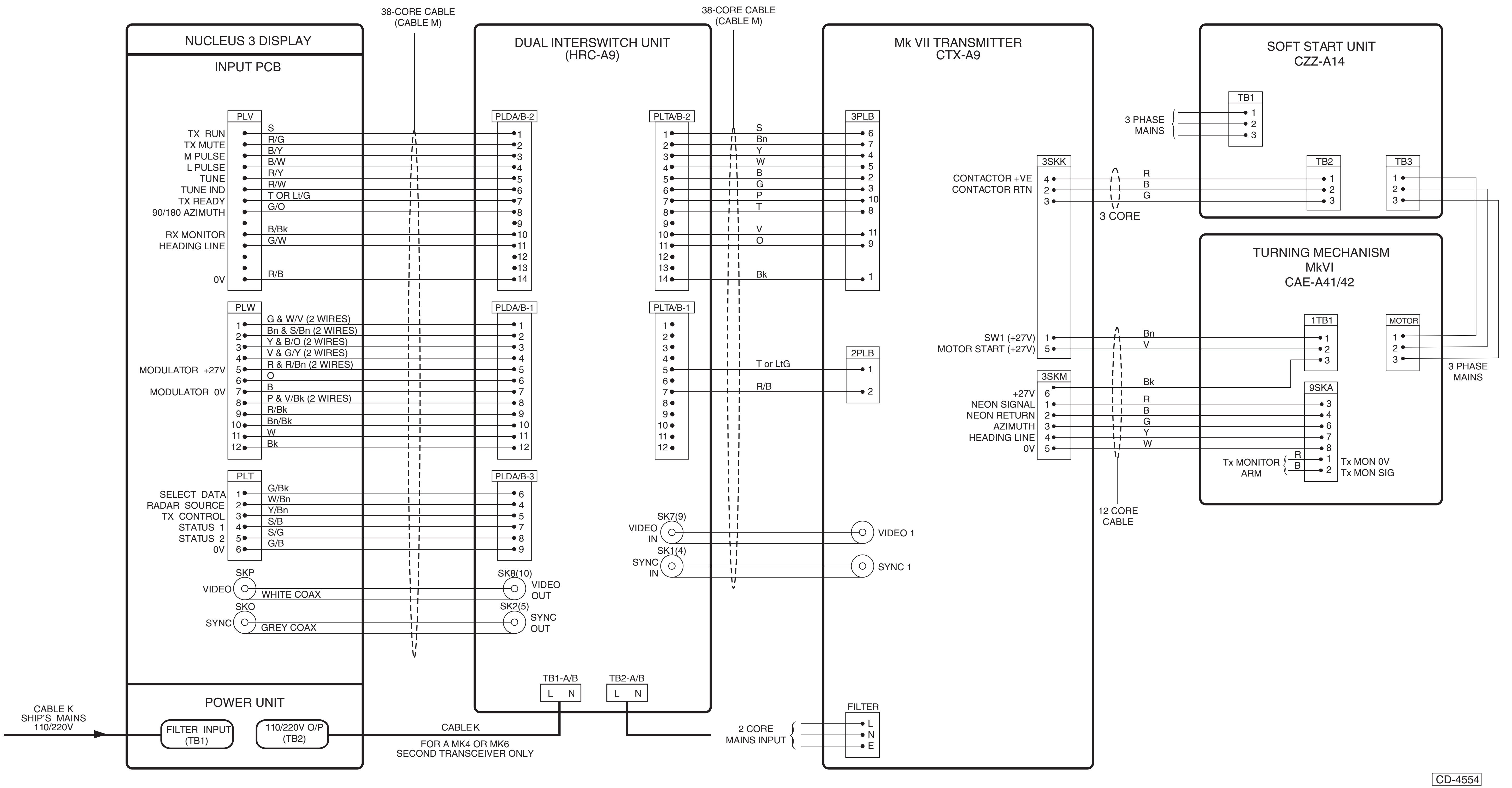


Figure 12a - Nucleus 3 Display to Transmitter (MkVII - S-Band) via Dual Interswitch Unit: Interconnections

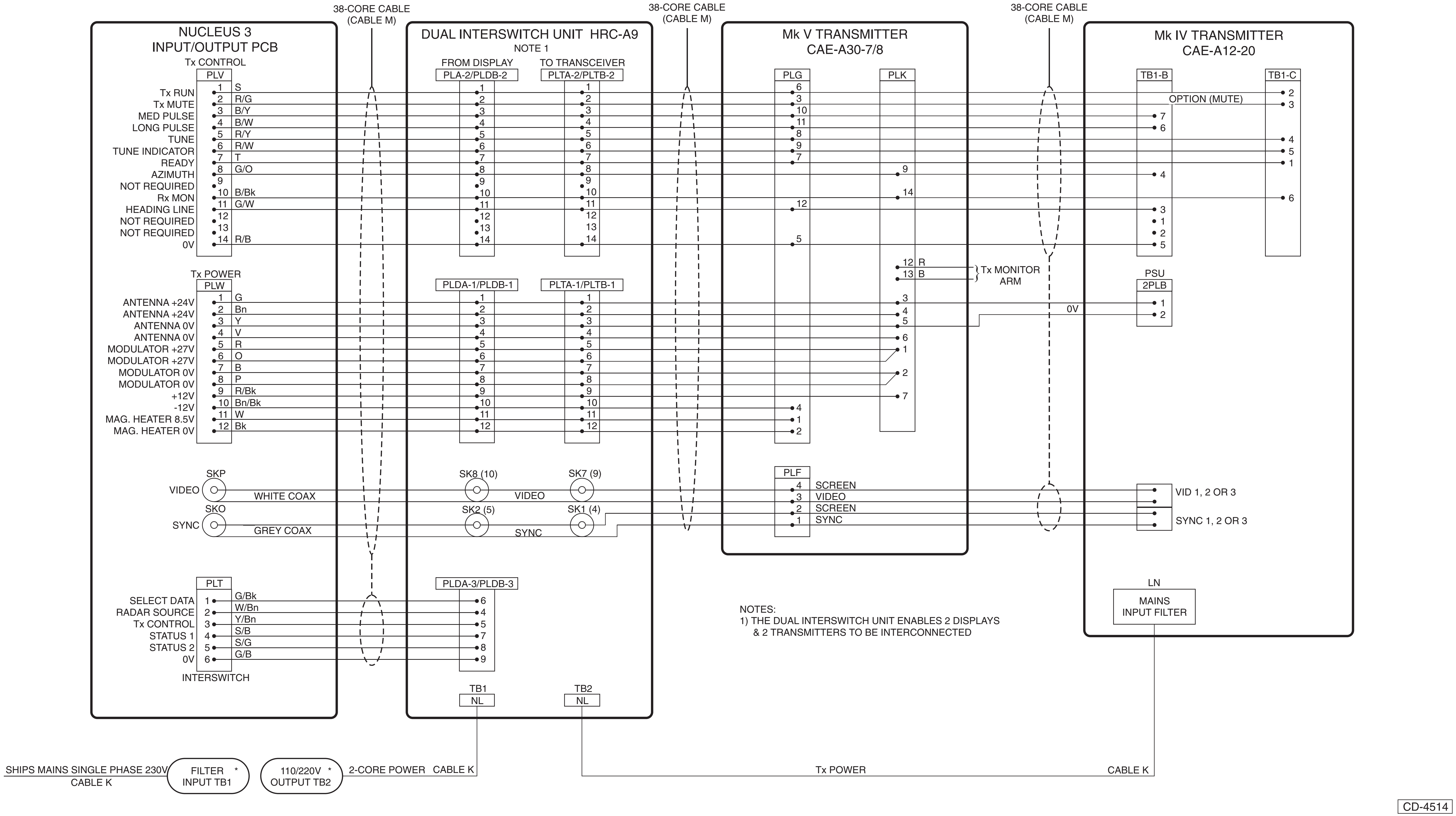


Figure 13a - Nucleus 3 Display to Transmitters (MkV & MkIV - Upmast), via Dual Interswitch Unit: Interconnections

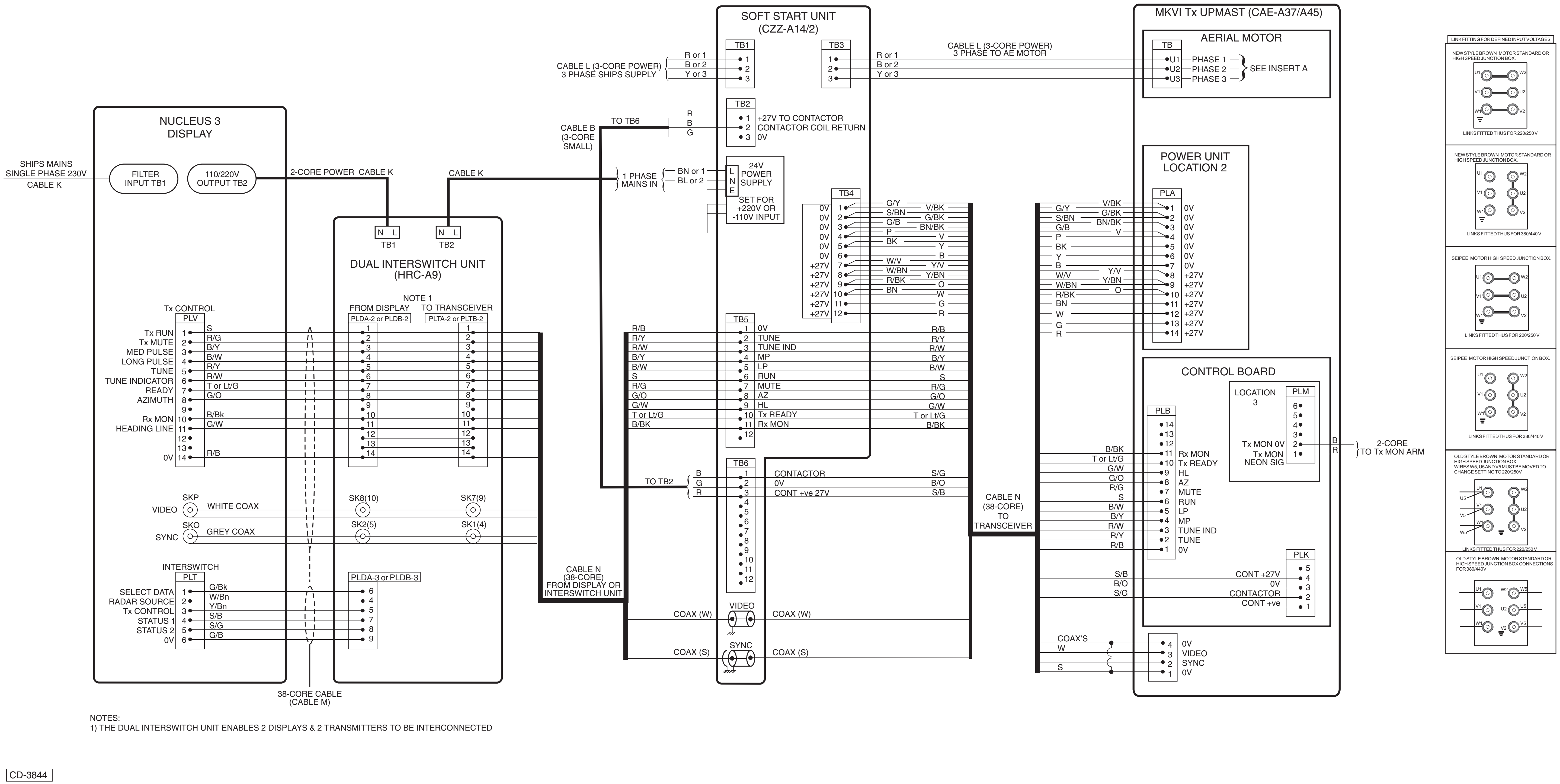


Figure 14a - Nucleus 3 Display to Transmitter (MkVI - Upmast), via Dual Interswitch Unit and Soft Start Unit: Interconnections

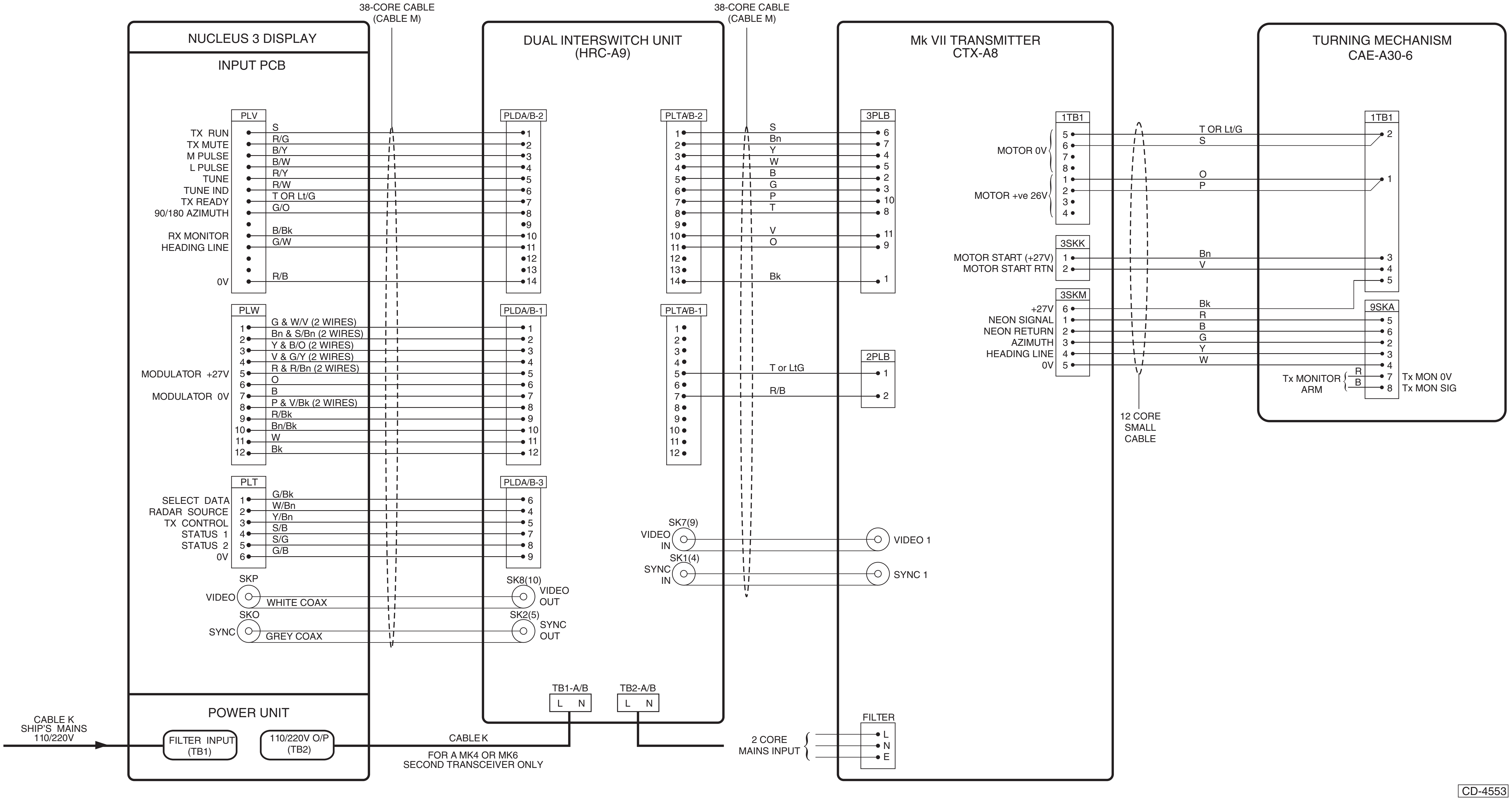


Figure 15a - Nucleus 3 Display to Transmitter (MkVII - X-Band, Low Speed), via Dual Interswitch Unit: Interconnections

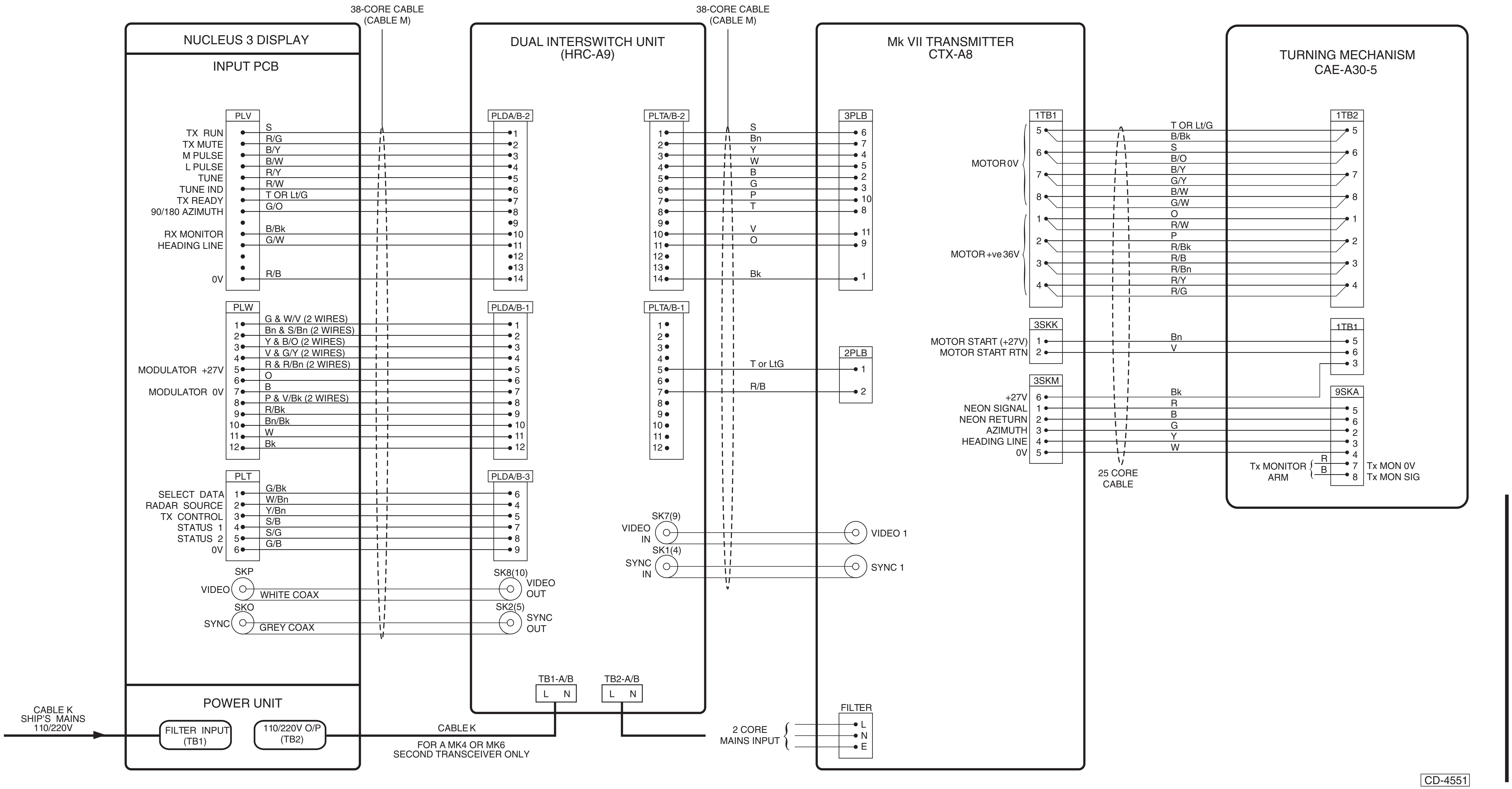
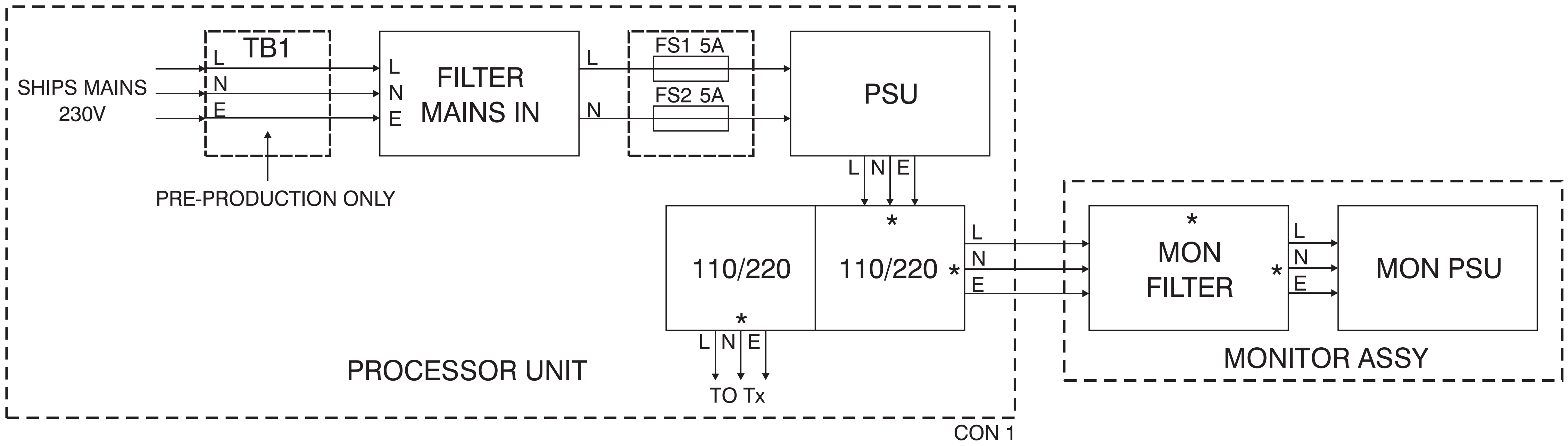
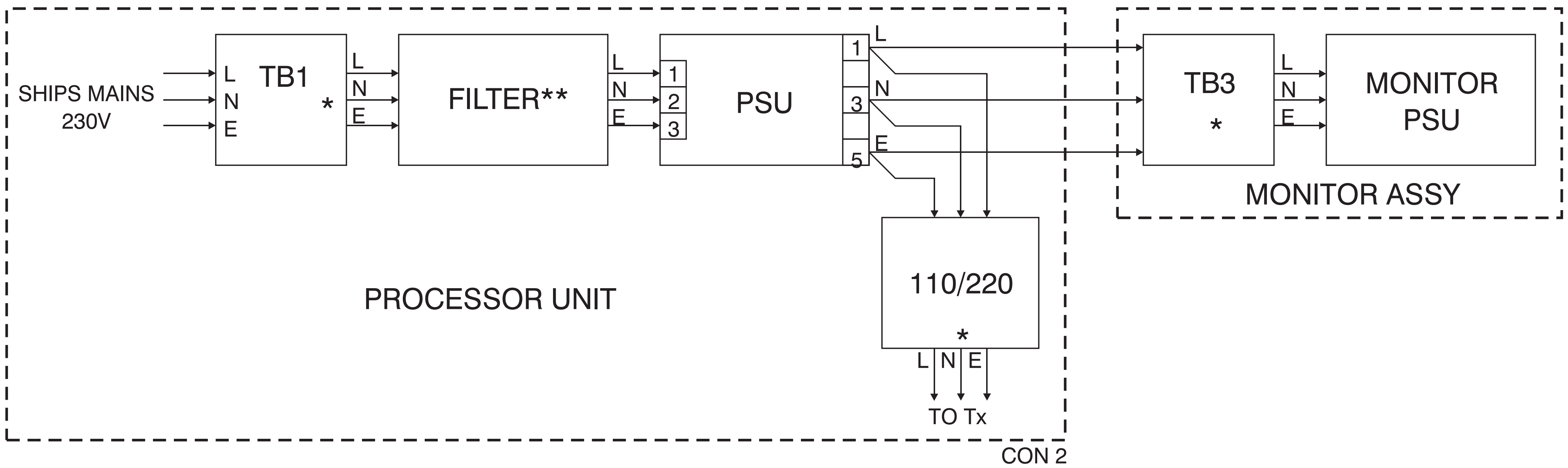


Figure 16a - Nucleus 3 Display to Transmitter (MkVII - X-Band, High Speed), via Dual Interswitch Unit: Interconnections



NUCLEUS 5000 EPA, ATA & ARPA



NUCLEUS 6000 EPA, ATA & ARPA

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*REFER TO LABEL FOR LNE CONNECTIONS
**LOCATION OF FS1 (5A) & FS2 (5A)

Figure 17a - Nucleus 3 Displays: Mains Power and Distribution

CHAPTER 4B

INSTALLATION & INTERCONNECTIONS - TRANSCEIVER MKIV

INTRODUCTION

1 Kelvin Hughes, or appointed agents, contracts only to supply the equipment, supervise the installation and final connection of the equipment. It is recommended that the installation is made by a fully qualified Kelvin Hughes Radar Engineer.

2 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 can 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.

3 This chapter covers Installation of the Mk IV Upmast Transmitter /Receivers.

4 The diagrams listed in Table 4.1b, provide installation information for the Transmitter/Receiver Units used in this system.

Table 4.1b - Installation Diagrams

Figure	Description
1b	Upmast X-Band Transceiver CAE-A12-20 (25kW): Installation Dimensions
2b	X-Band Upmast Transceiver: Cable Routing
3b	X-Band Upmast Transceiver Transmitter Monitor Arm: Connection Diagram
4b	Assembly of Cable Gland to Upmast Transceiver/Turning Mechanism
5b	X-Band Upmast Transceiver: Electrical Connections
6b	Optional Mains Isolator: Installation Dimensions
7b	Mk IV Transceiver Upmast (X-Band) to Nucleus (5000) Interconnections Diagram
8b	MkIV Transceiver Upmast (X-Band) to Radar Processor via RIU Interconnections Diagram

MAXIMUM RECOMMENDED WAVEGUIDE LENGTHS

5 The following maximum waveguide lengths are recommended:

	Std Speed	High Speed
X-band	28m	20m

SYSTEM CONFIGURATIONS (SEE FIGURE 1)

6 Combinations of Antennas and Upmast Transceivers are:

(1) 1.8m X-band 25kW Antenna (CAE-A13/2)
Turning Mechanism/Transceiver (CAE-A12-20)

(2) 2.4m X-band 25kW Antenna (CAE-A25)
Turning Mechanism/Transceiver (CAE-A12-20)

SAFETY NOTES

Observe the Health and Safety Notices at the front of this manual.

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

8 Mains supplies in the vicinity of the Upmast Transceiver are to be isolated when installing the equipment.

9 A suitable safety platform or harness should be used when siting the Upmast Transceiver aloft.

10 The Upmast Transceiver must be hoisted to the fixing position using a secured block and tackle or rope straps. The assembly MUST NOT be lifted by the antenna; the complete unit must be secured and hoisted evenly.

11 The transceiver must be earthed to the ship as shown on the appropriate illustration.

12 The earthing straps must be fitted prior to switching on the transceiver.

INSTALLATION OF UPMAST X-BAND TRANSCEIVER CAE-A12-20 (25KW)

GENERAL

13 The Upmast Transceiver comprises a casting with two cover plates. Both cover plates are secured by four bolts and may be removed to access the motor and transceiver PCBs mounted within. The PCBs are secured to mounting plates which form a safety cage whilst in the closed position.

FITTING

14 The Upmast Transceiver should be installed in such a position to avoid any RF interference and where Blind Arcs, caused by obstructions, e.g. 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.

15 The Upmast Transceiver must not be mounted where the temperature exceeds 70°C.

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

17 The Upmast Transceiver must be mounted more than 914mm above any flat surface, when the flat surface is greater than the diameter swept by the antenna.

18 The Upmast Transceiver must not be positioned in the close proximity of any magnetic compass or D/F antenna, etc.

NOTE:

A heavy duty earthing strap or cable must be taken from the upmast transceiver/turning mechanism to the ship's earth.

19 Position the Upmast Transceiver at the installation site, supporting the unit where necessary, and mark out the mounting holes for drilling. Refer to Figure 1b for dimensions.

20 Allow sufficient cable length, (approximately 1m) on all cables to enable them to be routed through the Transceiver unit. Refer to Figures 2b and 4b for details. Ensure that there is sufficient slack on all cables to allow for full movement of the equipment on its mounts during any sudden shock, or extreme movement of the vessel.

WARNING

THE UNIT MUST NOT BE LIFTED BY MEANS OF THE ANTENNA OR WING CASTING. THE LIFTING SUPPORTS MUST GO UNDER THE CASTING.

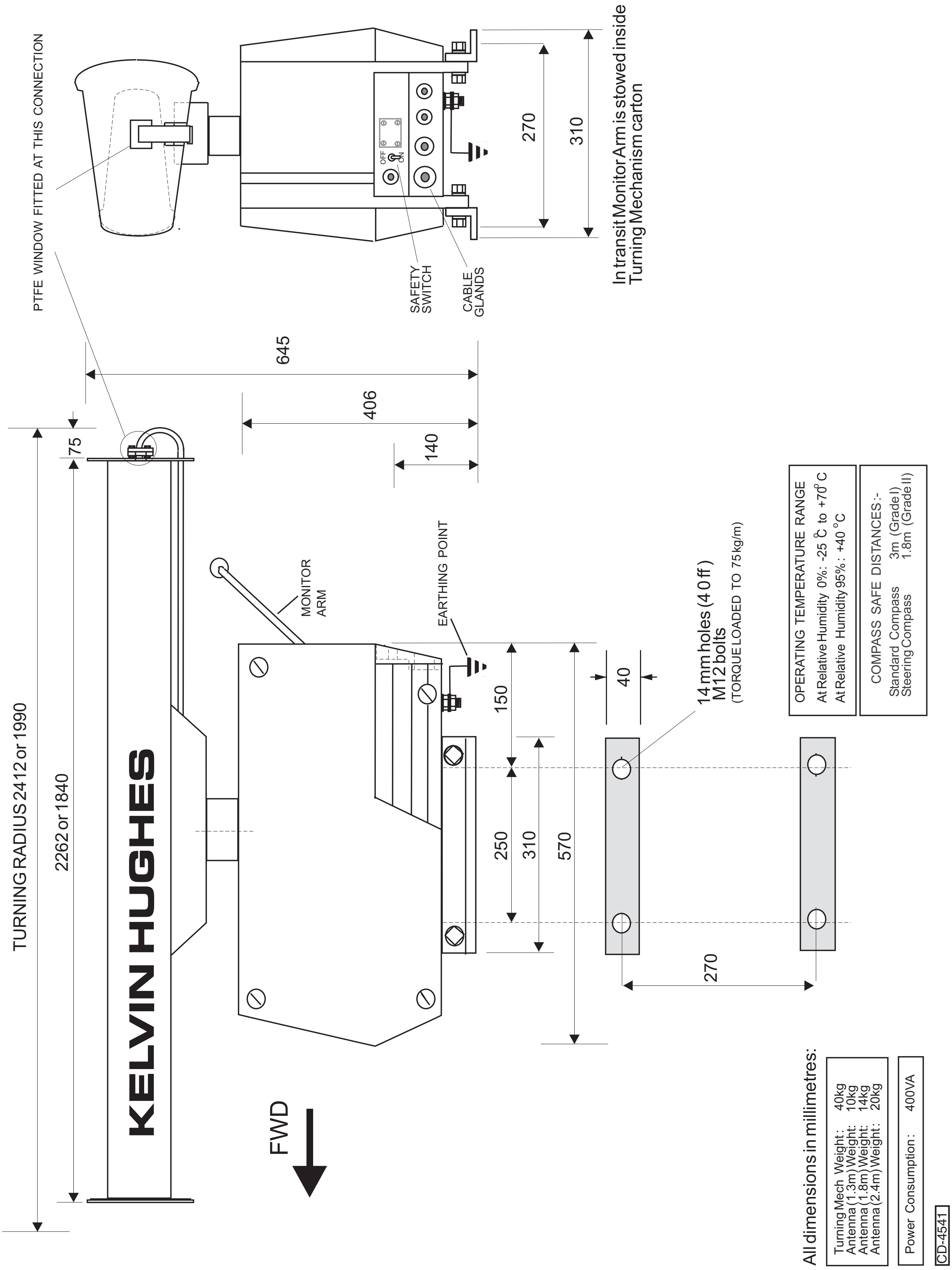


Figure 1b - Upmast X-Band Transceiver CAE-A12-20 (25kW): Installation Dimensions

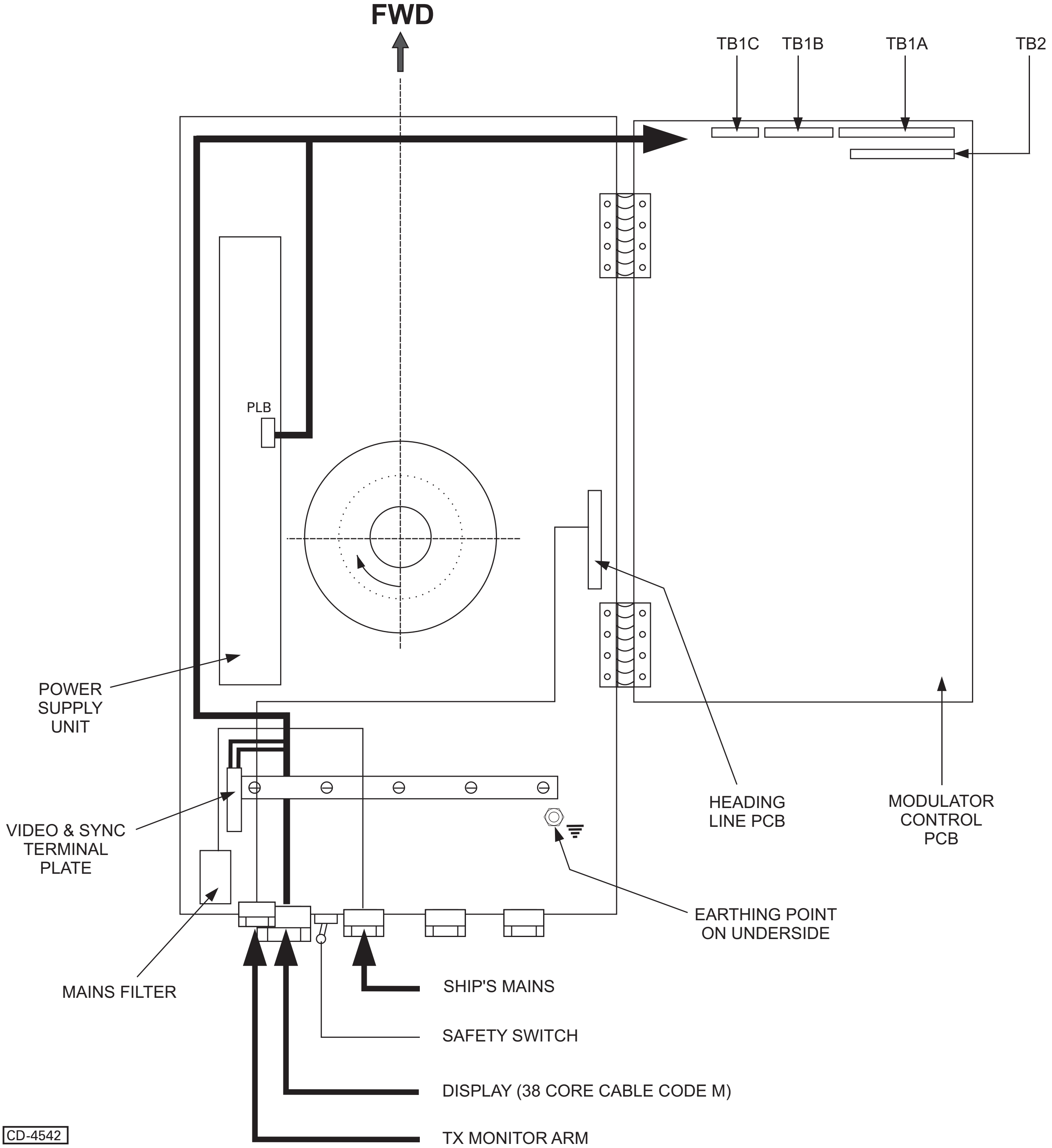


Figure 2b - X-Band Upmast Transceiver: Cable Routing

MONITOR ARM

21 The Monitor Arm is positioned by means of a channel above the glands at the rear of the casting, and is secured by a clamp with two retaining screws. The neon points to starboard when viewed from the rear of the transceiver.

22 The cable is routed through the gland nearest the channel and connects to PLA-7 (red) and PLA-8 (blue) on the Azimuth PCB (CTX-A106). Refer to Figure 3b.

ELECTRICAL CONNECTION

23 For detailed electrical connection of cables to the transceiver unit, refer to the installation diagrams in Figure 5b. Ensure that all cables are secured to their associated entry point and that screened cables are earthed to their respective units.

24 Connecting cables between the display and the transceiver should be limited to a length of 65 metres. Where the distance between transceiver and display is between 65-180 metres, special low loss co-axial cable is required.

25 Cable specifications are detailed in Paragraph 30 onwards.

CHECKS AFTER FITTING

26 Setting to work instructions are described in Chapter 5, Commissioning.

27 The transceiver must be thoroughly checked for security, accessibility, and correct cabling runs.

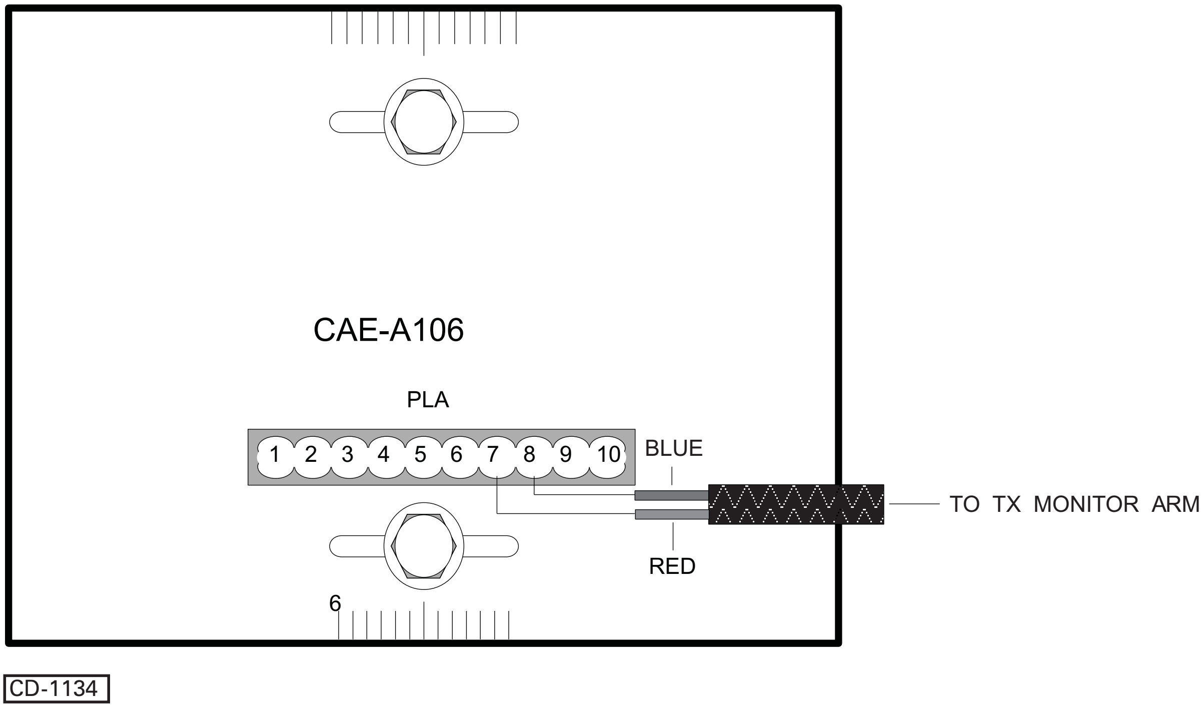


Figure 3b - X-Band Upmast Transceiver Transmitter Monitor Arm: Connection Diagram

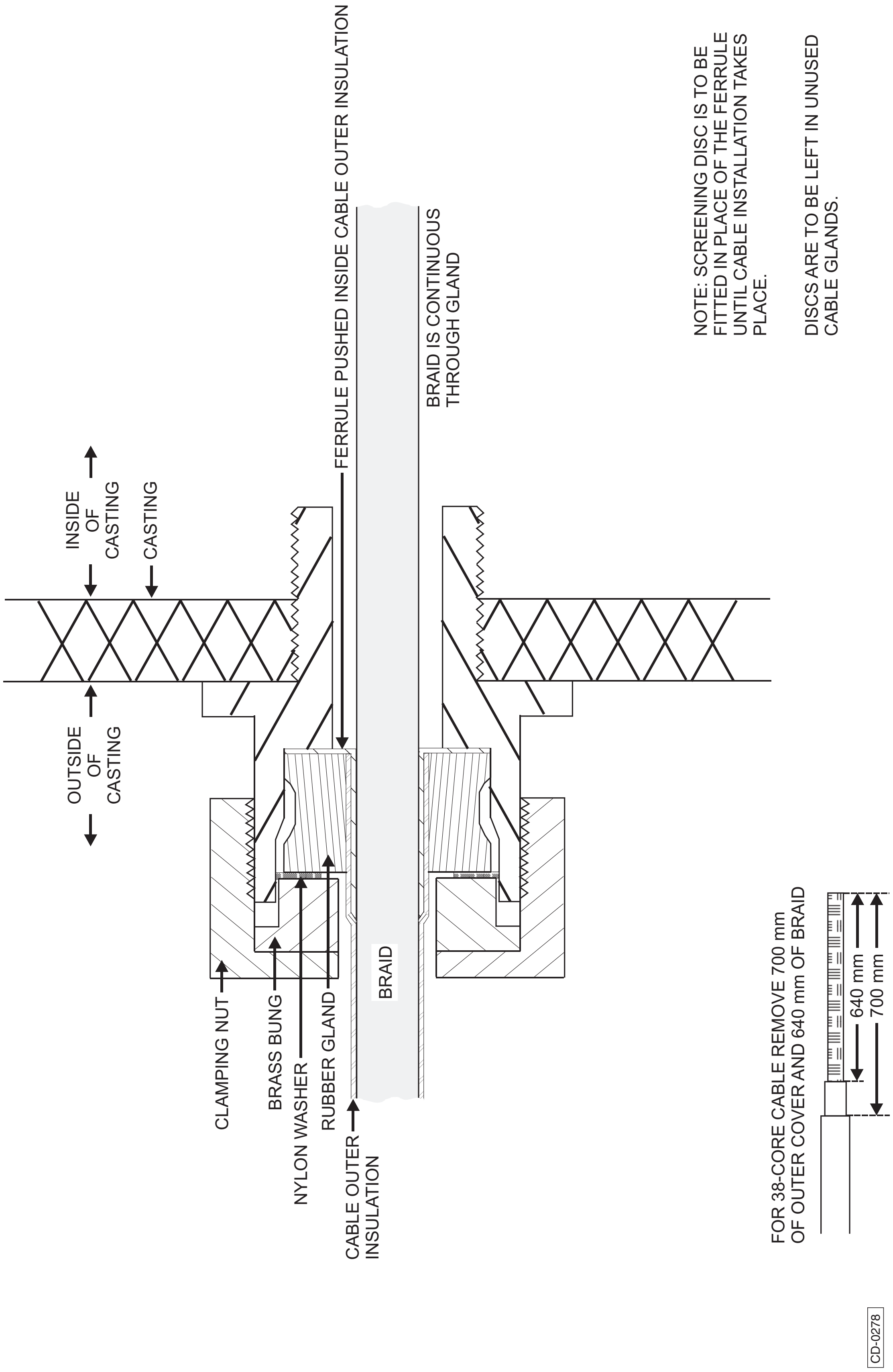
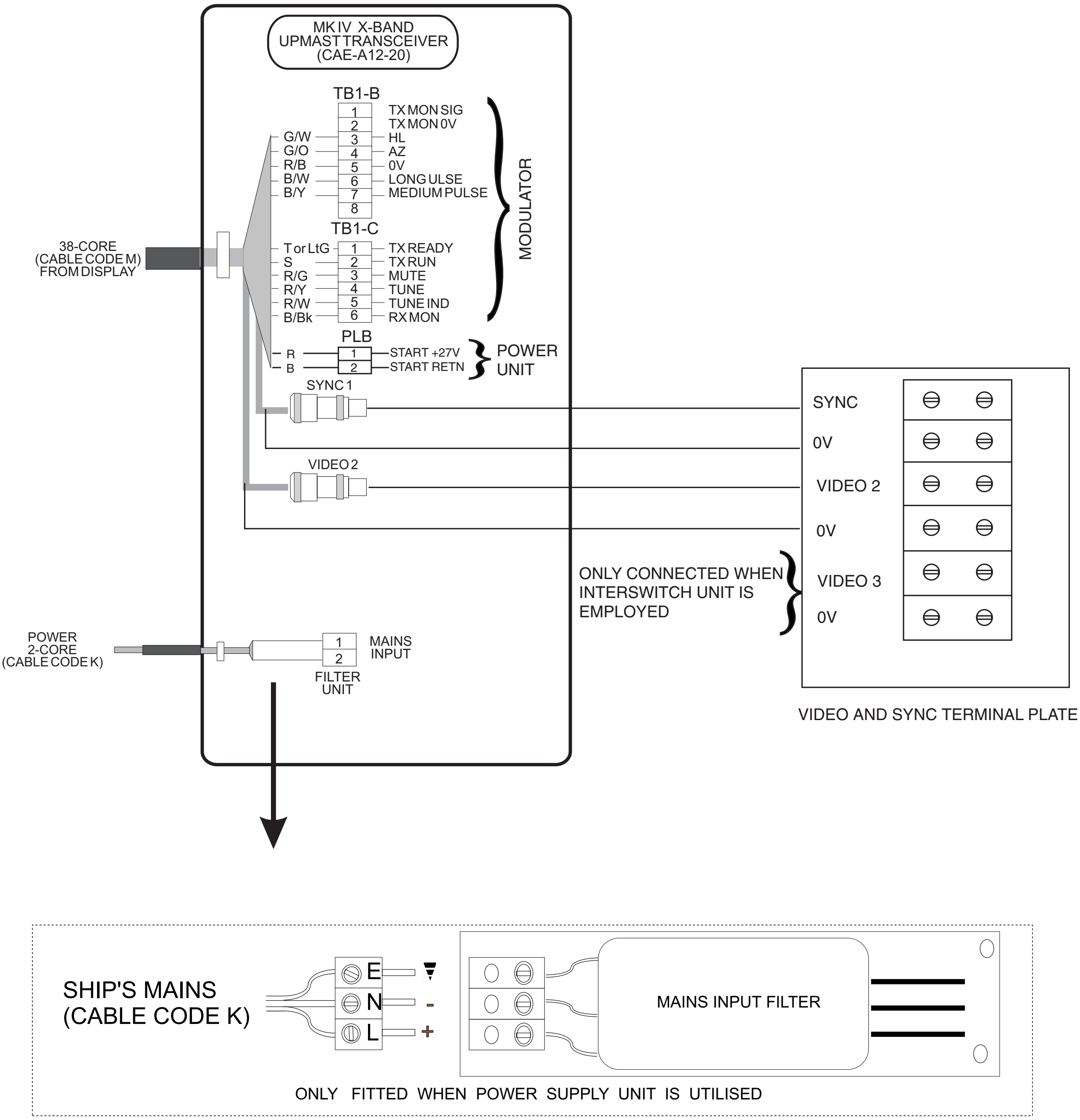


Figure 4b - Assembly of Cable Gland to Upmast Transceiver/Turning Mechanism



CD-4661

Figure 5b - X-Band Upmast Transceiver: Electrical Connections

OPTIONAL MAINS ISOLATOR (80-261-600)

28 The mains isolator must be fitted adjacent to the display or in the area of the operators control room and connected in parallel with the main display.

29 With reference to Figure 66, secure the Mains Isolator in the required position (no fittings are supplied).

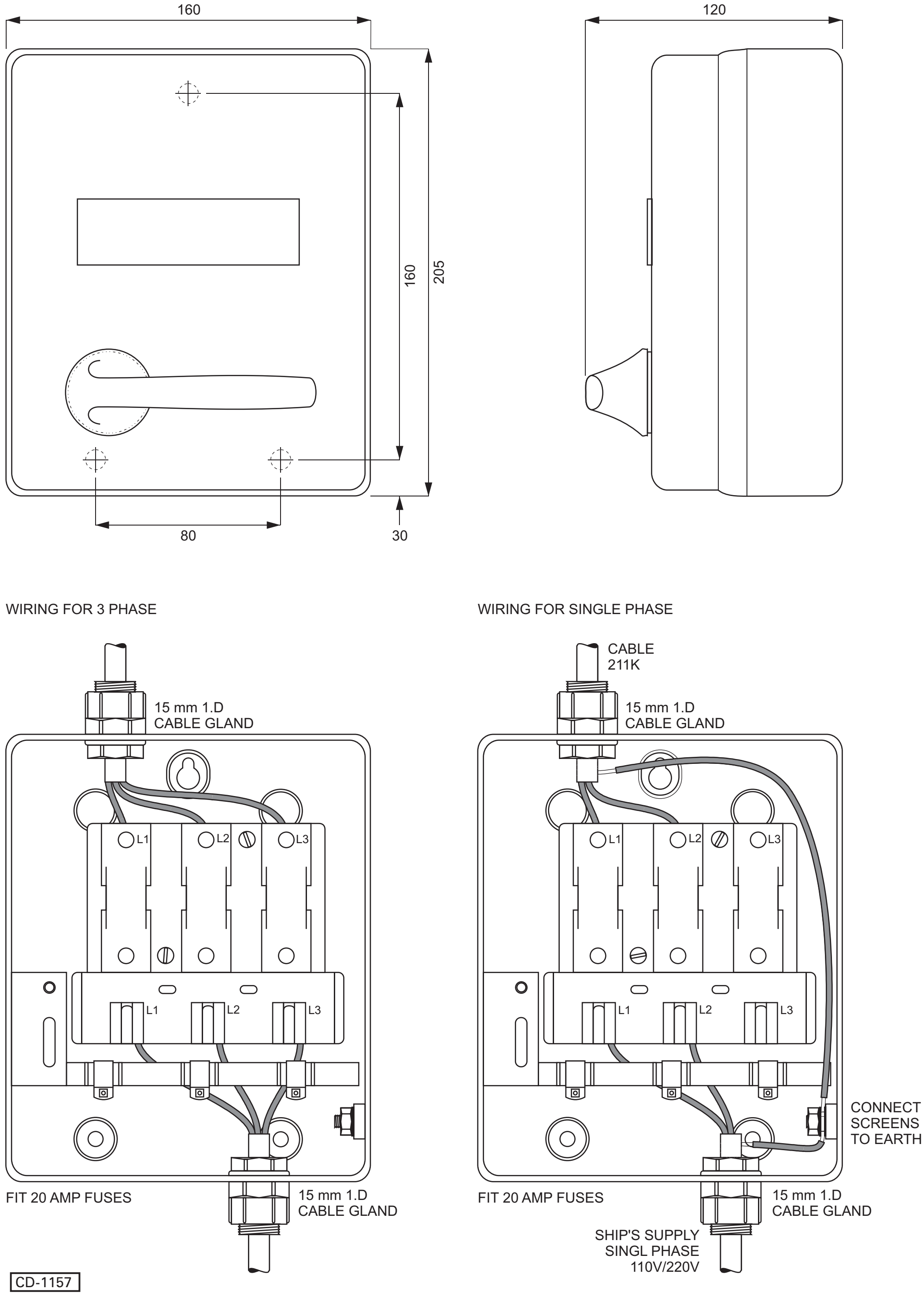


Figure 6b - Optional Mains Isolator: Installation Dimensions

CABLE SPECIFICATIONS

CABLE CODES

30 Each cable is identified by a letter code which defines the type of cable required, e.g. Cable code N is a 38-core cable. Table 1 provides detailed specifications for each cable type. For ease of identification, the cable cores are colour coded (refer to Table 2).

31 The cables used to connect Kelvin Hughes Radar equipment are to be to the following specification. If the cables are not purchased from Kelvin Hughes, the contractor must either confirm that the cables are to specification or submit samples to Kelvin Hughes for approval.

Table 4.2b - Cable Specification

CABLE	DESCRIPTION	CODE	CORE	DIAMETER
A	2-core small multi-core	1344-718	16/0.2	6.1mm 7.7mm
B	3-core small multi-core	1344-719	16/0.2	6.4mm 7.2mm
E	12-core small multi-core	1344-722	16/0.2	10mm 11mm
G	25-core small multi-core	1344-724	16/0.2	13.6mm 14mm
H.	TO BE SUPPLIED BY CONTRACTOR			
J	Co-axial 75 ohms d/s	5344-705	7/0.07	7mm
K	2-core Power	1344-1123	7/0.67	12mm
N	38-core small multi-core	5344-701		
P	Co-axial (Low Loss) Type ECL 125	5344-719 (for long cable lengths only)	Varies	8.3mm

SMALL MULTI-CORE CABLES

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

Core Details

33 The core details are as follows:

(1) Conductors consist of 16 strands of 0.2mm diameter tinned copper wire.

(2) Nominal cross-section area of conductor = 0.5 mm^2.

(3) Nominal diameter of conductor = 0.93mm

(4) Nominal thickness of insulation = 0.45mm

(5) Minimum thickness of insulation = 0.40mm

(6) Minimum diameter of core = 1.75mm

(7) Maximum diameter of core = 1.90mm

Braided Screen

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

Outer Sheath

35 An outer sheath of PVC compound is applied by extrusion over the wire braiding.

Maximum Current Rating

36 The maximum current ratings are as follows:

(1) 2.5 A at 1000 V dc.

(2) 2.5 A at 440 V ac at 1600Hz.

Table 4.3b - Cable Colour Abbreviations (38-Core)

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
W	WHITE
Bk	BLACK
Bn	BROWN
V	VIOLET
O	ORANGE
P	PINK
T	TURQUOISE
S	SLATE (grey)
R/B	RED/BLUE
R/G	RED/GREEN
R/Y	RED/YELLOW
R/W	RED/WHITE
R/Bk	RED/BLACK
R/Bn	RED/BROWN
B/Y	BLUE/YELLOW
B/W	BLUE/WHITE
B/Bk	BLUE/BLACK
B/O	BLUE/ORANGE
G/Y	GREEN/YELLOW
G/W	GREEN/WHITE
G/Bk	GREEN/BLACK
G/O	GREEN/ORANGE
G/S	GREEN/SLATE
Bn/Bk	BROWN/BLACK
Bn/Y	BROWN/YELLOW
Bn/W	BROWN/WHITE
S/B	SLATE/BLUE
S/Bn	SLATE/BROWN
V/Bk	VIOLET/BLACK
V/Y	VIOLET/YELLOW
V/W	VIOLET/WHITE
W/R	WHITE/RED
	WHITE CO-AX
	SLATE CO-AX
N/C	NO CONNECTION

POWER CABLES

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

2-Core E.P. Rubber:

Cable Code K:	KH Reference No. 1344-1123
250/440V grade:	7 x 0.67 mm (7 x 0.026") cores E.P. rubber insulated, cores laid-up, jute filled, proof cotton taped, braided with 0.2mm (0.0078") diameter tinned copper wire, PVC outer sheath.
Outer diameter:	12 mm (0.47 in.).

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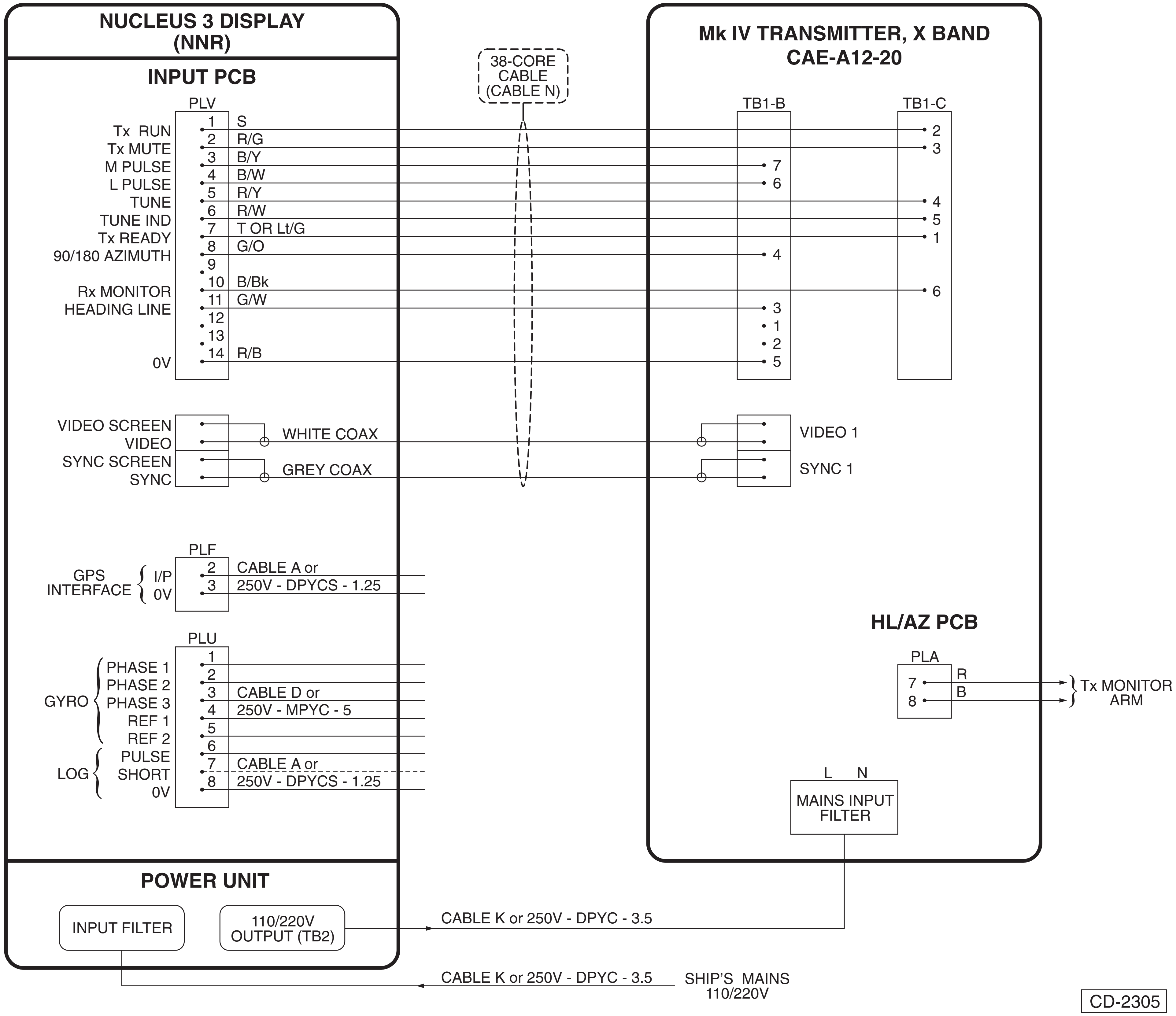

Figure 7b - Mk IV Transceiver Upmast (X-Band) to Nucleus 3 (5000) Interconnections Diagram

CHAPTER 4C

INSTALLATION & INTERCONNECTIONS - TRANSCEIVER MKV

INTRODUCTION

1 Kelvin Hughes, or appointed agents, contracts only to supply the equipment, supervise the installation and final connection of the equipment. It is recommended that the installation is made by a fully qualified Kelvin Hughes Radar Engineer.

2 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 can 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.

3 The Antenna/Transceiver is to be mounted on a rigid platform which provides clearance from other structures for the rotating antenna. The height and position of the platform is to be such that the radiated beam is unobstructed forward (i.e. beam-to-beam through the ship's head) and the vertical radiated beam clearing the ship's bow.

4 This Chapter covers Installation of the Mk V Transmitter/Receivers.

5 There are two versions of the MkV Transceiver covered in this publication:

(1) Low Speed Turning Mechanism CAE-A30-7.

(2) High Speed Turning Mechanism CAE-A30-8.

6 The High Speed Turning Mechanism requires a +36V to +40V supply to provide the supply to the motor drive PCB. This supply can be obtained from either a Transmitter Interface Unit (TIU) or from an external downmast Power Supply CZZ-A22.

NOTE:

The power unit in the TIU can be set, when installed, to provide either High or Low motor supplies.

7 The Low Speed Turning Mechanism uses +27V power supplies from the display to drive the turning motor.

8 The diagram(s) listed in Table 4.1c, provide installation information for the Transmitter/Receiver Units used in this system.

Table 4.1c

Figure	Description
1c	Mk V Upmast (X-Band) Transceiver Inter-unit Interconnections.
2c	Mk V Transceiver Interconnections Diagram

MAXIMUM RECOMMENDED WAVEGUIDE LENGTHS

9 The following maximum waveguide lengths are recommended:

	Std Speed	High Speed
X-band	28m	20m

SAFETY NOTES

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

(1) 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 Transceiver housing with a guard rail surrounding it.

(2) A flat steel plate (12mm thick approx.), pre-drilled (in accordance with Figure 1) to accommodate the Transceiver unit and the cable from the Display. The steel plate must be mounted horizontally and braced with struts for rigidity.

(3) The plate has to be sited in a clear area where the turning Antenna cannot be obstructed by any cables, mast halyards etc.

(4) The Antenna and Transceiver Unit must be hoisted to the fixing position using a secured block and tackle or rope straps.

(5) Safety personnel must ensure that persons do not encroach on the area of work.

(6) The Antenna and Transceiver Unit must **NOT** be lifted by the array, but the complete unit secured and hoisted evenly.

EQUIPMENT LOCATION

Transceiver and Turning Mechanism

11 The Transceiver/Turning Mechanism should be installed in such a position where Blind Arcs, caused by obstructions, e.g. masts, funnels, 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.

12 The Transceiver/Turning Mechanism **must not** be mounted where the temperature exceeds 70 C.

13 The Transceiver/Turning Mechanism must be kept clear of ship's flexible communication aerials to avoid damage to both.

14 The Transceiver/Turning Mechanism must be mounted more than 914mm above any flat surface, when the flat surface is greater than the diameter swept by the antenna.

15 The Transceiver/Turning Mechanism must not be positioned in the close proximity of any magnetic compass or D/F aerial, etc.

40V Power Supply (CZZ-A22)

16 The following points must be considered when selecting a suitable site for the Power Supply:

(1) The Power Supply is designed for bulkhead mounting, away from the turning mechanism.

(2) Consideration must be given to accessibility for servicing and protection from adverse conditions. For ease of maintenance, the top of the power supply should not be mounted more than 1.6m above the deck.

(3) Ensure that there is sufficient space below the unit for cable entries.

(4) The power supply should be mounted in a position which allows for ventilation and cooling.

NOTE:

*The power supply air circulation **MUST NOT** be obstructed.*

(5) Do not fit the power supply in an acoustic, noise sensitive area, e.g. The bridge or operations room.

FITTING

Transceiver and Turning Mechanism

17 The Antenna and Transceiver are specified and supplied separately. Refer to Figure 1c for outline dimensions and fixing centres. The following criteria are to be observed when installing:

NOTE:

Assemble the two units together prior to hoisting into the installation position.

> **CAUTION**
>
> **Do not remove the transparent film covering the waveguide outlet as this prevents the ingress of water or moisture.**

(1) Remove the protective caps, tapes etc. Ensure the waveguide faces are clean and free from grease. Fit the appropriate 'O' ring. Fit the Antenna array to the transceiver with the eight bolts, holding it loosely in position. **DO NOT TIGHTEN THE BOLTS**. Refer to Figure 2c.

(2) Align the waveguide from the Antenna to the Rotating Joint and fit the four waveguide bolts. Do not force the waveguide to the coupling face. Tighten the waveguide bolts evenly until the mating faces are flush. Torque load the Antenna retaining bolts to 19 to 24 Nm (14-16 lb./ft).

(3) Hoist the Transceiver and Antenna assembly, (ensuring the slings do not foul with the Array), to the mounting plate.

(4) Mount the Transceiver facing forward (removable cover facing aft). Fit the retaining bolts and torque load to 50lb/ft (75kg/m) then gain access to the interior by removing the rear cover.

NOTE:

The outer casing of the Transceiver must be bonded to the ship's superstructure using a copper earthing strap connected to the earthing point shown in Figure 1.

(5) The connecting cable from the Transceiver to the Display should be kept to a maximum of 60 metres. Do not exceed 60m without consulting the Kelvin Hughes Technical Department.

(6) Fit the Monitor Arm (if supplied) onto the side of the casing and secure the clamp with the four retaining screws. The monitor arm cable is passed through the smaller cable gland and clamped. The cable screen is to be earthed by the ferrules in the cable gland assembly.

40V Power Supply CZZ-A22

18 The +40V Power Supply is fitted to the bulkhead using the four installation bolts provided.

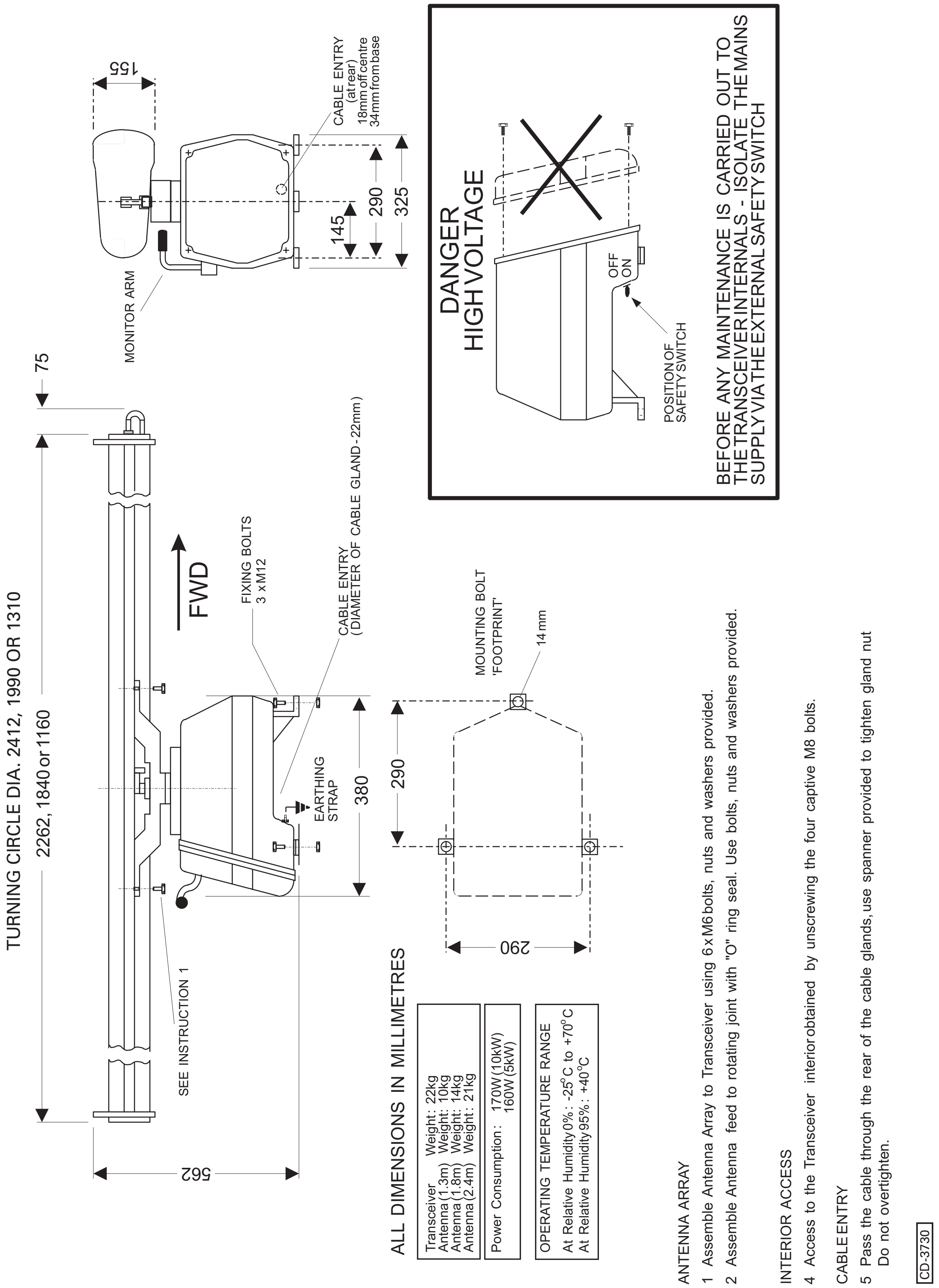

Figure 1c - Transceiver Fixing Centres and Outline Dimensions

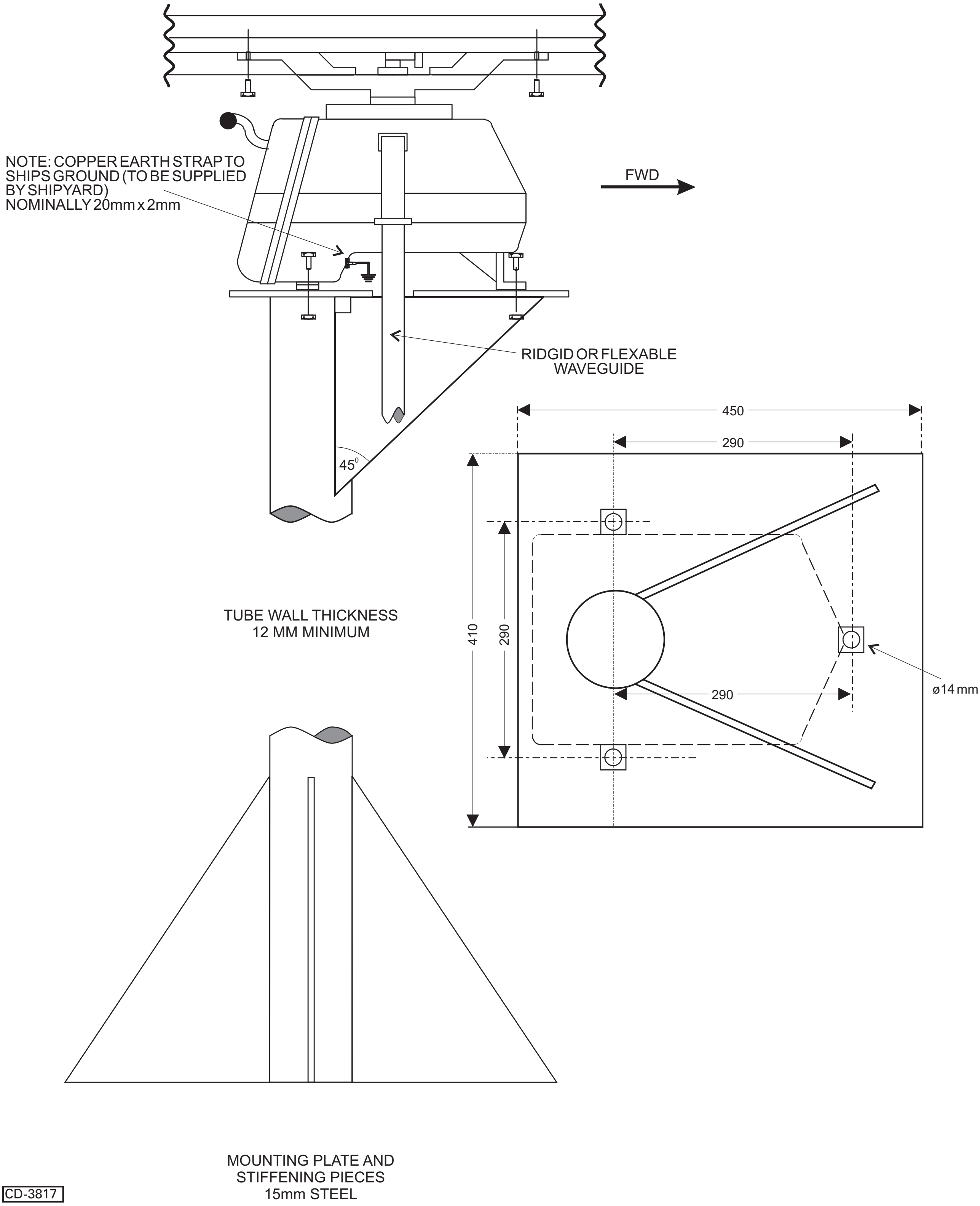

Figure 2c - Transceiver Mast Mounting

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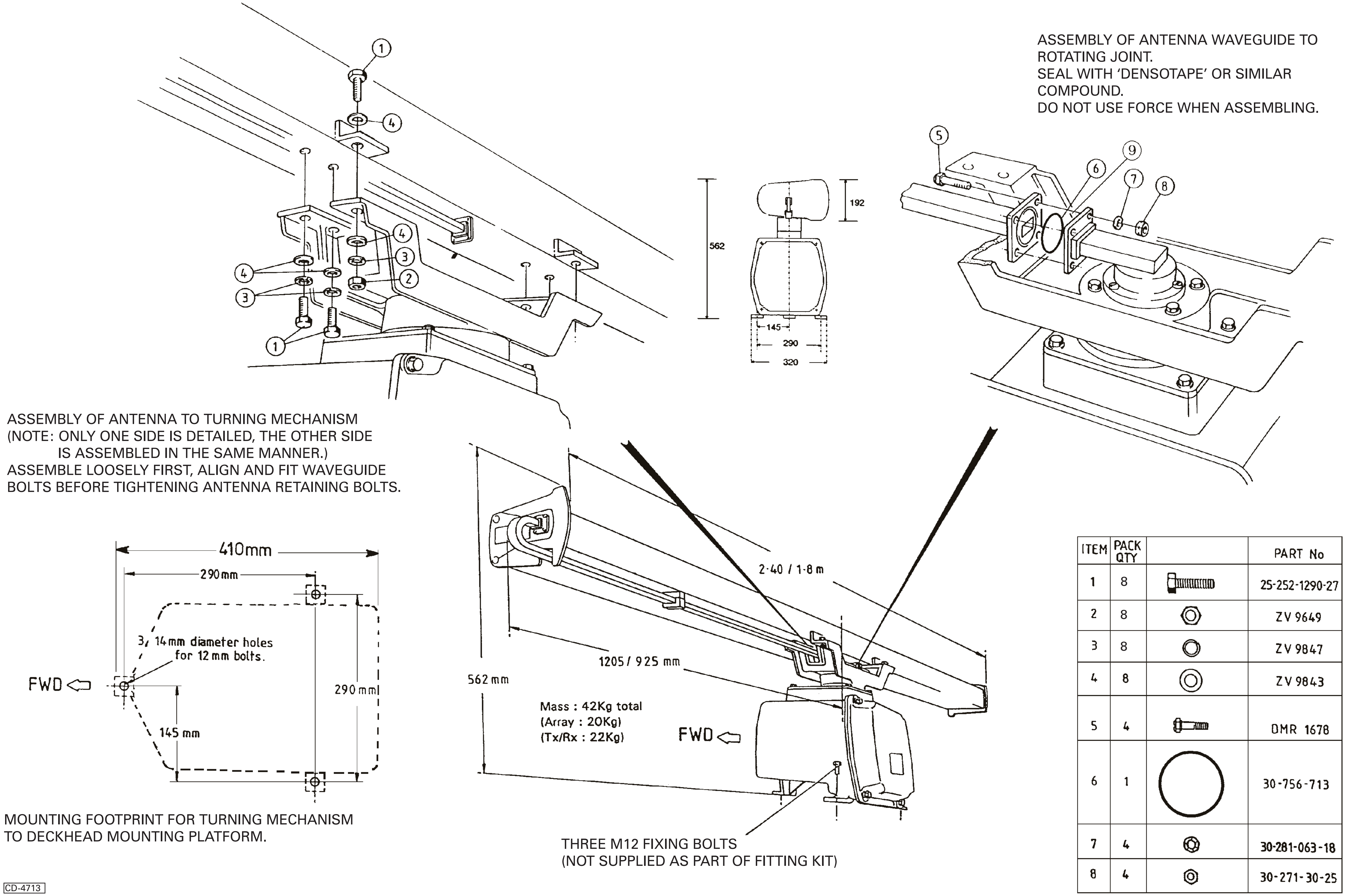

ITEM	PACK QTY		PART No
1	8		25-252-1290-27
2	8		ZV 9649
3	8		ZV 9847
4	8		ZV 9843
5	4		DMR 1678
6	1		30-756-713
7	4		30-281-063-18
8	4		30-271-30-25

Figure 3c - Assembling Antenna to Turning Mechanism

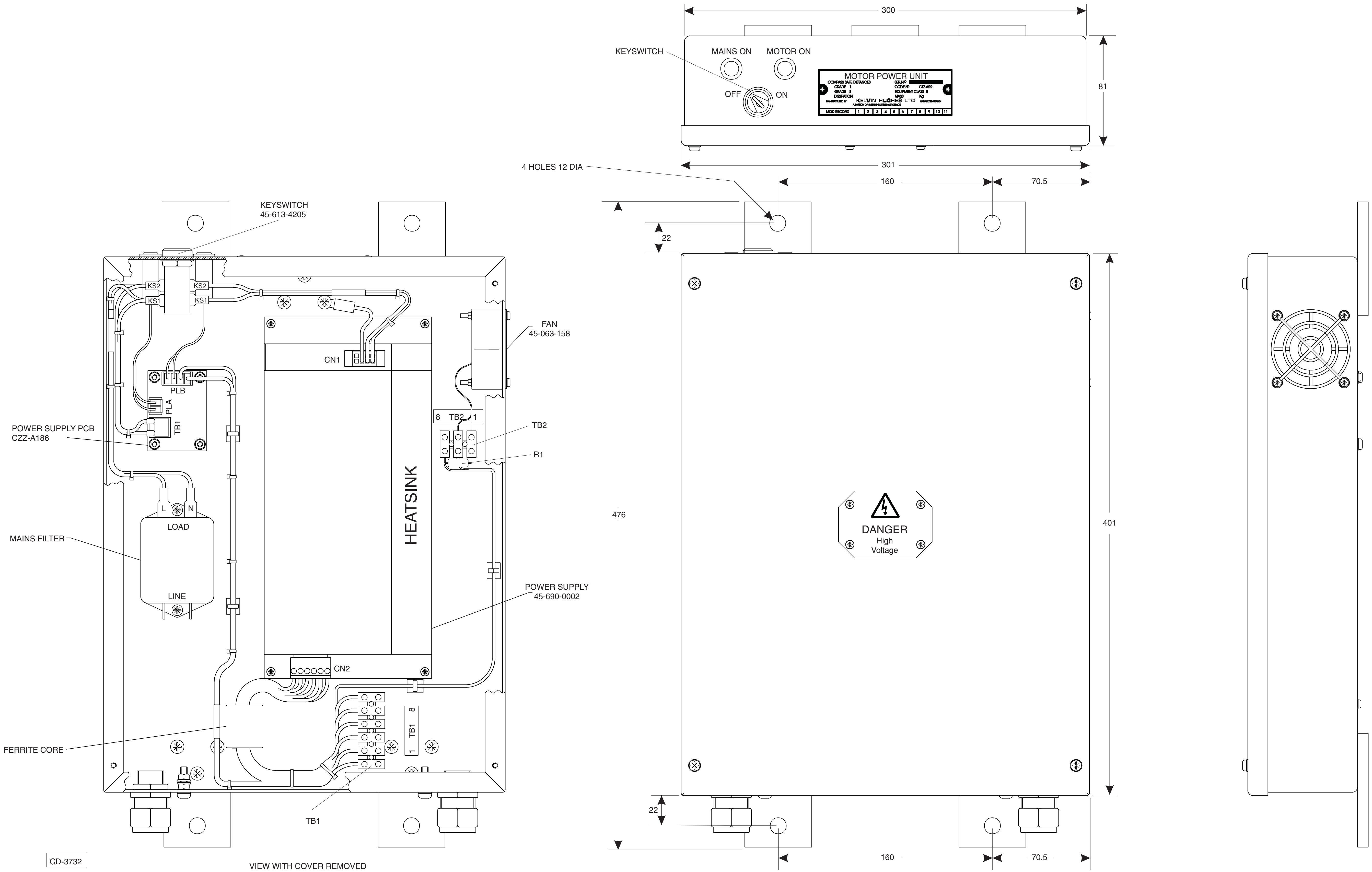

Figure 4c - 40V Power Supply CZZ-A22: Dimensions

ELECTRICAL CONNECTIONS

Cable Specifications

19 Each cable is identified by a letter code which defines the type of cable required, e.g. Cable code N is a 38-core cable. Table 1 provides specifications for each cable type. Table 2 provides 38-core cable, colour code abbreviations.

20 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.

38-Core Custom Built Cable

21 The 38-core composite cable (KH code number 5344-701) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0.2 mm copper wire.

(2) 32 cores of 16/0.2 mm copper wire.

(3) 2 cores of co-axial cable.

TABLE 1 - CABLE SPECIFICATION

CABLE	DESCRIPTION	CODE	CORE	DIAMETER
B	3-core small multi-core	1344-719	16/0.2	6.4mm 7.2mm
E	12-core small multi-core	1344-722	16/0.2	10mm 11mm
F	18-core small multi-core	1344-723	16/0.2	11.5mm 12.3mm
G	25-core small multi-core	1344-724	16/0.2	13.6mm 14mm
H.	TO BE SUPPLIED BY CONTRACTOR			
J	Co-axial 75 ohms double screened	5344-705	7/0.07	7mm
K	2-core Power	1344-1123	7/0.67	12mm
N	38-core small multi-core	5344-701		
P	Co-axial (Low Loss) Type ECL 125	5344-719 (for long cable lengths only)	Varies	8.3mm

TABLE 4.1 - 38-CORE CABLE COLOUR ABBREVIATIONS

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
W	WHITE
Bk	BLACK
Bn	BROWN
V	VIOLET
O	ORANGE
P	PINK
T or Lt/G	TURQUOISE or LIGHT GREEN
S	SLATE (grey)
R/B	RED/BLUE
R/G	RED/GREEN
R/Y	RED/YELLOW
R/W	RED/WHITE
R/Bk	RED/BLACK
R/Bn	RED/BROWN
B/Y	BLUE/YELLOW
B/W	BLUE/WHITE
B/Bk	BLUE/BLACK
B/O	BLUE/ORANGE
G/Y	GREEN/YELLOW
G/W	GREEN/WHITE
G/Bk	GREEN/BLACK
G/O	GREEN/ORANGE
G/S	GREEN/SLATE
Bn/Bk	BROWN/BLACK
Bn/Y	BROWN/YELLOW
Bn/W	BROWN/WHITE
S/B	SLATE/BLUE

Small Multi-Core Cables

22 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.

23 Core Details

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

24 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.

25 Outer Sheath

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

26 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 1600Hz.

Power Cables

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

2-Core (Power):

Cable Code Kit:	KH Reference No. 1344-1123
250/440V grade:	7 x 0.67mm cores Cross linked polythene insulation braided with 0.2mm diameter tinned copper wire, 79% coverage, low smoke, zero halogen outer sheath.
Outer Diameter:	9.95mm

Co-axial Cables

28 Where the distance between the Display and the Transceiver exceeds 60 metres, special co-axial cables and/or Sync and signal amplifiers may be required to obtain optimum results, consult Kelvin Hughes prior to installation of the cables.

Co-axial 75 ohms double screened

Cable Code J:	KH Reference No. 5344-705 2003A to CW1229C (BT1229B)
Specification:	
Inner Conductor:	0.61 mm single conductor
Dielectric:	Polyethylene
Screen:	Close knit braid - double screen
Overall Dia:	6.9 mm
Electrical	
Attenuation:	60MHz 9dB/100m MAX
Attenuation:	200MHz 18.5dB/100m MAX
Impedance:	75 Ohm

Co-axial Cable 75 ohms low loss (for extended cable runs)

Co-axial Cable:	CODE No. 5344-719 Type ECL 125 (Manufacturer's code)
Specification:	
Inner Conductor:	1.25 mm Single Conductor
Dielectric:	Air Spaced Polyethylene
Screen:	Tape Screen
Overall Dia:	8.3 mm
Electrical	
Attenuation:	60MHz 3.4dB/100m MAX
Attenuation:	100MHz 4.9dB/100m MAX
Attenuation:	200MHz 7.1dB/100m MAX
Impedance:	75 Ohm

Transceiver Wiring

29 Feed the 38-core composite cable into the Transceiver and prepare as instructed in Figure 5c. The earthing ferrules must be used.

30 Feed the 2-core cable from the Transmitter Monitor, if fitted, into the Transceiver.

31 Connect wires as shown in Figure 6c.

CHECKS AFTER FITTING

32 Setting to work instructions are described in Chapter 5. The antenna must be checked for security, freedom to rotate and that it does not foul any halyards or obstructions.

33 All cable entries must be checked for signs of fretting, chafing, water leakage or damage.

NOTE:

The fitting kit contains Densotape, which is used to seal the cable entries.

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1. Remove gland nut, plastic washer and seal and discard washer.

2. Thread cable (1N) through back of gland housing for approx 300mm.

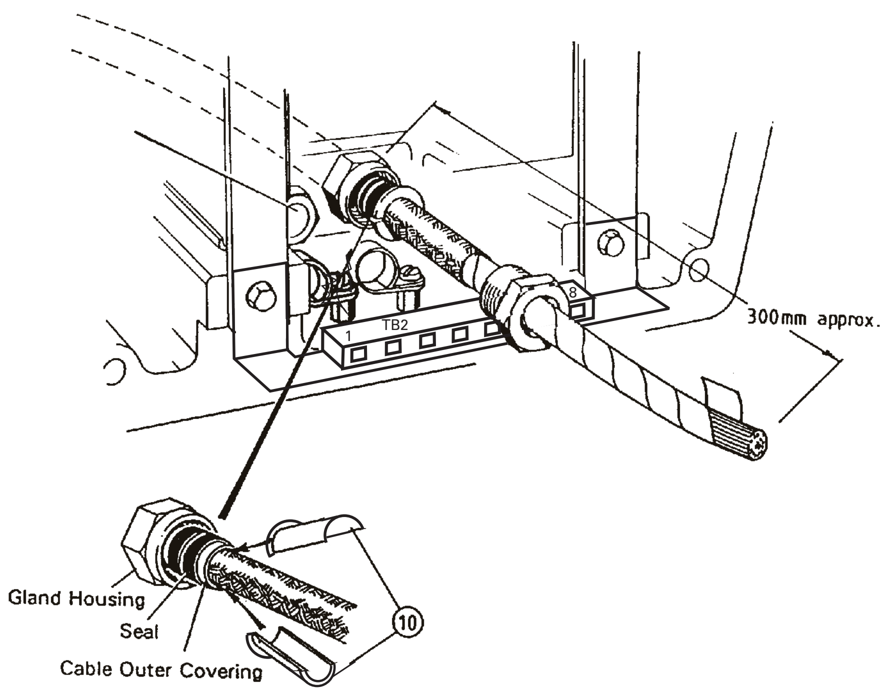
3. Remove cable outer covering (exposing braid) back as far as 15mm from the gland housing.

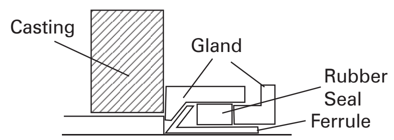
4. Fold braid double to 80mm from gland housing (remove excess).

5. Place seal over cable and onto outer covering at the gland housing.

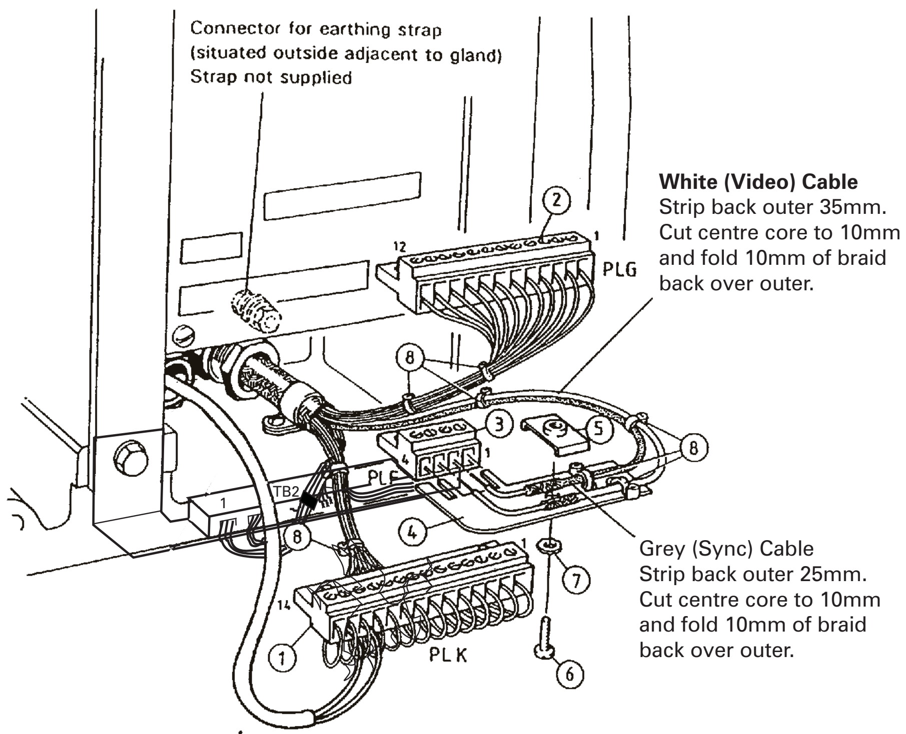
6. Insert the two screening ferrules (Item)10 between outer covering and screen braid at gland as shown.

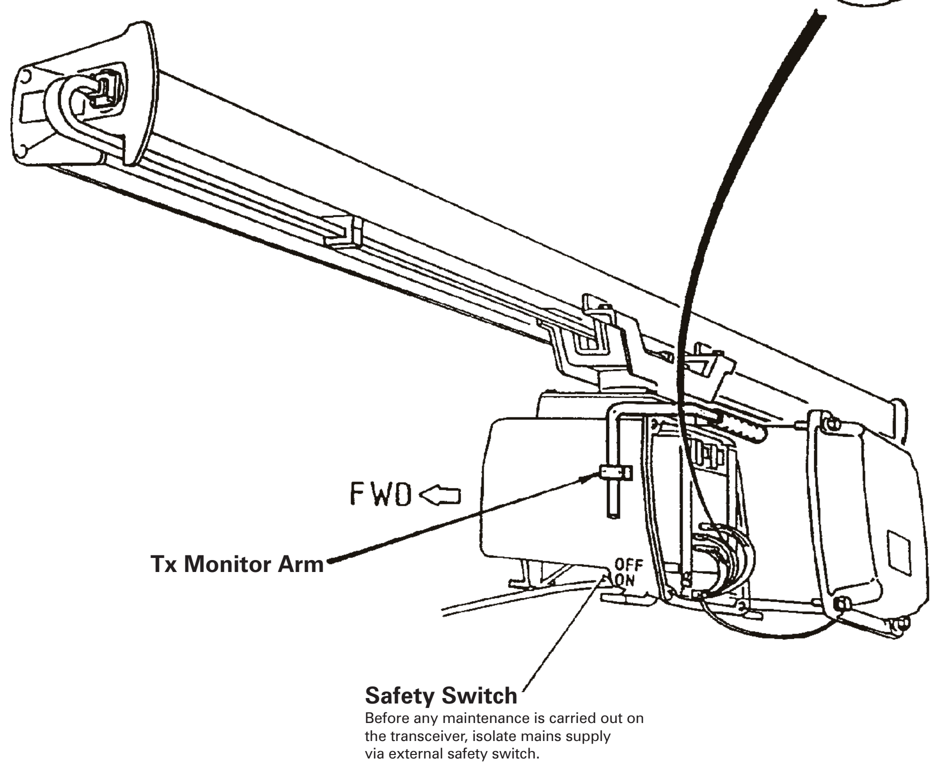
7. Place gland nut over cable and screw assembly into gland housing and secure screening and cable with `P' clip, unwrap paper insulation back to screening and discard.





ITEM	PACK QTY		PART No.
1	2		45-718-5144
2	2		45-718-5143
3	2		45-718-5163
4	2		CDY-4031
5	2		CDY-A425
6	2		20-233-1101-27
7	2		20-282-5006-25
8	22		30-762-502-00
9	2		45-716-6027
10	2		CAE 4054





CD-3731

Figure 5c - 38-Core Composite Cable: Installation

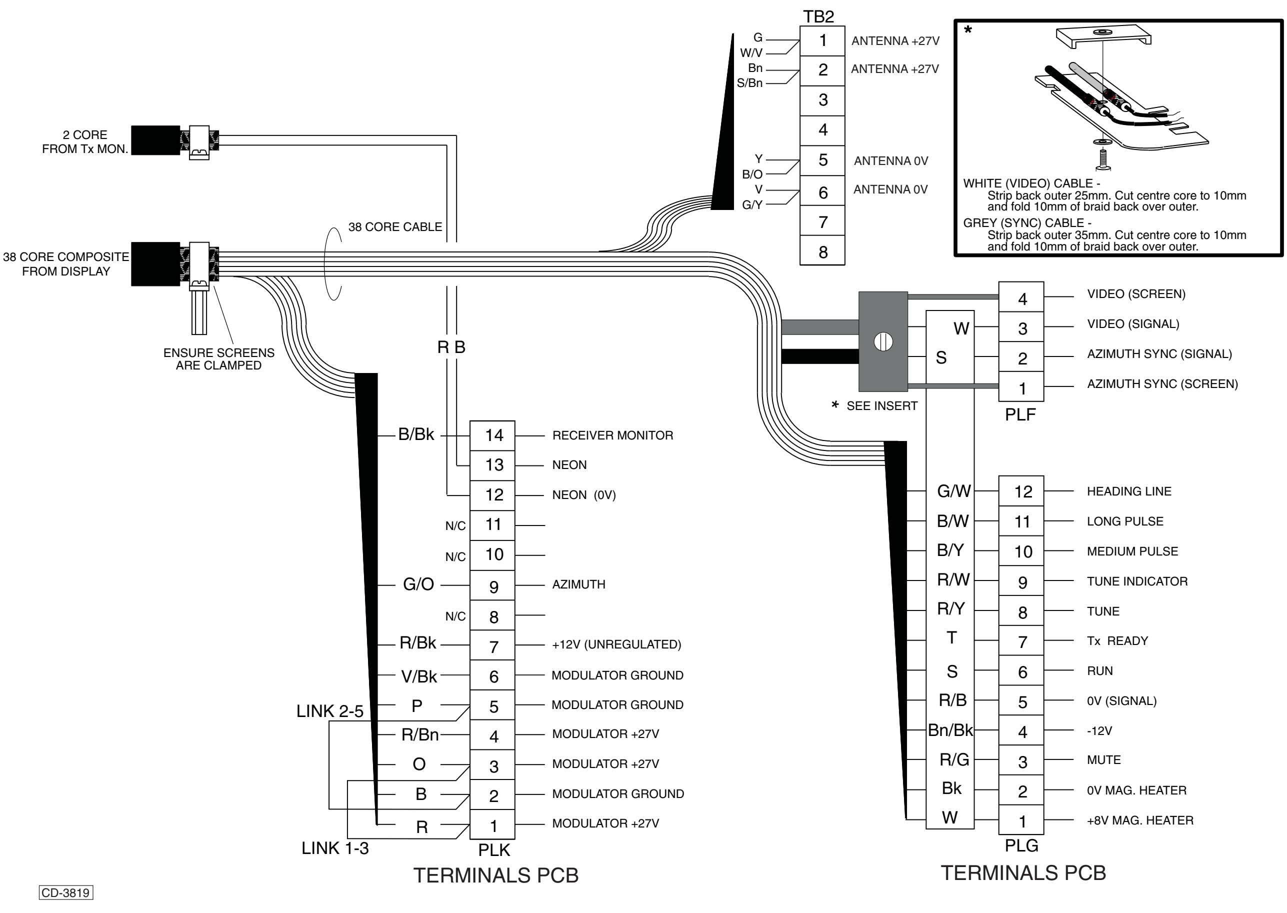


Figure 6c - Connection Diagram (CAE-A30-7)

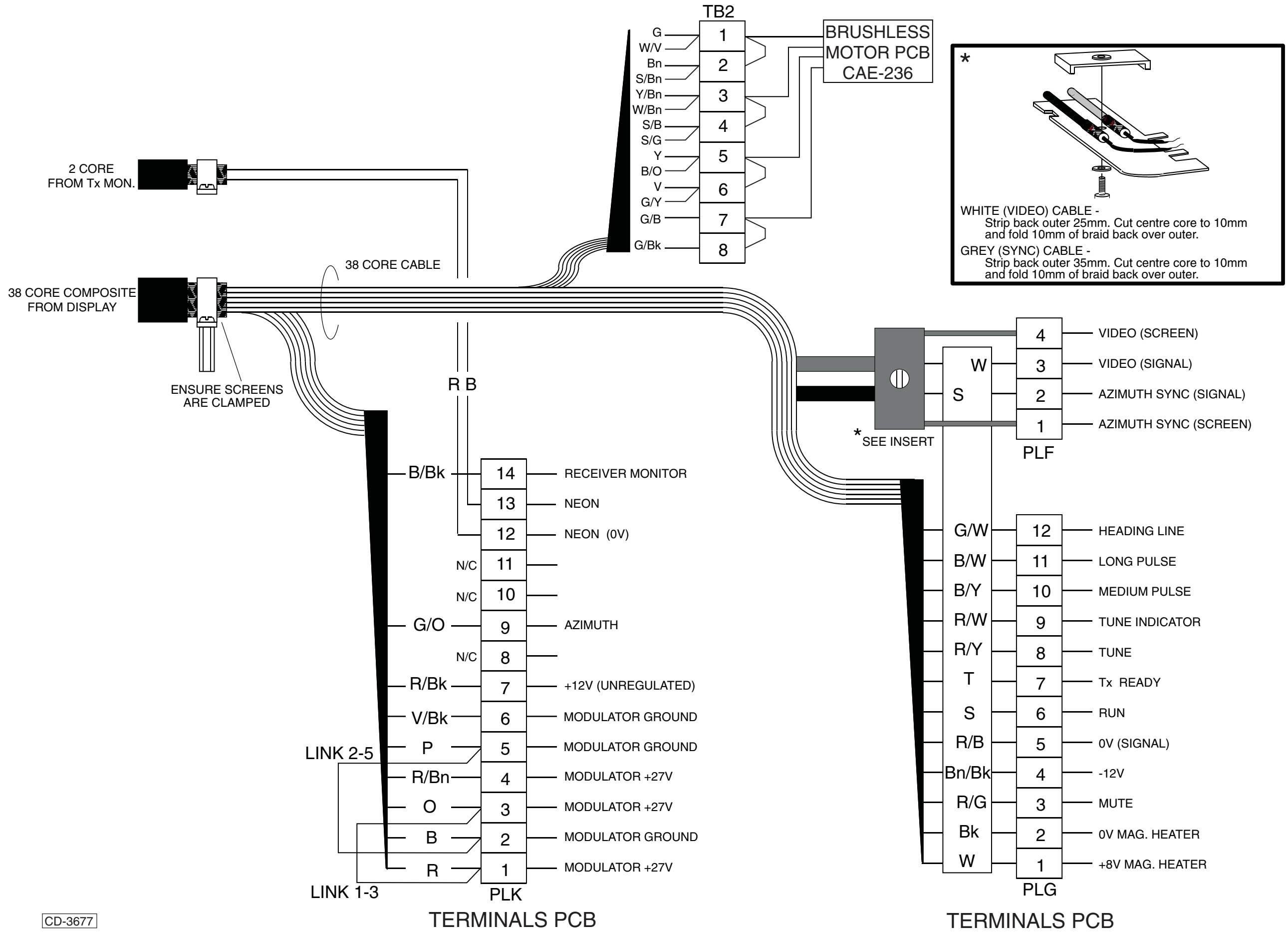


Figure 7c - Connection Diagram (CAE-A30-8)

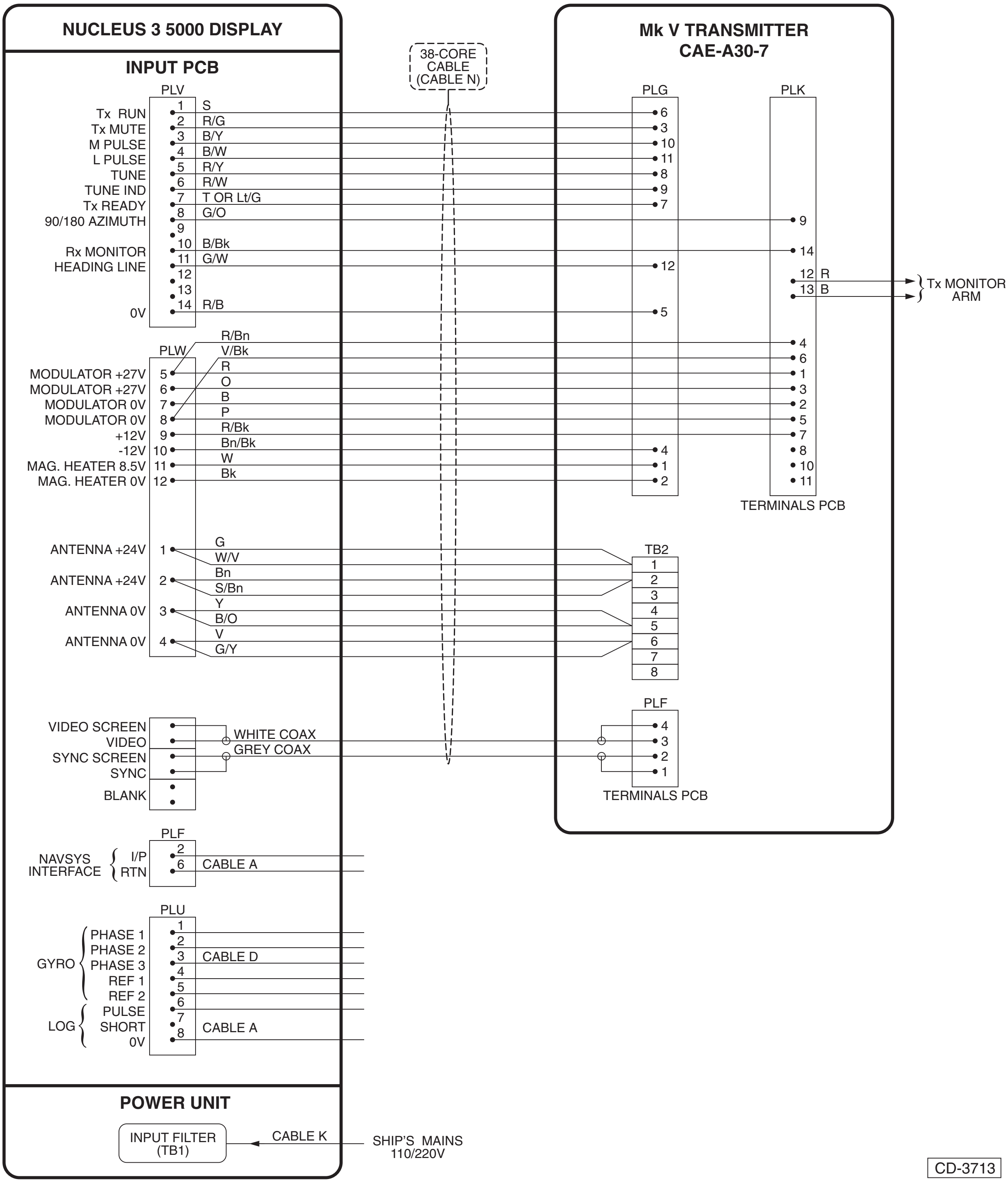


Figure 8c - Typical Low Speed Antenna System Interconnection (CAE-A30-7)

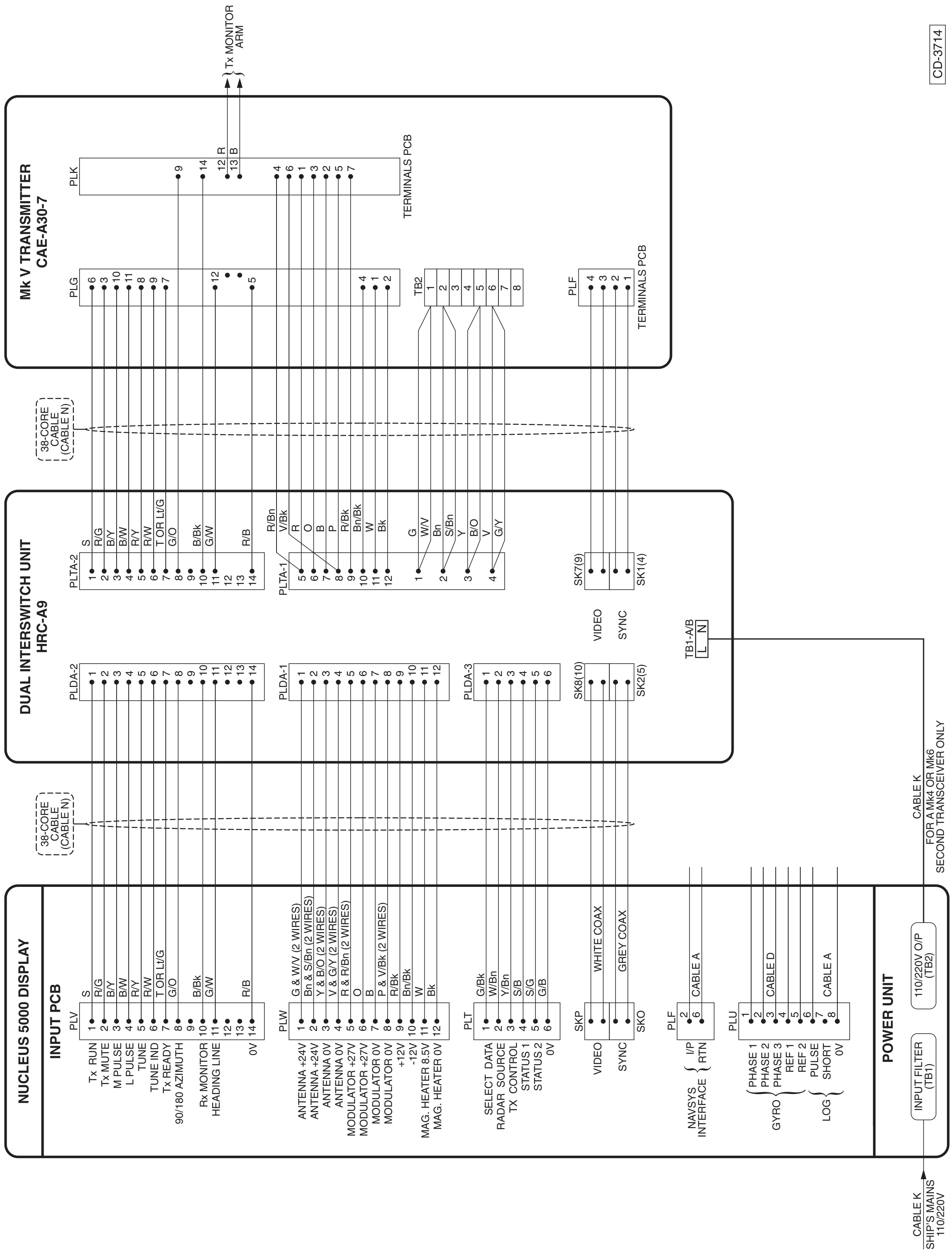


Figure 9c - Low Speed Antenna Interswitched System Interconnections (CAE-A30-7)

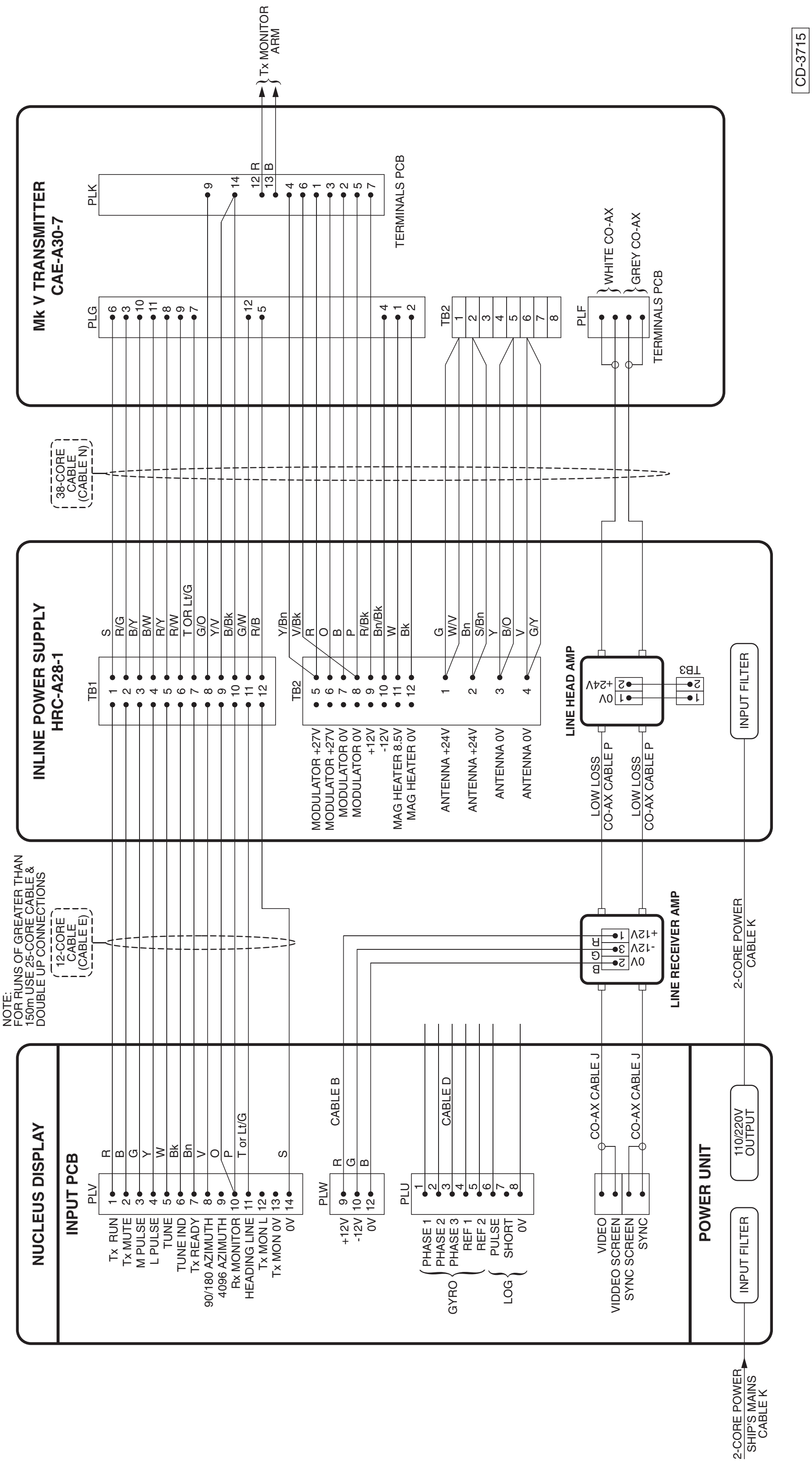


Figure 10c - Low Speed Antenna A typical System Interconnection with Long Cables (CAE-A30-7)

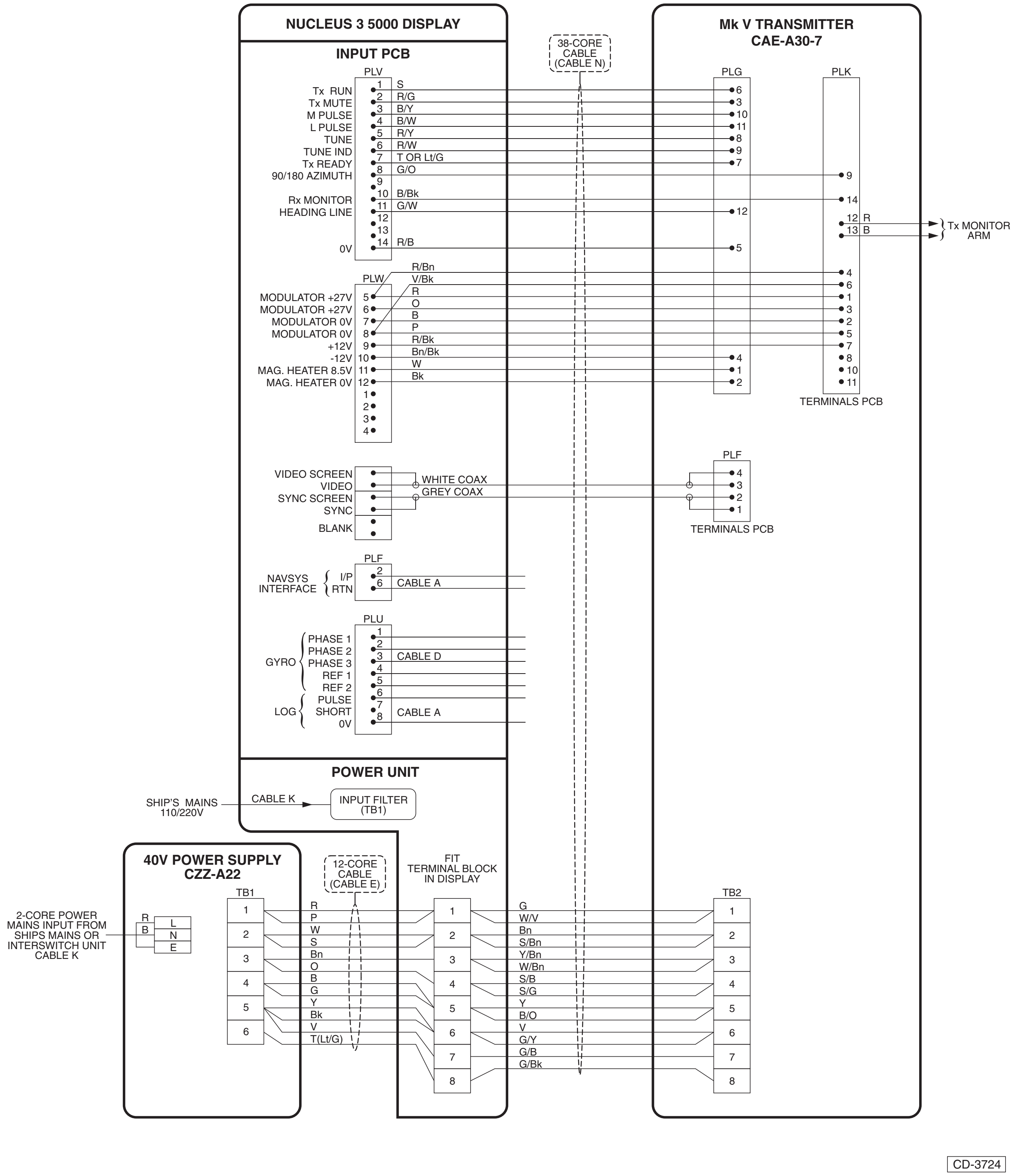


Figure 11c - Typical High Speed Antenna System Interconnections (CAE-A30-8)

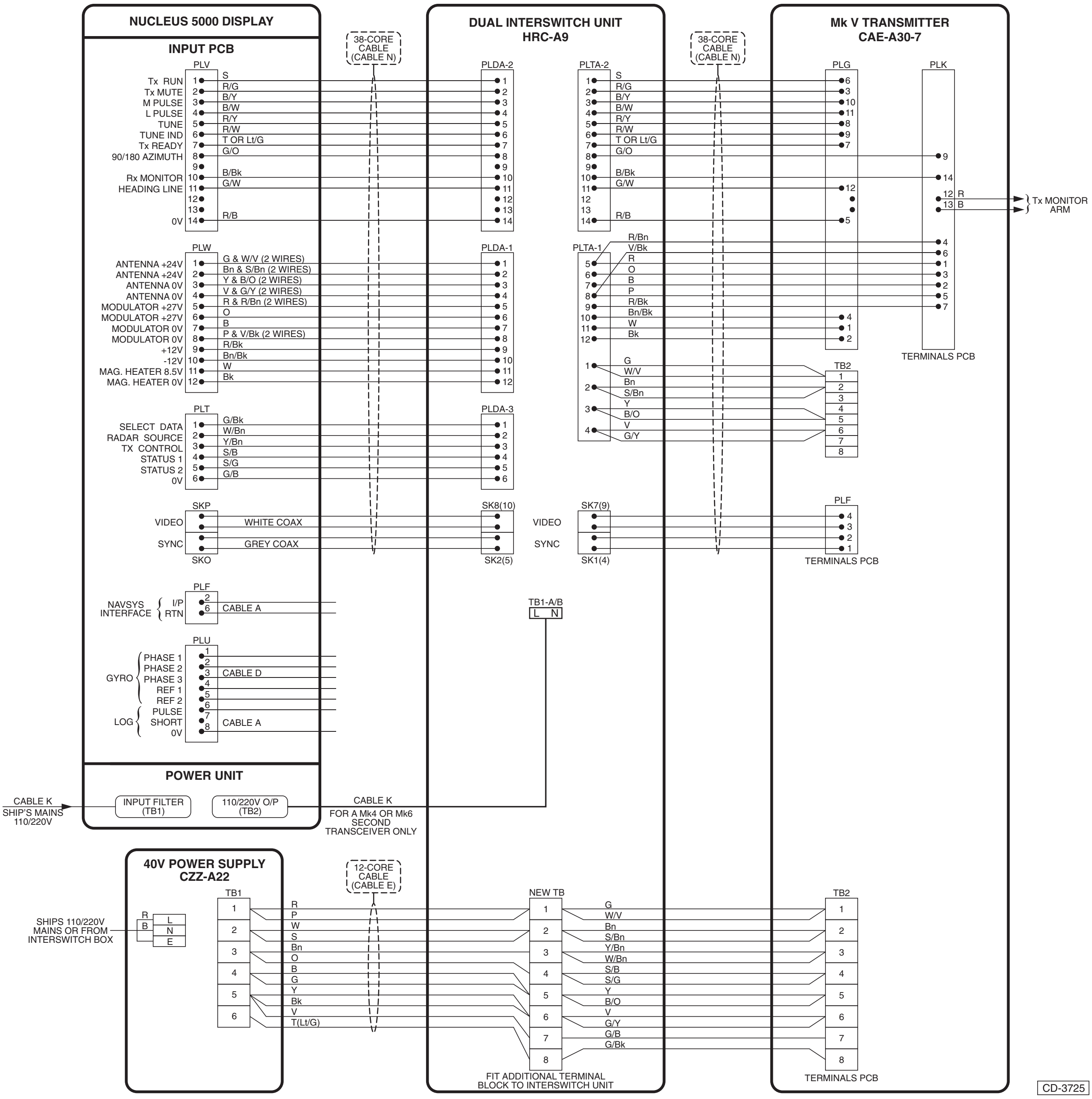


Figure 12c - High Speed Antenna Interswitched System Interconnections (CAE-A30-8)

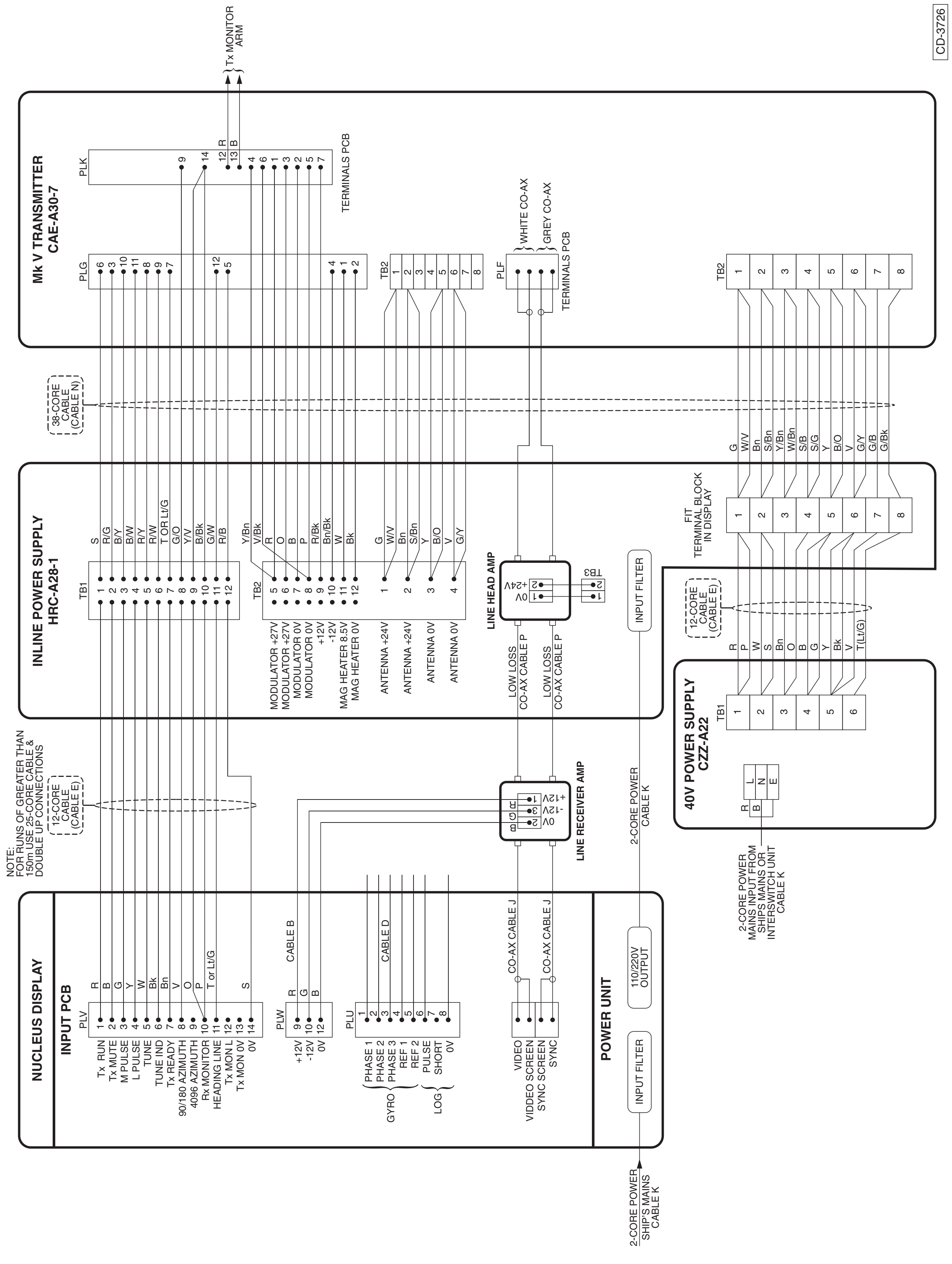


Figure 13c - High Speed Antenna: A Typical System Interconnection with Long Cables (CAE-A30-8)

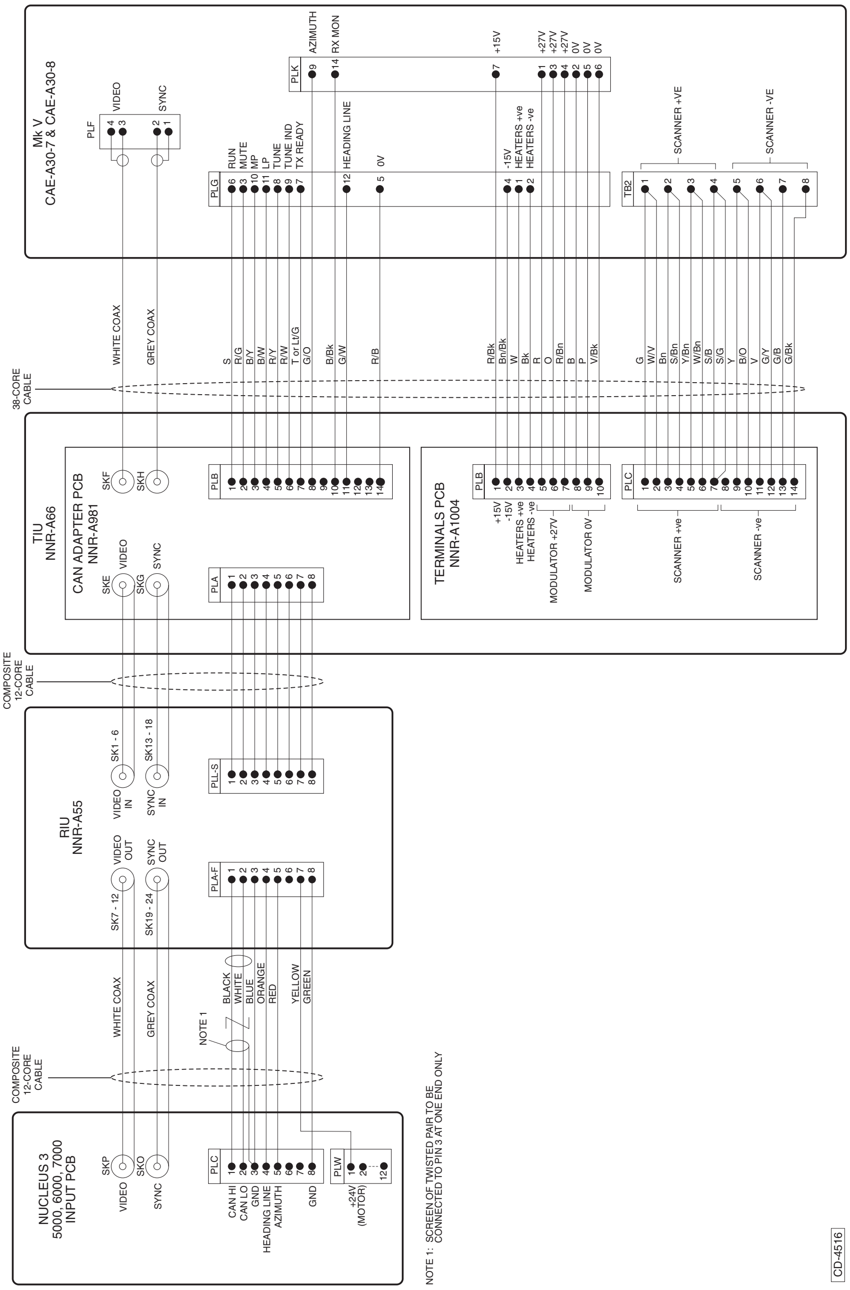


Figure 14c - Nucleus 3 Display - Radar Interswitch Unit - Transceiver Interconnections

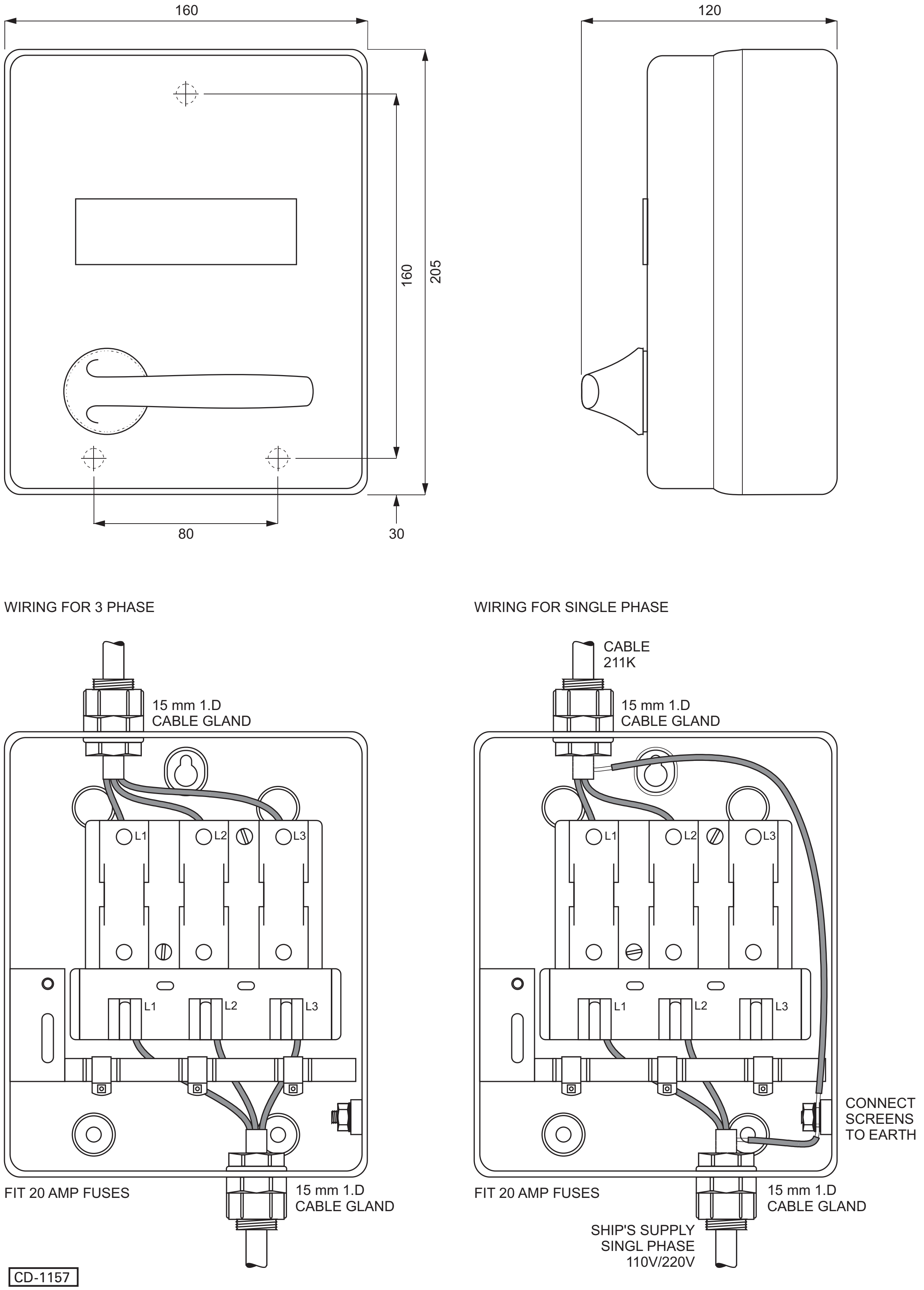


Figure 15c - Optional Mains Isolator: Installation Dimensions

OPTIONAL IN-LINE POWER SUPPLY UNIT

34 The In-Line PSU should be sited as close to the transceiver as possible.

35 Refer to Figure 16c for Installation details.

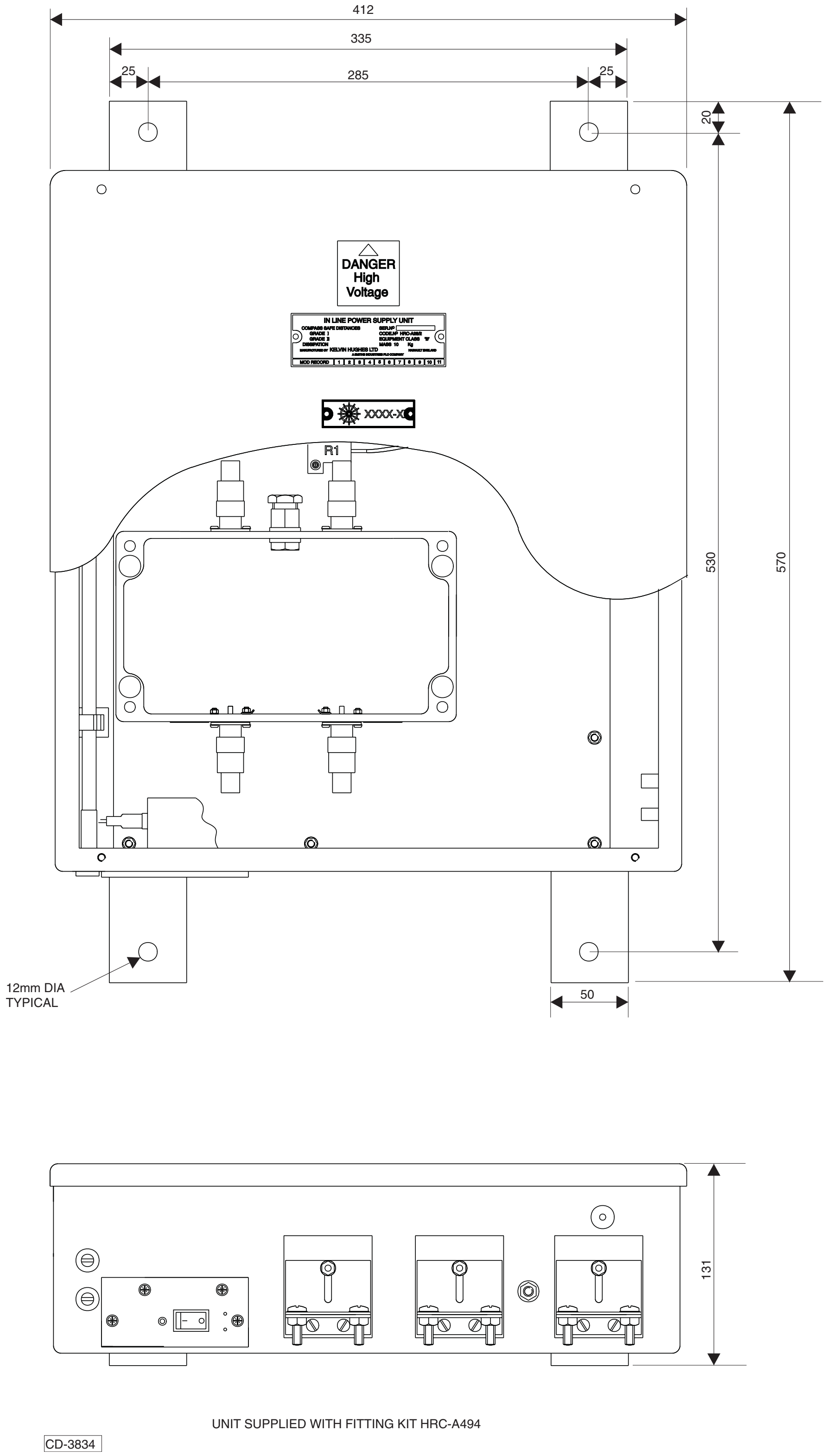


Figure 16c - Optional In-Line PSU: Installation Instructions

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CHAPTER 4D

INSTALLATION & INTERCONNECTIONS - TRANSCEIVER MKVI

INTRODUCTION

1 This Chapter provides information on installation of the system equipment. The overall chapter comprises a number of sections, each section covering the installation of the different equipment types that comprise the overall system.

2 This section covers Installation of the Mark VI Upmast Transmitter/Receivers. Two versions are available:

(1) Low Speed - 25rpm (CAE-A37).

(2) High Speed - 40rpm (CAE-A45).

MAXIMUM RECOMMENDED WAVEGUIDE LENGTHS

3 The following maximum waveguide lengths are recommended:

	Std Speed	High Speed
S-band	35m	20m

SOFT START UNIT

4 For cable runs of less that 60m both versions of the transceiver utilise a bulkhead mounted Soft Start Unit (CZZ-A14

5 Installations with interswitched units, or with long cable runs (i.e. greater than 60m) utilise a Soft Start Unit (CZZ-A14-2). This version of the Soft Start unit is fitted with an in-line power supply.

SAFETY NOTES

Observe the Health and Safety Notices at the front of this manual.

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

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

8 A working platform is to be provided for installing or servicing the assembly. This should be positioned approximately 1 metre below the base of the Turning Mechanism housing with a guard rail surrounding it.

9 The Antenna and Turning Mechanism must be hoisted to the fixing position using a secured block and tackle or rope strops.

10 Safety personnel must ensure that unauthorised persons **do not** encroach on the area of work.

11 The Antenna and Turning Mechanism **MUST NOT** be lifted by the array, but the complete unit secured and hoisted evenly.

EQUIPMENT LOCATION

UPMAST TX/RX (CAEA37/A45) AND TURNING MECHANISM (CAE-A41/42)

12 The Upmast Turning Mechanism 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.

13 The Upmast Turning Mechanism **must not** be mounted where the temperature exceeds 70°C.

14 The Upmast Turning Mechanism must be kept clear of ship's flexible communication aerials to avoid damage to both.

15 The Upmast Turning Mechanism must be mounted more than 914 mm above any flat surface, when the flat surface is greater than the diameter swept by the antenna.

16 The Upmast Turning Mechanism must not be positioned in the close proximity of any magnetic compass or D/F aerial, etc.

SOFT START UNIT

17 The Soft Start Unit must be sited as follows:

(1) Upmast installation, using Soft Start Unit (CZZ-A14) - near the display.

(2) Upmast installation with long cable run, using Soft Star Unit (CZZ-A14-2) - near the transceiver/turning mechanism.

18 The Soft Start Unit must be sited to allow removal of the front cover.

OPTIONAL MAINS ISOLATOR (80-261-600)

19 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

SOFT START UNIT (CZZ-A14 and CZZ-A14-2)

Fitting Thermal Overload Trip Unit To Soft Start Unit (CZZ-A14)

20 The thermal overload trip unit is supplied with the gearbox fitting kit.

21 Remove the soft start unit cover by releasing the four captive screws.

22 The trip unit, shown in Figure 1d, clips on the side of the contactor and is secured in position with relay termination screws 2T1, 4T2, 6T3, 14NO and A2.

23 Connect the cableform wires as shown in Table 1.

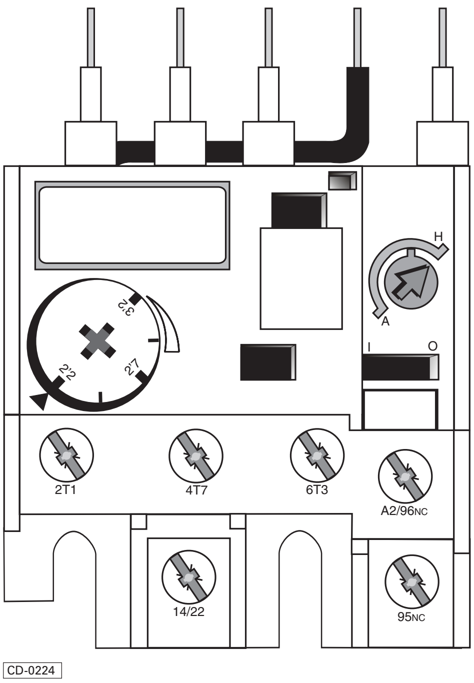
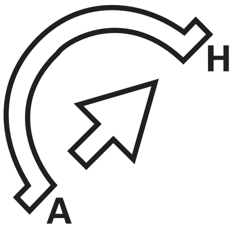


Figure 1d - Thermal Overload Trip Unit

TABLE 1: Trip Unit Cableform Connections

TERMINAL No.	WIRE COLOUR	WIRE No.	MARKERS	FROM
14/22	P	16	BN/BU	A2
95NC	P	28	R/S	KEYSWITCH
2T1	BK	-	-	NEON
	P	10	BN/BK	TB1-1
4T2	P	11	BN/BN	TB1-2
6T3	P	12	BN/R	TB1-3
A2/96NC	P	23	R/O	PCB SKA
	P	16	BN/BU	14/22

24 Set the blue trip button to the H (handset) position.



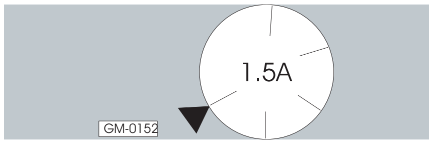
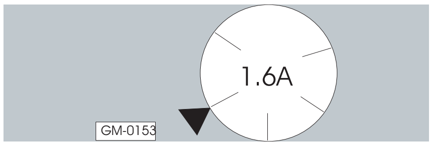
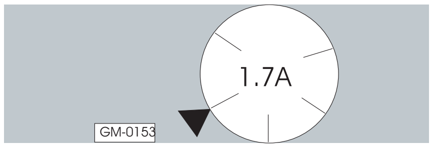
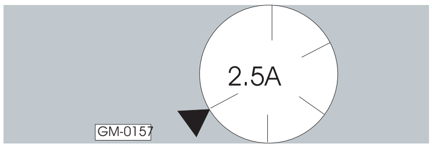
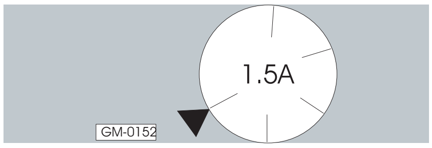
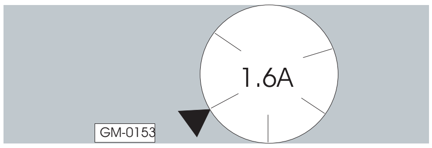
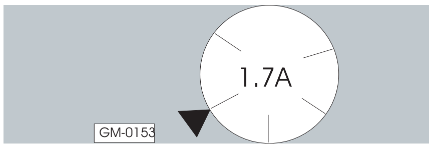
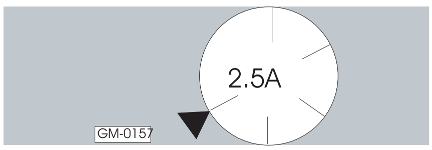
CD-0225

25 Set the dial position on the trip unit to the position shown in Table 2.

FITTING THE SOFT START UNIT

26 Fit the soft start unit to the securing bulkhead using the installation bolts supplied with the fitting kit. Refer to Figure 2d for dimensions.

TABLE 2: Trip Unit Dial Positions

ANTENNA SPEED	MOTOR VOLTAGE	THERMAL OVERLOAD TRIP UNIT - PART NO.	DIAL POSITION
25 rpm	440 V	45-617-1156-04	
25 rpm	415 V	45-617-1156-04	
25 rpm	380 V	45-617-1156-04	
25 rpm	220 V	45-617-1156-06	
40 rpm	440 V	45-617-1156-04	
40 rpm	415 V	45-617-1156-04	
40 rpm	380 V	45-617-1156-04	
40 rpm	220 V	45-617-1156-06	

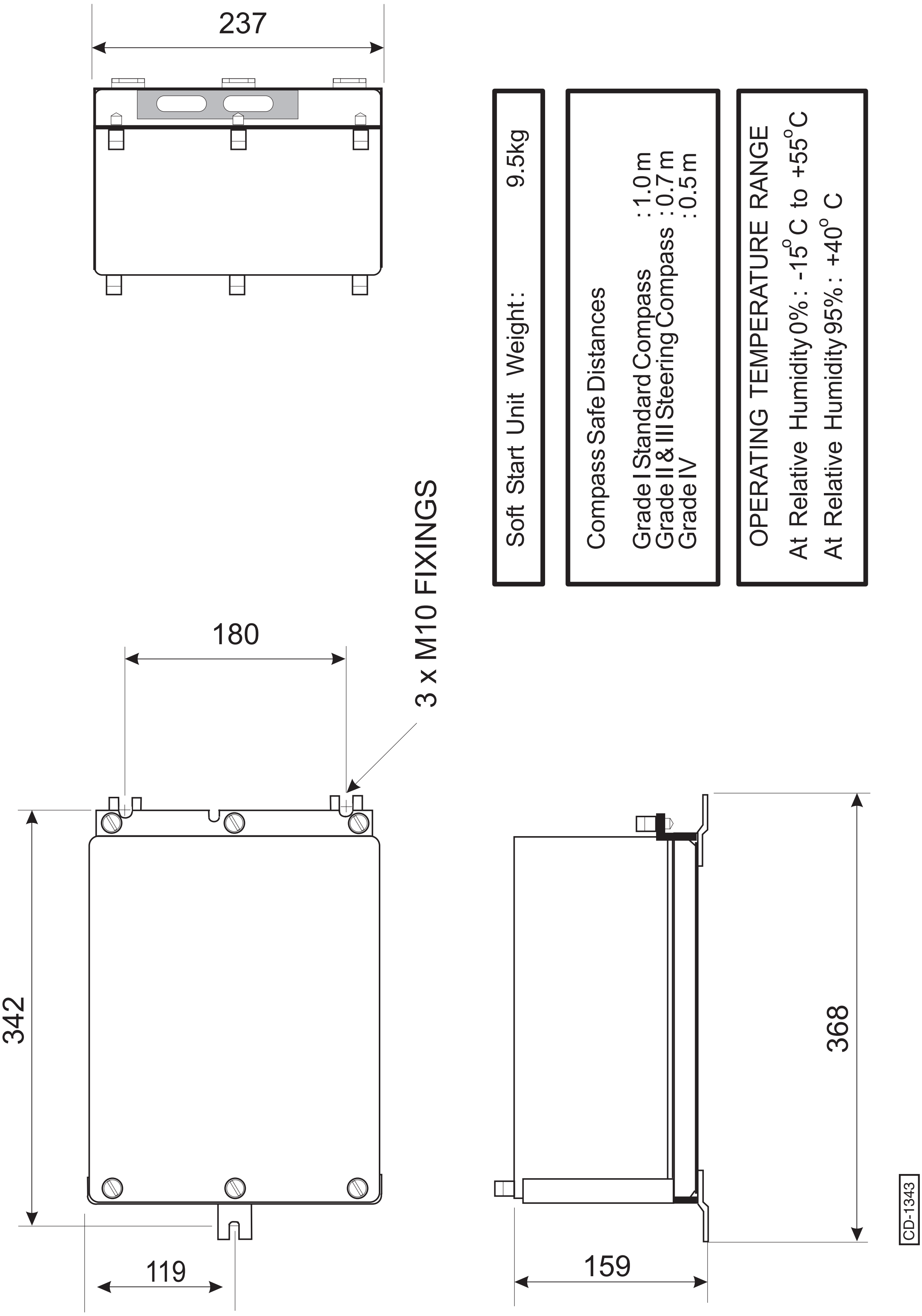
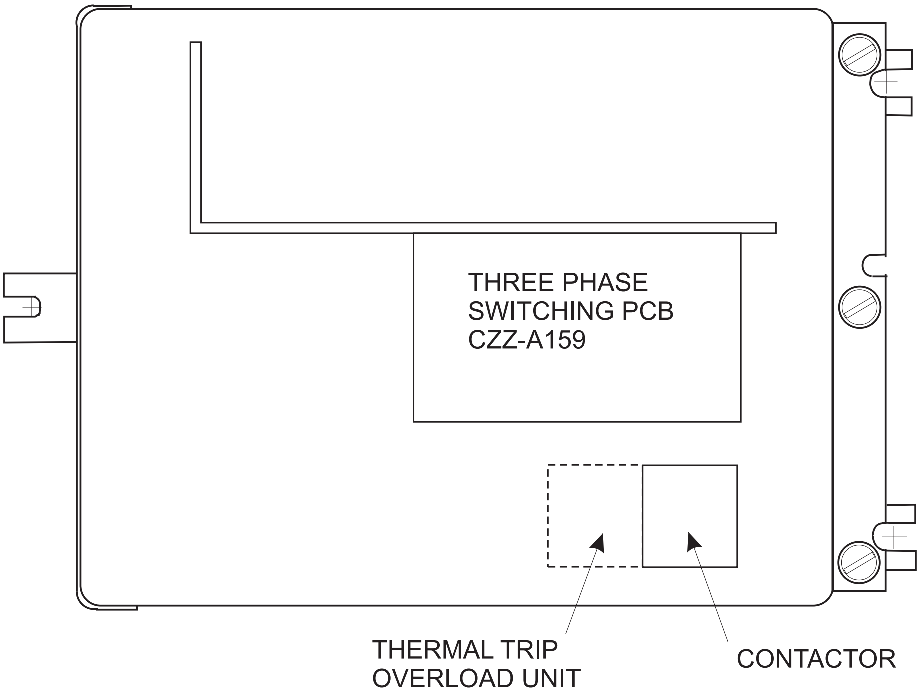
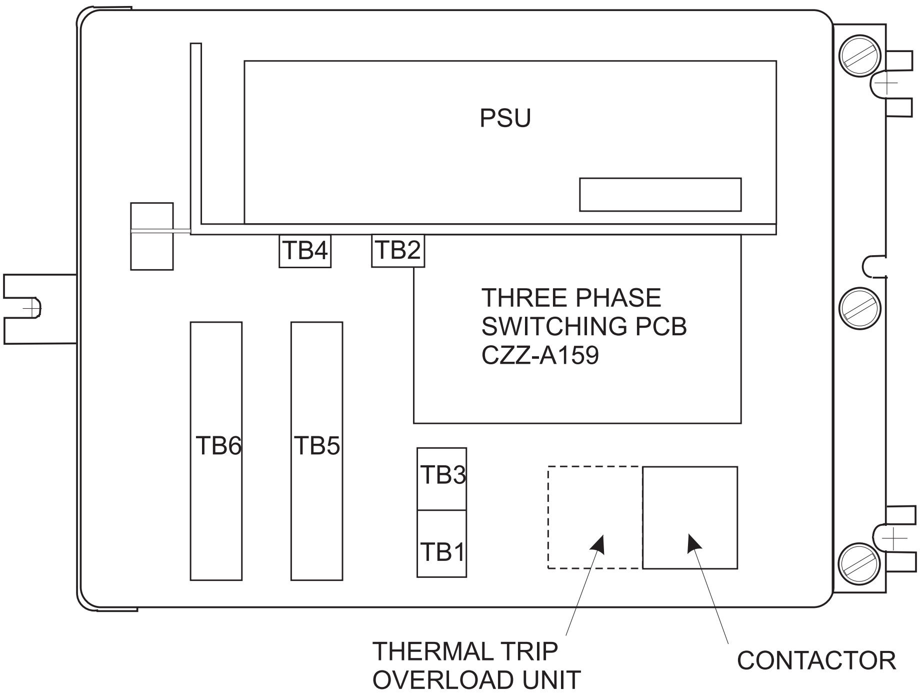


Figure 2d - Soft Start Unit (CZZ-A14): Installation Diagram



SOFT START UNIT CZZ-A14



SOFT START UNIT WITH INLINE PSU CZZ-A14/2

CD-0214

Figure 3d - Soft Start Unit (CZZ-A14-*): Component Layout

UPMAST TRANSCEIVER (CAEA37) AND TURNING MECHANISM (CAE-A42/41)

CAUTION

When Unpacking The Antenna, Ensure That The Semi-rigid Co-axial Cables Are Not Kinked, Crushed Or Bent. Support The Antenna Near Its Centre When Lifting It Out Of Its Packing And When Fitting It Into Position On The Turning Mechanism. Do Not Handle The Antenna By The Semi-rigid Co-axial Cable Input.

27 The Upmast Transceiver/Turning Mechanism is supplied in two parts:

(1) Transceiver with gearbox.

(2) Antenna.

28 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/turning mechanism.

29 When mounting the upmast turning mechanism observe the following:

(1) Use the fitting pack supplied with the equipment (refer to Figure 4d). The fitting pack contains fixings that have been tested to withstand the stresses detailed in paragraph 33.

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

(3) For upmast transceivers/turning mechanisms mounted in excess of 1.8m 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.

30 With reference to Figures 4d and 5d, install the upmast turning mechanism as follows:

(1) Fit the coupling element and sealing ring to the antenna connector.

(2) Fit the antenna to the upmast turning mechanism, ensuring that the connectors are aligned, and loosely secure using the eight M10 retaining bolts, washers and nuts.

CAUTION

When Rotating The Antenna Do Not Apply Excessive Force.

Ensure that the Semi-rigid Coax Assembly, on The Underside Of The Antenna, Is Not Crushed Or Damaged.

(3) Secure the co-axial connector using the three M6 bolts and washers provided.

(4) Tighten and torque load the eight antenna retaining bolts to 25 Nm.

CAUTION

Failure To Fit Antenna Spoilers Will Reduce System Life And Render The Radar Inoperative In High Winds.

(5) Fit the spoilers to the antenna using the fittings supplied.

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

(7) For semi-rigid cable access mark out and drill a 100 mm hole in the mounting platform, as shown on Figure 4d.

NOTE:

The upmast transceiver/turning mechanism is supplied with four M12 bolts, washers and fibre washers. These may be removed, but not discarded, and replaced with eye bolts. Once the upmast transceiver/turning mechanism is in position, the eye bolts are to be removed and replaced with the original bolts.

WARNINGS

THE UPMAST TRANSCEIVER/TURNING MECHANISM MUST NOT BE LIFTED BY THE ANTENNA AND MUST BE HOISTED TO THE FIXING POSITION USING A SECURED BLOCK AND TACKLE, OR, IF NO EYE BOLTS ARE FITTED, BY ROPE STROPS.

DO NOT FIT EYE BOLTS IF THERE ARE NO EXISTING FITTINGS.

(8) Install the upmast turning mechanism at the mounting position, ensuring correct orientation. 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.

(9) Secure the upmast turning mechanism with the four M16 bolts supplied and torque load them to 120Nm.

Optional Tx Monitor Arm (CAE-A38)

NOTE:

The Tx Monitor Arm is connected to the Control PCB.

31 The Monitor Arm is an optional item and is fitted to the outer casing. The Monitor Arm cable feeds through the small gland beside the aerial motor

32 Using a 12 mm spanner, release the six bolts securing the rear cover to the Turning Mechanism and remove the cover.

33 Route the Tx Monitor Arm cableform as shown in Figure 8d.

34 Connect the Tx Monitor Arm cableform to the Heading Line PCB (CAE-A180) as follows: red to 9PLA 7 and blue to 9PLA 8.

35 Refit the rear cover and secure using the six bolts.

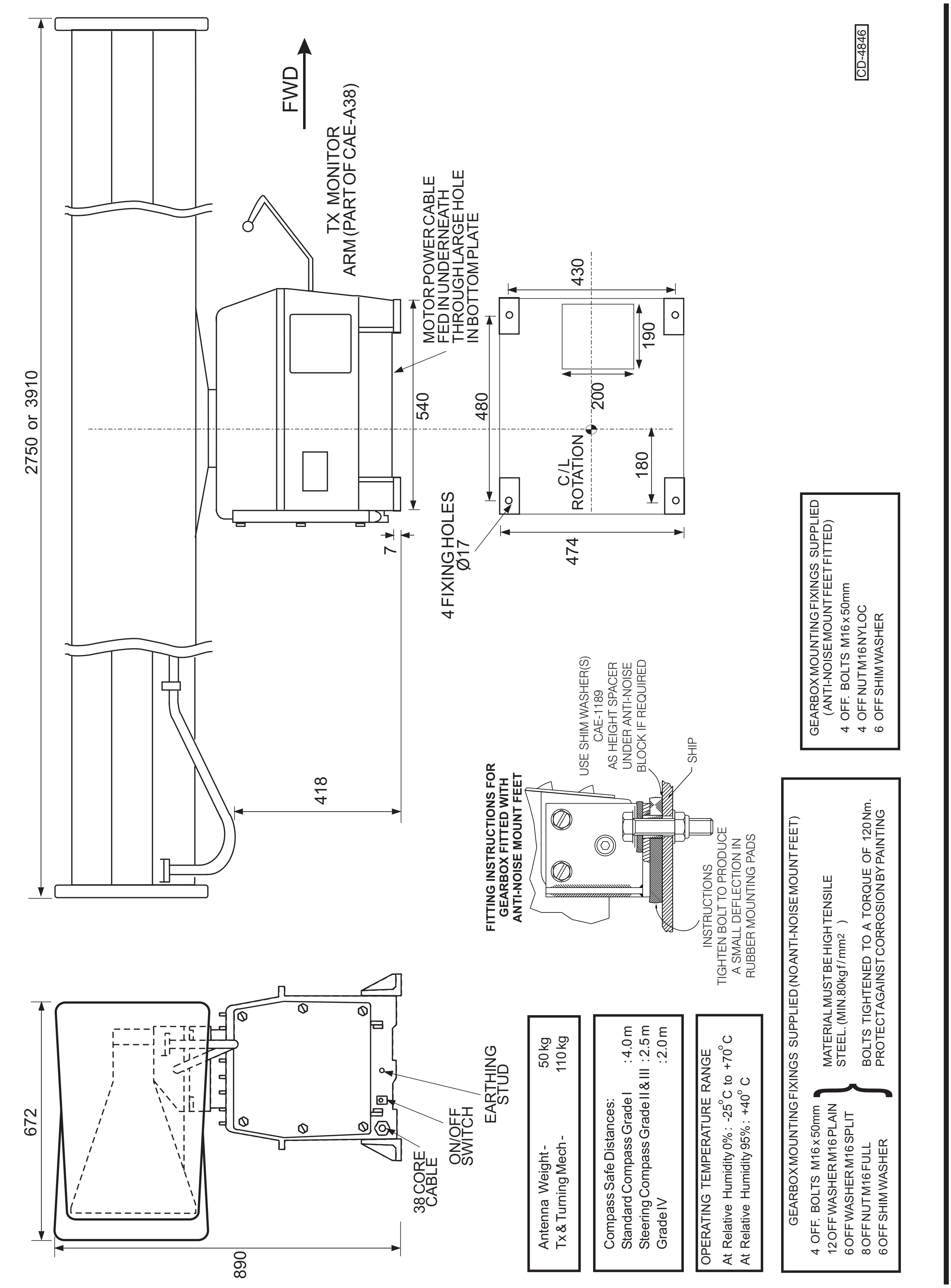


Figure 4d - Transceiver (CAE-A37/A45), Turning Mechanism (CAE-A41, A42) and Antennas: Installation Dimensions

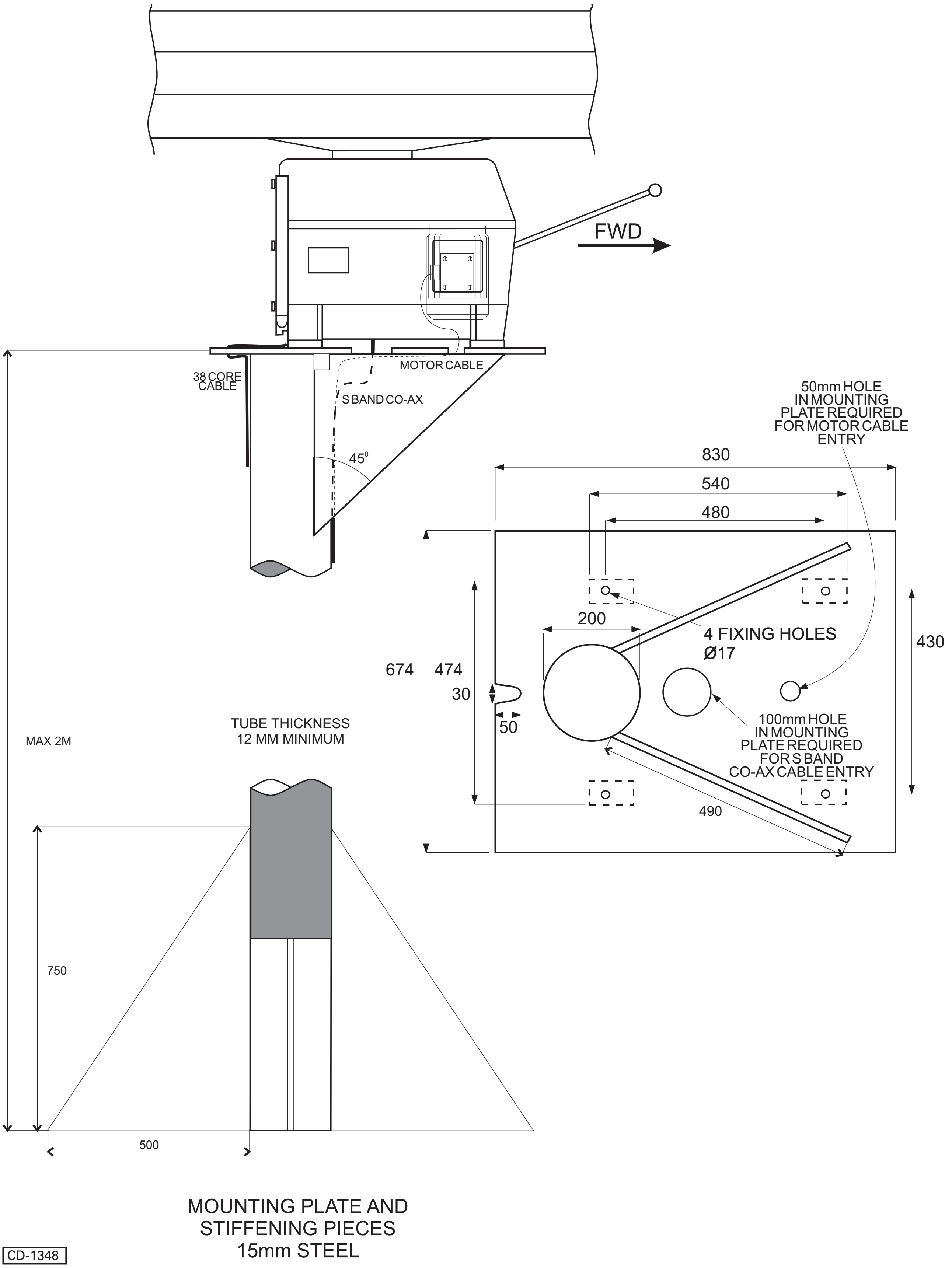


Figure 5d - Upmast Turning Mechanism: Mast Mounting

OPTIONAL MAINS ISOLATOR (80-261-600)

36 Refer to Figure 6d and secure the Mains Isolator in the required position (no fittings are supplied).

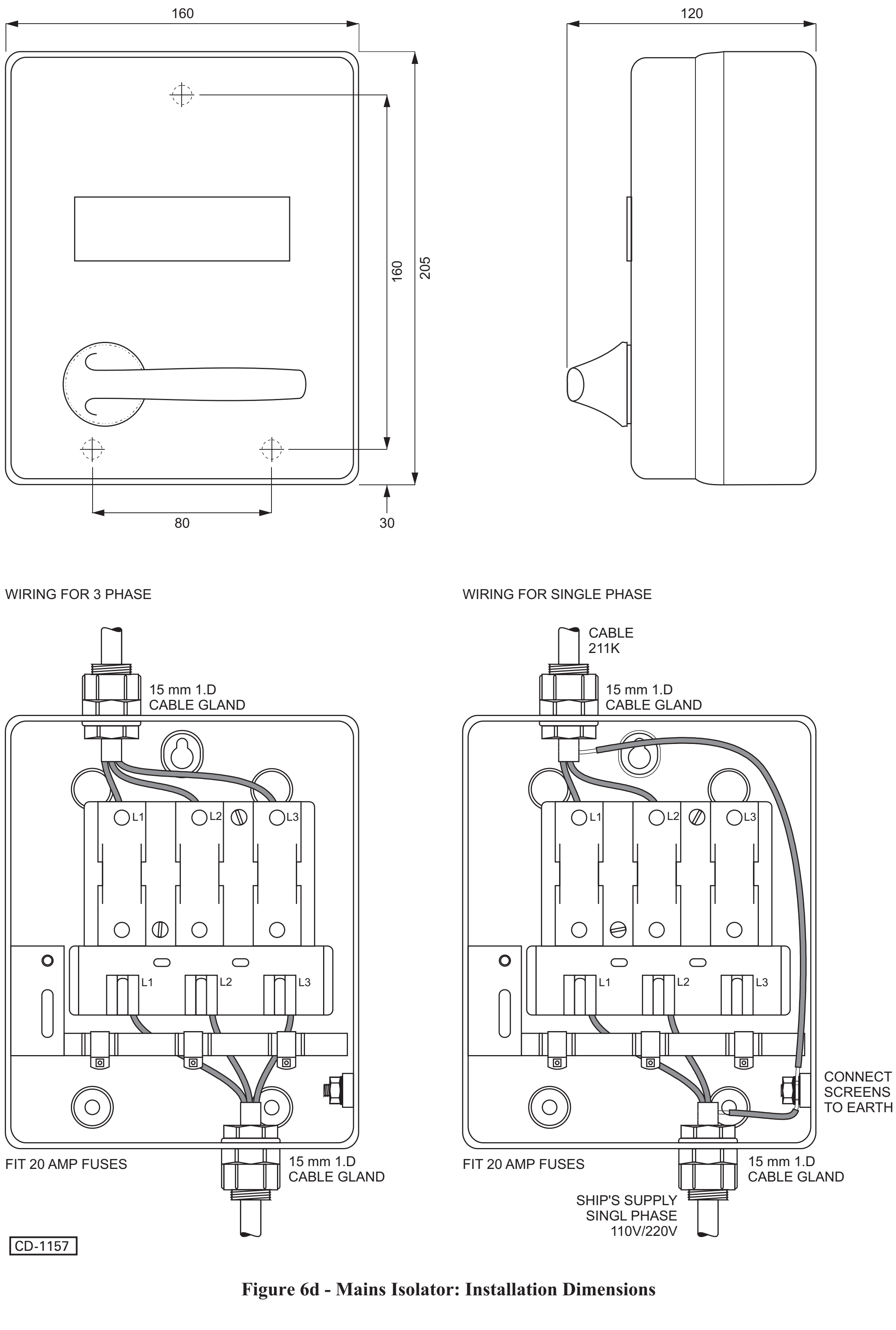


Figure 6d - Mains Isolator: Installation Dimensions

TABLE 4: 38-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
Bn	BROWN
V	VIOLET
O	ORANGE
P	PINK
T	TURQUOISE
S	SLATE (grey)
R/B	RED/BLUE
R/G	RED/GREEN
R/Y	RED/YELLOW
R/W	RED/WHITE
R/Bk	RED/BLACK
R/Bn	RED/BROWN
B/Y	BLUE/YELLOW
B/W	BLUE/WHITE
B/Bk	BLUE/BLACK
B/O	BLUE/ORANGE
G/Y	GREEN/YELLOW
G/W	GREEN/WHITE
G/Bk	GREEN/BLACK
G/O	GREEN/ORANGE
G/S	GREEN/SLATE
Bn/Bk	BROWN/BLACK
Bn/Y	BROWN/YELLOW
Bn/W	BROWN/WHITE
S/B	SLATE/BLUE
S/Bn	SLATE/BROWN
V/Bk	VIOLET/BLACK
V/Y	VIOLET/YELLOW
V/W	VIOLET/WHITE
W/R	WHITE/RED

TABLE 4 (Cont.): 38-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
W	WHITE
Bk	BLACK

12-core Composite Cable

37 The 12-core composite cable (KH code number 45-762-0041-001) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0.2 mm copper wire.

(2) 4 cores of 16/0.2 mm copper wire.

(3) 2 cores of 16/0.2 mm twisted and screened.

(4) 2 cores of co-axial cable.

Small Multi-Core Cables

38 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.

39 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 1600Hz.

Power Cables

40 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

250/440V 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:
10 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:
10 mm (0.44")

GENERAL

41 Before starting electrical connection observe the following:

WARNING

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

42 Isolate power supplies as follows:

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

(2) Remove fuses from mains isolators.

(3) On Turning Mechanism set ON/OFF switch to OFF.

43 The casing of the upmast turning mechanism must be securely earthed to the platform with braided copper wire.

44 The casing of the downmast transceiver must be securely earthed to the deck or bulkhead with braided copper wire.

45 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.

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

47 Fit cable through gland in accordance with the diagram shown on Figure 6d.

COVER REMOVAL

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

(1) Upmast Turning Mechanism.

(2) Downmast Transceiver.

(3) Soft Start Unit.

(4) Optional Mains Isolator.

Upmast Turning Mechanism

49 Using a 12 mm spanner, release the six bolts securing the rear cover to the Upmast Turning Mechanism and remove the cover.

Downmast Transceiver

50 Release the six captive screws securing the cover to the Downmast Transceiver and remove the cover.

Soft Start Unit

51 Remove the soft start unit cover by releasing the six captive screws.

Optional Mains Isolator

52 Open the mains isolator cover by releasing the captive screw.

PCB LOCATIONS AND CABLEFORM ROUTING

53 Location of PCBs and cableform routing in the transceiver are shown on Figure 8d.

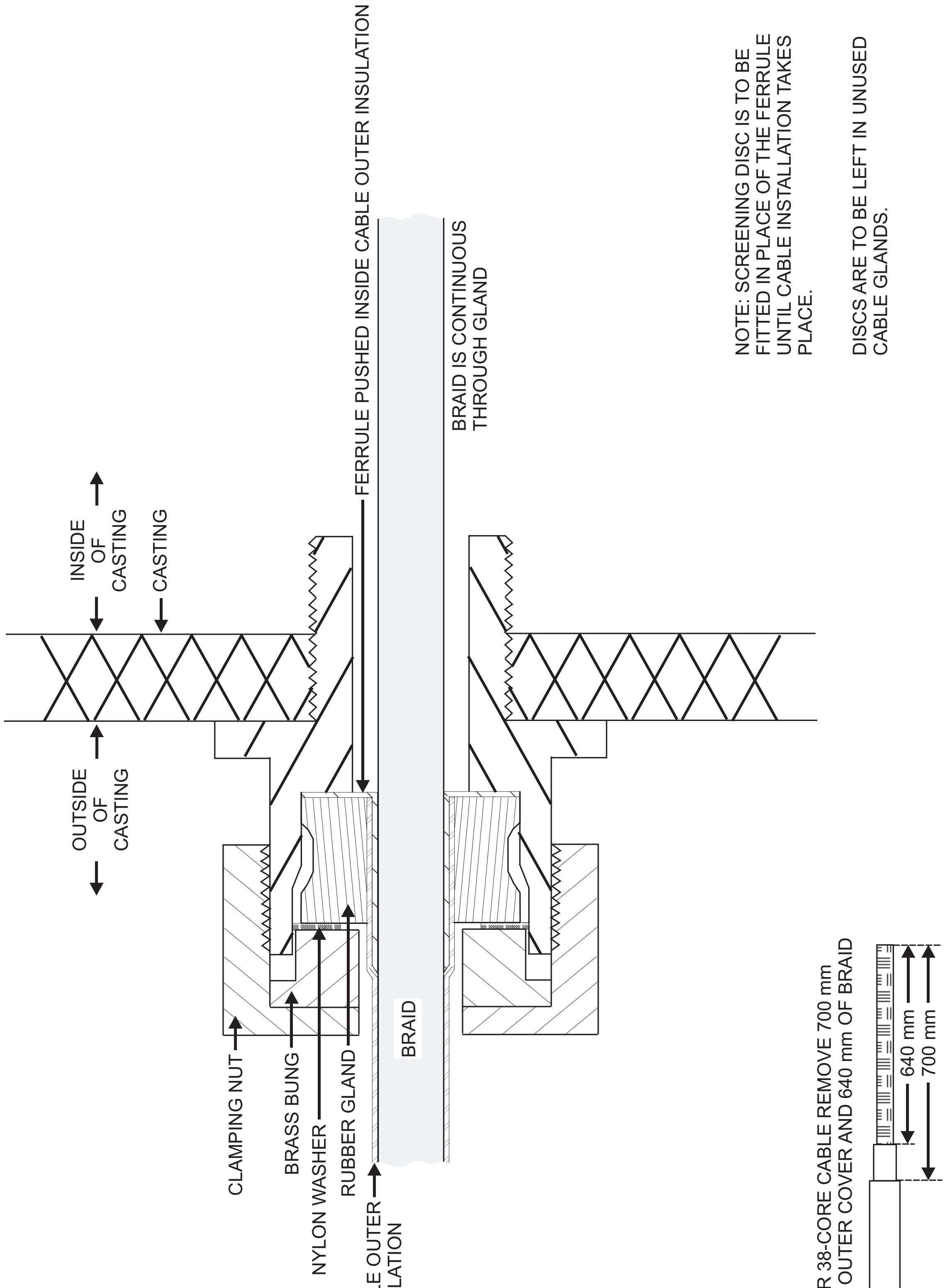


Figure 7d - Cable Gland Assembly

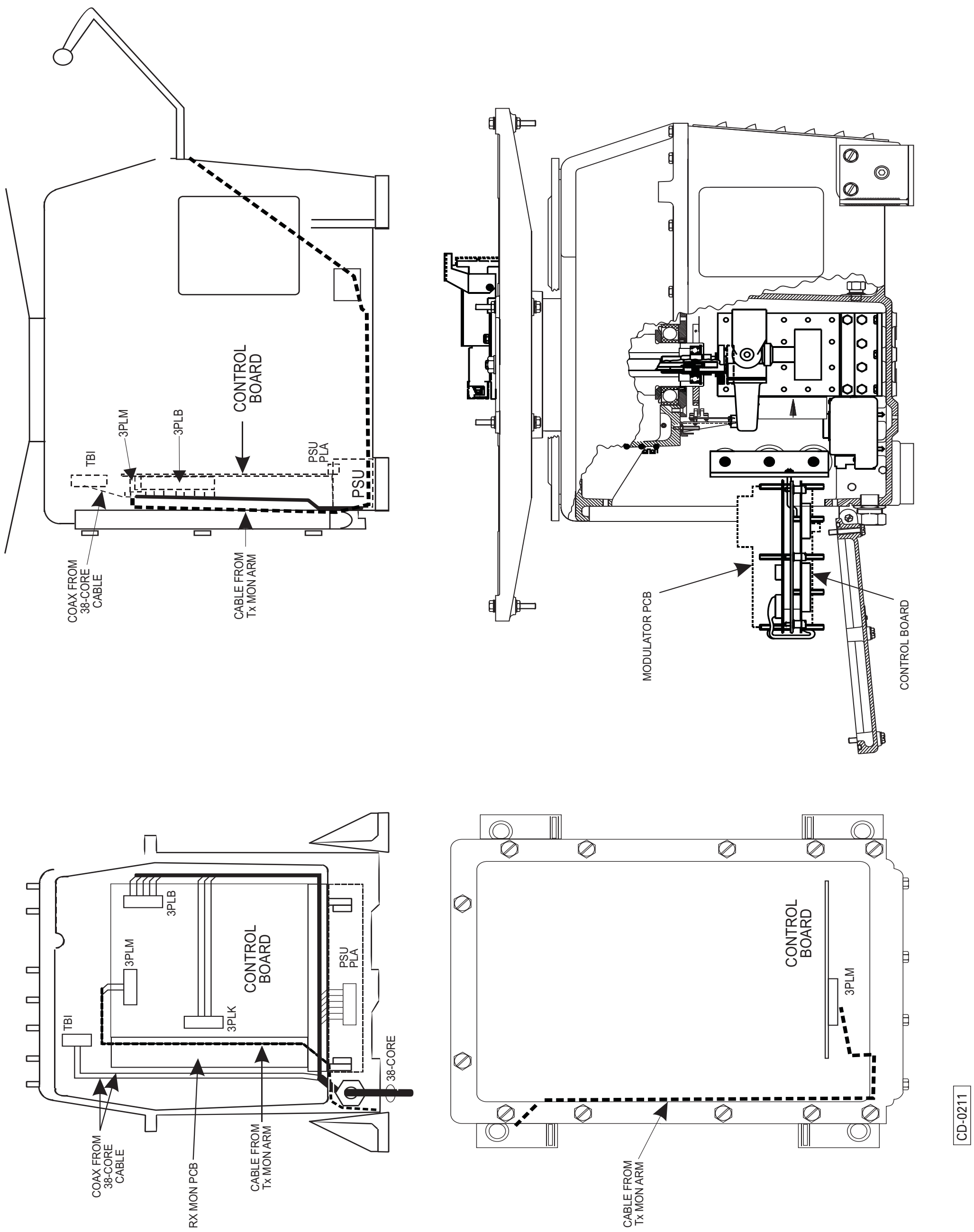


Figure 8d - Upmast Transceiver: PCB Location and Cableform Routing

WIRING DIAGRAMS

54 Electrical connections for upmast and downmast transceiver systems are detailed on the following wiring diagrams:

(1) Figure9 d - Motor Connections.

(2) Figure 10d - Soft Start Unit with In-line Power Supply connections.

(3) Figures 12d and 13d - Connections for Nucleus 3 systems using 38-core composite cable as follows:

(1) Connections for an interswitched system, via a Radar Interswitch Unit (RIU).

(2) Connections for an interswitched system, via the Dual Interswitch Unit (DIU).

CAUTION

There are two different types of Brown motor which may be used in the MkVI Turning Mechanism. Each type of motor has different connections. (Refer to Figure 9d for details). Take Care to ensure that the 3-phase Motor Connections are made correctly for the type of motor used.

IF THE MOTOR IS IDENTIFIED AS AN "Old Style" BROWN MOTOR (SEE BELOW), DO NOT USE THE WIRING DIAGRAM ON THE INSIDE OF THE COVER, AS THIS COULD DAMAGE THE MOTOR.

THE "Old Style" BROWN MOTOR MUST BE WIRED AS SHOWN ON FIGURE 9d.

If there is any doubt about which type of Motor is being installed, assume that it is the "Old Style" type and wire it accordingly(see Figure 9d). If the motor does not turn when wired as the "Old Style" motor, then fit the links as shown for the "New Style" motor.

55 The type of Motor can be identified as follows:

(1) First remove the wiring cover from the motor

(2) Old style motors have wires U5, V5, W5 connected to connectors U1, V1, W1 respectively.

(3) New style motors DO NOT have any wires marked U5, V5, W5.

CHECKS AFTER FITTING

56 The upmast turning mechanism must be checked for security and freedom to rotate.

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

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

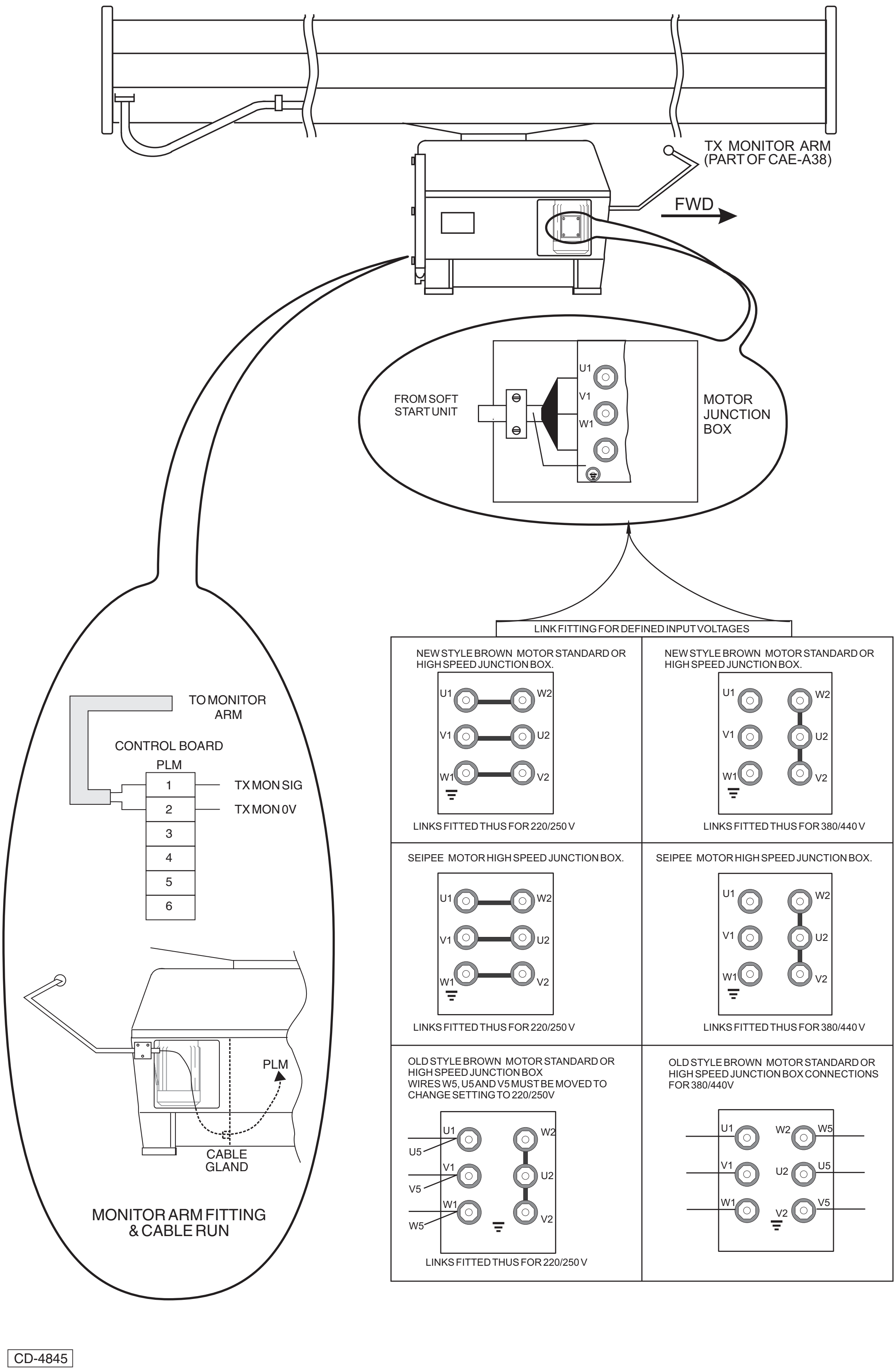


Figure 9d - Motor Connections

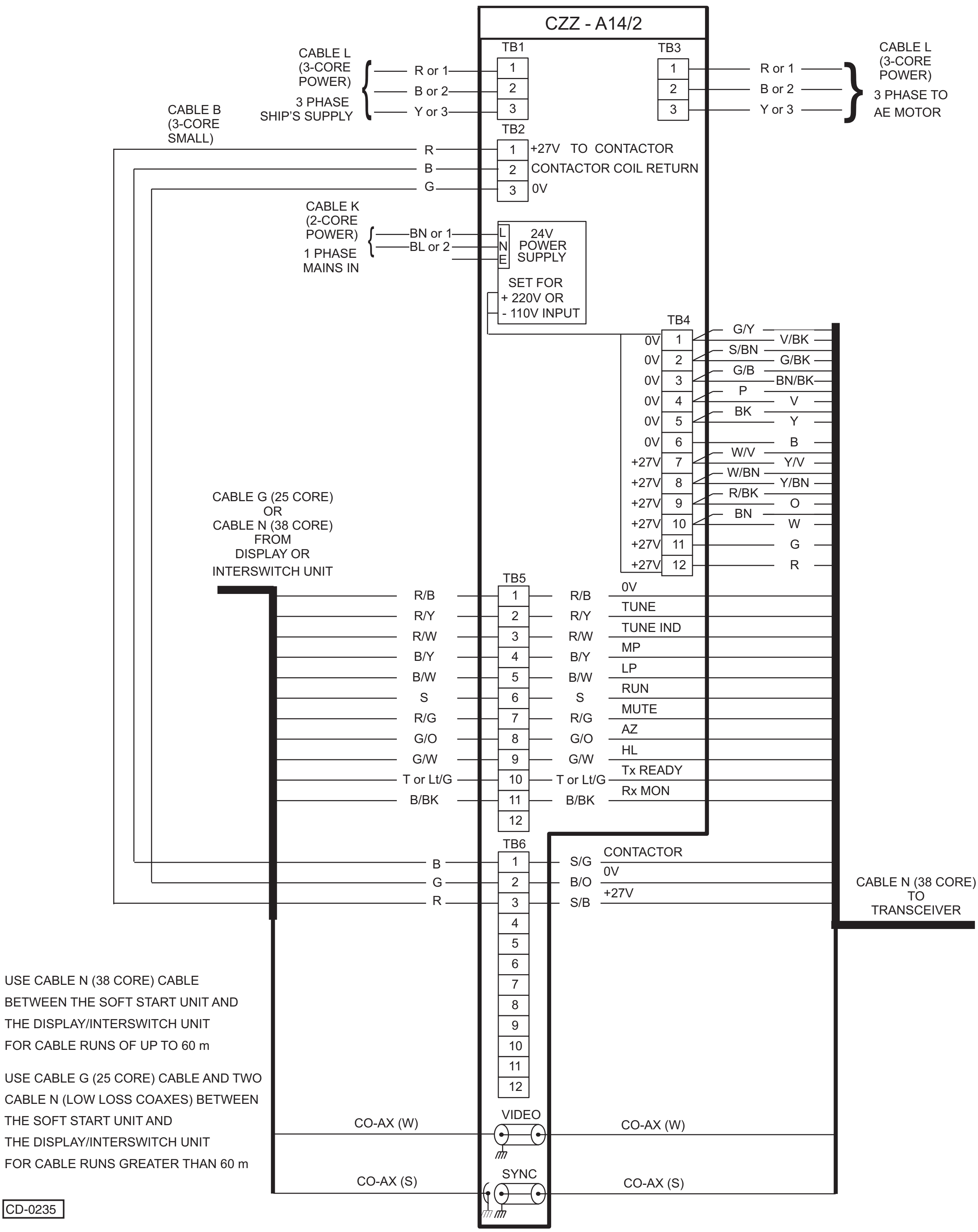


Figure 10d - Soft Start Unit with In-line Power Supply

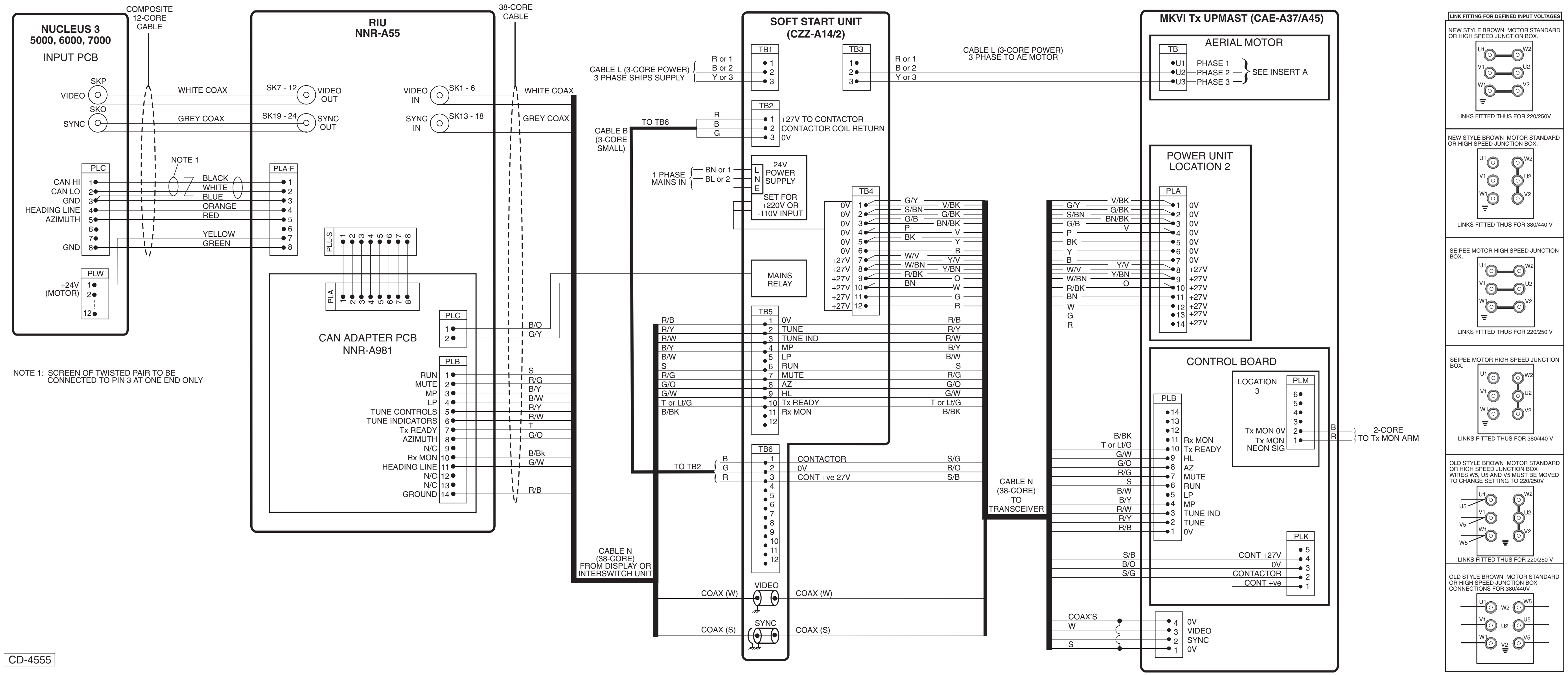


Figure 11d - Mk VI Transceiver Upmast (S-Band) Interswitched with Nucleus 3 via an RIU: Interconnections Diagram

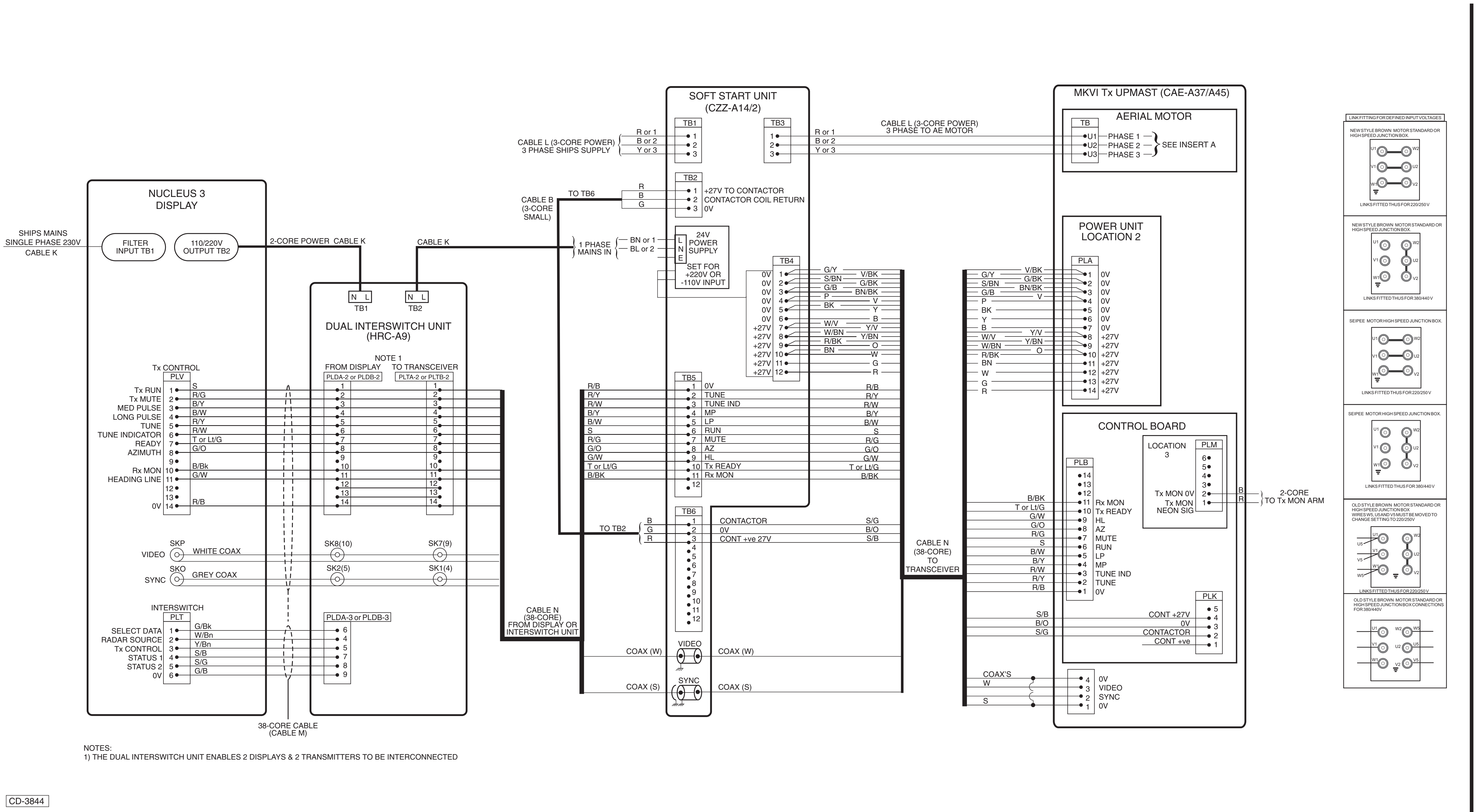


Figure 12d - Mk VI Transceiver Upmast (S-Band) Interswitched with Nucleus 3 via a DIU: Interconnections Diagram

CHAPTER 4E

INSTALLATION & INTERCONNECTIONS - TRANSCEIVER MKVII (S-BAND)

GENERAL

1 This section provides installation information for MkVII Downmast S-Band 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 400.

MAXIMUM RECOMMENDED WAVEGUIDE LENGTHS

4 The following maximum waveguide lengths are recommended:

	Std Speed	High Speed
S-band	35m	20m

COMPASS SAFE DISTANCES

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

	Grade I (0.25 degree)	Grade II (1 degree)
MkVII Transceiver	1.4 m	0.8 m

TRANSCEIVER AND TURNING MECHANISMS

6 The MkVII S-Band downmast Transceiver can be used with the MkVI Turning Mechanism (low speed - 25 rpm (CAE-A42) or high speed - 40 rpm (CAE-A41) versions). For completeness the installation procedure in this document uses the MkVI Turning Mechanism. Two versions of the turning mechanism are provided:

(1) 25 rpm CAE-A42 for normal applications.

(2) 50 rpm CAE-A41 for high speed craft.

7 The electronics for the downmast transceiver are housed in a separate bulkhead mounted enclosure. The downmast transceiver is connected to the turning mechanism, via semi-rigid coaxial cable.

SOFT START UNIT

8 Both versions of the MkVI Turning Mechanism utilise a bulkhead mounted Soft Start Unit (CZZ-A14)

SAFETY NOTES

Observe the Health and Safety Notices at the front of this manual.

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

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

11 A working platform is to be provided for installing or servicing the assembly. This should be positioned approximately 1 metre below the base of the Turning Mechanism housing with a guard rail surrounding it.

12 The Antenna and Turning Mechanism must be hoisted to the fixing position using a secured block and tackle or rope strops.

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

14 The Antenna and Turning Mechanism **MUST NOT** be lifted by the array, but the complete unit secured and hoisted evenly.

EQUIPMENT LOCATION

UPMAST TURNING MECHANISM (CAE-A41/42)

15 The Upmast Turning Mechanism 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.

16 The Upmast Turning Mechanism **must not** be mounted where the temperature exceeds 70°C.

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

18 The Upmast Turning Mechanism must be mounted more than 914 mm above any flat surface, when the flat surface is greater than the diameter swept by the antenna.

19 The Upmast Turning Mechanism must not be positioned in the close proximity of any magnetic compass or D/F aerial, etc.

DOWNMAST TRANSCEIVER (CTX-A9)

20 The following points must be considered when selecting a suitable site for the Downmast Transceiver:

(1) The transceiver is designed for bulkhead mounting.

(2) Consideration must be given to accessibility for servicing and protection from adverse conditions. For ease of maintenance, the top of the transceiver should not be mounted more than 1.6m above the deck.

(3) Ensure that there is sufficient space below the unit for cable entries, and above the unit to allow for connection of the semi-rigid co-axial cable coupling.

NOTE:

The semi-rigid co-axial cable has a minimum bend radius of 100 mm (4")

(4) The transceiver should be mounted in a position which allows for ventilation and cooling.

(5) Do not fit the transceiver in an acoustic, noise sensitive area, i.e. Bridge or Operations Room.

(6) Do not fit the transceiver in close proximity to any magnetic compass or D/F aerial.

(7) Connecting cables between the display and the transceiver should be limited to a length of 65 metres. Where the distance between transceiver and display exceeds 65 metres, advice must be obtained from Kelvin Hughes Ltd. Details of Line Amplifiers and Receivers for use with long cable runs are provided in Annex A to this manual.

21 Cable runs between the transceiver and the antenna turning mechanism should be kept to a minimum length, i.e. less than 35m, with as few bends and twists as possible. Supporting brackets and couplings are to be used to eliminate the effects of vibration.

22 Cable runs between the transceiver and the antenna turning mechanism should be kept to a minimum length, i.e. Less than 35m, with as few bends and twists as possible. Supporting brackets and couplings are to be used to eliminate the effects of vibration.

SOFT START UNIT (CZZ-A14)

23 The Soft Start Unit must be sited near the transceiver.

24 The Soft Start Unit must be sited to allow removal of the front cover.

OPTIONAL MAINS ISOLATOR (80-261-600)

25 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

SOFT START UNIT (CZZ-A14)

WARNING

ENSURE THAT ALL POWER SUPPLIES IN THE VICINITY OF THE SOFT START UNIT ARE ISOLATED BEFORE ANY INSTALLATION TAKES

Fitting Thermal Overload Trip Unit To Soft Start Unit (CZZ-A14)

26 The thermal overload trip unit is supplied with the gearbox fitting kit.

27 Remove the soft start unit cover by releasing the four captive screws.

28 The trip unit, shown in Figure 1e, clips on the side of the contactor and is secured in position with relay termination screws 2T1, 4T2, 6T3, 14NO and A2.

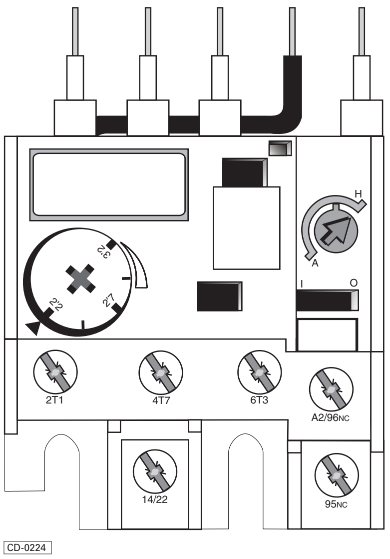


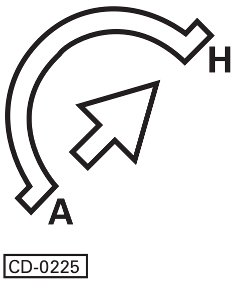
Figure 1e - Thermal Overload Trip Unit

29 Connect the cableform wires as shown in Table 1.

TABLE 1: Trip Unit Cableform Connections

TERMINAL No.	WIRE COLOUR	WIRE No.	MARKERS	FROM
14/22	P	16	BN/BU	A2
95NC	P	28	R/S	KEYSWITCH
2T1	BK	-	-	NEON
	P	10	BN/BK	TB1-1
4T2	P	11	BN/BN	TB1-2
6T3	P	12	BN/R	TB1-3
A2/96NC	P	23	R/O	PCB SKA
	P	16	BN/BU	14/22

30 Set the blue trip button to the H (handset) position.

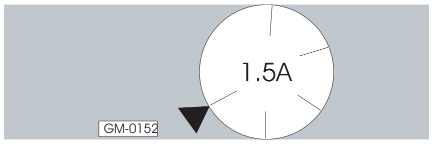
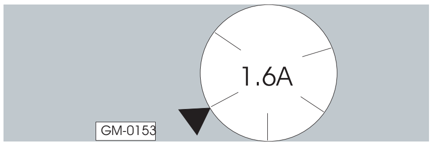
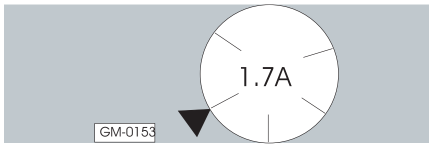
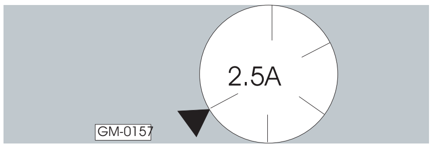
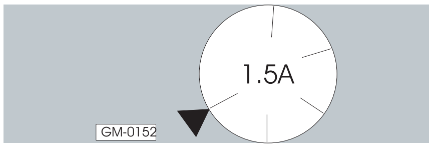
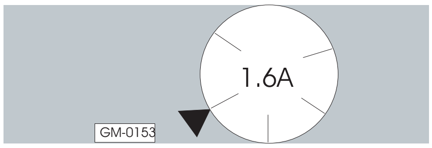
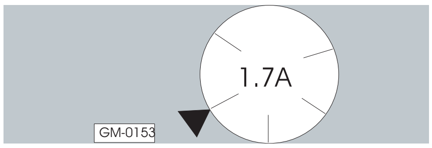
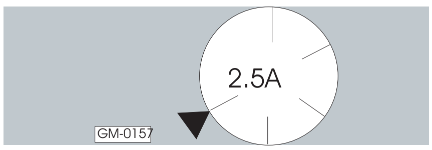


31 Set the dial position on the trip unit to the position shown in Table 2.

FITTING THE SOFT START UNIT

32 Fit the soft start unit to the securing bulkhead using the installation bolts supplied with the fitting kit. Refer to Figure 2e for dimensions.

TABLE 2: Trip Unit Dial Positions

ANTENNA SPEED	MOTOR VOLTAGE	THERMAL OVERLOAD TRIP UNIT - PART NO.	DIAL POSITION
25 rpm	440 V	45-617-1156-04	
25 rpm	415 V	45-617-1156-04	
25 rpm	380 V	45-617-1156-04	
25 rpm	220 V	45-617-1156-06	
40 rpm	440 V	45-617-1156-04	
40 rpm	415 V	45-617-1156-04	
40 rpm	380 V	45-617-1156-04	
40 rpm	220 V	45-617-1156-06	

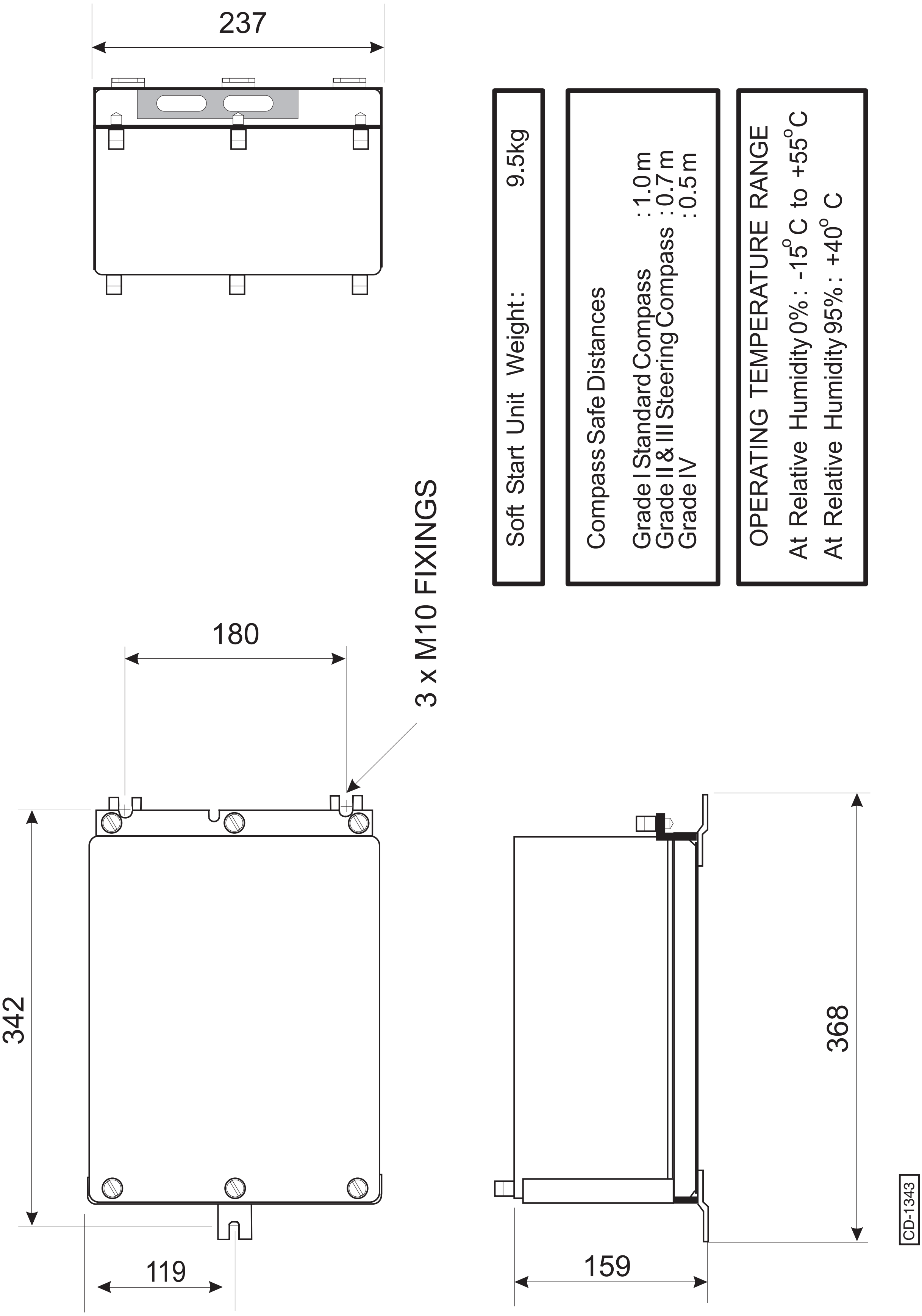


Figure 2e - Soft Start Unit CZZ-A14: Installation Diagram

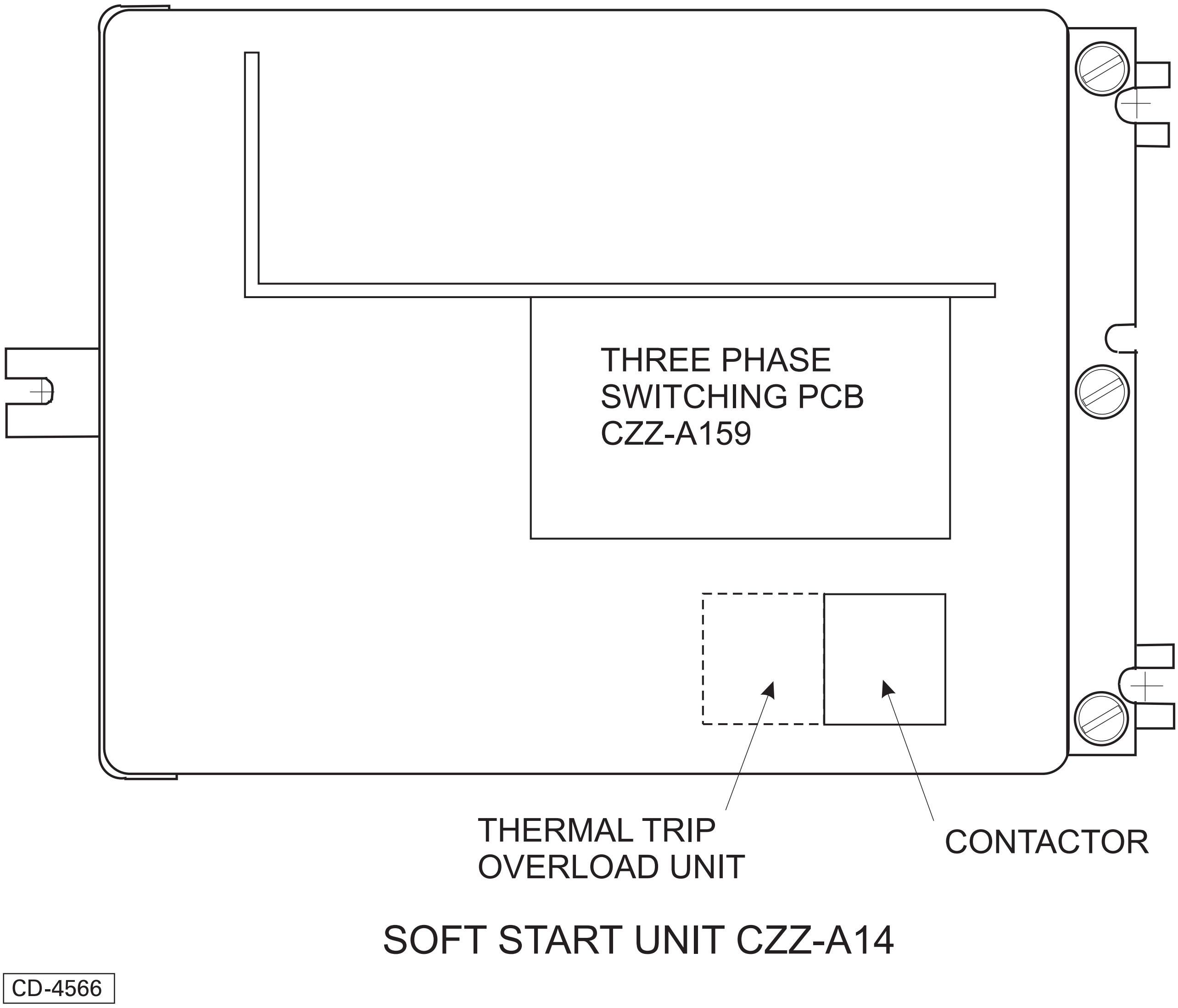


Figure 3e - Soft Start Unit CZZ-A14: Component Layout

UPMAST TURNING MECHANISM (CAE-A42/41)

WARNING

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

CAUTION

When Unpacking The Antenna, Ensure That The Semi-rigid Co-axial Cables Are Not Kinked, Crushed Or Bent. Support The Antenna Near Its Centre When Lifting It Out Of Its Packing And When Fitting It Into Position On The Turning Mechanism. Do Not Handle The Antenna By The Semi-rigid Co-axial Cable Input.

33 The Upmast Turning Mechanism is supplied in two parts:

(1) Gearbox.

(2) Antenna.

34 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/turning mechanism.

35 When mounting the upmast turning mechanism observe the following:

(1) Use the fitting pack supplied with the equipment (refer to Figure 4e). The fitting pack contains fixings that have been tested to withstand the stresses detailed in paragraph 33.

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

(3) For upmast transceivers/turning mechanisms mounted in excess of 1.8m 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.

36 With reference to Figures 4e and 5e, install the upmast turning mechanism as follows:

(1) Fit the coupling element and sealing ring to the antenna connector.

(2) Fit the antenna to the upmast turning mechanism, ensuring that the connectors are aligned, and loosely secure using the eight M10 retaining bolts, washers and nuts.

CAUTION

When Rotating The Antenna Do Not Apply Excessive Force.

Ensure that the Semi-rigid Coax Assembly, on The Underside Of The Antenna, Is Not Crushed Or Damaged.

(3) Secure the co-axial connector using the three M6 bolts and washers provided.

(4) Tighten and torque load the eight antenna retaining bolts to 25 Nm.

CAUTION

Failure To Fit Antenna Spoilers Will Reduce System Life And Render The Radar Inoperative In High Winds.

(5) Fit the spoilers to the antenna using the fittings supplied.

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

(7) For semi-rigid cable access mark out and drill a 100 mm hole in the mounting platform, as shown on Figure 4e.

NOTE:

The upmast transceiver/turning mechanism is supplied with four M12 bolts, washers and fibre washers. These may be removed, but not discarded, and replaced with eye bolts. Once the upmast transceiver/turning mechanism is in position, the eye bolts are to be removed and replaced with the original bolts.

WARNINGS

THE UPMAST TRANSCEIVER/TURNING MECHANISM MUST NOT BE LIFTED BY THE ANTENNA AND MUST BE HOISTED TO THE FIXING POSITION USING A SECURED BLOCK AND TACKLE, OR, IF NO EYE BOLTS ARE FITTED, BY ROPE STROPS.

DO NOT FIT EYE BOLTS IF THERE ARE NO

(8) Install the upmast turning mechanism at the mounting position, ensuring correct orientation. 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.

(9) Secure the upmast turning mechanism with the four M16 bolts supplied and torque load them to 120Nm.

Optional Tx Monitor Arm (CAE-A38)

37 Using a 12 mm spanner, release the six bolts securing the rear cover to the Turning Mechanism and remove the cover.

38 Route the Tx Monitor Arm cableform as shown in Figure 12e.

39 Connect the Tx Monitor Arm cableform to the Heading Line PCB (CAE-A180) as follows: red to 9PLA 7 and blue to 9PLA 8.

40 Refit the rear cover and secure using the six bolts.

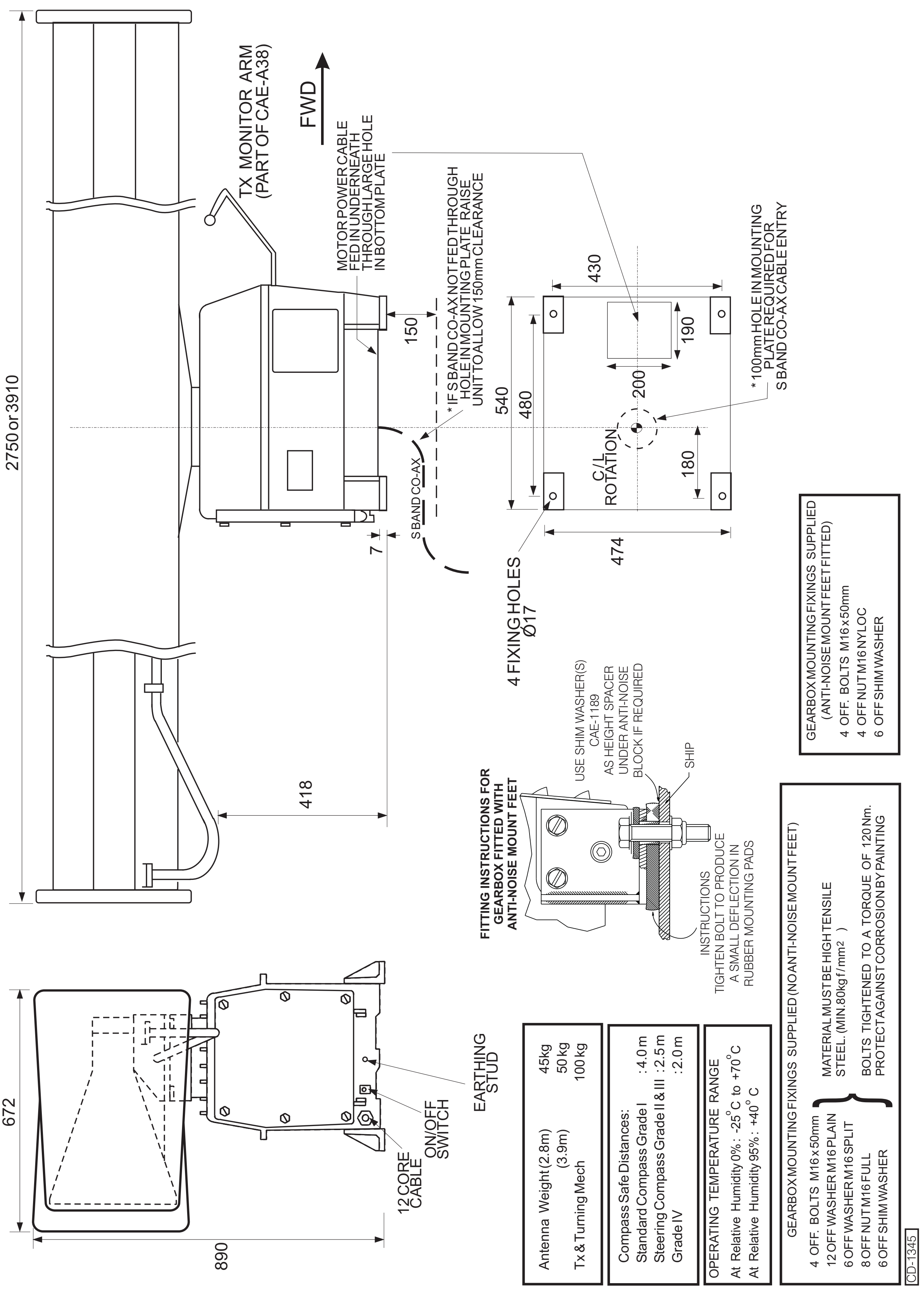


Figure 4e - Turning Mechanism (CAE-A41, A42): Installation Dimensions

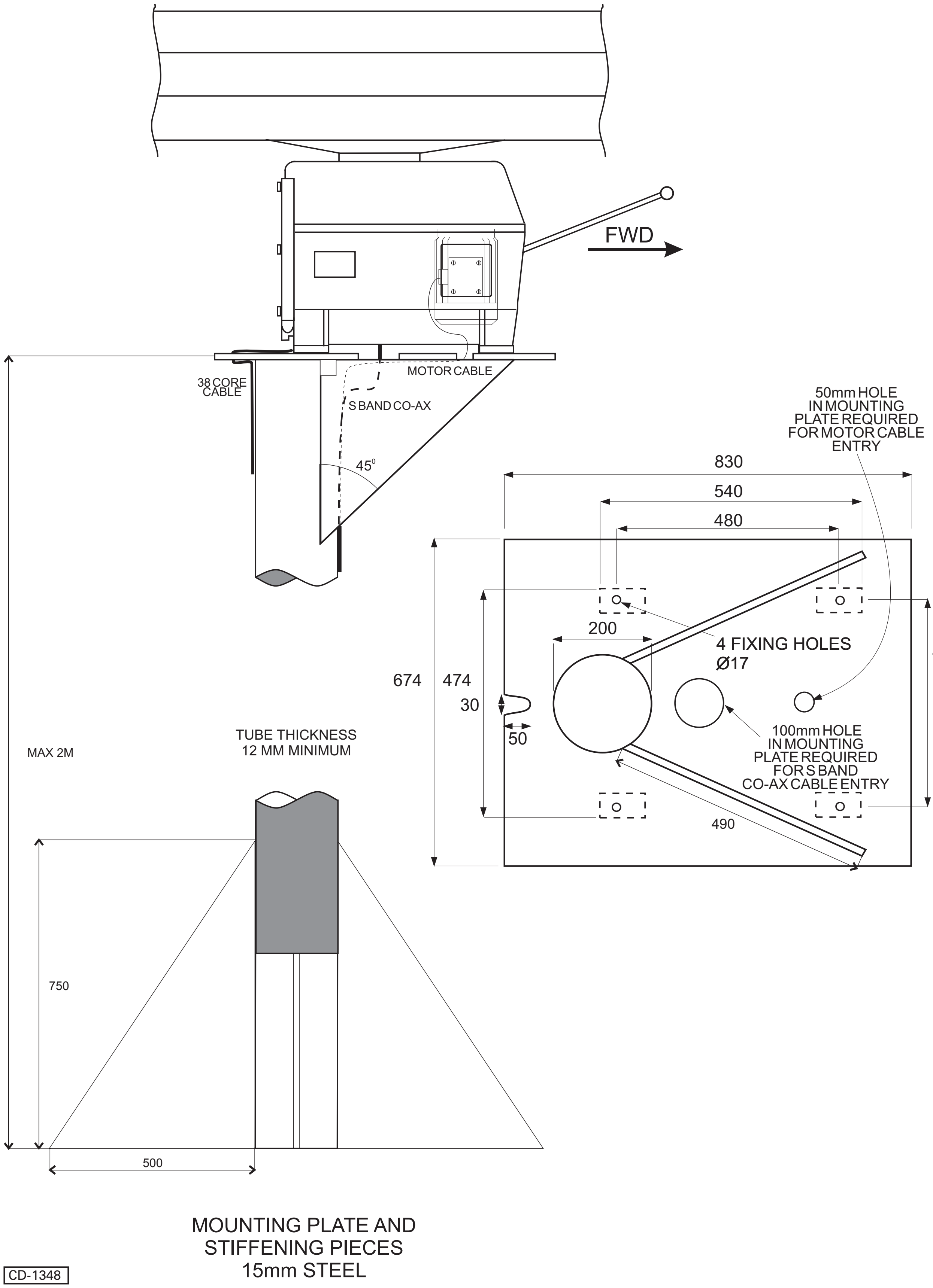


Figure 5e - Upmast Turning Mechanism: Mast Mounting

DOWNMAST TRANSCEIVER (CTX-A9)

WARNING

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

Construction

41 The general construction of the downmast S-Band transceiver comprises a sheet-metal rear plate which is formed, to include the top of the unit. This is braced by two 'U' sections which protrude above and below the plate, providing the bulkhead fixing points.

42 The PCBs are mounted both sides of the modulator chassis and are removed as a complete assembly.

43 A wrap-around cover made from sheet-metal, encloses the unit and is fixed by six captive screws. Removing the cover gives access to the front and sides of the Transceiver electronics. Cable entry is at the bottom of the unit.

Mounting

44 Fit the transceiver to the securing bulkhead using the installation bolts supplied with the fitting kit. Refer to Figure 6e for dimensions.

DOWNMAST TRANSCEIVERS HF CO-AXIAL CABLE

45 A semi-rigid co-axial cable is used to connect the S-Band Downmast Transceiver to the Antenna (refer to Figure 7e). The cable is supplied cut to length with a connector fitted to each end. Its general specification is as follows:

(1) Impedance: 50 Ohms

(2) Attenuation @ 3GHz: 0.1dB per metre

46 The cable is supplied cut to length and with a special coupling fitted to each end. The cable must not be cut, or shortened - any cable surplus should be accommodated in a 900 mm (3 ft) coil along its length.

47 The minimum bend radius is 100 mm (4"); the cable must be worked gradually to achieve the minimum bend and must not be bent across a radius sharper than the minimum bend radius.

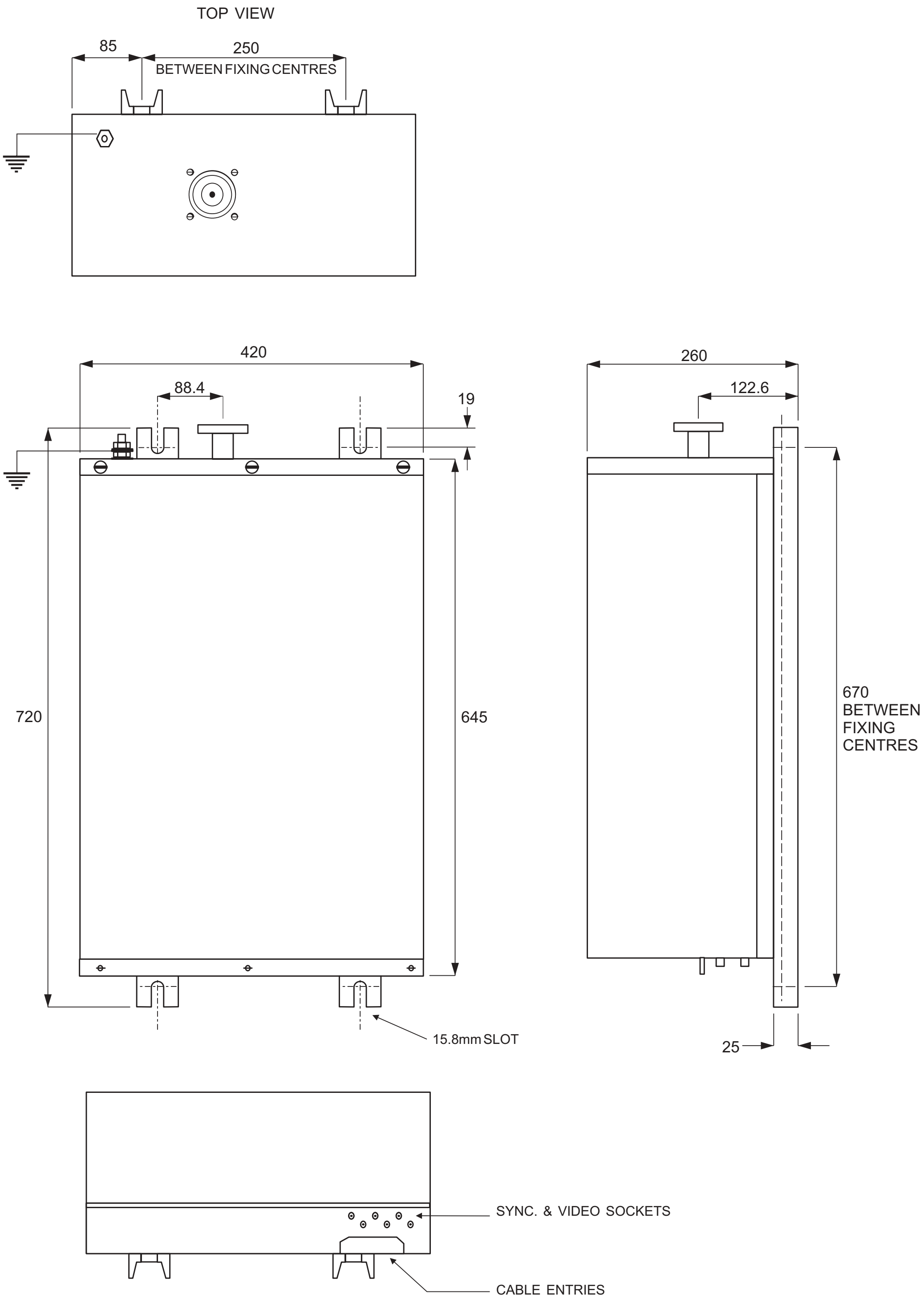
48 The cable must be suitably supported and secured along its length by special plastic cable cleats (Code No. 80-283-605-07) positioned at 1m (39") intervals. On vertical cable runs, where due to its own weight the cable might creep, the intervals between cable cleats at the top of the run should be reduced to 300 mm (12").

49 The cable may be run with other cables on a common channel plate or cable tray but it must be secured separately using the special plastic cable cleats.

50 Protect the cable from accidental damage by ensuring that any sections exposed to risk are protected by suitable covers. Pay particular attention to protecting the cable entries into transitions.

51 Do not run the cable on any surface or in any area where a temperature of 70^{o}C is exceeded.

52 Use deck gland TCR-1345 (refer to Figures 8e and 9e) to pass the cable through watertight decks, etc.



OPERATING TEMPERATURE RANGE
At Relative Humidity 0% : -15°C to +55°C
At Relative Humidity 95% : +40°C

Transmitter Weight : 30kg

Power Consumption : 140W

COMPASS SAFE DISTANCES :-
Standard Compass 2.3m (Grade I)
Steering Compass 1.4m (Grade II)

CD-4100

Figure 6e - Downmast Transceiver (CTX-A9): Installation Dimensions

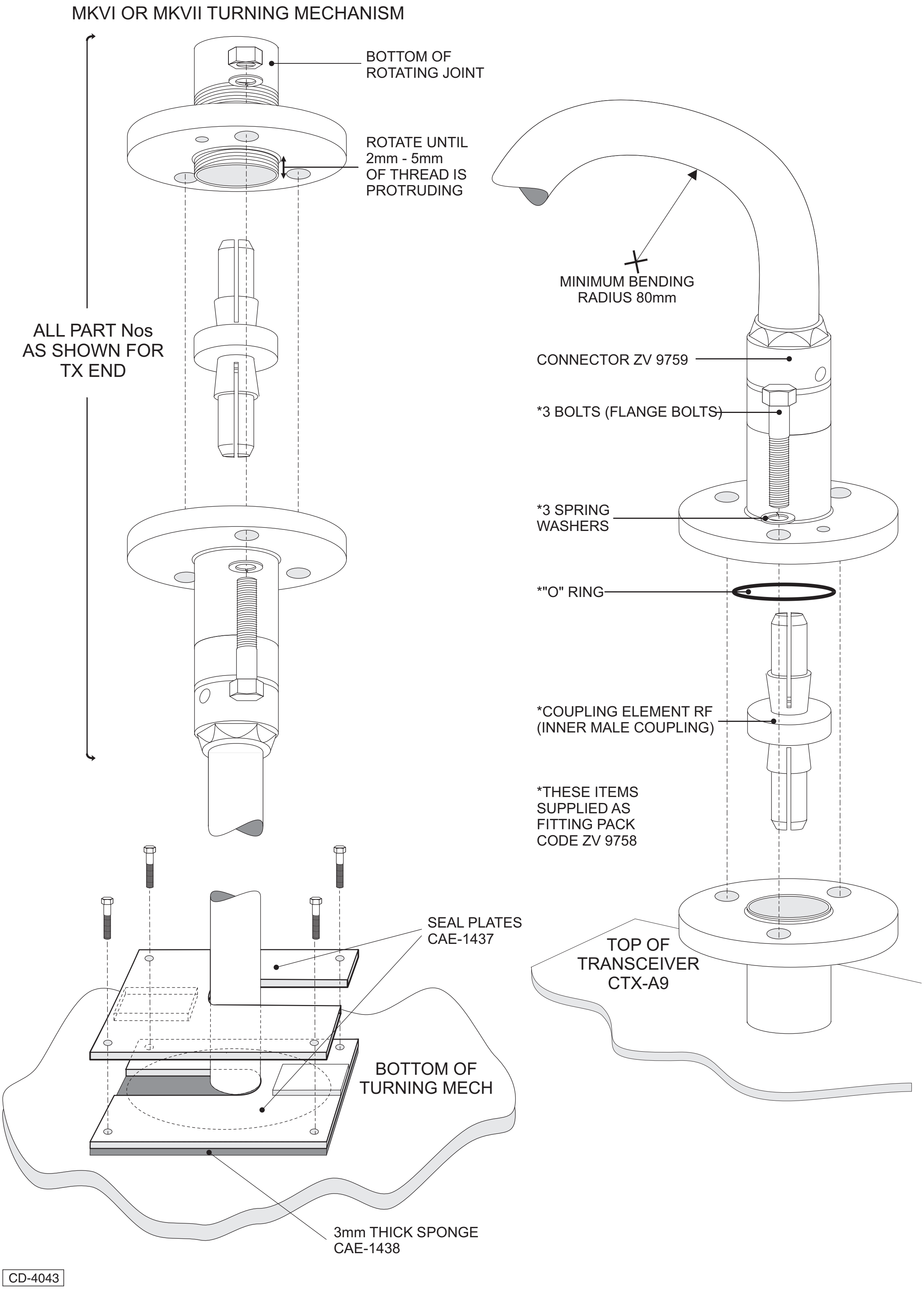


Figure 7e - Downmast Transceiver (CTX-A9) to Turning Mechanism Connection

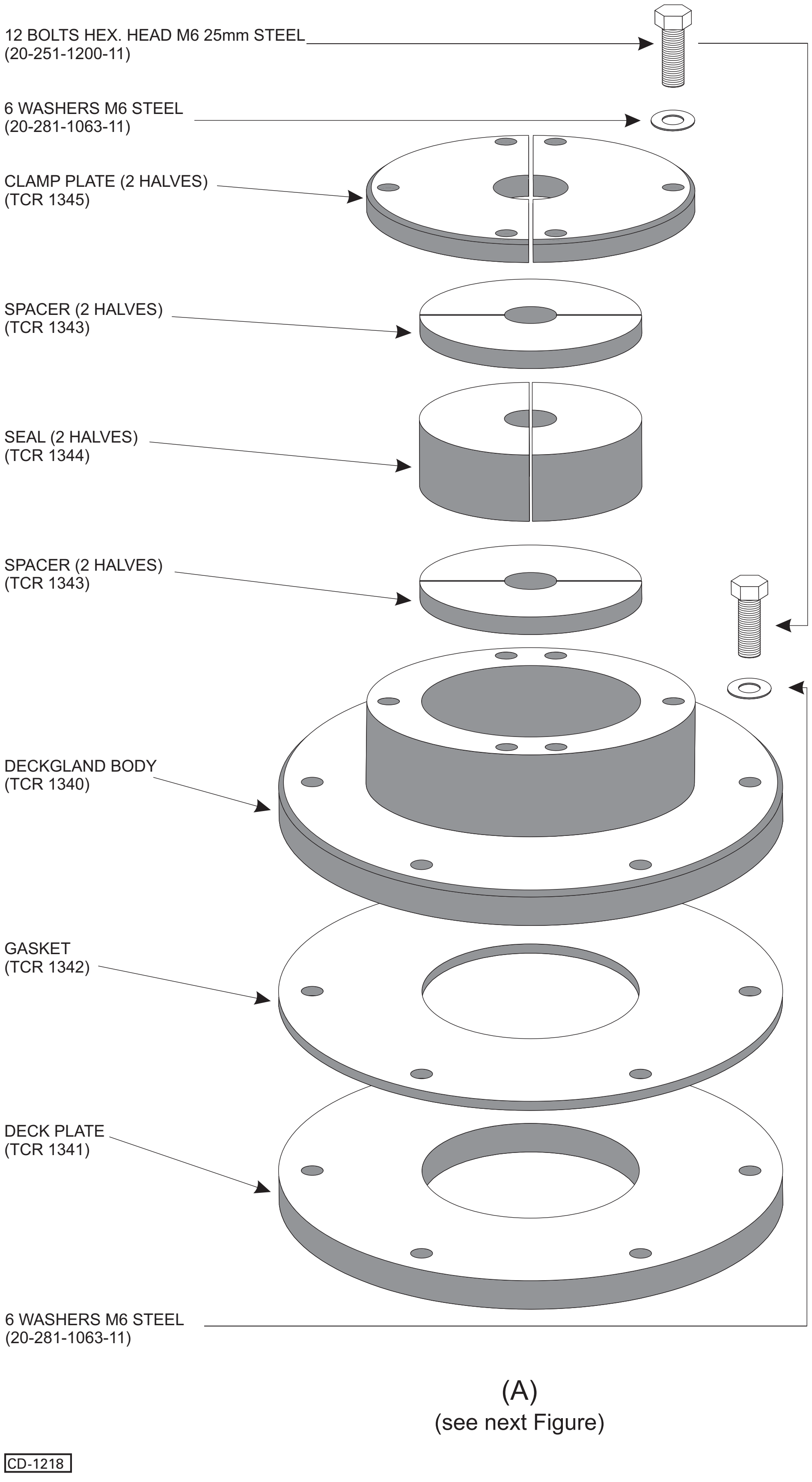


Figure 8e - Deck Gland Fitting

FITTING THE COAXIAL DECK GLAND (TCR A37)

STEEL DECK

To fit the deck gland to a steel deck, refer to diagrams (A) (see previous figure) and (E) and proceed as follows:

1) Weld the deck plate (TCR 1341) to the deck.

2) Pierce the deck with a 64 mm (2.5") diameter hole, concentric with the deck plate.

3) Place the gasket (TCR A1342) between the deck plate (TCR 1341) and the deck gland body (TCR 1340). Bolt the deck gland body to the deck plate using six M6 x 22 mm hexagonal head screws with spring washers.

4) Assemble the gland components in the deck gland body and temporarily secure clamp plates (TCR 1345) using the remaining six M6 x 22 mm hexagonal head screws with washers.

WOODEN OR COMPOSITION & STEEL DECKS

To fit the deck gland to a wooden, or composition & steel deck, refer to previous figure and Diagrams (C) and proceed as follows:

1) Where the composition has been removed, a wooden block is secured to the deck (diagram C).

2) A 64 mm (2.5") diameter hole is bored through the wooden block and the deck. The deck gland body (TCR 1340) and the gasket (TCR 1342) are secured to the wooden block using suitable coach bolts.

3) Assemble the gland components in the deck gland body and temporarily secure the clamp plates (TCR 1345) using six M6 x 22 mm hexagonal head screws with washers.

COMPOSITION DECKS

To fit the deck gland to a composition deck, refer to previous figure and Diagram (D) and proceed as follows:

1) A threaded deck tube (shipyard supplied) with a flange at one end is attached to the deck (Diagram D).

2) The deck plate (TCR 1341) is then welded to the flange and the the deck gland is assembled as for a steel deck fitting.

ASSEMBLING THE DECK GLAND TO THE COAXIAL CABLE

Refer to previous figure and proceed as follows:

1) Part the transition from the cable end connector and wrap the transition in a protective cover. **DO NOT REMOVE THE END CONNECTOR FROM THE CABLE.**

2) Remove the six screws securing the two halves of the clamp plate (TCR 1345) and remove the gland components.

3) Pass the coaxial cable through the gland.

4) Reassemble the gland components as shown (Figure 28) to ensure tat the join between the two halves of each gland component is at 90o to its neighbour.

5) Fit and tighten the six M6 x 25 mm screws in the clamp plate (TCR 1345) to expand the seal. **DO NOT OVER TIGHTE**N as this may cause distortion of the cable.

6) Coat the assembled gland with a protective finish.

7) The transmission is now bolted back on to the cable connector at the most convenient stage of running the coaxial cable.

CD-1219

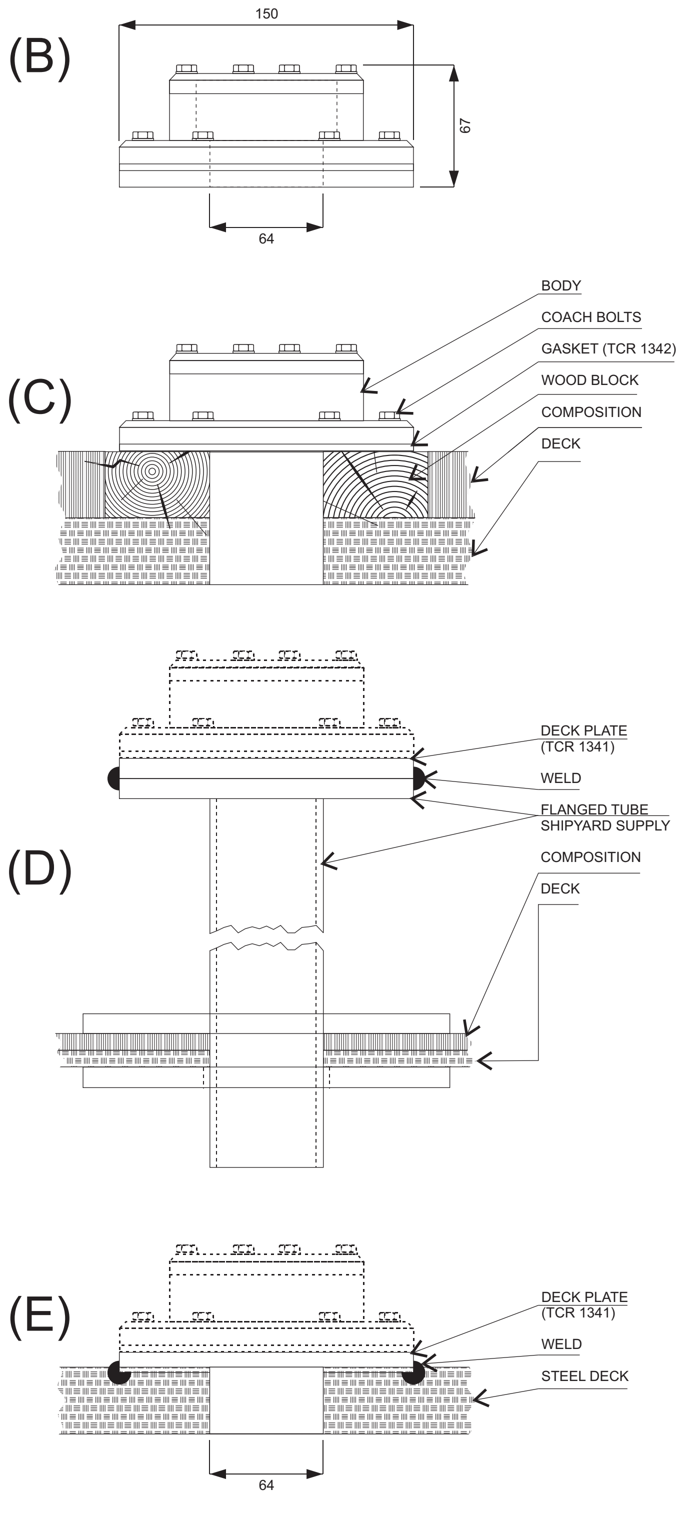


Figure 9e - Deck Gland Fitting

OPTIONAL MAINS ISOLATOR (80-261-600)

53 Refer to Figure 10e and secure the Mains Isolator in the required position (no fittings are supplied).

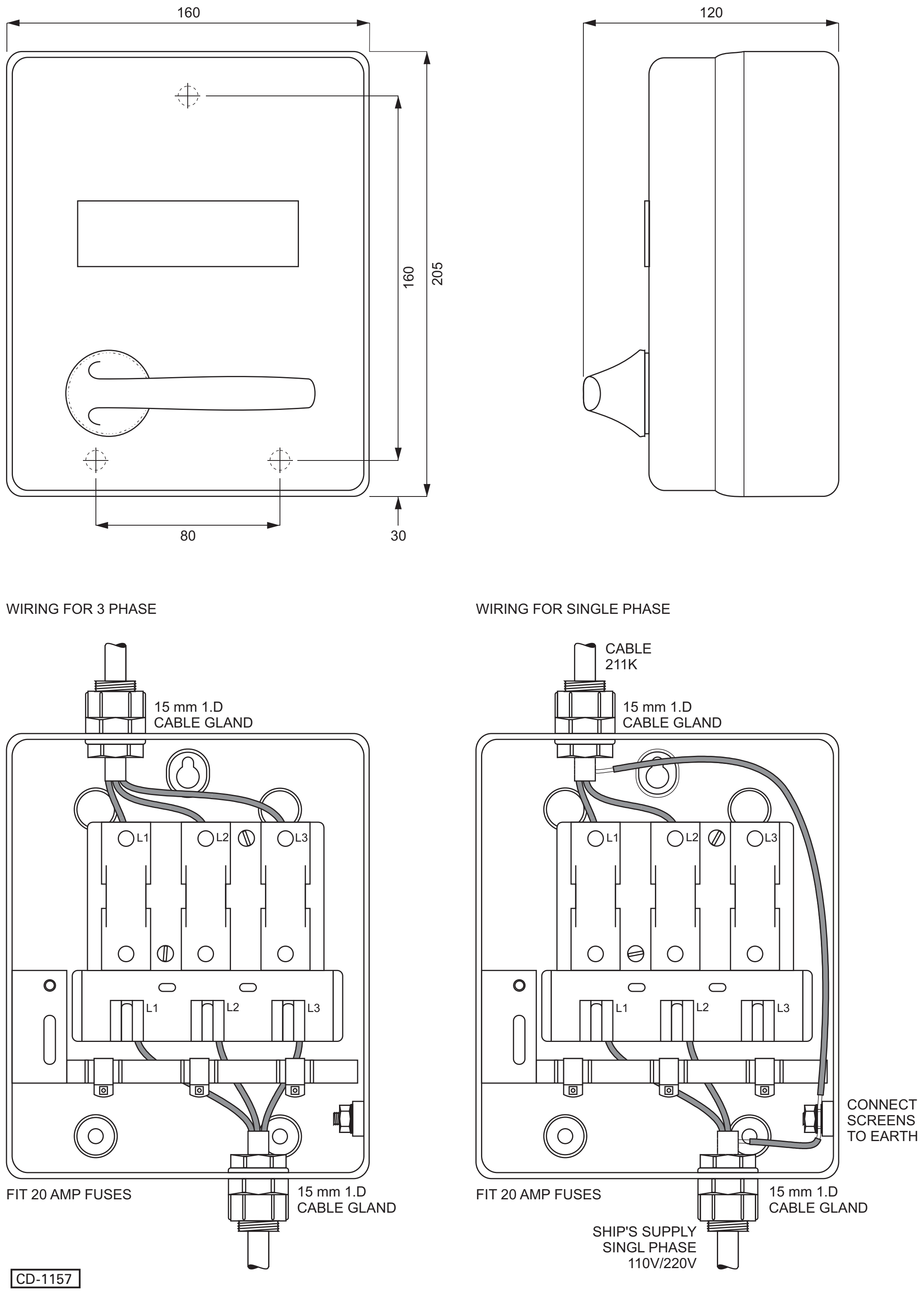


Figure 10e - Mains Isolator: Installation Dimensions

ELECTRICAL CONNECTION

CABLE SPECIFICATIONS

54 Each cable is identified by a letter code which defines the type of cable required, e.g. Cable code N is a 38-core cable. Table 3 provides specifications for each cable type. Table 4 provides 38-core cable, colour code abbreviations.

38-Core Custom Built Cable

56 The 38-core composite cable (KH code number 5344-701) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0.2 mm copper wire.

(2) 32 cores of 16/0.2 mm copper wire.

(3) 2 cores of co-axial cable.

TABLE 3: Cable Specification

CABLE	DESCRIPTION	CODE	CORE	DIAMETER
A	2-core small multi-core	1344-718	16/0.2	6.1 mm 7.7 mm
B	3-core small multi-core	1344-719	16/0.2	6.4 mm 7.2 mm
C	Not used			
D	Not used			
E	12-core small multi-core	1344-722	16/0.2	10 mm 11 mm
F	Not used			
G	Not used			
H. TO BE SUPPLIED BY CONTRACTOR				
J	Not used			
K	2-core Power	5344-787	7/0.67	10 mm
L	3-core Power	5344-787	7/0/67	13 mm
N	38-core small multi-core	5344-701		17 mm
R	12-core composite	45-762-0041-001	Mixed	15.4 mm

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

TABLE 4: 38-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
W	WHITE
Bk	BLACK
Bn	BROWN
V	VIOLET
O	ORANGE
P	PINK
T	TURQUOISE
S	SLATE (grey)
R/B	RED/BLUE
R/G	RED/GREEN
R/Y	RED/YELLOW
R/W	RED/WHITE
R/Bk	RED/BLACK
R/Bn	RED/BROWN
B/Y	BLUE/YELLOW
B/W	BLUE/WHITE
B/Bk	BLUE/BLACK
B/O	BLUE/ORANGE
G/Y	GREEN/YELLOW
G/W	GREEN/WHITE
G/Bk	GREEN/BLACK
G/O	GREEN/ORANGE
G/S	GREEN/SLATE
Bn/Bk	BROWN/BLACK
Bn/Y	BROWN/YELLOW
Bn/W	BROWN/WHITE
S/B	SLATE/BLUE
S/Bn	SLATE/BROWN
V/Bk	VIOLET/BLACK

TABLE 4 (Cont.): 38-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
V/Y	VIOLET/YELLOW
V/W	VIOLET/WHITE
W/R	WHITE/RED
	WHITE CO-AX
	SLATE CO-AX
N/C	NO CONNECTION

12-core Composite Cable

57 The 12-core composite cable (KH code number 45-762-0041-001) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0.2 mm copper wire.

(2) 4 cores of 16/0.2 mm copper wire.

(3) 2 cores of 16/0.2 mm twisted and screened.

(4) 2 cores of co-axial cable.

Small Multi-Core Cables

58 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.

59 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 1600Hz.

Power Cables

60 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

250/440V 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:
10 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:
10 mm (0.44")

GENERAL

61 Before starting electrical connection observe the following:

WARNING

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

62 Isolate power supplies as follows:

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

(2) Remove fuses from mains isolators.

(3) On Turning Mechanism set ON/OFF switch to OFF.

63 The casing of the upmast turning mechanism must be securely earthed to the platform with braided copper wire.

64 The casing of the downmast transceiver must be securely earthed to the deck or bulkhead with braided copper wire.

65 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.

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

67 Fit cable through gland in accordance with the diagram shown on Figure 11e.

COVER REMOVAL

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

(1) Upmast Turning Mechanism.

(2) Downmast Transceiver.

(3) Soft Start Unit.

(4) Optional Mains Isolator.

Upmast Turning Mechanism

69 Using a 12 mm spanner, release the six bolts securing the rear cover to the Upmast Turning Mechanism and remove the cover.

Downmast Transceiver

70 Release the six captive screws securing the cover to the Downmast Transceiver and remove the cover.

Soft Start Unit

71 Remove the soft start unit cover by releasing the six captive screws.

Optional Mains Isolator

72 Open the mains isolator cover by releasing the captive screw.

PCB LOCATIONS AND CABLEFORM ROUTING

73 Location of PCBs and cableform routing in the downmast transceiver are shown on Figure 12e.

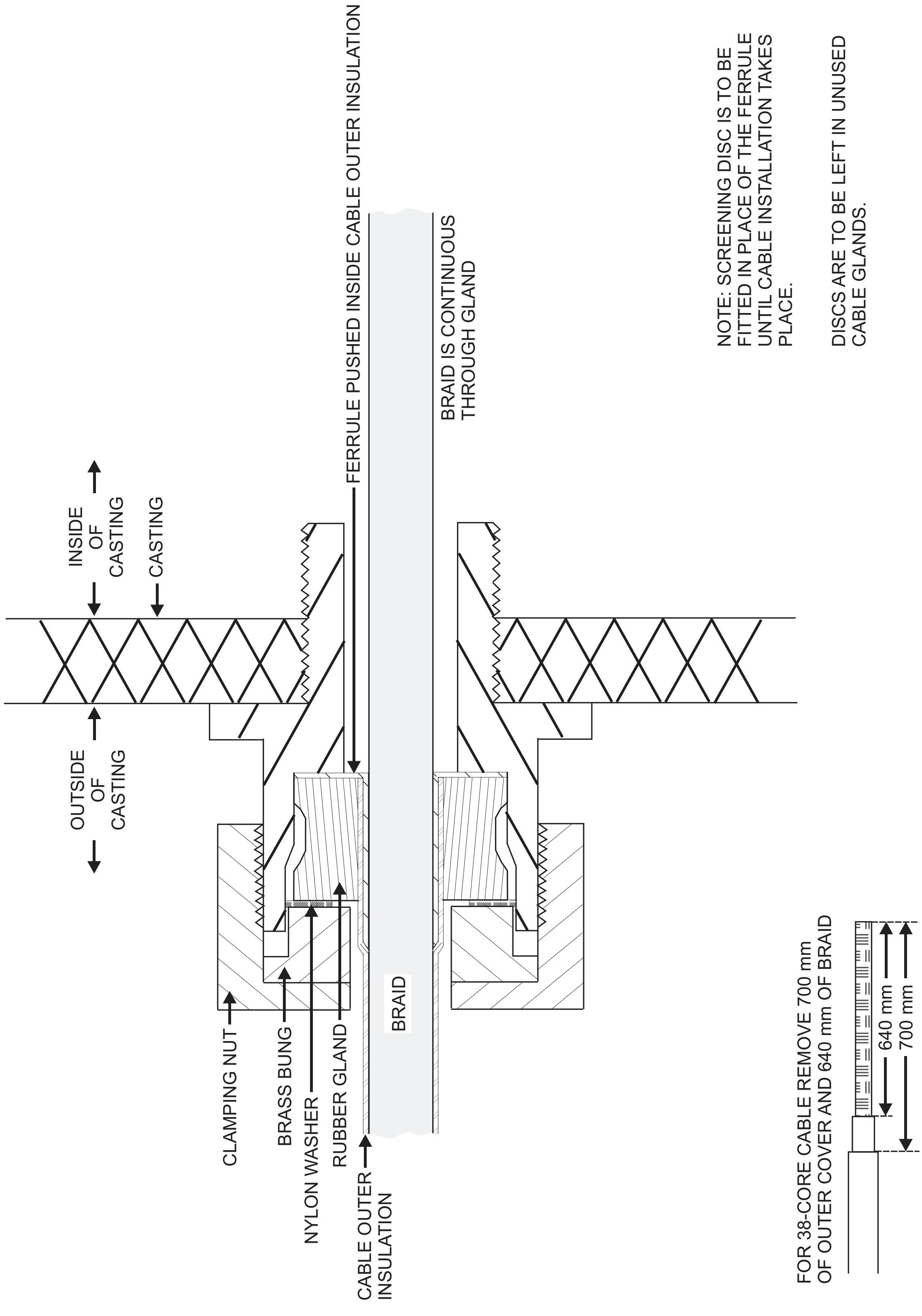
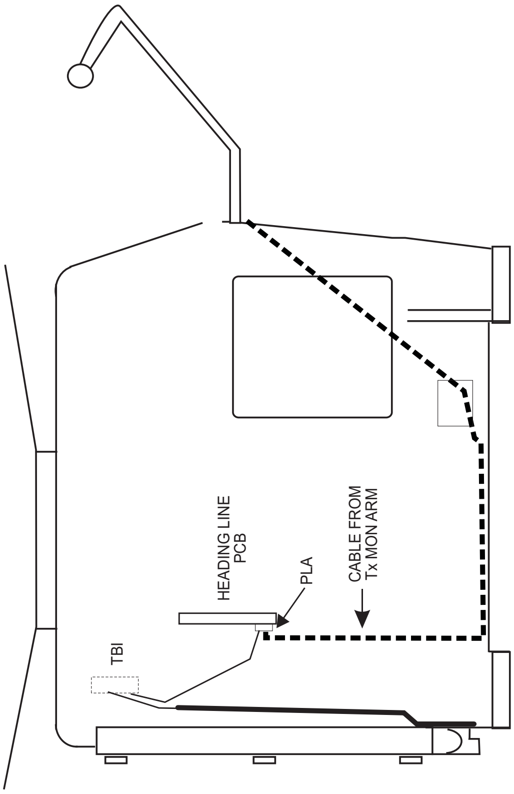
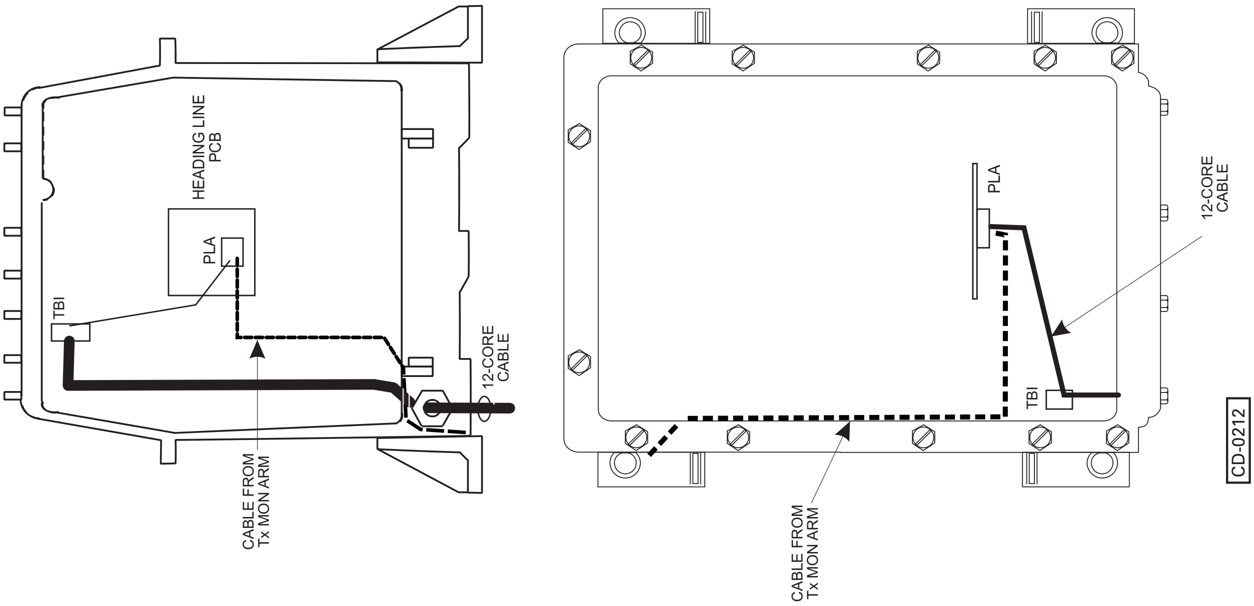


Figure 11e - Cable Gland Assembly


HEADING LINE
PCB
PLA
CABLE FROM
Tx MON ARM
TBI


HEADING LINE
PCB
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TBI
12-CORE
CABLE
CABLE FROM
Tx MON ARM
PLA
12-CORE
CABLE
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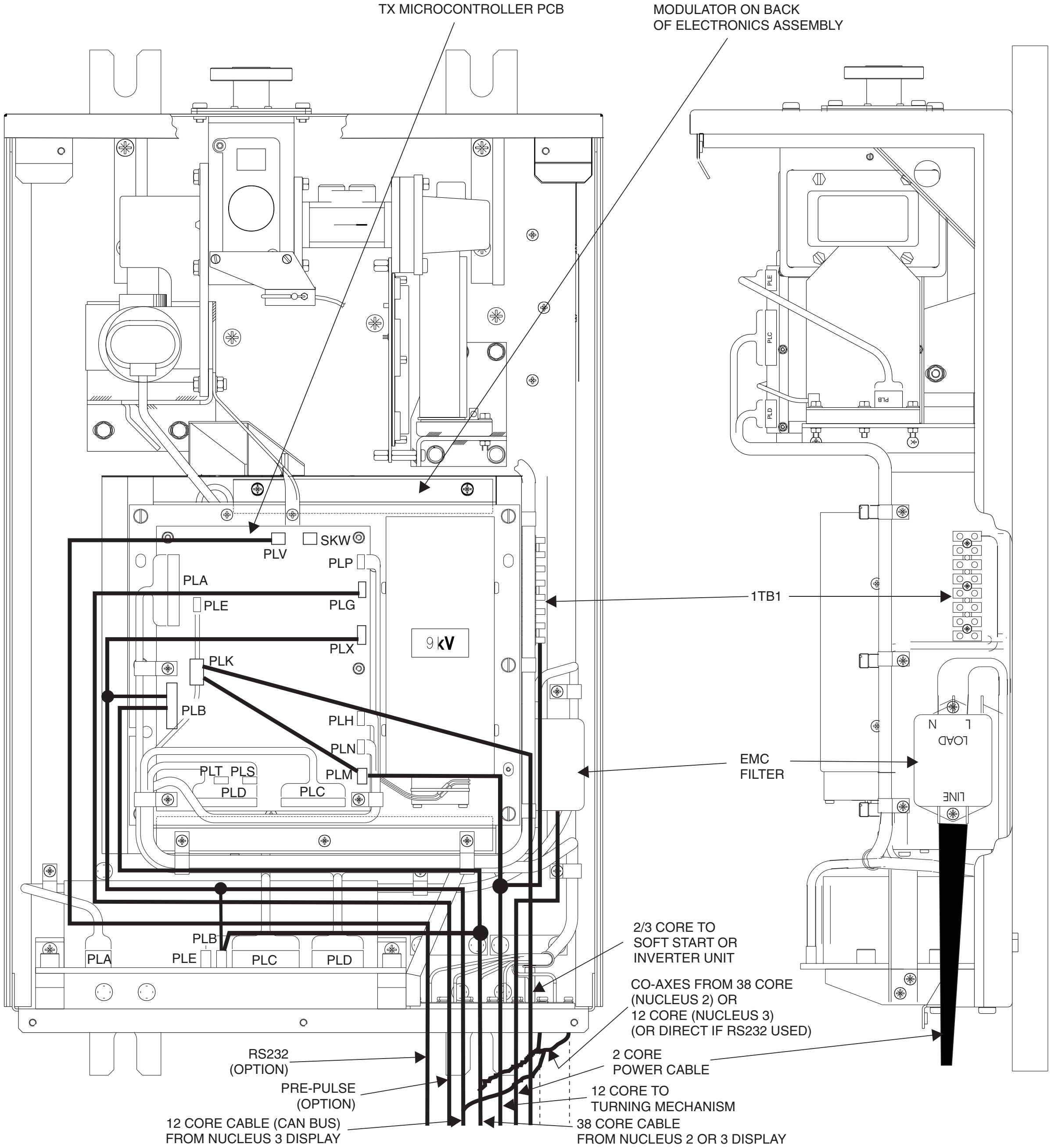
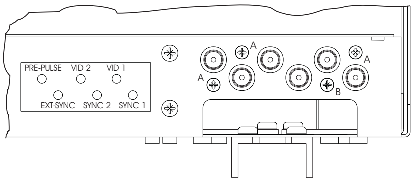
CABLE FROM
Tx MON ARM
CD-0212



NOTE: IF 38 CORE CONTROL CABLE FROM NUCLEUS 2 OR 3 OR 12 CORE CABLE FROM NUCLEUS 3 USED VIDEO AND SYNC FORM PART OF THE CABLE.
IF RS232 CONTROL CABLE USED, VIDEO AND SYNC ARE SEPARATE CABLES
ONLY ONE OF 38 CORE, 12 CORE (CAN BUS) OR RS232 CABLES USED



VIEW SHOWING
COAXIAL CONNECTORS

CD-4036

Figure 13e - Downmast Transceiver (CTX-A9): PCB Location and Cableform Routing

WIRING DIAGRAMS

74 Electrical connections for upmast and downmast transceiver systems are detailed on the following wiring diagrams:

(1) Figure 14e - Motor Connection (See CAUTION below).

(2) Figure 15e - Connections between the downmast Transceiver CTX-A9 and the upmast Turning Mechanism and Soft Start Unit (if fitted).

(a) For details of connections between the Soft Start Unit and the Turning Mechanism for MkVI Turning Mechanisms refer to publication KH 1250. Figure 18 shows a typical arrangement with a Nucleus 3 Display and Dual Interswitch Unit. Figure 21 shows a typical arrangement with a Nucleus 3 Display and Radar Interswitch Unit (RIU).

(b) For details of connections between the Soft Start Unit or Inverter and the Turning Mechanism for Mk VII Turning Mechanisms refer to publication KH 1253.

(3) Figures 16e and 17e - Connections for Nucleus 3 systems using 38-core composite cable as follows:

(a) Connections between the CTX-A9 Transceiver and the Nucleus 3 Display.

(b) Connections for an interswitched system, via the Dual Interswitch Unit.

(4) Figures 19e and 20e - Connections for Nucleus 3 systems using 12-core composite cable and the CANbus interface as follows:

(a) Connections between the CTX-A9 Transceiver and the Nucleus 3 Display.

(b) Connections for an interswitched system, via the Radar Interswitch Unit (RIU).

NOTE:

RS232 serial control can be used for changing the programme of the Tx Microcontroller PCB. It does not control the transceiver.

CAUTION

There are two different types of Brown motor which may be used in the MkVI Turning Mechanism. Each type of motor has different connections. (Refer to Figure 14e for details). Take Care to ensure that the 3-phase Motor Connections are made correctly for the type of motor used.

IF THE MOTOR IS IDENTIFIED AS AN "Old Style" BROWN MOTOR (SEE BELOW), DO NOT USE THE WIRING DIAGRAM ON THE INSIDE OF THE COVER, AS THIS COULD DAMAGE THE MOTOR.

THE "Old Style" BROWN MOTOR MUST BE WIRED AS SHOWN ON FIGURE 14e.

If there is any doubt about which type of Motor is being installed, assume that it is the "Old Style" type and wire it accordingly(see Figure 14e). If the motor does not turn when wired as the "Old Style" motor, then fit the links as shown for the "New Style" motor.

55 The type of Motor can be identified as follows:

(1) First remove the wiring cover from the motor

(2) Old style motors have wires U5, V5, W5 connected to connectors U1, V1, W1 respectively.

(3) New style motors DO NOT have any wires marked U5, V5, W5.

CHECKS AFTER FITTING

75 The upmast turning mechanism must be checked for security and freedom to rotate. The downmast transceiver must be checked for security, accessibility, and cabling 'runs'.

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

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

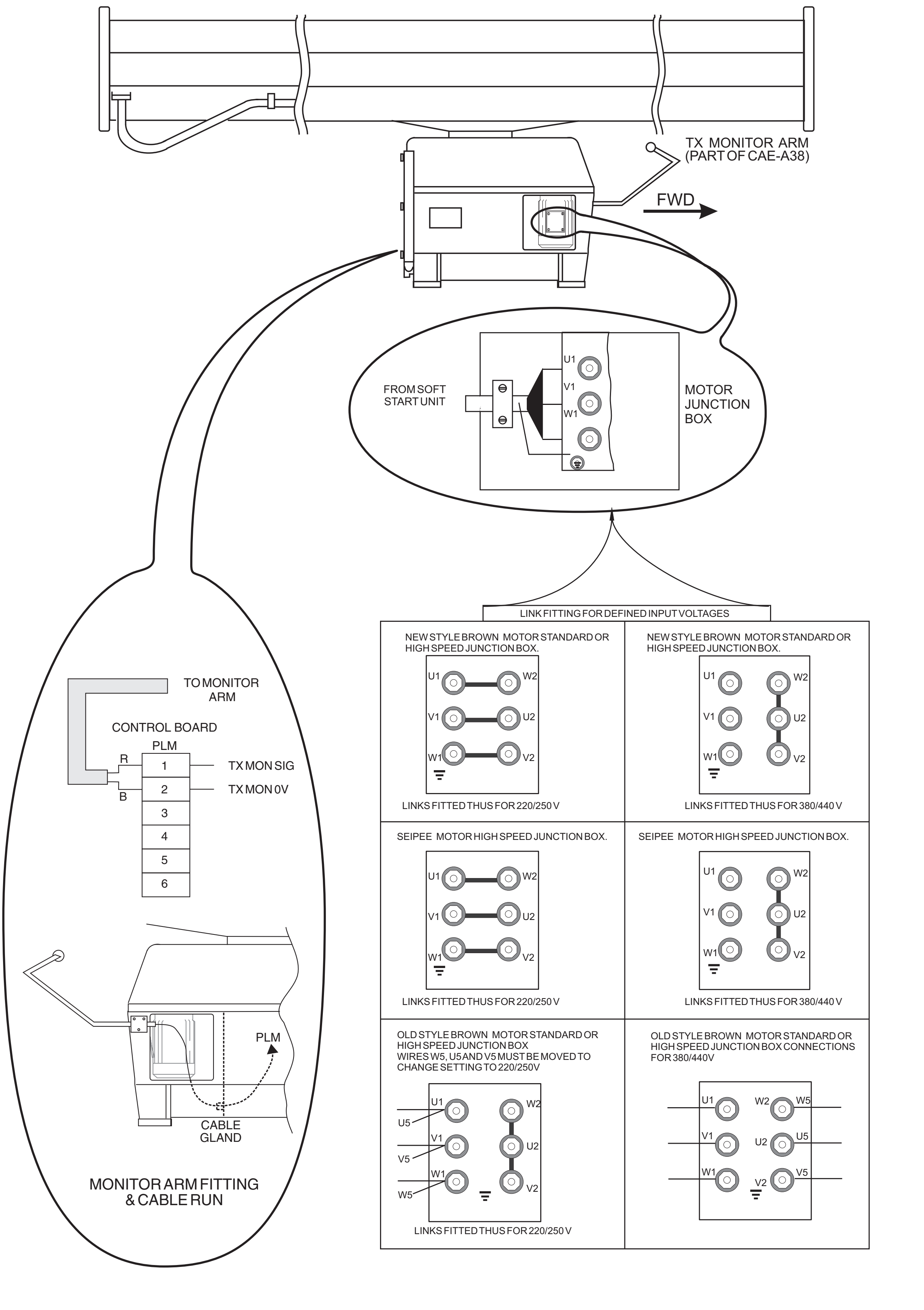


Figure 14e - Motor Connections

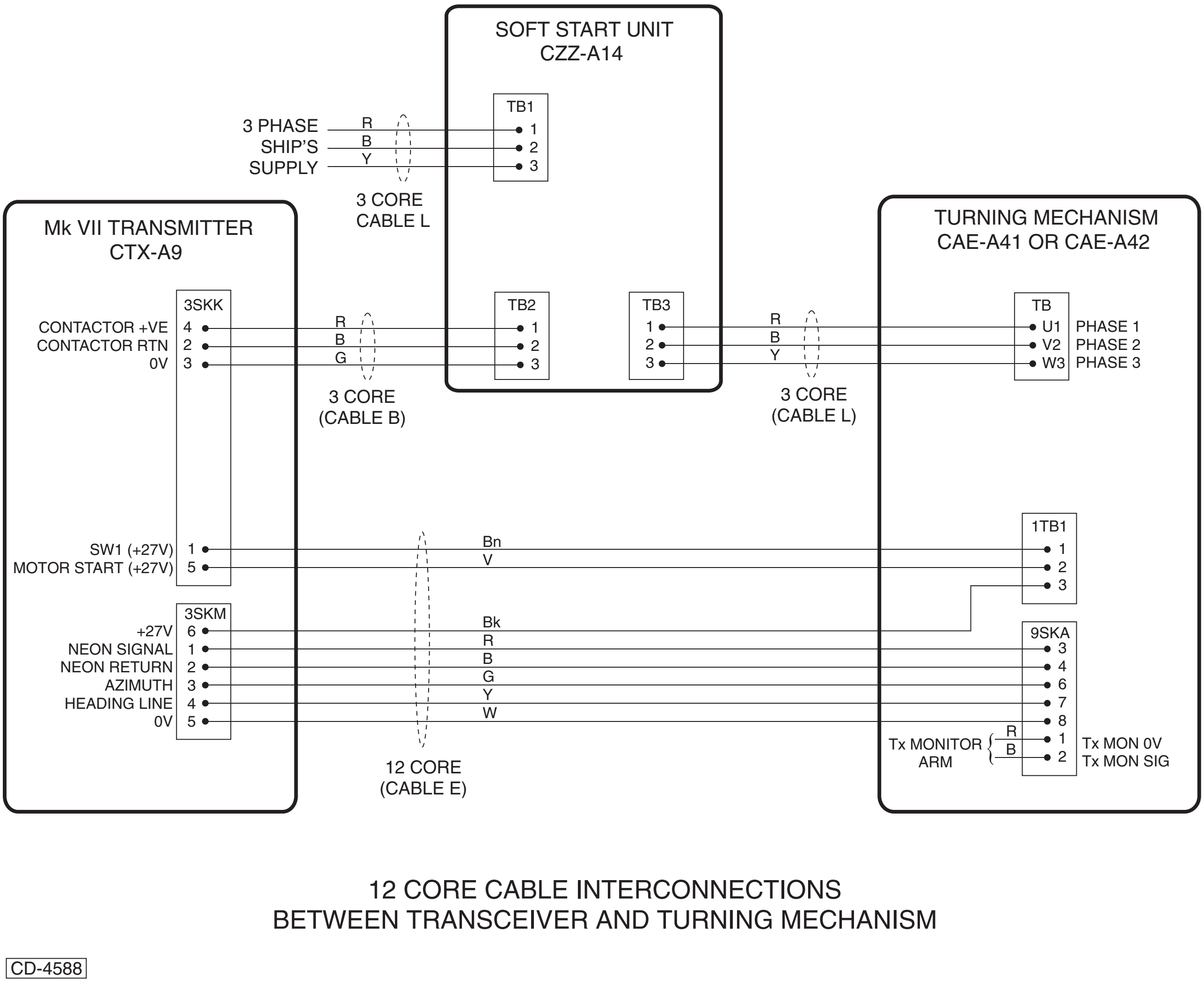


Figure 15e - Transceiver (CTX-A9) to Turning Mechanism Connections

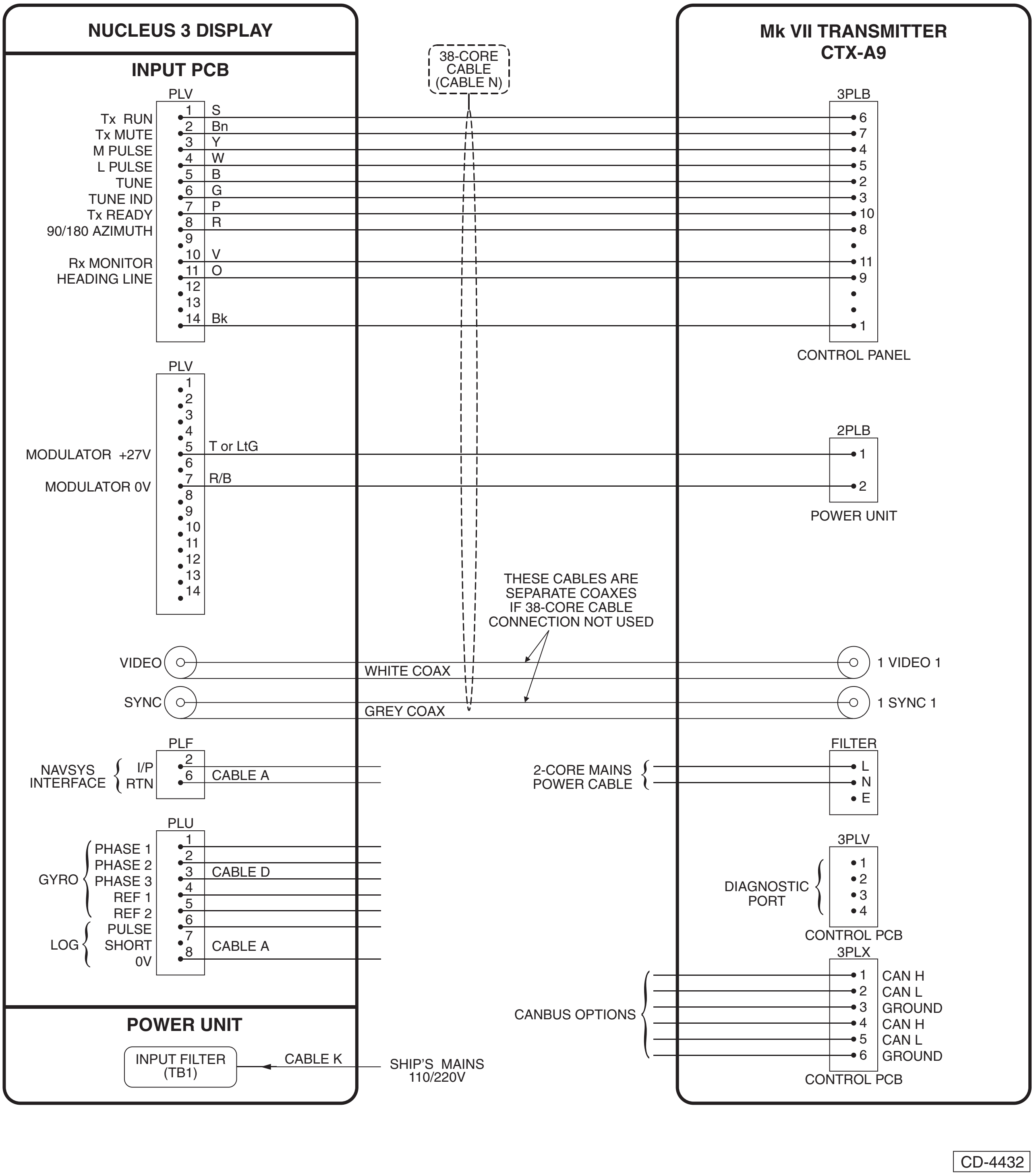


Figure 16e - Typical Nucleus 3 System Interconnections

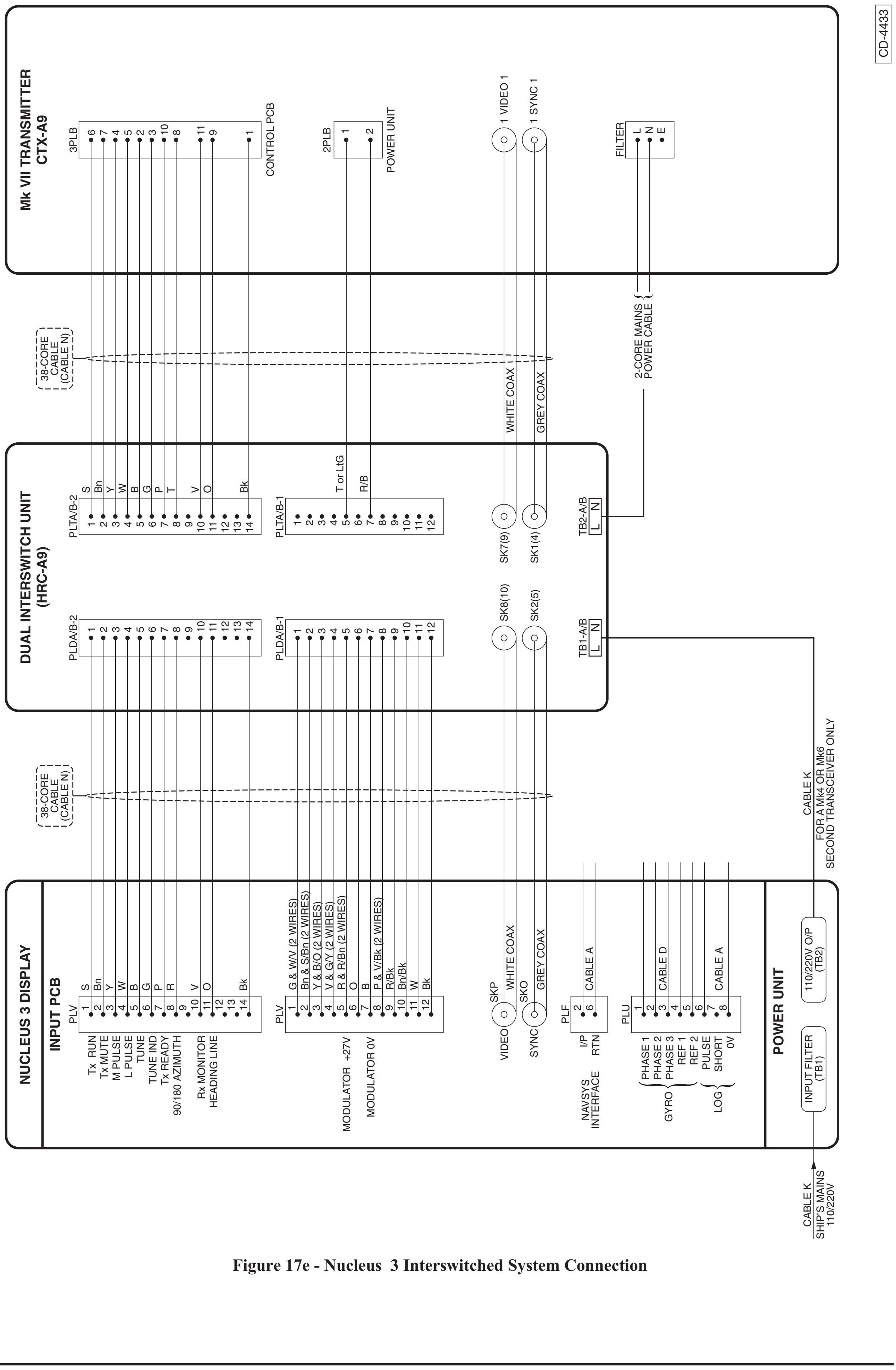


Figure 17e - Nucleus 3 Interswitched System Connection

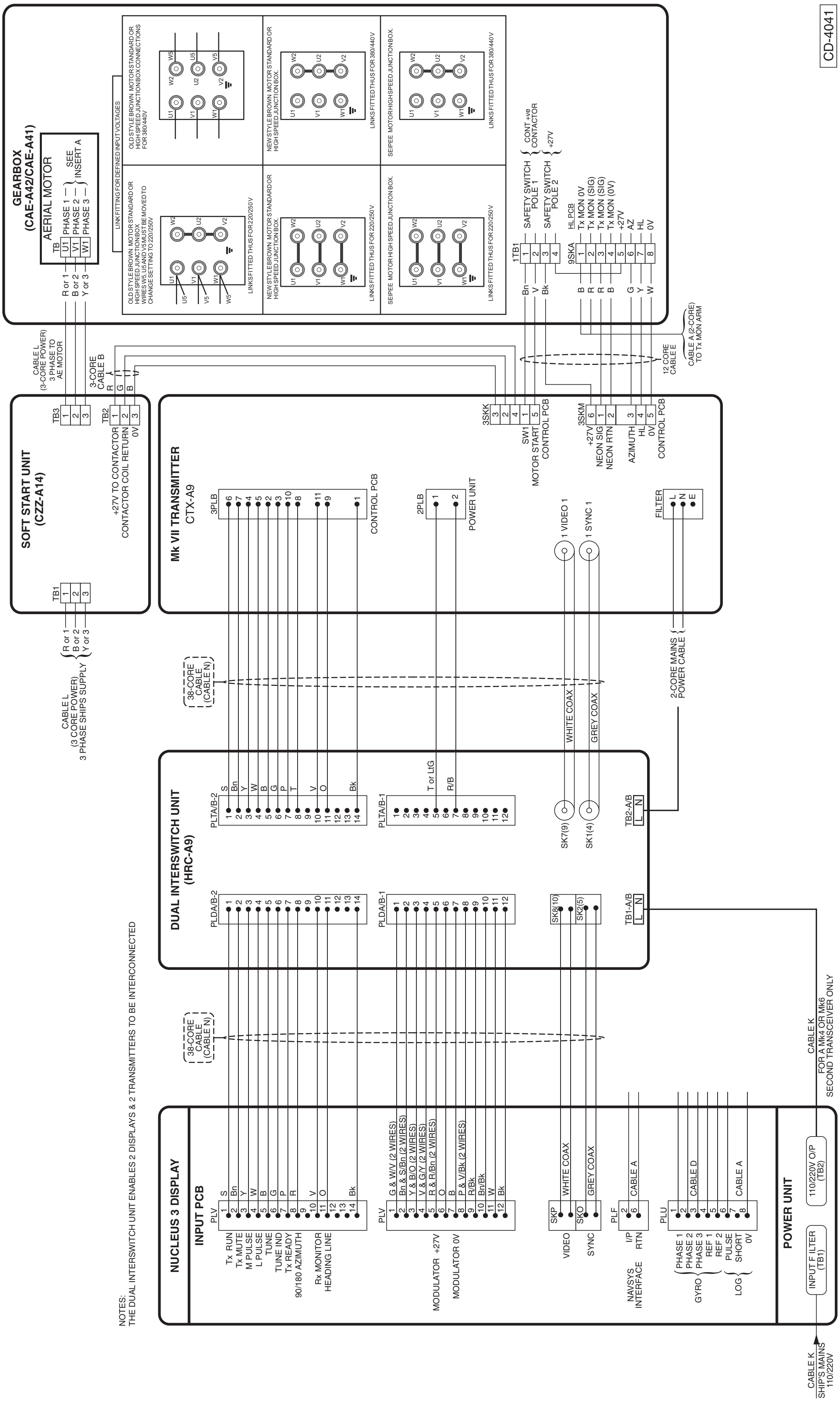
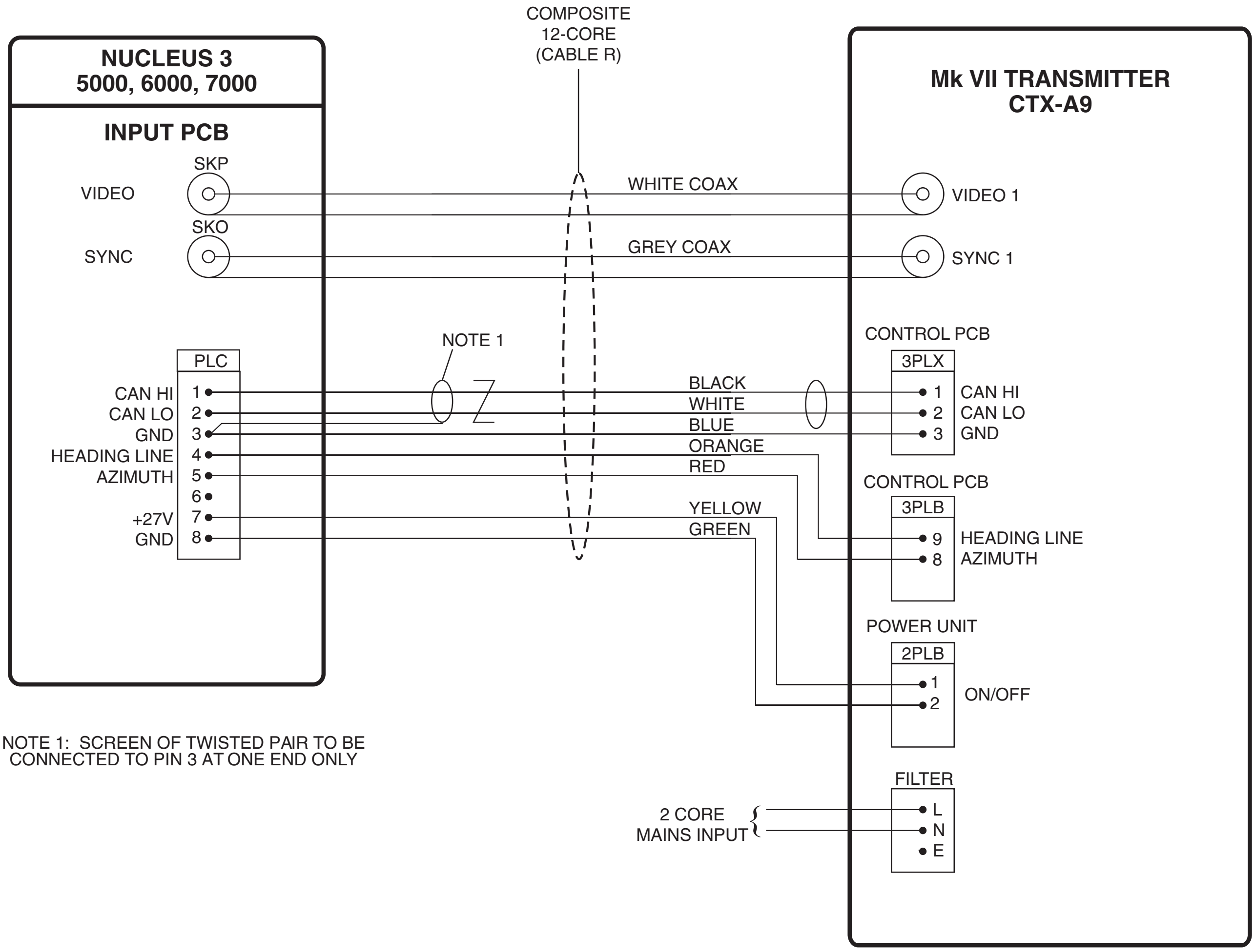


Figure 18e - Nucleus 3 Display to Dual Interswitch Unit to Downmast Transceiver CTX-A9 and MkVI Turning Mechanism with Soft Start Unit



NOTE 1: SCREEN OF TWISTED PAIR TO BE CONNECTED TO PIN 3 AT ONE END ONLY

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Figure 19e - Typical Nucleus 3 CANbus System Interconnection

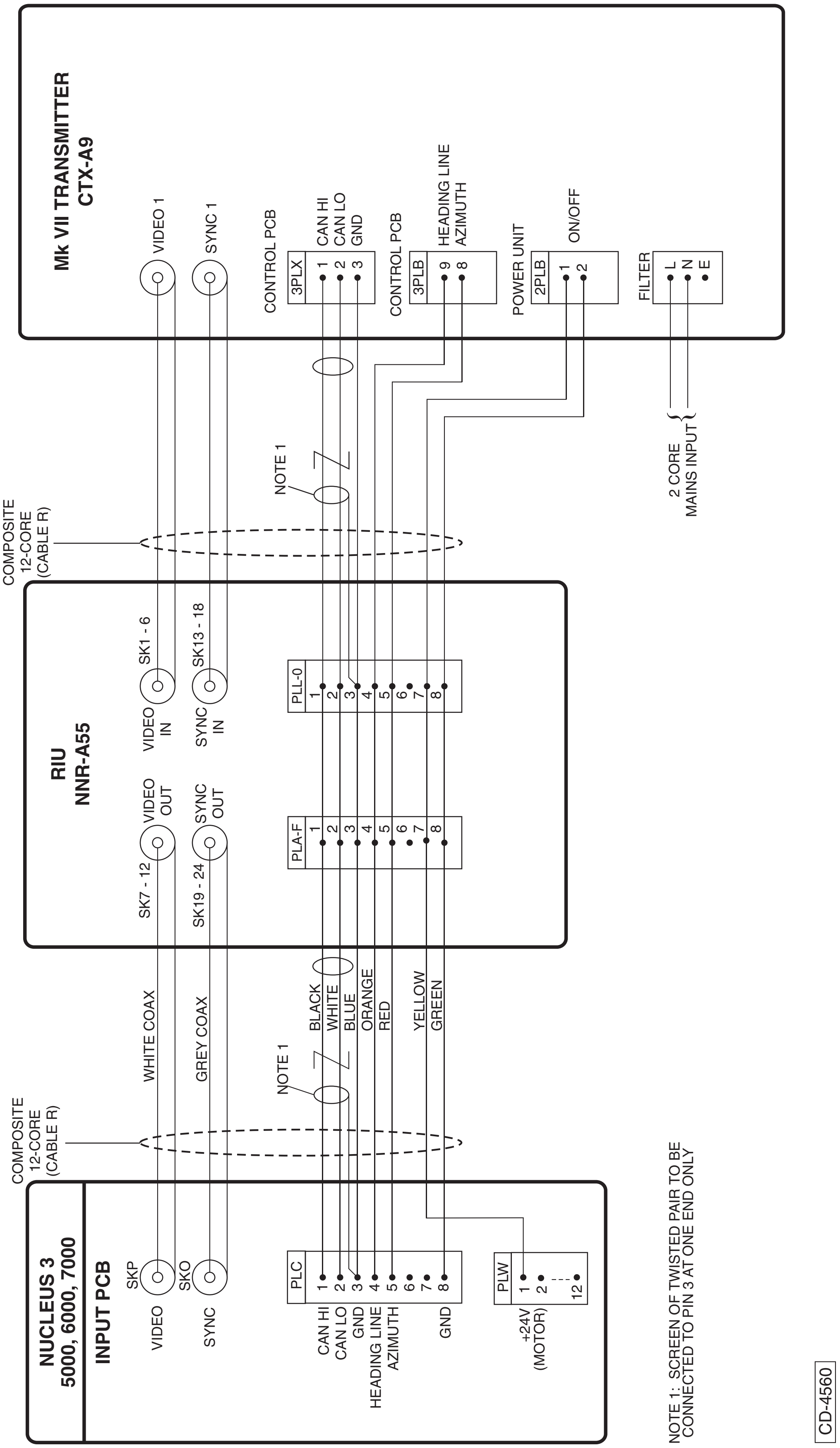

Figure 20e - Nucleus 3 Interswitched CANbus System Configuration

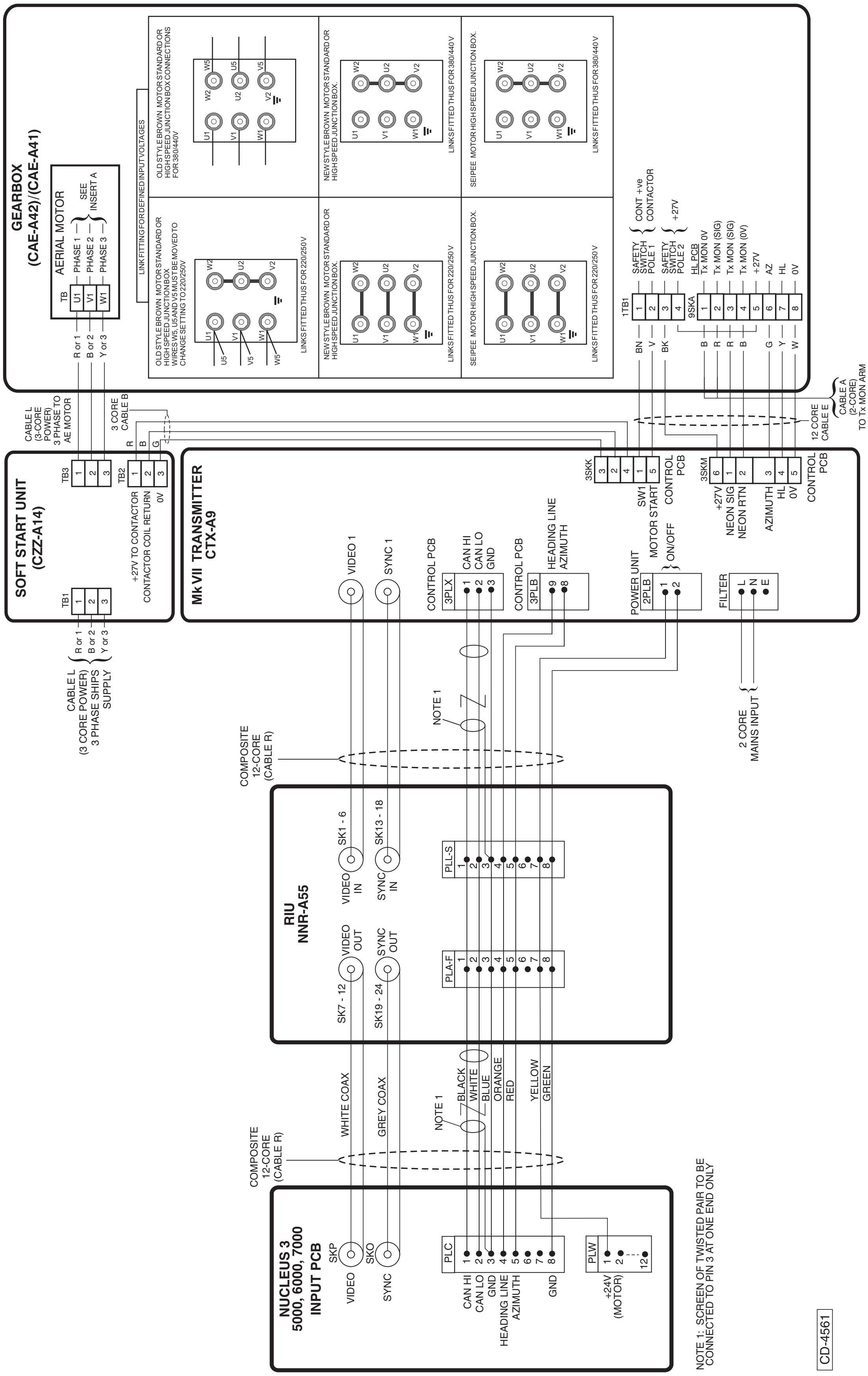

Figure 21e - Nucleus 3 Display to RIU to Downmast Transceiver CTX-A9 and Turning Mechanism with Soft Start Unit

LONG CABLE RUNS

INTRODUCTION

78 Where the distance between the transceiver and the display is greater than 65 metres up to a maximum of 180 metres, low loss co-axial cables must be used as specified below.

CABLE SPECIFICATIONS

Co-axial Cable 75 ohms low loss (for extended cable runs)

Coaxial Cable:	CODE number 5344-719
Type ECL 125	(Manufacturer's code)
Specification:	TBD
Inner conductor:	1.25 mm Single Conductor
Dielectric:	Air spaced Polyethylene
Screen:	Tape Screen
Overall Dia:	8.3 mm

Electrical

Attenuation:	60 MHz 3.4 dB/100m MAX
	100 MHz 4.9 dB/100m MAX
Impedance:	75 Ohm

CHAPTER 4F

INSTALLATION & INTERCONNECTIONS - TRANSCEIVER MKVII (X-BAND)

GENERAL

1 This section provides installation information for MkVII Downmast X-Band Transceivers.

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 400.

MAXIMUM RECOMMENDED WAVEGUIDE LENGTHS

4 The following maximum waveguide lengths are recommended:

	Std Speed	High Speed
X-band	28m	20m

COMPASS SAFE DISTANCES

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

	Grade I (0.25 degree)	Grade II (1 degree)
MkVII Transceiver	1.4 m	0.8 m

TRANSCEIVER AND TURNING MECHANISMS

6 There are two versions of the MkVII X-Band Transceiver and Turning Mechanism:

(1) 25 kW X-Band, Downmast 24 rpm (CTX-A8 Transceiver and CAE-A30-6 Turning Mechanism).

(2) 25 kW X-Band, Downmast 40 rpm (CTX-A8 Transceiver and CAE-A30-5 Turning Mechanism).

7 The electronics for the downmast system, are housed in a separate bulkhead mounted enclosure. The downmast transceiver is connected to the turning mechanism, via elliptical waveguide or waveguide 16.

8 The 24 rpm turning mechanism is used for normal applications. The 40 rpm turning mechanism is used for high speed craft.

SAFETY NOTES

CAUTION

Observe the Health and Safety Notices at the front of this manual.

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

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

11 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 Turning Mechanism housing with a guard rail surrounding it.

12 A flat steel plate (12 mm thick approx.), pre-drilled (in accordance with Figure 1f) to accommodate the Turning Mechanism and the cable and waveguide from the Transceiver. The steel plate must be mounted horizontally and braced with struts for rigidity.

13 The plate has to be sited in a clear area where the turning Antenna cannot be obstructed by any cables, mast halyards etc.

14 The Antenna and Turning Mechanism must be hoisted to the fixing position using a secured block and tackle or rope strops.

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

16 The Antenna and Turning Mechanism **MUST NOT** be lifted by the array, but the complete unit secured and hoisted evenly.

EQUIPMENT LOCATION

TURNING MECHANISM (CAE-A30-5 & CAE-A30-6))

17 The Turning Mechanism 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.

18 The Turning Mechanism is to be mounted on a rigid platform, which is positioned so that the rotating antenna is clear of other structures.

19 The primary consideration must be the strength of the support for the Turning Mechanism/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 0.6m (2ft) 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.

20 The Turning Mechanism **must not** be mounted where the temperature exceeds 70^{o}C.

21 The Turning Mechanism must be kept clear of ship's flexible communication aerials to avoid damage to both.

DOWNMAST TRANSCEIVER (CTX-A8)

22 The following points must be considered when selecting a suitable site for the Downmast Transceiver:

(1) The transceiver is designed for bulkhead mounting.

(2) Consideration must be given to accessibility for servicing and protection from adverse conditions. For ease of maintenance, the top of the transceiver should not be mounted more than 1.6m above the deck.

(3) Ensure that there is sufficient space below the unit for cable entries, and above the unit to allow for connection of the elliptical waveguide or waveguide 16 coupling. The semi-rigid elliptical waveguide has a minimum bend radius of 200 mm (8”) E plane, and 480 mm (19”) H plane.

(4) The transceiver should be mounted in a position which allows for ventilation and cooling.

(5) Do not fit the transceiver in an acoustic, noise sensitive area, i.e. Bridge or Operations Room.

(6) Do not fit the transceiver in close proximity to any magnetic compass or D/F aerial.

23 Connecting cables between the display and the transceiver should be limited to a length of 65 metres. Where the distance between transceiver and display exceeds 65 metres, advice must be obtained from Kelvin Hughes Ltd. Details of Line Amplifiers and Receivers for use with long cable runs are provided in Annex A to this manual.

24 Cable runs between the transceiver and the antenna turning mechanism should be kept to a minimum length, i.e. less than 35m, with as few waveguide bends and twists as possible. Supporting brackets and couplings are to be used to eliminate the effects of vibration.

OPTIONAL MAINS ISOLATOR (80-261-600)

25 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

TURNING MECHANISM (CAE-A30-5 &

WARNING

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

CAE-A30-6)

26 The Antenna and Turning Mechanism are specified and supplied separately. Refer to Figure 1f of this chapter for outline dimensions and fixing centres. The following criteria are to be observed when installing:

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

(2) Use a suitable jointing compound or sealant to prevent corrosion between the platform and the turning mechanism.

CAUTION

The Antenna Window must not be painted

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

NOTE:

Assemble the two units together prior to hoisting into the installation position.

(4) Remove the protective caps, tapes etc. Ensure the waveguide faces are clean and free from grease. Fit the appropriate 'O' ring. Fit the Antenna array to the Turning Mechanism with the eight bolts, holding it loosely in position. DO NOT TIGHTEN THE BOLTS. Refer to Figure 2f.

(5) Align the waveguide from the Antenna to the Rotating Joint and fit the four waveguide bolts. Do not force the waveguide to the coupling face. Tighten the waveguide bolts evenly until the mating faces are flush. Torque load the Antenna retaining bolts to 19 to 24 Nm (14-16 lb/ft).

(6) Hoist the Turning Mechanism and Antenna assembly, (ensuring the slings do not foul with the Array), to the mounting plate. DO NOT LIFT BY THE ANTENNA.

(7) Mount the Turning Unit facing forward (removable cover facing aft). Fit the retaining bolts and torque load to 75 kg/m (50 lb/ft) then gain access to the interior by removing the rear cover.

NOTE:

The outer casing of the Turning Unit must be bonded to the ship's superstructure using a copper earthing strap connected to the earthing point shown in Figure 1f.

(8) The connecting cable from the Turning Unit to the Transceiver should be kept to a maximum of 65 metres. Do not exceed 65m without consulting the Kelvin Hughes Technical Department.

(9) Fit the Monitor Arm (if supplied) onto the side of the casing and secure the clamp with the four retaining screws. The monitor arm cable is passed through the smaller cable gland and clamped. The cable screen is to be earthed by the ferrules in the cable gland assembly.

Waveguide Installation

27 Waveguide installation information is detailed in paragraph 32.

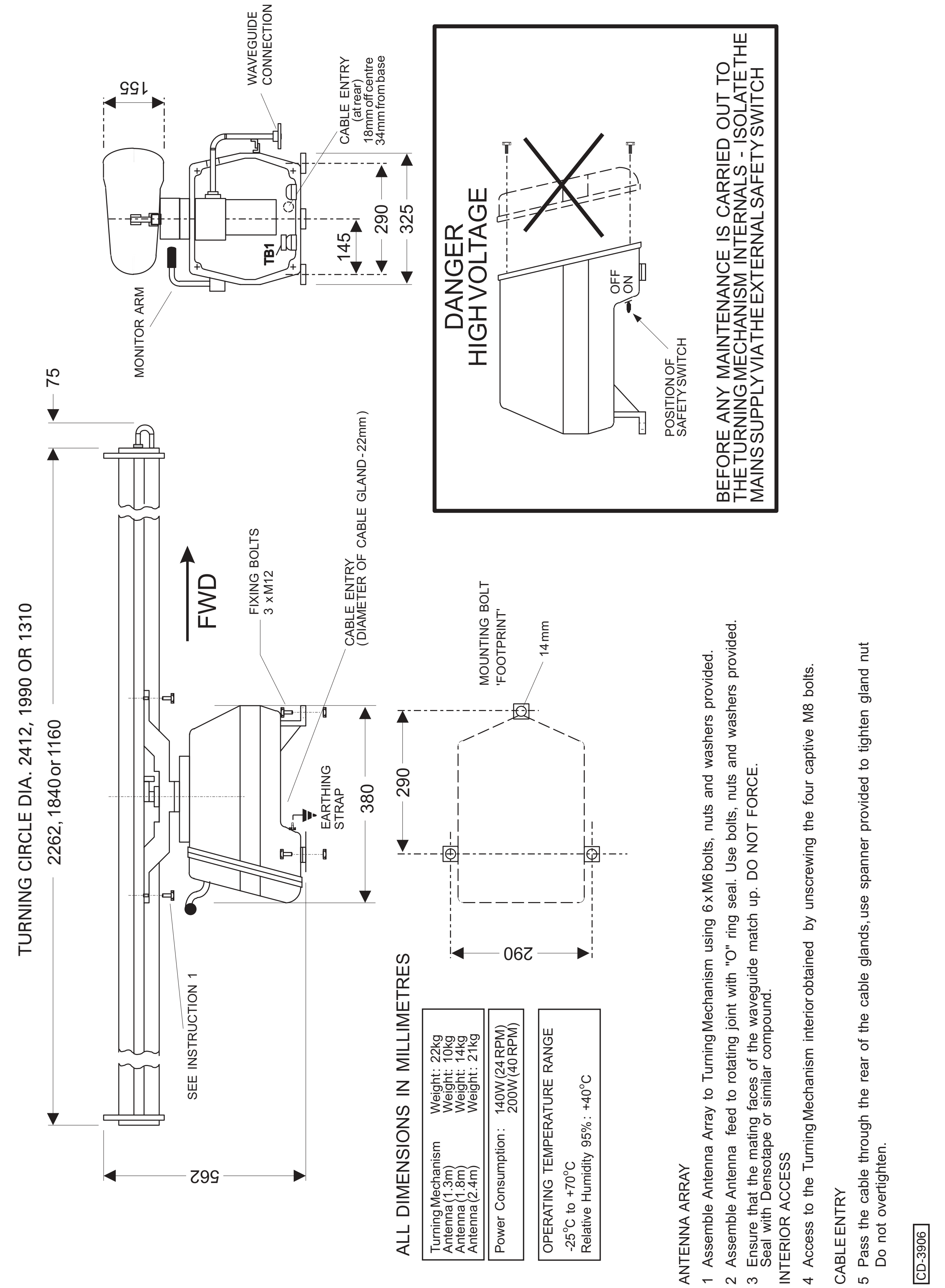

Figure 1f - Turning Unit Fixing Centres and Outline Dimensions

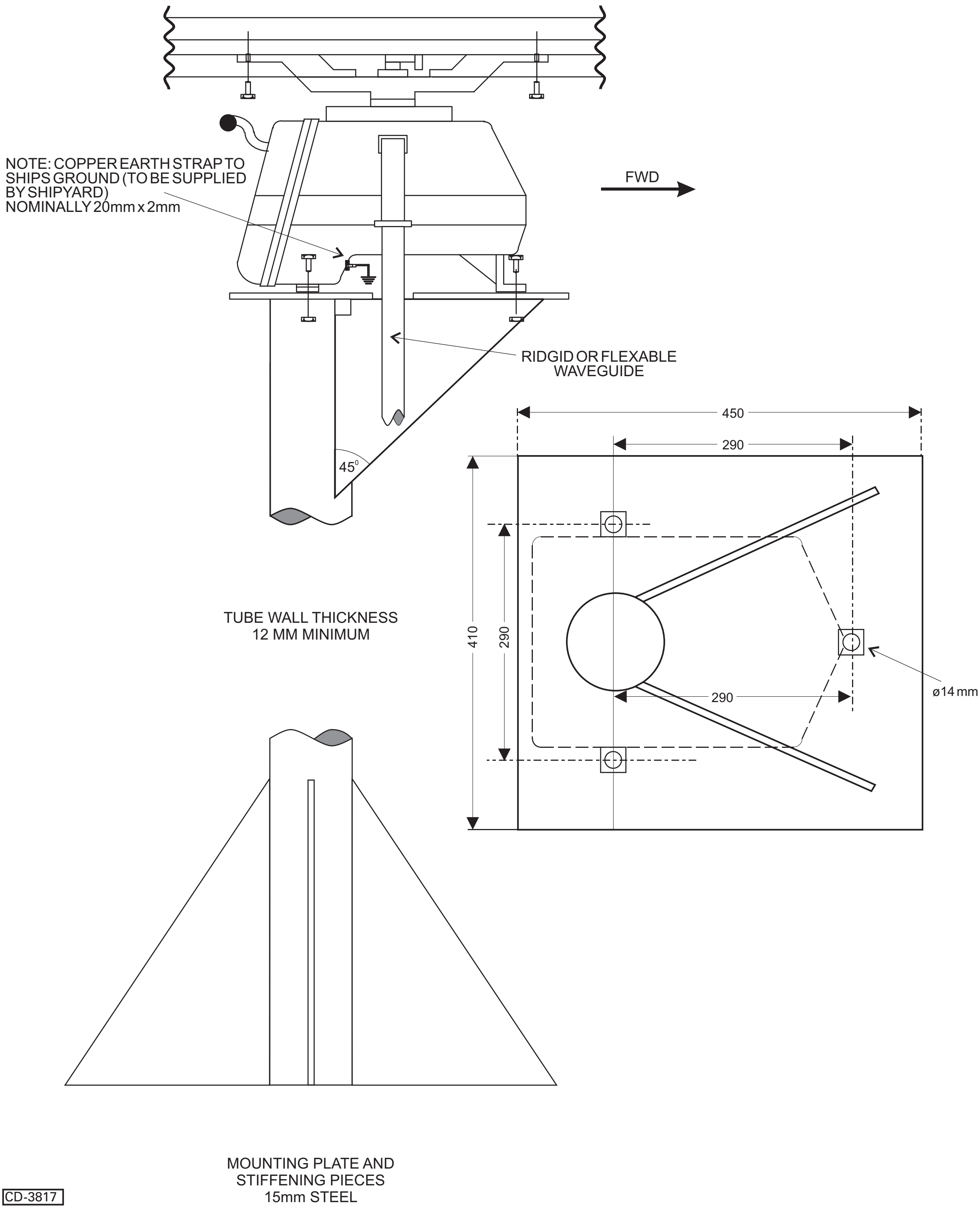

Figure 2f - Turning Unit Mast Mounting

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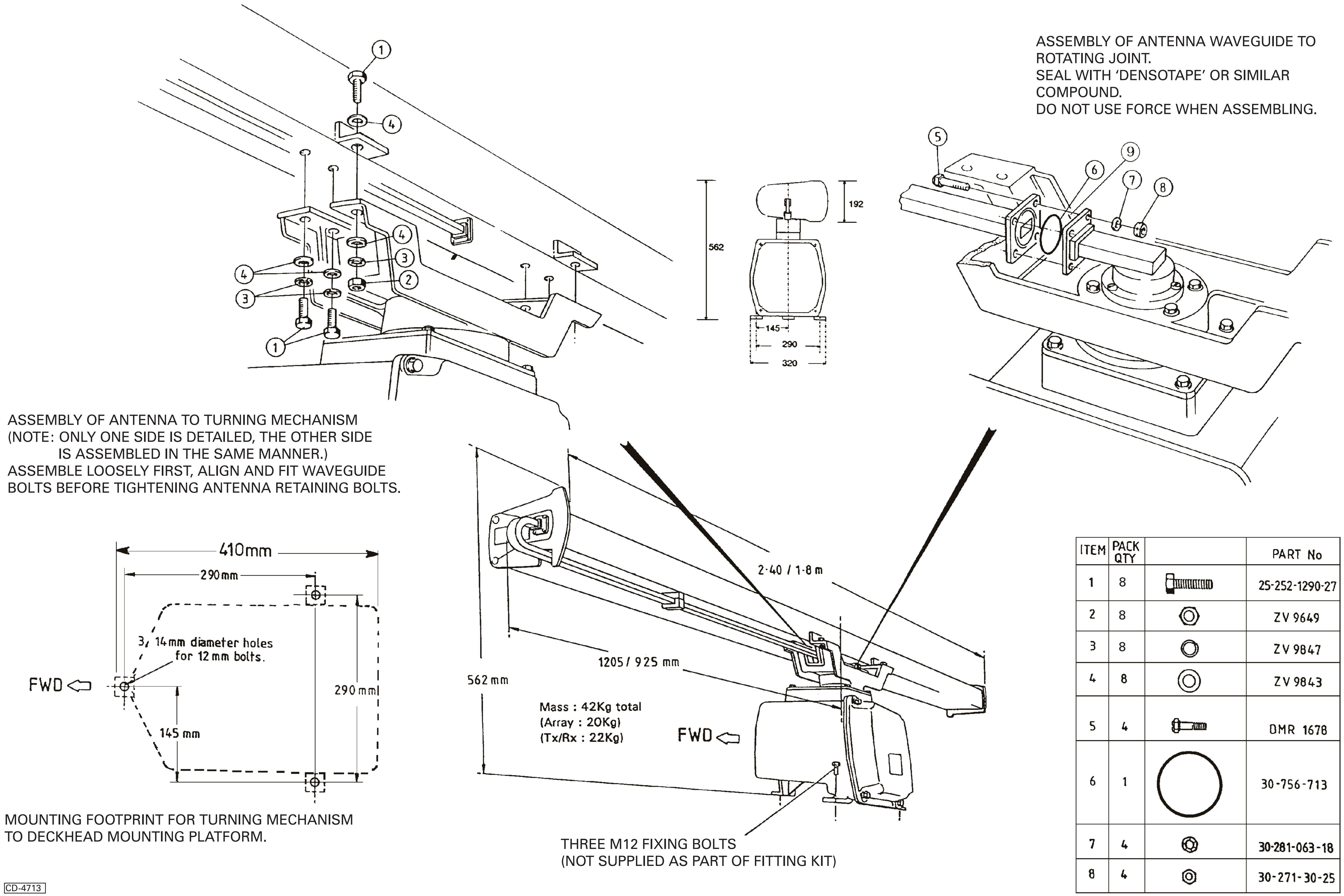


ITEM	PACK QTY		PART No
1	8		25-252-1290-27
2	8		ZV 9649
3	8		ZV 9847
4	8		ZV 9843
5	4		DMR 1678
6	1		30-756-713
7	4		30-281-063-18
8	4		30-271-30-25

Figure 3f - Assembling Antenna to Turning Mechanism

DOWNMAST TRANSCEIVER (CTX-A8)

WARNING

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

Construction

28 The general construction of the downmast X-Band transceiver comprises a sheet-metal rear plate which is formed, to include the top of the unit. This is braced by two 'U' sections which protrude above and below the plate, providing the bulkhead fixing points.

29 The PCBs are mounted both sides of the modulator chassis and are removed as a complete assembly.

30 A wrap-around cover made from sheet-metal, encloses the unit and is fixed by six captive screws. Removing the cover gives access to the front and sides of the Transceiver electronics. Cable entry is at the bottom of the unit.

Mounting

31 Fit the transceiver to the securing bulkhead using the installation bolts supplied with the fitting kit. Refer to Figure 4f for dimensions.

WAVEGUIDE INSTALLATION

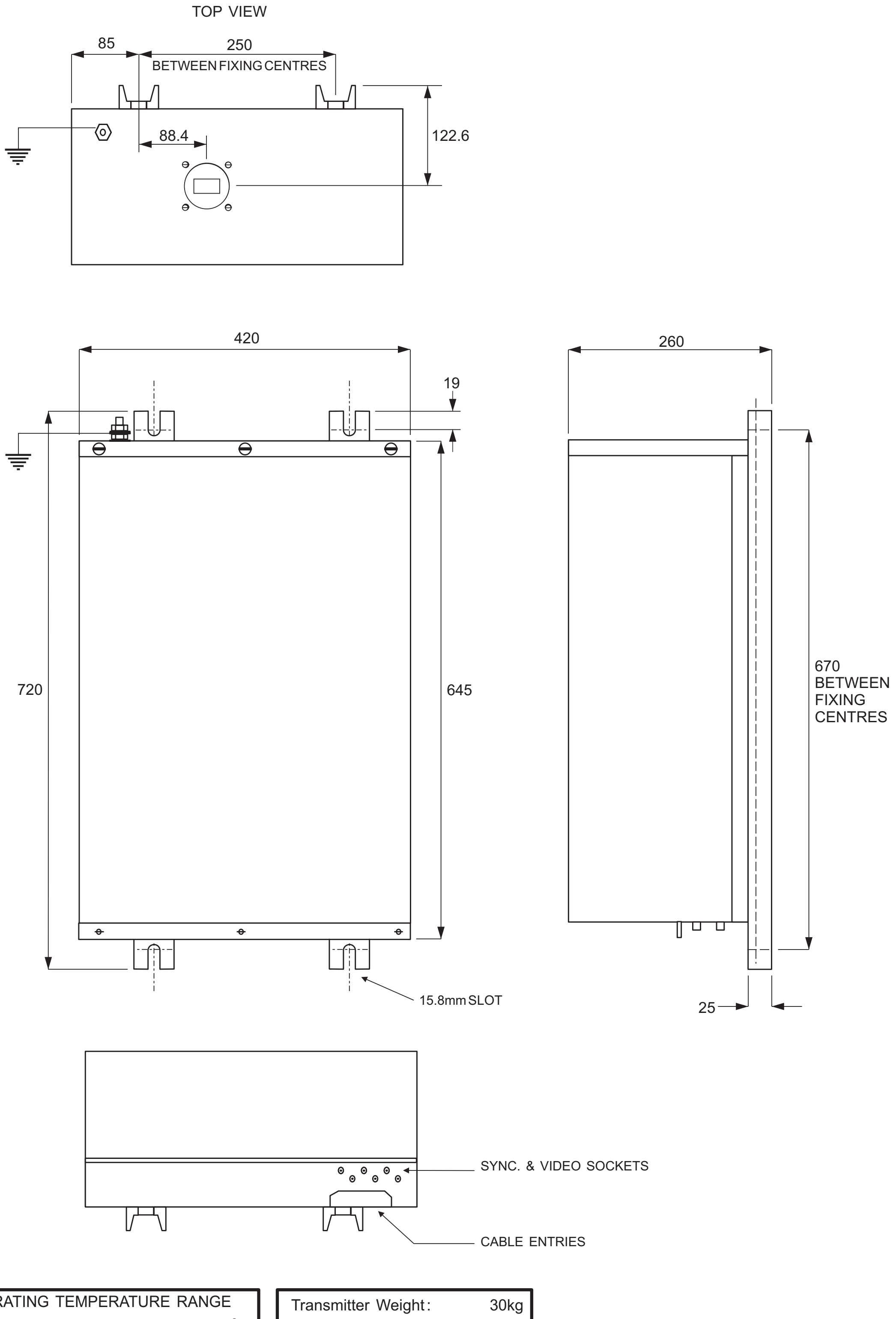
32 This section deals with the installation of the waveguide between the Turning Mechanism and the Transmitter/Receiver. It is not concerned with waveguide items inside the equipment.

33 Carefully and correctly installed waveguides are, up to the present, the most efficient means of transmitting electrical energy at high frequencies. Losses inherent in waveguides are, however, still considerable. To keep them to a minimum, the following factors are of great importance: minimum length, air tightness and electrical continuity.

34 The Transmitter, a magnetron type valve, is also the primary oscillator. Mismatches of impedances in the waveguide cause reflection of power back to the magnetron which can result in 'frequency pulling' and instability. Mismatches in a waveguide run can occur at joints, bends and twists – all of which must be kept to a minimum.

ELLIPTICAL WAVEGUIDE

35 Detailed instructions for the installation of elliptical waveguide are given in the following pages.



OPERATING TEMPERATURE RANGE
At Relative Humidity 0%   -15°C to +55°C
At Relative Humidity 95%: +40°C

Transmitter Weight: 30kg

Power Consumption:
CAE-A30-5   340W 500VA
CAE-A30-6   275W 400VA

COMPASS SAFE DISTANCES:-
Standard Compass   2.3m (Grade I)
Steering Compass   1.4m (Grade II)

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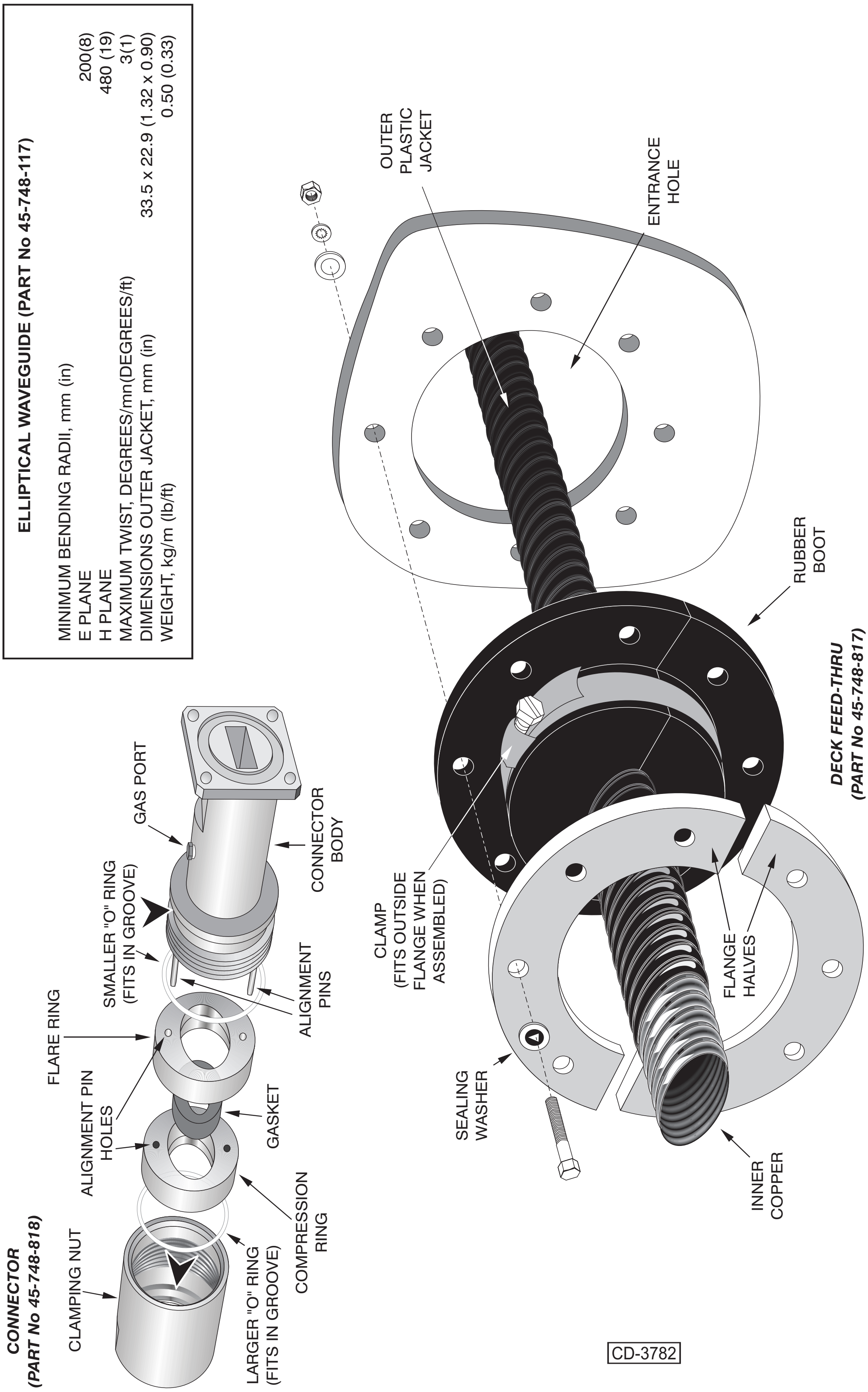
Figure 4f - Downmast Transceiver (CTX-A8): Installation Dimensions



ELLIPTICAL WAVEGUIDE (PART No 45-748-117)

MINIMUM BENDING RADII, mm (in)	
E PLANE	200(8)
H PLANE	480 (19)
MAXIMUM TWIST, DEGREES/mn(DEGREES/ft)	3(1)
DIMENSIONS OUTER JACKET, mm (in)	33.5 x 22.9 (1.32 x 0.90)
WEIGHT, kg/m (lb/ft)	0.50 (0.33)

Figure 5f - Elliptical Waveguide Assembly

Elliptical Waveguide Assembly Techniques

Tools and Materials Required for Assembly

Knife, Metal snips, Teflon tape, Bottle brush, Small flat file, Hacksaw (fine blade), Rule (150 mm), Mallet (plastic or nylon head), Wrenches (two needed: adjustable 3/4" to 2" & 1 15/16"), Solvent, Comothene, Vythene or other non-flammable cleaning fluid.

Step 1) Prepare waveguide (as shown in Figure 1). The end of the waveguide must be square. Use a straight edged piece of paper wrapped around the waveguide whilst cutting to stop copper chips from entering. Remove all burrs from the cut end of the waveguide using a knife and file. Clean exposed copper with solvent. Clean inside of the waveguide with a bottle brush.

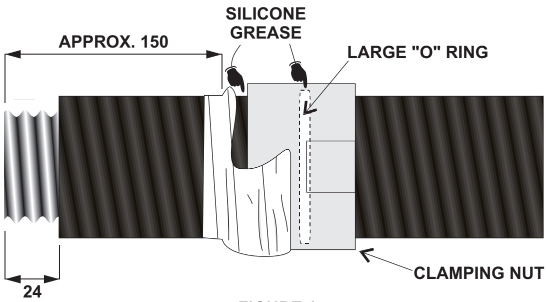


FIGURE 1

Step 2) Add a thin coating of silicone grease to the large "O" ring gasket and place it into the groove inside the clamping nut, then to the smooth inside surface of the clamping nut which slides over the smaller "O" ring (Step 8). Place the nut over the end of the waveguide approximately 150 mm from the end as shown. Secure the nut to the waveguide with several turns of tape, covering the end of the nut to stop foreign matter from entering during the assembly operation.

Step 3) Slip the compression ring over the waveguide until the recessed edge butts up against the jacket. Apply a small amount of silicone grease to the edge of the jacket to aid in installing the compression ring. Alignment pin hole openings must face away from the waveguide (as shown in Figures 2 & 3).

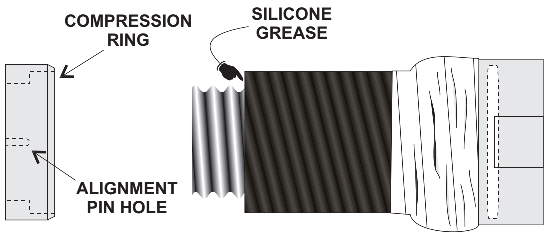


FIGURE 2

Step 4) Turn the gasket inside out and place over end of the waveguide. Apply very thin coating of silicone grease to the gasket threads, then flip the gasket over and butt up against the compression ring. Apply a thin coating of silicone grease to the outside surface of the gasket (refer to Figure 3). Clean any silicone grease from the exposed copper using solvent.

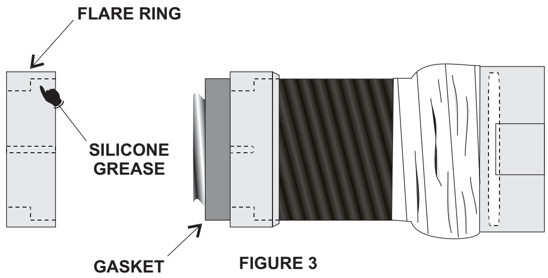


FIGURE 3

Step 5) Slip recessed side of flare ring over the gasket. Alignment pin holes in the flare ring and compression ring must be in line. The flare ring must be pushed against the compression ring as tight as possible (refer to Figures 3 & 4. Approximate opening between the flare ring and the compression ring should be as shown).

Step 6) Use metal snips to make cuts into the end of the waveguide at 3 mm intervals to form tabs (see Figure 4). Make the cuts as close as possible to the flare ring.

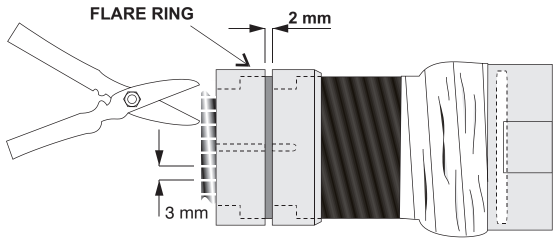


FIGURE 4

Step 7) Flatten tabs against the flare ring using a mallet (as shown in Figure 5). Use only enough force to flatten the tabs and ***do not strike so hard as to reduce the thickness of the metal.*** Trim any tab that protrudes past the outside of the groove in the flare ring. After the tabs are flattened and trimmed, tabs should be cleaned with solvent to remove any silicone grease. The face of the connector body which makes contact with the tabs should also be cleaned thoroughly so that no grease is present in the mating of the RF contact surfaces. Clean inside of the waveguide with a bottle brush.

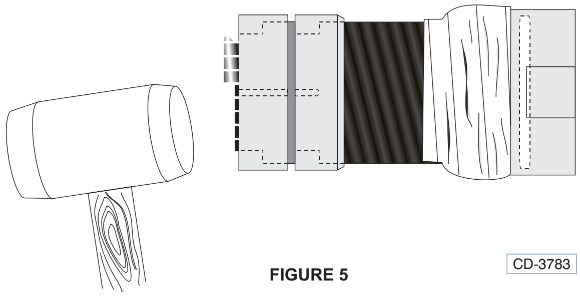


FIGURE 5

Elliptical Waveguide Assembly Techniques (continued)

Step 8) Place smaller "O" ring gasket into groove in connector body. ***Do not apply silicone grease to this gasket.*** Apply a thin coating of silicone grease to the rear outer surface of the compression ring. This will allow the large "O" ring gasket inside the clamping nut to slide over the compression ring.

Step 9) (Refer to Figure 6). Place connector body against flare ring. The alignment pins must be properly seated in the alignment holes of the flare ring and the compression ring. Untape the clamping nut and slide it over the assembled parts and screw it onto the connector body. Tighten the connection with wrenches. Use the adjustable wrench on the flattened portion of the connector body to hold it in position whilst the clamping nut is tightened. ***Only turn the clamping nut; do not turn the connector body.***

Step 10) The waveguide should be checked for leaks whenever connectors are attached, when connector attached waveguide is received on site or after installation. A dependable method is to apply a soap solution to cable connectors and pneumatic fixings and checking for bubbles. When mating two UG type flanges with gasket grooves, two flange gaskets must be used. If a flange with a gasket groove is mated to a flange without a groove, use only one gasket. Mating two EIA type flanges, use only one flange gasket. ***Do not apply silicone grease to flange gaskets.***

Caution!

When pressure fitting is connected to gas port on waveguide connector, avoid excessive tightening. Apply 1 1/2 turns of Teflon tape to threads and tighten fitting to only 2 1/2 foot-pounds (0.35 kg-m), which is

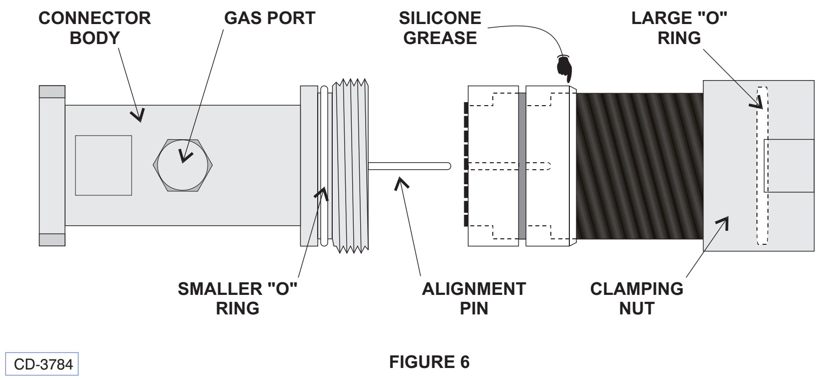
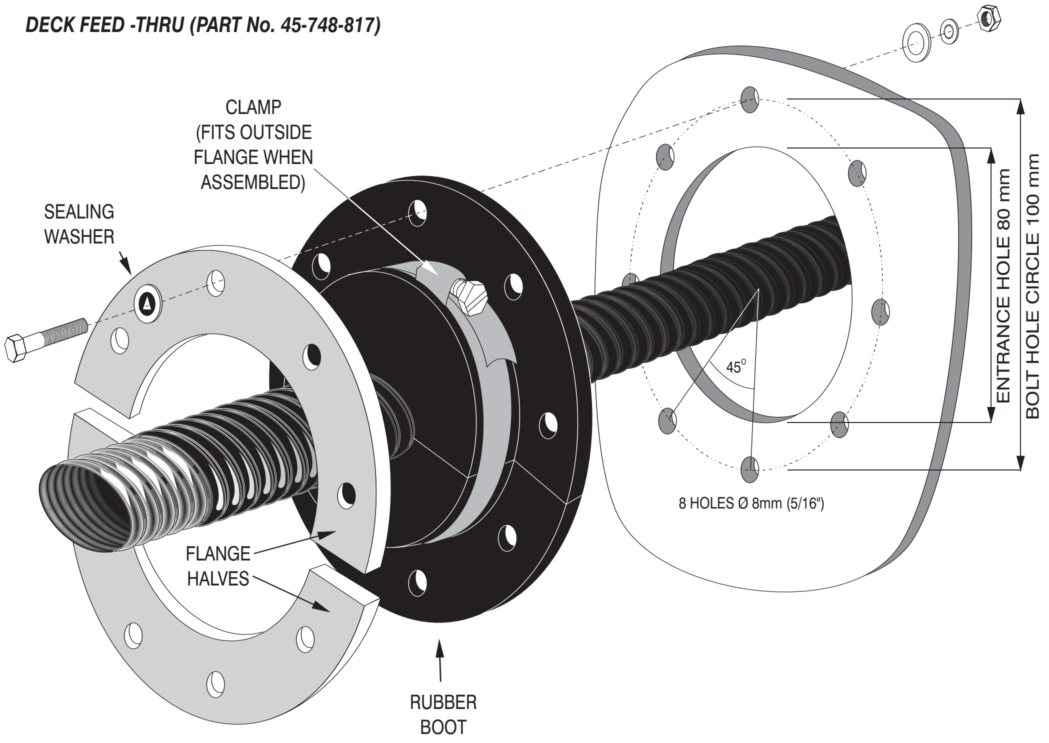


FIGURE 6

Elliptical Waveguide Assembly Techniques (continued)



Description

The deck feed through kit is designed to permit a weatherproof path through a deck for an elliptical waveguide. The kit can be mounted to metal or wood roofs and walls. It consists of a rubber boot, two metal flange halves, washers and an adjustable clamp.

Step 1) Cut an 80 mm entrance hole in the deck for the rubber boot.

Step 2) Insert the waveguide through the entrance hole and connect it to the components inside.

Step 3) Apply silicone grease to the hole and slit of the boot. Place the rubber boot around the waveguide. Slide the boot into the entrance hole and mark the locations of the 8 equally spaced mounting holes.

Step 4) Remove the rubber boot. Drill an 8 mm (5/16") clearance hole through the deck at the locations which you have marked.

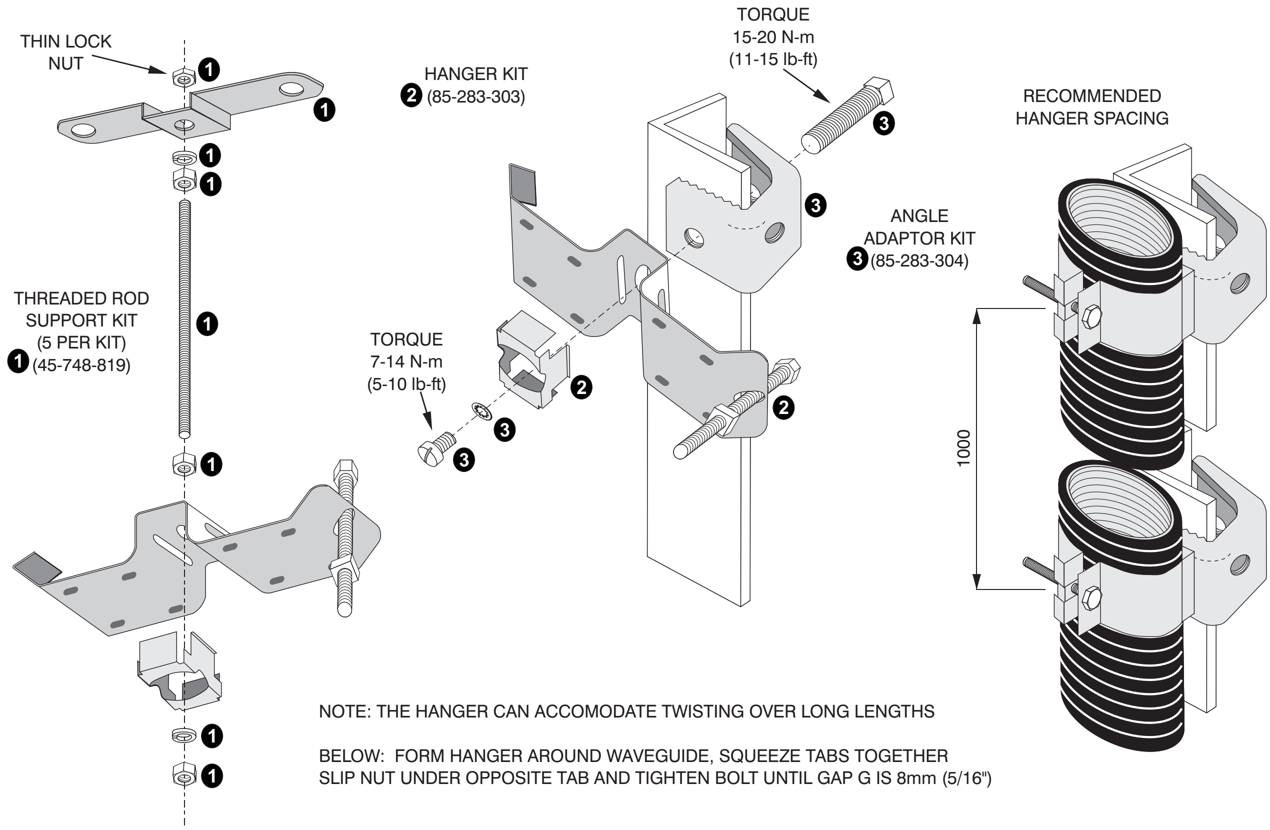
Step 5) Replace the rubber boot around the waveguide or cable and insert it into the entrance hole.

Step 6) Position the flange halves in the groove and align the holes with those in the rubber boot. Add the mounting fixings. Use 1/4" bolts, flat washers, lock washers, and nuts obtained locally. Place a flat washer against the inside of the deck and a sealing washer under the bolt head as shown in the illustration. Tighten the fixings.

Step 7) Add the adjustable clamp as shown and tighten it to ensure a leakproof seal.

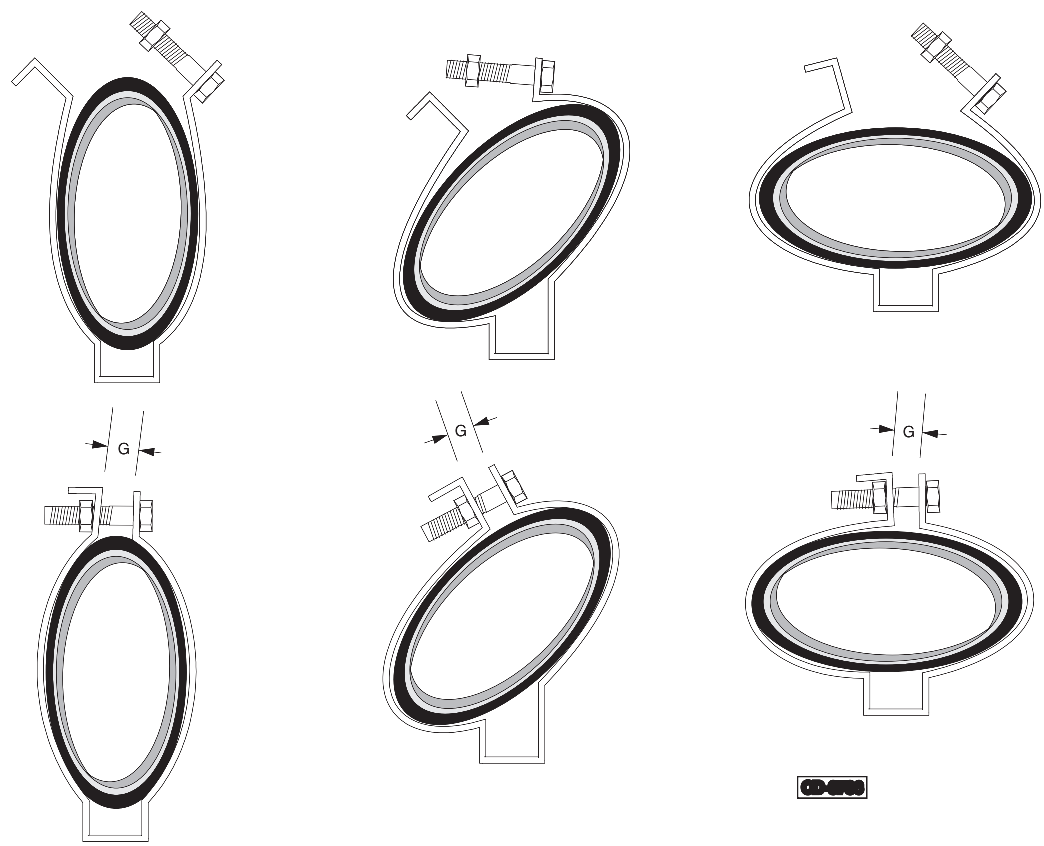
CD-3785

Elliptical Waveguide Assembly Techniques (continued)



NOTE: THE HANGER CAN ACCOMODATE TWISTING OVER LONG LENGTHS

BELOW: FORM HANGER AROUND WAVEGUIDE, SQUEEZE TABS TOGETHER
SLIP NUT UNDER OPPOSITE TAB AND TIGHTEN BOLT UNTIL GAP G IS 8mm (5/16")



OPTIONAL MAINS ISOLATOR (80-261-600)

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

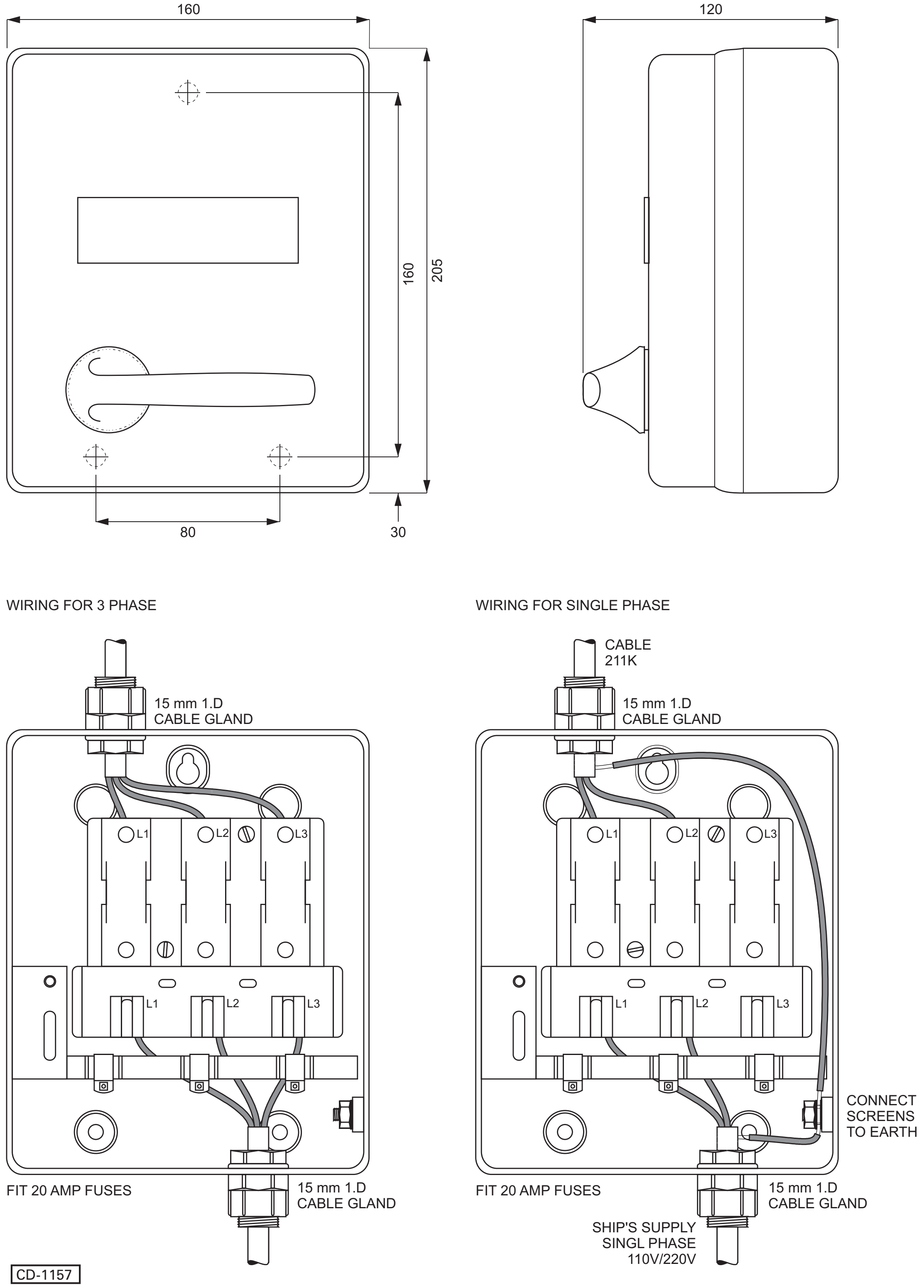


Figure 6f - Mains Isolator: Installation Dimensions

ELECTRICAL CONNECTION

CABLE SPECIFICATIONS

37 Each cable is identified by a letter code which defines the type of cable required, e.g. Cable code N is a 38-core cable. Table 4 provides specifications for each cable type. Table 5 provides 38-core cable, colour code abbreviations.

38 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 4: Cable Specification

CABLE	DESCRIPTION	CODE	CORE	DIAMETER
A	2-core small multi-core	1344-718	16/0.2	6.1 mm 7.7 mm
B	3-core small multi-core	1344-719	16/0.2	6.4 mm 7.2 mm
C	Not used			
D	Not used			
E	12-core small multi-core	1344-722	16/0.2	10 mm 11 mm
F	Not used			
G	25-core small multi-core	1344-724	16/0.2	13.6 mm 14 mm
H.	TO BE SUPPLIED BY CONTRACTOR			
J	Not used			
K	2-core Power	5344-787	7/0.67	10 mm
L	Not used			
N	38-core small multi-core	5344-701		17 mm
R	12-core composite	45-762-0041-001	Mixed	15.4 mm

38-Core Custom Built Cable

39 The 38-core composite cable (KH code number 5344-701) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0.2 mm copper wire.

(2) 32 cores of 16/0.2 mm copper wire.

(3) 2 cores of co-axial cable.

12 Core Composite

40 The 12-core composite cable (KH code number 45-762-0041-001) is made for Kelvin Hughes and comprises the following:

(1) 4 cores of 32/0/2 mm copper wire

(2) 4 cores of 16/0.2 mm copper wire

(3) 2 cores of 16/0.2 mm twisted and screened.

(4) 2 cores of co-axial cable.

TABLE 5: 38-Core Cable Colour Abbreviations

ABBREVIATION	COLOUR
R	RED
B	BLUE
G	GREEN
Y	YELLOW
W	WHITE
Bk	BLACK
Bn	BROWN
V	VIOLET
O	ORANGE
P	PINK
T	TURQUOISE
S	SLATE (grey)
R/B	RED/BLUE
R/G	RED/GREEN
R/Y	RED/YELLOW
R/W	RED/WHITE
R/Bk	RED/BLACK
R/Bn	RED/BROWN
B/Y	BLUE/YELLOW
B/W	BLUE/WHITE
B/Bk	BLUE/BLACK
B/O	BLUE/ORANGE
G/Y	GREEN/YELLOW
G/W	GREEN/WHITE
G/Bk	GREEN/BLACK
G/O	GREEN/ORANGE
G/S	GREEN/SLATE
Bn/Bk	BROWN/BLACK
Bn/Y	BROWN/YELLOW
Bn/W	BROWN/WHITE
S/B	SLATE/BLUE
S/Bn	SLATE/BROWN
V/Bk	VIOLET/BLACK
V/Y	VIOLET/YELLOW
V/W	VIOLET/WHITE
W/R	WHITE/RED
	WHITE CO-AX
	SLATE CO-AX
N/C	NO CONNECTION

Small Multi-Core Cables

41 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.

42 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 1600Hz.

Power Cables

43 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

250/440V 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: 10 mm (0.39 in.).

3-Core (Power):

Cable Code L: KH Reference No. 5344-787
(250/440 V grade):
Specification as for 2-core cable.
Outer Diameter: 10 mm (0.44")

GENERAL

44 Before starting electrical connection observe the following:

WARNING

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

45 Isolate power supplies as follows:

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

(2) Remove fuses from mains isolators.

(3) On the Turning Mechanism, set the ON/OFF switch to OFF.

46 The casing of the upmast turning mechanism must be securely earthed to the platform with braided copper wire.

47 The casing of the downmast transceiver must be securely earthed to the deck or bulkhead with braided copper wire.

48 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.

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

50 Fit cable through gland in accordance with the diagram shown on Figure 7f.

COVER REMOVAL

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

(1) Downmast Transceiver and Turning Mechanism.

(2) Optional Mains Isolator.

Turning Mechanism

52 Remove the four captive screws securing the rear cover to the Upmast Transceiver and remove the cover.

Downmast Transceiver

53 Release the six captive screws securing the cover to the Downmast Transceiver and remove the cover.

Optional Mains Isolator

54 Open the mains isolator cover by releasing the captive screw.

PCB LOCATIONS AND CABLEFORM ROUTING

55 Location of PCBs and cableform routing in the turning mechanism are shown on Figure 7f. To fit the cable proceed as follows:

(1) Remove gland nut, plastic washer and seal and discard washer.

(2) Thread cable through back of gland housing for approx. 300 mm.

(3) Remove cable outer covering (exposing braid) back as far as 15 mm from the gland housing.

(4) Fold braid double to 80mm from gland housing (remove excess).

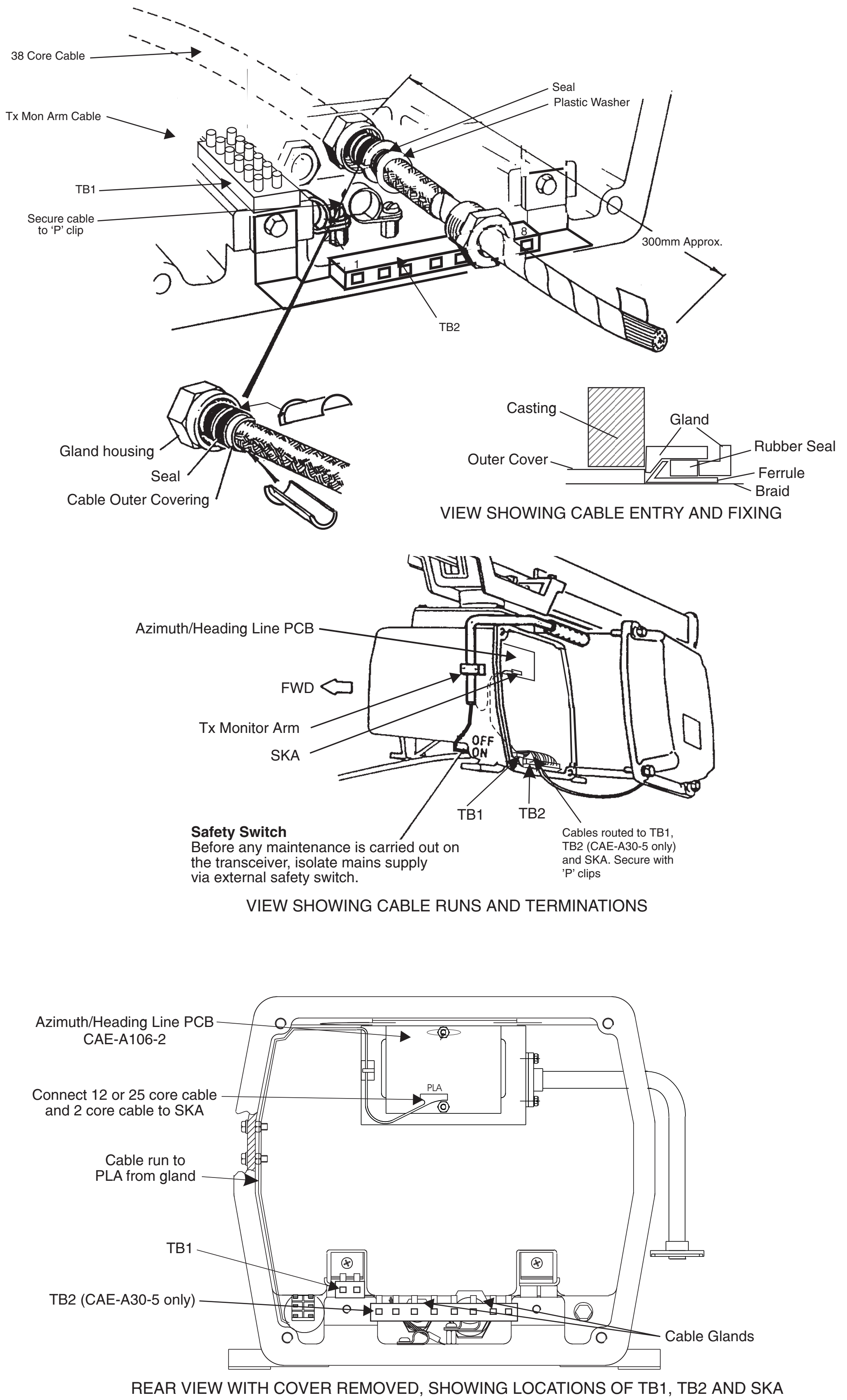
(5) Place seal over cable and onto outer covering at the gland housing.

(6) Insert the two screening ferrules between seal and screen at gland as shown.

(7) Place plastic washer and gland nut over cable and screw assembly into gland housing and secure screening and cable with ‘P’ clip, unwrap paper insulation back to screening and discard.

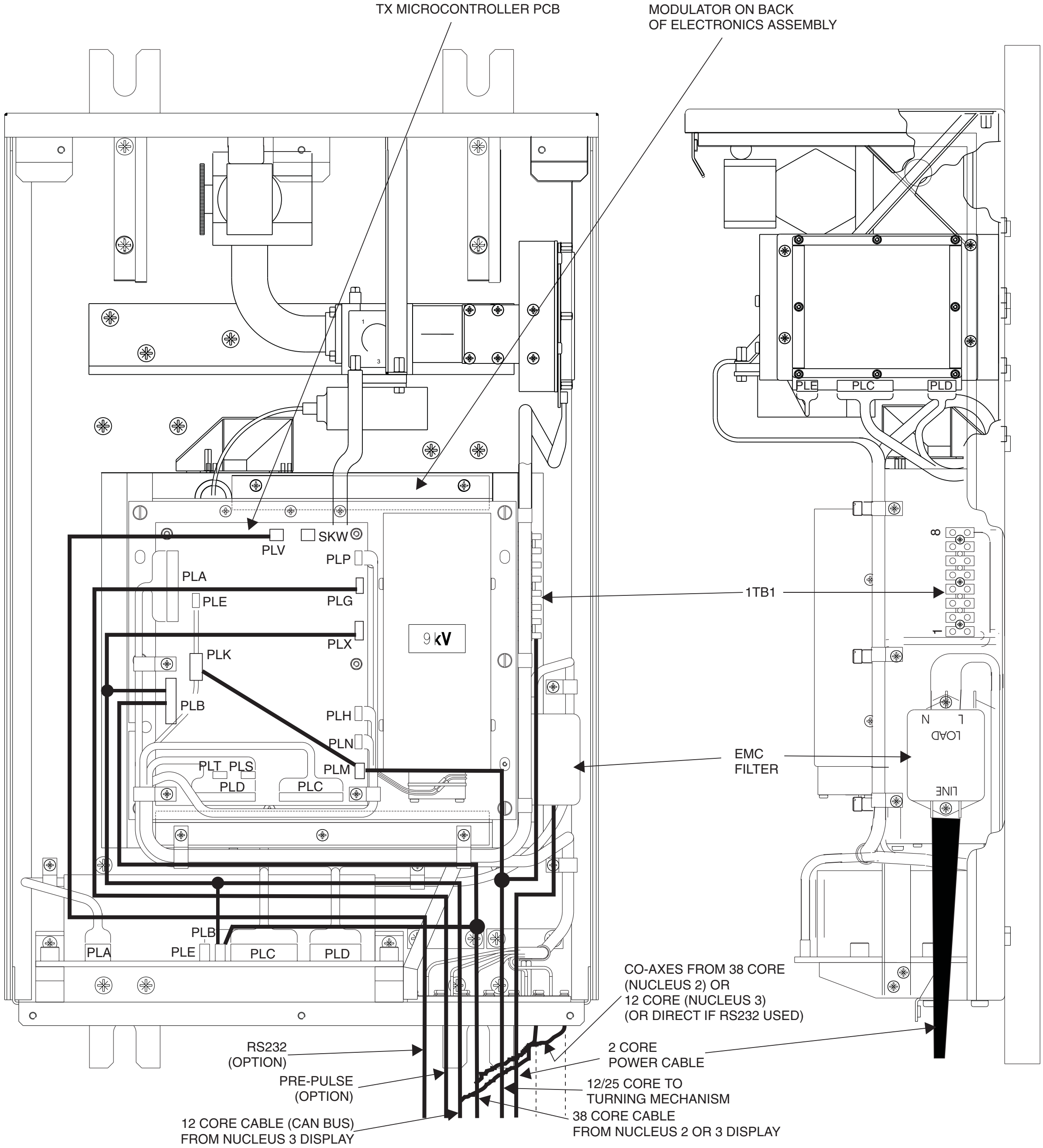
(8) Route cable strands to TB1, TB2 (CAE-A30-5 only) and SKA. Note that the Tx Monitor Arm cable is also connected to SKA. Refer to Figures 12f and 13f for wiring details.

56 Location of PCBs and cableform routing in the downmast transceiver are shown on Figure 8f.

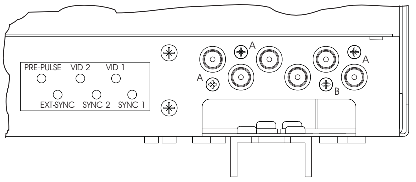


CD-3931

Figure 7f - Turning Mechanism: PCB Location and Cableform Routing



NOTE: IF 38 CORE CONTROL CABLE FROM NUCLEUS 2 OR 3 OR 12 CORE CABLE FROM NUCLEUS 3
USED VIDEO AND SYNC FORM PART OF THE CABLE.
IF RS232 CONTROL CABLE USED, VIDEO AND SYNC ARE SEPARATE CABLES
ONLY ONE OF 38 CORE, 12-CORE (CAN BUS) OR RS232 CABLES USED



VIEW SHOWING
COAXIAL CONNECTORS

CD-3932

Figure 8f - Downmast Transceiver: PCB Location and Cableform Routing

WIRING DIAGRAMS

57 Electrical connections for downmast transceiver systems are detailed on the following wiring diagrams:

(1) Figure 9f - Connections between the downmast Transceiver CTX-A8 and the upmast Turning Mechanism CAE-A30-6 (Low Speed Antenna), including the cable arrangement at the Turning Mechanism.

(2) Figure 10f - Connections between the downmast Transceiver CTX-A8 and the upmast Turning Mechanism CAE-A30-5 (High Speed Antenna), including the cable arrangement at the Turning Mechanism.

(3) Figures 11f and 12f - Connections for Nucleus 3 systems using 38-core composite cable as follows:

(a) Connections between the CTX-A8 Transceiver and the standard Nucleus 2 or 3 Display.

(b) Connections for an interswitched system, via the Dual Interswitch Unit.

(4) Figures 13f and 14f - Connections for Nucleus 3 systems using 12-core composite cable and the CANbus interface as follows:

(a) Connections between the CTX-A8 Transceiver and the standard Nucleus 3 Display.

(b) Connections for an interswitched system, via the Radar Interswitch Unit (RIU).

NOTE:

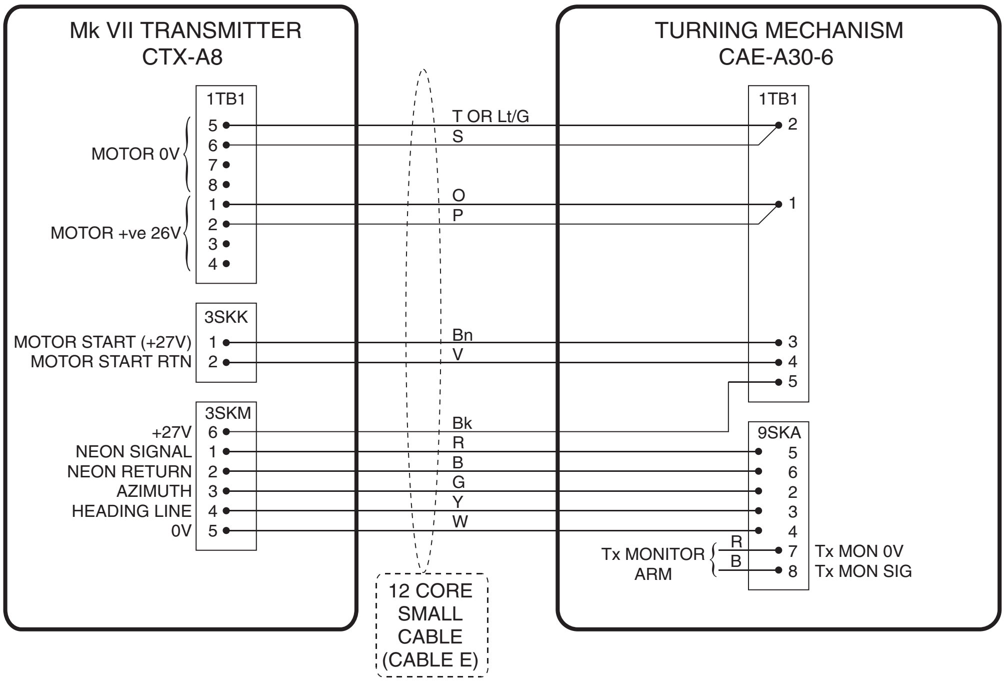
RS232 serial control can be used for changing the program of the Tx Microcontroller PCB. It does not control the transceiver.

CHECKS AFTER FITTING

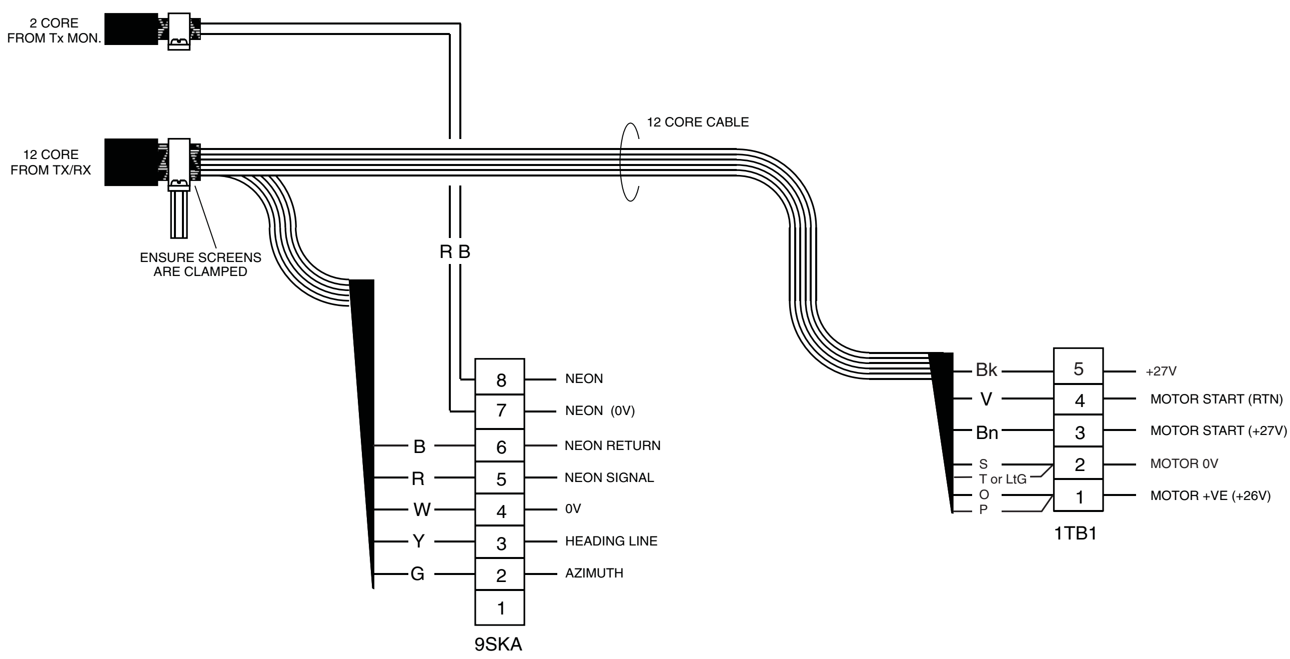
58 The upmast turning mechanism must be checked for security and freedom to rotate. The downmast transceiver must be checked for security, accessibility, and cabling ‘runs’.

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

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



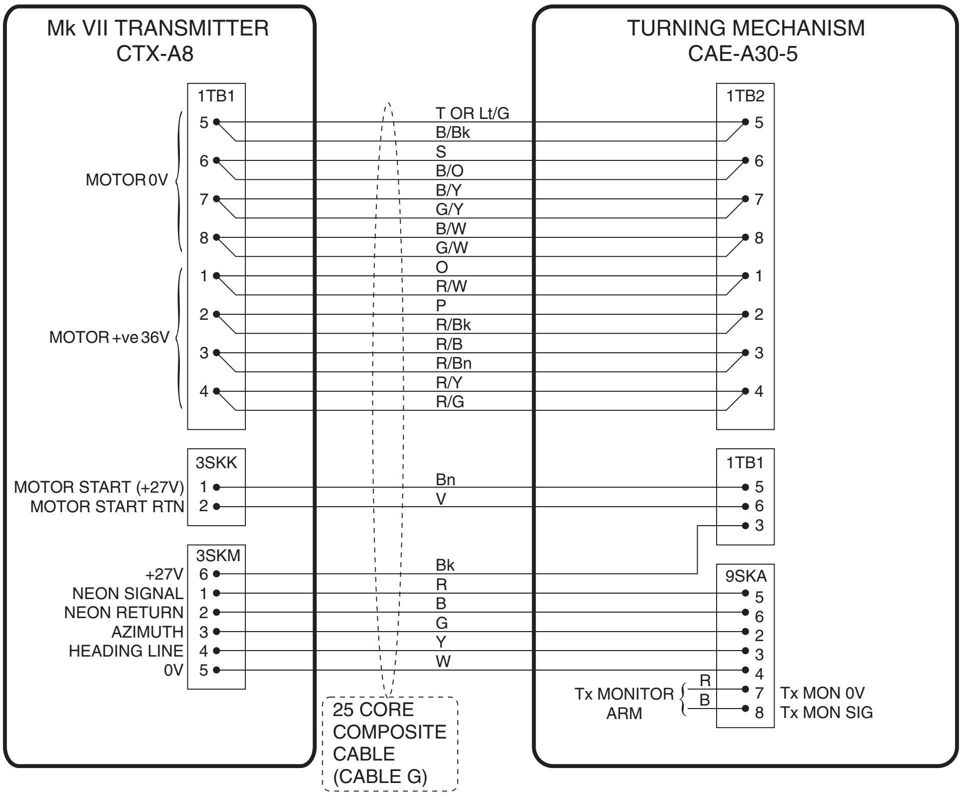
12 CORE CABLE INTERCONNECTIONS
BETWEEN TRANSCEIVER AND TURNING MECHANISM



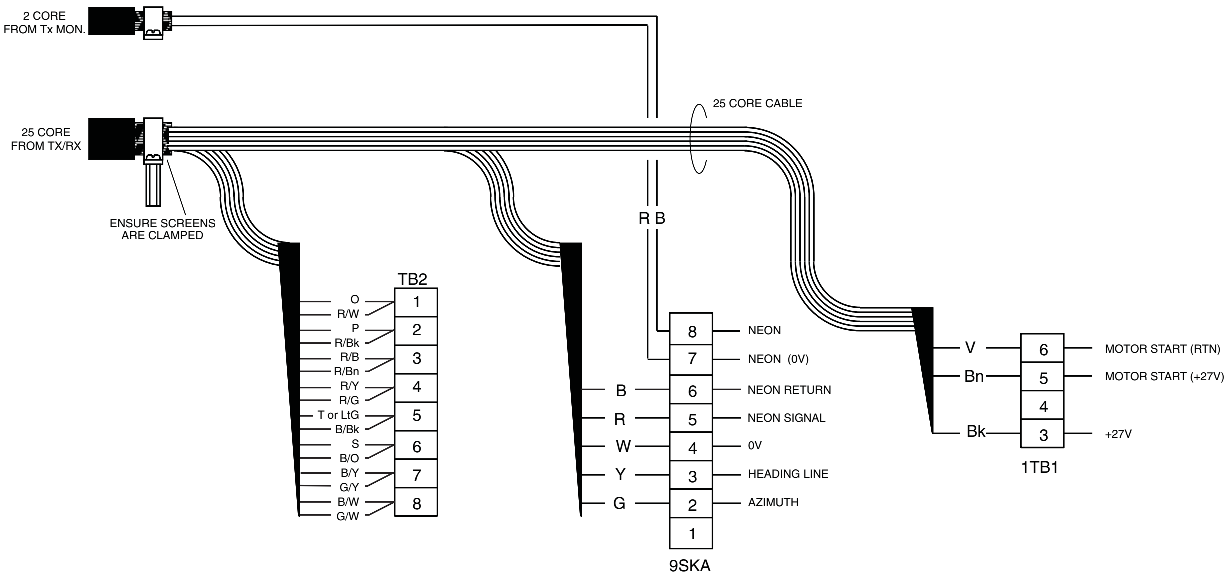
CABLE CONNECTIONS AT TURNING MECHANISM

CD-3942

Figure 9f - Transceiver (CTX-A8) to Low Speed Antenna (CAE-A30-6) Connections



25 CORE CABLE INTERCONNECTIONS
BETWEEN TRANSCEIVER AND TURNING MECHANISM



CABLE CONNECTIONS AT TURNING MECHANISM

CD-3938

Figure 10f - Transceiver (CTX-A8) to High Speed Antenna (CAE-A30-5) Connections

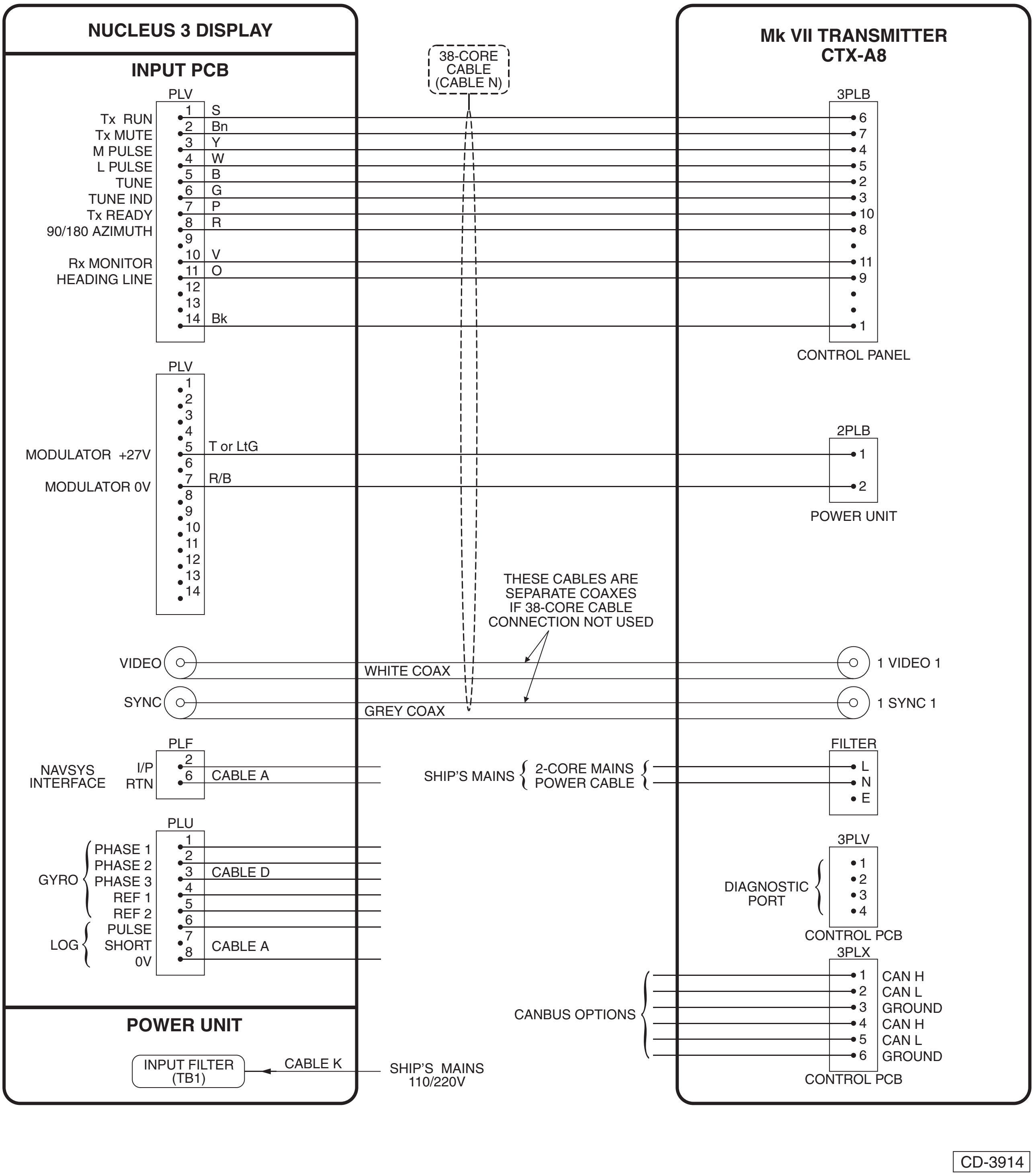


Figure 11f - Typical Nucleus 3 System Interconnection

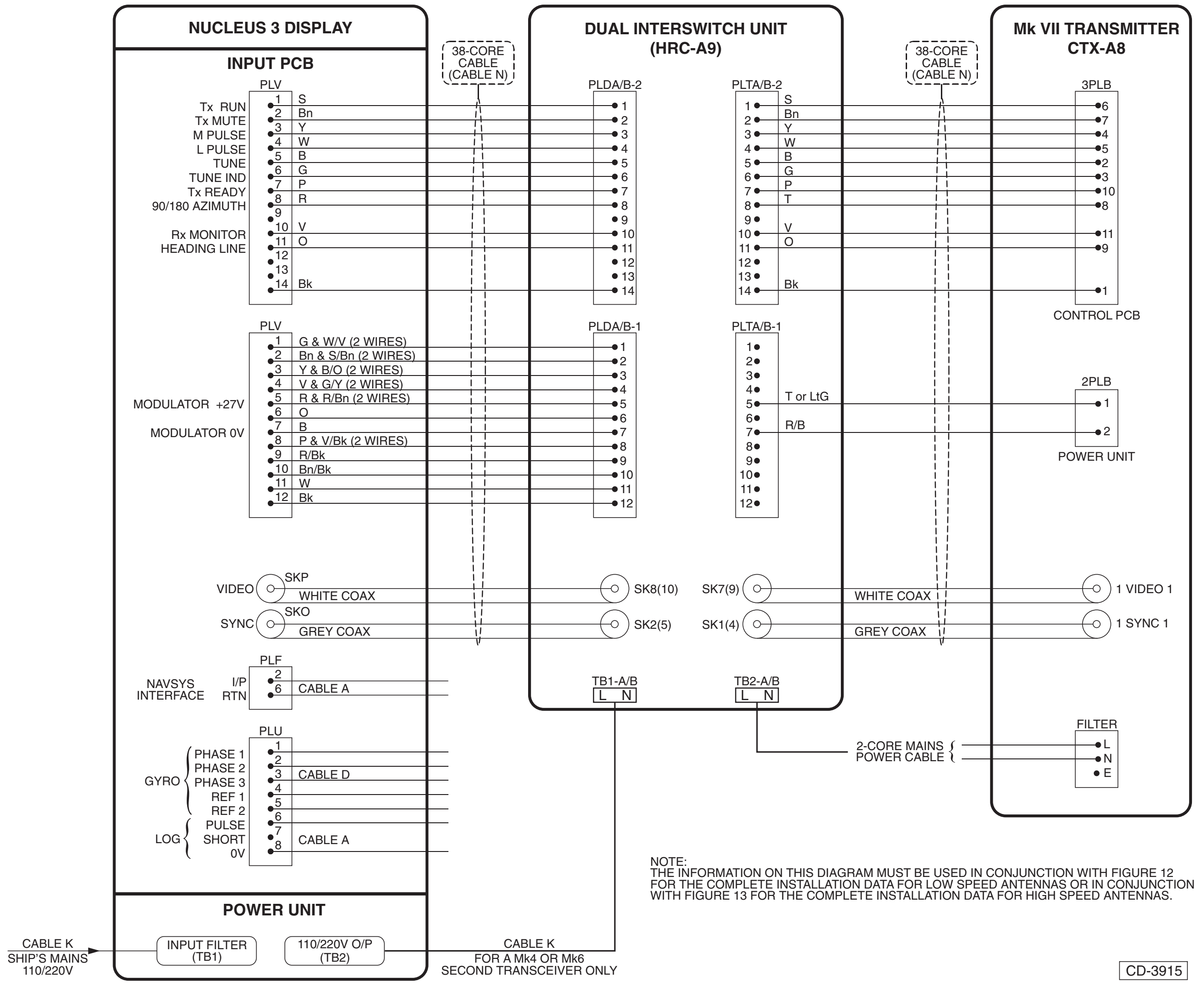


Figure 12f - Nucleus 3 Interswitched (via DIU) System Connection

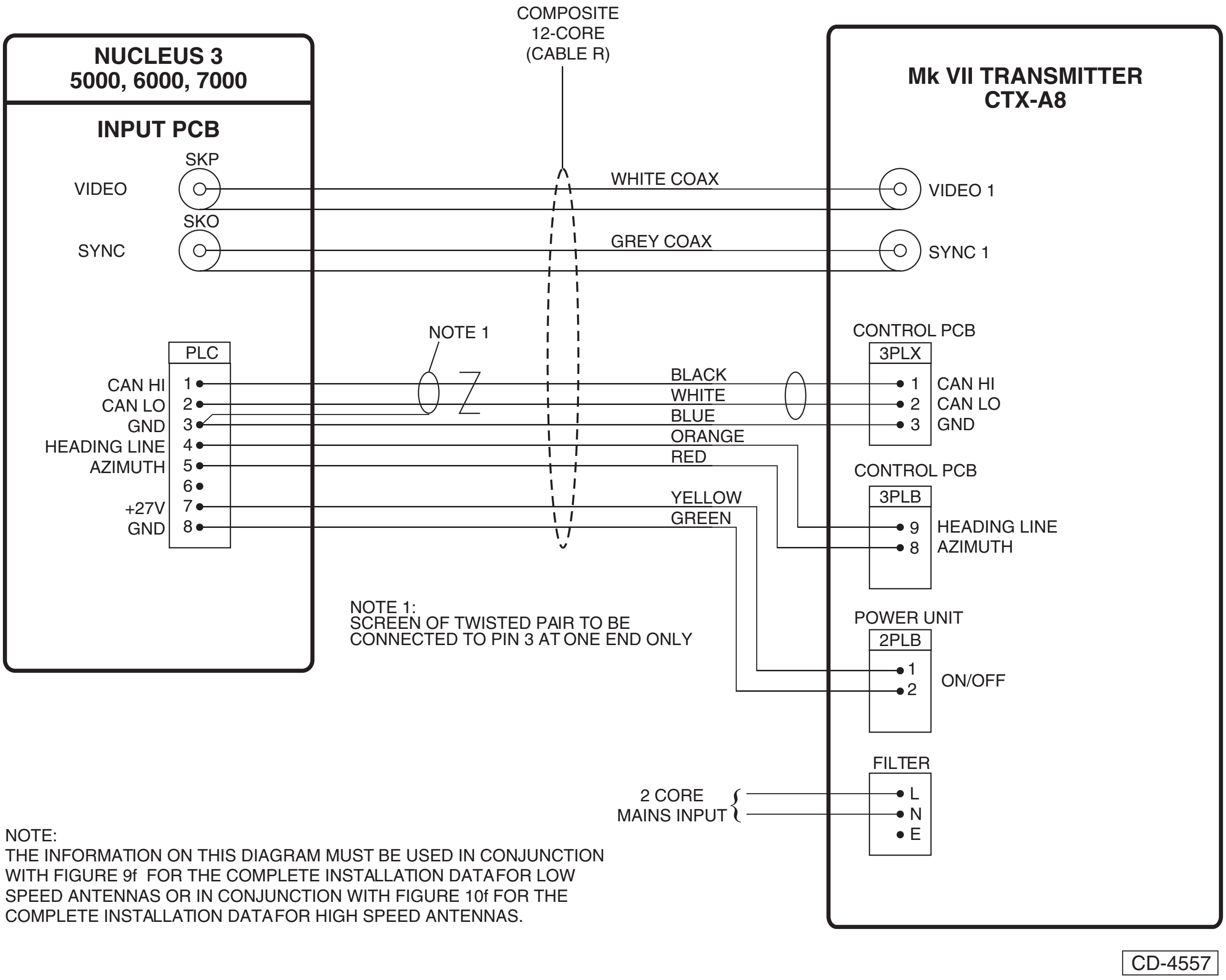


Figure 13f - Typical Nucleus 3 CANbus System Interconnection

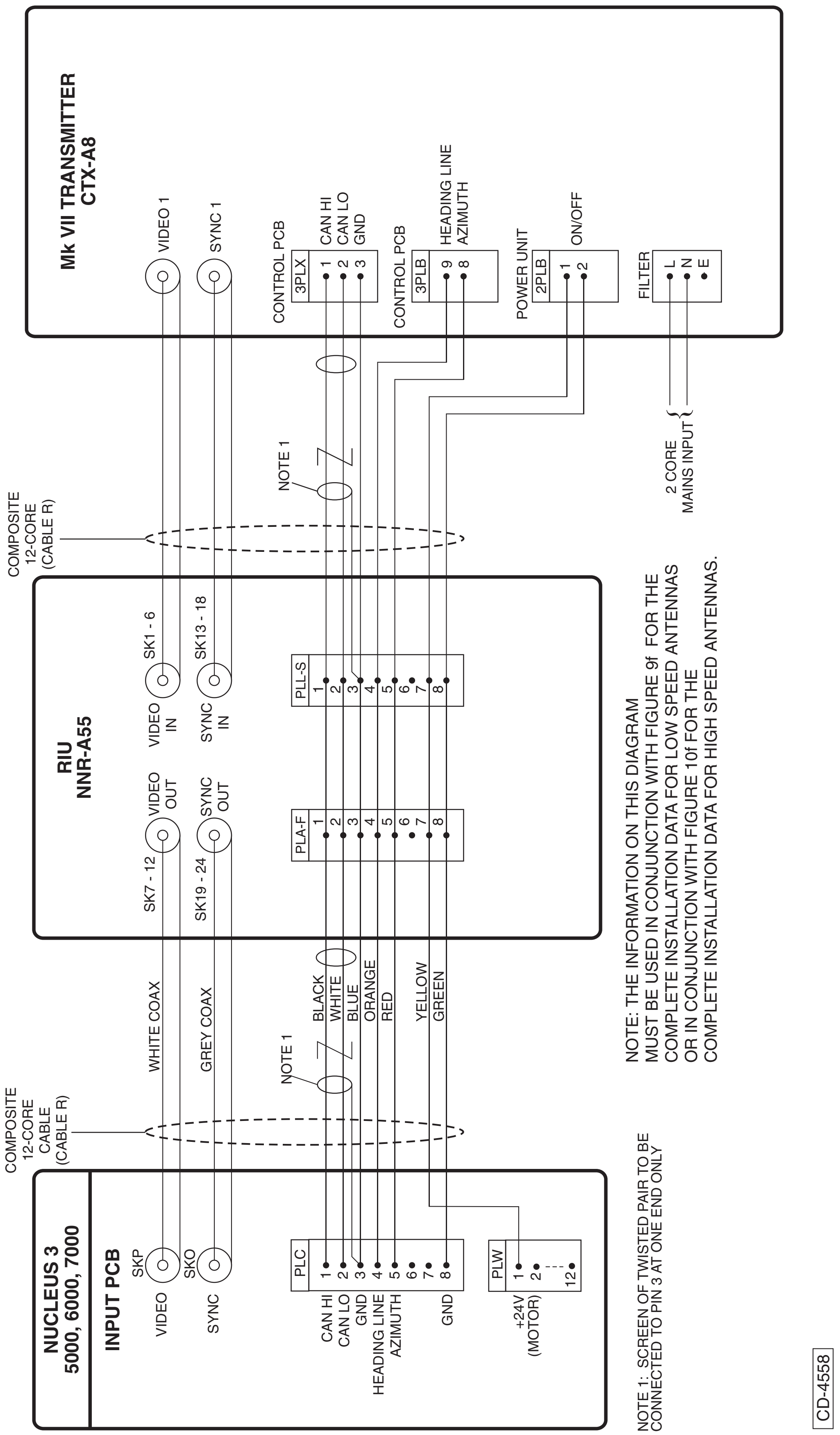


Figure 14f - Nucleus 3 Interswitched (via RIU) CANbus System Connection

LONG CABLE RUNS

INTRODUCTION

61 Where the distance between the transceiver and the display is greater than 65 metres up to a maximum of 180 metres, low loss co-axial cables must be used as specified below.

CABLE SPECIFICATIONS

Co-axial Cable 75 ohms low loss (for extended cable runs)

Coaxial Cable:	CODE number 5344-719
Type ECL 125 (Manufacturer's code)	
Specification:	TBD
Inner conductor:	1.25 mm Single Conductor
Dielectric:	Air spaced Polyethylene
Screen:	Tape Screen
Overall Dia:	8.3 mm

Electrical

Attenuation:	60 MHz 3.4 dB/100m MAX
	100 MHz 4.9 dB/100m MAX
Impedance:	75 Ohm

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CHAPTER 5

DISPLAY COMMISSIONING

INTRODUCTION

Prior to switching-on the display, read the Caution and Warning Notices contained in TO CHANGE THE INSTALLATION PARAMETERS Paragraphs.

1 The Installation Set-up parameters are subject to equipment type and configuration. Commissioning is carried out by the Installation Engineer. This Section contains the information required to change the Installation & Default Parameters plus any adjustments that may be necessary.

TO CHANGE THE INSTALLATION PARAMETERS

CAUTION

DISPLAY PERFORMANCE may be impaired if alterations to the INSTALLATION MENU are carried out by UNTRAINED PERSONNEL.

WARNING

IF THE DISPLAY IS SWITCHED OFF, ENSURE THAT NO PERSONNEL ARE IN THE VICINITY OF THE AERIAL WHEN SWITCHING THE EQUIPMENT ON.

2 Implement the following:

(1) If the Display is switched OFF, check that the mains supply at the Power Source is switched on.

(2) Set the display Power ON/OFF switch to ON. The screen shows the following menu options within a few seconds:

CD-4784

NOTE:

For ARPA displays 'GO TO TEST' is replaced with 'GO TO SIM'.

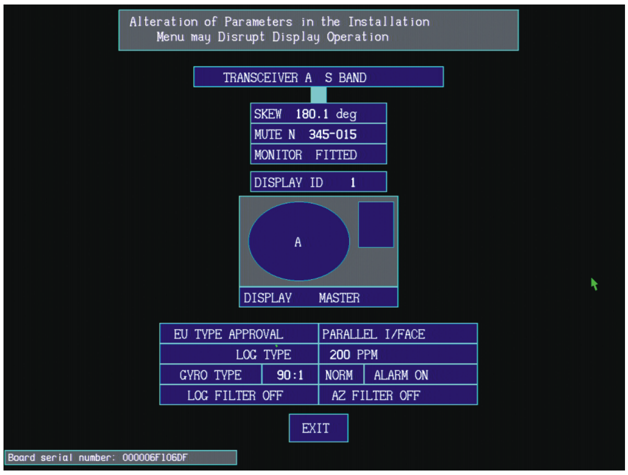
(3) From the Standby screen select the GO TO MENUS function, the Standby screen is replaced with the following menus:

CD-4728

INSTALLATION PARAMETERS

3 To change the Installation parameters:

(1) Select the GO TO INSTALL function, the Installation Menu appears as shown below :



CD-5051

4 This shows the system set up with one transceiver.

NOTE

To change the installation settings, Switch SW1 on the System PCB is to be made. Failure to do this before attempting to alter the installation settings results in the following Warning Message being displayed: ***INSTALLATION LOCKED ACCESS DENIED***

WARNING

THE DISPLAY AND PROCESSOR UNIT CONTAIN HIGH VOLTAGES, CARE MUST BE TAKEN WHEN MAKING SW1.

5 Switch SW1 is a toggle switch, located on the left-hand side of the System PCB. This switch locks/unlocks the Installation settings for the system.

SINGLE TX

6 To change the **Transceiver** Type:

(1) Position the cursor, using the trackerball, in the appropriate TRANSCEIVER box, the box is now highlighted.

(2) The pop-down boxes display the transceiver labels available, i.e. X, S or None.

CD-4788

NOTE:

If the display is connected to a mechanical interswitch press the right-hand pushbutton, this removes all Tx labels from the display.

(3) Press the appropriate pushbutton to select the label required.

NOTE:

The label selection thus displays TX A (B) X or S in the TX box in the top left-hand corner of the display.

7 The **Skew** facility is available to adjust any misalignment of the picture, due to the difference between the Heading Line and the Ship's centre, implement the following:

(1) Position the cursor, using the trackerball, in the SKEW box.

(2) Press and hold down any pushbutton and rotate the trackerball in the North/South axis until the correct picture alignment is obtained.

NOTE:

The skew can be set at +180/-179 degrees, to allow the gearbox to be mounted at any angle. The heading-line is corrected within the software.

8 To **Mute** the transmitter, between selected angles:

(1) Position the cursor, using the trackerball, in the MUTE box. The pop-down boxes read; ON, ON, No Sec (Sec).

NOTE:

Sec (S) does not allow selection of the MUTE facility when in RUN mode. No Sec allows MUTE to be switched ON/OFF while in RUN mode.

(2) Press the left-hand or centre pushbutton to enable the MUTE facility. The pop-down boxes read; Start/Stop/OFF.

(3) Press the left-hand pushbutton and rotate the trackerball until desired start angle of mute is reached, press the centre pushbutton to set the end of mute angle and then position the cursor in EXIT box and press any pushbutton.

(4) To switch off the Mute facility, press the right-hand pushbutton.

9 To change the display from **Master** to **Slave** or **Other**:

(1) Position the cursor, using the trackerball, in the DISPLAY box.

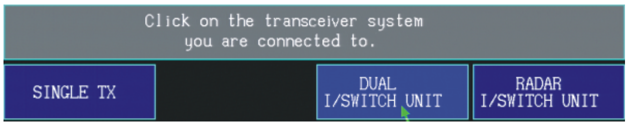
(2) Select the display required, as shown in the pop-down boxes; Slave, Master or Other.

10 If an installation has a **Transmission Performance Monitor** it will be indicated by the legend PM in the top left hand corner of the radar display. To select/deselect the Performance Monitor legend:

(1) Position the cursor over the PM box (in Run mode) and press any of the control buttons.

Other Selection

11 If Other is selected the following menu appears:



CD-4789

DUAL I/SWITCH UNIT

12 If DUAL I/SWITCH UNIT is selected the above menu is replaced with the following menu:

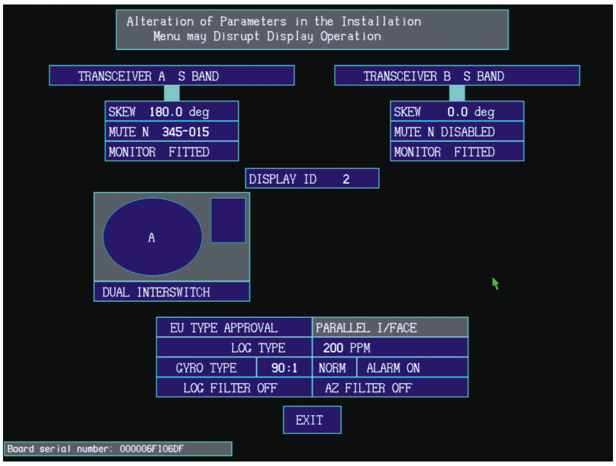
CD-4790

(1) Select A or B display by placing the cursor, using the trackerball, on letter A(B) and then pressing any pushbutton.

NOTE:

Other display is to be installed with the other letter B(A) on its installation.

13 When A or B display is selected the previous menu is replaced with the following menu:



CD-4791

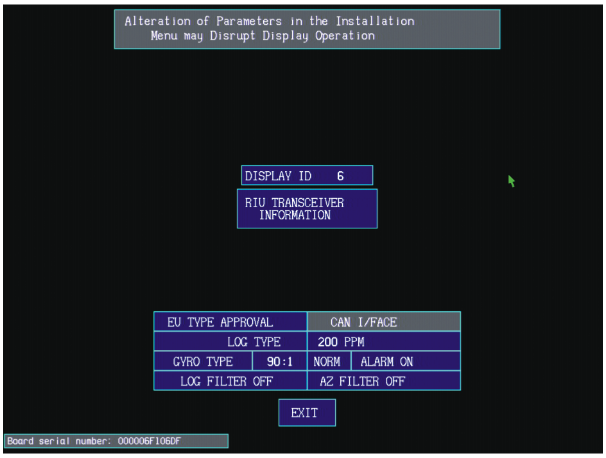
14 Set up both Transceivers A and B as for a single Transceiver installation, refer to Paragraph 4.

NOTE:

If the Dual Interswitch box is selected and any pushbutton pressed, then the menu reverts to that shown in Paragraph 11.

RADAR I/SWITCH UNIT

15 If RADAR I/SWITCH UNIT is selected, the above menu is replaced with the following RIU Installation screen:

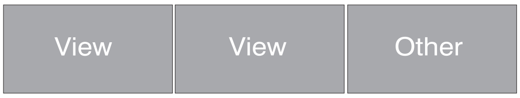


CD-4792

RIU System Setup

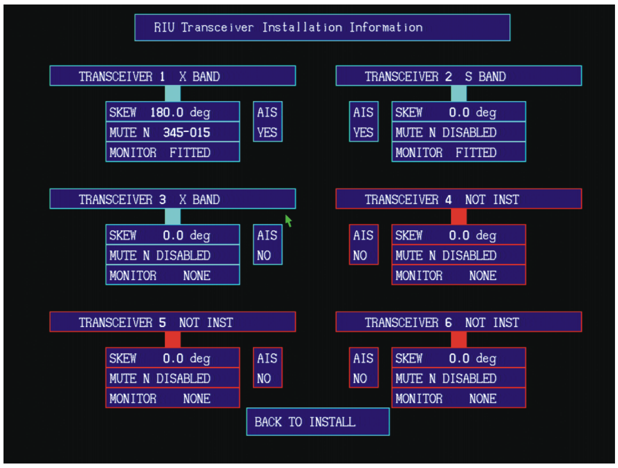
16 To set up a system using RIUs; configure one display, then configure each individual transmitter in turn, then transmit all configuration data from the first display to all other displays in the system.

17 Highlight the RIU TRANSCEIVER INFORMATION box and a pop-down box appears as follows:



CD-4658

18 Select VIEW to display the RIU Transceiver Installation Information screen, as shown below.



CD-4793

19 This screen shows the configuration of Transceivers used with the RIU.

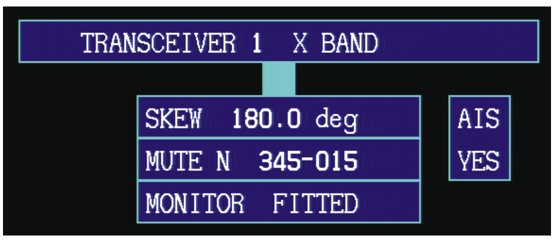
NOTE:

Up to 6 transceivers and 6 displays can be connected via an RIU. Transceivers not installed are labelled as NOT INST and are identified by a red border.

20 Highlighting the transceiver causes a pop-up box to appear indicating the selection options available. The transceiver can be configured for X band, S band or as Uninstalled. Turn AIS processing ON if scanner position is near enough to ownship's GPS position, otherwise turn AIS OFF.

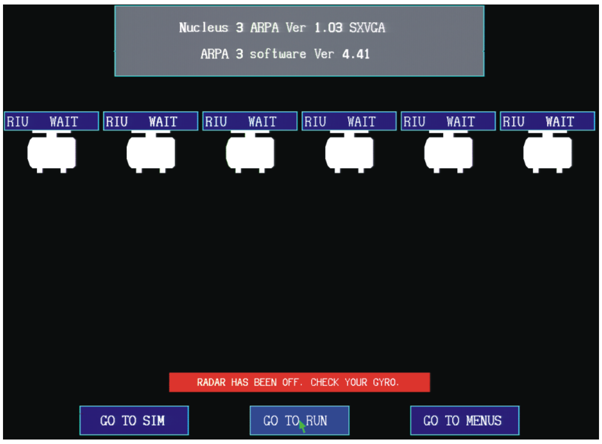
CD-4795

21 For each installed transceiver the SKEW and MUTE facilities can be set and the associated display can be selected as Fitted or None, as shown below. (Refer to paragraph 4). Turn AIS processing ON if scanner position is near enough to vessel's GPS position, otherwise turn off.



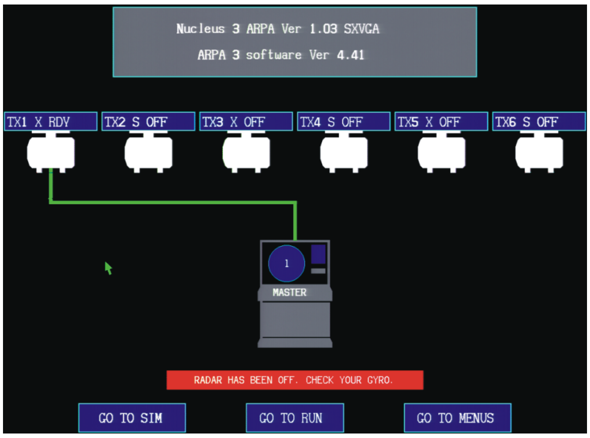
CD-4796

22 Go to the Standby Screen, there will be a short delay (10 seconds maximum) while the system checks the connections to the RIU(s). The screen display will be as shown below.



CD-5045

23 Once the display has successfully connected to the RIU(s), the screen display will change as shown below.

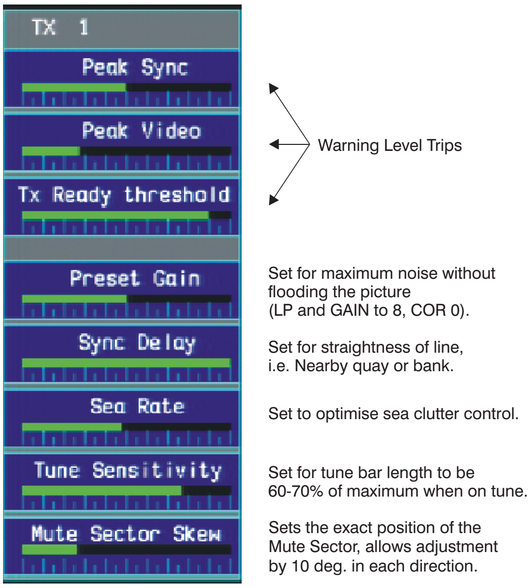


CD-5044

24 Select the first transceiver and setup the skew and mute facilities. Then select GO TO MENUS and from the Menus Screen select GO TO TEST and set the transceiver parameters (as shown below) for the selected transceiver.

NOTE:

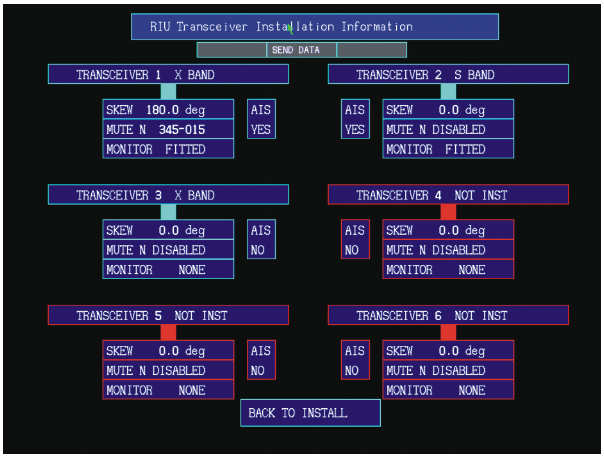
For EPA; GO TO TEST is located on the Standby Screen.



CD-5050

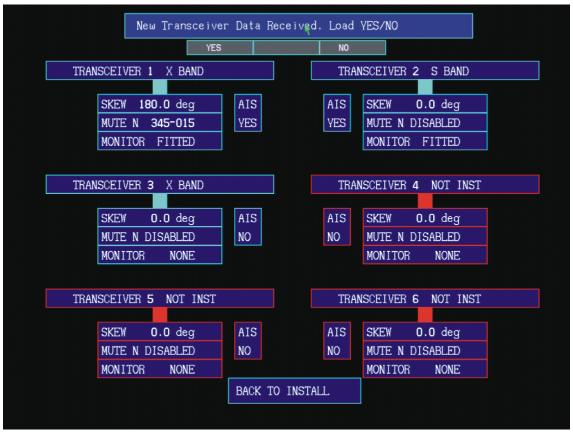
25 Repeat paragraph 24 for each transceiver in the system.

26 Once the settings for the first display and all individual transceivers have been configured, return to the RIU Transceiver Installation Information Screen. Highlight the RIU Transceiver Installation Information box and select SEND DATA from the pop-down box, as shown below. This causes all configuration data for both the configured display and all transceivers to be sent to all other displays in the system.



CD-5043

27 Once the data has been successfully received at the other system displays. A message appears on the right-hand side of the screen and the title box at the top of the screen changes to New Transceiver Data Received. Load YES/NO, as shown below. The received data needs to be loaded into each display. To load the received data, highlight the New Transceiver Data Received. Load YES/NO box and select YES from the pop-down box.

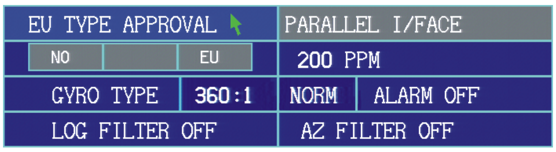


CD-5047

Display Configuration

28 To select the **Type Approval Authority**:

(1) Position the cursor, using the trackerball, in the APPROVAL box, the box is now highlighted and the pop-down boxes contain the options; EU (European Union) or NO (No Type Approval).



CD-4797

(2) Press the appropriate pushbutton for the Authority required.

NOTE

EU Approval does not allow the use of a VTG log source.

29 To Select the **Interface Type**:

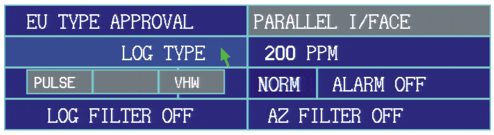
30 Position the cursor, using the trackerball, in the INTERFACE box, he box is now highlighted and the pop-down boxes contain the options: CAN I/FACE and PARALLEL I/FACE.

31 Transceiver Interfaces (Not CAN bus). CAN bus interface is selected for transceivers using 10-core plus 2-core coaxial cable either directly or via a Transmitter Interface Unit (TIU). CAN bus should be selected for multiple display/transceiver installations using a Radar Interswitch Unit (RIU)

32 To amend the **Log Type**:

(1) Position the cursor, using the trackerball, in the LOG TYPE box, the box is now highlighted.

(2) Choose the primary log source, either Pulse or VHW (VTG is available for systems with Type Approval set to No).



CD-4798

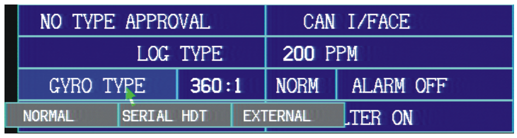
(3) Pop-down boxes contain the following; 100, 200, 400ppm appear when PULSE is selected.

(4) Press the appropriate pushbutton as required.

33 To select the **Gyro Type**:

(1) Position the cursor, using the trackerball, in the GYRO TYPE box, the box is now highlighted.

(2) Pop-down boxes contain the following; NORMAL, SERIAL HDT and EXTERNAL.



CD-4799

(3) Press the appropriate pushbutton as required.

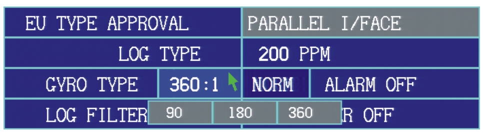
NOTE:

When EXTERNAL is selected, the Gyro is connected to a Low Ratio input from the Synchro Compass PCB. When SERIAL HDT is selected, the Gyro is able to receive serial HDT messages directly.

34 To amend the **Gyro Ratio** (when the NORMAL GYRO type is selected), carry out the following:

(1) Position the cursor, using the trackerball, in the Ratio box, the box is now highlighted.

(2) Pop-down boxes contain the following; 90, 180, 360.



CD-4800

(3) Press the appropriate pushbutton as required.

35 The system contains a **Gyro Failure Warning** which can be enabled (when at sea)/disabled (when land based) as follows:

(1) When the Gyro Failure Warning facility is 'OFF', gyro failure does not cause an alarm , To switch the facility OFF; position the cursor in the gyro alarm setting box and click to select ALARM OFF.

(2) When the Gyro Failure Warning facility is 'ON', gyro failure causes an alarm and after 60 seconds later the display is forced into Head Up, Relative Motion mode. To switch ON the facility; position the cursor in the gyro alarm setting box and click to select ALARM ON.

NOTE:

At run, when the Gyro failure warning is enabled and the system does not detect a gyro input, after 60 seconds the display defaults to Head Up, Relative Motion and displays a 'GYRO FAILURE' warning in the Red Warning box. Once the correct Gyro operation is restored a Red Warning box displays 'RESET GYRO', across the Gyro box. This is removed once the Gyro is reset.

36 The system contains a **Log Filter**, which provides hardware filtering of spurious log pulses. The Log Filter can either be set to OFF or to Stage 1 or Stage 2 filtering.

37 The system contains an **Azimuth Filter**, which provides hardware filtering of Azimuth pulses. Switching the filter 'ON' provides filtering for 90 and 180 azimuth pulses. Switching the facility to 'OFF' for a 4096 azimuth pulse input (i.e. Simulator).

38 On completion of the Installation Set-up select EXIT, this returns the screen to the MENU functions.

NOTE:

The Installation Menu can not be exited until SW1 is set to OFF.

TEST CARDS 1 & 2

39 Used to check screen linearity and colour alignment. Primarily used for a 'Service Aid'.

CHECKING THE DISPLAY OPERATION

40 To check the operation of the display, select GO TO TEST and ensure that a Radar picture is displayed within the Radar Bearing Scale area.

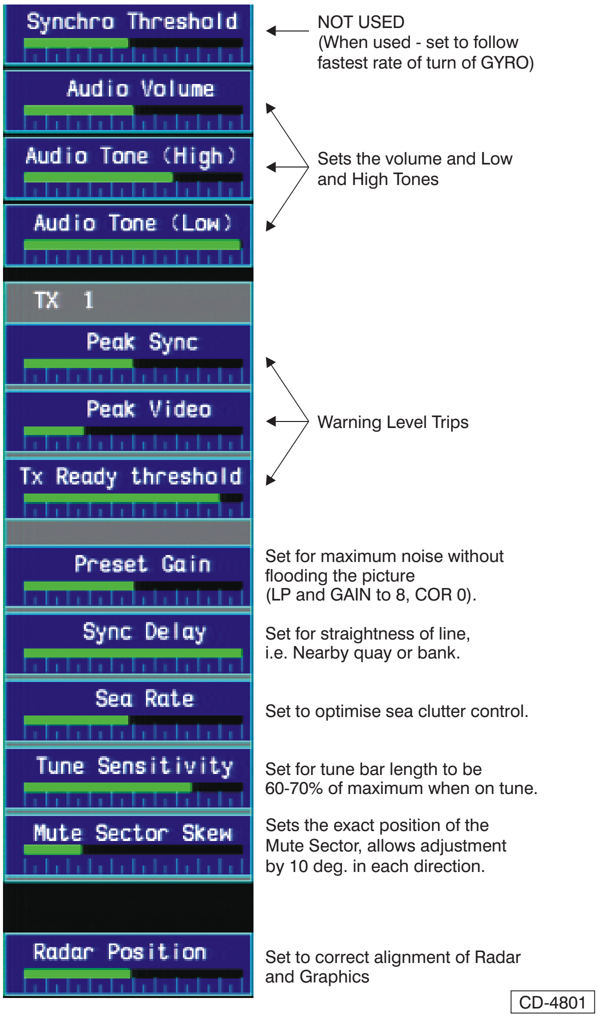
41 Implement a full operational check using the controls as described in Chapter 1. If any faults are detected, refer to Chapter 6 for Fault Diagnosis.

GO TO TEST

42 Select GO TO TEST and a menu appears down the right-hand side of the display screen and is used to set various levels as shown below:

NOTE:

SW1 must be set to ON, before making any changes



(1) To adjust a level, highlight the required box. Press and hold down the left-hand pushbutton and move trackerball until level is reached.

(2) To return to the previously set level press the right-hand pushbutton.

(3) To save the new settings, set switch SW1 to the OFF position and return to the Standby Screen.

NOTE:

The Mute Sector Skew facility applies only to the Transmitter displayed in the GO TO TEST menu (i.e. the transmitter currently selected in Standby mode). Where the system comprises multi-transmitters and Mute Sector is active, the Mute Sector Skew is to be applied to each selected Transmitter individually.

ADJUSTMENT OF MAIN BANG SUPPRESSION (MBS)

43 RV1 located on the System PCB (NNR-A911) is used to adjust MBS. RVI should be set to minimum suppression and only increased when necessary to remove short range noise rings.

NOTE:

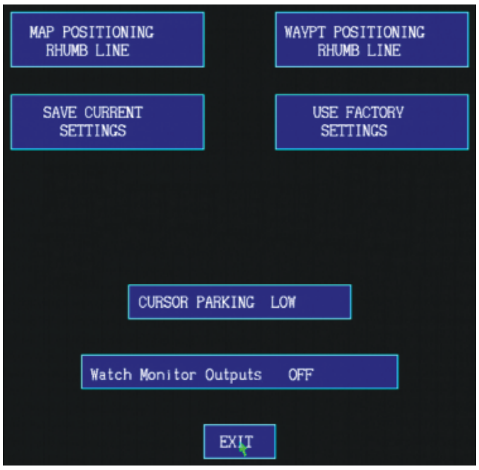
Setting MSB too high can result in loss of short range targets and should be avoided.

DEFAULT SETTINGS

44 To view/change the Default settings:

(1) Position the cursor in the GO TO MENUS box and press any pushbutton. Position the cursor in the GO TO DEFAULT box and press any pushbutton

(2) The display shows:



CD-4802

Map Positioning/Waypoint Positioning

45 The option exists to select either Great Circle (normally selected) or Rhumb Line.

NOTE

(1) To change the Default settings, Switch SW1 on the System PCB is to be switched ON. Failure to do this results in a Warning Message being displayed.

(2) The Default menu cannot be exited until switch SW1 is switched off.

Cursor Parking

46 This facility is provided for operator convenience. If Cursor Parking High is selected, the cursor will park (when outside the radar circle) in zone 2; if Cursor Parking Low is selected the cursor will park in zone 6.

47 Parking the cursor High gives quick access to the range change facility; parking the cursor Low gives quick access to the menus.

48 To change the high/low setting, position the cursor in the CURSOR PARKING box and press any of the three control buttons.

Watch Monitor Timeout

49 The Watch Monitor configuration setup is shown at the lower end of the menu display (IF FITTED). The Watch Monitor facilityenables or disables the system alarm outputs from PLE on the Input/Output PCB. The time period for the system alarm to inform the Operator that the IBS has not been used is fixed. To enable/disable the Watch Monitor Output alarms at PLE on the Input/Output PCB:

(1) Pressa nd hold down any pushbutton while the cursor is over the Watch Monitor configuration box to switch the Watch monitor ON or OFF.

(2) Movement of the trackerball switches on the alarm relay. The Sound relay is switched ON when a Collision warning message is received. The Sound relay will be switched OFF when the messsage is acknowledge.

(3) To exit from the menu, place the cursor over the EXIT box and press any pushbutton.

NOTE:

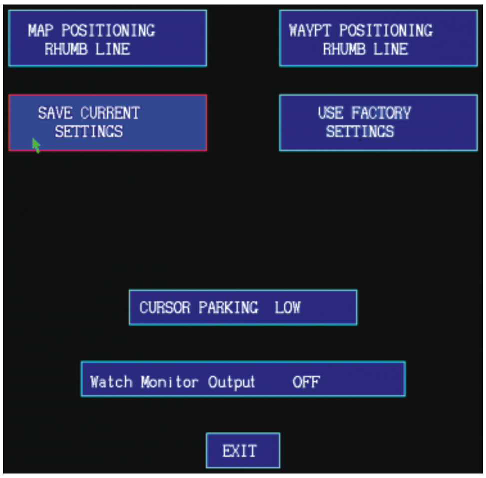
The Alarm Outputs available at PLE on the Input/Output PCB are as follows:

PIN	DESCRIPTION
1	LAMP-N/C
2	LAMP-COM
3	LAMP-N/O
4	SOUND-N/C
5	SOUND-COM
6	SOUND-N/O
7	FAIL-N/C
8	FAIL-COM
9	FAIL-N/O
10	EARTH

Saving the Settings

50 To save the new settings, position the cursor in the SAVE CURRENT SETTINGS box and press any pushbutton. The box outline momentarily highlights in red to show the operator that the settings are saved, as shown below.

51 To revert to the Factory settings (Initial settings) position the cursor in the USE FACTORY SETTINGS box and press any pushbutton.



CD-4804

CURVED EBL SETUP

52 The Curved EBL (EBL 2) is an Electronic Bearing Line that graphically displays the rate of turn or radius of turn that the vessel will take to effect a new course. The turn shown will include the ship's forwarding distance.

53 Before the Curved EBL can function correctly some turn performance figures must be available to the autopilot. The setting-up procedure makes provision for two types of autopilot (1) Radius Turn (2) Rate of Turn.

54 The setting-up screen shows a graph of Forwarding Distance versus Fractions of the Maximum Speed of the vessel.

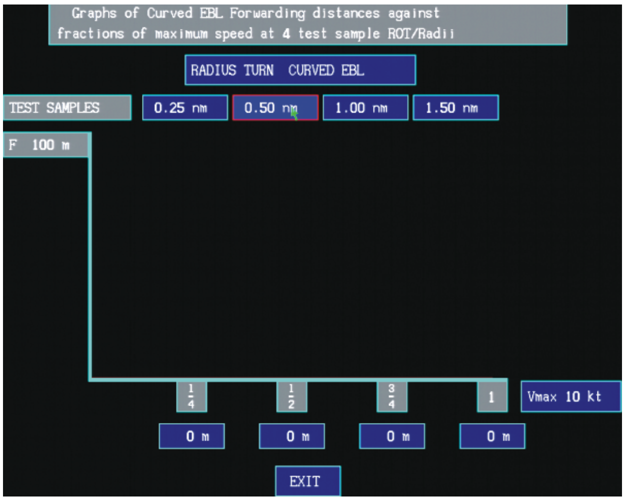
Radius Turn - Setting-up Procedure

55 From the Standby screen position the cursor over the GO TO MENUS box and press any of the three control buttons. The following display is seen:

56 Position the cursor in the CURVED SETUP box and press any of the control buttons.

CD-4805

57 The CURVED EBL SETUP SCREEN is displayed, as shown below.



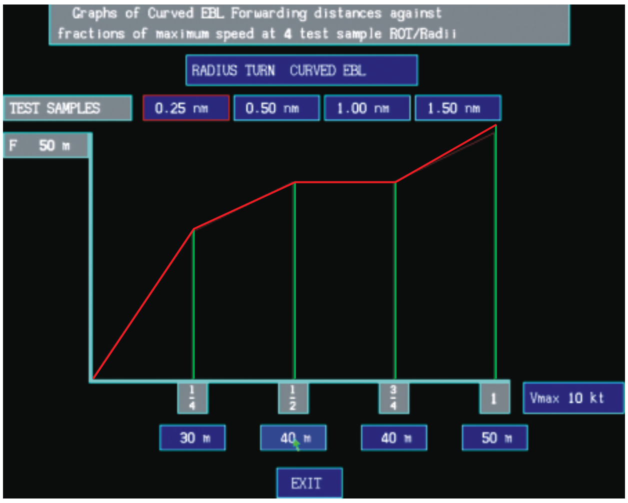
CD-4806

58 Information required for the Curved EBL setup:

(1) Maximum speed of the vessel

(2) Forwarding distances at $^1/_4$, $^1/_2$, $^3/_4$, & Full Speed for 4 sample Rates of Turn.

59 From the choice in the RADIUS TURN CURVED EBL / RATE OF TURN CURVED EBL box ensure that the legend reads RADIUS TURN CURVED EBL.



CD-4808

Maximum Speed Input

60 To input the maximum speed of the vessel:

(1) Position the cursor over the Maximum Speed box in the lower right of the display.

(2) Press the control button and (whilst maintaining pressure on the button) rotate the trackerball until the required speed is set in the box.

61 Input 4 sample radii, e.g. 0.25, 0.5, 1.0, 1.5nm, as described below.

Setting the Test Samples

62 To Set the Test Samples:

(1) Position the cursor in the first Test Sample box.

(2) Press any control button; the box outline highlights in red.

(3) Press any button and whilst maintaining pressure on the button rotate the trackerball until the required radius is set in the box.

(4) Repeat for Test Sample boxes 2, 3 & 4.

63 Input the vessel's forwarding distances, e.g. 20, 40, 70, 110m, at the 4 speeds shown, as described below.

Setting the Forwarding Distance

64 To set the Forwarding Distance:

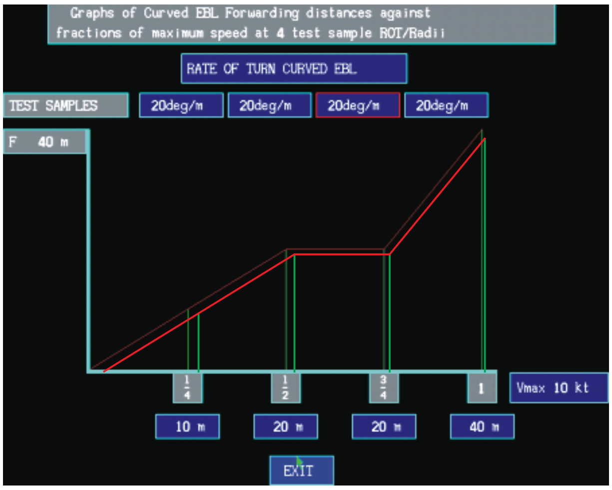
(1) Position the cursor in the first of the boxes

(2) Press any of the control buttons and whilst maintaining pressure on the button rotate the trackerball until the required distance is set in the box.

65 The graph that results from the input of the above information is self scaling. Data is Saved on Exit from the EBL setup screen.

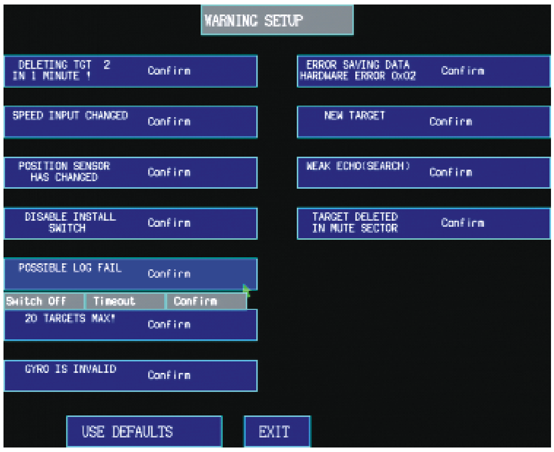
Rate of Turn Curved EBL

66 To input the parameters for the Rate of Turn Curved EBL, follow the setting-up procedure as above but input Rate of Turn data (degrees/minute) instead of Radius of Turn data (nautical miles radius).



CD-4809

WARNING SET UP SCREEN



CD-4810

67 Allows the operator to change the alarm type of messages displayed. The options are as follows:

(1) OFF - do not display this warning (not available for all warnings).

(2) TIMEOUT - 4 to 6 seconds display of the warning.

(3) CONFIRM - Operator acknowledgeable warning remains displayed until acknowledged.

(4) USE DEFAULTS - Sets all to Confirm.

NOTES:

(1) Ensure that switch SW1 on the System PCB is switched ON before any changes.

(2) Switch SW1 to OFF, on the System PCB, or switch SW1 off, before leaving Menu.

SERIAL MESSAGE SET UP SCREEN

68 Allows the operator to adjust the settings for the Four NMEA Serial Input Message Communications Ports.

69 Each of the following input message types can be received on one or more of the 4 serial input comms ports:

DPT, GGA, GLL, HDT, RNN, RTE, VBW, VHW, VTG, WPL, ZDA, ZZU.

NOTES:

(1) To adjust the settings for the Serial NMEA Input messages, the Installation must first be "unlocked". This is achieved by setting switch SW1, on the System PCB, to the ON position.

(2) Switch OFF switch SW1, on the System PCB, ,before leaving the Menu.

CD-4812

70 The following can be set for each Port:

(1) Priority
Each port is assigned a Priority (with 1 being the highest priority) the priority 1 indicates the preferred message source, with 2, 3 and 4 (if applicable) indicating the 2nd, 3rd and 4th choice of message source.

(2) Type Checking (i.e. Strict, or Relaxed)
This enables the listed NMEA serial messages to validated to be fully compliant with the Strict NMEA standard or alternatively to allow a Relaxed message checking to compensate for an external sensor that may not supply a correctly formatted message; this allows non-conforming equipment to be interfaced with the Nucleus display. (Refer to Chapter 8, Annex A for details of the NMEA Communications Specification).

NOTE:

Relaxed message checking cannot compensate for all deviations from the NMEA Standard.

(3) Timeout
This is the time period allowed before the failure (non-appearance) of a message is detected. Infrequent messages may require a longer timeout period.
If an alternative priority Port has been configured for the message, then that port will be used in place of the timed out port. (See (1) for information on port priorities).

(4) IBS / OS Data
This allows IBS/Ownship's data to be exchanged with IBS devices or other equipment.

The following messages are provided when the selected Port is enabled:
Cursor Position (CSR) output.
Radar/Ownship Data (OSD) output.
Target Data (TTM only) output
Watch Alarm (RSD) output.

When the Port is disabled, no messages are transmitted on the selected COM port.

71 The Diagnostic Mode screen can be accessed from the Comms Setup Menu, by selecting DIAGNOSTIC MODE. This displays the Diagnostic Mode screen, as described in paragraph 75.

72 The Baud Rate Setup Screen can be accessed from the Comms Setup Menu Screen, by selecting BAUDRATES. This displays the BAUD RATE SETUP Screen, as described in paragraph 78.

73 The Maps Setup Menu Screen can be accessed from the Comms Setup Menu Screen, by selecting MAPS. This displays the MAPS SETUP MENU Screen, as described in paragraph 87.

74 The settings can be reset to the system Default values, by selecting DEFAULTS. Refer to paragraph 44, for information on Default Settings.

NOTE:

For further information on configuring Serial Ports 1 to 4 (Input PCB; PLF & PLG), refer to Chapter 8A, Annex A - Serial and NMEA Communication Specification.

Diagnostic Mode Screen

75 Allows the operator to view the messages at a selected COM port, as shown below.

CD-4848

76 Each port can be selected individually. To select the required port, move the cursor over the MESSAGES RECEIVED ON COM 1 box and select the required port from the drop-down COM port selection box.

77 All messages received at the selected COM port can be viewed, when ALL is selected in the box adjacent to the MESSAGES RECEIVED ON COM 1 box. If required, only the filtered messages received at the selected COM port can be viewed. To view filtered messages only, click on the ALL box to toggle to the FILTERED setting. FILTERED is now displayed in place of ALL, as shown below.

CD-4904

Baud Rates Setup Screen

78 Allows the operator to set the transmit and receive baud rates for each of the comms ports.

79 Each port can be set to transmit and receive messages at a different Baud Rate, to allow for non-NMEA inputs. The Baud rates can be set within the range 1200 - 38400 baud.

NOTES:

(1) Care should be taken to ensure that the correct baud rate settings are used, to avoid possible loss of communication with the external devices connected to the comms ports.

(2) If the baud rates on serial ports 1 & 2 are set to above 9600, then both Tx and Rx settings on serial ports 1 & 2 must be identical (i.e. both 19200 or both 38400). If the baud rates on serial ports 3 & 4 are set to above 9600, then both Tx and Rx settings on serial ports 3 & 4 must be identical (i.e. both 19200 or both 38400). At settings below 19200 the Tx and Rx rates remain independent of each other.

(3) Ports 1 & 2 are located on one IC and ports 3 &4 are located on a another separate IC. Therefore, if more that one of the Tx or Rx baud rates on ports 1 or 2 are set to 19200, then to obtain a Tx or Rx baud rate setting of 38400, this will have to be configured on either Port 3 or 4.

Maps Setup Screen

80 Allows the operator to configure the I/O Ports 1 to 4, to allow Maps to be received as inputs from other Nucleus Displays and to be output to other displays, as required. The Maps Setup menu is shown below.

CD-5123

81 Each Comms port can be set to have Map inputs and Map outputs independently enabled or disabled.

82 Before setting up the MAPS input and output status at the Comms Ports, ensure that the Baud Rates for the Comms ports are set correctly.

NOTE:

Maps can be received whenever in Run. Maps are transmitted when they are loaded into the PPI in Run mode.

TABLE 1 - SYSTEM PCB (NNR-A911) - LINKS (Software version 1.0)

Link No.	Position	Description
1	OPEN	Main Processor Link - Shows font table
2	OPEN	Main Processor Link - Unused
3	MAKE	Main CAN terminator on (M)
4	OPEN	Heading Line, Shorting contacts (M), Pulse (O)
5	OPEN	Main Processor Link - Invert HVSync
6	OPEN	Main Processor Link - Invert VSync
7	MAKE	Processor Clock
8	OPEN	Main Processor Link - (M) = Enable diagnostics from I/O processor
9	MAKE	ATA CAN terminator on (M)
10	OPEN	Main Processor Link - Invert Hsync
11	OPEN	Scan Converter free run (M)
12	OPEN	I/O Processor Link - enable diagnostics to I/O processor
13	OPEN	Display Video Level = 0.7V (O) 1.0V (M)
14	OPEN	Spare Input to FPGA
15	OPEN	I/O Processor Link - includes CAN messages in diagnostics
16	OPEN	I/O Processor Link - Clears removable Flash memory
17	B	Diagnostics on Com3 (B), ATA download (A)
18	B	LOG Pulse (A), Shorting Contacts (B)
19	B	Compass Phase 2+ Step/Synchro
20	B	Compass Phase 2- Step
21	B	Compass Phase 1+ Step/Synchro
22	B	Compass Phase 1- Step
23	B	Compass Stepper (B) Synchro (A)
24	B	Compass Stepper (B) Synchro (A)
25	B	Compass Phase 3+ Step/Synchro
26	B	Compass Phase 3- Step
27	A	Download (A), PS2 input (B)
28	A	Hsync O/P (A) Compsync O/P (B)
29	MAKE	ATA Diagnostics Link / Made to enable serial 3 input
30	MAKE	I/O Processor Link
31	MAKE	Download (M), PS2 input (O)

KEY:

OPEN = No Link Fitted
MAKE = Link Fitted
A = Fit Link towards A end
B = Fit Link towards B end.

NOTE

Refer to Table 2 for GYRO settings.

TABLE 1 - SYSTEM PCB (NNR-A911) - LINKS (Software version 1.04)

Link No.	Position	Description
1	OPEN	Main Processor Link - Forces into CRT when Made, Must be used for 6000
2	OPEN	Main Processor Link - Prints out Azimuth & Heading Line diagrams, out of Port 3, when made.
3	MAKE	Main CAN terminator on (M)
4	OPEN	Heading Line, Shorting contacts (M), Pulse (O)
5	OPEN	Main Processor Link - Invert HVSync (not implemented, so should be reserved)
6	OPEN	Main Processor Link - Invert Vsync (not implemented, so should be reserved)
7	MAKE	Processor Clock
8	OPEN	Main Processor Link - (M) = Enable diagnostics from I/O processor
9	MAKE	ATA CAN terminator on (M)
10	OPEN	Main Processor Link - Invert Hsync (not implemented, so should be resrved)
11	OPEN	Scan Converter free run (M)
12	OPEN	I/O Processor Link - enable diagnostics to I/O processor
13	OPEN	Display Video Level = 0.7V (O) 1.0V (M) (removed issue E artwork)
14	OPEN	Open, blanks muted sector - Made displays video during muted sector.
15	OPEN	I/O Processor Link - iMade sets all serial messages to "super" relaxed
16	OPEN	I/O Processor Link - Clears removable Flash memory
17	B	Diagnostics on Com3 (B), ATA download (A)
18	B	LOG Pulse (A), Shorting Contacts (B)
19	A	Compass Phase 2+ Step/Synchro
20	A	Compass Phase 2- Step
21	A	Compass Phase 1+ Step/Synchro
22	A	Compass Phase 1- Step
23	B	Compass Stepper (B) Synchro (A)
24	B	Compass Stepper (B) Synchro (A)
25	A	Compass Phase 3+ Step/Synchro
26	A	Compass Phase 3- Step
27	A	Download (A), PS2 input (B)
28	A	Hsync O/P (A) Compsync O/P (B)
29	MAKE	Made to enable serial 3 input. Open for ATA Diagnostics Link
30	OPEN	I/O Processor Link. Made outputs all serial messages
31	MAKE	Download (M), PS2 input (O)

KEY

OPEN = No Link Fitted
MAKE = Link Fitted
A = Fit Link towards A end
B = Fit Link towards B end.

NOTE

Refer to Table 2 for GYRO settings.

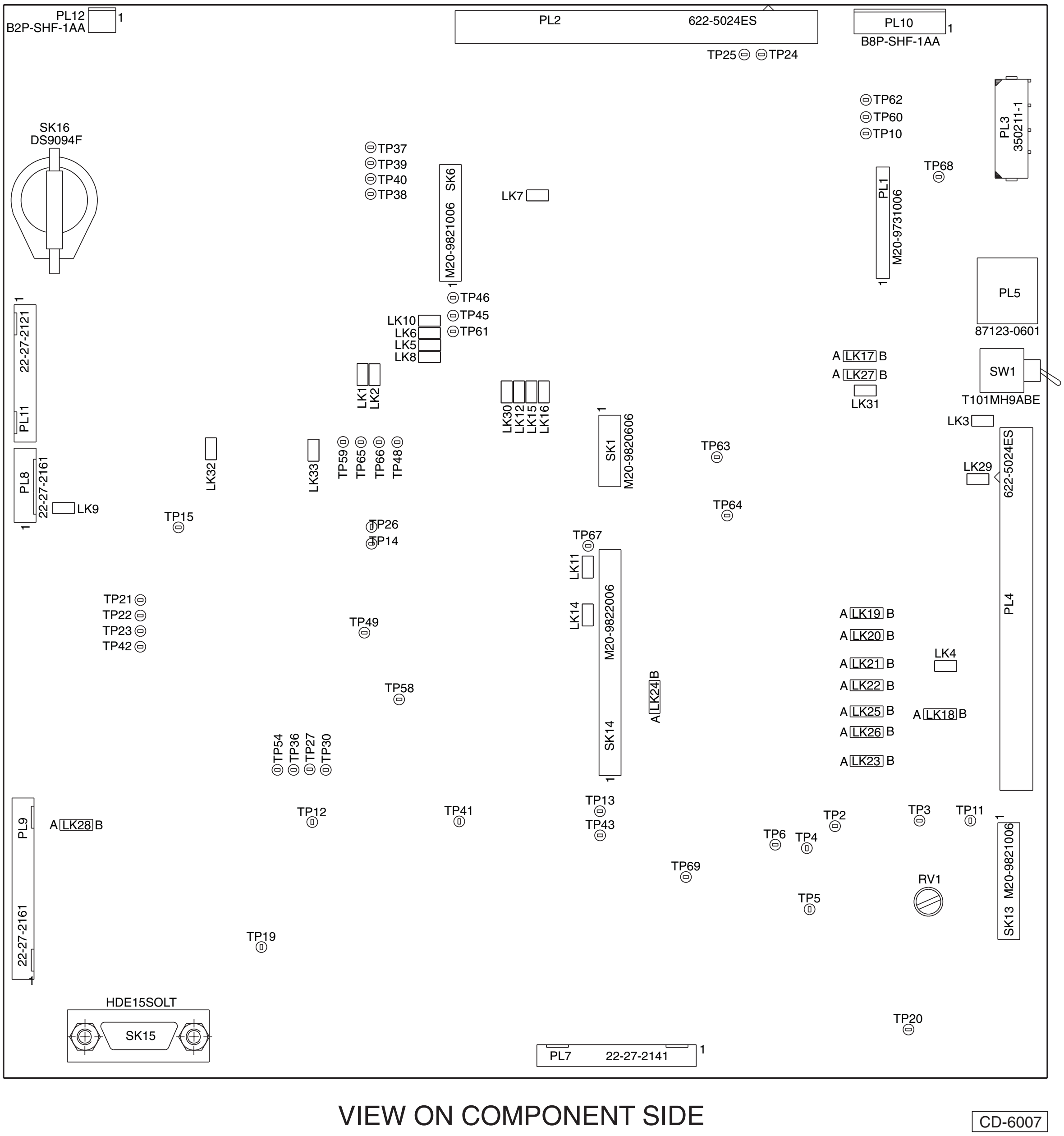


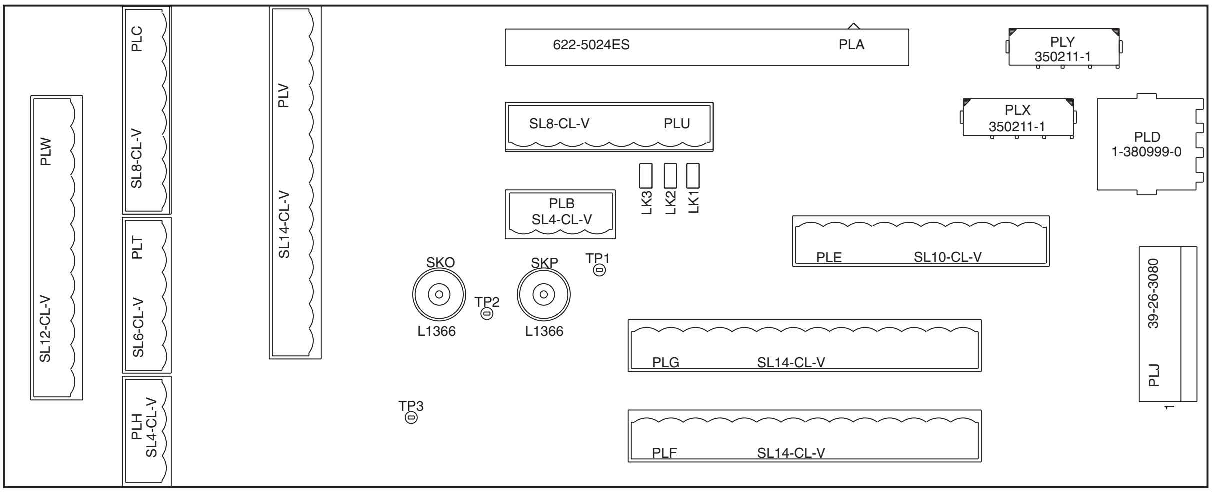
Figure 1 - System PCB (NNR-A911) : Links, Switch and Potentiometer Locations

TABLE 2 - GYRO LINK SETTINGS

NOTE:

For GYRO Type information, refer to Table 3

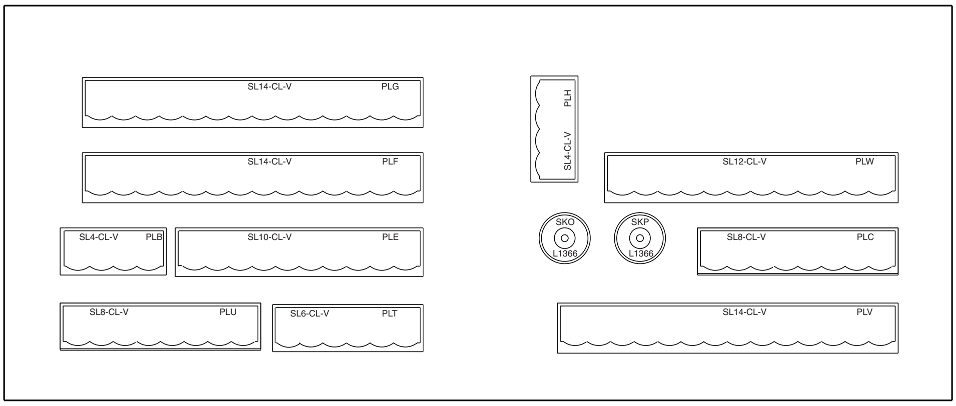
COMPASS TYPE/VOLTAGE	LINK STATUS System PCB (NNR-A911)	LINK STATUS Input PCB (NNR-A910) - 6000 Series Input PCB (NNR-A996) - 5000 Series
STEPPER COMPASSES:		
+Ve Stepper	Set to A; Links 19, 20, 21, 22, 25, 26 Set to B; Links 23, 24	Make Links LK1, LK2 & LK3
-Ve Stepper	Set to B; Links 19, 20, 21, 22, 23, 24, 25, 26	Make Links LK1, LK2 & LK3
Synchro	Set to A; Links 19, 20, 21, 22, 23, 24, 25,26	Unmake Links LK1, LK2 & LK3



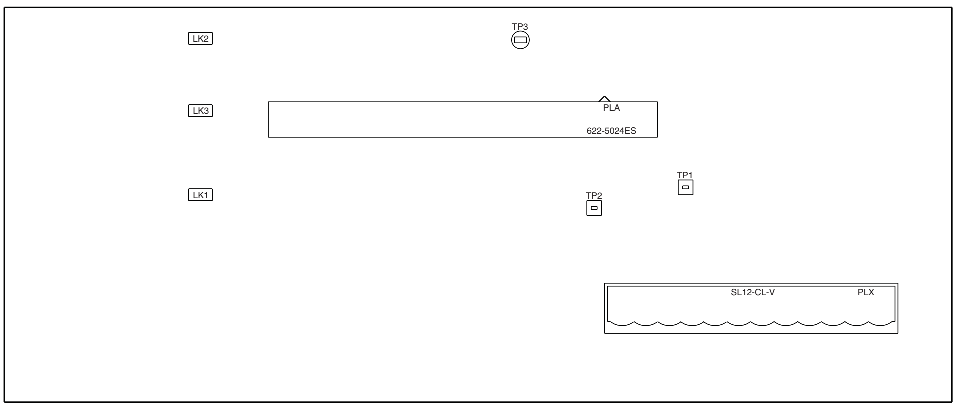
VIEW ON COMPONENT SIDE

CD-6006

Figure 2 - Input PCB (NNR-A910) : Link Locations



VIEW ON COMPONENT SIDE



VIEW ON SOLDER SIDE

CD-4823

Figure 3 - Input/Output PCB (NNR-A996): Link Locations

Table 3 - GYRO TYPES

GYRO NAME	TYPE	V REF.	V PHASE	RATIO
SPERRY GYROSYN			24	180:1
BROWN	-VE STEPPER	24	24	360:1
SPERRY/TKS Mk.37 SPERRY Mk.20	-VE STEPPER or +VE STEPPER	35 70	35 70	360:1 360:1
SPERRY Mk.30 SPERRY TKS SR120 TKS ES16	-VE STEPPER or +VE STEPPER	35 70	35 70	360:1 360:1
BROWN INDUCTION ARMA BROWN (STEP BY STEP) ARMA BROWN Mk.10	-VE STEPPER	50	50	360:1
SPERRY SR130 SPERRY 140 SPERRY/TKS SR140 SPERRY 227 SPERRY/TKS TG100 TKS GLT 202 TKS ES15	-VE STEPPER	35	35	360:1
PLATH: NAVIGAT IX NAVIGAT X NAVIGAT 2100	-VE STEPPER	24	24	360:1
ANSHUTZ ANSHUTZ STD.6 ANSHUTZ STD.20	SYNCHRO	50	20	360:1
HOKUSNIN C1 HOKUSNIN C2 HOKUSNIN C3	SYNCHRO	50	68	360:1
HOKUSNIN GYROpet CMZ 102	SYNCHRO	110	110	360:1
HOKUSIN IPS2	SYNCHRO	115	90	360:1
SPERRY 29 (360:1) SPERRY 35	SYNCHRO	115	90	360:1
SPERRY 29 (180:1)	SYNCHRO	115	90	180:1
RUSSIAN ANSHUTZ KURS 4	SYNCHRO	110	55	360:1
MICROTECHNICA: C19; BC25; SIRIUS	SYNCHRO	115	90	360:1
SAGEM	SYNCHRO	115	90	360:1
FUNKWERKE KOPENICK	SYNCHRO	110	110	360:1
SG BROWN SGB 1000 MERIDIAN	SYNCHRO	26	11.8	1:1
YOKOGAWA CMZ500	STEPPER	35	35	360:1
YOKOGAWA CMZ700	STEPPER	24 35 (Option)	24 35 (Option)	360:1 360:1 (Option)

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CHAPTER 6

MAINTENANCE & DIAGNOSTICS

WARNING

IF RADAR EQUIPMENT IS TO BE WORKED ON, WHILE POWERED UP, IN PORT, ENSURE THAT:

- **No one is working close to the scanner, i.e. No one is within a few metres of the Antenna.**
- **The Antenna is rotating, or if the work requires the Antenna to be stationary that it is directed towards unoccupied areas, e.g. out to sea.**
- **No one looks directly into the emission side of a slotted waveguide (open box type) Antenna.**
- **The risk of being hit by a rotating Antenna is not overlooked if work close to the Antenna is necessary.**
- **Any work required on such equipment must be implemented by competent persons, operating a safe system of work, so that no one is put at risk.**

INTRODUCTION

1 This Chapter is divided into three parts:

(1) Preventive Maintenance.

(2) Diagnostic Maintenance.

(3) Corrective Maintenance.

2 The following paragraphs outline the basic maintenance and fault finding procedures which can be implemented by the operator. The fault finding/repair philosophy is limited to checking cable connections and changing fuses.

NOTE:

For details of the Maintenance procedures applicable to the associated Transmitter/Receivers, refer to the appropriate part of Chapter 7.

MAINTENANCE

WARNING

LETHAL VOLTAGES ARE PRESENT INSIDE THE EQUIPMENT. ALL MAINTENANCE IS TO BE IMPLEMENTED WITH POWER SWITCHED OFF.

PREVENTIVE MAINTENANCE

3 Preventive maintenance consists of keeping the system clean, particularly the console, cabinets, and filters. External surfaces should be cleaned with a soft, non-abrasive cloth, moistened in a soap solution.

4 Screens are to be checked and cleaned regularly with a soap solution.

DIAGNOSTIC MAINTENANCE

5 Fault conditions detected by the system are highlighted by System Alarms which appear on the display. These are:

(1) No Video.

(2) No Sync.

(3) No Azimuth.

(4) No Heading Line.

(5) No Gyro.

6 A series of simple algorithms (Figures 5 to 11) form a brief, step-by-step outline to guide the operator through the fault finding procedure.

CORRECTIVE MAINTENANCE

7 Corrective maintenance by the operator is limited to changing fuses or cleaning the **Trackerball & rollers** .

CAUTION

It is recommended that ONLY an experienced engineer changes Nucleus 6000 Series Monitor Fuses.

Fuses

8 There are 3 fuses in the Nucleus Display System:

(1) Processor Assembly:

a. Mains Input Line (Filter) - 5A (220V) or 15A (110V)

b. Battery Unit - FS1 10A

(2) Monitor Assembly:

a. Power Supply Unit - FS1 2A FB

b. Deflection PCB - FS1 1.25A A/S

9 PCB locations are shown in Figures 12 to 16.

Trackerball

10 In the unlikely event that the operation of the Nucleus Trackerball becomes erratic and/or does not accurately position the cursor on the display, the Trackerball rollers may require cleaning. To overcome the problem, implement the instructions below.

Tools Required

11 The following items are required:

(1) Screwdriver - Posidrive.

(2) Cleaning Fluid, i.e. Alcohol or Solvent.

(3) Cotton Buds. 

5000 Series Screen Control Unit

12 To remove and Clean the Trackerball :

(1) Locate the Access Plate (A) on the underside of the Screen Control Unit (SCU). Refer to Figures 1 and 2 (for 5000 series) and Figures 3 and 4 (for 6000 series).

(2) Remove the screws that hold the access plate to the underside of the SCU.

(3) A flying lead runs from the base of the Trackerball unit to the Trackerball PCB. Disconnect the flying lead from the Trackerball PCB.

(4) Remove the four Trackerball Unit retaining screws.

(5) The Trackerball Unit can now be withdrawn from the upper part of the Screen Control Unit.

(6) Saturate the cotton buds with the cleaning fluid and clean the rollers and Trackerball.

(7) Re-assembly of the SCU is the reverse of the procedures in sub-paragraphs (2) to (5) above.

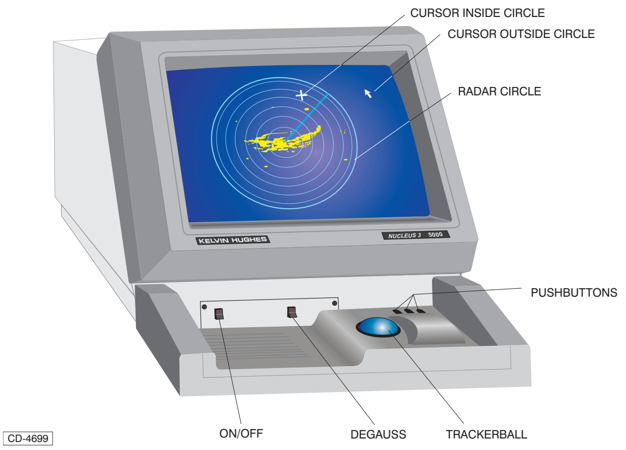

Figure 1 - Screen Control Unit (5000 Series)

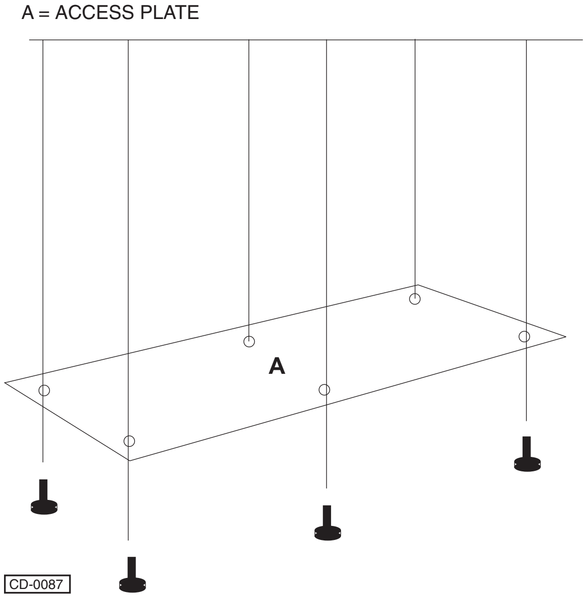

Figure 2 - Access Plate Removal (5000 Series)

6000 Series Screen Control Unit

13 To remove and Clean the Trackerball :

(1) Locate the Access Plate (A) on the underside of the Screen Control Unit (SCU). Refer to Figures 1 and 2 (for 5000 series) and Figures 3 and 4 (for 6000 series).

(2) Release the screws that hold the access plate to the SCU Baseplate.

(3) A flying lead runs from the base of the Trackerball unit to the Trackerball PCB. Disconnect the flying lead from the Trackerball PCB.

(4) Remove the four Trackerball Unit retaining screws.

(5) The Trackerball Unit can now be withdrawn from the upper part of the Screen Control Unit.

(6) Saturate the cotton buds with the cleaning fluid and clean the rollers and Trackerball.

(7) Re-assembly of the SCU is the reverse of the procedures in sub-paragraphs (2) to (5) above.

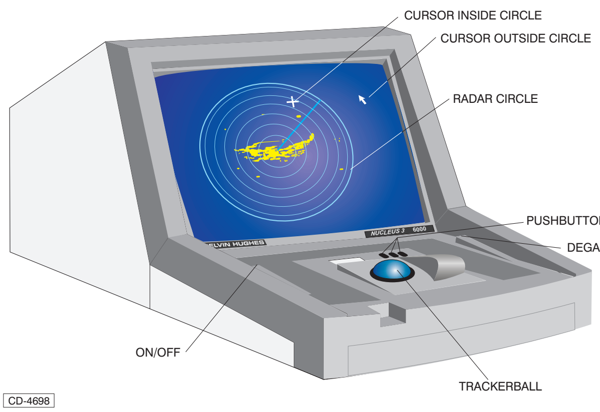

Figure 3 - Screen Control Unit (6000 Series)

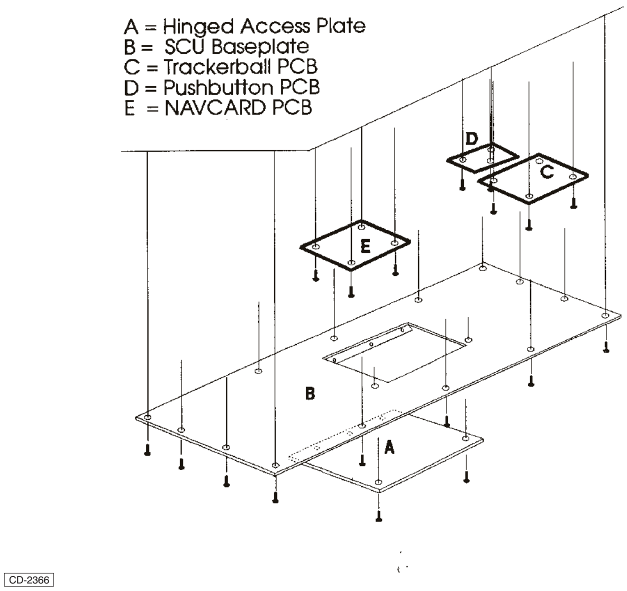

Figure 4 - Access Plate Removal (6000 Series)

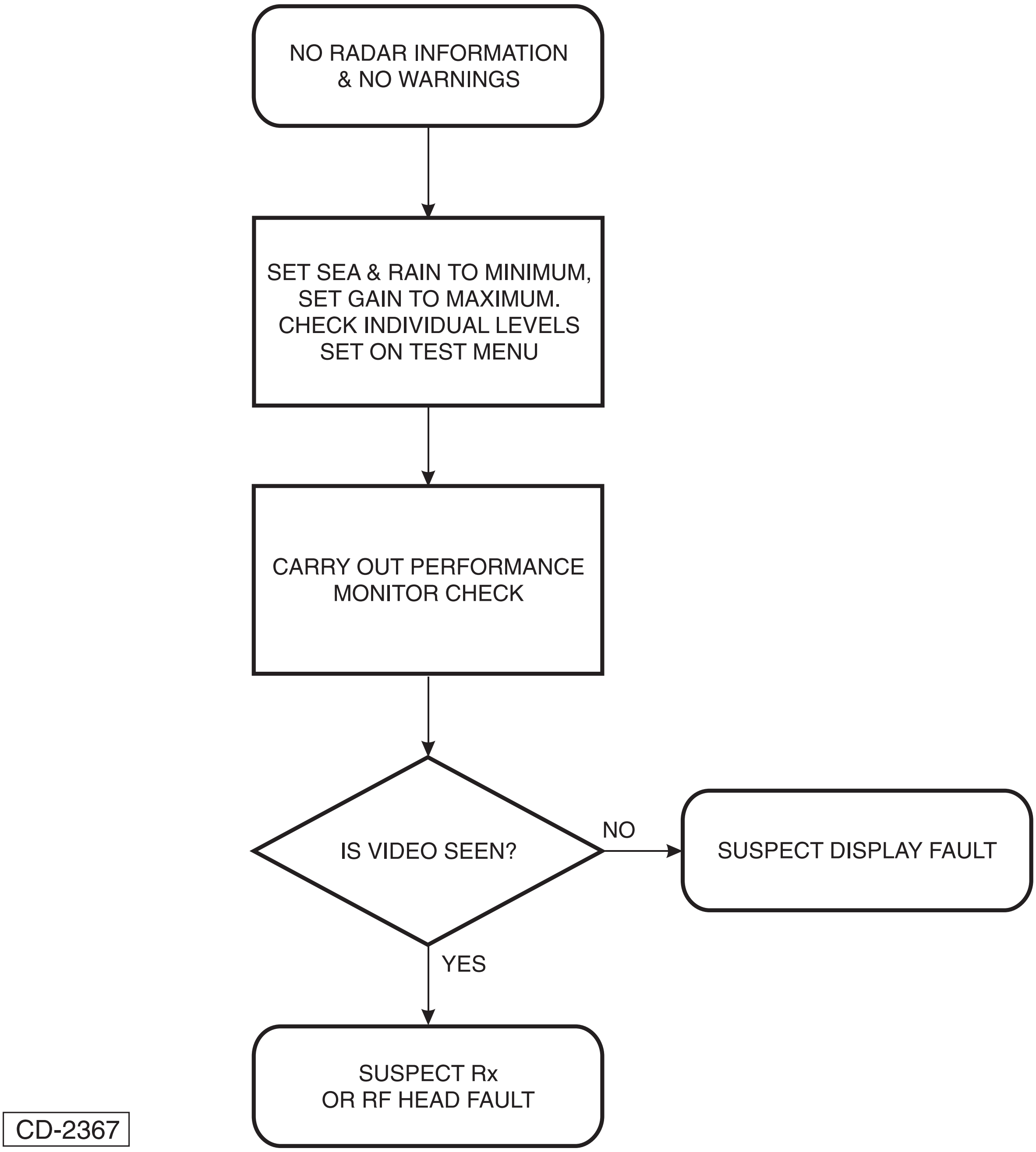

Figure 5 - No Radar Information (No Warning)

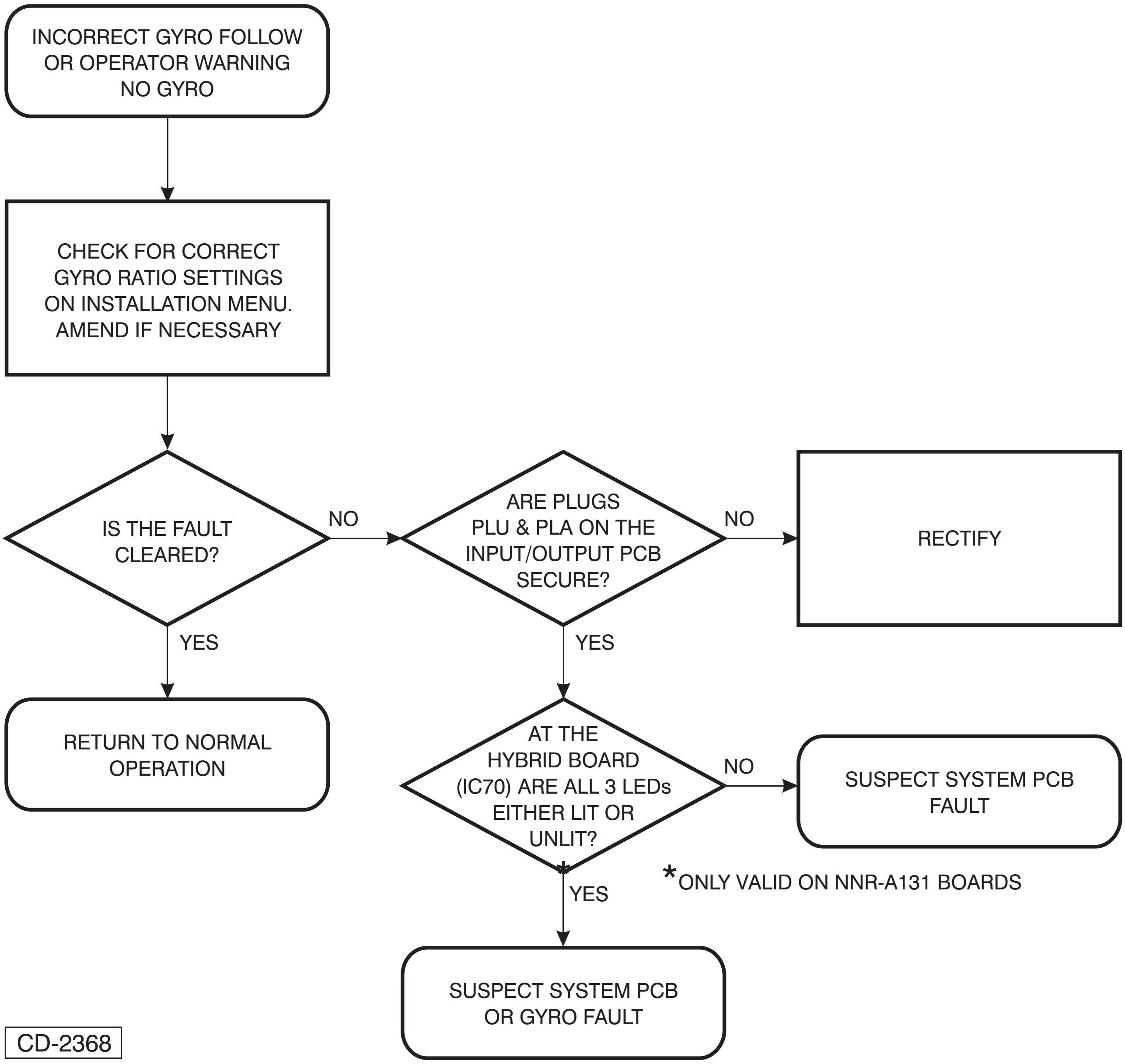

Figure 6 - Incorrect Gyro Follow or Operator Warning -No Gyro

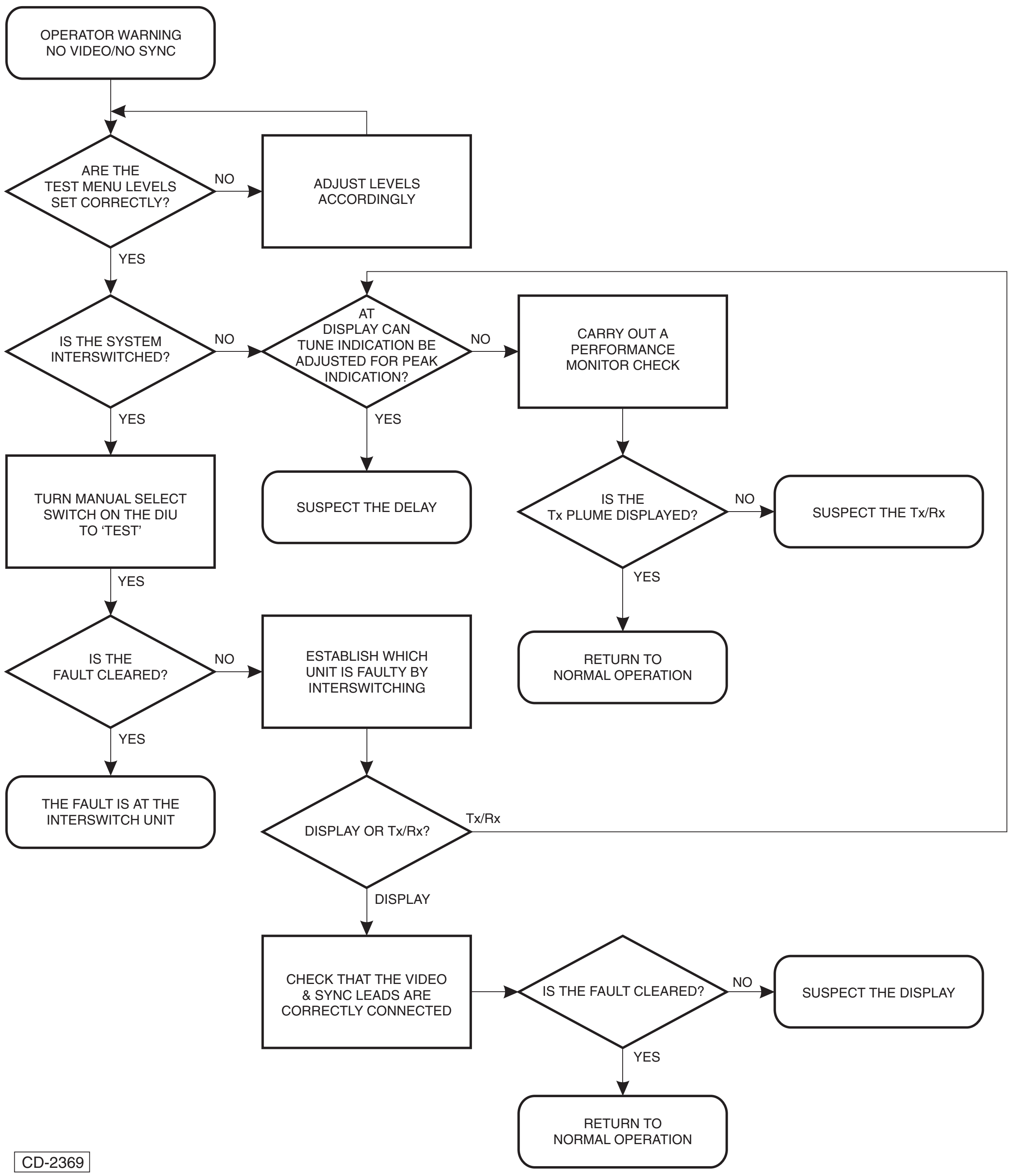

Figure 7 - Operator Warning (No Video/No Sync)

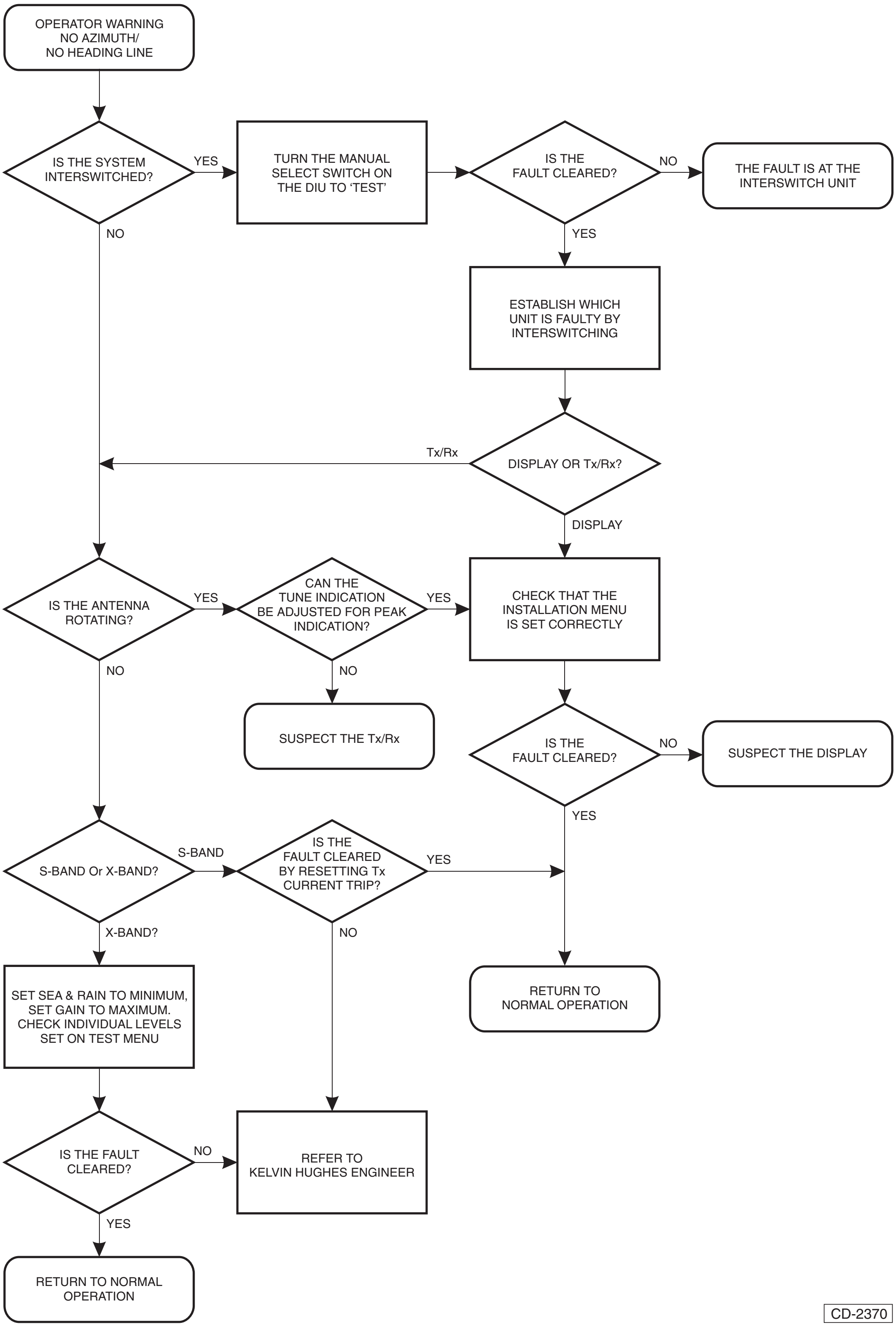

Figure 8 - Operator Warning (No Azimuth/No Heading Line)

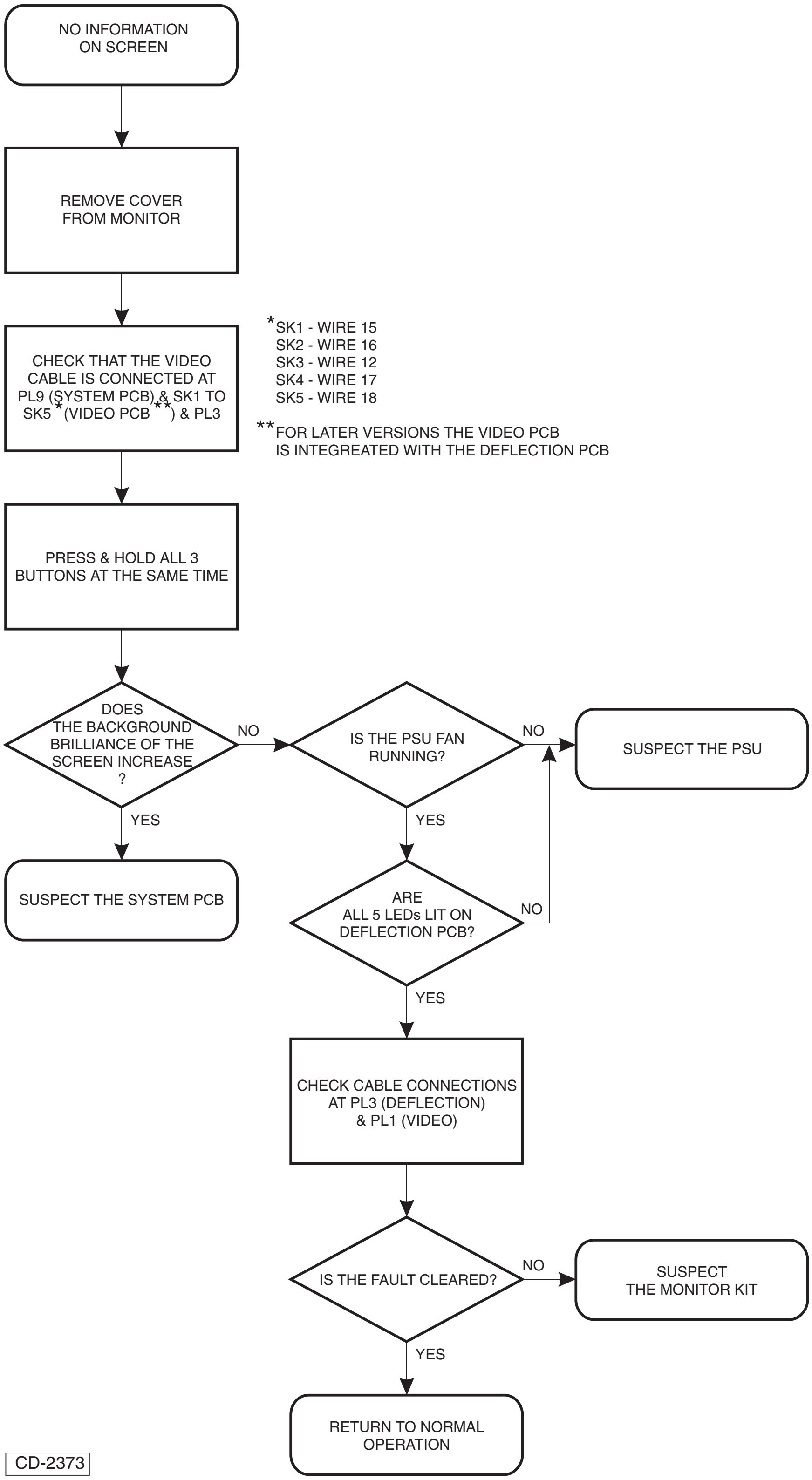

Figure 9 - No Information on Screen (5000 Series)

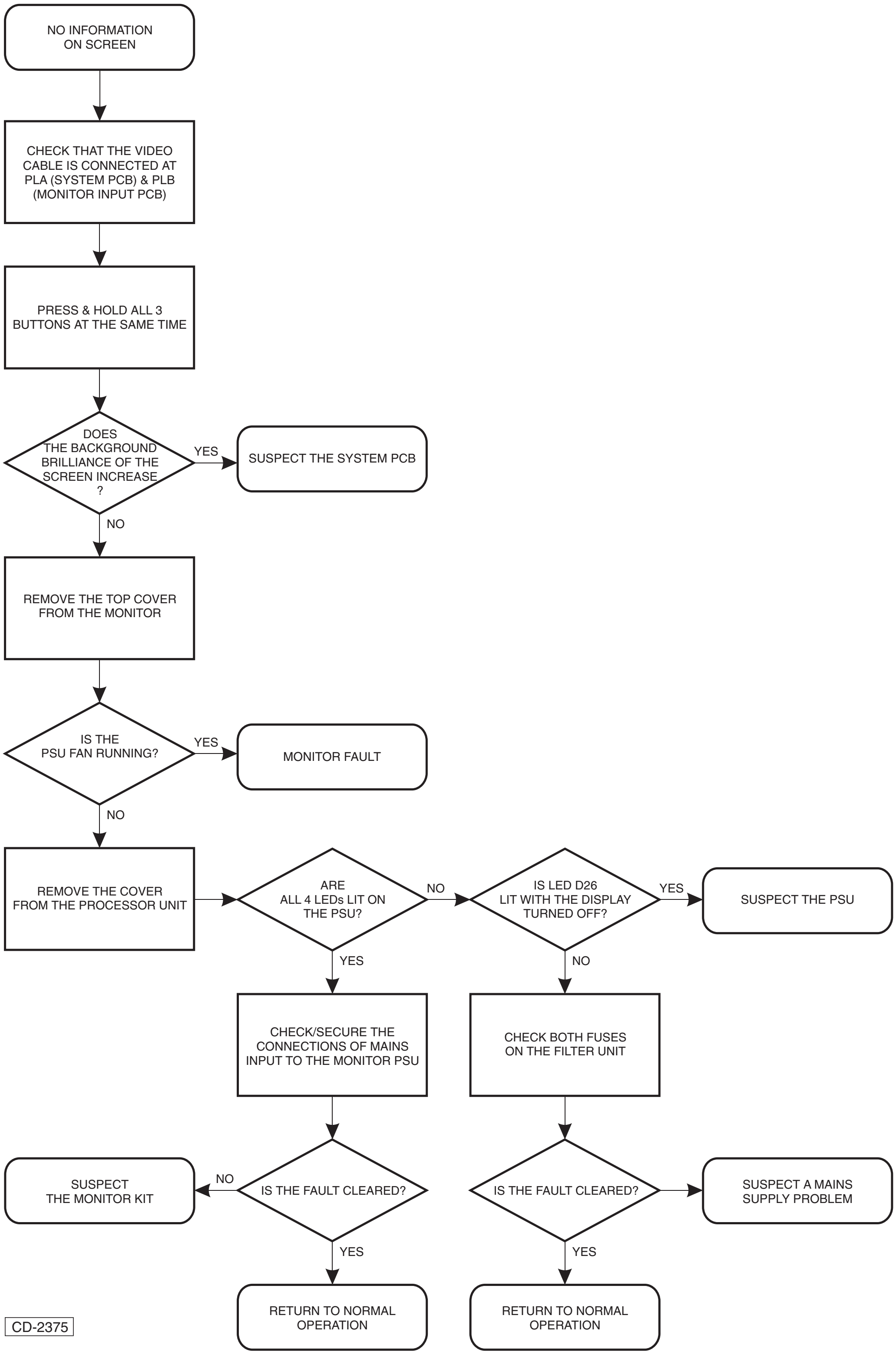

Figure 10 - No Information on Screen (6000 Series)

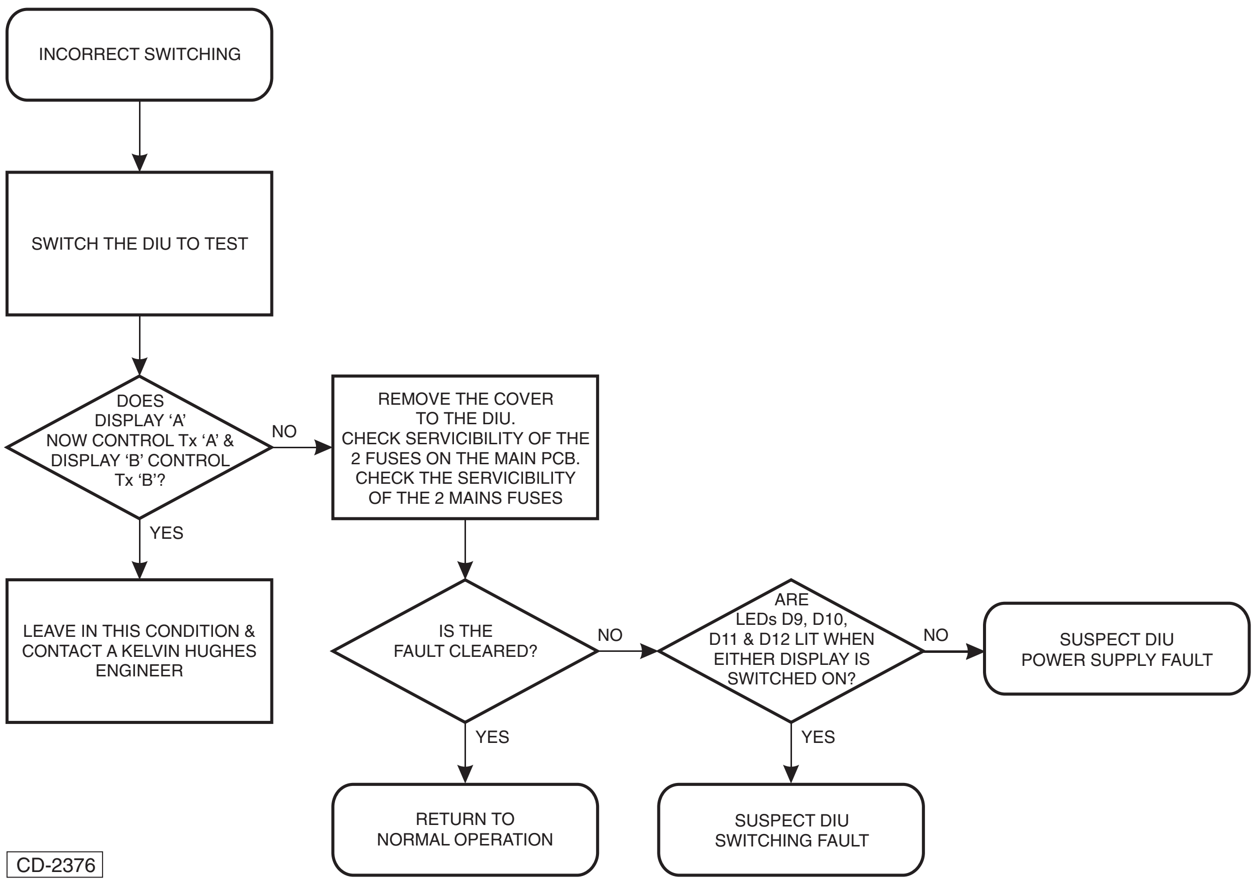

Figure 11 - Incorrect Interswitching

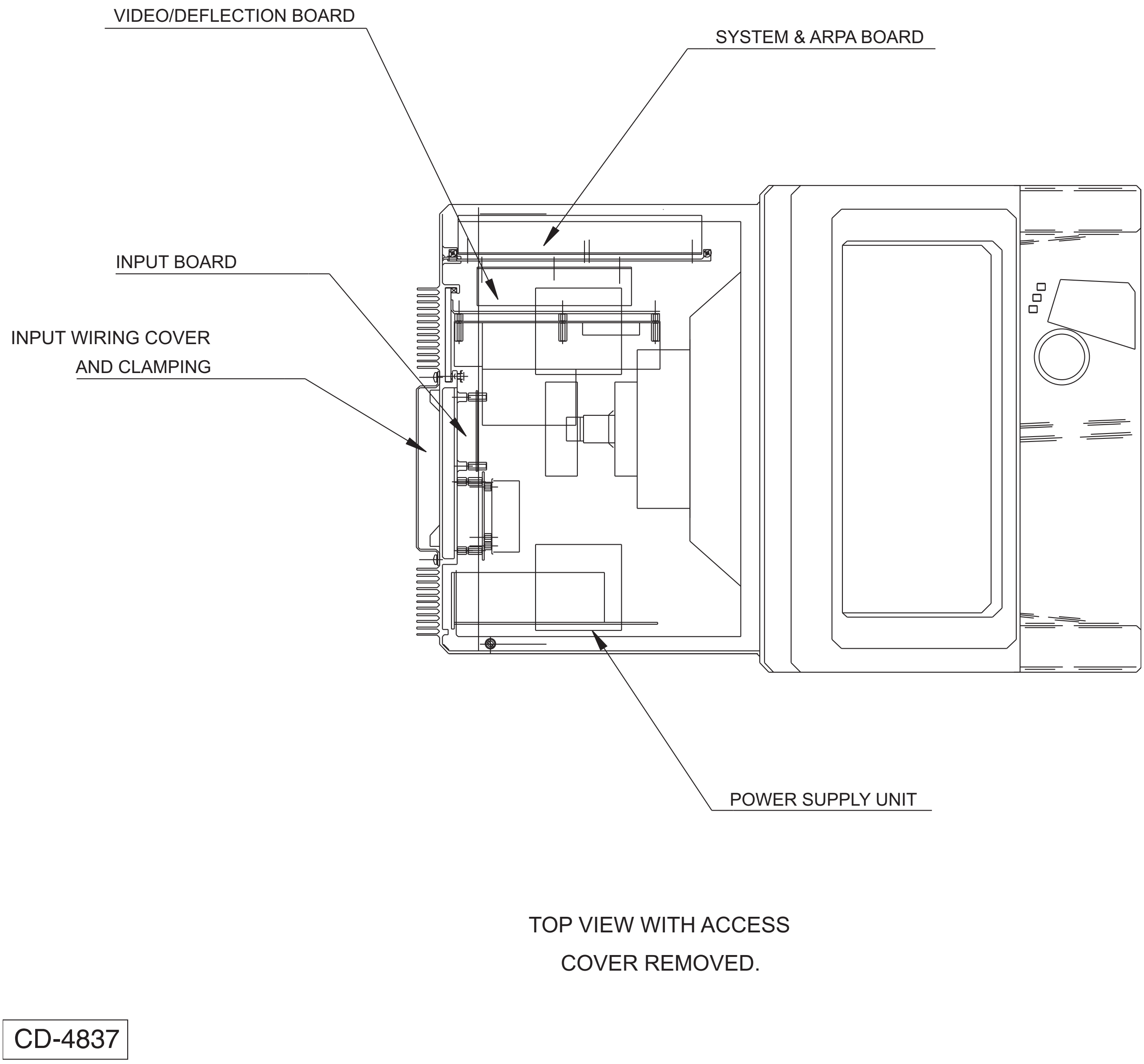

Figure 12 - PCB Locations (5000 Series)

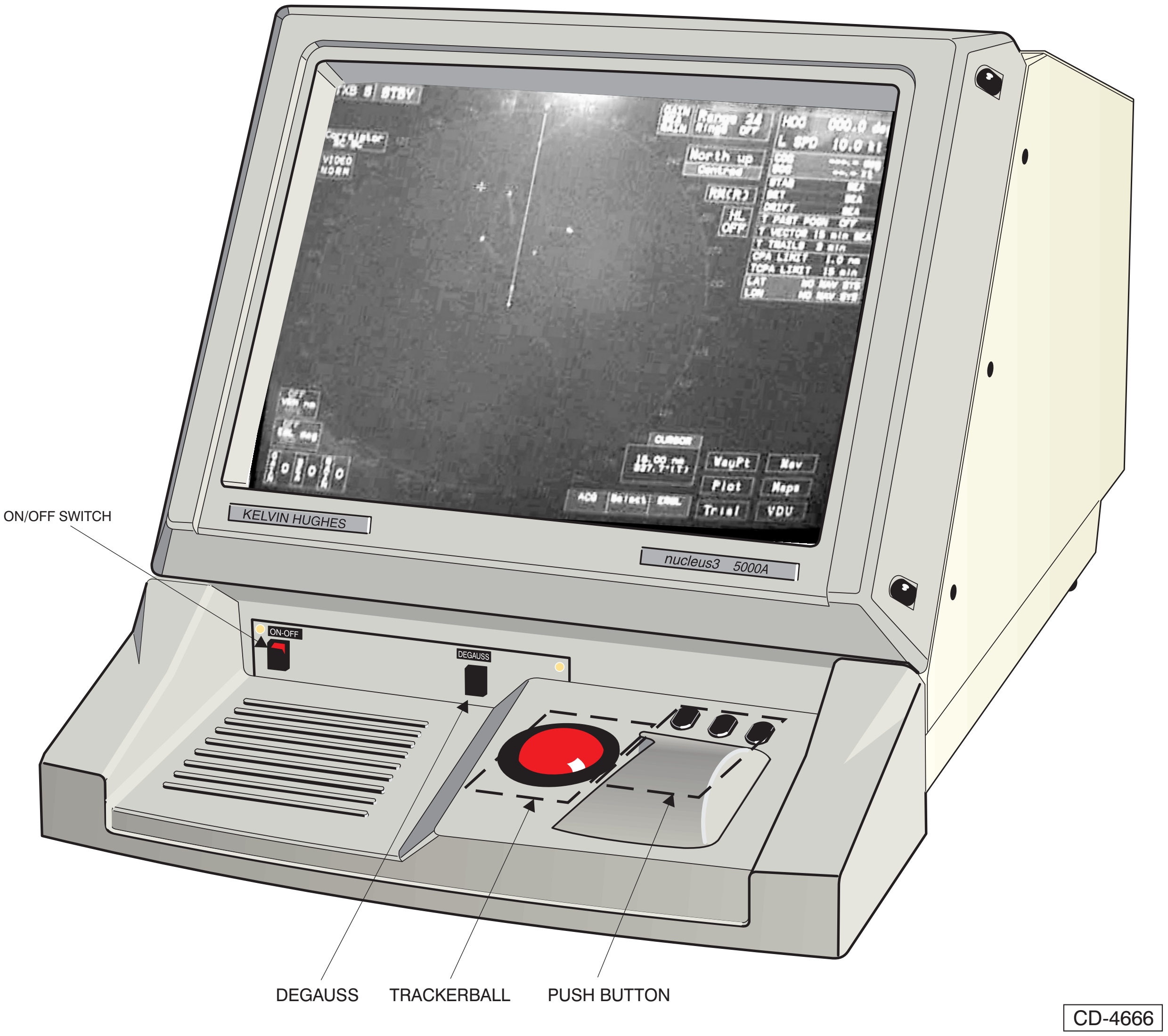

Figure 13 - Screen Control Unit (5000 Series) PCB Locations

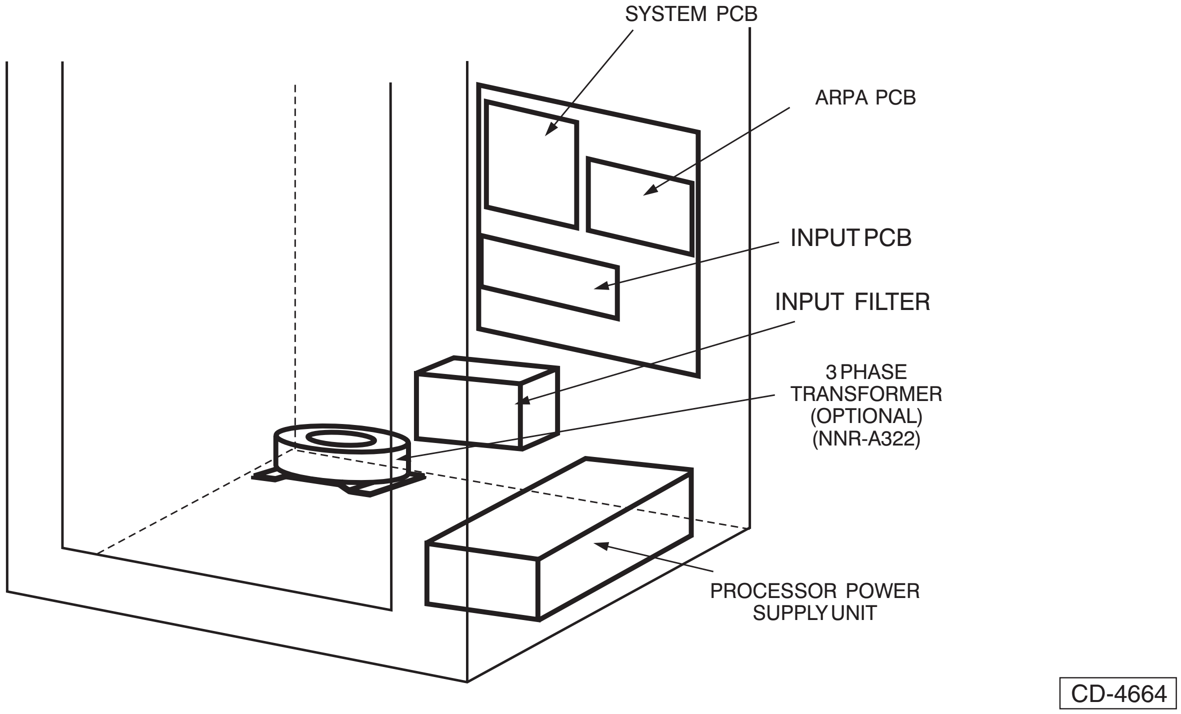

Figure 14 - Processor Assembly (6000 Series) PCB Locations

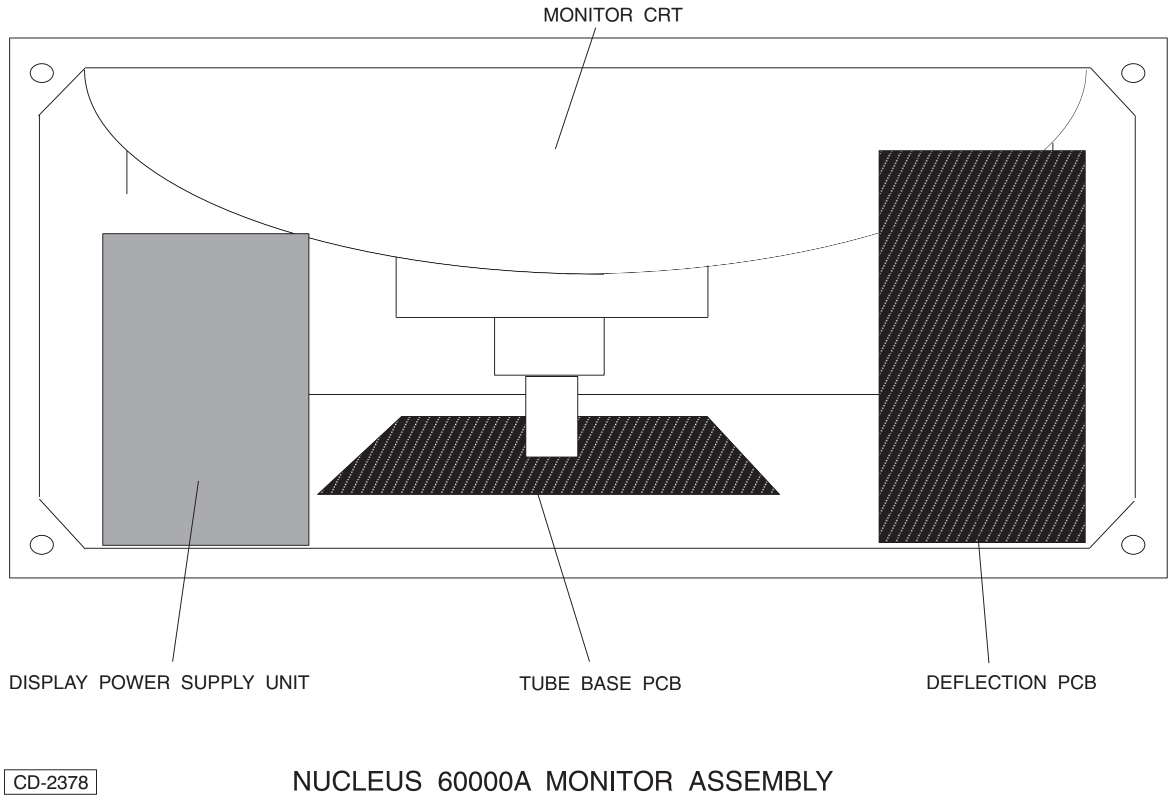

Figure 15 - Monitor Assembly PCB Locations

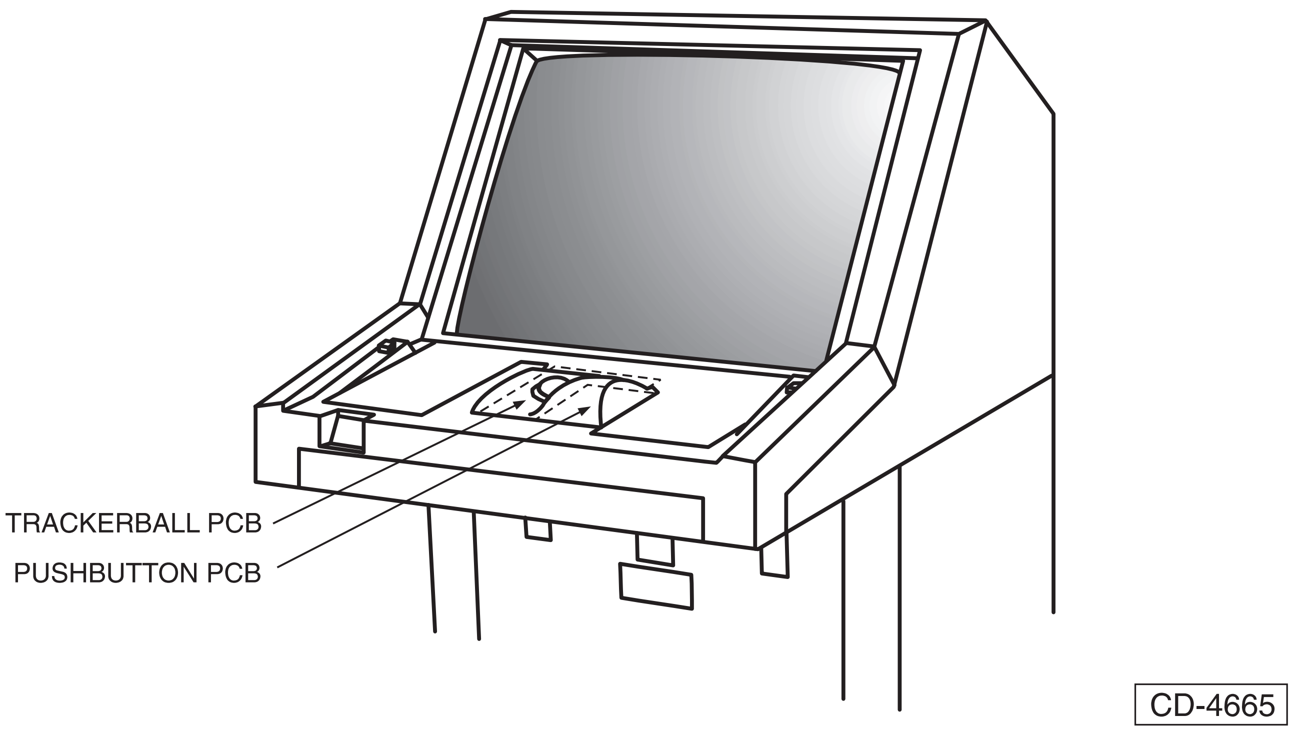

Figure 16 - SCU Assembly (6000 Series) PCB Locations

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CHAPTER 7A

MKIV TRANSMITTER/RECEIVER & ANTENNA

INTRODUCTION

1 The MkIV Transceiver is available in the Upmast X-Band configuration. (Refer to Figure 1a below):

2 The Transceiver is comprised of the following main units:

(1) A modulator unit.

(2) 60MHz logarithmic receiver CTX-A297.

(3) RF head and magnetron.

(4) Power Unit.

(5) Receiver Monitor.

(6) Transmission Monitor.

FUNCTIONAL DESCRIPTION

MODULATOR

3 The modulator is a line type with resonant charging from a stabilised line voltage, driving a 25kW rated magnetron via a pulse transformer.

4 Pre-pulse and jitter facilities and three separate sync. pulse outputs are provided.

5 The Modulator Unit contains the following two main circuits:

(1) Modulator Control.

(2) Modulator.

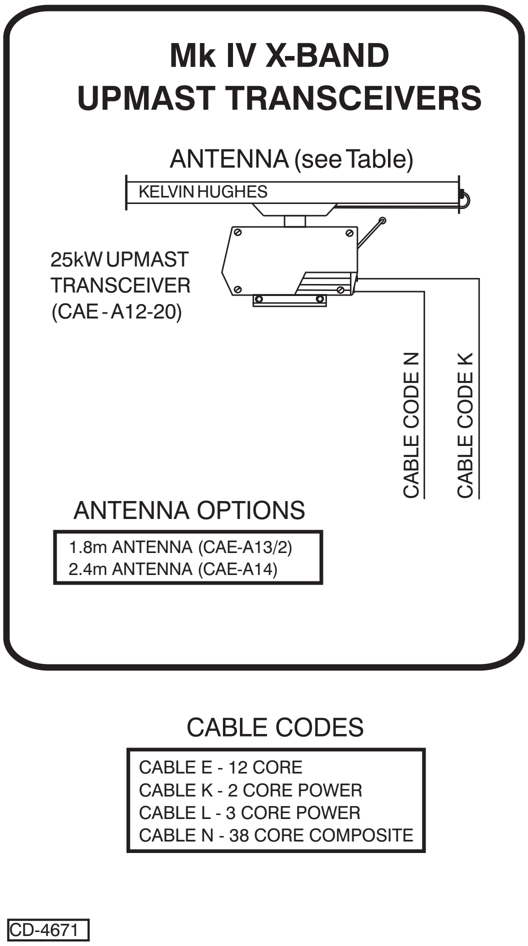


Figure 1a - MkIV Transceiver/Antenna Configurations

Modulator Control Circuit

6 A block diagram of the Modulator Control circuit is shown in Figure 2a, below.

7 The modulator control circuit monitors the PULSE LENGTH, STANDBY and MUTE control signals from the display, and senses the AZIMUTH pulses which indicate Antenna rotation. The circuit generates modulator triggers.

8 Three LEDs, labelled +27V, TX READY and TUNE, and an antenna motor relay (which can be activated when Switch S4 is closed) are mounted on the PCB.

9 Power supplies of +15V, +27V, +24V and +8.5V are supplied from the Power Unit. Supplies for other areas of the transmitter are generated on the PCB.

Modulator Circuit

10 A block diagram of the Modulator is shown in Figure 3a.

11 The modulator uses a line type circuit whose capacitors in the PFN are charged to double the HT supply. The line impedance is matched to the magnetron impedance by the pulse transformer.

Sync Pulse Output

12 One low impedance sync pulse output is produced by the modulator. This is split to provide three output connections from the downmast transceiver case.

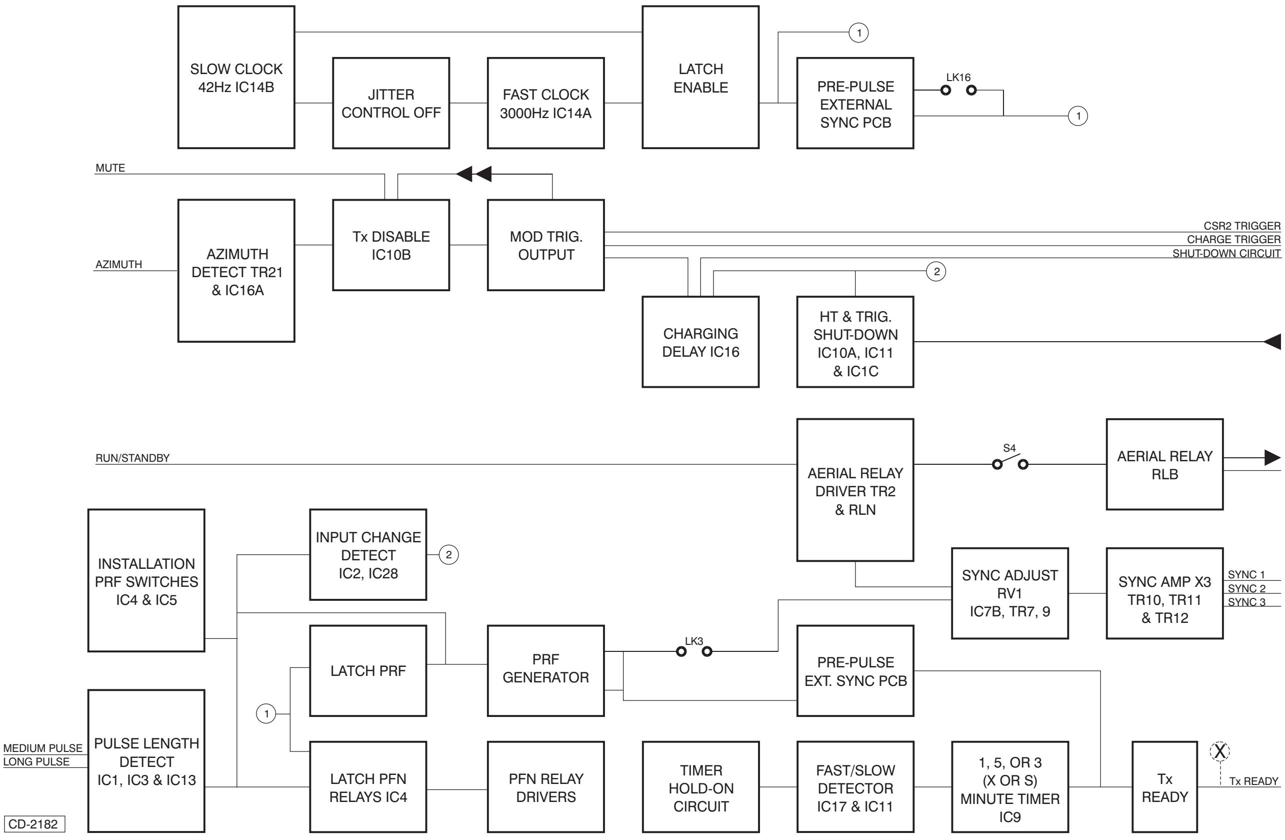


Figure 2a - Modulator Control Block Diagram

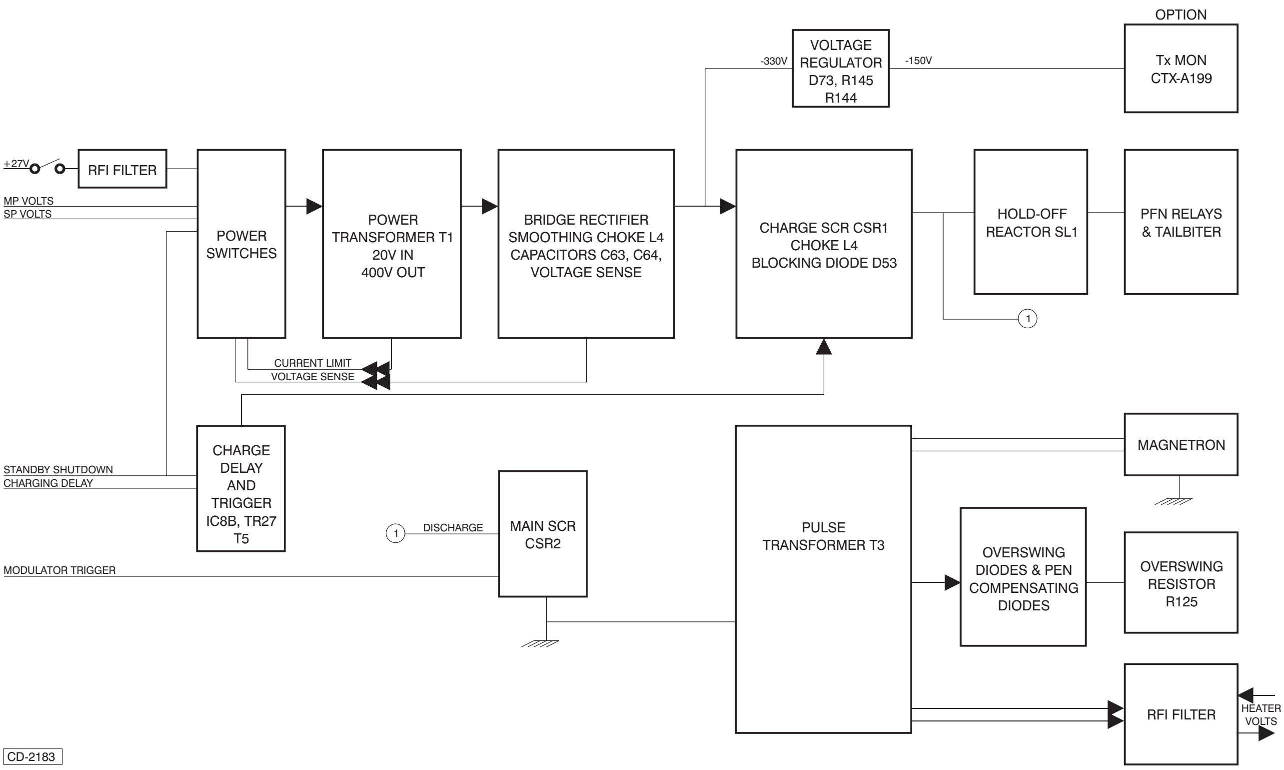


Figure 3a - Modulator Block Diagram

LOG RECEIVER CTX-A297

13 A block diagram of the Log Receiver CTX-A297 is shown in Figure 4a, below.

14 The Receiver comprises a logarithmic IF amplifier, Automatic Frequency Control (AFC) circuitry and tuning indicator circuitry.

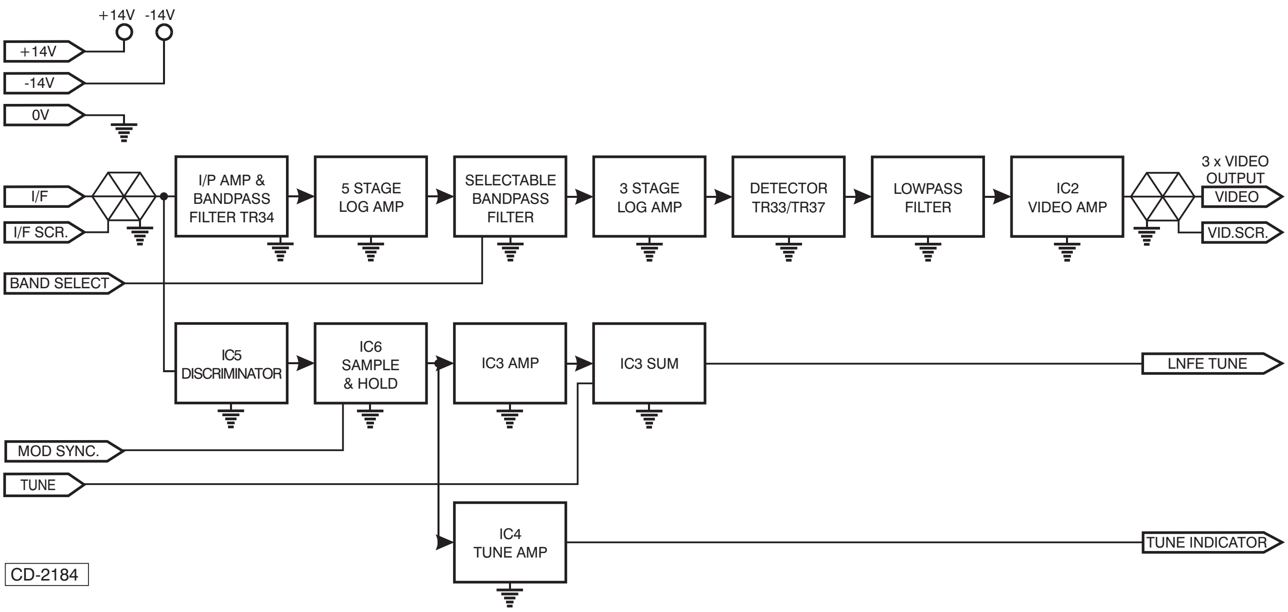


Figure 4a - Log Receiver (CTX-A297) Block Diagram

15 Received radar returns are mixed in the RF head with the local oscillator output to provide a 60 MHz Intermediate Frequency (IF) which is applied to the receiver input SKC.

RF HEAD (NJRC TYPE)

16 The RF Head is shown in Figure 5a, below.

17 The NJRC RF Head is of modular design and is situated in the upper part of the transceiver cabinet. The RF Head consists of a cavity magnetron, ferrite circulator, solid state limiter and a low noise front end. There are no replaceable components in the RF Head, other than the modules themselves.

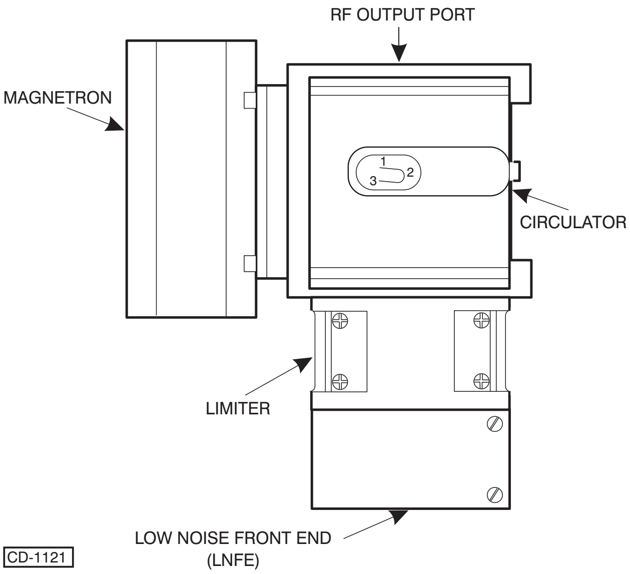


Figure 5a - X-Band RF Head (CTX-A230)

POWER SUPPLIES

18 A block diagram of the ac Power Unit is shown in Figure 6a.

19 An ac Power Unit is fitted as standard to all versions of the Transceiver. The Power Unit is designed to run from 100, 110, 200 and 220V at frequencies from 45-65Hz.

WARNING
LETHAL VOLTAGES ARE PRESENT IN THE TRANSCEIVER. CARE SHOULD BE TAKEN WHEN USING TEST EQUIPMENT FOR DIAGNOSTIC MAINTENANCE WITH THE EQUIPMENT IN AN OPERATIONAL CONDITION.

20 Fuse ratings for the input supply are as follows:

(1) 200/220V 3.15A Time lag

(2) 100/110V 5A Time lag

21 Output supplies produced by the unit are:

(1) +27V dc Modulator supply fused at 5A

(2) +15V dc Control circuits and Receiver

(3) +24V dc X-Band motor fused at 5A

(4) 7.5V ac X-Band magnetron heater supply

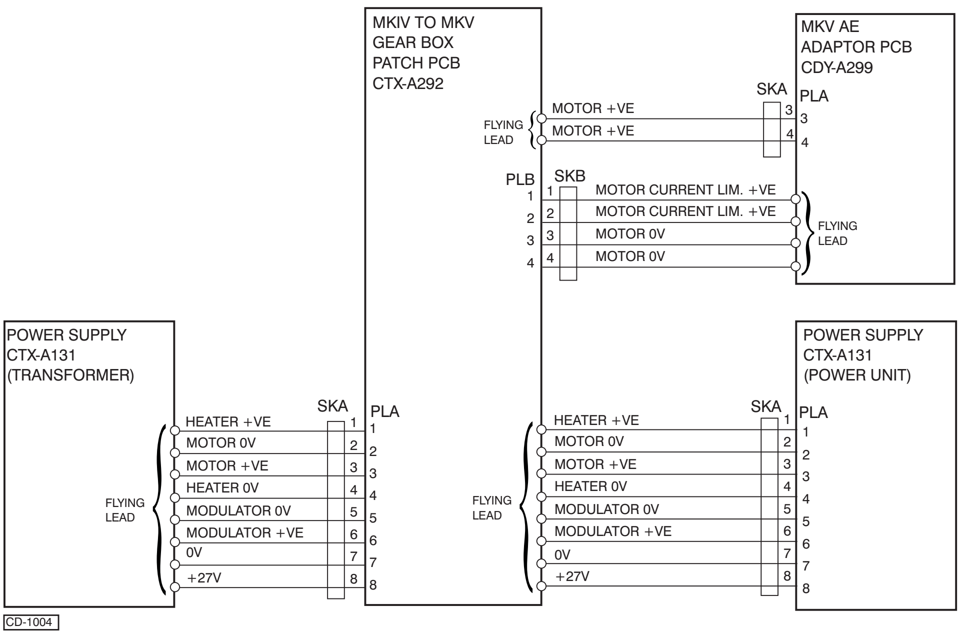


Figure 6a - AC Power Unit (CTX-A131)

RECEIVER MONITOR

22 The X-Band receiver monitor comprises a resonant cavity fitted to the waveguide transition joint at the entry to the transmitter. The resonant cavity contains an adjustable plunger that is factory set, according to magnetron frequency. When the monitor is activated, by pressing PM (Performance Monitor) on the display, a ‘sun’ shows in the centre of the radar screen area.

TRANSMISSION MONITOR

23 The Transmission Monitor comprises a monitor arm fitted to the outer case of the turning mechanism. Selecting PM (Performance Monitor) on the display activates the transmission monitor. The monitor arm neon is ionised as the antenna passes over the arm and the radiated signal impinges on the integral neon lamp. This causes a ‘plume’ to be displayed on the radar screen.

SPECIFICATION

24 Technical specifications for the MkIV Transceiver are provided in Table 1, below.

Table 1 - MkIV Transceiver Specification

Frequency:	X-Band 9410 30MHz
Peak Power output:	X-Band 25kW nominal
Magnetron Life:	10,000 Hours typical
Pulse Length and P.R.F:	
Short: (S):	X-Band 0.07 s (0.045-0.085) 1500 ±40, or 3000 pps 80
Medium (M)	0.25 s (0.20-0.30) 750pps 20 or 1500 40
Long (L)	1.0 s (0.85-1.0) 750pps 20
Long-Low PRF (VL)	1.0 s (0.85-1.0) 375pps ±10
Sync. Output:	3 x 75 Ohm outputs (Downmast) 1 x 75 Ohm output (Upmast not less than +12V amplitude
Receiver (used for all transceivers):	
Type:	Logarithmic Receiver
Transfer Characteristics:	Nominal
I.F.	60MHz
Video Outputs	3 x 75 Ohm outputs (Downmast) 2 x 75 Ohm outputs (Upmast) 5.5 peak amplitude.

NOTES:

(1) The PRF oscillator can be preset with a basic frequency range of 2400 - 3400 Hz (nominal 3000 Hz).

(2) Short pulse can be set to 3000 or 1500 Hz base.

(3) Medium pulse can be set to 1500 or 750 Hz base.

(4) Pulse to pulse jitter can be selected and set to 15 s from nominal.

DIAGNOSTICS

25 The Algorithms detailed in Figures 7a to 10a provide an aid to fault diagnosis in the transceiver. Entry to the algorithms is via Failure Messages generated at the display.

PREREQUISITES

26 Before any fault diagnosis and rectification is implemented, the radar system must be in a standard configuration, as detailed at the top of the appropriate fault diagnosis algorithm.

FAILURE MESSAGES

27 The failure messages detailed in Table 2 below, appear in the data field of the display monitor if certain signals are missing.

Table 2 - Failure Messages

SIGNAL	FAILURE MESSAGE
Sync.	**No Sync.**
Video	**No Video**

28 Refer to Figures 7 to 10 for fault diagnosis algorithms associated with these failures.

TEST EQUIPMENT

29 Routine field maintenance requires fault location down to fuse replacement level, or to change suspect PCBs/Units for known working ones. The only test equipment required for fault finding is a high impedance Multimeter and a 100MHz oscilloscope.

FUSES

30 References and ratings for the fuses fitted in the PSU are shown in Table 3.

Table 3- Fuse Ratings

PCB	Component Ref.	Rating	Service
PSU	FS1	5A	Modulator Supply +27V
	FS2	5A	Motor Supply +24V
	FS3/FS4	5A 3.15A	100/110V Input Supply 200/220V Input Supply

INDICATORS

31 Indicators are provided on some PCBs to signify the conditions outlined in Table 4.

Table 4 - Indicators

PCB	Component Ref.	Indication
PSU	LP1	Input Supply Present
Modulator	D25	On tune indication
Modulator	D32	Transmitter ready
Modulator	D67	Low voltage power supplies present

Figure 7a - Transceiver Fault Diagnosis (No Sync)

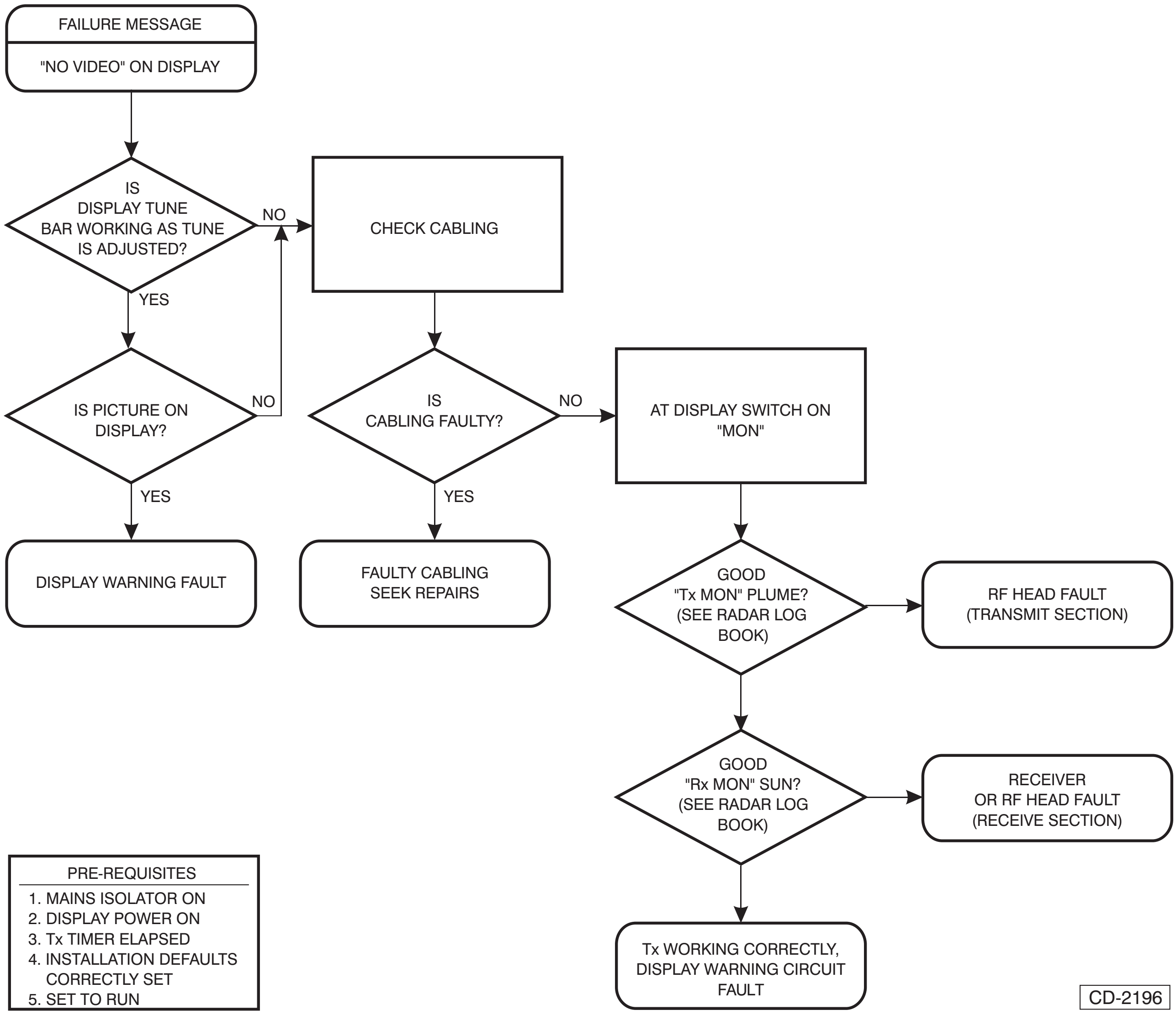


Figure 8a - Transceiver Fault Diagnosis (No Video)

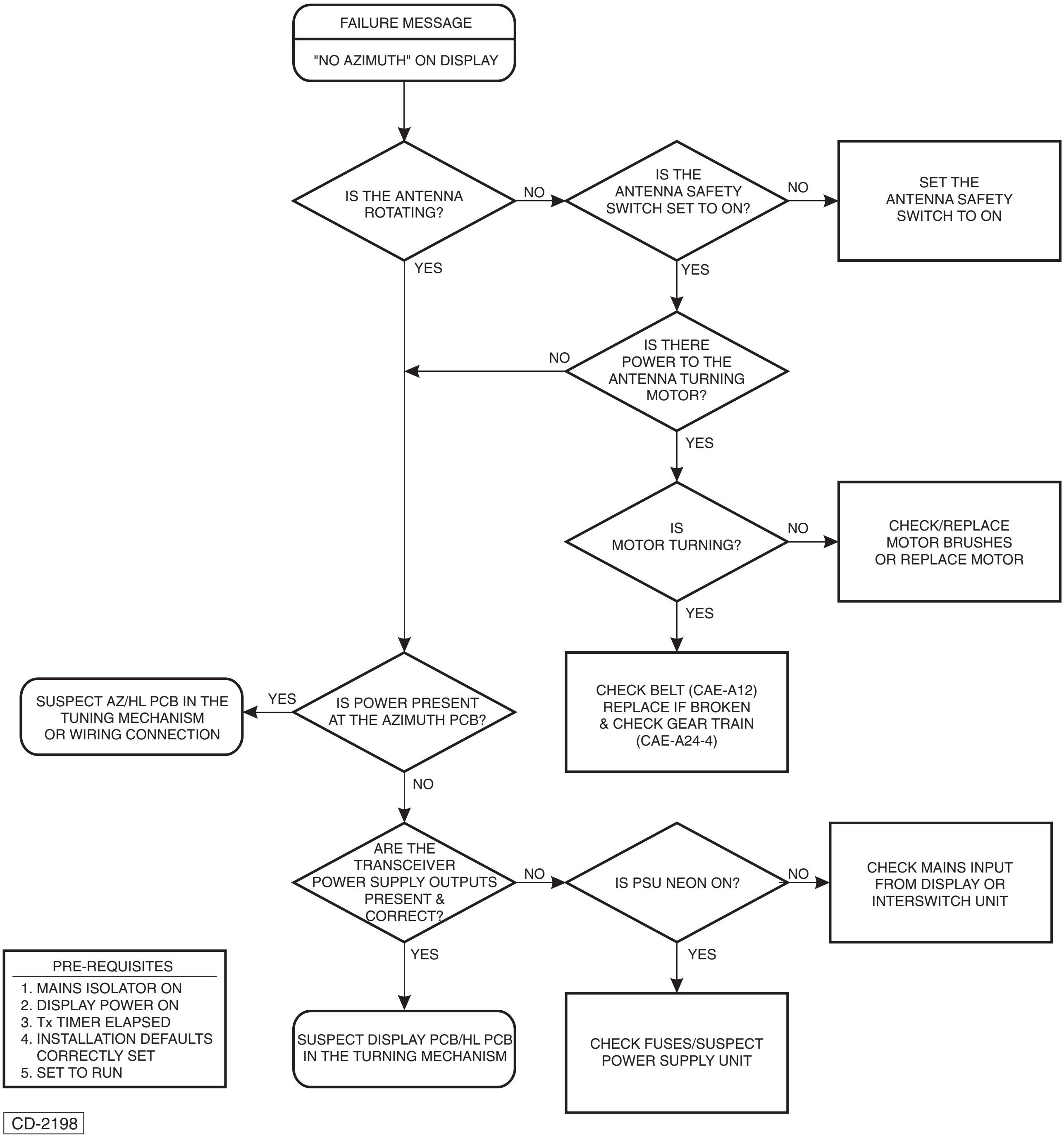


Figure 9a - Antenna Fault Diagnosis (No Azimuth)

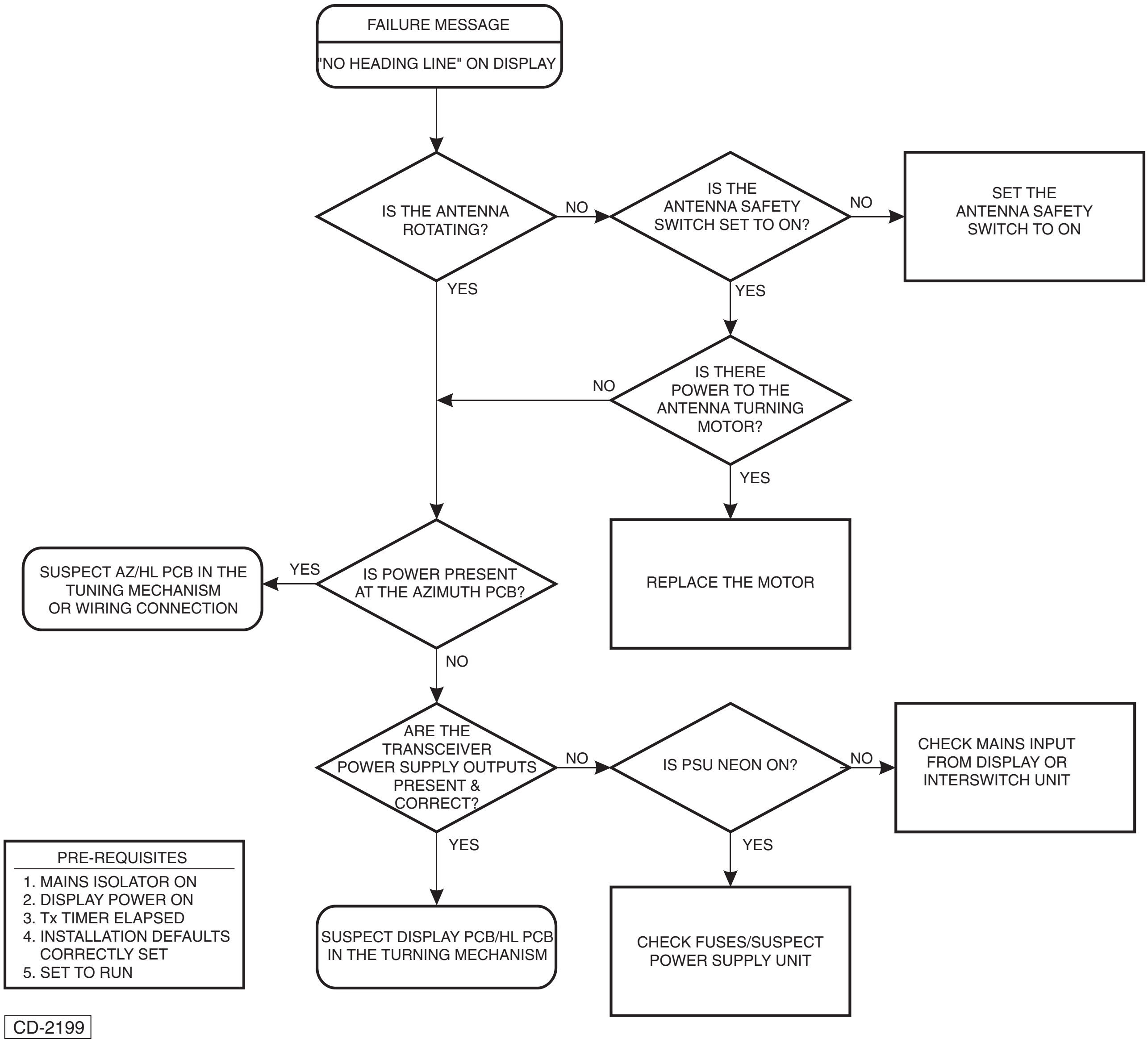


Figure 10a - Antenna Fault Diagnosis (No Heading Line)

MAINTENANCE

32 The following paragraphs describe preventive and corrective maintenance. The Diagnostics (refer to paragraphs 25 -31) complement this information.

PREVENTIVE MAINTENANCE

Transceiver

33 Every six months check the following:

(1) The fan is clean and rotates freely

(2) All screws, nuts, bolts and plugs are securely seated and free from corrosion.

(3) The turning mechanism rotates smoothly and is free from vibration.

(4) All connectors are securely seated.

Antenna Radiator

CAUTION

When working on the Antenna switch all displays to OFF.

34 Periodically wipe the antenna front radiating window using soap and water and a soft non-abrasive cloth.

NOTE:

Even a thin layer of soot or dirt may cause serious loss of radar performance.

CAUTION

NEVER PAINT the front of the radiating window.

X-Band Motor Brushes

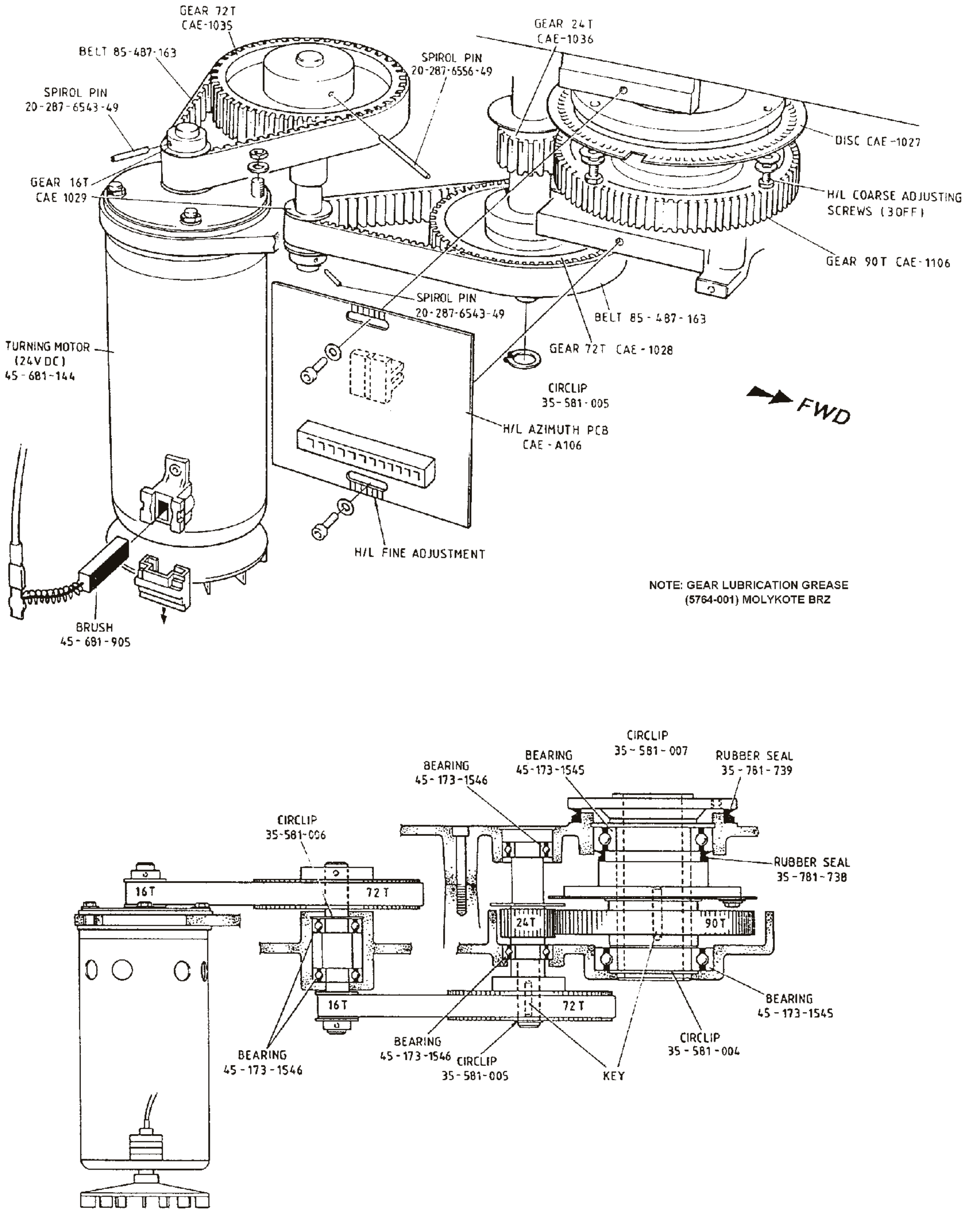
35 The Antenna Motor brushes are to be checked for wear every 6 Months or 2000 Hours. Gain access to the motor by removing the side panel of the Turning Mechanism casing, then examine the brushes for wear and replace if necessary, refer to Figure 11a.

Tx Monitor Arm

36 Regularly check the following:

(1) The Monitor Arm is securely fitted.

(2) The neon cover is clear.



CD-1256

Figure 11a - Gearbox; Brush Replacement

CORRECTIVE MAINTENANCE

WARNINGS

LETHAL VOLTAGES ARE PRESENT IN THE EQUIPMENT. THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS. THEREFORE ONLY QUALIFIED TECHNICIANS ARE TO GAIN ACCESS TO THE INTERIOR OF THE TRANSCEIVER.

BEFORE COMMENCING ANY REMOVAL AND/OR REPLACEMENT PROCEDURE ENSURE THAT THE WARNINGS AND CAUTIONS DETAILED AT THE FRONT OF THIS MANUAL AND THOSE DETAILED IN TEXT ARE STRICTLY ADHERED TO.

ISOLATE THE TRANSCEIVER BEFORE REMOVING/REPLACING MODULES.

SET THE TURNING MECHANISM SAFETY SWITCH TO OFF

37 Access to the majority of PCBs is gained by removing the front panel (six screws) on a downmast unit, or by removing both side panels (four self retaining bolts) on an upmast unit. A length of cord attached between the upmast unit side panels prevents them from falling.

38 Access to the H/L Azimuth PCB is via the rear panel of the unit.

39 The antenna can be prevented from rotating by sliding SW4 (on the Modulator PCB) to OFF. The Upmast gearbox/transceiver has a safety switch which can be set to OFF from outside the unit. (SW4 on the modulator can be operated once the side covers are off.

40 Refer to Figure 12a for graphical aid.

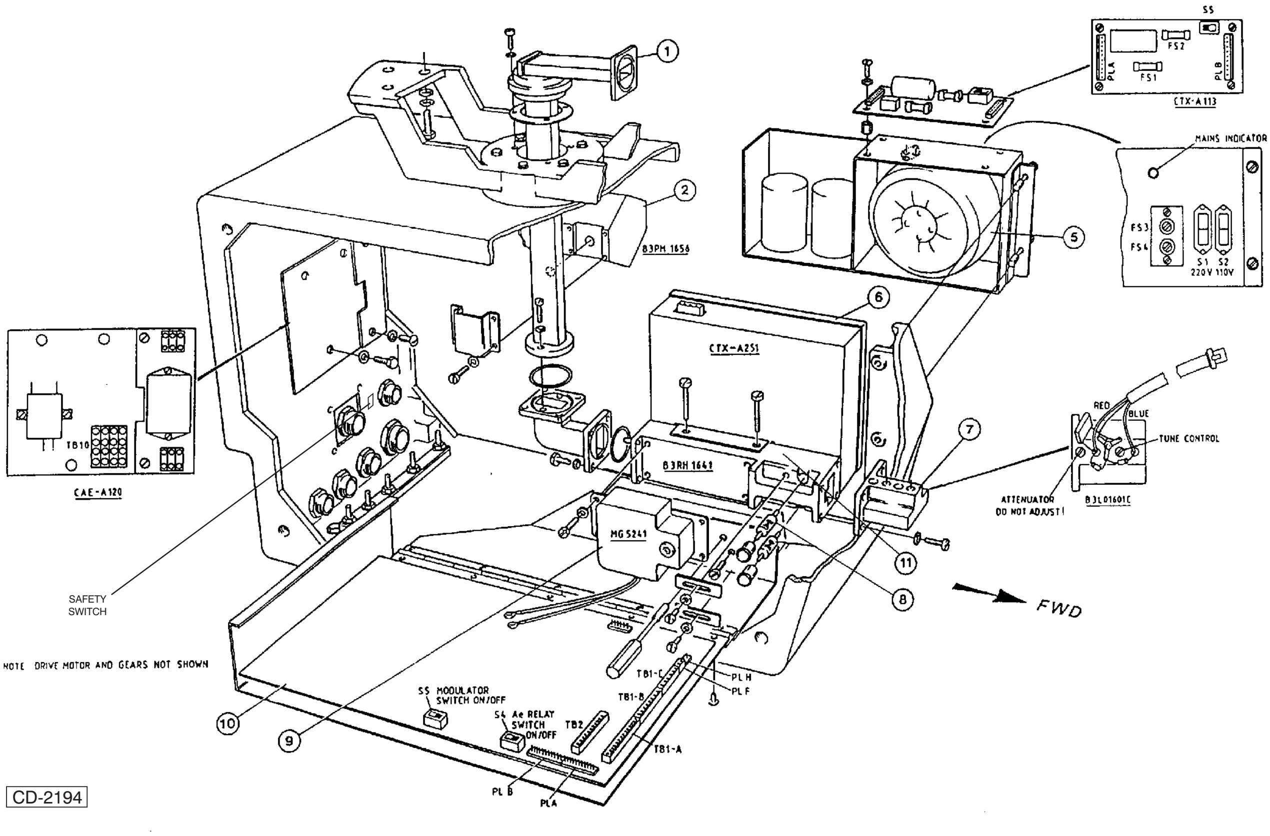


Figure 12a - Upmast X-Band Transceiver

Table 6 - Upmast X-Band Transceiver / Gearbox (10kW and 25kW)

ITEM NO	DESCRIPTION	KELVIN HUGHES Part Number
1	Rotating Joint	RAE-A138
2	Rx Monitor Cavity	CTX-A130
3	Not Used	
4	Not Used	
5	Power Unit	CTX-A4
6	Receiver	CTX-A297
7	Local Oscillator	CTX-A129
8	Mixer Diode IN23 WE X-Band	45-666-2419
9	Magnetron	CTX-A317
10	Modulator	CTX-A201-M (25kW) CTX-A202 (10kW)
11	RF Head	CTX-A251 (25kW)

CHAPTER 7B

MKV TRANSMITTER/RECEIVER & ANTENNA

FUNCTIONAL DESCRIPTION

INTRODUCTION

1 The MkV Transceiver is available for use with either the low speed (CAE-A30-7) or high speed (CAE-A30-8) turning mechanisms

2 The Transceiver can be interfaced with any of the Nucleus 3 series displays, via a parallel interface or via a Controller Access Network (CAN) Bus Link. The CANbus link is interfaced to the transceiver via a Transmitter Interface Unit (TIU). When a parallel interface is used, the Low Speed Turning Mechanism (CAE-A30-7) uses the +27V power supply from the display unit to drive the turning motor and the High Speed Turning Mechanism (CAE-A30-8) uses an external 40V power supply unit, which is bulkhead mounted below deck. When the CANbus interface is used, the power supplies for both the low and high speed turning mechanisms are provided by the Transmitter Interface Unit (TIU). The voltage can be set to meet the requirement of the specific turning mechanism.

3 A block diagram of the MkV Transceiver is shown in Figure 1b. The MkV Transceiver comprises the following main units:

(1) Terminals PCB
(2) Modulator
(3) Magnetron/RF Head
(4) Azimuth PCB
(5) Receiver
(6) Tx Monitor (Optional)

Terminals PCB

4 The Terminals PCB feeds the incoming power and data from the display to the other assemblies, providing modulator trigger pulses, pulse selection gating, antenna switching, voltage regulation and tune voltage. The PCB also receives the video from the Receiver and feeds the signals to the display processor.

Modulator

5 The Modulator provides a high voltage pulsed supply via a pulse width circuit and FET circuit into a pulse transformer to drive the Magnetron.

RF Head

6 The RF Head contains the Magnetron, Ferrite Circulator, Pulse Limiter and Low Noise Front End (LNFE). The LNFE comprises and RF Amplifier, Local Oscillator and IF Head Amplifier.

7 The magnetron energy is fed to the circulator and via the rotating joint to the antenna. The small leakage of power across the circulator, is fed into the pulse limiter and used by the LNFE as a tune signal.

8 Return signals from the antenna are fed through the circulator to the limiter and the LNFE, where they are amplified, mixed and converted to IF levels to interface with the receiver main IF.

Azimuth PCB

9 The Heading Line and Azimuth data are produced by the interaction between an opto-interrupter disc and sensors located on the PCB.

Receiver PCB

10 The Receiver amplifies and filters the IF from the RF Head and then feeds the signal to a cascade logarithmic amplifier which produces the video for the display monitor.

Brushless Motor PCB (CAE-A30-8 Only)

11 The Brushless Motor PCB provides switching of the 40V supply to drive the motor within the transceiver/tuning mechanism at a constant speed.

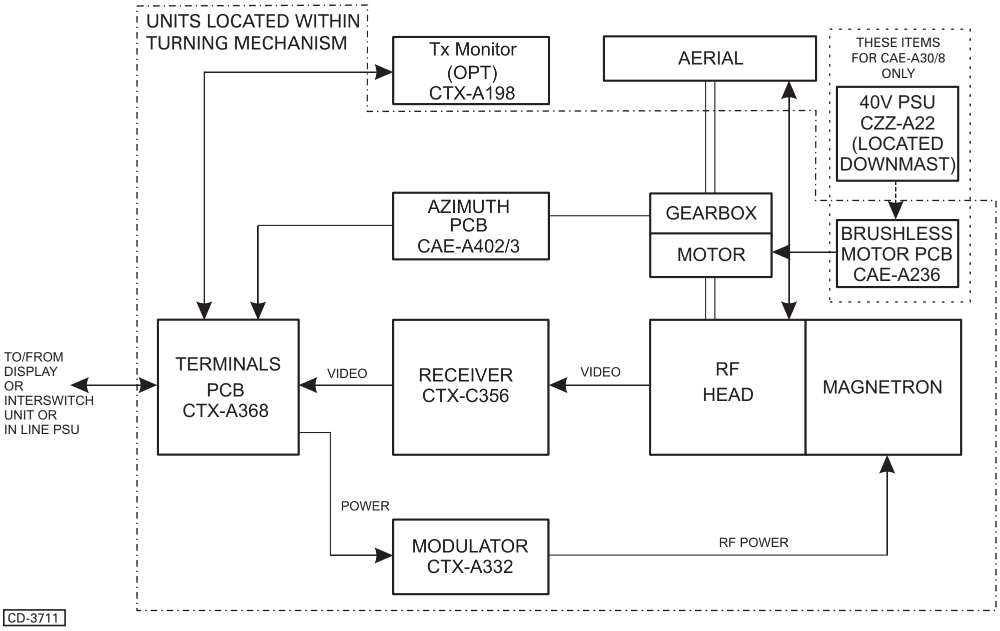
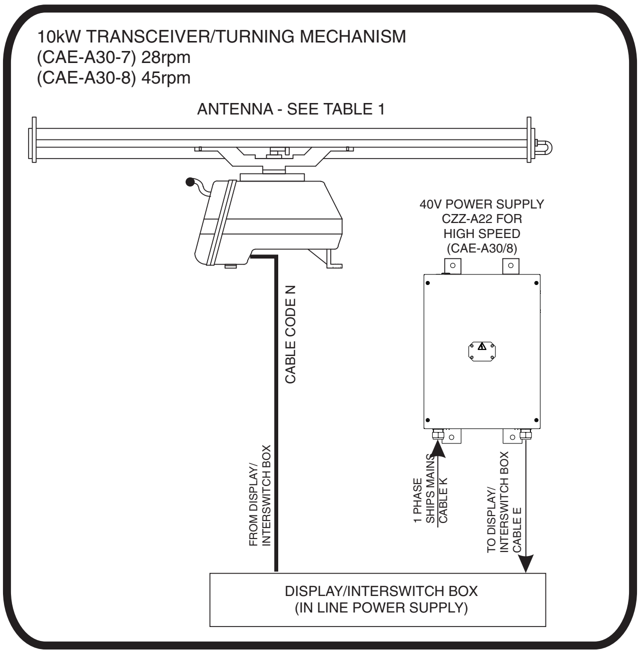


Figure 1b - Transceiver System Block Diagram



CABLE CODE N: 38-CORE

TABLE 1 ANTENNA OPTIONS
1.3m ANTENNA (CAE-A50)* 1.8m ANTENNA (CAE-A13/2) 2.4m ANTENNA (CAE-A25)

* NOT TYPE APPROVED

CD-4673

Figure 2b - Transceiver Configuration

SPECIFICATION

12 Technical specifications for the MkV Transceivers are provided in Table 1 below.

Table 1 - MkV Transceiver Specification

Frequency:	X (I) -Band 9410 30MHz
Peak Power output:	X-Band 10kW nominal
Magnetron Life:	10,000 Hours typical
Pulse Length and P.R.F:	**10kW**
Short: (S):	**55ns**
	3000pps*
Medium (M)	**230ns**
	1500pps*
Long (L)	**600ns**
	750pps*
Very Long (VL)	**600ns**
	375pps*
Sync. Output:	1 x 75 Ohm, not less than +12V amplitude
Receiver (used for all transceivers):	
Type:	Logarithmic Receiver
I.F.	60MHz
Video Outputs	3 x 75 Ohm, not less than 5.5V peak amplitude.

NOTES:

The PRF Oscillator can be preset with a basic frequency range of 700Hz to 800Hz (nominally set to 750Hz). Dual PRF version for high speed craft.

DIAGNOSTICS

13 The Algorithms detailed in Figures 5b to 7b provide an aid to fault diagnosis in the transceiver. Entry to the algorithms is via Failure Messages generated at the display.

PRE-REQUISITES

14 Before any fault diagnosis and rectification is implemented, the radar system must be in a standard configuration, as detailed at the top of the appropriate fault diagnosis algorithm.

FAILURE MESSAGES

15 The following failure messages, appear in the data field of the display monitor if certain signals are missing:

"Sync/Video Missing"

"No Azimuth"

"No Heading Line"

16 Refer to Figures 5b to 7b, for fault diagnosis algorithms associated with these failures.

TEST EQUIPMENT

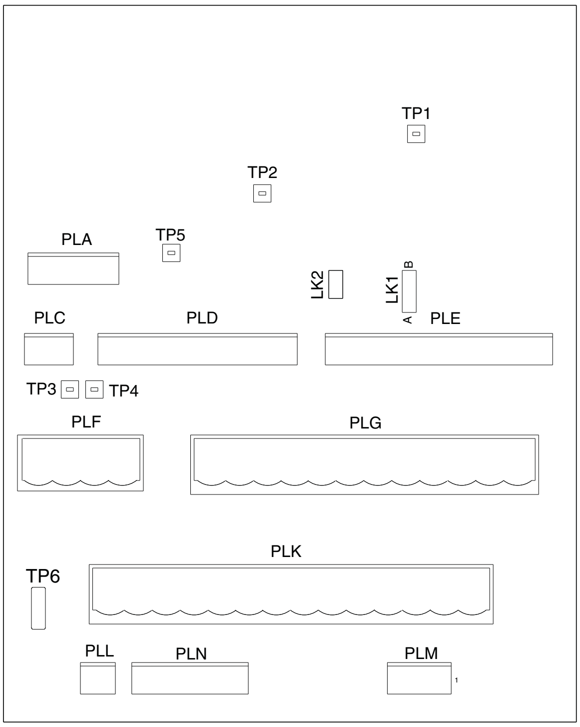
17 Routine field maintenance requires fault location down to fuse replacement level, or to change suspect PCBs/Units for known working ones. The only test equipment required for fault finding is a high impedance Multimeter and a 100MHz Oscilloscope.

TEST POINTS

18 Test Points are located on the following PCBs:

(1) **Transceiver Terminals PCB**

TP1 - Dummy Sync pulse astable output
TP2 - Gated Sync pulses
TP3 - Video Output
TP4 - Sync Output
TP5 - Rx Sync from Modulator
TP6 - 0V signal

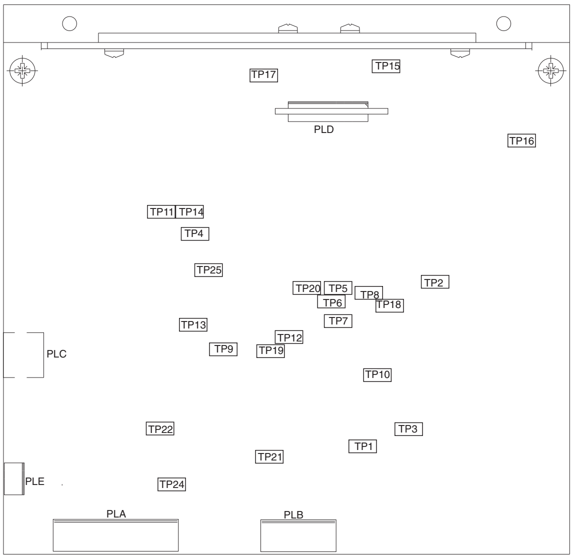


CD-3839

Figure 3b - Transceiver Terminals PCB: Test Point Locations

(2) **Modulator PCB**

TP1 - TR1 Gate Trigger Pulses
TP2 - High Voltage Supply
TP3 - TR5 Gate Drive Pulse
TP4 - MODSYNC Out
TP5 - HV Current Monitor
TP6 - HV Current Trip Reference Level
TP7 - Common for TP5
TP9 - HV Current Trip Pulse
TP10 - LV Current Trip Reference Level
TP11 - Magnetron Heater Current Monitor
TP12 - LV Current Trip Fixed Reference Level
TP13 - LV Current Trip Shutdown Pulse
TP14 - HTLO Monitor Output
TP15 - Pulse Transformer Power Drive Pulses
TP16 - Tail Biter Pulse
TP17 - Main FET Drive Pulses
TP18 - Power Ground
TP19 - Low if 350V line is over 450V
TP20 - Low Voltage Supply, nominally +14V
TP21 - Pulse Shaper Circuit Drive Pulses
TP22 - MOD_TRIG from microcontroller
TP23 - LPRE_PULSE Output
TP24 - Enable High Voltage
TP25 - Drive Pulse to CTX-A339



CD-3721

Figure 4b - Modulator PCB: Test Point Locations

PRE-REQUISITES
1. MAINS ISOLATOR ON 2. DISPLAY POWER ON 3. Tx TIMER ELAPSED 4. INSTALLATION DEFAULTS CORRECTLY SET 5. SET TO RUN

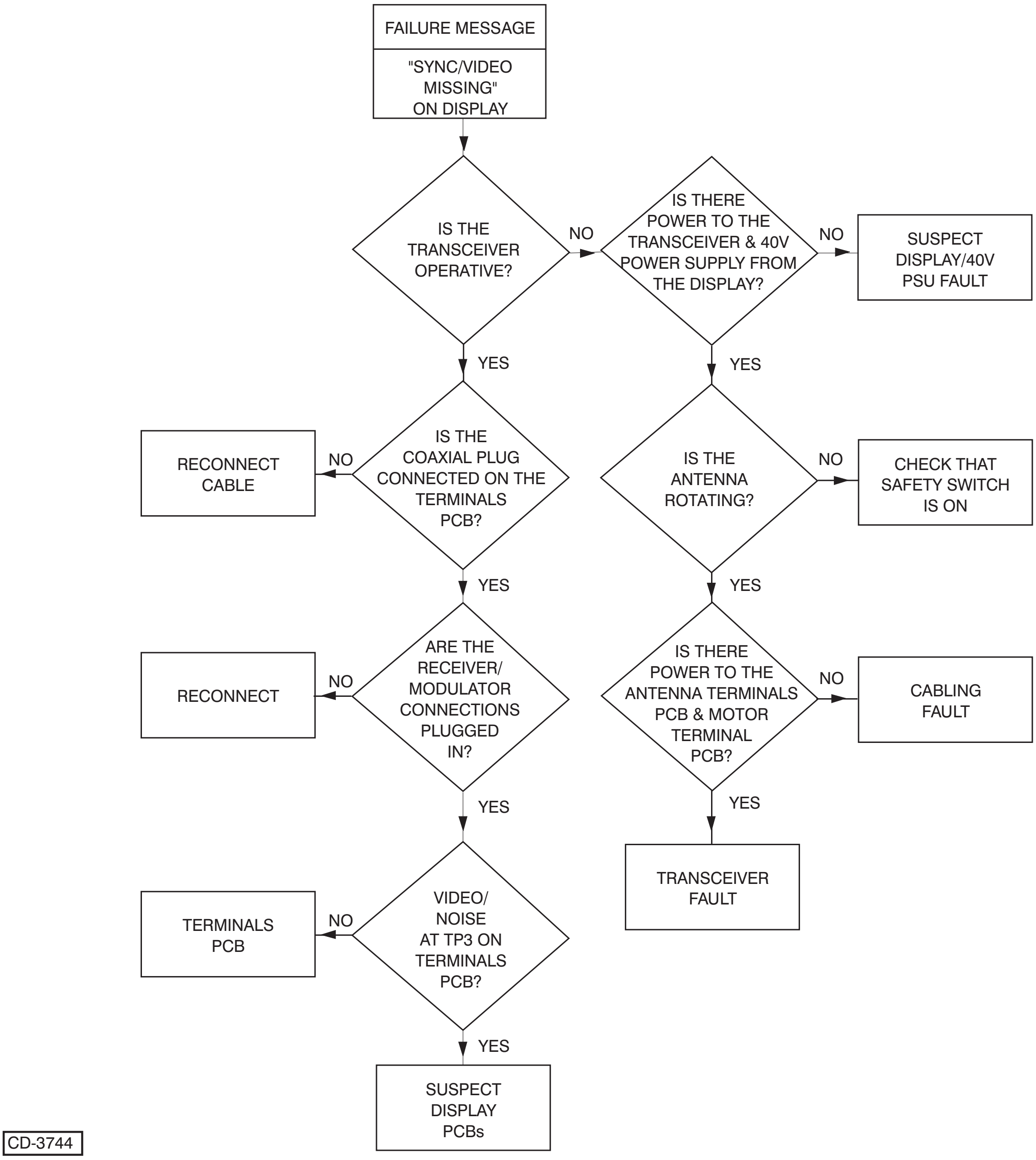


Figure 5b - Transceiver Fault Diagnosis (No Sync/No Video)

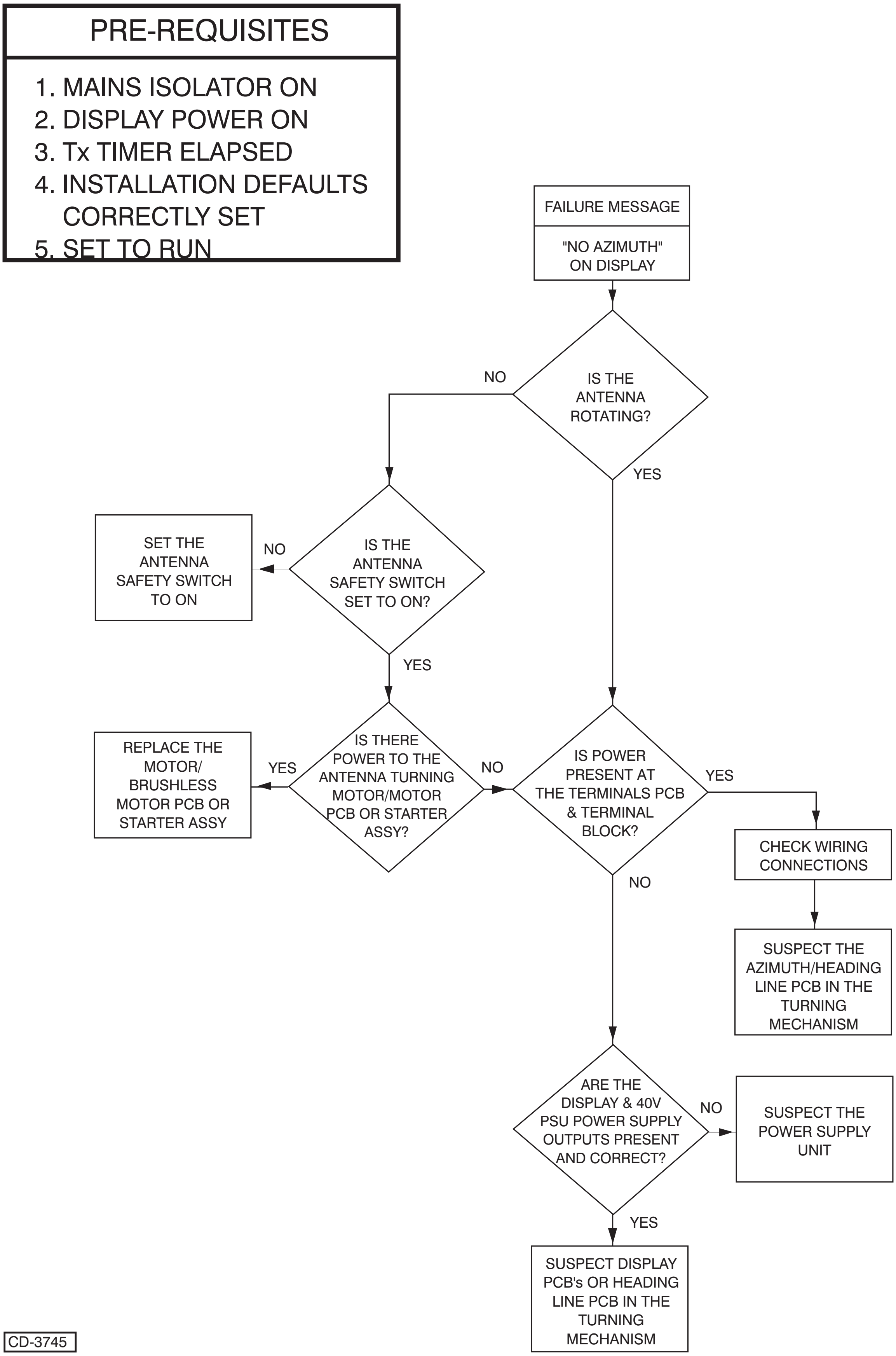


Figure 6b - Antenna Fault Diagnosis (No Azimuth)

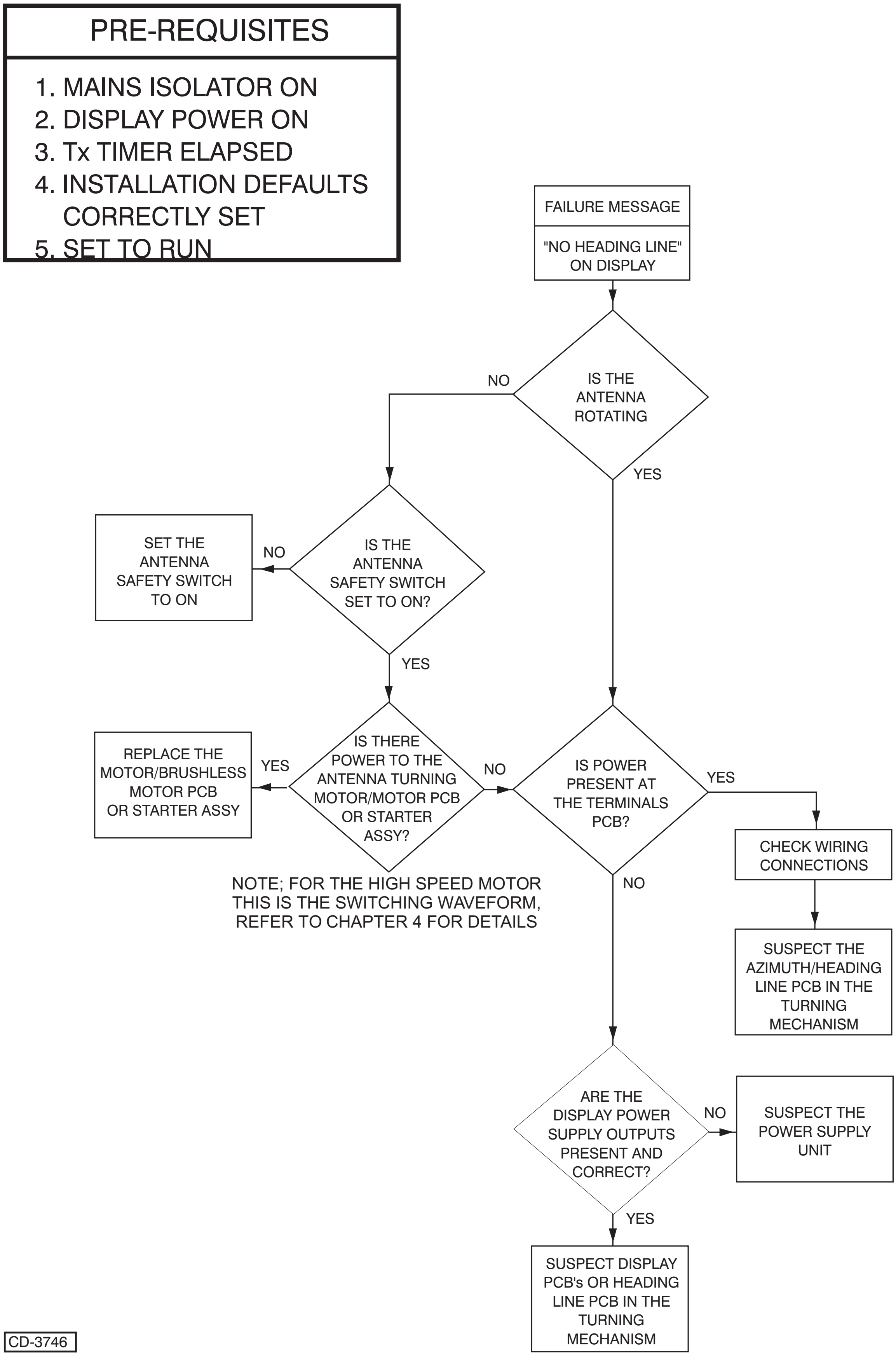


Figure 7b - Antenna Fault Diagnosis (No Heading Line)

MAINTENANCE

19 The following paragraphs describe preventive maintenance. The diagnostics information complements this (see paragraphs 13b to 18b).

PREVENTIVE MAINTENANCE

Antenna Radiator

> **CAUTION**
>
> **Always switch the Radar OFF, and as an additional precaution, Switch OFF the antenna safety switch when working on the antenna.**

20 Periodically wipe the antenna front Radiating window using soap and water and a soft non-abrasive cloth. Even a thin layer of soot or dirt can cause serious loss of radar performance.

> **CAUTION**
>
> **NEVER PAINT the front radiating window**

Antenna Motor/Gearbox

21 The antenna motor brushes should be checked every 6 months or 3000 hours, whichever is sooner. (Refer to Figure 8b). At the same time, check the commutator for wear. To check, proceed as follows:

(1) Remove the Transceiver Electronics Module, refer to paragraph 30.

(2) Remove the Motor from the Transceiver case.

(3) Remove brushes from the housing and check for wear, replace with new brushes if necessary.

(4) Refit brushes, ensuring brush retaining springs are in place, and refit the motor into the transceiver case.

22 The gearbox is lubricated at the factory, and should not normally require attention.

23 Check that the antenna gearbox mounting bolts are secure and kept free from corrosion.

Antenna Motor/Gearbox and Brushless Motor

24 The High Speed Turning Mechanism/Gearbox and the Brushless Motor PCB require no preventive maintenance.

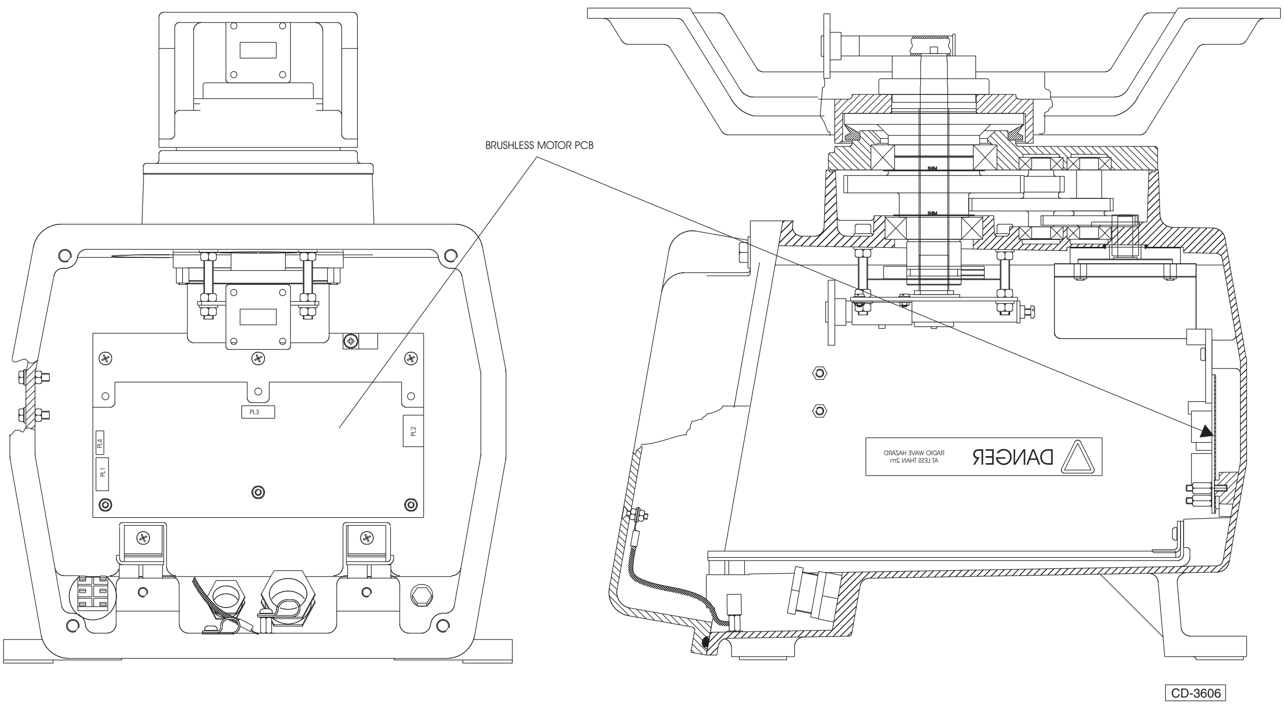


Figure 8b - Turning Mechanism: Showing Location of Brushless Motor PCB (CAE-A30-8 only)

Transceiver

25 The Transceiver requires no periodic maintenance. However, whenever the end cover casing is removed (for access to the Motor or Transceiver Electronics Module) ensure that the casting seal is clean and clear of obstacles. Check that all unit screws are secure whilst the casting end cover is removed.

26 Whenever the Transceiver Electronics Module is removed, inspect the input cable connections, look for worn seals/grommets, traces of water, loose connections and strands of wire.

27 The Transceiver Unit can be isolated in one of the following ways:

(1) Switching the display OFF.

(2) Isolating the display.

WARNINGS

(1) THIS EQUIPMENT IS NOT FITTED WITH SAFETY INTERLOCKS AND LETHAL VOLTAGES ARE PRESENT WITHIN THE UNIT. BEFORE REMOVING ANY SUB-UNIT OR PCB, ALL SUPPLIES MUST BE SWITCHED OFF.

(2) THE EXTERNAL ISOLATION SWITCH, LOCATED ON THE TRANSCEIVER CASING, REMOVES THE +27V MODULATOR SUPPLY INHIBITING THE HIGH VOLTAGE SUPPLY AND THE +24V AERIAL MOTOR SUPPLY.

Access

28 To gain access to PCBs and Modules (refer to Figure 9b):

(1) Remove the four captive screws securing the cover to the rear of the Transceiver and remove the cover.

(2) Disconnect Plugs PLF, G, K, M and L from the Antenna Terminals PCB.

(3) Remove the four screws securing the RF Head to the Rotating Joint.

(4) Remove the two bolts securing the Transceiver Electronics Module to the sliding rails

(5) The Transceiver Electronics Module can now be removed from the Transceiver.

NOTE:

When refitting any Module/PCB ensure that all Links/Switch positions are identical to those of the removed/defective unit.

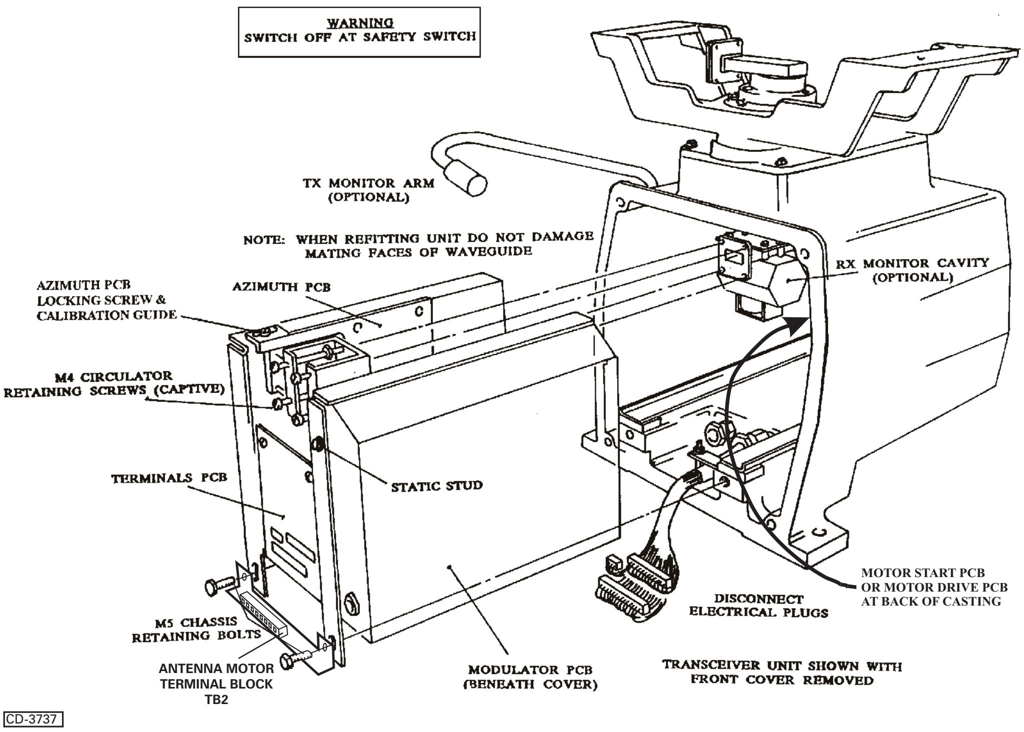


Figure 9b - Transceiver Electronics Module: Access

PCBs and Modules in the Transceiver

29 The Transceiver contains the following PCBs and Modules:

Table 2 - PCBs and Modules

PCB/Module	Identity
Modulator PCB Assembly	CTX-A332
Receiver PCB	CTX-A356
Antenna Terminals PCB	CTX-A204/3
Azimuth PCB	CAE-A402/3
Magnetron Assembly	CTX-A197 (10kW)
Circulator Assembly	45-646-604
Diode Limiter	45-646-603
Low Noise Front End Assembly	CTX-A323

30 The following options are available:

Table 3 - Optional PCBs and Modules

PCB/Module	Identity
Transmitter Monitor PCB	CTX-A198
Sector Mute PCB (Note that Nucleus displays can drive Sector Mute without the CTX-A162 option)	CTX-A162
Receiver Monitor Cavity	CTX-A173
Monitor Arm	CAE-A147

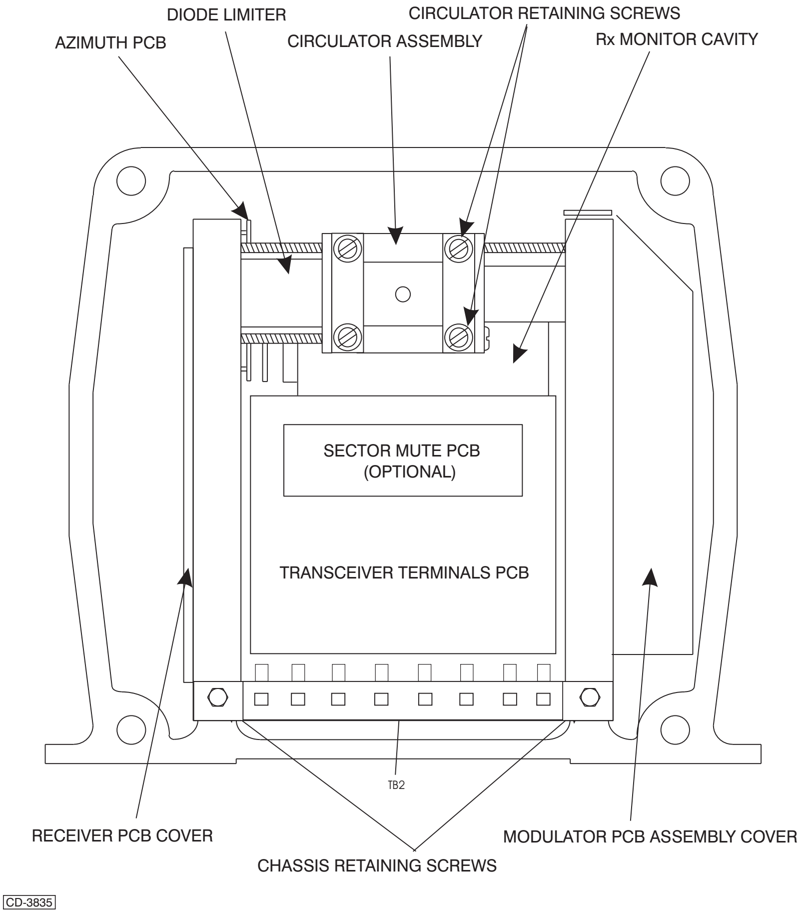


Figure 10b - Transceiver Electronics Module

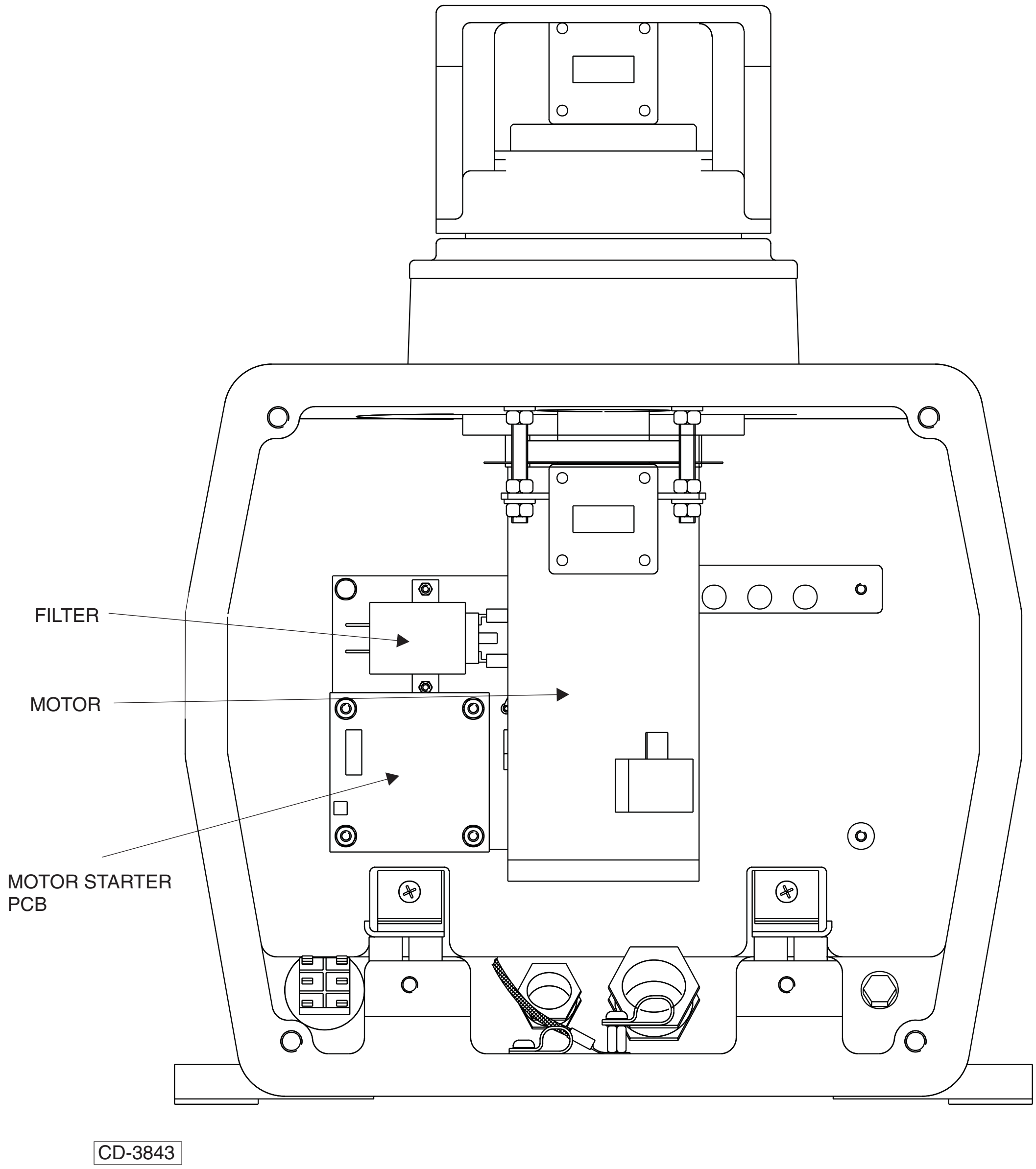


Figure 11b - Location of Motor Starter PCB (CAE-A30-7 only)

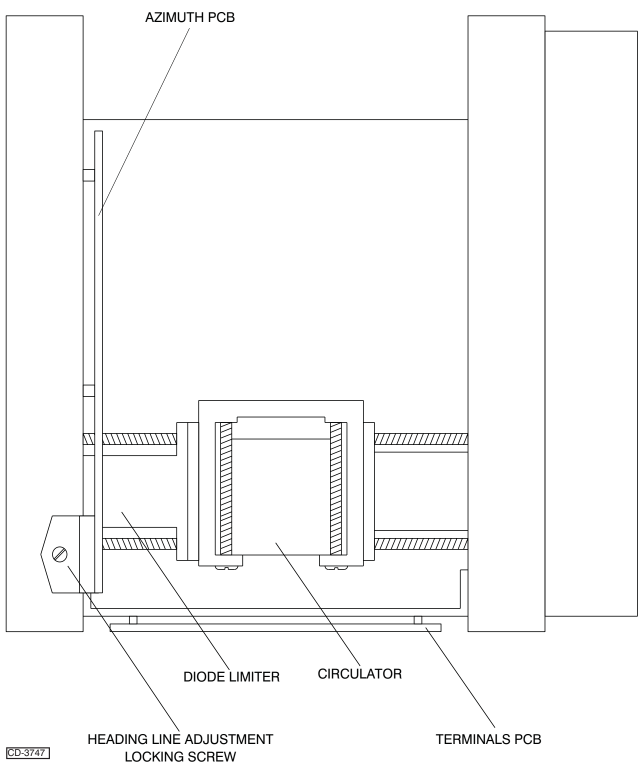


Figure 12b - Transceiver Electronics Module (Top View)

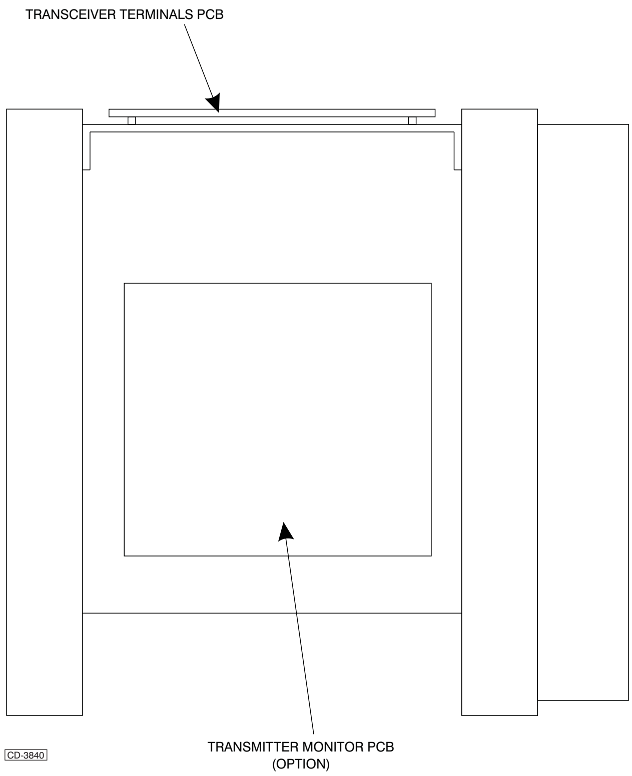


Figure 13b - Transceiver Electronics Module (From Base)

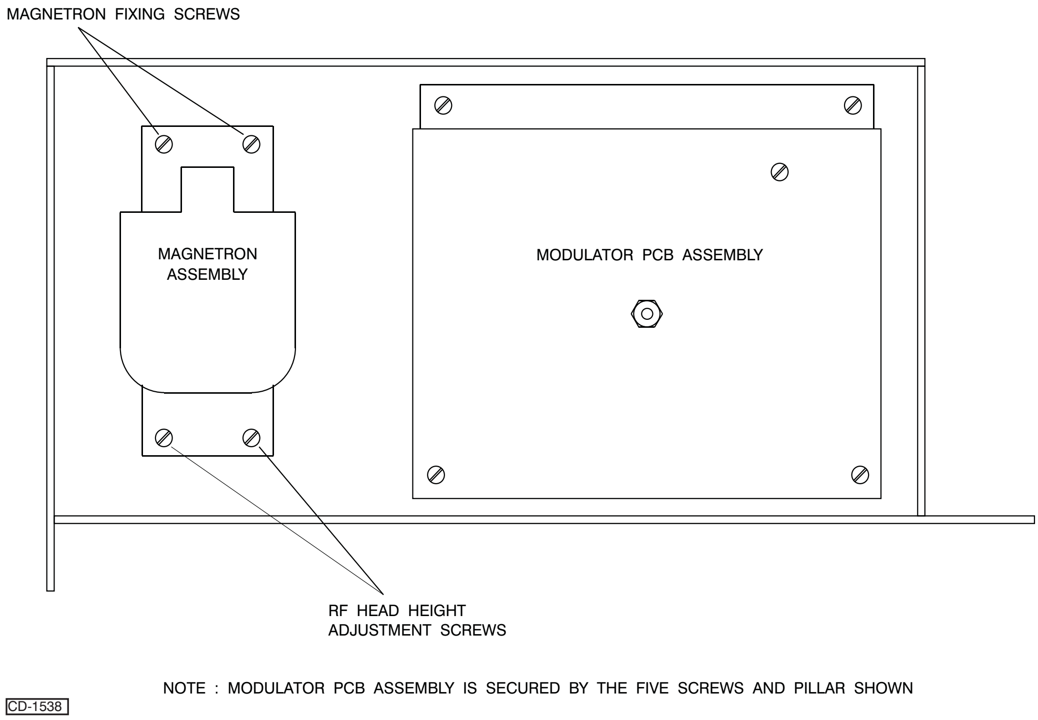


Figure 14b - Modulator PCB Assembly and Magnetron Assembly

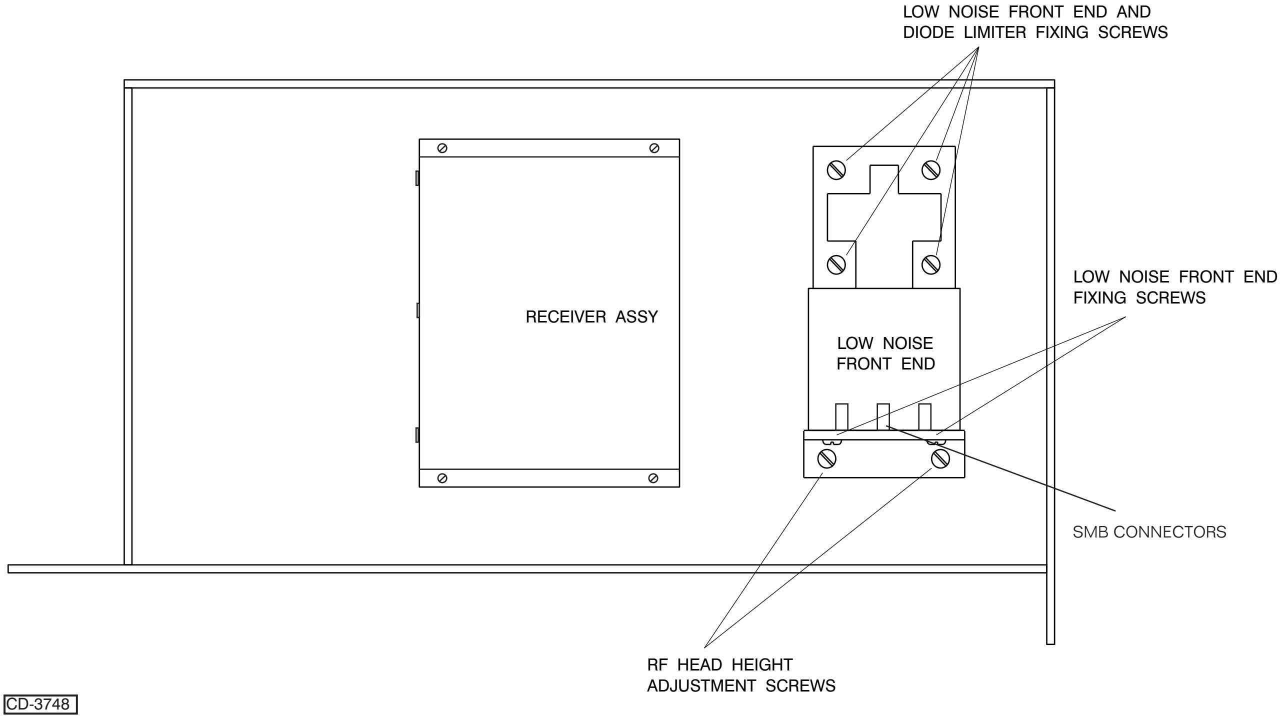
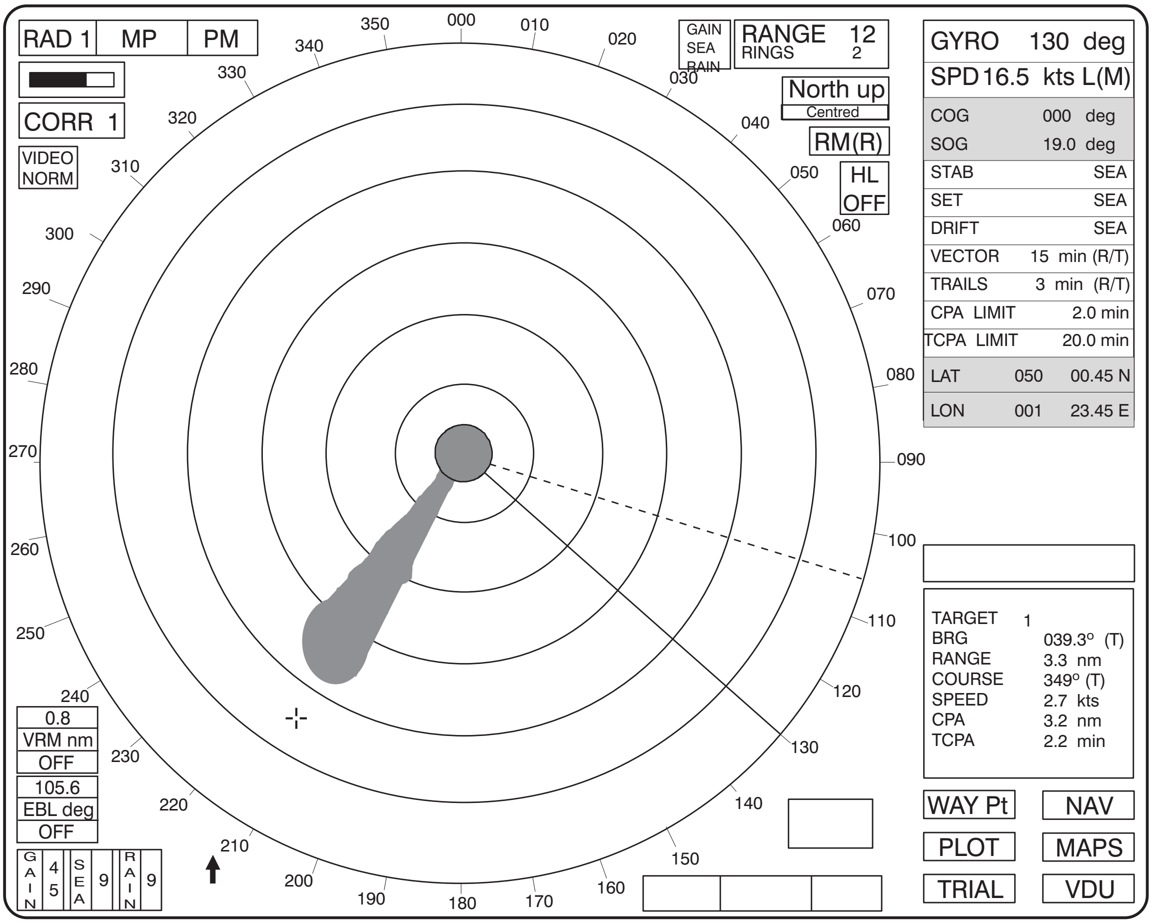


Figure 15b - Receiver PCB and Low Noise Front Assembly



CD-2543

Transmitter Monitor

Figure 16b - Performance Monitor Display

CHAPTER 7C

MKVI TRANSMITTER/RECEIVER & ANTENNA

INTRODUCTION

1 The MkVI Transceiver is available in an Upmast configuration, where the transceiver electronics are incorporated in the turning mechanism (see Figure1c, below). Two versions are available:

(1) Low Speed - 25 rpm.

(2) High Speed - 40 rpm.

2 A Soft Start Unit, which is required for both versions of the transceiver, switches three phase mains to the antenna motor. A thermal overload trip unit, mounted in the soft start unit, protects the supply to the motor. Access to the trip unit reset button is achieved by removing the soft start unit front cover. The soft start unit can also be fitted with an in-line single phase mains supply, for installations with long cable runs, or installations which are interswitched.

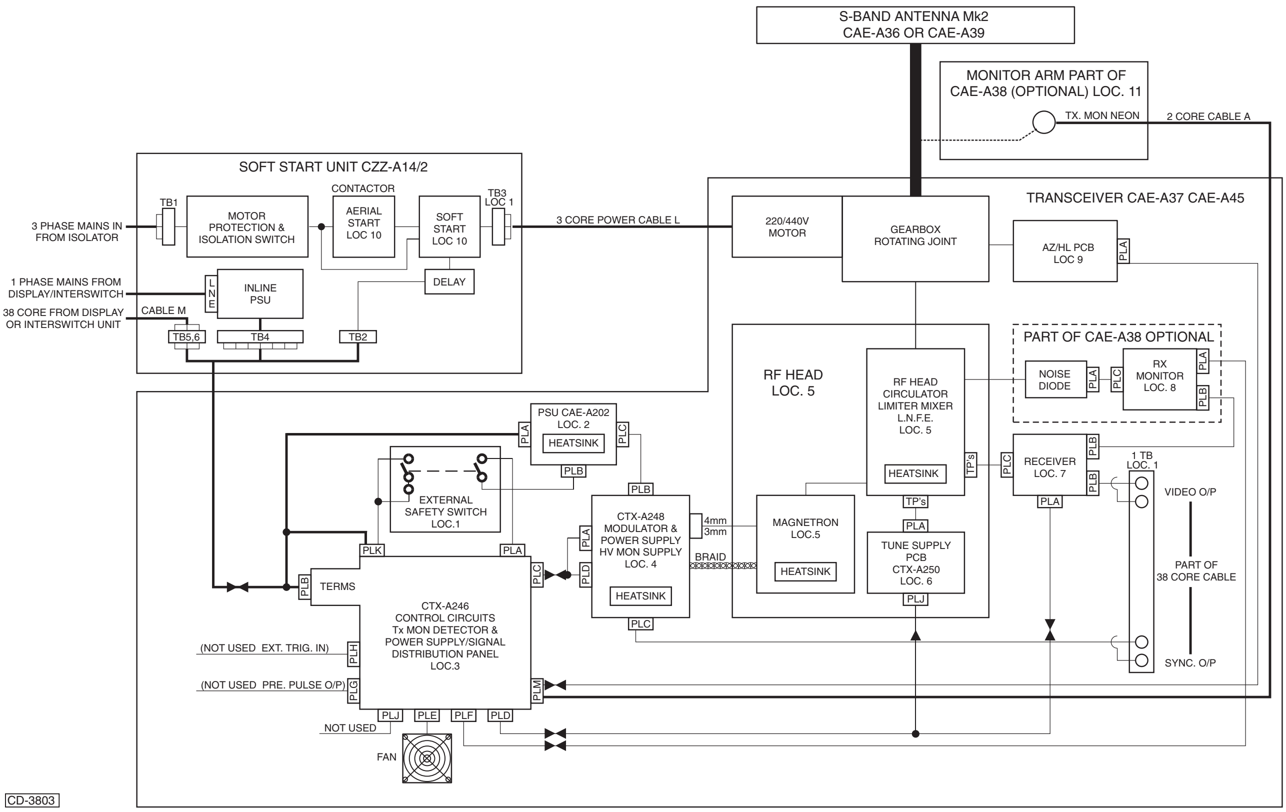


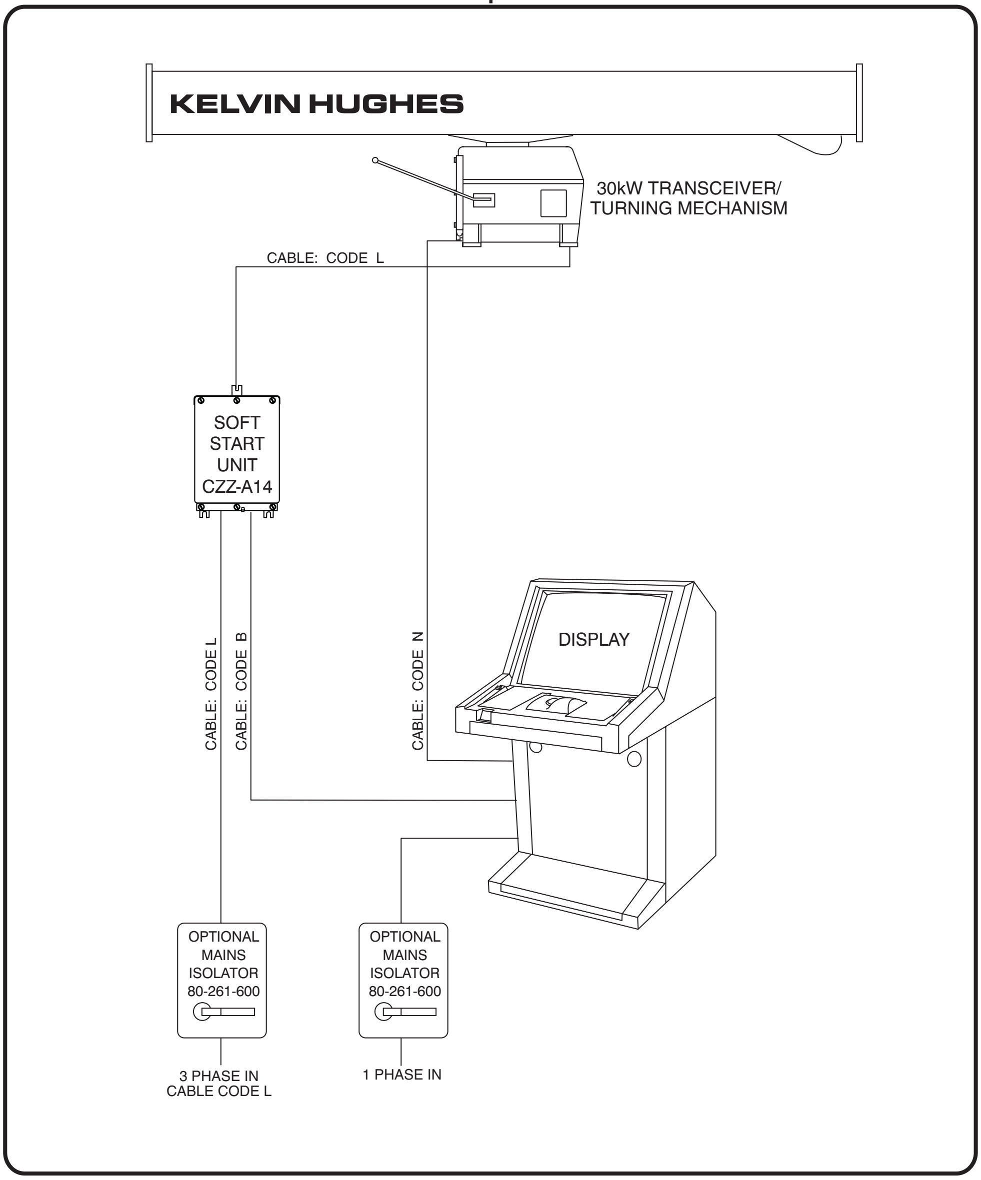
Figure 1c - Upmast Transceiver: Block Diagram

FUNCTIONAL DESCRIPTION

3 There are two types of upmast configuration:

(1) The upmast configuration, shown in Figure 2c, is provided with a +27V dc supply from a display for the transceiver electronics, and a three phase supply via the soft start unit, for the antenna motor.

(2) The upmast configuration for interswitched and long cable installations, is provided with a +27V dc supply for the transceiver electronics and a three phase supply for the antenna motor, via the soft start unit.



TRANSCEIVER	ANTENNA
25rpm CAE-A37	3.9m CAE-A36
40rpm CAE-A45	2.8m CAE-A39

CABLE CODES

CABLE B - 3-CORE SMALL
CABLE L - 3-CORE POWER
CABLE N - 38-CORE

CD-1335

Figure 2c - Upmast Transceiver Configuration

TRANSCEIVER

4 The transceiver is fitted with a logarithmic amplifier and employs fan cooling for the magnetron, AFC tuning, a common modulator control design and common terminal connections.

5 The transceiver is muted whenever the antenna ceases to rotate. Pulse jitter, muting and sector transmission are standard facilities, with options for pre-pulse generation and external synchronisation.

6 The transceiver can be interfaced with any of the NUCLEUS Series displays.

7 One VIDEO and one SYNC coaxial output are accessible.

8 This section provides functional and technical descriptions for the electronic units comprising the MkVI S-Band Transceiver. The Transceiver comprises the following electronic units:

(1) Power Unit CAE-A202.

(2) Control/Terminals PCB CTX-A246.

(3) Modulator Unit CTX-A248.

(4) Rx Monitor PCB CTX-A252 (optional) and Noise Diode with Mount.

(5) Tune Supply PCB CTX-A250.

(6) HL/AZ PCB CAE-A180 (part of the Antenna Turning Mechanism for a Downmast System).

(7) Assembly of True Log Receiver CTX-A297.

(8) Magnetron and RF Head with Low Noise Front End.

9 A brief description is also provided for the following:

(1) Antenna Turning Mechanism.

(2) Safety Switch.

(3) Soft Start Unit CZZ-A14/* (which also forms part of the system).

POWER UNIT CAE-A202

10 A block diagram of the Power Unit CAE-A202 is shown in **Figure 3c**.

11 The Power Unit CAE-A202 comprises PCB CTX-A283 mounted on a chassis. A +27 V dc input to the power unit is normally provided from a display. The power unit generates all the supplies required by the transceiver, from the +27 V dc input, using switching regulators.

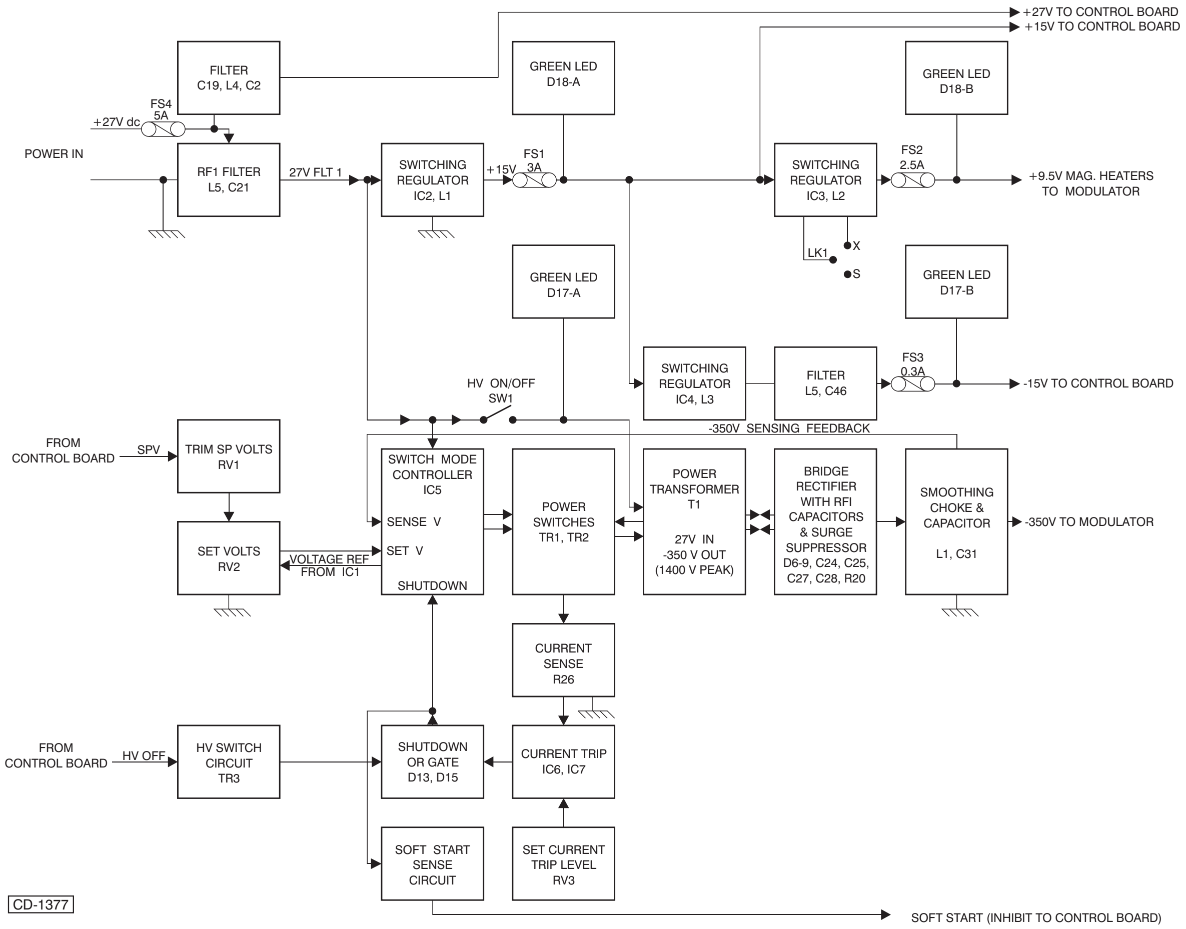


Figure 3c - Power Unit (CAE-A202): Block Diagram

CONTROL PCB CTX-A246 (Figures 8 and 9)

12 A block diagram of the Control PCB is shown in **Figures 4c and 5c**.

13 External cables (except power supply) from the Display/Interswitch Box and the Tx Monitor Arm are terminated on the Control/Terminals PCB. The PCB receives standby, run, pulse length, tune, Rx monitor and Tx monitor commands from the display and converts them to the correct format to produce the triggers for the rest of the transceiver units.

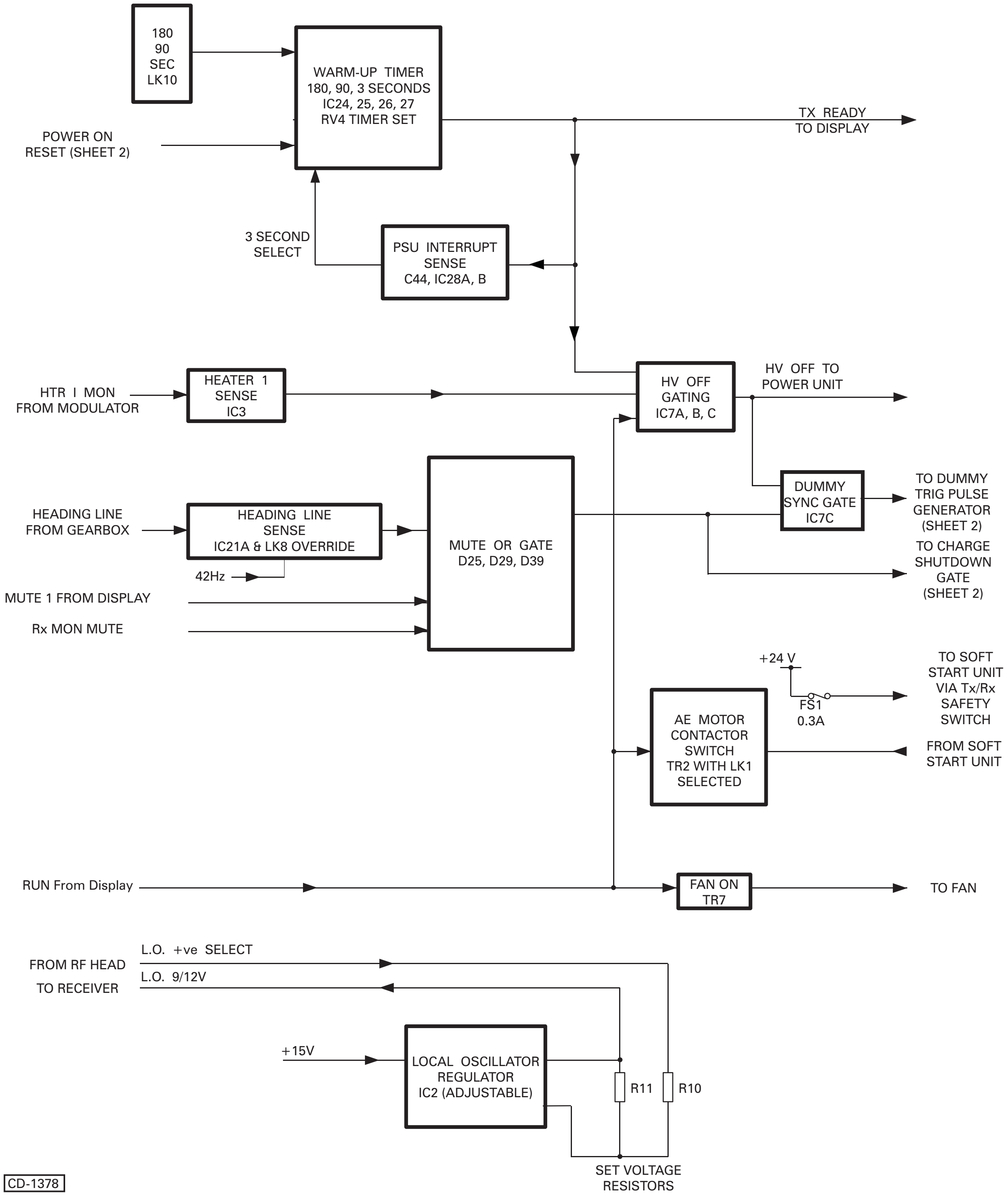


Figure 4c - Control PCB (CTX-A246): Block Diagram (1)

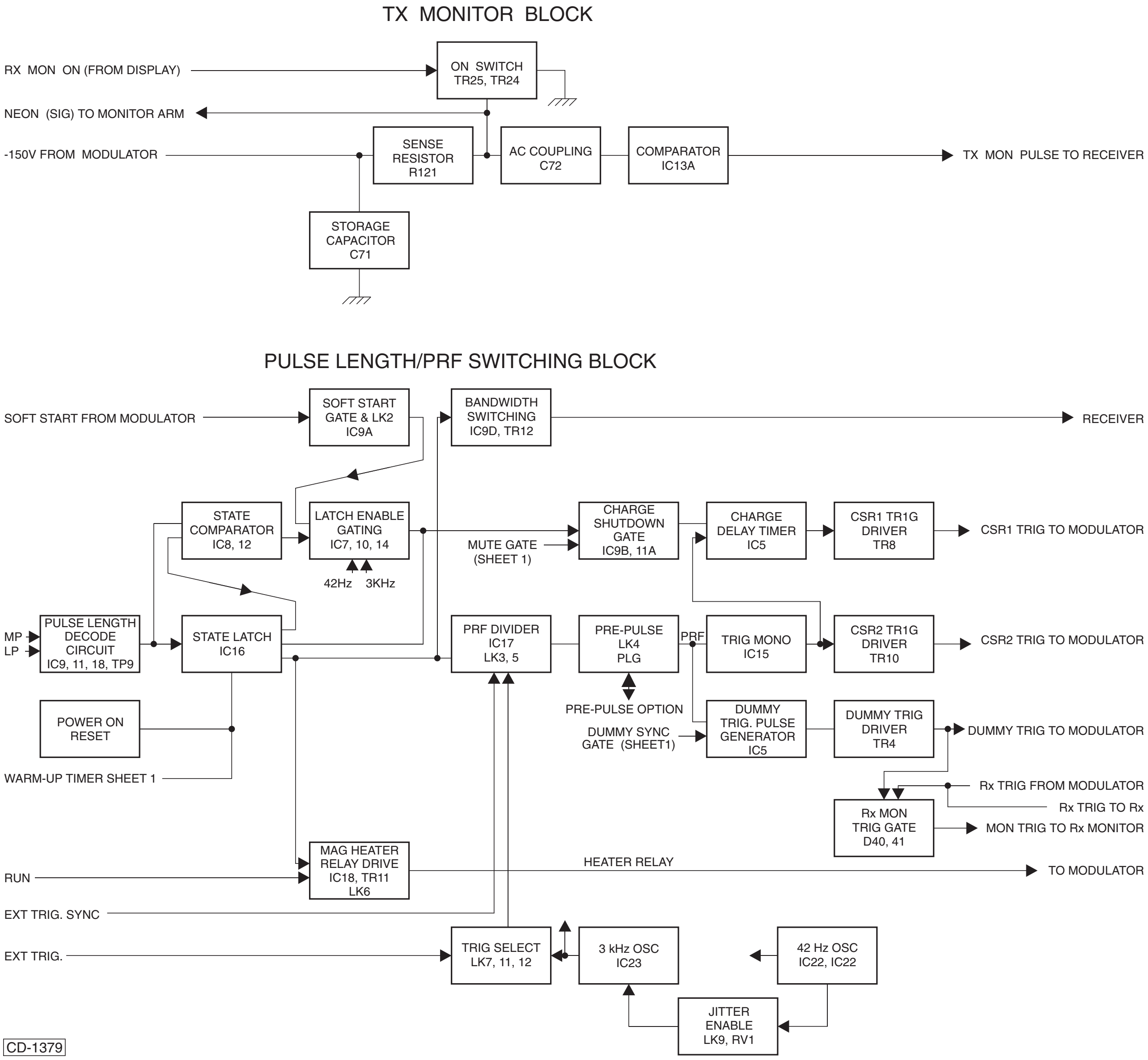


Figure 5c - Control PCB (CTX-A246): Block Diagram (2)

MODULATOR UNIT

14 A block diagram of the Modulator Unit is shown in **Figure 6c**, below.

15 The modulator unit comprises chassis CTX-A248 and PCB CTX-A247. This equipment utilises a line type modulator circuit where the Pulse Forming Network (PFN) capacitors are charged to double the HT supply by the resonance of the charging choke with the PFN capacitance. The line impedance is matched to the magnetron impedance by the pulse transformer.

16 The modulator circuit comprises a Charging Silicon Controlled Rectifier (SCR) CSR1, Charging Choke L5, Saturable Reactor SL1, Pulse Forming Network, Pulse Transformer T4, Discharge SCR CSR2, and "Tail Biter" SL2 which is used for short pulses.

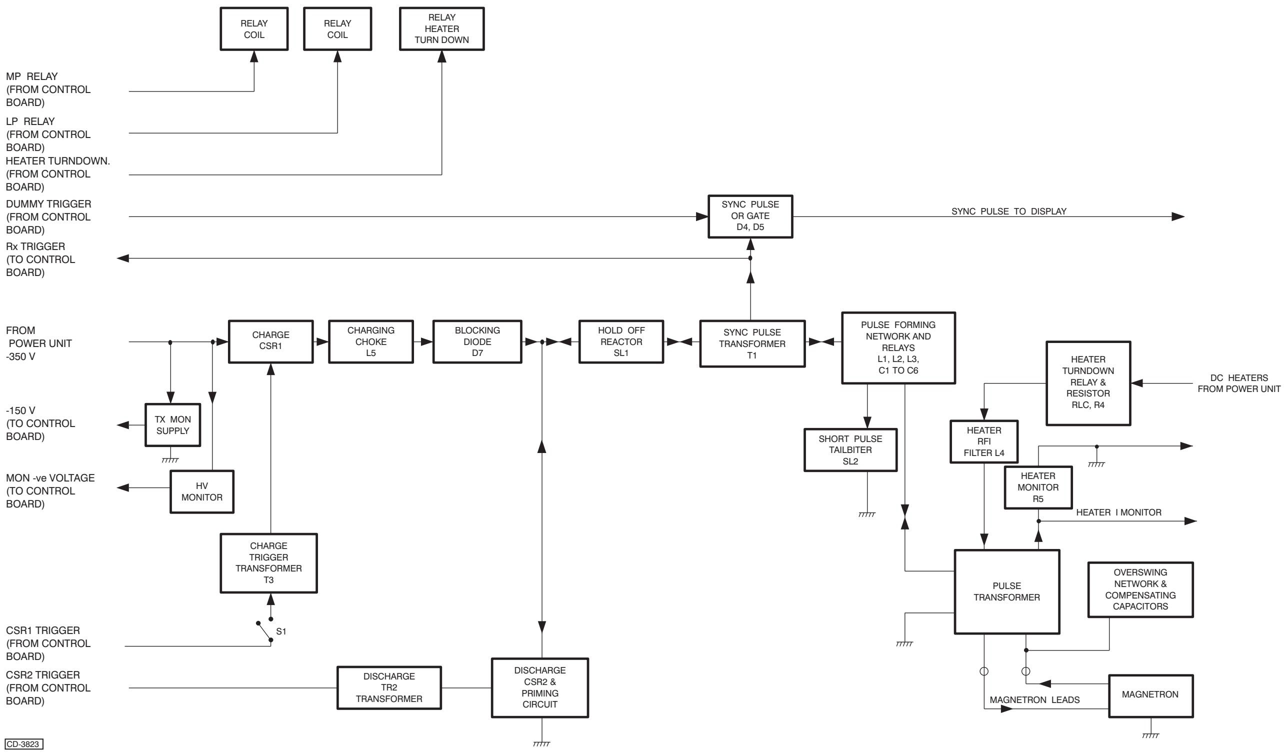


Figure 6c - Modulator Unit (A247/248): Block Diagram

RECEIVER MONITOR CTX-A252

17 A block diagram of the Receiver Monitor PCB is shown in Figure 7c, below.

18 The Rx Monitor circuit utilises a noise diode fitted in the receiver waveguide branch of the RF Head Circulator. When enabled, the noise diode is switched on for a sector of the Display Azimuth. The ratio of the Receiver noise to the noise diode output is compared using a ramp, which provides a time related noise sector. As the noise ratio reduces the noise sector becomes a shorter radius on the display. The noise sector is split into ‘fingers’ to enable it to stand out from the Tx Monitor plume and any land masses.

TUNE SUPPLY PCB CTX-A250

19 This board is used to dc offset the Receiver AFC tuned output voltage (approximately 5.5V) to the voltage required to tune the Low Noise Front End (approximately 12V).

HL PCB CAE-A180

20 Heading Line and Azimuth data is produced by interrupting two opto-coupler devices with a slotted disk mounted on the antenna final drive shaft.

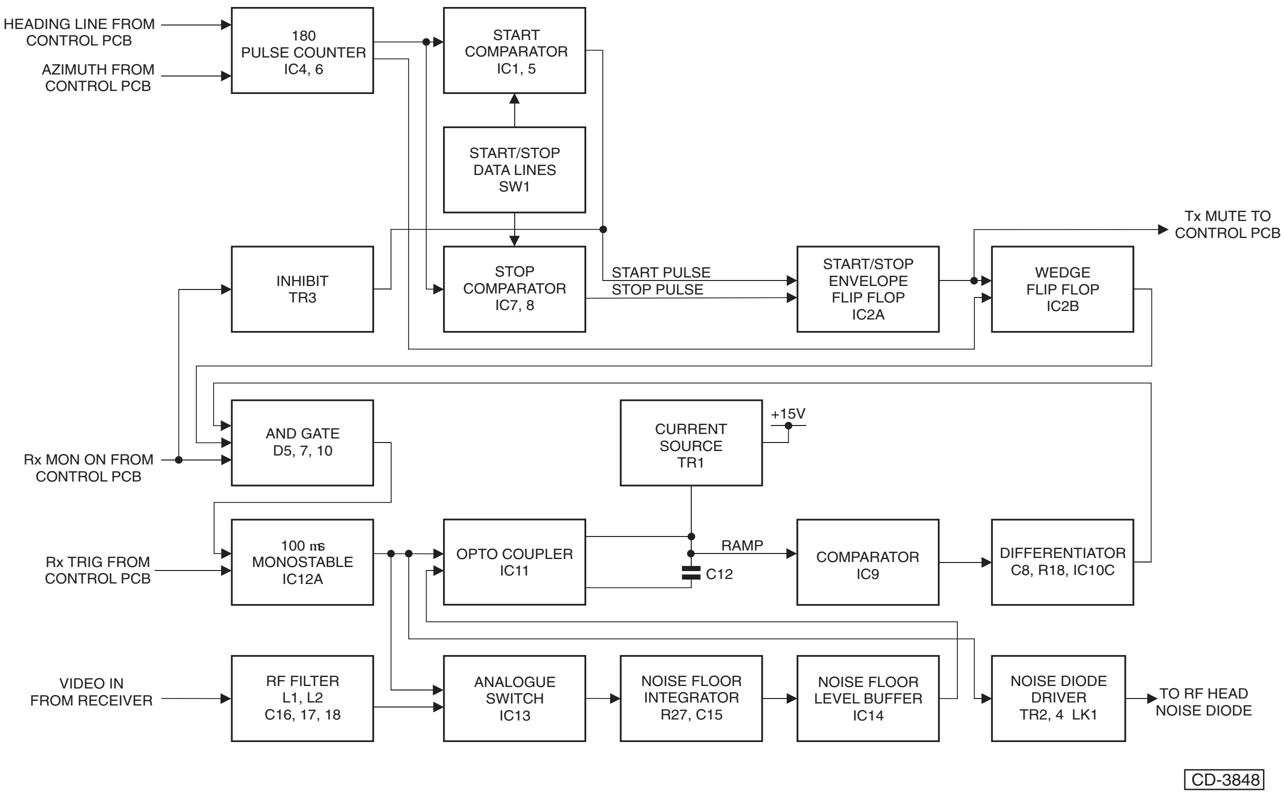


Figure 7c - Receiver Monitor PCB (CTX-A252): Block Diagram

LOG RECEIVER (CTX-A297)

21 A block diagram of the Log Receiver Assembly is shown in Figure 8c, below.

22 The Receiver comprises a logarithmic IF amplifier, Automatic Frequency Control (AFC) circuitry and tuning indicator circuitry.

23 Received radar returns are mixed in the RF head with the local oscillator output to provide a 60 MHz Intermediate Frequency (IF) which is applied to the receiver input SKC.

ANTENNA TURNING MECHANISM

24 Two versions are provided

(1) 25rpm

(2) 40rpm

25 The 25 rpm and 40 rpm versions are fitted with different motors.

26 The basic unit contains the Antenna Motor, Gearbox, RF Rotating Joint and Mount for the Antenna.

27 A slotted disc on the final drive provides 180 azimuth pulses and a heading line pulse per revolution of the antenna.

28 The HL PCB (CAE-A180) is mounted so that the slotted disc rotates within the opto-coupler slots on the PCB.

29 The PCB is fitted to an adjustable mounting bracket assembly. Loosening the mounting pillars allows the assembly to be moved positive or negative six degrees for fine heading line adjustment. The slotted disc can be rotated if the fine adjustment is not enough.

30 For Upmast Transceivers, the casing also contains the RF head and electronic units. The coaxial cable access hole is fitted with a bung.

SAFETY SWITCH

31 An ON/OFF switch located by the cable entries on the outside of the case provides safety isolation of the antenna motor when the switch is set to the OFF position. Power is provided from the motor, thus also disabling the transmitter when the switch is set to OFF

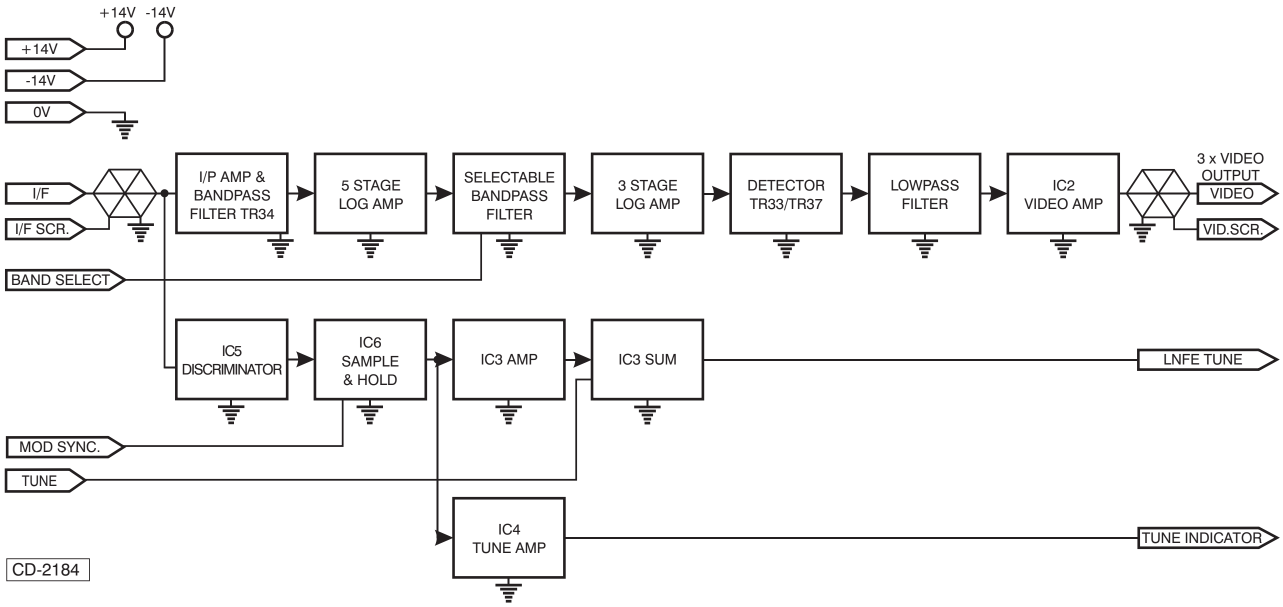


Figure 8c - Log Receiver Assembly CTX-A297: Block Diagram

SOFT START UNIT CZZ-A14 (/2)

32 A block diagram of the Soft Start Unit is shown in Figure 9c, below.

33 The soft start unit comprises a three phase contactor, thermal overload, three sets of power resistors and a controlling PCB. At switch on, the contactor coil is energised via the transceiver Control PCB CTX-A246 and the gearbox safety switch. The coil current is fed through the thermal overload switch to the contactor coil, which turns ON. The three phase supply to the motor passes through the current limiting resistor chain to reduce the motor start torque.

34 As the contactor switches on, its auxiliary contact connects the coil supply voltage to IC1 on the Control PCB, providing a 1.5 s delay at switch on.

35 At the end of the1.5 s delay, the output from IC1 goes low, causing transistor TR1 to switch off, transistor TR2 to turn on and Relays RLB, RLC and RLD to energise. The relays short out the resistor chain to apply full current to the motor.

36 The CZZ-A14/2 version of the Soft Start Unit, used for interswitched installations, or installations with 60m+ cable runs, is provided with a mains power supply and terminal blocks for use as an in-line power unit.

37 The neon indicators for the three phase supply are provided with series resistors which can be shorted out to allow for different motor voltages.

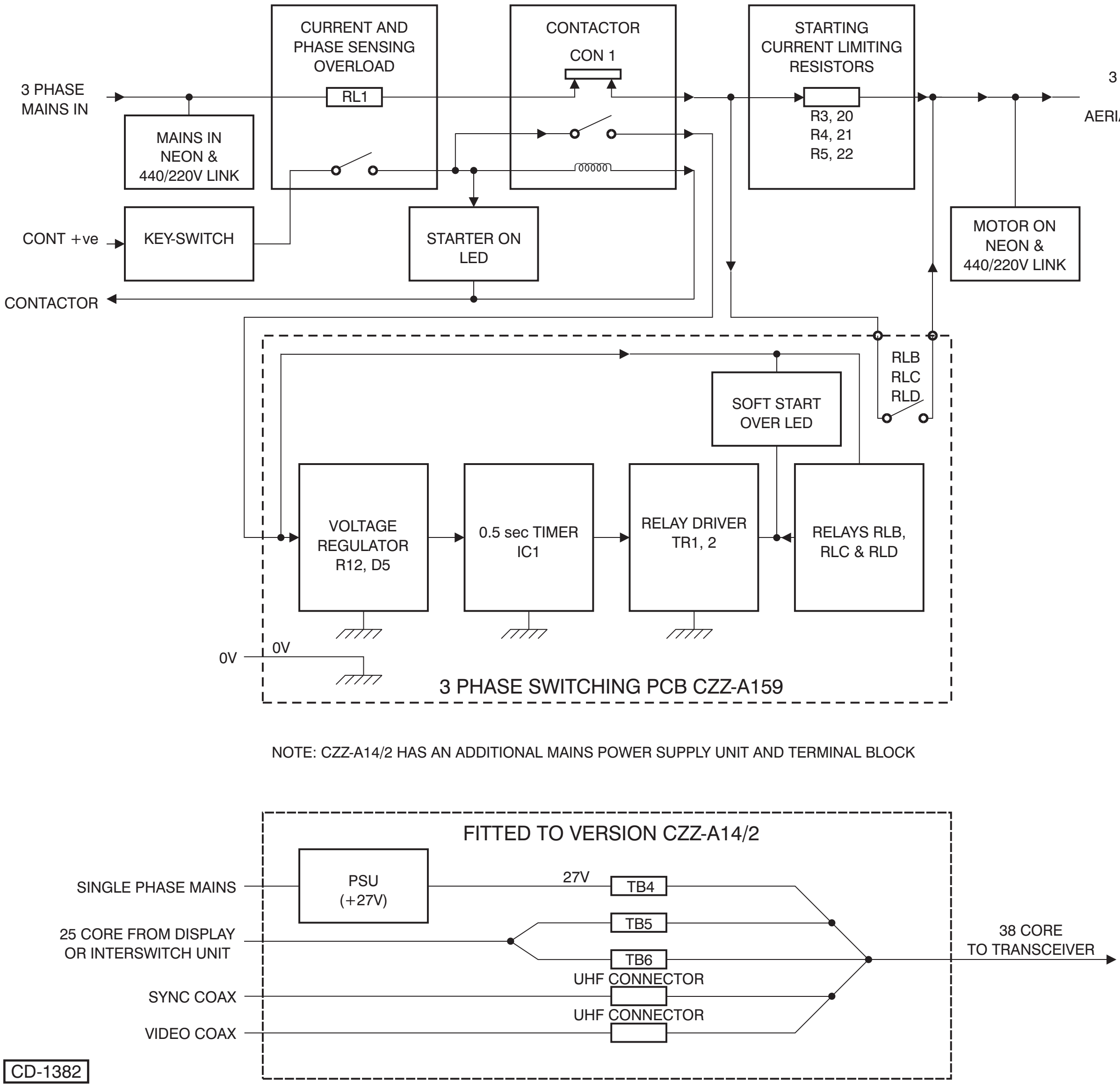


Figure 9c - Soft Start Unit CZZ-A14/*: Block Diagram

SPECIFICATION

38 Technical specifications for MkVI Transceivers are provided in Table 1, below.

Table 1 - Specification

Frequency:	3050 ± 10MHz
Peak Power output:	30kW nominal
Magnetron Life:	10,000 Hours typical
Pulse Length and P.R.F:	
Short: (S):	Nominal 0.055 s
	1500pps ± 40 or 3000pps ± 100
Medium (M)	Nominal 0.25 s
	750pps ± 20 or 1500pps ± 40
Long (L)	Nominal 0.95 s
	750pps ± 20
Long-Low PRF (VL)	Nominal 0.95 s
	375pps ± 10
Sync. Output:	1 x 75 Ohm output, not less than +12V amplitude
Receiver (used for all transceivers):	
Type:	Logarithmic Receiver
I.F.	60MHz
Video Outputs	1 x 75 Ohm, +5.5V to 6V peak amplitude.
System Overall Noise Figure	Nominal 4.5dB
Operating Temperature Ranges:	
Turning Mechanism, Upmast Transceiver:	
Ambient Range:	-25^{0}C to +70^{0}C
95% Humidity	+40^{0}C

NOTE

(1) The PRF oscillator can be preset with a basic frequency range of 2400 - 3400 Hz (nominal 3000 Hz).

(2) Short pulse can be set to 3000 or 1500 Hz base.

(3) Medium pulse can be set to 1500 or 750 Hz base.

(4) Pulse to pulse jitter can be selected and set to ±15 s from nominal.

DIAGNOSTICS

39 The Algorithms 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

40 Before any rectification is implemented, the radar system must be in a standard configuration, as shown at the top of the algorithm.

FAILURE MESSAGES

41 These failure messages appear in the data field of the display monitor if certain signals are missing. See Table 2 for details.

Table 2 Failure Messages

SIGNAL	FAILURE MESSAGE	SIGNAL	FAILURE MESSAGE
Sync.	**No Sync.**	**Azimuth**	**No Azimuth**
Video	**No Video**	**Heading Line**	**No Heading Line**

42

Fault diagnosis algorithms covering these failures are provided in Figures 10c to 17c.

TEST EQUIPMENT

43 Routine field maintenance requires fault location down to fuse replacement level. The only test equipment required for fault finding is a high impedance Multimeter. The location and rating of fuses is detailed in Table 3, below.

Table 4 Fuses

FUSE No	LOCATION	RATING
FS1	Power Unit	Resettable
FS2	Power Unit	Resettable
FS3	Power Unit	Resettable
FS1	Control Board	Resettable
FS1	Soft Start Unit CZZ-A14/2	Time Lag 5A for 220V Time Lag 6.3A for 110V

INDICATORS

44 Indicators provided on PCBs are detailed in Table 4, below.

Table 3 - Indicators

PCB	Component Ref.	Indication
PSU	D18-A	+15 V Low Supply
PSU	D18-B	+9.5 V Low Supply
PSU	D17-A	+6 V Low Supply
PSU	D17-B	-15 V Low Supply
Control	D4	Heater current OFF
Control	D6	+27V OK
Control	D17	Tune Indicator
Control	D24	prf ON
Control	D26	Mute ON
Control	D27	HL I/P OK
Control	D36	Tx Ready

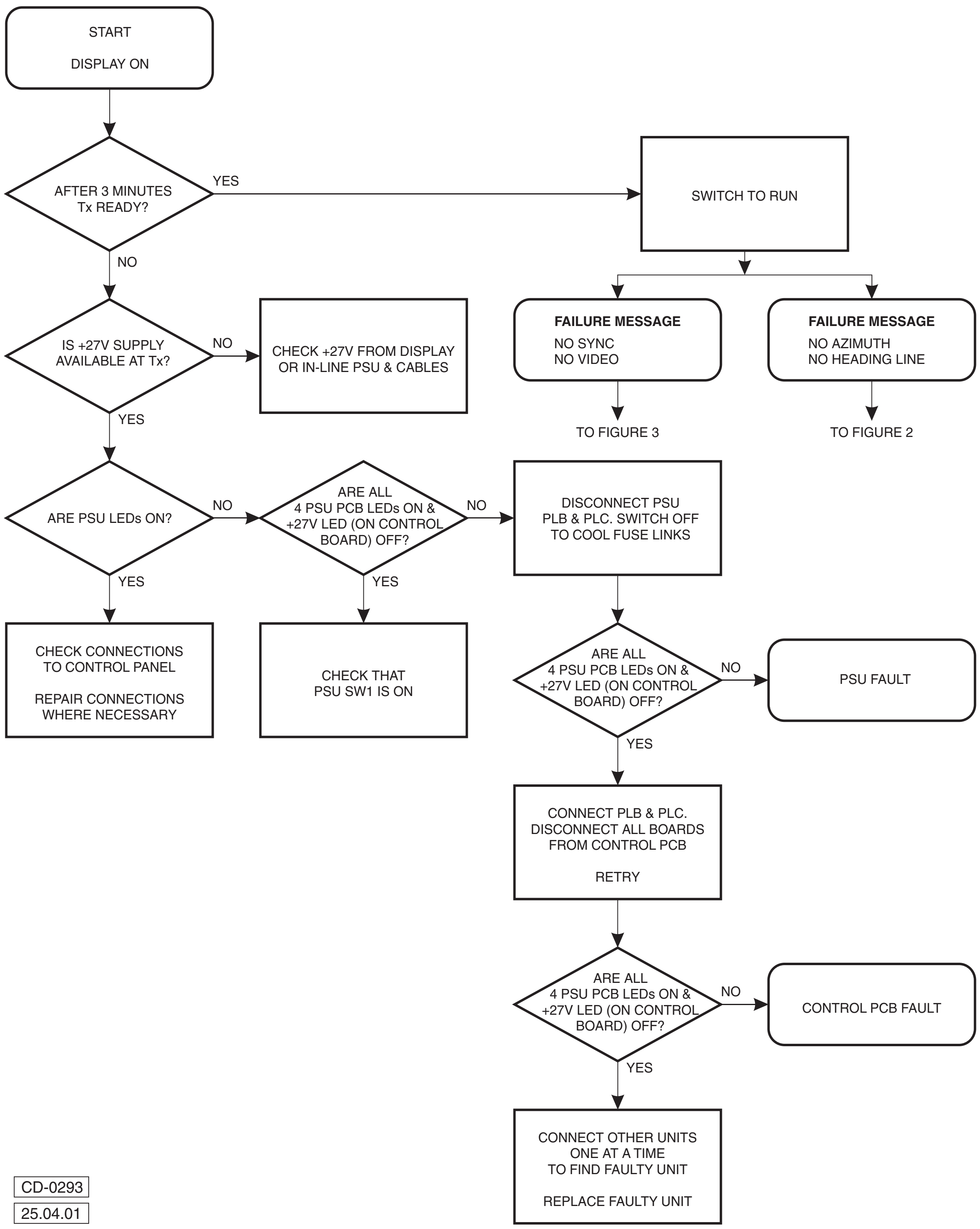


Figure 10c - Flowchart 1

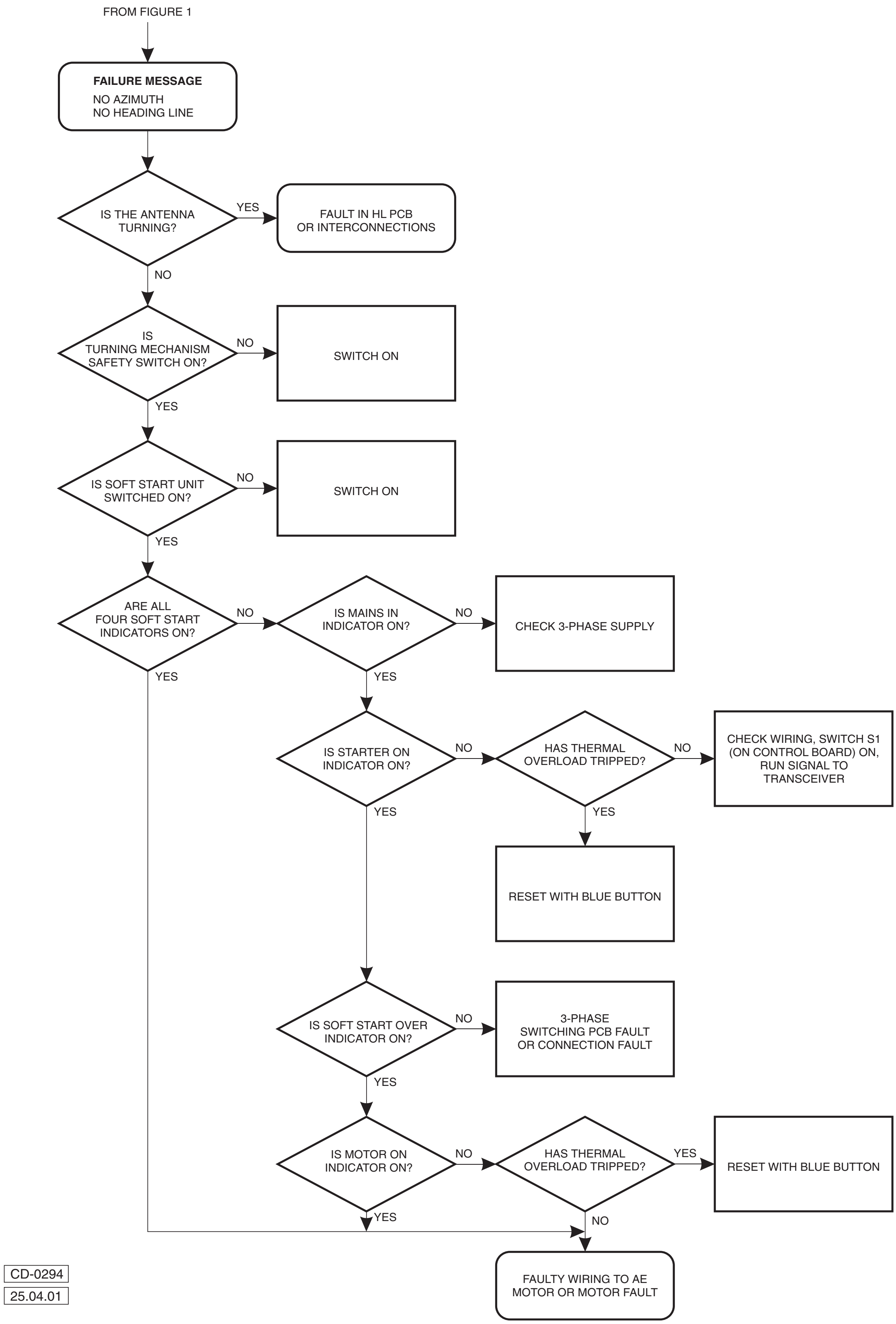


Figure 11c - Flowchart 2

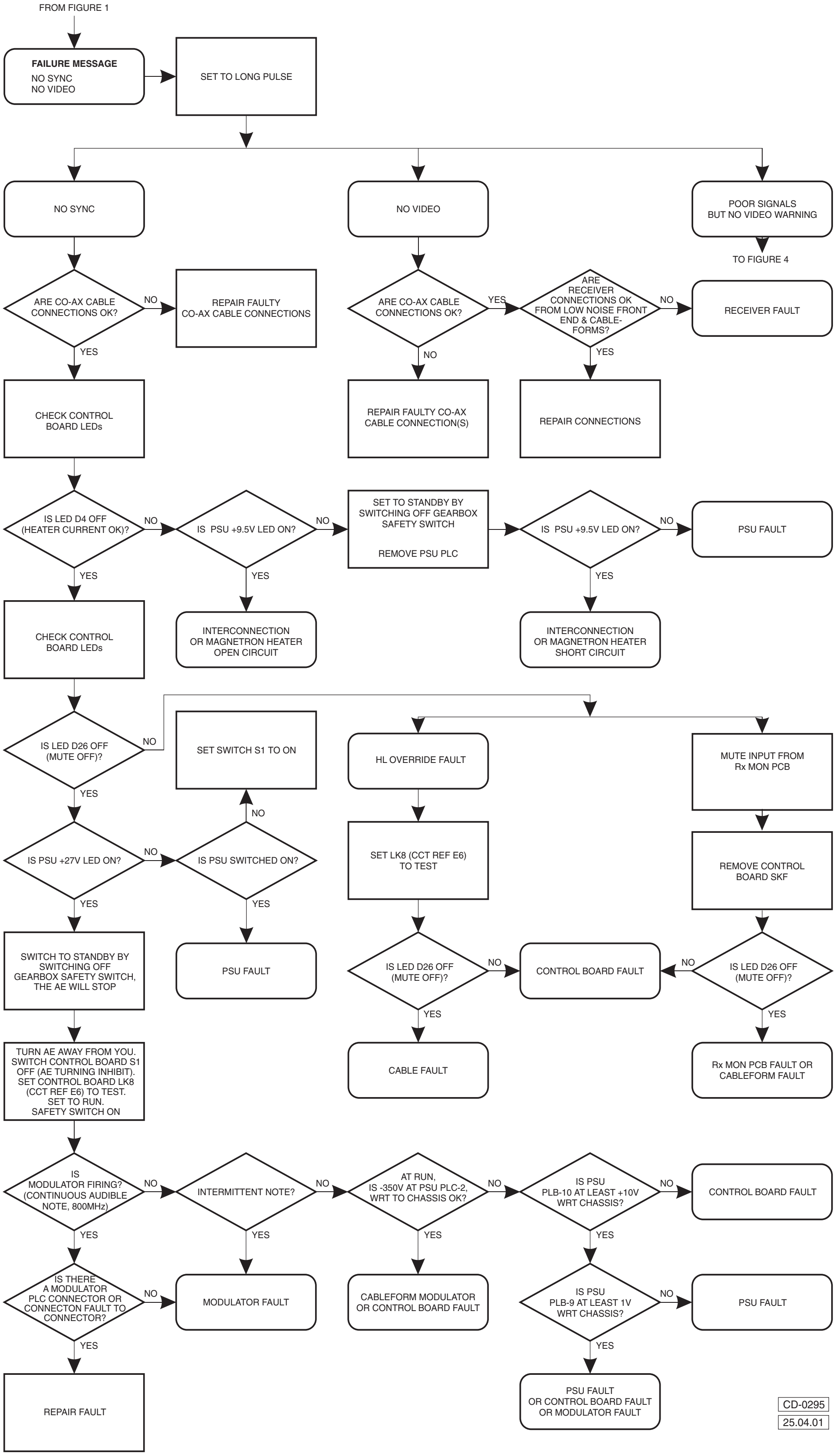


Figure 12c - Flowchart 3

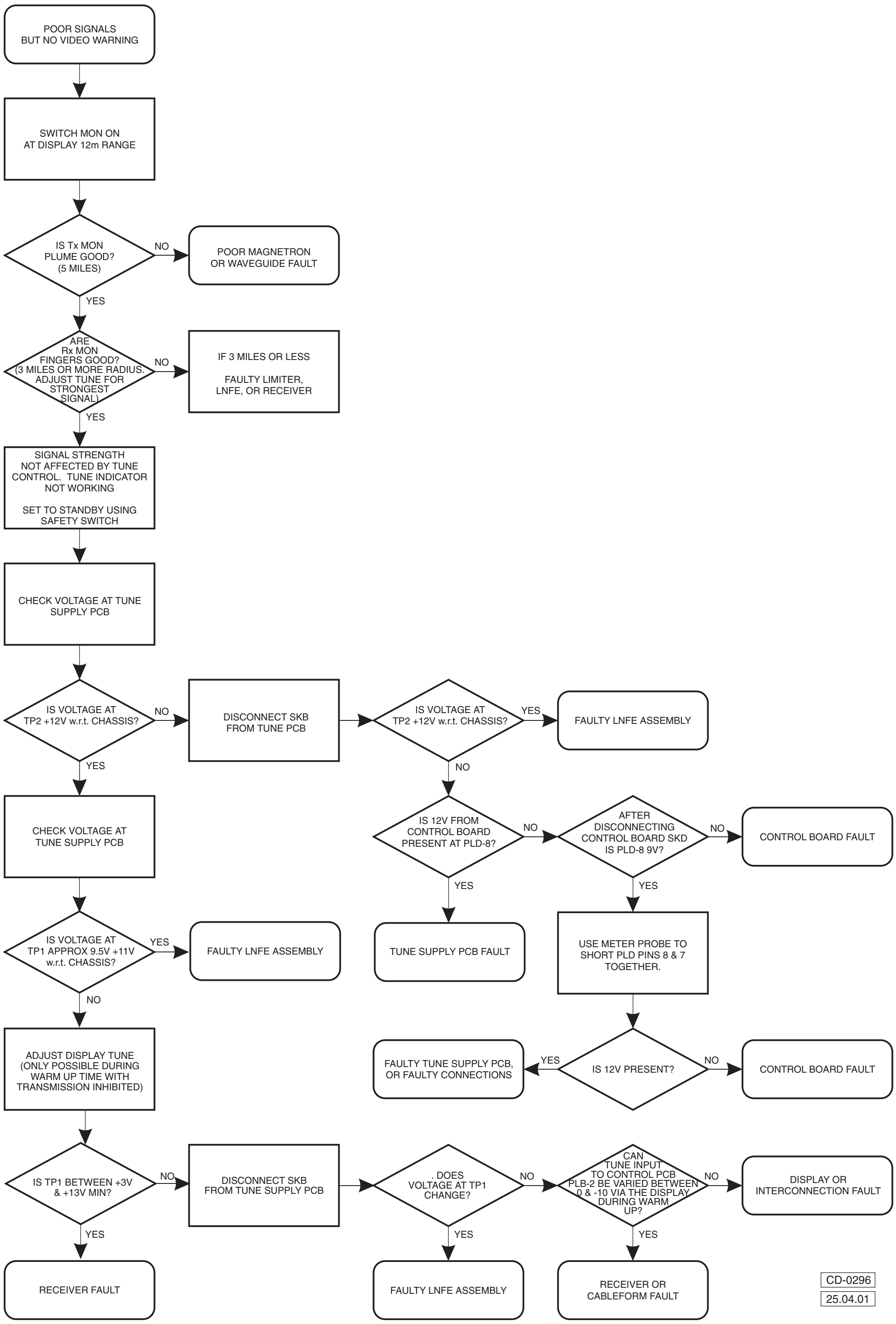


Figure 13c - Flowchart 4

PREVENTIVE 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 IMPLEMENTED BY A QUALIFIED TECHNICIAN

PREVENTIVE MAINTENANCE

45 The Transceiver requires no preventive maintenance, however periodically (around every 6 months) check that all screws, nuts and bolts are secure and free from corrosion, and wipe the scanner clean using a soft cloth with mild detergent.

46 Every 12 months open the transceiver and check that the inside connections are secure and free from corrosion.

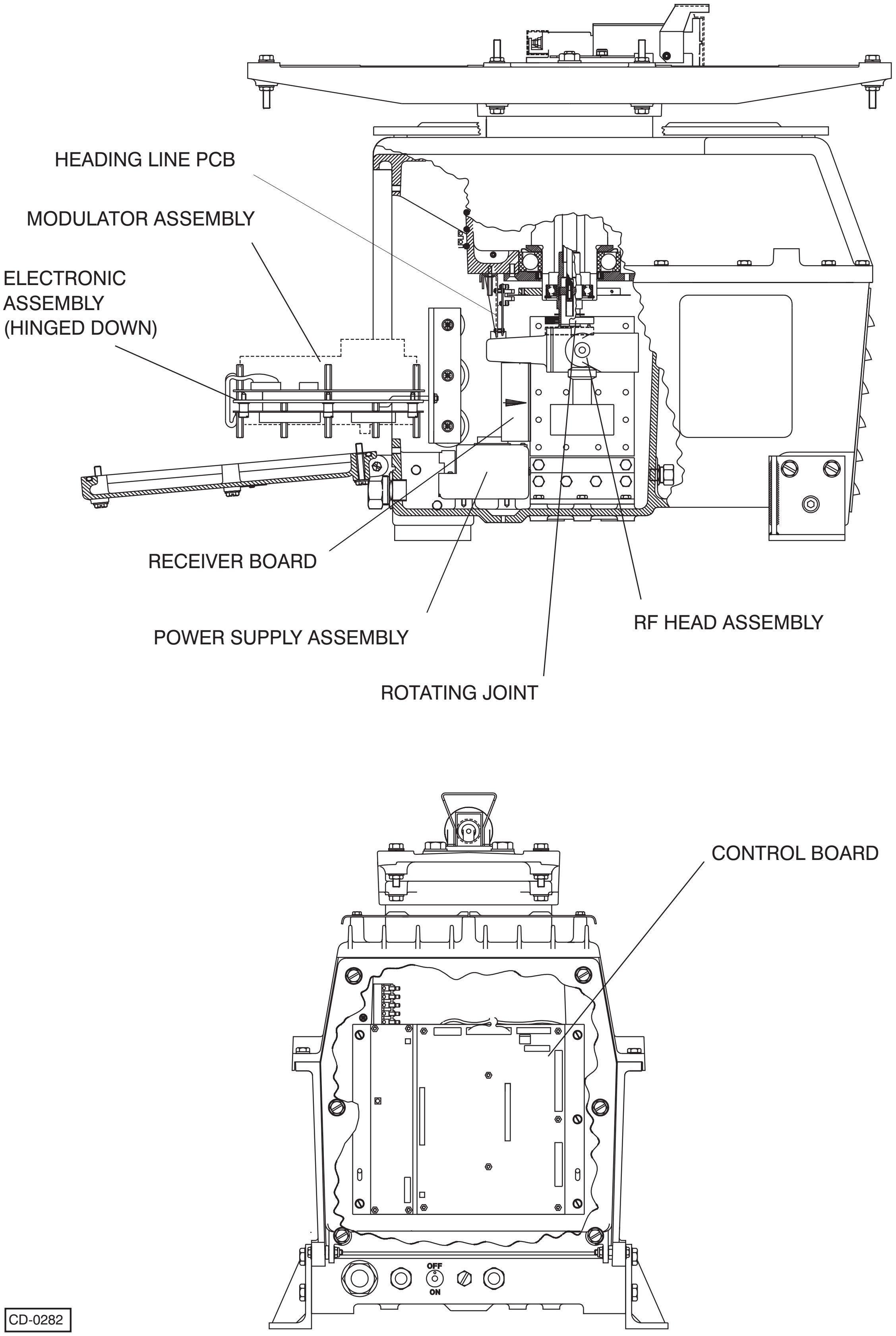


Figure 14c - Upmast Transceiver: Module Locations

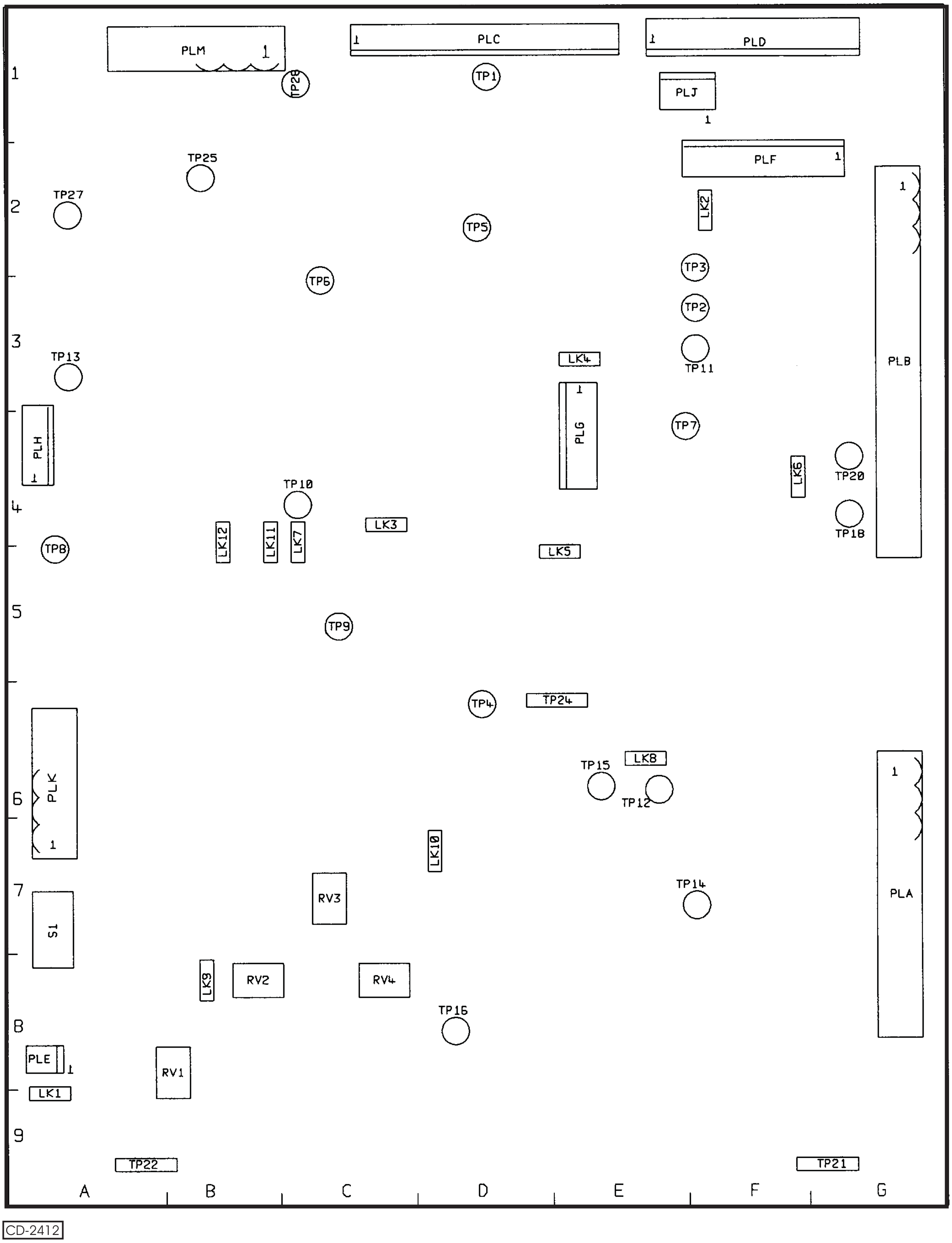


Figure 15c - Control PCB: Links, Switches, Potentiometers and Test Points

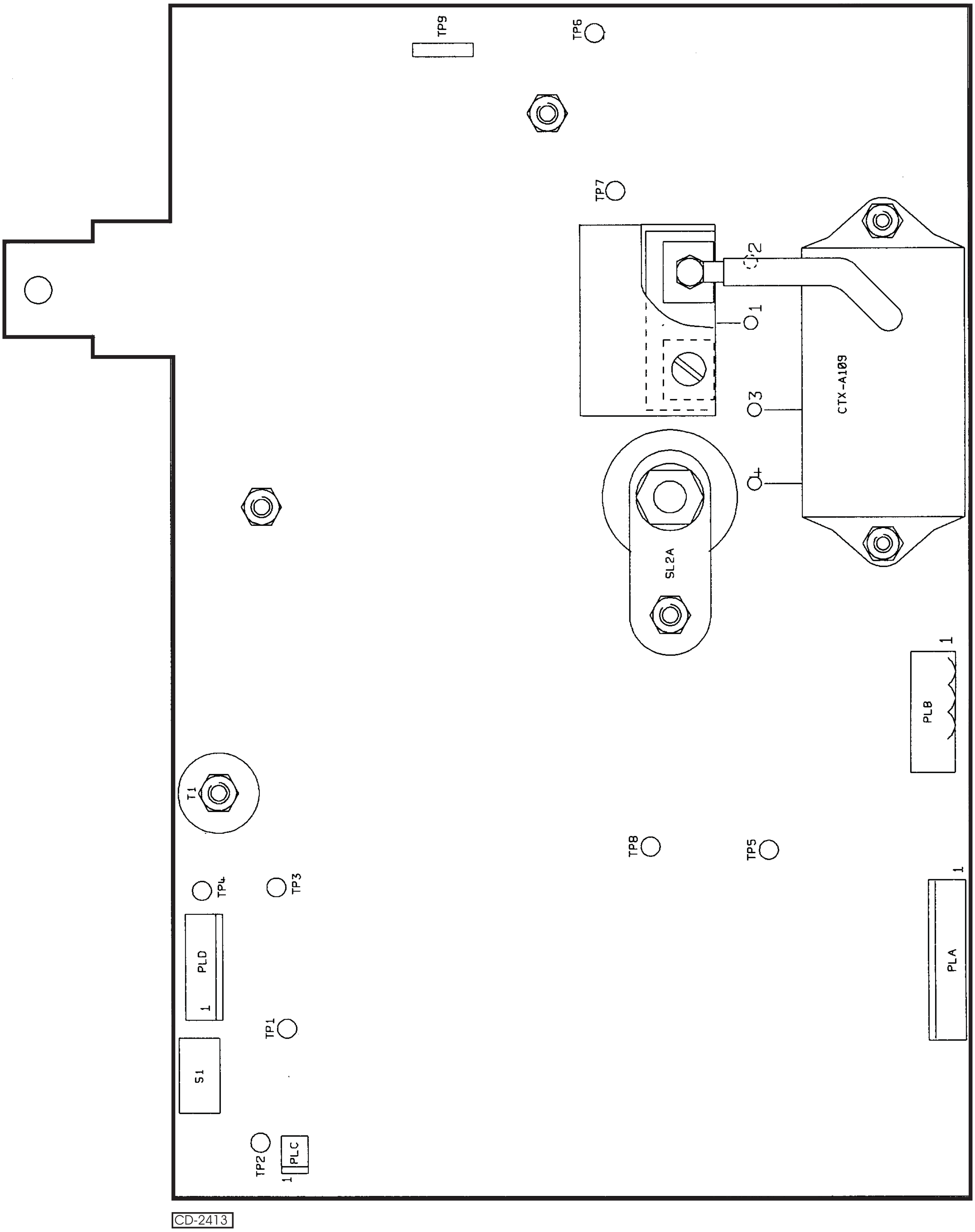
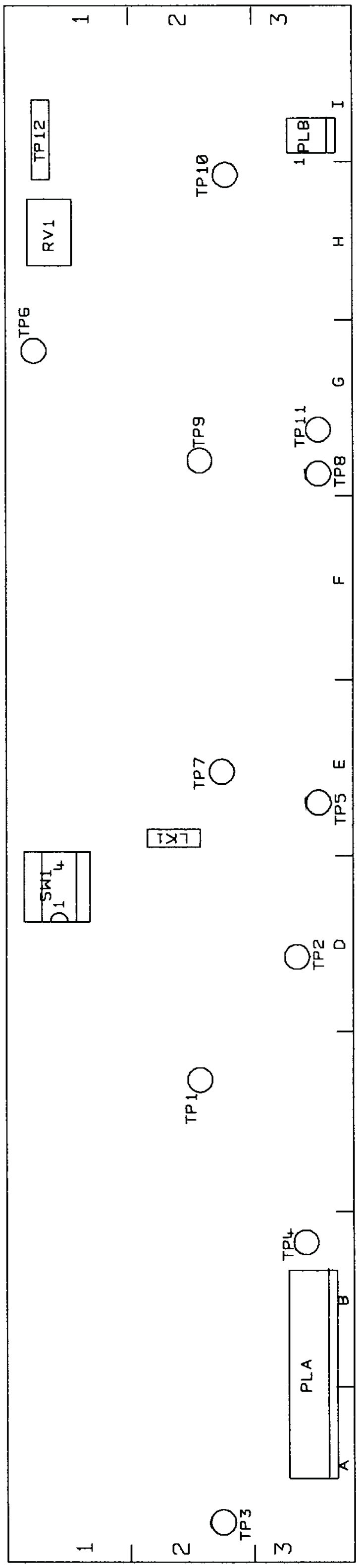


Figure 16c - Modulator PCB - Switches & Test Points



CD-2414

Figure 17c - Rx Monitor PCB - Links, Switches, Potentiometers & Test Points

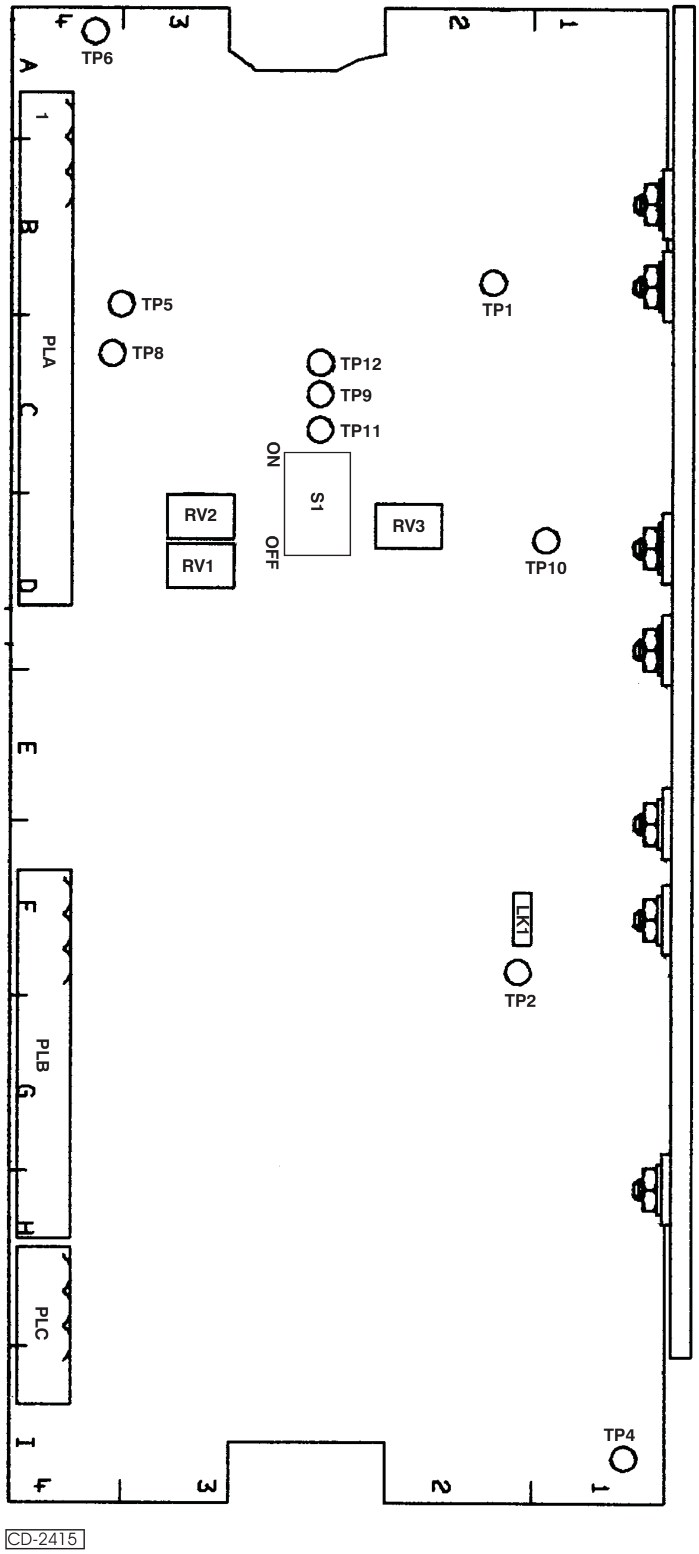


Figure 18c - Power Supply PCB - Links, Switches, Potentiometers & Test points

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CHAPTER 7D

MKVII TRANSMITTER/RECEIVER & ANTENNA (S-BAND)

INTRODUCTION

1 The MkVII S-Band Transceivers are available in a downmast configuration only, where the transceiver electronics are remote from the turning mechanism, being located in a separate enclosure located below deck.

2 The configuration, shown in Figures 1d and 2d, is provided with a single phase mains input to the transceiver, which provides dc supplies for the turning motor.

SYSTEM DESCRIPTION

3 The Transceiver (CTX-A9) is fitted with a logarithmic amplifier with AFC and employs fan cooling for the magnetron and modulator.

4 The magnetron energy is fed via a circulator and a semi-rigid coaxial cable run to the rotating joint located in the turning mechanism and onto the antenna. Received signals from the antenna are routed via the rotating joint and coaxial cable to the circulator. Within the transceiver the received signals are routed from the circulator to the RF limiter, bandpass filter and low noise front end to the Logarithmic receiver.

5 The transceiver is normally muted whenever the antenna ceases to rotate. Pulse jitter, muting and sector transmission are standard facilities, with options for pre-pulse generation and external synchronisation.

6 The transceiver can be interfaced with any of the Nucleus Series displays. In addition, facilities are provided for interfacing with the display via a Controller Area Network (CAN) bus link.

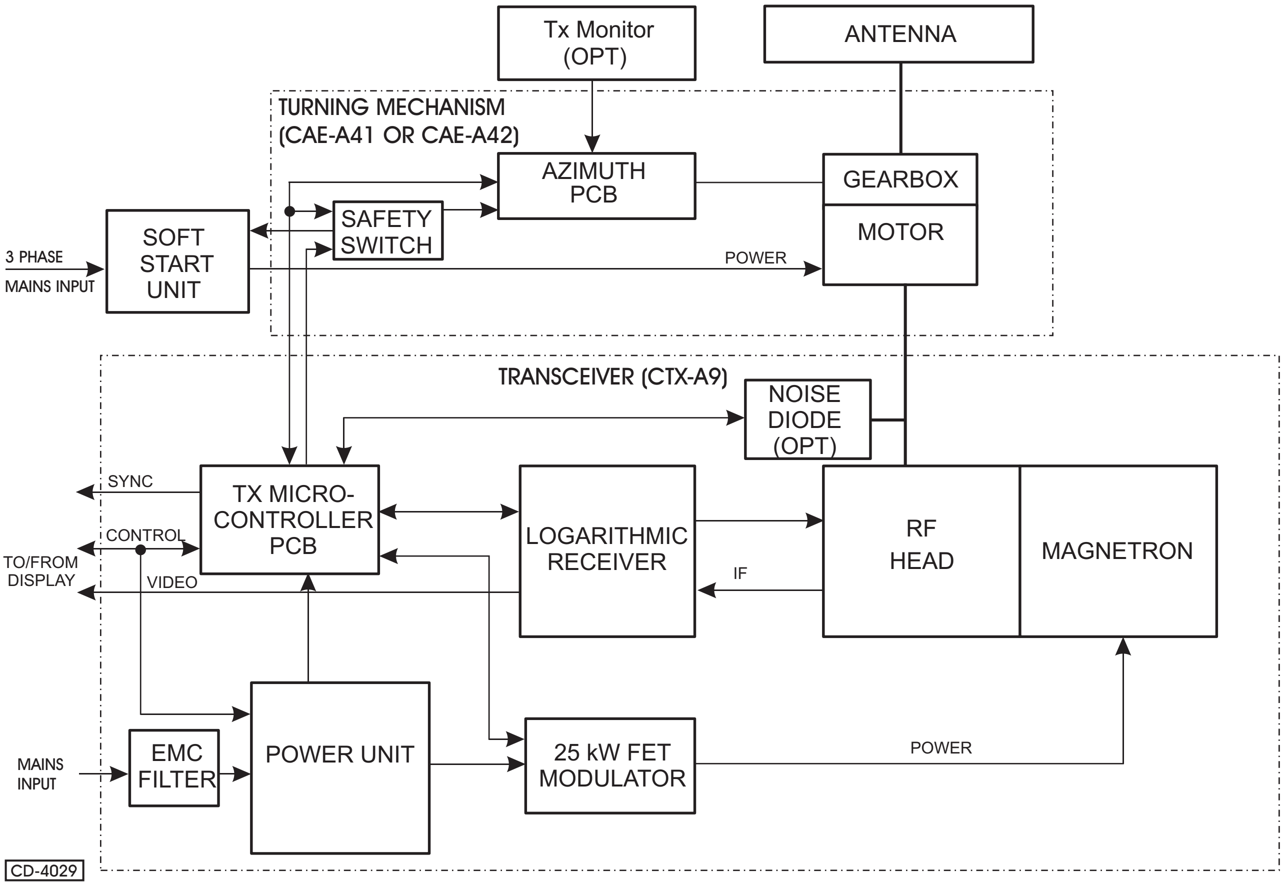
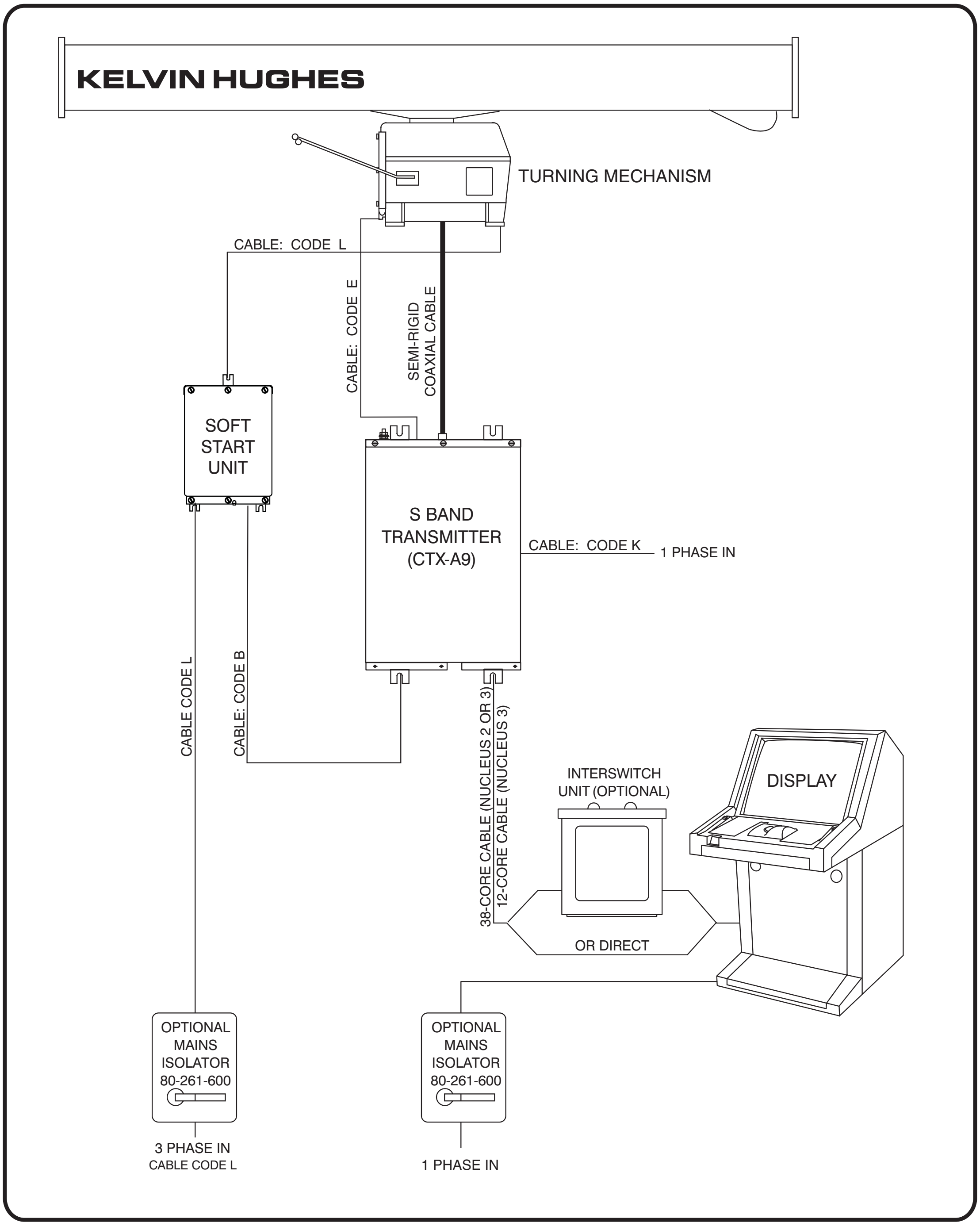


Figure 1d - S-Band (CTX-A9): Block Diagram



TURNING MECHANISM	ANTENNA
25rpm CAE-A42	3.9m CAE-A36
40rpm (minimum) CAE-A41	2.8m CAE-A39

CD-4035

CABLE CODES

CABLE A - 2 CORE SMALL
CABLE B - 3 CORE SMALL
CABLE E - 12 CORE
CABLE K - 2 CORE POWER
CABLE L - 3 CORE POWER
CABLE N - 38 CORE
CABLE S - 10 CORE + 2 COAXIAL

Figure 2d - Typical System Configuration S-Band (CTX-A9)

FUNCTIONAL DESCRIPTION

7 The S-Band downmast transceiver and antenna comprise a transceiver which is bulkhead mounted, and a mast mounted turning mechanism in a weatherproof compartment, with antenna attached. A Functional diagram for the S-Band transceiver, turning mechanism and antenna are provided in Figure 8d, and the interconnections are shown in Figure 9d.

DOWNMAST TRANSCEIVER

Transmitter Circuits

8 The Transceiver uses a 30 kW magnetron to generate the RF output. The magnetron is driven by the 30 kW FET Modulator (CTX-A369), which consists of a 30 kW Modulator PCB (CTX-A345) mounted on a chassis together with the high power components, heatsink and RF shield.

9 The 30 kW Modulator provides the following functions:

(1) A 300V power supply.

(2) Driver circuits for the modulator FETs.

(3) The FET modulator which drives the magnetron (these FETs are chassis mounted on the heatsink).

(4) Associated control and protection circuits.

10 A switch on the 30 kW Modulator PCB enables the +27V supply to the 300V power supply to be switched off for maintenance purposes (it is normally set to ON). The status of the power supply is indicated by LEDs mounted on the PCB as follows:

(1) When the +27V is disconnected the GREEN 300V SAFE LED is lit (ie the switch is set to OFF).

(2) When +27V is applied to the 300V power supply the YELLOW 300V UNSAFE LED is illuminated (ie the switch is set to ON).

(3) When the presence of the 300V output is detected the RED 300V ACTIVE LED is illuminated.

11 The status of the power supply is monitored by the protection circuits and the supply is switched off if an overvoltage is sensed.

12 The modulator magnetron drive automatically adjusts to compensate for variations in magnetron characteristics and to allow for the effects of the magnetron ageing. Control and protection circuits provide protection of the magnetron from overvoltages, etc.

13 The type of magnetron is detected and for this application as an S-band magnetron is used the RED S-BAND LED is lit indicating S-band.

14 The RED HEATER TURNDOWN LED is lit when the heater is switched off due to a fault being detected.

15 The output from the magnetron is passed via a circulator to the rotating joint and the antenna.

Receiver Circuits

16 The received RF radar returns are passed from the antenna to the circulator, which routes them to the Diode (RF) Limiter and Low Noise Front End (LNFE). The LNFE produces a 60 MHz IF signal which is passed to the Logarithmic Receiver PCB (CTX-A356), mounted in Receiver Assembly (CTX-A364), providing shielding of the PCB from high power RF signals. The Logarithmic Receiver provides two video outputs for use by the displays and one for the Rx Monitor in the Transceiver.

17 A Tx Mon pulse is injected into the video signal to indicate, on the displays, that sufficient power is being transmitted.

18 The Logarithmic Receiver provides tuning control of the LNFE and a tune indication signal to the Tx Microcontroller PCB. The Logarithmic Receiver provides the regulated DC supply for the Low Noise Front End.

Control Circuits

19 The Tx Microcontroller PCB (CTX-A346) provides overall control of the transceiver using a microprocessor, and interfaces with the Display. Commands to and from the Display may be provided by one of the following:

(1) Parallel inputs and outputs to a standard NUCLEUS display.

(2) Serial link to the display via an RS232 connection.

(3) Serial link to the display via a CAN bus connection.

20 The status of the control circuits is indicated by a number of LEDs as follows:

(1) The PROCESSOR RUNNING LED flashes when the microprocessor is running normally.

(2) The HEATER OK LED is lit when the magnetron heater circuits are operational.

(3) The TUNE LED is lit when the tune signal is produced by the logarithmic receiver.

(4) The EXT TRIG LED is lit when an external trigger pulse is detected.

Power Supplies and Cooling

21 The dc supplies for the Transceiver, with the exception of the 300V for the modulator are provided by a Power Supply Unit (45-677-124). The mains input is fed to the power supply via an EMC filter to prevent interference pulses from the transceiver circuits being conducted out onto the supply lines. The input is also protected against incoming high voltage spikes. The power supply provides the following DC supplies for the Transceiver and Turning Mechanism:

(1) +27V to drive the 300V power supply.

(2) +27V for general use.

(3) +15V.

(4) +5V.

(5) -15V.

22 Cooling of the transceiver is provided by two fans. One is located within the electronics unit and provides forced air cooling of the whole transceiver. The second fan is mounted on the front of the electronics unit and provides cooling for the high power components in the 25kW Modulator.

RF Head

23 The RF Head contains a Noise Source, Circulator, Diode Limiter, Bandpass Filter and Low Noise Front End (LNFE). The LNFE (CAE-A217) comprises an RF Amplifier, Balanced Mixer, Local Oscillator and IF Head Amplifier.

24 The Magnetron (CTX-A309) does not form part of the RF Head, but functionally completes the RF path.

Antenna Turning Mechanism

25 A separate Antenna Turning Mechanism is required for the Downmast Transceiver. The downmast transceiver can be used with the MkVI Turning Mechanism (refer to Chapter 7c for further information), or the Mk VII Turning Mechanism (refer to publication KH1253 for further information).

SPECIFICATION

26 The technical specifications for the MkVII S-band Transceiver are as follows:

Transmitter:

	S-Band
Frequency:	**3050 10 MHz**
Magnetron Rating:	**30 kW nominal**
Magnetron Life:	**10,000 Hours typical**
Pulse length and P.R.F:	**Short(S)** nominal 0.055 s 3000pps 100 **Medium(M)** nominal l 0.2 s 1500 pps 40 **Long(L)** nominal 0.9 s 750 pps 20 **Long-Low PRF(VL)** nominal 1.0 s 375 pps 10
Sync. Output:	**2 x 75 Ohm outputs not less than +12V amplitude**
Pulse to Pulse Jitter:	**This will normally be activated and is 15 s from nominal period. This function can be inhibited.**

27 The PRF and Pulse Length can be set to other values via the RS232 link.

28 The above values are the nominal settings.

29 Receiver specifications are detailed overleaf.

Receiver:

	S-Band
Type:	**Logarithmic Receiver**
I.F.	**60 MHz**
Video Output:	**2 x 75 +5.5V to 6V peak signal**
System Overall Noise Figure	**Nominal 4.5 dB**

Operating Temperature Ranges: Turning Mechanism:	S-Band
Ambient Temperature Range:	**-25°C to +70°C**
Humidity:	**95% at +40°C**
Downmast Transceiver:	
Ambient Temperature Range:	**-15 C to +55°C**
Humidity:	**95% at +40°C**
CAE-A30-5 and CAE-A30-6 Turning Mechanism	
Azimuth Data:	**90 pulses per revolution**
Heading Data:	**1 pulse per revolution**

Input Power:	S-Band
Input Power Single Phase:	**110V/220V ac input**
Input Power 3-Phase: Low Speed:	**0.55kW 0.75kVA**
High Speed:	**2.2kW 3kVA**

DIAGNOSTICS

30 The Algorithms 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

31 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

32 These failure messages appear in the data field of the display monitor if certain signals are missing. See Table 1 for details.

Table 1 - Failure Messages

SIGNAL	FAILURE MESSAGE	SIGNAL	FAILURE MESSAGE
Sync.	No Sync.	Azimuth	No Azimuth
Video	No Video	Heading Line	No Heading Line

33 Fault diagnosis algorithms covering these failures is provided in Figure 10d sheets 1 and 2.

Test Equipment

34 Routine field maintenance requires fault location down to fuse replacement level. The only test equipment required for fault finding is a high impedance Multimeter.

Table 2 - Fuses

FUSE No	LOCATION	RATING
FS1	Power Unit	Resettable
FS2	Power Unit	Resettable
FS3	Power Unit	Resettable
FS1	Tx Microcontroller PCB	Resettable

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 PERMITTED FOR QUALIFIED TECHNICIANS.**

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.

(2) Use non-magnetic tools when working near the magnetron.

35 To access the units inside the transceiver it is necessary to remove the front cover of the transceiver. This allows access to all the units except the 25 kW Modulator PCB. The cover is removed by releasing the six captive screws. Observe all safety precautions a up to 300V is present on the modulator with power applied.

36 To access the indicators and the test points on the 25kW Modulator PCB, it is necessary to place the Electronics Unit (CTX-A370) in the test position, refer to Figure 4d. To place the Electronic Unit in the test position proceed as follows:

(1) Remove all power supplies to the Transceiver.

(2) Release the six captive screws securing the electronic assembly in position and carefully remove, ensuring no cables are damaged.

(3) Secure in Electronics Unit the test position on the side of the frame with the left top and bottom captive screws (2 only), refer to Figure 4d. It is now possible to access the LED indicators and the test points on both sides of the unit.

(4) Restore power to the transceiver, observing all safety procedures as up to 300V may be present on the modulator.

37 If it is required to carry out fault diagnosis without the 300V present, set SW1 on the 25 kW Modulator PCB to OFF. Ensure the switch is returned to the ON position when testing is complete.

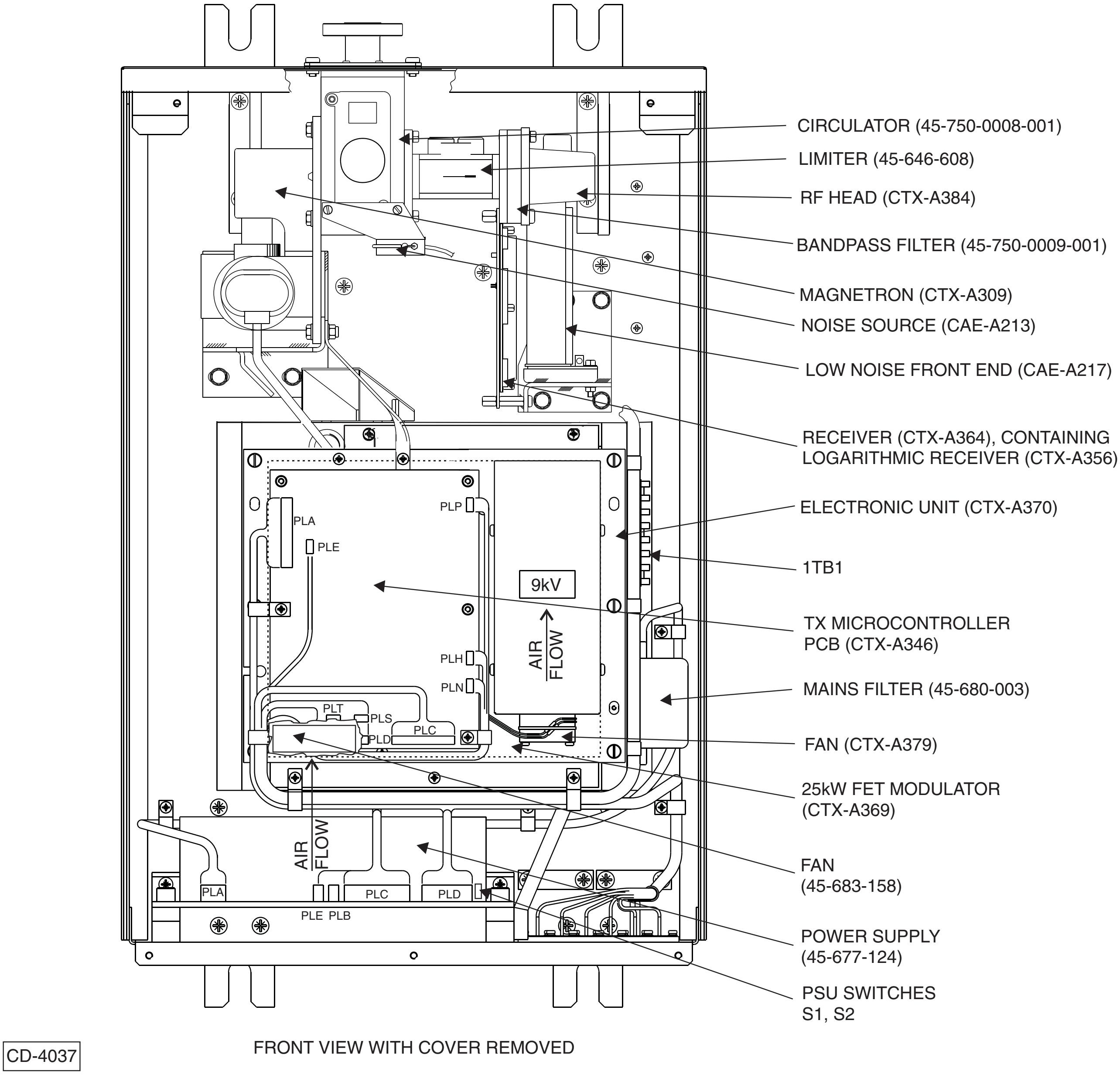


Figure 3d - Downmast Transceiver (CTX-A9): Module Locations

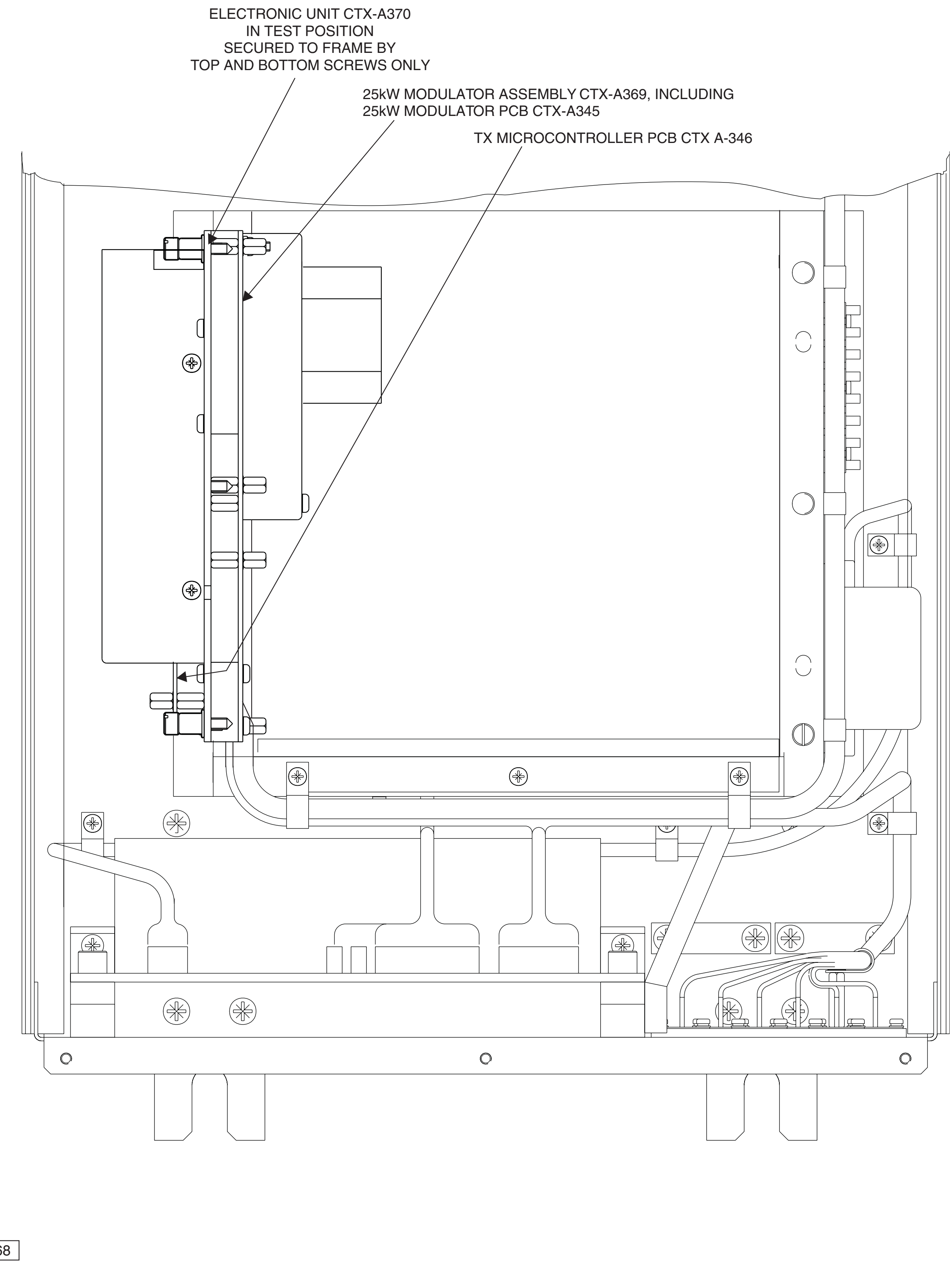


Figure 4d - Electronics Unit (CTX-A370) Mounted in the Test Position

Indicators, Test Points, Links and Switches (Figures 6d, 7d & 8d)

38 Indicators provided on PCBs are as follows:

(1) 25 kW FET Modulator PCB (CTX-A345)

	Grid		
D22	9G	300V SAFE	Lit when +27V disconnected from 300V power supply circuits (SW1 set to OFF)
D23	9F	300V UNSAFE	Lit when +27V applied to 300V power supply circuits (SW1 set to ON)
D24	4G	300V ACTIVE	Lit when 300V supply present Note: only lit when Tx Run command present.
D33	6E	HEATER	Lit when Heater Turndown circuit active TURNDOWN
D34	7D	S BAND	Lit for S-band magnetron

(2) Tx Microcontroller PC Figure 6d - 25kW Modulator Power PCB (CTX-A345): Indicators and Test Point Locations (CTX-A346)

	Grid		
D18	8F	TUNE	Lit when Tune ind signal present
D41	4E	PROCESSOR RUNNING	Flashes when processor running
D42	4E	EXT TRIG	Lit when external trigger pulses present
D43	4E	HEATER OK	Lit when heater OK, flashes slowly when timer running, flashes fast when heater has timed out
D44	4E	Not used	

39 Test points are located on the following PCBs;

(1) 25 kW FET Modulator PCB (CTX-A345)

	Grid	
TP1	7H	TR14 Gate Drive (27/300V FET)
TP2	8H	TR15 Gate Drive (27/300V FET)
TP3	3J	+5V
TP4	6D	+5V1
TP5	2H	REF V
TP6	9E	+10V
TP7	4J	+15V
TP8	9C	+27V Power
TP9	4J	+27V_B
TP10	3J	-15V
	Grid	
TP11	1E	Output of IC14 (Trig in Op Amp)
TP12	1D	Output of IC15, buffer for TRNN and TRNN (FET Gates Drive)
TP13	1C	Output of IC16 delay buffer for TR7 & TR9 (Tail Biter for FET Gates)
TP14	2B	Output of TRNN and TRNN (Main FETs Drive)
TP15	4G	Shorting point to test the 300 volts
TP16	1G	Output of IC2a (HV >250volts)
TP17	2J	Output of IC8b (Slow Start Ramp)
TP18	2J	Output of IC8a (AMC drive to IC1)
TP19	2H	IC8a pin 3 (SET Mag Current)
TP20	2G	Output of IC7 (Sample and Hold)
TP21	2G	IC7 pin 11 (Sample Pulse)
TP22	1J	Output of IC3a (Main FET I is Tripped)
TP23	1H	Output of IC3b (27V Power >6 amps) (I/P Overload Trip)
TP24	6E	Output of IC4b (27V Power >3 amps, Heater Turndown)
TP25	3F	Output of IC10 (Main FETs I Mon Pulse)
TP26	6D	Output of IC12a (Magnetron Type Detected)
TP27	7E	Output of IC12b (Magnetron Fitted)
TP28	2D	Positive for IC17 (approx +24V)
TP29	2D	Drain of TR9. FET Gate Amp
TP30	1E	FET Drive Voltage
TP31	4H	Positive end of D16 (+100V for Tx Mon)
TP32	8F	Positive end of D9 (to check L2 OK)
TP33	6F	Negative end of D11 (to check L2 OK)

	Grid	
TP34	2J	Input end of R10 (RUN STOP Command)
TP35	4J	IC1 pin 10 (Stop Run)
TP36	1J	Ground
TP37	1F	Ground
TP38	9A	Ground
TP39	9H	Ground
TP40	3H	RV1 Wiper (Test EHT)
TP41	4E/H	FET Leading Edge Drive Level

(2) Tx Microcontroller PCB (CTX-A346)

Test Point	Grid	Function
TP1	8A	Neon Signal
TP2	1B	Bootstrap Load enable. Serial link
TP3	1B	Reset. Serial link
TP4	7A	Azimuth Pulses
TP5	7A	Heading Line
TP6	7C	Tx Mon Pulse
TP7	5E	Rx Monitor Finger Reset
TP8	6E	Finger Reset Ramp
TP9	6A	Video Input
TP10	6A	Filtered Video Reference Level
TP11	5E	Finger Time Period
TP12	5B	Sample & Hold Output
TP13	5C	CAN Tx
TP14	5C	CAN Rx
TP15	1C	Dummy Trigger Pulse
TP16	2B	Mod Trigger Pulse
TP17	5C	Future use
TP18	5C	Future use
TP19	5D	Clock Pulse
TP20	5B	Rx Wedge Enable
EP1	1E	0V
EP2	8D	0V

(3) Logarithmic Receiver PCB (CTX-A356)

Test Point	Function
TP1	LED drive
TP2	Tune sample delay (intermediate)
TP3	LED drive
TP4	Sync
TP5	Tune Sample Delay
TP6	AFC drive
TP7	AFC
TP8	Vco indicator

40 Links and switches are located on the following PCBs:

(1) 25kW FET Modulator PCB (CTX-A345)

Link/ Switch	Grid	State	Function
LK1	**4G**	**MADE** **OPEN**	Connects 300V power output to FET drivers Disconnects 300V power output from FET drivers
SW1	**9F**	**MADE** **OPEN**	Enables +27V to SMPS Output Transformer (T1) HT (300V). Disabled for testing
SW2-A	**3H**	**MADE** **OPEN**	AMC connected AMC replaced with RV1 for servicing (Factory use only)
SW3-A	**2E**	**MADE** **OPEN**	Slope Control circuit working Slope control replaced by RV4 for servicing (Factory use only).
SW4-A	**7H**	**MADE** **OPEN**	+27V current overload protection circuit working For low power test of current trip level (Factory use only)

(2) Tx Microcontroller PCB (CTX-A346)

Switch	Grid	State	Function
SW1-1	**4A**	**ON** **OFF**	HL Interlock enabled HL Interlock overridden
SW1-2		**OFF** **ON**	Timer enabled Timer disabled
SW1-3		**ON** **OFF**	Jitter enabled No Jitter
SW1-4		**OFF** **ON**	HTLO inhibit enabled HTLO inhibit override
SW1-5			SPARE
SW1-6		**X**	A2 CAN bus } Set 0 to 7
SW1-7		**X**	A1 CAN bus } to give 1 of 8
SW1-8		**X**	A0 CAN bus } address codes
SW2-6	**3A**	**OFF** **ON**	Memory bank select No software in this memory
SW2-5		**ON** **OFF**	Ext trig terminated Ext trig not terminated
SW2-4		**ON** **OFF**	CAN bus terminated CAN bus not terminated

Switch	Grid	State	Function
SW2-3		**ON** **OFF**	Enables edge drive of noise diode Square wave drive
SW2-2		**ON** **OFF**	Video I/P terminated Video I/P unterminated
SW2-1		**OFF** **ON**	Antenna motor starts on RUN Antenna motor ON all the time

(3) Logarithmic Receiver PCB (CTX-A356)

Link	State	Function
LK1		Tune Sample delay (intermediate, approx 50ns)
LK2		Tune Sample delay (maximum, approx 100ns)
LK3		Tune Sample delay (minimum)
	NOTE: Only one of LK1, LK2 or LK3 is to be MADE. Selected for best AFC	
LK4		**Not Fitted**
LK5	**B** **A** **A & B** **OPEN**	Minimum AFC lock Intermediate AFC lock Maximum AFC lock
LK6	**A** **B**	3 bandwidths selected, SP, MP and LP/VLP 2 bandwidths selected, SP and LP
LK7	**OPEN** **MADE**	Minimum Vco gain Maximum Vco gain
LK8	**OPEN** **MADE**	X-band Selected S-Band Selected
LK9	**OPEN** **MADE**	S-Band Selected Sets regular output to +5V (X-band only)

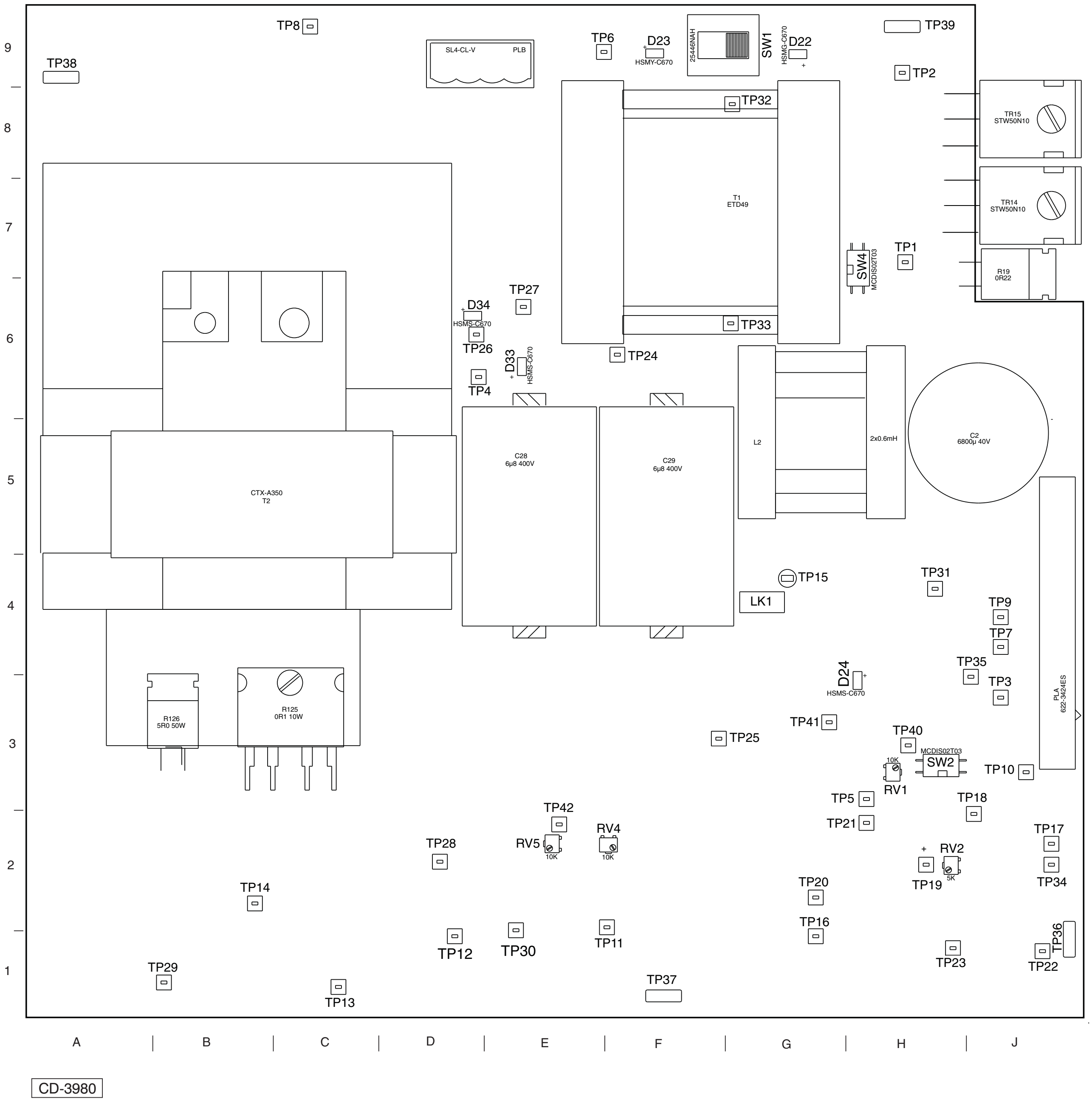


Figure 5d - 25kW Modulator Power PCB (CTX-A345): Indicators and Test Point Locations

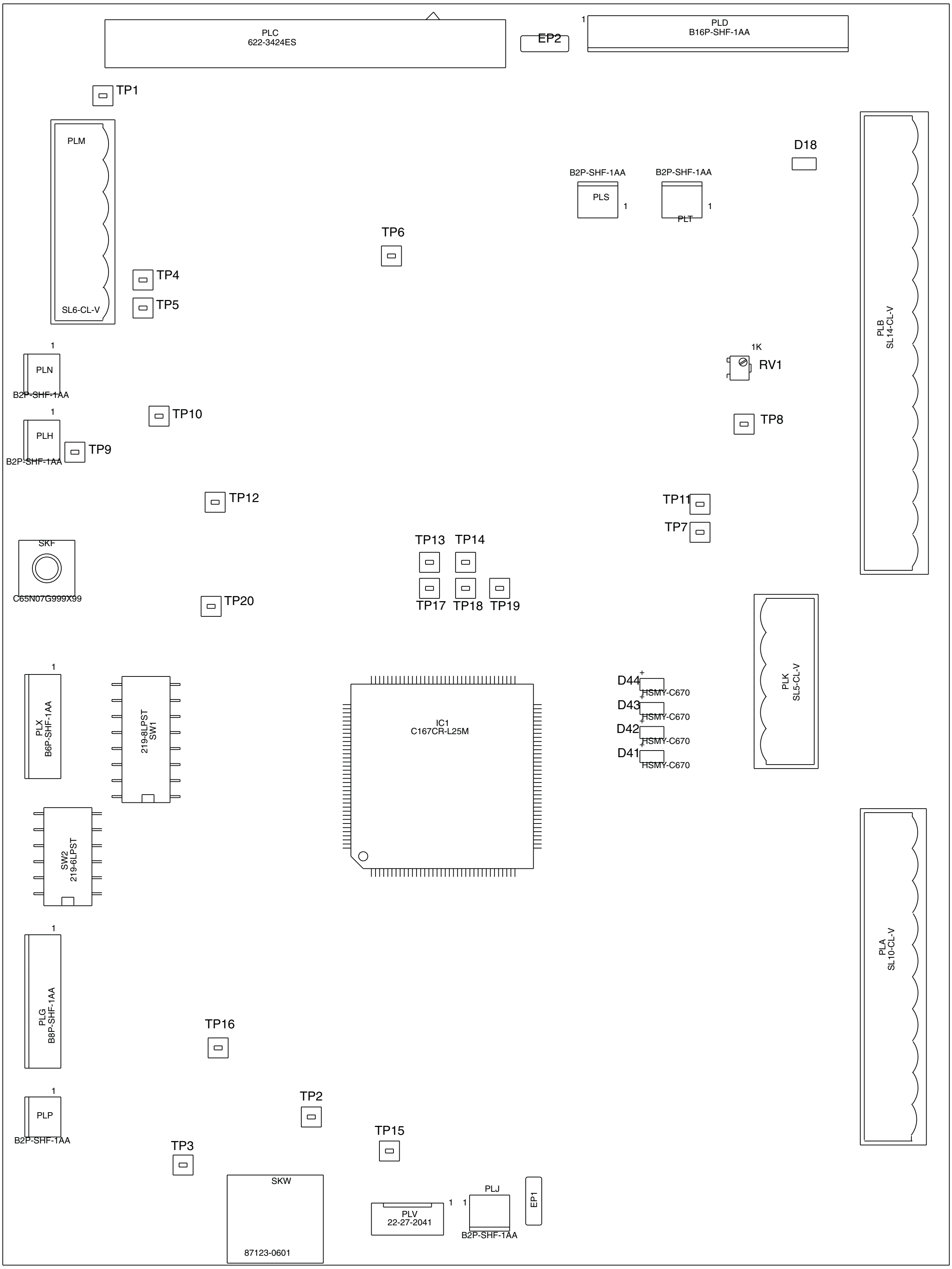


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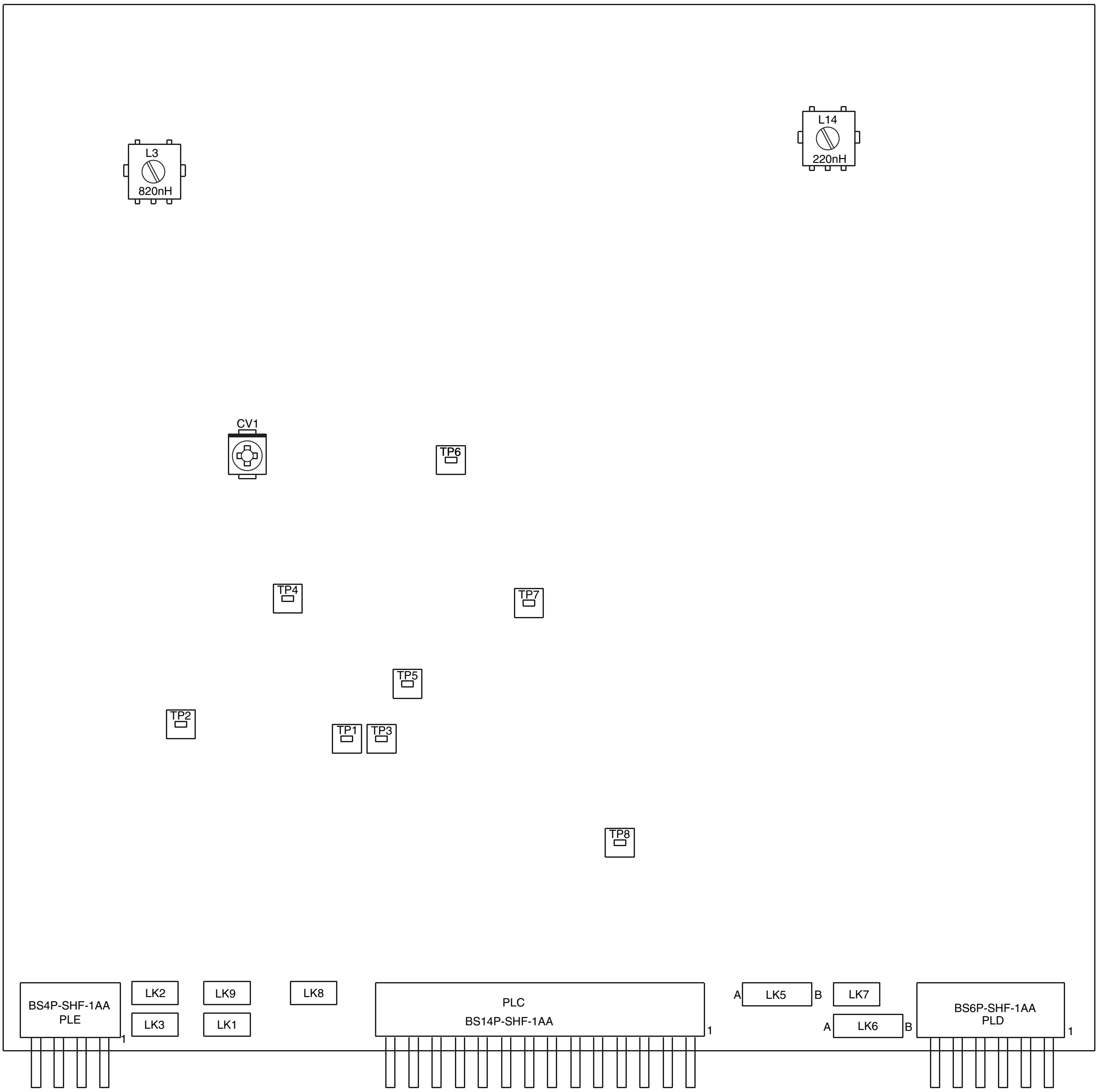
Figure 6d - Tx Microcontroller PCB (CTX-A346): Indicators and Test Point Locations



VIEW ON COMPONENT SIDE

NOTE: RV1 IS LOCATED ON UNDERSIDE OF PCB

CD-4012

Figure 7d - Logarithmic Receiver PCB (CTX-A356): Link and Test Point Locations

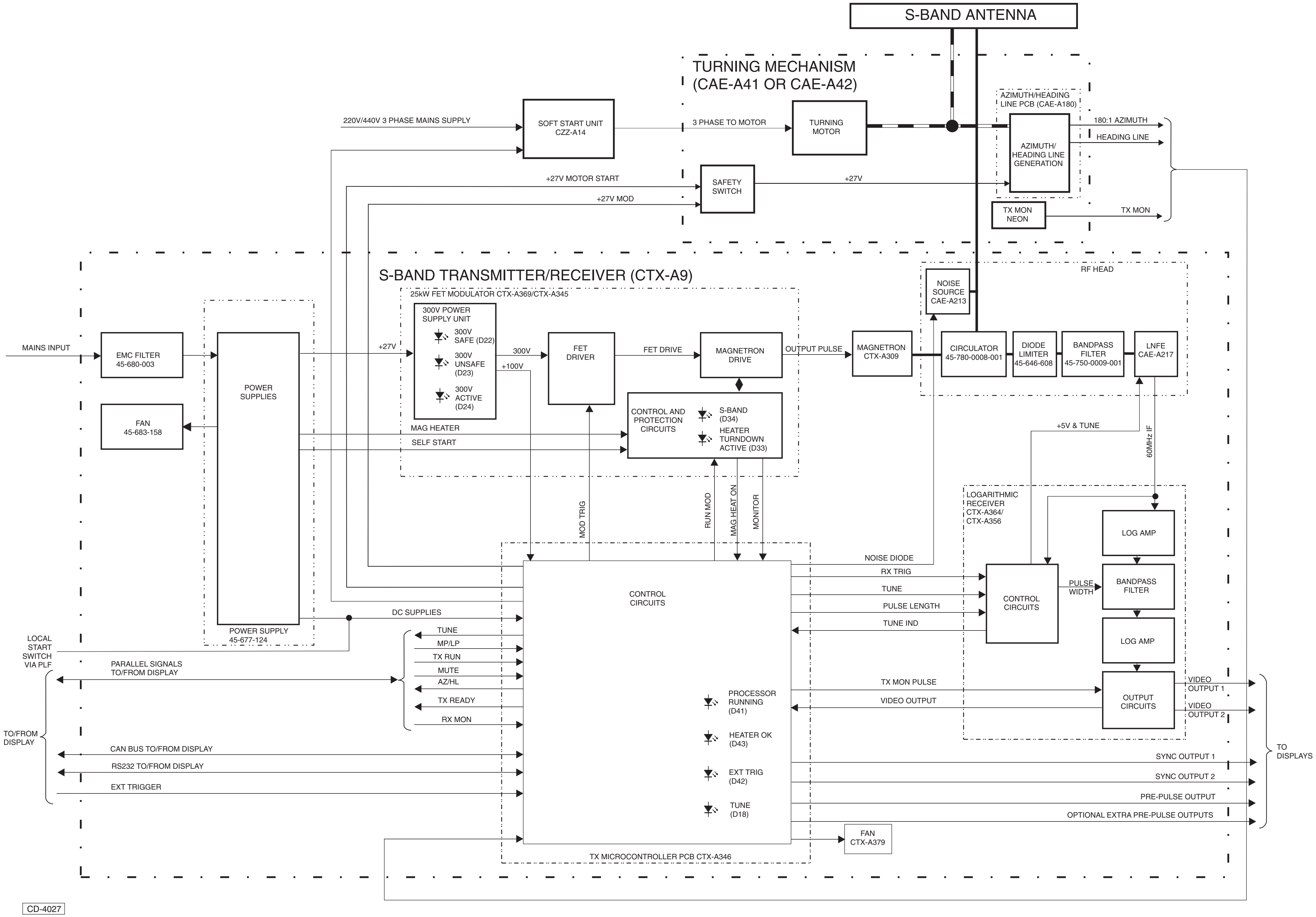


Figure 8d - MkVII S-Band Downmast Transceiver (CTX-A9) and Turning Mechanism: Functional Diagram **Figure 8d**

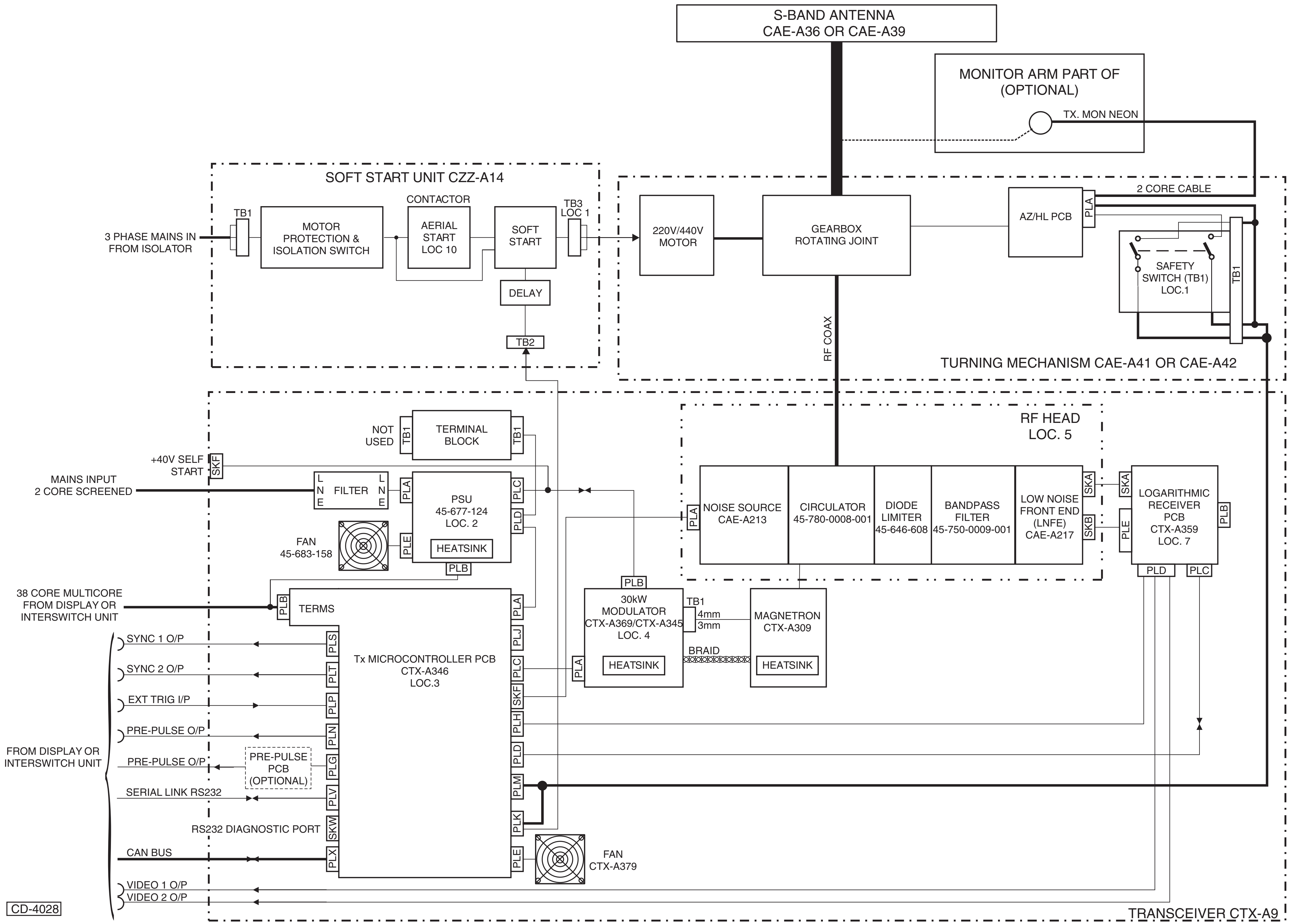


Figure 9d - MkVII S-Band Downmast Transceiver (CTX-A9) and Turning Mechanism: Interconnection Diagram **Figure 9d**

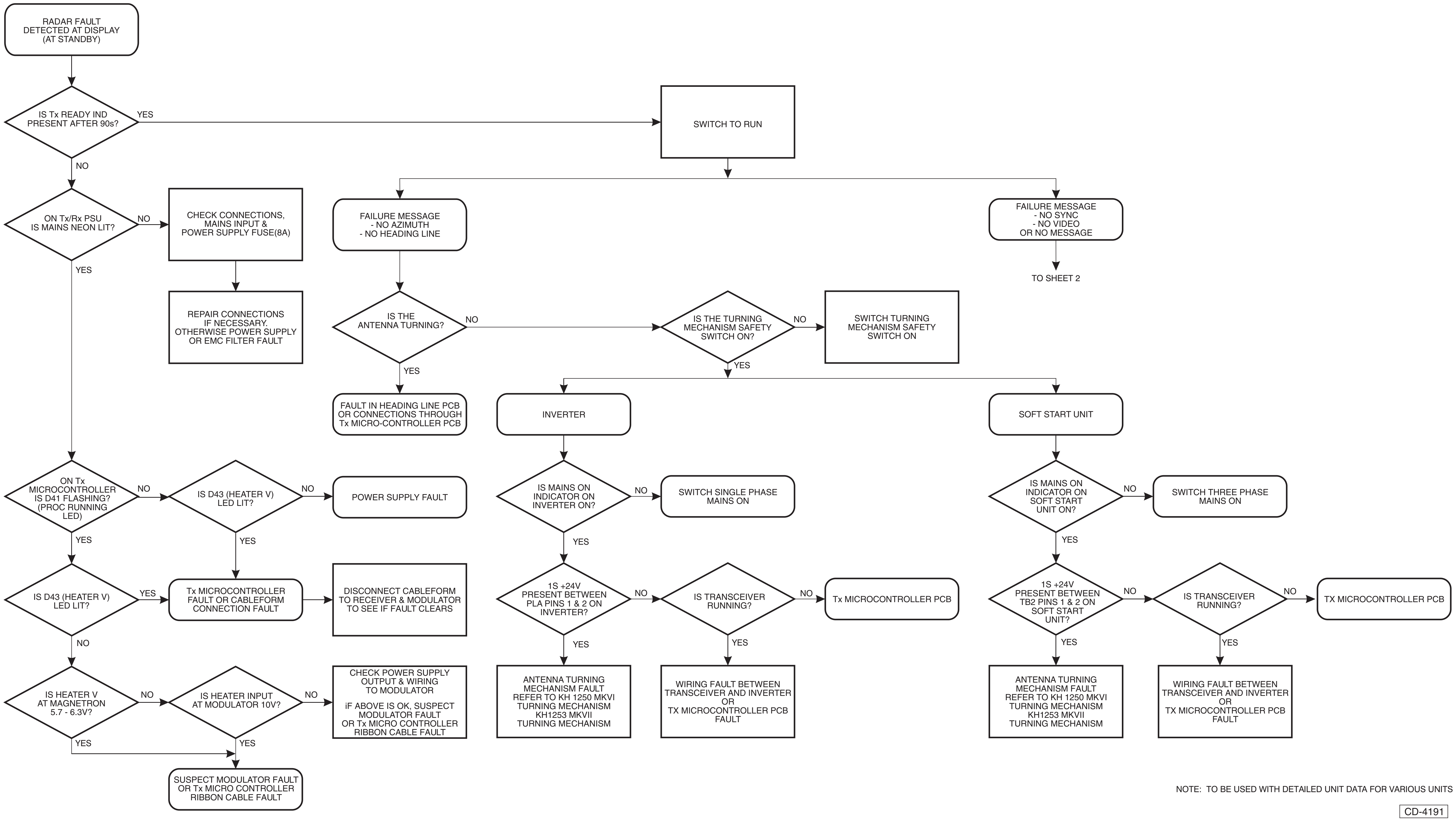


Figure 10d - Flowchart (sheet 1 of 2)

Figure 10d (Sheet 1)

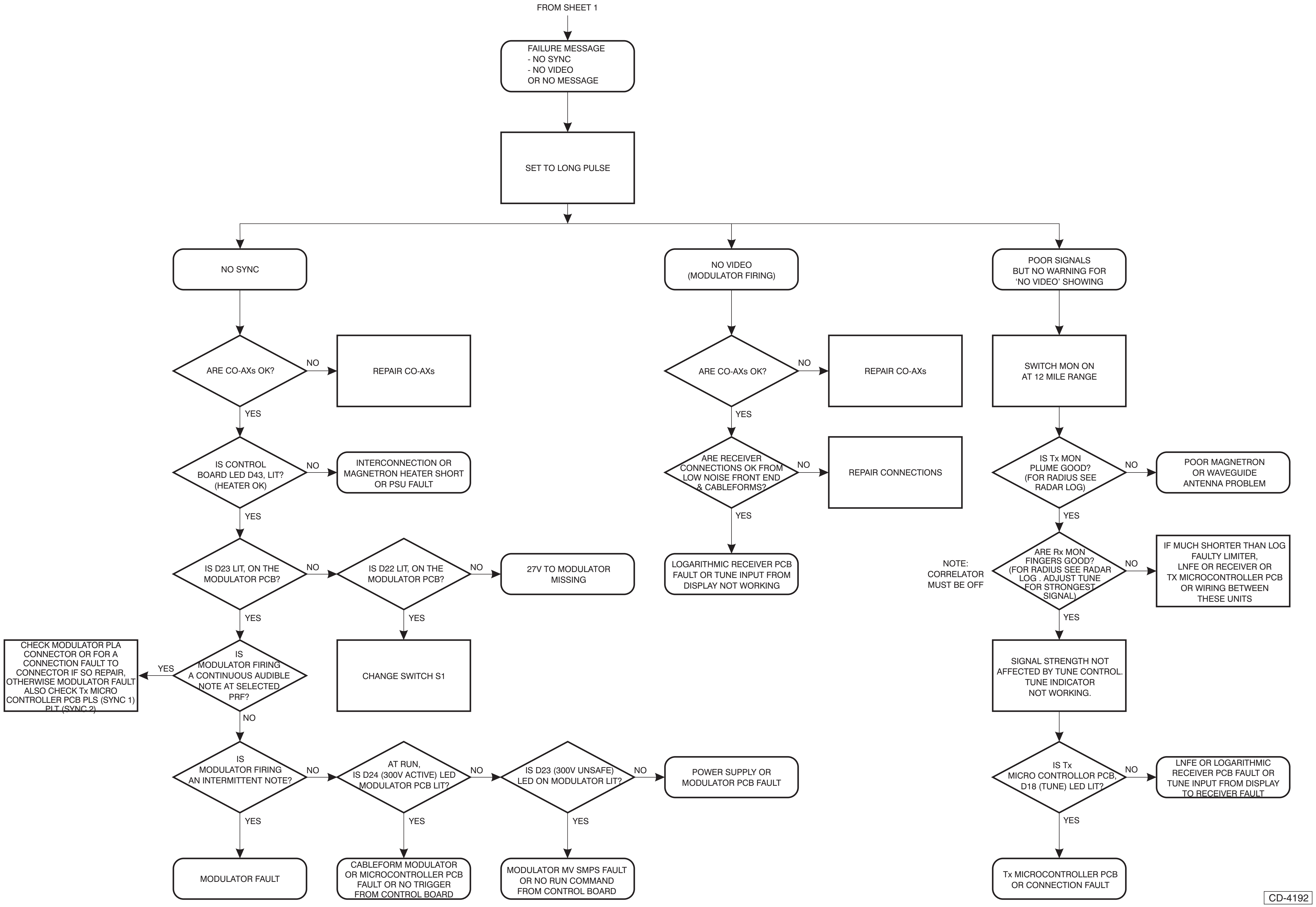


Figure 10d - Flowchart (sheet 2 of 2)

Figure 10d (Sheet 2)

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 PERMITTED FOR QUALIFIED TECHNICIANS.

PREVENTIVE MAINTENANCE

41 The following paragraphs describe preventive maintenance, expanding on the Diagnostics information.

42 The Transceiver requires no preventive maintenance, however, periodically (around every six months) check that all screws, nuts and bolts are secure and free from corrosion, and wipe the antenna clean using a soft cloth and mild detergent.

43 Every 12 months open the transceiver and check that the inside connections are secure and free from corrosion.

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CHAPTER 7E

MKVII TRANSMITTER/RECEIVER & ANTENNA (X-BAND)

INTRODUCTION

1 The MkVII X-Band Transceivers are available in a downmast configuration only, where the transceiver electronics are remote from the turning mechanism. The turning mechanism is located in a separate enclosure, located below deck.

2 The configuration shown in Figures 1e and 2e, is provided with a single phase mains input to the transceiver, which provides dc supplies for the turning motor.

SYSTEM DESCRIPTION

3 The transceiver (CTX-A8) is fitted with a logarithmic amplifier with AFC and employs fan cooling for the magnetron and modulator.

4 The magnetron energy is fed via a circulator and a waveguide 16 run to the rotating joint located in the turning mechanism and on to the antenna. Received signals from the antenna are routed via the rotating joint and waveguide to the circulator. Within the transceiver, the received signals are routed from the circulator to the RF limiter, bandpass filter and low noise front end to the Logarithmic Receiver.

5 The transceiver is normally muted whenever the antenna ceases to rotate. Pulse jitter, muting and sector transmission are standard facilities, with options for pre-pulse generation and external synchronisation.

6 The transceiver can be interfaced with any of the Nucleus series displays. In addition, facilities are provided for interfacing with the display via a Controller Area Network (CAN bus link).

7 The transceiver provides two SYNC and two VIDEO coaxial outputs.

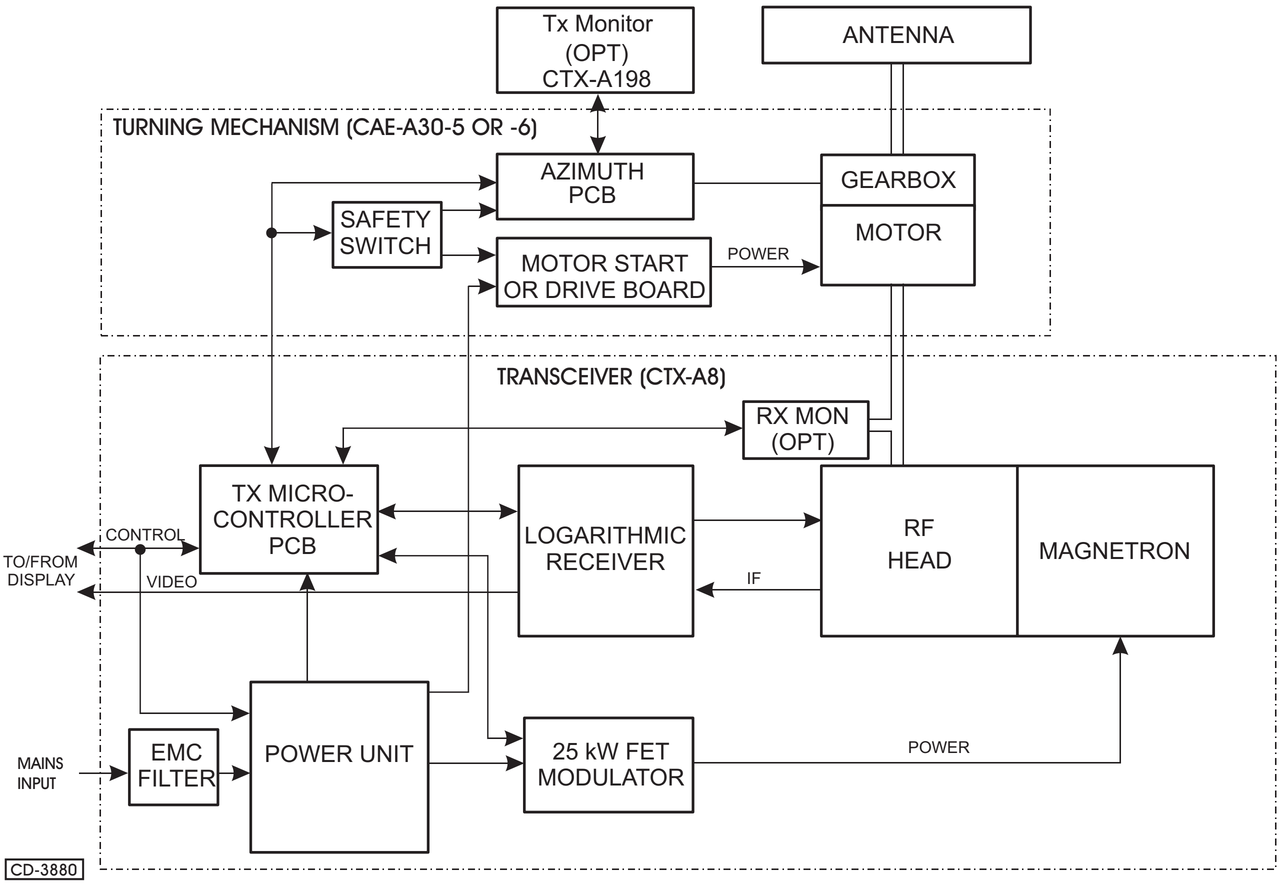

Figure 1e - X-Band (CTX-A8): Block Diagram

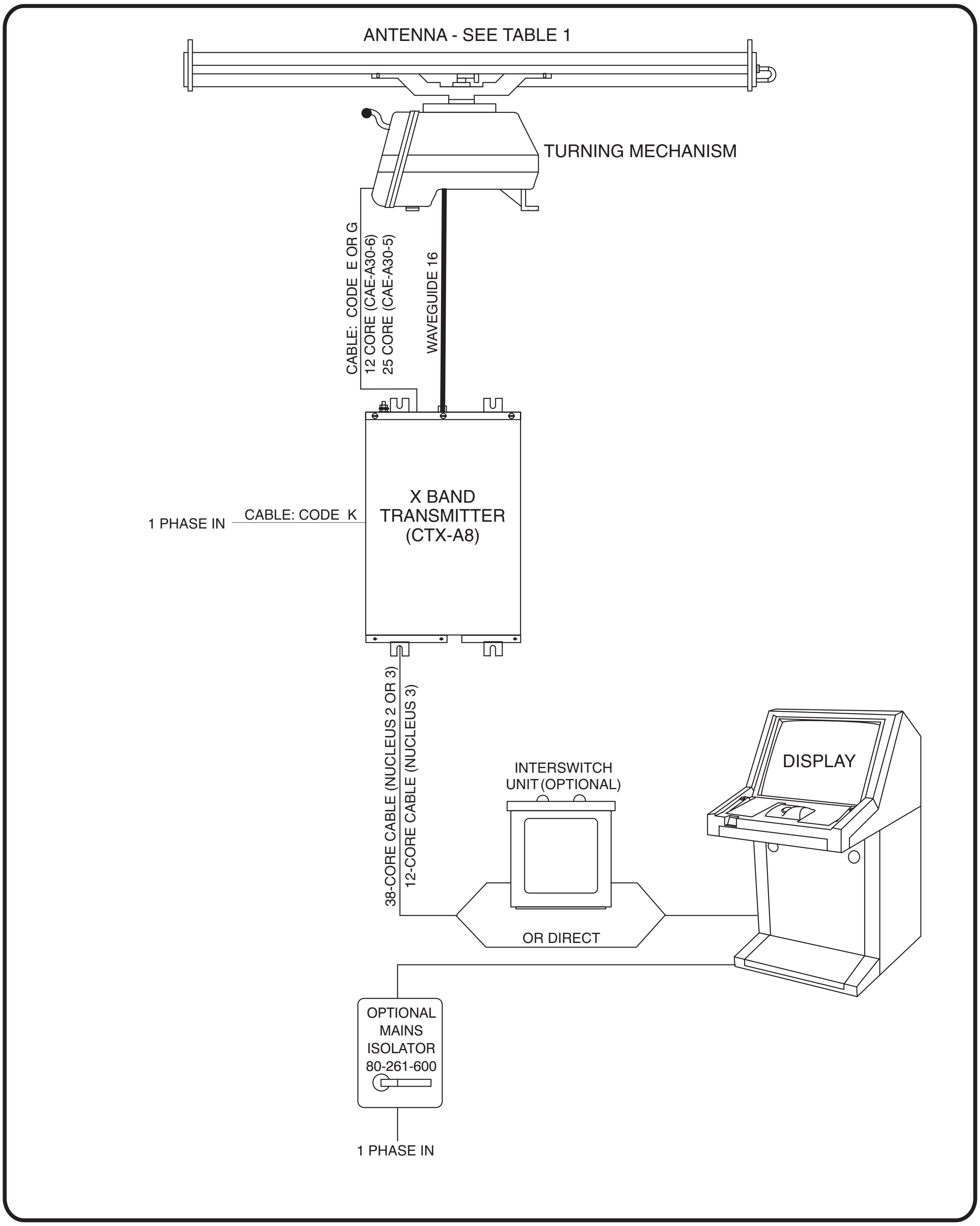

TABLE 1 ANTENNA OPTIONS
1.3m ANTENNA (CAE-A50)* 1.8m ANTENNA (CAE-A13/2) 2.4m ANTENNA (CAE-A25)
* NOT TYPE APPROVED

CABLE CODES

CABLE E - 12 CORE
CABLE G - 25 CORE
CABLE K - 2 CORE POWER
CABLE N - 38 CORE
CABLE R - 10 CORE + 2 COAXIAL

CD-3879

Figure 2e - Typical System Configuration X-Band (CTX-A8)

FUNCTIONAL DESCRIPTION

8 The X-Band downmast transceiver and antenna comprise a transceiver which is bulkhead mounted, and a mast mounted turning mechanism in a weatherproof compartment, with antenna attached. A Functional diagram for the X-band transceiver, turning mechanism and antenna is provided in Figure 10e, and the interconnections are shown in Figure 11e.

DOWNMAST TRANSCEIVER

Transmitter Circuits

9 The transceiver uses a 30kW magnetron to generate the RF output. The magnetron is driven by the 30kW FET modulator (CTX-A369), which consists of a 30kW Modulator PCB (CTX-A345)) mounted on a chassis together with the high power components, heatsink and RF shield.

10 The 30kW Modulator provides the following functions:

(1) A 300V power supply.

(2) Driver circuits for the modulator FETs.

(3) The FET modulator, which drives the magnetron (the FET are chassis mounted on the heatsink).

(4) Associated control and protection circuits

11 A switch on the 30kW Modulator PCB enables the +27V supply to the 300V power supply to be switched off for maintenance purposes (it is normally set to ON). The status of the power supply is indicated by LEDs mounted on the PCB, as follows:

(1) When the +27V is disconnected, the GREEN 300V SAFE LED is illuminated (i.e. The switch is set to OFF).

(2) When +27V is applied to the 300V power supply, the YELLOW 300V UNSAFE LED is illuminated (i.e. The switch is set to ON).

(3) When the presence of the 300V output is detected, the RED 300V ACTIVE LED is illuminated.

12 The status of the power supply is monitored by the protection circuits and the supply is switched OFF if an overvoltage is sensed.

13 The modulator magnetron drive automatically adjusts to compensate for variations in magnetron characteristics and to allow for the effects of the magnetron ageing. Control and protection circuits provide protection of the magnetron from overvoltages, etc.

14 The type of magnetron is detected and for this application, as an S-band magnetron is used, the RED S-BAND LED is illuminated indicating S-band.

15 The RED HEATER TURNDOWN LED is illuminated when the heater is switched OFF due to a fault being detected.

16 The output from the magnetron is passed via a circulator to the rotating joint and the antenna.

Receiver Circuits

17 The received RF radar returns are passed from the antenna to the circulator, which routes them to the Diode (RF) Limiter and Low Noise Front End (LNFE). The LNFE produces a 60MHz IF signal, which is passed to the Logarithmic Receiver PCB (CTX-A356), mounted in Receiver Assembly (CTX-A364), providing shielding of the PCB from high power RF signals. The Logarithmic Receiver provides two video outputs for use by the displays and one for the Rx Monitor in the transceiver.

18 A Tx Mon pulse is injected into the video signal to indicate, on the displays, that sufficient power is being transmitted.

19 The Logarithmic Receiver provides tuning control of the LFNE and a tune indication signal to the Tx Microcontroller PCB. The Logarithmic Receiver provides the regulated dc supply for the Low Noise Front End.

Control Circuits

20 The Tx Microcontroller PCB (CTX-A346) provides overall control of the transceiver using a microprocessor, and interfaces with the Display. Commands to and from the Display may be provided by one of the following:

(1) Parallel inputs and outputs to a standard Nucleus Display.

(2) Serial Link to the display, via an RS232 connection.

(3) Serial Link to the display, via a CAN bus connection.

21 The status of the control circuits is indicated by a number of LEDs, as follows:

(1) The PROCESSOR RUNNING LED flashes when the microprocessor is running normally.

(2) The HEATER OK LED is illuminated when the magnetron heater circuits are operational.

(3) The TUNE LED is illuminated when the tune signal is produced by the logarithmic receiver.

(4) The EXT TRIG LED is illuminated when an external trigger pulse is detected.

Power Supplies and Cooling

22 The dc supplies for the Transceiver, with the exception of the 300V for the modulator, are provided by a Power Supply Unit (45-677-124). The mains input is fed to the power supply via an EMC filter to prevent interference pulses from the transceiver circuits being conducted out onto the supply lines. The input is also protected against incoming high voltage spikes. The power supply provides the following dc supplies for the Transceiver and Turning Mechanism:

(1) +27V to drive the 300V power supply.

(2) +27V for general use.

(3) +15V.

(4) +5V.

(5) -15V.

23 Cooling of the transceiver is provided by two fans. One is located within the electronics unit and provides forced air cooling of the whole transceiver. The second fan is mounted on the front of the electronics unit and provides cooling for the high power components in the 25kW Modulator.

RF Head

24 The RF Head contains a 25kW magnetron, Circulator and a Waveguide outlet.

25 The Low Noise Front End (LFNE), (CTX-A323), Diode (pulse) Limiter and Filter Shim do not form part of the RF Head, but functionally complete the RF path. The LFNE (CTX-A323) comprises an RF Amplifier, Balance Mixer, Local Oscillator and IF Head Amplifier.

Antenna Turning Mechanism

26 A separate Antenna Turning Mechanism is required for the Downmast Transceiver.

27 Two versions of the turning mechanism can be used with the transceiver (CTX-A8)

(1) Low Speed (CAE-A30-6), which employs a 24V dc motor and rotates the antenna at 24rpm. The Transceiver power supply switch SW2 is set to ON to provide a +26V output to the motor.

(2) High Speed (CAE-A30-5), which employs a 36V brushless dc motor and rotates the antenna at 40rpm. The Transceiver power supply switch SW2 is set to OFF to provide the 36V dc output to the motor.

28 Either version of the turning mechanism can be fitted with 1.3m, 1.8m or 2.4m antennas.

SPECIFICATION

29 The technical specifications for the MkVII X-band Transceiver are as follows:

TRANSMITTER

	X-Band	
Frequency:	9410 10MHz	
Magnetron Rating:	25 kW nominal	
Magnetron Life:	10,000 Hours Typical	
Pulse Length and P.R.F:	Short (S)	nominal 0.055 s 3000pps 100
	Medium (M)	nominal 0.2 s 1500pps 40
	Long (L)	nominal 0.9 s 750pps 20
	Long-Low PRF(VL)	nominal 1.0 s 375pps 10
Sync. Output:	2 x 75 Ohm outputs not less than +12V amplitude	
Pulse to Pulse Jitter:	This will normally be activated and is 15 s from nominal period. This function can be inhibited.	

30 The PRF and Pulse Length can be set to other values via the RS232 link.

31 The above values are the nominal settings.

32 Receiver specifications are detailed opposite.

RECEIVER

	X-Band
Type::	**Logarithmic Receiver**
I.F:	**60MHz**
Video Output:	**2 x 75** **+5.5V to 6V peak signal**
System Overall Noise Figure:	**Nominal 4.5dB**

Operating Temperature Ranges: **Turning Mechanism**:	**X-Band**
Ambient Temperature Range::	-25°C to +70°C
Humidity:	95% at +40°C
Downmast Transceiver:	
Ambient Temperature Range:	-15°C to +55°C
Humidity:	95% at +40°C
CAE-A30-5 and CAE-A30-6 Turning Mechanism	**X-Band**
Azimuth Data:	90 pulses per revolution
Heading Data:	1 pulse per revolution

Input Power	**X-Band**
Input Power Single Phase:	110V/220V ac input
Input Power 3-Phase Low Speed (24rpm):	275W, 400VA
High Speed (40rpm):	340W, 500VA

DIAGNOSTICS

33 The Algorithms in this section 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

34 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

35 These failure messages appear in the data field of the display monitor if certain signals are missing. See Table 1 for details.

Table 1 - Failure Messages

SIGNAL	FAILURE MESSAGE	SIGNAL	FAILURE MESSAGE
Sync	No Sync.	Azimuth	No Azimuth
Video	No Video	Heading Line	No Heading Line

36 Fault diagnosis algorithms covering these failures are provided in Figure 12e, sheets 1 and 2.

TEST EQUIPMENT

37 Routine field maintenance requires fault location down to fuse replacement level. The only test equipment required for fault finding is a high impedance multimeter.

Table 2 - Fuses

FUSE No.	LOCATION	RATING
FS1	Power Unit	Resettable
FS2	Power Unit	Resettable
FS3	Power Unit	Resettable
FS1	Tx Microcontroller PCB	Resettable

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 PERMITTED FOR QUALIFIED TECHNICIANS.

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 static sensitive devices in their un-terminated state, or when handling modules containing such 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.

(2) Use non-magnetic tools when working near the magnetron.

38 To access the units inside the transceiver it is necessary to remove the front cover of the transceiver. This allows access to all the units except the 25kW Modulator PCB. The cover is removed by releasing the six captive screws. Observe all safety precautions as up to 300V is present on the modulator with power applied.

39 To access the indicators and the test points on the 25kW Modulator PCB, it is necessary to place the Electronics Unit (CTX-A370) in the test position, refer to Figure 6e. To place the Electronics Unit in the test position, proceed as follows:

(1) Remove all power supplies to the transceiver.

(2) Release the six captive screws securing the electronic assembly in position and carefully remove, ensuring that no cables are damaged.

(3) Secure the Electronics Unit in the test position on the side of the frame, with the left top and bottom captive screws (2 only), refer to Figure 6e. It is now possible to access the LED indicators and the test points on both sides of the unit.

(4) Restore power to the transceiver, observing all safety procedures, as up to 300VV may be present on the modulator.

40 If it is required to implement fault diagnosis without 300V present, set switch SW1 on the 25kW Modulator PCB to OFF. Ensure that the switch is returned to the ON position when testing is complete.

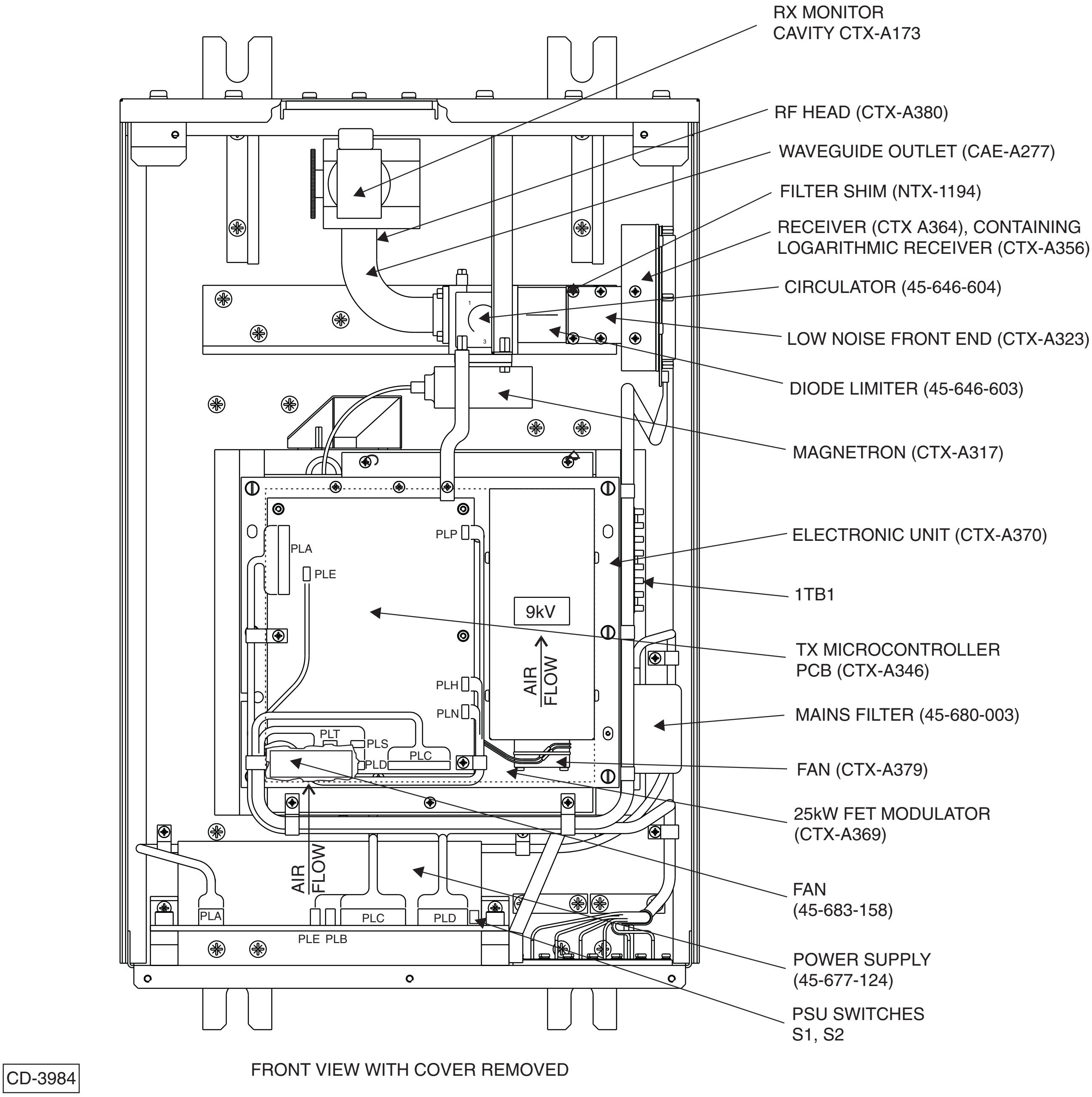

Figure 3e - Downmast Transceiver (CTX-A8): Module Locations

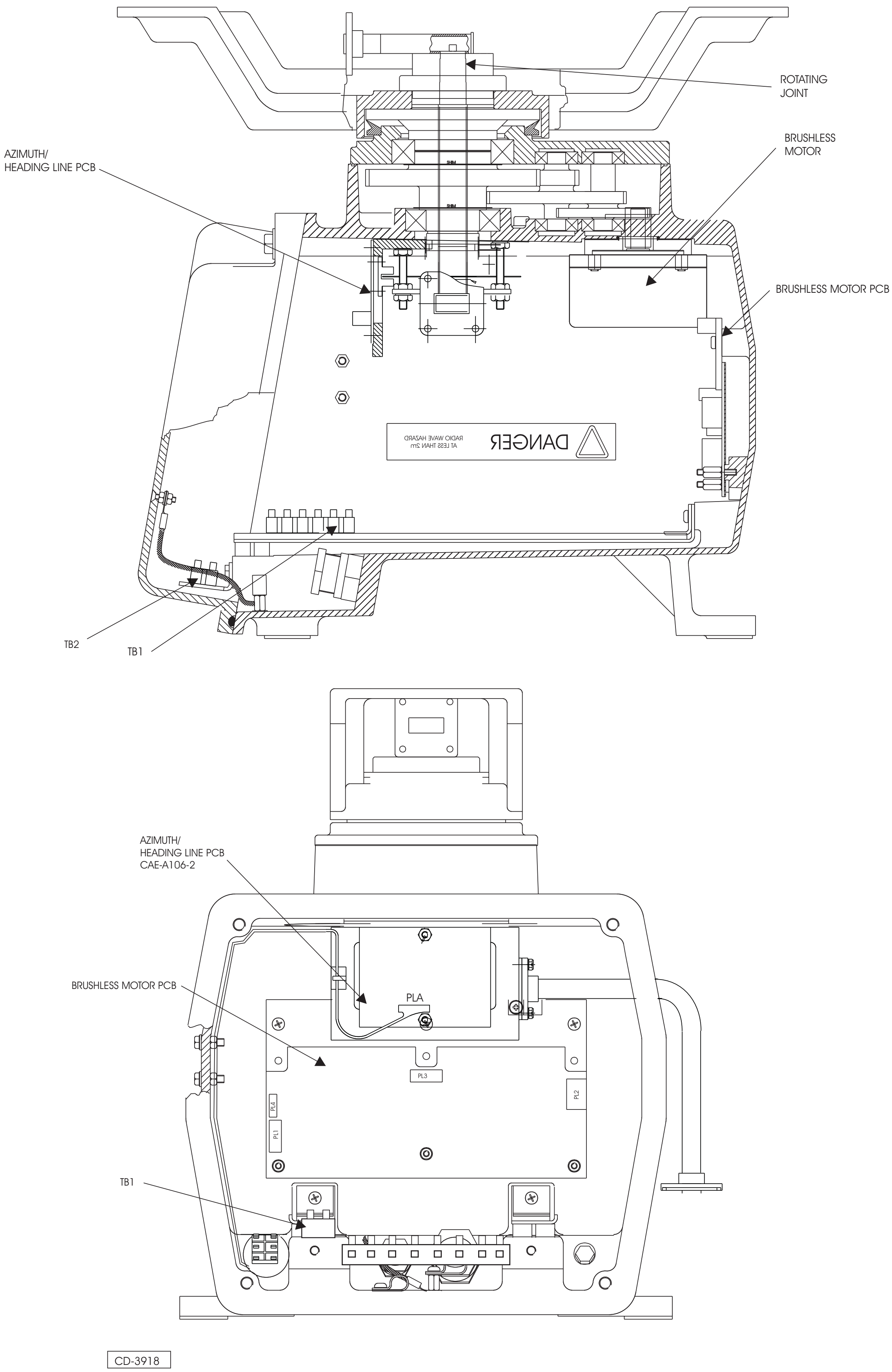

Figure 4e - Turning Mechanism (CAE-A30-5): Module Locations

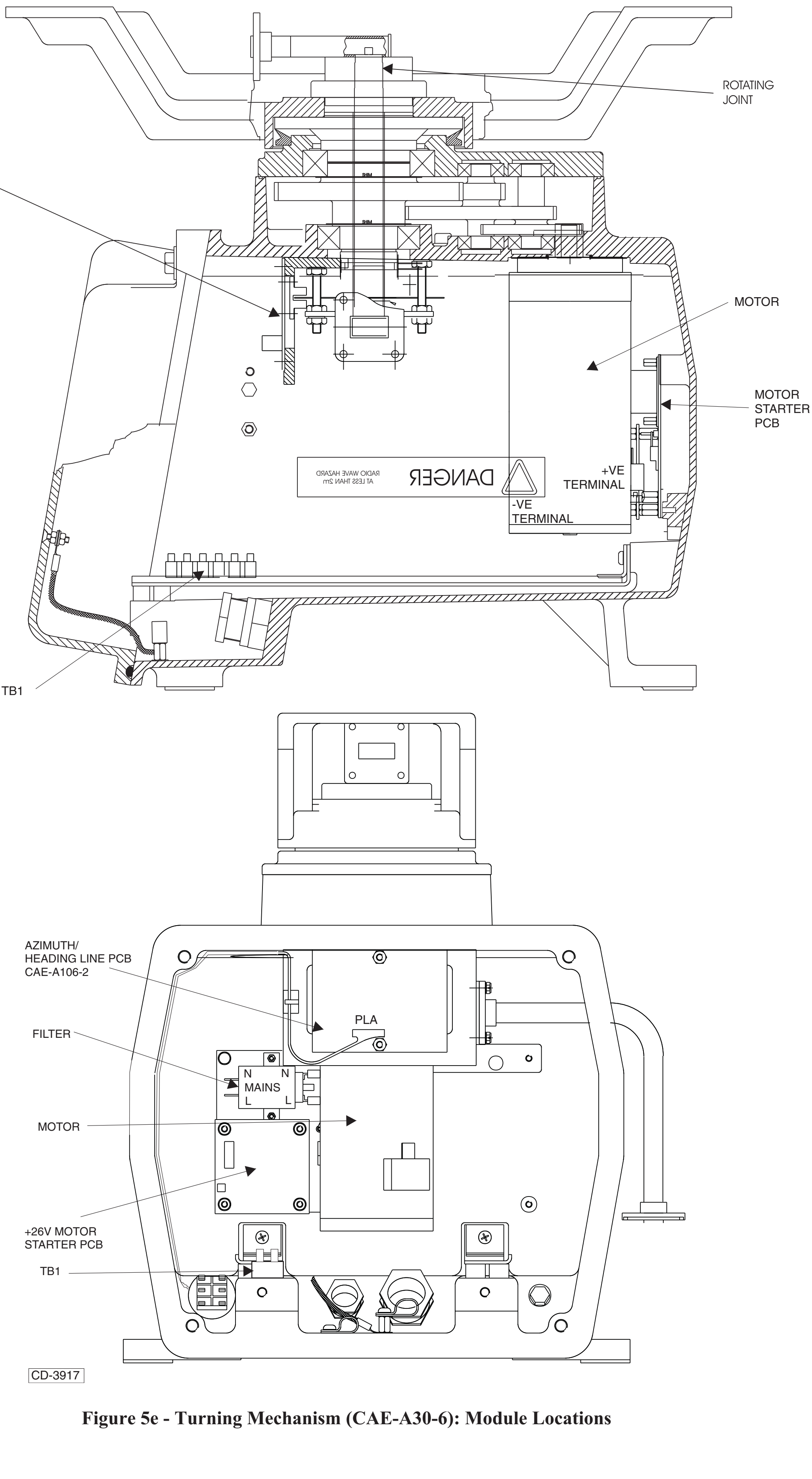

Figure 5e - Turning Mechanism (CAE-A30-6): Module Locations

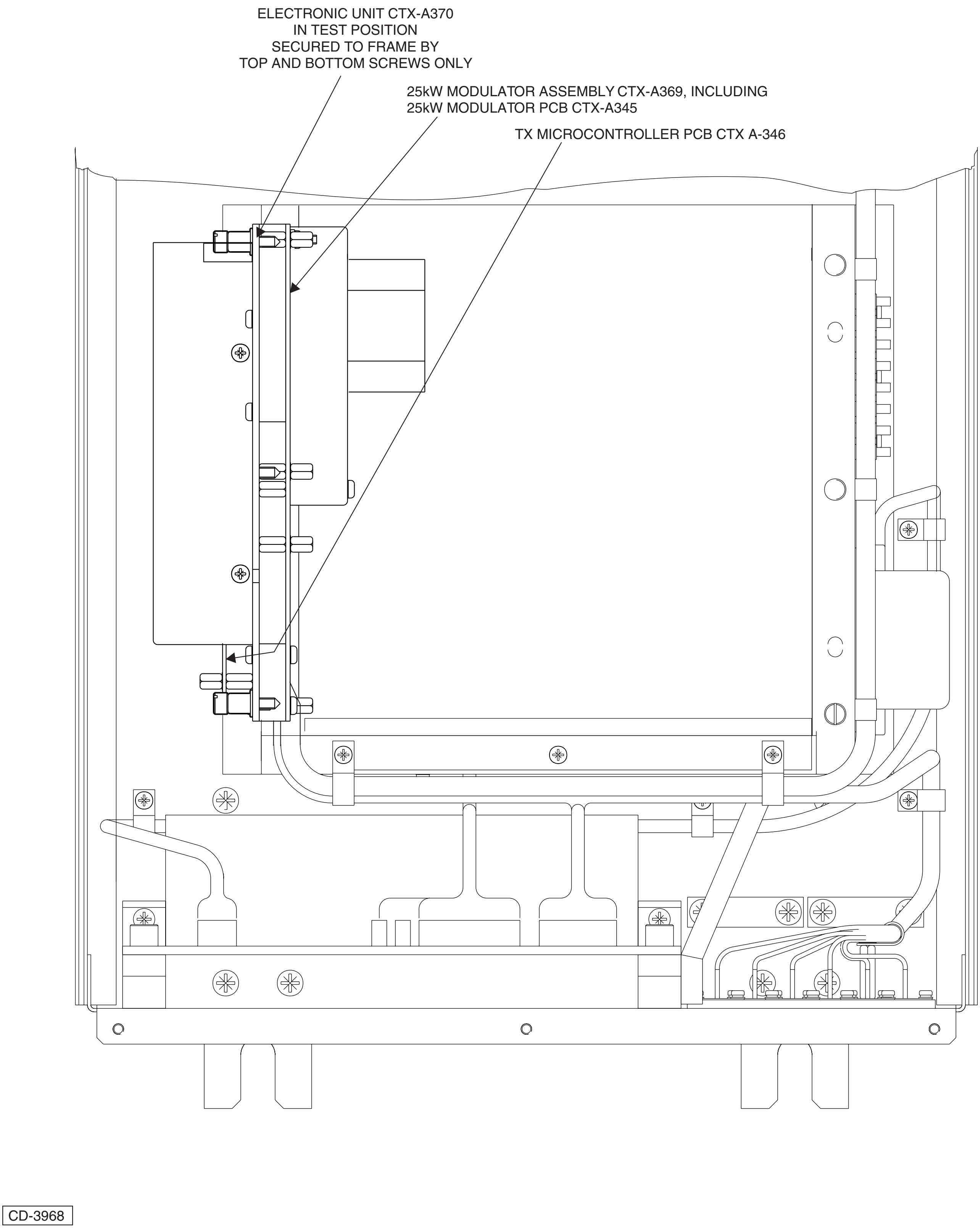

Figure 6e - Electronics Unit (CTX-A370) Mounted in the Test Position

INDICATORS, TEST POINTS, LINKS AND SWITCHES (FIGURES 7e, 8e & 9e)

41 Indicators provided on PCBs are as follows:

(1) 25kW FET Modulator PCB (CTX-A345)

	Grid		
D22	9G	300V SAFE	Illuminated when +27V disconnected from 300V power supply circuits (SW1 set to OFF)
D23	9F	300V UNSAFE	Illuminated when +27V applied to 300V power supply circuits (SW1 set to ON)
D24	4G	300V ACTIVE	Illuminated when 300V supply present Note: only illuminated when Tx Run command present
D33	6E	HEATER	Illuminated when Heater Turndown circuit is active TURNDOWN
D34	7D	S BAND	Illuminated for S-Band Magnetron use

(2) Tx Microcontroller PCB (CTX-A346)

	Grid		
D18	8F	TUNE	Illuminated when Tune Ind signal is present
D41	4E	PROCESSOR RUNNING	Flashes when processor is running
D42	4E	EXT TRIG	Illuminated when External Trigger pulses are present
D43	4E	HEATER OK	Illuminated when Heater OK, flashes slowly when timer is running. Flashes Fast when heater has timed out
D44	4E	Not Used	

42 Test Points are located on the following PCBs:

(1) 25kW FET Modulator PCB (CTX-A345)

Test Point	Grid	
TP1	7H	TR14 Gate Drive (27V/300V FET)
TP2	8H	TR15 Gate Drive 927V/300V FET)
TP3	3J	+5V
TP4	6D	+5V1
TP5	2H	REF V
TP6	9E	+10V
TP7	4J	+15V
TP8	9C	+27V Power
TP9	4J	+27V-B
TP10	3J	-15V
TP11	1E	Output of IC14 (Trig Op Amp)
TP12	1D	Output of IC15, buffer for TRNN and TRNN (FET Gates Drive)
TP13	1C	Output of IC16 delay buffer for TR7 & TR9 (Tail Biter for FET Gates)
TP14	2B	Output of TRNN and TRNN (Main FETs Drive)
TP15	4G	Shorting Point to test the 300V
TP16	1G	Output of IC2a (HV >250V)
TP17	2J	Output of IC8b (Slow Start Ramp)
TP18	2J	Output of IC8a (AMC drive to IC1)
TP19	2H	IC8a Pin 3 (SET Mag Current)
TP20	2G	Output of IC7 (Sample and Hold)
TP21	2G	IC7 pin 11 (Sample Pulse)
TP22	1J	Output of IC3a (Main FET I is tripped)
TP23	1H	Output of IC3b (27V Power >6 amps) (I/P Overload Trip)
TP24	6E	Output of IC4b (27V Power >3 amps, Heater Turndown)
TP25	3F	Output of IC10 (Main FETs I Mon Pulse)
TP26	6D	Output of IC12a (Magnetron Type Detected)
TP27	7E	Output of IC12b (Magnetron Fitted)
TP28	2D	Positive for IC17 (approx. +24V)
TP29	2D	Drain of TR9, FET Gate Amp
TP30	1E	FET Drive Voltage
TP31	4H	Positive end of D16 (+100V for Tx Mon)
TP32	8F	Positive end of D9 (to check L2 OK)
TP33	6F	Negative end of D11 (to check L2 OK)
TP34	2J	Input end of R10 (RUN STOP Command)

Test Point	Grid	
TP35	4J	IC1 Pin 10 (Stop Run)
TP36	1J	Ground
TP37	1F	Ground
TP38	9A	Ground
TP39	9H	Ground
TP40	3H	RV1 Wiper (Test EHT)
TP41	4E/H	FET Leading Edge Drive Level

(2) Tx Microcontroller PCB (CTX-A346)

Test Point	Grid	Function
TP1	8A	Neon Signal
TP2	1B	Bootstrap Load enable. Serial Link
TP3	1B	Reset Serial Link
TP4	7A	Azimuth Pulses
TP5	7A	Heading Line
TP6	7C	Tx Mon Pulse
TP7	5E	Rx Monitor Finger Reset
TP8	6E	Finger Reset Ramp
TP9	6A	Video Input
TP10	6A	Filtered Video Reference Level
TP11	5E	Finger Time Period
TP12	5B	Sample & Hold Output
TP13	5C	CAN Tx
TP14	5C	CAN Rx
TP15	1C	Dummy Trigger Pulse
TP16	2B	Mod Trigger Pulse
TP17	5C	Future Use
TP18	5C	Future Use
TP19	5D	Clock Pulse
TP20	5B	Rx Wedge Enable
EP1	1E	0V
EP2	8D	0V

(3) Logarithmic Receiver

Test Point	Function
TP1	LED Drive
TP2	Tune Sample Delay (intermediate)
TP3	LED Drive
TP4	Sync
TP5	Tune Sample Delay
TP6	AFC Drive
TP7	AFC
TP8	Vco Indicator

43 Links and switches are located on the following PCBS:

(1) 25kW FET Modulator PCB (CTX-A345)

Link/ Switch	Grid	State	Function
LK1	4G	MADE	Connects 300V power output to FET drivers
		OPEN	Disconnects 300V power output from FET drivers
SW1	9F	MADE	Enables +27V to SMPS Output Transformer (T1)
		OPEN	HT (300V0 Disabled for testing
SW2-A	3H	MADE	AMC Connected
		OPEN	AMC replaced with RV1 for servicing (Factory Use Only)
SW3-A	2E	MADE	Slope Control Circuit working
		OPEN	Slope Control replaced by RV4 for servicing (Factory Use Only)
SW4-A	7H	MADE	+27V current overload protection circuit working.
		OPEN	For low power test of current trip level (Factory Use Only)

(2) Tx Microcontroller PCB (CTX-A346)

Switch	Grid	State	Function
SW1-1	4A	ON OFF	HL Interlock enabled HL Interlock overridden
SW1-2		OFF ON	Timer enabled timer Timer disabled
SW1-3		ON OFF	Jitter enabled No Jitter
SW1-4		OFF ON	HTLO inhibit enabled HTLO inhibit override
SW1-5			SPARE
SW1-6		X	A2 CAN bus }Set 0 to 7
SW1-7		X	A1 CAN bus }to give 1 of 8
SW1-8		X	A0 CAN bus } address codes
SW2-6	3A	OFF ON	Memory Bank Select No software in this memory
SW2-5		ON OFF	Ext Trig terminated Ext. Trig not terminated
SW2-4		ON OFF	CAB bus terminated CAN bus not terminated
SW2-3		ON OFF	Enables wedge drive of noise diode Square Wave drive
SW2-2		ON OFF	Video I/P terminated Video I/P unterminated
SW2-1		OFF ON	Antenna Motor starts on Run Antenna Motor ON all the time

(3) Logarithmic Receiver PCB (CTX-A356)

Link	State	Function
LK1	MADE OPEN	Connects 300V power output to FET drivers Disconnects 300V power output from FET drivers
LK2	MADE OPEN	Enables +27V to SMPS Output Transformer (T1) HT (300V0 Disabled for testing
LK3	MADE OPEN	AMC Connected AMC replaced with RV1 for servicing (Factory Use Only)
	NOTE: Only one of LK1, LK2 or LK3 is to be MADE. Selected for best AFC.	
LK4		Not Fitted
LK5	B A A & B OPEN	Minimum AFC Lock Intermediate AFC lock Maximum AFC Lock
LK6	A B	3 bandwidths selected, SP, MP and LP/VLP 2 bandwidths selected, SP add LP
LK7	OPEN MADE	Minimum Vco gain Maximum Vco gain
LK8	OPEN MADE	X-band Selected s-band Selected
LK9	OPEN MADE	S-band Selected Sets regular output to +5V (X-band only)

Figure 7e - 25kW Modulator Power PCB (CTX-A345): Indicators and Test Point Locations

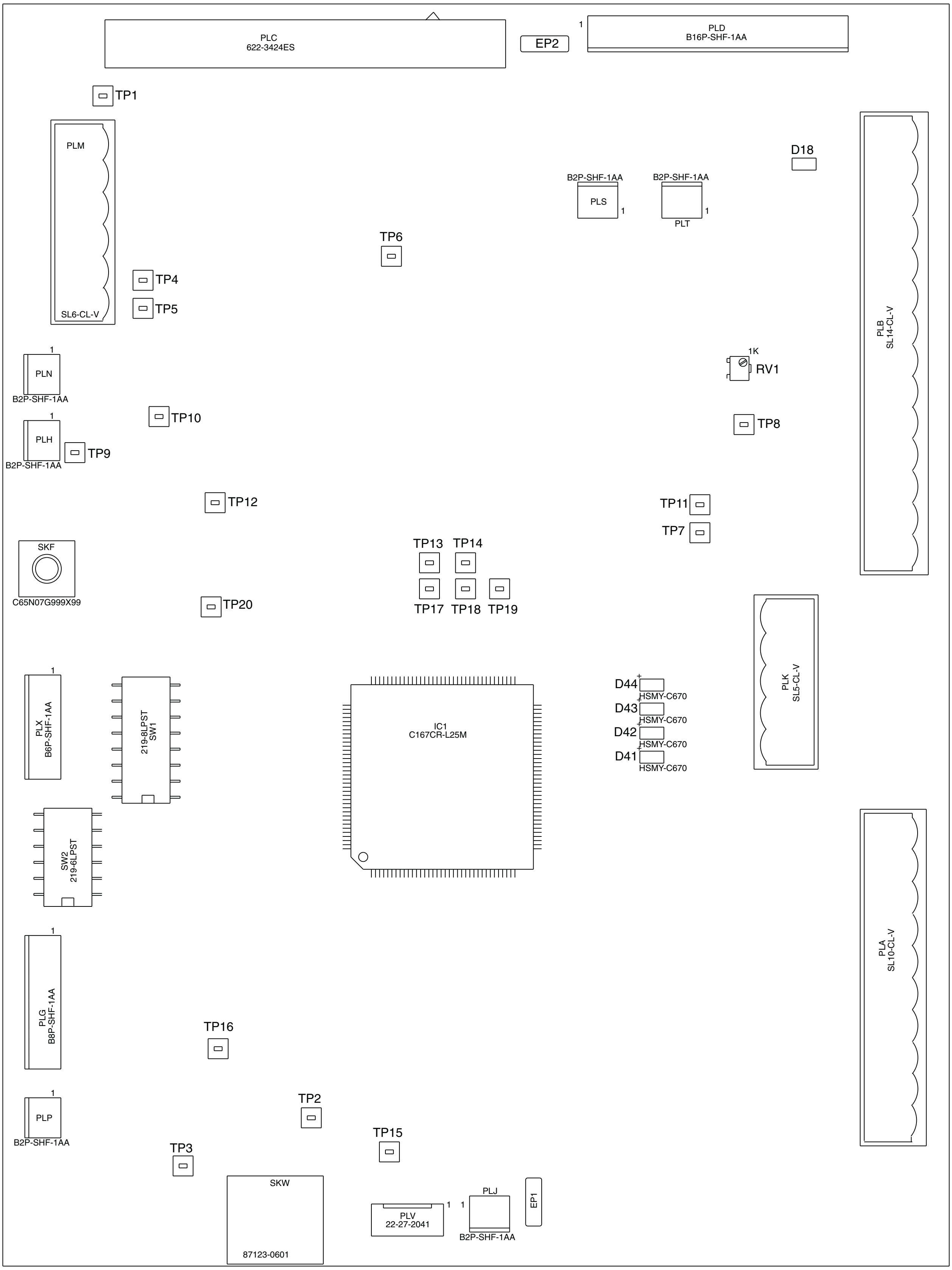

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Figure 8e - Tx Microcontroller PCB (CTX-A346): Indicators and Test Point Locations

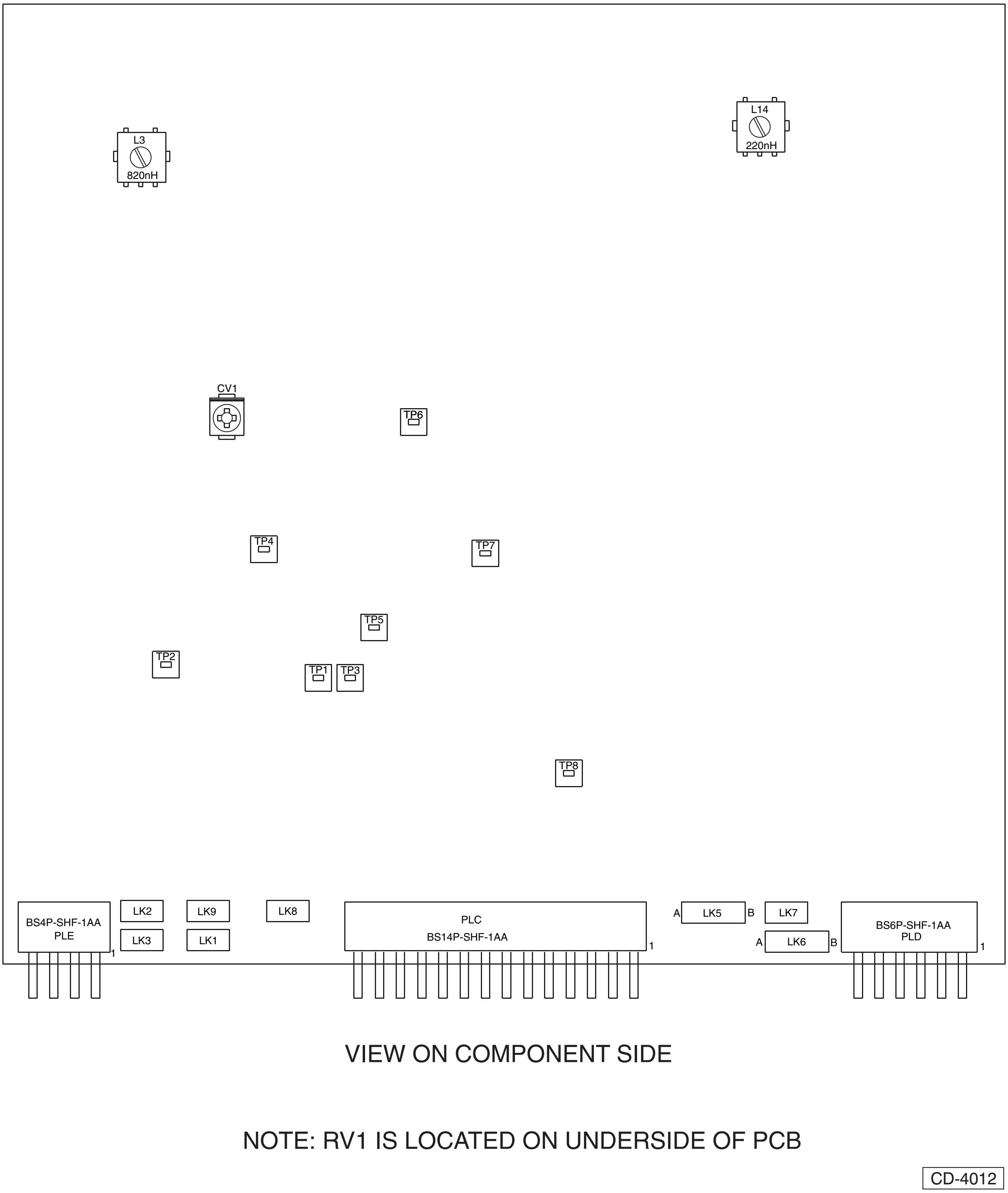


Figure 9e - Logarithmic Receiver PCB (CTX-A356): Link and Test Point Locations

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 PERMITTED TO QUALIFIED TECHNICIAN

PREVENTIVE MAINTENANCE

44 The Transceiver requires no preventive maintenance. However, periodically (around every six months) check that all screws, nuts and bolts are secure and free from corrosion, and wipe the antenna clean using a soft cloth and mild detergent.

46 Every 12 months, open the transceiver and check that the inside connections are secure and free from corrosion.

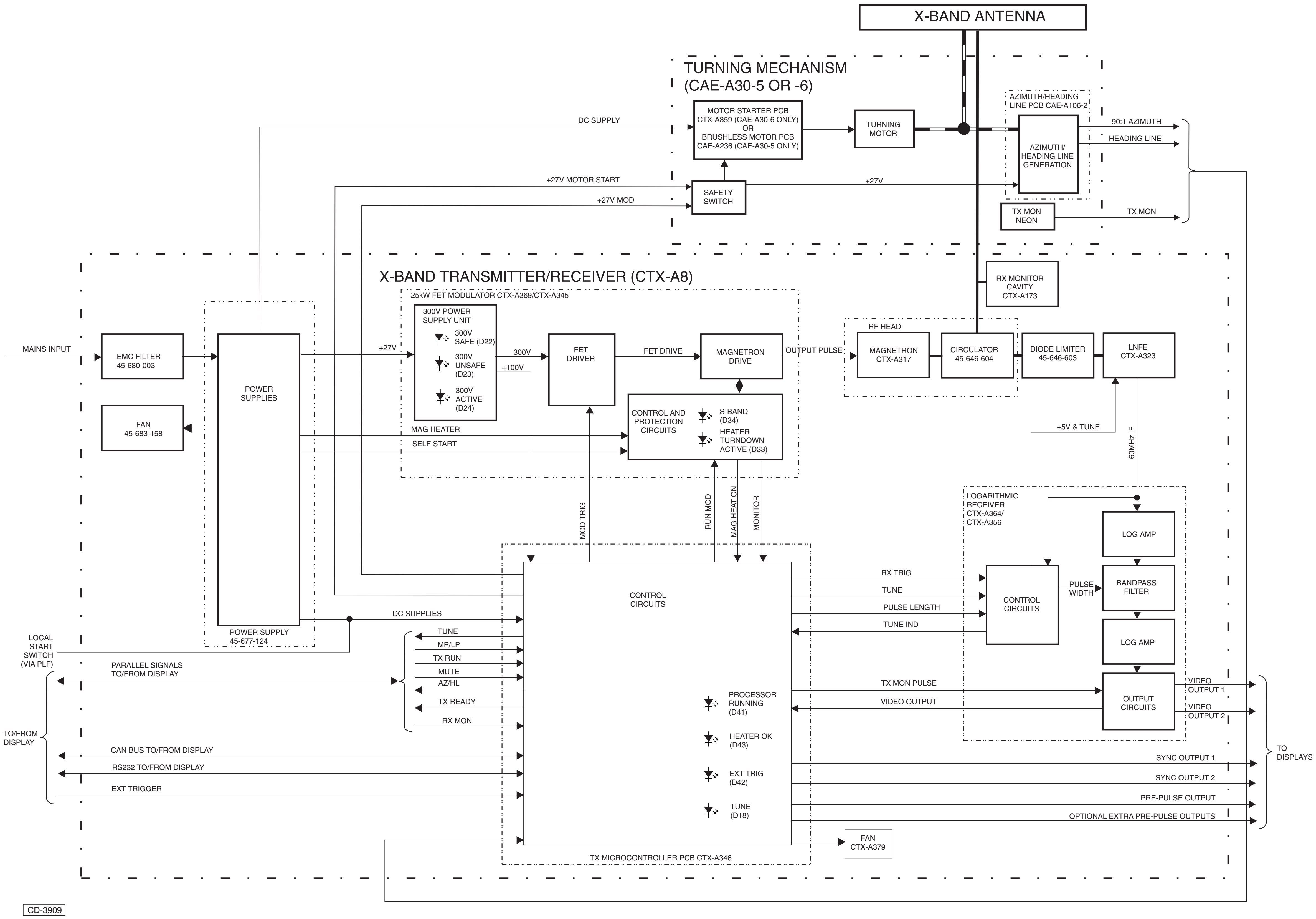


Figure 10e - MkVII X-Band Downmast Transceiver (CTX-A8) and Turning Mechanism: Functional Diagram **Figure 10e**

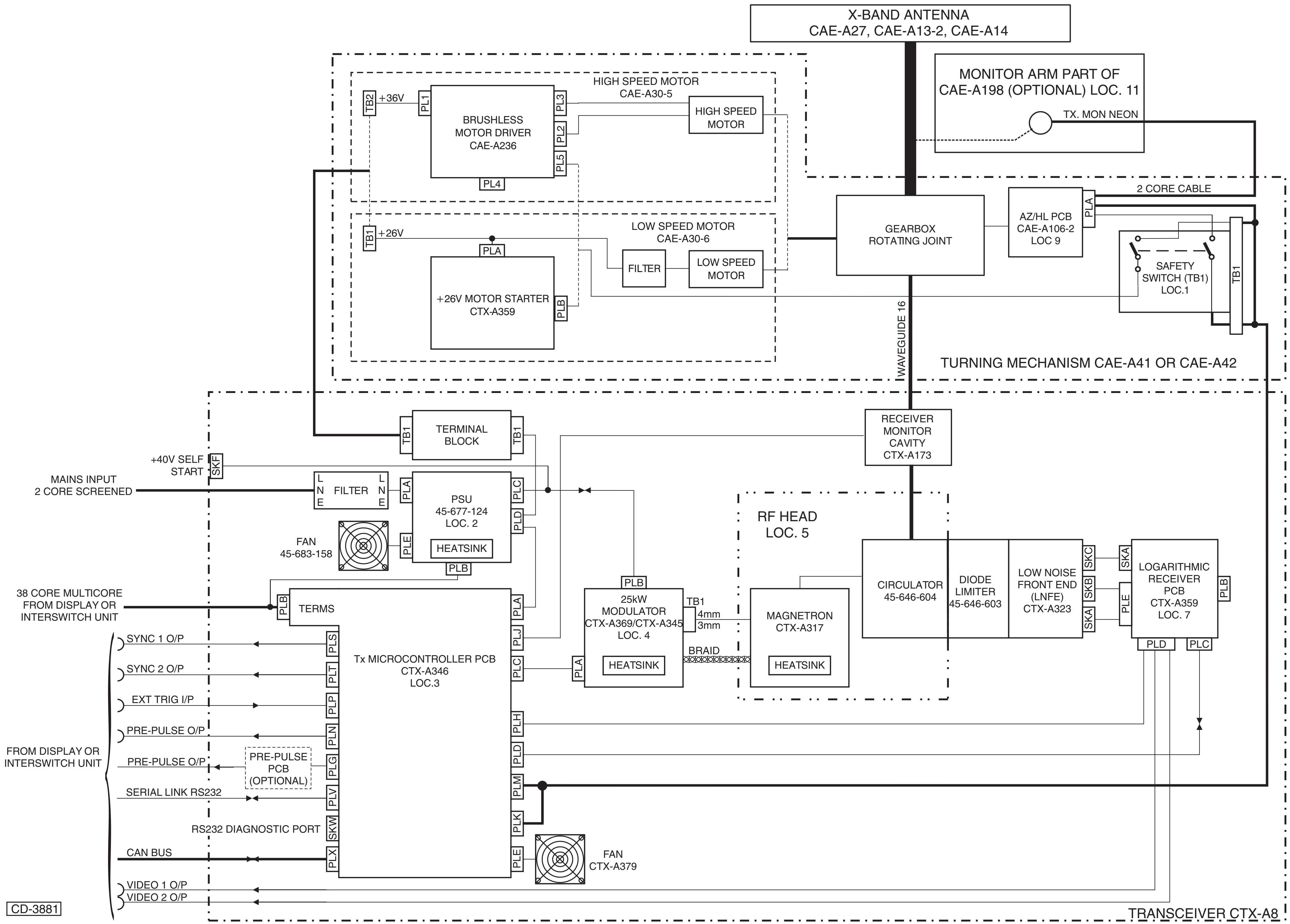


Figure 11e - MkVII X-Band Downmast Transceiver (CTX-A8) and Turning Mechanism: Interconnection Diagram **Figure 11e**

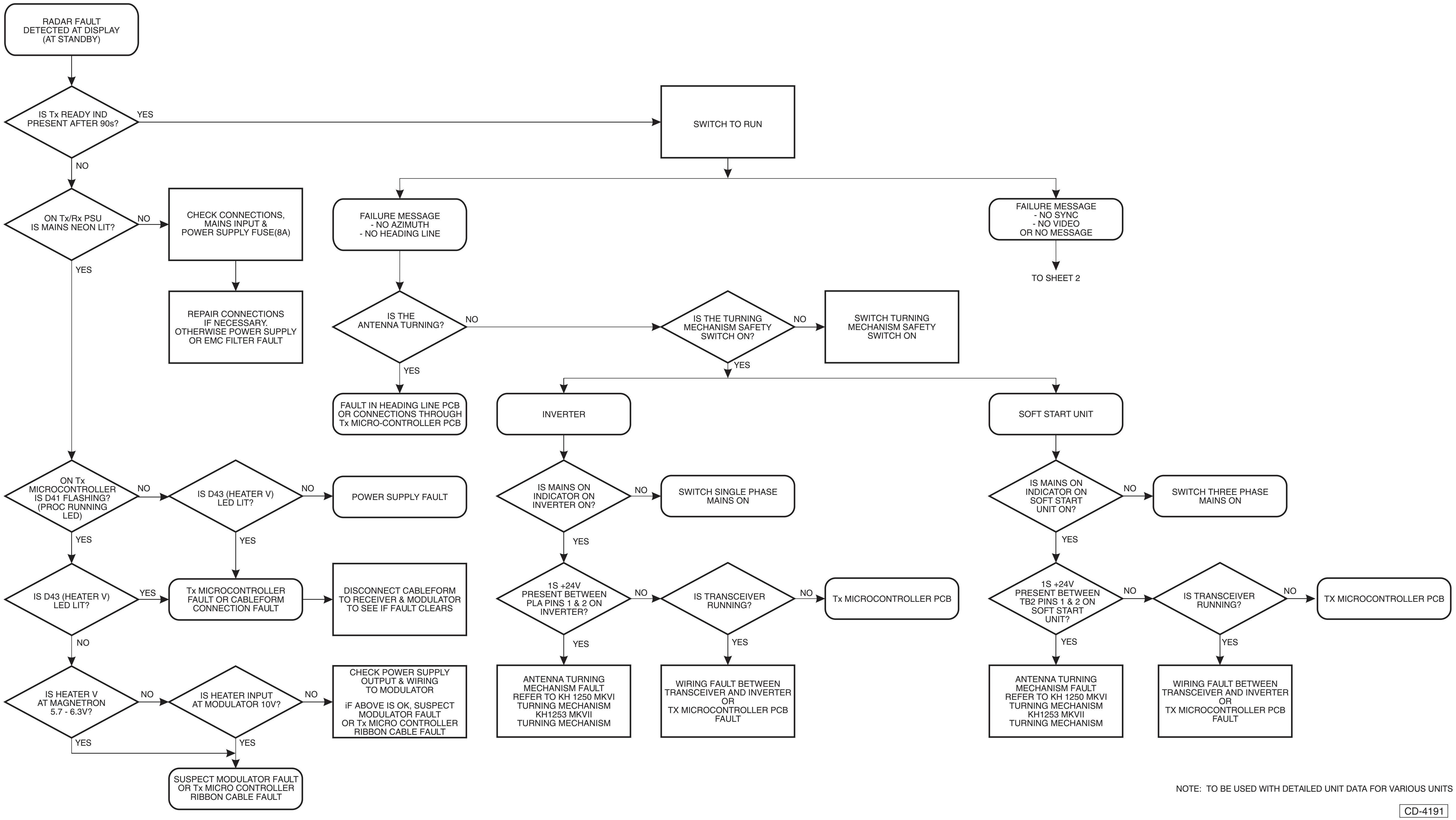


Figure 12e - Flowchart (sheet 1 of 2)

Figure 12e (Sheet 1)

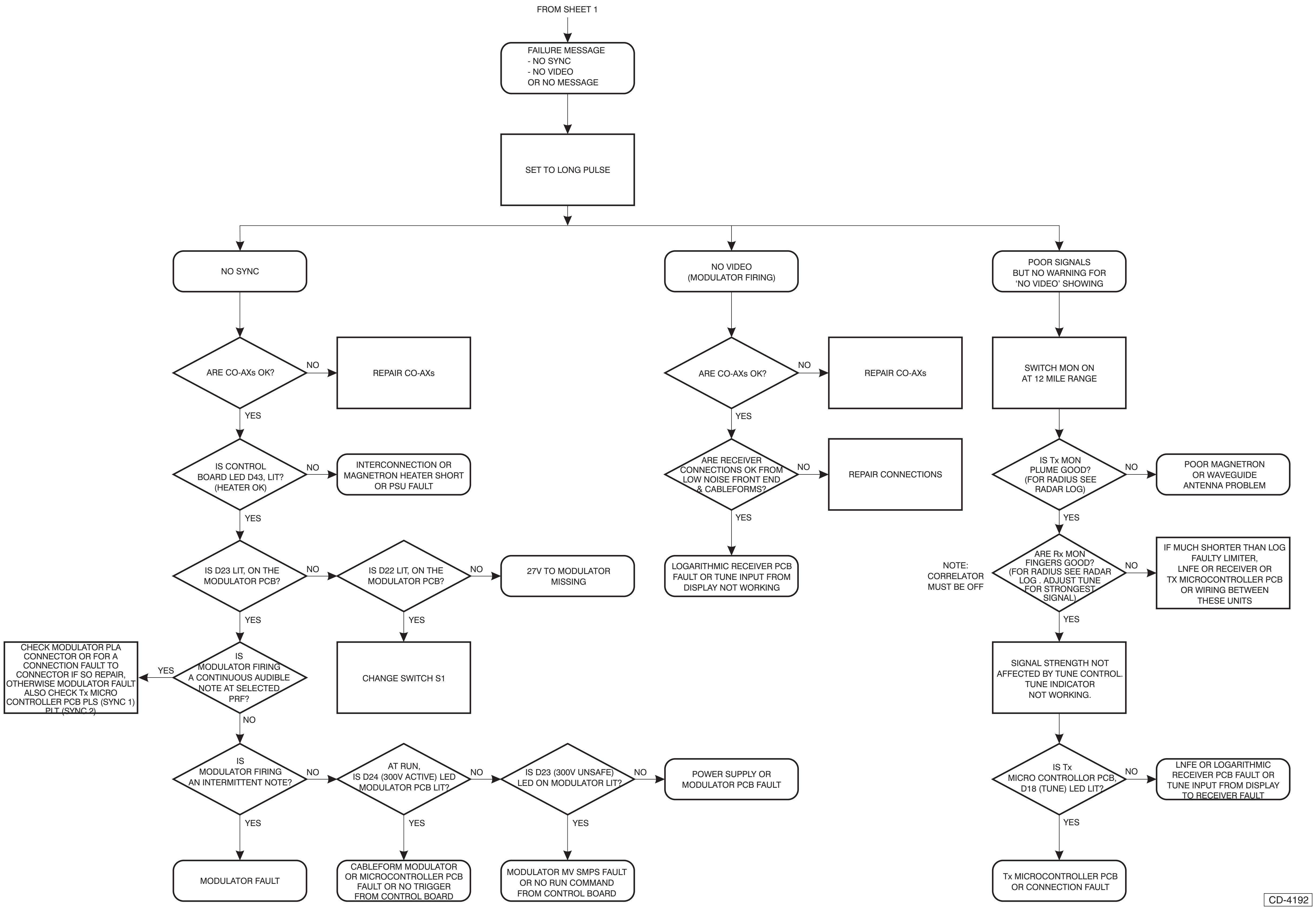


Figure 12e - Flowchart (sheet 2 of 2)

Figure 12e (Sheet 2)

CHAPTER 8A

OPTIONS FOR NUCLEUS 3 RADAR DISPLAYS

3-PHASE TRANSFORMER KIT (6000 DISPLAYS)

FUNCTIONAL DESCRIPTION

1 The 3-Phase Transformer Kit enables the transformation of the Ship's 440V, 3-phase supply to 220V/110V for use with Nucleus Radar Displays Type 6000 Series.

INSTALLATION

2 To install the 3-phase Transformer implement the following:

(1) Fix the 3-phase Transformer assembly (HRC - A190) to the back left corner of the base on the display console using the 2 self captivating panel screws (attached to the mounting plate) refer to Figure 1a.

(2) Locate the washers and fasten the nuts on the M6 studs provided.

(3) Plug the socket into the filter unit.

(4) Remove the cover plate of the assembly to reveal the terminals and then connect the 3-phase mains input to TBI on the Transformer.

TESTING PROCEDURE

WARNING

DANGEROUS VOLTAGES ARE PRESENT ON THE TRANSFORMER WHEN SHIP'S THREE PHASE MAINS IS CONNECTED AND LIVE.

3 Switch ON the mains isolator and using a Multimeter check the following:

(1) The three phase mains input is 380/440V.

(2) The output voltage is 220/110V as set. Refer to Figure 2a for link settings.

NOTE:

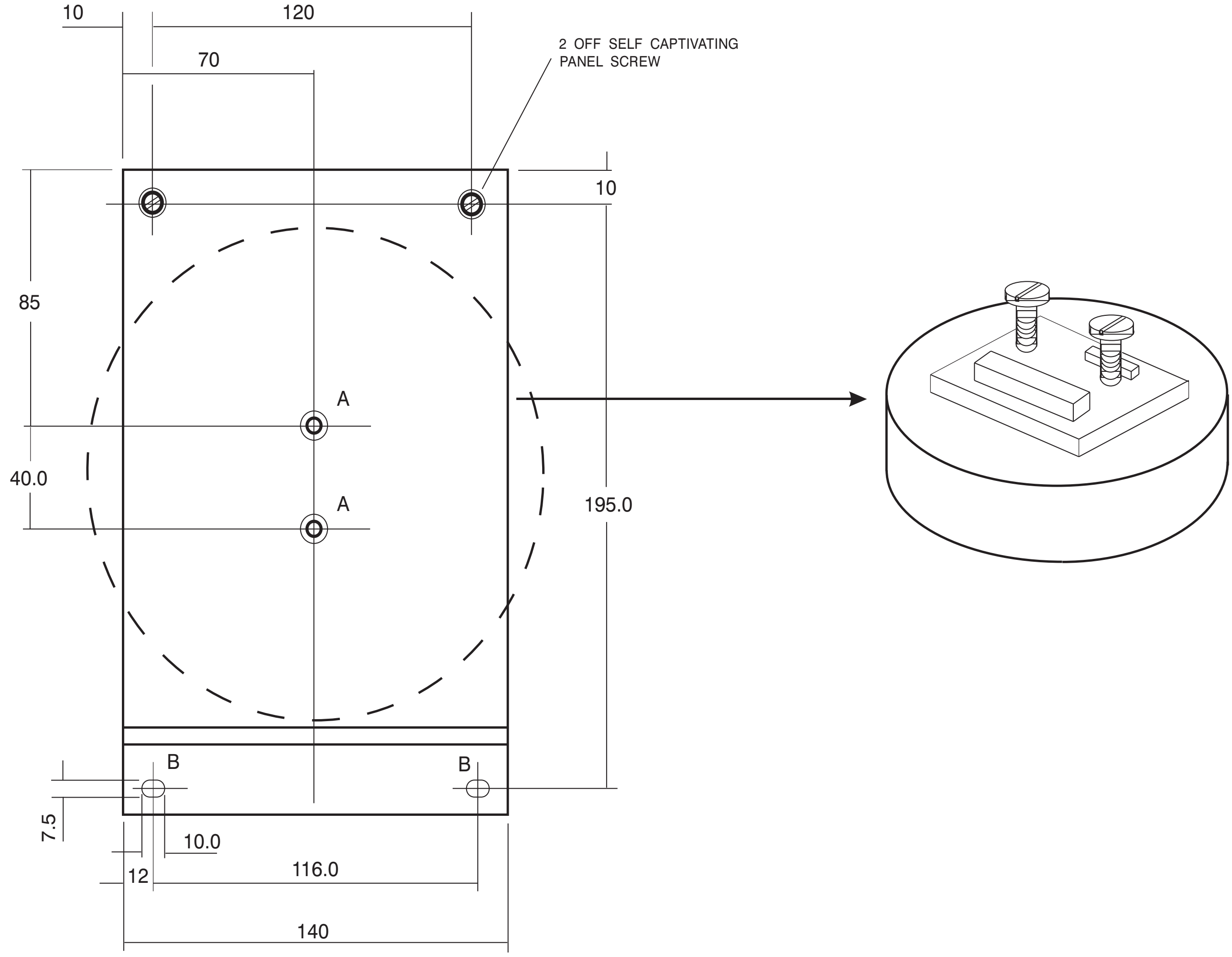
If the output voltage is not present check FS1.

PARTS

4 Table 4 provides the 3-phase transformer part number information.

Table 4 – 3-Phase Transformer Parts List

CCT REF.	GRID REF.	DESCRIPTION	KELVIN HUGHES PART No.
		3-Phase Transformer	NNR - A322
		Isolator Cable	
		Self Captivating Panel Screws	



CD-2299

Figure 1a - 3-Phase Transformer Kit (Installation Diagram)

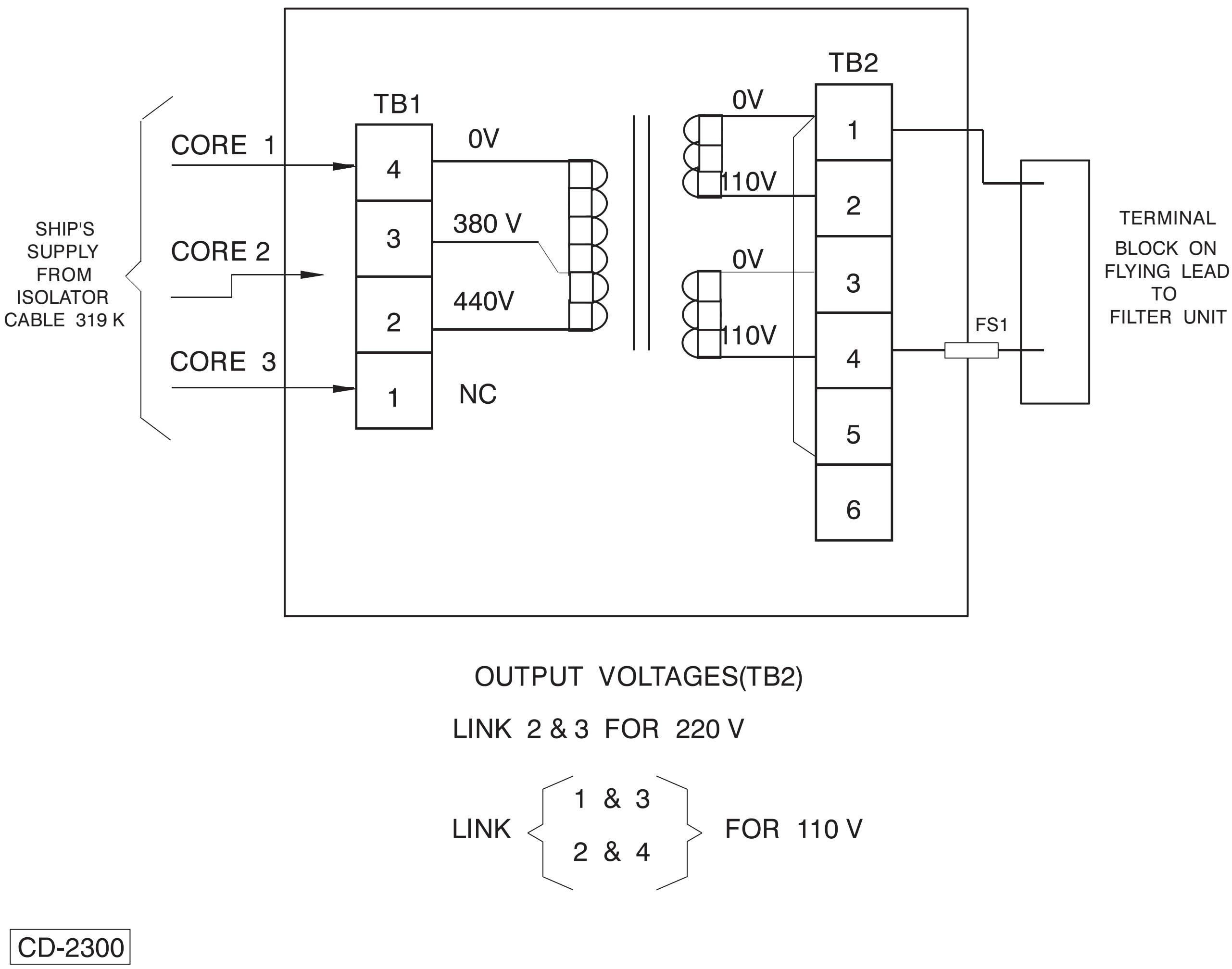


Figure 2a - 3-Phase Transformer Kit (Link Settings)

INTERFACING FOR THE LOW RATIO COMPASS & MASTER/SLAVE INSTALLATIONS

INTRODUCTION

5 The following information provides a guide for the installation of any of the Nucleus Interface Kits listed below:

(1) Low Ratio Compass Kit – HRC-A188 or HRC-A189
(2) Master/Slave Kit – NNR-A285 (N2 6000) or NNR-A440 (N2 5000)
(3) Master/Slave Synchro Kit – HRC-A289
(4) Divide By Four PCB – CDY-A55
(5) Interface Box – HRC-A26

Low Ratio Compass Kit

6 To fit the Kit follow Paragraph 17, then Paragraph 24 for Nucleus 6000 or Paragraphs 29 and 55 for Nucleus 5000. External connections are described in Paragraphs 34 to 42, complete the installation using Paragraphs 62 and 65.

Master/Slave Kit

7 Implement the instructions in Paragraph 17, as required. To fit the Kit follow Paragraph 23 then Paragraph 27 and 28 for Nucleus 6000 or Paragraphs 32 and 33 for Nucleus 5000. External connections are described in Paragraphs 34 to 42.

8 Implement the Interfacing & Setting up instructions in Paragraphs 43 to 56. The Master/Slave Interface PCB Link functions are described in Paragraphs 66 and 67.

Master/Slave Synchro Kit

9 Implement the instructions in Paragraph 17, as required. To fit the Kit follow Paragraph 21, then Paragraph 25 for all Nucleus 5000/6000 displays. External connections are described in Paragraph 35.

10 Implement the Interfacing instructions in Paragraphs 43 and 57 and Table 10.

Master/Slave Adapter Kit

11 To fit the Kit, implement the instructions in Paragraph 28 for Nucleus 6000 or Paragraph 33 for Nucleus 5000. External connections are described in Paragraphs34 to 42.

NOTE:

Refer to Paragraph 67 for Link 1 setting.

Divide By Four PCB

12 To fit the PCB implement the instructions in Paragraph 44, then Paragraph 48 for Nucleus 6000 or Paragraph 53 for Nucleus 5000.

Interface Box

13 For Nucleus 5000 and Split 6000A Systems the interfaces are mounted in a separate box.

Overall dimensions: 410mm long, 250mm wide, 162mm high.

All Installations

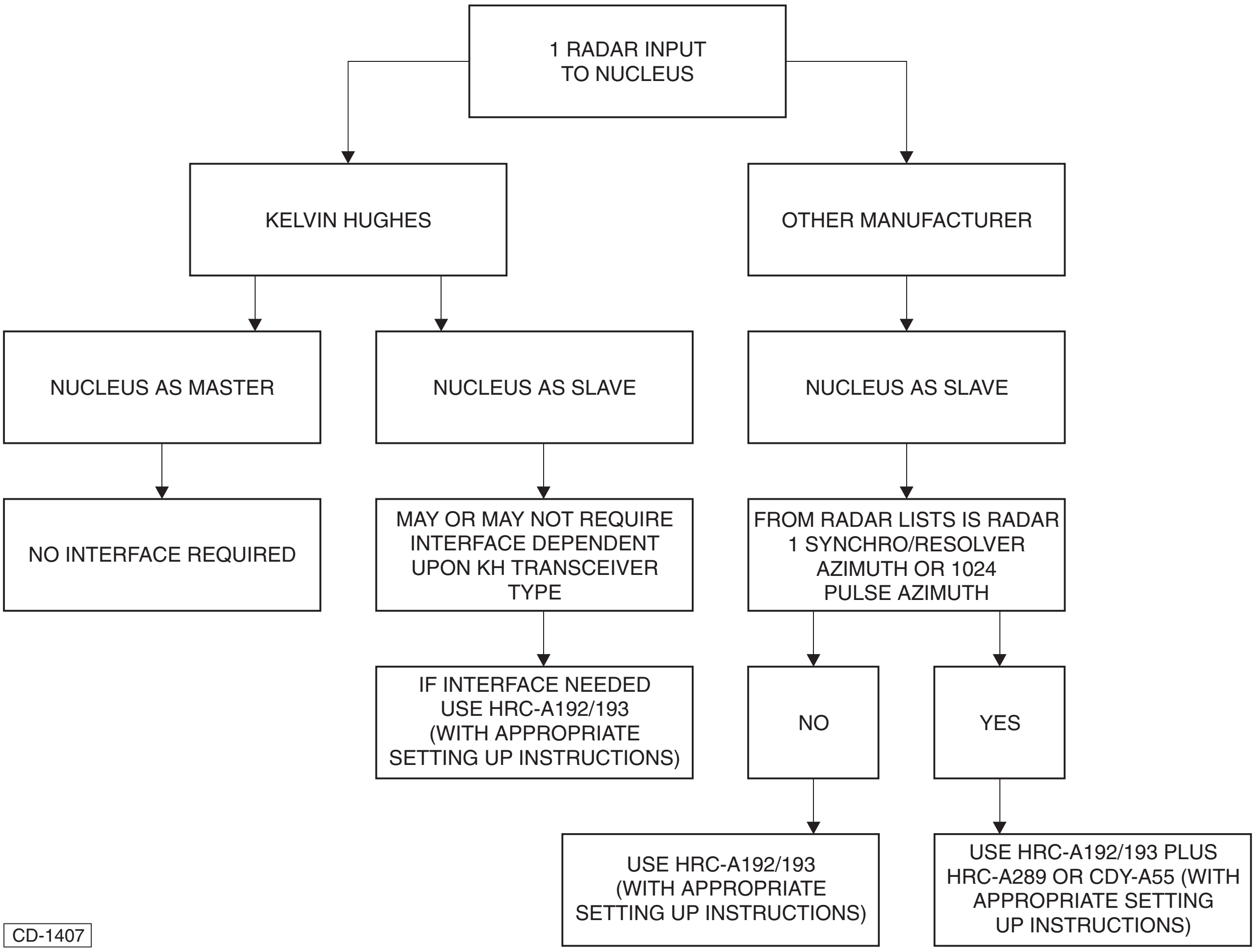
14 Implement the instructions in Paragraphs 54 and 55 after fitting the Installation Kit.

NUCLEUS INTERFACING CHART – Sheet 1

NOTE:

(1) Nucleus connected to 1 Radar Transmitter/Aerial only.

(2) A Kelvin Hughes Transmitter/Aerial controlled by the Nucleus Display counts as the 1 Radar Transmitter/Aerial.

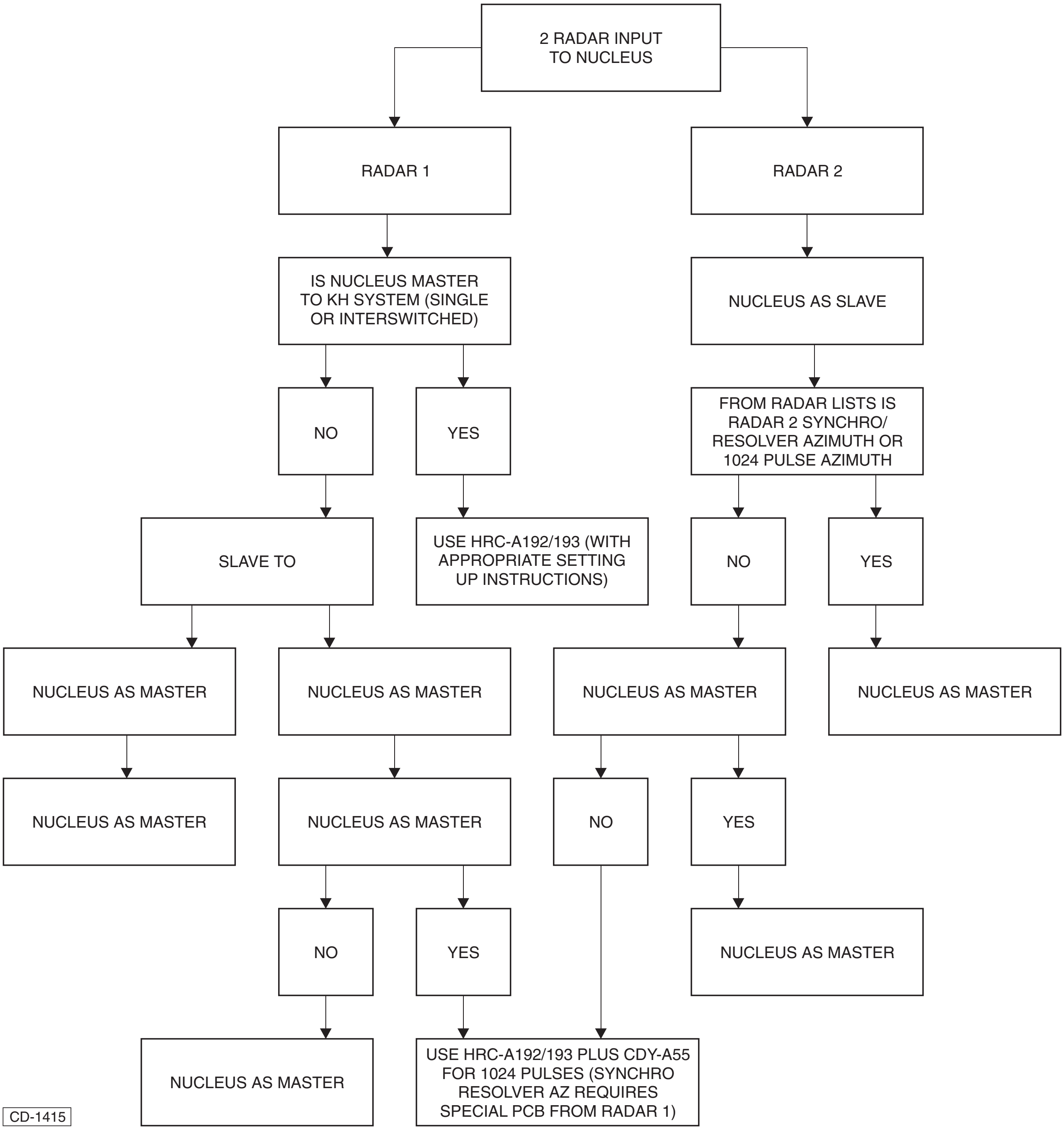


NUCLEUS INTERFACING CHART – Sheet 2

NOTE:

(1) Nucleus connected to 2 Radar Transmitter/Aerial only.

(2) A Kelvin Hughes Transmitter/Aerial controlled by the Nucleus Display counts as one of the possible 2 Radar Transmitter/Aerials, and its Interface requirements must be listed on the Indent.



CD-1415

FUNCTIONAL DESCRIPTION

15 The Master/Slave Interface, Master/Slave Synchro (for Radar 2 only) and Divide By 4 PCBs may receive inputs from any two Radars. The Master/Slave Synchro can accept an input from only one Radar (Radar 2 only). The Radar selection for the Nucleus range of displays is carried out on the Nucleus display. The Master/Slave Adapter PCB is used as the interface to the Display 'Input/Output PCB'. Many forms of input are acceptable, enabling interfacing with other compatible Radar Systems.

16 The Low Ratio Compass PCB receives the input from a 1:1 or 36:1 ratio Synchro Compass System.

PRE-FITTING CHECKS

17 Prior to installing the interface boards into the Nucleus Display, check that the signals from the host radars conform to the formats listed below. If the signals are different, refer to the Technical Description of the host radar or Kelvin Hughes to ensure compatibility.

Azimuth Types

Master/Slave Synchro PCB (HRC-A290)

(See Table 5)	3 phase Resolver	Excitation 50 to 1200 Hz sinewave.
	2 phase Resolver	Excitation 50 to 1200 Hz sinewave.
	2 phase Resolver	Excitation 900 to 4000 Hz squarewave.

Divide by 4 PCB (CDY-A297)

(See Table 7)	+3 to 7V pulses.	1024 pulses per rev.

Master/Slave Interface PCB (HRC-A197)

(see Table 9)	2 phase (No ac excitation)	90 cycles per rev.
	+ve Pulses, various voltages	90 to 360 pulses per rev (even no.'s only).
	+ve Pulses, various voltages	4096 pulses per rev.

Heading Line Types

Master/Slave Synchro PCB (HRC-A290)

No Heading line input required (generated on the PCB).

Divide by 4 PCB (CDY-A297)

See Table 11	+ve or -ve going input pulses of 4 to 15V from 0V.	1 per rev.

Master/Slave Interface PCB (HRC-A197)

See Table 11	+ve or -ve going input pulses of 4 to 15V from 0V.	1 per rev.

Video

Normally +ve 5.5V peak from Buffer Amplifier.
May be +ve or -ve 12V from 0V, 75 ohm without Buffer Amplifier.

Other video levels may be catered for using suitably modified Buffer Amps:
RAN-A23/** (75 ohm Co-axial input sockets)
or
RAN-A29/** (93 ohm UHF input sockets)

Sync Pulses

Normally +ve 12V from Buffer Amplifier.
May be -ve or +ve 3 to 50V from 0V, 75 ohm without Buffer Amplifier.

Sync pulse levels of up to 50V, +ve or -ve from 0V, may be catered for by Buffer Amps RAN-A23/** or RAN-A29/** without modification.

PRFs

Short Pulse	1500 to 3200 Hz.
Medium Pulse	750 to 1600 Hz.
Long Pulse	375 to 800 Hz.

INSTALLATION OF INTERFACES

18 The Interfaces required are to be installed in the following order:

(1) Low Ratio Compass Kit (HRC-A188)
(2) Master/Slave Synchro Kit (HRC-A289)
(3) Divide by 4 Kit (CDY-A55)
(4) Master/Slave Interface Kit (HRC-A192)

19 Prior to installation, the pre-fit requisites are to be established. Each PCB is to be fitted in the order shown above and links set before the next PCB is fitted. Figure 3a shows the stacking and arrangement of the PCBs on the side plate.

Low Ratio Compass PCB (CDY A188)

20 Install the Low Ratio Compass PCB as follows:

(1) Fit the required converter chip, refer to Table 13.
(2) Set the Links, refer to Paragraph 57.
(3) Set compass ratio switches, refer to Table 14.
(4) Set the links of the Display System PCB, refer to Low Ratio Compass PCB in Paragraph 64.
(5) Fit the PCB in the position shown in Figure 3a, using the pillars provided.

NOTE:

If other interfacing is required, refer to the following Paragraphs; if no other interfacing is required implement Paragraph 17.

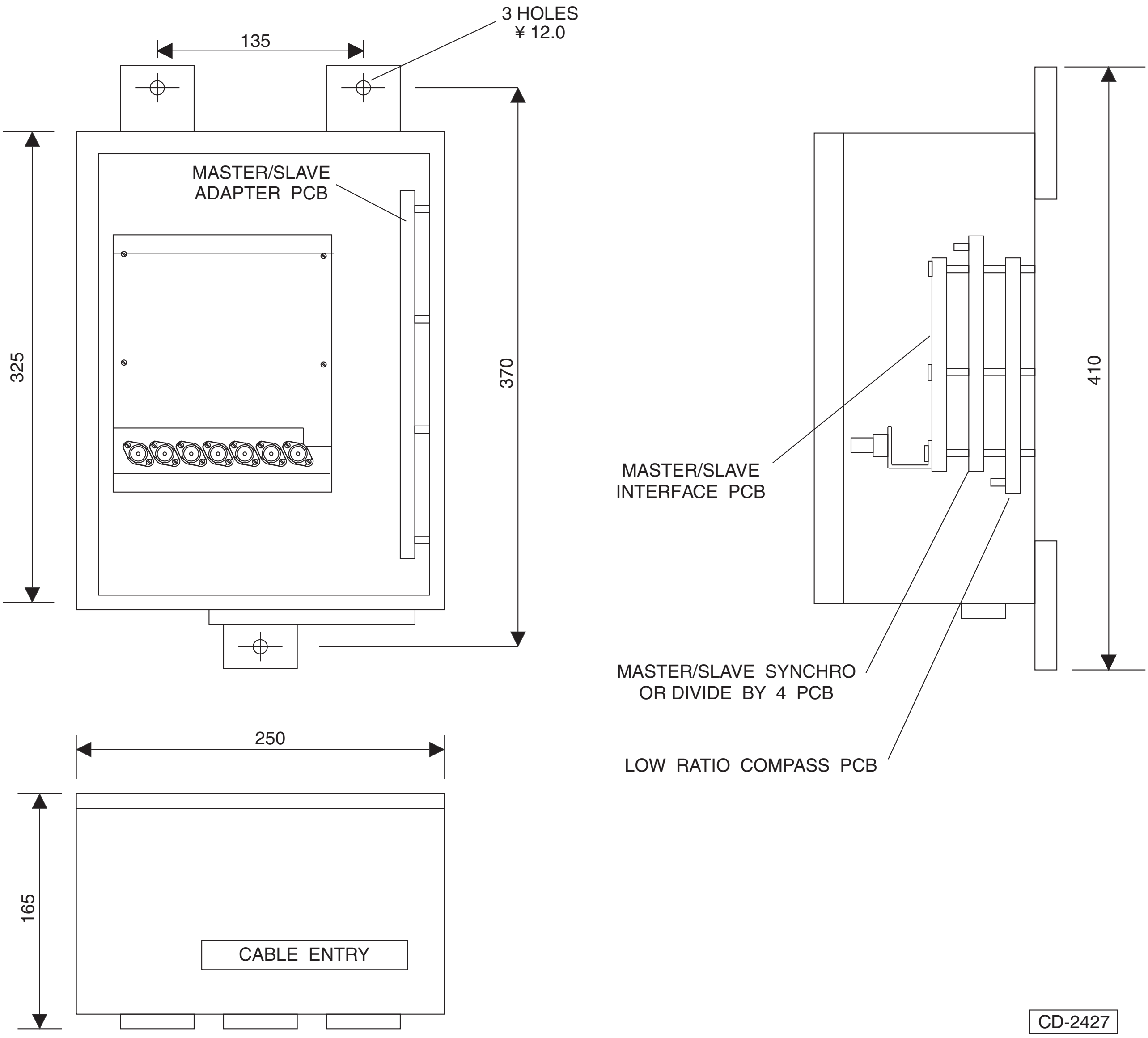


Figure 3a - Interfaces Installation Details: 5000/Split 6000A

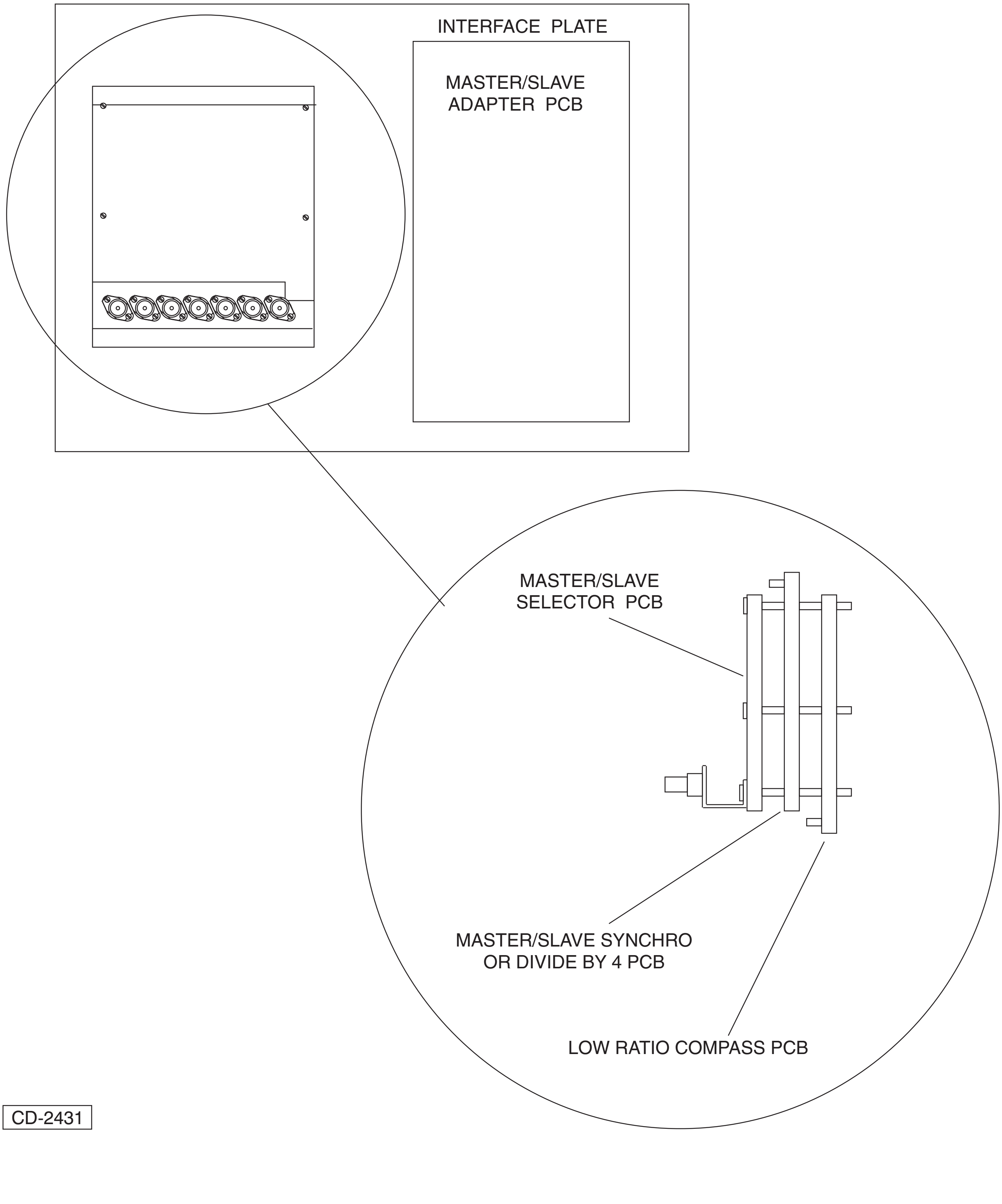


Figure 4a - Interfaces Installation Details: 6000 Series

Master/Slave Synchro PCB

NOTE:

This PCB is connected as Radar 2 input, even in 1 Radar System.

21 Install the Master/Slave Synchro PCB as follows:

(1) Fit the required converter chip, see Table 5.

(2) Make Links 1, 2, 3, 4, 5 and 6. Refer to Figure 5a, below, for link positions.

(3) Fit the PCB in the position shown in Figure 4a, using the pillars provided.

Divide By Four PCB

NOTE:

This PCB is fitted for Radar 1 and/or Radar 2 with 1024 pulse Azimuth.

22 For 1024 Azimuth inputs fit the Divide by Four PCB in the position shown in Figure 3a, using the pillars provided.

Master/Slave Interface PCB

NOTE:

Buffer Amplifiers (RAN-A23/ or RAN-A29/*) are to be fitted near host displays for video & sync inputs, 1 per radar.*

23 Install the Master/Slave Interface PCB as follows:

(1) Set switches and links, refer to Table 6, 8, 9, 10, 11, 12 for Radar 2 inputs.

(2) Set switches and links, refer to Table 8, 9, 10, 11, 12 for Radar 1 inputs.

(3) Fit the Master/Slave Interface PCB, as shown in Figure 4a.

(4) Fit the Master/Slave Adapter PCB, as shown in Figure 4a.

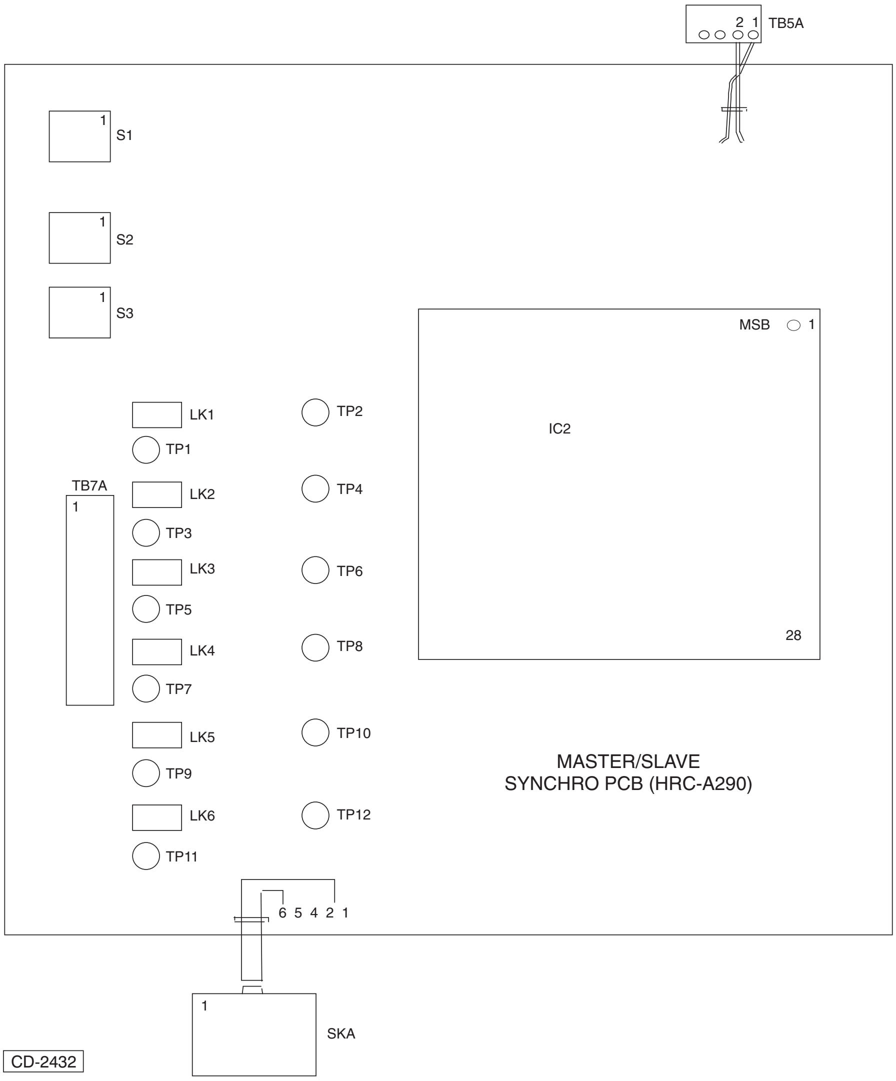


Figure 5a– Master/Slave Synchro PCB: Link Locations

CONNECTIONS REQUIRED FOR NUCLEUS 6000 SERIES

Low Ratio Compass PCB

24 Connect the Low Ratio Compass PCB as follows:

(1) Plug SKF Flylead (White) into PLF of Master/Slave Adapter PCB.

(2) Plug SKL Flylead (Orange) into PLC of Display Input/Output PCB. If other interfaces are to be fitted continue with Paragraph 47.

(3) If no other interface required connect 38 way cableform, HRC-A388 to Master/Slave Adapter PCB SKT C, SKT D and SKT P.

NOTE:

It is necessary to connect the co-axial cables using an in-line connector to the Input/Output PCB, fold back any unused wires.

(4) Connect cable form HRC-A341, between Master/Slave Adapter PCB PLB and PLE and Display Input/Output PCB PLA and PLG. Disconnect wire from SKA-8 and fold back. Move wire from SKA-9 to SKA-8.

Master/Slave Synchro PCB

25 Connect the Master/Slave Synchro PCB as follows:

(1) Plug SKA Flylead (White) into PLA of Master/Slave Interface PCB.

(2) Plug TB 5A/7A Flylead (4 way Orange) into TB 5A/7A of Master/Slave Interface PCB.

OR

Divide by Four PCB

26 Connect the Divide by Four Circuit Board as follows:

(1) Plug SKA Flylead (White) into PLA of the Master/Slave Interface PCB.

(2) For RADAR 2 (1024 pulse Azimuth) plug TB 5A/7A Flylead (4 way Orange) into TB 5A/7A of Master/Slave Interface PCB.

(3) For RADAR 1 (1024 pulse Azimuth) plug TB2A Flylead (10 way Orange) into TB2A of Master/Slave Interface PCB.

Master/Slave Interface PCB

27 Connect the Master/Slave Interface PCB as follows:

(1) Plug SKK (White) into PLP of Master/Slave Interface PCB.

(2) Connect TB2 Flylead (10 way Orange) into PLC of Master/Slave Adapter PCB.

(3) If RADAR 1 is not 1024 pulse:

Connect TB2A to PLD of Master/Slave Adapter PCB using Cableform HRC-A342.

Master/Slave Adapter PCB

28 Connect the Master/Slave Adapter PCB as follows:

(1) Connect PLB and PLE to Display Input/Output PCB, HRC-A102, PLA and PLG using Cableform HRC - A341.

CONNECTIONS REQUIRED FOR NUCLEUS SPLIT 6000A SERIES

NOTE:

The Interface PCBs are mounted in an extra box HRC-A26. Connections for the NUCLEUS Split 6000A are the same as for the NUCLEUS 6000 Series except for the following paragraphs:

Low Ratio Compass PCB

29 Implement the following:

(1) Disconnect SKC Flylead from its orange connection and fit the wires to the two way Terminal Block located in the bottom of the Interface box.
Wire 10 connects to 38 core Green/Blue
Wire 10 connects to 38 core Slate/Blue

(2) If no other interfaces are required use a length of 38 core cable and the SKTs supplied, to connect the Master/Slave Adapter PCB SKB and SKE to the Input/Output PCB SKA, SKG and SKC respectively (Pin 1 to Pin 1 etc. except for SKE-8 not connected, SKE-9 to SKC-8 and SKC-9 not connected.).

NOTE:

It is necessary to connect the co-axial cables using an in-line connector to the Input/Output PCB, fold back any unused wires.

Master/Slave Synchro PCB

30 Connect as for Nucleus 6000 Series.

Divide By Four PCB

31 Connect as for Nucleus 6000 Series.

Master/Slave Interface PCB

32 Implement the following:

(1) Connect the Master/Slave Interface PCB VIDEO and SYNC OUT to the Input/Output PCB VIDEO and SYNC input.

(2) Using an additional length of coaxial cable connect the Master/Slave Interface PCB BLANK OUT to the Display Input/Output PCB BLANK input.

Master/Slave Adapter PCB

33 Implement the following:

(1) Use a length of 38 core cable and the connectors supplied, to connect the Master/Slave Adapter PCB SKB and SKE to the Display Input/Output PCB NNR-A110 PLW4 and PLV respectively (Pin 1 to Pin 1 etc.).

EXTERNAL CONNECTIONS TO INTERFACES

Low Ratio Compass PCB

34 Connect as follows to PLA the external compass input:

Pin 1 - S1
Pin 2 - S2
Pin 3 - S3
Pin 4 - R1 (RHi)
Pin 5 - R2 (RLo)

Master/Slave Synchro PCB

35 Connect as follows to SKA the Synchro/Resolver Azimuth from Radar 2:

Pin 1 - S1
Pin 2 - S2
Pin 3 - S3
Pin 4 - S4 (Resolver only)
Pin 5 - R1 (RHi)
Pin 6 - R2 (RLo)

Divide By Four PCB

36 Connect as follows to TB5 the RADAR 2 Azimuth Input:

Pin 1 - Azimuth Pulses
Pin 2 - Azimuth 0V
Pin 3 - Heading Line Pulses
Pin 4 - Heading Line 0V

37 If RADAR 1 Azimuth is 1024 pulses connect to TB2 as follows:

Pin 1 - Azimuth Pulses
Pin 2 - Azimuth 0V
Pin 3 - Heading Line Pulses
Pin 4 - Heading Line 0V

Master/Slave Interface PCB

38 If RADAR 2 Azimuth is Master/Slave Interface PCB input, connect as follows:

(1) To TB7B:

Pin 1 - Azimuth Pulses
Pin 2 - Azimuth 0V

(2) To TB5A:

Pin 1 - Heading Line Pulses
Pin 2 - Heading Line 0V

39 For all RADAR 2 inputs:

Video2} via Buffer
Sync 2} Amp RAN-A23/A29

40 For all RADAR 1 inputs:

Video1} via Buffer
Sync1} Amp RAN-A23/A29

Master/Slave Adapter PCB

41 If RADAR 1 is a Master to Nucleus Transceiver connect:

(1) SKA and SKG connected with 38 core cable. (SKG used for Mk5 Tx only) coaxes connect to Master/Slave Adapter PCB.

42 If Radar 1 is slave only, connect as follows:

(1) To SKA:

Pin 11 - Heading Line Pulses
Pin 14 - Heading Line 0V
Pin 8 - Azimuth Pulses
Pin 9 - 4096 Azimuth Pulses
Pin 14 - Azimuth 0V

NUCLEUS INTERFACING INSTRUCTIONS

Azimuth Inputs

43 It is important that Radar 2 inputs are considered first as these can influence the settings for Radar 1.

For link tables, x = MADE
o = OPEN
- = Does Not Matter.
(Not Used)

Radar 2 Inputs Only (cannot be Radar 1)

44 Synchro/resolver Azimuths - using HRC-A289 Kit (Master Slave Synchro). The output from this kit feeds into HRC-A192 Kit (Master/Slave Interface).

Table 5 – Syncro & Resolver Azimuths

Reference Volts	Phase Volts	Frequency Hz	Converter Type	Output Pulses/Rev	Remarks
SYNCHRO (3 phase)					
26	11.8	50 to 1000	45-657-1037 (168F308)	4096	
115	90	50 to 1000	45-657-1042 (168F309)	4096	
RESOLVER (2 phase)					
26	11.8	50 to 1000	45-657-1040 (168F310)	4096	
40	20	50 to 1000	45-657-1040 (168F310)	4096	HRC-A290/2 PCB **
115	90	50 to 1000	45-657-1043 (168F311)	4096	
14 peak-peak	+/- 7 peak	4KHz squarewav e	45-657-1038 (168F383)	4096	
7 to 11 peak (Changes with range in use)	+/- 5 peak	900/1200 (Changes with range in use)	45-657-1039 (168F345)	4096	

** HRC-A290/2 PCB - Open Links 1 and 2. Four off 5K6 Ohm Resistors are to be fitted from TP1 to TP2, TP3 to TP4, TP2 to TP6, TP4 to TP8.

Link And Switch Settings For Radar 2 On Master/slave Interface PCB HRC-A197 (part of HRC-A192 Kit)

45 Refer to Table 6, below.

Table 6 – Radar Link & Switch Settings on Master/Slave Interface PCB

AZIMUTH					HEADING LINE		+
8	19	20	21	SW2	3	4	27
o	o	o	x	-	o	x	o

Radar 1 And/or Radar 2 Inputs

46 Radar 1 and Radar 2 may be different types. Set the links and Switches for the correct type on each channel.

1024 Pulse per Rev. Azimuth using CDY-A55 Kit (Divide By 4)

47 The output from this kit feeds into HRC-A192 Kit (Master/Slave Interface).

Table 7 – 1024 Pulse per Rev. Azimuth

INPUT TYPE	INPUT VOLTS	OUTPUT PULSES/ REV	REMARKS
1024 Pulse	+3 to 7V from 0V	256	

Azimuth Link And Switch Settings For Radar 2 On Master/Slave

Interface PCB HRC-A197 (part of HRC-A192 Kit)

48 Refer to Table 8, below.

Table 8 – Azimuth Link and Switch Settings for Radar 2 on Master/Slave Interface PCB

RADAR 2					RADAR 1						+
8	19	20	21	SW2	6	7	9	10	15	16	SW1
o	o	o	x	-	x	x	o	x	x	o	64

Link 24 OPEN (Radar 1) unless the Input is noisy.
Link 25 OPEN (Radar 1) unless the Input is noisy.

Radar 1 and/or Radar 2 Input using HRC-A192 Kit (Master/Slave)

49 PULSE INPUTS up to 360 per Rev for HRC-A197 PCB

For Azimuth Input Noise Suppression
MAKE Link 24 (Radar 1)
MAKE Link 25 (Radar 2)

50 If an Azimuth Input is a clean pulse its link may be OPEN.

Table 9 – Pulse Inputs Up To 360 per Rev.

	RADAR 2					RADAR 1					
	8	19	20	21	SW2	6	7	9	10	15	16
	o	o	o	x	-	x	x	o	x	x	o
2 phase 90V rms 90 pulses/rev (use 1 phase only)	x	o	o	45	o	o	x	x	x	o	45
2 phase 6V rms 90 pulses/rev (use 1 phase only)	x	o	o	45	x	o	x	x	x	o	45
2 phase 115V rms 132 pulses/rev (use 1 phase only)	x	o	o	33	o	x	o	x	x	o	33
		o	o		o	o	x		x	o	
OR	x			66				o			66
+ to -20V square wave 180 pulses/rev	x	o	o	45	o	x	o	x	x	o	45
		o	o		o	o	x		x	o	
OR	x			90				o			90
+15V pulse 180 pulses/rev	x	o	o	45	x	x	o	x	x	o	45
		o	o		x	x	o		x	o	
OR	x			90				x			90
+ 15V square wave 90 pulses/rev OR	x	o	o	45	o	o	x	x	x	o	45
20V pulse 132 pulses/rev	x	o	o	33	x	x	o	x	x	o	33
		o	o		x	o	x		x	o	
	x			66				o			66

SW1 and SW2 Settings for Azimuth Ratios from Table 8

51 Refer to Table 10, below.

Table 10 – SW1 and SW2 Settings for Azimuth Ratios from Table 8

SW POLE	1	2	3	4	5	6	7	8
RATIO	128	64	32	16	8	4	2	1
33	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
45	OFF	OFF	ON	OFF	ON	ON	OFF	ON
64	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
90	OFF	ON	OFF	ON	ON	OFF	ON	OFF
132	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF

Heading Line Inputs to HRC-A197 PCB (Part of HRC-A192 Kit) or CDY-A297 PCB (Part of CDY-A55 Kit)

52 Refer to Table 11, below.

Table 11 - Heading Line Inputs to HRC-A197 PCB or CDY-A297 PCB

	HEADING LINE LINKS					
	RADAR 2			RADAR 1		
INPUT TYPE	3	4	27	1	2	26
OPEN CONTACTS (HRC-A192 only) (Radar 1 as Master only) (Powered from this PCB)	-	-	-	x	o	x
POSITIVE GOING PULSE e.g. -ve 15V to 0V 0V to +5V	o	x	o	o	x	o
NEGATIVE GOING PULSE e.g. +ve 5V to 0V	x	o	o	x	o	o

NOTE:

Links 26 and 27 do not exist on CDY-A297 PCB

Video Switch Settings on HRC-A197

53 Refer to Table 12, below.

Table 12 – Video Switch Settings on HRC-A197

	VIDEO SWITCHES	
INPUT POLARITY	RADAR 2 SW4	RADAR 1 SW3
+VE GOING VIDEO (Direct or from Buffer Amplifier)	+ve	+ve
-VE GOING VIDEO (Direct from Radar only)	-ve	-ve

NOTE:

RADAR 1 and RADAR 2 Buffer Amps (RAN-A23/ and/or RAN-A29/*) must be set for +ve or -ve Video as required. The output is a +ve to feed HRC-A197 PCB.*

NUCLEUS DISPLAY SETTINGS - COMMISSIONING

54 Implement the following:

(1) Set Radar Display to ON.

(2) Make Link 26 on Display System PCB (Grid A3).

(3) From STANDBY screen, select INSTALLATION menu box.

(4) Position cursor in the DISPLAY box. Slave, Master, Other, may be chosen.

(5) Select OTHER option. Single Tx, Master Slave Interface, Dual Interswitch, may be chosen.

(6) Select Master Slave Interface. A and B Outlines show. (Azimuth is auto set to 4096).

(7) Move cursor to A and select.

(8) Move cursor to lower left hand area of A outline to get Slave, Master, Other, choice.

(9) Select Master or Slave as required for Radar 1. Radar 2 is preset to Slave.

(10) Remove Link 26.

(11) Exit Menu.

(12) When the Transmitter Ready Indicator is ON, SET RADAR DISPLAY to RADAR A, and SHORTEST RANGE.

Settings On System PCB (HRC-A159 for 6000, HRC-A160 for 5000, HRC-A343 for 5000A)

55 Implement the following:

(1) Set RV5 (Sync Delay, Grid H5) to MINIMUM (Anti-clockwise).

Master/Slave Interface PCB (HRC-A197)

Radar 1

56 Implement the following, referring to Figure 6a for locations of links and potentiometers:

(1) Set RV2 (NL1) Fully Anti-clockwise (Noise level).

(2) Set RV1 (Vid 1) Fully Clockwise, then Adjust until VID LED (D19) JUST FLICKERS (5.5V peak video).

(3) Set RV2 (NL1) to reduce NOISE LEVEL if necessary. Reset RV1.

NOTE:

RV2 is to be used only for Radars which have a very high background noise level.

(4) Set RV5 (SYNC1) for correct SYNC DELAY. MAKE LK 22 if longer delay range is necessary.

Heading Line Correction for CDY-A297 PCB (Divide by 4 PCB)

57 Implement the following:

(1) Set SW4, SW5 and SW6 on CDY-A298 PCB to position F.

(2) Using the Radar 1 Host Display, note the angle of a video target with respect to the Heading Line. Compare this with the angle seen on the Radar 2 Slave Display.

58 To correct any difference:

(1) Adjust SW4 (22.5 degree steps) anti-clockwise, i.e. from F to D etc., until the target has been over-adjusted. Turn SW1 back 1 step.

(2) Adjust SW5 (1.4 degree steps) anti-clockwise, until the target has been over-adjusted. Turn SW1 back 1 step.

(3) Adjust SW6 (0.088 degree steps) anti-clockwise, to give the final correction.

Radar 2

59 Implement the following:

(1) Set Radar Display to RADAR B. Set cursor into top left hand box, TXA, to get TXB, Standby choice. May also be changed in Standby menu.

(2) SET RV4 (NL2) fully anti-clockwise (noise level).

(3) SET RV3 (VID2) fully clockwise, then adjust until VID LED (D19) JUST FLICKERS (5.5V peak video).

(4) SET RV4 (NL2) to reduce NOISE LEVEL if necessary. Reset RV3.

NOTE:

RV4 is to be used only for Radars which have a very high background noise level.

(5) SET RV6 (SYNC2) for correct SYNC DELAY. Make Link 23 if a longer delay range is required.

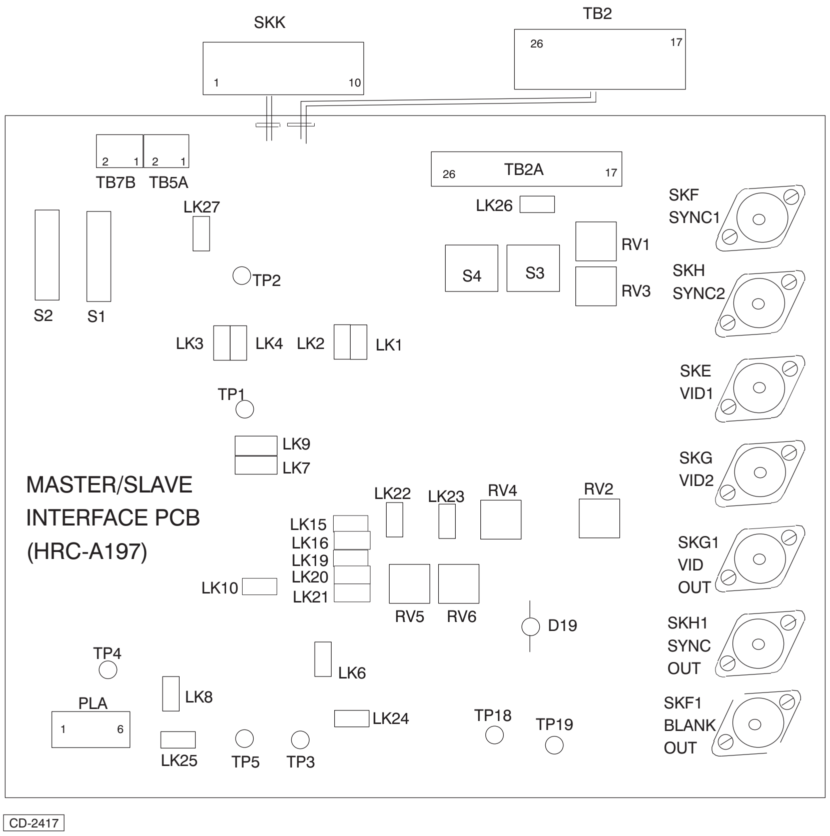


Figure 6a - Master/Slave Interface PCB: Link Locations

Heading Line Correction for HRC-A290 or CDY-A297 PCB (Master/Slave Synchro or Divide by 4)

60 Implement the following:

(1) Set SW1, SW2 and SW3 to position F.

(2) Using the Radar 2 Host Display, note the angle of a video target with respect to the Heading Line. Compare this with the angle seen on the Radar 2 Slave Display.

61 To correct any difference:

(1) Adjust SW1 (22.5 degree steps) anti-clockwise, i.e. from F to D etc., until the target has been over-adjusted. Turn SW1 back 1 step.

(2) Adjust SW2 (1.4 degree steps) anti-clockwise, until the target has been over-adjusted. Turn SW1 back 1 step.

(3) Adjust SW3 (0.088 degree steps) anti-clockwise to give the final correction.

Low Ratio Compass PCB (HRC-A107)

62 Refer to Table 13, below.

Table 13 – Converters for Low Ratio Compass PCB (HRC-A107)

Ref. Volts	Phase Volts	Frequency Hz	Converter Type	Output Pulses/ Rev	Remarks
26	11.8	50 to 1200	45-657-???? (268C300)	4096	
115	90	50 to 1200	45-657-1052 (268C301)	4096	

Settings For Display System PCB (HRC-A159/A160/A343)

63 OPEN Links 10, 12, 13, 16 (Grid M5/6) on the System PCB before switching ON.

Link And Switch Settings For Low Ratio Compass PCB (HRC-A107)

64 The LINK settings for Nucleus systems are:

(1) Link 1 MADE, Link 2 OPEN - For all ratios and 2048 pulses per rev output.

(2) For special applications outside the Nucleus system, the links may be set to Link 1 OPEN, Link 2 MADE, to give 1:1 ratio and 4096 pulses per rev.

65 The SWITCH settings for Nucleus systems are:

(1) Set SW2 to 2 times the division ratio required. The ON position gives the SW2 count. e.g. Set SW2 to 2 for 1:1 ratio and 72 for 36:1 ratio.

(2) Set SW1 to SW2 setting minus 1. The OFF position gives the SW1 count. e.g. Set SW1 to 1 if SW2 is at 2 and 71 if SW2 is at 72.

Table 14 – Compass PCB Switch Settings for Nucleus

	SW1/2 POLE	1	2	3	4	5	6	7	8
	Binary Count	1	2	4	8	16	32	64	128
Ratio 1:1	SW1 “OFF” Count=1	OFF	ON	ON	ON	ON	ON	ON	ON
	SW2 “ON” Count=2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
36:1	SW1 “OFF” Count=71	OFF	OFF	OFF	ON	ON	ON	OFF	ON
	SW2 “ON” Count=72	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF

FUNCTION OF LINKS

Master/Slave Interface PCB

66 The link settings for the Master/Slave Interface PCB are as follows:

Heading Line

Radar 1 **: Heading Line input**

LK1 Made, LK2 Open : -ve
LK1 Open, LK2 Made : +ve
LK26 Made : +12V to HL switch
LK26 Open : HL switch externally powered

Radar 2 **: Heading Line input**

LK3 Made, LK4 Open : -ve
LK3 Open, LK4 Made : +ve
LK27 Made : +12V to HL switch
LK27 Open : HL switch externally powered

Azimuth Input Amplitude

Radar 1 **: Inputs**
(2 phase, pulsed or 4096)

LK6 Open : greater than 25V peak
LK6 Made : less than 25V peak

Radar 2 **: Inputs**
(2 phase, pulsed or 4096)

LK8 Open : greater than 25V peak
LK8 Made : less than 25V peak

Phase Lock Loop (PLL)

LK7 Made, LK9 Open : 1024 multiplication
LK7 Open, LK9 Made : 2048 multiplication
LK10 Open : High PLL frequency
LK10 Made : Low PLL frequency

Azimuth Selection

Radar 1

LK15 Made, LK16 Open : 2 phase or pulsed, using PLL
LK15 Open, LK16 Made : 4096 pulse input

Radar 2

LK19 Made, LK20& LK21 Open : 2 phase or pulsed using PLL
LK20 Made, LK19 & LK20 Open : 4096 pulse input
LK21 Made, LK19 & LK20 Open : 4096 input from
: synchro/resolver PCB (HRC-A290)

Azimuth Input Noise Suppression Capacitors

Radar 1 **: Inputs**

LK24 Made : for Azimuth using PLL
LK24 Open : for 4096

Radar 2 **: Inputs**

LK25 Made : for Azimuth using PLL
LK25 Open : for 4096

Lock Delay (Sync Delay)

Radar 1

LK22 Open : Short Lock Delay, less than 500 ns
LK22 Made : Lock Delay from 500ns to 2 s

Radar 2

LK23 Open : Short Lock Delay, less than 500 ns
LK23 Made : Lock Delay from 500ns to 2 s

NOTE:

For some installations with longer delays, C58 may be incremented to1nF. (HRC-A197/2)

67 The link LK1 on the Master/Slave Adapter PCB is removed only to isolate the 4096 Azimuth pulses - Normally made.

FUNCTIONAL DESCRIPTION

Low Ratio Compass PCB

68 The PCB accepts inputs from Synchro Compass systems with ratios between 1:1 and 128:1. The normal ratios used are 1:1, 36:1 and 90:1. Nucleus systems can cater for 90:1 without this Low Ratio Compass PCB.

Master/ Slave Adapter PCB

69 The PCB mainly comprises a number of Plugs, which provide interconnections between the Master/Slave PCBs, (if fitted, the Synchro Compass PCB), the Tx/Rx's and the Display System.

Master/Slave Interface PCB

70 The Master/Slave Interface PCB takes inputs of Azimuth, Heading Line, Video and Sync from two Radars and converts the inputs to the standard Display requirements. The selection of Radar 1 or Radar 2 is controlled from the Display.

NOTE:

(1) If Radar 2 has a Synchro or Resolver Azimuth, the Synchro/Compass PCB must be used in addition to the Master/Slave Interface PCB.

(2) If Radar 1 and/or 2 is 1024 pulse Azimuth the Divide by 4 PCB must be used in addition to the Master/Slave Interface PCB.

Switches

71 The switch functions on the Master/Slave Interface PCB are as follows:

(1) SW1 sets the division ratio for Radar 1 Azimuth, using PLL.

(2) SW2 sets the division ratio for Radar 2 Azimuth, using PLL.

(3) SW3 sets the Radar 1 Video for + ve or - ve signal.

(4) SW4 sets the Radar 2 Video for + ve or - ve signal.

Potentiometers

72 The potentiometer functions on the Master/Slave Interface PCB are as follows:

(1) RV1, Radar 1 Video input to give +ve 5.5V standard Video.

(2) RV2, Radar 1 Noise Level threshold for high noise inputs.

(3) RV3, Radar 2 Video input to give +ve 5.5V standard Video.

(4) RV4, Radar 2 Noise Level threshold for high noise inputs.

(5) RV5, Radar 1 lock Delay.

(6) RV6, Radar 2 Lock Delay.

Master/Slave Synchro PCB Radar 2 only.

73 The PCB receives the input from a radar with 1:1 Synchro or Resolver azimuth transmission, and converts it to 4096 pulses per aerial revolution for the Master/Slave Interface PCB. The PCB also produces the Heading Line.

Links And Switches

74 Links 1 to 6 are normally MADE for Nucleus fittings, unless Table 5 indicates otherwise. The links may be changed to vary the input voltage range of the PCB.

75 Switches 1 to 3 are used to adjust the Heading Line to the correct angle.

(1) SW1, adjusts in 22.5 degree steps.

(2) SW2, adjusts in 1.4 degree steps.

(3) SW3, adjusts in 0.088 degree steps.

(4) Zero correction is with all switches in the F position.

Divide By 4 PCB

76 The PCB receives inputs of 1024 pulses per revolution, from either Radar 1 or Radar 2, and divides the input to produce 256 pulses per revolution for the Master/Slave Interface PCB. The board also produces Heading Line alignment correction.

Parts

77 Table 15 provides a list of parts.

Table 15 – Interface Units/Kits Parts List

DESCRIPTION	KELVIN HUGHES CODE NO.	HRC-A188	HRC-A189	NNR-A285	NNR-A440	HRC-A289	HRC-A337
Assembly Low Ratio Compass Kit	**HRC-A188**						
Assembly Low Ratio Compass Kit	**HRC-A189**						
Assembly of Master/Slave Kit	**NNR-A285**						
Assembly of Master/Slave Kit	**NNR-A440**						
Assembly of Master/Slave Synchro Kit	**HRC-A289**						
Assembly of Master/Slave Adaptor Kit	**HRC-A337**	*		*			
Assembly of PCB Compass (Low Ratio)	**HRC-A107**	*	*				
Assembly of Cableform, MSA Link	**HRC-A388**	*	*				
Assembly of Interface Unit (5000)	**HRC-A26**		*		*		
Assembly of PCB Master/Slave Adapter	**HRC-A288**		*		*		*
Assembly of PCB Master/Slave Interface	**HRC-A197**			*	*		
Assembly of Cableform TB2A-MSA	**HRC-A342**			*	*		
Assembly of PCB Master/Slave Synchro	**HRC-A290**					*	
Assembly of Cableform M.S.A.-Input PCB							*

NOTE:

**Items required in Kit.*

BUFFER AMPLIFIERS (RAN-A23/* AND RAN-A29/*)

78 The Buffer Amplifier may be one of two versions, RDY-A23/* and RDY- A29/*. The circuits are identical for both versions, differing only in casework and socket terminations and variant indication/*.

(1) RAN-A23/* has coaxial input sockets, (70 ohm).

(2) RAN-A29/* has an input terminal block, (93 ohm).

FUNCTIONAL DESCRIPTION

79 The Buffer Amplifier is used to "Pick Off" Video and Sync pulses from outputs that must not be loaded by the 75 ohm inputs of a Radar Display Unit. As the Amplifiers have high impedance inputs the coaxial connections to the signal source are to be as short as practicable.

INSTALLATION - FIGURE 7a

80 Check that the Buffer Amplifier is correct for the Video Input, refer to Variants - Paragraph 81. Refer to Figure 15a which shows the Buffer Amplifier Video and Sync connections to the Master/Slave Interface PCB and power supplies from the Master /Slave Adapter PCB.

VARIANTS TO RAN-A23 AND RAN-A29

Buffer Amplifiers 75 Ohm

81 All variants of RAN-A23 are produced from the Standard Units as required:

RAN-A235.5V VideoStandard PCB
RAN-A23/2 1.6V VideoAdd R23 (1K) across R11
RAN-A23/315V VideoAdd R24 (3K3) and R25 (1K5) at I/P
RAN-A23/48V VideoAdd R24 (1K5) and R25 (2K2) at I/P

Buffer Amplifiers 93 Ohm

82 All variants of RAN-A29 are produced from the Standard Units as required:

RAN-A295.5V VideoStandard PCB
RAN-A29/2 1.6V VideoAdd R23 (1K) across R11
RAN-A29/315V VideoAdd R24 (3K3) and R25 (1K5) at I/P
RAN-A29/48V VideoAdd R24 (1K5) and R25 (2K2) at I/P

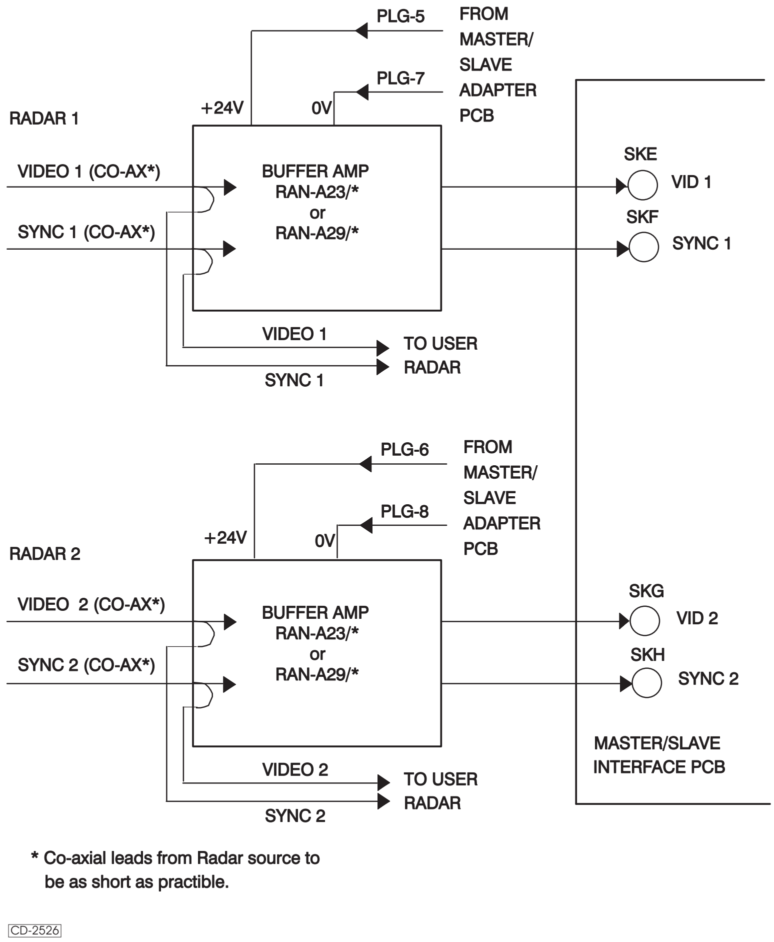


Figure 7a - Buffer Amplifier Installation Block Diagram

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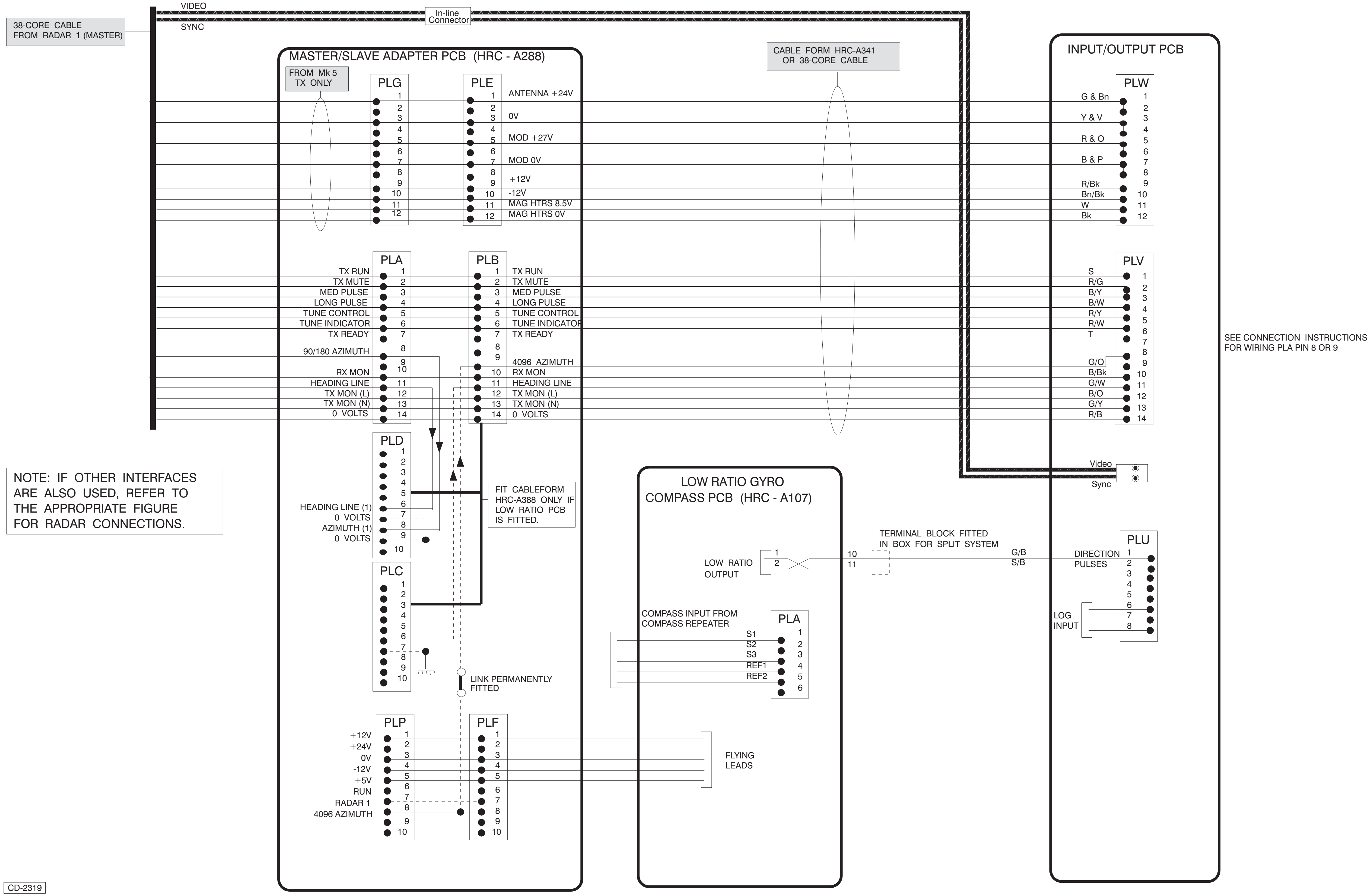

Figure 8a - Low Ratio Compass Kit: Wiring Diagram

Figure 8a

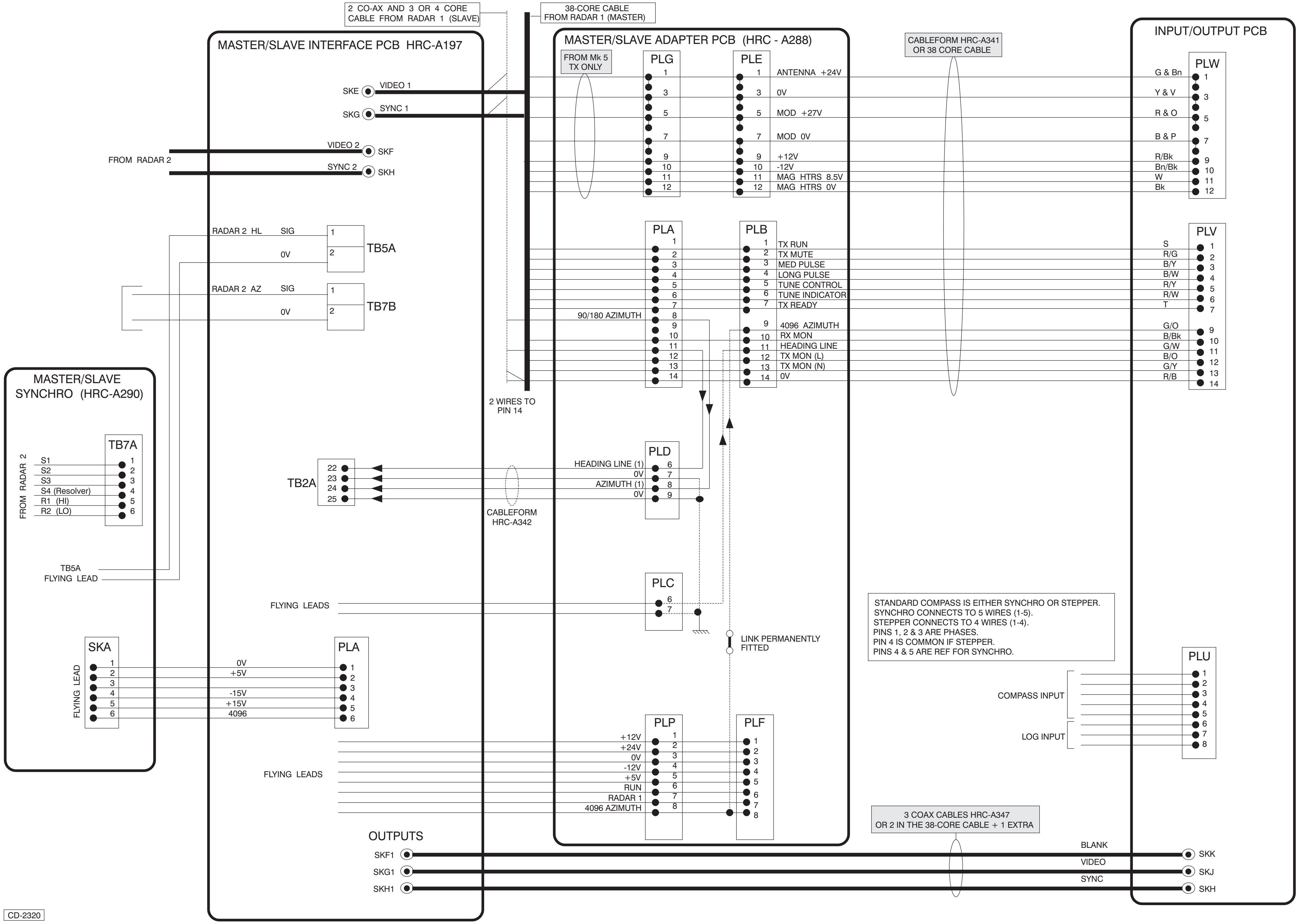

Figure 9a - Master/Slave Synchro Kit: Wiring Diagram **Figure 9a**

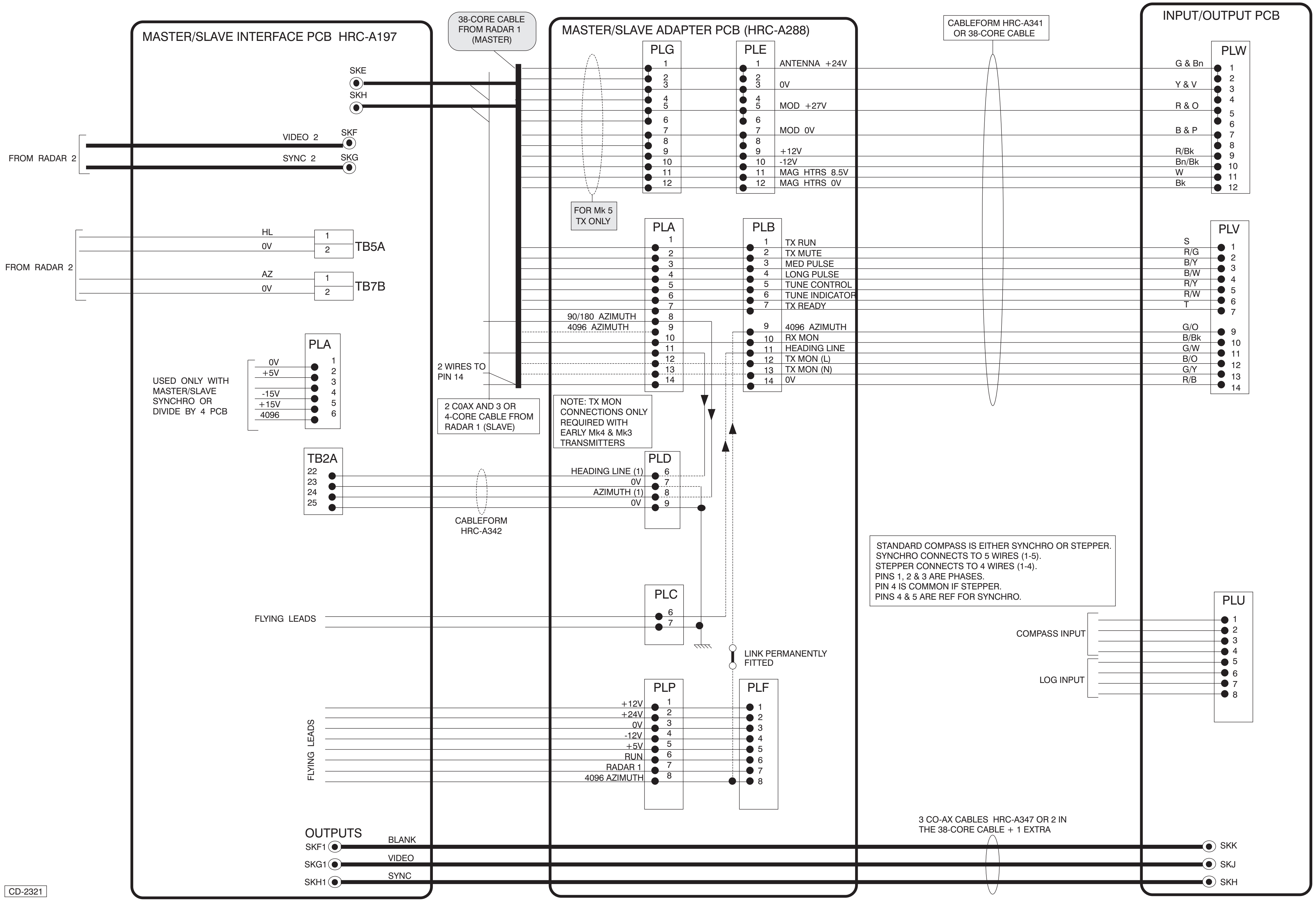

Figure 10a - Master/Slave Kit: Wiring Diagram **Figure 10a**

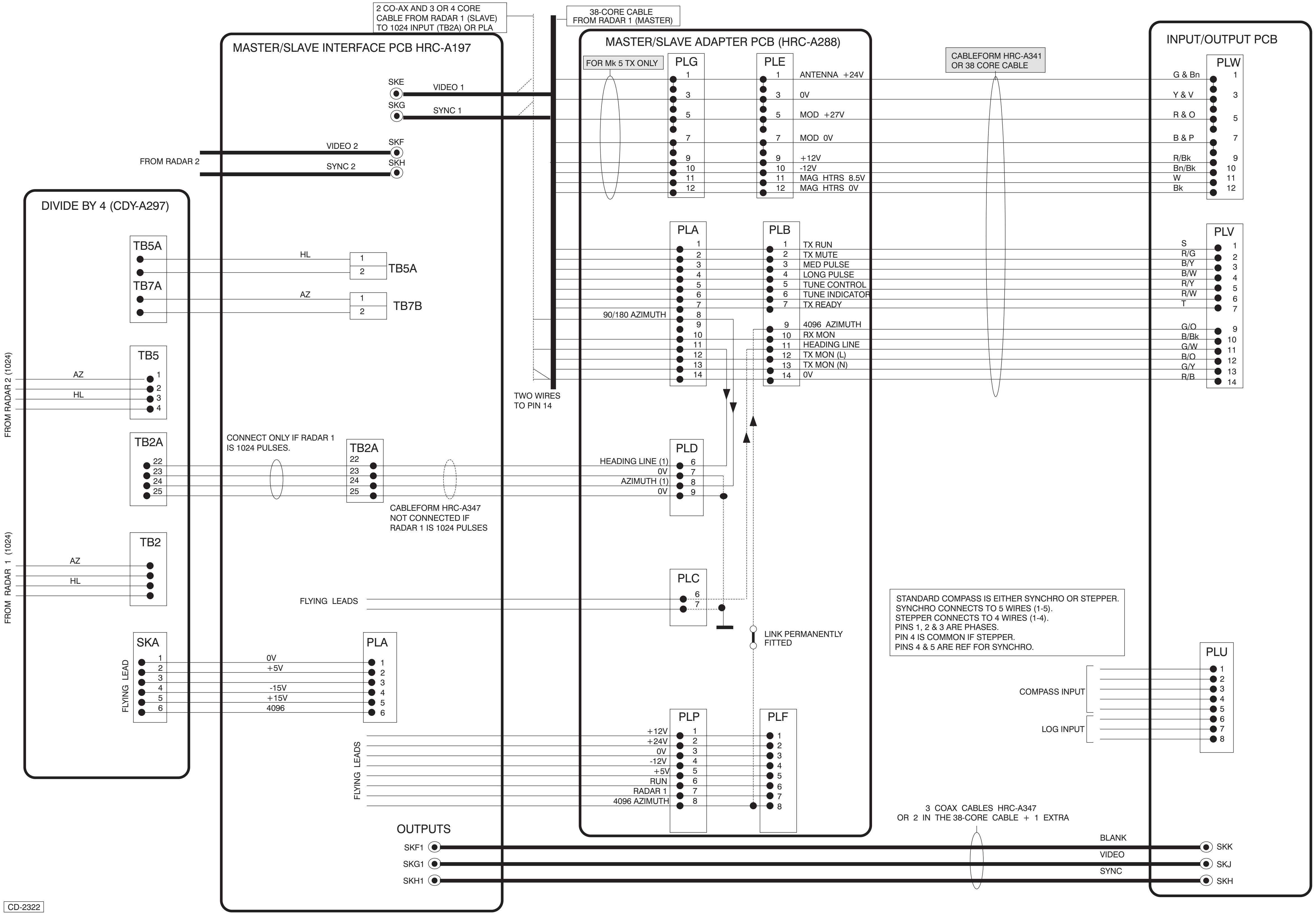

Figure 11a - Divide by Four PCB: Wiring Diagram **Figure 11a**

CHAPTER 8A

ANNEX A

SERIAL AND NMEA COMMUNICATIONS SPECIFICATION

OPTIONS FOR NUCLEUS 3 RADAR DISPLAYS

SCOPE OF THIS DOCUMENT

This document describes the input/output PCBs (NNR-A910, for series 6000 and 7000 displays and NNR-A996 for series 5000 displays) of the Nucleus 3 series of Radar Displays.

NOTE:

The input/output PCB (NNR-A996) used in the 5000 series displays is functionally equivalent to the input/output PCB (NNR-A910) used in the 6000/7000 series displays, but is mechanically different. I/O PCB (NNR-A996) fits internally and requires external connector access. Socket connectors are provided at the top and bottom of the PCB for this purpose.

GENERAL PURPOSE SERIAL INPUTS

The I/O PCBs have four general purpose RS232/RS422 inputs; serial 1, 2, 3 and 4, three RS232 outputs and one RS422 output. The inputs are opto-isolated, in accordance with IEC 1162 series specifications.

The inputs/outputs are primarily for NMEA ship's sensor inputs and inputs from external equipment (e.g. ECDIS, GPS, Depth indicators, etc.). A general purpose CTS (Clear to Send) input is also provided for use by "slow" external devices (e.g. a line printer). The implementation and use of this is target device and software dependent.

Serial Received Data

The serial received data (Receive data #1, #2, #3 and #4) can be either RS232 or RS422. Connections are via sockets PLF and PLG with pinouts as specified below.

PLF (Serial 1 & 2)

Pin	Description
1	Transmit Data #1 output - RS232
2	Receive Data #1 input 'A' - RS232 'data' or RS422 '+'
3	Local GND
4	+12V
5	+5V
6	Receive Data #1 input 'B' - RS232 'gnd' or RS422 '-'
7	Transmit Data #2 output - RS232
8	Receive Data #2 input 'A' - RS232 'data' or RS422 '+'
9	Local GND
10	+12V
11	+5V
12	Receive Data #2 input 'B' - RS232 'gnd' or RS422 '-'
13	CTS input - signal
14	CTS input - gnd

PLG (Serial 3 & 4)

Pin	Description
1	Transmit Data #3 output - RS232
2	Receive Data #3 input 'A' - RS232 'data' or RS422 '+'
3	Local GND
4	+12V
5	+5V
6	Receive Data #3 input 'B' - RS232 'gnd' or RS422 '-'
7	Transmit Data #4 output 'A' - RS232
8	RS232 Receive Data #4 input 'A' - RS232 'data' or RS422 '+'
9	Local GND
10	+12V
11	+5V
12	Receive Data #4 input 'B' - RS232 'gnd' or RS422 '-'
13	Transmit Data #4 output 'B' - RS422 '-'
14	Local GND

DEDICATED SERIAL INPUTS

The I/O PCBs have a dedicated Serial Trackerball input PLH, for either standard KH type desk top mouse systems trackball or Ergopod or MISC connections for multi-Ergopod installations.

Connections are via connector PLH, with pinouts as specified below.

Pin	Description
1	+5V
2	+12V
3	Receive Data input - RS232
4	Local GND

SERIAL INPUT SETUP

The serial messages received can be individually configured for:

1 Input port(s) received on. Data can come from several sources, i.e. Ownship position from GPS or ECDIS on two or more input ports.

2 Baud Rate of a specific input port. Not all peripheral devices are at standard 9600 baud. The input and output baud rate of a specific port should be kept the same, i.e. 9600 input and 9600 output.

3 Strict/Relaxed NMEA message checking. Not all peripheral devices provide correct messages.

4 Priority assignment. Radar uses message from Port 1 (i.e. ECDIS) in preference to message from Port 2 (i.e. GPS).

5 Timeout for received message. A period can be specified for the Radar to switch to another source (if available).

6 Send Time. The update frequency for passing data on to the Radar (i.e. Input at 5Hz, but only passed on at 1Hz).

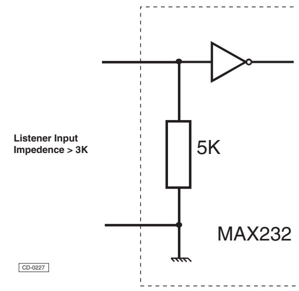

Figure 1. Simplified Other Ports Listener Circuit

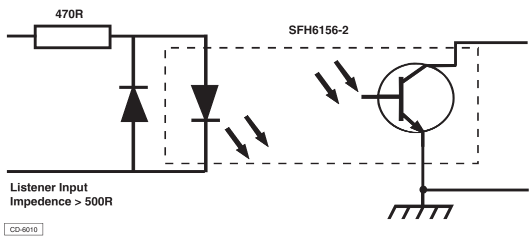

Figure 2. Simplified NMEA Port Listener Circuit

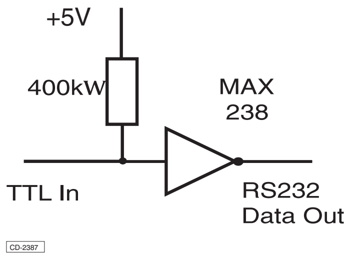

Figure 3. Simplified NMEA Port Talker Circuit

SOFTWARE SPECIFICATION

The message structure used will be compliant, where applicable, with the following Standards:

International Electrotechnical Commission

NMEA 0183 Version 2.01 (TC80/WG6): Standard for Interfacing Marine Electronic Devices (September 1994)

IEC 61162-1 : Digital Interfaces Standard)
Part 1 - Single Talker and Multiple Listener (2000 -07)

IEC 61162-2 : Part 2 - Single Talker and Multiple Listener.

IEC 61162-100 :Extra Requirements for IEC 61162-1 for AIS

IEC 945 : Marine Navigational Equipment - General requirements. Listeners and high speed transmission (1998-09)

American National Standards Institute (ANSI)

ANSI x3.15 1976 ANSI Character Structure and character Parity Sense for serial communication.

ANSI x3.16 1976 ANSI for Bit sequencing of the ANS Code for Information Interchange in serial-by-bit data transmission.

ANSI x3.4 1977 ANSI Code for Information Interchange

Electronic Industries Association Standards (EIA)

EIA-422-A December 1978 (CCITT X.27/V.11)

American Practical Navigator:

Defence Mapping Agency Hydrographic/Topographic Centre, Publication No.9, DMA Stock No NVPUB9V1, Volumes I and II.

Interface Control Document

Navstar GPS Space Segment/Navigation User Interface, Rockwell International Corporation Document No. ICD-GPS-200 Revision B (November 30, 1987).

DATA FORMAT

General Format

The maximum number of characters in a sentence shall be 82, consisting of a maximum of 79 characters between the starting '$' and the terminating '<CR><LF>'.

The minimum number of fields is one. The first field shall be an address field containing the identity of the TALKER and the sentence formatter which specifies the number of data fields in the sentence, the type of data they contain and the order in which the fields are transmitted. The remaining portion of the sentence may contain zero or multiple data fields.

Address fields consist of five characters. The first two characters are the talker identifier. The remaining three characters define the format and the type of data that follows.

The maximum number of fields allowed in a single message is limited only by the maximum message length of 82 characters. NULL fields may be present and shall always be used if the data for that field is unavailable.

All sentences begin with the sentence start delimiter character '$' and end with the sentence termination delimiter' '<CR><LF>'.

A checksum field may optionally be transmitted in any sentence. The checksum is the last field in a sentence and follows the checksum delimiter character '*'.

The checksum is an 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including ',' delimiters between but not including the '$' and the '*' delimiters.

Data fields may be alpha, numeric, alphanumeric, variable length, fixed length, fixed/variable (a portion fixed in length while the remainder varies). Some fields are constant, with their values dictated by a specific sentence definition.

All transmitted data shall be interpreted as ASCII characters. The most significant bit of the 8-bit character shall always be transmitted as zero (d7=0).

The valid character set consists of all printable ASCII Characters except those defined as reserve characters (see Table 3).

ASCII values not specified as either reserved characters or valid characters may not be transmitted.

Table 3. Reserved characters

<CR>	0x0d	13	Carriage Return
<LF>	0x0a	10	Line feed$
$	0x24	36	Start of sentence delimiter
*	0x2a	42	Checksum field delimiter
,	0x2c	44	Field delimiter
!	0x21	33	Start of extended NMEA sentence delimiter.
\	0x5c	92	Reserved for future use.
^	0x5e	94	Reserved for future use.
-	0x7e	126	Reserved for future use.

Messages can be received on one, some or all of the 4 serial input ports. Each input port has a Priority assigned to indicate the preferred source. The second, third and fourth choice if input (if applicable) are also assigned for use in the event of failure of the previous choice.

For example:
Two or more GPS' may be connected to Ports 1 & 2 and an ECDIS may also be supplying position data, via GGA message (Port 4). If ECDIS sourced position data is the preferred choice, then set Port 4 priority to a high number, the next choice to a lower number and the back up (third choice) to the lowest value.

Each message can be validated to the Strict NMEA standard or, alternatively if the third party equipment does not conform, a Relaxed checking can be applied to allow interfacing of non-conforming equipment.

The Timeout period is the time allowed before the failure (non-appearance) of a message is detected. Infrequent messages may require a longer timeout.

Send Time is the period of the message being passed onto the Main Radar Processor. NMEA inputs that are very frequent may cause an overload and provide superfluous information. This allows lethargic data to be passed less frequently to the Main Processor (i.e. the Heading realignment message HDT may be required only every 10 seconds or so.

Each Port can have a different Baud rate to allow for non NMEA inputs. The range is from 1200 to 38400 baud.

Proprietary Format

Kelvin Hughes Ltd has an assigned NMEA 0183 Manufacturers Mnemonic Code: KHU

Kelvin Hughes proprietary messages will have the following format:

$PKHUxabc

AIS Format

AIS related messages follow the IEC 61162-100 standard. All such messages use a '!' character to start the sentence instead of '!'. The sentences recognised are !AIVDM for other vessels and !AIVDO for ownship data.

STANDARD NMEA MESSAGES

$—ACK Acknowledge Alarm

Acknowledge device alarm. This sentence is used to acknowledge an alarm condition reported by a device.

$--ACK.xxx*hh<CR><LF>

Local alarm number (identifier) (identification number of alarm source)

$—ALR - Set Alarm Rate

Local alarm condition and status. This sentence is used to report an alarm condition on a device and its current state of acknowledgement.

$--ALR,hhmmss.ss,xxx,A,A,c--c*hh<CR><LF>

Alarm's description text
Alarm's acknowledge state,
A = acknowledged
V= unacknowledged
Alarm condition
(A = threshold exceeded,
V = not exceeded)
Local alarm number
(identifier) (identification
number of alarm source)
Time of alarm condition change, UTC

$—AAM

This message type is not used.

$—APB

This message type is not used.

$—ASD

This message type is not used.

$—BEC

This message type is not used.

$—BOD

This message type is not used.

$—BWC

This message type is not used.

$—BWR

This message type is not used.

$—BWW

This message type is not used.

$—DBT

This message type is not used.

$—DCN

This message type is not used.

$—DPT Depth

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	1 Hz	0.2 Hz

I.M.O. Ref. A224 (VII). Water depth relative to the transducer and offset of the measuring transducer. Positive offset numbers provide the distance from the transducer to the waterline. Negative offset numbers provide the distance from the transducer to the part of the keel of interest.

$xxDPT,x.x,x.x*hh<CR><LF>

Checksum

Offset from transducer (1), in metres:
“positive” = distance from transducer to water-line
“Negative”= distance from transducer to keel

Water depth relative to the transducer, in metres

(1) For I.E.C. applications the offset shall always be applied so as to provide depth relative to the keel.

$—DSC

This message type is not used.

$—DTM

This message type is not used.

$—FSI

This message type is not used.

$—GBS

This message type is not used.

5.17. $—GGA Global Positioning System Fix Data

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	1 Hz	0.2 Hz

Time, position and fix related data for a GPS receiver.

$--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

Checksum
Differential reference station ID 0000-1023
Age of differential GPS data2
Units of geoidal separation M=metres
Geoidal separation
Units of antenna altitude M=metres
Antenna altitude above/below mean-sea-level (geoid)
Horizontal dilution of precision
Number of satellites in use: 00-12, may be different from number of satellites in view
GPS quality indicator
Longitude cardinal, E=East, W=West
Longitude
Latitude Cardinal, N=North, S=South
Longitude
UTC of position

1) GPS quality indicator: 0 = fix not available or invalid
1 = GPS fix
2 = Differential GPS fix
3 = GPS PPS Mode GPS fix valid

2) Time in seconds since last SC104 Type 1 or 9 update, null field when DGPS is not used

3) Geoidal Separation: the difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid), “-” = mean-sea-level below ellipsoid.

NOTES:

1. If a GGA message is received from the same sensor as a GLL message, the GGA message is taken in preference to the GLL message.

2. If a position sensor is lost for any reason, the position will "time-out" after 20 seconds and the position sensor in use is set to zero (no sensor) allowing any sensor to provide position information.

$—GLC

This message type is not used.

$—GLL Geographical Location in Latitude / Longitude

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	**1A, 2A, 3A, 4A**	**1Hz**	**0.2 Hz**

Latitude and Longitude of present vessel position, time of position fix and status.

$—GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,A,a*hh<CR><LF>

Checksum
Mode indicator
Status: A = Data valid
UTC of position
Longitude cardinal, E=East, W=West
Longitude
Latitude cardinal, N=North, S=South
Latitude

NOTES:

1. If a GGA message is received from the same sensor as a GLL message, the GGA message is taken in preference to the GLL message.

2. If a position sensor is lost for any reason, the position will "time-out" after 20 seconds and the position sensor in use is set to zero (no sensor) allowing any sensor to provide position information.

3. Positioning Mode Indicator:
A = Autonomous
D = Differential
E = Estimated (dead reckoning)
M = Manual Target
S = Simulator
N = Data Not Valid

$—GRS

This message type is not used.

$—GSA

This message type is not used.

$—GST

This message type is not used.

$—GSV

This message type is not used.

$—GXA

This message type is not used.

$—HDG

This message type is not used.

$—HDT

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	**1A, 2A, 3A, 4A**	**1Hz**	**0.2 Hz**

True heading of Ownship in degrees.

$—HDT,x.x,T*hh<CR><LF>

Checksum
Degrees = True
Heading (degrees)

This message can be used for high speed serial gyro (61162-2) at 38400 baud. HDT messages from a valid source are used, i.e HEHDT. HC headed messages can be handled, but are Not Recommended due to their origin.

$—HSC

This message type is not used.

$—LCD

This message type is not used.

$—MSK

This message type is not used.

$—MSS

This message type is not used.

$—MTW

This message type is not used.

$—MWV

This message type is not used.

$—OLN

This message type is not used.

5.34. $—OSD Ownship Data

Message Type	Port	Maximum Message frequency	Minimum message frequency
Talker	**1 out, 2 out, 3 out 4 out**	**1 Hz**	**1Hz**

message description.

$RAOSD,x.x,A,x.x,a,x.x,a,x.x,x.x,a*hh<CR><LF>

Checksum
speed units K,N,S
vessel drift (speed) (manually entered)
vessel set, degrees true (manually entered)
speed reference - see Note
vessel speed
course reference - see Note
vessel course, degrees true
heading status, A= valid
heading, degrees true

NOTE:

*Course/speed reference refers to the **stab source** currently selected*

B = bottom tracking log (e.g doppler log bottom track)

M = manually entered (e.g a manually entered set and drift) when using manually entered set/drift the values are given in the 'manually entered' fields else 'manually entered' fields are NULL fields.

W = water referenced (e.g doppler log water track, single axis log VHW and EM log type)

R = radar tracking (e.g for reference target or anchor watch with ARPA)

P = positioning system ground reference (not used in EU type approval e.g. VTG message)

$—RMA

This message type is not used.

$—RMB

This message type is not used.

$—RMC

This message type is not used.

$—RNN: Route message (NMEA version 1.5 compliant)

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	**1A, 2A, 3A, 4A**	**1 Hz**	**0.2 Hz**

Way point identifiers, listed in order with starting Way point first for route number nn .

$XxRnn,c—c,c—c——,c—c*hh<CR><LF>

Checksum
14 field sequence of route Way point Ids
nn=Route number

NOTE:

It is important to decide on one message type (e.g. RTE or Rnn) and disable the other type from the NMEA setup menu, to avoid possible conflict. If the radar is displaying an RTE, receipt of an Rnn message from any source will corrupt the route. If the radar is displaying an Rnn, receipt of an RTE message from any source will corrupt the route.

$—ROT

This message type is not used.

$—RPM

This message type is not used.

$—RSA

This message type is not used.

$—RSD Radar System Data

Message Type	Port	Maximum Message frequency	Minimum message frequency
Talker	**1 out, 2 out, 3 out 4 out**	**1Hz**	**1Hz**

message description

```
$RARSD,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,a,a*hh<CR><LF>
```

Checksum
Display rotation - see note 1
Range units K/N/S
Range scale in use
Cursor bearing degrees clockwise from zero degrees
Cursor range from Ownship
EBL 2 degrees
VRM 2 range
Origin 2 bearing - see note 2
Origin 2 range - see note 2
Bearing line 1 (EBL1) degrees from 0
Variable range marker 1 (VRM 1) range
Origin 1 bearing degrees from 0 - see note 2
Origin 1 range from ownship - see note 2

NOTE:

1) Display rotation:
- C = Course-up, course-over-ground up, degrees True.
- H = Head-up, ship's heading (centre-line) 0 degrees up.
- N = North-up, True north is 0 deg up.

2) Origin 1 and 2 are located at the stated range and bearing from own ship and provide for two independent sets of variable range markers (VRM) and electronic bearing lines (EBL) originating away from own ship position.

$—RTE

Message Type	Port	Maximum Message frequency	Minimum message frequency
Talker	1A, 2A, 3A, 4A	1Hz	0.2Hz

Way point identifiers, listed in order with starting way point first, for the identified route. Two modes of transportation are provided: “c” indicates that the complete list of way points in the route are being transmitted; “w” indicates a working route, where the first listed Way Point is always the last Way Point that had been reached (FROM), while the second listed Way Point is always the Way Point that the vessel is currently heading for (TO), the remaining list of Way Points represents the remainder of the route.

$--RTE,x.x,x.x,a,c--c,c--c, ...c--c*hh<CR><LF>

Checksum
Way point ‘n’ identifier - see Note 1
Additional Way point identifiers - see Note 1
Way point identifier
Route identifier
Message Mode: C =Complete route, all Way points.
W = Working route, 1st listed Way point is ‘FROM’
2nd is ‘TO’
Remainder are the rest of the route.
Message number - see Note 2.
Total number of messages being transmitted - see Note 2.

NOTE:

1 A variable number of Way point identifiers, up to ‘n’, may be included within the limits of allowed sentence length. As there are no specific number of Way points, null fields are not required for Way point identifier fields.

2 A single route may require the transmission of multiple messages. The first field specifies the total number of messages, minimum value = 1. The second field identifies the order of the message (message number), minimum value = 1.

NOTE:

It is important to decide on one message type (e.g. RTE or Rnn) and disable the other type from the NMEA setup menu, to avoid possible conflict. If the radar is displaying an RTE, receipt of an Rnn message from any source will corrupt the route. If the radar is displaying an Rnn, receipt of an RTE message from any source will corrupt the route.

$—SFI

This message type is not used.

$—STN

This message type is not used.

$—TLL

This message type is not used.

$—TRF

This message type is not used.

$—TTM Target data

Message Type	Port	Maximum Message frequency	Minimum message frequency
Talker	1 out, 2 out, 3 out 4 out	5 Hz	0 Hz

message description

Type of acquisition A= automatic M= manual
Time of data UTC
Reference target = R else NULL field

```
$RATTM, xx, x.x,x.x,a,x.x,x.x,a,x.x,x.x,a,c—c,a,a,hhmmss.ss,a*hh<CR><LF>
```

Target status see Note
User data see Note
Speed/distance units K/N/S
Time to CPA, min, "-" = increasing
Distance of closest point of approach
Target course, true/relative (T/R)
Target course, degrees, true/relative
Target speed
Bearing from Ownship true/relative (T/R)
Bearing from ownship, degrees, true/relative
Target distance from ownship
Target number 00-99

Note - User data

When in Simulation Mode, 'Simulated' is sent in this field.
For 'real' target data this field will be NULL field.

Note - Target status

L = lost, tracked target has been lost

Q = query, this status is not used by Nucleus 2, as target data is not transmitted until target has been acquired

T = tracking

$—VBW Dual Ground / Water Speed (Doppler Log)

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	**1A, 2A, 3A, 4A**	**1 Hz**	**0.2 Hz**

Water referenced and ground referenced speed data.

$—VBW,x.x,x.x,A,x.x,x.x,A,x.x,A,x.x,A*hh<CR><LF>

Checksum
Status: Stern ground speed, A = Data valid, V= Data invalid
Stern transverse water speed[1], knots
Status: Stern water speed, A= Data valid, V = Data invalid
Stern transverse water speed[1], knots
Status: Ground speed, A = Data valid, V = Data invalid
Transverse ground speed[1], knots
Longitudinal ground speed[1], knots
Status: Water speed, A = Data valid
Transverse water speed[1], knots
Longitudinal water speed[1], knots

1) Transverse speed: “-” = port, longitudinal speed: “-” = astern

$—VDR

This message type is not used.

$—VHW Water Speed and Heading

This message is used if the log type is set to VHW log.

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	1 Hz	0.2 Hz

The compass heading to which the vessel points and the speed of the vessel relative to the water

$—VHW,x.x,T,x.x,M,x.x,N,x.x,K*hh<CR><LF>

Km/h
Speed km/h
Knots
Speed, knots
Magnetic
Heading, degrees Magnetic
True
Heading, degrees True.

$—VLW

This message type is not used.

$—VPW

This message type is not used.

$—VTG Actual Track and ground speed

This message type is used if the Log type is set as VTG log.

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	1 Hz	0.2 Hz

The actual Course Over Ground and speed relative to the ground.

$—VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Checksum
Mode Indicator
Speed Units: K=km/h
Speed
Speed Units: N=knots
Speed
degrees Magnetic
COG
degrees True
COG

1) Positioning system Mode indicator
A = Autonomous mode
D = Differential mode
E = Estimated (dead reckoning) mode
M = Manual input mode
S = Simulator mode
N = Data not valid
The positioning system Mode indicator field shall not be a null field

$—WNC

This message type is not used.

$—WPL Way point Location

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	———	Once only per way point

Latitude and longitude of specified Way point.

$—WPL,llll.ll,a,yyyyy.yy,a,c—c*hh<CR><LF>

Checksum
Way point Identifier
E/W
Way point longitude
N/S
Way point latitude

$—XDR

This message type is not used.

$—XTE

This message type is not used.

$—XTR

This message type is not used.

$—ZDA Time and Date

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3A, 4A	1 Hz	0.1 Hz

UTC, day, month, year and local time zone.

$-DA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Checksum
Local zone minutes description, same sign as local hours
Local zone description[1], 00 to +/-13 hours
Year
Month: 01 to 12
Day: 01 to 31
UTC

1) Zone description is the number of whole hours added to local time to obtain GMT, Zone description is negative for East longitudes.

$—ZDL

This message type is not used.

$—ZFO

This message type is not used.

$—ZTG

This message type is not used.

$—ZZU: UTC Time (NMEA version 2.00 compliant)

Message Type	Port	Maximum Message frequency	Minimum message frequency
Listener	1A, 2A, 3,A 4A	1 Hz	0.1 Hz

Time. UTC

$—ZZU,hhmmss.ss*hh<CR><LF>

UTC

QUERY ADDRESS FIELDS

The Nucleus 3 does not support the use of the query address field (section 5.2.1.2 IEC 1162) and will not respond to this message format.

AIS MESSAGES

VDM - AIS VHF Data Link Message

This sentence is used to transfer the entire contents of a received AIS message packet, as defined in ITU-R M.1371 and as received on the VHF Data Link (VDL), using the 'six-bit' field type. The structure provides for the transfer of long binary messages by using multiple sentences.

```
!--VDM,x,x,x,a,s--s,x*hh<CR><LF>
```

Checksum
Number of fill bits, 0 to 5
Encapsulated ITU-R M.1371 radio message
AIS Channel
Sequential Message Identifier, 0 to 9
Sentence Number, 1 to 9
Total Number of Sentences needed to transfer the message, 1 to 9

VDO - AIS VHF Data-link Own-vessel report

This sentence is used to transfer the entire contents of an AIS unit's broadcast message packet, as defined in ITU-R M.1371 and as sent out by the AIS unit over the VHF Data Link (VDL) using the 'Six-bit' field type. The sentence uses the same structure as the VDM sentence formatter.

```
!--VDO,x,x,x,a,s--s,x*hh<CR><LF>
```

Checksum
Number of fill bits, 0 to 5
Encapsulated ITU-R M.1371 radio message
AIS Channel
Sequential Message Identifier, 0 to 9
Sentence Number, 1 to 9
Total Number of Sentences needed to transfer the message, 1 to 9

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CHAPTER 8B

DUAL INTERSWITCH UNIT

INSTALLATION

INTRODUCTION

1 The Interswitch Unit is mounted as shown in Figure 1b, which provides the installation dimensions.

PRE-INSTALLATION REQUIREMENTS

2 Prior to installing the Interswitch Unit:

(1) Ensure adequate clearance for maintenance.

(2) Check that the input/output cables can be easily installed and have adequate clearance.

INSTALLATION INSTRUCTIONS

3 Mount the Interswitch Unit in the required position, ensuring sufficient clearance for ventilation, cable access and servicing as follows:

(1) Mark out the position of the Interswitch Unit and then drill the required bolt hole positions.

(2) Secure the Interswitch Unit in place.

(3) Feed the Display and Transmitter cables through the base of the unit and connect to the appropriate input/output sockets.

(4) Ensure that the Interswitch Unit is directly earthed to the Ship's earth, using the bolt provided.

4 All instructions for setting to work are contained in Commissioning, later in this Chapter.

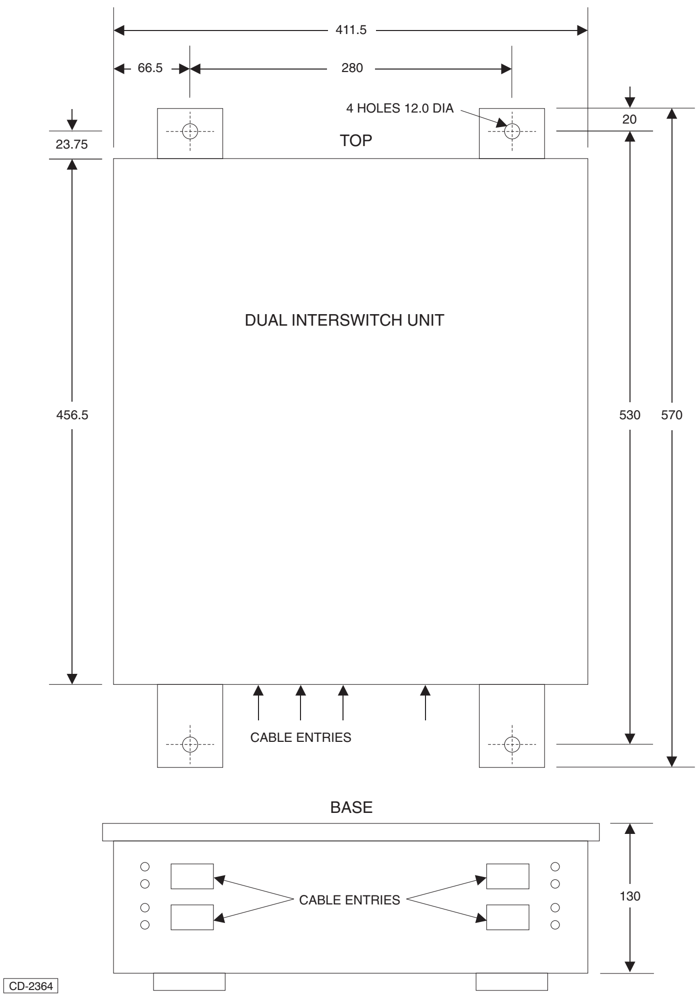


Figure 1b - Interswitch Unit (Dimensions & Mounting)

COMMISSIONING

INTRODUCTION

5 The Interswitch Unit has two rotary switches S1, 'CROSSED/UNCROSSED' and S2, 'STATUS', refer to Figure 2. The combinations offered by the interswitch configuration are as follows:

(1) 'A' Transceiver to 'A' Display.
'B' Transceiver to 'B' Display

(2) 'A' Transceiver to 'B' Display.
'B' Transceiver to 'A' Display

(3) 'A' Transceiver to 'A' Display as MASTER with 'B' Display as SLAVE.

(4) 'A' Transceiver to 'B' Display as MASTER with 'A' Display as SLAVE.

(5) 'B' Transceiver to 'A' Display as MASTER with 'B' Display as SLAVE.

(6) 'B' Transceiver to 'B' Display as MASTER with 'A' Display as SLAVE.

CONTROL SWITCHES (FIGURE 2)

6 The two switches, located on the Front Panel of the Unit, are used for configuration control. The configurations are annotated pictorially in relation to each switch position.

OPERATION

7 The unit operates as described later in this Chapter. The configuration combinations are shown in Figure 2b.

Link Settings

8 The following Table 1 gives a list and description of links in the unit.

Table 1 – Interswitch Unit Links

LINK	DESCRIPTION
LK3	Sync A Fine Delay
LK4	Sync A Coarse Delay
LK5	Sync B Fine Delay
LK6	Sync B Coarse Delay

Potentiometers

9 The following Table 2 gives a list and description of Potentiometers.

Table 2 – Interswitch Unit Potentiometers

POT	DESCRIPTION
RV1	NOT USED
RV2	NOT USED
RV3	NOT USED
RV4	NOT USED
RV5*	Display A - Video amplitude
RV6*	Display B - Video amplitude

NOTE:

RV5 and RV6 are factory preset and should not need to be adjusted.

LINK SETTINGS ON INSTALLATION

10 The links are set as follows:

Sync Delay Links LK3, LK4, LK5 and LK6 - Set to '0' on installation and then adjusted in 'Setting to Work'.

SETTING TO WORK

11 The following can be set up only when the System is operational:

(1) Set the CROSSED/UNCROSSED Switch to **Not Crossed** and the Display Connection Control Switch to MASTER position 2.

(2) Turn on both Displays and allow the Transceivers time to warm up.

(3) Set both displays to RUN and ensure that a Radar picture is displayed.

(4) Set both display ranges to 0.5nm or 0.25nm.

(5) Set Sync ‘A’ Coarse to 125ns (LK4) and Fine to 0ns (LK3) and on the System PCB of Display ‘A’, adjust the Sync Delay Pot (RV5) to remove any range index error on the picture.

(6) Set the Transceiver Control Selector Switch to the **Crossed** position.

(7) Use the Sync ‘B’ Delay links coarse (LK6) and Fine (LK5) to remove any range index error on the same Display (A).

(8) Switch the Transceiver Control Selector Switch to the **Not Crossed** position and on the System PCB of Display ‘B’, adjust the Sync Delay Pot (RV5) to remove the range index error.

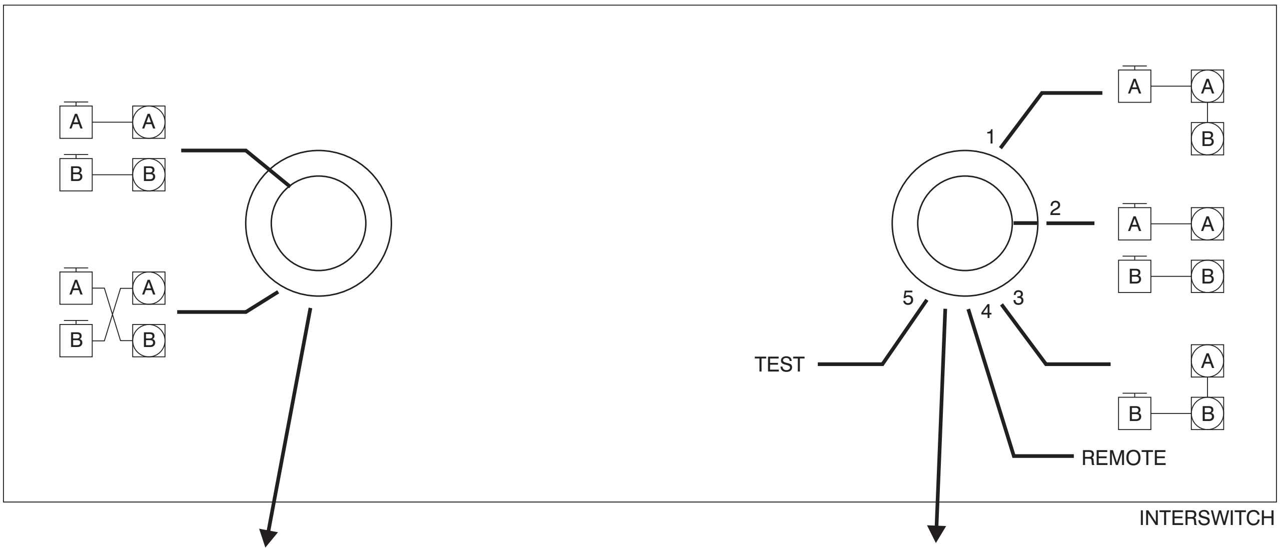
(9) Check that the range index error is acceptable for all configurations.

Video Amplitude Adjustments

12 No adjustments should be required, as RV5 and RV6 are factory preset. Confirm that the radar video is a 5V peak signal, measured from the mean noise level.

CHECKS AFTER SET UP

13 View both Displays and check that for each of the 6 configurations that can be selected, refer to Paragraph 5, the current Transceiver is correctly selected and/or controlled.



TRANSCEIVER CONTROL SELECTOR

SWITCH POSITION	CONFIGURATION
CLOCKWISE	‘A’ DISPLAY MASTER OF ‘A’ TRANSCEIVER
	‘B’ DISPLAY MASTER OF ‘B’ TRANSCEIVER
COUNTER-CLOCKWISE	‘A’ DISPLAY MASTER OF ‘B’ TRANSCEIVER
	‘B’ DISPLAY MASTER OF ‘A’ TRANSCEIVER

DISPLAY CONNECTION SELECTOR

SWITCH POSITION	CONFIGURATION
1	DISPLAY A & B CONNECTED TO Tx A
2	EACH DISPLAY INDEPENDENT
3	DISPLAY A & B CONNECTED TO Tx B
4	REMOTE CONTROL
5	TEST

CD-2362

Figure 2b - Interswitching Configurations

FUNCTIONAL DESCRIPTION

GENERAL

14 The Dual Display Interswitch Unit type HRC-A9 is designed for use as an interface between the Nucleus 5000 /6000 range of displays and the Nucleus Mk IV/VVI/VII Transmitters.

15 The basic role of the unit is to provide a means of interconnecting any two displays with any two transmitters (of the type specified above), and providing control facilities to enable either display to control either transmitter. Thus system capability and availability are both maximised.

16 The following is an example of a typical installation:

(1) Display A - ARPA Display (6000).

(2) Display B - True Motion Display (5000).

(3) Transmitter A - Mk V 10kW X Band.

(4) Transmitter B - Mk IV S Band.

17 In the example installation detailed above, the Dual Display Interswitch Unit will enable the ARPA Display to act as a 'master' to control either the Mk V or Mk IV Transmitter, with the True Motion Display controlling the other Transmitter (or acting as a 'slave'). Alternatively, the True Motion Display can be designated 'master', with the ARPA Display acting as 'slave'.

CONTROLS AND INDICATORS

18 Two switches are located on the top face of the Interface Unit, refer to Figure 2b. The switches: Transmitter Control Selector and Display Control Selector, control the following functions:

(1) Transmitter Control Selector - determines which Display controls which Transmitter when in Local mode.

(2) Display Control Selector - A four-position switch that determines the interswitch mode and connections in one of the Local positions

19 The Transmitter Control Selector is operative only if the Display Control Selector is in Positions 1 to 3. The switch may then be used to set which Display is master of which Transmitter. The Display Control Selector has five positions:

(1) Slaved off Transmitter A.

(2) Both Displays are Masters.

(3) Slaved off Transmitter B.

(4) Remote.

(5) Test.

DUAL INTERSWITCH PCB

20 The Dual Interswitch PCB provides the switching elements and associated control circuitry required for (a) interconnection of the system Displays and Transmitters, and (b) implementation of the selected role for each Display (i.e. 'master' or 'slave'). The following circuits are provided by the PCB:

(1) DC Regulators.

(2) Relay Banks.

(3) Switching Control Circuit.

(4) Status Circuit.

(5) Sync Pulse Circuit.

(6) Video Signal Circuit.

DC Regulators

21 The DC Regulator circuit comprises three voltage regulators, one providing +15V dc, one providing -6V dc and the other +5V dc The +15V dc regulator is powered from the +27V dc supply from either Display A or B. The -6V dc regulator is powered from the -12V dc supply from either Display A or B. The +5V regulator is powered from the +12V dc supply from either Display A or B.

22 An additional supply of +26V dc is produced by this circuit to power the relays. This supply is derived from the +27V dc supply from either Display A or B. The +26V is switched to the main relays by RL4 when not in the Test position, this ensures that the relays are in the normal position when in TEST.

Relay Banks

23 Three banks of relays are utilised as the switching elements that set the various signal routes through the PCB. All relays are powered from the +26V dc supply and are driven by appropriate signals produced by the Switching Control Circuit.

24 The three banks of relays are listed below:

(1) Signal Switching Relays - this bank of relays switches all control and data signals between the system Displays and Transmitters. The de-energised state is when Display A is connected to Transmitter A and Display B is connected to Transmitter B.

(2) Display A Relays - this bank of relays switches Azimuth data, Heading Line, Sync pulse and Video pulse inputs from Transmitter A or B through to Display A. The de-energised state connects Transmitter A to Display A.

(3) Display B Relays - this bank of relays switches Azimuth data, Heading Line, Sync pulse and Video pulse inputs from Transmitter A or B through to Display B. The de-energised state connects Transmitter B to Display B.

Switching Control Circuit

25 This controls the state of the three banks of relays and the RUN lines to both Transmitters. The circuit has inputs from the Selector switches on the DIU and the control lines from the two Displays.

26 Indicators are provided to show the state of the three banks of relays (LEDs are ON when the relay bank is energised).

Status Circuit (Nucleus 5000 & 6000 only)

27 Each Display receives two data and one select input which control and request status information from the DIU as shown below. This is provided via two status lines to each Display.

Control Signals

28 Outputs from each Display:

(1) Change control of Transmitter (this is normally at 0V and goes high for approximately 100ms to change over the control of the Transmitters).

(2) Display Own (0V) or Other (+12V) Transmitter radar data.

(3) Input data selector (0V or +12V).

29 Inputs to each Display with Input data selector = 0V:

Line 1 Local = 0, Remote = 1
Line 2 Straight = 0, Crossed = 1

30 Inputs to each Display with Input data selector = 12V & Remote

0,0 = Other Tx is OFF
0,1 = Other Tx is STANDBY but NOT READY
1,0 = Other Tx is STANDBY and READY
1,1 = Other Tx is RUNNING

31 Inputs to each Display with Input data selector = 12V & Local

Line 1 Master = 0, Slave = 1
Line 2 Connected to Own = 0, Other = 1

Sync Pulse Circuit

32 A Sync Pulse Circuit, comprising a presetable Delay Line and associated Buffer, is provided for each Transmitter.

33 Transmitter SYNC pulses are delayed by up to 350ns through a Sync Delay Line, and then passed to a Buffer. The buffered SYNC pulses are then passed via the Display A or B Relays and subsequently split to provide a SYNC pulse to the selected Display, and a BLANK pulse to the other Display (if required).

Video Signal Circuit

34 A Video Signal Buffer is provided for each Transmitter.

35 Transmitter VIDEO signals are terminated and then passed via the Display A or B relays to the selected Video Buffer, one for each Display.

OPERATION

36 The Interswitch Unit has two control switches, refer to Figure 2b, located on the top face which provide the following facilities:

(1) **TRANSMITTER CONTROL SELECTOR** CROSSED/UNCROSSED (two position switch) - determines which display controls which Transmitter when in LOCAL operation.

(2) **DISPLAY CONTROL SELECTOR** SLAVE A/MASTER/SLAVE B/REMOTE/TEST (five position switch - determines the Interswitch mode and connections in one of the local positions.

LOCAL MODE

37 The Local Interswitch mode of operation is as follows:

DISPLAY CONNECTION SELECTOR

Position 1 - SLAVE A; both Displays are connected to Transmitter A. If the Transmitter Control Selector switch is in the UNCROSSED position then Display A controls Transmitter A, if in the CROSSED position then Display B controls Transmitter A.

Position 2 - MASTER; if set to this position the mode of operation is as set by the Transmitter Control Selector.

Position 3 - SLAVE B; both Displays are connected to Transmitter B. If the Transmitter Control Selector switch is in the UNCROSSED position then Display B controls Transmitter B, if in the CROSSED position then Display A controls Transmitter B.

CAUTION

Before selecting REMOTE ensure that the Display(s) is/are switched to STANDBY.

Position 4 - REMOTE; on power up the system is connected as previously configured before power was turned off. Each display retains its configuration and the first display switched on determines the initial state.

Position 5 - TEST; used for Fault Finding purposes only, isolates most of the Interswitch circuits so that Straight Through operation only is selected.

TRANSMITTER CONTROL SELECTOR

38 The switch operates in conjunction with the Display Control Selector as described in the previous Paragraph. The following mode of operation is available when the Display Control Selector is set to MASTER:

(1) With the switch set to UNCROSSED each Display controls its own Transmitter.

(2) With the switch set to CROSSED then Display A controls Transmitter B and Display B controls Transmitter A.

Remote Mode

39 To operate the Interswitch facility from the Display(s) (Nucleus 5000 & 6000 only):

(1) Ensure that the Interswitch Unit is selected to REMOTE, if not switch the Display(s) to STANDBY and then select REMOTE on the Display Control Selector on the Interswitch Unit.

(2) The Display(s) show the mimic diagram on the Standby screen, as shown in Figure 3b below.

(3) To change the Transmitter selection position the cursor, using the trackerball, in the TX A(B) X(S) BAND IS READY box as required.

(4) The pop-down boxes display the following:

CD-2325

To Change Transmitter Control

40 Place the cursor, using the trackerball, in the new Transmitter box and press the right-hand pushbutton.

NOTE:

If the change is not possible or unavailable the system issues a warning in the Red Warning box i.e. other Display not in STANDBY, other Tx NOT READY.

To Select Data from other Transmitter

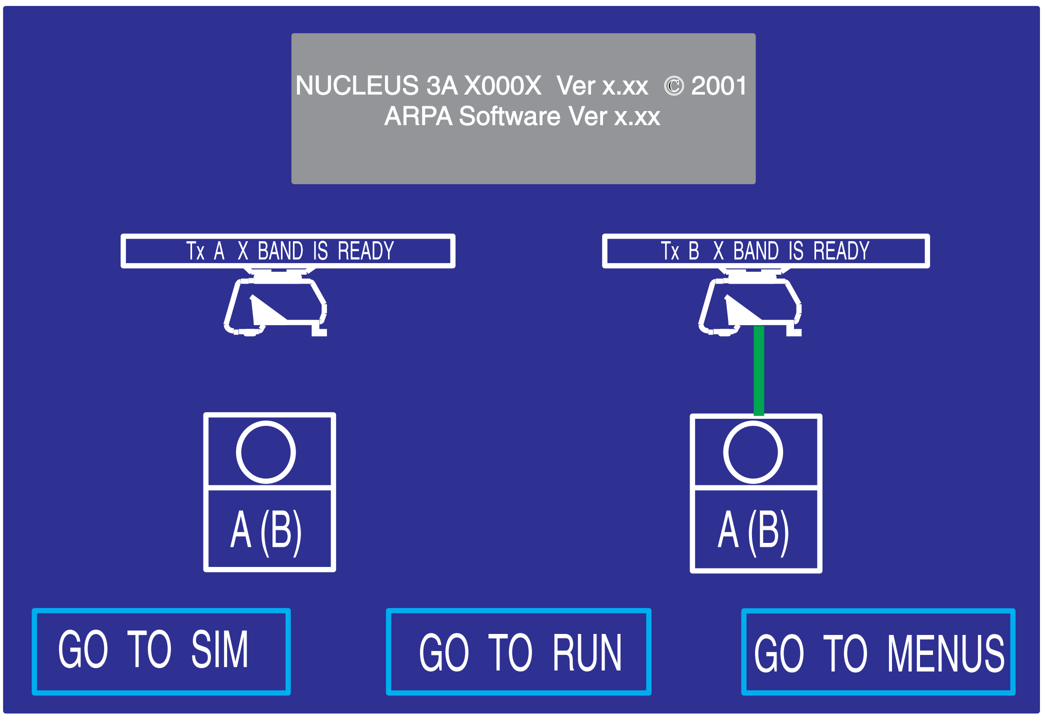
41 May be selected in STANDBY or RUN

(1) **Standby** - Position the cursor, using the trackerball, in the required TX A(B) X(S) BAND IS READY box and then press the left-hand pushbutton.

(2) **Run** - Position the cursor, using the trackerball, in the TX (A or B/X or S) box. The Pushbutton Selection box shows the following:

CD-2327

(3) Press the required pushbutton.



CD-4667

Figure 3b - STANDBY Screen - Mimic Diagram (Nucleus 5000 & 6000)

DIAGNOSTIC MAINTENANCE

42 A diagnostic algorithm is given in Figure 4b, to provide the operator/technician with a step-by-step guide through the fault finding procedure. The algorithm is intended for identification of faults to LRM level (e.g. a faulty PCB or cable/connector assembly).

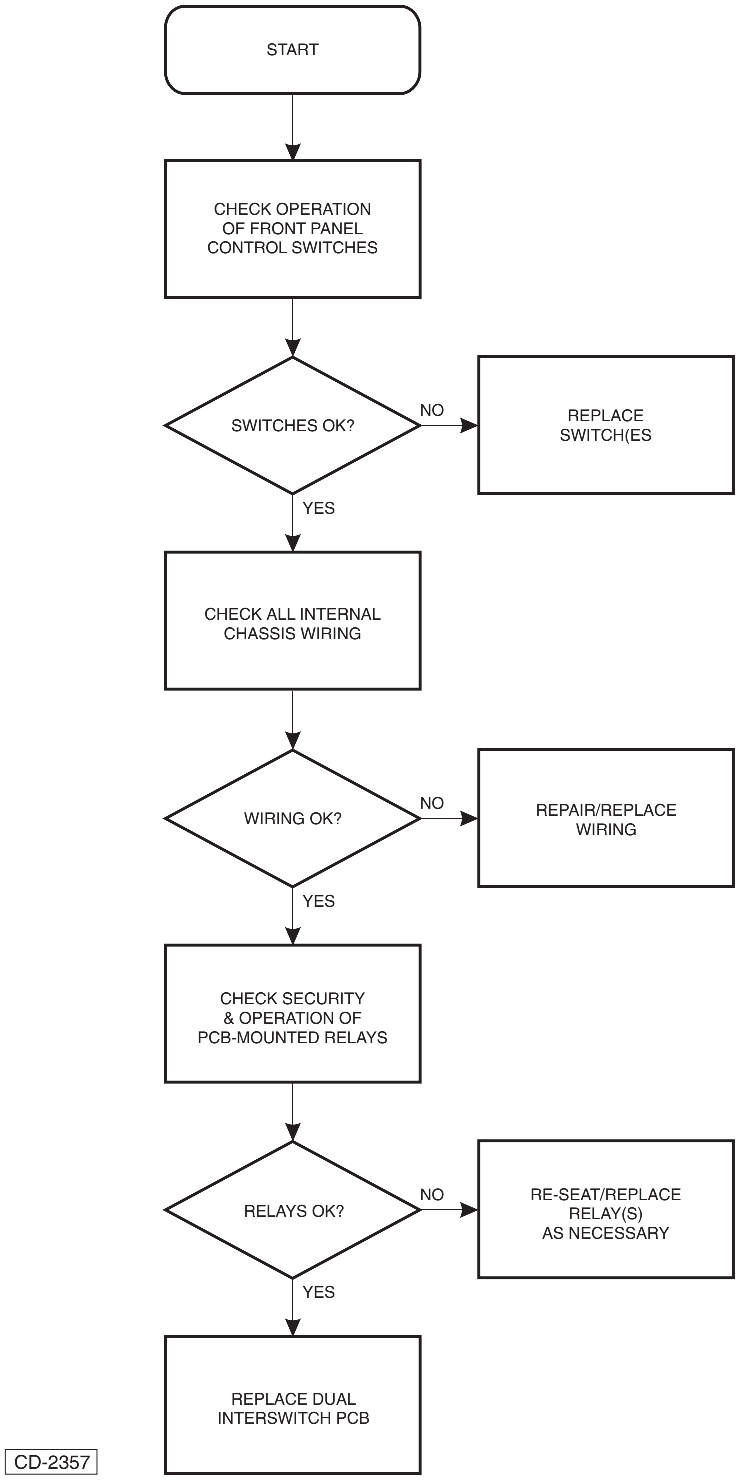


Figure 4b – Interswitch Unit - Fault Finding Algorithm

PARTS

43 Table 3 contains a list of replaceable items for the Dual Display Interswitch Unit (HRC-A9).

Table 3 – Dual Display Interswitch Unit (HRC-A9) Parts List

CCT. REF.	DESCRIPTION	KELVIN HUGHES PART No.
-	**DUAL DISPLAY INTERSWITCH UNIT**	**HRC-A9**
-	**Dual Interswitch PCB**	**HRC-C103**
-	**Front Panel**	
SW1	• Switch, Toggle, 2-Pole Changeover	
SW2	• Switch, Toggle, Single Pole Changeover	
	• Socket, 6-Way	

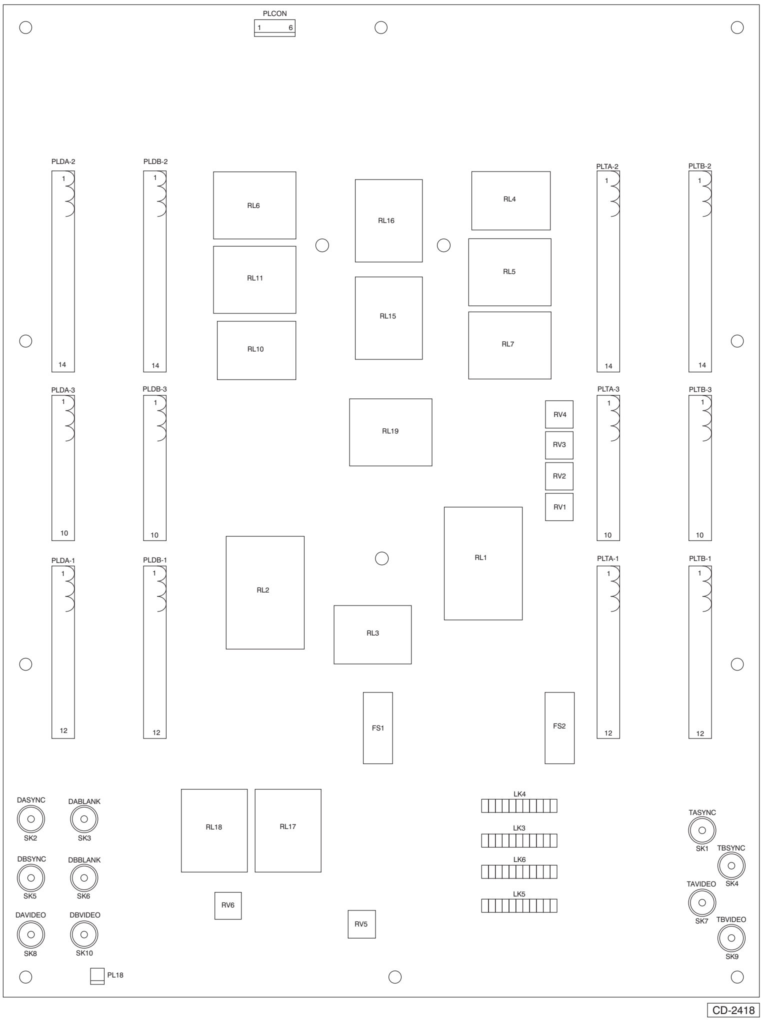


Figure 5b - Dual Interswitch Unit PCB - Links, Potentiometers & Switch Positions

CHAPTER 8C

FLAT PANEL DISPLAY

INTRODUCTION

1 This Chapter provides information on Nucleus 3 7000 Flat Panel Display equipment.

2 Two types of Nucleus 3 7000 Flat Panel Displays are available, these are:

(1) Nucleus 7000 20.1-inch Display (NNR-A69)

(2) Nucleus 7000 18-inch Display (NNR-A70)

3 The Nucleus 7000 Flat Panel Displays (NNR-A69/NNR-A70) are designed to be connected to a Nucleus 3 Split Processor unit, in conjunction with a Remote Trackerball and a Display ON-OFF Sounder, as an alternative to the Nucleus 6000 Display.

4 The Flat Panel Display systems comprise the following assemblies:

(1) Nucleus 7000 Flat Panel Display.

(2) Split Processor - containing Input/Output PCB, System PCB and Power Supply Unit.

(3) Remote Trackerball (Desktop Control Pod).

(4) Display On-Off Sounder Unit.

DISPLAY CHARACTERISTICS

5 The Characteristics of the Flat Panel Displays are detailed below.

.

Table 1 - Flat Panel Display Specifications

	NNR-A69 (20.1")	NNR-A70 (18")
Display Area	**399.36mm (H) x 319.5mm (V)**	**359mm (H) x 287mm (V)**
Resolution (pixels)	**1280 x 1024 XSVGA**	**1280 x 1024 XSVGA**
Dot Pitch	**0.312mm (H) x 0.312mm (V)**	**0.2805mm (H) x 0.2805mm (V)**
Power Requirements	**24V dc, 92W**	**24V dc, 90W (typical)**
Weight	**10.2 kg**	**-**
Compass Safe Distance	**Grade I = 0.3m Grade II & III = 0.3m**	**Grade I = 0.7m Grade II & III = 0.4m**

SYSTEM CONFIGURATIONS

6 Typical Flat Screen Display system configurations are shown in the Introduction to this Manual. Refer to the Introduction, paragraph 43, for further information.

PRE-INSTALLATION REQUIREMENTS

7 Prior to installation of the Flat Panel Display, implement the following:

(1) Ensure that there is adequate clearance for the Operator's position in front of the desk or pedestal display unit and at the rear of the unit to allow fitting of the power and other system cables.

(2) Lay in the ships cables to the required installation position.

INSTALLATION

INSTALLATION REQUIREMENTS

Space Requirements

8 The dimensions of equipment are shown in Figure 1c and Figure 2c. Adequate clearance at the front of the equipment must be maintained for access and servicing.

Position of the Display

9 The Nucleus 3 7000 Flat Panel Display is designed to be Panel or Console mounted, allowing easy access for the Operator.

Specifications

10 For details of the Weight, Power Supplies and Compass Safe distances of the Flat Panel Displays, refer to Table 1.

ELECTRICAL CONNECTIONS

Cable Screens

11 The cable screens are not to be stripped back further than is necessary to enable the cores to be connected. All exposed screens must be covered with PVC sleeving to prevent accidental contact with live terminals.

Cable Connections

12 The Flat Panel Display and associated Remote Trackerball and On/Off Sounder are connected to the processor as shown on Figure 1c and Figure 2c.

INPUT SIGNALS

13 Inputs to the Flat Screen Displays comprise video signals and power.

CONTROL SWITCHES

14 The control switches, located on the Front Panel of the Flat Panel Display Unit, are used for positioning the picture on the screen and configuring the picture parameters.

15 Refer to paragraphs 58 to 83, for details of the Controls and indications provided at the Flat Panel Display units.

INSTALLATION

Flat Panel Displays

16 The Flat Panel displays are designed to be either Panel-mounted or Console-mounted.

17 Refer to Figure 1c for installation of the 20.1-inch Flat Panel Display and Figure 2c for installation of the 18-inch Flat Panel Display.

18 Mark out the the cut-out position for the Flat Panel Display in the Panel or Console (as appropriate), allowing sufficient space for cable access and ventilation, and cut-out the aperture for the flat panel display.

19 Cut out the aperture for the Flat Panel Display and drill the required bolt positions for fixings.

20 Fit the Flat Panel Display into the Panel/Console and secure it in position, using the fixings supplied.

Processor Unit

21 Mark out the position of the Processor Unit, leaving sufficient clearance for ventilation, cable access and servicing.

22 Drill the required bolt positions and secure the Processor unit in position, using the fixings supplied.

23 Feed the ship's cables through the base of the unit and make the connections, as detailed in the appropriate Interconnections diagram. Figure 3c - 20.1-inch Display or Figure 4c - 18-inch Display.

On/Off Sounder Unit

24 Where the On/Off Sounder is to be panel mounted, refer to Figure 5c and mark out the position of the On/Off Sounder unit. Drill the required fixing positions and secure the unit in position, using the fixings supplied.

25 Connect the On/Off Sounder unit to the Processor Unit, as detailed in the appropriate interconnections diagram.

Remote Trackerball

26 Where the Remote Trackerball is to be mounted within a console, refer to Figure 6c and mark out the position of the Trackerball unit. Drill the required fixing positions and secure the unit in position, using the fixings supplied.

27 Connect the Remote Trackerball to the Processor Unit, as detailed in the appropriate interconnections diagram.

SETTING TO WORK

GENERAL

28 The Flat Screen Displays can be used in place of Nucleus 3 6000 series displays.

29 The displays have been factory set-up and therefore will not normally require any adjustment. However, adjustment of monitor settings may become necessary following monitor replacement.

SETTING-UP THE MONITOR

Pre-Switch On Checks

30 Check that all cables are correctly connected.

31 Check that the SYNC SETTINGS links at the Video Input PCB in the Processor Unit are set as follows:

LK 1 - OPEN
LK 2 - MADE(Closed)

Switching On

32 Switch on the power supply to the Flat Screen Display and check that the Power Indicator is illuminated.

Monitor Parameter Adjustments

20.1-inch Display (NNR-A69)

33 The brightness and contrast can be adjusted, if necessary.

34 For the best picture setting, a suitable test image of the required resolution should be used

35 Refer to paragraph 58 and set up the monitor as follows:

36 Press the SELECT button followed by the [+] and [-] of the ADJUST key to highlight the required parameter.

37 Press the SELECT button, then use the [+] and [-] of the ADJUST key to achieve the required correction.

38 Pressing the EXIT button saves the setting and returns the screen to the menu selection.

39 Once all required parameter adjustments have been made, press EXIT to exit from the parameter menu.

18-inch Display (NNR-A70)

40 The brightness and contrast can be adjusted, if necessary.

41 For the best picture setting, a suitable test image of the required resolution should be used

42 Refer to paragraphs 61 to 83 and set up the monitor as follows:

43 Press the MENU key to open the Main Menu.

44 Open the SETUP menu, using the [+] (up) and [-] (down) keys.

(1) Refer to paragraph 66 and make any adjustments required to the picture size and position.

(2) Save the new settings by pressing the DOWN key and close the SETUP menu.

45 Open the PICTURE menu, using the [+] (up) and [-] (down) keys to highlight, then press the ENTER key.

(1) Refer to paragraph 74 and make any adjustments required to the brightness, contrast and colour.

(2) Save the new settings by pressing the DOWN key and close the PICTURE menu.

46 Open the OPTIONS menu, using the [+] (up) and [-] (down) keys to highlight, then press the ENTER key.

(1) Refer to paragraph 78 and if required, alter the on screen language and select the Prompt mode.

(2) Save the new settings by pressing the DOWN key and close the OPTIONS menu.

47 Open the MODE INFO menu, using the [+] (up) and [-] (down) keys. Check that the settings are correct

48 Open the SERVICE Info box, using the [+] (up) and [-] (down) keys and pressing the ENTER key. Check that the correct version of software has been loaded

SETTING-UP THE REMOTE TRACKERBALL

49 Check that the DIP switches on the Remote Trackerball Unit (NNR-A10-3) are set correctly, as detailed below. Refer to Figure 6c for the location of the DIP switches.

Table 2 - Remote Trackerball DIP Switch Settings

DIP SWITCH SETTINGS	
1	ON
2	OFF
3	OFF
4	ON
5	OFF
6	ON
7	OFF
8	OFF

FUNCTIONAL DESCRIPTION

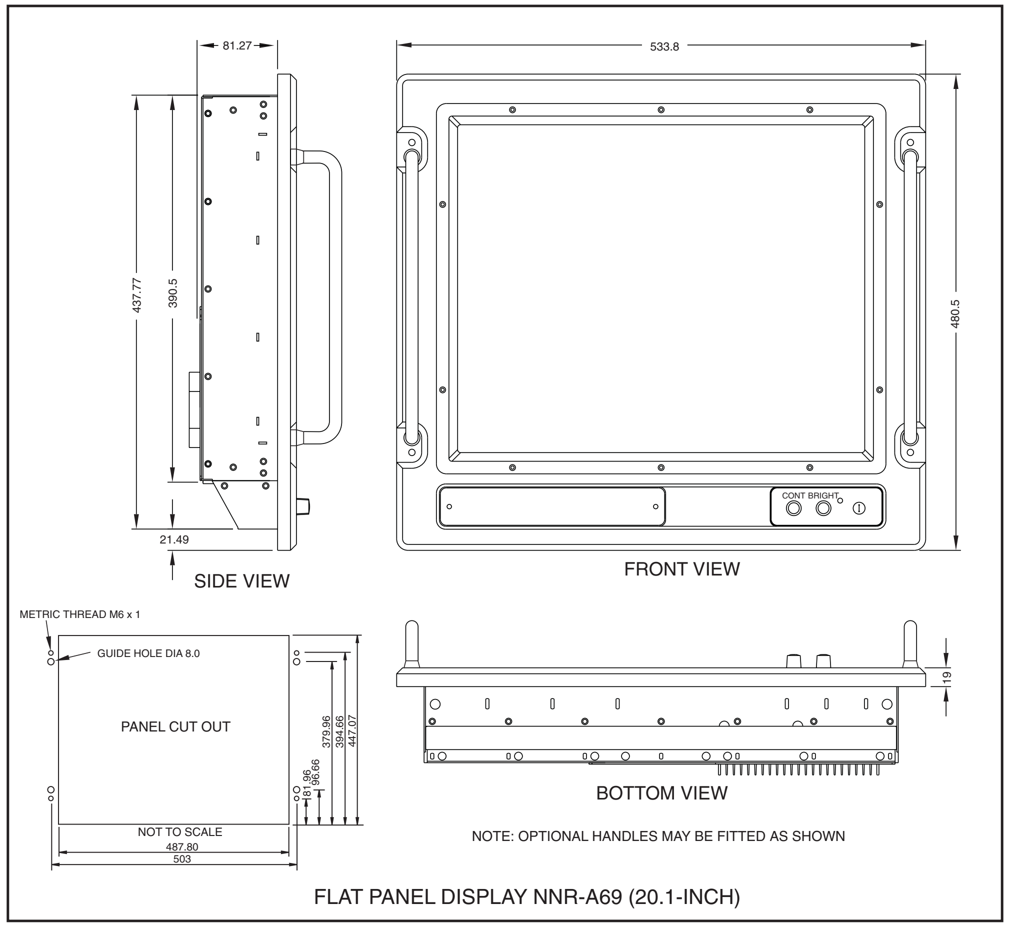
50 There are two types of Nucleus 7000 Flat Panel Display:

(1) 20.1-inch Display (NNR-A69)

(2) 18-inch Display (NNR-A70)

51 Both display types are designed to be ruggedised and lightweight, with EMI packaging.

52 The Nucleus 7000 Flat Panel Displays are designed to be used in place of the Nucleus 3 5000/6000 series display units. The Flat Panel displays are used in conjunction with a Remote Trackerball and an On/Off Sounder to provide the same functionality as that provided by the Nucleus 3 6000 displays.



FLAT PANEL DISPLAY NNR-A69 (20.1-INCH)

TO INSTALL THE NUCLEUS 7000 SPLIT PROCESSOR & FLAT PANEL DISPLAY

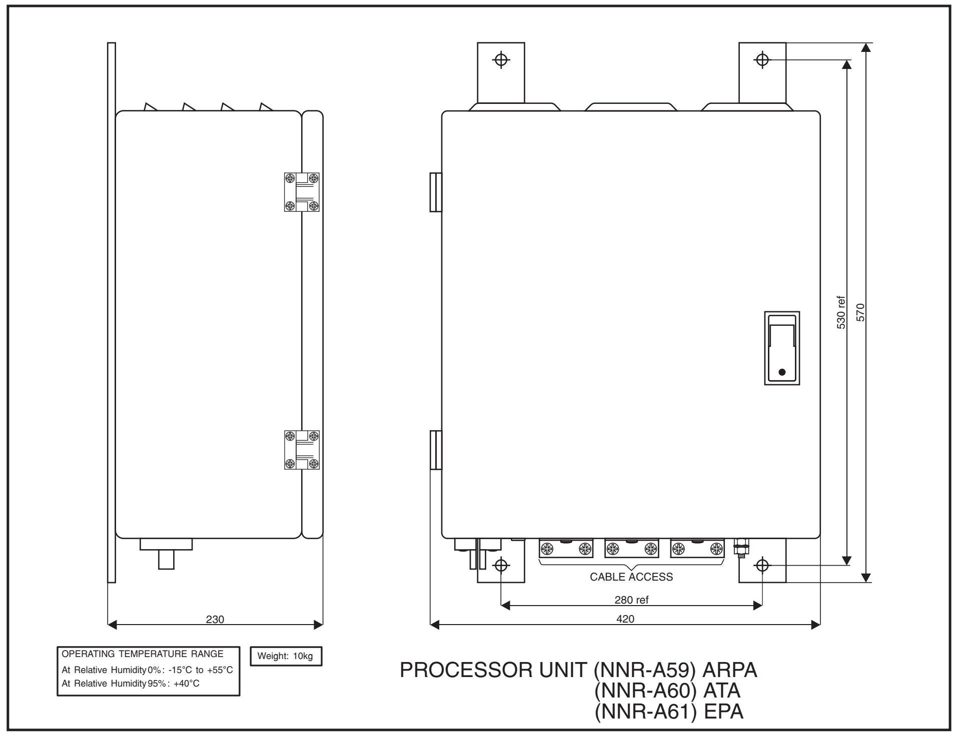
A) DISPLAY UNIT

1. Refer to the dimensioned drawing opposite for hole locations.
   Mark out the the cut-out position for the Flat Panel Display in the Panel or Console (as appropriate), allowing sufficient space for cable access and ventilation.
   Cut out the aperture for the Flat Panel Display and drill the required bolt positions for fixings.
2. Fit the Display Unit in the required location and fasten in position using the fixings supplied.

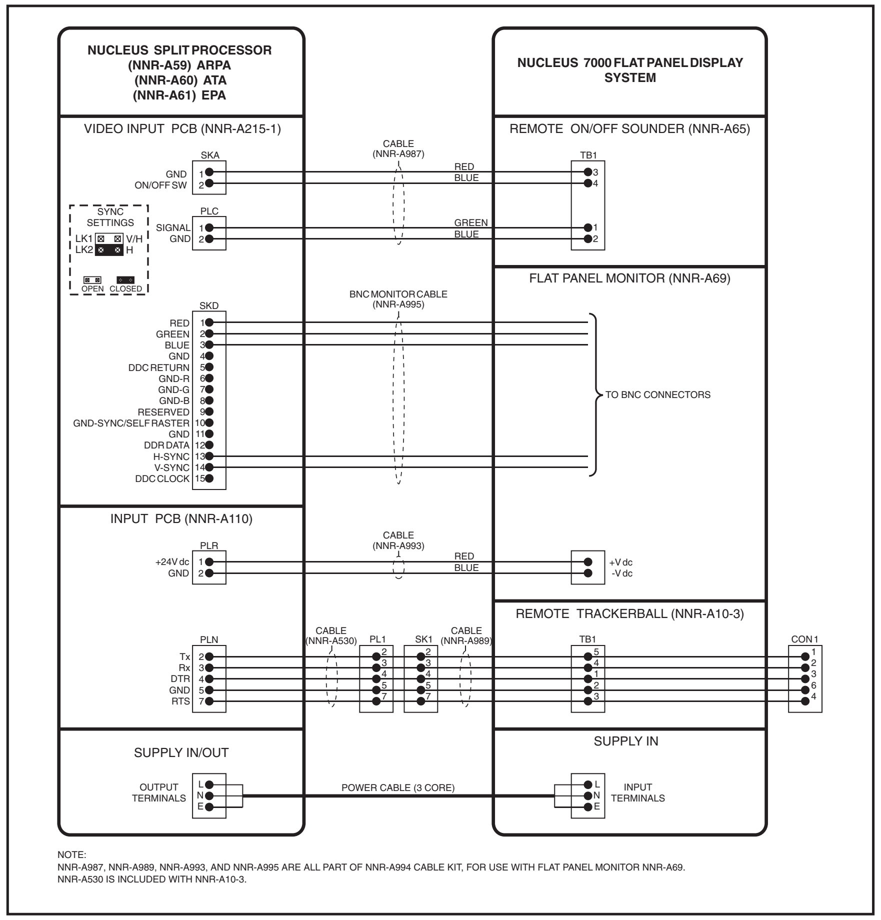
B) PROCESSOR UNIT

NOTE: A 2m Cable Kit is supplied as standard with optional 5, 10, 15 & 20m kits also available.

1. Mark out the position of the Processor Unit, leaving sufficient clearance for ventilation, cable access and servicing; drill the bolt positions as shown in the diagram.
2. Secure the Processor Unit in position.
3. Feed the ship's cables through the base of the unit and make the connections as detailed on the appropriate Connections Diagram(s).
4. Ensure that the Processor Unit is directly earthed to the ship's earth, using the bolt provided.
5. See Monitor to Processor Connections Diagram



PROCESSOR UNIT (NNR-A59) ARPA
(NNR-A60) ATA
(NNR-A61) EPA



OPERATING TEMPERATURE RANGE

AT RELATIVE HUMIDITY 0%: -15°C TO +55°C
AT RELATIVE HUMIDITY 95%: +40°C

POWER CONSUMPTION: 380VA

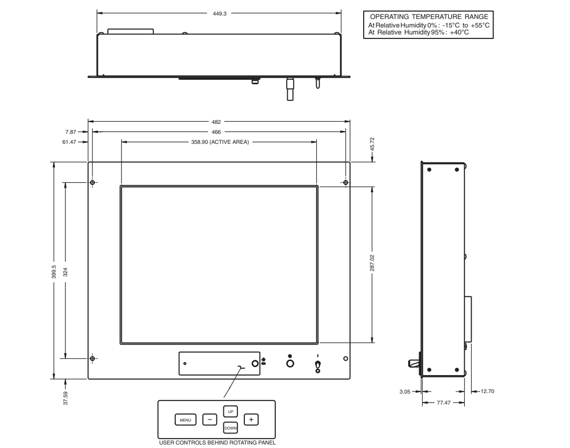
PROCESSOR UNIT: 13kg
FLAT PANEL DISPLAY: 10.2kg

COMPASS SAFE DISTANCES

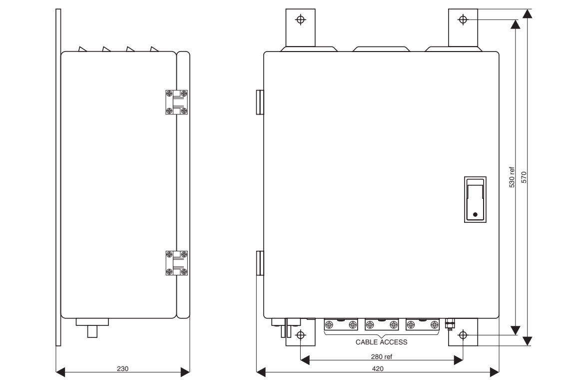
	GRADE 1 1/4°	GRADE 2 1°
DISPLAY	0.3m	0.3m
PROCESSOR	2.0m	0.8m

CD-4339

Figure 1c - Nucleus 7000 20.1-inch Flat Panel Display (NNR-A69): Installation Diagram **Figure 1c**



FLAT PANEL DISPLAY NNR-A70 (18-INCH)



PROCESSOR UNIT (NNR-A59) ARPA
(NNR-A60) ATA
(NNR-A61) EPA

TO INSTALL THE NUCLEUS 7000 SPLIT PROCESSOR & FLAT PANEL DISPLAY

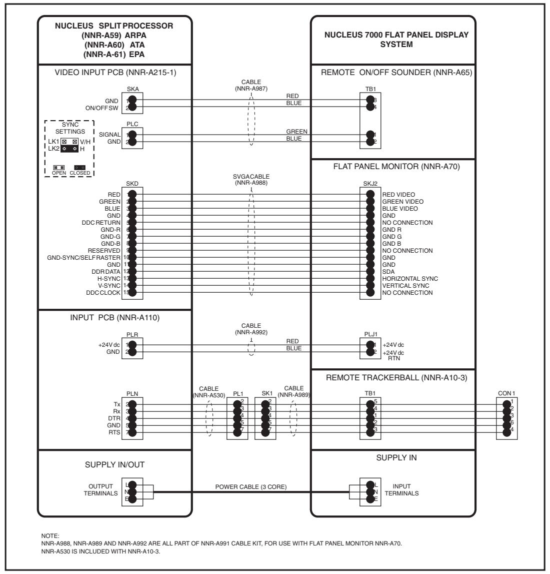
A) DISPLAY UNIT

1. Refer to the dimensioned drawing opposite for hole locations.
   Mark out the the cut-out position for the Flat Panel Display in the Panel or Console (as appropriate), allowing sufficient space for cable access and ventilation.
   Cut out the aperture for the Flat Panel Display and drill the required bolt positions for fixings.
2. Fit the Display Unit in the required location and fasten in position using the fixings supplied.

B) PROCESSOR UNIT

NOTE: A 2m Cable Kit is supplied as standard with optional 5, 10, 15 & 20m kits also available.

1. Mark out the position of the Processor Unit, leaving sufficient clearance for ventilation, cable access and servicing; drill the bolt positions as shown in the diagram.
2. Secure the Processor Unit in position.
3. Feed the ship's cables through the base of the unit and make the connections as detailed on the appropriate Connections Diagram(s).
4. Ensure that the Processor Unit is directly earthed to the ship's earth, using the bolt provided.
5. See Monitor to Processor Connections Diagram



OPERATING TEMPERATURE RANGE

AT RELATIVE HUMIDITY 0%: -15°C TO +55°C
AT RELATIVE HUMIDITY 95%: +40°C

POWER CONSUMPTION: 380VA

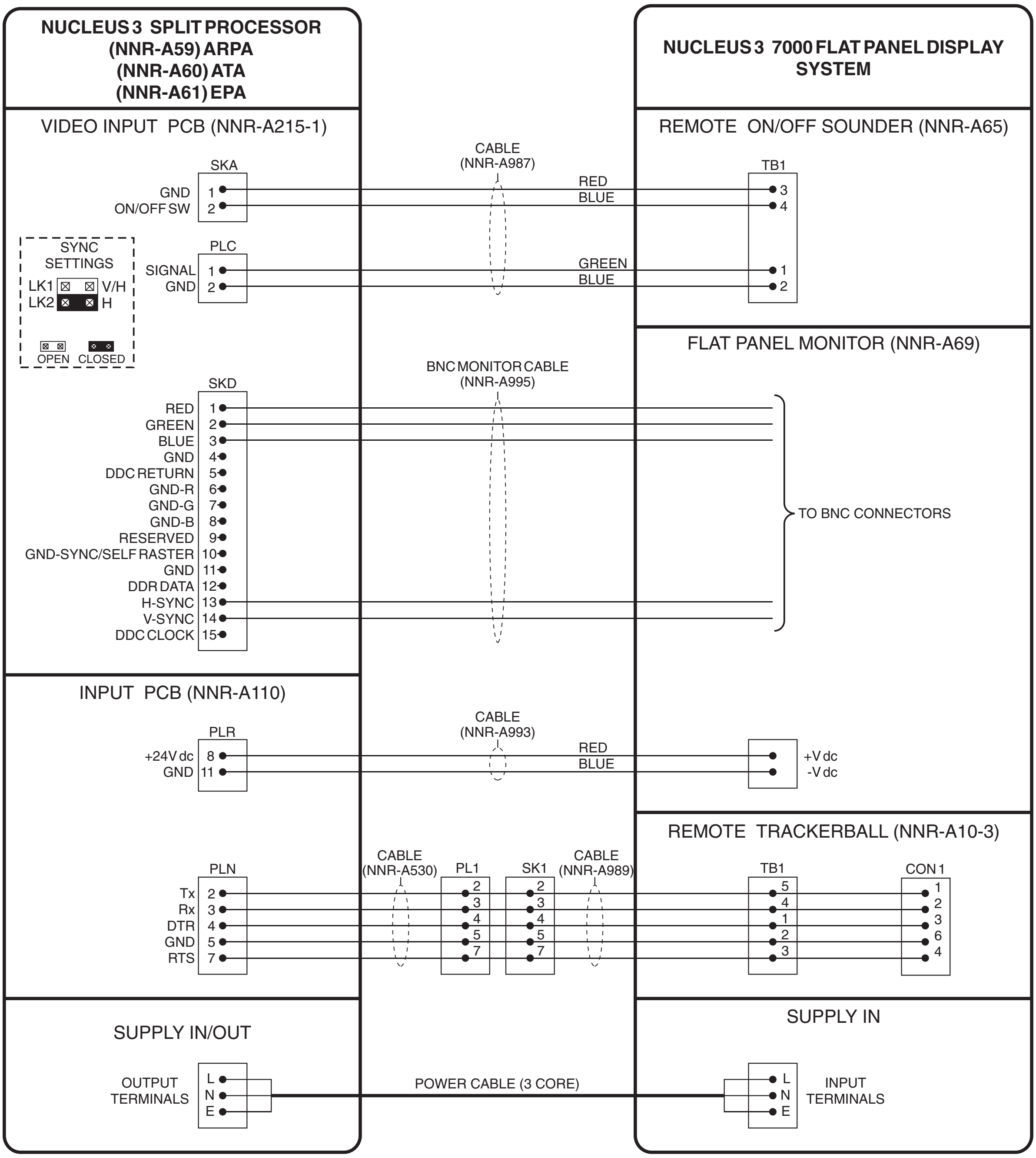
PROCESSOR UNIT: 13kg
FLAT PANEL DISPLAY: 10.2kg

COMPASS SAFE DISTANCES

	GRADE 1 1/4°	GRADE 2 1°
DISPLAY	0.7m	0.4m
PROCESSOR	2.0m	0.8m

CD-4333

Figure 2c - Nucleus 7000 18-inch Flat Panel Display (NNR-A70): Installation Diagram **Figure 2c**

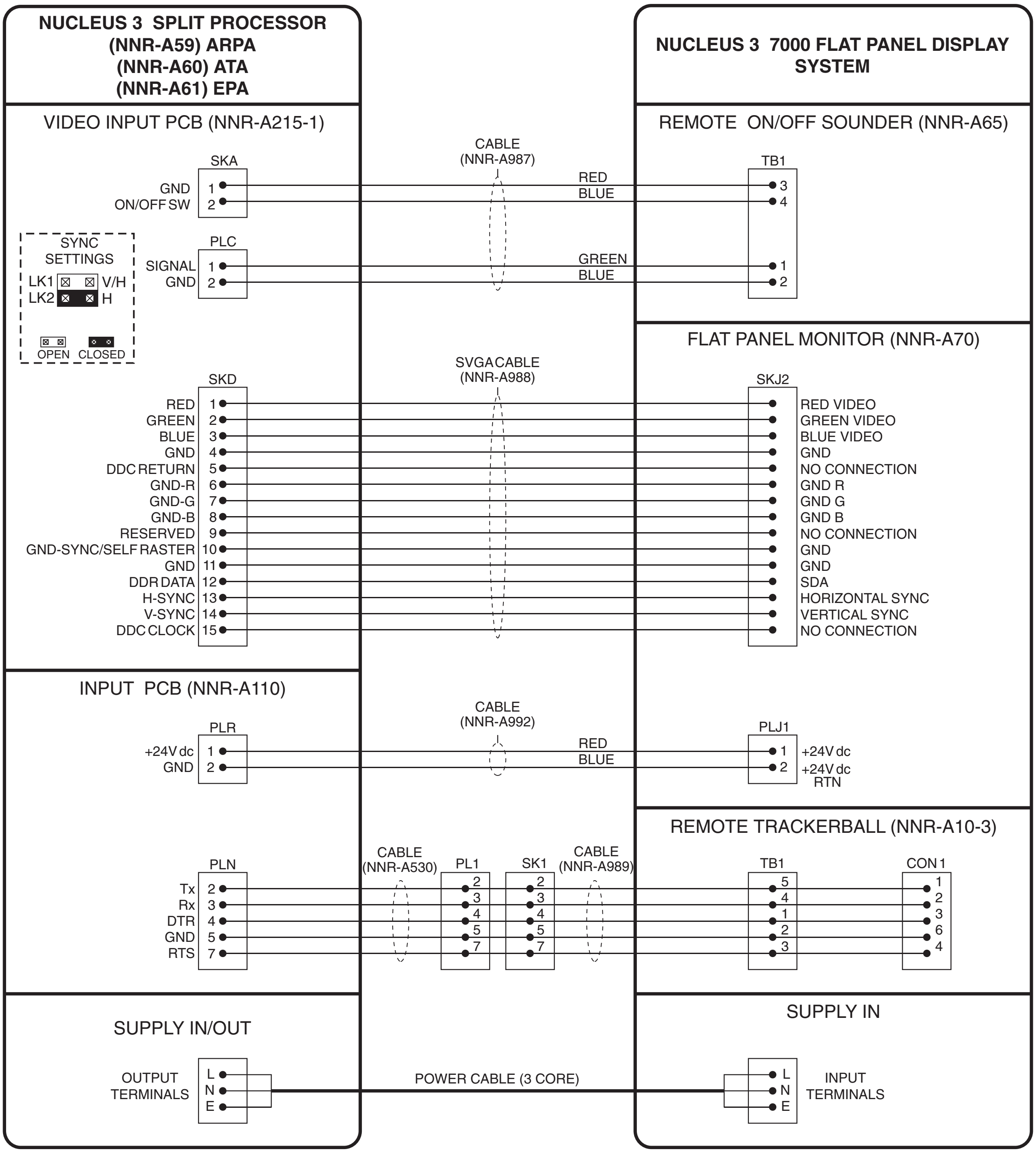


NOTE:
NNR-A987, NNR-A989, NNR-A993, AND NNR-A995 ARE ALL PART OF NNR-A994 CABLE KIT, FOR USE WITH FLAT PANEL MONITOR NNR-A69.

NNR-A530 IS INCLUDED WITH NNR-A10-3.

CD-4331

Figure 3c - 20.1-inch Flat Panel Display (NNR-A69): Interconnections Diagram



NOTE:
NNR-A988, NNR-A989 AND NNR-A992 ARE ALL PART OF NNR-A991 CABLE KIT, FOR USE WITH FLAT PANEL MONITOR NNR-A70.

NNR-A530 IS INCLUDED WITH NNR-A10-3.

CD-4332

Figure 4c - 18-inch Flat Panel Display (NNR-A70): Interconnections Diagram

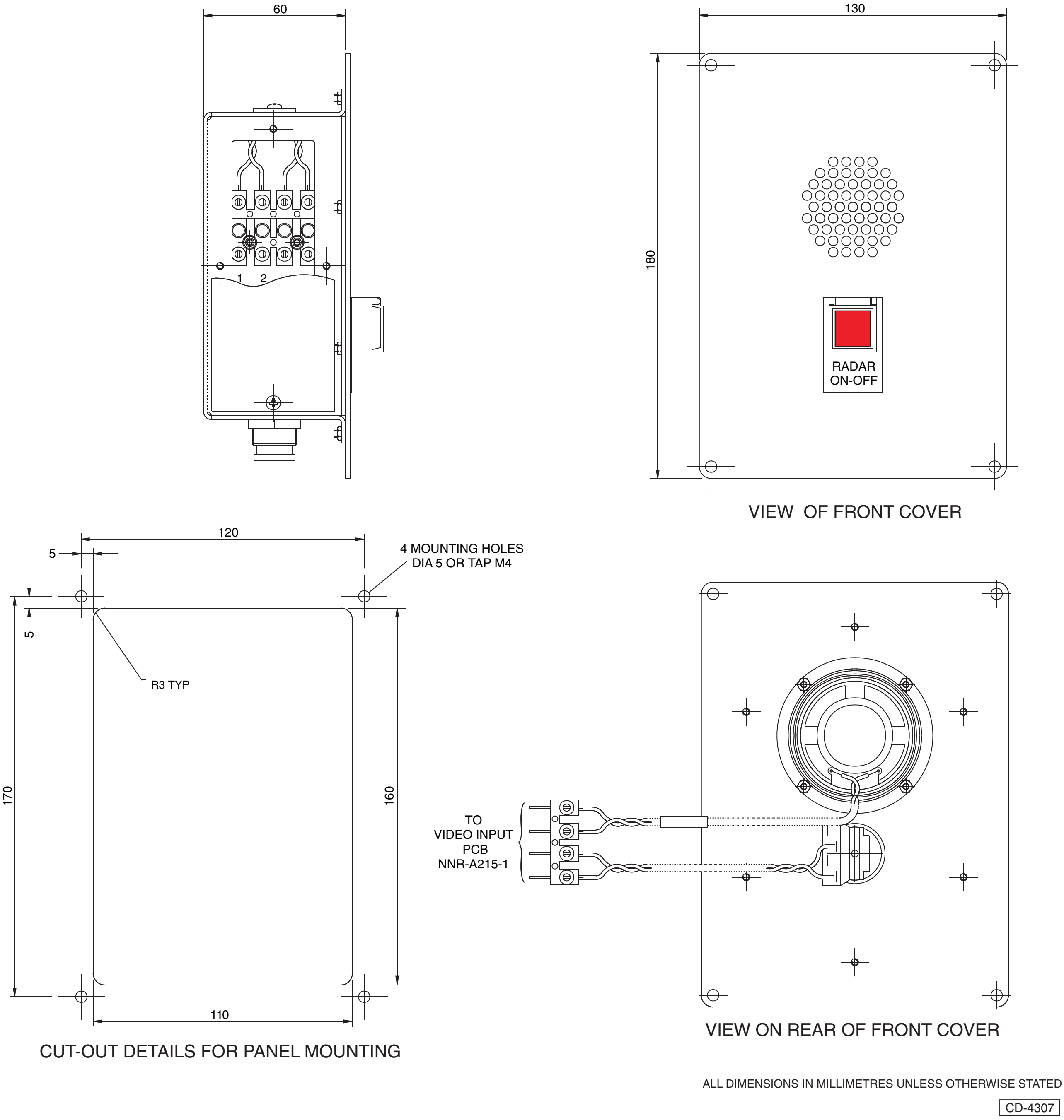


Figure 5c - Flat Panel Display ON/OFF Sounder (NNR-A65): Installation Diagram

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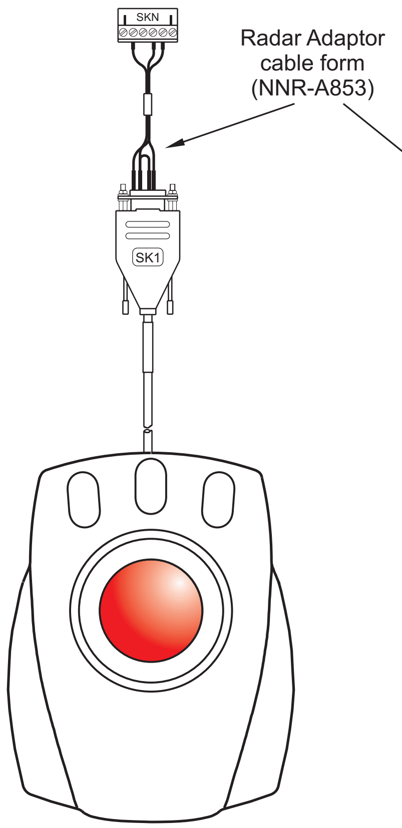
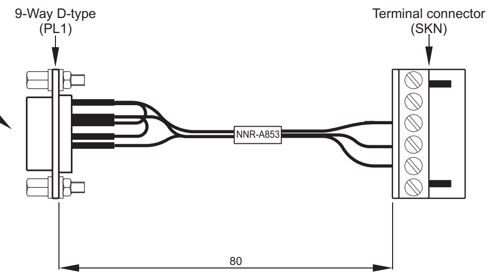
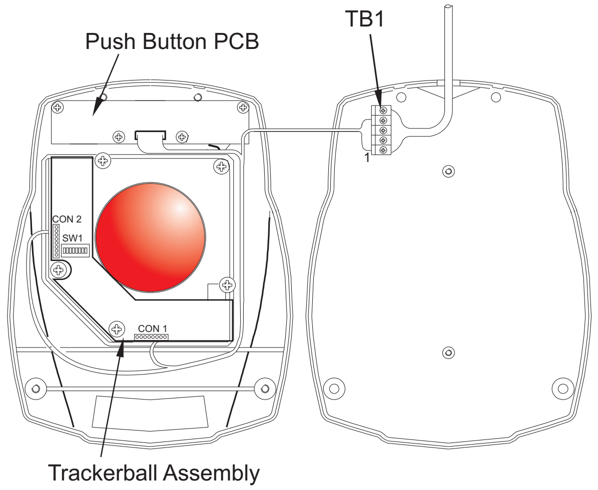


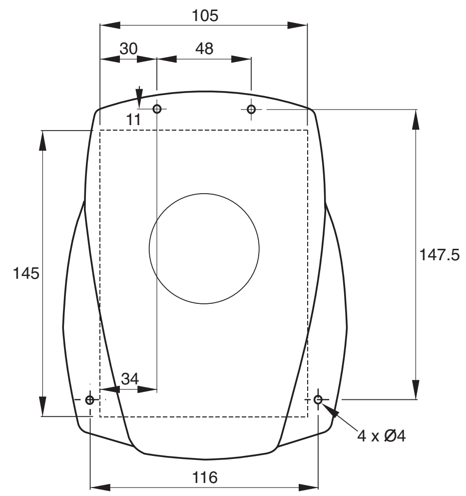


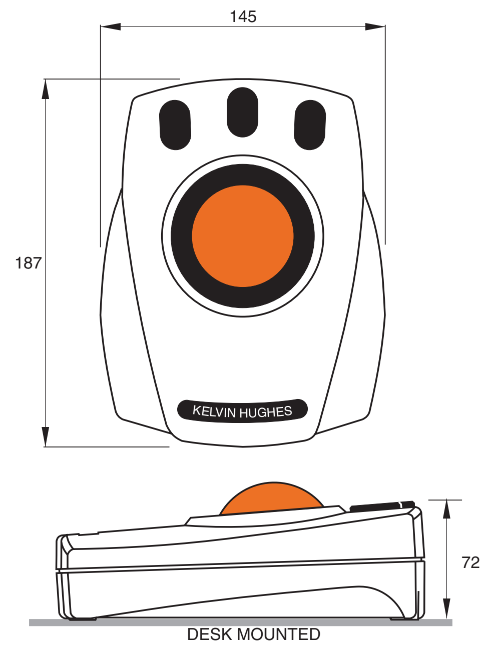
WIRE No.	TERMINATION FROM	TERMINATION TO	SIGNAL
10	PL1-2	SKN-2	Tx
11	PL1-4	SKN-4	+12V
12	PL1-4	PL1-7	
13	PL1-5	SKN-3	Gnd
14	PL1-5	PL1-3	



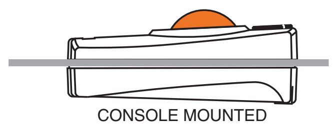
WIRE No.	COLOUR	TERMINATION FROM	TERMINATION TO	REMARKS	
1	RED	SK1-4	TB1-5	DTR	CON 1-3
2	YELLOW	SK1-5	TB1-4	GND	CON 1-6
3	BLUE	SK1-7	TB1-3	RTS	CON 1-4
4	GREEN	SK1-3	TB1-2	RX	CON 1-2
5	BLACK	SK1-2	TB1-1	TX	CON 1-1
6	WHITE	N/C			

SW1 SETTINGS
ON: 1, 4, 6* *(6 May not be required, dependant upon connected device)





FOR PANEL MOUNTING MAKE CUT-OUT AND FIXING HOLES AS SHOWN ABOVE AND FIX THE TWO HALVES OF THE TRACKERBALL EITHER SIDE OF THE PANEL AS SHOWN BELOW



CD-4306

Figure 6c - Remote Trackerball Unit (NNR-A10-3): Installation Diagram **Figure 6c**

OPERATING INSTRUCTIONS

53 The Flat Panel Display is used in conjunction with a Remote Trackerball and an ON/OFF Sounder. The following paragraphs provide information on operating and provide descriptions of the controls and indicators provided on the Flat Panel Displays and on the associated Remote Trackerball unit and ON/OFF Switch unit.

OPERATING

54 The Operation of the Nucleus 3 System, fitted with Flat Panel Displays is identical to that of a system using the 5000 and 6000 series displays. Refer to Chapter 1, for operating information.

POWER ON/OFF

55 The Display is switched ON using the ON/OFF switch, located on the front of the display unit.

56 The Radar System is switched ON using the ON/OFF switch on the ON/OFF Sounder Unit (NNR-A65).

57 It is recommended that the Display ON/OFF switch is set to the ON position and remains in the ON position, and that the system is switched ON/OFF at the ON/OFF Sounder Unit. This avoids confusion over whether the Radar system is on or off when the Display is switched OFF.

CONTROLS AND INDICATORS

20-inch Flat Panel Display

58 The 20-inch Flat Panel Display is fitted with the following controls and indicators:

(1) Display POWER ON/OFF switch, located on the front panel of the unit.

(2) BRIGHTNESS control, located on the front panel.

(3) CONTRAST control, located on the front panel.

(4) POWER (Green) LED - indicates Power ON.

On-Screen Adjustment Controls

59 The Display can be adjusted using an On-screen Display (OSD) and the following pushbutton controls:

(1) SELECT - enables the Parameter menu to be opened.

(2) EXIT - allows exit from menu selections.

(3) Adjust (+ and - keys) - used to select a parameter and to make adjustments once a parameter is selected.

60 For the best picture setting, a suitable test image of the required resolution should be used. Set up the monitor as follows:

(1) Press the SELECT key to open the required parameter.

(2) Open the required sub-menu/parameter, by pressing SELECT, then using the ADJUST [+] and [-] keys make the required adjustment.

(3) Press EXIT to save the setting.

(4) Once all required adjustments above been made, press EXIT again to exit from the parameter menu.

18-inch Flat Panel Display

Front Panel Control and Indicators

61 The 18-inch Flat Panel Display is fitted with the following controls and indicators:

(1) Display POWER ON/OFF switch, located on the front panel of the unit.

(2) BRIGHTNESS control, located on the front panel.

(3) POWER (Green) LED - indicates Power ON. The green POWER status indicator extinguishes and the amber NO SYNC indicator illuminates when in Power Save Mode.

(4) NO SYNC (Amber) LED - indicates that the monitor cannot synchronise to the external video input and has entered the power-save mode.

On-Screen Adjustment Controls

62 The Display can be adjusted using an On-screen Display (OSD) and the following pushbutton controls:

(1) MENU - enables the Main Menu to be opened and closed.

(2) RESET - allows exit from menu selections.

(3) UP/ DOWN Arrows - used to select a sub-menu and to make adjustments once a function is selected.

63 The On-Screen Display (OSD) facilities provided by the 18-inch Flat Screen Display are shown in Figure7.

64 For the best picture setting, a suitable test image of the required resolution should be used. Set up the monitor as follows:

(1) Press the MENU key to open the Main Menu.

(2) Open the required sub-menu, using the [+] (up) and [-] (down) keys

65 In the event that the unit comes up in the wrong resolution format (SXGA vs. XGA), use the following procedure to correct the situation:

(1) Press the Menu pushbutton and turn the power ON. Keep the Menu pushbutton depressed for several seconds, until a sub-menu is displayed. The sub-menu shows SXGA and GA for selection.

(2) Select the required resolution.

(3) Press the [+] pushbutton. The correct format is selected and the sub-menu disappears.

SETUP Menu

66 The SETUP menu allows adjustment of the position and size of the picture on the monitor's display. The following Menu options are provided:

67 Horizontal Position

To alter the picture's horizontal position, press the (UP) (DOWN) keys. If the display and graphic map resolution are the same (i.e. a 1:1 resolution), to achieve optimum picture setting, the whole of the picture should fill the monitor display area. This can be seen from the 1 pixel wide red line in the corners of the test picture. These lines are clearly visible when the picture is correctly aligned.

68 Horizontal Size

The picture can be expanded horizontally to the right. The position to the left-hand edge of the picture does not change. With a 1:1 resolution, when adjusting the horizontal size, ensure that the red 1 pixel lines in the corners of the test picture remain visible and that the test picture fills the whole of the display area on the right-hand edge of the screen.

69 Vertical Position

To alter the picture's vertical position, press the (UP) (DOWN) keys. With a 1:1 resolution, when adjusting the vertical position, ensure that the red 1 pixel lines in the corners of the test picture remain visible and that the test picture fills the full display area.

70 Vertical Size

The picture can be distorted vertically by percentage values. The displayed value indicates the percentage of distortion. The correct expansion is usually automatic, but can be manually corrected here.

71 Clock Phase

The scanning time (focus) can be set using the (UP) (DOWN) keys.

72 Save

To save the entered values, press the DOWN key. This avoids losing the data at the next mode change, as when a video mode is saved several times the previous save is always overwritten to reduce memory consumption. After each save the selected menu option is automatically de-activated after 0.5 second delay. Pressing any other key aborts the action, without saving the data.

73 Presets

The default setting of the test picture can be restored by pressing the (UP) key.

PICTURE Menu

74 Brightness

Adjust the Brightness using the DOWN (less) and UP (more) keys. The default value is set to 48. Settings below 48, dim the backlight. An increase in brightness is generated by a dc offset in the RGB level. The black level of the pictures is increased at the same time.

75 Contrast

Adjust the Contrast using the DOWN (less) and UP (more) keys

76 Colour Temperature

Select Colour Temperature, by pressing the ENTER key. A choice of three preset colour combinations(A, B or C) is provided or a user defined combination can be used. The saturation level of the colours can be adjusted by selecting the colours R (red), G (green) and B (blue) with the ENTER key, then pressing UP (for more saturation) or DOWN (for less saturation).

77 Save

To save the settings, press the DOWN key. After each save the selected menu option is de-activated after a 0.5 second delay. Pressing any other key aborts the action without saving the data.

OPTIONS Menu

78 Prompt

When PROMPT is selected, the info mode automatically appears for a short while when the video mode is changed

79 Language

The language on screen can be selected from a choice of English, German and French.

80 RS232 Address

81 This option is used to identify the unit, when operating on an RS232 serial interface.

MODE INFO Menu

82 The Mode Info menu displays the parameters of the current video mode.

Mode: Picture resolution, based in the number of lines.

H Freq: H-Sync-frequency to within 4Hz.

V Freq: V-Sync-frequency to within 0.003Hz.

H Pol: H-Sync-polarity, neg. = negative sync pulse.

V Pol: V-Sync-polarity, neg. = negative sync pulse

Sync: Type of synchronous signals (RGB, H-V, composite, on Green)

Lines: Absolute number of lines (active and inactive) forming the picture.

Hposition: Horizontal position of the displayed pixel.

Vposition: Vertical position of the displayed line.

Entry: Common memory allocation.

SERVICE Info Box

83 The following information is provided in the Service info box:

Software Version.
Serial Number of Software.
Number of Hours unit has been in use.
Number of times that the unit has been switch on.

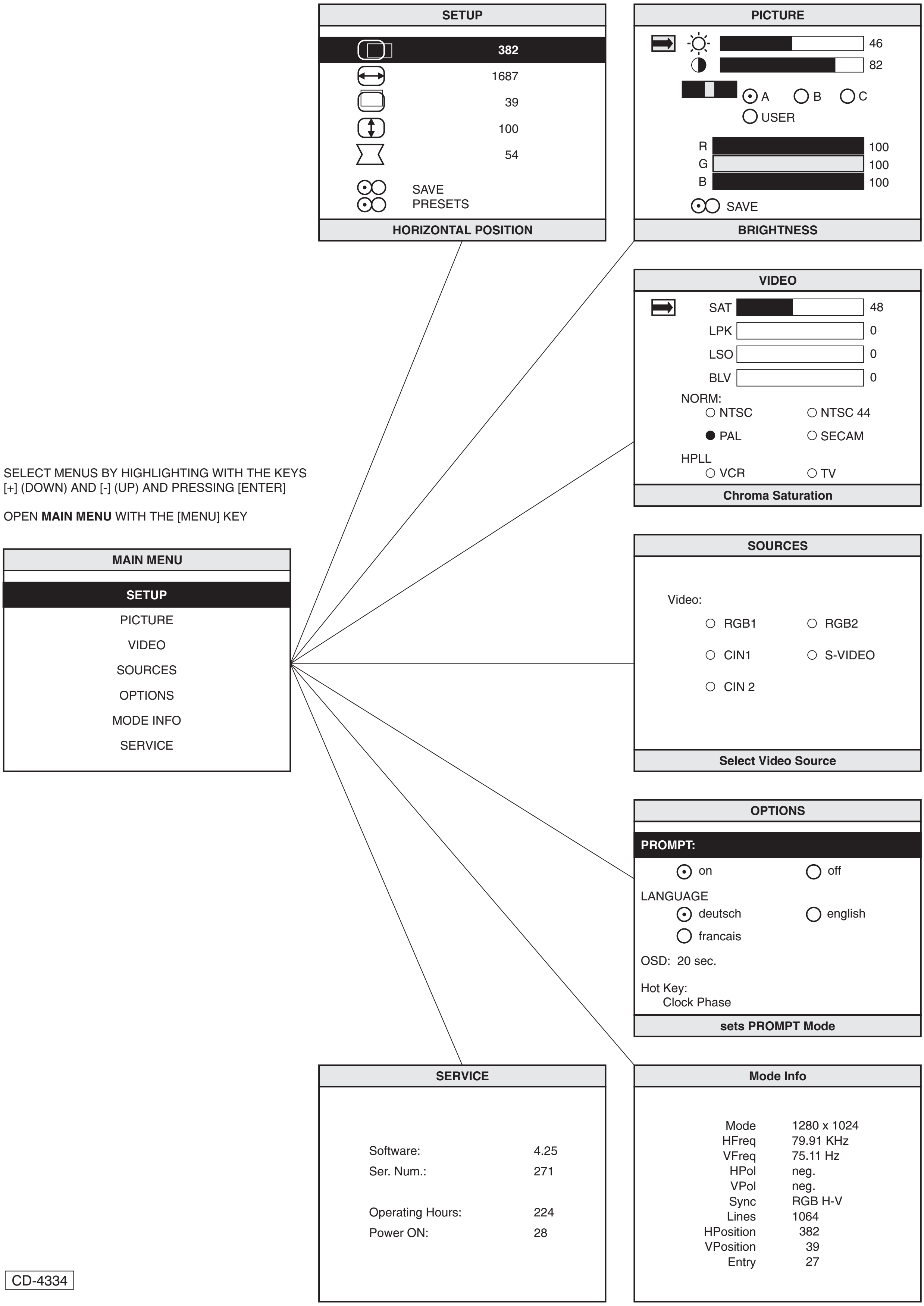
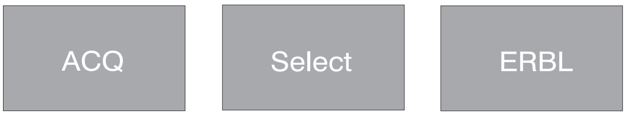


Figure 7c - On Screen Display (OSD) Facilities: Typical Screen Displays

Remote Trackerball (Desktop Control Pod)

84 The Remote Trackerball (Desktop Control Pod) is fitted with a trackerball and three pushbuttons.

85 The trackerball is used to position the cursor on the display screen. The pushbuttons are used to activate/select a particular function. On-screen guidance on which button to press, is provided in the Information Boxes located in the lower centre portion of the screen. When first displayed, after selecting RUN from STANDBY, the information boxes show:



CD-2469

86 When a function is selected (e.g. Range Rings) the Information box displays similar data to that in the pop-down (information) boxes which appear below the selected function box. If all pushbutton activities are the same, a red box appears on the display containing the legend:

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87 A facility which has been previously activated, such as EBL, is re-selected by positioning the cursor in close proximity to the required facility and pressing the centre pushbutton.

88 For further operating information, refer to Chapter 1 - Nucleus 3 Displays - Operating Information.

Radar System ON/OFF Sounder Unit

89 The Radar System ON/OFF switch unit, is fitted with an ON/OFF pushbutton switch and an audio speaker. The audio speaker provides audible indications/warnings in the same way as the audible speaker in the 5000 and 6000 series displays.

POWER ON/OFF

90 The Display **only** is switched ON using the ON/OFF switch, located on the front of the Flat Panel Display unit.

91 The Radar System is switched on using the ON/OFF switch, located on the ON/OFF Sounder unit (NNR-A65).

92 When the system is switched on, two short beeps sound at the ON/OFF Sounder unit, to indicate that all systems are functioning correctly. After a few seconds the Standby Screen appears on the Flat Panel Display screen.

DIAGNOSTIC MAINTENANCE

93 A diagnostic algorithm is provided in Figure 8c to provide the operator/technician with a step-by-step guide through the fault finding procedure. The algorithm is intended for identification of faults to LRM level (e.g. a faulty PCB or cable/connector assembly).

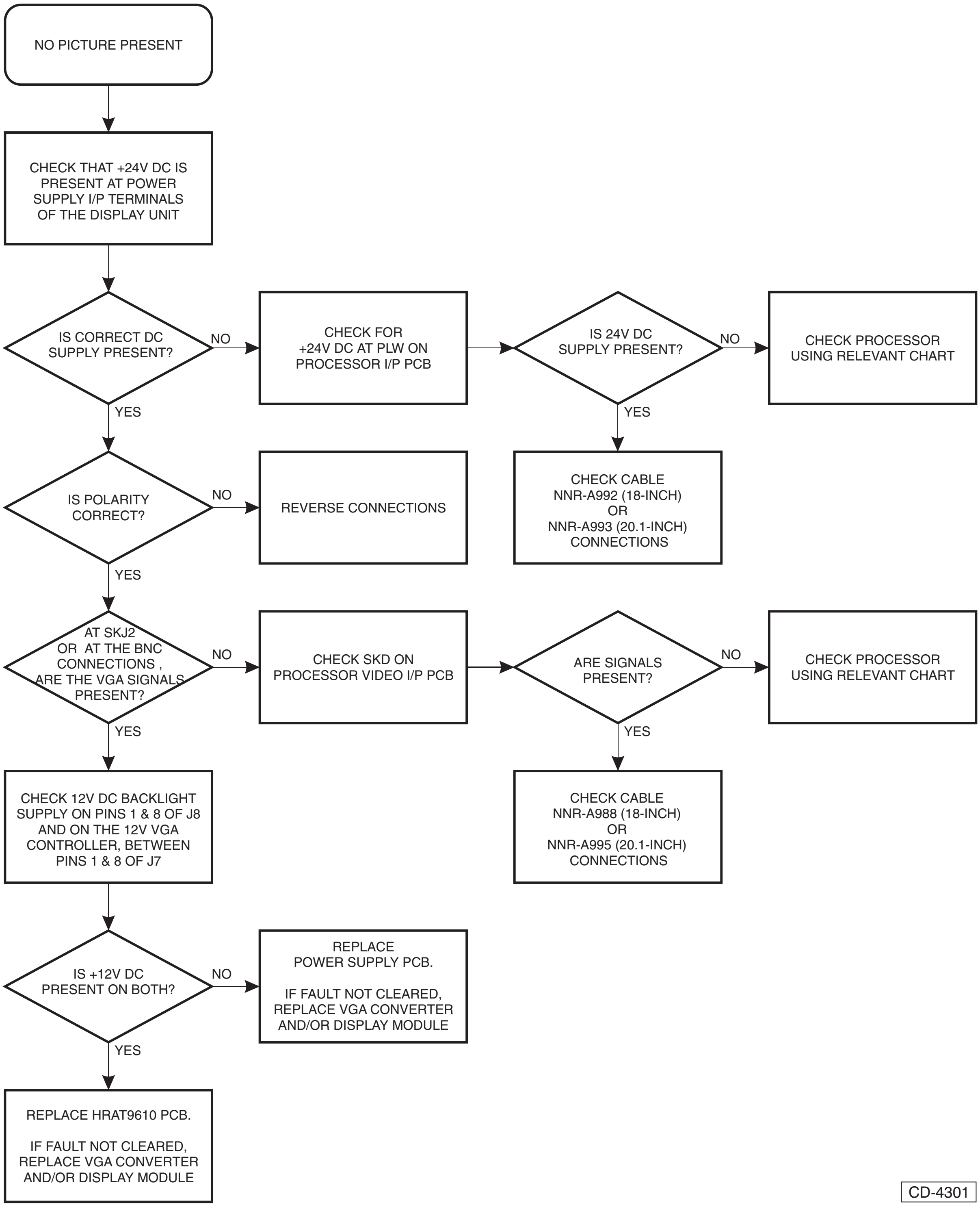

Figure 8c - Flat Panel Screen Display: Fault Finding Algorithm

PARTS LISTS

94 Parts Lists for a Typical Nucleus 3 Flat Panel Screen Display system are provided in Tables 1 to 3.

95 Flat Panel Display System

Table 2 - Flat Panel Display System: Parts List

ITEM No.	DESCRIPTION	KELVIN HUGHES PART No.
1	NUCLEUS 3 20.1-INCH FLAT PANEL DISPLAY	NNR-A69
2	NUCLEUS 3 18-INCH FLAT PANEL DISPLAY	NNR-A70
3	NUCLEUS 3 SPLIT PROCESSOR EPA ATA ARPA	NNR-A61 NNR-A60 NNR-A59
4	REMOTE TRACKERBALL	NNR-A10-3
5	NUCLEUS 3 ON-OFF SOUNDER	NNR-A65

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CHAPTER 8D

TRANSMITTER INTERFACE UNIT

INTRODUCTION

1 This Chapter provides information on the Transmitter Interface Unit (NNR-A66) for use with Nucleus 3 Display equipment.

2 The Transmitter Interface Unit (TIU) is designed to provide an interface between a MkV Transmitter and a large interswitched system.

3 The majority of KH Transmitters are mains powered and therefore do not require use of a TIU, as the CAN Adapter PCB can be mounted in the Radar Interswitch Unit

NOTE:

Systems utilising the pre-MkVII Transmitter/Receiver will either require a Transmitter Interface Unit, to enable interfacing to the Nucleus 3 Display via the RIU or require a CAN Bus adapter kit (NNR-A981) to be fitted in the RIU for each Transmitter/Receiver connected to the Nucleus 3 Display. For information on the Radar Interswitch Unit (RIU), refer to Chapter 8e.

4 A Transmitter Interface Unit can be used in systems comprising up to six Nucleus Displays connected to up to six Transmitter/Receivers.

PRE-INSTALLATION REQUIREMENTS

5 Prior to Installing the TIU (NNR-A66):

NOTE:

The dc power supplies to the MkV Transmitter are provided via the TIU. Therefore the TIU should be located as close to the MkV transmitter as possible. The maximum recommended distance between the TIU and the MkV transmitter is 35 metres.

(1) Ensure that adequate clearance is available for maintenance.

(2) Check that the Input/Output cables can be easily installed and have adequate clearance.

INSTALLATION

INSTALLATION REQUIREMENTS

6 The Transmitter Interface Unit (TIU) is designed to interface a MkV transceiver with either a Nucleus 3 display or via an RIU interswitching up to six Nucleus Radar Displays and Transceivers in any master/slave combination.

Space Requirements

7 Adequate clearance at the front of the equipment must be maintained for access and servicing.

Position of the TIU

8 The Transmitter Interface Unit (TIU) is designed to be bulkhead/wall mounted. Brackets are provided at either end of the unit, for this purpose. The dimensions of the TIU are shown in Figure 1d.

Weight

9 The Transmitter Interface Unit weighs 7kg (approximately).

Power Supplies

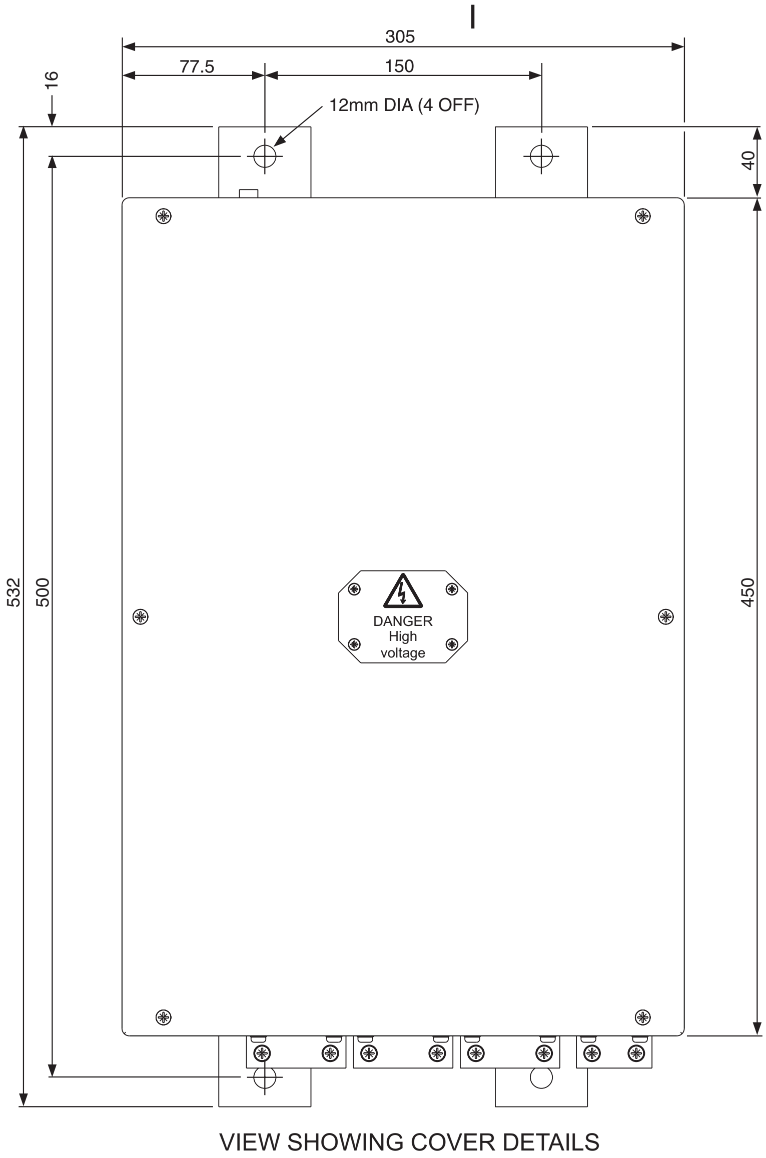
10 Power supplies to the TIU are as follows:

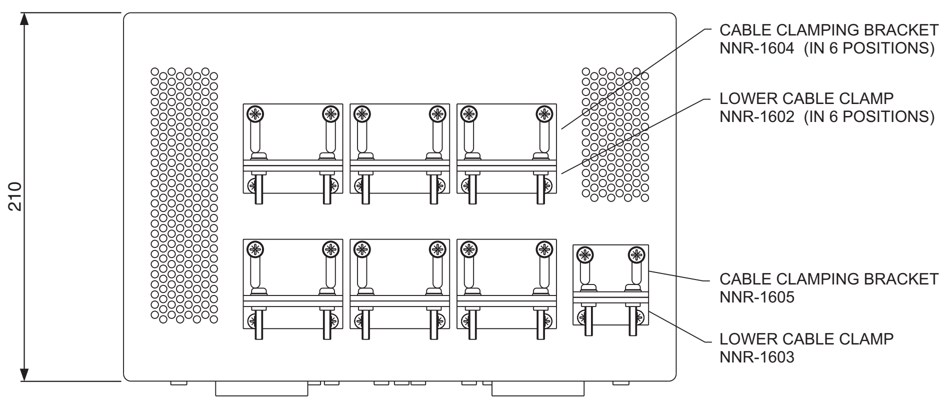
11 110V or 220/230V nominal, single phase 50/60Hz.

Compass Safe Distances

12 The minimum safe distances are as follows:

Grade I:	0.2m
Grade II/III:	0.1m





NOTE: ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED

CD-4572

Figure 1d - Transmitter Interface Unit (NNR-A66): Dimensions and Mounting

INSTALLING THE TIU

13 Refer to Figure 1d and mount the Transmitter Interface Unit (TIU) in its required location (ensuring sufficient clearance for ventilation, cable access and servicing) as follows:

(1) Mark out the position of the TIU and drill holes in the required positions for mounting.

(2) Secure the TIU in position, using suitable bolts.

Earthing

14 Ensure that the TIU is earthed correctly, to the ship's earth, using the earthing bolt provided.

ELECTRICAL CONNECTIONS

Cable Screens

15 The cable screens are not to be stripped back further than is necessary to enable the cores to be connected. All exposed screens must be covered with PVC sleeving to prevent accidental contact with live terminals.

Access for Cabling

16 Access to the TIU Terminals PCB and the CAN Adapter PCB is obtained by removing the TIU Front Panel. Cables are fed through cable clamps fitted to the base of the casing. Refer to Figure 2d for unit Locations.

NOTE:

Access to the inside of the TIU is via the front panel, which is secured in position by six screws.

Cable Installation

17 Refer to the appropriate interconnections diagram and connect the cables between the TIU and the Transmitter and between the TIU and the Nucleus 3 display , or RIU (as appropriate).

(1) Feed the Transmitter and Display cables through the base of the unit and connect to the appropriate input/output connectors.

18 Secure the cables in position, using the cable clamps provided at the base of the unit.

19 Instructions for setting to work are provided in the section on Commissioning, later in this chapter.

Interconnections to Mk V Transceiver

20 Connections between the TIU and the Transmitter require a 38-core cable carrying the following services: Control and Data, Tx/Rx data, Video, Sync and dc power supplies.

Interconnections to Nucleus 3 (5000) Display

21 Connection to a Nucleus 3 (5000) Display requires a composite 12-core cable carrying the following services: Control and Data, Tx/Rx data, Video and Sync.

Interconnections to Nucleus 3 (6000) Display

22 Connection to a Nucleus 3 (6000) Display requires a composite 12-core cable carrying the following services: Control and Data, Tx/Rx data, Video and Sync.

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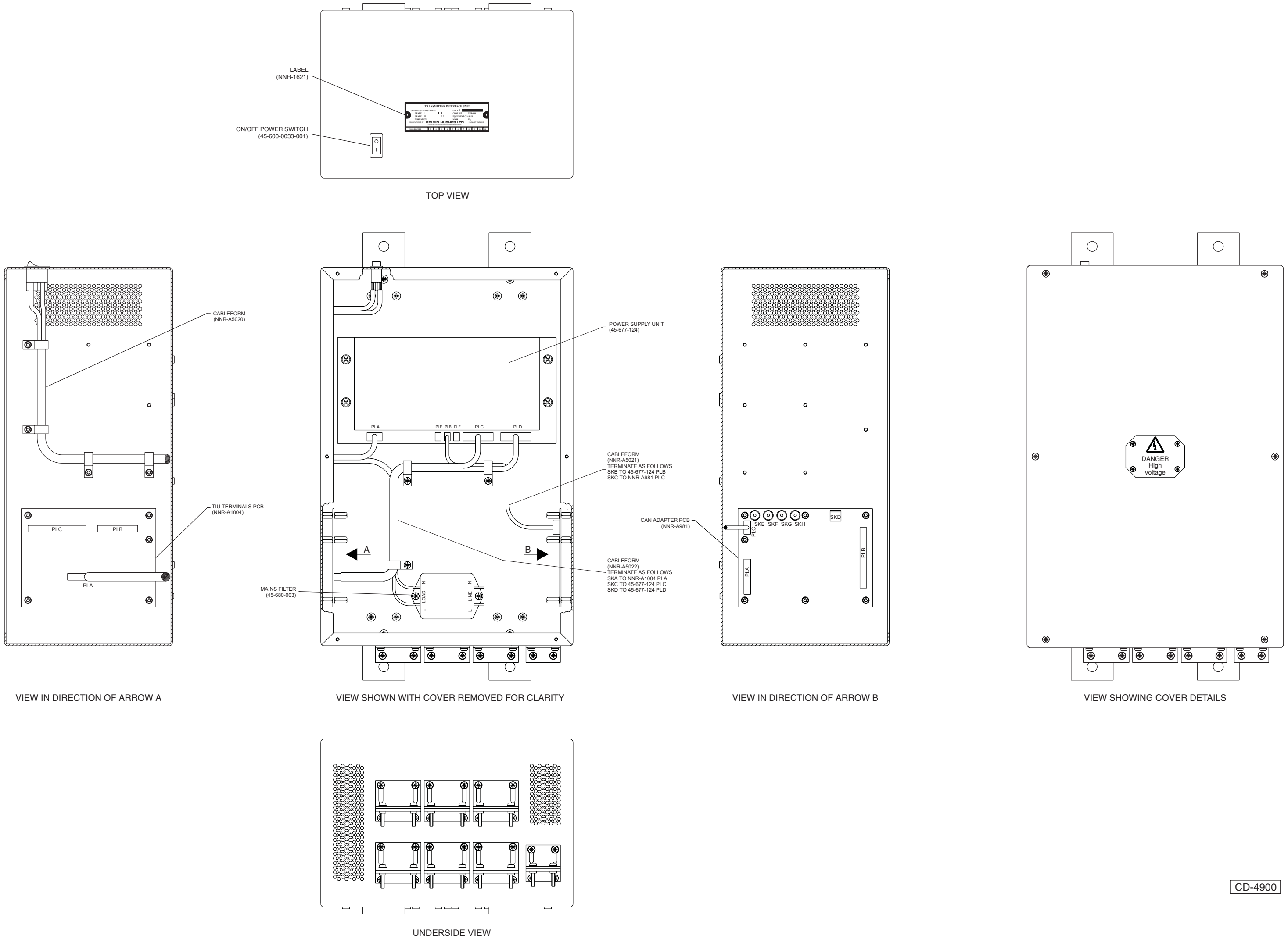

Figure 2d - Transmitter Interface Unit (NNR-A66): Cable Access

COMMISSIONING

23 The Transmitter Interface Unit (NNR-A66) is fitted with a power On/Off switch on the top of the unit.

24 Set the power unit to provide an antenna rotation supply of either 27V (normal speed units) or 36V (high speed units).

25 There is no specific commissioning procedure applicable to the Transmitter Interface Unit.

INDICATORS

CAN Adapter PCB (NNR-A981)

26 The following LED indicators are provided on the CAN Adapter PCB:

LED	LEGEND	INDICATION
D4	MUTE	MUTE Active
D5	RUN	RUN Active
D13	RUNNING	Processor Running (Flashes On/Off)
D14	LED 1	Receiving Heartbeat
D15	LED 2	Unused
D11	+15V	+15V supply is present
D12	-15V	-15V supply is present
D16	+24V	+24V supply is present
D38	-24V	+5V supply is present

TIU Terminals PCB (NNR-A1004)

27 There are no indicators provided on the TIU Terminals PCB.

LINK & SWITCH SETTINGS

CAN Adapter PCB (NNR-A981)

28 There are two links on the CAN Adapter PCB. The links are normally configured as follows:

LINK	DESCRIPTION	SETTING
LK1	CAN Bus Terminator	Normally Fitted
LK2	Crystal Connection	MUST Always Be Fitted

29 The link and switch positions for the CAN Adapter PCB are as shown in Figure 3d below.

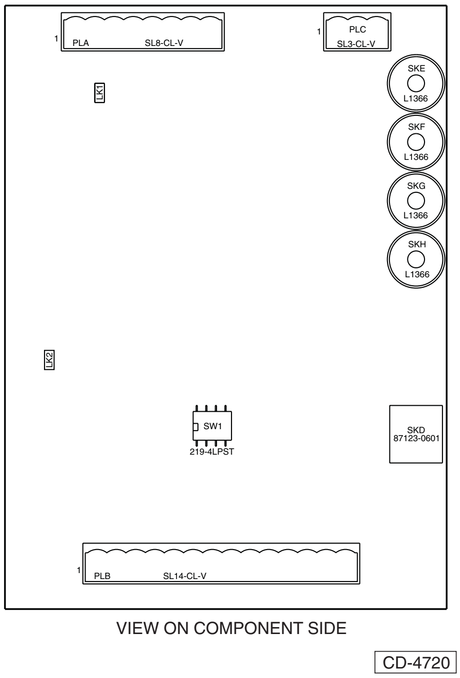

Figure 3d - CAN Adapter PCB (NNR-A981): Link and Switch Positions

NOTE:

Switch W1 is set to OFF.

Terminals PCB (NNR-A4001)

30 There are no links or switches on the TIU Terminals PCB.

Power Supply Unit

31 There are two switches on the Power Supply unit (45-677-124), which are used to set the required antenna rotation supply (see Figure 4d). Set the switches as follows:

	SW1 Heater Volts	SW2 Speed Volts
CAE-A30-7	OFF (8.4V)	ON (26V) Low Speed
CAE-A30-8	OFF (8.4V)	OFF (36V) High Speed

32

CANBUS DATA FORMAT

33 The Data Format of the CAN Bus is available for use by external units, by individual agreement.

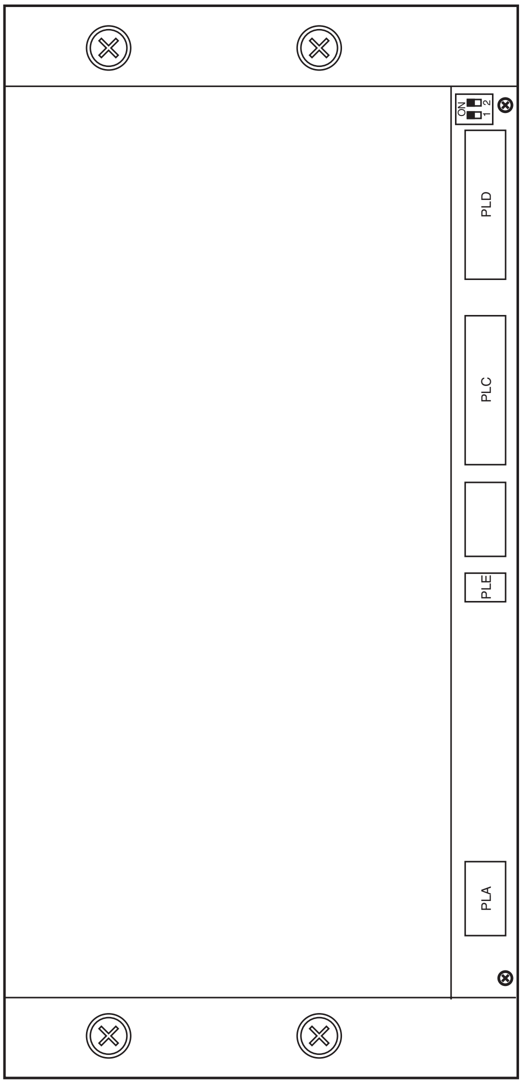

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Figure 4d - Power Supply Unit (45-677-124): Switch Positions

FUNCTIONAL DESCRIPTION

34 The Transmitter Interface Unit (NNR-A66) is designed to convert the CAN Bus control signals used by Nucleus 3 systems to control signals for the MkV transmitter. It also provides the dc power supplies required by the transmitter.

35 Typical configuration is shown in Figures 5d and 6d.

36 The Transmitter Interface Unit contains a CAN Adapter PCB (NNR-A981), a Terminals PCB (NNR-A1004) and a mains Power Supply Unit (45-677-124). The CAN Adapter PCB is used to Interface with pre-MkVII Transmitter/Receivers.

37 The TIU converts the CAN messages from the Nucleus 3 displays to control signals for use by the Transmitter. (In interswitched systems, an RIU is used in place of a TIU). The Transmitter status signals are passed back to the the Nucleus 3 Display Input PCB via the CAN Bus.

38 The TIU is connected to the Mk V Transmitters via composite 38-core cable and carries the following signals:

Signals	
VIDEO SYNC RUN MUTE MP LP TUNE TUNE IND TX READY AZIMUTH RX MON HEADING LINE 0V	CAN Adapter PCB
+15V -15V HEATERS +ve HEATERS -ve +27V 0V SCANNER +ve SCANNER -ve	Terminals PCB

39 The signals to the CAN Adapter PCB are then routed to the appropriate display(s), via the RIU.

CONTROLS AND INDICATORS

40 A power On/Off switch is provided on the top of the unit.

41 No other controls or indicators are provided.

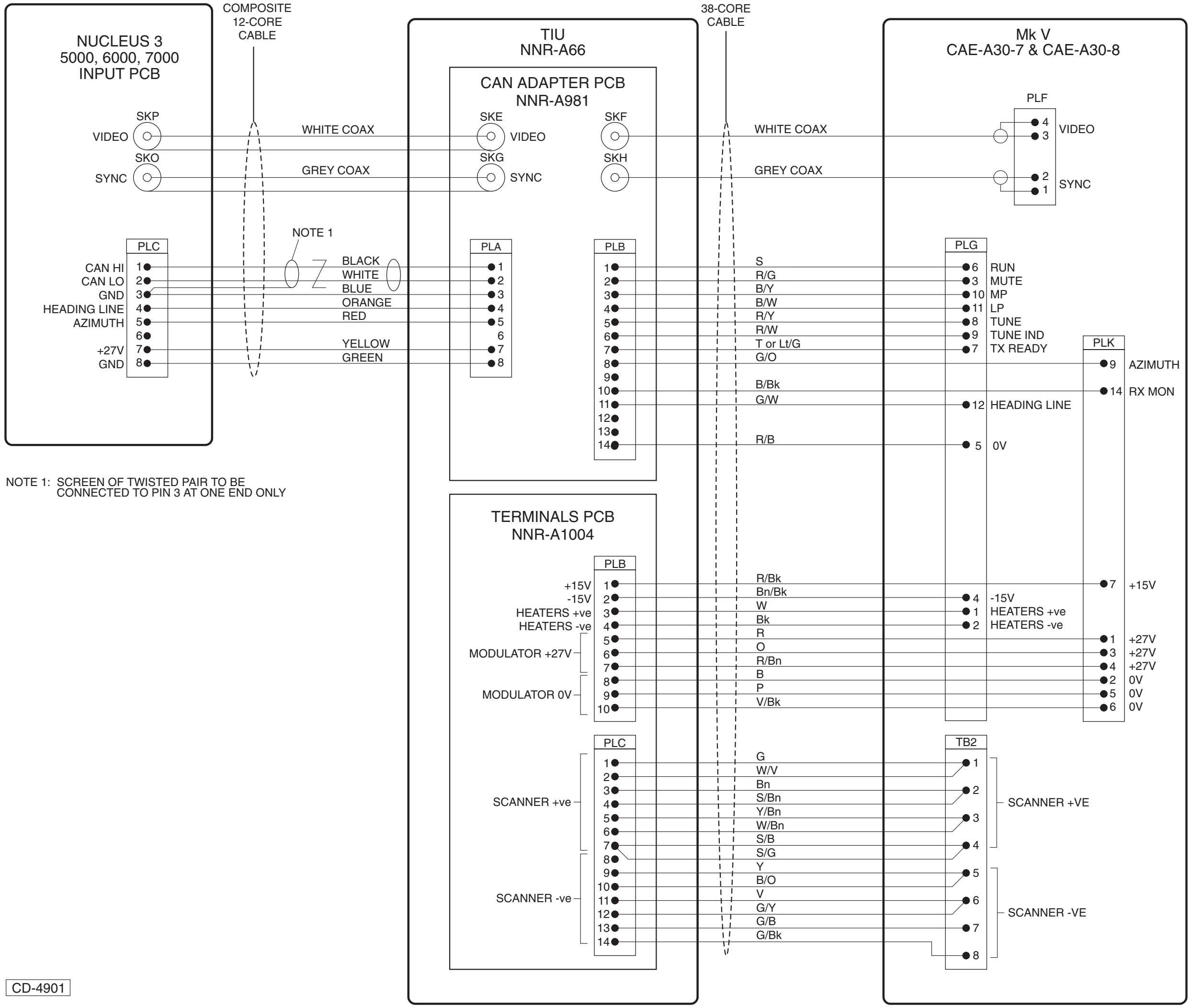


Figure 5d - Display to TIU to MkV Transmitter: Typical System Configuration

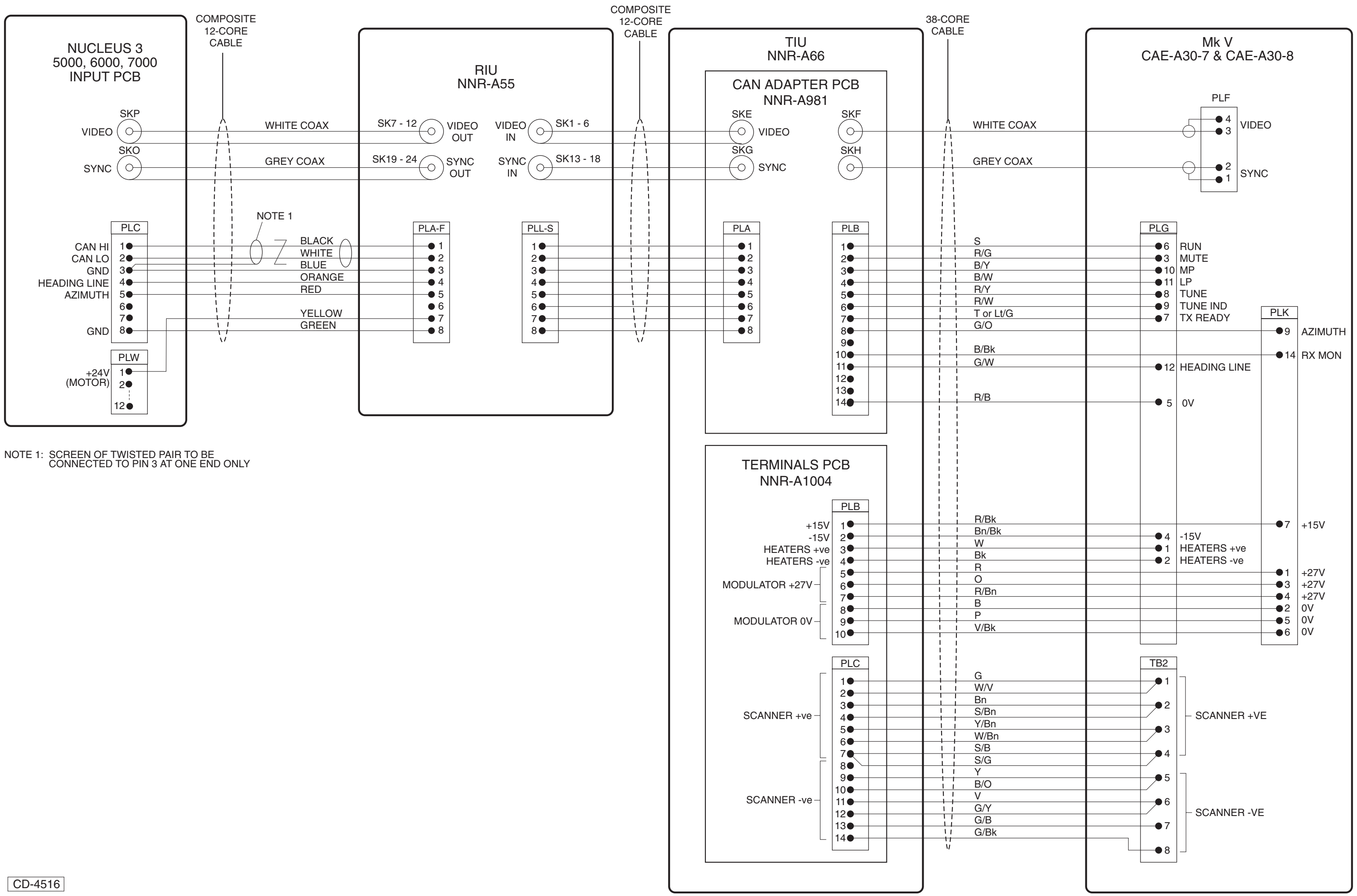


Figure 6d - Display to RIU via TIU to MkV Transmitter: Typical System Configuration

OPERATION

42 The Transmitter Interface Unit (NNR-A66) is fitted with an ON/OFF switch on the top of the unit. When set to the 1 position the power supply to the unit is switched ON.

43 There are no specific operating instructions applicable to the Transmitter Interface Unit.

DIAGNOSTIC MAINTENANCE

44 A diagnostic algorithm is shown in Figure 7d, to provide the operator/technician with a step by step guide through the fault finding procedure. The algorithm is intended for identification of faults to LRM level (e.g. A faulty cable/connector assembly).

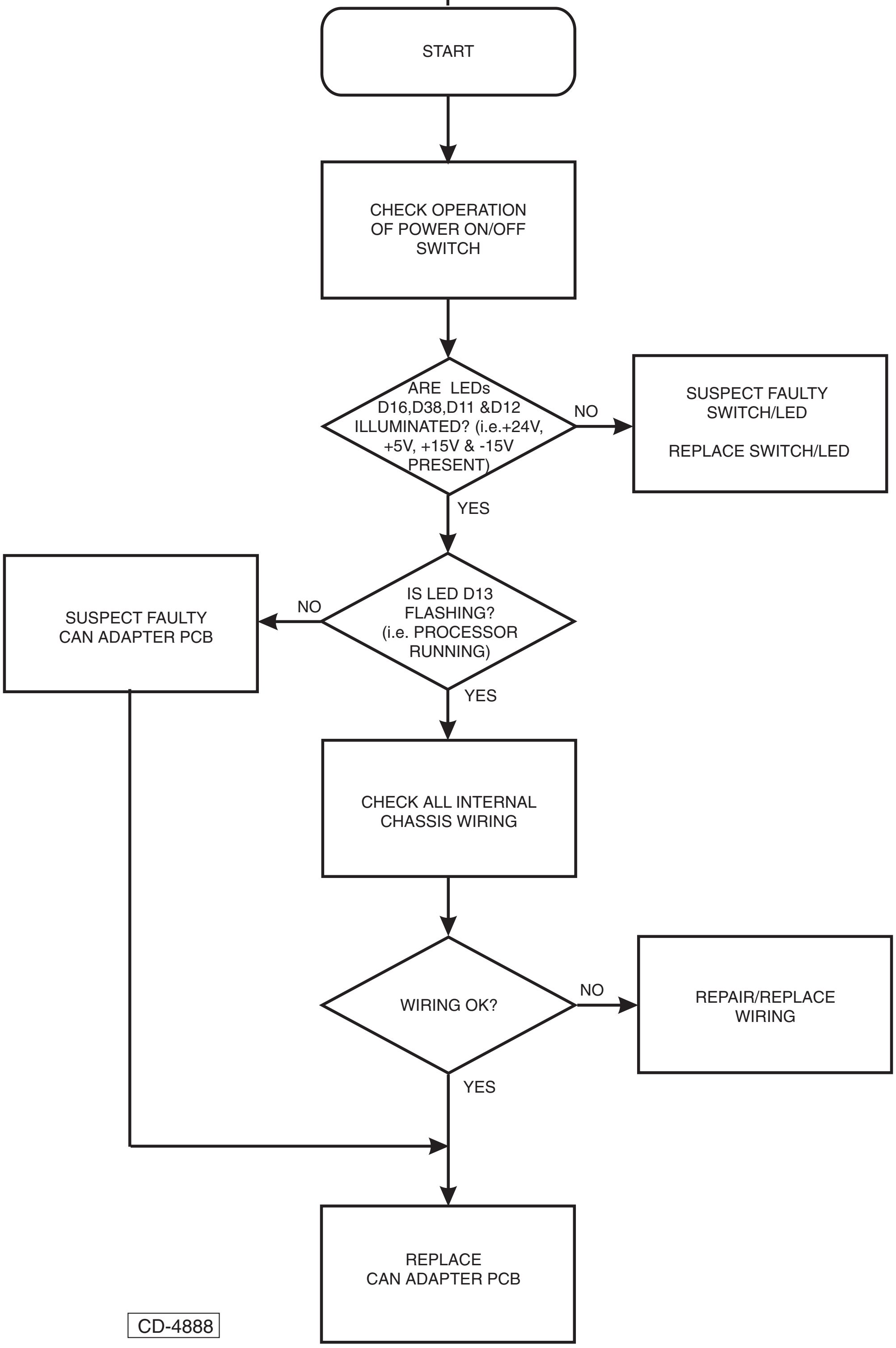


Figure 7d - Transmitter Interface Unit: Fault Finding Algorithm

PARTS

45 Table 1 contains a list of replaceable items for the Transmitter Interface Unit (NNR-A66).

Table 1 - TIU Parts List

Item Ref	Description	KH Part No.
1	Mounting Foot	CZZ-1121
2	Label	NNR-A1416
3	Unit Label (TIU)	NNR-A1621
4	CAN Adapter PCB	NNR-A981
5	RIU Terminals PCB	NNR-A1004
6	Assembly of Cableform	NNR-A5020
7	Assembly of Cableform	NNR-A5021
8	Assembly of Cableform	NNR-A5022
10	Pillar Mild Steel Hex Zinc PL M4 x 12 HSA.4070.12	25-335-749
11	Spacer M4 x 12mm Long Mild Steel Z type HTA. 4070.12	25-335-794
12	Clip Wire Harness PT. No. WHC-500-00	35-766-513
13	Power Supply Type MK4TX	45-677-124
14	Mains Filter 6A Type 6ET1	45-680-003

Table 1 (Cont.) - TIU Parts List

16	Washer Crinkle Beryllium Copper M3	20-282-5006-25
17	Washer Crinkle Beryllium Copper M4	20-282-5008-25
18	Washer Crinkle Beryllium Copper M5	20-282-5009-25
19	Screw Rec. Pan HD M4 x 8LG	25-243-1014-27
20	Screw M3 x 8 Rec. Pan HD	25-243-1020-27
21	Screw M4 x 25 Rec. Pan HD	25-243-1034-27
22	Screw M5 x8 Rec. Pan HD	25-243-1038-27
23	Nut Normal M3 ST. Steel	25-271-3063-27
24	Washer Plain M4	25-281-3075-27
25	Washer Plain M3	25-281-3080-27
26	Rocker Switch 10A 250Vac Double Pole Type C1250 AP	45-600-0033-001

CHAPTER 8E

RADAR INTERSWITCH UNIT

INTRODUCTION

1 This Chapter provides information on the Radar Interswitch Unit (NNR-A55) for use with Nucleus 3 Display equipment.

2 The Radar Interswitch Unit (RIU) is designed to provide an interface between multiple Nucleus 3 Display(s) and the associated Transmitter/Receiver(s).

NOTE:

Systems utilising the pre-MkVII Transmitter/Receiver will either require a Transmitter Interface Unit, to enable interfacing to the Nucleus 3 Display via the RIU or require a CAN Bus adapter kit (NNR-A981) to be fitted in the RIU for each Transmitter/Receiver connected to the Nucleus 3 Display. For information on the Transmitter Interface Unit (TIU), refer to Chapter 8d.

3 A Radar Interswitch Unit can be used in systems comprising up to six Nucleus Displays connected to up to six Transmitter/Receivers.

PRE-INSTALLATION REQUIREMENTS

4 Prior to Installing the RIU (NNR-A55):

(1) Ensure that adequate clearance is available for maintenance.

(2) Check that the Input/Output cables can be easily installed and have adequate clearance.

INSTALLATION

INSTALLATION REQUIREMENTS

5 The Radar Interswitch Unit (RIU) is designed to interswitch up to six Nucleus Radar Displays and six Transceivers in any master/slave combination.

Space Requirements

6 Adequate clearance at the front of the equipment must be maintained for access and servicing.

Position of the RIU

7 The Radar Interswitch Unit (RIU) is designed to be bulkhead/wall mounted. Brackets are provided at either end of the unit, for this purpose. The dimensions of the RIU are shown in Figure 1e.

Weight

8 The Radar Interswitch Unit weighs 7kg (approximately).

Power Supplies

9 Power supplies to the RIU are provided from the Nucleus Radar display.

Compass Safe Distances

10 The minimum safe distances are as follows:

Grade I: 0.3m
Grade II: 0.1m

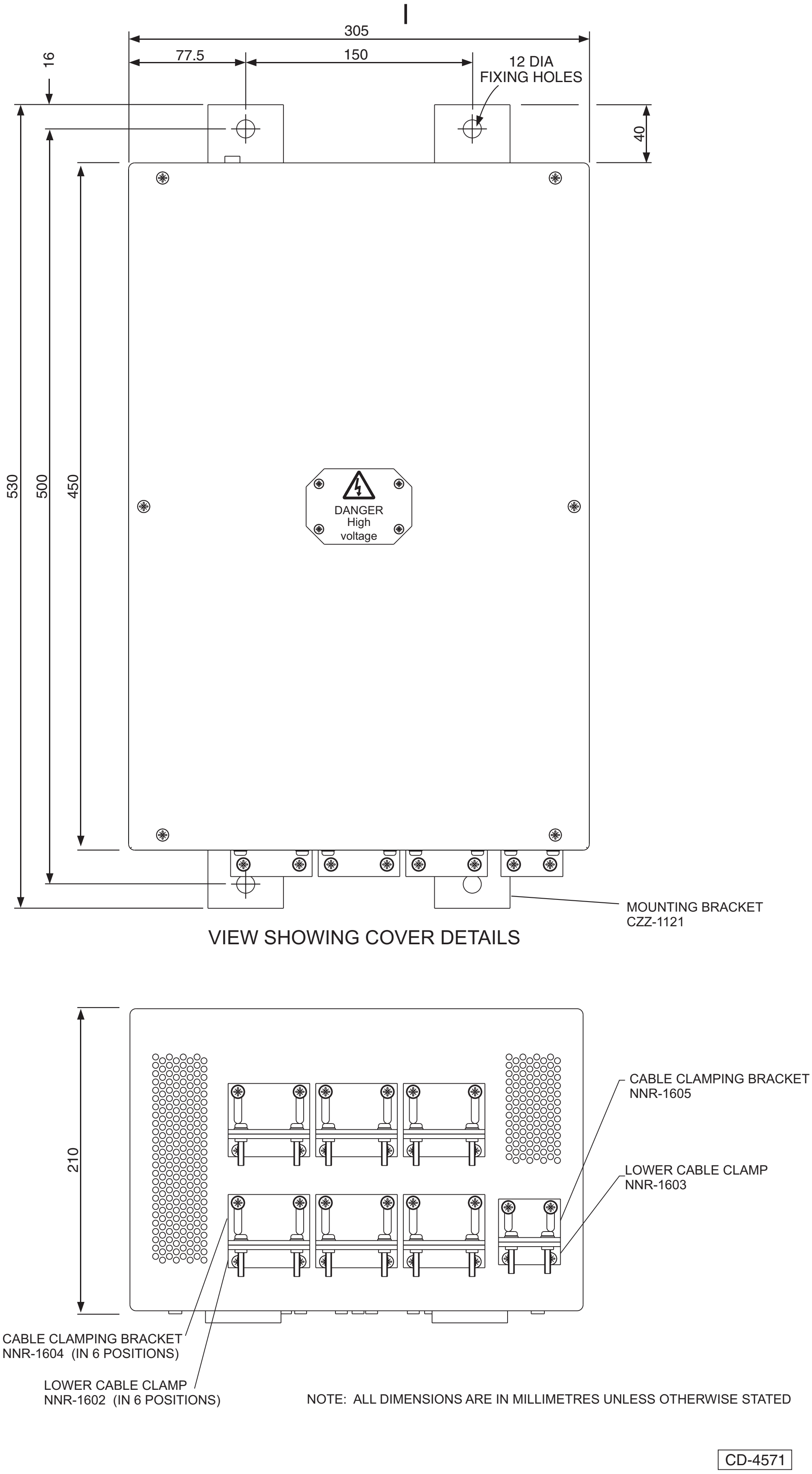


Figure 1e - Radar Interswitch Unit (NNR-A55): Dimensions and Mounting

INSTALLING THE RIU

11 Refer to Figure 1e and mount the Radar Interswitch Unit (RIU) in its required location, ensuring sufficient clearance for ventilation, cable access and servicing, as follows:

(1) Mark out the position of the RIU and drill holes in the required positions for mounting.

(2) Secure the RIU in position, using suitable bolts.

Earthing

12 Ensure that the RIU is earthed correctly, to the ship's earth, using the earthing bolt provided.

ELECTRICAL CONNECTIONS

Cable Screens

13 The cable screens are not to be stripped back further than is necessary to enable the cores to be connected. All exposed screens must be covered with PVC sleeving to prevent accidental contact with live terminals.

Access for Cabling

14 Access to the RIU Processor PCB and the Video Sync Switching Board is obtained by removing the RIU Front Panel. Cables are fed through cable clamps fitted to the base of the casing. Refer to Figure 2e for unit Locations.

NOTE:

Access to the inside of the RIU is via the front panel, which is secured in position by six screws.

Cable Installation

15 Refer to the appropriate interconnections diagram and connect the cables between the RIU and the Nucleus 3 display and between the RIU and the Transmitter, or TIU (as appropriate).

(1) Feed the Transmitter and Display cables through the base of the unit and connect to the appropriate input/output connectors.

16 Secure the cables in position, using the cable clamps provided at the base of the unit.

17 Instructions for setting to work are provided in the section on Commissioning, later in this chapter.

Interconnections to Mk IV Upmast Transceiver

18 Connection to a MkIV Upmast Transceiver (CAE-A12-20) requires a 38-core cable carrying the following services: Video and Sync, and Control and Data signals, via the optional CAN Adapter PCB.

Interconnections to Mk V Transceiver

19 Connection to a MkV Transceiver (CAE-A30-7 and CAE-30-8) requires the use of a Transmitter Interface Unit (NNR-A66), fitted with a CAN Adapter PCB (NNR-A981) and a Terminals PCB (NNR-A1004). Connections to the Transmitter Interface Unit (TIU) require a composite 12-core cable carrying the following services: Control and Data, and Video and Sync.

20 Connections between the TIU and the Transmitter require a 38-core cable carrying the following services: Control and Data, Tx/Rx data, Video and Sync.

Interconnections to a MkVI Transceiver

21 Connection to a MkVI Transceiver (CAE-A37/A45) requires the use of a Soft Start Unit (CZZ-A14/2). Connections to the Soft Start Unit require 38-core cable carrying the following services: Video and Sync, and Control and Data signals, via the optional CAN Adapter PCB.

22 Connections between the Soft Start Unit and the Transmitter require a 38-core cable carrying the following services: Power, Video and Sync, and Control and Data signals.

Interconnections to a MkVII S-Band Transceiver

23 Connection to a MkVII S-Band Transceiver (CTX-A9) requires a composite 12-core cable carrying the following services: Control and Data, Video and Sync.

24 Connections to the associated Turning Mechanism require a 12-core cable.

Interconnections to a MkVII X-Band Low Speed Transceiver

25 Connection to a MkVII X-Band Transceiver (CTX-A8) requires a composite 12-core cable carrying the following services: Control and Data, Video and Sync.

26 Connections to the associated Low Speed Turning Mechanism require a 12-core cable.

Interconnections to a MkVII X-Band High Speed Transceiver

27 Connection to a MkVII X-Band Transceiver (CTX-A8) requires a composite 12-core cable carrying the following services: Control and Data, Video and Sync.

28 Connections to the associated High Speed Turning Mechanism require a 25-core cable.

Interconnections to Nucleus 3 (5000) Display

29 Connection to a Nucleus 3 (5000) Display requires a composite 12-core cable carrying the following services: Control and Data, Tx/Rx data, Video and Sync.

Interconnections to Nucleus 3 (6000) Display

30 Connection to a Nucleus 3 (6000) Display requires a composite 12-core cable carrying the following services: Control and Data, Tx/Rx data, Video and Sync.

COMMISSIONING

31 The Radar Interswitch Unit (NNR-A55) is fitted with a power On/Off switch on the top of the unit.

32 There is no specific commissioning procedure applicable to the Radar Interswitch Unit.

INDICATORS

Processor PCB (NNR-A980)

33 The following LED indicators are provided on the Processor PCB:

LED	Indication
D37	+27V Present
D38	+5V Present (i.e. RIU is operating normally and backup has not been selected)
D39	Flashes to indicate that processor is running.
D40	Flashes with Heading Line output to Display 1
D41	Flashes with Heading Line output to Display 2
D42	Flashes with Heading Line output to Display 3
D46	Flashes with Heading Line output to Display 4
D47	Flashes with Heading Line output to Display 5
D48	Flashes with Heading Line output to Display 6

Video Sync Switching PCB (NNR-A979)

34 There are no indicators provided on the Video/Sync Switching PCB.

LINK & SWITCH SETTINGS

Processor PCB (NNR-A980)

Links

35 There are three links on the Processor PCB. The links are normally configured as follows:

Link	DESCRIPTION	SETTING
LK1	Disconnects 20mHz Oscillator	Normally MADE
LK2	TX 5 Azimuth Filter	Normally MADE
LK3	TX 6 Azimuth Filter	Normally MADE

NOTE:

Links 2 and 3 are only removed if a 4096 pulse input is being used.

Switches

36 There are two switches on the Processor PCB. The switch settings are as follows:

SW1	Description	Normal Position
1	CAN terminator for Display 1/Tx1	OFF
2	CAN terminator for Display 2/Tx2	OFF
3	CAN terminator for Display 3/Tx3	OFF
4	CAN terminator for Display 4/Tx4	OFF
5	CAN terminator for Display 5/Tx 5	OFF
6	CAN terminator for Display 6/Tx 6	OFF

NOTE:

The terminator is only required when each leg is not connected to both a display and a transceiver. E.g. In a system comprising 3 transceivers and 2 displays; both a display and a transceiver are connected to legs 1 and 2, but only a transceiver is connected to leg 3. For this configuration, the CAN terminator for Display 3/Tx 3 is set to ON.

SW2	Description	Normal Position
1	Tx Power always ON	ON
2	Spare	OFF
3	OP5 slaved to Display No. LSB	OFF
4	OP5 slaved to Display No.	OFF
5	OP5 slaved to Display No. MSB	OFF
6	OP6 slaved to Display No. LSB	OFF
7	OP6 slaved to Display No.	OFF
8	OP6 slaved to Display No. MSB	OFF

NOTES:

(1) If switch SW2-1 is set to OFF, the transmitter power will only be switched ON if a display is set to MASTER it. Therefore, when switching control between displays, the transmitter warm up period may be activated. If SW2-1 is set to ON, the power to all transmitters is switched ON when any display is switched ON.

(2) Display outputs 5 and 6 can be set to output the radar from the transmitter selected by any of the displays. The switches are set to the display number to be followed. If the switches are all set to OFF, the output can be used for a normal display.

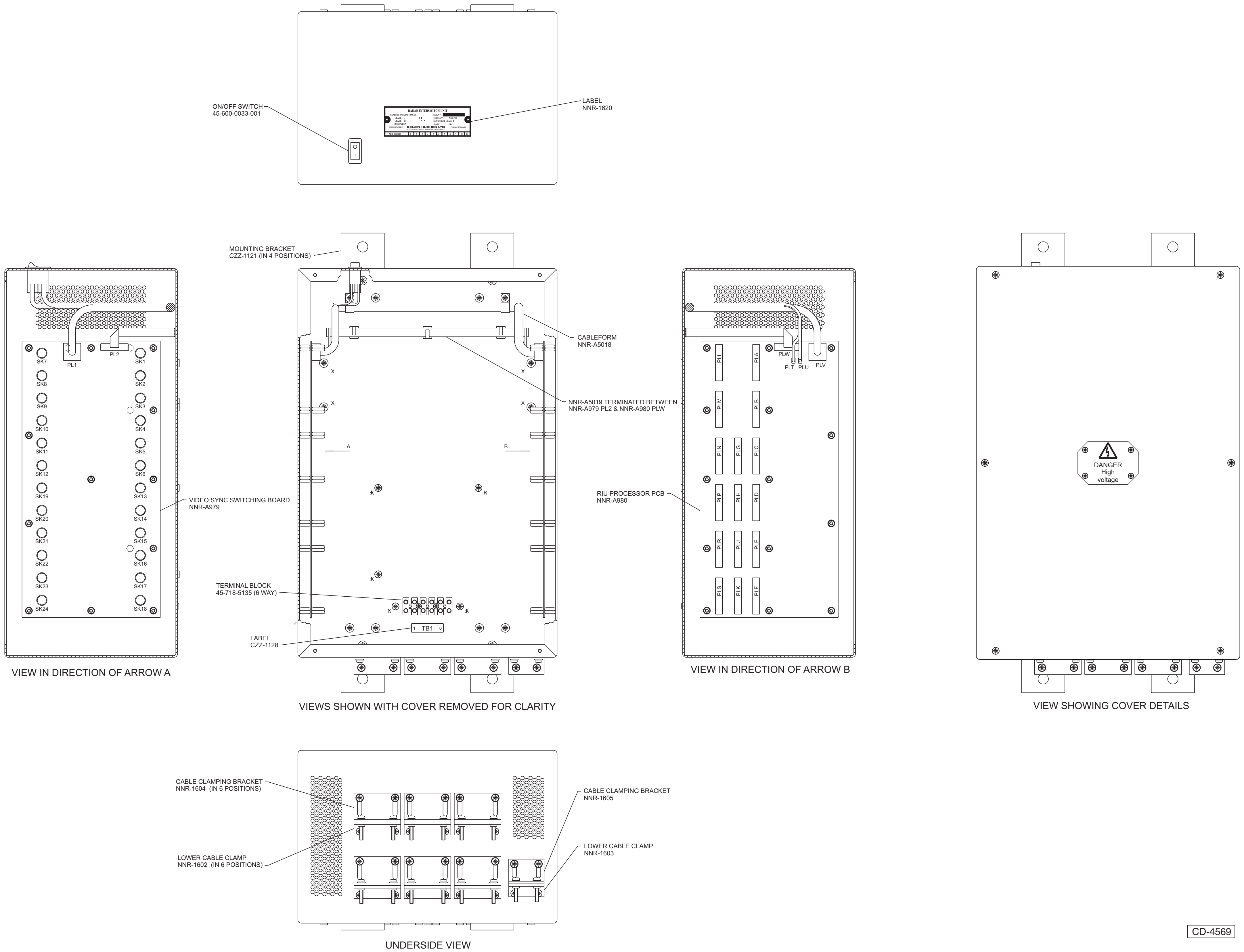


Figure 2e - Radar Interswitch Unit (NNR-A55): Cable Access

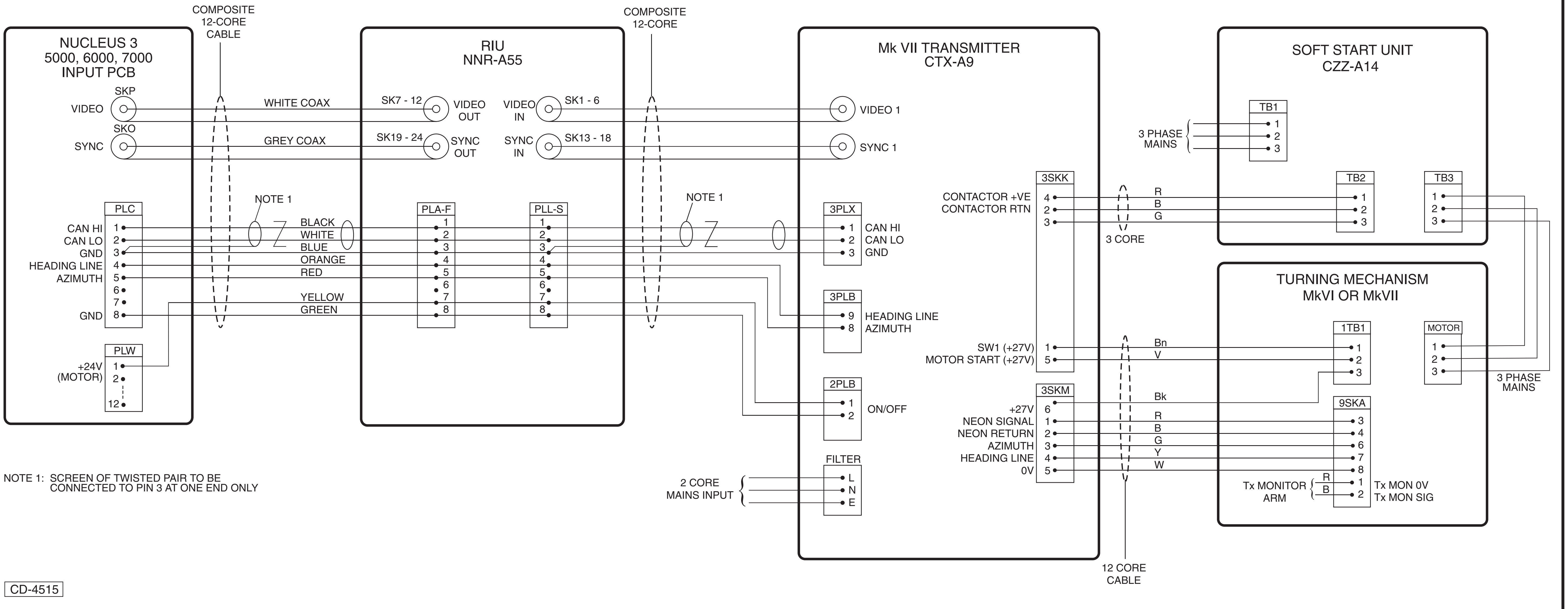


Figure 3e - Display to RIU to MkVII S-Band Transmitter: Typical System Configuration

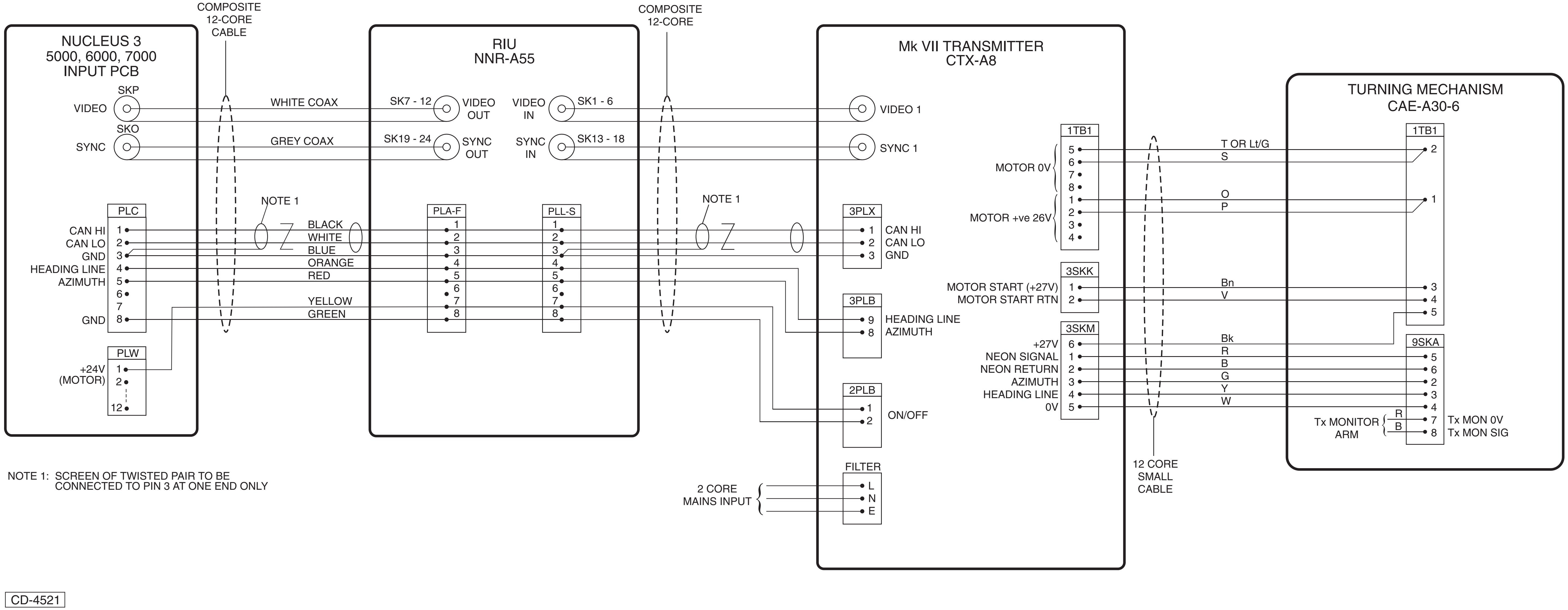


Figure 4e - Display to RIU to MkVII X-Band Transmitter (Low Speed): Typical System Configuration

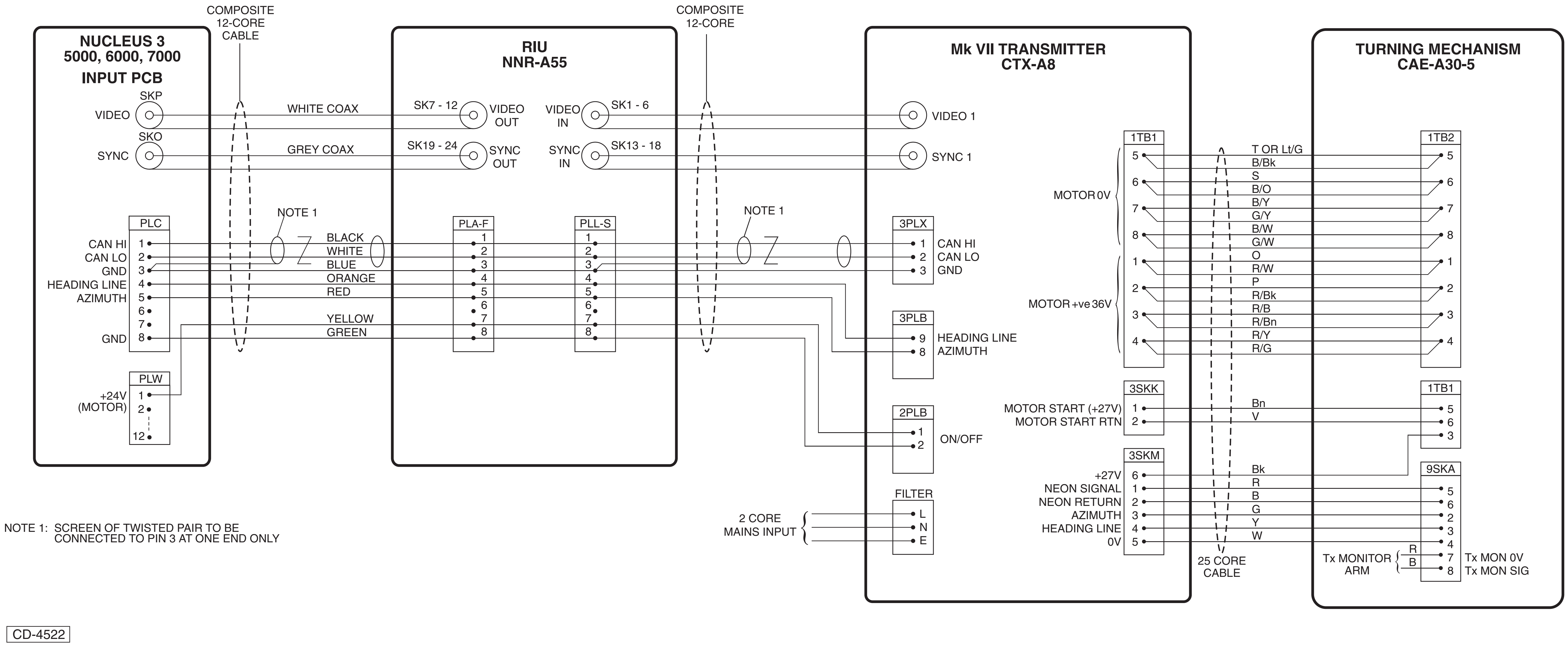


Figure 5e - Display to RIU to MkVII X-Band Transmitter (High Speed): Typical System Configuration

37 The link and switch positions for the Processor PCB are as shown in Figure 6e below.

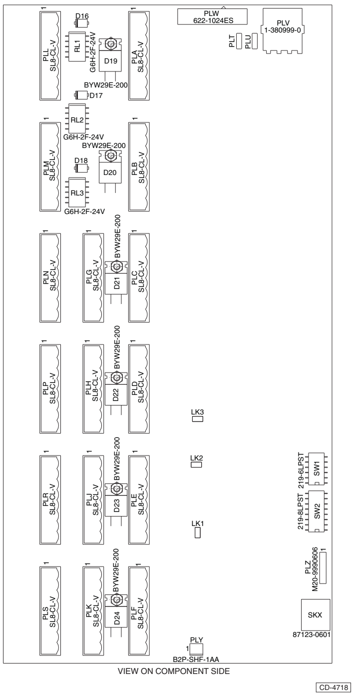


Figure 6e - Processor PCB (NNR-A980): Link and Switch Positions

Video Sync Switching PCB (NNR-A979)

Links

38 There are seventeen links on the Video/Sync Switching PCB. The links are configured as follows:

Link	DESCRIPTION	SETTINGS
LK1	Video 3 input	A = Normal B = Bypass
LK2	Video 4 input	A = Normal B = Bypass
LK3	Video 5 input	A = Normal B = Bypass
LK4	Video 6 input	A = Normal B = Bypass
LK5	Video 3 output	A = Normal B = Bypass
LK6	Video 4 output	A = Normal B = Bypass
LK7	Video 5 output	A = Normal B = Bypass
LK8	Video 6 output	A = Normal B = Bypass
LK9	Sync 3 input	A = Normal B = Bypass
LK10	Sync 4 input	A = Normal B = Bypass
LK11	Sync 5 input	A = Normal B = Bypass
LK12	Sync 6 input	A = Normal B = Bypass
LK13	Used for Test Only.	Must be Set to A
LK14	Sync 4 output	A = Normal B = Bypass
LK15	Sync 3 output	A = Normal B = Bypass
LK16	Sync 5 output	A = Normal B = Bypass
LK17	Sync 6 output	A = Normal B = Bypass

39 The link positions for the Video Sync Switching PCB are as shown in Figure 7e.

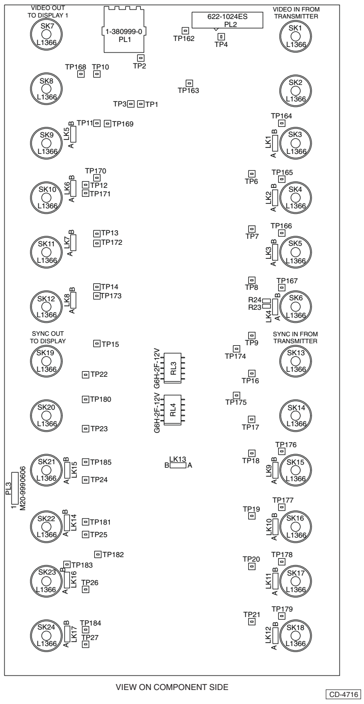


Figure 7e - Video Sync Switching PCB (NNR-A979): Link Positions

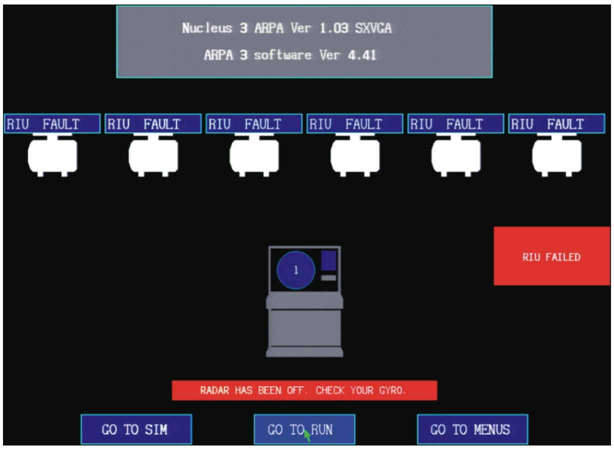
RIU SYSTEM STARTUP FAULT BYPASS FACILITY

40 The RIU incorporates a backup mode, to ensure that radar is available even when the RIU is faulty. If an RIU Failed warning is displayed, when starting up the system, the bypass facility can be used to connect each display up to its corresponding RIU. This involves switching off the displays, re-configuring the connectors and links on the RIU and switching the displays back on.

41 When the dc power is interrupted (turning OFF the switch on the outside of the unit) channels 1 & 2 are automatically switched so that display 1 is directly connected to transmitter 1 and display 2 is directly connected to transmitter 2.

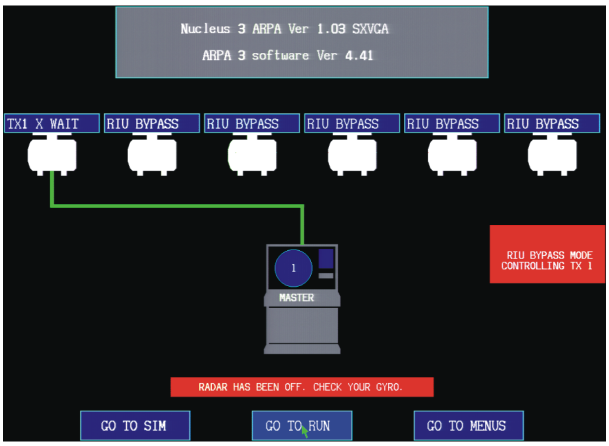
42 It is also possible to set channels 3 and 6 to be directly connected, but this requires moving connectors and changing link settings. Refer to paragraphs ? To ?, for further information.

43 If an RIU failure occurs the screen display will be as shown below.



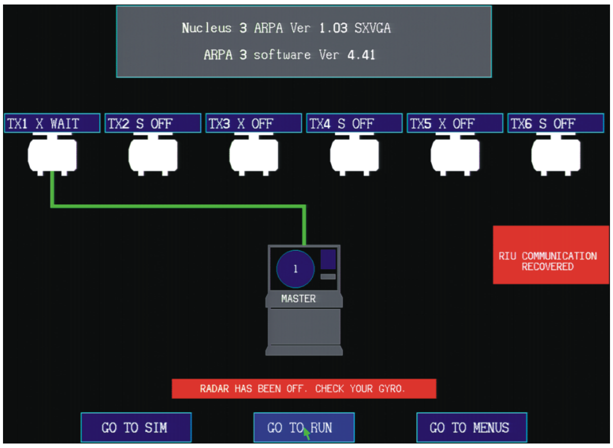
CD-5048

44 After a short delay (10 seconds, approximately), the automatic bypass facility will switch the connections so that display 1 is directly connected to transceiver 1 and display 2 (NOT Shown) is directly connected to transceiver 2. This is indicated by the warning message "RIU BYPASS MODE CONTROLLING TX 1" appearing on the right-hand side of the screen, as shown below.



CD-5049

45 Almost immediately the RIU communications will be recovered and the message "RIU COMMUNICATION RECOVERED" is displayed on the right-hand side of the screen, as shown below.



CD-5046

Manual Switch Configuration

46 To reconnect displays 3 to 6 directly to transceivers 3 to 6:

(1) Switch off ALL displays.

(2) Set the On/Off switch of the RIU to the OFF position.

(3) Reconfigure the RIU for direct connection, as detailed in paragraphs 48 to51.

(4) Switch on all displays.

47 To return to normal operation, once the fault has been cleared:

(1) Switch of ALL displays

(2) Reconfigure the RIU for normal operation

(3) Set the On/Off switch on the RIU to the ON position.

(4) Switch on all displays

NOTE:

It is recommended that where the system comprises more than 2 transceivers and 2 displays, channels 1 and 2 of the RIU are used in preference to other channels, to allow the automatic bypass facility for those channels to be used if required.

Manual Switch ConfigurationChannel 3 (Display 3 direct to Transmitter 3)

48 To manually configure channel 3 to have direct connection from display 3 to transmitter 3, the following links and connectors must be moved:

(1) Move the display plug in PLC to PLG on the RIU Processor PCB

(2) Move the following links on the RIU Video/Sync switching PCB from A to B

Sync in	LK9
Sync out	LK15
Video in	LK1
Video out	LK5

Channel 4 (Display 4 direct to Transmitter 4)

49 To manually configure Channel 4 to have direct connection from display 4 to transmitter 4, the following links and connectors must be moved.

(1) Move the display plug in PLD to PLH on the RIU Processor PCB.

(2) Move the following links on the RIU Video/Sync switching PCB from A to B:

Sync in	LK10
Sync out	LK14
Video in	LK2
Video out	LK6

Channel 5 (Display 5 direct to Transmitter 5)

50 To manually configure Channel 5 to have direct connection from display 5 to transmitter 5, the following links and connectors must be moved.

(1) Move the display plug in PLE to PLJ on the RIU Processor PCB.

(2) Move the following links on the RIU Video/Sync switching PCB from A to B:

Sync in	LK11
Sync out	LK16
Video in	LK3
Video out	LK7

Channel 6 (Display 6 direct to Transmitter 6)

51 To manually configure Channel 6 to have direct connection from display 6 to transmitter 6, the following links and connectors must be moved.

(1) Move the display plug in PLF to PLK on the RIU Processor PCB.

(2) Move the following links on the RIU Video/Sync switching PCB from A to B:

Sync in	LK12
Sync out	LK17
Video in	LK4
Video out	LK8

ECDIS OUTPUT CONFIGURATION

52 Display outputs 5 and 6 can be configured to provide radar signals to any slave display or to a Kelvin Hughes ECDIS. The RIU switches the same radar signals to the slave output as those being displayed on the designated display.

53 For example if SW2 is set:

Pos 3 ON
Pos 4 OFF
Pos 5 OFF

Pos 6 OFF
Pos 7 ON
Pos 8 OFF

Then output 5 will always output radar signals from the transmitter selected by Display 1 and output 6 will always output radar signals from the Transmitter selected by Display 2.

Output 5 comprises: SK11, SK23 and PLE.
Output 6 comprises: SK12, SK24 and PLF.

NOTES:

(1) To ensure that the outputs are correct after changing any of the above switches, the configuration of the designated display must be changed or the power switched OFF and then ON again.

(2) To select normal radar display operation, all three switches for the required channel must be set to OFF.

FUNCTIONAL DESCRIPTION

54 The Radar Interswitch Unit (NNR-A55) is designed to provide an interface between up to six Nucleus 3 Displays and up to six Transmitters. Typical configurations are shown in Figures 3e to 5e.

55 The Radar Interswitch Unit contains a Processor PCB (NNR-A980) and a Video Sync Switching PCB (NNR-A979). It may also contain CAN Adapter PCB(s) (NNR-A981), where required to interface with pre-MkVII Transmitter/Receivers.

56 The RIU receives signals from the Transmitter/Receiver and routes them through to the Nucleus 3 Display Input PCB. Control of the switching is via the CAN Bus.

57 The RIU is connected to the Mk VII Transmitters via composite 12-core cable and carries the following signals:

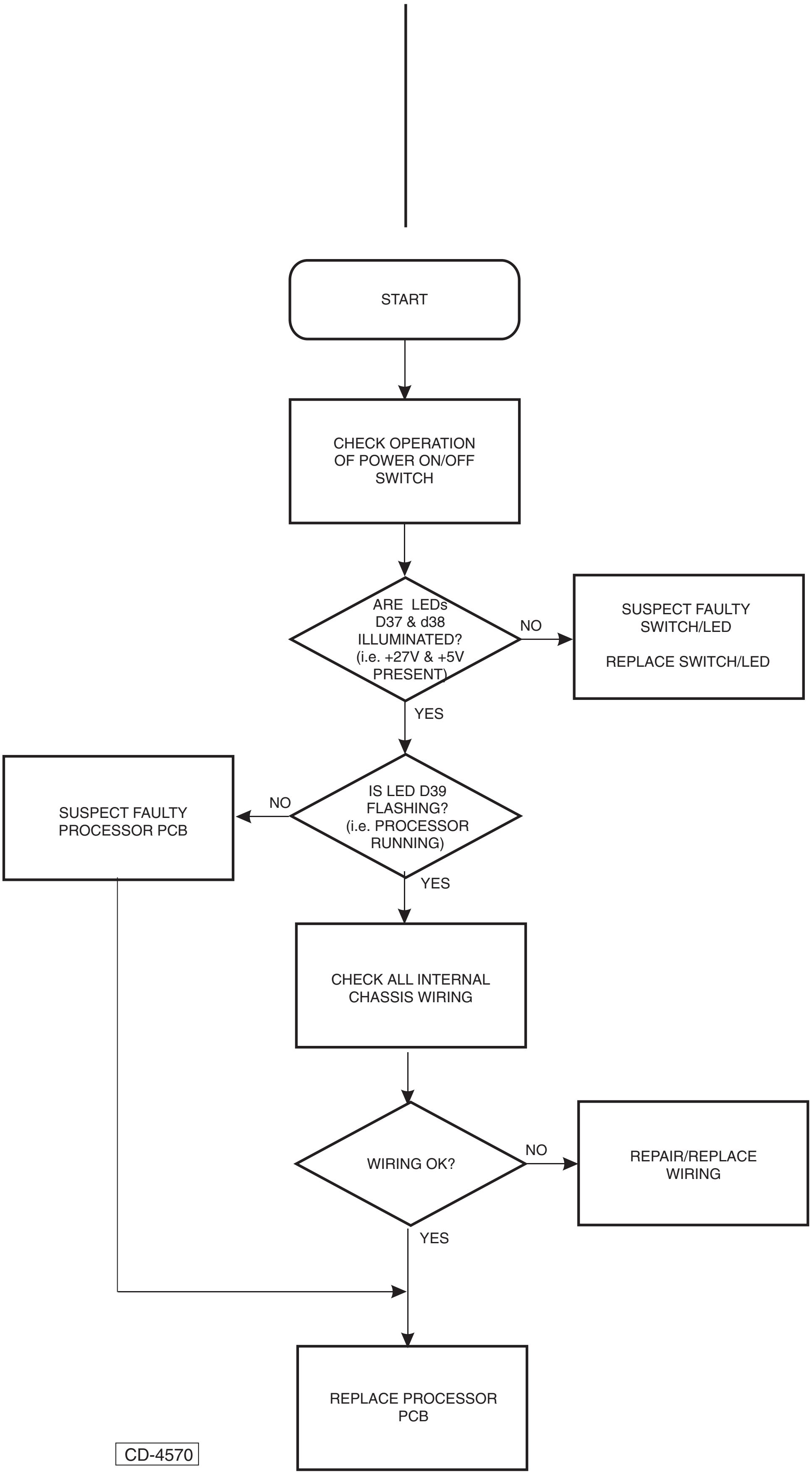
VIDEO
SYNC
CAN HI
CAN LO
GND
HEADING LINE
AZIMUTH
ON/OFF

58 These signals are then routed to the appropriate display(s).

CONTROLS AND INDICATORS

59 A power On/Off switch is provided on the top of the unit.

60 No other controls or indicators are provided.


START
CHECK OPERATION OF POWER ON/OFF SWITCH
ARE LEDs D37 & d38 ILLUMINATED? (i.e. +27V & +5V PRESENT)
NO
SUSPECT FAULTY SWITCH/LED
REPLACE SWITCH/LED
YES
IS LED D39 FLASHING? (i.e. PROCESSOR RUNNING)
NO
SUSPECT FAULTY PROCESSOR PCB
YES
CHECK ALL INTERNAL CHASSIS WIRING
WIRING OK?
NO
REPAIR/REPLACE WIRING
YES
REPLACE PROCESSOR PCB
CD-4570

PARTS

63 Table 1 contains a list of replaceable items for the Radar Interswitch Unit (NNR-A55).

Table 1 - RIU Parts List

Item Ref	Description	KH Part No.
1	Mounting Foot	CZZ-1121
2	Label (TB1)	CZZ-1128
3	Label	NNR-A1416
4	Unit Label (RIU)	NNR-A1620
5	Video Sync Switching Board	NNR-A979
6	RIU Processor PCB	NNR-A980
7	Assembly of Cableform	NNR-A5018
8	Assembly of Ribbon	NNR-A5019
15	Terminal Block 12-Way Type 500/HDS	45-718-5135
18	Lower Cable Clamp Bracket	NNR-1602-14
19	Lower Cable Clamp Bracket	NNR-1603-14
20	Cable Clamping Bracket	NNR-1604-14
21	Cable Clamping Bracket	NNR-1605-14

Table 1 (Cont.) - RIU Parts List

22	Washer Crinkle M3	22-282-5006-25
23	Washer Crinkle M3	20-282-5008-25
24	Washer Crinkle M5	20-282-5009-25
25	Screw Rec. Pan HD M4 x 8LG	25-243-1014-27
26	Screw M4 x 6 Rec. Pan HD	25-243-1017-27
27	Screw M3 x 8 Rec. Pan HD	25-243-1020-27
28	Screw M3 x 16LG Rec. Pan HD	25-243-1029-27
29	Screw M4 x 25 Rec. Pan HD	25-243-1034-27
30	Screw M5 x8 Rec. Pan HD	25-243-1038-27
31	Nut Normal M3 ST. Steel	25-271-3063-27
32	Washer Plain M4	25-281-3075-27
33	Washer Plain M3	25-281-3080-27
34	Rocker Switch 10A 250Vac Double Pole Type C1250 AP	45-600-0033-001

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CHAPTER 8F

ERGOPOD

INTRODUCTION

1 This Chapter provides information on the Ergopod for use with Nucleus Display equipment.

2 Two types of Ergopod are available, these are:

(1) ERGOPOD - Right-hand (NNR-A18).

(2) ERGOPOD - Left-hand (NNR-A18-2).

3 Figure 1f below shows a right-hand Ergopod.

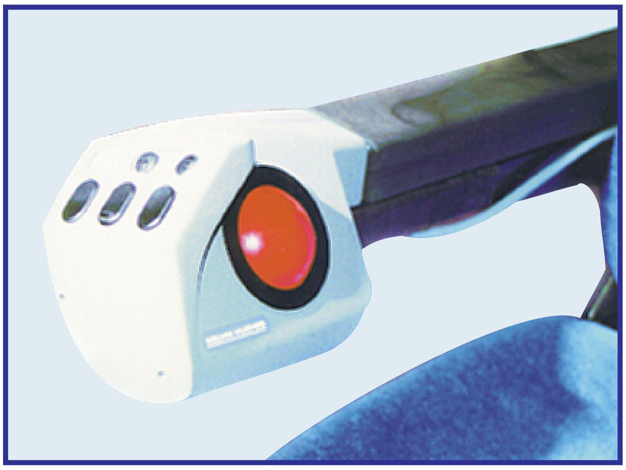

Figure 1f - Typical Ergopod

4 If more than one display is to be controlled by the Ergopod, an Ergopod Controller is also required. Four types of controller kits are available:

(1) Ergopod Controller Unit (NNR-A645-2)

(2) Ergopod Controller Kit for 5000 Series Display (NNR-A887-2)

(3) Ergopod Controller Kit for 6000 Series Display (NNR-A887-12)

(4) Ergopod Controller Kit for Nucleus 3 Split Processor (NNR-A887-22)

INSTALLATION

INSTALLATION OF ERGOPOD UNIT

5 The Ergopod is designed to be fitted to the end of a chair arm, using a mounting bracket. The dimensions and fixing holes for both left-hand and right-hand mounting brackets are shown in Figure 2f.

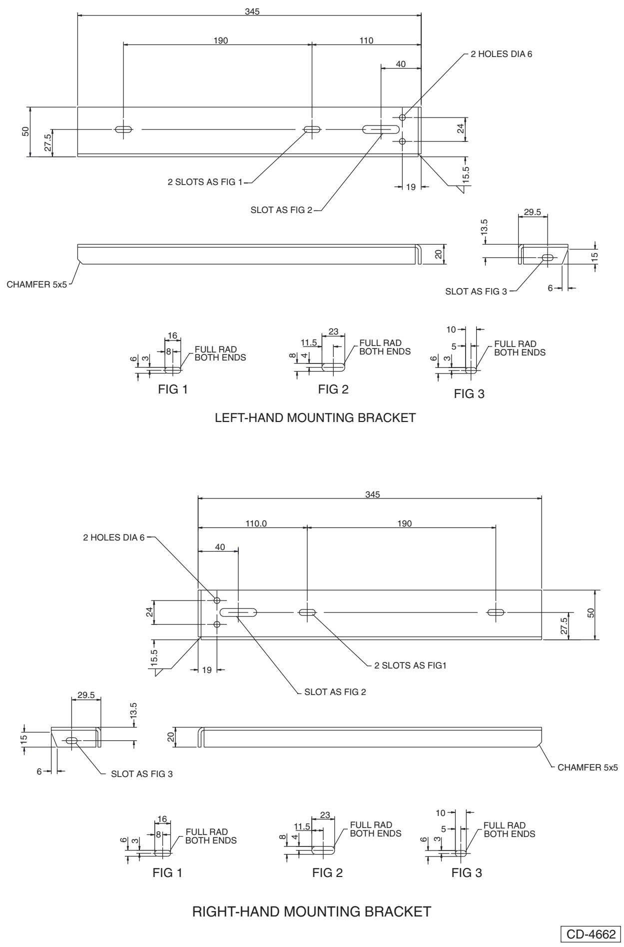

Figure 2f - Ergopod Mounting Brackets: Dimensions

6 Ensure that all connections are made correctly. Refer to paragraphs 12 to 18 For details.

INSTALLATION OF CONTROLLER UNIT

Ergopod Controller Unit

7 The Controller Unit comprises the Ergopod Controller PCB, which is contained within a unit. The dimensions of the Ergopod Controller unit are shown in Figure 3f. The unit is designed to be bolted to a bulkhead or console. A bracket is provided at either end of the unit, for this purpose.

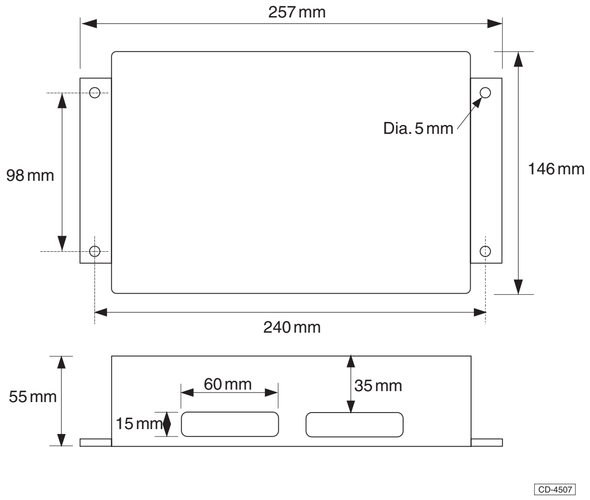

Figure 3f - Ergopod Controller Unit: Dimensions

Link and Switch Settings

Link Settings

8 The Ergopod Controller has two links LK1 and LK2, which are set according to the output required from the PCB, as follows:

Link	Setting	Function
LK1	A	+5V Pod Electronics
	B	RS422 Serial Out
LK2	A	+12V Key Backlight
	B	RS422 Serial Out

Switch Settings

9 Ensure that SW1 on the Ergopod Controller is set to the total number displays (including any shared displays) connected to the Ergopod MISC PCB.

10 Settings for switch SW2 are as follows:

(1) SW2 No.1 - ON = Dual Ergopods

(2) SW2 No.2 - ON = Master MISC PCB
OFF = Slave MISC PCB

(3) SW2 No.3 & 4 - Number of shared displays (see Table below).

SW2 No.3	SW2 No.4	No. of Shared Displays
OFF	OFF	1
ON	OFF	2
OFF	ON	3
ON	ON	4

11 The switch locations are shown in Figure 4f.

Connections

12 Display connection cables are 3-core cables

Ergopod Controller to Ergopod

13 Connections between the Ergopod and the Controller are via PL7 POD/422.

14 It has three Klippon connectors fitted as standard, these are:

(1) Direct Nucleus Radar Connection

(2) ECDIS Connection

(3) Ergopod Controller Connection (4-Way):

Connector	Wire Colour
PL7, Pin1 (+5V)	Blue
PL7, Pin 2 (+12V)	Yellow
PL7, Pin 3 (RXD)	Brown
PL7, Pin 4 (0V)	Orange & Green

Master Ergopod Controller to Slave Ergopod Controller

15 The Ergopod Controllers communicate via NMEA Interface -A6/B6/C6 (Serial Data Output Port) and Display 6 - MFD) (Serial Data Output Port). Connections are as follows:

Master Controller		Slave Controller	
PL6, B6	Rx Data	PL5, Pin8	Tx Data
PL6, A6	Rx Data	PL5, Pin6	Tx Data
PL5, Pin 8	Tx Data	PL6, B6	Rx Data
PL5, Pin 6	Tx Data	PL6, A6	Rx Data

NOTE:

To enable the Ergopod Controllers to communicate, data must go OUT of one controller and IN to the other.

Dual Ergopod Controller Settings

16 Ensure that the correct software is loaded, press F10 to reset the Controller. Using Sys_mon2 to interrogate the Controller, check that the following message is displayed by the Master Controller:

-$ZM1833 MISC Ergopod Controller I/F V1.1$
- 2 Displays has been set
- Dual Ergopods setting selected , "pod comms via display 6 port

- This controller set as Master
- Dual Ergopod with *shared displays

17 Check that the following message is displayed by the Slave Ergopod Controller:

- $ZM1833 MISC Ergopod Controller I/F V1.1$
- 2 Displays has been set
- Dual Ergopods setting selected, "pod comms via display 6 port
-This controller set as Slave
- Dual Ergopod with *Shared displays

NOTE:

Ensure that both messages report the correct software version.

Ergopod Controller to Display(s)

18 Where more than one display is connected to the Ergopod, the connections between the Ergopod controller and the displays, are as follows:

Display	Controller Connections
Display 1	**PL2, Pin 1 (Display 1 VIN3)** **PL2, Pin 2 (Display 1 GND)** **PL2, Pin 3 (Display 1 Data)**
Display 2	**PL2, Pin 4 (Display 2 VIN3)** **PL2, Pin 5 (Display 2 GND)** **PL2, Pin 6 (Display 2 Data)**
Display 3	**PL4, Pin 1 (Display 3 VIN3)** **PL4, Pin 2 (Display 1 GND)** **PL4, Pin 3 (Display 1 Data)**
Display 4	**PL4, Pin 4 (Display 2 VIN3)** **PL4, Pin 5 (Display 2 GND)** **PL4, Pin 6 (Display 2 Data)**
Display 5	**PL5, Pin 1 (Display 1 VIN3)** **PL5, Pin 2 (Display 1 GND)** **PL5, Pin 4 (Display 1 Data)**
Display 6	**PL5, Pin 5 (Display 2 VIN3)** **PL5, Pin 6 (Display 2 GND)** **PL5, Pin 8 (Display 2 Data)**

Display	Nucleus Display Connections
Nucleus 3 Radar	Input PCB: PLH, Pin 2 (+12V) PLH, Pin 3 (Data RS232) PLH, Pin 4 (0V)
Nucleus 5000 ECDIS	ERGO-POD Pin 4 (+12V) ERGO-POD Pin 3 (0V) ERGO-POD Pin 1 (Data RS232)
Nucleus 6000 ECDIS	To 9-Way D-Type Connector on front of processor, via adapter cable NNR-A887: D Pin 5 (0V) D Pin 2 (Data RS232)

19 Where an Ergopod is connected directly to a single display, the connections between the Ergopod and the display are as follows:

Display	Nucleus Display Connections
Nucleus 3 Radar	Input PCB: PLH, Pin 1 (+5V) PLH, Pin 2 (+12V) PLH, Pin 3 (Data RS232) PLH, Pin 4 (0V)
Nucleus 5000 ECDIS	ERGO-POD Pin 4 (+12V) ERGO-POD Pin 3 (0V) ERGO-POD Pin 1 (Data RS232)
Nucleus 6000 ECDIS	To 9-Way D-Type Connector on front of processor, via adapter cable NNR-A887: D Pin 5 (0V) D Pin 2 (Data RS232)

FUNCTIONAL DESCRIPTION

20 The Ergopod is designed to provide remote control of up to six displays. Typical configurations are shown in Figures 5f, and 6f.

21 For information on the control facilities provided, refer to paragraph 25 - Operating Information

22 The Ergopod Controller PCB is fitted with LED indicators which provide the following indications:

LED	Function
D1	Flashes at 1Hzto indicate correct operation of software.
D5, D12, D16, D18, D20	Serial Inputs
D23	Flash Programming
D31, D32, D33, D34, D35, D36	Power Supply from Displays 1 to 6 respectively.

23 When the Ergopod is used in the "Dual Ergopod" mode, up to 5 displays can be connected to a single Ergopod controller. The Display connected to PL2 on the PCB is the default display when power is switched on.

NOTE:

The Slave Ergopod Controller also uses the display connected to PL2 on the PCB as the default display when power is switched on, but will not take control until either the Master or Slave is moved on to another display.

24 The Ergopod Controller PCB requires a +12V power supply. The +12V supply is normally supplied via one of the displays.

NOTE:

If only one display is supplying +12V to an Ergopod controller PCB, then switching off this display will disable both the Ergopod and the associated controller.

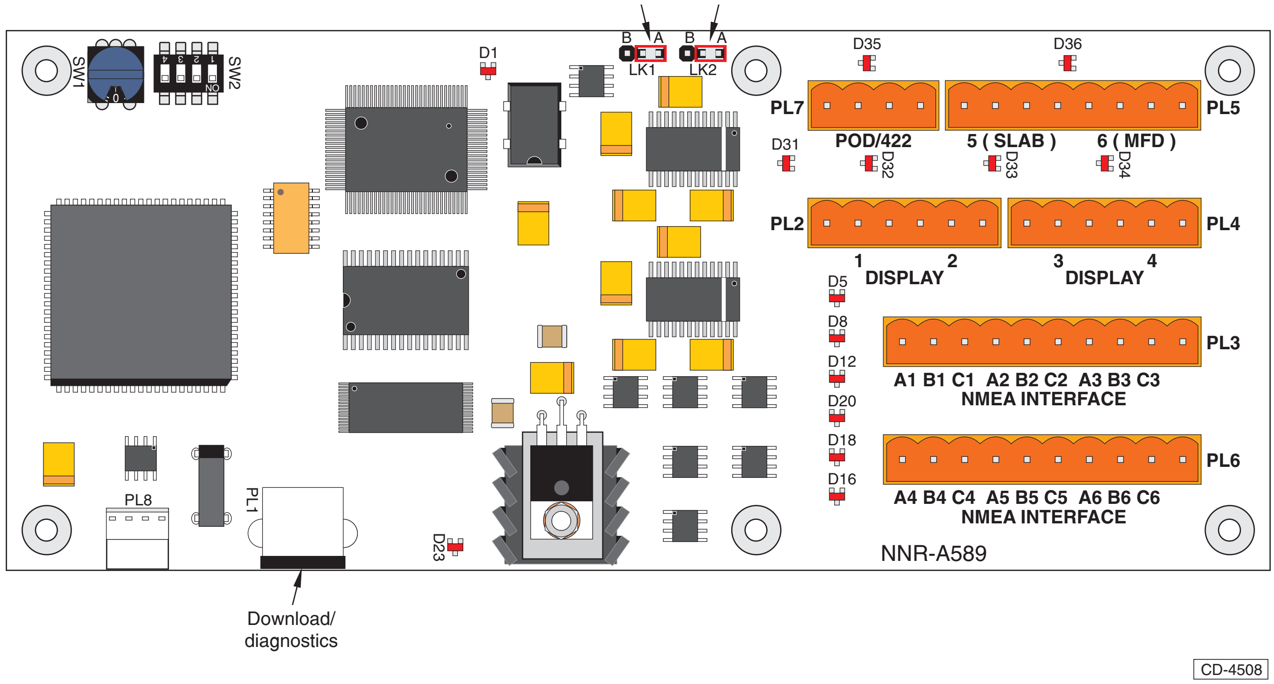

Figure 4f - Ergopod Controller (NNR-A645-2): Link and Switch Locations

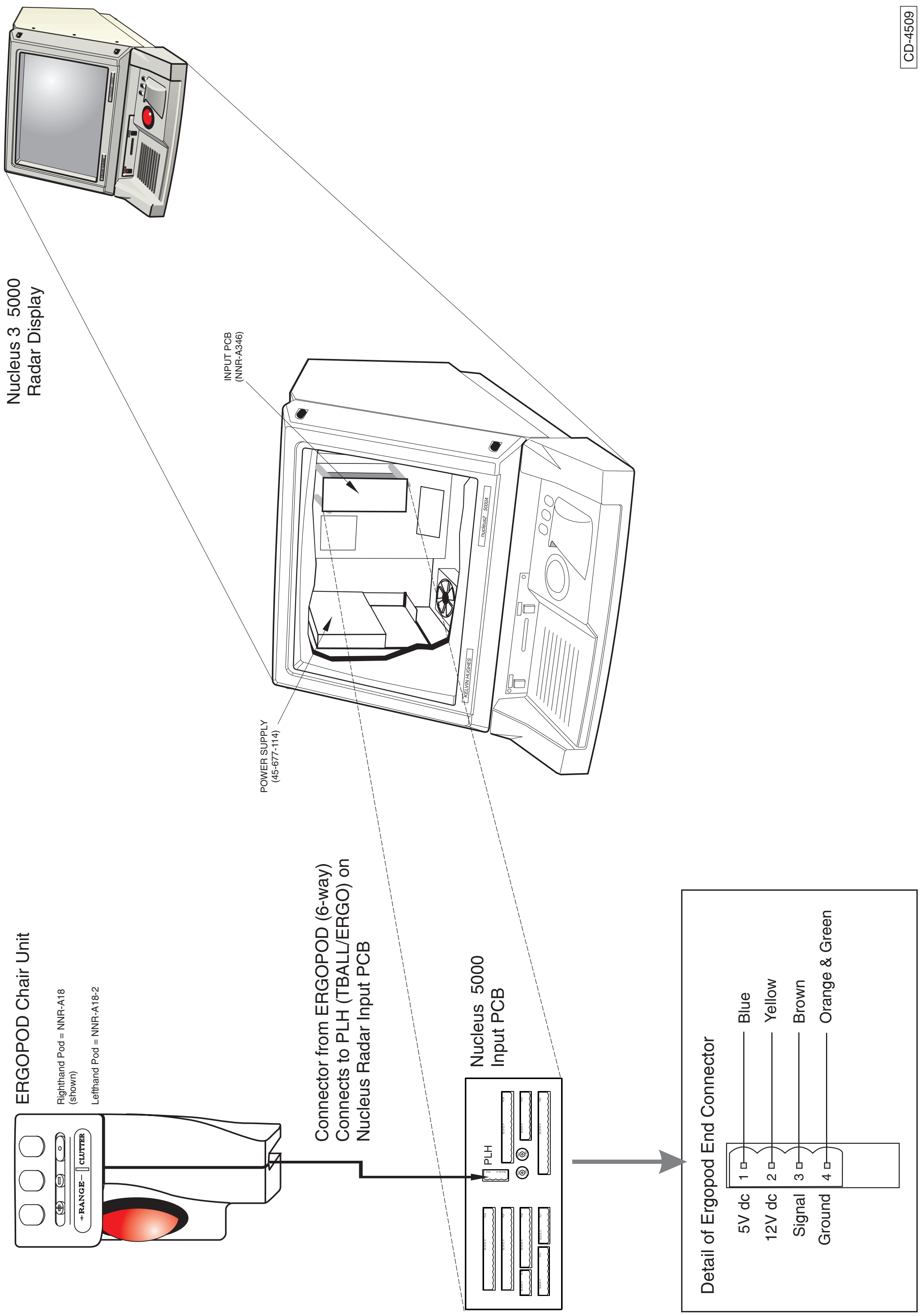

Figure 5f - Single Ergopod Connected to a Nucleus 5000 Display

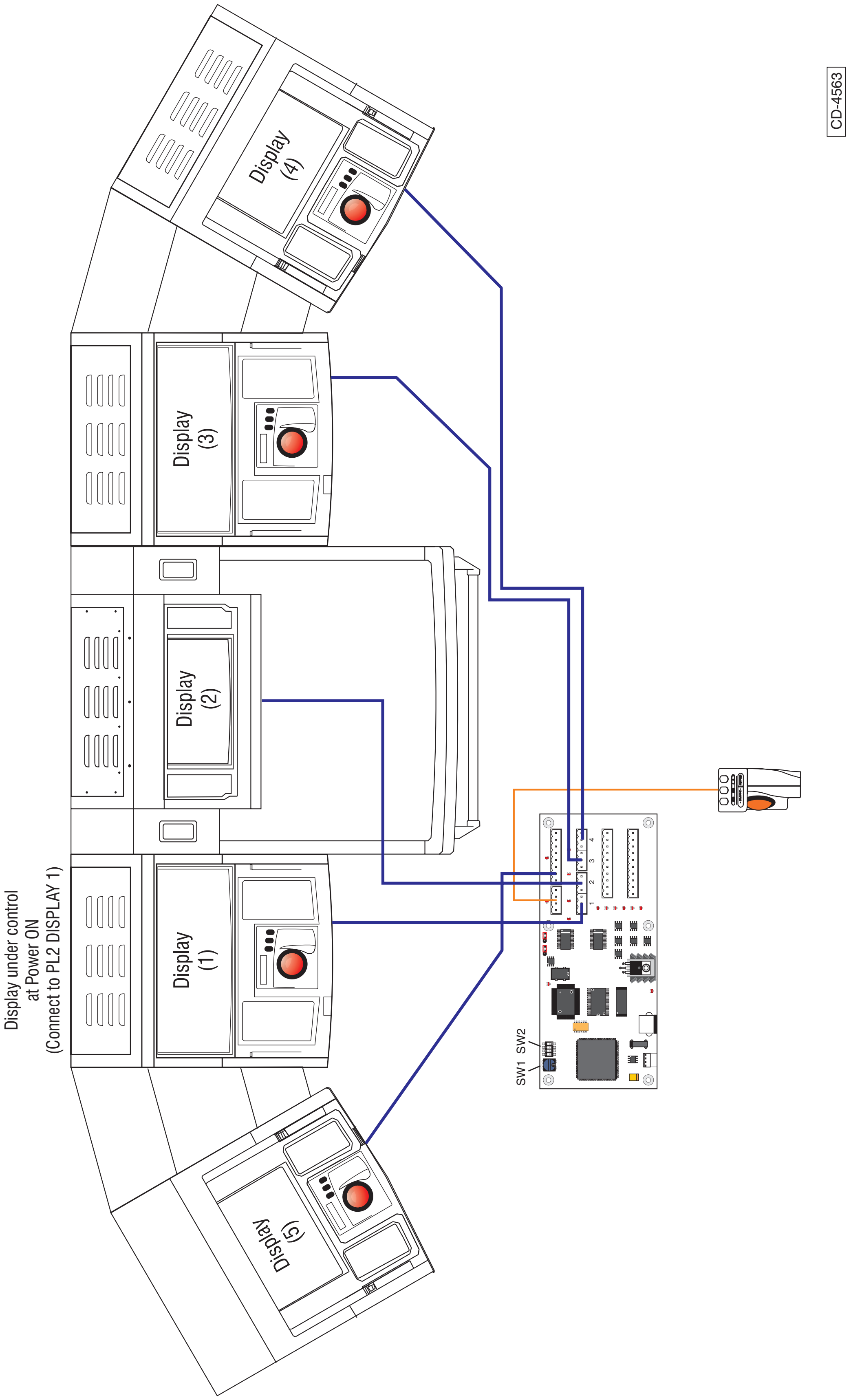

Figure 6f - Single Ergopod Connected to Five Displays

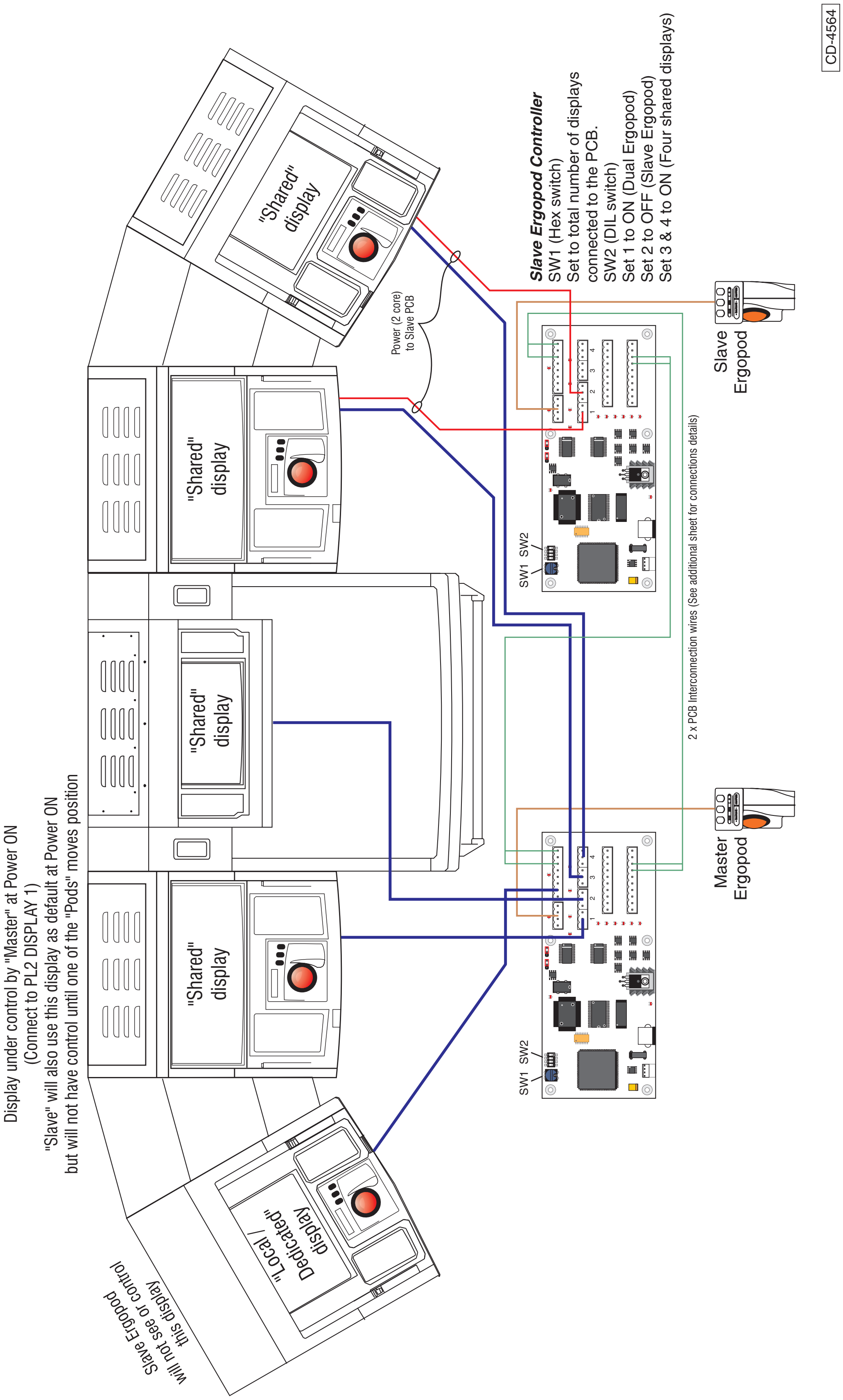

Figure 7f - Dual Ergopod Connected to Five Displays

OPERATION

25 The ERGOPOD provides the same basic operating facilities as the trackerball and three pushbuttons on the Nucleus Displays. In addition, the Ergopod is equipped with a plus (+) and minus (-) range button, a Clutter button and a screen select button (located on the underside of the main pushbutton area above the trackerball).

26 The ERGOPOD can be used 'Stand-alone' or in Dual configuration with two Ergopods configured as Master and Slave with shared displays.

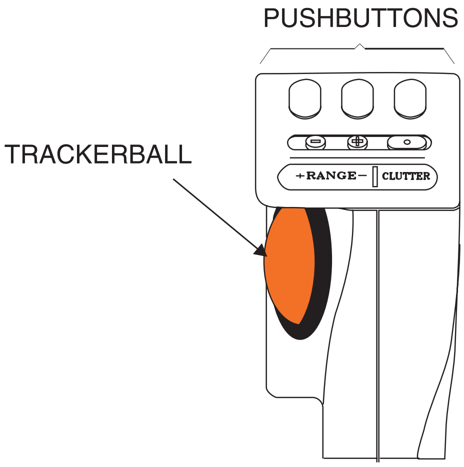

Figure 8f - Ergopod Controls

CONTROLS

Function Pushbuttons

27 The 3 Main pushbuttons are used to activate/select a particular function. On-screen guidance as to which button to press is given in the Information Boxes located in the lower portion of the screen display.

28 When a function is selected (e.g. Range/Rings) the Information box displays similar data to that shown in the **pop-down** (information boxes) which appear below the selected function box. If all pushbutton activities are the same, a red box appears on the display containing the legend:

USE ANY KEY

CD-1964

29 A facility which has been previously activated, such as EBL, is re-selected by positioning the cursor in close proximity to the required facility and pressing the centre pushbutton.

Range (-) & (+) Pushbuttons

30 The Range - and + pushbuttons provide a short-cut to that Range Function on a Nucleus Display.

(1) Pressing the minus (-) button decreases the range displayed on the screen.

(2) Pressing the plus (+) button increases the range displayed on the screen.

Clutter (   ) Pushbutton

31 The Clutter pushbutton provides a short-cut to activate the Gain/Sea/Rain box.

32 Pressing the clutter (   ) pushbutton, highlights the Gain/Sea/Rain boxes, which displays the current setting of the Gain, Sea and Rain controls.

(1) Holding down the left pushbutton and moving the trackerball through the north/south axis, increases/decreases the Gain setting.

(2) Holding down the middle pushbutton and moving the trackerball through the north/south axis, increases/decreases the Sea clutter level. Rapidly moving the trackerball in the south axis enables the Auto Sea mode. The Auto Sea mode is disabled by rapidly moving the trackerball in the north axis.

(3) Holding down the right pushbutton and moving the trackerball through the north/south axis, increases/decreases the Rain setting.

Screen Select Pushbutton

33 The Screen Select pushbutton is located on the underside of the main pushbutton area, above the trackerball. This pushbutton can be used, where two Ergopods are used, to select between the available screen displays. The Ergopod Symbol will be displayed at the bottom of the selected screen display.

NOTE:

The Screen Select pushbutton has no function when a single Ergopod is used.

Trackerball

34 The Trackerball is used to position the cursor on the screen, near to or on the function to be activated and to change parameters once a function is activated.

SHARED DISPLAY OPERATION

35 Up to a maximum of 5 displays can be used in in the "Dual Ergopod" mode. These may be any combination of Nucleus Radar and ECDIS displays.

36 If up to a maximum of 3 shared displays are used in the system, the Screen Select pushbutton can be held down in conjunction with the left, middle or right pushbuttons to select the required screen display.

37 When two Ergopods are used in Master/Slave configuration, to select between the available screen displays. Two coloured Ergopod symbols are used; Red for the Master Ergopod and Green for the Slave.

38 With the Master/Slave configuration, the Master Ergopod can take control of a shared display and the Slave control is automatically moved to the next available display.

NOTE:

Once a display has been selected for control by the Master Ergopod, it cannot be re-selected for control by the Slave Ergopod until control of that display has been relinquished by the Master Ergopod.

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