BridgeMaster E

Radar

Ship's Manual

Northrop Grumman Sperry Marine B.V.

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Revision: A

WARNINGS AND CAUTIONS

The Radar features, functionality and capability which are described in this manual are not necessarily present in all versions or configurations of the BridgeMaster E.

WARNING: Lethal Voltage Hazard

When access covers are removed, lethal voltages may be exposed. Some capacitors used in the equipment take several minutes to discharge their stored voltages after switch OFF, this is a lethal voltage hazard. Always set the supply switch-fuse to OFF and remove the fuses, before removing the access covers of the equipment.

WARNING: Health Hazard

When cleaning the inside of the equipment, take care not to inhale dust. The dust is a temporary health hazard, depending on individual allergies.

WARNING: Radiation Hazard

Keep outside the hazard zone around an antenna or open waveguide radiating power. Refer to the table below for hazard zones. When it is necessary to work on the Scanner Unit, make sure that radar is switched OFF, and that both the Mains Isolator and the Scanner Control Unit are turned to the OFF position.

Never look directly into an open waveguide.

Radar and other forms of RF radiation can cause Cardiac Pacemakers to malfunction. If you use a Cardiac Pacemaker and suspect a malfunction, leave the vicinity of the radar system immediately and seek medical advice.

Most countries accept that there is no significant radiation hazard at RF power density levels of up to 10 mW/cm^2.

Hazard Zones		
Antenna Length	10 mW/cm^2	1 mW/cm^2
1.2m X-band	1.7m	17m
1.8m X-band	1.05m	10.5m
2.4m X-band	0.75m	7.5m
2.7m S-band	0.73m	7.3m
3.7m S-band	0.55m	5.5m

CAUTION: Electrostatic Sensitive Devices (ESSDs)

The equipment contains ESSDs. Take care not to damage these devices by discharge of electrostatic voltages.

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REVISION RECORD

Revision No	Issue Date	Date Incorporated	Incorporated By

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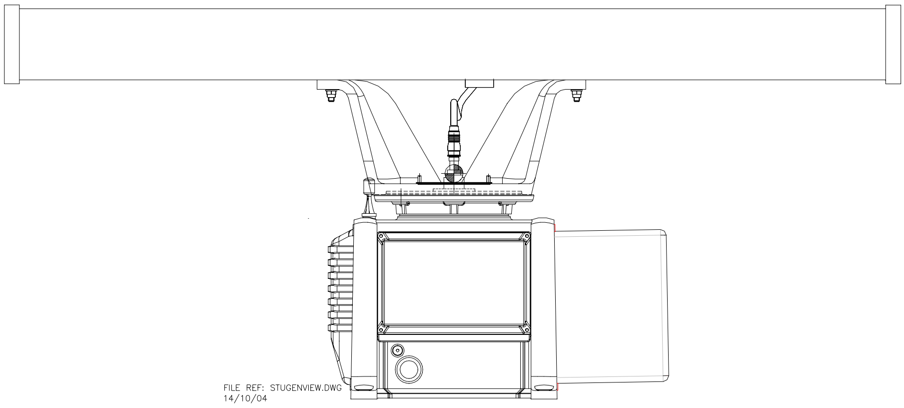
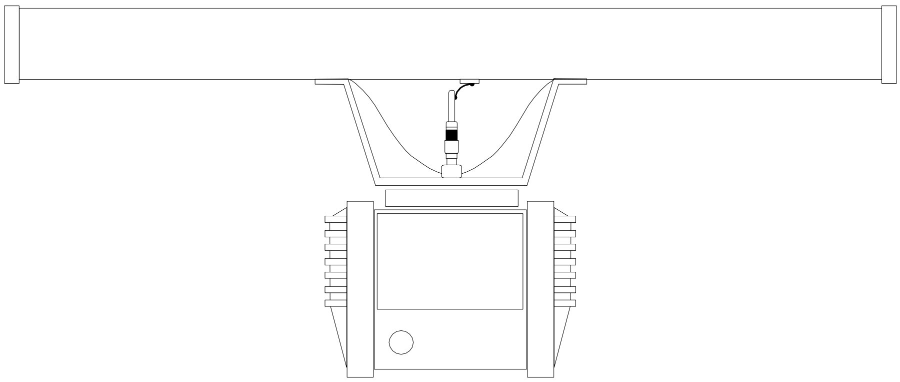
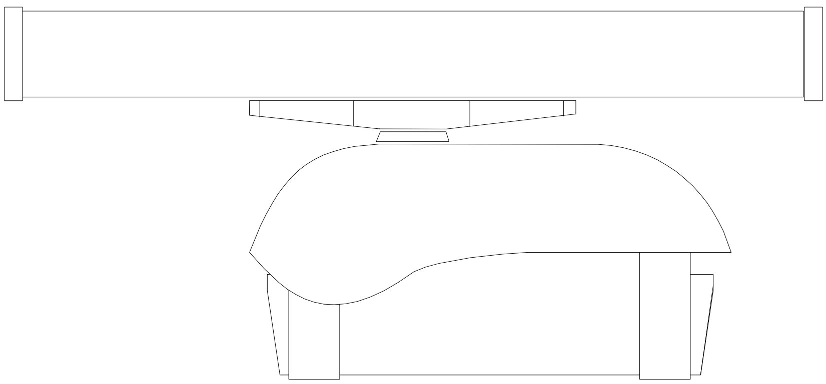


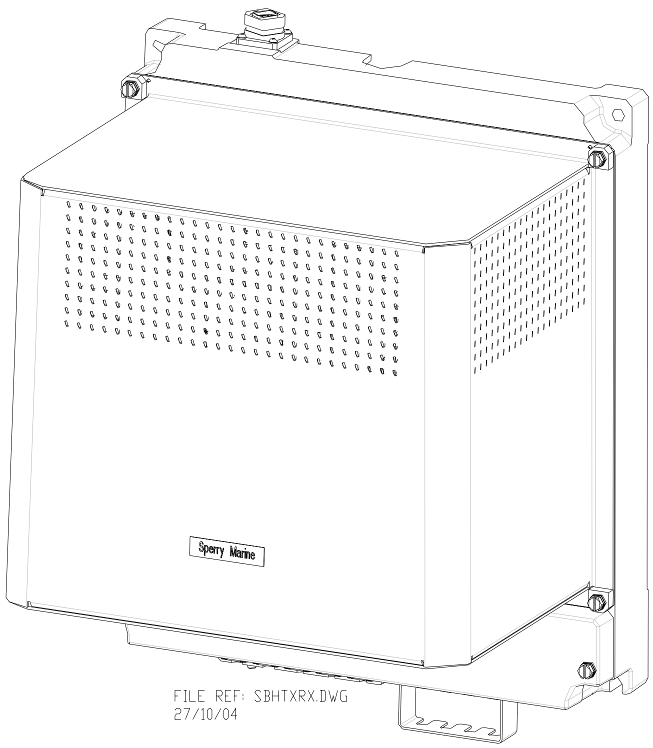
BridgeMaster E:- S-band Scanner Unit (with Integral Transceiver)



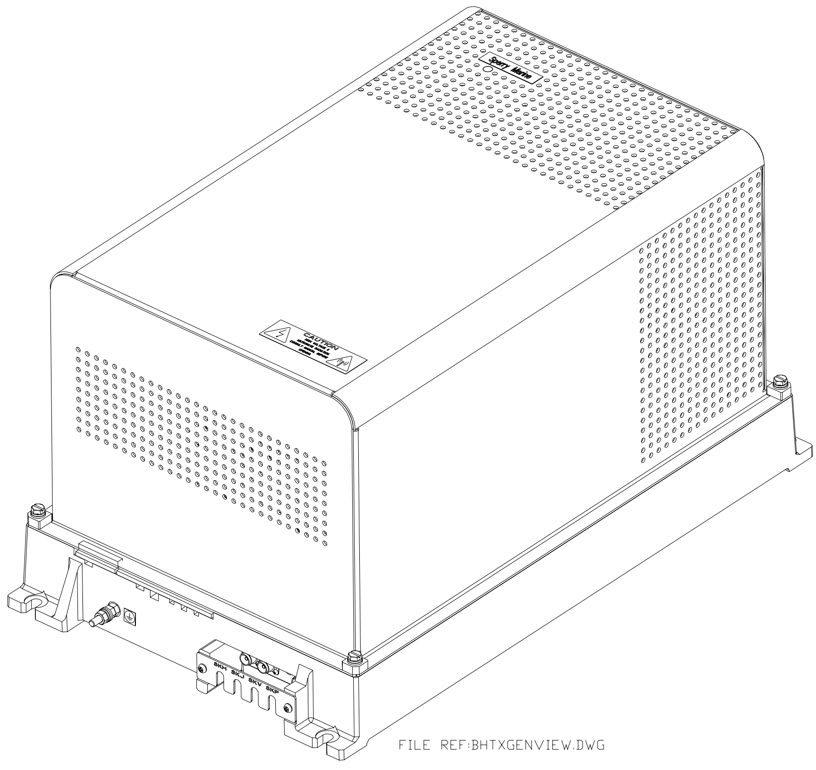
BridgeMaster E:- S-band Scanner Unit (for use with Bulkhead Transceiver)



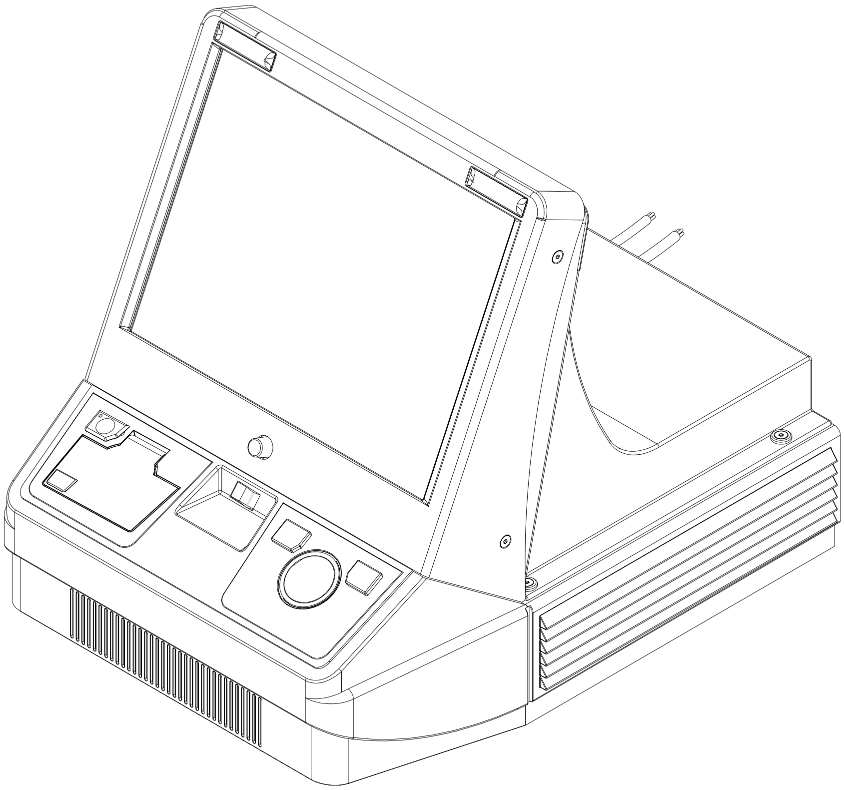
BridgeMaster E:- X-band Scanner Unit (with Integral or Bulkhead Transceiver)



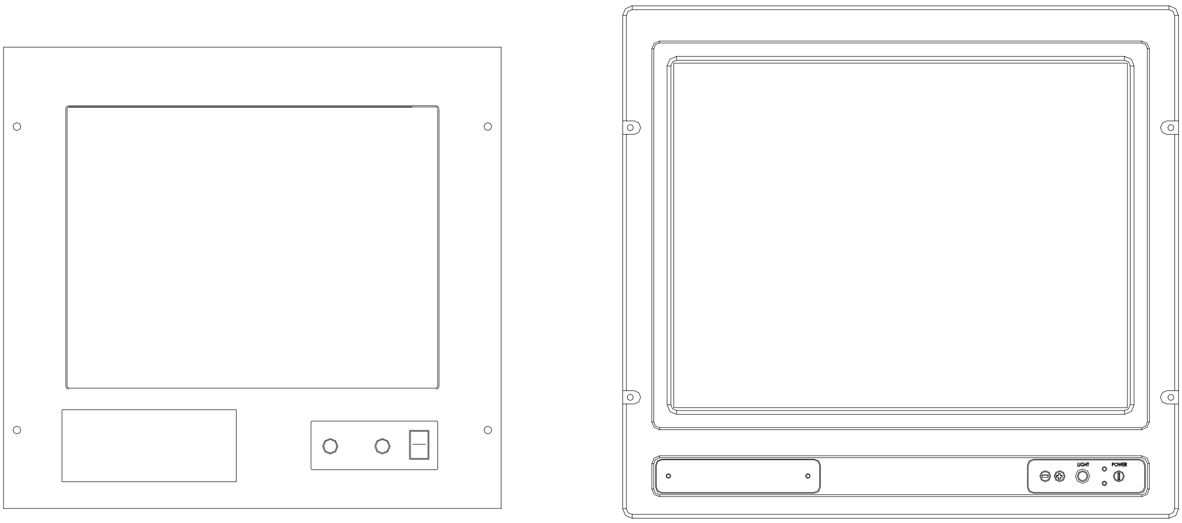
BridgeMaster E:- S-band Bulkhead Transceiver



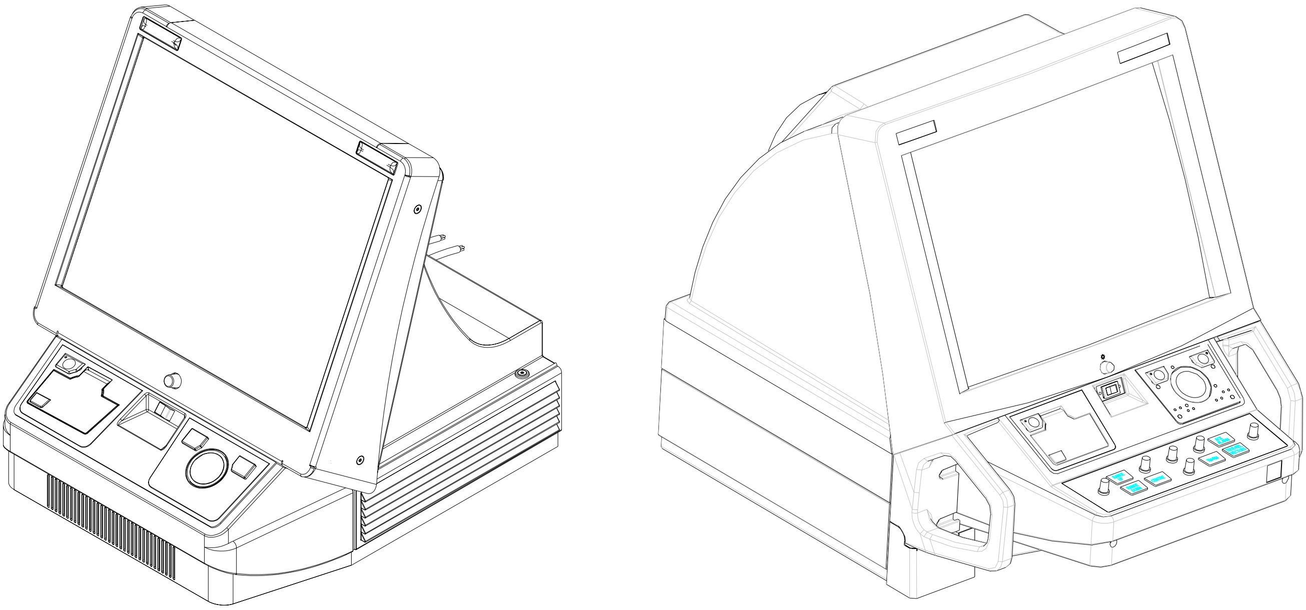
BridgeMaster E:- X-band Bulkhead Transceiver



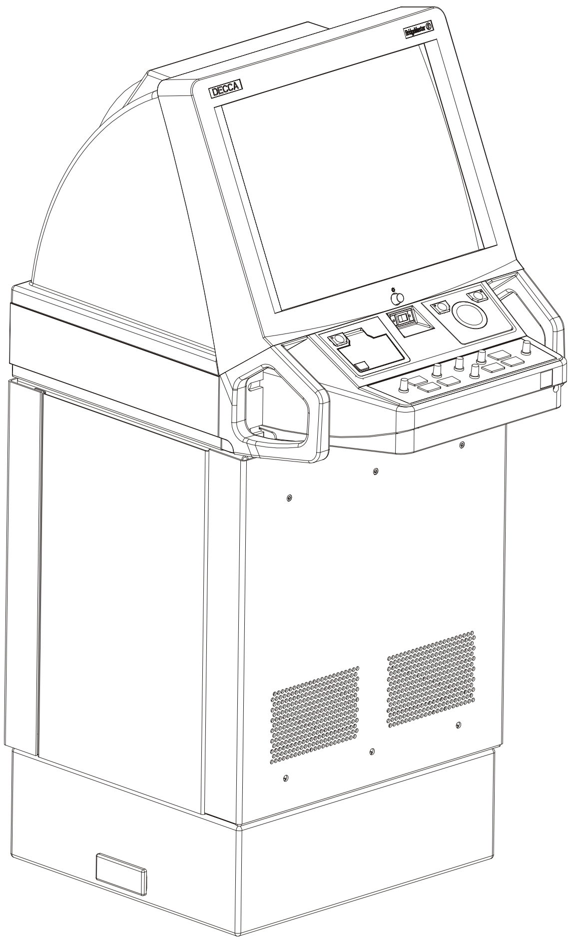
BridgeMaster E:- Desk Mounted 180 Display Unit



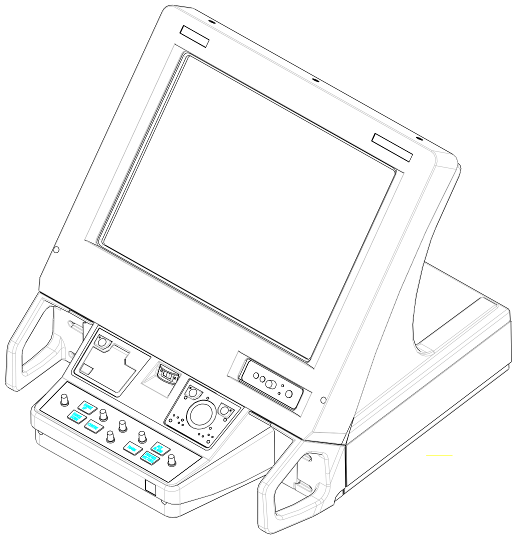
BridgeMaster E:- Flat Panel Monitors

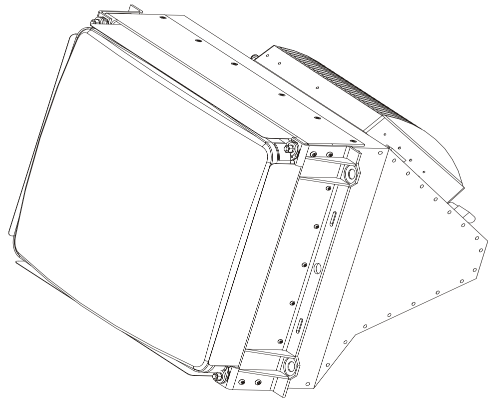


BridgeMaster E:- 250 Desk Mounted Standard and Extended Display Units

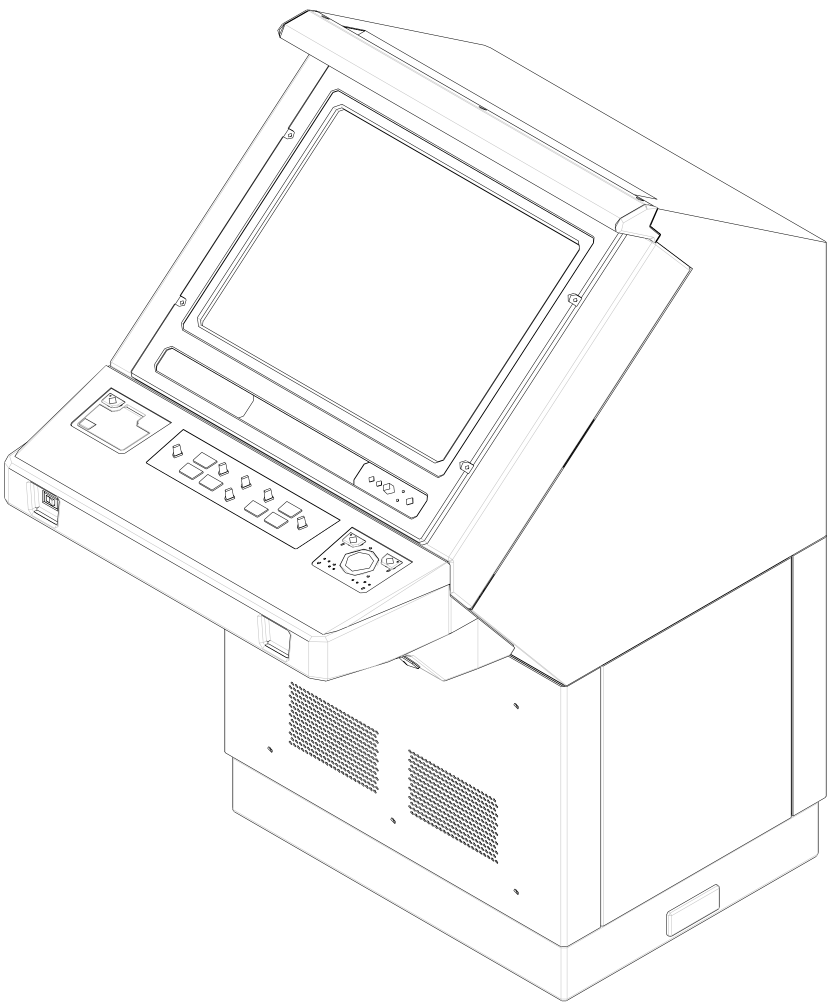


BridgeMaster E:- 250 Display Unit fitted with optional Deck Mounting Kit

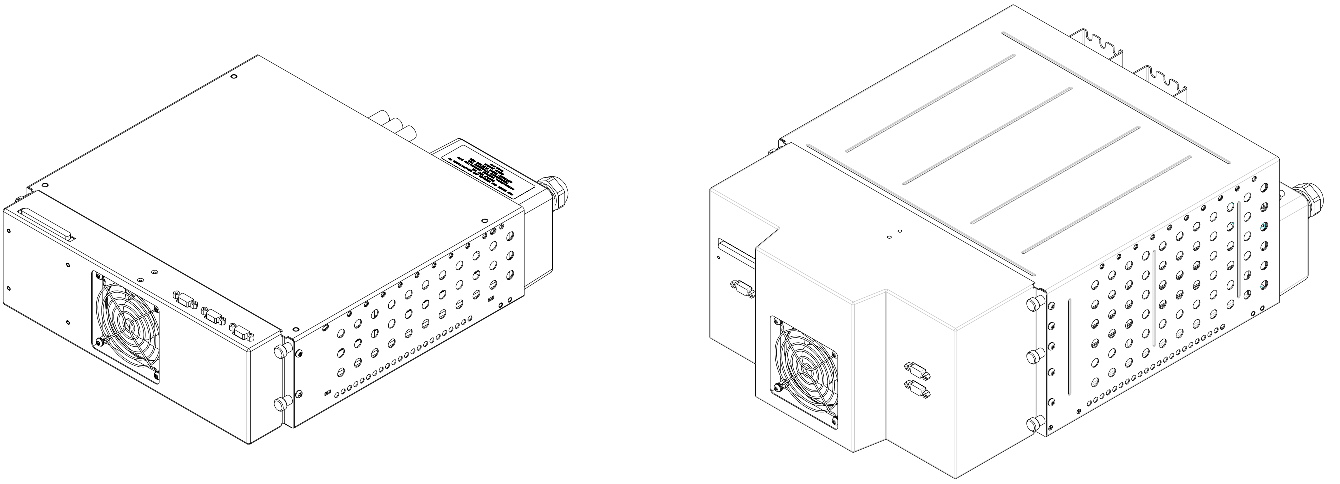




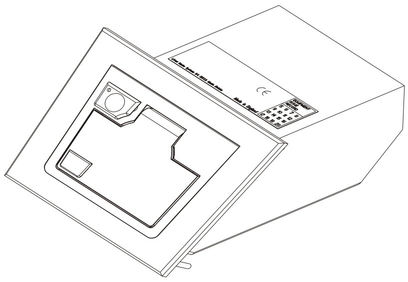
BridgeMaster E:- Desk Mounted 340 Display Unit and Kit 340 CRT Monitor



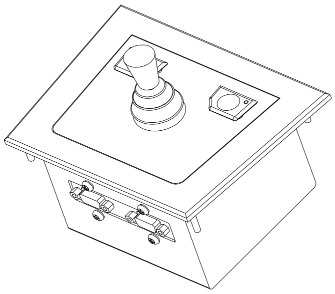
BridgeMaster E:- Deck Mounted 340 Display Unit



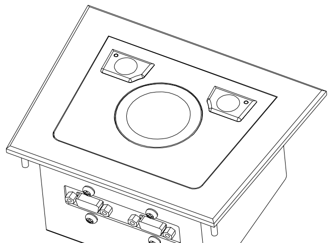
BridgeMaster E:- Kit and Extended Kit Processor Units



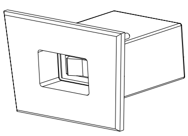
Memory Card Interface



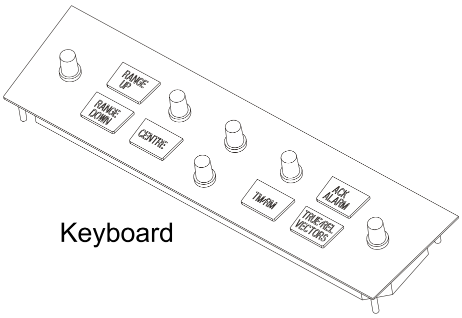
Joystick



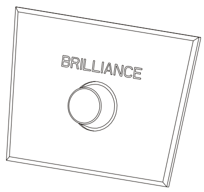
Trackerball



On/Off Switch



Keyboard



Monitor Brilliance

BridgeMaster E:- Kit Radar Display Modules

PREFACE

HOW TO USE THIS MANUAL

This manual is intended for use by the Installation Engineer and Radar Operator. The structure of the manual and the design of its pages can help you to find the information that you need. Consistent presentation techniques are used throughout the manual. For ease of use, the manual is divided into chapters as follows:

- Chapter 1 - Technical Specification. This chapter gives a full specification of the BridgeMaster E Radar Series, both operational and technical.
- Chapter 2 - System Configurations. This chapter details the system configurations available with the BridgeMaster E Radar Series.
- Chapter 3 - Installation. This chapter gives notes on installation with installation diagrams and inter-unit cabling information.
- Chapter 4 - Initialisation and Commissioning. This chapter details the Initialisation and Commissioning procedures for a BridgeMaster E installation.
- Chapter 5 - Operator Tests. This chapter details the operator tests, which are available at the Display Unit.
- Chapter 6 - Fault Reporting and First Line Servicing. This chapter gives procedures for fault reporting and details all first line servicing permitted.
- Chapter 7 - Routine Maintenance. This chapter gives procedures for routine maintenance.
- Chapter 8 - Modifications. This chapter is used for the recording of modifications and information released after publication.
- Chapter 9 - Additional Features. This chapter gives details of special options for transceivers and turning units. It covers the specification, installation, commissioning and servicing.

Operating procedures for the BridgeMaster E series radars are published under separate cover in the **Operator's User Guide** publication reference 65800010A.

NOTICE
Northrop Grumman Sperry Marine B.V. have a policy of continuous development. This may lead to the equipment described in this manual being at variance with equipment manufactured after its publication.

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BridgeMaster E Radar Series

Ship's Manual

OVERALL CONTENTS

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RELATED DOCUMENTS

Other documents in the series:

- Bridge Card..(Publications Ref 65800008)
- Bridge Card for Dual Channel Radars ....(Publications Ref 65818007)
- User Guide.. (Publications Ref 65800010A)
- User Guide for Dual Channel Radars .... (Publications Ref 65818014A)
- Technical Manual..(Publications Ref 65800011)
- Ancillary Units & Radar Systems Manual.............................(Publications Ref 65800012)
- BridgeMaster II S-band Supplement....................................(Publications Ref 65601012)
- BridgeMaster II X-band Supplement....................................(Publications Ref 65601013)

Note that the BridgeMaster II S-band Supplement, and the BridgeMaster II X-band Supplement, cover Hybrid Systems containing BridgeMaster II Series Display Units with BridgeMaster E Series Scanner Units.

Note that for original BridgeMaster, the 180/250 and 340 Display Technical Manuals are Publications Ref 65600011 and 65626011 respectively.

GLOSSARY OF TERMS

Antenna............................	Slotted waveguide array for transmitting and receiving microwave signals.
Bulkhead Transceiver	Transmitter/Receiver mounted below decks with microwave or co-axial connection to the Turning Unit.
Display Unit.......................	The Display Monitor, Processing Unit and Controls.
Extended Processor..........	This is a larger processor which houses two Radar Processors and one Display Processor, and is also referred to as a Dual Channel Processor.
Integral Transceiver	Transmitter/Receiver housed in the Turning Unit.
Interswitch Unit.................	Enables radar systems to be connected together so that any Display Unit may be connected to any Scanner Unit.
Monitor	The viewing unit, which could be a CRT or Flat Panel Monitor (also known as FPD or LCD).
Performance Monitor.........	A unit, which warns the operator of reduced radar performance. May be integral with the Turning Unit (X-Band) or separate (S-Band).
Scanner Unit	Comprises the Antenna and Turning Unit.
Scanner Control Unit.........	A unit which switches power to the S-Band Turning Unit, under the control of the Display.
Turning Unit	Contains the Antenna rotation motor, the microwave rotary joint, and may contain an integral Transceiver.
A.......................................	Ampere
AC	Alternating Current
AFC...................................	Automatic Frequency Control
ARPA	Automatic Radar Plotting Aid
ATA	Automatic Tracking Aid
BIST	Built in Self-Test
CRT...................................	Cathode Ray Tube
dB......................................	decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EPA...................................	Electronic Plotting Aid
ft	foot or feet
FPD...................................	Flat Panel Display
GMT	Greenwich Mean Time
GPS	Global Positioning System
Hz......................................	Hertz (unit of Frequency)
I/O	Input/Output
Km.....................................	Kilometre

GLOSSARY OF TERMS (continued)

Kt .... Knot
kW .... Kilowatt

LCD .... Liquid Crystal Display
LED .... Light Emitting Diode
LNFE .... Low Noise Front End

m .... metre
nm .... nautical mile

NMEA .... National Marine Electronic Association
NNF .... Not Normally Fitted

PCB .... Printed Circuit Board
PPI..................................... Plan Position Indicator
PRF .... Pulse Repetition Frequency
PRI .... Pulse Repetition Interval
PSU .... Power Supply Unit

RFI..................................... Radio Frequency Interference
rpm .... revolutions per minute

SART................................. Search and Rescue Transponder
sm...................................... statute mile

TX/RX................................ Transmitter/Receiver (Transceiver)

UTC .... Universal Time Constant

V .... Volt
VMS................................... Voyage Management System

SOFTWARE LICENCE AGREEMENT

When you receive your radar, it will include factory installed software, the use of which is subject to the following Licence Agreement below.

*** * * IMPORTANT * * ***

READ THE LICENCE TERMS PRINTED BELOW BEFORE USING THE EQUIPMENT. USE OF THE EQUIPMENT INDICATES YOUR ACCEPTANCE OF THE TERMS OF THE LICENCE AGREEMENT.

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MARINE EQUIPMENT DIRECTIVE - DECLARATION OF CONFORMITY

See certificate on next page.

NORTHROP GRUMMAN

Sperry Marine

Marine Equipment Directive Declaration of Conformity

Manufacturer: Northrop Grumman Sperry Marine B.V.
118 Burlington Road
New Malden, Surrey, KT3 4NR
United Kingdom

Declaration:
It is hereby certified that the Equipment listed conforms with the Council Directive for Marine Equipment 96/98/EC and 2002/75/EC and has been Type examined by Notified Body No 191 shown on Certificates of Type Examination No QQ-MED-28/03-01R, QQ-MED-29/03-01R and 02R, QQ-MED-30/03-01R, QQ-MED-31/03-01R, QQ-MED-32/03-01R, 02R and 03R, QQ-MED-17/04-01 and 02, QQ-MED-24/04-01 and 02.

Equipment: BridgeMaster E

Type Number	Description	Type Number	Description
65826L,N,P,W or Z	340 Monitor	65831A or B	Transceiver (30kW)
65821F,K,N,P,R,V,Y,Z,DF or DR	250 Monitor	65801BAR or CA◈	Turning Unit
65815A, C or D	180 FPD Monitor	65830B*R or C*◈	Turning Unit
65817A, C, D, G or H	250 FPD Monitor	65837A♣	Scanner Control Unit
65819A or D	250 FPD Monitor	65604A	X-Band Antenna 4ft
65823A, B or E	340 FPD Monitor	65606A	X-Band Antenna 6ft
65814F,N,R or Y	180 Monitor	65608A	X-Band Antenna 8ft
65800 R♦✟✠ or Z♦✟✠	Processor Unit (ARPA)	65609A	S-Band Antenna 9ft
65800 T♦✟✠ or Y♦✟✠	Processor Unit (ATA)	65612A	S-Band Antenna 12ft
65800 P♦✟✠	Processor Unit (EPA)	65842A	Interswitch Unit
65800 P♦M♠ or P♦N♠	Processor Unit EPA (L)	65846A	Interswitch Unit
65810 ⦿*◈	Transceiver/Turning Unit (10kW)	65847A	Serial Interface
65825 ⦿A◈	Transceiver/Turning Unit (25kW)	65849A	Slave Junction Box
65830 M*R or N*◈	Transceiver/Turning Unit (30kW)	65818YA⊗✠	Dual Processor (ATA)
65810A,B,E,F,G,H,L,P,T or W	Transceiver (10kW)	65818ZA⊗✠	Dual Processor (ARPA)
65825A,B,E,F,G,H,L,P,T or W	Transceiver (25kW)		

Option Codes * A or D for X-Band or E, F, G, H, J, K, L, M, P, Q, R or S for S-Band
♦ A or D ✟ R, T, V or X ♣ B, C, E, F or H ⦿ M, N, P, T or W ◈ R, T or U
✠ E, F, G, H, J, K, L, M, N, O, P, R, S, T, U, V, W, X, Y or Z ♠ A, B, C or D ⊗ S, U, W or Y

Standards Applied:-

EN 60936-1: 2000	Marine Shipborne Radar Equipment
EN 60936-2: 1999	Shipborne Radar for High Speed Craft
EN 60945: 1997	General Requirements for Marine Navigation Equipment
EN 60872-1: 1998	Automatic Radar Plotting Aids (ARPA)
EN 60872-2: 1999	Automatic Tracking Aids (ATA)
EN 60872-3: 2001	Electronic Plotting Aids (EPA)
EN 61162-1: 2000	Digital Interfaces

23rd February 2005

DOC 018

Mike Pope, Technical Director - Europe | Date of Issue | Certificate Number

CHAPTER 1

TECHNICAL SPECIFICATION

Contents

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1 Radar System Performance

Parameter	Detail
Minimum Range	Less than 35m using 10m^2 target, measured with short pulse, 4.5m antenna height, on 0.25 and 0.5nm range scales.
Range Discrimination	Better than 35m on 0.75nm range.
Bearing Discrimination (Typical figures)	2.0° with 4 ft antenna (X-Band). 1.3° with 6 ft antenna (X-Band). 1.0° with 8 ft antenna (X-Band). 2.8° with 9 ft antenna (S-Band). 2.0° with 12 ft antenna (S-Band) on 1.5 nm range using 10 m^2 reflector at a range of 1.0 nm.
Range Ring Accuracy	1% of the maximum range of the scale in use or 25m whichever is the greater.
Variable Range Marker Accuracy	1% of the maximum range of the scale in use or 25m whichever is the greater.

2 Antenna Specification (X-Band)

Operating frequency:9410MHz ± 30MHz

Specification	Aperture Size		
	1.2m (4ft)	1.8m (6ft)	2.4m (8ft)
Horizontal Beam Width, -3dB (maximum)	2.0°	1.3°	1.0°
Vertical Beam Width, -3dB (nominal)	24°	24°	24°
Sidelobes within 10° of Beam (minimum)	-23dB	-23dB	-23dB
Sidelobes outside 10° of Beam (minimum)	-30dB	-30dB	-30dB
Gain (nominal)	29dB	30dB	31dB
Polarisation	Horizontal	Horizontal	Horizontal
Limiting Relative Wind Speed	100kt	100kt	100kt

The rotational speeds given below apply to all sizes of X-Band antenna.

Rotational Speed	rpm
Standard	28rpm
High	45rpm

3 Antenna Specification (S-Band)

Operating frequency:3050MHz ± 10MHz

Specification	Aperture Size	
	2.7m (9ft)*	3.7m (12ft)
Horizontal Beam Width, -3dB (maximum)	2.8°	2.0°
Vertical Beam Width, -3dB (nominal)	30°	30°
Sidelobes within 10° of Beam (minimum)	-	-23dB
Sidelobes within 15° of Beam (minimum)	-23dB	-
Sidelobes outside 10° of Beam (minimum)	-	-30dB
Sidelobes outside 15° of Beam (minimum)	-28dB	-
Gain (nominal)	25dB	26dB
Polarisation	Horizontal	Horizontal
Limiting Relative Wind Speed	100kt	100kt

*The 2.7m (9ft) antenna is only Type Approved for use in High Speed craft

The rotational speeds given below apply to all sizes of S-Band antenna.

Mains Supply Frequency	50Hz	60Hz
Rotation Speed (standard)	25rpm	30rpm
Rotation Speed (high)	48rpm	50rpm

4 Transceiver Specification

The following specification applies equally to X-Band and S-Band Transceivers (except where shown).

4.1 Mounting Arrangements

Option	X-Band	S-Band
Masthead	Aloft within Turning Unit	
Bulkhead	Waveguide feed to Turning Unit	Co-axial feed to Turning Unit

4.2 Transmitter

Parameter	X-Band	S-Band
Magnetron Frequency	9410MHz ± 30MHz	3050MHz ± 10MHz
Magnetron Peak Power (nominal)	10kW or 25kW	30kW
Pulse Length/PRF (nominal)	0.05µs/1800Hz (Short Pulse) 0.05µs/3000Hz (Short Pulse option for X-Band only) 0.25µs/1800Hz (Medium Pulse) 0.75µs/785Hz (Long Pulse)	
Pulse Generator	Solid State with pulse forming network driving the magnetron.	

4.3 Receiver

Parameter	Detail
Type	Logarithmic, with Low Noise Front End (LNFE)
Tuning	AFC/Manual
IF (Intermediate Frequency)	Centred at 60MHz
IF Bandwidth (nominal)	20MHz on short and medium pulses 3MHz on long pulse
Noise Factor (nominal)	5.0dB
Dynamic Range (nominal)	80dB

4.4 Performance Monitor

This monitor is optional with non Type Approved systems.

Parameter	Detail
Monitored Performance	Radar Receiver and entire Radar System
Type	Transponder
Presentation	Four concentric arcs on Display Unit. Arcs are of reducing brightness outwards, showing degradation in performance (including antenna) in 5dB increments relative to inner arc.

4.5 Options

4.5.1 High Pulse Repetition Frequency

This option, available on 10kW and 25kW X-Band Transceivers, increases the short pulse repetition frequency to 3kHz. This can be combined with the Additional Features option listed below.

4.5.2 Antenna Rotation in Standby

This antenna is not available in combination with all other options.

This isolated closing contact input is used to make the antenna rotate when the Transceiver is in standby.

This option cannot be used in combination with the remote speed select option.

4.5.3 Additional Features

The additional-features versions of the Tuning Units and Transceivers provide the extra Input and output capabilities listed below.

The synchro or resolver output is only available as an option on Scanner Units with Additional Features.

4.5.3.1 Heading Marker Output

Output 1

Output 1 is an uncommitted contact output from a solid-state relay.

Output 2

Output 2 is an RS422 output, used to drive a differential line.

Both outputs share a common adjustment to correct for small errors in Heading Marker Alignment.

4.5.3.2 Azimuth Data Output

4096 Pulse Bearing Output

This incremental output is available either in RS422 format to drive a differential line, or as an open drain output to drive a single ended input.

Synchro or Resolver Bearing Data Output

The Scanner Unit may be fitted with size 11 synchro or resolver. This is not aligned. Any alignment must be provided externally.

The synchro may be a Control Transmitter (CX) or a Control Differential Transmitter (CDX).

4.5.3.3 External Trigger Input

This 75-Ohm coaxial input allows the Transmitter to be synchronized to other equipment on the ship.

Presence of the signal at the external trigger input will automatically select external trigger as the mode of operation.

Transmission occurs typically 11µs after the leading edge of the pulse.

4.5.3.4 Radar Silence Input.

On receipt of this input, the transmitter is switched to standby within one pulse repetition interval. The transmitter remains on standby as long as the signal is present.

The input signal format can be selected to be: RS422, RS423, or uncommitted contact.

The sense of the signal can be selected to be active high or active low.

4.5.3.5 Pre-Trigger Output

This 75-Ohm coaxial output allows other equipment on the ship to be synchronised with the Transmitter.

The leading edge of the positive output pulse occurs approximately 11µs before the magnetron output.

4.5.3.6 Speed Select Input (X-Band AC systems only)

This isolated closing contact input allows remote selection of either high or low antenna rotation speed.

5 Radar Display Specification

5.1 Monitors

5.1.1 BridgeMaster E CRT Monitors

Monitor Type:Colour raster scan with landscape mode picture format.

Type	Radar Circle Diameter (mm)	Pixel Grid Size	Screen Diagonal (inches)	Aspect Ratio
180	180	1365 x 1024	14	4:3
250	250	1365 x 1024	21	4:3
340	340	1024 x 768	29	4:3

5.1.2 BridgeMaster E Flat Panel Monitors

Monitor Type:Cold Cathode Florescent Lamp backlit transmissive Thin Film Transistor LCD, with landscape mode picture format.

Type	Radar Circle Diameter (mm)	Pixel Grid Size	Screen Diagonal (inches)	Aspect Ratio
180 Desktop	180	1024 x 768	15.1	4:3
180 Kit	180	1280 x 1024	15.4	5:4
250 Desktop	250	1280 x 1024	19.0	5:4
250 Kit	250	1280 x 1024	18.1,19.0 or 20.1	5:4
340	340	1280 x 972	23.1	4:3

Note – 180 and 250 kit monitors can be used as secondary monitors to a 1280 x 1024 or 1280 x 972 primary monitor.

340 kit monitors can be used as secondary monitors to a 340 type primary monitor.

Flat Panel monitors cannot be used as secondary monitors to primary CRT monitors

5.1.3 Non-BridgeMaster E CRT Monitors

BridgeMaster E CRT Monitors fitted with buffered video/sync output option can be used to drive a suitable Company approved CRT monitor as a secondary display.

Video signal characteristics conform to RS343A, A 2:1 interlace format is used, with line and field rates as shown in the following table.

Pixel Grid Size	Line Rate (kHz)	Field Rate (Hz)
1365 x 1024	42.5	79
1280 x 1024	42.5	79
1280 x 972	42.5	79
1024 x 768	30.7	76

5.2 Video Processing

Parameter	Detail
Manual Control	Variable controls for gain, anti-clutter sea and anti-clutter rain.
Anti-clutter Auto	Advanced adaptive rain and sea clutter suppression circuits, applied without manual adjustment.
Vision anti-clutter (option)	Advanced 2-dimensional thresholding process with target censoring for improved sea and rain clutter suppression without manual adjustment.
Enhance (echo stretch)	Operation available by selection on ranges of 0.75nm and above, with enhancement of targets over entire picture area except for a small area around the radar origin. Special circuitry for identifying weak/fading targets.
Multi-level Video	Radar video digitised at 16 levels. Scan integration employed at 16 levels and displayed at 8 levels on screen.
Picture Persistence/Trails	Medium persistence phosphor simulation with switchable true or relative motion trails, achieved by unique video processing.

5.3 Range Scales

Range Scales		Range Rings		Available Pulse Lengths		
nm*	km	nm*	km	Short	Medium	Long
0.125	0.25	0.025	0.05	√		
0.25	0.5	0.05	0.1	√		
0.5	1	0.1	0.2	√	√	
0.75	1.5	0.25	0.5	√	√	
1.5	3	0.25	0.5	√	√	
3	6	0.5	1	√	√	√
6	12	1	2		√	√
12	24	2	4		√	√
24	48	4	8		√	√
48	96	8	16			√
96	192	16	32			√

* Statute miles have the same range scale/ring values as Nautical Miles. Later references in this chapter to nm are equally applicable to sm if selected.

Display in nautical miles, kilometres or statute miles may be selected during initialisation.

5.4 Azimuth Stabilisation

Built-in stabilisation allows interfacing to most stepper and 360:1 ratio synchro compass types. A Special Compass Input Option provides interfacing to 180:1, 90:1, 36:1 and 1:1 ratio synchros.

Interfacing with Compasses with a Serial Output is also available. However, the preferred interface is a stepper or synchro compass. If only a serial compass is available and it is used for tracking, then the message rate should be 50Hz.

See Chapter 3 (section 3.2) for details of compass types and cabling details.

Parameter	Detail
Maximum Rate of Turn	1200°/m
Course Accuracy	Within 0.5° of input source.

5.5 Stabilisation Modes

Parameter	Detail
Head-Up (unstabilised)	Available with Relative Motion (Relative Trails).
North-Up	Available with Relative Motion (Relative Trails), Relative Motion (True Trails) and True Motion.
Course-Up	

Note – North-Up and Course-Up are only available with a valid compass input.

5.6 Speed Inputs

Speed information can be provided by several methods, selectable via the SPEED display.

Parameter	Detail
Speed Range and Input	0 to 75Kt, MANUAL 0 to 75Kt, Log (Serial or Pulse) Echo Reference Navigation Sensor
Steady State Speed Accuracy	±5% or ±0.25Kt, whichever is the greater, of that defined by the input source.

The log speed can be derived from either a Pulse Type or a Serial Output Type. Pulse Log types have outputs in the range 100 to 3000 pulses per NM, and can be incremental TTL or 'closing contact' type. The open circuit potential for the Pulse Log Input is approximately 5V. For acceptable serial message headers, see Section 5.22 in this chapter.

5.7 Presentation Modes

5.7.1 Relative Motion (Relative Trails)

Relative Motion (Relative Trails) – RM(R) – is available with Head-Up (unstabilised), North-Up (stabilised), or Course-Up (stabilised), on all range scales.

In the RM(R) mode, ownship is maintained at a selected point on the display and the motion of all echoes is shown **relative** to ownship. This is indicated by the Trails, if turned on.

5.7.2 True Motion, and Relative Motion (True Trails)

True Motion (TM) and Relative Motion (True Trails) – RM(T) – are available with North-Up or Course-Up Stabilisation on ranges 0.5 to 48 nm inclusive for TM, and ranges 0.5 nm and above for RM(T).

When using either TM or RM (T) modes, with either North-Up or Course-Up Stabilisation selected, Sea and Ground Stabilisation is available.

Heading and Speed inputs from compass and a water locked log (or manually set speed) provide a sea-stabilised presentation.

Course Made Good (CMG) and Speed Made Good (SMG) inputs, obtained by echo referencing (locking to an echo fixed with respect to the ground), or by using an input from a navigation sensor, provide a ground stabilised presentation.

Ground stabilisation is also available with dual-axis serial logs.

5.7.3 True Motion (TM) – Sea Stabilised

Ownship moves across the radar picture according to the input of heading (derived from the compass) and speed through the water (derived from the log or manually estimated).

Echoes from land and all other stationary targets are presented as objects, which are steady except for the movement due to tide or current experienced by ownship.

Moving targets generate Trails, representing their True heading and speed, but modified by the tide or current effects referred to above.

5.7.4 True Motion (TM) – Ground Stabilised

Ownship moves across the radar picture according to the inputs derived either from tracking a fixed echo (echo reference) or from a navigation sensor.

Echoes from land and all other stationary targets are presented as fixed objects i.e., without trails.

Moving targets generate True Trails, representing their Course Made Good and Speed Made Good.

A disadvantage of the TM presentation mode is that the radar display range ahead of ownship decreases as ownship moves across the display. The display has to be reset, automatically either when ownship reaches two thirds of display radius, or manually as required.

With TM selected, target trails may be selected or not as required. With Sea Stabilisation, Trails attached to fixed targets give a direct indication of tide or current set and rate experienced by ownship. Leeway effects, if significant, will modify the trails on stationary targets.

5.7.5 Relative Motion (True Trails) – RM(T) – Sea Stabilised

In this mode, ownship is maintained at a selected point on the radar screen, and True Trails of targets are built-up in memory. As with the True Motion presentation, all trails are modified from True by the effect of tidal set and drift experienced by ownship.

The advantage of RM (T) is that a constant range ahead of ownship is maintained and it is not necessary to reset the display as in TM.

5.7.6 Relative Motion (True Trails) – RM(T) – Ground Stabilised

Just as for the Sea Stabilised presentation, the position of ownship remains at a pre-selected position on the screen. With inputs derived either from tracking a fixed echo (echo reference) or from a navigation sensor, echoes from stationary targets move on the screen relative to ownship, but do not generate trails.

All moving targets, such as ships underway, generate True Trails representing their Course Made Good and Speed Made Good.

Note – The Echo Reference facility is only available when Autotrack is installed.

5.8 Range and Bearing Measurement

Parameter	Detail
Fixed Range Ring accuracy	1% of maximum of scale in use, or 25m, whichever is the greater.
Fixed Bearing Scale	Electronically generated scale markers at 1°, 5° and 10° with bearing annotation every 10°.

When the VRM and EBL or ERBL are centred on dual channel radar, all ranges and bearings are relative to the turning unit on channel 1.

5.8.1 Variable Range Marker (VRM)

Two independent VRMs are variable up to 480nm (limited to 5 times the range scale selected) with numeric readout on display. Accuracy is better than 1% of scale in use or 25m whichever is the greater.

VRM 1 is a 3:1 mark/space dashed circle and VRM 2 is an even mark/space dashed circle. VRM 2, in conjunction with EBL 2, can be centred, dropped or carried. VRM 1 is always centred. The range of the VRMs is limited to five times the range scale in current use.

When a change of range scale causes the limit to be exceeded, the VRM range remains unchanged until he VRM is altered. When it is altered, it immediately jumps to one and two thirds times the screen radius. These restrictions also apply in ERBL mode.

5.8.2 Electronic Bearing Line (EBL)

There are two EBLs variable from zero to 359.9°, in 0.1° increments, with numeric readout on display.

EBL 1 is a 3:1 mark/space dashed line and EBL 2 is an even mark/space dashed line. EBL 2, in conjunction with VRM 2, can be centred, shifted, dropped or carried relative to own ship. EBL 1 is always centred.

The EBL data display shows TRUE for a stabilised picture and REL for an unstabilised picture. Switching from an unstabilised picture to a stabilised picture or the opposite causes the EBLs to switch OFF and revert to the default values.

5.8.3 Electronic Range and Bearing Line (ERBL)

When VRM 1 is OFF, the VRM function is merged with EBL 1 to form ERBL 1. There is a small circle on ERBL 1 to indicate the range setting of VRM 1, set by the VRM/DATA control. ERBL 2 is related to VRM 2 in the same way.

If EBL 2 is off-centred, then VRM 2 will also be off-centred. The VRM 2 data display is shown when ERBL 2 is displayed, to indicate the position of the small ERBL circle.

5.9 Cursor Position Display

The position of the cursor, controlled by the joystick or trackball, is used to provide the positional coordinates of targets located within the radar circle. The cursor position is displayed as either Range or Bearing relative to ownship or in Latitude and Longitude. Alternatively, the Range/Bearing and Lat/Long readouts may be shown simultaneously. The cursor position, when in the video circle, can be configured as a serial output message.

5.10 Heading/Stern Marker Line

This can be displayed as heading or stern marker via the initialisation menu option. There is a momentary OFF facility that removes all synthetic data from within the video circle, including the heading or stern marker, leaving only radar video and trails. It is referenced to the selected turning unit (channel 1 in dual channel radar systems).

Note – In static site mode the softkey action is to display heading line only.

5.11 Trails

Long, Short and Permanent trails, and trails OFF are selectable. The long and short trail lengths are shown on the display, and are dependent on the selected range as follows:

Range Scale nm	Range Scale km	Short Time	Long Time
0.125	0.25	10 s	30 s
0.25	0.5	10 s	30 s
0.5	1	15 s	45 s
0.75	1.5	15 s	45 s
1.5	3	30 s	90 s
3	6	30 s	90 s
6 and above	12 and above	1 min	3 min

Permanent trails are timed for up to 100 minutes, and can be displayed until manually reset.

5.12 Guard Zones (EPA)

Two annular guard zones can be defined. Guard zones are shown on 3, 6 and 12nm range scales (6, 12 and 24km scales) only and up to 60 infringements in total can be detected. When an infringement is observed a GZ Entry alarm is raised and the guard zone infringement symbol (∆) is drawn at the azimuth of the infringement. The default guard zone definitions are given in the table below:

Parameter		Guard Zone 1	Guard Zone 2
Subtended Angle		180°	180°
Start Bearing(with respect to ship's heading)		270°	270°
Start Range	nm	4	8
	km	8	16
Depth	nm	0.4	0.4
	km	0.8	0.8

The table below indicates the range of values that can be set:

Parameter	Detail
Start and End Angle	No restriction
Subtended Angle	6° to 354° and 360°
Start Range	1nm to 10nm to a resolution of 0.1nm. 2km to 20km to a resolution of 0.2km.
End Range	As defined by the start range and range depth.
Range Depth	Fixed at 0.4nm (0.8km)

5.13 Auto-acquisition Zones (ATA/ARPA)

Two annular and two polygonal auto-acquisition zones are available. They are referenced to the turning units and maintain their orientation with ship's head. In dual channel radars, an auto-acquisition zone consists of two identically shaped zones each referenced to its own turning unit position and each acting independently.

5.13.1 Annular Auto-acquisition Zones

The default annular auto-acquisition zones will be two sections of an annulus, as described in the table below. Note that the ranges and depths are the same, irrespective of whether a metric, nm, or sm display has been selected.

Parameter	Detail
Auto-Acquisition Zone 1	
Subtended Angle	180°
Start Bearing	270° w.r.t. ship's head
Start Range	4nm
Depth	0.8nm
Auto-Acquisition Zone 2	
Subtended Angle	180°
Start Bearing	270° w.r.t. ship's head
Start Range	12nm
Depth	1.6nm

w.r.t = with respect to

The auto-acquisition zones can be redefined as needed within the limits defined in the table below. The range, depth and subtended angle may be altered.

The zones will always be shaped as a complete annulus or a section of one. They will be defined in a clockwise direction, i.e. the arcs will extend clockwise from the start position. If an attempt is made to define an auto-acquisition zone with a subtended angle greater than 354°, the result will be a 360° auto-acquisition zone.

Parameter	Detail
Start and End Angle	No restriction
Subtended Angle	6° to 354° and 360°
Min Start Bearing	1nm
Max End Range	40nm
Range Depth	0.4 to 2nm

5.13.2 Polygonal Auto-acquisition Zones

Two polygonal auto-acquisition zones are available, each bounded by a polygon of between 3 and 10 sides.

5.14 Sector Blanking

Parameter	Detail
Sectors	Two bearing sectors of antenna scan can be set on installation. These sectors inhibit radar transmission over an angular width of up to 180°, with a combined maximum blanking of 340°. Sectors are indicated on the outside of the bearing circle on the display.

5.15 Off-centre Display

Parameter	Detail
Picture Offset	Up to two thirds of the radius of the radar picture in any direction. Not available on 96 n.mile (192km) range.

5.16 Max View Ahead

A facility enabling the operator to off-centre ownship on the reciprocal course is provided on all range scales except 96nm (192km). On action, ownship is re-positioned at two-thirds radius with the ship's course line passing through the centre of the display. The course line will be the Heading for Sea Stabilised presentations, or Course Made Good for Ground Stabilisation.

5.17 Marks

Twenty cross-shaped markers are available in Relative and True Motion modes. Markers can be dropped or carried relative to ownship, by menu selection.

5.18 Index Lines

A group of five (four on EPA (L)) parallel index lines can be displayed simultaneously, using the menu, on range scales of 0.25 nm (0.5km) and above. The index lines are available in all presentation and motion modes. During positioning of each index line, the display shows the angle of the line and its perpendicular offset (range) to ownship's position. Groups of index lines are stored on the memory card, except for the EPA (L) where only one group is available and that is stored internally.

5.19 Rotating Parallel Cursor

A facility to display a HALF circle or FULL circle rotating parallel cursor is provided via the TOOLS menu. The cursor consists of a single diameter white line plus a number of equally spaced lines perpendicular to the single line. The spacing of the perpendicular lines corresponds to the range ring spacing on all ranges except the 0.75nm (1.5km) range where spacing is at half ring intervals. The rotating cursor is always centred on own ship.

5.20 Constant Radius Turn

A facility to plan and display a change of heading via a constant radius turn is provided for all range scales, all motion modes and all stabilised presentation modes. The facility is accessed via the TOOLS menu, providing that the radar is in the transmit mode. The menu prompts the operator for a start point, new course, and radius of turn. Once set, the proposed turn is displayed in red and may be toggled ON and OFF via the tools menu.

5.21 Own Ship's Profile

From the tools menu, the operator can select own ship's profile (a simple outline of the ship in plan view) to be displayed at own ship's position in the video circle. The profile is only shown on the lower range scales. The shape of the profile, and the maximum range scale at which it is displayed is determined from information entered during system initialisation (i.e., Ship's length and beam, and Turning Unit offset from own ship's centre).

5.22 Serial Interfacing

Two IEC61162-1 (NMEA 0183) serial inputs with optical isolation to 1000V are provided as standard. These can be used for a variety of different serial inputs such as from navigation sensors, logs and compasses. It should be noted that due to a baud rate limit of 4800 on these inputs, a serial compass would only be appropriate for the EPA variant. An additional three serial inputs to IEC61162-2 are available on a dual channel radar or when an optional Interface Unit 65847A is fitted, allowing baud rates of 4800 and 38K4 baud (38400 baud).

The following table shows the message types that can be interpreted from devices generating serial outputs.

Device	Message Types
Serial Compass	One of: HDT, HDM, HDG
Serial Log	One of: VBW, VHW
Depth Sensor	One of: DPT, DBT
Wind Sensor	One of: MWV, VWT, VWR
Nav Sensor	One of: GGA, GLL, GLL&SNU, GLL&SLL (Position Input)
	One of: ZDA, ZZU, GLL (Time Input)
	One of: R*nn*&WPL, RTE&WPL, BWC&BWR (Route Input)
	VTG only (Speed Input)
	VMSG (Proprietary VMS graphics message)
	VBW for LOG input (via NAV sensor rather than direct)
Target Rename	TLB (Used with Track Table Output)
Alarm Acknowledgement	ACK (Used with Alarm Status Output)
AIS Input	VDM, VDO and ALR
Route & Waypoint Transfer	RTE&WPL

All serial inputs can be connected for RS232, RS422 or current loop compatibility. Full details of the serial input specification are given in the Serial Input specification 65800/SIS/001.

Two serial outputs are provided as standard in addition to the dedicated Track Table Output (see Section 5.28). A further three outputs are available on the dual channel radar or if the Interface Unit is fitted.

All outputs are software configurable as RS232 or RS422. Serial output 5 is also configurable for RS485. There are only two serial outputs devices, the alarm status output (ALR messages) that is associated with the Alarm Acknowledgement Input, and the AIS output (ACK messages) that is associated with the AIS Input.

Note – The AIS Input/Output can only be fitted on Serial I/O Ports 3, 4 or 5.

5.23 Alarm/Watch Alarm

An internal audible alarm will beep for each new alarm. The alarm is also used for the Watch Alarm that can be programmed with time of 3, 6, 9 or 12 minutes. Both of these functions can be independently enabled and disabled. A dual-channel radar or the optional Interface Unit 65847A enable an external audible alarm to be driven, mimicking the internal one.

5.24 Interface Expansion for standard Radars (not for EPA(L))

An Interface Unit 65847A is available for single channel radars, giving the following additional interfacing capability:

- Three serial inputs and outputs, necessary for AIS input (see Section 5.22)
- External audible alarm drive (see Section 5.23)
- External Start O/P (N/O and N/C relay contacts*)
- Remote Alarms O/P (N/O and N/C relay contacts*)
- Vigilance Alarm O/P (N/O and N/C relay contacts*) – refer to Chapter 4 Section 3.2.12 for additional information

**All O/P relay contacts are rated at 1A 30V DC or 1A 250V AC RMS.*

5.25 Manual Target Plotting (EPA)

Parameter	Detail
Availability	Electronic plotting system on ranges 0.5nm to 48nm (1km to 96km), in RM(R), RM(T) and TM modes.
Number of Targets	10
Vectors	True or Relative. Vector time adjustable from 1 to 60 minutes. True Vectors only available when compass connected.

Plotted points are scaled with range changes and rotated with changes in orientation (stabilised modes only). Closest Point of Approach (CPA), Time to Closest Point of Approach (TCPA), Range, Bearing, Speed of plotted target(s) and Bow Crossing Time are given by alphanumeric readout on display.

5.26 Tracking & AIS (ATA/ARPA)

Targets can be acquired manually, automatically, or received from an AIS system up to a total of 80 targets. The maximum number of AIS targets is 40, and the maximum number of tracked targets is 60 if AIS is not being used. The total number of targets that can be manually acquired is also reduced by the number of targets that have already been automatically acquired.

By using the Auto Acquisition Zones of the BridgeMaster E, targets can be acquired automatically on entry to an acquisition zone.

Parameter	Detail
Targets	60 (Maximum) or 40 Tracked and 40 AIS
Manual Acquisition Range	0.25 to 40 nm.
Tracking Range	0.25 to 40 nm.
Information Displayed	0.5 to 96 nm (1km to 192km) range scales.
Tracking Performance	Continuous for acquired targets, for 5 out of 10 consecutive scans.
Relative Velocity	150kt maximum.
Vector Presentation	Full accuracy within 3 minutes, trend within 1 min.
Vector Length	1 to 60 minutes in 0.1-minute increments.
CPA Alarm Settings	0.1 to 20 nm in 0.1 nm increments.
TCPA Alarm Settings	1 to 99 minutes in 1-minute increments.
Auto-acquisition Zones	2 available.

CPA, TCPA, Range, Bearing, Bow Crossing, Speed and Course of all targets are given by alphanumeric readout on display. All distances and times displayed are relative to the Turning Unit's physical location (channel 1 on a dual channel radar).

Any display required to meet IEC60872-1 or IEC60872-2 specifications must be supplied with compass information in analogue form, or in serial form conforming to IEC61162-2.

If a serial compass is used for tracking, then the message rate should be 50Hz.

5.27 Multi-Target Tote (ATA/ARPA)

Three alternative display options to the single target data are provided showing limited information for up to six selected targets. The multiple target information comprises the target ID (Identification Number), TCPA, and CPA. Groups of targets can be automatically selected by CPA or range, or can be manually selected by the user.

5.28 Track Table Outputs (ATA/ARPA)

A dedicated Track Table Output is compliant to IEC 61162-1. Output formats RS232 or RS422, are selectable via the I/O Options Menu. A guide to the NMEA message content is given below:

Own ship's information, output every two seconds:

- Ship's heading and status
- Vessel's course and speed
- Reference for course and speed (e.g. manual or log)
- Speed units
- Manually entered set and drift

Radar system information, output every two seconds:

- Origin 1 range/bearing
- VRM 1 range
- EBL 1 bearing
- Origin 2 range/bearing
- VRM 2 range
- EBL 2 bearing
- Cursor range/bearing
- Range scale
- Range units
- Display presentation

Target information, output varies according to number of tracked targets, maximum of 10 being output every 2 seconds:

- Target number
- Target range from own ship
- Target bearing from own ship, TRUE
- Target speed
- Target course, TRUE
- CPA Distance
- Time to CPA (TCPA)
- Speed/distance units
- Target name
- Target status
- Echo reference target
- Acquisition calculation time in UTC.
- Acquisition type

Interface Specification 65800/SIS/003 shows full details of the output format.

5.29 Past Positions (ARPA)

This facility is only available on an ARPA. It is possible to display up to four past position dots indicating the past positions of all tracked targets, depending on how long the target has been tracked.

Parameter	Detail
Dot time intervals	15 sec
	30 sec
	1 min
	2 min
	4 min
	8 min
	16 min

The position of the dots will match the trails, i.e. they will be true position dots when the trails are true, and relative dots when the trails are relative. Past position dots are available in all presentation and motion modes on systems with a working compass. When the dots are selected, the time interval between dots will be displayed as a permanent prompt.

The selected interval will not alter when the range is changed. The selected time interval is stored in non-volatile memory; the default is 1 minute. The past position data will start to build up as soon as tracking of the target commences. It will only be cleared when the target is cancelled. The operator may switch the display of the dots off and on.

5.30 Trial Manoeuvres (ARPA)

Parameter	Detail
Trial Course	0 to 359.9, in 0.1° increments.
Trial Speed	0 to 75kts.
Trial Delay	1 to 30 minutes, in 0.1 minute increments.
Rate of Turn	1°/min to maximum set rate of turn in initialisation
Alarm (MVR) time	30 seconds before manoeuvre starts.

5.31 Degauss

Degauss occurs automatically after switch ON, and manually on selection via System Menu. This function is only required for colour CRT monitors.

5.32 Nav Lines Interface

A proprietary non-NMEA interface is selectable allowing radar maps to be transferred from VMS systems.

6 Radar Control Panels

With the exception of the ON/OFF switch, all the controls required for operating the radar are located on one (or two) Radar control Panel(s) mounted at the bottom edge of the display monitor. A simple control panel containing a joystick or trackerball and associated left/right keys is always fitted. This panel may also contain a memory card unit.

The controls offered by the **Simple Control Panel** are as follows:

Joystick/Trackerball	Used to move the screen cursor within the radar picture, and to position the arrowed cursor over menu items. It is also used to control primary operational functions of the radar, such as clutter and gain.
Left/Right Push Button Keys	These keys are positioned at the right hand side of the panel close to the joystick/trackerball. The left key is used to select (turn ON or OFF) the option over which the screen cursor is placed. The right key is used where appropriate to reveal an options menu for the selected facility, or to cancel a selection.
Duplicate Left Key:	This key is available when a memory card unit is fitted at the left hand side of the panel. Its operation is identical to that of the left key described above. However, its location allows for two-handed operation.

The second, **Dedicated Control Panel** (optional), offers the following controls:

Rotary Analogue Controls	Used to control primary operational functions of the radar: • Gain • Anti-clutter Rain • Anti-clutter Sea • EBL 1 • VRM 1 • Panel Brightness
Push Button Keys	Used to select the secondary functions of the radar: • Range Up • Range Down • Centre • TM/RM • True/Relative Vectors • Acknowledge

7 Radar Maps

The main features of Radar Maps are:

- Construction, display and maintenance of multi-source topographic maps.
- Guard Lines.

The facilities of Radar Maps are available in all stabilised modes of operation. All references for Radar Maps are in latitude and longitude, and therefore maps can only be used when ownship's position is available. Ownship's positions can be obtained from a Navigation Sensor or by using an EP.

Notes –

1. The integrity of Radar Maps is entirely dependent on there being a reliable, steady source for ownship's lat/long at all time.
2. To ensure the integrity of data stored on memory cards, refer to Chapter 7 'Routine Maintenance' for details of memory card battery maintenance.

Parameter	Detail
Availability	Ranges 0.5 to 96 nm (1 to 192km). Stabilised modes only. Ownship lat/long required (Nav, EP/DR). Latitude must be between 78°N and 78°S.

7.1 Maps

Parameter	Detail
Availability	A single map or folio of maps at any time, in all stabilised modes.
Selection	By name, from a menu list.
Alignment	If required, applied to all map elements.
Elements Displayed	500 closest displayable elements (maximum).
Elements per Map	Any number; recommended maximum 800.
Editing	By lat/long via control panel. By cursor via joystick.
Storage	By name, to a file on one of the two Memory Cards.

7.2 Guard Lines

Parameter	Detail
Number of Lines	20 maximum.

7.3 History Tracks

Parameter	Detail
Number of Tracks	Ownship and up to 6 tracked targets.
Availability	Stabilised Presentations only.
Operational Modes	Record and/or display.
Time Stamp Interval	1, 3, 6, 12, 30 and 60 minutes.
Storage	By time stamp, to file on one or two Memory Cards.
Replay	Standby or Transmit mode.
Event Marking	On demand for all history tracks.

7.4 Position Input

Parameter	Detail
Ownship's Lat/Long derived from	Navigation sensor, estimated position or dead reckoning.

8 Power Requirements

8.1 Power Requirements and Unit Characteristics (AC)

The prime power source must have a voltage between 92 and 276V RMS at a frequency between 47 and 64Hz.

For high voltage multiphase supplies, a step-down transformer is available.

Unit	Maximum Input Power	
Display Units (Including Monitor and Processor Unit)		
180/250/340 Display Unit (CRT)	240 VA	
250/340 Dual Channel Display Unit (CRT)	260 VA	
180 Display Unit (FPD)	130 VA	
250 Display Unit (FPD)	140 VA	
250 Dual Channel Display Unit (FPD)	160 VA	
FPD Monitor (All sizes with no Processor)	100 VA	
Processor Unit (No Monitor)	100 VA	
Dual Channel Processor Unit (No Monitor)	120 VA	
X-band Scanner Motor and Transceiver		
Standard Speed Unit	250 VA	
High Speed Unit	370 VA	
S-band Transceiver Unit	120 VA	
S-band Scanner Motor Unit	1 Phase	3 Phase
Standard Speed Unit (Per phase)	750 VA	500 VA
High Speed Unit (Per phase)	750 VA	600 VA

Parameter	All Units except S-band Scanner Motor Unit
Power Factor Correction	Better than 0.9
Transient protection	Over-voltage transient of up to 40% above nominal input voltage with maximum duration of one second. Pulse transient of up to ± 1200V peak, with a rise time of 2 to 10μs and duration up to 20μs.
Protection facilities	Output short circuit. High and low input voltage. Output over-voltage. Slow start.

8.2 Power Requirements and Unit Characteristics (DC)

The prime power source must have a voltage between 22 and 32V DC.

Unit	Maximum Input Power
180/250/340 Display Unit (CRT)	240W
180 Display Unit (FPD)	130W
250 Display Unit (FPD)	140W
Processor Unit (No Monitor)	100W
FPD Monitor (No Processor)	100W
X-band Scanner Motor and Transceiver	250W

Parameter	Detail
Transient protection	Symmetrical (line-line) 5000V of duration 10μs (100μs rise/fall time). Line to ground 500V of duration 60μs (1μs rise/fall time)
Protection facilities	Output short circuit. High and low input voltage. Slow start.

9 Mechanical Specification

9.1 Weights and Dimensions

Component	Height (mm)	Depth (mm)	Width (mm)	Weight (kg)
180 Display Unit (CRT)	439	598(694)†	403	28(29)†
180 Display Unit (FPD)	459	598(694)†	403	21(22)†
250 Display Unit (CRT)	547	632(726)†	538	49(51)†
250 Display Unit (CRT) + pedestal	1283	635(731)†	538	87(88)†
250 Display Unit (FPD)	535	598(694)†	458	25(26)†
250 Display Unit (FPD) + pedestal	TBA	TBA ()†	TBA	TBA ()†
250 Dual Channel Display Unit (CRT)	617	632(726)†	538	60(62)†
250 Dual Channel Display Unit (CRT) + pedestal	1283	635(731)†	538	86(87)†
250 Dual Channel Display Unit (FPD)	TBA	TBA ()†	TBA	TBA ()†
250 Dual Channel Display Unit (FPD) + pedestal	TBA	TBA ()†	TBA	TBA ()†
340 Display Unit (FPD) Desktop	610	632(727)†	640	53(54)†
340 Display Unit (FPD) Desktop + pedestal	1346	635(731)†	640	90(91)†
340 Dual Channel Display Unit (FPD) Desktop	TBA	TBA ()†	TBA	TBA ()†
340 Dual Channel Display Unit (FPD) Desktop + pedestal	TBA	TBA ()†	TBA	TBA ()†
340 Display Unit (CRT) Deck Mounted	1300	993	680	131
340 Display Unit (FPD) Deck Mounted	1300	993	680	105
340 Dual Channel Display Unit (FPD) Deck Mounted	1300	993	680	111
180 Monitor Module (CRT)	320	499	425	18.4
180 Monitor Module (FPD)	392.5	93	412	5
250 Monitor Module (CRT)	420	553	576	35.5
250 Monitor Module (18" FPD)	447	98	486	7
250 Monitor Module (19" FPD)	444	96	483	12
250 Monitor Module (20" FPD)	481	108	534	10.5
340 Monitor Module (CRT)	497	481	729	55
340 Monitor Module (FPD)	534	100	584	17
Processor Electronics Unit	120	454	387	12
Dual Channel Processor Electronics Unit	185	563	437	18
X-band Scanner Unit with 1.2m Antenna	440	586	1305*	49 42‡
X-band Scanner Unit with 1.8m Antenna	440	586	1914*	52 44‡
X-band Scanner Unit with 2.4m Antenna	440	586	2550*	55 47‡
X-band Bulkhead Transceiver (658xxA, B, P, T, W)	607	327	370	23
X-band Bulkhead Transceiver (658xxE, F, G, H, L)	607	330	370	19
S-band Scanner Unit + 2.7m Antenna + integral Transceiver	800	718	2800*	163.5
S-band Scanner Unit + 2.7m Antenna. No integral Transceiver	800	675	2800*	150.5
S-band Scanner Unit + 3.7m Antenna + integral Transceiver	800	718	3700*	176.5
S-band Scanner Unit + 3.7m Antenna. No integral Transceiver	800	675	3700*	163.5
S-band Bulkhead Transceiver Unit	515	318	402	25

* Antenna Turning Circle

† Depths and weights in brackets include keyboard

‡ Excluding Transceiver

Refer to individual installation drawings in Chapter 3 for dimensions and weights of smaller components, such as Control Panel Modules.

9.2 Display Mounting Options

The radar display components are supplied either as integrated unit (desk or deck mounting), or as a kit for fitting into customer specified console. See Chapter 3 for installation details.

10 Compass Safe Distance

Component	Standard	Steering
180 Display Unit (CRT)	1.4 m	0.8 m
180 Display Unit (FPD)	0.9 m	0.9 m
250 Display Unit (CRT)	1.8 m	1.1 m
250 Display Unit (CRT) + pedestal	2.0 m	1.1 m
250 Display Unit (FPD)	0.9 m	0.9 m
250 Display Unit (FPD) + pedestal	TBA	TBA
250 Dual Channel Display Unit (CRT)	2.0 m	1.3 m
250 Dual Channel Display Unit (CRT) + pedestal	2.2 m	1.3 m
250 Dual Channel Display Unit (FPD)	TBA	TBA
250 Dual Channel Display Unit (FPD) + pedestal	TBA	TBA
340 Display Unit (CRT) Deck Mounted	2.7 m	1.6 m
340 Display Unit (FPD) Deck Mounted	2.7 m	2.6 m
340 Display Unit (FPD) Desktop	2.6 m	2.6 m
340 Display Unit (FPD) Desktop + pedestal	2.2 m	1.2 m
340 Dual Channel Display Unit (FPD) Desktop	TBA	TBA
340 Dual Channel Display Unit (FPD) Desktop + pedestal	TBA	TBA
180 Monitor Module (CRT)	1.6 m	0.9 m
180 Monitor Module (FPD)	0.8 m	0.8 m
250 Monitor Module (CRT)	1.7 m	1.0 m
250 Monitor Module (18” FPD)	0.8 m	0.8 m
250 Monitor Module (19” FPD)	1.8 m	1.8 m
250 Monitor Module (20” FPD)	2.0 m	2.0 m
340 Monitor Module (CRT)	2.0 m	1.1 m
340 Monitor Module (FPD)	2.6 m	2.6 m
Processor Electronics Unit	2.0 m	1.0 m
Dual Channel Processor Electronics Unit	2.1 m	1.1 m
Brilliance Module	0.3 m	0.3 m
Memory Card Module	0.8 m	0.3 m
On-Off Switch Module	0.5 m	0.3 m
Joystick Module	0.9 m	0.4 m
Trackerball Module	0.8 m	0.3 m
Keyboard Module	0.5 m	0.3 m
X-band Scanner Unit 10kW	1.4 m	0.8 m
X-band Scanner Unit 25kW	3.3 m	2.0 m
X-band Scanner Unit (without Transceiver)	0.4 m	0.3 m
X-band Bulkhead Transceiver 10kW	1.3 m	0.7 m
X-band Bulkhead Transceiver 25kW	3.3 m	2.0 m
S-band Scanner Unit 30kW	TBA	TBA
S-band Scanner Unit (without Transceiver)	TBA	TBA
S-band Bulkhead Transceiver 30kW	4.3 m	2.6 m
S-band Scanner Control Unit	0.8 m	0.4 m
Interface Unit	0.3 m	0.3 m

11 International Specifications

Meets the requirements of the following International Standards for maritime navigation equipment:

Number	Version	Title
IEC 60872-1	1998	Maritime Navigation and Radiocommunication Equipment and Systems - Radar Plotting Aids - Automatic Radar Plotting Aids (ARPA) - Methods of Testing and Required Test Results
IEC 60872-2	1999	Maritime Navigation and Radiocommunication Equipment and Systems - Radar Plotting Aids - Part 2: Automatic Tracking Aids (ATA) - Methods of Testing and Required Test Results
IEC 60872-3	2000	Maritime Navigation and Radiocommunication Equipment and Systems - Radar Plotting Aids - Part 3: Electronic Plotting Aid (EPA) - Performance Requirements - Methods of Testing and Required Test Results
IEC 60936-1	2002	Maritime Navigation and Radiocommunication Equipment and Systems - Radar - Part 1: Shipborne Radar - Performance Requirements - Methods of Testing and Required Test Results
IEC 60936-2	1998	Maritime Navigation and Radiocommunication Equipment and Systems - Shipborne Radar For High-Speed Craft (HSC) - Methods of Testing and Required Test Results
IEC 60945	2002	Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results
IEC 61162-1	2000	Maritime Navigation and Radiocommunication Equipment and Systems - Digital Interfaces - Part 1: Single Talker and Multiple Listeners
IEC 61162-2	1998	Maritime Navigation and Radiocommunication Equipment and Systems - Digital Interfaces - Part 2: Single Talker and Multiple Listeners, High-Speed Transmission

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CHAPTER 2

SYSTEM CONFIGURATION

Contents

Figures

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1 Introduction

The alphanumeric System Number allocated to the BridgeMaster E Series of Radars details the various units of the particular system to which the number refers. Each System Number consists of up to seven identifying labels, which are listed below. The description below covers all variants except dual channel radars, some of which are not commercially available.

The various labels (from 1 to 7) of Figure 2.1, shown below, are explained in more detail in Section 2 – System Identification Labels, which follows.

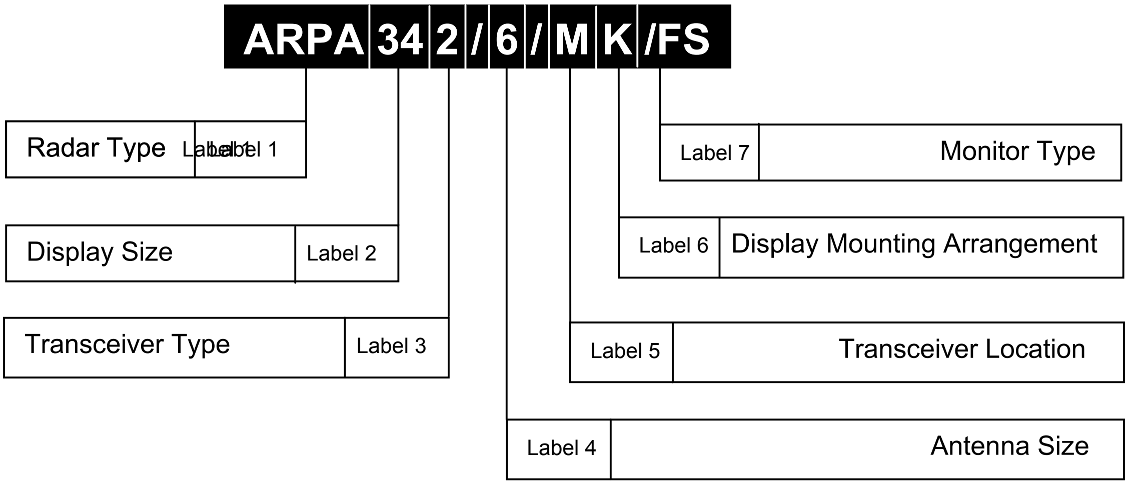


Figure 2.1 BridgeMaster E Series Part Numbers

2 System Identification Labels

Label 1 **Radar Size**

Label	Radar Type
EPA or EPA(L)	Electronic Plotting Aid
ATA	Automatic Tracking Aid
ARPA	Automatic Radar Plotting Aid

Label 2 **Display Type**

Label	Display Size
18	180mm Display PPI
25	250mm Display PPI
34	340mm Display PPI

Label 3 **Transceiver Type**

Label	Transceiver Type
0	10kW X-band DC*
1	10kW X-band AC
2	25kW X-band AC
3	30kW S-band AC

* The 10kW X-Band DC Transceiver is only for masthead installation where the transceiver is mounted as an integral part of the Scanner Unit. The other variants can be used in bulkhead or masthead systems.

Label 4 **Antenna Type**

Label	Antenna Size
4	4ft (X-band)
6	6ft (X-band)
8	8ft (X-band)
9	9ft (S-band)
12	12ft (S-band)

Label 5 **Transceiver Location**

Label	Transceiver Location
M	Masthead Transceiver
B	Bulkhead Transceiver

Label 6 **Display Mounting Arrangement**

Label	Display Mounting Arrangement
K	Kit format for mounting in console
Blank	Standard Configuration (Deck standing 340, Desktop 180/250)

Label 7 **Monitor Type**

Label	Monitor Type
FS	Flat Panel Display
Blank	CRT Monitor

3 Unit Type Numbers

A BridgeMaster E Radar System is configured from among the following unit types:

- Monitor Unit
- Processor Electronics Unit
- Antenna Unit
- Turning Unit (with or without Integral Transceiver)
- Bulkhead Transceiver Unit
- Scanner Control Unit (S-Band)
- Interswitch Unit
- Interface Unit

3.1 Monitor Unit

The Monitor Unit type number consists of a five-figure number (e.g. 65826) followed by a single letter suffix (e.g. L). A typical complete Monitor Unit Type Number may therefore be: 65826L. A further breakdown of the number is as follows.

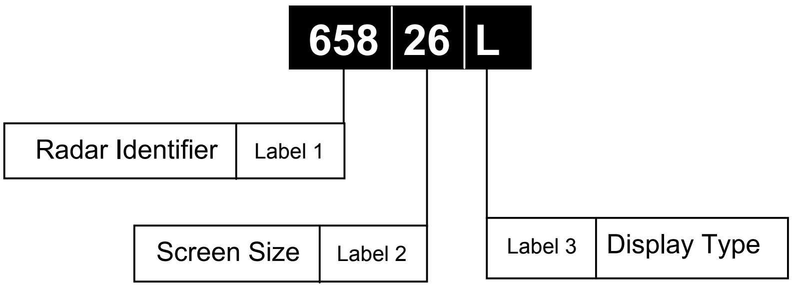


Figure 2.2 Monitor Unit label

Label 1 **BridgeMaster E Identifier**

Fixed as **658**

Label 2 **Screen Size**

Label	Diagonal
14	14" (180 CRT)
15	15.1" or 15.4" (180 FPD)
17	18.1" or 19.0" (250 FPD)
19	20.1" (250 FPD)
21	21" (250 CRT)
23	23.1" (340 FPD)
26	29" (340 CRT)

Label 3 **Monitor Type**

Label	Monitor Series	Mounting*	Resolution	Buffered Video O/P	Mains Input†
A	180/250/340 FPD	Kit	High	Yes	AC
B	340 FPD	Desk	High	Yes	AC
C	180/250 FPD	Desk	High	Yes	P
D	180/250 FPD	Kit	High	Yes	DC
E	340 FPD	Deck	High	Yes	AC
F	180/250 CRT	Desk	High	No	P
G	250 FPD	Kit	High	Yes	AC
H	250 FPD	Kit	High	Yes	DC
K	250 CRT	Desk	Medium	No	P
L	340 CRT	Deck	Medium	No	P
N	180/250 CRT	Kit	High	No	P
P	250/340 CRT	Kit	Medium	No	P
R	180/250 CRT	Desk	High	Yes	P
V	250 CRT	Desk	Medium	Yes	P
W	340 CRT	Deck	Medium	Yes	P
Y	180/250 CRT	Kit	High	Yes	P
Z	250/340 CRT	Kit	Medium	Yes	P
DF	250 Dual CRT	Desk	High	No	P
DR	250 Dual CRT	Desk	High	Yes	P

***Deck** means inclusion in a pedestal mounted display unit.
Kit means a screened monitor module for fitting into a customer specified console.
Desk means inclusion in a desk mounted display unit.

†**P** The Processor Electronics Unit supplies the Monitor power.

Note – There is an independent On/Off switch for AC and DC monitors.

3.2 Processor Electronics Unit

The type numbers are as follows:

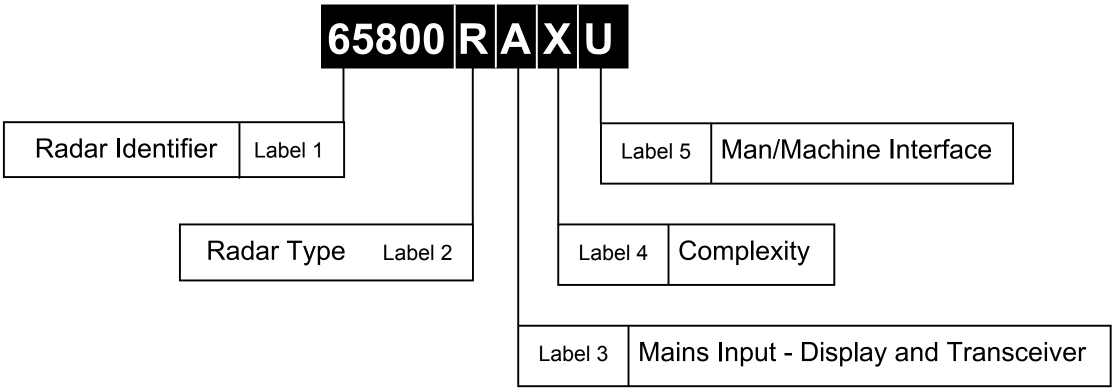


Figure 2.3 Processor Electronics Unit label

Label 1 **BridgeMaster E Identifier**

Label	Radar Identifier
65800	Standard BridgeMaster E Processor
65818	Dual Channel BridgeMaster E Processor

Label 2 **Radar Type**

Label	Radar Type
P	Electronic Plotting Aid
T	Automatic Tracking Aid
R	Automatic Radar Plotting Aid
Y	ATA with AIS capability
Z	ARPA with AIS capability

Label 3 **Mains Input** for the Display and Monitor

Label	Mains Input
A	110/240V AC, 50/60Hz Single Phase
D	24-32V DC

Label 4 **Complexity**

Label	No of Cards*	RVAP	Compass Type
M	1	No	Special
N	1	No	Standard
R	2	No	Standard
S	3	No	Standard
T	2	Yes	Standard
V	2	No	Special
W	3	No	Special
X	2	Yes	Special

* The number of cards relates to the number of Processor Cards in the Processor Electronics Unit. Two card systems consist of a Display Processor card and a Radar Processor card. Three card systems consist of a Display Processor and two Radar Processor cards (Dual).

Label 5 **Human Machine Interface**

Label	Pointer Type	Keyboard	Mounting/Fit*	Memory Card†
A	Joystick	No	Desk	No
B	Trackerball	No	Desk	No
C	Joystick	Yes	Desk	No
D	Trackerball	Yes	Desk	No
E	Joystick	No	Kit	Yes
F	Trackerball	No	Kit	Yes
G	Joystick	Yes	Kit	Yes
H	Trackerball	Yes	Kit	Yes
J	Joystick	No	Desk	Yes
K	Joystick	Yes	Desk	Yes
L	Trackerball	Yes	Desk	Yes
M	Joystick	No	Deck	Yes
N	Trackerball	No	Deck	Yes
O	Joystick	Yes	Deck	Yes
P	Trackerball	Yes	Deck	Yes
R	Trackerball	No	Desk	Yes
S‡	Joystick	No	Deck	Yes
T‡	Trackerball	No	Deck	Yes
U‡	Joystick	No	Kit	Yes
V‡	Trackerball	No	Kit	Yes
W‡	Joystick	Yes	Kit	Yes
X‡	Trackerball	Yes	Kit	Yes
Y‡	Joystick	Yes	Deck	Yes
Z‡	Trackerball	Yes	Deck	Yes

***Deck** means inclusion in pedestal mounted display unit.
Kit means a screened monitor module for fitting into a customer specified console.
Desk means inclusion in a desk mounted display unit.

†Memory card units cannot be fitted to EPA(L) variants.

‡Processors with these labels are now obsolete and have been replaced by others in the same table.

3.3 Antenna Unit

The type numbers are as follows:

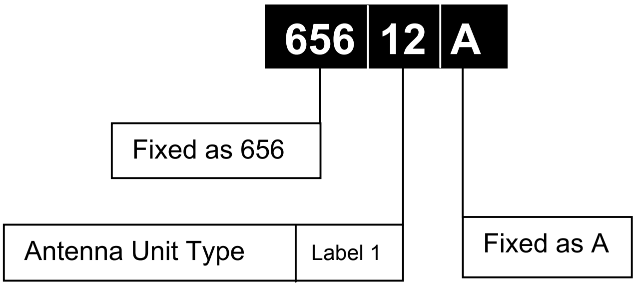


Figure 2.4 Antenna Unit label

Label 1 **Antenna Type**

Label	Radar Type
04	4ft (X-band)
06	6ft (X-band)
08	8ft (X-band)
09	9ft (S-band)
12	12ft (S-band)

3.4 Turning Units and Integral Transceivers

The type numbers are as follows:

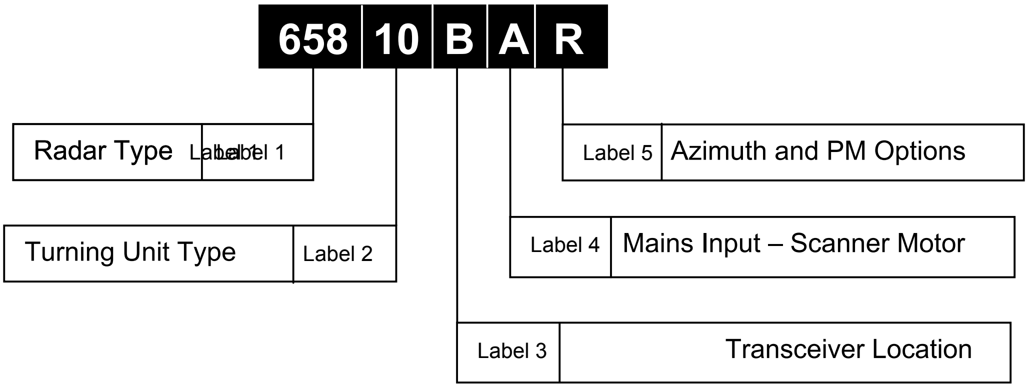


Figure 2.5 Turning Unit and Integral Transceiver label

Label 1 **BridgeMaster E Identifier**

Fixed as 658

Label 2 **Turning Unit Type**

Label	Turning Unit Type
01	X-band without Transceiver
10	X-band with 10kW Transceiver
25	X-band with 25kW Transceiver
30	S-band with 30kW Transceiver

X-band Turning Units are supplied set to 'Standard Speed'. Speed changes are effected by link changes within the unit. S-band Turning Units are correctly set for their turning speed.

Label 3 **Transceiver Location and Type**

Label	Transceiver Location
B	Bulkhead
C	Bulkhead with additional facilities
L*	Masthead special variant
M	Masthead with biased Limiter
N	Masthead with additional facilities
P	Masthead, 3kHz short pulse variant
R*	Masthead special variant
S	Pressure tested for lifeboat use.
T	Masthead, 3kHz with additional facilities
W	Masthead with non-biased Limiter

* These Scanner Units are special naval variants, and are covered in separate manuals.

Label 4 **Mains input – Scanner Motor**

Label	Phases	Voltages (V)	Frequency (Hz)	Speed	Band*
A	1	110/240	50/60	S/H	X
D	DC	24 – 32	0	S	X
E	1	110 – 120	50/60	S	S
F	1	220 – 240	50/60	S	S
G	3	110 – 120	50/60	S	S
H	3	220 – 240/380 – 440	50/60	S	S
J	1	110 – 120	50	H	S
K	1	220 – 240	50	H	S
L	3	110 – 120	50	H	S
M	3	220 – 240/380 – 440	50	H	S
P	1	110 – 120	60	H	S
Q	1	220 – 240	60	H	S
R	3	110 – 120	60	H	S
S	3	220 – 240/380 – 440	60	H	S

* For **X-band** Turning Units the motor is powered from the transceiver. This supply matches the Processor Electronics Unit supply.
For **S-band** Turning Units the motor is fed from its own supply via a Scanner Control Unit and can differ from the Transceiver/Processor Electronics Unit supply.

Label 5 **Azimuth and Performance Monitor Options**

Label	Performance Monitor	Synchro/ Resolver	Synchro Type
P	No	No	N/A
R	Yes	No	N/A
S	No	Synchro	CX
T	Yes	Synchro	CX
U	No	Synchro	CDX
V	Yes	Synchro	CDX
W	Yes	Resolver	11M6P1
X	No	Resolver	11M6P1

3.5 Bulkhead Transceiver Unit

The type numbers are as follows:

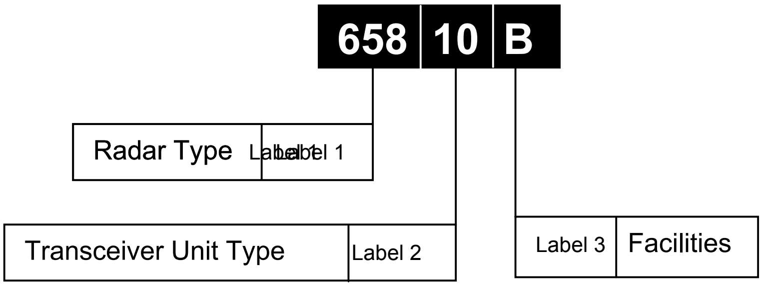


Figure 2.6 Bulkhead Transceiver Unit label

Label 1 **BridgeMaster E Identifier**

Fixed as **658**

Label 2 **Transceiver Type**

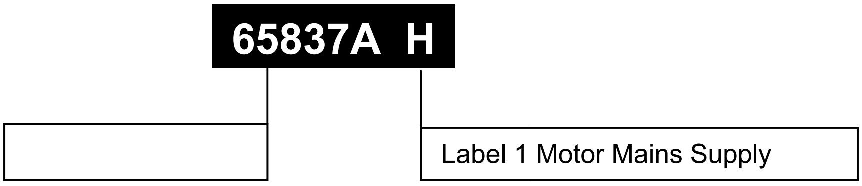
Label	Transceiver Type
10	10kW X-band
25	25kW X-band
31	30kW S-band

Label 3 **Facilities**

Label		Facilities
A*	**E**	Standard with biased limiter
B*	**F**	With additional facilities
P*	**G**	3kHz short pulse variant
T*	**L**	3kHz short pulse with additional facilities
W*	**H**	Standard non-biased limiter

* X-band Units with these labels are now obsolete, and have been replaced by units with the label in the adjacent column.

3.6 Scanner Control Unit



The type numbers are as follows:

Figure 2.7 Scanner Control Unit label

Label 1 **Motor Main Supply**

Label	Phases	AC Voltage	Antenna Speed
B	3	380/440	Standard
C	3	220/240	Standard
	3	380/440	High
E	1	220/240	Either
	3	110/120	Standard
	3	220/240	High
F	3	110/120	High
H	1	110/120	Either

Scanner Control Units (SCU) are adjusted internally for thermal trip current and the number of phases (1 or 3).

3.7 Interswitch Unit

Interswitch Type	System Configuration
65842A	Up to 4 Displays and 2 Top Units
65846A	Up to 6 Displays and 6 Top Units

Note – Either Interswitch unit may be mounted on a bulkhead, but only the 65842A can be fitted within the console Pedestal if available.

3.8 Interface Unit

Interface Unit Type	Requirement
65847A	Depends on system interface, watchdog and alarm annunciation requirements. Required for AIS input and high-speed serial Compass input.

4 Configuring a Typical System

The following shows how a typical system is configured using the information above. The requirement is for S-band ARPA radar with the following characteristics:

1.	Display Unit	Deck mounted 23” (340 series) flat panel monitor.
2.	Processor Unit	Keyboard, Trackerball and Standard Compass
3.	Antenna	12ft S-band, standard speed
4.	Transceiver	Masthead mounting with Performance Monitor
5.	Performance Monitor	Yes
6.	Ship's Mains Supply	220/240V AC, 50Hz, 1 Phase

The System Identification number for the system specified above would be:

ARPA	34	3	/	12	/	M		/FS

The individual Type Numbers for the specified units would be:

Monitor Unit	658 | 23 | E
Processor Electronics Unit	65800 | R | A | R | P
Antenna	656 | 12 | A
Turning Unit (including Transceiver)	658 | 30 | M | F | R
Scanner Control Unit	65837A | E

Note – The modular method for configuring BridgeMaster E Systems results in a large number of possible combinations, not all of which are commercially available. Consult NORTHROP GRUMMAN SPERRY MARINE for full details.

5 Options and Kits

An Interface Unit (Part No 65847A) is available for use with standard BridgeMaster E Systems.

250 and 340 pedestal and plinths are available for some systems.

Consult NORTHROP GRUMMAN SPERRY MARINE for further details and availability of these options.

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CHAPTER 3

INSTALLATION

Contents

Table of Figures

1 General Information

The Installation Engineer is responsible for providing the work needed for the installation and that the Contractor completes the work.

1.1 Preparation

Preparation for installation is as follows:

1. If necessary, the structure of the ship should be strengthened to support the components of the system
2. The provision and fitting of mounting facilities for the components of the system
3. The provision of power supplies terminated by a switch-fuse box. The Installation Engineer will specify the voltage level and current rating of the supplies.
4. The provision and installation of cable trays, battens and/or conduits for the interconnecting cables of the system
5. When a mast is to be mounted on a wooden deck, earth leads or strips are to be provided for connection to the mast

1.2 Installation Procedure

The Installation comprises the following operations:

1. The Contractor will install the mast. If required, the Contractor will provide and install adjustable stays for the mast, and take suitable precautions to minimise vibration.
2. The unpacking and external inspection of the components of the system
3. The installation of the Scanner Unit of the system
4. If required, installation of waveguide brackets and/or deck glands
5. The installation of the other components of the system
6. Planning and laying of cables

Note – If a bulkhead transceiver is to be installed, a mounting pad is to be provided.

1.3 Cable Details

Refer to the Cabling Schedules section below for details of cables and related terminations. Inter-unit cabling diagrams are given in Section 3. For details of the X-band RF waveguide, RF termination and installation see Section 2.3.2. Details of the S-band coaxial RF Feeder are given in Section 2.5.2.

1.3.1 Supply Cables

Consider the following points to determine the physical size of the cable used to connect the AC or DC supply of the ship to the radar:

a. The voltage drop from the supply to the radar must not exceed 2% of the supply voltage

b. The current required by the radar must not exceed the current rating of the cable

If the system is to be supplied by a three-phase supply, the system must be connected between two of the three phase lines. If it is a high voltage supply, an isolating transformer must be provided to reduce the voltage to 220/240V at the system input.

Note – S-band Turning Unit motors are fed directly from the AC supply via the appropriate Scanner Control Unit (SCU) – see Section 2.6 in this chapter for details of the SCU.

In a DC powered system, the physical size of the cable used to connect the DC supply should be chosen to achieve the minimum input voltage requirement of 21.6V without exceeding the maximum current rating of the cable, our recommendation for the processor and masthead transceiver is 37-3-4R (MA00014209). This cable cannot be used for DC Flat Panel Monitors, a cable capable of carrying 5 Amps only is required.

1.3.2 Power Consumption

The power consumption of the radar is given in Chapter 1 of the Technical Specification for the radar.

1.3.3 Switch Fuses

The radar is connected to the power supply of the ship via two Switch Fuses. The Switch Fuses are not supplied with the radar, and are therefore of local manufacture. The fuse ratings of the Switch Fuses are given in Section 3.6 of this Chapter.

1.3.4 Control Cables

The control cables detailed on the Inter-Unit Cabling diagrams may be used up to a maximum length of 180m, unless otherwise stated. (A connector kit is available for cable lengths from 180m to 300m where special cable is required.)

The DATA cable (Service Code MA00007419) conforms to UL Type CL2, AWM 2919 and CSA PCC FT4.

The other multi-core cables conform to IEC 92/3 and DEF STAN 61-12 Part 5.

The LSZH (low smoke zero halogen) cables follow the construction of DEF STAN 61-12 Part 5 but utilise polyethylene insulation over the cores instead of PVC.

The cables are multicore stranded or bunched, and have tinned copper wire conductors.

Each conductor is insulated with PVC to form cores. The cores are screened with braided tinned copper wire, and the complete cable is sheathed with PVC. The temperature range of the cables is -25°C to +70°C.

Ref	Service Code	Cable Diameter	Number of Cores	Core Strands/ Diameter	Resistance per 1000m (at 20°C)	Current Rating	Voltage (RMS)
		mm		mm	Ω	A	V
16-2-2C	3218376	6.9	2	16/0.2	40.1	2.5	440
16-2-4C	3209342	7.7	4	16/0.2	40.1	2.5	440
16-2-6C	3211274	8.7	6	16/0.2	40.1	2.5	440
16-2-12C	3211266	11.0	12	16/0.2	40.1	2.5	440
37-3-2R	3228207	10.3	2	37/0.32	6.79	13	440
37-3-4R	3214044	11.8	4	37/0.32	6.79	13	440
-	MA00007419	8.4	4 pairs	7/0.2	-	-	30
PT1YM	3236862	6	1	1X0.6	95		
FSJ1-75	MA00012534	7.4	1		49.2		
FSJ4-75A	MA00012880	13.2	1	1X3	4.9		

Note – PT1YM characteristic impedance is 75Ω, and is double screened; each screen provides 95% coverage.

Low Smoke Zero Halogen (LSZH) Alternatives to Standard Cables

Ref	Service Code	Cable Diameter	Number of Cores	Core Strands/ Diameter	Resistance per 1000m (at 20°C)	Current Rating	Voltage (RMS)
		mm		mm	Ω	A	V
16-2-2C	MA00014100	6.9	2	16/0.2	40.1	2.5	440
16-2-4C	MA00014167	7.7	4	16/0.2	40.1	2.5	440
16-2-6C	MA00014175	8.7	6	16/0.2	40.1	2.5	440
16-2-12C	MA00014183	11.0	12	16/0.2	40.1	2.5	440
37-3-2R	MA00014191	10.3	2	37/0.32	6.79	13	440
37-3-4R	MA00014209	11.8	4	37/0.32	6.79	13	440
-	MA00014126	8.4	4 pairs	7/0.2	-	-	30
PT1YM	91005248	6	1	1X0.6	95		
FSJ1RN-75A	MA00014142	7.4	1		49.2		
FSJ4RN-75A	MA00016089	13.2	1	1X3	4.9		

Note – 91005248 characteristic impedance is 75Ω, and is double screened; each screen provides 95% coverage.

1.3.5 Cable Core colour Coding

a) Multicore Cables

R	Red
B	Blue
G	Green
Y	Yellow
W	White
BK	Black

BN	Brown
V	Violet
O	Orange
P	Pink
L/G	Light Green
GY	Grey

b) DATA Cable (four twisted pairs)

B/W	Blue/White	Twisted Pair
W/B	White/Blue	
G/W	Green/White	Twisted Pair
W/G	White/Green	

BN/W	Brown/White	Twisted Pair
W/BN	White/Brown	
O/W	Orange/White	Twisted Pair
W/O	White/Orange	

Note – Blue/White is predominately blue with a narrow white trace; White/Blue is predominately white with a narrow blue trace and similarly with the other pairs.

c) DATA Cable (four twisted pairs) Low Smoke Zero Halogen alternative

B	Blue	Twisted Pair
BK	Black	
G	Green	Twisted Pair
BK	Black	

W	White	Twisted Pair
BK	Black	
R	Red	Twisted Pair
BK	Black	

1.3.6 Coaxial Cables

Signal Coaxial Cables

The coaxial signal cables detailed on the Inter-Unit Cabling diagrams may be used up to a maximum length of 300m depending on the type of cable chosen. These cables are double screened, and have a nominal impedance of 75Ω. Braiding is made from tinned copper to reduce corrosion problems.

Service Code	Cable Diameter mm	Nominal Impedance Ω	Attenuation at 10MHz dB/100m	Comments
3236862 91005248	6.0	75	3.9	Double screened, with Mylar insulation between screen (PT1YM), for use with cable runs not exceeding 67m
MA00012534 MA00014142	7.4	75	1.87	Low loss, copper clad steel inner, solid copper screen, for use with cable runs not exceeding 180m
MA00012880 MA00016089	13.2	75	0.96	Ultra low loss, solid copper inner, solid copper screen, for use with cable runs not exceeding 300m.

S-band Coaxial Cable

This is a ⅞" foam dielectric RF feeder cable. The cable has a minimum bend radius of 250mm (10") and may be used up to a maximum recommended length of 30m. Longer lengths may be used at the owner's discretion but performance will be significantly degraded for lengths over 30m.

Service Code	Cable Diameter mm	Nominal Impedance Ω	Attenuation at 3GHz dB/100m	Comments
9648577	28	50	8.31	Andrew Type LDF-50A

1.3.7 X-band Elliptical Waveguide

This is a 33.5 x 22.9mm corrugated elliptical waveguide. The waveguide has a minimum bend radius of 200mm in the 'H' plane, and 480mm in the 'E' plane, and may be used up to a maximum recommended length of 30m. Longer lengths may be used at the owner's discretion but performance will be significantly degraded for lengths over 30m.

Service Code	Waveguide Size mm	Attenuation at 9.4GHz dB/100m	Comments
9037748	33.5 x 22.9	9.96	Andrew Type EW85

1.4 Safety Earthing

All company equipment with internal voltages greater than 50V ac (RMS), and contained in a protective metal chassis, must have the chassis connected directly to earth. This is to protect against the chassis becoming live under fault conditions. The earth link should be made by connecting a low resistance conductor between the equipment's 6mm stainless steel safety earth stud (marked with ⏚) and the main ship's earth.

Particular attention should be paid to protecting the connections from both environmental and electro-chemical corrosion. Before assembly, it is essential to ensure that the contact areas are oxide-free and that they are coated with a thin layer of conducting paste to seal the joints The most suitable materials for making connections between the equipment's earthing bolt and the ship's earth are aluminium or tinned copper straps that provide a large contact area.

If an aluminium strap is connected to a ship's stainless steel earth, a zinc-plated washer should be used between the strap and the ship's earth.

If a tinned copper strap is connected to a ship's aluminium earth, an aluminium washer (rather than steel) should be used between the strap and the ship's earth.

The method of connecting the bonding straps together is very important. The connections must be made from each piece of equipment to the ship's earth not looped from unit to unit. No other connection must be made to the earth bolt to ensure that this is a non-current carrying connection.

The safety earth should never be removed during normal use or servicing. It is only safe to remove it once the equipment has been isolated from all external power sources.

1.5 EMC Screening Continuity

The object of EMC screening is to restrict the emission of electro-magnetic energy from the equipment, and to reduce its susceptibility to external electro-magnetic influence. Individual items of equipment are EMC screened by their protective chassis, but they generally require that this screening is extended to cover both input and output connections and cabling, to maintain overall electro-magnetic efficiency. To this end, particular attention should be paid to the bonding of the braids of interconnecting cables where indicated in the appropriate cable schedules.

1.6 Siting

The performance of the system is dependent on the correct siting of the system Scanner Unit (Turning Unit and Antenna). Scanner Unit siting must consider the following:

1. Compass safe distance
2. Satisfactory short and long-range performance of the radar
3. Protection of the equipment (cables and waveguide if applicable) from damage
4. Ease of access for safe servicing

5. Minimum practical length of waveguide or S-band coaxial cable, if applicable
6. Freedom from blind arcs and false echoes, particularly on the starboard side of the vessel, as own ship generally has to give way to vessels approaching from this direction. Port side visibility is also extremely important for monitoring approaching vessels, as these normally pass own ship on the port side. This is particularly important for vessels that navigate in narrow channels or canals.

   Ship features, which commonly obstruct the radar beam, are funnels, masts, Samson posts and crosstrees. A funnel usually throws a shadow aft, which may or may not be considered serious. However, it is a probable source of false echoes aft. Shadows thrown by Samson posts and masts will vary in extent with their size and proximity to the scanner.

   If there are obstacles around the selected site, it may be necessary to position the scanner towards the starboard side of the vessel (Figure 3.1 identifies this as position B). In this example, position B gives the antenna an unobstructed area for direction of traffic on ownship's starboard side. In practice, in the direction of the ship's bow, often a mast or crane can reflect or suppress signals transmitted from the antenna.

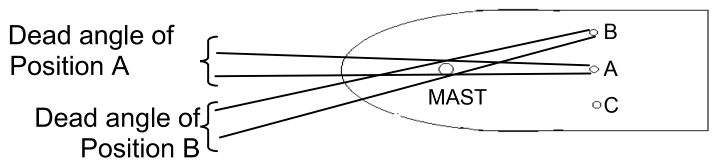


Figure 3.1. Scanner Siting

This type of obstruction can cause the system to display large false returns on the display and/or fail to detect target returns within a certain dead angle. On ARPA systems, this may also cause the radar to lose automatically tracked targets that move into such an area. If the obstacle is such that it forms a significant obstruction, the scanner height may have to be changed to ensure that the angle of depression is a minimum of 5 degrees (see Figure 3.2)

The scanner must be installed only as high as is necessary to clear major objects. It must also be borne in mind that when the scanner height is minimised the short-range performance is improved along with the effects of sea clutter. Therefore, position the scanner high enough to secure 5 degrees or greater angle of depression. The angle is measured between the horizontal line drawn from the antenna and the top of the mast or obstacle.

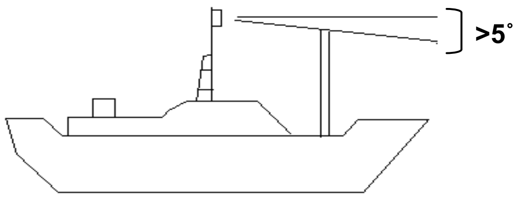


Figure 3.2. Minimum angle of Depression

7. Interference from an adjacent radar antenna: the vertical separation between antennas should be as large as practicable. As a minimum, the glaring angle between antennas should be less than 45° (see Figure 3.3).

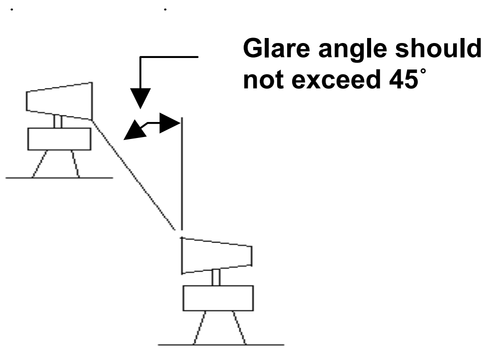


Figure 3.3. Dual Scanner Positioning (glare angle)

8. Local wind effect due to ship's structure
9. Local vibration environment

The site and method of mounting the below-decks equipment should be chosen to comply, as far as possible, with the wishes of the owner or master of the vessel. The following points should also be considered:

1. Compass safe distance
2. Ease of access for servicing
3. Positioning to avoid the ingress of moisture
4. Positioning away from doors or ports that are frequently used
5. Positioning to minimise accidental damage
6. Environmental considerations such as; adequate ventilation, dust, dirt, clean air
7. Position the display unit away from strong magnetic fields
8. Position the display screen away from direct sunlight
9. Local vibration environment

2 Securing of System Components

2.1 Mains Isolator (Optional Fit)

It is good practice to include Mains Isolator Switches Type 65800700 in the system wiring of AC powered systems. Its function is to enable the Scanner Unit (with the exception of the Motor Supply in S-band systems) and the Processor Unit (and Monitor) to be isolated from the ship's mains supply. In S-band systems, the Scanner Unit Motor Supply is isolated separately via the Scanner Control Unit. From a safety standpoint, the Mains Isolator should be mounted adjacent to the SCU so that the S-band system can be isolated from a single location. If required, the Mains Isolator may be locked in the **OFF** position by means of a suitable padlock.

In multiple radar systems, a number of isolating switches may be required.

Note – Refer to System Diagrams and Cabling Schedules (Section 3) for connection details.

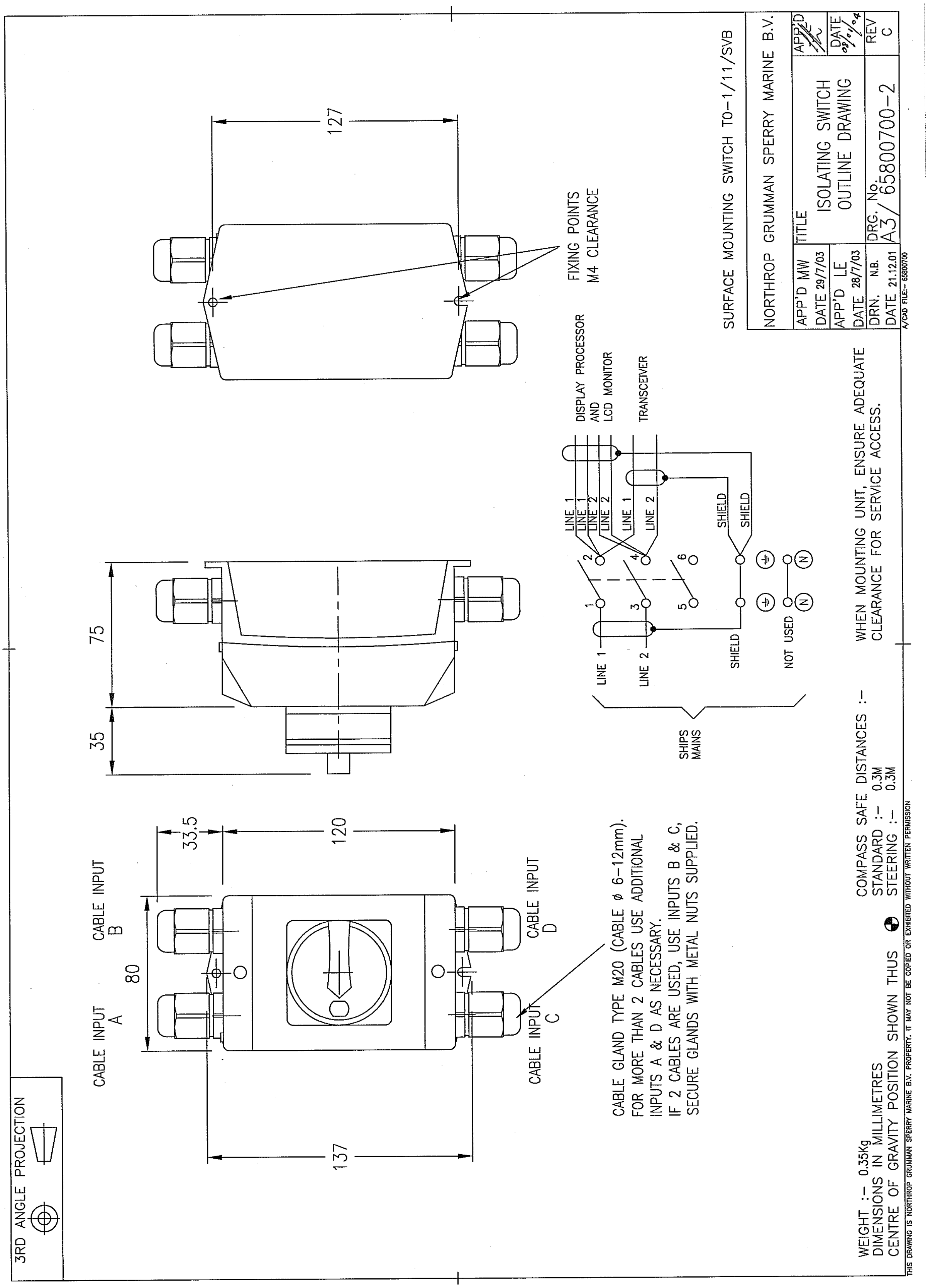


Figure 3.4. Isolation Switch Installation

2.2 X-band Scanner

The Scanner Unit comprises the following main elements, each of which is supplied in its own packing, together with relevant Installation Drawings:

Turning Unit	With/without Masthead Transceiver (10 or 25kW) Despatch Kit 65801660 (Installation Drawing 65801050)

NB: *a Bulkhead system would also be supplied with the following:*

Bulkhead Transceiver	(10 or 25kW) Despatch Kit 65825660 (Installation Drawing 65825050 OR 65825055)

Turning Units or Transceivers fitted with additional facilities option are supplied with a supplementary despatch kit 65825661 in addition to the above.

Antenna	4ft, 6ft or 8ft Despatch Kit is supplied in Antenna carton. (Installation Drawing 65601275)

Installation of the Scanner Unit entails carrying out the following operations, preferably in the sequence outlined below:

1. Preparation of the site (see notes at the beginning of this chapter)
2. Bolting the Turning Unit to the mounting platform (ship's structure) as detailed in Installation Drawing 65801050 supplied with the Turning Unit
3. Bolting the Antenna to the Support Casting as detailed in Installation Drawing 65601275 supplied with the Antenna
4. Laying in and installing the cables for the Turning Unit in accordance with the Cabling Schedules below
5. Ensuring that in the Turning Unit, the Motor Drive Board and the Pulse Bearing Board are correctly set for the required High or Low Speed option set via their relevant jumper links

Figure 3.5 to Figure 3.10 also show installation details that are intended to duplicate those provided with the equipment. However, as changes may occur to the details that may not be reflected in this manual, the installation drawings supplied with the equipment take precedence in the event of differences arising.

Turning Unit

!CAUTION!

The Turning Unit should only be lifted using the four fixing holes at the base of the unit. The weight and spread of the Antenna can cause a freestanding Turning Unit to topple over. The Turning Unit should therefore be bolted down onto its mounting platform before attaching the Antenna to the Turning Unit. When working on the X-band Turning Unit with the top casting raised, always make sure the locking bolt or latch on the stay is in the locked position.

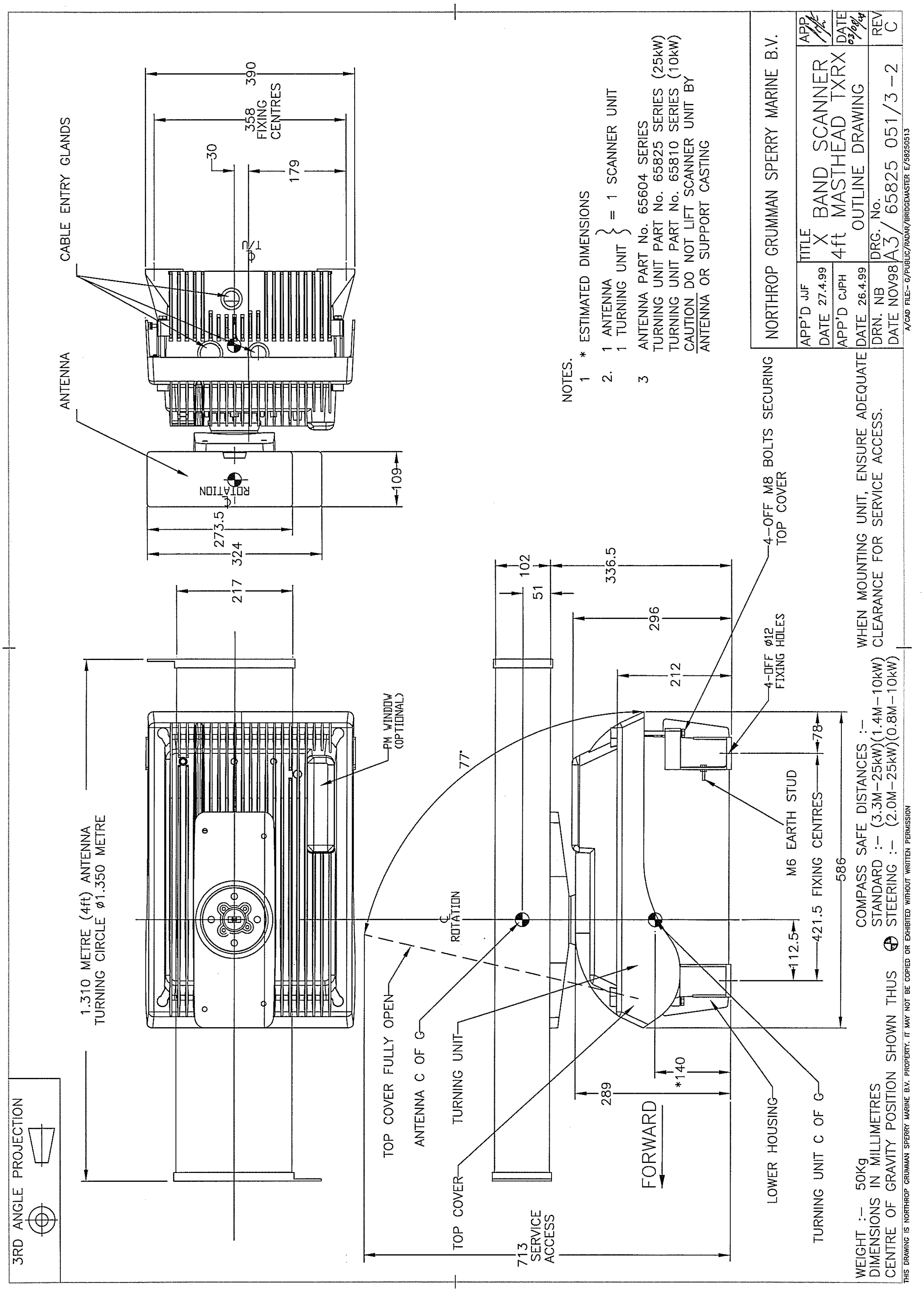


Figure 3.5. **X-band Scanner 4ft Masthead Tx/Rx Installation**

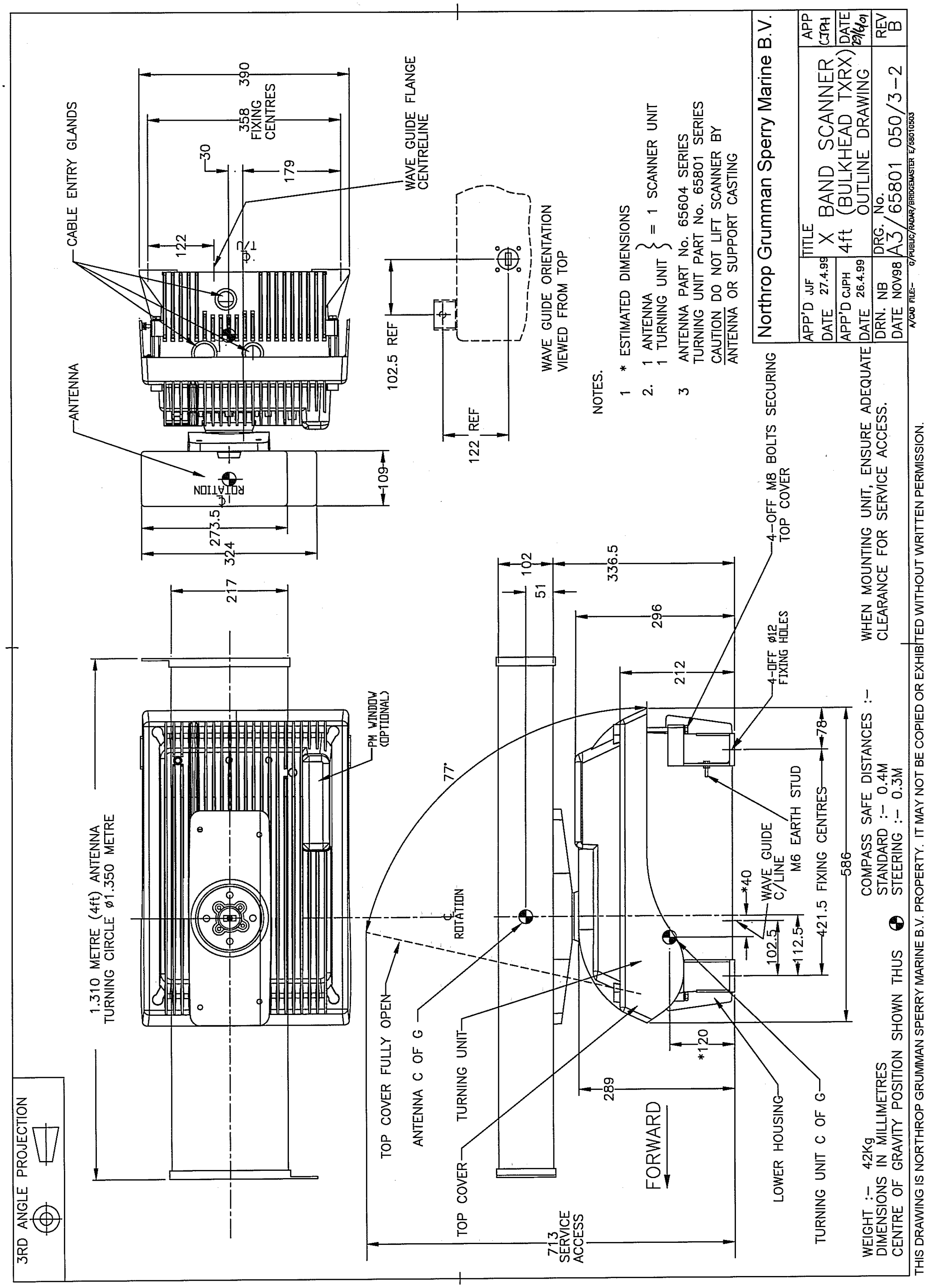


Figure 3.6. **X-band Scanner 4ft Bulkhead Tx/Rx Installation**

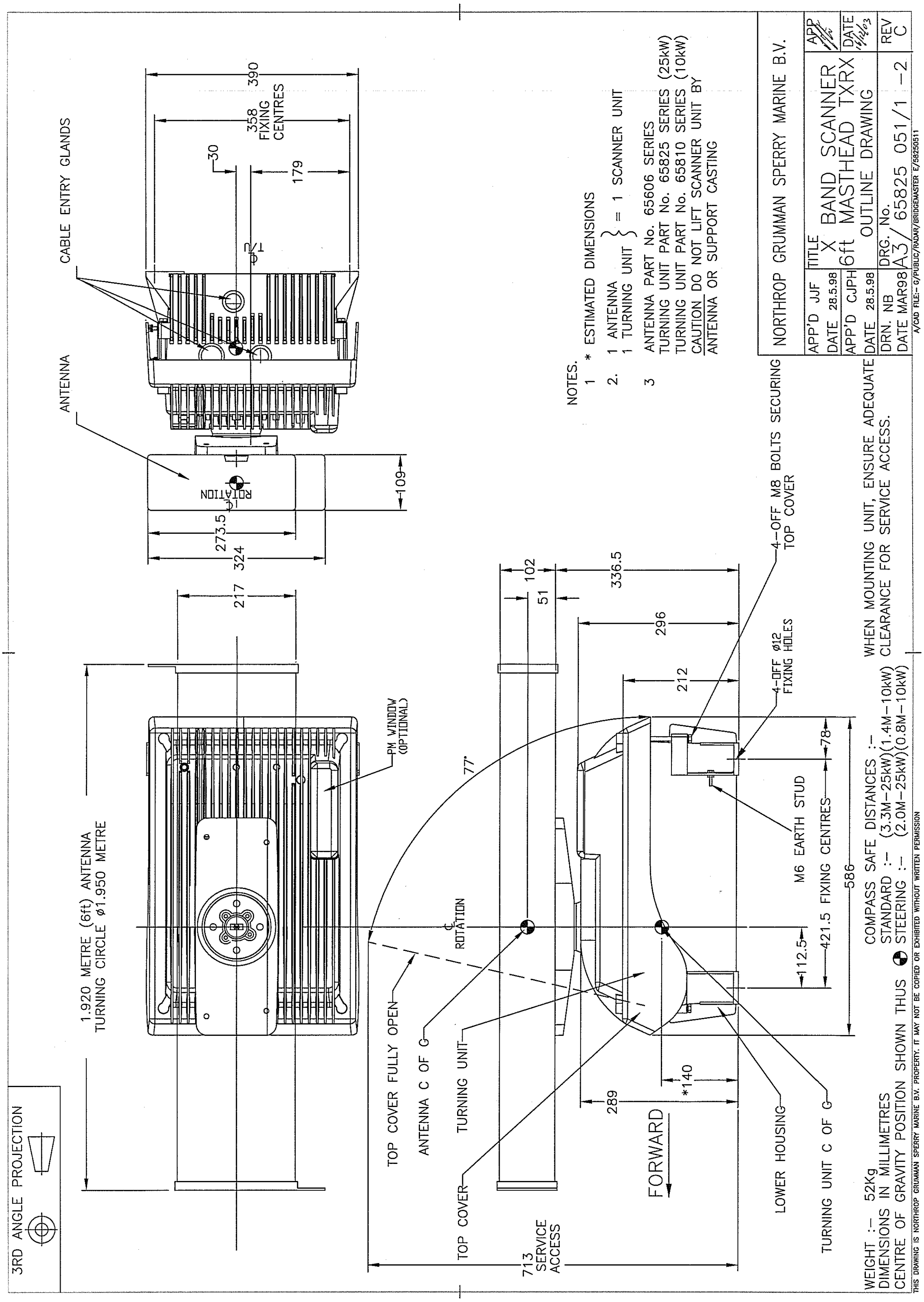


Figure 3.7. X-band Scanner 6ft Masthead Tx/Rx Installation

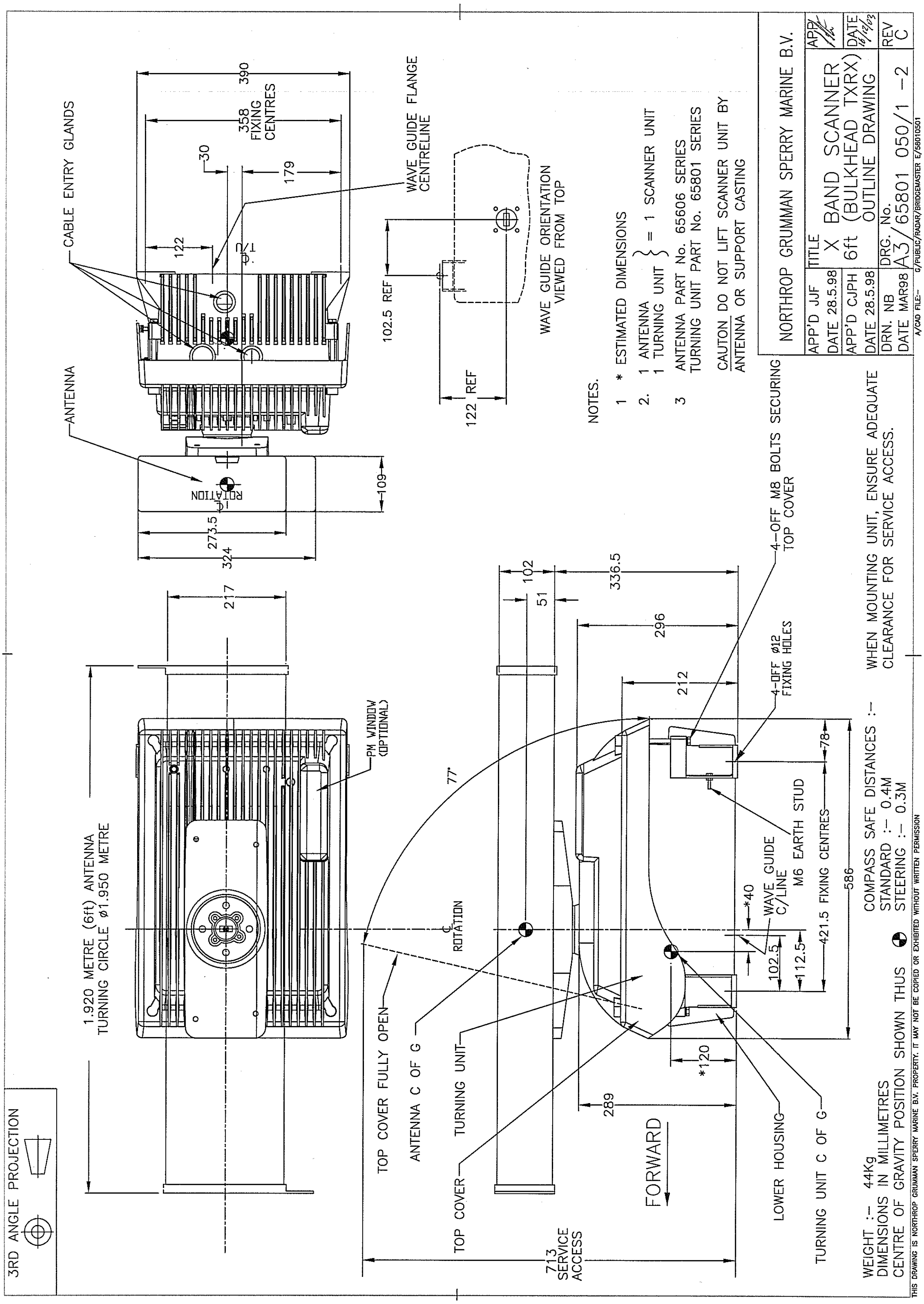


Figure 3.8. X-bancd Scanner 6ft Bulkhead Tx/Rx Installation

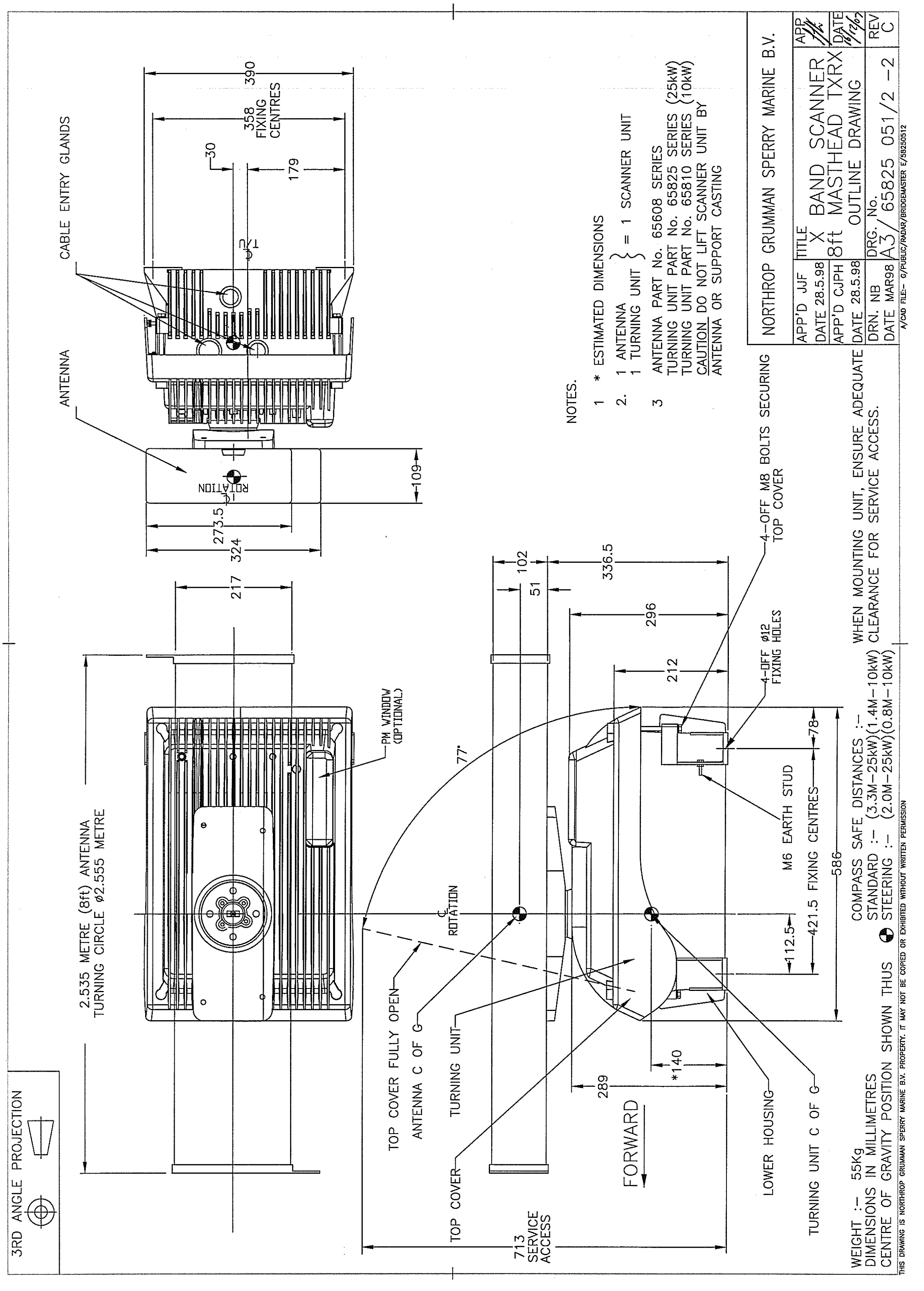


Figure 3.9. **X-band Scanner 8ft Masthead Tx/Rx Installation**

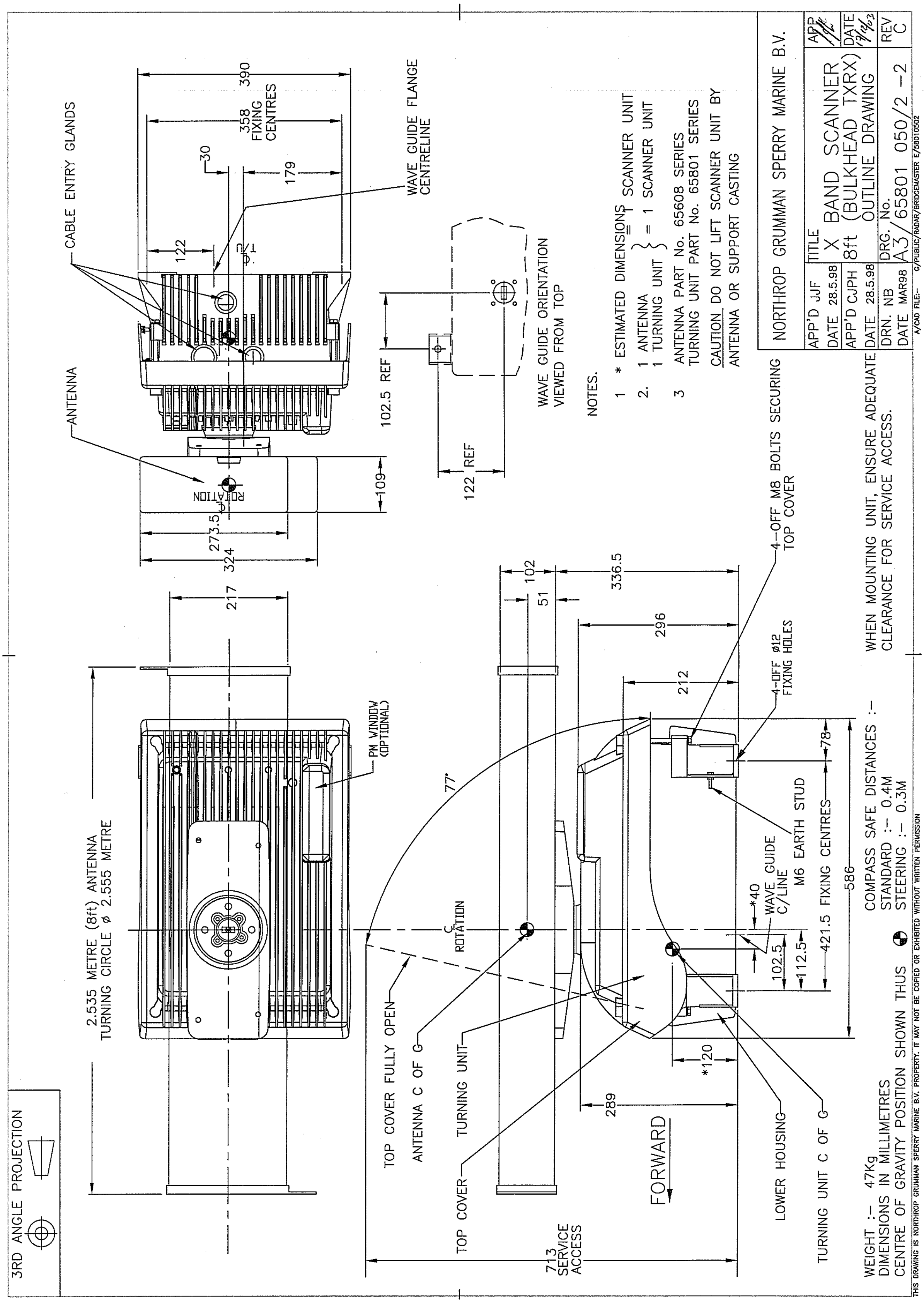


Figure 3.10. X-band Scanner 8ft Bulkhead Tx/Rx Installation

Note – The Turning Unit is bolted to the mounting platform with Neoprene isolating pads (4 off – 65601251) between the Turning Unit casting and the mounting platform, to prevent galvanic corrosion. Additional washers or pads may be added to level the mounting so that the Turning Unit casting is not subject to twist when the bolts are tightened. M10 washers may be used as shims, or purpose made parts produced locally may be used.

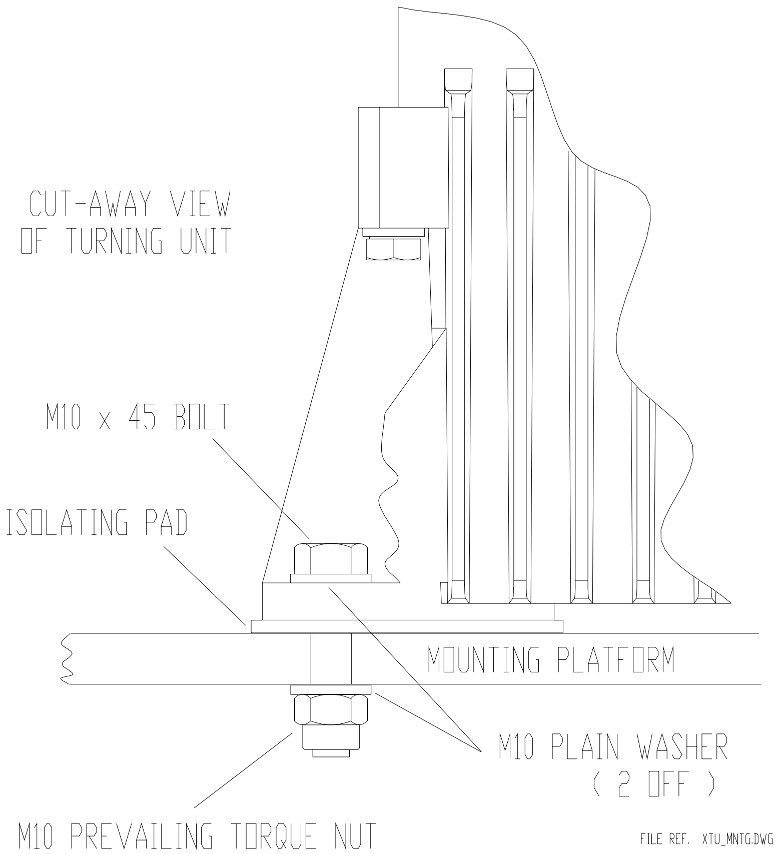


Figure 3.11. Fixing the Turning Unit to the Mounting Platform

2.2.1 Support Casting

The Support Casting is factory fitted to the Turning Unit and requires no further assembly during installation.

2.2.2 Performance Monitor

The Performance Monitor comprises the Performance Monitor module, and an associated control cable. The equipment is normally factory fitted.

2.2.3 Antenna

The Antenna is fitted to the Support Casting using the parts listed below that are supplied with the antenna. Note that the holes in the support casting are asymmetrically placed to prevent the antenna being fitted backwards. The support casting has the letters 'FRONT' visible from the above to aid initial antenna location.

4 off – M8 Stainless Steel Plain Nut (grade 316S16)	4411544
4 off – Washer with locking tab	65602122

Figure Figure 3.12 shows how these are fitted.

Ensure that all threads and bushes are coated with Densopaste.

Note – The lock tab ends must be bent as shown to prevent rotation of the nuts.

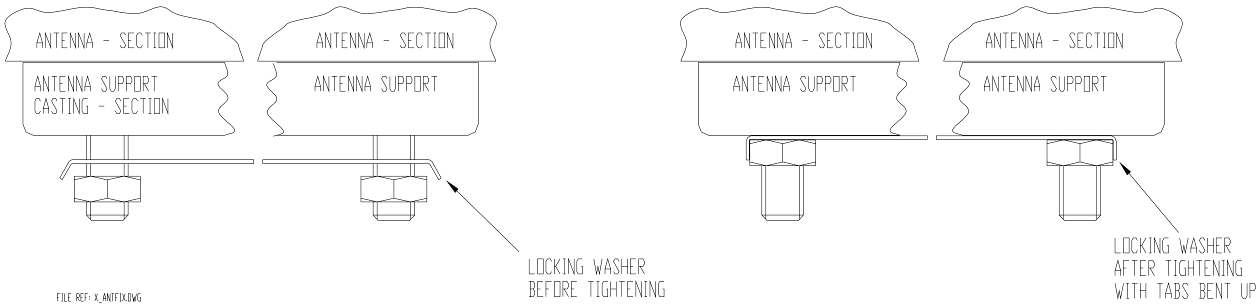


Figure 3.12. Fixing the Antenna to the Support Casting

2.2.4 Turning Unit Link Settings (standard turning units)

Standard Turning Units include the following types:

65801Bxx
65810Mxx, 65810Pxx, 65810Sxx, 65810Wxx
65825Lxx, 65825Mxx, 65825Pxx, 65825Wxx

For link settings on additional features turning units, see Chapter 9

Additional features turning units include the following types:

65801Cxx
65810Nxx, 65810Txx
65825Nxx, 65825Txx

For the standard turning units, two scanner speed settings are available, 'LOW' and 'HIGH', depending on the following settings of the Motor Drive Board and the Pulse Bearing PCB Assembly.

For the additional features turning units fitted with Motor Drive Board 65801827 and Pulse Bearing Board 65801826, there is a third option that allows remote selection between the two scanner speed settings.

Motor Drive PCB Assembly (65801811)

For Motor Drive PCB Assembly 65801827 (fitted to additional facilities turning units) see Chapter 9.

Setting link LK1 on the Motor Drive Board 65801811

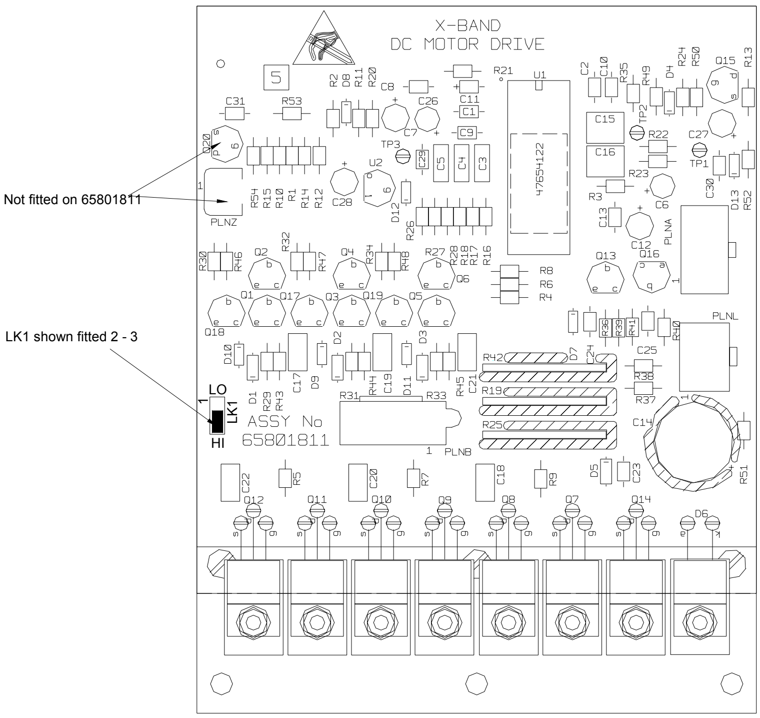
This link is set during installation and commissioning, and requires no tools to change.

The factory default setting is 'NORMAL' speed. Note that with no jumper fitted, the rotational speed defaults to HIGH speed.

Under no circumstances should the link position be moved whilst the motor is running.

With the jumper in the position marked 'LO' (pins 1 & 2 – left hand pair), the nominal scanner speed is 28 RPM.

With the jumper in the position marked 'HI' (pins 2 & 3 – right hand pair), the nominal scanner speed is 45 RPM.



file ref:65801811.dwg

Figure 3.13. Motor Drive Board 65801811 – Showing Link Position

Pulse Bearing PCB Assembly (65801805)

For Pulse Bearing PCB Assembly 65801826 (fitted to additional facilities turning units) see Chapter 9.

Setting link LK1 on the Pulse Bearing PCB Assembly 65801805

Note – This link does not change the rotational speed of the scanner, but does alter the ability of the phase-locked loop within the board to track the scanner rotational speed.

The factory default setting is optimised for 'LOW' speed.

Note – With no jumper fitted, Pulse Bearing PCB Assembly is optimised for HIGH speed. Under no circumstances should the link be moved whilst the motor is running.

Set the jumper in the position marked '1' (pins 1 & 2 – the lower pair) when the nominal scanner speed is 28 RPM ('LOW').

Set the jumper in the upper pair position (pins 2 & 3) when the nominal scanner speed is 45 RPM ('HIGH').

The link is set during installation and commissioning. The link can be moved with the PCB in place using long nose pliers but the operation is not easy due to the PCB mounting bracket that tends to obscure the position of the link.

The recommended method is to loosen the two Pozidriv screws that retain the mounting bracket and slide the whole assembly to the right using the slotted screw holes in the mounting bracket. The assembly can then be brought forward into a more accessible position for the link to be moved.

Take care during removal and refitting of the mounting bracket not to damage the teeth on the pulse disc assembly that run between optocouplers mounted on the rear of the Pulse Bearing PCB. Before re-tightening the two Pozidriv screws, check that both pairs of plain and single coil washers are above the top surface of the mounting bracket and not trapped beneath it.

For ease of installation, it is recommended that this operation be carried out, if required, before mounting the Turning Unit aloft.

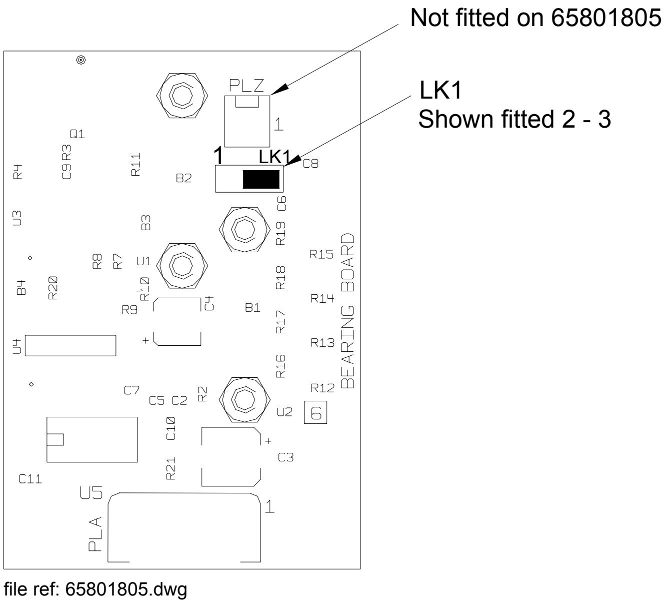


Figure 3.14. Pulse Bearing Board 65801805 – Showing Link Position

Turning Unit Input PCB Assembly 65801813 (fitted to standard Turning Units)

For Input PCB Assembly 65801819 (fitted to additional facilities turning units), see Chapter 9.

The diagram below shows details of the Turning Unit Input Board 65801813. Lifting up the upper casting cover on its hinges after releasing the four retaining bolts gives access to the unit (see Figure 3.5 to Figure 3.10). The screening cover can then be removed.

Normal configuration of the PCB links is as follows:

LK1 Not Normally Fitted (deleted from later issue boards)
LK2 Not Normally Fitted (deleted from later issue boards)
LK3 Link Pins 2 & 3 (deleted from later issue boards)
LK4 Link Pins 2 & 3 (deleted from later issue boards)

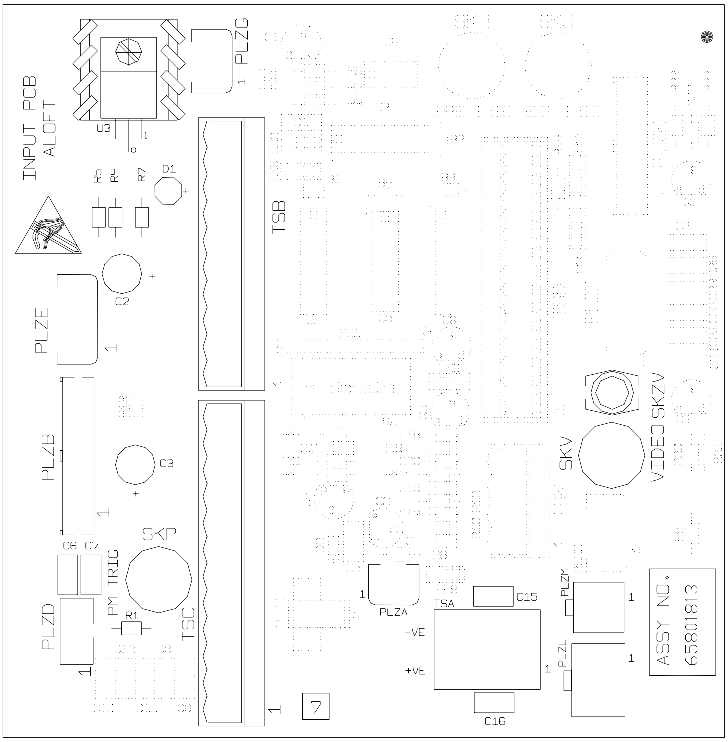


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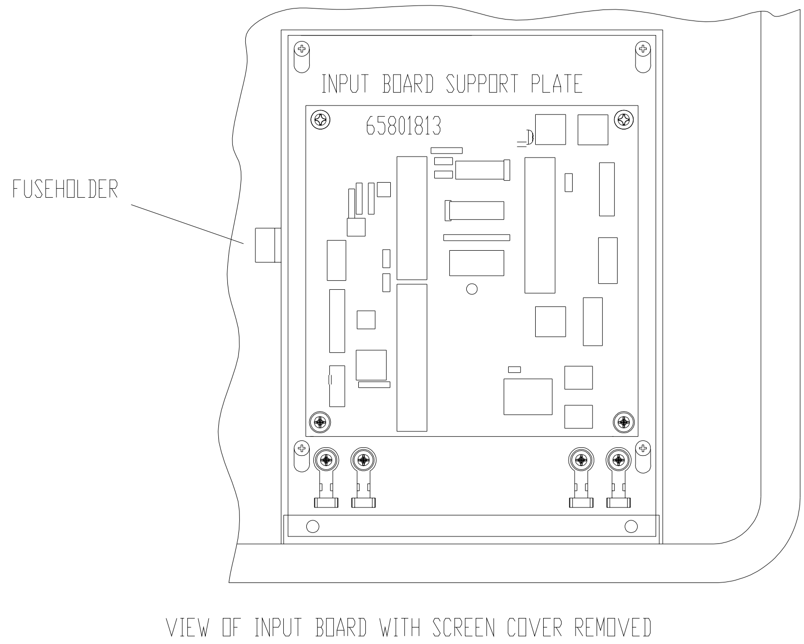
Figure 3.15. Turning Unit – Input Board Details

Note – The video cable does not plug into the Input Board, but goes directly to the Receiver. Refer to Section 2.2.6 'Fitting the Cable Glands' for further details.

Turning Unit Mains Input Connector (Aloft Transceiver)

The diagram below shows details of the Mains Input Connector TSE (Integral Transceiver only). These are revealed on removal of the support plate that is retained by four fixing screws (see below). Note that the screws need only be partially undone before the plate can be slid out.



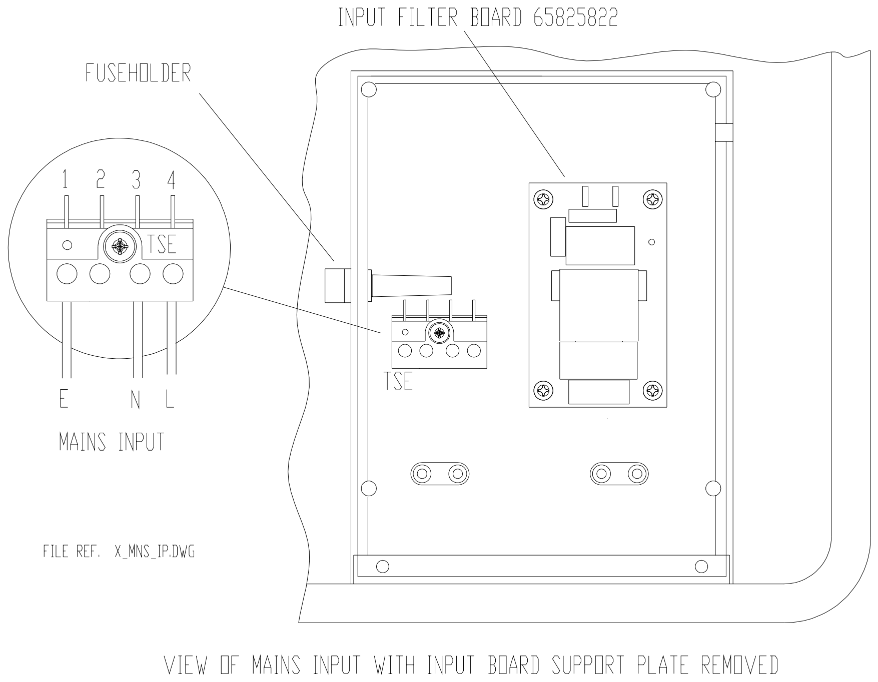


Figure 3.16. Turning Unit – Mains Input Details

2.2.5 Cabling Information

The table below shows the route by which each cable enters the turning unit (with or without an integral transceiver). Figure 3.17 shows the cable entry points. Three of these are via cable glands labelled 1, 2 & 3.

Note – For cable entry details for turning units with additional features, see Chapter 9.

The RF feeder (waveguide) input is only required when the transceiver is mounted below decks (bulkhead). The bulkhead lower casting is different from the masthead variant in the respect that an X-band waveguide flange is mounted on the underside face. See Figure 3.6, Figure 3.8 or Figure 3.10 for details.

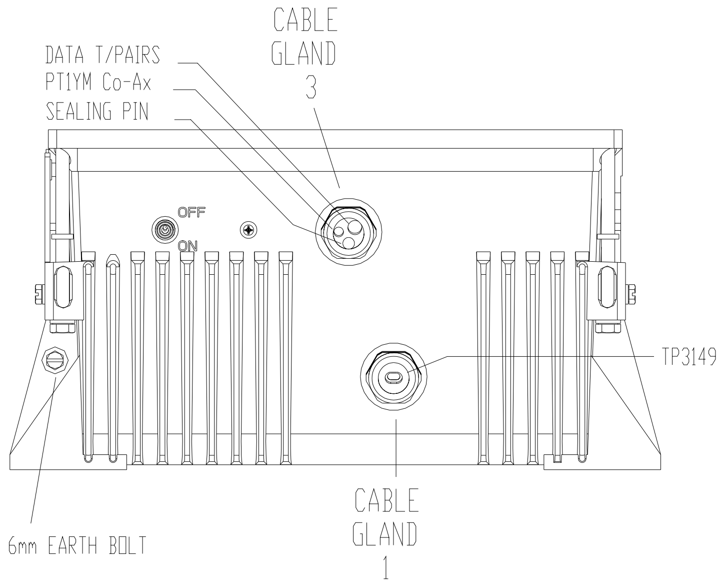
A 6mm bolt is fitted to enable the unit to be bonded to the ship's structure. This must not be used for any other connection.

For details of how to terminate the cables into their connector blocks, see the Interconnection Diagrams and Cabling Schedules in Section 3.

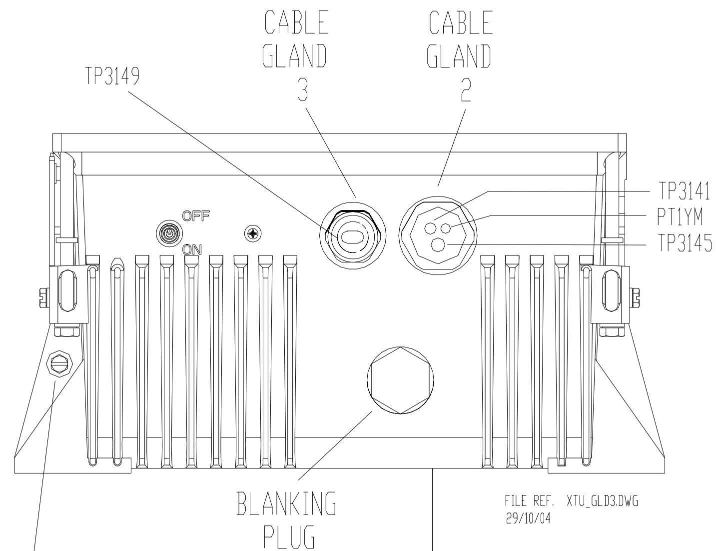
Each cable gland has a waterproof seal and a separate EMC seal, both of which must be installed as shown in Figure 3.19.

Details for terminating the RF feeder (waveguide) are given in Section 2.3.2.

Cable Gland	Turning Unit without Integral Transceiver		Turning Unit with Integral Transceiver	
	Description	**Cable Type**	**Description**	**Cable Type**
Cable Gland 1	Blanking Plug	-	Mains Input AC	37-3-2R
			Mains Input DC	37-3-4R
Cable Gland 2	PM/Bearing	16-2-12C	Blanking Plug	-
Cable Gland 2	PM Trigger	75Ω co-ax	-	-
Cable Gland 2	TU Enable	16-2-2C		
Cable Gland 3	Motor 50V	37-3-2R	Radar Video	75Ω co-ax
Cable Gland 3	-	-	Data	T/Pairs
RF Connector	RF Feed	X-band Waveguide	-	-



Turning Unit for Use with Aloft Transceiver



Turning Unit for Use with Bulkhead Transceiver

Figure 3.17. Turning Unit – Cable Entry Positions

2.2.6 Fitting the Cable Glands

The installation cables are connected into the turning unit via the proper cable glands (see earlier table). The body of the gland fits through a hole in the casting and is held in position by the Top Nut. Note the 'O' ring seal, which is fitted below the casting surface (input side). A waterproof seal and an EMC seal are provided with each gland as shown in Figure 3.18. Some glands are designed for a single cable; others are intended for several cables. Unused glands are fitted with a blanking plug. Unused cable entries are fitted with a sealing pin to maintain the seal integrity.

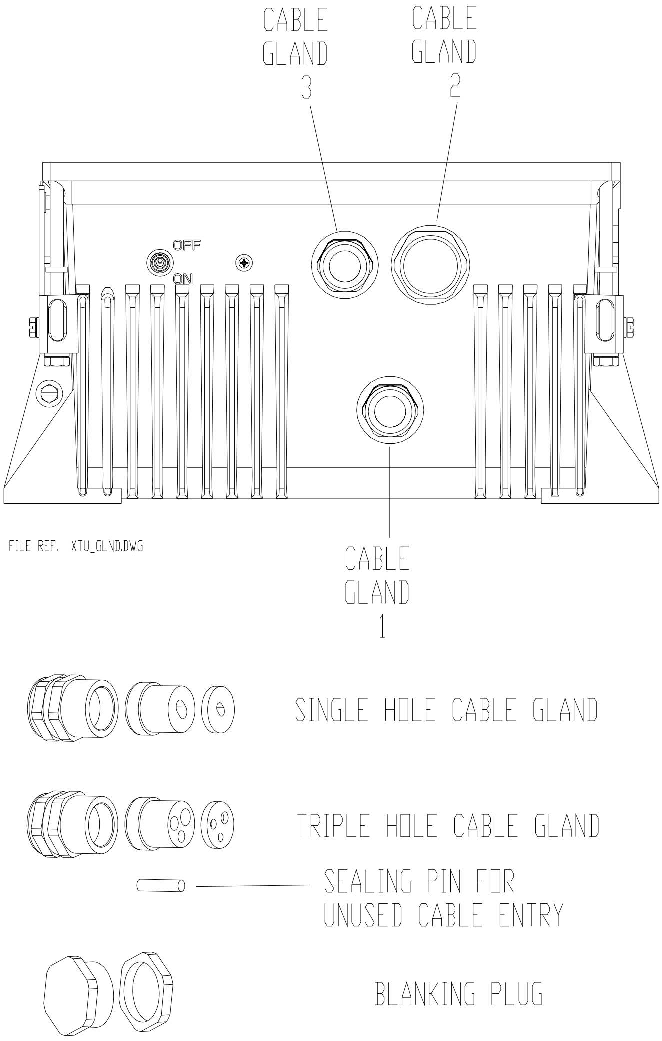


Figure 3.18. Turning Unit (Bulkhead Transceiver) – Cable Entry Positions

Note – Cable Glands and Blanking Plugs are normally Factory fitted to the Turning Unit. Later Turning Units for aloft transceivers do not have three cable gland holes.

CABLE INSTALLATION "X" BAND SCANNER UNIT

The waterproofing seal works by clamping onto the cable PVC sheath whereas the EMC seal clamps onto the cable braid. It is important not to force the outer sheath through the EMC seal, as the seal is liable to split. The braid is also formed into a tail that is grounded by means of an adjacent earth tag. The fitting procedure is detailed in Figure 3.19.

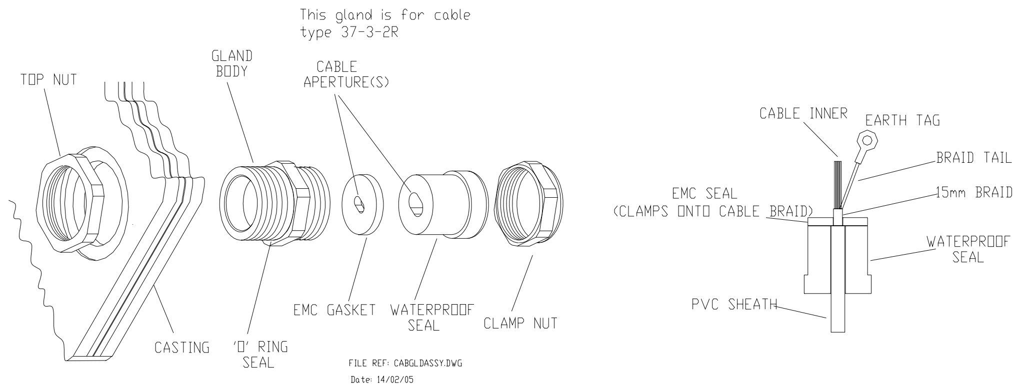


Figure 3.19. Detailed view of Cable Gland Assembly

To Install the Cables:

Unscrew the gland nut and remove the waterproof seal and the EMC gasket. Feed the cables through the gland nut and waterproof seal.

For the multicore cables, strip the outer sheath to expose approximately 300mm of braid, and for the video coaxial cable to expose about 1200mm of braid.

Push the braid back to expose approximately 50mm of the inner cores.

Trim 50mm off the cores, and pull the braid back and twist into a point.

Feed the cable through EMC gasket until it is position as shown above.

For the Multicore Cable:

Flare the braid out to within approximately 15mm of the EMC gasket and form a tail.

For the Coaxial Cable:

Do not fit the connector at this time.

Assembly into the Scanner Unit:

Feed the assembled cables and seals into the gland body, and tighten the gland nut to compress the waterproof seal.

Crimp the earth tags provided to the braids of the multicore cables, keeping them as short as possible. Attach them with the screws provided. Trim and make off the cable inners to the appropriate connectors.

The video coaxial cable does not plug into SKV on the Input PCB, but is connected to SKV on the Receiver Assembly.

Sleeve the braid of the coaxial cable with the 6mm sleeving provided.

Route the cable through the slot at the end of the filter box cover, along the cable loom on the right hand side of the scanner unit. Use cable ties to clip it to the loom.

Trim to length and fit the coaxial plug.

For systems using below decks transceivers, the Performance Monitor Trigger coaxial cable is terminated in the same manner but only needs to be stripped back 200mm as it is plugged into SKP on the input PCB.

2.3 X-band Bulkhead Transceiver

The Bulkhead Transceiver, type 65810A to 65810W (10kW) or 65825A to 65825W (25kW), is installed below decks in a suitable location such as the ship's equipment room. The installation should pay due regard to accessibility for maintenance and servicing, and the distance between the Transceiver and the Scanner Unit. For maximum performance, this should be kept as short as practicable, as the loss per metre of the X-band waveguide is typically 10dB per 100 metres, i.e. 2dB for 20 metres. This loss applies to both the transmitted RF pulse and the received signals.

The maximum recommended cable length between the Turning Unit and the Transceiver Unit is 30 metres, and that between the Transceiver and Display is 67 metres using standard coaxial cable (PT1YM). Greater separation is possible by using a lower loss cable. Contact Northrop Grumman Sperry Marine B.V. if greater separation is required. When choosing the installation location for the Transceiver, due regard must be made for the routing of the RF Feeder (waveguide).

The Transceiver may be attached to the bulkhead by several methods. The actual method chosen will depend on individual circumstances, but due regard must be given to the likely vibration and shock loading which may be experienced. The available methods include through bolting to the bulkhead, or mounting on studs provided by the shipyard. Note that slotted mounts are provided at the bottom for ease of installation.

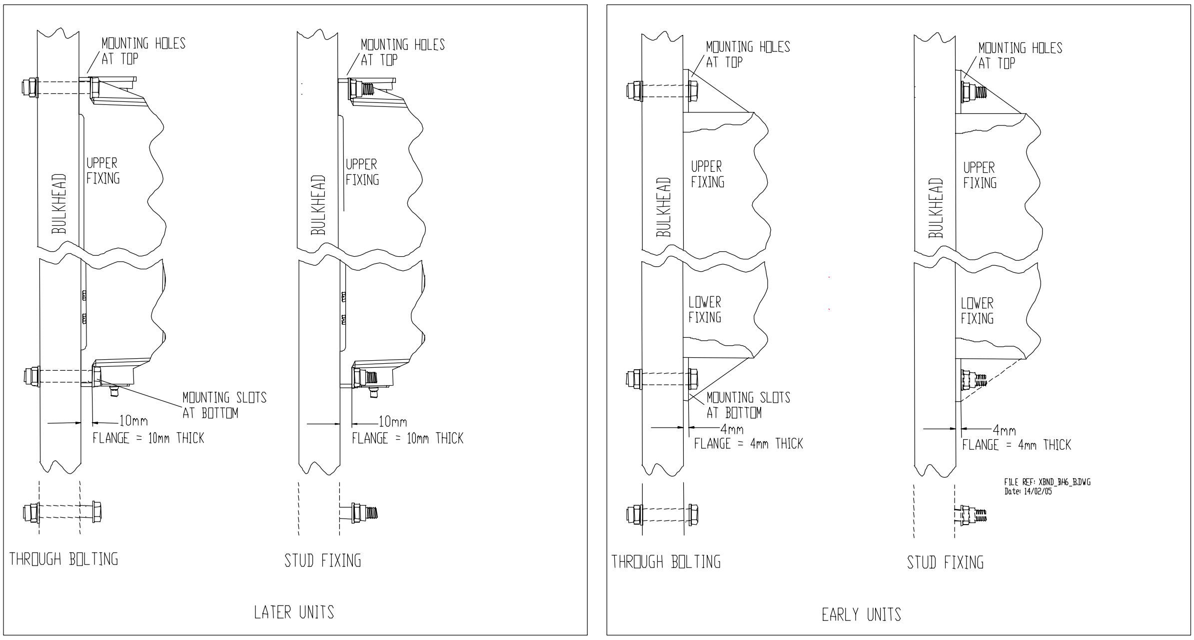


Figure 3.20. X-band Bulkhead Transceiver – Mounting Alternatives

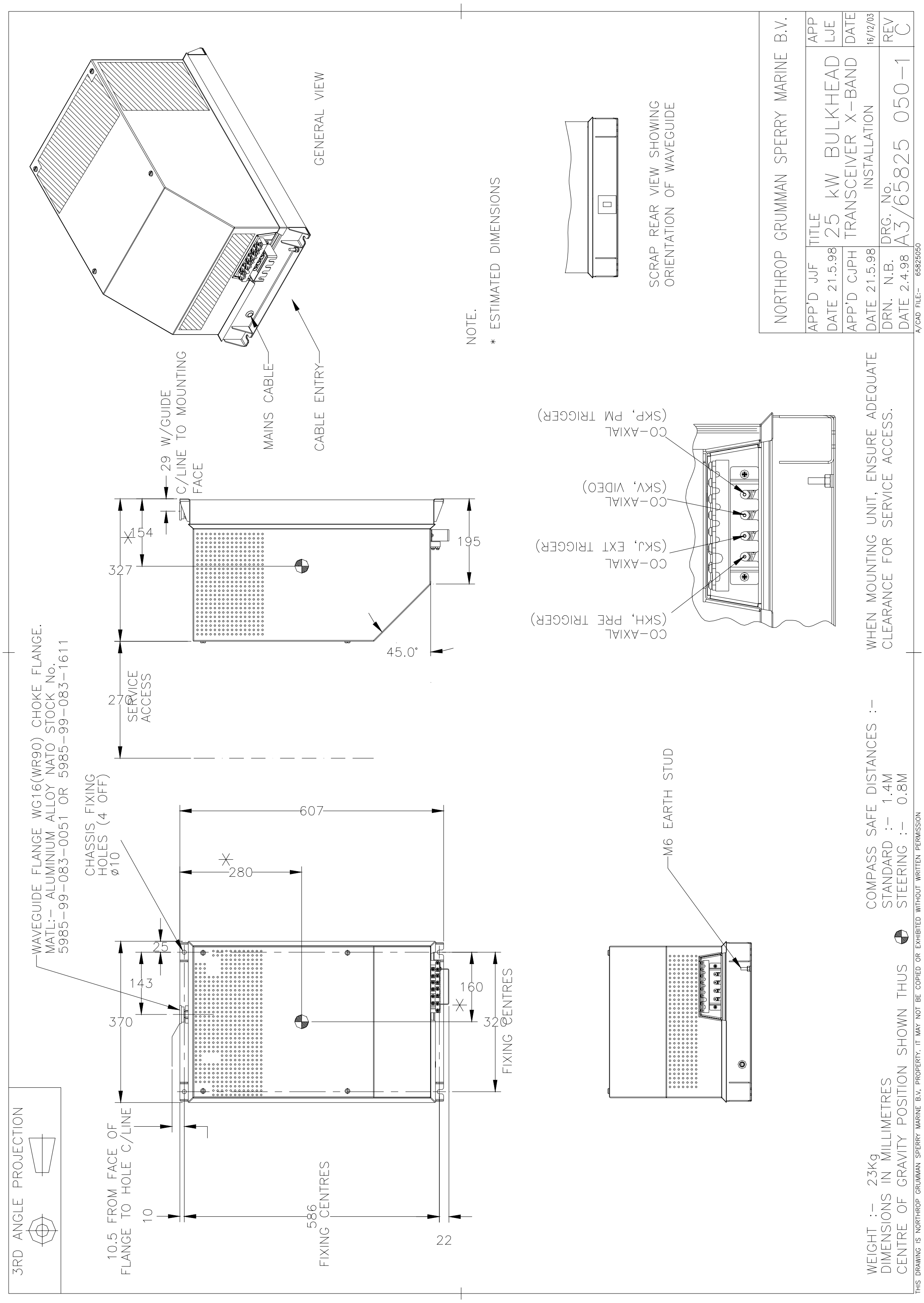


Figure 3.21. X-band Bulkhead Transceiver 25kW Installation

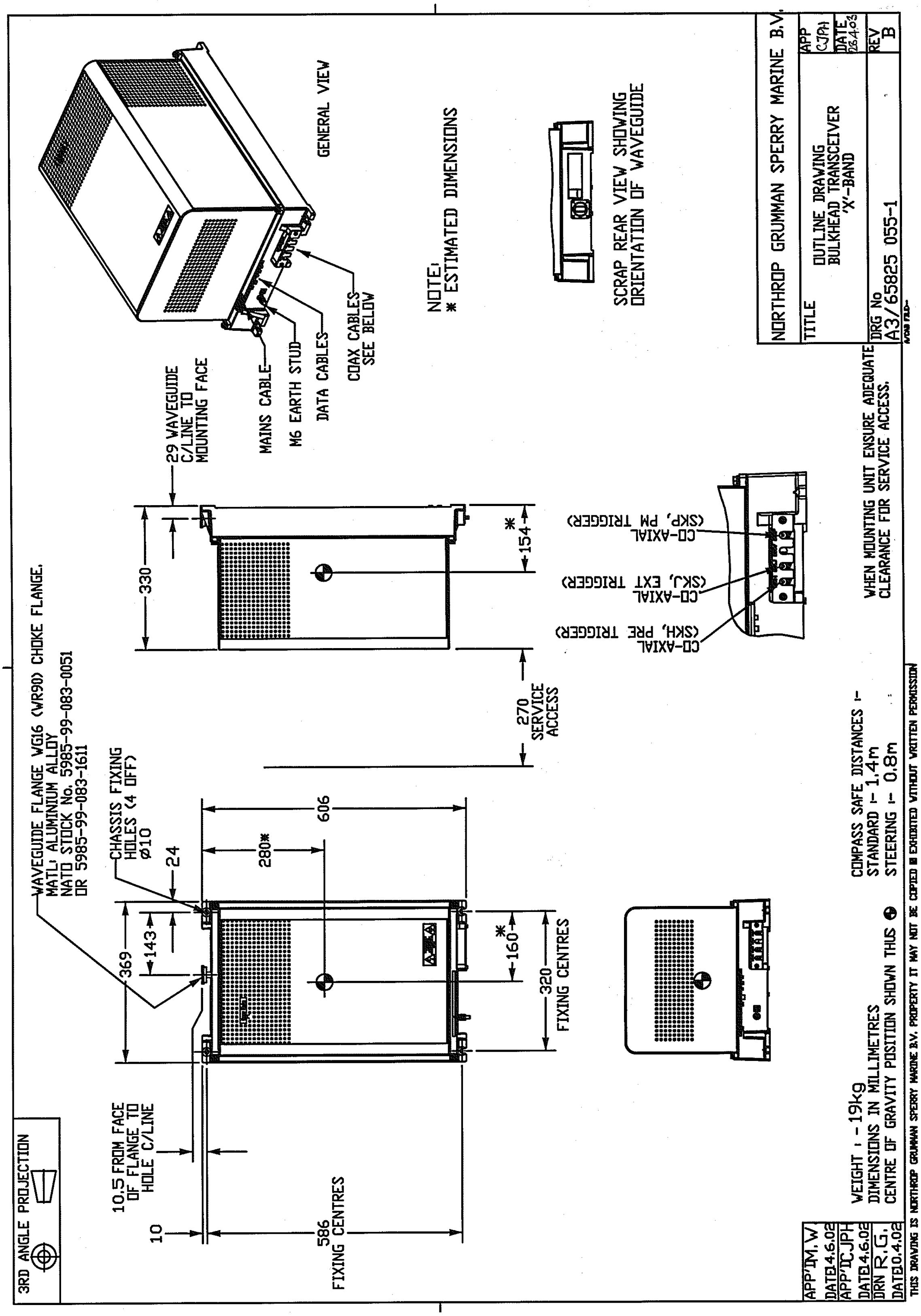


Figure 3.22. X-band Bulkhead Transceiver 25kW (later version) Installation

2.3.1 Cabling Information

Figure 3.23 and Figure 3.24 show details of the cable input. The Transceiver cover, which is secured by four fixing screws, is shown removed. Note that a cable retainer retains the coaxial cables. This must be fitted after the cables are in place. All other cables, with the exception of the X-band RF feeder (waveguide), are individually clamped on their cable braids to provide EMC shielding. The braids are also made off as tails and connected to earth tags provided. The AC mains input is connected to TSE located underneath the cover plate as shown.

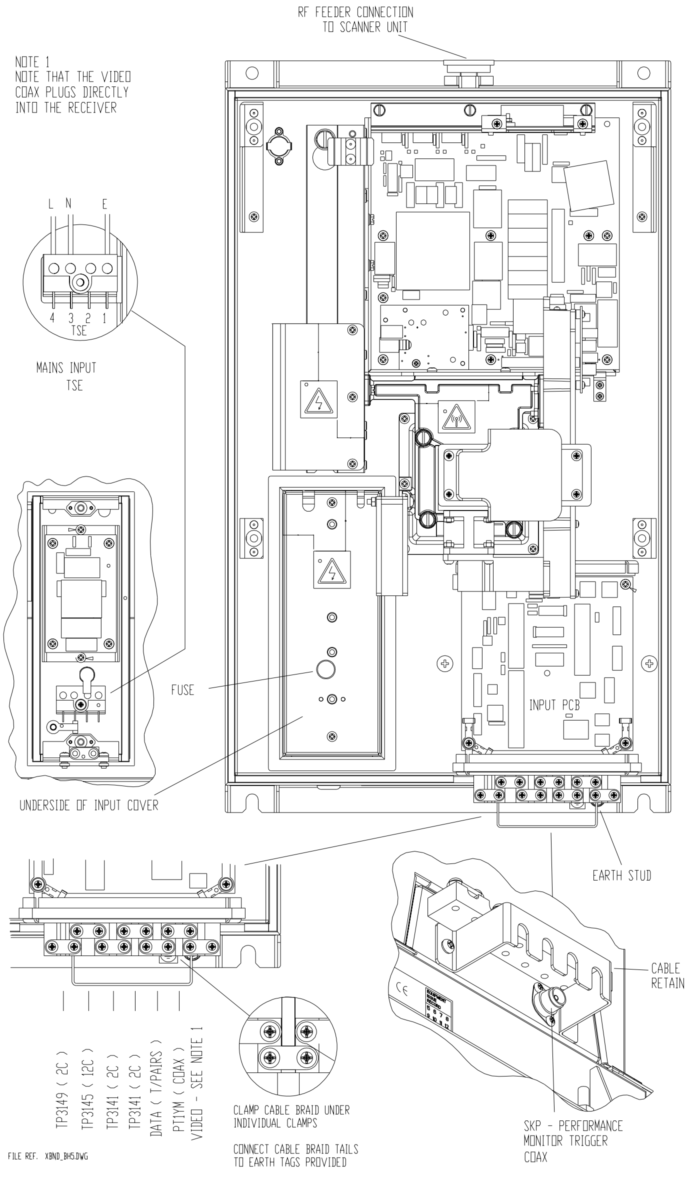


Figure 3.23. X-band Bulkhead Transceiver (early version) – Cable Input Details

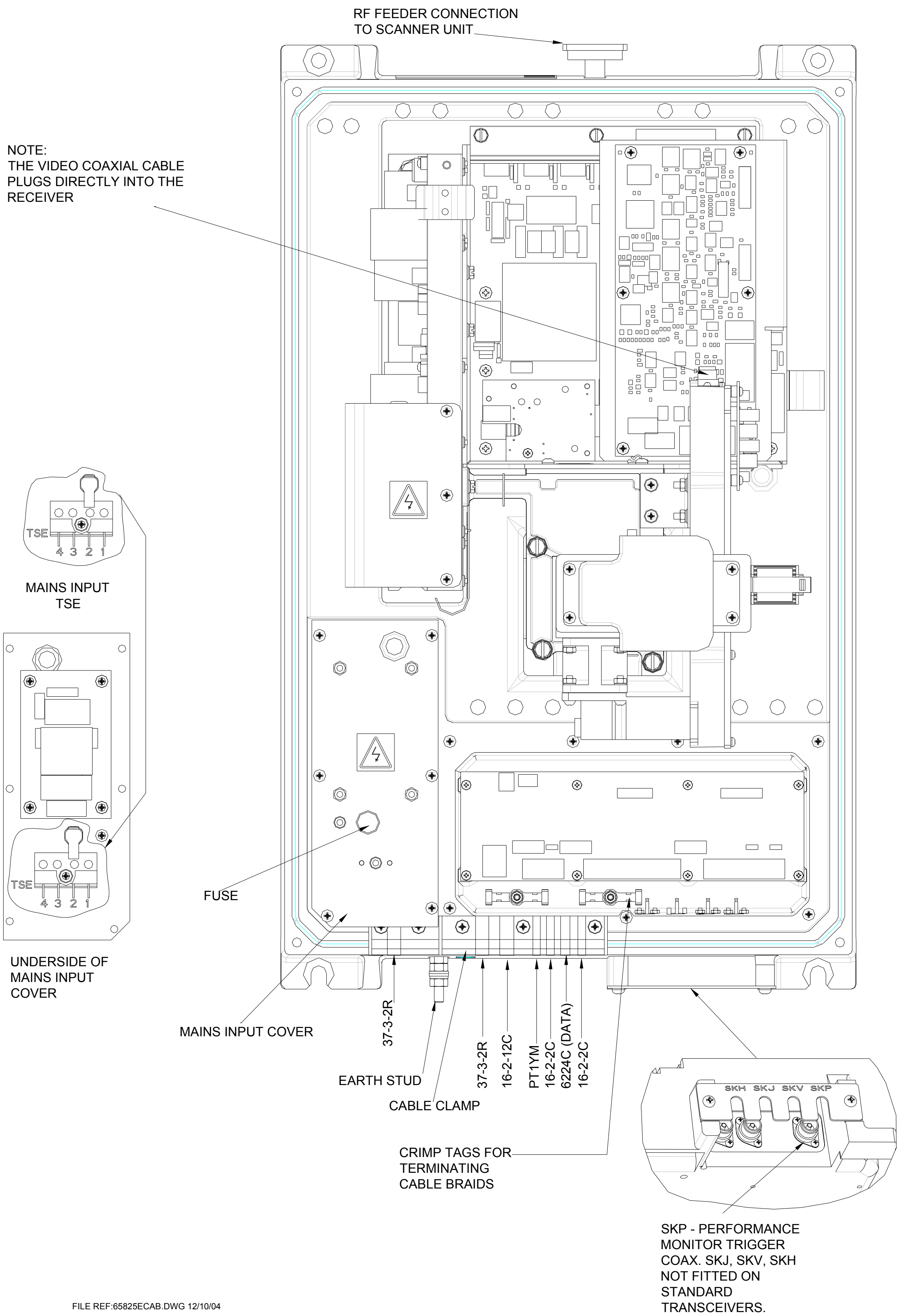


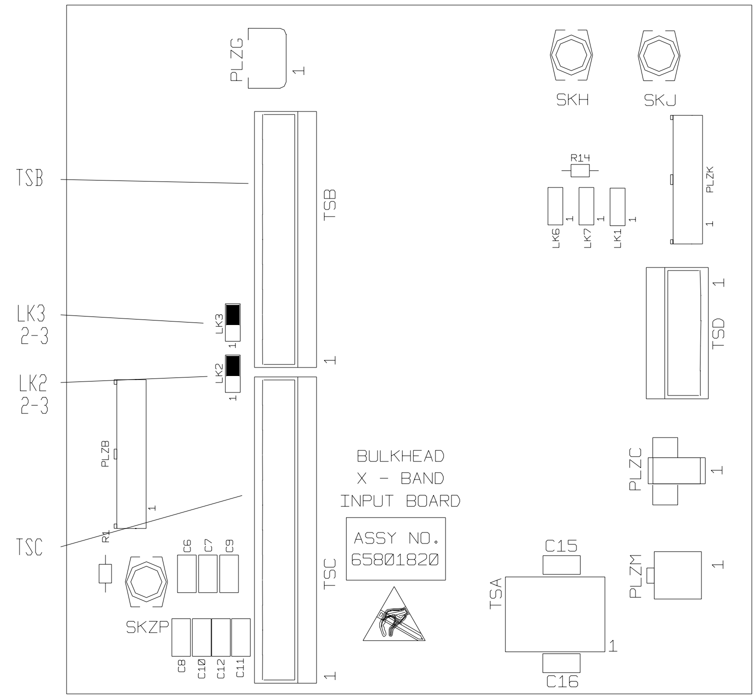
Figure 3.24. X-band Bulkhead Transceiver (later version cast base) – Cable Input Details

Figure 3.25 and Figure 3.26 show details of the Input PCB Assemblies, 65801820 (fitted to earlier units) and 65801814 (fitted to later units). Access to the board is made by removal of the main Transceiver cover, and the Filter Box cover. Refer to the cabling schedules in Section 3 for details of the connections, which are made via the two-part connectors provided.

For additional features transceivers fitted with PCB 65801815 or 65801821, see Chapter 9.

Configuration for normal operation is by link settings as follows:

LK2 Link pins 2 & 3 LK3 Link pins 2 & 3



The following components are not fitted to this PCB:
PLZK, LK1. LK5, LK7, SKH, SKJ, C6-C12,TSD

Figure 3.25. X-band Bulkhead Transceiver (earlier version) - Input Board Details

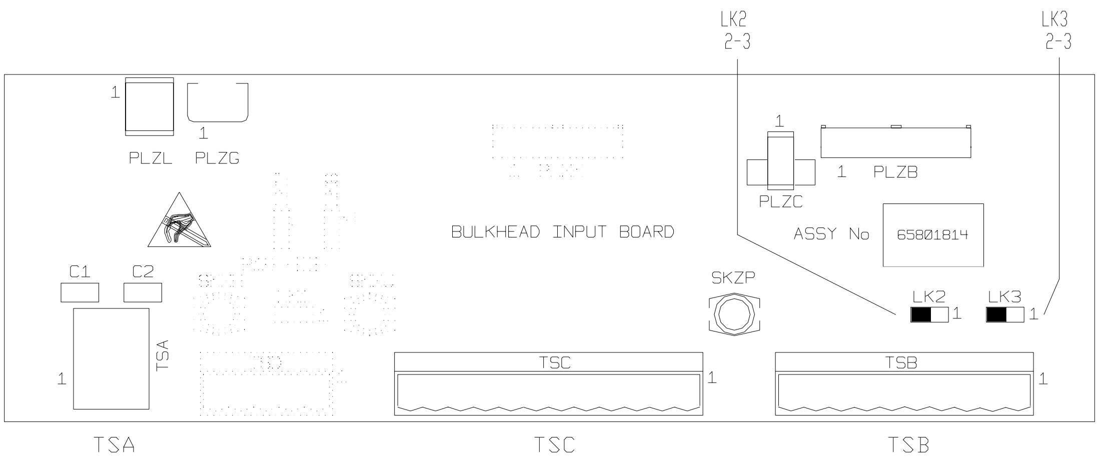


Figure 3.26. X-band Bulkhead Transceiver (later version) – Input Board Details

2.3.2 Fitting the RF Elliptical Waveguide (X-band)

General Information

1. A 33.5mm x 22.9mm corrugated elliptical waveguide is used for the run between the Bulkhead Transceiver Unit and the Turning Unit with X-band radars. The waveguide used is Andrew Antennas Type EW85.

   A 12" flexible waveguide (Part No 1189.z, supplied) must be fitted between the elliptical waveguide and the turning unit.

   (Figure 3.27 to Figure 3.31 are reproduced by permission of Andrew Antennas).
2. Although apparently robust, the waveguide must be protected against strain and kinking, and must be treated with the utmost care at all times. The ends of the waveguide must be kept sealed against the ingress of moisture before the connectors are assembled. The maximum permissible twist is 3°/metre (39").
3. Wherever possible, bends should have a great a bending radius as practicable. A single bend may be made when necessary with a minimum bending radius (measured from the axis of the waveguide) of 203mm (8in) in the 'E' plane, and 482mm (19in) in the 'H' plane.
4. For convenience, the upper (Turning Unit) connector can be fitted prior to installation of the waveguide, (waveguide kits supplied by Sperry Marine have one connector fitted) but the following precautions must be taken:
   a. Any bend required within 1m (3ft) of the waveguide end must be formed before carrying out the cutting and assembly procedure detailed in subsequent paragraphs. Note that no bend may be nearer than 250mm (10in) from the end of the waveguide.
   b. Whenever possible, to allow for movement between the Turning Unit and mast, a double bend should be formed in the waveguide to produce an offset immediately below the Turning Unit.
   c. The waveguide and assembled connector should be fitted to the Turning Unit so that a minimum amount of distortion of the waveguide occurs between the connector and the pre-formed bend.
   d. The waveguide should be installed and secured in position (using the waveguide supports shown in Figure 3.35 as far as is practicable before the lower (Transceiver Unit) connector is fitted to the waveguide. The precautions given in subparagraph **a** above must be observed if a bend is required adjacent to the Transceiver Unit.

ASSEMBLING THE CONNECTORS

General

5. A straight connector (Type 185BC) is used to terminate the waveguide at each end.

Tools required

6. The normal tools found in an engineer's tool kit, a hacksaw (with a fine-toothed blade) and 1-15/16in open-ended spanner will be sufficient for fitting the connectors to the waveguide.

Procedure

7. The procedure that follows is applicable to the straight connectors at each end of the waveguide. Note that it is most important that swarf and other foreign matter should be prevented from entering the waveguide.
8. Prepare the waveguide end and assemble the connector as follows:
   a. Ensure that the end of the waveguide is straight for at least 250mm (10in). The ends of the EW85 must be cut squarely. Wrap a straight edged piece of paper around the waveguide to ensure squareness, tilt waveguide downwards to prevent copper swarf entering and then remove a 24mm (15/16in) length of the polyethylene jacket. Clean the external copper with Comothene (or Ultraclean) solvent and the interior with a bottlebrush, (see Figure 3.27).

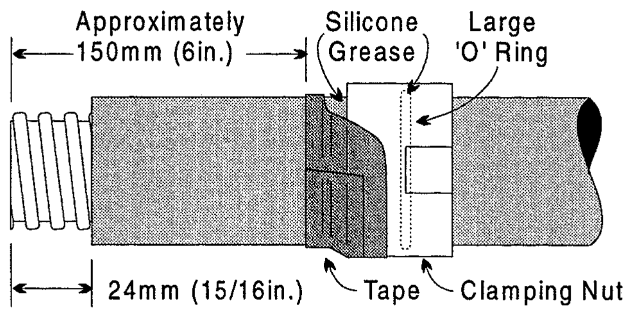


Figure 3.27. Cut Jacket

   b. Apply a thin film of silicone grease (MS4 or similar) to the large 'O' ring and insert in the internal groove of the clamping nut; apply a thin film of grease to smooth internal surface of the clamping nut and slip the nut over the end of the waveguide as shown in Figure 3.27. Wrap several turns of tape around the clamping nut and jacket to prevent foreign matter from entering.

c. Grease the cut edge of the jacket, slip the chamfered end of the compression ring over until the recessed edge bottoms against the jacket (align pin in holes facing away from the jacket) as shown in Figure 3.28 and.Figure 3.29.

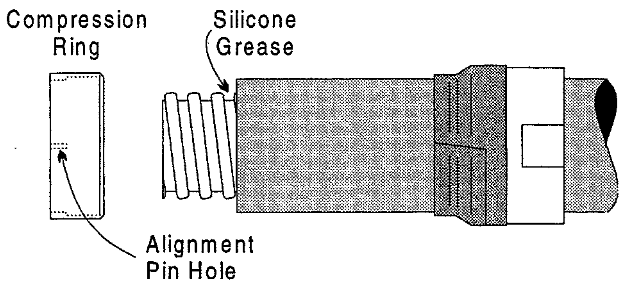


Figure 3.28. Fit Compression Ring

d. Turn the gasket inside out and fit on the end of the waveguide, apply a thin film of silicone grease to the gasket threads, roll the gasket over to the correct position and against the compression ring. See Figure 3.29 and apply a thin film of grease to the outside surface of the gasket. Clean any grease from the exposed copper with solvent.

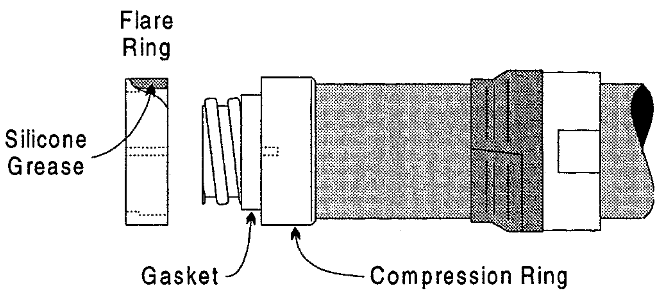


Figure 3.29. Fit Flare Ring

e. Fit the recessed side of the flare ring over the gasket, with alignment holes of the flare ring and compression ring corresponding. Push the flare ring firmly against the compression ring (see Figure 3.30).

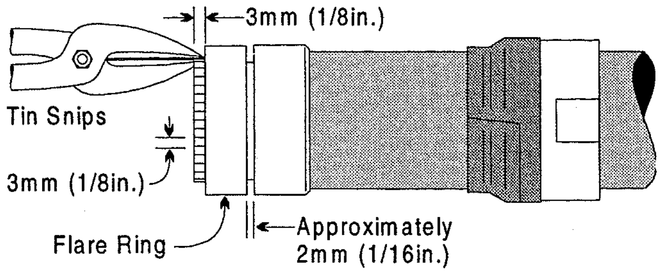


Figure 3.30. Cut Tabs

f. With tin-snips, cut the bared end of the waveguide into tabs 1/8in wide and 1/8in deep – as close to the flange as possible, (see Figure 3.30) Flatten the tabs against the flare ring with a mallet using minimum force. Heavy blows will reduce the thickness of the copper, (see Figure 3.31). Trim off any tab protruding beyond the periphery of the flare ring; clean the tabs with solvent to remove any silicone grease.

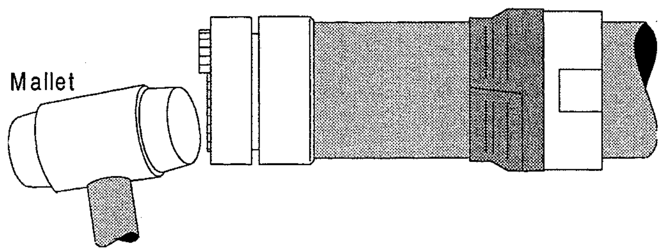


Figure 3.31. Flare End

g. Ensure that the mating RF contact face of the Type 185AC connector body is clean and thoroughly grease-free. Clean the inside of the waveguide with a bottlebrush.

h. Fit the smaller 'O' ring to the external groove on the connector body without any grease, (see Figure 3.32). Apply a thin film of grease to the rear outer surface of the compression ring (so that large 'O' ring in the clamping nut will slide over the compression ring and seat in the recess).

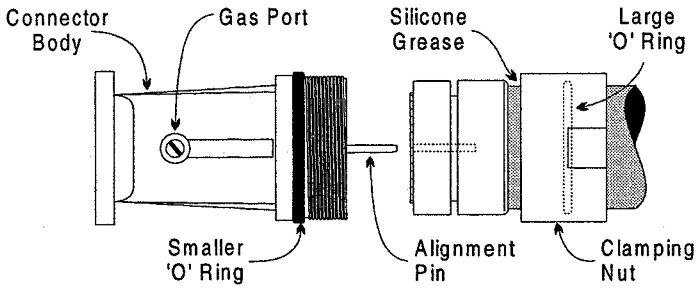


Figure 3.32. Fit Connector

i. Place the connector body against the flare ring. Insert the alignment pin in the holes of the flare ring and compression ring. Remove the tape from the clamping nut, slide it over the rings and screw to the thread on the connector body.

j. Hold the rectangular part of the connector body with an adjustable spanner and tighten the clamping nut with 1-15/16in set spanner across the flats. DO NOT turn the connector body.

Fitting the Deck Gland

9. The EW85 waveguide passes through its own separate deck gland, part no 9391991 (sks86347/a), positioned near the foot of the mast. The kit comprises a deck gland, gasket, upper and lower pressure plates, 4 off m6x25 screws and 4 off split gaskets.

10. After cutting the deck and fitting the flange using suitable fixings (not supplied – see Figure 3.33), assemble the deck flange split gaskets (refer to notes) loosely around the waveguide section from below and slide the assembly upwards into the deck gland (see Figure 3.34). Secure the waveguide down the mast then tighten the four split gasket screws carefully. <u>Do not over-tighten the screws.</u> This avoids possible distortion of the waveguide.

    a. Fill the space between the waveguide and deck gland with hermastic oil-proof compound (see Figure 3.34).

Notes: Split gaskets are to be fitted in alternative positions to ensure that the split does not line up with the split of adjacent gasket.

Initially, assemble the gaskets loosely before inserting them into the deck flange (see Figure 3.34). This assembly may be inverted to allow greater accessibility to the screws.

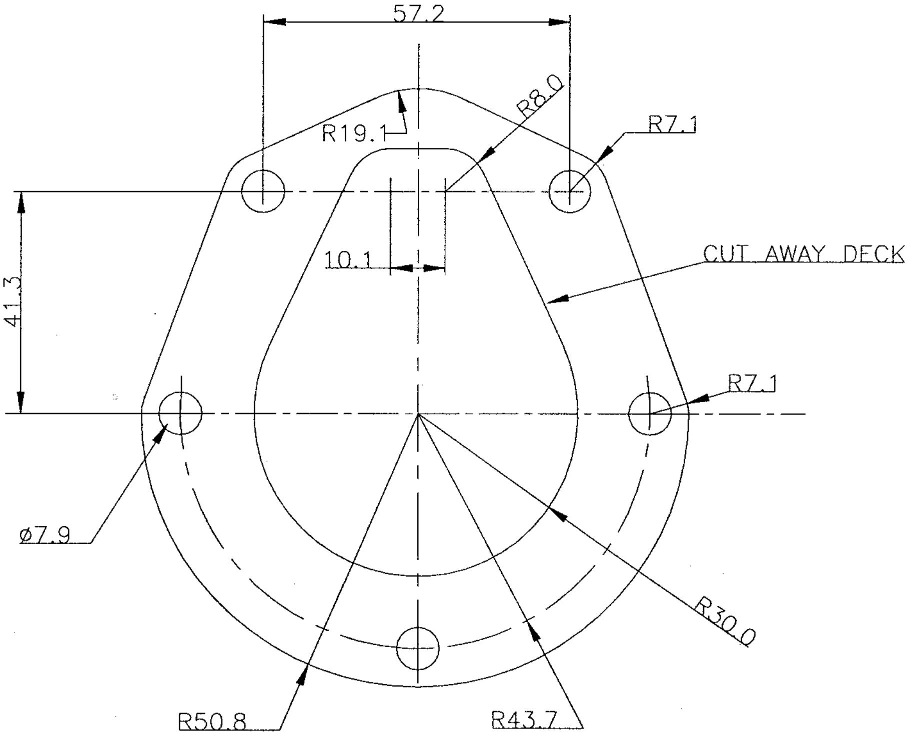


Figure 3.33. Deck Gland Fixings

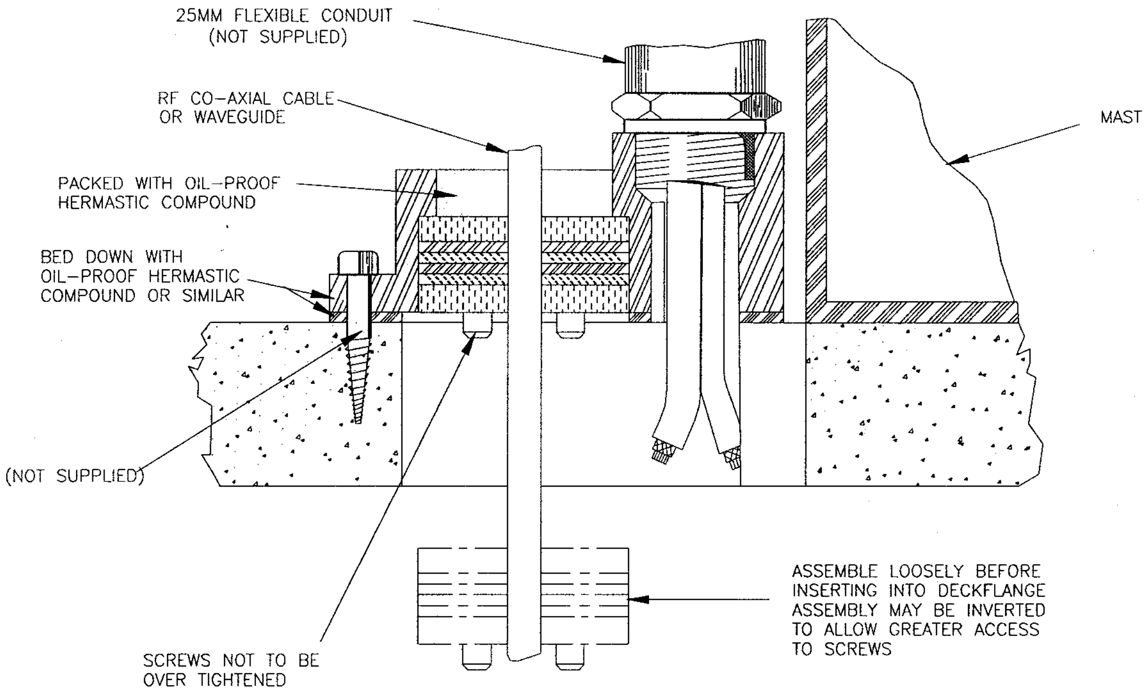


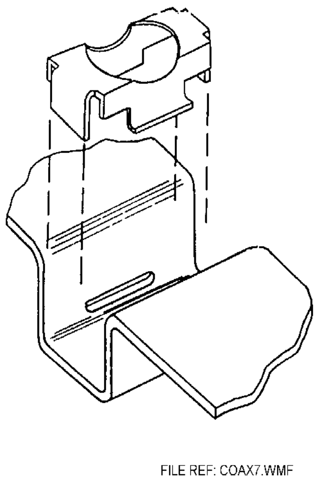
Figure 3.34. Deck Gland Details

Note – If cables are not routed via conduit into a deck gland, ensure that the cable entry hole is fully sealed using a suitable silicone sealant.

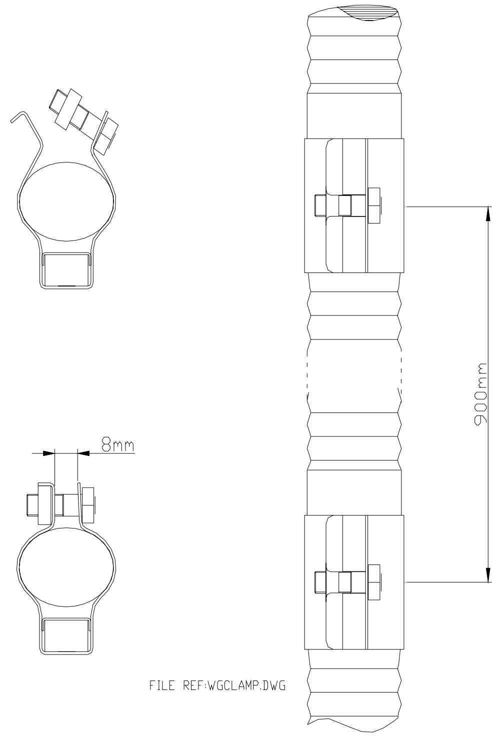
Installing the Waveguide

11. Waveguide hangers are supplied (Andrew hanger kit type 42396a-5) for supporting the waveguide along its run between the scanner unit and the bulkhead transceiver. Each kit contains 10 hangers. Their associated support assembly (Andrew type 1116.b) and fixing kit (Andrew type 31769-1) are included as part of the installation kit. Normally, a hanger is attached to a cable entry tray using suitable bolts at the recommended spacing of 0.9 metres (3ft). The support brackets must be fitted to the hangers to prevent distortion when the hanger is wrapped around the waveguide as show in Figure 3.35.
12. Figure 3.35 also shows additional hardware (not supplied in the installation kit) that facilitates special mounting arrangements. If required, these are obtainable from Andrew Corporation.

Add support bracket 42241



Recommended
hanger spacing



Attach hangers to support structure

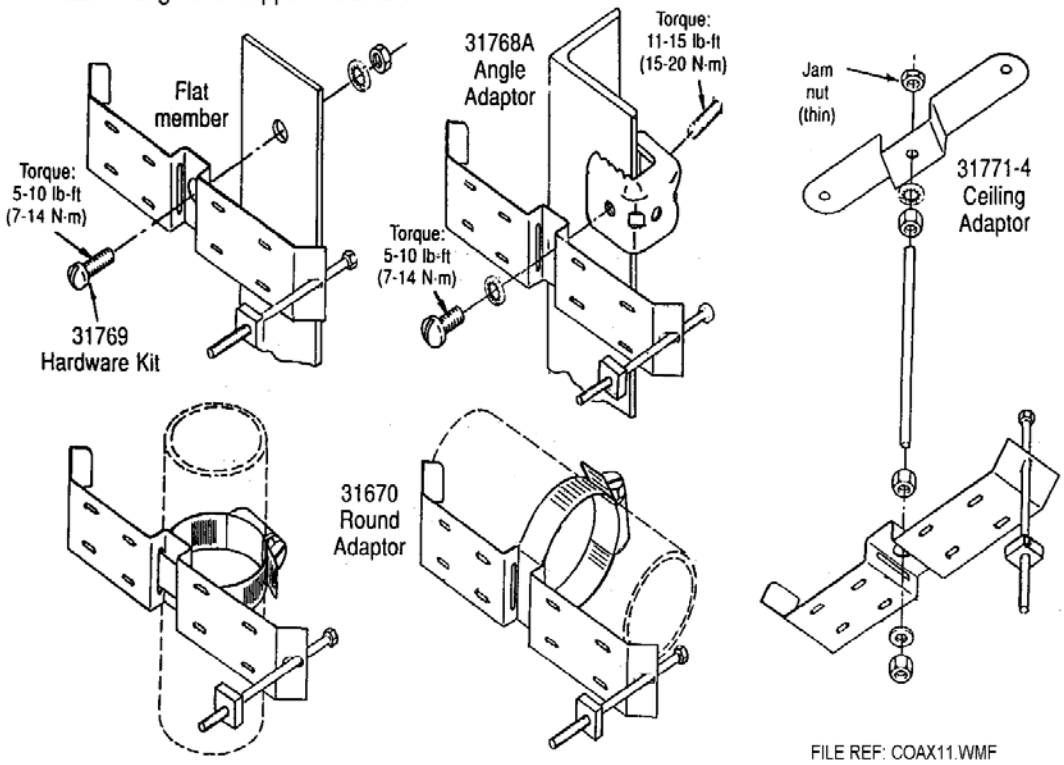


Figure 3.35. Waveguide Support Details

2.4 S-band Scanner Unit

The Scanner Unit comprises the following main elements, each of which is supplied in its own packing, together with relevant Installation Drawings:

Turning Unit With/without Integral Transceiver (30kW)
Despatch Kit 65830660
(Installation Drawing 65830050)

NB: a Bulkhead system would also be supplied with the following:

Bulkhead transceiver (30kW)
Despatch Kit 65831660
(Installation Drawing 65831050)

Antenna 12ft or 9ft

Antenna Despatch Kit 65612610
(Installation Drawing 65612050-054)

Installation of the Scanner Unit entails carrying out the following operations, preferably in the sequence outlined below:

1. Preparation of the site (see notes at the beginning of this chapter).
2. Bolting the Turning Unit to the mounting platform (ship's structure) as detailed in Installation Drawing 65830050 supplied with the Turning Unit
3. Bolting the Support Casting to the Turning Unit as detailed in Installation Drawing 65612050-054 supplied with the Antenna Despatch Kit
4. Bolting the Antenna to the Support Casting as detailed in Installation Drawing 65612050-054 supplied with the Antenna Despatch Kit
5. Laying in and installing the cables for the motor and the Turning Unit in accordance with the Cabling Schedules below

Figure 3.36 to Figure 3.40 also show installation details that are intended to duplicate those provided with the equipment. However, as changes may occur to the details that may not be reflected in this manual, the installation drawings supplied with the equipment take precedence in the event of differences arising.

Turning Unit

CAUTION

The weight and spread of the Antenna can cause a freestanding Turning Unit to topple over. The Turning Unit should therefore be bolted down onto its mounting platform before attaching the Antenna and Support Casting to the Turning Unit.

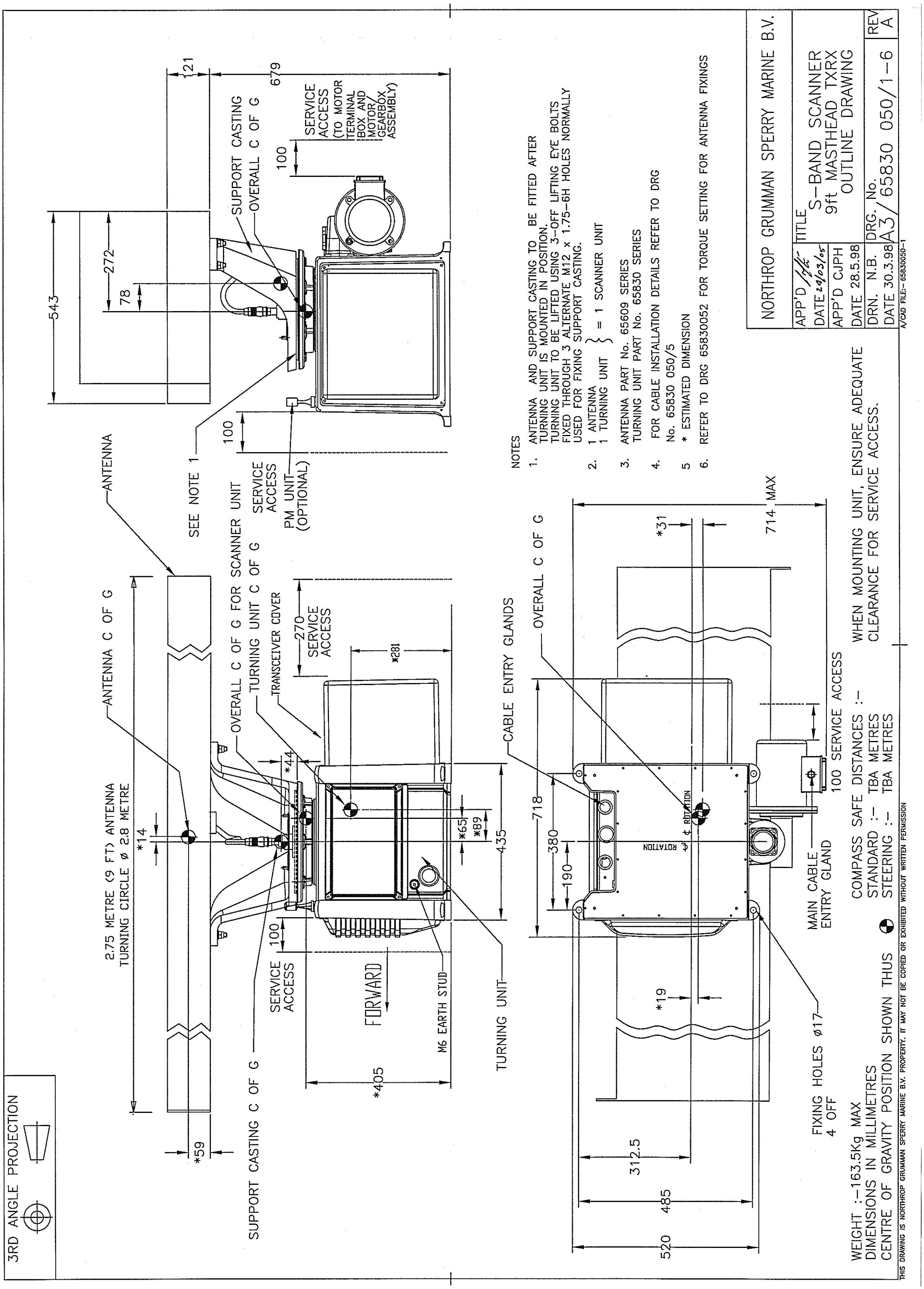


Figure 3.36. S-Band Scanner 9ft Masthead Tx/Rx 30kW Installation

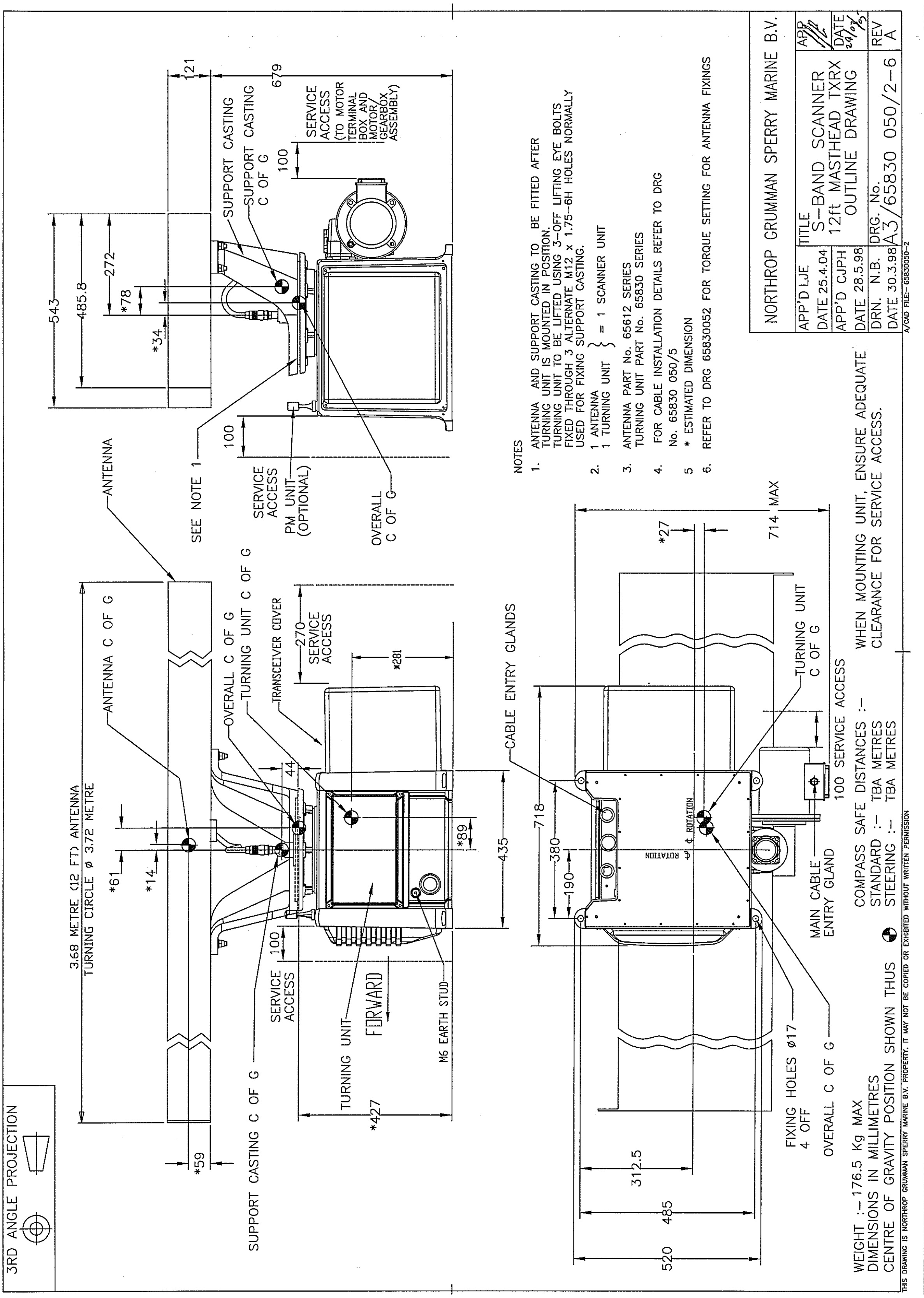


Figure 3.37. S-Band Scanner 12ft Masthead Tx/Rx 30kW Installation

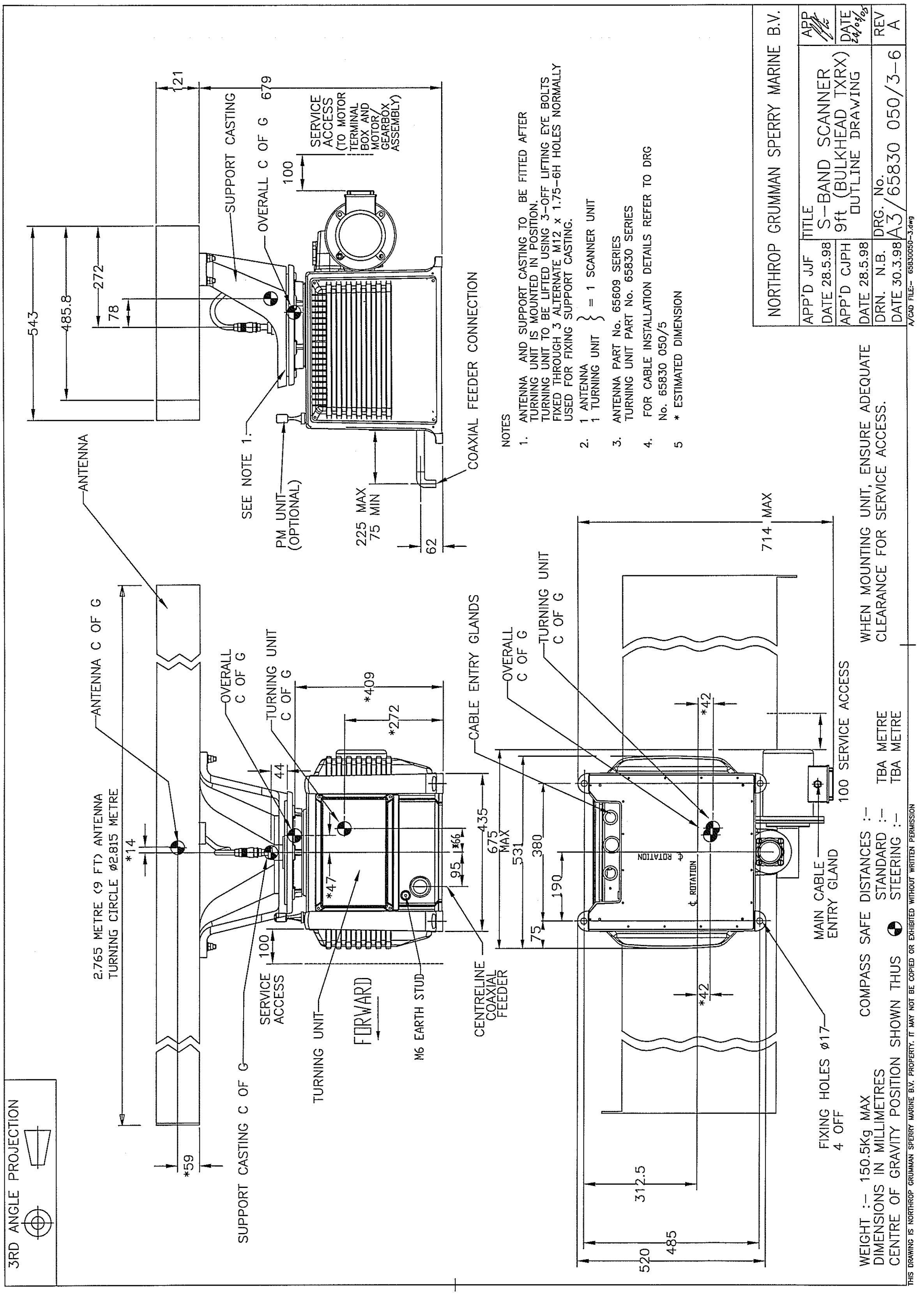


Figure 3.38. S-Band 9ft Bulkhead Tx/Rx Installation

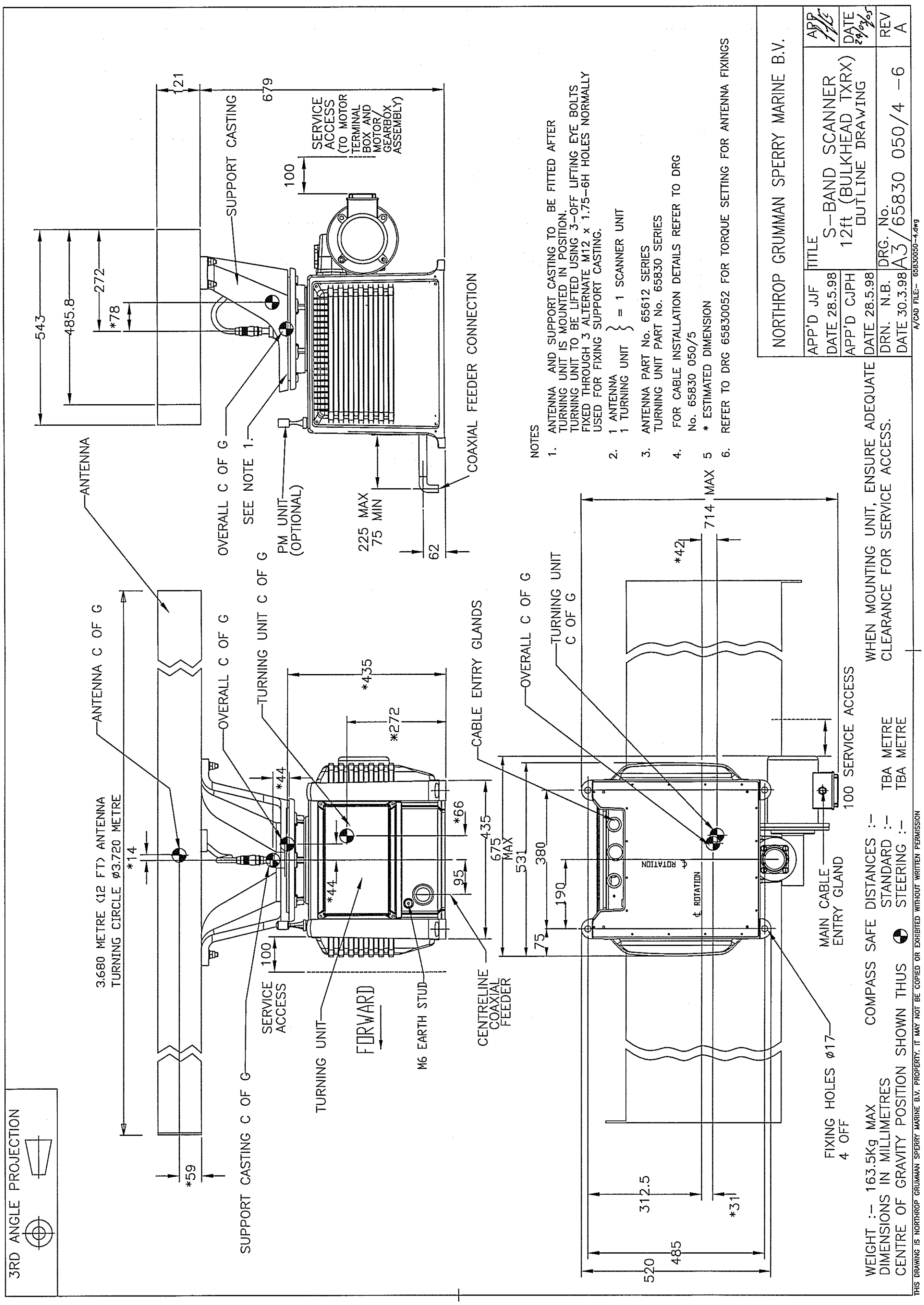
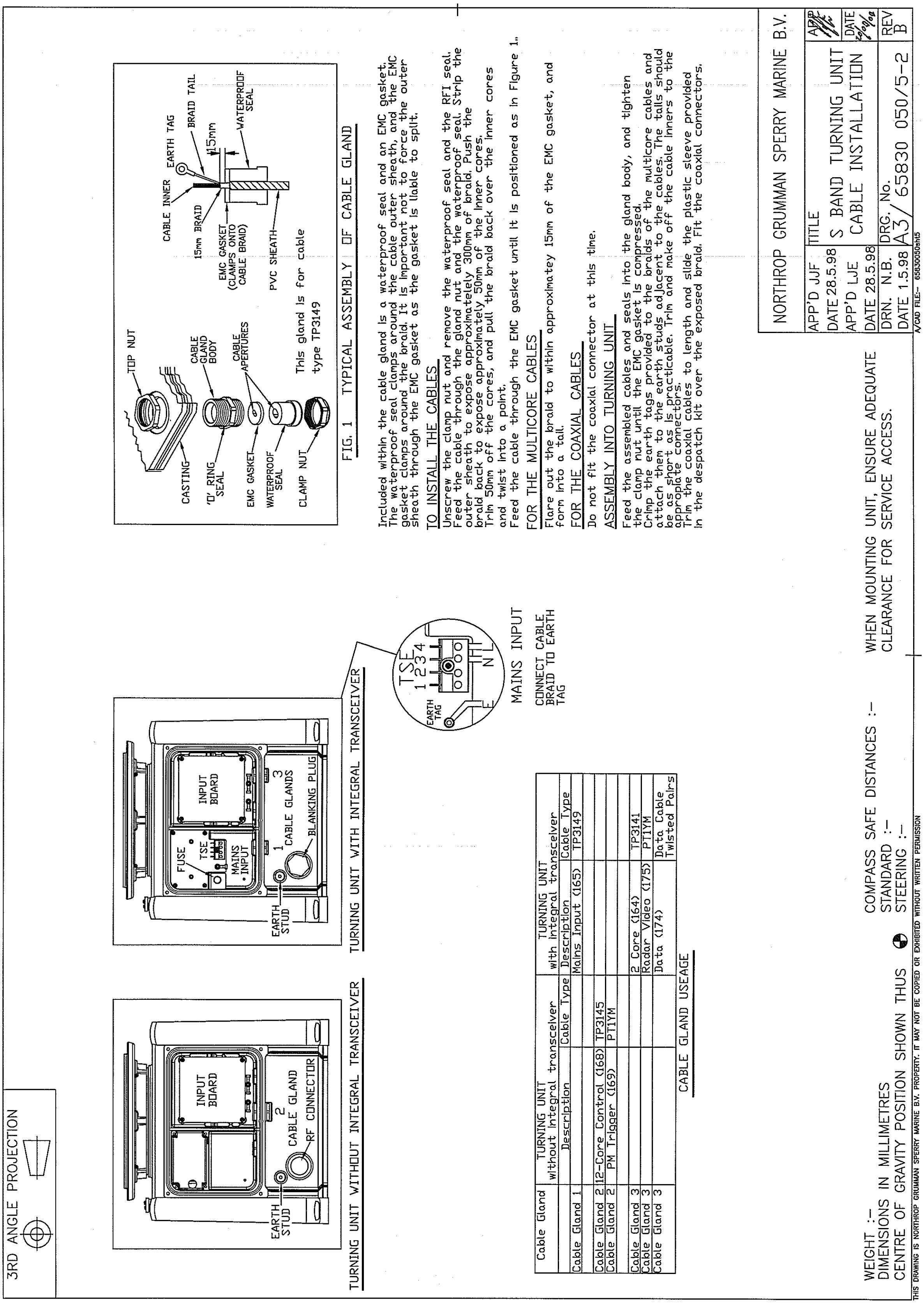


Figure 3.39. S-Band Scanner 12ft Tx/Rx Installation



Cable Gland	TURNING UNIT without integral transceiver		TURNING UNIT with integral transceiver	
	Description	Cable Type	Description	Cable Type
Cable Gland 1			Mains Input (165)	TP3149
Cable Gland 2	12-Core Control (168)	TP3145		
Cable Gland 2	PM Trigger (169)	PT1YM		
Cable Gland 3			2 Core (164)	TP3141
Cable Gland 3			Radar Video (175)	PT1YM
Cable Gland 3			Data (174)	Data Cable Twisted Pairs

CABLE GLAND USEAGE

Figure 3.40. S-Band Turning Unit Cable Installation

If it is necessary to lift the Turning Unit by crane, three M12 lifting eyebolts must first be screwed into the torque tube in the three positions shown in Figure 3.41. The eyebolts are fitted in a symmetrical pattern in three of the six holes normally used for attaching the Support Casting to the Turning Unit; only three of the holes are tapped. Remove the eyebolts after the Turning Unit has been bolted to the mounting platform. (Reference should be made to "BS4278 Eyebolts for Lifting Purposes" and the safe use of lifting equipment in accordance with the Health and Safety Work Act, Part 1 Section 6.)

Note – Under no circumstances should a combined Turning Unit and Antenna Unit be lifted by the Antenna Unit. To do so would be dangerous and would result in damage to the Antenna Unit.

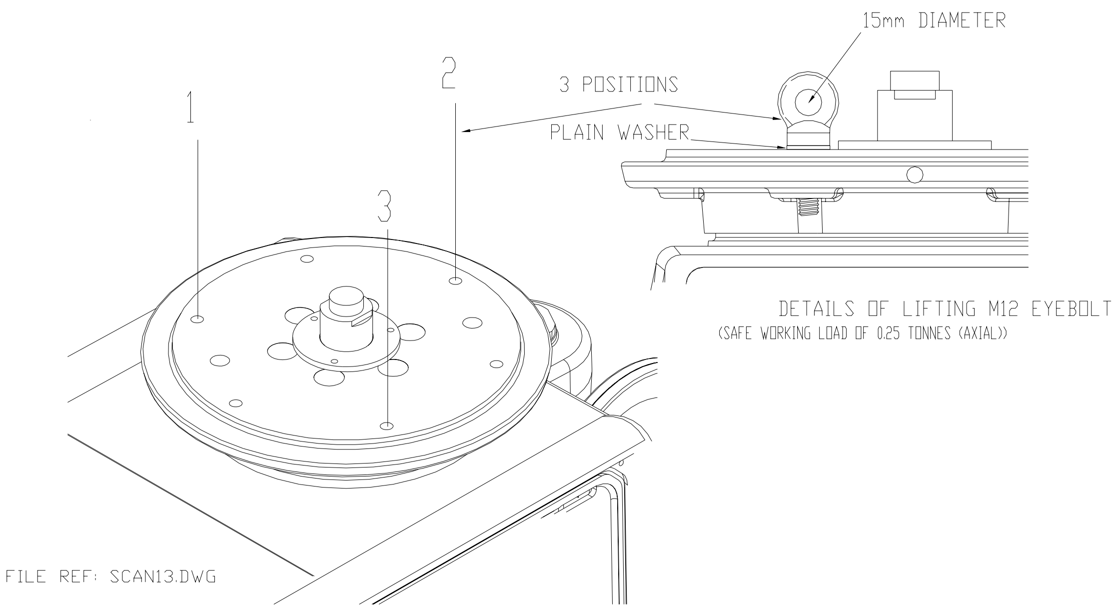


Figure 3.41. Attachment of Lifting Eyebolts

The Turning Unit is attached to the mounting platform using the fixings supplied in the Turning Unit Despatch Kit 65830660.

Figure 3.42 shows how these are fitted. Ensure that all threads and bushes are coated with Densopaste.

Note – The Turning Unit is bolted directly to the mounting platform without any intervening washer or pad, except for the purpose of levelling the mounting so that the Turning Unit casting is not subject to twist when the bolts are tightened. M16 washers may be used as shims, or purpose made parts produced locally may be used.

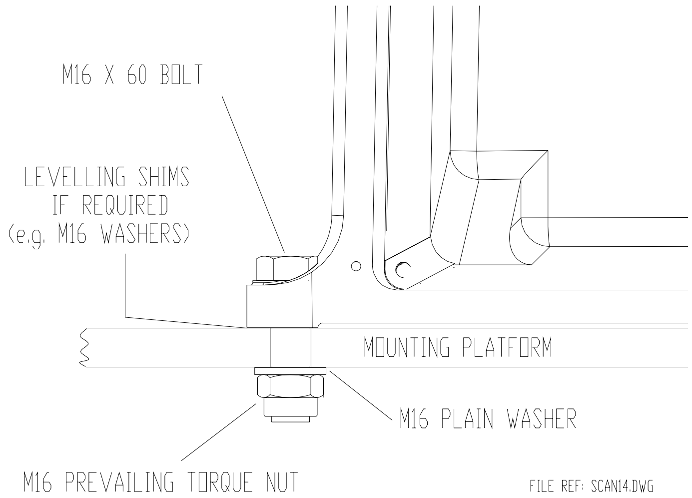


Figure 3.42. Fixing the Turning Unit to the Mounting Platform

2.4.1 Support Casting

The Support Casting is fitted to the Turning Unit torque tube using Fixing Kit 65612611, which is part of the Antenna Despatch Kit 65612610.

Figure 3.43 shows how these are fitted. Ensure that all threads and bushes are coated with Densopaste.

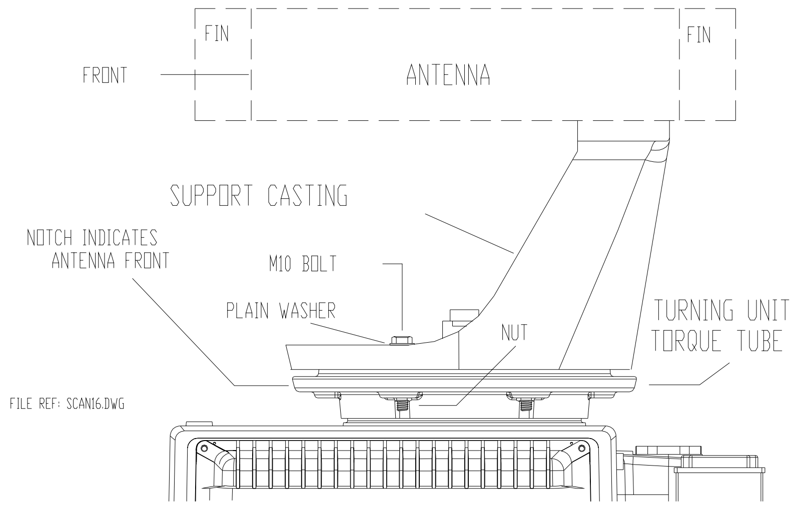


Figure 3.43. Fixing the Support Casting to the Torque Tube

2.4.2 Antenna

The Antenna is fitted to the Support Casting using the parts listed below which are supplied with the antenna:

4 off M12 Stainless Steel Prevailing Torque Nuts (grade 316S16)
6 off Spacers
2 off Lock Tabs

Figure 3.44 shows where these are fitted. Ensure that all threads and bushes are coated with Densopaste. For full fitting instructions see drawing 65830052 supplied with the equipment.

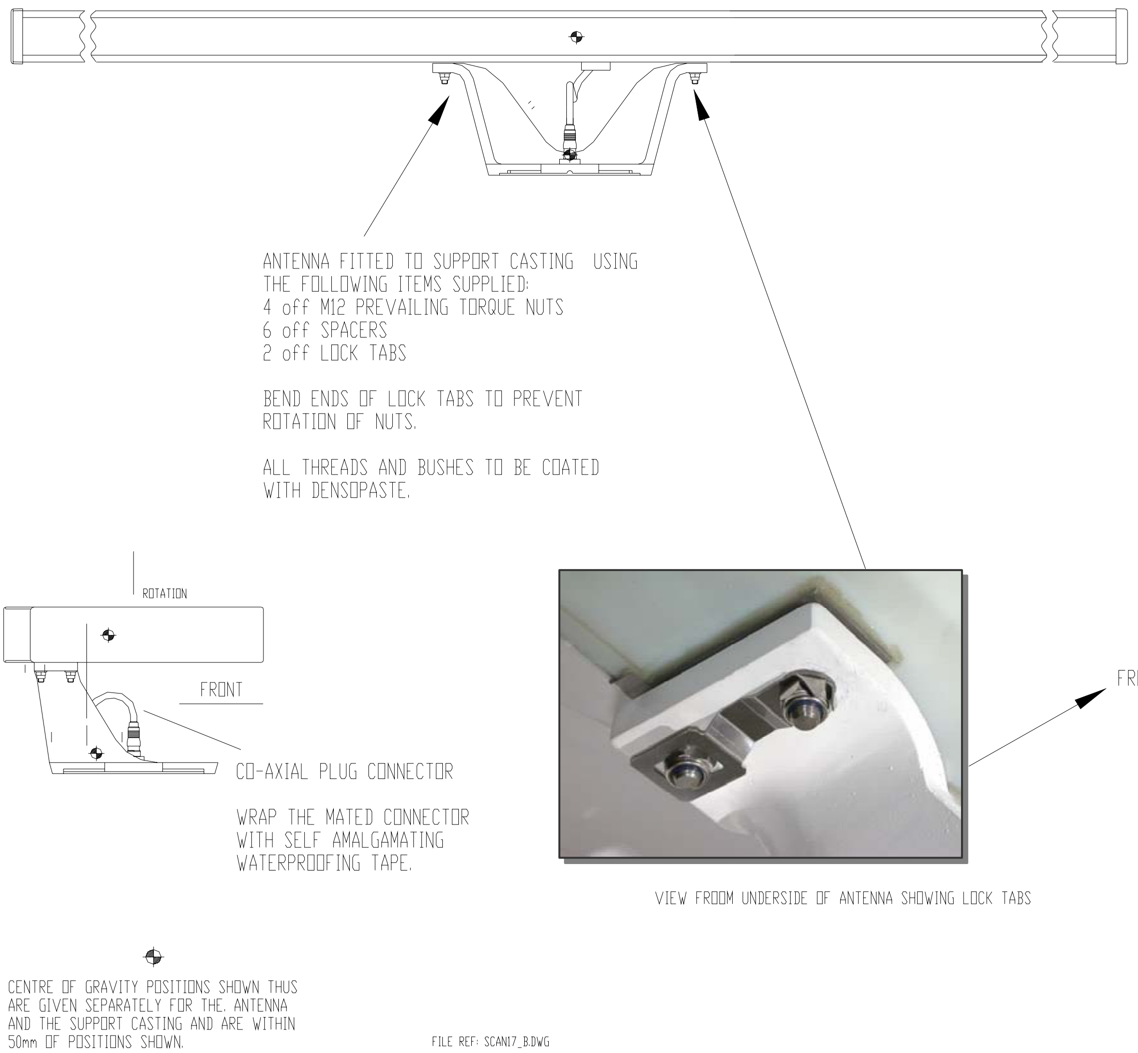


Figure 3.44. Fixing the Antenna to the Support Casting

Note – The lock tab ends must be bent as shown to prevent rotation of the nuts.

The next step is to mate the S-Band coaxial cable from the Antenna with the Turning Unit RF connector and to wrap the mated connector with self-amalgamating tape as an additional precaution against water ingress.

2.4.3 Cabling Information

Figure 3.45 shows the cable entry points. Three of these are via cable glands labelled 1, 2 & 3 details of which are given in the accompanying table.

The RF cable input is only required when the Transceiver is mounted below decks (Bulkhead).

The motor supply cable is connected directly to the motor termination blocks mounted in the box on the side of the motor.

A 6mm stud is fitted to enable the unit to be bonded to the ship's structure. This must not be used for any other connection.

Note – Drawing is for turning unit without integral transceiver. Refer to the table later in this section for details of cable fitted for different variants.

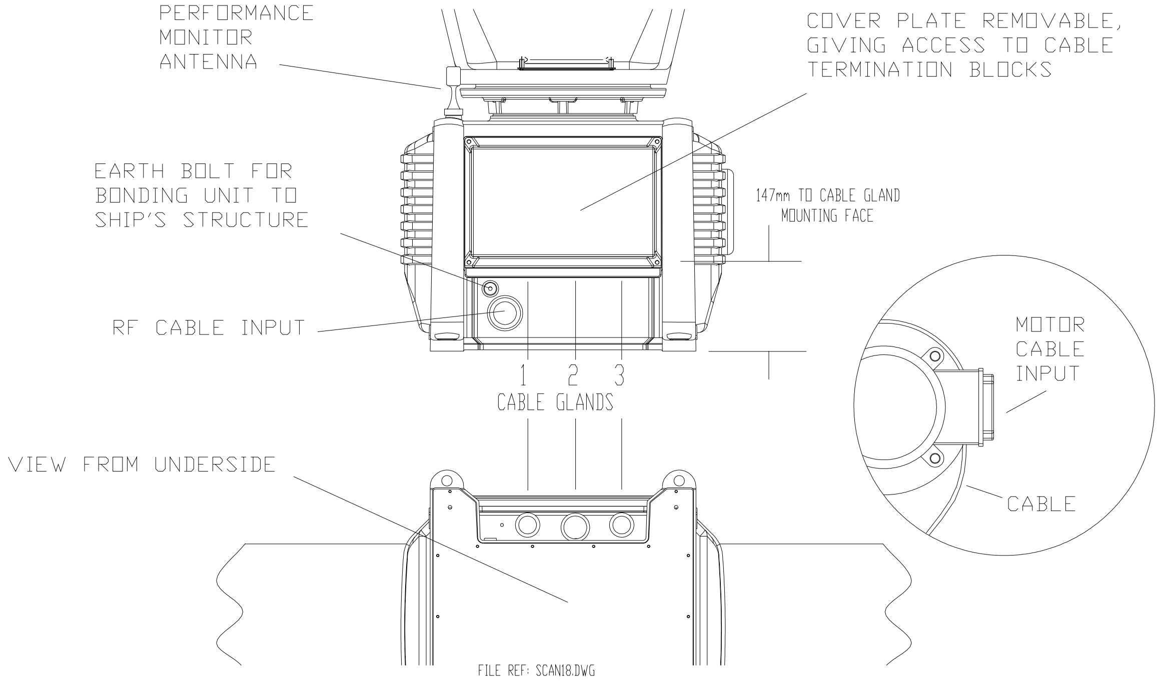


Figure 3.45. Turning Unit – Cable Entry Locations

The diagrams below show details of the Input Board 65801813 or (65801819) and the Mains Input connector, (integral transceiver only) TSE. These are revealed on removal of the cover plate, which is retained by four fixing screws (see Figure 3.45). Links LK3 and LK4 on the Input Board should be set as shown in.Figure 3.46 Link LK5 is fitted. Details of the motor connections are described separately.

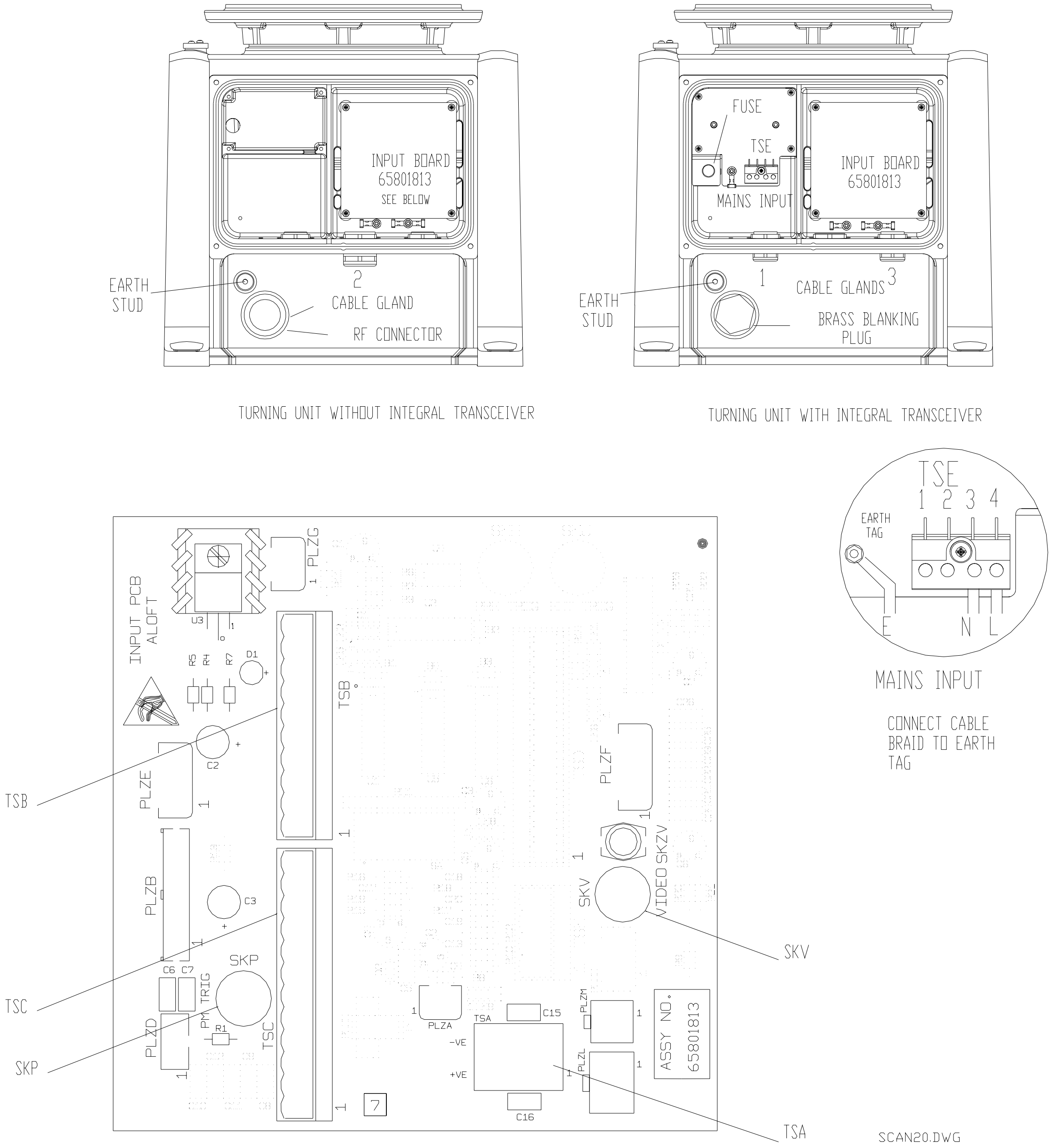


Figure 3.46. Turning Unit – Input Board and Mains Input Details

Input Board 65801813 fitted to later units

For earlier units fitted with Input Board 65801804:

LK3 and LK4 should be set in position 2 - 3

LK5 should be fitted ("S" band only)

For Input Board 65801819, see Chapter 9.

The table below shows the route by which each cable enters the Turning Unit (with or without an Integral Transceiver) for systems with Additional Features see drawing in Chapter 9. For details of how to terminate the cables into their connector blocks, see the cabling schedules (Section 3.5) and system diagrams (Section 3.1).

Each of the cable glands has a waterproof seal and a separate EMC seal, both of which must be installed as shown in Figure 3.50.

Details of terminating the RF feeder cable (S-Band coaxial) are in Section 2.5.2.

Cable Gland	Turning Unit without Integral Transceiver		Turning Unit with Integral Transceiver	
	Description	**Cable Type**	**Description**	**Cable Type**
Cable Gland 1	-	-	Mains Input	37-3-2R
Cable Gland 2	12-Core	16-2-12C	-	-
Cable Gland 2	PM Trigger	75Ω co-ax	-	-
Cable Gland 3	-	-	2-Core	16-2-2C
Cable Gland 3	-	-	Radar Video	75 Ω co-ax
Cable Gland 3	-	-	Data	T/Pairs
RF Connector	RF Feed	S-Band co-ax	-	-

2.4.4 Motor Connections

Various motor types are available to cater for the different mains supplies and the standard/high speed antenna rotation rate variants.

The following table gives the available motor alternatives:

Mains Supply Characteristics	Motor Type for Standard Speed Antenna	Motor Type for High Speed Antenna
110/120/220/240 Volts, 1ϕ (50/60 Hz)	91003757	91003759
110/120 Volts, 3ϕ (50/60 Hz)	91003752	91003754
220/240/380/440 Volts, 3ϕ (50/60 Hz)	91003751	91003753

CAUTION

As can be seen from the table, dual voltage motors are used for both single and 3 phase supplies. 110-120/220-240 Volts for single phase, 220-240/380-440 Volts for 3 phase. In addition to the wiring up of the mains supply to these motors, the windings must also be correctly configured for the appropriate voltage. Incorrect configuration will adversely affect the unit's performance – refer to connection details below.

For all motor types, the mains cable must first be fed through the cable gland on the motor termination box housing. The cable braid must be connected to the motor chassis, and the individual insulated conductors connected to the appropriate terminals as detailed for each motor type in the following section. Ensure that the cable is not under strain in the termination box area, and that sufficient slack is available to remake the connection, should this ever be necessary, e.g. if a motor is changed in service. Also, ensure that the insulated conductors are terminated appropriately, using ring crimp terminals on threaded studs, or stripping insulation back by 5mm for screw compression pillars.

Ensure that any gasket fitted for sealing the terminal box cover is correctly seated when the cover is re-secured.

Single Phase Motor Connections

Make connections according to the label on the inside of the termination box cover. Ensure that the rated motor volts are matched to the supply. If the radar antenna rotates in the wrong direction, re-configure the connections on the motor according to the diagram on the motor housing (the radar antenna should rotate anti-clockwise when viewed from below).

Dual voltage single phase motors; connection details are shown in Figure 3.47.

There are 6 wires from the motor housing to the terminal block numbered 1, 2, 3, 4, 5 and 8. Connect the wires to the terminal block as detailed in Figure 3.47 for the required motor supply voltage.

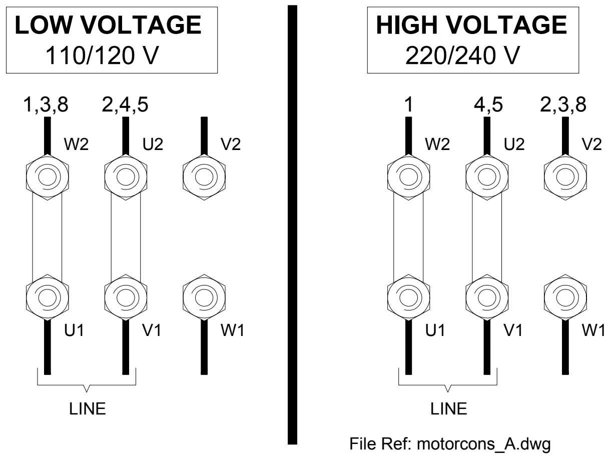


Figure 3.47. Dual Voltage Single Phase Motor Connections

Cable Schedule No 166 Reference	Description	Motor Label Reference
TSH1	AC LINE	L, L1 or U1
TSH2	AC NEUTRAL	N, L2, U2 or V1

Three Phase Motor Connections

For dual voltage motors, ensure that windings are configured for the appropriate voltage. Delta (triangle) connected windings are for low voltage operation, Star (Y) for high voltage.

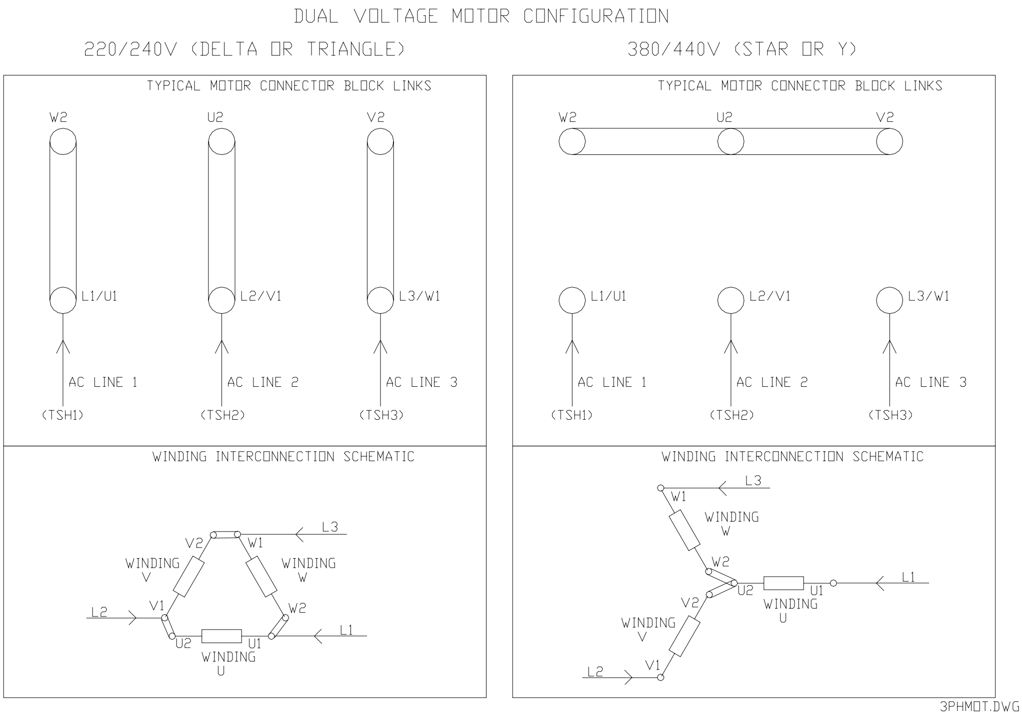


Figure 3.48. Dual Voltage 3 Phase Motor Configuration

The label on the inside of the termination box cover gives details of mains supply connections, and of the winding re-configuration details for alternate voltages if appropriate.

Ensure that the rated motor volts are matched to the supply. If the radar antenna rotates in the wrong direction, reversal of any two phases will correct this (the radar antenna should rotate anti-clockwise when viewed from below).

Cable Schedule No 166 Reference	Description	Motor Label Reference
TSH1	AC LINE 1	L1 or U1
TSH2	AC LINE 2	L2 or V1
TSH3	AC LINE 3	L3 or W1

2.4.5 Fitting the Cable Glands

The installation cables are connected into the Turning Unit via the appropriate cable glands (see earlier table). The body of the gland fits through a hole in the casting and is held in position by the Top Nut. Note the 'O' ring seal, which is fitted below the casting surface (input side). A waterproof seal and an EMC seal are provided with each gland as shown inFigure 3.49. Some glands are designed for a single cable whilst others are intended for several cables.

Note – Cable Glands and Blanking Plates are normally factory fitted to the Turning Unit.

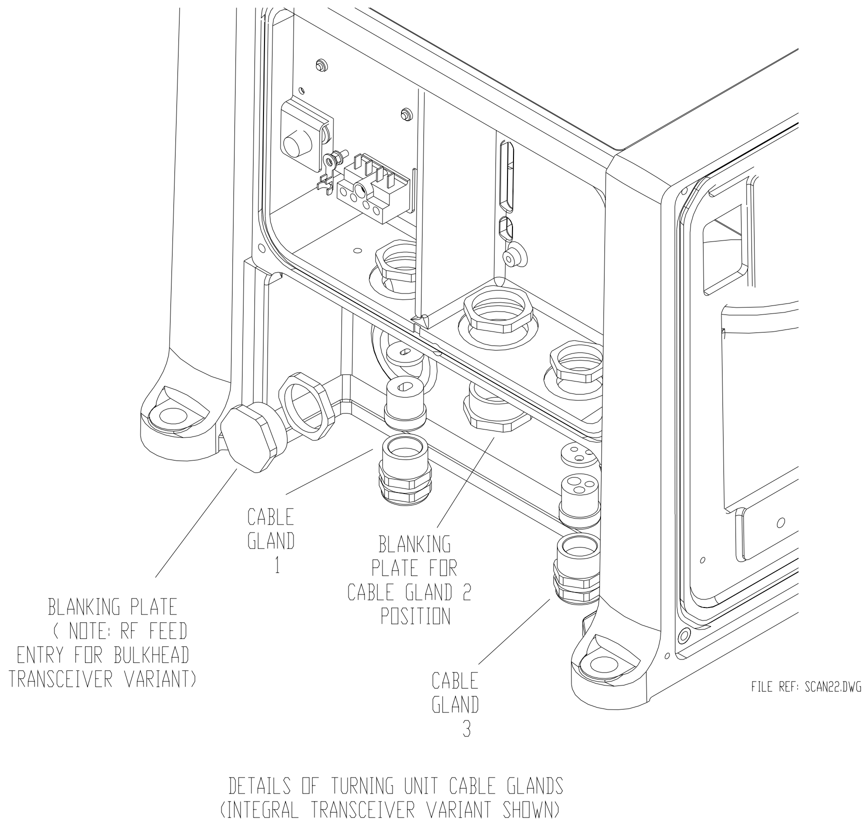


Figure 3.49. General View of the Cable Glands

The waterproofing seal works by clamping onto the cable PVC sheath whereas the EMC seal clamps onto the cable braid. **It is important not to force the outer sheath through the EMC seal, as the seal is liable to split.** The braid is also formed into a tail that is grounded by means of an adjacent earth tag. The fitting procedure is detailed in Figure 3.51.

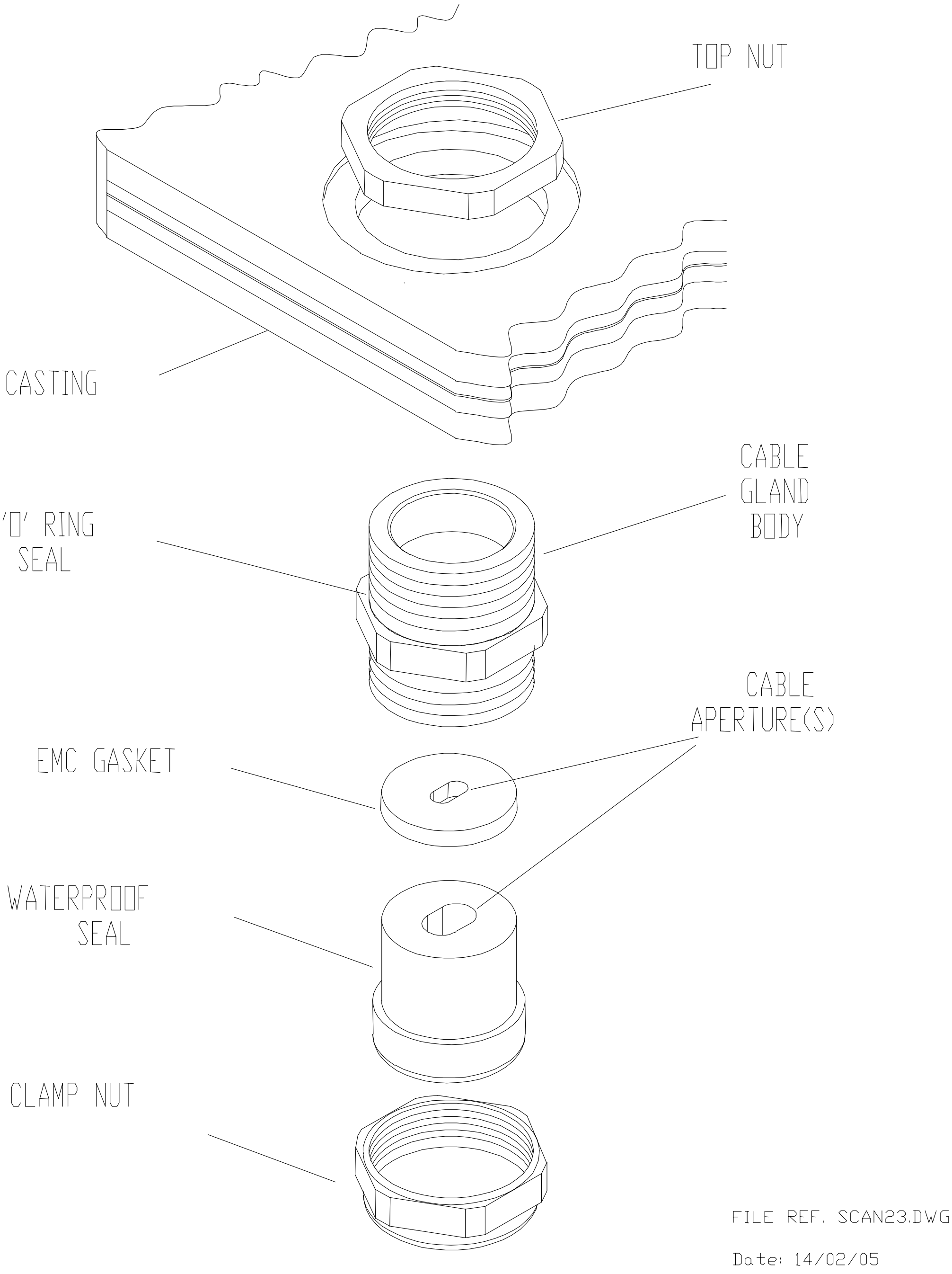


Figure 3.50. Detailed view of a Cable Gland

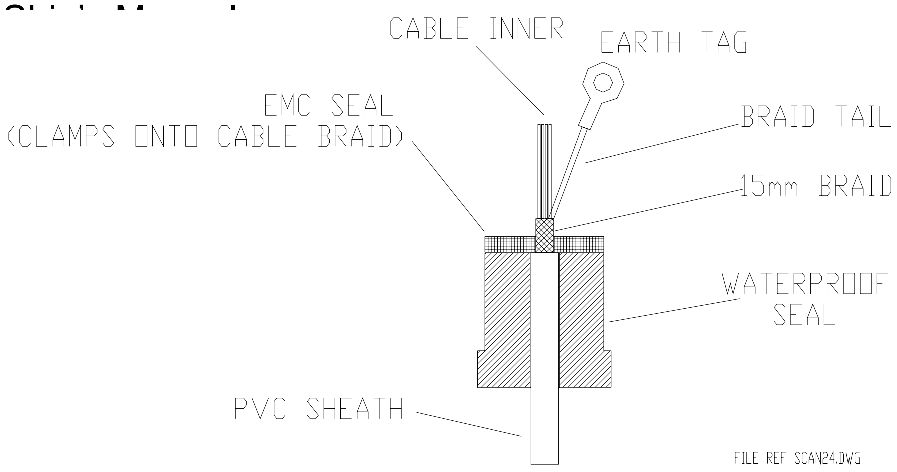


Figure 3.51. Cable Installation Details

Included within the cable gland is a waterproof seal and an EMC seal. The waterproof seal clamps around the cable outer sheath, and the EMC seal clamps around the braid. It is important not to force the outer sheath through the EMC seal as the seal is liable to split.

To install the cables:

Unscrew the gland nut and remove the waterproof seal and the EMC seal. Feed the cable through the gland nut and the waterproof seal. Strip the outer sheath to expose approximately 300mm of braid. Push the braid back to expose approximately 50mm of the inner cores. Trim 50mm off the inner cores, and pull the braid back over the inner cores and twist into a point. Feed the braid through the EMC seal until the cable is positioned as in Figure 3.51.

For the multicore cables:

Flare out the braid to within approximately 15mm of the EMC seal, and form into a tail.

For the coaxial cables:

Do not fit the coaxial connector at this time.

Assembly into Turning Unit

Feed the assembled cables and seals into the gland body, and tighten the gland nut until the EMC seal is compressed. Crimp the earth tags provided to the braids of the multicore cables and attach them to the earth studs adjacent to the cables. The tails should be as short as is practicable. Trim and make off the cable inners to the appropriate terminal blocks. Trim the coaxial cables to length and slide the plastic sleeve provided in the despatch kit over the exposed braid. Fit the coaxial connectors, and plug them into the appropriate sockets.

2.4.6 Performance Monitor

The Performance Monitor comprises the Antenna, the Performance Monitor module and an associated cable. The equipment is normally factory fitted.

2.5 S-band Bulkhead Transceiver

The Bulkhead Transceiver, 65831A, is installed below decks in a suitable location such as the ship's equipment room. The installation should pay due regard to accessibility for maintenance and servicing, and the distance between the Transceiver and the Scanner Unit. For maximum performance, this should be kept as short as practicable, as the loss per metre of the S-Band coaxial cable is typically 8.31dB per 100 metres, i.e. 1.7dB for 20 metres. This loss applies to both the transmitted RF pulse and the received signals.

The maximum recommended cable length between the Turning Unit and the Transceiver Unit is 30 metres, and that between the Transceiver and Display is 67 metres using standard coaxial cable (PT1YM). Greater separation is possible by using a lower loss cable. Contact: Northrop Grumman Sperry Marine B.V. if greater separation is required.

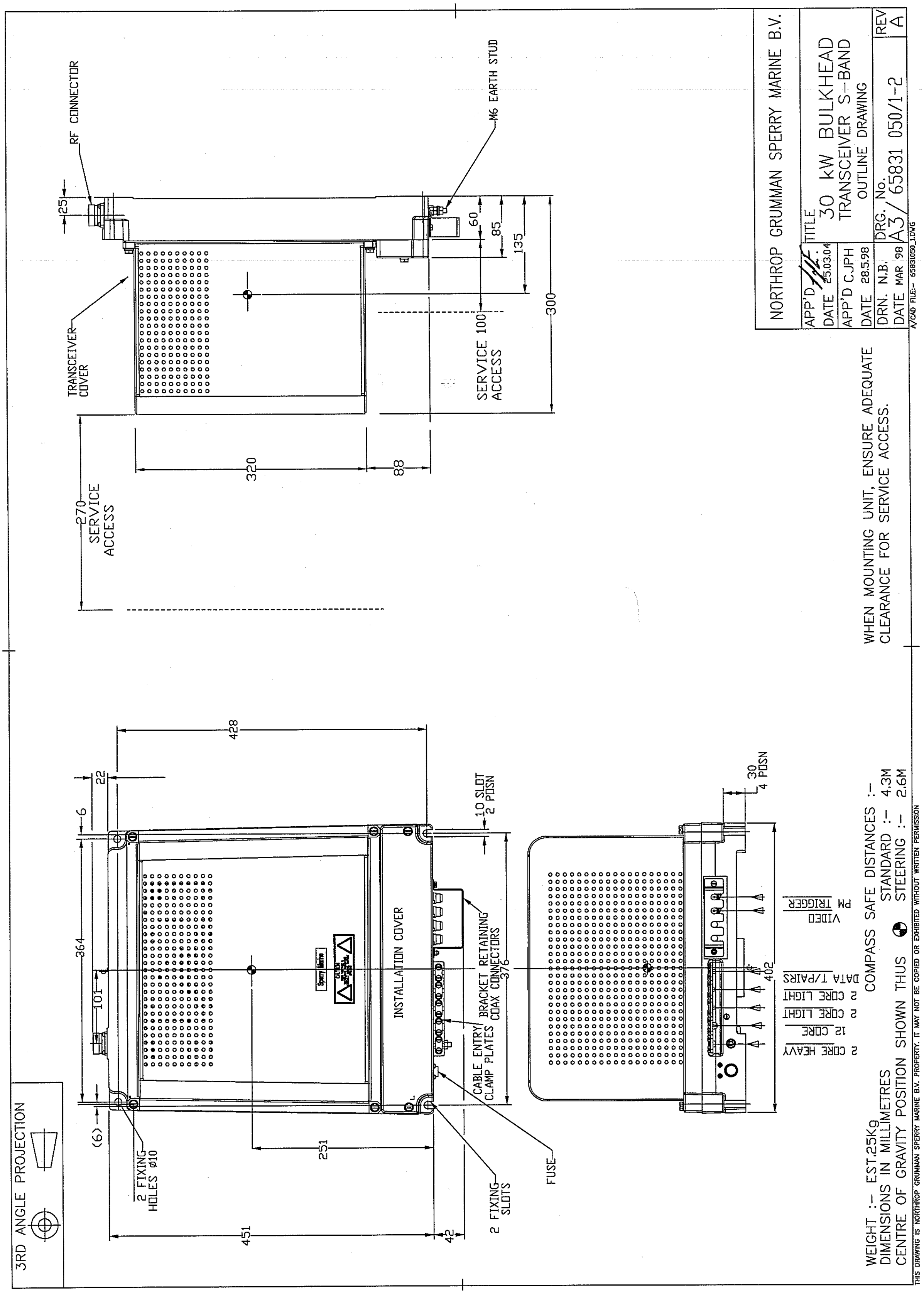


Figure 3.52. S-Band Bulkhead Transceiver 30kW Installation

The Transceiver may be attached to the bulkhead by several methods. The actual method chosen will depend on individual circumstances, but due regard must be given to the likely vibration and shock loading which may be experienced. The available methods include through bolting to the bulkhead, or mounting on studs provided by the shipyard.

Note – The positions of the four fixings for the unit are not on a rectangle – i.e., the horizontal spacing of the top fixings is 364mm compared with 376mm for the lower fixings.

When choosing the installation location for the Transceiver, due regard must be made for the routing of the RF feeder coaxial cable.

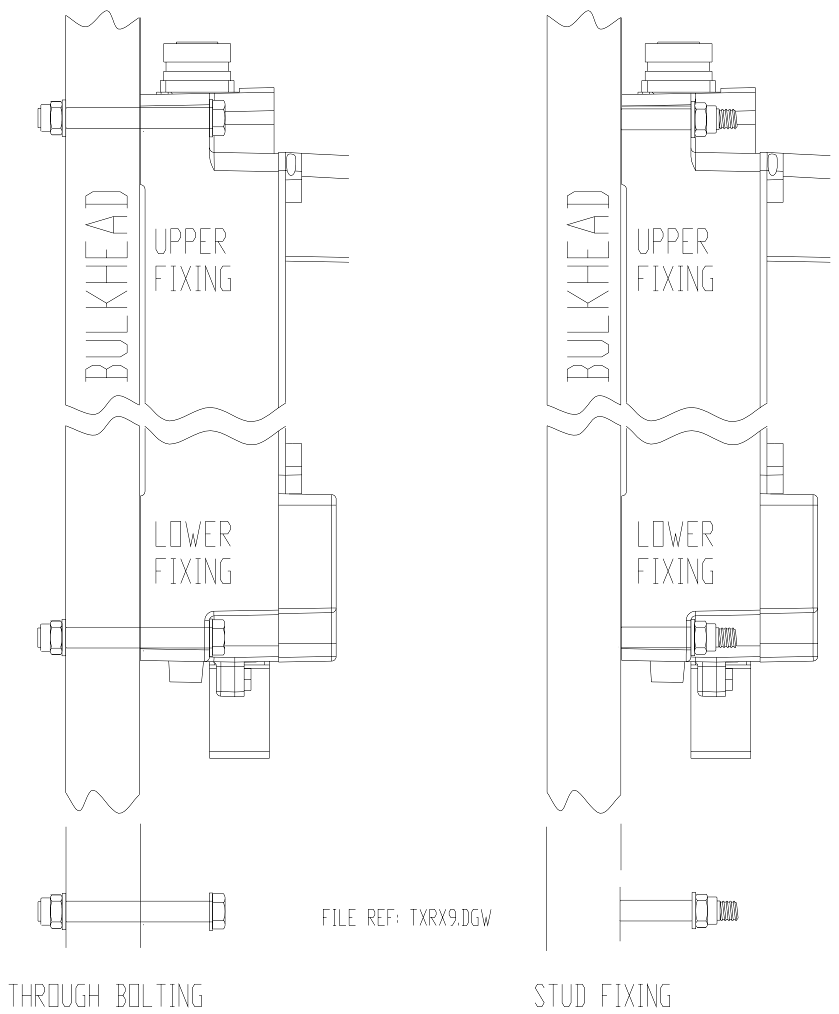


Figure 3.53. Bulkhead Transceiver – Mounting Alternatives

2.5.1 Cabling Information

Figure 3.54 below shows details of the cable inputs. The cable cover plate, which is secured by two fixing screws, is shown removed. Note: a cable retainer holds the coaxial cables. This must be fitted after the cables are in place. All other cables, with the exception of the RF feeder S-Band coaxial cable, are individually clamped on their cable braids to provide emc shielding. The braids are also made off as tails and connected to earth tags provided. The ac mains input is connected to TSE as shown.

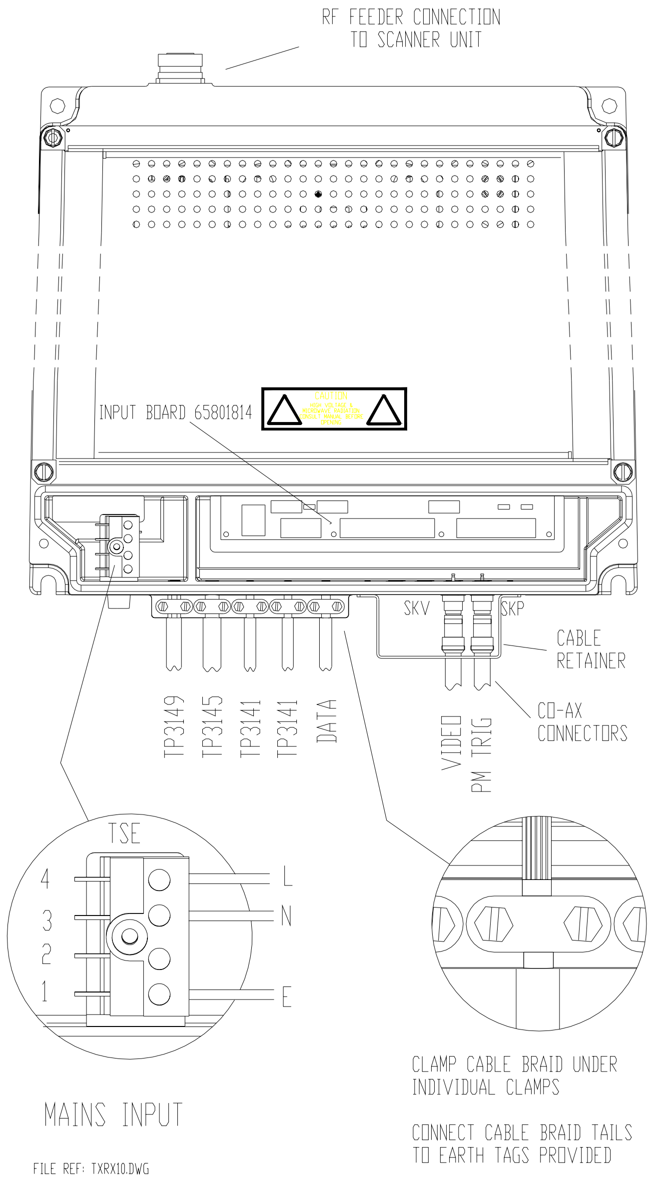


Figure 3.54. Bulkhead Transceiver – Cable -Input Details

Figure 3.55 shows details of the Input Board, 65801814. Refer to the cabling schedules for details of the connections, which are made via the two part connectors provided. Links LK2 and LK3 on the Input Board should be set as shown. Link LK1 is not fitted. Refer to Chapter 9 for details of PCB 65801815 fitted to additional features transceivers.

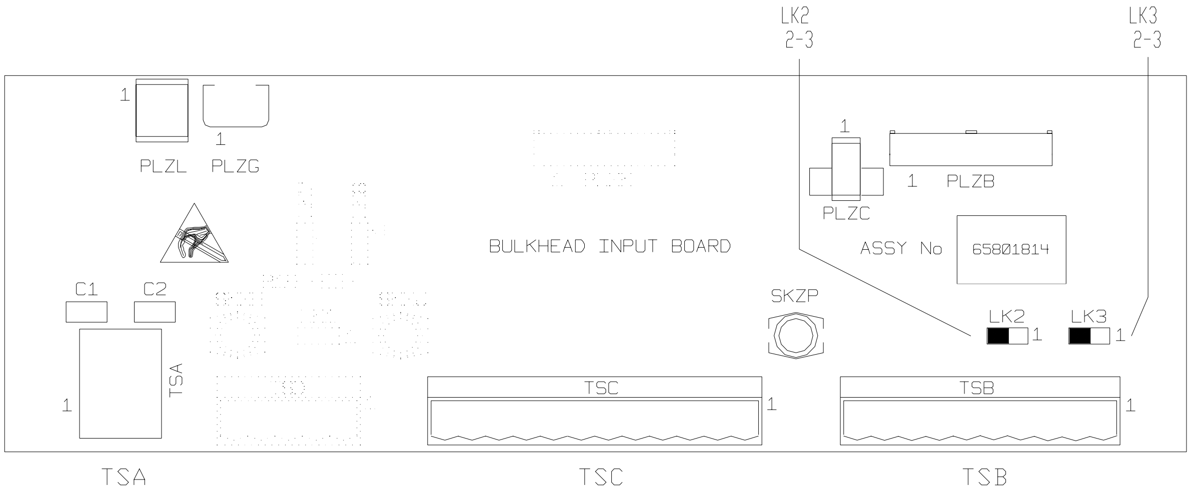


Figure 3.55. Bulkhead Transceiver – Input Board Details

2.5.2 Fitting the RF Feeder Cable (S-Band Coaxial Cable)

General Information

1. A radio frequency (RF) coaxial cable is used for the run between the Bulkhead Transceiver Unit and the Turning Unit with S-Band radars. The cable used is Andrew Antennas Heliax LDF5-50A 7/8in 50-ohm – overall diameter 28mm (1.1in).
(Figure 3.56 to Figure 3.63 are reproduced by permission of Andrew Antennas).
2. Although apparently robust, the cable must be protected against strain and kinking, and must be treated with the utmost care at all times. The ends of the cable must be kept sealed against the ingress of moisture before the connectors are assembled.
3. Wherever possible, bends should have as great a bending radius as practicable. A single bend may be made when necessary with a minimum bending radius (measured from the axis of the cable) of 250mm (10in).
4. For convenience, the upper (Turning Unit) connector can be fitted prior to installation of the cable, but due to the possibility of movement of the inner conductor relative to the outer conductor, the following precautions must be taken.
   a. Any bend required within 1m (3ft) of the cable end must be formed before carrying out the cutting and assembly procedure detailed in subsequent paragraphs. Note that no bend may be nearer that 250mm (10in) from the end of the cable.

b. To allow for movement between the Turning Unit and mast, whenever possible a double bend should be formed in the cable to produce an offset immediately below the Turning Unit.

c. The cable and assembled connector should be fitted to the Turning Unit so that a minimum amount of distortion of the cable occurs between the connector and the pre-formed bend.

d. The cable should be installed and secured in position (using the waveguide supports shown in as far as is practicable before the lower (Transceiver Unit) connector is fitted to the cable. The precautions given in subparagraph **a** above must be observed if a bend is required adjacent to the Transceiver Unit.

ASSEMBLING THE CONNECTORS

General

5. A straight connector (Type L45DM) is used to terminate the feeder cable at each end.

Tools required

6. The normal tools found in an engineer's tool kit, a hacksaw (with a fine-toothed blade) and 1¼in open-ended spanners will be sufficient for fitting the connectors to the cable.

Procedure

7. The procedure that follows is applicable to the straight connectors at each end of the feeder cable. Note that it is most important that swarf and other foreign matter should be prevented from entering the cable.

8. Prepare the cable end and assemble the connector as follows:

   a. Ensure that the end of the cable is straight for at least 10in (250mm). Using a knife, remove approximately 1in of the jacket. Deburr the sharp end of the cut outer conductor (Figure 3.56).

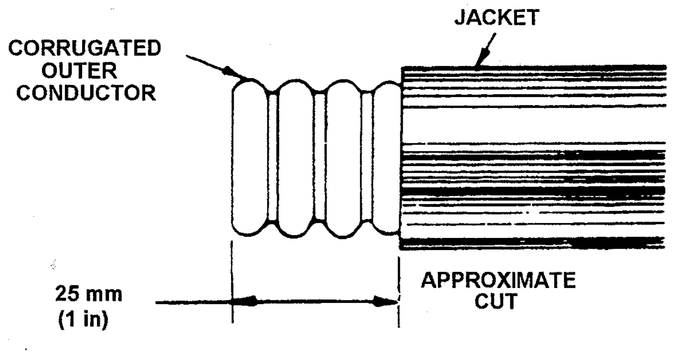


Figure 3.56. Preparing the Cable

b. Scribe a line on a ridge of the exposed corrugated outer conductor (Figure 3.57). Using a straight-edged piece of heavy paper, wrapped around the cable as a cutting guide, remove the jacket to the dimension shown in Figure 3.57.

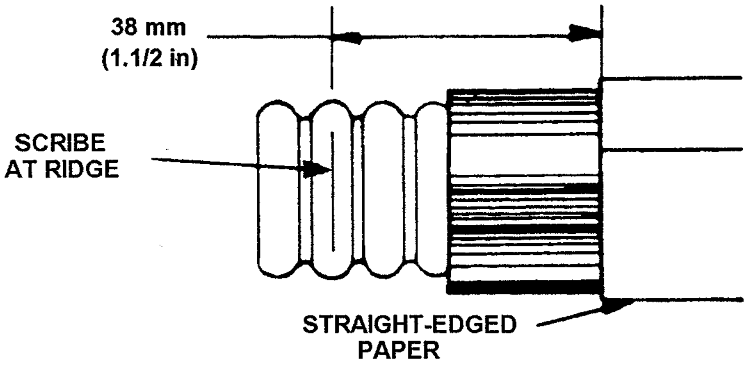


Figure 3.57. Second Jacket Cut

c. Clean the outer conductor with solvent and then add the small thick 'O' ring gasket to the second fully exposed corrugation groove from the jacket (see Figure 3.58). Apply a thin coating of silicone grease to the outer surface of the gasket and the gasket lead chamfer in the clamping nut, using the fingertip.

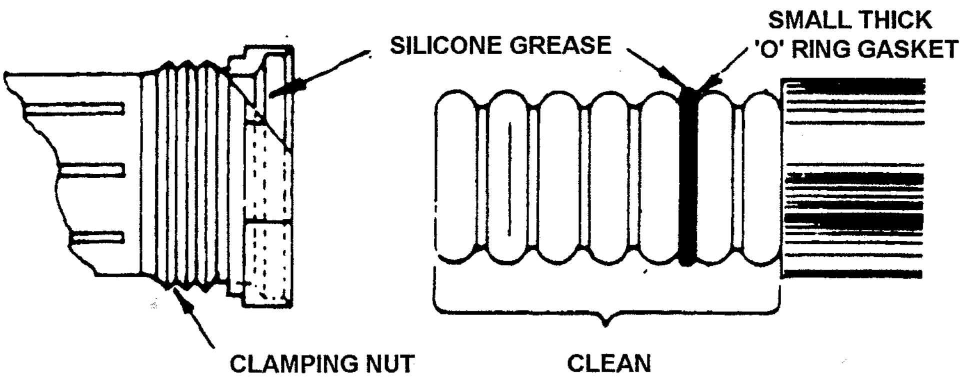


Figure 3.58. Installing the Gasket

d. Push the clamping nut onto the cable, using a twisting motion to ensure that the spring contacts snap into the first groove (see cutaway view in Figure 3.59). Grip the clamping nut with one hand and align the edge with the scribed line. Using a hacksaw with a fine-toothed blade, carefully cut the cable flush with the end of the clamping nut (see Figure 3.59).

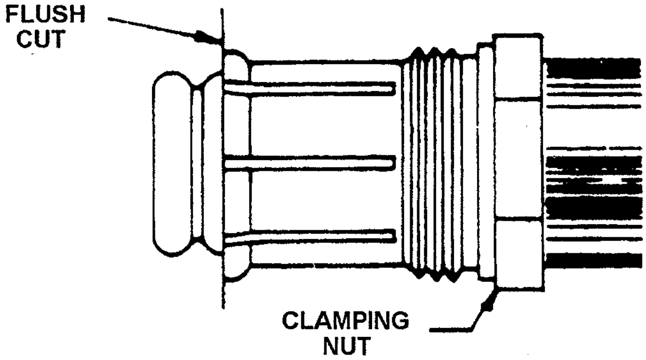


Figure 3.59. Adding the Clamping Nut and Cutting the Cable

e. Using the tip of a knife, work around the entire circumference separating all foam completely from the edge of the outer conductor. This is to ensure a good electrical contact between the outer conductor and the outer body of the connector. (See the enlarged cutaway view in Figure 3.60 that (at the arrow) shows the eventual positive grip of the outer conductor between the clamping nut and the outer body of the connector).

f. Use a knife to remove all burrs from the inside edges of the outer and inner conductors. Use a wire brush or scraper to remove all copper particles from the foam (see Figure 3.60).

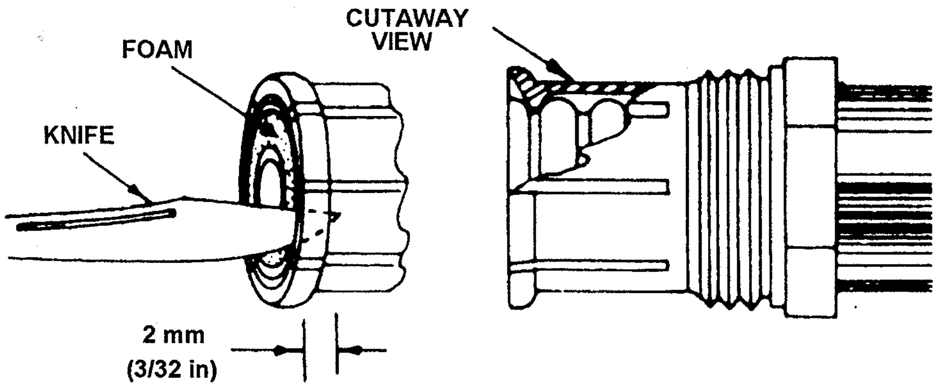


Figure 3.60. Detaching Foam and Removing Burrs

g. Screw the outer body on to the clamping nut and tighten with the 1¼in spanners. Hold the clamping nut and turn the connector outer body; do not turn the clamping nut. Unscrew and remove the outer connector body and inspect the end of the outer conductor for good metal-to-metal contact (see Figure 3.61).

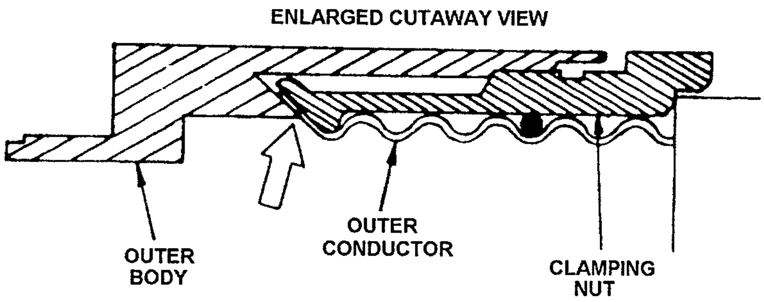


Figure 3.61. Enlarged Cutaway View

h. Place a 'pin' through the hole in the self-tapping inner connector (see Figure 3.62) and use it as a 'tommy bar' to tap the connector into the inner conductor. To aid tapping, use a small amount of solvent as a lubricant. If tapping becomes difficult, 'back off' the inner connector after every few turns. Tap until the inner connector 'bottoms' against the inner conductor and then tighten. Remove the 'pin' from the inner connector.

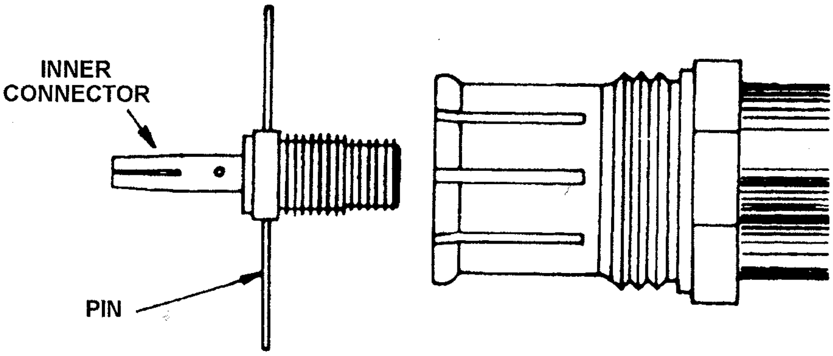


Figure 3.62. Installing the Inner Connector

i. Place the large thin 'O' ring in the gasket groove in the clamping nut (see Figure 3.63) and coat the outer surface of the gasket lightly with silicone grease. Screw the outer body of the connector onto the clamping nut and tighten with spanners. Turn the outer body only; do not turn the clamping nut.

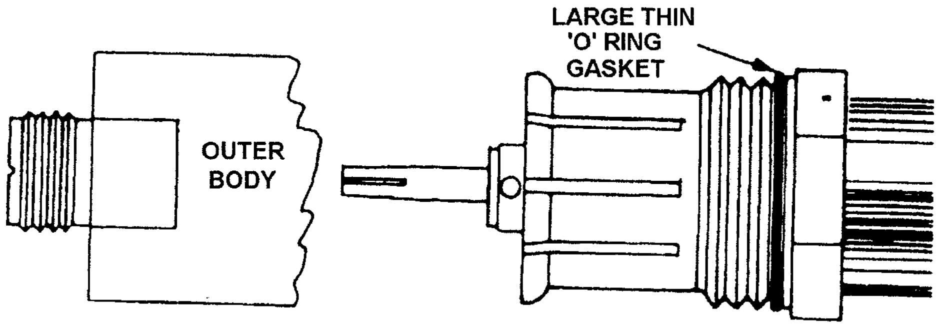


Figure 3.63. Installing the Outer Body

FITTING THE DECK GLAND

9. The ⅞in RF feeder cable passes through its own separate deck gland (Andrew Feed-Thru Kit Type 40656-1), positioned near the foot of the mast. The gland kit comprises a rubber boot, metal flange halves, eight Lock-o-seal washers and an adjustable clamp (Jubilee clip). In addition, eight ¼in bolts (of suitable length), flat washers, lock washers and nuts will be required. (See Figure 3.64).
10. To fit the deck gland proceed as follows:
    a. Cut a 75mm (3in) diameter hole in the deck and, having installed and secured the cable from the Turning Unit downwards, pass the Transceiver Unit end down through the hole.
    b. Apply silicone grease to the hole and to the slit and tapered edge of the rubber boot.
    c. Place the boot around the feeder, slide the boot down into the hole in the deck and then mark the location of the eight holes for the fixing bolts.
    d. Withdraw the boot from the hole and drill eight 8mm (5/16in) mounting holes through the deck.
    e. Slide the boot back into the hole in the deck and position the flange halves in the groove in the boot.
    f. Align the flange holes with the boot holes and secure the assembly in position with eight ¼in bolts, flat washers, lock washers and nuts, together with the Lock-o-seal washers provided in the gland kit. Note that the bolts are inserted downwards and that the Lock-o-seal washers only go under the bolt heads.
    g. Fit the adjustable clamp (Jubilee clip) around the boot and tighten to ensure a leak proof seal.

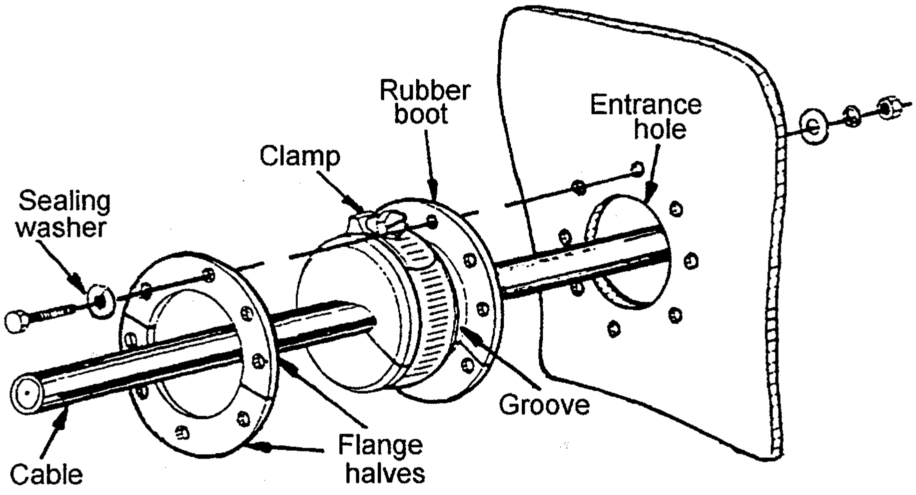


Figure 3.64. Deck Gland Details

INSTALLING THE CABLE

11. Cable Hangers are supplied (Andrew Hanger Kit Type 42396A-5) to support the cable along the cable run between the Scanner Unit and the Bulkhead Transceiver. Each kit contains 10 Hangers. Their associated Fixing Kit (Andrew Type 31769-1) is included as part of the Installation Kit. Normally, a hanger is attached to a cable tray, using suitable bolts, at a recommended spacing of 0.9 metres (3 feet). The support brackets must be fitted to the hangers to prevent distortion when the hanger is wrapped around the coaxial cable as shown in Figure 3.65.
12. Figure 3.65 also shows additional hardware (not supplied in the Installation Kit) that facilitates special mounting arrangements. If required, these are obtainable from Andrew Corporation.

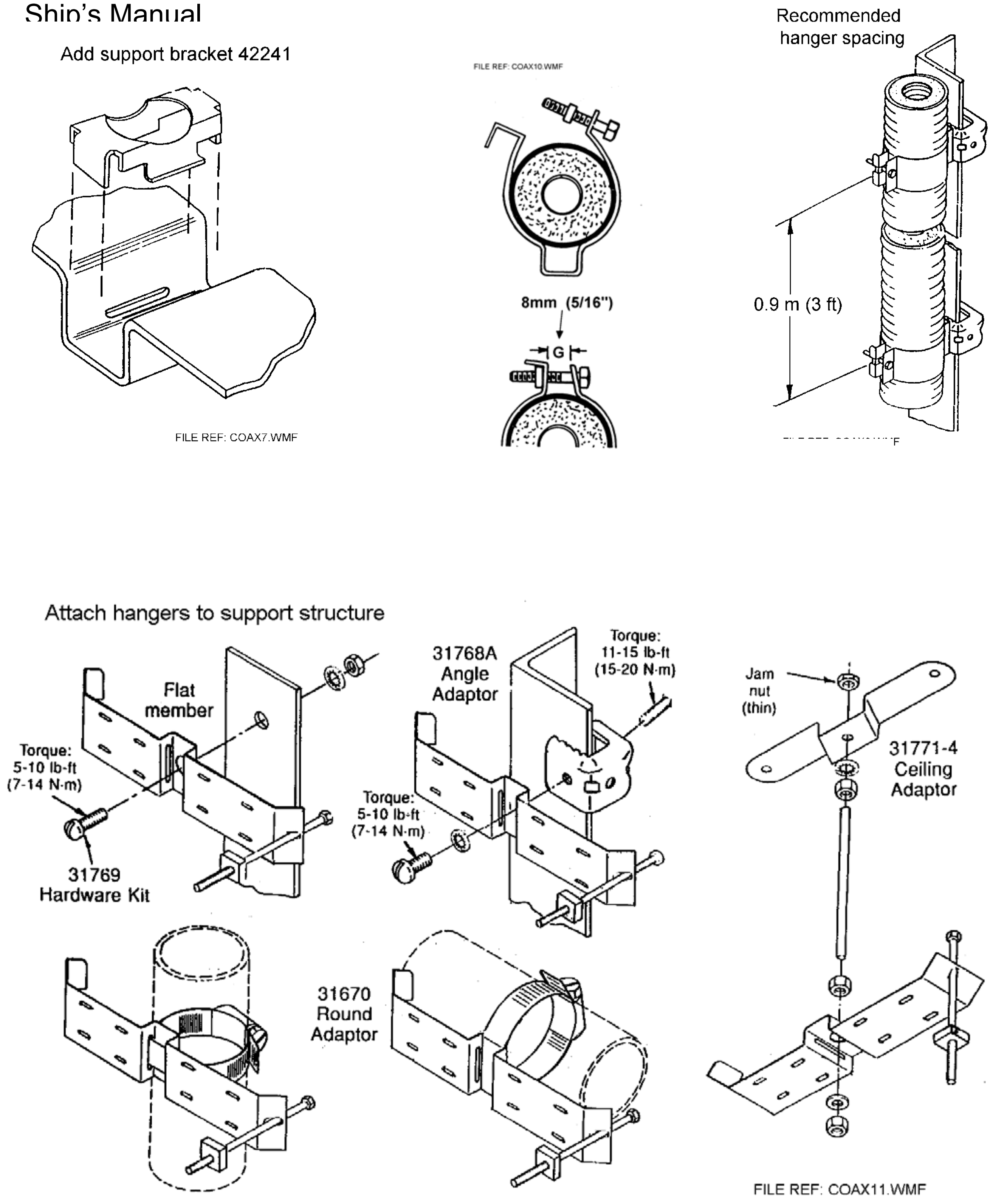


Figure 3.65. Cable Support Details

2.6 Scanner Control Unit

Single Phase (1ϕ) or Three Phase (3ϕ) Mains Supply Voltage

For single-phase scanner motors refer to Figure 3.68, for three-phase scanner motors refer to Figure 3.69, and the relevant cabling schedules for connection details for the Scanner control Unit (SCU).

Mounting Position

The SCU must be mounted in such a position that it allows access by a service engineer for the isolation of the mains supply to the Turning Unit motor. For this reason, it is preferable to mount the SCU close to the Mains Isolator (see below). Normally, the SCU is mounted so that it is accessible to the radar operator.

Scanner Speed Option

Two scanner speed options, 'standard' and 'high', are available, depending on the type of scanner motor. Motor types 91003751, 52, 57 & 58 are standard speed; 91003753, 54, 59 & 60 are high speed. See Section 0 for connection details.

Note – The table below defines the Thermal Current Trip settings for each variant that must be set at the time of installation.

Mains Supply Voltage	Standard Speed Scanner 50Hz	60Hz	High Speed Scanner 50Hz	60Hz
110/120 Volts	8.0A	8.0A	8.0A	8.0A
1ϕ	65837AH	65837AH	65837AH	65837AH
220/240 Volts	4.0A	4.0A	4.0A	4.0A
1ϕ	65837AE	65837AE	65837AE	65837AE
110/120 Volts	5.2A	5.2A	6.4A	6.4A
3ϕ	65837AE	65837AE	65837AF	65837AF
220/240 Volts	2.2A	2.2A	4.0A	4.0A
3ϕ	65837AC	65837AC	65837AE	65837AE
380/440 Volts	1.3A	1.3A	1.8A	1.8A
3ϕ	65837AB	65837AB	65837AC	65837AC

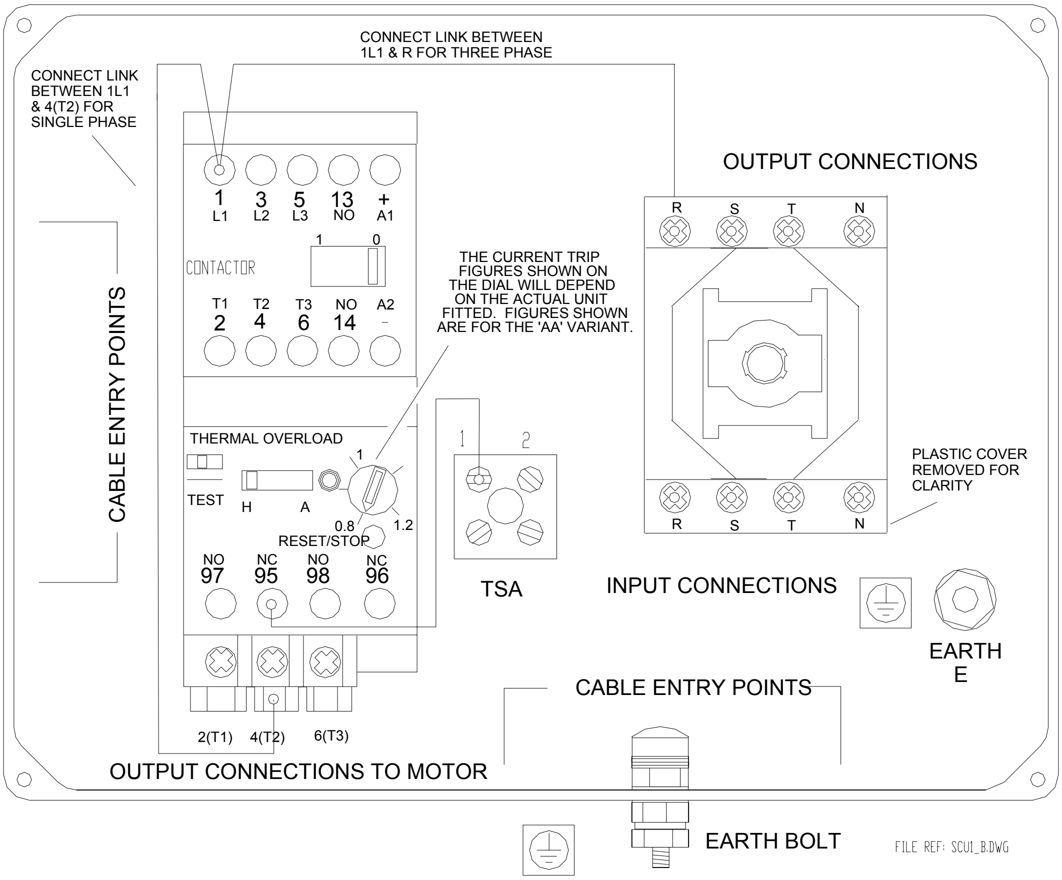


Figure 3.66. Scanner Control Unit – Internal Layout

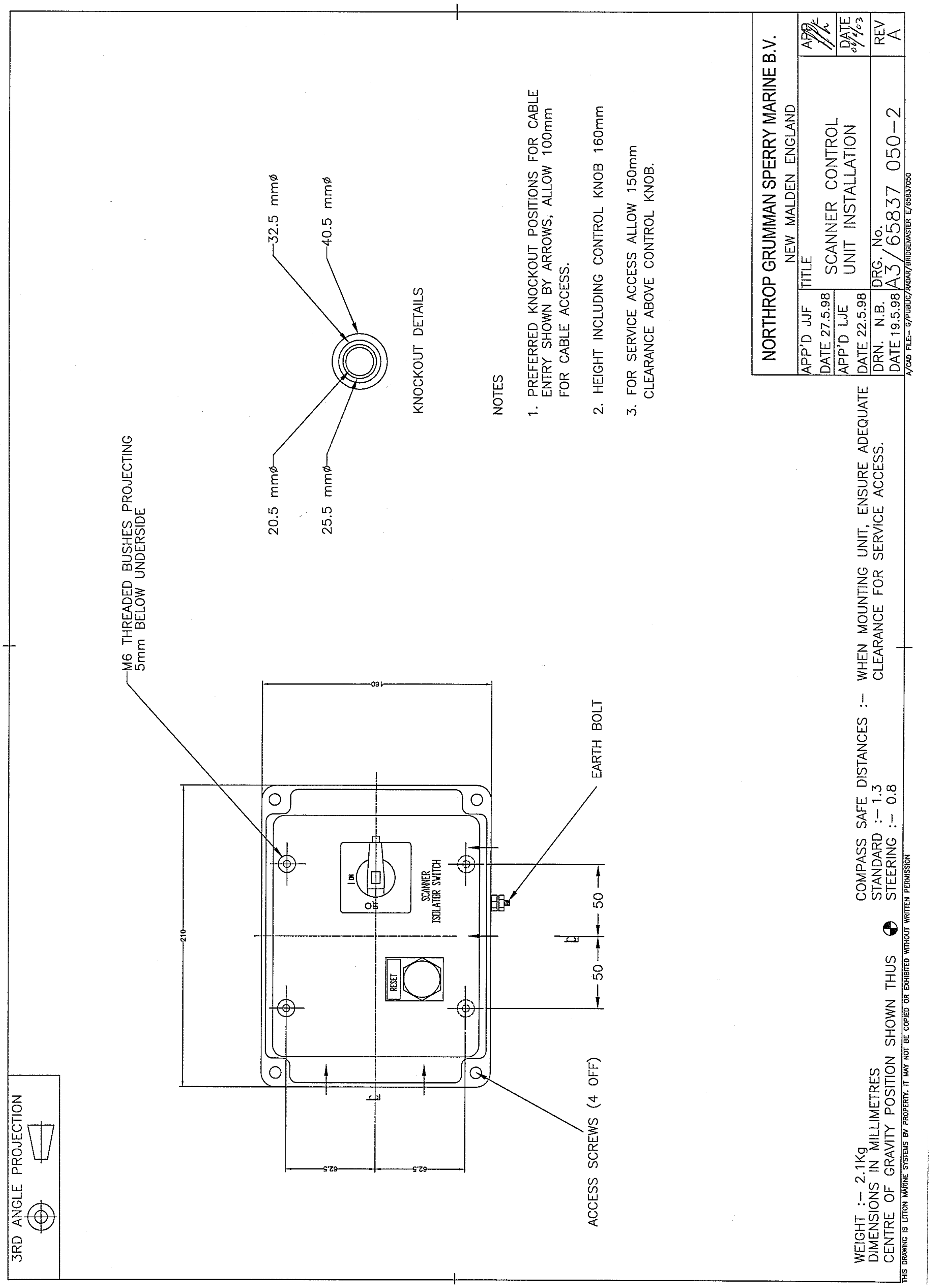


Figure 3.67. **Scanner Control Unit Installation**

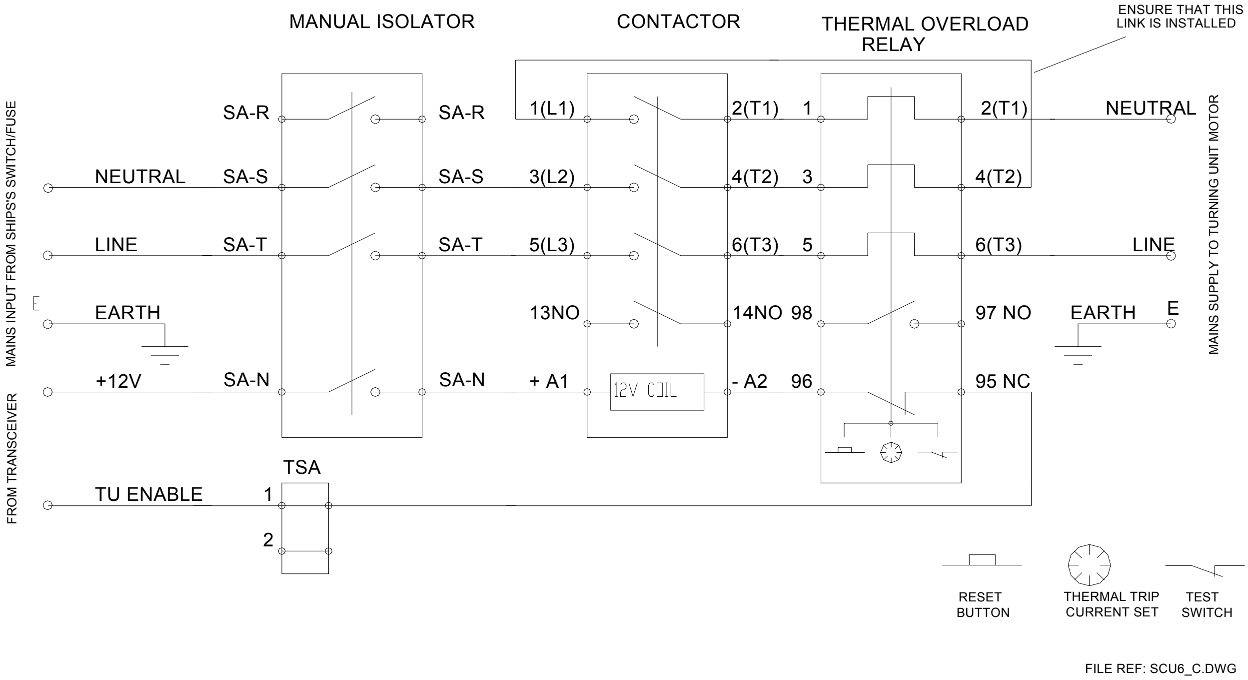


Figure 3.68. Scanner Control Unit – Single Phase Supply Arrangement

Notes: Refer to Cable Schedules for details of connections to the ship's supply and the Turning Unit motor.
For Thermal Trip current settings, refer to the table at the start of Section 2.6.
Cable type 37-3-2R may be used for 220/240V supplies.

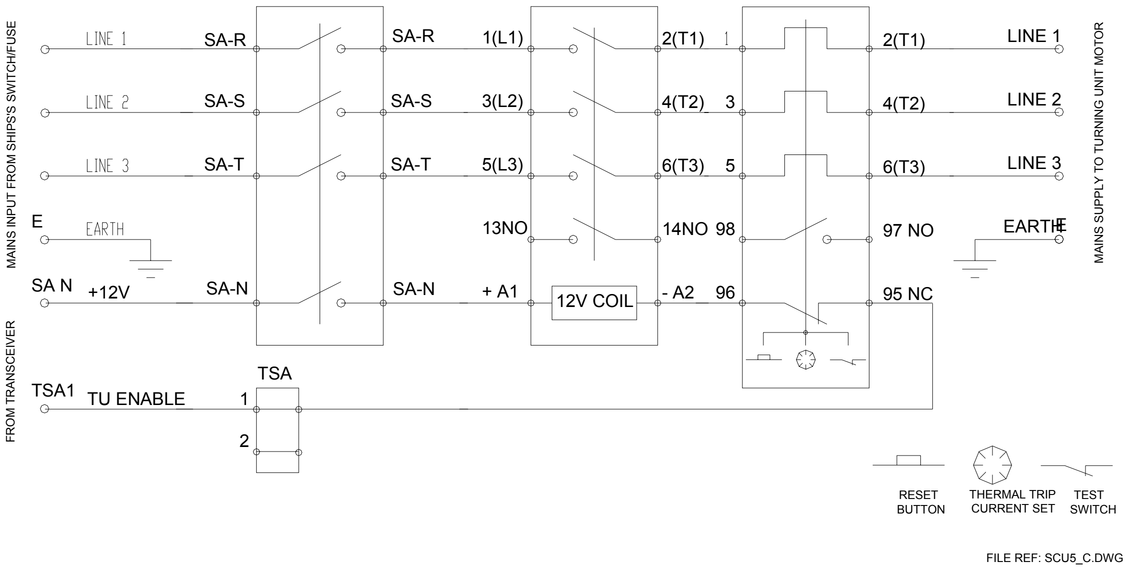


Figure 3.69. Scanner Control Unit – Three-Phase Supply Arrangement

Notes: Refer to Cable Schedules for details of connections to the ship's supply and the Turning Unit motor.

For Thermal Trip current settings, refer to the table at the start of Section 2.6

2.7 Display Units

Note – In order to assemble display units from their supplied parts, refer to the documentation supplied with the parts.

Refer to Figure 3.70 and Figure 3.71 for a 180 Display Unit (CRT)

Refer to Figure 3.72 and Figure 3.73 for a 180 Display Unit (FPD)

Refer to Figure 3.74 to Figure 3.77 for a 250 Display Unit (CRT)

Refer to Figure 3.78 and Figure 3.79 for a 250 Display Unit (FPD)

Refer to Figure 3.80 to Figure 3.82 for a 250 Extended Display Unit (CRT)

Refer to Figure 3.83 and Figure 3.84 for a 340 Display Unit (FPD)

Refer to Figure 3.85 for a 340 Deck Mounted Display Unit (CRT with extruded tray)

Refer to Figure 3.86 for a 340 Deck Mounted Display Unit (CRT with moulded tray)

Refer to Figure 3.87 for a 340 Deck Mounted Display Unit (FPD)

2.7.1 Secondary Viewer Output

All display units can be fitted with a secondary viewer output. CRT units can have a factory fitted output. Alternatively all CRTs can have a secondary viewer output kit (65800720) fitted.

FPD units are all factory-fitted. However, to gain access to the connector inside the 180 and 250 desktop monitors, follow these instructions:

1. Remove the bezel and the rear cover.
2. Bend down the tab on the rear of the chassis where the cable will exit.
3. Temporarily plug in the 15pin hi-density D cable into SK3 at the right side (viewed from the rear) of PCB assembly 658xx891.
4. Dress the cable so it exits through the hole, and mark it where it goes through the hole
5. Remove the parked grommet from the sidewall.
6. Unplug the cable, and fit the grommet to the cable.
7. Copy the orientation of the grommet to match the other ones fitted.
8. Close the snap grommet onto the cable using large-jawed pliers or a vice.
9. Insert the cable back into the hole and push the grommet home from the outside.
10. Make sure the click retainers spring out correctly.
11. Refit the D connector and tighten the jack screws.
12. Refit the rear cover but not the bezel yet.
13. Plug the other end of the cable into the Secondary Viewing unit.
14. Switch the unit on.
15. Re-test the system and adjust the Phase parameter via the menu if required.
16. Refit the bezel.

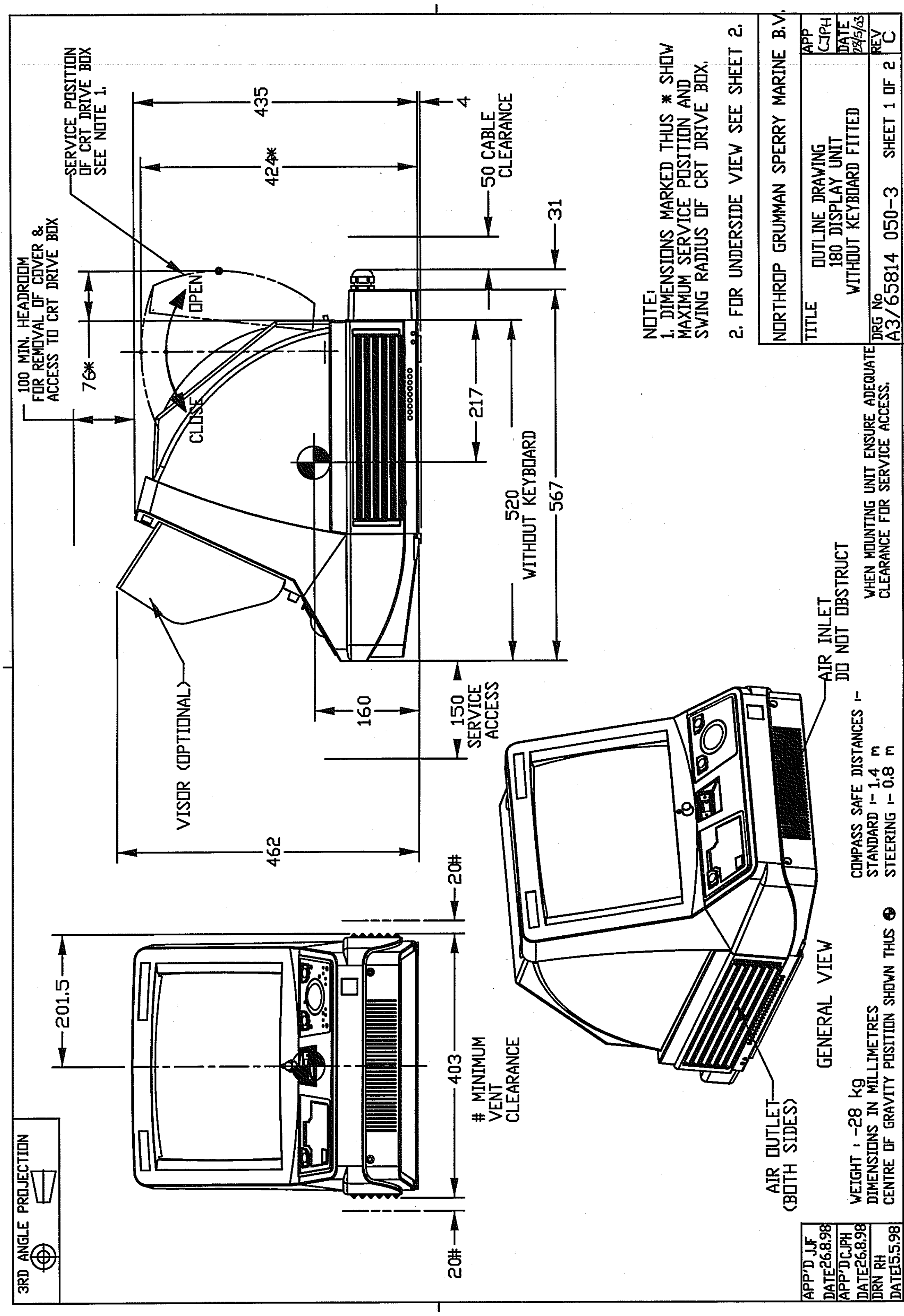


Figure 3.70. 180 Display Unit (CRT) Outline Drawing

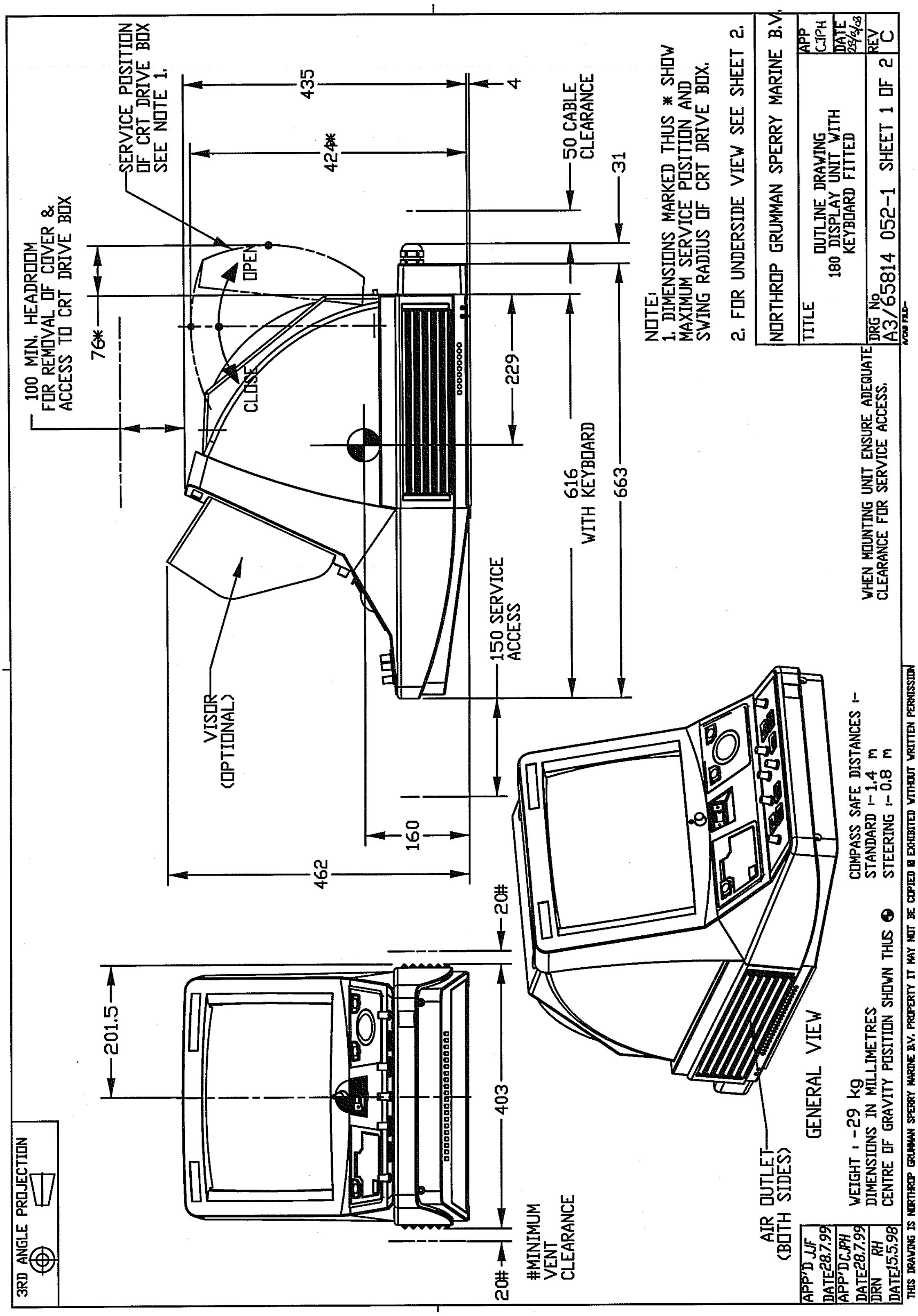


Figure 3.71. 180 Display Unit (CRT with Keyboard) Outline Drawing

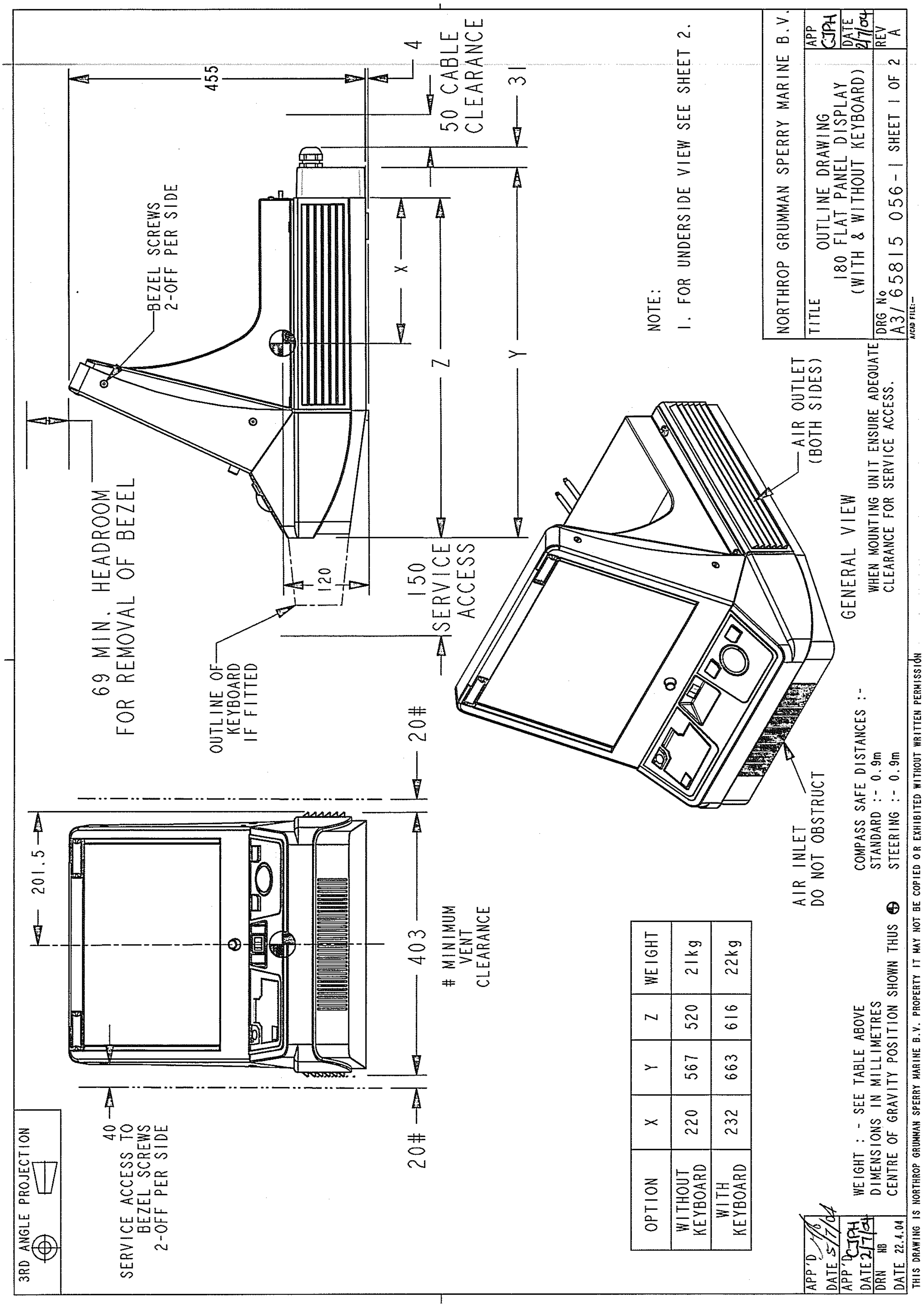


Figure 3.72. 180 Display Unit (FPD) Outline Drawing

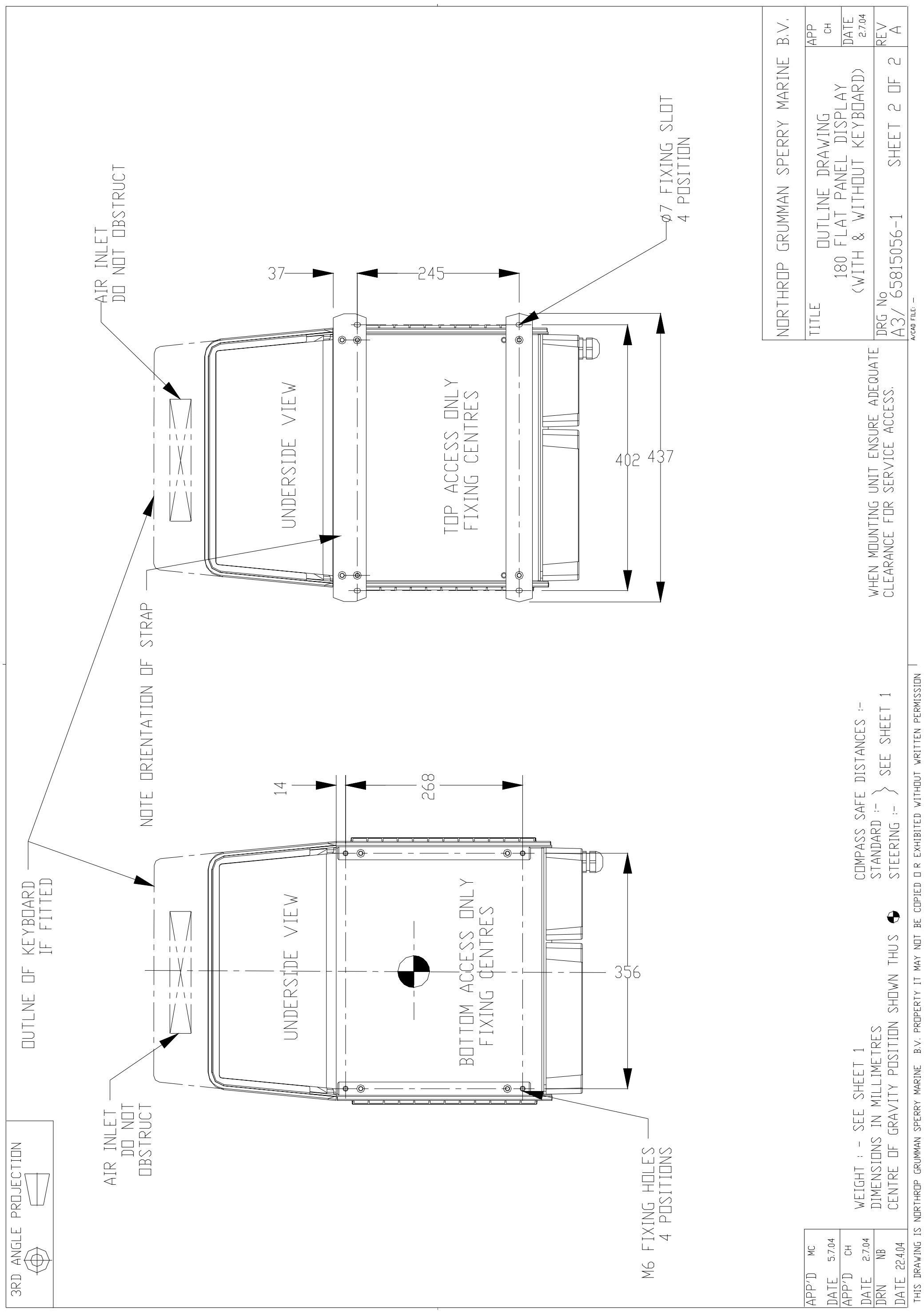


Figure 3.73. 180 Display Unit (FPD) Outline Drawing

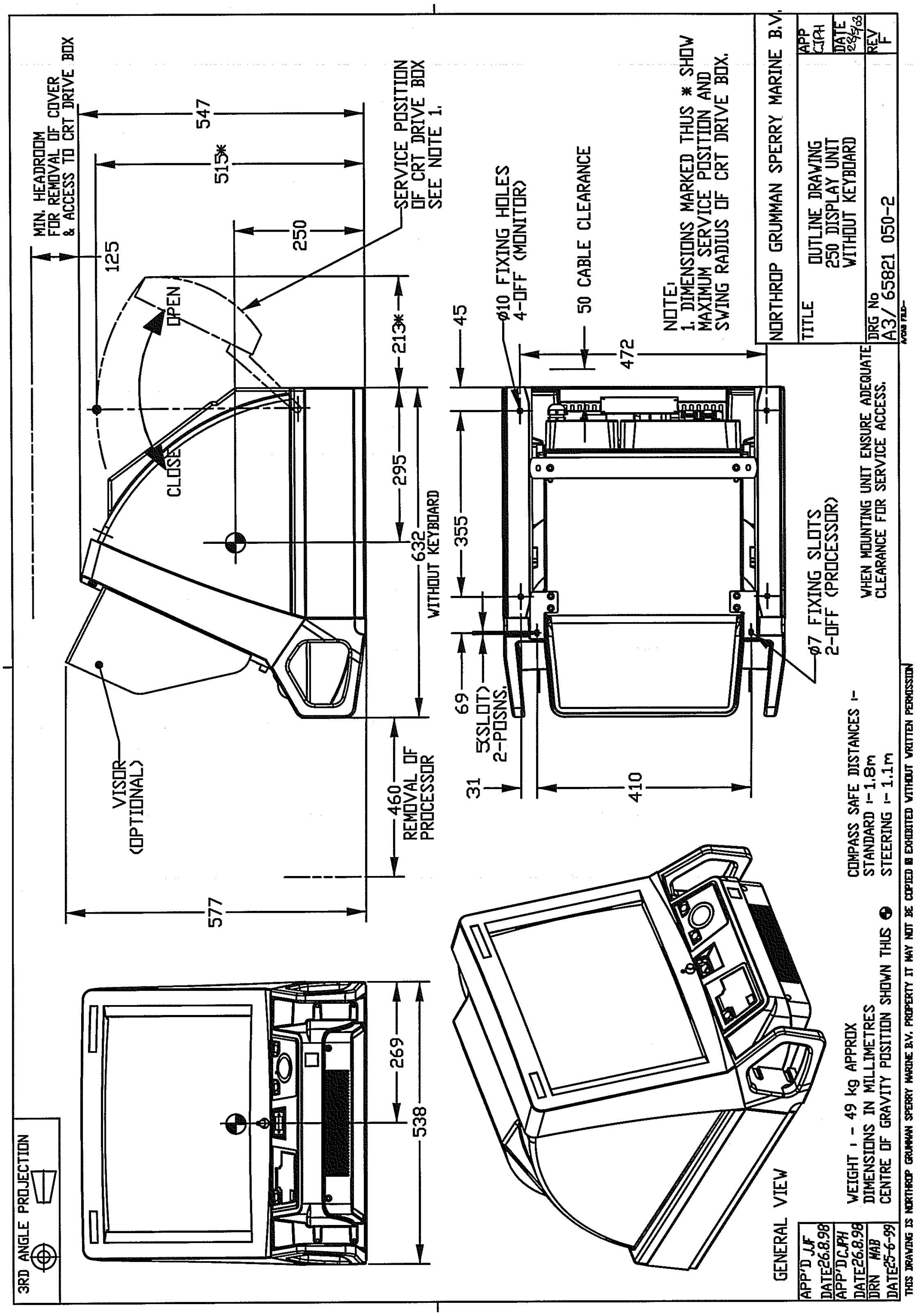


Figure 3.74. 250 Display Unit (CRT) Outline Drawing

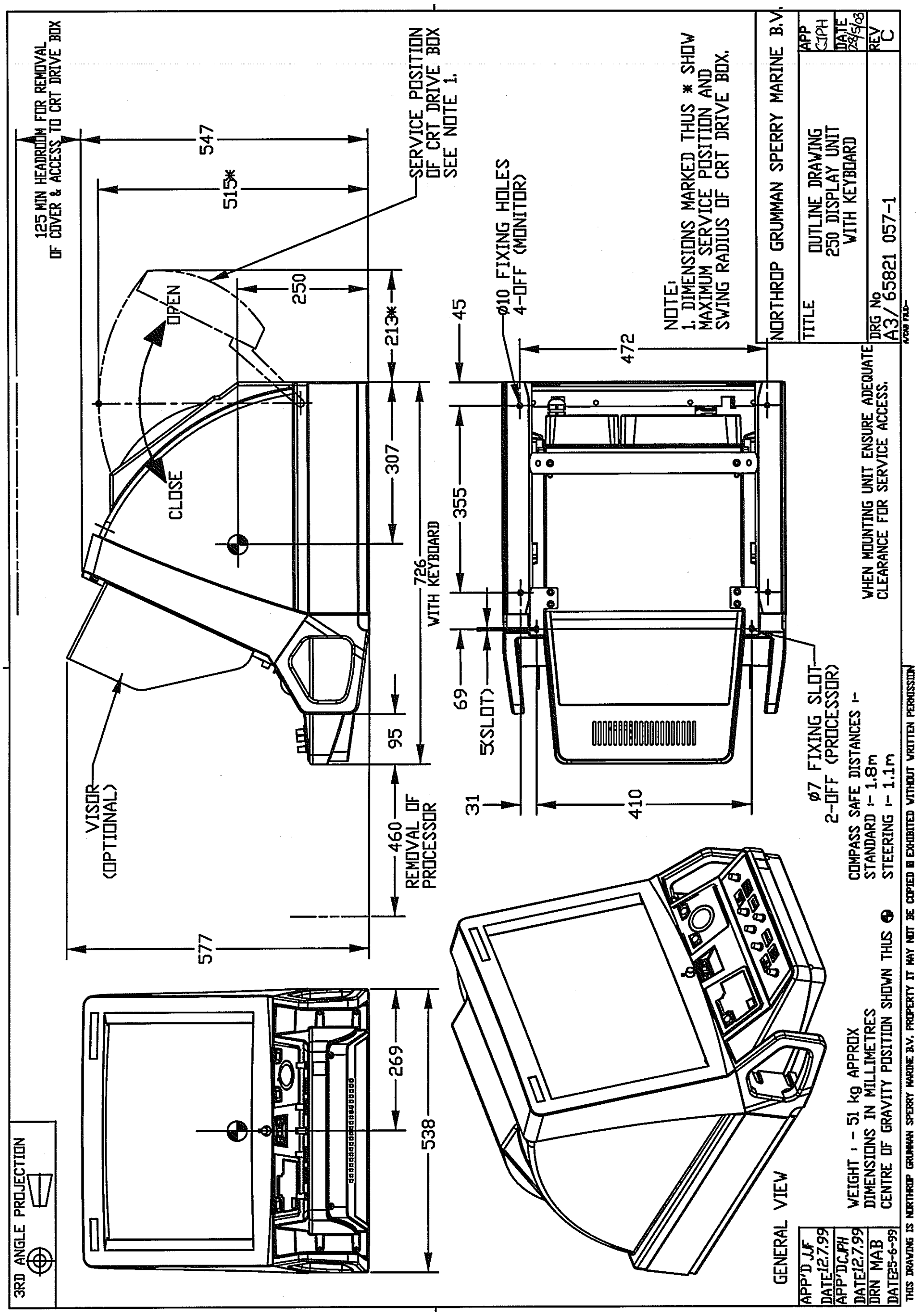


Figure 3.75. **250 Display Unit (CRT with Keyboard) Outline Drawing**

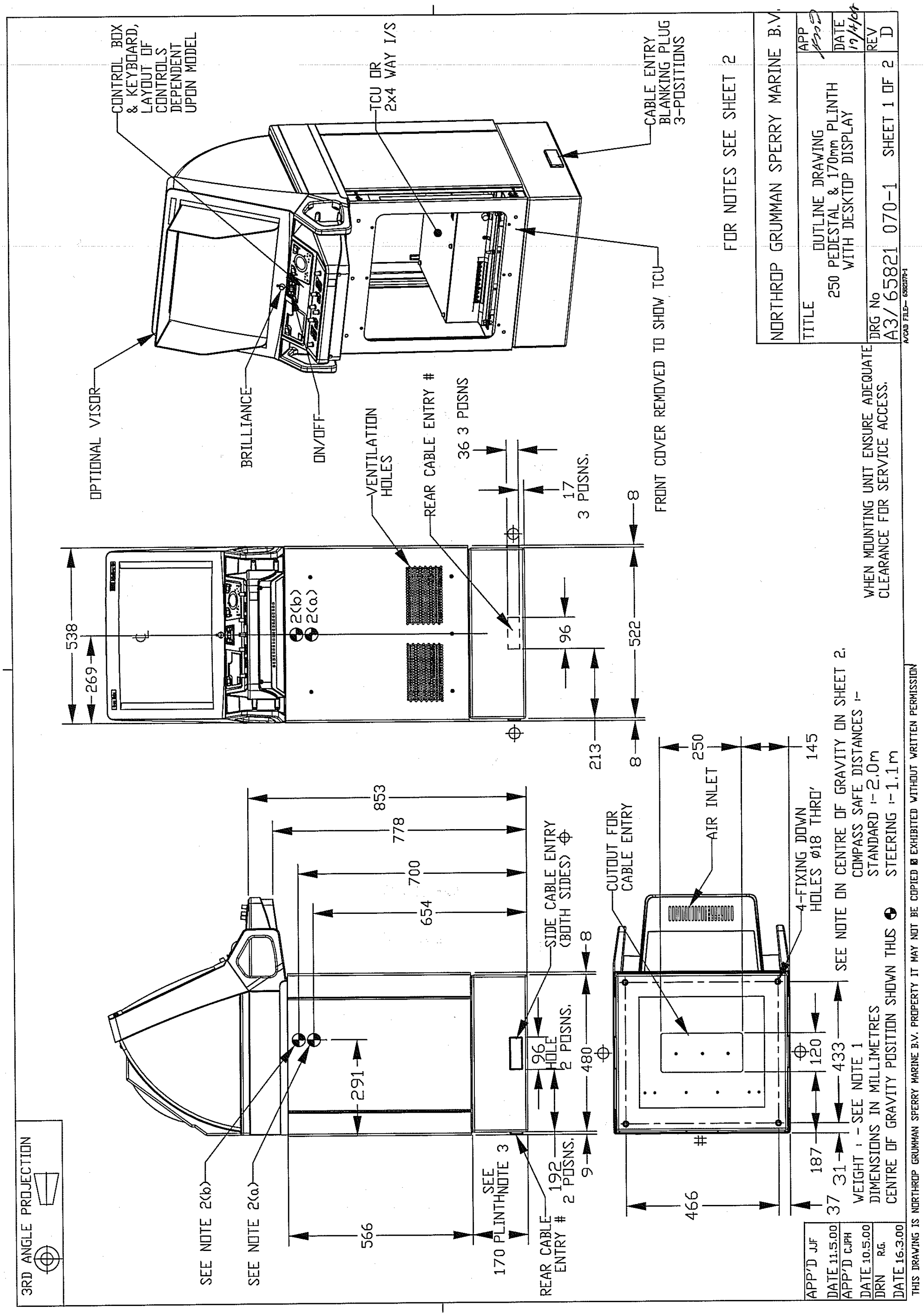


Figure 3.76. **250 Display Unit (CRT with Pedestal) Outline Drawing**

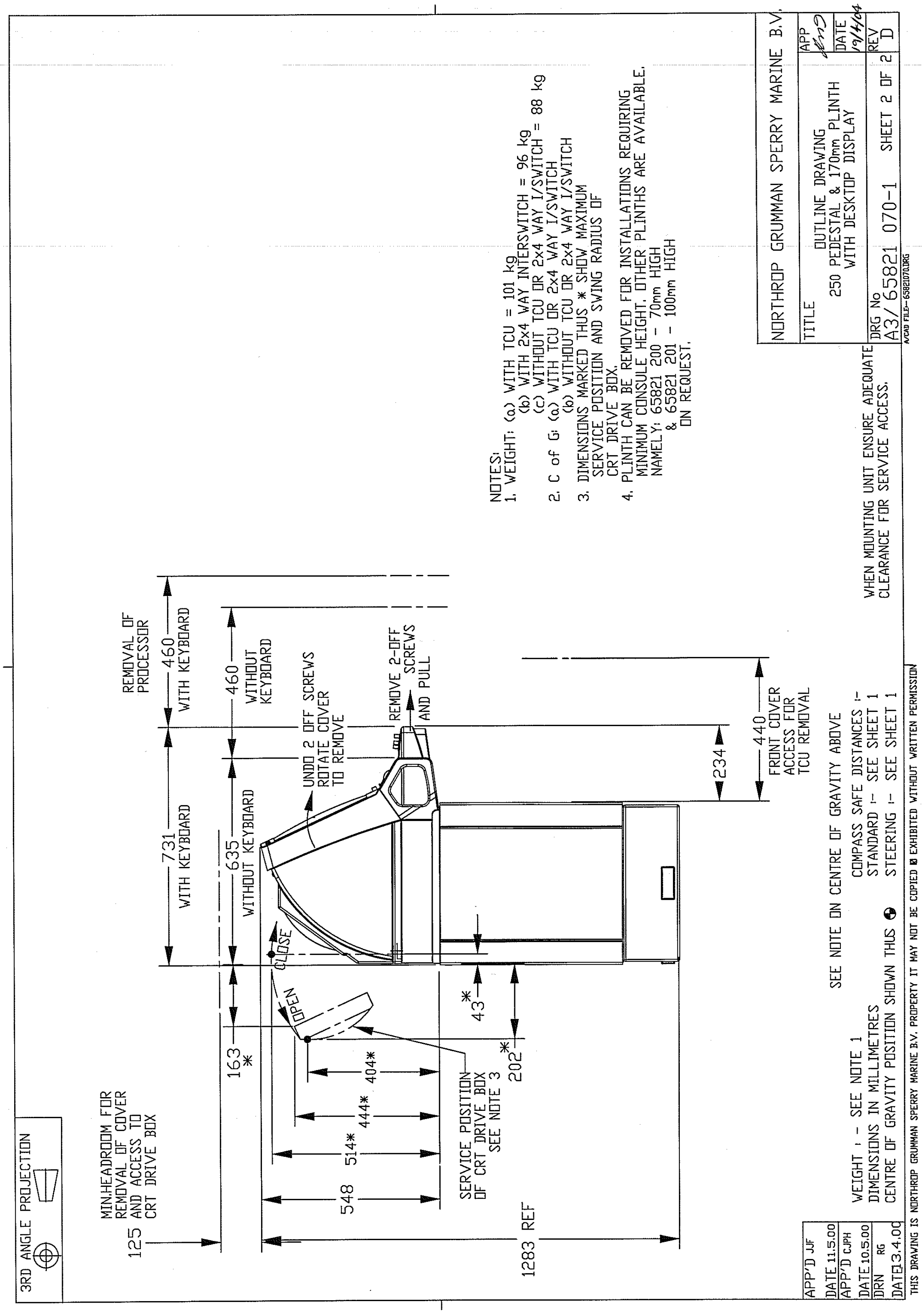


Figure 3.77. 250 Display Unit (CRT with Pedestal) Outline Drawing

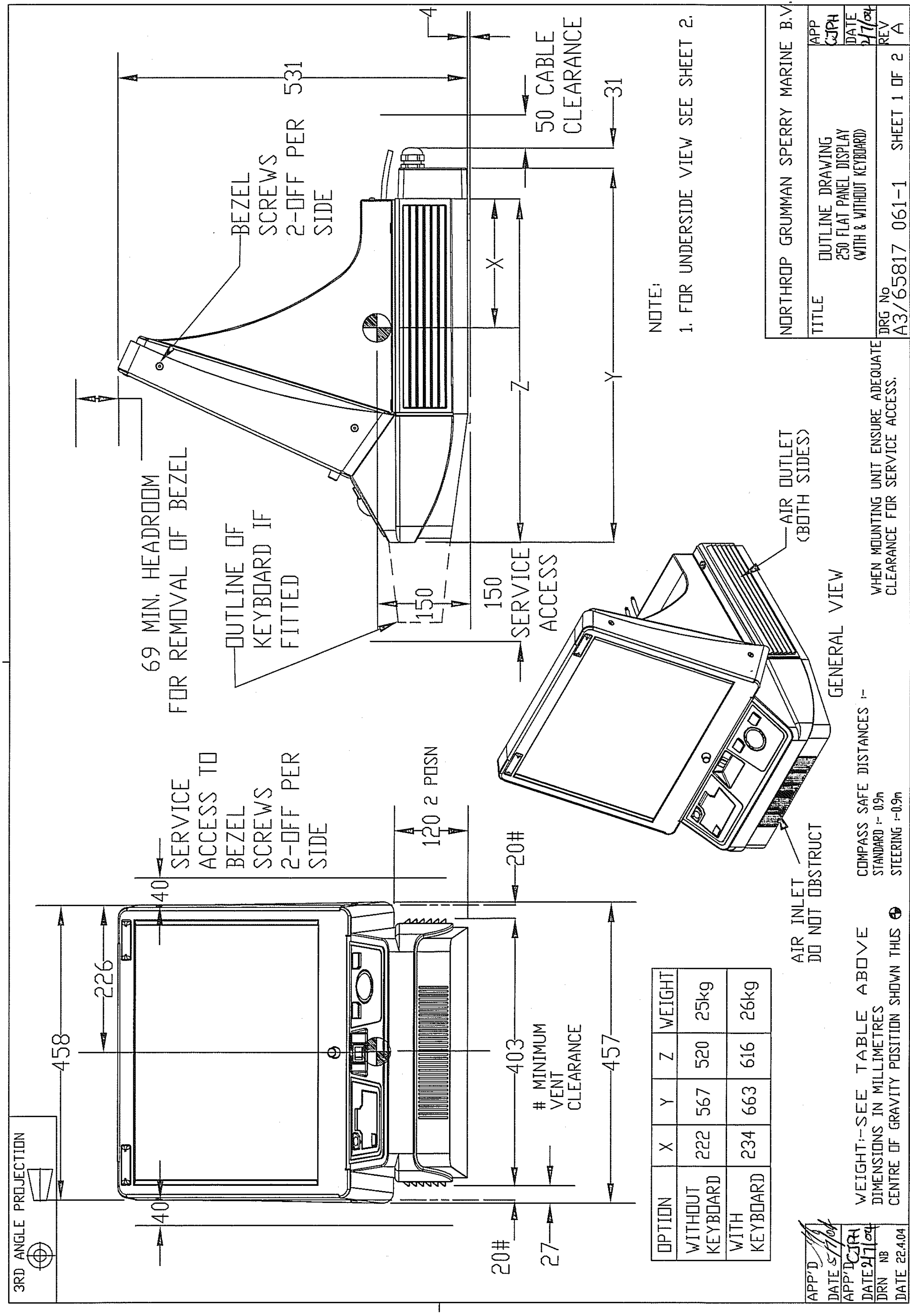


Figure 3.78. **250 Display Unit (FPD) Outline Drawing**

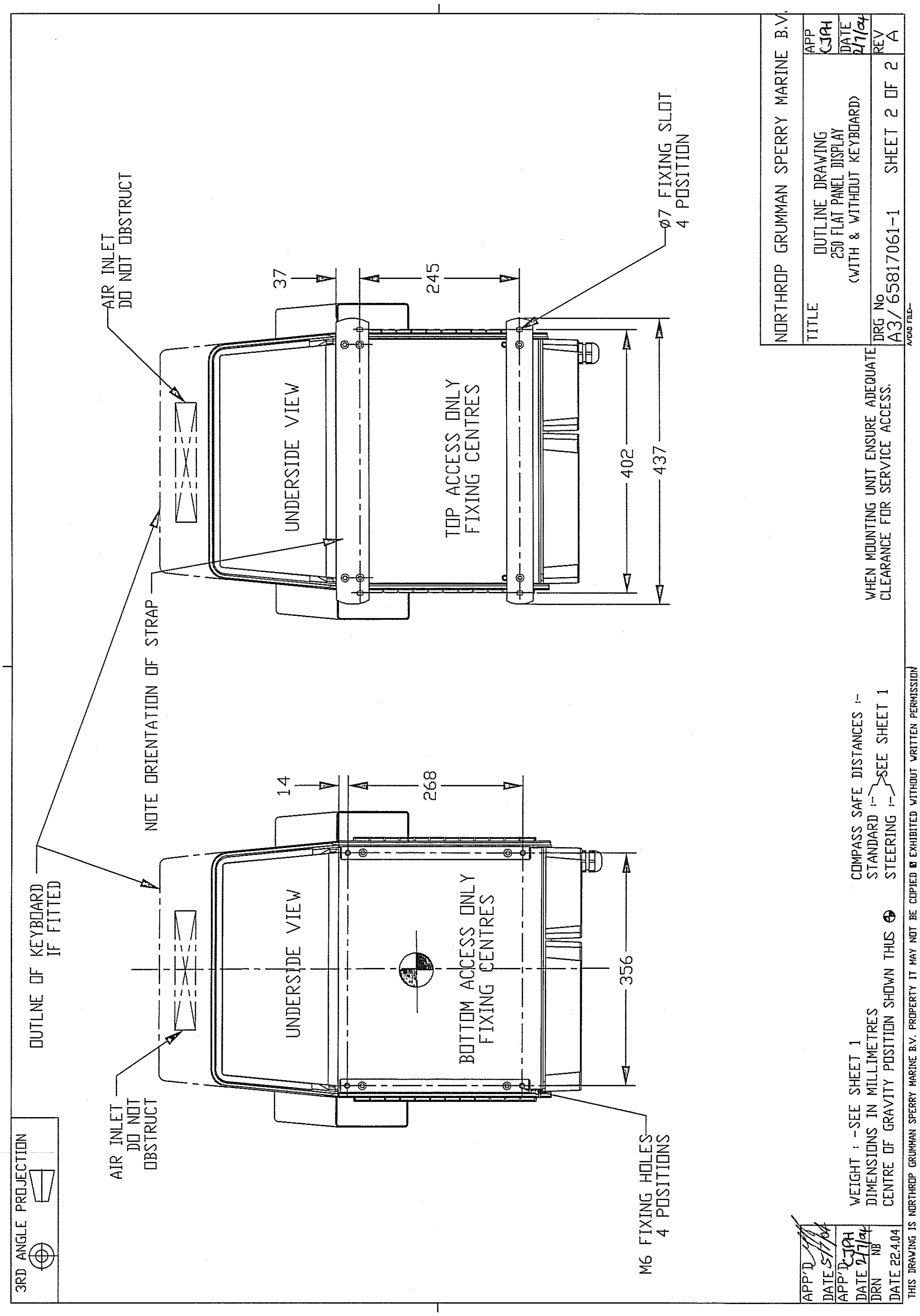


Figure 3.79. 250 Display Unit (FPD) Outline Drawing

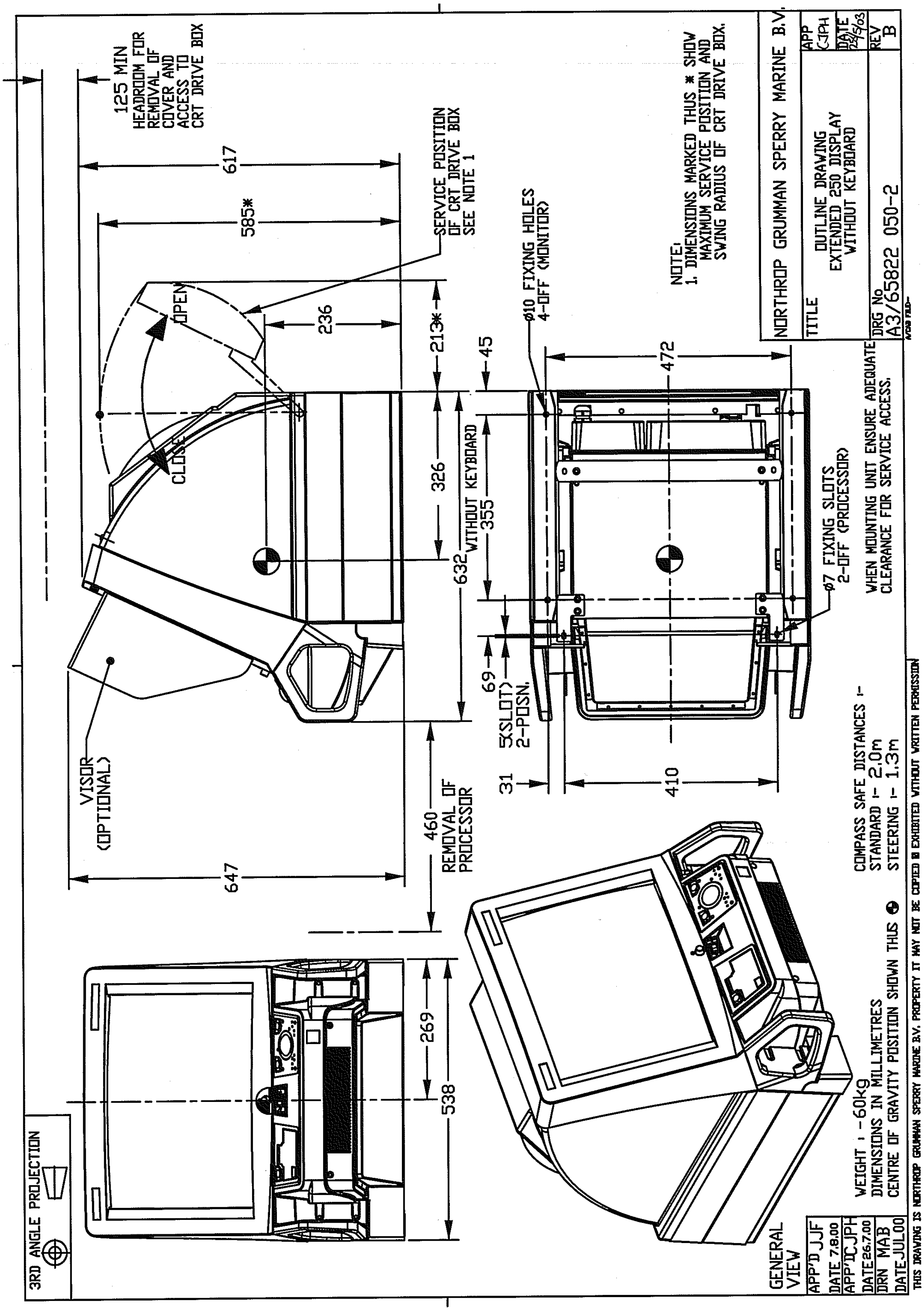


Figure 3.80. **250 Extended Display Unit (CRT) Outline Drawing**

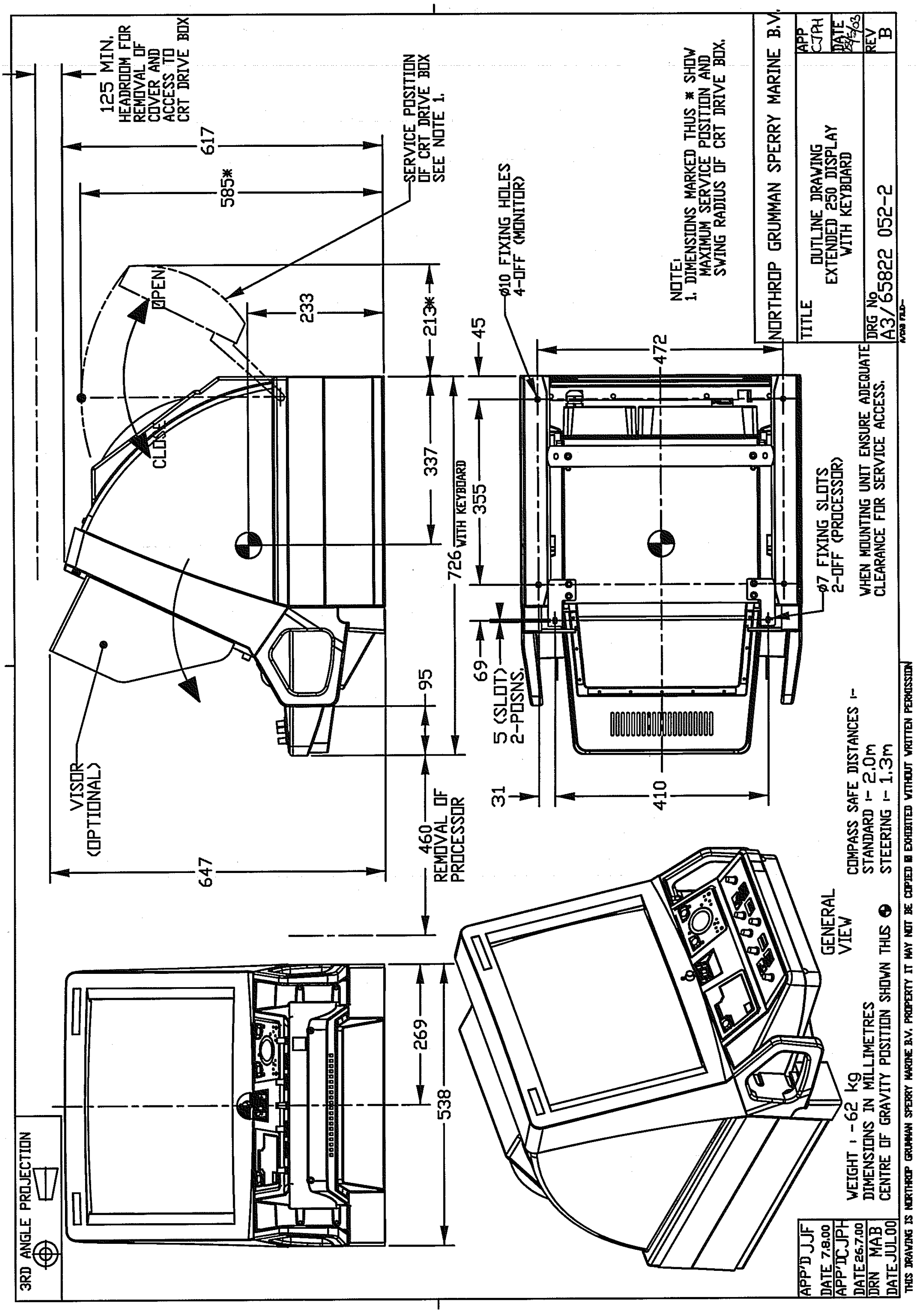


Figure 3.81. **250 Extended Display Unit (CRT with Keyboard) Outline Drawing**

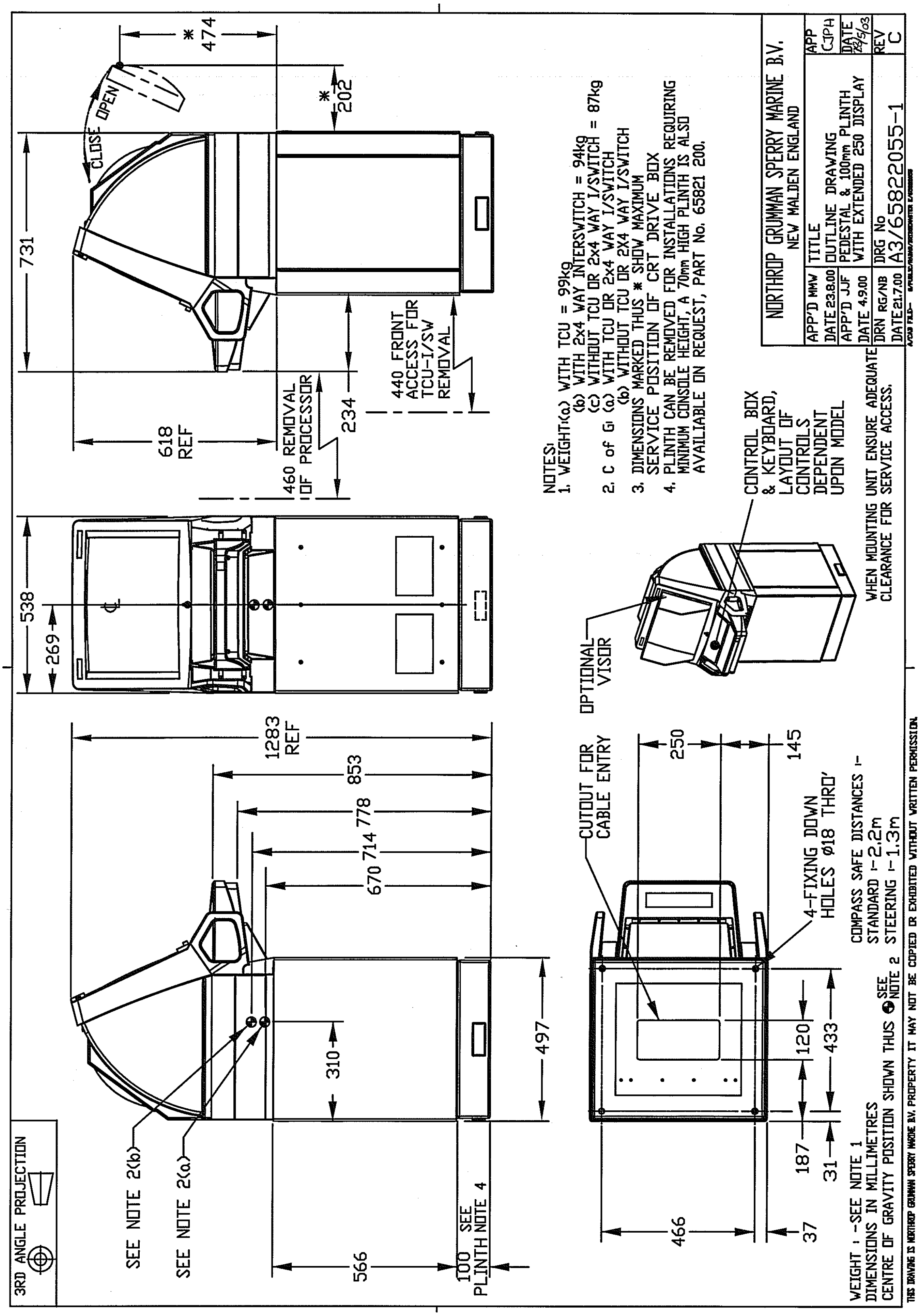


Figure 3.82. 250 Extended Display Unit (CRT with Pedestal) Outline Drawing

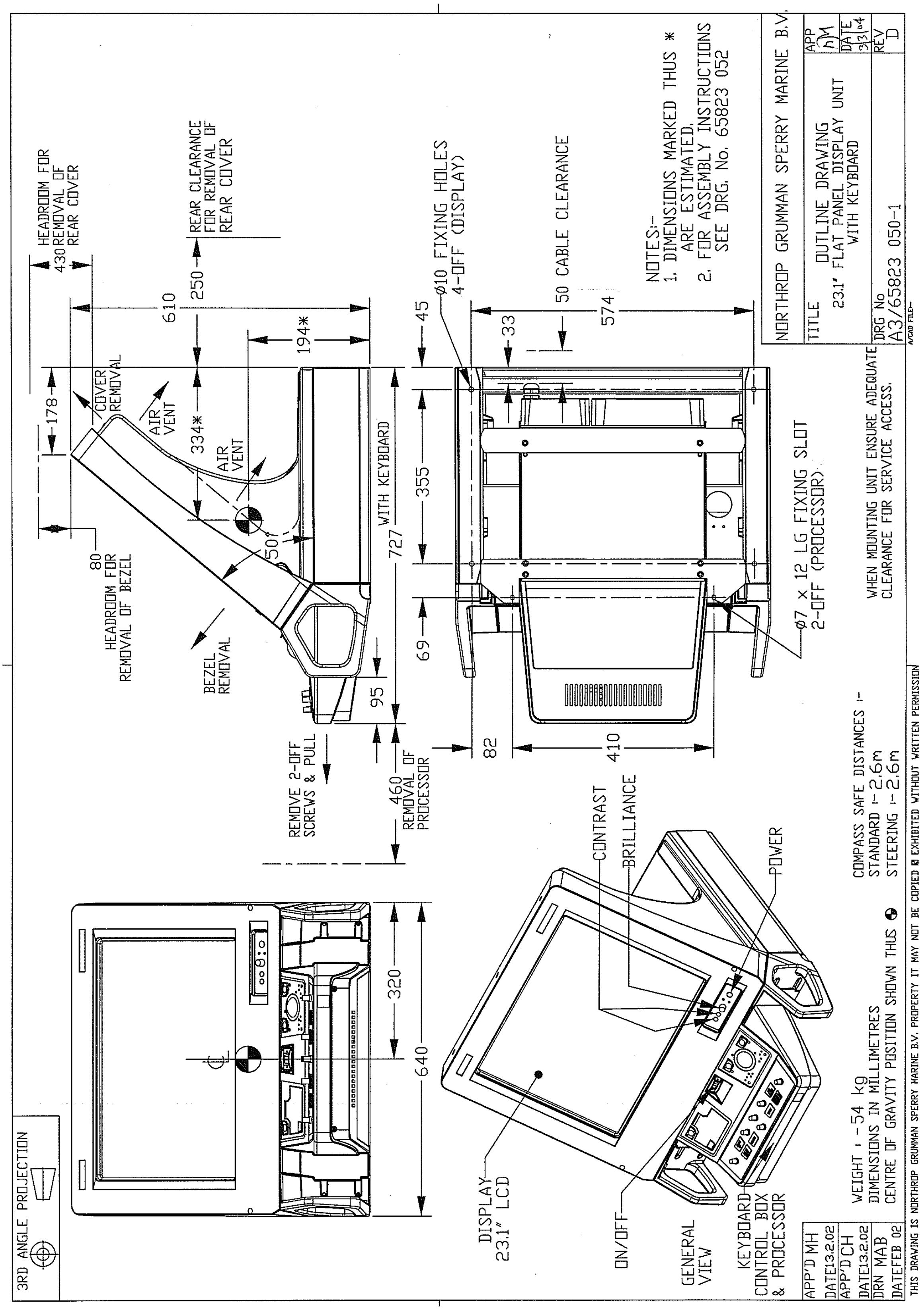


Figure 3.83. 340 Display Unit (FPD) Outline Drawing

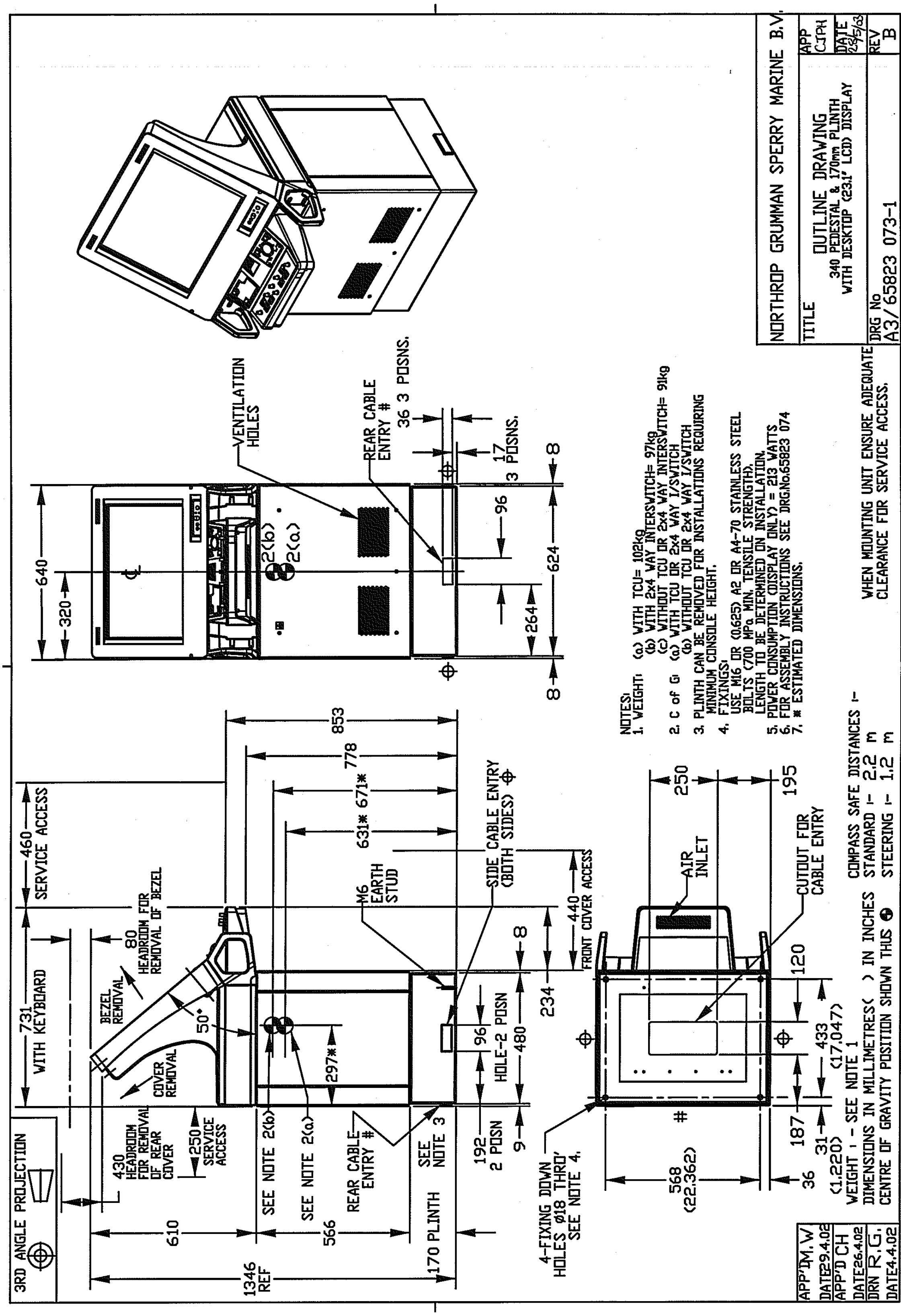


Figure 3.84. 340 Display Unit (FPD with Pedestal) Outline Drawing

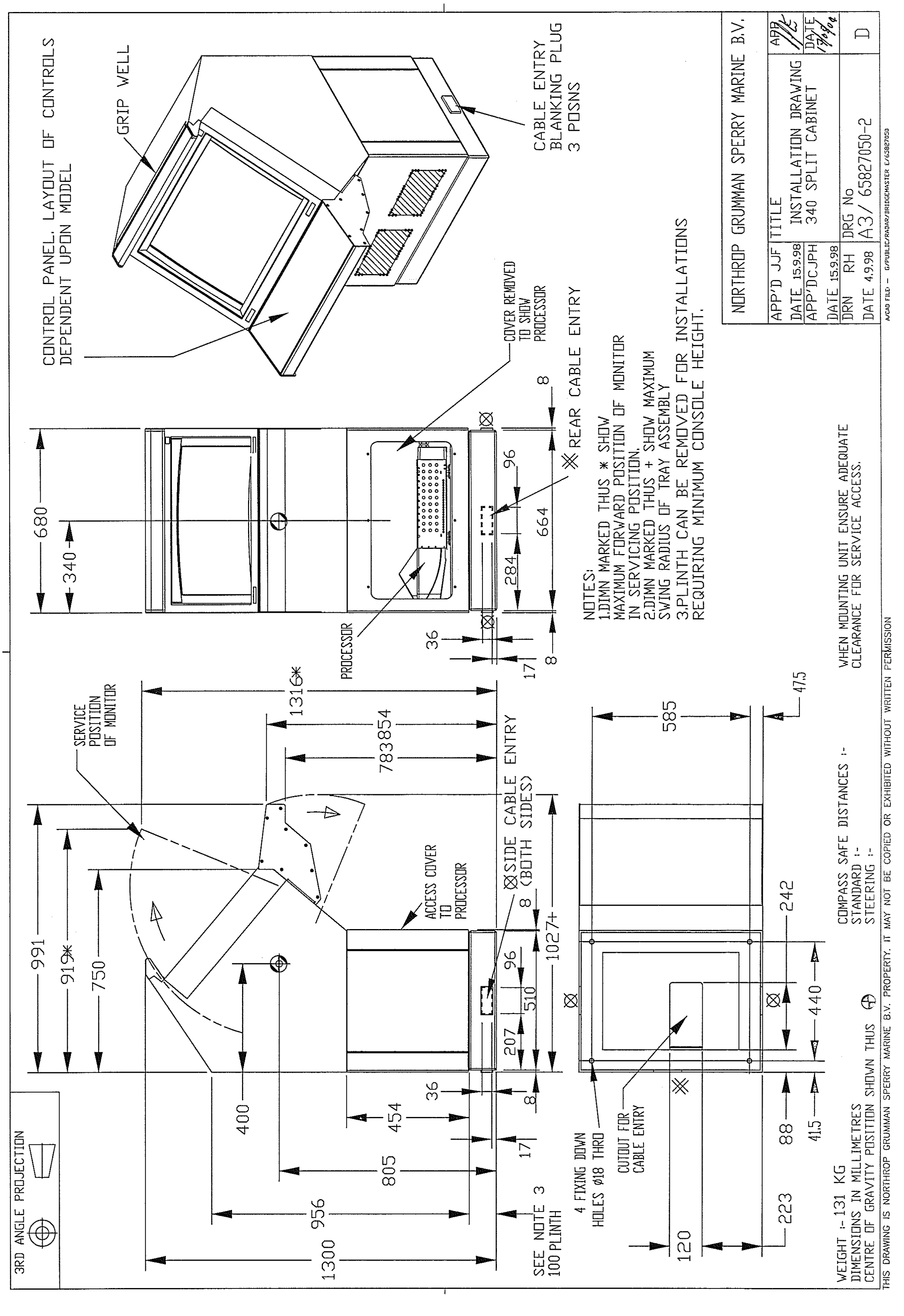


Figure 3.85. 340 Deck Mounted Display Unit (CRT with extruded tray) Outline Drawing

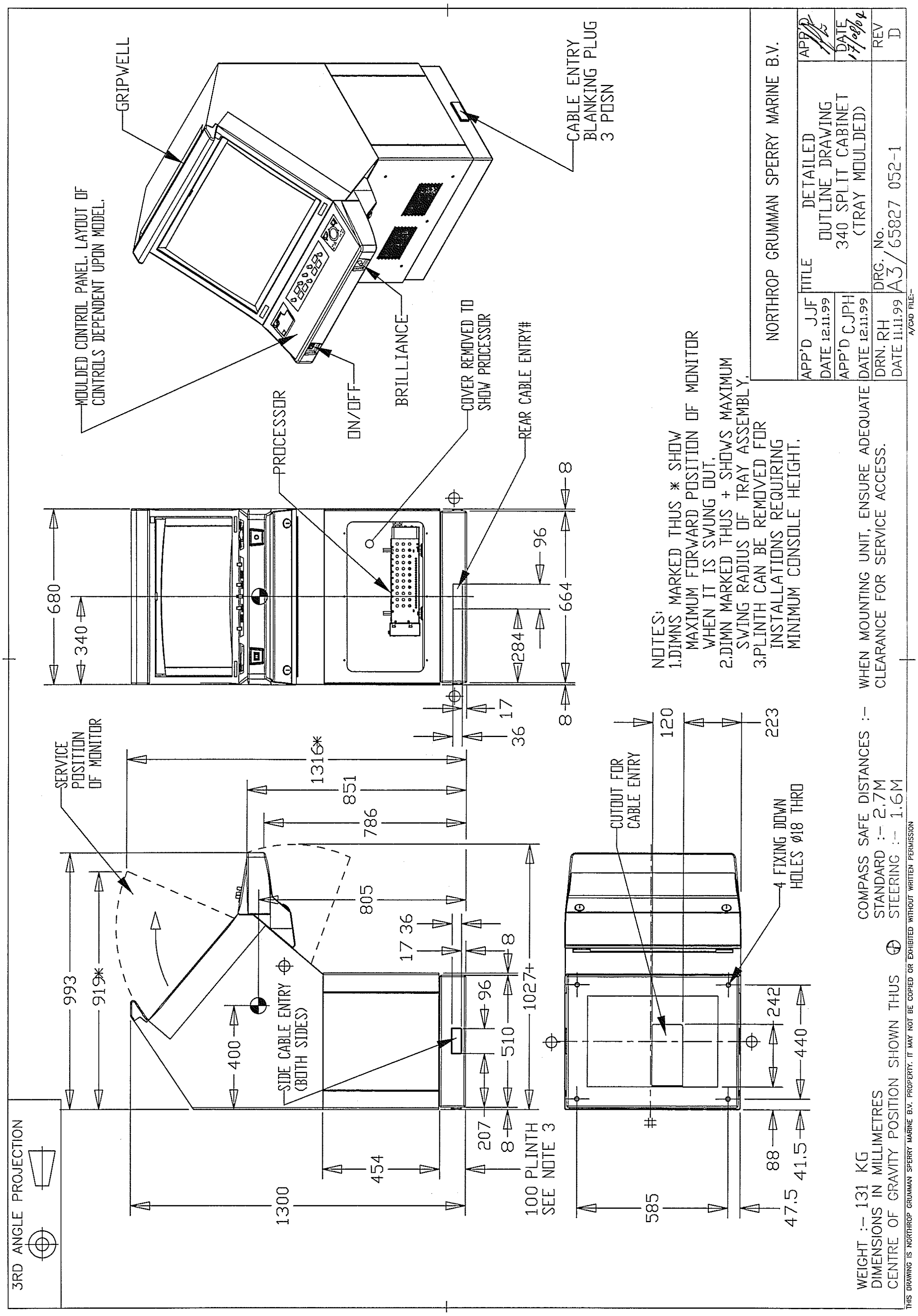


Figure 3.86. 340 Deck Mounted Display Unit (CRT with moulded tray) Outline Drawing

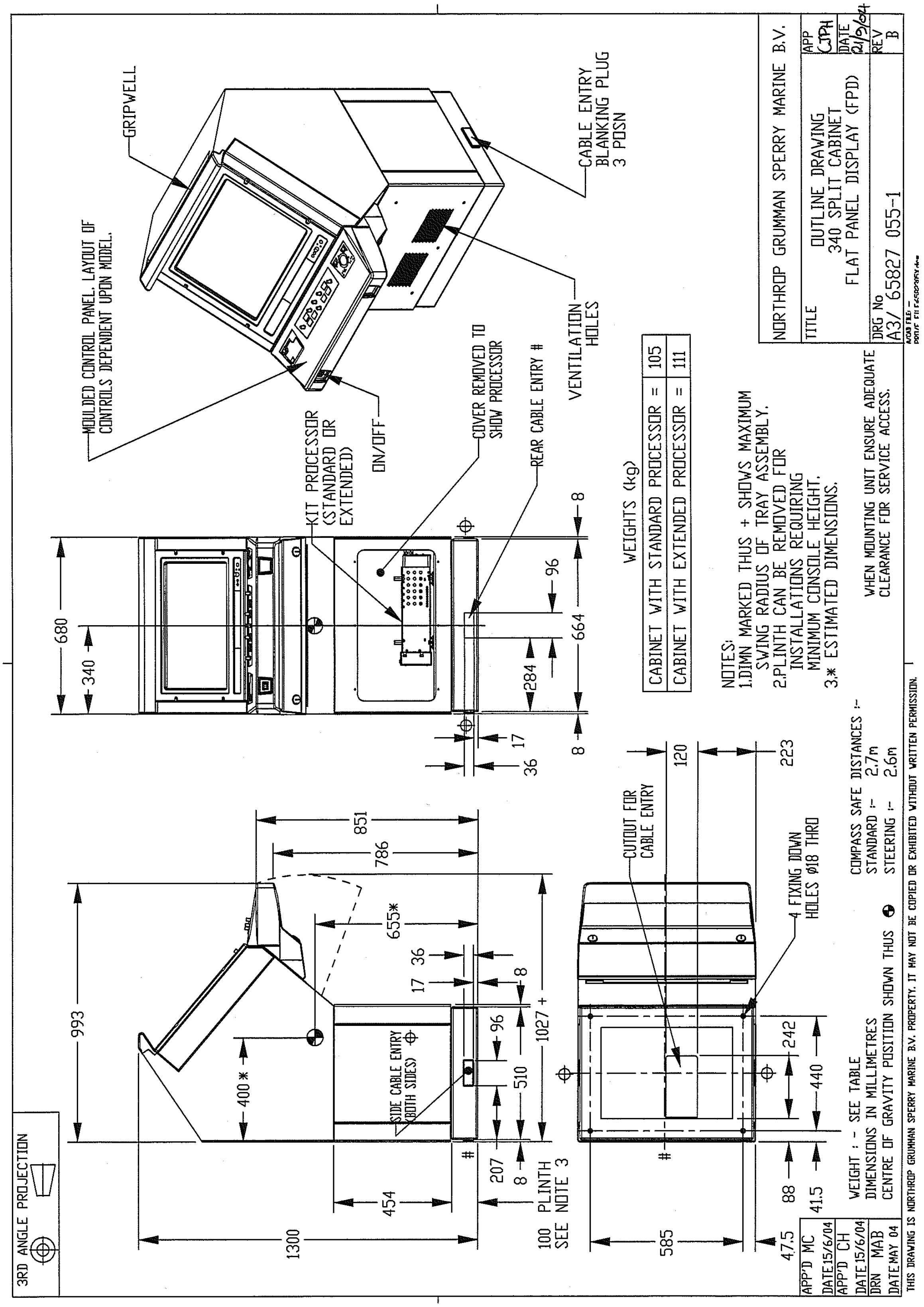


Figure 3.87. 340 Deck Mounted Display Unit (FPD with moulded tray) Outline Drawing

2.8 Modular Units

Note – In order to assemble the modules from their supplied parts, refer to the documentation supplied with the parts.

2.8.1 Processor Modules

Refer to Figure 3.88 and Figure 3.89 for installation of the Standard Processor

Refer to Figure 3.90 for installation of the Extended Processor

Note – Particular attention should be given to ensuring adequate connector clearance.

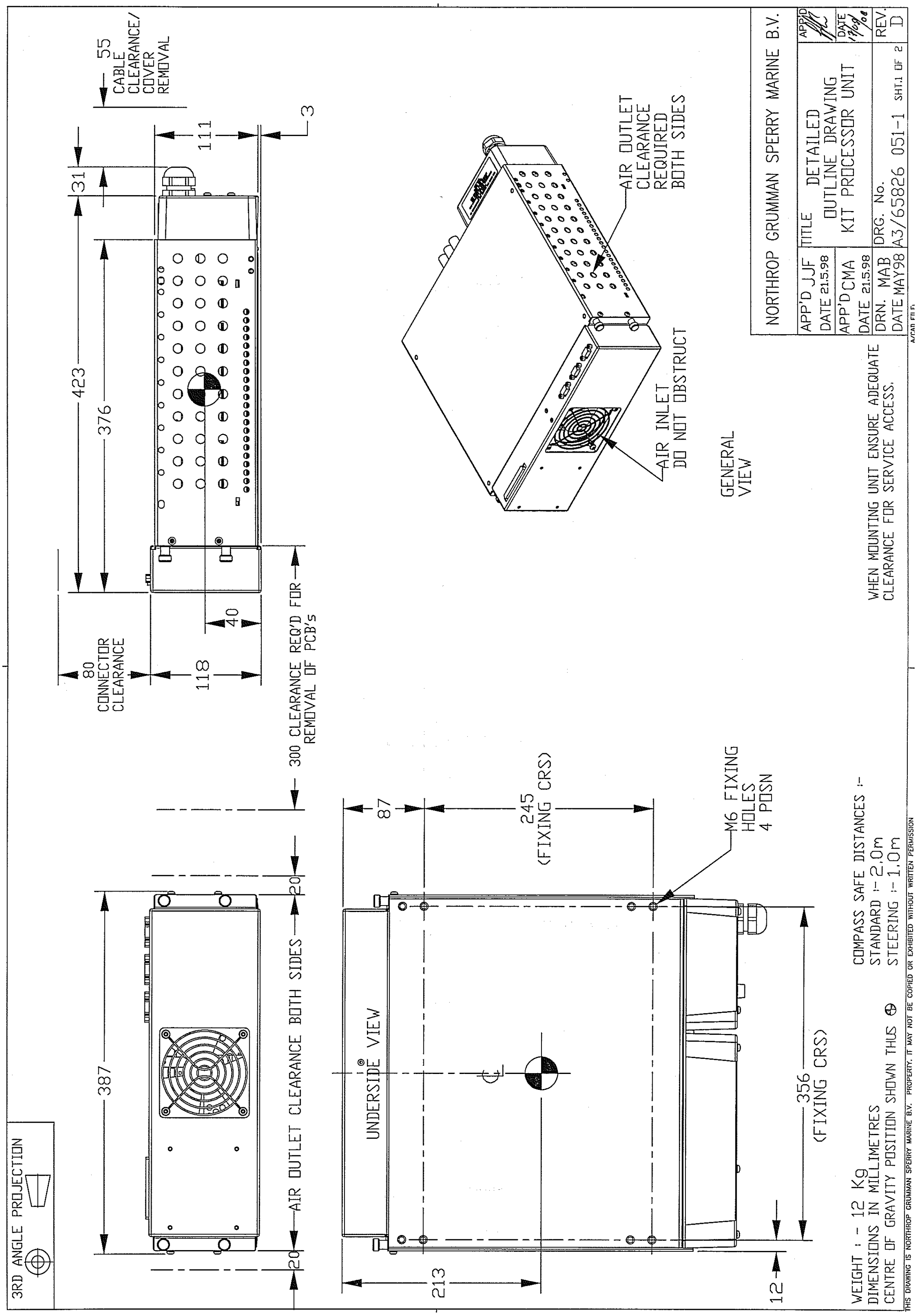


Figure 3.88. Processor Module Outline Drawing

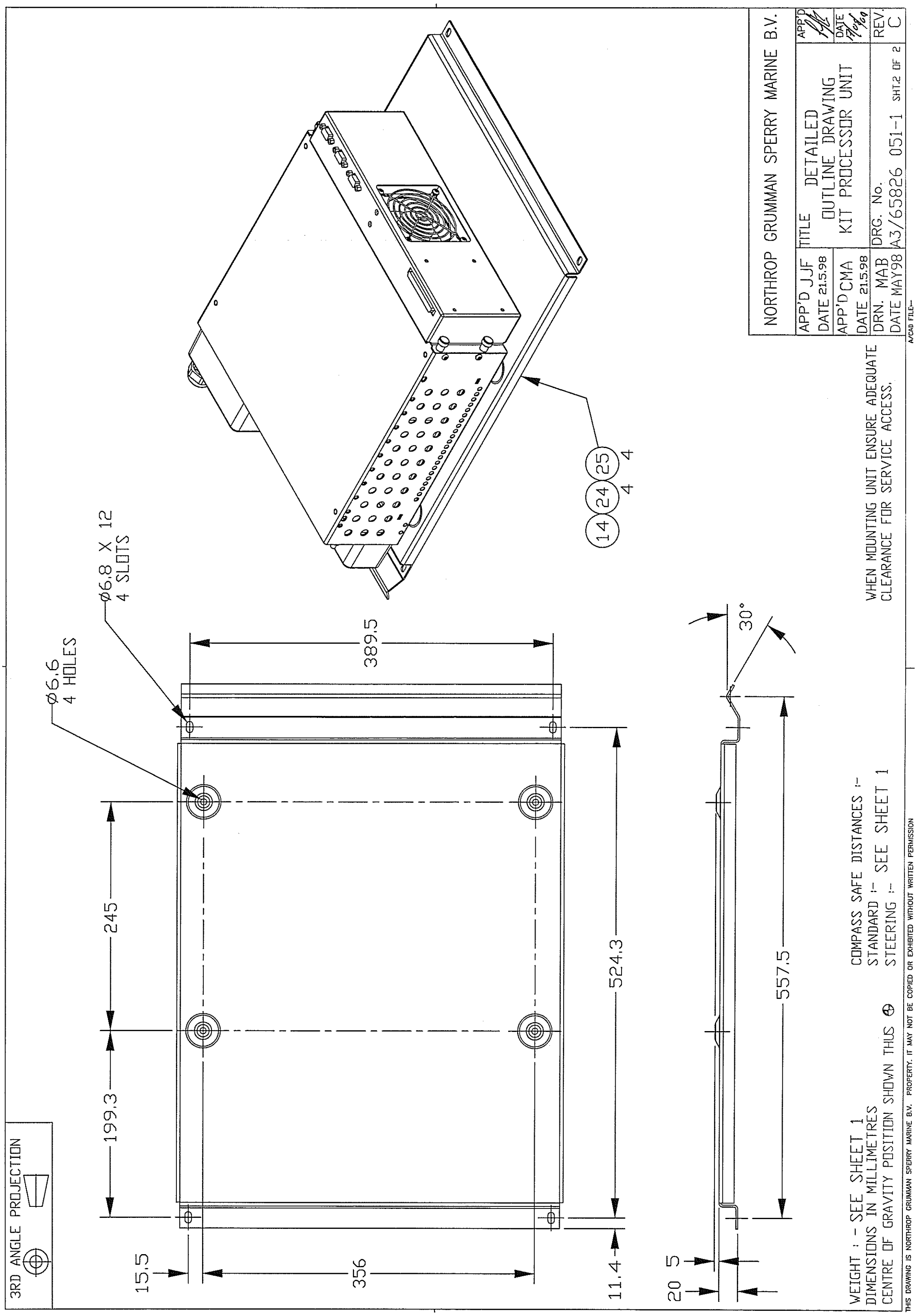


Figure 3.89. Processor Module (for VT cabinet) Outline Drawing

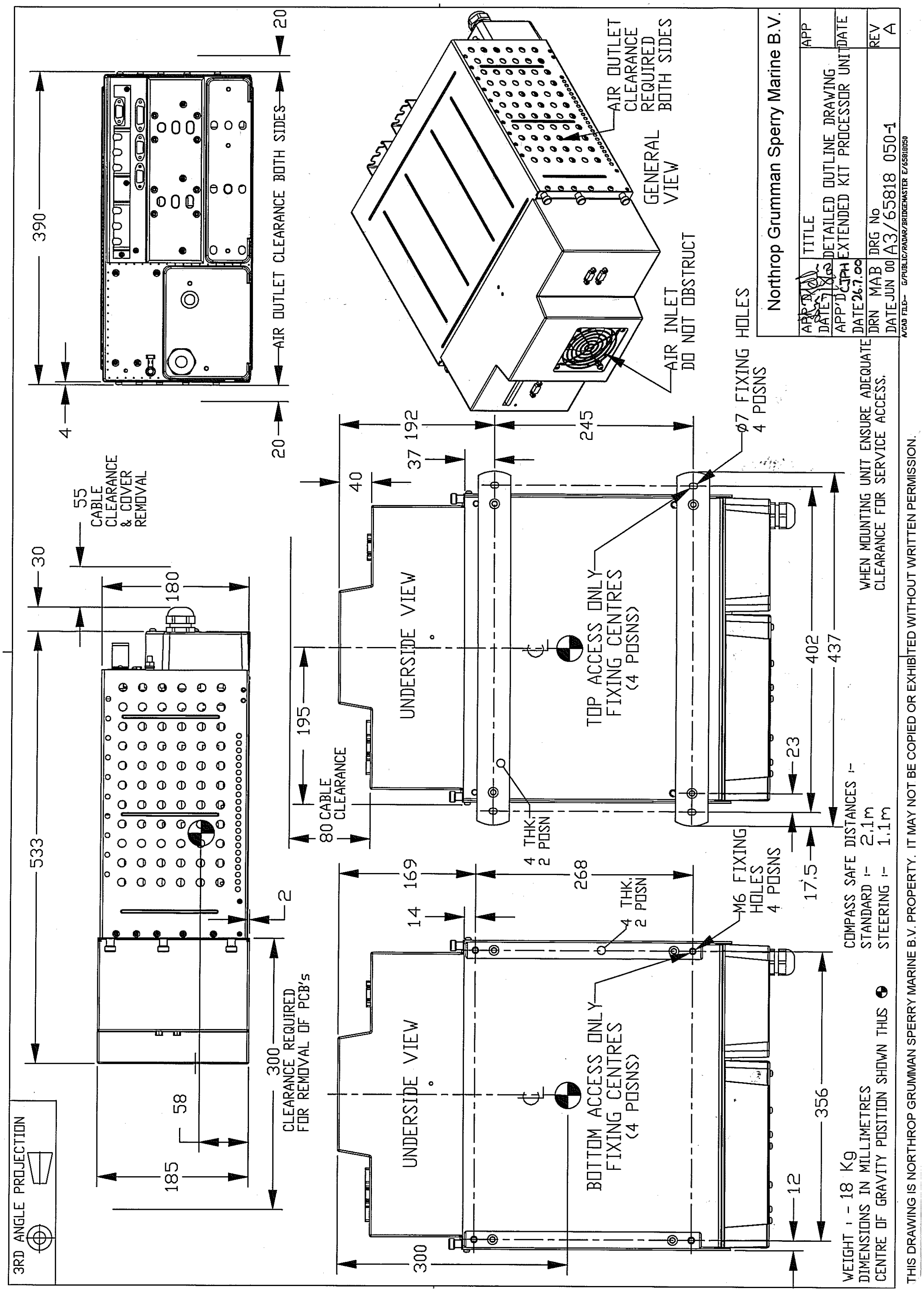


Figure 3.90. Extended Processor Module Outline Drawing

2.8.2 Monitor Modules

Refer to Figure 3.91 for a 180 Monitor Module (CRT)

Refer to Figure 3.92 for a 180 Monitor Module (FPD)

Refer to Figure 3.93 for a 250 Monitor Module (CRT)

Refer to Figure 3.94 to Figure 3.96 for a 250 Monitor Module (FPD)

Refer to Figure 3.97 for a 340 Monitor Module (FPD)

Refer to Figure 3.98 to Figure 3.102 for a 340 Monitor Module (CRT)

Refer to Figure 3.124 for information on interconnecting cables required to connect the Monitor Modules to the Processor Electronics Unit, and to connect the Brilliance Control Module to the Monitor.

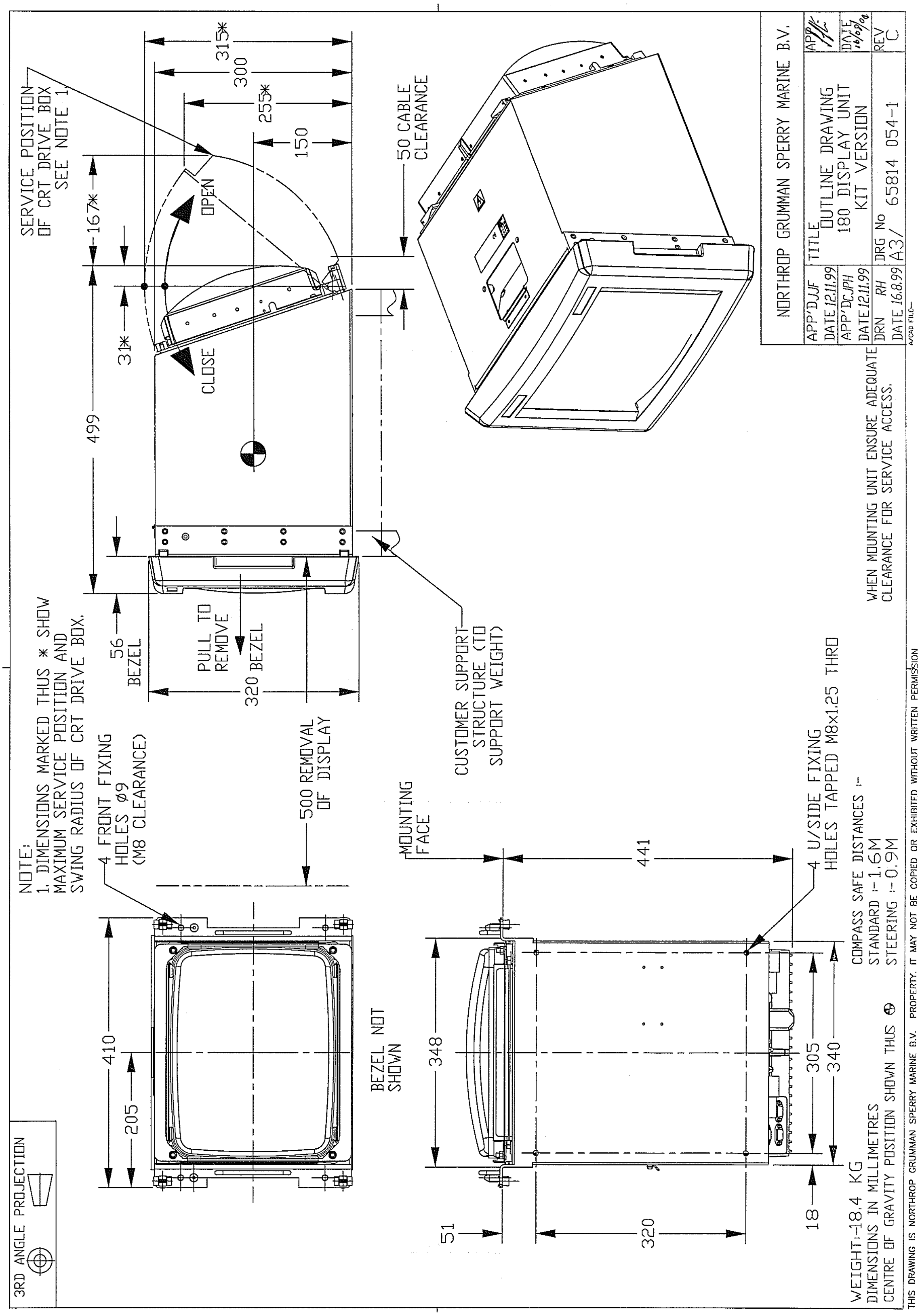


Figure 3.91. 180 Monitor Module (CRT) Outline Drawing

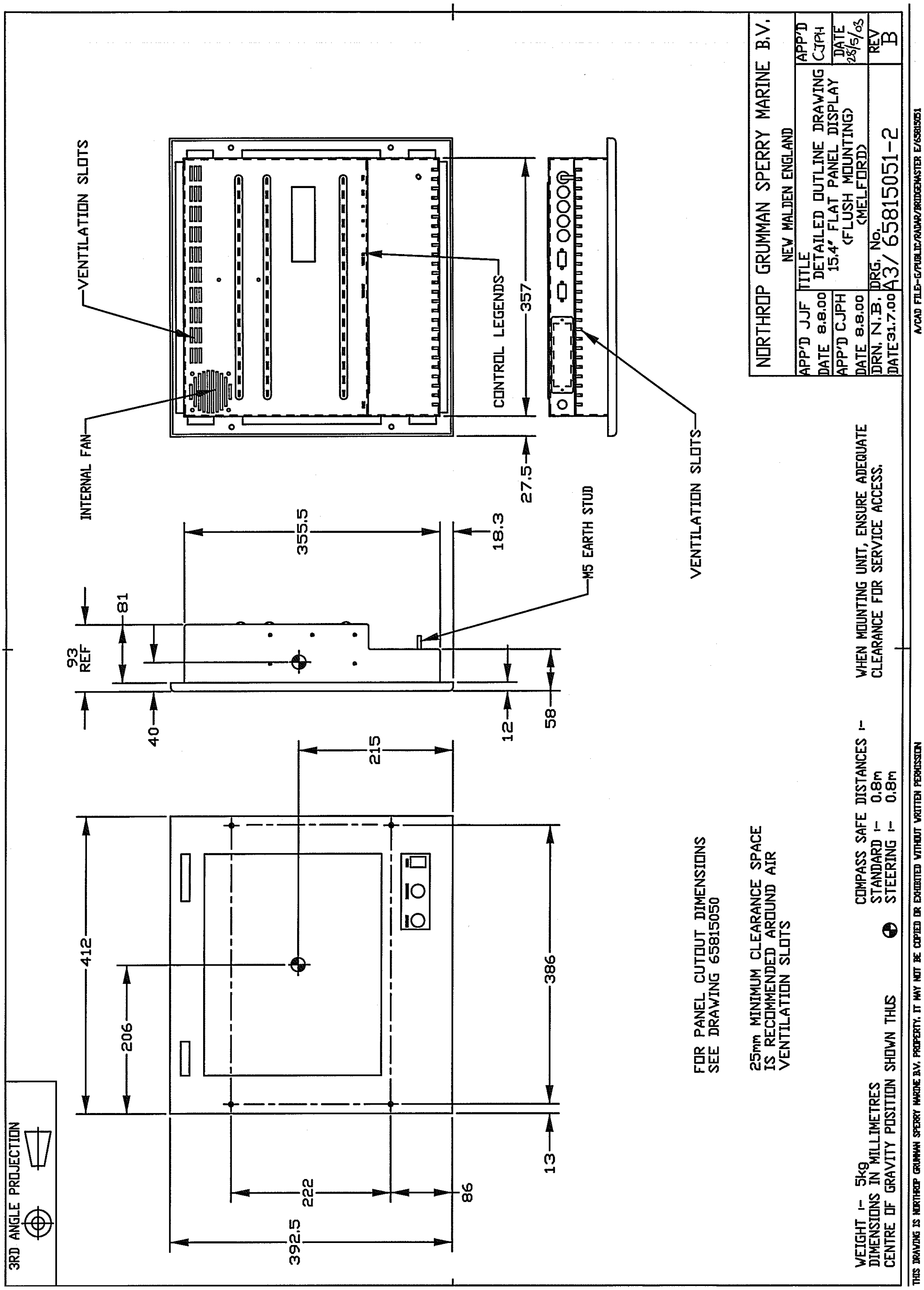


Figure 3.92. 180 Monitor Module (FPD) Outline Drawing

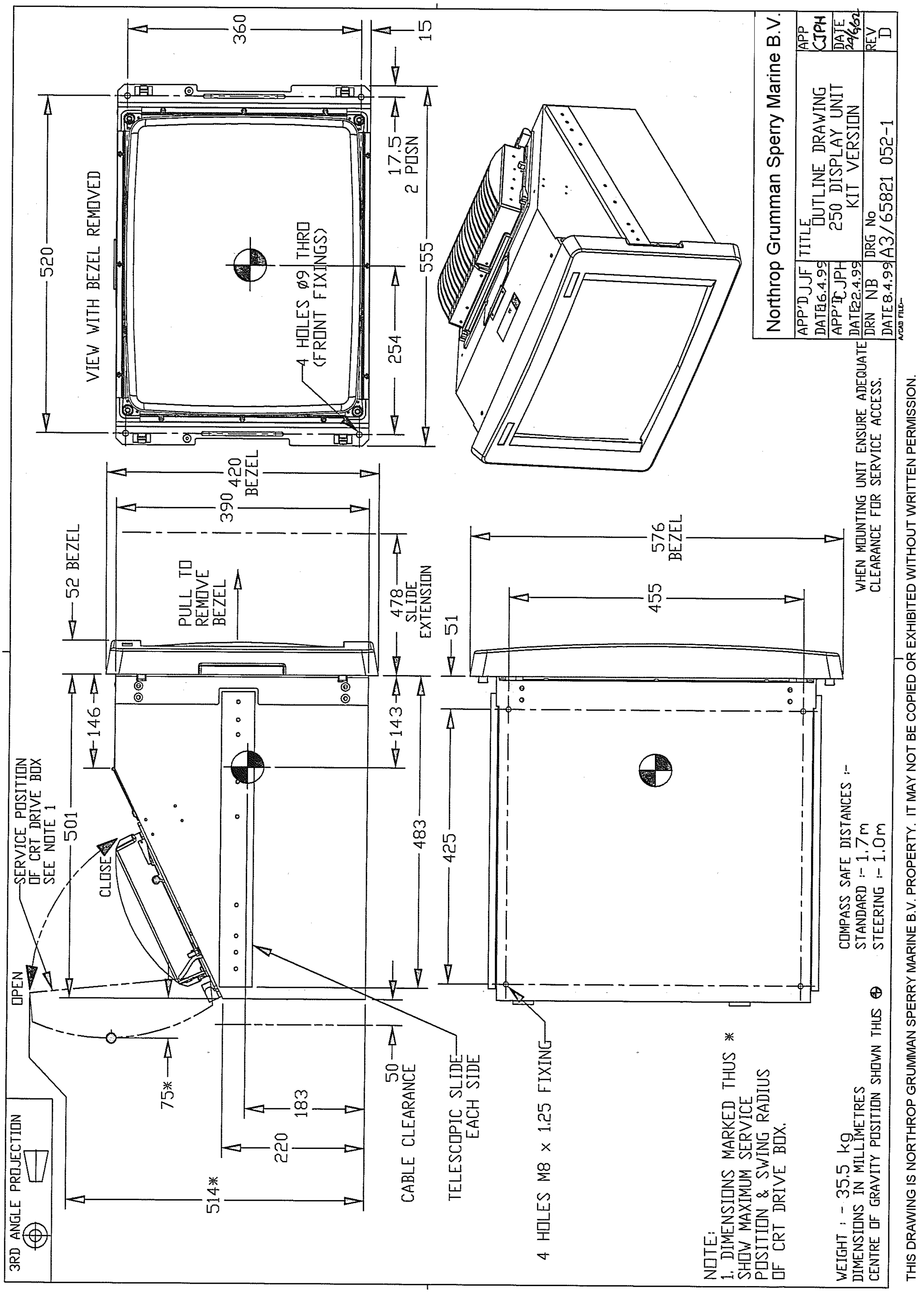


Figure 3.93. 250 Monitor Module (CRT) Outline Drawing

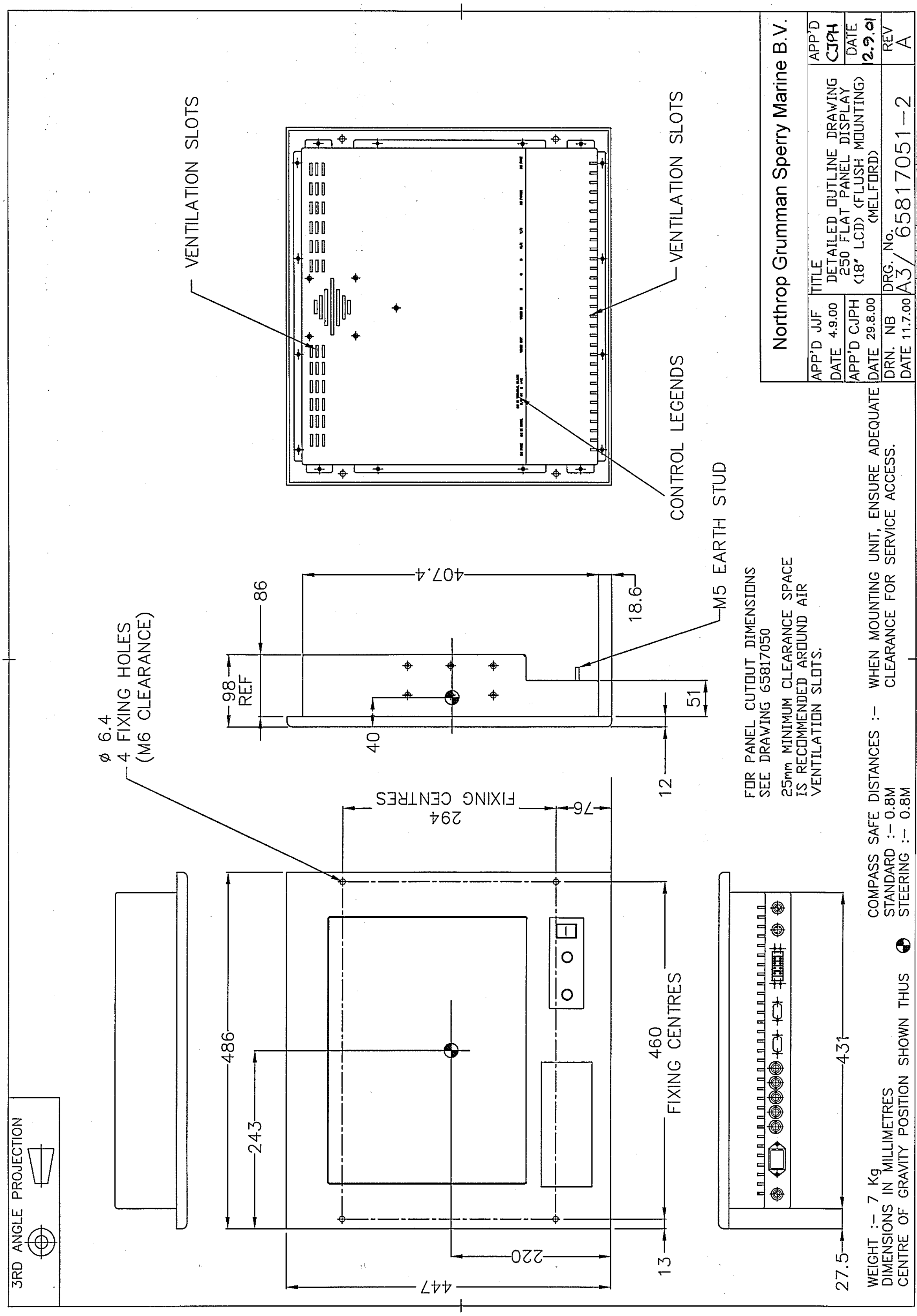


Figure 3.94. 250 Monitor Module (FPD 18") Outline Drawing

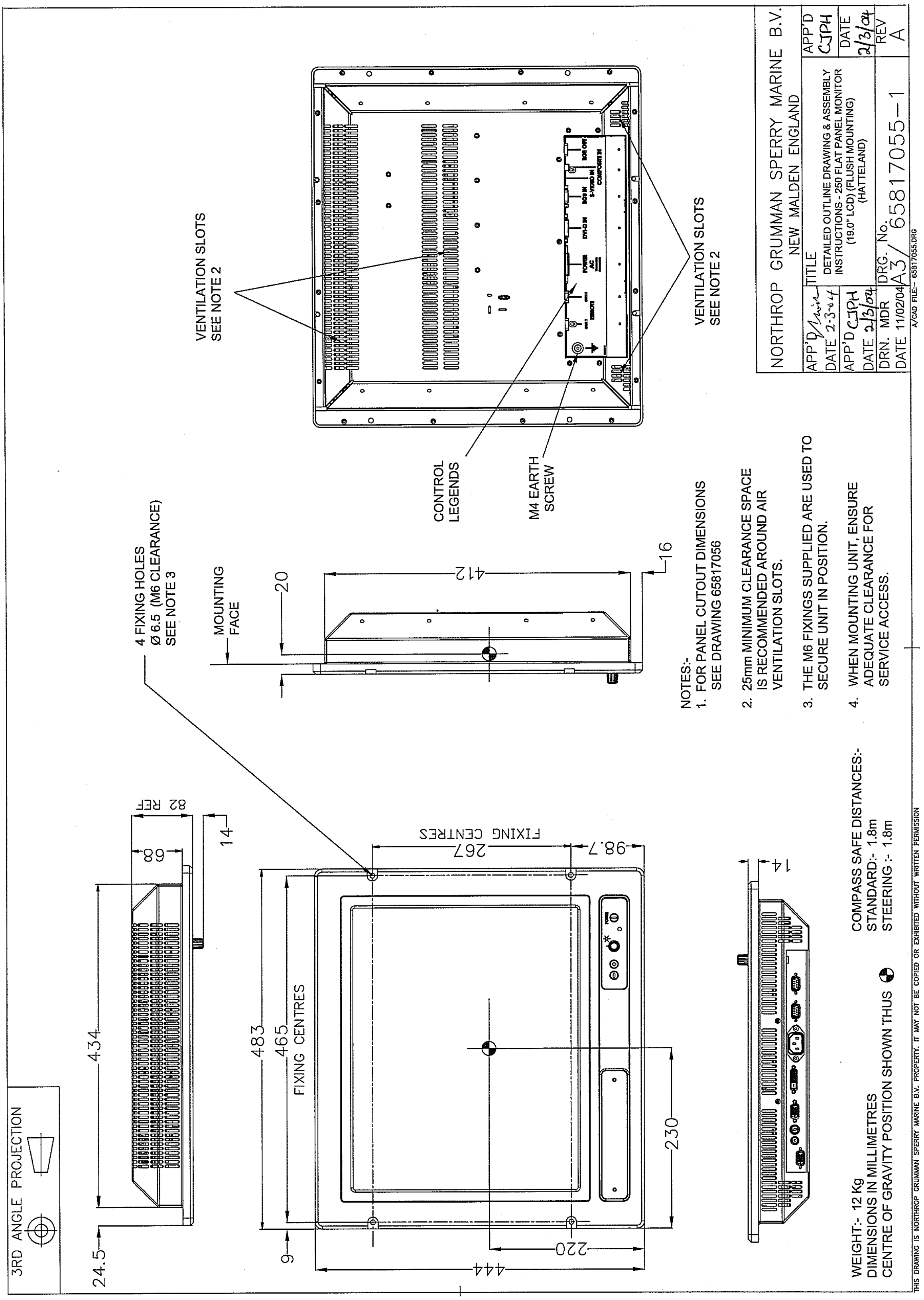


Figure 3.95. 250 Monitor Module (FPD 19") Outline Drawing

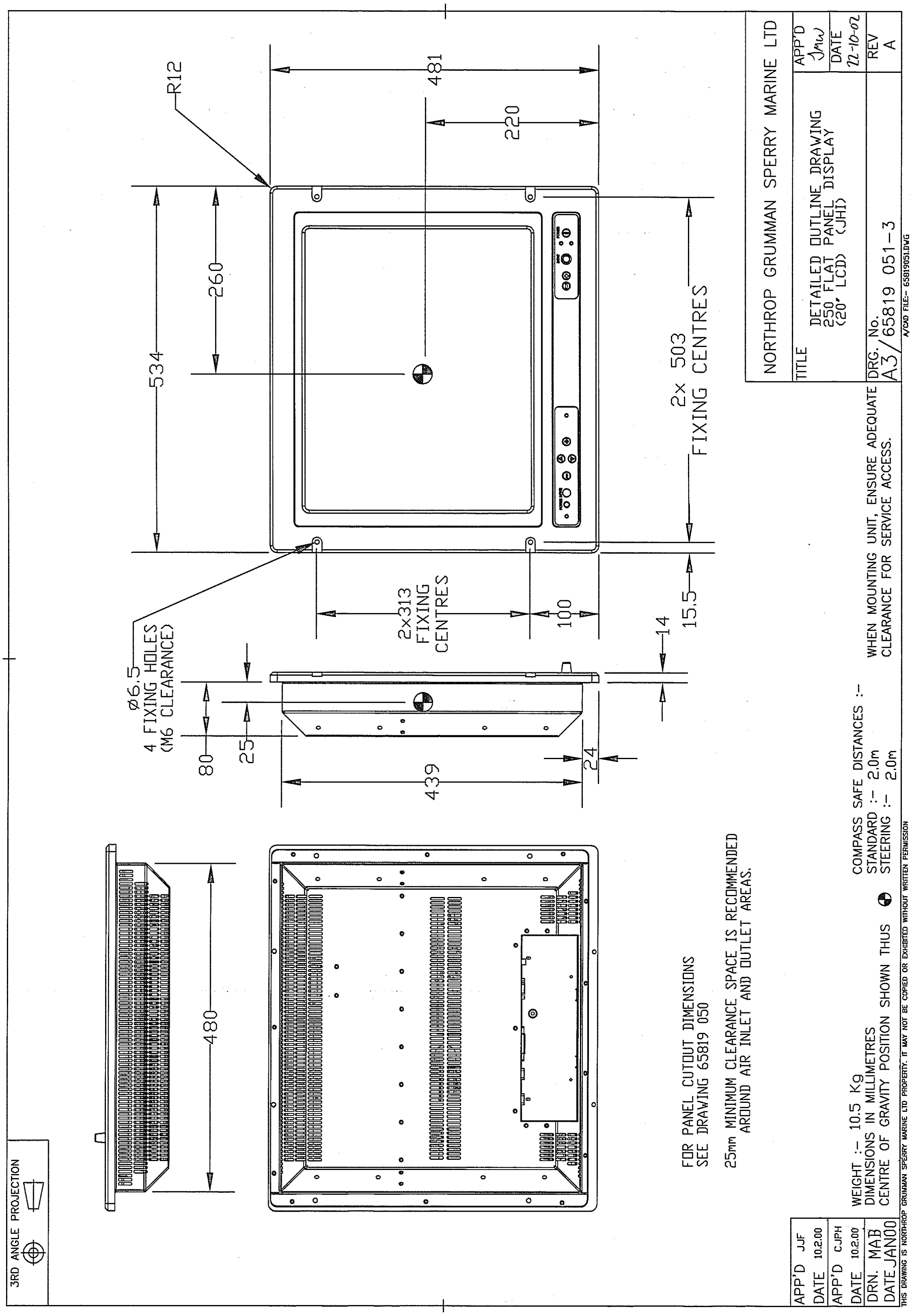


Figure 3.96. 250 Monitor Module (FPD 20") Outline Drawing

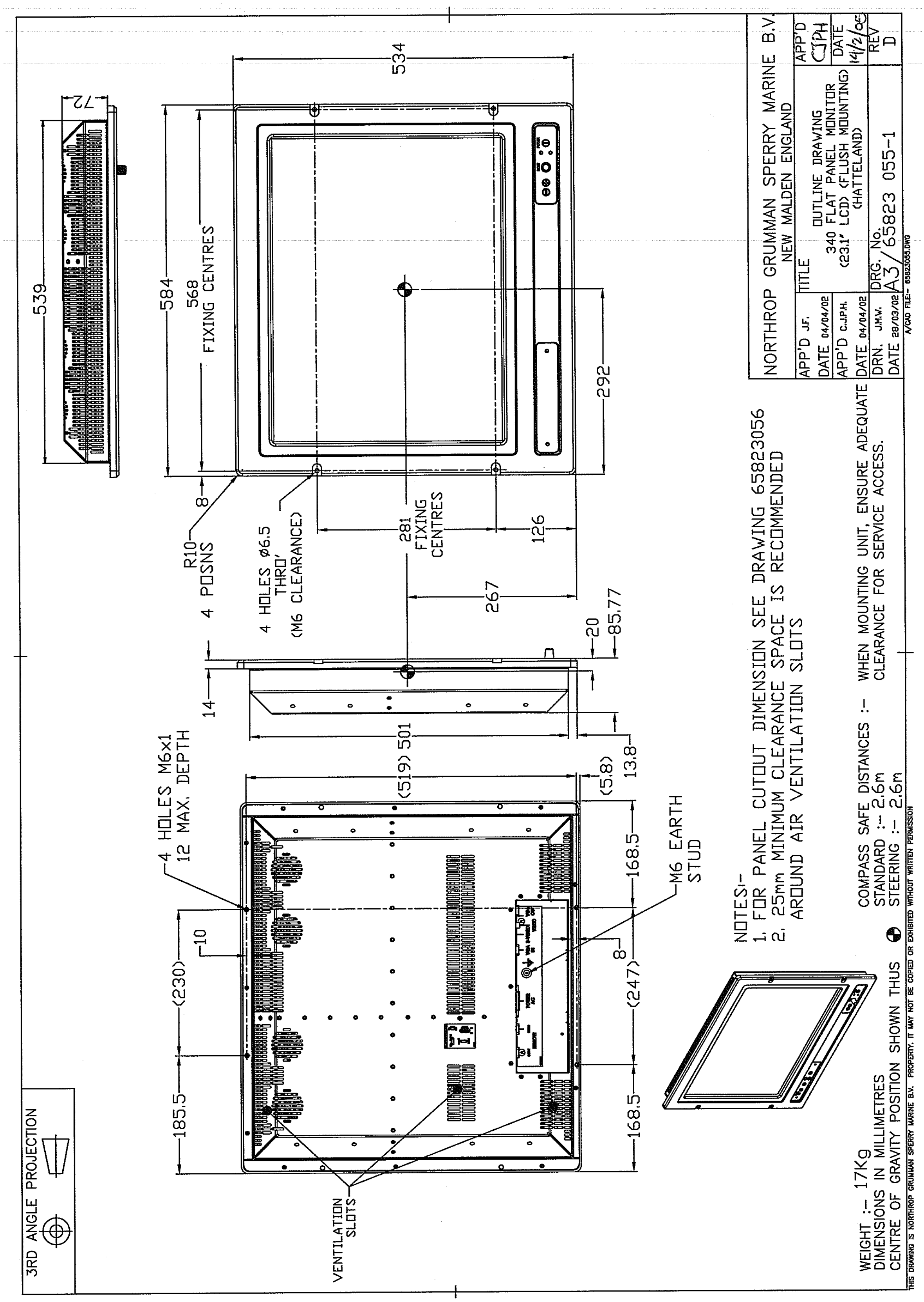


Figure 3.97. 340 Monitor Module (FPD) Outline Drawing

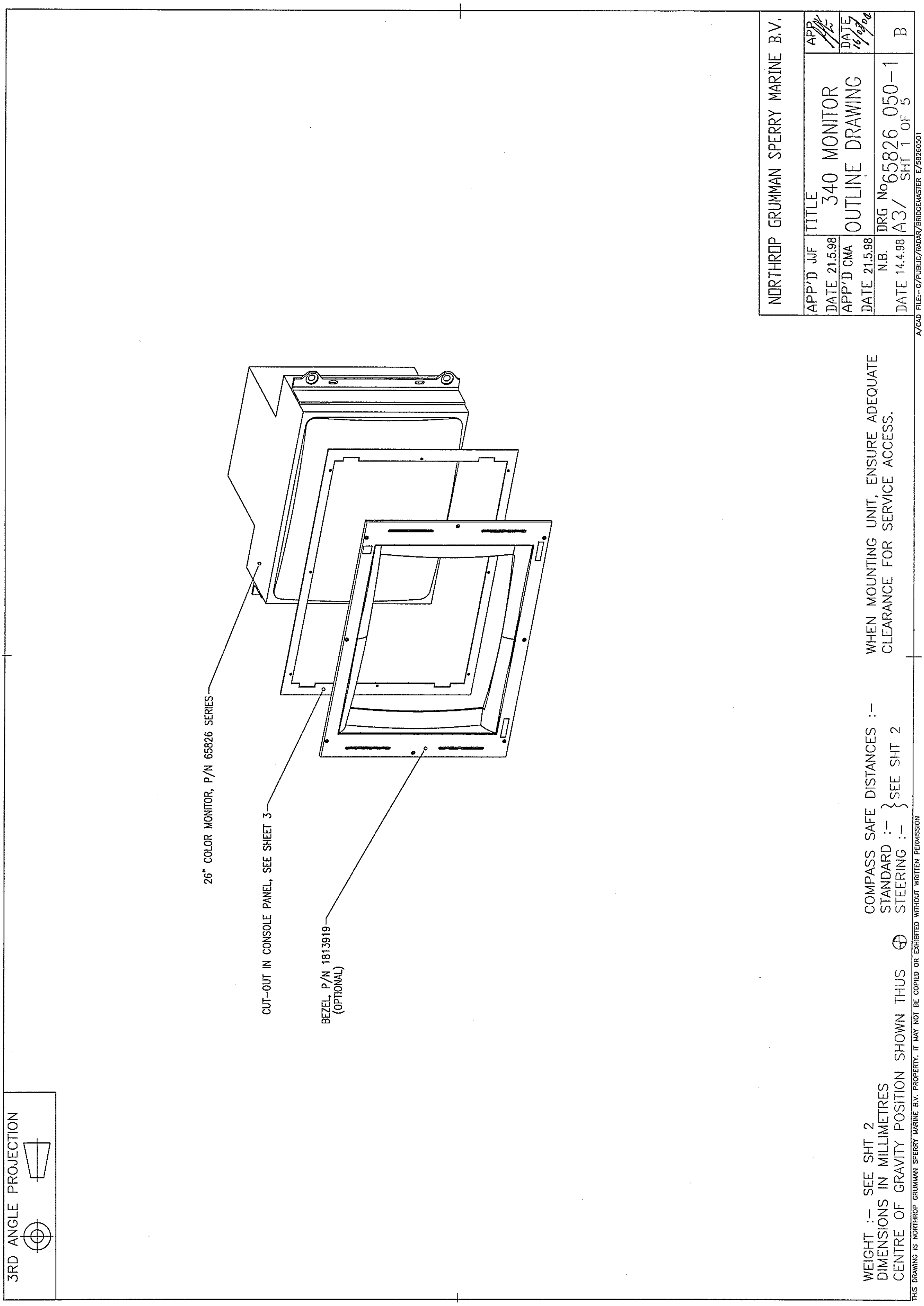


Figure 3.98. 340 Monitor Module (CRT) Outline Drawing (Sheet 1 of 5)

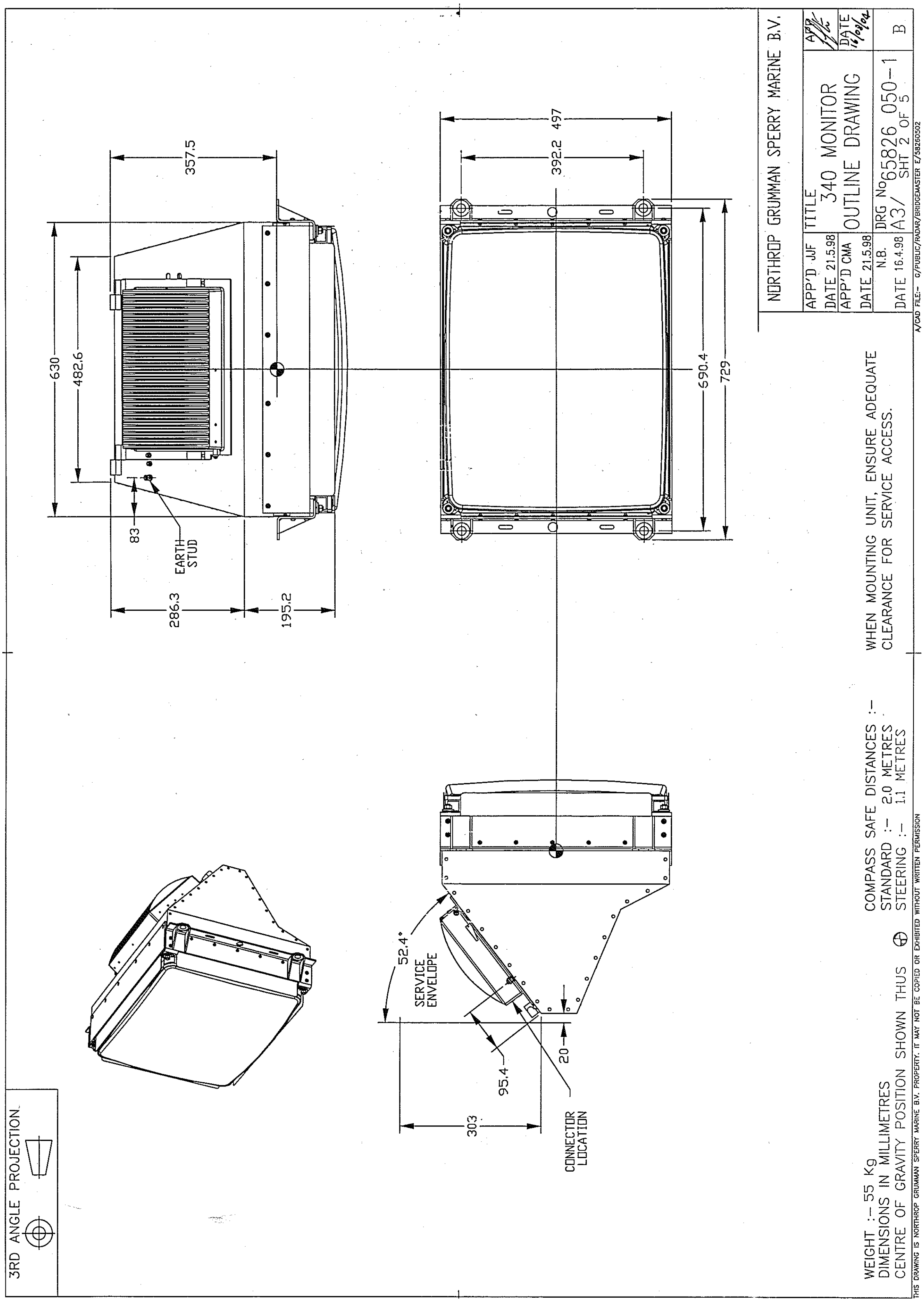


Figure 3.99. 340 Monitor Module (CRT) Outline Drawing (Sheet 2 of 5)

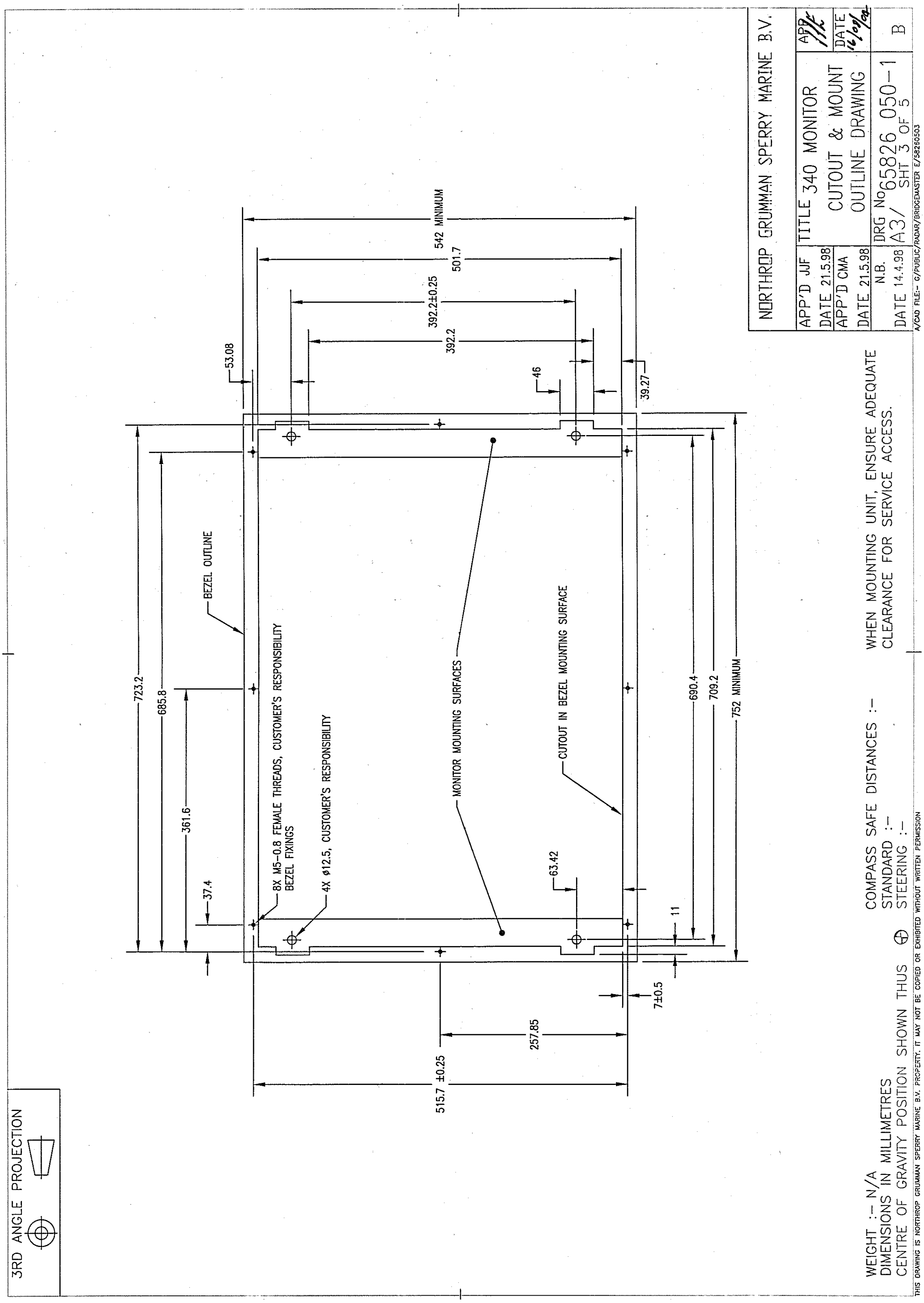


Figure 3.100. 340 Monitor Module (CRT) Outline Drawing (Sheet 3 of 5)

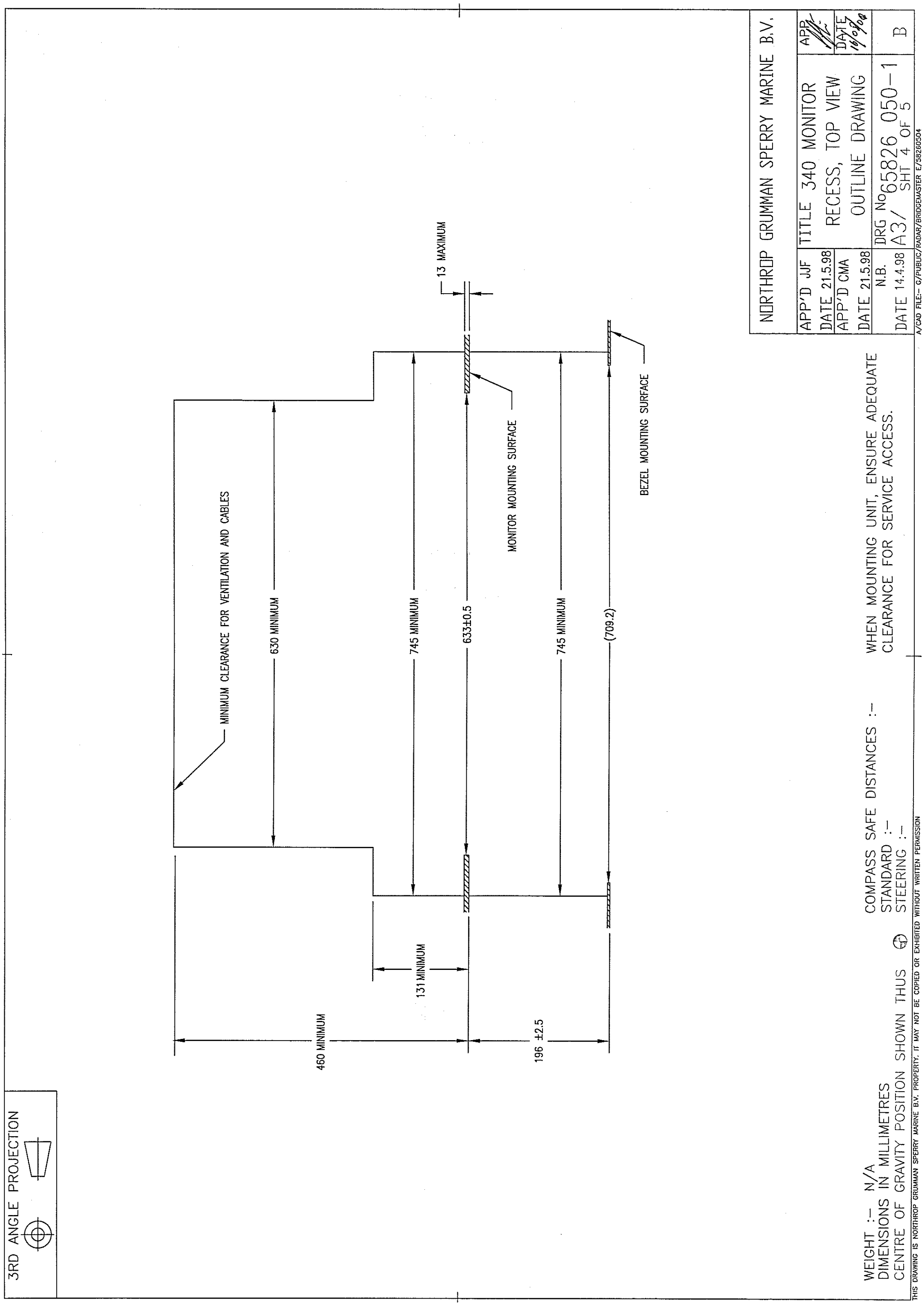


Figure 3.101. 340 Monitor Module (CRT) Outline Drawing (Sheet 4 of 5)

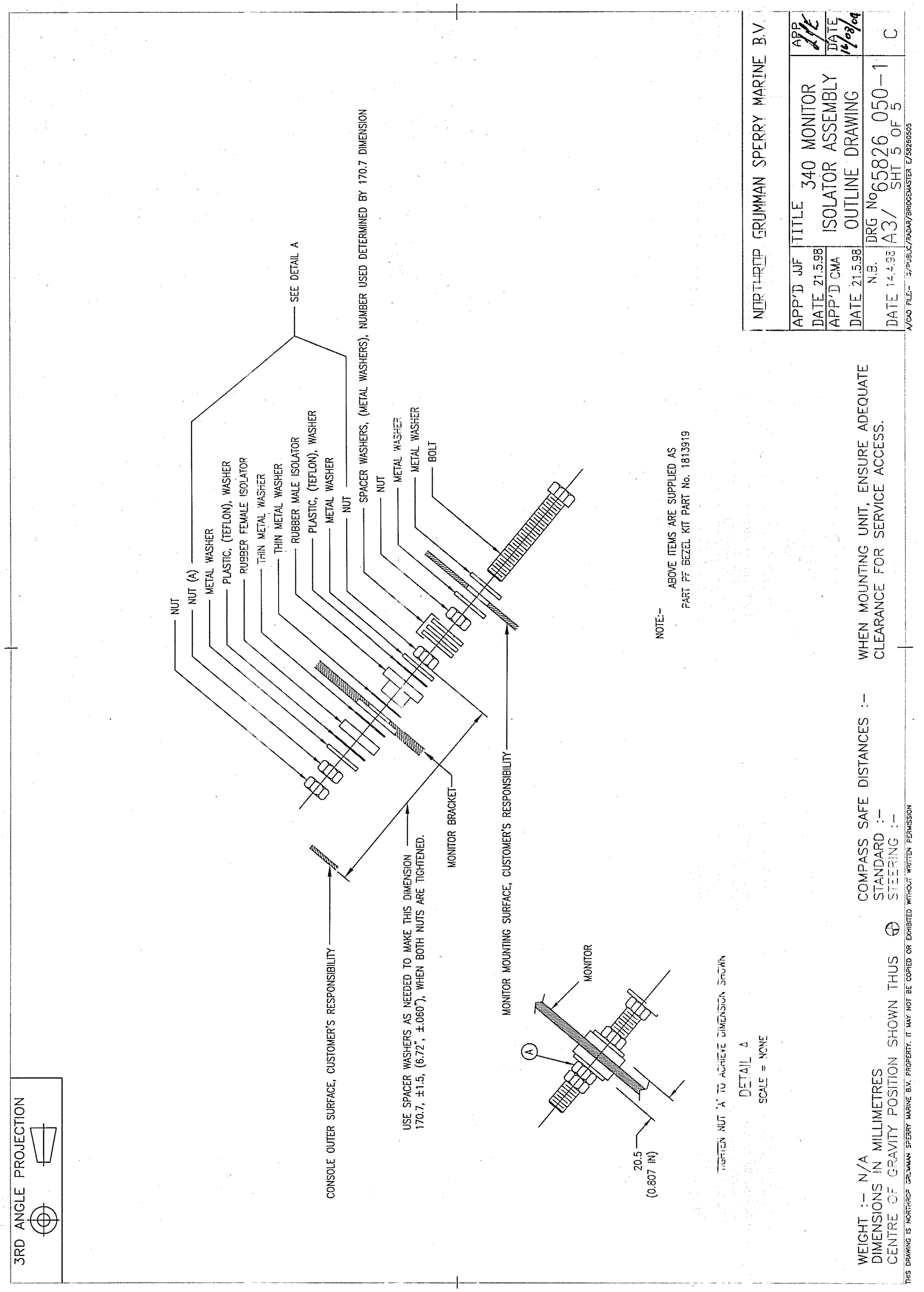


Figure 3.102. **340 Monitor Module (CRT) Outline Drawing (Sheet 5 of 5)**

2.8.3 Control Panel Modules

The following table shows the figure number of the drawing related to the installation of a particular module type:

Module	Maximum Width (mm)	Type Number	Figure Number
Keyboard	-	65845600	Figure 3.103
On/Off Switch	-	65826656	Figure 3.104
Joystick	154	65826658	Figure 3.105
	170	65821620	Figure 3.106
Trackerball	154	65826654	Figure 3.107
	170	65821623	Figure 3.108
Memory Card	154	65826655	Figure 3.109
	170	65821619	Figure 3.110
Brilliance Control	163	65826657	Figure 3.111
	73	65821621	Figure 3.112

Refer to Figure 3.125 to Figure 3.128 for information on interconnecting cables required to connect the modules to the Processor Electronics Units.

The 170mm versions of the Joystick, Trackerball and Memory Card are now supplied as standard. The 154mm versions are the earlier version.

All items required for securing the modules are supplied with the units.

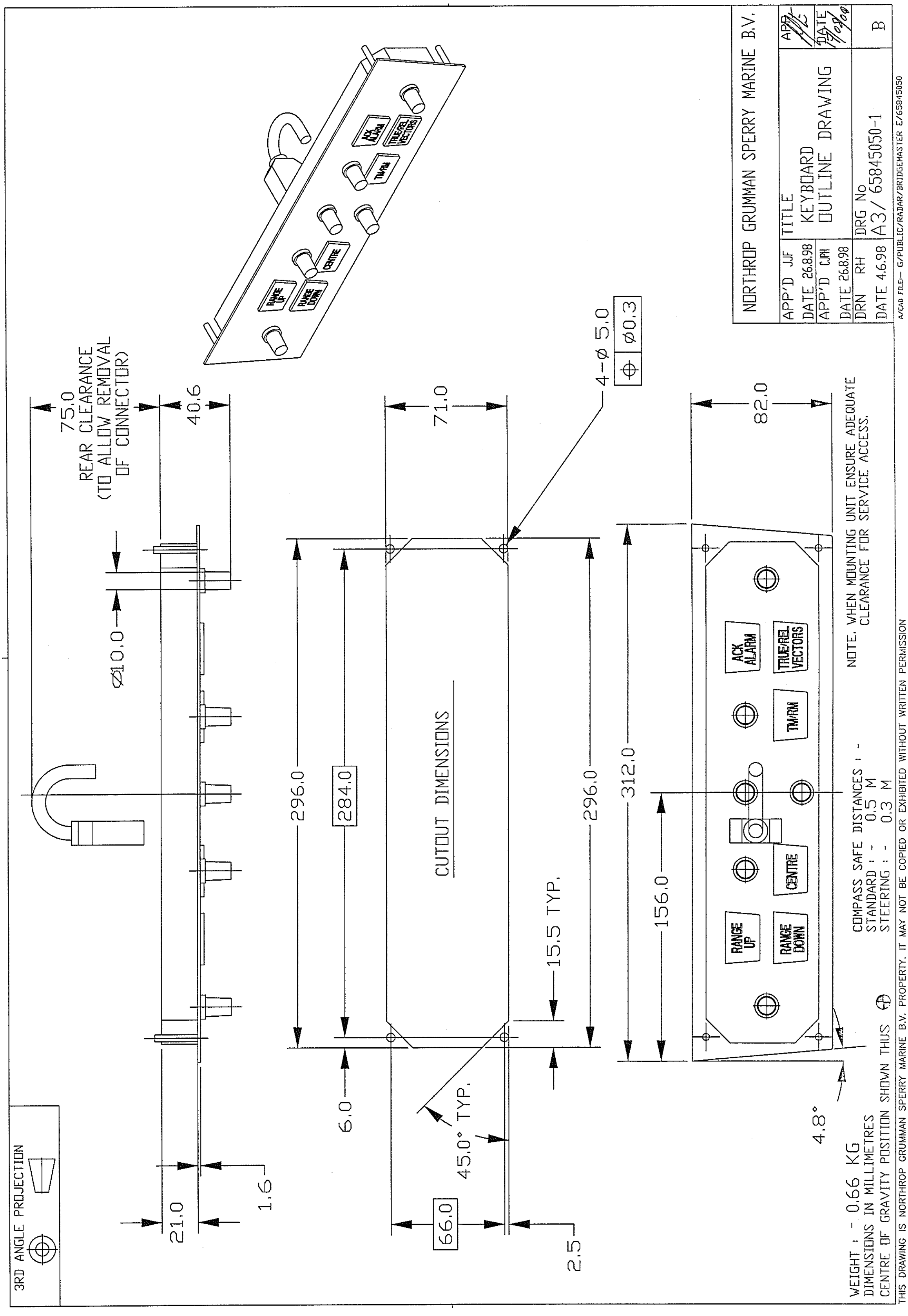


Figure 3.103. Keyboard Module Outline Drawing

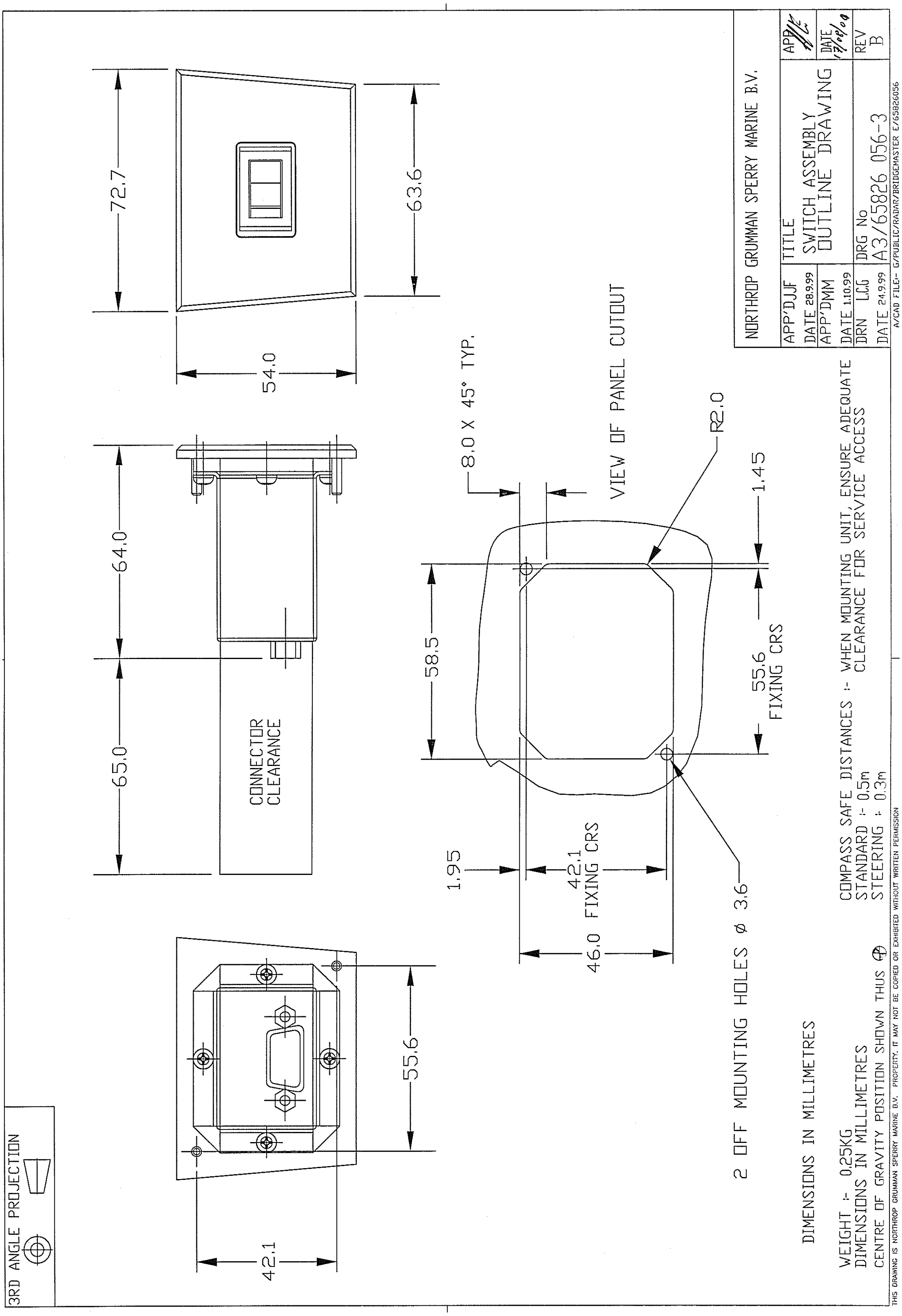


Figure 3.104. ON/OFF Switch Module Outline Drawing

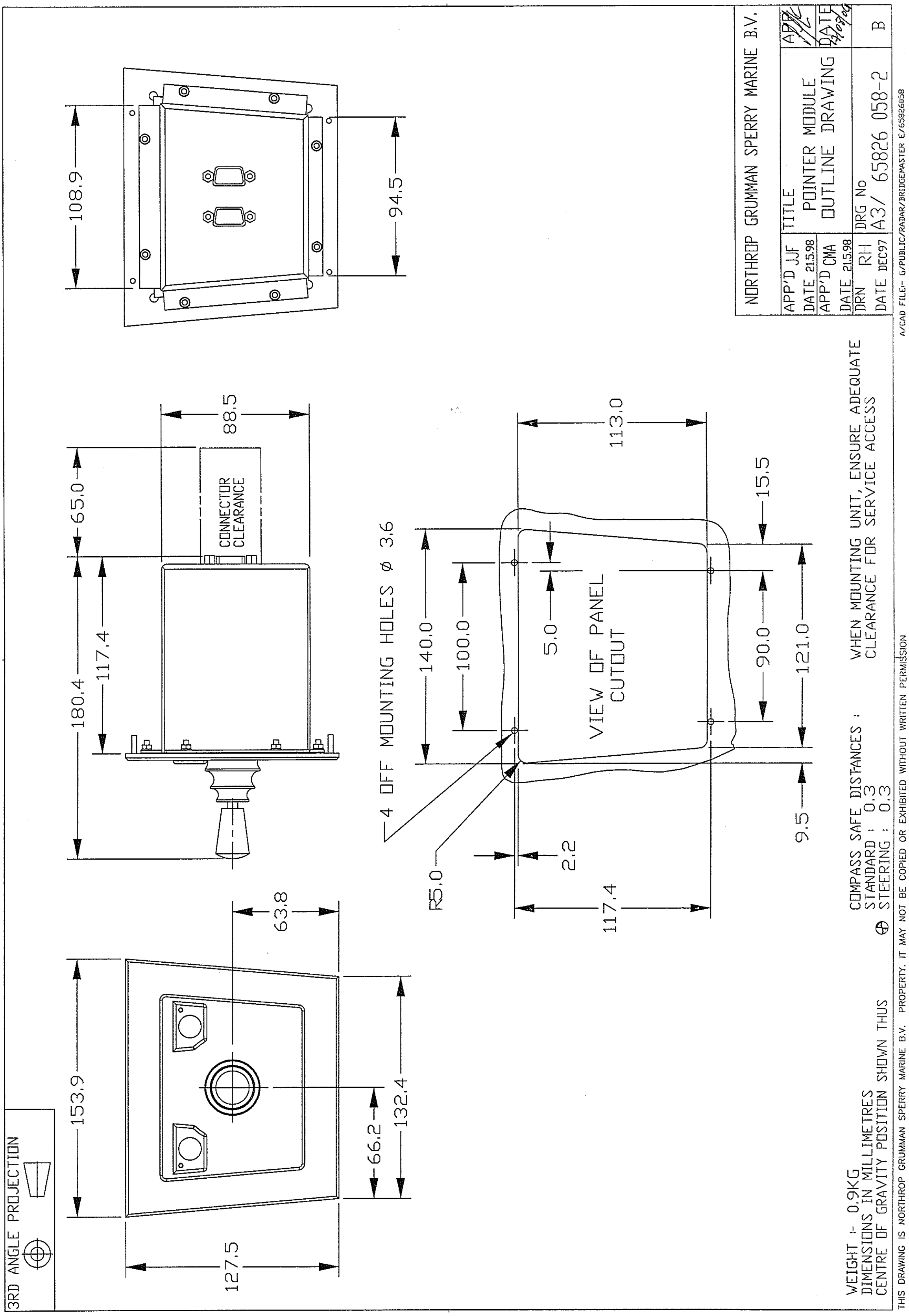


Figure 3.105. Joystick Module Outline Drawing (154mm version)

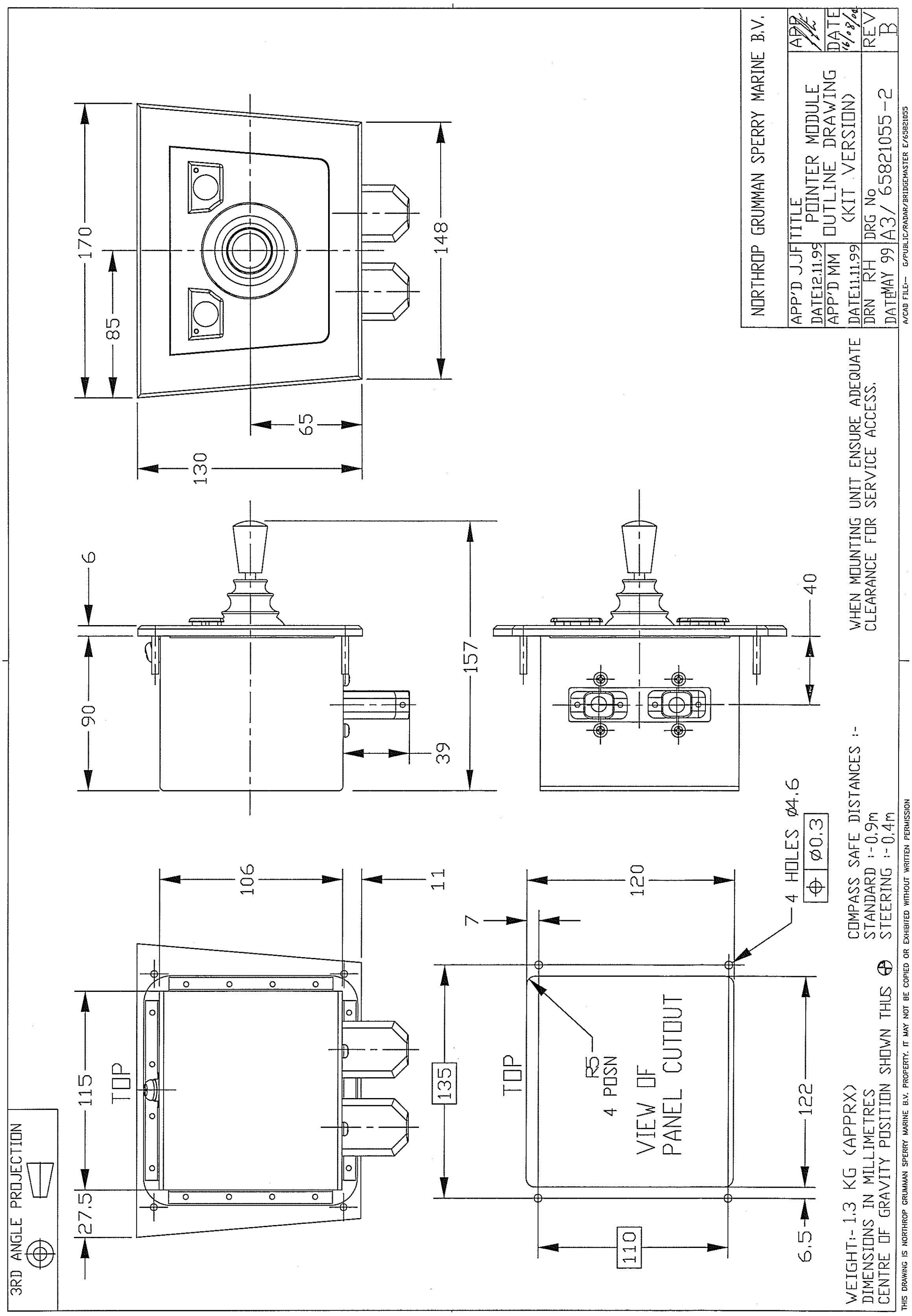


Figure 3.106. Joystick Module Outline Drawing (170mm version)

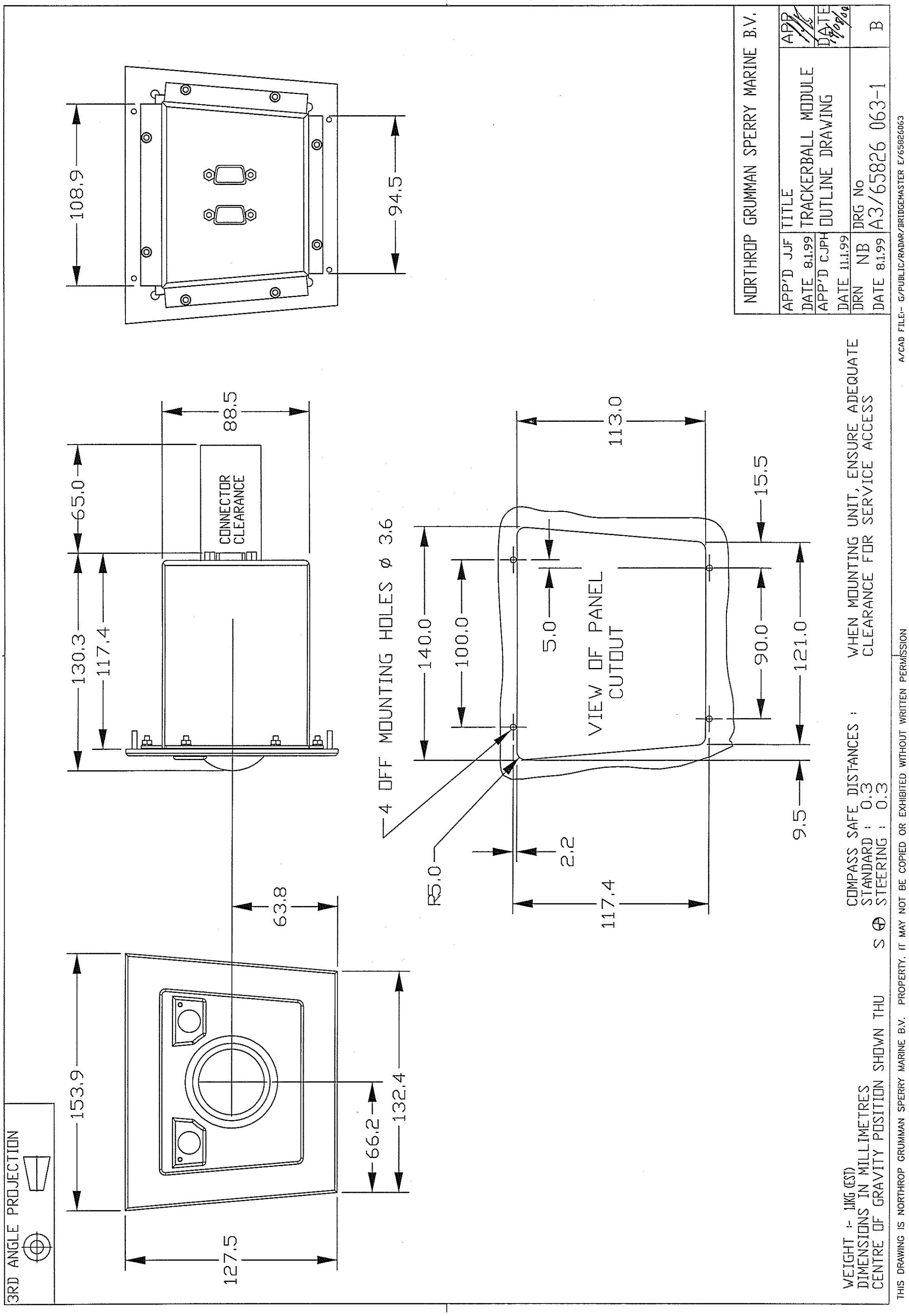


Figure 3.107. Trackerball Module Outline Drawing (154mm version)

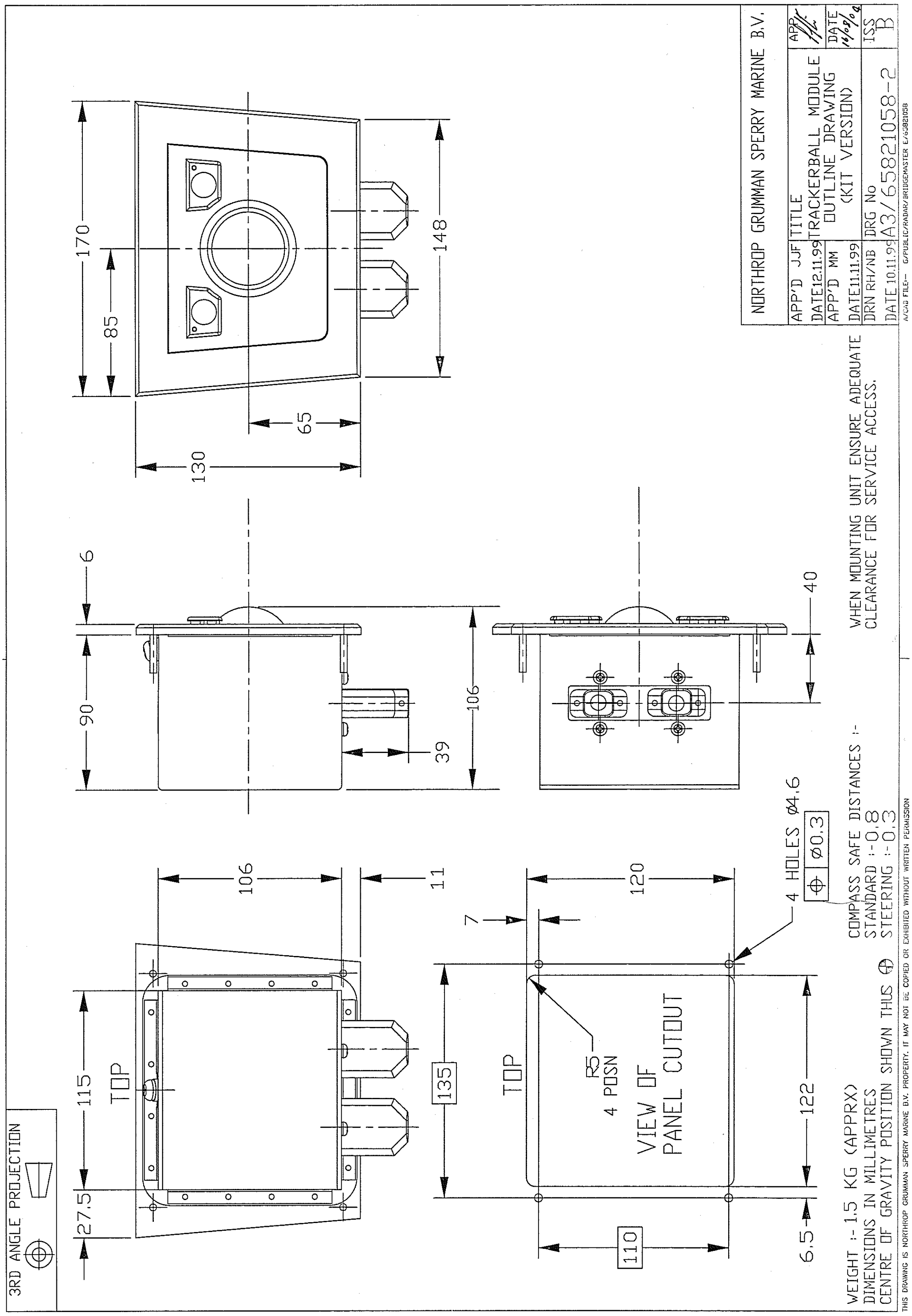


Figure 3.108. Trackerball Module Outline Drawing (170mm version)

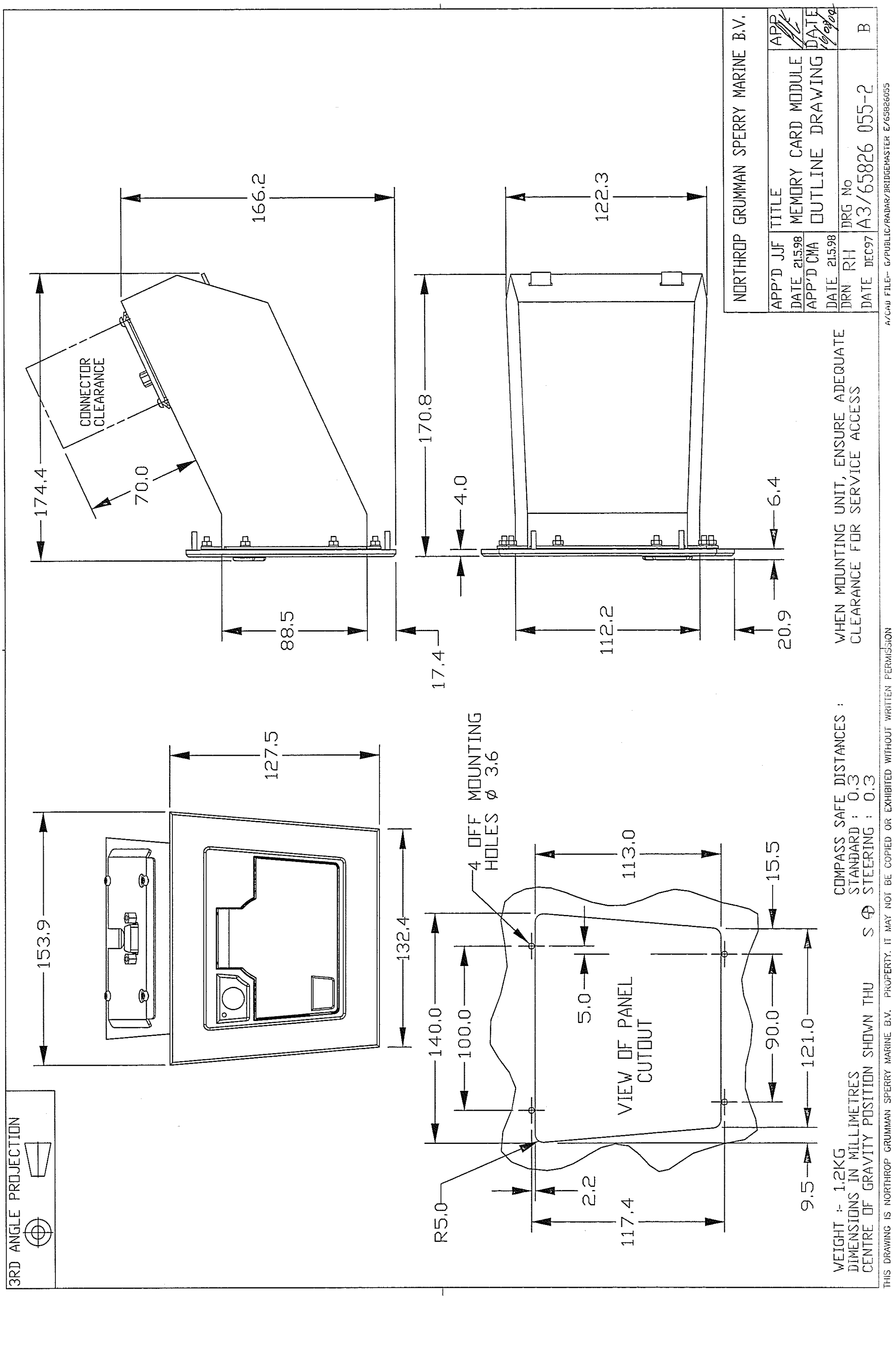


Figure 3.109. Memory Card Module Outline Drawing (154mm version)

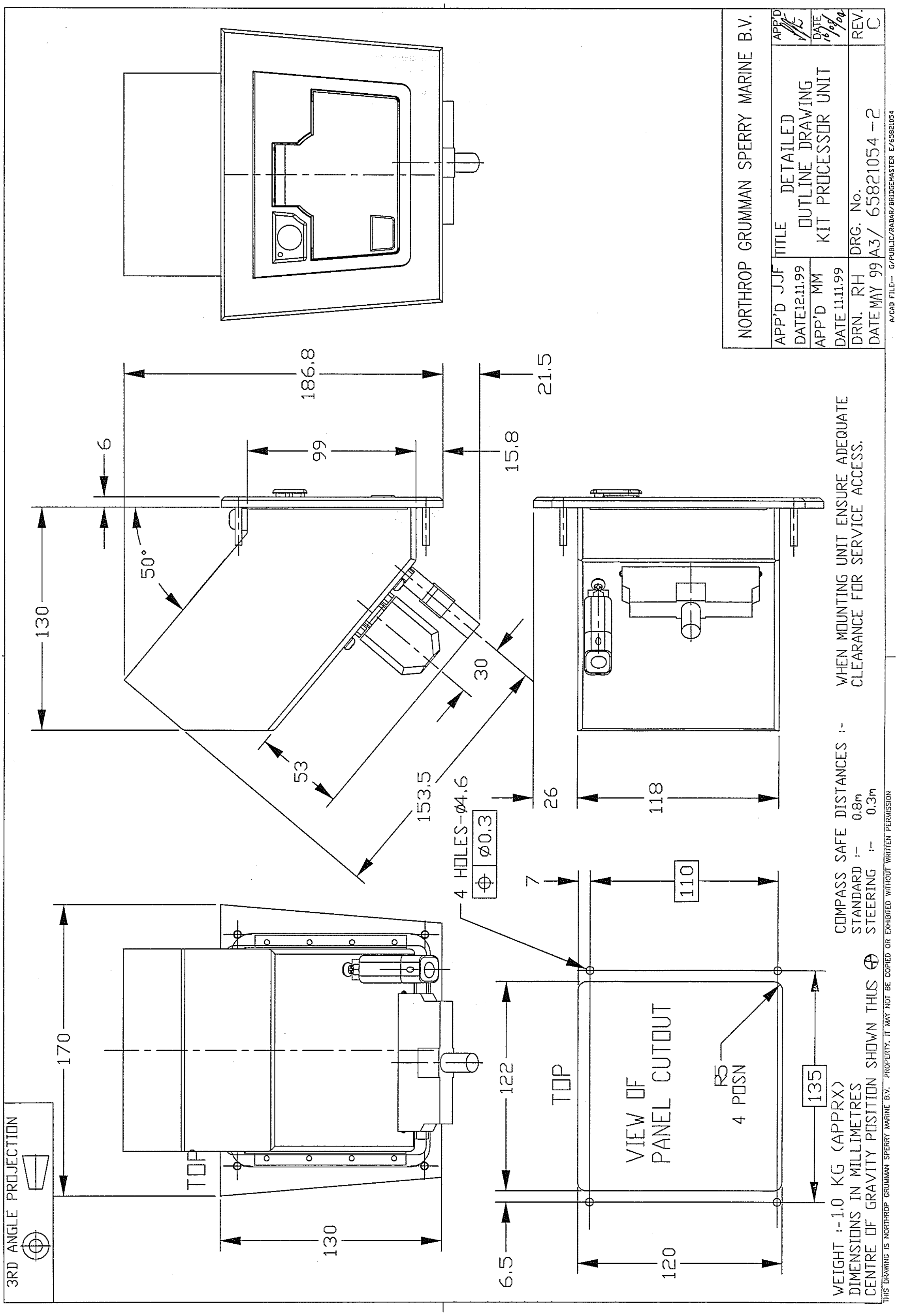


Figure 3.110. Memory Card Module Outline Drawing (170mm version)

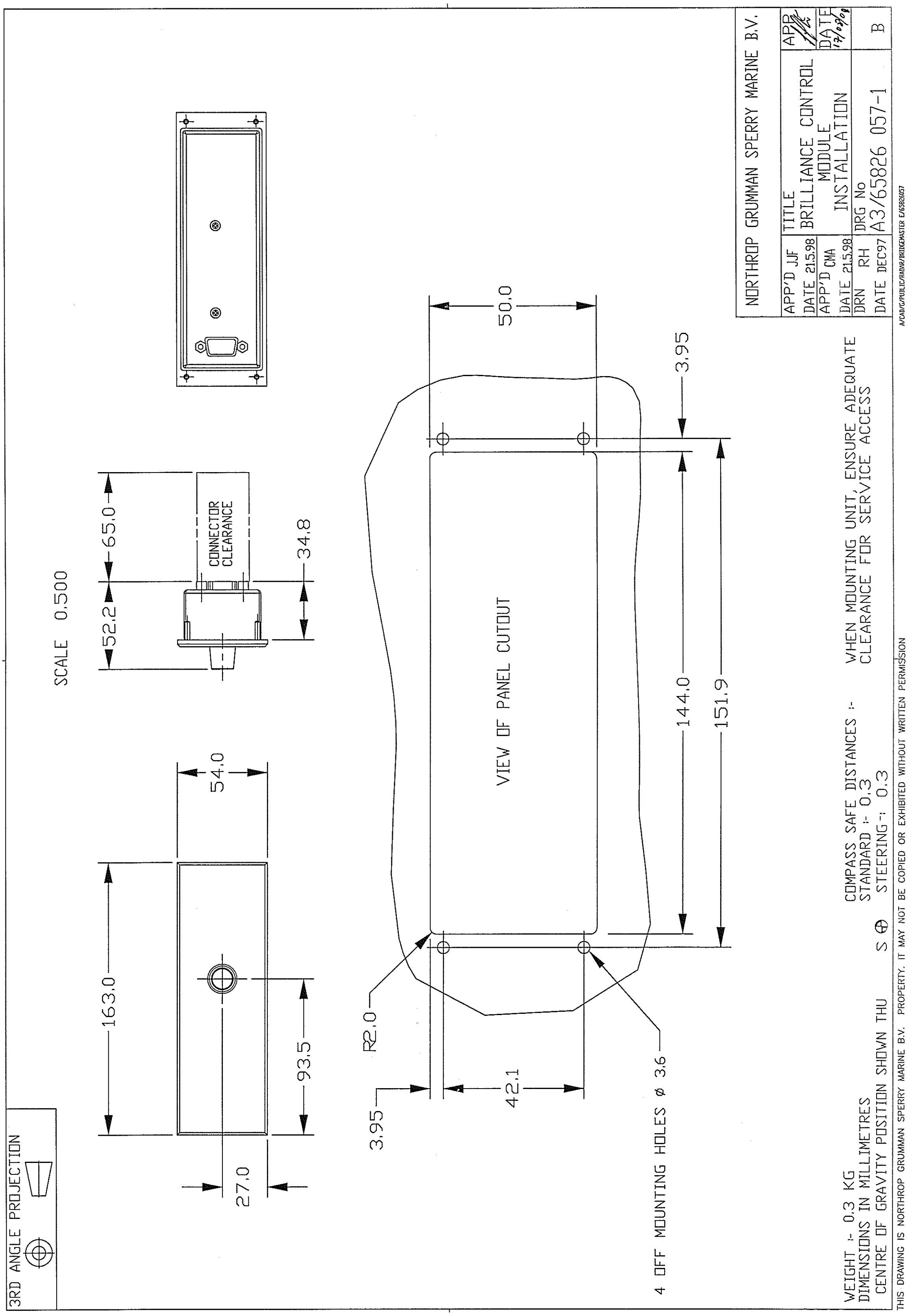


Figure 3.111. Brilliance Control Module Outline Drawing (163mm version)

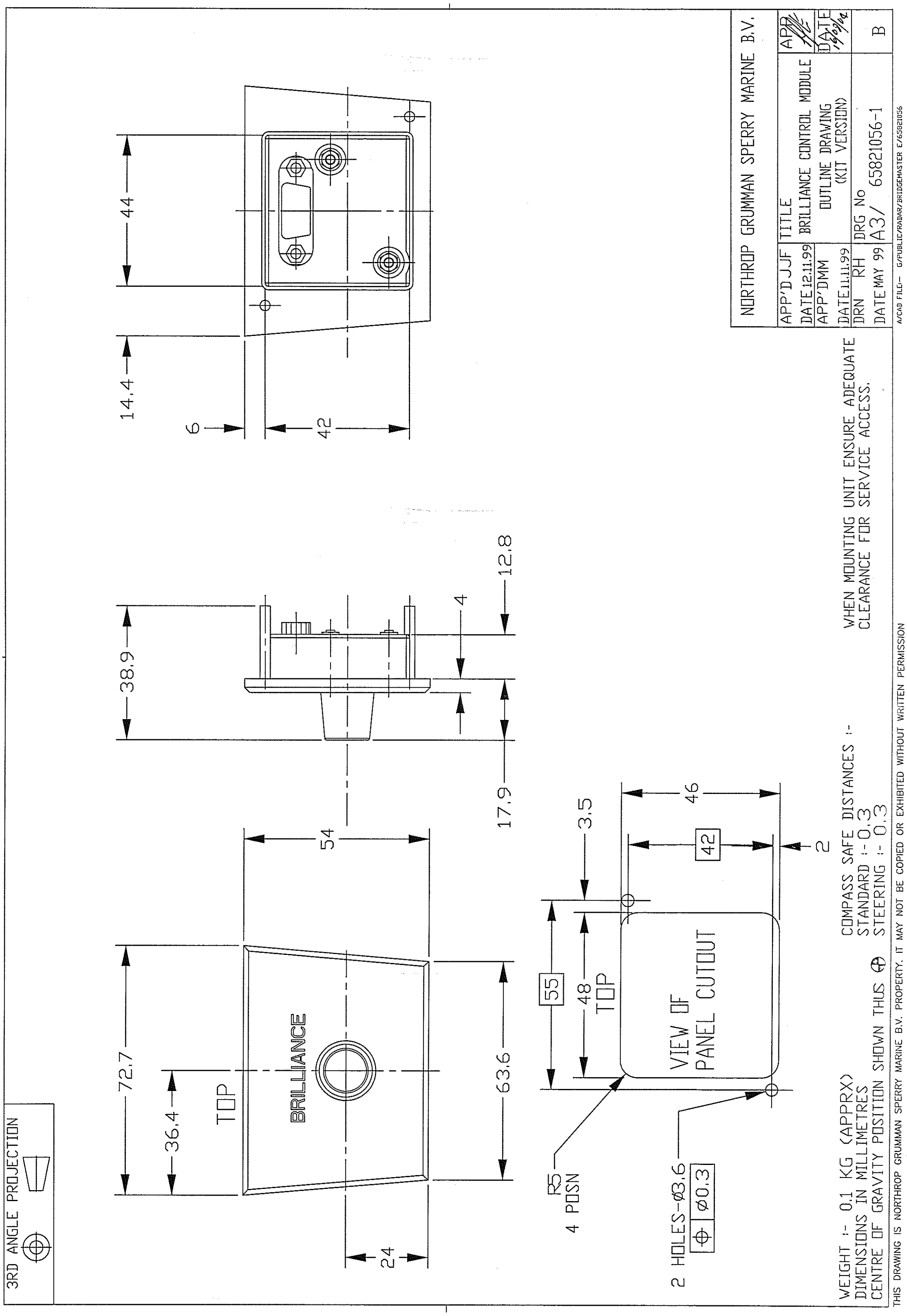


Figure 3.112. Brilliance Control Module Outline Drawing (73mm version)

2.9 Interface Unit

The Interface Unit, type 65847A, is designed to expand the range of input and output options available to the standard BridgeMaster E range of Displays. (These features are built-in as standard on extended displays.)

The unit has three serial inputs with optoisolation, three serial outputs, three relay outputs and several miscellaneous signals. The three serial inputs (3, 4 & 5) are in addition to the standard two inputs fitted to the Display, and have the capability of operating at data rates of up to 38.4Kbaud.

All relays provide normally open and normally closed contacts. One relay is used to start external equipment (or may be used as a power fail indicator). The second and third relays are called Remote Alarm (ALARM1) and Vigilance Alarm (ALARM2). The Display software controls the categories of alarm.

The Interface Unit also has the following miscellaneous signals:

1. Track Data – serial data about Own Ship and tracked targets. *(This output is not available on EPA systems.)*
2. Freeze Frame – when grounded, this stops the radar picture updating. *(This function is not implemented on commercial units.)*
3. Buzzer+ and Buzzer Return – provides an external repeat of the internal buzzer

The host Display Unit provides power for the unit via the supplied 2-metre long interface cable, 65800514.

The Interface Unit is supplied with all items required for installation, including the Interface Cable 65800514.

This unit does not need configuration or setting up. See Section 3.4 for information on cabling the Interface Unit.

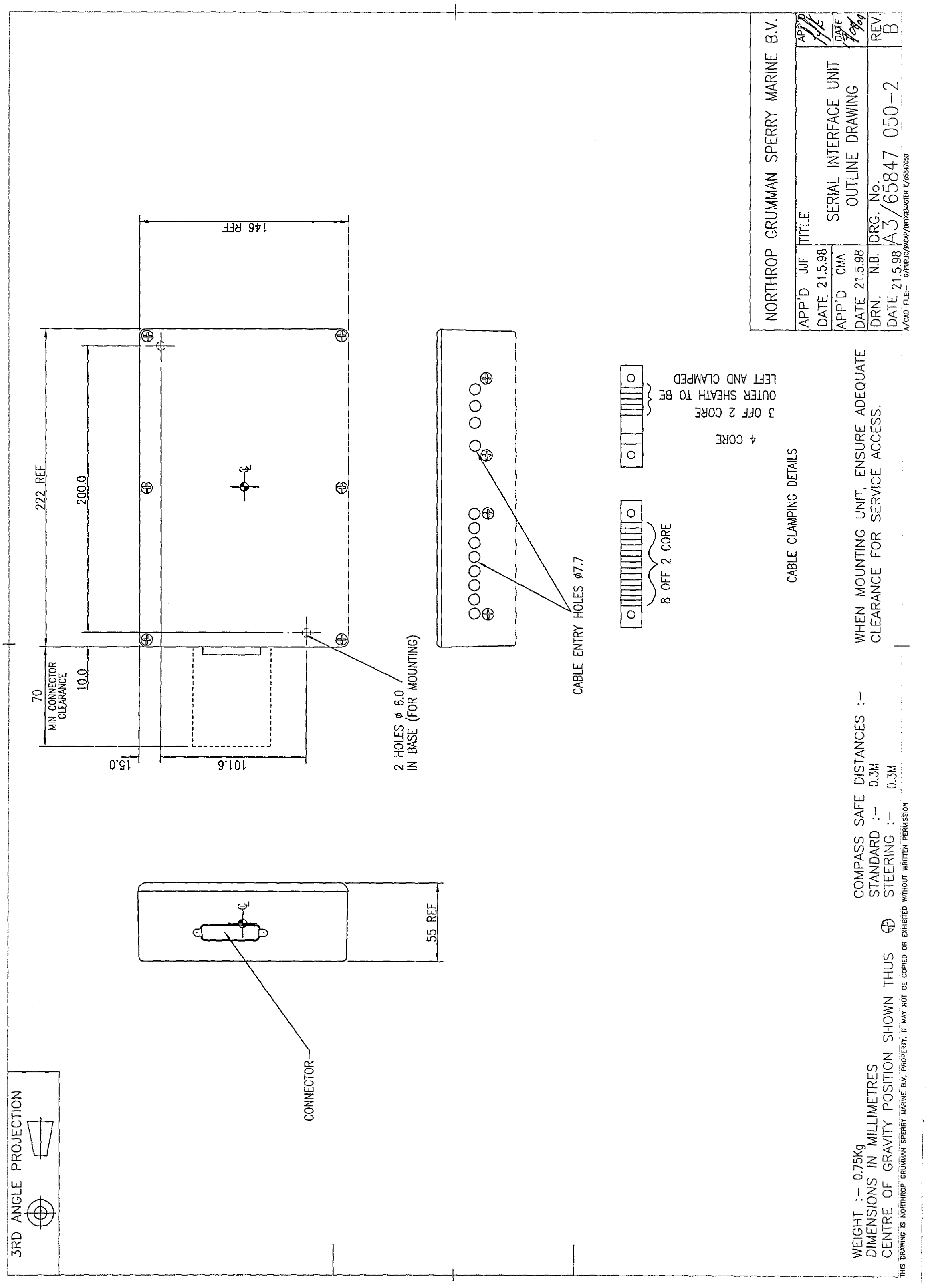


Figure 3.113. Interface Unit Installation

2.10 Isolation Transformer Unit

Refer to Figure 3.114 for the installation of this unit.

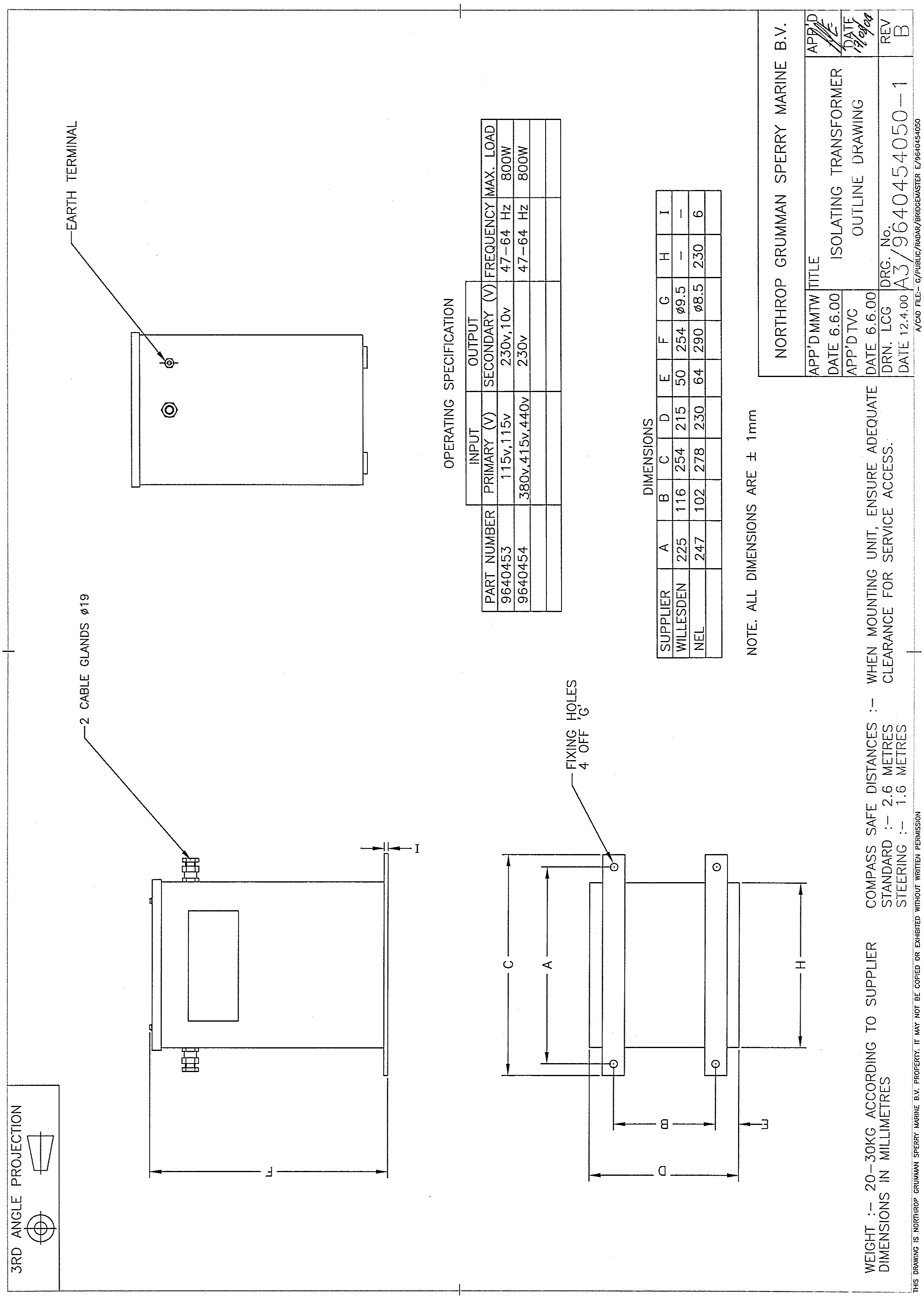


Figure 3.114. Isolation Transformer Unit Installation

2.11 Despatch Kits

In order to assemble the equipment, Despatch Kits, including assembly instructions, are sent as shown in the following table:

Unit	Despatch Kit
Display & Module Units	
Desktop Processor	65800660
EPA(L) Desktop Processor	65800664
Kit Processor	65800662
340 Kit Processor for CRT	65826660
340 Deckstand Processor	65827621
Extended Desktop Processor	65818660
Extended kit Processor	65818661
180 Desktop (CRT)	65814608
180 Desktop (FPD)	65815608
180 Kit (CRT)	65814609
250 Desktop (CRT)	65821608
250 Desktop (FPD)	65815608
250 Kit (CRT)	65821609
250 Extended Desktop (CRT)	65822608
340 Desktop (FPD)	65823625
340 Kit (CRT)	65826661
S-Band Systems	
Turning Unit	65830660
Antenna Unit	65612610
Bulkhead Transceiver	65831660
X-Band Systems	
Turning Unit	65801660
Bulkhead Transceiver	65825660

2.12 Installation Kits

S-Band

There are three Installation Kits for S-Band Bulkhead Transceiver installations:

- 10 metre S-Band Coaxial Cable Kit Type 112/MIK/10
- 20 metre S-Band Coaxial Cable Kit Type 112/MIK/20
- 30 metre S-Band Coaxial Cable Kit Type 112/MIK/30

There are various length Installation Kits common to all S-Band Installations:

- 33 metre S-Band Cable Kit Type 115/MIK/33
- 67 metre S-Band Cable Kit Type 115/MIK/67
- 100 metre S-Band Cable Kit Type 115/MIK/100
- 130 metre S-Band Cable Kit Type 115/MIK/130
- 150 metre S-Band Cable Kit Type 115/MIK/150
- 180 metre S-Band Cable Kit Type 115/MIK/180

X-Band

There are three Installation Kits for X-Band Bulkhead Transceiver installations:

- 10 metre X-Band Waveguide Kit Type 116/MIK/10
- 20 metre X-Band Waveguide Kit Type 116/MIK/20
- 30 metre X-Band Waveguide Kit Type 116/MIK/30

There are various length Installation Kits common to all X-Band Installations:

- 33 metre X-Band Cable Kit Type 119/MIK/33
- 67 metre X-Band Cable Kit Type 119/MIK/67
- 100 metre X-Band Cable Kit Type 119/MIK/100
- 130 metre X-Band Cable Kit Type 119/MIK/130
- 150 metre X-Band Cable Kit Type 119/MIK/150
- 180 metre X-Band Cable Kit Type 119/MIK/180

Connector Kit for Long Cable Runs

In addition to the above installation kits, a special connector kit is available for installations where cable lengths of up to 300m require the use of low loss video cable type FSJ4-75.

- Video Connector Kit Type 117/MIK

Most of the above kits can be supplied with LSZH equivalent cables.

3 System Component Interconnections

This section contains information on the interconnection of system components, any setting up that is required and details of all system fuses.

3.1 Interconnection Diagrams

Figure 3.115 to Figure 3.120 give wiring details of the X-Band and S-Band systems and typical examples of the Dual Radar systems.

Figure 3.115 – BridgeMaster E X-Band Masthead Tx/Rx Cabling

Figure 3.116 – BridgeMaster E X-Band Bulkhead Tx/Rx Cabling

Figure 3.117 – BridgeMaster E S-Band Masthead Tx/Rx Cabling

Figure 3.118 – BridgeMaster E S-Band Bulkhead Tx/Rx Cabling

Figure 3.119 – BridgeMaster E Dual Radar S-Band and X-Band Masthead Tx/Rx Cabling

Figure 3.120 – BridgeMaster E Dual Radar S-Band and X-Band Bulkhead Tx/Rx Cabling

Figure 3.121 to Figure 3.128 give interconnection details between the Processor Unit, the Monitor, the Interface Unit and the Kit Modules.

Figure 3.121 – Processor Electronics Unit Rear Panel/Interface Connections

Figure 3.122 – Extended Radar Processor Electronics Unit Rear Panel Connections

Figure 3.123 – Kit Processor Electronics Unit Front Panel Connections

Figure 3.124 – Monitor Unit Connections

Figure 3.125 – Desk Mounted Display Unit Inter-Unit Cabling

Figure 3.126 – Kit Display Unit Inter-Module Cabling

Figure 3.127 – Deck Mounted 340 Display Unit (CRT) Inter-Unit Cabling

Figure 3.128 – Deck Mounted 340 Display Unit (FPD) Inter-Unit Cabling

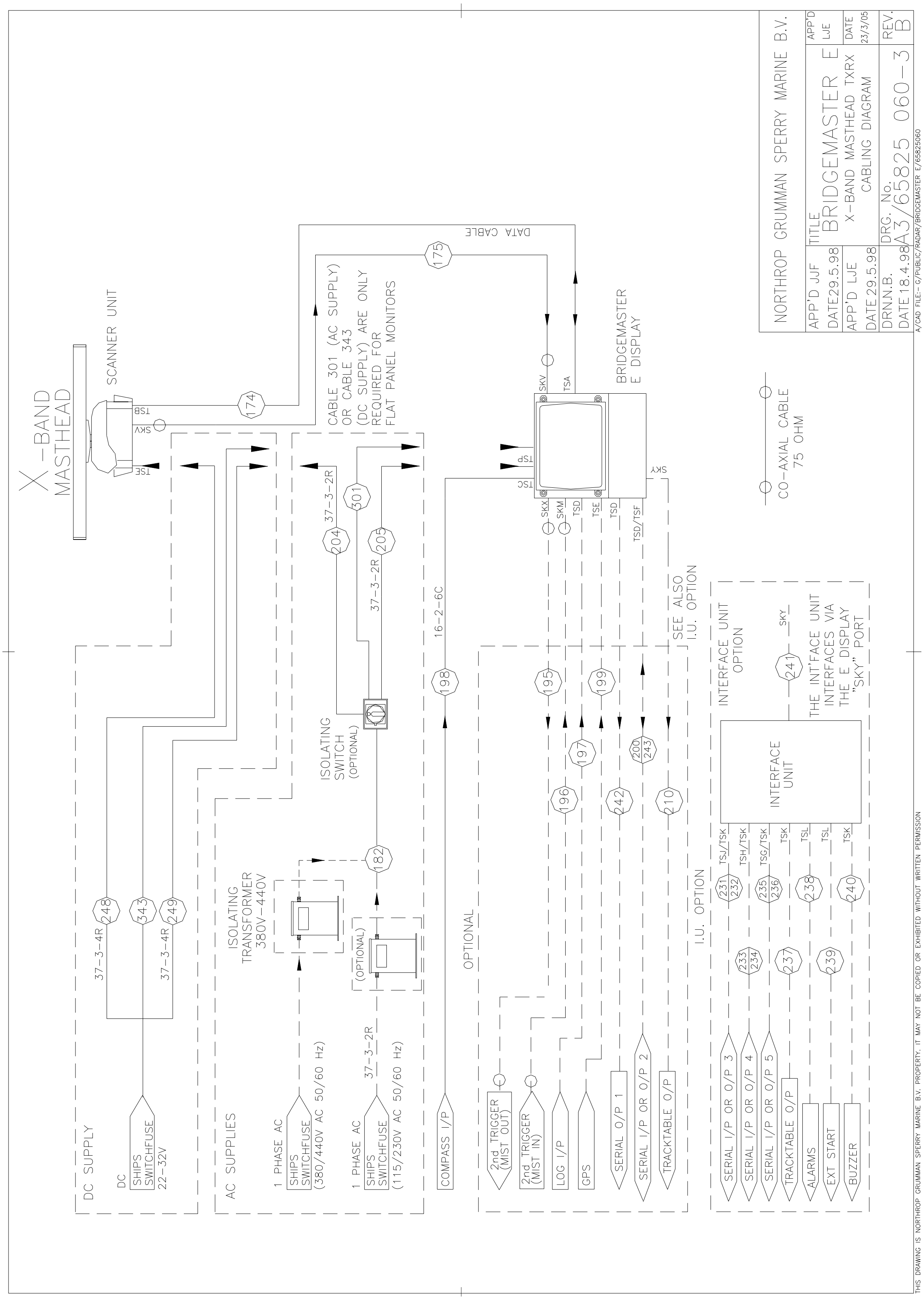


Figure 3.115. BridgeMaster E X-Band Masthead Tx/Rx Cabling

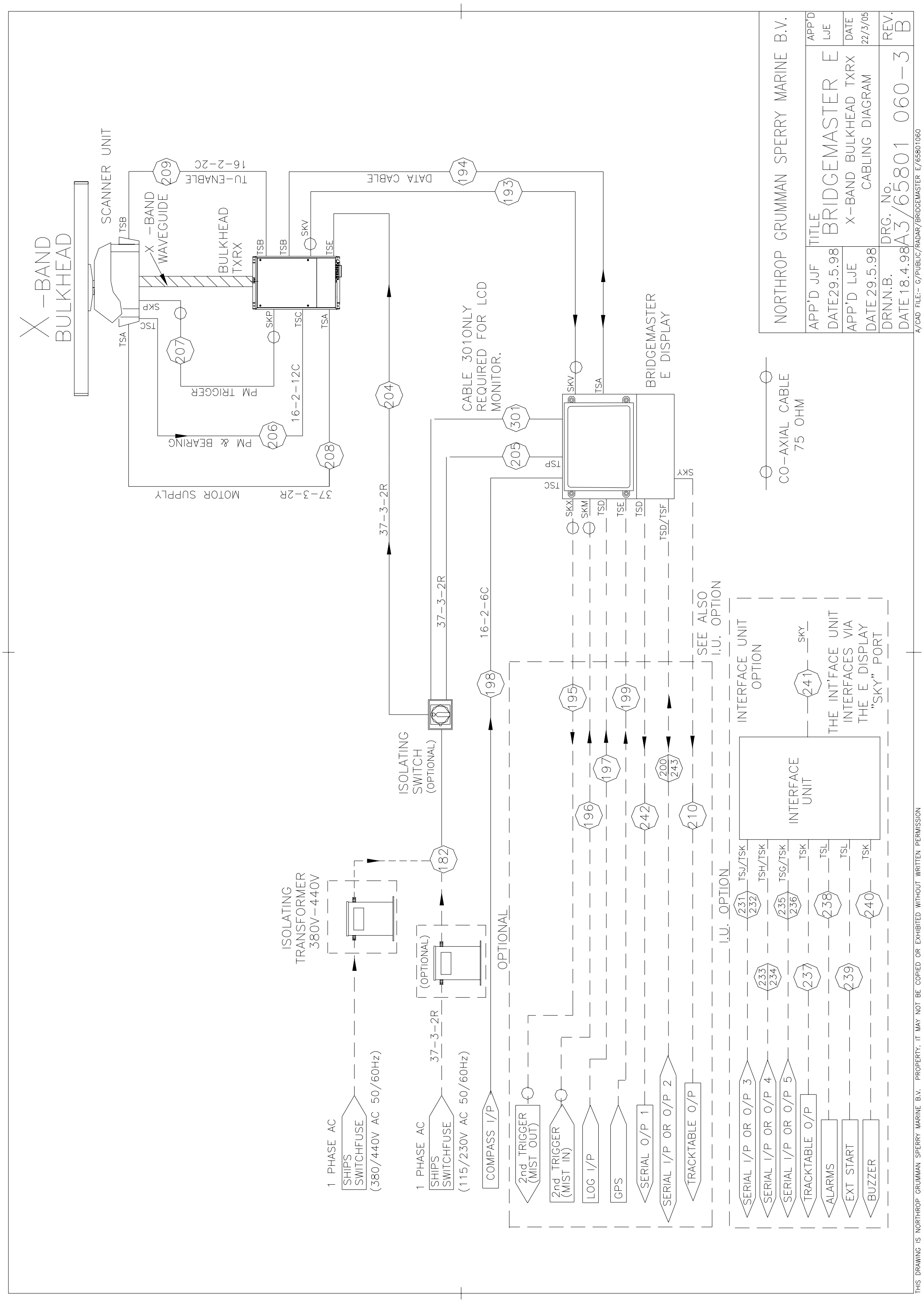


Figure 3.116. BridgeMaster E X-Band Bulkhead Tx/Rx Cabling

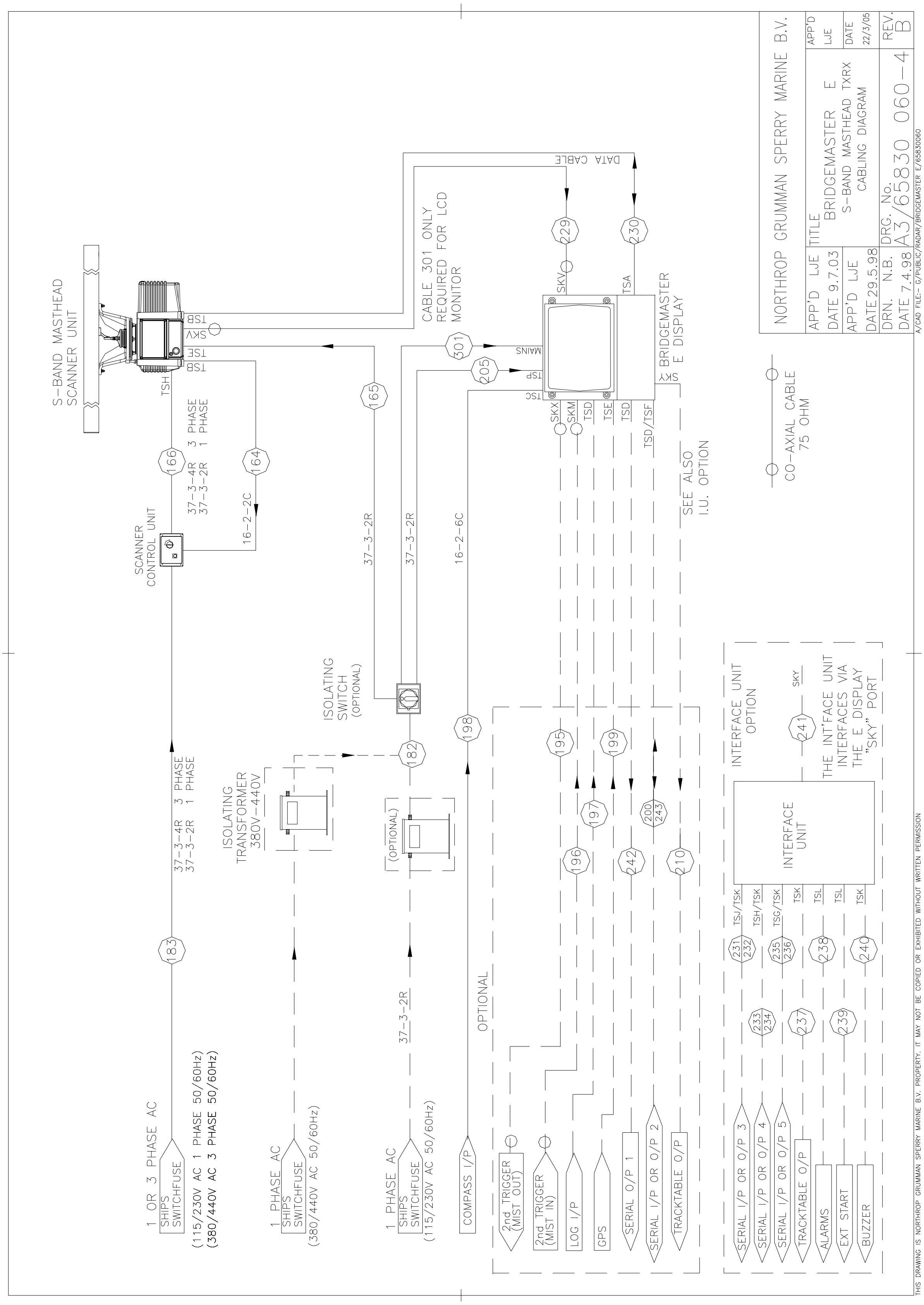


Figure 3.117. BridgeMaster E S-Band Masthead Tx/Rx Cabling

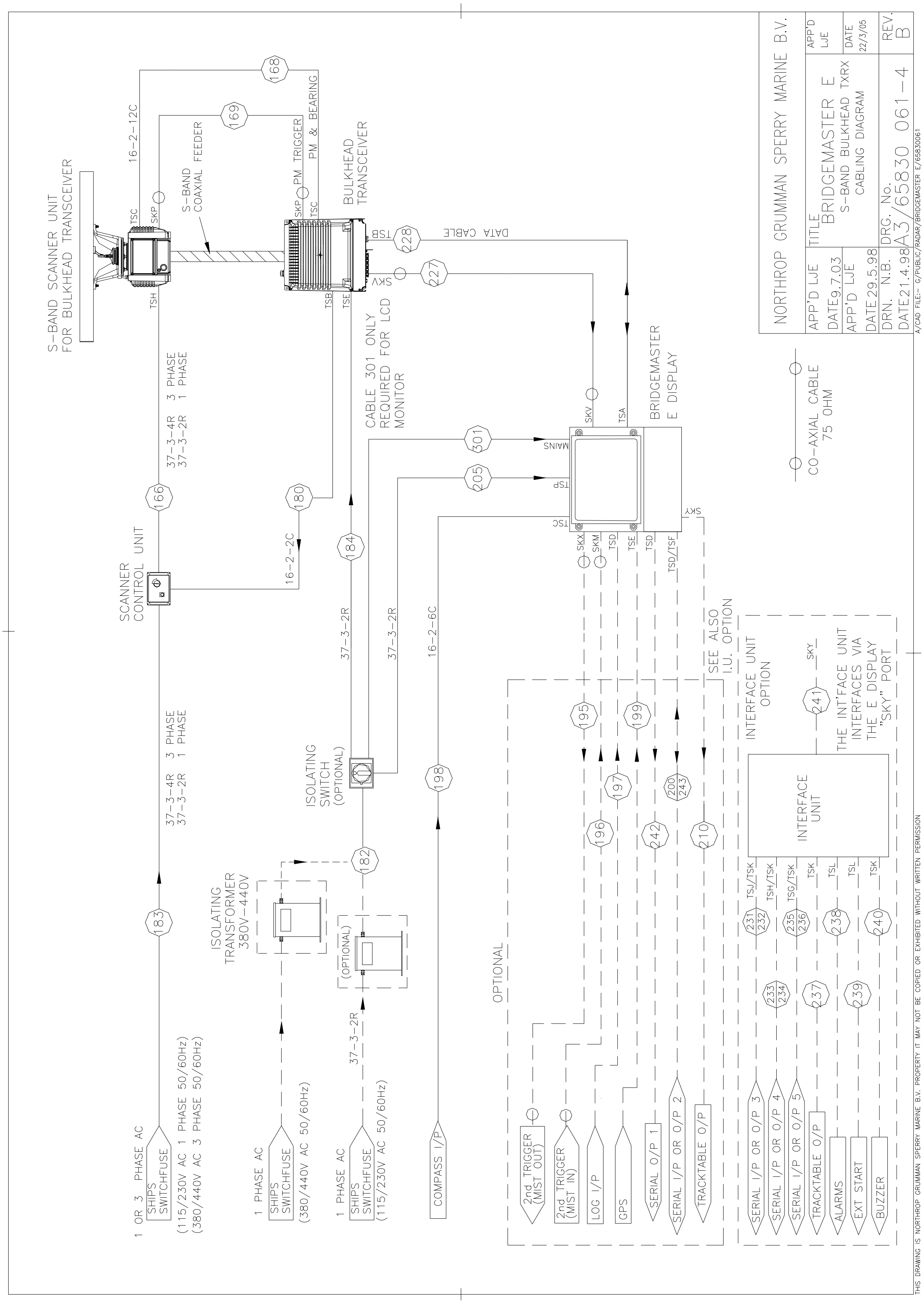


Figure 3.118. BridgeMaster E S-Band Bulkhead Tx/Rx Cabling

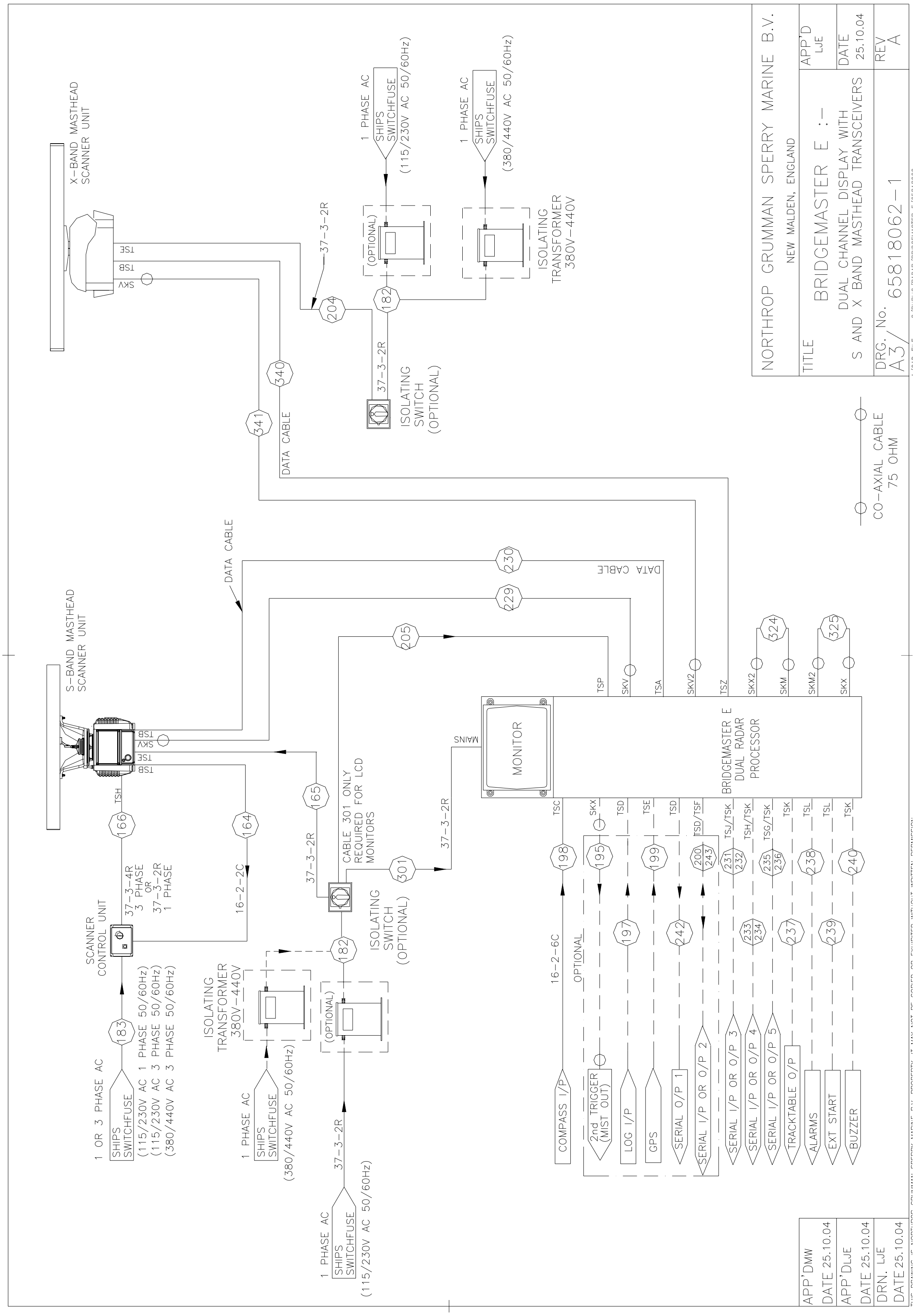


Figure 3.119. BridgeMaster E Dual Radar S-Band and X-Band Masthead Tx/Rx Cabling

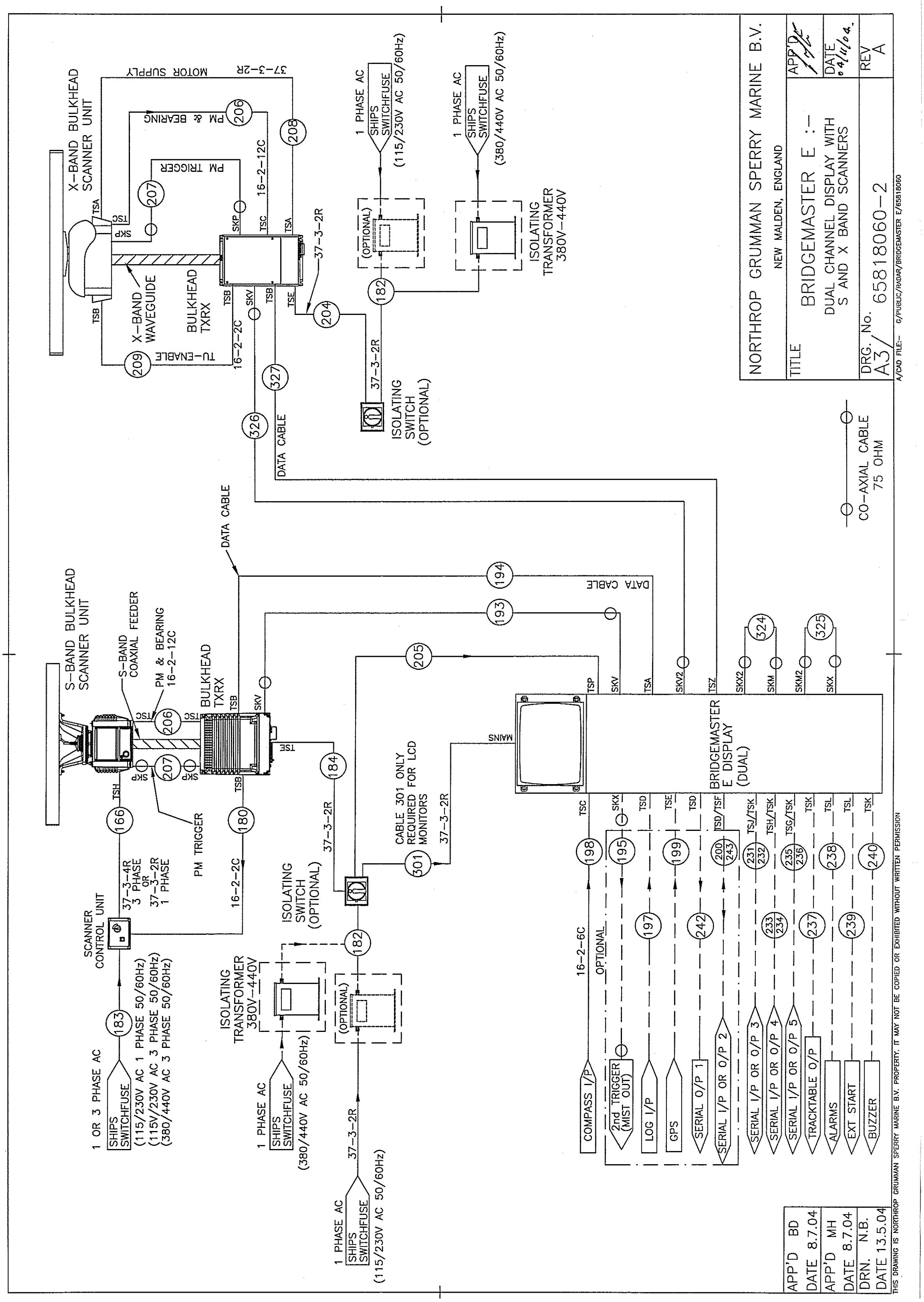
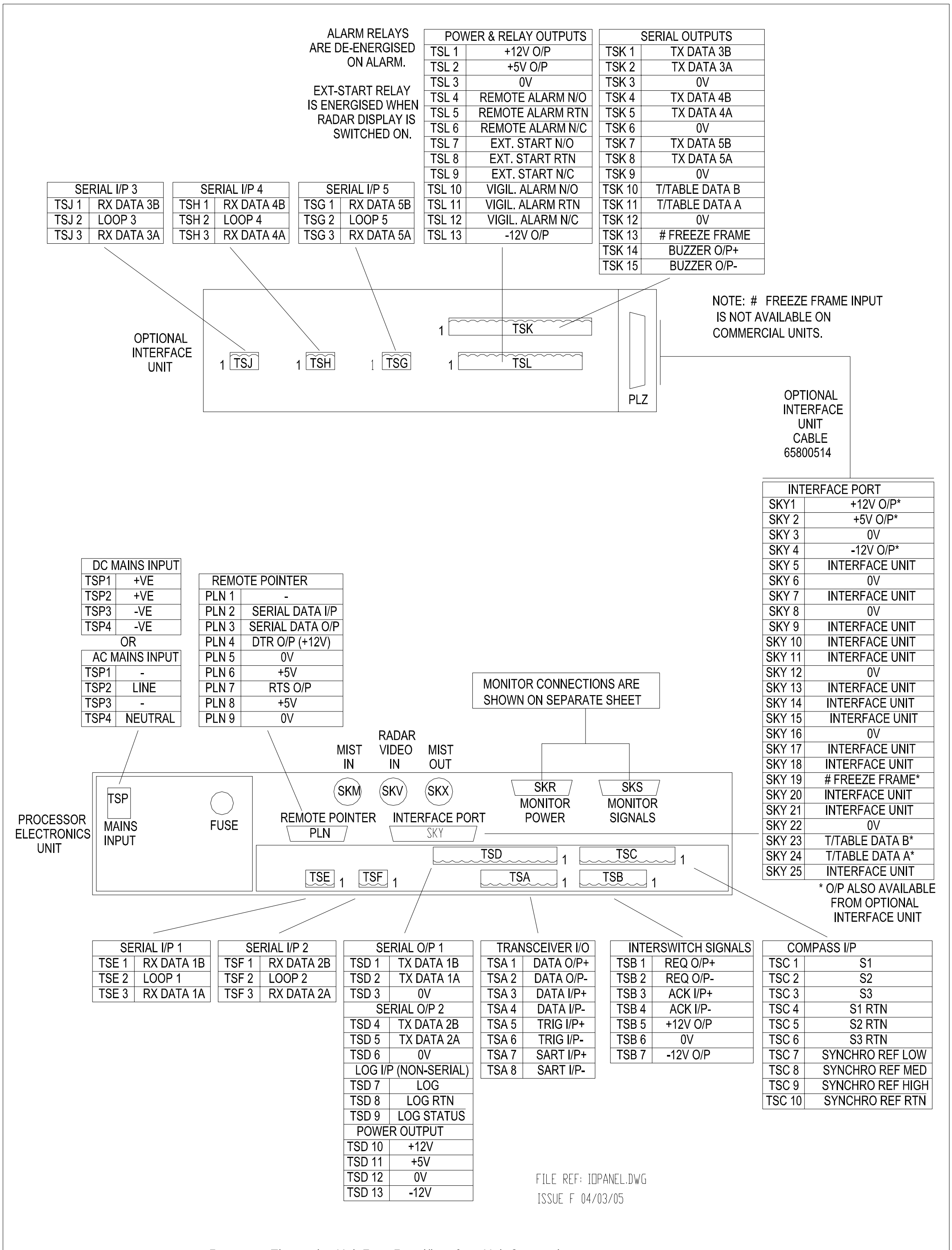


Figure 3.120. BridgeMaster E Dual Radar S-Band and X-Band Bulkhead Tx/Rx Cabling



Processor Electronics Unit Rear Panel/Interface Unit Connections

Figure 3.121. Processor Electronics Unit Rear Panel/Interface Connections

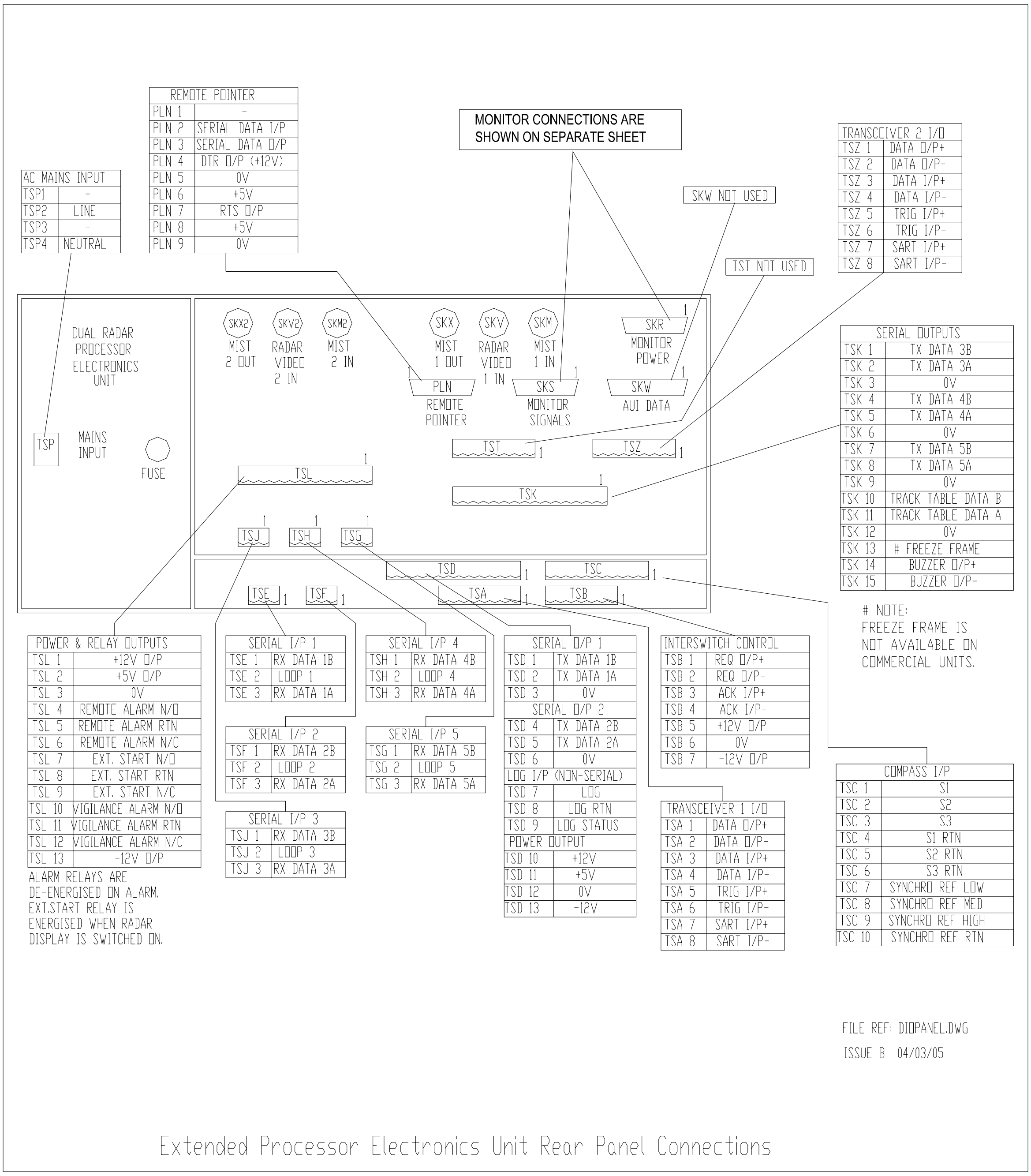


Figure 3.122. Extended Processor Electronics Unit Rear Panel Connections

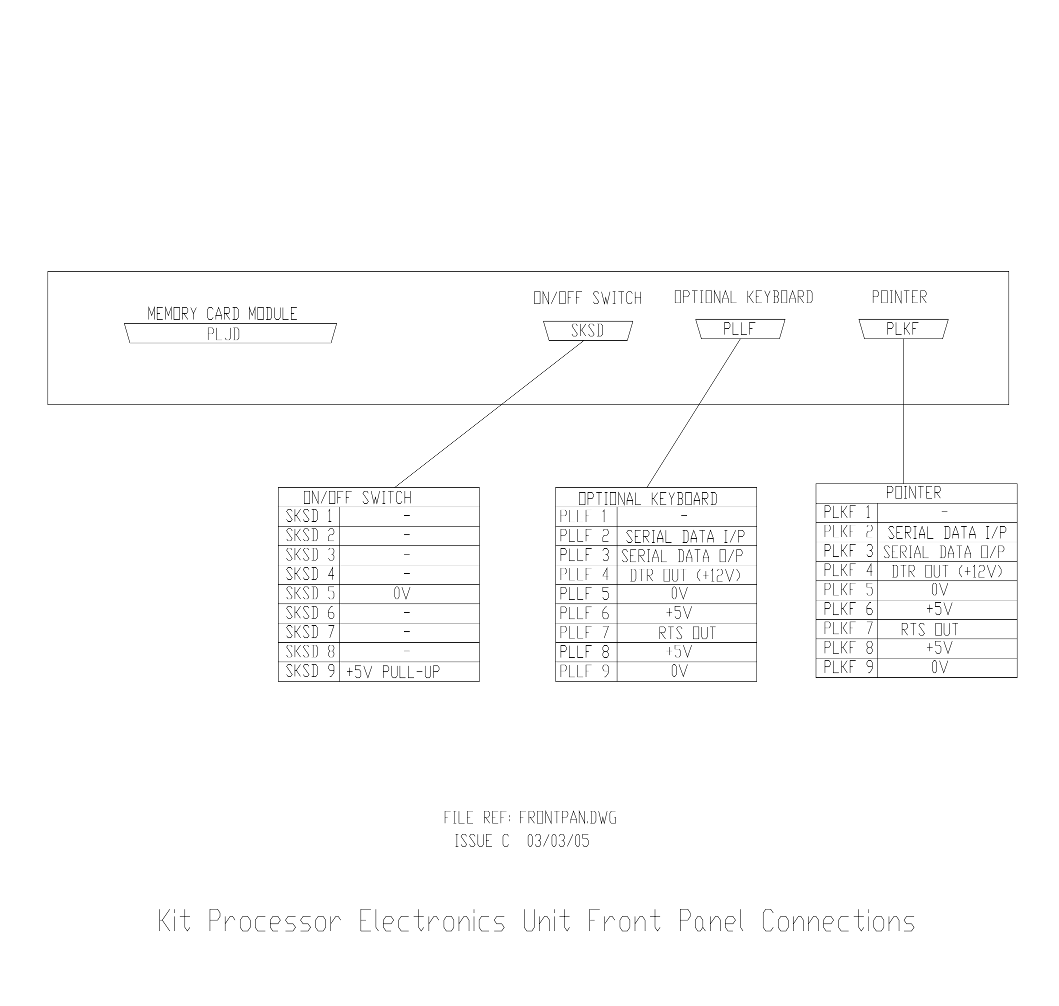


Figure 3.123. Kit Processor Electronics Unit Front Panel Connections

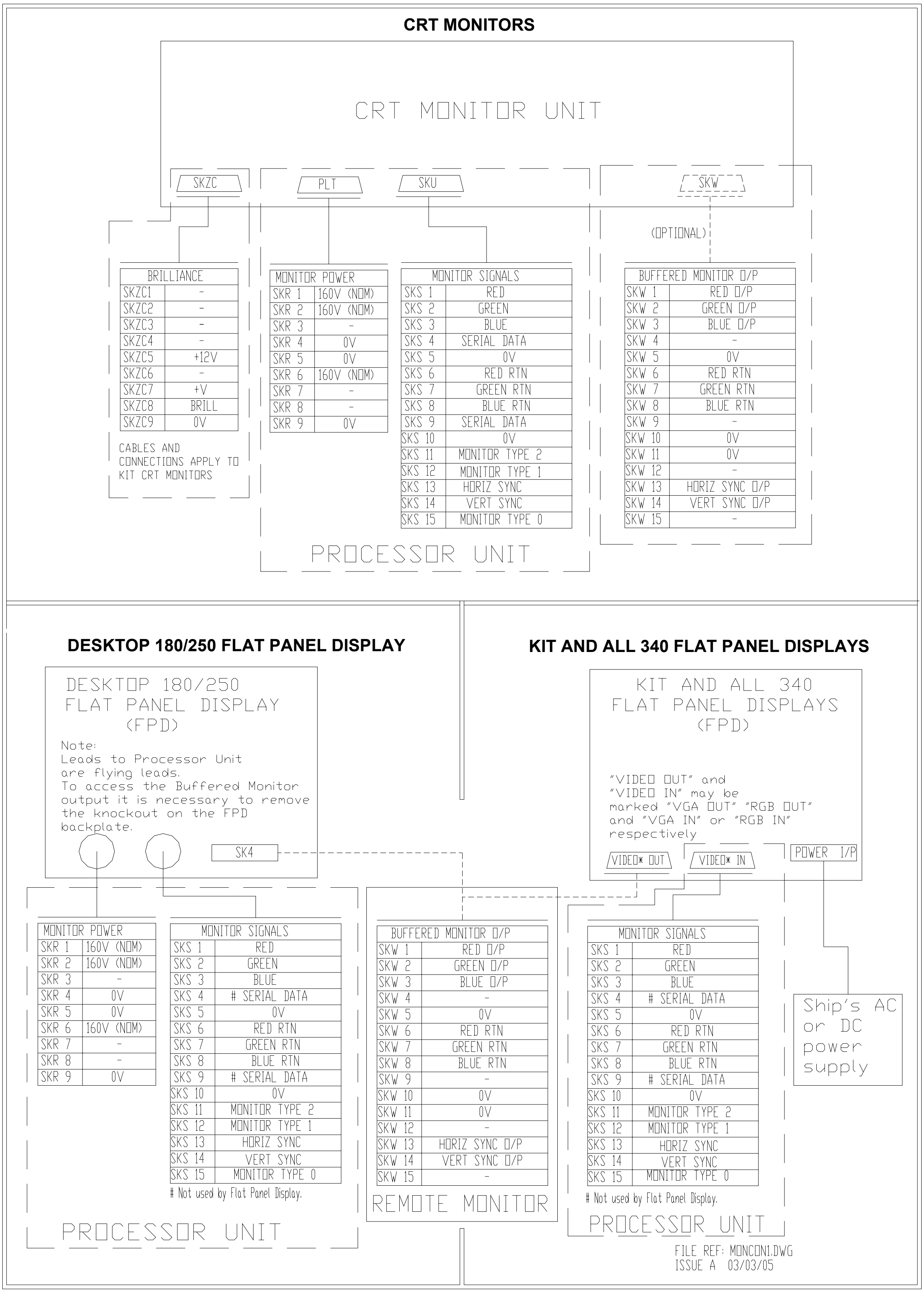


Figure 3.124. Monitor Unit Connections

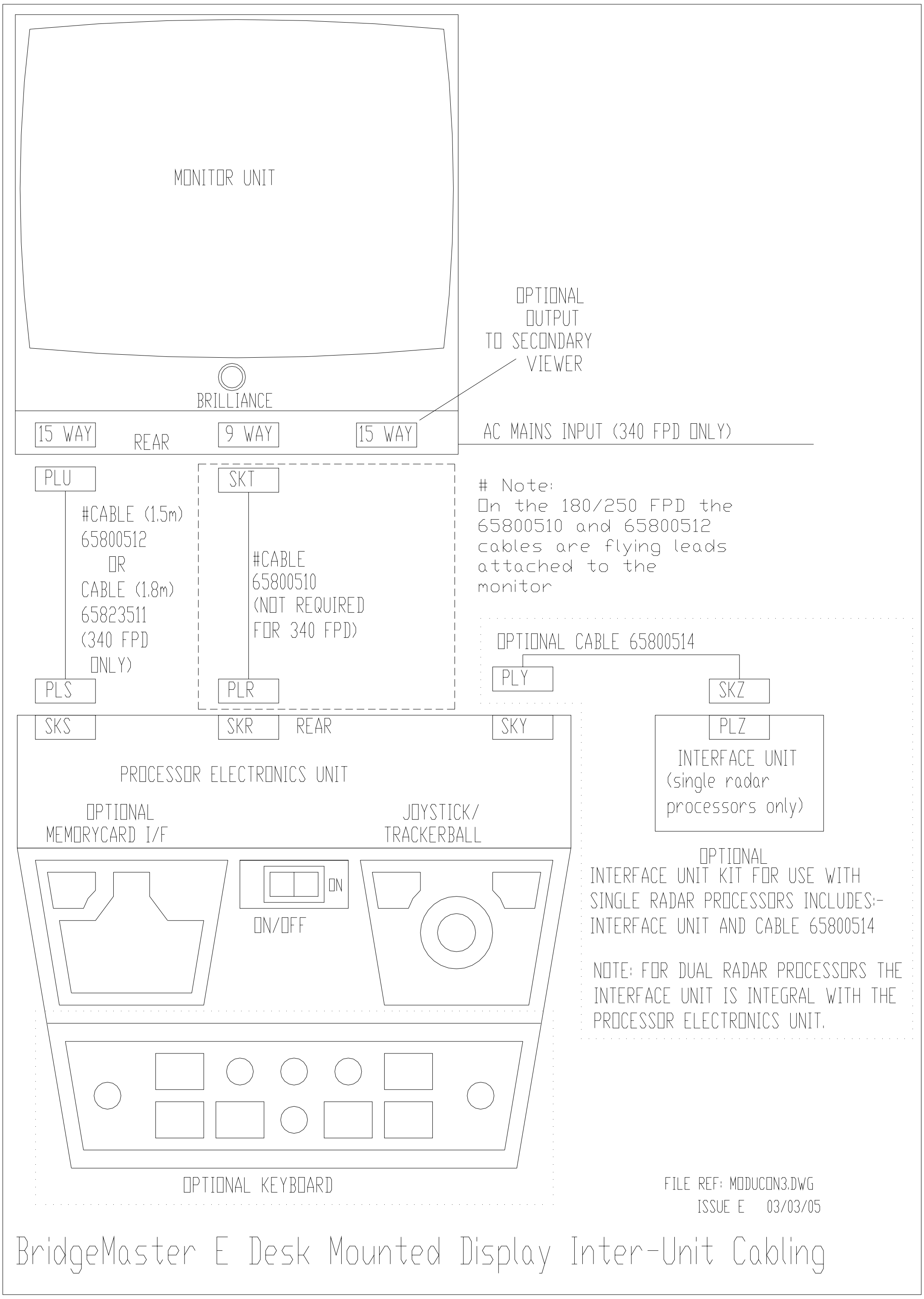


Figure 3.125. Desk Mounted Display Unit Inter-Unit Cabling

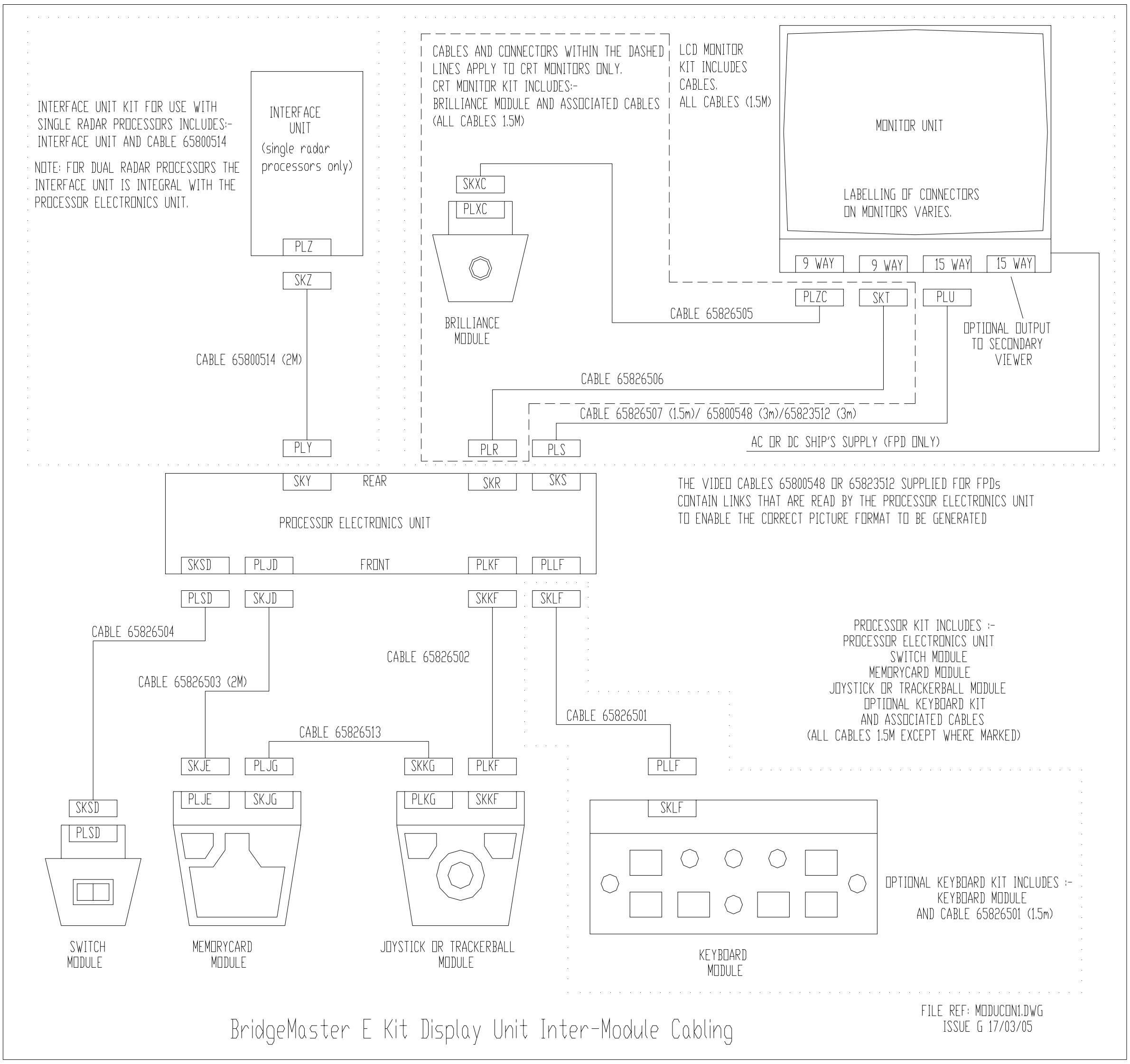


Figure 3.126. Kit Display Unit Inter-Module Cabling

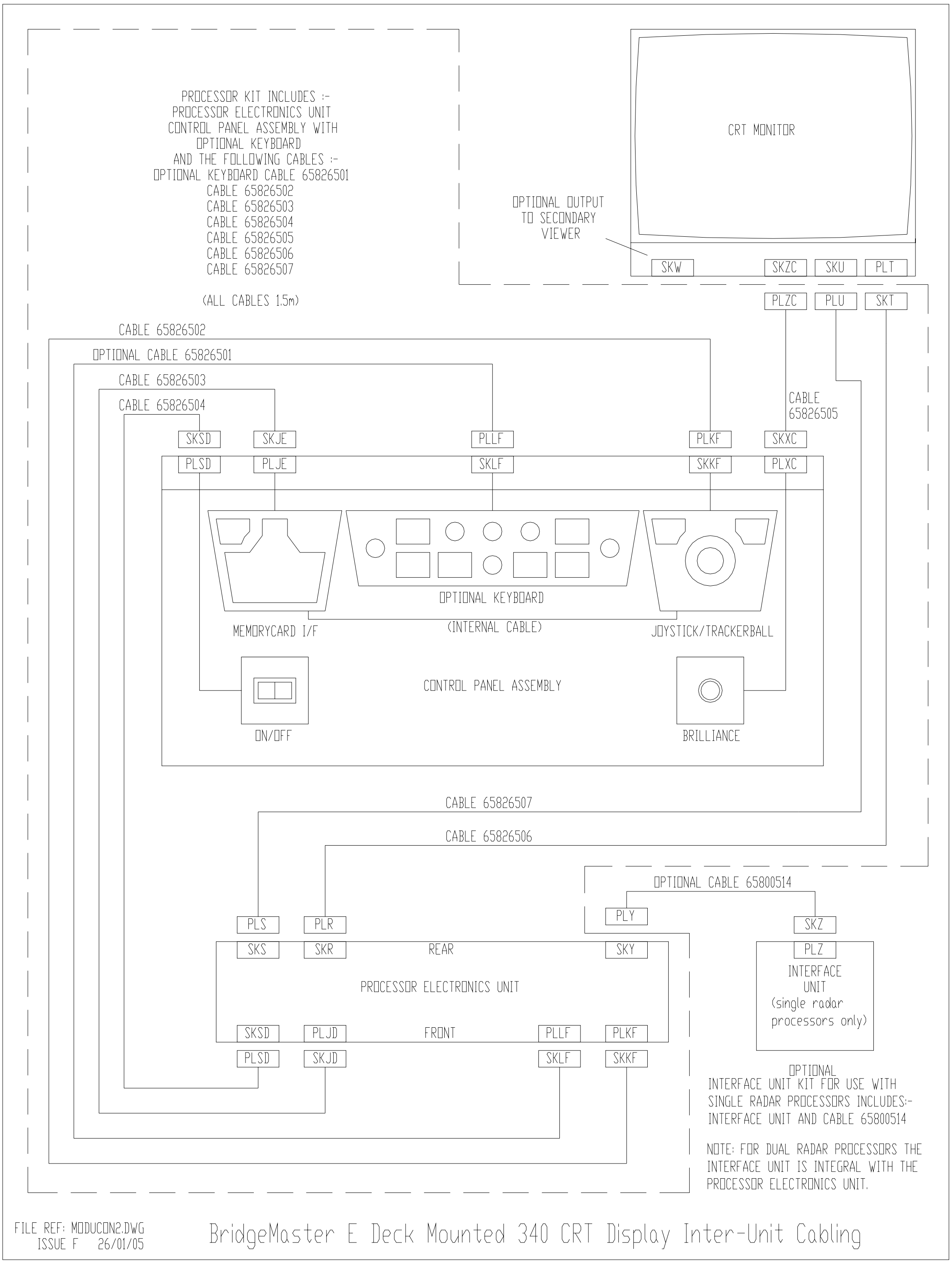


Figure 3.127. Deck Mounted 340 Display Unit (CRT) Inter-Unit Cabling

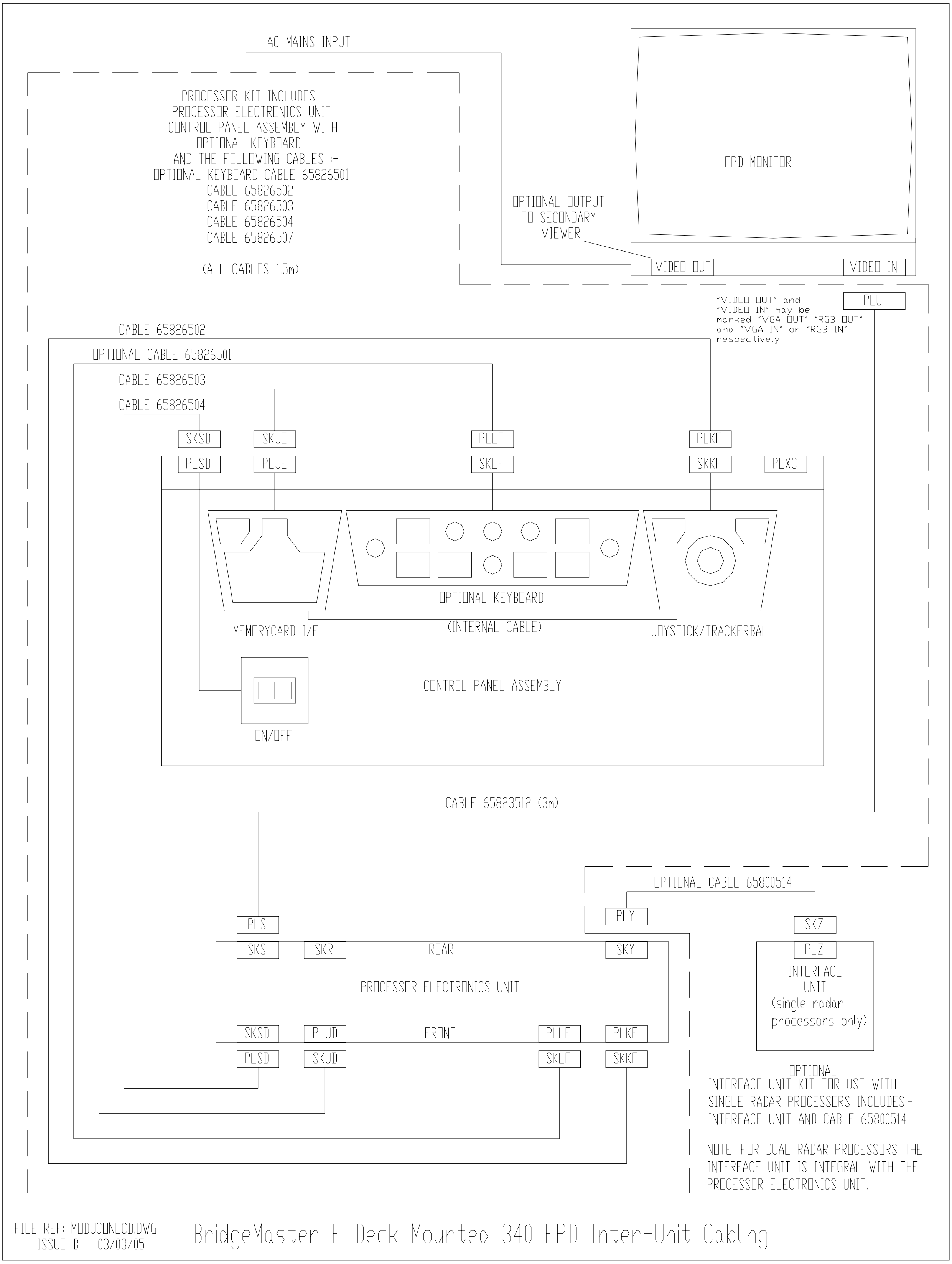


Figure 3.128. Deck Mounted 340 Display Unit (FPD) Inter-Unit Cabling

3.2 Compass Cabling and Link Settings

General

Compass cabling and linking information for BridgeMaster E Series Radars is detailed below for stepper and synchro type compasses.

Note – Details of cabling information for compasses with a serial output are described in Section 3.4.1 in this chapter. For ARPA and ATA variants, the serial data must conform to IEC 61162-2 and must be connected to serial input 3, 4 or 5.

The Compass Interface board is mounted as a daughter board onto the Display Processor Board in the Processor Electronics Unit.

The type of compass interface board fitted will determine the type of compass that can be used with the system. Two compass interface boards are available:

<table>
<tr><th>Interface Board</th><th>Compass Type</th><th>Ratio</th><th>Signal Voltages</th><th>Impedance</th></tr>
<tr><td rowspan="4">Standard
65800831</td><td>Stepper – S Type</td><td>360:1</td><td rowspan="2">16-100V DC line-line
8-100V DC line-line return.</td><td rowspan="2">10kΩ Min</td></tr>
<tr><td>Stepper – M Type</td><td>180:1</td></tr>
<tr><td rowspan="2">Synchro (50–500Hz)</td><td rowspan="2">360:1</td><td>16-100V RMS line-line</td><td>10kΩ Min</td></tr>
<tr><td>25-165V RMS reference</td><td>47kΩ Min</td></tr>
<tr><td rowspan="3">Special
65800832</td><td rowspan="3">Synchro (50-500Hz)</td><td rowspan="3">180:1
90:1
36:1
1:1</td><td>9.3-37V RMS line-line</td><td>40k to 60kΩ</td></tr>
<tr><td>32-126V RMS line-line</td><td>133k to 200kΩ</td></tr>
<tr><td>26-150V RMS reference</td><td>100kΩ Min</td></tr>
</table>

At system power up, the Display Processor detects the type of compass interface board, if any.

During System Initialisation, the compass type must be selected if the standard compass interface board is fitted, and the number of cycles per compass revolution (ratio) must be selected if the special compass interface board is fitted.

Standard Compass Board Links and Interconnections

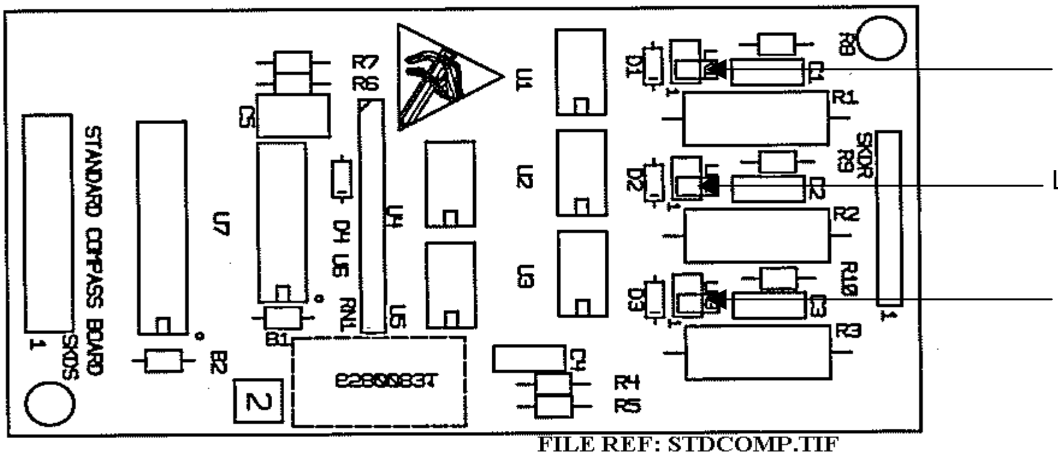


Figure 3.129. Standard Compass Interface PCB

There are three links on the Standard Compass Board, LK1, LK2 and LK3.

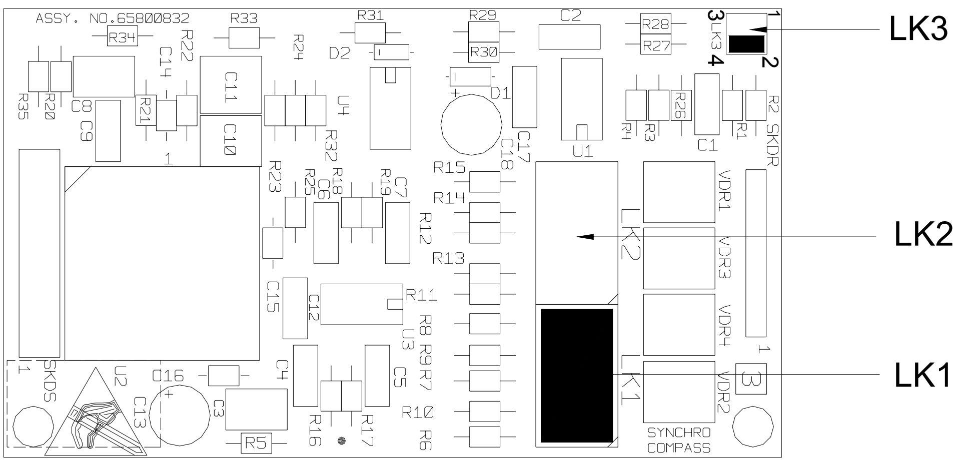
These need only be fitted between the pins if the 'OFF' state current from an 'S' type stepper compass is too high and causes the board to generate compass errors, otherwise leave in the parked position as shown in Figure 3.129 above.

Compasses should be connected in accordance with the following tables:

Stepper Compass					
S Type +ve Ref.		S Type -ve Ref.		M Type	
I/O Panel	Compass	I/O Panel	Compass	I/O Panel	Compass
TSC1		TSC1	S1	TSC1	S1
TSC2 Link		TSC2	S2	TSC2	S2
TSC3	Common Ref.	TSC3	S3	TSC3	S3
TSC4	S1	TSC4	Common Ref.	TSC4	
TSC5	S2	TSC5 Link		TSC5 Link	
TSC6	S3	TSC6		TSC6	
TSC7 (no connection)		TSC7 (no connection)		TSC7 (no connection)	
TSC8 (no connection)		TSC8 (no connection)		TSC8 (no connection)	
TSC9 (no connection)		TSC9 (no connection)		TSC9 (no connection)	
TSC10 (no connection)		TSC10 (no connection)		TSC10 (no connection)	

Synchro Compass					
Ref. Below 61V RMS		Ref. 61V - 115V RMS		Ref. Above 115V RMS	
I/O Panel	Compass	I/O Panel	Compass	I/O Panel	Compass
TSC1	S1	TSC1	S1	TSC1	S1
TSC2	S2	TSC2	S2	TSC2	S2
TSC3	S3	TSC3	S3	TSC3	S3
TSC4		TSC4		TSC4	
TSC5 Link		TSC5 Link		TSC5 Link	
TSC6		TSC6		TSC6	
TSC7	Synchro Ref.	TSC7 (no connection)		TSC7 (no connection)	
TSC8 (no connection)		TSC8	Synchro Ref.	TSC8 (no connection)	
TSC9 (no connection)		TSC9 (no connection)		TSC9	Synchro Ref.
TSC10	Ref. Return	TSC10	Ref. Return	TSC10	Ref. Return

Special Compass Board Links and Interconnections



FILE REF: 65800832M date:02/02/05

Figure 3.130. Special Compass Interface PCB

There are three links on the Special Compass Board, LK1, LK2 and LK3.

The voltage at the S1, S2 & S 3 inputs defines whether a shorting link is fitted to position LK1 or LK2.

If the input voltages are greater than 32V RMS, the link must be fitted in position LK1, otherwise, fit the link in position LK2.

The default setting is with the link fitted in position LK1.

The reference voltage determines the setting of LK3 as follows:

Reference Voltage	LK3
150V RMS	2 - 4
115V RMS	3 - 4
50V RMS	1 - 2
26V RMS	1 - 3

The default setting is with pins 2 and 4 of LK3 linked.

Compasses should be connected in accordance with the following table:

Synchro Compass	
I/O Panel	**Compass**
TSC1	S1
TSC2	S2
TSC3	S3
TSC4 (no connection)	
TSC5 (no connection)	
TSC6 (no connection)	
TSC7	Synchro Ref.
TSC8 (no connection)	
TSC9 (no connection)	
TSC10	Ref. Return

3.3 Log Cabling

Serial Logs are connected to serial inputs as described in Section 3.4.1.

The BridgeMaster analogue log input can accept signals from a water-locked, single axis, pulse or Doppler log with 100 to 3000 pulses per nm at a speed range of 0 to 75 knots. The signal can be from a closing contact or be a TTL compatible signal (1=2.4 to 5V, 0=0 to 0.4V).

The Log signal is connected to TSD 7, the Log Return to TSD 8 and the Log Status to TSD 9.

3.4 Processor Electronics Unit Additional Signals

All BridgeMaster E Processors have two general-purpose serial input and output ports with a dedicated serial output for Track Table data.

An extended Processor Unit has three more general-purpose serial input and output ports and some additional signals.

An Interface Unit (65847A) may be fitted to a standard processor to expand the system capability to that given by an extended processor.

3.4.1 Serial Ports

The table below gives details of the serial input and output connections.

See also Figure 3.121and Figure 3.122 earlier in this chapter.

Port	Terminal	Function	Features
Standard Serial Ports			
Serial I/P 1	TSE 1	RX Data 1B	+/- 1000V isolation. For RS232/RS422 use pins 1 (rtn/B) & pin 3 (sig/A). For current loop use pins 1 & 2 linked (+ve), Pin 3 (-ve).
	TSE 2	Loop 1	
	TSE 3	RX Data 1A	
Serial I/P 2	TSF 1	RX Data 2B	
	TSF 2	Loop 2	
	TSF 3	RX Data 2A	
Serial O/P 1	TSD 1	TX Data 1B	RS232/RS422 configured via Display menu. For RS232 use pins 1 (sig) & 3 (rtn). For RS422 use pins 1 (B) & 2 (A).
	TSD 2	TX Data 1A	
	TSD 3	0V	
Serial O/P 2	TSD 4	TX Data 2B	RS232/RS422 configured via Display menu. For RS232 use pins 4 (sig) & 6 (rtn). For RS422 use pins 4 (B) & 5 (A).
	TSD 5	TX Data 2A	
	TSD 6	0V	
Additional Serial Ports (Extended Processor & Interface Unit)			
Serial I/P 3	TSJ 1	RX Data 3B	+/- 1000V isolation. For RS232/RS422 use pins 1 (rtn/B) & pin 3 (sig/A). For current loop use pins 1 & 2 linked (+ve), Pin 3 (-ve).
	TSJ 2	Loop 3	
	TSJ 3	RX Data 3A	
Serial I/P 4	TSH 1	RX Data 4B	
	TSH 2	Loop 4	
	TSH 3	RX Data 4A	
Serial I/P 5	TSG 1	RX Data 5B	
	TSG 2	Loop 5	
	TSG 3	RX Data 5A	
Serial O/	TSK 1	TX Data 3B	RS232/RS422 configured via Display menu. For RS232 use pins 1 (sig) & 3 (rtn). For RS422 use pins 1 (B) & 2 (A).
	TSK 2	TX Data 3A	
	TSK 3	0V	
Serial O/	TSK 4	TX Data 4B	RS232/RS422 configured via Display menu. For RS232 use pins 4 (sig) & 6 (rtn). For RS422 use pins 4 (B) & 5 (A).
	TSK 5	TX Data 4A	
	TSK 6	0V	
Serial O/P 5	TSK 7	TX Data 5B	RS232/RS422/RS485 configured via Display menu. For RS232 use pins 7 (sig) & 9 (rtn). For RS422/RS485 use pins 7 (B) & 8 (A).
	TSK 8	TX Data 5A	
	TSK 9	0V	
Track Table Output			
Track Table O/P (See note)	SKY 23	Track Data B	Serial Track Table O/P configured via Display menu. For RS232 use pins 22 (rtn) & 23 (sig). For RS422 use pins 23 (B) & 24 (A). NMEA format. Contains Own Ship's information, Radar information, and Tracked Target information.
	SKY 24	Track Data A	
	SKY 22	0V	
Track Table O/P (See note	TSK 10	Track Data B	Serial Track Table O/P configured via Display menu. For RS232 use pins 12 (rtn) & 10 (sig). For RS422 use pins 10 (B) & 11 (A). NMEA format. Contains Own Ship's information, Radar information, and Tracked Target information.
	TSK 11	Track Data A	
	TSK 12	0V	

Note – The Track Table is on SKY for a standard processor and TSK for an extended processor and interface unit.

3.4.2 Additional Input and Outputs

The Dual Channel Processor and the Interface Unit provide the following additional ports:

- Remote Alarm (Alarm 1) via relay contacts (N/O & N/C)
- Vigilance Alarm (Alarm 2) via relay contacts (N/O & N/C)
- External Start (or Power-On/Power-Fail indicator) via relay contacts (N/O & N/C)
- Buzzer output
- Power output
- Freeze Frame input - not available on commercial units

The table below details the additional I/O connections for an extended processor or an interface unit. See Figure 3.122 for Interconnection Diagrams and I/O port connections.

Port	Terminal	Function	Features
Remote Alarm	TSL 4	Remote Alarm N/O	Remote Alarm with Relay Contacts. Normally Open (N/O) and Normally Closed (N/C) available. N/C shorts to return in alarm condition.
	TSL 5	Remote Alarm Return	
	TSL 6	Remote Alarm N/C	
Vigilance	TSL 10	Vigilance Alarm N/O	Vigilance Alarm with Relay Contacts. Normally Open (N/O) and Normally Closed (N/C) available. N/O shorts to return during output pulse.
	TSL 11	Vigilance Alarm Return	
	TSL 12	Vigilance Alarm N/C	
External Start	TSL 7	Ext Start N/O	Additional use as 'Power ON' indicator and 'Power Fail' indicator with Relay Contacts. Normally Open (N/O) and Normally Closed (N/C) available. N/C shorts to return on Power Fail.
	TSL 8	Ext Start Return	
	TSL 9	Ext Start N/C	
Buzzer	TSK 14	Buzzer +	Buzzer + is to +12V via 2k2 resistor. Buzzer Return is via 2k2 resistor switched to 0V.
	TSK 15	Buzzer Return	
Power Output	TSL 1	+12V	External Power Output to proprietary low current equipment.
	TSL 2	+5V	
	TSL 3	0V	
	TSL 13	-12V	
Freeze Frame	TSK 13	Freeze Frame-	Reserved for Special Options Radar requirements only. Pull down to ground to activate function.

3.5 Cabling Schedules

164 16-2-2C (TP3141)

TxRx	FUNCTION	CLR	SCU
TSB9	CONTR + 12V	R	SA N
TSB10	TU ENABLE	B	TSA1
E/TAG	EARTH (0V)	SCR	E/TAG

165 37-3-2R (TP3149)

ISO	FUNCTION	CLR	TU
2	AC LINE	R	TSE4
4	AC NEUTRAL	B	TSE3
EARTH	EARTH (0V)	SCR	TSE1

166 37-3-2R (TP3149) SHORT RUN
SINGLE PHASE 110/120V & 220/240V

SCU	FUNCTION	CLR	TU
TRIP 6	AC LINE	R	TSH1
TRIP 2	AC NEUTRAL	B	TSH2
E/TAG	EARTH (0V)	SCR	E/TAG

166 37-3-4R (TP3150) LONG RUN
SINGLE PHASE 110/120V & 220/240V

SCU	FUNCTION	CLR	TU
TRIP 2	AC LINE	R	TSH1
TRIP 6	AC NEUTRAL	B	TSH2
TRIP 2	AC LINE	G	TSH1
TRIP 6	AC NEUTRAL	Y	TSH2
E/TAG	EARTH (0V)	SCR	E/TAG

166 37-3-4R (TP3150) THREE PHASE
110/120V & 220/240V & 380/440V

SCU	FUNCTION	CLR	TU
TRIP 2	AC LINE 1	R	TSH1
TRIP 4	AC LINE 2	B	TSH2
TRIP 6	AC LINE 3	Y	TSH3
-	NOT USED	G	-
E/TAG	EARTH (0V)	SCR	E/TAG

168 16-2-12C (TP3145)

TU	FUNCTION	CLR	Tx/Rx
TSC1	PM ON	R	TSC1
TSC2	PM Tx/Rx	B	TSC2
TSC3	PM TUNE	G	TSC3
TSC4	XR ADJUST	Y	TSC4
TSC5	XT ADJUST	W	TSC5
TSC6	+12V (PM)	BK	TSC6
TSC7	+12V (PM)	BN	TSC7
TSC8	0V	V	TSC8
TSC9	-12V (PM)	O	TSC9
TSC10	-12V (PM)	P	TSC10
TSC11	AZI PULSES	L/G	TSC11
TSC12	HEADING MKR	GY	TSC12
E/TAG	EARTH (0V)	SCR	E/TAG

169 PT1YM - 75Ω COAXIAL

TU	FUNCTION	CLR	Tx/Rx
SKP	PERF MON TRIG	-	SKP

174 DATA CABLE (4 T/PAIRS)

TU	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSA1
TSB2	DU DATA -	W/B	TSA2
TSB3	TX DATA +	O/W	TSA3
TSB4	TX DATA -	W/O	TSA4
TSB5	TX TRIG +	G/W	TSA5
TSB6	TX TRIG -	W/G	TSA6
TSB7	TX SART +	BN/W	TSA7
TSB8	TX SART -	W/BN	TSA8
E/TAG	EARTH (0V)	SCR	E/TAG*

* located on lower back cover, adjacent to cable clamp. Cable clamp should grip onto cable braid.

175 PT1YM - 75Ω COAXIAL

TU	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV

180 16-2-2C (TP3141)

Tx/Rx	FUNCTION	CLR	SCU
TSB9	CONTR +12V	R	SA N
TSB10	TU ENABLE	B	TSA1
E/TAG	EARTH (0V)	SCR	E/TAG

182 37-3-2R (TP3149)

S/F	FUNCTION	CLR	ISO
-	AC LINE	R	1
-	AC NEUTRAL	B	3
E/TAG	EARTH (0V)	SCR	E/TAG

183 37-3-2R (TP3149) SHORT RUN
SINGLE PHASE 110/120V & 220/240V

S/F	FUNCTION	CLR	SCU
-	AC LINE	R	6/T3
-	AC NEUTRAL	B	4/T2
E/TAG	EARTH (0V)	SCR	E/TAG

183 37-3-4R (TP3150) LONG RUN
SINGLE PHASE 110/120V & 220/240V

S/F	FUNCTION	CLR	SCU
-	AC LINE	R	6/T3
-	AC NEUTRAL	B	4/T2
-	AC LINE	G	6/T3
-	AC NEUTRAL	Y	4/T2
E/TAG	EARTH (0V)	SCR	E/TAG

183 37-3-4R (TP3150) THREE PHASE
110/120V & 220/240V & 380/440V

S/F	FUNCTION	CLR	SCU
-	AC LINE 1	R	2/T1
-	AC LINE 2	B	4/T2
-	AC LINE 3	Y	6/T3
-	NOT USED	G	-
E/TAG	EARTH (0V)	SCR	E/TAG

184 37-3-2R (TP3149)

ISO	FUNCTION	CLR	Tx/Rx
2	AC LINE	R	TSE4
4	AC NEUTRAL	B	TSE3
EARTH	EARTH (0V)	SCR	TSE1

193 PT1YM - 75Ω COAXIAL

Tx/Rx	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV

194 DATA CABLE (4 T/PAIRS)

Tx/Rx	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSA1
TSB2	DU DATA -	W/B	TSA2
TSB3	TX DATA +	O/W	TSA3
TSB4	TX DATA -	W/O	TSA4
TSB5	TX TRIG +	G/W	TSA5
TSB6	TX TRIG -	W/G	TSA6
TSB7	TX SART +	BN/W	TSA7
TSB8	TX SART -	W/BN	TSA8
E/TAG	EARTH (0V)	SCR	E/TAG*

* located on lower back cover, adjacent to cable clamp. Cable clamp should grip onto cable braid.

195 PT1YM - 75Ω COAXIAL

DU	FUNCTION	CLR	
SKX	MIS TRIG OUT	-	

Note: Only if required for the system configuration

196 PT1YM - 75Ω COAXIAL

DU	FUNCTION	CLR	
SKM	MIS TRIG IN	-	

Note: Only if required for the system configuration

197

LOG	FUNCTION	CLR	DU
	LOG		TSD7
	LOG RETURN		TSD8
	LOG STATUS		TSD9
	EARTH (0V)	SCR	E/TAG*

* located on lower back cover, adjacent to cable clamp. Cable clamp should grip onto cable braid.

198

	FUNCTION	CLR	DU
	S1		TSC1
	S2		TSC2
	S3		TSC3
	S1 RTN		TSC4
	S2 RTN		TSC5
	S3 RTN		TSC6
	SYNCH Ref Low		TSC7
	SYNCH Ref Med		TSC8
	SYNCH Ref High		TSC9
	SYNCH REF RTN		TSC10
	EARTH (0V)		E/TAG*

* located on lower back cover, adjacent to cable clamp. Cable clamp should grip onto cable braid.

199 16-2-2C (TP3141)

	FUNCTION	CLR	DU
	RX DATA 1B		TSE1
	LOOP 1		TSE2
	RX DATA 1A		TSE3

Note: DO NOT Earth Cable Screen at DU

200 16-2-2C (TP3141)

	FUNCTION	CLR	DU
	RX DATA 2B		TSF1
	LOOP 2		TSF2
	RX DATA 2A		TSF3

Note: DO NOT Earth Cable Screen at DU Earth

204 37-3-2R (TP3149)

ISO	FUNCTION	CLR	TxRx
2	AC LINE	R	TSE4
4	AC NEUTRAL	B	TSE3
EARTH	EARTH (0V)	SCR	E/TAG

205 37-3-2R (TP3149)

ISO	FUNCTION	CLR	DU
2	AC LINE	R	TSP2
4	AC NEUTRAL	B	TSP4
E/TAG	EARTH (0V)	SCR	E/TAG

206 16-2-12C (TP3145)

TU	FUNCTION	CLR	Tx/Rx
TSC1	PM ON	R	TSC1
TSC2	PM Tx/Rx	B	TSC2
TSC3	PM TUNE	G	TSC3
TSC4	XR ADJUST	Y	TSC4
TSC5	XT ADJUST	W	TSC5
TSC6	+12V (PM)	BK	TSC6
TSC7	+12V (PM)	BN	TSC7
TSC8	0V	V	TSC8
TSC9	-12V (PM)	O	TSC9
TSC10	-12V (PM)	P	TSC10
TSC11	AZI PULSES	L/G	TSC11
TSC12	HEADING MKR	GY	TSC12
E/TAG	EARTH (0V)	SCR	E/TAG

207 PT1YM - 75Ω COAXIAL

TU	FUNCTION	CLR	TxRx
SKP	PERF MON TRIG	-	SKP

208 37-3-2R (TP3149)

Tx/Rx	FUNCTION	CLR	TU
TSA1	MOTOR +	R	TSA1
TSA2	MOTOR -	B	TSA2
E/TAG	EARTH (0V)	SCR	E/TAG

209 16-2-2C (TP3141)

Tx/Rx	FUNCTION	CLR	TU
TSB9	CONTR +12V	R	TSB9
TSB10	TU ENABLE	B	TSB10
E/TAG	EARTH (0V)	SCR	E/TAG

210 16-2-2C (TP3141)

	FUNCTION	CLR	DU
	0V		SKY22
	TX DATA B		SKY23
	TX DATA A		SKY24
	EARTH (0V)	SCR	E/TAG

Note: For RS232 use SKY 22/23
For RS422 use SKY 23/24

227 PT1YM - 75Ω COAXIAL

TXRX	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV

228 DATA CABLE (4 T/PAIRS)

TXRX	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSA1
TSB2	DU DATA -	W/B	TSA2
TSB3	TX DATA +	O/W	TSA3
TSB4	TX DATA -	W/O	TSA4
TSB5	TX TRIG +	G/W	TSA5
TSB6	TX TRIG -	W/G	TSA6
TSB7	TX SART +	BN/W	TSA7
TSB8	TX SART -	W/BN	TSA8
E/TAG	EARTH (0V)	SCR	E/TAG*

* located on lower back cover, adjacent to cable clamp.
Cable clamp should grip onto cable braid.

229 PT1YM - 75Ω COAXIAL

TU	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV

230 DATA CABLE (4 T/PAIRS)

TU	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSA1
TSB2	DU DATA -	W/B	TSA2
TSB3	TX DATA +	O/W	TSA3
TSB4	TX DATA -	W/O	TSA4
TSB5	TX TRIG +	G/W	TSA5
TSB6	TX TRIG -	W/G	TSA6
TSB7	TX SART +	BN/W	TSA7
TSB8	TX SART -	W/BN	TSA8
E/TAG	EARTH (0V)	SCR	E/TAG*

* located on lower back cover, adjacent to cable clamp.
Cable clamp should grip onto cable braid.

231 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	RX DATA 3B		TSJ1
	LOOP 3		TSJ2
	RX DATA 3A		TSJ3

Note: DO NOT Earth Cable Screen at IF

232 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	TX DATA 3B		TSK1
	TX DATA 3A		TSK2
	0V		TSK3

233 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	RX DATA 4B		TSH1
	LOOP 4		TSH2
	RX DATA 4A		TSH3

Note: DO NOT Earth Cable Screen at IF

234 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	TX DATA 4B		TSK4
	TX DATA 4A		TSK5
	0V		TSK6

235 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	RX DATA 5B		TSG1
	LOOP 5		TSG2
	RX DATA 5A		TSG3

Note: DO NOT Earth Cable Screen at IF

236 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	TX DATA 5B		TSK7
	TX DATA 5A		TSK8
	0V		TSK9

237 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	TRACK DATA B		TSK10
	TRACK DATA A		TSK11
	0V		TSK12

238 16-2-6C (TP3144)

	FUNCTION	CLR	IF or DU
	ALARM 1 NO		TSL4
	ALARM 1 RTN		TSL5
	ALARM 1 NC		TSL6
	ALARM 2 NO		TSL10
	ALARM 2 RTN		TSL11
	ALARM 2 NC		TSL12

239 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	EXT START NO		TSL7
	EST START RTN		TSL8
	EXT START NC		TSL9

240 16-2-2C (TP3141)

	FUNCTION	CLR	IF or DU
	BUZZER +	R	TSK14
	BUZZER RTN	B	TSK15
	0V	SCR	E/TAG

241 2M CABLE 65800514 SUPPLIED WITH INTERFACE UNIT

DU	FUNCTION	CLR	IF
SKY1	+12V OUT		SKZ1
SKY2	+5V OUT		SKZ2
SKY3	0V		SKZ3
SKY4	-12V OUT		SKZ4
SKY5	INTERFACE		SKZ5
SKY6	0V		SKZ6
SKY7	INTERFACE		SKZ7
SKY8	0V		SKZ8
SKY9	INTERFACE		SKZ9
SKY10	INTERFACE		SKZ10
SKY11	INTERFACE		SKZ11
SKY12	0V		SKZ12
SKY13	INTERFACE		SKZ13
SKY14	INTERFACE		SKZ14
SKY15	INTERFACE		SKZ15
SKY16	0V		SKZ16
SKY17	INTERFACE		SKZ17
SKY18	INTERFACE		SKZ18
SKY19	FREEZE FRAME*		SKZ19
SKY20	INTERFACE		SKZ20
SKY21	INTERFACE		SKZ21
SKY22	0V		SKZ22
SKY23	TRACK DATA B		SKZ23
SKY24	TRACK DATA A		SKZ24
SKY25	INTERFACE		SKZ25

* Not used on commercial units

242 16-2-2C (TP3141)

	FUNCTION	CLR	DU
	TX DATA 1B		TSD1
	TX DATA 1A		TSD2
	0V		TSD3

243 16-2-2C (TP3141)

	FUNCTION	CLR	DU
	TX DATA 2B		TSD4
	TX DATA 2A		TSD5
	0V		TSD6

248 DC SUPPLY CABLE

SF	FUNCTION	CLR	TXRX
FOR TP3150 CONNECTIONS			
-	DC -	B	TSE3
-	DC -	G	TSE4
-	DC +	Y	TSE1
-	DC +	R	TSE2
E/TAG	EARTH	SCR	E/TAG

249 DC SUPPLY CABLE

SF	FUNCTION	CLR	TXRX
FOR TP3150 CONNECTIONS			
-	DC -	B	TSP3
-	DC -	G	TSP4
-	DC +	Y	TSP1
-	DC +	R	TSP2
E/TAG	EARTH	SCR	E/TAG

301 See note

ISO	FUNCTION	CLR	MU
2	AC LINE	BN	LINE1
4	AC NEUTRAL	BE	NEUTRAL
EARTH	EARTH (0V)	GN/Y	EARTH

Unit is supplied with 2-metre mains cable; if necessary, this can be extended using three core 0.75mm^2 supplied by shipyard.

324 PT1YM - 75Ω COAXIAL

DU	FUNCTION	CLR	DU
SKM	MIS TRIG	-	SKX2

325 PT1YM - 75Ω COAXIAL

DU	FUNCTION	CLR	DU
SKM2	MIS TRIG	-	SKX

326 PT1YM - 75Ω COAXIAL

TXRX	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV2

327 DATA CABLE (4 T/PAIRS)

TXRX	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSZ1
TSB2	DU DATA -	W/B	TSZ2
TSB3	TX DATA +	O/W	TSZ3
TSB4	TX DATA -	W/O	TSZ4
TSB5	TX TRIG +	G/W	TSZ5
TSB6	TX TRIG -	W/G	TSZ6
TSB7	TX SART +	BN/W	TSZ7
TSB8	TX SART -	W/BN	TSZ8
E/TAG	EARTH (0V)	SCR	E/TAG

340 DATA CABLE (4 T/PAIRS)

TU	FUNCTION	CLR	DU
TSB1	DU DATA +	B/W	TSZ1
TSB2	DU DATA -	W/B	TSZ2
TSB3	TX DATA +	O/W	TSZ3
TSB4	TX DATA -	W/O	TSZ4
TSB5	TX TRIG +	G/W	TSZ5
TSB6	TX TRIG -	W/G	TSZ6
TSB7	TX SART +	BN/W	TSZ7
TSB8	TX SART -	W/BN	TSZ8
E/TAG	EARTH (0V)	SCR	E/TAG

341 PT1YM - 75Ω COAXIAL

TU	FUNCTION	CLR	DU
SKV	VIDEO	-	SKV2

343 DC SUPPLY CABLE

SF	FUNCTION	CLR	FPD
-	No Connection	.	N/C
-	DC -	.	DC -
-	Earth	.	E
-	DC +	.	DC +
E/TAG	EARTH	SCR	E/TAG

3.6 System Fuses

Switch – Fuse Current Ratings

	Current Rating		
ly	Radar	S-Band Motor le Phase	 Three Phase
0/120V AC	10A	10A	10A
220/240V AC	5A	5A	5A
380/440V AC	-	-	5A
22-32V DC	25A	-	-

Processor Electronics Unit Fuse

Refer to Figure 3.121 and Figure 3.122 for fuse location.

	Supply	Rating
Mains Fuse (FS1)	110/120V AC	5A
	220/240V AC	5A
	22-32V DC	15 or 16A

Transceiver Unit Fuse

Refer to Figure 3.46 and Figure 3.52 for S-Band fuse location.

Refer to Figure 3.16, Figure 3.23 and Figure 3.24 for X-Band fuse location.

	Supply		X-Band
(FS1)	110/120V AC	3.15A	5A
	220/240V AC	3.15A	3.15A
	22-32V DC	-	15 or 16A

Note – All fuses are 1¼in (31mm) ceramic, anti-surge, cartridge types.
3.15A fuse is code number MA00007245.
5A fuse is code number 2180413.
15 or 16A fuse is code number 2162342.

CHAPTER 4

INITIALISATION AND COMMISSIONING

Contents

Figures

1 Introduction

Use the following procedures to start the system correctly. **Use the checklist given at the end of this chapter to record the settings made during the procedures.** This will provide a reference for future use and record that all of the procedures have been completed.

1.1 Using the Radar Controls

General operating instructions for the radar are contained in the User Guide, publication reference 65800010A for Single Channel Radars or 65818014A for Dual Channel Radars.

A description of the operation of the radar control panel is in Chapter 2 of the User Guide. You use a simple pointing device (joystick or tracker-ball), with two associated keys (left and right) to control the radar and its display.

Throughout this manual, reference to the 'cursor control' relate to the joystick of tracker-ball (depending on which is fitted). Similarly, instructions to 'left click' or 'right click' relate to a press-and-release of the left or right key associated with the cursor control.

1.2 Standby Display

The radar starts up for the first time, it goes into STANDBY mode.

2 Selecting the Initialisation Mode

You will find the soft key for selecting the INITIALISATION mode at the bottom left hand corner of the display.

From the STANDBY display:

1. Left click on the **INITIALISATION** soft key.

This will show the Initialisation page, see Figure 4.1below. The SYSTEM CONFIGURATION soft key has an automatic highlight, and the menu associated with this soft key is shown. Soft keys for I/O OPTIONS and TRANSCEIVER SETTINGS are also available at the top of the display.

Some menu items are not shown, depending on the hardware and configuration. For example, Remote Alarm and Vigilance Alarm are only available you have an extended radar or a Serial Interface has been fitted.

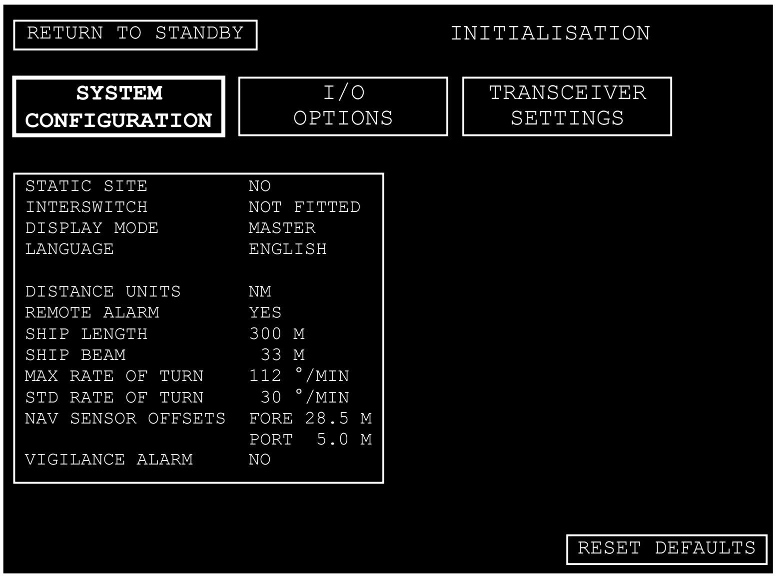
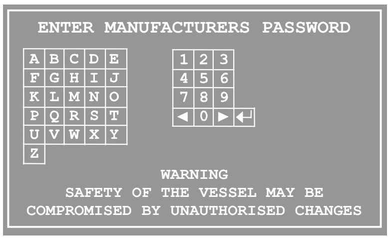


Figure 4.1 Initialisation Mode (System Configuration) Display

2.1 Menus and Passwords

You can see the menus for SYSTEM CONFIGURATION, I/O OPTIONS and TRANSCEIVER SETTINGS at any time by left clicking on the appropriate soft key.



The first attempt to change a menu item will result in the display of an alpha-numeric keypad prompting you for the input of the manufacturer's password, see example right. Enter an appropriate password at the keypad to proceed further, or right click to close the keypad without further action. For more information on menus and keypads, refer to the Reference Section in Chapter 15 of the User Guide. The navigator's password will also be accepted for making changes to items in the I/O OPTIONS menu.

After entering a correct password and making a change, the caption in the soft key at the top left hand corner of the display will change from RETURN TO STANDBY to SAVE CHANGES AND RESTART.

Sperry-Marine recommends that you make settings within the System Configuration menu before making changes to items in the menus for I/O Options and Transceiver Settings.

2.2 Returning to Standby

If you have made no changes to the initialisation menus, left click on the RETURN TO STANDBY soft key (top left hand corner of display) to return the system to Standby. If you have entered a password to make changes and you have made at least one change; the soft key caption will have changed from RETURN TO STANDBY to SAVE CHANGES AND RESTART, see Section 7 (Restarting) later in this chapter.

3 System Configuration

3.1 Password Access

1. If necessary, left click on the SYSTEM CONFIGURATION soft key to reveal the System Configuration menu. See Figure 4.1.
2. Position the screen cursor over the input field of the first item in the menu to be changed.
3. Left click in an attempt to change the setting.
4. This will reveal an alphanumeric keypad prompting the input of the manufacturer's password. See Section 2.1 earlier in the chapter.
5. Use the keypad to enter the required password.

3.2 Menu Items

Select items in the System Configuration menu in order from the top. The menu only shows items applicable to the actual system.

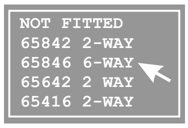
3.2.1 Static Site

Left click to toggle for YES or NO.

Note – If a static site is selected (YES) various items in the System Configuration and I/O Options menus will be removed and not appear, and all offsets will be referenced to N, S, E and W.

3.2.2 Interswitch

1. Left click to reveal a drop down menu listing the Interswitch types, see example right.
2. Within the drop down menu, left click on the Interswitch type if fitted.



Note – Selecting NOT FITTED will force the Display ID to 'A'. Channel 1 is set to 'A' and channel 2 is set to 'B' in dual channel radars.

3.2.3 Display Mode

This menu item will only be available if an Interswitch is NOT FITTED, and it is not a dual channel radar.

Left click to toggle for MASTER or permanent SLAVE Display option. For a dual channel radar, refer to Section 5.1.9 for setting a SLAVE only channel.

3.2.4 Language Mode

Left click to toggle for ENGLISH or JAPANESE.

3.2.5 Distance Units

Left click to toggle for NM (nautical miles), KM (kilometres) or SM (statute miles).

3.2.6 Remote Alarm

The remote alarm output is available if an optional Interface Unit is fitted, or if the system is a dual channel radar. You can configure it as follows.

1. Left click to toggle for YES or NO.
2. Right click on the input field to reveal a drop down menu containing the alarms applicable to the system configuration. See Figure 4.2 for a list of all possible alarms. The alarms shown will depend on your configuration.

REMOTE ALARMS

CONTROL PANEL		TM RESET
PROCESSOR	YES	MVR TIME
DISPLAY RESET	YES	TRACKS FULL
RADAR RESET	YES	GUARD LINE
GRAPHICS RESET	YES	ZONES FULL
MEMORY		AZ OVERLOAD
RADAR CONFIG		GZ ENTRY
RADAR LINK		AZ ENTRY
		LOST TARGET
STBY/TX ERR		ROUTE ERROR
AZI ERROR		APPROACH
TX COMMS		OFF TRACK
INTERSWITCH		LEG CHANGE
LOW VIDEO		WATCH ALARM
COMPASS		MOTION MODE
MISSING HL		CHECKSUM
MISSING SL		AIS INTEGRITY
NO SCAN HL		AIS INPUT
		DEPTH INPUT
TX BIST		WIND INPUT
VISION		ALARM INPUT
TRIG ERROR		VMS GRAPHIC
LOG ERROR		PLOT UPDATE
LOST REF		GPS QUALITY
BOW CROSS		AUTOTIDE
CPA/TCPA		TEMPERATURE
NAV INPUT		CARD BATTERY
NAV SPEED		PC CARD
POSITION		EXTERNAL MAP
PL ERROR		CARD FULL

Figure 4.2 Remote alarms

3. Within the drop down menu, left click on an alarm item to toggle for YES or "…" (BLANK – not selected).
4. Repeat Step 3 until the alarm selections are as required.
5. Right click to close the alarms menu.

3.2.7 Ship Length

You use this menu to size the ship's profile symbol. It is not available if you have selected Static Site. Input range is 0-999m.

1. Left click to access.
2. Move the cursor control left or right to change the ship length value to that required.
3. Left click to accept.

Alternatively, a right click on the input field will reveal a drop down numeric keypad from which a 'ship length' value can be entered.

3.2.8 Ship Beam

You use this menu item to size the ship's profile symbol. It is not available if you have selected Static Site. Input range is 0-300m.

1. Left click to access.
2. Move the cursor control left to right to change the ship beam value to that required.
3. Left click to accept.

Alternatively, a right click on the input filed will reveal a drop down numeric keypad from which you can enter a 'ship beam' value.

3.2.9 Max Rate of Turn

You use this menu item when using the Constant Radius Turn planning tool. It is not available if you have selected Static Site. Input range is 0-1200°/min.

1. Left click to access.
2. Move the cursor control left to right to change the max-rate-of-turn value to that required.
3. Left click to accept.

Alternatively a right click on the input field will reveal a drop down numeric keypad from which a 'max rate of turn' value can be entered.

3.2.10 STD Rate of Turn

You use this menu item when using the Constant Radius Turn planning tool. It is not available if you have selected Static Site. Input range is 0-1200°/min.

The standard rate of turn can never exceed the Max Rate of Turn. If the standard rate of turn is set to be greater than the Max rate of turn, the Max rate of turn will be increased to be equal to the standard rate of turn. If the Max rate of turn is reduced below the standard rate of turn, the standard rate of turn will be reduced to the Max rate of turn.

1. Left click to access.
2. Move the cursor control left to right to change the standard-rate-of-turn value to that required.
3. Left click to accept.

Alternatively, a right click on the input field will reveal a drop down numeric keypad from which you can enter a 'standard rate of turn'.

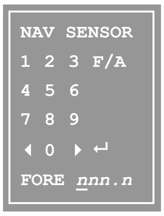
3.2.11 Nav Sensor Offsets

The nav sensor offsets are the distances fore/aft and port/stbd of the nav sensor from the centre of the ship. They are essential to provide accurate positional information. Input ranges are limited to half ship's length and half ship's beam.

To change the offset value:

1. Left click on the offset.
2. Move the cursor control left or right to change the offset value to that required.
3. Left click to accept.

Alternatively:



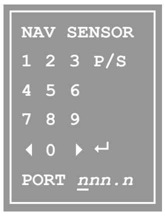
4. Right click on the FORE (or AFT) caption to reveal a drop down numeric keypad, see example right.
5. If required, left click on the F/A caption within the keypad to toggle for FORE or AFT.
6. The numeric keypad can be used to enter the offset directly.

If you have selected STATIC SITE, then FORE (AFT) changes to NORTH (SOUTH) and F/A changes to N/S.

To change the offset value:

1. Left click on the offset.
2. Move the cursor control left or right to change the offset value to that required.
3. Left click to accept.

Alternatively



4. Right click on the PORT (or STBD) caption to reveal a drop down numeric keypad, see example right.
5. If required, left click on the P/S caption within the keypad to toggle for PORT or STBD.
6. The numeric keypad can be used to enter the offset directly.

If you have selected STATIC SITE, then PORT (STBD) changes to EAST (WEST) and P/S changes to E/W.

3.2.12 Vigilance Alarm

Not available on EPA(L) systems and only available on dual channel radars or other systems if an Interface Unit is fitted.

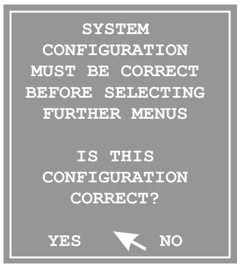
1. Left click to toggle for YES or NO.

The Vigilance alarm output provides for the requirements of Watch 1 systems. In direct response to an operator action, the output changes state for 1 second (either opening or closing contacts). The alarm is then inhibited for a period of 1 minute, whether operator action takes place or not, after which time the output will activate at the next operator action.

4 I/O Options

1. Left click on the **I/O OPTIONS** soft key.This will reveal the dialog box shown on the right.
2. Left click on YES to reveal the I/O Options menu as illustrated at Figure 4.3 below.

Note – A left click on the NO caption will close the dialog box without further action.



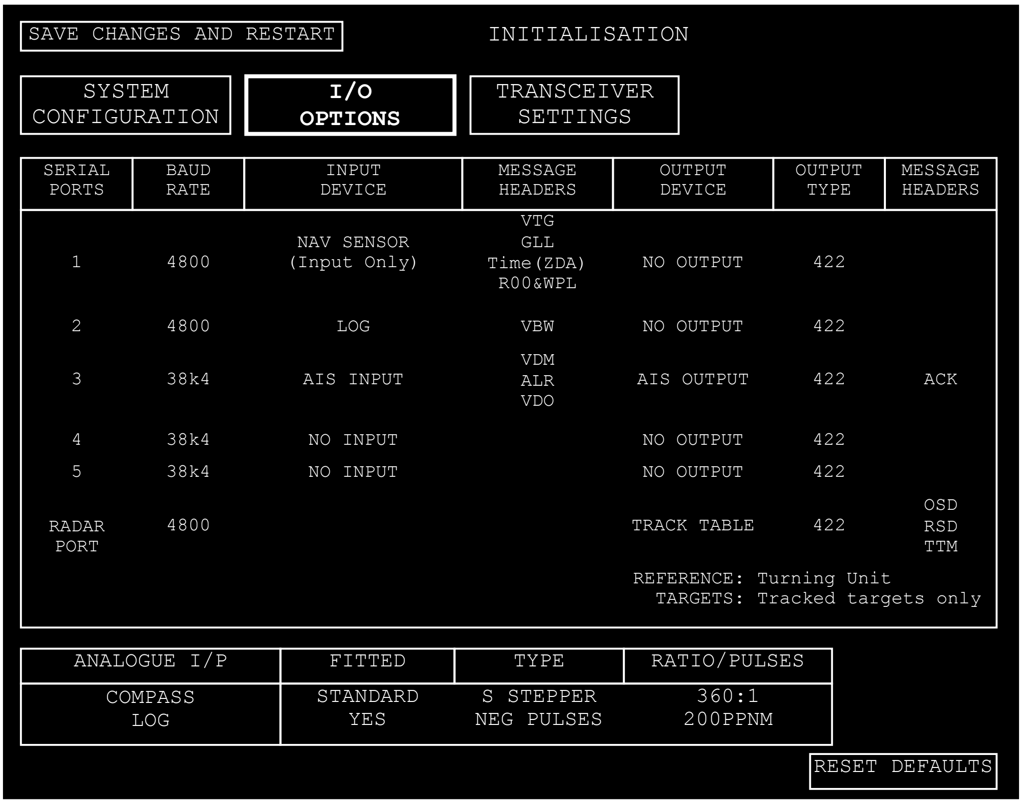


Figure 4.3 Initialisation Mode (I/O Options) Display

4.1 Menu Items

The input of a password may be required, see sub-section 2.1.

4.1.1 Serial Ports 1 to 5 and Radar Port

You should repeat the following procedures for all applicable serial ports.

Port 3, 4 and 5 are not available on EPA(L) systems and only available on single channel radars with an Interface Unit fitted or on dual channel radars.

BAUD RATE

The BAUD RATE for serial ports 1 & 2, and for the Radar port, is fixed at 4800.

For serial ports 3, 4 and 5 ONLY

1. Left click on the BAUD RATE input field to change the rate between 4800 and 38K4 for both INPUT and OUTPUT for that port

INPUT DEVICE

The RADAR port does not have an input device.

1. Left click on the INPUT DEVICE input field to reveal a drop down menu listing the available device selections.
2. From within the drop down menu, left click on the appropriate option for the selected Serial Port.

The NO INPUT option is included to enable the port to be de-selected. When the system is a static installation the COMPASS, LOG and DEPTH inputs are not available.

Notes The AIS INPUT option is only available on PORT 3, 4 and 5. The Route & WPT TRANSFER INPUT is only available on an ARPA system.

The Target Rename Inputs are used so that external devices (including VMS) can name track targets on the radar. This is useful where several radars are tracking the same targets as it allows the use of a common name.

The NAV Lines Interface is used to transfer maps from a VMS to the BridgeMaster E.

The Alarm Acknowledge Input is used to provide remote acknowledgement of unacknowledged alarms.

The AIS Input is used for the output from an AIS system.

The Route & Waypoint Transfer Input is used to transfer routes from an external system into the Internal Route System. This is different from the routes and waypoints sent from the NAV Sensor. See User Guide Section 9 for more details.

INPUT MESSAGE HEADERS

For the INPUT DEVICES, COMPASS, LOG, NAV SENSOR, DEPTH & WIND, it is necessary to select the message headers that are being received.

1. Left click on the INPUT MESSAGE HEADERS input field to reveal a drop down menu listing the available message headers for the selected input device. See example right which is for a serial compass input device.
2. From within the drop down menu,
3. Left click on the appropriate option to assign it to the selected Serial Port:

Or

4. To remove a header if previously assigned, left click on the appropriate option (this only applies to the time, VMSG and VBW headers on the NAV SENSOR INPUT.)

Notes – You can set the Compass Message Header to HDT, HDM or HDG.

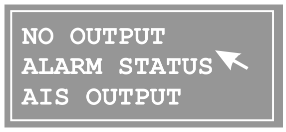
You can set the Log Message Header to VBW or VHW. If you have not configured a Log then a VBW sentence can be received via the NAV sensor input.

The NAV Sensor is used to set: headers for position (GGA, GLL, GLL&SNU or GLL&SLL); time (ZDA, ZZU or GLL); speed (always set as VTG); routes and waypoints (RTE&WPL, R00&WPL or BWC&BWR); log (VBW) if no LOG input is set. It also sets VMS graphics (VMSG) if the system is used with a VMS and next turn EBL and predicted vector are required.

The Depth Message Header can be set to DBT or DPT.

The Wind Message Header can be set to MWV, VWT or VWR.

OUTPUT DEVICE – RADAR PORT



1. Left click on the OUTPUT DEVICE input field to reveal a drop down menu listing the available device selections. See example right.
2. From within the drop down menu, left click on the appropriate option for the selected Serial Port.

Notes – The ALARM STATUS output reports the state of alarms local to the system.

The AIS OUTPUT option is used to provide remote acknowledgement of unacknowledged alarms on an AIS. It is only available on PORTS 3, 4 and 5.

The TRACK TABLE output is only available on the **RADAR PORT**.

The TRACK TABLE information can be referenced to the turning unit (channel 1 for a dual channel system) or to the centre of the ship.

Left click on the REFERENCE field to select ‘Turning Unit’ or ‘Centre’.

The Track Table output can be set for tracked targets only or for AIS and tracked targets if an AIS INPUT DEVICE is set up.

Left click on the TARGETS field to select ‘Tracked targets only’ or ‘AIS & Tracked targets’.

OSD and RSD messages are transmitted every 2 seconds. The TTM message rate depends on the number of tracked targets.

OUTPUT TYPE

Left click on the OUTPUT TYPE input field to toggle for (RS) 422 or (RS) 232.

Serial Port 5 OUTPUT TYPE toggles between (RS) 422, (RS) 232 and (RS) 485.

4.1.2 Analogue I/P (COMPASS)

The ANALOGUE I/P box will not be available if a static site has been selected. An analogue compass cannot be used if a serial compass has been selected. The box will show COMPASS (Not in use).

COMPASS FITTED

This is an indication only of the type of compass board fitted. The options are STANDARD, SPECIAL or NONE (if none fitted).

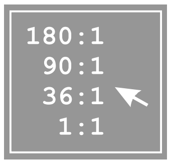
COMPASS TYPE

This is an indication of the type of compass information being received, and will be set to SYNCHRO if a SPECIAL compass board is fitted, or NONE if no compass board is fitted.

1. If a STANDARD compass board is fitted, left click on the COMPASS TYPE input field to reveal a drop down menu listing the types available. See example right.
2. From within the drop down menu, left click on the appropriate option.

COMPASS RATIO/PULSES

When a STANDARD compass board is fitted, the ratio is set by the compass type above and will be set to one of the following:
M STEPPER 180:1, S STEPPER 360:1 or SYNCHRO 360:1.



1. If a SPECIAL compass board is fitted, left click on the COMPASS RATIO input field to reveal a drop down menu listing the ratios available for the synchro. See example right.
2. From within the drop down menu, left click on the appropriate option.

4.1.3 Analogue I/P (LOG)

The ANALOGUE I/P box will not be available if a static site has been selected. This input can be selected even if a serial log has been selected. The particular input required can be selected from the speed menu during normal radar operation.

LOG FITTED

Left click on the LOG FITTED input field to toggle for YES or NO.

LOG TYPE

Left click on the LOG TYPE input field to toggle for NEG PULSES or POS PULSES. Select NEG PULSES if the log is a closing contact type.

LOG RATIO/PULSES

1. Left click on the LOG RATIO/PULSES input field to highlight the PPNM (Pulses/NM) number.
2. Move the cursor control left or right to change the number to that required. The Range is 100 to 3000ppnm, in steps of 10.
3. Left click to accept new number

5 Transceiver Settings

Left click on the **TRANSCEIVER SETTINGS** soft key to reveal the TRANSCEIVER SETTINGS menu illustrated at Figure 4.4 below.

Note – The number of transceivers shown (TX A to TX F in the figure) will depend on whether an Interswitch is fitted or not and whether it is a dual channel radar. If a 65846 Interswitch is fitted, TX A to TX F will be available. If a 65842, 65642 or 65416 Interswitch is fitted, only TX A and TX B will be available. For a single channel radar without Interswitch, only TX A will be available. For a dual channel radar without Interswitch, only TX A and TX B will be available.

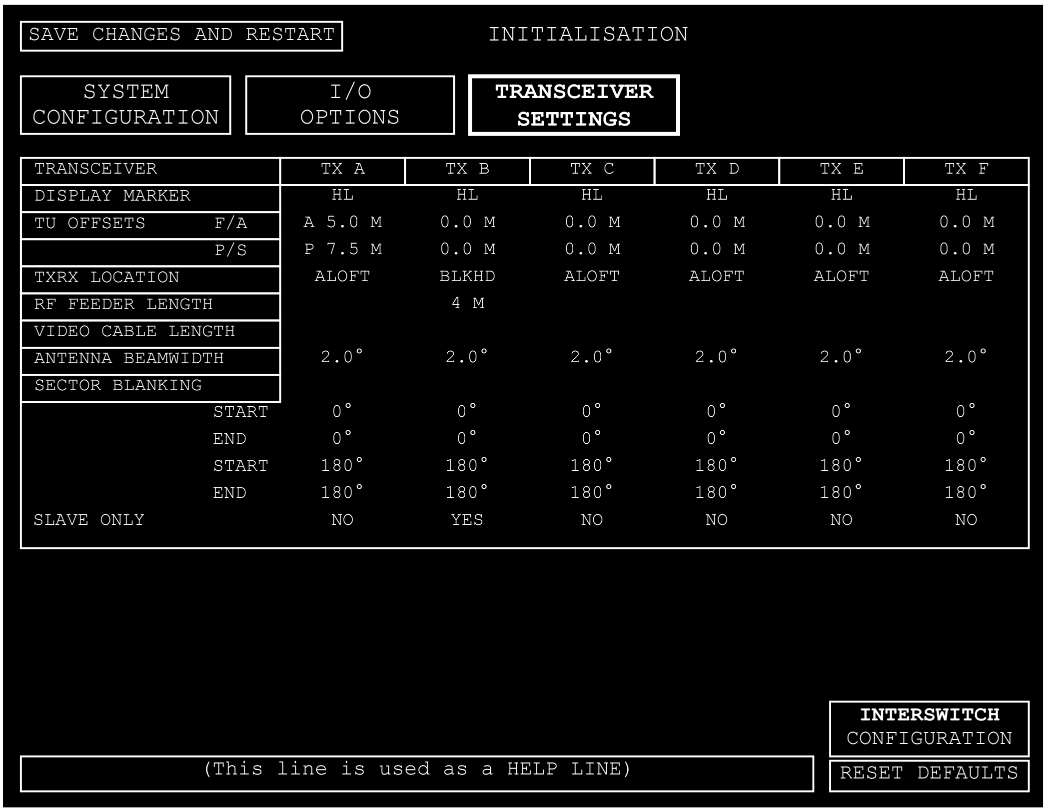


Figure 4.4 Initialisation Mode (Transceiver Settings) Display

5.1 Menu Items

You must complete the following procedures for all available transceivers. The input of a manufacturer's password may be required, see Section 2.1.

5.1.1 Display Marker

Under the selected transceiver heading, left click in the DISPLAY MARKER input field to toggle for SL (Stern Line) or HL (Heading Line).

5.1.2 TU (Turning Unit) Offsets

The turning unit offsets are the distances fore/aft and port/stbd of the TU from the centre of the ship. They are essential to provide accurate presentation of own ship's profile and output information. The range is limited to half ship's length or beam.

1. Under the selected transceiver heading, left click on the F/A input field. If ship's length is set to 0, a message "Setup ship's length first" appears at the lower left of the screen.
2. Move the cursor control left or right to change the offset value to that required.
3. Left click to accept.

Alternatively a right click on the F/A input field will reveal a drop down numeric keypad from which fore or aft offset can be entered.

If STATIC SITE is selected, then FORE (AFT) changes to NORTH (SOUTH) and F/A changes to N/S.

1. Under the selected transceiver heading, left click on the P/S input field. If ship's beam is set to 0, a message "Setup ship's beam first" appears at the lower left of the screen.
2. Move the cursor control left or right to change the offset value to that required.
3. Left click to accept.

Alternatively, a right click on the P/S input field will reveal a drop down numeric keypad from which a port or starboard offset can be entered.

If STATIC SITE is selected, then PORT (STBD) changes to EAST (WEST) and P/S changes to E/W.

5.1.3 TXRX Location

Under the selected transceiver heading, left click in the TXRX LOCATION field to toggle for ALOFT or BLKHD (Bulkhead) depending on where the transceiver is located.

5.1.4 RF Feeder Length

This can only be entered for bulkhead located transceivers.

1. Under the selected transceiver heading, a left click on the RF FEEDER LENGTH input field.
2. Move the cursor control left or right to change the RF feeder length value to that required (between 0 and 99 metres).
3. Left click to accept.

Alternatively, a right click on the input field will reveal a drop down numeric keypad from which an RF feeder length can be entered.

The RF Feeder length is used to calculate an approximate trigger delay. The exact trigger delay should be set as described in this chapter at Section 8.4.

5.1.5 Video Cable Length

Under the selected transceiver heading, left click in the VIDEO CABLE LENGTH field to select a cable length range appropriate for the total length of video cable between the transceiver and the display. A left click will cycle through the values, however a right click will reveal a pop up menu as shown displaying the four options. The correct option can be selected by left clicking on it.

When setting the cable length ensure that the total video cable length is used (Transceiver to Display, via Interswitch if fitted).

```
0 to 10m
11 to 40m
41 to 70m
>70m
```

For cable types FSJ1/75A and FSJ4/75A, apply the correction factor, as shown in the table below, to the actual cable length to determine the VIDEO CABLE LENGTH setting. Further information about the selection of cable type is shown in Chapter 3, Section 1.3.6.

Service Code (Cable Type)	Actual Cable Length	Correct selection on Transceiver Settings
3236862 (PT1YM) *91005248 (PT1YM)	0 to 10 m	0 to 10 m
	11 to 40 m	11 to 40 m
	41 to 70 m	41 to 70 m
MA00012534 (FSJ1-75) *MA00014142 (FSJ1RN-75A)	0 to 25 m	0 to 10 m
	26 to 100 m	11 to 40 m
	101 m to 175 m	41 to 70 m
	> 175 m	> 70 m
MA00012880 (FSJ4-75A) *MA00016089 (FSJ4RN-75A)	0 to 50 m	0 to 10 m
	51 to 200 m	11 to 40 m
	201 to 350 m	41 to 70 m
	> 350 m	> 70 m

***** Denotes zero halogen cables.

5.1.6 Antenna Beamwidth

Under the selected transceiver heading, left click in the ANTENNA BEAMWIDTH field to select a beamwidth appropriate for the transceiver's antenna. A left click will cycle through the values

A right click will reveal a pop up menu as shown. This shows all the options, including associated BridgeMaster antenna types. An option can then be selected by left clicking on it. Always select the option closest to the antenna beamwidth if the exact figure is not available.

```
0.5°
1.0° (BM 8′ X)
1.3° (BM 6′ X)
1.6°
2.0° (BM 4′ X, BM 12′ S)
2.4°
2.8° (BM 9′ S)
3.3°
```

5.1.7 Sector Blanking

This allows radar transmissions to be inhibited between specified start and end bearings.

1. Under the selected transceiver heading, a left click on one of the SECTOR BLANKING input fields. The first START and END are for SECTOR 1, and the second for SECTOR 2.
2. Move the cursor control left or right to change the start (or stop) value to that required.

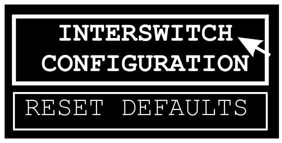
Note – As the END value must be clockwise with respect to the START value, it may be necessary to set the STOP value before the START value. For example, when the system is first used, both values of SECTOR 1 are set to 0°. If the user requires a blanking sector between 20° and 40°, it will be necessary to set the END to 40° and then set the START to 20°.

3. Left click to accept.
4. Repeat steps 1 to 3 as required.

Alternatively, a right click on the input field will reveal a drop down numeric keypad from which a sector start (or sector end) value can be entered.

Note – The two sectors associated with a particular transceiver are not allowed to overlap – a warning prompt is given if this is attempted.

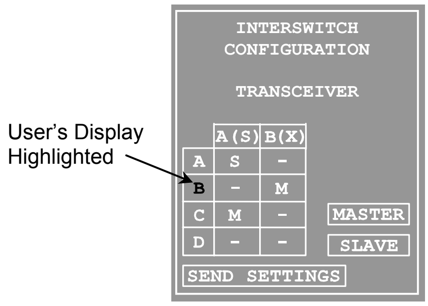
5.1.8 Interswitch Configuration



If an Interswitch Unit has been selected on the System Configuration menu (see Section 3.2.2), left click on the INTERSWITCH CONFIGURATION soft key in the bottom right-hand corner of the Transceiver Settings menu.

This will reveal a drop down menu (see example right) which gives the current transceiver/display configuration of the **whole system** with the **user's display channel(s)** highlighted in the left hand column.

Note – A right click at any time will close the menu.



The example shows the menu for a Type 65842 (4-display, 2-transceiver) Interswitch with the Interswitch in global mode. The rows labelled A, B, C & D represent the system **Display channels**, and the columns headed A(S) & B(X) represent the **Transceivers**, one S-Band and one X-Band.

A light blue dash shows that no interswitched connection is configured between the display channel and transceiver on the corresponding row and column.

A dark blue dash indicates that a display or transceiver is not fitted.

An M shows that an interswitched connection is configured between the display channel and transceiver on the corresponding row and column, and that the display has Master control of the transceiver.

An S shows that an interswitched connection is configured between the display channel and transceiver on the corresponding row and column, and that the display is slaved to the transceiver.

Each display indicates the type of transceiver ((X) or (S)) that is selected for that display. Other transceivers are shown with (-).

Consequently the example shows that the user's display channel B (highlighted) is connected to transceiver B (X-band) as Master, display channel A is connected to transceiver A (S-band) as Slave, display channel C is connected to transceiver A as Master and display channel D is not fitted.

For Dual Channel systems you must connect the displays consecutively and the wire connection must be to the lower letter, i.e. C if C & D displays are used.

The amount of configuration that can be set from the menu will depend on the type of Interswitch fitted, and how it is connected and set-up. You may only be able to configure your own display. In all cases, the connections that CAN be configured are displayed in light blue. Automatic built-in safeguards will prevent you from making inappropriate selections. As a rule, make Master connections first, followed by any Slave connections.

Note – If the Interswitch is set to **Local** mode, the MASTER, SLAVE and SEND SETTINGS soft keys are not displayed in the Interswitch Configuration menu, and the menu is for information only. Changes can only be made when the Interswitch is set to **Global** mode, in which case the configuration for the whole system can be set from one display.

Making Display/Transceiver Connections

Within the Interswitch Configuration menu,

1. Left click on the MASTER or SLAVE soft key as appropriate (Bottom right hand side of menu).
2. Position the cursor over the box that links the required Display (row) to the required Transceiver (column).
3. Left click to update the box. (If necessary, previously entered connections will be updated automatically in line with the general points raised below.)
4. Repeat steps 1 to 3 as necessary to make all required changes.
5. When configuration is complete left click on SEND SETTINGS soft key and then, right click to close the menu.

Note – A right click without using the SEND SETTINGS soft key, will exit the Interface Configuration menu without any changes being made.

The procedure on the previous page is subject to the following general points.

- Connections that CANNOT be made or changed are displayed in dark blue.
- Connections that CAN be made or changed are displayed in light blue, and are highlighted in yellow when the cursor is placed over them.
- A single channel display can only be connected to one transceiver. A dual channel display can be connected to one or two transceivers.
- One (but ONLY one) of the displays connected to a transceiver MUST be a MASTER, unless the transceiver is set as a SLAVE only (see Section 5.1.9).

5.1.9 Slave Only Transceiver

The Slave only line at the bottom of the Transceiver Settings Display will appear if either a 65842 or 65846 Interswitch is fitted or the system is a dual channel radar.

The default setting is NO, but can be toggled to YES. This should only be set to YES when that particular transceiver will always be a slave, as a separate system is driving the transceiver as a master. Because this is applied globally, it only needs to be set from one display for the complete system.

In an interswitched system this data is sent to and stored in the Interswitch, but will only be effective if the Interswitch is set to Global mode, otherwise a Not available prompt will be displayed.

For a non-interswitched Dual Channel Radar, if SLAVE ONLY is set to YES, the setting for TX A determines that transceiver A and channel 1 together will be set to SLAVE ONLY; and the setting for TX B determines that transceiver B and channel 2 together will be set to SLAVE ONLY.

If NO is set then that channel and transceiver will always be a master. This data is stored inside the display.

6 Reset Defaults

The system can be restored to the SYSTEM DEFAULTS using the RESET DEFAULTS soft key located in the bottom right hand corner of the display. This facility required the input of the Manufacturer's password, see Section 2.1 earlier in the chapter for further information.

1. Left click on the RESET DEFAULTS soft key.
2. This will reveal a drop down alphanumeric keypad for the input of the Manufacturer's password.
3. Use the keypad to enter the password.
4. On input of a correct password, the dialog box shown right is revealed.
5. Within the dialog box, left click on the ACCEPT caption.
6. This will again reveal the alphanumeric keypad for input of the Manufacturer's password.
7. Use the keypad to re-enter the password.

A left click on the CANCEL caption within the dialog box will close the dialog box and exit the reset facility without further action. The double entry of Manufacturer's password is used to confirm a positive and deliberate action to restore the system defaults. All user data is reset apart from the 'Hours Run' and 'Hours in Transmit' counters.

7 Restarting

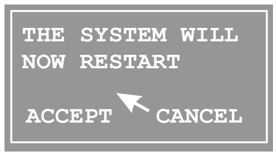
Whenever changes are made, the system must be re-started to invoke the new settings.

After all changes entered during the INITIALISATION process have been made, the system must be re-started as follows.

1. Left click on the SAVE CHANGES AND RESTART soft key located in the top left hand corner of the display.

This will reveal the dialog box shown on the right.

2. Within the dialog box, left click on ACCEPT. This will cause the system to restart with the new settings, and reinstate password protection. The system will restart in **STANDBY** mode.



Note – A left click on the CANCEL caption will close the dialog box without further action

8 Initialisation in Transmit Mode

Some operational parameters require the radar picture to ensure that they are set correctly. These include some of the transceiver settings and the video settings. Setting up the performance monitor also requires the radar picture. All of the parameters that required setting up with the radar picture are accessed from the SYSTEM menu.

These parameters will not normally need to be altered once set and therefore require the manufacturer's password to be entered before they can be changed, although the current settings can be viewed without entering a password.

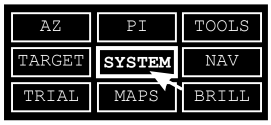
8.1 Selecting Transmit Mode

On all but dual channel radars the TRANSMIT soft key is located in the bottom left hand corner. On dual channel displays the key is also a tell back and shows STANDBY for each channel in the top left hand corner of the display.

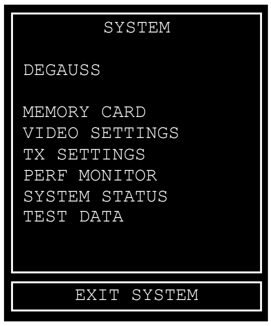
Select TRANSMIT mode by left clicking on the STANDBY/TRANSMIT soft key.

Note – A slave display can only be switched to TRANSMIT if its associated master display is in Transmit mode. In dual channel radars, both channels may be selected to transmit during the initialisation process.

8.2 Accessing the SYSTEM Menu



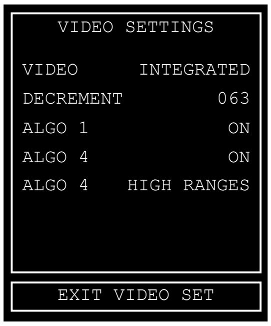
1. Position the screen cursor over the SYSTEM soft key.
2. Left click to reveal the SYSTEM menu shown on the right.



Note – A left click on the EXIT SYSTEM soft key will close the menu and exit system settings.

8.3 Accessing the VIDEO SETTINGS Menu

The video settings menu is mainly for information only. However, all parameters except decrement may be manually altered in exceptional circumstances. The menu pictured shows the normal/default settings for the parameters of a single channel radar, when the range is set to 3nm or above.



1. Position the screen cursor over the VIDEO SETTINGS option in the SYSTEM menu.
2. Left click to reveal the VIDEO SETTINGS menu shown on the right.

Note – A left click on the EXIT VIDEO SET soft key will close the menu and exit video settings. In dual channel displays, the menu heading shows the channel number to which the menu relates, i.e. VIDEO SETTINGS 1 or VIDEO SETTINGS 2. A left click on this line will toggle the channel number.

8.4 Adjusting the TX Settings

A group of settings must be stored in each radar display for all the transceivers with which the display can operate (up to a maximum of 6).

8.4.1 Selecting the Required Transceiver

This is only available on Interswitched Systems.

Depending on the type of Interswitch Unit fitted, settings can be entered for up to six transceivers which are identified by letter in the range from A to F.

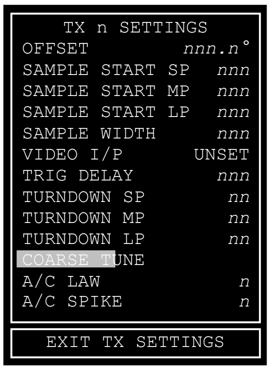
1. From the TRANSMIT mode display, position the screen cursor over the TX n (n) soft key at the top left hand side of the screen.
2. Left click to reveal a drop down menu containing the current transceiver/display configuration from which the required transceiver can be selected.
3. From within the drop down menu, select the required transceiver. Select Transceiver 'A' as a Master initially. See User Guide, Chapter 3.

Note – The settings for a given transceiver must be the same on all displays in the system.

8.4.2 Accessing the TX n SETTINGS Menu

1. Position the Screen cursor over the TX SETTINGS option in the SYSTEM menu.
2. Left click to reveal the TX n SETTINGS menu shown on the right. The letter **n** in the menu heading indicates the transceiver currently selected, **SP** is for Short Pulse, **MP** for Medium Pulse and **LP** for Long Pulse.

Note – A left click on the EXIT TX SETTINGS soft key will close the menu and exit TX settings. For a dual channel radar there will be two TX SETTING menus, one for each channel and its associated transceiver. This menu can be toggled by left clicking on the TX n SETTING caption. However, with the exception of the video input (see 8.4.5) there is only one set of settings per transceiver. The video input shows as VIDEO I/P 1 or VIDEO I/P 2 as selected by the TX n SETTING.



Manufacturer's Password

Data in the TX n SETTINGS menu can only be changed after the manufacturer's password has been entered. Any attempt to change the data will reveal an alphanumeric keypad prompting the input of the manufacturer's password, see sub-section 2.1 earlier in the chapter.

8.4.3 Setting the TX Parameters

The procedure for adjusting all of the parameters in the TX SETTINGS menu, except the VIDEO I/P and COARSE TUNE settings, is as follows.

1. Within the TX SETTINGS menu, position the screen cursor over the setting to be changed.
2. Left click to access.
3. Move the cursor control left or right to change the setting to that required.
4. Left click to select.

Alternatively, a right click will reveal a drop down numeric keypad from which a setting can be entered.

Information on the individual parameters of the Tx n Settings menu is given below.

OFFSET (Range 0.0° to 359.9°, default 0.0°)

Standard Setting (Not Static Site)

This is the value of the Heading/Stern Line Offset, and is the angular amount required to align the heading/stern marker with the fore/aft line and hence compass of the ship. This adjustment is present to allow compensation for the combined errors in physical positioning of the scanner unit and the 'squint angle' of the antenna. When a Stern Line is selected in place of a Heading Line (see Section 5.1.1 earlier in the chapter), 180° must be added to the offset value. The nominal offset value required for BridgeMaster E scanning units is 350° (170° for Stern Line).

Static Site Setting

This offset is the angular value required to align the heading marker with the 'straight ahead' view from the static site window. The adjustment should be made with the compass angle set to 000° and the display in N UP mode. The compass angle should then be adjusted to give north-up view. This allows the normal window view to be shown in C UP mode.

Note – When checking alignment, allowance should be made for the position of the scanner unit in relation to the radar display.

SAMPLE START SP, MP, LP (Range 6 to 350, defaults 48, 90, 250 respectively)

Values from the following table should be input, according to the height of the antenna above sea level.

Antenna Height (metres)	Sample Start		
	Short Pulse (SP)	Medium Pulse (MP)	Long Pulse (LP)
0 - 10	48	90	250
11 - 20	75	150	250
21 - 30	100	150	250
31 - 40	130	180	250
41 - 50	160	200	260
51 - 60	180	200	280

SAMPLE WIDTH (Range 6 to 70, default 14)

It should not normally be necessary to change this setting from its default value.

TURNDOWN SP, MP, LP (Range 0 to 15, default 6 for SP, 7 for MP, 8 for LP)

It should not normally be necessary to change these settings from their default values.

Note – Older processor units (manufactured before 2000) used values of 14 for SP, 11 for MP and 8 for LP.

COARSE TUNING

The current level of coarse tuning is indicated by the shaded bar behind the COARSE TUNE caption in the TX n SETTINGS menu. This bar indicates the level in percentage terms with 0% on the left, 100% on the right. It will only be possible to set the tuning if the Display is a MASTER to the transceiver.

1. ENSURE that the fine tuning indicator in the bottom left hand corner of the transmit display is set for MAN (Manual) tuning (i.e. AFC off) for that transceiver.
2. Position the screen cursor over the COARSE TUNE caption in the TX n SETTINGS menu.
3. Left click to make the bar active. The bar will appear yellow.
4. Move the cursor control left to reduce the yellow bar to a minimum. Slowly increase the bar by moving the cursor to the right.
5. If radar returns are available, adjust the bar to maximise the display of the radar returns.
6. If no radar returns are available, adjust the coarse tuning bar so that the fine tuning bar (bottom left hand corner of screen) is at maximum after its first minimum point has been reached.
7. On a dual channel radar there are two bars, the top relates to channel 1 and the bottom to channel 2.
8. Left click to set the level and de-activate the bar. The bar will return to its dimmed shaded state.
9. If radar returns are available, select AFC, and confirm that the radar returns are not seriously degraded. If they are, repeat Step 4, and ensure that the first tuning maximum is selected.

A/C LAW (Range 0 to 7, default 3)

Use the table below for the required setting for the Anti-Clutter Law.

Antenna Height above sea level (m)	A/C LAW Setting
32 and above	7
28 – 31	6
24 – 27	5
20 – 23	4
16 – 19	3
12 – 15	2
4 – 11	1
3 and below	0

A/C SPIKE (Range 0 to 3, default 3)

It should not normally be necessary to change this setting from its default value.

VIDEO I/P (Defaults to UNSET)

This menu item indicates whether the radar video input level to the display processor has been set up. It is advisable to set the Coarse Tune level before setting the Video I/P level. The VIDEO INPUT level should ONLY be set when the Master is transmitting in LONG PULSE. The default is UNSET, but after the set up procedure has been initiated, it will show SET OK, SET LOW or SET HIGH as appropriate.

1. Within the TX SETTINGS menu, position the screen cursor over the VIDEO I/P option.
2. Left click to initiate the set up procedure.
3. The result of the set up procedure, which can be SET OK, SET LOW or SET HIGH, is shown after a period.
4. After the result of the Video I/P setting is shown in the menu, left click on the EXIT TX SETTINGS soft key to close the menu.

TRIG DELAY (Range 6 to 350, default 12)

Note – Default is adjusted by RF feeder length in initialisation if Bulkhead Tx is fitted.

For this setting, the radar must be set to the shortest practicable range, and the value adjusted to display known features at the correct range. Echoes from quaysides should appear straight with no 'pushing' or 'pulling' near the centre of the picture.

8.4.4 Selecting and Setting the other Transceivers in Interswitched Systems

1. Use the procedure given at Section 8.4.1 to select the next transceiver.
2. Use the procedures given at Sections 8.4.2 and 8.4.3 to set the TX parameters for the selected transceiver.
3. Repeat steps 1 and 2 until all system transceivers have been set up.

8.4.5 Dual Channel Display Settings

For non interswitched dual channel radars:

1. Position the screen cursor over the TX A SETTING caption in the menu.
2. Left click to reveal the TX B SETTING menu.
3. Use the procedure given in Section 8.4.3 to set the TX parameters for TX B.

For interswitched dual channel radars, in addition to the parameters set up already, the VIDEO I/P settings must be carried out for each transceiver on each channel individually.

1. In the top left hand corner, set both channels to the same transceiver (one Master, one Slave), TX n using the Interswitch configuration menu. Refer to the User Guide, Chapter 3 if necessary.
2. Select the TX SETTINGS menu from the SYSTEM menu.
3. If UNSET appears on the VIDEO I/P 1 line, adjust the video input level, as shown in Section 8.4.3.
4. Left click on the TX n SETTINGS menu heading.
5. If UNSET appears on the VIDEO I/P 2 line, adjust the video input level as shown in Section 8.4.3.
6. Repeat steps 1 to 5 until the Video I/P has been set for all transceivers.

8.5 Selecting the Performance Monitoring Facility

1. If an Interswitch unit is fitted, select the required transceiver that is fitted with the Performance Monitor you wish to set up (see Section 8.4). Ensure that coarse tuning has been carried out. (See Section 8.4.3).
2. With reference to the User Guide, select the following operating parameters:
   - Transmit Mode
   - 12nm range scale, LP
   - AFC ON (Fine tuning)
   - Manual clutter processing with A/C Rain and A/C Sea set to minimum.
3. Left click on the SYSTEM soft key to reveal the SYSTEM menu.
4. Select the PERF MONITOR option from the SYSTEM menu.
5. Enter the Manufacturer's Password.

   After the password has been entered the PERF MONITOR menu will be revealed, see example right.
6. On a dual channel display, it will be possible to left click on the TX n PERF MONITOR line in the menu to select the other transceivers performance monitor.

```
TX n PERF MONITOR

TUNE
XR
XT

MODE SYSTEM

EXIT PERF MONITOR
```

Warning Prompt

If sector blanking is active, the warning prompt shown below is displayed continually while the Performance Monitor drop down menu is displayed.

```
Sector blanking inhibited
```

8.5.1 Selecting the Required Performance Monitor

1. Position the screen cursor over the MODE caption in the menu.
2. Left click to toggle to MODE SYSTEM or MODE RX as required. Set to MODE RX initially.

Note – While the PM drop down menu is being displayed and the PM has been set up, four arcs are shown on the radar screen. These arcs are approximately 0.3nm apart and start at a range of 8nm. The arcs extend from 290° to 320° (S Band), or from 155° to 185° (X Band), with respect to the heading line. The precise bearing value will alter depending on the Heading/Stern line offset value.

The shaded bars above the MODE SYSTEM or MODE RX caption in the PM menu indicate the PM tuning point and attenuator levels. The particular mode selected (SYSTEM or RX) will determine which of the shaded bars (TUNE, XR and XT) can be activated.

8.5.2 Adjusting the Performance Monitor

1. Left click on the XT caption to make the shaded bar active. The bar will appear yellow.
2. Use the cursor control (Joystick or Trackerball) to reduce the bar to zero.
3. Left click to de-activate the bar.
4. Left click on the TUNE caption to make the shaded bar active. The bar will appear yellow.
5. Use the cursor control to give maximum presentation of the four Performance Monitor arcs that should be visible in the video circle sector from 290° to 320° (S Band) or from 155° to 185° (X Band). See note below.
6. Left click to de-activate the bar. The bar will be returned to its dimmed shaded state.

Note – In both modes of operation (SYSTEM and RX), the performance monitor shows a maximum of four arcs on the display. The TUNE level should be adjusted for maximum visibility of the four arcs. The arcs are spaced at 5dB intervals. If during operation performance decreases below the second arc, it shows a 10dB drop in performance.

7. Left click on the XT caption to make the shaded bar active. The bar will appear yellow.
8. Use the cursor control to adjust the bar so that the outermost arc is just visible.
9. Left click to de-activate the bar. The bar will be returned to its dimmed shaded state.
10. Repeat steps 4 to 9 inclusive until no further adjustment is required.
11. Left click on the MODE line of the menu to select MODE SYSTEM.
12. Left click on the XR caption to make the shaded bar active. The bar will appear yellow.
13. Use the cursor control to reduce the bar to zero.
14. Left click to de-activate the bar.
15. Left click on the TUNE caption to make the shaded bar active. The bar will appear yellow.
16. Use the cursor control to give maximum presentation of the four Performance Monitor arcs that should be visible in the video circle sector from 290° to 320° (S Band), or form 155° to 185° (X Band).
17. Left click to de-activate the bar. The bar will be returned to its dimmed shaded state.
18. Left click on the XR caption to activate the shaded bar. The bar will appear yellow.
19. Use the cursor control to adjust the bar so that the outermost arc is just visible.

20. Left click to de-activate the bar. The bar will be returned to its dimmed shaded state.
21. Repeat steps 15 to 20 inclusive until no further adjustment is required.
22. Left click on the EXIT PERF MONITOR soft key (below the PM menu) to complete the adjustment procedure and close the menu.
23. Left click on EXIT SYSTEM to return to normal transmit mode.

8.6 Operating the Performance Monitor

When viewing the Performance Monitor as described in the User Guide (Chapter 3), the bar indicating the tuning level must be adjusted for maximum presentation of the four arcs to correctly ascertain performance. No password is required for this operation.

Note – If for a period of 10 seconds, neither key (left or right) is pressed nor the screen cursor is moved, then the PM drop down menu is removed from display automatically.

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SYSTEM CONFIGURATION		INSTALLATION REFERENCE No		
REF	**PARAMETER**		**OPTIONS/COMMENTS**	**SETTING**
3.2.1	STATIC SITE		YES	
			NO	
3.2.2	INTERSWITCH		NOT FITTED	
			65842 2 –WAY	
			65846 6 – WAY	
			65642 2 – WAY	
			65416 2 – WAY	
3.2.3	DISPLAY MODE (If single channel without INTERSWITCH)		MASTER	
			SLAVE	
3.2.4	LANGUAGE		ENGLISH	
			JAPANESE	
3.2.5	DISTANCE UNITS		NM (Nautical Miles)	
			KM (Kilometres)	
			SM (Statute Mile)	
3.2.6	REMOTE ALARMS (Tick individual alarms to indicate a YES selection)			
	CONTROL PANEL		MVR TIME	
	PROCESSOR		TRACKS FULL	
	DISPLAY RESET		GUARD LINE	
	RADAR RESET		ZONES FULL	
	GRAPHICS RESET		AZ OVERLOAD	
	MEMORY		GZ ENTRY	
	RADAR CONFIG		AZ ENTRY	
	RADAR LINK		LOST TARGET	
	STBY/TX ERR		ROUTE ERROR	
	AZI ERROR		APPROACH	
	TX COMMS		OFF TRACK	
	INTERSWITCH		LEG CHANGE	
	LOW VIDEO		WATCH ALARM	
	COMPASS		MOTION MODE	
	MISSING HL		CHECKSUM	
	MISSING SL		AIS INTEGRITY	
	NO SCAN HL		AIS INPUT	
	TX BIST		DEPTH INPUT	
	VISION		WIND INPUT	
	TRIG ERROR		ALARM INPUT	
	LOG ERROR		VMS GRAPHIC	
	LOST REF		PLOT UPDATE	
	BOW CROSS		GPS QUALITY	
	CPA/TCPA		AUTO TIDE	
	NAV INPUT		TEMPERATURE	
	NAV SPEED		CARD BATTERY	
	POSITION		PC CARD	
	PL ERROR		EXTERNAL MAP	
	TM RESET		CARD FULL	
3.2.7	SHIP LENGTH	(Not Static Site)	In METRES	
3.2.8	SHIP BEAM	(Not Static Site)	In METRES	
3.2.9	MAX RATE OF TURN	(Not Static Site)	In DEGREES/MINUTE	
3.2.10	STANDARD RATE OF TURN	(Not Static Site)	In DEGREES/MINUTE	
3.2.11	NAV SENSOR OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	
			PORT or STBD (EAST or WEST)	
			In METRES	
3.2.12	VIGILANCE ALARM (ONLY available if Interface Unit fitted or dual channel)		YES	
			NO	

Complete this Sheet for Serial Port No 1

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**1**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	INPUT DEVICE (4800 BAUD)	NO INPUT	
		COMPASS	
		LOG	
		NAV SENSOR (input only)	
		DEPTH	
		WIND	
		TARGET RENAME	
		TARGET RENAME (VMS Source)	
		NAV LINES INTERFACE	
		ALARM ACKNOWLEDGE	
		ROUTE & WPT TRANSFER	
		(Other)	
4.1.1	INPUT MESSAGE HEADERS		
4.1.1	OUTPUT DEVICE	NO OUTPUT	
		ALARMS STATUS	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	

Complete this Sheet for Serial Port No 2

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**2**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	INPUT DEVICE (4800 BAUD)	NO INPUT	
		COMPASS	
		LOG	
		NAV SENSOR (input only)	
		DEPTH	
		WIND	
		TARGET RENAME	
		TARGET RENAME (VMS Source)	
		NAV LINES INTERFACE	
		ALARM ACKNOWLEDGE	
		ROUTE & WPT TRANSFER	
		(Other)	
4.1.1	INPUT MESSAGE HEADERS		
4.1.1	OUTPUT DEVICE	NO OUTPUT	
		ALARMS STATUS	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	

Complete this Sheet for Serial Port No 3
(For Dual Channel Radar or if an interface unit is fitted)

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**3**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	BAUD RATE	4800	
		38k4	
		(Other)	
4.1.1	INPUT DEVICE	NO INPUT	
		COMPASS	
		LOG	
		NAV SENSOR (input only)	
		DEPTH	
		WIND	
		TARGET RENAME	
		TARGET RENAME (VMS Source)	
		NAV LINES INTERFACE	
		ALARM ACKNOWLEDGE	
		AIS INPUT	
		ROUTE & WPT TRANSFER	
		(Other)	
4.1.1	INPUT MESSAGE HEADERS		
4.1.1	OUTPUT DEVICE	NO OUTPUT	
		ALARMS STATUS	
		AIS OUTPUT	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	

Complete this Sheet for Serial Port No 4
(For Dual Channel Radar or if an Interface Unit is fitted)

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**4**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	BAUD RATE	4800	
		38k4	
		(Other)	
4.1.1	INPUT DEVICE	NO INPUT	
		COMPASS	
		LOG	
		NAV SENSOR (input only)	
		DEPTH	
		WIND	
		TARGET RENAME	
		TARGET RENAME (VMS Source)	
		NAV LINES INTERFACE	
		ALARM ACKNOWLEDGE	
		AIS INPUT	
		ROUTE & WPT TRANSFER	
		(Other)	
4.1.1	INPUT MESSAGE HEADERS		
4.1.1	OUTPUT DEVICE	NO OUTPUT	
		ALARMS STATUS	
		AIS OUTPUT	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	

Complete this Sheet for Serial Port No 5
(For Dual Channel Radar or if an Interface Unit is fitted)

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**5**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	BAUD RATE	4800	
		38k4	
		(Other)	
4.1.1	INPUT DEVICE	NO INPUT	
		COMPASS	
		LOG	
		NAV SENSOR (input only)	
		DEPTH	
		WIND	
		TARGET RENAME	
		TARGET RENAME (VMS Source)	
		NAV LINES INTERFACE	
		ALARM ACKNOWLEDGE	
		AIS INPUT	
		ROUTE & WPT TRANSFER	
		(Other)	
4.1.1	INPUT MESSAGE HEADERS		
4.1.1	OUTPUT DEVICE	NO OUTPUT	
		ALARMS STATUS	
		AIS OUTPUT	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	
		(RS) 485	

Complete this Sheet for the RADAR Port

The RADAR port has NO Input Device and therefore NO Input Message Header.

I/O OPTIONS		INSTALLATION REFERENCE No	
SERIAL PORT		SERIAL PORT No	**RADAR**
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
4.1.1	OUTPUT DEVICE (4800 BAUD)	NO OUTPUT	
		TRACK TABLE	
4.1.1	REFERENCE:	Turning Unit	
		Centre	
4.1.1	TARGETS:	Tracked targets only	
		AIS & Tracked targets only	
4.1.1	OUTPUT TYPE	(RS) 422	
		(RS) 232	

<table>
<tr><td colspan="3">I/O OPTIONS INSTALLATION REFERENCE No</td><td colspan="2"></td></tr>
<tr><th>REF</th><th>PARAMETER</th><th colspan="2">OPTIONS/COMMENTS</th><th>SETTING</th></tr>
<tr><td></td><td colspan="4">Analogue Inputs are NOT applicable to Static Sites</td></tr>
<tr><td rowspan="14">4.1.2</td><td colspan="4">ANALOGUE I/P (COMPASS)</td></tr>
<tr><td rowspan="3">COMPASS FITTED</td><td colspan="2">STANDARD</td><td></td></tr>
<tr><td colspan="2">SPECIAL</td><td></td></tr>
<tr><td colspan="2">NONE</td><td></td></tr>
<tr><td rowspan="4">COMPASS TYPE</td><td rowspan="3">If STANDARD compass board fitted</td><td>M STEPPER</td><td></td></tr>
<tr><td>S STEPPER</td><td></td></tr>
<tr><td>SYNCHRO</td><td></td></tr>
<tr><td>If NO compass board fitted</td><td>NONE</td><td></td></tr>
<tr><td rowspan="4">COMPASS RATIO/PULSES</td><td rowspan="4">If SPECIAL compass board fitted</td><td>180:1</td><td></td></tr>
<tr><td>90:1</td><td></td></tr>
<tr><td>36:1</td><td></td></tr>
<tr><td>1:1</td><td></td></tr>
<tr><td colspan="4" style="display:none"></td></tr>
<tr><td colspan="4" style="display:none"></td></tr>
<tr><td rowspan="6">4.1.3</td><td colspan="4">ANALOGUE I/P (LOG)</td></tr>
<tr><td rowspan="2">LOG FITTED</td><td colspan="2">YES</td><td></td></tr>
<tr><td colspan="2">NO</td><td></td></tr>
<tr><td rowspan="2">LOG TYPE</td><td colspan="2">NEG PULSES</td><td></td></tr>
<tr><td colspan="2">POS PULSES</td><td></td></tr>
<tr><td>LOG RATIO/PULSES</td><td colspan="2">PPNM</td><td></td></tr>
</table>

The number of Transceivers in a system is dependent on the type of Interswitch fitted.

Complete for Transceiver ‘A’.

TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	**A**
REF	**PARAMETER**	**OPTIONS/COMMENTS**		**SETTING**
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

Complete for Transceiver ‘B’.

TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	**B**
REF	**PARAMETER**	**OPTIONS/COMMENTS**		**SETTING**
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

Complete for Transceiver 'C'.

TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	**C**
REF	**PARAMETER**	**OPTIONS/COMMENTS**		**SETTING**
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

Complete for Transceiver 'D'.

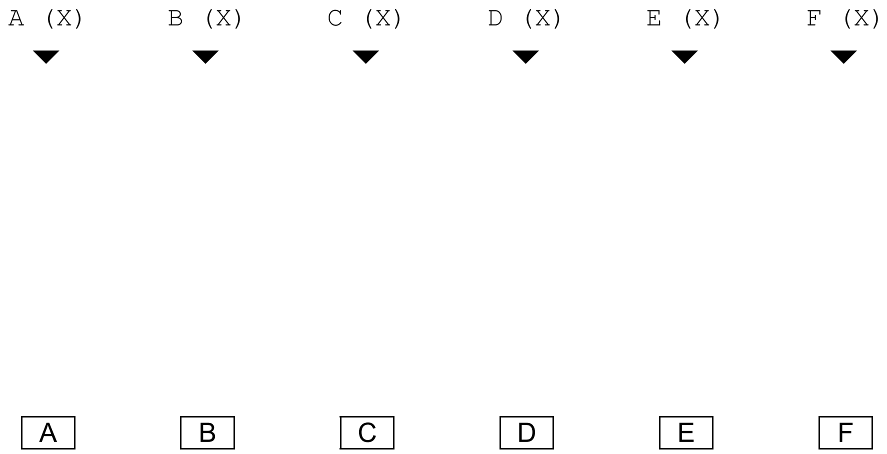
TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	**D**
REF	**PARAMETER**	**OPTIONS/COMMENTS**		**SETTING**
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

Complete for Transceiver 'E'.

TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	E
REF	PARAMETER	OPTIONS/COMMENTS		SETTING
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

Complete for Transceiver 'F'.

TRANSCEIVER SETTINGS		INSTALLATION REFERENCE No		
TRANSCEIVER			TRANSCEIVER ID	F
REF	PARAMETER	OPTIONS/COMMENTS		SETTING
5.1.1	DISPLAY MARKER		SL (Stern Line)	
			HL (Heading Line)	
5.1.2	TU (Turning Unit) OFFSETS (w.r.t. centre ship)		FORE or AFT (NORTH or SOUTH)	
			In METRES	m
			PORT or STBD (EAST or WEST)	
			In METRES	m
5.1.3	TXRX LOCATION		ALOFT	
			BULKHEAD	
5.1.4	RF FEEDER LENGTH	For Bulkhead Units ONLY.	In METRES	m
5.1.5	VIDEO CABLE LENGTH		In Metres	m
5.1.6	ANTENNA BEAMWIDTH		In Degrees	°
5.1.7	SECTOR BLANKING	SECTOR 1	START	°
			END	°
		SECTOR 2	START	°
			END	°
5.1.9	SLAVE ONLY		YES/NO	

TRANSCEIVER SETTINGS	INSTALLATION REFERENCE No	
REF	**PARAMETER**	
5.1.8	INTERSWITCH CONNECTIONS Indicate the Display/Transceiver links by drawing lines between appropriate displays (lettered boxes) and transceivers (lettered triangles). Use solid lines to indicate master connections and dotted lines to indicate slave connections. Circle the User's Display.  ***NOTE*** *– The number of Displays and Transceivers is dependent on the type of Interswitch fitted. The figure above allows for the maximum arrangement.*	

Initialisation settings in TRANSMIT MODE

TRANSMIT MODE	INSTALLATION REFERENCE No		
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.3	VIDEO SETTINGS (Range scale MUST be set to 3nm or above)	VIDEO	
		ALGO 1	
		ALGO 4 (ON/OFF)	
		ALGO 4 (HIGH RANGES/ALL RANGES)	

The number of Transceivers in a system is dependent on the type of Interswitch fitted.

Complete for Transceiver ‘A’.

TRANSMIT MODE	INSTALLATION REFERENCE No		
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**A**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Complete for Transceiver ‘B’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**B**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Complete for Transceiver ‘C’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**C**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Complete for Transceiver ‘D’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**D**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Complete for Transceiver ‘E’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**E**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Complete for Transceiver ‘F’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.4.1	TRANSCEIVER Selected	(TX)	**F**
8.4.2	TX SETTINGS Menu Selected	(From SYSTEM Menu)	
8.4.3	OFFSET	0.0° to 359.9° (Default 0.0°)	
	SAMPLE START SP	6 to 250 (Default 48)	
	SAMPLE START MP	6 to 350 (Default 90)	
	SAMPLE START LP	6 to 350 (Default 250)	
	SAMPLE WIDTH	6 to 70 (Default 14)	
	VIDEO INPUT (1) (Channel 1 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	
	TRIGGER DELAY	6 to 350 (Default 12)	
	TURNDOWN SP	0 to 15 (Default 6)	
	TURNDOWN MP	0 to 15 (Default 7)	
	TURNDOWN LP	0 to 15 (Default 8)	
	COARSE TUNING completed	(COARSE TUNE)	
	A/C LAW	0 to 7 (Default 3)	
	A/C SPIKE	0 to 3 (Default 3)	
8.4.5	VIDEO INPUT (2) (Only applicable to channel 2 on a dual channel radar)	SET OK	
		SET LOW	
		SET HIGH	

Setting up the Performance Monitor (Where applicable)

Complete for Transceiver ‘A’.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER ‘A’ Selected	(TX)	**A**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

Complete for Transceiver 'B'.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER 'A' Selected	(TX)	**B**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

Complete for Transceiver 'C'.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER 'A' Selected	(TX)	**C**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

Complete for Transceiver 'D'.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER 'A' Selected	(TX)	**D**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

Complete for Transceiver 'E'.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER 'A' Selected	(TX)	**E**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

Complete for Transceiver 'F'.

TRANSMIT MODE		INSTALLATION REFERENCE No	
REF	**PARAMETER**	**OPTIONS/COMMENTS**	**SETTING**
8.5	TRANSCEIVER 'A' Selected	(TX)	**F**
	COARSE TUNING carried out	(Sub-section 8.4.3)	
	PERF MONITOR FACILITY selected	(From SYSTEM menu)	
8.5.1	MODE RX Selected		
8.5.2	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XT Adjusted		
	MODE SYSTEM Selected		
	PERFORMANCE MONITOR TUNE Adjusted		
	PERFORMANCE MONITOR XR Adjusted		

COMMENTS		
Use this space to comment on any anomalies arising during the commissioning. Use the next sheet if necessary.		
COMMISSIONING ENGINEER		
Printed Name:	Signature:	Date:

COMMENTS (continued)
Use this space to comment on any anomalies arising during the commissioning. Use a continuation sheet if necessary.

COMMISSIONING ENGINEER		
Printed Name:	Signature:	Date:

CHAPTER 5

OPERATOR TESTS

Contents

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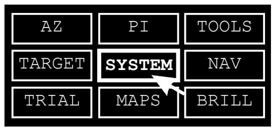
1 Introduction

A series of Test Menus let you monitor certain operating parameters of the radar while the system is operating. The results of the selected transceiver’s Built-in Self Tests (BIST) can also be viewed. This lets you check parameters affecting the operation of the system, and any fault arising to be defined as external or internal.

You can also select three test patterns to check the video operation of the monitor. You access these patterns using the MONITOR TEST mode.

2 Test Menus

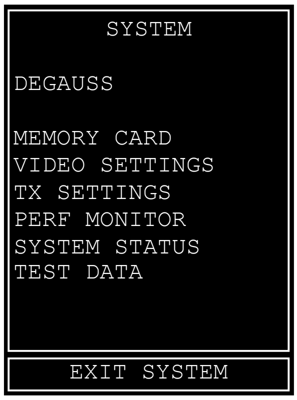


You access the TEST MENU facilities from the SYSTEM menu.

Accessing the SYSTEM Menu

1. Position the screen cursor over the SYSTEM soft key.
2. Left click to reveal the SYSTEM menu shown on the right.

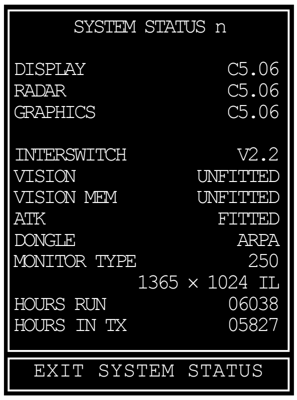
Note – A left click on the EXIT SYSTEM soft key will close the menu and exit the system facilities.



2.1 System Status

1. Position the screen cursor over the SYSTEM STATUS option in the SYSTEM menu.
2. Left click to reveal the SYSTEM STATUS menu shown on the right.
3. In dual channel radars the channel number (that the radar processor information relates to) is shown on the top line of the menu. Left click on this line to toggle between the channels

Note – A left click on the EXIT SYSTEM STATUS soft key will close the menu and exit the system status facility.



Status Display

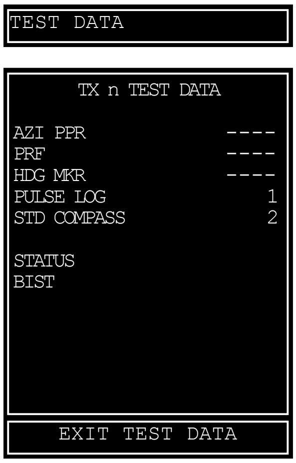
The SYSTEM STATUS menu gives an indication of prevailing conditions, as listed below, which are for information only.

- The software version for the Display Processor
- The software version for the Radar Processor
- The software version for the Graphics Processor
- The software version for the Interswitch (if fitted)
- Whether Vision is fitted on Radar Processor board
- Whether extra Vision memory is fitted on Radar Processor board
- Whether Autotrack is fitted on Radar Processor board
- Type of dongle fitted (eg: ARPA)
- Monitor size and line rate (IL = interlaced)
- Hours run (Incremented by one for every full hour that the display is ON)
- Hours in Transmit (Incremented for every hour in Transmit mode)

2.2 Test Data

The test data facilities provide the means of monitoring system performance and displaying the results of Built-in Self Tests (BIST). BIST tests the selected transceiver's hardware.

Selecting the Test Data Menu



1. Position the screen cursor over the TEST DATA option in the SYSTEM menu.
2. Left click to reveal the TEST DATA menu shown on the right.
3. In dual channel radars, left click on the top line of the menu to select the required transceiver.

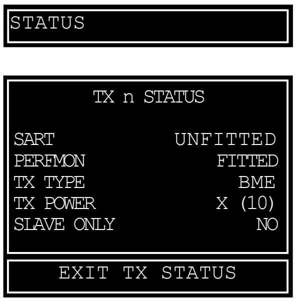
Note – A left click on the EXIT TEST DATA soft key will close the menu and exit the test data facility.

2.2.1 Input Status

The first half of the TEST DATA menu monitors the status of the following inputs:

- Azimuth pulses per revolution
- Pulse repetition frequency
- Heading contact
- Log pulses
- Analogue compass

2.2.2 Transceiver Status



1. Position the screen cursor over the STATUS option in the TEST DATA menu.
2. Left click to reveal the drop down menu shown on the right.
3. In dual channel radars, left click on the top line of the menu to select the required transceiver.

Note – A left click on the EXIT TX STATUS soft key will close the menu and exit the TX status facility.

The parameters monitored in the TX STATUS menu are as follows:

- Search and Rescue Transponder (SART) fitted or not fitted
- Performance Monitor (PERFMON) fitted or not fitted
- Transceiver Type: BridgeMaster E (BME), BridgeMaster (BM) or UNKNOWN
- Transmitter Power: X(10), X(25) or S(30)
- Slave only: YES or NO for Slave Transceiver only.

2.2.3 Results of the TX BIST

The TX BIST (Transceiver Built-in Self Test) results are shown for the selected transceiver.

1. Position the screen cursor over the BIST option in the TEST DATA menu.
2. Left click to reveal the TX BIST menu shown on the right.
3. In dual channel radars, left click on the top line of the menu to select the required transceiver.

Note – A left click on the EXIT TX BIST soft key will close the menu and exit the TX BIST facility.

BIST

TX n BIST	
MAGNETRON	n A
MODULATOR	nn V
+30V LINE	nn V
+12V LINE	nn V
SPARK GAP	PASS
CORRUPT DATA	PASS
MESSG TO TXRX	PASS
HDG MARKER	PASS
CHARGE TRIG	PASS
MODULATOR TRIG	PASS
S/W VERSION	nn.n

EXIT TX BIST

- The parameters monitored in the TX BIST menu are as follows:
- Magnetron Current. AMPS
- Modulator Voltage. VOLTS
- +30V supply line. VOLTS
- +12V supply line. VOLTS
- Spark Gap. PASS or FAIL
- Corrupt Data (Messages received by the transceiver are corrupt). PASS or FAIL
- Messg to TxRx (Messages not being received by TxRx): PASS or FAIL
- HDG Marker (Transceiver has detected a heading marker failure): PASS or FAIL
- Charge Trigger. PASS or FAIL
- Modulator Trigger: PASS or FAIL
- Software Version (Version of software fitted to transceiver or transceiver compatibility unit)

3 Monitor Test Mode

Monitors are supplied fully set-up. If the picture appears to be incorrect, then follow the procedures below.

Note – Make sure you use the specified video cables with these monitors – otherwise you may not get the correct picture presentation.

You can check correct picture presentation on the monitor screen by selecting the MONITOR TEST mode from the STANDBY display.

3.1 Accessing the Monitor Test Mode

From within the standby display, left click on the MONITOR TEST soft key (bottom left hand corner). You will be prompted for the input of the Manufacturer's or Navigator's password, see Chapter 4, Section 2.1.

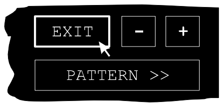
After you enter the password, the Test Pattern 1 display is revealed (one of three test patterns available) as shown in the following sections.

Follow the appropriate part of Section 4 below for an FPD monitor or Section 5 for a CRT monitor.

3.2 Return to Standby (Exit from the Monitor Test Mode)

From within the Monitor Test mode (Pattern 1 and Pattern 3 only).

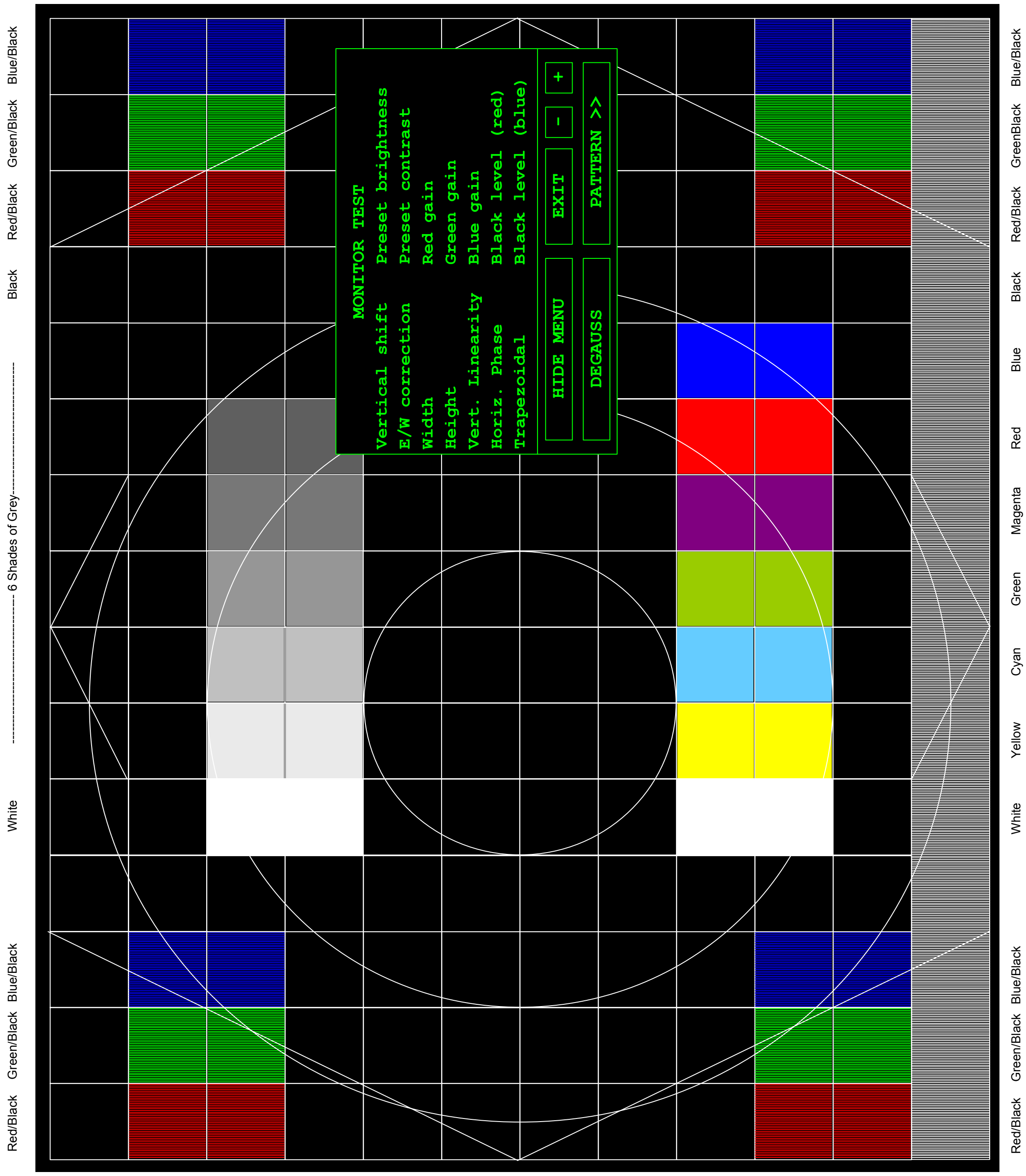
1. Position the screen cursor over the EXIT soft key.
2. Left click to exit from the Monitor Test mode and return to the STANDBY mode display.



4 Testing an FPD monitor

The test method depends on the model of FPD. Identify the model and use the appropriate section below.

Although there are three test patterns available, only Test Pattern 1 as shown below is necessary to check an FPD monitor. Also the only functions in the Monitor Test Menu that operate are HIDE MENU and PATTERN. For a full description of these functions refer to Section 5 Testing a CRT Monitor. The EXIT key is used to return to the STANDBY mode from the Monitor Test Mode.



Note – That the black and white stripes across the bottom of the pattern may not be visible on some monitors depending on the format. The outside border should show as a double white line when properly adjusted (except where noted).

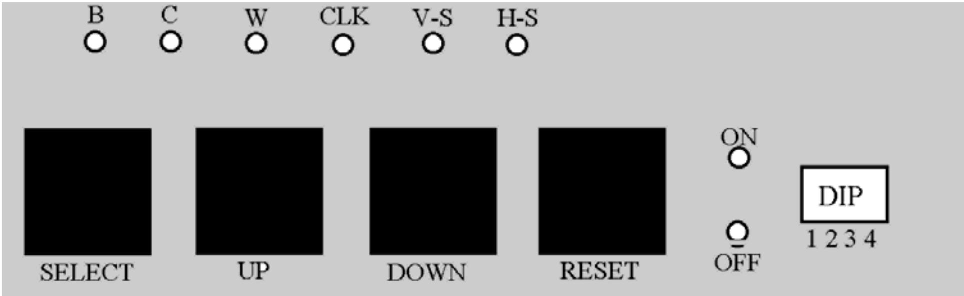
4.1 Testing Melford Kit Models

This section is for models 65815A & D and 65817A & D.

Remove the small cover held by two screws on the front of the monitor fascia to reveal the 'set-up' controls. Turn the Contrast and Brightness controls fully clockwise. Check that the 'ON' LED adjacent to the set-up controls is illuminated. Illumination of the 'OFF' LED indicates a lack of video input sync signals.

Test Pattern 1 should be fully visible, and completely fill the screen, when you have adjusted the set-up controls correctly.

The set-up controls on the flat panel display are shown below:



The LEDs marked 'B', 'C', 'W', 'CLK', 'V-S' and 'H-S', and the DIP switches are non-operational.

The set-up parameters are adjusted by means of on-screen menus.

The pushbuttons control the on-screen menus as indicated in the following table:

Button	Operation
SELECT	Chooses a Menu.
UP/DOWN	Changes value of Selected Parameter.
RESET	Used to return to previous menu.

Setting the parameters:

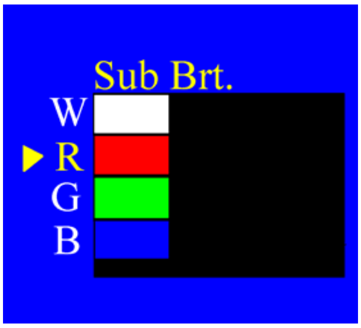
1. Push the 'Select' Button and the Main Menu appears.
2. Use the UP/DOWN buttons to scroll through each of the options. Use the 'Select' Button to enter the required option.
3. Use the 'Reset' Button to exit the chosen option and return to the Main Menu.

Note – Selection and adjustment is the same in all submenus. It is described fully in the Brightness Menu description below.

Brightness Menu:

Note – It should not be necessary to change this parameter from its factory default setting.

By selecting Brightness from the Main Menu and pressing 'Select', the Brightness menu appears.

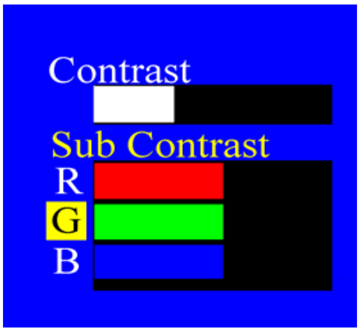


Use the UP/DOWN keys to select one of the parameters then use the 'Select' Button to highlight the option. The arrow is removed and the selected option is shown with black text in a yellow box. Use the UP/DOWN keys to adjust its value.

Reset each of the parameters to its default setting by selecting the required parameter and pressing 'Select' again. You are asked if you want to reset the parameter. Selecting YES will set it to default by using the UP/DOWN and the Select button. Selecting NO will set the parameter to the value set by the user.

The 'Reset' button de-selects the current parameter and the arrow reappears, as above, and allowing the next parameter to be selected. Pressing 'Reset' again will return to the Main Menu.

Contrast Menu

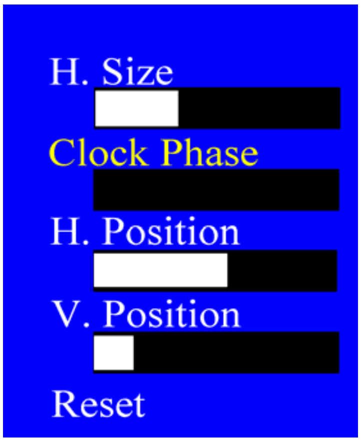


Note – It should not be necessary to change this parameter from its factory default setting.

This menu allows the user to control each individual RGB, as shown in the above figure and adjust its value. It can be reset back to its default condition as described in the Brightness Menu.

Position Menu

The position menu allows the user to adjust the Horizontal Size, Horizontal/Vertical Position and the Clock Phase.



Each of the parameters can be individually reset. If all parameters need to be reset then selecting Reset from the menu will list all the parameters to be reset. Use the UP/DOWN buttons to select YES and confirm with the 'Select' Button.

Note – Correct Clock Phase adjustment can only be achieved if the Horizontal Size is correctly set. After Clock Phase adjustment has been carried out, it may be necessary to re-adjust Horizontal Position to re-centre the image.

Information Menu

The information menu displays the current pixel size of the image along with Horizontal and Vertical frequencies.

All Reset

Selecting this option from the Main Menu allows the user to reset all parameters in all menus to their default values.

4.2 Testing Melford Desktop Models

This section is for models 65815C and 65817C.

Remove the bezel by undoing the four pozidriv screws. The bezel is attached to the chassis with an electrical earth bond wire. Do not allow the bezel to hang from the bond wire: either remove the bond wire or support the bezel.

Turn the brilliance control fully clockwise.

Test Pattern 1 should be fully visible, and completely fill the screen, when the set-up controls are correctly adjusted.

Note – 65815C monitors use CRT Test Pattern 1 and do not show the black and white striped pattern across the bottom of the screen and only show a single line border. 65817C monitors show a black and white striped pattern across the bottom of the screen and a double line border.

To the left of the brilliance control, there are four pushbuttons marked MENU, SELECT, MINUS and PLUS.

MENU is used to activate the On-Screen Display (OSD). Once the OSD is shown, the MENU pushbutton is used to enter and Exit a specific submenu.

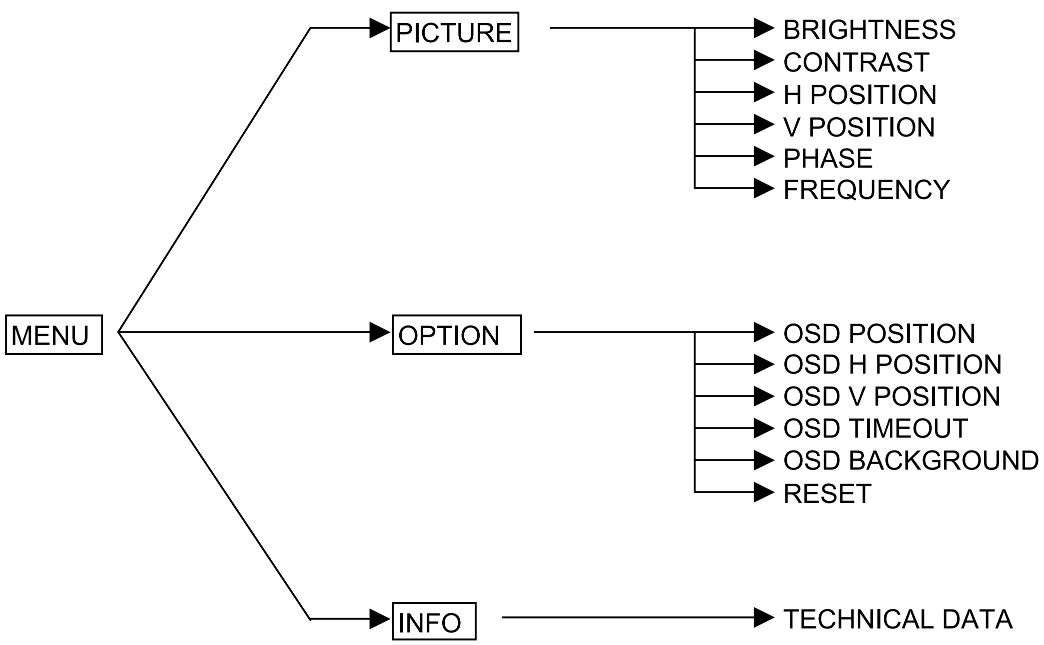
SELECT scrolls through top level and submenus.

MINUS & PLUS adjust the selected value.

The menu structure is illustrated below. To activate:

1. Press MENU.
2. Press SELECT to select the menu item (shown by the highlight).
3. Press MENU to open that submenu.
4. Use SELECT again to pick (highlight) the item required.
5. Use MINUS or PLUS to adjust the value (if applicable).

The menu screen will time-out after a default time of 60 seconds of inactivity.



The typical values are:

Parameter	Setting 65815C	Setting 65817C
Brightness	17	18
Contrast	70	68
H Position	50	50
V Position	50	50
Frequency	1260	1744
OSD Position	Top Left	Top Left
OSD Timeout	60	60
OSD Background	Opaque	Opaque
Mode	7	13
Resolution	1024x768	1280x1024
H Frequency kHz	30,703	42,426 or 42,444
V Frequency Hz	38	39

Phase control

The phase control does not have a typical value as it varies from unit to unit. Adjust this parameter to make the picture as sharp as possible.

Reset

The RESET function, on the Option submenu, relies on the monitor being presented with full screen graphics in order to assess how the signal should be shown.

Do NOT perform a RESET while showing the Radar graphics as it has poorly defined “edges”. Instead, use Test Pattern 1 (with the continuous border). After performing a reset, the brightness, contrast, OSD Position and OSD Timeout settings must be re-adjusted to their nominal values shown above.

Refitting the Bezel

When the picture has been properly aligned, ensure that the LCD surface and the inside face of the glass are clean before refitting the bezel. Do not rub the surface of the LCD with anything that can generate static electricity. The LCD surface should not be touched with bare fingers. The bezel glass can be cleaned with a soft lint free cloth. Dust on these surfaces is best removed with an air duster.

4.3 Testing Original Hatteland Models

This section is for models 65819A that are fitted with five BNC connectors for the video and sync signals. 65819A models that are fitted with a 15-way D-Sub connector are described in Section 4.4 below.

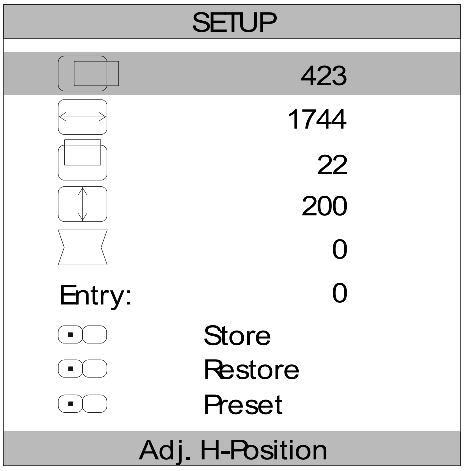
Remove the small cover held by two screws on the front of the monitor fascia to reveal the 'set-up' controls. Turn its Contrast/Brightness/Brilliance control(s) fully clockwise. Check that the LED adjacent to the set-up controls is illuminated green. A red illumination indicates a lack of video input sync signal(s).

Test Pattern 1 should be fully visible, and completely fill the screen, when the set-up controls are correctly adjusted.

Use the set-up buttons MENU, +/DOWN, -/UP and ENTER as follows:

Press the MENU button to display the Main Menu. Select 'SETUP' from this menu using +/DOWN or +/UP buttons, and press ENTER.

On the SETUP menu now displayed, check that the parameters are as follows:

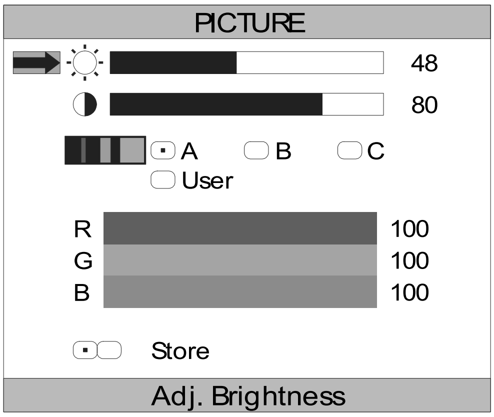


If necessary, parameters can be adjusted by using the +/DOWN and +/UP buttons. Ensure that the left and right edges visible.

If any changes are made, select the 'Store' line in the menu and press the ENTER button.

An accurately positioned Radar Standby screen should now be displayed on the monitor.

Press the MENU button to return to the main menu, select the PICTURE menu, and check that the parameters are as follows:



If necessary, parameters can be adjusted by using the +/DOWN and +/UP buttons.

If any changes are made, select the 'Store' line in the menu and press the ENTER button.

A final check may now be required of the Clock Phase parameter on the SETUP menu.

If necessary, concentrate on the four RGB groups of squares in the test pattern (or on the screen-wide strip of white vertical lines at the bottom of the pattern, if present) when adjusting the clock phase, and adjust for maximum clarity and minimum noise (position and amplitude) on the fine vertical lines. As a final check, ensure that the vertical white lines on the pattern are noise free and have a similar appearance to each other across the screen.

If any changes are made, select the 'Store' line in the menu and press the ENTER button.

Note – Re-adjustment of the clock phase and horizontal position parameters may be required if the video cable is changed.

4.4 Testing New Hatteland Models

This section is for models 65817G or H, 65819A and 65823A, B or E. This 65819A has a 15-way D-SUB connector for the video and sync signals; the original had five BNC connectors and is described in Section 4.3 above.

For the 65823B desktop variant only, remove the bezel by undoing the five screws (two on the lower front surface and three across the top).

Remove the small cover held by two screws on the front of the monitor fascia to reveal the 'set-up' controls. Turn the Brilliance control fully clockwise. Check that the LED adjacent to the set-up controls is illuminated green. Red illumination indicates a lack of video input sync signals.

Test Pattern 1 should be fully visible, and completely fill the screen, when the set-up controls are correctly adjusted. The black and white striped band across the bottom of the pattern is not visible on the 65823 because of its picture format.

Use the set-up buttons "MENU", "UP", "DOWN", "+" and "-" to display an "On Screen Display" menu (OSD menu) and change parameters as follows:

- Press the "MENU" button to display the Main Menu.
- The selected sub menu icon is highlighted. The sub menu function is written toward the upper left of the OSD menu.
- Move to successive icons by pressing "MENU".
- Each OSD shows the present function of the "UP", "DOWN", "+" and "-" buttons. Typically, select options within a sub menu by pressing "UP" or "DOWN" buttons and adjust values by pressing the "+" and "-" buttons.
- Press the MENU button to return to the main menu from a sub menu.

There are two OSD main menus:

- Simplified OSD menu with a Hatteland logo, three icons across the top of the OSD and six icons across the bottom of the OSD.
- Advanced OSD menu without a logo, six icons across the top of the OSD and six icons across the bottom of the OSD.

It should not normally be necessary to access the Advanced OSD menu. Only those functions that are relevant to the operation of the BridgeMaster radar are described in detail in Section 4.4.2. To access the Advanced OSD menu, press and hold the "DOWN" button while switching the power on.

4.4.1 Simplified OSD menu

Frequency and Phase

These functions modify the image horizontal size and fine-tune the image quality.

FREQUENCY has a default value of 0 and should not be changed.

PHASE adjusts the image quality. Concentrate on the four RGB groups of squares in the test pattern (or on the screen-wide strip of white vertical lines at the bottom of the pattern, if present) and adjust for maximum clarity and minimum noise (position and amplitude) on the fine vertical lines. As a final check, ensure that the vertical white lines on the pattern are noise free and have a similar appearance to each other across the screen. It is not possible to give a typical figure for this parameter, as each unit may be different.

SHARPNESS has a default value of 1 and should not be changed.

PICTURE TYPE should be at a default setting of "Still".

Status

This sub menu displays, but cannot adjust, the resolution and frequency as follows:

Parameter	Variant	Horizontal	Vertical
Resolution	65817, 65819	1280	1024
	65823	1296	972
Frequency	All	42.4kHz	39 or 40Hz

Position

These functions move the image within the display area.

The "+" and "-" buttons move the image right and left respectively. Ensure that the double lines are visible at left and right edges.

The "UP" and "DOWN" buttons move the image up and down respectively. Ensure that the picture is symmetrical with a white double line at top and bottom edges for the 65817 and 65819. The 65823 should have a white single line at the top and bottom edge.

Picture in Picture

The picture-in-picture parameters are set by this function but they are not used for BridgeMaster displays. There are two menu styles.

Ensure that PIP Size is set to "Off" if the menu displays Off, Size1, Size2 and Size 3.

Ensure that PIP Size is set to "0" if the menu displays a horizontal slider.

Language

This menu allows the user to choose between English, Danish and Simplified Chinese for the text and messages in the OSD menus.

Video Source

This menu displays the video source. It is preset to Analog RGB and must not be changed.

Utilities

This menu displays several sub menus but only one may be of use for a BridgeMaster display.

The "OSD Setting" sub menu displays the following parameters with their default values:

Parameter	Default value	Notes
OSD H-Position	100	Do not change
OSD V-Position	100	Do not change
OSD Background	Translucent	User may prefer Opaque
OSD Menu Rotate	Normal	Do not change
User time Out	10s	User may need to increase this

Do not use sub menus "Direct Access 1", "Direct Access 2", "Calibrate RGB gain", "Load Defaults" and "Test Pattern".

Volume

This menu has no function for a BridgeMaster display.

Exit Menu

Selecting this menu will exit the OSD menu. Press "+" or "-" to save the current settings and then exit.

4.4.2 Advanced OSD menu

If "Load Defaults" is activated in error, or the brilliance or aspect ratio are wrongly set, then it will be necessary to use the Advanced OSD menu functions to check and, if necessary, set some of the parameters.

All of the Simplified Menu functions are repeated on the Advanced OSD menus. Refer to Section 4.4.1 above for their descriptions. Only the additional functions are described below.

Brightness and Contrast

The values set by activating Load Defaults are 50 for the Brilliance and 50 for the Contrast.

Color Temperature

The default value is 8000K and must be set to this value.

Graphic Scaling Modes

The default setting is 'Fill to Aspect Ratio' and must be set to this value.

Utilities

Additional sub menus are shown compared with the Simplified OSD menu but the parameters must be set to their default values as follows:

Sub menu	Parameter	Default setting
User Setting	DPMS	Enable
	Display Input	Enable
	Auto Source Select	Off
	Gamma	1.0
Freeze		Not frozen
Zoom	Zoom Level	0
	Horizontal Pan	0
	Vertical Pan	0
Display Orientation	Orientation	Normal

4.5 Normal Operation – All FPD Models

Normal operation of the Flat Panel Display Monitor requires only the operation of its On/Off switch, Contrast and Brightness controls.

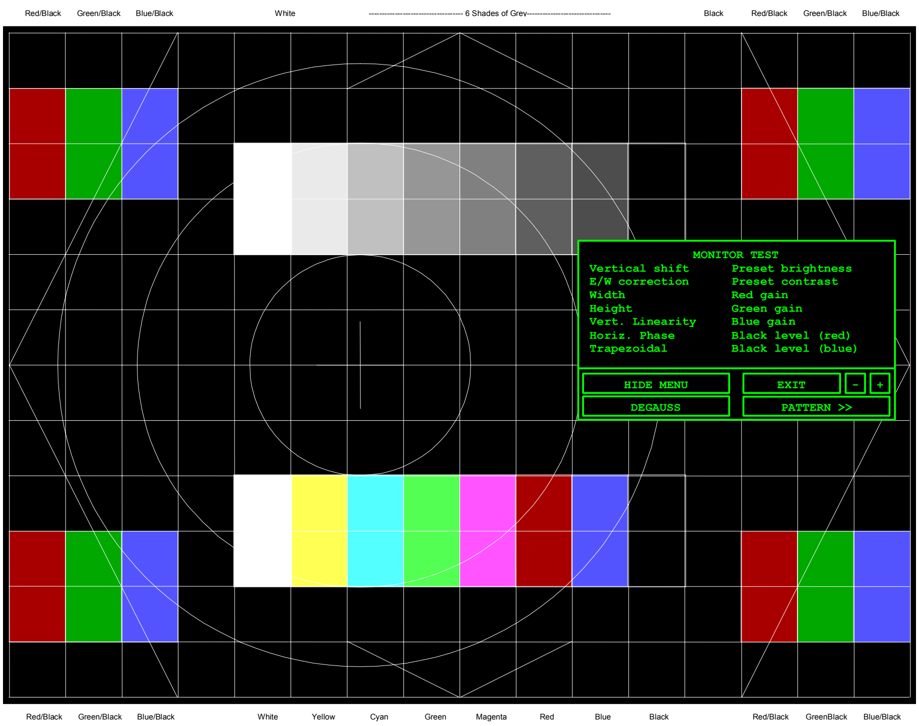
The Contrast and Brightness controls should be adjusted to maintain picture visibility in response to varying ambient lighting conditions.

Note – Power to these monitors is not switched by the On/Off switch associated with the radar display processor. To prolong the life of the backlight in these displays, it is recommended that the monitors be switched off when not in use.

5 Testing a CRT Monitor

Picture adjustment can be made to BridgeMaster E CRT monitors.

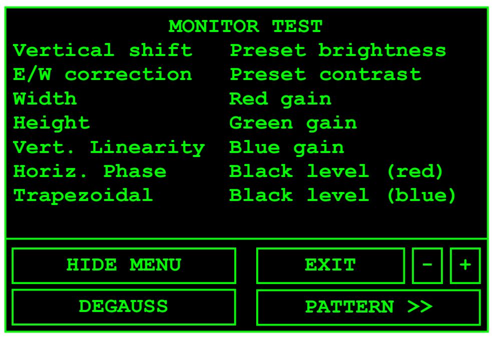
5.1 CRT Test Pattern 1



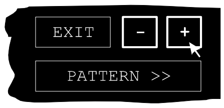
Test Pattern 1 consists of various lines, circles and coloured rectangles. A MONITOR TEST Parameter Menu and several soft keys are also displayed.

5.1.1 Selecting a Test Parameter

1. Within the MONITOR TEST menu (shown below), position the screen cursor over the required parameter.
2. Left click to select that parameter for adjustment. The selected parameter will be highlighted.



5.1.2 Adjusting a Selected Parameter



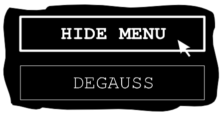
Once a parameter has been selected, it can be changed using the plus (+) and minus (-) soft keys.

1. Position the screen cursor over the '+' or '-' soft key.
2. Left click to increase or decrease the selected parameter.

Note – The '+' and '-' soft keys will auto-repeat for as long as the left button is kept pressed.

5.1.3 Hiding Menu & Lines

Note – The HIDE MENU soft key may show any one of three different captions - HIDE MENU, HIDE LINES or SHOW LINES.



1. Position the screen cursor over the HIDE MENU soft key.
2. Left click to toggle between HIDE LINES, SHOW LINES and HIDE MENU.

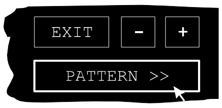
Initially, Test Pattern 1 (as shown above) is displayed and the soft key caption is HIDE MENU. A left click on this soft key will remove the menu and all of its associated soft keys except the HIDE soft key which now shows the caption HIDE LINES. A left click on this soft key will remove all lines from the test pattern and change the soft key caption to SHOW LINES. A left click on this soft key will restore Test Pattern 1 (as shown above, complete with menu and all lines). The soft key caption is also restored to HIDE MENU.

5.1.4 Degaussing the Monitor

1. Position the screen cursor over the DEGAUSS soft key.
2. Left click to initiate a degauss. See Chapter 14 of the User Guide.

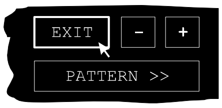
Note – There is a 30 second inhibit on this function after use.

5.1.5 Selecting Test Pattern 2



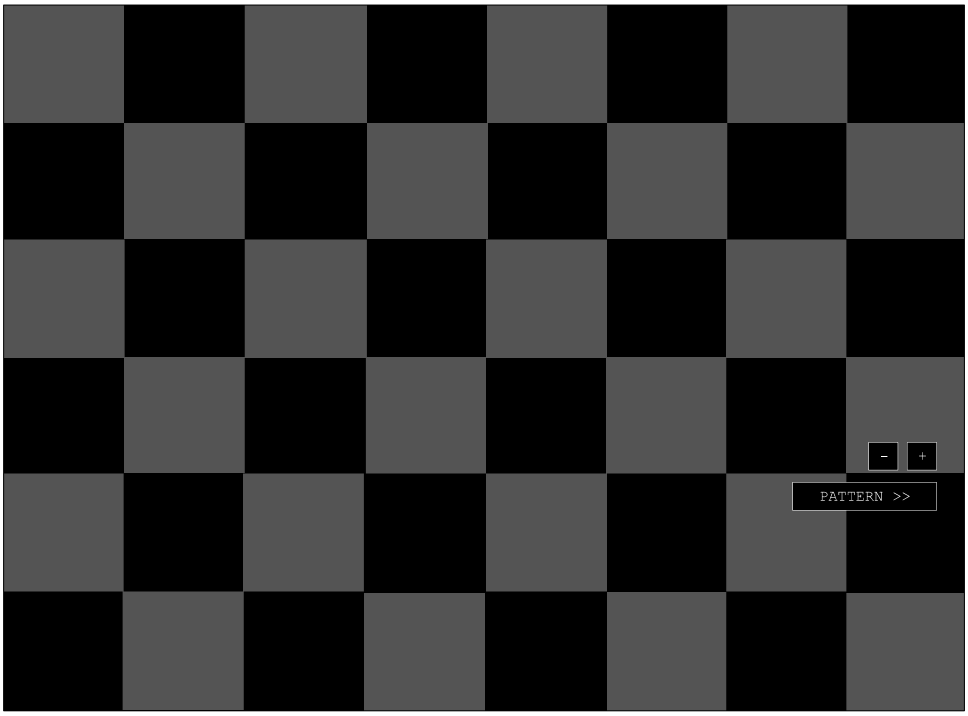
1. Position the screen cursor over the PATTERN >> soft key.
2. Left click to display Test Pattern 2.

5.1.6 Returning to Standby (Exit from Monitor Test)



3. Position the screen cursor over the EXIT soft key.
4. Left click to exit from the Monitor Test mode and return to the STANDBY mode display.

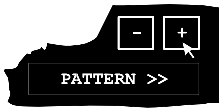
5.2 CRT Test Pattern 2



Black Dark Grey

Test Pattern 2 consists of a chequered pattern of black and dark grey squares. It is important that the darkest possible grey can just be seen against the black background so, initially, NO menu or soft keys are displayed. After a short delay the '+', '-' and PATTERN > > soft keys will appear.

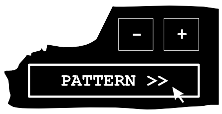
5.2.1 Changing the Preset Brightness



1. Position the screen cursor over the '+' or '-' soft key.
2. Left click to increase or decrease the preset brightness until the dark grey of the chequerboard can just be seen against the black background in the **darkest of operating conditions**.

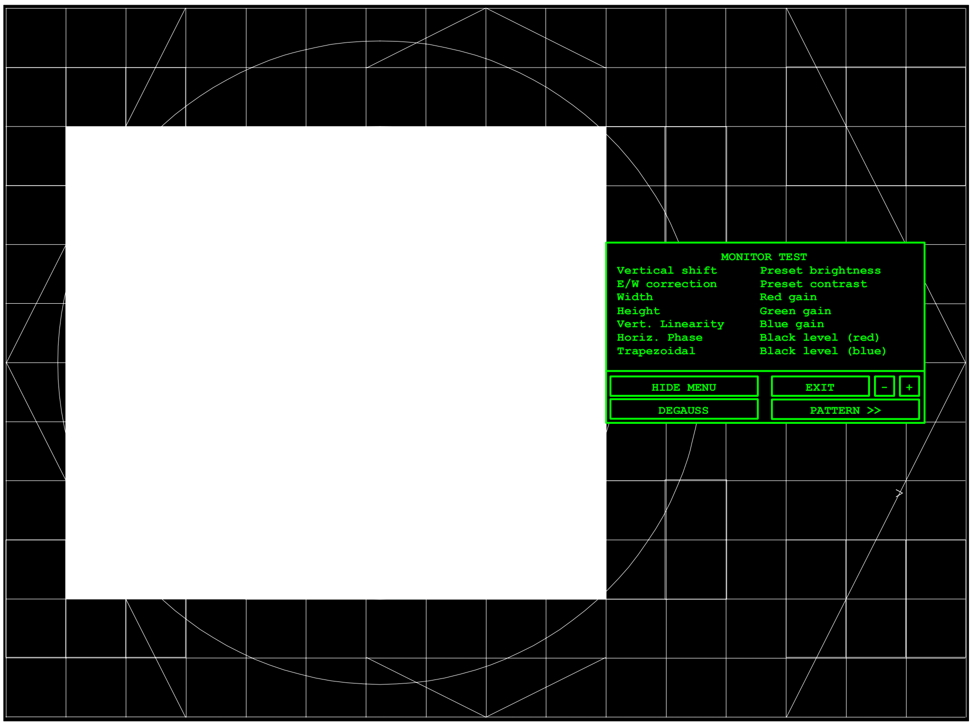
Note – Note: The '+' and '-' soft keys will auto-repeat for as long as the left button is kept pressed.

5.2.2 Selecting Test Pattern 3



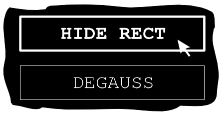
1. Position the screen cursor over the PATTERN >> soft key.
2. Left click to display Test Pattern 3.

5.3 CRT Test Pattern 3



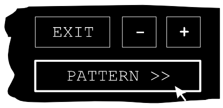
Test Pattern 3 consists of the lines and circles associated with Test Pattern 1, plus a large, solid-white rectangle in the centre of the screen. The rectangle can be hidden or made to flash, and all menu items associated with Test Pattern 1 can be selected.

5.3.1 Controlling the Large White Rectangle



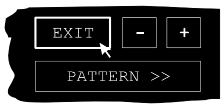
1. Position the screen cursor over the HIDE RECT soft key.
2. Left click to toggle between FLASH RECT, SHOW RECT and HIDE RECT.

5.3.2 Returning to Test Pattern 1



1. Position the screen cursor over the PATTERN >> soft key.
2. Left click to return to Test Pattern 1.

5.3.3 Returning to Standby (Exit from Monitor Test)



1. Position the screen cursor over the EXIT soft key.
2. Left click to exit from the Monitor Test mode and return to the STANDBY mode display.

CHAPTER 6

FAULT REPORTING AND FIRST LINE SERVICING

Contents

Figures

Flowcharts

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1 Introduction

Fault diagnosis to component level is not possible without the use of specialised test equipment.

The majority of the PCBs are assembled using surface mount techniques.

Service repair is therefore by module (PCB) replacement only.

The module may be covered by the Service Exchange scheme.

1.1 Contact

If a unit exhibits a fault, please contact you supplier or local dealer, or if on International trade, contact:

Northrop Grumman Sperry Marine B.V.		
SERVICE CONTROL	Telephone:	+(44)(0) 208 329 2400
Burlington House	Or	+(44)(0) 208 329 2000
118 Burlington Road		
New Malden	Fax:	+(44)(0) 208 329 2458
Surrey KT3 4NR		
England		

or:

Request support on line by going to www.sperry-marine.com, and clicking on the customer support link.

For general non-urgent enquiries, the following e-mail address is also available:

service@sperry-marine.com

1.2 Information Required for Service

Please give the following details when reporting a fault:

1. Name of vessel (Satcom or Fax number if fitted).
2. Equipment type, including prefix and suffix letters.
3. Software status (version number).
4. Next port of call, ETA and ship's agents.
5. Fault description (with as much detail as possible).
6. Contact name.

2 Fault Identification and Isolation

Refer to the following associated manuals for assistance in identifying and isolating System faults.

65601012	BridgeMaster II S-Band Supplement (Hybrid Systems)	Chapter 6
	Additionally covers DCU and Scanner Control Unit faults.	
65601013	BridgeMaster II X-Band Supplement (Hybrid Systems)	Chapter 6
	Additionally covers DCU faults.	
65800011	Ship's Technical Manual	
65800012	Ancillary Units and Radar Systems Manual	
	Covers DCU, TCU, 2- & 6-way Interswitch, Interface Unit,	
	and Radar Slave Interface Unit.	

!WARNING!

Lethal voltages are exposed when the covers are removed from the units. Only qualified persons should work on the equipment when power is applied. ALWAYS isolate the unit from the mains supply when removing or replacing the cover. To make the units safe it is necessary to isolate them from the mains supply. It is not adequate to turn the unit off, as there are high voltages present at any Power Supply that is not mains isolated.

2.1 BME System Fundamentals

In order to simplify the diagnosis of system faults, the following paragraphs describe some fundamental characteristics of the BME units.

Power Supply Start-up

!WARNING!

Once mains is applied to the PSU board in either the Transceiver, the Display or the TCU, high voltage DC is present on all primary power components. This voltage is present even when the unit is switched off. **This fact should be noted when servicing the Display, the Transceiver and the TCU. The high voltage is only removed if the unit is isolated from the mains supply.**

For the Power Supply to operate, the DU Data+ and DU Data- signal lines must be active. It is not necessary for serial data to be present, the presence of a DC voltage >2.5V between the lines will start the Power supply.

Note – A test link LKA on Power Supply PCB's can be set to position 1 – 2 to make the Power Supply operate independently of the DU Data input. This link **must only** be used in this position as a service aid. It **must** be reset afterwards to position 2 – 3 for normal operation otherwise the display will not be able to switch the transceiver on or off.

Azimuth and Comms

There are four separate signals between a BME Display and Transceiver:

- serial control messages from the Display;
- video;
- RS422 trigger; and
- serial tellback messages from the Transceiver.

The tellback messages are a serial message stream. They contain the azimuth and heading marker information as well as BIST and status tellback bits. The messages are made up of a number of characters. As the antenna rotates, azimuth pulses are produced. Each pulse causes the Transceiver or TCU to send one character of data. If the antenna stops rotating synthetic azimuth pulses are produced by the Pulse Bearing PCB to maintain the serial comms between the Transceiver and the Display. The frequency of the messages is reduced under this condition.

Loss of azimuth pulses will result in no messages being sent to the display, which results in the display raising a "TX Comms" alarm.

Fault Identification and Isolation

Each of the various signals in the radar system may pass through a number of units before reaching its final destination. Therefore, a low video alarm on a display could be caused by a failure in the Transceiver, TCU, Interswitch or cabling. The fault in a particular unit may then be due to defective hardware or lack of power to that unit.

With many of the faults it is only possible to identify a particular missing signal. It is then simply a case of using an oscilloscope to trace inputs to and outputs from each unit in turn in order to isolate the fault. Once this has been done, the faulty unit can be examined in more detail using the diagnosis charts in the relevant manual.

It is assumed that the engineer will make sure that ships mains is present at each of the units where expected and that all isolating switches are in the correct operating position before proceeding with fault diagnosis.

2.2 Display Unit

Flowcharts for the isolation of Display Unit faults are given on the following pages. Flowcharts 1 & 2 cover the situation where there is no picture, and Flowchart 3 & 4, where there is a picture but there are other faults.

The Flowcharts should be read in conjunction with the following notes.

Notes –Before using the following fault finding flow chart visually check the units to make sure there are no loose plugs or connections.

A YELLOW LED shows when the power supply is active It is found approximately 100mm from the right-hand side of the power supply, towards the rear of the PSU. It can be seen through the front grill of the PSU.

A RED LED shows if there is a power supply trip. It can be found approximately 125mm from the right-hand side of the power supply, towards the rear of the PSU. It can be seen through the front grill of the PSU.

The DISPLAY EHT SUPPLY has a thermal trip circuit. After the removal of an overload, it automatically resets after 15 seconds.

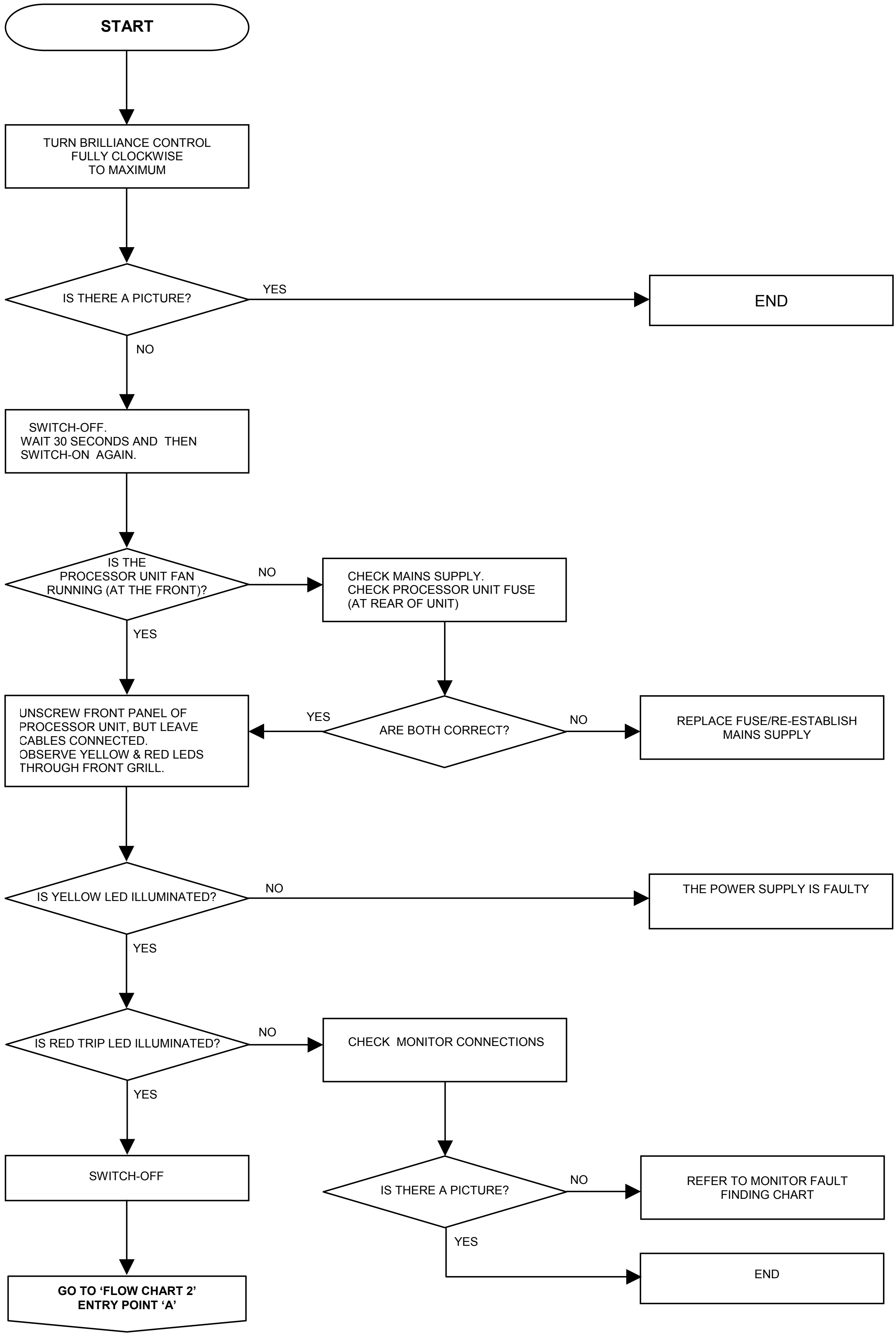
The DISPLAY POWER SUPPLY has a thermal trip that shuts down the power supply if the heat sink temperature exceeds 110°C. This thermal trip will not activate the PCU RED TRIP LED. The YELLOW LED is similarly not affected. The PSU will automatically reset when the heat sink cools to approximately 90°C.

For a Flat Panel Monitor that is powered directly from an AC or DC input, ensure that the power is applied and that the power LED is lit. Refer to Chapter 5, Section 4 for its position.

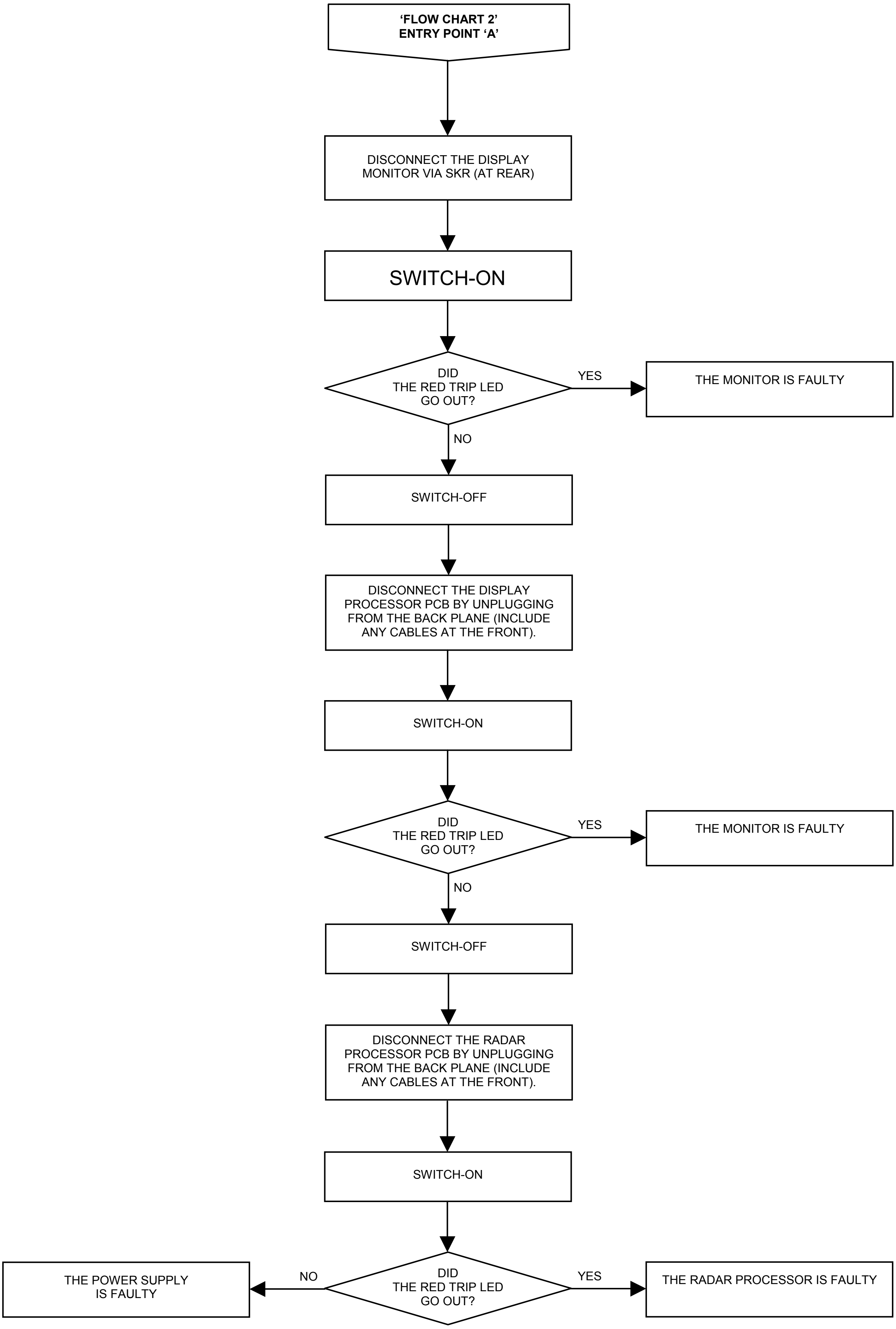
Use the following table to help with decisions on Flowchart 3 and 4.

Decision	Answers	Example Symptoms
Is the display distorted?	Digital Distortion	Broken or missing text, misaligned text.
	Analogue Distortion	Non-circular range rings.
Are the colours correct?	Incorrect Colours	Different colours shown from those set.
	Discolouration	Set colours vary.
Where is the fault?	Within Radar Picture	Missing targets, no gain, strange patterns.
	Text and Synthetics	Missing text, non-function of menus, strange patterns.

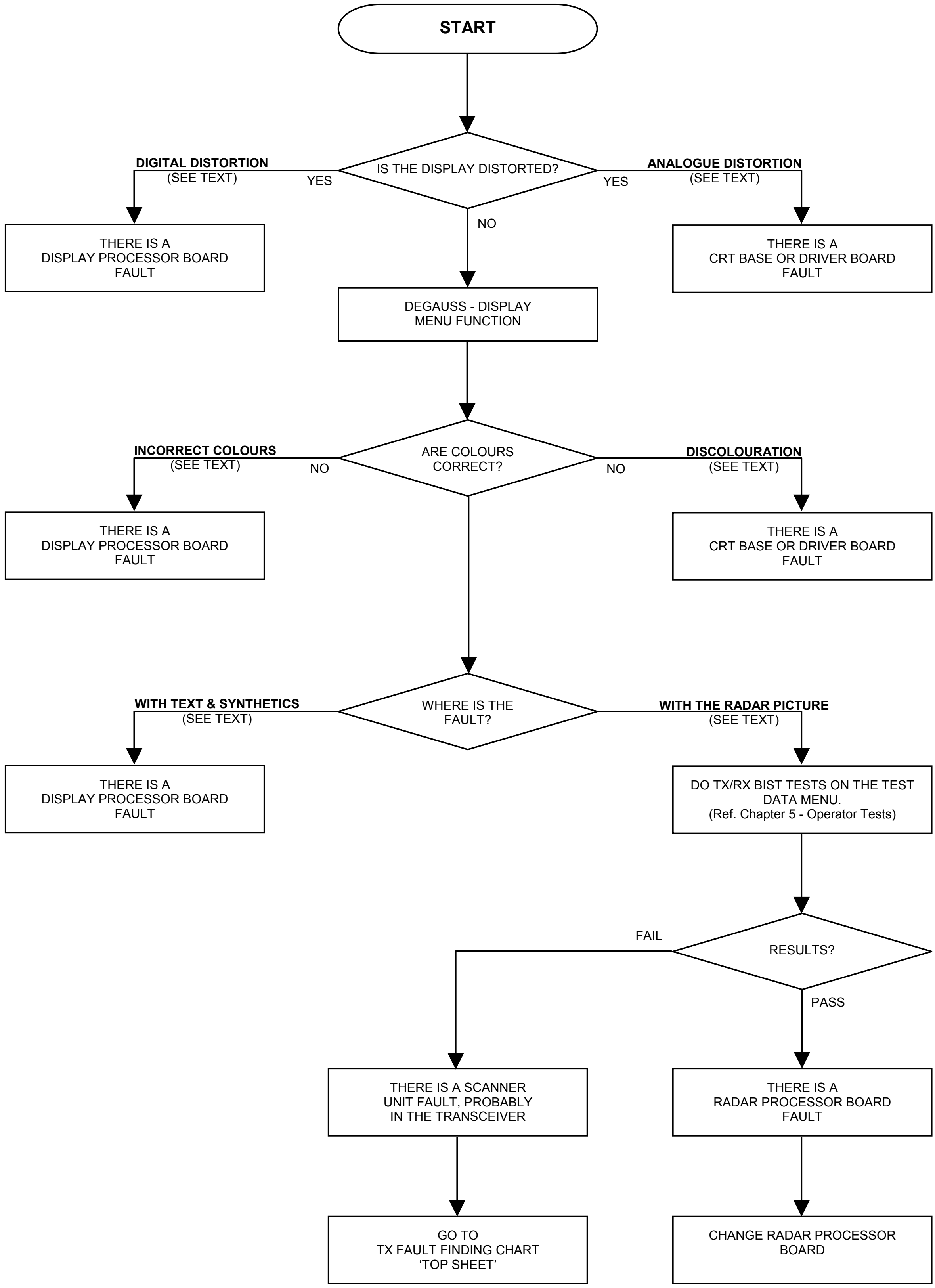
FLOWCHART 1 DISPLAY UNIT FAULTS (NO PICTURE)



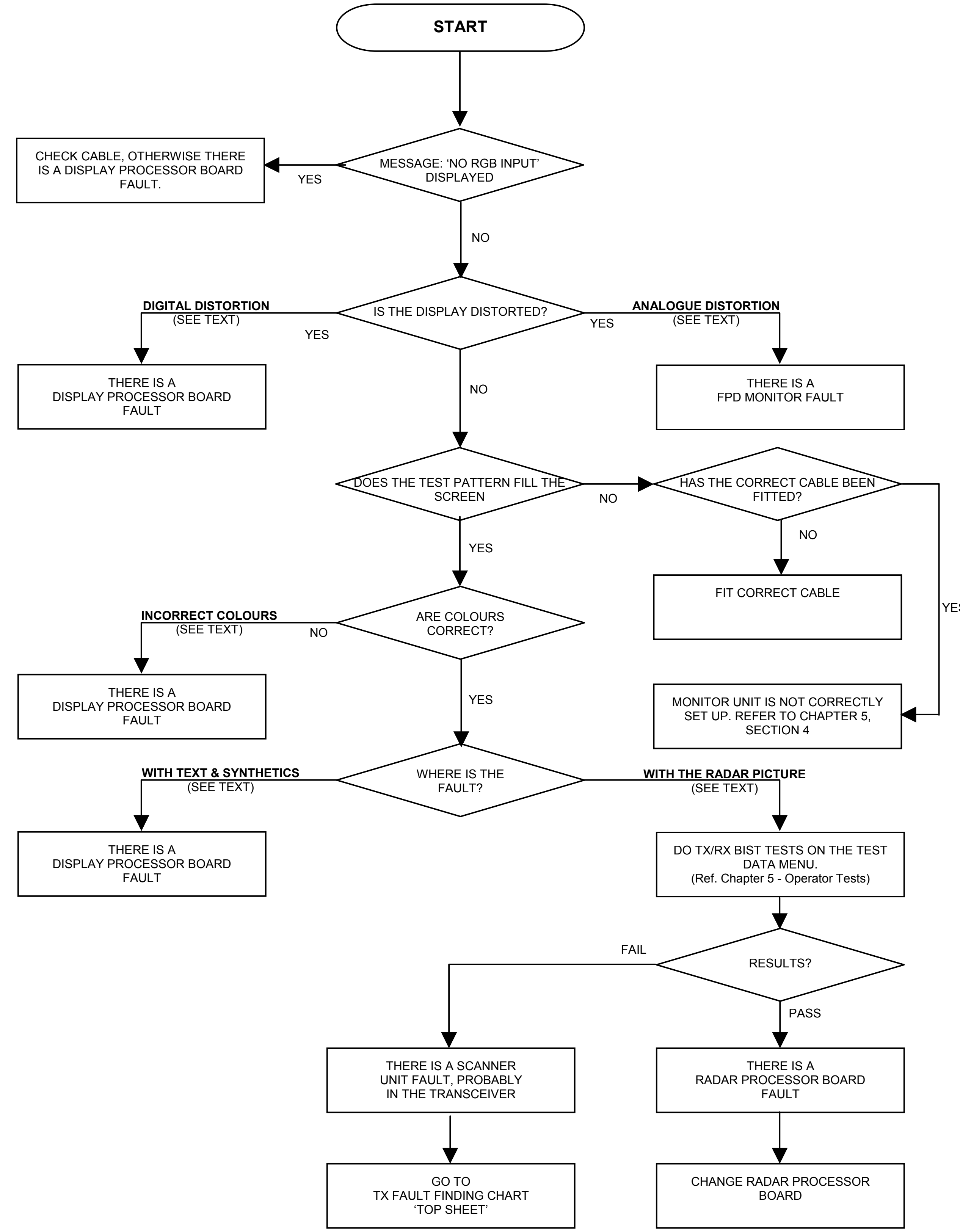
FLOWCHART 2 MONITOR UNIT FAULTS (NO PICTURE)



FLOWCHART 3 MONITOR UNIT (CRT) FAULTS (WITH PICTURE)



FLOWCHART 4 MONITOR UNIT (FPD) FAULTS (WITH PICTURE)



2.3 Error Messages and Tellbacks for 'S' and 'X' Band Transceivers

2.3.1 Error Messages

The following errors are reported by the transceiver:

Message Failure

The transceiver expects to receive a message from the display at least once per second. If the message rate drops below this the transmitter is switched to Standby and a Message Fail error is shown. The Transmitter will remain in Standby until the next message is received which contains a 'transmit request bit' set to transmit.

Possible causes:

- Controlling device failure.
- Inter unit cabling.
- Inter PCB cabling in transceiver.
- Defective Input PCB (signal is only looped through).
- Defective Trigger PCB.

Corrupt Data

The transceiver checks the parity of each character in an incoming message and verifies the checksum for each complete message. If enough corrupt messages are received a Corrupt Data error is returned. The transceiver stays in the state it was in when it received the last valid message. Normal operation will be resumed, and the Corrupt Data error will be cleared when the next valid message is received.

Possible causes:

- Controlling device failure.
- Bad connections or earth bonding on inter unit cabling between Transceiver and controlling device.
- Defective Inter PCB cabling in transceiver.
- Defective Input PCB (signal looped through only).
- Defective Trigger PCB.

Spark Gap Detect

The Modulator incorporates a spark gap to protect the pulse transformer from the excessive voltage that is generated if the magnetron misfires.

If the spark gap operates for more than two seconds this is detected and Spark Detect error is signalled, and the Transmitter is switched to Standby.

Possible causes;

- Magnetron instability at end of its life.
- Missing magnetron heaters, due to Modulator PCB failure.
- Failure of Magnetron Heater Supply from the Power Supply PCB.
- Defective Inter PCB cable from Power Supply to Modulator PCB.
- Defective Modulator PCB.
- Defective Trigger PCB.

HMKR Failure

When operating normally the transmitter will not transmit unless the antenna is rotating.

Antenna rotation is confirmed by checking for the presence of the Heading Marker.

If the Heading Marker is missing but azimuth pulses are still present the Transceiver will be switched to Standby and a HMKR Failure error message is shown on the display.

Transmission is restored if a Heading Marker is detected, provided the display has not switched the transmitter to standby.

Possible causes:

- Defective Inter unit cabling from Transceiver to Scanner unit.
- Defective Digitiser or Pulse Bearing Board in Turning Unit.
- Incorrectly configured Input PCB.
- Defective Input PCB.

Mod Trig Fail, Charge Trig Fail

The Trigger PCB generates the Modulator, and Charge Triggers. If either pulse is detected as missing a Mod Trig Fail, or Charge Trig Fail error is returned as applicable.

Possible causes;

- Defective Trigger PCB

2.3.2 BIST DATA

The following information is transmitted from the transceiver to the display unit to be shown in the TX BIST box.

Parameter	Normal Range	Remarks
Magnetron Current	6.0A – 9.5A	25kW and 30kW
Magnetron Current	4.0A – 7A	10kW
+12V	+11V - +13.4V	
+30V	+26V - +36V	
MOD HT	-500V - -680V	
Mod Trigger	Pass	
Charge Trig	Pass	

BIST data is only approximate and must not be used for making adjustments.

A deviation from the above values shows a possible fault condition.

2.3.3 TELLBACKS

Within the serial data transmitted by the transceiver are a number of status tellbacks to show the Transceiver status. This data is monitored and shown on the display unit.

The following tellbacks are used:

Transmit

This bit is set if the controlling device requests transmit and:

- The transceiver has completed its warm up.
- The Heading Marker has not failed.
- There is not a Message Fail error.
- There is not a Spark Gap error.

Inhibit

This bit is set whenever the display unit requests 'Transmit' and the transmitter is inhibited. For example, when the Radar Silence input is active on units fitted with the additional features option.

Medium Pulse and Short Pulse

These bits reflect the status of the pulse length control signals within the transceiver.

They show the status as follows:

Selection	SP Bit	MP Bit	Receiver Bandwidth
Short Pulse	1	0	Wide
Medium Pulse	0	1	Wide
Long Pulse	0	0	Narrow
(Illegal Code)	1	1	Undefined

Wide-band

This bit shows the bandwidth selected for the receiver, when set to "1" "wideband" is selected.

The selected bandwidth is linked to the pulse-width as shown in the table above.

AFC On

This bit indicates the tuning mode selected for the receiver. When set to "1" AFC mode is selected. For some transceivers, this bit may be permanently set to "1" as a result of internal link settings.

Timer

This bit indicates the status of the magnetron "warm-up" timer within the transceiver. It is set to "0" for a preset period of 180 seconds after the transceiver is turned on. The timer lets the magnetron cathode reach its operating temperature before the HT is applied.

After the warm-up delay the transceiver can be turned off. If it is turned back on within 10 seconds the timer will be overridden, letting it immediately return to the transmit condition.

2.4 S-Band Scanner Unit

2.4.1 Technical Description

There are two basic types of S-Band Scanner Unit:

- With an integral transceiver module
- Without an integral transceiver

Each type has variants dependent on motor supply and the options that are fitted.

The Scanner Unit is comprises of an Antenna, an antenna support casting, and a Turning Unit.

The Turning Unit contains the following items:

- a motor and gearbox
- a Bearing and Heading Marker PCB
- an Input PCB
- an optional Performance Monitor
- an optional integral transceiver module.

The Transceiver Unit contains the following items:

- a base casting
- a cover
- a transceiver module
- an Input PCB.

A serial data link is used to communicate between the Transceiver and the Display. If a separate Transceiver Unit is used, an RF feeder (coaxial) is used to transfer the microwave energy between the Transceiver Unit and the Turning Unit.

The Scanner Unit and the Transceiver Unit are compatible with BridgeMaster display units if a Display Compatibility Unit is used.

Physical Arrangements

The Turning Unit is constructed from a central aluminium casting, to one side of which is attached a motor and gearbox. The terminal strips for interconnecting cables to other units are under a cover on the opposite side to the motor and gearbox.

At either end of the Turning Unit there is an aluminium cover. The performance monitor is housed under the front cover. When fitted, the Transceiver Unit is housed under the rear cover. If no transceiver module is fitted, a shallower cover is used. The transceiver module can be removed for below decks servicing.

Four M16 bolts are used to attach the Scanner Unit to the radar platform or wheelhouse roof. The Antenna is attached to the Turning Unit by the antenna support casting. An RF feeder cable is used to transfer the microwave signals between the Turning Unit and the Antenna.

Interconnections between the Scanner Unit and other units in the system are made using screened cables. All the cables that enter the Scanner Unit do so via waterproof cable glands that use an EMC gasket that makes contact with the cable braid.

The separate Transceiver is designed to be Bulkhead mounted and is attached using four M8 bolts, studs or screws (coachbolts).

TRANSCEIVER MODULE OVERVIEW (S-Band)

The transceiver module can be fitted in the Turning Unit, or mounted on a casting for below decks bulkhead mounting as a separate unit. The module contains:

- the Modulator PCB;
- a Power Supply PCB;
- the Trigger PCB;
- the Receiver; and
- the microwave components.

Communication between the Transceiver Unit and the Display Unit uses two serial data links:

- one from the Transceiver to the Display Unit
- one from the Display Unit to the Transceiver.

This information is transmitted using a special data cable that incorporates four twisted pairs:

- two pairs are used for data transmission
- one pair is used for the trigger
- the other pair is spare.

The data passed from the Transceiver to the Display includes:

- Heading Marker
- Increment Bearing
- Transceiver Status
- Error Messages
- Built In Test Equipment (BITE) data
- Tuning Indicator

The data transmitted from the Display to the Transceiver includes:

- Standby/Transmit
- Pulse Length
- Tuning
- AFC/Manual
- Sector Blanking
- Performance Monitor control, and Installation Settings

Power Supply

The power supply operates from the ship's AC mains, and provides all of the power requirements for the electronic modules within the Turning Unit and Transceiver. The AC mains is always present at the power supply even when the radar is switched off at the display.

The presence of data on the serial data link when the display is switched on is detected by the power supply, which then becomes active. The power supply includes a Power Factor Correction circuit, and a number of switching regulators to generate the necessary voltage supplies. Overcurrent detection circuits protect the power supply against overloads on its outputs.

Trigger PCB

The Trigger PCB processes the serial data from the Display Unit, and generates the required control signals for the Transceiver. It monitors functions within the Transceiver, the Heading Marker, and encodes the information for transmission to the Display Unit. The data is transmitted each time a bearing pulse is received from the Turning Unit. The trigger PCB generates the various timing signals required by the transceiver, including the Pulse Repetition Frequency (PRF).

Modulator PCB

The modulator PCB generates high voltage negative pulses required to drive the magnetron. The modulator pulse widths and timing signals are controlled from the trigger PCB. A spark gap on the modulator is fired if the magnetron fails to operate. Continual operation of the spark gap is detected and a signal is fed back to the trigger PCB. When the trigger PCB detects this signal it switched the radar to standby, and generates an error signal to be transmitted to the Display Unit via the serial data link. The error signal causes the Display Unit to switch to standby and generate an error alarm.

Microwave

The transceiver uses a conventional three-port circulator to direct the path of the microwave energy to and from the antenna. A magnetron coupled to the circulator provides the RF energy to be transmitted. A solid-state limiter coupled to the circulator protects the receiver from high-powered microware signals from the magnetron, or adjacent radars. A signal from the trigger PCB is used to enable swept attenuation to be applied to the solid-state limiter to reduce the system sensitivity at short ranges.

Receiver

The receiver consists of:

- a low noise amplifier;
- a mixer;
- a linear preamplifier;
- a logarithmic amplifier; and
- a video amplifier.

The mixer has a 60MHz output, which is amplified by the linear pre-amplifier followed by the logarithmic amplifier. When the output is detected, the resulting video signal is then further amplified before transmission to the Display or Compatibility Unit.

The receiver also incorporates an AFC system. Once the receiver has been tuned, the AFC system makes sure the receiver remains in tune during variations in tuning due to thermal drift of the mixer, magnetron etc.

The operator can select between manual tuning and automatic tuning. A signal from the trigger PCB is used to select the mode of operation. A signal from the AFC circuit is fed to the trigger circuit to indicate the state of tune of the receiver. This signal is at its minimum value when the receiver is correctly tuned.

AUTOMATIC START-UP SEQUENCE (S-Band)

The automatic start-up sequence described below, should be read in conjunction with Figure 6.28 S-Band Turning Schematic'.

Start-up

!WARNING!

When mains power is applied to the PSU board the Power Factor Correction (PFC) circuitry starts and generates 390V. When mains power is applied the PFC is active and cannot be manually switched off. The start circuitry only controls the flyback converter so High Voltage DC is present on primary power components whenever mains power is present on the board. **This fact should be noted when servicing the Transceiver**.

The Power Supply in the Transceiver is only active during normal operation when there is a Display (or Compatibility Unit) connected to it. The RS422 serial data stream from the Display is used to drive an opto-coupler in the PSU, which detects the presence of either polarity voltage and enables the flyback converter in the PSU.

The RS422 serial data stream from the Display enters the Input Board on connector TSB1, 2 (as "DU DATA +" and "DU DATA-"). It is then passed to the Trigger Board via PLYB 16, 17, and then on to the PSU via PLTH 11, 12 (as "PSU START" and "PSU START RTN"). For test purposes the PSU can be turned on in the absence of a serial data stream by linking pins 1-2 on LKA (PSU).

Transmit Enable

When the operator selects Transmit, the TU Enable signal is activated LOW on the Trigger PCB (PLYH 10). On the S-Band Scanner Unit, this signal is fed via the Power Supply Unit to the Input PCB and (via TSB 10) to the Scanner Control Unit to start the antenna rotating. Once the antenna has done one complete revolution transmission is started. When standby is selected, transmission is immediately halted and, after one complete revolution of the antenna, TU Enable is disabled.

The Modulator starts to generate radar pulses when the Trigger PCB sends it MOD TRIGGER pulses (to PLVC 9). Note that the CHARGE TRIGGER pulse (on PLVC 8) is present even in Standby mode.

A signal indicating that the Magnetron has fired is fed via MAG SAMPLE from PLVC 7 on the Modulator PCB to the Trigger PCB. This signal is processed on the Trigger PCB and outputted as TX TRIG (PLYB 20 & 21) to the Input PCB (PLZB 20 & 21) and then to the Display Unit via TSB 5 & 6.

Note – TX DATA is sent from the Transceiver to the Display Unit.
DU DATA is sent from the Display Unit to the Transceiver Unit.

The Trigger PCB processes the serial data input from the display, and generates the required control signals for the Transceiver. The data is transmitted each time a bearing pulse is received from the Turning Unit. The Trigger PCB generates the various timings signals required by the Transceiver including the Pulse Repetition Frequency (PRF).

Magnetron Operation

The Modulator PCB generates the high-voltage negative pulses required to drive the magnetron. The modulator pulse widths and timing signals are controlled from the Trigger PCB. A spark gap on the Modulator is fired if the magnetron fails to operate. Continual operation of the spark gap is detected and a signal is fed back to the Trigger PCB.

On detection of this signal, the Trigger PCB switches the radar to Standby, and generates an error signal, which is transmitted to the Display Unit via the serial data link. The error signal causes the Display Unit to switch to Standby and generates an error alarm.

When Standby is selected, rotation of the Antenna is inhibited. Transmission from the radar is inhibited if the Antenna is not rotating (unless in Test Mode).

On the Trigger PCB, there is a timer circuit. This is basically a capacitor that slowly discharges (between 4s and 18s) when power is removed from the PCB. On power-up the microcontroller measures the charge remaining on the capacitor. It determines whether the transceiver has been switched off for long enough to require inhibiting transmit for three minutes until the magnetron heaters have had time to warm up again.

The other analogue signals into the Trigger PCB come from the Modulator. The Modulator supply voltage and the magnetron current (only when transmitting) are measured and sent to the Display as an aid to fault finding. The spark gap detect signal is generated by the modulator when the magnetron arcs over. If it reaches a predetermined level the microcontroller inhibits transmission for approximately one second and sends an error messages to the Display.

TURNING UNIT OVERVIEW (S-Band)

Drive System

The scanner motor is an AC induction motor. It drives either a 12:1 or a 20:1 reduction gearbox. The output of the gearbox drives the final output helical gear via a pinion to give an overall reduction between the motor and Antenna of approximately either 30:1 or 60:1 dependent on whether the Turning Unit is a high speed variant or not.

A Scanner Control Unit connects the scanner motor to the ship's AC Supply. This unit incorporates a contactor controlled by the Transceiver to switch the scanner motor on.

When standby is selected, rotation of the Antenna is inhibited. Transmission from the radar is inhibited if the Antenna is not rotating (unless in test mode). An isolating switch is provided for AC systems to switch the scanner motor supply off for safe servicing.

Bearing and Heading Marker System

A disc with 128 teeth is attached to the antenna torque tube and, combined with an opto-coupler, generates 128 pulses per rotation of the Antenna.

A second opto-coupler together with a flag on the toothed disc generates a Heading Marker approximately 10° before the Antenna is pointing dead ahead. Correct alignment of the Heading Marker is set at installation by electronic adjustment within the Display Unit.

Where it is not possible to adjust the Heading Marker alignment at the display, optional extra circuitry can be fitted to the Input PCB to let the alignment to be made electronically within the Turning Unit. When this option is fitted an additional (isolated) Heading Marker output is provided. As an option for special applications a size 11 synchro can be fitted as an alternative source of bearing information.

Interconnections

AC power to the motor is by direct connection to terminal strips in the terminal box attached to the motor. The terminations for interconnections for the transceiver and the Turning Unit are under a cover on the side of the Turning Unit. The AC power from the isolating switch is terminated at a terminal block within the filter box. All other connections are made to plugs or removable terminal strips on the input PCB.

TRIGGER PCB (S-Band)

General Description

The Trigger PCB controls the operation of the Transceiver under instruction from the Display. There are two serial links, which are used to transfer control messages from the Display to the Trigger PCB and Transceiver information back to the Display. The Trigger PCB generates the control and tuning signals required by the Modulator, Receiver, Performance Monitor and Biased Limiter. The PSU is enabled with a signal from the Trigger PCB.

Signals To/From the Trigger PCB

To/From Display

- Serial Data to Display
- Serial Data from Display
- Trigger to Display

To/From Modulator

- Pulse Length select lines
- Charge and Modulator Triggers
- Magnetron Heater Turndown signal (only used for S-Band, Long Pulse operation)
- Voltage/Current Monitor signals
- 10/25kW and S-/X-Band Configuration signals

To/From Receiver

- Tuning Voltage signal
- Bandwidth Control signal
- AFC/Manual control
- AFC Trigger
- Tune Indicator signal

To Biased Limiter

- Trigger signal

To Performance Monitor

- On/Off signal
- Mode Control signal
- Tuning Voltage signals

To/From Power Supply PCB

- +30V, +12V, +5V, 0V & -12V Supply lines
- Turning Unit Enable
- Power Supply Start and Return

FUNCTIONAL DESCRIPTION (S-Band Trigger PCB)

The 80C51 family microcontroller provides overall control of the Trigger PCB functions. Program memory and RAM are included within the microcontroller IC. Serial I/O is handled by the microcontrollers internal UART and an external RS422A driver and receiver. Baud rate is fixed at 76800 baud for operational use but is link selectable to 19200 or 38400 baud for test purposes. The serial data format is 8-bit data, 1 stop bit and even parity.

The Display sends serial messages comprising four or five characters depending on message content. Control messages are four bytes long and tuning messages are five. The tuning voltage levels are sent as 12-bit values, which are converted on the Trigger PCB using a four channel DAC before amplification/buffering and distribution to the Receiver and Performance Monitor.

The Bearing signal from the Turning Unit is used to initiate serial transmission from the Trigger PCB. Each time one of the 4096 azimuth pulses per rev is generated and fed into one of the microcontroller's interrupt pins, a character (one byte) is sent to the Display. One bit in each of the characters sent is dedicated to the heading marker. On every new heading marker pulse from the Turning Unit, the bit is toggled.

The Power Supply in the Transceiver is only active during normal operation when there is a Display (or Compatibility Unit) connected to it. The RS422 serial input from the Display is used to drive an opto-isolator, which detects the presence of either polarity voltage and enables the PSU.

Trigger Outputs

There are a number of trigger signals generated by the Trigger PCB:

- Pre-Trigger
- Charge Trigger
- Modulator Trigger
- Display Trigger
- Performance Monitor Trigger
- AFC Trigger
- Swept Attenuation Initiate

The Charge Trigger is the timing signal used to recharge the Modulator PFN. This is generated by the microcontroller using an internal timer routine set to the appropriate PRF for the pulse length selected. A wobbulation factor is added to the basic timing to ensure that no two radar transmissions are locked together. The wobbulation is calculated according to the number of serial messages received before going to transmit and the position of the antenna between each trigger pulse.

An optional Pre-trigger will be produced approximately 11μs before the modulator trigger. This is not normally fitted and is intended for use in Special Options applications.

The Modulator Trigger is used to let the charge out of the PFN into the magnetron and is the trigger that starts the modulator firing. It is delayed from the Charge Trigger by 100µs and gated off when the transceiver is in standby.

In standby, the Display and Performance Monitor Triggers are generated from the Mod Trigger pulse. When the transceiver is in transmit mode the triggers begin on the leading edge of the magnetron sample pulse and end after a preset time, adjustable using RV1.

The AFC Trigger is used by the receiver when in AFC mode and is only generated when the transceiver is in transmit mode. The pulse is started on the front edge of the Modulator Trigger and terminates on the back edge of the magnetron sample pulse.

The Swept Attenuation Initiate pulse is the timing signal fed to the Limiter Drive PCB, which generates the control for the biased limiter. It is started by the edge of the Pre-trigger (approximately 2µs prior to magnetron firing) and terminated 2.5µs after the leading edge of the magnetron sample pulse.

The Display and PM Triggers are essentially the same trigger and are present at all times when the radar is powered up. They are initiated by the Modulator Pulse and last for approximately 2.5µs.

Analogue Outputs

The Trigger PCB generates four tuning signals:

- LO Tune
- PM Tune
- Xr Adjust
- Xt Adjust

These signals are coded as 12-bit digital values and incorporated into the serial messages from the Display. A 12-bit, four channel DAC is used to generate the tuning signals from the message data. Additional buffering is added to the LO and PM Tune outputs of the DAC and x3.5 amplification to the Xr and Xt Adjust signals.

LO Tune is the 0V to +5V receiver tuning control and PM Tune the 0V to +5V Performance Monitor main tuning control. Xr and Xt Adjust are 0V to +15V signals used to control the receive and transmit attenuators in the Performance Monitor.

Analogue Inputs

There are various analogue inputs to the Trigger PCB from other PCBs in the transceiver. There are also some on-board signals that are fed into an eight channel 8-bit ADC, and converted to digital values. These are used for further processing by the microcontroller or are passed to the Display via the serial message link.

The signals on the Trigger PCB that are measured are the dropout timer and +12V and +30V supplies. The timer circuit is basically a capacitor that slowly discharges (between 4s and 18s) when power is removed from the PCB. On power-up the microcontroller measures the charge remaining on the capacitor to determine whether the transceiver has been switched off for long enough to warrant inhibiting transmit for three minutes until the magnetron heaters have had time to warm up again. The power supply levels are measured and the results sent to the Display as an aid to fault diagnosis.

One channel of the ADC is used to detect whether a Performance Monitor has been fitted to the system. The voltage on this channel will be lower than a preset value if a Performance Monitor is present otherwise it will be pulled to the +5V supply rail. This information is encoded and sent as part of the configuration message to the Display.

The Receiver sends a tune indicator signal to the Trigger PCB, which shows how close it is to being on tune. This signal is coded as part of the serial message and sent to the Display.

The other analogue signals into the Trigger PCB come from the Modulator. The Modulator supply voltage and the magnetron current (only when transmitting) are measured and sent to the Display as an aid to fault finding. The spark gap detect signal is generated by the modulator when the magnetron arcs over. If it reaches a predetermined level the microcontroller inhibits transmission for approximately one second and sends an error message to the Display.

Digital Outputs

The digital outputs from the Trigger PCB are all simple on/off control signals to various parts of the transceiver.

Signals to the Receiver select wide or narrow bandwidth (Wideband) and AFC or manual tuning mode (AFC On). Narrowband is selected when the modulator is transmitting in long pulse and briefly during pulse length changing. AFC or manual mode is selected by the radar operator and is part of the control message sent from the Display.

Modulator signals MP and SP are used to set the pulse length as requested by the radar operator:

- SP set to 0V indicates short pulse operation
- MP set to 0V indicates medium pulse operation
- Both SP and MP set to +5V indicates long pulse operation.
- SP and MP both set to 0V is an illegal state and will not happen in normal operation.

Turndown enable is used to reduce the heater current in the magnetron and is only set when an S-Band magnetron is fitted and is transmitting in long pulse.

The control signals PM On/Off and PM Tx/Rx are used to switch the Performance Monitor on and to switch it between system test mode and receiver test mode.

TU Enable is the control signal fed to the Motor Drive PCB to start the antenna rotating. When the operator selects transmit, the TU Enable signal is activated to start the antenna rotating.

Once the antenna has done one complete revolution transmission is started. When standby is selected, transmission is immediately halted and, after one complete revolution of the antenna, TU Enable is disabled.

Optional I/O

There are several optional I/O signals for use with Special Options variants of the PCB:

- Pre-trigger (as describe in the section on triggers)
- External Trigger Input
- Radar Inhibit.

The External Trigger input is used when the modulator needs to be triggered from an external source rather than the Trigger PCB. Trigger signals fed to this input are PRF limited to prevent damage to the modulator. Radar Inhibit is a method of inhibiting transmission without using the appropriate command in the serial message. An active signal at this input will cause the microcontroller to inhibit transmission within one trigger pulse at either of the internal PRFs.

Built In Self Test (BIST)

The microcontroller performs a number of self-test operations and reports the results to the Display as part of the serial message link.

Error situations that are monitored in the transceiver are:

- Serial message corruption
- Loss of Display messages
- Loss of Heading Marker signal
- Loss of either Charge or Modulator Trigger
- Magnetron arcing

Error situations will in all cases cause the microcontroller to inhibit transmission until the error has been cleared. The other signals that are monitored and sent directly to the Display without further action by the microcontroller are the power supply lines and magnetron current as described in the section on analogue inputs.

Test Modes

There are two test modes for the Trigger PCB. The production test mode is used solely during production testing of the PCB and is initiated by fitting the test link LK4. This must only be done on the production test bed as connecting this link when incorporated into a transceiver could lead to unpredictable and possibly dangerous operation.

The second test mode, of use to service engineers, can be initiated by fitting the two links LK5 and LK6 to position 2-3. When in this mode the transceiver can be removed from the turning unit, reconnected to the Display below decks (with suitable test cables) and run as per normal operation. A dummy load MUST be connected to the RF output. Since the Transceiver has been removed from the Turning Unit and the Pulse Bearing PCB outputs, the bearing and heading marker information normally required for Trigger PCB operation is simulated on a section of test circuitry on the Trigger PCB.

TRANSCEIVER POWER SUPPLY (S-Band)

General Information

The power supply is an AC to DC inverter that generates the supplies for the Transceiver. The inverter is housed on a single board and is powered by an AC supply of nominal 115V or 230V in the frequency range 47-64Hz.

The power unit uses a boost converter front-end to provide a regulated high voltage DC to a flyback converter providing the output supplied. Some of these supplies use additional switch mode converters to provide regulated outputs.

The outputs supplied by this power supply are:

- variable –600V;
- +30V;
- +20V;
- magnetron heaters (via further regulator, +12V, -12V and +5V); and
- +50V for the Motor Drive PCB (for the X-Band Turning Unit variant).

The power unit has the following features:

- -600V adjustable over the range -550V to -650V for control of magnetron current via modulator.
- Output short circuit protection.
- Universal input from 95V to 276V without tap changing. Power factor corrected providing a PF of better than 0.9.

The opto-coupler detects the presence of a serial data stream from the display at PLTH 11, 12 and switches the flyback converter on. On detection of the data stream the photo-transistor in U5 is turned on, pulling down the gate of Q2 below its threshold voltage. Q2 turns off allowing the compensation pin 1 of U4 to lift enabling output of the IC U4. In the PSU off state Q2 is held on by current in R37 from Vcc.

For test purposes the PSU can be turned on in the absence of a serial data stream by linking 1-2 on LKA.

Note – After the mains supply is applied to the PSU board, the Power Factor Correction (PFC) circuit starts and generates 390V. While mains power is applied, the PFC is active and cannot be manually switched off. The start circuitry only controls the flyback converter and so High Voltage DC is present on primary power components whenever mains is present on the board. **This fact should be noted when servicing the Transceiver**.

MODULATOR PCB (S-Band)

Functional Description

The principal function of the Modulator PCB is to generate an 8kV, 8A negative pulse to drive the cathode of the magnetron. An SCR is used to resonantly charge a Pulse Forming Network (PFN) to –1200V from the –600V Modulator HT supply. The Charge Trigger starts the charging cycle. The number of sections of the PFN is selectable by the replays controlled by the Pulse Length Control Lines. The number of sections of the PFN used defines the length of the output pulse.

At a define time after the PFN is fully charged it is discharged by three series-connected Insulated Gate Bipolar Transistors through a pulse transformer. The Modulator Trigger starts the discharge. The Pulse Transformer, which has a set-up ratio of 12:1, transforms the resulting pulse to 8kV. A saturable reactor connected across the primary of the pulse transformer speeds up the back edges of the medium and short pulses.

Other functions include:

- regulating the magnetron heater supply;
- monitoring a spark gap to ensure correct operation of the magnetron; and
- generation of a timing reference for the Radar Trigger.

Inputs to the Modulator PCB

- -600V Modulator HT Supply
- +20V Modulator Trigger Supply
- +16V - +27V Magnetron Heater Bulk Supply
- +12V
- -12V

Short Pulse Control Line	When 0V selects short pulse.
Medium Pulse Control Line	When 0V selects medium pulse.
Charge Trigger	Starts charging of Pulse Forming Network. Typically 1Amp current pulse.
Modulator Trigger	Starts discharging of Pulse Forming Network. Typically 4μs, 3.5V positive pulse.
Turn Down Enable	DC voltage controls the magnetron heater voltage. 0V on long pulse, 3.5V Standby Medium and Short Pulse.

Outputs from the Modulator PCB

Primary sample	Positive pulse sample from pulse transformer used to initiate Radar Trigger. Typically 40V amplitude.
Magnetron current sample	A DC voltage proportional to the magnetron current derived from the secondary of the pulse transformer. Typically +2.5V.
TX Active	A signal that is normally 0V that rises to >2.5V if the spark gap operates continuously for 2 seconds. This signal is used by the Trigger PCB to indicate a transmitter fault to the display.
HT Sense	Sample of Modulator HT Supply fed to Trigger PCB for inclusion in BITE message sent to display.
TX Define	Link settings used to define modulator type to Trigger PCB. 0V or 3.5V dependant on link settings.

Magnetron Heater Supply

The magnetron heaters are derived from the Magnetron Heater Supply at PLVD1 and PLVD2. This supply may vary between 16V and 27V.

The setting of link LK1 (fitted to the Modulator PCB) configures the Modulator PCB for the intended magnetron. Refer to Figure 6.19 'Link Settings – Modulator PCB', in this chapter, for further information.

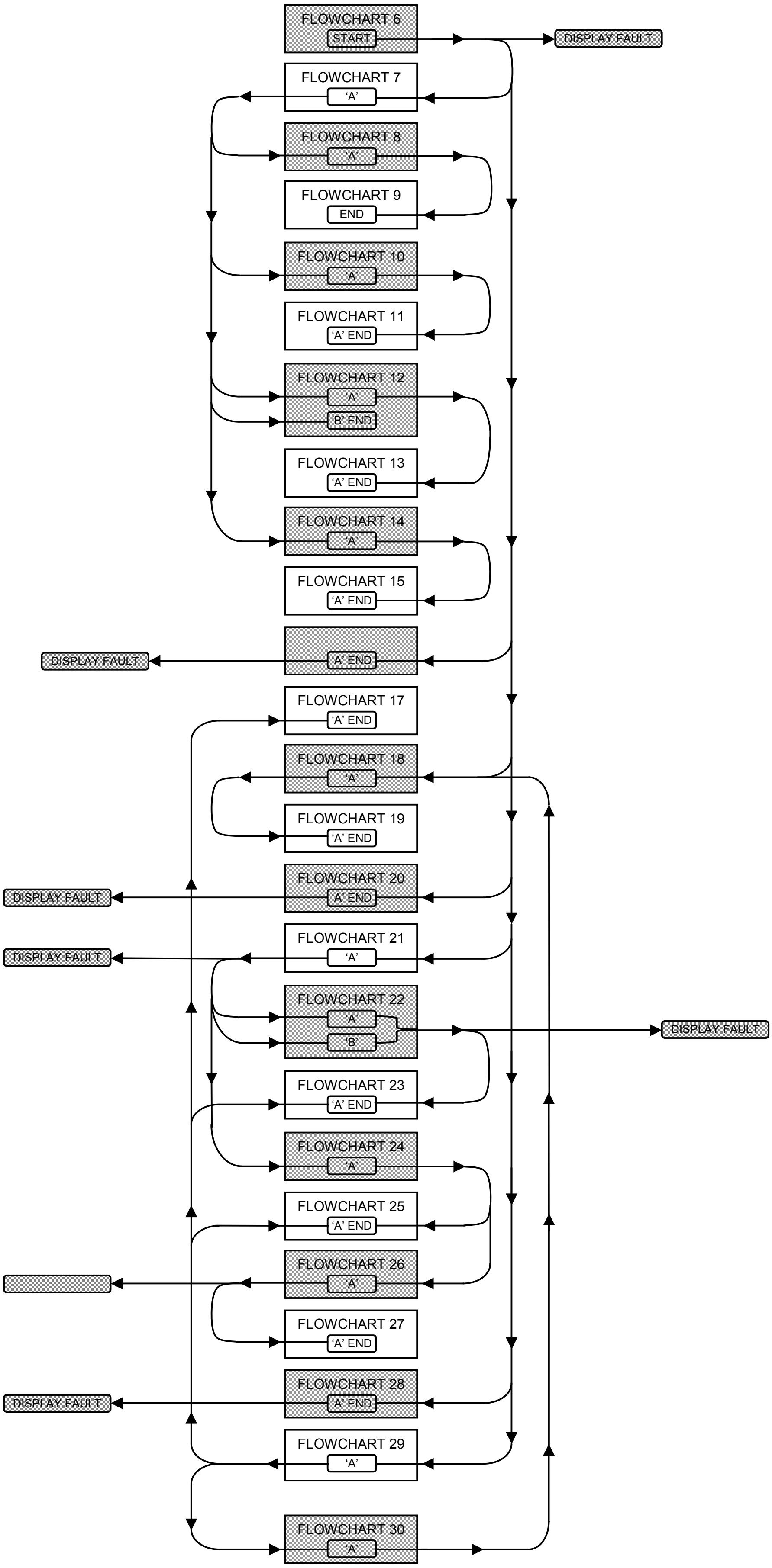
!WARNING!
On no account should the heater voltage be measured while the Transceiver is transmitting.

System	Mode	Required Magnetron heater voltage (measured between TSJ1 and TSJ2)
10kW X-Band	Standby, Short Pulse, Medium Pulse and Long Pulse	6.1V
25kW X-Band	Standby, Short Pulse and Medium Pulse	6.1V
	Long Pulse	Can be reduced to 5.1 V depending on the type of magnetron fitted
30kW S-Band	Standby, Short Pulse and Medium Pulse	6.1V
	Long Pulse	Can be reduced to 5.1 V depending on the type of magnetron fitted

2.4.2 Fault Isolating Flowcharts (S-Band Scanners)

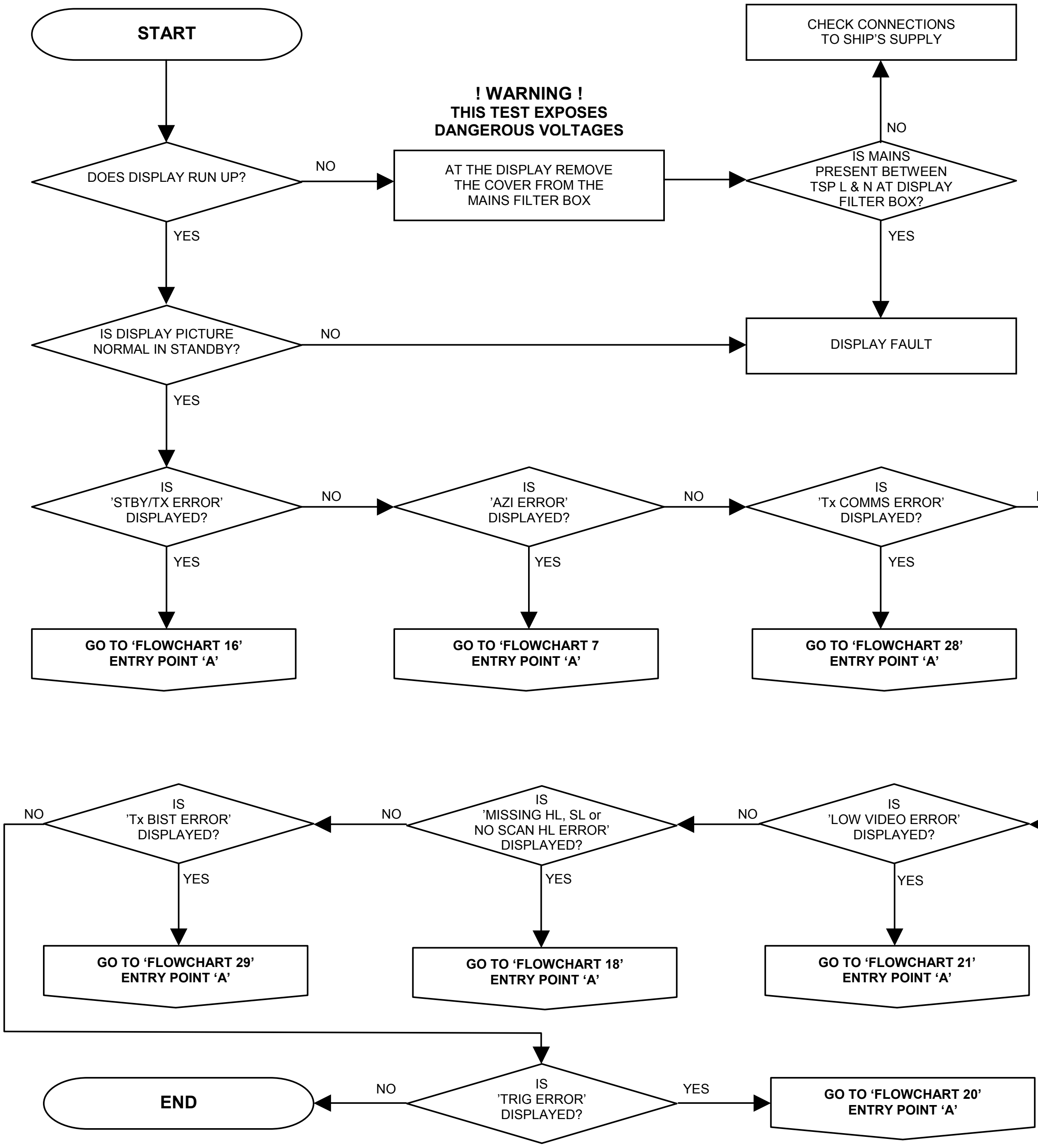
Flowcharts for isolating faults on S-Band Scanner Units are given on the following pages. Flowchart 5 shows the overall flow through Flowchart 6 to Flowchart 30 .

FLOWCHART 5 OVERALL FLOWCHART – S-BAND SCANNER FAULTS

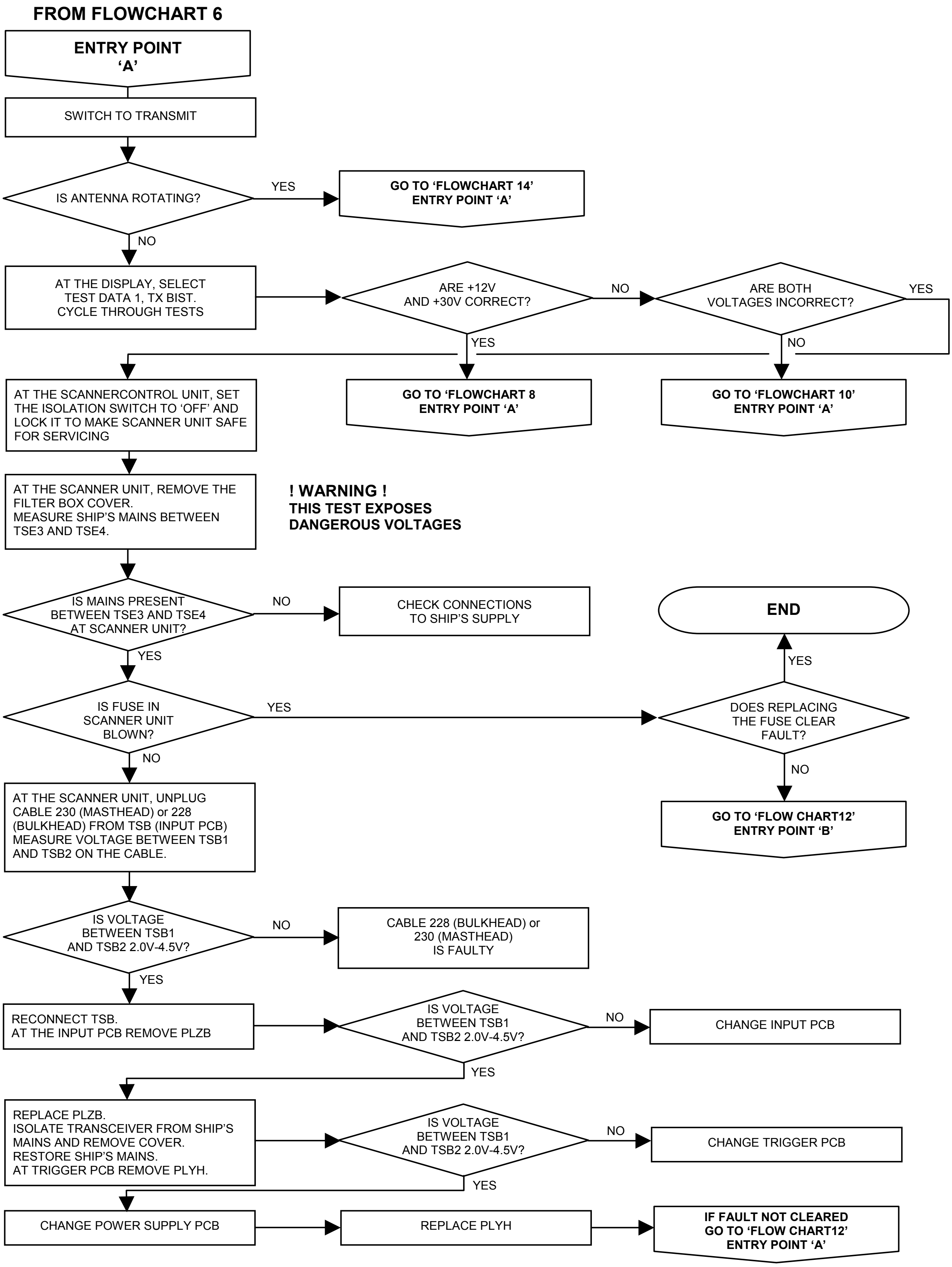


FLOWCHART 6 S-BAND SCANNER FAULTS

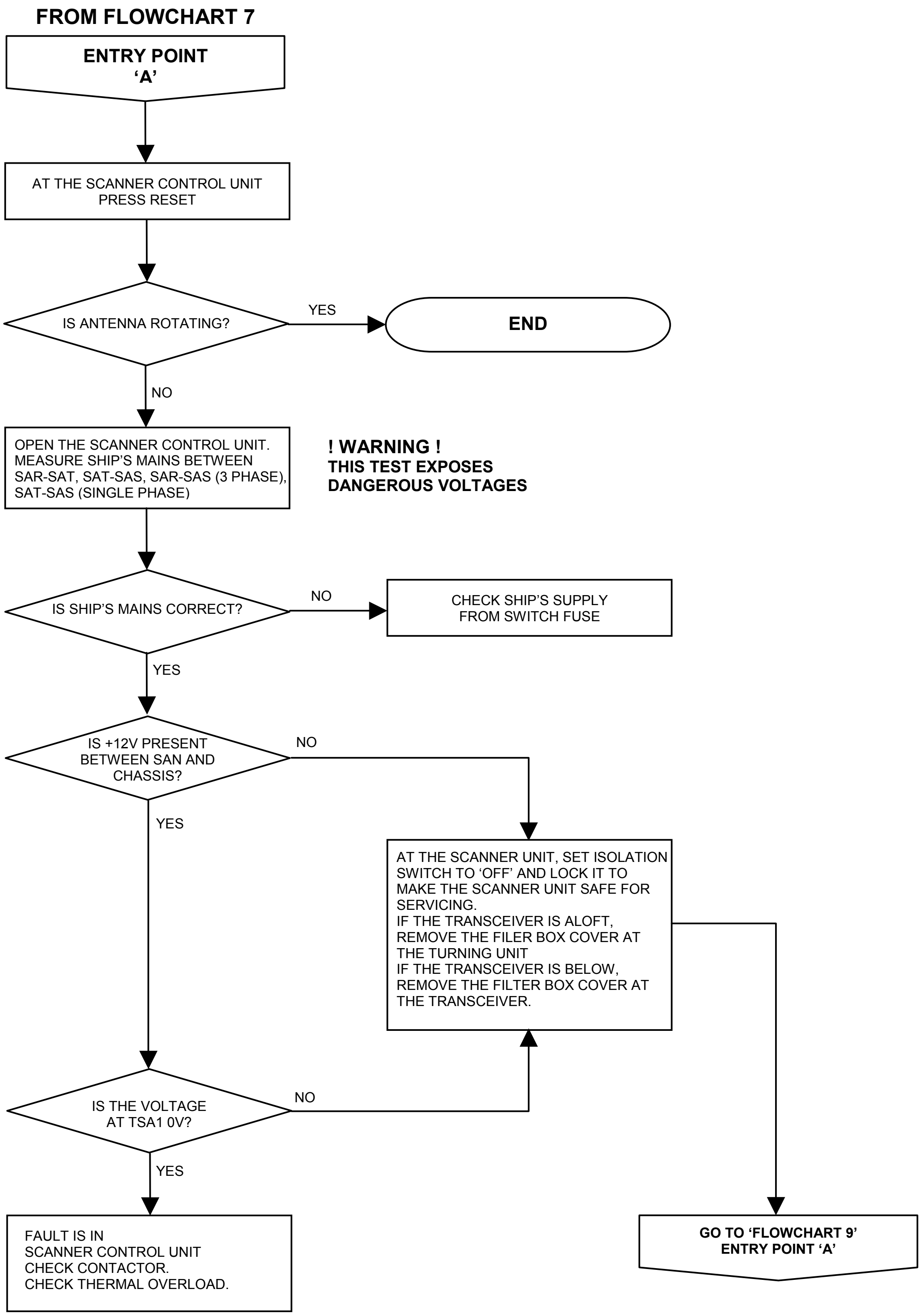
! WARNING !
When the covers are removed from the equipment, dangerous voltages are exposed.
Only qualified persons should work on the equipment when power is applied.
Always isolate the turning unit from the ship's supply before working on it.
Always isolate the transceiver from the ship's supply while removing or replacing the transceiver cover.



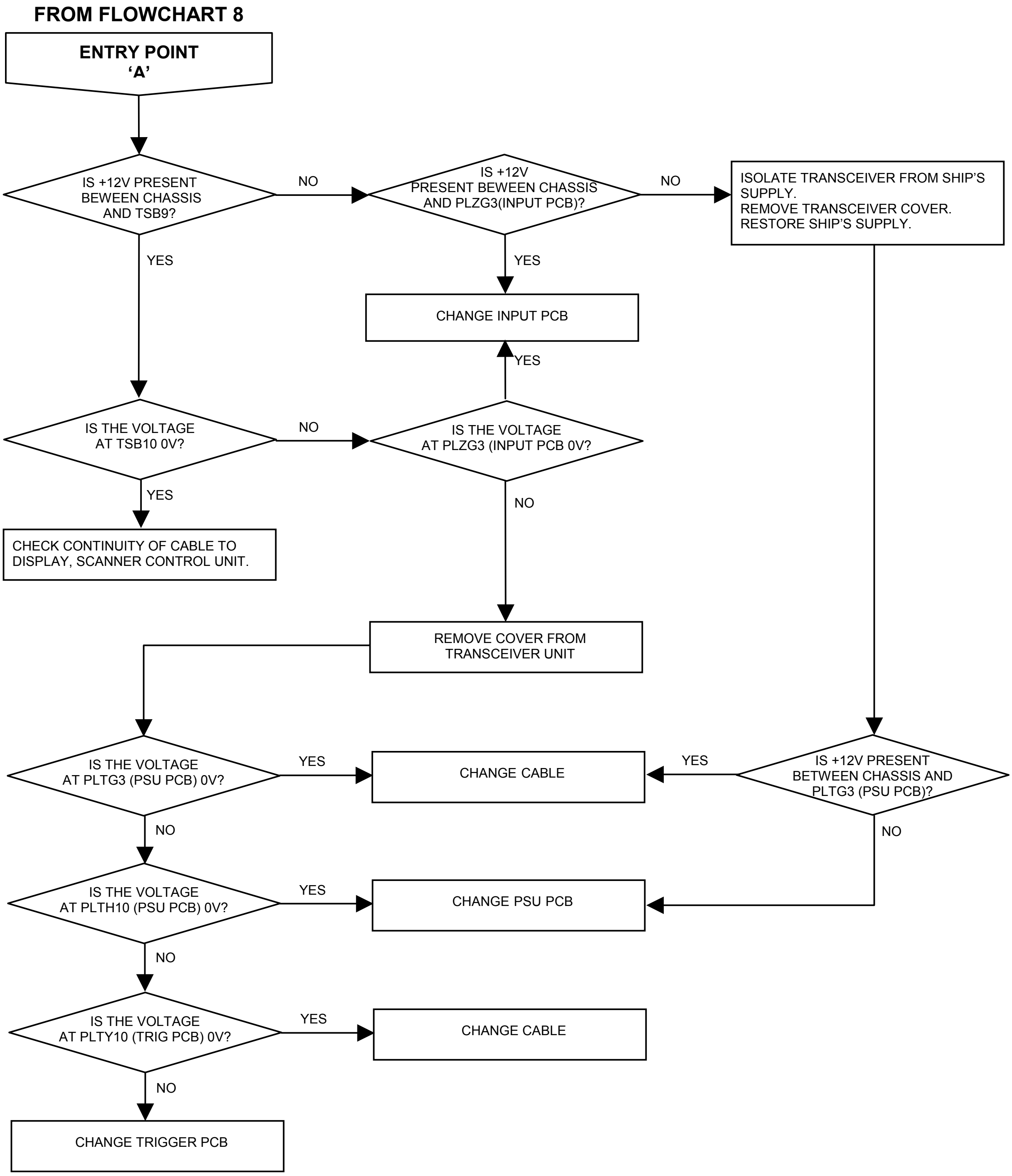
FLOWCHART 7 S-BAND SCANNER FAULTS ('AZI ERROR' SHOWN)



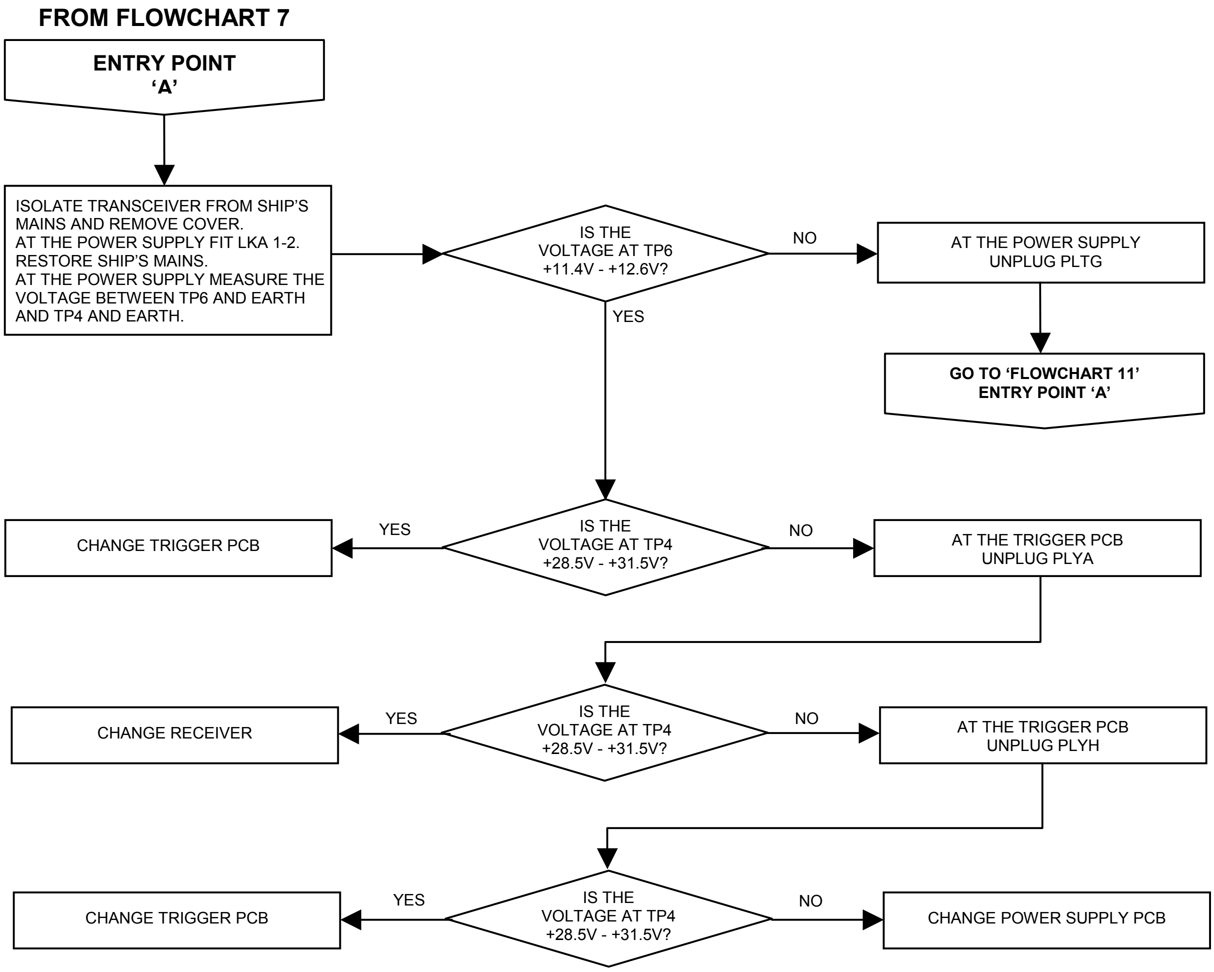
FLOWCHART 8 S-BAND SCANNER FAULTS



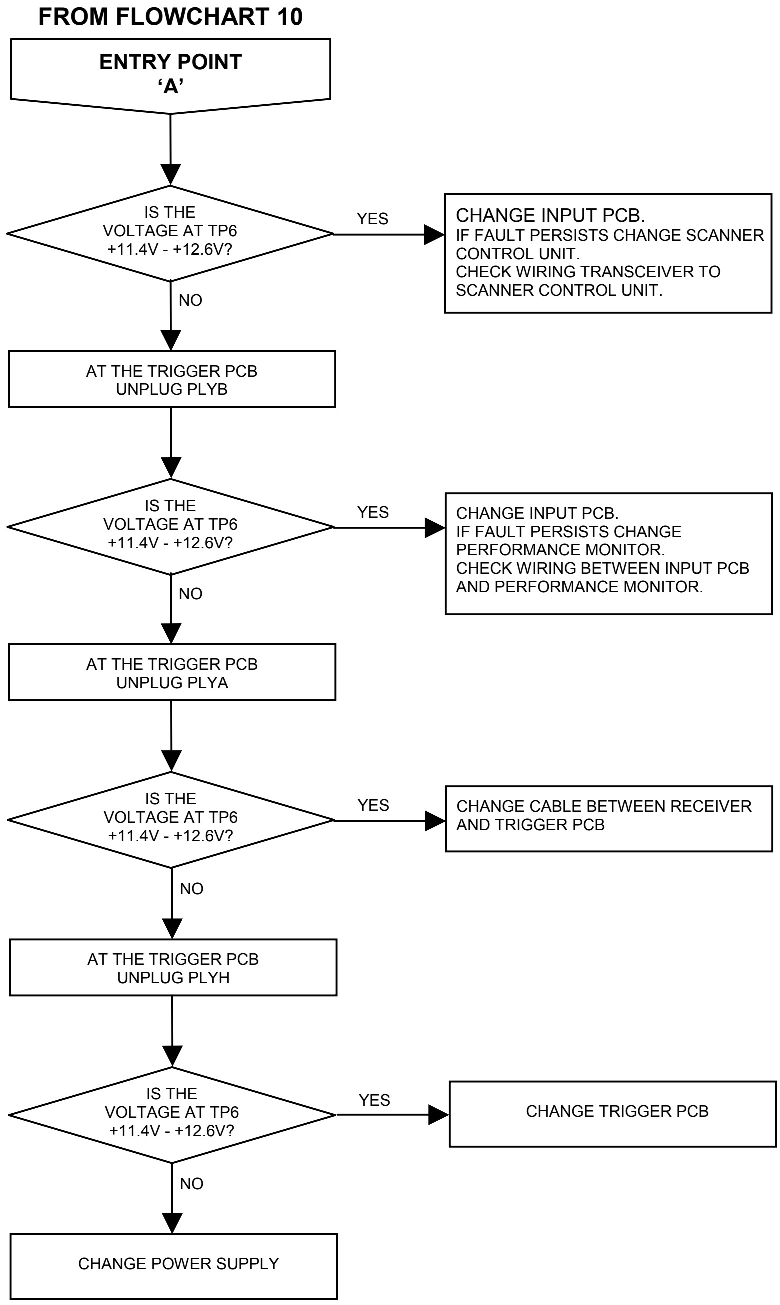
FLOWCHART 9 S-BAND SCANNER FAULTS



FLOWCHART 10 S-BAND SCANNER FAULTS

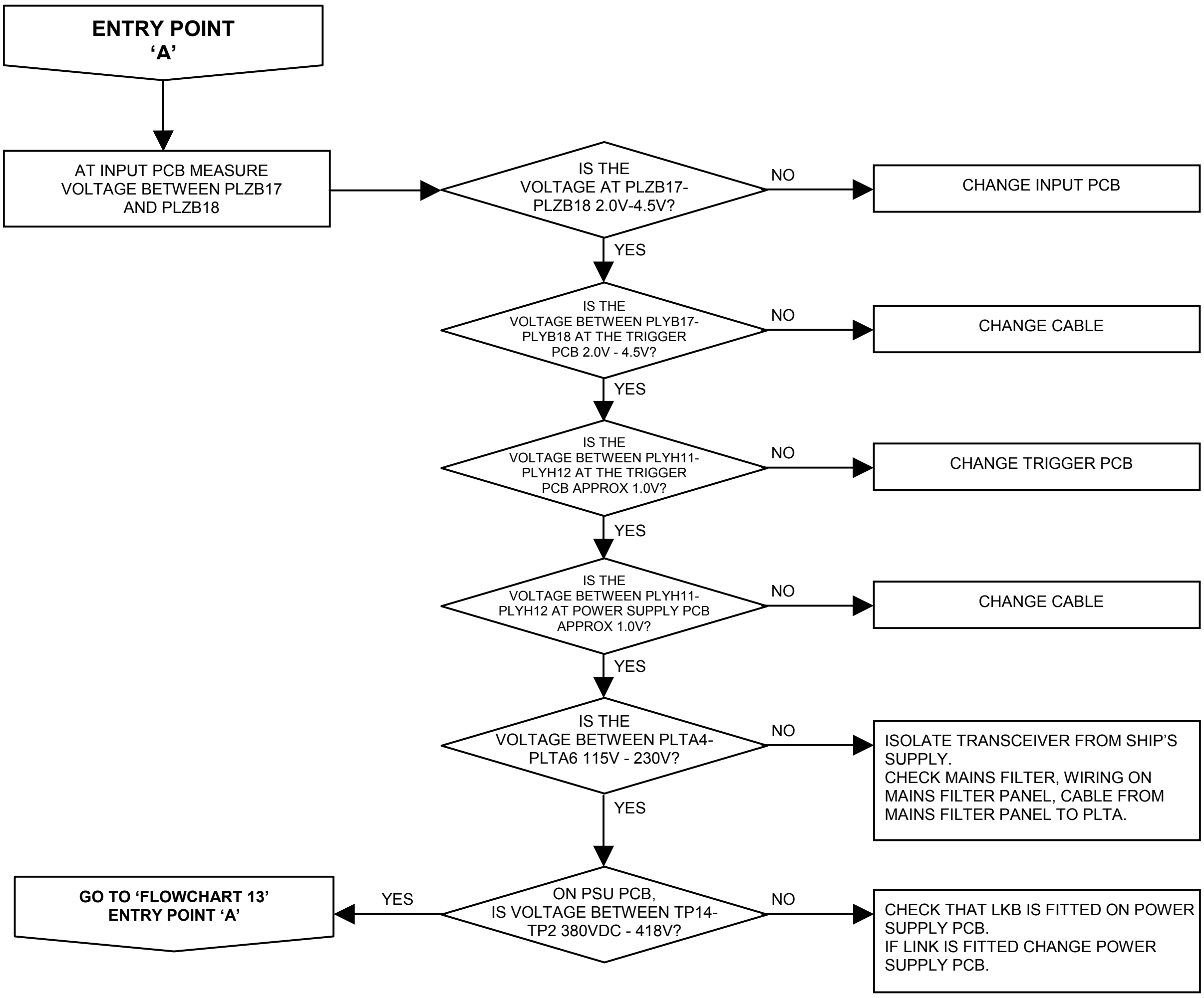


FLOWCHART 11 S-BAND SCANNER FAULTS

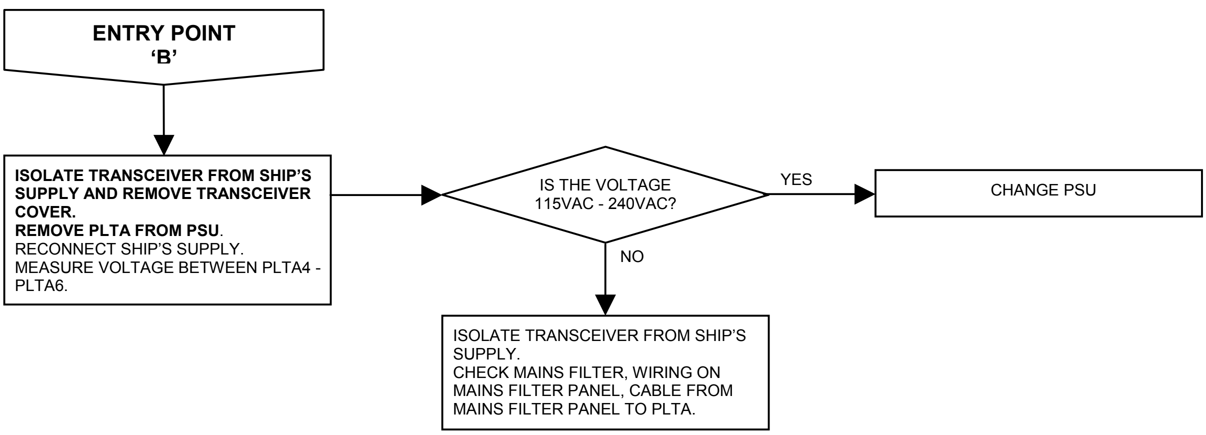


FLOWCHART 12 S-BAND SCANNER FAULTS

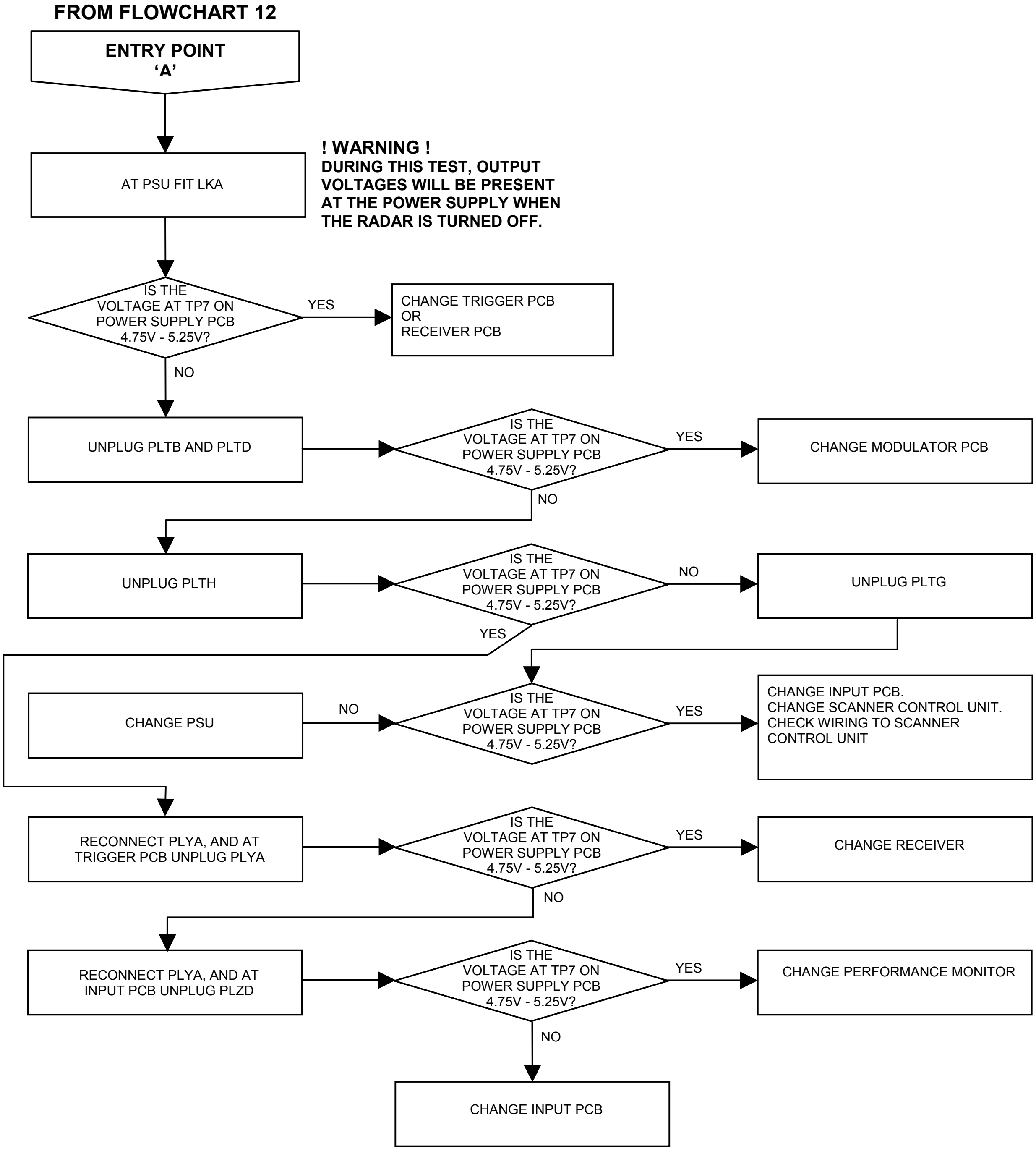
FROM FLOWCHART 7



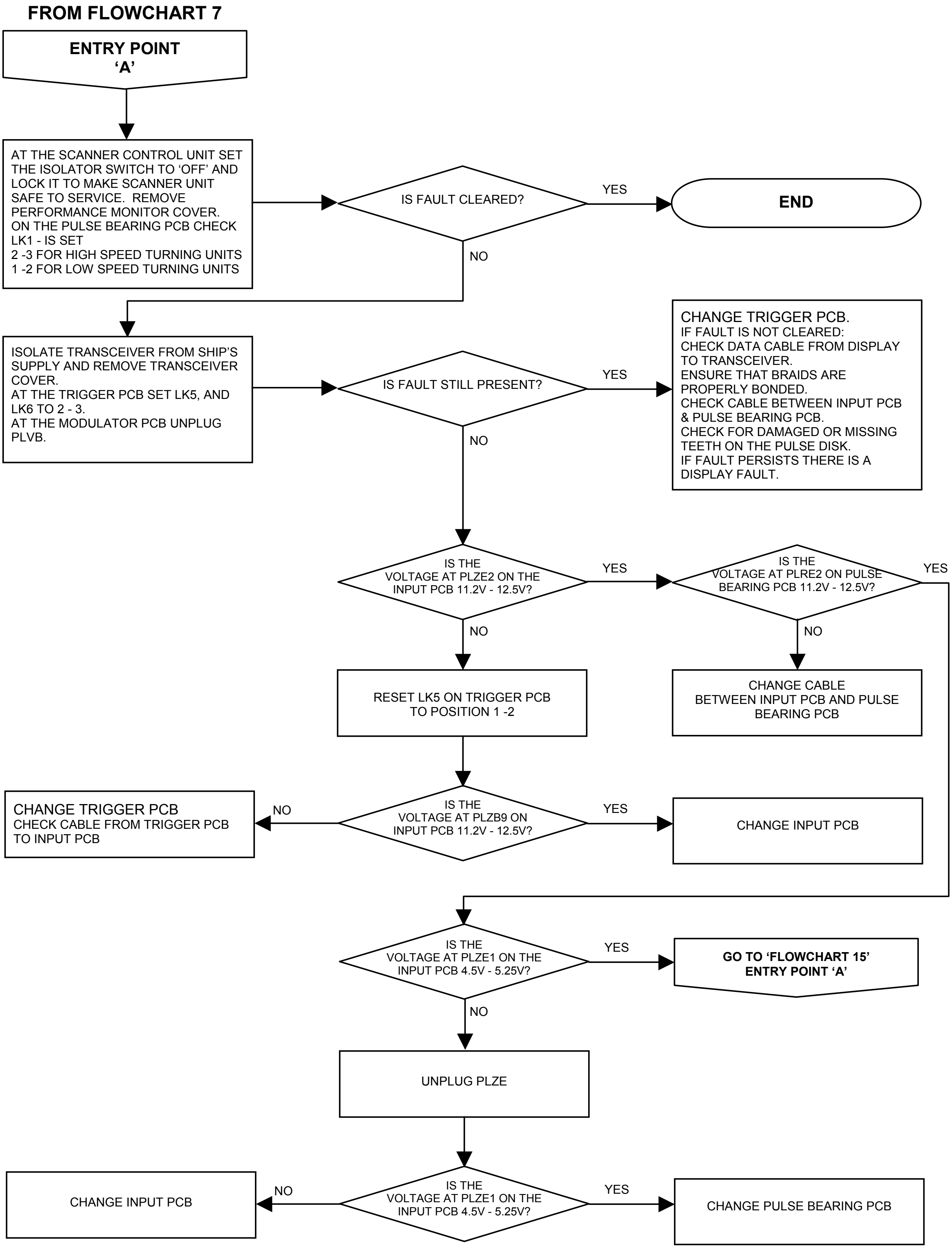
FROM FLOWCHART 7



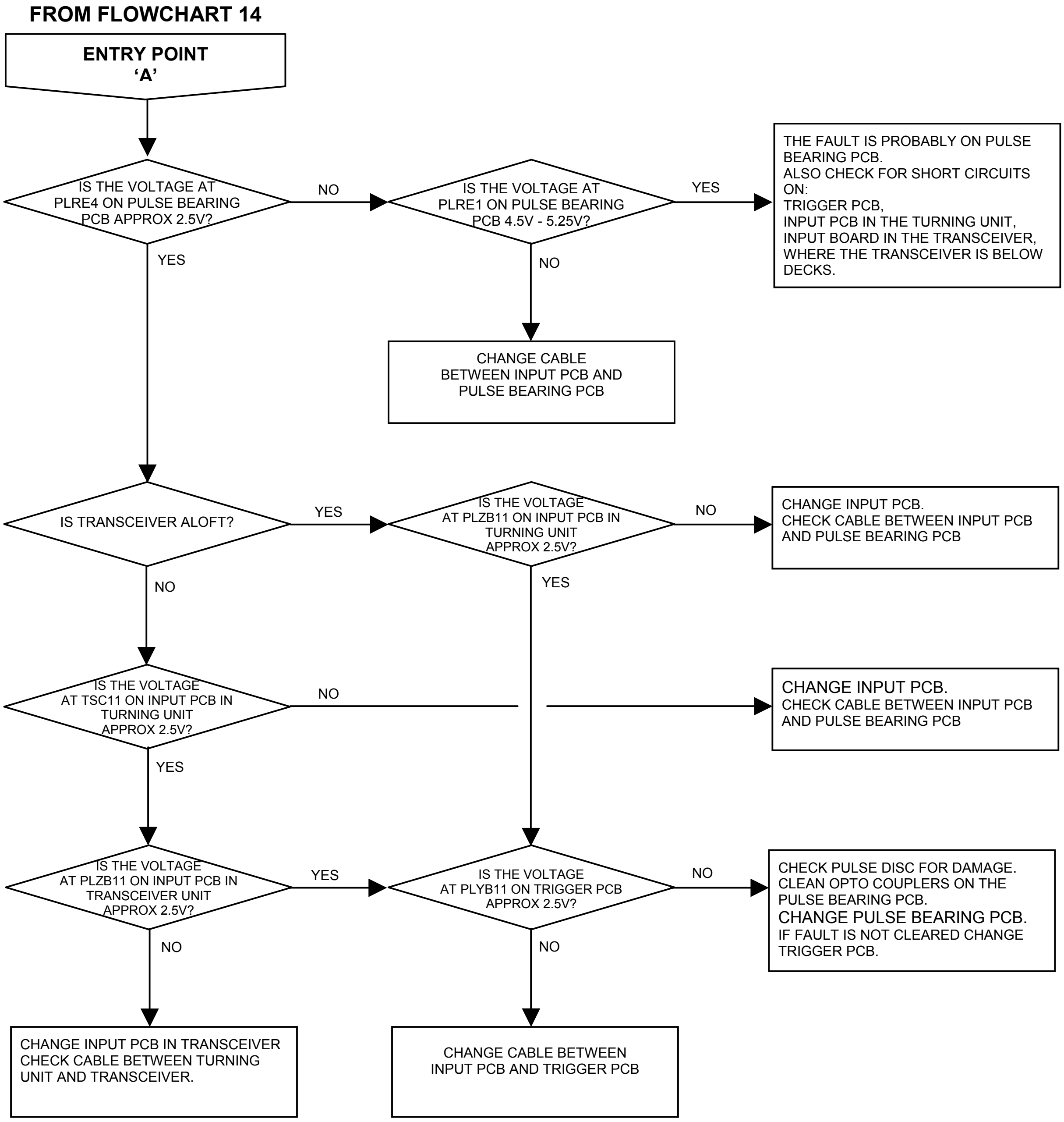
FLOWCHART 13 S-BAND SCANNER FAULTS



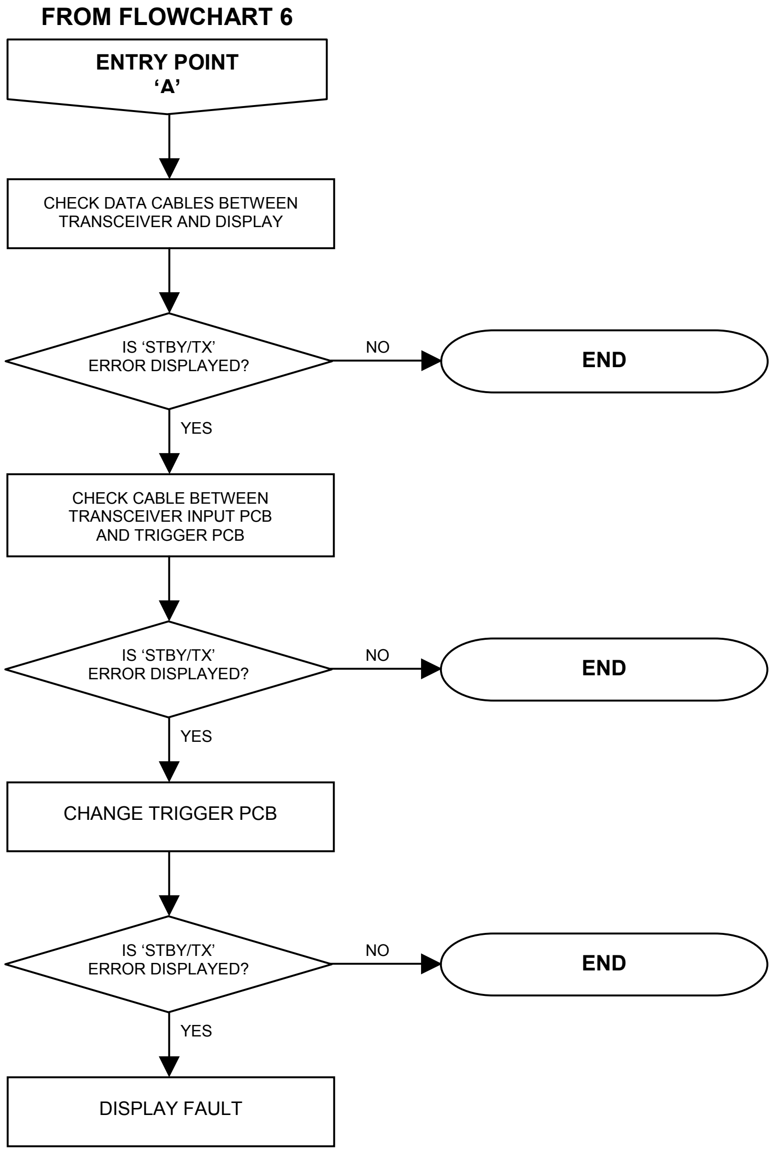
FLOWCHART 14 S-BAND SCANNER FAULTS



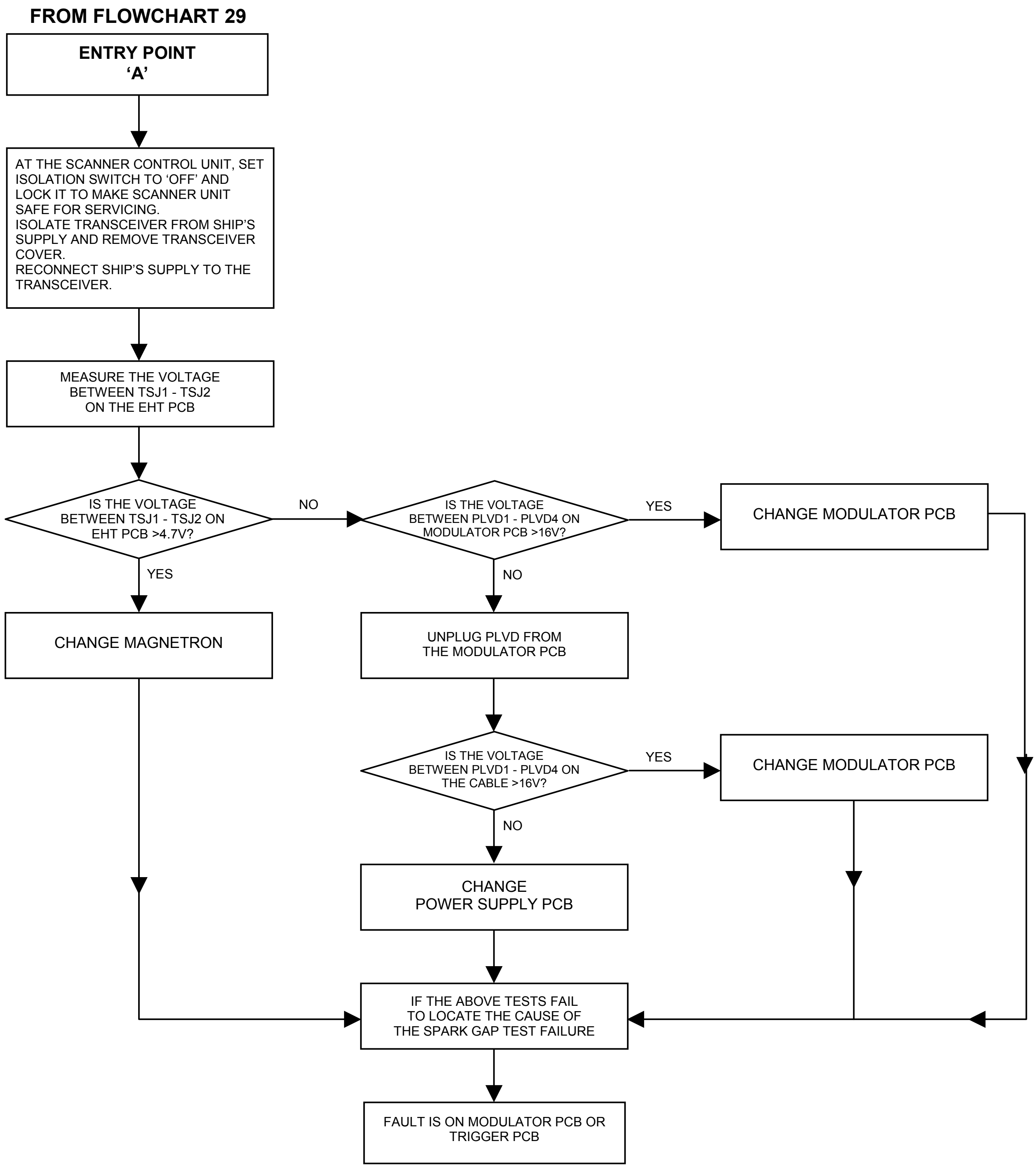
FLOWCHART 15 S-BAND SCANNER FAULTS



**FLOWCHART 16 S-BAND SCANNER FAULTS
('STBY/TX ERROR' SHOWN)**

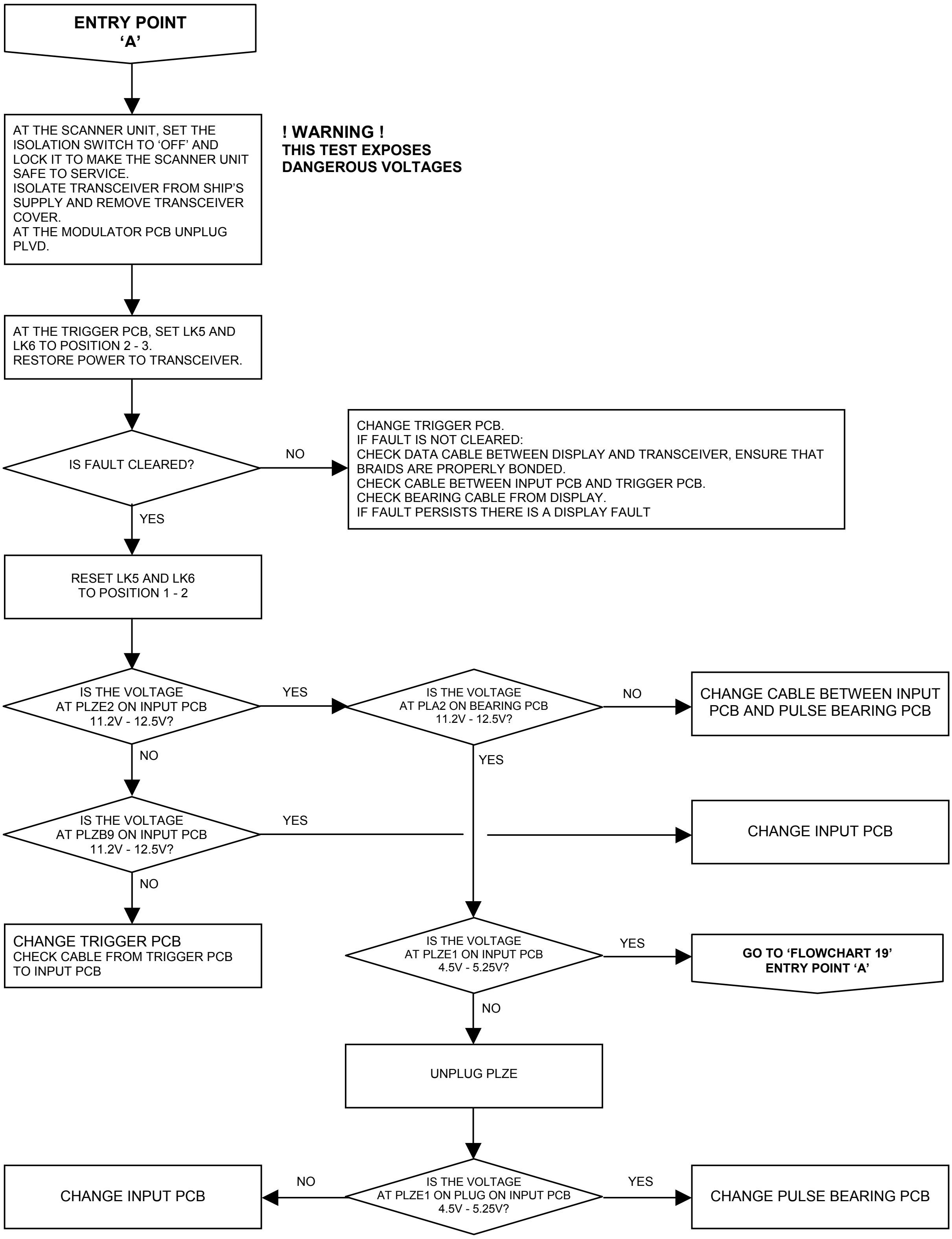


FLOWCHART 17 S-BAND SCANNER FAULTS ('SPARK GAP TEST' FAILURE)

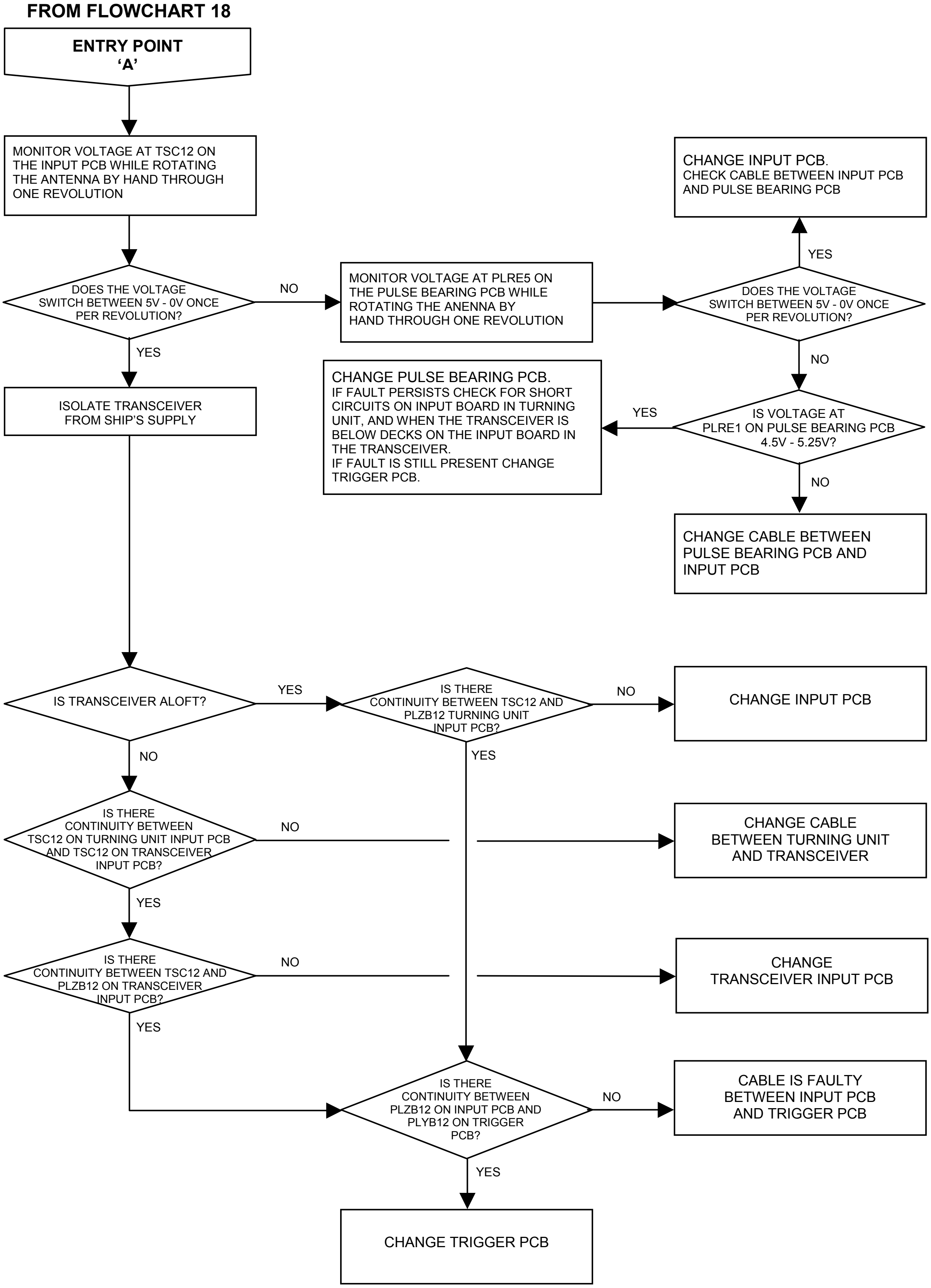


FLOWCHART 18 S-BAND SCANNER FAULTS ('MISSING HMKR ERROR' SHOWN)

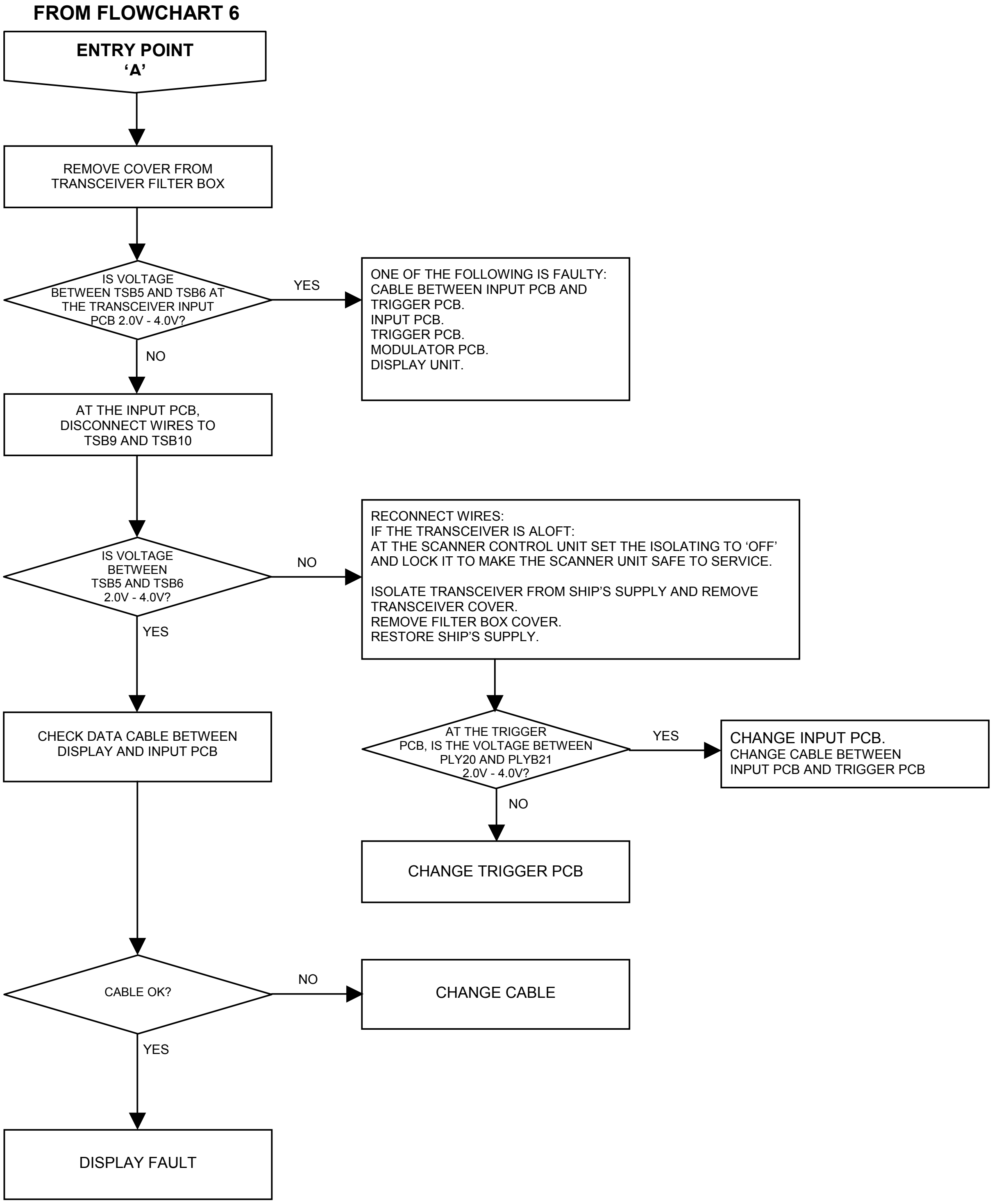
FROM FLOWCHART 6 OR 30



FLOWCHART 19 S-BAND SCANNER FAULTS

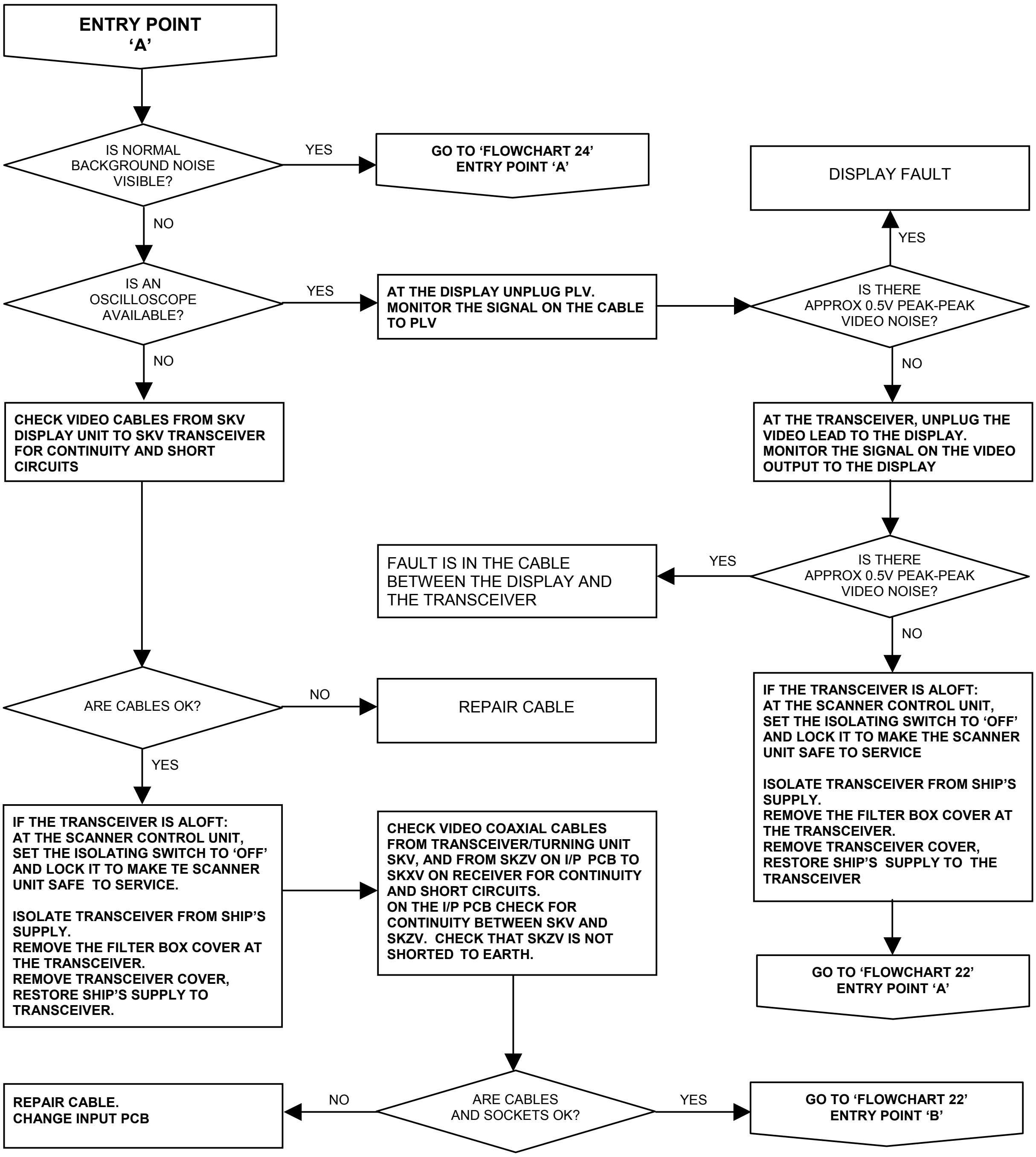


FLOWCHART 20 S-BAND SCANNER FAULTS ('TRIGGER ERROR' SHOWN)

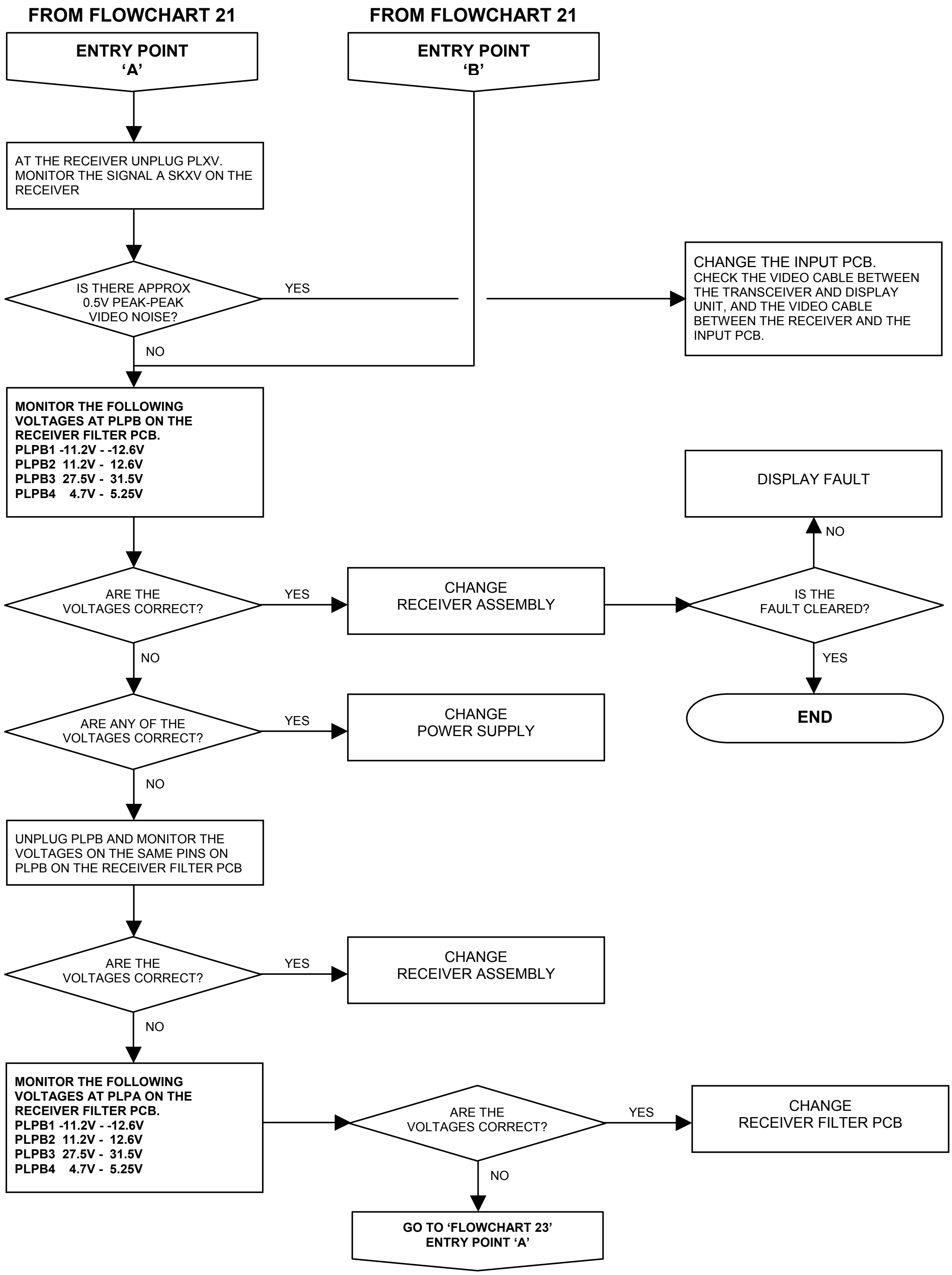


FLOWCHART 21 S-BAND SCANNER FAULTS ('TX ERROR'/'LOW VIDEO ERROR' SHOWN)

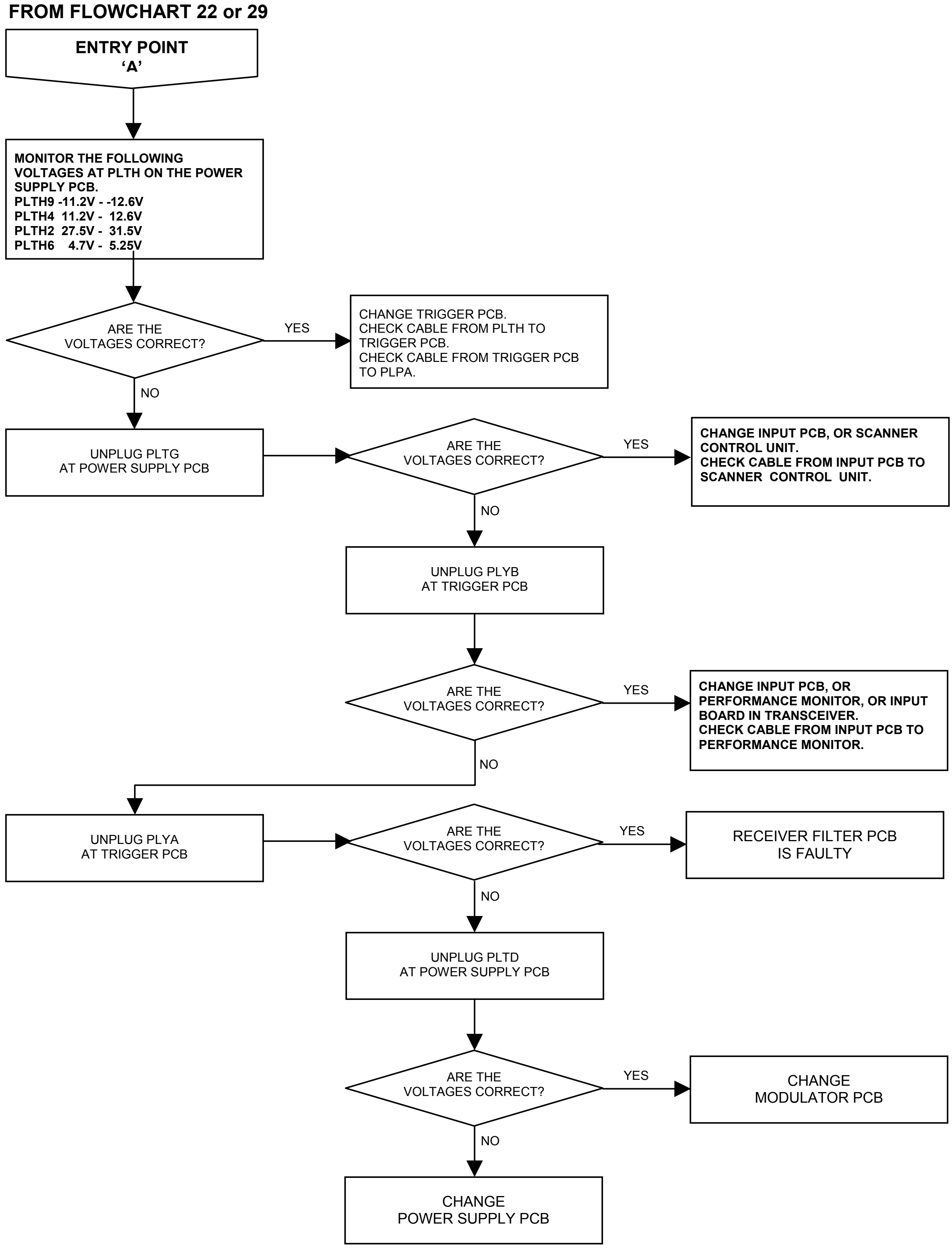
FROM FLOWCHART 6



FLOWCHART 22 S-BAND SCANNER FAULTS

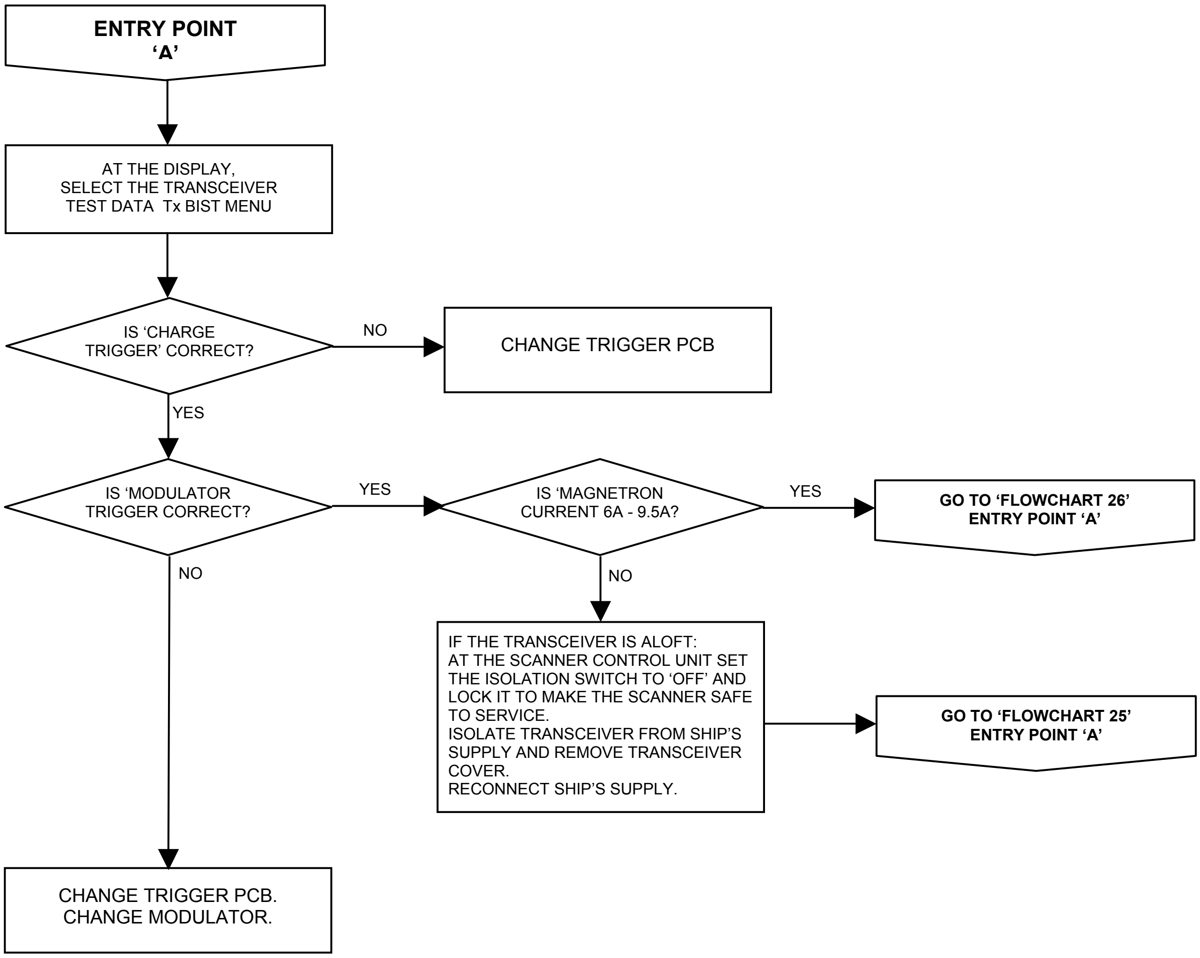


FLOWCHART 23 S-BAND SCANNER FAULTS



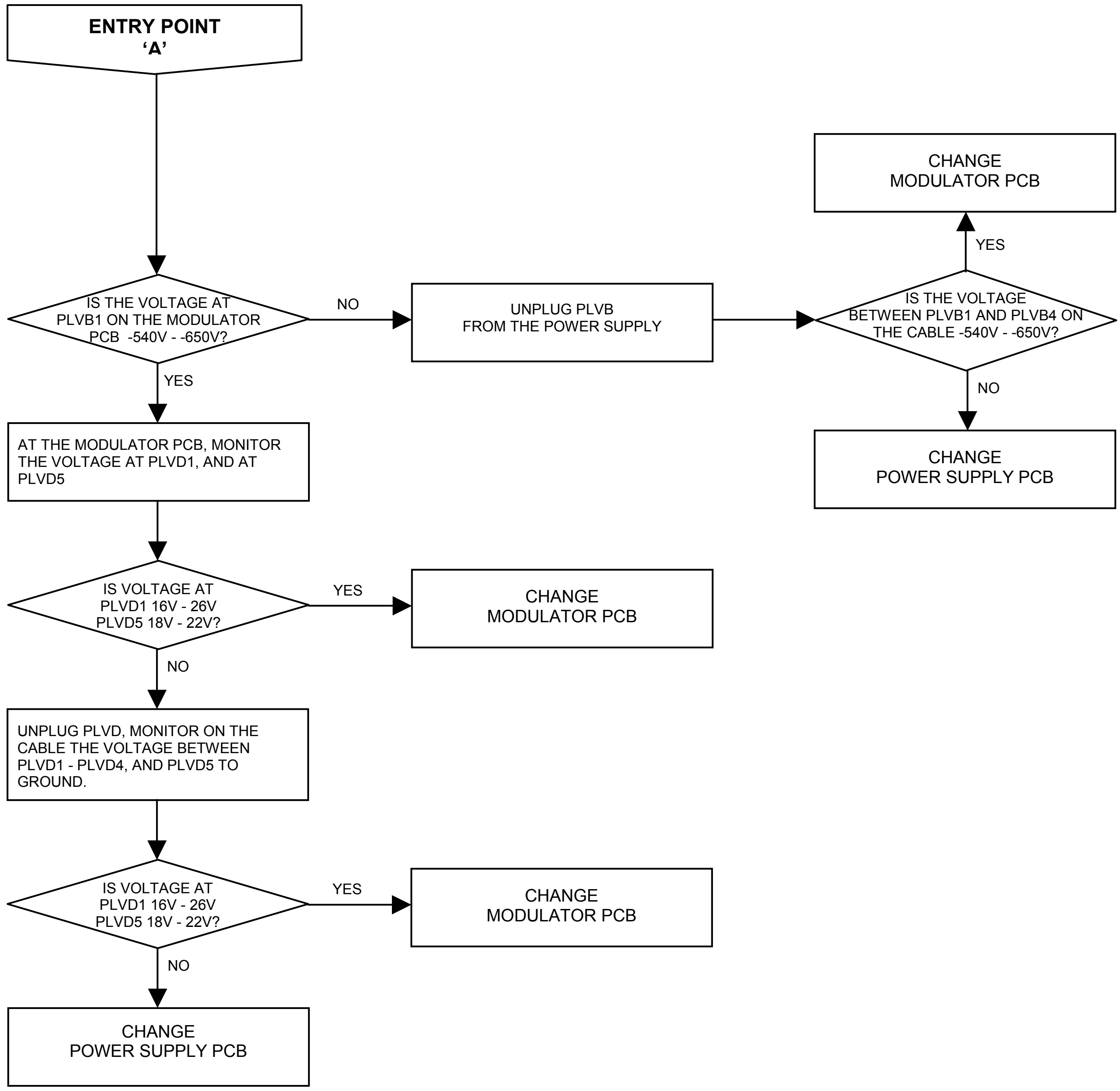
FLOWCHART 24 S-BAND SCANNER FAULTS ('LOW VIDEO ERROR' SHOWN)

FROM FLOWCHART 21

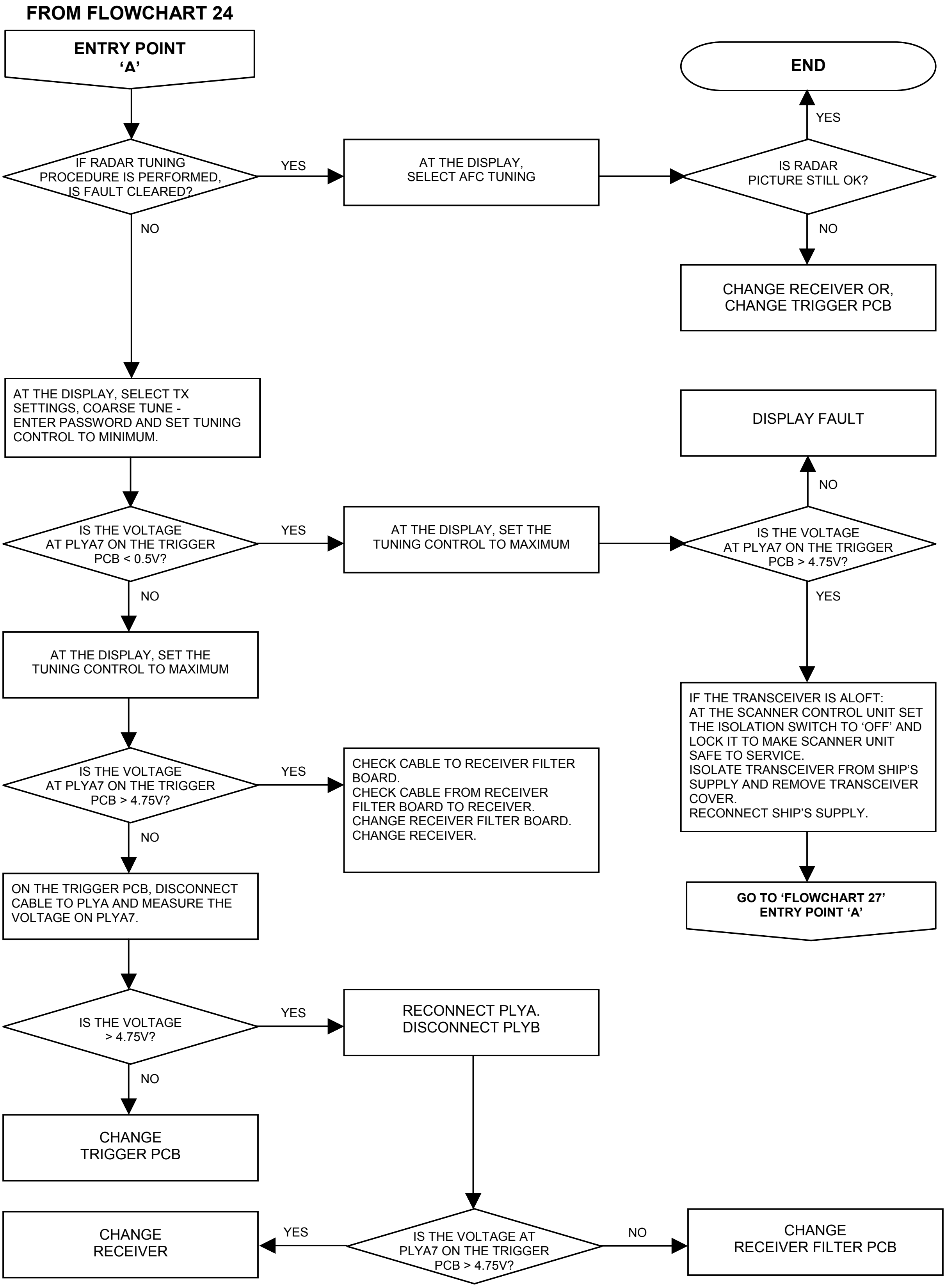


FLOWCHART 25 S-BAND SCANNER FAULTS

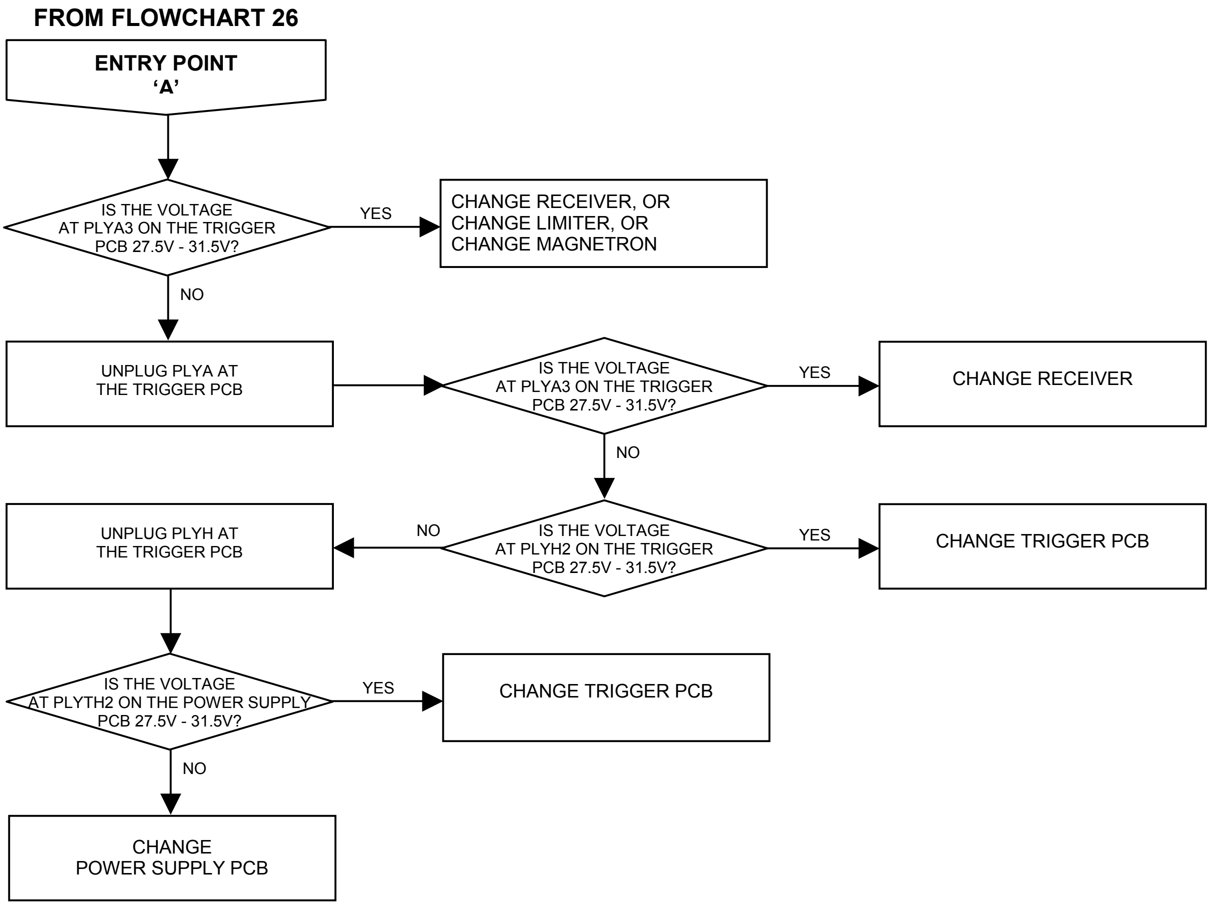
FROM FLOWCHART 24 OR 29



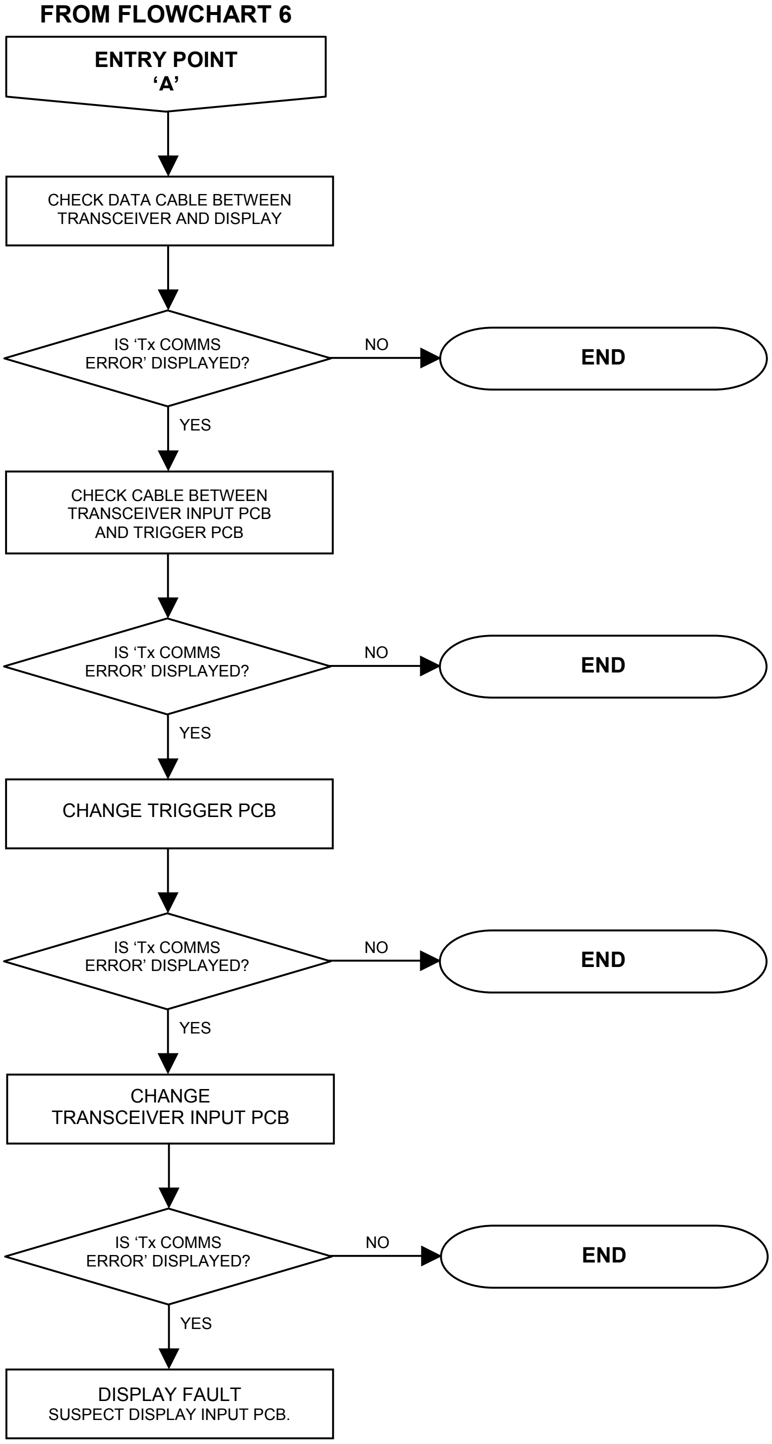
FLOWCHART 26 S-BAND SCANNER FAULTS



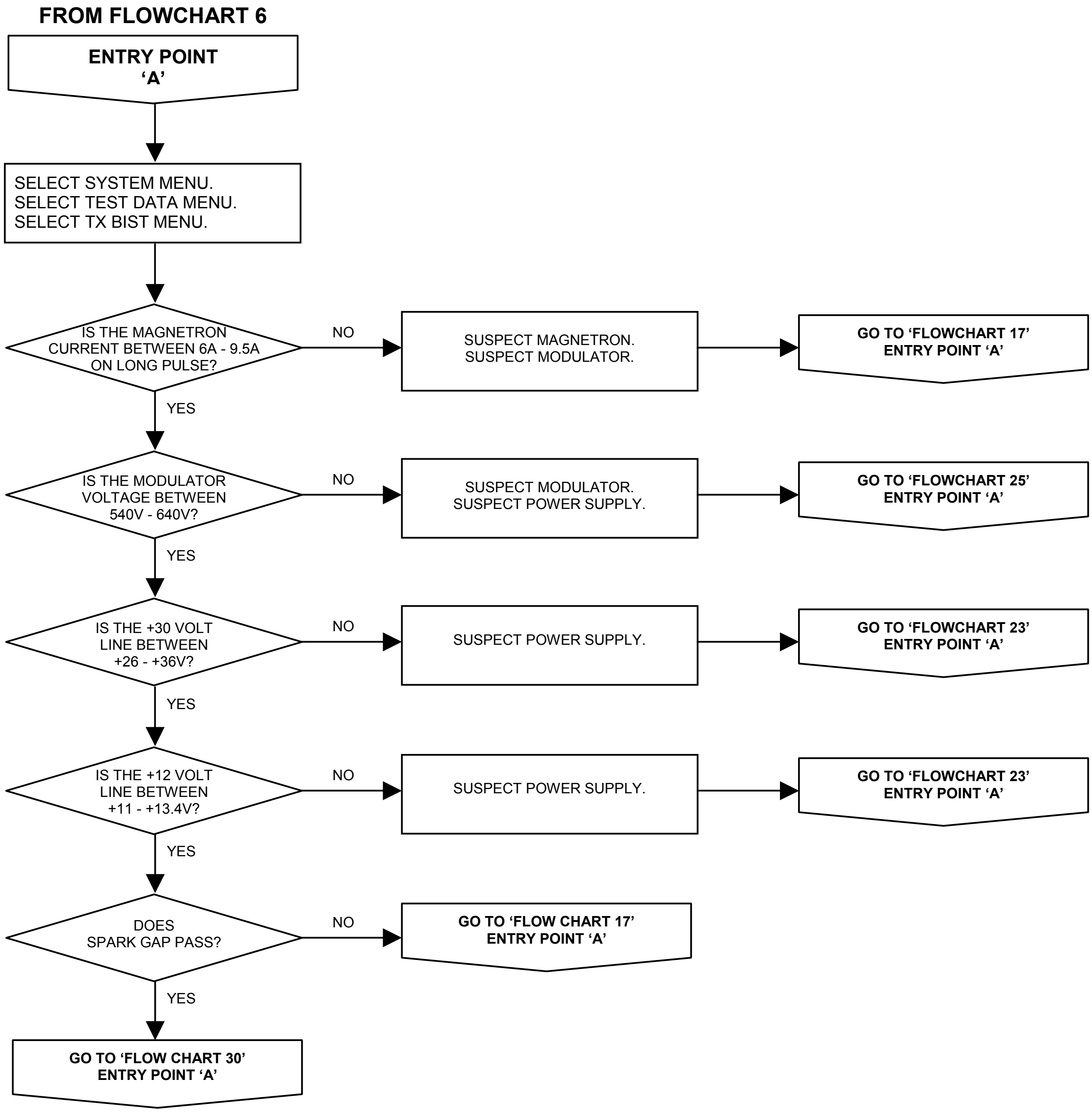
FLOWCHART 27 S-BAND SCANNER FAULTS



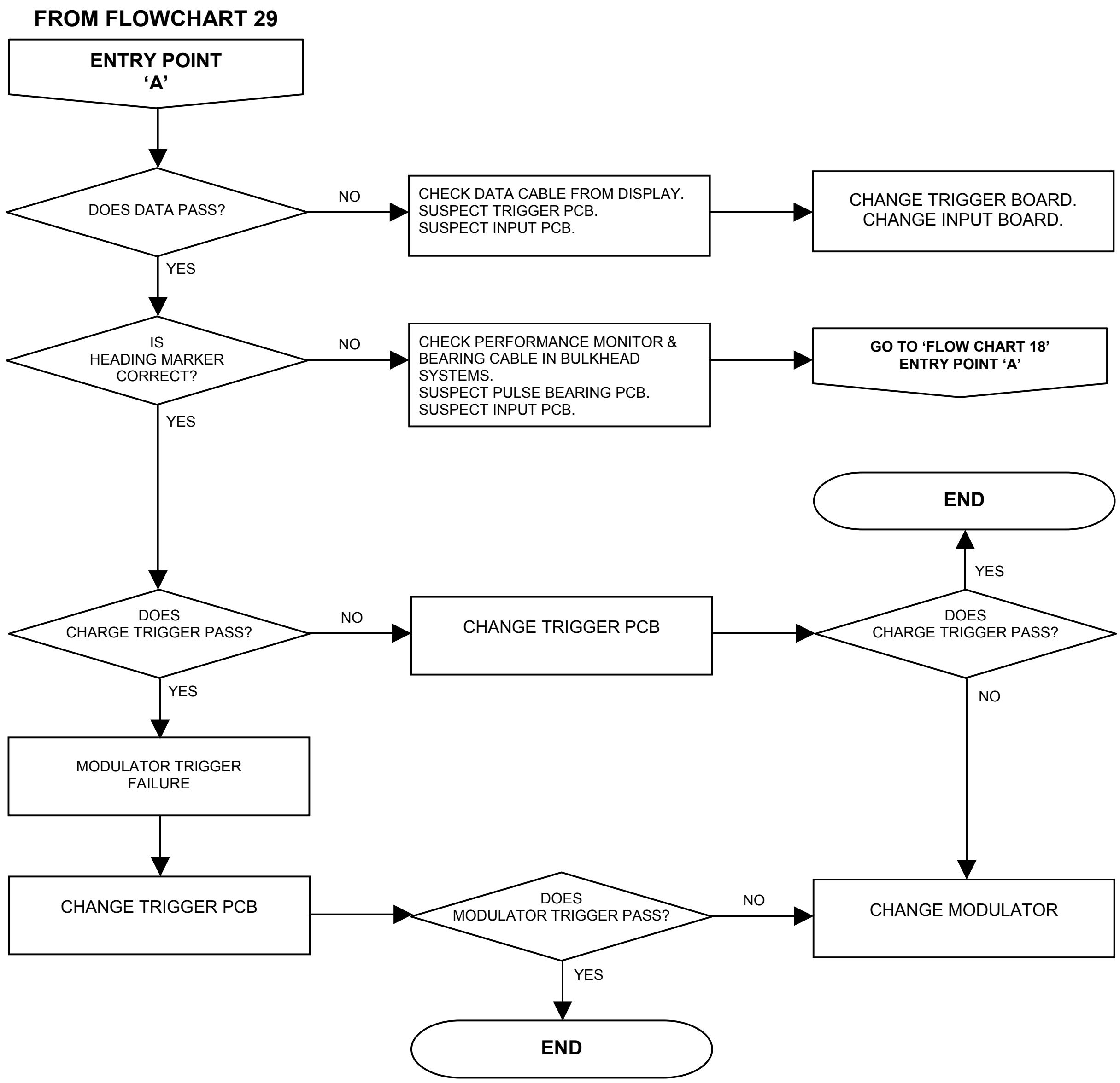
FLOWCHART 28 S-BAND SCANNER FAULTS ('TX COMMS ERROR' SHOWN)



FLOWCHART 29 S-BAND SCANNER FAULTS ('TX BIST ERROR' SHOWN)



FLOWCHART 30 S-BAND SCANNER FAULTS



2.5 X-Band Scanner Unit

2.5.1 Technical Description

There are two basic types of X-Band Scanner Unit:

- With an integral transceiver module.
- Without an integral transceiver.

Each type can have a number of variants dependent on motor supply and the options that are fitted.

The Scanner Unit includes:

- an Antenna
- an antenna support casting
- a Turning Unit.

Included in the Turning Unit is:

- a motor and gearbox
- a Bearing and Heading Marker PCB
- an Input PCB
- a Performance Monitor and integral transceiver module (optional).

The Transceiver Unit includes:

- a base casting
- a cover
- a transceiver module
- an Input PCB.

Communication between the Transceiver and the Display is by means of a serial data link. Where a separate Transceiver Unit is used, an RF feeder (waveguide) is used to transfer the microwave energy between the Transceiver Unit and the Turning Unit.

The Scanner Unit and the Transceiver Unit are compatible with BridgeMaster Display Units if a Display Compatibility Unit is used.

Physical Arrangements

The Turning Unit is constructed from upper and lower aluminium castings. The upper casting is hinged at one end to the lower casting for service and installation. The motor, gearbox and drive assembly are bolted to the upper casting. The transceiver module, when fitted, is bolted to the upper casting and can be removed as a unit for below-decks servicing.

The terminal strips for the interconnecting cables to other units are under a screen cover on the base of the lower casting. The Performance monitor is housed beneath the upper casting and has a microwave transparent cover protecting it, fitted on the top surface of the upper casting.

Four M10 x 45 bolts are used to attach the Scanner Unit to the radar platform or wheelhouse roof. The Antenna Support Casting attaches the Antenna to the Turning Unit. This directly transfers the microwave signals between the Turning Unit and the Antenna.

Interconnections between the Scanner unit and other units in the system are made using screened cables. The exception is the Bulkhead system, where the microwave signals are carried between the Turning Unit and the Transceiver via a waveguide.

All the cables that enter the Scanner Unit through waterproof cables glands. These incorporate an EMC gasket that makes contact with the cable braid.

The separate Transceiver is designed to be bulkhead mounted and is attached using four M8 bolts, studs or screws (coachbolts).

TRANSCEIVER MODULE OVERVIEW (X-Band)

The transceiver module can be fitted in the Turning Unit, or mounted on a casting for below-decks bulkhead mounting as a separate unit.

The module consists of:

- the Modulator PCB
- a Power Supply PCB
- Trigger PCB
- the Receiver
- the microwave components.

Communication between the Transceiver Unit and the Display Unit is by means of two serial data links:

- one from the Transceiver to the Display Unit; and
- one from the Display Unit to the Transceiver.

This information is transmitted using a special data cable that incorporates four twisted pairs:

- two pairs are used for data transmission
- one pair is used for trigger
- the other pair is spare.

The data passed from the Transceiver to the Display includes:

- Heading Marker
- Incremental Bearing
- Transceiver Status
- Error Message
- Built In Test Equipment (BITE) data
- Tuning Indicator

The data transmitted from the Display to the Transceiver includes:

- Standby/Transmit
- Pulse Length
- Tuning
- AFC/Manual
- Sector Blanking
- Performance Monitor Control, and Installation Settings

Power Supply

The power supply operates from the ship's AC mains, and provides all of the power requirements for the electronics modules within the Turning Unit and Transceiver. The AC mains is always present at the power supply even when the radar is switched off at the display.

The presence of data on the serial data link when the display is switched on is detected by the power supply, which then becomes active.

The power supply includes a Power Factor Correction circuit, and a number of switching regulators to generate the necessary voltage supplies. Overcurrent detection circuits protect the power supply against overloads on its outputs.

Trigger PCB

The Trigger PCB processes the serial data from the Display Unit, and generates the required control signals for the Transceiver. It monitors functions within the Transceiver, the Heading Marker, and encodes the information for transmission to the Display Unit. The data is transmitted each time a bearing pulse is received from the Turning Unit. The trigger PCB generates the various timing signals required by the transceiver including the Pulse Repetition Frequency (PRF).

Modulator PCB

The modulator PCB generates the high voltage negative pulses needed to drive the magnetron. The modulator pulse widths and timing signals are controlled from the trigger PCB.

A spark gap on the modulator is fired if the magnetron fails to operate. Continual operation of the spark gap is detected and a signal is fed back to the trigger PCB. When the trigger PCB detects this signal it switches the radar to standby, and generates an error signal to be transmitted to the Display Unit via the serial data link. The error signal causes the Display Unit to switch to standby and generate an error alarm.

Microwave Circuit

The transceiver uses a conventional three-port circulator to direct the path of the microwave energy to and from the antenna. A magnetron coupled to the circular provides the RF energy to be transmitted. A solid-state limiter coupled to the circulator protects the receiver from high-powered microwave signals from the magnetron, or adjacent radars.

On Scanner Units and Transceivers fitted with additional features options, or for use with Vision processing, a biased limiter is fitted in place of the standard limiter. Under the control of a signal from the trigger PCB the limiter applies swept RF attenuation to radar returns to reduce the system sensitivity at short ranges.

Receiver

The receiver consists of:

- a low noise amplifier
- a mixer
- a linear preamplifier
- a logarithmic amplifier
- a video amplifier.

The linear preamplifier followed by a logarithmic amplifier amplifies the 60MHz output of the mixer, the output of which is detected. The resulting video signal is then further amplified before transmission to the Display or Compatibility Unit.

The receiver also incorporates an AFC system. Once the receiver has been tuned, the AFC system makes sure that the receiver remains on tune during variations in tuning due to thermal drift of the mixer, magnetron etc.

The operator can select between manual tuning and automatic tuning. A signal from the trigger PCB is used to select the mode of operation. A signal from the AFC circuit is fed to the trigger circuit to indicate the state of tune of the receiver. This signal is at its minimum value when the receiver is correctly tuned.

AUTOMATIC START-UP SEQUENCE (X-Band)

The automatic start-up sequence described below, should be read in conjunction with Figure 6.46 'X-Band Turning Unit (Aloft) Schematic'.

Start-up

!WARNING!

Once mains power is applied to the PSU board the Power Factor Correction (PFC) circuitry starts and generates 390V. It should be noted that while mains is applied the PFC is active and cannot be manually switched off. The start circuitry only controls the flyback converter so High Voltage DC is present on primary power components whenever mains power is present on the board. **This fact should be noted when serving the Transceiver**.

The Power Supply in the Transceiver is only active during normal operation when there is a Display (or Compatibility Unit) connected to it. The presence of a voltage on DU DATA input from the Display is used to drive an opto-coupler in the PSU. This detects the presence of either polarity voltage and enables the flyback converter in the PSU.

The DU DATA signals from the Display enter the Input Board on connector TSB 1, 2 (as "DU DATA +" and "DU DATA-"). It is then passed to the Trigger Board via PLYB 16, 17, and then on to the PSU via PLTH 11, 12 (as "PSU START" and "PSU START RTN"). It is the presence of a voltage on the DU DATA inputs, not the presence of serial data, that starts the Power Supply.

For test purposes the PSU can be turned on in the absence of a serial data stream by linking pins 1-2 on LKA (PSU).

Transmit Enable

When the operator selects Transmit, the TU Enable signal is activated LOW on the Trigger PCB (PLYH 10). On the X-Band Scanner Unit, this signal is fed to the Power Supply Unit and via the Turning Unit On/Off and Input PCB to the Motor Drive PCB to start the antenna rotating.

Once the antenna has done one complete revolution, transmission is started. When standby is selected, transmission is immediately halted and, after one complete revolution of the antenna, TU Enable is disabled.

The Modulator starts to generate radar pulses when the Trigger PCB sends it MOD TRIGGER pulses (to PLVC 9). Note that the CHARGE TRIGGER pulses (on PLVC 8) are present even in Standby mode.

A signal indicating that the Magnetron has fired is fed via MAG SAMPLE from PLVC 7 on the Modulator PCB to the Trigger PCB. This signal is processed on the Trigger PCB and outputted as TX TRIG (PLYB 20 & 21) to the Input PCB (PLZB 20 & 21) and then to the Display Unit via TSB 5 & 6

Note – TX DATA is sent from the Transceiver to the Display Unit.
DU DATA is sent from the Display Unit to the Transceiver Unit.

The Trigger PCB processes the serial data input from the display, and generates the required control signals for the Transceiver. The data is transmitted each time a bearing pulse is received from the Turning Unit. The Trigger PCB generates the various timing signals required by the Transceiver including the Pulse Repetition Frequency (PRF).

Magnetron Operation

The Modulator PCB generates the high-voltage negative pulses required to drive the magnetron. The modulator pulse widths and timing signals are controlled from the Trigger PCB. A spark gap on the Modulator is fired if the magnetron fails to operate. Continual operation of the spark gap is detected and a signal is fed back to the Trigger PCB.

On detection of this signal, the Trigger PCB switches the radar to Standby, and generates an error signal that is transmitted to the Display Unit via the serial data link. The error signal causes the Display Unit to switch to Standby and generate an error alarm.

When Standby is selected, rotation of the Antenna is inhibited. Transmission from the radar is inhibited if the Antenna is not rotating (unless in Test Mode).

On the Trigger PCB, there is a timer circuit that is basically a capacitor that slowly discharges (between 4s and 18s) when power is removed from the PCB. On power-up the microcontroller measures the charge remaining on the capacitor. It determines if the transceiver has been switched off for long enough to warrant inhibiting transmit for three minutes until the magnetron heaters have had time to warm up again.

The other analogue signals into the Trigger PCB come from the Modulator. The Modulator supply voltage and the magnetron current (only when transmitting) are measured and sent to the Display as an aid to fault finding. The spark gap detect signal is generated by the modulator when the magnetron arcs over. If it reaches a predetermined level the microcontroller inhibits transmission for approximately one second and sends an error messages to the Display.

TURNING UNIT OVERVIEW (X-Band)

Drive System

The scanner motor is a 3-phase electronically commutated DC motor. The motor commutation drive signals are provided by the Motor Drive PCB, which has the capability of providing High and Low speed operation by link selection.

The motor drives an integral 32:1 reduction gearbox. The output of the gearbox drives a pulley system with a single toothed belt having a reduction ratio of 3:1. The final pulley is attached to the Antenna torque tube assembly. The overall reduction between the motor and Antenna is approximately 96:1.

When standby is selected, rotation of the Antenna is inhibited. Transmission from the radar is inhibited if the Antenna is not rotating (unless in test mode).

A switch is provided on the Scanner Unit to inhibit rotation for safe servicing.

Motor Drive Board (Incorporating the Dynamic Brake facility)

The Motor Drive PCB generates the supply and control signals for the 3-phase electronically commutated DC motor that turns the Scanner Unit.

Link LK1 is used to select between High or Low speed operation. The link should be set between pins 1 & 2 for Low Speed operation (Factory Default). For High Speed operation, the link is parked on pin 1, or not fitted. For remotely selectable antenna speed the link should be set between pins 2 & 3. Note that if no link is fitted, the default is High Speed operation.

On Scanner units fitted with the additional features option additional circuitry allows the links to be selected by a remotely mounted switch. This gives the operator the option to change the antenna rotation speed.

The Motor Drive PCB is supplied with +50VDC from the Transceiver power supply (in both Aloft and Bulkhead fits).

Pulling control line 'TU Enable' below 1.5 volts starts a slow build up of speed up to the maximum set by the speed selection link. The 6 output FET switches, which perform the commutation, are protected by a current sensing and limiting circuit, in the event of overload or stall.

Signals form the Hall Sensors in the motor are used to control the commutation sequence, and are also used to provide a degree of speed compensation in high wind load conditions. An additional feature of the PCB is a Dynamic Brake that prevents the antenna from 'windmilling' when the radar is turned off or on standby. This circuit is passive and will operate with no supply voltage.

Bearing and Heading Marker System

A disc with 128 teeth is attached to the Antenna torque tube and combined with an opto-coupler generates 128 pulses per rotation of the Antenna.

A second opto-coupler together with a flag on the toothed disc generates a Heading Marker approximately 10° before the Antenna is pointing dead ahead. Correct alignment of the Heading Marker is set at installation by electronic adjustment with the Display Unit.

Both opto-couplers are on the Pulse Bearing PCB. The Pulse Bearing PCB multiplies the 128 bearing pulses by 32 to generate 4096 pulses per antenna revolution. The 4096 azimuth pulses and the heading marker are routed through the Input PCB to the Trigger PCB. They are then incorporated into the serial data to be transmitted to the Display Unit.

Link LK1 is used to select between High or Low speed operation. The link should be set between pins 1 & 2 for Low Speed operation (Factory Default). For High Speed operation, the link is parked on pin 1. For remotely selectable antenna speed, the link should be set between pins 2 & 3. Note that if no link is fitted, the default is High Speed operation.

On Scanner units fitted with the additional features option an additional relay allows the links to be selected by the same remotely mounted switch used to select the antenna rotation rate. This makes sure speed settings match those remotely selected on the motor drive PCB.

On scanner units fitted with the additional features option, a method is given (on the Input PCB) to allow the heading marker alignment to be made electronically within the Turning Unit. When this option is fitted an additional (isolated) Heading Marker output is provided. As an option for special applications a size 11 synchro can be fitted as an alternative source of bearing information.

Interconnections

The terminations for interconnections for the Transceiver and the Turning Unit are under a cover on the inside of the lower casting of the Turning Unit. The AC power from the isolating switch is terminated at a terminal block within the filter box on the inside of the lower casting of the Turning Unit. All other connections are made to plugs or removable terminal strips on the input PCB.

TRIGGER PCB (X-Band)

General Description

The trigger PCB controls the operation of the Transceiver under instruction from the Display. There are two serial links, which are used to transfer control messages from the Display to the Trigger PCB and Transceiver information back to the Display. The Trigger PCB generates the control and tuning signals required by the Modulator, Receiver, Performance Monitor and Biased Limiter. The PSU is enabled with a signal from the Trigger PCB.

Signal To/From the Trigger PCB

To/From Display

- Serial Data to Display
- Serial Data from Display
- Trigger to Display

To/From Modulator

- Pulse Length select lines
- Charge and Modulator Triggers
- Magnetron Heater Turndown signal (only used for S-Band, Long Pulse operation)
- Voltage/Current Monitor signals
- 10/25kW and S-/X-Band Configuration signals

To/From Receiver

- Tuning Voltage signal
- Bandwidth Control signal
- AFC/Manual control
- AFC Trigger
- Tune Indicator signals

To Biased Limiter

- Trigger signal

To Performance Monitor

- On/Off Signal
- Mode Control signal
- Tuning Voltage signals

To/From Power Supply PCB

- +30V, +12V, +5V, 0V & -12V Supply lines
- Turning Unit Enable
- Power Supply Start and Return

FUNCTION DESCRIPTION (X-Band Trigger PCB)

The 80C5 family microcontroller provides overall control of the Trigger PCB functions. Program memory and RAM are included within the microcontroller IC. Serial I/O is handled by the micrcontrollers internal UART and an external RS422A driver and receiver. Baud rate is fixed at 76800 baud for operational use but is link selectable to 19200 or 38400 baud for test purposes. The serial data format is 8-bit data, 1 stop bit and even parity.

The Display sends serial messages comprising four or five characters depending on message content. Control messages are four bytes long and tuning messages are five. The tuning voltage levels are sent as 12-bit values, which are converted on the Trigger PCB using a four-channel DAC before amplification/buffering and distribution to the Receiver and Performance Monitor.

The Bearing signal from the Turning Unit is used to initiate serial transmission from the Trigger PCB. Each time one of the 4096 azimuth pulses per rev is generated and fed into one of the microcontrollers interrupt pins, a character (one byte) is sent to the Display. One bit in each of the characters sent is dedicated to the heading marker on every new heading marker pulse from the Turning Unit (the bit is toggled).

The Power Supply in the Transceiver is only active during normal operation when there is a Display (or Compatibility Unit) connected to it. The RS422 serial input from the Display is used to drive an opto-islolator that detects the presence of either polarity voltage and enables the PSU.

Trigger Outputs

There are a number of trigger signals generated by the Trigger PCB:

- Pre-Trigger
- Charge Trigger
- Modulator Trigger
- Display Trigger
- Performance Monitor Trigger
- AFC Trigger
- Swept Attenuation Initiate

The Charge Trigger is the timing signal used to recharge the Modulator PFN. This is generated by the microcontroller using an internal timer routine set to the appropriate PRF for the pulse length selected. A wobbulation factor is added to the basic timing to ensure that no two radar transmissions are locked together. The wobbulation is calculated according to the number of serial messages received before going to transmit and the position of the antenna between each trigger pulse.

Transceivers fitted with additional features provide a Pre-trigger approximately 11µs before the modulator trigger.

The Modulator Trigger is used to let the charge out of the PFN into the magnetron and is the trigger that starts the modulator firing. It is delayed from the Charge Trigger by 100μs and gated off when the transceiver is in standby.

In standby, the Display and Performance Monitor Triggers are generated from the Mod Trigger pulse. When the transceiver is in transmit mode the triggers begin on the leading edge of the magnetron sample pulse and end after a preset time, adjustable using RV1.

The AFC Trigger is used by the receiver when in AFC mode and is only generated when the transceiver is in transmit mode. The pulse is started on the front edge of the Modulator Trigger and terminates on the back edge of the magnetron sample pulse.

The Swept Attenuation Initiate pulse is the timing signal fed to the Limiter Drive PCB which generates the control for the biased limiter. It is started by the front edge of the Pre-trigger (approximately 2μs prior to magnetron firing) and terminated 2.5μs after the leading edge of the magnetron sample pulse.

The Display and PM Triggers are essentially the same trigger and are present at all times when the radar is powered up. They are initiated by the Modulator Pulse and last for approximately 2.5μs.

Analogue Outputs

The Trigger PCB generates four tuning signals:

- LO Tune
- PM Tune
- Xr Adjust
- Xt Adjust.

These signals are coded as 12-bit digital values and incorporated into the serial messages from the Display. A 12-bit, four channel DAC is used to generate the tuning signals from the message data. Additional buffering is added to the LO and PM Tune outputs of the DAC and x3.5 amplification to the Xr and Xt Adjust signals.

LO Tune is the 0V to +5V receiver tuning control and PM Tune the 0V to +5V Performance Monitor main tuning control. Xr and Xt Adjust are 0V to +15V signals used to control the receive and transmit attenuators in the Performance Monitor.

Analogue Inputs

There are various analogue inputs to the Trigger PCB. These are from other PCBs in the transceiver and some on-board signals. The on-board signals are fed into an eight channel 8-bit ADC. They are then converted to digital values either for further processing by the microcontroller or to be passed to the Display via the serial message link.

The signals on the Trigger PCB that are measured are the dropout timer +12V and +30V supplies. The timer circuit is basically a capacitor that slowly discharges (between 4s and 18s) when power is removed from the PCB. On power-up the microcontroller measures the charge remaining on the capacitor to determine whether the transceiver has been switched off for long enough to warrant inhibiting transmit for three minutes until the magnetron heaters have had time to warm up again. The power supply level is measured and the results are sent to the Display as an aid to fault diagnosis,

One channel of the ADC is used to detect whether a Performance Monitor has been fitted to the system. The voltage on this channel will be lower than a preset value if a Performance Monitor is present otherwise it will be pulled to the +5V supply rail. This information is encoded and sent as part of the configuration message to the Display.

The Receiver sends a tune indicator signal to the Trigger PCB that shows how close it is to being on tune. This signal is coded as part of the serial message and sent to the Display.

The other analogue signals into the Trigger PCB come from the Modulator. The Modulator supply voltage and the magnetron current (only when transmitting) are measured and sent to the Display as an aid to fault finding. The spark gap detect signal is generated by the modulator when the magnetron arcs over. If it reaches a predetermined level the microcontroller inhibits transmission for approximately one second and sends an error message to the Display.

Digital Outputs

The digital outputs from the Trigger PCB are all simple on/off control signals to various parts of the transceiver.

Signals to the Receiver select wide or narrow bandwidth (Wideband) and AFC or manual tuning mode (AFC On). Narrowband is selected when the modulator is transmitting in long pulse and briefly during pulse length changing. AFC or manual mode is selected by the radar operator and is part of the control message sent from the Display.

Modulator signals MP and SP are used to set the pulse length as requested by the radar operator.

- SP set to 0V indicates short pulse operation
- MP set to 0V indicates medium pulse operation
- both SP and MP set to +5V indicates long pulse operation.
- SP and MP both set to 0V is an illegal state and will not happen in normal operation.

Turndown enable is used to reduce the heater current in the magnetron and is only set when an S-Band magnetron is fitted and is transmitting in long pulse.

The control signals PM On/Off and PM Tx/Rx are used to switch the Performance Monitor on and to switch it between system test mode and receiver test mode.

TU Enable is the control signal fed to the Motor Drive PCB to start rotation of the antenna. When the operator selects transmit the TU Enable signal is activated to start the antenna rotation.

Once the antenna has done one complete revolution, transmission is started. When standby is selected, transmission is immediately halted and, after one complete revolution of the antenna, TU Enable is disabled.

Optional I/O

There are several optional I/O signals for use with the additional features variant of the PCB:

- Pre-trigger – described in the section on triggers.
- External Trigger Input – used when the modulator needs to be triggered from an external source rather than the Trigger PCB. Trigger signals fed to this input are PRF limited to prevent damage to the modulator.
- Radar Silence – used to inhibit transmission without using the appropriate command in the serial message. An Active signal at this input will cause the microcontroller to inhibit transmission within one trigger pulse at either of the internal PRFs.

Built In Self Test (BIST)

The microcontroller performs a number of self test operations and reports the results to the Display as part of the serial message link. Error situations that are monitored in he transceiver are:

- Serial message corruption.
- Loss of Display messages.
- Loss of Heading Marker signal.
- Loss of either Charge orModulator Trigger.
- Magnetron arcing.

Error situations will in all cases cause the microcontroller to inhibit transmission until the error has been cleared. The other signals that are monitored and sent directly to the Display without further action by the microcontroller are the power supply lines and magnetron current (as described in the section on analogue inputs)

Test Modes

There are two test modes for the Trigger PCB.

The production test mode is used solely during production testing of the PCB and is initiated by fitting the test link LK4. This must only be done on the production test bed. Connecting this link when incorporated into a transceiver could lead to unpredictable and possibly dangerous operation.

The second test mode, of use to service engineers, can be initiated by fitting the two links LK5 and LK6 to position 2-3. These links allow the Trigger PCB to generate azimuth pulses and heading marker pulses internally. When in this mode the transceiver will transmit without the antenna rotating. The transceiver assembly can then be removed from the turning unit, and be connected to the Display below decks (with suitable test cables) and run as per normal operation. A dummy load MUST be connected to the waveguide outlet of the transceiver. Failure to do so may result in serious personal injury and could cause severe damage to the transceiver..

TRANSCEIVER POWER SUPPLY (X-Band)

General Information

The power supply is an AC to DC inverter that generates the supplies for the Transceiver. The inverter is housed on a single board and is powered by an AC supply of nominal 115V or 230V in the frequency range 47-64Hz.

The power unit uses a boost converter front end to provide a regulated high voltage DC to a flyback converter providing the output supplied. Some of these supplies use additional switch mode converters to provide regulated outputs.

The outputs supplied by this power supply are:

- variable
- –600V
- +30V
- +20V
- magnetron heaters (via further regulator, +12V, -12V and +5V)
- +50V for the Motor Drive PCB (for the X-Band Turning Unit variant).

The power unit has the following features:

- -600V adjustable over the range –550V to –650V for control of magnetron current via modulator.
- Output short circuit protection.
- Universal input from 95V to 276V without tap changing. Power factor corrected providing a PF of better than 0.9.

The opto-coupler detects the presence of a serial data stream from the display at PLTH 11, 12 to switch the flyback converter on. On detection of the data stream the photo transistor within U5 is turned on, pulling down the gate of Q2 below its threshold voltage. Q2 turns off allowing the compensation pin 1 U4 to rise enabling output of the IC U4. In the PSU off state Q2 is held on by current in R37 from Vcc.

For test purposes the PSU can be turned on in the absence of a serial data stream by linking 1-2 on LKA.

Note that once the mains supply is applied to the PSU board, the PFC (Power Factor Correction) circuit starts and generates 390V. While mains is applied, the PFC is active and cannot be manually switched off. The start circuitry only controls the flyback converter and so High Voltage DC is present on primary power components whenever mains is present on the board. **This fact should be noted when servicing the Transceiver**.

MODULATOR PCB (X-Band)

Functional Description

The principal function of the Modulator PCB is to generate an 8kV, 8A negative pulse to drive the cathode of the magnetron. An SCR is used to resonantly charge a Pulse Forming Network (PFN) to –1200V from the –600V Modulator HT supply. The Charge Trigger initiates the charging cycle. The number of sections of the PFN is selectable by the relays controlled by the Pulse Length Control Lines. The number of sections of the PFN used defines the length of the output pulse.

At a defined time after the PFN is fully charged it is discharged by three series-connected Insulated Gate Bipolar Transistors through a pulse transformer. The Modulator Trigger initiates the discharge. The Pulse Transformer, which has step up ratio of 12:1, transforms the resulting pulse to 8kV. A saturable reactor connected across the primary of the pulse transformer speeds up the back edges of the medium and short pulses.

Other functions include regulating the magnetron heater supply, monitoring a spark gap to ensure correct operation of the magnetron, and generation of a timing reference for the Radar Trigger.

Inputs to the Modulator PCB

- -600V Modulator HT Supply
- +20V Modulator Trigger Supply
- +16V - +27V Magnetron Heater Bulk Supply
- +12V
- -12V

Short Pulse Control	When 0V selects short pulse.
Medium Pulse Control Line	When 0V selects medium pulse.
Charge Trigger	Initiates charging of Pulse Forming Network. Typically 1Amp current pulse.
Modulator Trigger	Initiates discharge of Pulse Forming Network. Typically 4µs, 3.5V positive pulse.
Turn Down Enable	DC voltage controls the magnetron heater voltage. 0V on long pulse, 3.5V Standby Medium and Short Pulse.

Outputs from the Modulator PCB

Primary sample	Positive pulse sample from pulse transformer used to initiate Radar Trigger. Typically 40V amplitude.
Magnetron current sample	A DC voltage proportional to the magnetron current derived from the secondary of the pulse transformer. Typically +2.5V.
TX Active	A signal that is normally 0V that rises to >2.5V if the spark gap operates continuously for 2 seconds. This signal is used by the Trigger PCB to indicate a transmitter fault to the display.
HT Sense	Sample of Modulator HT Supply fed to Trigger PCB for inclusion in BITE message sent to display.
TX Define	Link settings used to define modulator type to Trigger PCB. 0V or 3.5V dependant on link settings.

Magnetron Heater Supply

The magnetron heaters are derived from the Magnetron Heater Supply at PLVD1 and PLVD2. This supply may vary between 16V and 27V.

The setting of link LK1, fitted to the Modulator PCB, configures the Modulator PCB for the intended magnetron. Refer to Figure 6.19 'Link Settings Modulator PCB', in this chapter, for further information.

!WARNING!

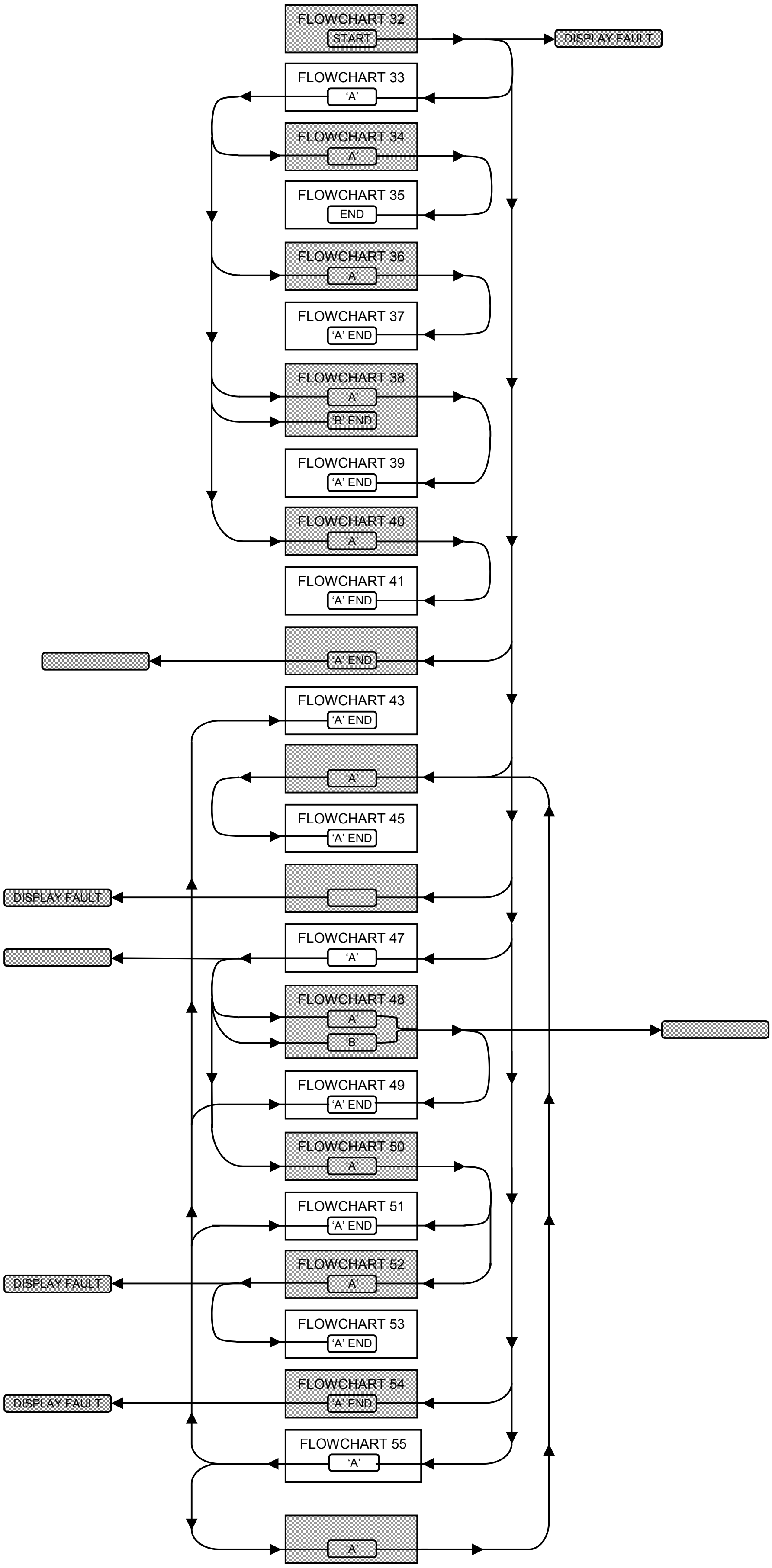
On no account should the heater voltage be measured whilst the Transceiver is transmitting.

System	Mode	Required Magnetron heater voltage (measured between TSJ1 and TSJ2)
10kW X-Band	Standby, Short Pulse, Medium Pulse and Long Pulse	6.1V
25kW X-Band	Standby, Short Pulse and Medium Pulse	6.1V
	Long Pulse	Can be reduced to 5.1 V depending on the type of magnetron fitted
30kW S-Band	Standby, Short Pulse and Medium Pulse	6.1V
	Long Pulse	Can be reduced to 5.1 V depending on the type of magnetron fitted

2.5.2 Fault Isolation Flowcharts (X-Band Scanners)

Flowcharts for isolating faults on X-Band Scanner Units are given on the following pages. Flowchart 31 shows the overall flow through Flowchart 32 to Flowchart 56 .

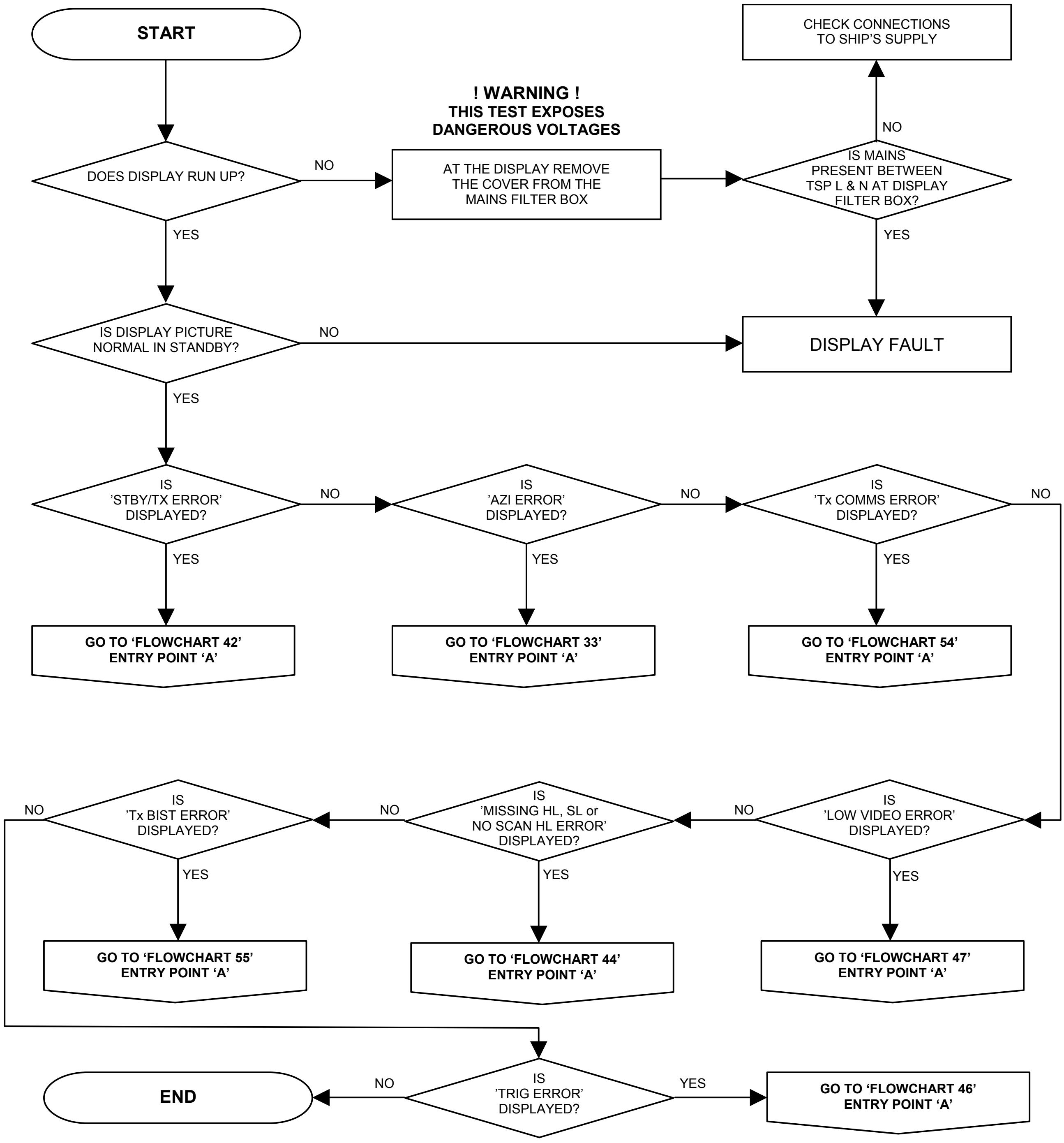
FLOWCHART 31 OVERALL FLOWCHART – X-BAND SCANNER FAULTS



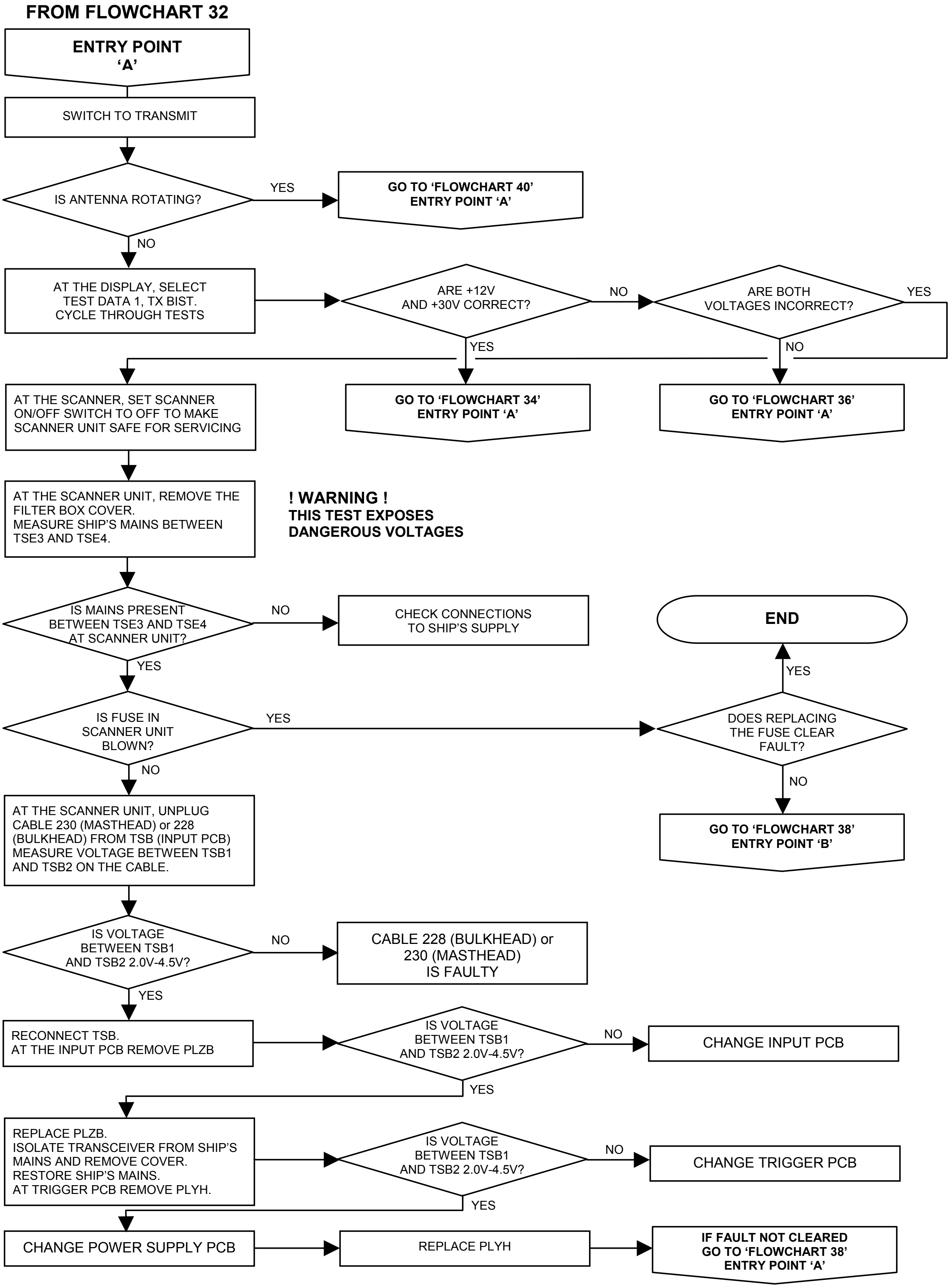
FLOWCHART 32 X-BAND SCANNER FAULTS

!WARNING!

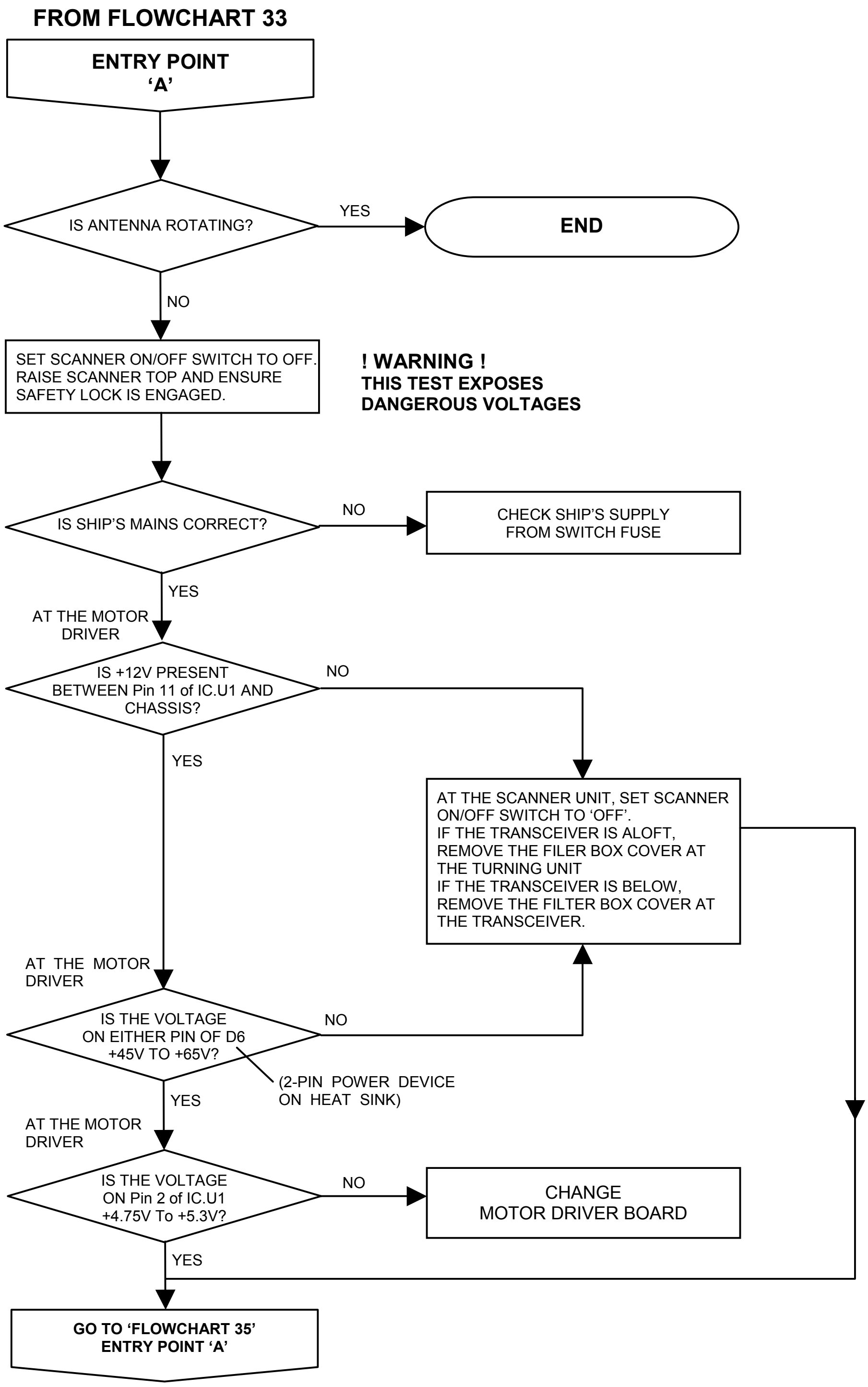
When the covers are removed from the equipment, dangerous voltages are exposed.
Only qualified persons should work on the equipment when power is applied.
Always isolate the turning unit from the ship's supply before working on it.
Always isolate the transceiver from the ship's supply while removing or replacing the transceiver cover.



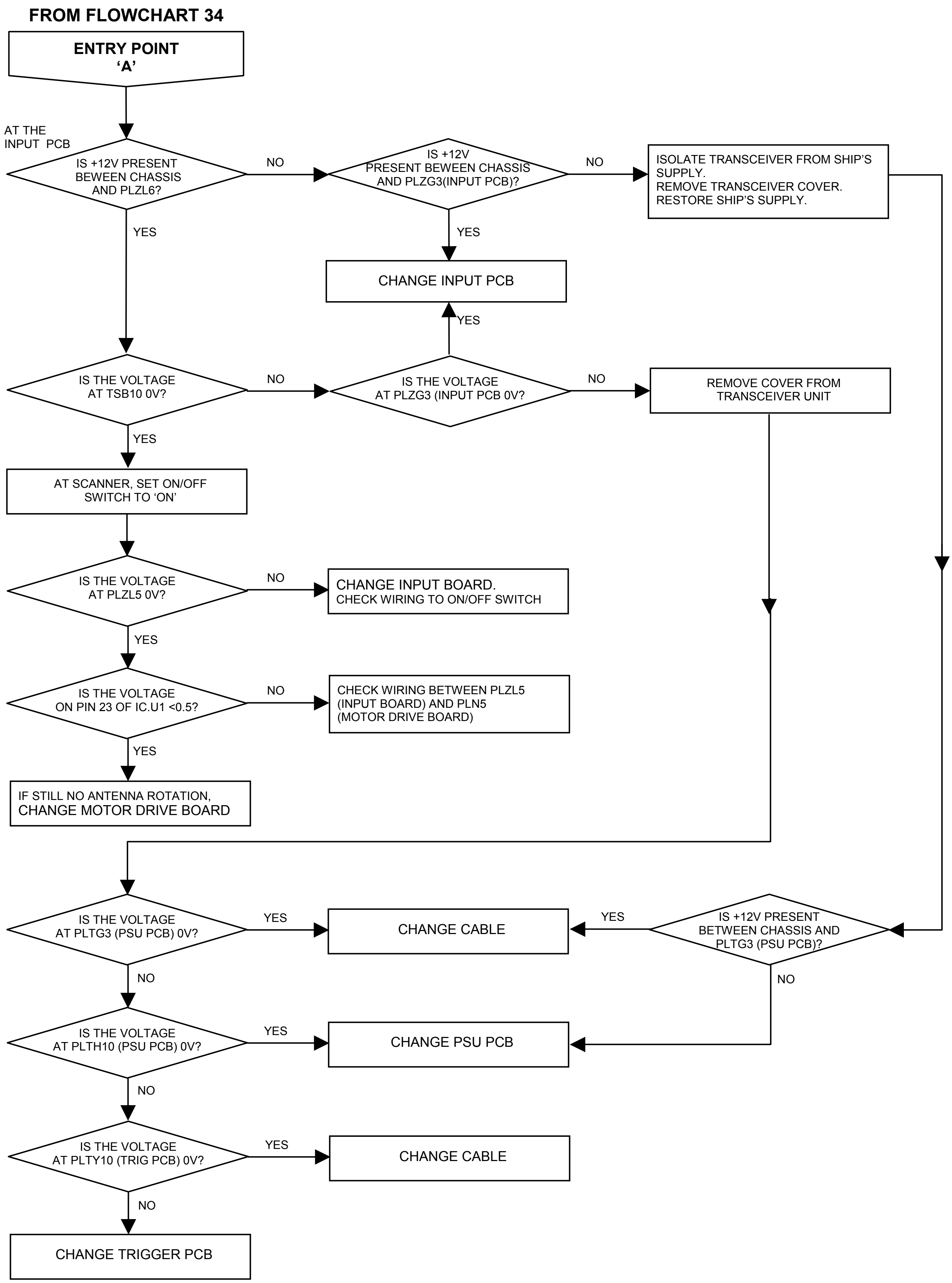
FLOWCHART 33 X-BAND SCANNER FAULTS ('AZI ERROR' SHOWN)



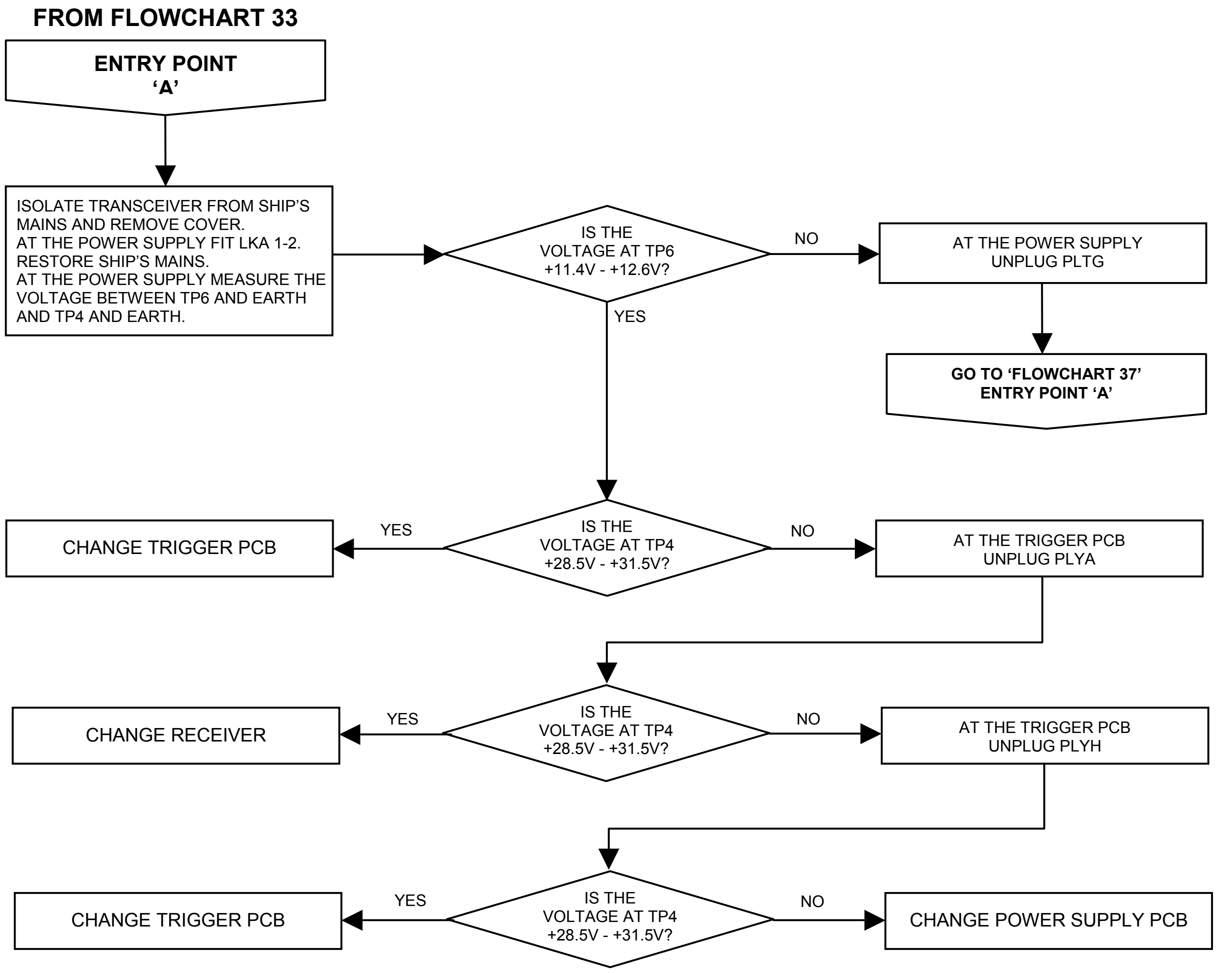
FLOWCHART 34 X-BAND SCANNER FAULTS



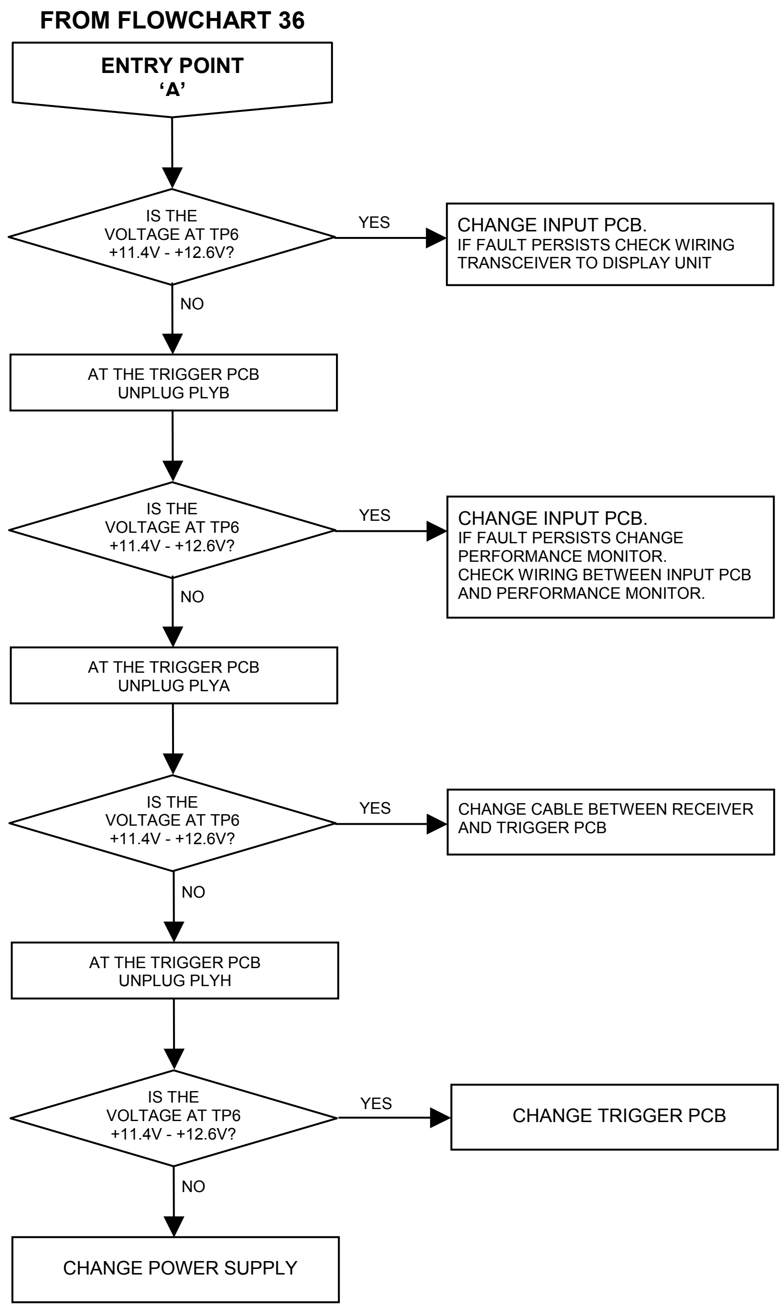
FLOWCHART 35 X-BAND SCANNER FAULTS



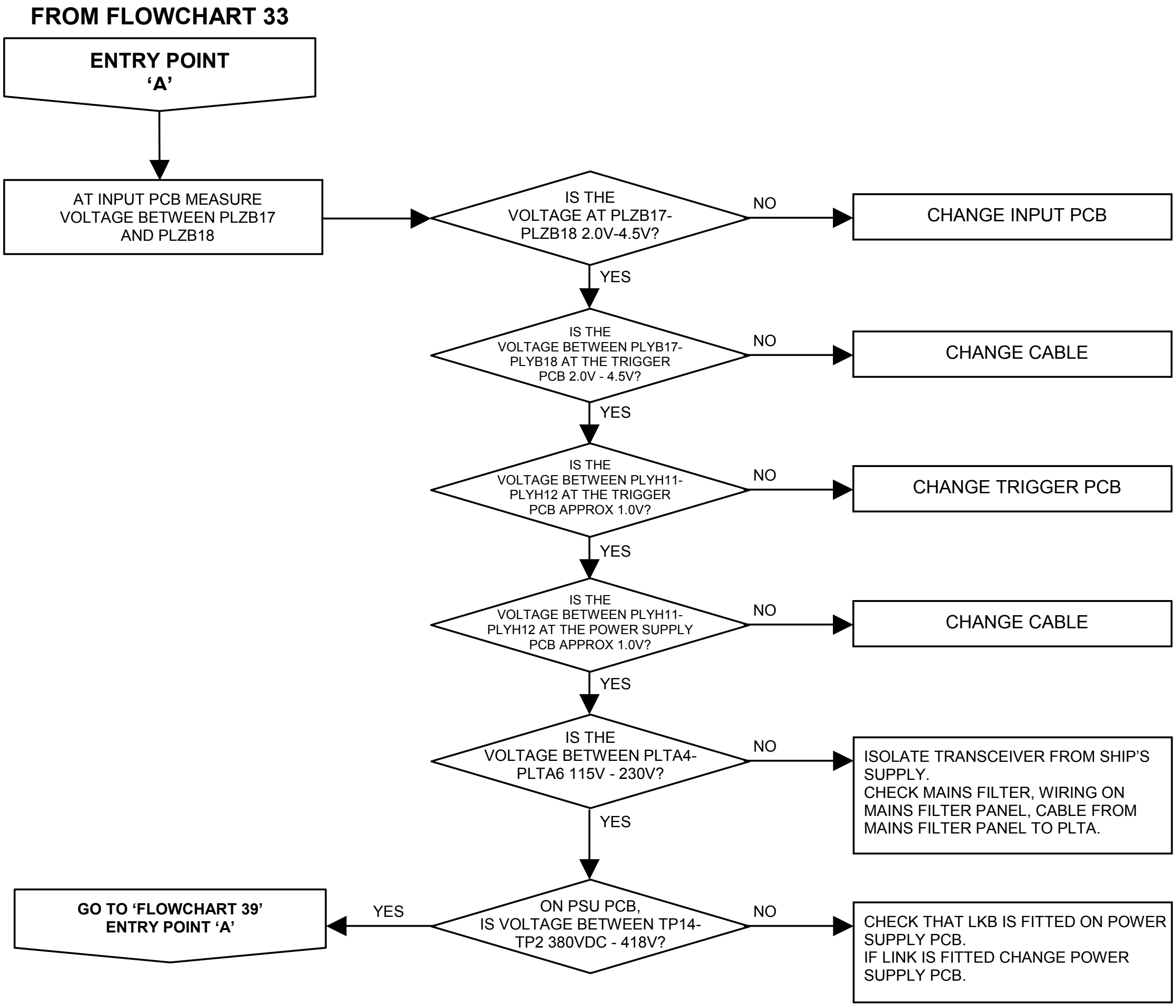
FLOWCHART 36 X-BAND SCANNER FAULTS

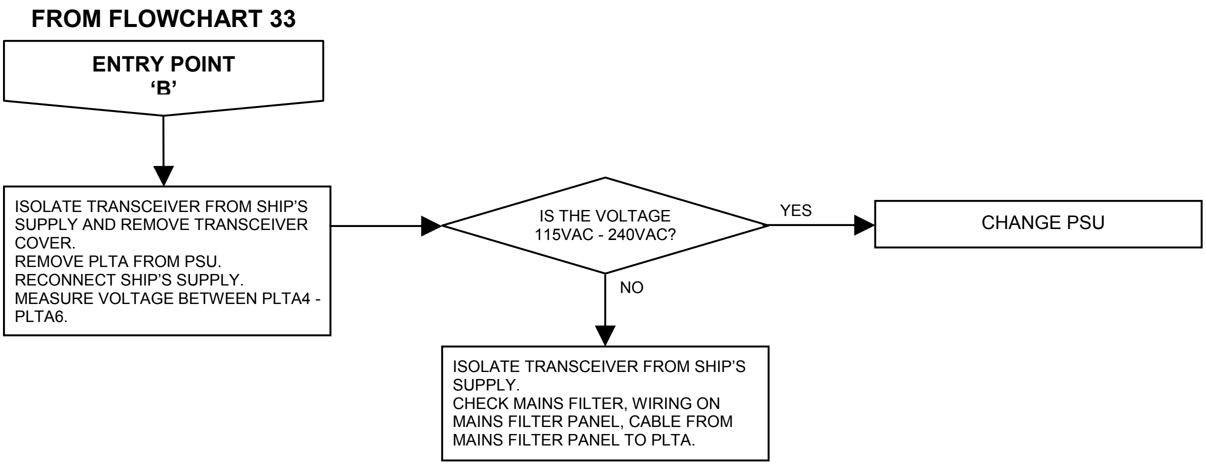


FLOWCHART 37 X-BAND SCANNER FAULTS

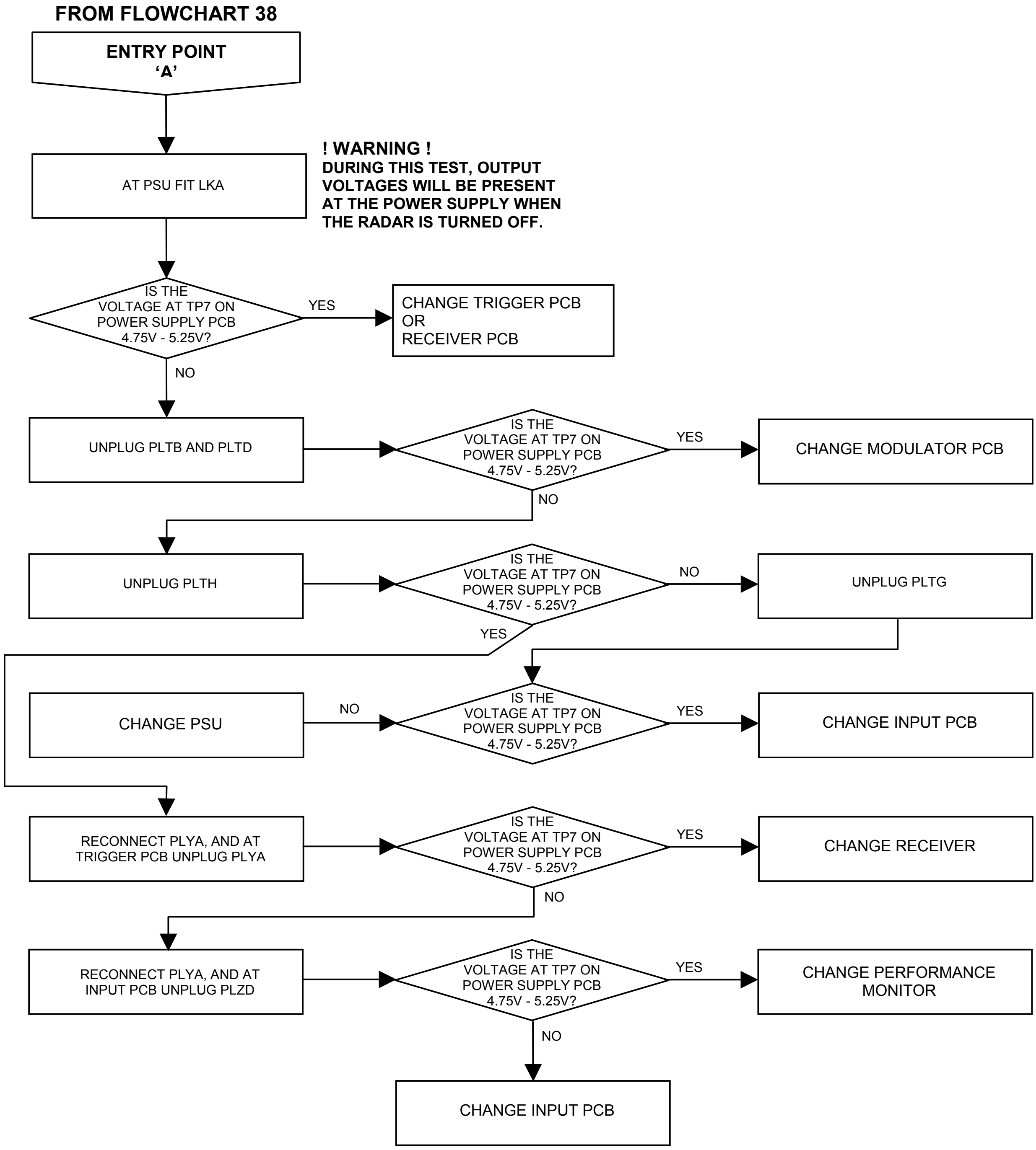


FLOWCHART 38 X-BAND SCANNER FAULTS

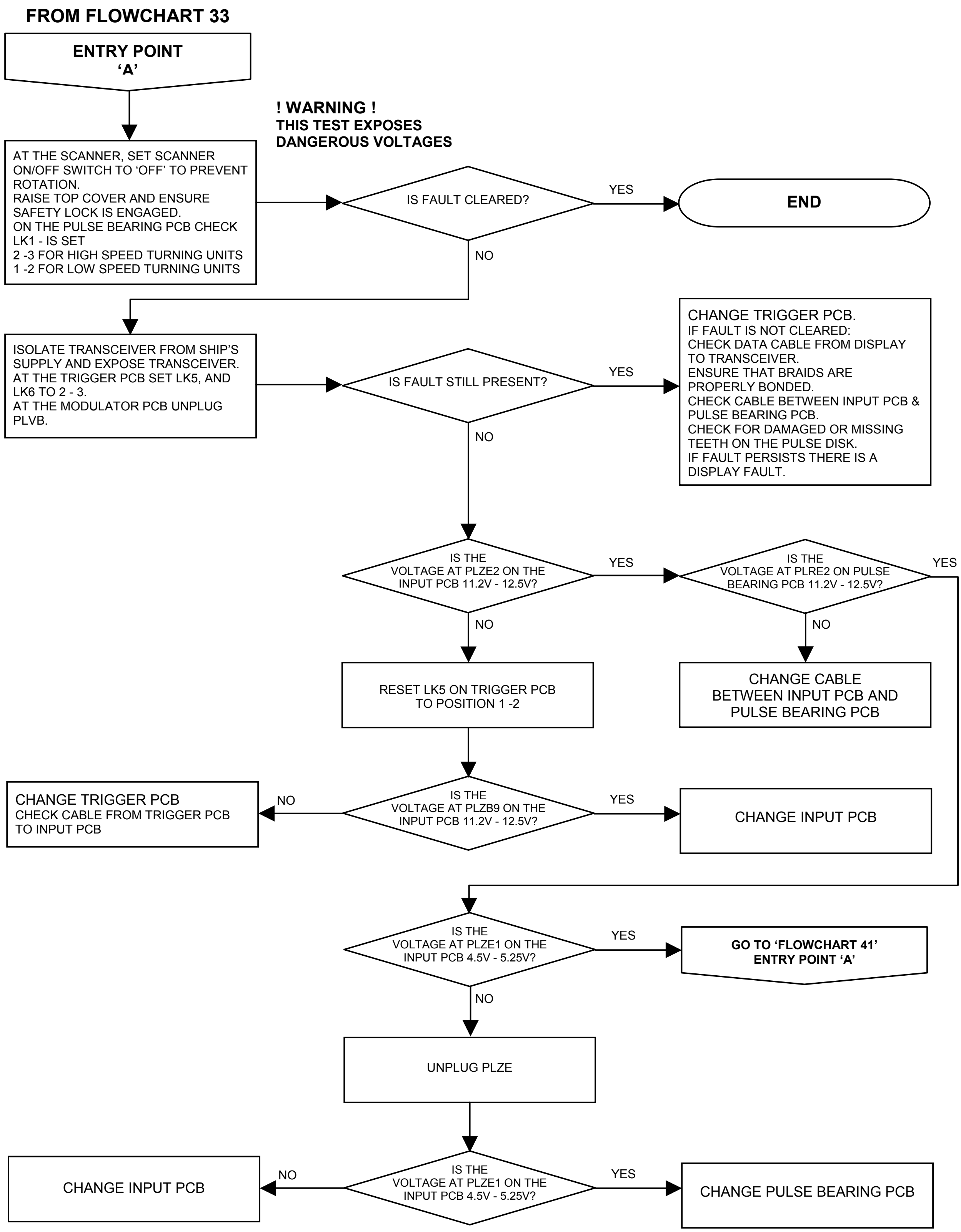




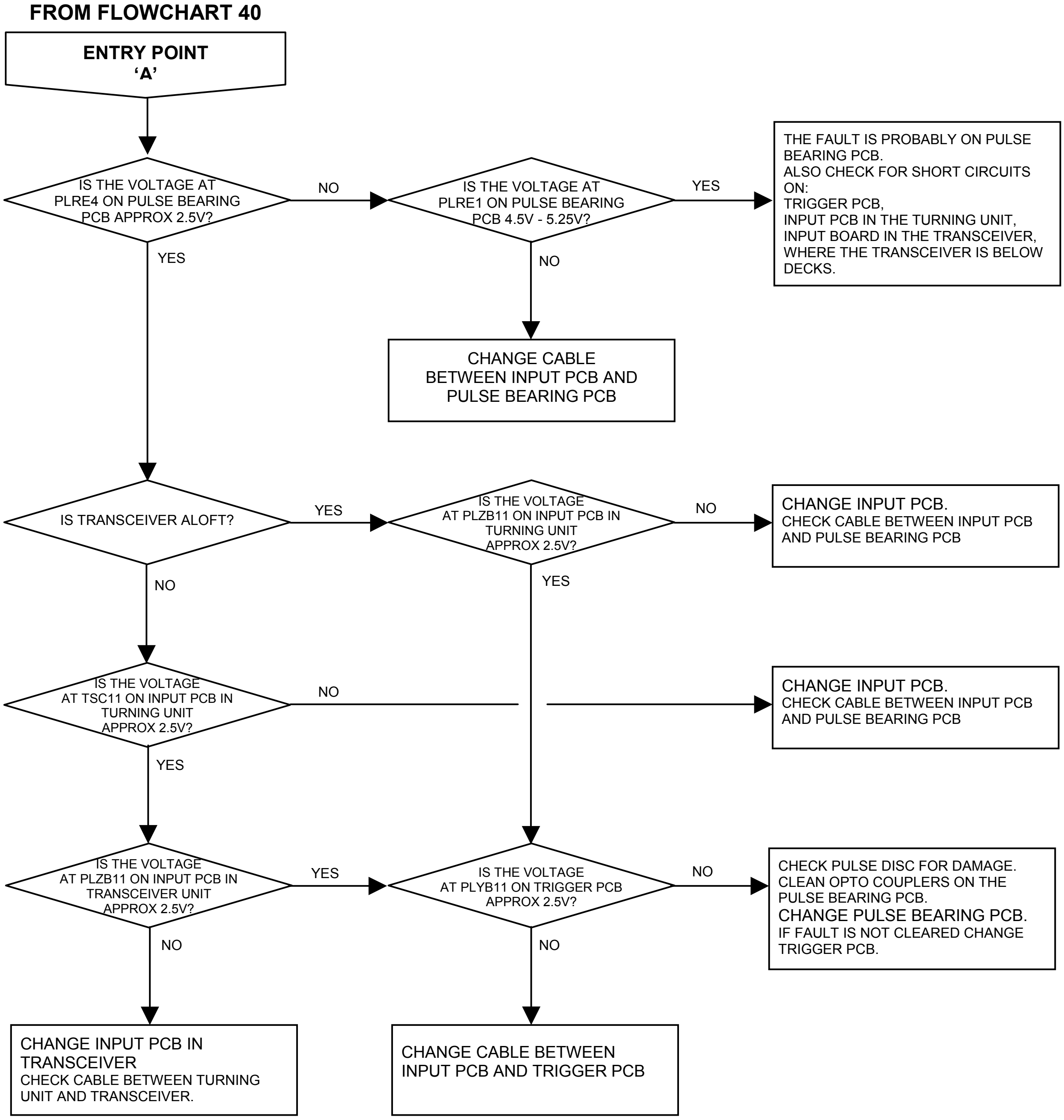
FLOWCHART 39 X-BAND SCANNER FAULTS



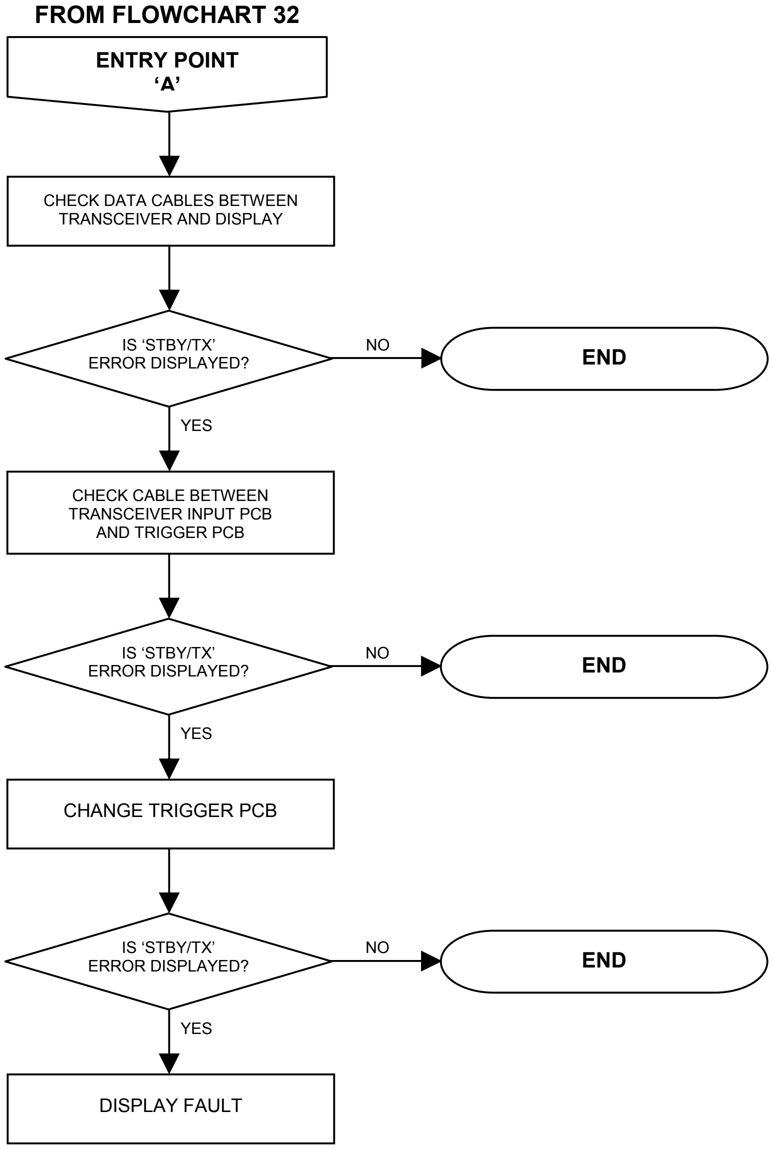
FLOWCHART 40 X-BAND SCANNER FAULTS



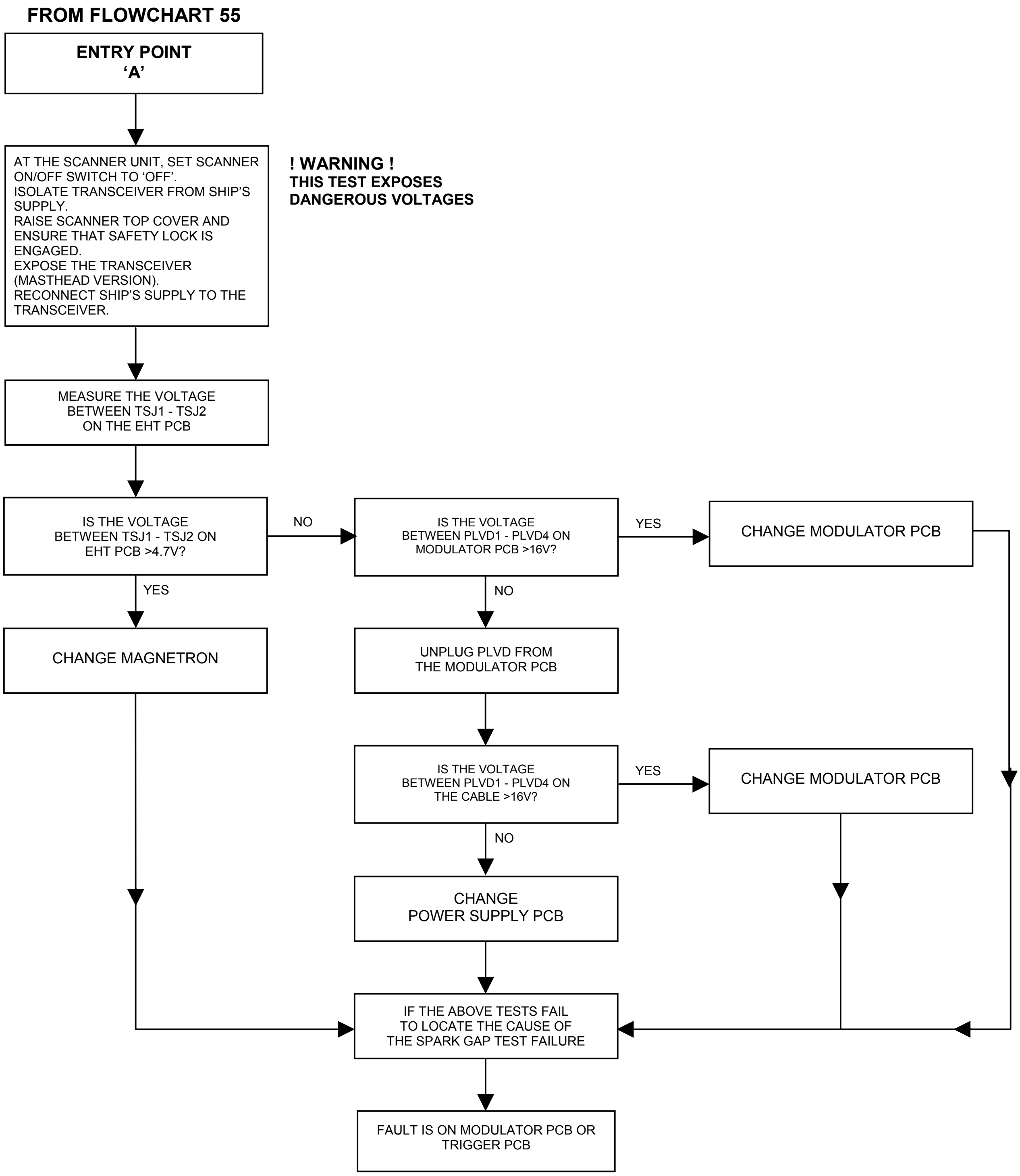
FLOWCHART 41 X-BAND SCANNER FAULTS



FLOWCHART 42 X-BAND SCANNER FAULTS ('STBY/TX ERROR SHOWN)

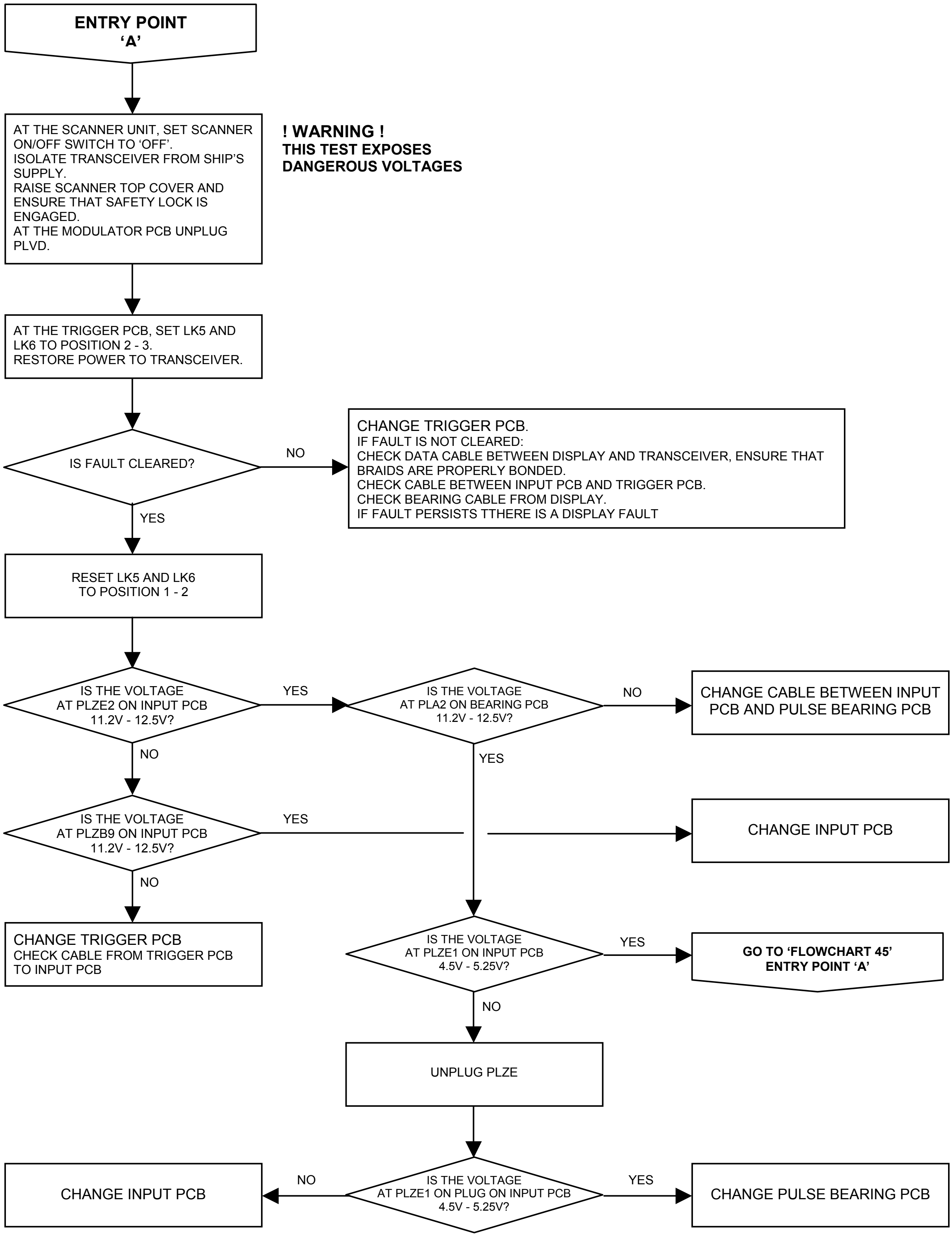


FLOWCHART 43 X-BAND SCANNER FAULTS ('SPARK GAP TEST' FAILURE)

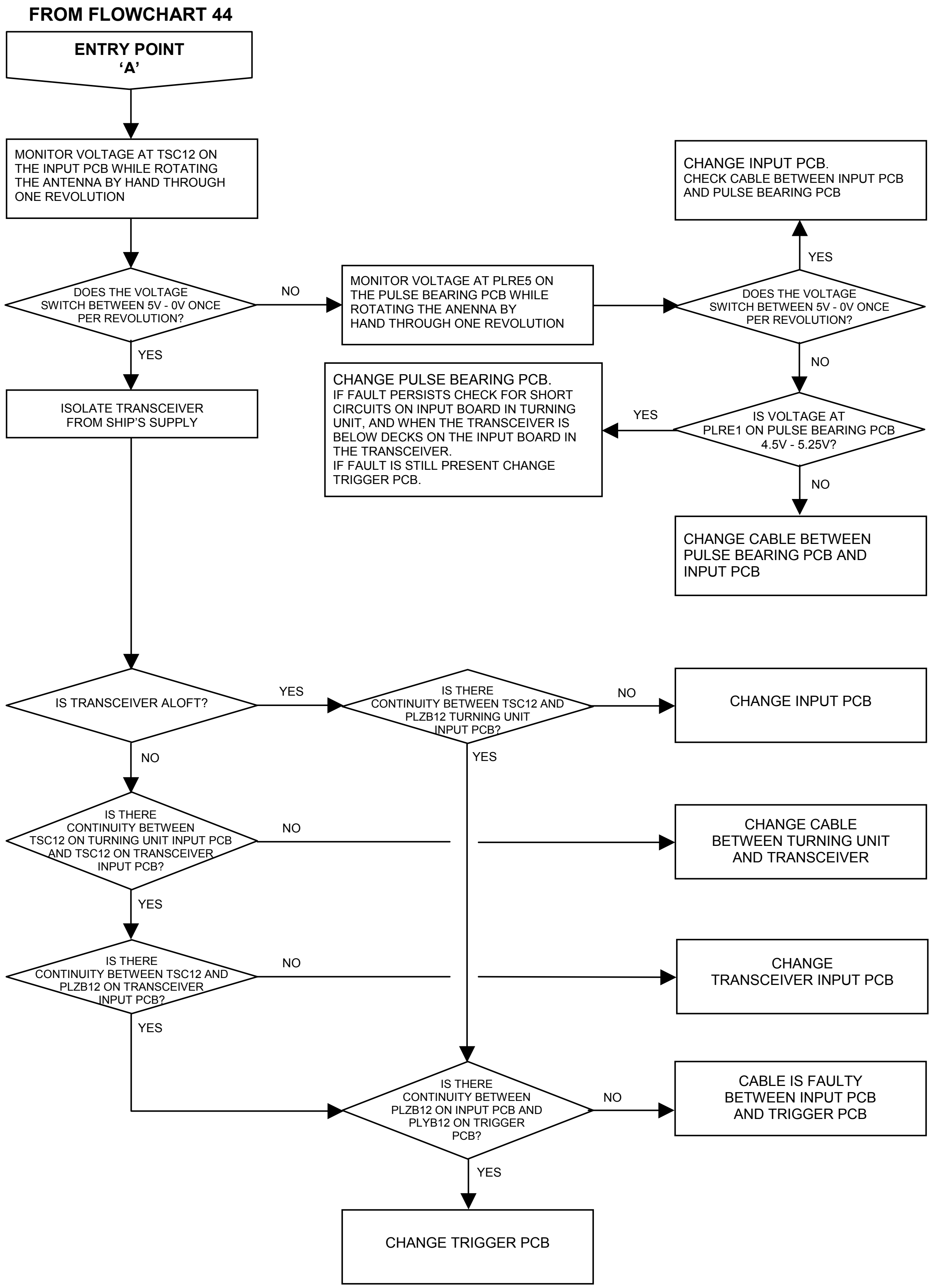


FLOWCHART 44 X-BAND SCANNER FAULTS ('MISSING HMKR ERROR' SHOWN)

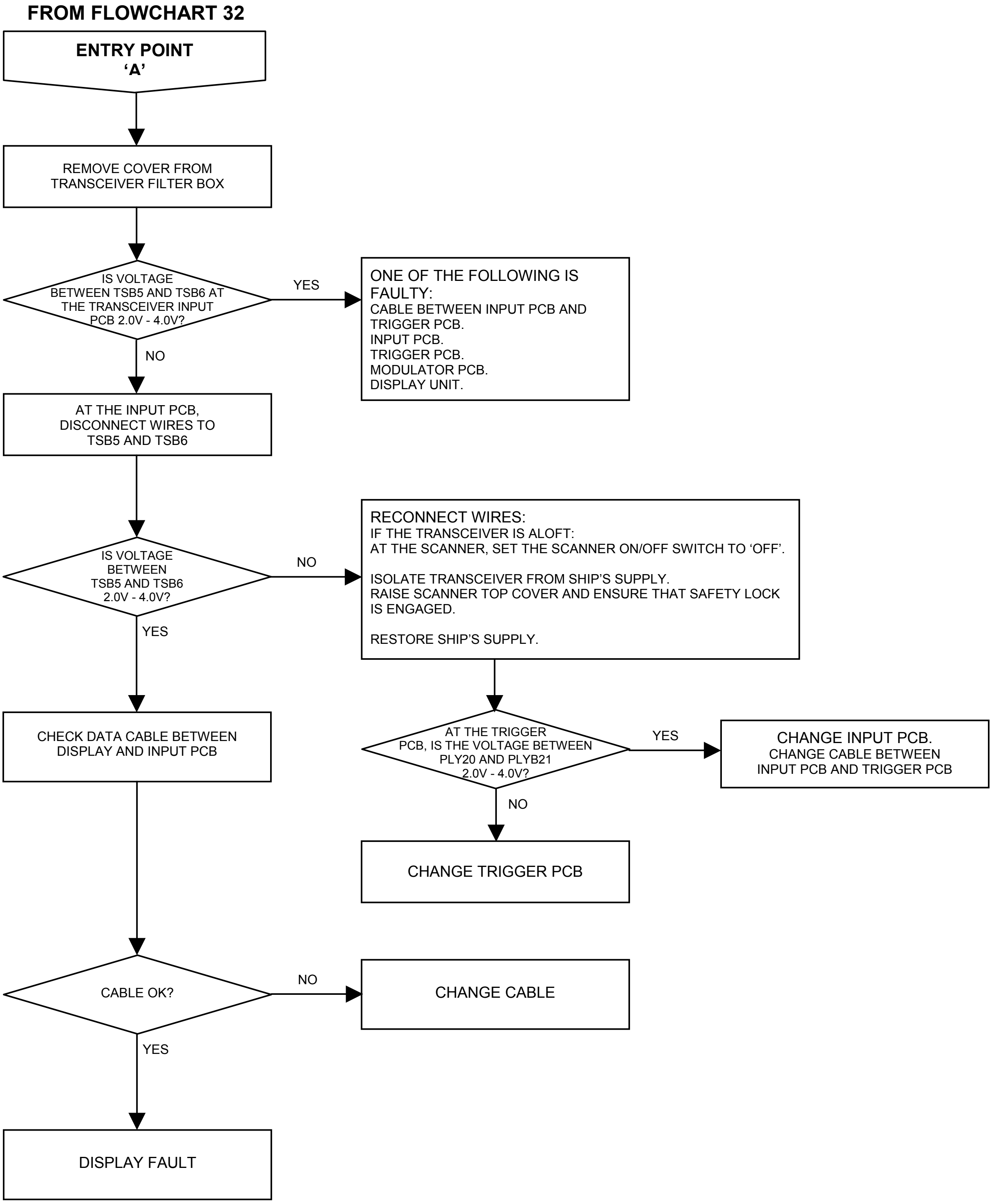
FROM FLOWCHART 32 OR 56



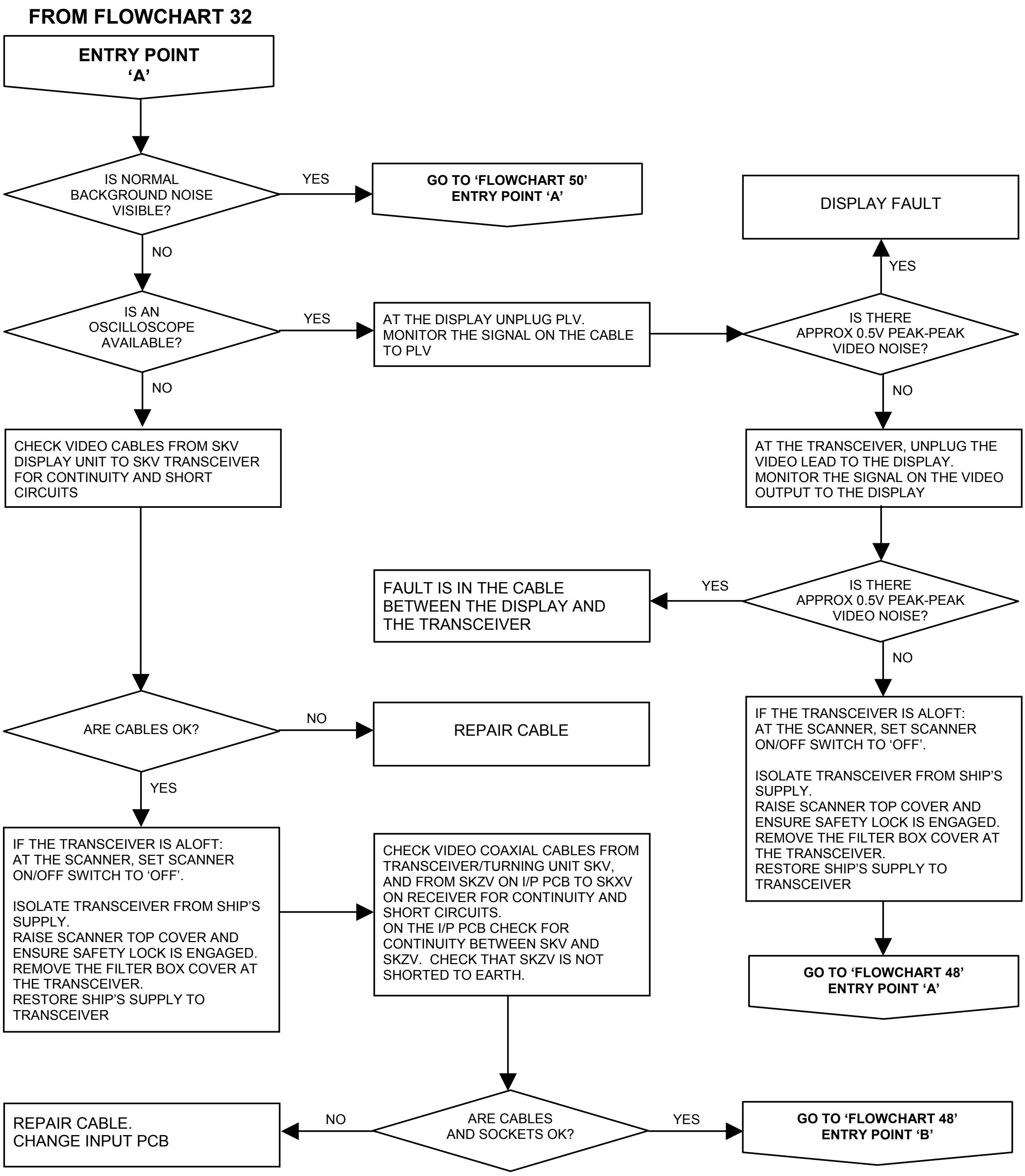
FLOWCHART 45 X-BAND SCANNER FAULTS



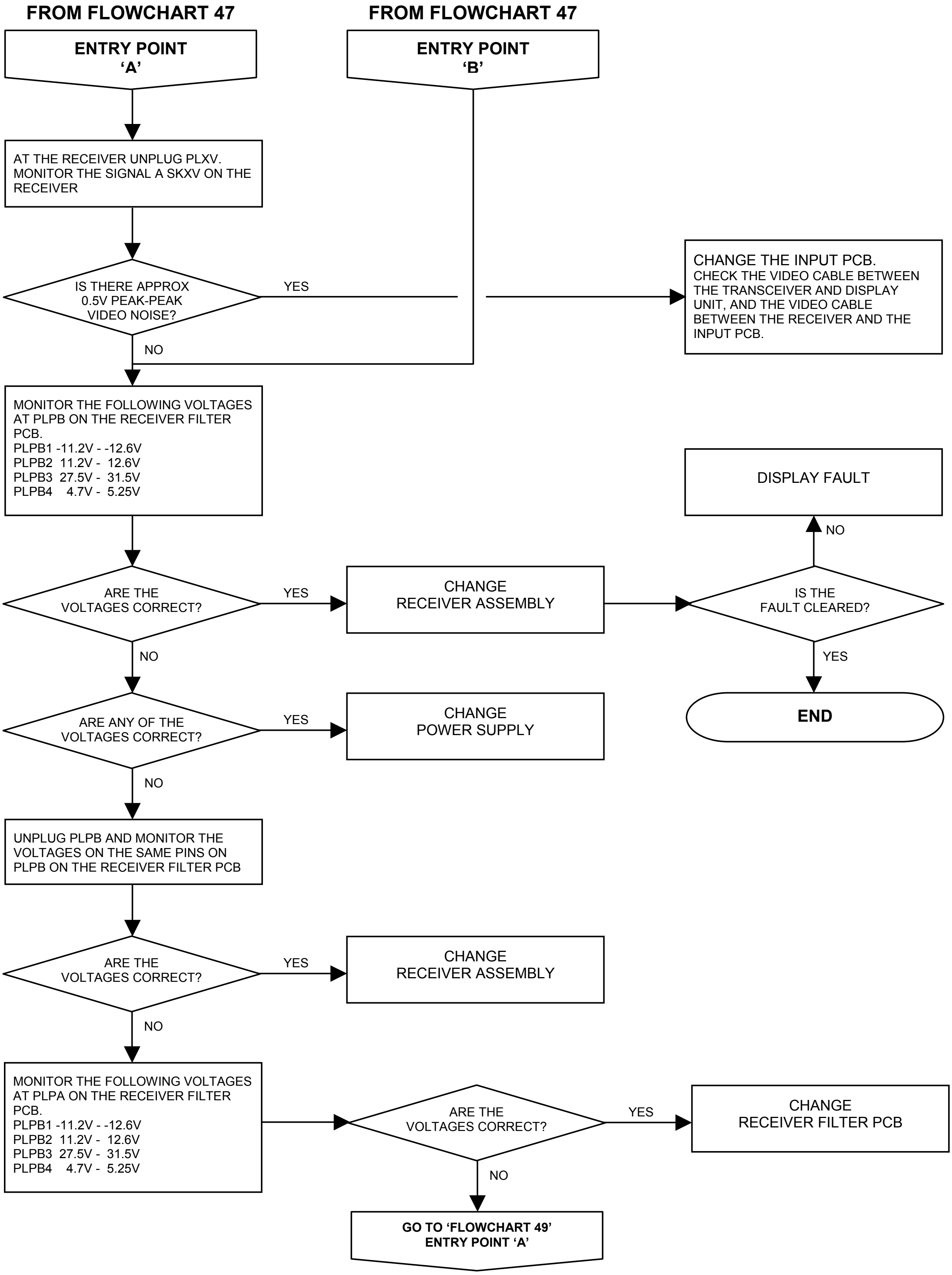
FLOWCHART 46 X-BAND SCANNER FAULTS ('TRIGGER ERROR' SHOWN)



FLOWCHART 47 X-BAND SCANNER FAULTS (‘TX ERROR’/’LOW VIDEO ERROR’ SHOWN)

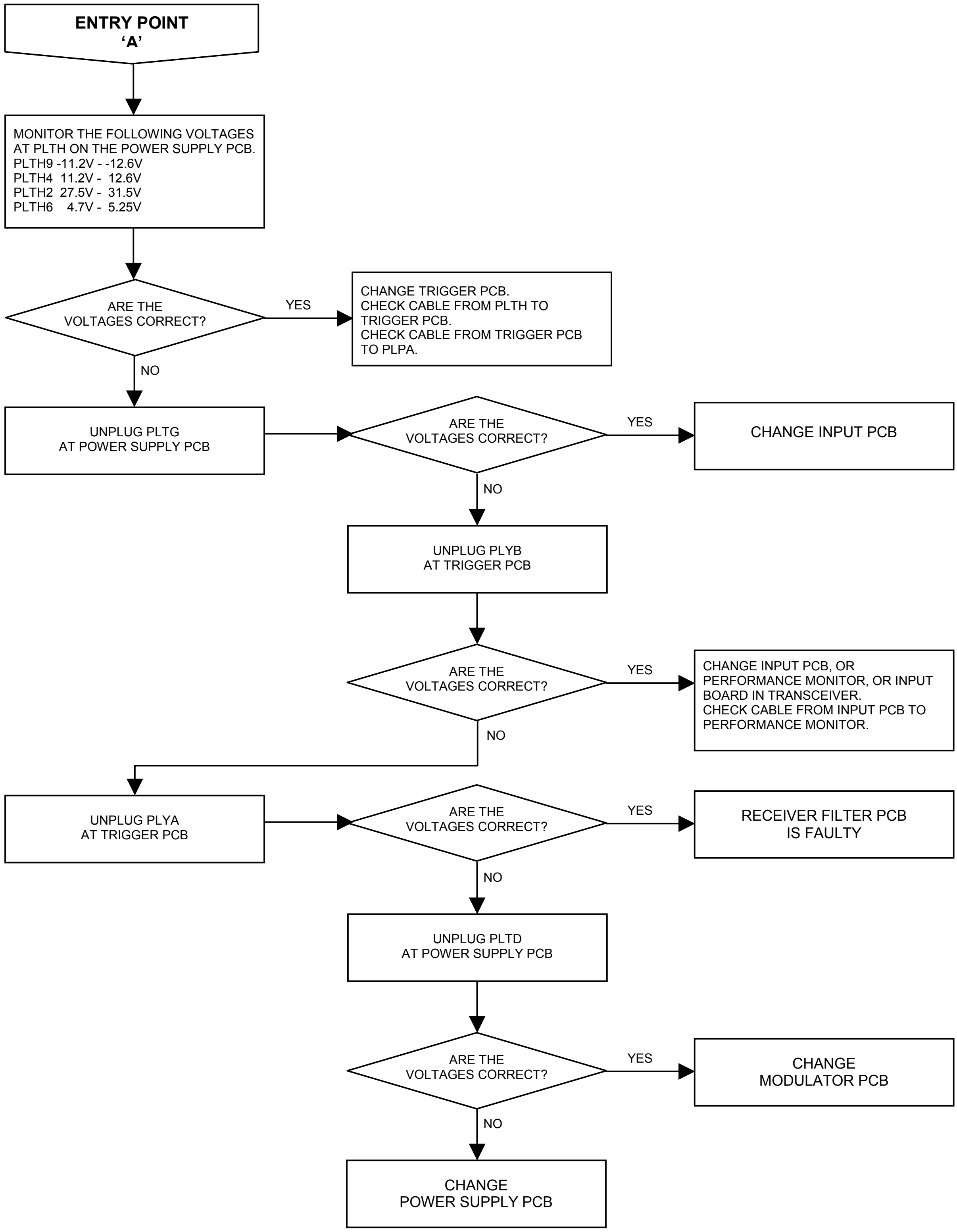


FLOWCHART 48 X-BAND SCANNER FAULTS

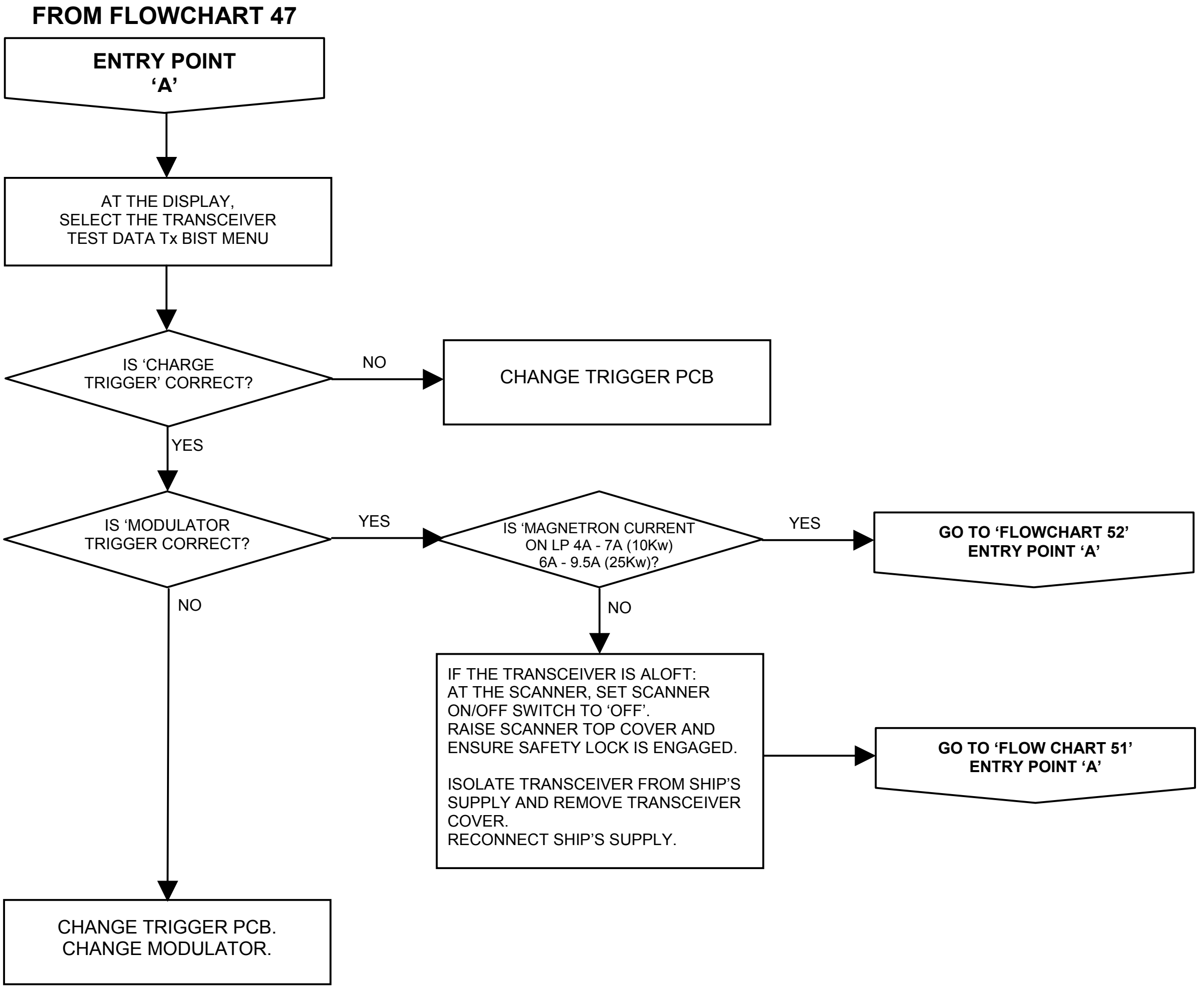


FLOWCHART 49 X-BAND SCANNER FAULTS

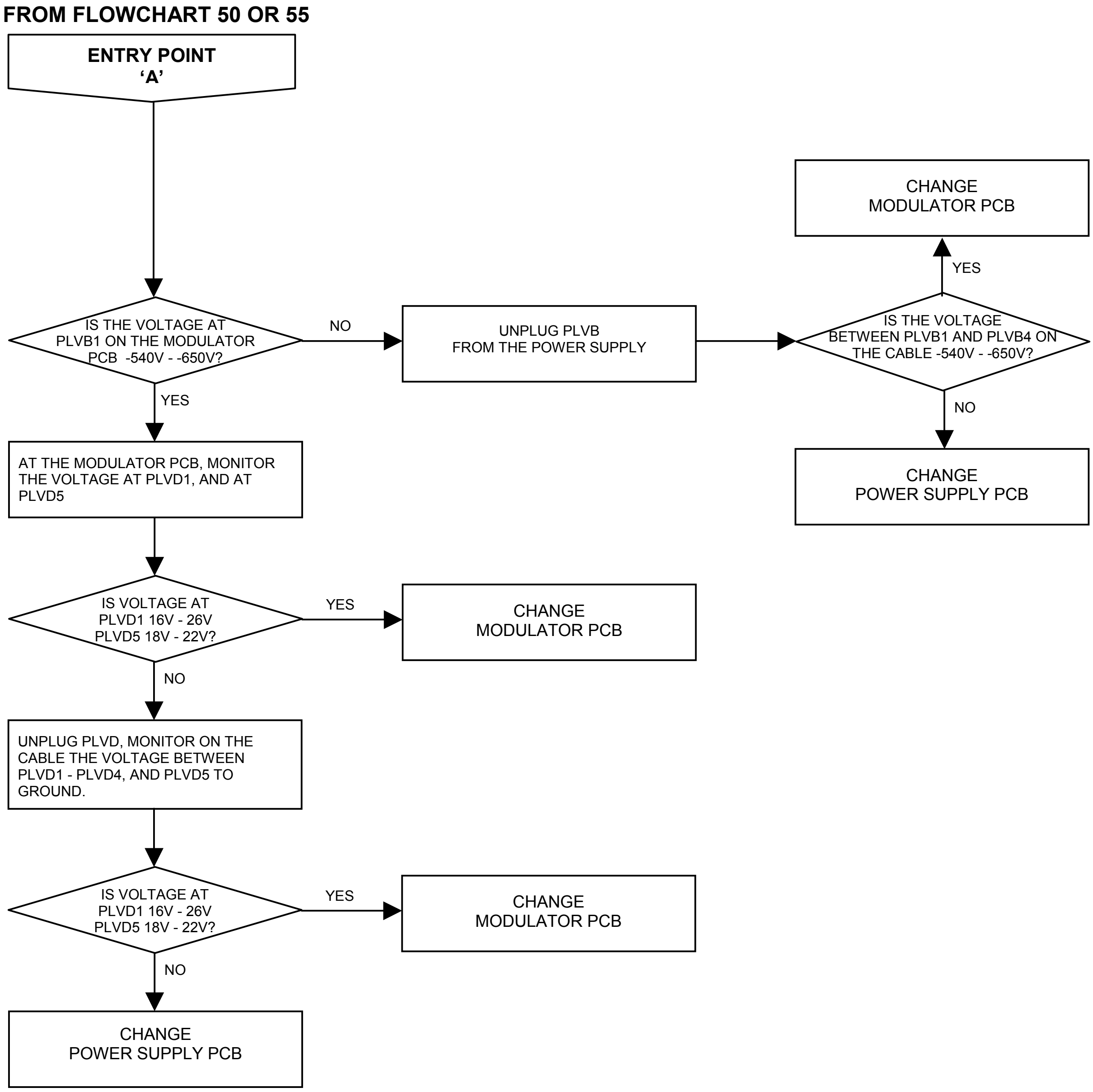
FROM FLOWCHART 48 OR 55



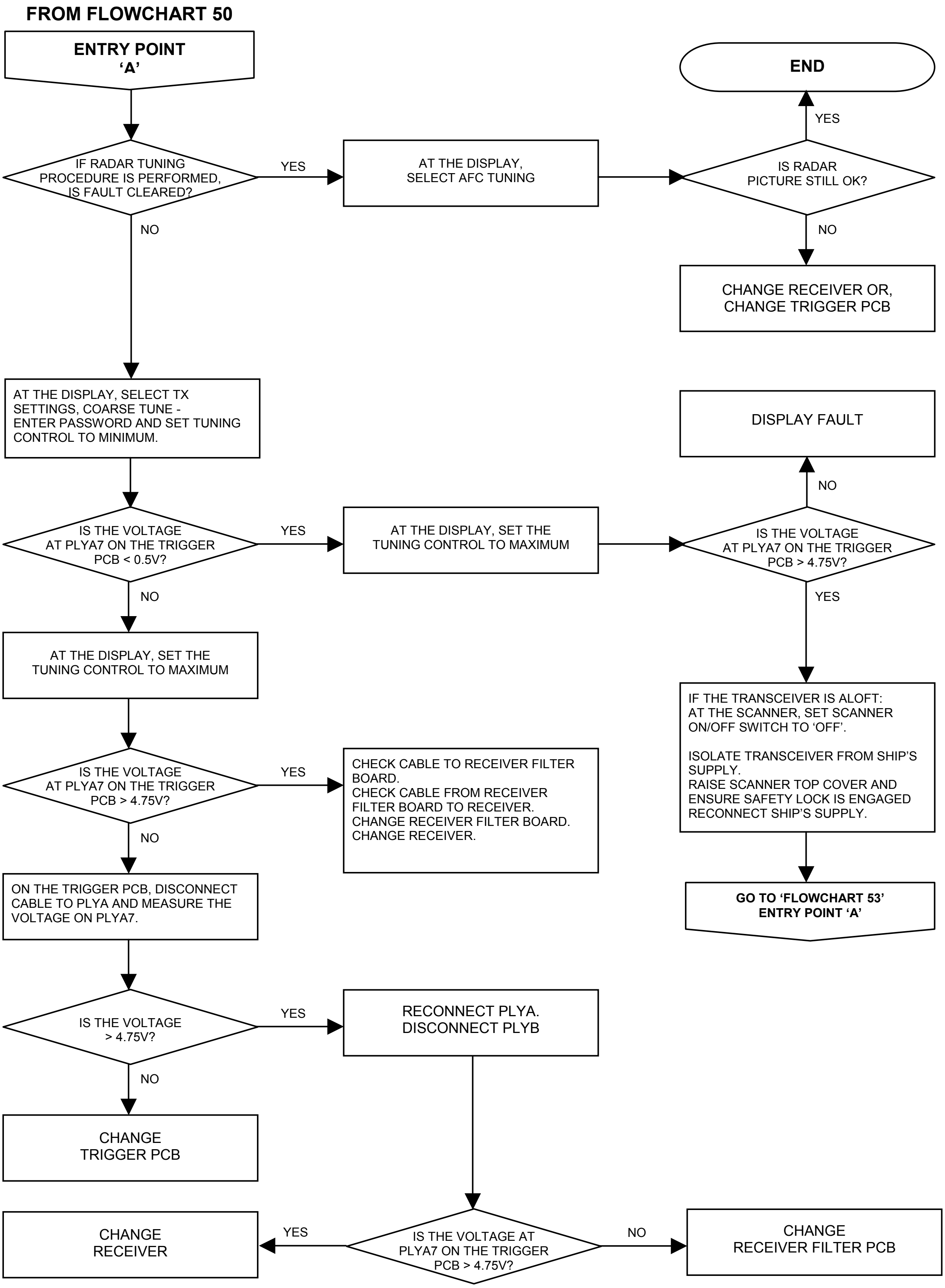
FLOWCHART 50 X-BAND SCANNER FAULTS ('LOW VIDEO ERROR' SHOWN)



FLOWCHART 51 X-BAND SCANNER FAULTS

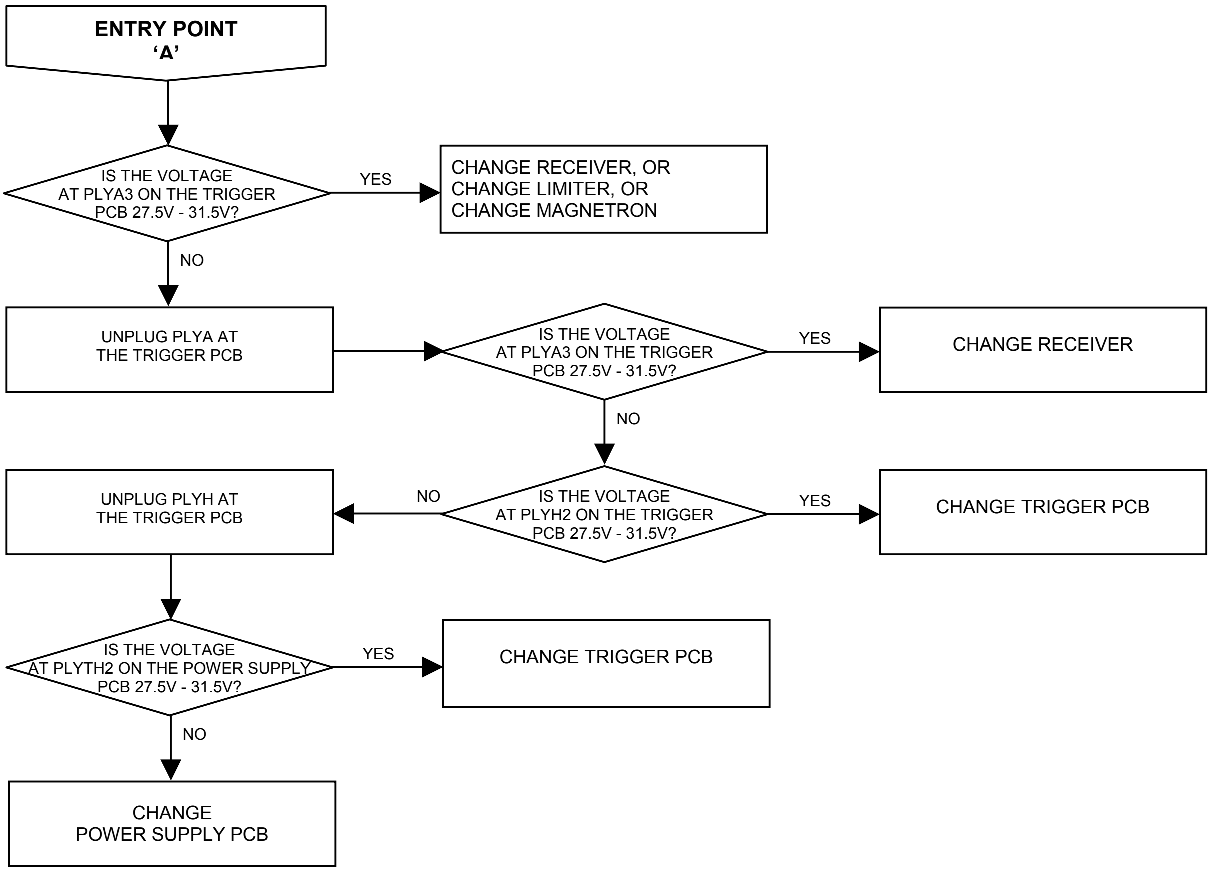


FLOWCHART 52 X-BAND SCANNER FAULTS

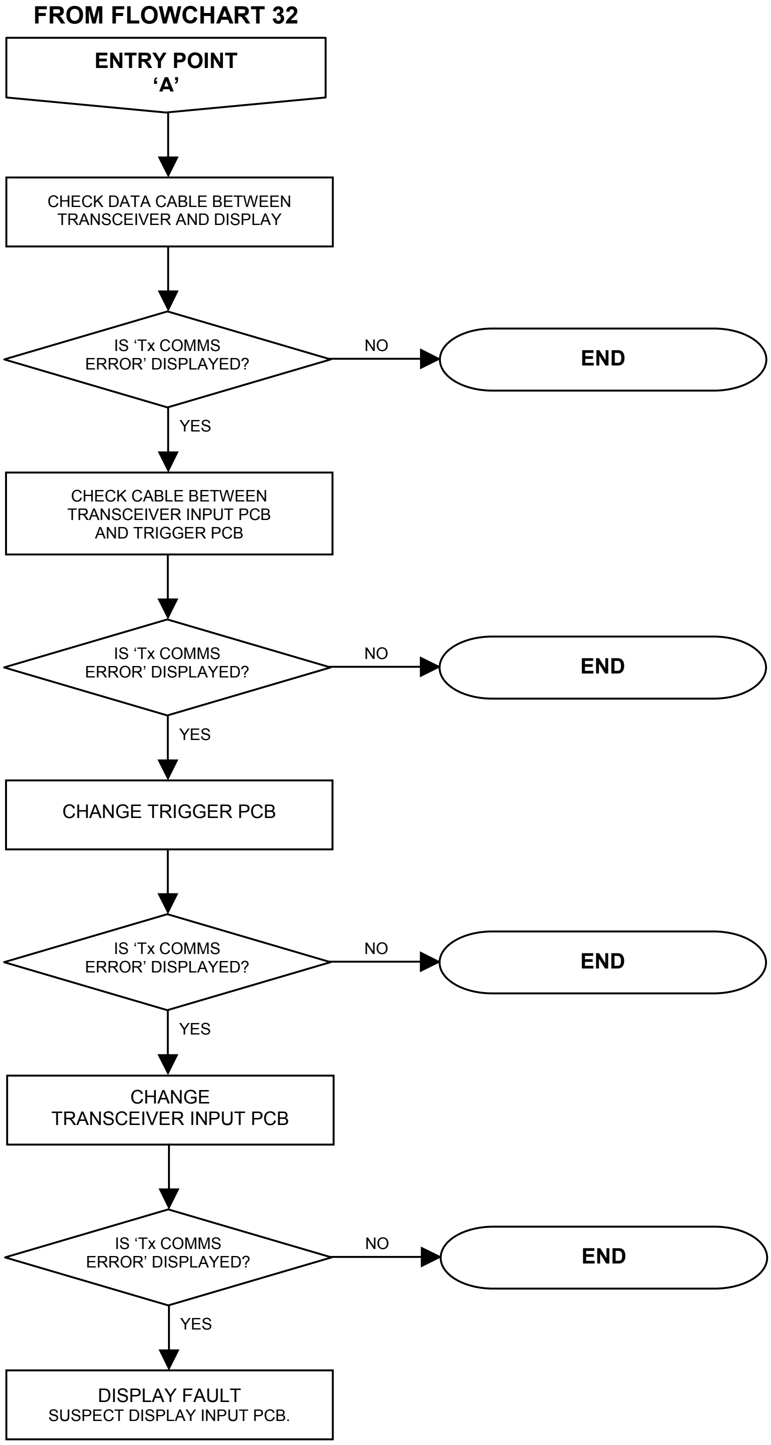


FLOWCHART 53 X-BAND SCANNER FAULTS

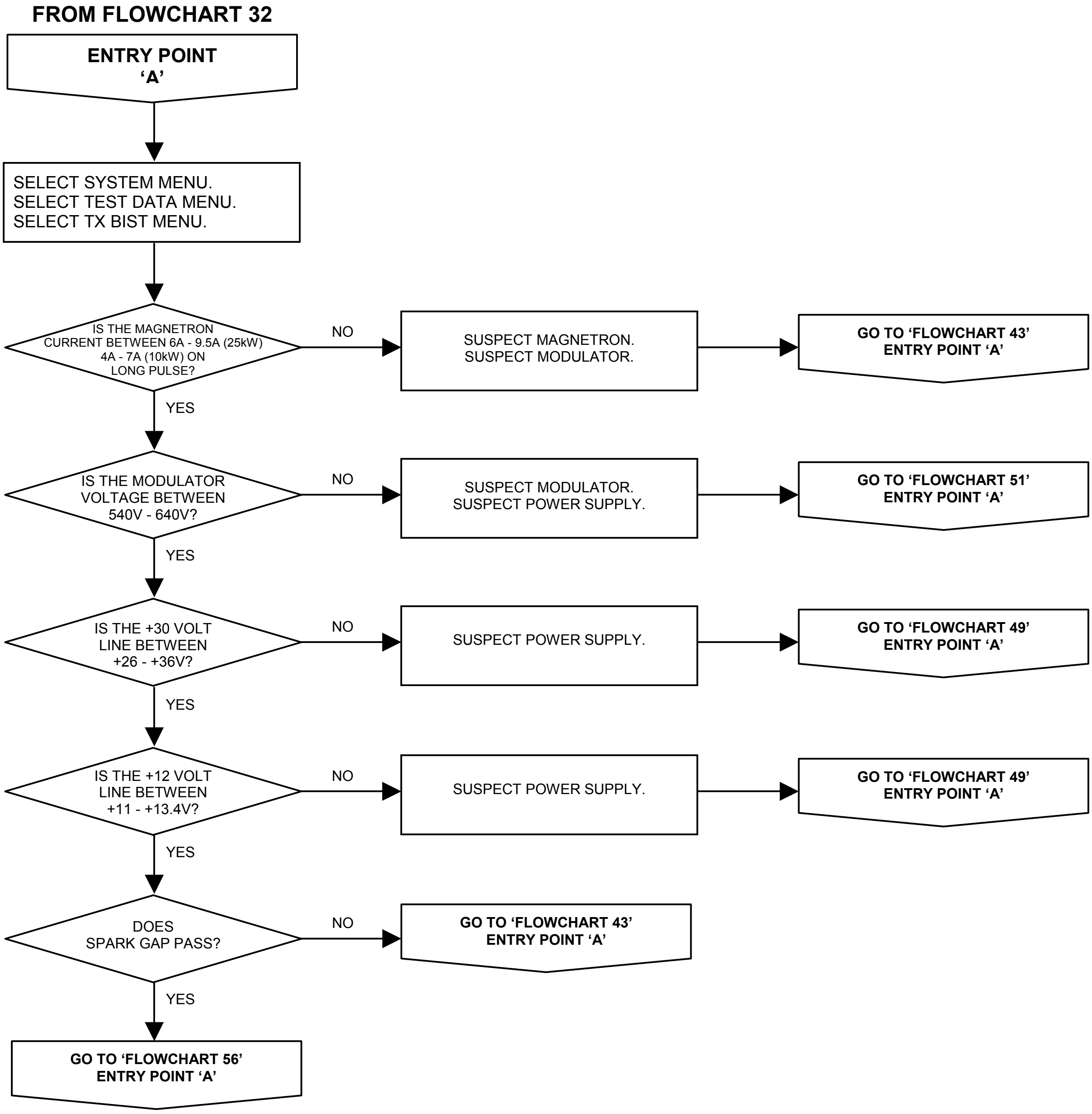
FROM FLOWCHART 52



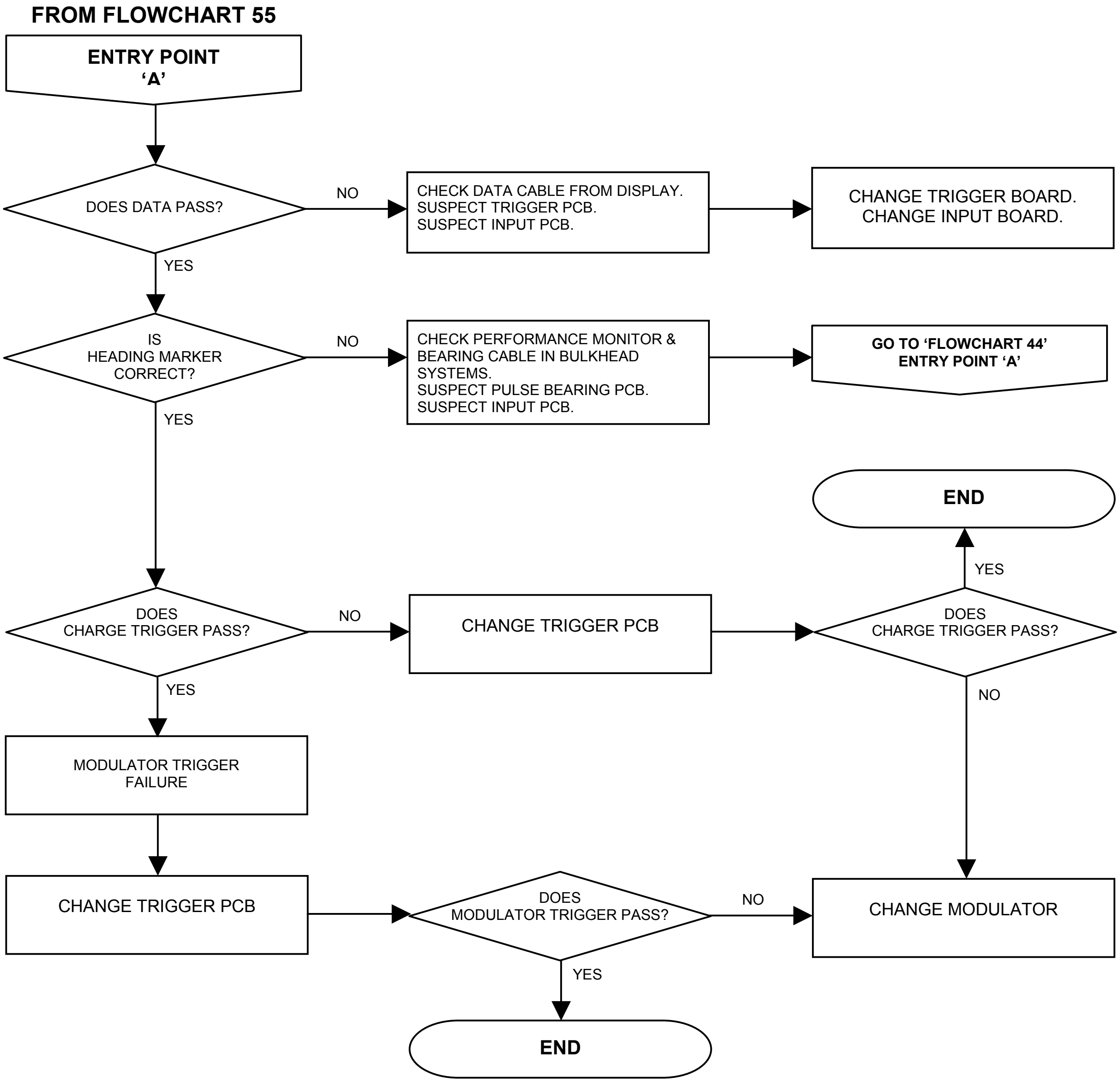
FLOWCHART 54 X-BAND SCANNER FAULTS (‘TX COMMS ERROR’ SHOWN)



FLOWCHART 55 X-BAND SCANNER FAULTS (‘TX BIST ERROR’ SHOWN)



FLOWCHART 56 X-BAND SCANNER FAULTS



3 First Line Servicing

!WARNING!
Before removing any component parts,
the equipment must be isolated from the mains supply.

3.1 Display Units

(Including Processor Electronics Units (PEUs) and Control Modules)

3.1.1 Preliminary Notes

1. Isolate the mains supply to the display unit.
2. Before disassembling the Processor Electronics Unit or Monitor components of the Display Unit, make sure the integrity of the connections to the units has been checked.
3. All radar user controls, except for monitor brilliance, are routed through the Display Processor board. Therefore, a display processor fault may indicate faults on the Display Processor board, the Joystick/Trackerball, the Memory Card Unit or the Keyboard.

3.1.2 Removal and Replacement of Processor Electronics Unit Sub-assemblies

Processor Electronics Unit sub-assemblies may include the following units:

- Display Power Supply
- Display/Radar Processor board(s)
- Integral Keyboard (optional)
- Integral Joystick/Trackerball
- Integral Memory Card Unit
- On/Off Switch assembly

The Integral Processor Electronics Unit is mounted underneath the display monitor. The Kit Processor Electronics Unit is fitted into the pedestal of deck or console-mounted displays. Refer to Figure 6.1 and Figure 6.2 and the steps below for access to these units.

Make sure that access is available to the front of the PEU. This is identified by the location of either the operator controls or the fan. In console displays:

1. Remove the pedestal covers.
2. Unbolt the PEU for access.
3. Unplug the cables connected to the front of the PEU.

To release the outer PEU moulding:

1. Remove the two fixing screws at the front.
2. Pull the moulding forward.

Removing and Replacing the Fan Filter

The fan filter is located in the rectangular filter recess at the front of the inner moulding for non-keyboard integral displays. It is removable once the outer moulding has been released.

For an integral keyboard or kit version:

1. Remove the four screws securing the fan grill.
2. Change the filter and refit the grill.

Removing and Replacing the Integral Keyboard (optional)

1. Disconnect the cable from the keyboard and where it plugs into the inner moulding.
2. Remove the four nuts securing the keyboard into the outer moulding.
3. Reverse the procedure for replacement.

To release the Inner PEU moulding:

1. Undo the fixing screws securing the inner moulding to the PEU main body.
2. Pull the moulding away from the body.
3. Disconnect all cables to units in the inner moulding at the processor boards and power supply in the main body of the PEU.

Removing and Replacing the Integral On/Off Switch assembly

1. Remove the switch fixing plate from the inner moulding using a small M3 spanner
2. Push the switch assembly out of the fixing plate
3. Reverse the procedure for replacement.

Removing and Replacing the Integral Joystick/Trackerball and Memory Card assemblies

1. If a memory card assembly is fitted, disconnect the cable linking it to the joystick/ trackerball assembly.
2. Loosen the locating screws for the appropriate assembly – see Figure 6.1
3. Pull the required assembly out from its moulding aperture by pivoting it on the lower edge of the aperture, and then lifting up.
4. Reverse the procedure for replacement.

Removing and Replacing the Power Supply

1. Disconnect the power cable at the front of the power supply.
2. Pull on the strap at the front of the power supply cover and slide the unit out.
3. Slide the replacement unit back in, ensuring that it is firmly pressed home.
4. Reconnect the power cable.

Removing and Replacing the Processor Board(s)

In displays with a single Combined Processor board, replace this board if either radar processor or display processor faults are suspected.

In displays with separate Radar and Display Processor boards, identify the board to be replaced. The display processor has more connectors on its edge than the radar processor.

1. Remove any cables still connected to the board.
2. Use the plastic ejection levers at each end of the board to lever the board out.
3. Pull out the board.
4. Remove all daughter boards from the processor board.
5. Transfer the daughter boards to the replacement board, ensuring correct orientation and location.
6. Make sure links on the replacement board are set appropriately.
7. Replace the board.
8. Make sure the ejection levers are in their home position when the board is plugged in.
9. Make sure that the board is firmly pressed home.
10. Reconnect any cables, if appropriate, to other processor boards.

Removing and Replacing the Compass Board

The compass board is a daughter board on the Display Processor board or Combined Processor board.

1. Use the above procedure for replacing the processor board(s), but in this case only replace the compass board, with one of the same type.
2. Make sure the links on the replacement board are set appropriately.

Re-assembling the Processor Electronics Unit

1. Reconnect cables from front PEU moulding.
2. Secure the moulding, remembering to re-connect the Keyboard, if appropriate.
3. Refer to Figure 6.7 and Figure 6.8 when re-connecting cables.

3.1.3 Removal and Replacement of Kit Control Panel Modules

Kit Control Panel modules may include the following modules:

- Keyboard module (optional)
- Joystick/Trackerball module
- Memory Card module
- On/Off Switch module
- Brilliance module

1. Remove the nuts securing each module (underneath the control panel top surface).
2. Unplug connecting cables to the modules before removing them.
3. Refer to Figure 6.7 and Figure 6.8 when re-connecting cables.

3.1.4 Removal and Replacement of Operator controls on 340 Display Units

For versions with extruded control panel (as shown in Figure 6.2 in this chapter):

1. Remove the control panel lower cover
2. Proceed as in sub-section 3.1.3.

For versions with the moulded control panel (as shown in the Preamble at the front of the manual):

1. Release the two securing screws hidden behind the slotted covers on the underside of the control panel (the control panel will be hinged down).
2. This will expose the locating screws for the Trackerball/Joystick and Memory Card assemblies at the back of the unit.
3. Loosen the locating screws for the appropriate assembly
4. Remove the assembly by pivoting it upwards on the front edge of the moulding aperture.
5. Unplug the interconnecting cables before fully removing the assembly from the aperture.
6. Reverse the procedure for replacement.

3.1.5 Removal of CRT Display Monitor Unit Sub-assemblies

Desk Mounted 180 and 250 Display Monitors

Remove the monitor outer cover as follows:

1. Unscrew the two screws on the top of the cover.
2. Lift the cover up and then forward.
3. Unplug the brilliance control cable at the Brilliance board (mounted on the bezel moulding).
4. Remove the Brilliance board, if necessary, by unscrewing it from the bezel moulding.
5. Unplug all cables connected to the monitor, taking note of the location of the Secondary Viewer cable, if fitted.
6. Unscrew the four screws at the edge of the finned drive board heat sink (used secure it to the chassis) and hinge it away from the chassis.
7. Using the appropriate monitor block diagram for the particular monitor display (Figure 6.3 to Figure 6.6, identify the monitor components contained within the dotted outline in the diagram, these must be replaced as a group).
8. **Make sure that at least 3 minutes has elapsed from switch-off for the CRT anode voltage to safely discharge**.
9. Disconnect the identified interconnected components from the rest of the unit, leaving the drive board until last
10. Remove the drive board assembly (this includes the finned heat sink) by unscrewing the hinge arms and board stay from the unit.

340 Deck Mounted Display Monitors

To gain access to the display monitor in the 340 deck-mounted display unit refer to Figure 6.2.

1. Make sure the display unit is securely fixed to the deck.
2. While supporting the console control panel, release its two captive fixing screws, and then let it swing down carefully. Note: it may be necessary to remove the control panel lower cover to access these fixing screws.
3. Release the two captive monitor fixing bolts under the monitor (accessible from between the control panel and display monitor).
4. Remove the display top handle by undoing its three fixing screws.
5. Undo the four CRT bezel fixings, and guide the top of the monitor forward into the unit's service position.
6. Continue as for monitor modules below.

180, 250 and 340 Kit Monitor Modules

1. Unplug all cables connected to the monitor, taking note of the location of the Secondary Viewer cable, if fitted.
2. Release the two latch levers securing the finned drive-board heat sink to the chassis, and hinge it away from the chassis.
3. Using the appropriate monitor block diagram for the particular monitor display (Figure 6.3 to Figure 6.6), identify the monitor components contained within the dotted outline in the diagram (these must be replaced as a group).
4. **Make sure at least 3 minutes have elapsed since switch-off for the CRT anode voltage to safely discharge**.
5. Disconnect the identified interconnected components from the rest of the unit as a group, leaving the drive board until last.
6. The drive board (this includes the finned heat sink) can be removed as follows:
   a. Detach the earth braid connection to the chassis at the drive board.
   b. Release the board stay if fitted.
   c. Slide the drive board hinges apart.

3.1.6 Replacing and Setting-up of CRT Display Monitor Unit Sub-assemblies

Replace the boards using the appropriate board set as shown in Section 4.1 of this chapter. To fit the board sets:

1. Use the reverse of the removal procedure.
2. After reconnecting the external monitor cables, connect the internal brilliance control up (if applicable)
3. Leave the drive board in its hinged down position to facilitate adjustments during the setting up procedure below.

Note – If an RGB output board is fitted to the drive board that is being replaced, this must be transferred to the drive board in the replacement board set. Two screws on the drive board heatsink secure it. Its ribbon cable plugs into the drive board.

4. After checking that the display boards are fully reconnected, power up the radar display.
5. Check that the fan (if fitted) is operating.
6. Refer to 'Monitor Test Mode' section in Chapter 5 for the following adjustments:
   a. Adjust the brilliance control to a normal level.
   b. Access the monitor test mode, and select Test Pattern 1.
   c. Identify the location of the focus and screen (Grid 2) controls. If they are not situated on the LOPT, they will be found on the adjoining dual focus module.
   d. Adjust the focus control(s) for the sharpest white grid lines.

Geometry

Using the Monitor Test menu on the screen:

1. Adjust (if necessary) the geometrical parameters in the left hand column of the menu to produce the closest match to Test Pattern 1 as shown in the manual.
2. If necessary, adjust the horizontal linearity inductor L1 to match the width of the left hand squares to the other squares.
3. Adjust the pattern size to fill the screen with its white border fully visible.

Colour Level Adjustment

This must be carried out under the minimum operating ambient light level conditions:

1. Select Test Pattern 2
2. Adjust the display brilliance control to maximum.
3. Adjust the present brightness parameter (Monitor Test menu) so that the pattern is just visible.
4. Select Test Pattern 3 (which shows a solid white rectangle).
5. Adjust the display brilliance control, black level (red) and black level (blue) so that the white rectangle is just visible and a good white.
6. Adjust the display brilliance, and red and blue gain controls to give the brightest picture without any signs of video overload (streaking), and a white rectangle with a hint of blue. If necessary, the green gain can also be adjusted.
7. Repeat the colour level adjustment procedure until no further adjustments are required.

If any problems are encountered regarding insufficient control range on any of the controls, adjust the screen (G2) control on the drive board as follows:

1. Using a DVM, measure the voltages on TP26, 27 and 28 on the drive board (on external connectors edge of board) with respect to the chassis.
2. Adjust the screen control so that the three voltages measured are in the range 65 to 95V.
3. Carry out the colour level adjustment procedure again.

Final check

4. Set the display brilliance to maximum.
5. Adjust the preset contrast control to give the brightest picture without video overload.
6. Switch off and complete the re-assembly of the display monitor.
7. If the picture size was adjusted without the CRT bezel fitted, re-adjust the picture size so that the white border of Test Pattern 1 is fully visible.

3.1.7 Removal and Replacement of Flat Panel Monitors

There are no user serviceable parts for Flat Panel Monitors, the only service replacement is the whole unit.

Desk Mounted 180 and 250 Flat Panel Monitors

1. Remove the four screws securing the monitor to the PEU.
2. Disconnect the connecting cables at the PEU.
3. Reverse the procedure for replacement.

Desk Mounted 340 Flat Panel Monitor

1. Undo the five screws holding the bezel to the cover, two at the sides and three at the top.
2. Remove the eight screws securing the monitor to the chassis.
3. Disconnect the connecting cables and power cables.
4. Reverse the procedure for replacement.

Deck Mounted 340 Flat Panel Monitor

1. Remove the four screws securing the monitor to the chassis.
2. Disconnect the connecting cables and power cables.
3. Reverse the procedure for replacement.

Kit 180, 250 and 340 Flat Panel Monitors

1. Disconnect the connecting cables and power cables.
2. Reverse the procedure for replacement.

Final check

Refer to Chapter 5, Section 4 for full details of setting up. The only parameter they may require setting after a change of Flat Panel Monitor is the phase parameter.

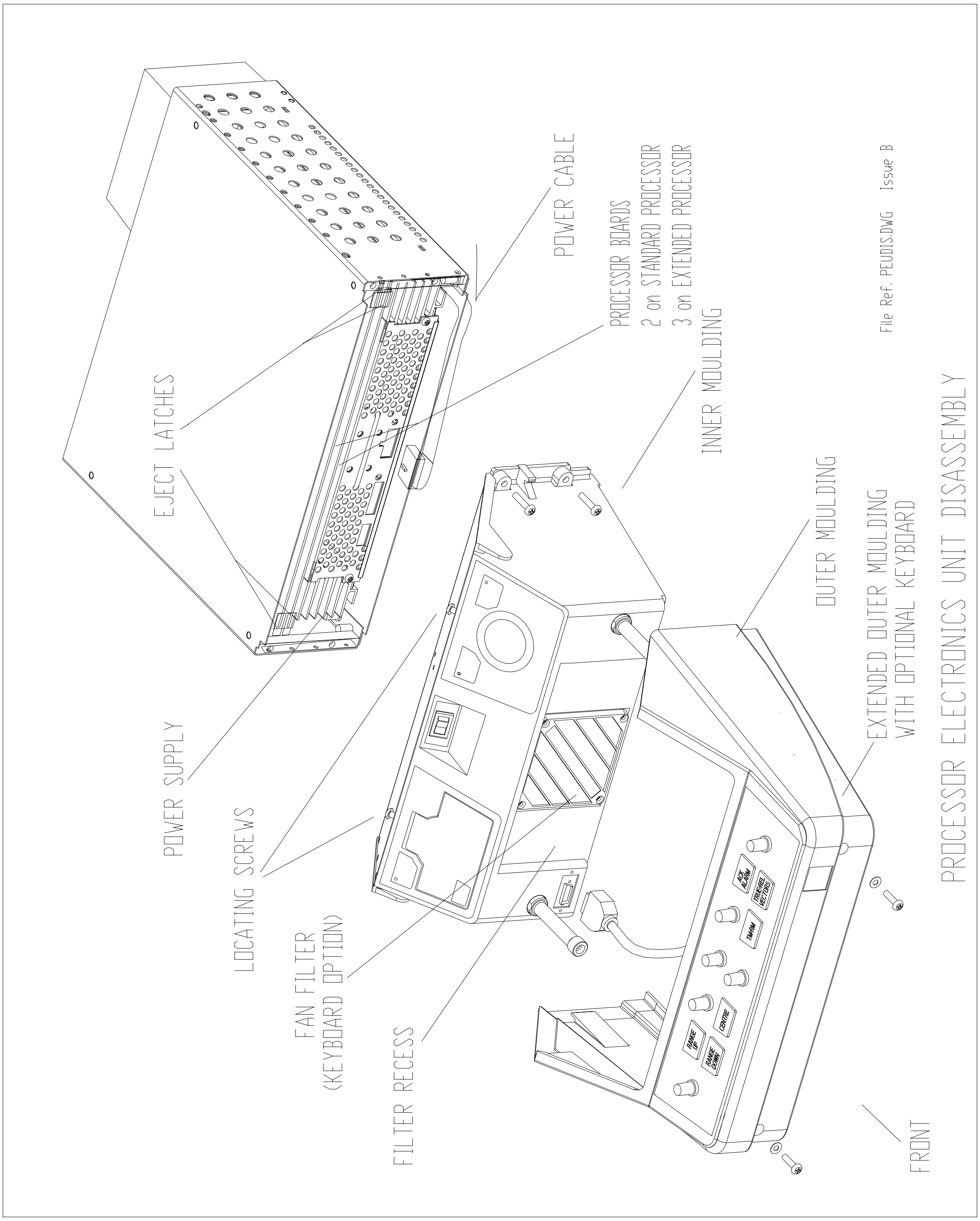


Figure 6.1. Processor Electronics Unit – Disassembly

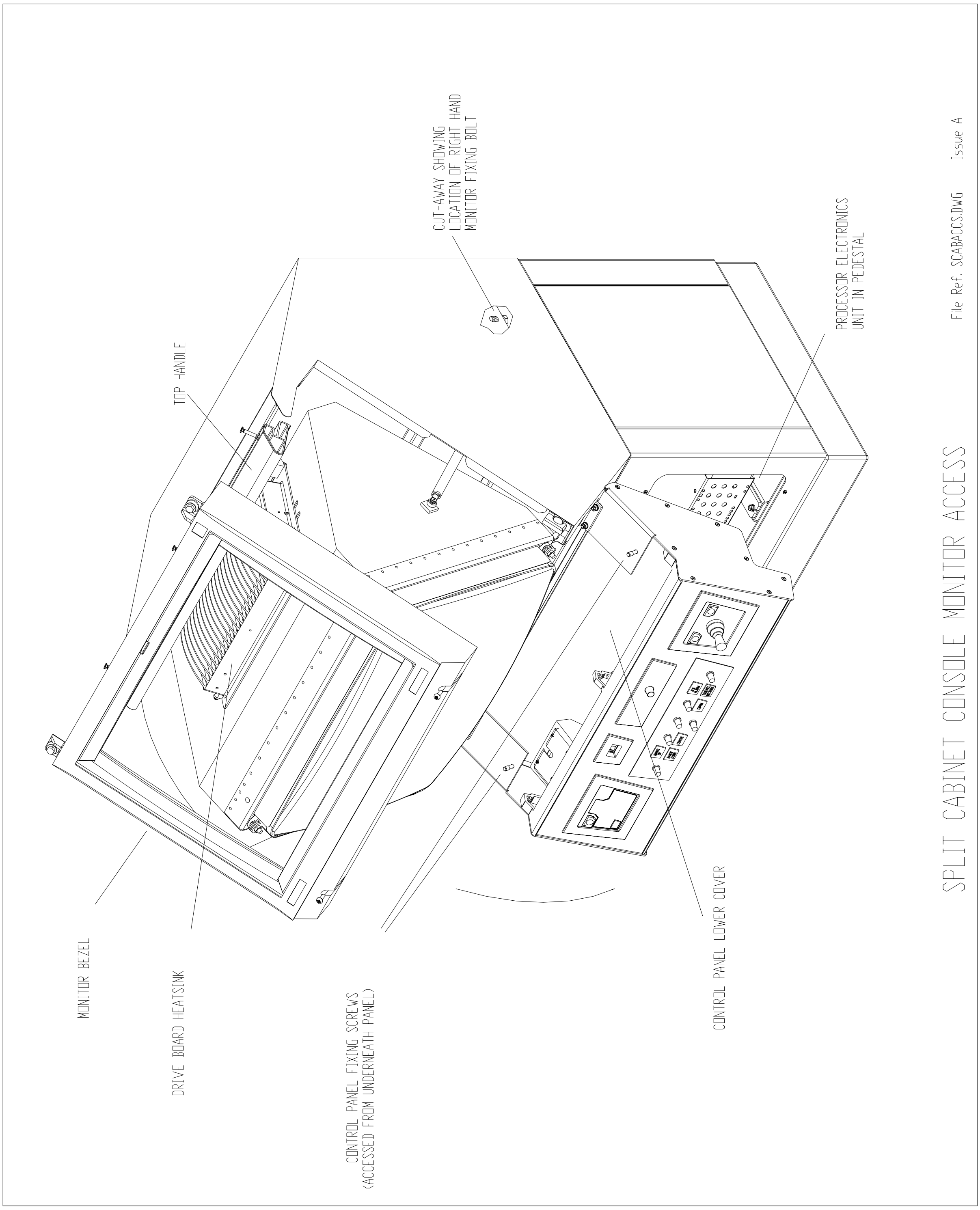


Figure 6.2. Split Cabinet Console – Monitor Access

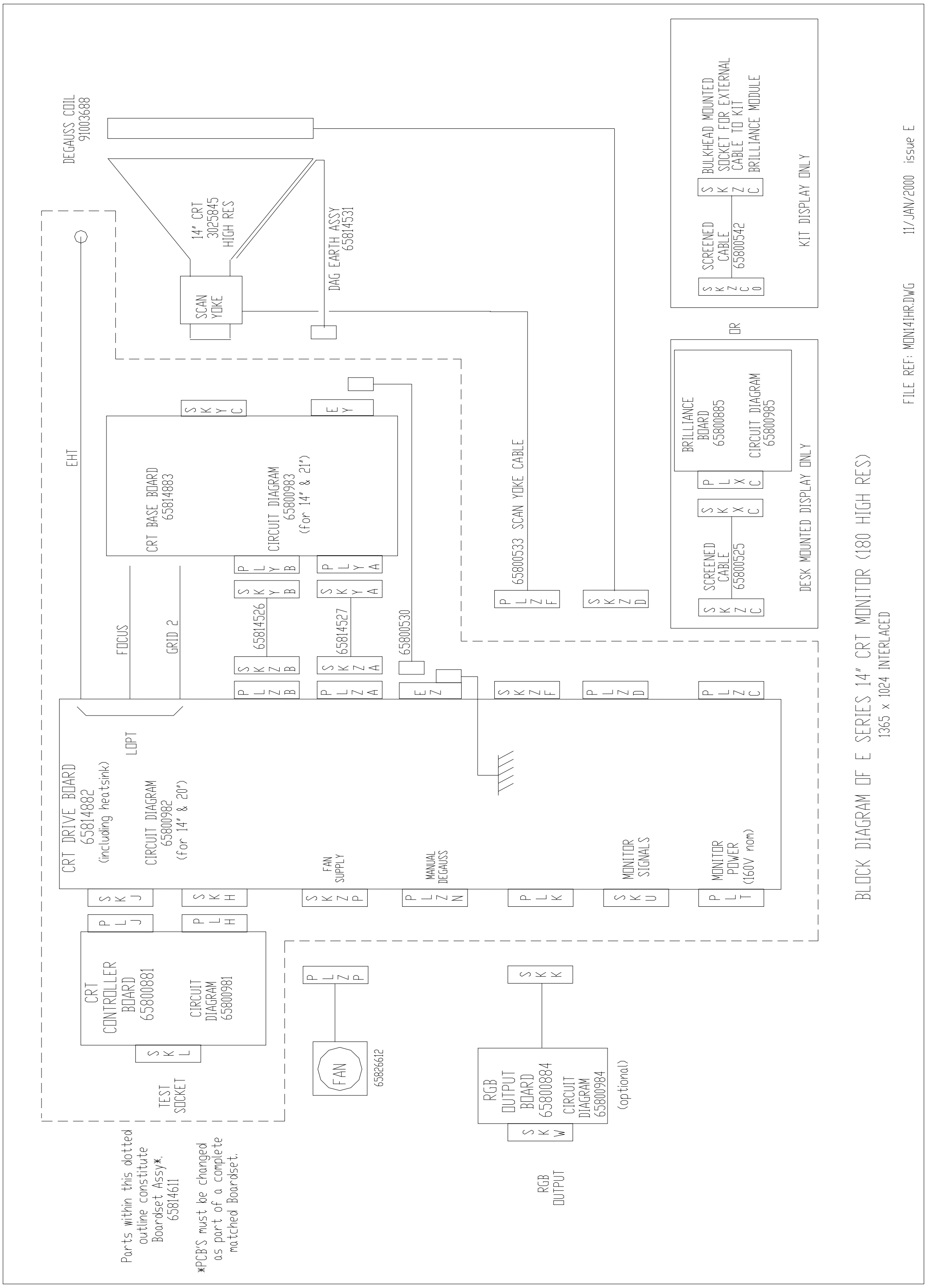


Figure 6.3. Block Diagram – 180 Monitor (14" High Resolution)

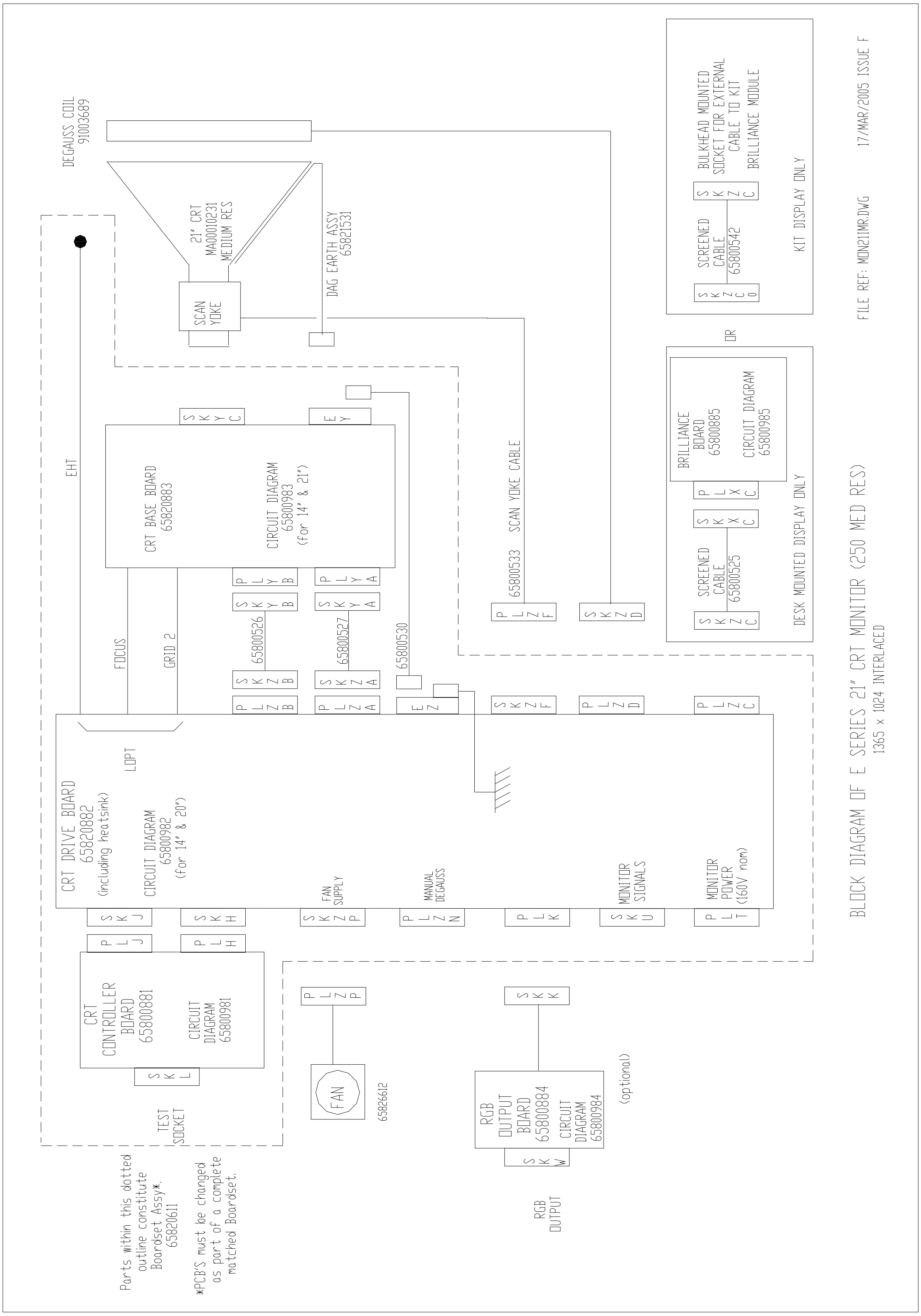


Figure 6.4. Block Diagram – 250 Monitor (21" Medium Resolution)

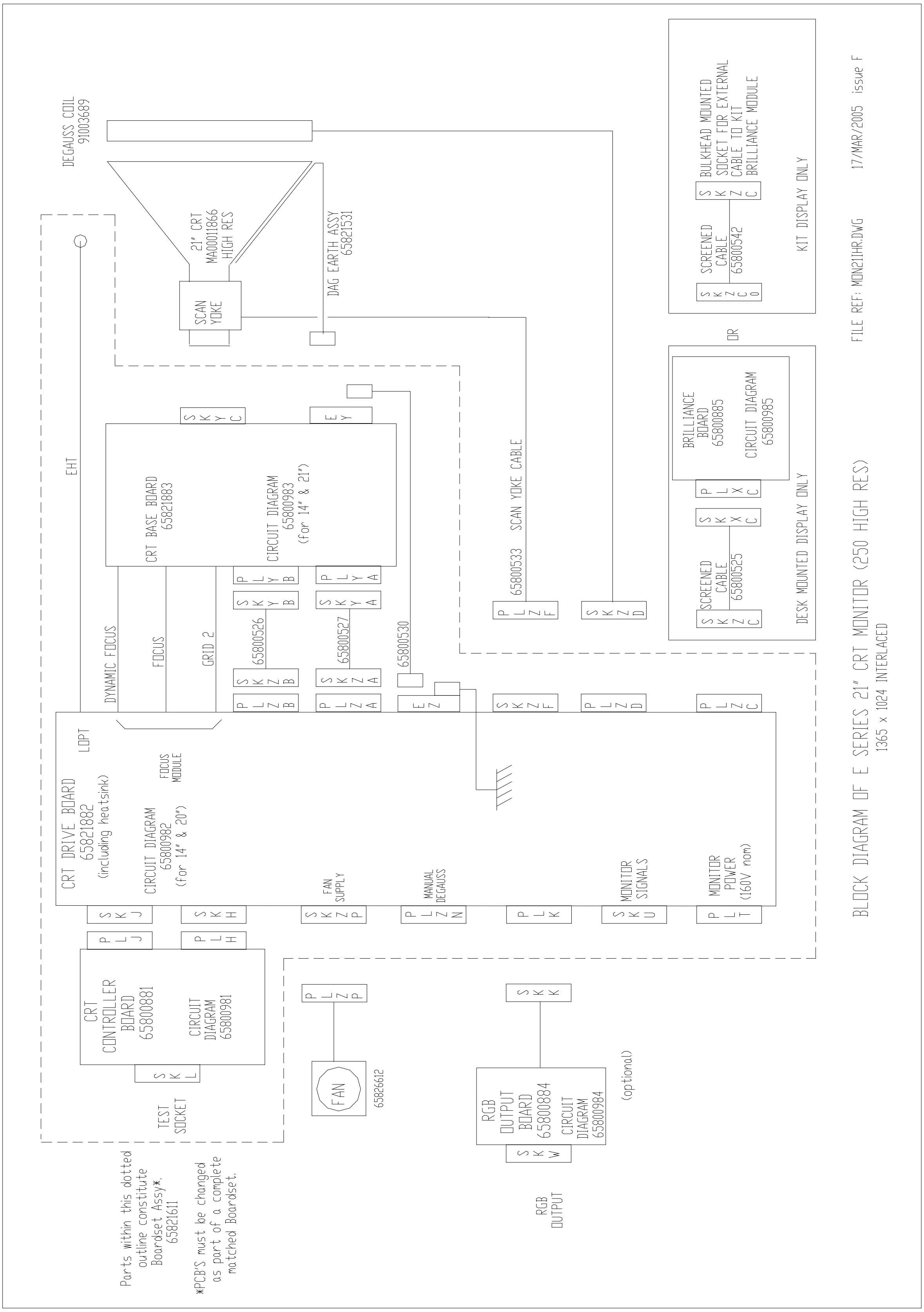


Figure 6.5. Block Diagram – 250 Monitor (21" High Resolution)

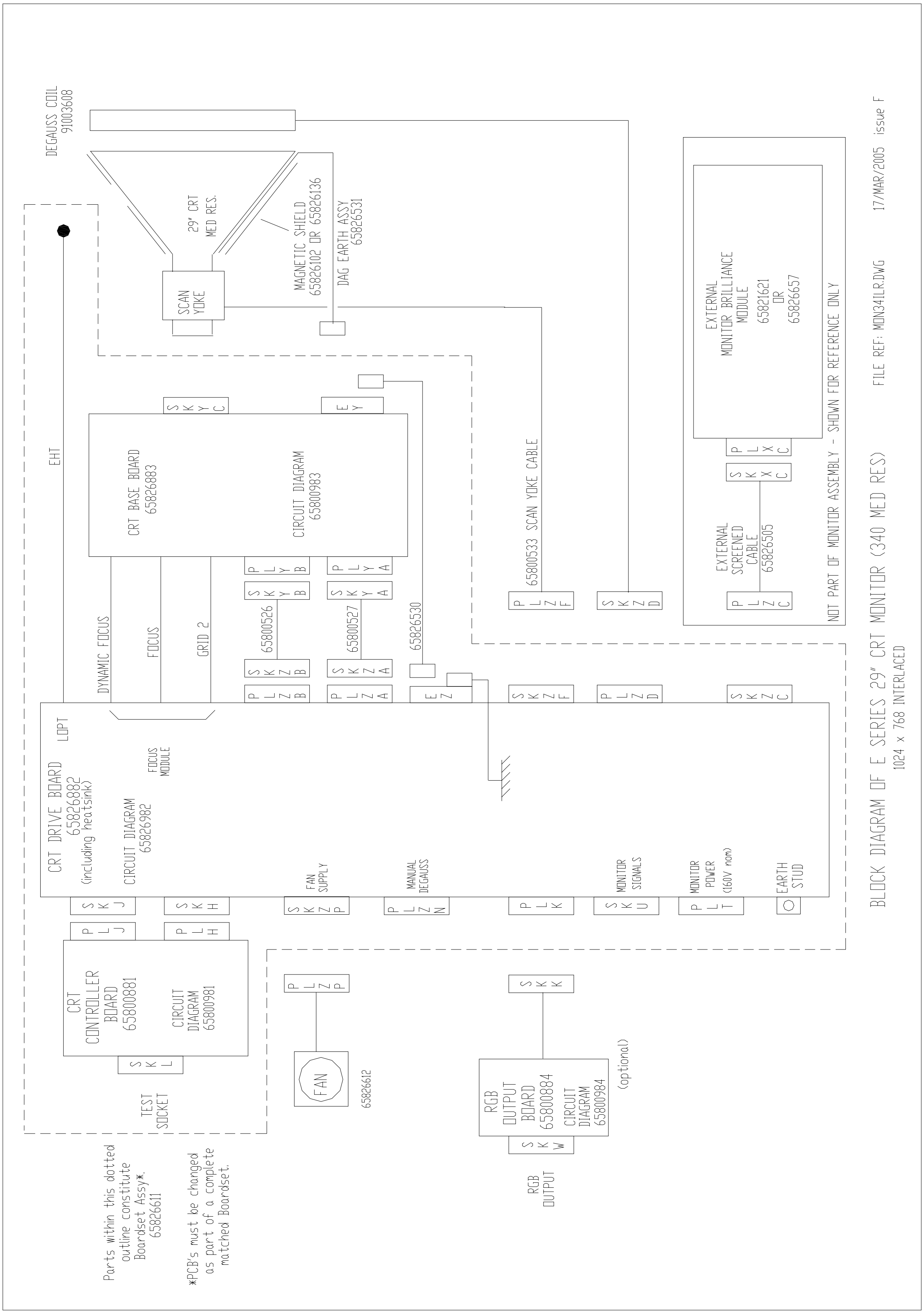


Figure 6.6. Block Diagram – 340 Monitor (29" Medium Resolution)

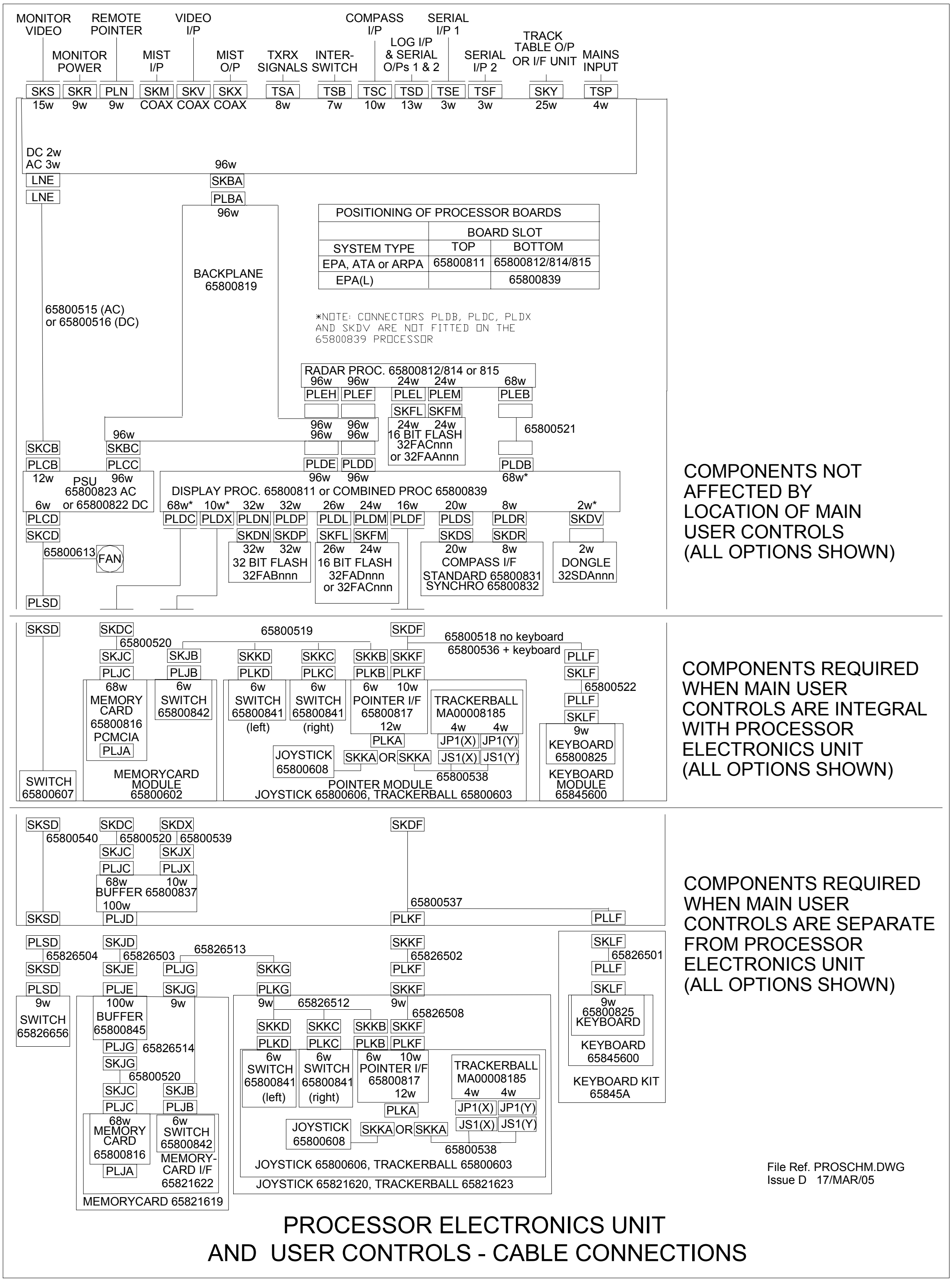


Figure 6.7. Interconnection Diagram – Processor Electronics Unit

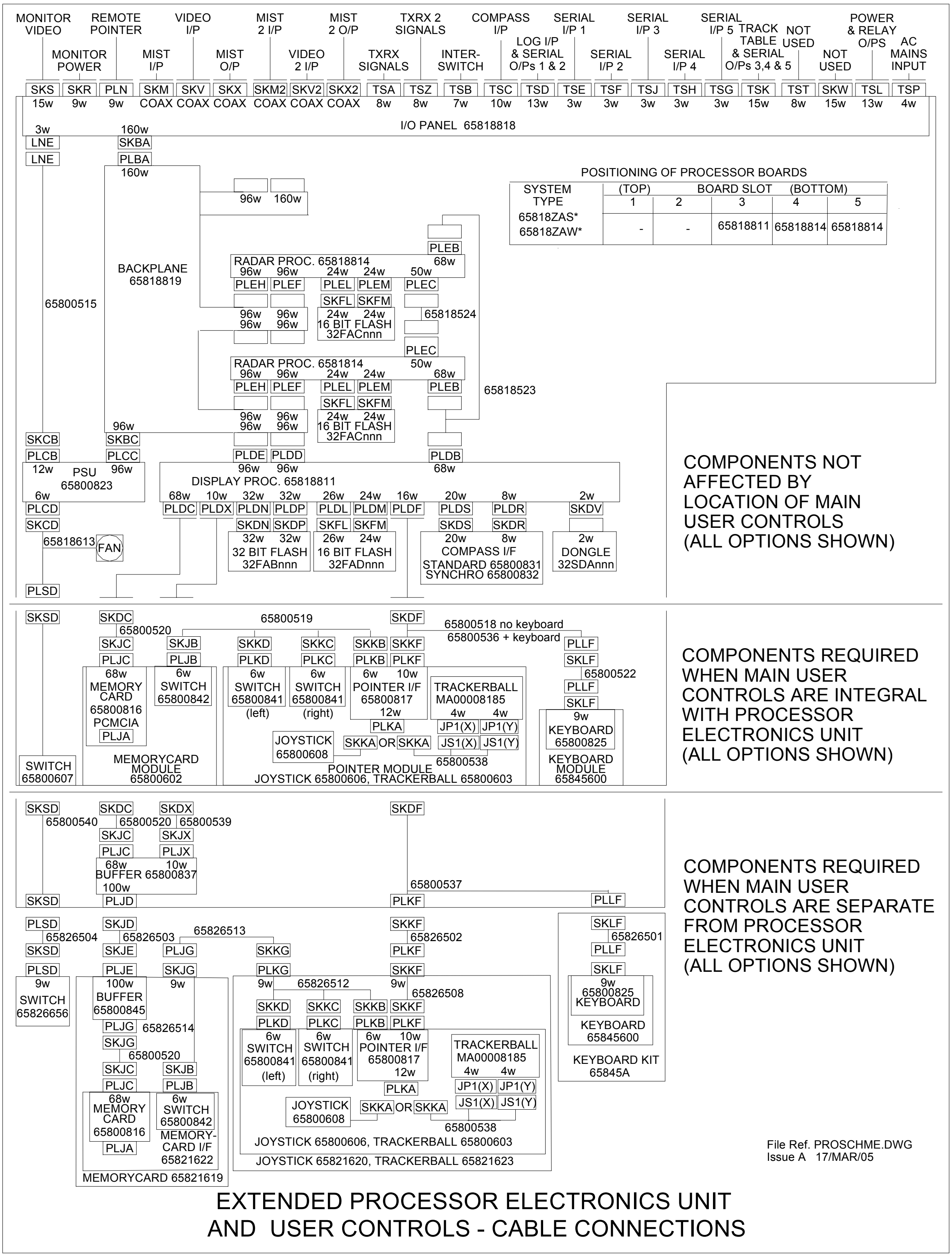


Figure 6.8. Interconnection Diagram – Extended Processor Electronics Unit

3.2 S-Band Scanner Unit

3.2.1 Magnetron Replacement

(Scanner Unit – Masthead Transceiver)

1. At the Scanner Control Unit set the isolating switch to the 'OFF' position and lock it.
2. Rotate the antenna until the front face is pointing away from the transceiver.
3. Isolate the radar from the ship's mains supply using the isolating switch provided.
4. Refer to Figure 6.9, and remove the transceiver cover from the scanner unit.
5. Refer to Figure 6.14, and follow the procedure for removing and replacing the magnetron.

Magnetron Current (Scanner Unit with Integral Transceiver)

When a Magnetron is replaced, the magnetron current must be set as follows:

1. On the Trigger PCB set links LK5 and LK6 to position 2-3.
2. Reconnect the ship's mains supply, and switch the radar ON.
3. Wait 3 minutes for the magnetron time delay to expire, and select long pulse.
4. Set the magnetron current as detailed in 0.
5. Isolate the radar from the ship's mains supply using the isolating switch provided.
6. Reset LK5 and LK6 to position 1-2.
7. Replace the transceiver cover.

3.2.2 Magnetron Replacement (Bulkhead Transceiver)

1. Isolate the radar from the ship's mains supply using the isolating switch provided.
2. Refer to Figure 6.10, and remove the transceiver cover.
3. Refer to Figure 6.14, and follow the procedure for removing and replacing the magnetron.

Magnetron Current (Bulkhead Transceiver)

When a magnetron is replaced, the magnetron current must be set as follows:

1. Reconnect the ship's mains supply, and switch the radar ON.
2. Wait 3 minutes for the magnetron time delay to expire, and select long pulse.
3. Set the magnetron current as details in 0.
4. Isolate the radar from the ship's mains supply using the isolating switch provided.
5. Replace the transceiver cover.

3.2.3 Bearing and Heading Marker PCB – Replacement

1. At the Scanner Control Unit set the isolating switch to the 'OFF' position and lock it.
2. Rotate the antenna until the front face is pointing away from the transceiver.
3. Isolate the radar from the ship's mains supply using the isolating switch provided.
4. Refer to Figure 6.24, and remove the Performance Monitor cover.
5. The location of the Pulse Bearing PCB is shown in Figure 6.25.
6. Remove the two securing screws and remove the PCB.
7. Replace the PCB and secure with the two screws (two dowels of different diameters locate the PCB in the correct orientation).

3.2.4 Heading Marker Alignment

Alignment of the Heading Marker is achieved via the Initialisation menu at the Display Unit.

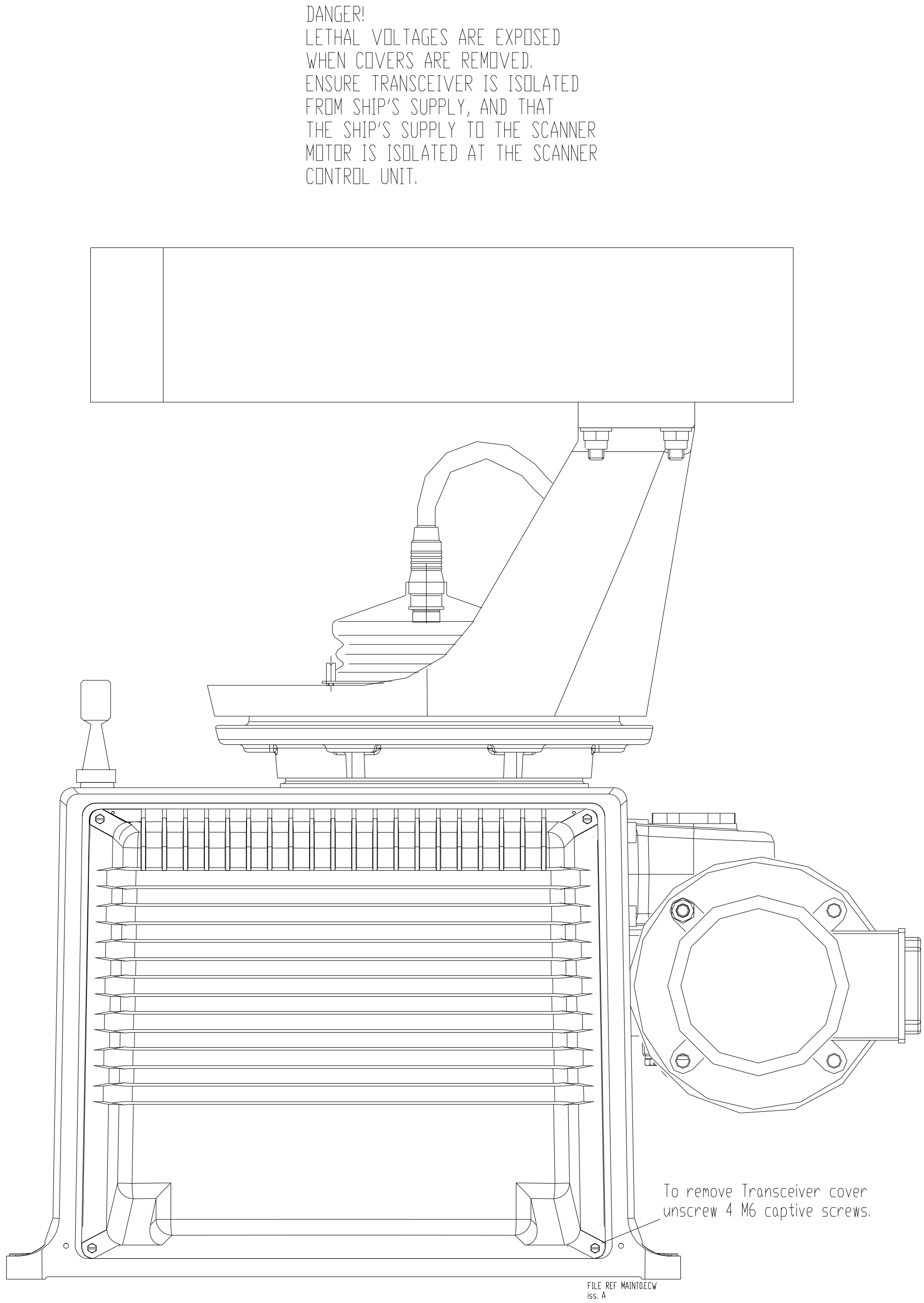


Figure 6.9. Access to Transceiver (Turning Unit with Integral Transceiver)

DANGER!
LETHAL VOLTAGES ARE EXPOSED
WHEN COVERS ARE REMOVED.
ENSURE THAT TRANSCEIVER IS
ISOLATED FROM SHIP'S SUPPLY
BEFORE REMOVING COVERS.

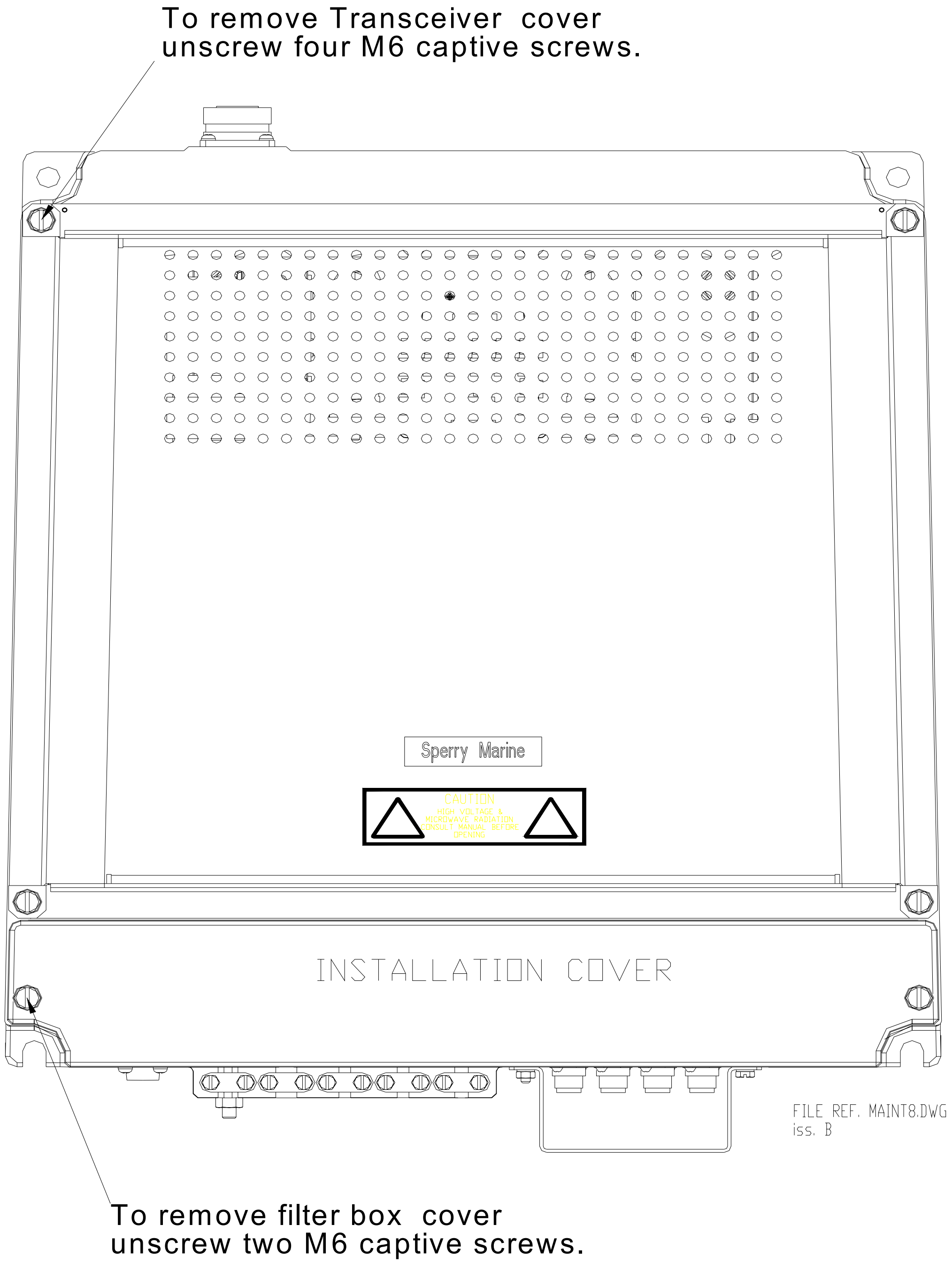


Figure 6.10. Access to Transceiver (Bulkhead Transceiver)

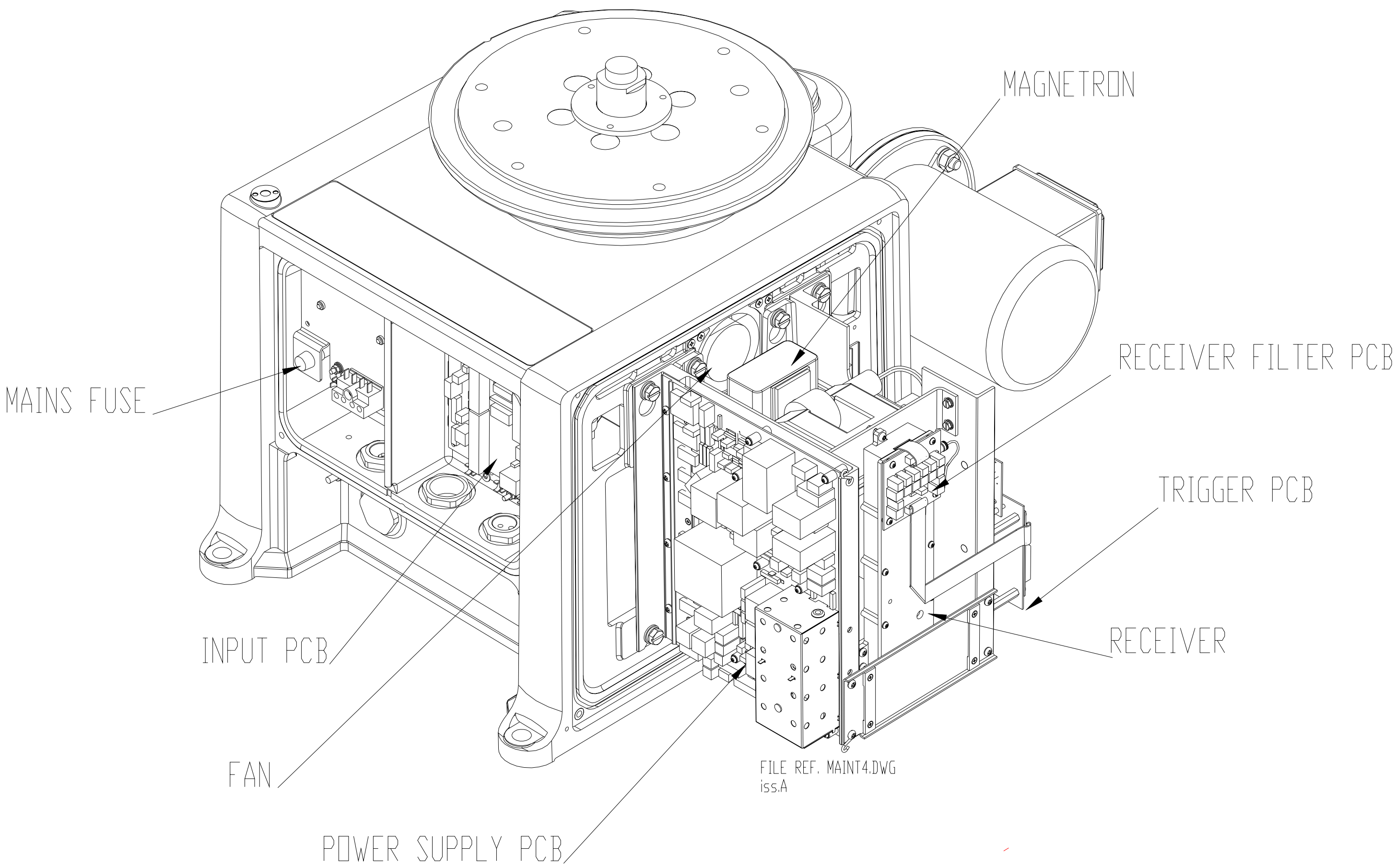


Figure 6.11. Location of Major Parts

DANGER!
LETHAL VOLTAGES ARE EXPOSED
WHEN COVERS ARE REMOVED.
ENSURE TRANSCEIVER IS ISOLATED
FROM SHIP'S SUPPLY BEFORE
REMOVING TRANSCEIVER

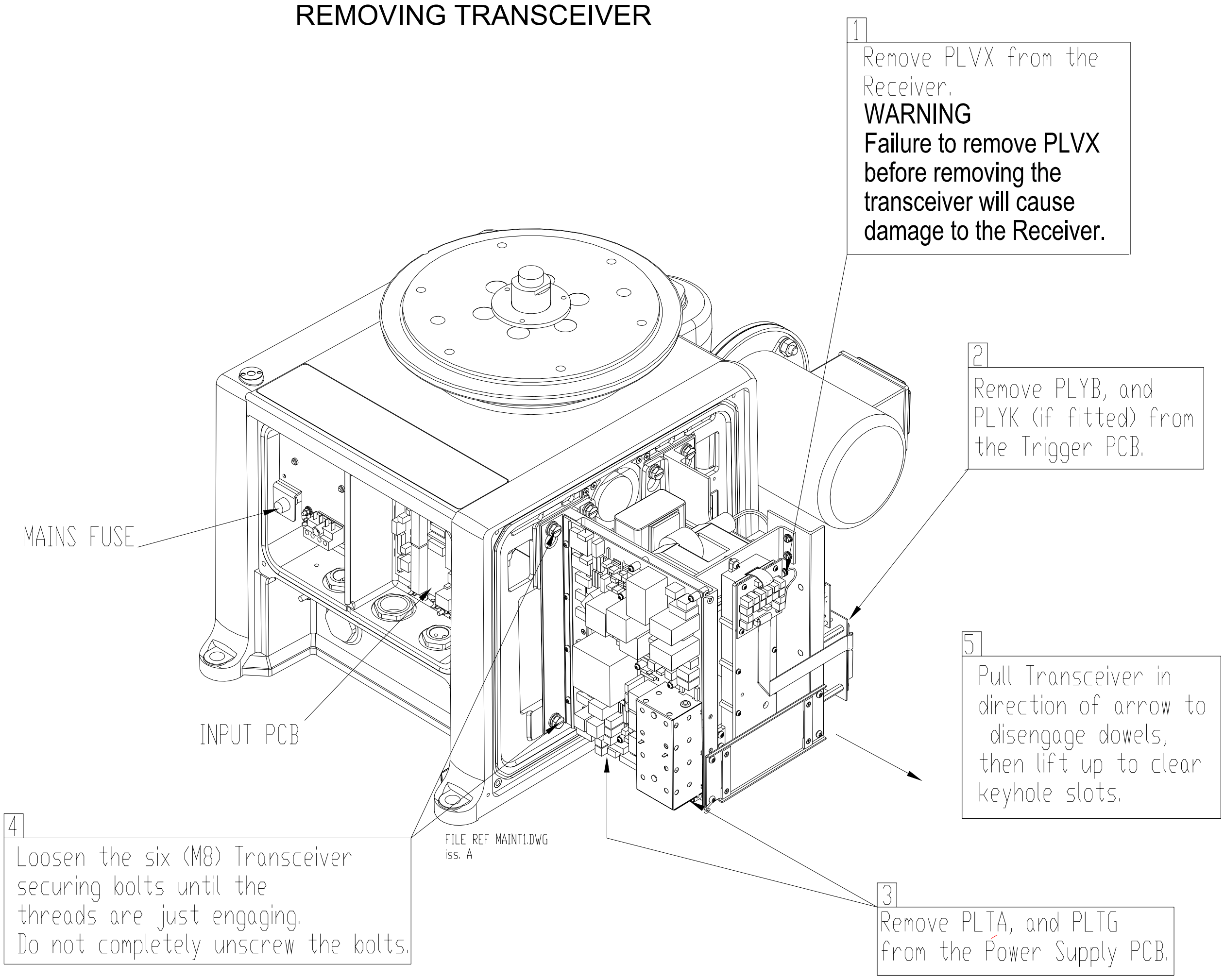


Figure 6.12. Removing Transceiver from Turning Unit

DANGER!
LETHAL VOLTAGES ARE EXPOSED
WHEN THE COVERS ARE REMOVED.
ENSURE TRANSCEIVER IS ISOLATED
FROM THE SHIP'S MAINS SUPPLY
BEFORE REMOVING COVERS.

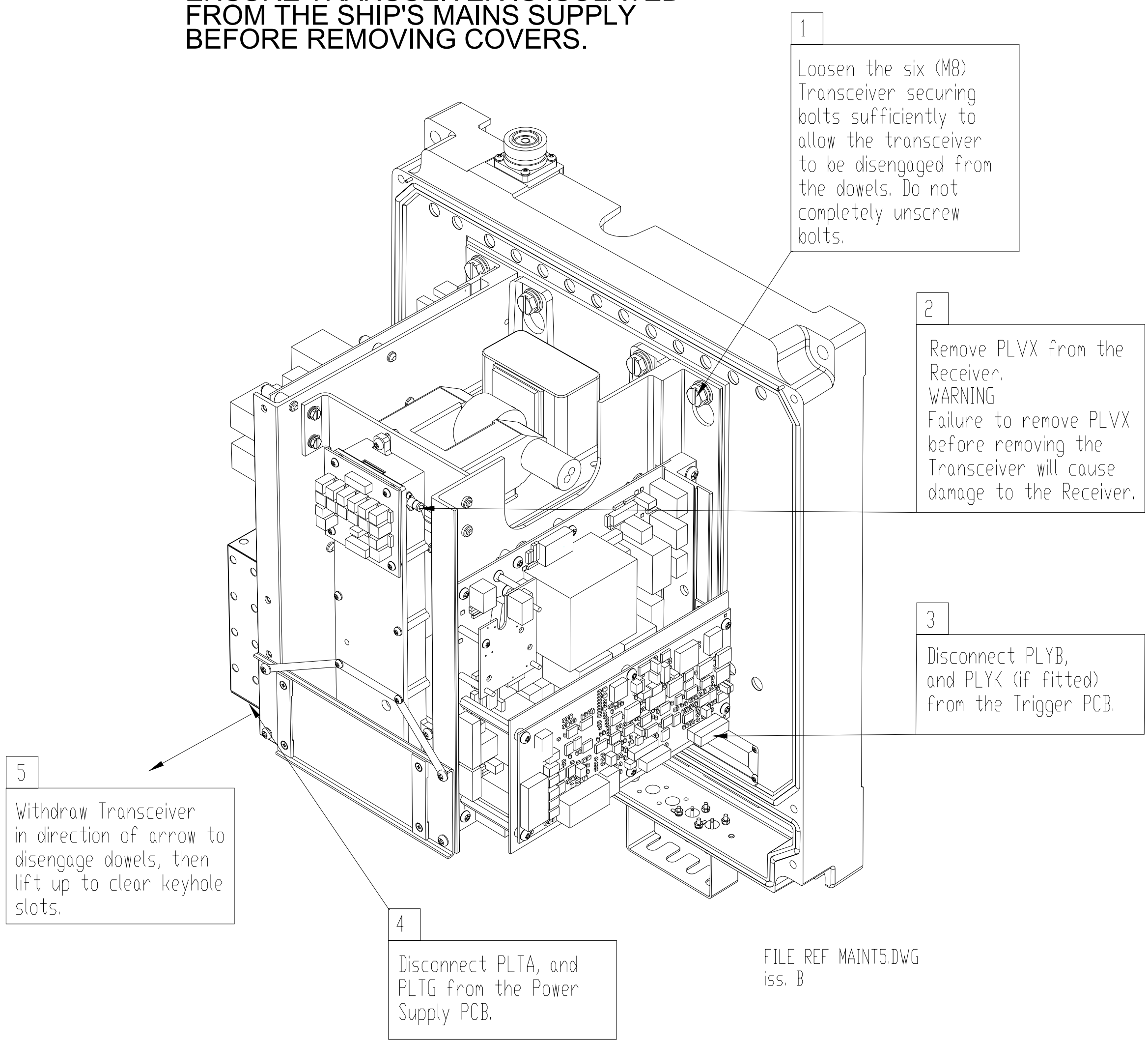


Figure 6.13. Removing Transceiver Assembly 65830630 (Bulkhead Transceiver)

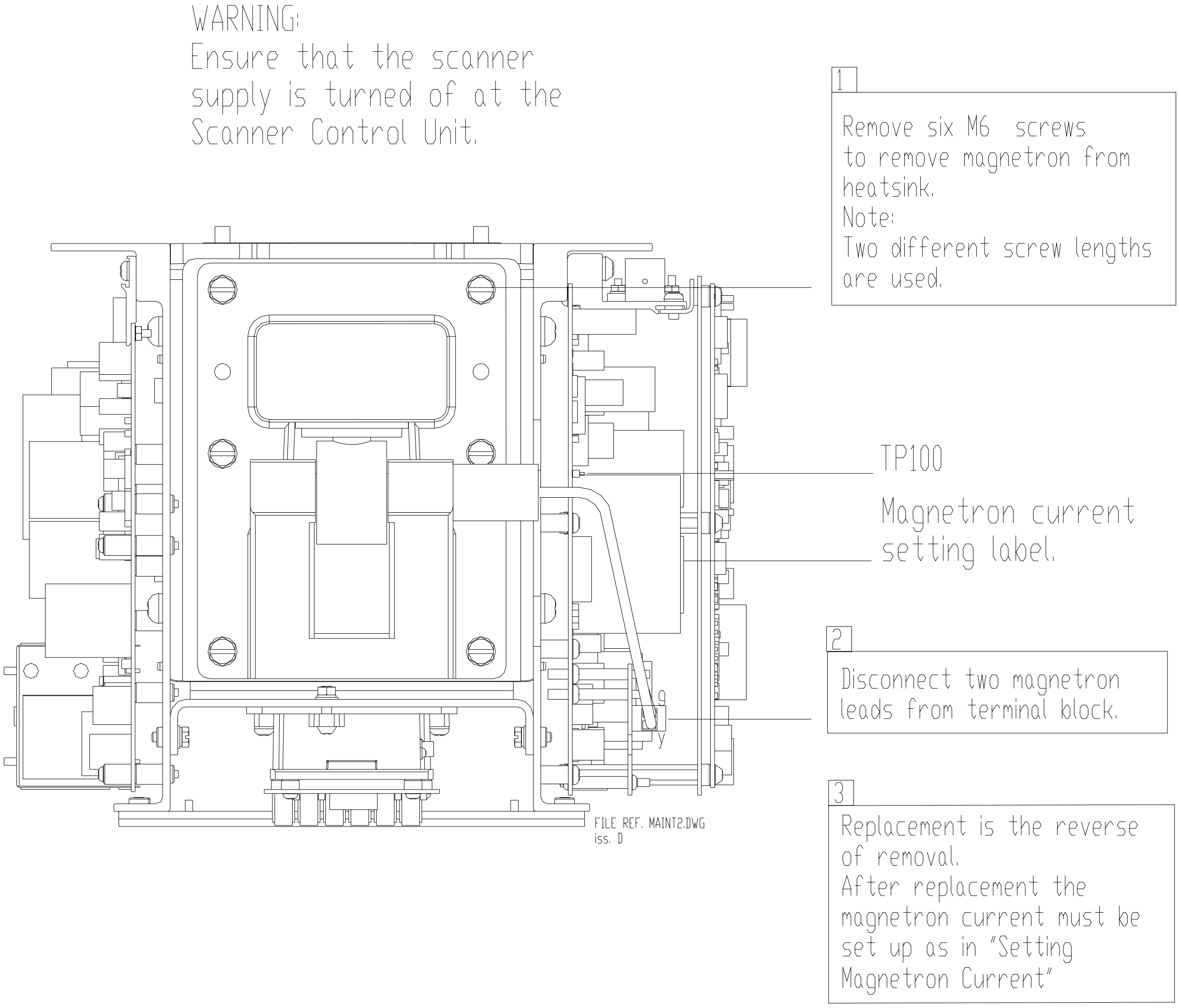


Figure 6.14. Magnetron Replacement

1

On the Trigger PCB set:
LK5, and LK6 to 2 - 3.
This is the service position, and will allow the transmitter to transmit when the antenna is stationary.

2

Restore the ship's supply to the transceiver.
Select Long Pulse, Transmit at the display.

3

On the Modulator PCB measure the voltage between TP100 and ground.
Note:
A DVM with an input impedance greater than 10 Mohms must be used for this measurement. Use of a meter with lower impedance could result in damage to the magnetron.

4

Adjust RV1 on the Power Supply PCB to give the same voltage on TP100 as is recorded on the label on the pulse transformer on the Modulator PCB.

6

On completion of the procedure.
Switch off.
Reset LK5 and LK6 on the Trigger PCB to 1 - 2.

FILE REF. MAINT3.DWG
iss. B 23/03/05

Figure 6.15. Setting Magnetron Current

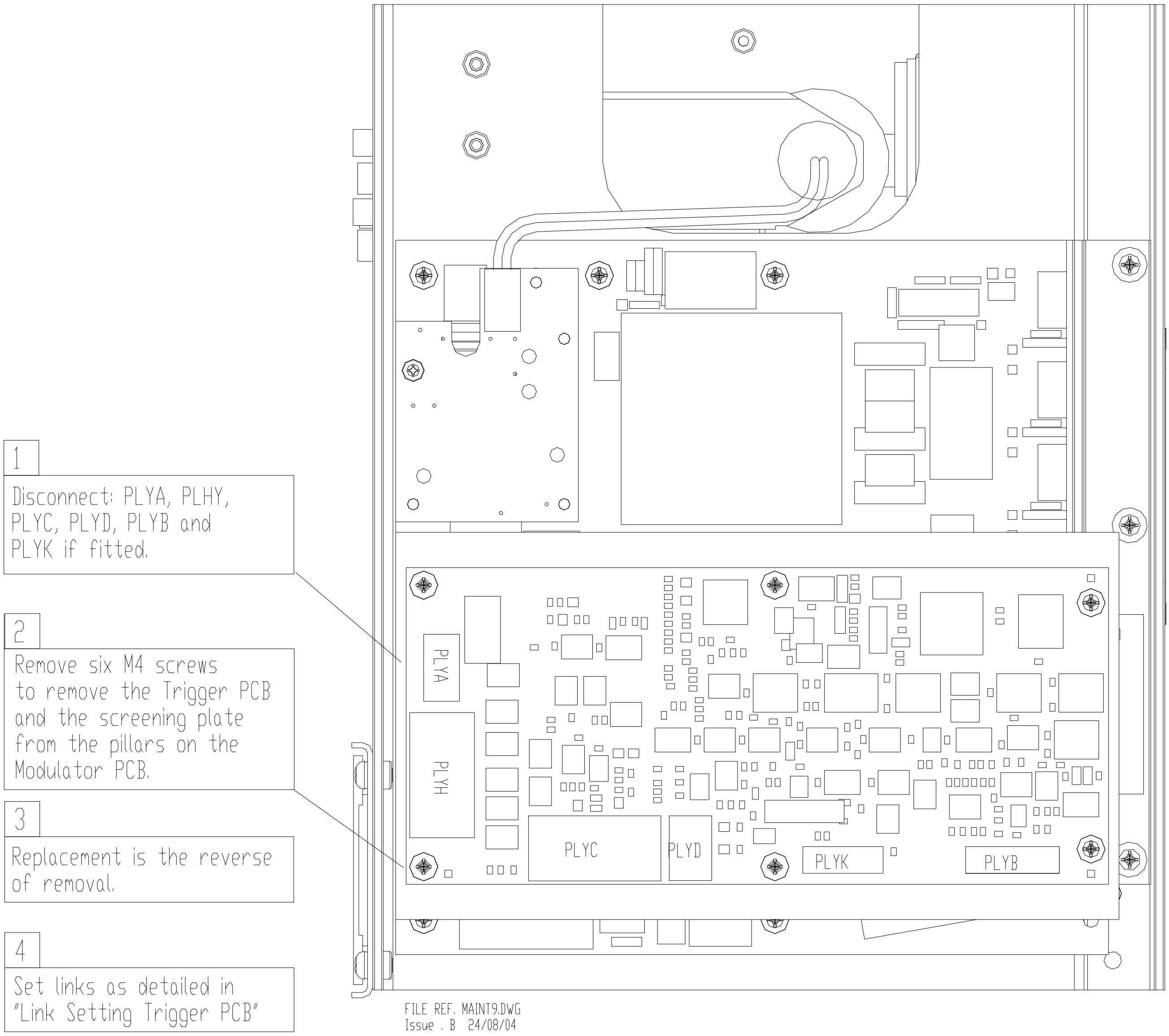
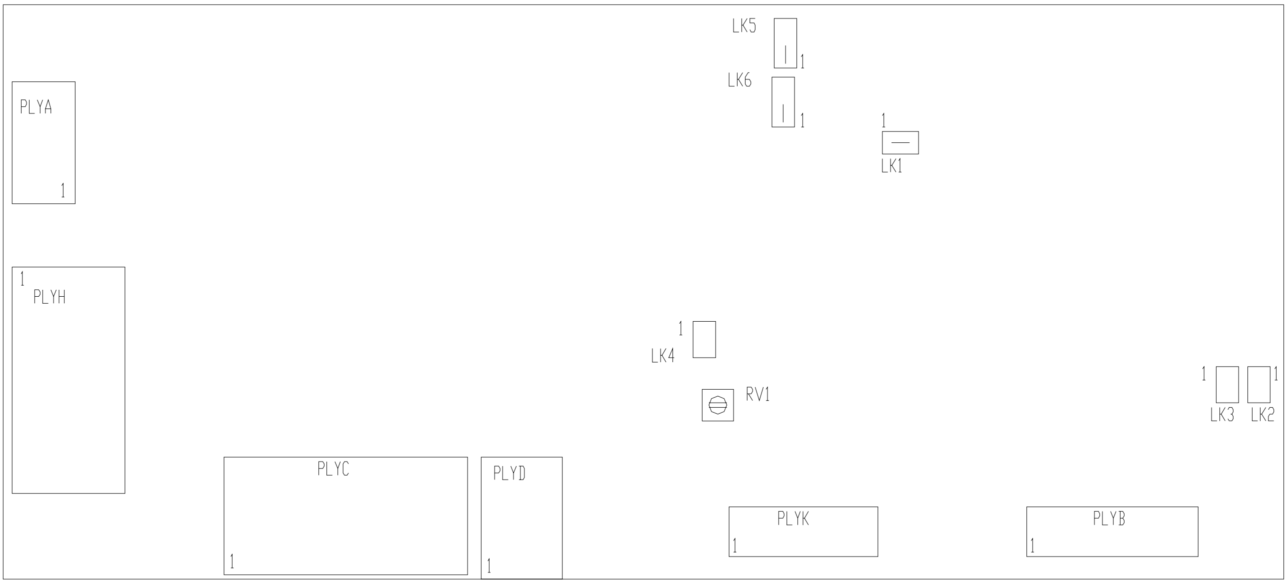


Figure 6.16. Replacing Trigger PCB



FILE REF. TRIGGER.DWG
iss. C 24/08/04

ATE TEST LINKS
LK1 FITTED
LK4 NOT FITTED

BAUD RATE LINKS
LK2 NOT FITTED
LK3 NOT FITTED

SERVICE LINKS
LK5 NORMAL OPERATION FITTED 1 - 2
LK6 NORMAL OPERATION FITTED 1 - 2

LK5 SERVICE FITTED 2 - 3
LK6 SERVICE FITTED 2 - 3
WHEN FITTED 2 - 3 THE TRANSMITTER
WILL OPERATE WHEN THE ANTENNA IS
STOPPED.

RV1 SWEPT GAIN DELAY
FACTORY SET DO NOT ADJUST

Figure 6.17. Link Settings Trigger PCB

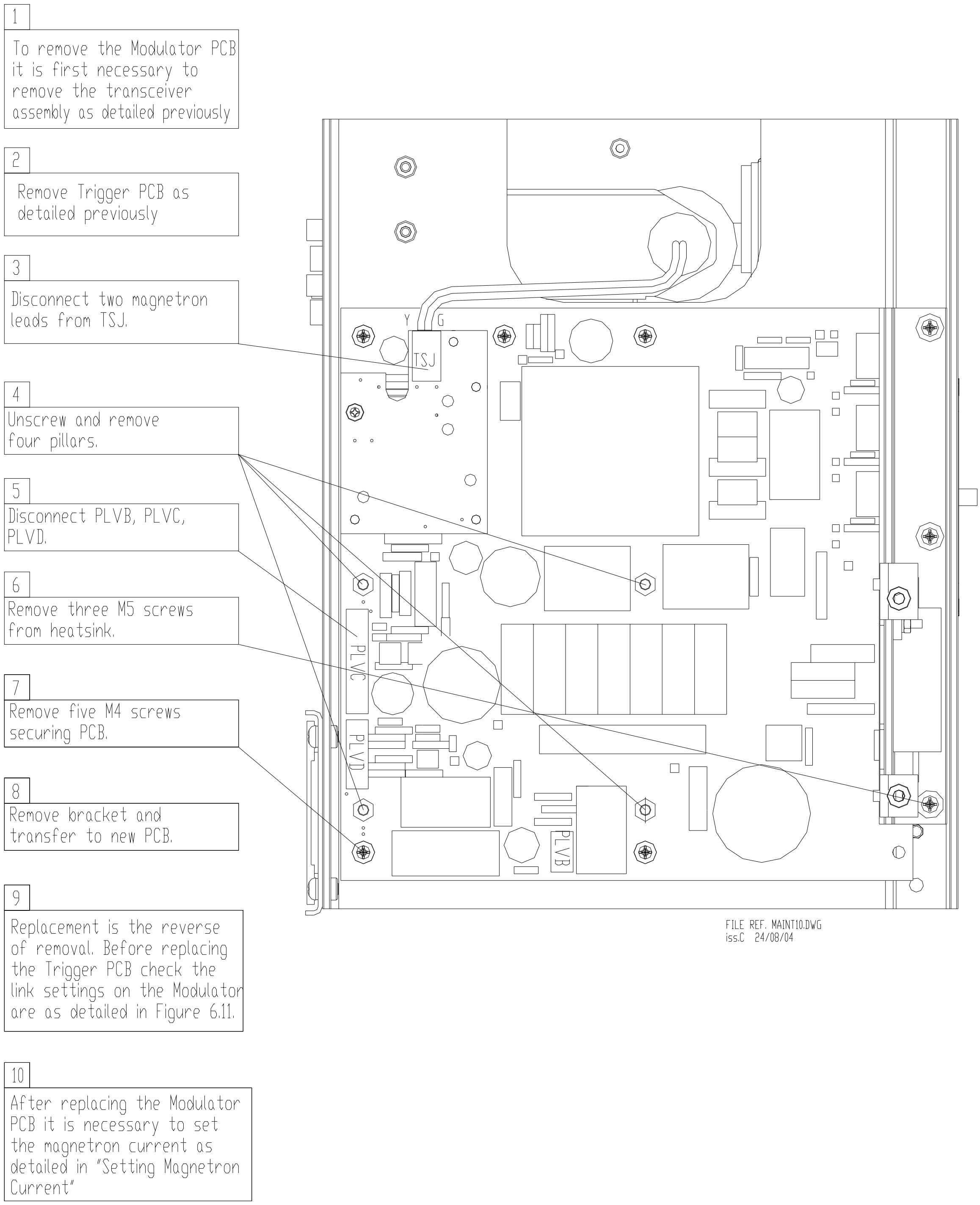
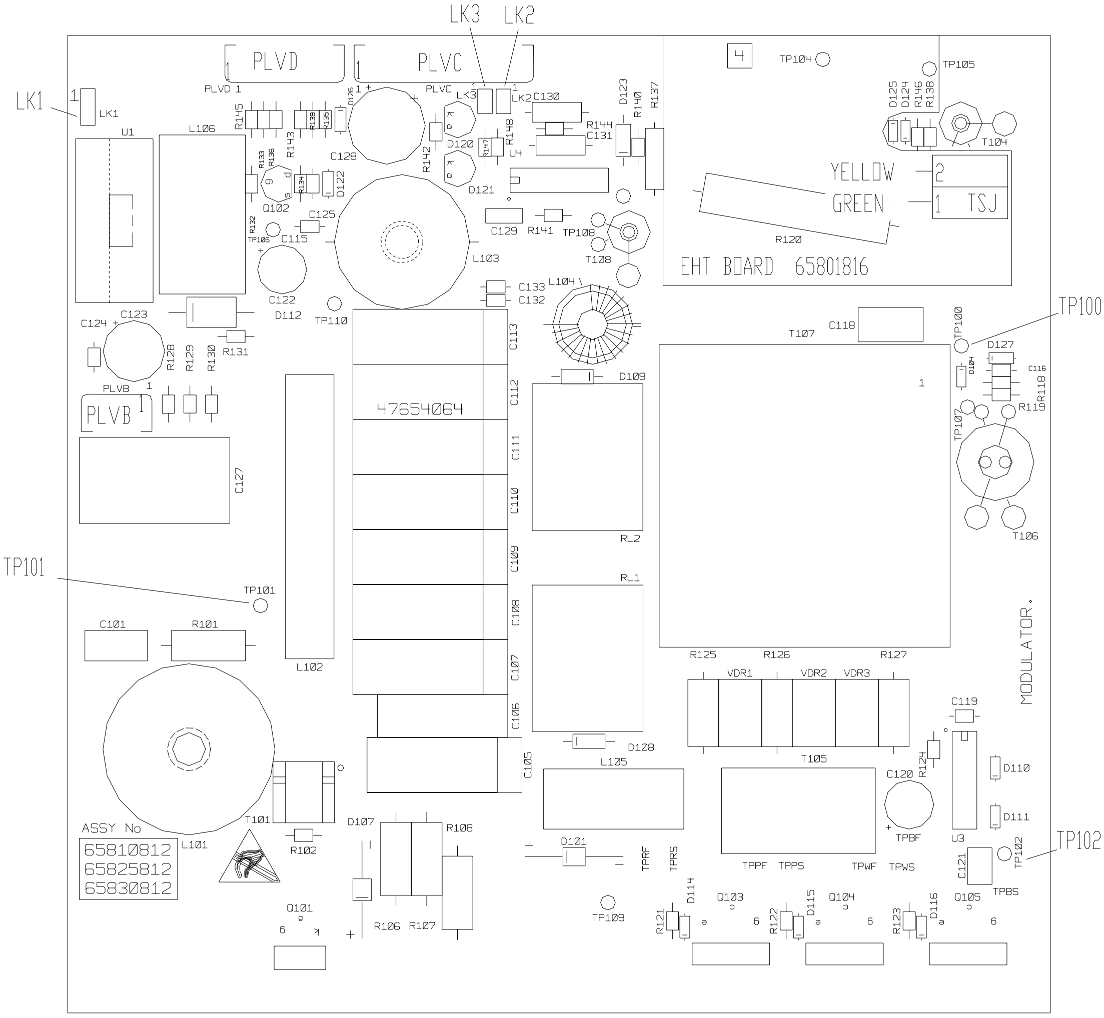


Figure 6.18. Replacing Modulator PCB



FILE REF. X_MODLTR.DWG
ISSUE B 24/08/04

MODULATOR LINK SETTINGS FOR 65810812 / 65825812 / 65830812

	S-BAND	10 kW X-BAND	25 kW X-BAND
LK1	FITTED 2 - 3	FITTED 1 - 2	FITTED 1 - 2 FOR MAGNETRON MG5424
LK1			FITTED 2 - 3 FOR MAGNETRON M1458
LK2	FITTED	NOT FITTED	NOT FITTED
LK3	NOT FITTED	FITTED	NOT FITTED

NOTE THAT LINK 1 IS CONFIGURABLE FOR HEATER TURNDOWN ON 25kW X-BAND

NOTE THAT LINKS 2 & 3 ARE HARDWIRED FOR SPECIFIC USEAGE ON LATER MODULATORS.

TEST POINTS:

TP100 MAGNETRON CURRENT MONITOR

TP101 CHARGE TRIGGER

TP102 MODULATOR TRIGGER

Figure 6.19. Link Settings – Modulator PCB

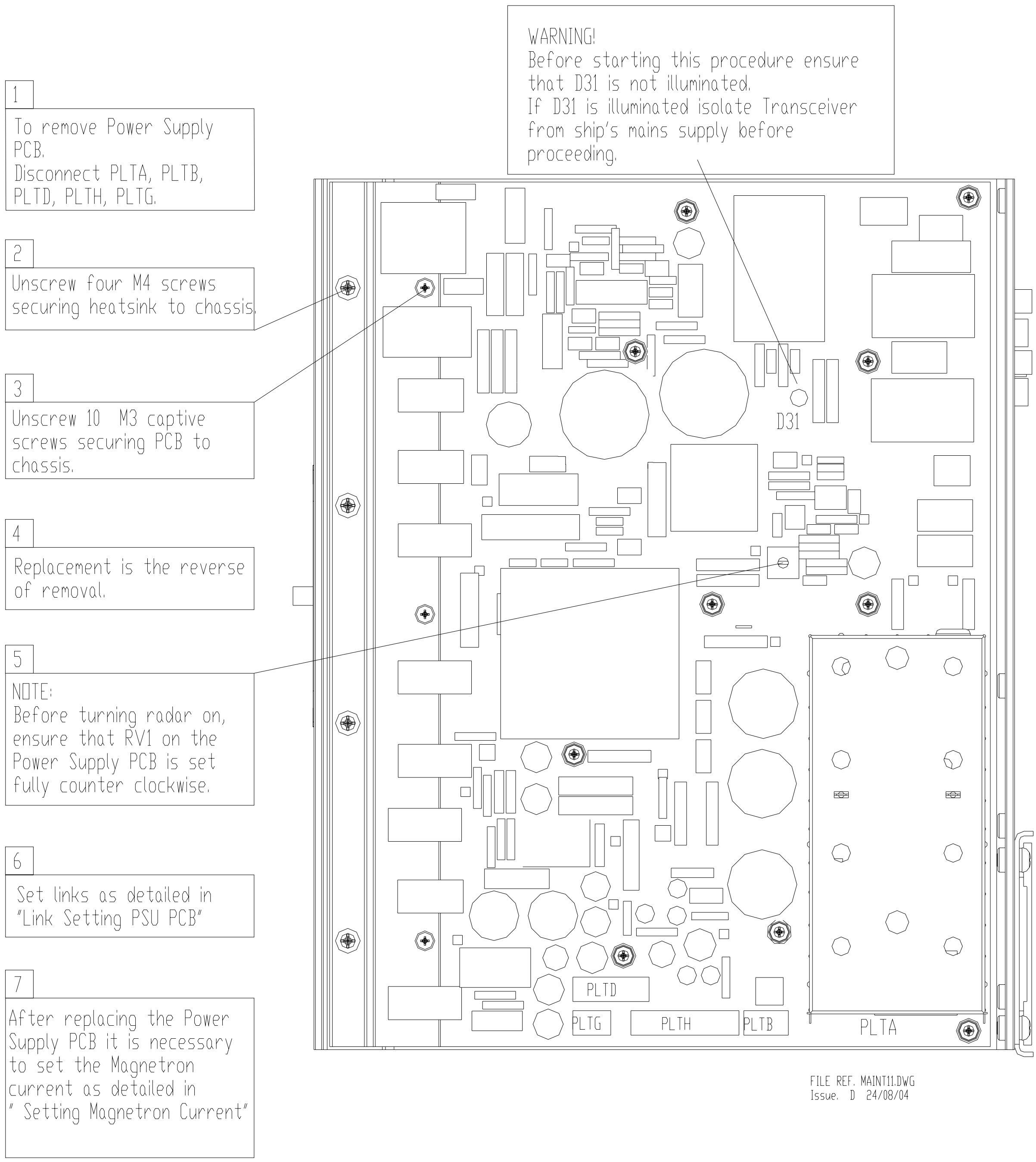
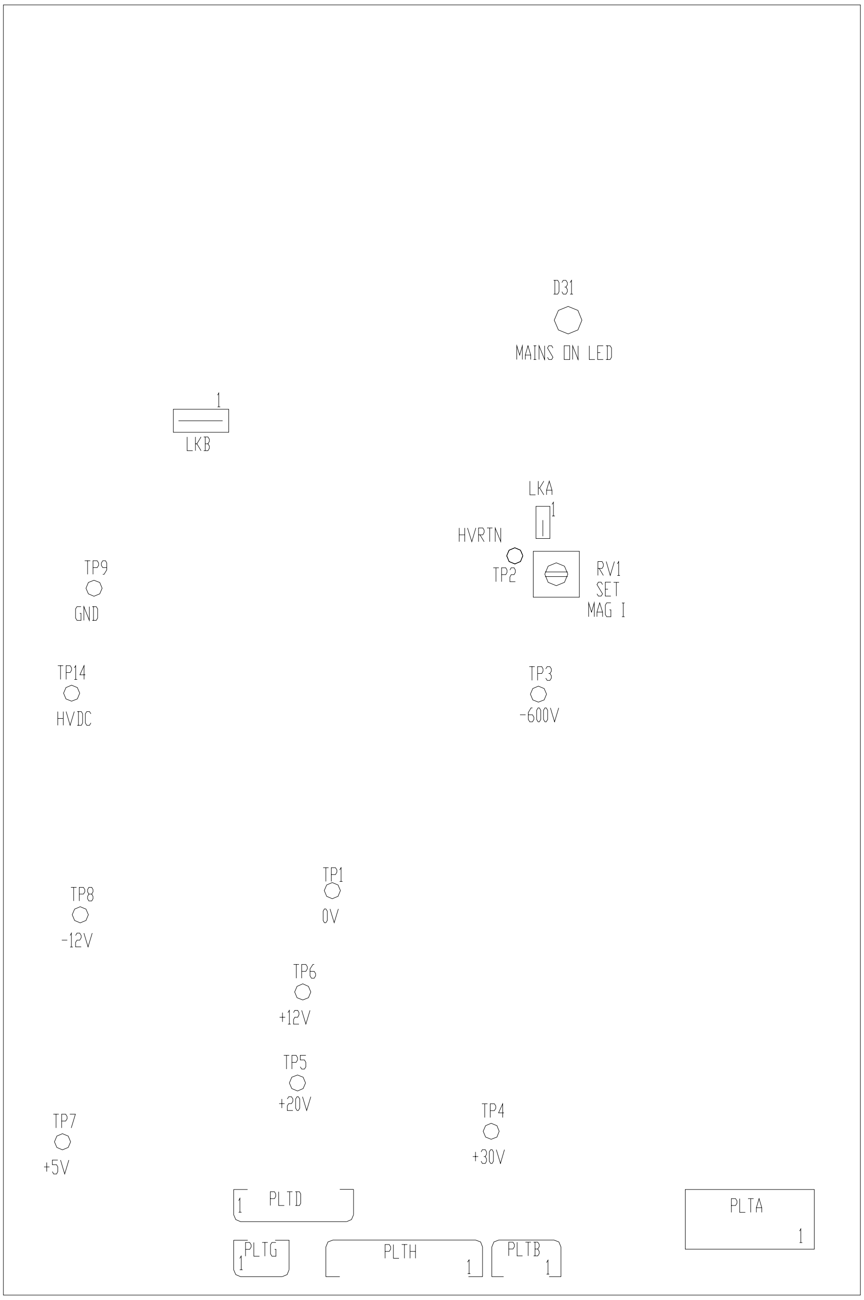


Figure 6.20. Replacing Power Supply PCB



TEST POINTS

TP1 0V
TP3 -600V
TP4 +30V
TP5 +20V
TP6 +12V
TP7 +5V
TP8 -12V

The above voltages are measured with respect to TP1.

TP2 HVRTN
TP14 HVDC (380V)

The voltage on TP14 is measured with respect to TP2.

"LKA" START TEST LINK

LKA NORMAL OPERATION FITTED 2 - 3
LKA TEST FITTED 1 - 2
WHEN IN THE TEST POSITION THIS LINK ALLOWS THE POWER SUPPLY TO OPERATE WITHOUT BEING CONNECTED TO THE CONTROL SIGNALS FROM THE DISPLAY COMPATIBILITY UNIT.

"LKB" HIGH VOLTAGE ISOLATION LINK

LKB NORMAL OPERATION FITTED
LKB ISOLATE HV SUPPLY NOT FITTED

THIS LINK CAN BE USED TO ISOLATE THE POWER FACTOR CORRECTION CIRCUIT FROM THE REST OF THE POWER SUPPLY AS AN AID TO FAULT FINDING.

FILE REF PSU.DWG
Issue. D 24/08/04

Figure 6.21. Link Settings – Power Supply PCB

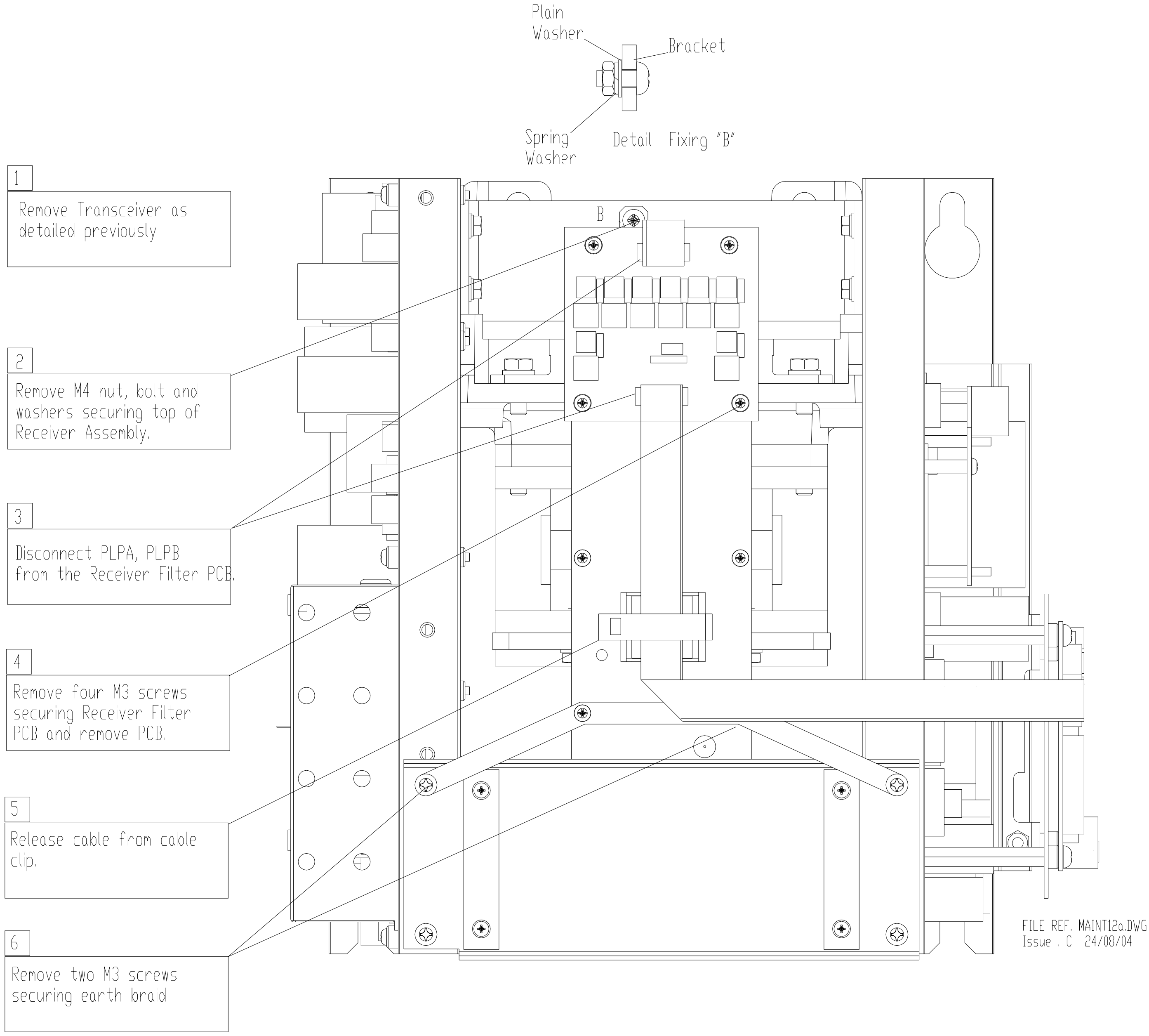


Figure 6.22. (Sheet 1 of 2) – Replacement of Receiver Assembly 65830616

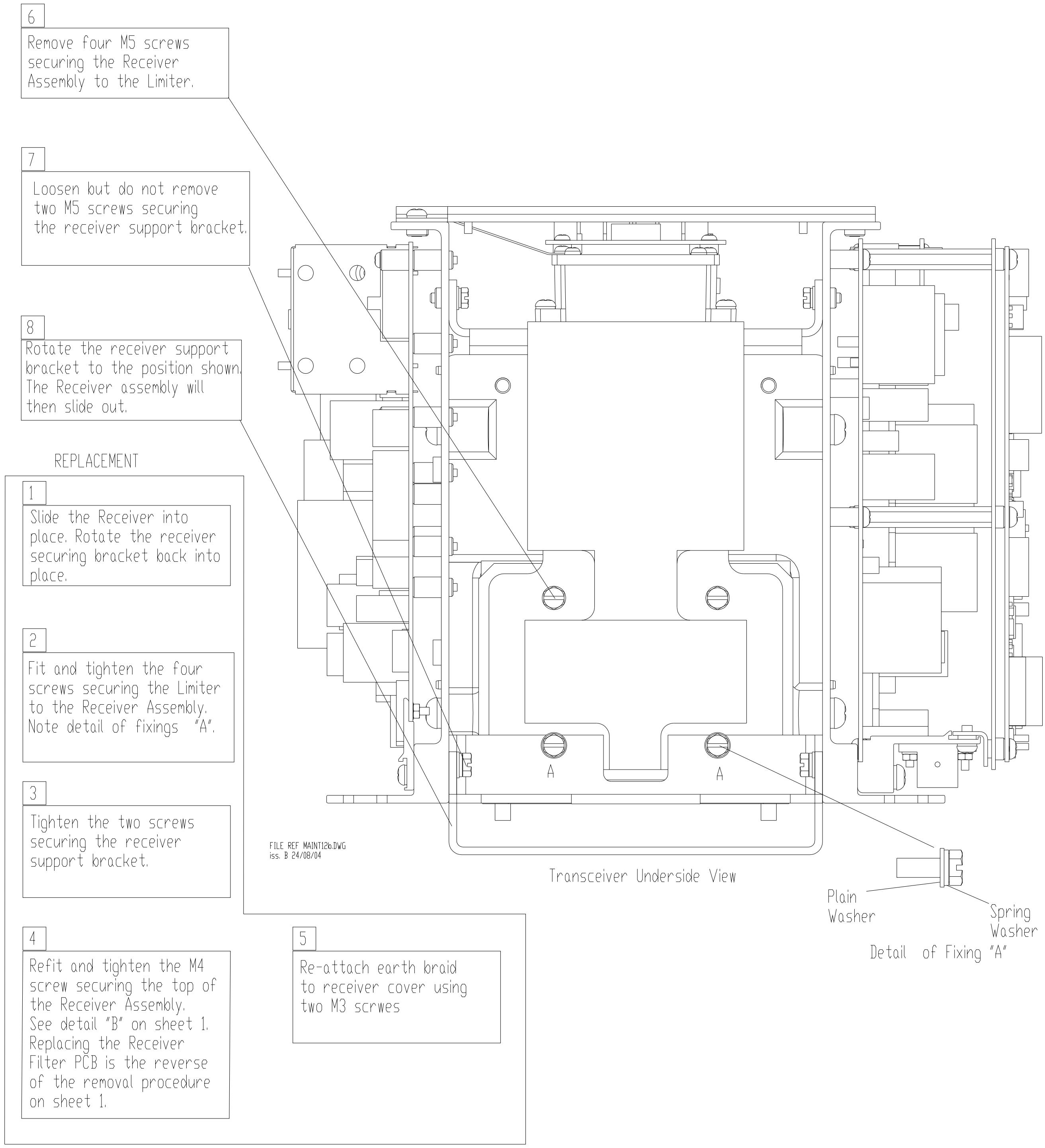


Figure 6.23. (Sheet 2 of 2) – Replacement of Receiver Assembly 65830616

DANGER!
LETHAL VOLTAGES ARE EXPOSED
WHEN COVERS ARE REMOVED.
ENSURE TRANSCEIVER IS ISOLATED
FROM SHIP'S SUPPLY, AND THAT
THE SHIP'S SUPPLY TO THE SCANNER
MOTOR IS ISOLATED AT THE SCANNER
CONTROL UNIT.

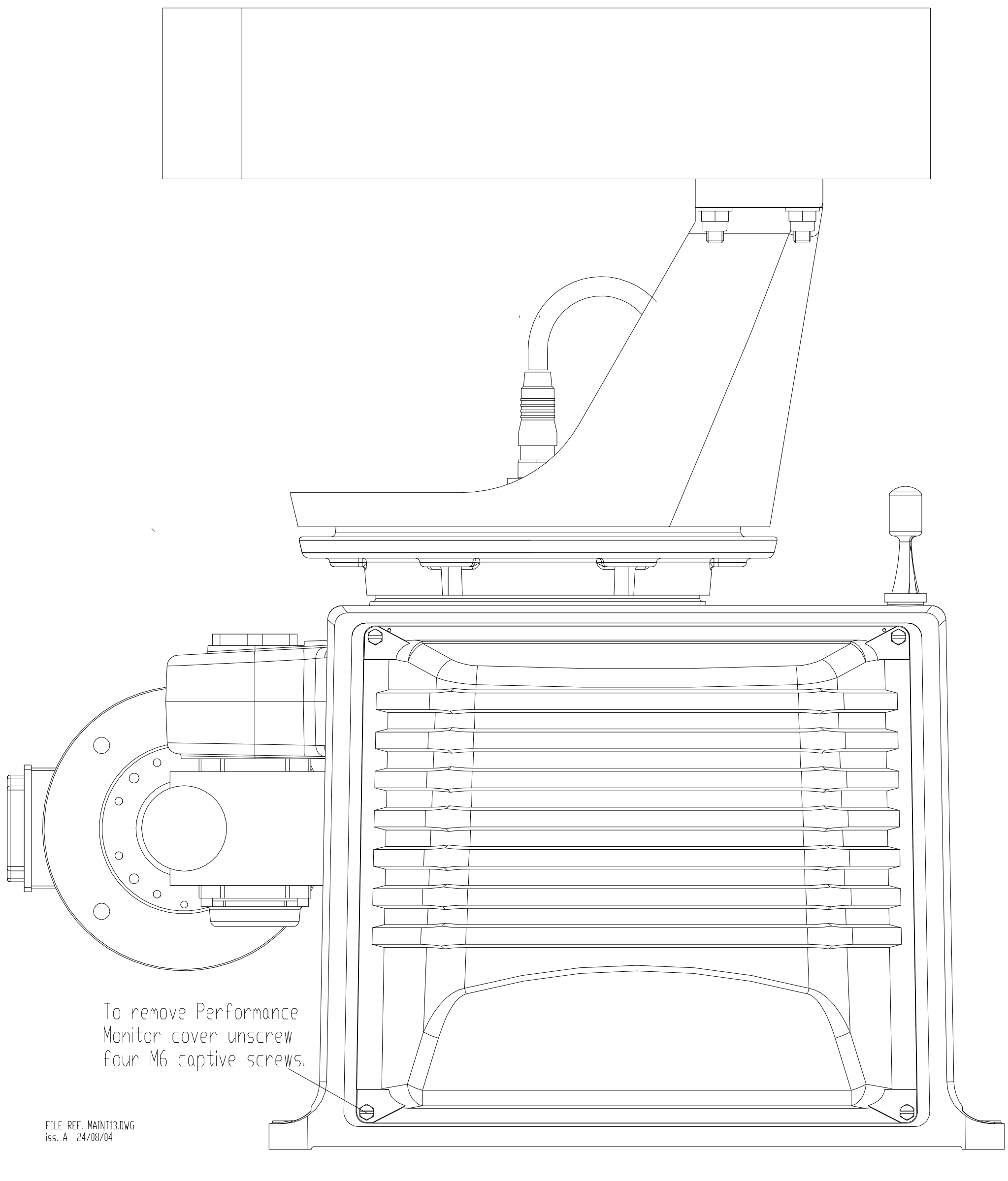


Figure 6.24. Access to Performance Monitor and Bearing and Heading Marker PCB

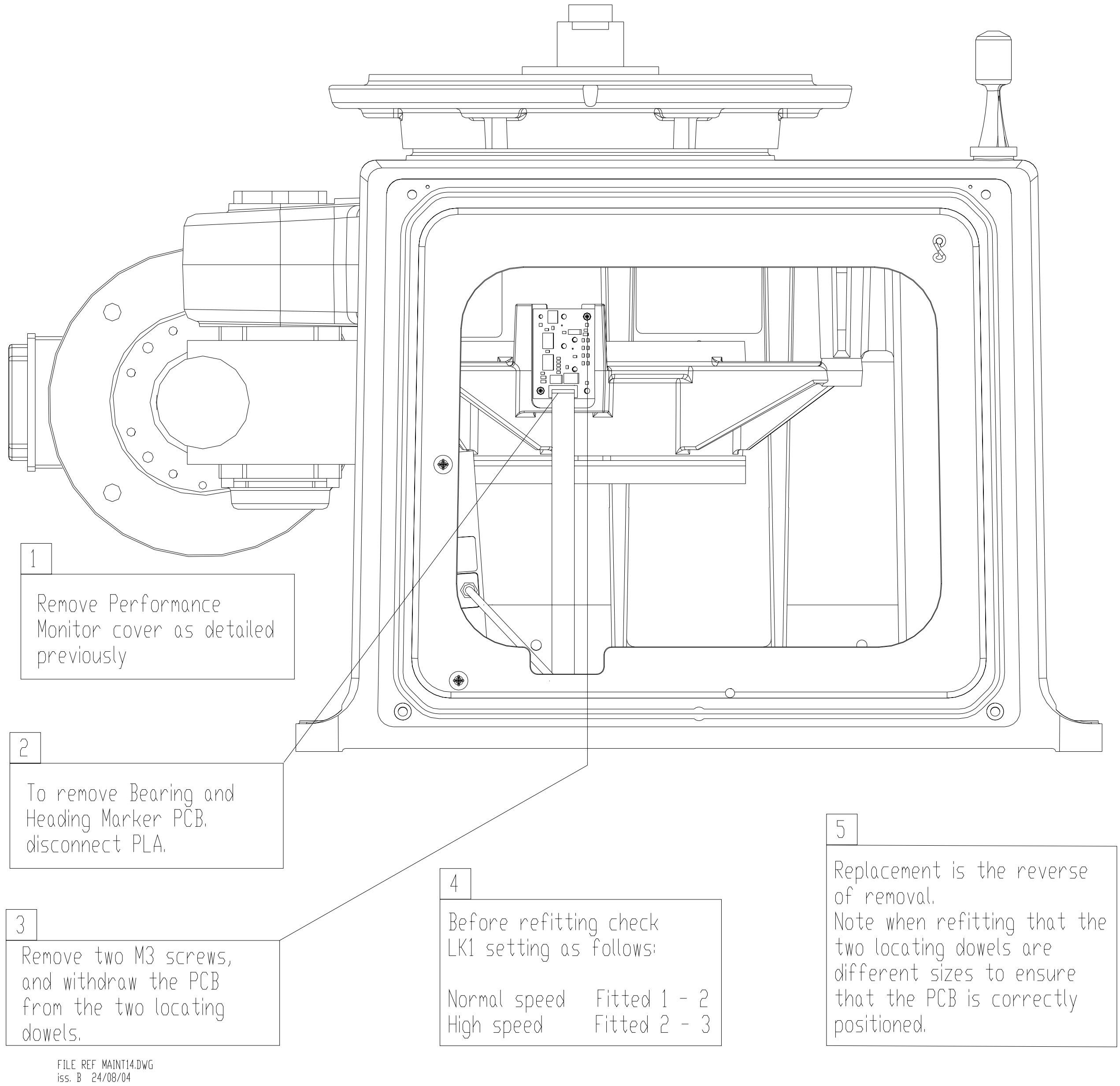


Figure 6.25. Replacing Bearing and Heading PCB

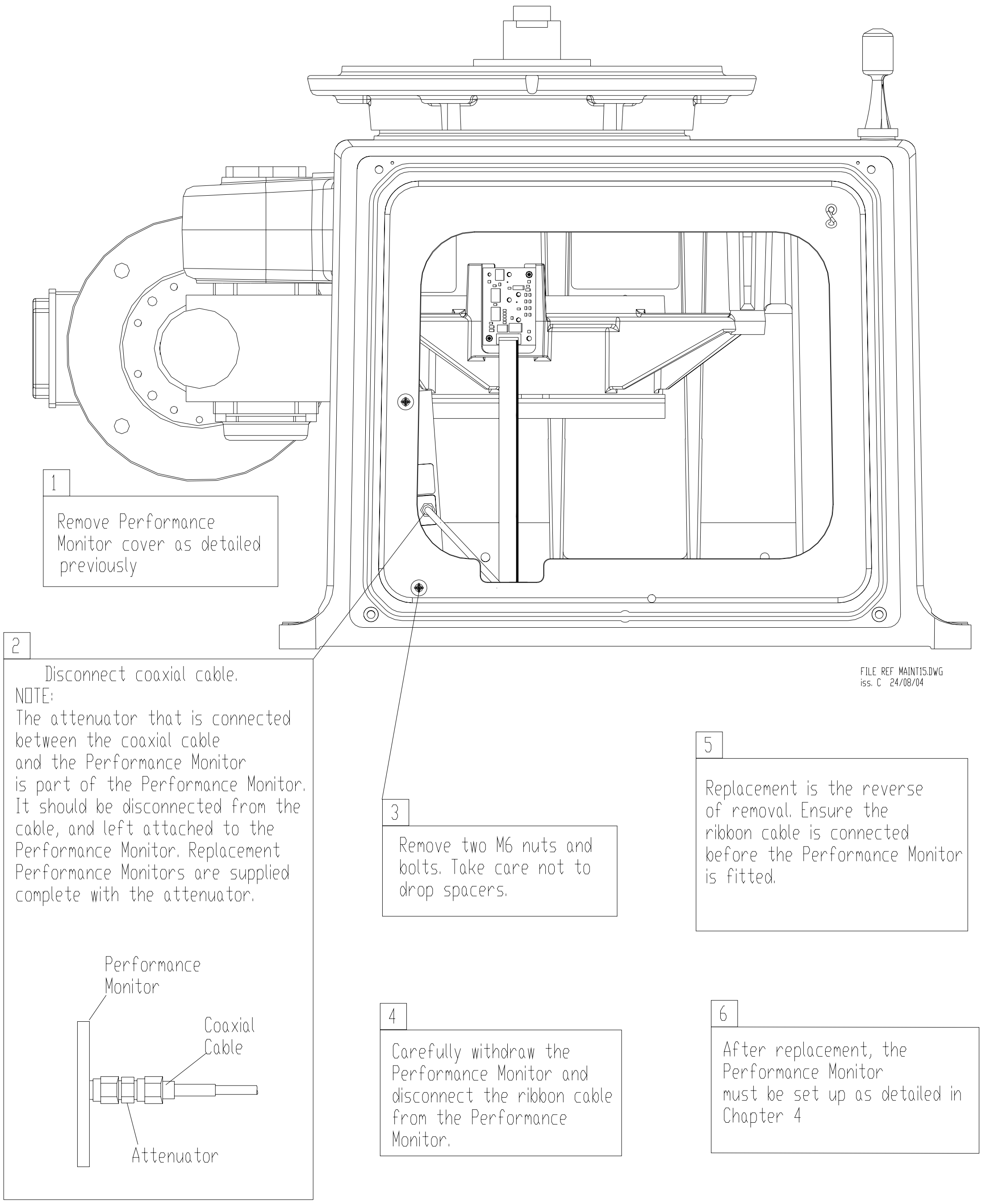


Figure 6.26. Replacing Performance Monitor

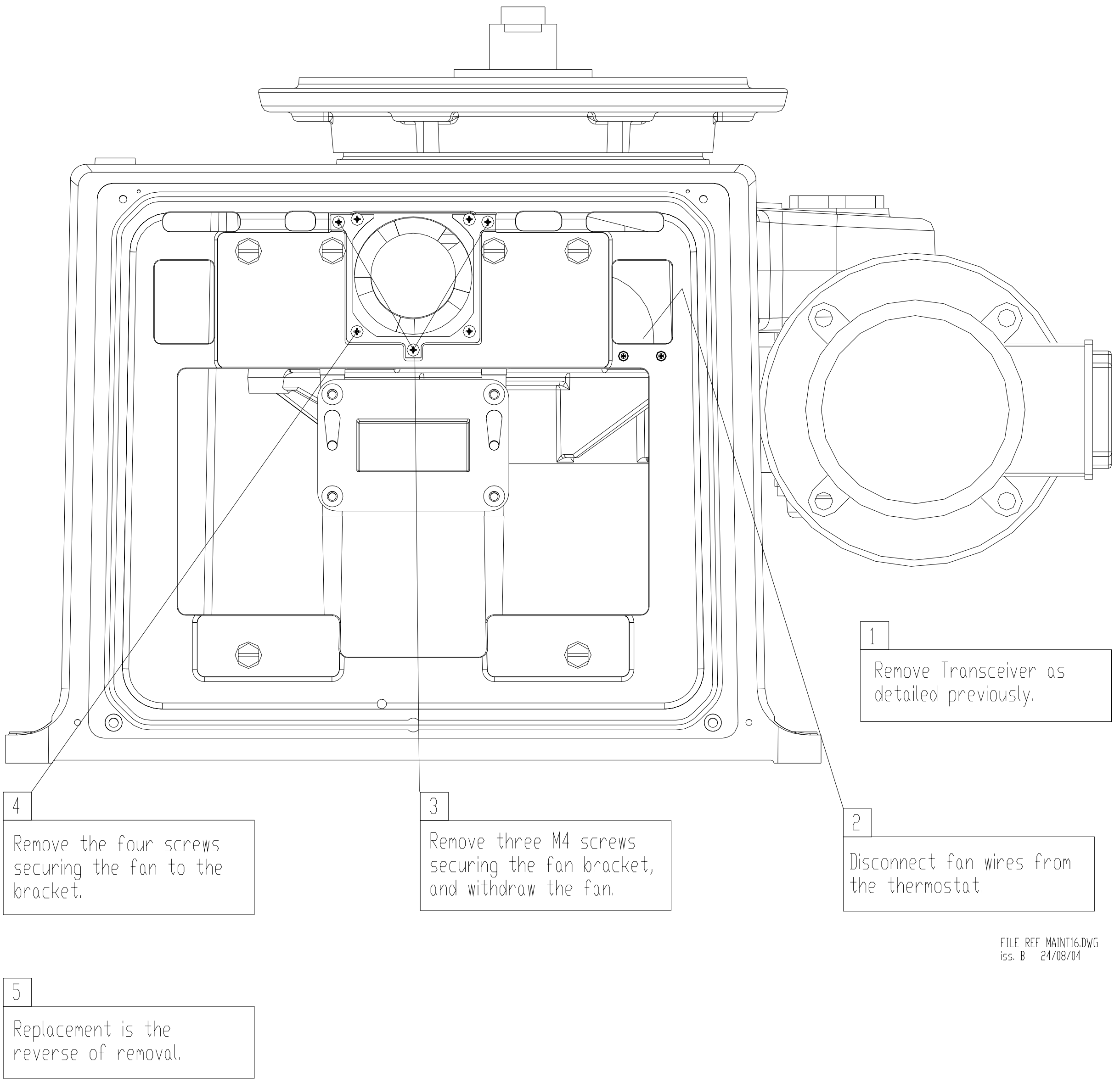


Figure 6.27. Replacement of Fan Assembly

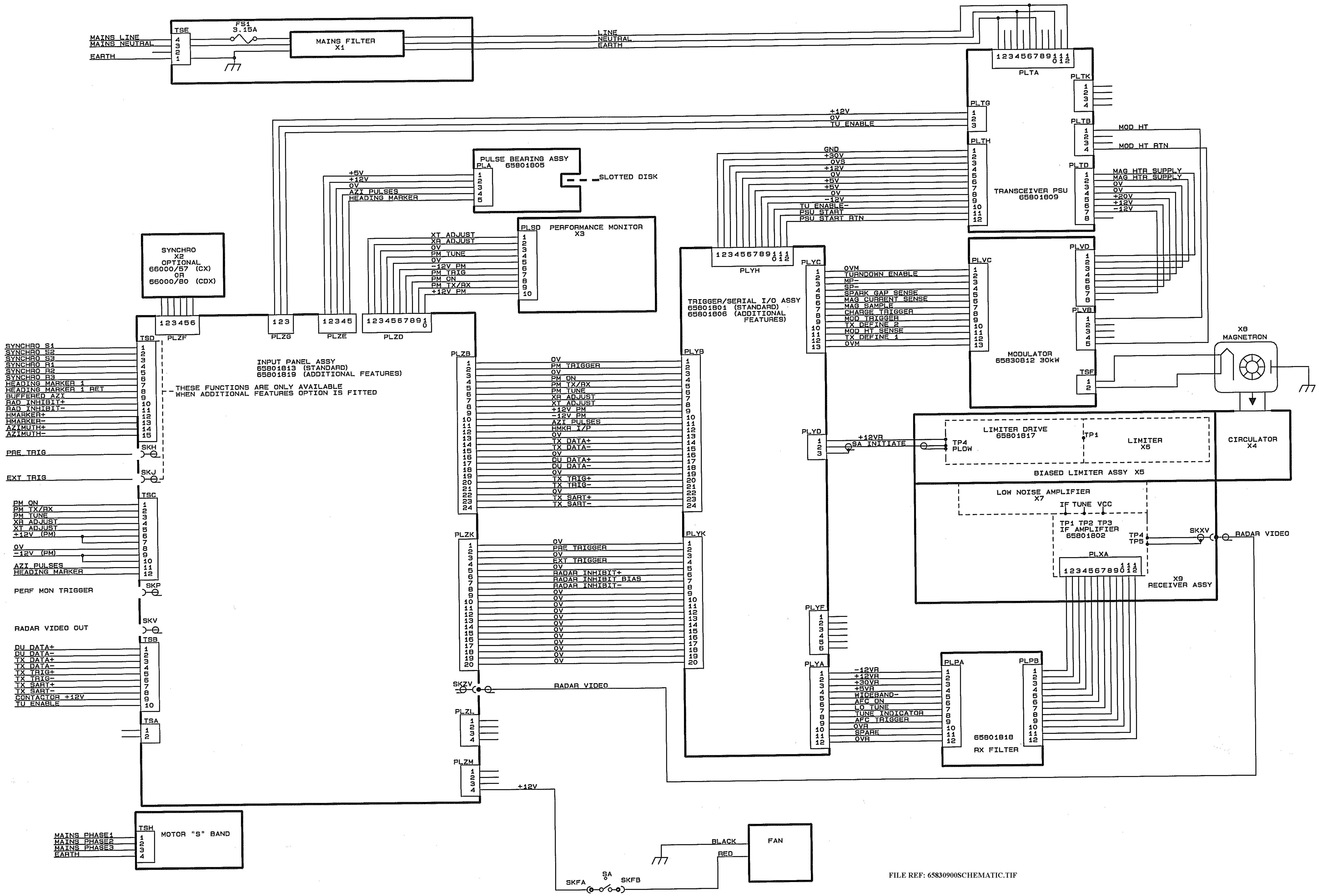


Figure 6.28. S-Band Turning Unit Schematic

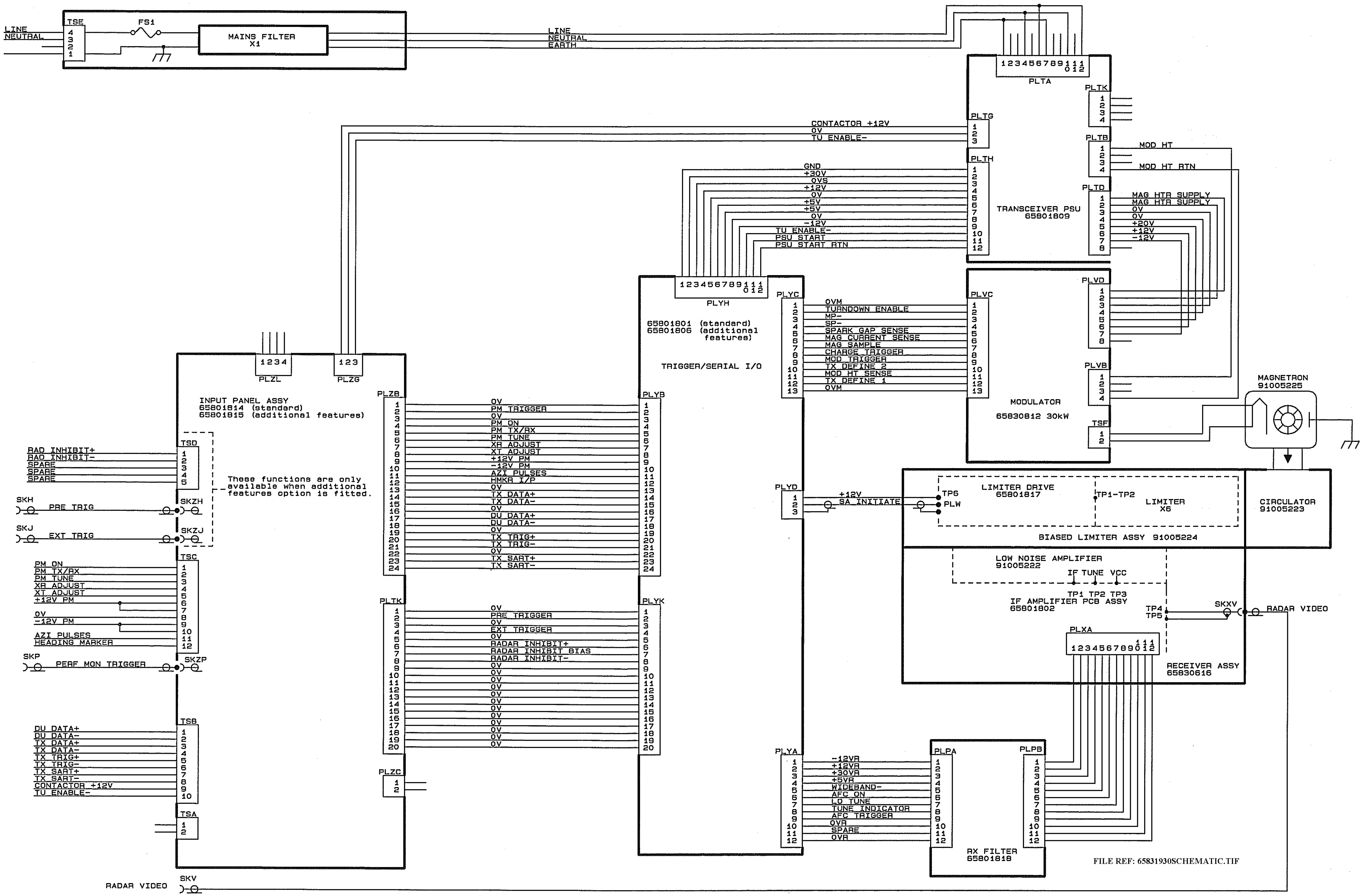


Figure 6.29. S-Band Bulkhead Transceiver Schematic

3.3 X-Band Scanner Unit

3.3.1 Access to Masthead Transceiver

1. Set Transceiver Unit to Standby.
2. Switch off the Display Unit from the front panel.
3. Isolate and remove both Ship's Switch Fuses in DC systems.
4. Isolate the radar from the ship's mains supply using the Isolating Switch provided for AC systems.
5. Turn the antenna into the service position, i.e. across the Transceiver axis, clear of any obstructions.
6. Undo the **four** captive bolts on the underside of each the upper casting (these secure the upper casting to the base casting).
7. Raise the upper casting into the upright position and **make sure the support stay engages in the locked position.**
8. **On earlier units the sliding locking bolt should be pushed to the bottom of the slot in the stay to prevent inadvertent release of the upper casting**. Refer to Figure 6.30.

3.3.2 Access to Bulkhead Transceiver

1. Set Transceiver Unit to Standby.
2. Switch off the Display unit from the front panel.
3. Isolate and remove both Ship's Switch Fuses in DC systems.
4. Isolate the radar from the ship's mains supply using the Isolating Switch provided for AC systems.
5. Undo the **four** screws that retain the upper cover to the lower chassis and lift clear.

3.3.3 Removing and Replacing the Transceiver from Masthead Turning Unit

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the transceiver is fully isolated from the ship's supply.

Note – The Masthead and Bulkhead Transceiver Units are identical and only minor differences exist in terms of fixtures.

3. Disconnect the cables from the following sockets:

SKV	Video co-axial cable to receiver assembly.
PLYB	Ribbon cable to Trigger PCB.
PLTK	Cable from PSU to Motor Drive PCB.
PLTA	Cable from PSU to Input Filter PCB (mains supply).
PLTG	Cable from PSU to Input PCB.

4. Refer to Figure 6.32.
5. Release the four M6 captive screws that hold the microwave assembly to the waveguide transition (around the base of the Circulator plate).
6. Remove the three screws that hold the Modulator heat sink to the chassis.
7. Slacken the two large bolts that hold the PSU heat sink to the chassis.

8. Before sliding up and removing the Transceiver, make sure that no cables are caught on any of the metalwork to avoid damage.
9. The PSU heat sink has slotted holes: slide upwards (towards the microwave output transition) and remove without fully removing the two bolts.

Replacement

The replacement sequence is as follows:

1. Place the Transceiver approximately onto the upper casting using the two large slotted holes in the PSU heat sink.
2. Slacken the two screws that hold the PSU chassis plate to the Modulator chassis plate, see Figure 6.32.
3. Slacken the screw that holds the Circulator mounting plate to the PSU chassis plate.
4. Fit and only **partially** tighten the three screws in the Modulator heat sink.
5. Fully tighten the four M6 microwave assembly-retaining screws.
6. Fully tighten the three screws in the Modulator heatsink.
7. Fully tighten the two large bolts in the slotted holes in the PSU heat sink.
8. Fully tighten the two screws that hold the PSU chassis plate to the Modulator chassis plate.
9. Fully tighten the screw that holds the circular mounting plate to the PSU chassis.

Note – This sequence is important to make sure the microwave alignment takes priority in terms of mechanical tolerances.

10. Replace all cables removed earlier.

3.3.4 Removing and Replacing the Transceiver from Bulkhead Transceiver Chassis

1. Refer to sub-section 3.3.2 (Access to Bulkhead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.

Note – The Masthead and Bulkhead Transceiver Units are identical and only minor differences exist in terms of fixtures.

3. Disconnect the cables from the following sockets:

SKV	Video co-axial cable to receiver assembly.
PLYB	Ribbon cable to Trigger PCB.
PLTK	Cable from PSU to Input PCB (motor supply).
PLTA	Cable from PSU to Input Filter PCB (mains supply).
PLTG	Cable from PSU to Input PCB.

4. Refer to Figure 6.32 and Figure 6.37.
5. Release the four M6 captive screws that hold the microwave assembly to the waveguide transition (around the base of the Circulator plate).

6. Remove the three screws that hold the Modulator heat sink to the chassis.
7. Slacken the two large bolts that hold the PSU heat sink to the chassis.
8. Before sliding up and removing the Transceiver, make sure that no cables are caught on any of the metalwork to avoid damage.
9. The PSU heat sink has slotted holes: slide upwards (towards the microwave output transition) and remove without fully removing the two bolts.

Note – On Bulkhead Transceivers, a small clip is fitted to the chassis to retain the lower edge of the Modulator PCB and support plate. This is purely a slide-in fixture and does not require undoing.

Replacement

1. Locate the Transceiver approximately onto the chassis using the two large slotted holes in the PSU heatsink.
2. Make sure the small clip fitted to the chassis engages the lower edge of the Modulator PCB and support plate during the replacement process.
3. Slacken the two screws that hold the PSU chassis plate to the Modulator chassis plate, refer to Figure 6.37.
4. Fit and **partially** tighten the three screws in the Modulator heat.
5. Fully tighten the four M6 microwave assembly-retaining.
6. Fully tighten the three screws in the Modulator heat sink.
7. Fully tighten the two large bolts in the slotted holes in the PSU heat sink.

Note – This sequence is important to make sure the microwave alignment takes priority in terms of mechanical tolerances.

8. Replace all cables removed earlier.

3.3.5 Magnetron Replacement – Masthead and Bulkhead Transceivers

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.32.
4. Disconnect the two EHT leads from the Modulator PCB terminal block.
5. Remove the four screws holding the Magnetron to the Circulator plate.

Replacement

1. Replacement is the reverse of the removal process.
2. Make sure the polarity of the EHT leads is correct. The PCB is marked 'Y' for yellow and 'G' for green.
3. Make sure any earth bonding leads to the Magnetron are refitted.

After replacement the magnetron current must be set up as in the following sub-section.

3.3.6 Setting the Magnetron Current

1. Refer to Figure 6.39 for the necessary procedure for setting Magnetron current.

3.3.7 Trigger PCB – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.40 for the necessary procedure for replacing the Trigger PCB.

3.3.8 Trigger PCB – Link Settings

1. Refer to Figure 6.41 for the necessary procedure for setting the link settings on the Trigger PCB.

3.3.9 Modulator PCB – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.42 for the necessary procedure for replacing the Modulator PCB.

3.3.10 Modulator PCB – Link Settings

1. Refer to Figure 6.43 for the necessary procedure for setting the link settings on the Modulator PCB.

3.3.11 PSU PCB – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.44 for the necessary procedure for replacing the PSU PCB.

3.3.12 PSU PCB – Link Settings

1. Refer to Figure 6.45 for the necessary procedure for setting the link settings on the PSU PCB.

3.3.13 Bearing and Heading Marker PCB – Replacement

1. Refer to section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.32.
4. The PCB is attached to a support casting and should be removed as a combined assembly as follows:
   a. Slacken the two screws retaining the support casting.
   b. Slide it towards the outside of the upper casting to clear the screws.
5. Unplug the cable from the PLRE.
6. Remove the PCB and support casting.

Note – When refitting the PCB to the support casting there are dowel pegs of different diameters used to locate the PCB in the correct orientation.

7. Before refitting the assembly, check that the link LK1 is set for either Normal Speed (pins 1-2) 28 RPM or High Speed (pins 2-3) 45 RPM.
8. For PCB assembly 65801826 see Chapter 9.

3.3.14 Heading Marker Alignment

1. Alignment of the Heading Marker is achieved via the Initialisation menu at the Display Unit.

3.3.15 Receiver Assembly – Replacement (Masthead)

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Remove the Transceiver Assembly as described at sub-section 3.3.3.
4. Unplug the ribbon cable from the Receiver to the Receiver Filter PCB.
5. Unplug the ribbon cable from the Receiver Filter PCB to the Trigger PCB.
6. Refer to Figure 6.32 for location of the screws securing the Low Noise Front End (LNFE) to the Limiter.

Note – The replacement Receiver is supplied with the LNFE already fitted.

7. Remove the four screws that hold the LNFE to the Limiter.
8. Remove the bracket that secures the Receiver to the microwave assembly at the Receiver end.
9. Remove the whole Receiver assembly.
10. Before fitting the replacement assembly, remove the Receiver Filter PCB from the old unit, and fit it to replacement unit.
11. Replacement is the reverse of the removal process.

3.3.16 Receiver Assembly – Replacement (Bulkhead)

1. Refer to sub-section 3.3.2 (Access to Bulkhead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.32, Figure 6.37 and Figure 6.38.
4. Unplug the ribbon cable from the Receiver to the Receiver Filter PCB.
5. Unplug the ribbon cable from the Receiver Filter PCB to the Trigger PCB.
6. Unplug the video co-axial cable from the Receiver.
7. Refer to Figure 6.32 for the location of screws securing the Low Noise Front End (LNFE) to the Limiter.

Note – The replacement Receiver is supplied with the LNFE already fitted.

8. Remove the four screws that hold the LNFE to the Limiter and remove the whole assembly.
9. Before fitting the replacement assembly, remove the Receiver Filter PCB from the old unit, and fit it to replacement unit.
10. Replacement is the reverse of the removal process.

3.3.17 Performance Monitor – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Remove the two retaining screws that hold the Performance Monitor to the upper casting (see Figure 6.32) and withdraw the unit.
4. Un-screw the bar that retains the RF absorber to the body of the Performance Monitor.
5. Disconnect the ribbon cable to the Performance Monitor.
6. Replacement is the reverse of the removal process.
7. Make sure the ribbon cable is reconnected to the Performance Monitor, the RF absorber is refitted.

After replacement, the Performance Monitor must be set up as detailed in Chapter 4 under 'Selecting the Performance Monitor' Facility.

3.3.18 Motor Drive Board – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Unplug the three cable assemblies from the Motor Drive PCB.
4. Remove the three screws (refer to Figure 6.33).
5. Slide the PCB out of the retaining clip at the opposite end of the PCB.
6. **Before fitting the replacement PCB, make sure the speed setting link LK1 is correctly set for the intended operational speed.**
   - Position 1 & 2 marked 'LO' is for 28 RPM operation.
   - Position 2 & 3 marked 'HI' is for 45 RPM operation.
7. If in doubt, compare the setting with the old PCB.
8. For PCB Assembly 65801827 see Chapter 9.
9. Replacement is the reverse of the removal process.
10. Make sure all three cable-assemblies are reconnected to the PCB.

3.3.19 Motor and Gearbox Assembly – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Refer to Figure 6.33 for the location of the three screws that retain the motor support casting to the upper casting.
4. Remove the screws.
5. Withdraw the motor support casting complete with Motor Drive PCB from the belt drive.
6. Remove the four screws that retain the motor and gearbox assembly to the support casting.

Note – These four countersink screws are fitted with screw retaining fluid. When fitting the new motor, these screws should be refitted using 'Loctite Screwlock 222' low breaking strength fluid.

7. Remove the impeller from the old motor
8. Fit the replacement impeller.
9. Replacement is the reverse of the removal process, taking care to engage the motor pulley into the drive belt.

3.3.20 Drive Belt – Replacement

1. Refer to sub-section 3.3.1 (Access to Masthead Transceiver), paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship's supply.
3. Remove the Transceiver as detailed at sub-section 3.3.3.
4. Remove the motor support casting and motor assembly as detailed in sub section 3.3.19.
5. Refer toFigure 6.33.
6. Remove the three bolts (as shown in Figure 6.31) that retain the waveguide transition support casting to the rotating joint.

Note – Since the waveguide transition support casting has two sleeve inserts to aid accuracy in alignment, some resistance may be felt when removing it.

7. Care should be exercised when removing the casing to avoid damage to the assembly or to the brass microwave probe at the centre of the hub.
8. Fit the replacement drive belt.
9. Re-assembly is the reverse of the removal process.
10. Care should be exercised to avoid damage to the brass microwave probe at the centre of the hub during re-insertion into the transition.
11. Make sure the motor pulley is correctly engaged into the belt.

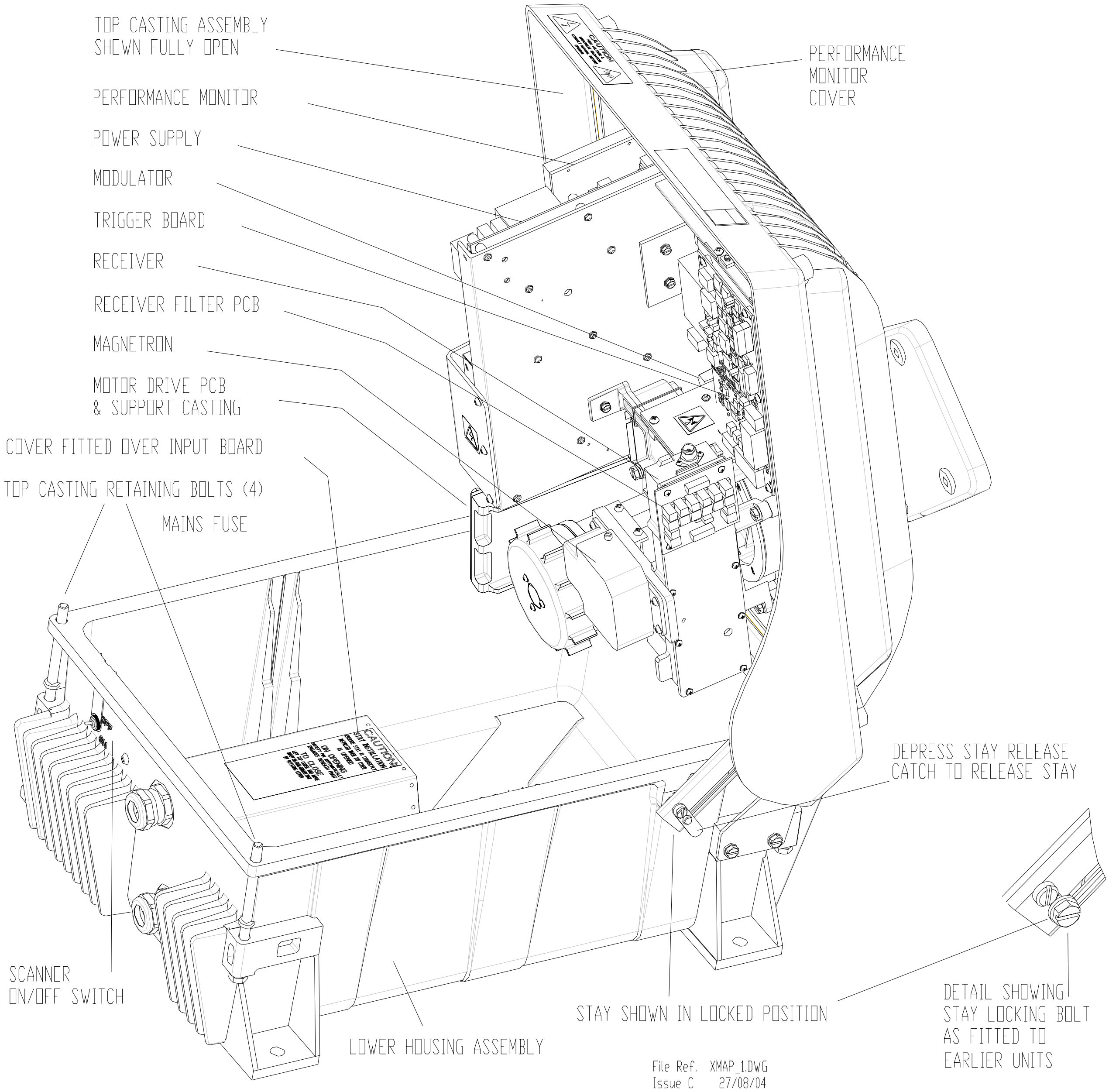


Figure 6.30. X-Band Masthead Turning Unit – Internal view showing Transceiver

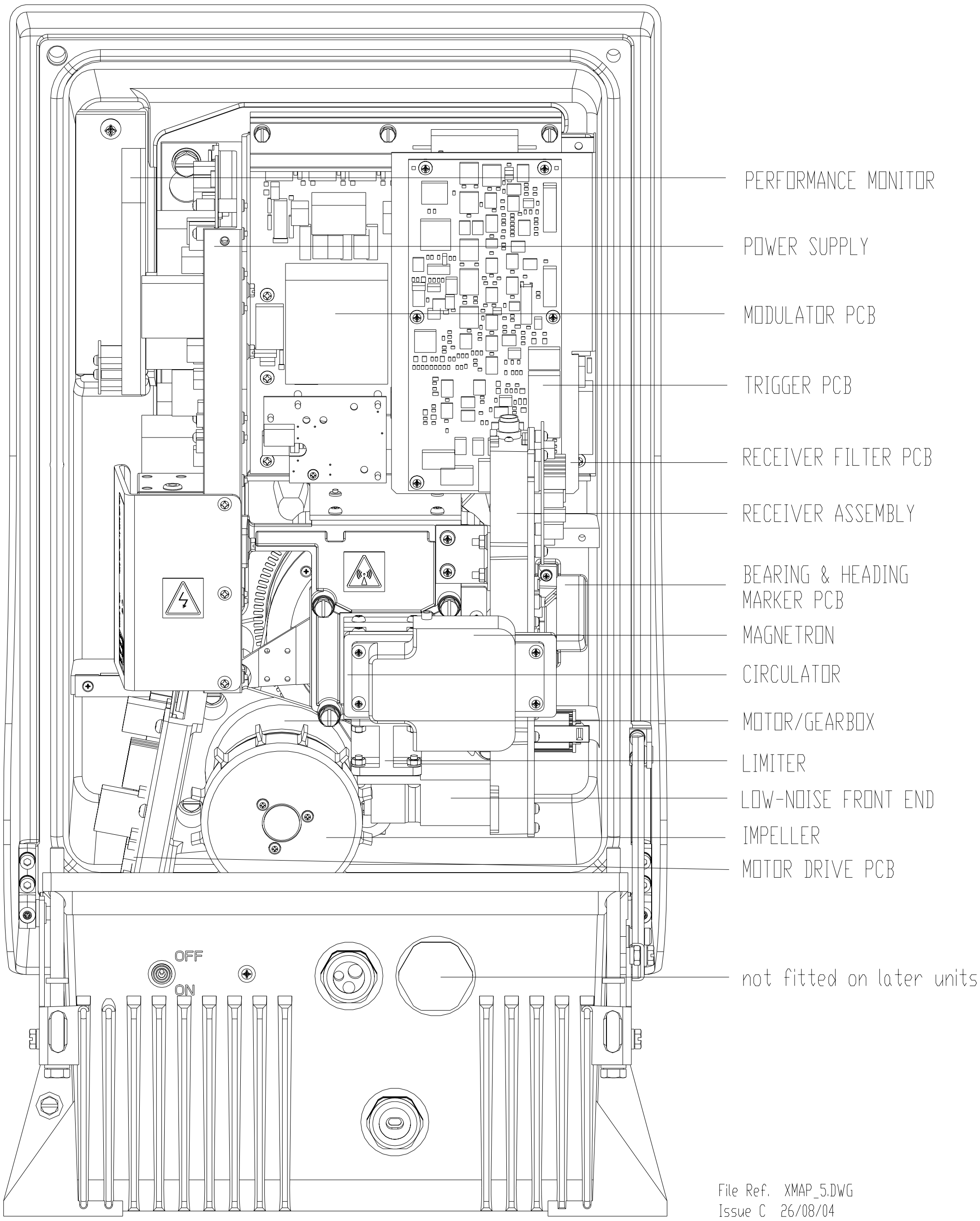


Figure 6.31. X-Band Masthead Turning Unit – View showing Main Assemblies

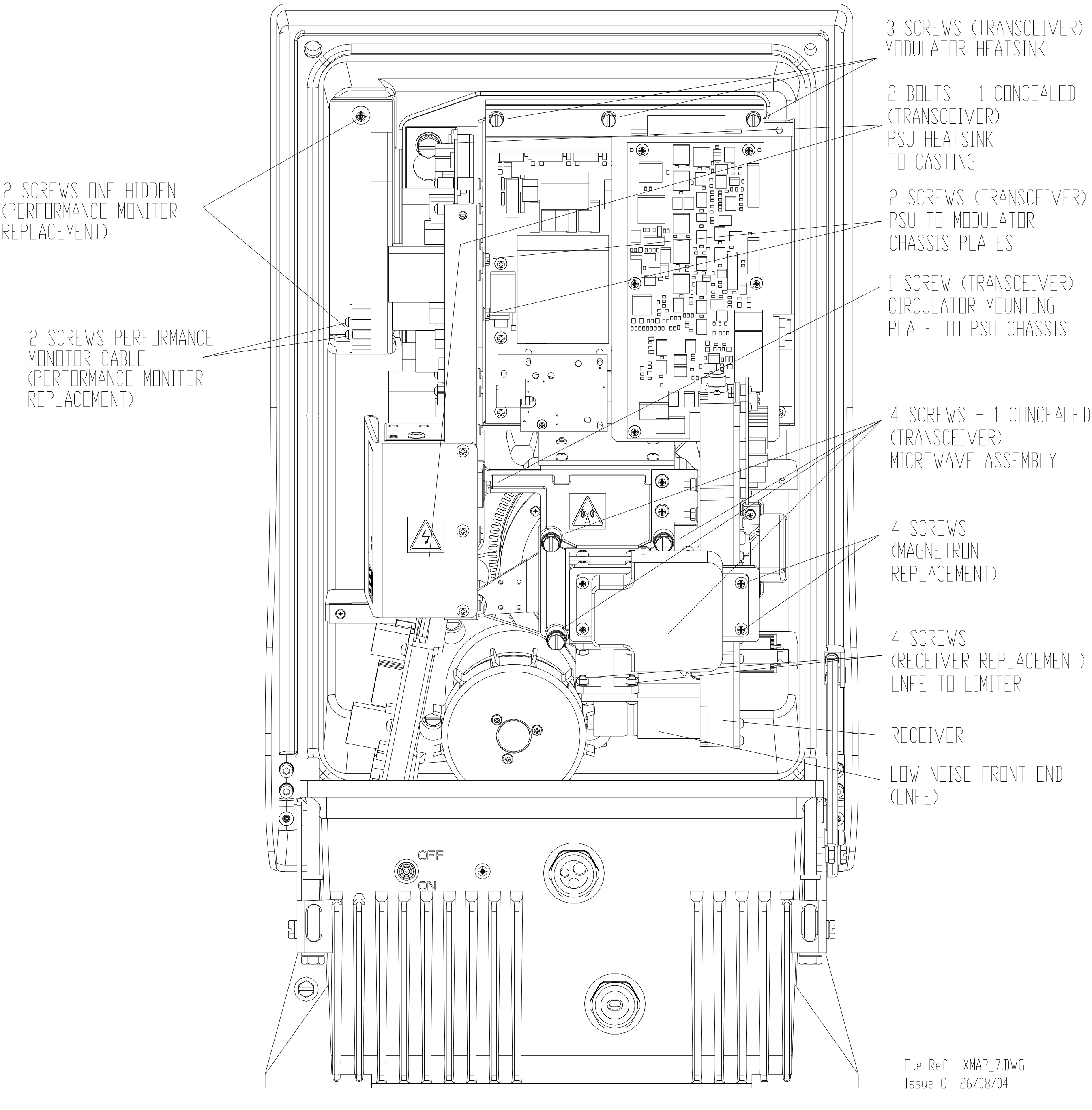


Figure 6.32. X-Band Masthead Turning Unit – Fitment of Main Assemblies

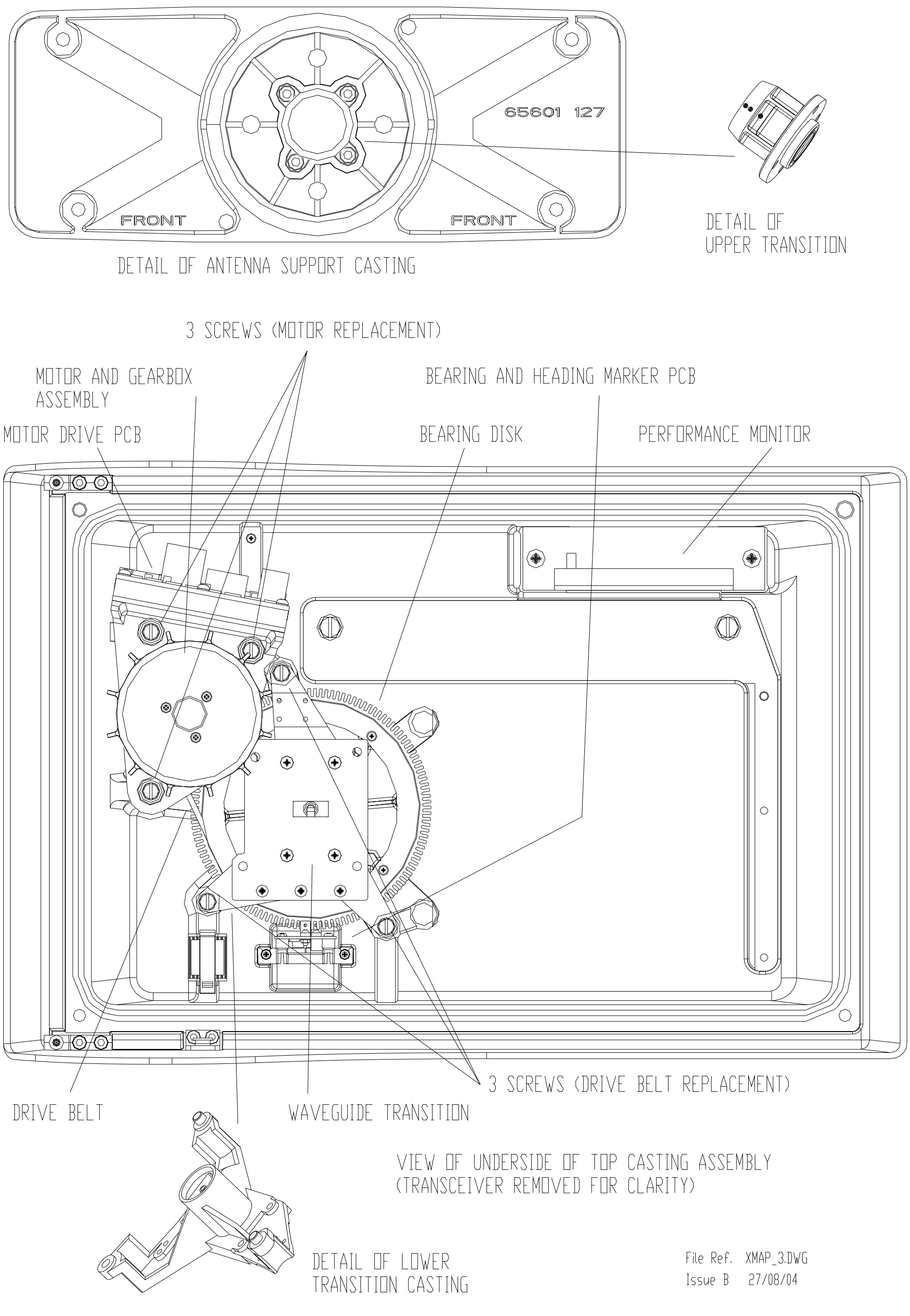


Figure 6.33. X-Band Masthead Turning Unit – View inside upper casting with Transceiver removed

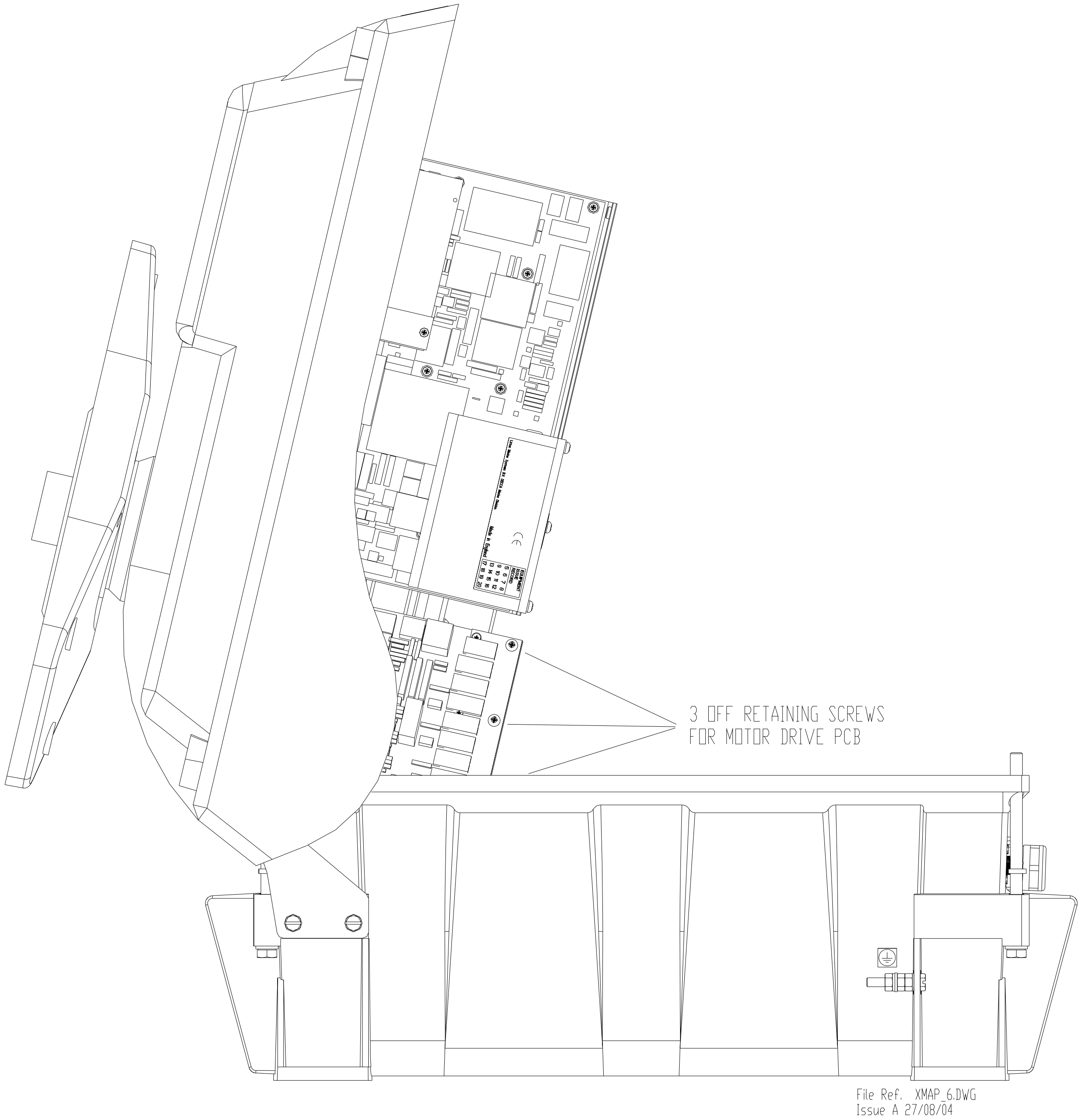


Figure 6.34. X-Band Masthead Turning Unit – Side view showing Motor Drive Board retaining screws

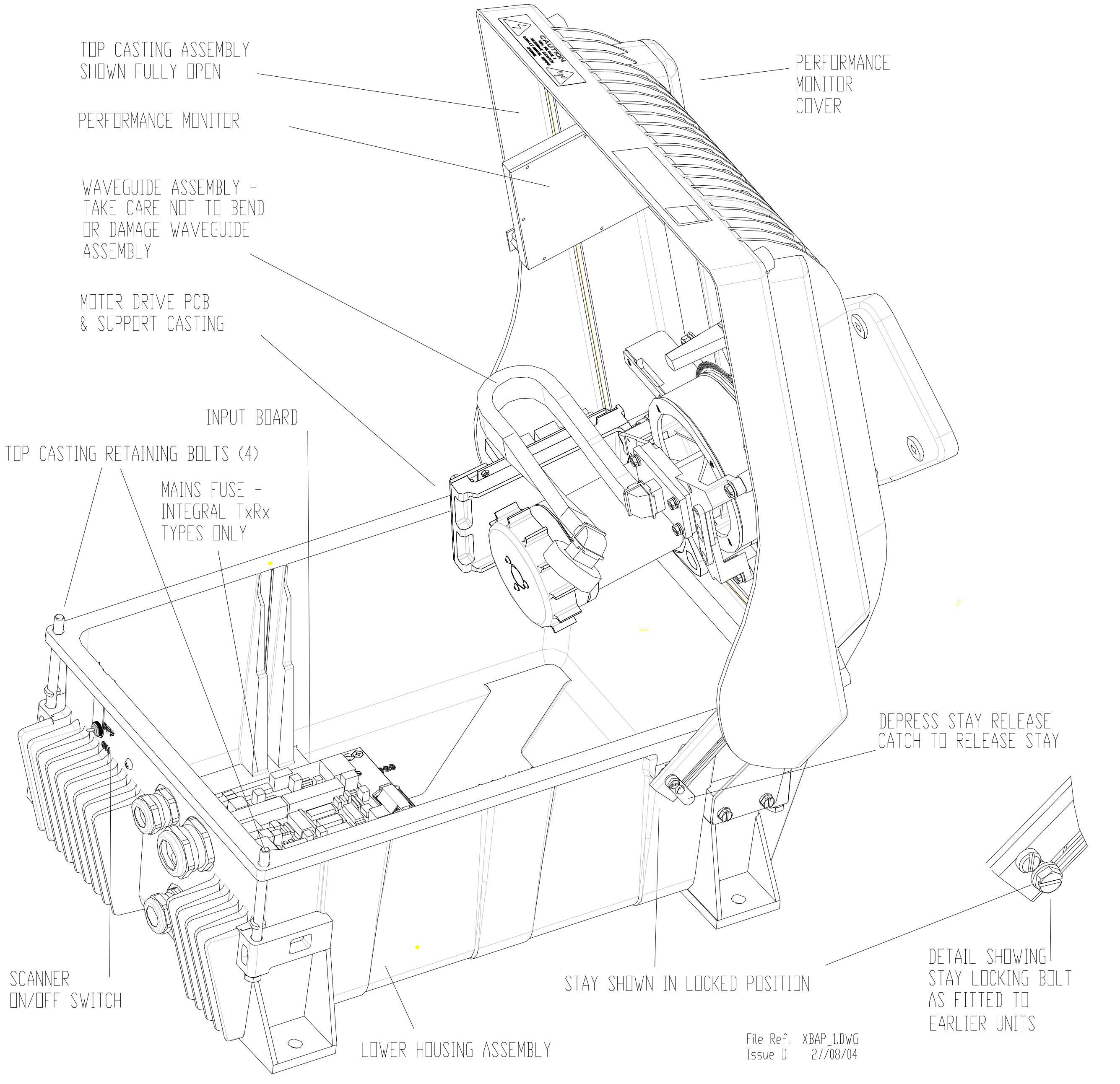


Figure 6.35. X-Band Bulkhead Turning Unit – View showing Main Assemblies

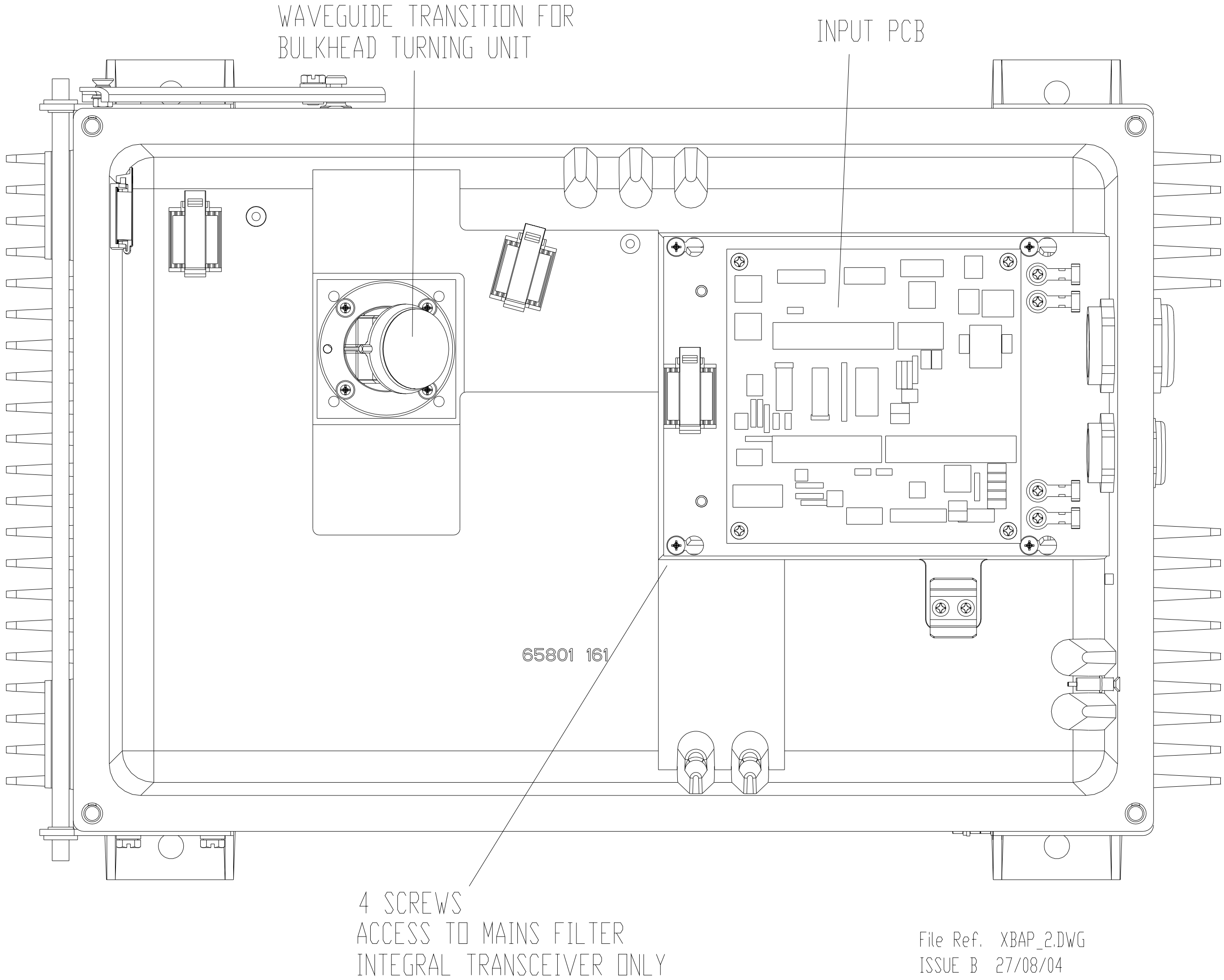


Figure 6.36. X-Band Bulkhead Turning Unit – View showing assemblies fitted to lower casting

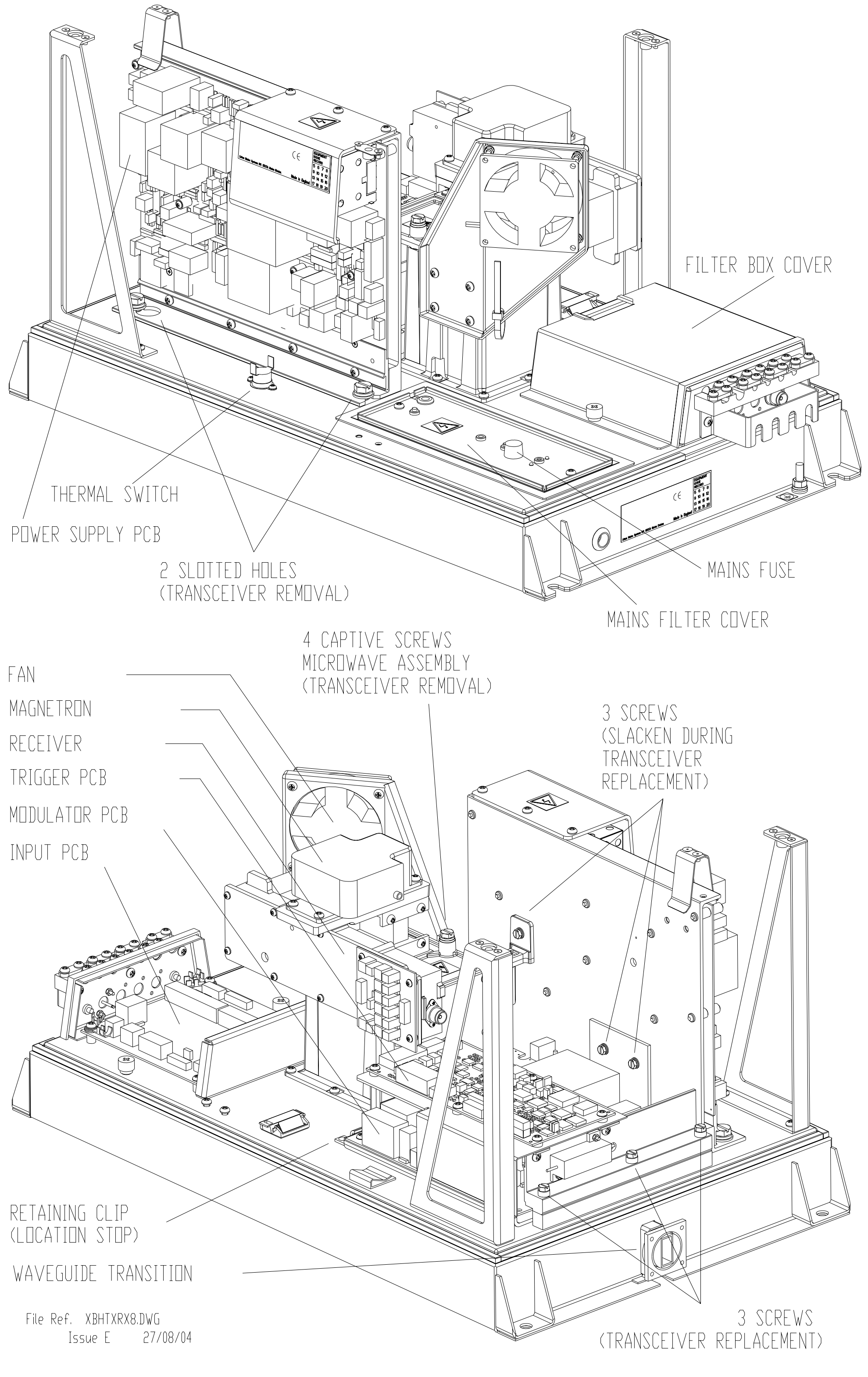


Figure 6.37. Bulkhead Transceiver – View with Cover Removed (earlier version)

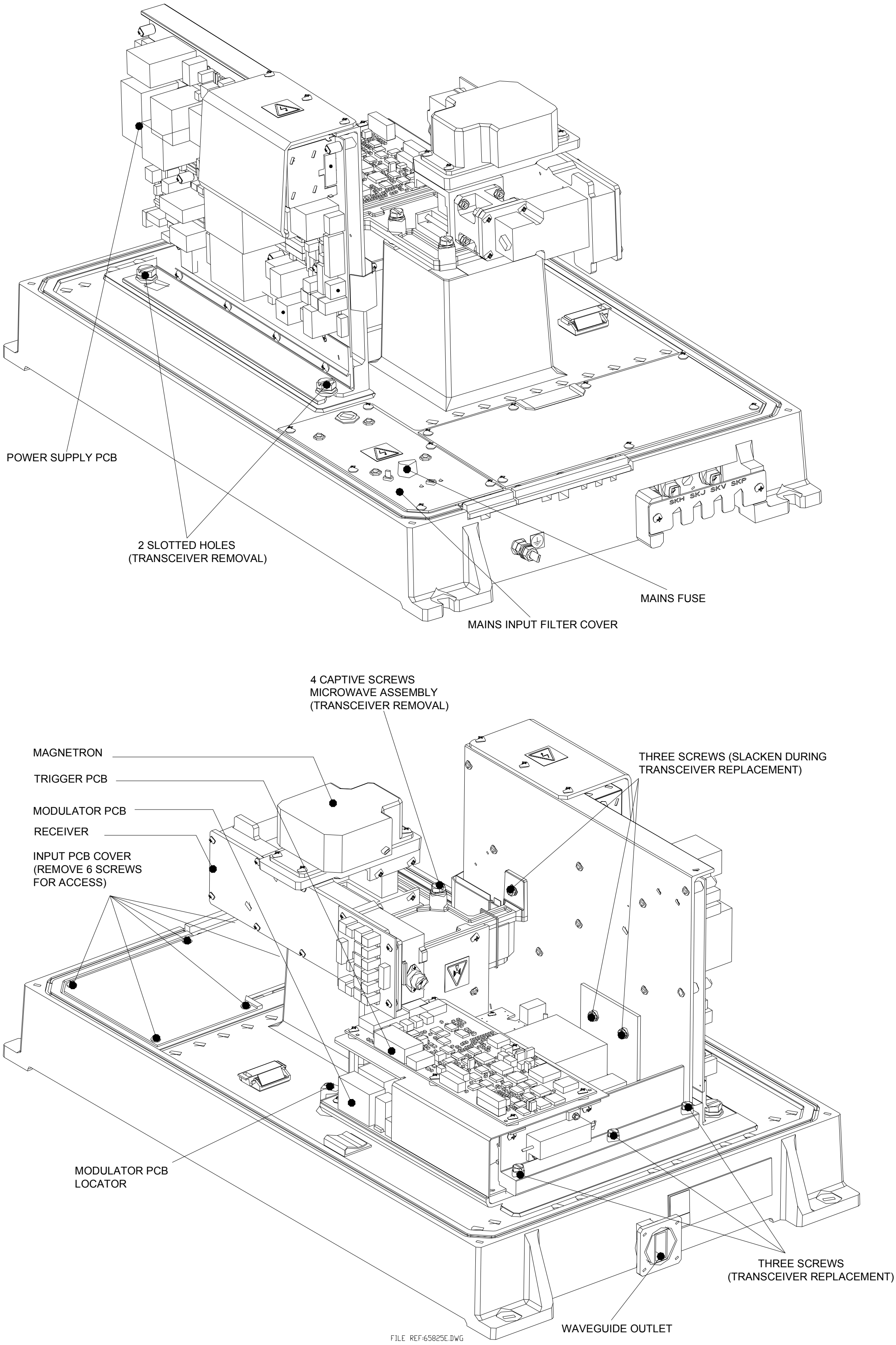


Figure 6.38. Bulkhead Transceiver – View with Cover Removed

1

On the Trigger PCB set:
LK5, and LK6 to 2 - 3.
This is the service position,
and will allow the transmitter
to transmit when the antenna
is stationary.

2

Restore the ship's supply
to the transceiver.
Select Long Pulse, Transmit
at the display.

3

On the Modulator PCB measure
the voltage between TP100 and
ground.
Note:
A DVM with an input impedance
greater than 10 Mohms must be
used for this measurement. Use
of a meter with lower impedance
could result in damage to the
magnetron.

4

Adjust RV1 on the Power Supply
PCB to give the same voltage on
TP100 as is recorded on the label
on the pulse transformer on the
Modulator PCB.

6

On completion of the procedure.
Switch off.
Reset LK5 and LK6 on the
Trigger PCB to 1 - 2.

FILE REF. MAINT3.DWG
iss. B 23/03/05

Figure 6.39. Setting Magnetron Current

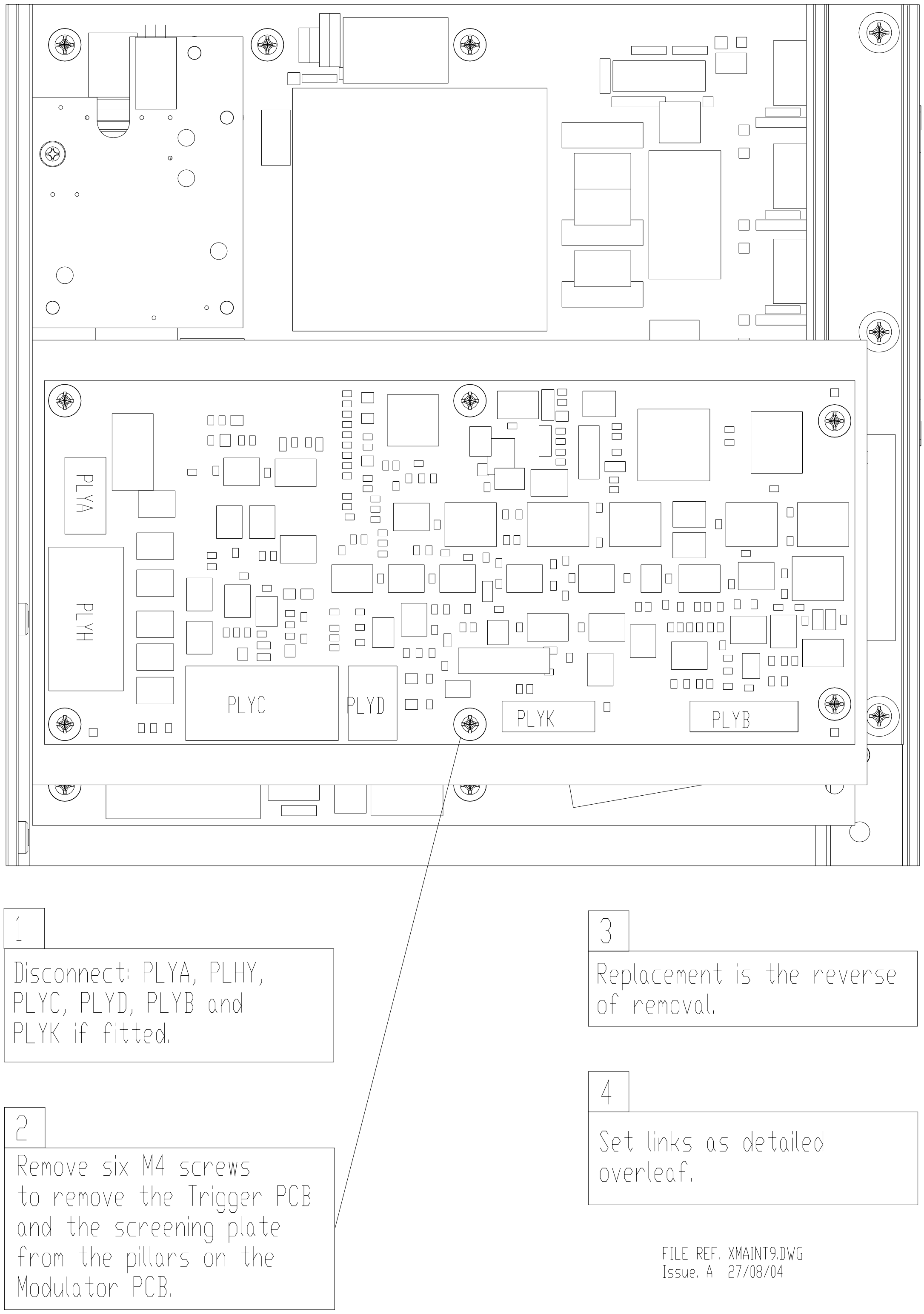
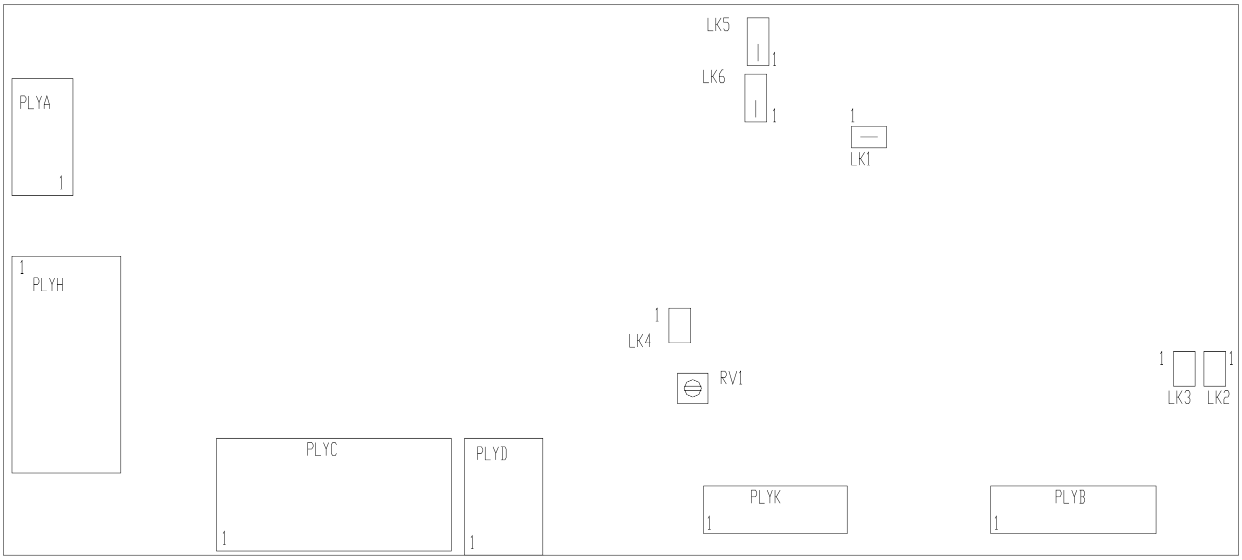


Figure 6.40. Replacing Trigger PCB



FILE REF. TRIGGER.DWG
iss. C 24/08/04

ATE TEST LINKS
LK1 FITTED
LK4 NOT FITTED

BAUD RATE LINKS
LK2 NOT FITTED
LK3 NOT FITTED

SERVICE LINKS
LK5 NORMAL OPERATION FITTED 1 - 2
LK6 NORMAL OPERATION FITTED 1 - 2

LK5 SERVICE FITTED 2 - 3
LK6 SERVICE FITTED 2 - 3
WHEN FITTED 2 - 3 THE TRANSMITTER
WILL OPERATE WHEN THE ANTENNA IS
STOPPED.

RV1 SWEPT GAIN DELAY
FACTORY SET DO NOT ADJUST

Figure 6.41. Link Settings – Trigger PCB

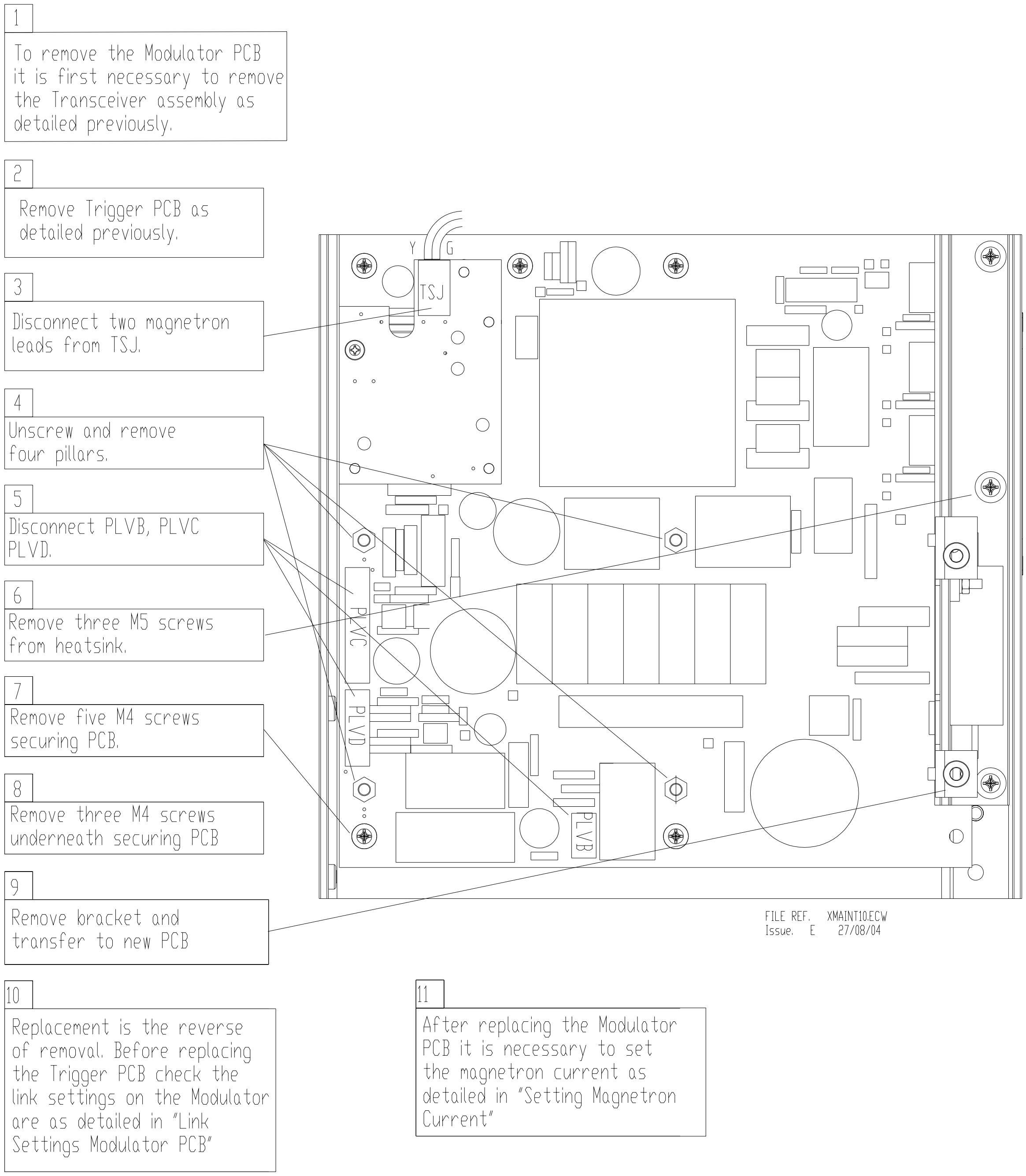
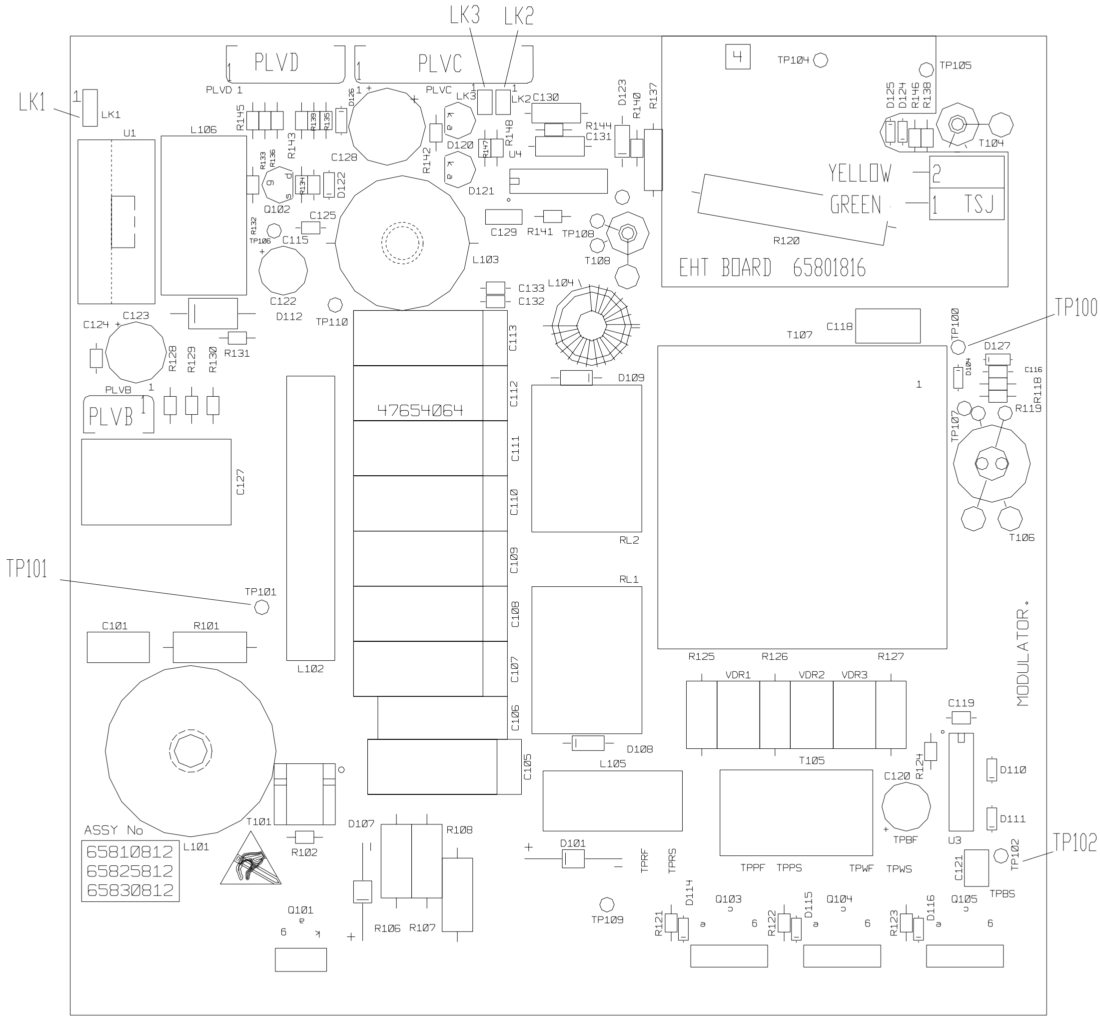


Figure 6.42. Replacing Modulator PCB



FILE REF. X_MODLTR.DWG
ISSUE B 24/08/04

MODULATOR LINK SETTINGS FOR 65810812 / 65825812 / 65830812

	S-BAND	10 kW X-BAND	25 kW X-BAND
LK1	FITTED 2 - 3	FITTED 1 - 2	FITTED 1 - 2 FOR MAGNETRON MG5424
LK1			FITTED 2 - 3 FOR MAGNETRON M1458
LK2	FITTED	NOT FITTED	NOT FITTED
LK3	NOT FITTED	FITTED	NOT FITTED

NOTE THAT LINK 1 IS CONFIGURABLE FOR HEATER TURNDOWN ON 25kW X-BAND
NOTE THAT LINKS 2 & 3 ARE HARDWIRED FOR SPECIFIC USEAGE ON LATER MODULATORS.

TEST POINTS:
TP100 MAGNETRON CURRENT MONITOR
TP101 CHARGE TRIGGER
TP102 MODULATOR TRIGGER

Figure 6.43. Link Settings – Modulator PCB

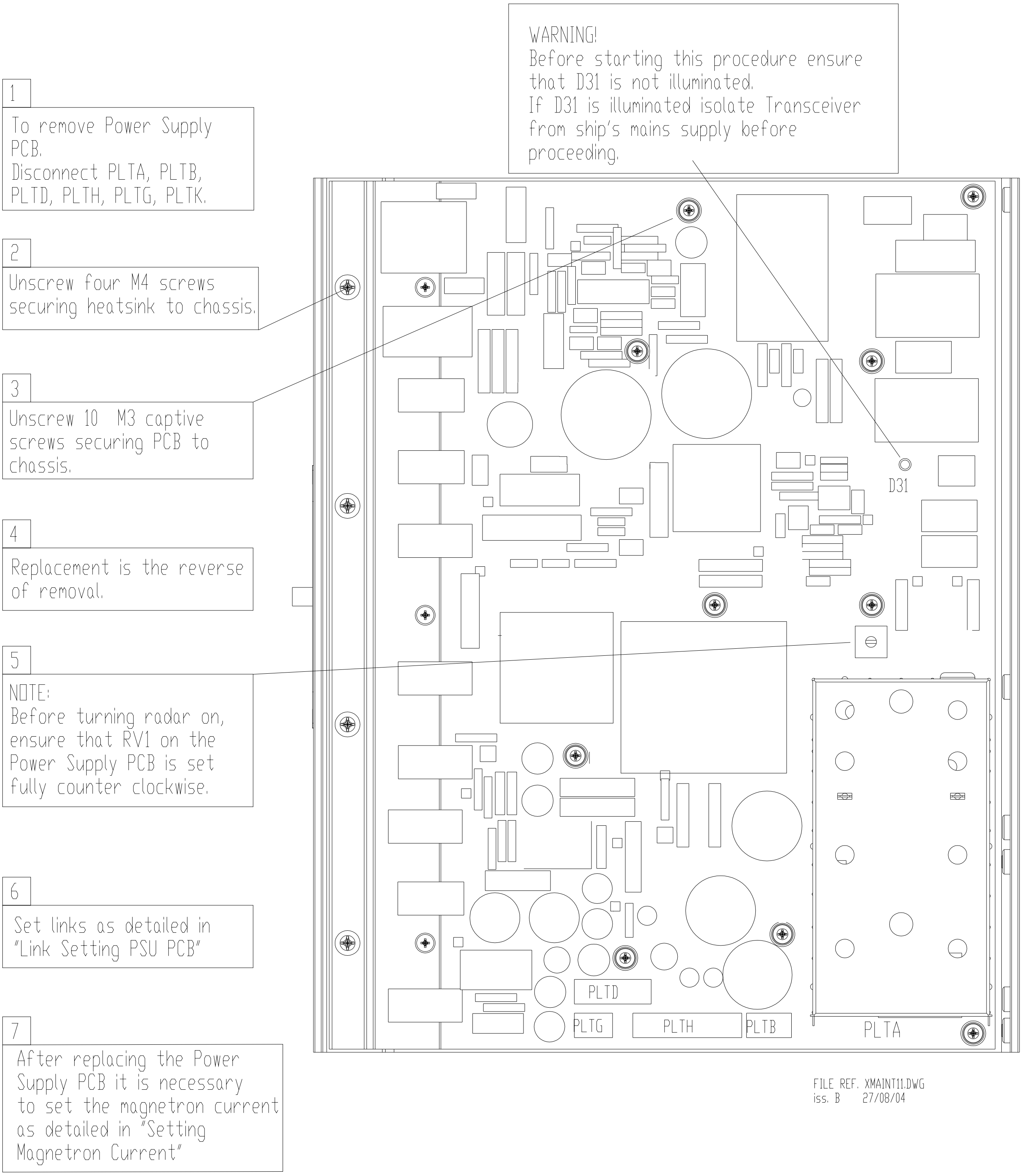
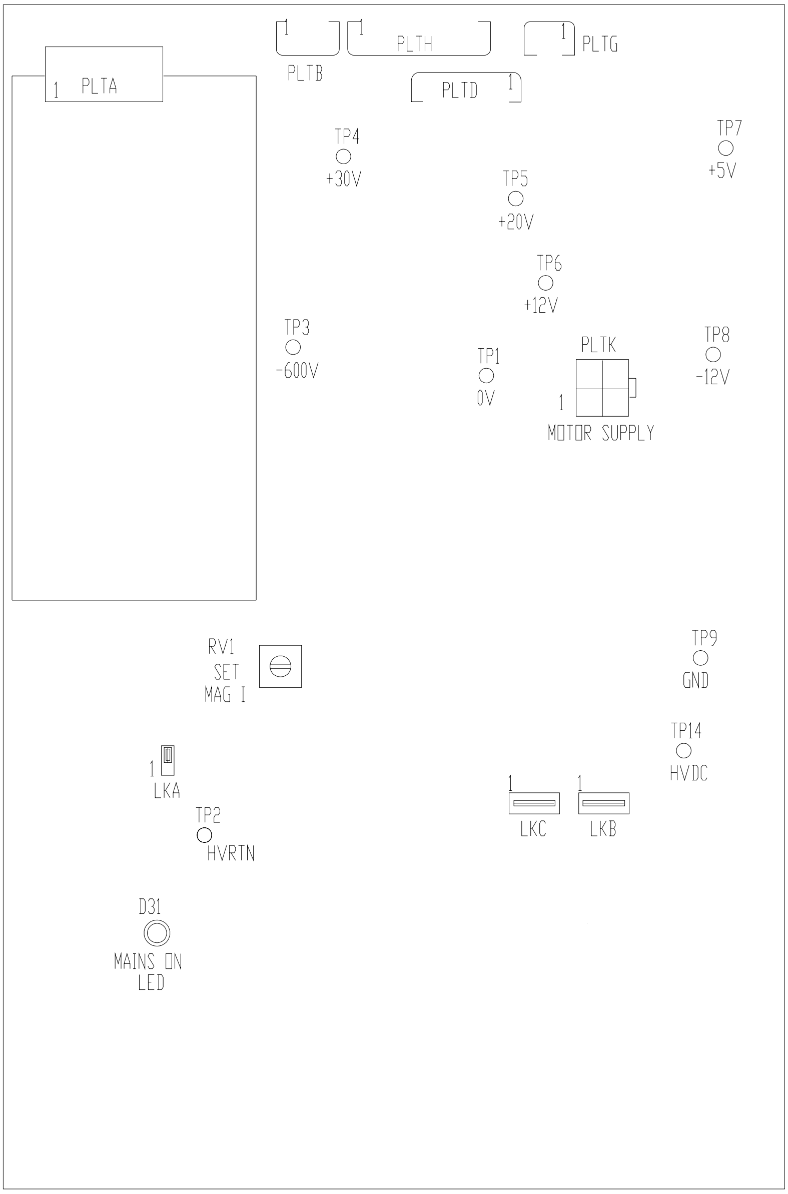


Figure 6.44. Replacing PSU PCB



"LKA" START TEST LINK
LKA NORMAL OPERATION FITTED 2 - 3
LKA TEST FITTED 1 - 2
WHEN IN THE TEST POSITION THIS LINK ALLOWS THE POWER SUPPLY TO OPERATE WITHOUT BEING CONNECTED TO THE CONTROL SIGNALS FROM THE DISPLAY UNIT.

HIGH VOLTAGE ISOLATION LINK
LKB NORMAL OPERATION FITTED
LKB ISOLATE HV OPERATION NOT FITTED
THIS LINK CAN BE USED TO ISOLATE THE POWER FACTOR CORRECTION CIRCUIT FROM THE REST OF THE POWER SUPPLY AS AN AID TO FAULT FINDING

LKC - MOTOR SUPPLY ISOLATION LINK NORMALLY FITTED

TEST POINTS

TP1	0V
TP3	-600V
TP4	+30V
TP5	+20V
TP6	+12V
TP7	+5V
TP8	-12V

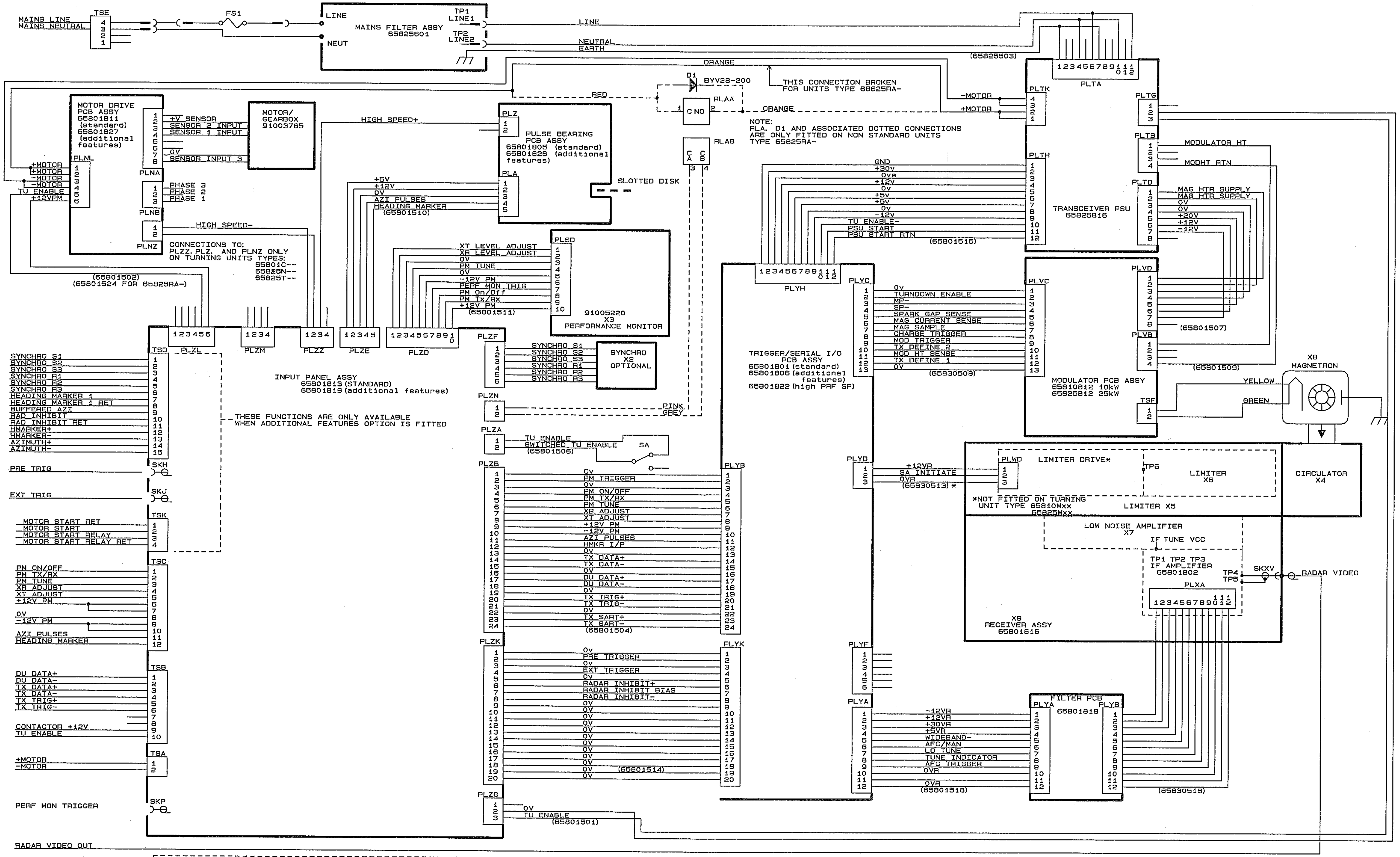
THE ABOVE VOLTAGES ARE MEASURED WITH RESPECT TO TP1

TP2	HVRTN
TP14	HVDC (380V)

THE VOLTAGE ON TP14 IS MEASURED WITH RESPECT TO TP2.

FILE REF XPSU.DWG
ISS. B 24/08/04

Figure 6.45. Link Settings – PSU PCB



UNIT TYPE			
REF	25kW 65825XXX	10kW 65810XXX	DESCRIPTION
X2	66000/57	66000/57	SYNCHRO ASSY (CX)
X2	66000/80	66000/80	SYNCHRO ASSY (CDX)
X3	9105220	9105220	PERFORMANCE MONITOR
X4	91005227	91005227	CIRCULATOR
X5	91005226	91005221	BIASED LIMITER ASSY
X5	91005210	91003431	NON BIASED LIMITER USED ON 65825Wxx 65810Wxx
X6	91005219	91005235	LIMITER
X7	91003241	9103241	LOW NOISE AMPLIFIER
X8	91005208	9103015	MAGNETRON
X9	65801616	65801616	RECEIVER ASSY

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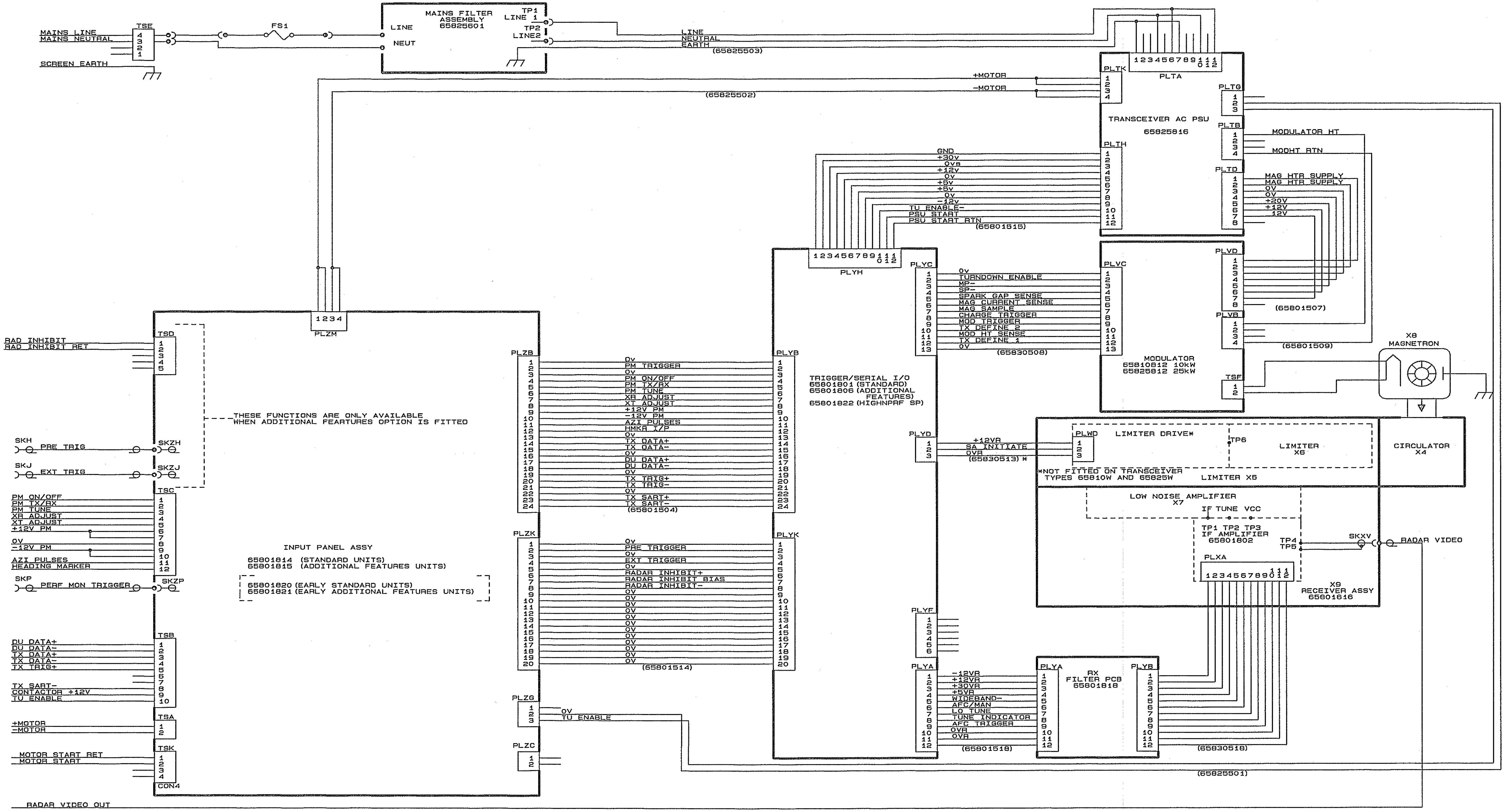
Figure 6.46. X-Band Turning Unit (Aloft) Schematic



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REF	UNIT TYPE 25kW 65825XXX	UNIT TYPE 10kW 65810XXX	DESCRIPTION
X3	91005220	91005220	PERFORMANCE MONITOR
X4	91005227	91005227	CIRCULATOR
X5	91005226	91005221	BIASED LIMITER ASSY
X5	91005210	91003431	NON BIASED LIMITER USED ON 65810H, 65810W, AND 65825W, 65825H
X7	91003241	91003241	LOW NOISE AMPLIFIER
X8	91003496	910/3015	MAGNETRON
X9	65801616	65801616	RECEIVER ASSY

Figure 6.47. **X-Band Transceiver Schematic**

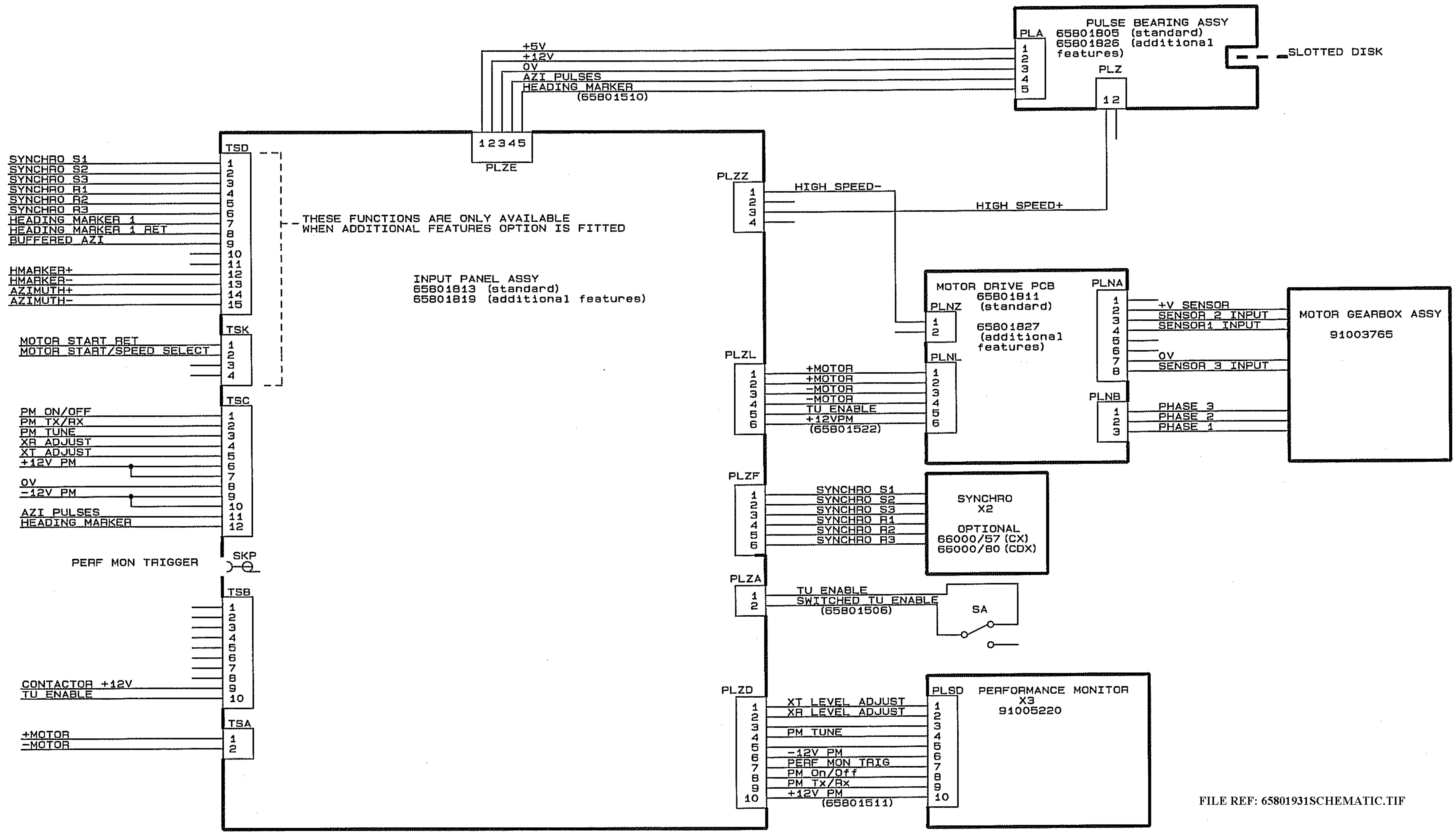

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Figure 6.48. X-Band Turning Unit (Bulkhead) Schematic

3.4 2-Way Interswitch 65842A

Refer to next section for actual spares order code.

First Line Servicing for this unit is limited to field replacement of the following item.

Assembly	Part Number
PCB ASSEMBLY	65842800

3.5 6-Way Interswitch 65846A

First Line Servicing for this unit is limited to field replacement of the following item.

Assembly	Part Number
PCB ASSEMBLY	65846800
BYPASS PCB ASSEMBLY	65846801

3.6 Interface Unit 65847A

First Line Servicing for this unit is limited to field replacement of the following item.

Assembly	Part Number
PCB ASSEMBLY	65847851

4 Limited Spares List for Field Replacement

4.1 CRT Monitors

	Part Numbers			
Assembly Type	180	250 Med Res.	250 High Res.	340
CRT	3025845	MA00010231	MA00011866	N/A
Degauss Coil	91003688	91003689	91003689	91003608
CRT Board Set* consisting of:- Drive PCB Base PCB Controller PCB	T65814611 consisting of:- 65814882 65814883 65800881	T65820611 consisting of:- 65820882 65820883 65800881	T65821611 consisting of:- 65821882 65821883 65800881	T65826611 consisting of:- 65826882 65826883 65800881
Brilliance PCB	T65800885 (desk mounting displays ONLY)			
Fan	65826612			
Video O/P (Optional)	T65800884			

*Note that all three CRT PCBs must be ordered and changed as a complete matched set.

4.2 FPD Monitors

FPD Assembly Type	Part Number
180 DESKTOP	65815C
180 KIT (AC)	65815A
180 KIT (DC)	65815D
250 DESKTOP	65817C
250 KIT (AC-18.1")	65817A
250 KIT (AC-19.0")	65817G
250 KIT (AC-20.1")	65819A
250 KIT (DC-18.1")	65817D
250 KIT (AC-19.0")	65817H
250 KIT (AC-20.1")	65819D
340 DESKTOP	91003790
340 KIT	91003791
340 DECKSTAND	91003799

4.3 2-Way Interswitch 65842A

Assembly	Part Number
PCB ASSEMBLY	T65842800

4.4 6-Way Interswitch 65846A

Assembly	Part Number
PCB ASSEMBLY	T65846800
BYPASS PCB ASSEMBLY	T65846801

4.5 Interface Unit 65847A

Assembly	Part Number
PCB ASSEMBLY	T65847851

4.6 Spares for Transceivers and Turning Units

The tables below list the spares for standard transceivers and turning units.

For units fitted with additional features options see Chapter 9.

In the tables below replace "xx" with 10 or 25 as appropriate. (e.g 658xxA becomes 65825A or 65810A), and "yy" with suffix as explained in Chapter 2 (e.g 65825WAR is a 25KW Turning Unit without biased limiter, with performance monitor , and AC mains input)

4.6.1 S-Band Turning Units (Masthead and Bulkhead)

Assembly	Part Number
TRIGGER PCB ASSEMBLY	T65801801
INPUT PCB ASSEMBLY (MASTHEAD TRANSCEIVER)	T65801804 or T65801813*
INPUT PCB ASSEMBLY (BULKHEAD TRANSCEIVER)	T65801814
POWER SUPPLY PCB ASSEMBLY	T65801809
BEARING AND HEADING MARKER PCB ASSEMBLY	T65801805
RECEIVER FILTER PCB ASSEMBLY	T65801818
RECEIVER ASSEMBLY	T65830616
MODULATOR PCB ASSEMBLY	T65830812
LIMITER ASSEMBLY	T91005224
MAGNETRON	T91005225
CIRCULATOR	T91005223
PERFORMANCE MONITOR	T91003746
MOTOR 110/120V AND 220/240V Normal Speed	T91003757
MOTOR 110/120V AND 220/240V High Speed	T91003759
MOTOR 220/240V AND 380/440 3PH Normal Speed	T91003751
MOTOR 110/220V 3PH Normal Speed	T91003752
MOTOR 220/240V AND 380/440V 3PH High Speed	T91003753
MOTOR 110/220V 3PH High Speed	T91003754
MAINS FILTER PCB ASSEMBLY	T91005228
FUSE	MA00007245
FAN – AXIAL 80x80x25 24VDC (MASTHEAD Tx/Rx)	T65830656
THERMAL SWITCH (FOR FAN – MASTHEAD Tx/Rx)	MA00007765

* 65801804 can be replaced with T65801813
65801813 must be replaced with T65801813

4.6.2 Standard X-Band Turning Units and Transceivers

65825A, 65825G, 65825H, 65825P, 65825W, 65825Lyy, 65825Myy, 65825Pyy, 65825Wyy,

65810A, 65810G, 65810H, 65810P, 65810W, 65810Myy, 65810Pyy, 65810Wyy

Assembly	Part Number
TRIGGER PCB ASSEMBLY (STANDARD)	T65801801
TRIGGER PCB ASSEMBLY (FOR UNITS PART No. 658xxP, 658xxG, 658xxPyy)	T65801822
INPUT PCB ASSEMBLY (TURNING UNIT)	T65801813
INPUT PCB ASSEMBLY (TURNING UNIT) (FOR TURNING UNIT PART No.65825Lyy)	T65801819
INPUT PCB ASSEMBLY (FOR BULKEAD TRANSCEIVERS PART No. 658xxH, 658xxG)	T65801814
INPUT PCB ASSEMBLY (FOR BULKHEAD TRANSCEIVERS PART No. 658xxA, 658xxP, 658xxW)	T65801820
POWER SUPPLY PCB ASSEMBLY AC MAINS INPUT	T65825816
POWER SUPPLY PCB ASSEMBLY DC MAINS INPUT	T65810816
BEARING AND HEADING MARKER PCB ASSEMBLY	T65801805
RECEIVER FILTER PCB ASSEMBLY	T65801818
RECEIVER ASSEMBLY	T65801616
MODULATOR PCB ASSEMBLY	T65810812
LIMITER ASSEMBLY (10kW) (NITS FOR UNITS PNo 65810A, 65810P, 65810G, 65810Myy, 65810Pyy, 65810SDy,	T91005221
LIMITER (10KW) (FOR UNITS PNo. 65810W, 65810H, 65810Wyy	T91003241
LIMITER ASSEMBLY (25KW) FOR UNITS PNo. 65825A, 65825G, 65825Lyy, 65825Myy, 65825Pyy,	T91005226
LIMITER 25KW FOR UNITS PNo. 65825H, 65825W, 65825Wyy	T91005210
MAGNETRON (10kW)	T91003582
MODULATOR PCB ASSEMBLY (25kW) (STANDARD)	T65825812
MODULATOR PCB ASSEMBLY (25Kw HIGH PRF) FOR UNITS PNo. 65825P, 65825Pyy.	T65825813
MAGNETRON (25kW)	T91003496
CIRCULATOR	T91005227
PERFORMANCE MONITOR	T91005220
MOTOR DRIVE & DYNAMIC BRAKE PCB ASSEMBLY	T65801811
MOTOR & GEARBOX ASSEMBLY	T91003765
IMPELLER	65801136
MAINS FILTER PCB ASSEMBLY	T65825601
FUSE	MA00007245
BELT DRIVE (40W)	MA00008979
FAN – AXIAL 80x80x25 24VDC (BULKHEAD Tx/Rx)	T65830656
THERMAL SWITCH (FOR FAN – BULKHEAD Tx/Rx)	MA00007765
CABLE ASSY – SCANNER ON/OFF (INC SWITCH)	T65801506

4.7 Processor Electronics Unit

Assembly	Part Number
DISPLAY PROCESSOR PCB	T65800811
RADAR PROCESSOR PCB (ATA/ARPA + VISION)	T65800812
RADAR PROCESSOR PCB (ATA/ARPA)	T65800814
RADAR PROCESSOR PCB (EPA)	T65800815
COMBINED PROCESSOR PCB (EPA(L))	T65800839
STANDARD COMPASS PCB	T65800831
SPECIAL COMPASS PCB	T65800832
AC INPUT/OUTPUT PANEL PCB	T65800818
DC INPUT/OUTPUT PANEL PCB	T65800821
BACKPLANE PCB	T65800819
AC POWER SUPPLY PCB	T65800823
DC POWER SUPPLY PCB	T65800822
JOYSTICK ASSEMBLY	T65800606
TRACKERBALL ASSEMBLY	T65800603
MEMORY CARD ASSEMBLY	T65800602
MEMORY CARD BUFFER PCB (for KIT versions)	T65800837
KEYBOARD ASSEMBLY	T65845600
ON/OFF SWITCH ASSEMBLY	T65800607
FAN ASSEMBLY	T65800613
AIR FILTER (STANDARD)	65800111
AIR FILTER (INTEGRAL KEYBOARD OPTION)	65800214

4.8 Extended Processor Electronics Unit

Assembly	Part Number
DISPLAY PROCESSOR PCB	T65818811
RADAR PROCESSOR PCB (ATA/ARPA)	T65818814
STANDARD COMPASS PCB	T65800831
SPECIAL COMPASS PCB	T65800832
AC INPUT/OUTPUT PANEL PCB	T65818818
BACKPLANE PCB	T65818819
AC POWER SUPPLY PCB	T65800823
JOYSTICK ASSEMBLY	T65800606
TRACKERBALL ASSEMBLY	T65800603
MEMORY CARD ASSEMBLY	T65800602
MEMORY CARD BUFFER PCB (for KIT versions)	T65800837
KEYBOARD ASSEMBLY	T65845600
ON/OFF SWITCH ASSEMBLY	T65800607
FAN ASSEMBLY	T65818613
AIR FILTER (STANDARD)	65800111
AIR FILTER (INTEGRAL KEYBOARD OPTION)	65800214

4.9 Kit Control Panel Modules

Module	Width (mm)	Part Number
JOYSTICK	154	T65826658 or T65800606
	170	T65821620 or T65800606
TRACKERBALL	154	T65826654 or T65800603
	170	T65821623 or T65800603
MEMORY CARD	154	T65826655
	170	T65821619
KEYBOARD	312	T65845600
ON/OFF SWITCH	73	T65826656
BRILLIANCE	163	T65826657
	73	T65821621

Note – To replace the joystick or trackerball, it is possible to just replace the internal assembly.

4.10 Deck Mounting 340 Display Control Panel

Note – For units fitted with extruded panel (as shown at Figure 6.2 in this chapter), refer to Section 4.9.

Assembly	Part Number
JOYSTICK ASSEMBLY	T65800606
TRACKERBALL ASSEMBLY	T65800603
MEMORYCARD ASSEMBLY	T65800602
MEMORY CARD BUFFER PCB	T65800845
KEYBOARD ASSEMBLY	T65845600
ON/OFF SWITCH ASSEMBLY	T65827617
BRILLIANCE PCB	T65800885

CHAPTER 7

ROUTINE MAINTENANCE

Contents

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1 Introduction

The BridgeMaster E Radar System is designed to function reliably for many years. To make sure of the best possible performance, you must complete specific maintenance tasks at regular intervals. This chapter has details of the recommended maintenance plan.

2 Maintenance Plan

!WARNING!
Lethal voltage hazard

Before the following maintenance tasks are started (except the fan operation check), the equipment must be isolated from the mains supply. In addition to this, no components or assemblies should be touched for at least five minutes. This is to make sure any high voltage capacitors have discharged.

Interval	Action	Notes
3 Monthly	Check the screen of the Display for dirt.	Use a soft cloth to clean the screen. If available, use an anti-static spray. **Solvents must not be used as a cleaning agent**.
3 Monthly	Check that the Processor Electronics Unit fan is working (with unit switched ON). If practicable, check that the CRT Monitor fan is working (with unit switched on)	To ensure good reliability, it is essential that the circulating air within the unit is maintained. Refer to Figure 6.1 (Chapter 6) to remove any dust build up on the air intake filters at the front of the unit. If necessary, wash or replace the filter.
3 Monthly	Plug rechargeable memory cards into a powered-up display for at least one hour.	Rechargeable memory cards have no removable batteries.

Interval	Action	Notes
6 Monthly	Check the window of the Antenna for excessive dirt.	Excessive dirt or carbon deposits from the ship's funnels may cause reduced radar performance. Use hot soapy water to clean the antenna window. **Never use solvents**.
6 Monthly	Check all external nuts, bolts and washers on the Scanner Unit, for corrosion and for correct tightness.	The nuts, bolts and washers must be replaced if they are heavily corroded, and suitable anti-corrosion compound applied.
6 Monthly	In the S-band Scanner unit check for oil leaks in the gearbox. In the X-band Scanner unit check for condition of the drive belt.	If leaks are detected, refer to Service Engineer.

Interval	Action	Notes
2 Yearly	Replace the primary battery on non-rechargeable memory cards. (Memory card battery replacement kit Part No 65600712)	Change battery while card is plugged into a powered-up display.

Note – If damage to any of the items being checked during routine maintenance is observed, call for a service repair.

CHAPTER 8

MODIFICATIONS

Contents

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1 Introduction

This chapter will be used for recording system and equipment modifications (including the issue of Modification Leaflets), and for conveying information released after publication.

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CHAPTER 9

ADDITIONAL FEATURES

Contents

List of Figures

1 Introduction

This chapter contains the additional information required to cover the installation and operation of radar systems equipped with the Additional Features option. The additional features are as follows:-

Isolated Ship's Heading Marker output, RS422, and uncommitted relay contacts

4096 Pulse Bearing Data output, RS422, and open drain FET output

External Triggering input

Pre-trigger output

Radar Silence input i.e.(transmission inhibit control . Selectable for RS422, RS423 voltage levels, and on later units closing contact input.

Antenna Rotation in Standby Input (X-Band only)

On later X-Band units remote selection of high and normal rotation rates for antenna. (not available on early units that have high PRF option fitted)

Optional synchro or resolver bearing output.

Note – Some options are mutually exclusive.

2 Technical Specification

2.1 General

This section only gives details of the technical specification for the additional features, for all other parameters see Chapter 1.

Except where indicated, the following specification applies equally to X-Band and S-Band Transceivers, and Turning Units.

2.2 Isolated Ship's Heading Marker Output

Output 1

Parameter	Value
Output Type	Uncommited contact (solid state relay)
Voltage Rating	24V dc maximum
Current Rating	0.7A maximum
Closure Duration	20° approx
Adjustment Range	±10° approx wrt true heading
Adjustment Increment	0.088°
Reference	Leading edge
Sense	Selectable to be rising or falling edge

Output 2

Parameter	Value
Output Type	RS422 (differential)
Output Drive	To drive 120ohm twisted pair
Vout high	2.0V min Isource -20mA
Vout low	0.5V max Isink 20mA
Closure Duration	20° approx
Adjustment Range	±10° approx wrt true heading
Adjustment Increment	0.088°
Reference	Leading edge
Sense	Selectable to be rising or falling edge

2.3 Pulse Bearing Output

Output 1

Parameter	Value
Output Type	Open drain FET (referenced to 0V)
Pulses per Revolution	4096
Voltage Rating	25V dc maximum
Current Rating	100mA maximum
Mark Space Ratio	<1.5:1

Output 2

Parameter	Value
Output Type	RS422 (differential)
Pulses per Revolution	4096
Output Drive	To drive 120ohm twisted pair
Vout high	2.0V min Isource -20mA
Vout low	0.5V max Isink 20mA
Mark Space Ratio	<1.5:1

2.4 Synchro and Resolver Bearing Output

The turning unit may be fitted with one size 11 synchro or resolver. This is not aligned, any alignment must be made externally.

Control transmitter (CX) or control differential transmitter (CDX) synchro options are available.

The reference supply is assumed to be from an external source.

Standard synchros available are:

11CX4c

Parameter	Value
Type	Control transmitter
Ratio	1:1
Reference Voltage	115V rms
Output Voltage	90V rms line to line
Frequency	400Hz

11CDX4b

Parameter	Value
Type	Differential control transmitter
Ratio	1:1
Input Voltage	78V rms line to line
Output Voltage	90V rms line to line
Frequency	400Hz

Standard resolver available is:

11M6P1

Parameter	Value
Type	Data transmission
Ratio	1:1
Input Voltage	26V rms line to line
Output Voltage	11.8V rms line to line
Frequency	400Hz

2.5 Pre-trigger Output

Parameter	Value
Amplitude	8V min 15V max
Duration	1.0 μs nominal
Polarity	Positive
Rise Time (10% - 90%)	<100ns
Time wrt Magnetron Output	-11μs typical
Drive Capability	75 ohms

2.6 Radar Silence Input

RS422

Parameter	Value
InputType	RS422 (differential)
Response Time	Within 1 PRI
Input Impedance	120 ohms

Closing Contact (later units only)

Parameter	Value
Input Type	Uncommitted closing contact
Voltage on Open Conatct	6V max
Sink Current Through Closed Contact	4mA max
Response Time	Within 1 PRI
Sense	Selectable

RS423

Parameter	Value
Input Type	RS423 bipolar
Response Time	Within 1 PRI
Minimum Differential Input Voltage	+/-2V
Input Voltage	+/-7V max
Input Current	.<-10mA for Vin -7V other input at 0V
Sense	Selectable

2.7 External Trigger Input

Parameter	Value
Amplitude	4.0V min 40.0V max
Duration	0.2μs min 40μs max
Polarity	Positive
Rise Time (10% - 90%)	<50ns
Delay to Magnetron Output	11μs approx.
Input PRF	5.5kHz max 200Hz min (Output PRF limited within the TxRx)
Input Impedance	75 ohms
Average Input Power*	0.4W max

Trigger pulse amplitude, duration and PRF must be considered in limiting the input power.

The presence of a signal at the external trigger input will automatically select external trigger operation.

2.8 Forced Antenna Rotation in Standby Input. (later X-Band units only)

An isolated closing contact can be connected to X-band turning unit to force the antenna to rotate when in the standby mode. Rotation is forced when the contact is closed.

Note – This function cannot be used in conjunction with the remote speed change option. i.e. they are mutually exclusive.

Parameter	Value
Input Type	Uncommitted closing contact
Voltage Applied to Open Conatct	5.5V max
Sink Current Through Closed Contact*	1mA max
Sense	Rotation enabled when contact is closed

*The switch or contacts should be specified for switching low currents.

2.9 Antenna Speed Selection Input (later X-Band units only)

An isolated closing contact can be connected to the X-band turning unit to enable remote selection between normal and high speed antenna rotation.

In the absence of the closing contacts links allow the rotation speed to be preset to normal or high speed.

Notes: This function cannot be used in conjunction with the Forced Antenna Rotation in Standby feature. i.e. they are mutually exclusive.

This feature is not available on early units fitted with the high PRF option.

For 10KW dc systems high speed operation should only be used where a 1.2m (4ft) antenna is fitted to the turning unit. For 1.8m (6ft) and 2.4m (8ft) antennas the antenna rotation speed must be preset to the Normal setting.

Parameter	Value
Antenna Speed Normal	28 rpm nom.
Antenna Speed High	45 rpm nom
Control Signal Type	Uncommitted closing contact
Signal Sense	Closed contacts select 28rpmOpen contacts select 45rpm
Voltage Applied to Open Contact	< 5.5V DC
Sink Current Through Closed Contact	<500uA

3 Installation and Interconnections

3.1 General

To make use of the additional features requires the fitting of extra cables to the turning unit or transceiver.

To facilitate the fitting of the extra cables the turning units are supplied with additional cable glands fitted.

For details see Figure 9.1 and Figure 9.2.

3.2 Interconnections

Only the extra connections required for the additional features are listed in this section, for all other connections see Chapter 2.

X and S Band Turning Unit Connections

Cable No:	EMC CAT —		Cable Type: PT1YM (75ohm coax)		
From Turning Unit			To:		
Unit Connector No: SKH			Unit Connector:		
Cable Connector Type: L734PNI			Cable Connector Type:		
Manufacturer; Belling Lee			Manufacturer:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	PRE-TRIGGER O/P	PIN	INNER	PIN	Masthead transceiver only
2	SCREEN	OUTER	BRAID	OUTER	

Cable No:	EMC CAT —		Cable Type: PT1YM (75ohm coax)		
To: Turning Unit			From:		
Unit Connector No: SKJ			Unit Connector:		
Cable Connector Type: L734PNI			Cable Connector Type:		
Manufacturer; Belling Lee			Manufacturer:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	EXT-TRIGGER I/P	PIN	INNER	PIN	Masthead transceiver only
2	SCREEN	OUTER	BRAID	OUTER	

Cable No:	EMC CAT —		Cable Type: 16 - 2 - 6C		
From: Turning Unit			To:		
Unit Connector No: TSD			Unit Connector No:		
Cable Connector Type: 159749 BL3.5/15			Cable Connector Type:		
Manufacturer: Weidmuller			Manufacturer: Connector:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	SYNCHRO S1	1	R		
2	SYNCHRO S2	2	B		
3	SYNCHRO S3	3	G		
4	SYNCHRO R1 (Ref)	4	Y		
5	SYNCHRO R2 (Ref Ret)	5	W		
6	SYNCHRO R3	6	BK		
7	SCREEN	ETAG	BRAID		

Cable No:	EMC CAT —		Cable Type: 16 - 2 - 6C		
From: Turning Unit			To:		
Unit Connector No: TSD			Unit Connector No:		
Cable Connector Type: 159749 BL3.5/15			Cable Connector Type:		
Manufacturer: Weidmuller			Manufacturer: Connector:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	RESOLVER S1	1	R		
2	RESOLVER S2	2	B		
3	RESOLVER S3	3	G		
4	RESOLVER R1	4	Y		
5	RESOLVER S4	5	W		
6	RESOLVER R3	6	BK		
7	SCREEN	ETAG	BRAID		

Cable No:	EMC CAT —		Cable Type:*		
From: Turning Unit			To:		
Unit Connector No: TSD			Unit Connector No:		
Cable Connector Type: 159749 BL3.5/15			Cable Connector Type:		
Manufacturer: Weidmuller			Manufacture:		
Line No.	Function	Pin No.	Colour.	Pin No.	Remarks
1	ISOLATED HMKR	7			
2	ISOLATED HMKR RET	8			
3	PULSE BEARING 4096	9			
4	RADAR SILENCE	10			Masthead transceiver only
5	RADAR SILENCE RET	11			
6	HEADING MKR+ (RS422)	12			Twisted Pair
7	HEADING MKR- (RS422)	13			
8	PULSE BEARING+ (RS422)	14			Twisted Pair
9	PULSE BEARING- (RS422)	15			
Unit Connector No: TSK			Unit Connector No:		
Cable Connector Type: 171634 BL5.08/4			Cable Connector Type:		
Manufacturer: Weidmuller			Manufacture:		
Line No.	Function	Pin No.	Colour.	Pin No.	Remarks
10	SPEED SELECT/ MOTOR START	1			X-Band only Function depends on link settings
11	SPEED SELECT RET/ MOTOR START RET	2			
12	SCREEN	E/TAG	Braid		

*Cable gland is designed to fit 8-core cable type 6224C (MA00007419). Any alternative cable should have similar dimensions to 6224C.

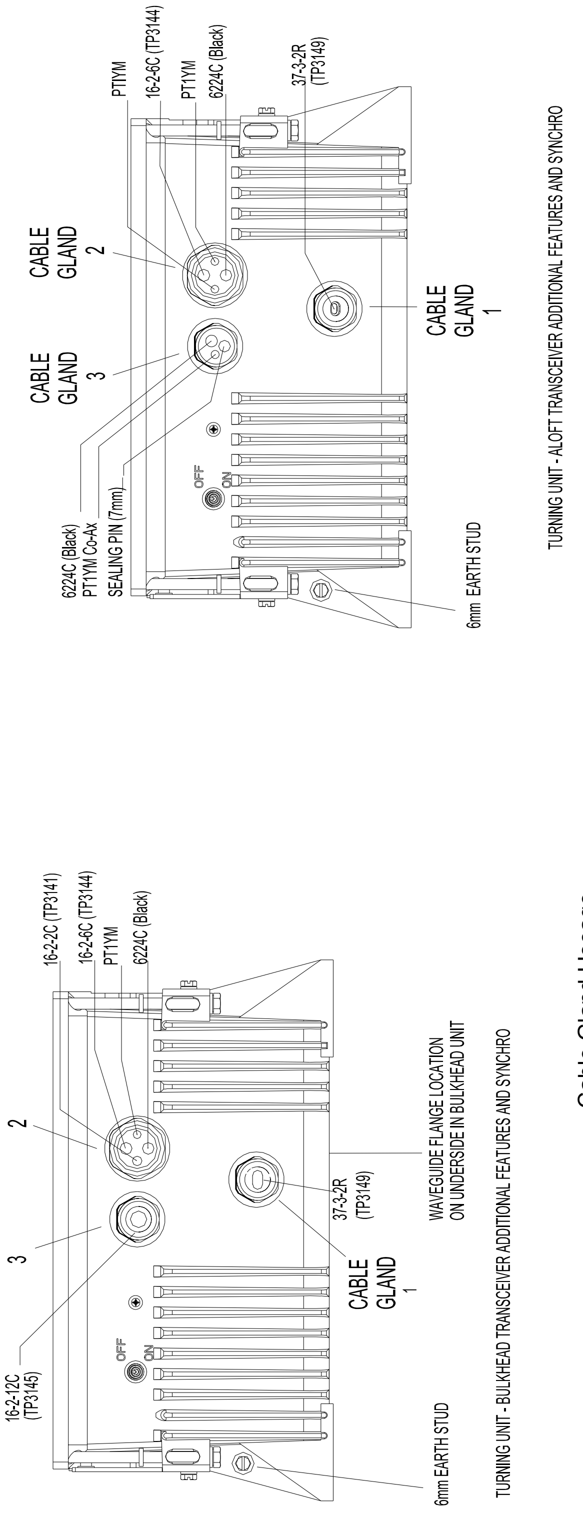
X and S Band Transceiver Connections

Cable No:	EMC CAT —		Cable Type: PT1YM (75ohm coax)		
From Transceiver Unit			To:		
Unit Connector No: SKH			Unit Connector:		
Cable Connector Type: L734PNI			Cable Connector Type:		
Manufacturer; Belling Lee			Manufacturer:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	PRE-TRIGGER O/P	PIN	INNER	PIN	
2	SCREEN	OUTER	BRAID	OUTER	

Cable No:	EMC CAT —		Cable Type: PT1YM (75ohm coax)		
To: Transceiver Unit			From:		
Unit Connector No: SKJ			Unit Connector:		
Cable Connector Type: L734PNI			Cable Connector Type:		
Manufacturer; Belling Lee			Manufacturer:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	EXT-TRIGGER I/P	PIN	INNER	PIN	
2	SCREEN	OUTER	BRAID	OUTER	

Cable No:	EMC CAT —		Cable Type: 16 - 2 - 2C or 6224C		
To: Transceiver Unit			From:		
Unit Connector No: TSD			Unit Connector No:		
Cable Connector Type: 171635 BL5.08/5			Cable Connector Type:		
Manufacturer: Weidmuller			Manufacturer: Connector:		
Line No.	Function	Pin No.	Colour	Pin No.	Remarks
1	RADAR SILENCE	1			If RS422 use twisted pair
2	RADAR SILENCE RET	2			
3	SCREEN	ETAG	BRAID		

NOTE:
This drawing is to be used in conjunction with drawings: 65801050/1, 65801050/2, 65801050/3 contained in Despatch Kit 65801660.
See ship's manual for details of assembling cables into cable glands.



Cable Gland Useage

Cable gland No.	Turning Unit Without Integral Transceiver			Turning Unit With Integral Transceiver		
	Function	Cable Type	Sealing Pin	Function	Cable Type	Sealing Pin
Cable Gland 1	Motor Supply	37-3-2R (TP3149)		Mains Input	37-3-2R	
Cable Gland 2	PM - Trigger	Coaxial (PT1YM)	6mm (MA00009738)	Ext - Trigger	Coaxial (PT1YM)	6mm (MA00009738)
Cable Gland 2	TU Enable	16-2-2C (TP3141)	7mm (MA00009662)	Pre - Trigger	Coaxial (PT1YM)	6mm (MA00009738)
Cable Gland 2	Isolated HMkr, Azimuth, Antenna Speed Select	6224C (Black) (4 twisted pairs)	8mm (MA00012039)	Isolated HMkr, Azimuth Radar Silence, Antenna Speed Select	6224C (Black) (4 twisted pairs)	8mm (MA00012039)
Cable Gland 2	Synchro	16-2-6C (TP3144)	8mm (MA00012039)	Synchro	16-2-6C (TP3144)	8mm (MA00012039)
				DU Data, TX Data, Trigger	6224C (Black) (4 twisted pairs)	
Cable Gland 3	PM Control +/-12V	16-2-12C (TP3145)				
Cable Gland 3				Not Used	16-2-2C (TP3141)	7mm (MA00009662)
Cable Gland 3				Video	Coaxial (PT1YM)	
Seal unused cable entries in the glands with the sealing pins supplied.				Seal unused cable entries in the glands with the sealing pins supplied.		

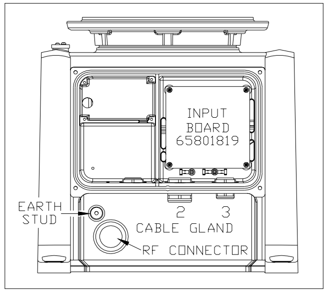
NORTHROP GRUMMAN SPERRY MARINE B.V.		
APP'D LJE DATE 03/02/00	TITLE CABLE INSTALLATION DRAWING FOR TURNING UNIT WITH ADDITIONAL FEATURES	APP LJE
APP'D MW DATE 03/02/00		DATE 16/10/04
DRN. LJE DATE 03/02/00	DRG. No. A3/ 65801050/4-1	REV B

A/CAD FILE:- 65801050sht4.dwg

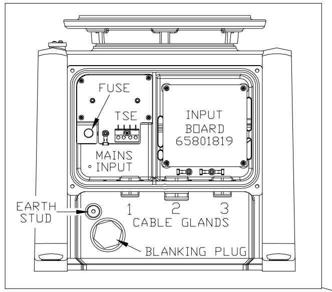
Figure 9.1. X-Band Turning Unit Cable Entry Installation Drawing

3RD ANGLE PROJECTION

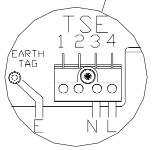
NOTE:
This drawing is to be used in conjunction with drawings:
65830050/1, 65830050/2, 65830050/3, 65830050/4
contained in Despatch Kit 65830660.



TURNING UNIT WITHOUT INTEGRAL TRANSCEIVER



TURNING UNIT WITH INTEGRAL TRANSCEIVER



MAINS INPUT

CONNECT CABLE BRAID TO EARTH TAG

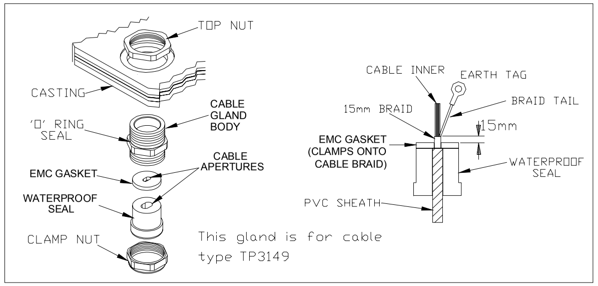


FIG. 1 TYPICAL ASSEMBLY OF CABLE GLAND

Included within the cable gland is a waterproof seal and an EMC gasket. The waterproof seal clamps around the cable outer sheath, and the EMC gasket clamps around the braid. It is important not to force the outer sheath through the EMC gasket as the gasket is liable to split.

TO INSTALL THE CABLES

Unscrew the clamp nut and remove the waterproof seal and the RFI seal. Feed the cable through the gland nut and the waterproof seal. Strip the outer sheath to expose approximatelely 300mm of braid. Push the braid back to expose approximately 50mm of the inner cores.
Trim 50mm off the cores, and pull the braid back over the inner cores and twist into a point.
Feed the cable through the EMC gasket until it is positioned as in Figure 1.

FOR THE MULTICORE CABLES

Flare out the braid to within approximatey 15mm of the EMC gasket, and form into a tail.

FOR THE COAXIAL CABLES

Do not fit the coaxial connector at this time.

ASSEMBLY INTO TURNING UNIT

Feed the assembled cables and seals into the gland body, and tighten the clamp nut until the EMC gasket is compressed.
Crimp the earth tags provided to the braids of the multicore cables and attach them to the earth studs adjacent to the cables. The tails should be as short as is practicable. Trim and make off the cable inners to the appropriate connectors.
Trim the coaxial cables to length and slide the plastic sleeve provided in the despatch kit over the exposed braid. Fit the coaxial connectors.

UNUSED CABLES

Where cables are not fitted, the cable glands are to be sealed with the sealing pins supplied, as detailed in the Cable Gland Useage table.

Cable gland No.	Turning Unit Without Integral Transceiver			Turning Unit With Integral Transceiver		
	Function	Cable Type	Sealing Pin	Function	Cable Type	Sealing Pin
Cable Gland 1				Mains Input	37-3-2R (TP3149)	
Cable Gland 2	PM - Trigger	Coaxial (PT1YM)	6mm (MA00009738)	Ext - Trigger	Coaxial (PT1YM)	6mm (MA00009738)
Cable Gland 2	Not Used	16-2-2C (TP3141)	7mm (MA00009662)	Pre - Trigger	Coaxial (PT1YM)	6mm (MA00009738)
Cable Gland 2	Isolated HMkr, Azimuth,	6224C (Black) (4 twisted pairs)	8mm (MA00012039)	Isolated HMkr, Azimuth Radar Silence	6224C (Black) (4 twisted pairs)	8mm (MA00012039)
Cable Gland 2	Synchro	16-2-6C (TP3144)	8mm (MA00012039)	Synchro	16-2-6C (TP3144)	8mm (MA00012039)
Cable Gland 3	PM Control +/-12V	16-2-12C (TP3145)		DU Data, TX Data, Trigger	6224C (Black) (4 twisted pairs)	
Cable Gland 3				TU Enable	16-2-2C (TP3141)	7mm (MA00009662)
Cable Gland 3				Video	Coaxial (PT1YM)	

Cable Gland Useage

WEIGHT :-
DIMENSIONS IN MILLIMETRES
CENTRE OF GRAVITY POSITION SHOWN THUS

COMPASS SAFE DISTANCES :-
STANDARD :-
STEERING :-

WHEN MOUNTING UNIT, ENSURE ADEQUATE CLEARANCE FOR SERVICE ACCESS.

NORTHROP GRUMMAN SPERRY MARINE B.V.

APP'D LJE	TITLE		APP LJE
DATE 03/02/00	S BAND TURNING UNIT		
APP'D MW	WITH ADDITIONAL FEATURES		DATE 18.10.04
DATE 03/02/00	CABLE INSTALLATION		
DRN. L.J.E	DRG. No.		REV
DATE 21/01/00	A3/	65830 050/6-1	C

A/CAD FILE:- 65830050_6.DWG

Figure 9.2. S-Band Turning Unit Cable Entry Installation Drawing

3.3 Configuring Printed Circuit Boards.

3.3.1 Input PCB Assembly 65801815

(Used in S Band and X Band bulkhead transceiver types 65810F, 65810L, 65825F, 65825L, 65831B)

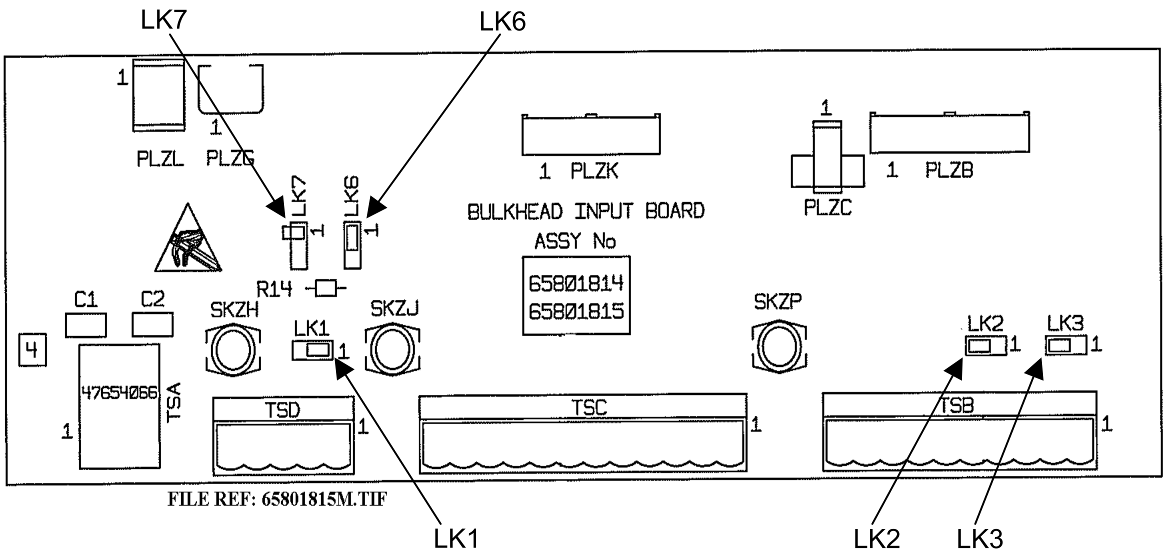


Figure 9.3. Input PCB Assembly 65801815

Default Settings

Unit Type		LK1	LK2	LK3	LK6	LK7
65810F	65825F	1 - 2	2 -3	2 -3	1 - 2	Parked
65810L	65825L	1 - 2	2 -3	2 -3	1 - 2	Parked
65831B		1 - 2	2 -3	2 -3	1 - 2	Parked

LK1, LK6 and LK7 :-Radar Silence

These links allow the radar silence input to be configured for different signal types.

The closing contact option is only available on later units, that have LK6 on the Input PCB, and Trigger PCB type 65801806 fitted in the transceiver.

When LK6 is fitted in position 2 – 3 a 120 ohm terminating resistor is connected across the input. If a termination is not required (e.g. for daisy chained inputs) fit the link in position 1 – 2.

Input Type

RS422

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 2 – 3
LK7 not fitted (park on pin 1)
Transmission is inhibited when the input at TSD1 is positive wrt that at TSD2
To change the sense of operation of the input reverse the connections to TSD1 and 2

RS423

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 1 – 2
LK7 fitted 1 – 2
Connect the input to TSD1
Transmission is inhibited when the voltage at TSD1 is positive.

To change the sense of operation of the input:

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 1 – 2
LK7 fitted 2 – 3
Connect the input to TSD2.
Transmission is inhibited when the voltage at TSD2 is negative.

Closing Contact or No Input (default setting)

Closing contact option not available on early units fitted with Trigger PCB 65801803

LK1 fitted 1 – 2
LK6 fitted 1 – 2
LK7 not fitted (park on pin 1)
Connect input to TSD2
Transmission is inhibited when TSD2 is shorted to 0V. (TSC8)

To change the sense of operation of the input:

LK1 fitted 2 – 3
LK6 fitted 1 – 2
LK7 not fitted (park on pin 1)
Connect input to TSD1
Transmission is enabled when TSD1 is shorted to 0V. (TSC8)

3.3.2 Input PCB Assembly 65801819

(Used in S and X Band Turning Units)

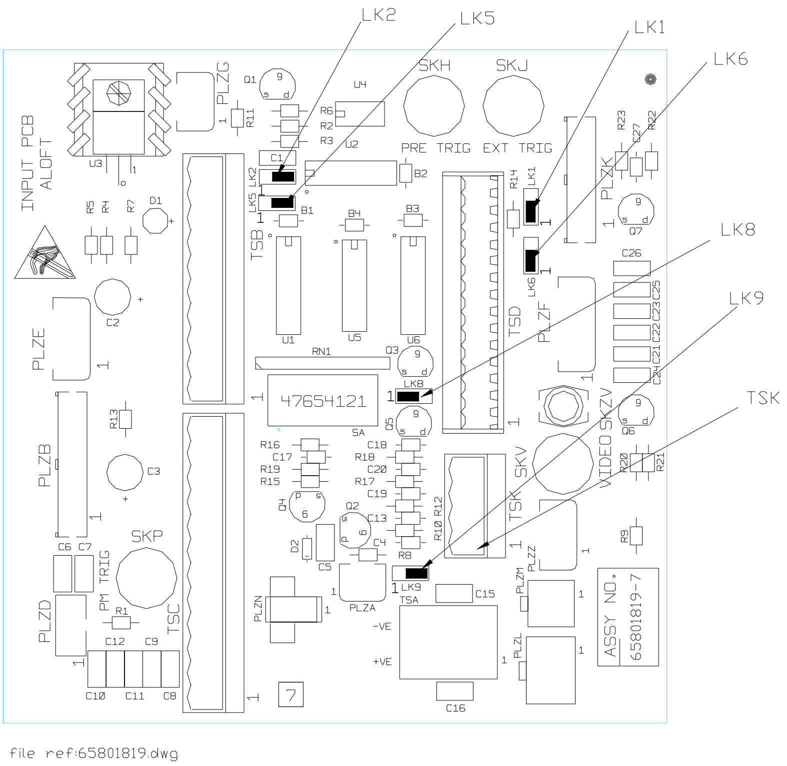


Figure 9.4. **Input PCB Assembly 65801819**

Default Settings

The default setting for Turning Units 65801Cxx, 65825Nxx, 65825Txx, 65810Nxx, 65810Txx is for high speed rotation.

To select normal speed rotation link TSK1 to TSK2.

Unit Type	LK1	LK2	LK5	LK6	LK8	LK9
65801CAx	x	2 - 3	2 - 3	x	1 - 2	2 - 3
65810Nxx	1 - 2	2 - 3	2 - 3	1 - 2	1 - 2	2 - 3
65810Txx	1 - 2	2 - 3	2 - 3	1 - 2	1 - 2	2 - 3
65825NAx	1 - 2	2 - 3	2 - 3	1 - 2	1 - 2	2 - 3
65825TAx	1 - 2	2 - 3	2 - 3	1 - 2	1 - 2	2 - 3
65830Cxx	x	2 - 3	2 - 3	x	1 - 2	parked
65830Nxx	1 - 2	2 - 3	2 - 3	1	1 - 2	parked
65830Txx	1 - 2	2 - 3	2 - 3	1	1 - 2	parked
65825Lxx	x	x	x	x	1 - 2	1 - 2

'x' Don't care for this unit.

*LK6 is not fitted to earlier issue printed boards.

LK8 and LK9 are not fitted to earlier issues of the printed circuit board, units fitted with the earlier issue boards do not have the remote speed selection option.

Remote selection of antenna rotation speed is not available on turning unit type: 65825Lxx, 65830Cxx, 65830Nxx.

LK1, LK6 and LK 8: Radar Silence

(only applicable to Turning Unit Types 65810Nxx, 65810Txx 65825Nxx, 65825Txx, and 65830Nxx, 65830Txx)

These links let the radar silence input be configured for different signal types. The closing contact option is only available on later units, that have LK6 on the Input PCB, and Trigger PCB 65801806 fitted in the transceiver.

When LK6 is fitted in position 2 – 3 a 120ohm terminating-resistor is connected across the input. If a termination is not required (e.g. for daisy-chained inputs) fit the link in position 1 – 2.

Input Type

RS422

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 2 – 3
LK8 fitted 1 – 2
Transmission is inhibited when the input at TSD10 is positive wrt TSD11
To change the sense of operation of the input, reverse the connections to TSD10 and TSD11.

RS423

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 1 – 2
LK8 fitted 1 – 2
Link TSD11 to 0V on TSC8
Connect the input to TSD10
Transmission is inhibited when the voltage at TSD10 is positive.

To change the sense of operation of the input:

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 1 – 2
LK8 fitted 1 – 2
Link TSD10 to 0V on TSC8.
Connect the input to TSD11.
Transmission is inhibited when the voltage at TSD11 is negative.

Closing Contact or No Input (default setting)

No closing contact option available on units with Trigger PCB 65801803

LK1 fitted 1 – 2
LK6 fitted 1 – 2
LK8 fitted 1 – 2
Connect input to TSD11
Transmission is inhibited when TSD11 is shorted to 0V (TSC8)

To change the sense of operation of the input:

LK1 fitted 2 – 3
LK6 fitted 1 – 2
LK8 fitted 1 – 2
Connect input to TSD10
Transmission is enabled when TSD10 is shorted to 0V (TSC8)

LK2: Heading Marker Polarity Selection.

Heading Marker Polarity Normal

LK2 fitted 2 – 3

Defined as valid on falling edge of signal on TSD12 and rising edge of signal on TSD13 or, contact closure between TSD5 and TSD7.

Heading Marker Polarity Inverted

LK2 fitted 1 – 2

Defined as valid on rising edge of signal on TSD12 and falling edge of signal on TSD13 or, contact opening between TSD5 and TSD7.

LK5: Fixed/Adjustable Heading Marker Selection.

This link allows selection between an adjustable heading marker that can be preset to lead or lag the true heading, or a fixed heading marker.

Usually the link will be set to the adjustable heading maker position.

The standard heading marker output (on TSC12) occurs approximately 10° before ship's head. The timing of the isolated heading marker output can be delayed in increments of 0.088° from this, covering an approximate range of ±10° about ship's head. Adjustment is effected by setting DIL switch SA in a binary sequence. Switch 1 sets the least significant bit. When all switches are set to OFF (binary 00000000) the output is set to approximately 10° before ship's head. When all switches are set to ON (binary 11111111) the heading marker is delayed to approximately 10° after ship's head. A binary setting of 10000000 (when only switch 8 is ON) equates approximately to ship's head (0°).

Fixed Heading Marker Position

LK5 fitted 1 – 2
The fixed Heading marker precedes true heading by approximately 10°
The fixed heading marker output is only available in RS422 format.

Adjustable Heading Marker Position

LK5 fitted 2 – 3
Heading marker can be preset to lead the or lag the true heading.

LK9

This link is used to select one of two options. Remote selection of antenna rotation speed, or forced antenna rotation.

The two functions are mutually exclusive.

LK9: Remote Speed Selection LK9

(only applicable to later versions of X-Band Turning Unit types 65801Cxx, 65810Nxx, 65810Txx, 658825Nxx, 65825Txx)

This link has to be set in conjunction with LK1 on the Pulse Bearing PCB (65801826), and LK1 on the Motor Drive PCB (65801827).

When LK9 is set to enable remote selection of antenna rotation speed a short circuit between TSK1 and TSK2 selects normal speed, and an open circuit selects high speed.

Remote Speed Selection Enabled

LK9 fitted 2 – 3

Remote Speed Selection Disabled

LK9 not fitted or parked on pin1 (i.e. not linking two pins)

LK9: Forced Antenna Rotation

(only applicable to Turning Unit Type 65825LAR, 65801Cxx, 65810Nxx, 65810Txx, 65825Nxx, 65825Txx)

This link allows an external switch to override the internal control logic to force the antenna to rotate when it would normally be inhibited, for example when the transceiver is switched to standby.

The function can only be used if the Remotely Selectable Antenna Speed facility is not required.

Forced Rotation Enabled

LK9 fitted 1 – 2

Forced Rotation Disabled

LK9 fitted 2 –3 or parked on pin1(i.e. not linking two pins)

If TSK1 is shorted to TSK2 the antenna will rotate and override the internal control logic.

3.3.3 Input PCB Assembly 65801821

(Used in X Band bulkhead transceiver types 65810B, 65810T, 65825B, 65825T)

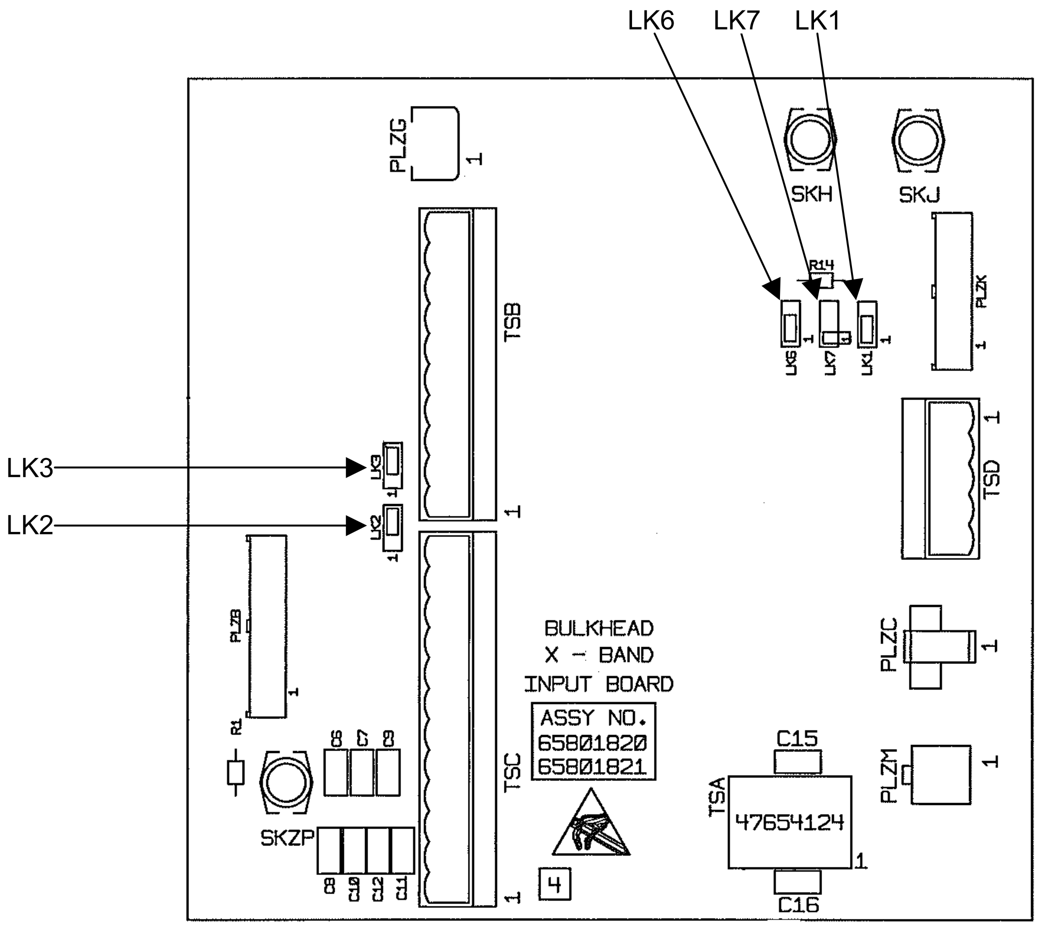


Figure 9.5. Input PCB Assembly 65801821

Default Settings

Unit Type		LK1	LK2	LK3	LK6	LK7
65810B	65825B	1 - 2	2 -3	2 -3	1 - 2	Parked
65810T	65825T	1 - 2	2 -3	2 -3	1 - 2	Parked

LK1, LK6 and LK7: Radar Silence

These links allow the radar silence input to be configured for different signal types.

The closing contact option is only available on later units, that have LK6 on the Input PCB, and Trigger PCB type 65801806 fitted in the transceiver.

When LK6 is fitted in position 2 – 3 a 120 ohm terminating resistor is connected across the input. If a termination is not required (e.g. for daisy chained inputs) fit the link in position 1 – 2.

Input Type

RS422

LK1 not fitted or parked on pin 1 (i.e. not linking two pins.)
LK6 fitted 2 – 3
LK7 not fitted (park on pin 1)
Transmission is inhibited when the input at TSD1 is positive wrt that at TSD2
To change the sense of operation of the input reverse the connections to TSD1 and 2

RS423

LK1 fitted 2 – 3
LK6 fitted 1 – 2
LK7 fitted 1 – 2
Connect the input to TSD1
Transmission is inhibited when the voltage at TSD1 is positive.

To change the sense of operation of the input:

LK1 fitted 1 – 2
LK6 fitted 1 – 2
LK7 fitted 2 – 3
Connect the input to TSD2.
Transmission is inhibited when the voltage at TSD2 is negative.

Closing Contact or No Input (default setting)

Closing contact option not available on units fitted

LK1 fitted 1 – 2
LK6 fitted 1 – 2
LK7 not fitted (park on pin 1)
Connect input to TSD2
Transmission is inhibited when TSD2 is shorted to 0V. (TSC8)

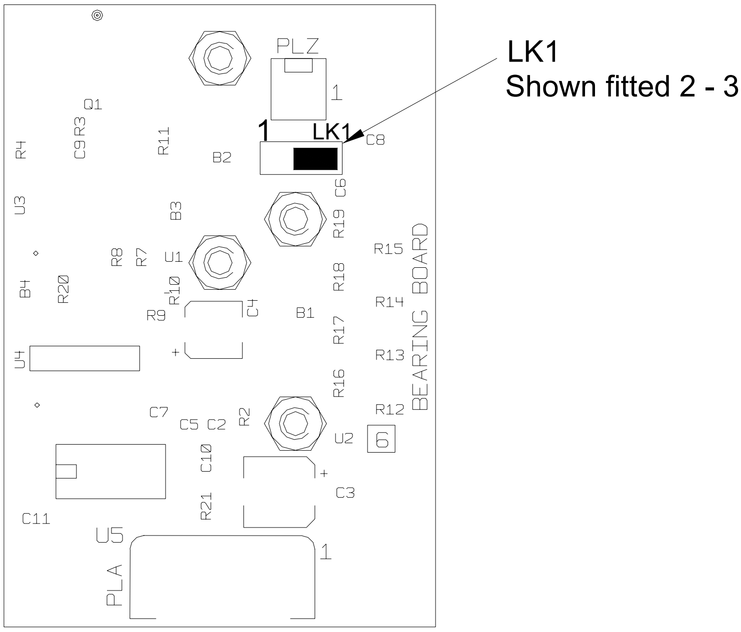
To change the sense of operation of the input:

LK1 fitted 2 – 3
LK6 fitted 1 – 2
LK7 not fitted (park on pin 1)
Connect input to TSD1
Transmission is enabled when TSD1 is shorted to 0V. (TSC8)

3.3.4 Pulse Bearing PCB Assembly 65801826

(fitted to later versions of X-Band Turning Unit types 65801Cxx, 65810Nxx, 65810Txx, 658825Nxx, 65825Txx)

Earlier units were fitted with standard Pulse Bearing PCB Assembly 65801805.



file ref: 65801805.dwg

Figure 9.6. Pulse Bearing PCB Assembly 65801826

LK1: Speed Select

Normal Speed Selected

LK1 fitted 1 – 2

High Speed Selected

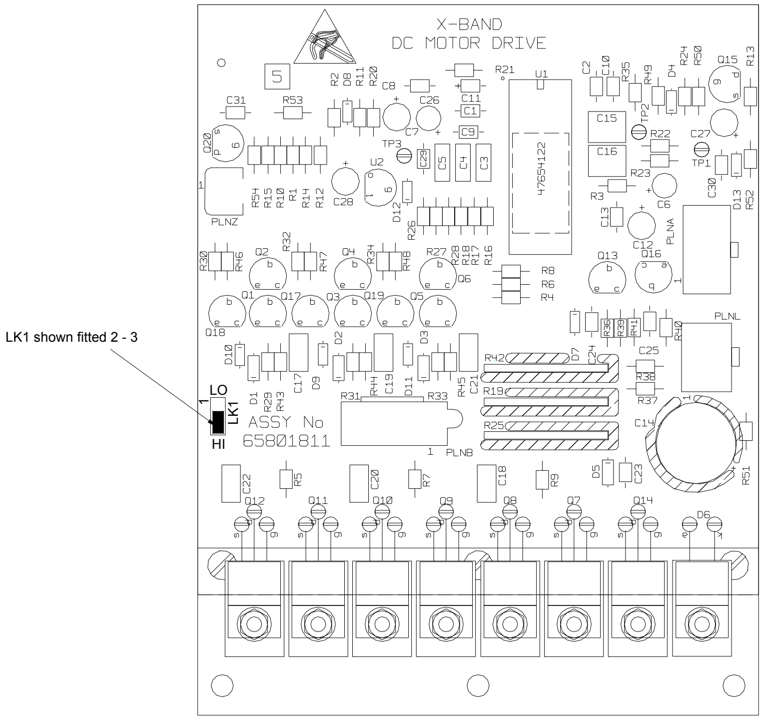
LK1 not fitted or parked on pin1 (i.e. not linking two pins)

Selectable Speed Selected

LK1 fitted 2 – 3

3.3.5 Motor Drive Board 65801827

(fitted to later versions of X-Band Turning Unit types 65801Cxx, 65810Nxx, 65810Txx, 658825Nxx, 65825Txx)
Earlier units were fitted with standard Motor Drive PCB Assembly 65801811



file ref:65801811.dwg

Figure 9.7. Motor Drive PCB Assembly 65801827

LK1: Speed Select

Normal Speed Selected

LK1 fitted 1 – 2

High Speed Selected

LK1 not fitted or parked on pin1 (i.e. not linking two pins)

Selectable Speed Selected

LK1 fitted 2 – 3

4 Spares List for Field Replacement Modules

Standard PCBs are replaced by Additional Features variants in systems with additional features. The following list shows the boards that are different in the Additional Features systems. During the life of the equipment there has been some rationalisation and modifications to some of the PCB's. As a general rule the PCB's fitted to later units can used as replacements for those used in earlier units.

Input PCB T65801819 can be used to replace **Input PCB** T65801804

Pulse Bearing PCB T65801826 can be used to replace **Pulse Bearing PCB** T65801805

Motor Drive PCB T65801827 can be used to replace **Motor Drive PCB** T65801811

Trigger PCB T65801806 can be used to replace **Trigger PCB** T65801803, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between input terminals on the tagstrip.

4.1 X-Band Turning Unit (Masthead Transceiver)

Description	Spare Part Number		
Turning Unit Type	**65810Nxx, 65825Nxx,	**65810Txx, 65825Txx	65825Lxx
Trigger Board*	T65801803 or T65801806	T65801825	T65801801
Input Board	T65801819	T65801819	T65801819
Pulse Bearing PC	T65801826	T65801826	T65801805
Motor Drive PCB	T65801827	T65801827	T65801811

*T65801806 can be used to replace T65801803 fitted to earlier units, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between TSD10 and TSD11

** Early units do not have selectable speed option so standard Pulse Bearing and Motor DrivePCB's are fitted

4.2 S-Band Turning Unit (Masthead Transceiver)

Description	Spare Part Number
Trigger Board*	T65801803 or T65801806
Input Board	T65801819

* T65801806 can be used to replace T65801803, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between TSD1 and TSD2.

4.3 X-Band Turning Unit (for use with Bulkhead Transceiver)

Description	Spare Part Number
Input PCB	T65801819
Pulse Bearing PCB	T65801826
Motor Drive PCB	T65801827

4.4 S-Band Turning Unit (for use with Bulkhead Transceiver)

Description	Spare Part Number
Input Board	T65801819

4.5 X-Band Bulkhead Transceiver Units Type 65810F, 65810L, 65825F, 65825L

Description	Spare Part Number	
Transceiver Type	65810F, 65825F	65810L, 65825L
Trigger Board*	T65801803 or T65801806	T65801825
Input Board	T65801815	T65801815

* T65801806 can be used to replace T65801803, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between TSD1 and TSD2.

4.6 X-Band Bulkhead Transceiver Units Type 65810B, 65810T, 65825B, 65825T

Description	Spare Part Number	
Transceiver Type	65810B, 65825B	65810T, 65825T
Trigger Board*	T65801803 or T65801806	T65801825
Input Board	T65801821	T65801821

* T65801806 can be used to replace T65801803, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between TSD1 and TSD2.

4.7 S-Band Bulkhead Transceiver Units 65831B

Description	Spare Part Num
Trigger Board*	T65801803, T65801806
Input Board	T65801815

* T65801806 can be used to replace T65801803, but if the radar silence input is being used with the RS422 format it will be necessary to connect a 120ohm resistor between TSD1 and TSD2.

5 Circuit Diagrams.

This sections includes circuit diagrams for the Input PCB's, for the main unit schematic diagrams see Chapter 6.

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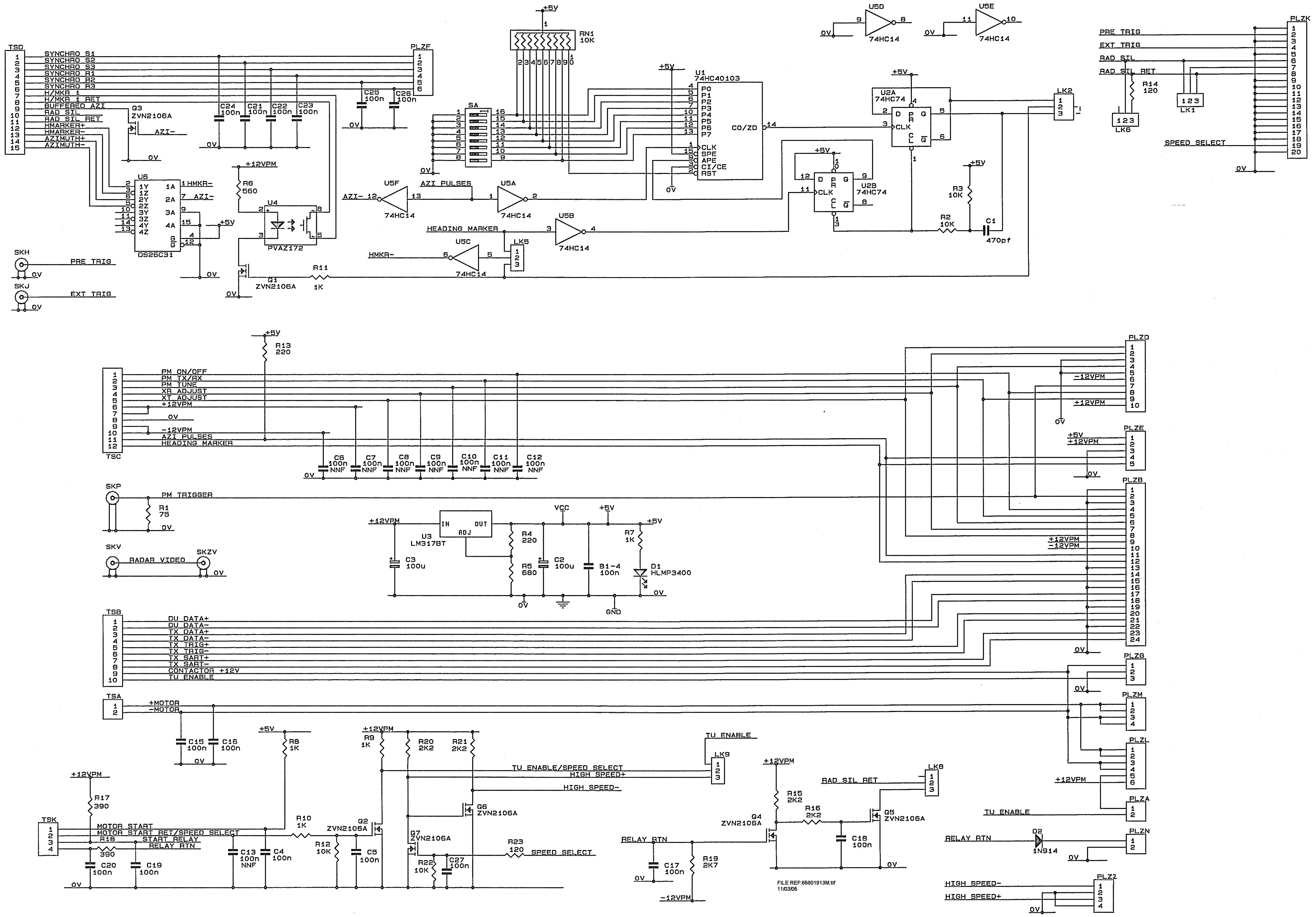

Figure 9.8. Circuit Diagram Input PCB 65801819

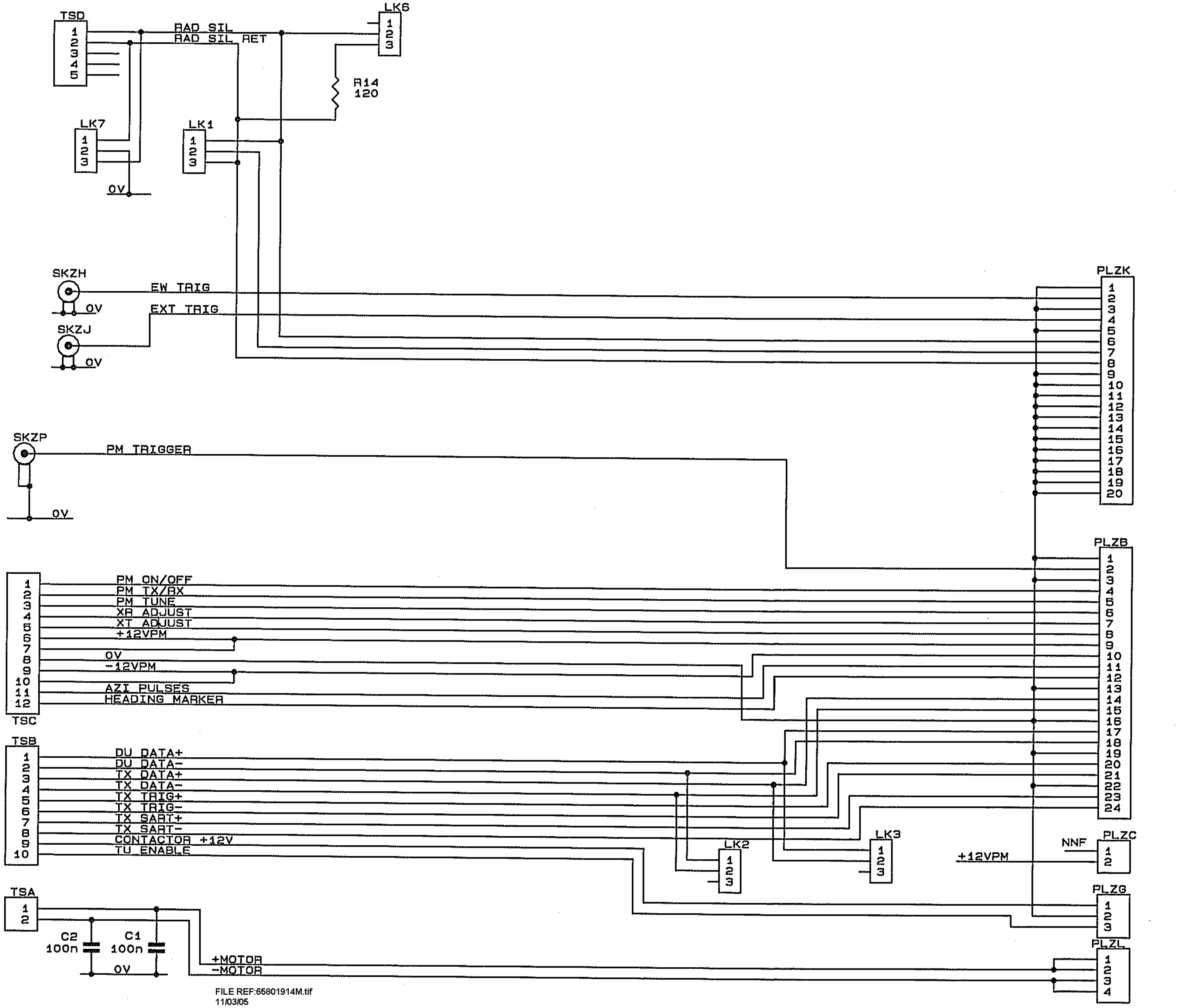

Figure 9.9. **Circuit Diagram Input PCB 65801815**

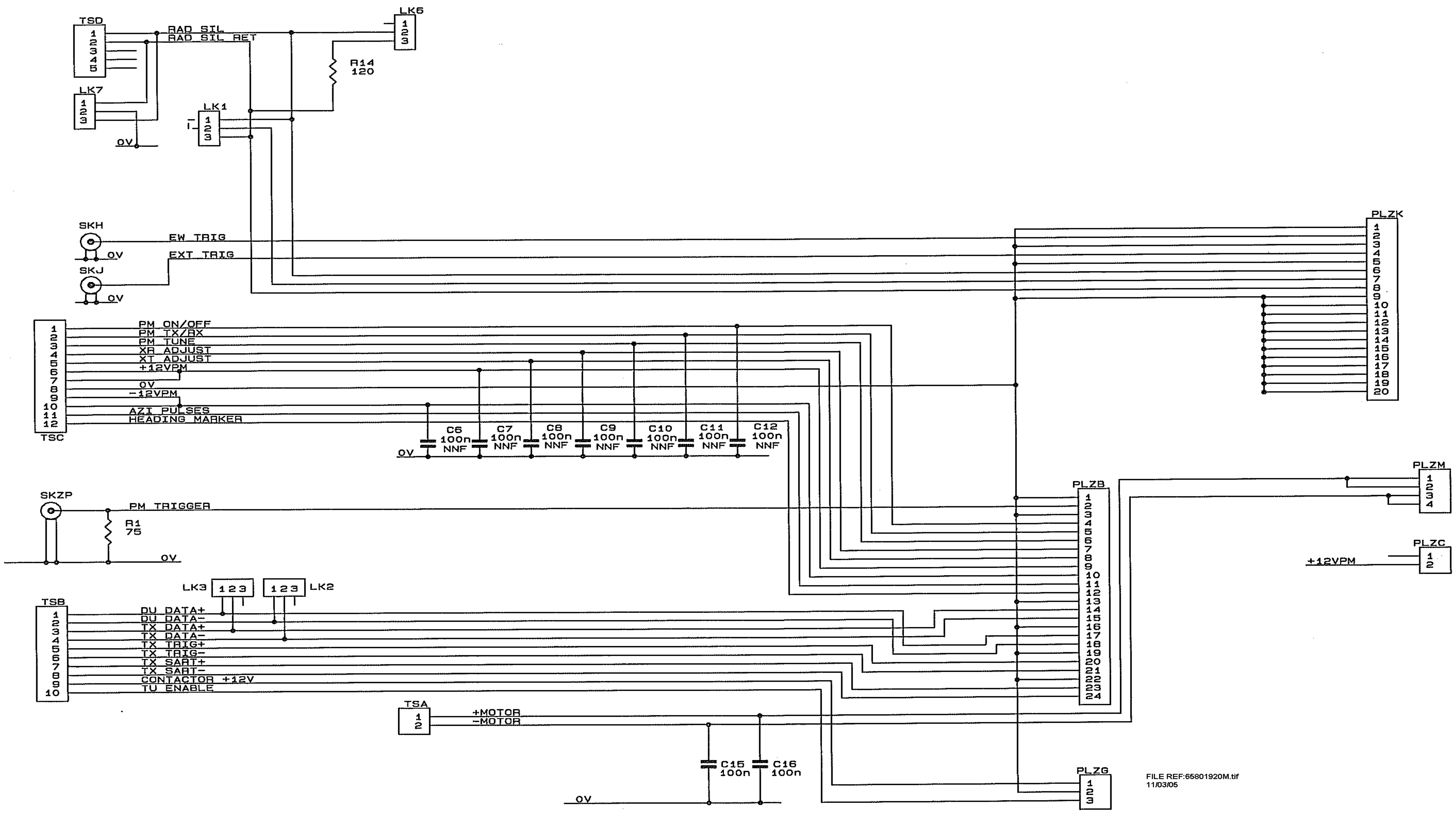

Figure 9.10. Circuit Diagram Input PCB 65801821