Sperry Marine

NORTHROP GRUMMAN

VISIONMASTER FT®

Ship's Manual
Volume 1

(Installation, Servicing & Maintenance)

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PREAMBLE

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Warnings and Cautions

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. SOME CAPACITORS TAKE SEVERAL MINUTES TO DISCHARGE THEIR STORED VOLTAGES AFTER THE EQUIPMENT IS SWITCHED 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 YOU NEED TO WORK ON THE SCANNER UNIT, MAKE SURE THE 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.

WARNING! – X-RAY RADIATION

X - RAYS MAY BE PRODUCED BY HIGH VOLTAGE EQUIPMENT SUCH AS MAGNETRONS IN RADAR TRANSMITTERS. TESTS HAVE SHOWN THAT LEVELS OF IONISING RADIATION (X-RAYS) EMITTED FROM NGSM S AND X BAND RADARS ARE NO HIGHER THAN NORMAL BACKGROUND LEVELS.

OBSERVE ALL WARNING SIGNS ON EQUIPMENT AND IN SUPPLIED DOCUMENTATION.

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 $100W/m^2$ ($10mW/cm^2$).

.

Table 1: Hazard Zones

Antenna Length	100 W/m^2	50 W/m^2	10 W/m^2
1.2m X-band	1.7m	8.5 m	17m
1.8m X-band	1.05m	5.25 m	10.5m
2.4m X-band	0.75m	3.75 m	7.5m
2.7m S-band	0.73m	3.65 m	7.3m
3.7m S-band	0.55m	2.75 m	5.5m

CAUTION! – ELECTROSTATIC SENSITIVE DEVICES (ESSDS)

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

CAUTION! – ANTI-VIRUS PROTECTION

Before connecting an external device such as a USB memory stick, or external media such as a CD or DVD to the VisionMaster PC it is important that the external device/media should first be scanned with a recognised virus and malware scanning program that includes up-to-date virus definitions. Also, the external device/media should be reserved for use with VisionMaster PCs, with use on other computers kept to an absolute minimum.

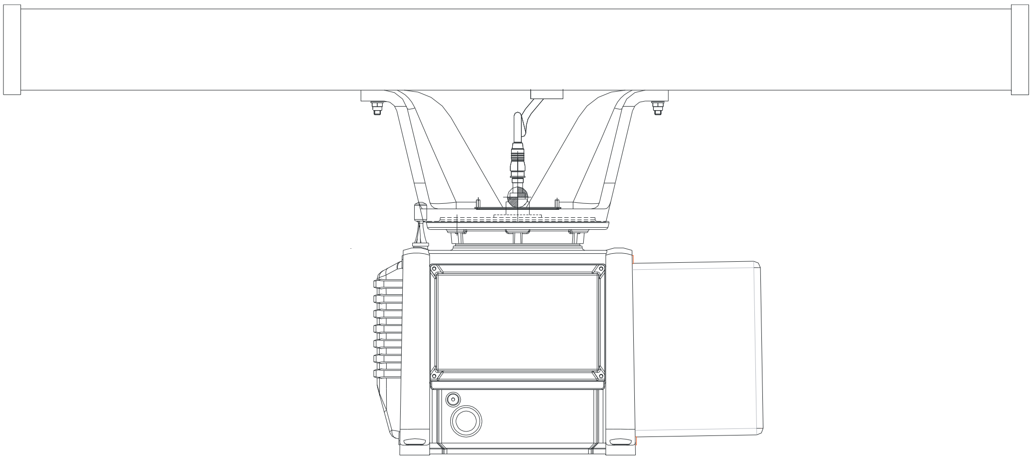
Care should be taken to ensure that any PCs (e.g. laptops) that have been previously connected to other networks are subject to the same checks as external media prior to being connected to the network on which VisionMaster PCs are connected.

Revision Record

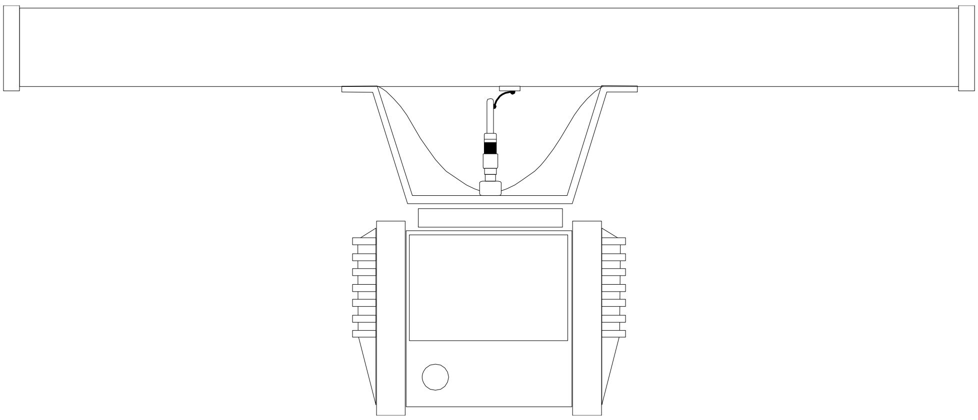
Table 2: Revision Record

Revision No	Issue Date	Date Incorporated	Incorporated By
Issue 1	November 2006		
Issue 2	December 2006		
Issue 3	April 2008		
Issue 4	July 2008		
Issue 5	October 2008		
Issue 6	June 2009		
Issue 7	September 2009		
Issue 8	November 2010		
Issue 9	June 2011		
Issue 10	March 2012		
Issue 11	February 2013		

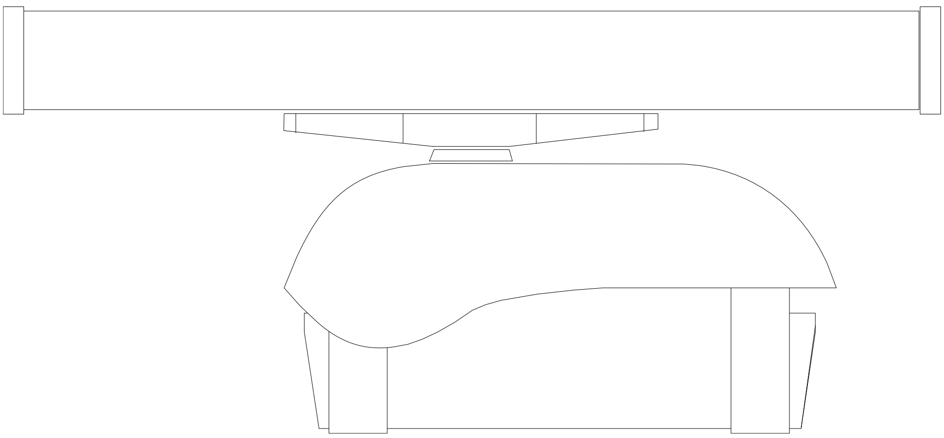
Modules and Assemblies



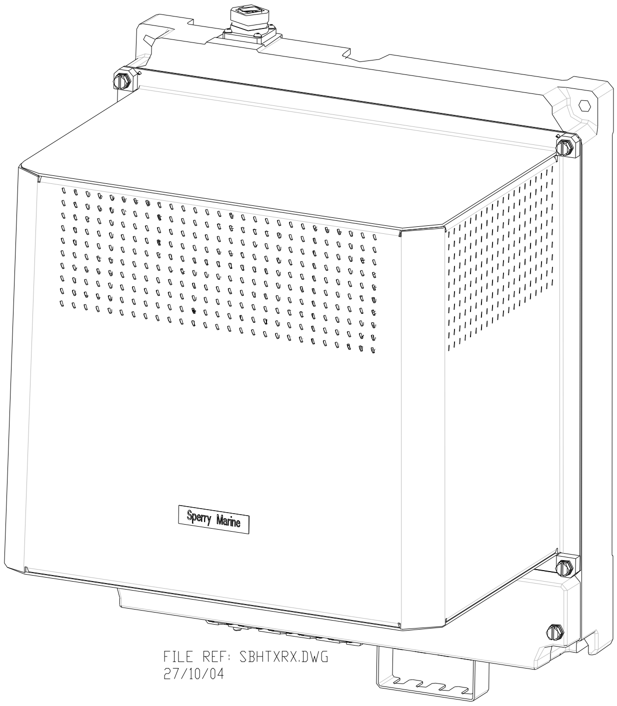
VisionMaster - S-band Scanner Unit (with integral Transceiver)



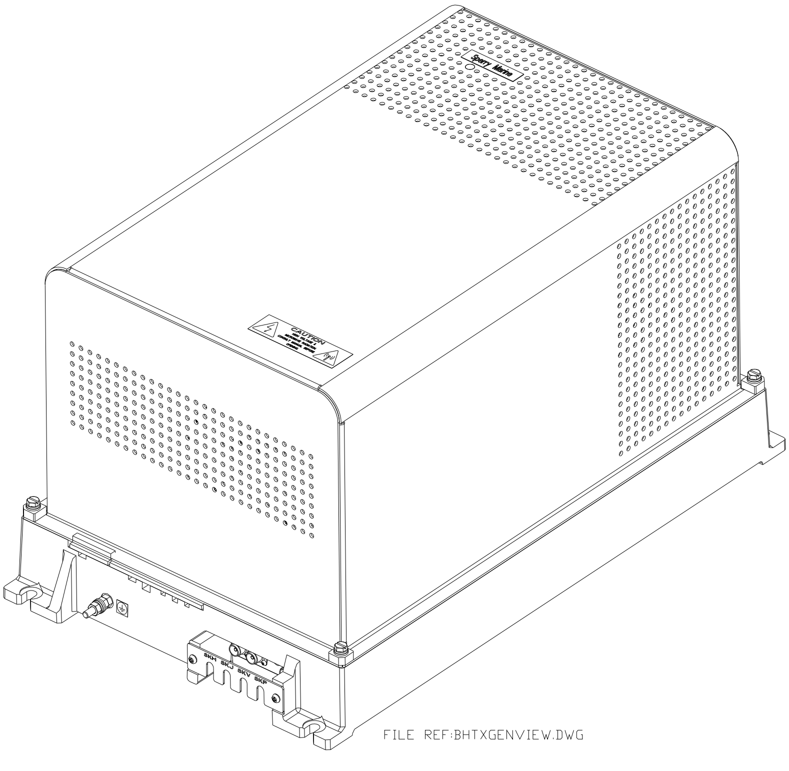
VisionMaster - S-band Scanner Unit (for use with bulkhead Transceiver)



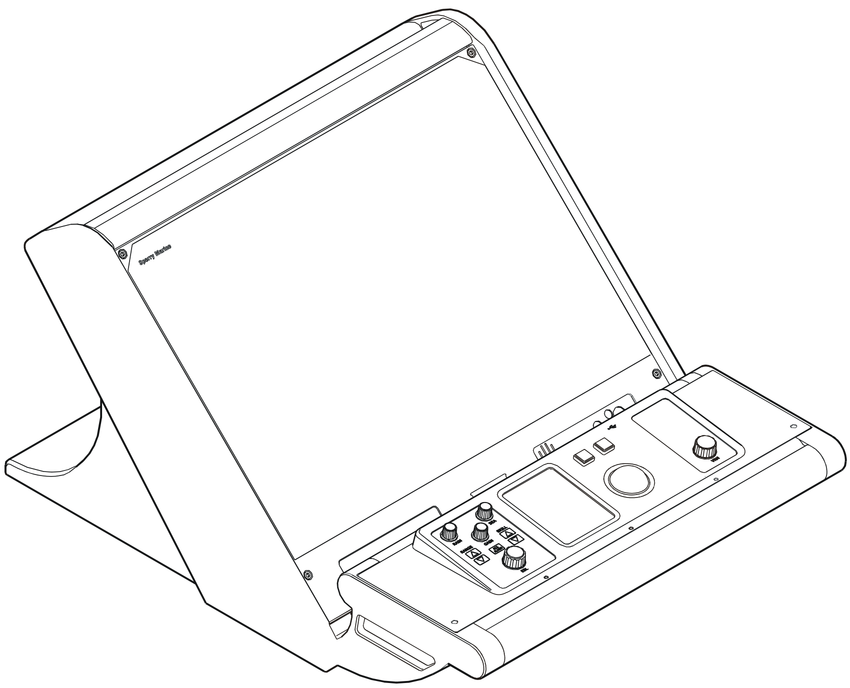
VisionMaster - X-band Scanner Unit (with integral or bulkhead Transceiver)



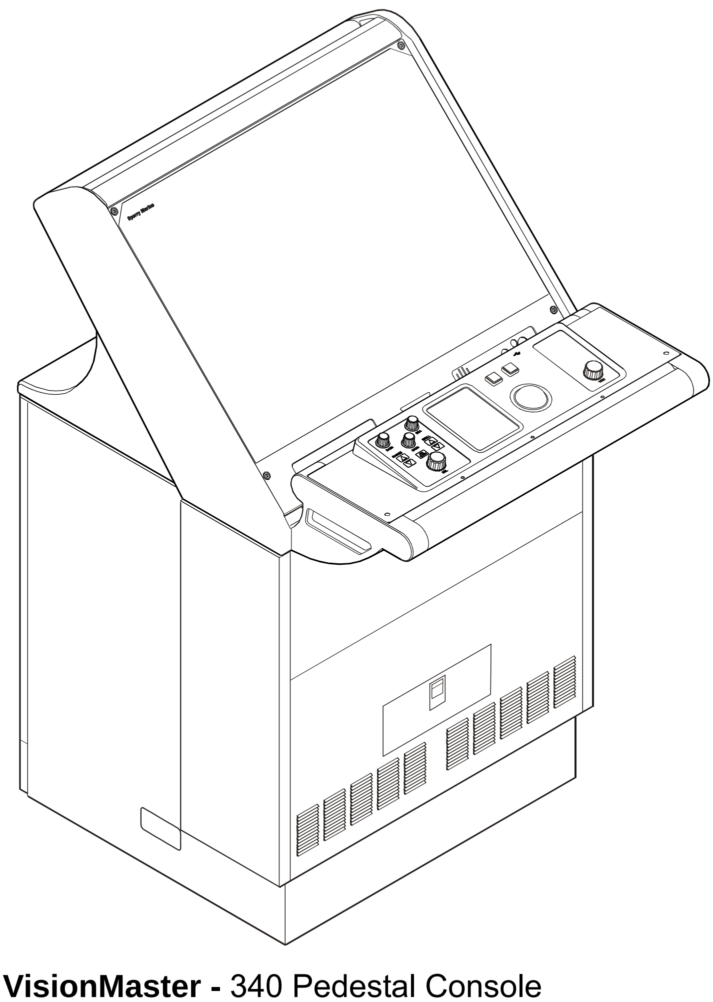
VisionMaster - S-Band Bulkhead Transceiver



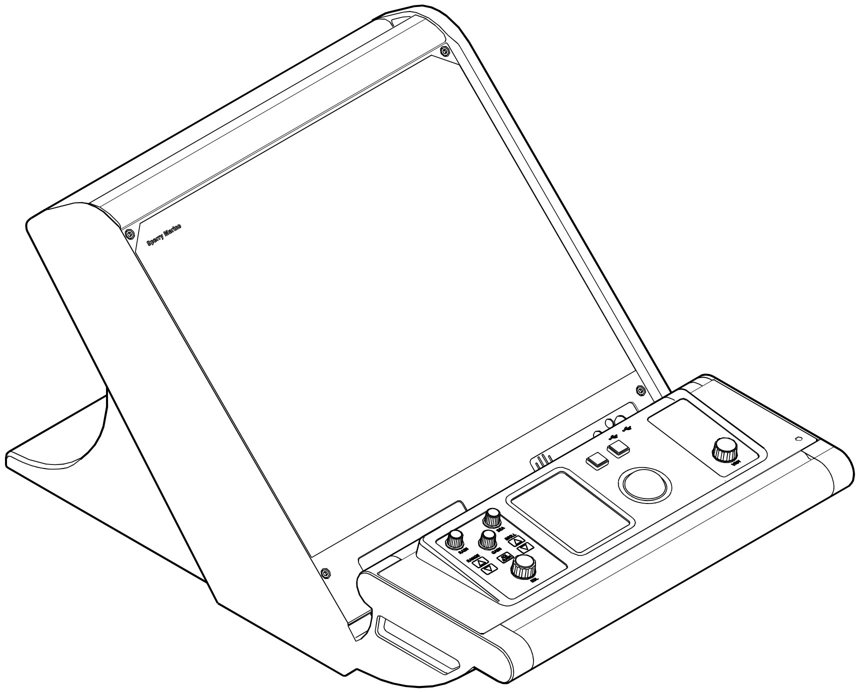
VisionMaster - X-Band Bulkhead Transceiver



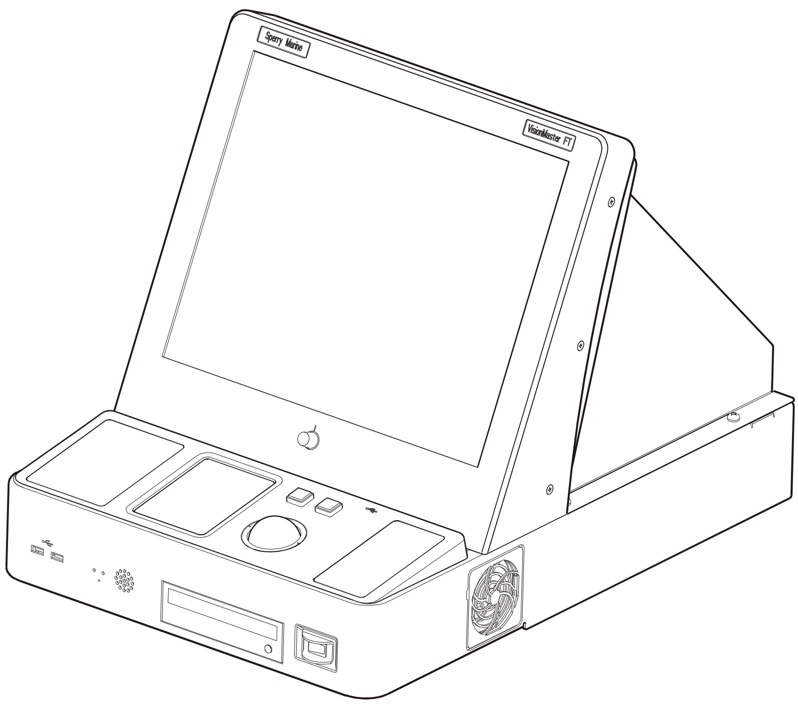
VisionMaster - 340 Table Mounted Console



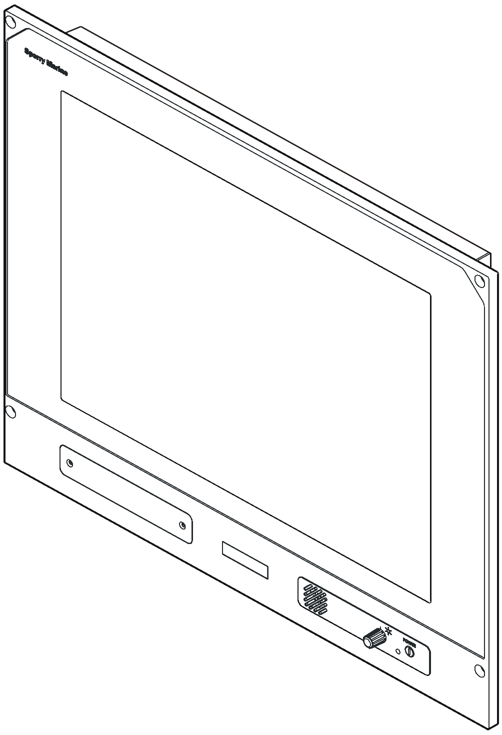
VisionMaster - 340 Pedestal Console



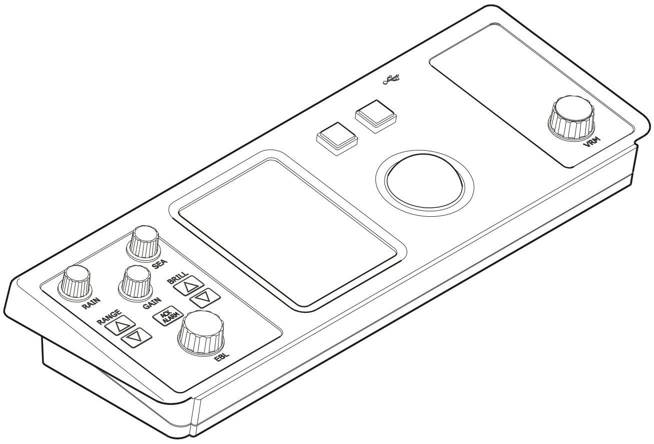
VisionMaster - 250 Table Mounted Console



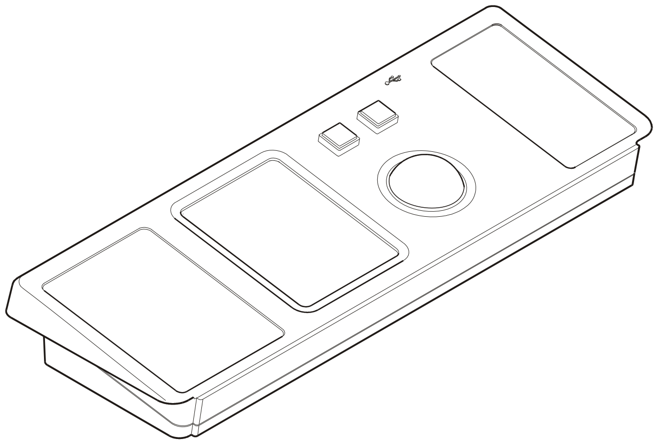
VisionMaster - 19" Integrated Tabletop Display



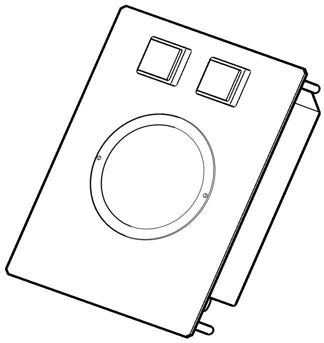
Flat Panel Monitor



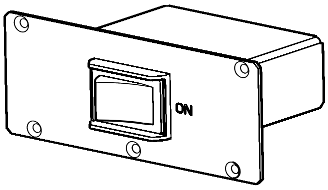
Control Panel



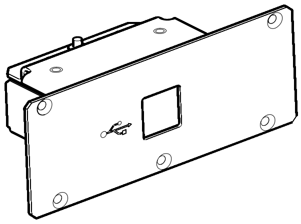
Basic Control Panel



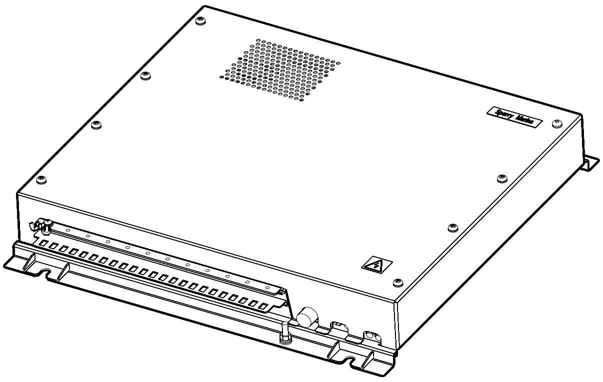
Trackball



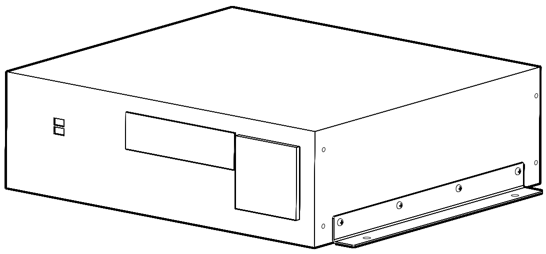
On/Off Switch



USB Connector



PCI/O Unit



Processor Unit

Preface

HOW TO USE THIS MANUAL

The VisionMaster Ship's Manual is divided into two volumes.

Volume 1 (this manual) is intended for use by installation and service engineers.

Volume 2 includes service functions, including configuration and commissioning, carried out at the VisionMaster display.

The structure and design of the manual should help you to quickly find the information that you need. Consistent presentation techniques are used throughout the manual.

Volume 1 is divided into the following chapters:

- **Chapter 1 - Technical Specification**. Includes a full specification of the VisionMaster FT Series, both operational and technical.
- **Chapter 2 - System Identification**. Details the system's identity labels and unit type numbers.
- **Chapter 3 - Installing Top Units**. Includes descriptions on siting, cabling, installing X-band and S-band Scanner assemblies and system component interconnections.
- **Chapter 4 - Installing Consoles & Displays**. Includes descriptions of installing all tabletop and console variants, and inter-unit cabling information. The following appendices are included in this chapter:
    - Appendix A details the ECDIS display calibration procedure.
    - Appendix B describes the installation of a PCI Serial Card.
- **Chapter 5 - Fault Reporting and First Line Servicing**. Describes the procedures for fault identification and details all first line servicing permitted.
- **Chapter 6 - Routine Maintenance**. Describes the procedures for routine maintenance.
- **Chapter 7 - Interswitch Units**. Describes 2-way and 6-way Interswitch units.
- **Chapter 8 - Additional Features**. Details the special options for transceivers and turning units, covering the specification, installation, commissioning and servicing.

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.

Copyright Permission

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The author thanks the International Electrotechnical Commission (IEC) for permission to reproduce information from its International Standard IEC 62388 ed.1.0 (2007).All such extracts are copyright of IEC, Geneva, Switzerland. All rights reserved. Further information on the IEC is available from www.iec.ch. IEC has no responsibility for the placement and context in which the extracts and contents are reproduced by the author, nor is IEC in any way responsible for the other content or accuracy therein.

Related Documents

Other publications in the VisionMaster FT series are listed in Table 3 below:

Table 3: Related Documents

Document Title	Document Number
VisionMaster Ship's Manual - Volume 2	65900011V2
ECDIS Bridge Card	65900008
Radar/Chart Radar Bridge Card	65900009
Radar/Chart Radar User's Guide	65900010
ECDIS User's Guide	65900012
Supplementary Features User Guide	65900014

Chapter 1

Technical Specification

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1 Radar System Performance

Table 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)	2.5° with 4 ft antenna (X-Band). 1.7° with 6 ft antenna (X-Band). 1.3° with 8 ft antenna (X-Band). 4.0° with 9 ft antenna (S-Band). 2.4° 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.
Radar System Bearing Accuracy	Better than ± 1º

1.1 Radar Performance in Defined Climatic and Sea Conditions

The maximum distance in service may differ from the values calculated below, depending on climatic and sea conditions, efficiency of the radar and the target's reflecting ability. The following tables are provided to illustrate that the detectable distances and the sea clutter extent increase when the height of the antenna is increased.

The pulse width used to define the following data is the one best suited for the relevant conditions, this is typically Long Pulse (LP), unless otherwise stated.

1.1.1 Masthead Installation (Transceiver up-mast)

Table 2: X band radar performance in clear conditions (no rain, sea state1)

Parameters		Radar Height above the sea level (metres)			
		10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	4.3	5.1	6.9	8.5
	SOLAS vessel greater than 500GT	7.6	8.7	11.3	13.9
Sea clutter maximum extent (n.miles)		0.6	0.7	1.1	1.4

Table 3: X band radar performance in sea state 5 (no rain)

Parameters		Radar Height above the sea level (metres) 10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	4.2	5.0	1.3*	0.5*
	SOLAS vessel greater than 500GT	7.6	8.7	11.3	13.9
Sea clutter maximum extent (n.miles)		4.0	5.0	3.3*	3.6*

* Short Pulse

Table 4: S band radar performance in clear conditions (no rain, sea state1)

Parameters		Radar Height above the sea level (metres) 10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	3.1	3.7	5.1	6.5
	SOLAS vessel greater than 500GT	7.6	8.6	11.1	13.6
Sea clutter maximum extent (n.miles)		0.4	0.6	0.8	1.1

Table 5: S band radar performance in sea state 5 (no rain)

Parameters		Radar Height above the sea level (metres) 10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	2.9	3.3	4.0 †	4.4*
	SOLAS vessel greater than 500GT	7.6	8.6	11.1	13.6
Sea clutter maximum extent (n.miles)		3.0	3.8	4.2 †	3.9*

* Short Pulse
† Medium Pulse

1.1.2 **Bulkhead Installation** (Transceiver down-mast)

The following values are based on a 20 metre length waveguide cable for X band radar and a 20 metre length coax cable for S band radar.

Table 6: X band radar performance in clear conditions (no rain, sea state1)

Parameters		Radar Height above the sea level (metres)			
		10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	4.0	4.7	6.2	4.1
	SOLAS vessel greater than 500GT	7.1	8.2	10.7	13.3
Sea clutter maximum extent (n.miles)		0.5	0.6	0.9	1.3

Table 7: X band radar performance in sea state 5 (no rain)

Parameters		Radar Height above the sea level (metres)			
		10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	3.8	4.4	0.9*	0.5*
	SOLAS vessel greater than 500GT	7.1	8.2	10.7	13.3
Sea clutter maximum extent (n.miles)		3.7	4.5	2.5*	2.7*

* Short Pulse

Table 8: S band radar performance in clear conditions (no rain, sea state1)

Parameters		Radar Height above the sea level (metres)			
		10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	2.7	3.3	4.6	5.8
	SOLAS vessel greater than 500GT	7.0	8.0	10.3	12.7
Sea clutter maximum extent (n.miles)		0.4	0.5	0.7	1.0

Table 9: S band radar performance in sea state 5 (no rain)

Parameters		Radar Height above the sea level (metres) 10	15	30	50
Maximum range of detection (n.miles)	Navigation Buoy without radar reflector	2.6	3.0	3.5†	3.6*
	SOLAS vessel greater than 500GT	7.0	8.0	10.3	12.8
Sea clutter maximum extent (n.miles)		2.7	3.5	3.7†	3.2*

* Short Pulse
† Medium Pulse

1.1.3 Effect of Transmission-line Length

Values based on Radar at 30 metres above sea level.

Table 10: X band radar performance in clear conditions (no rain, sea state1)

Waveguide length (metres)	Range of 1st detection (n.miles) SOLAS vessel greater than 500GT	Navigation Buoy without radar reflector
30	10.4	5.9
20	10.7	6.2
10	11.0	6.6

Table 11: S band radar performance in clear conditions (no rain, sea state1)

Waveguide length (metres)	Range of 1st detection (n.miles) SOLAS vessel greater than 500GT	Navigation Buoy without radar reflector
30	10.0	4.3
20	10.3	4.6
10	10.7	4.9

1.2 Degradation of Radar Performance in Clutter Conditions

1.2.1 Rain Clutter

Rain clutter creates a high return of noise-like reflections that effectively decreases the signal-to-noise levels within the radar receiver. In addition, it creates an attenuation of the radar signal, which also decreases the signal-to-noise levels. Both these effects reduce the target detection capability of a radar system.

1.2.2 Sea Clutter

The presence of sea clutter degrades the detection performance of radar. Three main effects cause this degradation:

a) Large waves which can obscure targets.

b) Waves reflecting radar energy that compete with the reflection from the target. This increases the noise levels that the target is embedded within.

c) Waves which can exist over several scans and during this time exhibit a target-like behaviour. This causes sea 'spikes' that can obscure or be confused with real targets. Appropriate anti-clutter processing can sometimes reduce this effect, but not consistently.

At longer distances, typically over a mile or two (depending for example on antenna height), the effect of b) above is greatly lessened. At shorter distances, this effect becomes very marked, anti-clutter processing should be used in order to improve the detection performance of the radar caused by this effect.

Signal processing, for example scan-to-scan correlation can reduce the effects of c).

1.2.3 Sea State, Wind and Wave Height

Sea Clutter is generally defined in terms of a sea state. Establishing the sea state is important for assessing the visibility of radar targets in sea clutter. Sea state is a term used as a measure of wave height and can be defined by the Douglas scale, the Hydrographic Office scale and the Beaufort scale, which is a wind speed scale. Guidance for the sea state and wind speed is provided in the following Douglas Sea State Parameter table.

The sea state describes the roughness of the sea, but is not a full indication of the strength of sea clutter. Wind speed is often a better indication of sea clutter, though this does depend on the duration (time blowing over sea) and the fetch (the maximum length of open water over which wind can blow). When wind begins to blow, the sea requires a finite time to reach a condition known as a fully developed sea.

Sea states in the table below are approximately equated to wind speeds. Sea swell will make accurate assessment of wave observations very difficult and the table is only applicable to waves formed by local wind conditions.

Cross winds relative to the line of sight to the target produce less clutter than head winds and in terms of clutter returns, this represents approximately half a numerical sea state less clutter signal return than detecting a target in head wind.

Table 12: Douglas Sea State Parameters.

Douglass sea state	Mean wind speed (kn)	Significant wave height (m)	Sea state description
0	<4	<0,2	Flat, very calm
1	5-7	0,6	Smooth
2	7-11	0,9	Slight
3	12-16	1,2	Moderate
4	17-19	2,0	Rough
5	20-25	3,0	Very rough
6	26-33	4,0	High

Note 1: *This table only applies to waves formed by local wind. Significant wave height is defined as the crest to trough height of the highest 1/3 waves. Individual waves and/or swell can combine to significantly increase the wave height and may result in obscuration of the target.*

Note 2: *The table values are approximate due to the subjective nature of the sea state assessment. Sea swell will make assessment of wave height very difficult.*

1.2.4 Range of First Detection

The following tables show estimated ranges of first detection in various weather conditions. These figures are provided as an approximate guide; there are many other factors that can influence detection range.

For moving targets, the video build up process will be most effective when the range scale is increased, and with longer pulse lengths.

All small vessel radar reflectors are to meet IMO performance standards.

Table 13: X band radar performance in sea state 2

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in sea state 2 (NM)
Shorelines rising to 60m	20.0	20.0
Shorelines rising to 6m	8.7	8.7
Shorelines rising to 3m	6.9	6.9
SOLAS ships (>5000 gross tonnage)	11.7	11.7
SOLAS ships (>500 gross tonnage)	8.2	8.2
Small vessel with radar reflector	5.1	5.1
Navigation buoy with corner reflector	5.0	5.0
Typical Navigation buoy	4.7	4.7
Small vessel of length 10 m with no radar reflector	3.6	3.6
Channel markers	2.4	2.4

Table 14: X band radar performance in sea state 5

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in sea state 5 (NM)
Shorelines rising to 60m	20.0	20.0
Shorelines rising to 6m	8.7	8.7
Shorelines rising to 3m	6.9	6.9
SOLAS ships (>5000 gross tonnage)	11.7	11.7
SOLAS ships (>500 gross tonnage)	8.2	8.2
Small vessel with radar reflector	5.1	5.0*
Navigation buoy with corner reflector	5.0	4.9*
Typical Navigation buoy	4.7	4.4*
Small vessel of length 10 m with no radar reflector	3.6	Target not visible
Channel markers	2.4	Target not visible

* In smooth swell the target may be visible up to the stated range. In the presence of strong winds (>20 knots) and breaking waves, detection of the target is likely to be reduced, or may not be visible.

Table 15: X band radar performance in 4mm rain

Target description	Max. detection range in clear conditions (NM)	Max detection range in 4mm rain (NM)	
		Long Pulse	Short Pulse
Shorelines rising to 60m	20.0	19.3	17.9
Shorelines rising to 6m	8.7	7.7	7.3
Shorelines rising to 3m	6.9	5.6	5.6
SOLAS ships (>5000 gross tonnage)	11.7	11.0	10.1
SOLAS ships (>500 gross tonnage)	8.2	7.1	6.8
Small vessel with radar reflector	5.1	1.4	3.5
Navigation buoy with corner reflector	5.0	1.3	3.6
Typical Navigation buoy	4.7	1.2	3.2
Small vessel of length 10 m with no radar reflector	3.6	0.7	2.3
Channel markers	2.4	0.4	1.5

Table 16: X band radar performance in 16mm rain

Target description	Max. detection range in clear conditions (NM)	Max detection range in 16mm rain (NM)	
		Long Pulse	Short Pulse
Shorelines rising to 60m	20.0	17.0	11.6
Shorelines rising to 6m	8.7	6.4	6.5
Shorelines rising to 3m	6.9	4.3	5.0
SOLAS ships (>5000 gross tonnage)	11.7	9.7	9.0
SOLAS ships (>500 gross tonnage)	8.2	5.7	6.0
Small vessel with radar reflector	5.1	0.5	1.4
Navigation buoy with corner reflector	5.0	0.6	1.3
Typical Navigation buoy	4.7	0.5	1.2
Small vessel of length 10 m with no radar reflector	3.6	0.4	0.7
Channel markers	2.4	0.2	1.0

Table 17: X band radar performance in 4mm rain, sea state 5

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in 4mm rain, sea state 5 (NM)
Shorelines rising to 60m	20.0	19.3
Shorelines rising to 6m	8.7	7.7
Shorelines rising to 3m	6.9	5.8 *
SOLAS ships (>5000 gross tonnage)	11.7	11.0
SOLAS ships (>500 gross tonnage)	8.2	7.1*
Small vessel with radar reflector	5.1	3.1 †
Navigation buoy with corner reflector	5.0	3.3 †
Typical Navigation buoy	4.7	1.2 †
Small vessel of length 10 m with no radar reflector	3.6	Target not visible
Channel markers	2.4	Target not visible

* Medium Pulse

† Short Pulse. In smooth swell the target may be visible up to the stated range. In the presence of strong winds (>20 knots) and breaking waves, detection of the target is likely to be reduced, or may not be visible.

Table 18: S band radar performance in sea state 2

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in sea state 2 (NM)
Shorelines rising to 60m	20.0	20.0
Shorelines rising to 6m	8.8	8.8
Shorelines rising to 3m	6.8	6.8
SOLAS ships (>5000 gross tonnage)	12.0	12.0
SOLAS ships (>500 gross tonnage)	8.0	8.0
Small vessel with radar reflector	3.7	3.7
Navigation buoy with corner reflector	3.6	3.6
Typical Navigation buoy	3.3	3.3
Small vessel of length 10 m with no radar reflector	3.0	3.0
Channel markers	1.5	1.5

Table 19: S band radar performance in sea state 5

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in sea state 5 (NM)
Shorelines rising to 60m	20.0	20.0
Shorelines rising to 6m	8.8	8.8
Shorelines rising to 3m	6.8	6.8
SOLAS ships (>5000 gross tonnage)	12.0	12.0
SOLAS ships (>500 gross tonnage)	8.0	8.0
Small vessel with radar reflector	3.7	3.5 *
Navigation buoy with corner reflector	3.6	3.4 *
Typical Navigation buoy	3.3	3.0 *
Small vessel of length 10 m with no radar reflector	3.0	Target not visible
Channel markers	1.5	Target not visible

* In smooth swell the target may be visible up to the stated range. In the presence of strong winds (>20 knots) and breaking waves, detection of the target is likely to be reduced, or may not be visible.

Table 20: S band radar performance in 4mm rain

Target description	Max. detection range in clear conditions (NM)	Max detection range in 4mm rain (NM)	
		Long Pulse	Short Pulse
Shorelines rising to 60m	20.0	19.9	17.8
Shorelines rising to 6m	8.8	8.3	7.1
Shorelines rising to 3m	6.8	5.9	5.2
SOLAS ships (>5000 gross tonnage)	12.0	11.8	10.2
SOLAS ships (>500 gross tonnage)	8.0	7.3	6.4
Small vessel with radar reflector	3.7	2.3	2.7
Navigation buoy with corner reflector	3.6	2.3	2.6
Typical Navigation buoy	3.3	2.1	2.4
Small vessel of length 10 m with no radar reflector	3.0	1.8	2.2
Channel markers	1.5	0.7	1.1

Table 21: S band radar performance in 16mm rain

Target description	Max. detection range in clear conditions (NM)	Max detection range in 16mm rain (NM)	
		Long Pulse	Short Pulse
Shorelines rising to 60m	20.0	19.4	17.7
Shorelines rising to 6m	8.8	6.9	7.1
Shorelines rising to 3m	6.8	4.5	5.1
SOLAS ships (>5000 gross tonnage)	12.0	10.7	10.1
SOLAS ships (>500 gross tonnage)	8.0	5.9	6.3
Small vessel with radar reflector	3.7	1.4	2.4
Navigation buoy with corner reflector	3.6	1.5	2.3
Typical Navigation buoy	3.3	1.3	2.1
Small vessel of length 10 m with no radar reflector	3.0	1.2	1.9
Channel markers	1.5	0.5	0.8

Table 22: S band radar performance in 4mm rain, sea state 5

Target Description	Max. detection range in clear conditions (NM)	Max. detection range in 4mm rain, sea state 5 (NM)
Shorelines rising to 60m	20.0	19.9
Shorelines rising to 6m	8.8	8.3
Shorelines rising to 3m	6.8	5.9
SOLAS ships (>5000 gross tonnage)	12.0	11.8
SOLAS ships (>500 gross tonnage)	8.0	7.3
Small vessel with radar reflector	3.7	2.7 *
Navigation buoy with corner reflector	3.6	2.6 *
Typical Navigation buoy	3.3	2.3 *
Small vessel of length 10 m with no radar reflector	3.0	Target not visible
Channel markers	1.5	Target not visible

* Short Pulse. In smooth swell the target may be visible up to the stated range. In the presence of strong winds (>20 knots) and breaking waves, detection of the target is likely to be reduced, or may not be visible.

2 Antenna Specification (X-band)

Operating frequency: 9410MHz ± 30MHz

Table 23: Antenna Specification – X-band

Parameter	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 shown in Table 24 apply to all sizes of X-band antenna.

Table 24: Rotational Speeds – X-band

Rotational Speed	rpm
Standard	28rpm
High	45rpm

3 Antenna Specification (S-band)

Operating frequency: 3050MHz ± 10MHz

Table 25: Antenna Specification – S-band

Parameter	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 not type approved to IEC 62388 specification.

The rotational speeds shown in Table 26 apply to all sizes of S-band antenna.

Table 26: Rotational Speeds – S-band

Rotation Speed	Mains Supply Frequency	
	50Hz	60Hz
Standard	25rpm	30rpm
High	48rpm	48rpm

4 Transceiver Specification

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

4.1 Mounting Arrangements

The transceiver can be mounted inside the Antenna Turning Unit or it can be a separate module inside the ship's bulkhead.

Table 27: 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

Table 28: Transmitter Specifications

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 optional 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

Table 29: Receiver Specifications

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

Type Approved systems require a Performance Monitor to be present in the system.

Table 30: Performance Monitor Specifications

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

4.5 Display to Transceiver Interface

Table 31: Display to Transceiver Interface

Parameter	Detail
Radar Video Output	Peak amplitude -2.0V to -5.0V
	Shoulder Noise -0.25V minimum
	Input Impedance 75Ω ± 10%
Trigger Output	RS422 differential signals
Display to Transceiver Data	RS422 differential signals

4.6 Options

4.6.1 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.

4.6.2 Antenna Rotation in Standby

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

This option cannot be used with the Speed Select Input option, see Section 4.6.3.6 '*Speed Select Input (X-band systems only)*'.

4.6.3 Additional Features

The 'additional features' versions of the Tuning Units and Transceivers give 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'.

4.6.3.1 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.

4.6.3.2 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 can be fitted with a size 11 Synchro or Resolver. This is not aligned: any alignment must be given externally.

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

4.6.3.3 External Trigger Input

This 75ohm coaxial input lets the Transmitter synchronise with other equipment on the ship.

When there is a signal at the external trigger input, external trigger will be automatically chosen as the mode of operation.

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

4.6.3.4 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 occurs.

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.

4.6.3.5 Pre-trigger Output

This 75ohm coaxial output lets other equipment on the ship synchronise with the Transmitter.

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

4.6.3.6 Speed Select Input (X-band systems only)

This isolated closing-contact input lets you remotely select between high and low antenna rotation speed.

This option cannot be used with the Antenna Rotation in Standby option, see Section 4.6.2 ‘*Antenna Rotation in Standby*’.

5 Interswitch Units

On a conventional VisionMaster system a basic single radar may be expanded by the addition of up to six transceivers and consoles, connected via an Interswitch unit. The two types of interswitch units are:

- 2-Way Interswitch - allows one or two transceivers to be connected to up to four consoles.
- 6-Way Interswitch - allows up to six transceivers to be connected to up to six consoles.

For details on the Interswitch, refer to *Chapter 7 ‘Interswitch Units’*.

On a Client/Server radar system a separate Interswitch unit is not included. Interswitching is done virtually from the Server PCs which distribute data to the Clients via an Ethernet network.

For details on Client/Server Radar, refer to Section 6.3 ‘*Client/Server Radar*’

6 Description of VisionMaster Displays

6.1 250 Kit and 340 Kit, Tabletop and Deckstand Versions

The 250 kit and 340 kit, tabletop and deckstand versions of the VisionMaster FT comprise the following:

- PC Input/Output (PCIO) Unit
- Processor Unit
- Display Unit
- Control Panel assembly
- Auxiliary PCIO Unit (for Dual Radar only)

Console assemblies are supplied as a standalone pedestal version (i.e. deck mounted) or a kit version (i.e. without pedestal for installation into an existing console suite).

The deckstand console version is supplied with display side cheeks and pedestal side panels.

6.1.1 PCIO Unit

The PCIO unit is the interface to the external sensors and the connection interface to the top unit assembly.

On a multi-node system all PCIO boards must have the same heading sensors configured.

There are two PCIO Unit variants; one fitted with a standard compass board and one fitted with a special compass board.

The following inputs are provided:

- analogue compass data (stepper or synchro)
- analogue log (pulse) data
- nine serial data inputs, (one being a dedicated serial compass input).

The following outputs are provided:

- six serial data outputs
- three relay outputs for vigilance alarm, remote alarm and system operational
- one buzzer output to monitor.

Note: *Two of the serial input/outputs are used for Interswitch and Monitor Control.*

6.1.1.1 Auxiliary PCIO Unit

The auxiliary PCIO provides an interface between the second top unit assembly and the Channel 2 scan converter card in the Processor Unit.

6.1.2 Processor Unit

The Processor unit is based on an Core 2 Duo Processor running Windows XP at 1280 x 1024 resolution (or 1920 x 1200 for widescreen), 32 bit colour at 2.8GHz. It contains a Scan Converter (SC) PCB that processes data from the top unit. A processor unit for dual radar will contain two SC PCBs.

The Processor unit has the following inputs and ports:

- two PS2 inputs, one of which is used by the trackball
- one serial input
- one parallel input
- six USB ports (two ports go to the control panel, two are used for USB security devices, one is used for the PCIO and one is spare).

The Processor unit also provides the output for a CID secondary monitor, or a VDR output when a widescreen monitor is used.

The Processor contains a CR2032 Lithium battery. NGSM recommends that the battery is replaced every 5 years, see Chapter 6 ‘*Routine Maintenance*’.

6.1.3 Display Unit

The display unit is supplied with one of the following flat panel monitors:

Table 32: Monitors Specification

Radar Circle Diam. (mm)	Screen Diag. (inches)	Aspect Ratio	Resolution	Pixels Ratio	Pitch (mm)
273	19.0	5:4	1280x1024	5:4	0.29
338	23.1	4:3	1280x1024	5:4	0.29
328	25.5	16.10	1920x1200	16:10	0.29
338	27.0	16:10	1920x1200	16:10	0.30

The monitor has a power switch which controls the monitor only, and a brightness adjustment control. The brightness adjustment control has an indexed position, marked as a white line. This indexed position sets the default brightness and calibrated operation.

The monitor supports a minimum of 64 colours.

The 19” or 23” display units provide buffered video and sync output for a VDR. The output is at the same frequency and resolution as the output of the processor unit.

The display unit is designed for a nominal viewing distance of one metre.

In CID watch mode the instrumentation text should be readable from at least two metres.

The display unit should be installed in accordance with IMO resolution MSC/Circ.982 ‘Guidelines on Ergonomic Criteria for Bridge Equipment and Layout’.

6.1.4 Control Panel Assembly

The Control Panel Assembly includes the following variants:

- Control Panel or Trackball
- Power On/Off switch
- USB connector (supplied when the assembly includes a trackball)

The control panel includes the following group of controls:

- Trackball, with left and right keys
- Rotary controls
- Adjustment and Acknowledgement buttons

The control panel is connected to the Processor Unit by a USB cable. The USB cable also provides power to the control panel.

The trackball is connected separately to the Processor Unit by a PS2 cable. This ensures that should the control panel USB fail the trackball can still be operated.

6.2 19” Integrated Tabletop

The 19” integrated tabletop is a unit where the LCD, Processor assembly, PCIO, Control Panel and security device are all contained in a single mechanical housing.

The external controls include a brightness control for the LCD and a power On/Off switch.

6.2.1 PCIO Board

The PCIO board is the same board as used on the 250/340 Tabletop displays. The PCIO is attached to the base enclosure of the unit.

6.2.2 Processor Assembly

The Processor assembly includes the following modules:

- DVD Rewriter
- Fan with filter

The following inputs and ports are provided:

- two PS2 inputs, for the trackball and a standard PC keyboard for commissioning only
- one serial input
- one network port (10/100/1000 Base-T)
- ten USB ports (two can be used for security devices, two ports are at the front of the unit, one is used for the control panel, one is used for the PCIO and four are spare).

The Processor also provides an RGB output for a CID secondary monitor or a VDR output.

The Processor contains a CR2032 Lithium battery. Under normal operation this battery should last last the lifetime of the Processor.

6.2.3 Monitor

The monitor for the 19” Integrated includes a brightness control only.

6.3 Client/Server Radar

A Client/Server Radar system will comprise the following:

- Servers
- Clients
- Mains Distribution Unit
- Gigabit Ethernet Network
- PCIO Unit (same as standard system)
- Display Unit (same as standard system)
- Control Panel with I/O

6.3.1 Server

The Server is based on a Core 2 Quad Processor running Windows XP at 1280 x 1024 resolution, 32 bit colour at 2.66GHz. It contains a Network Front End (NFE) PCI card that processes data from the top unit.

6.3.2 Client

The Client is based on the same Core 2 Quad Processor as the Server. It has the same input and ports as described for a conventional radar processor unit, see Section 6.1.2 ‘*Processor Unit*’, but does not include a Scan Converter card.

6.3.3 Mains Distribution Unit

The Mains Distribution Unit provides AC power from the ship’s supply to the Client PC and monitor and provides connection to the console On/Off switch.

6.3.4 Network Connection

Each Server connects to a transceiver via the PCIO unit. The PCI card in the Server samples radar video from the transceiver and the Server provides up to eight digital output streams called radar video channels.

The radar video is distributed over the network via Ethernet switches using a one Gigabit Ethernet network connection.

There is no physical interswitching connection between Servers and Clients. Each Client can request a specific service from any one of the Servers and thereby effectively change the Transceiver to which it is connected. This process is controlled by negotiation between the Servers and is known as Virtual Interswitching.

6.4 Product Types

The table below lists the Radar and Chart Radar product types available:

Table 33: Radar Product Types

Product	Type	Monitor	Max No. of tracked targets
CAT 1 Radar	CAT1	23", 25.5" or 27"	100
CAT 1 Chart Radar	CAT1C	23", 25.5" or 27"	100
CAT 2 Radar	CAT2	19"	60
Enhanced CAT 2 Radar	CAT2	19"	100
Enhanced CAT 2 Chart Radar	CAT2C	19"	100

The following features are not available to a CAT2 Radar:

- Trial Manoeuvre
- Route Planning
- ETA Calculator
- User Profiles
- Predicted Areas of Danger (PAD)
- Playback
- Clearing Lines
- Search and Rescue Patterns
- the following Nav Tools:
  - Next Turn EBL
  - LAT/LON Grid
- the following ownship display settings:
  - Predicted ship position
  - Predicted Vector/Path

7 Total Watch

If a node is configured as a Total Watch workstation the following presentation modes may be available:

- Chart Radar
- ECDIS
- Conning Information Display
- Central Alarm Management
- Playback

The operator may switch between presentation modes using the Watch Mode button.

The availability of the watch modes listed above (and other optional presentation modes not listed) is dependent on the configuration settings and the security device installed at initialisation.

8 Radar Specification

8.1 Range Scales & Range Rings

Table 34: Range Scales and Range Rings

Range Scales	Range Rings	Available Pulse Lengths		
NM	NM	Short	Medium	Long
0.125	0.025	4		
0.25	0.05	4		
0.5	0.1	4	4	
0.75	0.25	4	4	
1.5	0.25	4	4	
3	0.5	4	4	4
6	1		4	4
12	2		4	4
24	4		4	4
48	8			4
96	16			4

8.2 Range Rings and Bearing Scale

Table 35: Range Ring and Bearing Scale Parameters

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°.

8.3 Own Ship

There are three types of symbol used to display own ship’s position and heading, defined as follows:

- Minimised Symbol: The minimised symbol is drawn where the scaled outline symbol cannot be resolved at the given range scale. The minimised symbol may be drawn in one of two ways, as described below:.
    - Circle Symbol: The circle symbol is drawn if the system is in Charts view. The symbol is displayed in addition to the heading line and beam line.
    - Heading and Beam Line Symbol: This symbol is drawn when the system is in Radar Maps or Charts Off view. The symbol consists of the heading line and beam line only.
- Outline Smbol: This symbol is drawn such that its length and width represent the configured length and beam of the ship. Outline symbol is displayed in addition to the heading line and beam line.
- Custom Symbol: This symbol is drawn to represent the actual outline of the ship. It is defined by entering co-ordinates for the start and end point of each line segment in the Configuration tool.

If the position data becomes invalid, ship's symbol is shown in red and the system switches to water stabilised mode. The heading line and beam line remain in green.

If the heading data becomes invalid, ship's outline and circle symbol are not displayed and heading line/beam line is shown in red. After a short period of time the presentation mode reverts to Head Up. In Head Up the ship's outline or circle symbol re-appear and are then shown in green.

8.3.1 Heading Line

The ship's heading line (HL) is shown as a single line starting from own ship’s CCRP and drawn to the edge of the radar video display.

The bearing of the HL is dependent on the presentation mode.

- In Head Up modes (Stabilised or Unstabilised) the heading line is always drawn vertically.
- In Course Up (C UP) mode the heading line is initially drawn vertically at the time the mode was selected and then changes to the appropriate bearing as ship's course changes.
- In north up (N UP) mode the heading line is drawn at the correct compass heading.

The HL may be shown as a stern line (SL) drawn behind own ship. The type of marker (HL or SL) can be selected for one or more transceivers during top unit configuration, see VMFT Ships Manual, Volume 2, Chapter 1, *Configuration*.

8.3.2 Beam Line

The Beam Line is a line displayed at right angles to the Heading line and extends each side of own ship's CCRP. The beam line length can be increased from the default length.

8.3.3 Own Ship Vector

A vector of own ship is drawn with a length corresponding to the distance on the video display that own ship will cover, given its current speed, in the current vector time.

Own ship vector is shown in True Vectors only, with a double arrowhead when in ground stabilisation mode, and a single arrowhead when in water stabilisation mode.

8.4 Centring

If the screen has been off centred or panned it can be redrawn with own ship's CCRP at the centre of the video display. All chart data and target positions are also moved in accordance.

8.5 Max View

Max View off-centres the video display at approximately 70% of the range scale radius so that a line drawn from it in the direction of the current course passes through the centre of the video circle.

Max View is not available at a range scale of 96 NM.

In Head Up presentation mode (Stabilised H UP or Unstabilised H UP), the direction is reciprocal to the heading marker.

In North Up or Course Up presentation mode the direction is reciprocal to the course over ground (COG), or heading marker if COG is unavailable.

8.6 Off Centring, Panning and GoTo

8.6.1 Off Centring

Own ship’s CCRP can be moved anywhere within approximately 70% of the range scale radius. Also a selected screen position (chart marker or object) can be positioned at the centre of the display with own ships position and all other chart and target positions moved in accordance.

Off Centring is not available at a range scale of 96 NM.

8.6.2 Panning

Panning moves a selected chart position or object to the centre of the display. Own ship's position, chart data and target positions are all moved in accordance.

Panning is only available in Standby mode.

8.6.3 GoTo

GoTo moves the centre of the video display to a specific LAT/LON position or a location name specified by the operator.

GoTo is only available in Standby mode.

8.7 Video Processing

Table 36: Video Processing

Function	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.
Enhance	Operation available on range scales of 0.75nm and above. Target enhancement is shown over entire video circle, except for a small area around the radar origin. Special circuitry for identifying weak/fading targets.
Scan Filtering	Scan integration for the reduction of noise and radar interference.
Peak Intensification	High level video which by-passes filtering process.
Video Build Up	Scan integration build up of persistent targets.
Video Fade and Trails Decay	Fast fade of video levels and slow decay of trails over the whole image.

8.8 Cursor Readout

The position of the cursor is used to provide the positional coordinates of targets located within the display. The cursor position is displayed as either True or Relative bearing to own ship in Latitude and Longitude.

Table 37: Cursor Readout

Parameter	Detail
Range	Defined as the distance between the CCRP and cursor position as measured in nautical miles.
Bearing	Angle from the CCRP to the cursor position, displayed as true or relative.
Reciprocal Bearing	Defined as bearing from the cursor position to the CCRP, displayed true or relative.
Latitude/Longitude	Corresponding to the current cursor position.
Time To Go	Estimated from the geographical distance between the CCRP and the cursor position divided by speed over ground (in ground stabilised mode) or speed through water (in water stabilised mode).

LAT/LON readings are not available if the following happen:

- own ship's position is lost when in Transmit
- the compass is unaligned
- there is a compass error

8.9 Presentation Modes

Table 38: Presentation Modes

<table>
<tr><th>Parameter</th><th>Detail</th></tr>
<tr><td>Unstabilised Head-Up</td><td>Maintained relative to the ship's fore/aft axis. Only Relative Motion mode is available.</td></tr>
<tr><td>Stabilised Head-Up</td><td>Maintained relative to the ship's fore/aft axis. Requires a valid compass input. Only Relative Motion mode is available.</td></tr>
<tr><td>North-Up</td><td rowspan="2">Maintained relative to a fixed true bearing. Requires a valid compass input.
Relative Motion and True Motion modes available.</td></tr>
<tr><td>Course-Up</td></tr>
</table>

8.10 Motion Modes

8.10.1 Relative Motion

Own ship is shown at a selected point or fixed point on the radar screen. The advantage of RM is that a constant range ahead of own ship is maintained making it not necessary to reset the display as in TM.

RM is available in all presentation modes and at all range scales.

If the presentation mode is Head Up (Stabilised or Unstabilised) only RM is available.

8.10.2 True Motion

Own ship moves across the radar screen at the selected ground or water stabilised velocity.

TM is available on range scales 0.5 NM to 48 NM. If the range scale is outside these limits, the motion mode will temporarily revert to RM.

TM is available with North Up or Course Up presentation modes only.

A disadvantage of the TM presentation mode is that the radar display range ahead of own ship decreases as own ship moves across the display. The display has to be reset, automatically either when own ship reaches approximately 70% of display radius, or manually as required.

8.10.2.1 True Motion – Water Stabilised

Own ship moves across the radar picture according to the input of heading (derived from the compass) and speed through water (STW) (derived from the waterlocked log).

With water stabilisation, stationary targets will appear to move due to tide/ leeway and effects of current.

8.10.2.2 True Motion – Ground Stabilised

Own ship moves across the radar picture according to the inputs derived either from tracking a fixed echo (echo reference) target, or from a fixed position sensor. The fixed position sensor must be approved in accordance with the requirements of IMO in resolution MSC.112(73).

A ground stabilisation presentation is provided using course over ground (COG) and speed over ground (SOG) inputs, obtained when a position sensor such as GPS is providing data, or locked to an echo fixed with respect to ground.

With ground stabilisation, the ship will show its true movement over the ground. Tide, leeway and effects of current are removed.

8.11 Trails Modes

Video trails may be displayed in True or Relative mode.

The Trails mode selection is reflected in the vector mode, i.e. if the mode is True Trails then True Vectors will automatically be selected.

If a range scale lower than 0.5 NM is selected in True Trails then the trail mode will change to Relative. If the display becomes 'unstabilised' only Relative Trails are available.

Long, Short and Permanent trails are selectable. Trails can be removed from the display by selecting Off, or the trails time reset to zero by selecting Reset. The long and short trail lengths are shown on the display, and are dependent on the selected range as follows:

Table 39: Trails Parameters

Range Scale NM	Short Time	Long Time
0.125	10 seconds	30 seconds
0.25	10 seconds	30 seconds
0.5	15 seconds	45 seconds
0.75	15 seconds	45 seconds
1.5	30 seconds	90 seconds
3	30 seconds	90 seconds
6 and above	1 minute	3 minutes

Permanent trails are timed for up to 60 minutes, and can be displayed until manually reset.

8.11.1 Relative Trails

In unstabilised Head Up presentation mode, relative trails will represent the exact motion of objects relative to own ship.

In stabilised presentation modes, the trails are generated from the azimuth stabilised position of own ship. Stationary objects will produce trails if own ship moves its position relative to the objects, whether by tide or leeway effects on own ship, or by own ship's actual motion.

The ground stabilisation or water stabilisation reference has no effect on relative trails.

8.11.2 True Trails

In True Trails mode the trails are generated using the water or ground stabilisation of own ship.

8.11.2.1 True Trails – Water Stabilised

Own ship moves across the radar picture according to the input of heading (derived from the compass) and speed through water (STW) (derived from the log).

With water stabilisation, trails attached to fixed targets give a direct indication of tide or current set and rate experienced by own ship. Leeway effects, if significant, will produce trails on stationary targets.

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

8.11.2.2 True Trails – Ground Stabilised

Own ship moves across the radar picture according to the course over ground (COG) and speed over ground (SOG) inputs, obtained when a position sensor such as GPS is providing data; or locked to an echo fixed with respect to ground.

Moving targets generate trails, representing their own COG and SOG. Stationary targets do not produce trails.

8.12 Colour Management

The Colour Management feature utilises common colour sets comprised of RGB values that are calibrated for the monitor in use by the system.

On a multi-node system all nodes, by default, are affected by a global colour set change The operator may change the colour set from any node.

Table 40: Colour Sets

Colour Set	Inside Radar Circle	Outside Radar Circle
Day Bright	Blue background, yellow radar video	White text on light grey background
Day Black	Black background, yellow radar video	Off white text on darker grey background
Dusk	Black background, yellow radar video	Light grey text on dark grey background
Night	Black background, yellow radar video	Grey text on black background
Night Red	Black background, red radar video	Red text on black background

8.12.1 Brilliance Groups

The brilliance groups feature initially provides predefined brilliance groups, which can be independently adjusted by the operator.

8.12.2 SENC Data

The SENC feature ensures adjustments made to the brightness and contrast settings on the monitor will enable SENC data such as coastlines, safety contour and other objects to be adequately displayed.

8.13 Synthetics Control

The Synthetics control suppresses all synthetics other than the radar video.

8.13.1 Synthetics Colours

- Readout Data is invalid and unusable : Red
- Readout Data is degraded : Amber
- Readout Data is valid : Green
- Own Ship Invalid Synthetics : Red

8.14 EBLs, VRMs & ERBLs

8.14.1 Variable Range Marker (VRM)

Two independent VRMs are available. Each VRM is a ring of long dashes, the first and second VRMs having different mark/space ratio of line dashes.

VRMs can be offset or dropped to a LAT/LON referenced position. If the VRM is offset from the CCRP, the centre of the VRM is indicated by a dot. If the VRM is activated and the range scale is changed the VRM maintains its range.

8.14.2 Electronic Bearing Line (EBL)

There are two EBLs, variable from 0° to 359.9° in 0.1° increments. Each EBL is a line of dashes, the first and second EBLs having different mark/space ratio of dashes.

When an EBL is turned on the value of its associated VRM is also shown.

The origin of an EBL can be offset or dropped to a LAT/LON referenced position. If the EBL is offset from the CCRP, its origin is indicated by a dot.

8.14.3 Electronic Range and Bearing Line (ERBL)

When a VRM is turned off, the VRM function is merged with the EBL to form an ERBL. There is a marker on the ERBL where the VRM intersects to indicate the range setting of the VRM.

8.15 Trial Manoeuvre

A Trial Manoeuvre is based on speed, rate of turn and course through water values entered for own ship. The following parameters are used to define the manoeuvre:

- A true course to follow after the manoeuvre.
- A true speed to be maintained during and after the manoeuvre.
- A delay time before the manoeuvre is to start.
- A rate of turn for the manoeuvre.

Table 41: Trial Manoeuvre

Parameter	Detail	Power on default
Final True Course	0 to 359.9°, in 0.1° increments.	000.0°
Manoeuvre Speed	0 to 75kts.	15kt
Delay Time	0 to 30 minutes, in 0.1 minute increments.	0.0 min
Rate of Turn	1°/min to maximum set rate of turn in initialisation	Ownship's commissioned standard rate of turn
Alarm raised	30 seconds before manoeuvre starts.	

The manoeuvre course and speed is either STW or SOG, depending on the currently selected stabilised mode (ground or water).

8.16 Announcements

Announcements include alarms, warnings and cautions. Alarms and warnings are indicated visually and audibly, via the alarm buzzer. Cautions, which indicate less critical conditions, are only indicated visually.

Announcements are initially displayed on the Alarm Status Indicator, from where they can be acknowledged. Some announcements are automatically cleared by the system. A list of all currently active and unacknowledged announcements are shown in the Alarms Display.

There are two types of announcement sources: internal and external. Internal announcements are generated by the VisionMaster FT system. External announcements are those relayed to the Central Alarm Management (CAM) by external sources.

Table 42: Announcement Status

Type	Indication	Display Area
Unacknowledged Active Alarm	Flashing red	Indicator and Display
Unacknowledged Active Warning or Caution	Flashing yellow	Indicator and Display
Unacknowledged Inactive Announcements	Flashing grey	Indicator and Display
Acknowledged Active Alarm	Steady red	Red lettering
Acknowledged Active Warning or Caution	Steady yellow	Yellow lettering
Acknowledged Inactive Announcements	No indication	Removed from both areas

8.16.1 Announcements on a Multi-Node System

On a multi-node system generated announcements are designated as ‘system’ or ‘local’. System alarms or warnings are always displayed and audibly announced on all nodes in the system. Local alarms or warnings are always displayed and audibly announced on the node that generated the local announcement. An alarm or warning that is designated as local may optionally be displayed and audibly announced on any node in the system other than the one upon which it was generated.

Acknowledgement of a system announcement at one node acknowledges that announcement at all nodes on the system.

8.16.2 Prompts

Prompts appear directly underneath the Announcements field and can be either temporary or permanent.

Permanent prompts denote a state or mode of operation, provide instruction to the operator, or may display settings.

Temporary prompts are general system responses to a user interaction and are displayed briefly for a commissioned time period.

A list of all all the permanent prompts and temporary prompts, as they occur, are shown in the Prompts window.

8.16.3 Alarm Buzzer

The alarm buzzer is located in the monitor and controlled by the PCIO Unit.

On a Client/Server Radar system the alarm buzzer is controlled by the Control Panel.

The alarm buzzer may be muted (either temporarily or permanently, dependant on commissioning). If the buzzer has been commissioned to be temporarily mute, the system will automatically re-enable the buzzer once the commissioned timeout period for the mute has elapsed.

The mute alarm buzzer is a global mute across all nodes.

8.17 Sensors

8.17.1 Serial Interfacing

The system supports acquisition of sensor data via serial interfaces having 1000V optical isolation, connected to the PCIO board.

The sensor data must comply with international specifications IEC 61162-1 and IEC 61162-2.

On a multi-node system all nodes use the same sensor for each type of sensor data, for example, GPS1 for position data.

All serial inputs can accept RS232 or RS422 format.

The system can accept the following sentences (defined at system configuration) to obtain the types of data listed in Table 43.

Table 43: Sentences and Sensor Data

Sentence	Data
ACK, ALR	Alarms
DPT	Depth Below Keel, Depth Below Transducer, Depth Below Waterline
DTM	Datum Offset
GGA, GLL, GNS	Geodetic Position
HDG	Magnetic Deviation, Magnetic Sensor Heading, Magnetic Variation
HDM	Heading, Magnetic
HDT	True Heading
MWV	Wind Speed and Angle
RMC	Position, Ground Speed, Course over Ground
ROT	Rate of Turn
RTE	Routes
THS	True Heading and Status
TLB	Target Label
VBW	Ground Speed and Water Speed
VDM	AIS data
VDO	AIS data (own ship)
VHW	Water Speed
VTG	Ground Speed and Course Over Ground
WPL	Waypoints for Routes
ZDA	Date and Time, Local Time Offset

The following table lists the PCIO unit serial inputs available and configurable for IEC 61162-1 and IEC 61162-2 sensor data.

Table 44: PCIO unit serial inputs

IEC Type	Baud Rate	Serial Input
IEC 61162-1	4800	All IEC 61162-1 sensors via serial inputs TSCD, TSCE, TSCF, TSCG TSCH and TSCJ of PCIO.
IEC 61162-2	38400	HDG, HDT and ROT sentences via serial input TSCA of the PCIO. All other IEC 61162-2 sensors via serial inputs TSCB and TSCC. TSCB and TSCC may be configured to accept 4800 and 9600 baud.

Serial inputs TSCF, TSCG TSCH and TSCJ can be configured to operate at 9600 baud, although these serial inputs cannot be configured as a heading source.

If a serial input is used for tracking, then the serial form must conform to IEC61162-2, i.e. 38400 baud and a message rate of approximately 50Hz.

All serial outputs are available in RS232 and RS422 format (on different terminal positions).

8.17.2 Azimuth Stabilisation

A standard compass board allows interfacing to most stepper and 360:1 ratio synchro compass types. A special compass board provides interfacing to 180:1, 90:1, 36:1 and 1:1 ratio synchros. This interface board is mounted in the PCIO unit.

Interfacing with compasses that have a serial output is also available. However, the preferred interface is a stepper or synchro compass.

- Maximum Rate of Turn 1200°/m
- Course Accuracy within 0.5° of input source.

See Chapter 4 '*Installing Consoles & Displays*', Section 5.4 '*Compass Cabling and Link Settings*' for details of compass types and cabling details.

8.17.3 Pulse Log Input

The system supports acquisition of single axis water speed data via a pulse log interface, complaint to IMO resolution A 824 (19). The pulses can be TTL or 'closed contact' type. The open circuit potential for the Pulse Log input is approximately 5V.

The following interface options can be selected:

- Whether or not a pulse log is connected, default is `not connected'.
- The polarity of the pulses (positive or negative).
- The pulse log rate, 100 to 2560 pulses per nautical mile.

Table 45: Pulse Log Input

Parameter	Detail
Speed Range and Input	0 to 75Kt
Steady State Speed Accuracy	±5% or ±0.25Kt, whichever is the greater, ignoring errors defined from the input source.

8.17.4 Manual Sensor Data

Sensor data can be manually entered by the operator to the following criteria.

Table 46: Sensor Data Manual Entry

Data Type	Manual Entry Requirements
Course Over Ground* Vessel Set	A range of 0.0º to 359.9º, and resolution of 0.1º.
Geodetic Position*	A range of 89°48.000' south to north latitude and 180°00.000' east to west longitude, and resolution of 0.001 minute, in latitude and in longitude.
Speed Over Ground* (single axis only) Vessel Drift Speed Through Water (single axis only)	A range of 0.0 to 99.9 knots, and resolution of 0.1 knots.

* Manual data cannot be entered for COG, SOG or Position if AIS input is enabled.

8.17.5 Computed Data

The term “computed data” is used to indicate the source of data when the system itself is responsible for computing this data, usually based on other types of sensor data received conventionally via an interface.

8.17.5.1 Radar Target Based Data

The system provides the following target based data:

- echo referenced velocity
- echo referenced position

The values of both target based data is determined by the operator selecting a fixed-position radar target, for an echo referenced position a geographic position is also assigned. The system then determines the ship's ground velocity or position based on changes in the range and true bearing to the target.

8.17.5.2 Other Computed Data

The system provides the following additional computed data:

- Set and Drift
- Ground Velocity (including ground speed and course over ground)
- Water Speed
- Rate of Turn (calculated on selected Heading source).

8.17.6 Dead Reckoning of Position

Where valid position data for own ship is not received the system establishes a computed position by dead reckoning from the last valid position received using own ship's direction and speed.

The timeout limit applied to valid dead reckoning values defaults to 30 seconds.

The system considers position data to be invalid if the most recent usable sample data received from a position sensor is older than the timeout limit.

8.17.7 Transmitted Sentences

The following sentences, defined in IEC 61162-1, may be output from VisionMaster to an external system, e.g. BridgeMaster Radar.

Table 47: Transmitted Sentences

Sentence	Data
GGA *	Position data from the GPS Quality Indicator
ZDA *	Current system date and time
VTG *	Ground Velocity
VBW *	Water Velocity
DBT	Depth Below Transducer
GLL	Geodetic Position
HDT	True Heading
MWD	True Wind
MWV	Relative Wind
ROT	Rate Of Turn
VHW	Water Speed and Heading

* Default output sentences.

8.18 Target Data

8.18.1 Tracked Targets

The Tracker allows targets to be acquired manually by the operator or automatically by the auto-acquisition zones. The tracker parameters are shown below.

Table 48: Tracker Parameters

Parameter	Value
Tracking range	0.25 to 40.0 nm
Acquisition range	0.25 to 40.0 nm
Cancellation range	0.0 to 40.0 nm
Max number of tracked targets in a single node system	100
Max number of tracked targets in a CAT 2 single node system	60
Max number of tracked targets in a multi node system	200
Max tracking velocity	150 knots true
Time to display motion trend vector	After 12 good plots from acquisition
Vector Length	1 to 60 minutes in 0.1 minute increments
Time to display a tracked target lost	After 6 consecutive plot attempts
CPA/BCR Alarm Settings	0.1 to 20 nm in 0.1 nm increments
TCPA/BCT Alarm Settings	1 to 99 minutes in 1 minute increments

All tracked targets are monitored for Lost Target. Only established tracked targets are monitored for CPA/TCPA and bow crossing infringements. All distances and times are relative to the own ship’s physical location.

The velocity of the tracked target is through the water if own ship's selected speed is water stabilised, or over the ground if own ship's selected speed is ground stabilised.

When a tracked target's predicted range is less than the minimum tracking range the tracked target is dead reckoned using a constant velocity without any Lost Target alarms being raised.

Any VisionMaster FT console required to meet the target accuracy scenarios of IEC62388 must be supplied with compass information in analogue form, or in serial form conforming to IEC61162-2.

Note: *If heading data input fails then it will not be possible to track targets and the presentation mode changes to Head Up Unstabilised.*

8.18.1.1 Tracking Targets on a Multi-Node System

Whenever the limits for CPA/TCPA or BCR/BCT are changed, they are distributed to all other nodes. This ensures that all nodes are evaluating the alarm condition using the same values. Each node evaluates the alarm conditions on the targets processed by that node.

Whenever a target alarm (CPA, BCR, lost target) is acknowledged on a node, all targets of the same number on other nodes have their alarm condition acknowledged. If other nodes have alarms for targets not present on the acknowledging node, the alarm condition for these targets remains unchanged.

8.18.1.2 Automatic Dropping of Targets

An auto-drop mode can be enabled in which individual AIS or tracked targets, deemed not to be a threat to own ship, are automatically dropped by the tracker without an alarm being raised.

8.18.2 Target Vectors

Vectors indicate the velocity (speed and direction) of own ship and moving targets. All vectors are shown as a dashed line beginning at own ship CCRP or the target origin. The length of the vector indicates speed and its bearing indicates direction.

The vector mode determines whether the vectors represent the true velocity of targets or their velocity relative to own ship. The vector mode is either True (T) or Relative (R) and is aligned with the Trails mode (relative or true).

8.18.3 AIS Targets

AIS targets are displayed in a Sleeping or Activated state. AIS targets can become activated either manually or automatically. An activated AIS target can be manually changed to Sleeping.

An activated AIS target is displayed with heading and speed/course vector, if heading data is invalid the course vector is shown in place of the heading line.

Sleeping targets will become automatically activated:

- when selected by the operator
- when the target infringes the CPA/TCPA limits
- when the target enters an auto-acquisition zone

The following alarm states apply to all AIS targets:

- Infringe bow crossing limits (range and time)
- Dangerous target (CPA/TCPA infringement)
- Enter acquisition zone
- Lost (sleeping targets do not raise a Lost alarm)

The system uses ship categories and intervals to define when a target is shown as lost.

AIS targets are prioritised as Class A or Class B, according to importance. The system can display class A targets only, class B targets only, or class A and B.

Table 49: Ship Categories and Lost Target Intervals

Ship Category	Lost Target Interval (Class A)	Lost Target Interval (Class B)
anchored or moored and speed <= 3 knots (class A), <= 2 knots (class B)	18 minutes	18 minutes
anchored or moored and speed > 3 knots	60 seconds	18 minutes
0 <= speed <= 14 knots (class A), 2 to 24 knots (class B)	60 seconds	180 seconds
0 <= speed <= 14 knots and changing course	60 seconds	180 seconds
14 < speed <= 23 knots	36 seconds	180 seconds
14 < speed <= 23 knots and changing course	36 seconds	180 seconds
speed > 23 knots	30 seconds	180 seconds
speed > 23 knots and changing course	30 seconds	180 seconds

When an AIS target is activated the system displays alphanumeric information on the target.

In addition to the tracker parameters shown in Table 48, for AIS targets the system displays the additional information of the target's current heading.

Up to 240 AIS targets and other AIS navigation symbols can be displayed in the video circle at any one time. The targets closest to the CCRP will be displayed.

When AIS targets are not displayed, received AIS transmissions continue to be processed so that the targets will be displayed if they move into the closest 200 to the CCRP.

The maximum number of active AIS targets on a single node or multi-node is 40.

An alarm is raised if the number of displayed AIS targets or activated AIS targets exceeds the maximum.

8.18.4 Multi-Node Targets

Targets are distributed to all other nodes to allow correlation. Only one node is responsible for correlating targets at any one time. The correlation information is distributed to ensure target numbering across all nodes is identical.

On an Radar/Chart Radar only local tracked targets, acquired by the operator on that node, are displayed. These tracked targets will not appear on other Radar nodes unless the operator manually acquires the same target. In the same way AIS targets may be activated and set to sleeping on an individual node without appearing on other nodes.

8.18.5 Auto-acquisition Zones

An acquisition zone is defined as a annular or polygonal area of the display. Two annular and two polygonal acquisition zones can be defined by the operator. Any target that enters these areas is automatically acquired and tracked by the system. Each acquisition zone can be turned on or off. Acquisition zones are relative to own ship's heading and are disabled after the heading data becomes unusable.

8.18.5.1 Annular Acquisition Zones

The default annular acquisition zones are two sections of an annulus. The zone annulus is defined from the start bearing clockwise to the end bearing, i.e. the arcs will extend clockwise from the start position. The ranges and depths are the same, irrespective of whether a metric, NM, or SM display has been selected.

If an attempt is made to define a zone with a subtended angle of >354º, the result will be a 360º zone.

Table 50: Auto Acquisition Zone Parameters

Limits on Annulus		
Parameter	**Min**	**Max**
Range	1.0 NM	40.0 NM
Depth	0.4 NM	2.0 NM
Bearing (when not a full annulus)	6°	354°

The initial auto-acquisition zone definitions (i.e. the first time the system is run) are shown below.

Table 51: Auto Acquisition Default Zone Definitions

Default Zone Definitions	
Zone 1	
Range	4 to 5 NM
Bearing	270° to 90°
Zone 2	
Range	12 to 14 NM
Bearing	270° to 90°

8.18.5.2 Polygonal Acquisition Zones

Up to 10 randomly shaped polygonal zones may be constructed from defined points, at a maximum distance of 40NM from own ship. Once defined, polygonal zones may be turned on and off (active or inactive).

8.18.6 Cancel All Targets

When this option is selected tracked targets are dropped and AIS targets set to a sleeping state if they meet the following criteria:

- It is not the echo reference target
- The target is an AIS target that does not infringe the CPA/TCPA or Bow Crossing alarm criteria
- The target is an AIS target and is not in an auto-acquisition zone.

8.18.7 Past Position Dots

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.

Table 52: Past Position Dots Intervals

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.

8.18.8 Test Targets

Test Targets include a fixed test target pattern which is stationary relative to own ship, and a number of user defined movable test targets (the number is defined by the radar interface board). Test targets’ video is mixed with the radar video so that they can be displayed and tracked in exactly the same manner as live targets.

Both fixed and moveable test targets are displayed on the screen as flashing crosses.

When either test target is on, a letter ‘X’ is displayed at the bottom of the presentation area.

When test targets are displayed on a simulated radar video the letters XX are displayed.

8.18.9 Track Table Output

Track table transmits data for own ship, system information and all system target data. This data includes course, speed, position, type (e.g. tracked, AIS etc.) and source of target (e.g. tracker).

The CCRP is used as the data reference point.

The system provides RS232 and RS422 serial output of the track table data with the following options:

- No output (default)
- Output as IEC 61162-1
  (i.e. serial interface at recommended baud rate of 4800)
- Output as IEC 61162-2
  (i.e. serial interface at recommended baud rate of 38400)

Other baud rates (for example, 9600) are available if a non IEC 61162 output is required.

The track table output contains the following message types, output every two seconds:

- Own ship data (OSD)
- Radar system data (RSD)

The following target message formats may be selected for output:

- Tracked Target Data (TTD) default setting - data on up to four targets is encapsulated within each TTD sentence.
- Tracked Target Message (TTM)
- Target Latitude & Longitude (TLL)

  TTM and TLL messages are sent in rotation, actual output rates depend on the baud rate and how many targets have been selected for output.

  A TLB (target label) message is always output if configured.

8.19 Navigation Tools

8.19.1 Navigation Marks

Navigation marks can be defined anywhere within the video circle by the operator. Each Nav mark corresponds to a LAT/LON position.

8.19.2 Parallel Index Lines

Multiple sets of parallel index (PI) lines can be defined and displayed simultaneously on range scales of 0.25 NM and above, with each set including up to fifteen PI lines. Each PI line spans the video circle.

Sets of PI lines can be imported or exported between consoles.

Saved PI lines are distributed among system nodes.

8.19.3 Mapping Objects

A selection of pre-defined mapping objects (lines, danger points, areas, buoys, nav marks and beacons) can be defined by the operator.

Mapping objects can be saved as groups. Grouped objects and geographic mark-up areas can be saved, or saved and retrieved from a shared database and imported and exported to or from other nodes or external drives.

8.19.4 Parallel Cursor

A rotating parallel cursor, centred on the CCRP, can be displayed. The parallel cursor consists of two orthogonal lines (axes) extending to the edge of the video circle with their axis crossing point at CCRP. A series of equally spaced parallel lines, spaced at the currently set range ring interval, are shown on either both sides of the CCRP (full mode) or one side of the CCRP (half mode).

The parallel cursor bearing can be true or relative. In True Bearing the parallel cursor is azimuth stabilised (i.e. maintains a constant orientation with respect to north). In Relative Bearing the parallel cursor is unstabilised (i.e. maintains a constant orientation with respect to ship's heading).

8.19.5 OwnShip History

Ownship history tracks are a series of lines indicating the past locations of ownship as defined by position sources. There are two types of history track:

- Primary - a line indicating the past location of ownship as defined by the configured position sensor (usually GPS).
- Secondary - lines indicating the past locations as defined by other position data sources.

Primary and Secondary history tracks may be displayed simultaneously . The displayed track length is variable from 1.0 minute to 24.0 hours.

Event marks may be added at any time to ownship's history track.

8.19.6 Line of Position

The geographic location of own ship can be determined by using Lines of Position (LOP), which are created by taking bearings and/or radar measurements from own ship to suitable objects on the radar display. When two or more LOPs are created a fix of own ship's position may be obtained.

8.19.7 Anchoring

Anchoring enables the operator to plan an anchorage, monitor the anchoring status, control the display of the anchorage parameters, and monitor the anchor drag after the ship is anchored.

8.19.8 Man Overboard

The MOB function of the system enables management of a MOB emergency. The estimated position of the person in the water is calculated based on the Set and Drift values that were active when the MOB operation was initiated.

8.19.9 Display Settings

8.19.9.1 Ownship

The display of the following own ship synthetics data may be controlled:

- Beam Line length adjustment.
- Display of the following:
  - True Scale Outline
  - Stern Line
  - Antenna position
  - Predicted ship position
- Own ship vector settings, including tick marks, tick mark interval time and arrow heads.
- Ground Stabilized Vectors, including:
  - Predicted Vector display
  - Ownship Vector display
- Predicted Outlines, including:
  - Predicted Ship display
  - Predicted Path display

8.19.10 Next Turn EBL

Next Turn EBL is data transferred from an external Voyage Management System (VMS), which can then be represented graphically in the video circle.

8.19.11 Grid

A LAT/LON grid can be displayed. The grid values are taken from the latest valid position of the CCRP, as reported by the position sensor.

The grid is only displayed when the presentation mode is North Up (N-UP). If the presentation mode is changed to Course Up or Head Up the grid is removed from the video circle.

The grid can display between two and four LAT/LON lines, based on the scale of the display.

The LAT/LON grid will not be displayed when the chart orientation is 45° to 135° and from 225° to 315°.

8.19.12 Clearing Lines

Clearing Lines are bearing lines or range lines used to approximate a position where a danger to ownship lies. These lines enable the mariner to navigate around the dangerous area.

8.20 Routes

Route plans may be created, stored and exported. A route is made up from a number of user defined waypoints. A route can contain up to 200 waypoints.

When a route is monitored, the system tracks own ship’s movement in relation to the route plan, and provides notification of wheel-over points, dangerous objects in the area, and other required information.

Up to a 100 route plans may be saved to a database, which are then editable from any node on the system. If the same route plan is being edited on more than one node at the same time, the operators at the other editing nodes are notified when the plan is saved.

Route plans cannot be created or edited on a CAT2 Radar system.

8.20.1 External Route Plans

External Route Plans (ERPs) are route plans that were created and stored on a GPS unit, a legacy VMS unit, or some other device external to VisionMaster FT. These route plans may be displayed if they are sent using IEC 61162 RTE and WPL sentences over a serial connection.

Only basic monitoring (cross-track distance, distance to waypoint, and estimated time to waypoint) is provided for ERPs. Track control, return-to-plans, alarms, and the ability to save are not provided for ERPs.

8.21 Charts

Charts are available for display if the product type is a Chart Radar.

Chart information uses the same reference and coordinate criteria as the radar and AIS, including datum, scale orientation, CCRP and azimuth stabilisation mode.

Radar information has priority over chart information. Chart data is displayed such that the radar is not substantially masked, obscured or degraded.

All chart information may be temporarily removed from the video circle by a single operator action.

All chart information, with the exception of coastlines, may be temporarily removed from the video circle by a single operator action.

A Chart Radar node allows vector charts only to be displayed. The system supports both C-MAP and SevenCs vector chart engines.

8.21.1 C-MAP Chart Formats

The C-MAP chart engine supports the following chart formats:

- Professional (unofficial chart format*)
- Professional + (extended version of CM93v3 charts supplied on DVD)
- ENC (official S-57 encypted charts converted to C-MAP's proprietary chart database format)
- Jeppesen Primar†

8.21.2 SevenCs Chart Formats

The SevenCs chart engine supports the following chart formats:

- S-57 (unencrypted official chart format‡, implementation based on IHO S57 standard)
- S-63 (encrypted S-57 official chart format, implementation based on IMO S63 standard).
- World Map (ENC)**.

SevenCs presentation libraries are supported.

* Unofficial chart format is data which does not comply with the S-57 Edition 3 format (document published by National Hydrographic Offices).

† The JeppesenPrimar database consists of official ENC data from Primar and unofficial C-Map chart data where official data is not present.

‡ Official chart format data which complies with the S-57 Edition 3 format.

** The World Map database is delivered with the SevenCs Chart Engine and is based on the NGA World Vector Shoreline 1:250,000 charts. The structure of the data is defined by the IHO S-57 specification

8.21.3 Chart Display Mode

Charts can be displayed in the following modes:

- Chart Filled - the land colour fill shows as a different colour than the water and chart objects are filled with the applicable colours.
- Chart Unfilled - the land and sea are the same colour and coastlines, safety contours and other objects are shown in outline only.
- Charts Off - no chart information is displayed.

The display of charts is suppressed if the presentation mode is in Head Up, i.e. unstabilised.

8.21.4 Chart Feature Sets

The following types of chart feature sets can be selected: Base (default), Standard and Other.

Base is the bare minimum allowable feature set. Standard is a superset of Base that includes additional information. Other is also a superset of Base, but may contain information not available in Standard.

Some features are common across chart formats, while others are particular to a specific format. A chart feature set can be customised by applying specifically selected features.

The selection of chart feature sets and the application of custom features is governed by the current range scale. All feature sets are available and custom features can be applied at range scales of 12 NM and below.

At higher range scales the following feature sets can be applied.

- at 96 NM Base chart set only is available;
- at 48 NM Base and Standard chart sets are available;
- at 24 NM Base, Standard and Other chart sets are available.

8.21.5 Chart Match

Chart Match allows the operator to correct any discrepancy between the radar video and the chart display. By selecting the radar object and the chart object to be matched, an offset can be created that is applied to the chart display. This offset persists until the chart match is cancelled, or until the chart cells displayed on the screen at the time of the selection are no longer on the screen.

Chart Match includes the capability to specify a range and bearing adjustment to be applied to any loaded chart in order to alter the chart's relative position to the own ship's CCRP plotted position.

8.21.6 Chart Updates

All chart updates made by the operator are logged in the chart engines. A record of C-MAP updates is kept in the C-MAP database; the SevenCs engine keeps a record of updates in a log file.

If an update is not properly applied or the update is out of sequence the update is terminated, an update rejection is logged by the system and a warning of this action is given.

8.21.7 Chart Installation

Chart Installation enables the loading of charts onto the system hard drive from a chart installer utility. If the chart type supports network installation, chart installation can be made from any node on the system.

Chart databases can be installed from a CD/DVD or external device such as a USB memory stick. A license file (C-MAP) or user permit (SevenCs) for the chart database, provided by the chart supplier, is installed from a memory stick.

Information on installing charts is given in Chapter 1 of the VisionMaster FT Supplementary Features User Guide, 65900014.

8.21.8 Chart Permissions

Information on chart license and permit expiration can be viewed. When a chart license or permit is about to expire a warning is generated. If the C-MAP license has expired the system stops displaying the respective charts.

8.21.9 Chart Depths/Heights

The following depth and height safety threshold values may be applied:

Table 53: Chart depth/height threshold values

Depth	Default	Min	Max
Safety Depth	30 metres	Distance from water surface to bottom of ship's keel, plus own ship's safety buffer (usually half ship's beam)	N/A
Safety Height	30 metres	Distance from ship's highest point to lowest point of the overhead obstruction.	N/A
Shallow Contour	2 metres	0 metres	30 metres (default safety depth)
Deep Contour	30 metres	30 metres (default safety depth)	N/A

8.21.10 Chart Query

The chart query facility enables detailed information on geographic objects and specific chart areas to be made.

The following query options can be selected:

- Filter - search by geographic type (points, lines, areas, arcs and/or 3D and cluster points)
- Area Size - search area as a factor of scale (small, medium, large)

8.21.11 Chart Dangers

Safety checking continuously searches the chart database and mariner objects database for objects that could endanger the safety of own ship.

Contours, prohibited areas, and areas with special conditions are considered dangerous if their depth is less than own ship's safety depth or no depth is defined for that object.

All objects above the water are considered dangerous if their clearance is less than own ship safety height. When safety checking detects a dangerous object, a Chart Dangers alarm appears and a Dangers icon is displayed with a red background.

Own ship's safety region is indicated by a lined area following own ship's course over ground, as own ship moves across the screen the line is redrawn every 30 seconds. The time or distance length of the safety region line may be changed.

8.21.12 Chart Copy

Chart Copy enables charts that have been installed locally on a node to be copied to other nodes in a multi-node system.

8.21.13 Chart Projections

Chart Projections enables Mercator or Polar Stereographic projection types to be selected. The preferred projection is local to each node.

Mercator is the default chart projection, used to display geographic areas between 0 degrees and 80 degrees latitude north or south. The exception to that is with non-navigational scales (1:1,000,000 or above) where Mercator can view regions up to 85 degrees North/South.

In a Polar Stereographic projection the lines of longitude emanate from either the north or south pole (depending on which hemisphere is being displayed), and lines of latitude are displayed as concentric circles around the pole.

8.22 Safety Checking

Depth, height and look-ahead time/distance safety checking parameters may be specified on any node and then synchronized between all nodes.

Each node only lists the objects of concern detected by own ship safety checking the charts on that node. The periodic own ship safety checking is triggered on all nodes at the same time.

Only one alarm is raised for all chart dangers or cautions found on all nodes during safety checking. Chart Danger announcements will appear on all nodes, irrespective of whether a node has the necessary chart installed.

8.23 Time Management

Time management is controlled by the selected sensor source, for example GPS. The selected time sensor is used by the system to synchronize the time for all nodes.

Time Management provides the operator with the option of entering a local date and time offset from GMT in hours and minutes. The time zone offset may then used by the system to display local time.

8.24 Data Logging

The system logs the following voyage data to XML files:

- Sensor
- Own ship/CCRS
- Routes
- Targets
- Charts

Node state information for all nodes in the system is logged to XML files at a periodic default rate of 5 seconds (configurable between 1 and 60 seconds).

8.25 Supplementary Features

The following supplementary features will be available at the VisionMaster console if commissioned:

- NAVTEX
- Weather Fax
- Third Party Applications

8.25.1 NAVTEX

This is an optional feature whereby VisionMaster is able to access information from NAVTEX transmitting stations, which routinely broadcast urgent coastal marine safety information to ships with a NAVTEX receiver. The information is received by installing a Client/Server application called PC NAVTEX.

The Server communicates with the NAVTEX receiver through a serial connection and stores the messages in a database. Only one Server is configured in a multi-node system.

The Client provides the user interface that presents NAVTEX messages to all nodes on a multi-node system.

Information on installing and configuring the PC NAVTEX software for Server and Clients is given in VisionMaster Ships Manual Volume 2, Chapter 1 '*Appendix C Configuring Peripheral Devices*'.

8.25.2 Weather Fax

The Furuno Weather Fax (FAX30) is a device that receives weather images and navigational information from a built in radio receiver and displays the information on a web page using an internet browser installed on the VisionMaster PC.

8.25.3 Third Party Applications

Third Party Applications can be launched and viewed from VisionMaster, either as a popup window, or as an integrated watch mode.

8.26 VDR Output

The radar display output for VDR (Voyage Data Recorder) can be located in dfferent positions depending on the monitor in use.

The 19” and 23.1” monitors provide buffered SXGA video outputs on a 15-way high density plug at a resolution of 1280 x 1024.

When using a 25.5” or 27” monitor with a 1920 x 1200 widescreen picture format there will be a DVI or HDMI output from the processor that can be used for the VDR.

If the VDR does not support the 1920 x 1200 widescreen format then the monitor resolution must be downgraded to 1280 x 1024. In this format the VDR output will be via a 15-way plug on the processor. For information on changing the monitor settings refer to VisionMaster Ships Manual Volume 2, Chapter 1 ‘*Configuration*’, section 6.13 ‘*Monitors*’.

When the output is required to come from the processor it will be necessary to configure a ‘Secondary Monitor’ output. Information on configuring secondary monitor output is given in the VisionMaster FT Ship’s Manual, Vol 2, Chapter 3 ‘*Conning Information Display*’, Appendix A ‘*Configuring a Second Monitor*’.

A video splitter will be required if a VDR output and a Conning Info Display (CID) secondary screen is required.

9 ECDIS Specification

The following ECDIS specification sub-sections are included where there are differences between the ECDIS and Radar specification, or where the ECDIS specification includes features additional to radar. For information on common features, refer to Section 8 '*Radar Specification*'.

If a workstation is to be used as an ECDIS, either configured as a standalone or as a Total Watch, then the system requires an Uninterruptible Power Supply (UPS) to be fitted.

For further information on connecting a UPS, see *Chapter 3 'Installation'*.

9.1 Scale Ratio

Scale Ratio includes two selection modes: Automatic and Manual.

- Auto Scale - the current scale ratio of the display area for ownship is regularly checked against the compilation scale of the largest chart cell. If the scales differ, the scale ratio is changed to match the compilation scale of the chart.
- Manual Scale - the scale ratio that may be selected manually is between 1:500 and 1:8,000,000.

Table 54: Scale Ratio, Range Rings and Pulse Lengths

		Available Pulse Lengths		
Scale Ratio	**Range Rings (NM)**	Short	Medium	Long
1:4,000	0.05	4		
1:5,000	0.05	4		
1:8,000	0.1	4	4	
1:10,000	0.25	4	4	
1:15,000	0.25	4	4	
1:20,000	0.25	4	4	
1:30,000	0.25	4	4	
1:40,000	0.5	4	4	
1:50,000	0.5		4	4
1:80,000	1		4	4
1:100,000	1		4	4
1:150,000	2		4	4
1:200,000	2		4	4
1:300,000	4		4	4

Note: *Only the scale ratios where radar video is present are listed in Table 54.*

9.2 Own Ship

There are two types of symbol used to display own ship’s position and heading, defined as follows:

- Outline Symbol: This symbol is drawn such that its length and width represent the configured length and beam of the ship.
- Circle Symbol: The circle symbol is displayed if the outline symbol cannot be resolved at the given scale.

Either symbol is shown in red if the position data is invalid. If heading data is invalid the outline symbol is not displayed, although the circle symbol remains in the system colour.

9.2.1 Heading Line

The ship's heading line (HL) is shown as a single line starting from own ship’s CCRP and drawn to the edge of the chart display.

The bearing of the HL is dependent on the presentation mode.

- In Course Up (C UP) mode the heading line is initially drawn vertically and then changes dependant on the current heading bearing.
- In North Up (N UP) mode the heading line is drawn at the current compass heading.

The HL may be shown as a stern line (SL) drawn behind own ship. The type of marker (HL or SL) can be selected for one or more transceivers during top unit configuration, see VisionMaster Ships Manual, Volume 2, *Chapter 1, ‘Configuration’*.

9.3 Presentation Modes

There are two presentation modes available: North Up and Course Up.

- **North Up** - power on default mode. True north is at the top of the chart window with the North arrow pointing vertically and ship’s heading marker shown at the appropriate bearing. North Up is selected when a valid compass input is unavailable.
- **Course Up** - the ship’s bearing is shown pointing north with the North arrow pointing in the direction of true north. A valid compass input is required for Course Up mode.

If raster charts are displayed the presentation mode is dictated by the orientation of the currently loaded chart. If the displayed chart is a north oriented raster chart then North Up will be the only available presentation mode. If the raster chart is not north oriented then an additional presentation mode ‘**Chart Up’** will be the only presentation mode available.

9.4 Motion Modes

The only motion mode currently available for ECDIS is True Motion (TM).

In TM mode the movement of own ship is confined to a TM limits box, the size of which may be defined by the user. When own ship reaches the edge of the TM limits box, and true motion reset limits are enabled, the display is reset automatically, or reset manually as required.

9.5 Trails

Long, Short and Permanent trails are selectable. Trails can be removed from the display by selecting Off, or the trails time reset to zero by selecting Reset. The long and short trail lengths are shown on the display, and are dependent on the selected scale ratio as shown below.

Table 55: Trails Parameters

Scale Ratio	Short Time	Long Time
1:4,000 to 1:10,000	15 seconds	30 seconds
1:15,000 to 1:40,000	30 seconds	60 seconds
1:50,000 and above	60 seconds	120 seconds

True Trails are selected by default, and represent either ground stabilised or water stabilised motion. Relative trails can also be selected.

Permanent trails are timed for up to 60 minutes, and can be displayed until manually reset. > 60 minutes is displayed when above 60 minutes.

9.6 Video Transparency Levels

If the ECDIS has radar overlay, the radar video can be turned on or off in ECDIS presentation mode.

The video shall not obscure chart information and be clearly distinguishable from the chart information within appropriate tolerances in:

- Scale
- Orientation
- Projection

Radar video is removed from the chart window if the scale ratio is 1:500,000 or more, or 1:3,000 or less.

The transparency level of the radar video may be set from 20%, 40%, 60%, 80% or 100% (opaque).

9.7 Primary and Secondary Presentations

The ECDIS may be viewed as a primary display (where one chart covers the whole display area), or a primary and secondary presentation.

The chart presentation options available are:

- Primary (secondary presentation off)
- Primary and Secondary (vertical split screen)
- Primary and Secondary (horizontal split screen)
- Primary, with secondary screen as popup window (picture in picture mode)

9.7.1 Picture in Picture Mode

When the system is first switched into picture-in-picture mode, the secondary chart window is shown as a popup window over the primary chart window. The secondary chart window can be moved and resized within the maximum and minimum limits.

9.7.2 Split Screen Mode

When the system is first switched into a split screen mode (vertical or horizontal), the primary and secondary chart windows occupy an equal amount of area on the display. The secondary chart window can be resized within the maximum and minimum limits.

9.8 Chart Formats

In addition to the C-MAP and SevenCs vector chart formats listed in Section 8.21 '*Charts*', the ECDIS also includes the ability to display charts in raster format. Raster charts are available as ARCS format under the SevenCs chart engine. ARCS charts are installed via the Chart Installer.

9.9 Navigation Tools

The following Navigation Tool features are specific to ECDIS.

9.9.1 Distance Line

The Distance Line facility enables a Rhumb line to be drawn with a start and end point at specified locations. If the line covers a large distance a Great Circle line is visible on the display, in addition to the Rhumb line.

9.10 Multi-Node Targets

An ECDIS in a multi-node system will display all tracked targets from other nodes and all AIS targets in the system.

The following apply for an ECDIS with radar overlay:

1. Targets may be acquired and AIS targets activated.
2. Targets may be cancelled, providing they are not being tracked on other radar nodes, or selected on other ECDIS nodes.
3. AIS targets may be set to sleeping providing they are not selected on other nodes.

The following apply for an ECDIS without radar overlay:

1. Targets may not be acquired or cancelled.
2. AIS targets may be activated and set to sleeping providing they are not selected on other nodes.

Radar and Chart Radar nodes on a multi-node system are not affected by actions taken on ECDIS nodes.

9.11 TotalTide

The TotalTide feature allows tidal data from the UKHO TotalTide application to be obtained. The feature enables tide heights and tidal currents from thousands of tidal stations around the world to be viewed.

TotalTide includes the following tab folders:

- TotalTide - lists the tide stations (onshore and offshore) visible on the chart display, the data from each selected station also appears.
- Administration - allows access to the Total Tide application and the License Wizard, which enables TotalTide licenses to be updated as and when required.

9.12 Speed Control

The Speed Control feature may include the following interface options:

- Track Control (Autopilot Interface)
- Propulsion Control (Propulsion interface)

9.12.1 Track Control System

Track Control, in conjunction with position, heading and speed information is intended to keep the ship automatically on the currently monitored route under various conditions and within the limits related to the ship's manoeuvrability.

A track control system consists of one or more VisionMaster nodes and an Autopilot. If compliance with international standards for track control is required, the configured autopilot for the VisionMaster system must be a Sperry NAVIPILOT 4000.

9.12.2 Autopilot

The Autopilot interface enables operator selection of three heading control modes, or the system may automatically switch the heading control mode under certain failure scenarios. The Autopilot control modes are:

- Autopilot Heading Mode
- VisionMaster Heading Control
- Track Control

An Autopilot interface may also include a Joystick Controller.

9.12.2.1 Autopilot Heading Control

Autopilot heading control enables the Autopilot to have full control of ship's heading. In this mode the heading order and turn rate is set at the Autopilot.

9.12.2.2 VisionMaster Heading Control

VisionMaster Heading Control is the default steering mode when NAV Mode (external heading control) is selected from the Autopilot. In this mode the heading order and turn rate is set at the VisionMaster console.

9.12.2.3 Track Control

Track Control mode allows the VisionMaster system to automatically adjust the heading order and the rate order to steer own ship along the track of a monitored route.

9.12.2.4 Joystick Heading Control

A Joystick Controller, generally mounted in the armrests of chairs on the bridge, provide simple heading control of the autopilot and entry of temporary route plans that connect to a monitored route plan.

9.12.3 Propulsion Control

Propulsion Control enables VisionMaster to control the speed of the ship by interfacing to the ship's propulsion system via an external controller.

The following types of propulsion control interfaces may be used with VisionMaster:

- Kamewa
- Emri

The following control modes are available when VisionMaster is connected to an external propulsion interface:

- Propulsion System - indicates that control of the propulsion system is at the propulsion hardware (i.e. VisionMaster is not in control).
- VisionMaster Speed Control (Manual) - this is the propulsion control mode that is automatically selected when the propulsion system state first becomes external control enabled. In VisionMaster Speed Control the water speed order may be manually entered.
- Route-Based Speed Control (Automatic) - a control mode in which the speed orders are automatically generated based on the monitored Speed Plan, see Note below.

Note: *Automatic Route Based Speed Control is a purchasable feature (see Section 10 'Purchasable Features') whereas manual speed control (Propulsion System) and VisionMaster Speed Control are available in a Propulsion Control system without purchase.*

10 Purchasable Features

The following products and interfaces are purchasable features that can be added to VisionMaster FT (VMFT):

- iView3D
- iView3D with SonarWatch
- iVideo (CCTV LAN and PiP)
- Automatic Route Based Speed Control (see Section 9.12.3 '*Propulsion Control*')
- Dual Channel Radar
- PBN: Fuel Navigator

10.1 iView3D

iView3D is a 3D display which shows a 3D visualization of ownship, chart depth information, and sonar data (if enabled).

The View window shows the size of the 3D ownship so that its height, width, and length are drawn to scale as specified in the Configuration tool. Ownship is drawn so that its keel is shown at maximum draft.

A 3D representation of the ocean floor is produced based on depth information provided by chart data in S-57, VPF or C-Map proprietary format.

The actual 3D display is square and has finite extents outside which no data is displayed. The area within the extents is called the scene. VMFT supports a scene of at least 2,500 meters by 2,500 meters.

On non-widescreen displays, the iView3D is only available in the ECDIS watch mode.

On widescreen displays, the iView3D may be displayed in Radar/Chart Radar watch modes as part of the left side CID panel.

10.2 iView3D with SonarWatch

The iView3D with SonarWatch feature includes a 3D display and also enables the VMFT to process and display information provided by an external sonar device.

The SonarWatch uses a sonar array, mounted on the bow of the ship and below the water line. The sonar returns two types of data, bottom data and in-water objects. Bottom data is the sonar return that reflects the depth of the ocean floor within the limits of the sonar. In-water objects are sonar returns that are disassociated with the bottom of the ocean such as a buoy, a dock or a whale.

Display of the underwater environment in 2D or 3D space is generated by the SonarWatch and then sent to VMFT.

10.3 iVideo

iVideo refers to a Closed Circuit Television (CCTV) feature which allows the operator to view real time streaming video over a network, or use the Picture in Picture (PIP) feature of the monitor to display CCTV. These dual capabilities are defined as CCTV-LAN and CCTV-HW respectively.

If the video feed is enabled via CCTV-HW, the CCTV will only be available on a full screen CID page, or the left side CID panel of a widescreen monitor.

If the video is generated via CCTV-LAN then up to four video feeds may be received and displayed as separate CCTVs.

The following video coding formats are supported for CCTV:
MPEG-4 and H-264.

10.4 Dual Channel Radar

A dual channel radar will include the following hardware:

- Two scan converter cards.
- PCIO plus an Auxiliary PCIO Unit.

The following general features are applicable to a dual channel radar:

- Targets can be tracked on one channel through blind arc of the other channel.
- Output of targets on the Track Table Output irrespective of the channel they are being tracked on.
- Allows X and S band transceiver superimposition.
- Displays origin symbol for Channel 1.

Transceiver features specific to a dual channel radar are:

- Independent display of transceiver video.
- Individual control of the transceiver.
- Individual Video Display On/Off control.
- Individual control of the other video related parameters (e.g. Gain and clutter controls).

10.4 PBN: Fuel Navigator

The PBN Fuel Navigator is an integrated VisionMaster feature that enables route optimisation, weather overlay location, and ship reporting data to be displayed.

The PBN Fuel Navigator communicates with the PBN Enterprise Server, a system external to VisionMaster.

For route optimisations, route data and configured ship characteristics are sent to the PBN system where it is used to create fuel optimized routes. The optimized routes are then sent back to the PBN Fuel Navigator for display.

For weather overlay location, type of overlay, and forecast time data is sent to the PBN system where it is used to generate an image. The image is then sent back to the PBN Fuel Navigator where it is overlaid on the chart.

For ship reporting from other VisionMaster subsystems data is retrieved to populate ship reports. The PBN Fuel Navigator sends the ship reports to the PBN Enterprise Server where they are transferred to the shore based reporting system via the ship’s on-board satellite communication system.

The PBN Fuel Navigator only runs on an ECDIS watch mode, as part of a multi-node system.

11 Conning Information Display

The Conning Information Display (CID) is available in the following configurations:

- When a node has been commissioned as a dedicated CID.
- When a node has been commissioned as a Total Watch, with CID available as a watch mode.
- On the left side of the display when using a widescreen monitor (in both Radar and ECDIS modes).

CID pages may display a variety of read-only information, including engine automation data, heading, position, route and steering status, CCTV video, weather data, etc.

The layout and mix of readouts on the CID pages is customised and edited from the CID Designer, which is accessed from the Config tool, for details see Volume 2 of the VMFT Ships Manual.

12 Central Alarm Management

Central Alarm Management (CAM) enables VisionMaster to serve as a central point for alarm announcements coming from external equipment on the ship.

The CAM uses the VMFT alarm output to forward unacknowledged announcements to all nodes on the system, and to other locations of the ship as necessary.

Only nodes configured as a CAM, Total Watch, ECDIS, or ECDIS with Radar Overlay product type support the CAM watch mode.

The CAM watch mode provides a full screen user interface where CAM announcements are displayed and can be acknowledged by the operator.

13 Playback

Playback enables the operator to view a history of recorded VMFT data through a series of two second screen captures, which are stored on the node in which they were recorded.

The amount of playback data that can be recorded is variable dependent on the actual node usage. In normal operating conditions the amount of recorded data available will be around 8 hours. When the size of retained Playback data has reached its maximum, the oldest data is automatically deleted until the amount of data is reduced to a defined minimum folder size. This renewal and deletion of playback data is a continuous process.

14 Transceiver Interface

14.1 Standby/Transmit

The display and the transceiver are in one of two operational modes, standby or transmit. In addition, when the transceiver is in standby it may also be warming up.

Note: *The operational mode of the display is considered separate from the operational mode of the transceiver to which it is connected.*

In the event of a Transceiver error the display switches from Transmit to Standby.

When a display is powered on in an Interswitch system the interswitch allocates a transceiver for the display to be connected to.

A dual channel radar includes two independent transceivers. Only when both transceivers are set to Standby is the system fully in Standby.

14.1.1 Warm Up

Upon power-on of a “cold” transceiver, a warm up period is required to prevent damage to the magnetron before it can start transmitting.

Note: *The power-on of a display will not necessarily mean the connected transceiver will start in warm up, as an interswitch in the system may maintain power to the transceiver even if no displays are currently connected to it.*

Note: *BME transceivers give an indication of warm up in the serial messages transmitted to the display. For use with non-BME transceivers a transceiver compatibility unit (TCU) must be used. If a TCU is not used then the interfacing equipment must conform to the protocols detailed in 65800/HIS/001 Display – Transceiver Interface.*

When a display is connected to a transceiver that is in warm up, either because of interswitching or from power-on, a count for the warm up period is displayed, starting at 0 and incrementing each second up to a maximum of 999. When the warm up period has ended the count is removed and the display is in Standby.

14.1.2 Master/Slave Control

The method of selecting Master or Slave Display operation is dependent on whether an interswitch is fitted.

1. Where no interswitch is fitted the system defaults to Master. The Master/ Slave Display selection is done as part of Commissioning and the transceiver identification is fixed at A.
2. Where an Interswitch is fitted the Master/Slave selection and Transceiver identification (A to F) is determined by the Interswitch.

A dual radar display must always be connected to the consecutive letters in the Interswitch, i.e. C and D.

When operating as a Slave Display on power-on the display defaults to standby but the connected transceiver does not change its operational mode.

14.2 Pulse Length

Three pulse length options are available:

- Short Pulse
- Medium Pulse
- Long Pulse.

Pulse lengths can only be selected on a Master Display, when the display is in Transmit.

The pulse lengths available depend on the selected range scale.

Where a change of range scale results in the pulse length having to change then the pulse length closest to the existing range scale is automatically selected. If the display's requested pulse length does not match the pulse length of its connected transceiver a pulse length error alarm is raised.

On a dual channel radar, channels 1 and 2 may have a different pulse length selected, providing both transceivers are in Transmit mode.

14.3 Transceiver Tuning

Two transceiver tuning modes are available, Automatic Frequency Control (AFC) and Manual. The current level of tuning is indicated by a shaded bar adjacent to the caption.

For a Master Display there are three tuning controls:

- AFC On/Off (power on default)
- Coarse Tune
- Manual Fine Tune

For a Slave Display the tuning mode and tune level are not controlled by the display but mirror the values of the connected transceiver.

The coarse tune level control allows the centre tune frequency to be set up for the transceiver to which a display is connected This control is typically done at Commissioning with the system default set to the centre value of the AFC tune range. A different level is stored for each transceiver and restored both at power on and when the transceiver is selected.

During the coarse tuning process any configured Sector Blanking is suppressed, when coarse tuning is complete the Sector Blanking is restored to its original setting.

When AFC is turned off manual fine tune is available for the operator to tune the connected transceiver.

14.4 Sector Blanking

Two blanking sectors can be set up for each Transceiver during Commissioning. These sectors inhibit radar transmission over an angular width of up to 180°, with a combined maximum blanking of 340°. Each sector is aligned and maintained with respect to own ship's head in all presentation modes for both centred and off-centred video displays.

On a dual channel radar both top units may have different blanking sectors active. Sector blanking for Channel 1 top unit may have the same start and stop angles as Channel 2 top unit, or a different set of start/stop angles.

Sector blanking is suppressed when:

- Coarse tuning the transceiver
- Performance monitor is on
- Video level is being adjusted.

14.5 Transceiver Interface in a Multi-Node System

The following settings are distributed and used among the system nodes:

- Coarse and fine tune levels
- Transceiver settings (i.e. Heading Marker Offset, Sample Pulse Start, Sample Pulse Width, Trigger Delay, AC Law and AC Spike)
- Performance monitor tune and XR/XT attenuator values

15 Power Requirements

15.1 Power Requirements and Unit Characteristics

The main 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.

Table 56: Power Requirements

Unit	Maximum Input Power
Consoles (Including Monitor, PCIO and Processor Units)	
250 Console (with 19" LCD)	310VA
340 Console (with 23" LCD)	310VA
19" Integrated Tabletop	250VA
Individual Units	
19" LCD	100VA
23" LCD	100VA
25.5" LCD	160VA
27" LCD	200VA
Processor Unit	150VA
PCIO Unit	60VA
X-band Scanner Motor and Transceiver	
Standard Speed Unit	250VA
High-Speed Unit	370VA
S-band Transceiver	
S-band Transceiver Unit	120VA
S-band Scanner Motor	
Standard Speed Unit - single phase	750VA
High-Speed Unit - single phase	750VA
Standard Speed Unit - 3 phase (per phase)	500VA
High Speed Unit - 3 phase (per phase)	600VA

Table 57: Unit Characteristics

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.

16 Mechanical Specification

16.1 Weights and Dimensions

Table 58: Weights and Dimensions

Console Assembly (including modules)	Height (mm)	Depth (mm)	Width (mm)	Weight (kg)
250 Console deck mounted	1102(1223*)	843	680	131.5
340 Console deck mounted	1102(1223*)	843	680	136.5
340 Console deck mounted (dual radar)	1102(1223*)	843	680	138
19" Integrated Tabletop	480 (484#)	650	460 (517#)	26
Desktop Assembly (not including modules)				
340 Console desktop	450(585*)	843	680	47.5
250 Console desktop	450(585*)	843	530	34
Console Modules				
250 Monitor (19" LCD) kit version	444	82	483	11.2
340 Monitor (23" LCD)	534	98	632	19
340 Monitor (25.5" LCD)	534	98	632	15.5
340 Monitor (27" LCD)	534	97	698	16
250 Monitor (19" LCD) in 340 console	534	86	632	14
Processor Unit (including mounts)	172.5	382	518.5	14
PCIO Unit	84	452	457	8.5
Auxiliary PCIO Unit	57	131	205	1
X-band Units				
Scanner Unit with 1.2m Antenna	440	586	1305†	42 36‡
Scanner Unit with 1.8m Antenna	440	586	1914†	44 38‡
Scanner Unit with 2.4m Antenna	440	586	2550†	46 40‡
Bulkhead Transceiver (658xxA, B, P, T, W)	607	327	370	23
Bulkhead Transceiver (658xxE, F, G, H, L)	607	330	370	19
S-band Units				
Scanner Unit + 2.7m Antenna + integral Transceiver	800	718	2800†	163.5
Scanner Unit + 2.7m Antenna. No integral Transceiver	800	675	2800†	150.5
Scanner Unit + 3.7m Antenna + integral Transceiver	800	718	3700†	176.5
Scanner Unit + 3.7m Antenna. No integral Transceiver	800	675	3700†	163.5
Bulkhead Transceiver Unit	515	318	402	25

* When monitor is in service position
\# When mounting straps are fitted.
† Antenna Turning Circle
‡ Excluding Transceiver

Refer to individual drawings in Chapter 3 ‘*Installing Top Units*’ and Chapter 4 ‘*Installing Consoles & Displays*’ for dimensions and weights of smaller components, such as the Control Panel Modules.

16.2 Console Mounting Options

The console components are supplied either as integrated unit (deck mounting) or as a kit for fitting into customer specified consoles. See Chapter 4 ‘*Installing Consoles & Displays*’ for installation details.

17 Compass Safe Distance

Table 59: Compass Safe Distance

Console Assembly	Standard	Steering
250 Console deck mounted	2.4 m	1.6 m
340 Console desktop	2.4 m	1.6 m
250 Console desktop	2.4 m	1.6 m
340 Console deck mounted	2.4 m	1.6 m
19" Integrated Tabletop	1.3 m	1 m
Console Modules		
250 Monitor (19" FPD)	1.8 m	1.8 m
340 Monitor (23.1" FPD)	2.6 m	2.6 m
340 Monitor (25.5" FPD)	1.2 m	0.8 m
340 Monitor (27" FPD)	0.5 m	0.3 m
Processor Unit	2.0 m	1.3 m
PCIO Unit	2.2 m	1.5 m
Auxiliary PCIO Unit	0.2 m	0.1 m
On-Off Switch Module	0.1 m	0.1 m
Trackball Module	0.4 m	0.3 m
USB connector	0.1 m	0.1 m
Control Panel Keyboard Module	0.4 m	0.3 m
X-band Units		
Scanner Unit 10kW	1.4 m	0.8 m
Scanner Unit 25kW	3.3 m	2.0 m
Scanner Unit (without Transceiver)	0.4 m	0.3 m
Bulkhead Transceiver 10kW	1.3 m	0.7 m
Bulkhead Transceiver 25kW	3.3 m	2.0 m
S-band Units		
Scanner Unit 30kW	4.1 m	2.4 m
Scanner Unit (without Transceiver)	0.8 m	0.5 m
Bulkhead Transceiver 30kW	4.3 m	2.6 m
Scanner Control Unit	0.8 m	0.4 m

18 International Specifications

This equipment meets the requirements of the following International Standards for maritime navigation equipment:

Table 60: International Specifications

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 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	2010	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
IEC 61174	2008	Maritime Navigation and Radiocommunication Equipment and Systems - Electronic Chart Display and Information System (ECDIS). Operation and performance requirements - Methods of testing and required test results.
IEC 62065	2002	Maritime Navigation and Radiocommunication Equipment and Systems - Track Control systems. Operation and performance requirements - Methods of testing and required test results.
IEC 62288	2008	Maritime Navigation and Radiocommunication Equipment and Systems - Presentation of navigation related information - General requirements, methods of test and required test results
IEC 62388	2007	Maritime navigation and radio-communication equipment and systems - Shipborne radar - Performance requirements, methods of testing and required test results

* These IEC documents are superseded by IEC 62388.

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Chapter 2

System Identification

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1 Introduction

The alphanumeric System Number allocated to the VisionMaster FT Series details the various units of the particular system to which the number refers. Each System Number may consist of up to seven identifying labels.

1.1 Radar System Identification

The description below covers all CAT 1 and CAT 2 Radar/Chart Radar variants.

The various labels (from 1 to 7) of VisionMaster FT Radar Series Part Numbers, shown below, are explained in more detail in Section 2 '*Radar System Identification Labels*'.

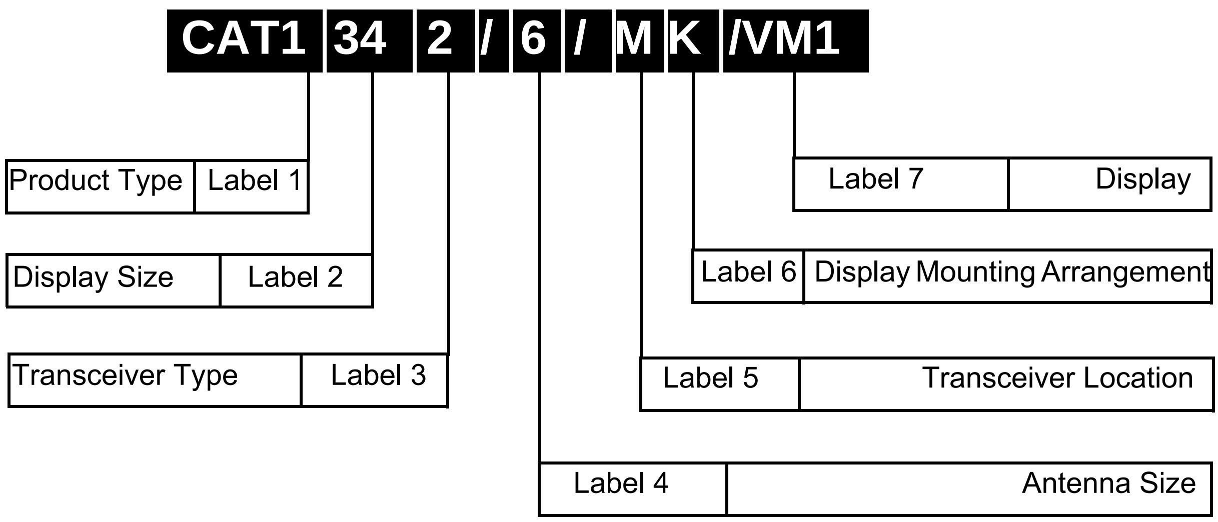

Figure 2.1 VisionMaster FT Radar Series Part Numbers

1.2 ECDIS System Identification

The various labels for a VisionMaster FT ECDIS (Electronic Chart Display and Information System) are shown in Figure 2.2, and are explained in more detail in Section 3 '*ECDIS System Identification Labels*'.

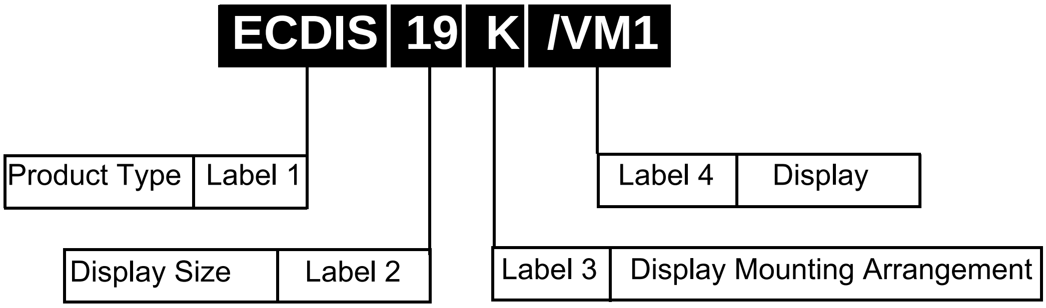

Figure 2.2 VisionMaster FT ECDIS Series Part Numbers

2 Radar System Identification Labels

2.1 Label 1 Radar Type

Label*	Radar Type
CAT1	CAT 1 Radar
CAT1C	CAT 1 Chart Radar
CAT1H	CAT 1 HSC† Radar
CAT1HC	CAT 1 HSC Chart Radar
CAT2	CAT 2 Radar
ECAT2	Enhanced CAT 2 Radar
ECAT2C	Enhanced CAT 2 Chart Radar
CAT2H	CAT 2 HSC Radar
ECAT2H	Enhanced CAT 2 HSC Radar
ECAT2HC	Enhanced CAT 2 HSC Chart Radar

*. With the exception of CAT2 and CAT2H, all other systems that are supplied as Dual Radar will have '(D)' added to the label ident
†. High Speed Craft

2.2 Label 2 Display Size

Label	Display Size
25	19" Display
34	23", 25.5" or 27" Display

2.3 Label 3 Transceiver Type

Label	Transceiver Type
1	10kW X-band AC Ship's Mains
2	25kW X-band AC Ship's Mains
3	30kW S-band AC Ship's Mains

2.4 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)

*. For non type approved systems

2.5 Label 5 Transceiver Location

Label	Transceiver Location
M	Masthead Transceiver
B	Bulkhead Transceiver

2.6 Label 6 Display Mounting Arrangement

Label	Display Mounting Arrangement
K	Kit format for mounting in console
T	Tabletop mounted
D	Deck Standing

2.7 Label 7 Display Technology

Label	Monitor Type
VM1	VisionMaster (for IEC 60936 & IEC 60872)
VM2	VisionMaster (for IEC 62388)

3 ECDIS System Identification Labels

3.1 Label 1 Product Type

Label	Product Type
ECDIS	ECDIS
ECDISRO	ECDIS with Radar Overlay

3.2 Label 2 Display Size

Label	Display Size
19	19" Display
23	23" Display
26	25.5" Display (widescreen)
27	27" Display (widescreen)

3.3 Label 3 Display Mounting Arrangement

Label	Display Mounting Arrangement
K	Kit format for mounting in console
T	Tabletop mounted
D	Deck Standing

3.4 Label 4 Display Technology

Label	Monitor Type
VM1	VisionMaster (1st Generation)
VM2	VisionMaster (2nd Generation)

4 Unit Type Numbers

A VisionMaster FT Radar System is configured from among the following unit types:

- Monitor Unit
- Processor Unit
- Security Block
- PCIO Unit
- Auxiliary PCIO Unit (Dual Radar Systems only)
- Control Panel Assembly
- 19" Integrated Tabletop (self contained console assembly)
- Interswitch Unit
- Antenna Unit
- Turning Unit (with or without Integral Transceiver)
- Bulkhead Transceiver Unit
- Scanner Control Unit (S-Band)

A VisionMaster FT ECDIS (without radar overlay) is configured from among the following unit types:

- Monitor Unit
- Processor Unit
- Security Block
- PCIO Unit
- Control Panel Assembly

A Client/Server Radar system is configured from among the following unit types:

- Monitor Unit
- Control Panel with I/O
- Processor Unit (Client)
- Processor Unit (Server)
- PCIO Unit
- Mains Distribution Unit
- Ethernet Server Switches
- 24V Power Supply Units (for Client and Server Ethernet switches)
- Security Block
- Antenna Unit
- Turning Unit (with or without Integral Transceiver)
- Bulkhead Transceiver Unit
- Scanner Control Unit (S-Band)

4.1 Monitor Unit

The Monitor Unit type number consists of a five-figures (e.g. 65923) followed by a single letter suffix (e.g. C). A typical complete Monitor Unit Type Number may therefore be 65923C. A further breakdown of the number is as follows:

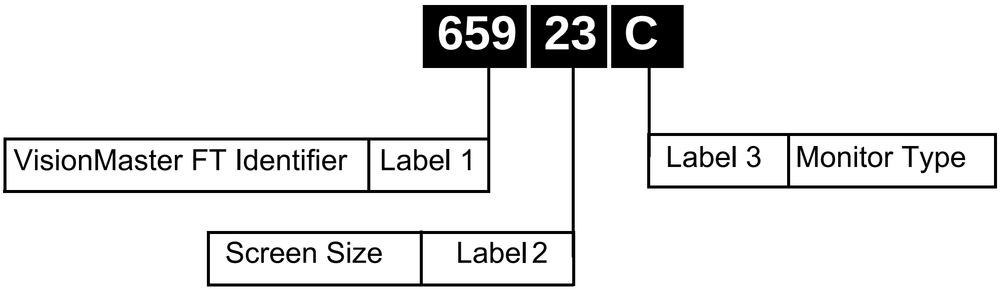

Figure 2.3 Monitor Unit Label

4.1.1 Label 1 Identifier

Label	Monitor Type
659	Visionmaster FT (glass fronted)
658	Kit format only (black bezel)

4.1.2 Label 2 Screen Size

Label	Diagonal
17	19" FST (250mm radar circle) Kit only
19	19" FST (250mm radar circle)
23	23" FST (340mm radar circle)
26	25.5" FST (320mm radar circle)
27	27" FST (340mm radar circle)

Note: *The 23" and 19" BridgeMaster E monitors (type 65823A and 65817G respectively) may be used in kit systems.*

4.1.3 Label 3 Monitor Type

Label	Monitor Series	Variant and Size
A	340	340 kit (Hatteland) black bezel
C	250/340	340 console/desktop (Hatteland)
E	340	340 console (Melford)
G	250	250 kit (Hatteland) black bezel
K	340	340 console (ISIC) - Radar only
L	340	340 console (ISIC)
T	250	250 desktop (Hatteland)

Note: *There is an independent On/Off switch for all monitors.*

Note: *The 19" and 23" monitors have a buffered video output. For the 25.5" and 27" monitors the buffered video output is from the processor.*

4.2 Processor Unit

The type numbers for the Processor Unit are as follows:

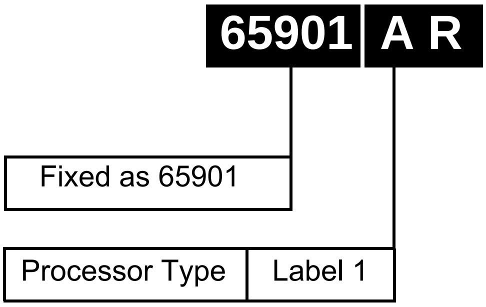

Figure 2.4 Processor Electronics Unit label

4.2.1 Label 1 Processor Type

Label	Processor Type
AR	Radar/Chart Radar and ECDIS with Radar Overlay (60936 and 60872 standards only)
AN	ECDIS only
AT	CAT 1 and CAT 2 versions of Radar/Chart Radar and ECDIS with Radar Overlay (62388 standard only)
AD	CAT 1 and CAT 2 versions of Dual Radar Chart Radar and ECDIS with dual radar overlay (62388 standard only)
AE	CAT 1 and CAT 2 versions of Dual Radar Chart Radar and ECDIS with dual radar overlay for standard and high speed antenna (62388 standard only)
AC	CAT1/CAT2 Client Processor Unit (no SC card)
AS	Server Processor Unit (with NFE 3 card)

4.3 Security Device

Security devices (product type identifiers) are provided as a 32SDV (32k memory size) or 32SDR (72k memory size) followed by a three-digit number, as defined below:

- 001 for CAT 1 Radar (also Enhanced CAT 2 Radar)
- 002 for CAT 1 Chart Radar (also Enhanced CAT 2 Chart Radar)
- 003 for ECDIS
- 004 for ECDIS with Radar Overlay
- 005 for Multi-node workstation
- 006 for Total Watch (CAT 1 Chart Radar and ECDIS)
- 008 for CAT 2 Radar
- 010 for Training mode

The security devices listed above are for individual workstations, with the configured product type for each workstation matching the security device fitted. The exception being 005 (multi-node workstation) where the product type selected in the configuration determines the mode of operation.

4.4 PCIO Unit

There are two types PCIO unit:

- 65900AA for Standard Compass (stepper & 360:1 synchro)
- 65900AB for Special Compass (1:1, 36:1, 90:1 & 180:1 synchro)

The standard compass PCIO unit is supplied for all serial compass input systems.

4.4.1 Auxiliary PCIO Unit

The following auxiliary PCIO unit is required for a dual radar system:

- 65940AA

4.5 Mains Distribution Unit

The following Mains Distribution Unit is required for a Client/Server Radar system:

- 65900685

4.6 Ethernet Switches

The following Ethernet switches are required for a Client/Server Radar system:

- RA00009746

4.7 Control Panel Assembly

The Control Panel Assembly includes Control Panel, On/Off switch and USB sub assemblies.

The control panel sub assembly includes a trackball (with integral keys), rotary controls, adjustment and acknowledgement buttons.

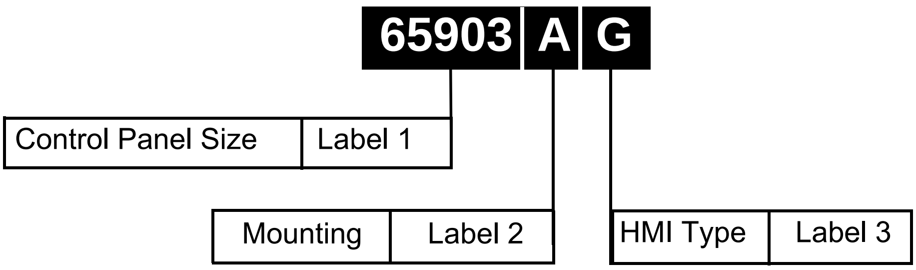

Figure 2.5 Control Panel Assemblies

4.7.1 Label 1 Control Panel Size

Label	Size
65903	23" FST
65909	19" FST

4.7.2 Label 2 Mounting

Label	Mounting
A	Integral
K	Kit

4.7.3 Label 3 HMI Type

Label	HMI Type
F	Trackball only
G	Control Panel with integral trackball
H	Control Panel with I/O Board

4.8 19" Integrated Tabletop

The 19" integrated tabletop display is a unit where the LCD, Processor, PCIO, Control Panel and security device (see Section 4.3 '*Security Device*') are all contained in a single mechanical housing.

There is no dual channel radar or Client/Server Radar (CSR) version of the 19" Integrated Tabletop.

The 19" Integrated Tabletop type numbers are as follows:

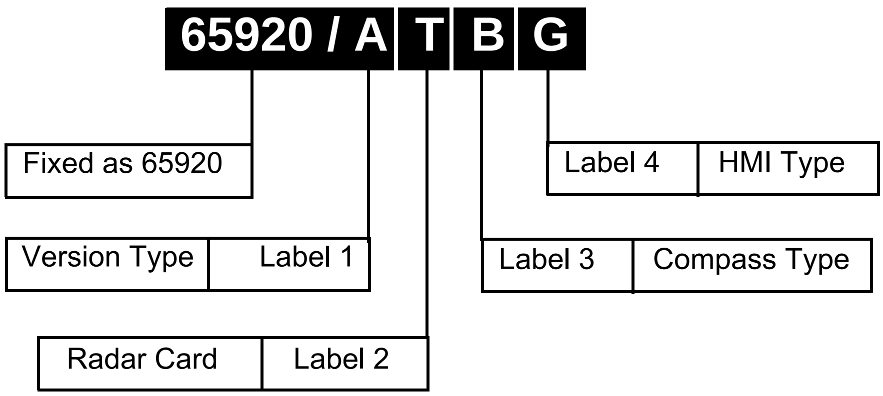

Figure 2.6 19" Integrated Tabletop Label

4.8.1 Label 1 Version Type

Label	Version Type
A	Mk 1 version
B	Mk 2 version

4.8.2 Label 2 Radar Card Type

Label	Radar Type
N	ECDIS (no radar fitted)
T	SC3 card fitted

4.8.3 Label 3 Compass Type

Label	Compass
A	Standard Compass
B	Special Compass

4.8.4 Label 4 HMI Type

Label	HMI Type
F	Trackball only
G	Control Panel with integral trackball

4.9 Antenna Unit

The Antenna unit type numbers are as follows:

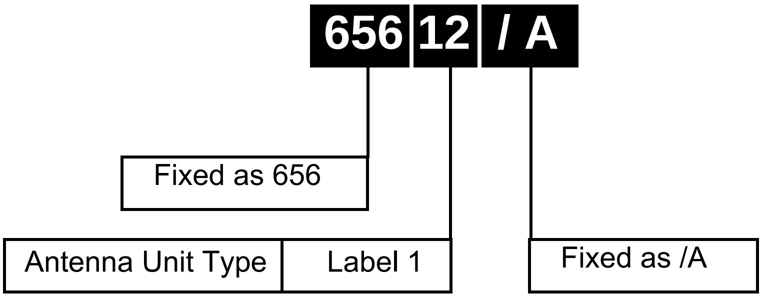

Figure 2.7 Antenna Unit Label

4.9.1 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)

*. Non Type Approved System

4.10 Turning Units and Integral Transceivers

The type numbers for Turning Units and Integral Transceivers are as follows:

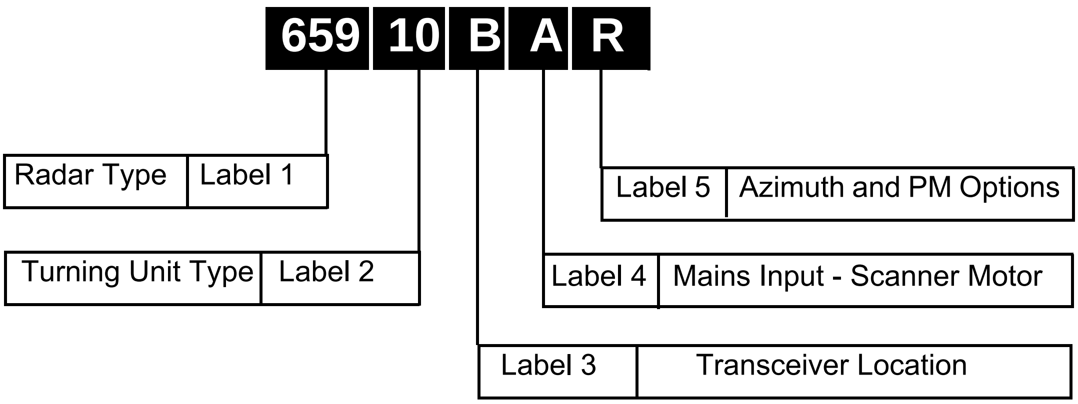

Figure 2.8 Turning Unit and Integral Transceiver label

4.10.1 Label 1 Radar Type

Label	Radar Type
658	BridgeMaster E
659	VisionMaster FT

4.10.2 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.

4.10.3 Label 3 Transceiver Location and Type

Label	Transceiver Location
B	Bulkhead
C	Bulkhead with additional facilities
M	Masthead with biased Limiter
N	Masthead with additional facilities
P	Masthead, 3kHz short pulse variant
T	Masthead, 3kHz with additional facilities
W	Masthead with non-biased Limiter

4.10.4 Label 4 Mains Input – Scanner Motor

Label	Phases	Voltages (V)	Frequency (Hz)	Speed	Band*
A	1	110/240	50/60	S/H	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.

4.10.5 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	Yes	Synchro	CDX
V	No*	Synchro	CDX
W	Yes*	Resolver	M6PI
X	No*	Resolver	M6PI

*. Non Type Approved System

4.11 Bulkhead Transceiver Unit

The type numbers for the Bulkhead Transceiver Unit are as follows:

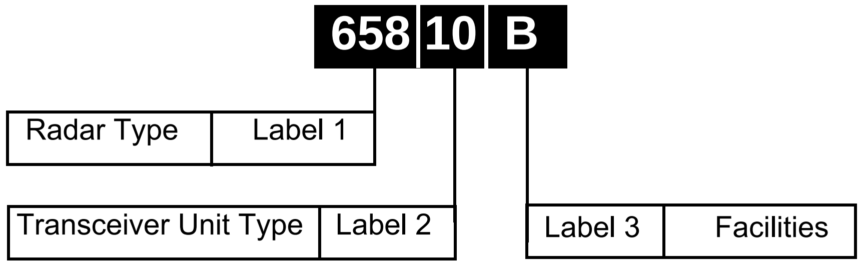

Figure 2.9 Bulkhead Transceiver Unit label

4.11.1 Label 1 BridgeMaster E Identifier

Fixed as **658**

4.11.2 Label 2 Transceiver Type

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

4.11.3 Label 3 Facilities

Label	Facilities
S-Band Units	
A	Standard with biased limiter
B	With Additional Facilities
X-Band Units	
E	Standard with biased limiter
F	With Additional Facilities
G	3kHz short pulse variant
L	3kHz short pulse with additional facilities
H	Standard non-biased limiter

4.12 Scanner Control Unit

The type numbers for the Scanner Control Unit are as follows:

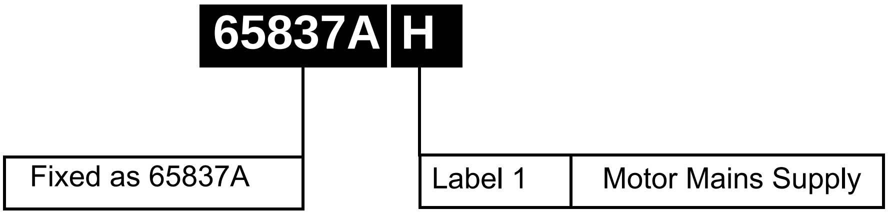

Figure 2.10 Scanner Control Unit label

4.12.1 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).

4.13 Interswitch Unit

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

5 Configuring a Typical System

The following shows how a typical system is configured using the information above. The requirement is for an S-band CAT 1 Chart Radar with the following characteristics:

1. Display Unit — Deck mounted 23" (340mm) flat panel monitor.
2. Processor Unit — Standard
3. Security Block — CAT 1 Chart Radar
4. PCIO Unit — Standard Compass
5. Tray Assembly — Control Panel
6. Antenna — 12ft S-band, standard speed
7. Transceiver — 30kW Masthead mounted with Performance Monitor
8. Ship's Mains Supply — 220/240V AC, 50Hz, 1 Phase

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

CAT1C	34	3	/	12	/	M	/	VM1

The individual Type Numbers for the specified units would be:

Monitor Unit	659 | 23 | C
Processor Unit	65901 | AT
Security Device	32SDV002
PCIO Unit	65900 | AA
Tray Assembly	65903A | G
Antenna	656 | 12 | /A
Turning Unit (including Transceiver)	658 | 30 | M | F | R
Scanner Control Unit	65837A | E

Note: *The modular method for configuring VisionMaster FT systems results in a large number of possible combinations, not all of which are commercially available. Consult NORTHROP GRUMMAN SPERRY MARINE for full details.*

6 Options and Kits

9640454	Step down transformer for use with 380-440V 50/60Hz 3-phase mains.
65800700	Isolation Switch

Various kits with different lengths of installation cable are available.

Consult NORTHROP GRUMMAN SPERRY MARINE for full details.

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CHAPTER 3

INSTALLING TOP UNITS

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1 General Information

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

1.1 Preparation

The preparation required for installation is as follows:

1. If necessary, the structure of the ship should be strengthened to support the system components. For weights and measurements of system components, *see Chapter 1, Technical Specification*.
2. The supplying and fitting of mounting facilities for the system components.
3. The supplying of power supplies terminated by a switch-fuse box. The Installation Engineer will specify the voltage level and current rating of the supplies. For power requirements, *see Chapter 1, Technical Specification*.
4. The supplying 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 must be supplied for connection to the mast.

1.2 Installation Procedure

Installation includes the following operations:

1. The Contractor will install the mast. If required, the Contractor will supply and install adjustable stays for the mast, and take suitable precautions to minimise vibration.
2. Unpacking and external inspection of the system components.
3. Installation of the Scanner Unit.
4. If required, installation of waveguide brackets and/or deck glands.
5. Installation of the other system components. If a bulkhead transceiver is to be installed a mounting pad must be supplied.
6. Planning and laying of cables.
7. Installation of Console Assembly.
8. Interconnection of system components.

2 Siting

2.1 General considerations

The performance of the system depends on the correct siting of the system Scanner Unit (Turning Unit and Antenna). When siting the Scanner Unit you should consider the following:

1. Compass safe distance.
2. Satisfactory short-range 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 usually 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 own ship's starboard side. In practice, in the direction of the ship's bow, a mast or crane can often reflect or suppress signals transmitted from the antenna.

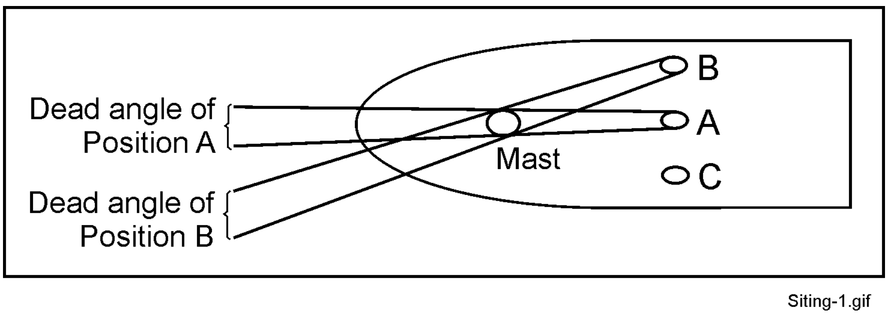
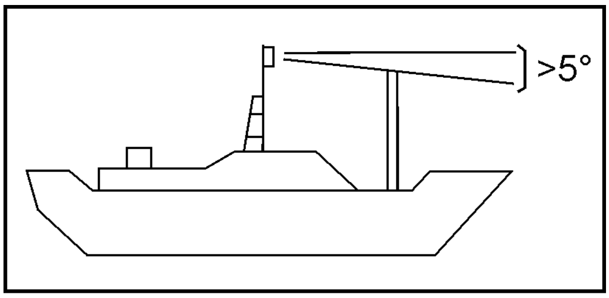


Figure 3.1 Scanner Siting

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

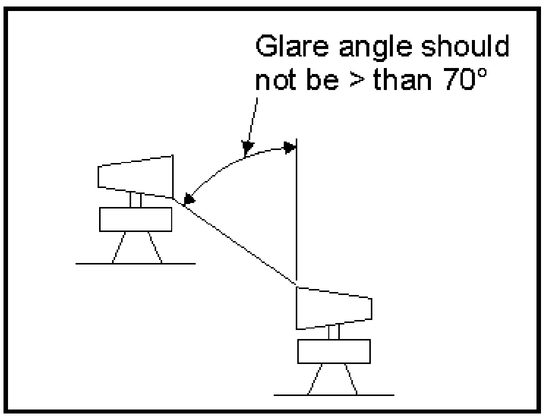
The scanner must be installed only as high as is necessary to clear major objects. It must also be remembered that when the scanner height is minimised the short-range performance is improved along with the effects of sea clutter. Therefore, position the scanner high enough to secure 5 degrees or greater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



Siting-2.gif

Figure 3.2 Minimum angle of Depression

7. To avoid interference from an adjacent radar antenna the vertical separation between antennas should be as large as practicable. As a minimum, the glare angle between antennas should be not greater than 70 degrees (see Figure 3.3).



Siting-3.gif

Figure 3.3 Dual Scanner Positioning (glare angle)

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

2.2 Bulkhead Specific Considerations

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 used frequently.
5. Positioning to minimise accidental damage.
6. Environmental considerations such as adequate ventilation, dust, dirt and clean air.
7. Position the Workstation assembly away from strong magnetic fields.
8. Position the Display Screen away from direct sunlight.
9. Local vibration environment.

2.3 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 stop the chassis becoming live under fault conditions. The earth link is 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 care must be taken when protecting the connections from environmental and electro-chemical corrosion. Before assembly, you must make sure 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 give a large contact area.

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

CAUTION - SAFETY EARTHING

The connecting of the bonding straps must be made from each piece of equipment to the ship's earth. You must not loop from unit to unit. To ensure this is a non-current-carrying connection no other connection must be made to the earth bolt.
The safety earth must 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.

2.4 Electromagnetic Continuity Screening

The purpose of EMC screening is to:

- restrict the emission of electro-magnetic energy from the equipment; and
- reduce its susceptibility to external electro-magnetic influence.

Individual items of equipment are EMC screened by their protective chassis. However, the screening should be extended to cover both input and output connections and cabling. This will maintain overall electro-magnetic efficiency.

Care must be taken when bonding the braids of interconnecting cables where indicated in the appropriate cable schedules.

2.5 System Fuses

Switch – Fuse Current Ratings

The table below shows the ratings for the ship's switch fuse for the radar and the S-band motor.

	Radar	S-Band Motor	
Ship's Supply		Single Phase	Three Phase
110/120V AC	10A	10A	10A
220/240V AC	5A	5A	5A
380/440V AC	-	-	5A

Transceiver Unit Fuses

For X-Band fuse location refer to Figure 3.17 (masthead transceiver) and Figure 3.26 (bulkhead transceiver).

For S-Band fuse location refer to Figure 3.59 (masthead transceiver) and Figure 3.62(bulkhead transceiver).

	Supply	S-Band	X-Band	Code No.
Mains Fuse (FS1)	110/120V AC	3.15A	-	MA00007245
	110/120V AC	-	5A	2180413
	220/240V AC	3.15A	3.15A	MA00007245

Fuse Types

MA00007245 - 3.15A, 1¼" (31mm) ceramic, anti surge, cartridge.

2180413 - 5A, 1¼" (31mm) ceramic, anti surge, cartridge.

2162326 - 3.15A, 20mm ceramic, anti surge, cartridge.

3 Cabling

Refer to the Cabling Schedules section below for details of cables and related terminations. Inter-unit cabling diagrams are given in Section 7. For details of the X-band RF waveguide, RF termination and installation see Section 6. Details of the S-band coaxial RF Feeder are given in Section 5.8.

3.1 Supply Cables

The following points should be considered when you decide which size of cable to use to connect the ship's supply 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 radar system is to be supplied by a three-phase supply, the radar system must be connected between two of the three phase lines. If it is a high-voltage supply, an isolating transformer must be supplied 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 5.9 for details of the SCU.*

3.2 Power Consumption

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

3.3 Switch Fuses

The radar is connected to the power supply of the ship by 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 2.5 '*System Fuses*' page 12.

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. Special cable kits are available for cable lengths up to 300m.

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

The other multicore 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 have 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.

Table 1: Standard Cable details

Ref.	Service Code	Cable Diameter mm	Number of Cores	Core Strands/ Diameter mm	Resistance per 1000m (at 20°C) W	Current Rating A	Voltage (RMS) V	Min Bend Radius mm
16-2-2C	3218376	6.9	2	16/0.2	40.1	2.5	440	50
16-2-4C	3209342	7.7	4	16/0.2	40.1	2.5	440	60
16-2-6C	3211274	8.7	6	16/0.2	40.1	2.5	440	65
16-2-12C	3211266	11.0	12	16/0.2	40.1	2.5	440	85
37-3-2R	3228207	10.3	2	37/0.32	6.79	13	440	80
37-3-4R	3214044	11.8	4	37/0.32	6.79	13	440	90
—	MA00007419	8.4	4 pairs	7/0.2	—	—	30	80
PT1YM	91005263	6	1	1X0.6	95	—	—	30
FSJ1-75	MA00012534	7.4	1		49.2	—	—	25
FSJ4-75A	MA00012880	13.2	1	1X3	4.9	—	—	32

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

Table 2: Low Smoke Zero Halogen (LSZH) Alternatives to Standard Cables

Reference	Service Code	Cable Diameter mm	Number of Cores	Core Strands/ Diameter mm	Resistance per 1000m W	Current Rating A	Voltage (RMS) V	Min Bend Radius mm
16-2-2C	MA00014100	6.9	2	16/0.2	40.1	2.5	440	50
16-2-4C	MA00014167	7.7	4	16/0.2	40.1	2.5	440	60
16-2-6C	MA00014175	8.7	6	16/0.2	40.1	2.5	440	65
16-2-12C	MA00014183	11.0	12	16/0.2	40.1	2.5	440	85
37-3-2R	MA00014191	10.3	2	37/0.32	6.79	13	440	80
37-3-4R	MA00014209	11.8	4	37/0.32	6.79	13	440	90
—	MA00014126	7.8	4 pairs	7/0.2	—	—	30	80
PT1YM	91005248	6	1	1x0.6	95	—	—	36
FSJ4RN-75A	MA00016089	13.2	1	1x3	4.9	—	—	32
LMR-400-75-FR	RB00000331	10	1	1x1.5	11	—	—	40

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

3.5 Cable Core Colour Coding

3.5.1 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

3.5.2 Data Cables

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	

Data Cable (four twisted pairs) 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	

Note: *The data cable colours shown in the left column of the Data Cable table only apply to standard data cables. Alternative Low Smoke Zero Halogen (LSZH) cables may be supplied in either colour option shown in the table.*
The data cables shown in the system interconnection diagrams in Section 7 'System Component Interconnections' and Section 6 'Cabling and Interconnection Diagrams' in Chapter 4 'Installing Consoles & Displays' are the standard cable colours.

3.6 Coaxial Cables

3.6.1 Signal Coaxial Cables

The coaxial signal cables detailed on the Inter-unit Cabling diagrams can 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

Table 3: Signal Coaxial Cable Details

Service Code	Cable Diameter mm	Nominal Impedance Ω	Attenuation at 10MHz dB/100m	Comments
91005263 91005248	6.0	75	3.9	Double screened, Mylar insulation between screen (PT1YM), use with cable runs <67m
MA00012534	7.4	75	1.87	Low-loss, copper-clad steel inner, solid copper screen, use with cable runs <180m
RB00000331	10	75	1.29	
MA00012880 MA00016089	13.2	75	0.96	Ultra-low-loss, solid-copper inner and screen, use with cable runs <300m.

3.6.2 S-band Coaxial Cable

This is a 7/8" 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.

Table 4: S-band Coaxial Cable Details

Service Code	Cable Diameter mm	Nominal Impedance Ω	Attenuation at 3GHz dB/100m	Comments
RA00002170	28	50	8.31	Andrew Type AVA5-50

3.7 Crimping co-axial cables

The co-axial cables must be prepared for insertion into BNC connectors as described below.

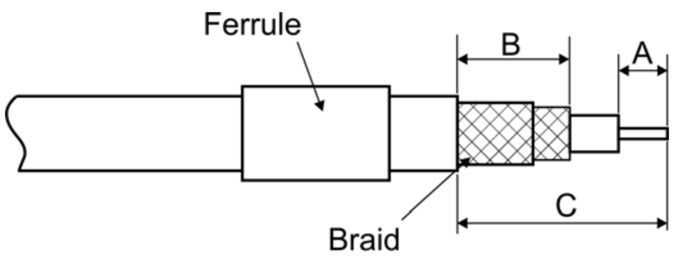
Tools Required

You will need a crimping tool (MA00018119).

Procedure

Prepare the cable end as follows:

1. Slide the ferrule onto the cable and strip away the outer cable cover to dimension C as shown in Figure 3.4.
2. Where the cable is double screened strip back the outer braid, remove the clear mylar sheath separating the outer and inner braids and strip back the inner braid and inner dielectric to the lengths shown in Figure 3.4.



A = 4mm (0.157inch)
B = 8.5mm (0.335inch)
C = 15mm (0.591inch)

Figure 3.4 Preparing Cable End

3. Slide centre contact onto inner copper wire until the contact bottoms against cable dielectric. Crimp centre contact using crimping tool.

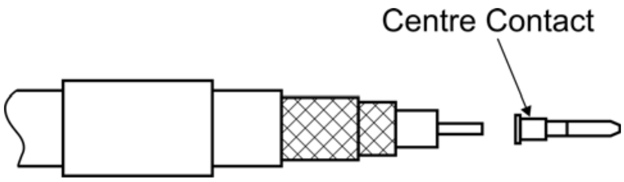


Figure 3.5 Inserting Centre Contact

4. Fan braids out and slide cable into connector body until the cable bottoms against insulator. Slide ferrule over braids in the direction shown in Figure 3.6.

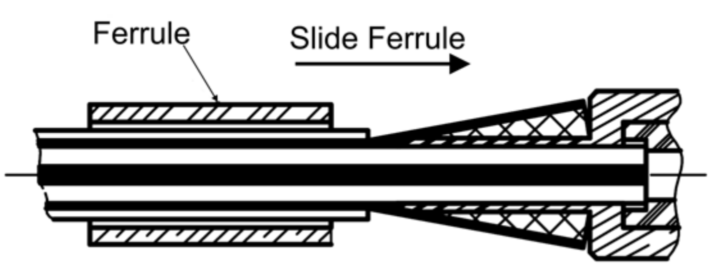


Figure 3.6 Inserting Cable into connector body

5. Crimp the ferrule with crimping tool, Cut excess braid if necessary, see Figure 3.7.

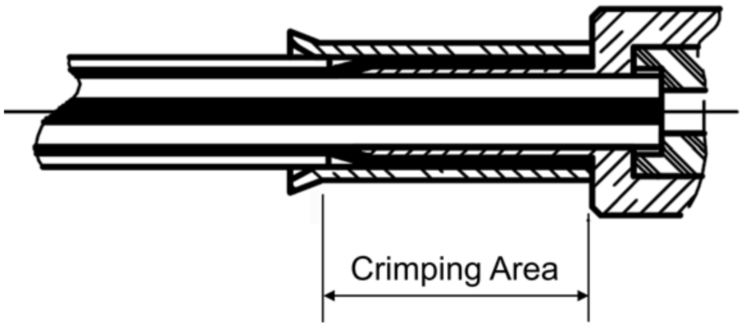


Figure 3.7 Crimping the ferrule

3.8 X-band Elliptical Waveguide

This is a 33.5 x 22.9mm corrugated elliptical waveguide. The waveguide has a minimum bend radius of 480mm in the 'H' plane and 200mm in the 'E' plane. It can be used 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.

Table 5: Waveguide Details

Service Code	Waveguide Size mm	Attenuation at 9.4GHz dB/100m	Comments
RA00000109	33.5 x 22.9	9.96	Andrew Type EW85
RA00000075	33.5 x 22.9	9.96	RFS Type EP100

4 Installing X-band Scanner Assembly

The X-band Scanner assembly is made up of the following sub-assemblies. Each of these is supplied in its own packing, with relevant installation drawings:

Turning Unit with Bulkhead Transceiver (10 or 25kW)	Installation Kit 65901660 (Installation Drawing 65901050)
Turning Unit with Masthead Transceiver (10 or 25kW)	Installation Kit 65901660 (Installation Drawing 65925051)

Note: *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 Turning Units with integral Transceivers fitted with the 'additional features' 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)

To install the X-band Scanner assembly carry out the following operations, preferably in the sequence outlined below:

1. Prepare the site (refer to Section 2 '*Siting*').
2. Bolt the Turning Unit to the mounting platform (ship's structure) as shown in Installation Drawings 65901050 or 65925051 supplied with the Turning Unit, and in Figure 3.8.
3. Bolt the Antenna to the Support Casting as shown in Installation Drawing 65601275 supplied with the Antenna, and in Figure 3.13.
4. Lay in and install the cables for the Turning Unit following the Cabling Schedules in Section 4.6 '*Installing X-Band Cables*'.
5. Make sure the Turning Unit, the Motor Drive Board and the Pulse Bearing Board are correctly set for the required high or low-speed option, set using their relevant jumper links, see Section 4.5 '*Turning Unit Link Settings*'.

Figures 3.9 to 3.12 shows X-band Scanner outline drawings 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.

4.1 Turning Unit

WARNING!

THE TURNING UNIT MUST 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 MUST THEREFORE BE BOLTED 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.

The Turning Unit is bolted to the mounting platform with four Neoprene isolating pads (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 does not twist when the bolts are tightened. M10 washers can be used as shims, or purpose made parts, produced locally, may be used.

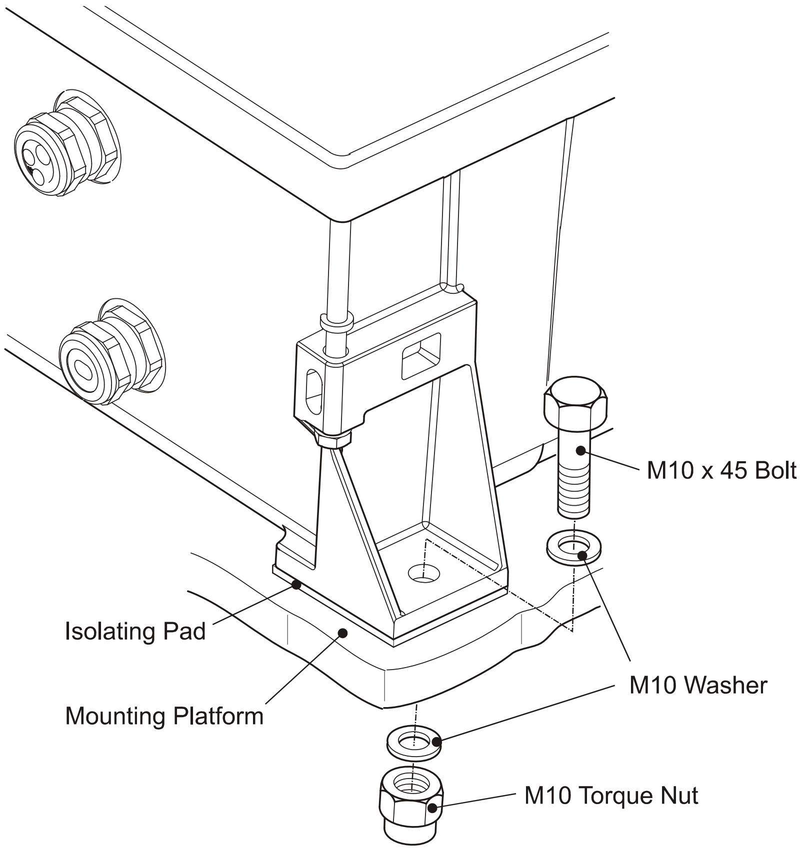
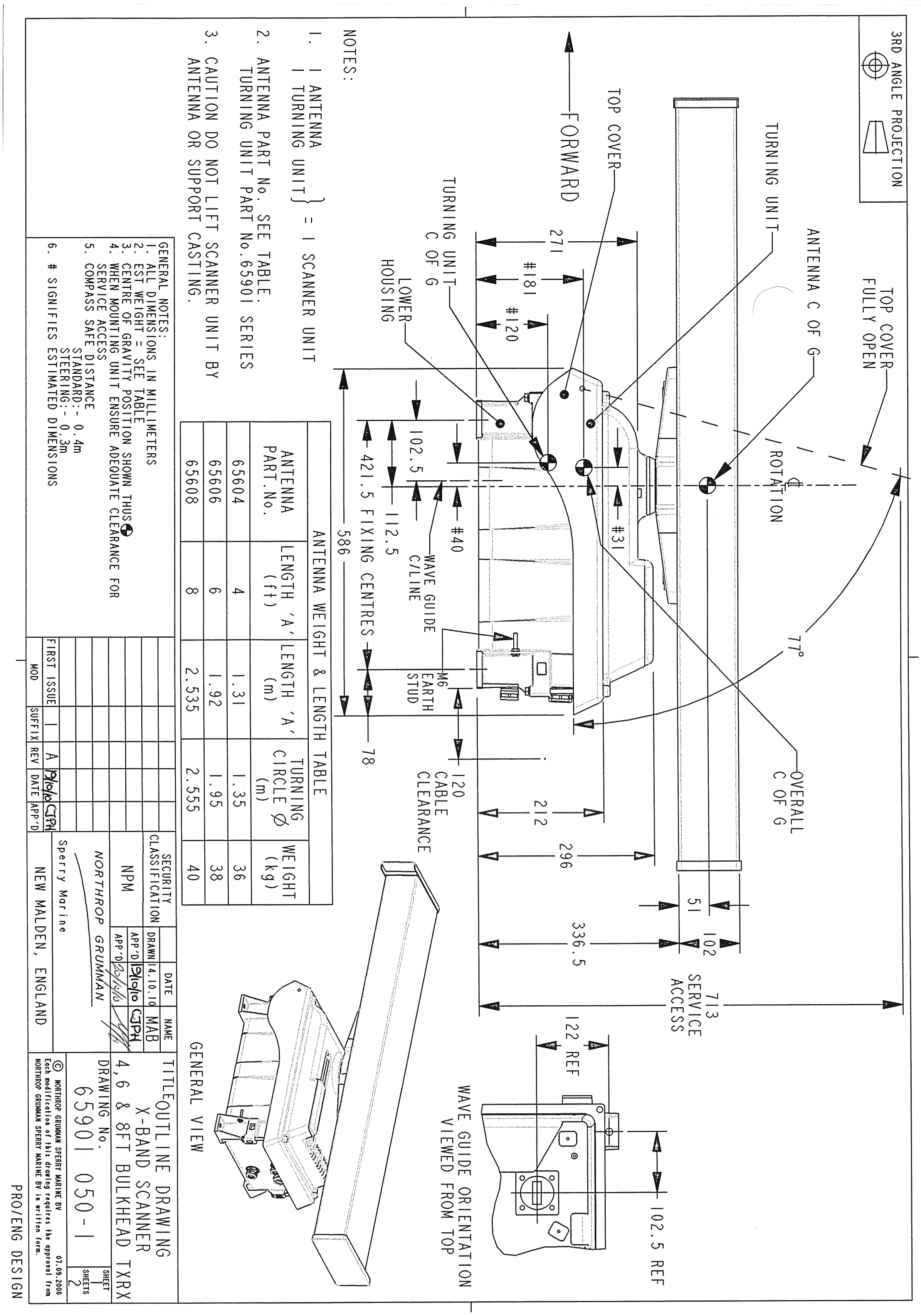


Figure 3.8 Fixing the Turning Unit to the Mounting Platform



ANTENNA PART No.	LENGTH 'A' (ft)	LENGTH 'A' (m)	TURNING CIRCLE Ø (m)	WEIGHT (kg)
65604	4	1.31	1.35	36
65606	6	1.92	1.95	38
65608	8	2.535	2.555	40

Figure 3.9 X-band Scanner 4ft, 6ft and 8ft Bulkhead Tx/Rx Installation - Sheet 1

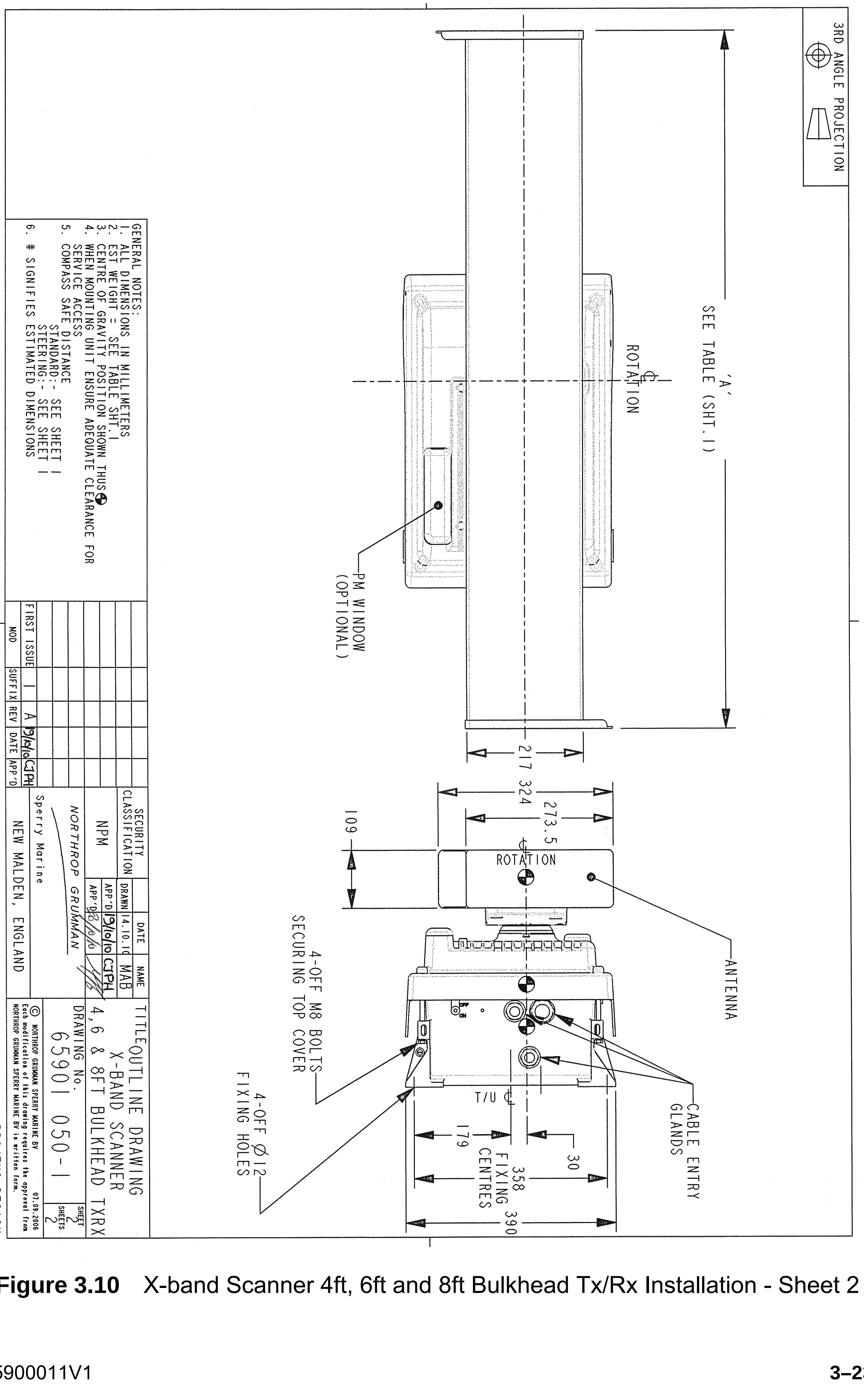


Figure 3.10 X-band Scanner 4ft, 6ft and 8ft Bulkhead Tx/Rx Installation - Sheet 2

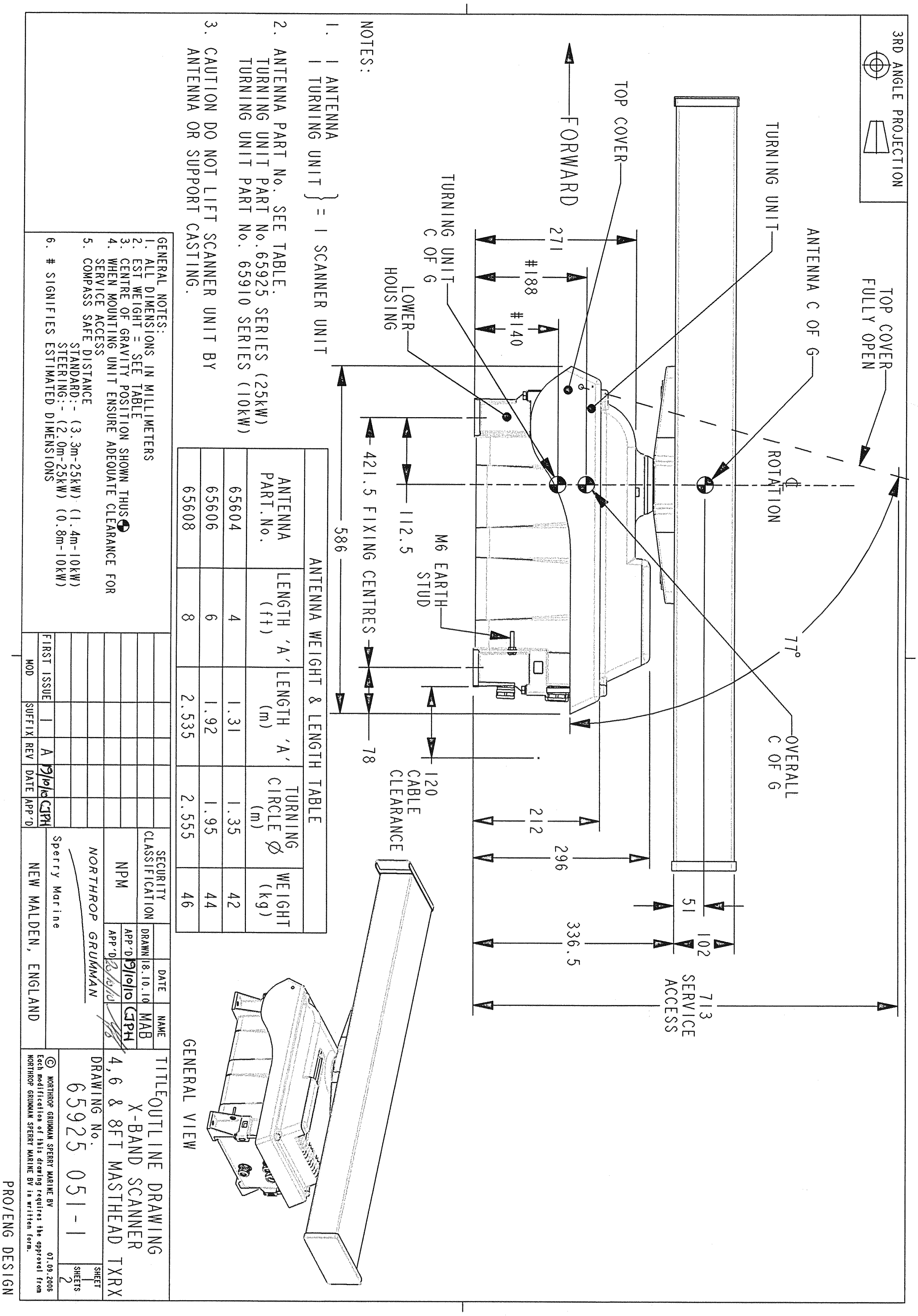


Figure 3.11 X-band Scanner 4ft, 6ft and 8ft Masthead Tx/Rx Installation - Sheet 1

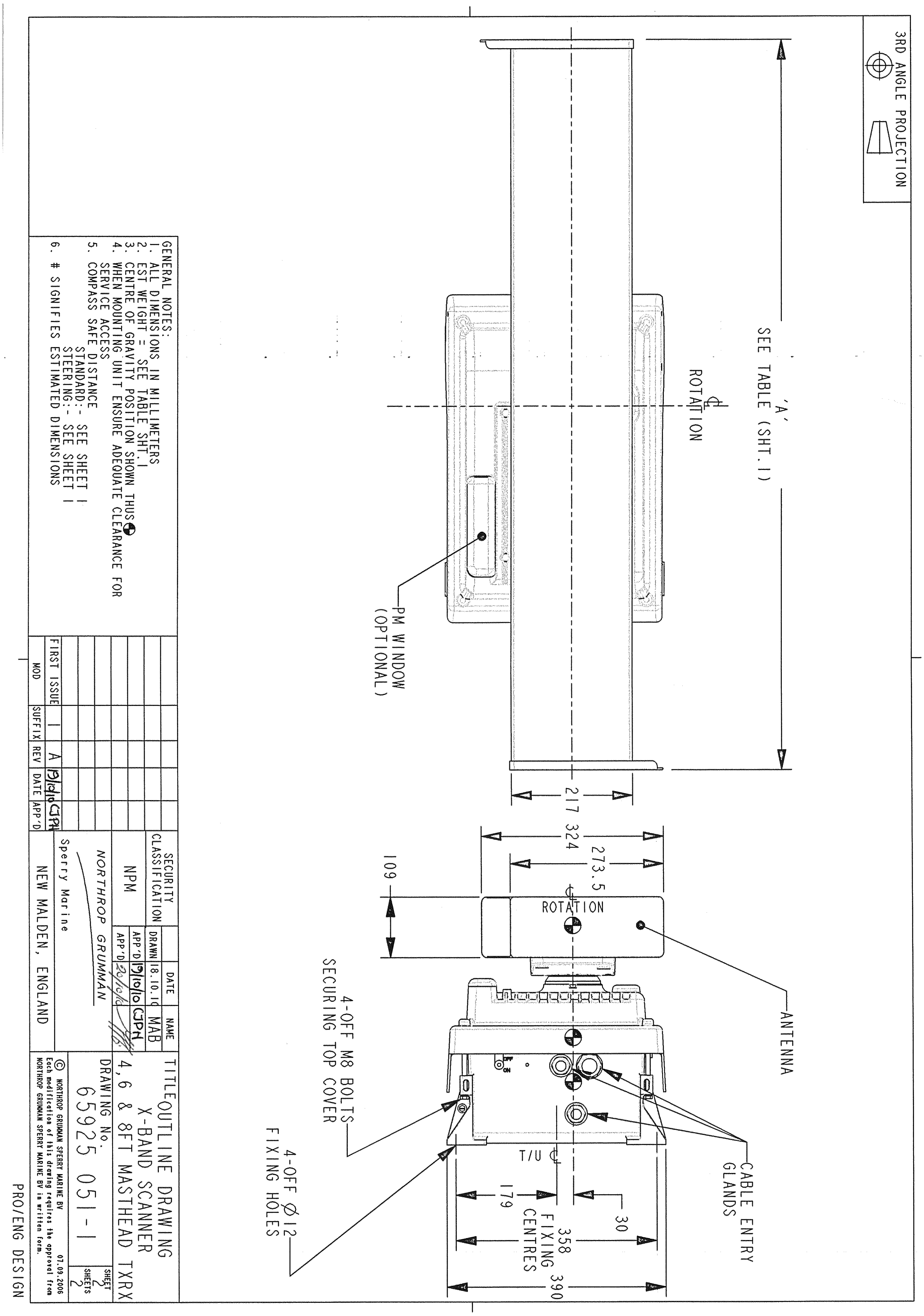


Figure 3.12 X-band Scanner 4ft, 6ft and 8ft Masthead Tx/Rx Installation - Sheet 2

4.2 Support Casting

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

4.3 Performance Monitor

The Performance Monitor consists of the Performance Monitor module and a control cable. The equipment is normally factory fitted.

4.4 Antenna

The Antenna is fitted to the Support Casting using the parts listed below (supplied with the antenna).

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

Before assembling the Antenna to the Turning Unit, remove the waveguide plug from the underside of the Antenna and the yellow sealing cap from the waveguide aperture on the top of the Turning Unit. Do NOT remove the plastic membrane over the Turning Unit waveguide aperture.

The holes in the support casting are asymmetrically placed to prevent the antenna being fitted backwards. The support casting has the word 'FRONT' visible from above to help with initial antenna location.

Figure 3.13 shows how these are fitted.

Make sure the four Antenna fixing bolts are well coated with Denso Paste before securing to the turning unit.

Note: *The lock tab ends must be bent as shown in Figure 3.13 to prevent rotation of the nuts.*

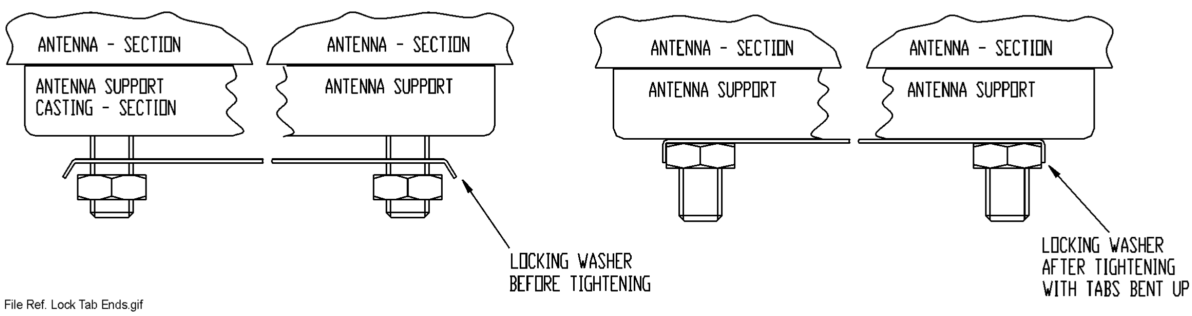


Figure 3.13 Fixing the Antenna to the Support Casting

After assembling and securing the Antenna to the turning unit apply a bead of sealant around the joint between the Antenna and support casting. Smooth the sealant finish with a damp cloth.

4.5 Turning Unit Link Settings

To access the PCBs housed in the Turning Unit loosen the four bolts securing the top casting to the bottom casting. Lever the top casting up and secure in position with the stay locking bracket, see Figure 3.43, page 54.

Standard Turning Units include the following types:

- 65901Bxx
- 65925Mxx

For link settings on 'additional features' turning units, see Section 3 '*Installation and Interconnections*' in Chapter 8 *'Additional Features*'.

'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 lets you remotely select between the two scanner speed settings.

4.5.1 Motor Drive PCB Assembly (65801811)

For Motor Drive PCB Assembly 65801827 (fitted to 'additional features' turning units) see Section 3.3.5 in Chapter 8 *'Additional Features'*.

4.5.1.1 Setting link LK1 on the Motor Drive Board 65801811

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

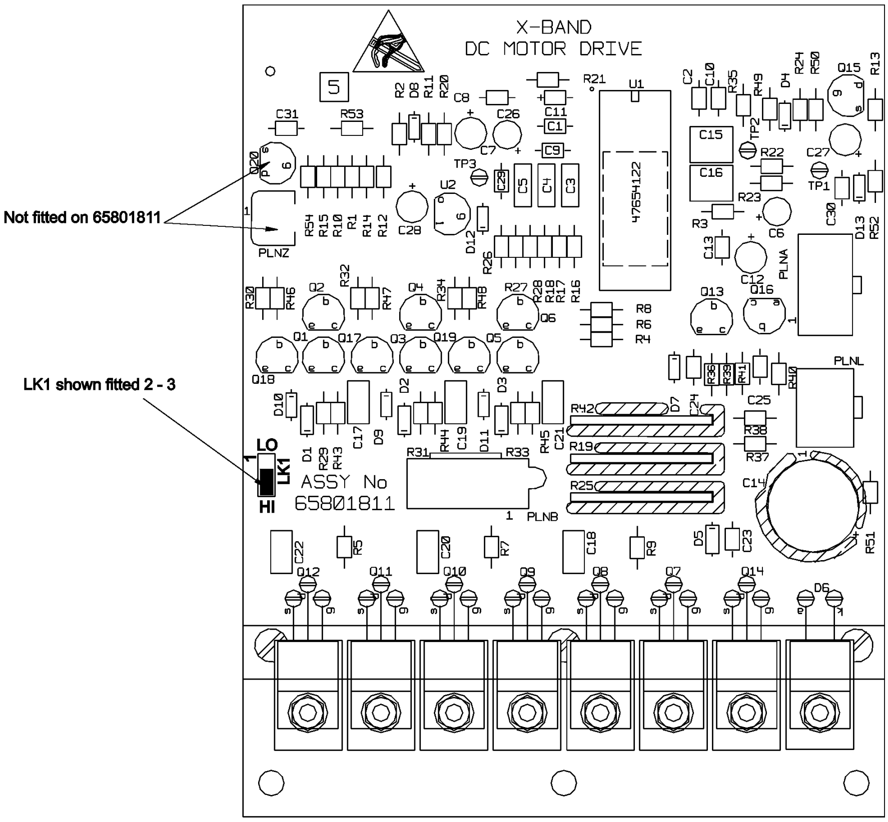
The factory default setting is 'NORMAL' speed. If no jumper is fitted, the rotational speed defaults to high-speed.

WARNING!

UNDER NO CIRCUMSTANCES SHOULD THE LINK POSITION BE MOVED WHILST THE MOTOR IS RUNNING.

With the jumper in the position marked 'LO' (pins 1 and 2 – left hand pair), the nominal scanner speed is 28 rpm, see Figure 3.14.

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



File Ref. 65801811.gif

Figure 3.14 Motor Drive Board 65801811 – Showing Link Position

4.5.2 Pulse Bearing PCB Assembly (65801805)

For Pulse Bearing PCB Assembly 65801826 (fitted to ‘additional features’ Turning Units) see Section 3.3.4 in Chapter 8 *‘Additional Features’*.

4.5.2.1 Setting link LK1 on the Pulse Bearing PCB Assembly 65801805

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. If no jumper is fitted, the Pulse Bearing PCB Assembly is optimised for high-speed.

WARNING!

UNDER NO CIRCUMSTANCES SHOULD THE LINK POSITION BE MOVED WHILST THE MOTOR IS RUNNING.

1. Set the jumper in the position marked ‘1’ (pins 1 and 2 – the lower pair) when the nominal scanner speed is 28 RPM (‘LOW’), see Figure 3.15.
2. Set the jumper in the upper pair position (pins 2 and 3) when the nominal scanner speed is 45 RPM (‘HIGH’).

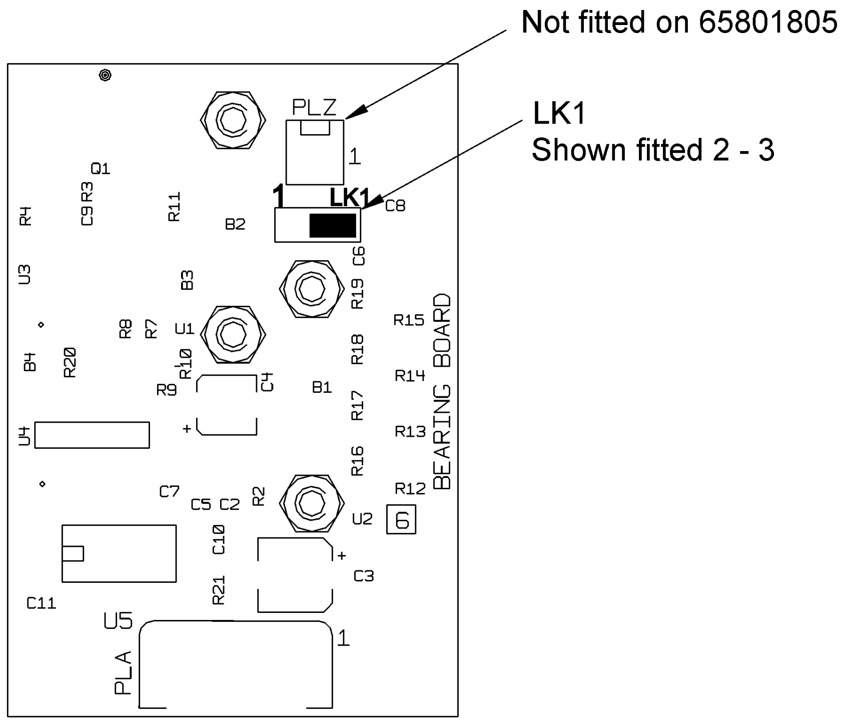
The link is set during installation and commissioning. The link can be moved with the PCB in place using long nose pliers. This is not easy because the PCB mounting bracket obscures the position of the link.

The recommended method is:

1. Loosen the two Pozidriv screws that hold the mounting bracket in place.
2. Slide the whole assembly to the right using the slotted screw holes in the mounting bracket.
3. Move the assembly forward into a more accessible position for the link to be moved.

During removal and refitting of the mounting bracket, take care not to damage the teeth on the pulse disc assembly that run between opto-couplers 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 an easier installation, it is recommended that you complete this operation, if it is required, before mounting the Turning Unit aloft.



File ref: 65801805.gif

Figure 3.15 Pulse Bearing Board 65801805 - Showing Link Position

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

For Input PCB Assembly 65801819 (fitted to 'additional features' Turning Units), see Section 3.3.2 in Chapter 8 *'Additional Features'.*

The diagram below shows details of the Turning Unit Input Board 65801813. To access the board:

1. Release the four retaining bolts (see Figures 3.9 to 3.12).
2. Lift up the upper casting cover on its hinges.
3. Remove the screening cover.

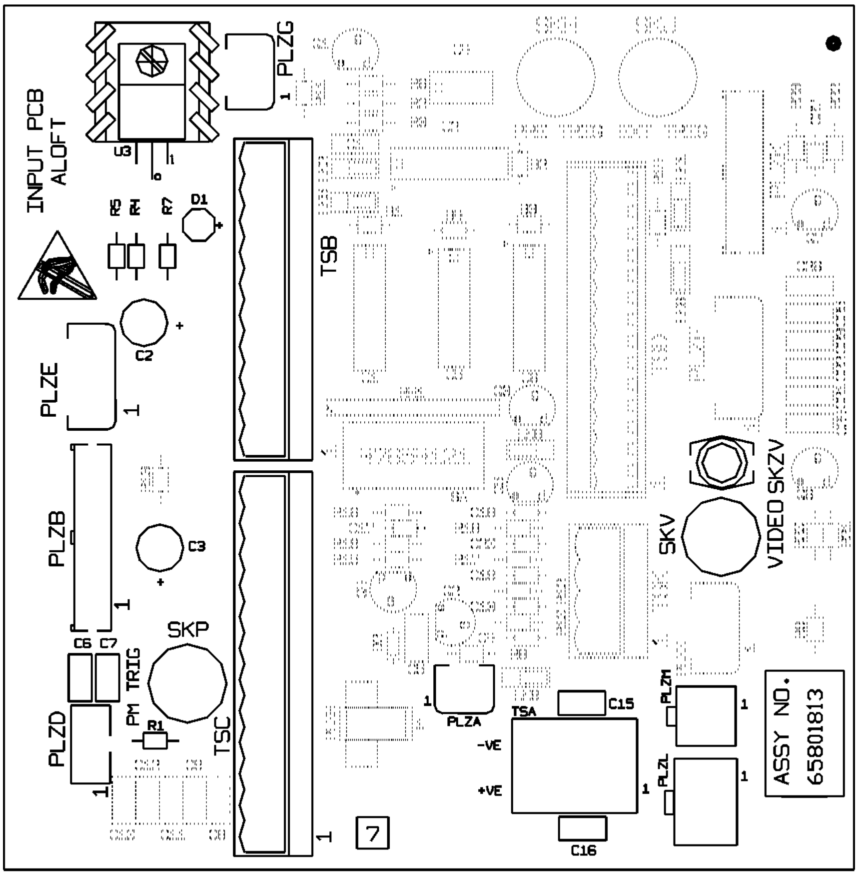


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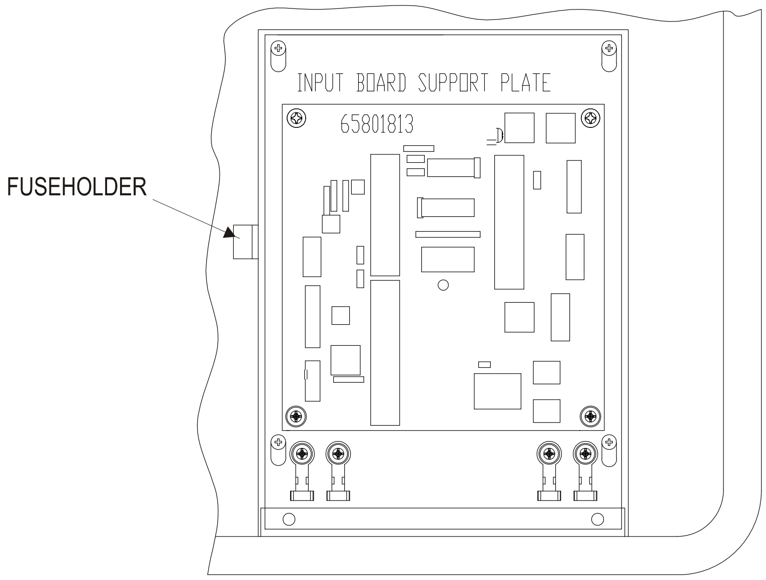
Figure 3.16 Turning Unit – Input Board Details

Note: *The video cable does not plug into the Input Board, but goes directly to the Receiver. Refer to Section 4.6.1 'Fitting the Cable Glands' for further details.*

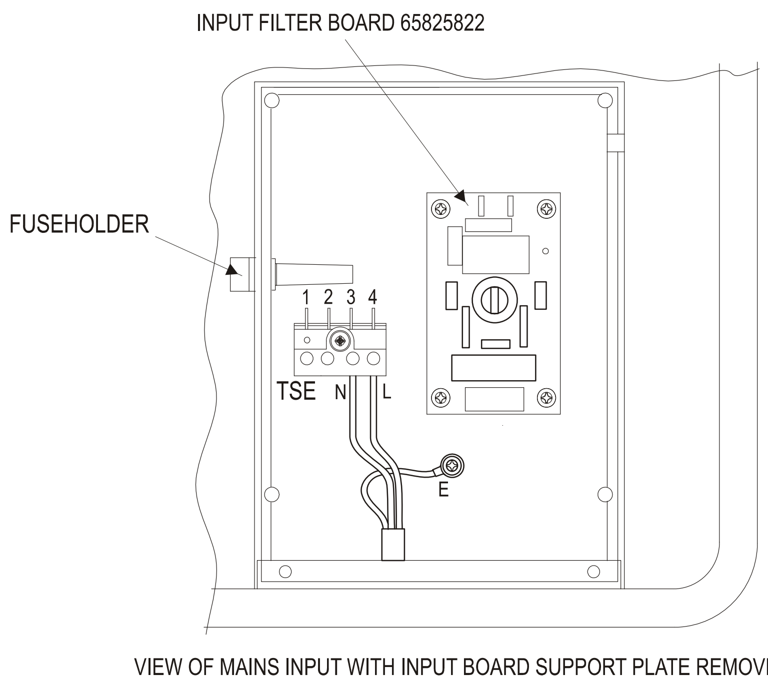
4.5.4 Turning Unit Mains Input Connector (Aloft Transceiver)

Figure 3.17 shows details of the Mains Input Connector TSE (Integral Transceiver only). These are accessed by removing the support plate that is held by four fixing screws (see below).

Note: *The screws only need to be partially undone to let the plate slide out.*



VIEW OF INPUT BOARD WITH SCREEN COVER REMOVED



VIEW OF MAINS INPUT WITH INPUT BOARD SUPPORT PLATE REMOVED

Figure 3.17 Turning Unit – Mains Input Details

4.6 Installing X-Band Cables

Before fitting the cables in the Turning Unit loosen the four bolts securing the top casting to the bottom casting. Lever the top casting up and secure in position with the stay locking bracket, see Figure 3.43.

Table 6 shows the route each cable uses to enter the turning unit (with either bulkhead or masthead transceiver). Figure 3.18 shows the cable entry points; three of these are via cable glands labelled 1, 2 and 3.

Note: *For cable entry details for turning units with 'additional features', see Section 3.2 'Interconnections' in Chapter 8 'Additional Features'.*

The RF feeder (waveguide) input is only needed when the transceiver is mounted below decks (bulkhead). The bulkhead lower casting is different from the masthead variant because the X-band waveguide flange is mounted on the underside face. See Figure 3.9, Figure 3.10 or Figure 3.14 for details.

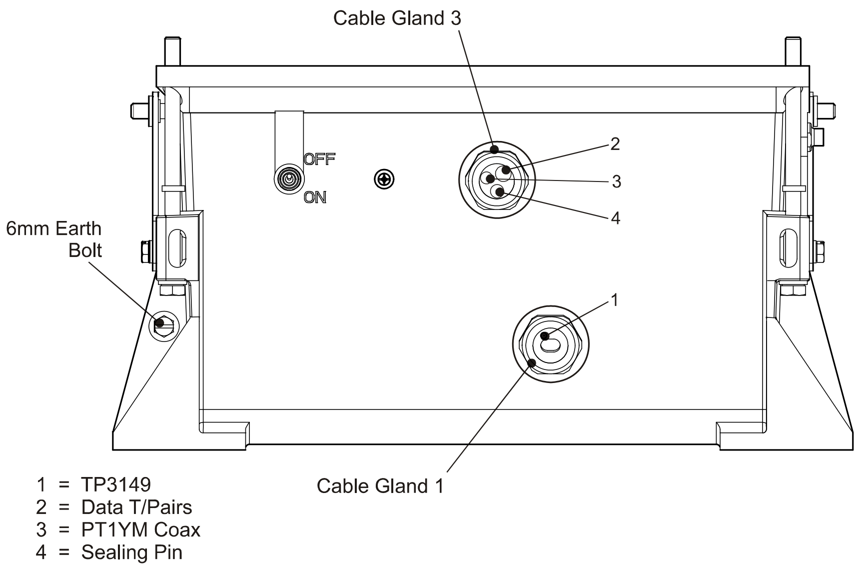
A 6mm bolt is fitted so that the unit can be connected to the ship's structure. This **must not** be used for any other connection.

For details of how to terminate the cables into their connector blocks, see the Interconnection Diagrams and Cabling Schedules in Section 7 '*System Component Interconnections*'.

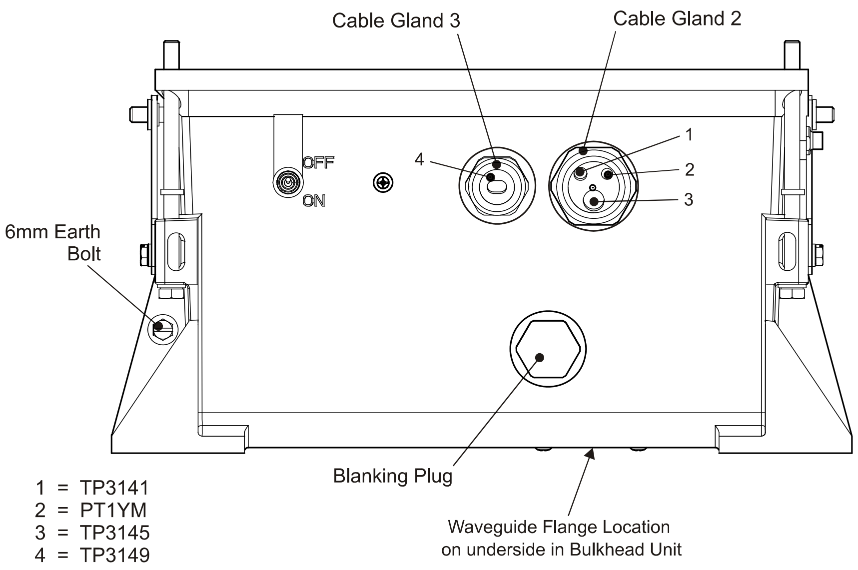
Details for terminating the RF feeder (waveguide) are given in Section 3.8 '*X-band Elliptical Waveguide*'.

Table 6: X-band Cable Gland Details

Cable Gland	Turning Unit with Bulkhead Transceiver		Turning Unit with Masthead Transceiver	
	Description	**Cable Type**	**Description**	**Cable Type**
Cable Gland 1	Blanking Plug	—	Mains Input AC	37-3-2R
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 with Masthead Transceiver



Turning Unit with Bulkhead Transceiver

Figure 3.18 Turning Unit - Cable Entry Positions

4.6.1 Fitting the Cable Glands

The installation cables are connected into the turning unit via the correct cable glands (see Table 6). The body of the gland fits through a hole in the casting and is held in position by the Top Nut. An 'O' ring seal is fitted below the casting surface (input side).

Figure 3.19 shows the cable gland assembly on a turning unit with bulkhead transceiver. A masthead transceiver includes similar cable gland units.

A waterproof seal and an EMC gasket are provided with each gland. 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.

The waterproof seal works by clamping onto the cable PVC sheath. The EMC gasket clamps onto the cable braid.

The braid is also formed into a tail that is grounded by means of an adjacent earth tag. The fitting procedure is shown in Figure 3.19.

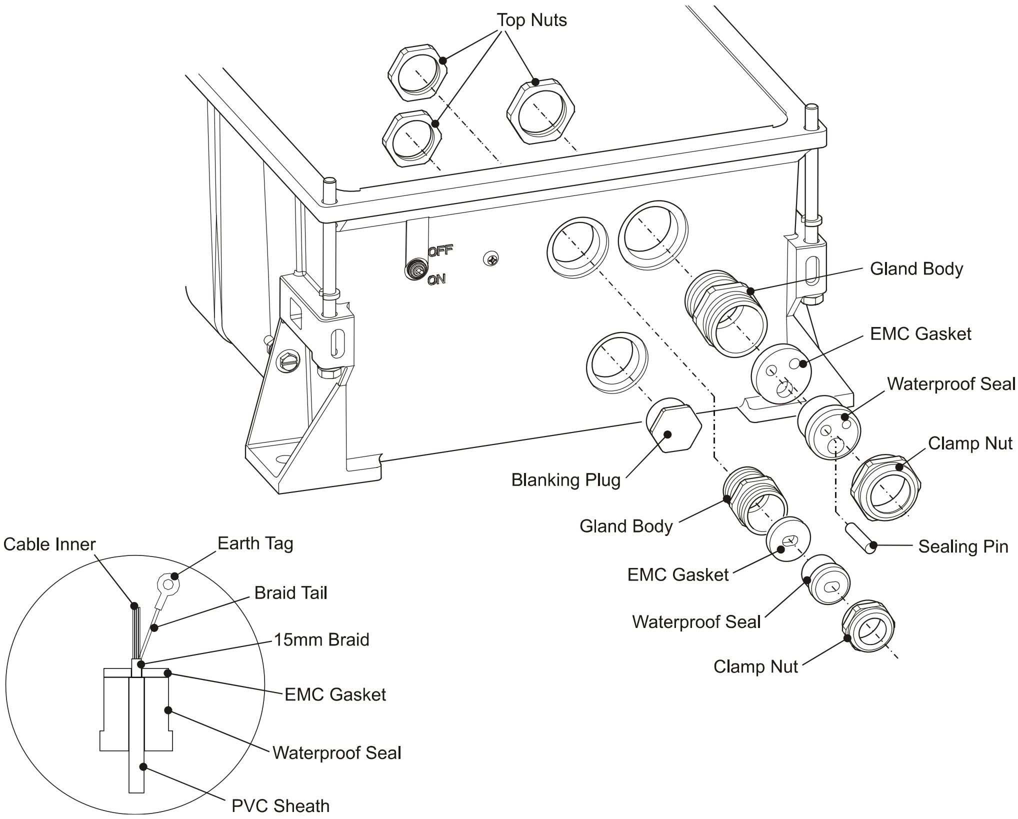


Figure 3.19 Turning Unit (Bulkhead Transceiver) – Cable Gland Assemblies

Note: *Cable Glands and Blanking Plugs are normally factory fitted to the Turning Unit. Turning Units for masthead transceivers do not have cable gland holes.*

Note: *Do not to force the outer sheath through the EMC gasket as the gasket can split.*

4.6.2 Fitting Cables to the Cable Glands

To install the cables to the cable gland assemblies:

1. Unscrew the clamp nut.
2. Remove the waterproof seal and the EMC gasket.
3. Feed the cables through the clamp nut, gland body and waterproof seal.
4. Strip the outer sheath to expose approximately:
   a. 300mm of braid for the multicore cables.
   b. 10 to 15mm of braid for the video coaxial cable.
5. Push the braid back to expose approximately 50mm of the inner cores.
6. Trim 50mm off the inner cores.
7. Pull the braid back over the core and twist into a point.
8. Feed the cable through the EMC gasket until it is positioned as shown in Figure 3.19.
9. For the Multicore cable: flare the braid out to within approximately 15mm of the EMC gasket and form a tail.
10. For the coaxial cable: do not fit the connector at this time, refer to Section 4.6.3.1 and Section 4.6.3.2 below.

4.6.3 Fitting Cables into Turning Unit

To fit the cables into the turning unit:

1. Feed the assembled cables and seals into the gland body making sure that the EMC gasket is in contact with the exposed cable braid, as shown in Figure 3.19.
2. Tighten the gland nut to compress the waterproof seal.
3. Crimp the earth tags to the braids of the multicore cables, keeping them as short as possible.
4. Attach them to the earth studs adjacent to the cables. The tails should be as short as is practicable.
5. Trim and attach the cable inners to the appropriate connectors.

4.6.3.1 Fitting Coaxial Cable in Masthead Turning Unit

The coaxial cable on a masthead turning unit connects to the SKV on the Receiver Assembly and must therefore be routed along the base of the bottom housing and right side of the top housing as shown in Figure 3.20.

1. Remove the Input PCB cover.
2. The coaxial cable is secured using all of the flat cable clips on the top and bottom housings, except the one near the top unit hinge.
3. Open the four flat cable clips and route the cable under the clips.
4. Cable tie the coaxial cable to the power cable, where the cable passes in front of the flat cable clip and power cable bracket near the hinge.
5. Secure the cable using two 'P' clips attached to the transceiver assembly.
6. Trim the cable to the required length and fit the coaxial plug.
7. Fit the coaxial cable to the coax connector on top of the Receiver assembly.

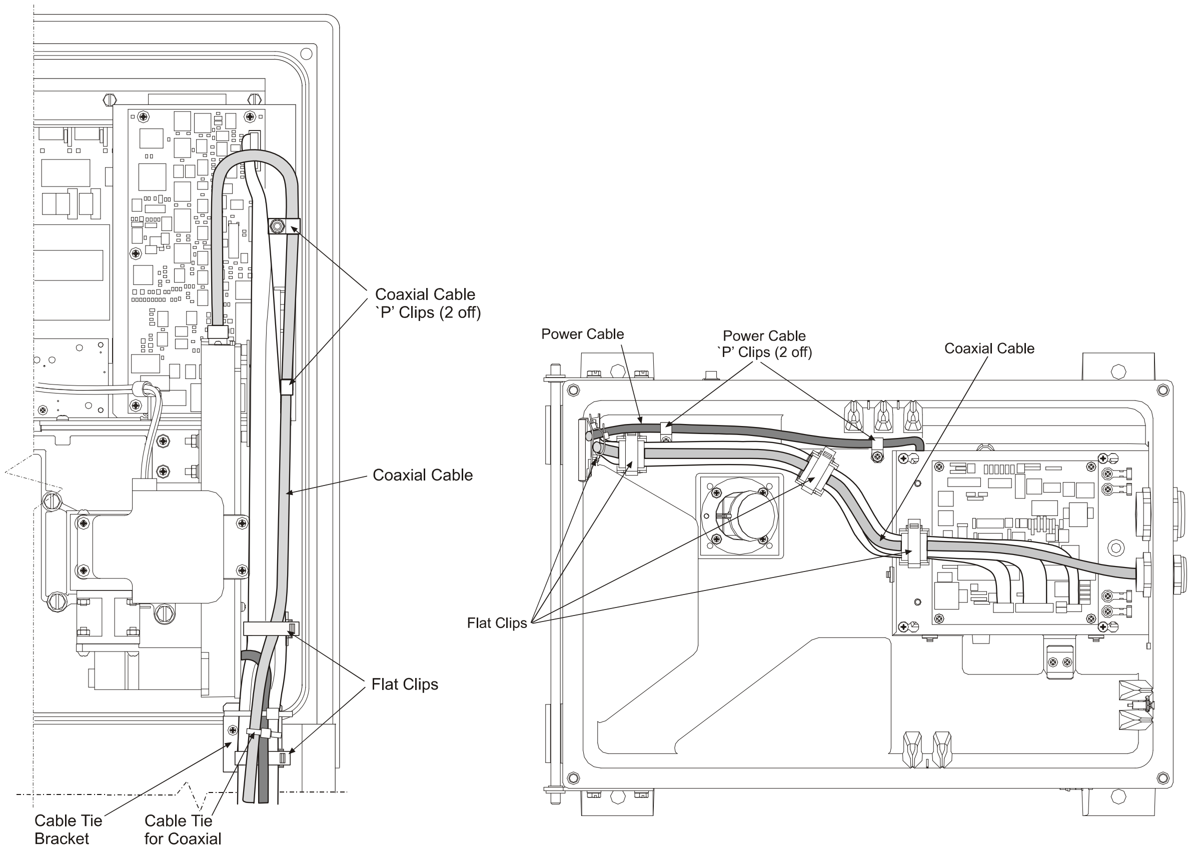


Figure 3.20 Fitting Coaxial cable in Masthead Turning Unit

4.6.3.2 Fitting Coaxial Cable in Bulkhead Turning Unit

The coaxial cable on a bulkhead turning unit connects to the SKV coax connector on the Input PCB, therefore a much shorter length of cable than the cable used on a masthead turning unit is required.

1. Remove the Input PCB cover.
2. Trim the cable to the required length and fit the coaxial plug.
3. Fit the coaxial cable to the SKV connector on the Input PCB as shown in Figure 3.21.

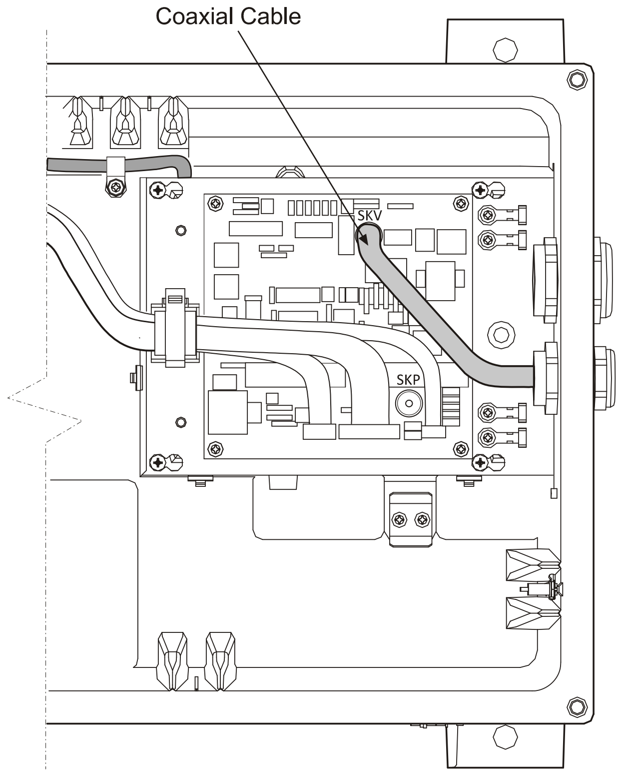


Figure 3.21 Fitting Coaxial cable in Bulkhead Turning Unit

4.7 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 consider 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: the loss per metre of the X-band waveguide is typically 10dB per 100 metres (2dB for 20 metres). This loss applies to both the transmitted RF pulse and the received signals.

The maximum recommended cable length using standard coaxial cable (PT1YM) is:

- 30 metres between the Turning Unit and the Transceiver Unit; and
- 67 metres between the Transceiver and Display.

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, routing of the RF Feeder (waveguide) should be carefully considered.

The Transceiver may be attached to the bulkhead by several methods. The actual method chosen will depend on individual circumstances, with due regard 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 supplied by the shipyard. Slotted mounts are supplied at the bottom for ease of installation.

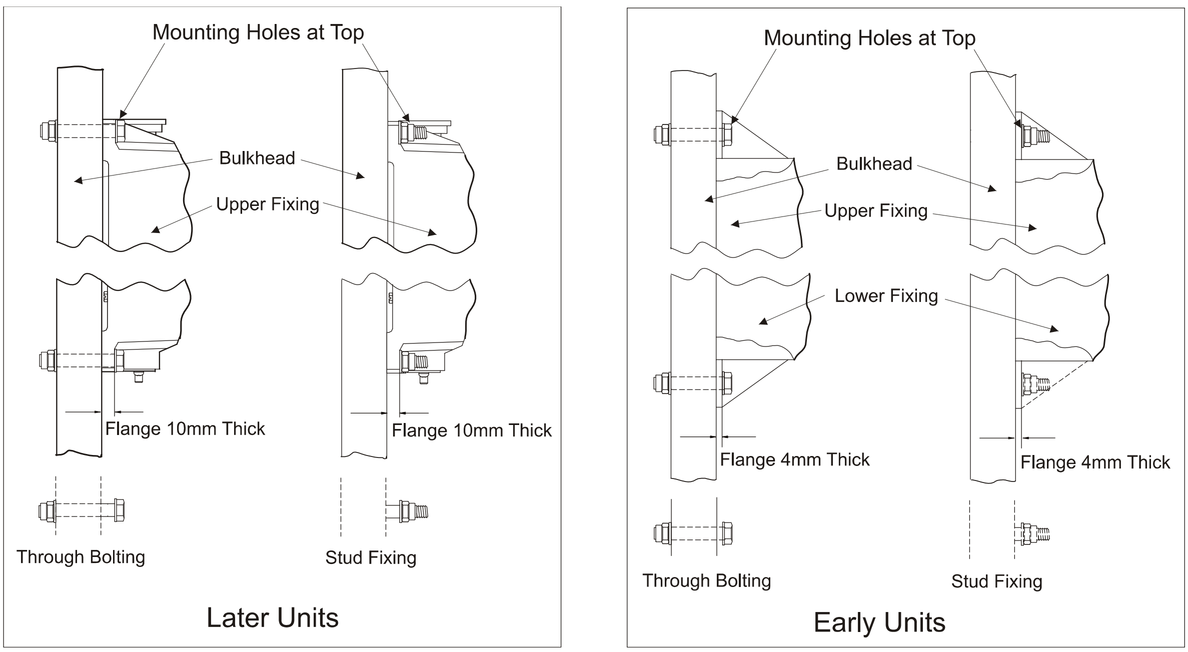


Figure 3.22 X-band Bulkhead Transceiver – Mounting Alternatives

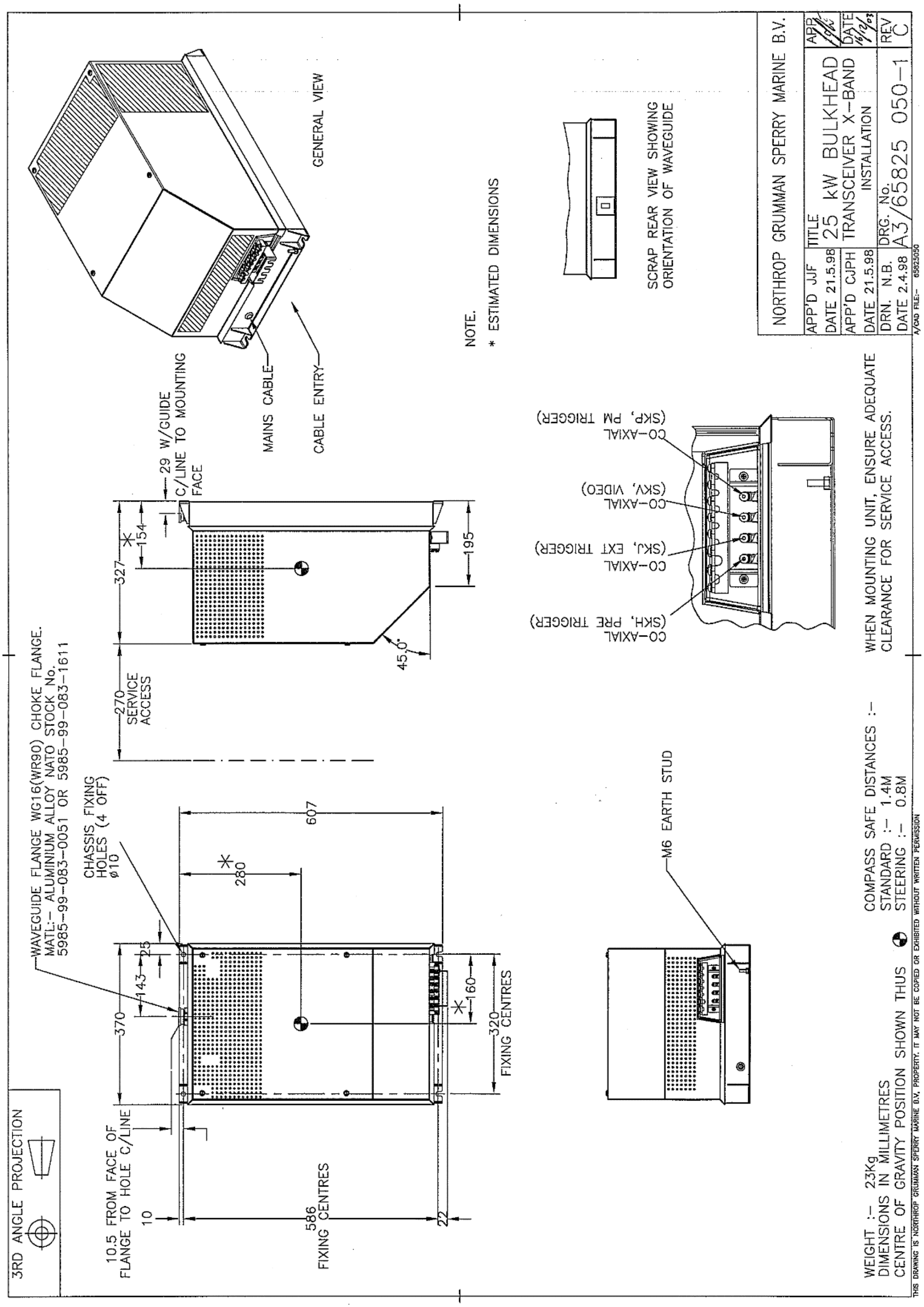


Figure 3.23 X-band Bulkhead Transceiver 25kW Installation

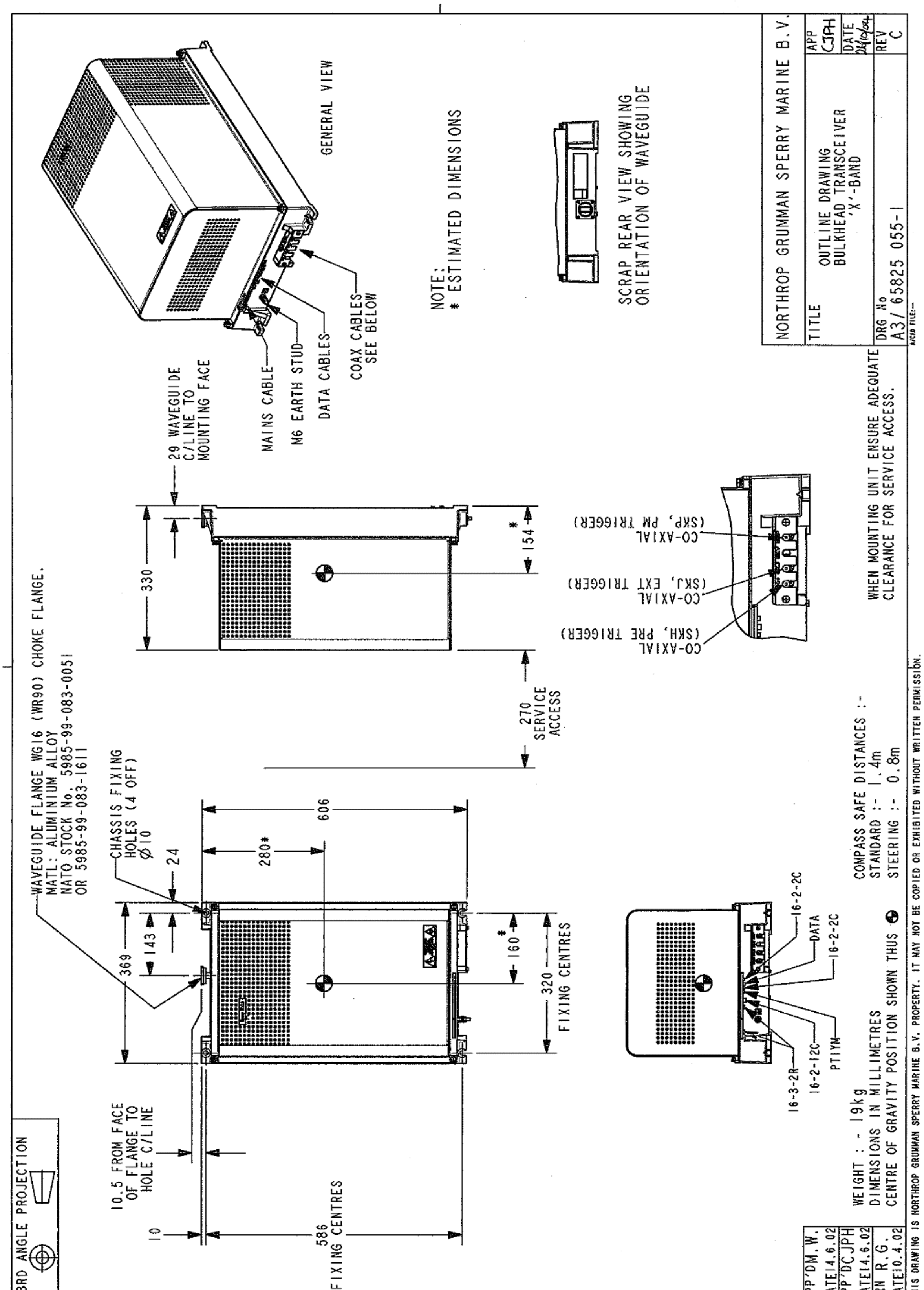


Figure 3.24 X-band Bulkhead Transceiver 25kW (later version) Installation

4.7.1 Bulkhead Transceiver Cabling Information

Figure 3.26 shows details of the cable input. The Transceiver cover, which is secured by four fixing screws, is shown removed. A cable-retainer holds the coaxial cables in place. The cables must be fitted to the retainer 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 supplied.

The AC mains input is connected to TSE located underneath the cover plate as shown in Figure 3.26.

4.7.1.1 Bulkhead Transceiver Input PCB Details

Figure 3.25 shows details of the Input PCB Assembly 65801814.

Access to the board is made by removing the main Transceiver cover and the Filter Box cover. Refer to the cabling schedules in Section 7 '*System Component Interconnections*' for details of the connections, which are made by using the two-part connectors supplied.

For 'additional features' transceivers fitted with PCB 65801815 or 65801821, see Section 3.3 *'Configuring Printed Circuit Boards'* in *Chapter 8 'Additional Features'.*

Configuration for normal operation is by link settings as follows:

LK2	Link pins 2 and 3
LK3	Link pins 2 and 3

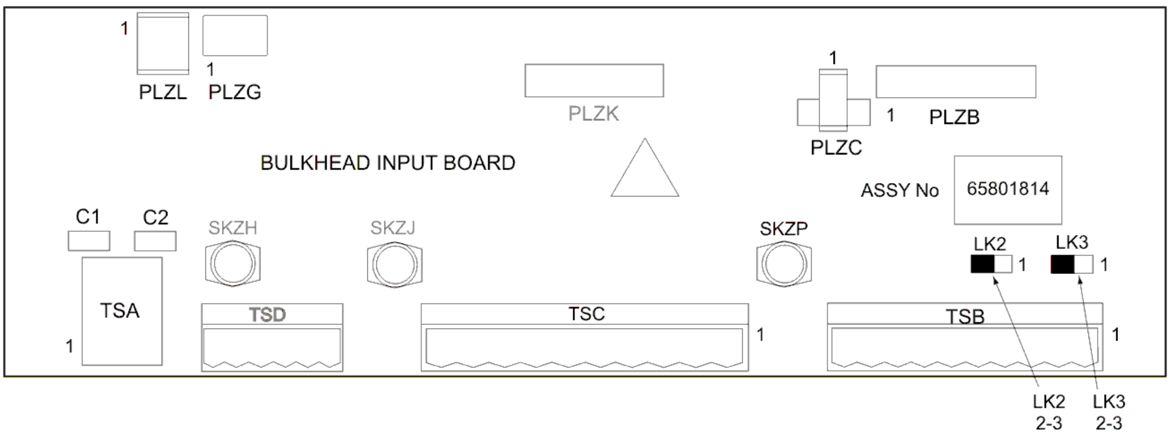


Figure 3.25 X-band Bulkhead Transceiver - Input Board Details

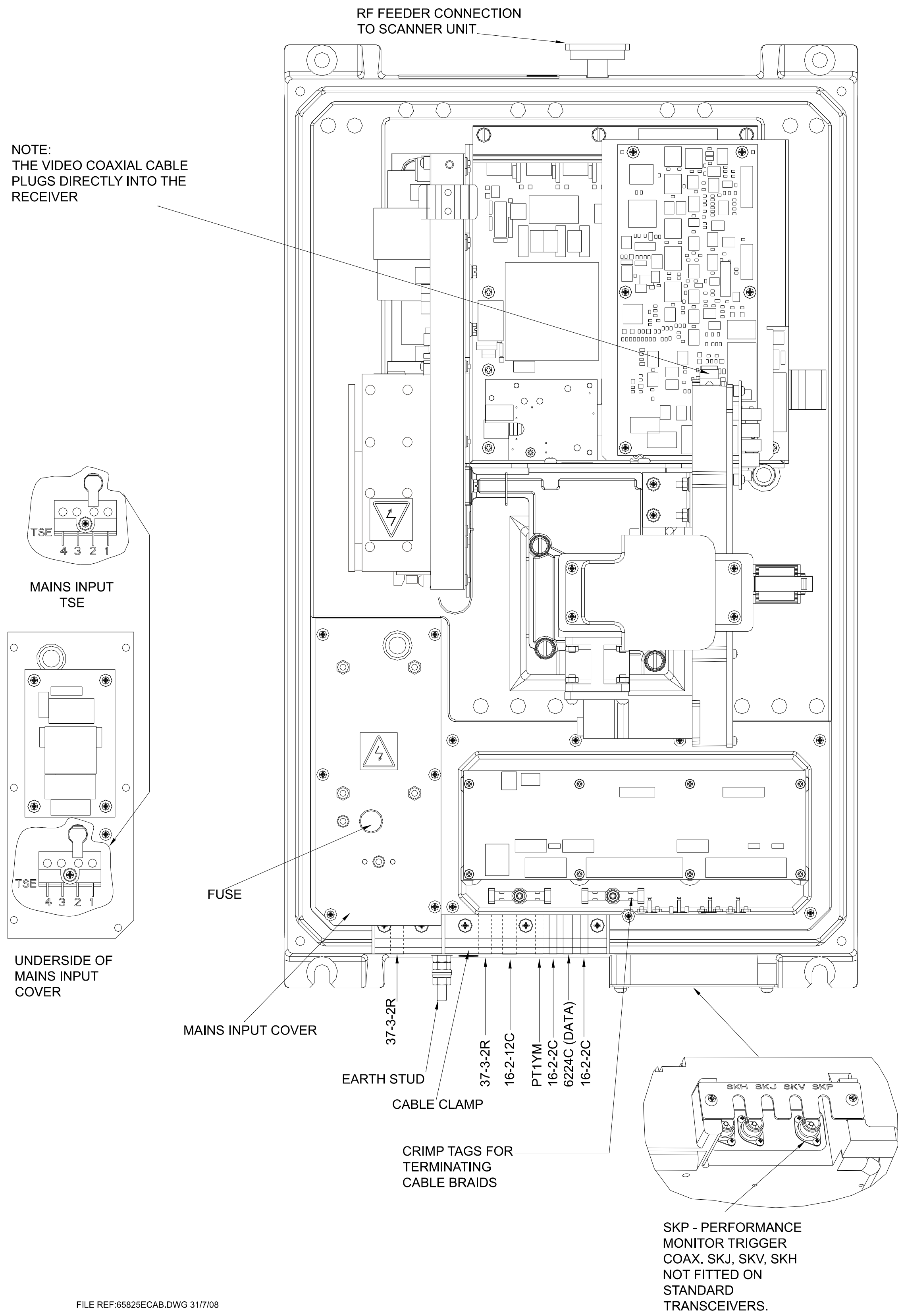


Figure 3.26 X-band Bulkhead Transceiver – Cable Input Details

4.8 Fitting the RF Elliptical Waveguide

For X-band radars a 33.5mm x 22.9mm corrugated elliptical waveguide is used for the run between the Bulkhead Transceiver Unit and the Turning Unit. 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.

Although apparently robust, the waveguide must be protected against strain and kinking, and must be treated with great care. 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").

Bends should have the largest bending radius 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.

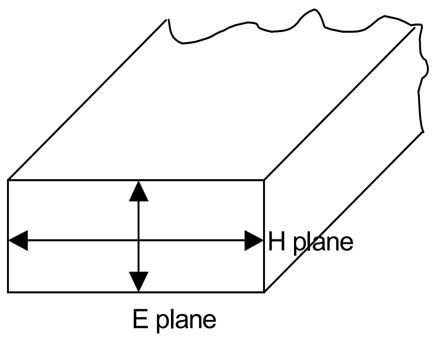


Figure 3.27 Waveguide Planes

For convenience, the upper (Turning Unit) connector can be fitted before installation of the waveguide (waveguide kits supplied by Sperry Marine have one connector fitted) but the following precautions must be taken:

1. Any bend required within 1m (3ft) of the waveguide end must be formed before carrying out the cutting and assembly procedure described in subsequent paragraphs. No bend may be nearer than 250mm (10in) from the end of the waveguide.
2. 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.
3. Remove the waveguide plug from the underside of the Antenna and the yellow sealing cap from the waveguide aperture on the Turning Unit. Do NOT remove the plastic membrane over the Turning Unit waveguide aperture.
4. 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.

5. The waveguide should be installed and secured in position (using the waveguide supports shown in Figure 3.42) as far as is practicable before the lower Transceiver Unit connector is fitted to the waveguide. The precautions given in paragraph 1. above must be observed if a bend is required adjacent to the Transceiver Unit.

4.8.1 Assembling the Connectors to the Waveguide

When assembling the connectors to an Andrew Antennas waveguide kit, refer to Section 4.8.1.1. When assembling the connectors to an RFS waveguide kit, refer to Section 4.8.1.2.

4.8.1.1 Assembling the Connectors using Andrew Antenna Waveguide kit

Figures 3.28 to 3.33 are reproduced by permission of Andrew Antennas.

General

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

Tools required

You will need a hacksaw (with a fine-toothed blade) and 1-15/16" open-ended spanner to fit the connectors to the waveguide.

Procedure

The procedure that follows applies to the straight connectors at each end of the waveguide. It is very important that swarf and other foreign matter is prevented from entering the waveguide.

Prepare the waveguide end and assemble the connector as follows:

1. Make sure the end of the waveguide is straight for at least 250mm (10in). The ends of the waveguide must be cut squarely, to ensure this wrap a straight edged piece of paper around the waveguide. Tilt the waveguide downwards to prevent copper swarf entering. 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 3.28.

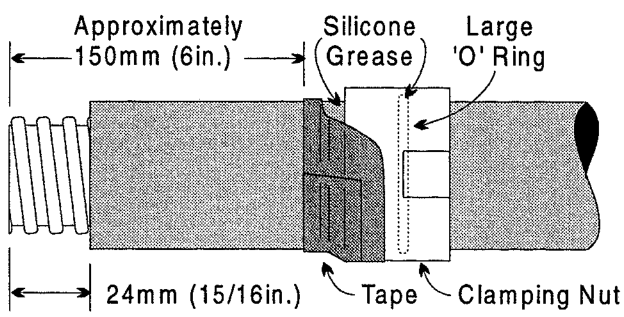


Figure 3.28 Cut Jacket

2. Apply a thin film of silicone grease (MS4 or similar) to the large 'O'-ring and insert it in the internal groove of the clamping nut. Apply a thin film of grease to the smooth internal surface of the clamping nut and slip the nut over the end of the waveguide, as shown in Figure 3.28. Wrap several turns of tape around the clamping nut and jacket to prevent foreign matter from entering.
3. 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 the pin in holes facing away from the jacket), as shown in Figure 3.29 and Figure 3.30.

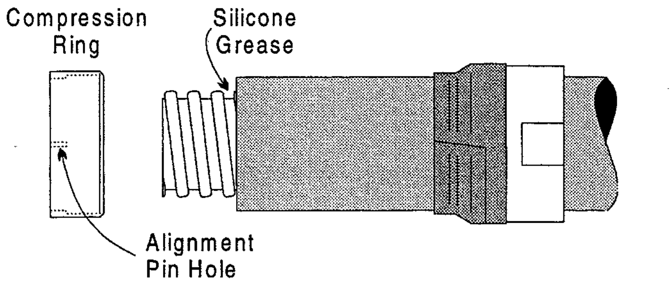


Figure 3.29 Fit Compression Ring

4. Turn the gasket inside out and fit it on to 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 3.30, and apply a thin film of grease to the outside surface of the gasket. Clean any grease from the exposed copper with solvent.

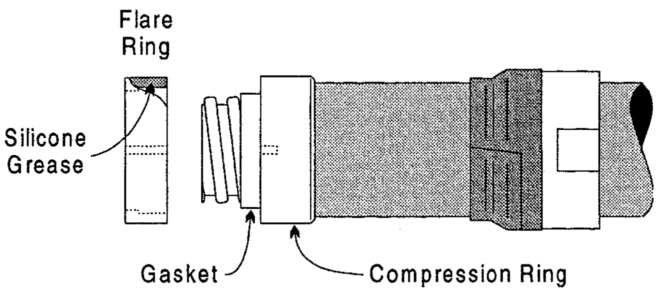


Figure 3.30 Fit Flare Ring

5. 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.

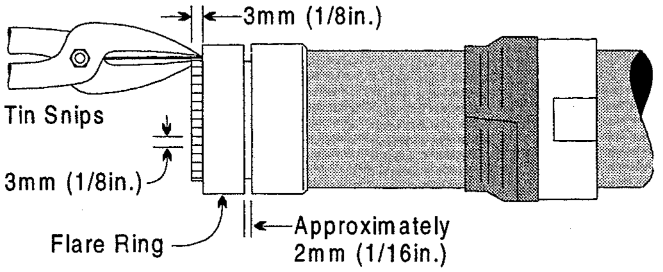


Figure 3.31 Cut Tabs

6. 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 3.31. Flatten the tabs against the flare ring with a mallet using minimum force. Heavy blows will reduce the thickness of the copper, *see* Figure 3.32. Trim off any tab protruding beyond the edge of the flare ring. Clean the tabs with solvent to remove any silicone grease.

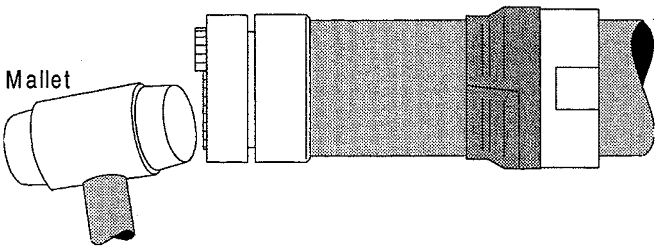


Figure 3.32 Flare End

7. Make sure 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.
8. Fit the smaller 'O'-ring to the external groove on the connector body without any grease, *see* Figure 3.33. Apply a thin film of grease to the rear outer surface of the compression ring (so that the large 'O'-ring in the clamping nut will slide over the compression ring and seat in the recess).

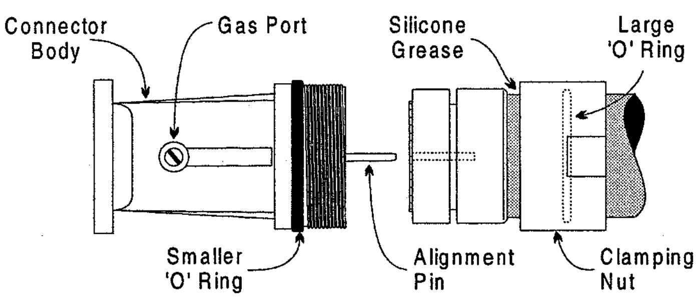


Figure 3.33 Fit Connector

9. 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 it to the thread on the connector body.
10. 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.

4.8.1.2 Assembling the Connectors using RFS Waveguide Kit

The following instructions and figures 3.34 to 3.39 are reproduced by permission of RFS (Radio Frequency Systems).

Tools and Materials Required

The following tools and materials are required.

- Tape measure, hammer, pliers, fine-toothed saw, brush, half-round file (fine), solid small tin shears, knife, open-ended spanners 12 mm set of allen wrenches, cloth, Plast 2000 20 ccm, adhesive tape.

Termination Disassembly

Refer to Figure 3.34 and list below for components in mounting of terminations.

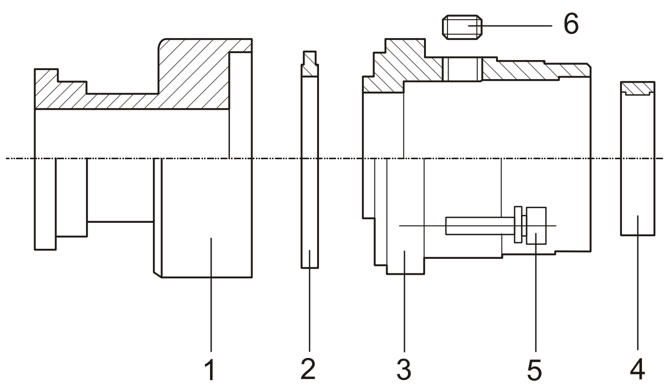


Figure 3.34 Termination Disassembly

1 Adapter section
2. Sealing ring
3. Back end
4. Sealing profile
5. Screw set with lock washers
6. Plastic screw (filling port for Plast 2000)

Waveguide Trimming

1. Cut waveguide at right angle to axis. Tilt the waveguide downwards to prevent swarf from entering the centre of the waveguide, or block off the waveguide centre using a cloth. Remove 35 mm length of polyethylene jacket as shown in Figure 3.35. Remove burrs and swarf.

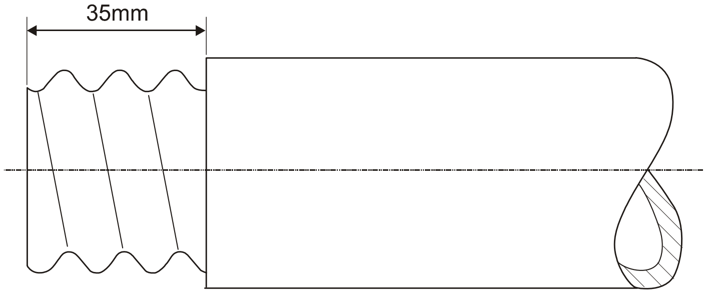


Figure 3.35 Waveguide Trimming

Waveguide Flanging

2. Slide the sealing profile (4) onto the corrugated tube, as shown in Figure 3.36.
3. Slide back end (3) onto waveguide up to sealing profile.

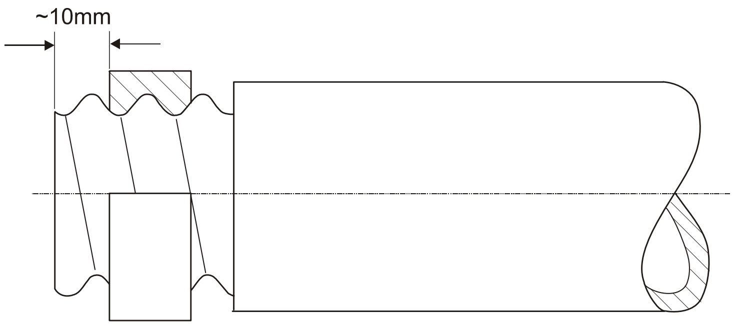


Figure 3.36 Waveguide Flanging

4. Cut in the corrugated copper tube circumferential up to the back end using tin shears. The distance between the copper tube end and the back end should be approximately 4 mm. Cut evenly with a space of approximately 3 mm, with spacing smaller than 2 mm at ends of larger elliptical axis, see Figure 3.37.

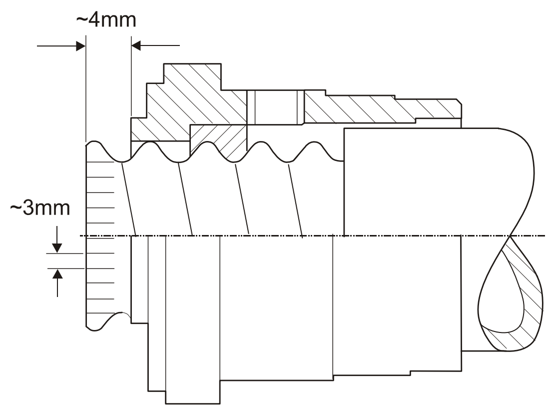


Figure 3.37 Cutting Copper Tube

5. Bend the feathered ends of the copper tube out and flange to the back end using a hammer, see Figure 3.38. Do not deform the inner bending area. If necessary, flatten the contact surface with a file. Remove cloth and any swarf from the inside of the waveguide.

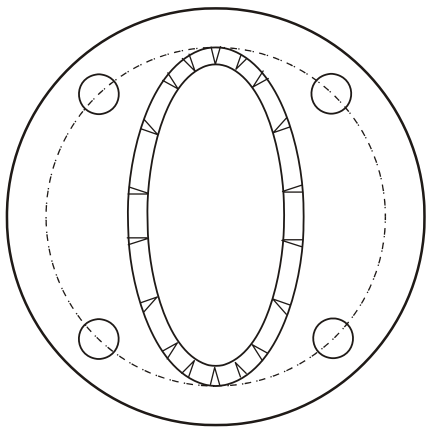


Figure 3.38 Treating the Copper Tube End

Assembly of Adapter Section

6. Screw together the back end (3) with sealing ring (2) and adapter section (1). Tighten allen screws rigidly alternating crosswise.
7. Wrap up the gap between the back end and the waveguide jacket with adhesive tape.
8. Screw Plast tube into the M9 filling port, tilt the assembly downwards and slowly fill up with the Plast 2000, see Figure 3.39. The back end is filled completely when the tape swells all around.
9. Remove the tube and close the port with the plastic screw (6). Clean surplus Plast from the area.

Note: *The curing time for Plast 2000 is at least 24 hours. The waveguide **must not** be pressurized before this period.*

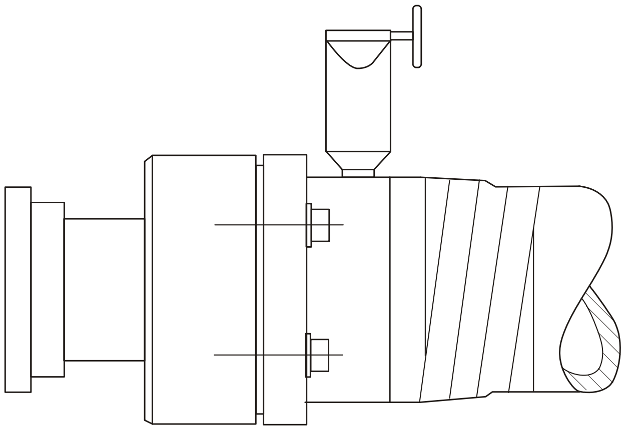


Figure 3.39 Injection of Plast 2000

4.8.2 Fitting the Deck Gland

The EW85 waveguide passes through its own separate deck gland (part number 9391991 (sks86347/a), positioned near the foot of the mast. The kit consists of a deck gland, gasket, upper and lower pressure plates, four m6 x25 screws and four split gaskets.

To fit the deck gland:

1. Cut the deck and fit the flange using suitable fixings (not supplied – *see* Figure 3.40).
2. Assemble the deck flange split gaskets (refer to note below) loosely around the waveguide section from below.
3. Slide the assembly upwards into the deck gland, *see* Figure 3.41.
4. Secure the waveguide down the mast.
5. Tighten the four split gasket screws carefully. Do **not** over-tighten the screws. This avoids possible distortion of the waveguide.
6. Fill the space between the waveguide and deck gland with hermastic oil-proof compound.

Note: *Split gaskets must be fitted in alternative positions to make sure the split does not line up with the split of an adjacent gasket.*

Initially, assemble the gaskets loosely before inserting them into the deck flange, see Figure 3.41. The assembly may be inverted to give you better access to the screws.

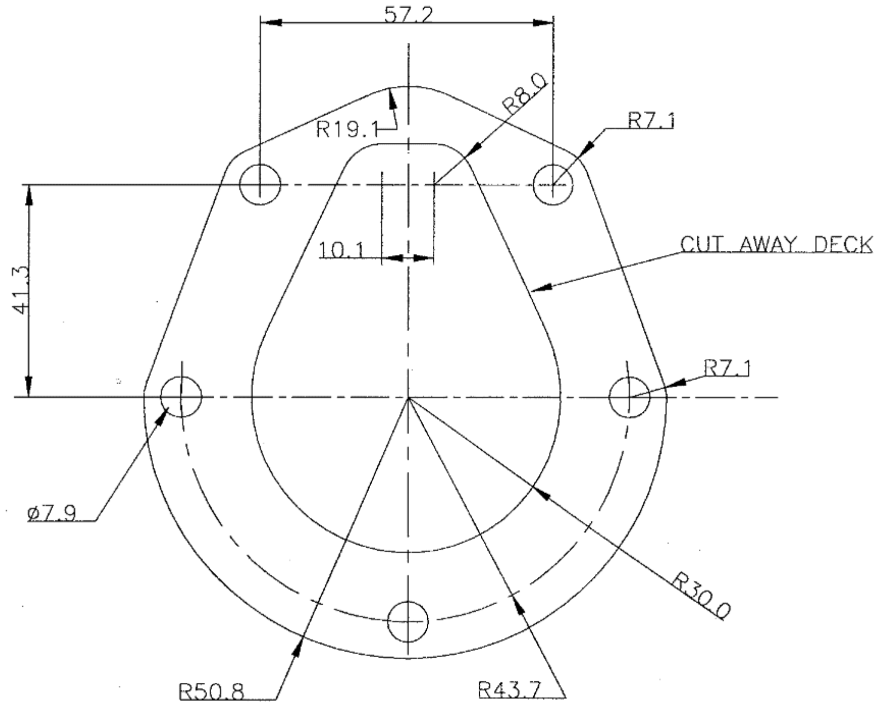


Figure 3.40 Deck Gland Fixing

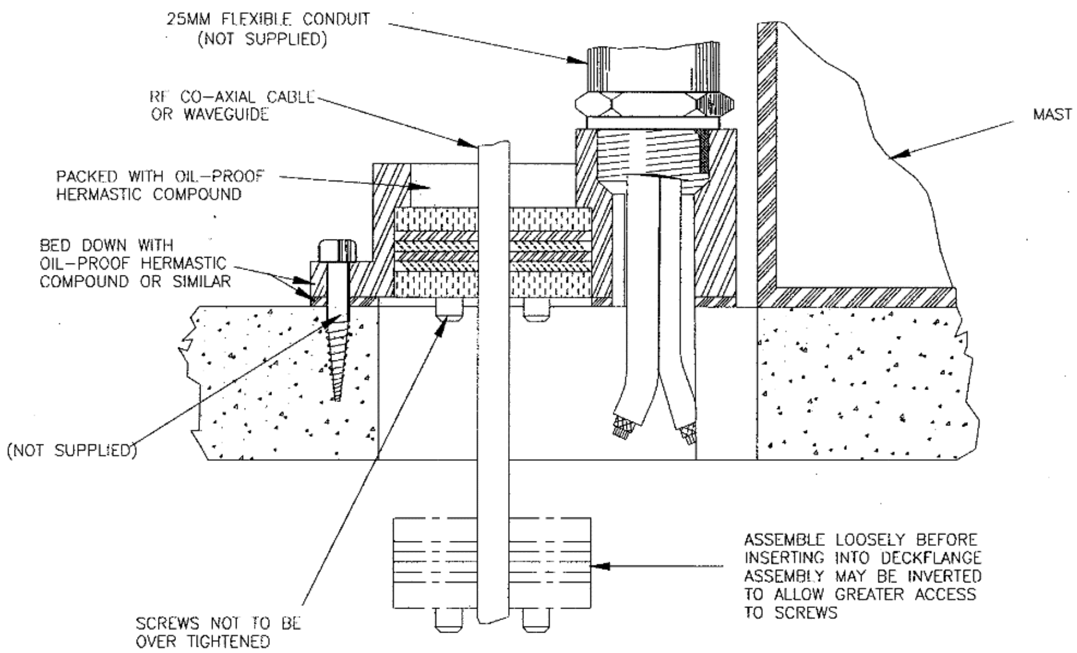


Figure 3.41 Deck Gland Details

Note: *If cables are not routed via conduit into a deck gland, make sure the cable entry hole is fully sealed using a suitable silicone sealant.*

4.8.3 Installing the Waveguide

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 3.42.

Figure 3.42 also shows additional hardware (not supplied in the installation kit) that can be used for special mounting arrangements. If required, these can be purchased from Andrew Corporation.

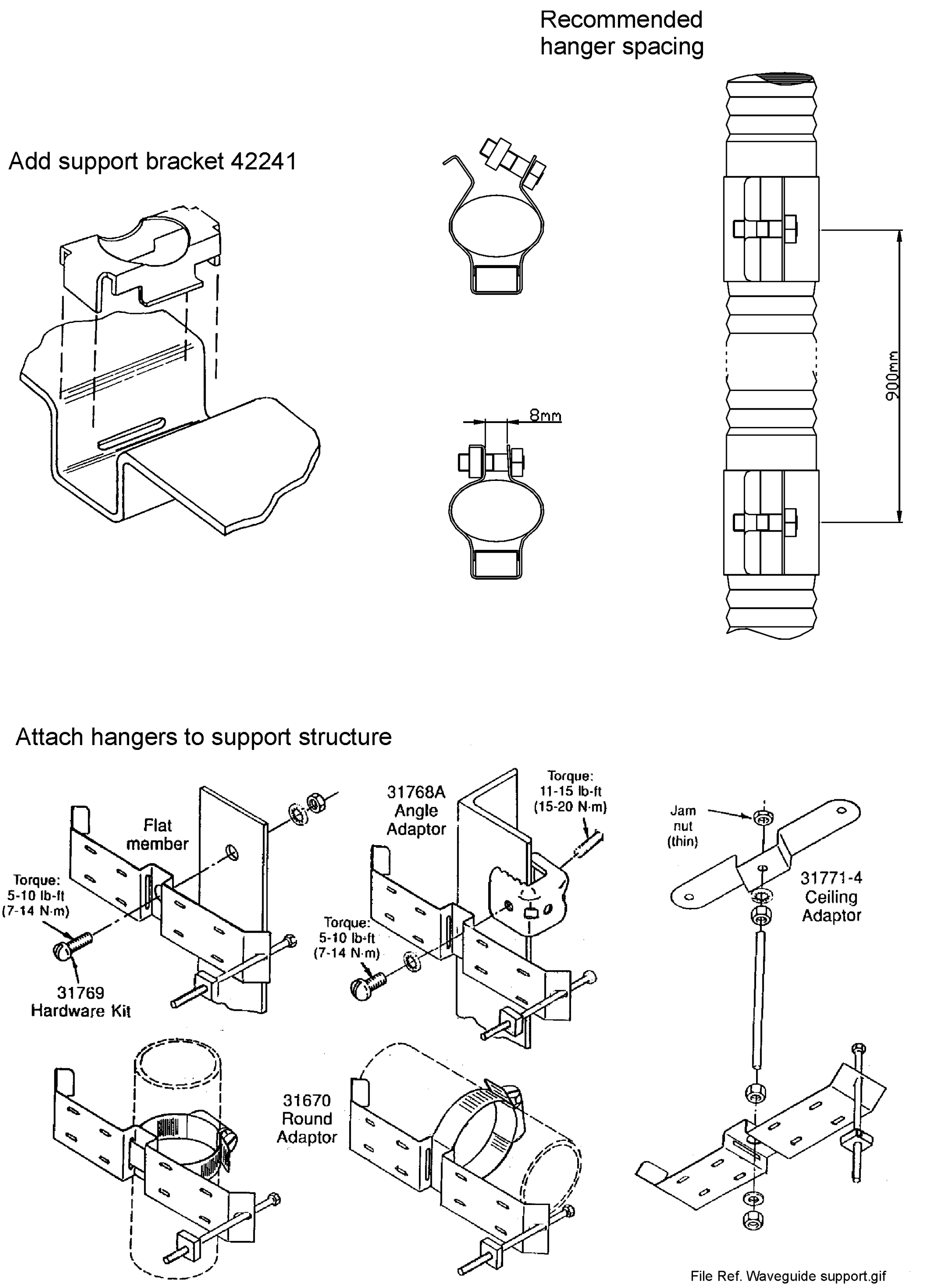


Figure 3.42 Waveguide Support Details

4.9 Sealing the Turning Unit

Before securing the top casting and bottom casting of the Turning Unit ensure the seal groove in the top casting and the mating faces of the top casting and lower casting are liberally coated with the petroleum jelly supplied (MA00013789).

Apply denso paste (9037446) to the four top casting retaining bolts.

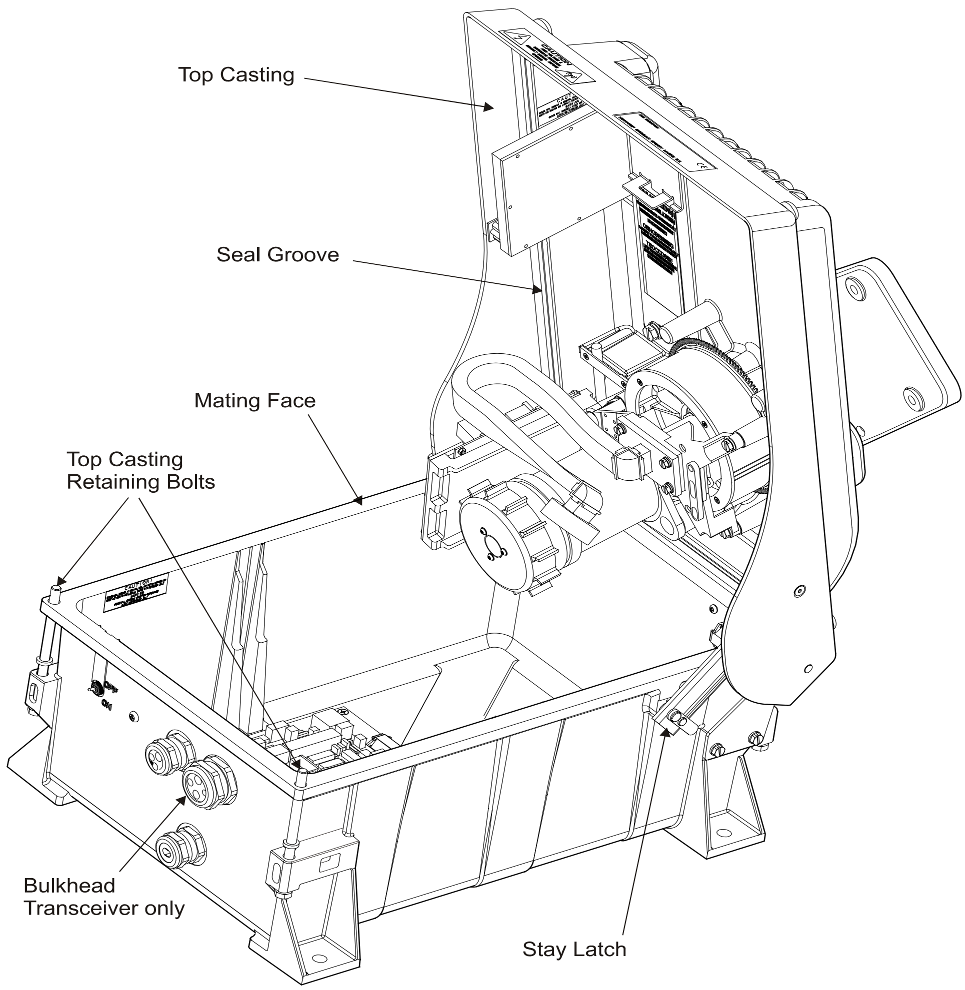


Figure 3.43 Sealing the Turning Unit

4.10 X-Band Installation Kits

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

4.10.1 Connector Kit for Long Cable Runs

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.

4.11 Despatch Kits

To help assemble the equipment, Despatch Kits, including assembly instructions, are sent as shown in the following table:

Table 7: Despatch Kits

Unit	Despatch Kit
X-band Systems	
Turning Unit	65901660
Bulkhead Transceiver	65825660

5 Installing the S-band Scanner Assembly

The S-band Scanner assembly is made up of the following sub-assemblies. Each component is supplied in its own packing, together with relevant installation drawings:

Turning Unit	With/without Integral Transceiver (30kW) Despatch Kit 65830660 (Installation Drawing 65830050)
Note: 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	65612620 (Installation Drawing 65612050-054)

To install the S-band Scanner assembly carry out the following operations, preferably in the sequence outlined below:

1. Preparation of the site (refer to Section 2 ‘*Siting*’).
2. Bolting the Turning Unit to the mounting platform (ship’s structure) as detailed in Installation Drawing 65830050 supplied with the Turning Unit, and in Figure 3.51.
3. Bolting the Support Casting to the Turning Unit as detailed in Installation Drawing 65612050-054 supplied with the Antenna Despatch Kit, and in Figure 3.52.
4. Bolting the Antenna to the Support Casting as detailed in Installation Drawing 65612050-054 supplied with the Antenna Despatch Kit, and in Figure 3.53.
5. Laying in and installing the cables for the motor and the Turning Unit in Section 5.6 ‘*Cabling Connections*’.

Figures 3.44 to 3.48 show S-band Scanner outline drawings 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 any differences.

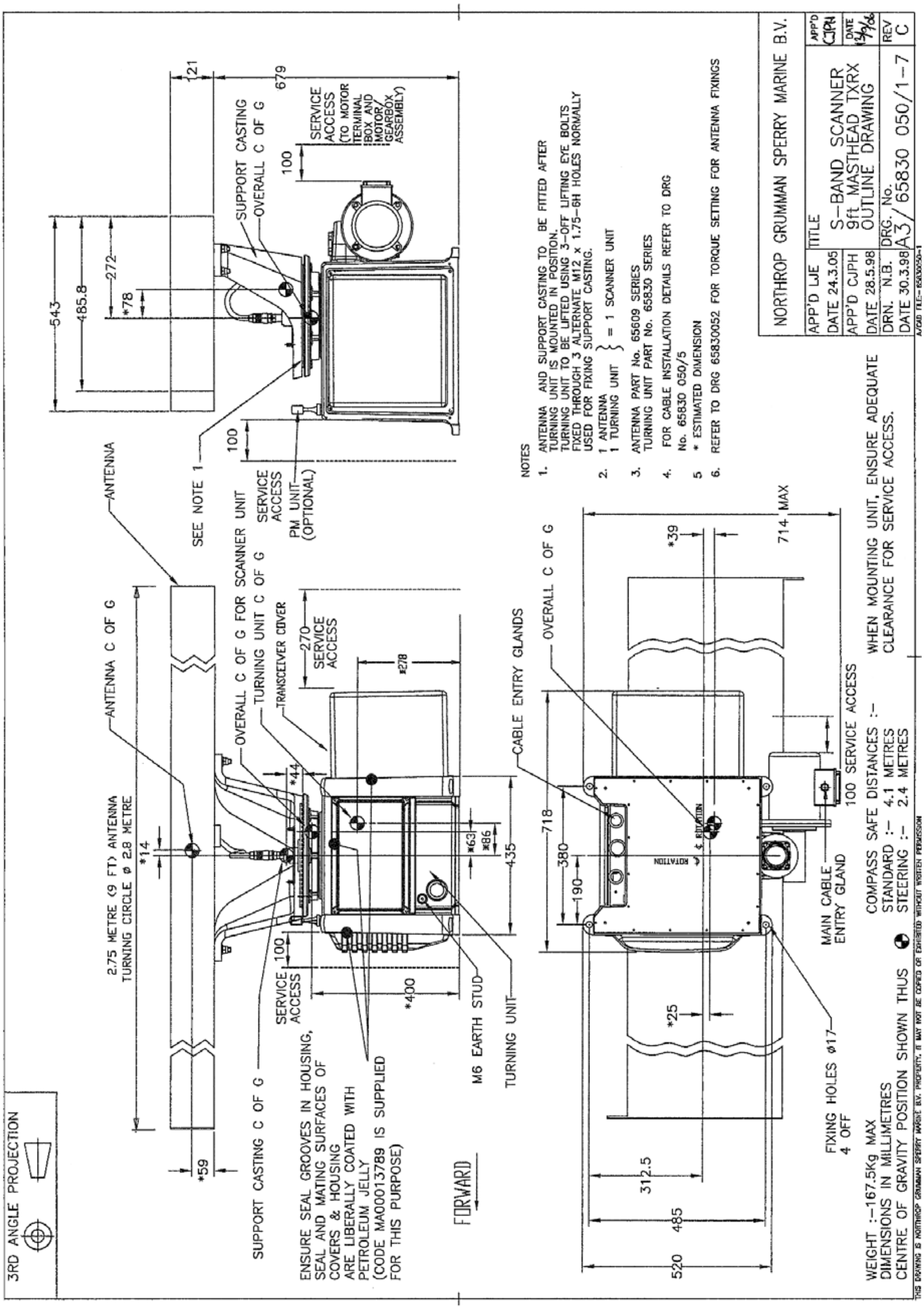


Figure 3.44 S-band Scanner 9ft Masthead Tx/Rx 30kW Installation

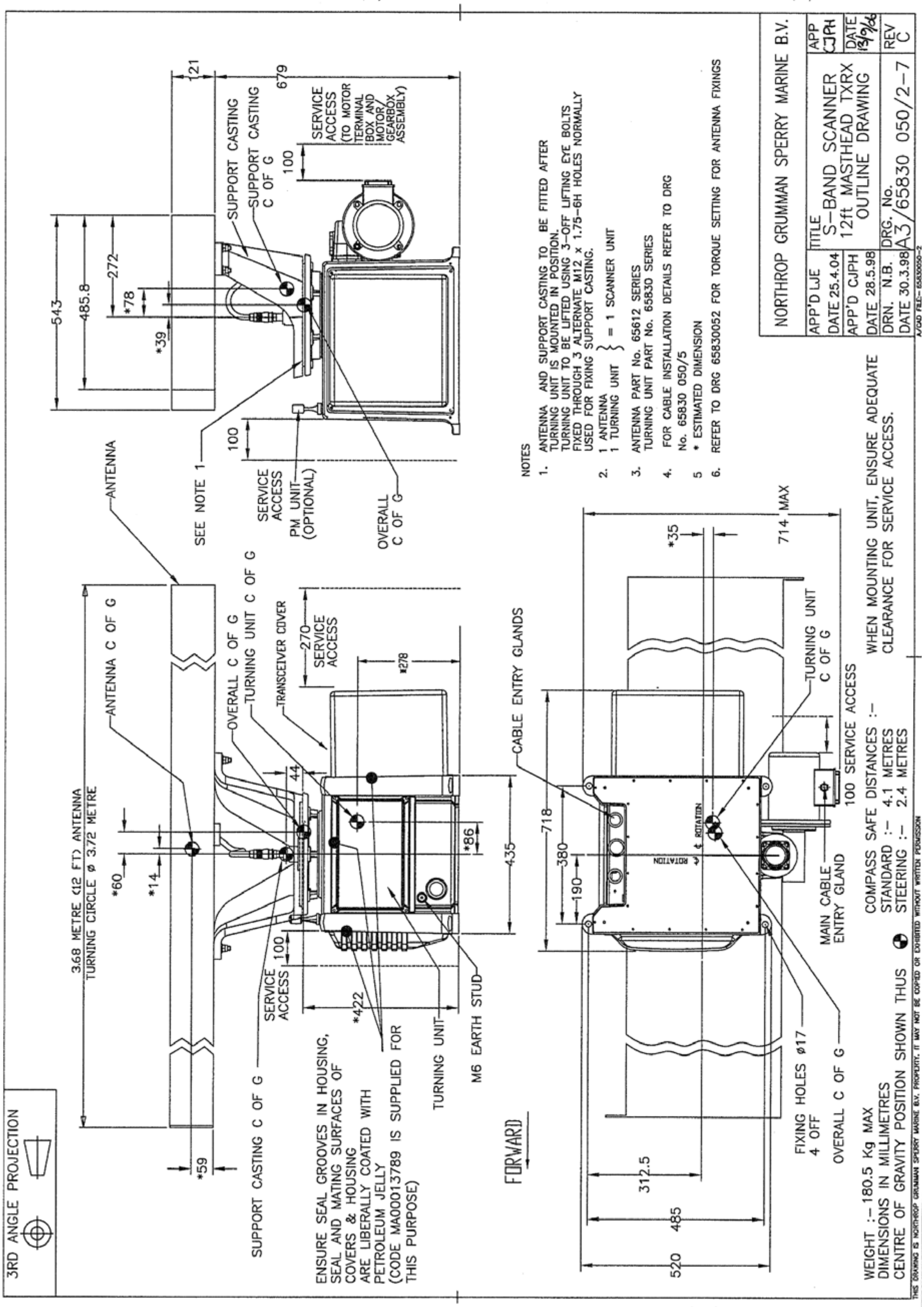


Figure 3.45 S-band Scanner 12ft Masthead Tx/Rx 30kW Installation

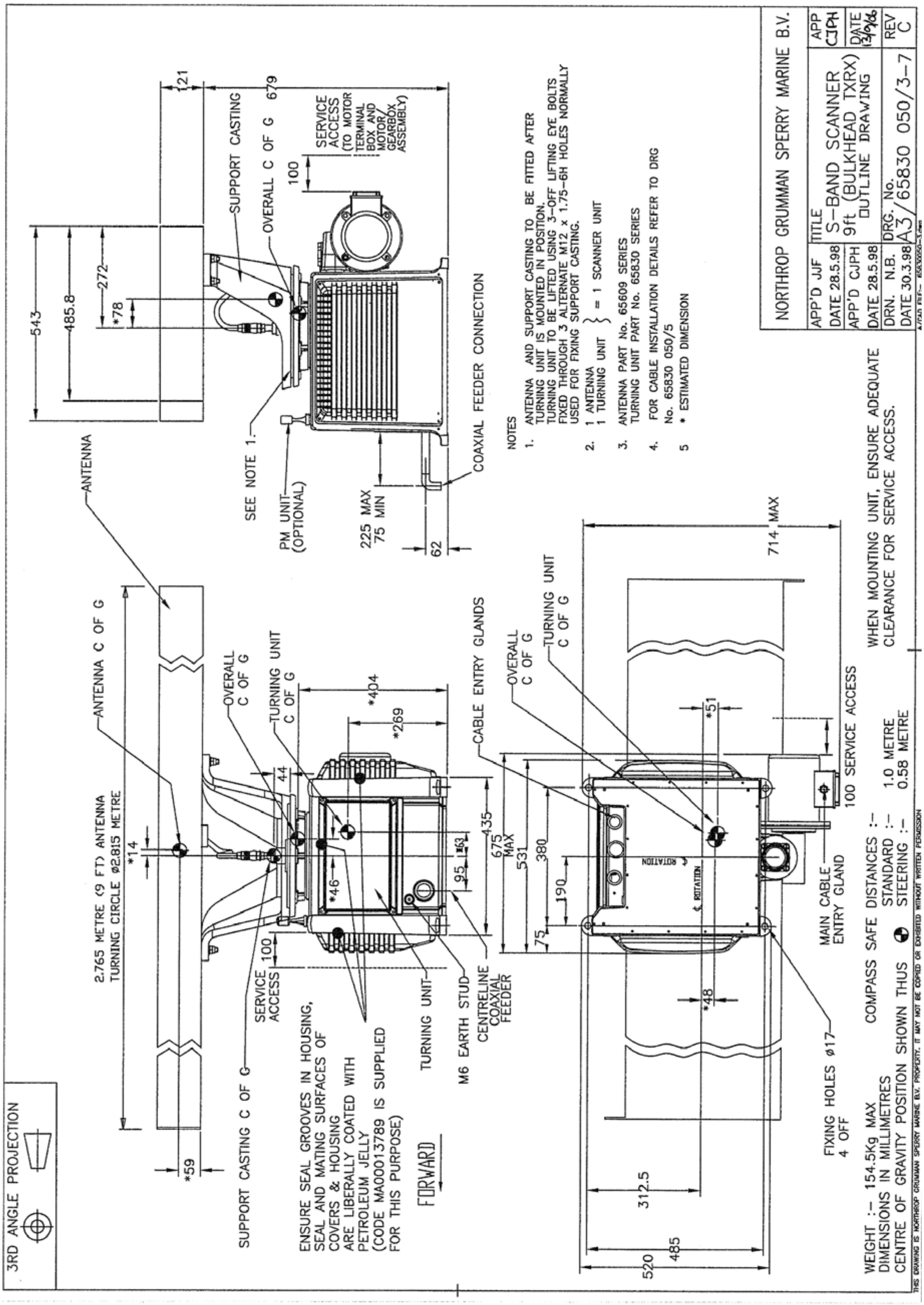


Figure 3.46 S-band 9ft Bulkhead Tx/Rx Installation

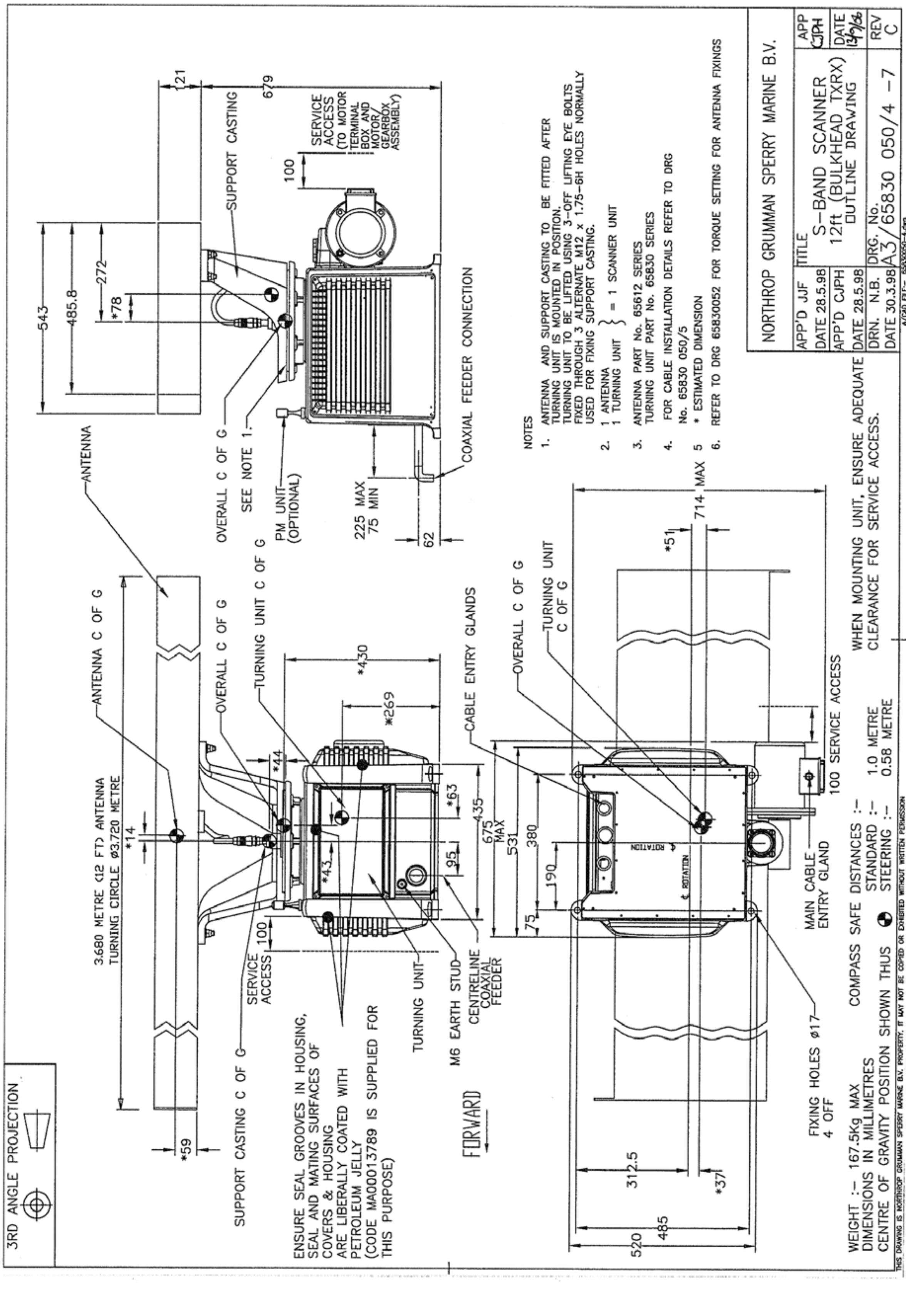


Figure 3.47 S-band Scanner 12ft Tx/Rx Installation

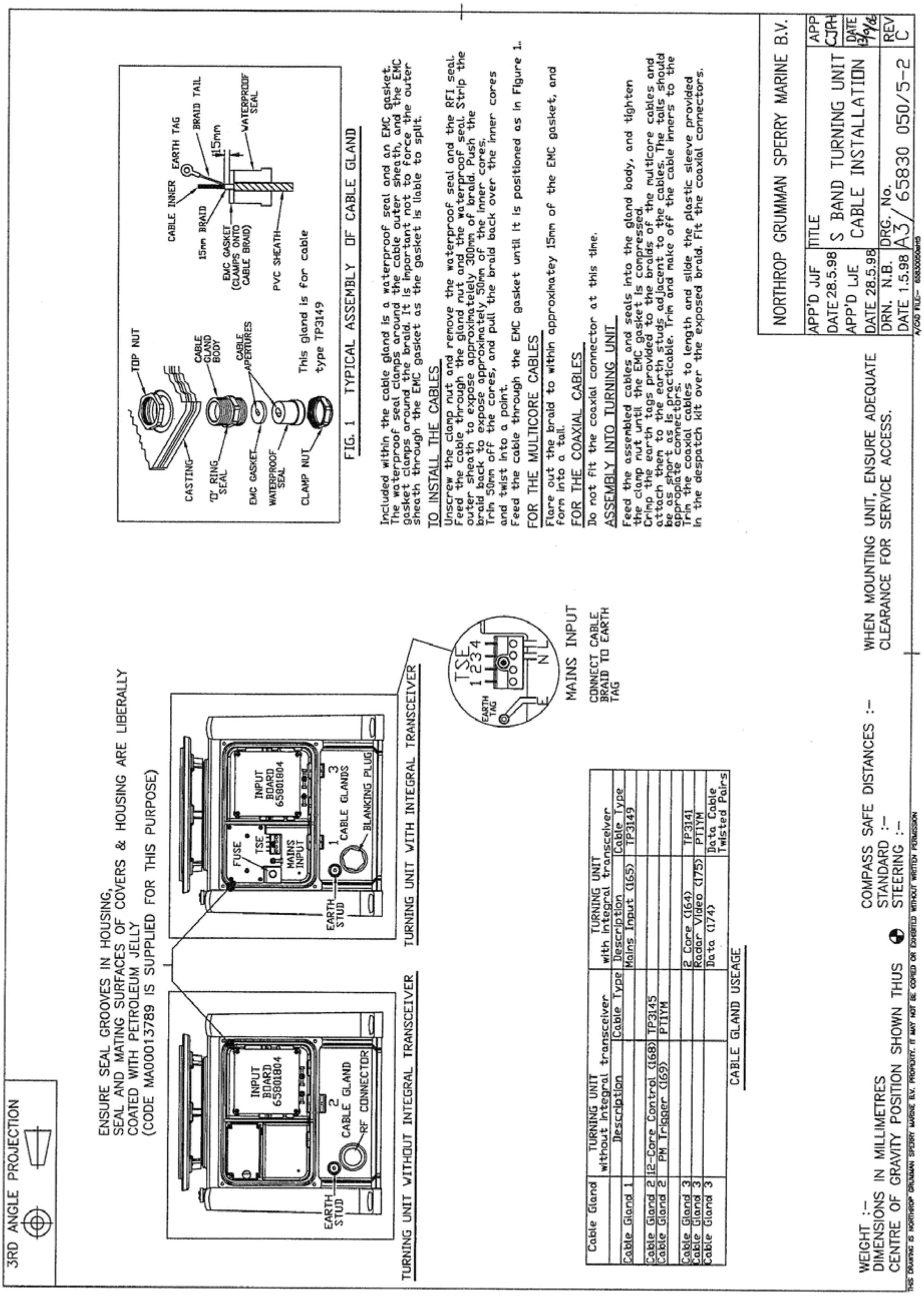


Figure 3.48 S-band Turning Unit Cable Installation

5.1 Turning Unit

	WARNING! HEAVY WEIGHT
	THE TURNING UNIT MUST BE LIFTED BY CRANE, DO NOT ATTEMPT TO LIFT THE TURNING UNIT BY HAND. NEVER LIFT A COMBINED TURNING UNIT AND ANTENNA UNIT BY THE ANTENNA UNIT. THIS IS DANGEROUS AND WOULD CAUSE DAMAGE TO THE ANTENNA UNIT. NGSM RECOMMEND THE USE OF LIFTING SLINGS TO PREVENT DAMAGE TO THE TURNING UNIT, SUPPORT CASTING AND ANTENNA.

	WARNING! HEAVY WEIGHT
	THE WEIGHT AND SPREAD OF THE ANTENNA CAN CAUSE A FREESTANDING TURNING UNIT TO TOPPLE OVER. THE TURNING UNIT SHOULD BE BOLTED DOWN ONTO ITS MOUNTING PLATFORM BEFORE REMOVING THE LIFTING SLINGS FROM THE EYEBOLTS.

The S-Band Turning Unit includes three lifting eyebolts (RA00012823), which are screwed into tapped holes on the top face of the turning unit housing, see Figure 3.49.

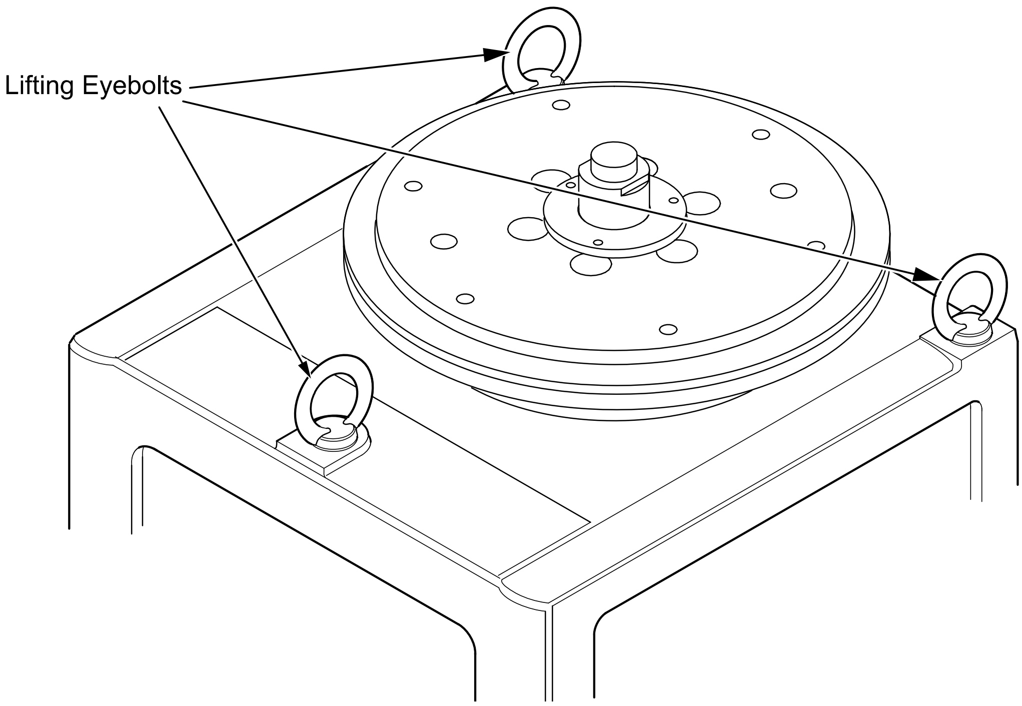


Figure 3.49 S-Band Turning Unit with Eyebolts

5.1.1 Lifting the Turning Unit Assembly

The Turning Unit, Support Casting and Antenna can be lifted as a complete assembly from the dockside onto the mounting platform using three lifting slings (RA00012831) which are secured to the eyebolts as a choker hitch configuration (see Figure 3.50). If lifting slings cannot be obtained other suitable, approved lifting tackle may be used.

To lift the assembly onto the mounting platform:

1. Secure the three lifting slings to the eyebolts as shown in Figure 3.50. Attach the other end of the lifting slings to the crane hook, which should be positioned directly above the turning unit.
2. In order to protect the antenna during lifting all new antennas are fitted with two edge protectors (65612201) either side of the antenna. The edge protectors are secured using plastic banding tape. When lifting ensure the slings are positioned over the edge protectors.

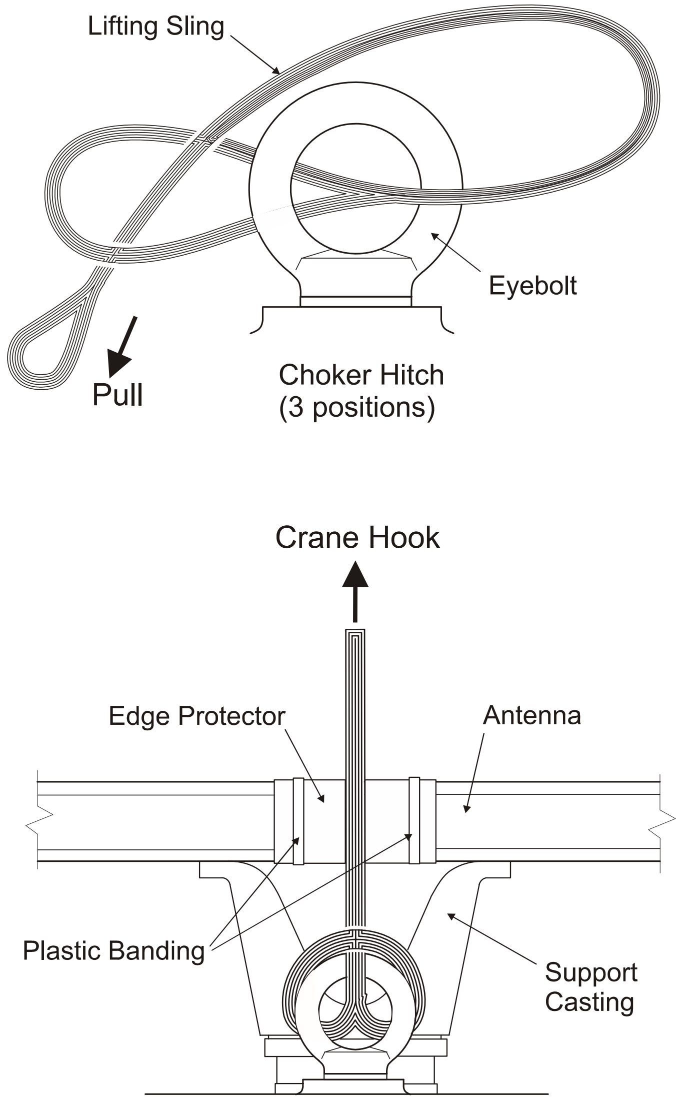


Figure 3.50 Attachment of Lifting Slings to Eyebolts and Hook

3. When installation is complete the edge protectors must be removed from the antenna. Remove by cutting the two banding tapes, if required retain the edge protectors for future use.

Note: *The lifting eyebolts are guaranteed for up to one year from the date shown on the Certificate of Conformance supplied with the eyebolts. Once the certificate has expired NGSM cannot guarantee the safety of the eyebolts for lifting purposes. The responsibility for validating the use of the eyebolts for lifting is then transferred to the ship owner.*

5.1.2 Securing the Turning Unit Assembly

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

Figure 3.51 shows how these are fitted. Before assembly make sure all threads and bushes are coated with Denso Paste.

Note: *The Turning Unit is bolted directly to the mounting platform. No intervening washer or pad is used, except for the purpose of levelling the mounting. This stops the Turning Unit casting from twisting when the bolts are tightened. M16 washers may be used as shims, or purpose made parts, produced locally, may be used.*

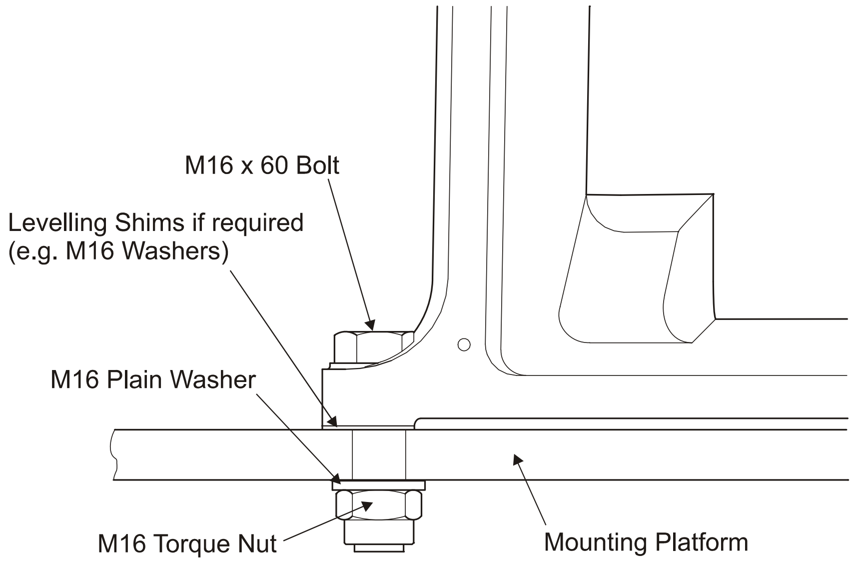


Figure 3.51 Fixing the Turning Unit to the Mounting Platform

5.2 Support Casting

The Support Casting is fitted to the Turning Unit torque tube using a fixing kit supplied with the antenna despatch kit.

There are two despatch kits available, depending on which antenna support assembly has been supplied:

1. Support Casting 65612100 is part of Despatch Kit 65612610 (using fixing kit 65612611-1).
2. Support Casting 65612603 is part of Despatch Kit 65612620 (using fixing kit 65612611-3).

Note: *Antenna support casting parts are supplied only via the despatch kits and therefore cannot be supplied as standalone units.*

Figure 3.52 shows how the antenna support casting is fitted to the turning unit. Note that the figure applies to both antenna support despatch kits.

Ensure that all threads and bushes are coated with Denso paste.

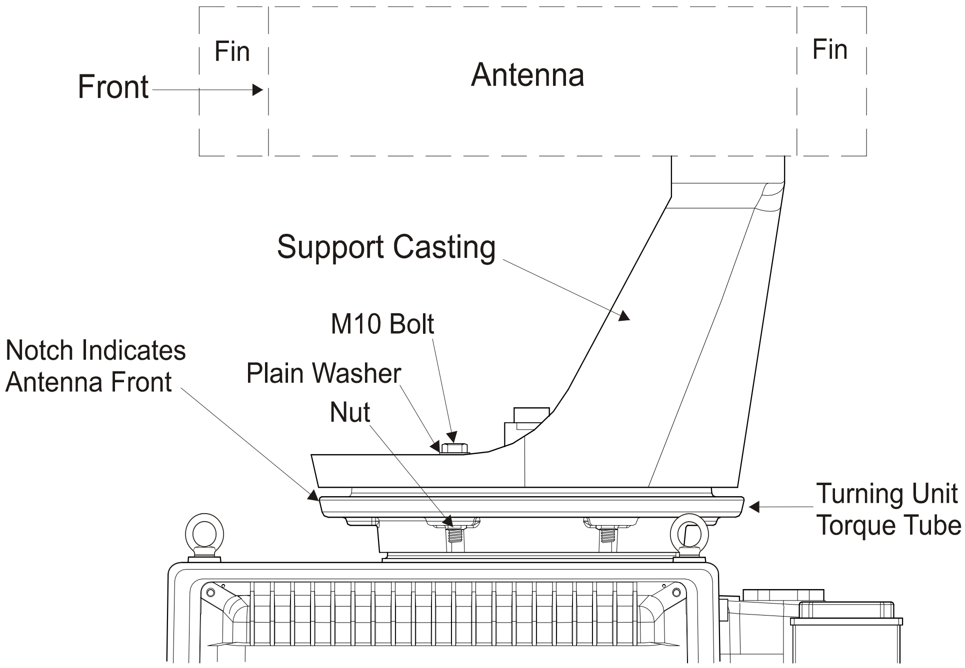


Figure 3.52 Fixing the Support Casting to the Torque Tube

5.3 Performance Monitor

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

5.4 Antenna

There are two methods of fitting the Antenna to the Support Casting. The method is dependent on which antenna support assembly has been supplied, see Section 5.2 '*Support Casting*'.

5.4.1 Fitting Support Casting 65612100

The Antenna is fitted to the Support Casting 65612100 using the parts listed below which are supplied with the antenna:

- 4 x M12 Plain Nuts
- 4 x Plain Washers (Spacers)
- 2 x Lock Tabs

Figure 3.53 shows where these are fitted. Make sure all threads and bushes are coated with Denso Paste. For full fitting instructions see drawing 65830052 supplied with the equipment.

Note: *The lock tab ends must be bent to stop the nuts rotating.*

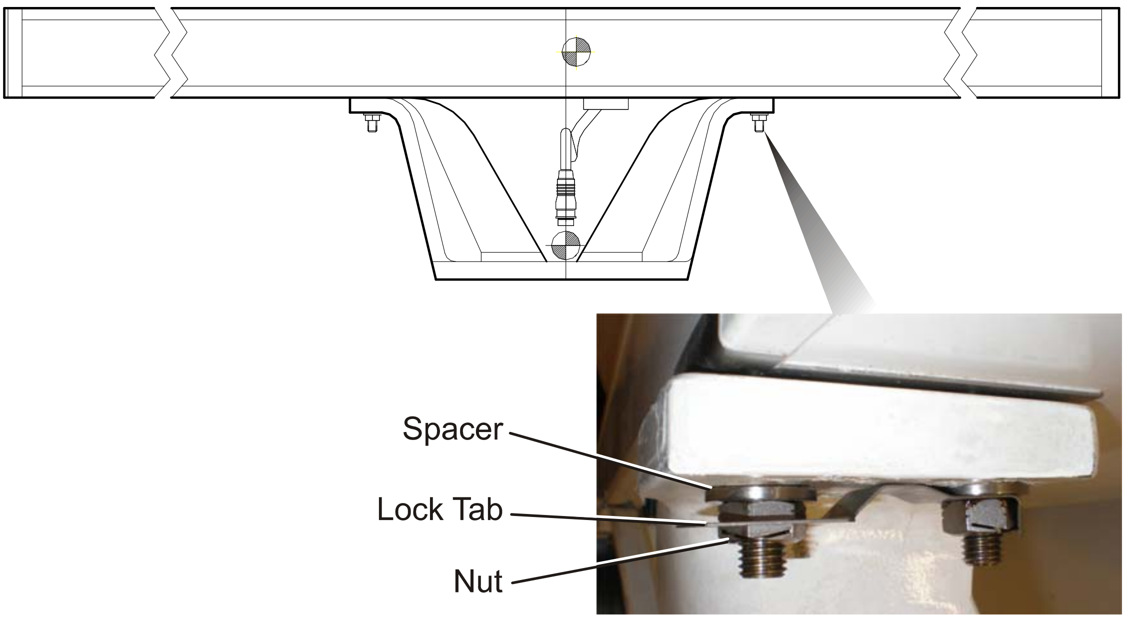


Figure 3.53 Fixing the Antenna to the Support Casting

5.4.2 Fitting Support Casting 65612603

The Antenna is fitted to Support Casting 65612603 using the parts listed below which are supplied with the antenna:

- 4 x M12 Hardlock Convex Nuts
- 4 x M12 Hardlock Concave Nuts
- 4 x Plain Washers (Spacers)

Figure 3.54 shows where these are fitted. Make sure all threads and bushes are coated with Densopaste. For full fitting instructions see drawing 65830068 supplied with the equipment.

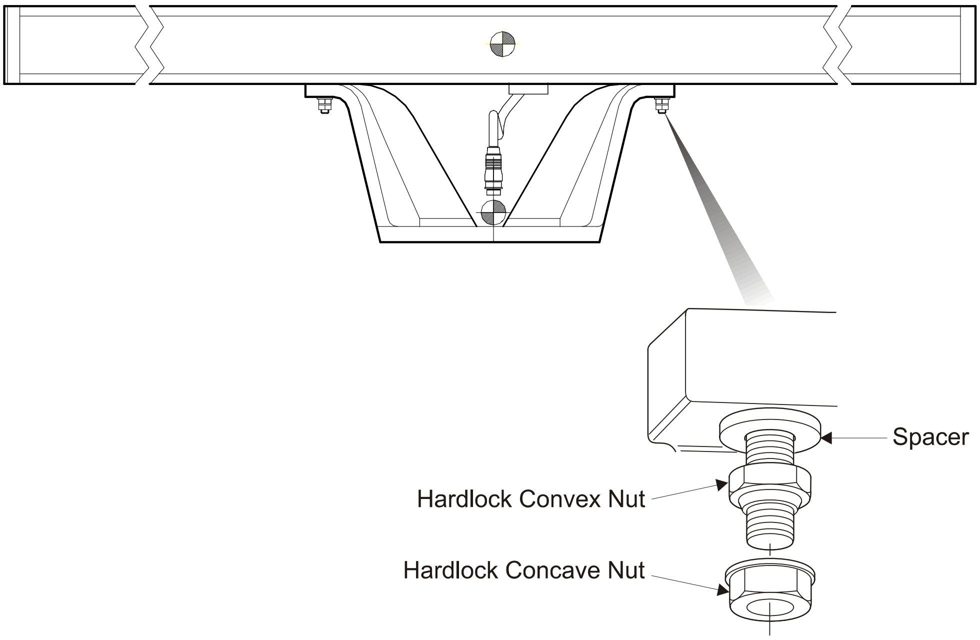


Figure 3.54 Fixing the Antenna to the Support Casting 65612603

5.4.3 Connecting Coaxial Cable

The next step is to connect the S-band coaxial cable from the Antenna to the Turning Unit RF connector as shown in Figure 3.55. The mated connector must then be wrapped with self-amalgamating tape as an additional precaution against water ingress.

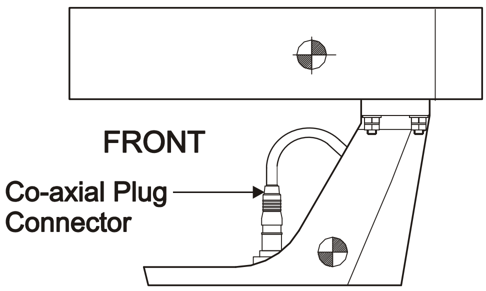


Figure 3.55 Connecting Coaxial Cable

5.5 Motor Connections

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

The following table gives the motor types that are available:

Table 8: Motor Types

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 referenced in Table 8, dual voltage motors are used for both single and 3 phase supplies. 110-120/220-240Volts for single phase; 220-240/380-440Volts for 3 phase. In addition to the wiring 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:

1. First, feed the mains cable through the cable gland on the motor termination box housing.
2. Connect the cable braid to the motor chassis.
3. Connect the individual insulated conductors to the appropriate terminals as detailed for each motor type in the following section.
4. Make sure the cable is not under strain in the termination box area, and sufficient slack is available to remake the connection, should this ever be necessary, for example, if a motor is changed in service.
5. Make sure the insulated conductors are terminated appropriately:
   - using ring crimp terminals on threaded studs; or
   - stripping insulation back by 5mm for screw compression pillars.
6. Ensure that any gasket fitted for sealing the terminal box cover is correctly seated when the cover is re-secured.

5.5.1 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).

For dual voltage single phase motors connection details are shown in Figure 3.56.

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 3.56 for the required motor supply voltage.

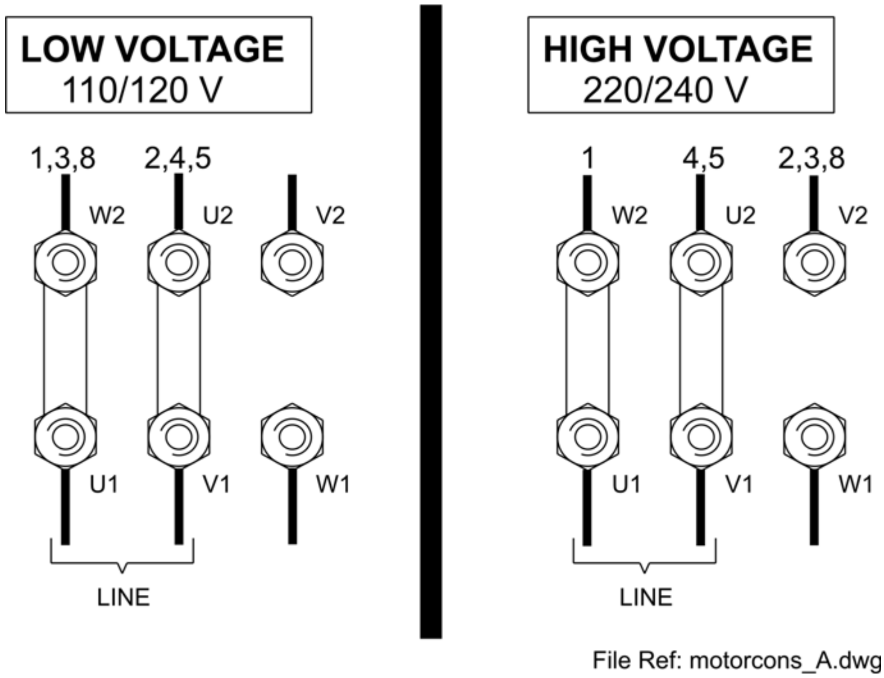


Figure 3.56 Dual Voltage Single Phase Motor Connections

Table 9: Single Phase Motor Cable Data

Wiring Diagrams 65900061 or 65900062	Description	Motor Label Reference
TSH1	AC LINE	L, L1 or U1
TSH2	AC NEUTRAL	N, L2, U2 or V1

5.5.2 Three Phase Motor Connections

For dual voltage three phase motors, ensure that windings are configured for the appropriate voltage, see Figure 3.57. Delta (triangle) connected windings are for low voltage operation, Star (Y) for high voltage.

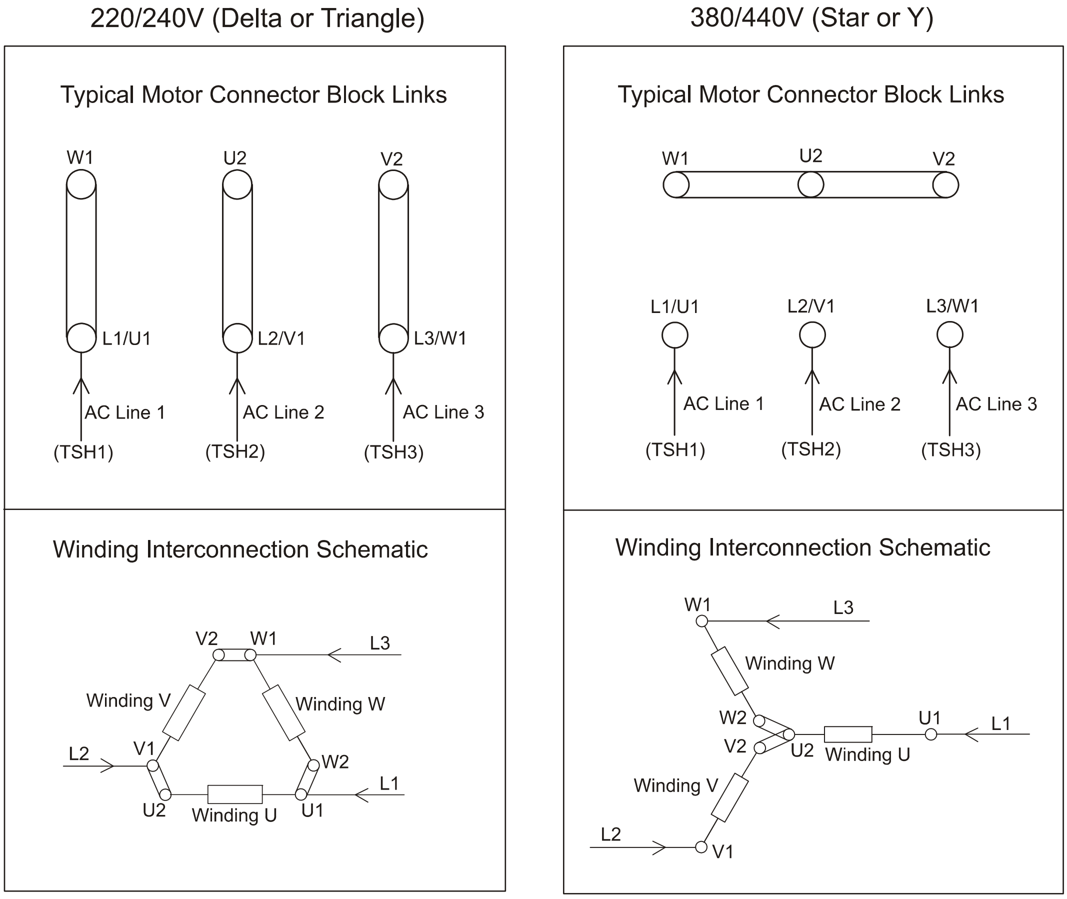


Figure 3.57 Dual Voltage 3 Phase Motor Configuration

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).

Table 10: Three Phase Motor Cable Data

Wiring Diagrams 65900061 or 65900062	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

5.6 Cabling Connections

Figure 3.58 shows the cable entry points. Three of these are via cable glands labelled 1, 2 and 3. Details of these cable glands are given in Table 11.

The RF cable input is only needed 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 let the unit bond to the ship's structure: this must **not** be used for any other connection.

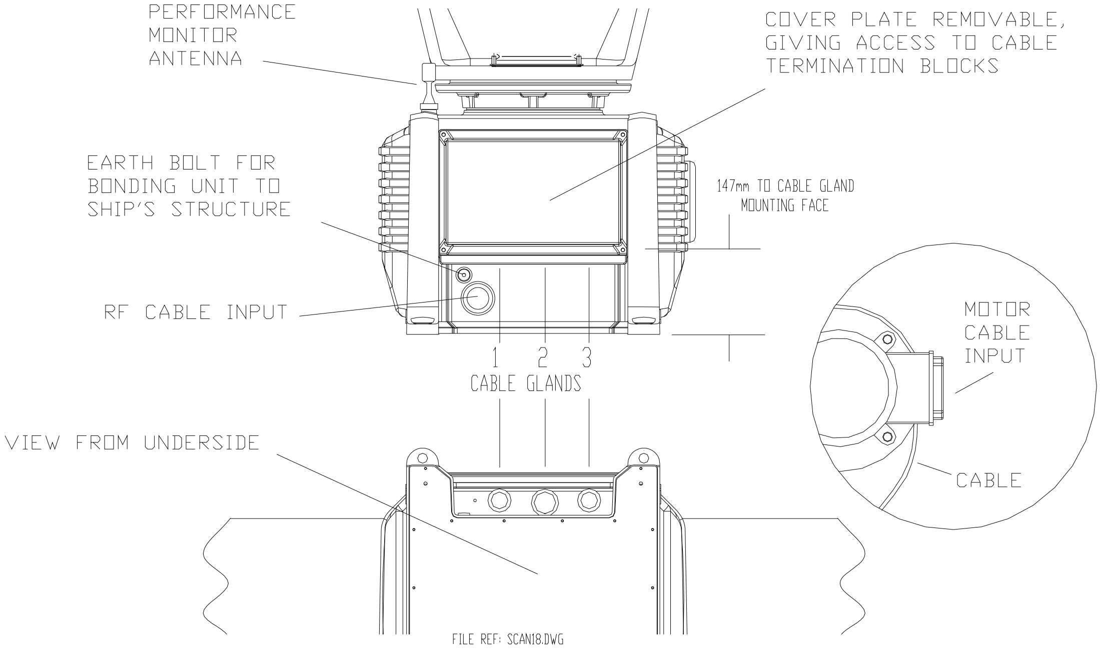


Figure 3.58 Turning Unit – Cable Entry Locations*

* This drawing is for a turning unit without integral Transceiver. Refer to the Table 11 for details of cable fitted for different variants.

Figure 3.59 shows details of the Input Board 65801813 (or 65801819) and the Mains Input connector (integral transceiver only) TSE.

The input board is accessed by removing the cover plate, which is held by four fixing screws (see Figure 3.58). Links LK3 and LK4 on the Input Board should be set as shown in Figure 3.59. Link LK5 is fitted.

For information on input board 65801819 see Section 3.3.2 in Chapter 8 *'Additional Features'.*

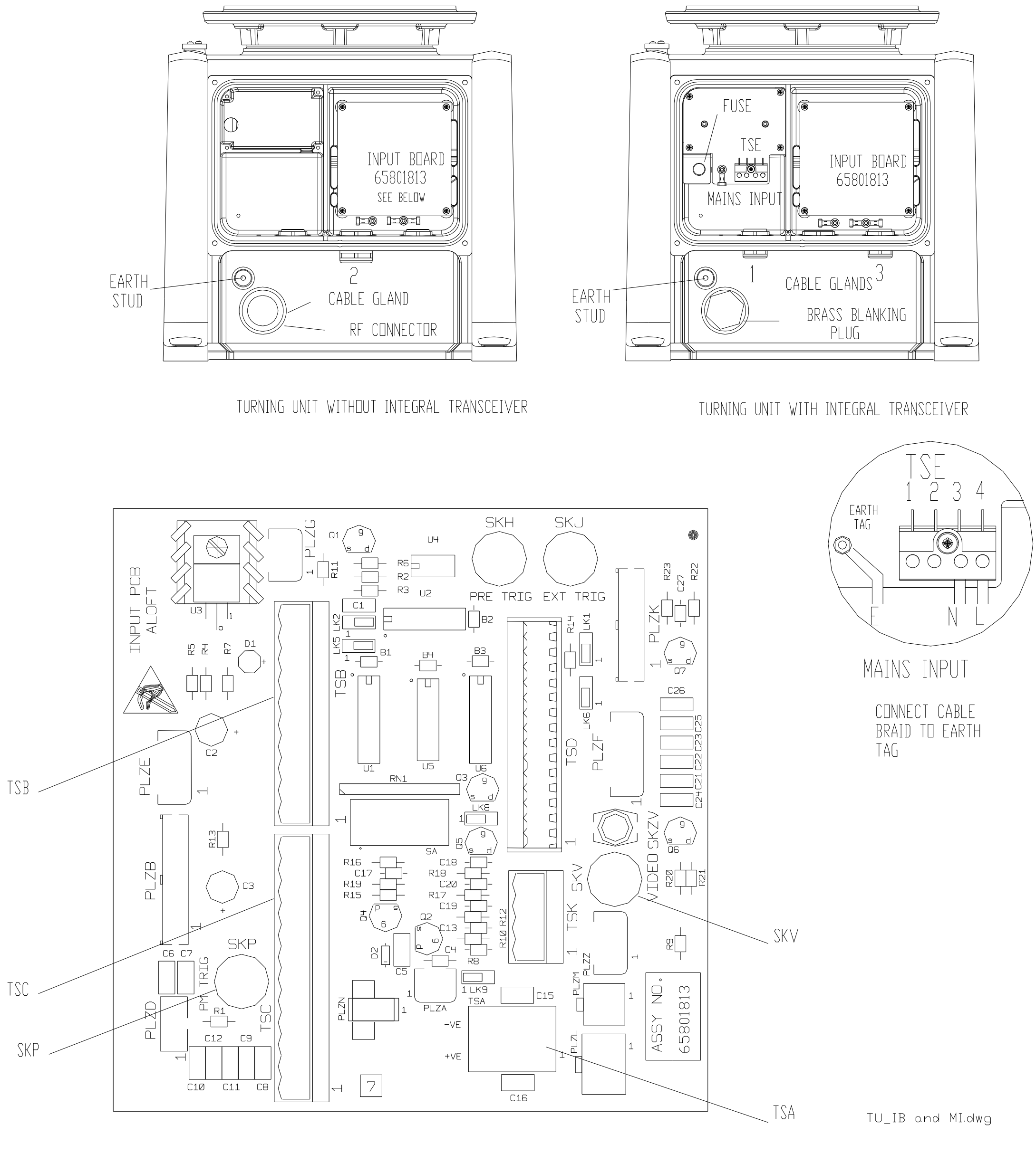


Figure 3.59 Turning Unit – Input Board and Mains Input Details

5.6.1 Fitting the Cable Glands

The installation cables are connected into the Turning Unit (with or without an Integral Transceiver) via the appropriate cable glands, see Table 11 below.

For systems with ‘additional features’ see the relevant figures in Chapter 8 *‘Additional Features’*.

Table 11: S-band Cable Gland Details

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	—	—

The body of the gland fits through a hole in the casting and is held in position by the Top Nut. An ‘O’ ring seal is fitted below the casting surface (input side), see Figure 3.60.

A waterproof seal and an EMC gasket are supplied with each gland. Some glands are designed for a single cable; other glands are used for several cables.

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

Information about fitting and terminating the RF feeder cable (S-band coaxial) are in Section 5.8.

For information on how to terminate the cables into their connector blocks, see Section 7 ‘*System Component Interconnections*’.

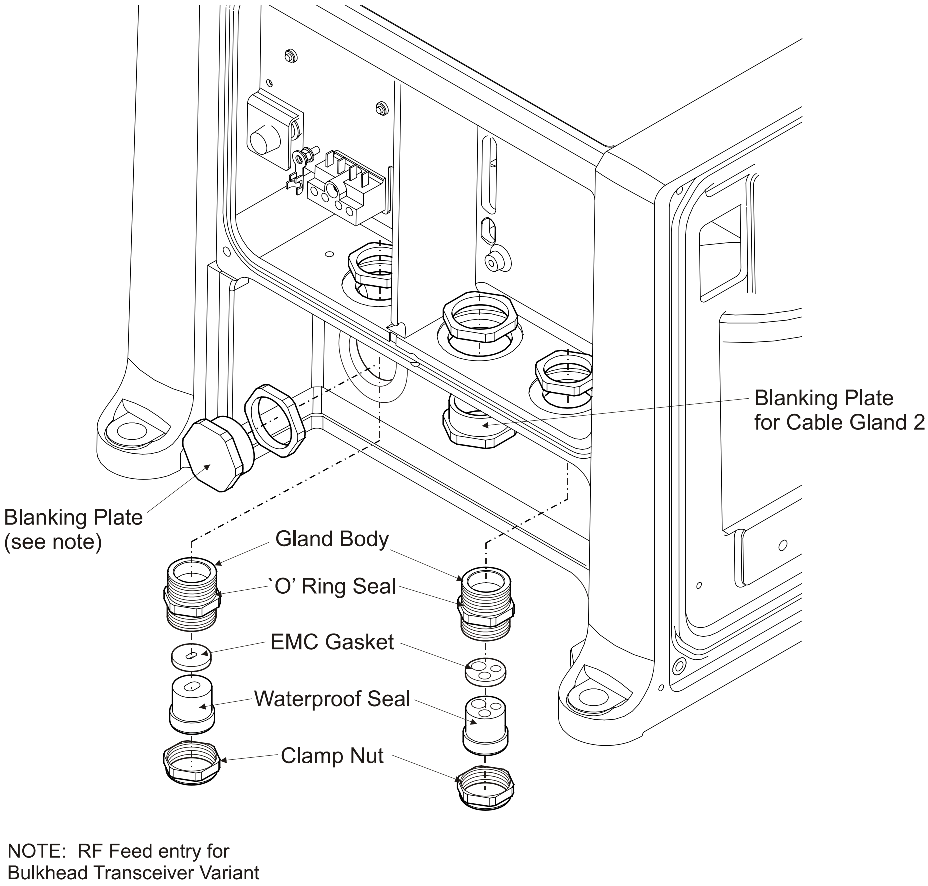


Figure 3.60 General View of the Cable Glands

The waterproof seal works by clamping onto the cable PVC sheath. The EMC seal clamps onto the cable braid.

Note: *Do not force the outer sheath through the EMC gasket; the gasket can 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 3.61.

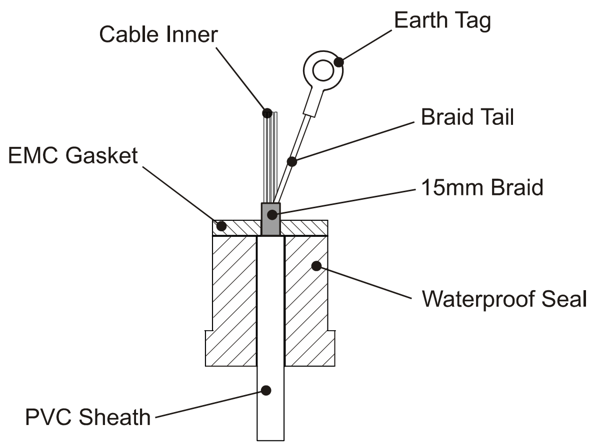


Figure 3.61 Cable Installation Details

5.6.2 Installing the Cables

To install the cables:

1. Unscrew the gland nut.
2. Remove the waterproof seal and the EMC seal.
3. Feed the cable through the gland nut and the waterproof seal.
4. Strip the outer sheath to expose approximately 300mm of braid.
5. Push the braid back to expose approximately 50mm of the inner cores.
6. Trim 50mm off the inner cores.
7. Pull the braid back over the inner cores and twist into a point.
8. Feed the braid through the EMC seal until the cable is positioned as in Figure 3.61.

For the multicore cables:

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

For the coaxial cables:

Do not fit the coaxial connector at this time.

5.6.2.1 Assembling cables into Turning Unit

To assemble the cables into the turning unit:

1. Feed the assembled cables and seals into the gland body.
2. Tighten the gland nut until the EMC seal is compressed.
3. Crimp the earth tags provided to the braids of the multicore cables
4. Attach them to the earth studs adjacent to the cables: the tails should be as short as is practicable.
5. Trim and make off the cable inners to the appropriate terminal blocks.
6. Trim the coaxial cables to length.
7. Slide the plastic sleeve supplied in the despatch kit over the exposed braid.
8. Fit the coaxial connectors.
9. Plug them into the appropriate sockets.

5.7 S-band Bulkhead Transceiver

The S-band Bulkhead Transceiver, 65831A, is installed below decks in a suitable location such as the ship's equipment room. The installation should consider 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 (1.7dB for 20m). This loss applies to both the transmitted RF pulse and the received signals.

The maximum recommended cable length using standard coaxial cable (PT1YM) is:

- 30 metres between the Turning Unit and the Transceiver Unit; and
- 67 metres between the Transceiver and Display.

Greater separation is possible by using a lower loss cable. Contact Northrop Grumman Sperry Marine B.V. if greater separation is needed.

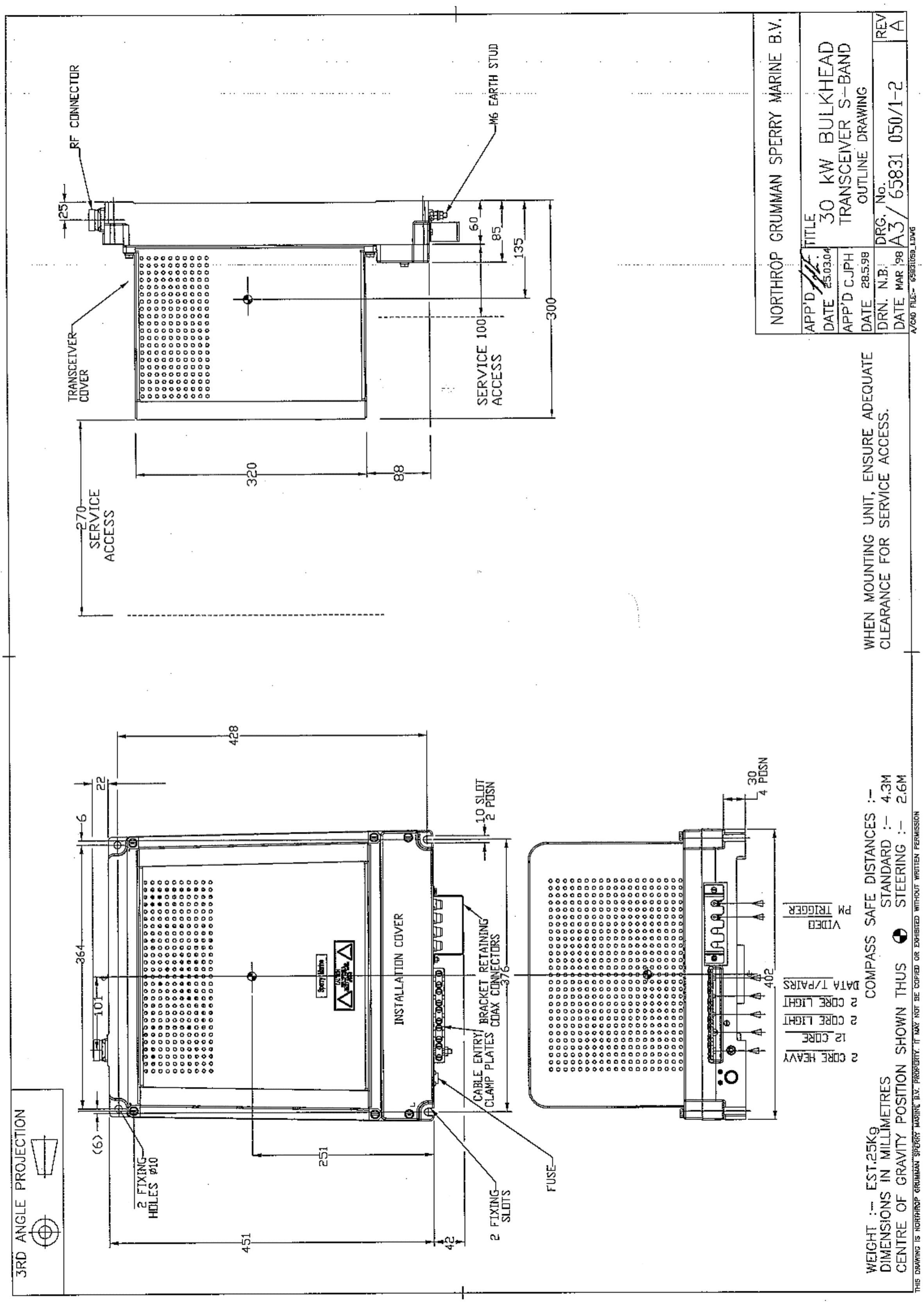


Figure 3.62 S-Band Bulkhead Transceiver 30kW Installation

5.7.1 Assembling the Bulkhead Transceiver

The Transceiver may be attached to the bulkhead by several methods. The actual method chosen will depend on individual circumstances: consider the likely vibration and shock loading which may be experienced. The available methods include through bolting to the bulkhead, or mounting on studs supplied by the shipyard, see Figure 3.63 below. Slotted mounts are supplied at the bottom for ease of installation.

Note: *The positions of the four fixings for the unit are not on a rectangle. The horizontal spacing of the top fixings is 364mm compared with 376mm for the lower fixings. When choosing the installation location for the Transceiver, consider how the RF feeder coaxial cable is to be routed.*

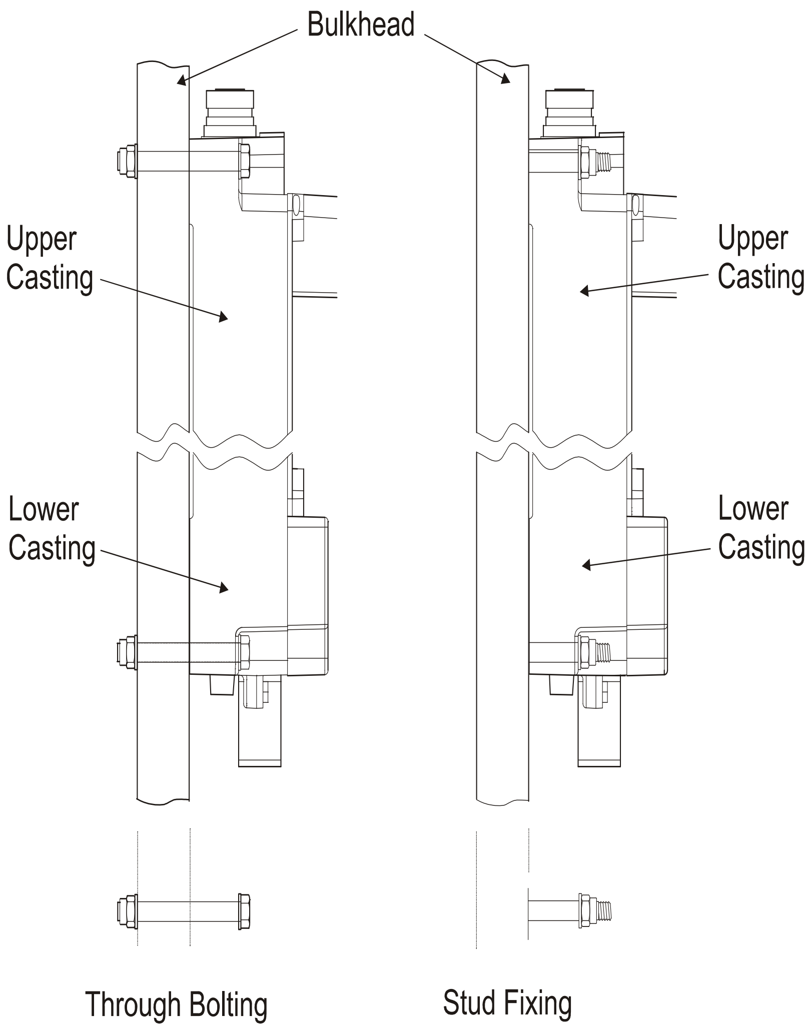


Figure 3.63 Bulkhead Transceiver – Mounting Alternatives

5.7.2 Installing Cables on a Bulkhead Transceiver

Figure 3.64 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.

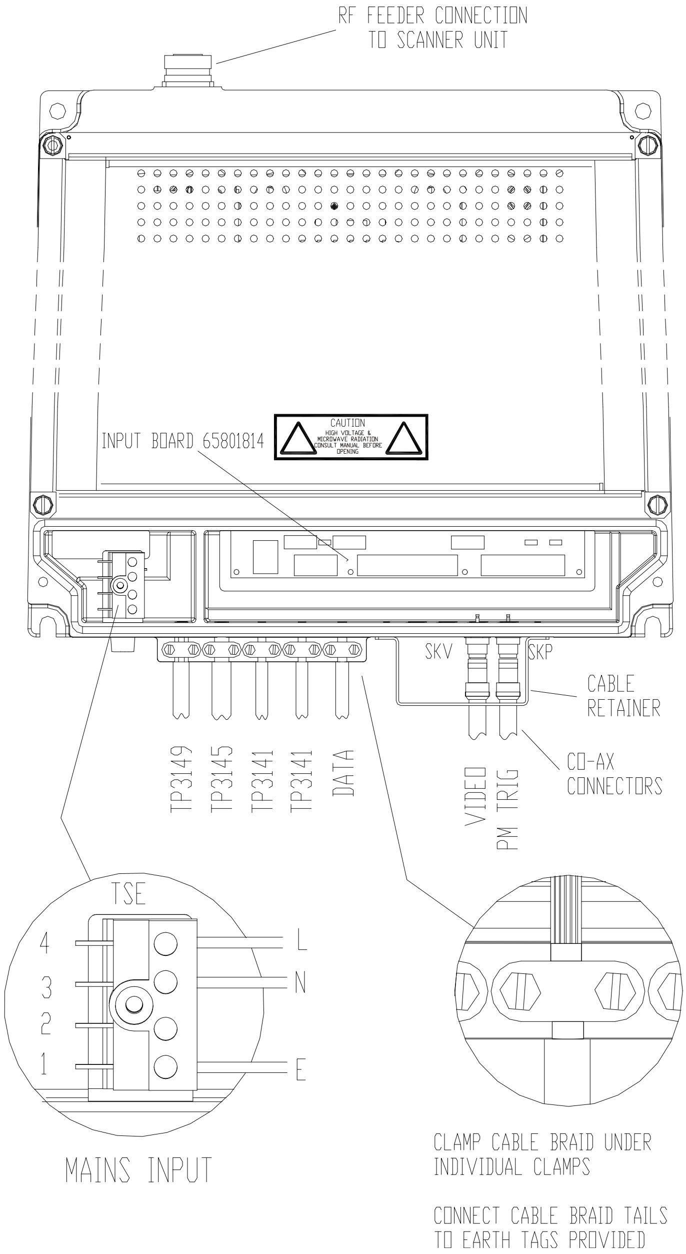


Figure 3.64 Bulkhead Transceiver – Cable Input Details

Figure 3.65 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 Section 3.3.1 in Chapter 8 *'Additional Features'* for details of PCB 65801815 fitted to 'additional features' Transceivers.

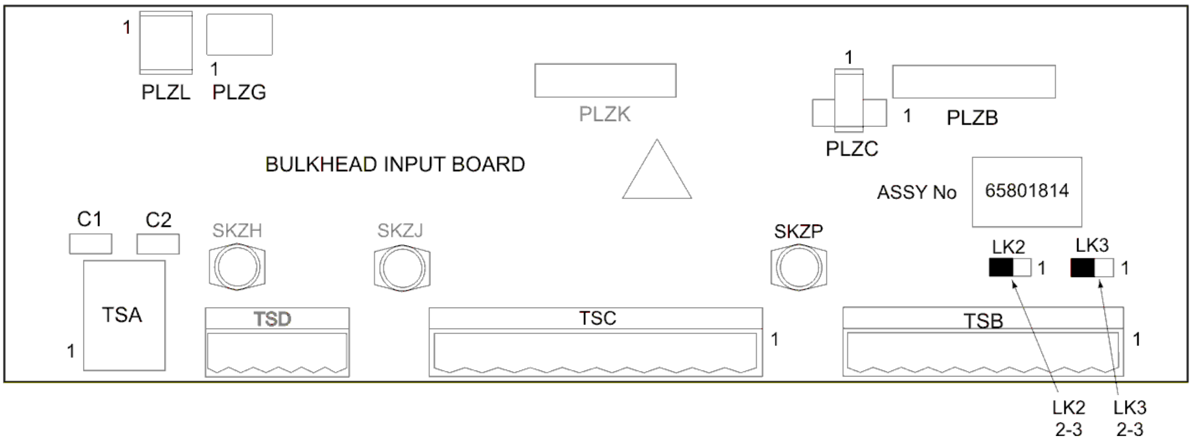


Figure 3.65 Bulkhead Transceiver – Input Board Details

5.8 Fitting the RF Feeder Cable (S-band Coaxial Cable)

5.8.1 General Information

A 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 AVA 5-50 50-ohm, overall diameter 28mm (1.1in).

Although robust, the cable must be protected against strain and kinking, and must be treated with the greatest care at all times. The ends of the cable must be kept sealed against the ingress of moisture before the connectors are assembled.

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).

For convenience, the upper (Turning Unit) connector can be fitted before you install the cable. Because of the possibility of movement of the inner conductor relative to the outer conductor the following precautions must be taken:

1. 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. No bend may be closer that 250mm (10in) from the end of the cable.

2. 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.
3. 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.
4. The cable should be installed and secured in position (using the waveguide supports) as far as is practicable before the lower (Transceiver Unit) connector is fitted to the cable. The precautions given in paragraph 1 above must be observed if a bend is required adjacent to the Transceiver Unit.

5.8.2 Assembling the Connectors

Figures 3.66 to 3.74 are reproduced by permission of Andrew Antenna.

General

A straight connector assembly (Type AL5DM-PS) is used to terminate the feeder cable at each end. The assembly comprises a clamping nut, spring ring, outer connector, cable cutting guide and compression cap.

Tools required

A fine-toothed blade hacksaw, a 1¼in open-ended spanner and a $1^3/_8$in open-ended spanner will be sufficient for fitting the connectors to the cable.

Procedure

The procedure that follows applies to the straight connectors at each end of the feeder cable. It is very important that swarf and other foreign matter is prevented from entering the cable.

Prepare the cable end and assemble the connector as follows:

1. Using a knife, remove approximately 2in (50mm) from the end of the jacket.

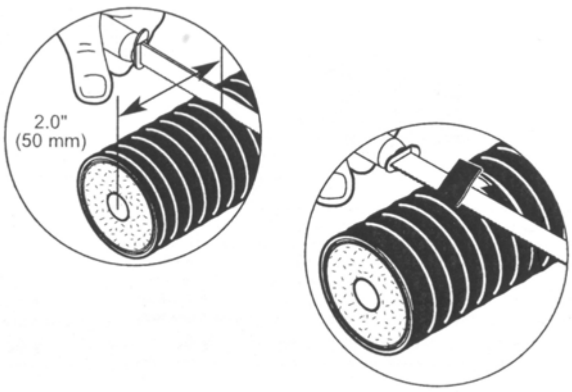


Figure 3.66 Removing Cable Jacket

2. Make sure the end of the cable is straight by attaching the cable cutting guide approximately 1 1/2 in (38mm) from the jacket and cutting the end of the cable using a hacksaw, see Figure 3.67.

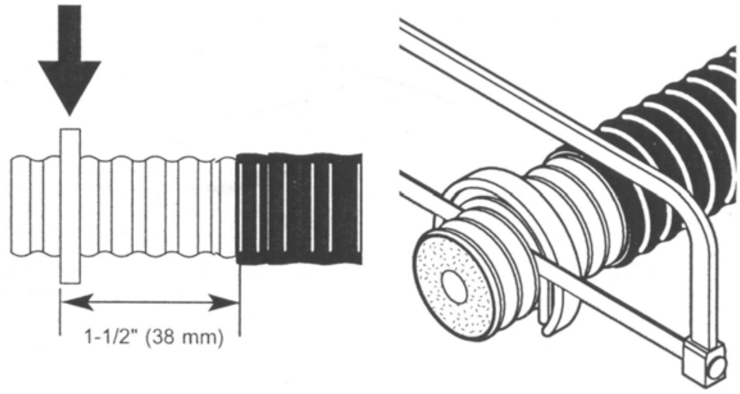


Figure 3.67 Cutting the Cable End

3. Deburr the inside edge of the inner conductor and the inside edge of the outer conductor, see Figure 3.68.

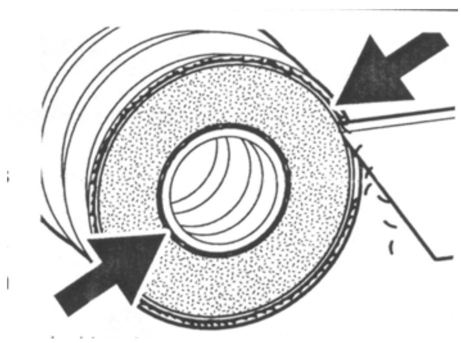


Figure 3.68 Deburring inside edges of conductor

4. Deburr the outside edge of the outer conductor, see Figure 3.69. Be sure outer conductor is round and undistorted.

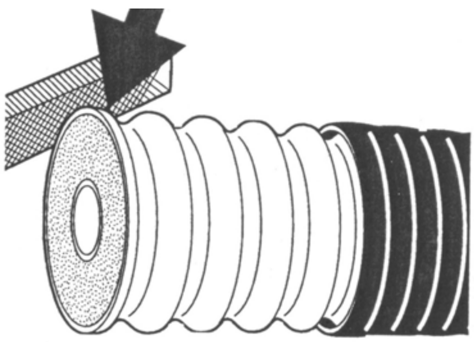


Figure 3.69 Deburring outside edge of conductor

5. Using a wire brush carefully remove debris from the end of the cable.
6. Add the clamping nut to the end of the cable, push the nut up the cable until it covers the jacket end, see Figure 3.70.

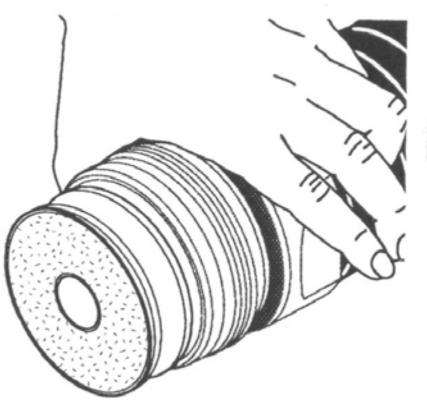


Figure 3.70 Adding Clamping Nut to Cable

7. Add the spring ring to the cable end, see Figure 3.71.

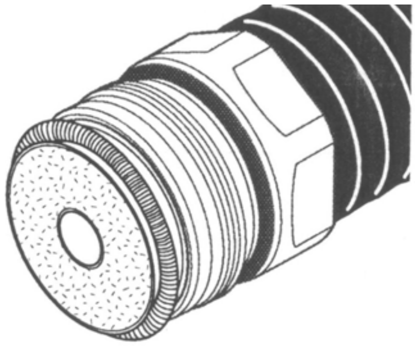


Figure 3.71 Adding the Spring Ring

8. Attach the compression cap to the cable end and using a twisting motion compress the cable foam against the clamping nut, see Figure 3.72.

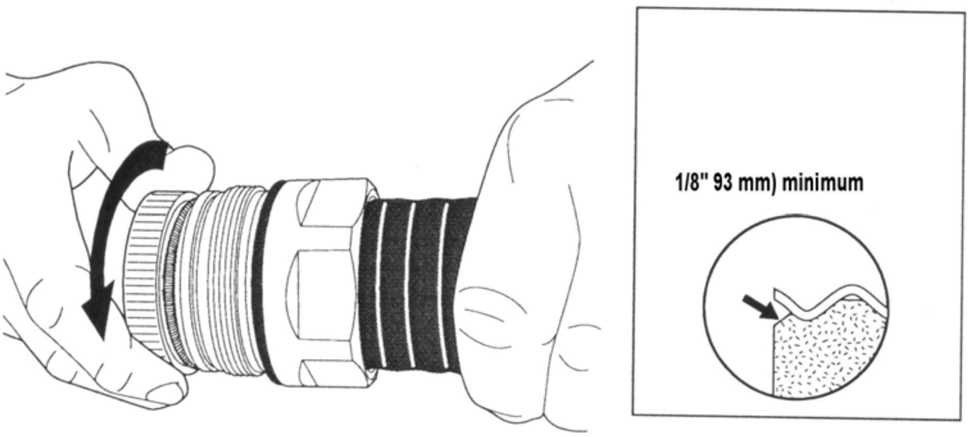


Figure 3.72 Attaching end cap and compressing foam

9. Attach the outer connector to cable end and screw onto the clamping nut, see Figure 3.73.

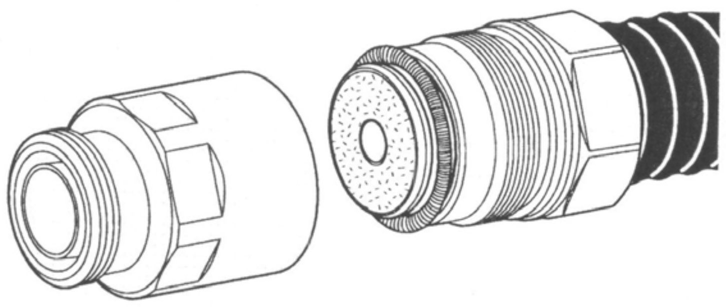


Figure 3.73 Attaching Connector to Body

10. Tighten the outer connector using the 1¼in and 1³/8in spanners. Hold the outer connector with one spanner and turn the clamping nut; do **not** turn the outer connector. Make sure there is good metal to metal contact between the clamping nut and outer connector, see Figure 3.74.

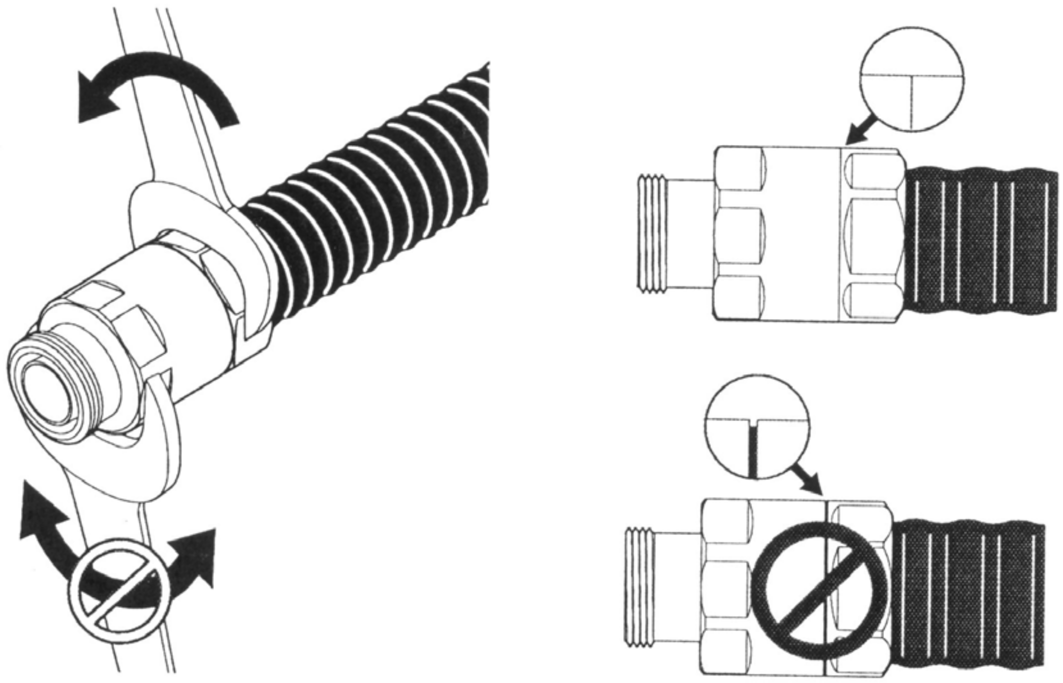


Figure 3.74 Screwing the Connector to the Clamping Nut

5.8.3 Fitting the Deck Gland

The 7/8in RF feeder cable passes through its own separate deck gland, positioned near the foot of the mast. The gland kit consists of:

- a rubber boot
- adjustable tension clamp (with screws)
- gland half plates
- six sealing washers
- butyl sealing tape.

In addition you will need the following (obtained locally) (see Figure 3.75):

- six M6 bolts (of suitable length)
- six M6 flat washers
- six M6 lock washers
- six M6 nuts.

To fit the deck gland do the following:

1. Cut a 40 mm diameter entrance hole in the deck, having installed and secured the cable from the Turning Unit down the mast; pass the Transceiver Unit end through the entrance hole.
2. Remove the paper from the Butyl tape.
   Cover the cable in the area of the Deck Gland with the butyl tape.
3. Place the boot around the feeder, position the boot over the butyl tape, and fit the tension clamp. Offer the boot up to the entrance hole in the deck and mark the location of the six holes for the fixing bolts.
4. Withdraw the boot from the hole and drill six 7mm mounting holes through the deck.
5. Slide the boot back over the entrance hole in the deck and tighten the tension clamp. Apply sealant to the face of the gland boot.
6. Align the holes in the gland half plates with the holes in the boot and the holes in the deck. Secure the assembly in position with six M6 bolts, flat washers, lock washers and nuts, together with the sealing washers provided in the kit.
   The bolts are inserted downwards and the sealing washers only go under the bolt heads, see Figure 3.75 for location details.

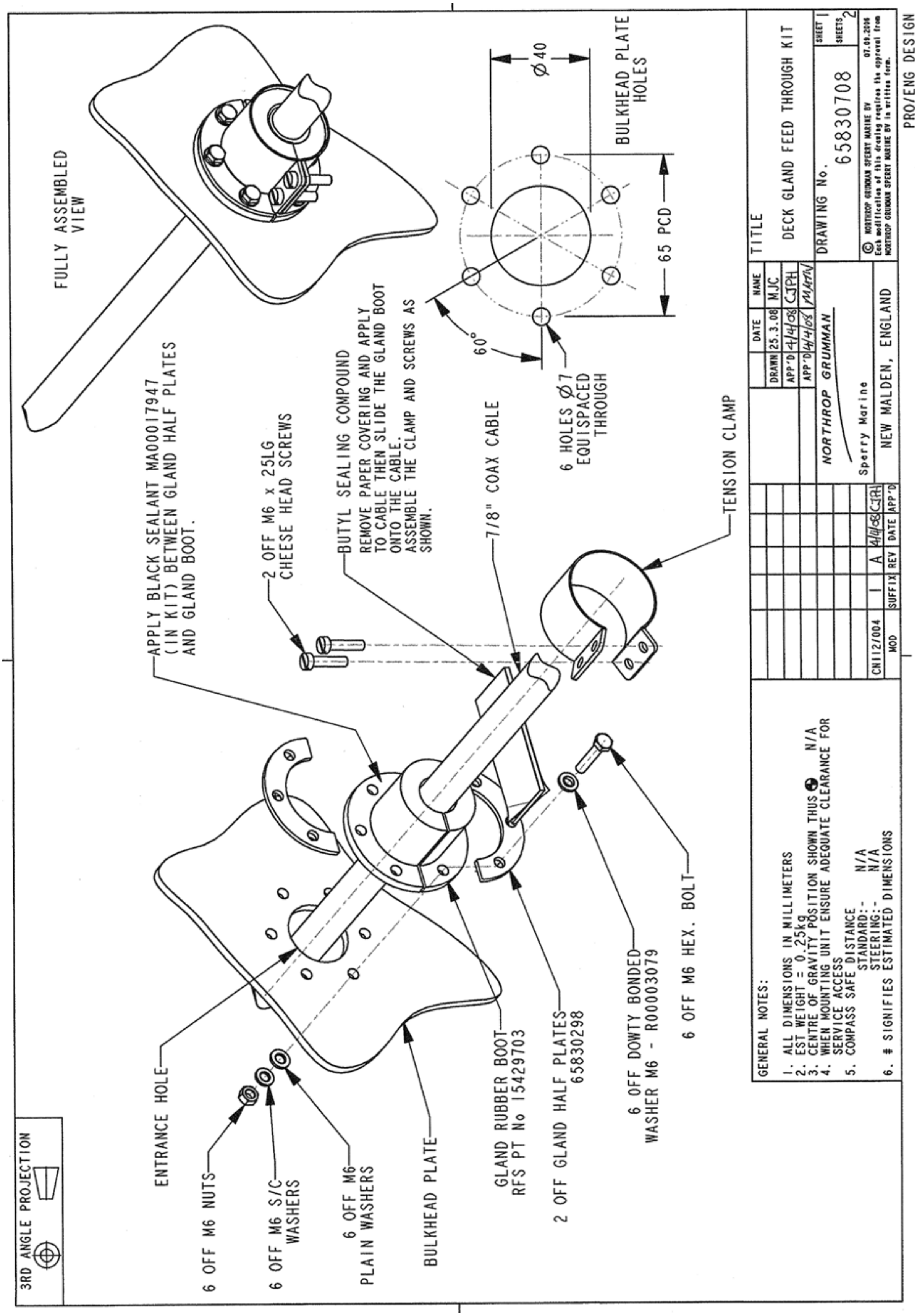


Figure 3.75 Deck Gland Feed Through Kit

5.8.4 Installing Cable Supports

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 3.76.

Figure 3.76 also shows additional hardware (not supplied in the Installation Kit) that helps with special mounting arrangements. If required, these can be purchased from Andrew Corporation.

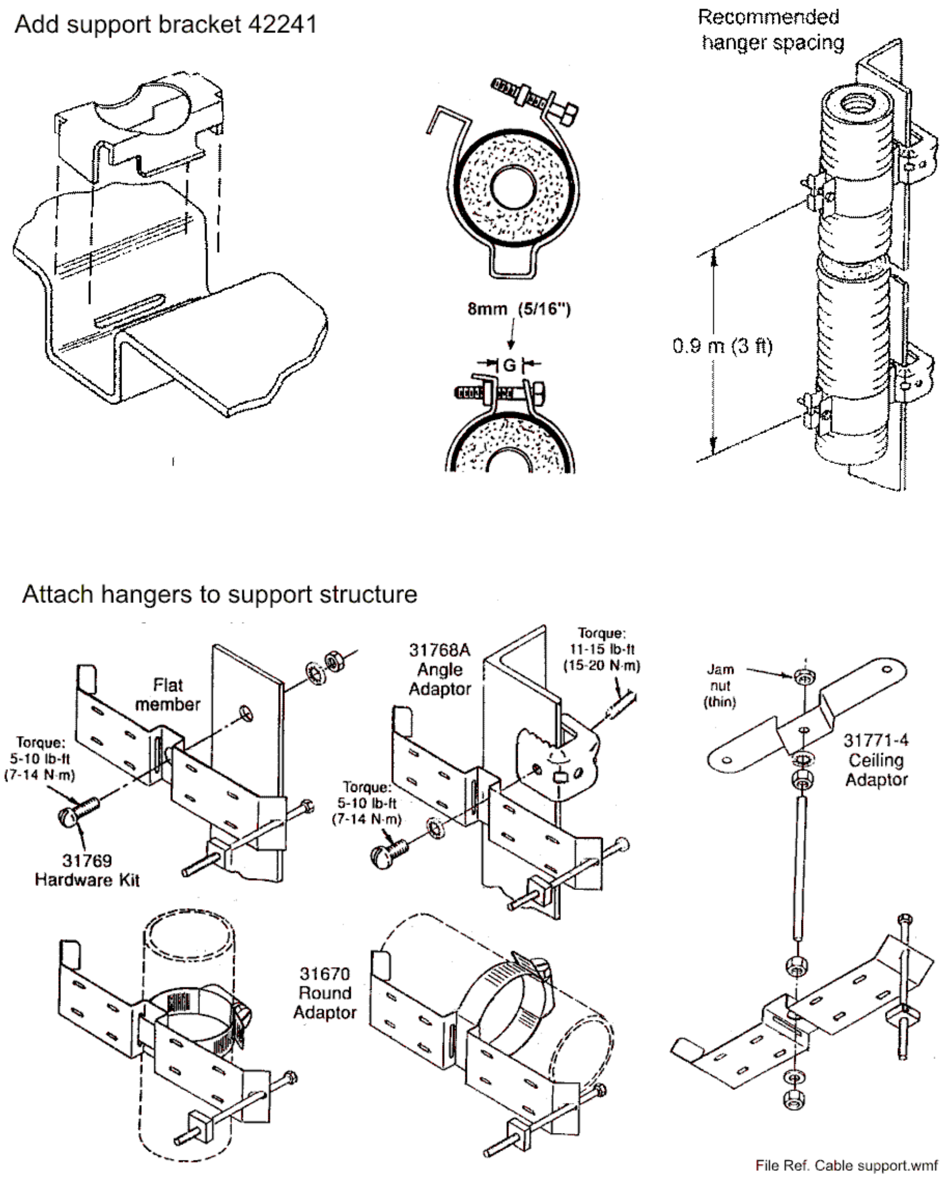


Figure 3.76 Cable Support Details

5.9 Scanner Control Unit

5.9.1 Mounting Position

Normally, the Scanner Control Unit (SCU) is mounted so that it is accessible to the radar operator. Also it must be mounted so that a service engineer can get access to the isolator for the mains supply to the Turning Unit motor. Therefore, it is preferable to mount the SCU close to the Mains Isolator, see Figure 3.78 for the SCU Installation drawing.

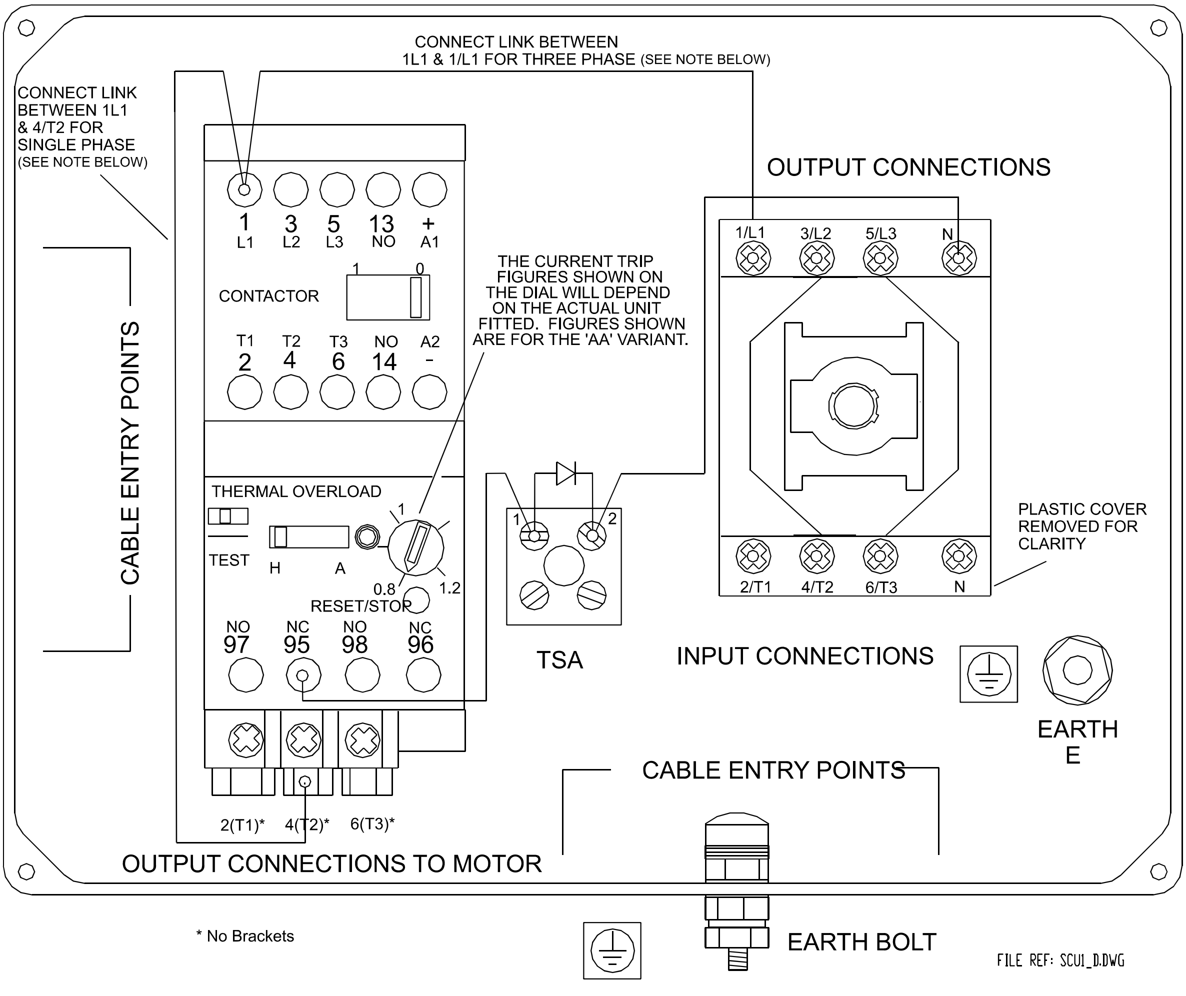


Figure 3.77 Scanner Control Unit - Internal Layout

Note: *Refer to Figure 3.79 and Figure 3.80 for linking of single phase and three phase supplies.*

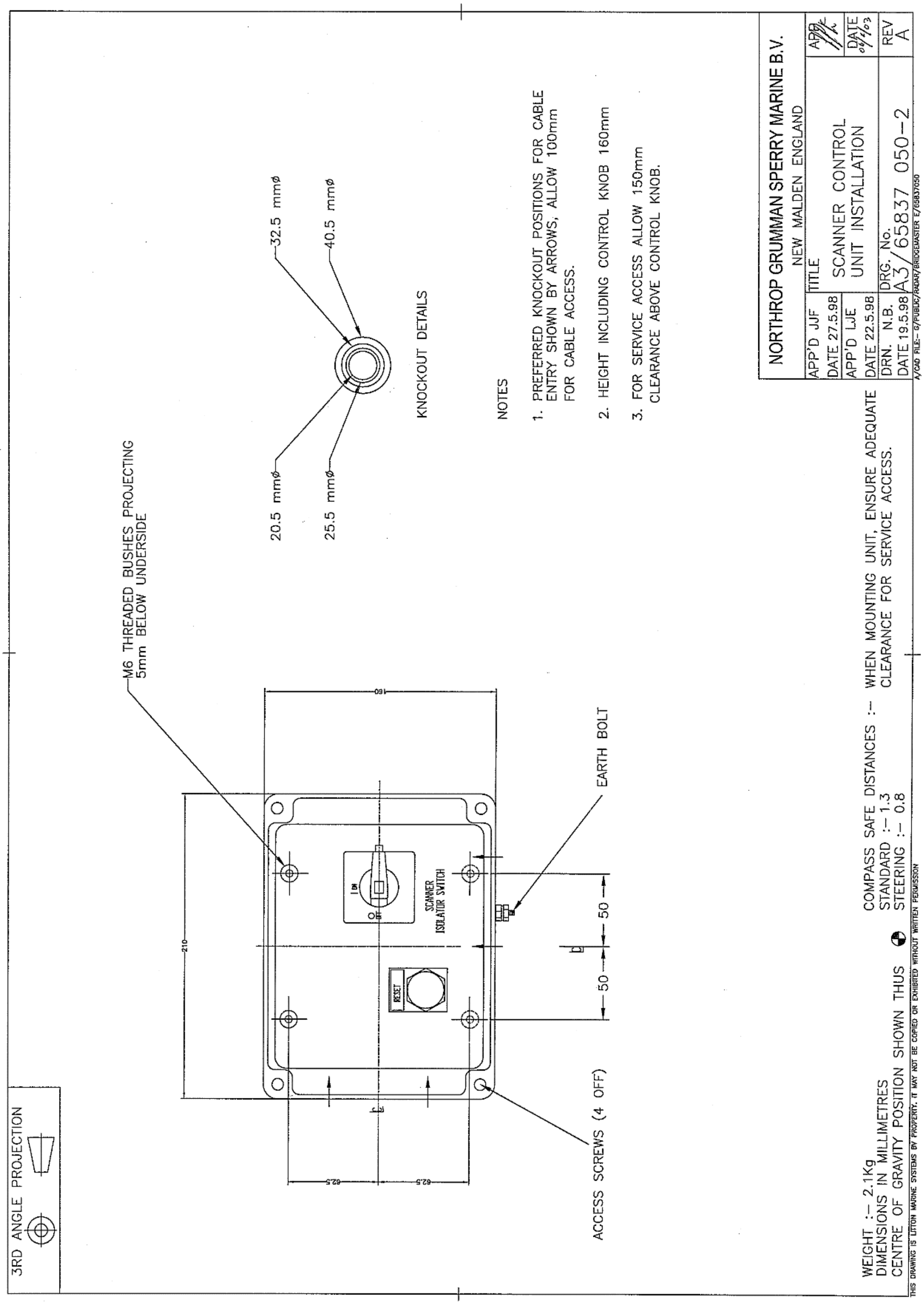


Figure 3.78 Scanner Control Unit Installation

5.9.2 Single Phase or Three Phase Mains Supply Voltage

The connection details and relevant cabling schedules for a single-phase supply (1ϕ) SCU and three-phase supply (3ϕ) SCU are shown in Figure 3.79 and Figure 3.80 respectively.

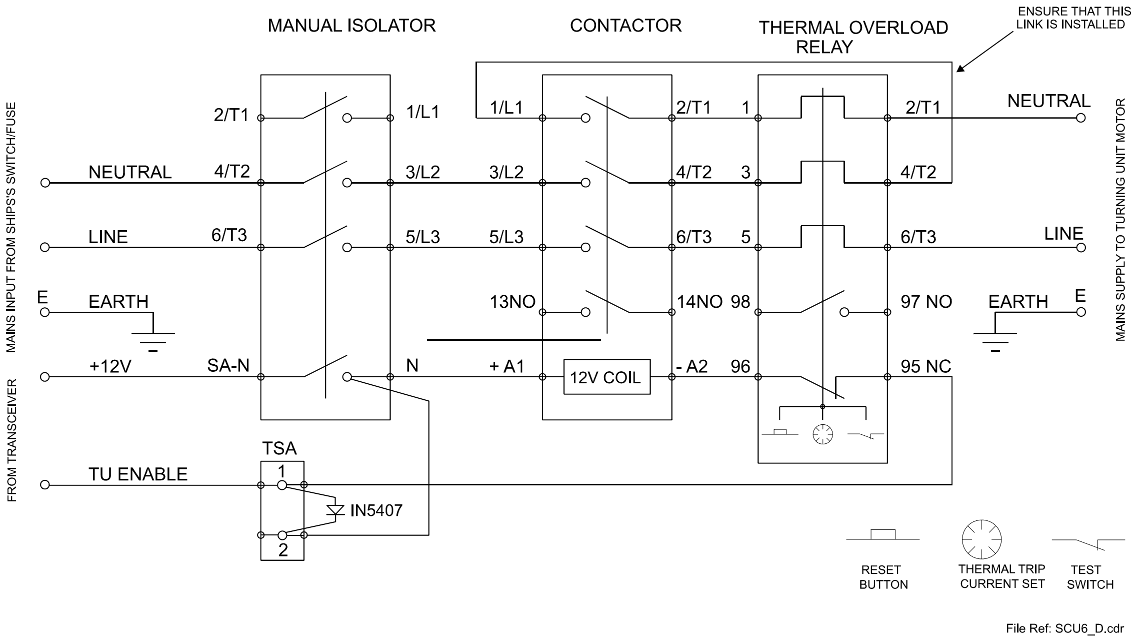


Figure 3.79 Scanner Control Unit – Single Phase Supply Arrangement*

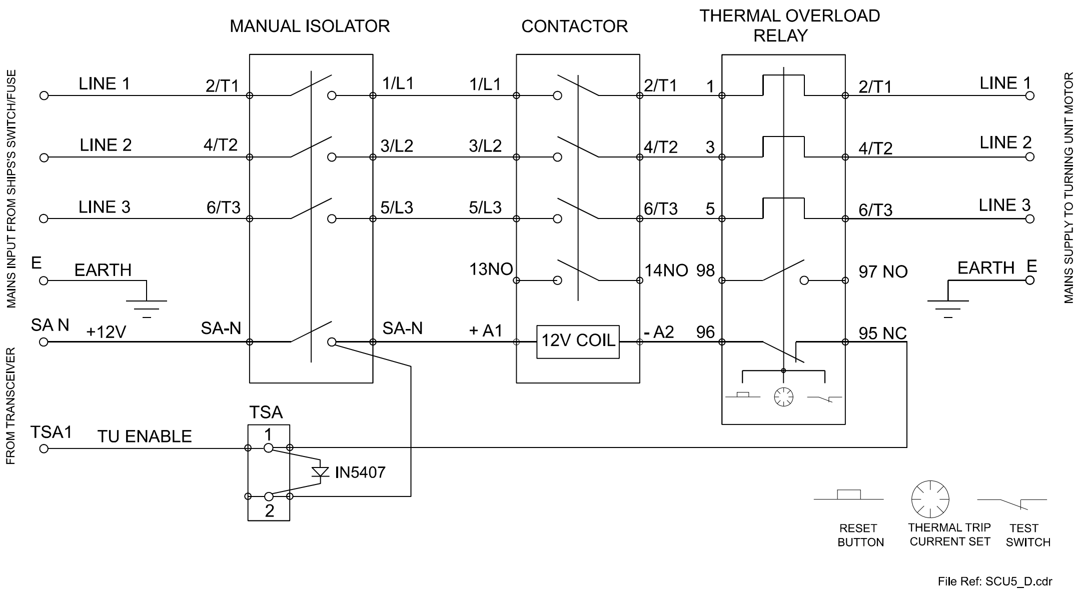


Figure 3.80 Scanner Control Unit – Three-Phase Supply Arrangement*

* 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 Table 12 in Section 5.9.3.
Cable type 37-3-2R may be used for 220/240V supplies.

5.9.3 Scanner Speed Option

Two scanner speed options, 'Standard' and 'High', are available, depending on the type of scanner motor. Motor types 91003751, 52, 57 and 58 are standard speed; 91003753, 54, 59 and 60 are high-speed.

See Section 5.8.4 '*Installing Cable Supports*' for connection details.

Table 12 below defines the Thermal Current Trip settings for each variant. These settings must be set during installation.

Table 12: Thermal Current Trip Settings

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

5.10 Installation Kits

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

5.11 Despatch Kits

To help assemble the equipment, Despatch Kits, including assembly instructions, are sent as shown in the following table:

Table 13: Despatch Kits

Unit	Despatch Kit
S-band Systems	
Turning Unit	65830660
Antenna Unit	65612610
Bulkhead Transceiver	65831660

6 Installing Optional Units

6.1 Mains Isolator

It is good practice to include Mains Isolator Switches Type 65800700 in the system wiring of AC powered systems. Their function is to let the Scanner Unit (with the exception of the Motor Supply in S-band systems), the PCIO unit, the Processor Unit, and Display be isolated from the ship’s mains supply.

The Scanner Unit Motor supply in S-band systems is isolated separately by the Scanner Control Unit. For safety reasons, the Mains Isolator must be mounted next to the SCU so that the S-band system can be isolated from a single location.

If needed, the Mains Isolator can be locked in the **OFF** position using a suitable padlock.

In multiple radar systems more than one isolating switch may be needed.

Note: *Refer to Section 7 ‘System Component Interconnections’ for connection details.*

6.2 Uninterruptible Power Supply

If a workstation is to be used as an ECDIS, then the system requires an Uninterruptible Power Supply (UPS) to be fitted.

The UPS is usually connected between the ship’s mains supply and the mains isolator switch.

The system monitors the UPS via analogue interface or Track Control. An alarm is raised when there is a reduction in power causing the UPS to be on battery backup or a power failure to a UPS.

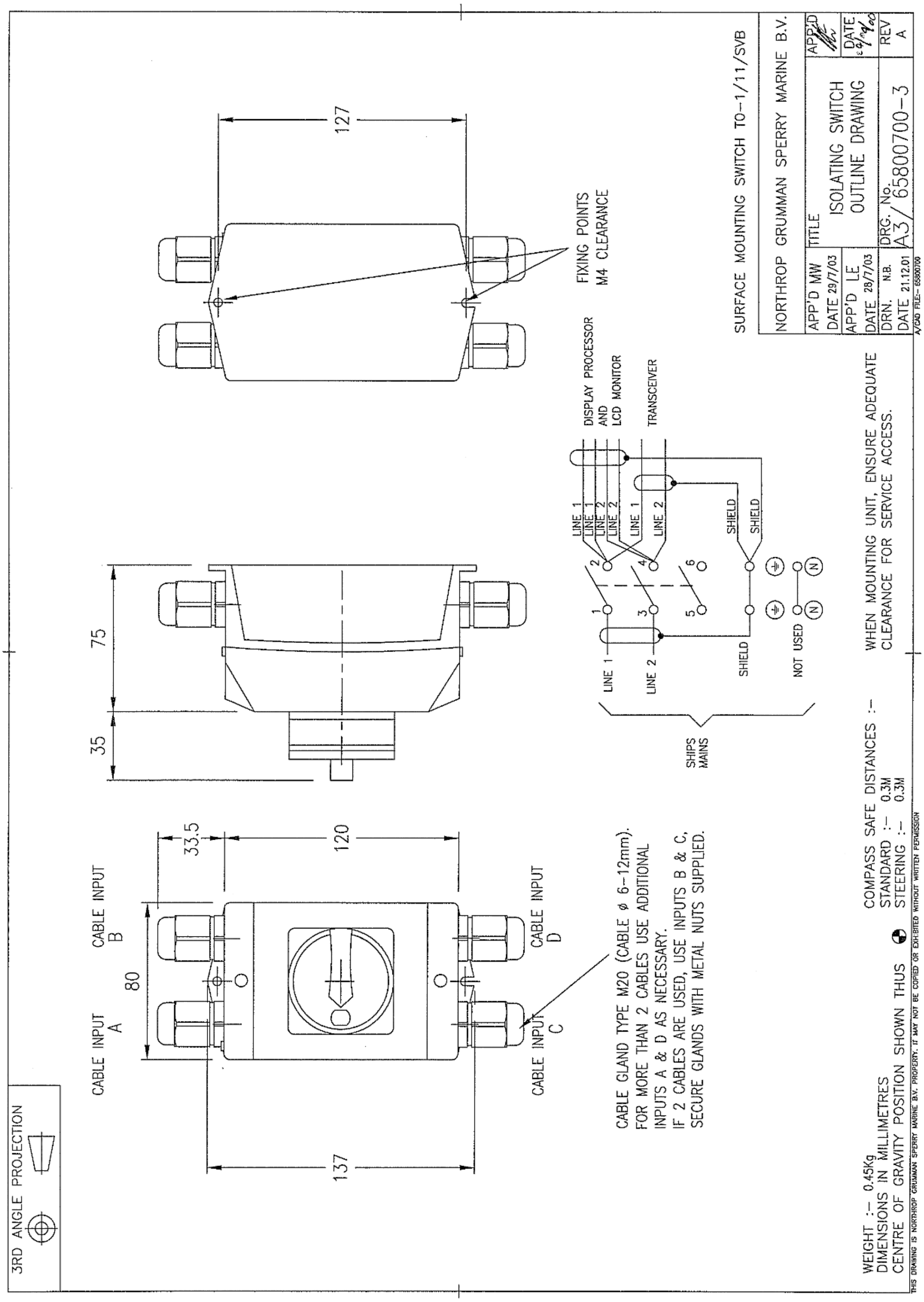


Figure 3.81 Isolation Switch Installation

6.3 Isolation Transformer Unit

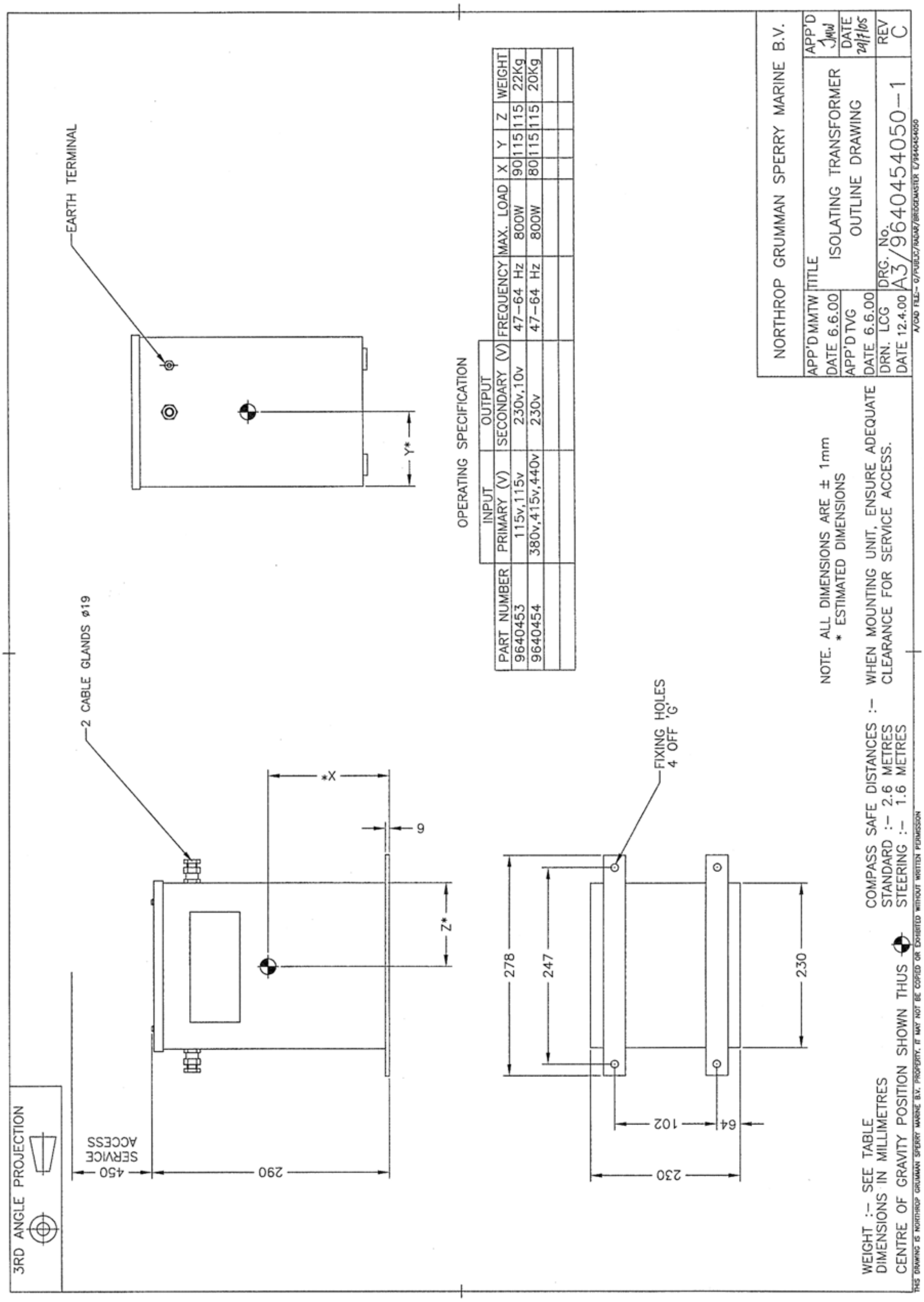


Figure 3.82 Isolation Transformer Unit Installation

7 System Component Interconnections

The following figures give cabling and interconnection details of the S-Band and X-Band top units.

- Figure 3.83 '*Interconnection Diagram for S-Band Bulkhead Transceiver*'
- Figure 3.84 '*Interconnection Diagram for S-Band Masthead Transceiver*'
- Figure 3.85 '*Interconnection Diagram for X-Band Bulkhead Transceiver*'
- Figure 3.86 '*Interconnection Diagram for X-Band Masthead Transceiver*'

For interconnection diagrams for the Console assemblies (below deck units) see Chapter 4 - '*Installing Consoles and Displays*'.

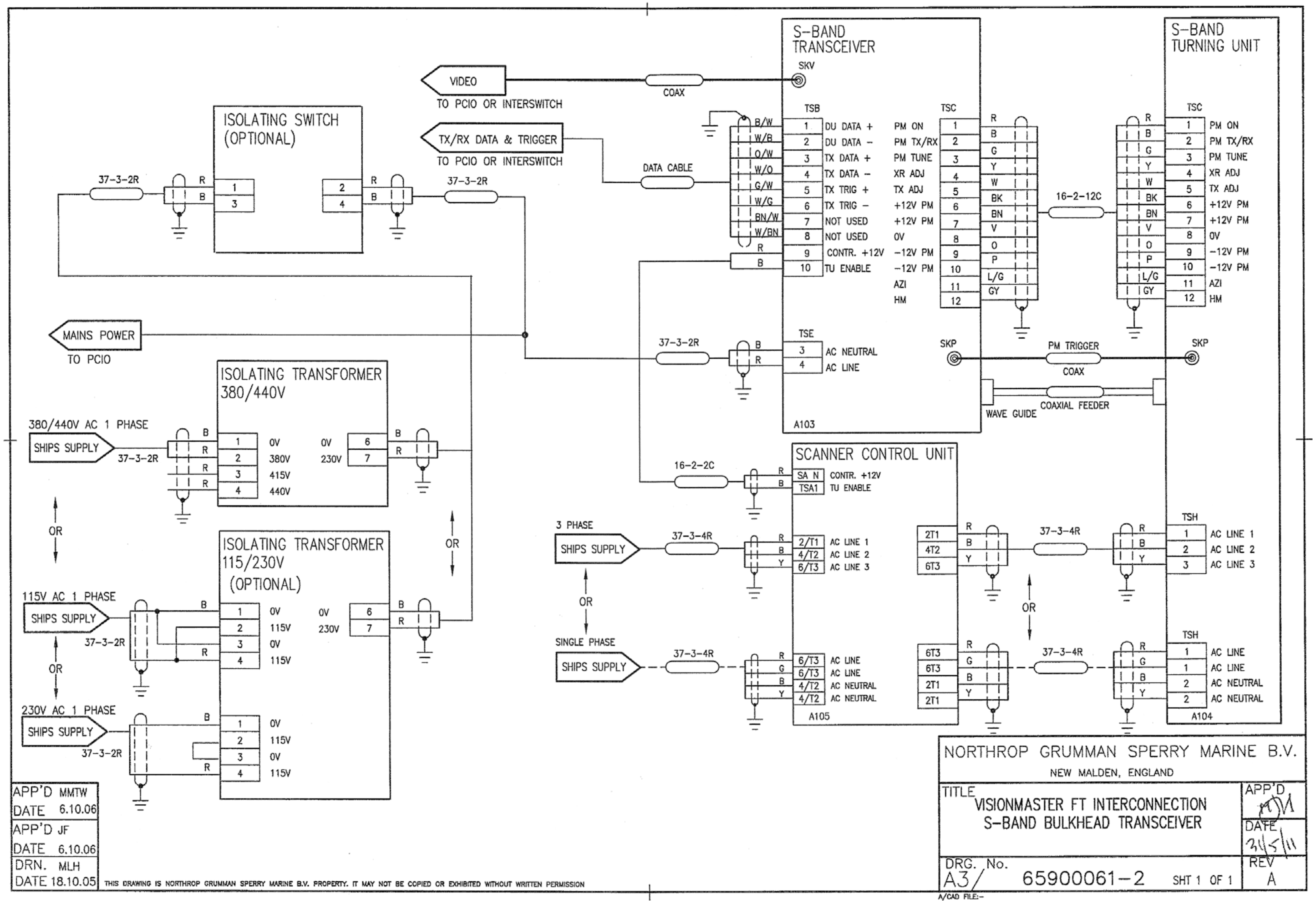


Figure 3.83 Interconnection Diagram for S-Band Bulkhead Transceiver

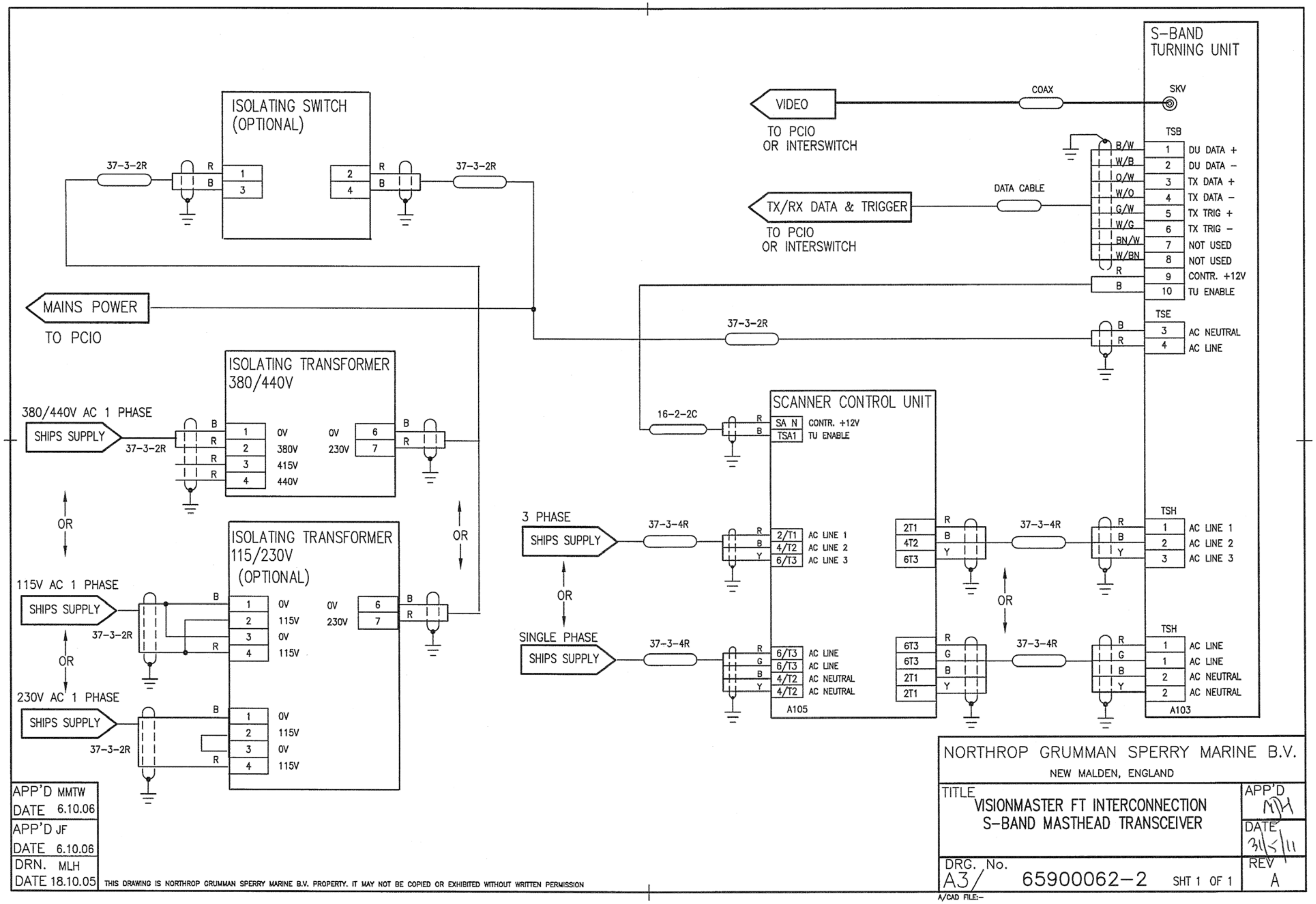


Figure 3.84 Interconnection Diagram for S-Band Masthead Transceiver

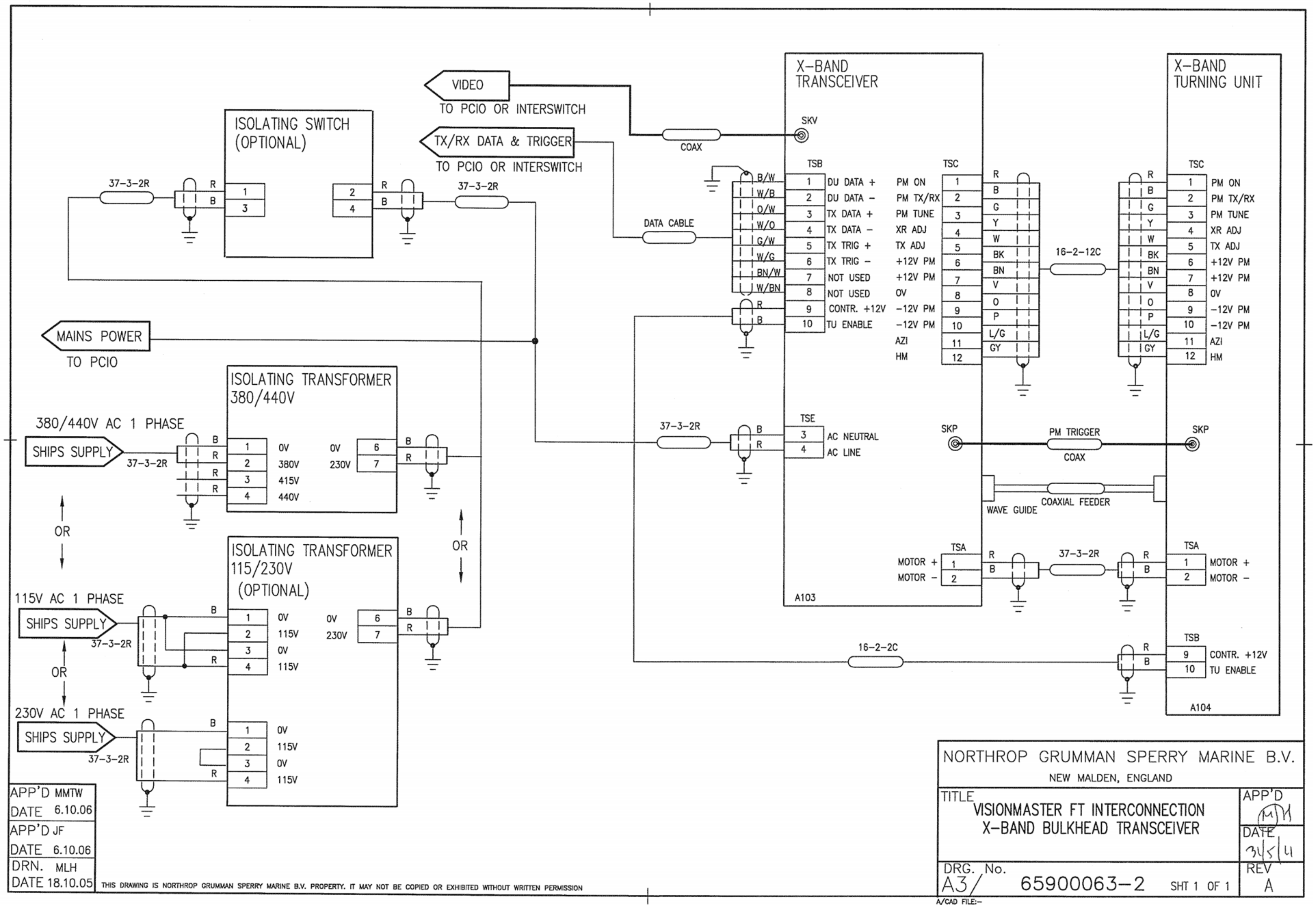


Figure 3.85 Interconnection Diagram for X-Band Bulkhead Transceiver

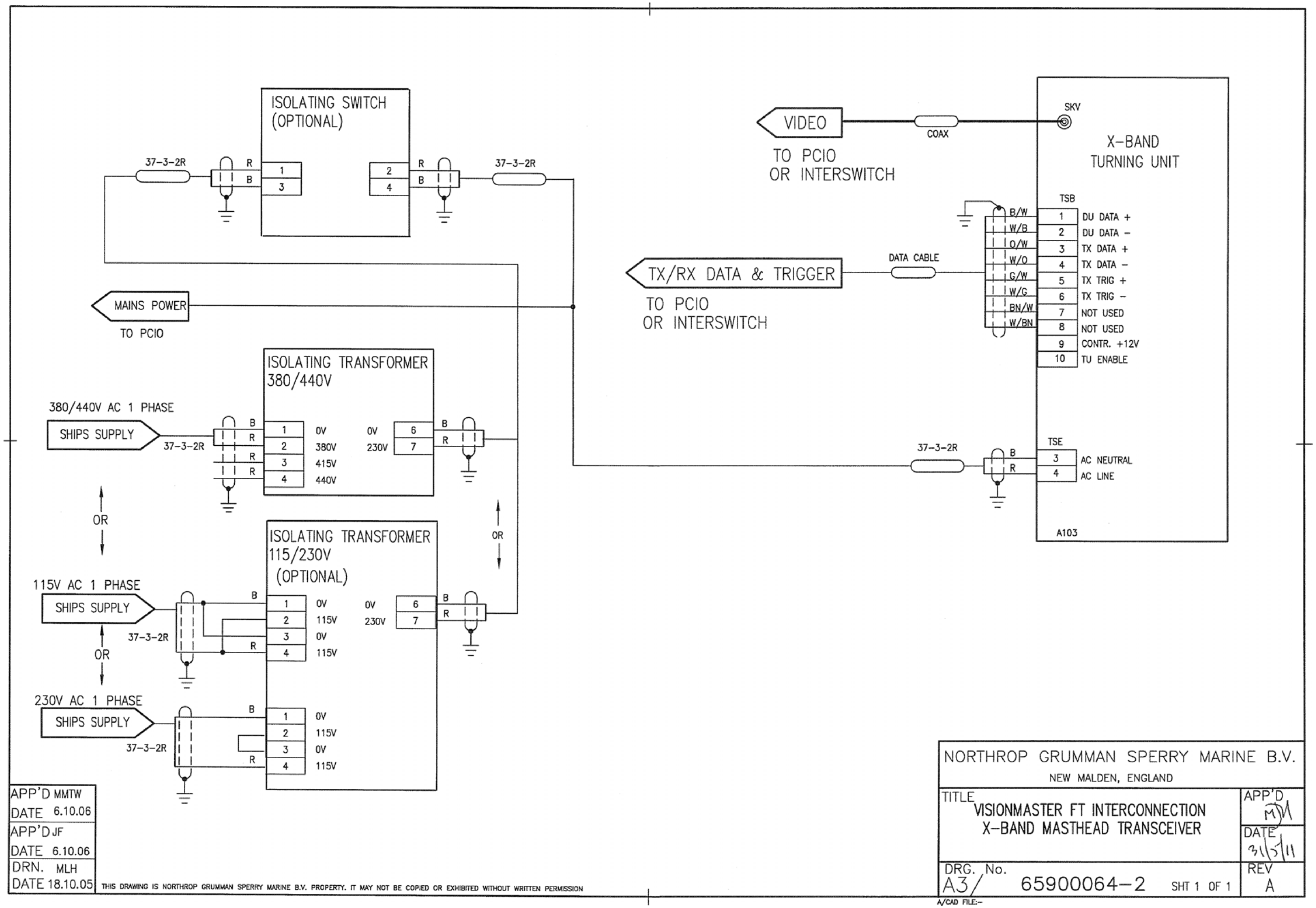


Figure 3.86 Interconnection Diagram for X-Band Masthead Transceiver

Chapter 4

Installing Consoles & Displays

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Appendices

Appendix A ECDIS Calibration Procedure

Appendix B RS422/485 PCI Serial Card InstallationECDIS

1 General Information

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

For the preparation required and the installation procedure when installing the scanner assembly (including bulkhead transceiver and scanner control unit) refer to Chapter 3 'Installing Top Units'.

1.1 Preparation

The preparation required for installation of consoles and/or displays is as follows:

1. If necessary, the structure of the ship should be strengthened to support the system components. For data on system components, *see Chapter 1, Technical Specification*.
2. The supplying of power supplies terminated by a switch-fuse box. The Installation Engineer will specify the voltage level and current rating of the supplies.
3. The supplying and installation of cable trays, battens and/or conduits for the interconnecting cables of the system.

1.2 Installation Procedure

Installation includes the following operations:

1. Unpacking and external inspection of the system components.
2. Planning and laying of cables.
3. Installation of Console Assembly.
4. Interconnection of system components.

1.3 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 stop the chassis becoming live under fault conditions. The earth link is 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 care must be taken when protecting the connections from environmental and electro-chemical corrosion. Before assembly, you must make sure 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 give a large contact area.

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

CAUTION

The connecting of the bonding straps must be made from each piece of equipment to the ship's earth. You must not loop from unit to unit. To ensure this is a non-current-carrying connection no other connection must be made to the earth bolt.
The safety earth must 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.

1.4 Electromagnetic Continuity Screening

The purpose of EMC screening is to:

- restrict the emission of electro-magnetic energy from the equipment; and
- reduce its susceptibility to external electro-magnetic influence.

Individual items of equipment are EMC screened by their protective chassis. However, the screening should be extended to cover both input and output connections and cabling. This will maintain overall electro-magnetic efficiency.

Care must be taken when bonding the braids of interconnecting cables where indicated in the appropriate cable schedules.

1.5 System Fuses

Processor Electronics Unit Fuses

	Supply	Rating	Code No.	Location
Mains Fuse (FS1) (external)	110/120V AC	5A	2180413	On outside of PCIO unit
	220/240V AC			
Mains Fuse (FS1) (internal)	110/120V AC	3.15A	2162326	On PSU PCB inside the PCIO unit
	220/240V AC			

Fuse Types

MA00007245 - 3.15A, 1¼" (31mm) ceramic, anti surge, cartridge.

2180413 - 5A, 1¼" (31mm) ceramic, anti surge, cartridge.

2162326 - 3.15A, 20mm ceramic, anti surge, cartridge.

1.6 Despatch Kits

To help assemble the equipment, Despatch Kits, including assembly instructions, are sent as shown in the following table:

Table 1: Despatch Kits

Unit	Despatch Kit
Processor and PCIO Kits	
PCIO Unit	65900600
Processor Unit	65900637
Display Kits	
Display Unit	65923608
Deckstand Console	65923609
Modular Console	65923610
Control Panel	65923611
19" Integrated Tabletop	
19" Integrated Tabletop Display (Mk 1)	65919607
19" Integrated Tabletop Display (Mk 2)	65920607
Pedestal Kits	
Pedestal Shelf	65923680
Cable Tray	65923681
Mounting Plate	65923682
Display Unit Side Panel	65923683
Termination Kit	65923688
Dual Radar Systems	
Auxiliary PCIO Unit	65900674
Auxiliary Box Mounting Kit	65923689
Client/Server Radar Systems	
Mains Distribution Unit	65900685
Mains Distribution Unit Mounting Kit	65923689
Client Unit and Server Unit	65900637

1.7 Console Variants

A VisionMaster FT console/display may be supplied in one of the following variants:

- 19” Integrated Tabletop Display - this is an assembly where the LCD, Processor, PCIO, Control Panel and security device are all contained in a single mechanical housing. For information on installing a 19” Integrated Tabletop refer to Section 2 ‘*19” Integrated Tabletop Display*’.
- Console, kit version - supplied as a table top or deck mounted modular kit, this includes a monitor, control panel, PCIO and Processor. For information on installing a kit version console refer to Section 4 ‘*Installing the Console Assembly*’
- Console, Deck mounted version - supplied as either a standalone console, or installed in an existing console suite. A deck mounted console includes all the modules included in a kit version but with the addition of a pedestal, which includes shelves for the Processor PC and PCIO unit (for conventional radar systems). For information on installing a deck mounted version console refer to Section 4 ‘*Installing the Console Assembly*’.

A VisionMaster console (kit version or deck mounted version) may be part of the following types of system:

- Interswitched System - where up to four consoles are connected via a 2-way interswitch to two top units, or up to six consoles are connected via a 6-way interswitch to a maximum of six top units.
- Dual Radar - where one console can be connected to two top units, enabling radar video from both top units to form a composite display. Dual radar consoles may also be interswitched with standard consoles.
- Client/Server - includes a Server and PCIO for each top unit, a number of Client processors, a mains distribution unit, a control panel with I/O and Ethernet switches. A Client/Server display includes the same monitor variants found on conventional radar systems, but does not include an Interswitch. For information on installing a Client/Server system refer to Section 4.9 ‘*Installing Client/Server Modules*’

1.7.1 System Block Diagrams

For cabling and system interconnection details for all system types refer to Section 6 ‘*Cabling and Interconnection Diagrams*’.

2 19" Integrated Tabletop Display

The 19" integrated tabletop display is a combined monitor, processor, PCIO, and control panel (basic or trackball only).

The integrated tabletop display comprises the following sub-assemblies and modules:

- 19" LCD Monitor
- PC sub unit - comprises a processor, hard disk, SC3 card and graphics card.
- PCI/O PCB
- Control Panel
- DVD drive
- Security Device
- 24V Power Supply
- DC/DC Converter
- On/Off switch
- Two USB ports
- Buzzer PCB
- 5 Amp Fuse

All sub-assemblies and modules are housed in an enclosure chassis, monitor bezel and rear cover.

For the 19" Integrated Tabletop outline drawings refer to the following:

- Figure 4.1 and Figure 4.2 (19" Integrated Tabletop Outline Drawing 65919 Series, sheets 1 and 2).
- Figure 4.3 and Figure 4.4 (19" Integrated Tabletop Outline Drawing 65920 Series Mk 2, sheets 1 and 2).

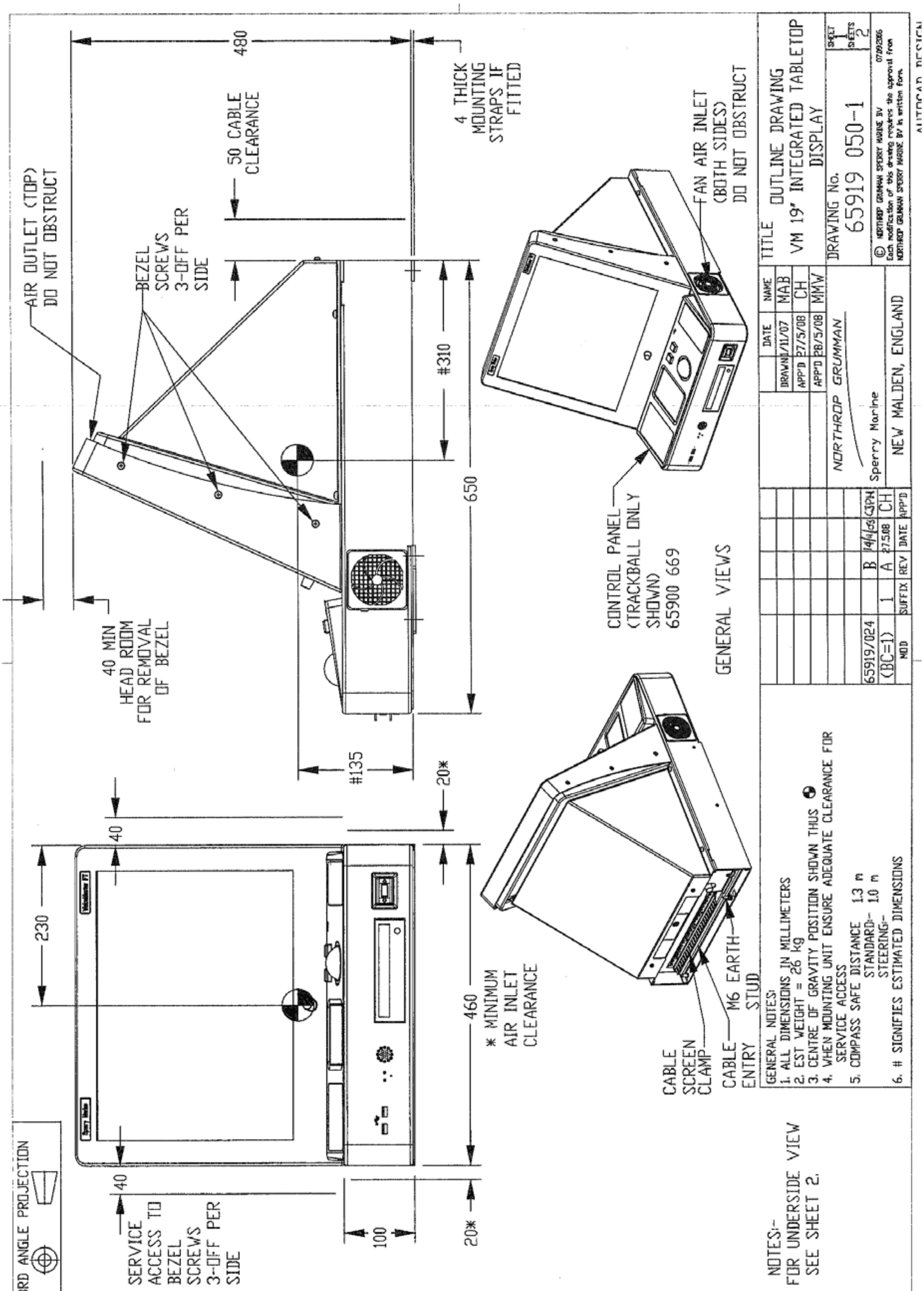

Figure 4.1 19" Integrated Tabletop Outline Drawing 65919 Series - Sheet 1

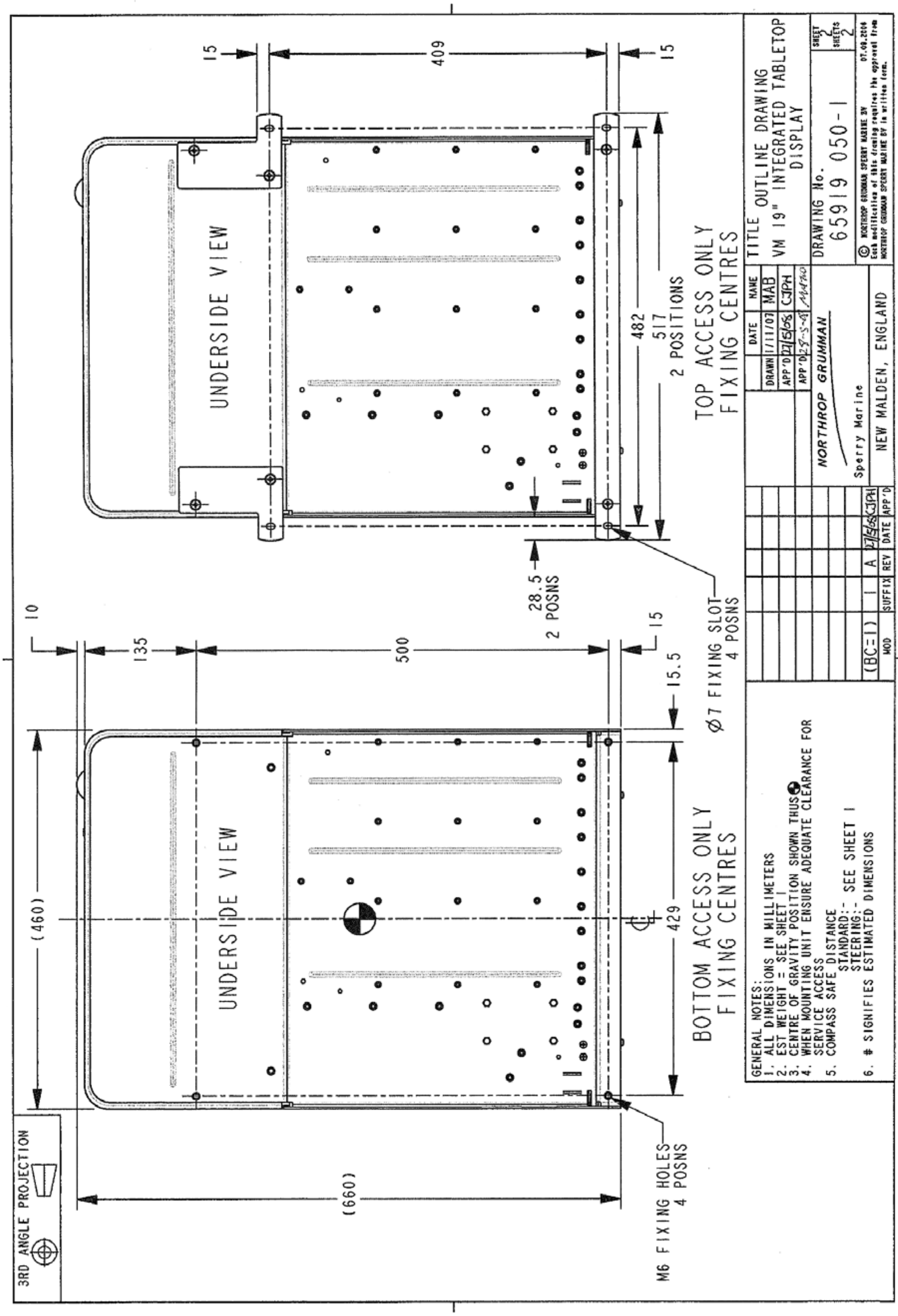

Figure 4.2 19" Integrated Tabletop Outline Drawing 65919 Series - Sheet 2

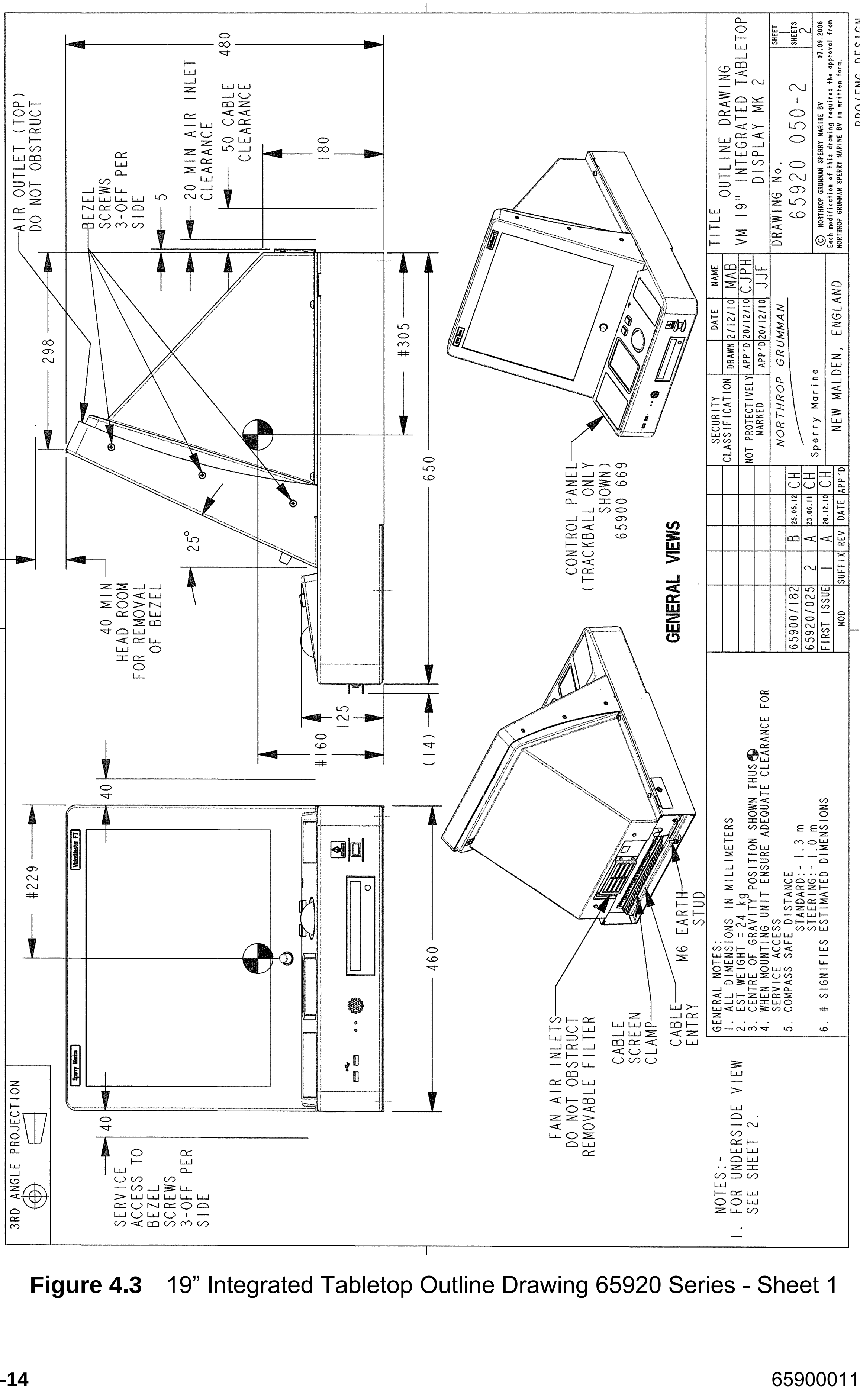

Figure 4.3 19" Integrated Tabletop Outline Drawing 65920 Series - Sheet 1

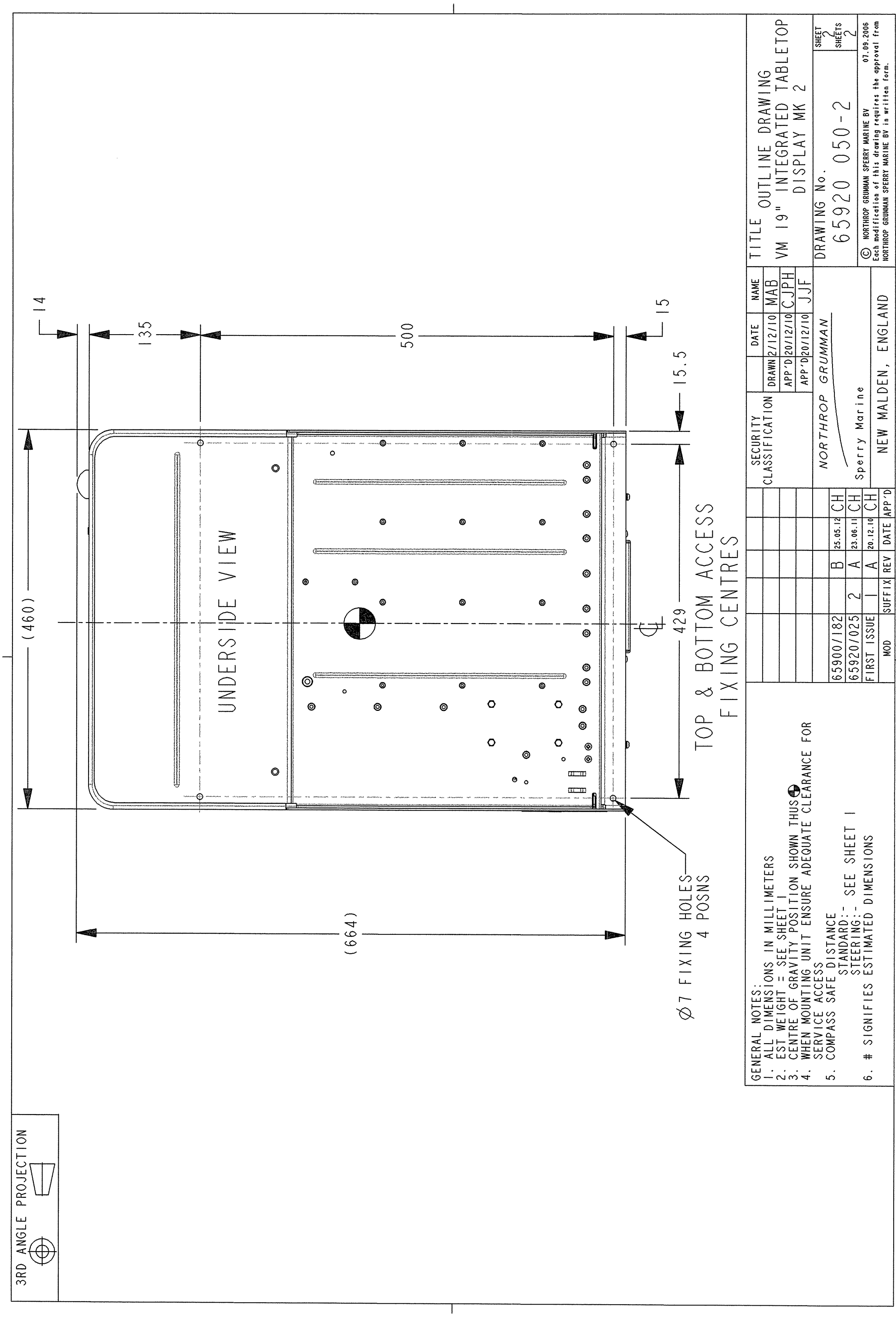

Figure 4.4 19" Integrated Tabletop Outline Drawing 65920 Series - Sheet 2

2.1 Installing the 19” Integrated Display to a Tabletop

There are two methods of securing the 65919 series (Mk 1) to the tabletop:

- Top Access Installation, where the display is fixed from the top of the table. When using this method, the left and right hand mounting bracket and mounting strap listed below must be attached to the underside of the enclosure.
- Bottom Access Installation, where the display is fixed from the underside of the table top.

The 65920 series (Mk 2) integrated display is secured to the tabletop by the bottom access installation method only.

2.1.1 Top Access Installation

To secure the 65919 series integrated display from the top of the table you will need the following parts, supplied with Installation Kit 65919607:

- four wood screws (4107624)
- four large M6 washers (4711203)
- six M6 x 10 locking screws (65800258)

The following additional parts are supplied with the installation kit for the 65919 series integrated display:

- Mounting Bracket - RH (65919165)
- Mounting Bracket - LH (65919166)
- Mounting Strap (65919114)

To install the display to the tabletop:

1. For the 65919 series attach the two mounting brackets and mounting strap to the underside of the enclosure using the six M6 locking screws.
2. Mark and drill the four M6 fixing holes on the table top to the dimensions shown in Figure 4.2 (65919050, sheet 2 - top access only) and Figure 4.4 (65920050, sheet 2).
3. Attach the display assembly to the table top using the four wood screws and M6 washers. Or, use suitable length M6 bolts to secure.

2.1.2 Bottom Access Installation

If you are fixing the display from the underside, mark and drill the four M6 fixing holes on the table as shown in Figure 4.2 (65919050, sheet 2 - bottom access only) and Figure 4.4 (65920050, sheet 2).

Use suitable length M6 bolts and nuts to secure.

2.2 Removing 19” Integrated Display Modules

To install the input cables to the 19” integrated display the following modules must be removed from the main assembly:

- LCD Bezel
- Rear Cover
- Rear Panel
- Cable Clamp

Refer to Figure 4.6 for an illustration of the 19” Integrated Display with the modules removed.

2.2.1 Removing the Bezel and Rear Cover

1. Remove the six bezel retaining screws (three each side).
2. Remove the four M6 screws, plain washers and spring washers (two either side) from the rear cover. Remove the two M4 screws, plain washers and spring washers from the rear of the cover.
3. Pull the bezel forward from the top to disengage the bezel from the rear cover spring clips.
4. Remove the two M4 screws, plain washers and spring washers from the top of the rear cover. Slide the rear cover backwards, remove the cover earth strap and then remove the cover from the enclosure assembly.
5. To remove the bezel, disconnect the bezel earth strap from the display chassis.

2.2.2 Removing the Rear Panel

1. Remove the three M6 screws and spring washers retaining rear panel. The left and right hand screws attach the panel directly to the enclosure chassis; the centre screw attaches the display chassis to the rear panel.
2. After the Processor and LCD assembly have been pivoted upwards, (see Section 2.2.3 ‘*Pivoting the Processor and LCD Assembly*’) pull and manoeuvre the rear panel up and backwards to remove it from the enclosure chassis.

Note: *Removing the fuse holder may help in the removal of the rear panel.*

2.2.3 Pivoting the Processor and LCD Assembly

When the LCD bezel, rear cover and the rear panel's centre screw have been removed, the combined Processor plate assembly and the LCD assembly may be pivoted up from the main enclosure assembly.

1. To open the Processor/LCD assembly, lift up the assembly from the rear of the display chassis. The assembly hinges on two brackets attached to the enclosure chassis.
2. To secure the assembly in the open position, push the Stay forward, which is attached to the underside of the display chassis and the side of the enclosure chassis, see Figure 4.5 below.

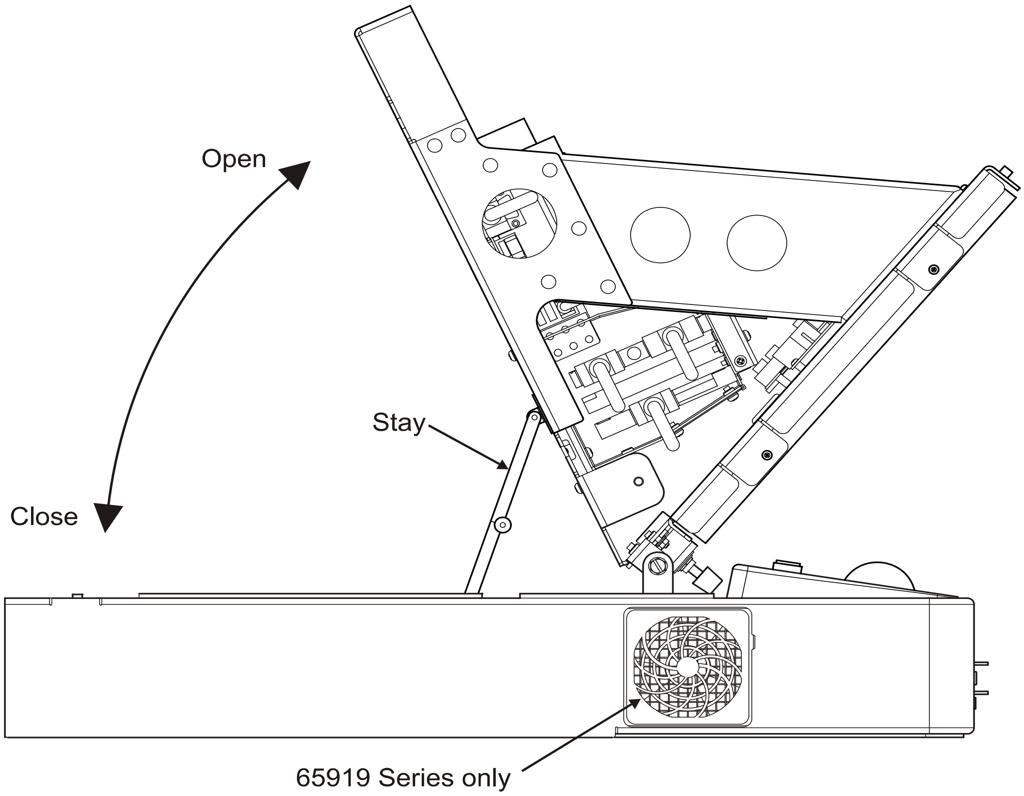

Figure 4.5 Pivoting the Processor and LCD Assembly

2.2.4 Removing the Cable Clamp Top Plate

Remove the five M4 countersunk screws securing the cable clamp top plate to the cable clamp bottom plate.

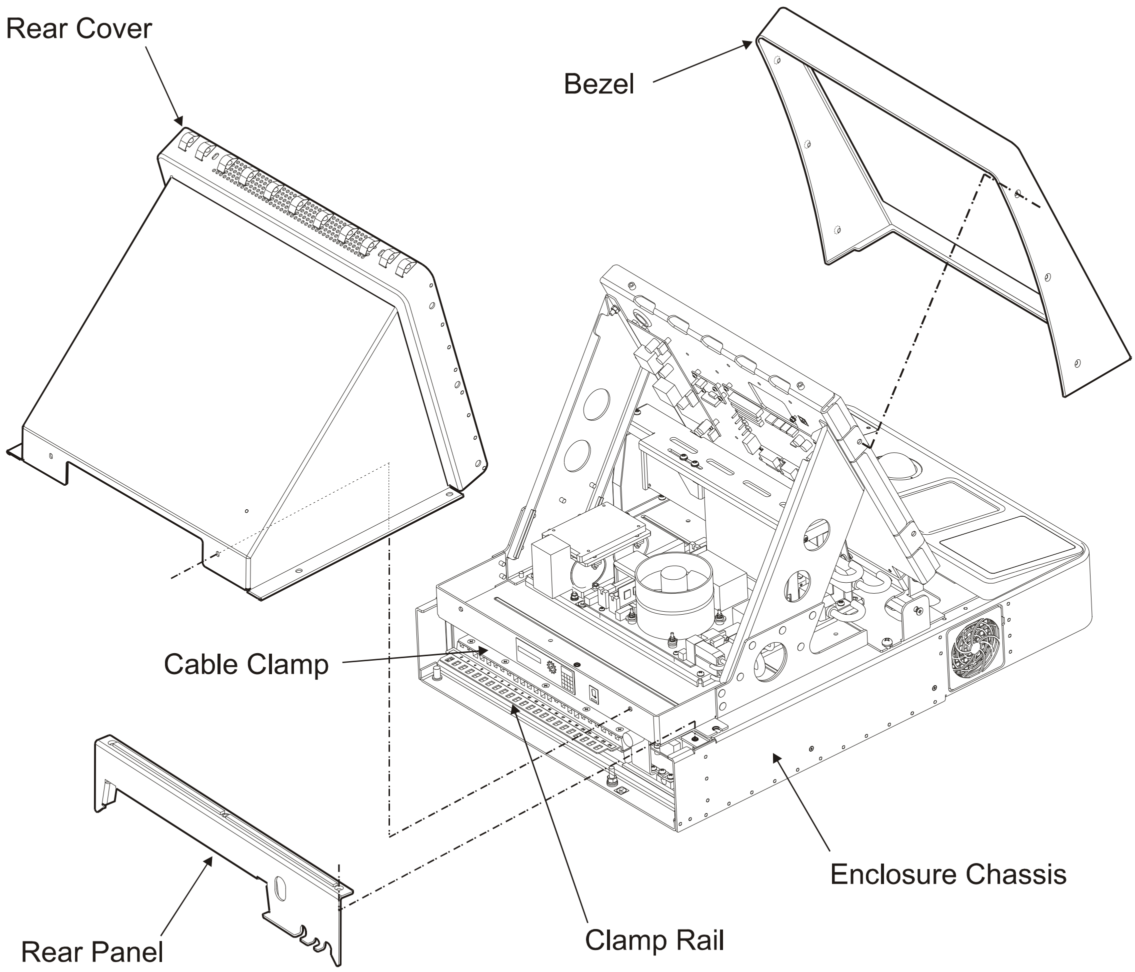

Figure 4.6 19" Integrated Display - Covers & Panel Removal

2.3 Installing a Secondary Viewer Output

A second dedicated monitor, used to display CID pages, or output to a VDR, may be connected to the 19” Integrated Display. A 15-way VGA cable for output to the secondary viewer can be installed when the tabletop covers are removed, see Figure 4.7 for the connection location of the cable.

Route the cable through the cable hole on the base of the Processor/LCD assembly. Lift the assembly from the rear of the enclosure chassis and secure in the open position, as described in Section 2.2.3.

Secure the cable to the cable tray which is attached to the enclosure chassis.

Remove the cable clamp and rear panel and secure the cable to clamp rail.

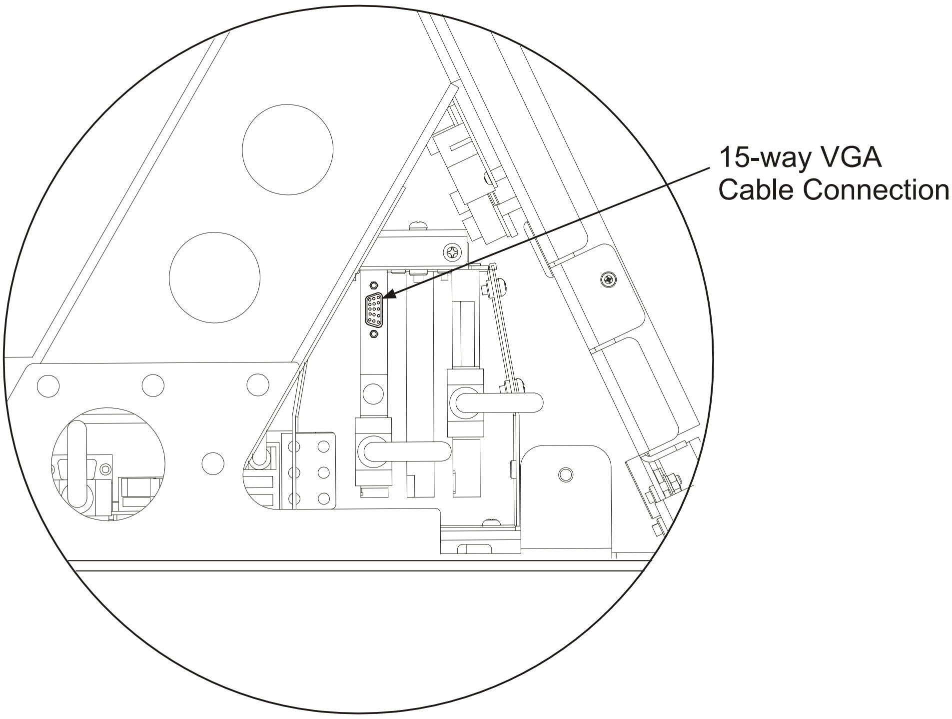

Figure 4.7 Location of VGA Cable Output

To configure the secondary monitor, refer to Appendix A ‘*Configuring a Second Monitor*’ in Chapter 4 ‘Conning Information Display‘ of the VMFT Ships Manual, Volume 2 .

3 Consoles (deck mounted and tabletop kit versions)

3.1 Standard Console

The standard VisionMaster console assembly can be supplied in one of the following variants:

- a 340 mm (23.1" or 25.5" LCD) deck mounted modular unit
- a 340 mm (23.1" LCD) table top kit version
- a 250 mm (19.0" LCD) table top kit version
- a 250 mm (19.0" LCD) deck mounted modular kit (same physical size as the 340mm kit)

A standard console comprises the following sub assemblies and modules:

- Display Unit - comprises a flat panel monitor (FPM) held in a chassis.
- Control Panel Assembly - contains a control panel (or trackball), power On/Off switch. A USB connector is included when only the trackball is supplied.
- PCIO Unit.
- Processor Unit.

The deck mounted unit also includes a Pedestal, which houses shelves for the PCIO unit and Processor unit. The deck mounted unit can be supplied either as a standalone console, or installed in an existing console suite. A standalone pedestal version includes display side cheeks and side panels.

3.1.1 Dual Radar Console

A console connected to a dual radar will include the following additional module to the units listed for a standard console assembly:

- Auxiliary PCIO Unit (for Channel 2 connections).

3.2 Client/Server Radar System

A system that is configured as a Client/Server Radar (CSR) will include the following two sub-assemblies:

1. Client Console - this will include the following modules:
    - Display Unit (same as standard consoles)
    - Client PC - configured from a standard Processor Unit, but without a scan converter (SC) card or Network Front End (NFE) card.
    - Mains Distribution Unit
    - Control Panel with I/O
    - Client Ethernet switches
    - 24V Power Supply Unit (for Client and switches)
2. Server Rack - this will include the following modules:
    - Server PC - configured from a standard Processor Unit, but includes a NFE card.
    - PCIO Unit
    - Server Ethernet switches
    - 24V Power Supply Unit (for Server and switches)

3.3 Outline Drawings

For 340 mm outline drawings refer to the following:

- Figure 4.8 and Figure 4.9 (sheets 1 and 2) for the 340 mm deck mounted console, standalone version.
- Figure 4.10, Figure 4.11 and Figure 4.12 (sheets 1 to 3) for the 340 mm deck mounted console assembly (23.1" or 25.5") for installation into an existing console suite.
- Figure 4.13 for the 340 mm (23.1") table top console assembly.

For 250 mm outline drawing refer to the following:

- Figure 4.14 for the 250 mm table top console assembly.

The assembly instructions are given in the order they should be done. To assemble the console units from their supplied parts, refer to the documentation supplied with the parts and the following sub-sections:

- Section 4.1 '*Installing a Standalone Pedestal to the Deck*'.
- Section 4.1.1 '*Installing the Control Panel to the Display Chassis*'.
- Section 4.1.2 '*Installing the Control Panel/Display Chassis to the Pedestal*'.
- Section 4.5 '*Installing the Monitor to the Display Chassis*'.

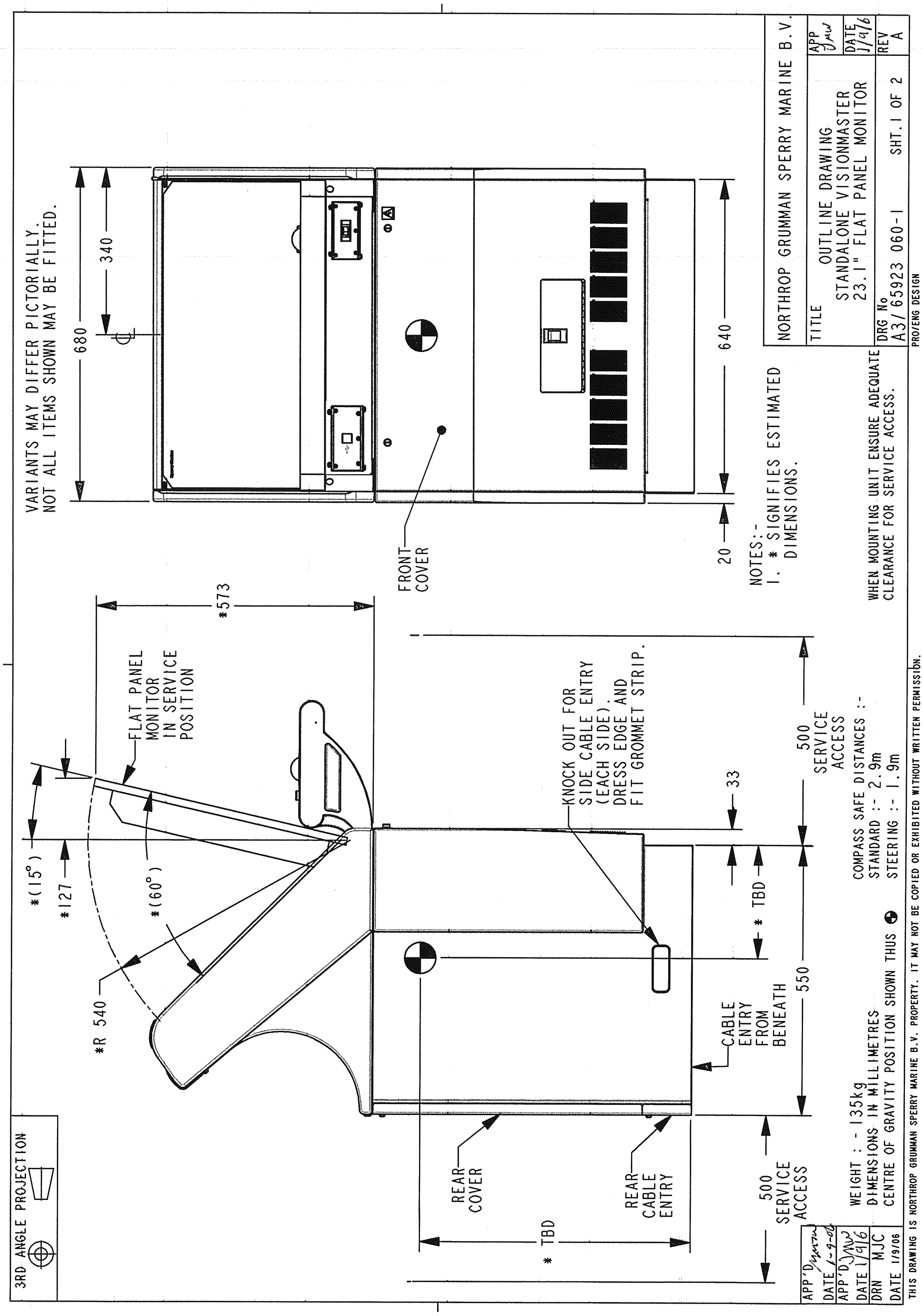

Figure 4.8 Deck Mounted 340 mm Console Assembly Outline Drawing Standalone Version - Sheet 1

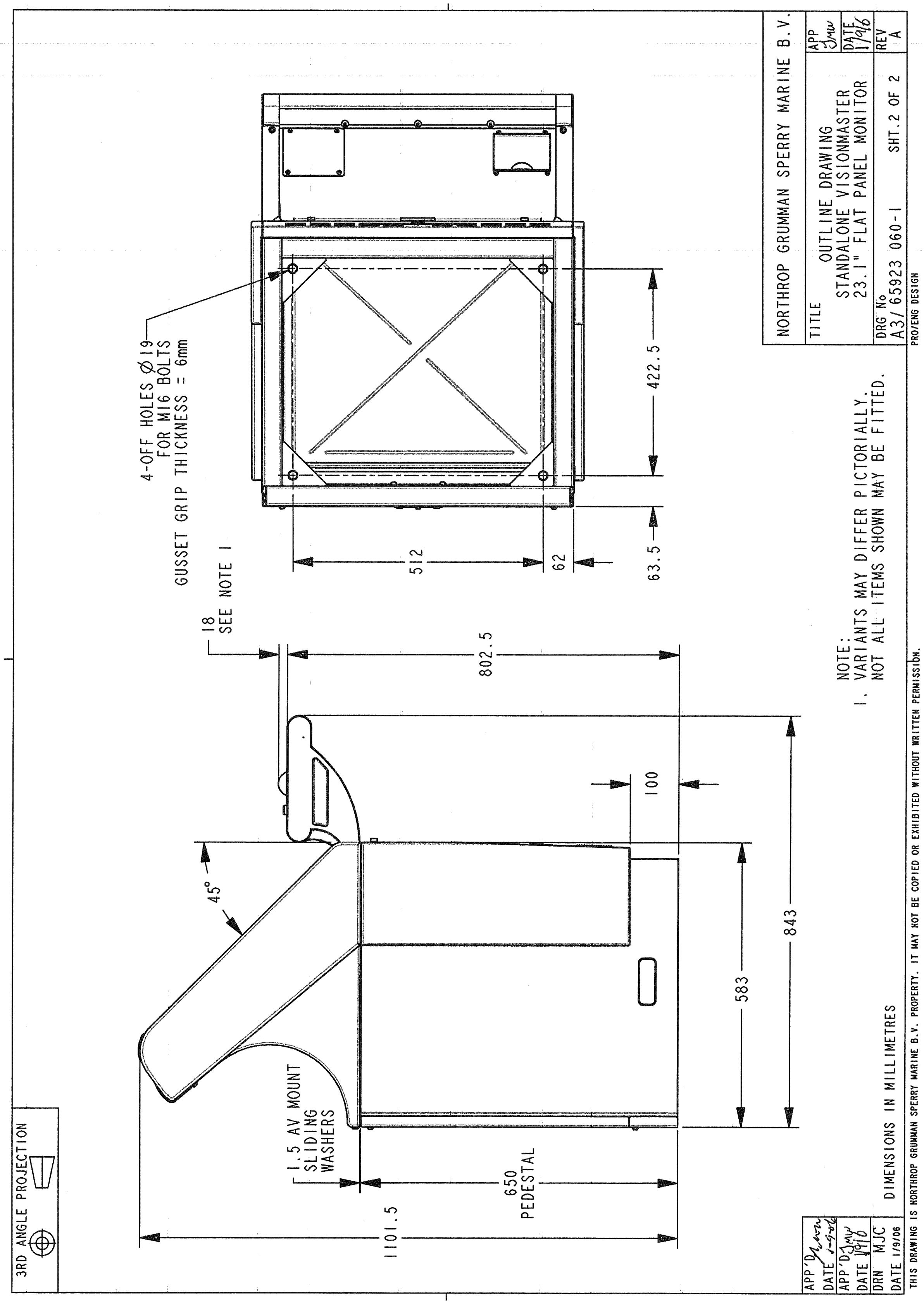

Figure 4.9 Deck Mounted 340 mm Console Assembly Outline Drawing
Standalone Version - Sheet 2

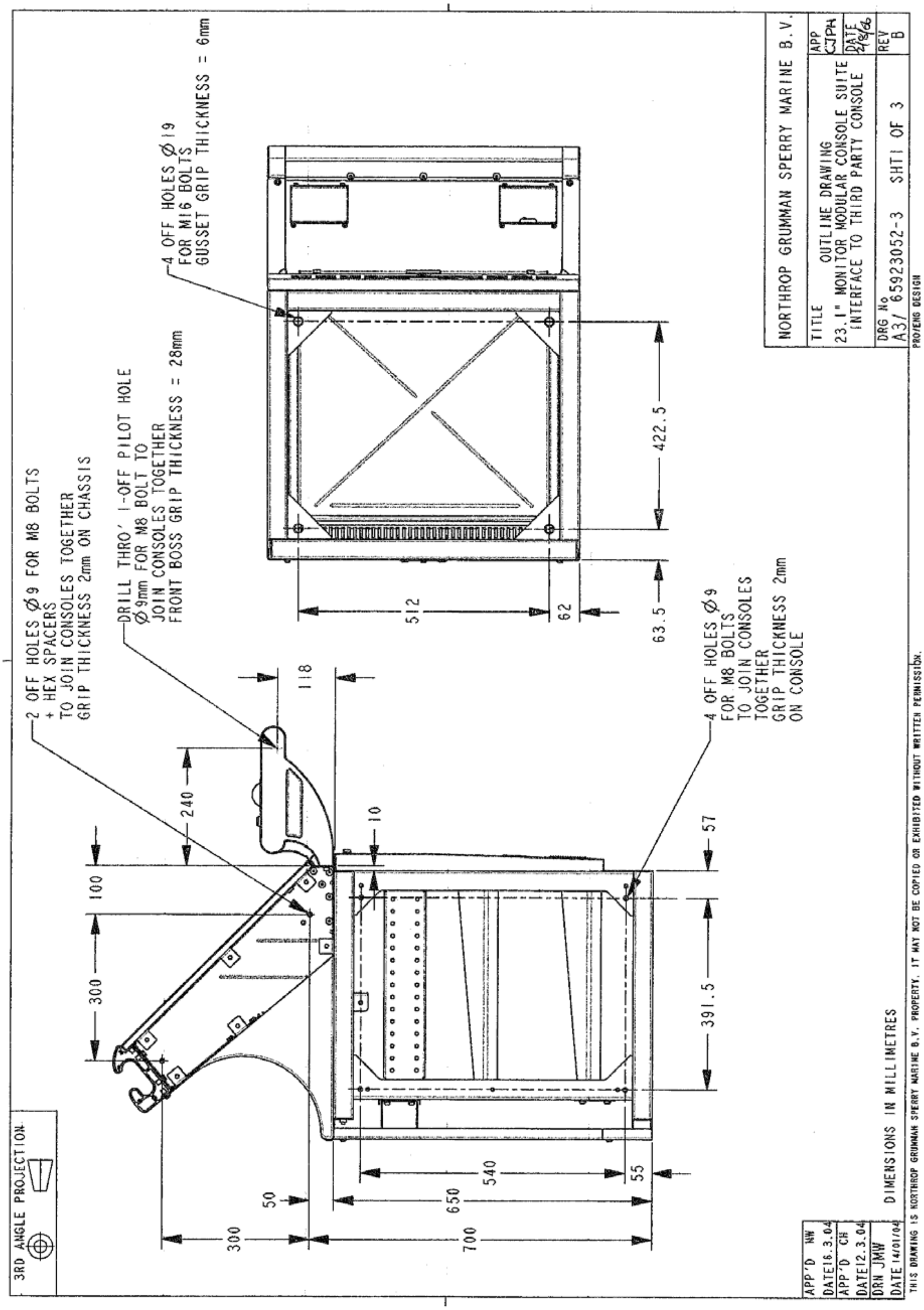

Figure 4.10 Deck Mounted 340 mm Console Assembly Outline Drawing for installation into a Console Suite - Sheet 1

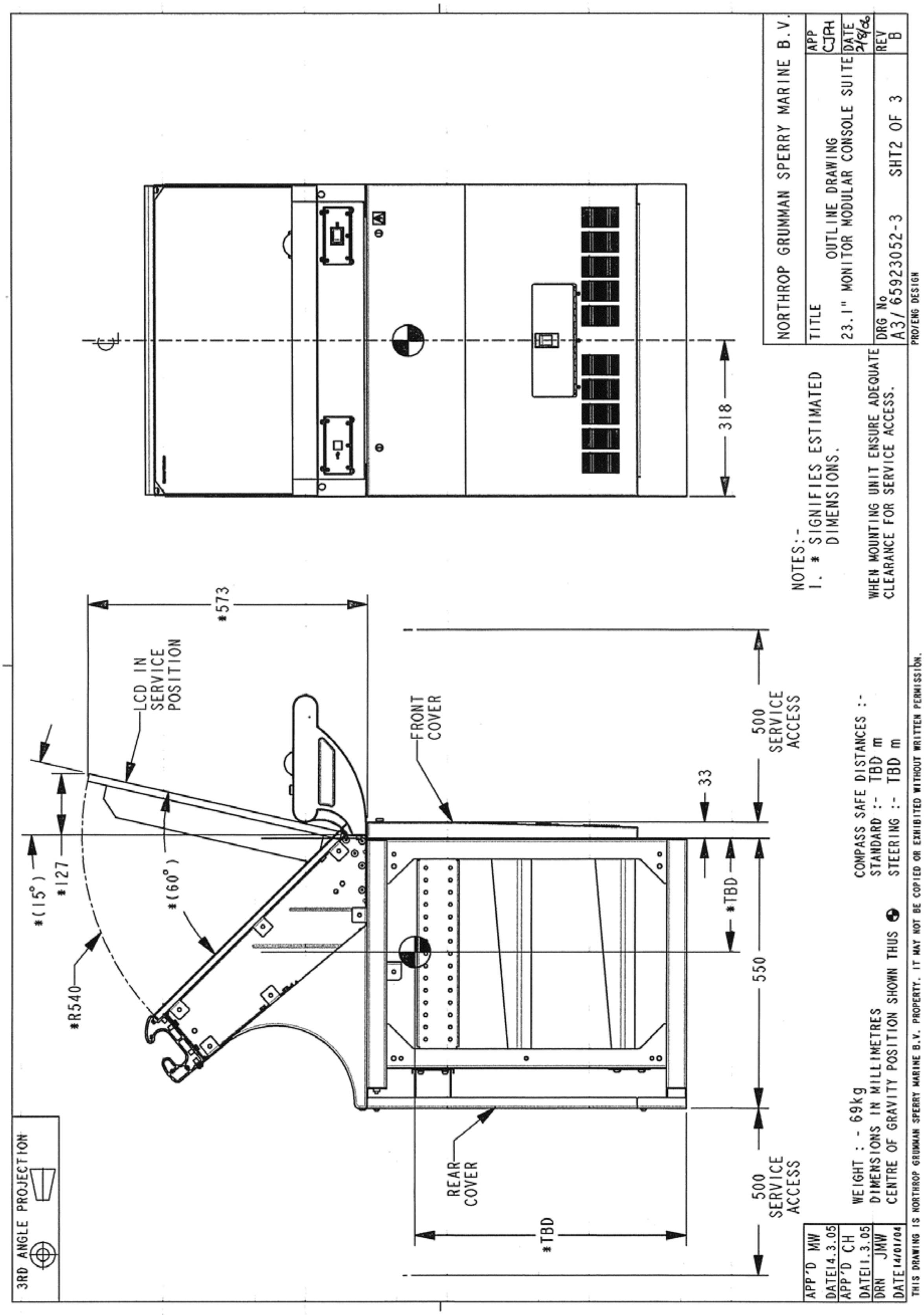

Figure 4.11 Deck Mounted 340 mm Console Assembly Outline Drawing for installation into a Console Suite - Sheet 2

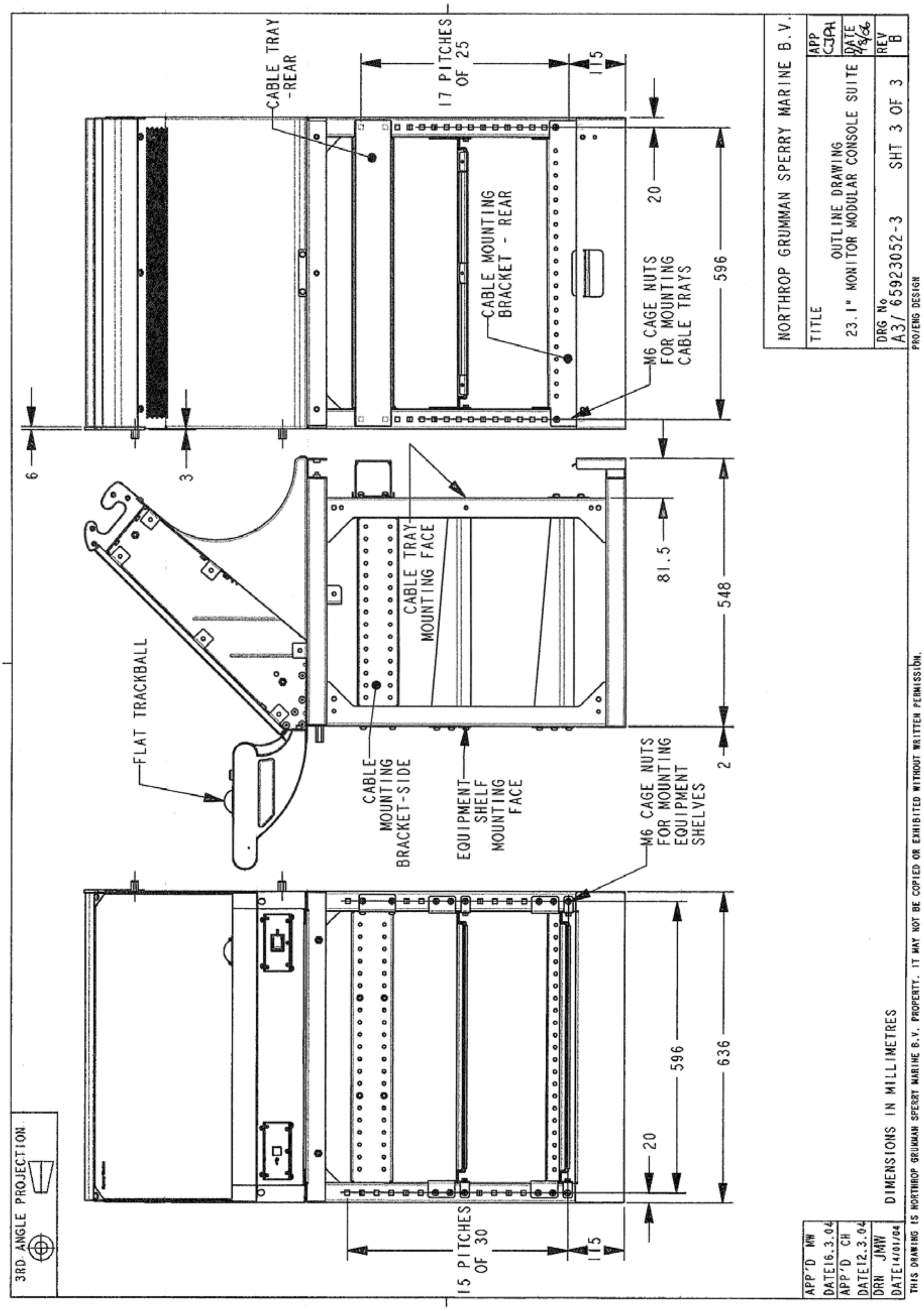

Figure 4.12 Deck Mounted 340 mm Console Assembly Outline Drawing for installation into a Console Suite - Sheet 3

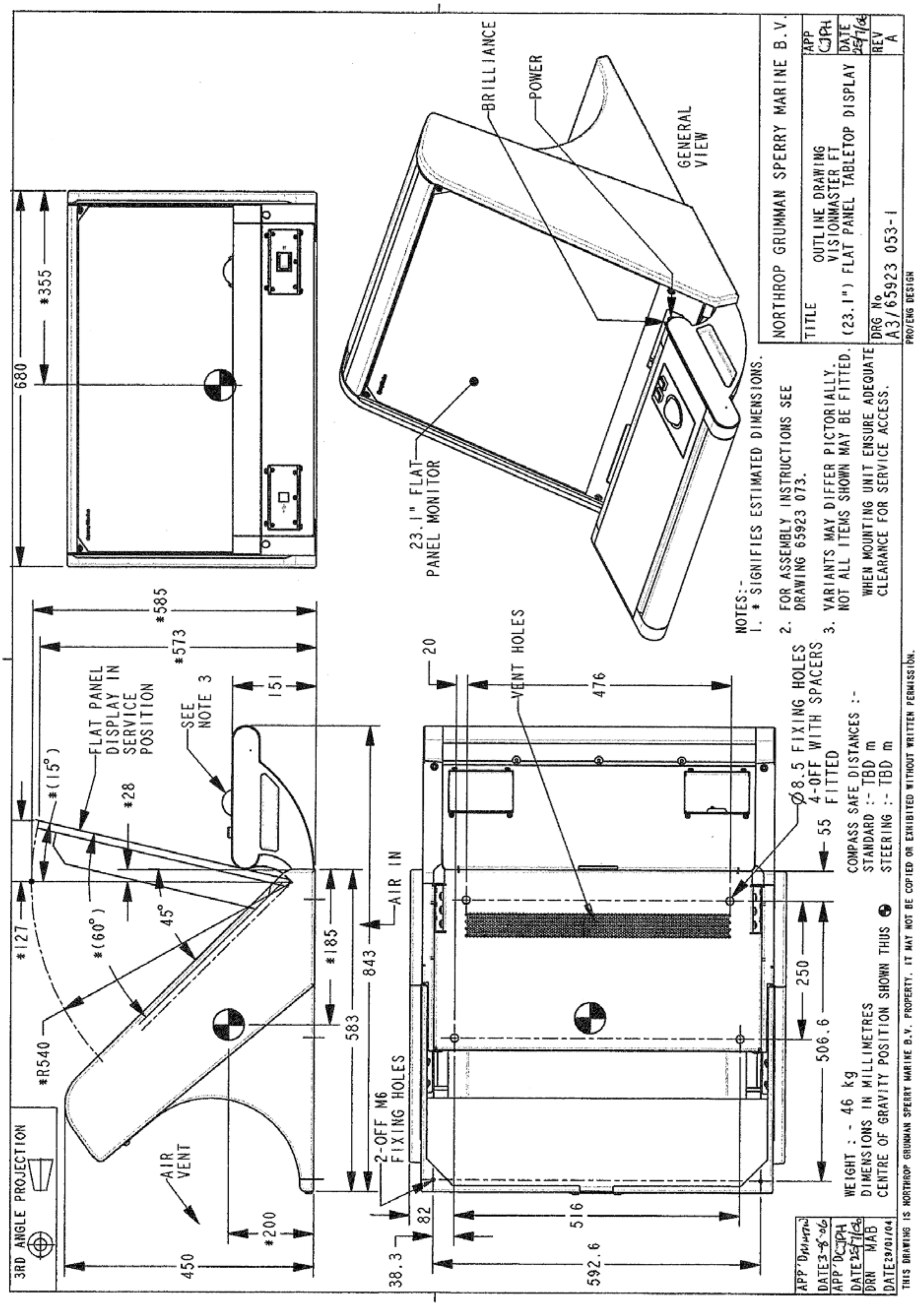

Figure 4.13 Console Assembly 340 mm Table Top Version Outline Drawing

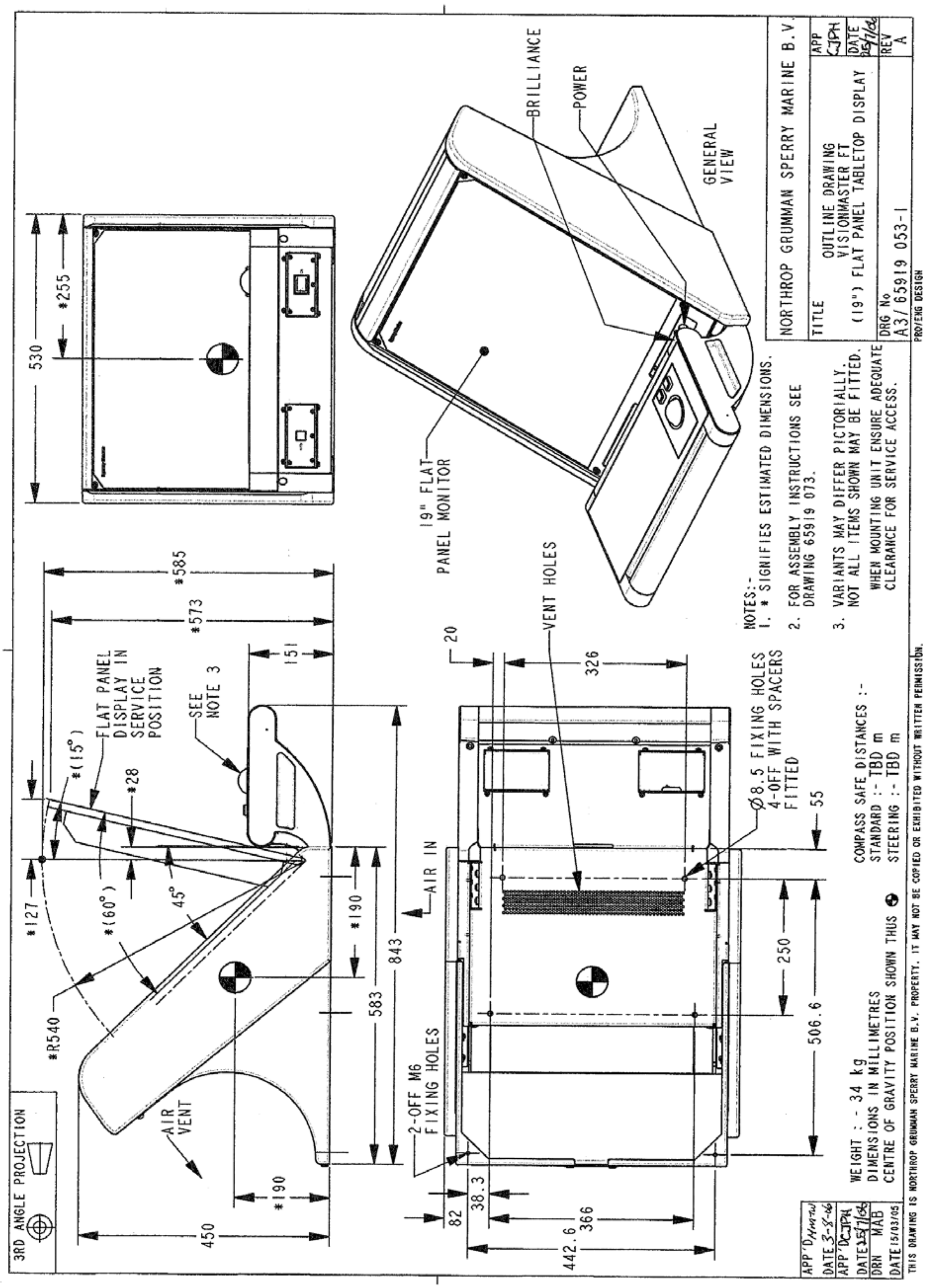

Figure 4.14 Console Assembly 250 mm Table Top Version Outline Drawing

3.4 Display Unit

The Display Unit assembly includes a 19", 23.1", 25.5" or 27" flat panel monitor (FPM) for use with a 110/220 V AC power supply.

A 19" FPM with a 23.1" metalwork frame can also be housed in a 340mm display unit.

The FPM includes an independent On/Off switch and brilliance control.

The 19" and 23.1" FPMs include a buffered video and sync output for a VDR, at the same frequency and resolution as the output of the processor unit, see Cabling diagrams, Figure 4.55 to Figure 4.58. The VDR output is connected to the RGB OUT terminal at the rear of the FPM.

The FPM is housed in a metal chassis. On the deck mounted console version the chassis is attached to a pedestal; on the table top version the chassis is mounted to the table top.

In the standalone console version the chassis is supplied with left and right hand side cheeks.

Refer to the following figures for general information on the display units.

- Figure 4.15 for the 65919T 19" FPM outline drawing.
- Figure 4.16 for the 65817G 19" Hatteland FPM outline drawing.
- Figure 4.17 for the 65923C 23.1" Hatteland FPM outline drawing.
- Figure 4.18 for the 65823A 23.1" Hatteland FPM outline drawing.
- Figure 4.19 for the 65919C 19" FPM in a 23.1" frame outline drawing.
- Figure 4.20 for the 65923E 23.1" Melford FPM outline drawing.
- Figure 4.21 for the 65926E 25.5" Melford FPM outline drawing.
- Figure 4.22 for the 65926K 25.5" ISIC FPM outline drawing.
- Figure 4.23 for the 65927C 27" Hatteland FPM outline drawing.
- Figure 4.24 for the 340 mm Display Unit chassis with side cheeks removed (for an existing console suite).

The 65817G, 65823A and 65927C are supplied as kit versions only for installation into third party consules.

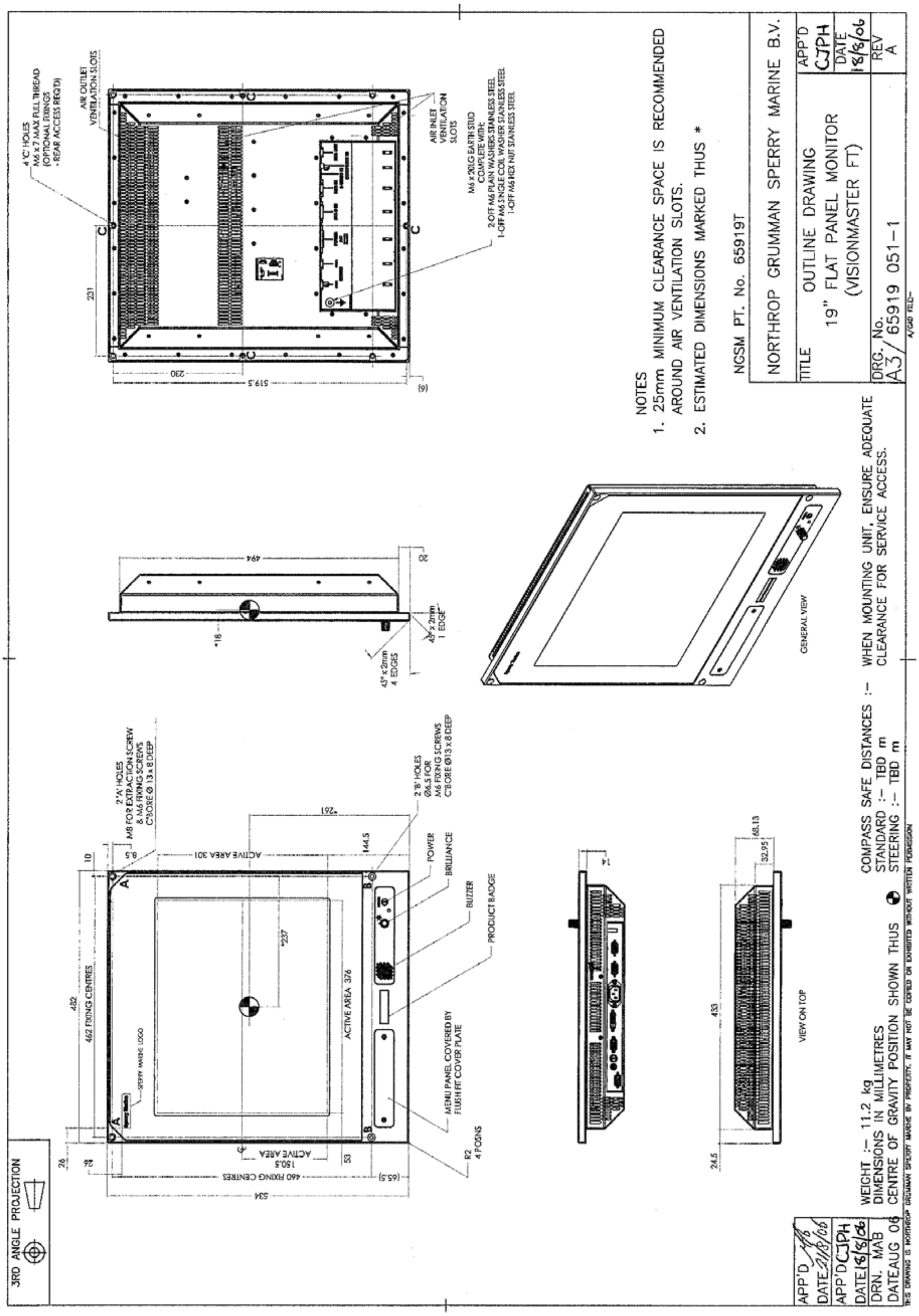

Figure 4.15 19" Hatteland Flat Panel Monitor - Outline Drawing

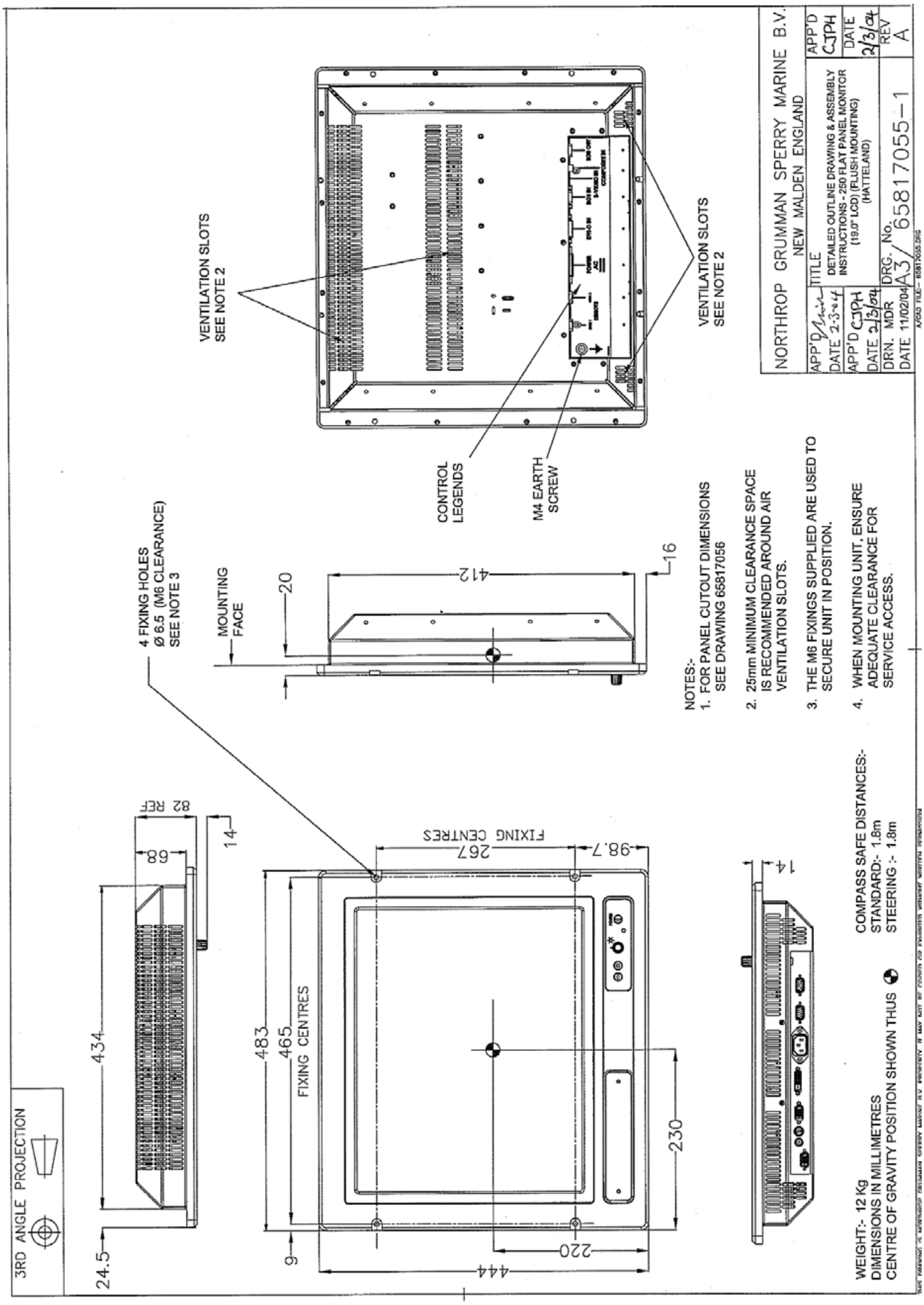

Figure 4.16 19" Hatteland Flat Panel Monitor (Kit version) - Outline Drawing

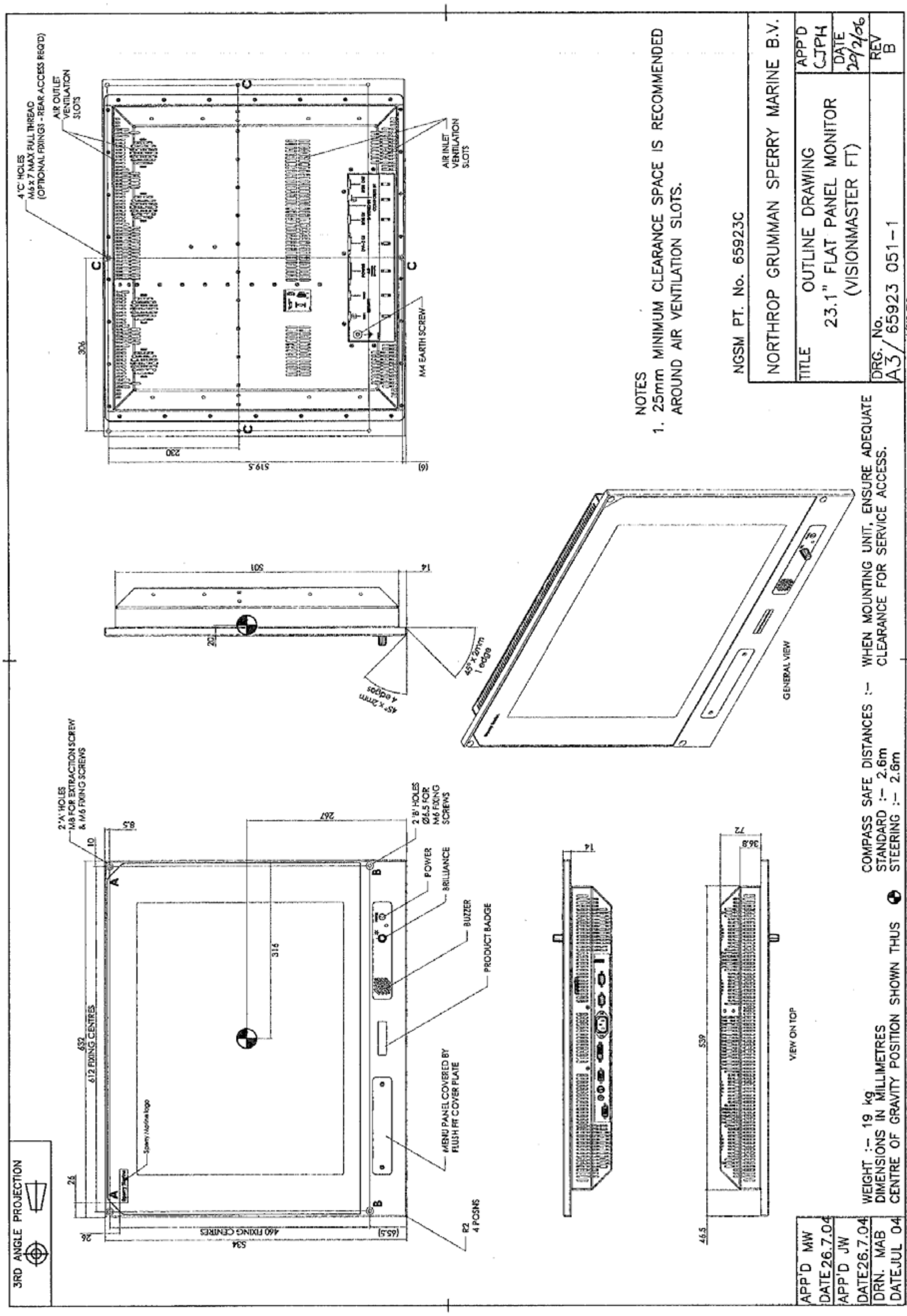

Figure 4.17 23.1" Hatteland Flat Panel Monitor - Outline Drawing

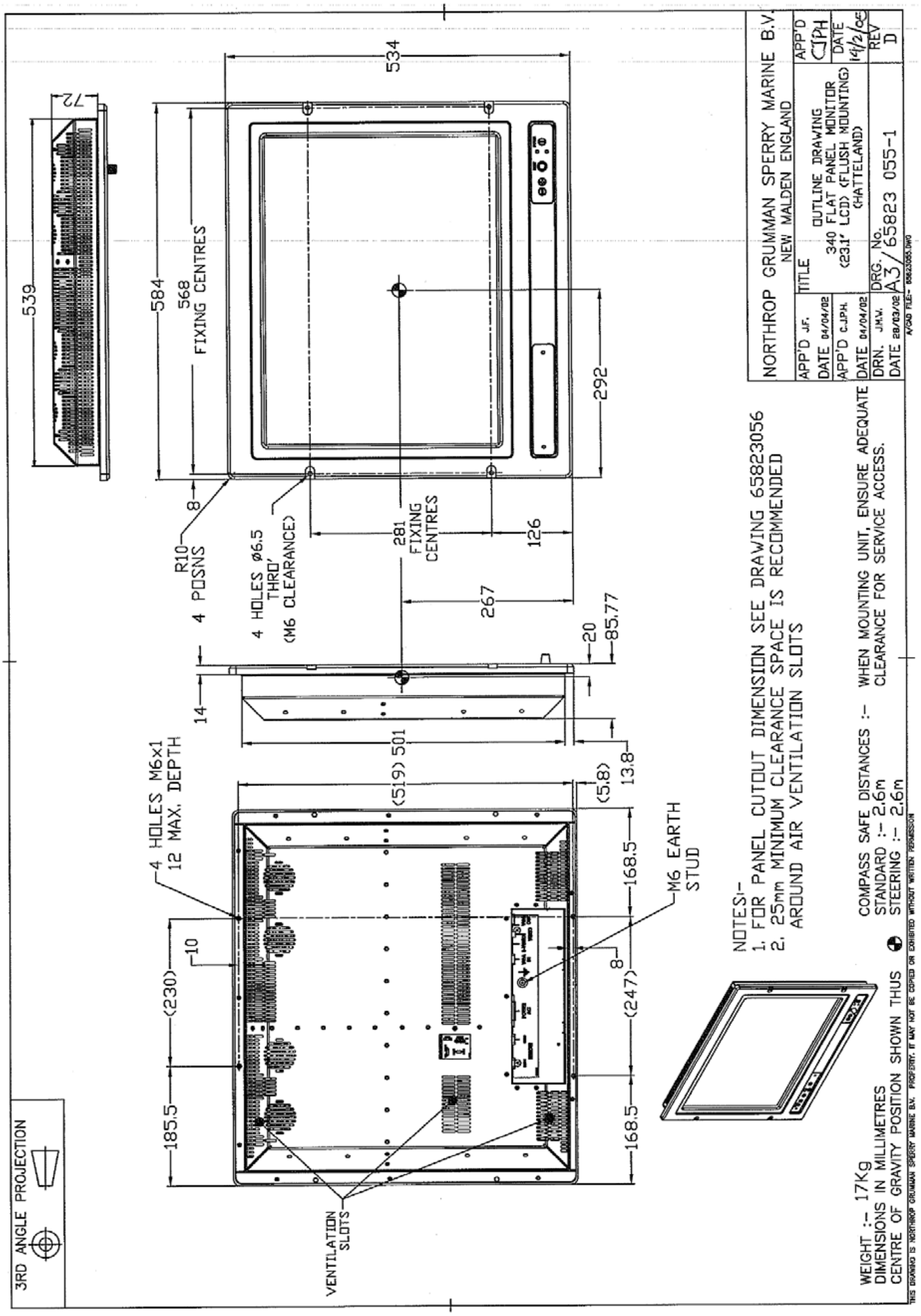

Figure 4.18 23.1" Hatteland Flat Panel Monitor (Kit version) - Outline Drawing

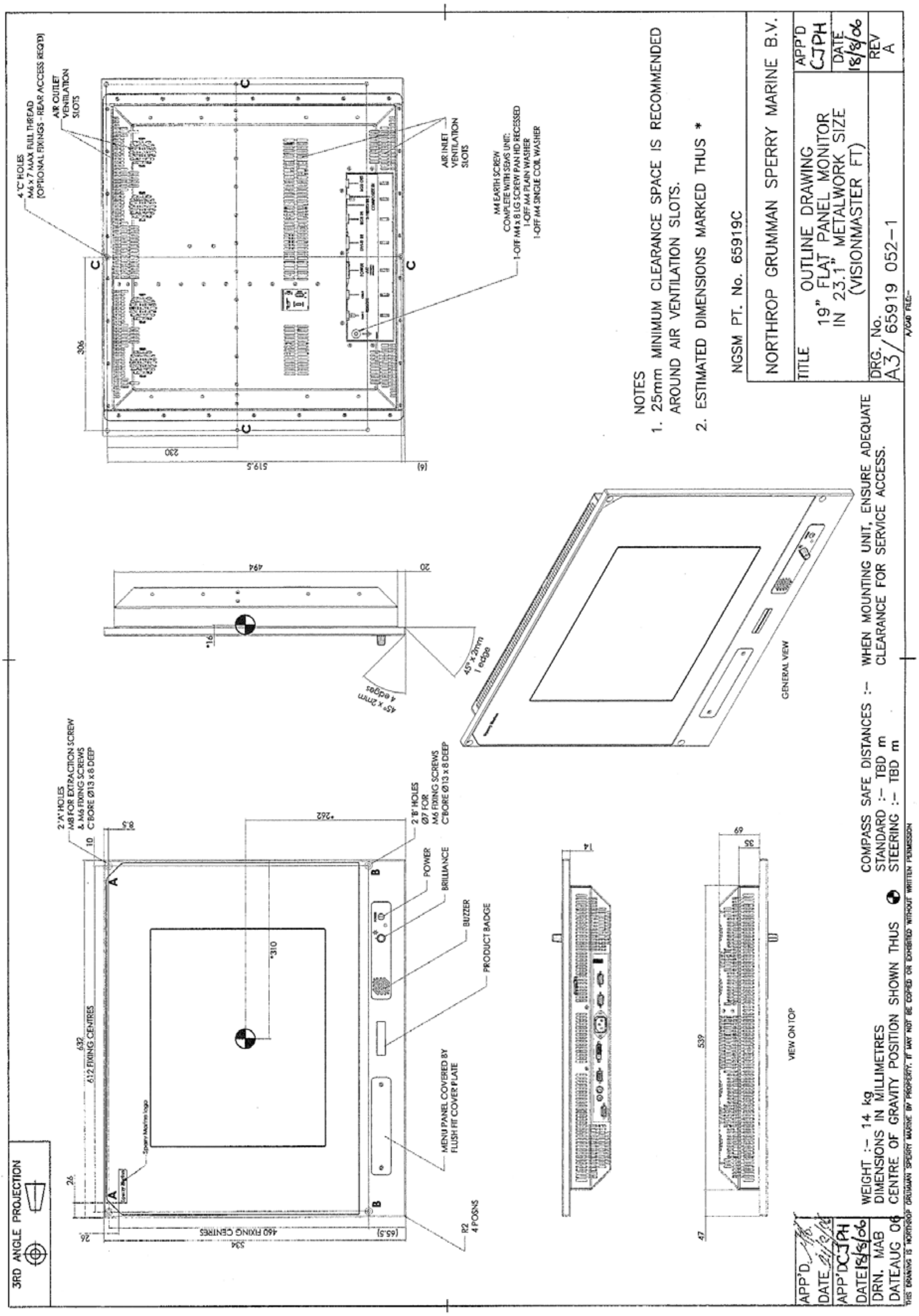

Figure 4.19 19" Hatteland Flat Panel Monitor in 23.1" Frame - Outline Drawing

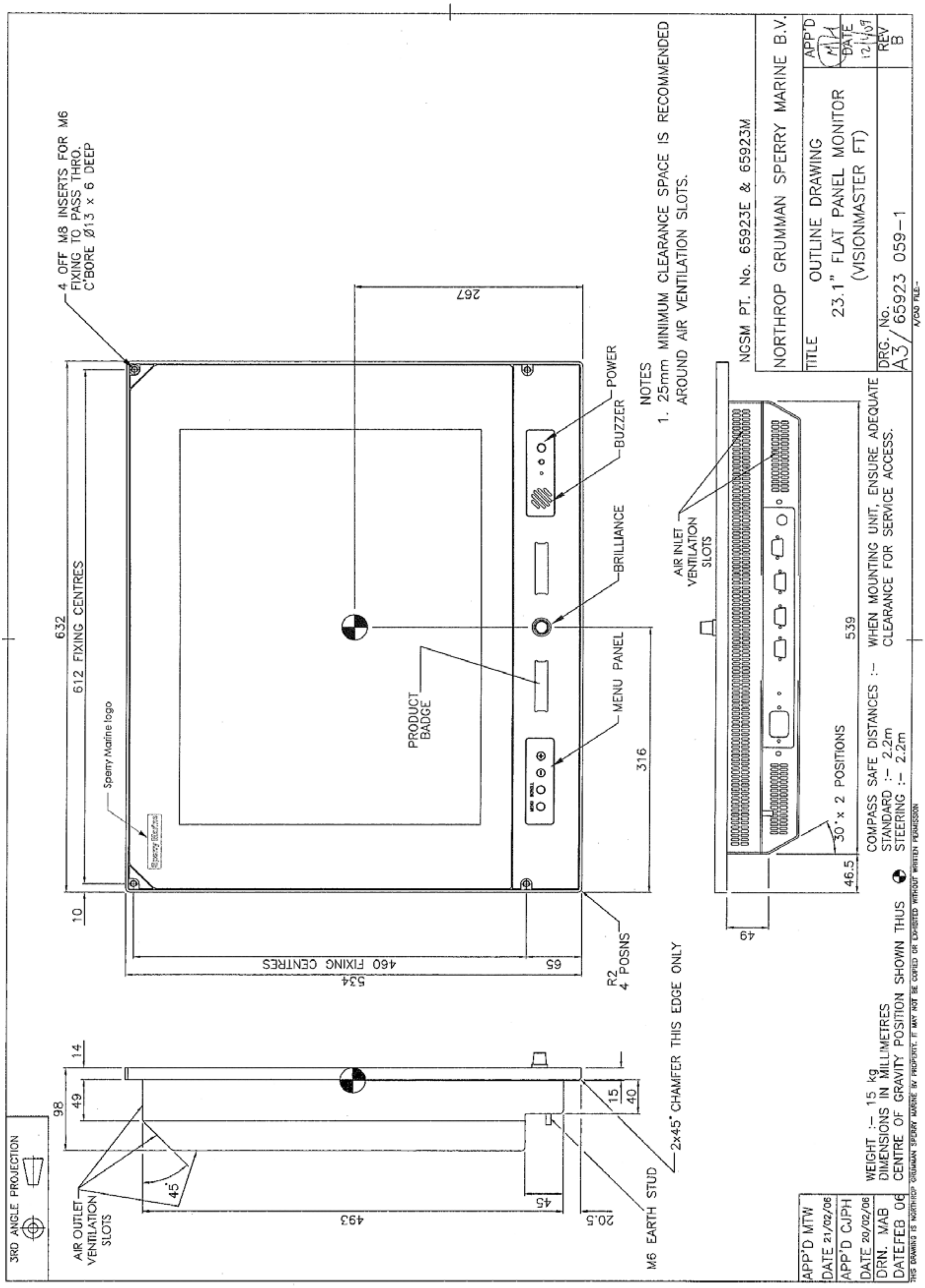

Figure 4.20 23.1" Melford Flat Panel Monitor - Outline Drawing

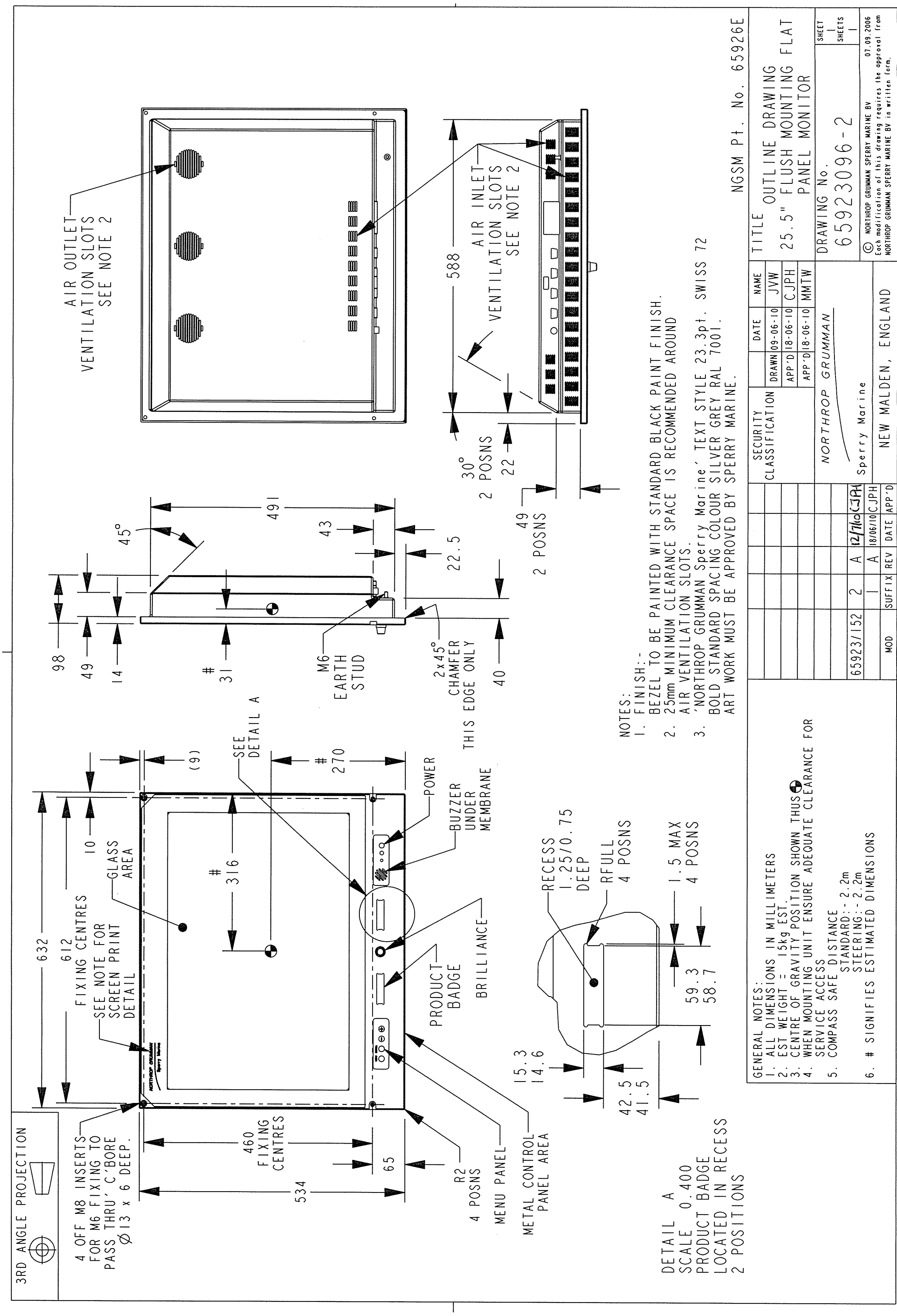

Figure 4.21 25.5" Melford Flat Panel Monitor - Outline Drawing

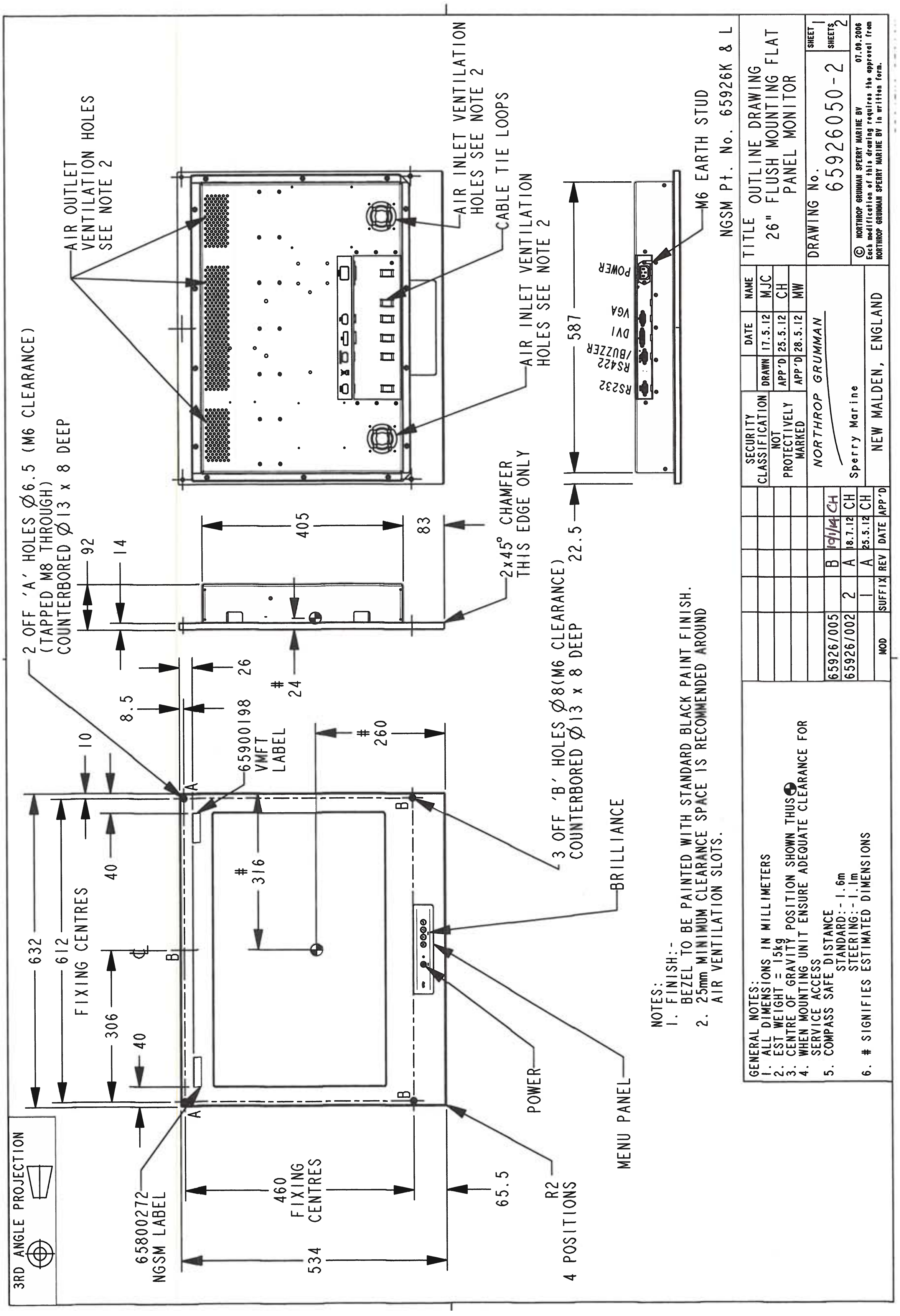

Figure 4.22 26" ISIC Flush Mounted Flat Panel Monitor - Outline Drawing

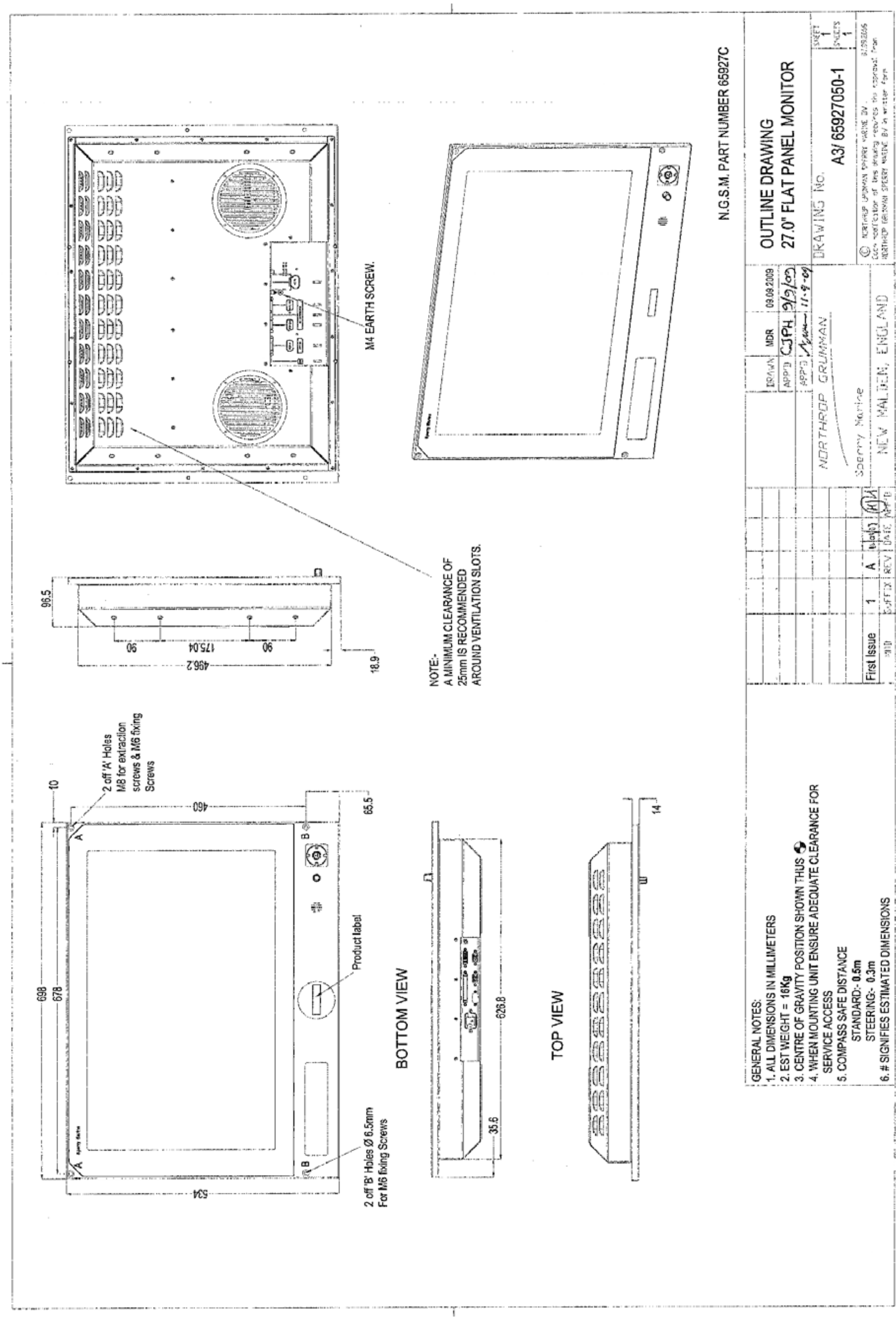

Figure 4.23 27" Hatteland Flat Panel Monitor - Outline Drawing

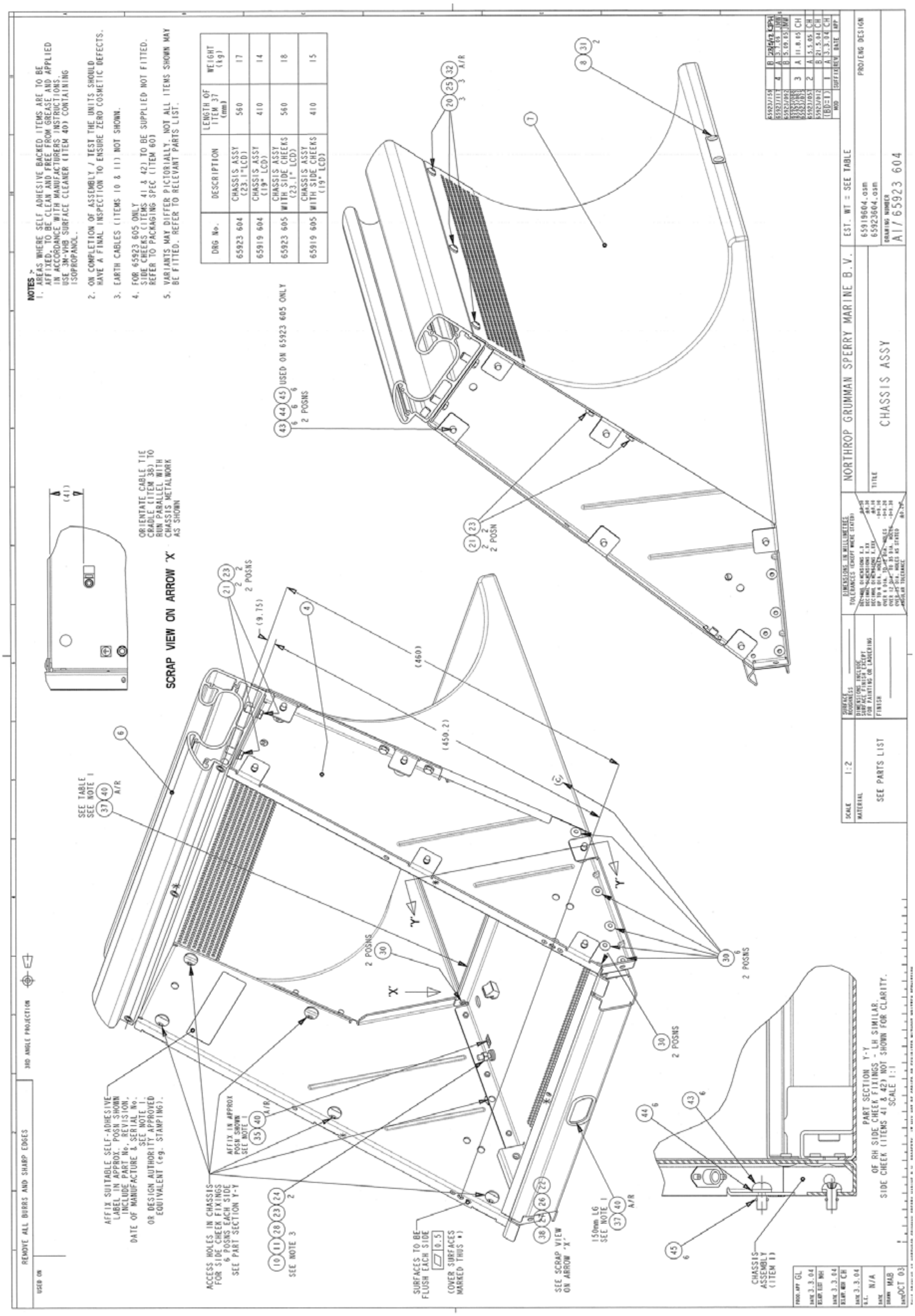

Figure 4.24 340 mm Chassis Assembly with side cheeks removed

3.5 Control Panel Assembly

The Control Panel assembly houses the following modules:

- Control Panel or Trackball
- On/Off switch

A USB connector is included if the control panel assembly houses only a trackball.

3.5.1 Removing the Mounting Plate

In order to install any of the control panel modules the module mounting plate must first be removed from the control panel assembly. To remove the mounting plate, refer to steps 1) to 5) below and Figure 4.25.

1. Remove two cap head screws and single coil washers from the underside of the control panel tray, using a hex key. Retain fixings for later use.
2. Remove the three torque prevailing nuts. Retain fixings for later use.
3. Dislodge the mounting plate from the control panel tray by inserting the hex key through the holes that the cap head screws came out of and pushing the plate up.
4. Pull the mounting plate forward to unclip from the back of the control panel tray.
5. Disconnect any cables running from the modules attached to the module mounting plate at the processor end, remove any cable restraints and pull the cables through and remove the plate and modules.

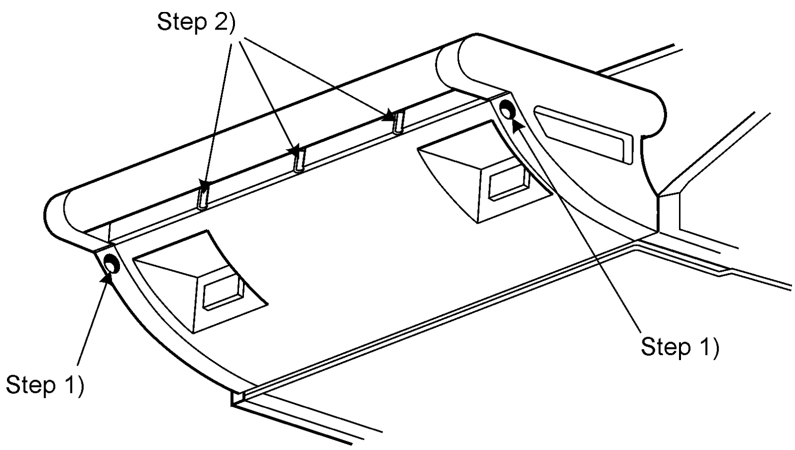

Figure 4.25 Removing control panel mounting plate

The following outline drawings are provided for control panel module kit versions only:

- Figure 4.27 for Control Panel outline drawing.
- Figure 4.28 for Trackball outline drawing.

- Figure 4.29 for USB connector kit outline drawing.
- Figure 4.30 and Figure 4.31 for On/Off switch kit outline drawings.

For instructions on assembling the modules into the control panel assembly see:

- Section 3.5.2 '*Installing the Control Panel*'
- Section 3.5.3 '*Installing the Trackball*'
- Section 3.5.5 '*Installing the USB Connector*'
- Section 3.5.6 '*Installing the On/Off Switch*'

3.5.2 Installing the Control Panel

The control panel consists of a trackball (with left and right keys), rotary controls, and adjustment and acknowledgement buttons.

The control panel is supplied and installed as one unit. To install the control panel in the housing, refer to steps 1) to 4) below and Figure 4.26.

1. Assemble control panel (65900667) to mounting plate (65923659) by dropping the control panel through the aperture in the mounting plate and securing with two M5 pan screws (4012623) and two washers (4709195).
2. Attach mounting strap (65900239) to control panel with two M5 pan head screws, M5 washers and M5 single coil washers using fixings already attached to the control panel.
3. Attach mounting strap to mounting plate with two M5 torque prevailing nuts (4415388). Do not over tighten and bend strap, there should be a gap between the plate and the strap.
4. Feed cables through aperture in control panel tray, connect to processor unit as shown on Figure 4.53.

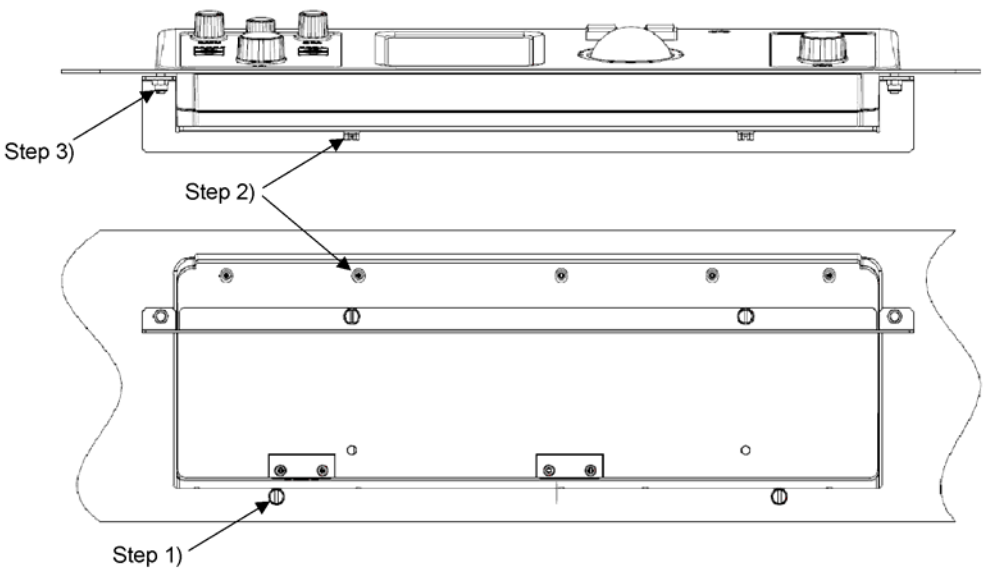

Figure 4.26 Installing Control Panel

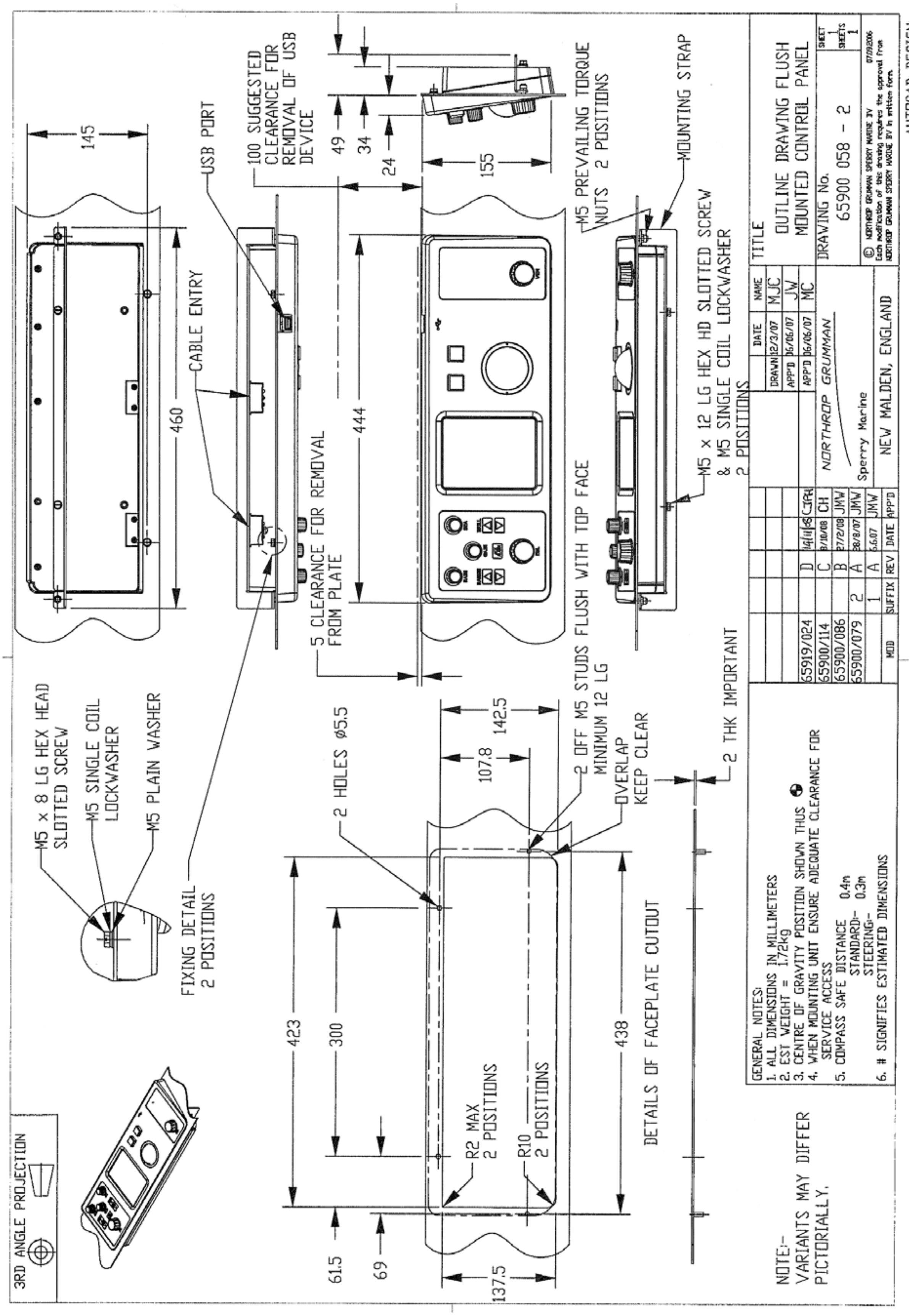

Figure 4.27 Control Panel Outline Drawing

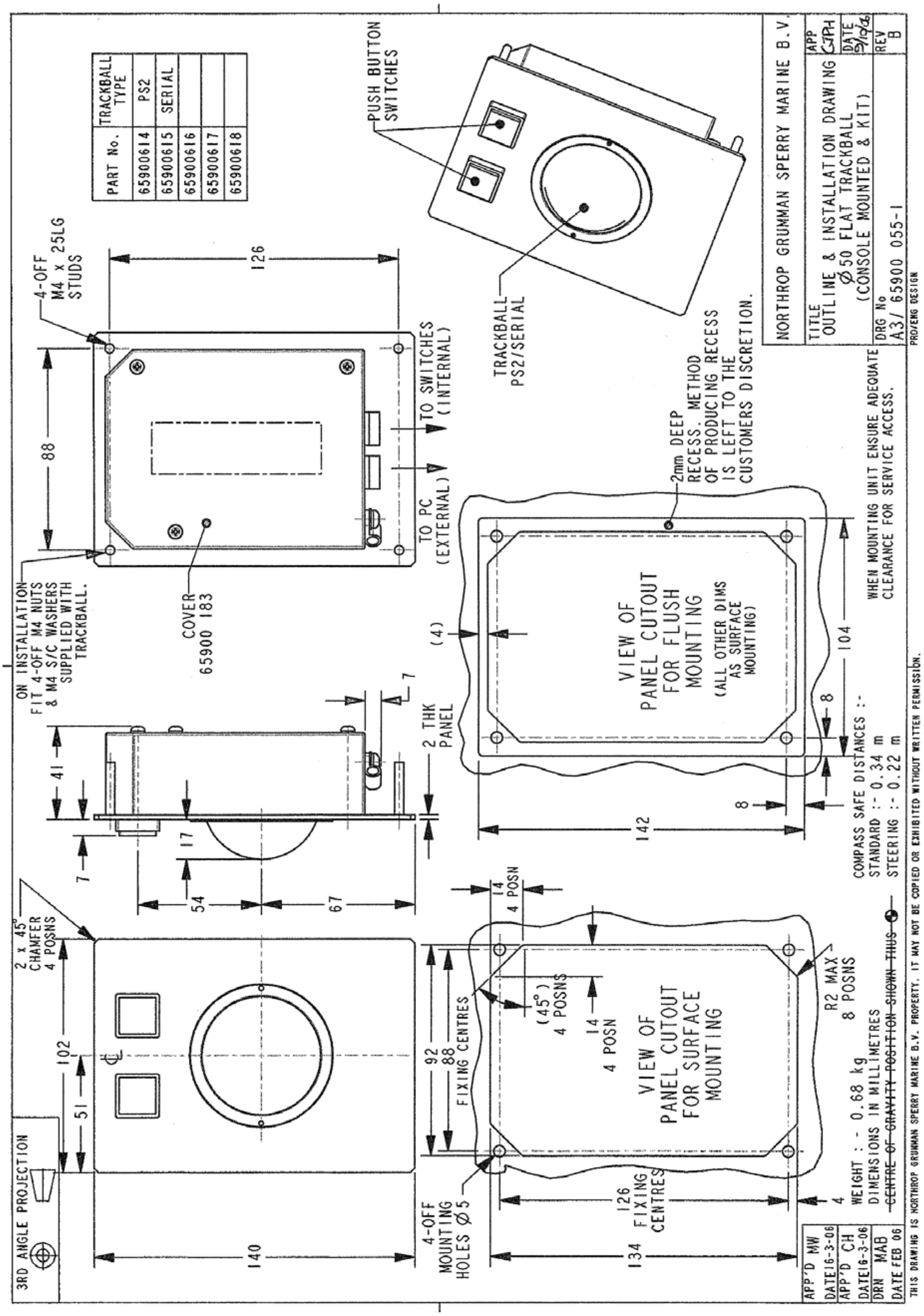

Figure 4.28 Flat Trackball Outline Drawing

3.5.3 Installing the Trackball

To fit the trackball to the Control Panel assembly do the following:

1. Install the trackball into the connecting holes of the module mounting plate and secure with four M4 nuts and four S/C washers supplied with the trackball kit.
2. Connect the trackball cable from Plug P2 to the PS2 socket on the Processor unit as shown Figure 4.53.
3. Install the trackball and mounting plate to the control panel as described below.

3.5.4 Installing the Mounting Plate

When the modules have been installed secure the mounting plate by doing the following:

1. Place the mounting plate into the recess at top of the control panel housing.
2. From the underside of the control panel secure the mounting plate at the left and right front ends with two cap head screws (4006224) and two washers (4709195).
3. Between the two screws secure the mounting plate with three insert nuts (4415787).

3.5.5 Installing the USB Connector

To fit the USB connector to the Control Panel assembly do the following:

1. Install the USB connector into the underside of the Control Panel housing (see Figure 4.25) and secure with four M4 countersunk screws.
2. Plug the USB connector cables to the front USB connector on the processor unit, as shown on Figure 4.53.

3.5.6 Installing the On/Off Switch

To fit the On/Off switch to the Control Panel assembly do the following:

1. Install the On/Off switch into the underside of the Control Panel housing (see Figure 4.25) and secure with four M4 countersunk screws.
2. Connect the On/Off switch cable to the PCIO unit, as shown on Figure 4.53.

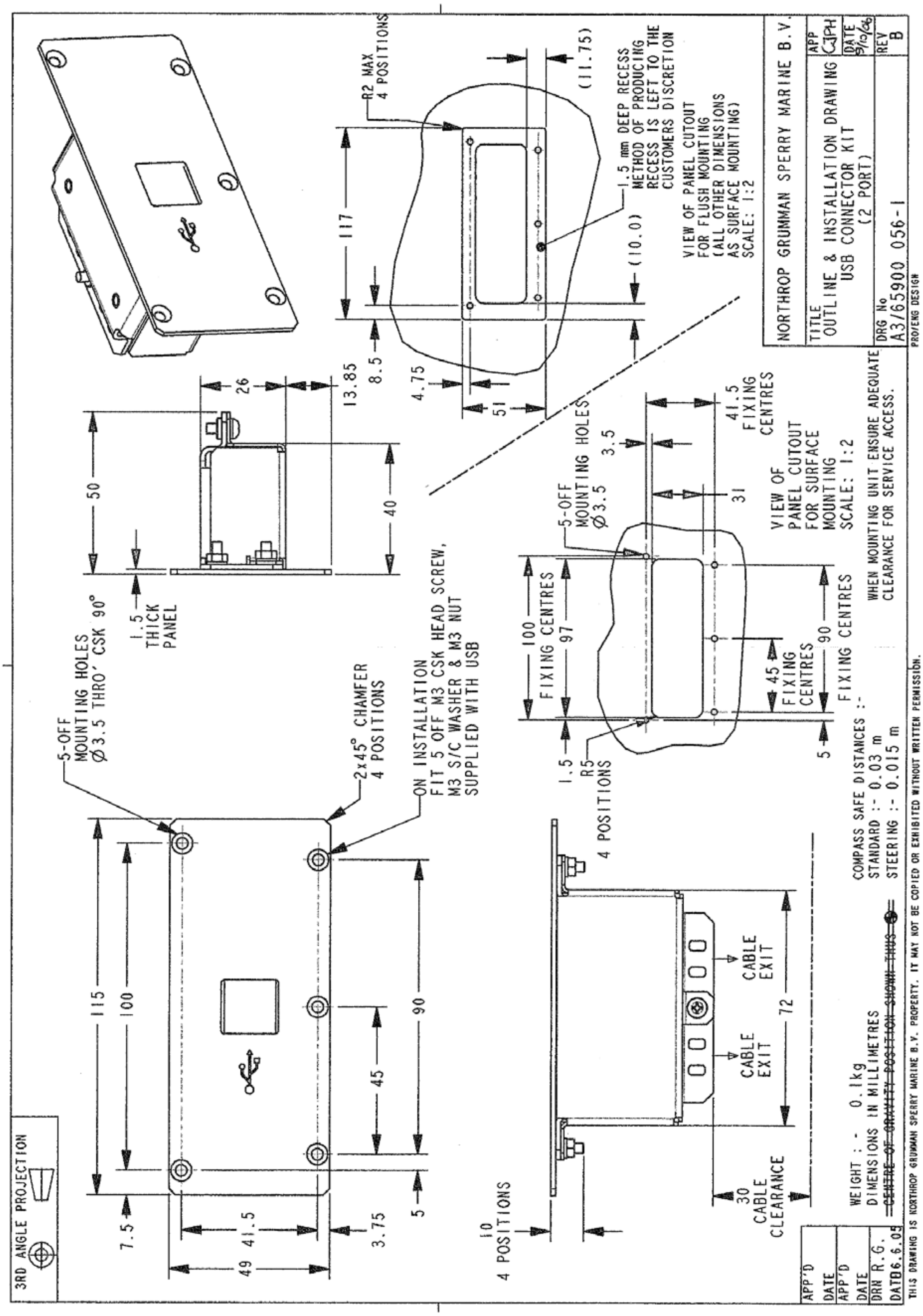

Figure 4.29 USB Connector Kit Outline Drawing

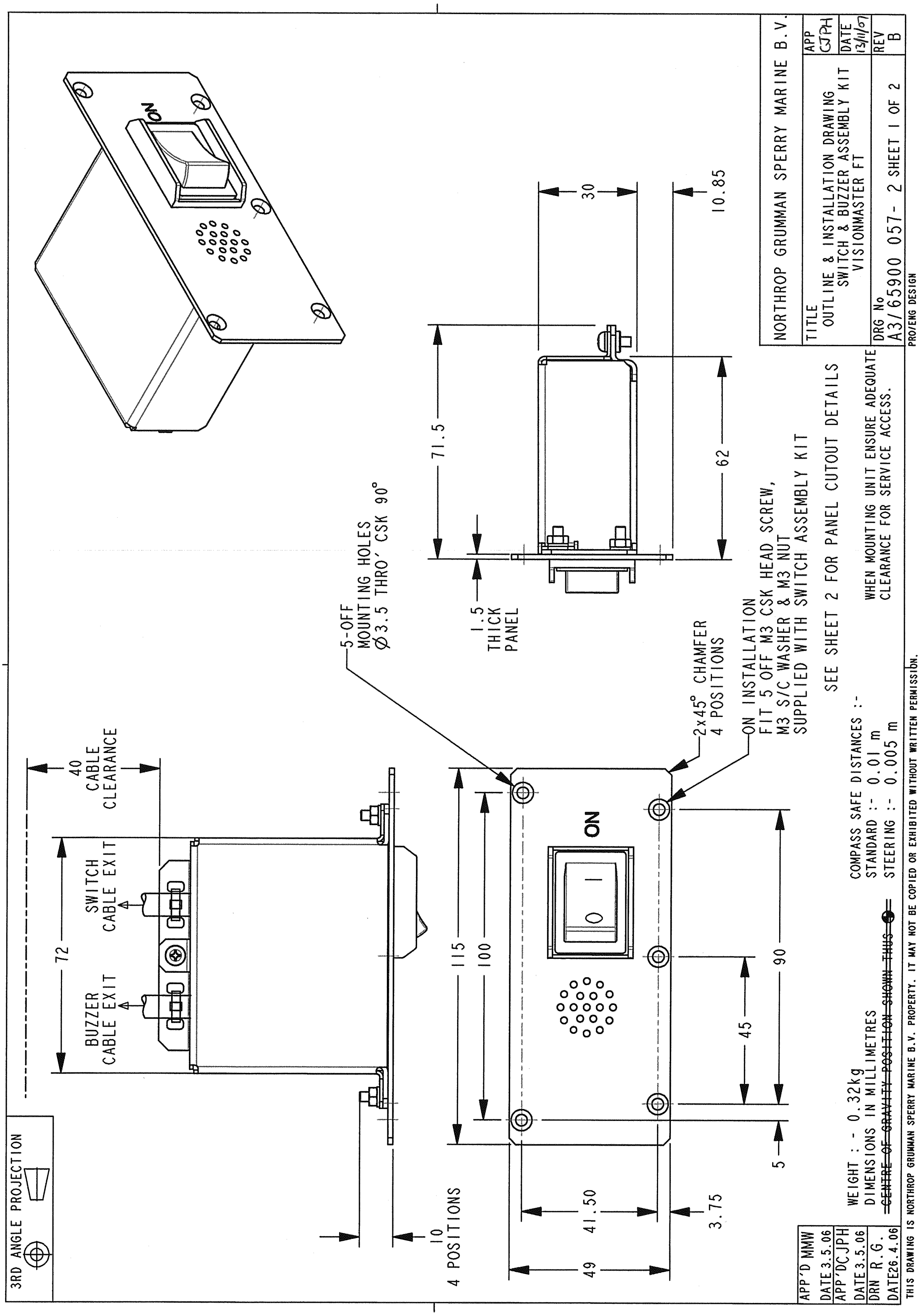

Figure 4.30 On/Off Switch & Buzzer Kit Outline Drawing - Sheet 1

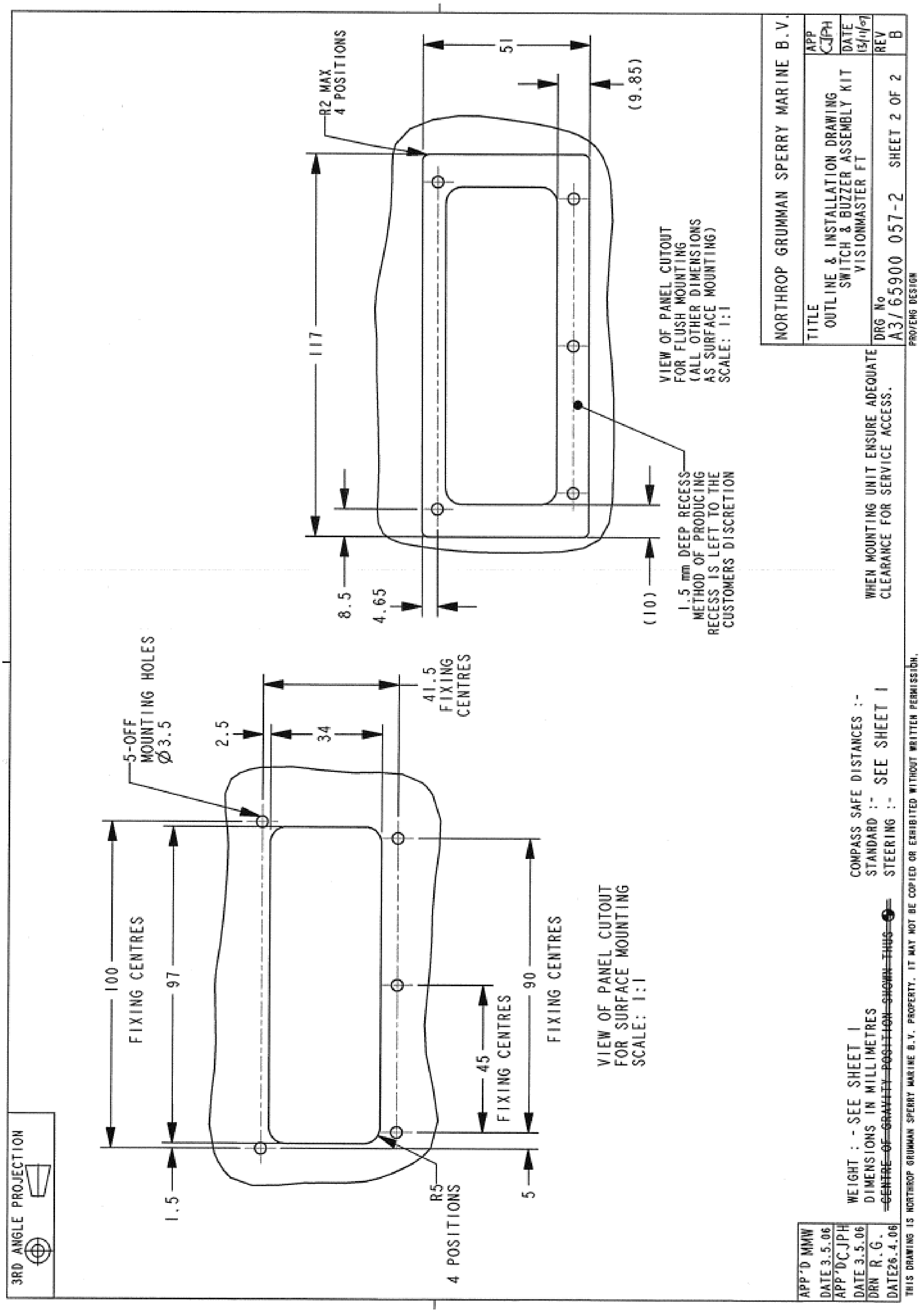

Figure 4.31 On/Off Switch & Buzzer Kit Outline Drawing - Sheet 2

3.6 Processor Unit and PCIO Unit

In deck mounted consoles the processor unit and PC/IO unit are secured to removable trays in the pedestal. In table top kit versions the units are secured to existing consoles suites.

Note: *In both deck mounted or kit versions anti-vibration (AV) mounts must be installed to the underside of the processor unit.*

To assemble the Processor unit refer to Section 4.6.1 '*Installing the Processor Unit to Console*'.

To assemble the PCI/O unit refer to Section 4.6.2 '*Installing the PCIO Unit to Console*'

Refer to the following figures for outline drawings of the processor and PCIO:

- Figure 4.32 for the PCIO Unit
- Figure 4.33 and 3.108 for the Processor Unit.

For information on the connecting cables between the processor and the PCIO unit, see Section 5.1.1 '*Installing Processor and PCIO cables*'.

3.6.1 Connecting VDR to the Processor

If you are integrating a VDR (Voyage Data Recorder) to a VMFT system with a widescreen monitor that does not have a secondary output, then the VDR output must be connected to the processor.

The connection required will depend on the capability of the VDR and the graphics card fitted in the processor unit, which will be either a HDMI, DVI or SXGA connector.

To configure a secondary monitor output from the processor, refer to VisionMaster Ships Manual Volume 2, Chapter 3 '*Configuring a Conning Information Display*', Appendix A '*Configuring a Second Monitor*'.

A video splitter will be required if a VDR output and a Conning Info Display (CID) secondary screen is required.

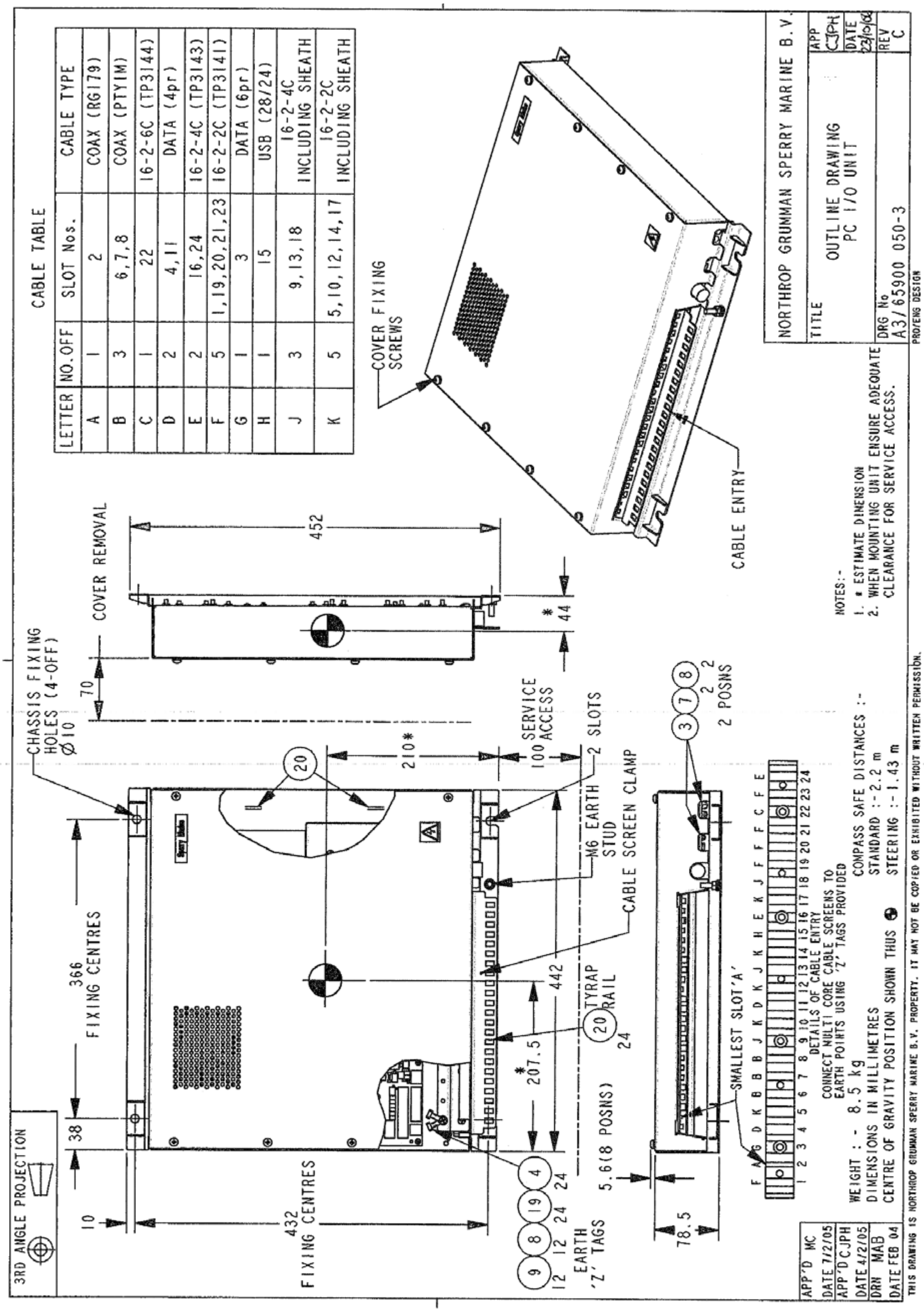

Figure 4.32 PCIO Unit - Outline Drawing

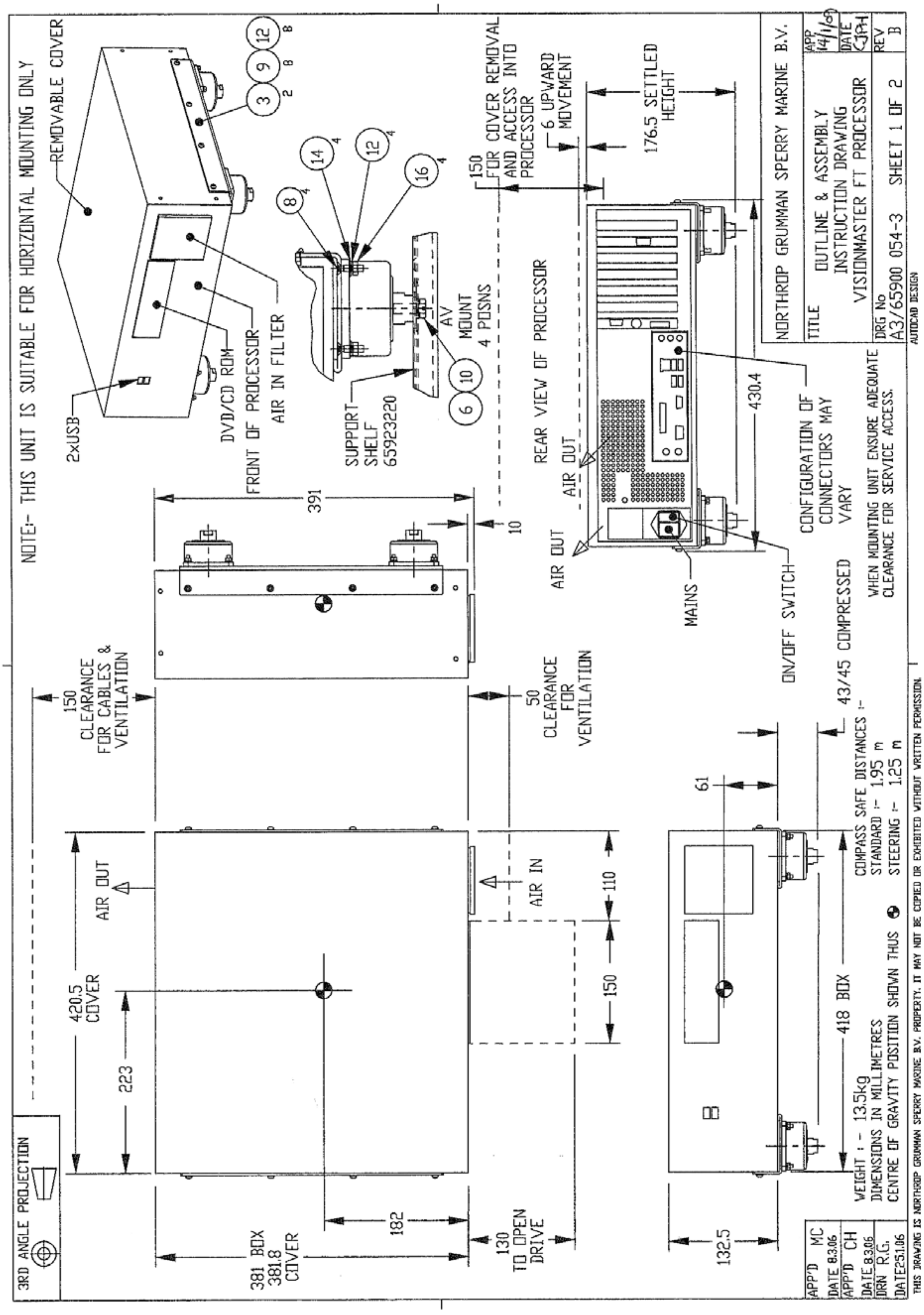

Figure 4.33 Processor Outline Drawing - Sheet 1

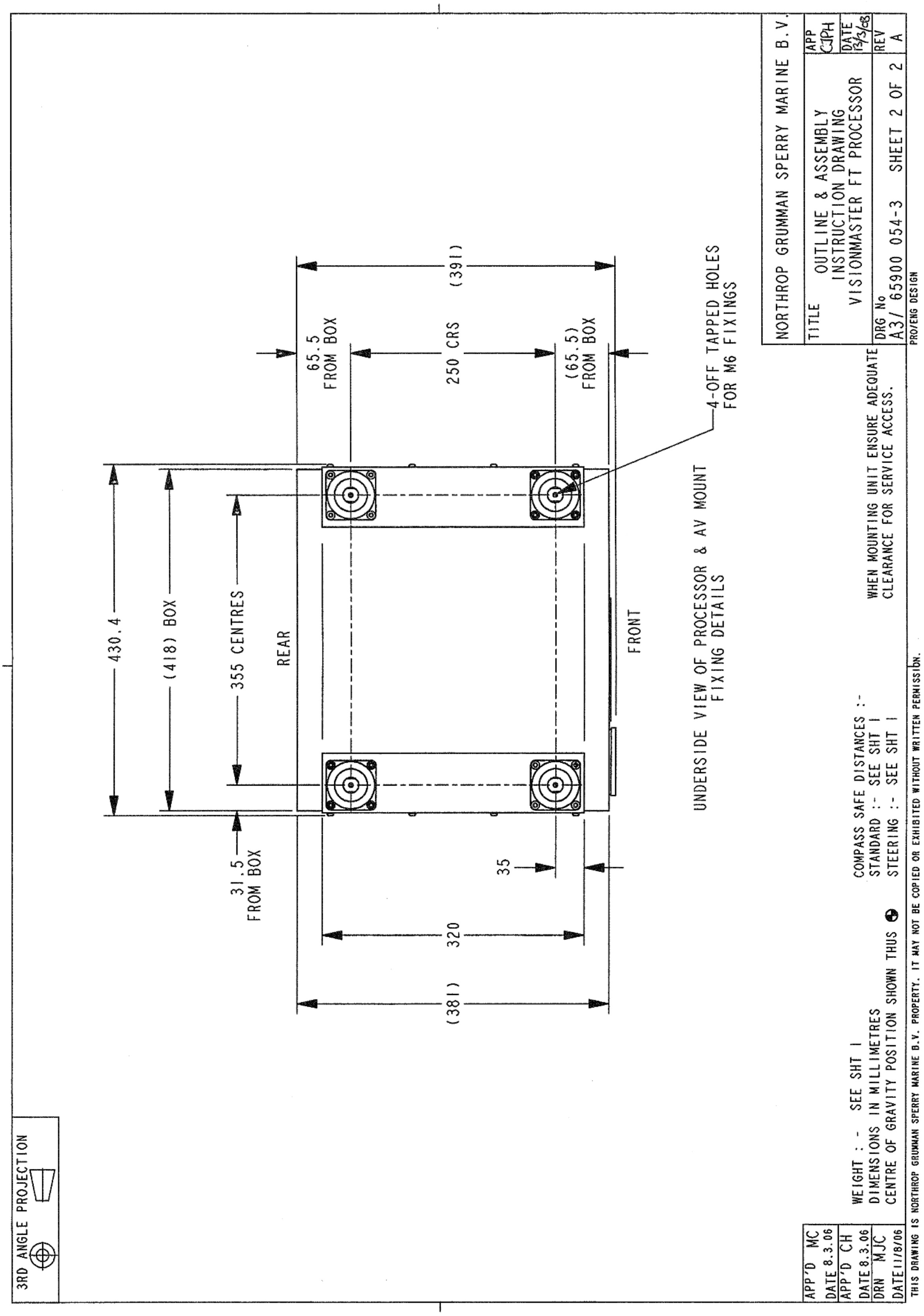

Figure 4.34 Processor Outline Drawing - Sheet 2

3.7 Auxiliary Modules

The following auxiliary modules may be included in a Console assembly:

- Auxiliary PCIO unit
- Mains Distribution Unit

A dual radar system will include an auxiliary PCIO unit. For information on installing the Auxiliary PCIO, see Section 4.8 '*Installing an Auxiliary PCIO Unit*'.

A Client/Server system will include a mains distribution unit. For information on installing the mains distibution unit, see Section 4.9.3 '*Installing a Mains Distribution Unit*'.

Both units are attached to a mounting plate at the rear of the pedestal, or mounted underneath the tabletop.

Refer to the following figures for outline drawings of the auxiliary modules:

- Figure 4.35 for the Auxiliary PCIO Unit
- Figure 4.36 for the Mains Distribution Unit.

For information on the connecting cables between the Processor unit and the I/O unit, see Section 5.1.1 '*Installing Processor and PCIO cables*'

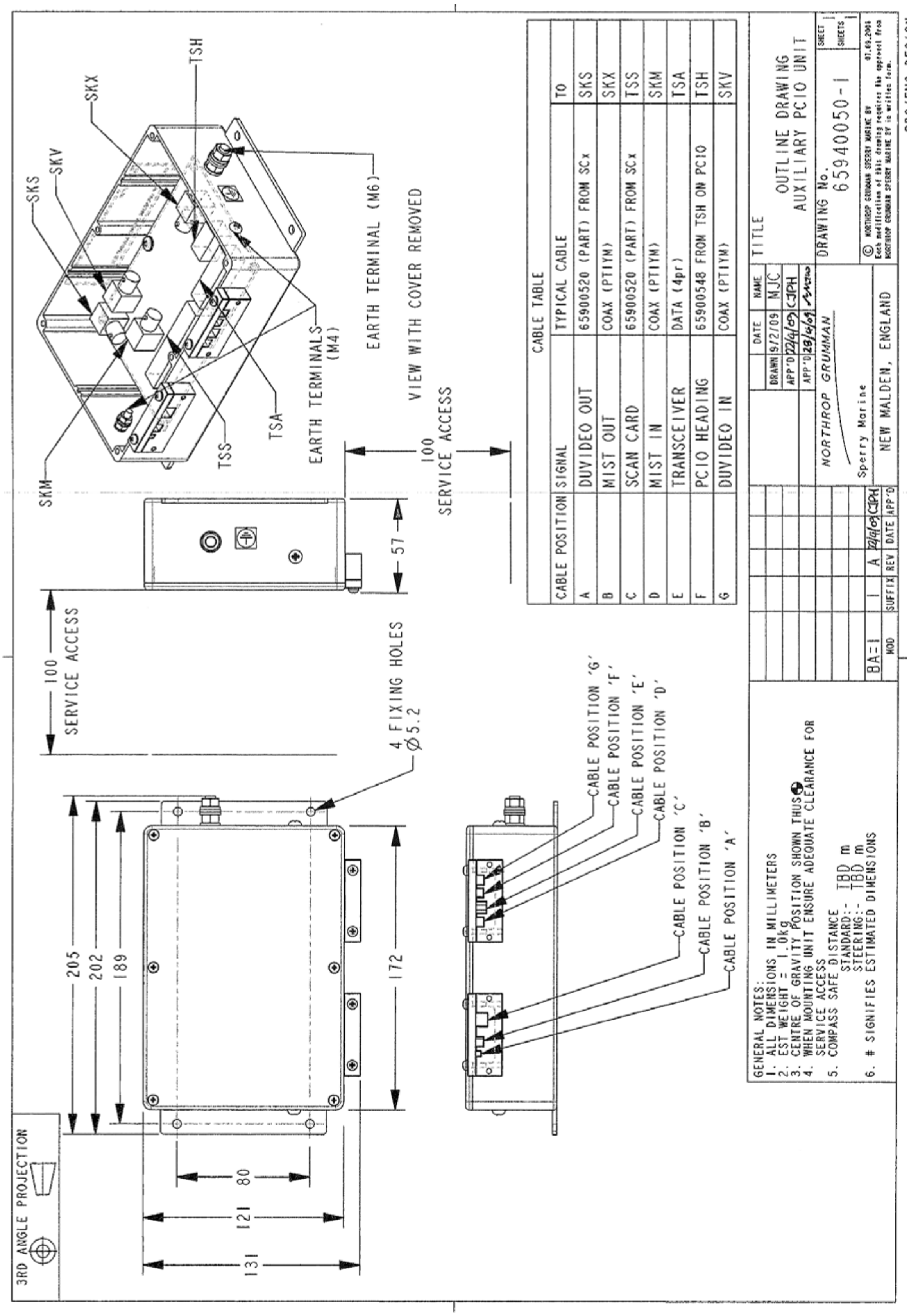

Figure 4.35 Auxiliary PCIO Unit Outline Drawing

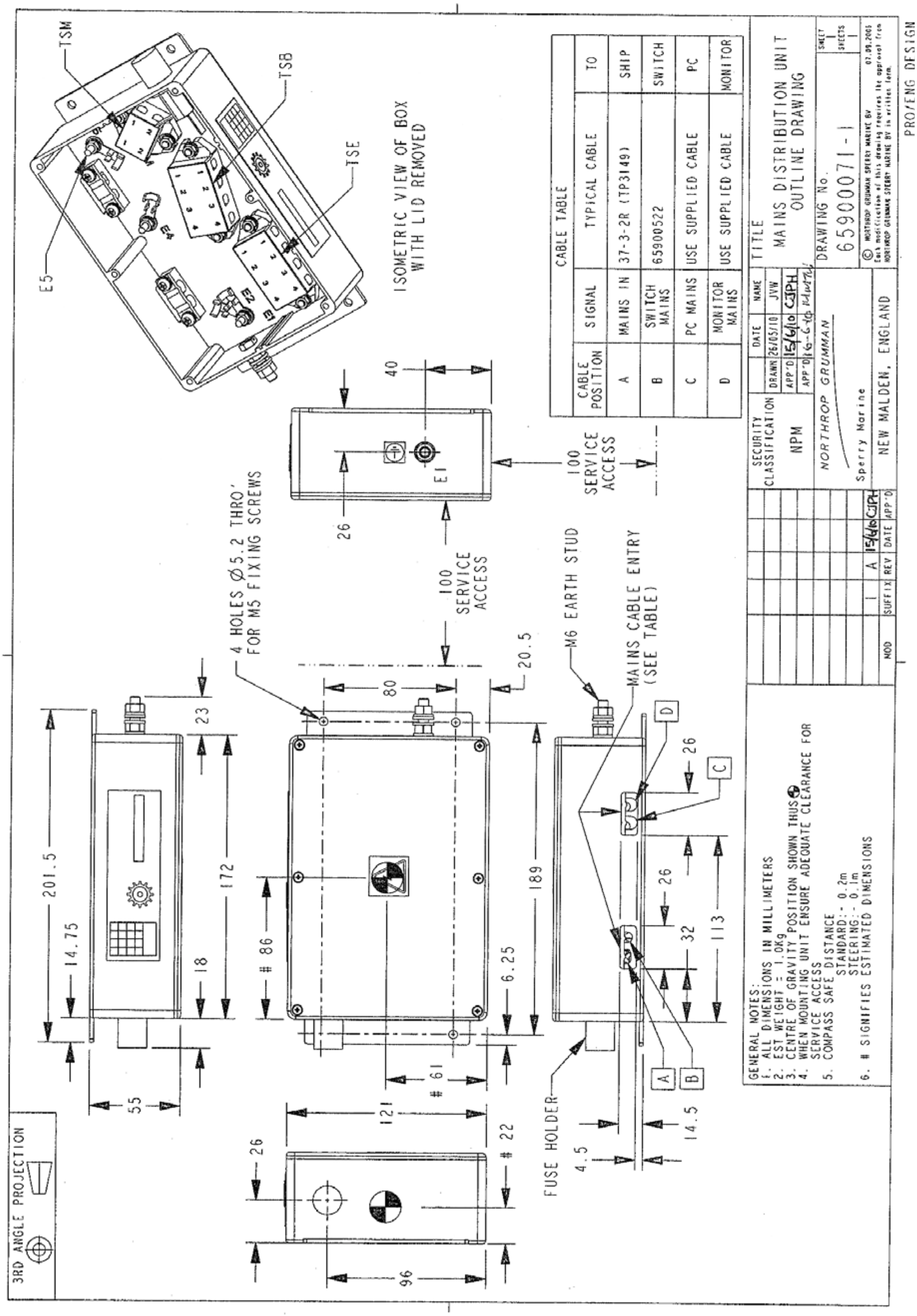

Figure 4.36 Mains Distribution Unit Outline Drawing

4 Installing the Console Assembly

4.1 Installing a Standalone Pedestal to the Deck

The pedestal assembly is secured to the ship's deck or foundation by four hex head bolts, supplied by the shipyard.

Note: *To enable ease of position it is advisable to install the pedestal to the deck before the control panel and display chassis are attached to the pedestal.*

To assemble a standalone pedestal you will need the following parts, supplied with Despatch Kit 65923 610:

- four M16 hex head steel bolts, A2 or A4-70 (length to suit foundation/deck)
- eight M16 plain steel washers (4709322)
- four M16 S/C steel washers (4709241)
- four M16 hex head steel nuts (4411579).

To assemble the pedestal do the following:

1. Drill four 19mm holes in the foundation /deck to the dimensions shown in the plan view of Figure 4.10.
2. Undo the two captive screws at the top of the front cover panel and remover the front cover.
3. Remove the five screws attaching the rear cover to the pedestal and remove the rear cover.
4. Remove the four screws attaching the lower cable support shelf to the pedestal (two at the front and two each side) and remove the shelf.
5. Remove 'knockout' panels from either the lower side panel (for side cable entry) or lower rear panel (for rear cable entry). Fit grommet strip (MA00010173) to the edges where the panel has been removed.
6. Bolt down the pedestal to the foundation/deck using the bolts, washers and nuts, as shown in Figure 4.37.
7. Refit front cover, rear cover and cable support shelf to pedestal.

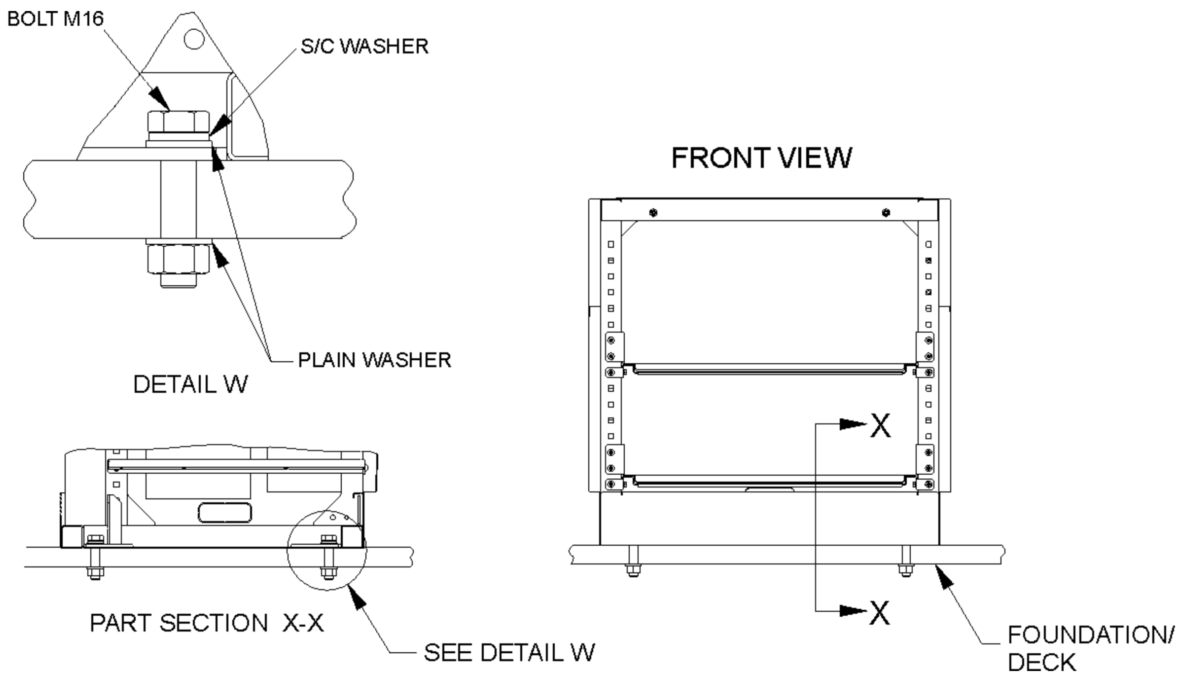

Figure 4.37 Installing a Standalone Pedestal to Foundation/Deck

4.1.1 Installing the Control Panel to the Display Chassis

To assemble you will need the following parts, supplied with Despatch Kit 65923 611:

- six M6 x 20 cap head screws (4006267)
- two M6 x 16 cap head screws (4006259)
- eight M6 S/C washers (4709209)
- two shims (65900145)

To assemble the control panel to the display chassis do the following:

1. Attach the control panel to the chassis using six M6 x 20 screws and six S/C washers (three either side). Do not fully tighten the screws.
2. If required, fit shims between arm of control panel and chassis, left and right side.
3. Attach control panel to the bottom of the chassis using two M6 x 16 screws and M6 S/C washers.
4. Fully tighten all eight screws.

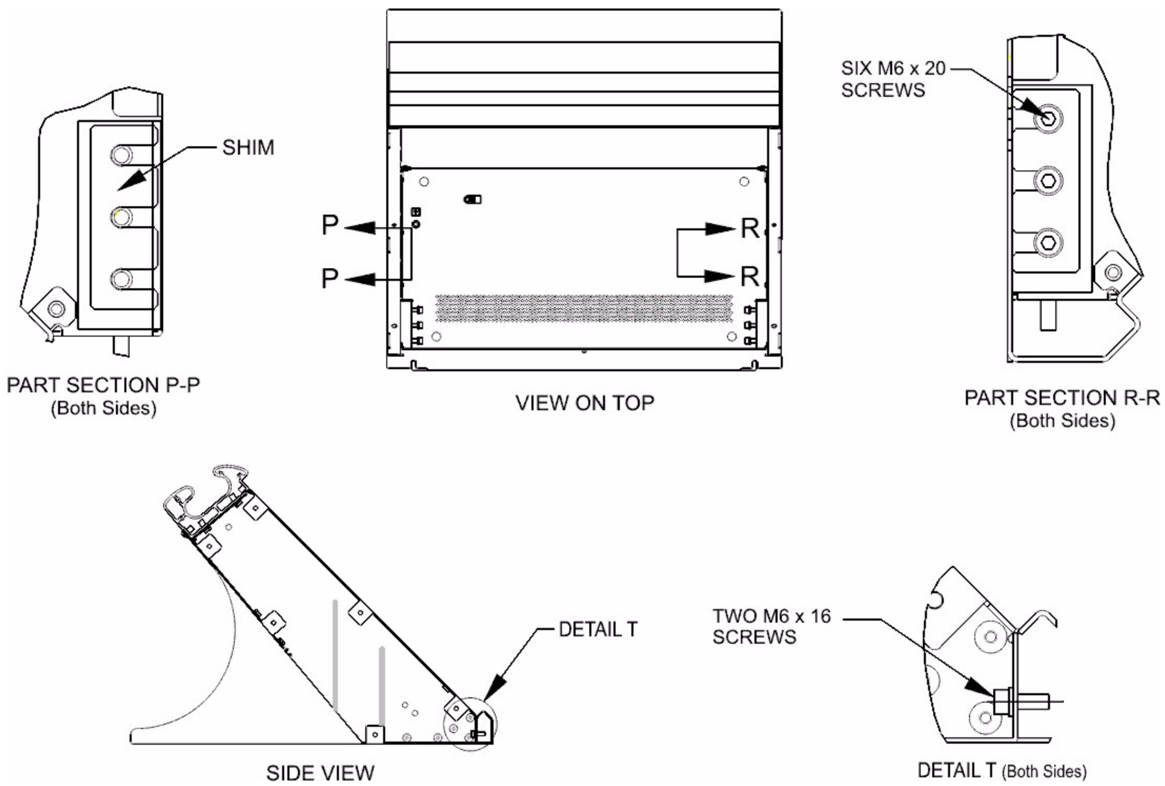

Figure 4.38 Installing Control Panel to Display Chassis

4.1.2 Installing the Control Panel/Display Chassis to the Pedestal

To assemble you will need the following parts, supplied with Despatch Kit 65923 609:

- two M6 studs (65900 131)
- six sliding washers (65900 137)
- four M8 studs (65900 130)
- six 'O' rings (MA00015271)
- six isolator assemblies (65900 640)
- twelve M6 x 12 cap head screws (4012690)
- twelve M6 S/C washers (4709209)
- twelve M6 retaining washers (MA00006650)

To assemble the Control Panel/Display Chassis to the Pedestal do the following:

1. Fit two M6 studs to the underside of rear cover chassis, remove backing from sliding washers and affix around studs.
2. Fit four M8 studs to pedestal frame, remove backing from sliding washers and affix around studs.
3. Fit four 'O' rings to the four M8 studs.

4. Place the control panel/chassis assembly onto the M8 pedestal studs and ensure that the two rear cover chassis M6 studs fit in the corresponding pedestal holes.
5. From the chassis side attach four isolator assemblies to the four M8 studs. Do not fully tighten the isolators.
6. Fit two 'O' rings to the two isolators, from the underside of the pedestal attach the two isolator assemblies to the chassis studs.
7. Fully tighten all six isolator assemblies.

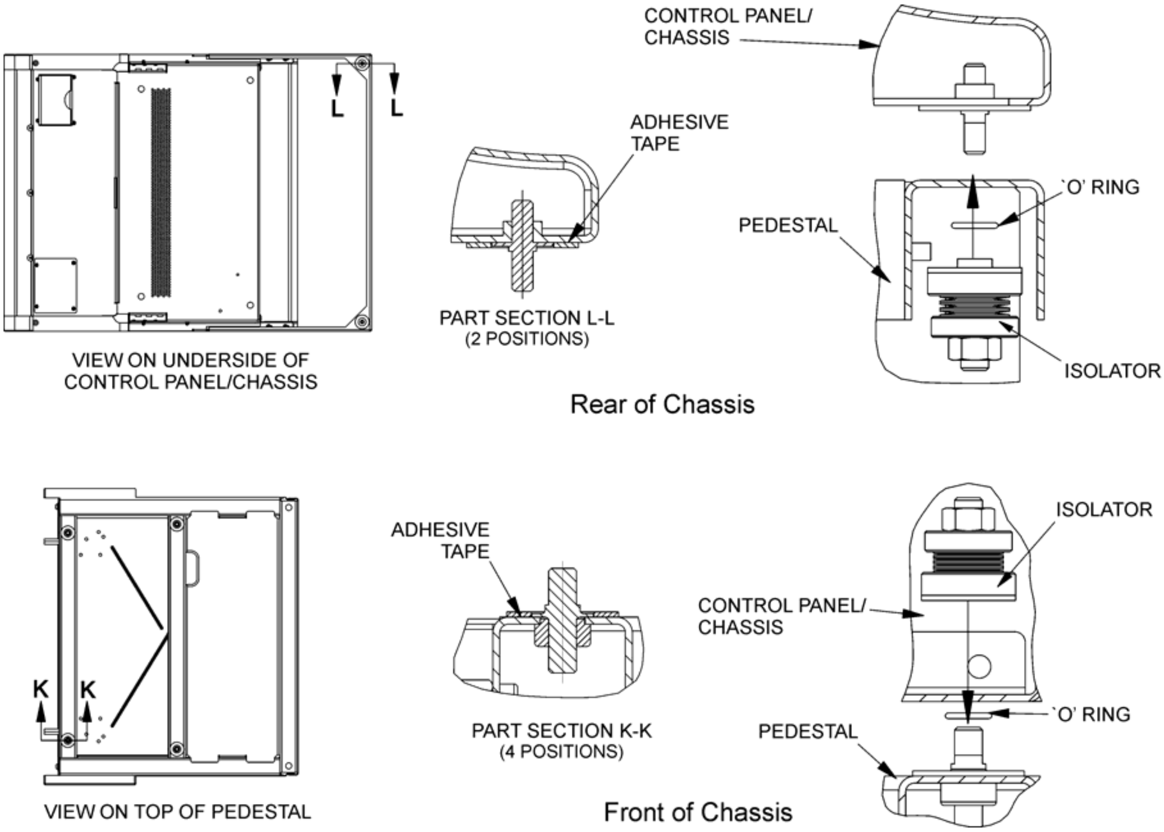

Figure 4.39 Installing Control Panel and Display Chassis to Pedestal

4.2 Installing a Pedestal Assembly to a Console Suite

To assemble a pedestal assembly to an existing console suite you will need the following parts, supplied with Despatch Kit 65923 610:

- ten hex head M8 x 16 screws (3610462)
- one hex head M8 x 75 screw (3610594)
- four csk M4 x 16 thread forming screws (4080416)
- two hex head M6 x 12 screws (4009088)
- thirteen M8 single coil washers (4709217)
- two M6 single coil washers (4709209)
- seven M8 nuts (4411544)
- one spacer - handrail (65923120)
- two hex spacers (MA00014787)
- four M8 spacers (65900138)
- two M6 spacers (65900139)

To fit a pedestal to an existing console suite do the following:

1. Using the four M8 x 16 screws, washers and nuts attach each side of the pedestal to the adjoining pedestal as shown in Figure 4.40.
2. Repeat step 1 for each additional pedestal added to the console suite.

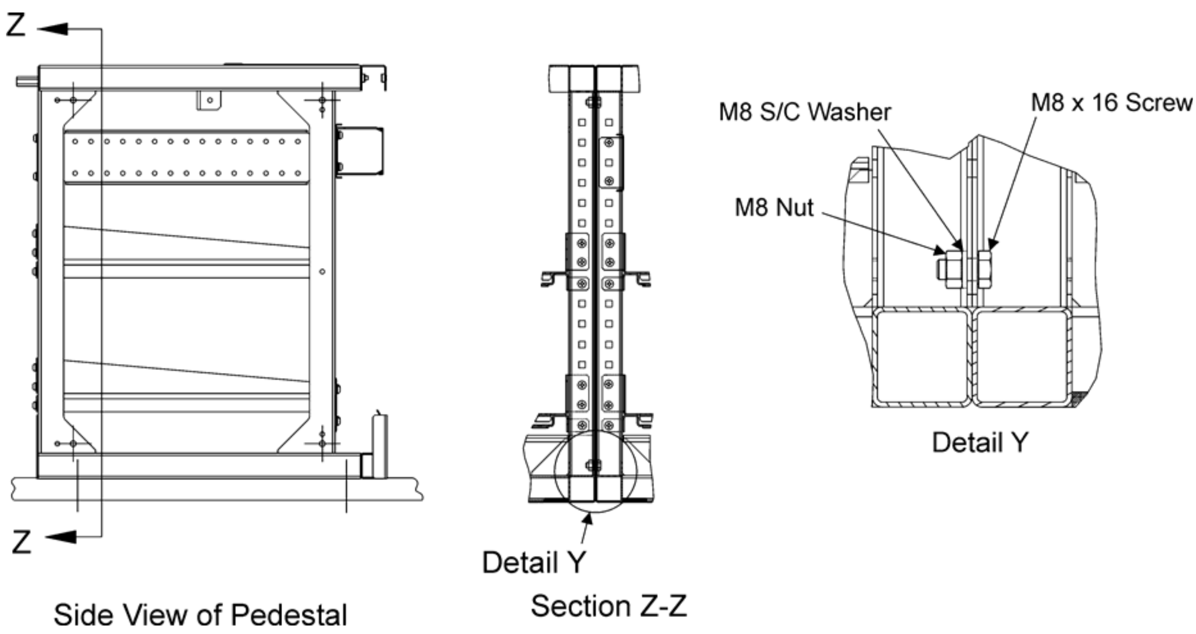

Figure 4.40 Attaching the pedestal to the existing consoles

To fit a pedestal to the ship's deck refer to the assembly instructions given in Section 4.1.

4.2.1 Preparing the Control Panel for installation into a Console Suite

Before fixing the control panel assembly to the display chassis do the following:

1. Drill a 9mm diameter hole through the 1mm diameter front pilot hole on both sides of the control panel casting, see Figure 4.41.

Note: *Do NOT drill a hole in the final left hand or right hand end control panel of the console suite.*

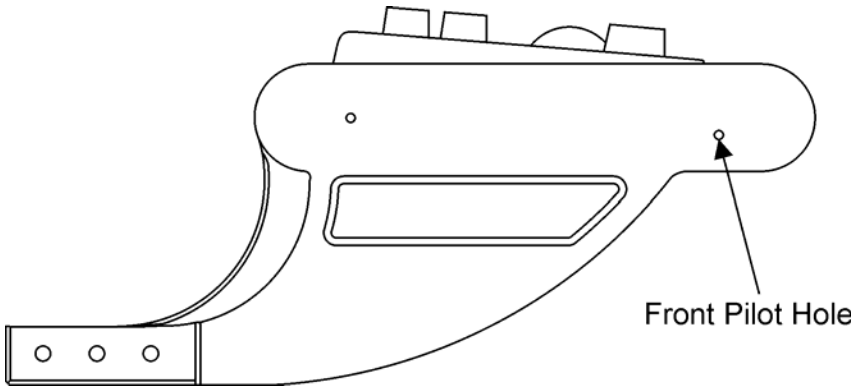

Figure 4.41 Front Pilot Hole on side of Control Panel

For information on fitting the Control Panel assembly to the console chassis, see Section 4.1.1 '*Installing the Control Panel to the Display Chassis*'.

4.2.2 Fitting Spacers to the Display Chassis

With reference to Figure 4.42 below, attach the display chassis/control panel assembly to the pedestal using the spacers and fixings.

1. To fill the gap between each chassis handrail fit the handrail spacer (65923120) to the right hand side of the display chassis using the four M4 x 16 csk screws.
2. Attach the two M8 hex spacers (MA00014787) to the right side of display chassis using M8 S/C washers and M8 nuts. Fully tighten nuts.

Note: *Do NOT fit the handrail spacer or the M8 hex spacers to the final right hand end display chassis.*

3. From the top of the display chassis fit the four M8 spacers (65900138) using M8 x 16 screws and M8 S/C washers.
4. From underneath the pedestal at the display rear attach the two M6 spacers (65900139) using M6 x 12 screws and M6 S/C washers.

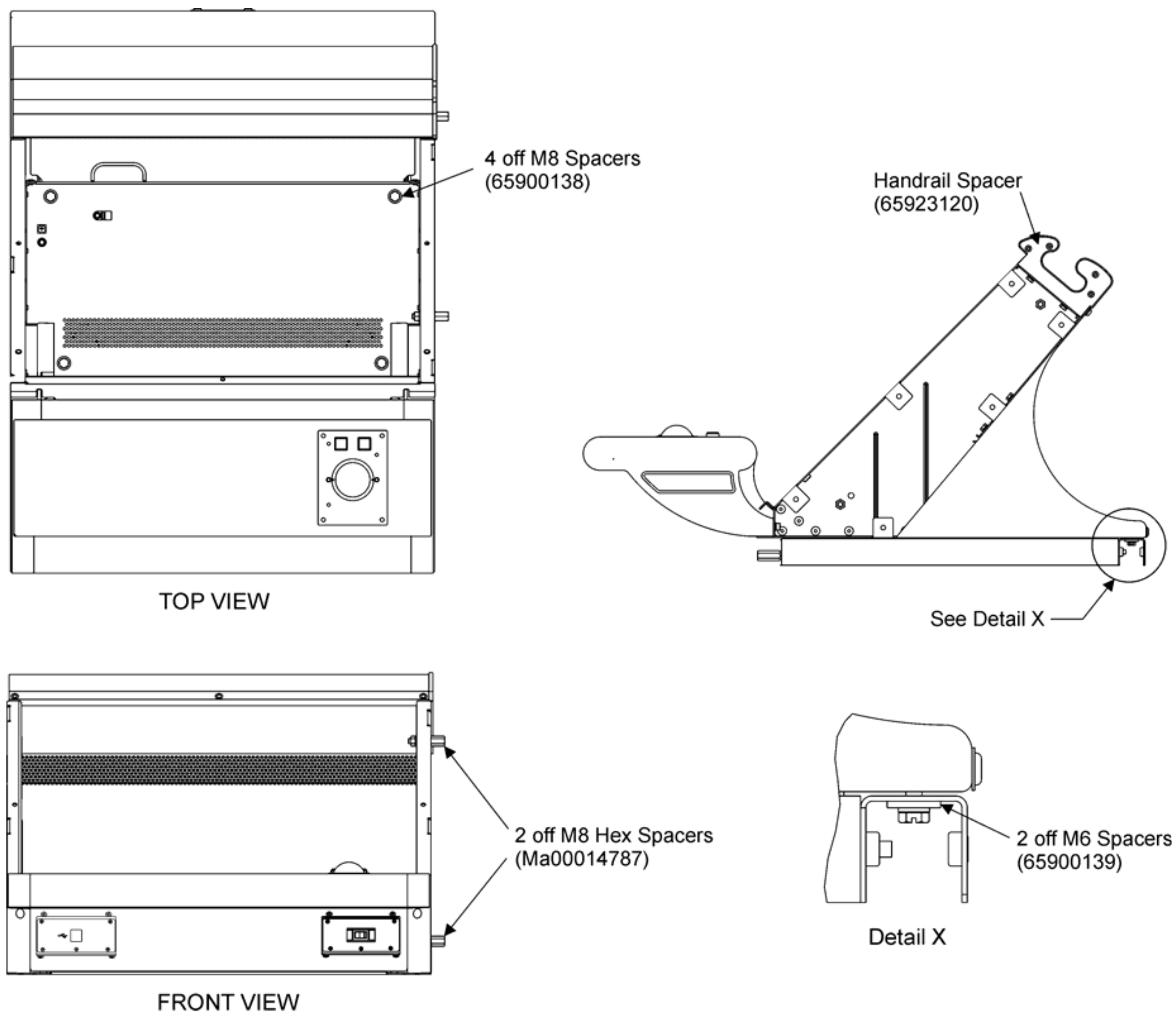

Figure 4.42 Location of Spacers on Display Chassis Assembly

4.2.3 Attaching Console Assemblies

With reference to Figure 4.43, attach the control panel assemblies and display chassis assemblies together as described below:

1. Attach each control panel assembly together using one M8 x 75 bolt (3610594), M8 S/C washer and M8 nut, inserted through the 9 mm hole in the side of the control panel.
2. Attach each display chassis assembly together using two M8 x 16 hex head screws (3610462) and M8 S/C washers. See Figure 4.10 for location of the two holes in side of display chassis.

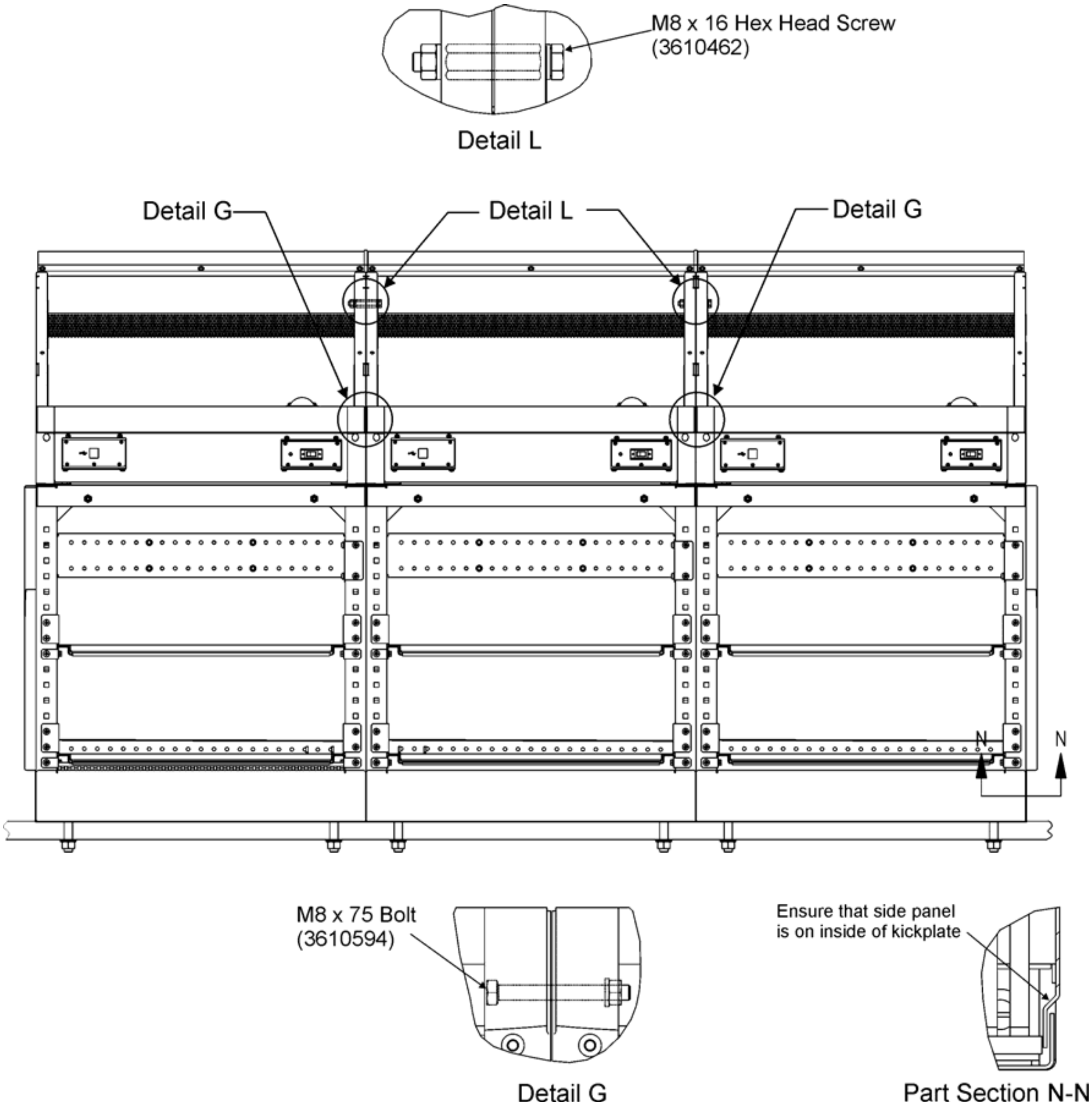

Figure 4.43 Attaching Console Assemblies together

4.3 Installing the Cable Tray and Mounting Plates

The cable mounting plates are attached to the pedestal framework and can fitted at any convenient height and on either side of the framework. The data cable tray is attached to the top rear mounting plate and pedestal framework.

To assemble the mounting plates and data cable tray you will need the following parts, supplied with Despatch Kit 65923 681 (for cable tray) and Despatch Kit 65923 682 (mounting plate):

- twelve M6 x 16 pan head screws (4012704)
- twelve M6 single coil washers (4709209)
- four M6 plain washers (4709284)

- four M6 nuts (4411536)
- twelve M6 cage nuts (MA00014738)

With reference to Figure 4.44, attach the rear mounting plate, side mounting plate and cable tray to the required position as described below:

1. Attach the lower mounting plate and side mounting plate using four M6 x 16 screws, single coil washers and cage nuts.
2. Remove the lid from the cable tray and attach each end of the tray to the upper mounting plate and pedestal framework using four M6 x 16 screws, single coil washers and cage nuts.
3. Secure the cable tray to the upper mounting plate using four M6 x 16 screws, plain washers and M6 nuts.
4. Re-install the cable tray lid.

Additional mounting plates and/or cable trays can be fixed to the pedestal by using the fixings supplied in despatch kits 65923 681 (cable tray) and 65923 682 (mounting plates).

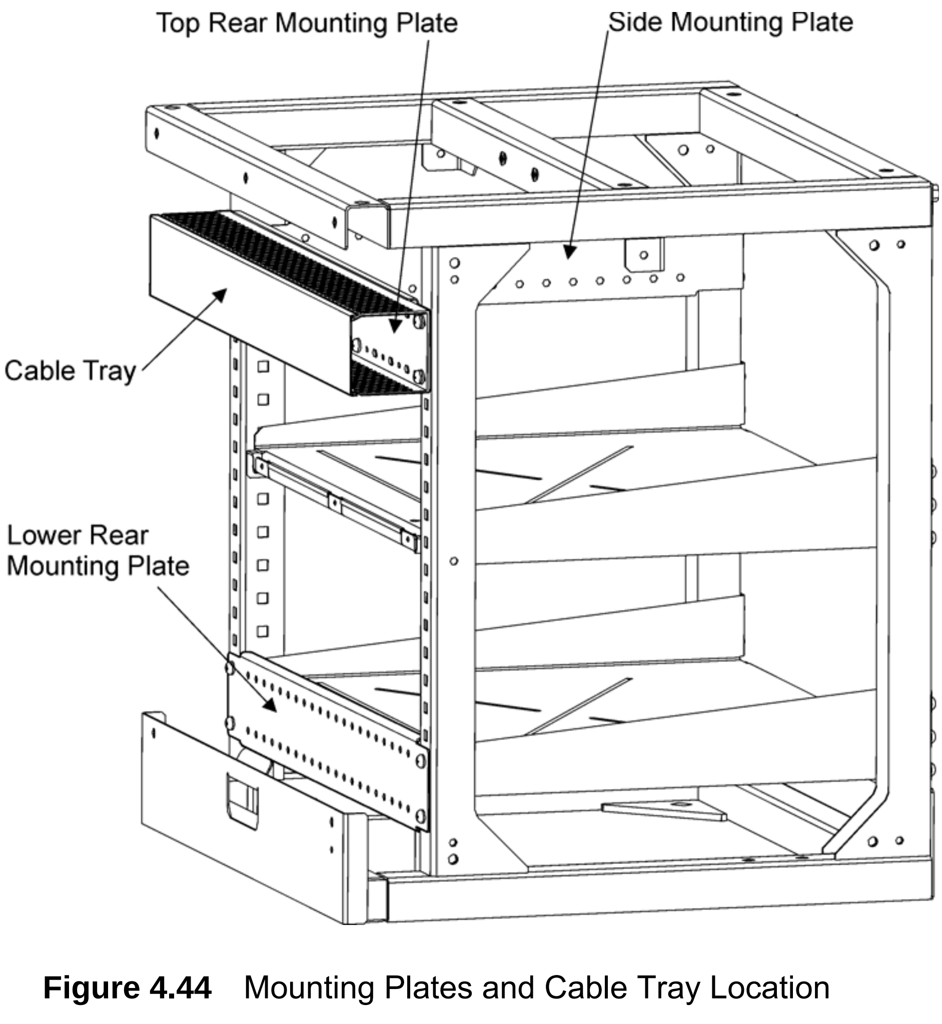

Figure 4.44 Mounting Plates and Cable Tray Location

4.4 Attaching Side Panels and Side Cheeks

The left hand and right hand side cheeks (65923110 and 111) are attached to each side of the console, or each end of a console suite.

The left hand and right hand side panels (65923197 and 198) are attached to to each side of the pedestal, or each end of a console suite.

To assemble the side panels you will need the following parts, supplied with Despatch Kit 65923 683:

- twelve (six each side) M6 grounding washers (MA00016477)
- twelve (six each side) M6 nuts (4411536)

To assemble the side cheeks you will need the following parts, supplied with Despatch Kit 65923 683:

- twelve (six each side) M6 x 12 pan head screws (4012690)
- twelve (six each side) M6 single coil washers (4709209)
- twelve (six each side) M6 retaining washer (MA00006650)

4.4.1 Attaching the Side Panels

1. Insert the six threaded studs attached to each side panel through the corresponding holes on the pedestal framework.
2. From inside the pedestal assembly place the six grounding washers over the side panel bolts, ensuring the cutting edges of the washers are against the pedestal framework.
3. Attach the M6 nuts to the side panel studs and secure each panel by fully tightening the nuts.

4.4.2 Attaching the Side Cheeks

1. Position the left hand and right hand side cheeks on each end of the display chassis.
2. From the access holes of the chassis (see Figure 4.45) attach the side cheeks using the M6 screws, S/C washers and retaining washers, six positions each side. Fully tighten the screws gradually in rotation.

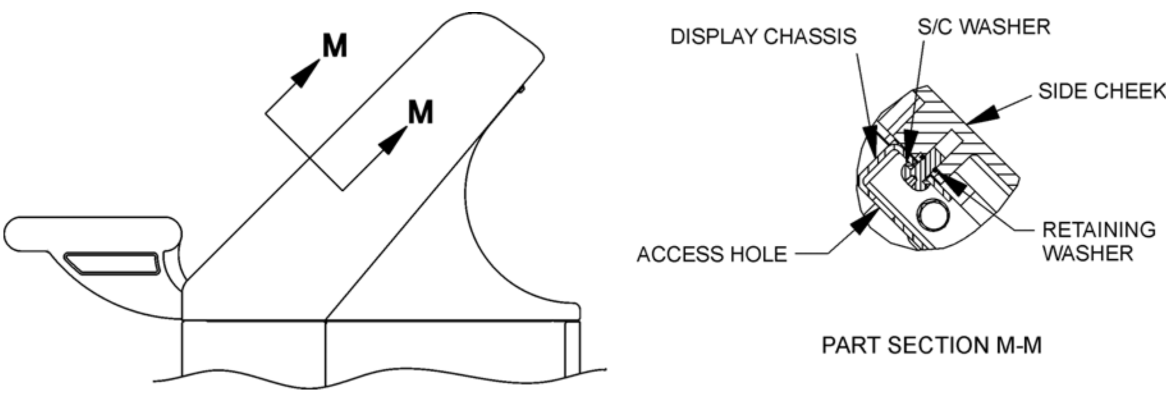

Figure 4.45 Installing side cheeks to console chassis

4.5 Installing the Monitor to the Display Chassis

To assemble you will need the following parts, supplied with Despatch Kit 65923 608:

- two M8 x 40 hex head screws (4008553)
- four M6 x 20 cap head screws (65923125)

To fit the Monitor to the display chassis do the following:

1. Attach the two M8 screws to the upper set of holes in the monitor and use these to lower the monitor into the chassis aperture, allowing the lower edge of the monitor to sit along the chassis.
2. When the monitor is correctly positioned in the chassis remove the M8 screws, which can then be discarded or retained for service applications.
3. Attach the Monitor to the chassis using the four M6 screws. Fully tighten the screws.
4. Fit required cables to the Monitor as shown in Table 2 below.

Note: *Apart from the earth tags, at this stage all cables should only be attached to the monitor (the 'From' destination).*

5. Tywrap cables together and clip through the cable restraint attached to chassis.

Table 2: Cable Installation

Part No.	Description	From	To
65800548	Cable assy. for 19" monitor - Video	RGB IN (monitor)	Processor unit
65823512	Cable assy. for 23.1" monitor - Video	RGB IN (monitor)	Processor unit
DVI Cable	Cable assy. for 25.5" and 27" monitor - Video	DVI-I IN (monitor)	Processor unit
VDS100692-8*	160 Way cable assy	Multi-function connection (monitor)	Various†
65900531	Cable assy. - Earth	Earth Tag (monitor chassis)	Earth Tag (pedestal)
65900532	Cable assy. - Earth	Earth Tag (monitor Chassis)	Earth Tag (monitor)
Power Cable	Cable - Mains	Mains In (IEC)	PCIO unit

*. This cable is only used on new Hatteland monitors (65817G, 65823A and 65927C). A 9-way terminator plug needs to be fitted to one of the COM ports connectors, either directly on the monitor, or via one of the RS422 cables in the multi-way cable.

†. For Brilliance and Buzzer cable use RS422 input. For CCTV input use the composite cable.

4.6 Installing the Display Assembly to a Table Top

To install the Display assembly (with control panel and monitor assembled) you will need the following parts, supplied with Despatch Kit 65923 608:

- four M8 x 40 hex head screws (4008553)
- four M8 Washers (4709217)
- four M8 Nuts (4411544)
- four M8 Spacers (65900138) - for 23.1” display only.
- four Woodscrews (4107624)
- M6 Washers (4711203).

To prepare a table top do the following:

1. Mark four holes for the M8 screws. Refer to Figure 4.13 for the 340mm display version, and Figure 4.14 for the 250mm display version for fixing hole dimensions.
2. If the display is to be attached to a wooden top, drill four blind holes to a dimension smaller that the M8 screws.

To fit the Display to the table top do the following:

1. Attach the display using the four M8 screws, nuts and washers. If the display is a 23.1” console suite use the additional M8 spacers.
2. Or, use the four woodscrews and M6 washers, if the Display is to be attached to a wooden table top.

4.6.1 Installing the Processor Unit to Console

To assemble the Processor unit you will need the following parts, supplied with Despatch Kit 65900 637:

- four AV mounts (MA00018036)
- four M6 x 16 Hex head slotted screws (4009053)
- four M6 S/C washers (4709209)
- sixteen M4 x 16 Csk screws (4013026)
- sixteen M4 plain washers (4707699)
- sixteen M4 SC washers (4709187)
- sixteen M4 nuts (4410149).

To install the Processor unit into the console assembly do the following:

1. Attach the four AV mounts to the Processor unit shelf using the sixteen M4 screws, M4 SC washers, M4 plain washers and M4 nuts, see Figure 4.33 and Figure 4.34. The AV mount fixing holes are marked on the shelf as ‘C’, see Figure 4.46.
2. Attach the Processor unit to the AV mounts using the four M6 x 16 screws (4009053) and M6 washers (4709209), as shown in Figure 4.33.

3. Fit the assembled Processor unit and shelf to the pedestal, directly above the lower cable support shelf using the four screws and washers. Ensure the unit shelf rear locators are properly engaged in the cable support shelf.

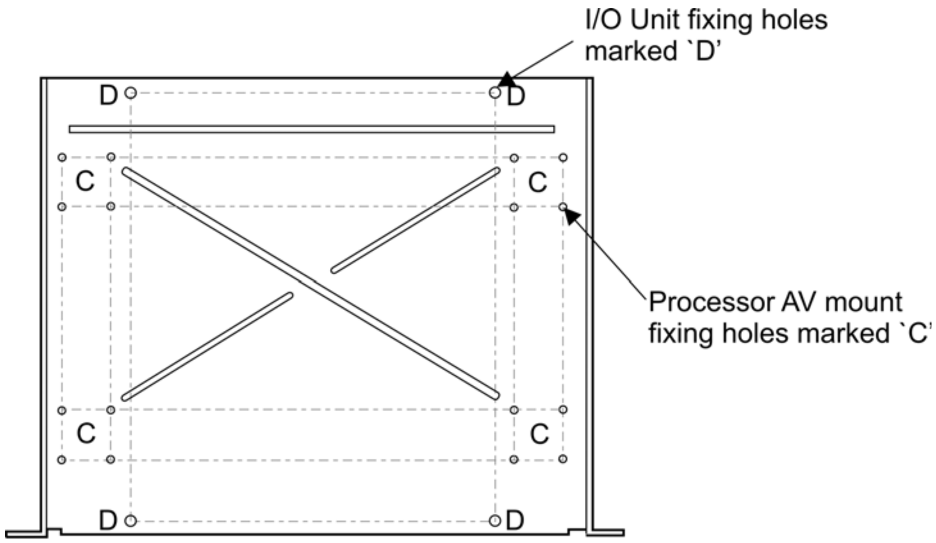

Figure 4.46 Fixing hole positions for Processor and PCIO Unit

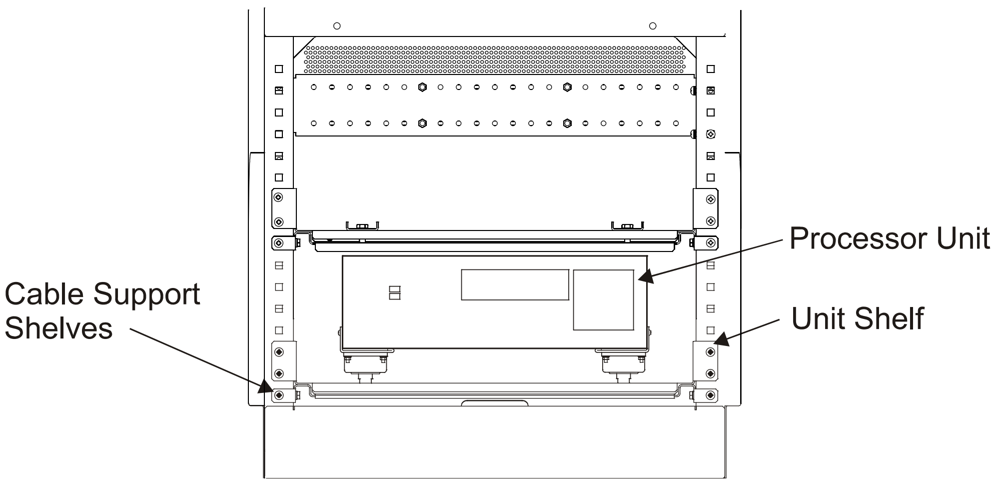

Figure 4.47 Front View of Console with PC Installed

4.6.2 Installing the PCIO Unit to Console

To assemble the PCIO unit you will need the following parts, supplied with Despatch Kit 65900 600:

- four M8 x 16 Hex head bolts (3610462)
- four M8 S/C washers (4709217)
- two M8 plain washers (4709292)
- four M8 nuts (4411544).

To fit the PCIO unit to the console assembly do the following:

1. Attach the PCIO unit to the unit shelf using the four bolts, washers, nuts and two plain washers listed above. The two plain washers are fitted to the PCIO unit's rear attachment brackets. The two front holes for the PCIO unit are marked on the shelf as 'D', see Figure 4.46.
2. Fit the assembled PCIO unit and shelf to the pedestal, directly above the upper cable support shelf using the four screws and washers. Ensure the unit shelf rear locators are properly engaged in the cable support shelf.

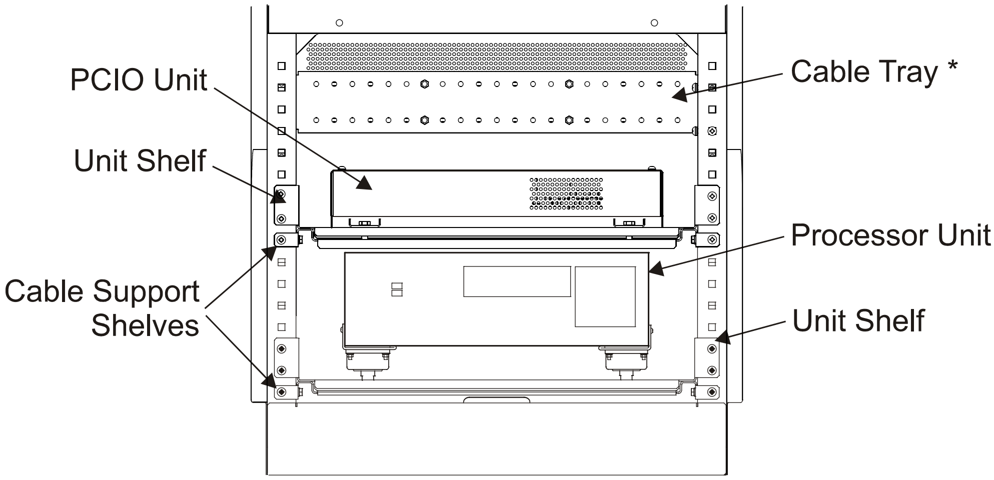

Figure 4.48 Front View of Console showing PC and PCIO installed*

* The cable tray assembly is only fitted in the Console suite, see drawing 65923 072 for details.

4.7 Installing the Termination Assembly

The installation of the termination assembly is an optional requirement.

To assemble the termination assembly to the pedestal framework you will need the following:

- four M6 x 16 pan head screws (4012704)
- four M6 single coil washers (4709209)
- four M6 cage nuts (MA00014738)

To install the termination assembly to the pedestal framework do the following:

1. Remove any mounting plate and/or cable tray that may have been previously installed in the required position.
2. Using the four M6 screws, washers and nuts, attach the termination assembly to the rear of the framework at a convenient height. It is recommended to fit the assembly as high up the pedestal framework as possible.

4.8 Installing an Auxiliary PCIO Unit

The installation of an auxiliary PCIO unit is required when the system is a dual channel radar.

On a deck mounted assembly the unit is attached to a mounting plate, which is attached the rear of the pedestal, see Figure 4.49. For a Tabletop kit version, the unit may be mounted underneath the tabletop.

To install the mounting plate (65940103) to the pedestal framework you will need the following:

- four M6 x 16 pan head screws (4012704)
- four M6 single coil washers (4709209)
- four M6 cage nuts (MA00014738)

To install the auxiliary unit to the mounting plate you will need the following:

- four M4 x 10 pan head screws (4012550)
- four M4 plain washers (4707699)
- four M4 spring washers (4709187)

To install the auxiliary unit to a tabletop you will need the following:

- four No 8 x 1in Woodscrews (MA00018994)

To install the mounting plate to the pedestal framework do the following:

1. Remove any mounting plate and/or cable tray that may have been previously installed in the required position.
2. Using the four M6 screws, washers and nuts, attach the plate to the rear of the framework at a convenient height. It is recommended to fit the assembly as high up the pedestal framework as possible.

The mounting plate has two sets of four pre-drilled holes, with both sets of holes at the same dimensions. One set is for the auxiliary PCIO box, the other set is used when an additional unit such as a freeze frame mixer is required.

To install the auxiliary unit to the mounting plate do the following:

1. Using the four M4 screws and washers, attach the auxiliary unit to the mounting plate. Either set of holes may be used, depending on ease of access for installation and servicing.

To install the auxiliary unit to a tabletop do the following:

1. Select a suitable area on the underside of the tabletop below the display and mark the four fixing holes.
2. Attach the unit to the tabletop using the four woodscrews.

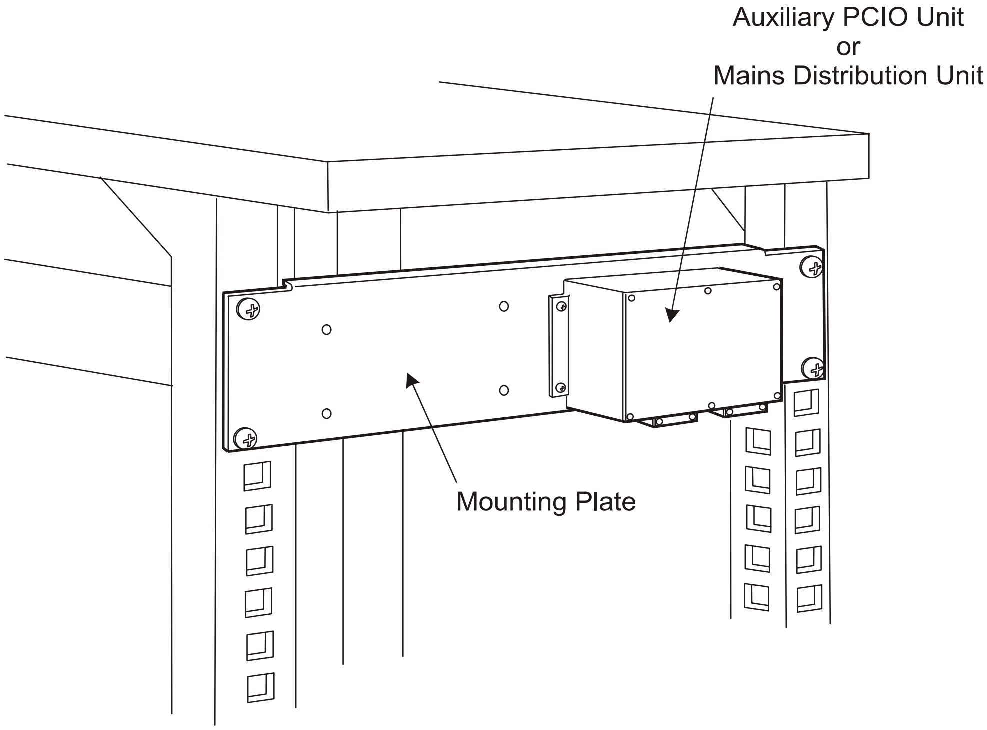

Figure 4.49 Mounting Plate on Pedestal

4.9 Installing Client/Server Modules

4.9.1 Installing a Client PC

A Client PC is installed in the same way as described previously in Section 4.6.1 '*Installing the Processor Unit to Console*'.

4.9.2 Installing a Server PC

A Server PC is usually installed in a separate area to the Console (Client PC and Display). This would normally be in a Server rack, at a location adjacent to the associated PCIO and suitable for connection to the system top units.

4.9.3 Installing a Mains Distribution Unit

The mains distribution unit is usually installed in the same console or cabinet as the Client PC. The unit is supplied with the same attaching parts, and is mounted in the same way as described in Section 4.8 '*Installing an Auxiliary PCIO Unit*'.

4.9.4 Installing Ethernet Switches

Ethernet switches for Client PCs are installed in or nearby the Client console. Ethernet switches for Server PCs are either installed in a Server rack, or at a nearby location, suitable for connection to the Servers.

4.10 Installing a Secondary Viewer Output

A second dedicated monitor, used to display CID pages, or output to a VDR, may be connected to the 250mm and 340mm consules via a 15-way VGA output cable.

If you are connecting a secondary monitor to a 250mm 19.0" or a 340mm 23.1" consule connect the VGA cable to the RGB OUT terminal at the rear of the monitor.

If you are connecting a secondary monitor to a 340mm 25.5" or 340mm 27" widescreen console connect the VGA cable to the RGB terminal at the rear of the VisionMaster processor. If the processor has a DVI only terminal use a cable with a DVI connector, or connect an RGB to DVI adaptor to the VGA cable.

To configure the secondary monitor, refer to Appendix A '*Configuring a Second Monitor*' in Chapter 4 'Conning Information Display' of the VMFT Ships Manual, Volume 2 .

4.11 Authorising the System

Before VisionMaster FT can be run, the USB pre-programmed security block, supplied with each node, must be installed in one of the three USB sockets at the rear of the Processor unit, (the fourth USB socket is used to connect the Processor to the PCIO unit).

All security blocks are labelled with the System PIN, the S63 permit code, the ARCS permit code, and the product type identifier.

The security blocks are provided as a 32SDV (32k memory size) or 32SDR (72k memory size) followed by a three-digit number, as defined below:

- 001 for CAT 1 Radar (also Enhanced CAT 2 Radar)
- 002 for CAT 1 Chart Radar (also Enhanced CAT 2 Chart Radar)
- 003 for ECDIS
- 004 for ECDIS with Radar Overlay
- 005 for Multi-node workstation
- 006 for Total Watch (CAT 1 Chart Radar and ECDIS)
- 008 for CAT 2 Radar
- 010 for Training mode

On a multi-node system, in addition to the security block, a security string is required to be entered in the configuration tool when commissioning the system. See Ships Manual 65900011V2, Chapter 1, '*Configuration*'.

The Security String contains an encryption of the following data:

- the System PIN.
- the number of nodes in the system of each product type (for example, a five node system could include two CAT 1 Chart Radars, two ECDIS and one Total Watch).
- the list of purchasable features that have been purchased.

The ship is provided with paperwork that contains the information that is encrypted into the security string.

5 System Component Interconnections

This section contains details of cable installation, the interconnection of system components and any additional setting up, such as link settings and input/output settings required.

5.1 Cable Installation on a Standard System

5.1.1 Installing Processor and PCIO cables

Table 3 below lists description and connection details of all the cables to and from the Processor and PCIO unit.

Cables are tywrapped to the perforated plate at the rear of the processor and clamped to the cable restraints provided on the console chassis base.

Table 3: Cable Installation Details

Part Number	Description	From	To
65823 512*	Cable Assy - Video	Monitor	Processor Unit
Power Cable	Cable - Mains	PCIO Unit	Monitor
Power Cable	Cable - Mains	PCIO Unit	Processor Unit
65900 520	Cable Assy - SC	PCIO Unit	Processor Unit
65900 521	Cable Assy - USB	PCIO Unit	Processor Unit
65900 523	Cable Assy - Trackball	Trackerball	Processor (PS2 Input)
65900 528	Brilliance & Buzzer cable	PCIO Unit	Monitor†
65900 530	Cable Assembly Earth	Processor Unit	Pedestal Earth
65900 530	Cable Assembly Earth	PCIO Unit	Pedestal Earth
65900 621	Cable Assembly Power Control Switch	Switch	PCIO Unit
65900 624	Cable Assembly USB Connector	USB	Processor Unit (front)

*. This is the cable assembly for the 23.1” monitor. For the 19” monitor use 65800548, for 25.5” and 27” monitor use the DVI cable, see Table 2, “Cable Installation,” on page 66.

†. Either connected directly to the monitor, or via an RS422 cable when using a VDS100692-8 cable, see Table 2, “Cable Installation,” on page 66.

5.1.2 Installing cables from the Termination Assembly to the PCIO

The following three cable types are used for connection between the Termination assembly and the PCIO unit:

- part number 3218376 (16-2-2C)
- part number 3209342 (16-2-4C)
- part number 3211274 (16-2-6C)

The table below lists cable type, signal and connection details of external cables from the termination block to the PCIO unit.

Table 4: Cable connections in Termination Block and PCIO

Termination Block			PCIO Unit			
No.	**Cable Type**	**Colour**	**Slot**	**Connector**		**Signal**
1		Red			1	Serial Compass - COM 3 (38400)
2	16-2-2C	Blue	5	TSCA (Input)[*]	2	
3		Screen			3	
4		Red		TSCB (Input)	1	
5		Blue			2	AIS - COM 5 (38400)
6	16-2-4C	Green	9 *	TSCN (Output)	1	
7		Yellow			2	
8		Screen		TSCB	3	
9		Red		TSCG (Input)	1	Comms - COM 7 (4800)
10	16-2-2C	Blue	10		2	
11		Screen		See Footnote[†]		
12		Red		TSCR (Output)	1	Comms - COM 7 (4800)
13	16-2-2C	Blue	12		2	
14		Screen		See Footnote[†]		
15		Red		TSCC (Input)	1	
16		Blue			2	Comms - COM 7 (38400, I/O)
17	16-2-4C	Green	13 *	TSCP (Output)	1	
18		Yellow			2	
19		Screen		TSCC	3	
20		Red		TSCD (Input)	1	Comms - COM 3 (4800)
21	16-2-2C	Blue	14		2	
22		Screen		See Footnote[†]		
23		Red		TSCJ (Input)	1	
24		Blue			2	Comms - COM 9 (4800, I/O)
25	16-2-4C	Green	18	TSCT (Output)	1	
26		Yellow			2	
27		Screen		See Footnote[†]		
28		Red		TSL	1	
29	16-2-2C	Blue	19		2	Pulse Log
30		Screen		See Footnote[‡]		
31		Red		TSR	1	
32	16-2-2C	Blue	20		2	Relay Output
33		Screen		See Footnote[‡]		
34		Red		TSR	1	
35	16-2-2C	Blue	21		2	Relay Output
36		Screen		See Footnote[‡]		

37	16-2-6C	Red
38		Blue
39		Green
40		Yellow
41		White
42		Black
43		Screen
44	16-2-2C	Red
45		Blue
46		Screen
47	16-2-4C	Red
48		Blue
49		Green
50		Yellow
51		Screen

22	TSC (type dependant)		Analogue compass
	See Footnote‡		
17	TSCE (Input)	1	
		2	
	See Footnote†		
16	TSR	7	Relay Output (and Digital output)
		9	
	(TSD)		
	See Footnote‡		

L	16-2-2C	Red
N		Blue
E		Screen

Cable Clamp**	TSA	1	
		2	
	E5		

*. Clamp over outer sheath.
†. Clamp over outer sheath, strip braid away with outer sheath as required.
‡. Clamp braid and connect ring terminal, screw to plate.
**. Connect braid to ring terminal.

Secure cables to the termination assembly using the ty-wraps (MA00009928).

5.2 Cable Installation specific to Dual Radar

Table 5 below lists description and connection details of all the cables that connect the Auxiliary PCIO unit to the Processor and PCIO unit.

Cables are tywrapped together and clipped through the cable restraints provided.

Table 5: Cable Installation Details for Aux PCIO Unit

Part Number	Description	From	To
65900520	DU Video Out	Processor*	SKS
	Scan Card		TSS
65900548	PCIO Heading	PCIO	TSH
Coax (PTIYM)	MIST In	Transceiver or Interswitch†	SKM
	MIST Out		SKX
	DU Video In		SKV
Data (4pr)	Transceiver	Transceiver	TSA

*. Connected to channel 2 terminal at the rear of the Processor.
†. If an Interswitch is not used, the MIST In and MIST Out signals of PCIO and Aux PCIO are cross connected.

5.3 Cable Installation on a Client/Server System

5.3.1 Installing cables for Servers

Table 6 below lists description and connection details of the cables to and from the 24V Power Supply Unit (PSU), PCIO Unit and Server.

Cables are tywrapped to the perforated plate at the rear of the processor and clamped to the cable restraints provided on the console chassis base.

Table 6: Server - Cable Installation Details

Part Number	Description	From	To
Power Cable	Cable Assy - 24V	PSU	PCIO
Power Cable	Cable Assy - 24V	PSU	Server Switches (2)
Power Cable	Cable - Mains	PCIO	Server
65900 520	Cable Assy	PCIO	Server NFE
65900 521	Cable Assy - USB	PCIO	Server
65900522	Cable Assy	PCIO	On/Off Switch
Data Cable	CAT5e STP Cable	Server	Server Switch

5.3.2 Installing cables for Clients

Table 7 below lists description and connection details of the cables to and from the 24V Power Supply Unit (PSU), Mains Distribution Unit (MDU) and the Client PC.

Cables are tywrapped to the perforated plate at the rear of the processor and clamped to the cable restraints provided on the console chassis base.

Table 7: Client - Cable Installation Details

<table>
<tr><th>Part Number</th><th>Description</th><th>From</th><th>To</th></tr>
<tr><td>Power Cable</td><td>Cable Assy - 24V</td><td>PSU</td><td>Client Switches (2)</td></tr>
<tr><td rowspan="2">Power Cable</td><td rowspan="2">Cable Assy</td><td rowspan="2">MDU</td><td>Monitor</td></tr>
<tr><td>Client</td></tr>
<tr><td>65900522</td><td>Cable Assy</td><td>MDU</td><td>On/Off Switch</td></tr>
<tr><td>Power Cable</td><td>Cable Assy - 24V</td><td>Client (via PSU)</td><td>Client Switch</td></tr>
<tr><td>Data Cable</td><td>Ethernet Cable</td><td>Client</td><td>Client Switch</td></tr>
</table>

5.4 Compass Cabling and Link Settings

Compass cabling and linking information for VisionMaster FT 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 5.4.1 'Standard Compass Board Links and Interconnections' and Section 5.4.2 'Special Compass Board Links and Interconnections'.*

The Compass Interface board is mounted as a daughter board onto the PCIO board in the PCIO Unit.

The type of compass being used with the system will determine the type of compass interface that must be fitted. Two compass interface boards are available: Standard and Special.

Table 8: Compass Interface Boards - Standard & Special

Interface Board	Compass Type	Ratio	Signal Voltage	Impedance
Standard 65800831	Stepper – S Type	360:1	16-100V DC line-line 8-100V DC line-line return.	10kΩ Min
	Stepper – M Type	180:1		
	Synchro (50–500Hz)	360:1	16-100V RMS line-line	10kΩ Min
			25-165V RMS reference	47kΩ Min
Special 65800832	Synchro (50-500Hz)	180:1 90:1 36:1 1:1	9.3-37V RMS line-line	40k to 60kΩ
			32-126V RMS line-line	133k to 200kΩ
			22-165V RMS reference	100kΩ Min

At system power up, the system detects the type of compass interface board (standard or special), if any.

During system configuration, the compass type must be selected if the standard compass interface board is fitted, and the number of cycles per compass revolution (ratio) selected if the special compass interface board is fitted. For information on configuring the compass type and ratio settings refer to *'PCIO Sensor Interface'* in Volume 2, Chapter 1 '*Configuration*'.

5.4.1 Standard Compass Board Links and Interconnections

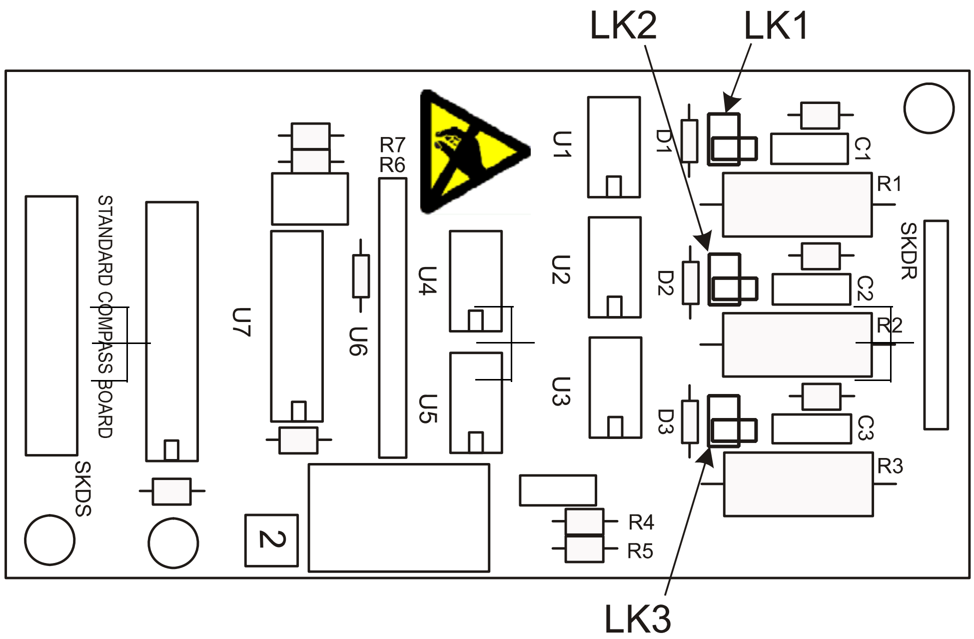

Figure 4.50 Standard Compass Interface PCB

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 4.50.

Compasses should be connected in accordance with Table 9 and Table 10.

Table 9: Stepper Compass Settings

Stepper Compass					
S Type +ve Ref.		S Type -ve Ref.		M Type	
PCIO Panel		PCIO Panel		PCIO Panel	
TSC1 TSC2 TSC3	Common Ref. Common Ref. Common Ref.	TSC1 TSC2 TSC3	S1 S2 S3	TSC1 TSC2 TSC3	S1 S2 S3
TSC4 TSC5 TSC6	S1 S2 S3	TSC4 TSC5 TSC6	Common Ref. Common Ref. Common Ref.	TSC4 TSC5 TSC6	Common Ref. Common Ref. Common Ref.
TSC7 TSC8 TSC9 TSC10	no connection no connection no connection no connection	TSC7 TSC8 TSC9 TSC10	no connection no connection no connection no connection	TSC7 TSC8 TSC9 TSC10	no connection no connection no connection no connection

Table 10: Synchro Compass Settings

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

5.4.2 Special Compass Board Links and Interconnections

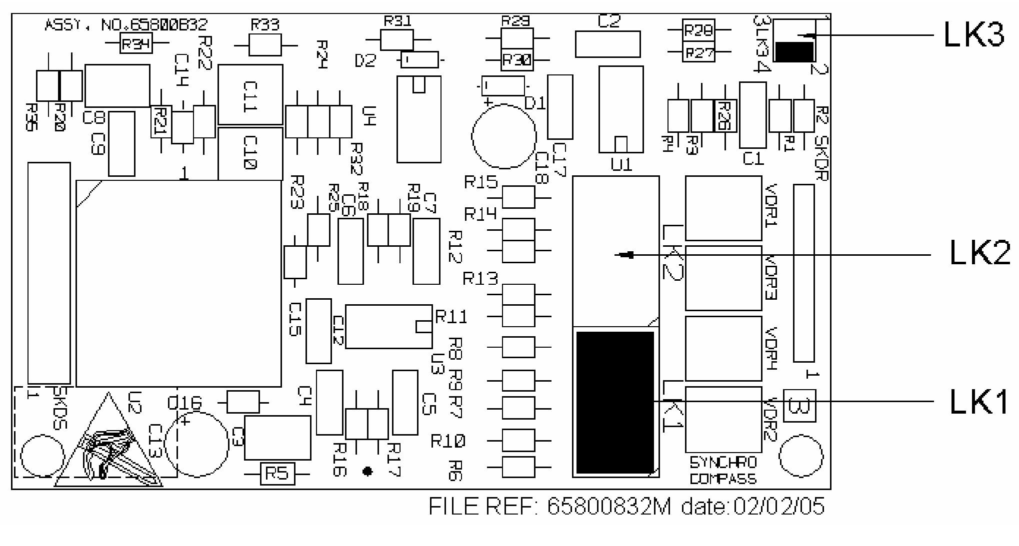

Figure 4.51 Special Compass Board Interface PCB

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 shown in Table 11 determines the setting of LK3.

Table 11: Reference Voltage for LK3

Nominal 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:

Table 12: Compass Settings

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

5.5 Log Cabling

A dual axis serial log is connected to a two way serial input (TSCE).

The log input can accept signals from a water-locked, single axis, pulse or Doppler log with 100 to 2560 pulses per nm at a speed range of 0 to 99.9 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 TSL 1, the log return to TSL 2.

5.6 PCIO Board

The PCIO Board has three high speed serial inputs (38400 baud) and six low speed serial inputs (4800 and 9600 baud).

Communication to the Processor is via an embedded USB hub (TSU). Video and data to the Scan Converter (SC) card is via an 12 way connector (TSS).

Check that the switches on the PCIO board are in the correct position, i.e. switches 1 to 3 are on, switch 4 is off, and switches 5 to 8 are on, see Figure 4.52.

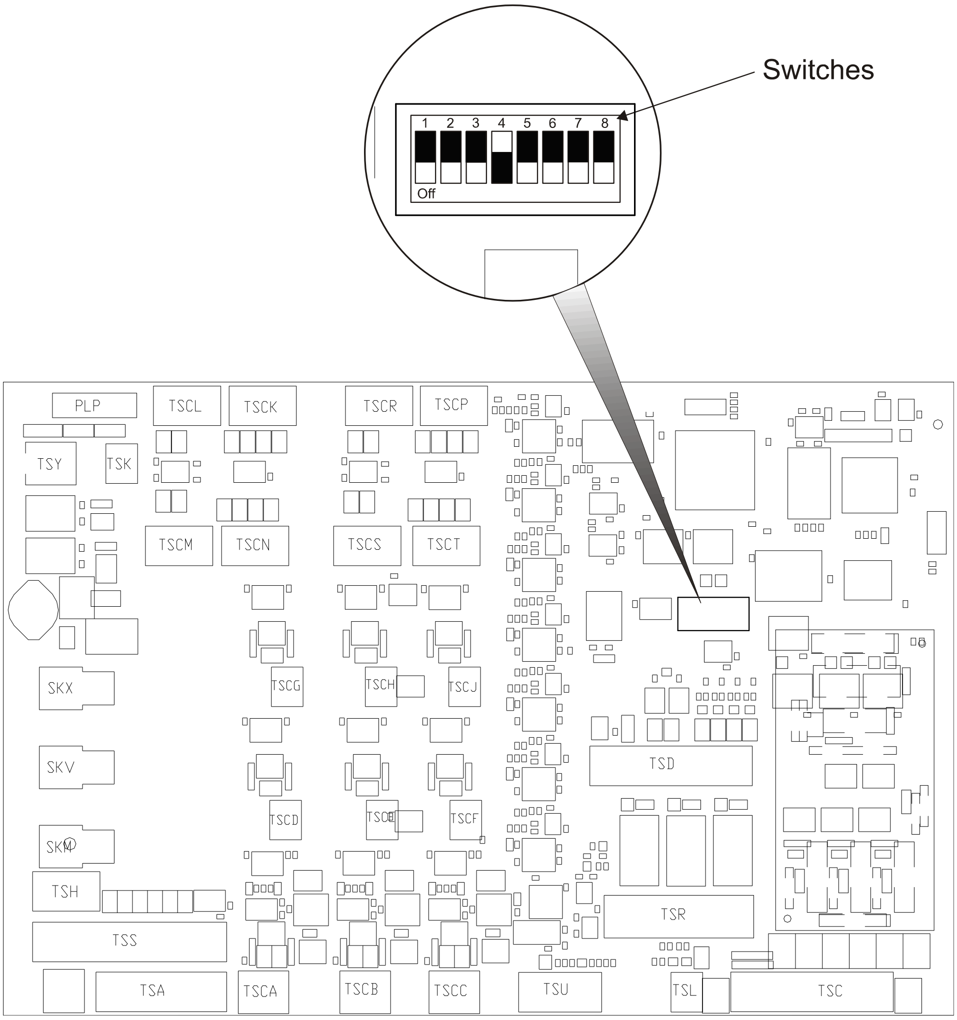

Figure 4.52 PCIO Board Switch Positions

5.6.1 PCIO Board - Serial Inputs and Outputs

Table 13 below gives details of the serial input and output connections.

Table 13: PCIO Board Serial Inputs and Outputs

Port	Terminal	Function	Features
COM 3	TSCA 1	Data B (RS422 or RS232 rtn)	Heading and ROT input, 38400 baud*
	TSCA 2	Data A (RS422 or RS232 signal)	
	TSCA 3	Isolated earth	
	TSCD	Spare	Input only
	TSCE 1	Data B (RS422 or RS232 rtn)	Log Input, 4800 baud *
	TSCE 2	Data A (RS422 or RS232 signal)	
COM 4	TSCF 1	Data B (RS422 rtn)	Monitor control input, 9600 baud
	TSCF 2	Data A (RS422 signal)	
	TSCM 1	Data B (RS422)	Monitor control output, 9600 baud
	TSCM 2	Data A (RS422)	
COM 5	TSCB 1	Data B (RS422 or RS232 rtn)	AIS input, 38400 baud *
	TSCB 2	Data A (RS422 or RS232 signal)	
	TSCB 3	Isolated earth	
	TSCN 1	Data B (RS422)	AIS output, 38400 baud (optional)
	TSCN 2	Data A (RS422)	
	TSCN 3	Data A (RS232 signal)	
	TSCN 4	0 V	
COM 6	TSCC	Spare Input	
	TSCP	Spare output	
COM 7	TSCG 1	Data B (RS422 or RS232 rtn)	GPS, 4800 baud (input only) *
	TSCG 2	Data A (RS422 or RS232 signal)	
	TSCR 1	Data B (RS422)	Tracktable output, 4800 baud
	TSCR 2	Data A (RS422)	
	TSCR 3	Data A (RS232 signal)	
	TSCR 4	0 V	
COM 8	TSCH 1	Data B (RS422 or RS232 rtn)	Interswitch input, 4800 baud†
	TSCH 2	Data A (RS422 or RS232 signal)	
	TSCS 1	Data B (RS422)	
	TSCS 2	Data A (RS422)	
COM 9	TSCJ	Spare Input	
	TSCT	Spare Output	

*. Do not earth cable on these serial inputs
†. Interswitch not used on Client/Server Radar

5.6.2 Additional Input and Outputs

The PCIO board provides the following additional ports:

- Transceiver connections
- Pulse Log
- System Operational indicator via relay contacts
- Remote Alarm via relay contacts
- Vigilance Alarm via relay contacts
- Buzzer output via Discrete I/O

Table 14: Additional PCIO Inputs and Outputs

<table>
<tr><th>Port</th><th>Terminal</th><th>Function</th><th>Features</th></tr>
<tr><td rowspan="8">Transceiver</td><td>TSA 1</td><td>DU DATA +</td><td rowspan="2">Data to Transceiver</td></tr>
<tr><td>TSA 2</td><td>DU DATA -</td></tr>
<tr><td>TSA 3</td><td>TX DATA +</td><td rowspan="2">Data from Transceiver</td></tr>
<tr><td>TSA 4</td><td>TX DATA -</td></tr>
<tr><td>TSA 5</td><td>TX TRIG +</td><td rowspan="2">Trigger from Transceiver</td></tr>
<tr><td>TSA 6</td><td>TX TRIG -</td></tr>
<tr><td>TSA 7</td><td>Not used</td><td rowspan="2"></td></tr>
<tr><td>TSA 8</td><td>Not used</td></tr>
<tr><td rowspan="3">Transceiver
(BNC connectors)</td><td>SKX</td><td>MIST OUT</td><td>MIS Trigger from SC card</td></tr>
<tr><td>SKM</td><td>MIST IN</td><td>MIS Trigger to SC card</td></tr>
<tr><td>SKV</td><td>VIDEO IN</td><td>Video from Transceiver</td></tr>
<tr><td rowspan="2">Pulse Log</td><td>TSL 1</td><td>LOG</td><td rowspan="2"></td></tr>
<tr><td>TSL 2</td><td>LOG RTN (0V)</td></tr>
<tr><td rowspan="3">System Operational</td><td>TSR 1</td><td>System Op (N/O)</td><td rowspan="3">System Operational with Relay Contacts.
Normally Open (N/O) and Normally Closed (N/C) available. N/C shorts to return in alarm condition *</td></tr>
<tr><td>TSR 2</td><td>System Op (N/C)</td></tr>
<tr><td>TSR 3</td><td>System Op (Common)</td></tr>
<tr><td rowspan="3">Remote Alarm</td><td>TSR 4</td><td>Remote Alarm (N/O)</td><td rowspan="3">Remote Alarm with Relay Contacts.
Normally Open (N/O) and Normally Closed (N/C) available. N/C shorts to common in non-operational condition *.</td></tr>
<tr><td>TSR 5</td><td>Remote Alarm (N/C)</td></tr>
<tr><td>TSR 6</td><td>Remote Alarm (Common)</td></tr>
<tr><td rowspan="3">Vigilance Alarm</td><td>TSR 7</td><td>Vigilance Alarm (N/O)</td><td rowspan="3">Vigilance Alarm with Relay Contacts.
Normally Open (N/O) and Normally Closed (N/C) available. N/O shorts to return during output pulse *.</td></tr>
<tr><td>TSR 8</td><td>Vigilance Alarm (N/C)</td></tr>
<tr><td>TSR 9</td><td>Vigilance Alarm (Common)</td></tr>
<tr><td rowspan="2">Buzzer</td><td>TSD 6</td><td>Buzzer signal</td><td rowspan="2">Buzzer signal goes to low volts to sound buzzer.</td></tr>
<tr><td>TSD 10</td><td>Buzzer (+12 V)</td></tr>
</table>

*. Contacts rated at: 1.0A @ 24VDC, 0.6A @ 110VDC, 0.6A @ 125VAC (50/60Hz).

5.6.3 Ancillary and Interswitch Outputs

The PCIO board provides the following power output ports, protected by re-usable fuses:

- Ancillary Power Output (+24 V) - not available on the 19" Integrated Tabletop
- Interswitch Power Output (+/- 15 V)
- Ancillary Power Output (+5 V)

Table 15: Ancillary and Interswitch Outputs

Port	Terminal	Function	Features
Ancillary Power Output	TSX 1	+ 24 V	< 700 mA
	TSX 2	0 V	
Interswitch Power* Output	TSY 1	+ 15 V	< 700 mA
	TSY 2	0 V	
	TSY 3	- 15 V	< 300 mA
Ancillary Power Output	TSD 8	0 V	
	TSD 9	+ 5 V	< 200 mA

*. Not used on Client/Server Radar

5.6.4 Relay Outputs

The three Relay Outputs provide a set of contacts; Normally Open, Normally Closed and Common. The relay is set ON for a logic '1' written to the appropriate latch bit. These may be used to switch external circuits with current/voltages up to 2.0A/15VDC.

6 Cabling and Interconnection Diagrams

6.1 Cabling and Interconnection Diagrams for Standard Consoles

The following figures give cabling and interconnection details for standard VisionMaster FT consoles.

- Figure 4.53 '*Intermodule Cabling - Sheet 1*'
- Figure 4.54 '*Intermodule Cabling - Sheet 2*'
- Figure 4.55 '*PCIO Connections*'
- Figure 4.56 '*Interswitch Cabling Diagram*'
- Figure 4.57 '*Cabling Diagram for Standard Display*'
- Figure 4.58 '*Cabling Diagram for Dual Channel Radar Display*'
- Figure 4.59 '*Cabling Diagram for Auxiliary PCIO*'
- Figure 4.60 '*Cabling Diagram for Interswitch*'

6.2 Cabling and Interconnection Diagrams for Client/Server Radar Consoles

The following figures give cabling and interconnection details for Client/Server Radar VisionMaster FT consoles.

- Figure 4.61 '*Intermodule Cabling Client/Server Radar - Sheet 1*'
- Figure 4.62 '*Intermodule Cabling Client/Server Radar - Sheet 2*'
- Figure 4.63 '*Intermodule Cabling Client/Server Radar - Sheet 3*'
- Figure 4.64 '*PCIO Connections Client/Server Radar*'
- Figure 4.65 '*Network Connections Client/Server Radar - Sheet 1*'
- Figure 4.66 '*Network Connections Client/Server Radar - Sheet 2*'
- Figure 4.67 '*Intermodule Cabling Client/Server Radar*'
- Figure 4.68 '*Client/Server Radar Network Configuration - Sheet 1*'
- Figure 4.69 '*Client/Server Radar Network Configuration - Sheet 2*'

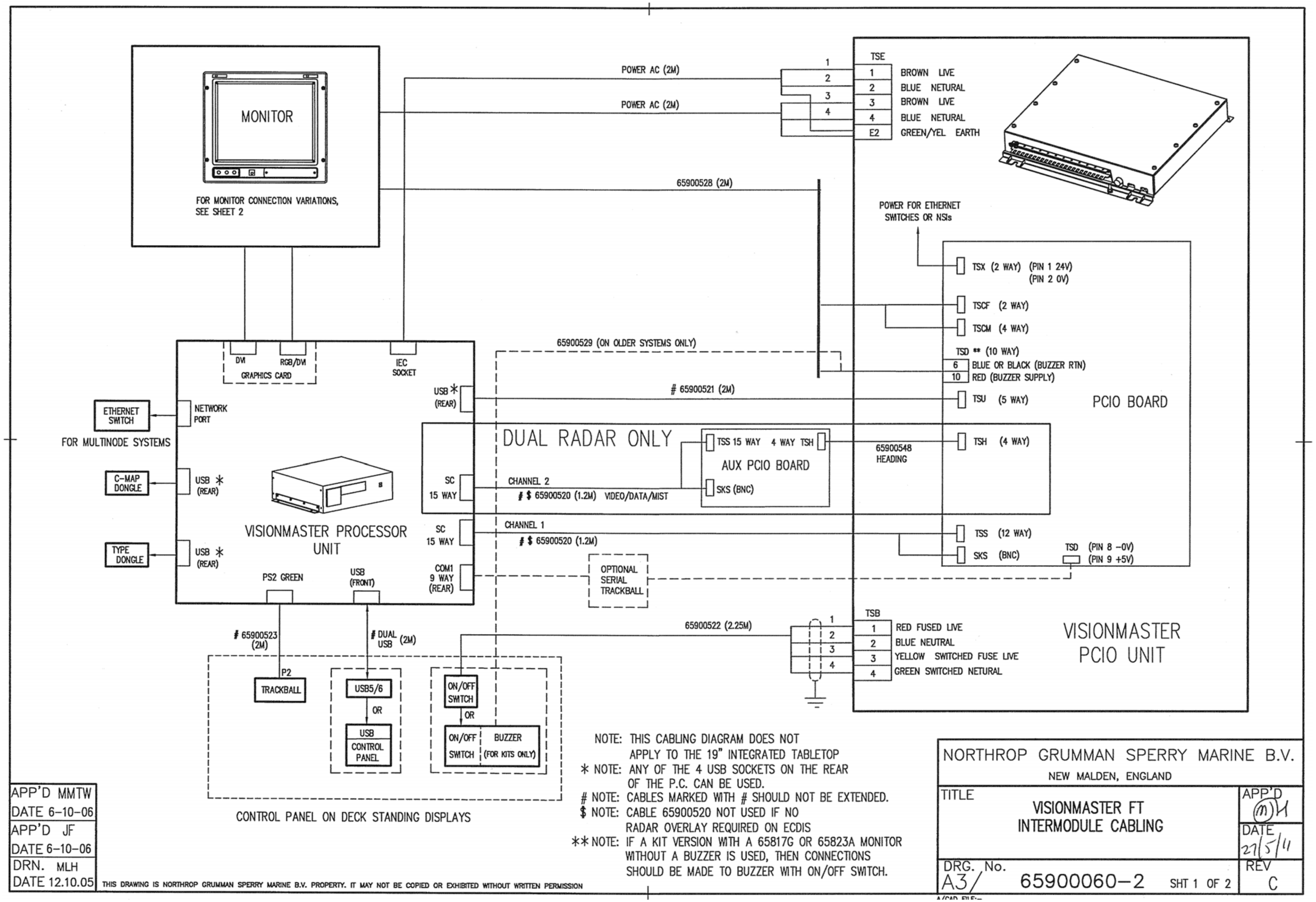

Figure 4.53 Intermodule Cabling - Sheet 1

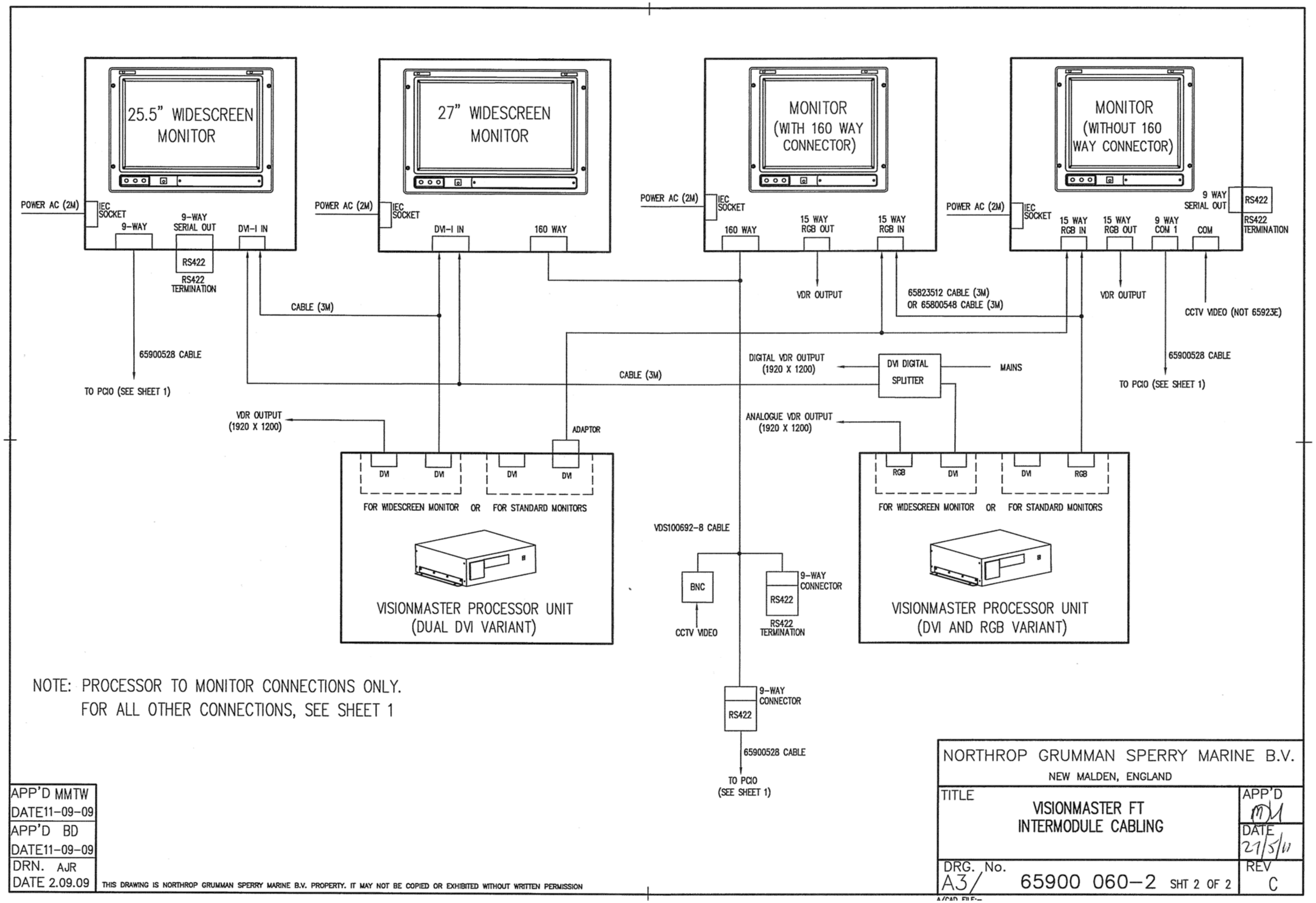

Figure 4.54 Intermodule Cabling - Sheet 2

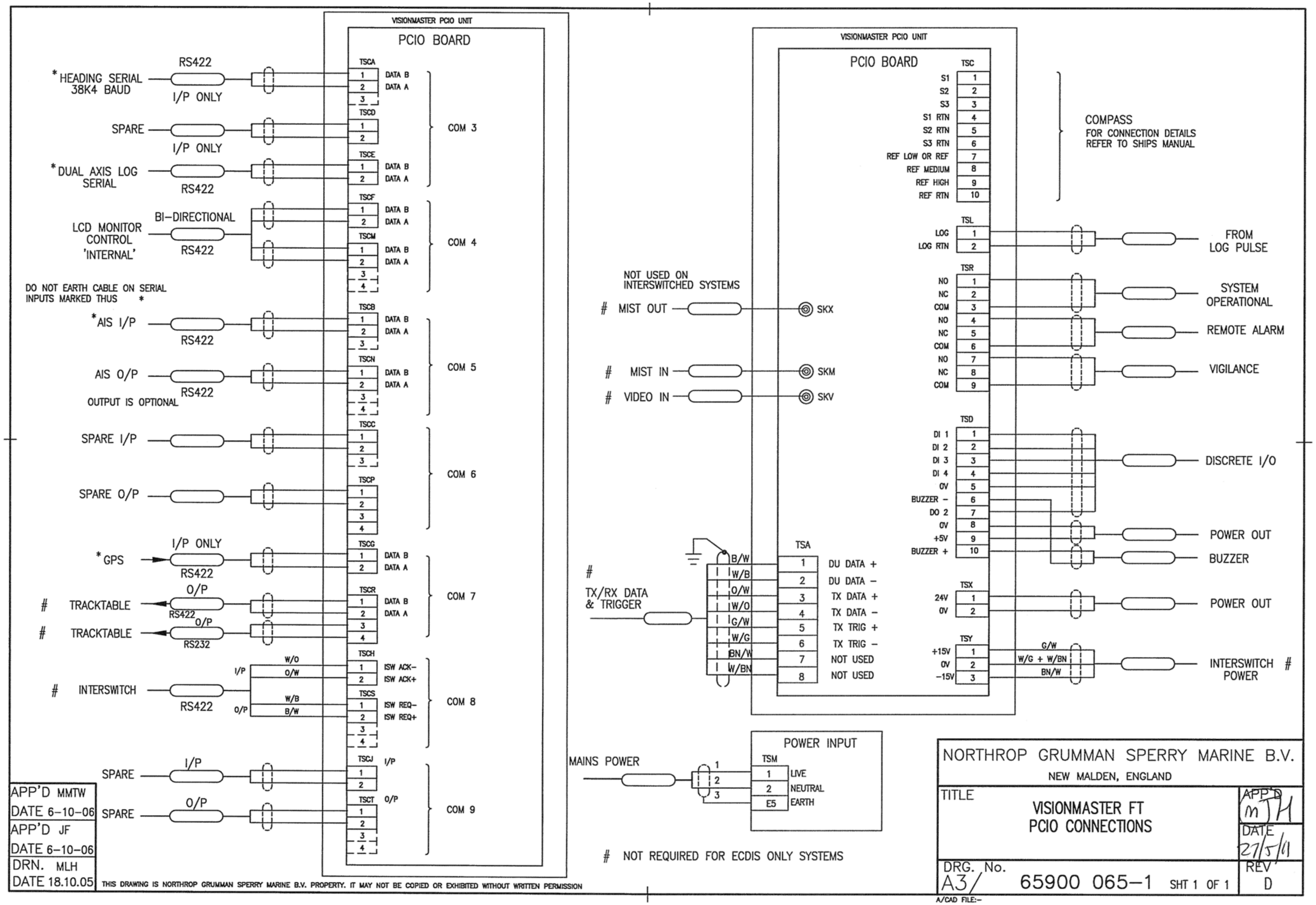

Figure 4.55 PCIO Connections

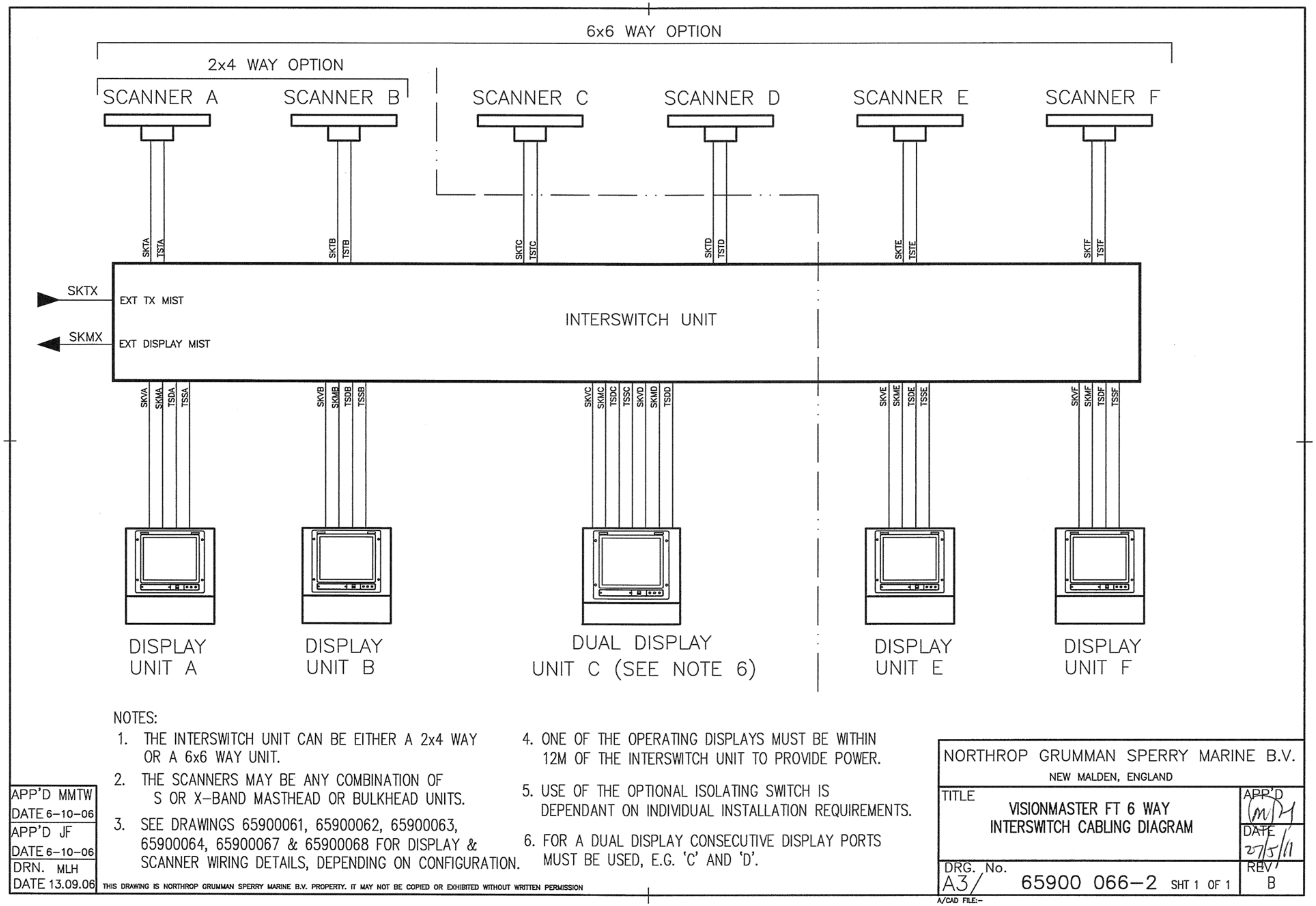

Figure 4.56 Interswitch Cabling Diagram

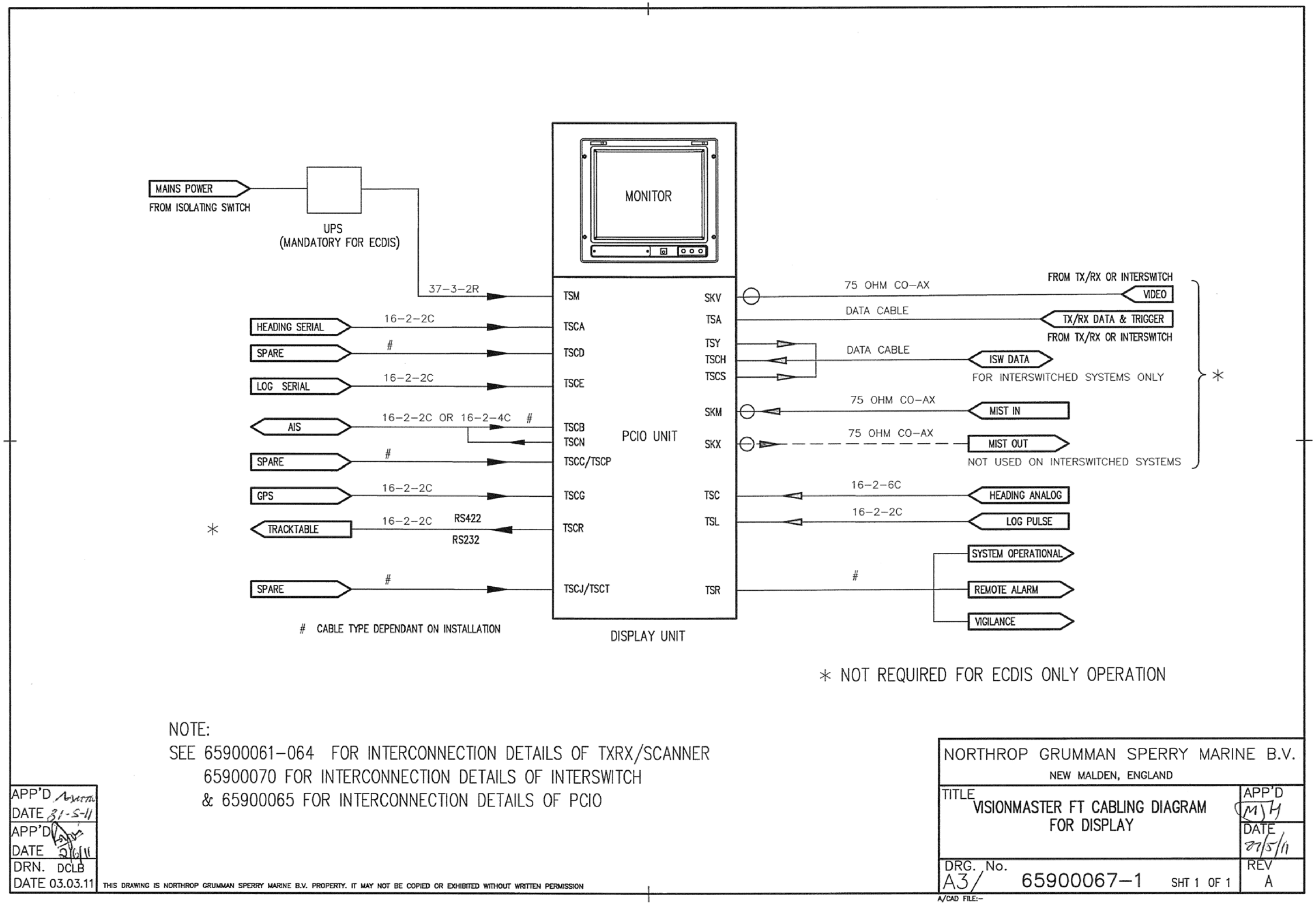

Figure 4.57 Cabling Diagram for Standard Display

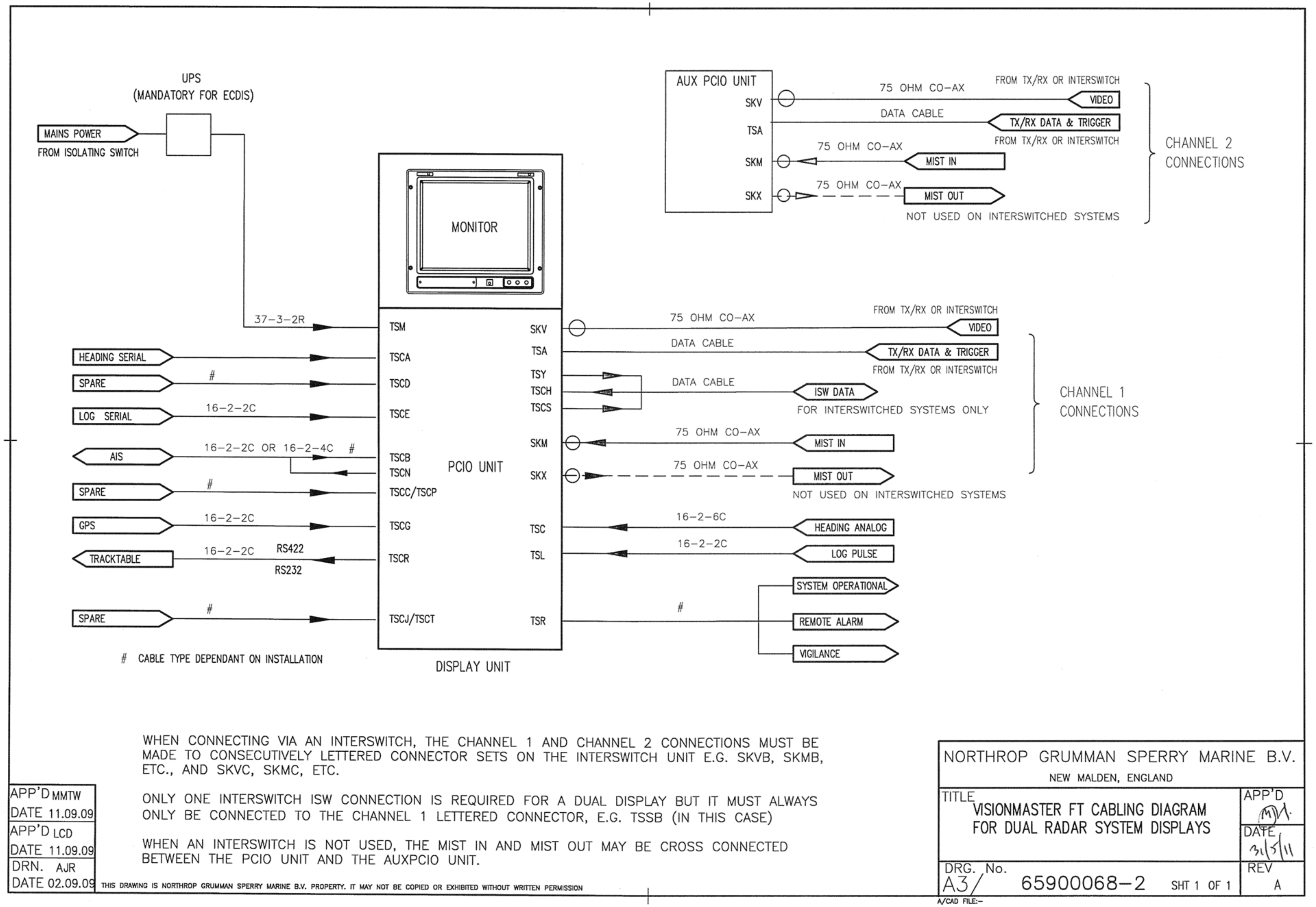

Figure 4.58 Cabling Diagram for Dual Channel Radar Display

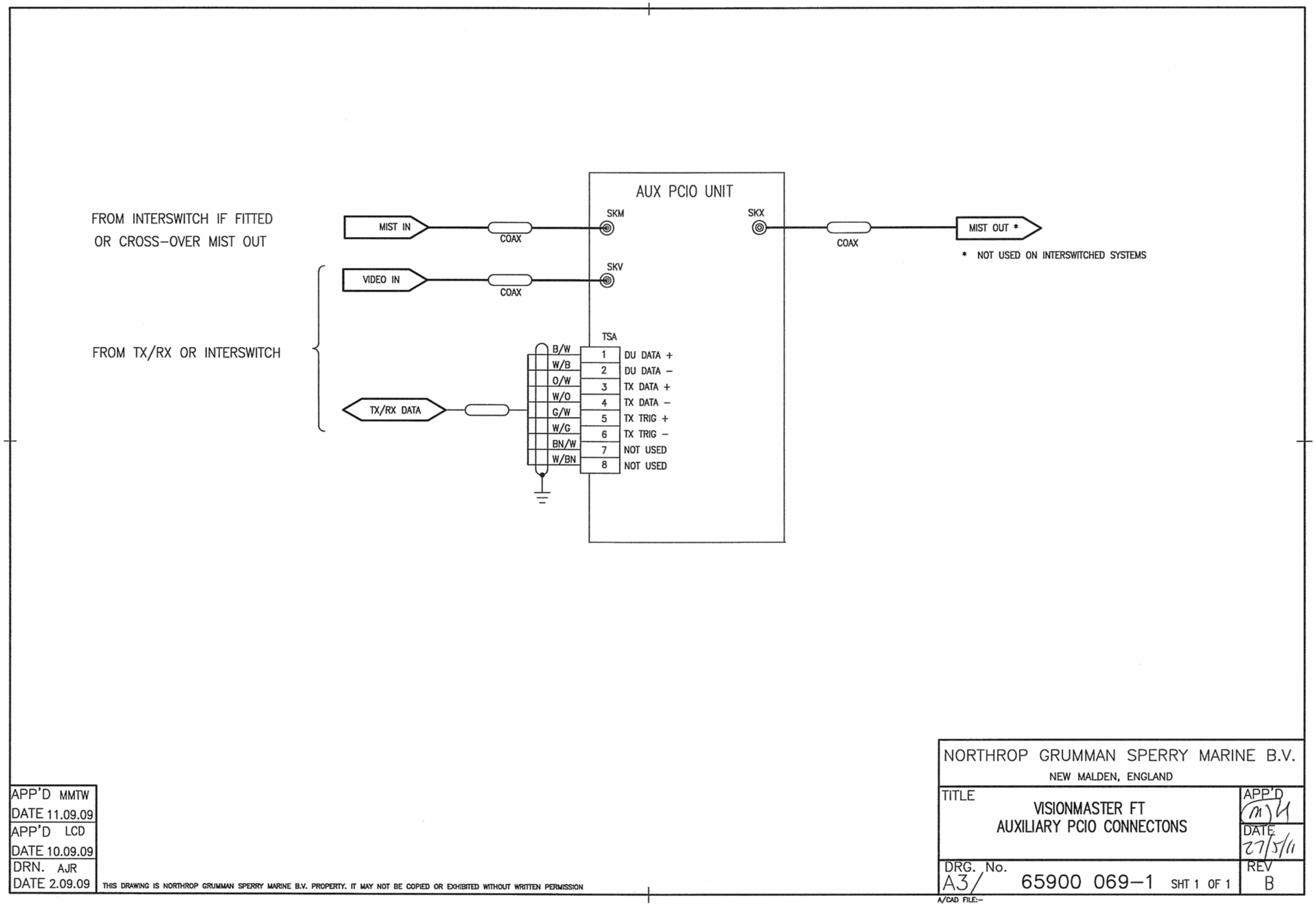

Figure 4.59 Cabling Diagram for Auxiliary PCIO

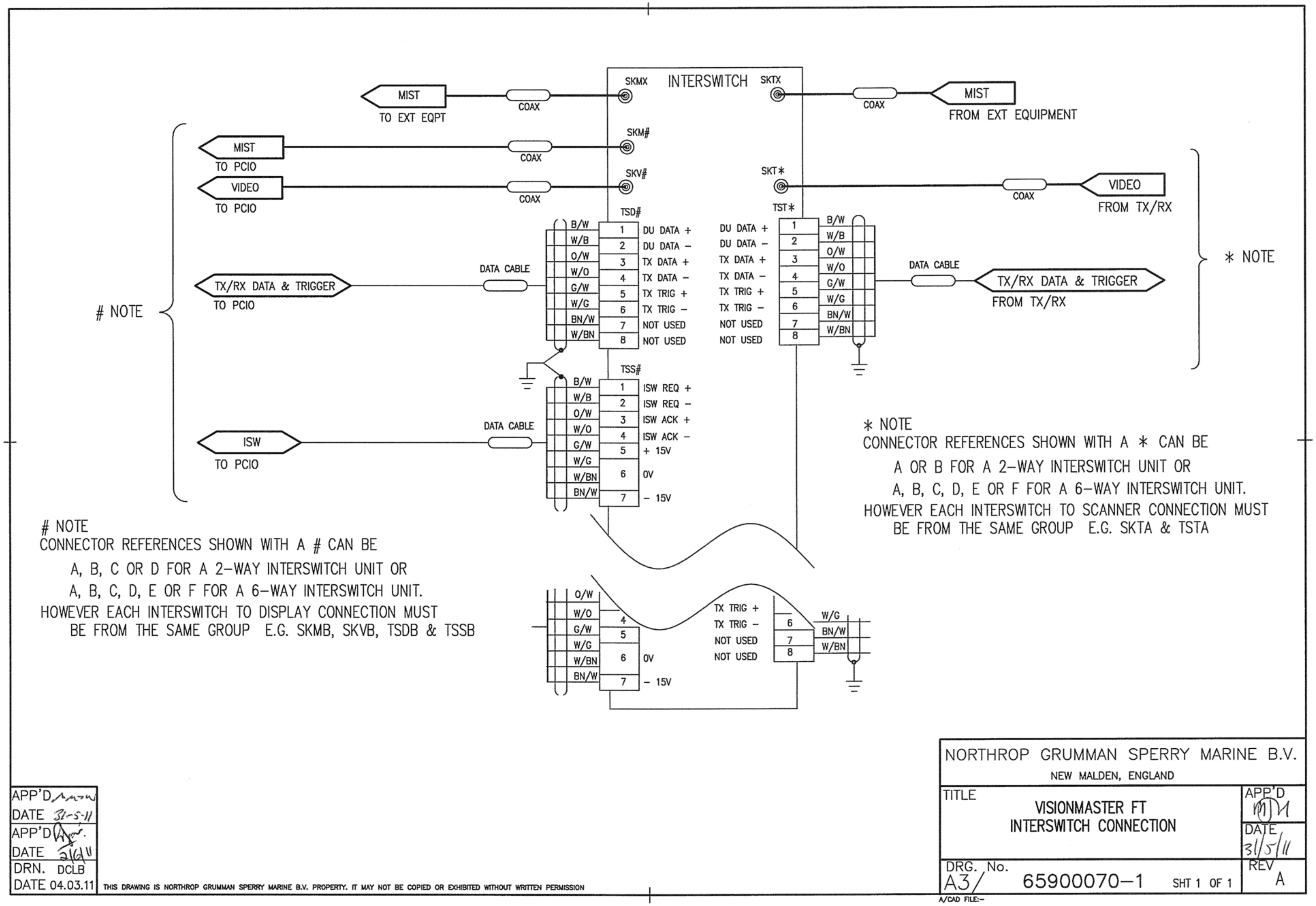

Figure 4.60 Cabling Diagram for Interswitch

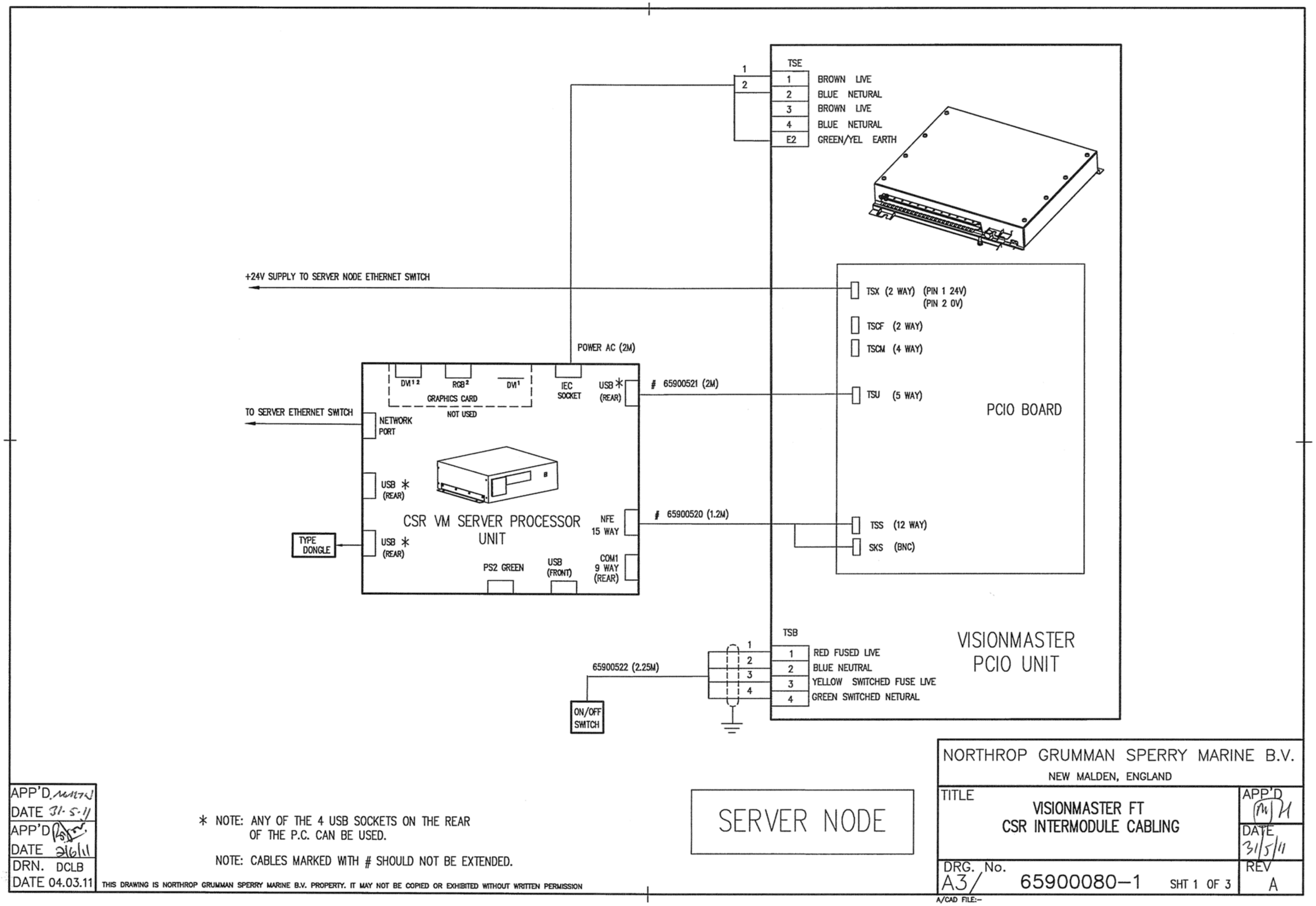

Figure 4.61 Intermodule Cabling Client/Server Radar - Sheet 1

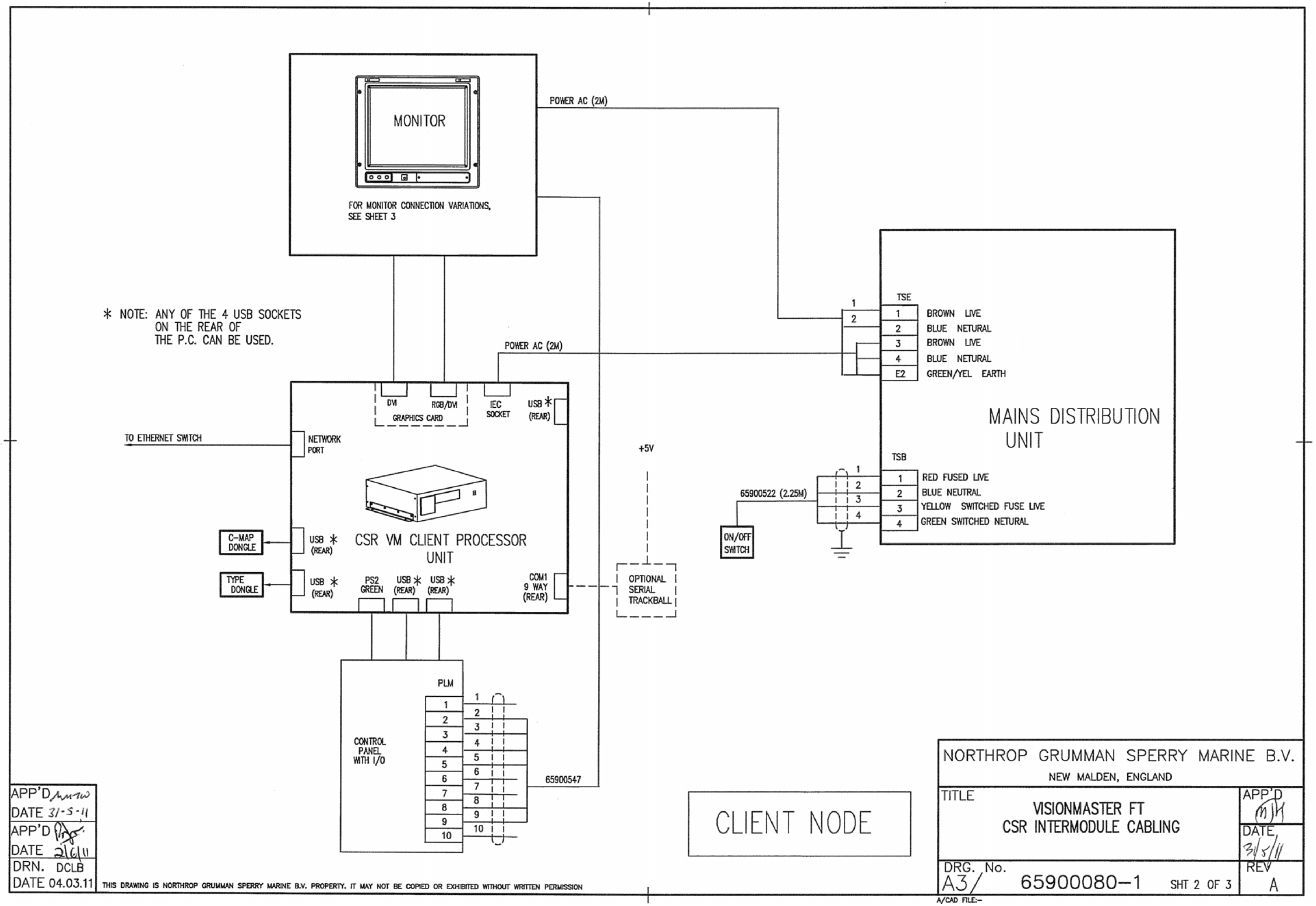

Figure 4.62 Intermodule Cabling Client/Server Radar - Sheet 2

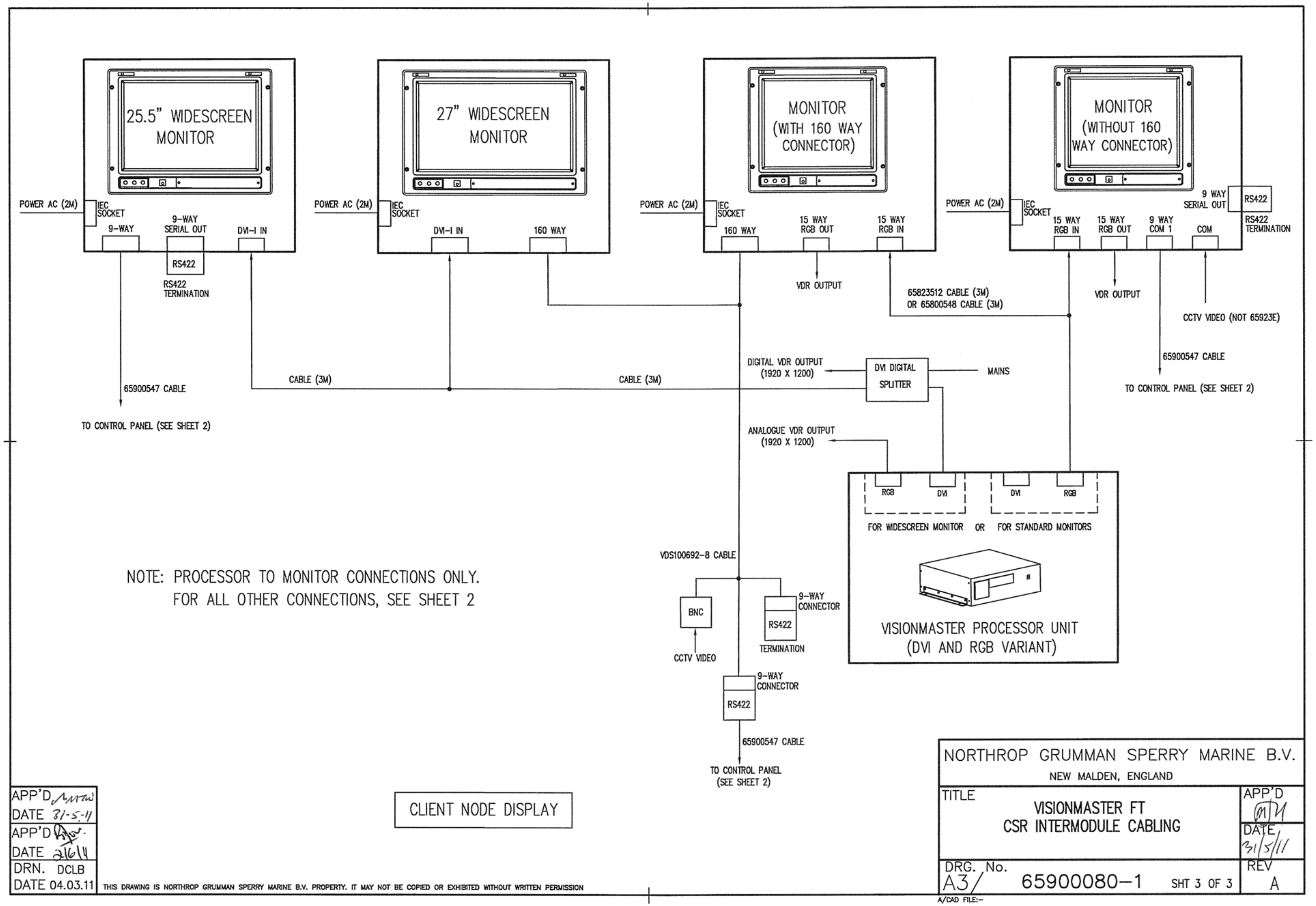

Figure 4.63 Intermodule Cabling Client/Server Radar - Sheet 3

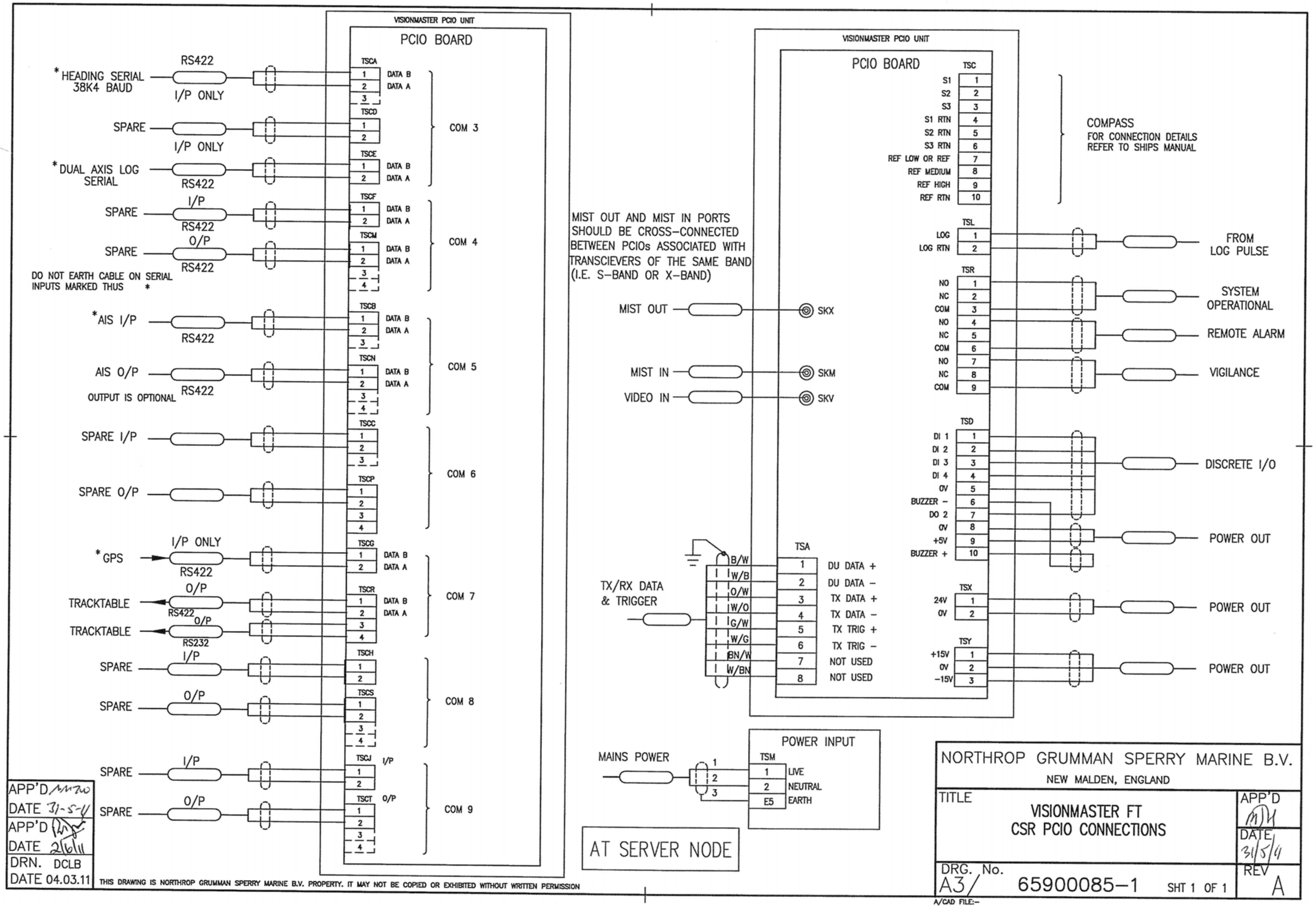

Figure 4.64 PCIO Connections Client/Server Radar

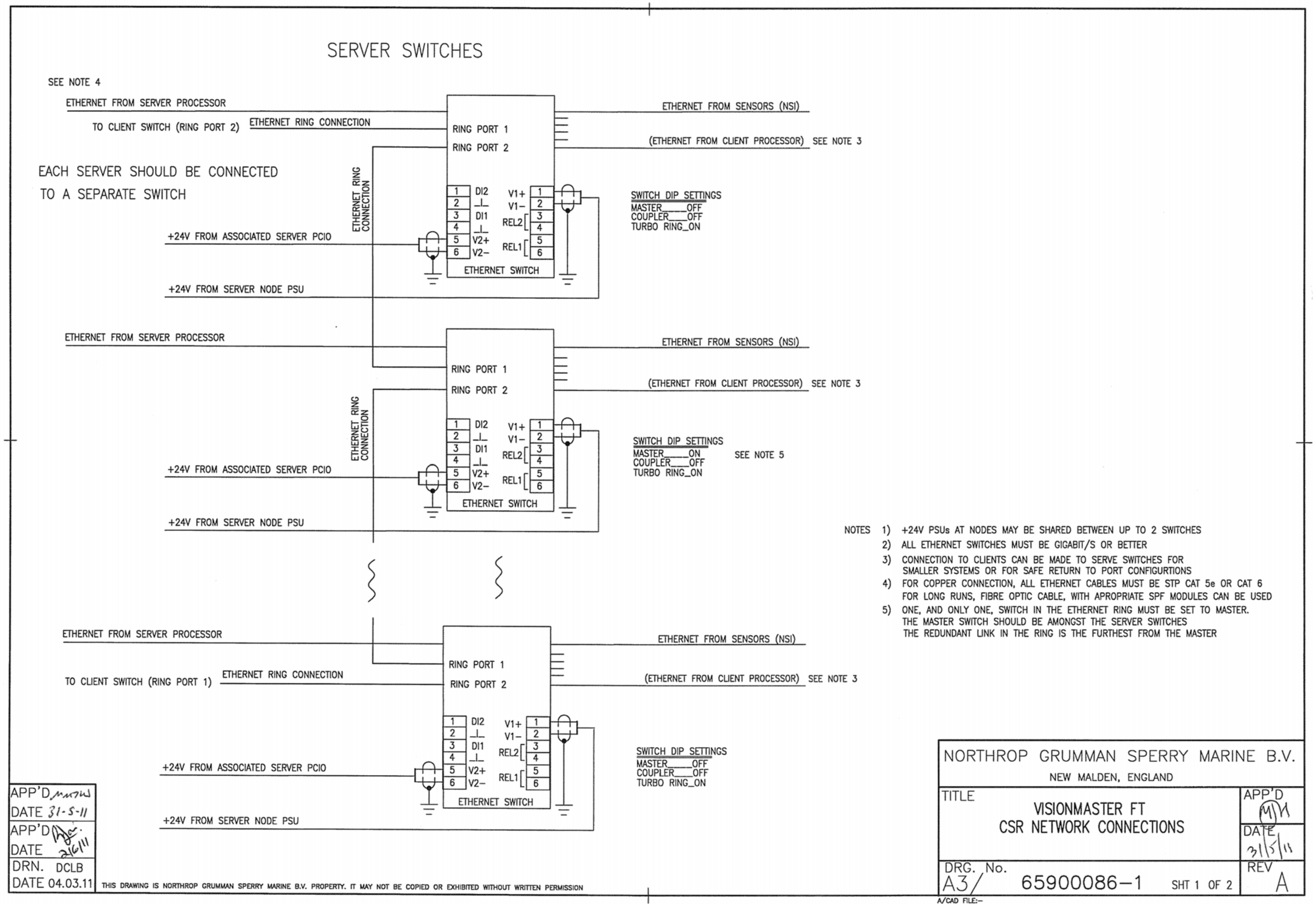

Figure 4.65 Network Connections Client/Server Radar - Sheet 1

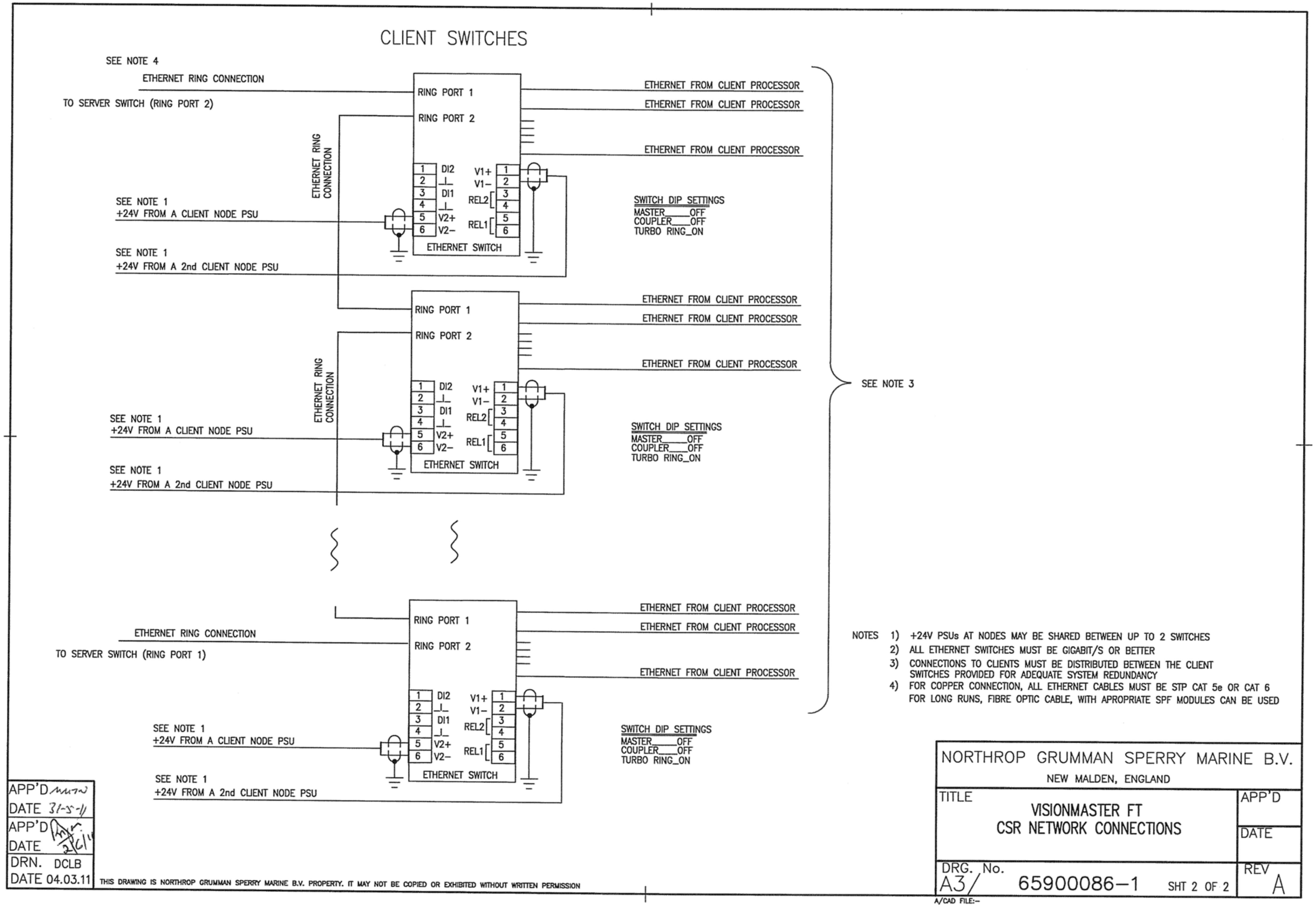

Figure 4.66 Network Connections Client/Server Radar - Sheet 2

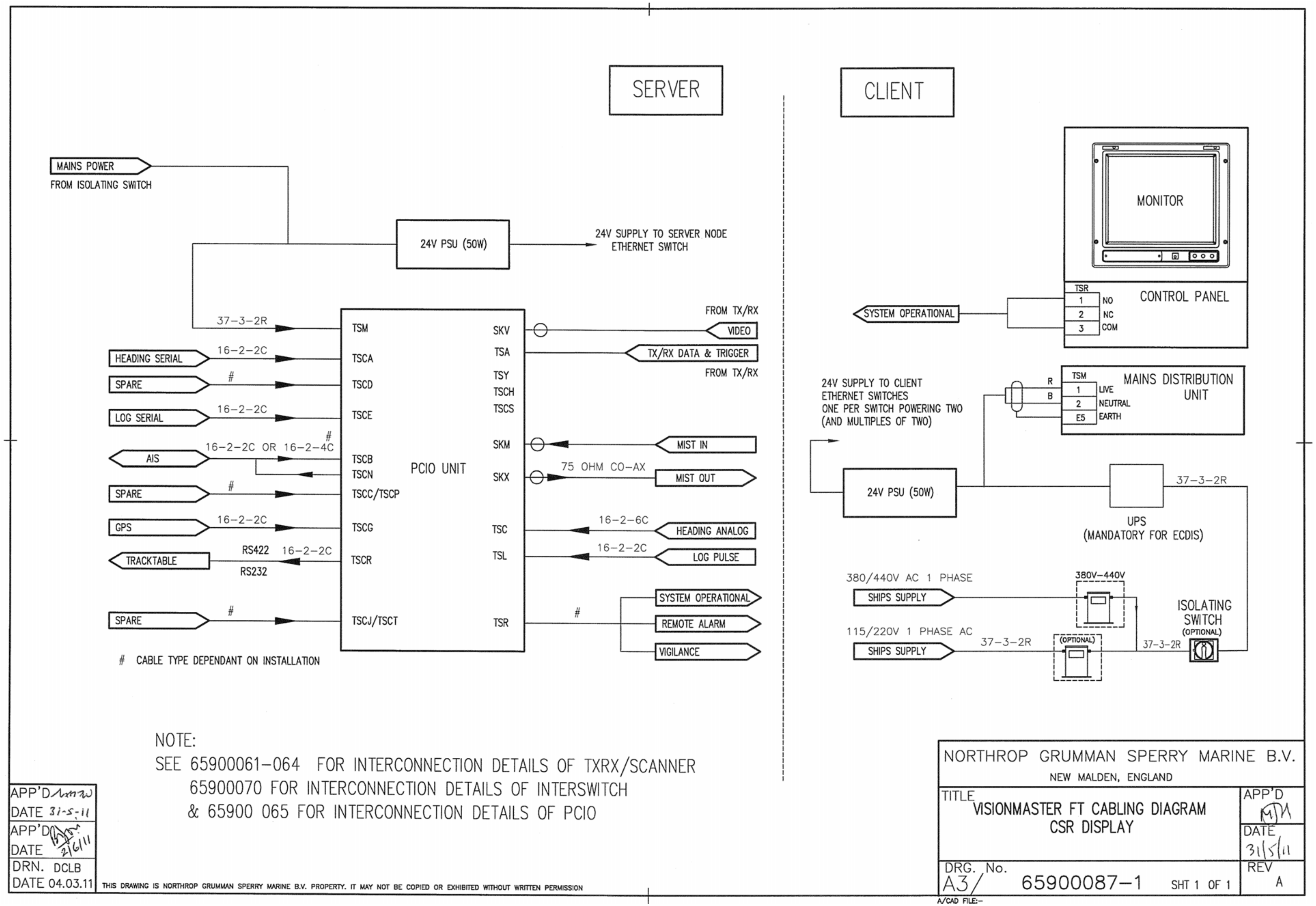

Figure 4.67 Intermodule Cabling Client/Server Radar

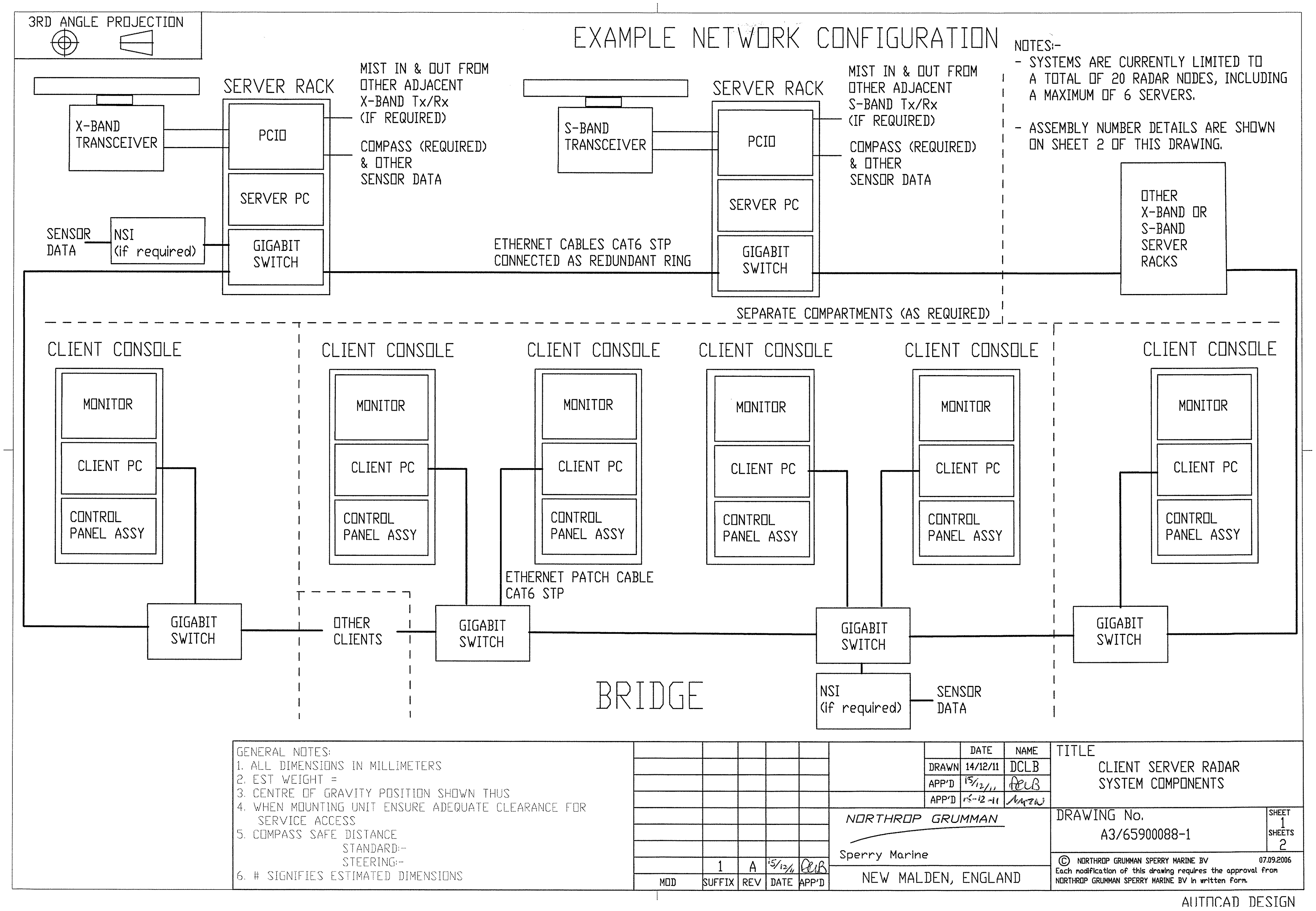

Figure 4.68 Client/Server Radar Network Configuration - Sheet 1

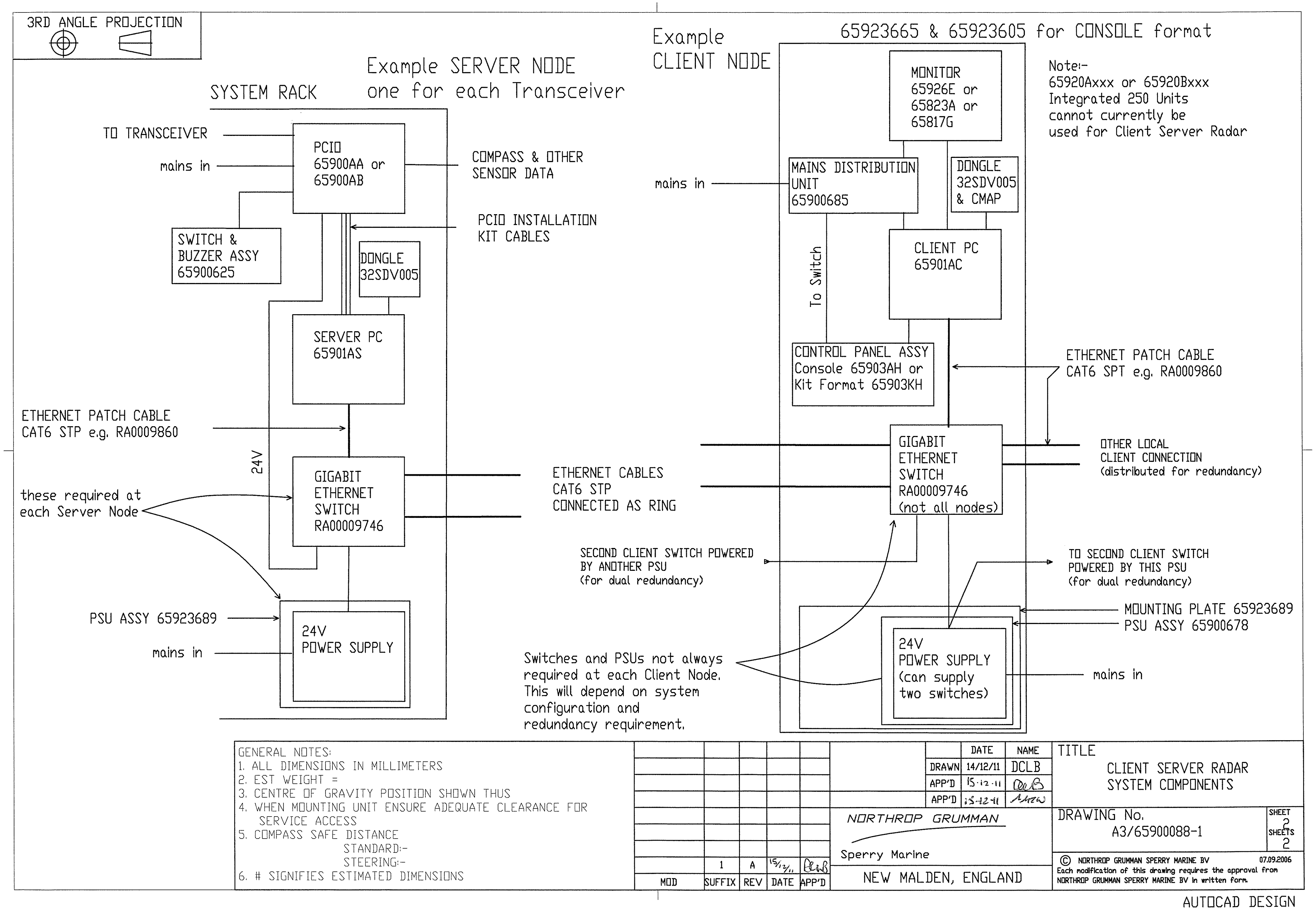

Figure 4.69 Client/Server Radar Network Configuration - Sheet 2

Appendix A

ECDIS Calibration Procedure

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A.1 ECDIS Colour Calibration File

The colour calibration file for a VisionMaster LCD monitor provides the necessary data for the ECDIS to provide the proper red, blue & green video output levels for compliance with IEC 61174, ECDIS.

When a display is installed or replaced, it is required that the colour calibration file be installed on the navigation PC which is connected to this monitor and which is intended to be ECDIS compliant.

Note: *If your VisionMaster system has been re-imaged the existing colours will be lost, therefore the colour calibration file must always be re-applied after a re-image.*

The following two methods can be used to install the colour calibation file:

a. From the Monitor Calibration utility, which appears as an icon on the VisionMaster Service desktop.

b. From a CD or 3 ½ " floppy disk, supplied with the monitor.

Note: *The Monitory Calibration utility is only available on VisionMaster systems where the software is version 5.5. or later.*

To install the file using the Monitor Calibration utility, refer to Section A.2.3 '*Installing via the Monitor Calibration Utility*'.

To install the file from a CD or floppy disk, refer to Section A.2.4 '*Installing via an External Device*'.

A combined backlight and buzzer control cable is also required to connect the monitor to the PCIO port.

A.1.1 LCD Backlight & Buzzer Control Cable

The purpose of this interface cable is to provide a means for the PC to control the LCD backlight. The control will vary the display's brightness for various Day/Night conditions via RS-422 communications.

VisionMaster uses this interface cable to automatically set the LCD backlight to the correct luminance for the ambient light condition selected by the operator, based on the calibration data stored in the PC. When a different setting is selected, the software outputs a serial message to the LCD, setting the backlight brightness to the calibrated level for this setting. The software will monitor periodic communications of this serial interface to detect failure and will display an alarm message to the user if the serial interface fails.

A.2 Installation Procedures

A.2.1 Installing the Backlight & Buzzer Control Cable

1. Connect the LCD backlight and buzzer control cable from the monitor to the PCIO, as shown in Figure 4.53 '*Intermodule Cabling - Sheet 1*' and Figure 4.54 '*Intermodule Cabling - Sheet 2*' in Chapter 4 '*Installing Consoles & Displays*'.
2. Configure the system so the PCIO serial and discrete output ports are assigned to the LCD backlight control and buzzer output. Refer to Volume 2, Chapter 1 '*Configuration*', (Section 7.9.2 '*Configuring a PCIO Serial Port*' and Section 5.5 '*Monitors*').

A.2.2 Copying the Calibration File

Before installing the colour calibration file, either via the Monitor Calibration utility, or from an external device, it is recommended that the following procedure be carried out in order to preserve a copy of the existing calibration file:

1. From the **Start** button at the lower left corner of the desktop open Windows Explorer and navigate to the following directory:

   C:\Program Files\Sperry Marine\VisionMaster\Output\ColorFiles\ECDIS
2. If there is an existing 'EcdisColors.dat' file, rename the file to: 'EcdisColors.old'

A.2.3 Installing via the Monitor Calibration Utility

1. From the Service desktop, open the Monitor Calibration Utility icon. The Monitor Calibration Data Reader popup window appears, see Figure A.1.

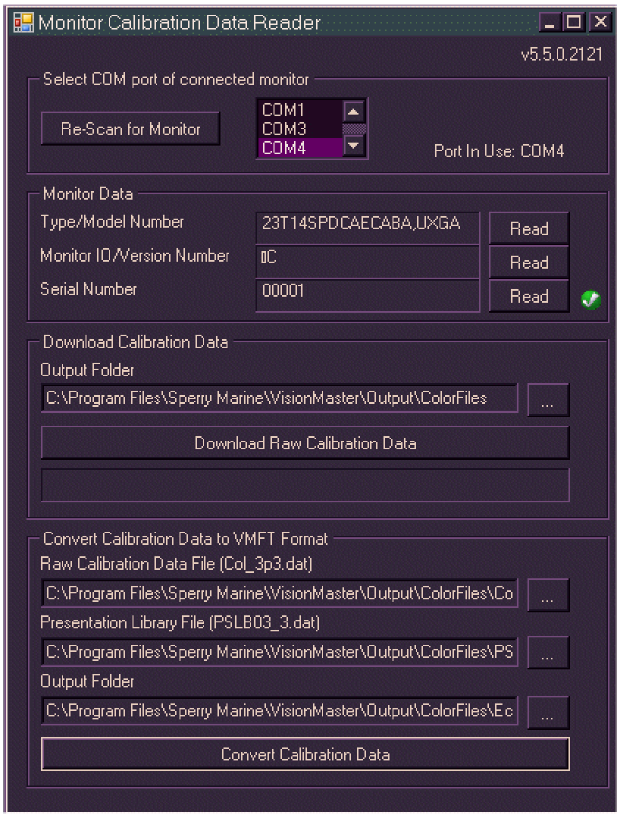

Figure A.1 Monitor Calibration Data Reader

2. The COM port for the connected monitor should be automatically highlighted, if not select the correct COM port from the list. (For information on locating the COM port for your monitor, refer to *section 6.10 I/O Port Manager* in Chapter 1 *Configuration*).

3. The **Re-Scan for Monitor** button is used to search for an appropriate port if the COM port is not known. The re-scan function will cancel the current selection and should not be used if a port has been selected.

4. To confirm the monitor port selection click the **Read** buttons in the 'Monitor Data' area. When the Calibration facility verifies the data is valid a green tick icon appears . If the data is deemed to be invalid an orange exclamation icon appears .

5. The 'Download Calibration Data' area shows the output folder where the raw calibration data from the monitor will be downloaded to. The destination may be changed from its default by clicking the Browse button and navigating to the required destination, although it is recommended that the default setting is not changed.

6. To download the data click the **Download Raw Calibration Data** button. The status bar below the button shows the download progress. When the download is complete the green tick icon appears to the right of the status bar.

7. The 'Convert Calibration Data to VMFT Format' area shows the names and locations of the calibration data file, presentation library file and output folder. The folders can be changed by clicking on their respective Browse buttons and navigating to the required destination, although it is recommended that these default settings are not changed.
8. Click the **Convert Calibration Data** button to convert the raw calibration data to VMFT format. When successfully converted the green tick icon appears next the Convert button.
9. The Monitor Calibration Data Reader window can now be closed.

A.2.4 Installing via an External Device

Note: *If a colour calibration file is not available, contact Sperry Marine for this information, quoting Display model and serial numbers.*

The calibration file is normally supplied with the monitor, either on CD, or on a 3 ½ " floppy disk, and is named 'Mon_VM_3p4.dat' or similar. Before proceeding with installation the calbration file must be transfered to a USB memory stick.

To install the ECDIS colour calibration file do the following:

1. With the calibration file transfered to a memory stick, insert the memory stick into one of the USB connectors at the front of the VisionMaster PC.
2. Navigate to the memory stick and copy the new calibration file, 'Mon_VM_3p4.dat', to the following directory: C:\Program Files\Sperry Marine\VisionMaster\Output\ColorFiles\ECDIS
3. Name the new file as: 'EcdisColors.dat'.

A.2.5 Checking for Alarms

Verify no alarms or warning are present. Alarms and Warnings that may be displayed in case of issues are:

- **Colours Not Approved** - indicates that the correct colour calibration file is missing, invalid, has an incorrect filename, or is located in the wrong directory.
- **Monitor Comm Error: Bad Data** - indicates that the monitor failed to acknowledge a command.
- **Monitor Comm Error: No Response -** indicates that the system is unable to communicate with the monitor.

For information on other alarms and warnings, refer to the ECDIS and Chart Radar User Guides.

Set and test display brightness and colours as described in section Section A.3.1 '*Monitor Brightness Check*'.

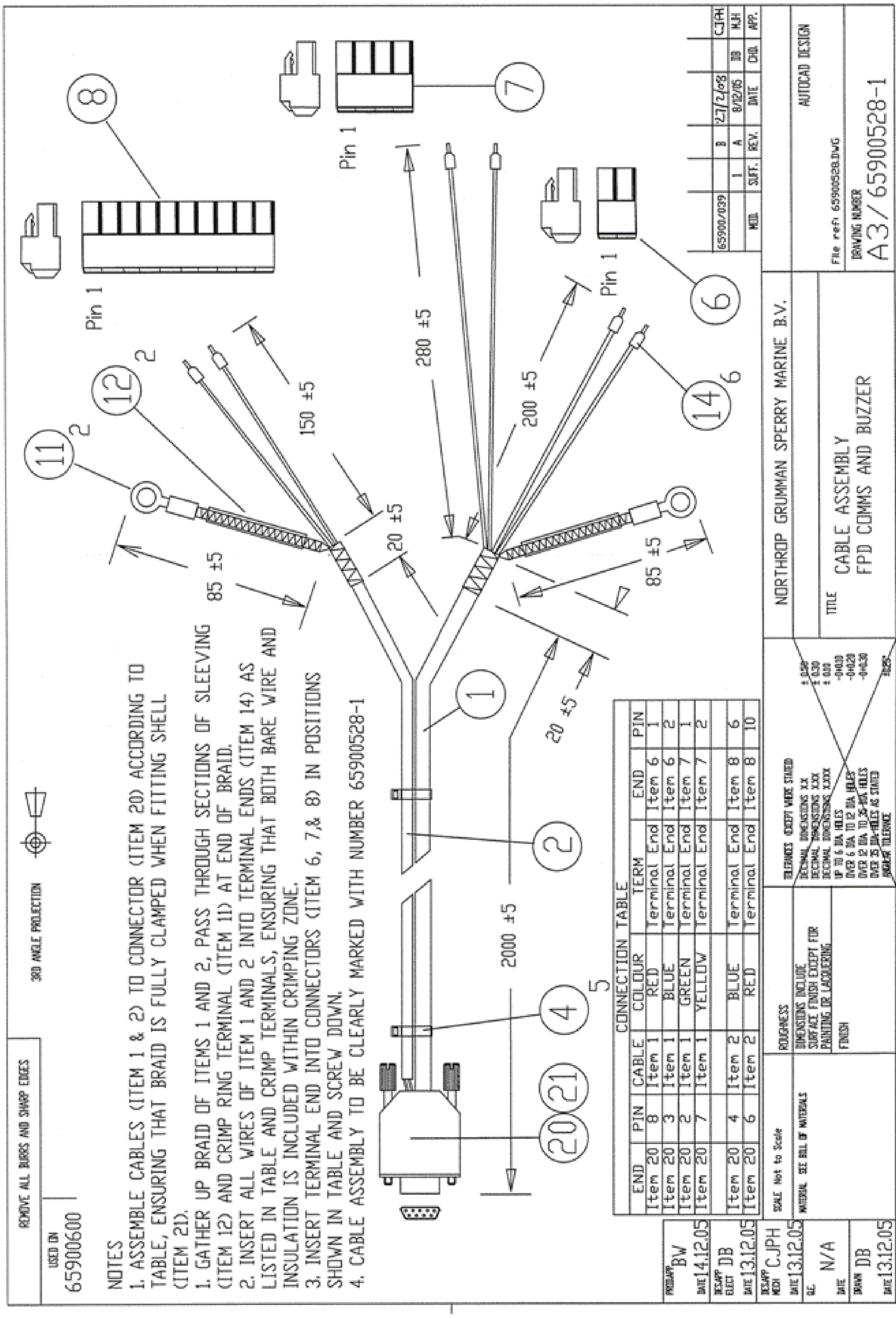

Figure A.2 Cable Assembly for Monitor Comms & Buzzer

A.3 Adjustment for Ambient Lighting Conditions

To match the VisionMaster display to ambient lighting conditions, the display brilliance is selected from a list of pre-defined Day/Night settings. Darker settings are intended to reduce the effects of the display on the operator's vision at night.

Colours used in the display of electronic charts are affected when a selection is made. To ensure that all chart information is visible, the controls on the monitor must be set properly.

For information and selection of the Day/Night modes and Brightness Check, refer to the ‘Brilliance’ chapter in the ECDIS and Chart Radar User Guides.

The LCD monitor has a single brightness adjustment control on the front panel. Contrast adjustments for LCD monitors are preset to an optimal setting, and there is no contrast control on the monitor. The brightness adjustment control is marked with an indexed setting, calibrated at the time of system installation. Before making an adjustment for ambient light, the control should be set to its indexed position.

On workstations that are configured for an LCD monitor, the system has the capability to automatically set the optimal monitor brightness level, based upon known display characteristics of the hardware. The automatic adjustment is made whenever a new ambient light option is selected. Once the automatic setting for monitor brightness has been made, the manual controls can be used to change monitor brightness from the preset level if necessary.

To ensure that the chart display conforms to established standards, it is recommended that the monitor brightness check be performed after changing the setting for ambient light.

In addition to the brightness check, a periodic test of chart colours should be made to evaluate the performance of the monitor. This evaluation is made via the SENC Color Diagram facility. Refer to the ‘Brilliance’ chapter in the ECDIS or Chart Radar User Guides.

A.3.1 Monitor Brightness Check

The brightness check is a method for accurately setting the monitor's brightness control to an optimal setting. This adjustment is made from the Brightness Check window.

Figure A.3 Brightness Check Window

The Brightness Check window contains a gray box within a black rectangle. When the brightness check is performed, the operator adjusts the monitor controls while observing the gray box. All colors used in the electronic chart should be clearly visible when the gray rectangle can just be seen.

To perform the Brightness Check:

1. From the **Brilliance** menu, select the **Brightness Check** submenu.
2. Turn the brightness control so that the white index line is at the top position.
3. Turn the brightness control down (anti-clockwise) and observe the grey box in the centre of the window.
4. If the box is not visible, increase the brightness setting until it can be just distinguished in the window; or
5. If the box is clearly visible, leave the brightness control at the indexed setting.

After the brightness check adjustments have been made, the `black level' of the monitor is correctly set. Use the brightness control only if further adjustment is required for visibility.

A.3.1.1 Monitor Brightness Check on new Hatteland Monitors

For ECDIS calibrated units that use the later version of Hatteland monitors, the brightness is checked via the monitor’s keypad status LED.

For information on checking the brightness level on these monitors, see “Keypad Status LED for ECDIS Calibrated Products” on page 4-16 of Chapter 5 ‘*Fault Reporting and First Line Servicing*’.

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Appendix B

RS422/485 PCI Serial Card Installation

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Figure B.1 Outline Drawing of PCI Serial Card B-4

B.1 RS-422/485 PCI Serial Card

This Appendix describes the installation of a Dual Port RS422/485 PCI Serial Card into the Processor unit of a VisionMaster consule (deck mounted or tabletop version).

A PCI Serial Card is installed if the product type you are using does not require radar input, (i.e. an ECDIS without radar overlay or a Conning Information Display) then a PCIO unit may not be fitted to the node.

Note: *The PCI Serial Card is not suitable for installation into a 19" Integrated Display.*

The default communication protocol setting for the card is RS485, but in general, the card should be configured for RS422.

For information on configuring the PCI serial card after installation, refer to VisionMaster Ship's Manual - Volume 2, Chapter 1 '*Appendix C Configuring Peripheral Devices*'.

B.2 Installation Procedures

B.2.1 Preparing the PCI Card

Before installing the PCI card into the card slot in the Processor set the termination jumpers and switches to the interface type (RS485 or RS422) as described below and shown in Figure B.1.

Note: *The configuration for most applications, including Hatteland monitors, is RS422 with no termination.*

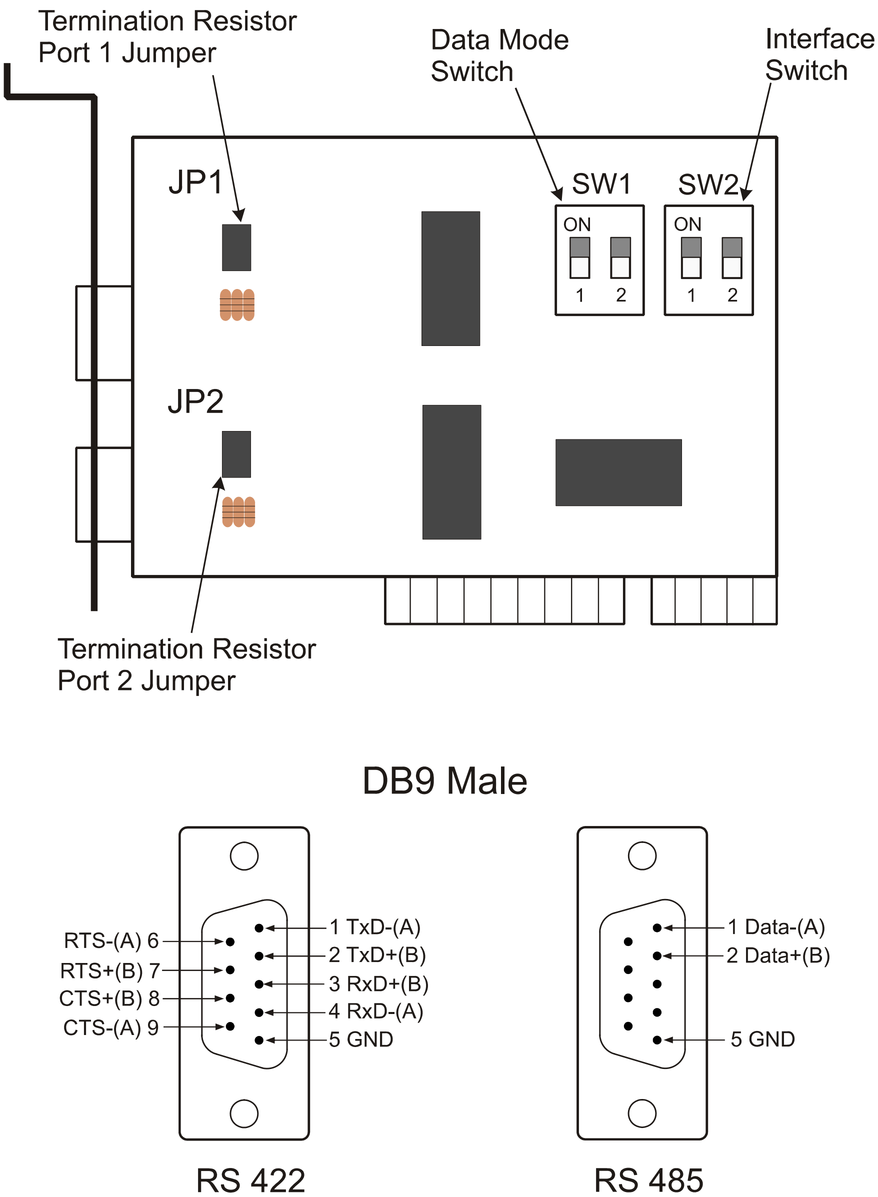

Figure B.1 Outline Drawing of PCI Serial Card

B.2.1.1 RS422 Configuration for VisionMaster Systems

1. Set the SW2 Interface switches for Port 1 and Port 2 to **OFF**
2. Set the SW1 Data Mode switches for Port 1 and Port 2 to **ON** or **OFF** (invalid when SW2 is set to **OFF**)
3. Set the JP1 Termination Resistor Port 1 to **OPEN**
4. Set the JP2 Termination Resistor Port 1 to **OPEN**

B.2.1.2 RS485 Configuration

1. Set the SW2 Interface switches for Port 1 and Port 2 to **ON**
2. Set the SW1 Data Mode switches for Port 1 and Port 2:
   a. **ON** to Automatic Data Direction Control Mode
   b. **OFF** to By TRS Mode
3. Set the JP1 Termination Resistor Port 1 (valid when SW2 is set to **ON**):
   a. **OPEN** not using Termination Resistor
   b. **SHORT** using Termination Resistor
3. Set the JP2 Termination Resistor Port 1 (valid when SW2 is set to **ON**):
   a. **OPEN** not using Termination Resistor
   b. **SHORT** using Termination Resistor

B.2.2 Installing the PCI Card into the Processor

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

CAUTION – Electrostatic Sensitive Devices (ESSDs)

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

Before installing the PCI serial card shut down the system from the VisionMaster FT application, and when fully powered down, switch the On/Off switch located on the underside of the Control Panel to OFF.

1. Turn the On/Off switch at the rear of the Processor to Off.

2. From the front of the Processor disconnect the two USB cables from the control panel USB port.
3. Remove the four screws and washers securing the Processor shelf to the console frame. Pull the Processor and shelf forward and lever the unit down to access the rear cables.
4. From the rear of the Processor disconnect the following two cables (the remaining cables to the Processor do not need to be disconnected) :
   a. power cable from the PCIO unit;
   b. video/data cable from the PCIO unit.
5. Unscrew the nine pan head screws securing the top cover of the Processor.
6. With the top panel removed, disconnect a pan head screw securing one of the PCI blanking plates at the rear of the unit.
7. Plug the PCI card firmly into the free 32-bit PCI slot.
8. Secure the PCI card to the Processor chassis with the blanking plate screw.
9. Replace the top cover.
10. Power up the Processor. The BIOS will automatically set the IRQ and I/O address.
11. For software installation, refer to VisionMaster Ship’s Manual - Volume 2, Chapter 1 ‘*Appendix C Configuring Peripheral Devices*’.

CHAPTER 5

FAULT REPORTING AND FIRST LINE SERVICING

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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 printed circuit boards (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 Information

If the unit has a fault, please contact your supplier, local dealer, or one of our 24/7 service locations listed below:

Europe & Middle East:	24-Hour Service (Netherlands) Tel: +31 (0) 10 44 51 630 Fax: +31 (0) 10 44 51 632 service.eu@sperry.ngc.com
Asia:	24-Hour Service (Singapore) Tel: +65 6274 3332 Fax: +65 6271 3339 service.asia@sperry.ngc.com
North & South America:	24-Hour Service (USA, New Orleans) Tel: +1 504 371 8365 Fax: +1 504 371 8368 service.us@sperry.ngc.com

Or, request service support on-line by visiting www.sperrymarine.com, where a list of our offices can also be found.

1.2 Information Required for Service

Please give the following details when reporting a fault:

- Name of vessel (Satcom or Fax number if fitted).
- Equipment type, including prefix and suffix letters.
- Software status (version number).
- Next port of call, ETA (estimated time of arrival) and ship's agents.
- Fault description (with as much detail as possible).
- Contact name.

2 Fault Identification and Isolation

WARNING! – Lethal Voltage Hazard

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: THERE ARE HIGH VOLTAGES PRESENT AT ANY POWER SUPPLY THAT IS NOT MAINS ISOLATED.

2.1 VMFT Ship’s Manual FT System Fundamentals

To help simplify the diagnosis of system faults, the following paragraphs describe some fundamental characteristics of the VMFT Ship’s Manual FT units.

2.1.1 Power Supply Start-up

WARNING! – Lethal Voltage Hazard

ONCE MAINS IS APPLIED TO THE PSU BOARD IN THE TRANSCEIVER, HIGH-VOLTAGE DC IS PRESENT ON ALL PRIMARY POWER COMPONENTS. THIS VOLTAGE IS PRESENT EVEN WHEN THE UNIT IS SWITCHED OFF. 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: a DC voltage >2.5V between the lines will start the Power supply.

Note: *A test link LKA on Power Supply PCBs 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 to position 2–3 for normal operation otherwise the PCIO will not be able to switch the Transceiver on or off.*

2.1.2 Azimuth and Comms

There are four separate signals between the PCIO unit and the Transceiver:

- serial control messages from the PCIO;
- video;
- RS422 trigger; and
- serial tellback messages from the Transceiver.

The tellback messages are a serial message stream. They contain the azimuth, heading marker information, 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 PCIO. The frequency of the messages is reduced under this condition.

If azimuth pulses are lost no messages will be sent to the PCIO causing a "TX Comms" alarm.

2.1.3 Fault Identification and Isolation

Each of the various signals in the radar system may pass through several of the units before reaching its final destination. Therefore, a low video alarm on a Display could be caused by a failure in the Transceiver, PCIO unit, Processor unit, Interswitch (if fitted) 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 section.

Note: *The service engineer must check the following before proceeding with fault diagnosis:*

1. *Ships mains is present at each of the units where expected.*
2. *All isolating switches are in the correct operating position.*

2.2 Monitor Unit

Note: *The following sub-sections refer to 320mm and 250mm monitors on deck mounted and tabletop console assemblies. The LCD unit on the 19” integrated tabletop includes a brilliance control only; there are no test controls as described below.*

There are four sizes of flat panel monitor:

- 250mm radar circle, 19” screen diagonal (Hatteland)
- 320mm radar circle, 23” screen diagonal (Hatteland or Melford)
- 320mm radar circle, 25.5” screen diagonal (Melford and ISIC)
- 320mm radar circle, 27” screen diagonal widescreen (Hatteland)

2.2.1 Hatteland Monitor User Controls

This section applies to the following legacy Hatteland modules: 65817G, 65823A, 65923C, 65919C and 65919T.

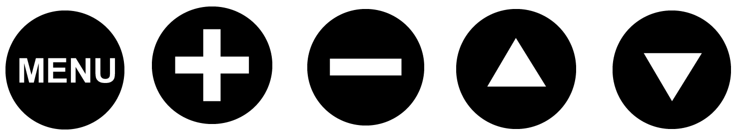
An LED between the On/Off button and the brightness control shows the operational status of the monitor.

- A Green LED shows when the power supply is active;
- A Red LED shows if the monitor is switched off or there is a power supply trip.

The On Screen Display (OSD) controls are located under a small metal cover located on the lower left side of the monitor fascia. To access the OSD controls, remove the cover, which is held by two screws

The following monitor OSD controls are available:

Menu Plus Minus Up Down



Before using the OSD controls turn the brightness control fully clockwise. Check that the LED adjacent to the brilliance control is illuminated green.

To use the OSD controls:

- Press **Menu**. The OSD main menu will appear superimposed over the lower right area of the VisionMaster screen.
- The OSD includes sub menu icons at the top and bottom of the screen. To move to each successive icon press **Menu**.
- Select options within a sub menu by pressing **Up** or **Down**, the selected option will turn yellow.
- Use the **Plus** or **Minus** buttons to increase/decease values.

- Use the **Plus** or **Minus** buttons to move the selection left or right, the selected option will appear green.
- To confirm a selection press **Plus**, to abort press **Minus**.

There are two OSD main menus:

- Simplified OSD menu, which includes three icons across the top of the OSD and six icons across the bottom of the OSD.
- Advanced OSD menu, which includes six icons across the top of the OSD and six icons across the bottom of the OSD.

Note: *It should not normally be necessary to access the Advanced OSD menu. Only those functions that are relevant to the operation of the VisionMaster FT radar are described in detail in Section 2.2.1.2 'Advanced OSD menu'.*

To access the Advanced OSD menu, press and hold the **Down** button while switching the power on.

2.2.1.1 Simplified OSD Menu

The simplified OSD main menu includes the following nine sub menus:

The three top icons are:

- Frequency and Phase
- Status
- Position

The six bottom icons are:

- Picture in Picture
- Language
- Video Source
- Utilities
- Volume
- Exit

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 and has a default value of 100%. Use the **Plus** and **Minus** buttons to fine tune the data sampling position. It is not possible to give a typical figure for this parameter, as each unit may be different.
- **Sharpness** adjusts the image sharpness, the default value is 100%. Use the **Plus** and **Minus** buttons to change the sharpness. The values range from 0 to 4, with 4 as maximum value.

- **Picture Type** should be at a default setting of **Still**.

Status

This sub menu displays, but cannot adjust, the monitor resolution and frequency as follows:

Table 1: Monitor Resolution and Frequency Status

Parameter	Horizontal	Vertical
Resolution	1280	1024
Frequency	63.9kHz	60kHz

Position

These functions move the image within the display area.

- The **Plus** and **Minus** buttons move the image right and left respectively.
- The **Up** and **Down** buttons move the image up and down respectively.

Picture in Picture

The picture in picture (PIP) parameters include PIP size, PIP source and horizontal/vertical position.

- **PIP Size** - ensure that the PIP window size is set to **0** (minimum value).
- **PIP Source** - select the video input source to be displayed.
- **Horizontal/Vertical** - adjust the PIP window horizontally and vertically (defaults to 0%).

Language

This sub 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 the OSD Settings will be of use for a VisionMaster FT Display.

The **OSD Setting** sub menu displays the following parameters with their default values:

Table 2: Monitor OSD Settings

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 Rotate	Normal	Do not change
User time Out	10 seconds	User may need to increase this

CAUTION

Do not change settings in Utilities sub menus Direct Access, Calibrate RGB gain or Load Factory Defaults.

Do not change the default settings in Advanced Utilities.

Volume

This menu has no function for a VisionMaster FT Display.

Exit

Selecting this sub menu will exit the OSD main menu. Press the **Plus** or **Minus** buttons to save the current settings and then exit.

2.2.1.2 Advanced OSD menu

If **Load Factory Defaults** is activated in error, or the brilliance or aspect ratio are incorrectly set, then it will be necessary to use the Advanced OSD menu functions to check and, if necessary, set certain parameters.

All of the Simplified Menu functions are repeated on the Advanced OSD menus. Only the additional functions are described below.

Brightness and Contrast

The values set by activating Load Factory 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.

2.2.2 New Hatteland Monitor User Controls (Keypad with HOTKEY Function)

This section applies to the following Hatteland modules: 65817G, 65823A, 65927C and 65923C.

The new monitor user controls include a potmeter and tactile keypad. Brightness is adjusted by using the potmeter. The keypad provides access to the control of brightness, the configuration menu and hotkey functionality.

The keypad includes 5 push buttons and a status LED ring, see Figure 5.1 below. The LED ring provides feedback for various operational modes of the monitor, see Figure 5.2 and Figure 5.3.

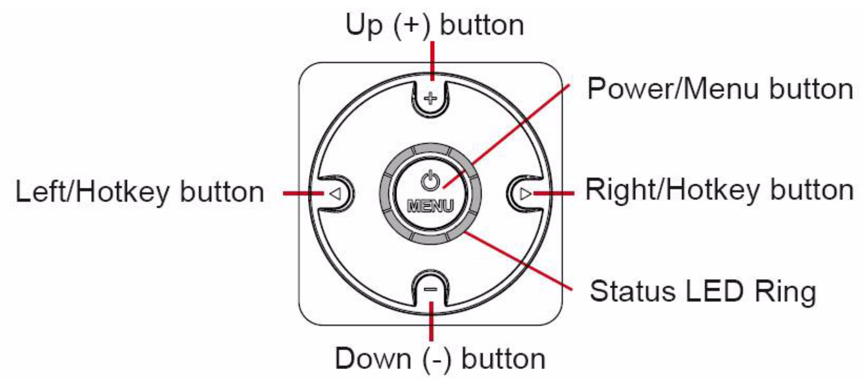


Figure 5.1 Hatteland Monitor Keypad Functionality

2.2.2.1 Keypad Functionality

Turning Power On

To turn the unit on, push the navigator MENU button inwards and release instantly. The unit will start searching for signal sources and a green LED will move around the LED ring to indicate the search. Refer to Status LED for the various LED patterns that can occur.

Turning Power Off

To turn the unit off, push the navigator MENU button inwards and hold down for 6 seconds. After the first 3 seconds the menu will appear, 3 seconds later the unit is turned off and all LED indicators will turn red. Release the MENU button.

Keypad Button Functions

The following functions are available from the Keypad push buttons:

- **Power Menu** - On/Off & On Screen Display (OSD) menu access.
- **Left/Hotkey** - exit the current function and navigate to the previous OSD menu.
- **Right/Hotkey** - enter sub-menu and execute/set selected function.

- **Up (+)** - increase brightness, adjust positive values, visual movement, OSD menu navigating upwards and confirm.
- **Down (-)** - decrease brightness, adjust negative values, visual movement, OSD menu navigating downwards and confirm.

2.2.2.2 Hotkey Function

To access the OSD menu press the MENU button for 3 seconds. The OSD menu appears as a popup window over the Display, with the current selection highlighted in red.

Hotkeys are assigned to both the Left and Right buttons. To activate the hotkey functionality, press one of the buttons and release instantly. Press the **(+)** or **(-)** buttons to navigate up or down the menu. To select a function, or enter the sub-menu for that function, press the **Right/Hotkey** button. To exit the OSD menu press the MENU button and release instantly.

For all information on the OSD menu functions, refer to the Hatteland User Manual - Maritime Multi Display Models Series 1, document number INB100036-1.

2.2.2.3 Keypad Status LED Overview

The keypad includes a multi-purpose indicator LED status ring, which through different patterns based on realtime activity displays the status of the signal detected, including power on/off, calibration, menu activity etc.

The LEDs illuminate either green or red, based on activity, see Figure 5.2.

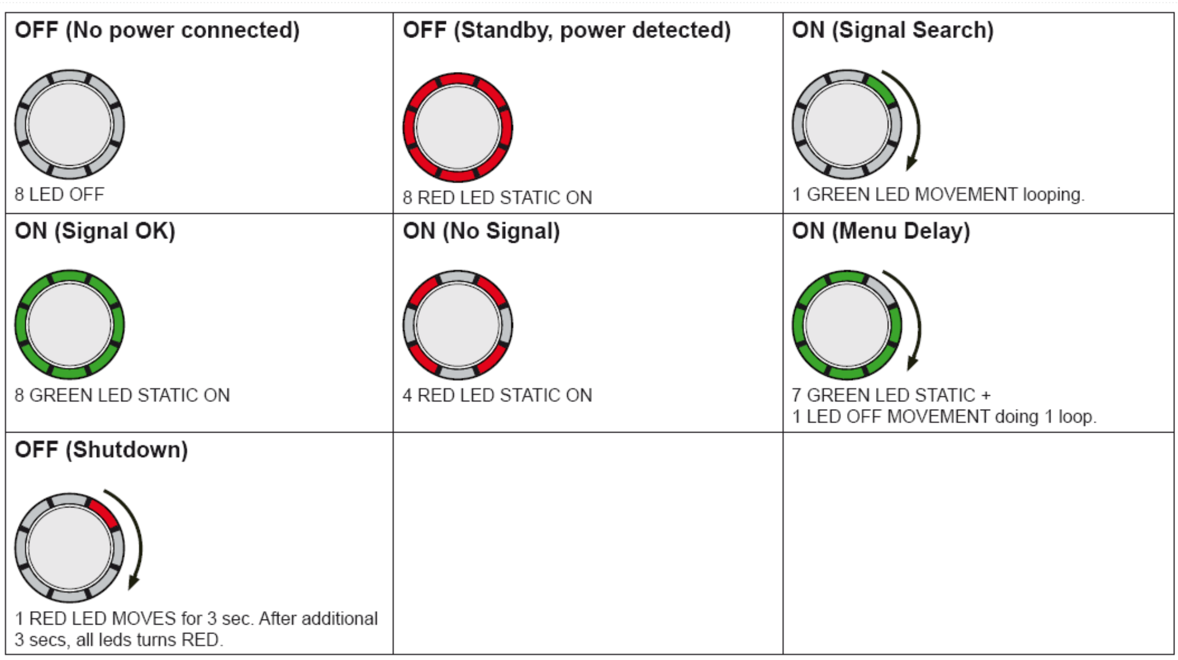


Figure 5.2 Status LED Overview

2.2.2.4 Keypad Status LED for ECDIS Calibrated Products

For units that are ECDIS calibrated the following LED pattern indicates that the backlight/brightness is at calibrated level. **(Calibrated +)** or **(Calibrated -)** means that the brightness adjustment value is above or below the calibrated brightness level. Adjust the brightness until the pattern **(Calibrated)** is displayed, see Figure 5.3 below.

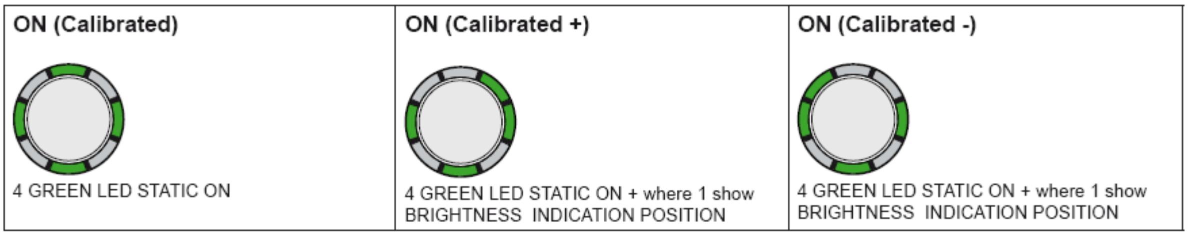


Figure 5.3 Status LED for ECDIS Calibrated Products

2.2.3 Melford Monitor Test Controls

This section is for Melford console models 65923E (23.1") and 65926E (25.5").

Turn the brilliance control fully clockwise. Check that the 'ON' LED adjacent to the set-up controls is illuminated.

To the left of the brilliance control, there are four push buttons marked MENU, SCROLL, MINUS and PLUS.

MENU is used to activate the On-Screen Display (OSD). Once the OSD is shown, the MENU push button is used to enter or exit a specific sub menu.

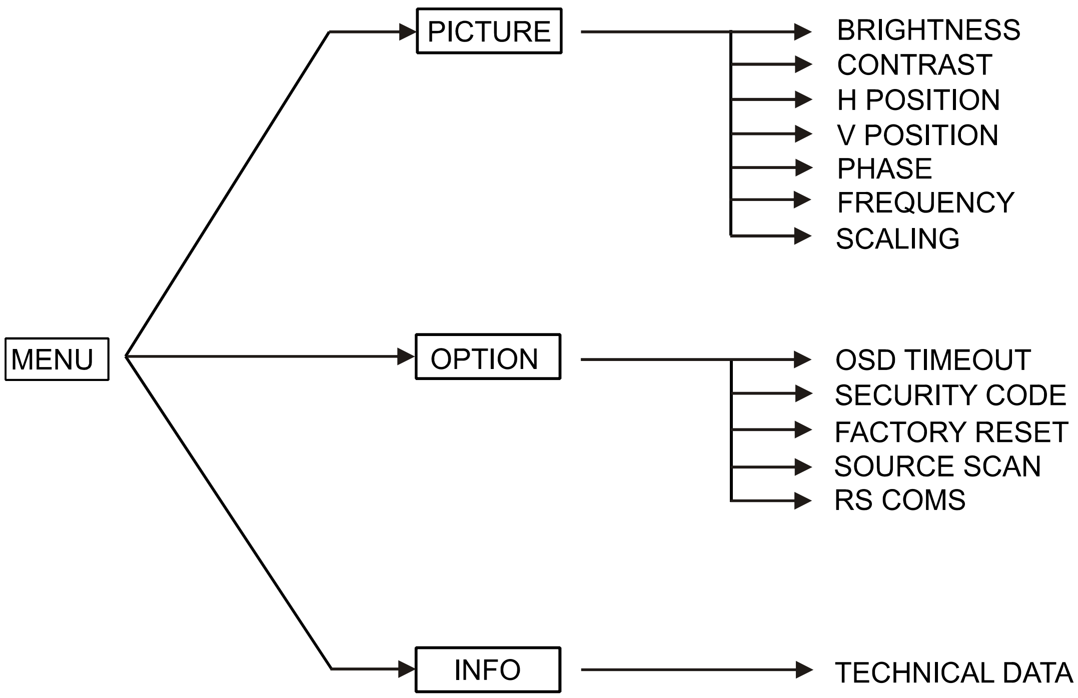
SCROLL enables you to move through top level and sub menus.

MINUS & PLUS adjust the selected value.

The menu structure is illustrated below. To activate:

1. Press MENU.
2. A prompt for a code appears. Press SCROLL, PLUS, MENU, MINUS.
3. Press SCROLL to select the menu item (shown by the highlight).
4. Press MENU to open that submenu.
5. Use SCROLL again to pick (highlight) the item required.
6. 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.



Typical values are shown in Table 3 below.

Table 3: Melford Monitor Parameter Values

Parameter	Setting
Brightness	19
Contrast	68
H Position	50
V Position	50
Frequency	1744
Scaling	Fill Aspect ratio
Security Code En	Enable
OSD Timeout	60
Source Scan	Off
RS Comms	422
Mode	13
Resolution	1280 x 1024
H Frequency	63,979 KHz
V Frequency	60 Hz

2.2.3.1 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.

2.2.3.2 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.

After performing a reset, the brightness, contrast and OSD Timeout settings must be re-adjusted to their nominal values shown above.

2.2.4 ISIC Monitor User Controls

This section applies to the following ISIC modules: 65926K and 65926L.

The control panel touch buttons at the front of the monitor are illuminated and will be dimmed depending on the backlight brightness (see Figure 5.4).

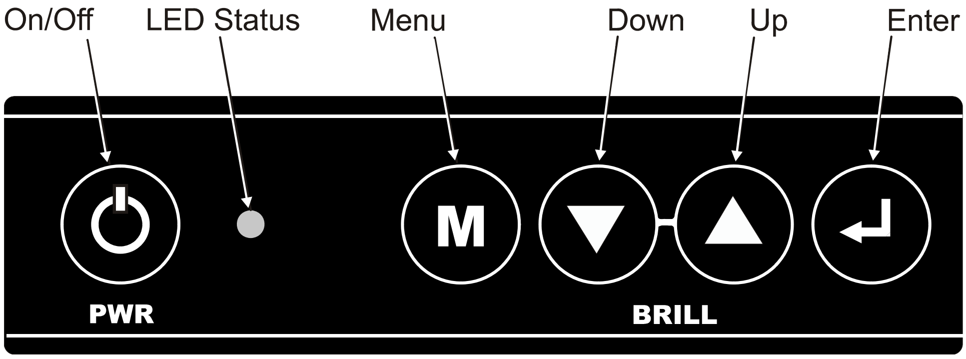


Figure 5.4 ISIC Monitor Controls

2.2.4.1 Turning the Monitor On and Off

The On/Off (**PWR)** button turns the monitor on or off. In Off mode the status LED to the right of the button displays red. Press the button briefly to turn on, the LED changes to green. To turn off press the button and hold for about 5 seconds until the LED changes to red.

2.2.4.2 Accessing the OSD

To access the on-screen display (OSD) functions press the **Menu** and **Enter** buttons simultaneously. The OSD main menu and sub-menu for the currently selected menu item appear to the side of the screen. If no menu selections are made after approximately 30 seconds the OSD closes.

2.2.4.3 OSD Functions

Note: *The OSD functions on the ISIC monitor are factory set. It is advised NOT to change any of these settings without first contacting NGSM service.*

Each OSD main menu feature includes associated sub-menu features. Sub menus will in turn include specific functions. Note that some OSD features may not be available, if a feature is not available the text is greyed out.

Figure 5.5 shows all the main menu features and the sub menu features for **Image Select**.

1. To navigate through the OSD press the **Up** and **Down** buttons and then press the **Enter** button to select a specific setting.
2. To go back to the previous menu item press the **Menu** button.

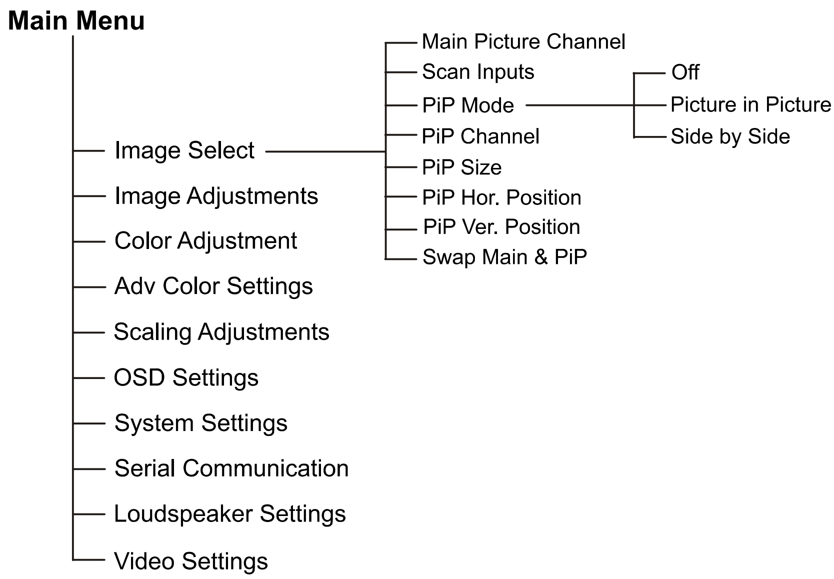


Figure 5.5 ISIC OSD Menu Structure

2.2.5 Monitor Cables

The following Monitor cables are included:

- AC power from the PCIO to the IEC power input
- 15-way VGA video cable or DVI cable from the Processor unit
- 9-way comms and buzzer cable from the PCIO unit.

On legacy Hatteland monitors (see Section 2.2.1) ensure the switch at the rear of the monitor is set to RS422, in order to receive the correct monitor communication with VisionMaster.

On new Hatteland monitors (see Section 2.2.2) ensure the cable from the PCIO is plugged into an RS422 labelled connector, which is connected to the 160-way connector.

2.3 Control Panel

The control panel assembly on deck mounted and tabletop console assemblies houses the following serviceable modules:

- Control Panel or Trackball
- On/Off switch
- USB connector (included if the control panel assembly houses a trackball).

On the 19” integrated tabletop version the complete control panel (basic or trackball only) is a serviceable module.

2.3.1 Control Panel Cables

Check the connector security of the following cables:

For a basic control panel (BCP)

- Two USB cables from Processor unit for radar controls and USB socket on BCP.
- PS2 cable from Processor unit to trackball.
- Power control switch to PCIO unit.

For a trackball with separate USB connector:

- PS2 cable from Processor unit to trackball
- Power control switch to PCIO unit
- Dual USB cable to Processor unit

2.4 Processor Unit

The following section refers to Processor units used on deck mounted and tabletop 250mm and 340mm console assemblies.

2.4.1 General Description

The Processor unit is based on a Core 2 Duo processor running Windows XP at 2.8GHz and a graphics card running with 32bit colour at 1280 x 1024 resolution. It contains the Scan Converter (SC) interface PCB that processes data from the top unit.

The front of the Processor unit includes the following:

- Power On LED and HDD (hard disk drive) LED
- two USB ports (both going to the control panel)
- one DVD/CD ROM drive
- an Air In filter (air out is at the rear of the unit)

The rear of the Processor unit includes the following:

- two PS2 inputs, one of which is used by the trackball
- one serial input
- one parallel input
- four USB ports (two ports can be used for security devices, one is used for the PCIO and one is spare)
- one mains power input
- Processor unit On/Off switch

2.4.2 Physical Arrangements

Two metal brackets attached to the left and right side of the Processor unit are used for the attachment of four AV mounts. The assembly is then attached to the lower pedestal support shelf.

2.4.3 Processor Unit Cables

Check the connector security of the following Processor unit cables:

- AC power from the PCIO to the IEC power input
- Rear USB port to PCIO unit
- Processor SC card (15 way) to PCIO unit
- Processor graphics card (15 way) to Monitor unit
- PS2 port to trackball
- Front USB port to control panel

2.5 Processor for 19” Integrated Tabletop

The following section refers to the Processor used in the 19” integrated tabletop.

2.5.1 General Description

The Processor unit installed in the 19” Integrated Tabletop is based on a Core 2 Duo processor running Windows XP at 1280 x 1024 resolution, 32 bit colour at 60Hz. It includes a slot for the Scan Converter (SC) interface PCB that processes data from the radar top unit.

The processor includes the following modules, inputs and ports:

- Fan assembly
- two PS2 inputs, one of which is used by the trackball
- one serial input
- one network port (10/100/1000 Base-T)
- ten USB ports (two ports are at the front of the tabletop, two ports can be used for security devices, one port is used for the control panel, one is used for the PCIO and four are spare).

2.5.2 Processor Unit Cables

Check the connector security of the following processor unit cables:

- USB port to PCIO unit
- Processor SC card (15 way) to PCIO unit
- Processor graphics card (15 way) to LCD
- PS2 port to trackball
- USB port to control panel

2.6 PCIO

The following section describes the separate PCIO unit used on deck mounted and tabletop 250mm and 340mm console assemblies, and the PCIO board used in the 19" integrated tabletop version.

Any differences between the PCIO board and the PCIO unit are described in the relevant sections.

2.6.1 General Description

There are two PCIO unit variants; one fitted with a standard compass board and one fitted with a special compass board.

The following inputs are provided on the PCIO PCB:

- analogue compass data (stepper or synchro)
- analogue log (pulse) data
- nine serial data inputs, (one being a dedicated serial compass input).

The following outputs are provided:

- six serial data outputs
- three relay outputs for vigilance alarm, remote alarm and system operational
- one buzzer output to monitor.

2.6.2 Technical Description

2.6.2.1 PCIO Microcontroller PCB

The PCIO is operated by a microcontroller. This supervises the receipt and transmission of external data to the Processor in a number of formats.

Serial Inputs/Outputs

Three serial inputs (1, 2 and 3) are connected to the microcontroller, via a 4-channel UART and are transmitted to the Processor Control Port at a baud rate up to 38400. Only IEC 61162 format sentences are accepted at these inputs. The drive to these inputs may be either RS422 or RS232.

External 61162-2 heading data sentences may be received at Serial Input 1. These will be used, when the serial heading source mode 1 is selected, to supply heading data into the PCIO. They will be checksum checked before use by the PCIO to generate heading output messages.

External 61162-1 heading data sentences may be received at Serial Input 2. These will be used, when the serial heading source mode 2 is selected, to supply heading data into the PCIO. They will be checksum checked before use by the PCIO to generate heading output messages.

External 61162-1 sentences may be received at the Serial Input 3. These messages, when recognised as complete sentences, will be combined with other sentences appearing at the Processor Control Port output. These input sentences are not checksum checked by the PCIO but passed through to the Processor and are checked there.

Heading data sentences presented at the Serial Input 1 and 2 will also be combined at the Processor Control Port output, limited to a maximum message rate of 10Hz, with the other sentences received and generated.

Six serial inputs/outputs (4 through to 9) are provided that transmit external character based messages. These inputs and outputs are associated with USB devices 2 through 7, see Section 2.6.2.2 '*USB Port*'.

Serial messages received from the Processor are announced by interrupts to the microcontroller. The data is collected and the message type is interpreted by the microcontroller. The stored data either effects a configuration and control function or is stored ready for output message generation.

Relay Outputs

Three Relay outputs are provided for vigilance alarm, remote alarm and system operational. Each output provides a set of contacts; Normally Open Normally Closed and Common. The relay will be set ON for a logic '1' written to the appropriate latch bit. These may be used to switch external circuits with current/voltages up to 2.0A/15VDC.

Discrete Outputs

Two discrete (digital) outputs are provided. These outputs are pulled up to +5v via diodes so that the output may pull down an externally provided higher voltage (15V/1A max). The output will be pulled down for a logic '1' written to the appropriate latch bit. They are clamped to chassis for protection by transient suppressors.

Internal Timer

The internal timer is configured to generate an interrupt every 5ms. This generates the highest priority event timing for the main program and will drive a scheduler. This will initiate all the transmission of serial data and regulates the accesses to the various other inputs and outputs. External interrupts will have higher priority. Events requiring lower rates will occur less often in the scheduler.

2.6.2.2 USB Port

The USB port communicates all message and control data between the PCIO and the Processor. The PCIO contains seven USB UART devices that are connected via a USB Hub to the associated Processor USB Port.

The USB device number and serial ports associated with each UART are shown below.

USB No.	Serial Port
1	PC Control Port
2	Serial Input/Output 4 Port
3	Serial Input/Output 5 Port
4	Serial Input/Output 6 Port
5	Serial Input/Output 7 Port
6	Serial Input/Output 8 Port
7	Serial Input/Output 9 Port

The Input/output signals for each serial port are shown on the PCIO PCB by flashing red LEDs.

The baud rate for USB device 1 is set to 115200 by default. For USB devices 2 to 7, the baud rate required is defined by the requirements of the associated serial inputs and outputs.

2.6.2.3 Compass PCB

The compass PCB (standard or special) is mounted onto the microcontroller PCB. Appropriate input interfacing for the Stepper or Synchro inputs is provided on this PCB and a binary input is made available to be read by the microcontroller. The compass type is indicated by a three bit compass type code. Only one byte of the data can be read at a time. The interrupts are disabled during a read and each byte is read twice to ensure a valid correctly aligned value is obtained.

2.6.2.4 Watchdog Timer

The watchdog timer is driven by a toggling Watchdog output signal. This signal is shown by a flashing red LED on the microcontroller PSB. If a failure of the software lasts for a period longer than the Watchdog device delay, (approximately 1½ seconds), the LED will stop flashing and the watchdog device will generate a hardware reset to the microcontroller. This will ensure that a ‘hung’ system will always try to recover.

The Watchdog link is normally set at pin1 to pin2. If the link is set pin2 to pin3, the reset will repeatedly occur, if the link is not fitted at all the reset will not be generated except at power-up.

2.6.2.5 Power Supply Unit PCB

The power supply unit PSB provides a 24V external supply and a +/-15v external supply for an Interswitch (if fitted). It also supplies +/-15v to the PCIO PCB, which uses regulators to provide +/-12V, +5V and +3.3V.

2.6.3 PCIO Cables

On the PCIO unit check the connector security of the following power cable:

- Mains power to TSM terminal

On the PCIO PCB check the connector security of the following power cable:

- +/- 15V power to DC/DC Converter

Cables to Transceiver or Interswitch:

- 75 ohm Co-Ax from SKV terminal - Video In
- 75 ohm Co-Ax from SKM terminal - MIST IN
- 75 ohm Co-Ax from SKX terminal - MIST OUT
- Data cables from COM ports 3 to 7.
- Data cable from COM 8 to Interswitch (if fitted)

Cables to Processor:

- Video/Data cable (combined coax)
- USB cable from TSU terminal

2.7 Client/Server Radar Components

The following sub-sections detail the Client/Server Radar (CSR) system where the characteristics of the CSR components differ from the standard VisionMaster system described in preceding sections 2.1 to 2.6.

2.7.1 Server Processor Unit

The Server processor unit is based on a Core 2 Quad processor running Windows XP at 2.66GHz and a graphics card running with 32bit colour at 1280 x 1024 resolution. It contains a Network Front End (NFE) PCI card that processes data from the top unit. The NFE card samples analogue radar video and provides 8 separate digital output channels into system memory using DMA transfers.

The front and rear ports of the Server Processor are the same as described in Section 2.4.1 '*General Description*'.

2.7.1.1 Server Processor Cables

Check the connector security of the following Server processor cables:

- AC power from the PCIO Unit to the IEC power input
- USB port to PCIO unit
- Processor NFE card (15 way) to PCIO unit
- CAT5e or CAT6 Ethernet cable to network switch

2.7.2 Client Processor Unit

The Client processor unit is based on a Core 2 Quad processor running Windows XP at 2.66GHz and a graphics card running with 32bit colour at 1280 x 1024 resolution.

The front and rear ports of the Client Processor are the same as described in Section 2.4.1 '*General Description*'.

2.7.2.1 Client Processor Cables

Check the connector security of the following Client processor cables:

- AC power from the Mains Distribution Unit to the IEC power input
- Processor graphics card (15 way) to Monitor unit
- PS2 port to control panel
- Two rear USB ports to control panel
- CAT5e or CAT6 Ethernet cable to network switch

2.7.3 Mains Distribution Unit

The Mains Distribution Unit (MDU) takes 240V AC mains power from the ship's supply and provides switched AC power to the Monitor and Client processor. Power to two Client Ethernet switches comes via a 24V 50W Power Supply Unit (PSU).

Check the connector security of the following MDU cables:

- AC power to the Monitor
- AC power to the Client Processor
- Cable assembly (4-way) to On/Off switch

2.7.4 Ethernet Switches

The Ethernet switches used are 9G-port full Gigabit managed switches, supporting up to 5 100/1000BaseSFP slots.

2.7.4.1 Setting the DIP Switches

On a CSR system one of the Ethernet switches, typically a Server switch, should have their Master DIP switch enabled (see Figure 4.65 in Chapter 4 '*Installing Consoles & Displays*'). All other DIP switch settings should be set to enable Turbo Ring, with DIP switches 1, 2 and 3 set to off, see below.

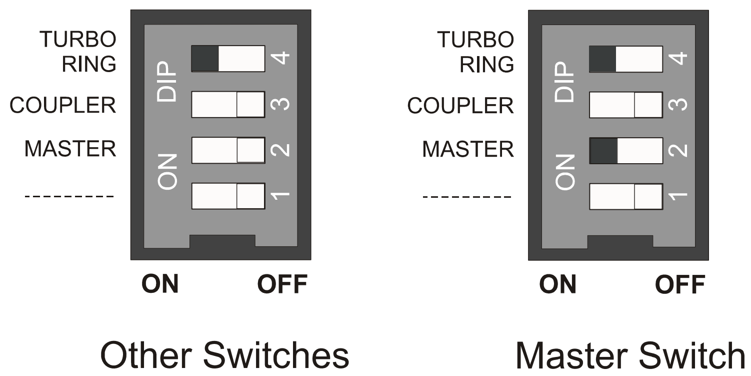


Figure 5.6 Ethernet Switch - DIP Switches

When Turbo Ring is selected the Ethernet switches will not normally require any further configuration such as adjustments to the switch's IP address or modes of operation.

2.7.4.2 Connecting the Ethernet Switch Ring Ports

The default ports used on the Ethernet switch (EDS-G509 series only) when the DIP switch is set to Turbo Ring are as follows:

- 1st Ring Port : G8
- 2nd Ring Port : G9

The 2nd Ring Port of one switch should be connected to the 1st Ring Port of the next switch in the ring. For details see Section 6 '*Cabling and Interconnection Diagrams*' in Chapter 4 '*Installing Consoles & Displays*'.

2.8 Fault Isolating Flow Charts (Console Assembly)

Flowcharts for the isolation of faults on the console assembly (Monitor, PCIO unit and Processor unit) and the 19” Integrated tabletop are shown on page 30 to page 41.

Flowcharts 2a, 2b, 3 and 4 cover the monitor and 19” integrated LCD picture faults. Flowcharts 5 to 11 cover the error messages that may appear which are relevant to the Console assembly hardware.

The Flowcharts should be read in conjunction with the following notes.

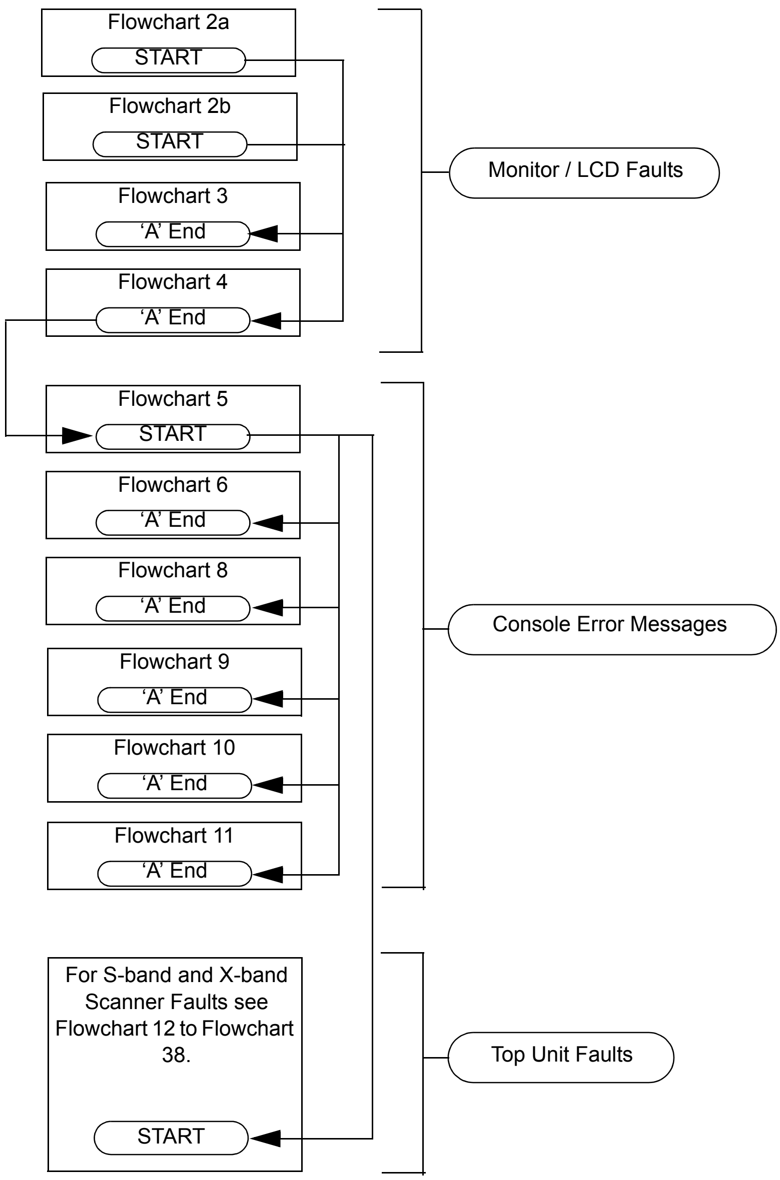
Notes: *Before using the following fault finding flow charts visually check the console modules to make sure there are no loose plugs or connections. After checking the module connection status always check that the configuration of all components on the system is correct by accessing the Configuration tool, see Volume 2, Chapter 1, ‘Configuration’.*

If faults cannot be rectified after reference to the console assembly fault finding flowcharts you may need to contact the VisionMaster FT service department to resolve the problem. Prior to contacting the service department use Table 4 to help specify the problem you may have with the console assembly.

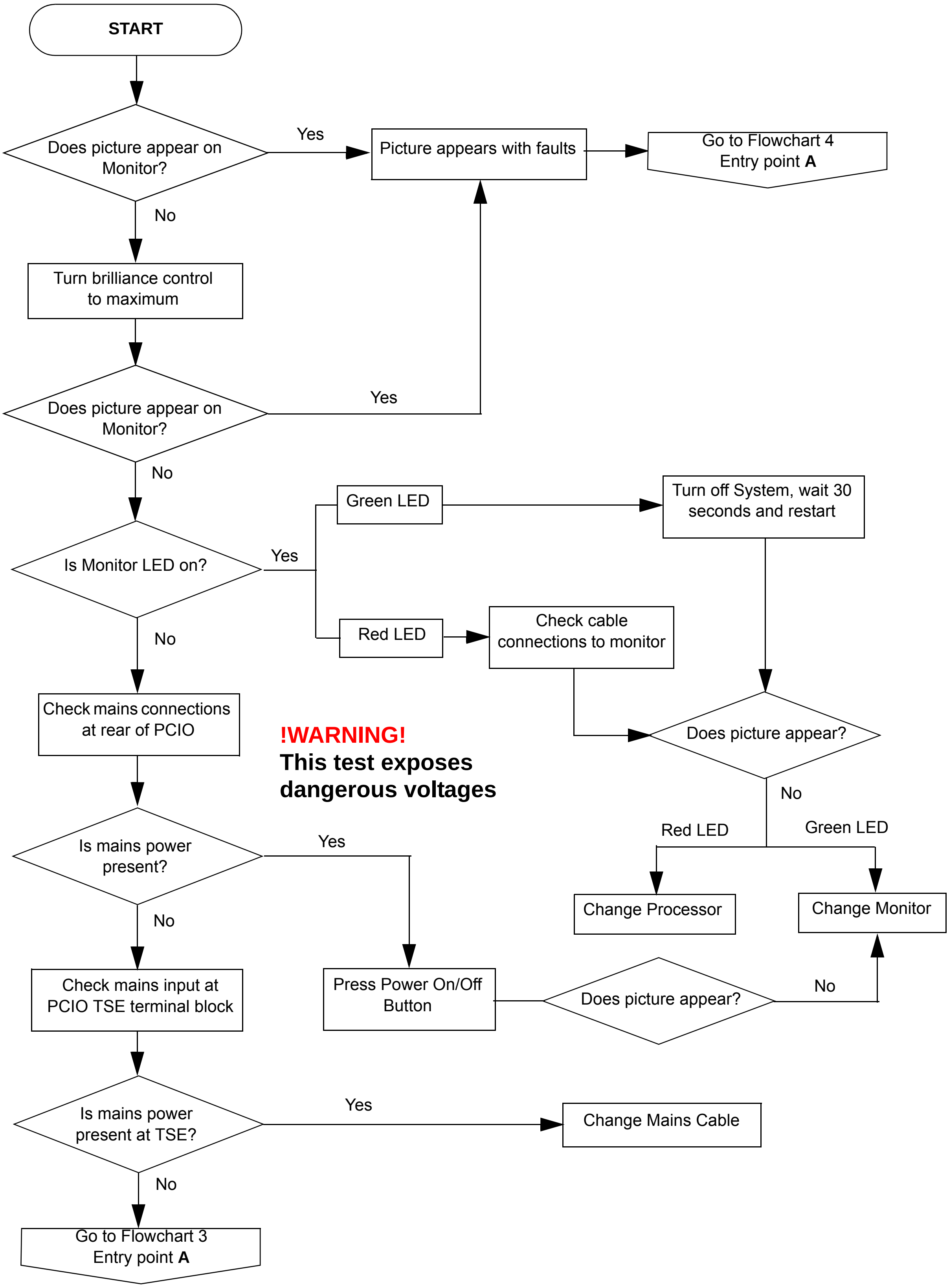
Table 4: Queries and Symptoms on Console faults

General Query	Specific Query	Example Symptoms
Is the display distorted?	Digital Distortion	Broken or missing text, misaligned text.
	Size Distortion	Non-circular range rings. Or picture too large/too small for the screen.
Are the colours correct?	Incorrect Colours	Different colours shown from those set.
	Discolouration	Set colours vary.
Where is the fault in the picture?	Within Radar Circle	Missing targets, no gain, strange patterns.
	Text and Synthetics outside radar circle	Missing text or strange patterns.
Is picture showing incorrect data?	Picture is OK but data is incorrect, or operation is incorrect	Incorrect data in menu. Non-function of menu.
Is the picture frozen?	Picture is partially frozen	Radar video updates appear but synthetics are frozen.
	Picture is fully frozen	No visible changes on screen and no audible alarm.
		No visible changes on screen and audible alarm.

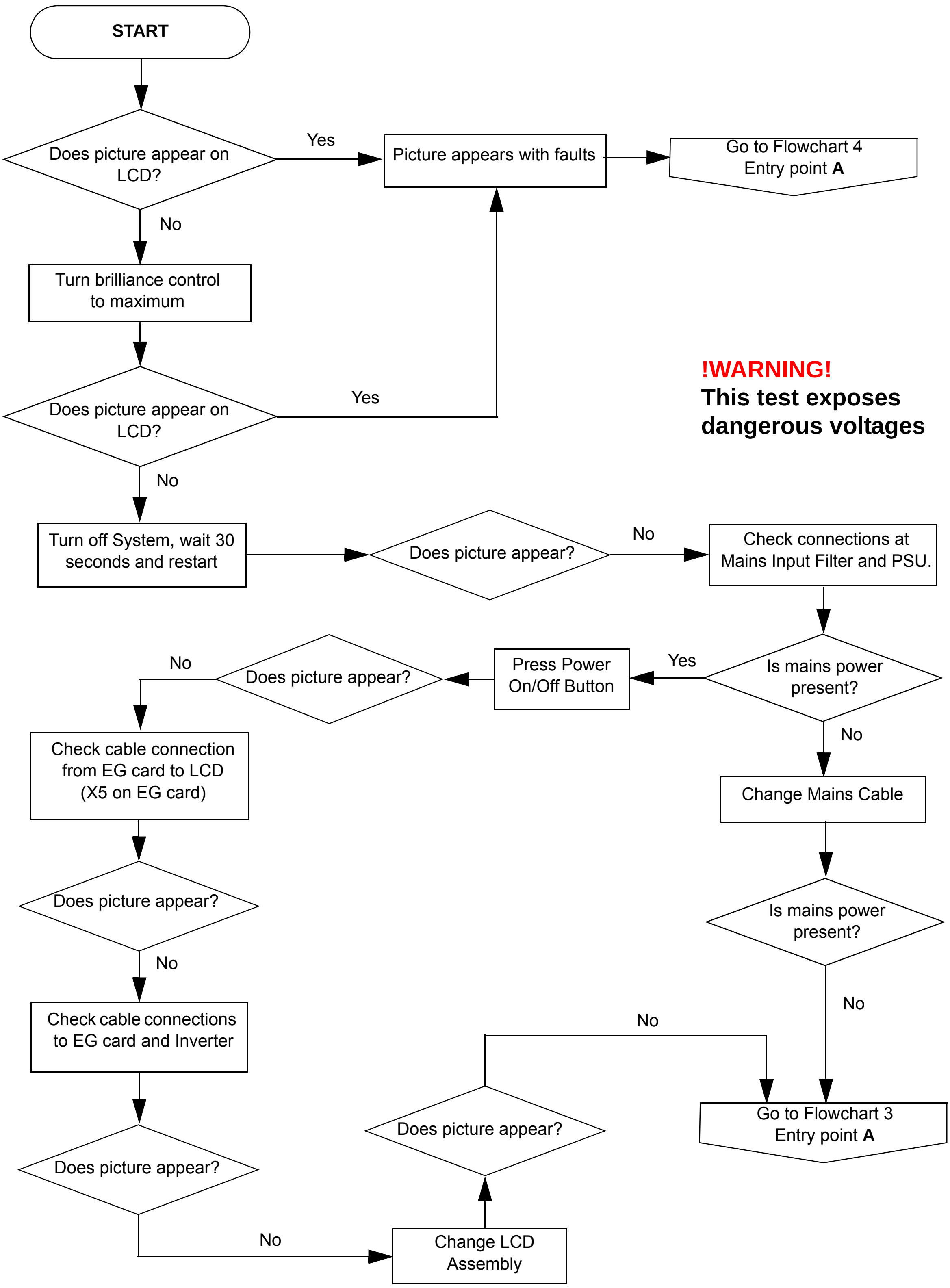
FLOWCHART 1 Overall Flowchart - Console Assembly



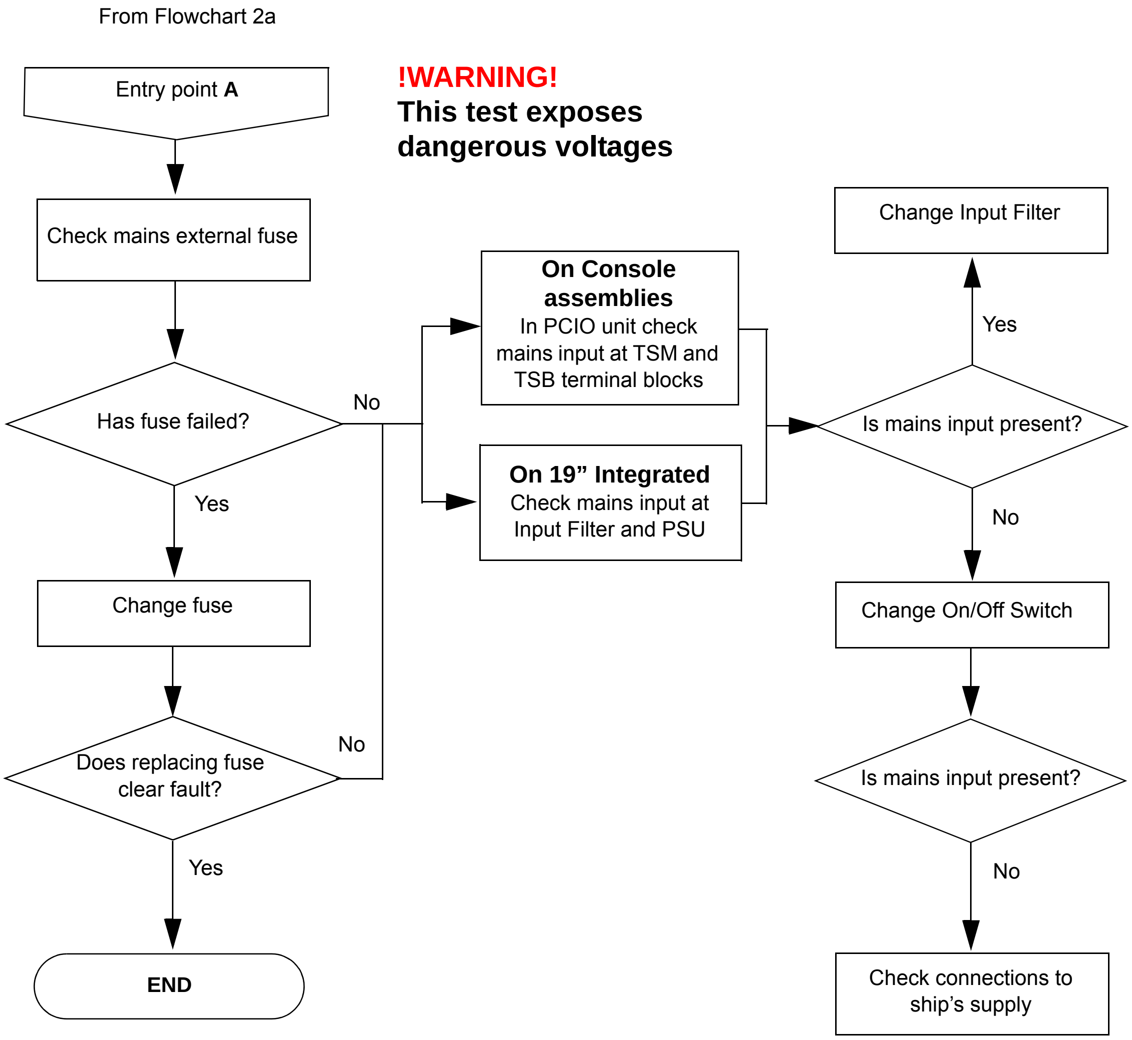
FLOWCHART 2A Console Faults (No Picture)



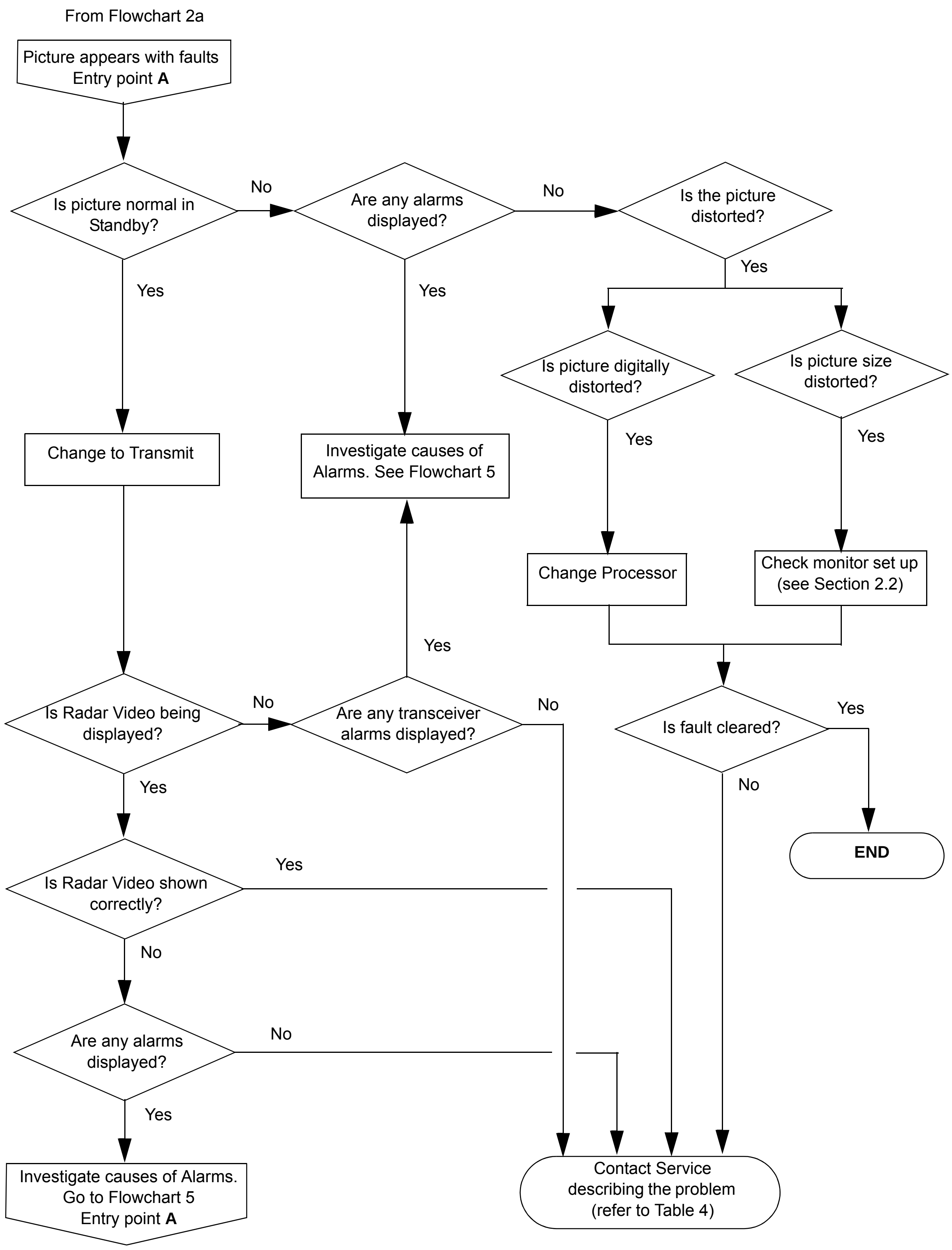
FLOWCHART 2B LCD Faults on 19" Integrated Tabletop (No Picture)



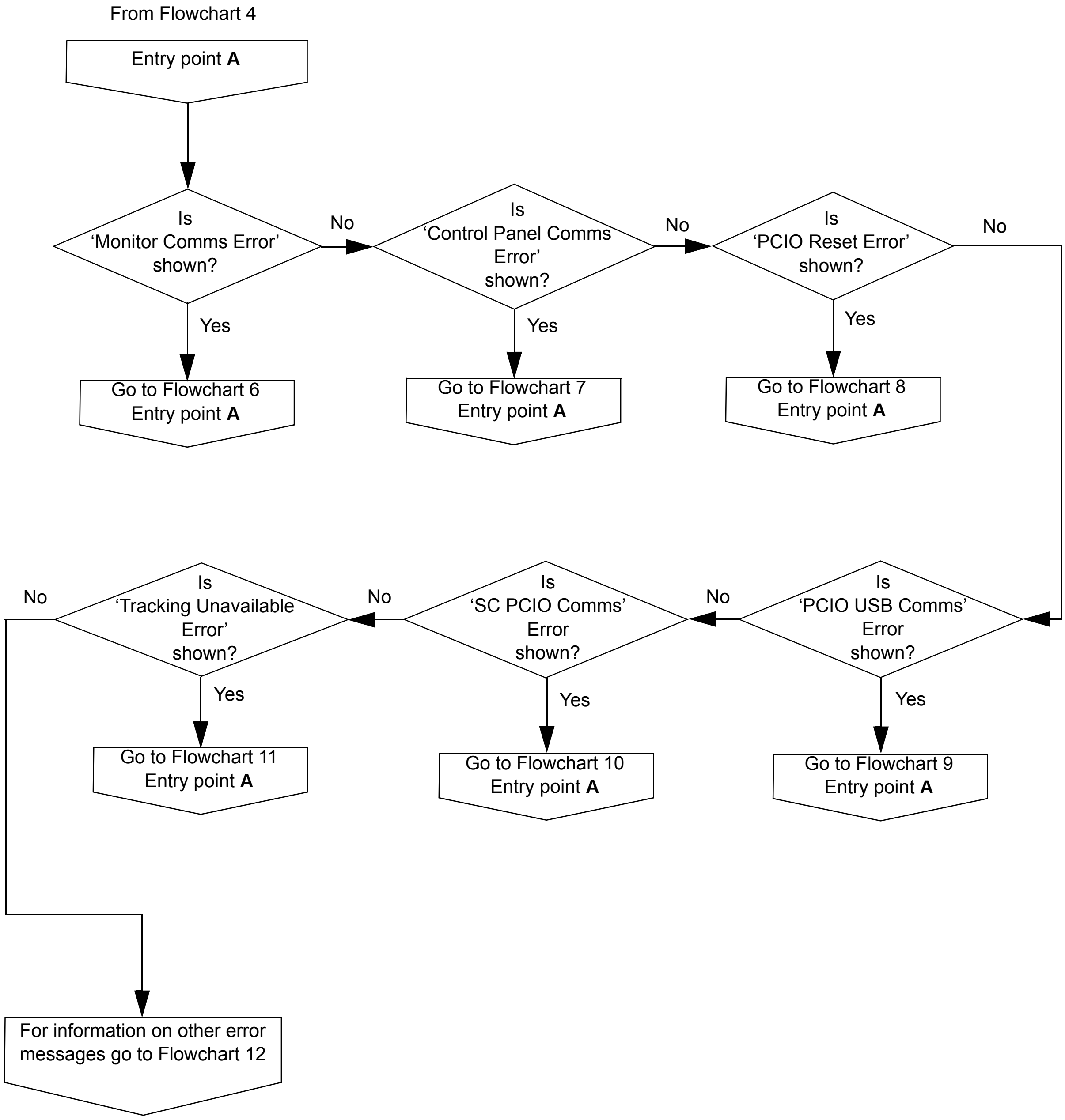
FLOWCHART 3 Console Faults (No Picture contd.)



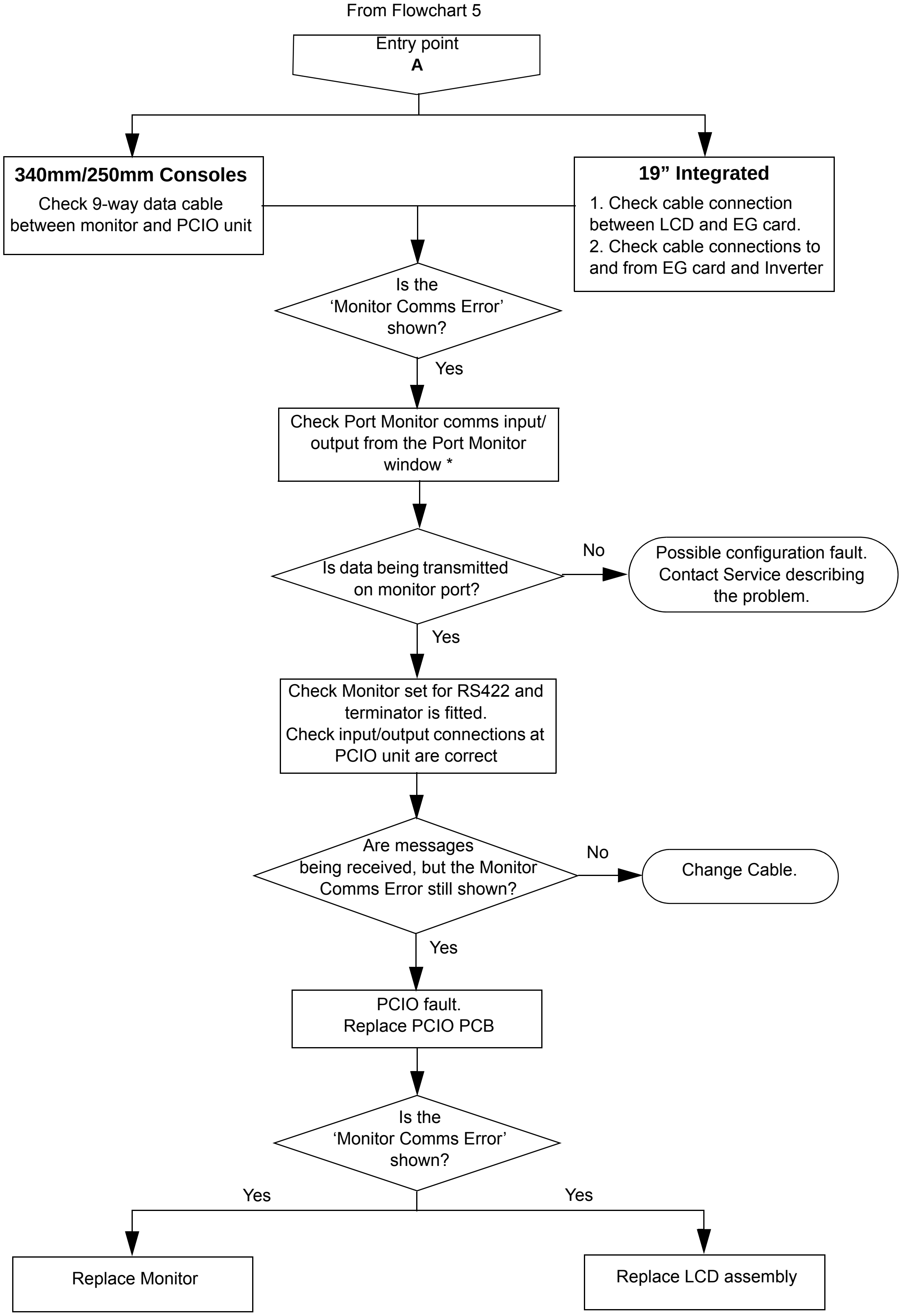
FLOWCHART 4 Console Faults (Picture appears with faults)



FLOWCHART 5 Console Hardware Error Messages

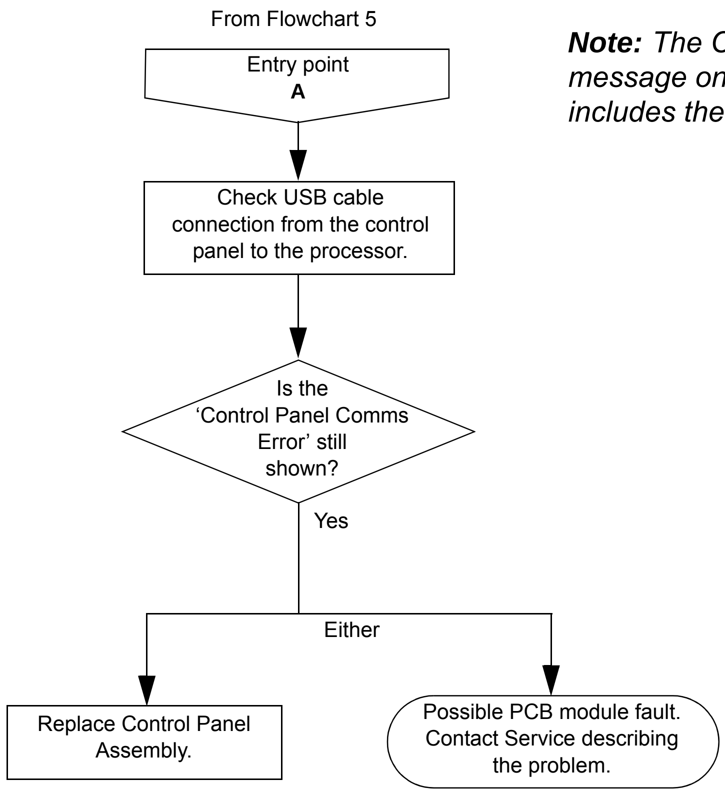


FLOWCHART 6 Error Messages (Monitor Comms Error)



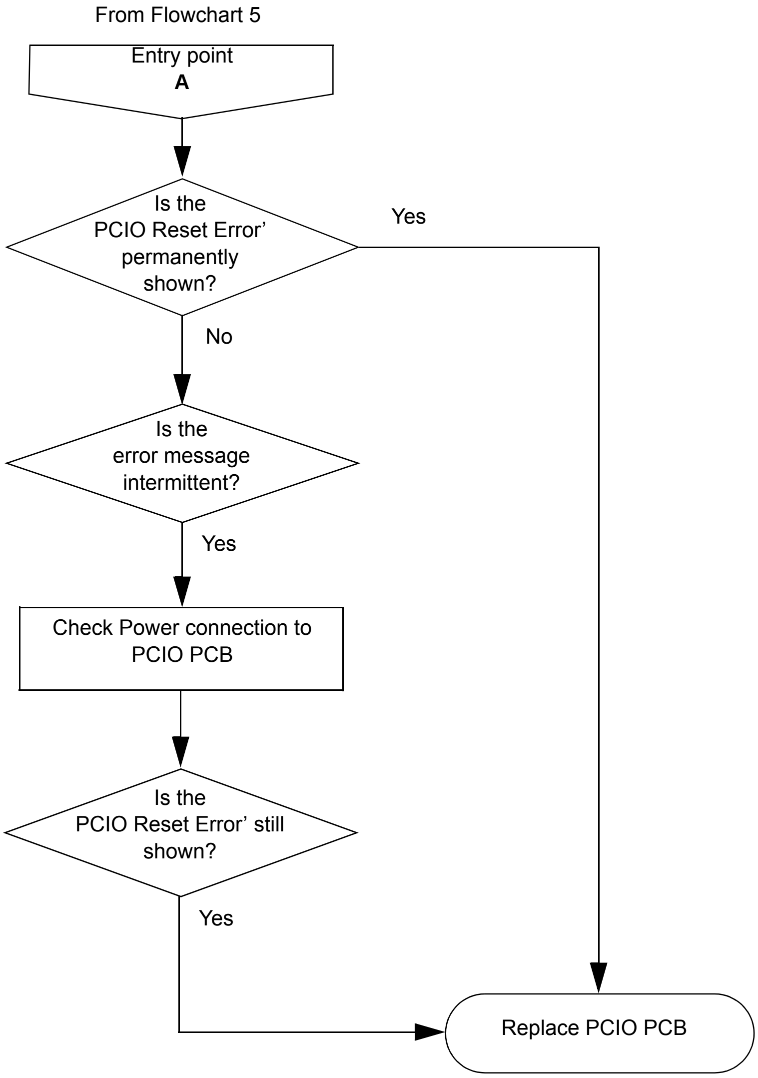
*. See Service section in the 'System' chapter of the VisionMaster FT Radar/Chart Radar User Guide, 65900010.

FLOWCHART 7 Error Messages (Control Panel Comms Error)



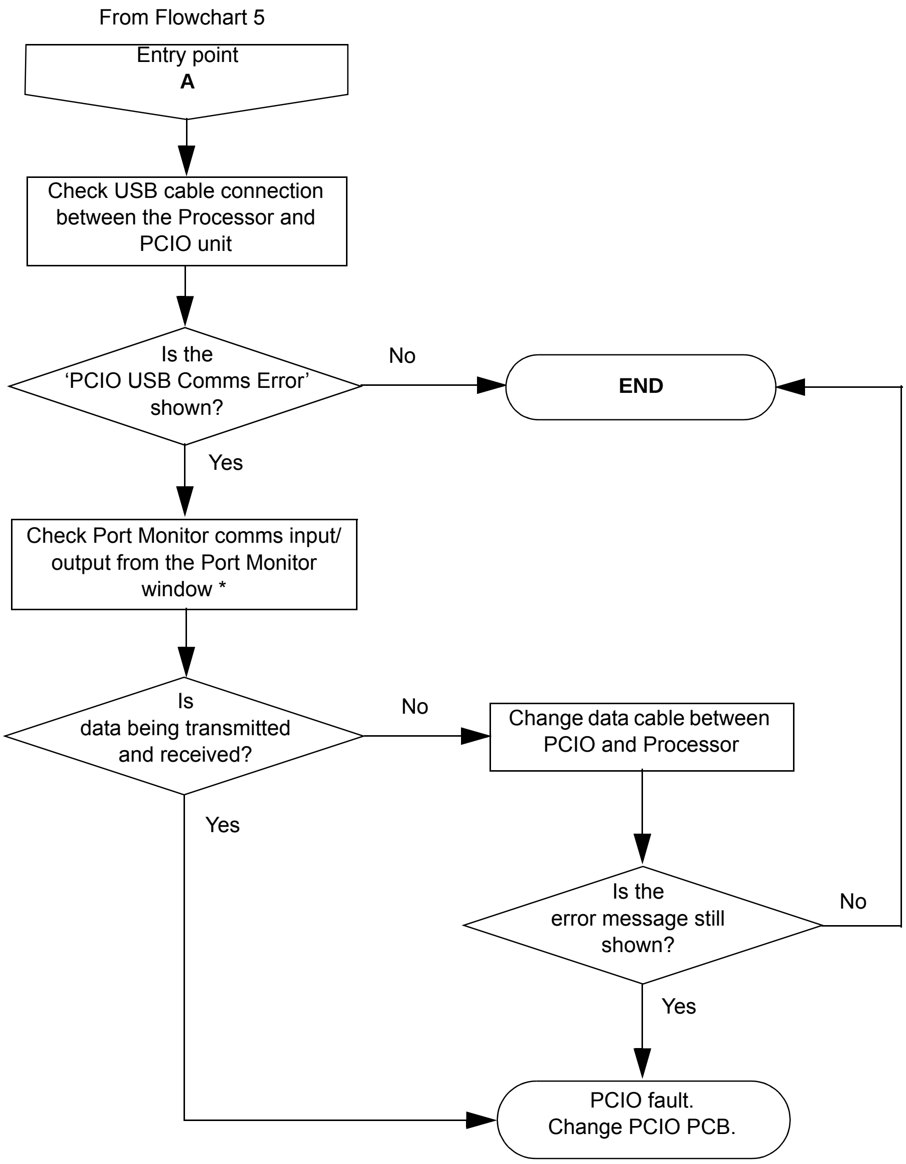
Note: *The Control Panel Comms Error message only appears if the Console includes the basic control panel (BCP).*

FLOWCHART 8 Error Messages (PCIO Reset Error)



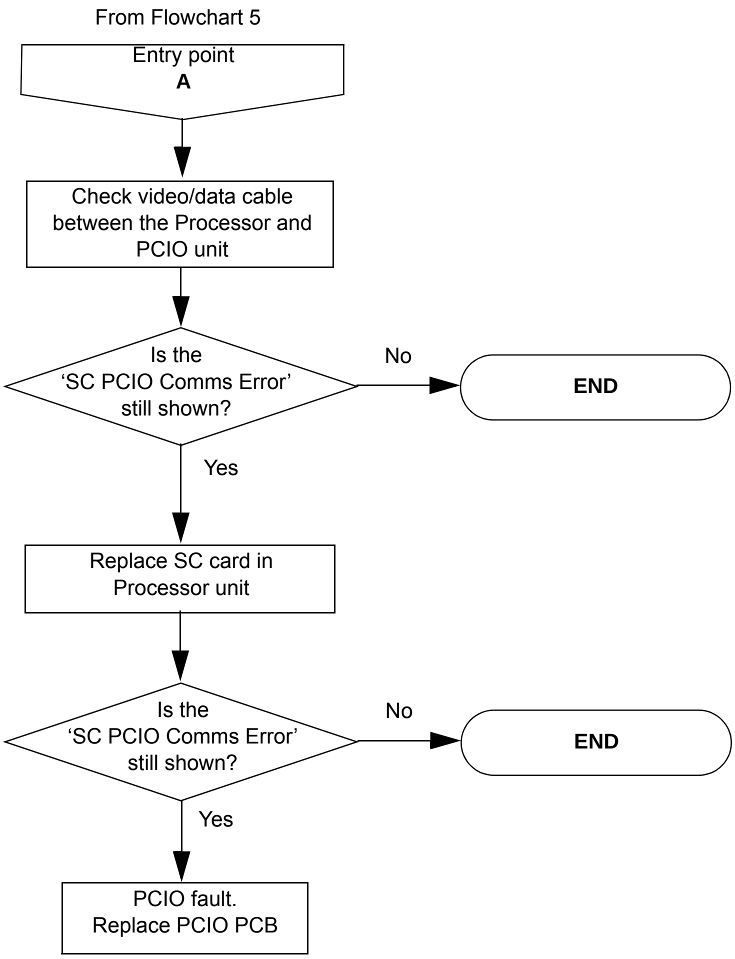
*.

FLOWCHART 9 Error Messages (PCIO USB Comms Error)

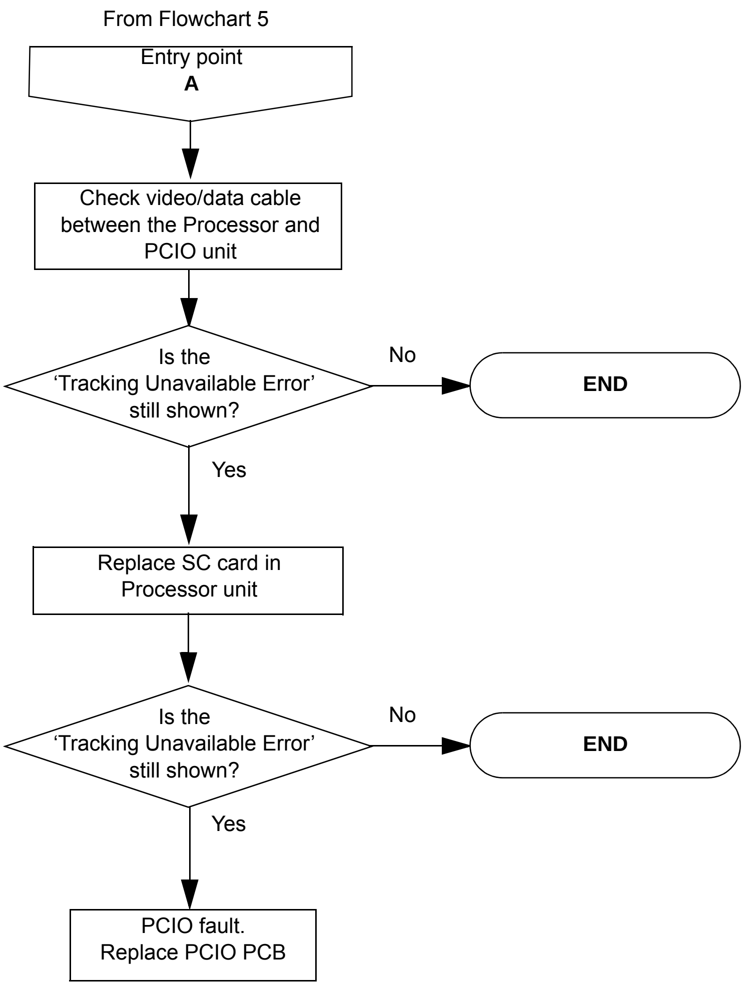


*. See Service section in the 'System' chapter of the VisionMaster FT Radar/Chart Radar User Guide, 65900010.

FLOWCHART 10 Error Messages (SC PCIO Comms Error)



FLOWCHART 11 Error Messages (Tracking Unavailable Error)



2.9 Scanner Unit (S-band and X-band)

2.9.1 Technical Description

There are four basic types of Scanner Unit:

- S-band with an integral transceiver module
- S-band without an integral transceiver (bulkhead mounted)
- X-band with an integral transceiver module
- X-band without an integral transceiver (bulkhead mounted)

Each type has variants dependent on motor supply and the options that are fitted.

Each Scanner Unit includes the following assemblies:

- Antenna
- Antenna Support Casting
- Turning Unit.

The Turning Unit includes the following items:

- Motor and Gearbox
- Bearing and Heading Marker PCB
- Input PCB
- optional Performance Monitor
- optional integral Transceiver module.

The Transceiver Unit includes the following items:

- Base casting
- Cover
- Transceiver module
- Input PCB.

A serial data link is used to communicate between the Transceiver and the Console. If a separate Transceiver Unit is used, an RF feeder (coaxial for S-band; waveguide for X-band) is used to transfer the microwave energy between the Transceiver unit and the Turning Unit.

2.9.2 S-Band Unit Physical Arrangements

The S-band Turning Unit is constructed from a central aluminium casting, with a motor and gearbox attached to one side. 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 (if fitted) is housed under the front cover. The integral Transceiver Unit is housed under the rear cover. If Transceiver Unit is bulkhead mounted, a shallower cover is used.

The Transceiver Unit 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 which makes contact with the cable braid.

The bulkhead mounted Transceiver is attached using four M8 bolts, studs or screws (coachbolts).

2.9.3 X-Band Unit Physical Arrangements

The X-band 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).

2.9.4 Transceiver Module Overview

The Transceiver module can be fitted in the Turning Unit, or mounted on a casting for below-decks bulkhead mounting as a separate unit.

Both Transceiver units (integral and bulkhead mounted) contain the following modules:

- Modulator PCB;
- Power Supply PCB;
- Trigger PCB;
- Receiver;
- microwave components.

Communication between the Transceiver unit and the PCIO unit is via two serial data links; one from the Transceiver to the PCIO unit, and one from the PCIO unit to the transceiver.

This data is transmitted using a special cable that consists of four twisted pairs:

- two pairs are used for data transmission as above
- one pair is used for the trigger
- the other pair is spare

The data passed from the Transceiver to the PCIO includes:

- Heading Marker
- Incremental Bearing
- Transceiver Status
- Error Messages
- Built In Test Equipment (BITE) data
- Tuning Indicator

The data transmitted from the PCIO to the Transceiver includes:

- Standby/Transmit
- Pulse Length
- Tuning
- AFC/Manual
- Sector Blanking
- Performance Monitor control, and Installation Settings

2.9.4.1 Power Supply

The power supply operates from the ship's AC mains, and supplies 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.

2.9.4.2 Trigger PCB

The Trigger PCB processes the serial data from the PCIO Unit, and generates the required control signals for the Transceiver. It monitors functions within the Transceiver and the Heading Marker and then encodes the information for transmission to the PCIO.

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).

2.9.4.3 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 that is sent to the PCIO Unit via the serial data link. The error signal causes the display to switch to standby and generate an error alarm.

2.9.4.4 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, produces the RF energy that is 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, a biased limiter is fitted in place of the standard limiter.

A signal from the Trigger PCB is used to enable swept attenuation to be applied to the solid-state limiter. This reduces the system sensitivity at short ranges.

2.9.4.5 Receiver

The receiver consists of the following:

- low noise amplifier;
- mixer;
- linear pre amplifier;
- logarithmic amplifier;
- 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 PCIO.

The Receiver also includes 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.

2.9.5 Automatic Start-up Sequence

The automatic start-up sequence described below, should be read in conjunction with Figure 5.26 '*S-band Turning Unit Schematic*' for S-band scanners and Figure 5.51 '*X-Band Turning Unit (Aloft) Schematic*' for X-band scanners.

2.9.5.1 Start-up

WARNING! – Lethal Voltage Hazard

WHEN MAINS POWER IS APPLIED TO THE TRANSCEIVER 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. HIGH-VOLTAGE DC IS PRESENT ON PRIMARY POWER COMPONENTS WHENEVER MAINS POWER IS PRESENT ON THE BOARD.

The Power Supply in the Transceiver is only active during normal operation when there is a PCIO connected to it. The RS422 serial data stream from the PCIO 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 RS422 serial data stream from the PCIO 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).

2.9.5.2 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.

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 MOD TRIGGER pulses (to PLVC 9).

Note: *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 outputs as TX TRIG (PLYB 20 and 21) to the Input PCB (PLZB 20 and 21) and then to the PCIO Unit via TSB 5 and 6.

Note: *TX DATA is sent from the Transceiver to the PCIO. DU DATA is sent from the PCIO to the Transceiver.*

The Trigger PCB processes the serial data input from the PCIO, 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).

2.9.5.3 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. This 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 4 seconds and 18 seconds) 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. Transmit is inhibited 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 PCIO 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.

2.9.6 Turning Unit Overview (S-band)

2.9.6.1 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. This gives 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 includes 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 supplied, for AC systems, to switch the scanner motor supply off for safe servicing.

2.9.6.2 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. This is approximately 10° before the Antenna is pointing dead ahead. Correct alignment of the Heading Marker is set at system configuration.

Sometimes it is not possible to adjust the Heading Marker alignment at configuration. Optional extra circuitry can be fitted to the Input PCB to let the alignment be set electronically within the Turning Unit. When this option is fitted an additional (isolated) Heading Marker output is supplied.

As an option, for special applications, a size 11 synchro can be fitted as an alternative source of bearing information.

2.9.6.3 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.

2.9.7 Turning Unit Overview (X-band)

2.9.7.1 Drive System

The scanner motor is a 3-phase electronically commutated DC motor. The motor commutation drive signals are supplied by the Motor Drive PCB, which can give 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.

2.9.7.2 Motor Drive Board (Including 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 and 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 and 3. 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 versions).

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.

2.9.7.3 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 system configuration.

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 PCIO Unit.

Link LK1 is used to select between high- or low-speed operation. The link should be set between pins 1 and 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 and 3. 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 supplied. As an option for special applications a size 11 synchro can be fitted as an alternative source of bearing information.

2.9.7.4 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.

2.9.8 Trigger PCB

2.9.8.1 General Description

The Trigger PCB controls the operation of the Transceiver, under instruction from the PCIO. There are two serial links, which are used to transfer control messages from the PCIO to the Trigger PCB and Transceiver information back to the PCIO.

The Trigger PCB generates the control and tuning signals required by the Modulator, Receiver, Performance Monitor (PM) and Biased Limiter. The PSU is enabled with a signal from the Trigger PCB.

Signals To/From the Trigger PCB

To/From the PCIO unit:

- Serial Data to PCIO
- Serial Data from PCIO
- Trigger to PCIO

To/From the 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-band/X-band Configuration signals

To/From the Receiver:

- Tuning Voltage signal
- Bandwidth Control signal
- AFC/Manual control
- AFC Trigger
- Tune Indicator signal

To Biased Limiter

- Trigger signal

To the Performance Monitor:

- On/Off signal
- Mode Control signal
- Tuning Voltage signals

To/From the Power Supply PCB:

- +30V, +12V, +5V, 0V and -12V Supply lines
- Turning Unit Enable
- Power Supply Start and Return

2.9.8.2 Functional Description (Trigger PCB)

The 80C51 family microcontroller supplies overall control of the Trigger PCB functions. Program memory and RAM are included within the microcontroller IC. Serial I/O is handled by the microcontroller's 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 PCIO sends serial messages consisting of four or five characters depending on the message content. Control messages are four bytes long and tuning messages are five.

The tuning voltage levels are sent as 12-bit values. These are converted on the Trigger PCB using a four-channel DAC. They are then amplified/ buffered and distributed to the Receiver and PM.

The Bearing signal from the Turning Unit is used to start serial transmission from the Trigger PCB. Each time one of the 4096 azimuth pulses per revolution is generated and fed into one of the microcontroller's interrupt pins, a character (one byte) is sent to the PCIO. 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 PCIO connected to it. The RS422 serial input from the PCIO is used to drive an opto-isolator, which detects the presence of either polarity voltage and enables the PSU.

2.9.8.3 Trigger Outputs

The following trigger signals are generated by the Trigger PCB:

- Pre-Trigger
- Charge Trigger
- Modulator Trigger
- PCIO 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 make sure 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 PCIO and PM Triggers are generated from the Modulator 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 PCIO 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.

2.9.8.4 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 PCIO. 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 ×3.5 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 PM main tuning control. Xr and Xt Adjust are 0V to +15V signals used to control the receive and transmit attenuators in the PM.

2.9.8.5 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 PCIO 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.

The microcontroller determines whether the transceiver has been switched off for long enough to require inhibiting transmit. Transmit is inhibited 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 PCIO as an aid to fault diagnosis.

One channel of the ADC is used to detect if a PM has been fitted to the system. The voltage on this channel will be lower than a preset value if a PM 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 PCIO.

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 PCIO.

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 PCIO 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 PCIO.

2.9.8.6 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 (AFC On) or manual tuning mode. 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 PCIO.

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. It 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 PM 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.

2.9.8.7 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.

2.9.9 Built In Self Test (BIST)

The microcontroller performs several self-test operations and reports the results to the PCIO as part of the serial message link.

Error situations that are monitored in the Transceiver are:

- Serial message corruption
- Loss of PCIO 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 PCIO without further action by the microcontroller are the power supply lines and magnetron current (described in Section 2.9.8.2 '*Functional Description (Trigger PCB)*'.

2.9.9.1 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 PCIO below decks (with suitable test cables) and run as per normal operation. A dummy load MUST be connected to the RF output.

In this mode, 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.

2.9.10 Transceiver Power Supply

2.9.10.1 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 110/120V (low voltage) or 220/240V (high voltage) in the frequency range 50 to 60Hz.

The power unit uses a boost converter front-end to supply a regulated high-voltage DC to a flyback converter supplying the output. Some of these supplies use additional switch mode converters to supply 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 PCIO at PLTH 11, 12. The flyback converter switches on and the photo-transistor in U5 is turned on, pulling down the gate of Q2 to below its threshold voltage. Q2 turns off, letting the voltage increase on compensation pin 1 of U4. The output of IC U4 is enabled. In the PSU off state, Q2 is kept 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.*

2.9.11 Modulator PCB

2.9.11.1 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 can be selected by the replays that are 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 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 make sure the magnetron operates correctly; and
- generation of a timing reference for the Radar Trigger.

2.9.11.2 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.

2.9.11.3 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 PCIO.
HT Sense	Sample of Modulator HT Supply fed to Trigger PCB for inclusion in BITE message sent to PCIO.
TX Define	Link settings used to define modulator type to Trigger PCB. 0V or 3.5V dependant on link settings.

2.9.11.4 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 5.16 '*Modulator PCB Link Settings*' for further information.

WARNING! – HIGH TEMPERATURES

NEVER MEASURE THE HEATER VOLTAGE WHILE THE TRANSCEIVER IS TRANSMITTING.

Table 5: X-band & S-band Magnetron Heater Supply

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

2.10 Error Messages and Tellbacks for Transceivers

2.10.1 Error Messages

The following errors may be reported by the Transceiver:

2.10.1.1 Message Failure

The Transceiver expects to receive a message from the PCIO at least once per second. If the message rate drops below this level, 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.

2.10.1.2 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.

2.10.1.3 Spark Gap Detect

The Modulator contains a spark gap to protect the pulse transformer from excessive voltage if the magnetron misfires.

If the spark gap operates for more than two seconds this is detected and a Spark Detect error is signalled. 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.

2.10.1.4 Heading Marker 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 Heading Marker Failure error message is shown on the Display.

Transmission is restored if a Heading Marker is detected, provided the PCIO 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.

2.10.1.5 Mod Trig Fail, Charge Trig Fail

The Trigger PCB generates the Modulator, and Charge Triggers. If either pulse is detected as missing a Trigger Error message is returned.

Possible causes

- Defective Trigger PCB.

2.10.2 Transceiver BITE Data

The following information is transmitted from the Transceiver to the PCIO unit to be shown in the TxRx BITE folder of the Diagnostics sub menu.

Table 6: Transceiver BITE data

Parameter	Normal Range	Remarks
Magnetron Current	6.0A to 9.5A	25kW and 30kW
+12V Supply	+11V to +13.4V	
+30V Supply	+26V to +36V	
Modulator Volts	-500V to -680V	
Swept Gain	On or Off	BME transceivers only
Spark Gap	Pass	
Corrupt Data	Pass	
Message Failure	Pass	
Heading Marker	Pass	
Mod Trigger	Pass	
Charge Trigger	Pass	

Transceiver BITE data is only approximate and must not be used for making adjustments. A deviation from the above values shows a possible fault condition.

2.10.3 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:

2.10.3.1 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.

2.10.3.2 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.

2.10.3.3 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:

Table 7: SP and MP bits

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

2.10.3.4 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 Table 7.

2.10.3.5 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.

2.10.3.6 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.

2.11 Fault Isolating Flowcharts for S-band and X-band Scanner Units

WARNING! – LETHAL VOLTAGE HAZARD

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.

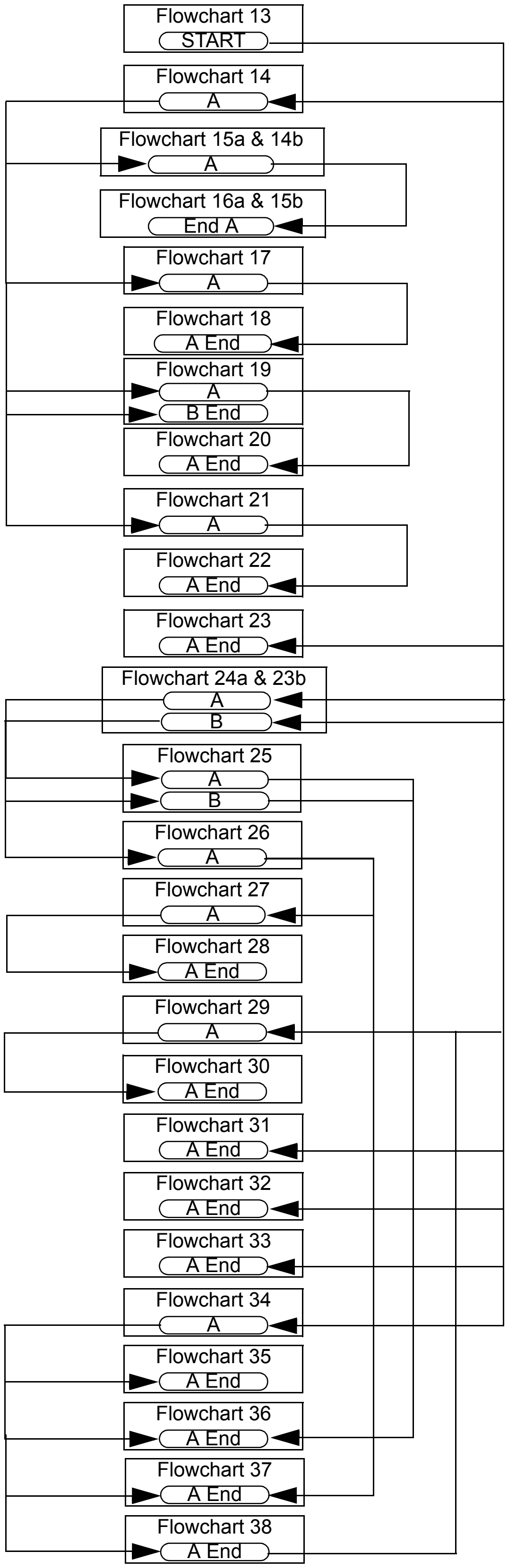
Flowcharts for isolating faults for S-band and X-band Scanner Units are given on the following pages. Flowchart 12 shows the overall flow through Flowchart 13 to Flowchart 38.

The Flowcharts should be read in conjunction with the following notes.

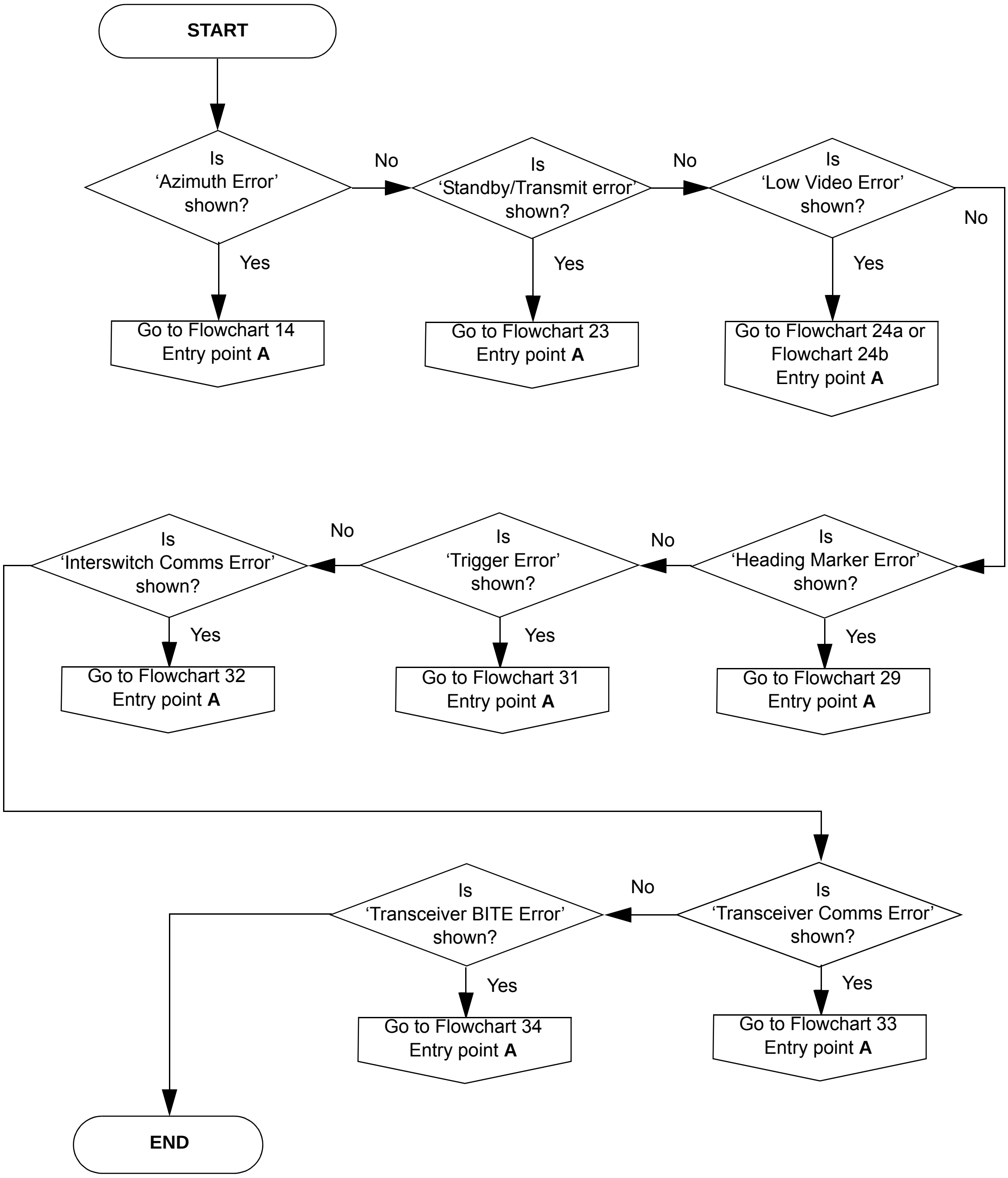
Note: *Before using the following fault finding flow charts visually check the components to make sure there are no loose plugs or connections.*

Note: *After checking the connection status of the components always check that the configuration of all components on the system is correct by accessing the Configuration tool, for details see VisionMaster Ships Manual Volume 2, Chapter 1 'Configuration'.*

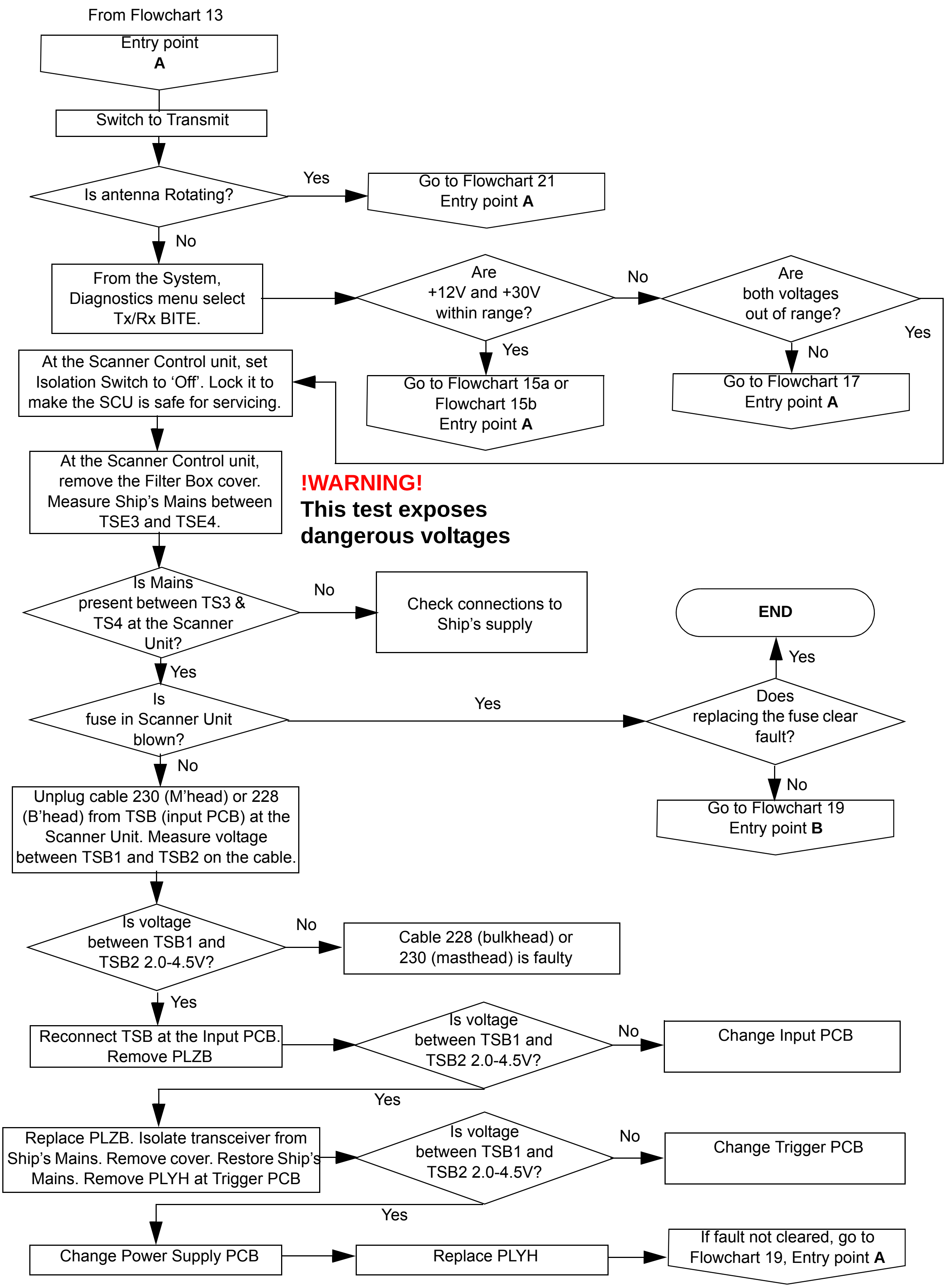
FLOWCHART 12 Overall Flowchart - Scanner Units



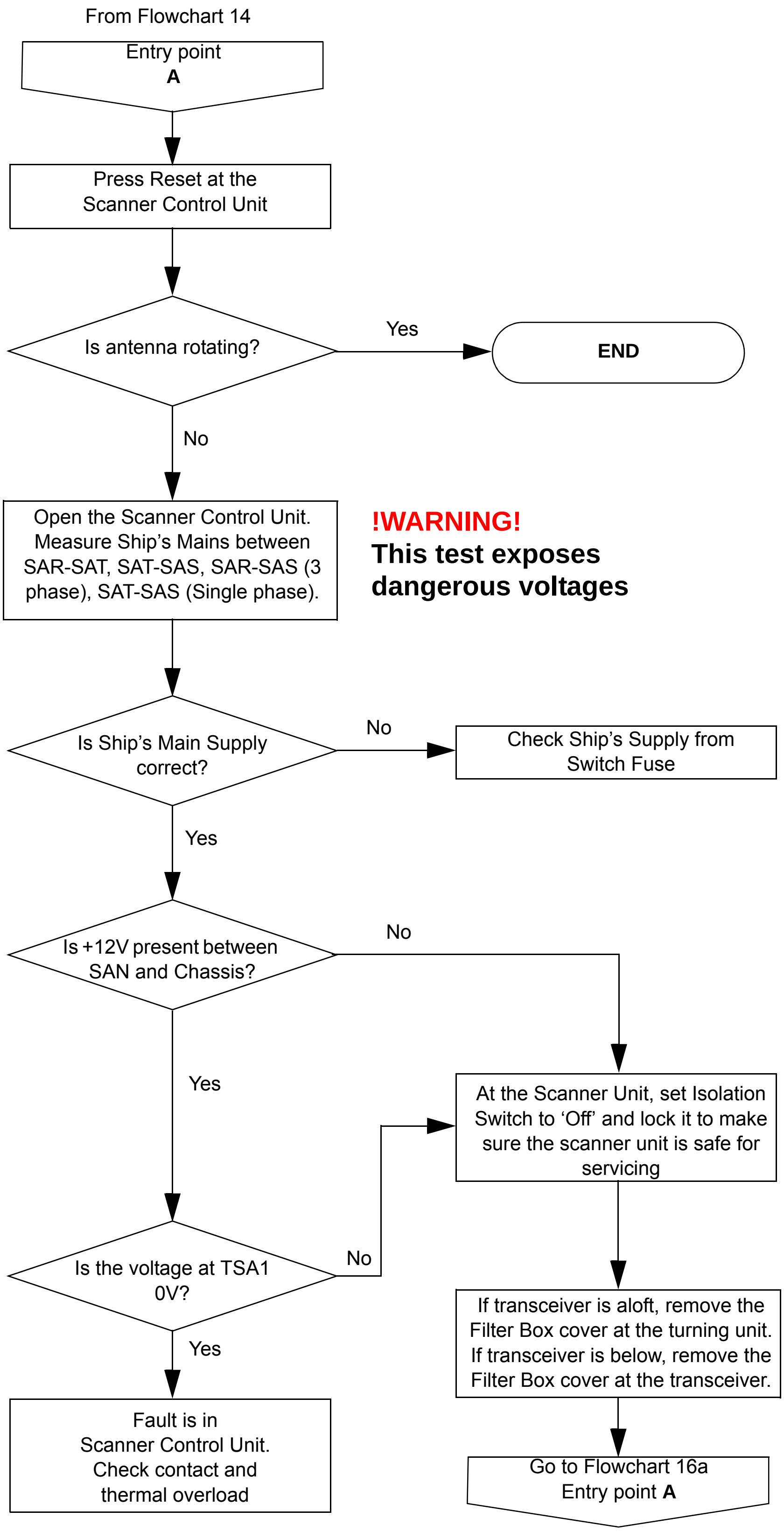
FLOWCHART 13 S-band and X-band Hardware Error Messages



FLOWCHART 14 Azimuth Error Message

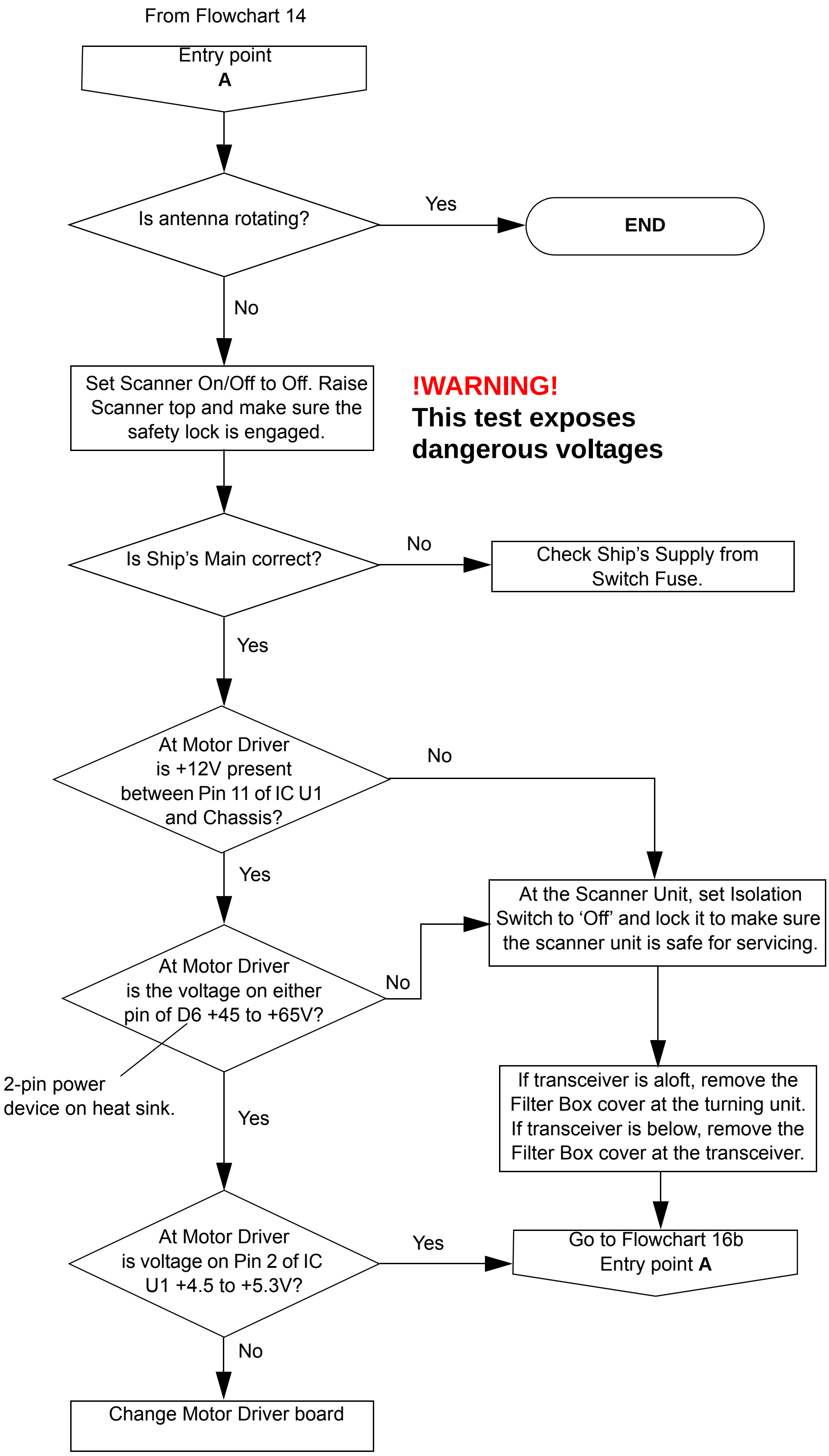


FLOWCHART 15A Azimuth Error Message (S-band Scanner)

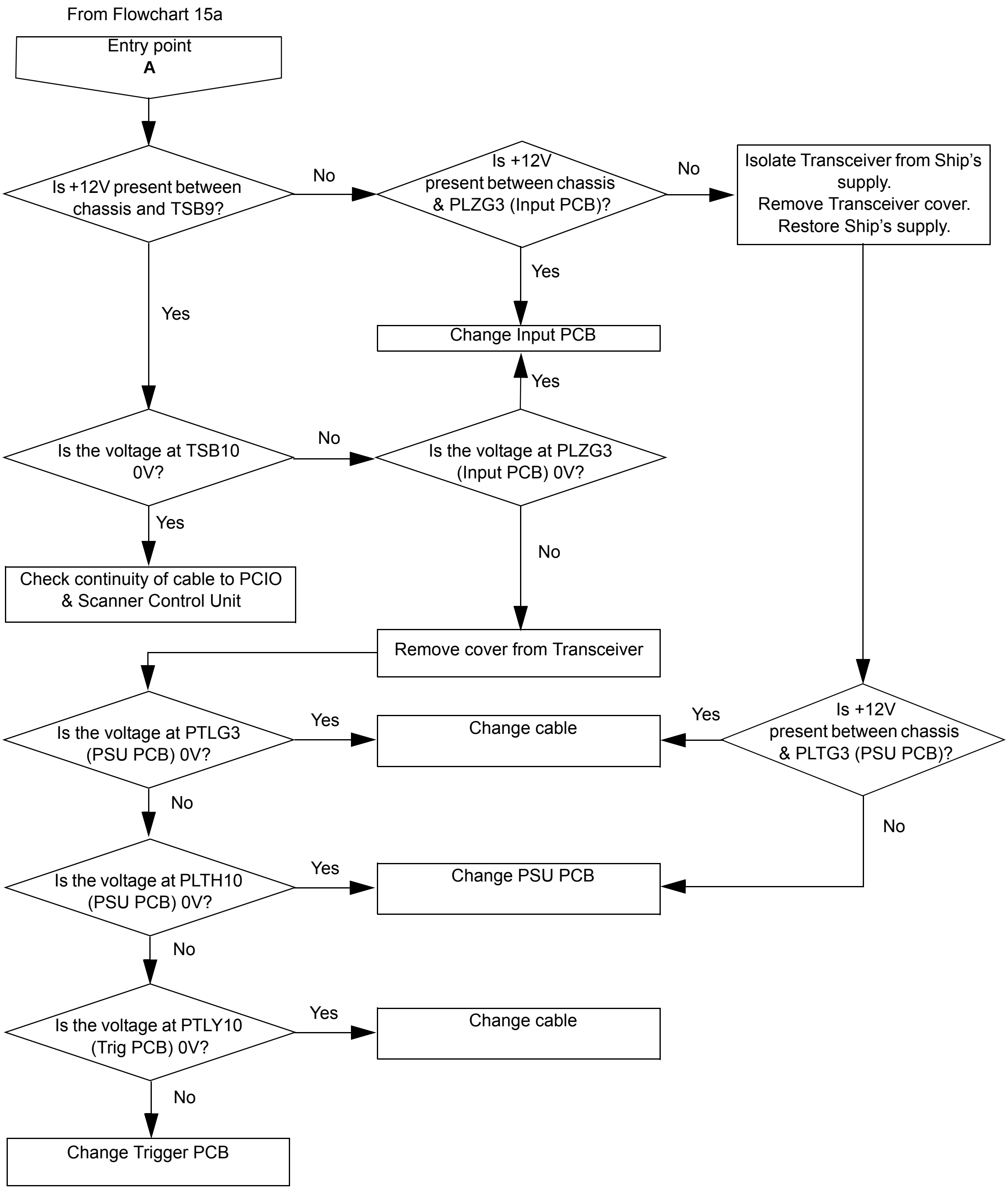


!WARNING!
This test exposes dangerous voltages

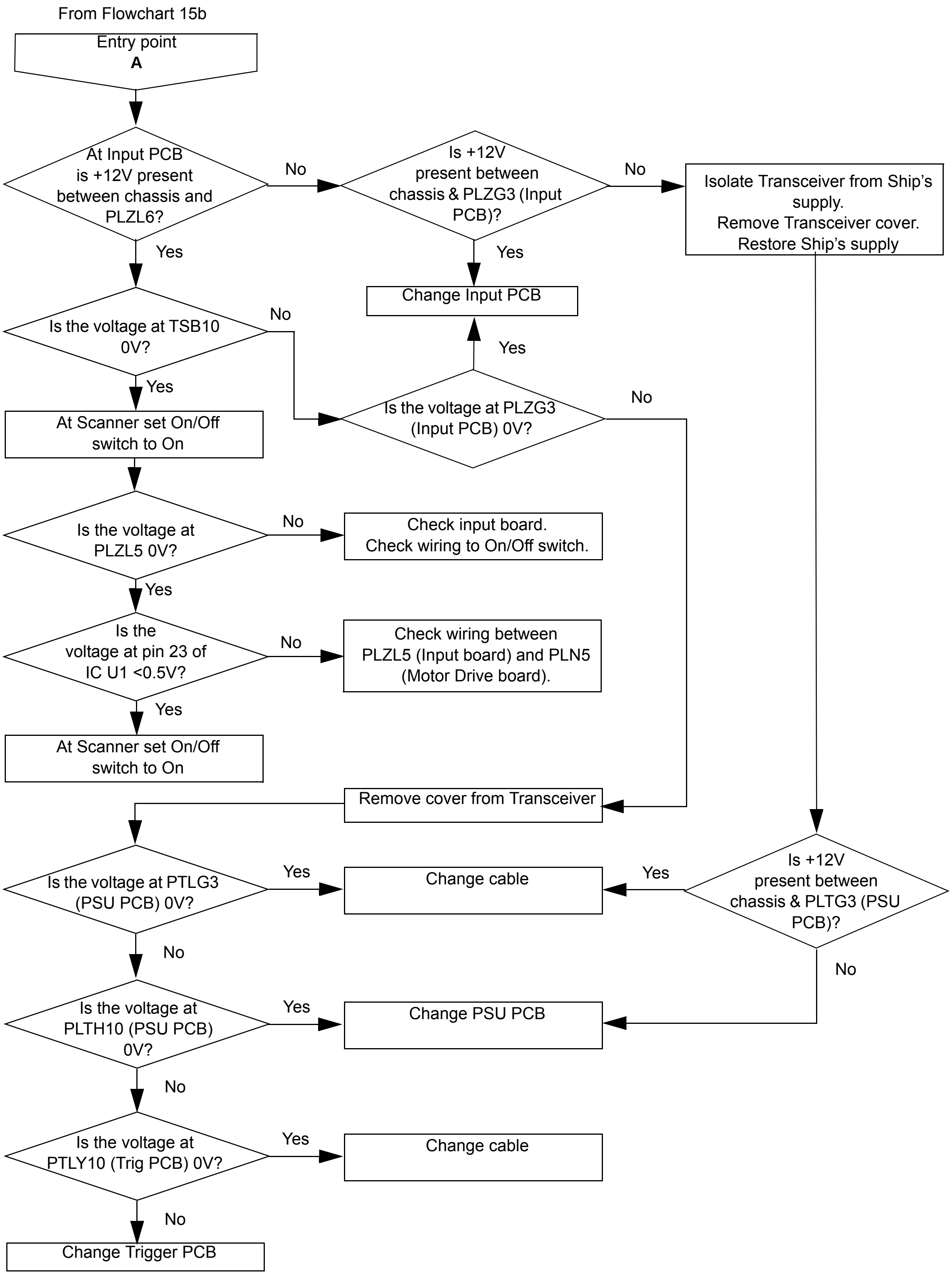
FLOWCHART 15B Azimuth Error Message (X-band Scanner)



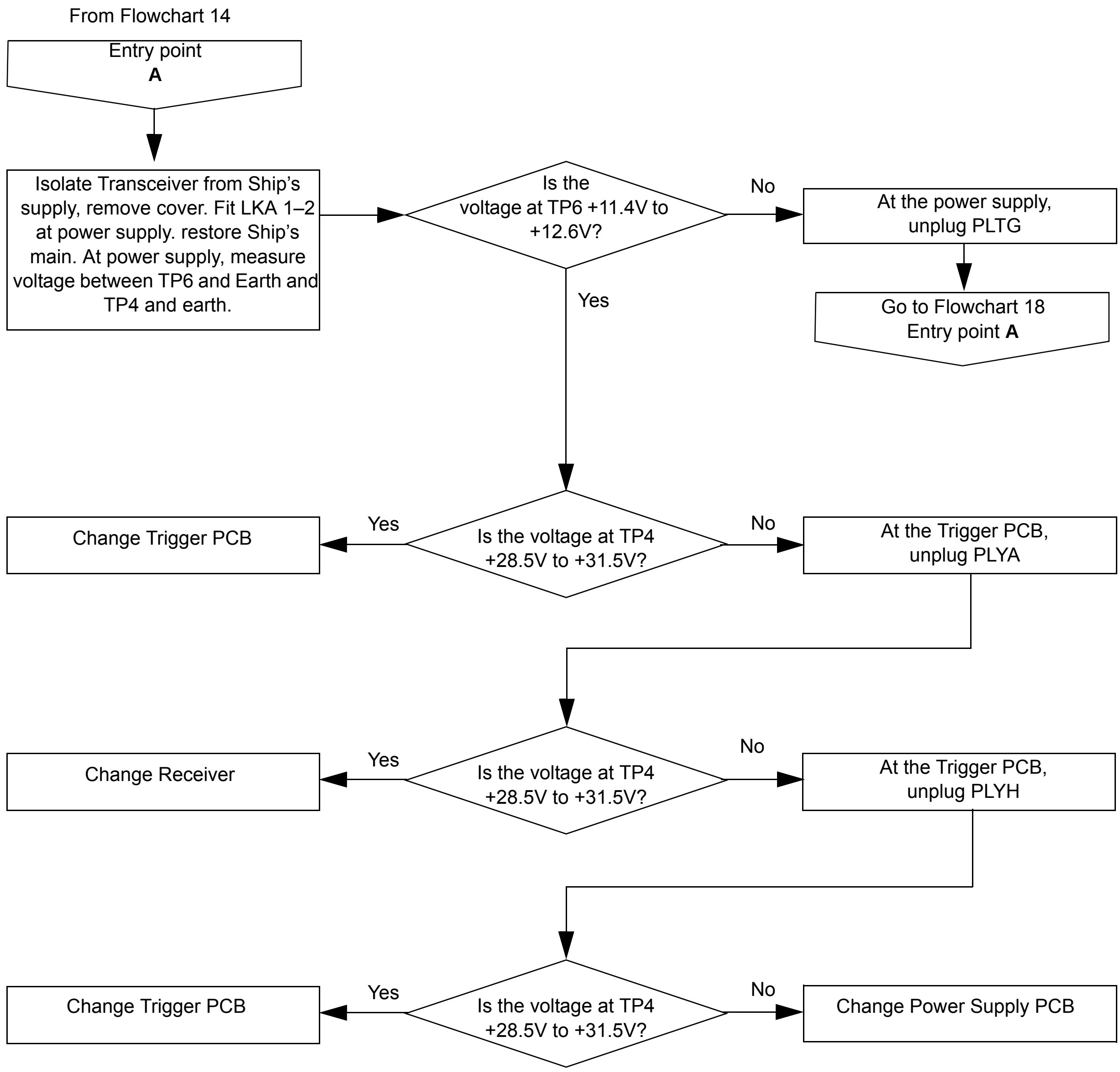
FLOWCHART 16A Azimuth Error Message (S-band Scanner)



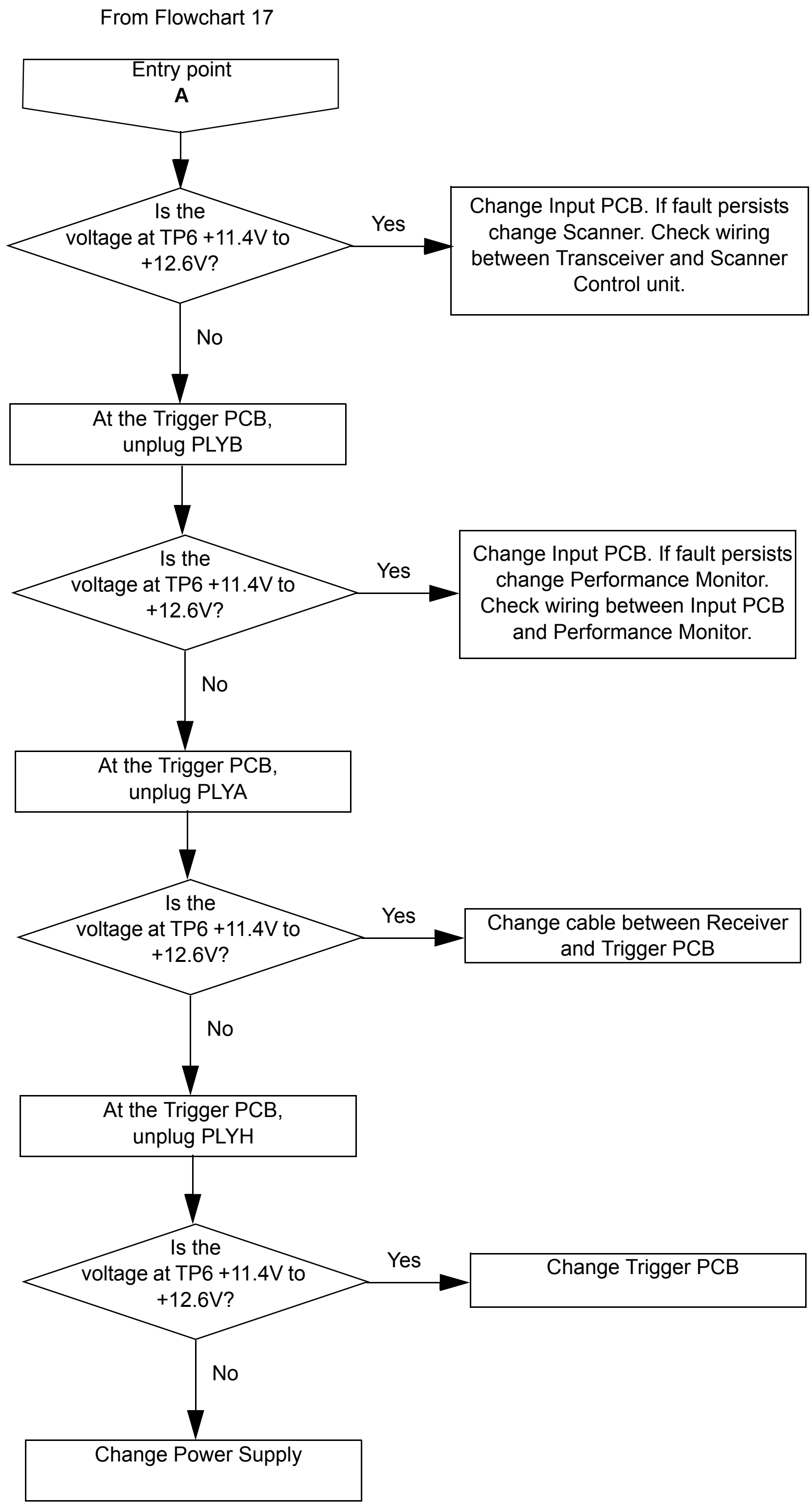
FLOWCHART 16B Azimuth Error Message (X-band Scanner)



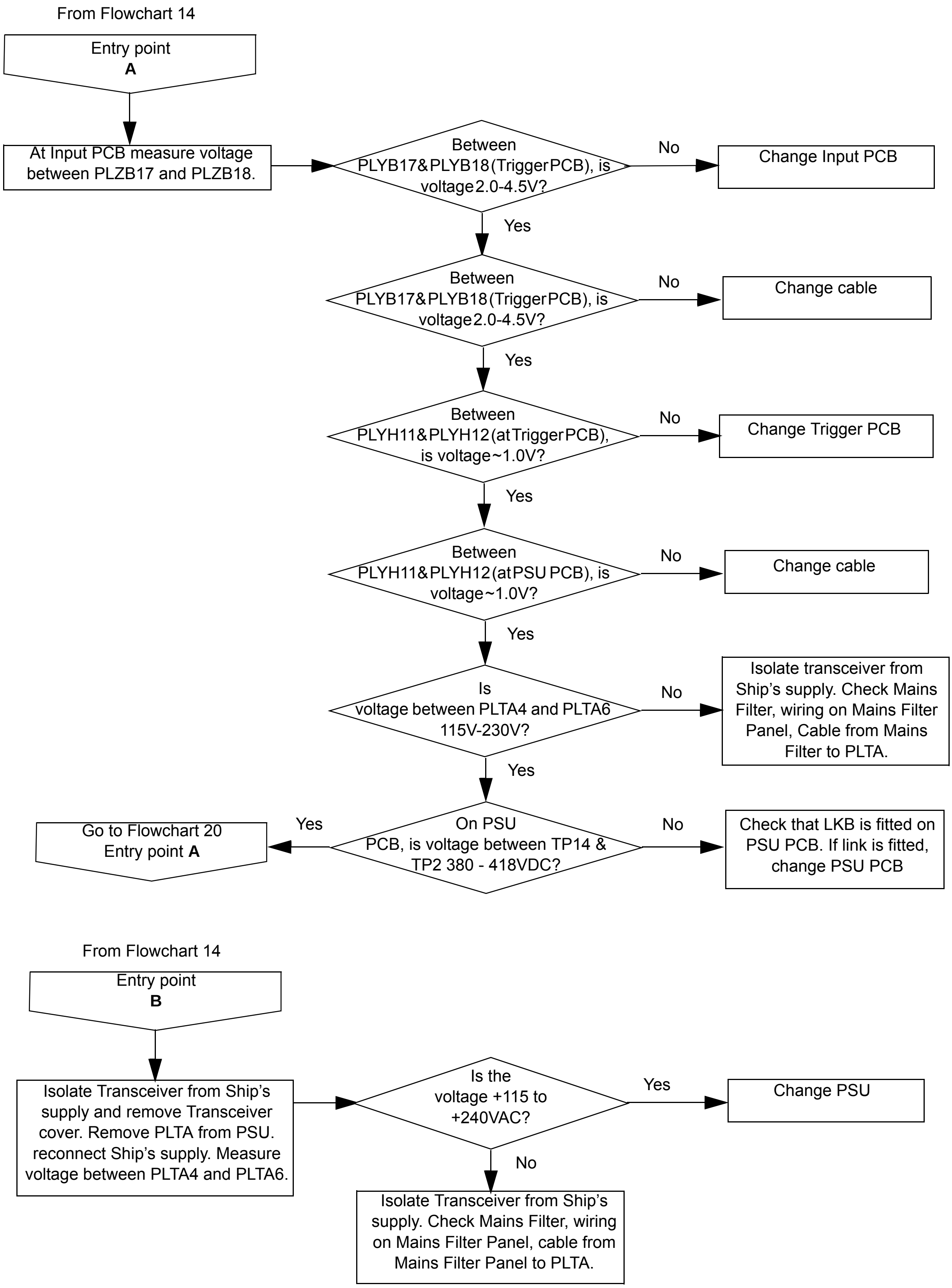
FLOWCHART 17 Azimuth Error Message (contd.)



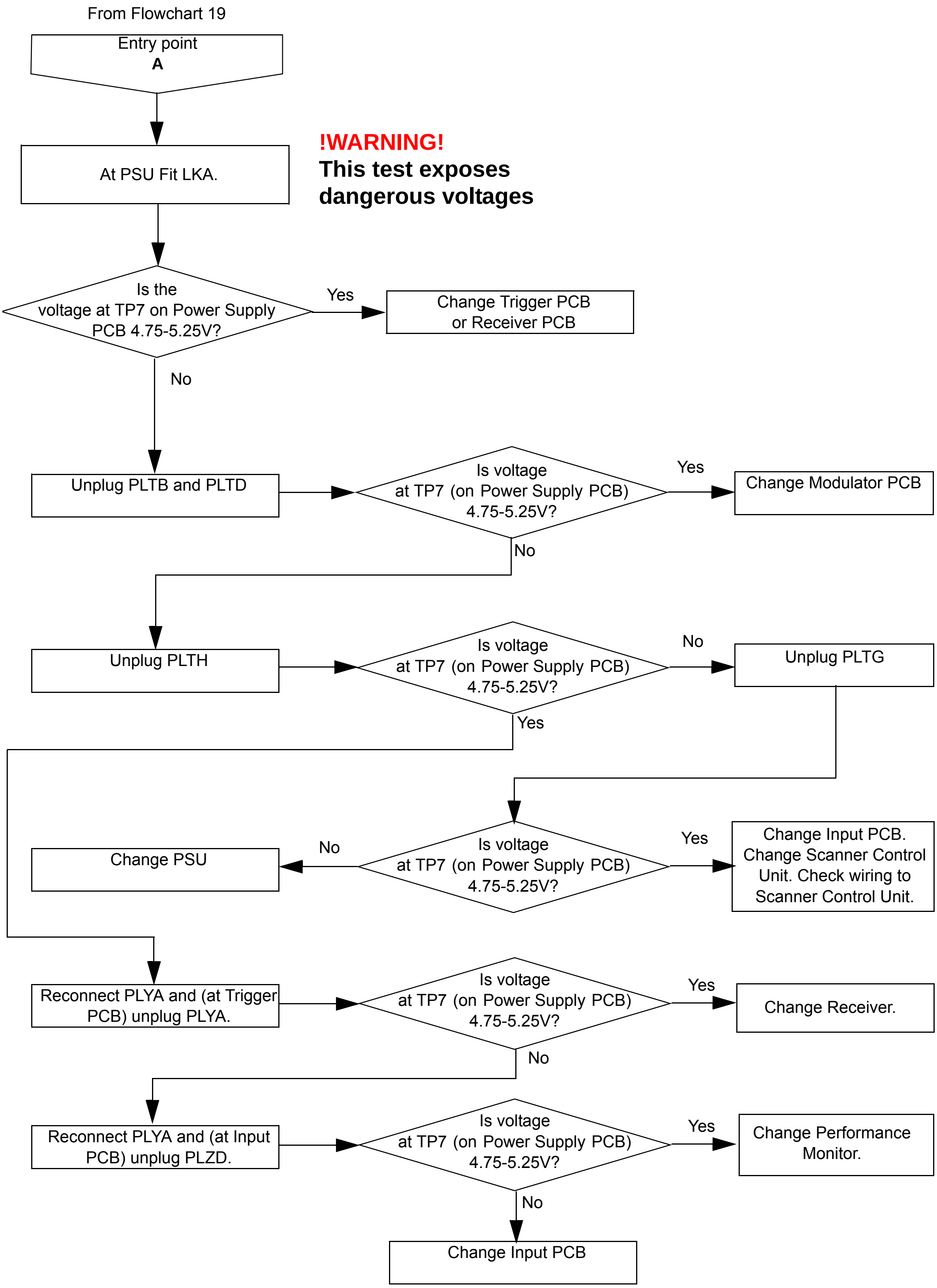
FLOWCHART 18 Azimuth Error Message (contd.)



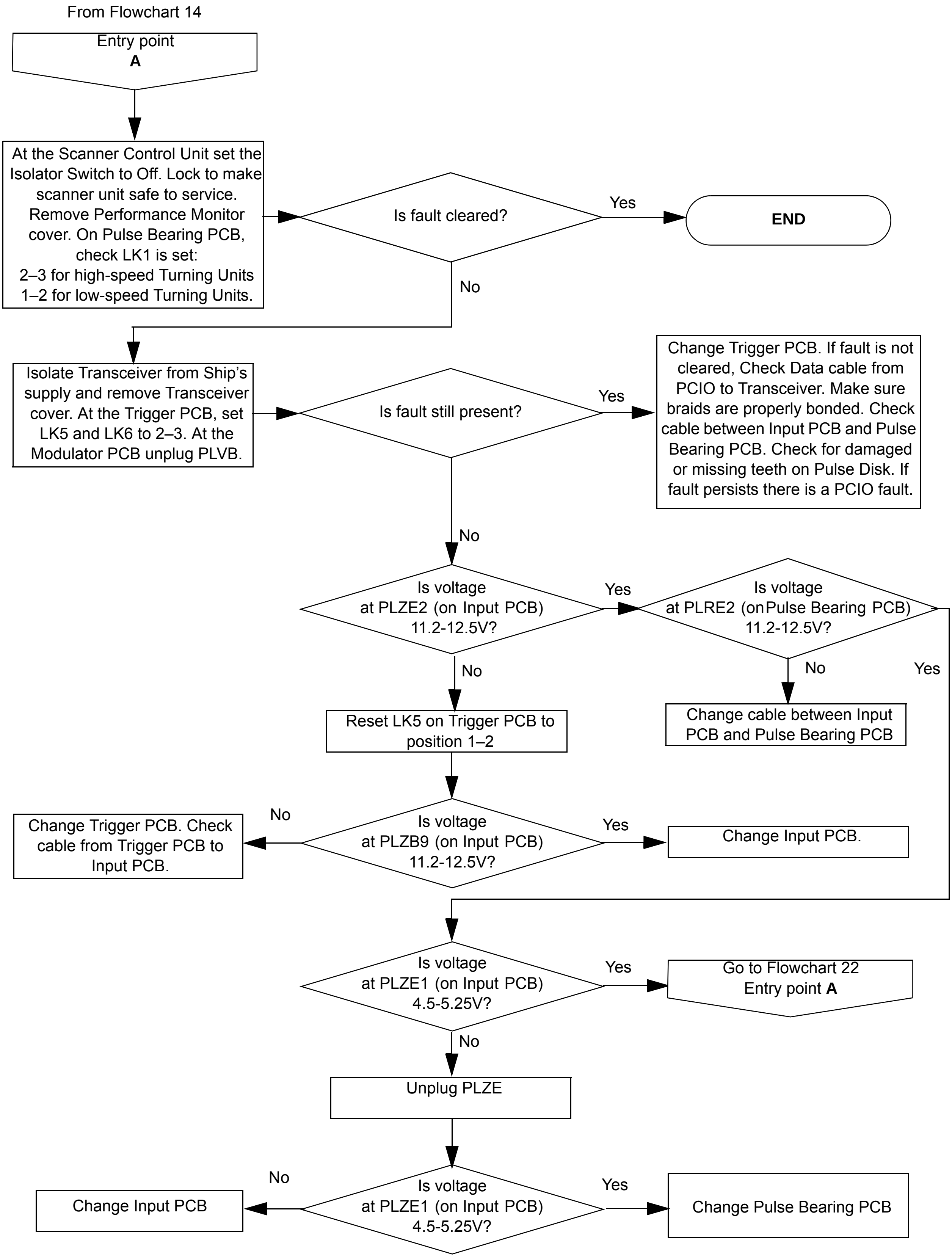
FLOWCHART 19 Azimuth Error Message (contd.)



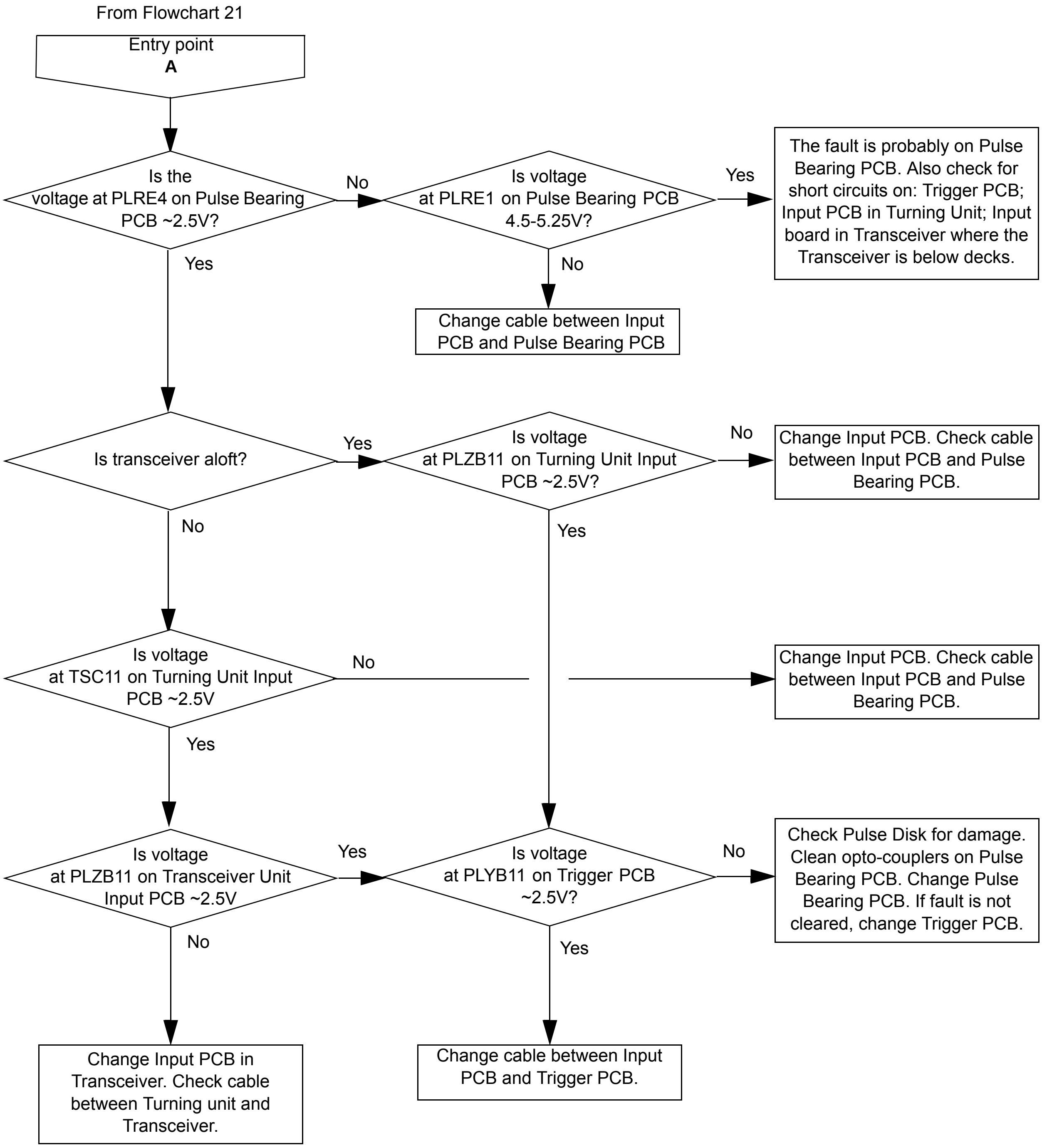
FLOWCHART 20 Azimuth Error Message (contd.)



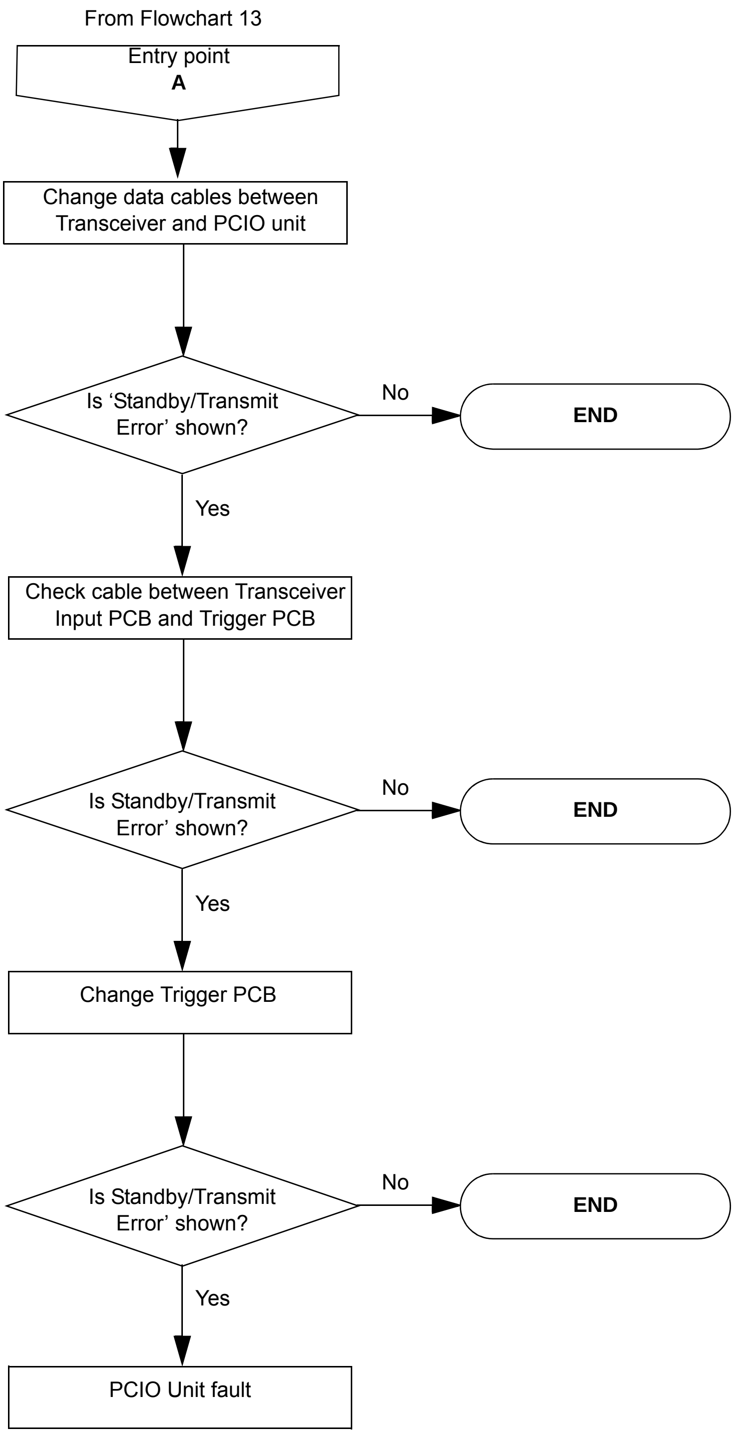
FLOWCHART 21 Azimuth Error Message (contd.)



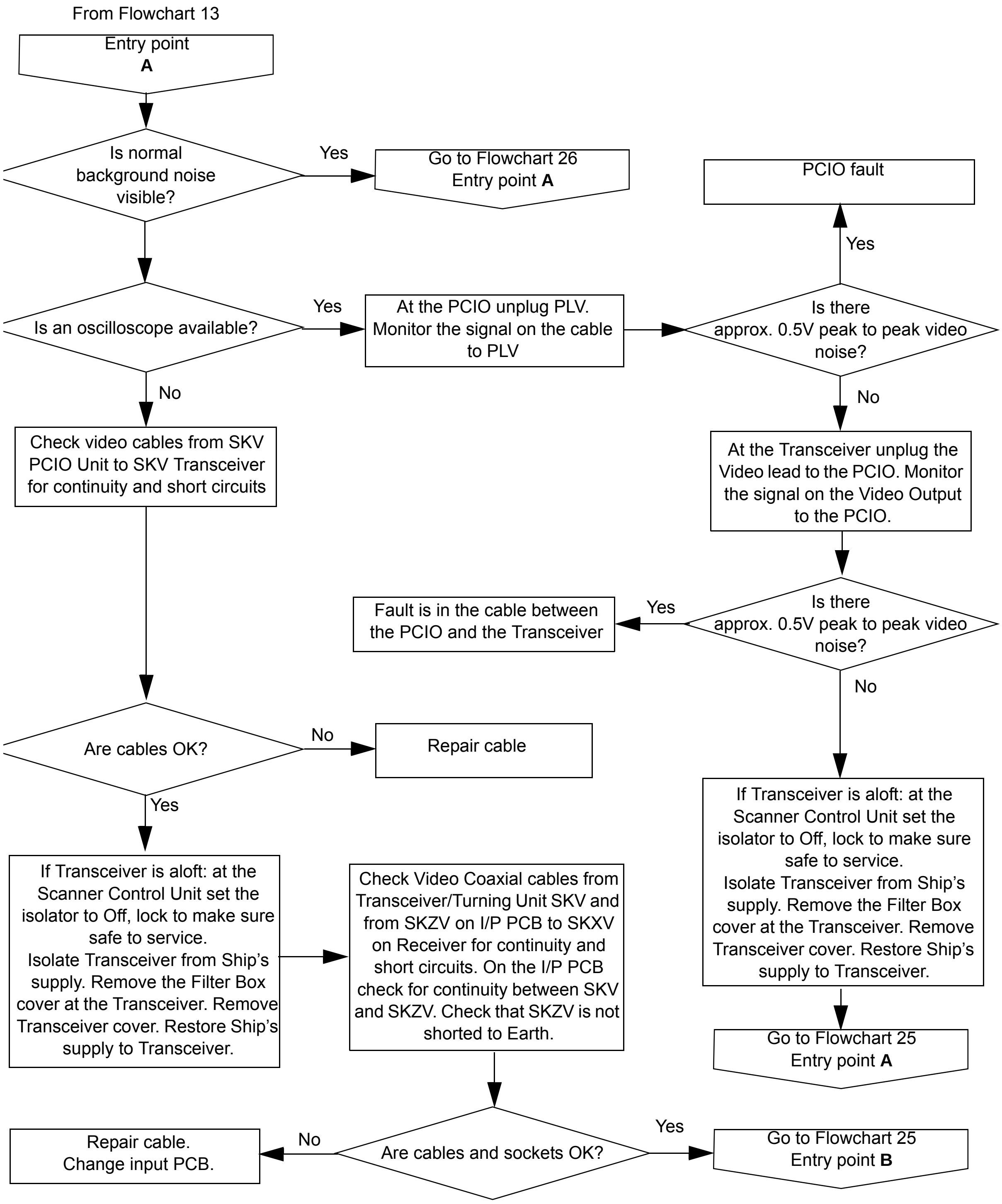
FLOWCHART 22 Azimuth Error Message (contd.)



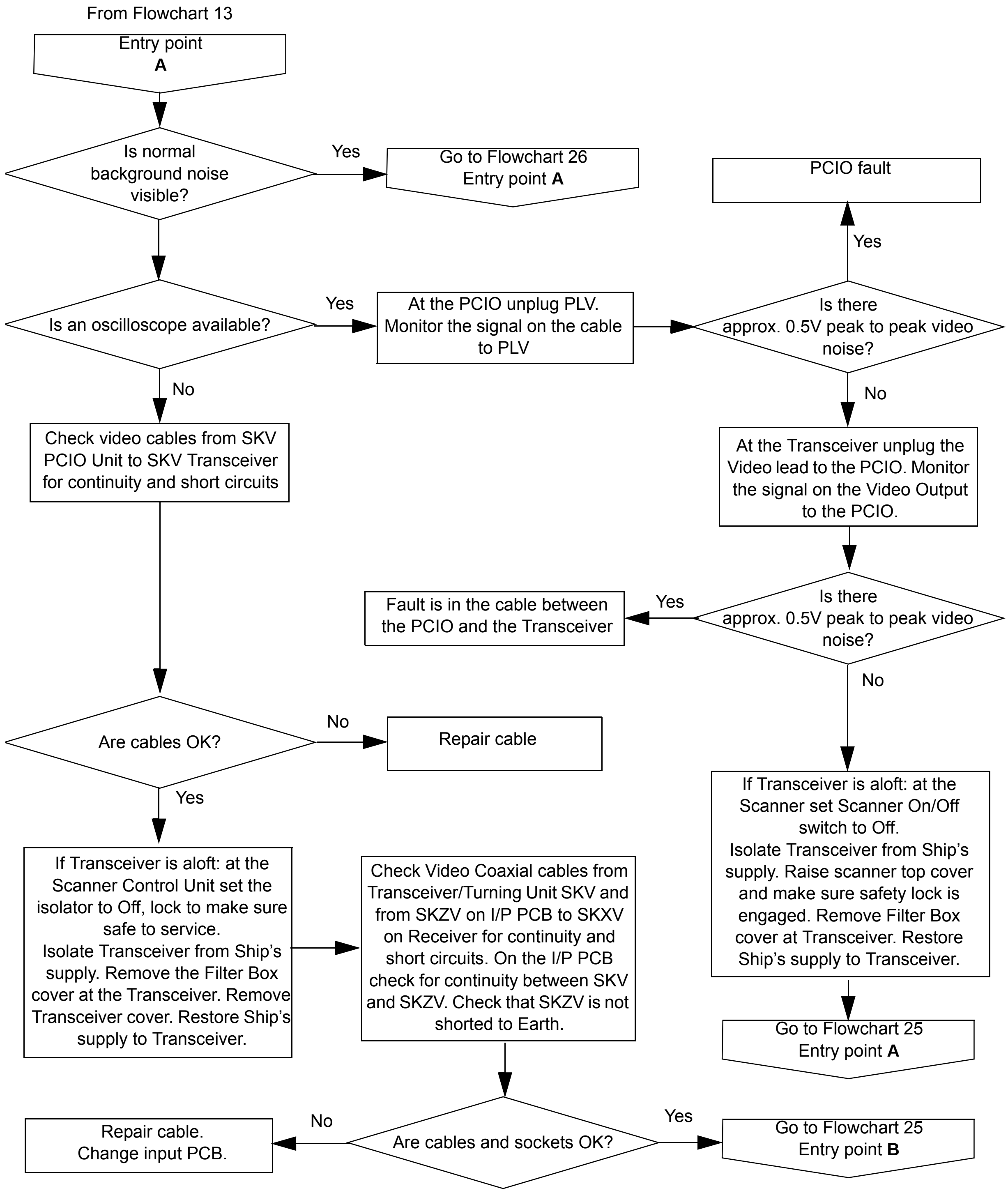
FLOWCHART 23 Standby/Transmit Error Message



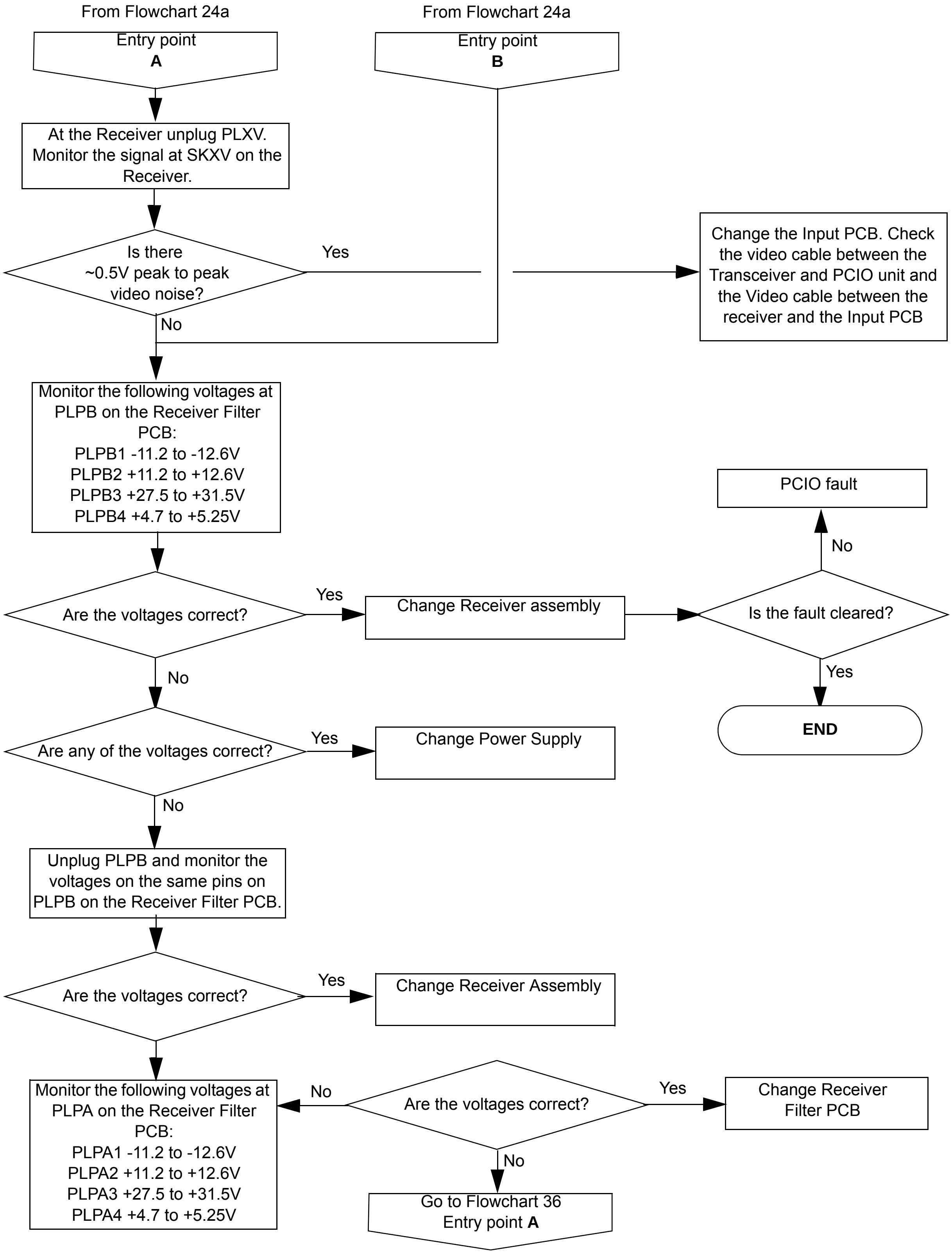
FLOWCHART 24A Low Video Error Message (S-band Scanner)



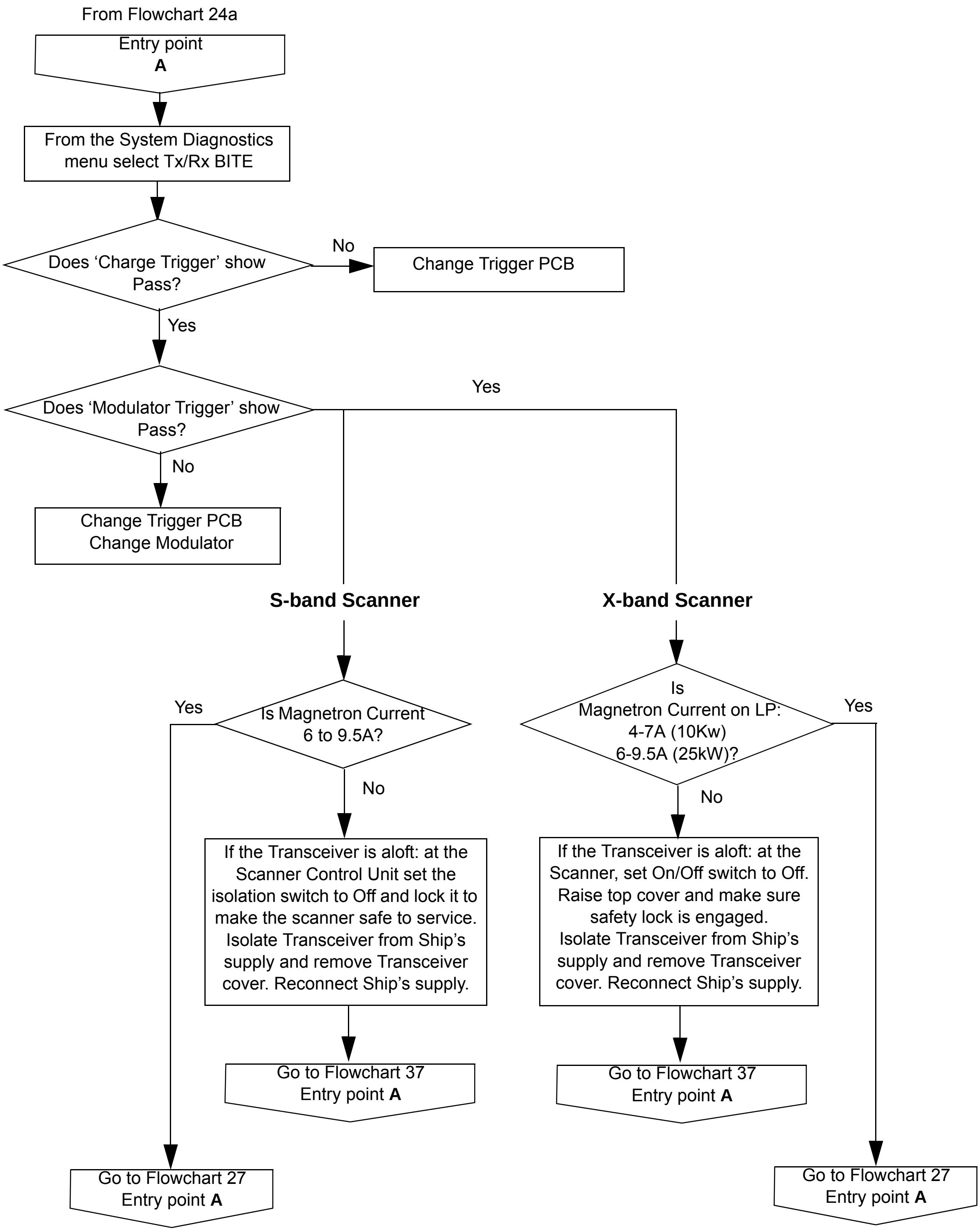
FLOWCHART 24B Low Video Error Message (X-band Scanner)



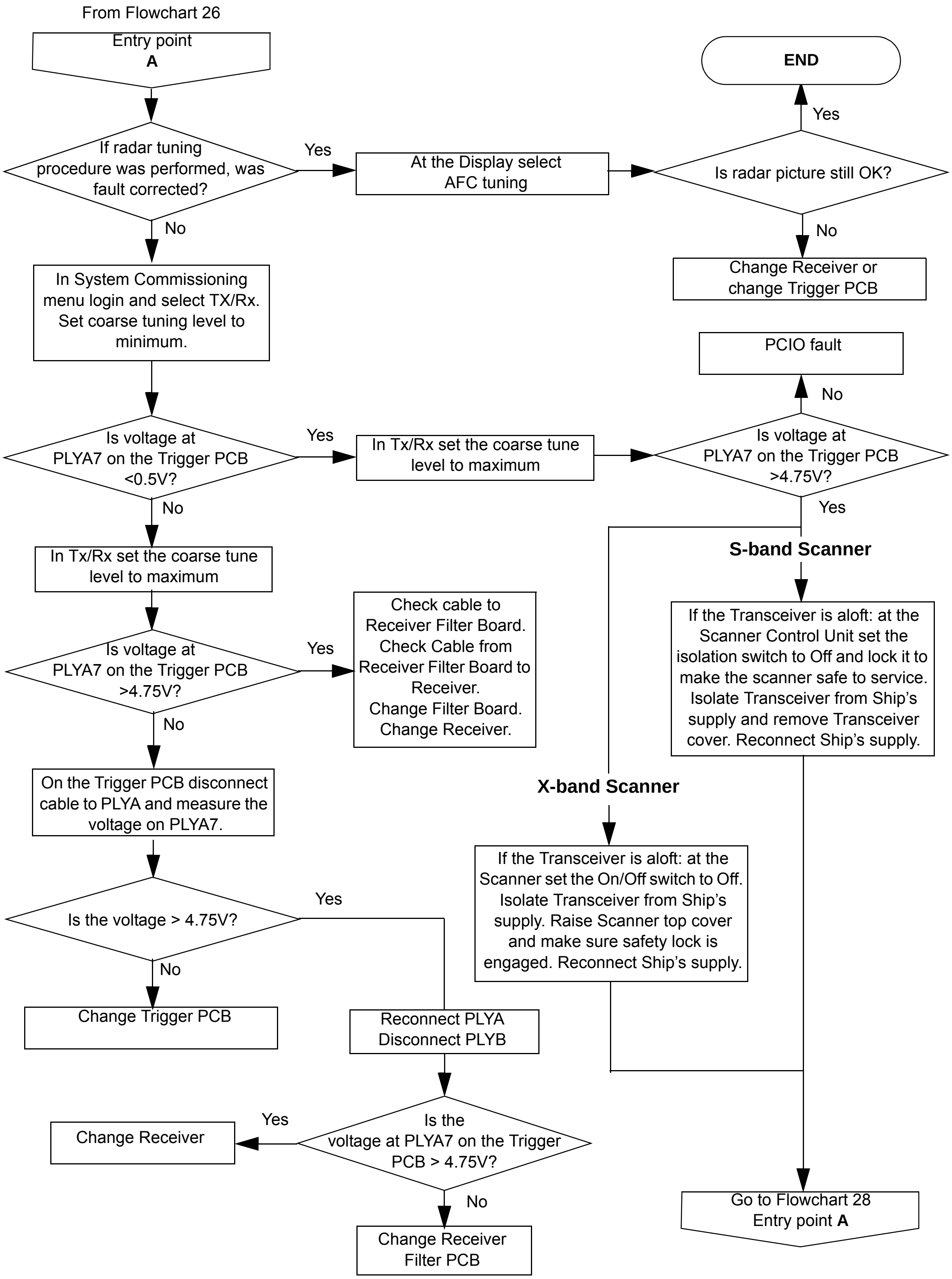
FLOWCHART 25 Low Video Error Message (contd.)



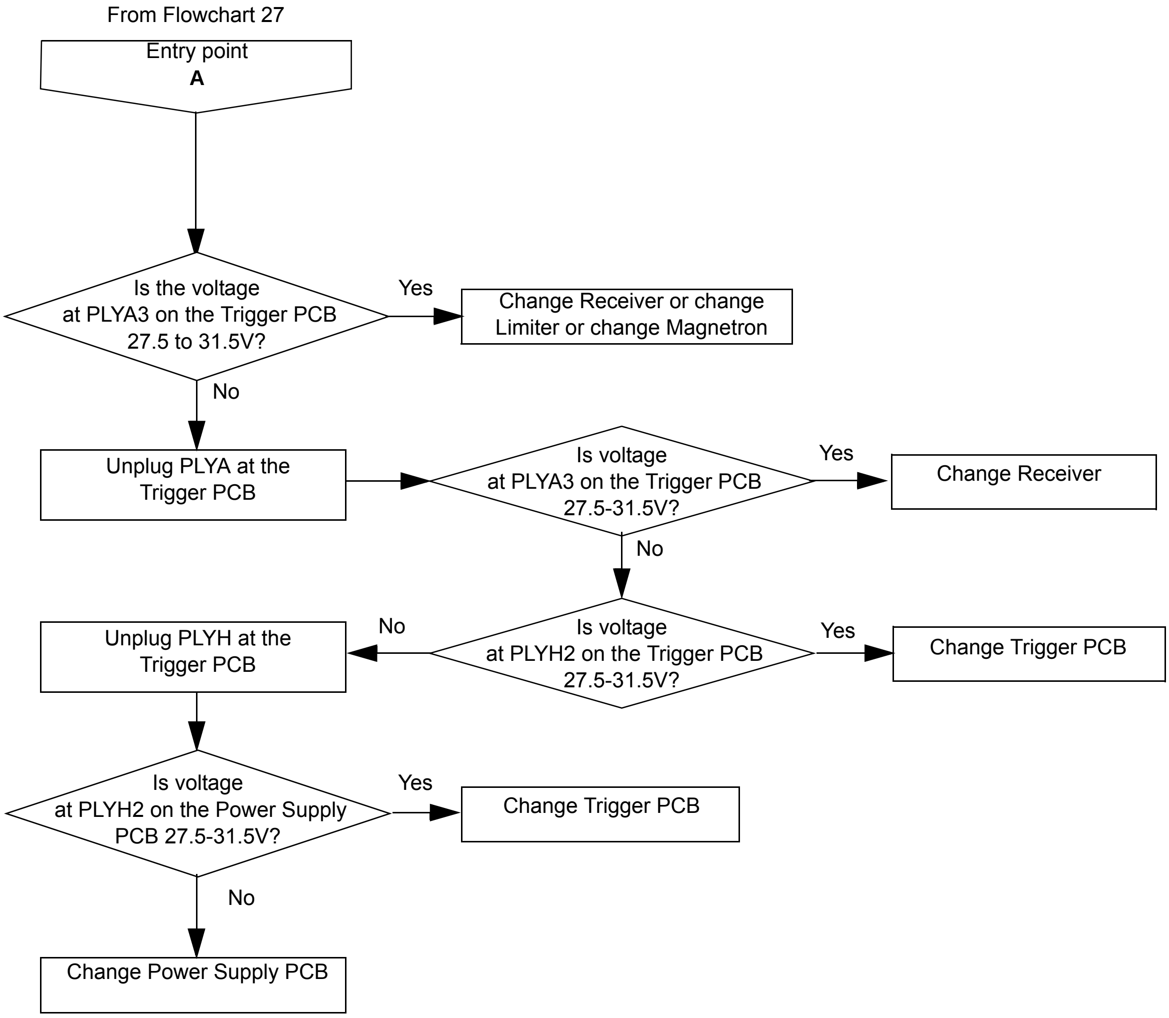
FLOWCHART 26 Low Video Error Message (contd.)



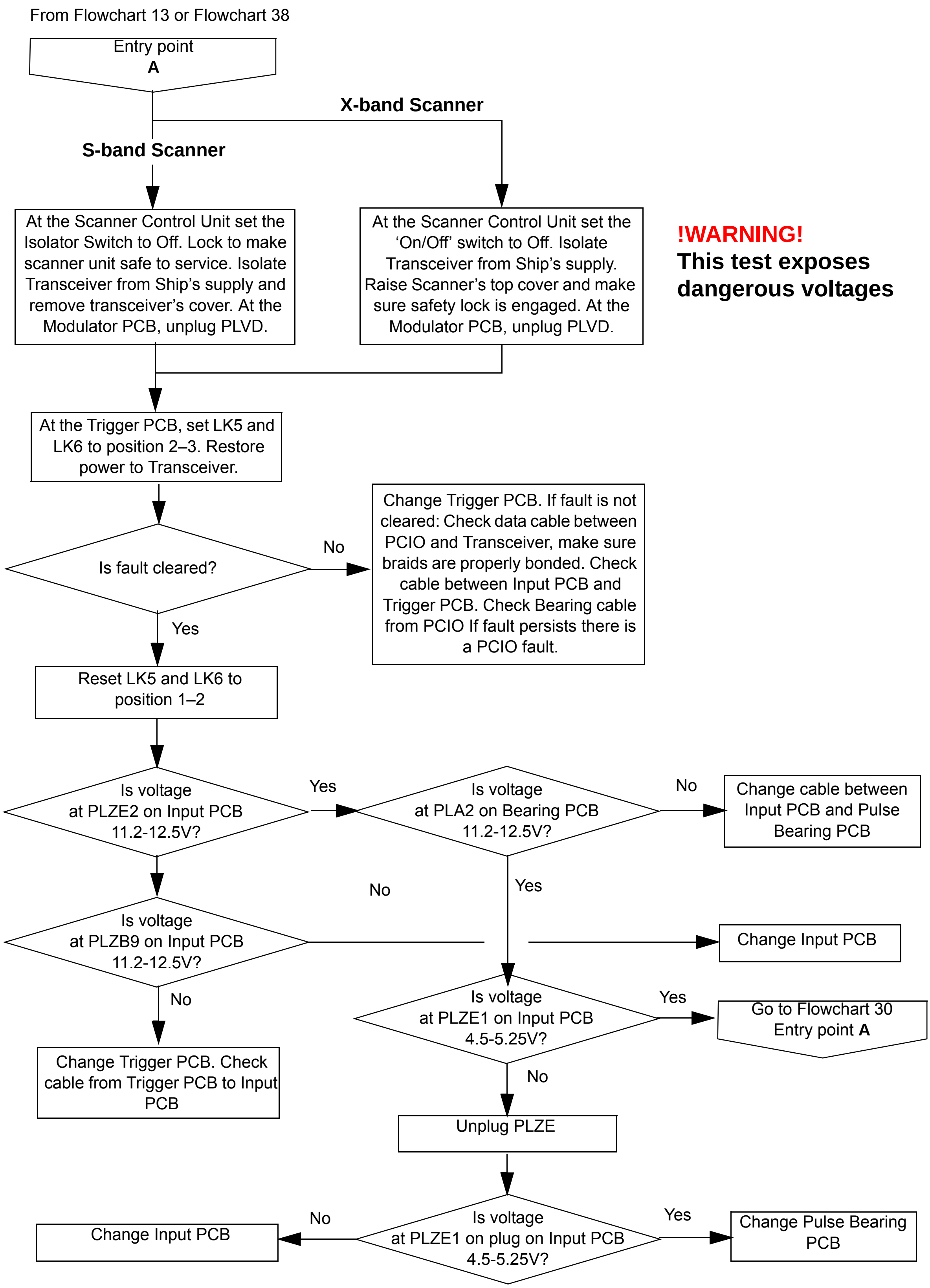
FLOWCHART 27 Low Video Error Message (contd.)



FLOWCHART 28 Low Video Error Message (contd.)

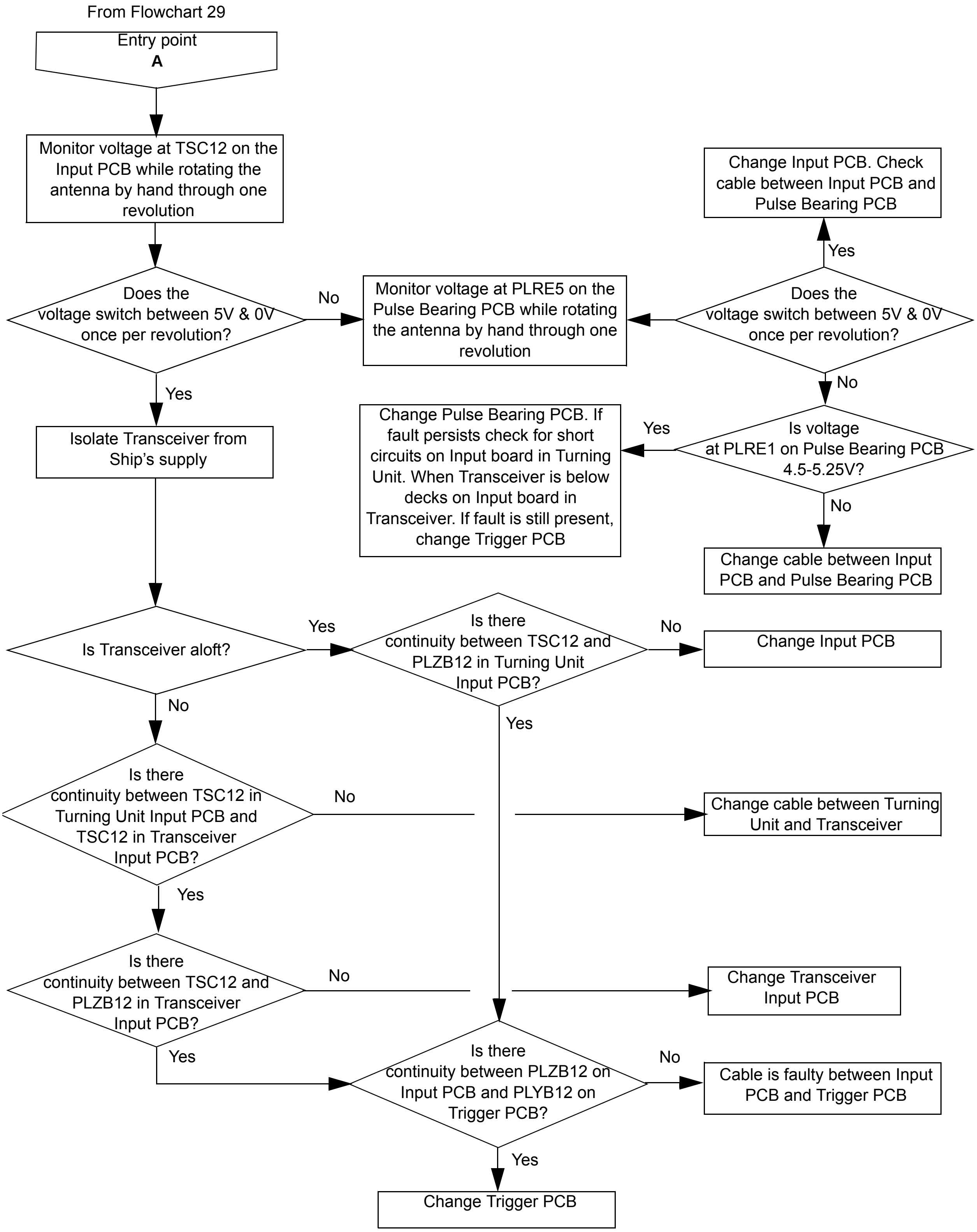


FLOWCHART 29 Heading Marker Error Message

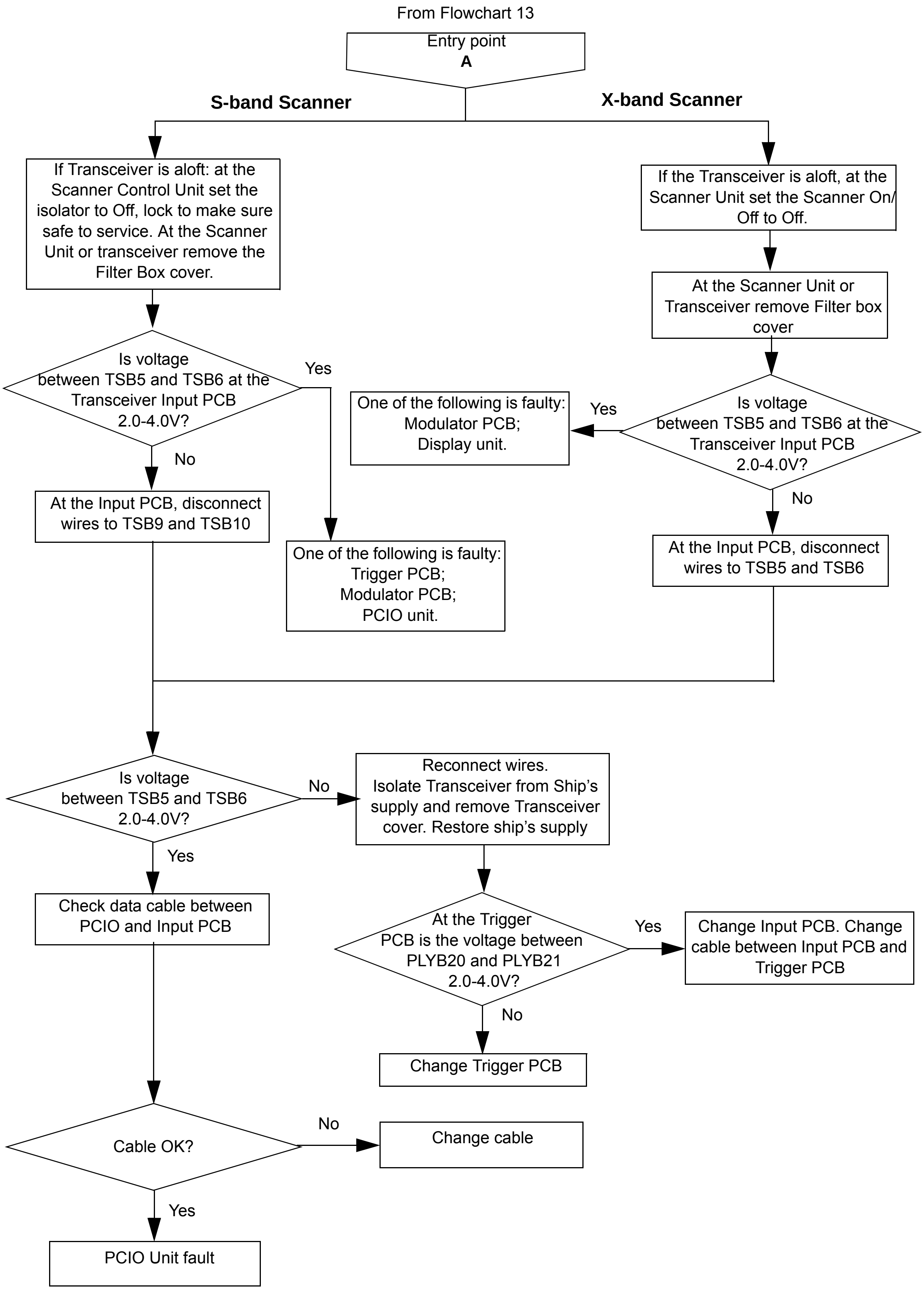


!WARNING!
This test exposes dangerous voltages

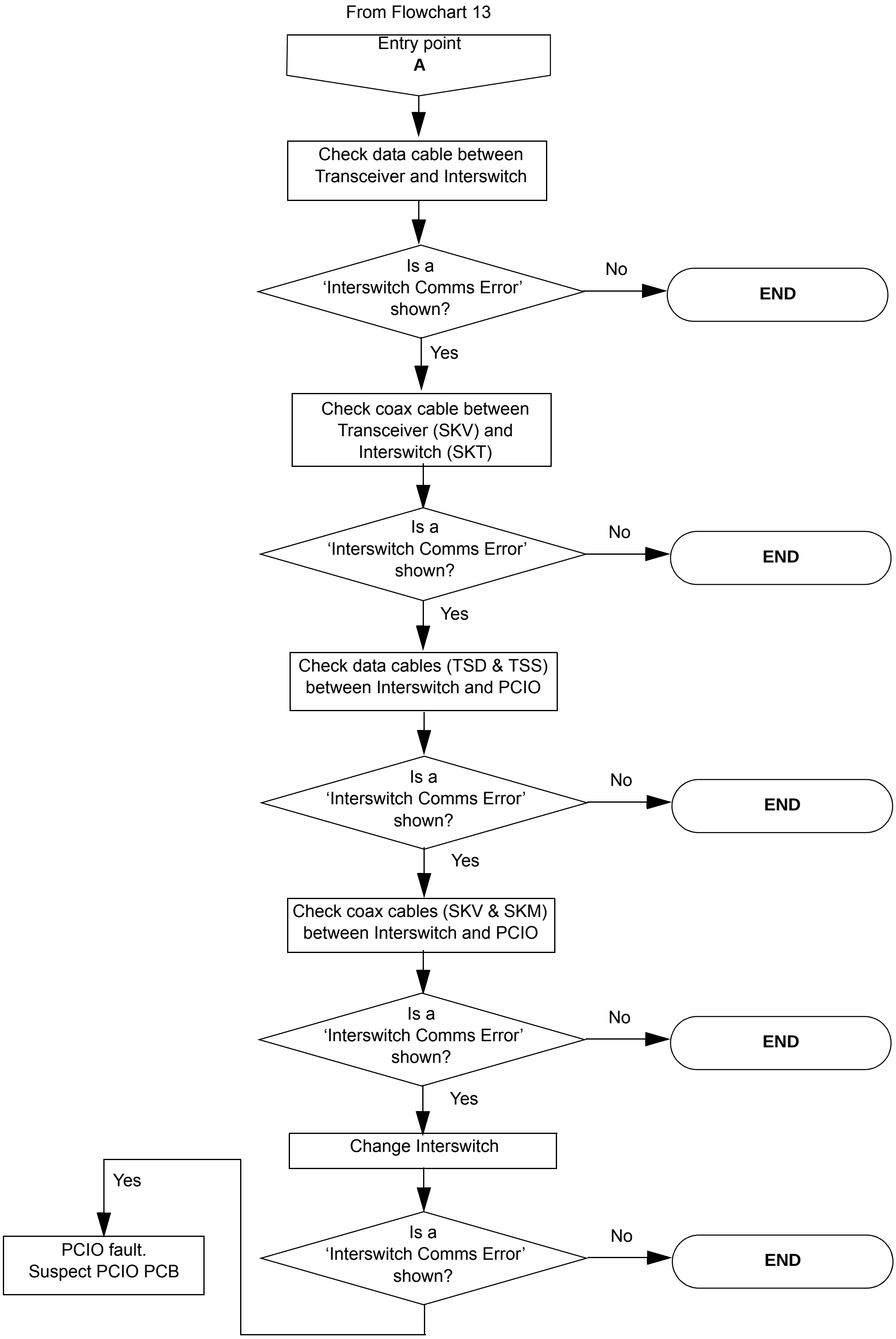
FLOWCHART 30 Heading Marker Error Message (contd.)



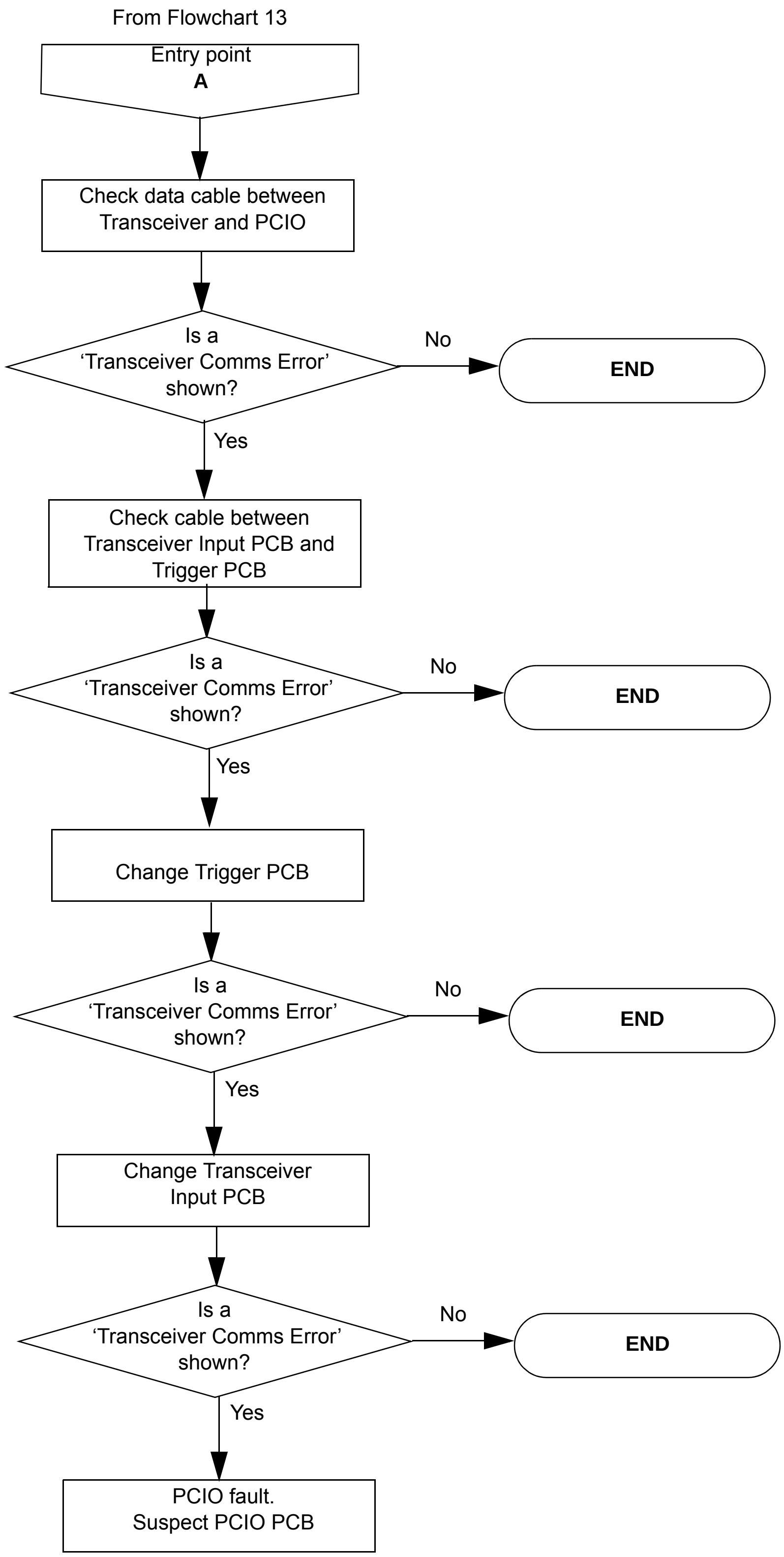
FLOWCHART 31 Trigger Error Message



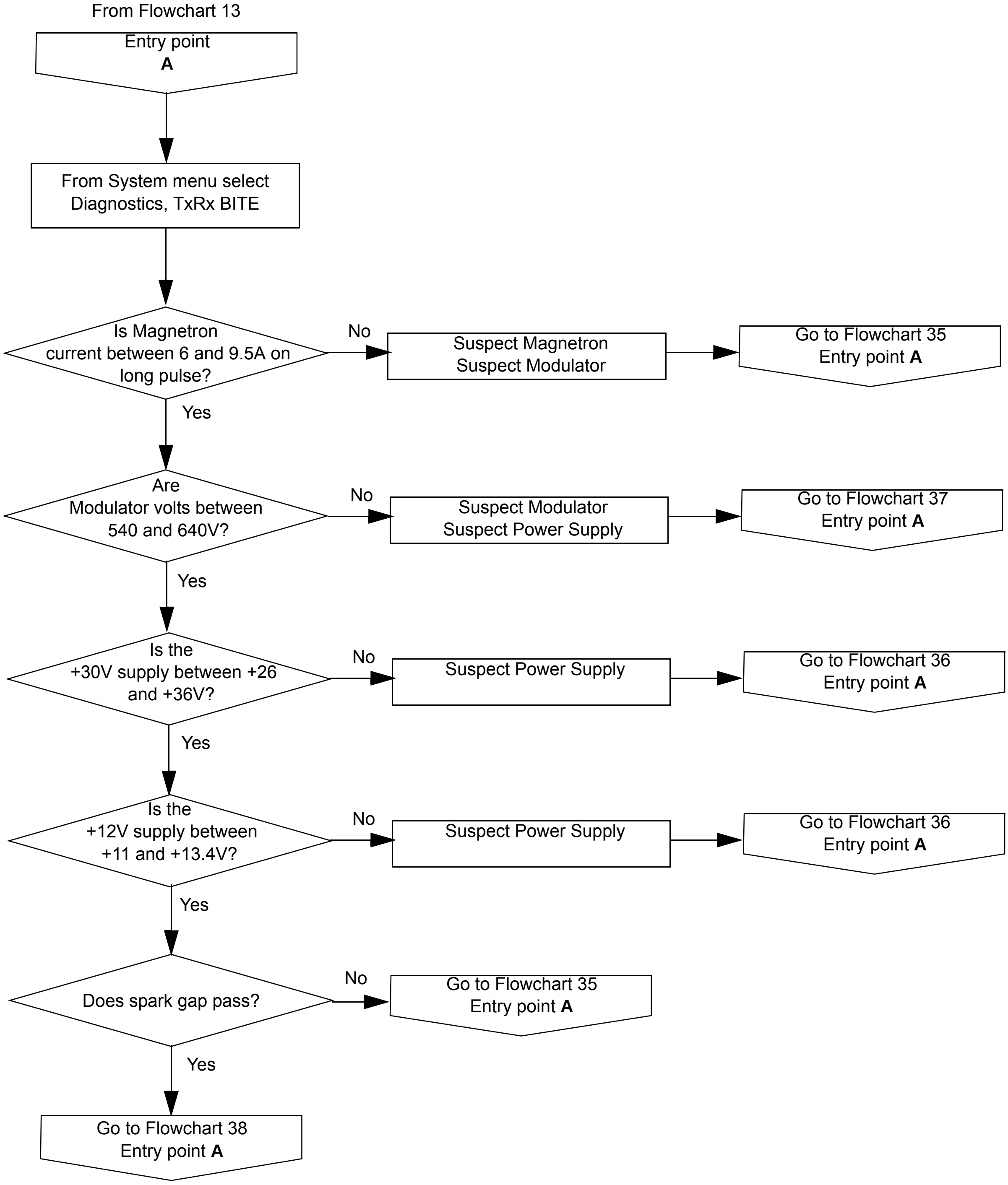
FLOWCHART 32 Interswitch Comms Error Message



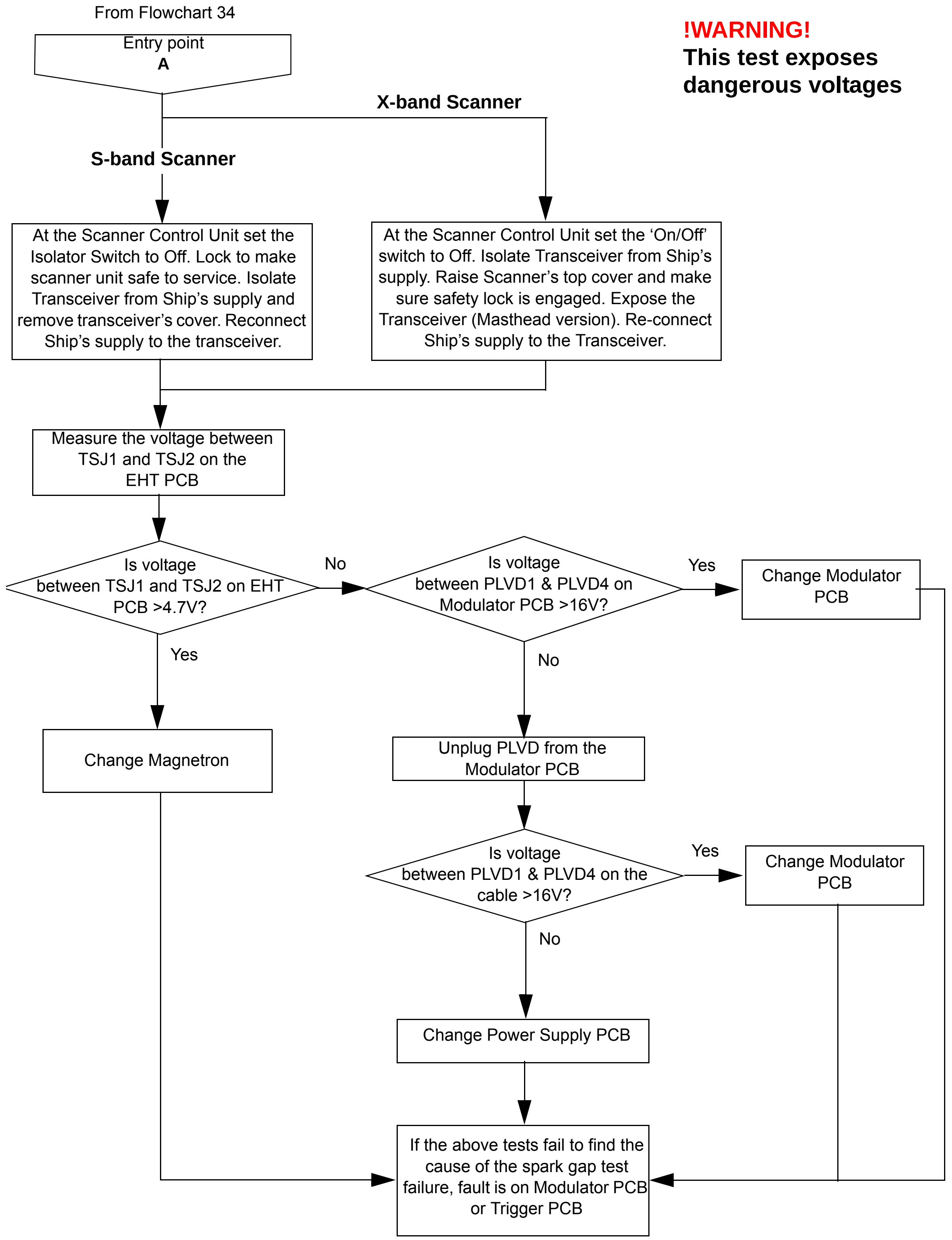
FLOWCHART 33 Transceiver Comms Error Message



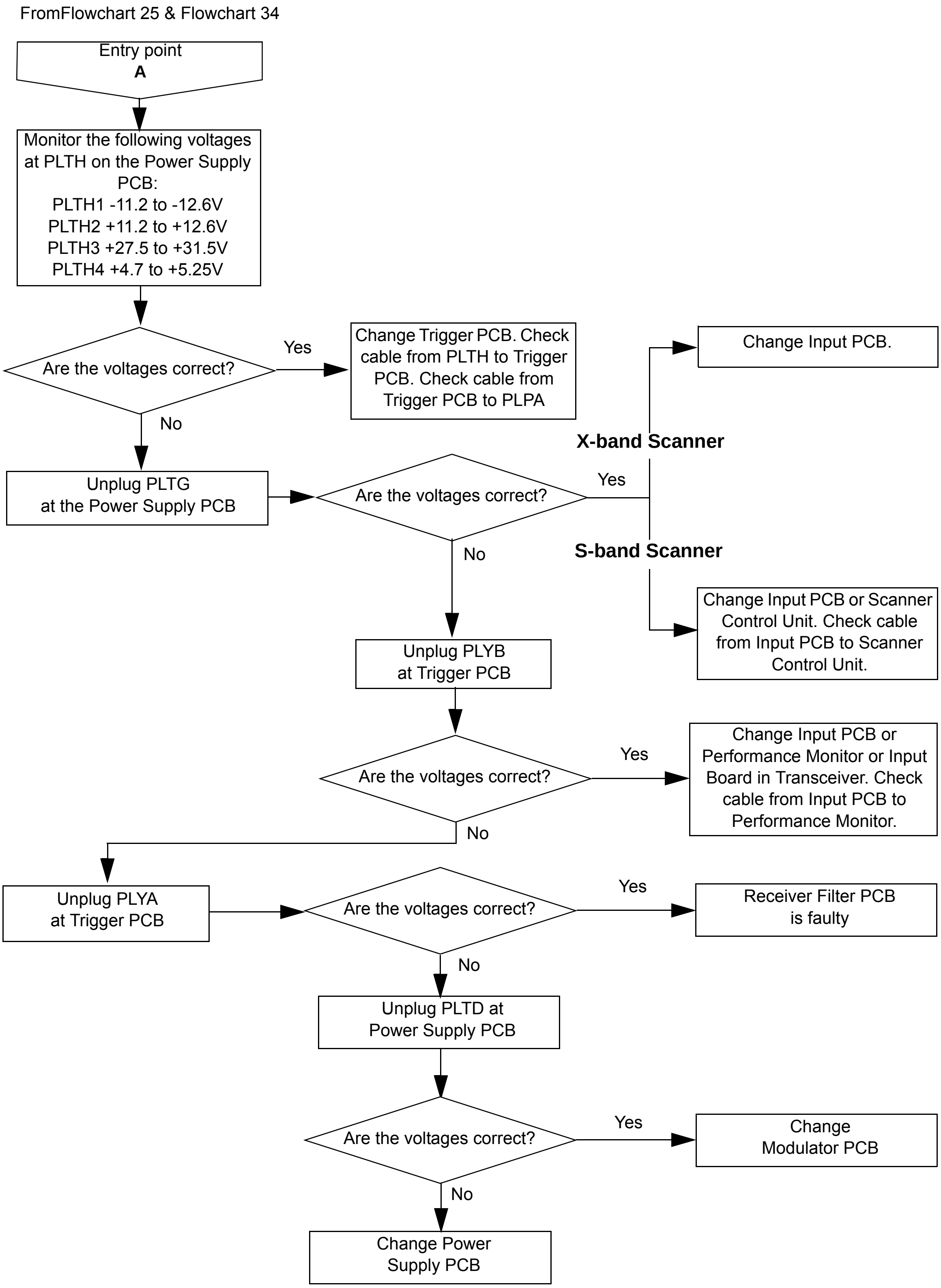
FLOWCHART 34 Transceiver BITE Error Message



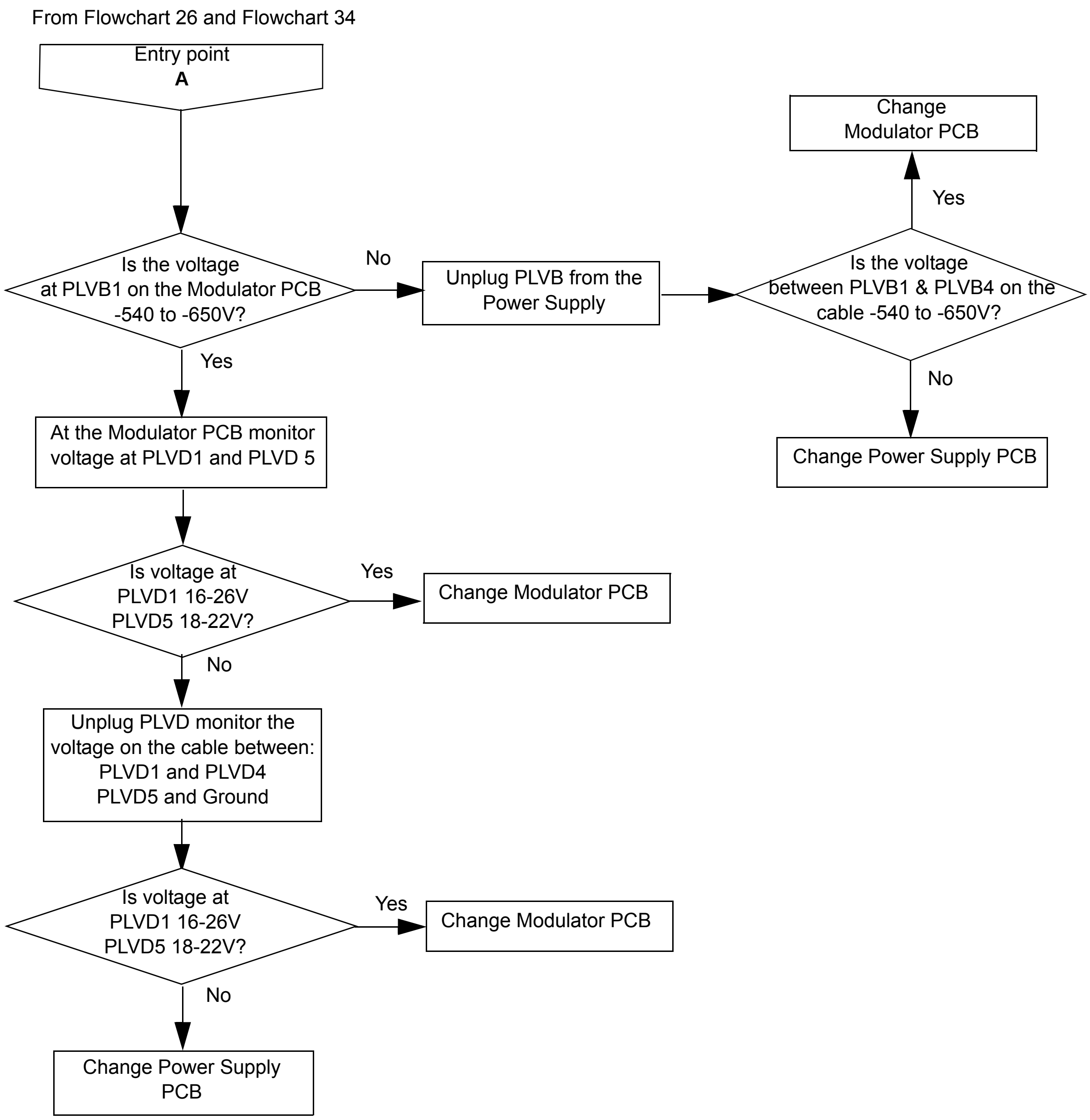
FLOWCHART 35 Transceiver BITE Error Message (Spark Gap Test Failure)



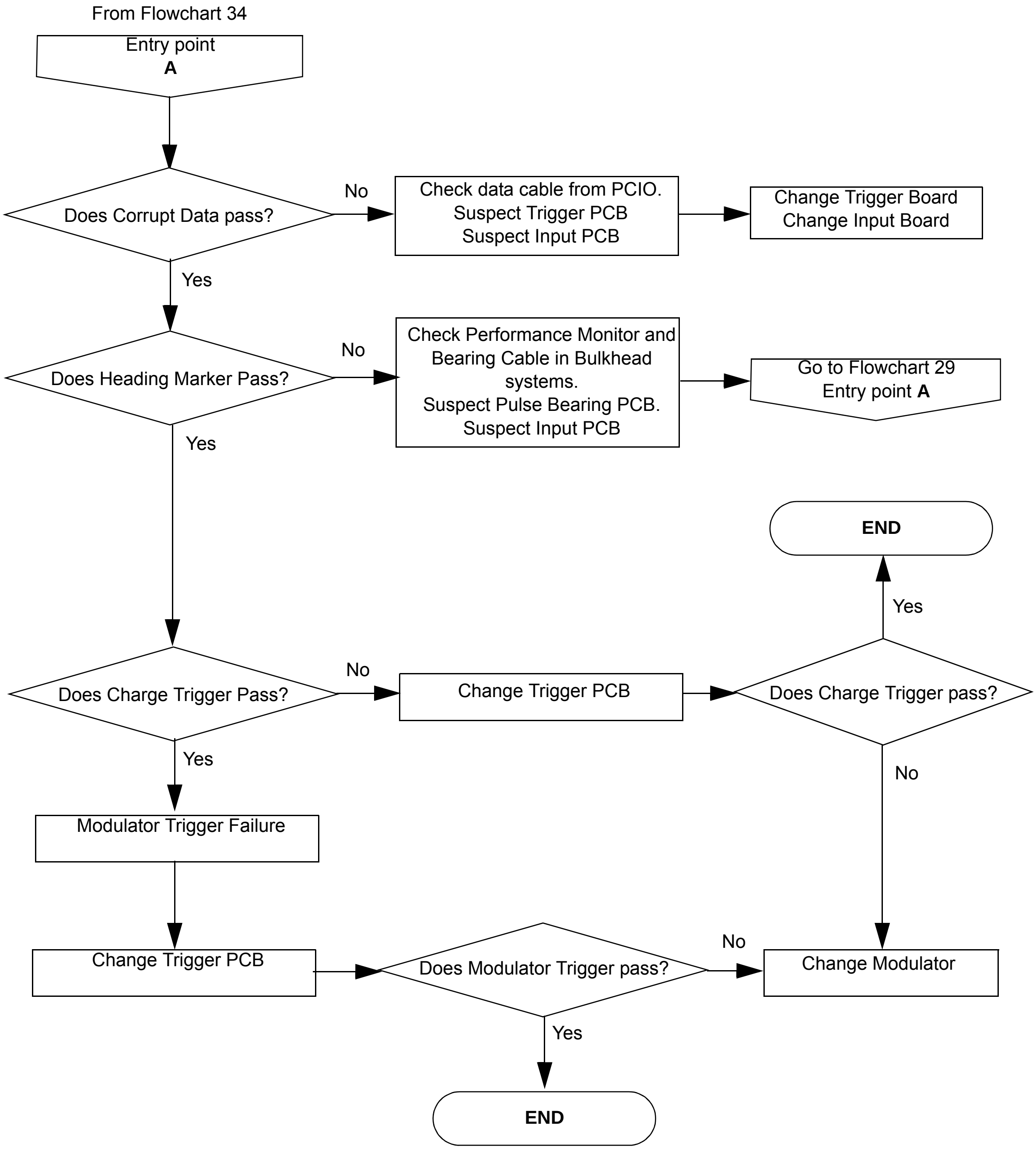
FLOWCHART 36 Transceiver BITE Error Message (contd.)



FLOWCHART 37 Transceiver BITE Error Message (contd.)



FLOWCHART 38 Transceiver BITE Error Message (contd.)



3 First-line Servicing

WARNING! – LETHAL VOLTAGE HAZARD

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. IT IS NOT ADEQUATE TO TURN THE UNIT OFF: THERE ARE HIGH VOLTAGES PRESENT AT ANY POWER SUPPLY THAT IS NOT MAINS ISOLATED.

3.1 S-band Scanner Unit

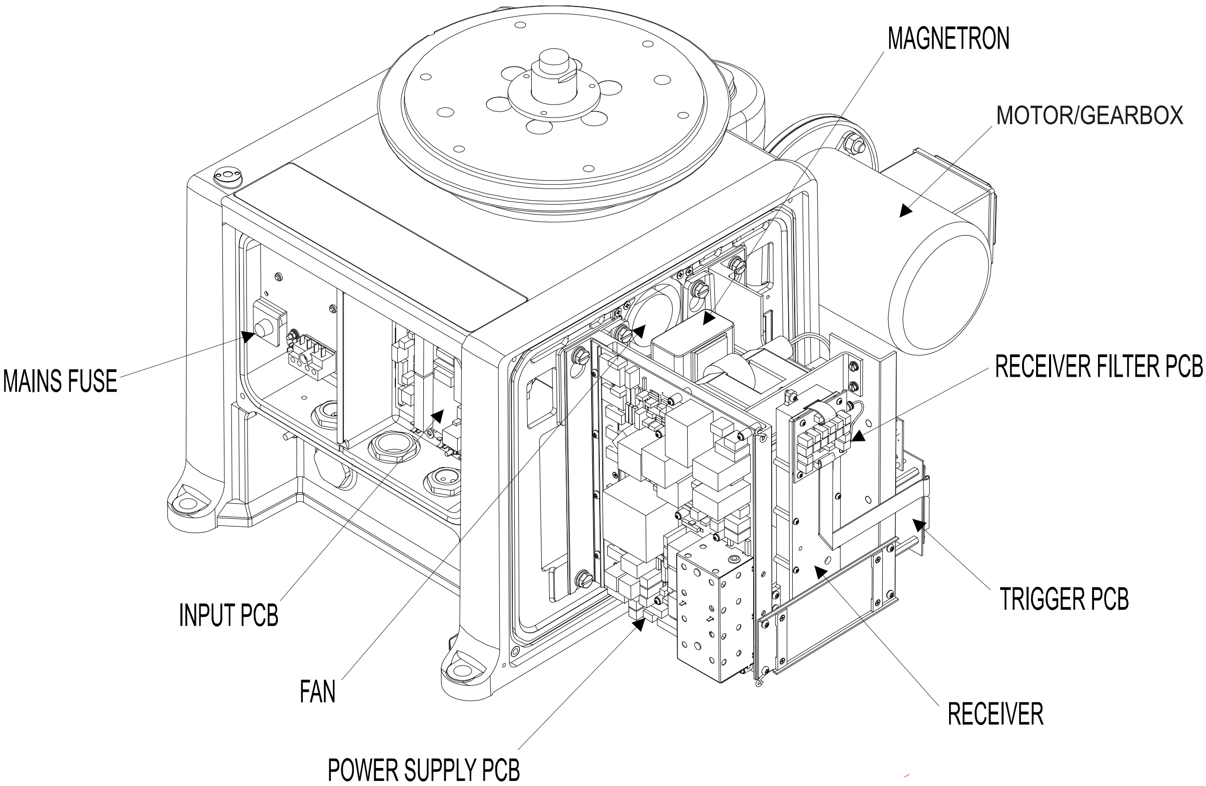


Figure 5.7 Location of S-Band Scanner Major Parts

3.1.1 Access to Masthead Transceiver

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES ARE EXPOSED WHEN THE COVERS ARE REMOVED. ENSURE THE TRANSCEIVER IS ISOLATED FROM SHIP’S SUPPLY, AND THAT THE SHIP’S SUPPLY TO THE SCANNER MOTOR IS ISOLATED AT THE SCANNER CONTROL UNIT.

See Figure 5.8 for instructions on how to access the masthead transceiver.

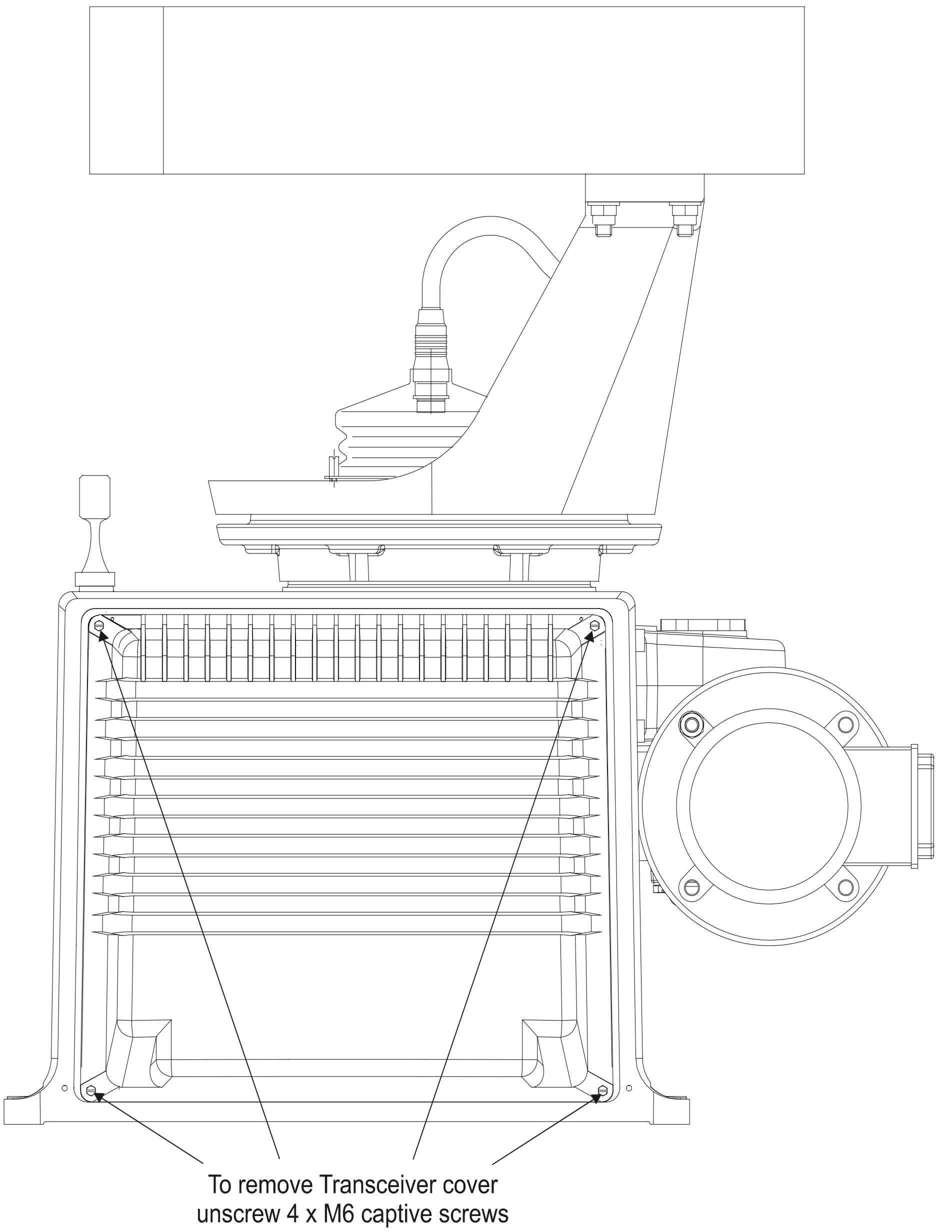


Figure 5.8 Access to Masthead Transceiver

3.1.2 Access to Bulkhead Transceiver

WARNING! – LETHAL VOLTAGE HAZARD
LETHAL VOLTAGES ARE EXPOSED WHEN THE COVERS ARE REMOVED. ENSURE THE TRANSCEIVER IS ISOLATED FROM SHIP'S SUPPLY BEFORE REMOVING THE COVERS.

See Figure 5.9 for instructions on how to access the bulkhead transceiver.

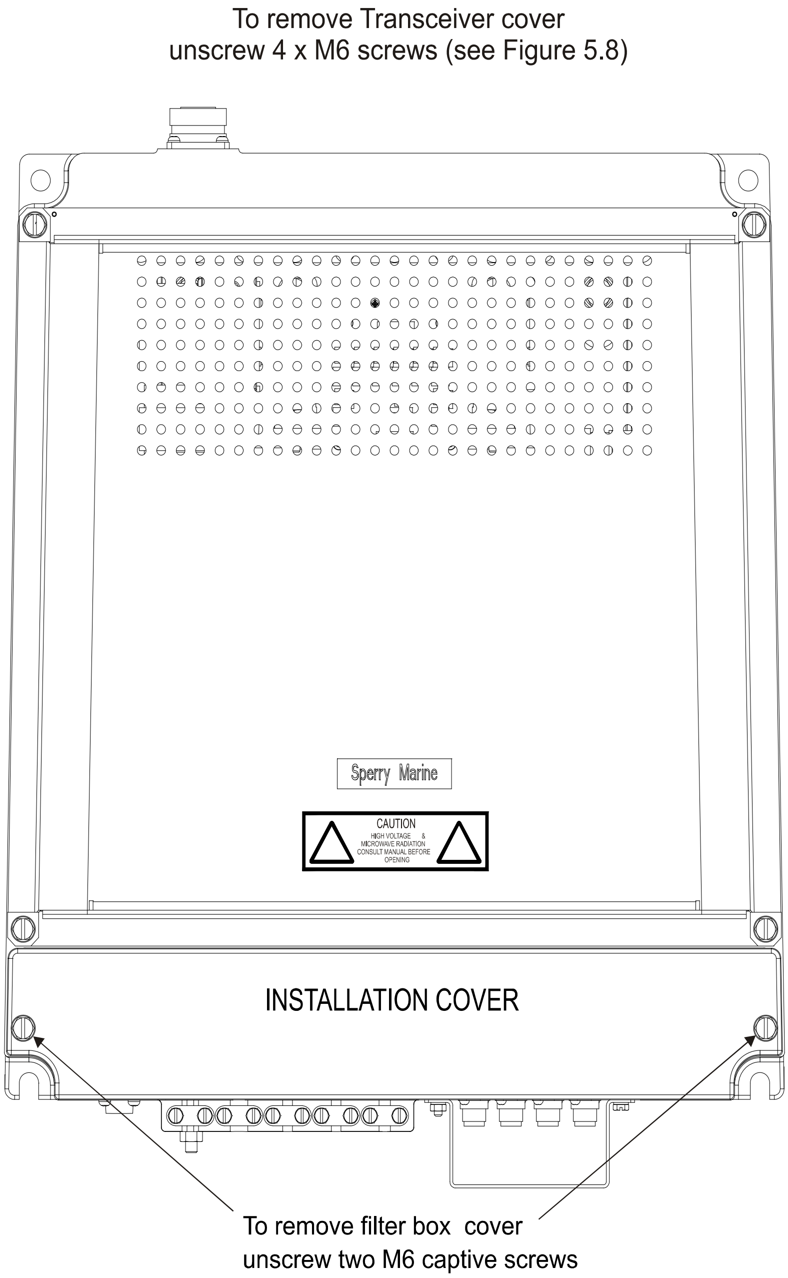


Figure 5.9 Access to Bulkhead Transceiver

3.1.3 Replacing the Transceiver in the Masthead Turning Unit

	WARNING! – LETHAL VOLTAGE HAZARD
	LETHAL VOLTAGES ARE EXPOSED WHEN THE COVERS ARE REMOVED. ENSURE THE TRANSCEIVER IS ISOLATED FROM SHIP'S SUPPLY BEFORE REMOVING THE TRANSCEIVER.

See Figure 5.10 for instructions on removing and replacing the Transceiver from the masthead Turning Unit.

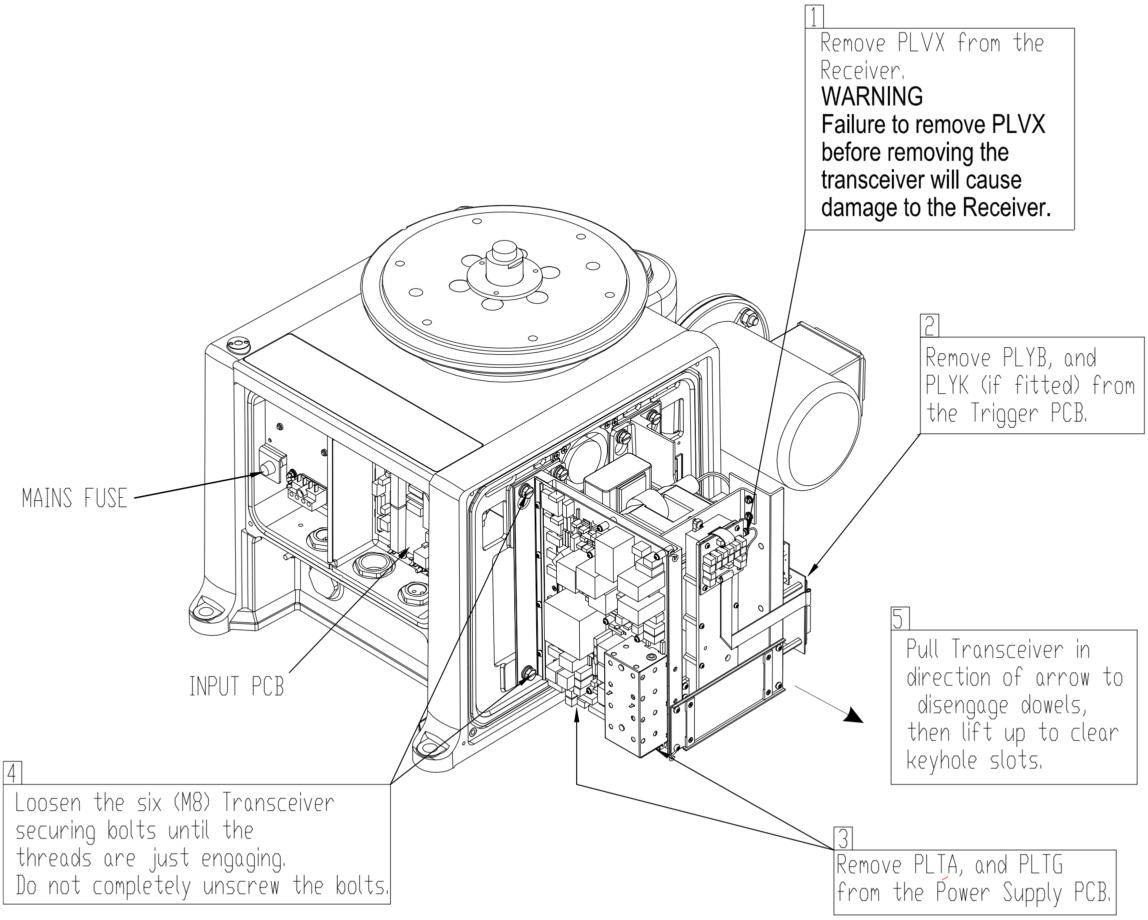


Figure 5.10 Removing the Transceiver from the Masthead Turning Unit

3.1.4 Replacing the Transceiver in the Bulkhead Turning Unit

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES ARE EXPOSED WHEN THE COVERS ARE REMOVED. ENSURE THE TRANSCEIVER IS ISOLATED FROM SHIP'S SUPPLY BEFORE REMOVING THE TRANSCEIVER.

See Figure 5.11 for instructions on removing and replacing the Transceiver from the bulkhead Tuning Unit.

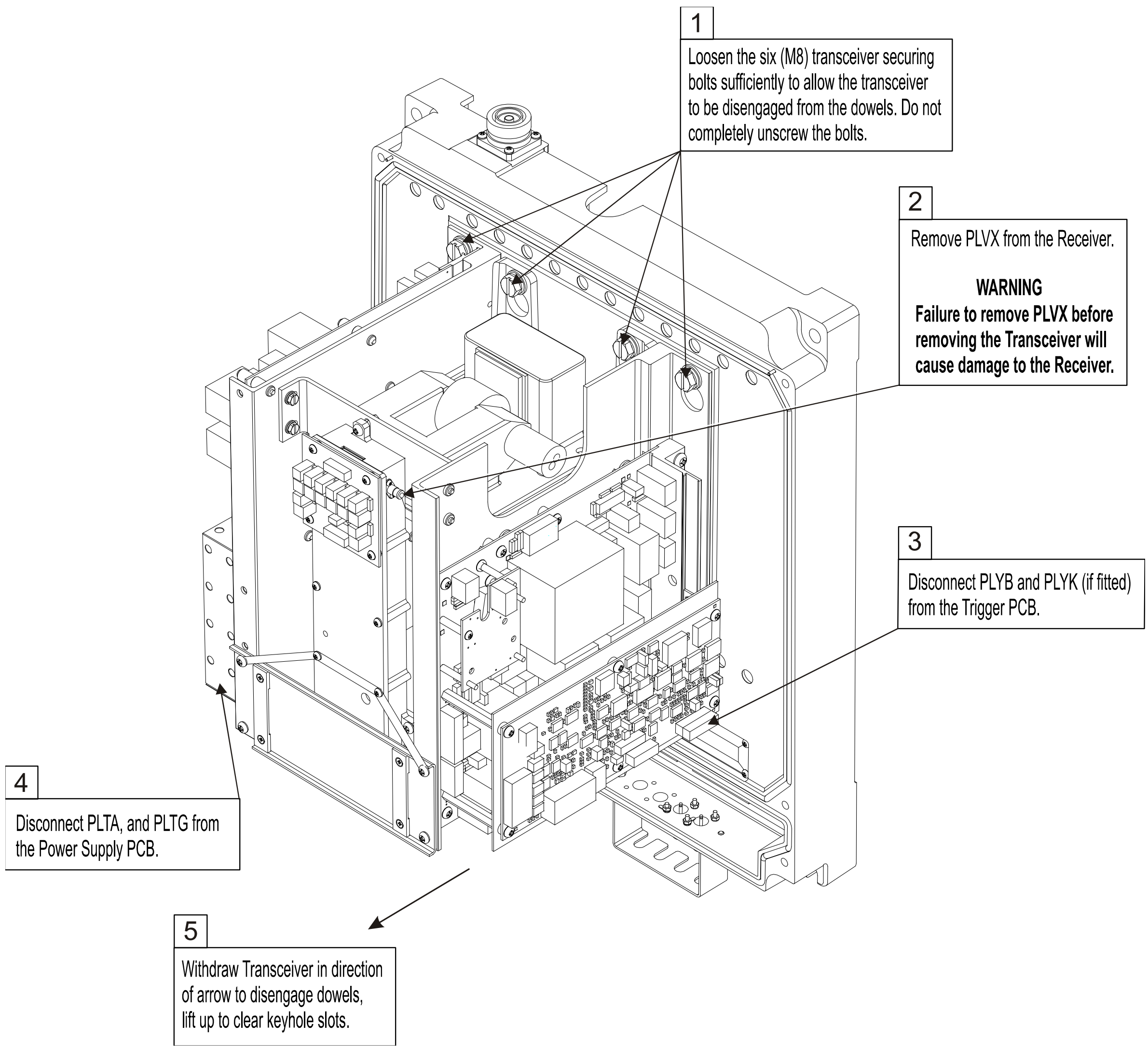


Figure 5.11 Removing Bulkhead Transceiver Assembly 65830630

3.1.5 Magnetron Replacement – 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 supplied.
4. Refer to Figure 5.8, and remove the Transceiver cover from the scanner unit.
5. Refer to Figure 5.12, and follow the procedure for removing and replacing the magnetron.

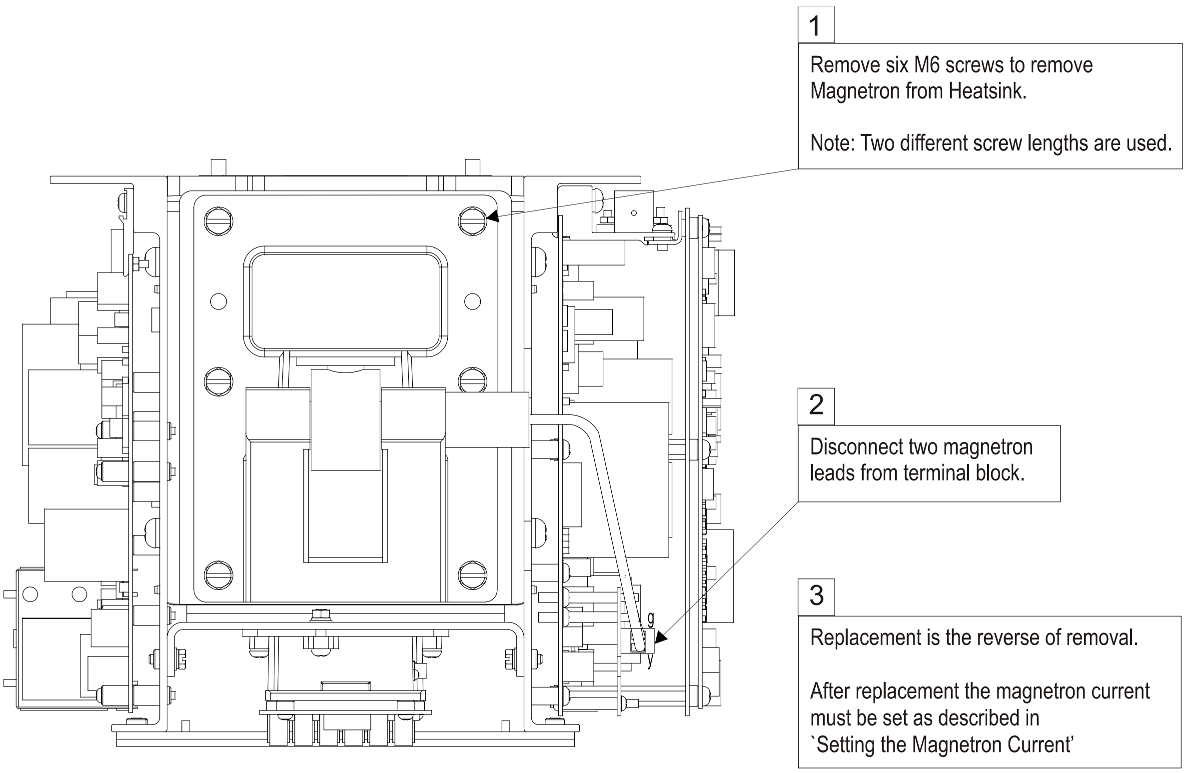


Figure 5.12 Magnetron Replacement

When a magnetron is replaced, the magnetron current must be set as follows:

6. On the Trigger PCB set links LK5 and LK6 to position 2–3.
7. Reconnect the ship's mains supply, and switch the radar ON.
8. Wait 3 minutes for the magnetron time delay to expire, and select long pulse.
9. Set the magnetron current as detailed in Section 3.1.7.

10. Isolate the radar from the ship's mains supply using the isolating switch supplied.
11. Reset LK5 and LK6 to position 1–2.
12. Replace the Transceiver cover.

3.1.6 Magnetron Replacement – Bulkhead Transceiver

1. Isolate the radar from the ship's mains supply using the isolating switch supplied.
2. Refer to Figure 5.9 and remove the transceiver cover.
3. Refer to Figure 5.12, and follow the procedure for removing and replacing the magnetron.

When a magnetron is replaced, the magnetron current must be set as follows:

4. Reconnect the ship's mains supply, and switch the radar ON.
5. Wait 3 minutes for the magnetron time delay to expire, and select long pulse.
6. Set the magnetron current as detailed in Section 3.1.7.
7. Isolate the radar from the ship's mains supply using the isolating switch supplied.
8. Replace the transceiver cover.

3.1.7 Setting the Magnetron Current

The magnetron current is required to be set whenever a magnetron, modulator PCB or transceiver power supply PCB is replaced.

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES ARE EXPOSED IN THIS PROCEDURE ENSURE THAT THE POWER SUPPLY TO THE SCANNER UNIT IS TURNED OFF AT THE SCANNER CONTROL UNIT.

WARNING! – RADIATION HAZARD

ANTENNA ROTATION IS DISABLED AS PART OF THIS PROCEDURE. IF FACTORY SET PCB CONFIGURATION LINKS ARE IN PLACE, MICROWAVE TRANSMISSION IS PREVENTED. OBSERVE SAFETY DISTANCES FOR MICROWAVE TRANSMISSION AND ROTATING ANTENNAS WHEN ANTENNA ROTATION IS ENABLED.

1. Power up the radar and set the system to Standby.
2. Inhibit the antenna rotation by setting the isolating switch on the Scanner Control Unit to '**OFF**' or '**O**' position and lock the switch.
3. At the Transceiver use a digital volt meter (DVM) and clip probes to measure the 'Modulator HT' voltage between the TP3 test point on the Power Supply PCB (refer to Figure 5.18 for location) and the transceiver chassis.
4. Adjust RV1 on the Power Supply PCB to achieve the following voltage between TP3 and chassis:

   S-band 30kW: -630 to -650V
5. Ensure the antenna is free to rotate, clear the safety distance around the turning unit and re-enable antenna rotation by setting the isolating switch on the Scanner Control Unit to '**ON**' or '**I**'.
6. After enabling antenna rotation, keep out of the antenna arc and observe the microwave radiation hazard zone safety distances given in the Preamble chapter ('Warnings and Cautions' section) of this manual.
7. Check the magnetron current reported at the VisionMaster FT (VMFT) display by doing the following:

   7.1 In the System/Diagnostics menu open the Tx/Rx BITE tab folder (see *Chapter 2 'Diagnostics, Commissioning & Service Mode*' in Volume 2 of the Ships Manual).

   7.2 Set the radar to Transmit and select Long Pulse (LP) transmission pulse length (LP is available at range scales of 3NM and above).

7.3 Note the magnetron current setting in the TxRx BITE tab folder. If the value is within a range of between -7.0 to 9.0 Amp, the magnetron current settings procedure is complete.

8. If the magnetron current setting in TxRx BITE is not within the range given above do the following:

   8.1 Set the system to Standby and disable antenna rotation by setting the isolating switch on the Scanner Control Unit to ‘**OFF**’ or ‘**O**’ position.

   8.2 If the reported magnetron current was too low, adjust RV1 on the Power Supply PCB <u>clockwise</u> to increase Modulator HT.

   8.3 If the reported magnetron current was too high, adjust RV1 on the Power Supply PCB <u>anticlockwise</u> to decrease Modulator HT.

   Note: *It is recommended to increase or decrease the voltage by approximately 50V, which is about one quarter turn of RV1.*

   8.4 Measure the ‘Modulator HT’ voltage between PSU TP3 and chassis as described in step 3.

9. Re-check the magnetron current at the VMFT display as described in step 7.

10. If the reported magnetron current is still outside the limits then step 8 may be repeated, however it is more likely that a defect has occurred within the system. The most probable cause of this will be in the following modules: Magnetron, Modulator, Transceiver PSU, Transceiver cabling or the Trigger PCB.

11. Once the magnetron current has been successfully set the Transceiver and/or turning unit can be sealed up as described in Section 3.1.4. Observe hazard zone safety distances, disable rotation during access to turning units and isolate power to the system when replacing covers.

3.1.8 Trigger PCB – Replacement

See Figure 5.13 and Figure 5.14 for instructions on replacement of the Trigger PCB.

Set the links as shown in Figure 5.14.

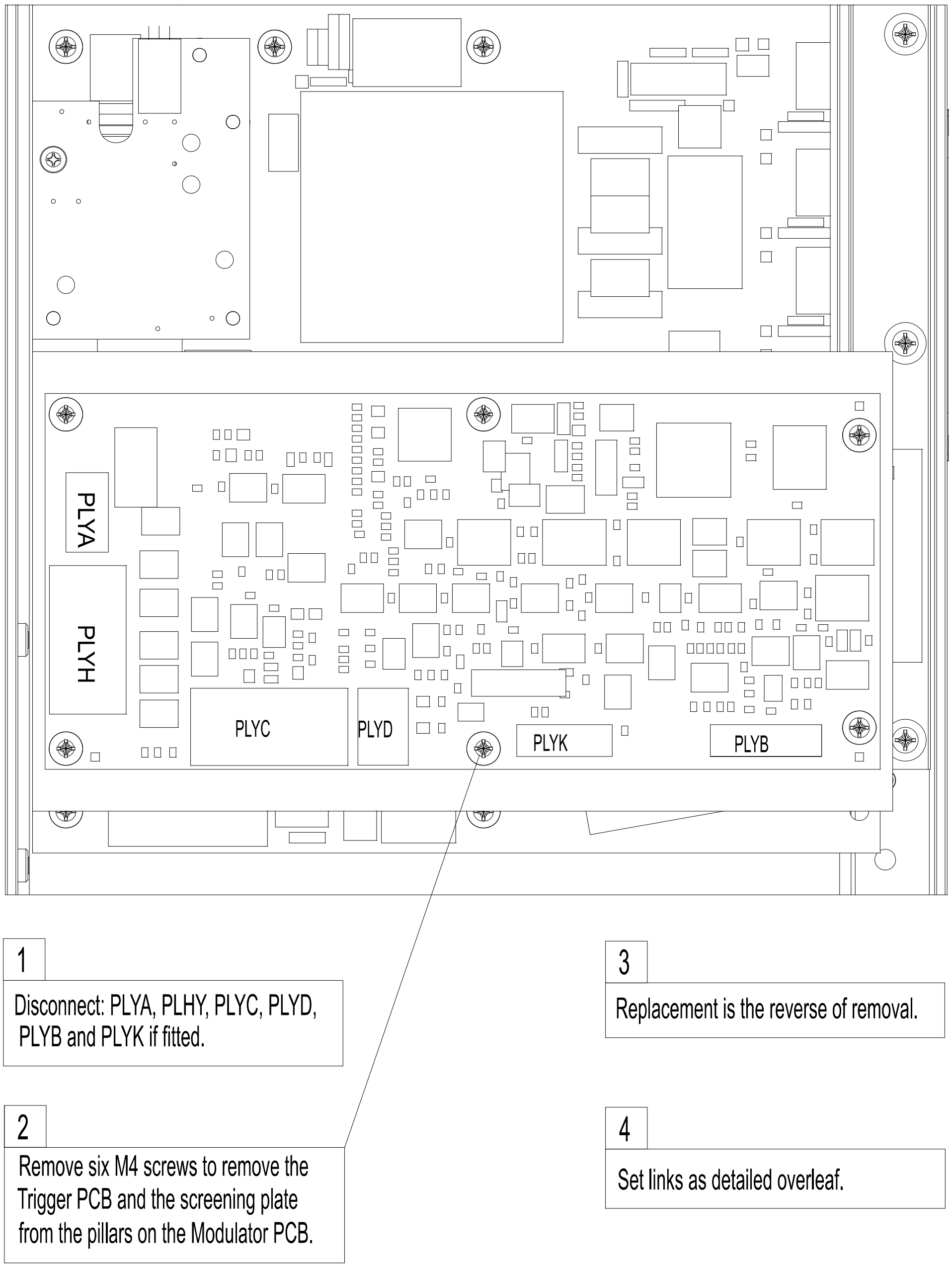
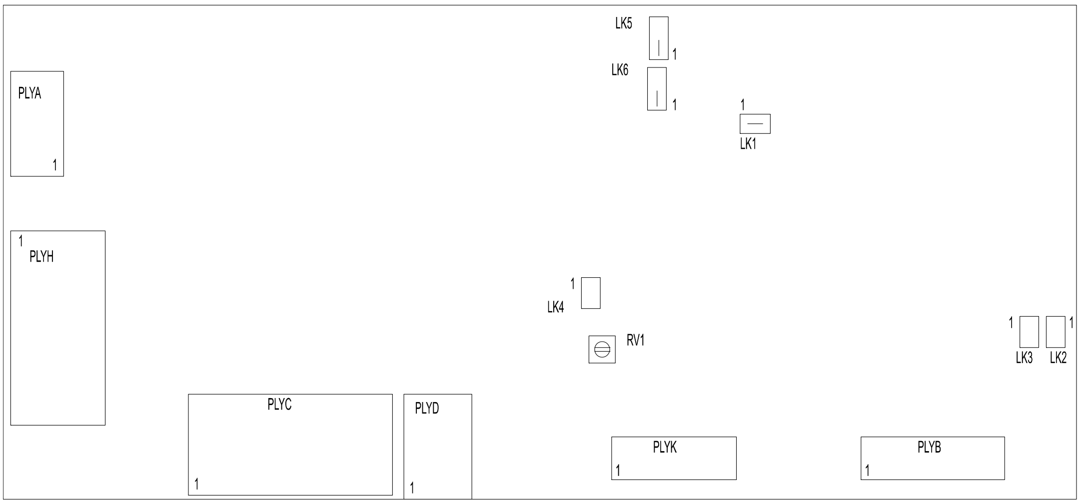


Figure 5.13 Replacing the Trigger PCB



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 5.14 Trigger PCB Link Settings

3.1.9 Modulator PCB – Replacement

See Figure 5.15 and Figure 5.16 for instructions on replacement of the Modulator PCB.

Set the links as shown in Figure 5.16.

The magnetron current should be set as described in Section 3.1.7 after a Modulator PCB is replaced.

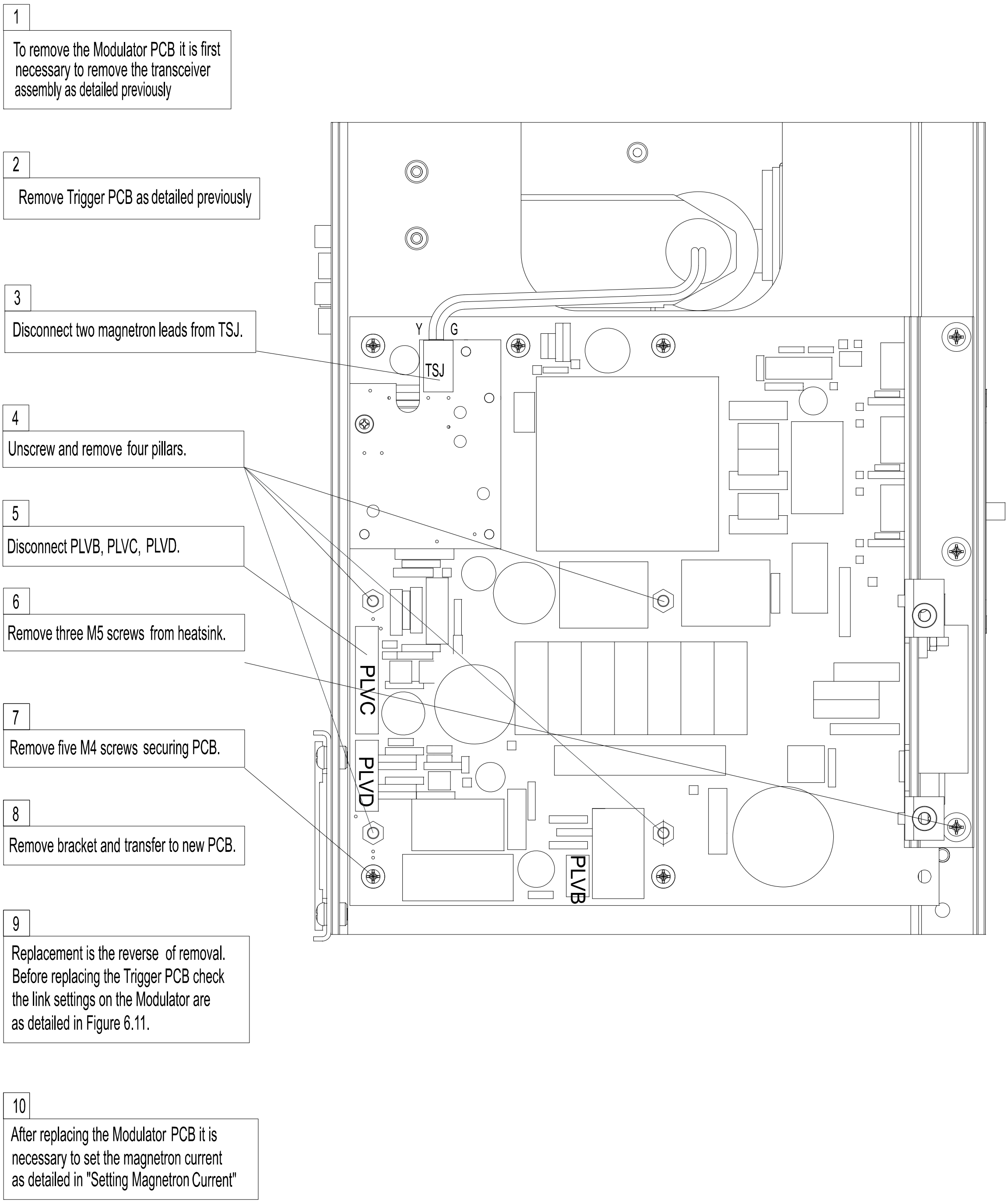
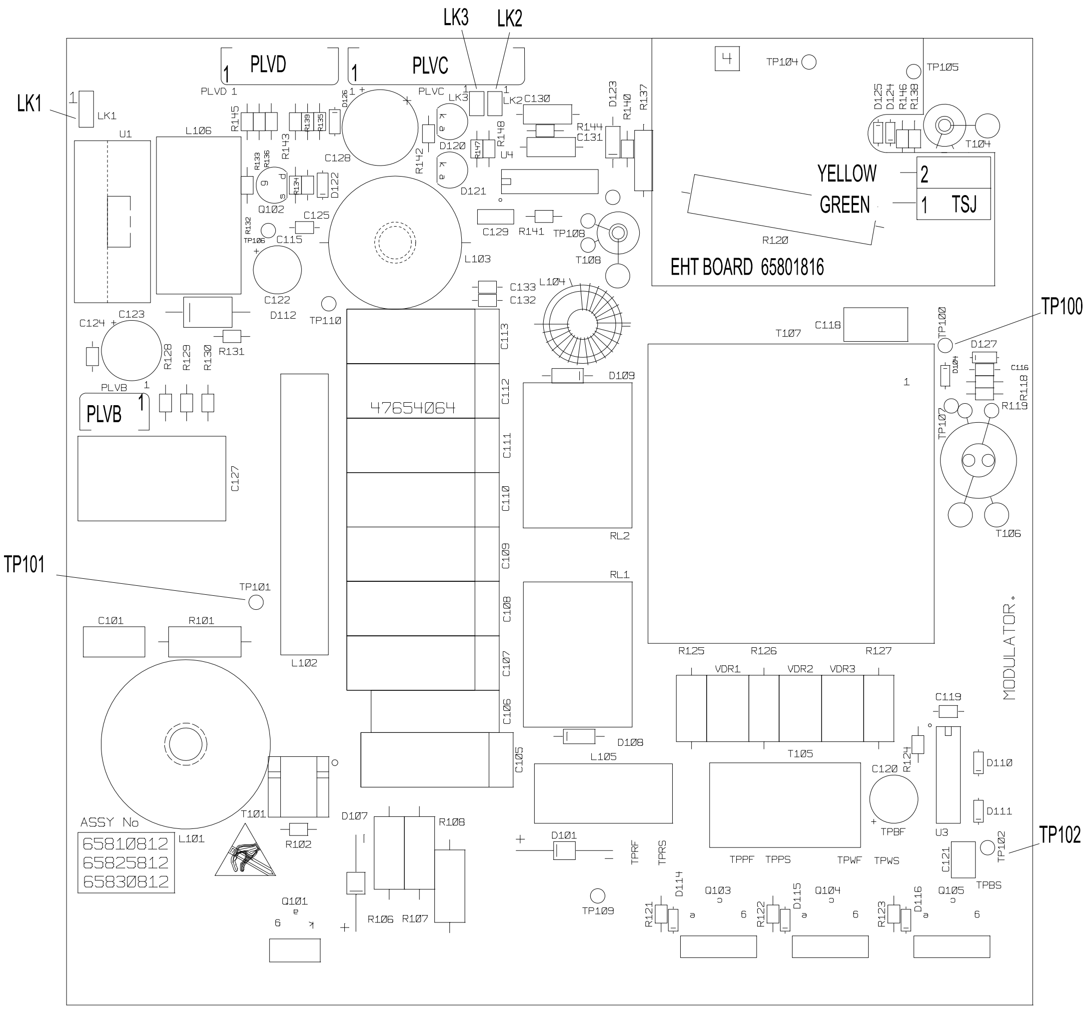


Figure 5.15 Replacing the Modulator PCB



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 5.16 Modulator PCB Link Settings

3.1.10 Power Supply PCB Replacement

WARNING! – LETHAL VOLTAGE HAZARD
BEFORE STARTING THIS PROCEDURE ENSURE THAT D31 LED IS NOT ILLUMINATED. IF D31 IS ILLUMINATED ISOLATE TRANSCEIVER FROM SHIP'S MAIN SUPPLY BEFORE PROCEEDING.

See Figure 5.17 and Figure 5.18 for instructions on replacement of the Power Supply PCB.

Set the links as shown in Figure 5.18.

The magnetron current should be set as described in Section 3.1.7 after a Power Supply PCB is replaced.

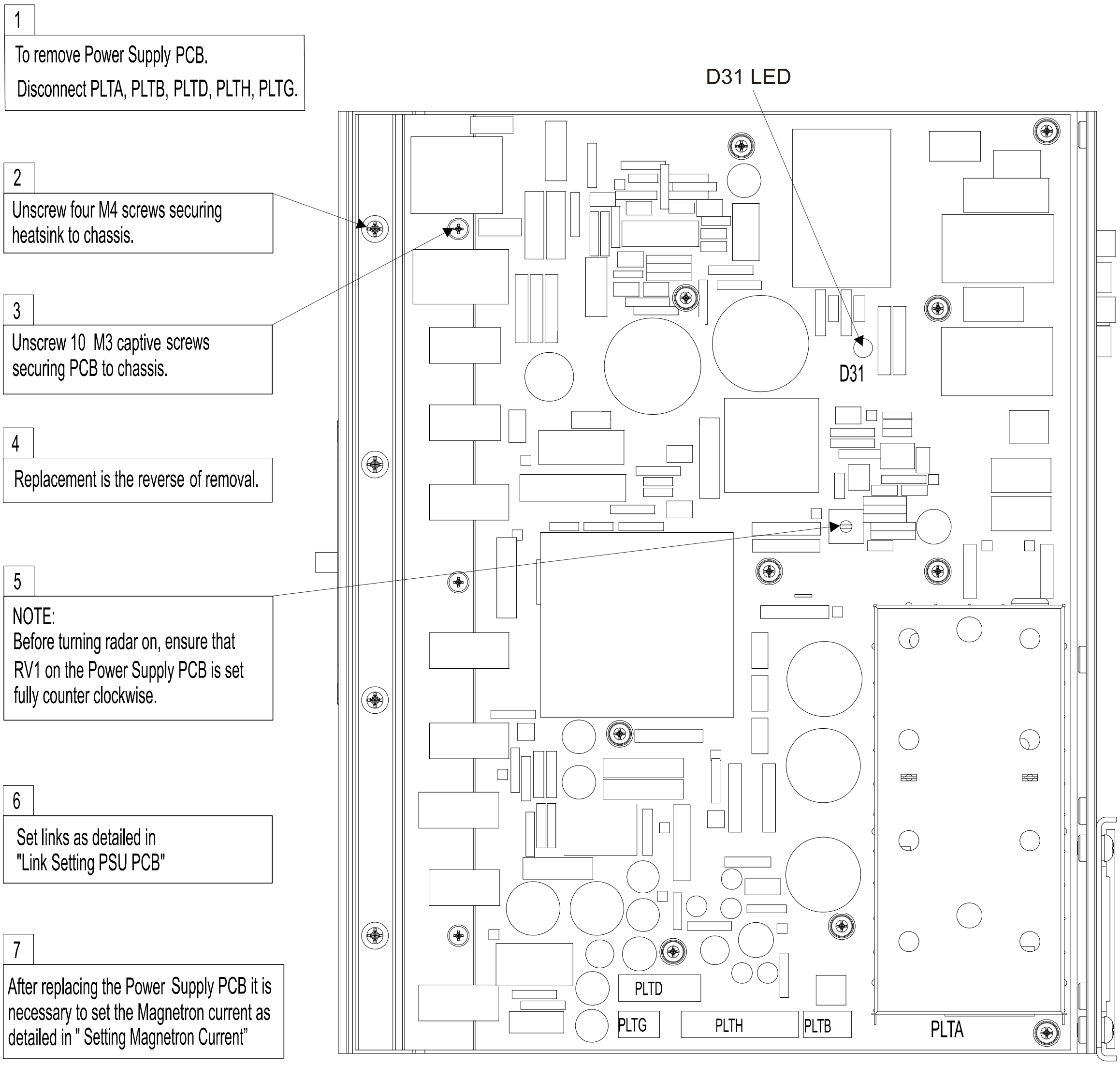
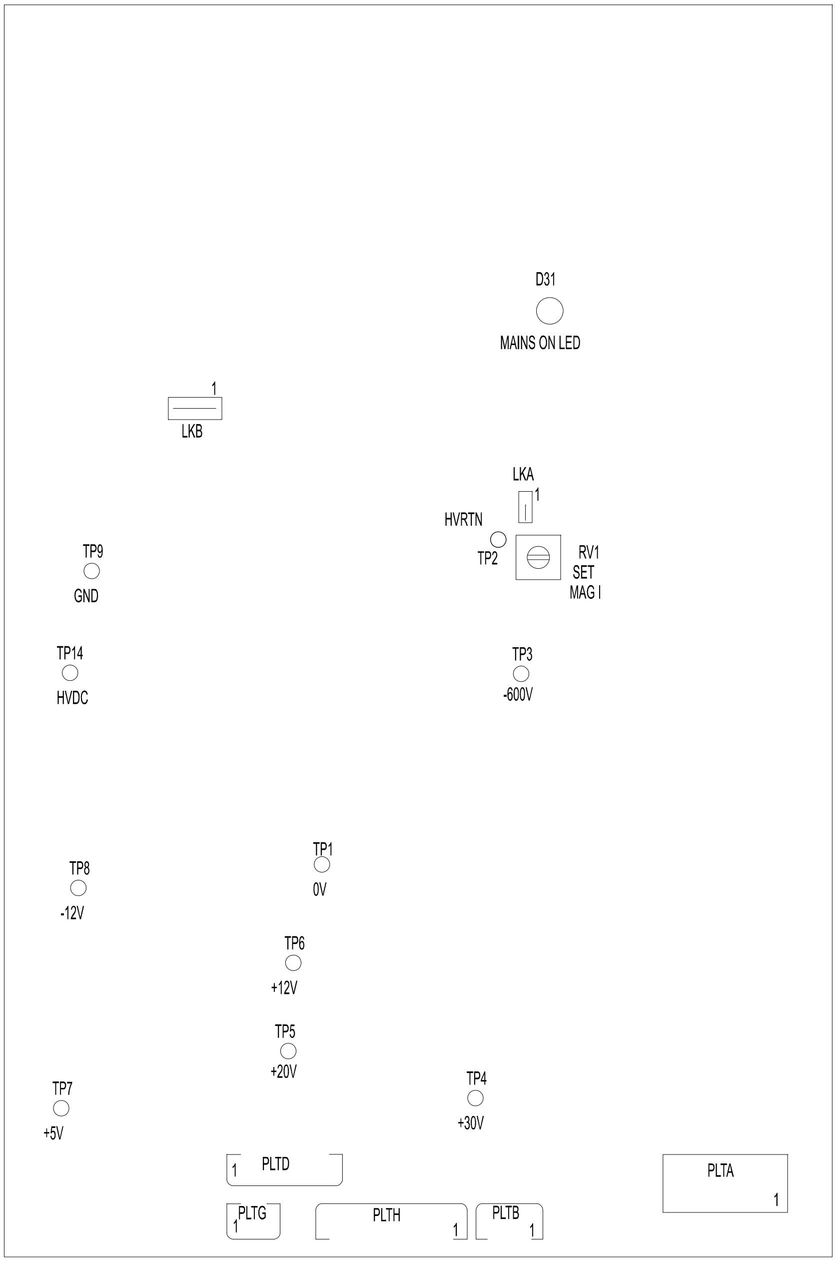


Figure 5.17 Replacing the Power Supply PCB



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.

Figure 5.18 Power Supply PCB Link Settings

3.1.11 Receiver Assembly – Replacement

See Figure 5.19 and Figure 5.20 for instructions on replacement of the Receiver Assembly:

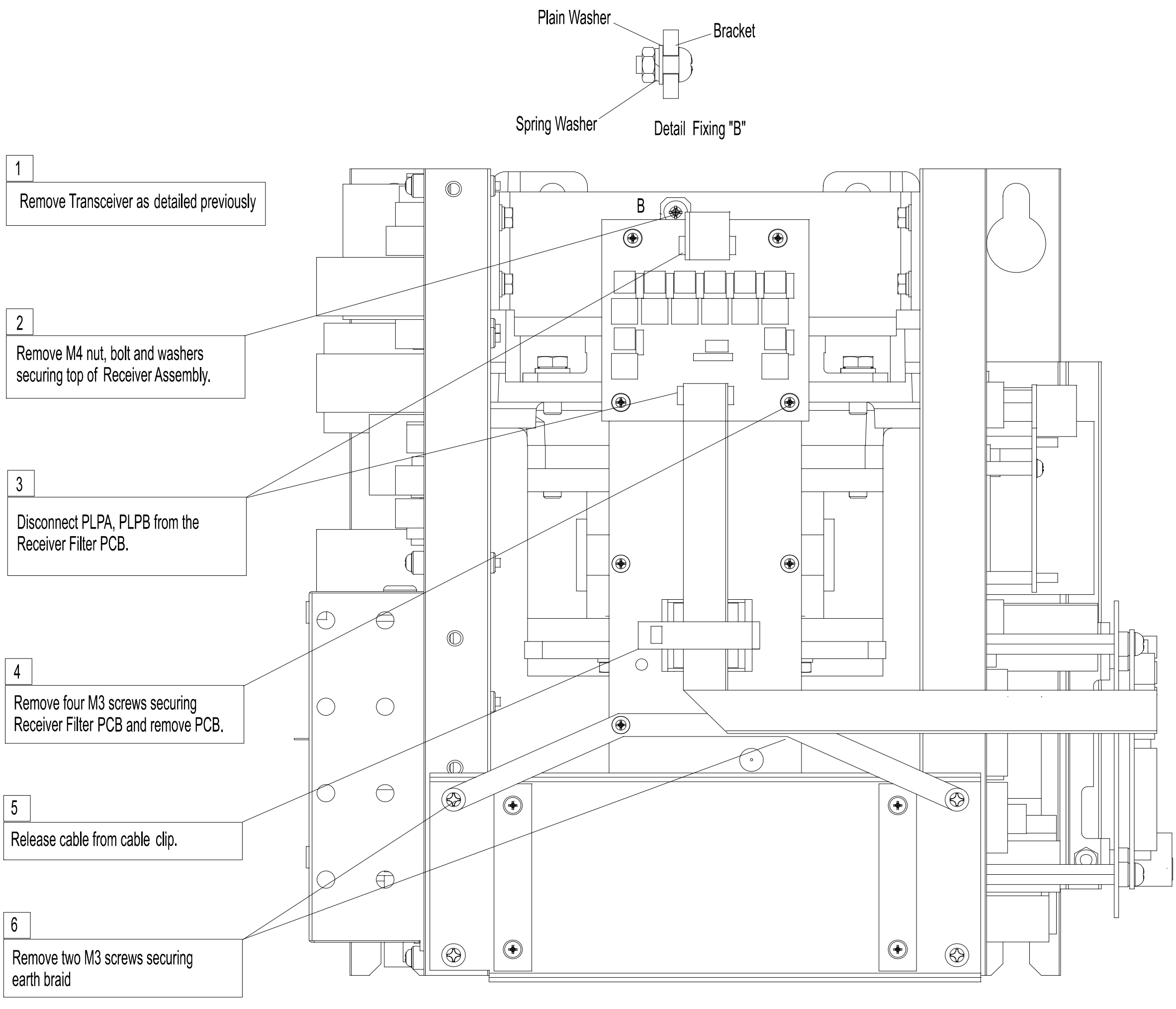


Figure 5.19 Replacing the Receiver Assembly 65830616 (sheet 1)

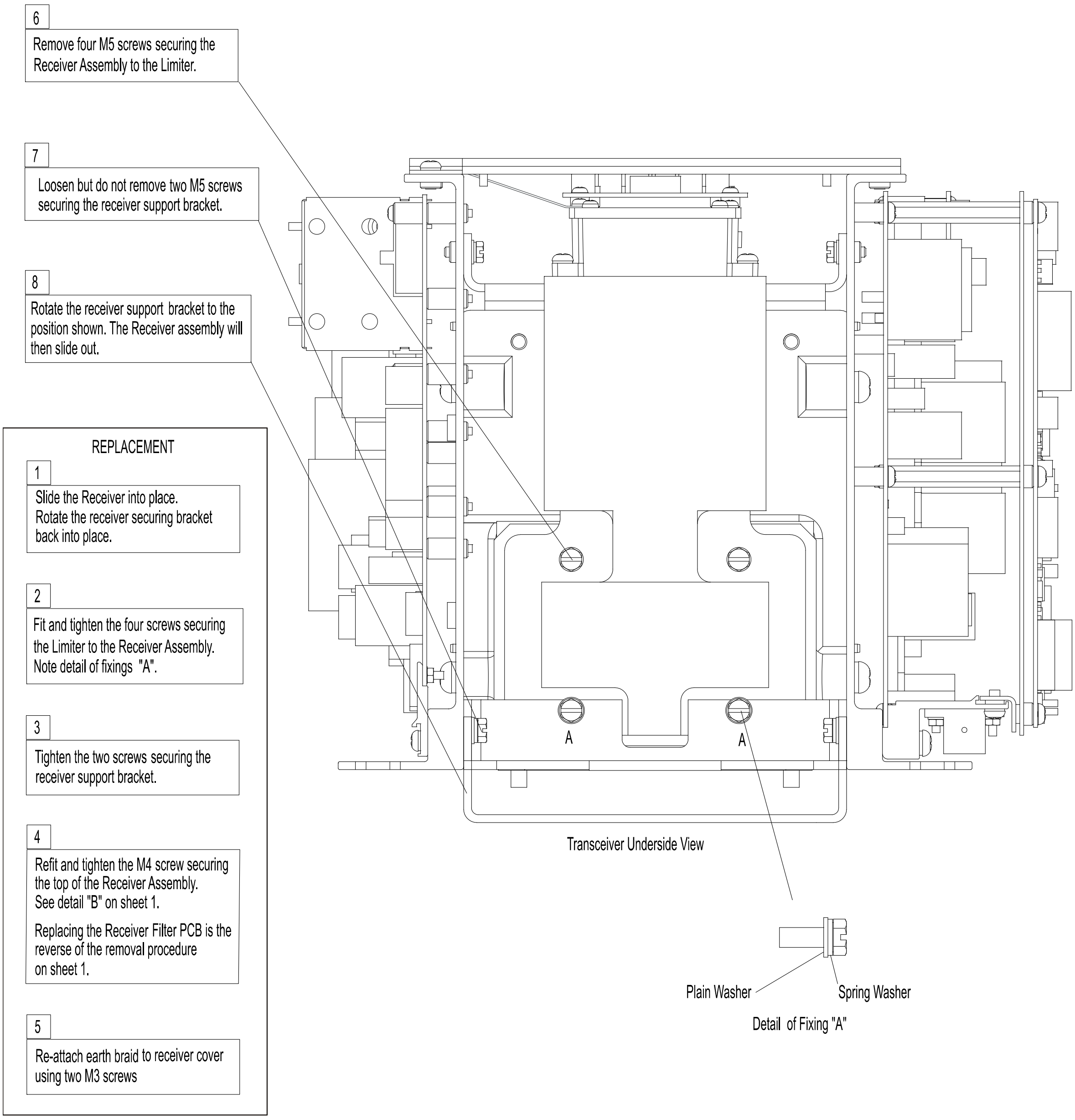


Figure 5.20 Replacing the Receiver Assembly 65830616 (sheet 2)

3.1.12 Bearing and Heading Marker PCB – Replacement

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES ARE EXPOSED WHEN THE COVERS ARE REMOVED. ENSURE THE TRANSCEIVER IS ISOLATED FROM SHIP'S SUPPLY, AND THAT THE SHIP'S SUPPLY TO THE SCANNER MOTOR IS ISOLATED AT THE SCANNER CONTROL UNIT.

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 supplied.
4. Refer to Figure 5.21, and remove the Performance Monitor cover.
5. The location of the Pulse Bearing PCB is shown in Figure 5.22.
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).
8. Align the Heading Marker using the configuration tool.

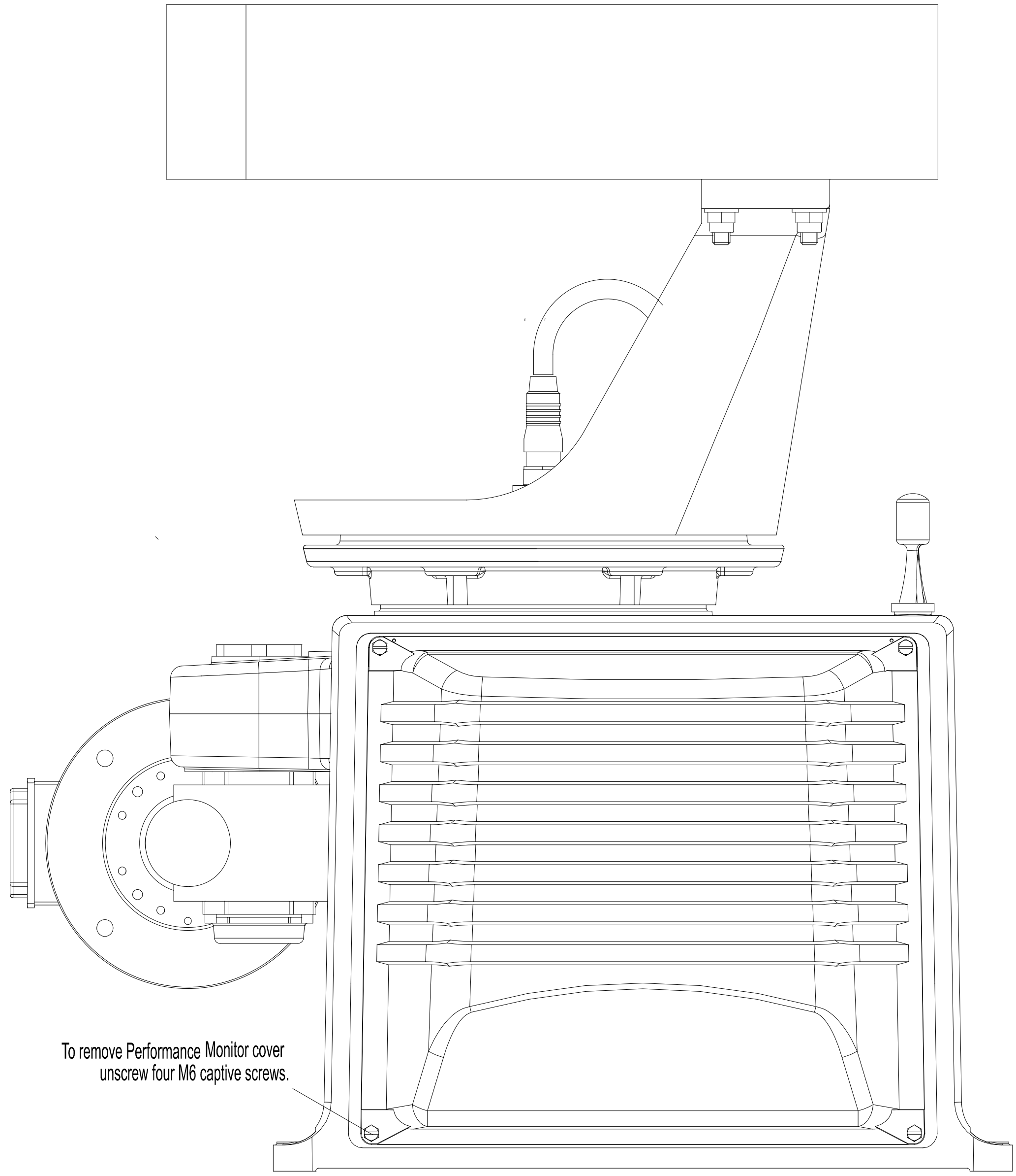


Figure 5.21 Access to Performance Monitor, Bearing and Heading Marker PCB

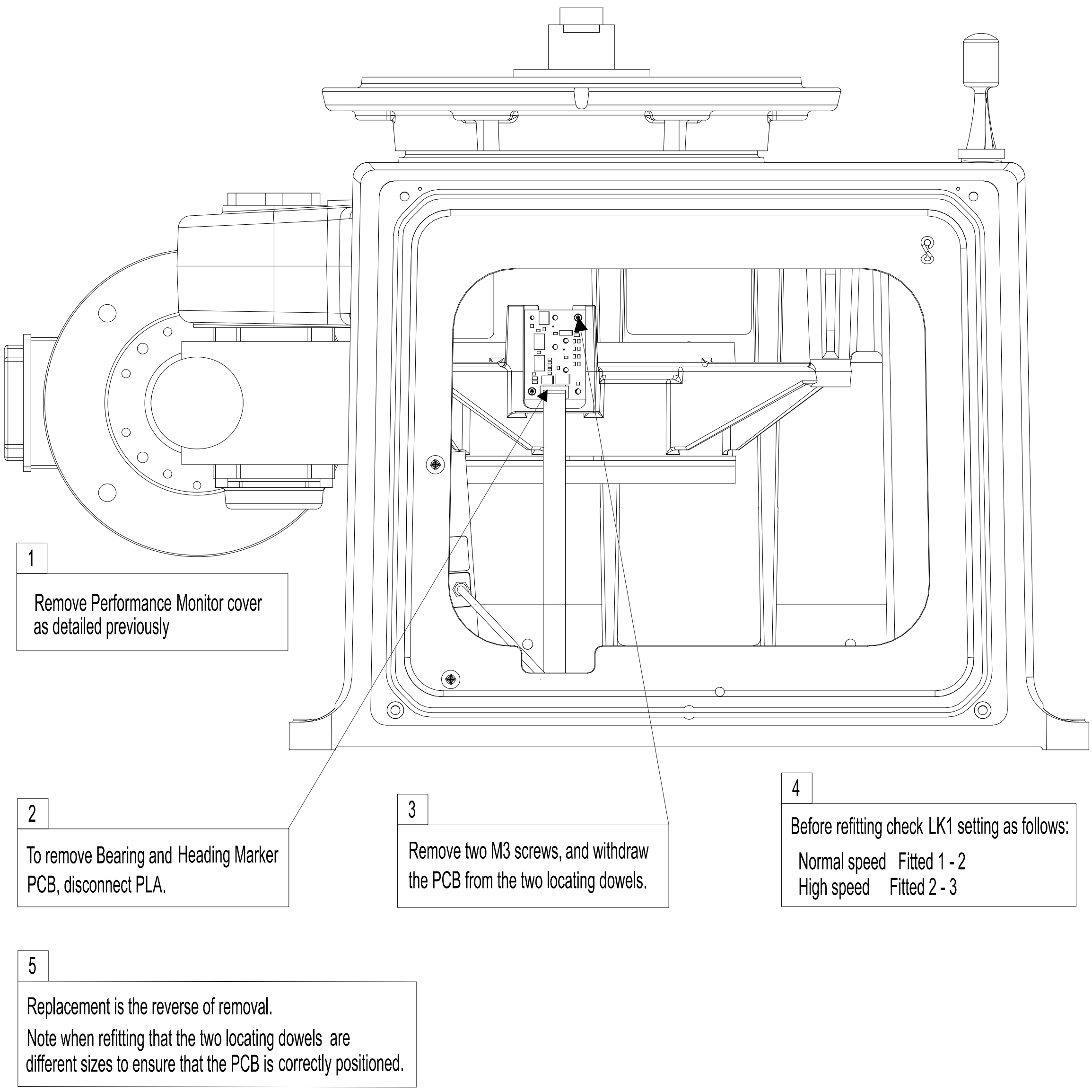


Figure 5.22 Replacing the Bearing and Heading PCB

3.1.13 Performance Monitor – Replacement

See Figure 5.21 and Figure 5.23 for instructions on replacement of the Receiver Assembly:

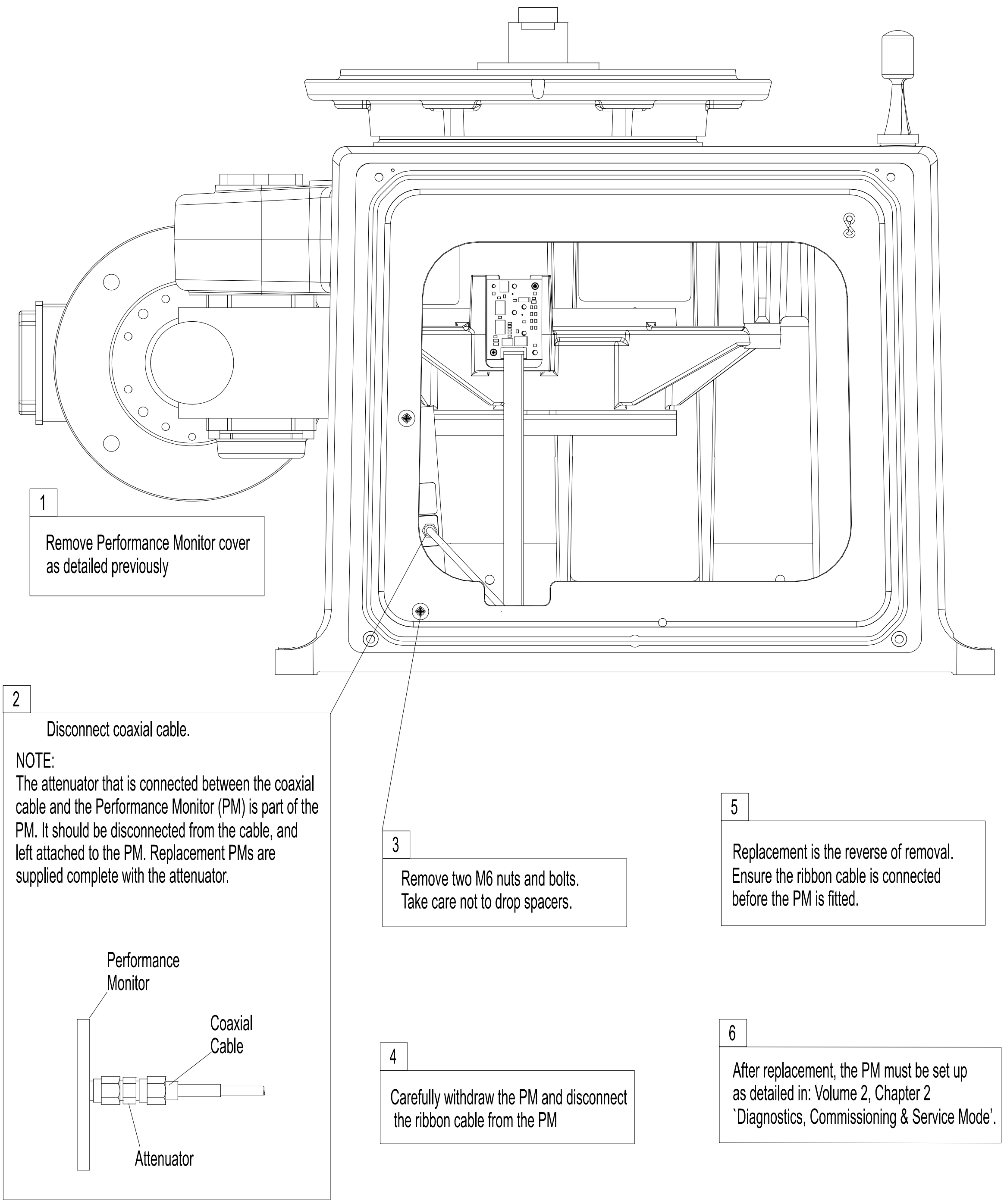


Figure 5.23 Replacing the Performance Monitor

3.1.14 Fan Assembly – Replacement

See Figure 5.24 for instructions on replacement of the Fan Assembly:

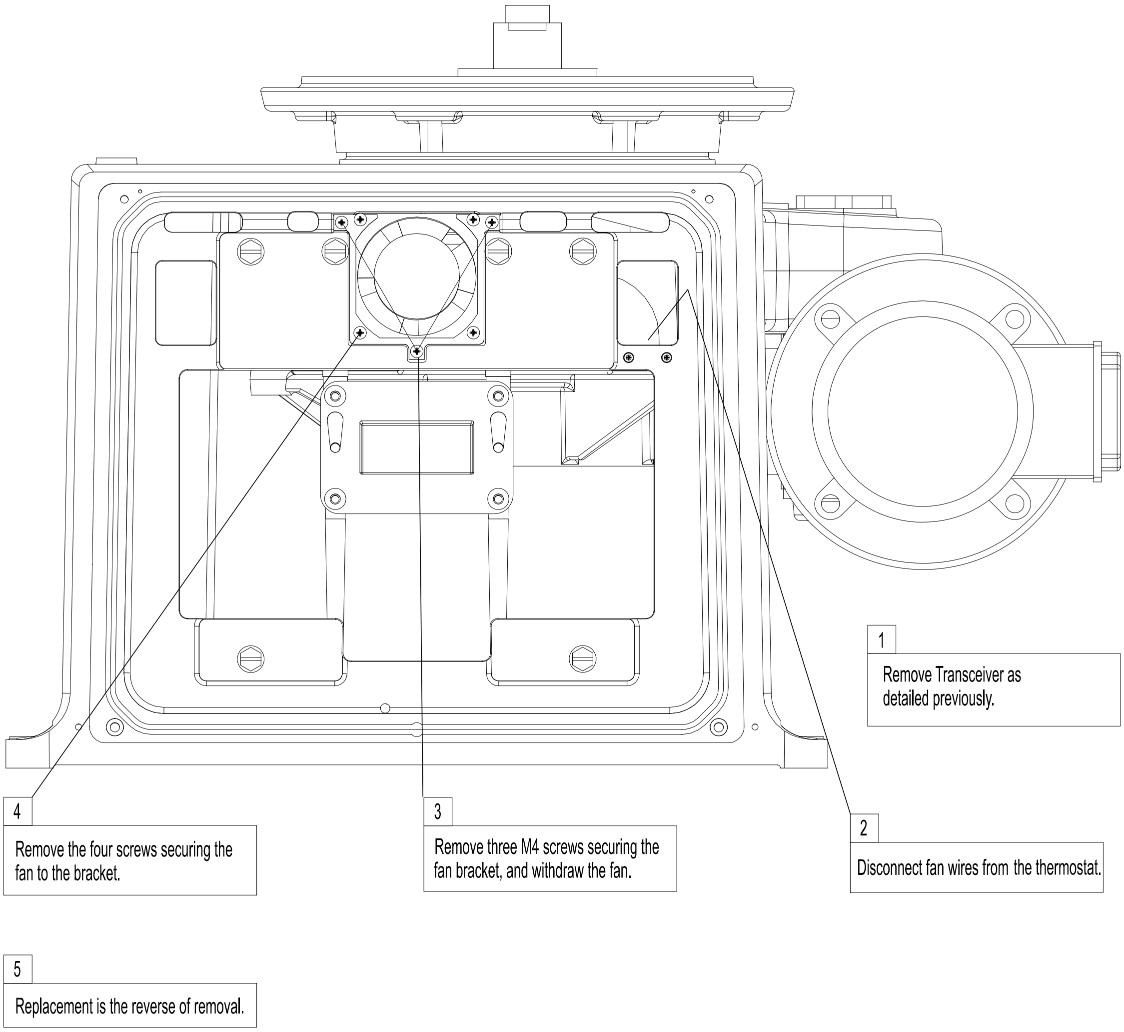


Figure 5.24 Replacing the Fan Assembly

3.1.15 Rotating Joint Assembly - Replacement

See Figure 5.25 and the instructions below for removal and replacement of the rotating joint assembly.

1. Remove the black amalgamating tape from around the upper coaxial connection and disconnect the upper coaxial cable from the antenna to rotating joint.
2. Remove the three screws connecting the rotating joint assembly (65830642) to the turning unit torque tube.
3. If the rotating joint is difficult to retract from the torque tube it may be necessary to use a wrench tool, such as a pair of pipe pliers, or a 36mm A/F open ended spanner on the flat sides of the rotating joint body to disengage the assembly from the torque tube.
4. When the rotating joint has been disengaged pull the assembly up from the torque tube until the lower RF coaxial cable connection is visible.
5. If necessary, use two suitable spanners to disconnect the rotating joint from the lower RF coaxial cable.

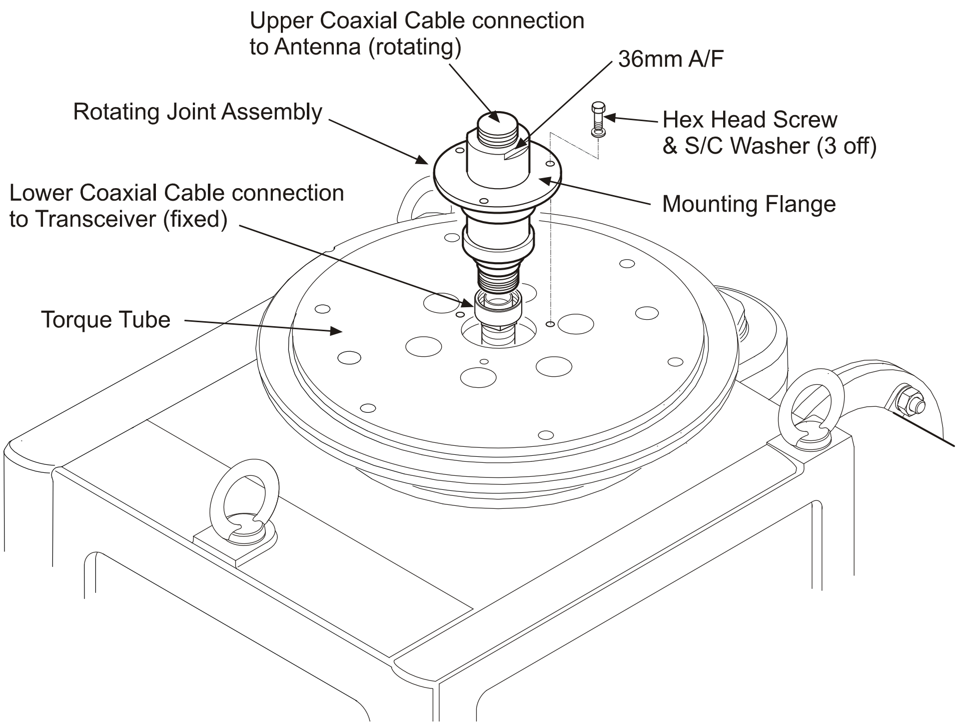


Figure 5.25 Replacing Rotating Joint Assembly

6. When replacing a rotating joint assembly fit a new ‘O’ ring (6083498) into the groove on the underside of the rotating joint mounting flange.
7. Ensure the ‘O’ ring is seated correctly in its groove on the mounting flange, some grease or corrosive preventative compound may help retain it in the groove, also smear the location diameter with the same grease or compound before assembly.

8. When fully installed ensure that the lower coaxial cable is correctly seated/fitted into the lower bracket grommet to ensure that any radial and axial loading on the rotating joint bearings is minimised.
9. Ensure that the amalgamating tape (6050050) is replaced around the coaxial connection between the antenna and rotating joint otherwise water ingress will result.

3.1.16 Motor/Gearbox - Removal

The following sub sections detail the removal of the S-band AC motor and the gearbox (Rehfuss or Zurrer).

3.1.16.1 Removing the Motor from the Gearbox

With the motor/gearbox assembly attached to the S-band turning unit remove the AC motor as described in the following steps:

1. Remove the four bolts, nuts and washers from the motor/gearbox interface flanges and retain the attaching parts.

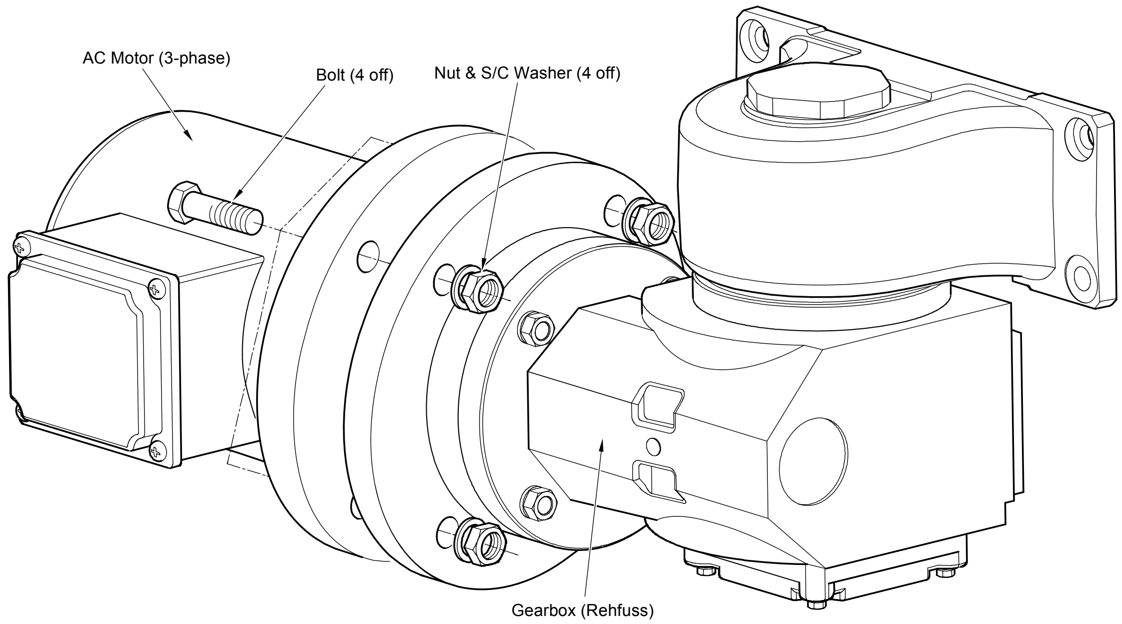


Figure 5.26 Removing the Motor from the Gearbox

2. Hold the motor terminal box and rotate the motor assembly clockwise and anti-clockwise until the gasket seal is broken. If the motor does not rotate use a hide mallet or wooden block to gently hammer the side of the terminal box.

	CAUTION
	Do NOT use a screwdriver between the motor and gearbox flanges as damage to the flanges may occur.

3. When the gasket seal is broken pull the motor away from the gearbox flange while holding the motor assembly square in both planes. The motor spigot will detach from the gearbox recess and the shaft coupling will part from the input drive flange on the gearbox.
4. Remove the sealing gasket from the motor flange.

Removing the Coupling

The following instructions describe the different procedures for removing the motor/gearbox coupling for a Rehfuss gearbox and a Zurrer gearbox.

To remove a Rehfuss coupling:

1. Using a 2.5mm Allen Key, loosen the grub screw in the coupling hub and remove the coupling hub from the shaft. If the unit is a tight fit, use the two leg puller supplied (MA00017913) to remove the coupling hub.
2. Using a 5mm allen key, loosen the two M6 cap screws from either side of the plastic coupling and remove. Reassemble the two screws into the coupling hub.
3. Fit the two leg puller onto the motor shaft with the puller legs under the cap screws. tighten the central screw thread with a 14mm spanner to remove the hub, see Figure 5.27.
4. Discard hub and plastic coupling (if damaged).

Figure 5.27 Removing Rehfuss coupling hub using Two Leg Puller

To remove a Zurrer coupling:

1. Remove the Rotex Spider and discard.
2. Using a 2.5mm allen key, loosen the grub screw in the Rotex hub and remove the hub from the shaft. If the unit is a tight fit, use the two leg puller supplied (MA00017913) to remove the hub.
3. Fit the two leg puller under the lower part of the hub, tighten the central screw thread with a 14mm spanner to remove the hub, see Figure 5.28
4. Discard the hub.

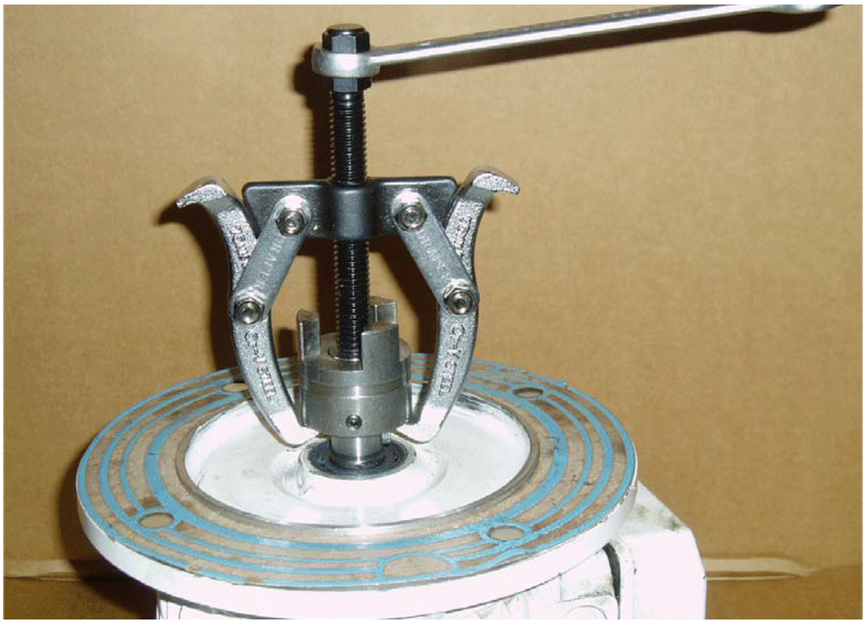


Figure 5.28 Removing Zurrer coupling hub using Two Leg Puller

3.1.16.2 Removing the Gearbox

Both types of gearbox (Rehfuss and Zurrer) are attached to the turning unit via the pinion housing. To remove the gearbox assembly:

1. Using a 8mm Allen Key, remove the four bolts securing the gearbox assembly to the side of the turning unit, see Figure 5.29.
2. Holding the assembly from the underside carefully remove the gearbox from the turning unit.

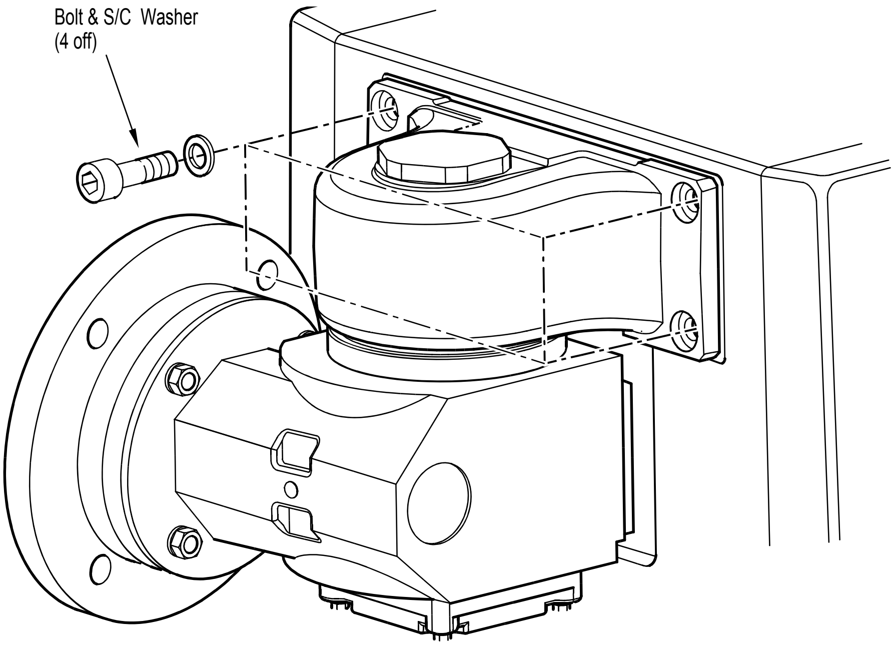


Figure 5.29 Removing Gearbox assembly

3.1.17 Motor/Gearbox - Replacement

The following sub sections detail the replacement of the gearbox and motor.

Attach the replacement gearbox assembly (Rehfuss or Zurrer) to the side of the turning unit using the four 8mm Allen key bolts and washers as described in Section 3.1.16.2 '*Removing the Gearbox*'.

3.1.17.1 Replacing an AC Motor using a Rehfuss Coupling

In addition to the assembly instructions below refer to Figure 5.30 for location information.

1. Before assembly ensure that motor shaft, key, coupling bore and keyway are clean and free from burrs, apply anti-scuffing paste to the shaft to help assembly and prevent seizure of the parts after prolonged usage.
2. Slide and lightly press the coupling up to the motor shaft until the hub rests against the shaft collar, the facing flanges lie on a single plane and the coupling chamfered side faces the motor flange. This guarantees the correct distance between the coupling and the coupling shaft.
3. Tighten the radial locking screw in the hub and remove any excess anti-scuffing paste before final assembly.
4. Fit a new sealing gasket (MA00007815 for 3 Phase, or MA00008037 for 1 Phase) onto the motor flange spigot and align holes.

5. Apply anti-scuffing paste onto coupling socket pins and gearbox recess only, the paste must not be applied direct to the gasket face area before fitting the motor. Now place the motor onto the IEC adaptor. In doing so, ensure that the socket pins have been correctly inserted into the bore holes of the coupling ring.
6. Attach the motor and the IEC adaptor together using the fixing screws supplied.
7. Finally apply a smear of Denso Paste around the joint line. Note, Denso Paste must not be applied direct to the gasket surfaces.

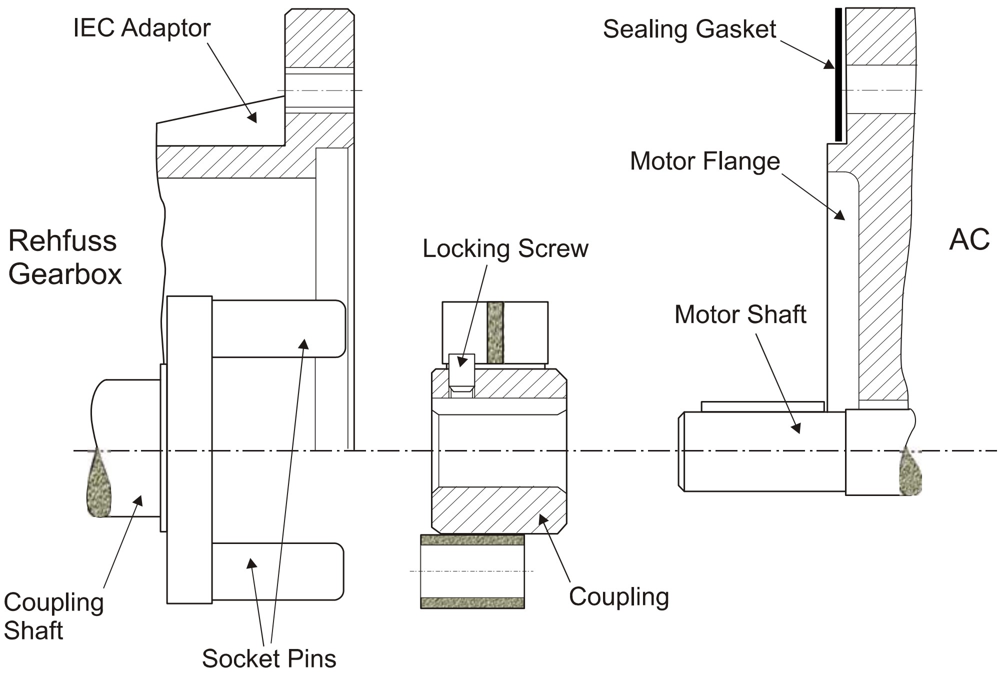


Figure 5.30 Assembling Motor using Rehfuss Coupling

3.1.17.2 Replacing an AC Motor using a Zurrer Coupling

In addition to the assembly instructions below refer to Figure 5.31 for location information.

1. Before assembly ensure that motor shaft, key, hub bore and keyway are clean and free from burrs, apply anti-scuffing paste to the shaft to help assembly and prevent seizure of the parts after prolonged usage.
2. Slide or lightly press the hub onto the motor shaft and position the hub so that the end of the motor shaft aligns with the inner face of the hub to achieve the 40mm setting dimension shown in Figure 5.31. This guarantees the correct distance between the hubs and the coupling shaft.
3. Tighten the radial locking screw in the hub and remove any excess anti-scuffing paste before final assembly.

4. Fit a new sealing gasket (MA00007815 for 3 Phase, or MA00008037 for 1 Phase) onto the motor flange spigot and align holes. Apply anti-scuffing paste onto the gearbox recess only, it must <u>not</u> be applied direct to the gasket face area before fitting the motor.
5. Fit the red Rotex 'Spider' into the hub on the gearbox input shaft.
6. Align the hub drive to fit into the opposing hub and place the motor onto the IEC adaptor. In doing so, ensure that the Motor hub drive dogs have been correctly inserted into the gearbox hub drive dogs and that the flanges fit together without any gap between them.
7. Attach the motor and the IEC adaptor together using the fixing screws supplied.
8. Finally apply a smear of Denso Paste around the joint line. Note: Denso Paste must <u>not</u> be applied direct to the gasket surfaces.

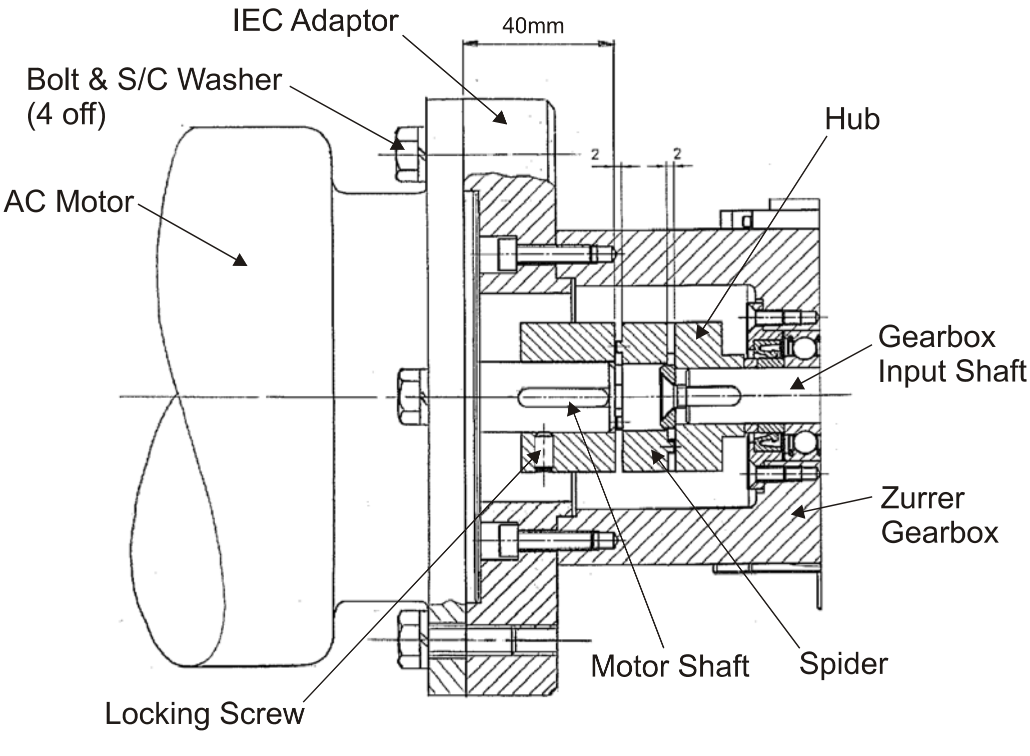


Figure 5.31 Assembling Motor using Zurrer Coupling

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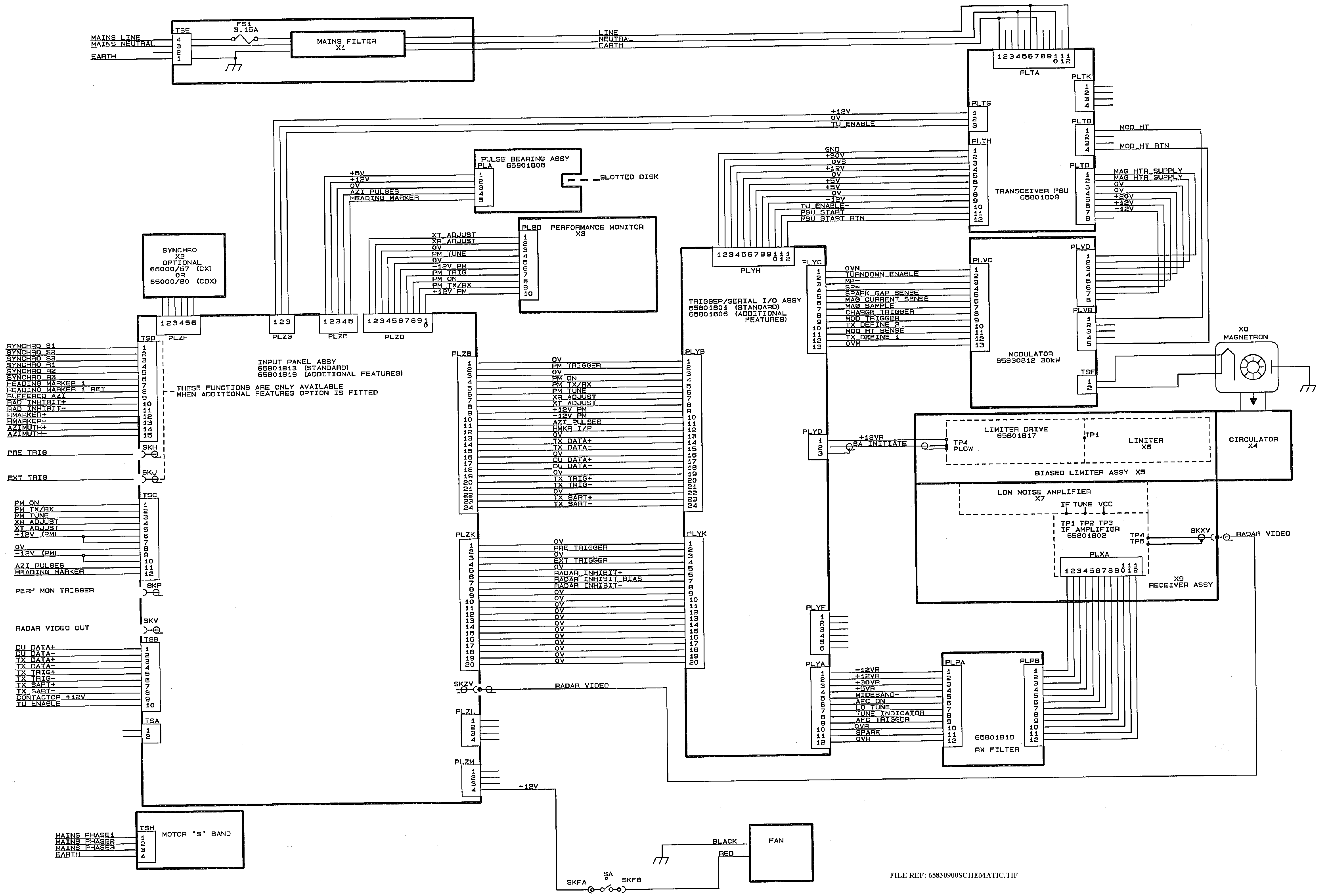


Figure 5.32 S-band Turning Unit Schematic

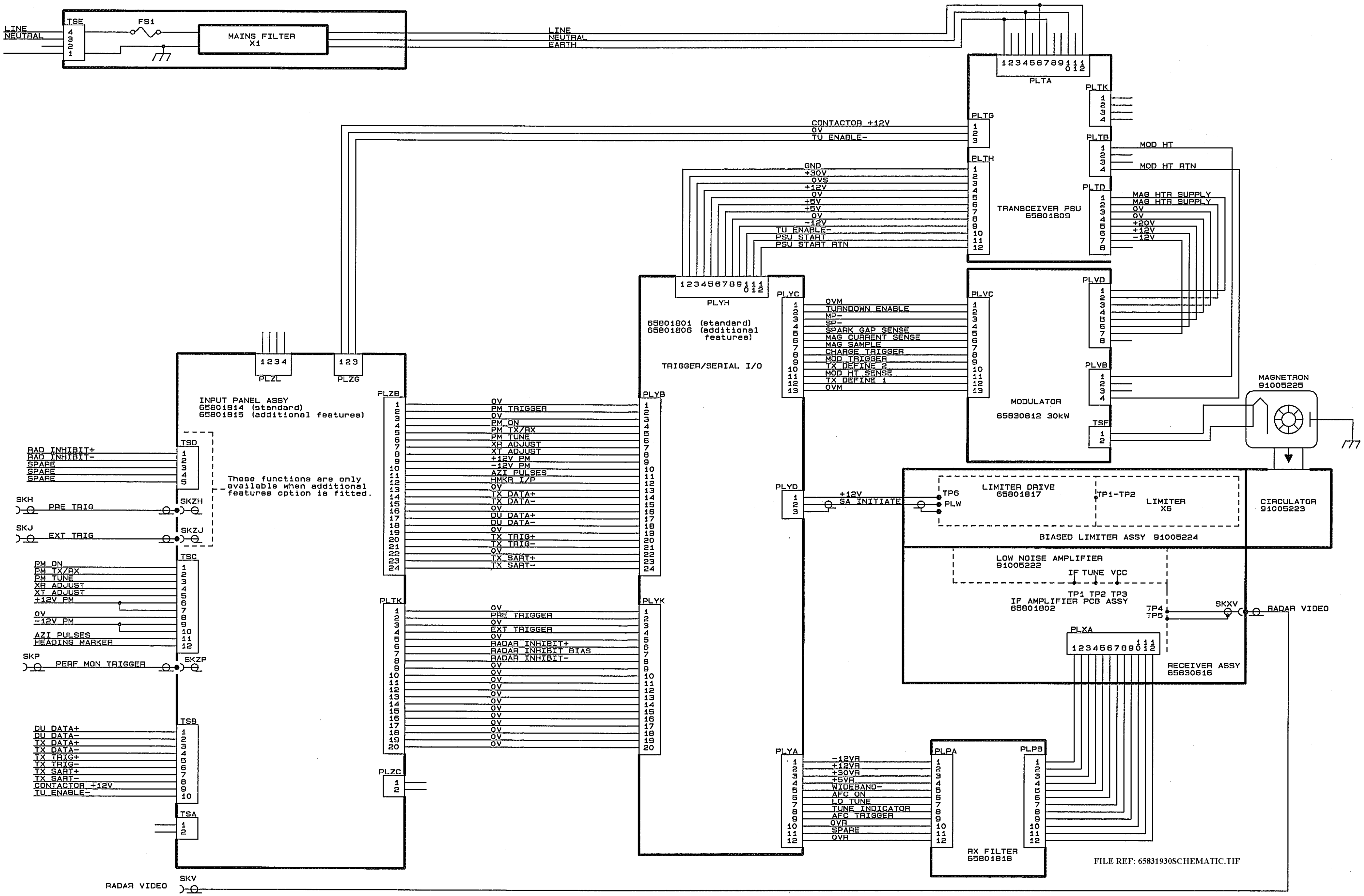


Figure 5.33 S-band Bulkhead Transceiver Schematic

3.2 X-band Scanner Unit

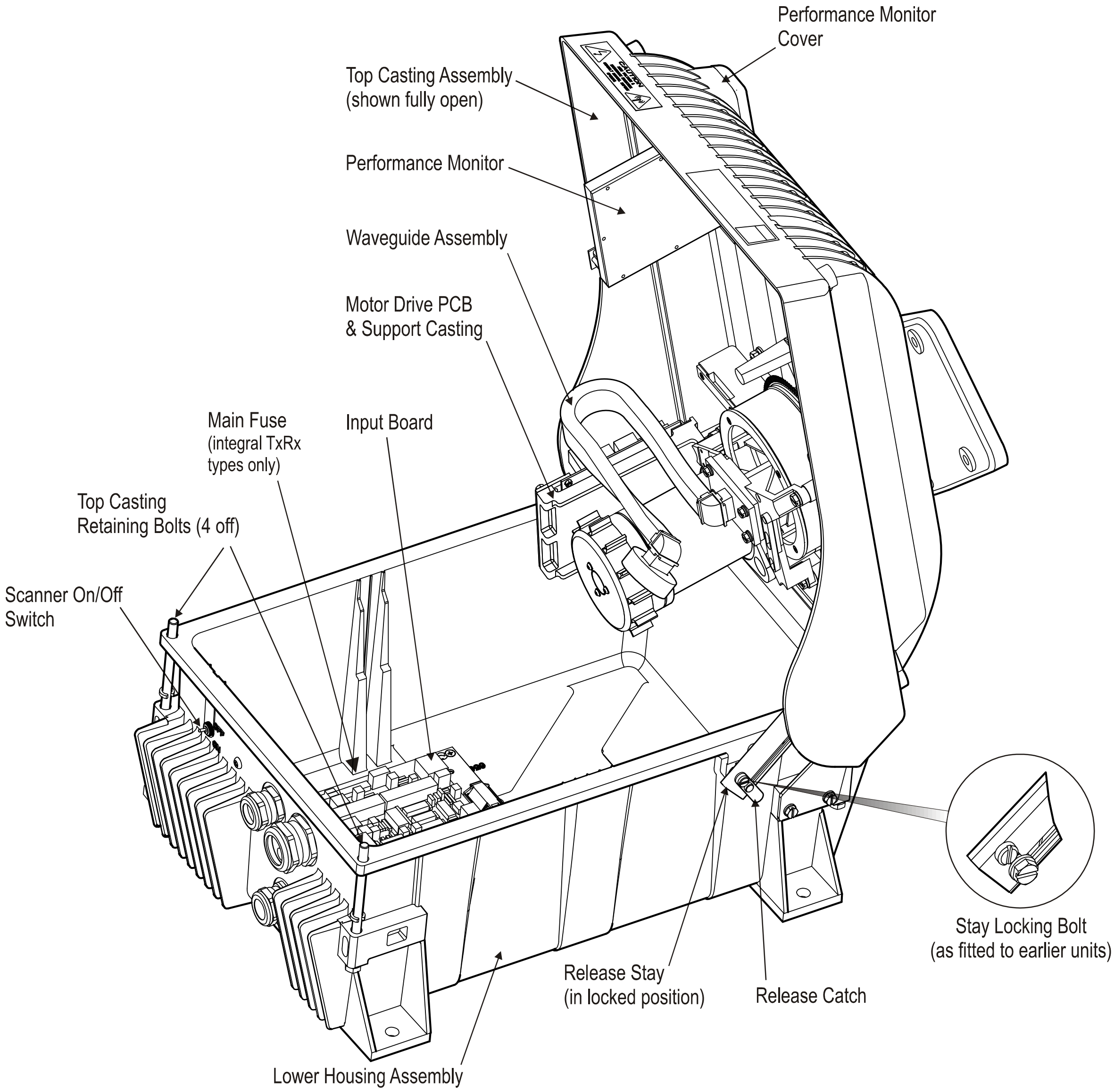


Figure 5.34 Main Assemblies of X-band Bulkhead Turning Unit

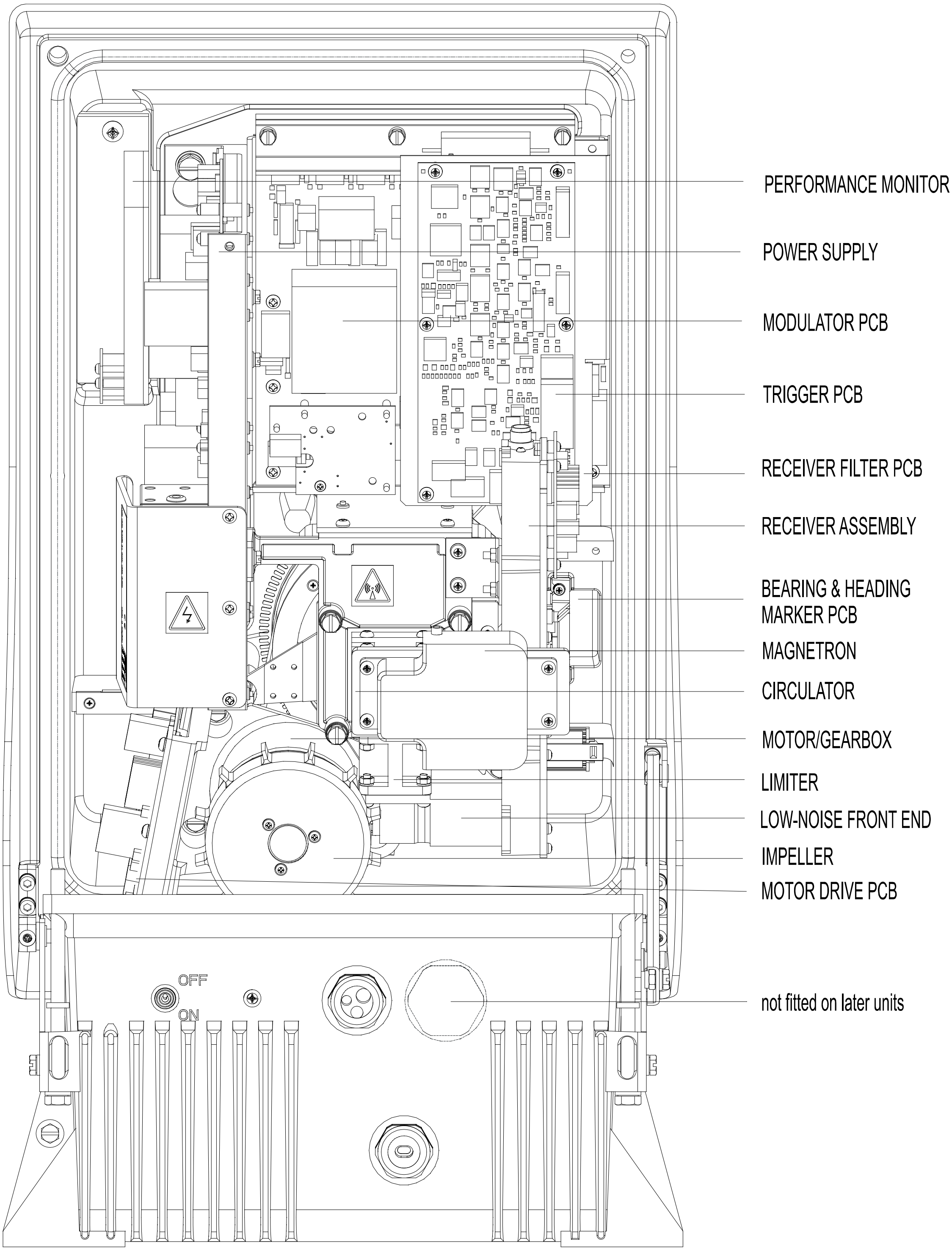


Figure 5.35 Main Assemblies of X-band Masthead Turning Unit (internal)

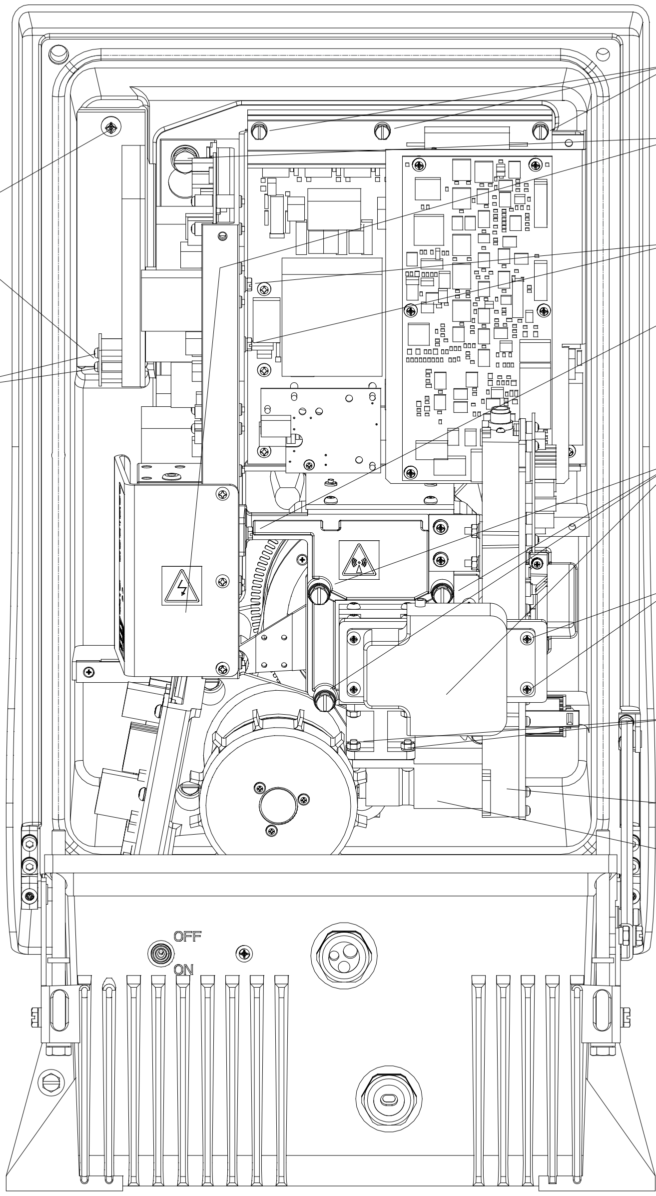


Figure 5.36 Fitment of Main Assemblies on X-band Masthead Turning Unit

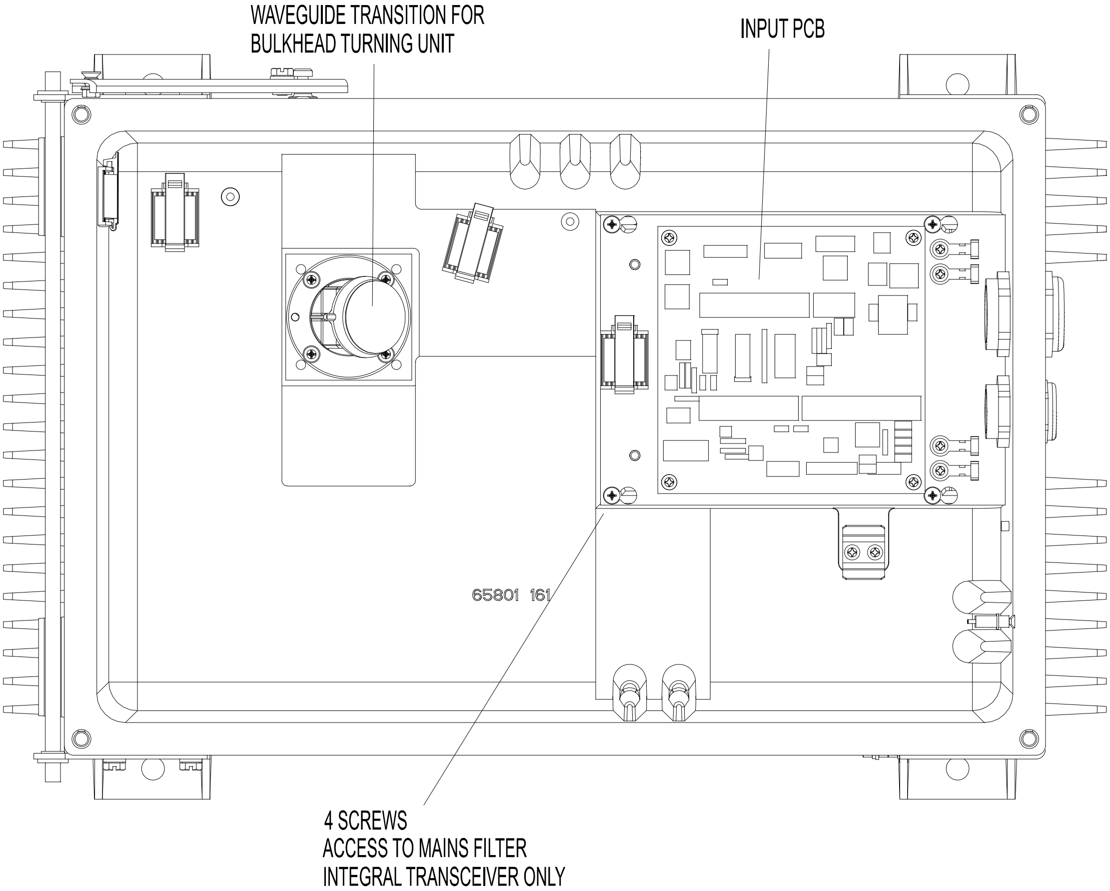


Figure 5.37 Assemblies Fitted to Turning Unit Lower Casting

3.2.1 Access to Masthead Transceiver

1. Select **Shutdown System** in the Display System menu and wait for the VisionMaster FT application and Windows to fully power down.
2. Switch the Control Panel On/Off switch to Off.
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, across the Transceiver axis, clear of any obstructions.
6. Undo the four captive bolts on the underside of each 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 5.38.

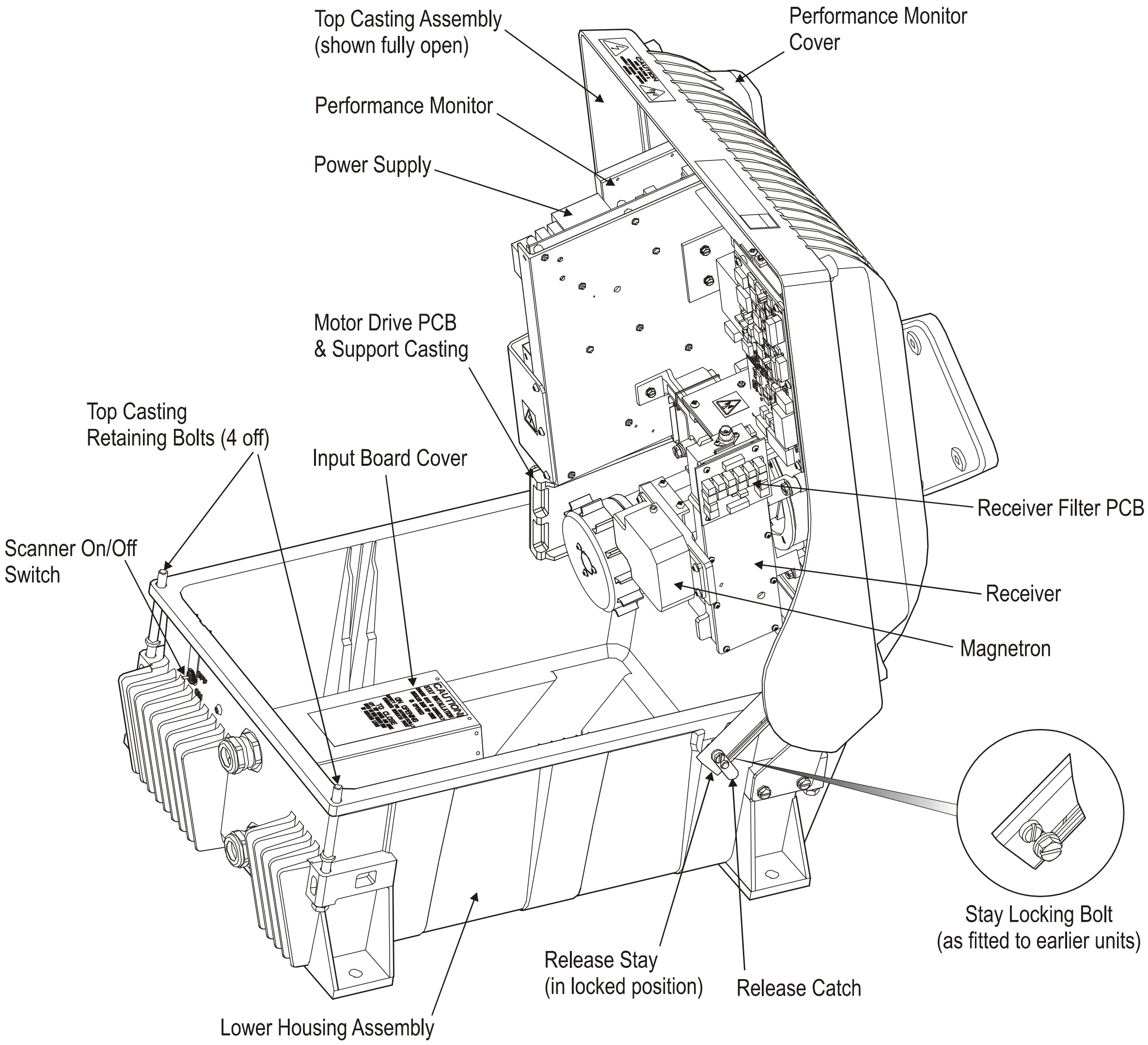


Figure 5.38 Internal view of X-band Masthead Turning Unit (showing Transceiver)

3.2.2 Access to Bulkhead Transceiver

1. Select **Shutdown System** in the Display System menu and wait for the VisionMaster FT application and Windows to fully power down.
2. Switch the Control Panel On/Off switch to Off.
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.

3.2.3 Replacing the Transceiver in the Masthead Turning Unit

1. Refer to Section 3.2.1 '*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 5.36.
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.

The replacement sequence is as follows:

10. Place the Transceiver approximately onto the upper casting using the two large slotted holes in the PSU heat sink.
11. Slacken the two screws that hold the PSU chassis plate to the Modulator chassis plate, see Figure 5.36.
12. Slacken the screw that holds the Circulator mounting plate to the PSU chassis plate.
13. Fit and only **partially** tighten the three screws in the Modulator heat sink.
14. Fully tighten the four M6 microwave assembly-retaining screws.
15. Fully tighten the three screws in the Modulator heatsink.
16. Fully tighten the two large bolts in the slotted holes in the PSU heat sink.

17. Fully tighten the two screws that hold the PSU chassis plate to the Modulator chassis plate.
18. 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.*

19. Replace all cables removed earlier.

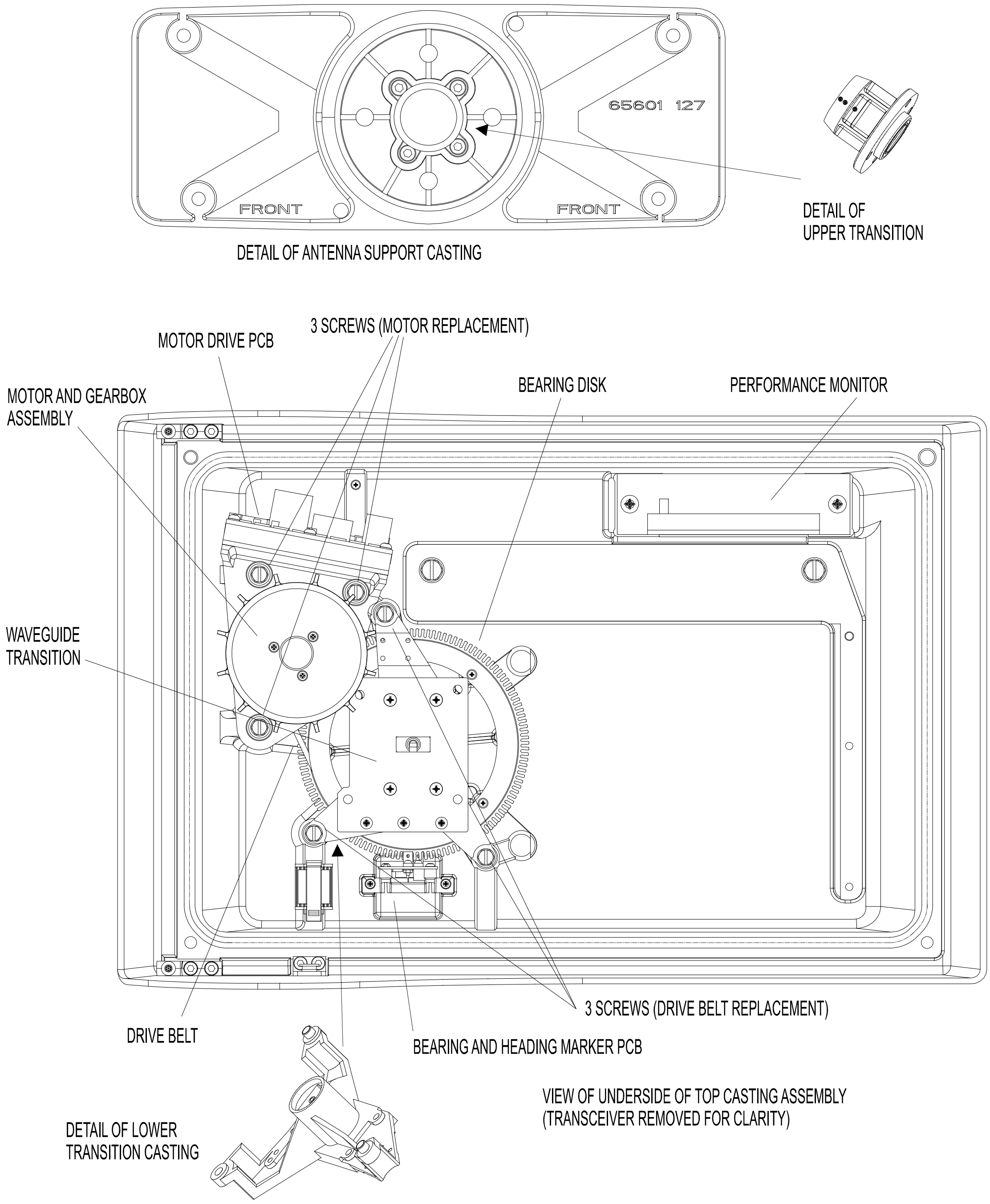


Figure 5.39 View inside Upper Casting with Transceiver removed

3.2.4 Replacing the Transceiver in the Bulkhead Turning Unit

1. Refer to Section 3.2.2 '*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 5.36 and Figure 5.40.
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.*

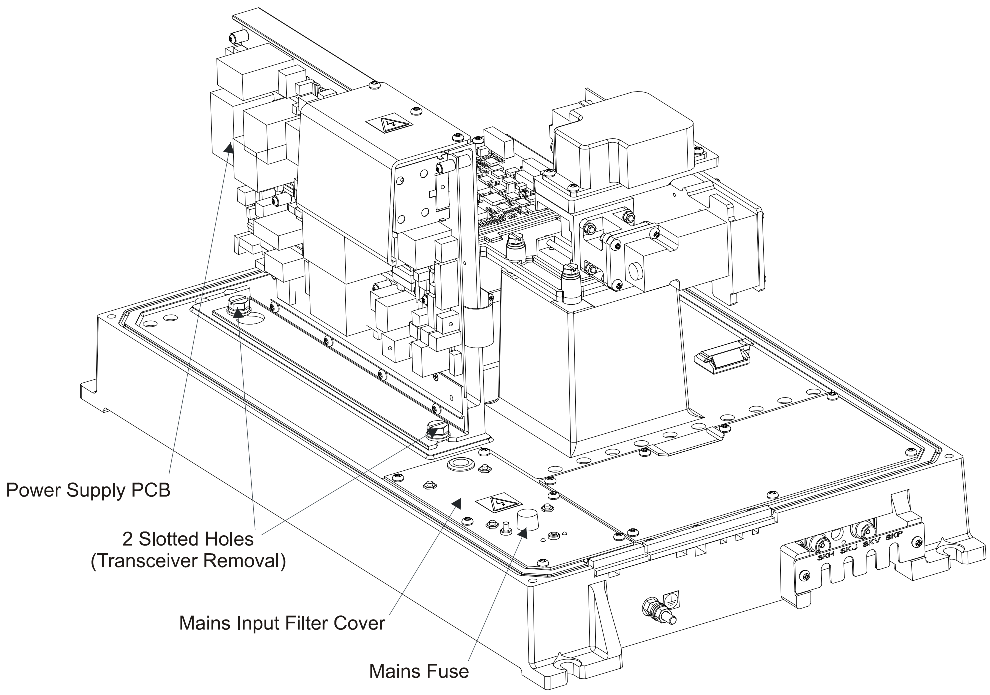
The replacement sequence is as follows:

10. Locate the Transceiver approximately onto the chassis using the two large slotted holes in the PSU heatsink.
11. Make sure the small clip fitted to the chassis engages the lower edge of the Modulator PCB and support plate during the replacement process.
12. Slacken the two screws that hold the PSU chassis plate to the Modulator chassis plate, refer to Figure 5.40.
13. Fit and **partially** tighten the three screws in the Modulator heat.
14. Fully tighten the four M6 microwave assembly-retaining.

15. Fully tighten the three screws in the Modulator heat sink.
16. 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.*

17. Replace all cables removed earlier.



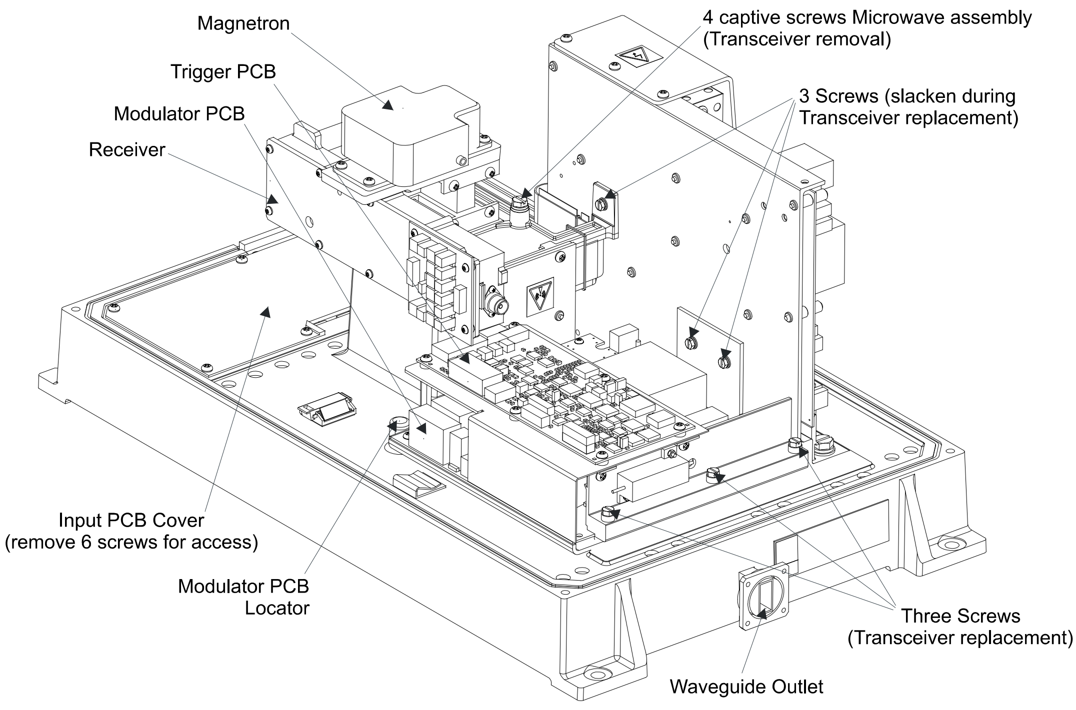


Figure 5.40 Bulkhead Transceiver - View with Cover Removed

3.2.5 Magnetron Replacement – Masthead and Bulkhead Transceivers

1. Refer to Section 3.2.1 ‘*Access to Masthead Transceiver*’ or Section 3.2.2 ‘*Access to Bulkhead Transceiver*’, paying attention to all safety warnings.
2. Check that the Transceiver is fully isolated from the ship’s supply.
3. Refer to Figure 5.36.
4. Disconnect the two EHT leads from the Modulator PCB terminal block.
5. Remove the four screws holding the Magnetron to the Circulator plate.

The replacement sequence is as follows:

6. Replacement is the reverse of the removal process.
7. Make sure the polarity of the EHT leads is correct. The PCB is marked ‘Y’ for yellow and ‘G’ for green.
8. 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.

3.2.6 Setting the Magnetron Current

The magnetron current is required to be set whenever a magnetron, modulator PCB or transceiver power supply PCB is replaced.

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES ARE EXPOSED IN THIS PROCEDURE ENSURE THAT THE POWER SUPPLY TO THE SCANNER UNIT IS TURNED OFF AT THE SCANNER CONTROL UNIT.

WARNING! – RADIATION HAZARD

ANTENNA ROTATION IS DISABLED AS PART OF THIS PROCEDURE. IF FACTORY SET PCB CONFIGURATION LINKS ARE IN PLACE, MICROWAVE TRANSMISSION IS PREVENTED. OBSERVE SAFETY DISTANCES FOR MICROWAVE TRANSMISSION AND ROTATING ANTENNAS WHEN ANTENNA ROTATION IS ENABLED.

1. Power up the radar and set the system to Standby.
2. Inhibit the antenna rotation by setting the scanner On/Off switch on the turning unit to **OFF**, see Figure 5.41 .

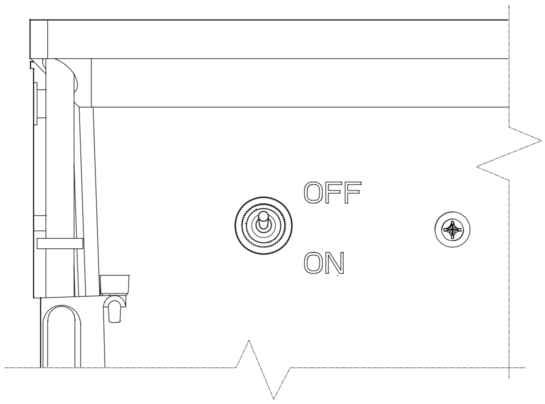


Figure 5.41 Scanner On/Off switch

3. At the Transceiver use a digital volt meter (DVM) and clip probes to measure the 'Modulator HT' voltage between the TP3 test point on the Power Supply PCB (refer to Figure 5.47 for location) and the transceiver chassis.
4. Adjust RV1 on the Power Supply PCB to achieve the following voltage between TP3 and chassis:

   X-band 25kW: -620 to -640V
   X-band 10kW: -610 to -630V

5. Close the turning unit and ensure that the antenna is free to rotate, clear the safety distance around the turning unit and re-enable antenna rotation by setting the scanner On/Off switch on the turning unit to **ON**.
6. After enabling antenna rotation, keep out of the antenna arc and observe the microwave radiation hazard zone safety distances given in the Preamble chapter ('Warnings and Cautions' section) of this manual.
7. Check the magnetron current reported at the VisionMaster FT (VMFT) display by doing the following:

   7.1 In the System/Diagnostics menu open the Tx/Rx BITE tab folder (see *Chapter 2 'Diagnostics, Commissioning & Service Mode*' in Volume 2 of the Ships Manual).

   7.2 Set the radar to Transmit and select Long Pulse (LP) transmission pulse length (LP is available at range scales of 3NM and above).

   7.3 Note the magnetron current setting in the TxRx BITE tab folder. If the value is within the following ranges the magnetron current settings procedure is complete.

   X-band 10kW: 4.5 to 7.0 Amp
   X-band 25kW: 6.0 to 8.0 Amp

8. If the magnetron current setting in TxRx BITE is not within the range given above do the following:

   8.1 Set the system to Standby and disable antenna rotation by setting the scanner On/Off switch on the turning unit to **OFF**.

   8.2 If the reported magnetron current was too low, adjust RV1 on the Power Supply PCB <u>clockwise</u> to increase Modulator HT.

   8.3 If the reported magnetron current was too high, adjust RV1 on the Power Supply PCB <u>anticlockwise</u> to decrease Modulator HT.

   Note: *It is recommended to increase or decrease the voltage by approximately 50V, which is about one quarter turn of RV1.*

   8.4 Measure the 'Modulator HT' voltage between PSU TP3 and chassis as described in step 3.

9. Re-check the magnetron current at the VMFT display as described in step 7.
10. If the reported magnetron current is still outside the limits then step 8 may be repeated, however it is more likely that a defect has occurred within the system. The most probable cause of this will be in the following modules: Magnetron, Modulator, Transceiver PSU, Transceiver cabling or the Trigger PCB.
11. Once the magnetron current has been successfully set the Transceiver and/or turning unit can be sealed up as described in previous sections. Observe hazard zone safety distances, disable rotation during access to turning units and isolate power to the system when replacing covers.

3.2.7 Trigger PCB – Replacement

1. Refer to Section 3.2.1 '*Access to Masthead Transceiver*' or Section 3.2.2 '*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 5.42 and Figure 5.43 for the necessary procedure for replacing the Trigger PCB.
4. Set the links as shown in Figure 5.43.

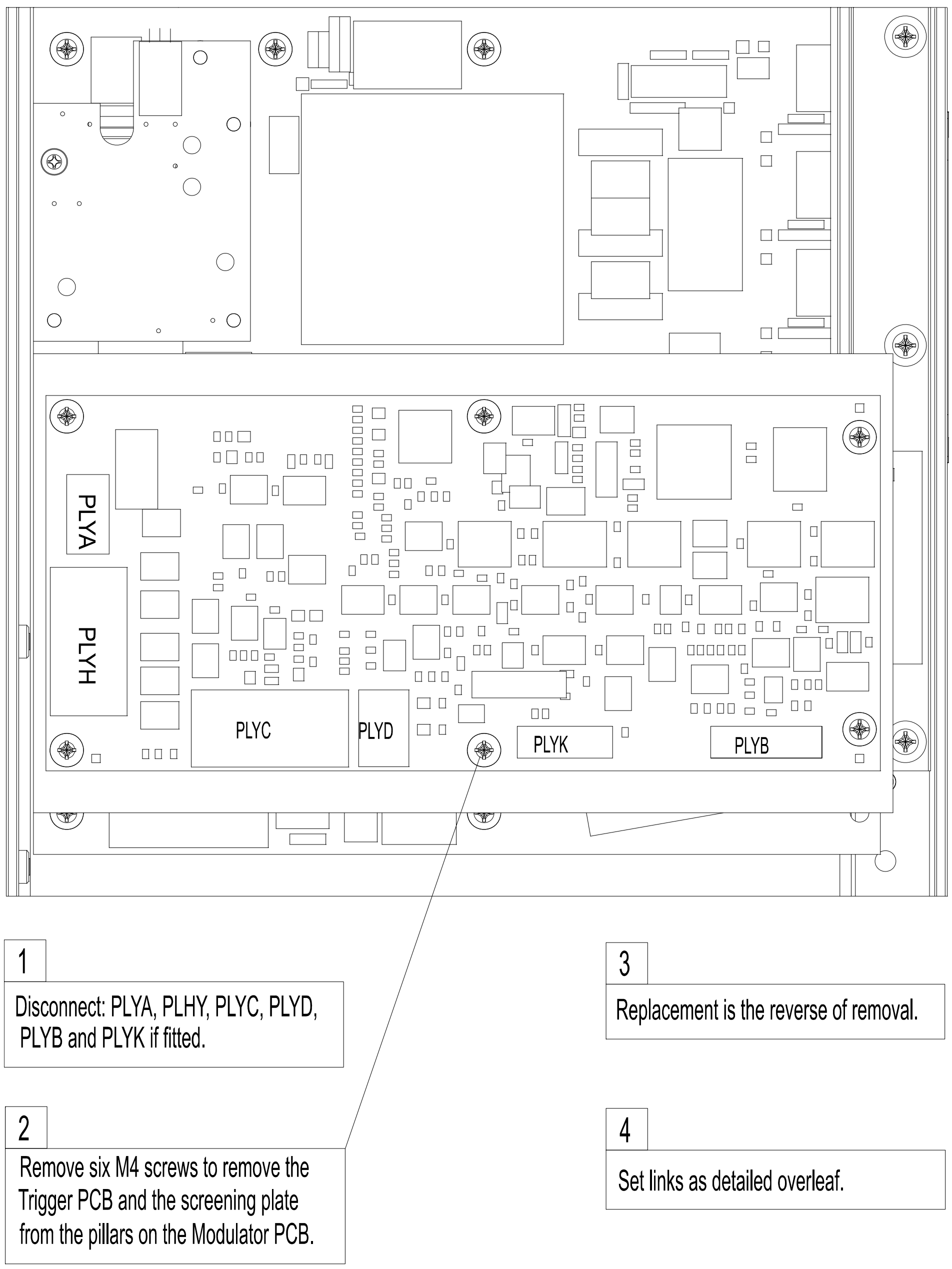
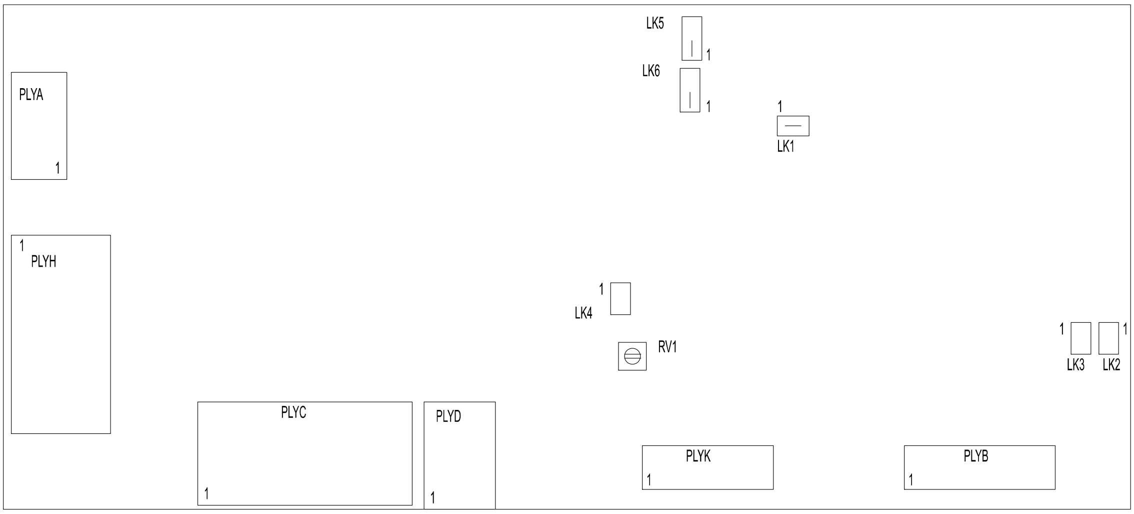


Figure 5.42 Replacing the Trigger PCB



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 5.43 Trigger PCB Link Settings

3.2.8 Modulator PCB – Replacement

1. Refer to Section 3.2.1 ‘*Access to Masthead Transceiver*’ or Section 3.2.2 ‘*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 5.44 and Figure 5.45 for the necessary procedure for replacing the Modulator PCB.
4. Set the links as shown in Figure 5.45.

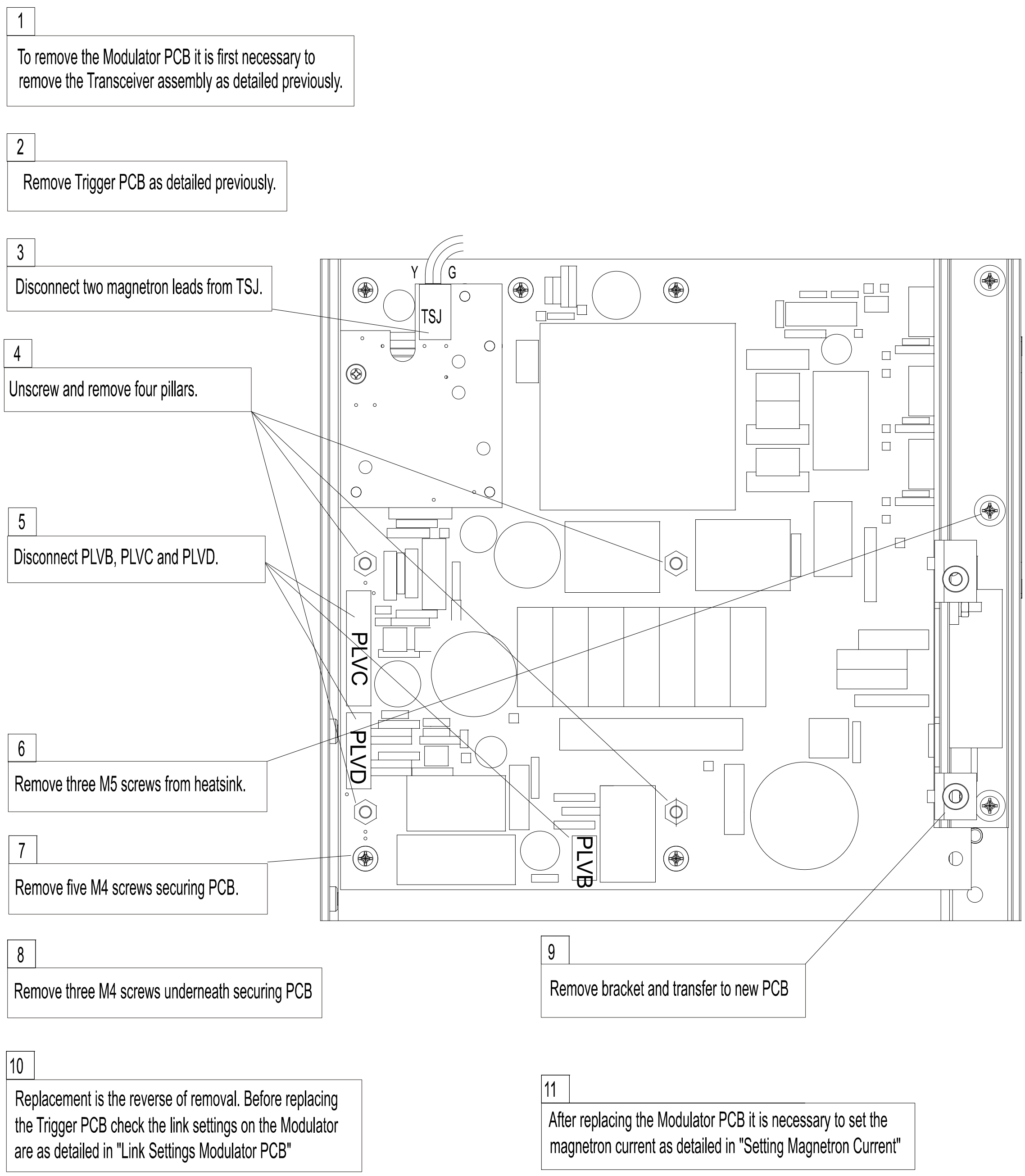
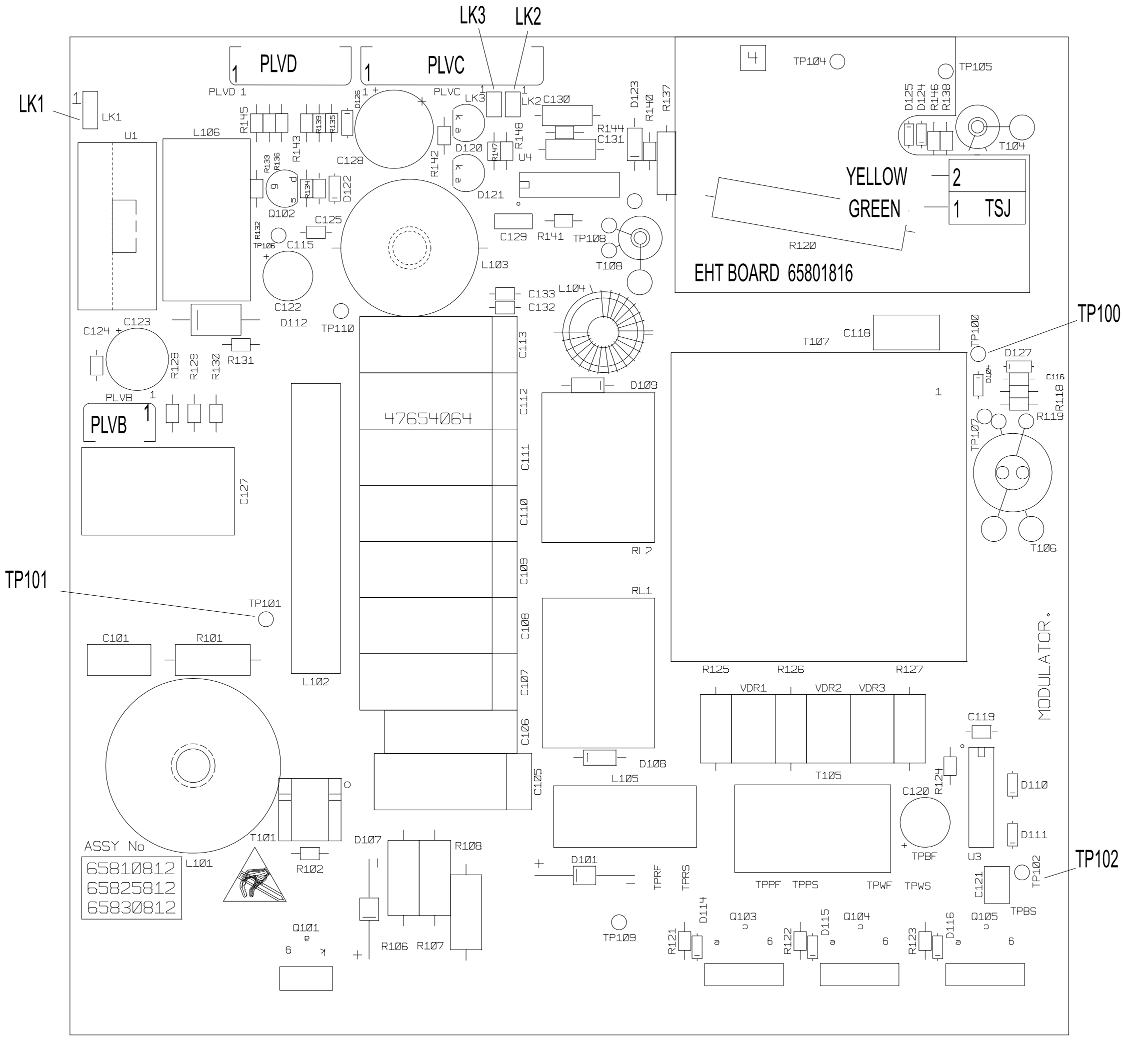


Figure 5.44 Replacing the Modulator PCB



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 5.45 Modulator PCB Link Settings

3.2.9 Power Supply PCB – Replacement

	WARNING! – LETHAL VOLTAGE HAZARD
	BEFORE STARTING THIS PROCEDURE ENSURE THAT D31 LED IS NOT ILLUMINATED. IF D31 IS ILLUMINATED ISOLATE TRANSCEIVER FROM SHIP'S MAIN SUPPLY BEFORE PROCEEDING.

1. Refer to Section 3.2.1 '*Access to Masthead Transceiver*' or Section 3.2.2 '*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 5.46 and Figure 5.47 for the necessary procedure for replacing the PSU PCB.
4. Set the links as shown in Figure 5.47.

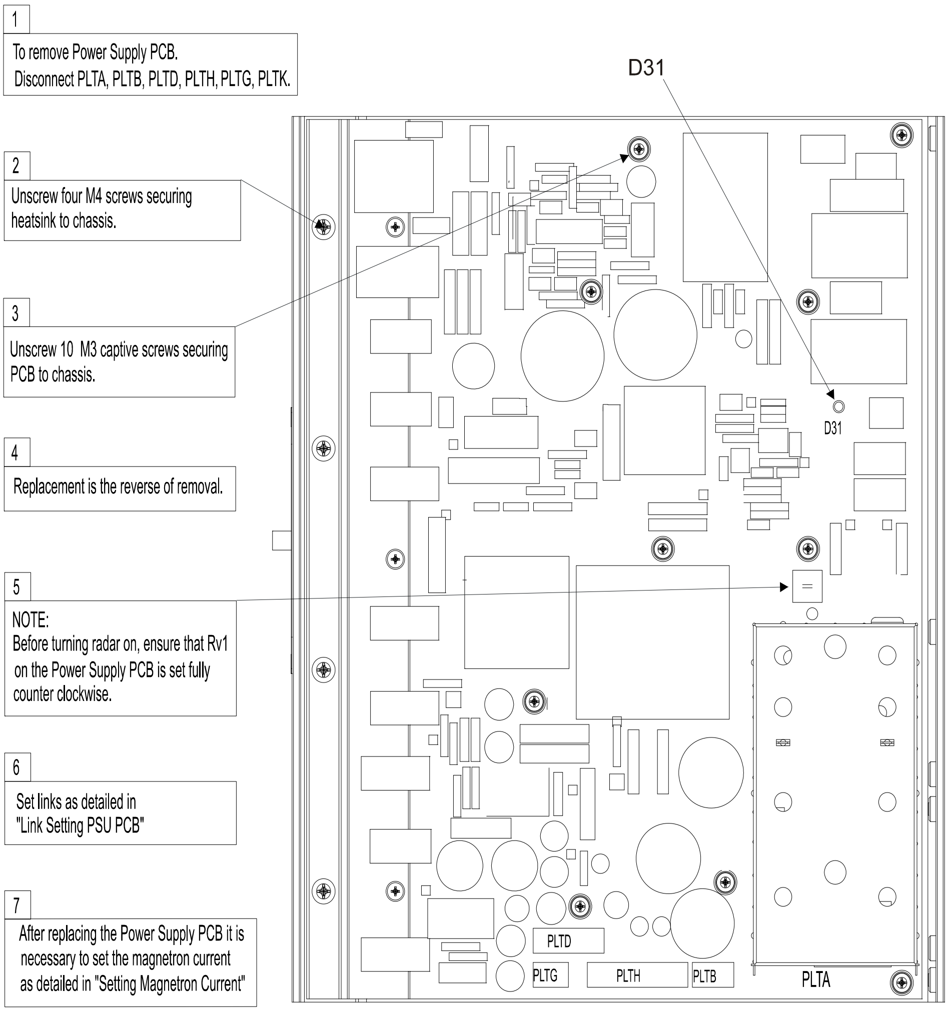
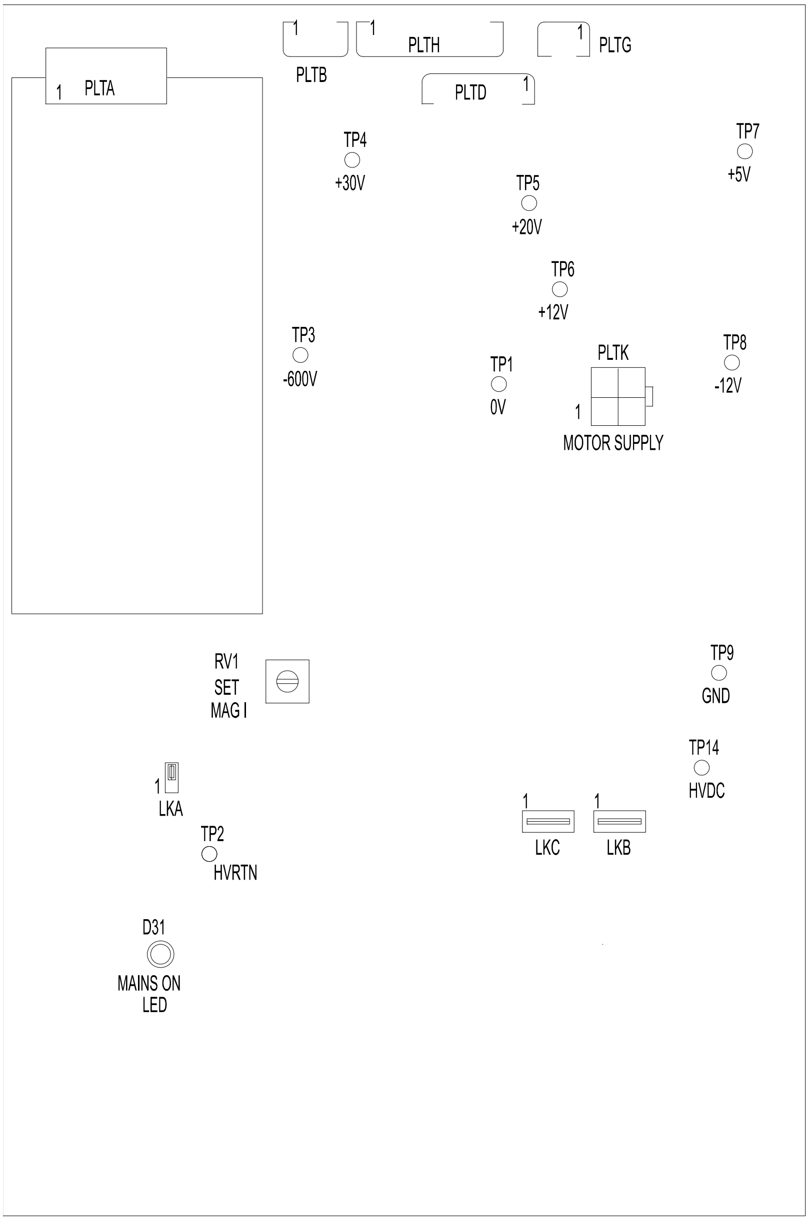


Figure 5.46 Replacing the Power Supply PCB



"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.

Figure 5.47 Power Supply PCB Link Settings

3.2.10 Receiver Assembly – Replacement (Masthead)

1. Refer to Section 3.2.1 '*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 Section 3.2.3.
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 5.36 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.

3.2.11 Receiver Assembly – Replacement (Bulkhead)

1. Refer to Section 3.2.2 '*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 5.36 and Figure 5.40.
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 5.36 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.

3.2.12 Bearing and Heading Marker PCB – Replacement

1. Refer to Section 3.2.1 ‘*Access to Masthead Transceiver*’ or Section 3.2.2 ‘*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 5.36.
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 Section 3.3.4 in Chapter 8 ‘*Additional Features*’.

3.2.13 Heading Marker Alignment

Alignment of the Heading Marker is set at system configuration, see *Ship’s Manual Volume 2*, *Chapter 1 ‘Configuration’*.

3.2.14 Performance Monitor – Replacement

1. Refer to Section 3.2.1 ‘*Access to Masthead Transceiver*’ or Section 3.2.2 ‘*Access to Bulkhead Transceiver*’, paying attention to all safety aspects.
2. Check that the Transceiver is fully isolated from the ship’s supply.
3. Remove the two retaining screws that hold the Performance Monitor to the upper casting (see Figure 5.36) 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.

Note: *After replacement, the Performance Monitor must be set up as described in Ship's Manual Volume 2, Chapter 2 - Diagnostics and Commissioning.*

3.2.15 Motor Drive Board – Replacement

1. Refer to Section 3.2.1 '*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 5.48).
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.
   a. Position 1 & 2 marked 'LO' is for 28 RPM operation.
   b. 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 Section 3.3.5 in Chapter 8 '*Additional Features*'.
9. Replacement is the reverse of the removal process.
10. Make sure all three cable-assemblies are reconnected to the PCB.

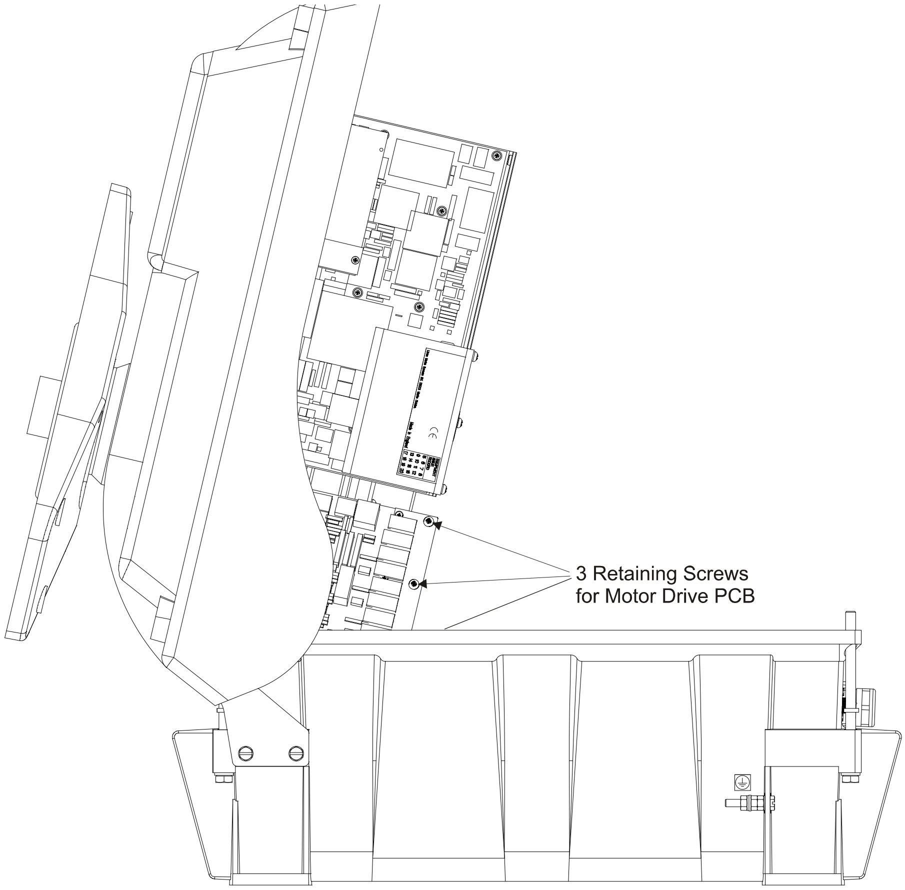


Figure 5.48 Motor Drive Board Retaining screws

3.2.16 Adjusting the Waveguide Flange Angles

1. Remove the waveguide gauge (item 65801387) from the underside of the turning unit upper casting, see Figure 5.39.
2. To accommodate the waveguide gauge, remove the two screws on the right side (looking forward) of the waveguide base flange.
3. Position the gauge on the flanges of the waveguide, as shown in Figure 5.49.
4. Check that the side edges of the gauge are in full contact with the faces of the waveguide flanges, as shown in Figure 5.50.
5. If the waveguide flanges do not align with the gauge, apply slight force in the direction required to achieve alignment. Offer the gauge to the waveguide after each adjustment.

	CAUTION
⚠	**Do NOT use excessive force, which could result in permanent displacement of the unit. If the waveguide cannot be adequately adjusted in this way then the unit must be replaced..**

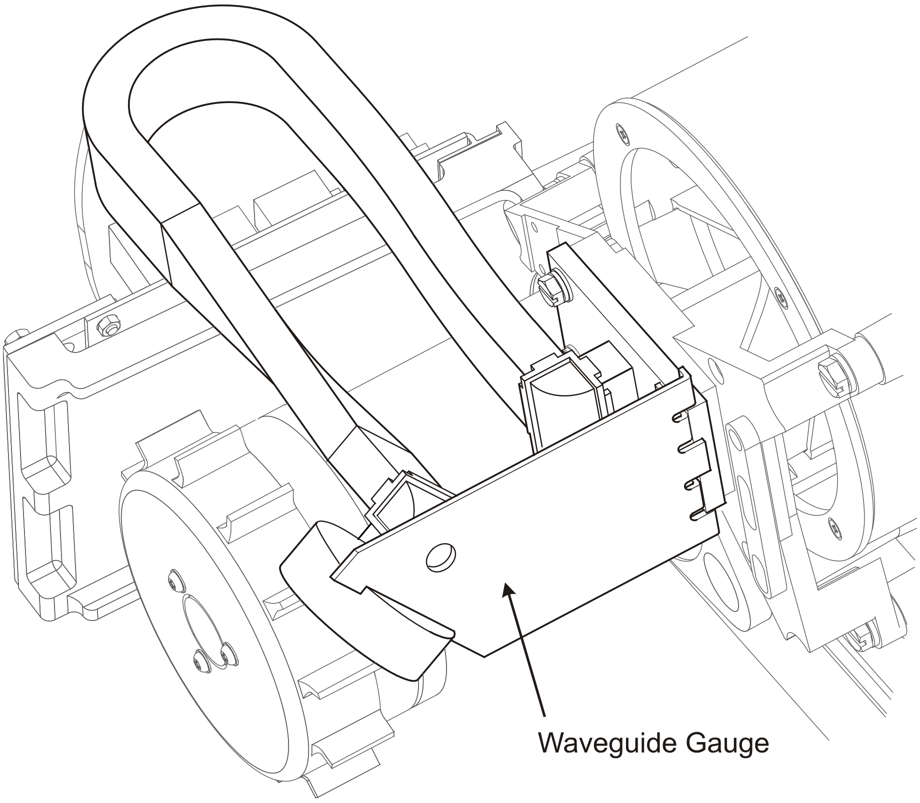


Figure 5.49 Positioning Gauge on Waveguide Flanges

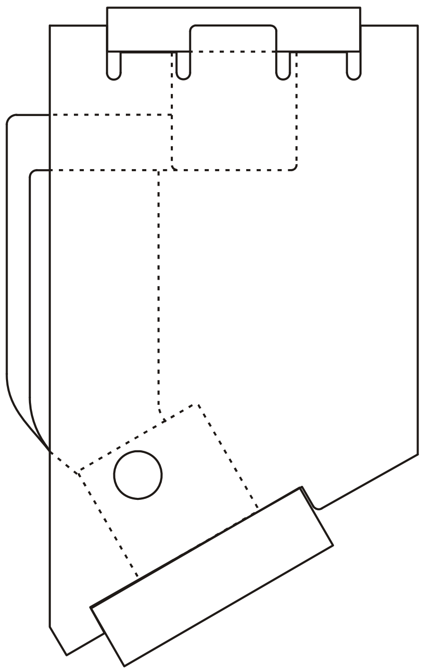


Figure 5.50 Waveguide Gauge - front view

3.2.17 Waveguide - Replacement

If the waveguide cannot be adequately adjusted as described in Section 3.2.16 then the unit must be replaced.

1. Refer to Figure 5.39 for the location of the four screws that retain the waveguide flange to the waveguide transition plate.
2. Remove the screws, plain washers and spring washers.
3. Fit the replacement waveguide.
4. Check the replacement waveguide flange angles using the waveguide gauge.

3.2.18 Motor and Gearbox Assembly – Replacement

1. Refer to Section 3.2.1 ‘*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 5.39 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.

3.2.19 Drive Belt – Replacement

1. Refer to Section 3.2.1 '*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 Section 3.2.3.
4. Remove the motor support casting and motor assembly as detailed in Section 3.2.18.
5. Refer to Figure 5.39. Remove the three bolts that attach 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.*

6. 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.
7. Fit the replacement drive-belt.
8. Re-assembly is the reverse of the removal process.
9. Care should be exercised to avoid damage to the brass microwave probe at the centre of the hub during re-insertion into the transition.
10. Make sure the motor pulley is correctly engaged into the drive-belt.

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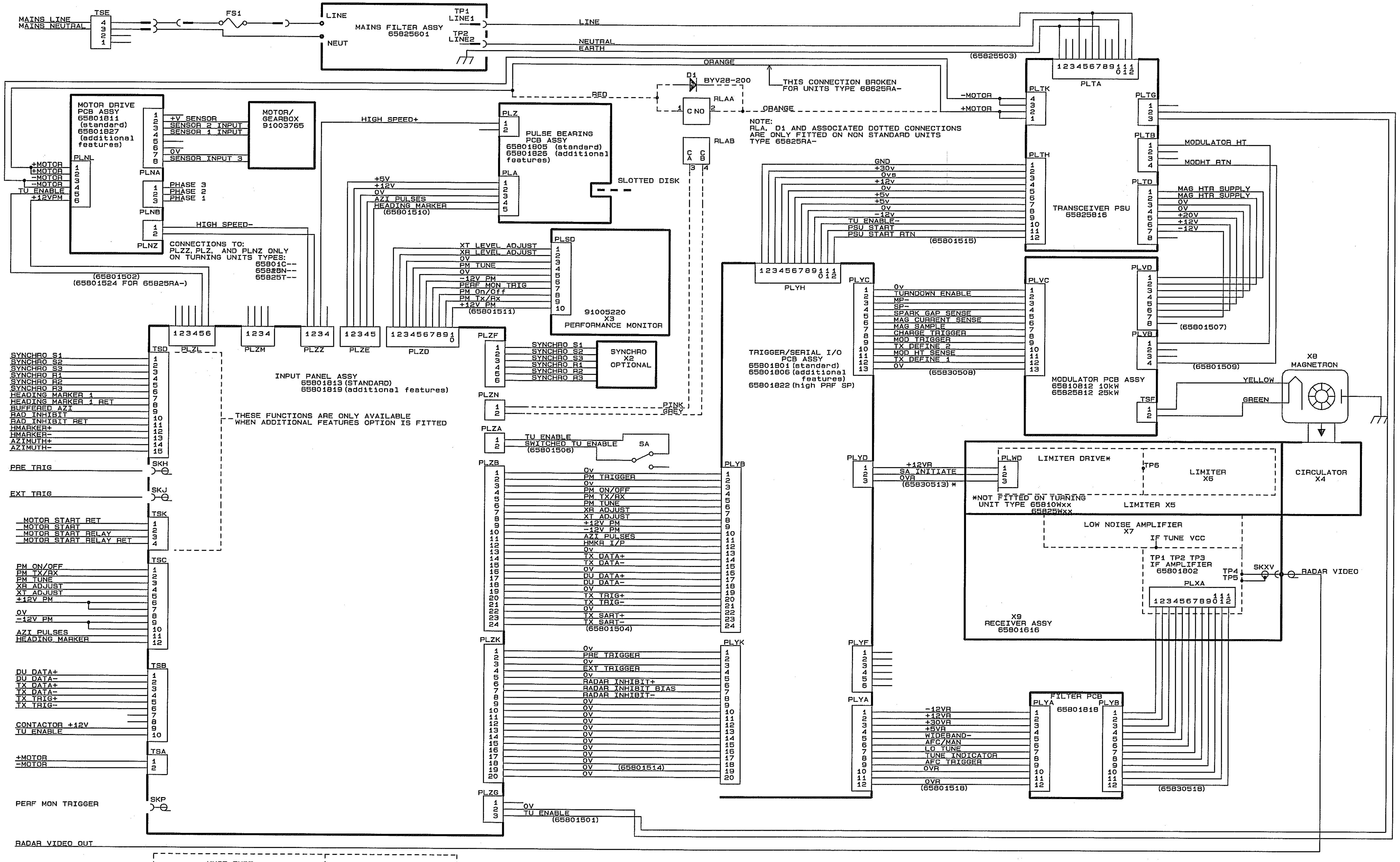
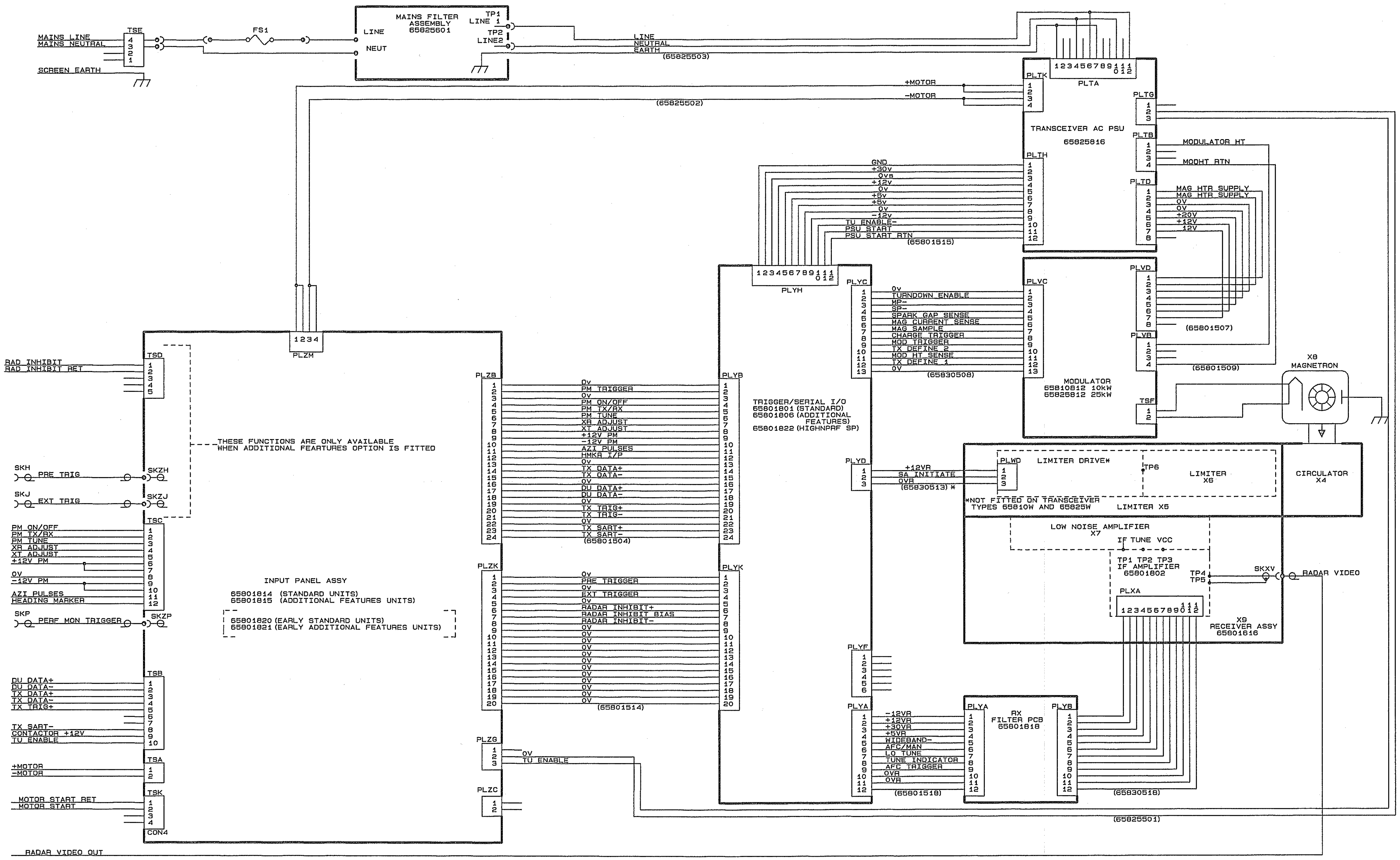


	UNIT TYPE		
REF	25kW 65825XXX	10kW 65810XXX	DESCRIPTION
X2	66000/57	66000/57	SYNCHRO ASSY (CX)
X2	66000/80	66000/80	SYNCHRO ASSY (CDX)
X3	9105220	9105220	PERFORMANCE MONITOR
X4	91005227	91005227	CIRCULATOR
X5	91005226	91005221	BIASED LIMITER ASSY
X5	91005210	91003431	NON BIASED LIMITER USED ON 65825Wxx 65810Wxx
X6	91005219	91005235	LIMITER
X7	91003241	9103241	LOW NOISE AMPLIFIER
X8	91005208	9103015	MAGNETRON
X9	65801616	65801616	RECEIVER ASSY

FILE REF: 65801900SCHEMATIC.TIF

Figure 5.51 X-band Turning Unit (Aloft) Schematic



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18/03/05

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 5.52 X-band Transceiver Schematic

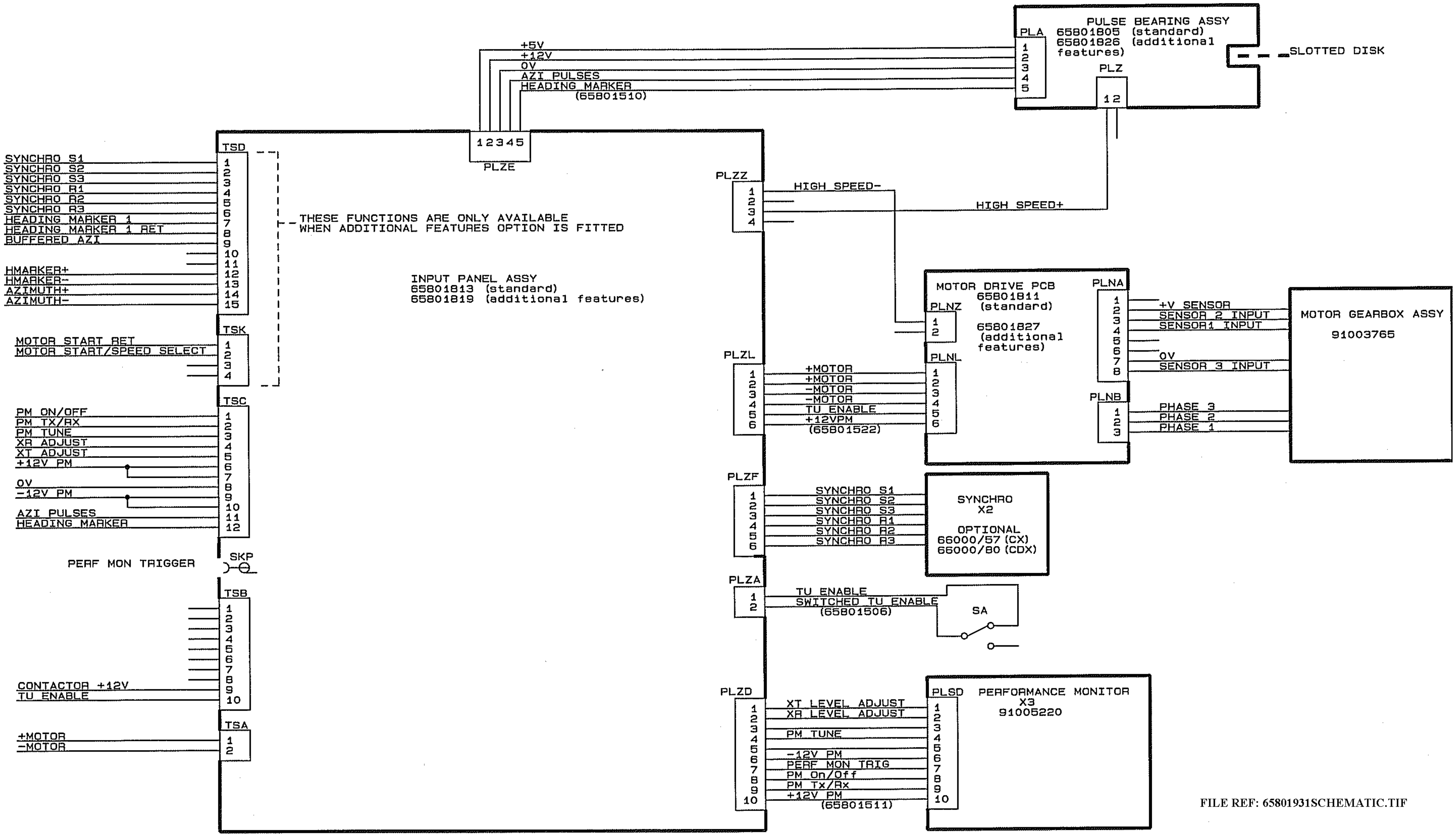


Figure 5.53 X-band Turning Unit (Bulkhead) Schematic

3.3 19” Integrated Tabletop Display

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED.

Shut down the system from the VisionMaster FT application and switch the On/Off switch located on the front of the enclosure panel to OFF.

Isolate the unit from the mains power supply.

3.3.1 Replacing the Control Panel

There are no attaching parts connecting the control panel to the enclosure assembly.

1. To remove the control panel insert a flat bladed screwdriver between the control panel side and the enclosure top and lever the control panel upwards. Take care not to damage the paint work on the enclosure.
2. When there is a sufficient gap between the control panel and the enclosure, pull firmly upwards from the far edge of the panel. The control panel can now be removed from the assembly.
3. For instructions on removing individual control panel modules, refer to Section 3.4.2 ‘*Control Panel Assembly*’
4. Replacing the control panel is a reversal of the removal procedure. When connected ensure the cable(s) are tie wrapped.

3.3.2 Fan Filter Removal

3.3.2.1 Removing the Fan Filters (Mark 1 version)

There are two fans, positioned on each side of the enclosure chassis.

The fan filter, behind the plastic fan filter cover, should be removed and cleaned periodically, see Section 2 *'Maintenance Plan'* in Chapter 6 '*Routine Maintenance*'. To remove the fan filter:

1. Insert a flat bladed screwdriver into a slot on the side of the fan housing and use the screwdriver to lever off the plastic fan cover, see below.

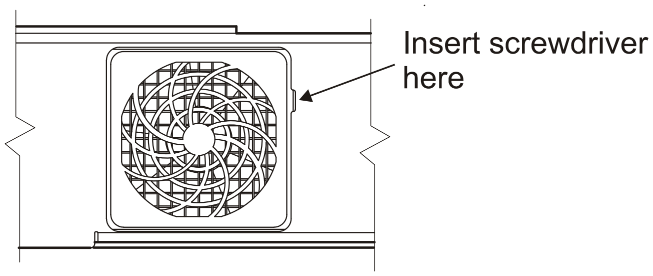


Figure 5.54 Removing the Fan Filter (Mk 1 version)

2. Remove the filter from the fan housing and clean.
3. Re-insert the fan filter and filter cover into the fan housing.

3.3.2.2 Removing the Fan Filter (Mark 2 version)

There is one fan filter for the two fans. The fan filter is located on the rear face of the Processor/Chassis assembly, see Figure 5.55.

To remove the fan filter:

1. Remove the four pan head screws securing the fan filter housing to the chassis.
2. Remove the filter and clean.
3. Re-insert the fan filter into the filter housing and secure to the chassis using the four pan head screws.

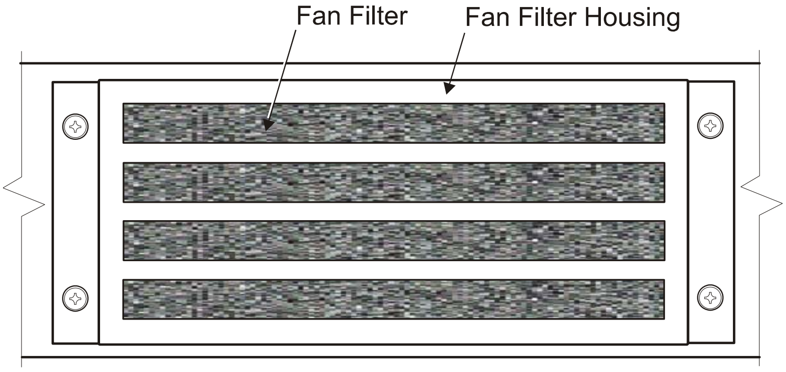


Figure 5.55 Removing the Fan Filter (Mk 2 version)

3.3.3 Replacing the DVD Writer

1. With the control panel removed, the DVD writer may be removed from the housing.
2. Remove the eight M3 pan head screws and eight M3 washers (four each side) which secure the DVD to the DVD bracket (see Figure 5.56). Carefully pull the DVD unit out from the front of the enclosure.
3. From the rear of the DVD unit disconnect the DVD PWR cable to the DC/DC converter, and the DVD SATA cable to the graphics card.
4. Replacing the DVD writer is a reversal of the removal procedure.

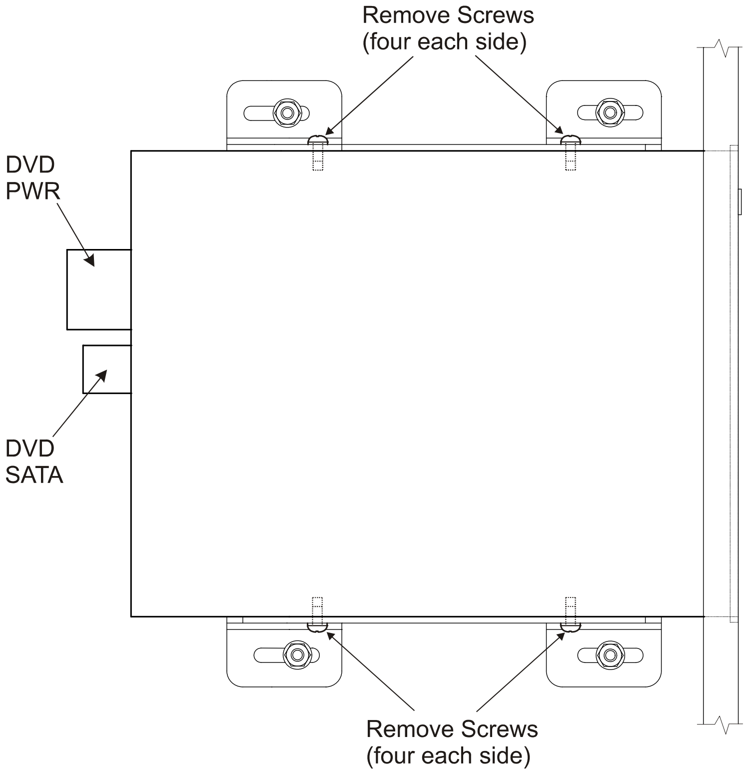


Figure 5.56 Removing the DVD Writer

3.3.4 Replacing the On/Off Switch (Mark 1 version)

1. With the control panel removed and the system powered down, disconnect the red and purple wires that connect the On/Off switch to the DC/DC converter.
2. Remove the two M3 nuts and M3 washers securing the switch to the enclosure.
3. Remove the switch plate and On/Off switch.
4. Replacing the On/Off switch is a reversal of the removal procedure.

3.3.5 Replacing the LED and Buzzer Panel PCB

1. With the control panel removed and the system powered down, disconnect the buzzer board interface cable. Disconnect the cable's earth lead, which is attached to the top left PCB retaining screw.
2. Remove the four M3 pan head screws and four crinkle washers that attach the PCB to the pillar studs.
3. When replacing the LED and Buzzer panel PCB, ensure the paper cover has been removed from the buzzer before assembly.
4. After connecting the interface cable to the PCB, add a blob of silicone sealant to each end of the cable connector, see Figure 5.57.

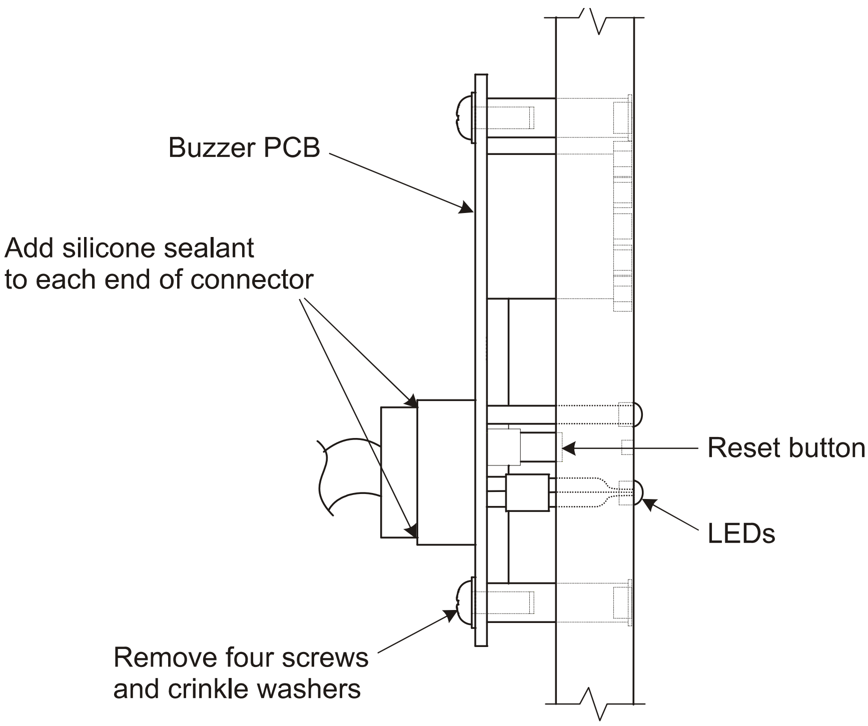


Figure 5.57 Removing the LED and Buzzer Panel PCB

3.3.6 Removing the 19" Integrated Tabletop Covers

To replace the 19" Integrated Tabletop modules, as described in sections 3.3.7 to 3.3.11, the bezel, rear cover and rear panel must be removed.

3.3.6.1 Removing the Bezel and Rear Cover

1. Remove the six bezel retaining screws (three each side).
2. Remove the four M6 screws, M6 plain washers and M6 spring washers (two either side) from the rear cover. Remove the two M4 screws, M4 plain washers and M4 spring washers from the rear of the cover.
3. Pull the bezel forward from the top to disengage the bezel from the rear cover spring clips.
4. Remove the two M4 screws, M4 plain washers and M4 spring washers from the top of the rear cover. Slide the rear cover backwards, remove the cover earth strap and then remove the cover from the enclosure assembly.
5. To remove the bezel, disconnect the bezel earth strap from the display chassis.

3.3.6.2 Removing the Rear Panel

1. Remove the three M6 screws and M6 spring washers retaining rear panel. The left and right hand screws attach the panel directly to the enclosure chassis; the centre screw attaches the display chassis to the rear panel.
2. Lift up the combined Processor plate and LCD assembly from the rear of the display chassis. The assembly hinges on two brackets attached to the enclosure chassis.
3. Secure the Processor/LCD assembly in the open position by pushing the Stay bracket forward. The Stay bracket is attached to the underside of the display chassis and the side of the enclosure chassis.
4. After the Processor/LCD assembly have been pivoted upwards, pull and manoeuvre the rear panel up and backwards to remove it from the enclosure chassis.

Note: *Removing the fuse holder may help in the removal of the rear panel.*

3.3.7 Replacing the LCD Assembly (Mark 1 version)

Before detaching the LCD assembly from the display chassis, remove all external cables from the Inverter card and EG card. Note the position, polarity and orientation of all components removed from the assembly.

1. Remove the four M5 nuts and M5 washers from the left hand and right hand support brackets of the display chassis (two each side). The nuts are screwed to studs on the LCD plate, see Figure 5.58.
2. From the front of the LCD, remove the four M4 screws and M4 washers securing the bottom of the LCD plate to the display chassis.
3. Replacing the LCD assembly is a reversal of removal.

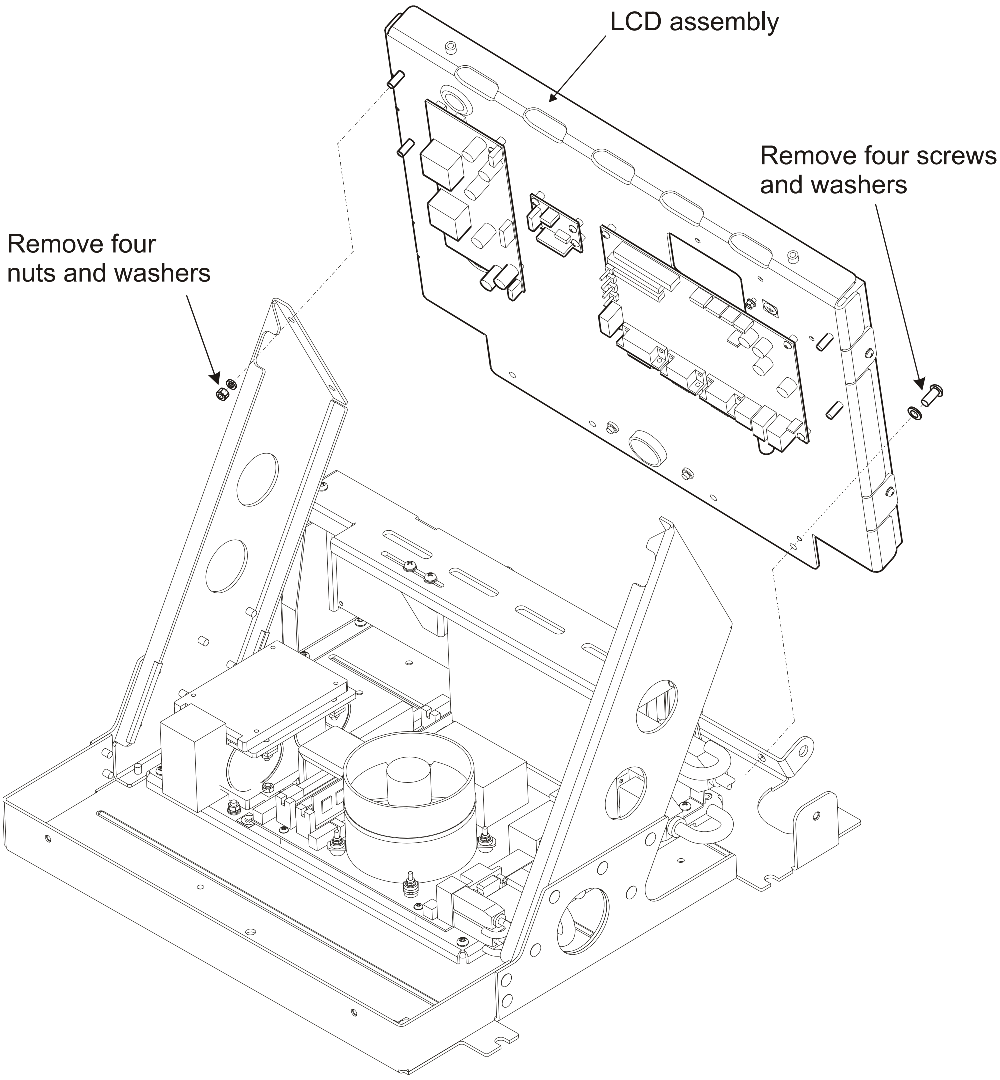


Figure 5.58 Removing the LCD Assembly

3.3.8 Removing the Processor Plate Assembly (Mark 1 version)

CAUTION – Electrostatic Sensitive Devices (ESSDs)

The Processor unit contains Electrostatic Sensitive Devices (ESSDs). Take care not to damage these devices by discharge of electrostatic voltages.

Before detaching the processor plate assembly from the display chassis, remove all external cables and USB devices from the Processor board, SC3 card, Graphics card and hard disk drive. Note the position, polarity and orientation of all components removed from the processor assembly.

The Processor plate assembly on a Mark 1 version (65919 series) is attached to the display chassis by five screws. Two screws are accessible from the top of the processor plate; the other three are accessible from the underside of the display chassis, see Figure 5.59.

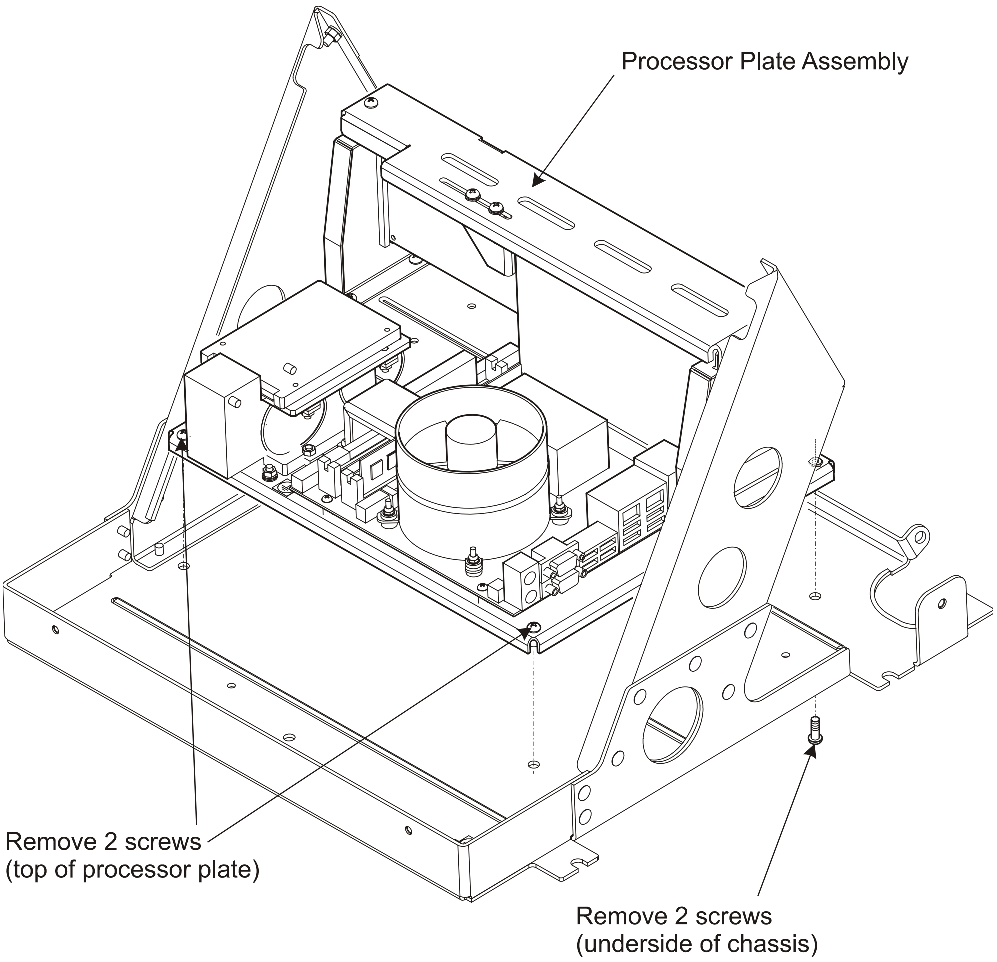


Figure 5.59 Removing the Processor Plate Assembly - Mk 1 version

Removing the Processor Plate Assembly (Mark 1 version)

1. Pull open the Processor assembly and chassis and secure in position with the stay.
2. Remove two M4 screws with M4 washers and one M4 countersunk screw from the underside of the processor chassis.
3. Close the processor assembly and remove the two M4 screws and M4 washers from the topside of the processor chassis.
4. Move the Processor assembly a few centimetres to the right in order to remove the assembly from the plate chassis.

3.3.8.1 Replacing the Processor Battery

Figure 5.60 shows the location of the CR2032 lithium battery on the PCB motherboard for a Mark 1 processor.

The battery is removed by releasing the battery holder catch.

Note that on a Mark 1 series Tabletop the processor top plate will need to be removed to locate the battery. The graphics PCB may also need to be removed in order to gain access to the battery, which is mounted vertically on the processor PCB.

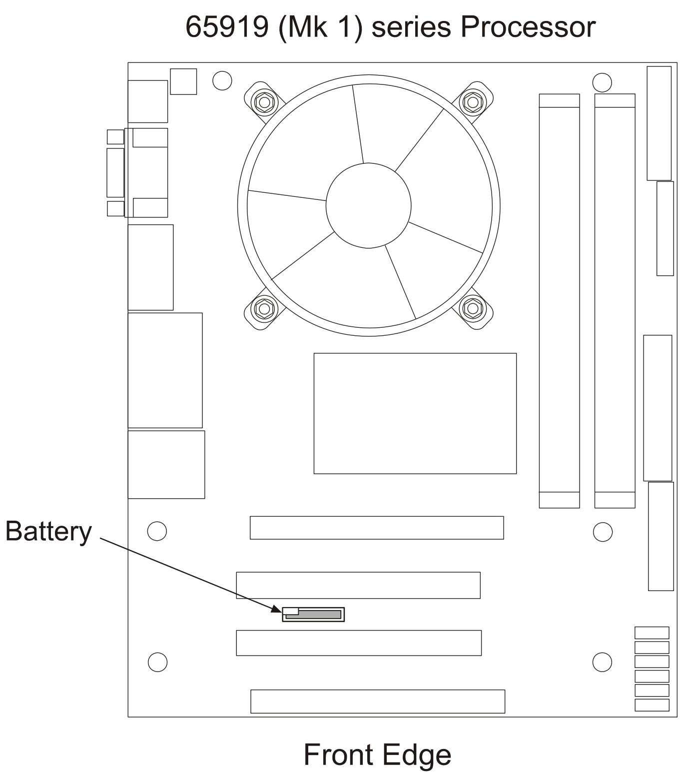


Figure 5.60 Location of Lithium Battery on Mk 1 version Processor

3.3.9 Removing the Processor Assembly (Mark 2 version)

CAUTION – Electrostatic Sensitive Devices (ESSDs)

The Processor unit contains Electrostatic Sensitive Devices (ESSDs). Take care not to damage these devices by discharge of electrostatic voltages.

On a Integrated Tabletop Mark 2 version (65920 series) the processor is part of the overall top chassis assembly. If a replacement processor is required the top chassis, complete with processor and other Tabletop modules attached to the chassis, must be removed from the base enclosure.

Before detaching the processor/chassis assembly remove all external cables and USB devices from the processor board, SC3 card, graphics card and hard disk drive. Remove cables connecting components to modules in the base enclosure. Note the position, polarity and orientation of all cables removed from the processor/chassis assembly.

Remove all earth connections from the top chassis to the base enclosure.

Remove the LCD assembly, as described in Section 3.3.7 '*Replacing the LCD Assembly (Mark 1 version)*'.

To remove the processor/chassis assembly from the base enclosure refer to Figure 5.61 (for item numbers) and the following instructions:

1. Remove the four M6 screws (item 1) securing the top chassis to the base.
2. Pull open the processor assembly and top chassis and secure in position with the lid stay arm.
3. Remove the two M3 screws that secure the lid stay arm to the underside of the top chassis.
4. Lower the processor/chassis assembly back down onto the base.
5. Remove the two M6 Nyloc nuts (item 2) and M6 washers (item 3) on the top chassis pivot brackets.
6. Remove the nylon washers (item 4) between the pivot brackets and base enclosure and remove the M6 bolts (item 5) and washers (item 3).
7. The processor/chassis assembly can now be removed from the base enclosure.

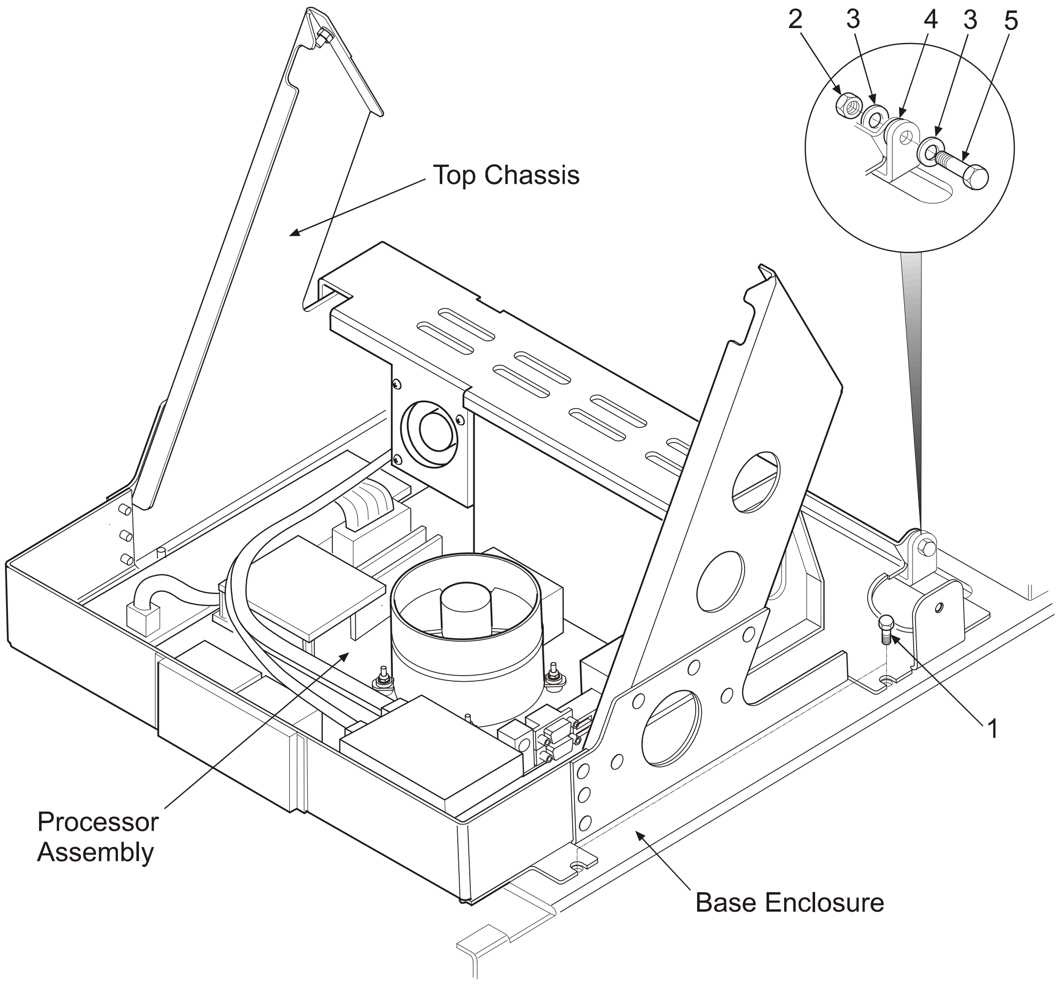


Figure 5.61 Removing the Processor/Chassis Assembly - Mk 2 version

3.3.9.1 Replacing the Processor Battery

Figure 5.62 shows the location of the CR2032 lithium battery on the PCB motherboard for a Mark 2 processor (65920 series).

The battery is removed by releasing the battery holder catch.

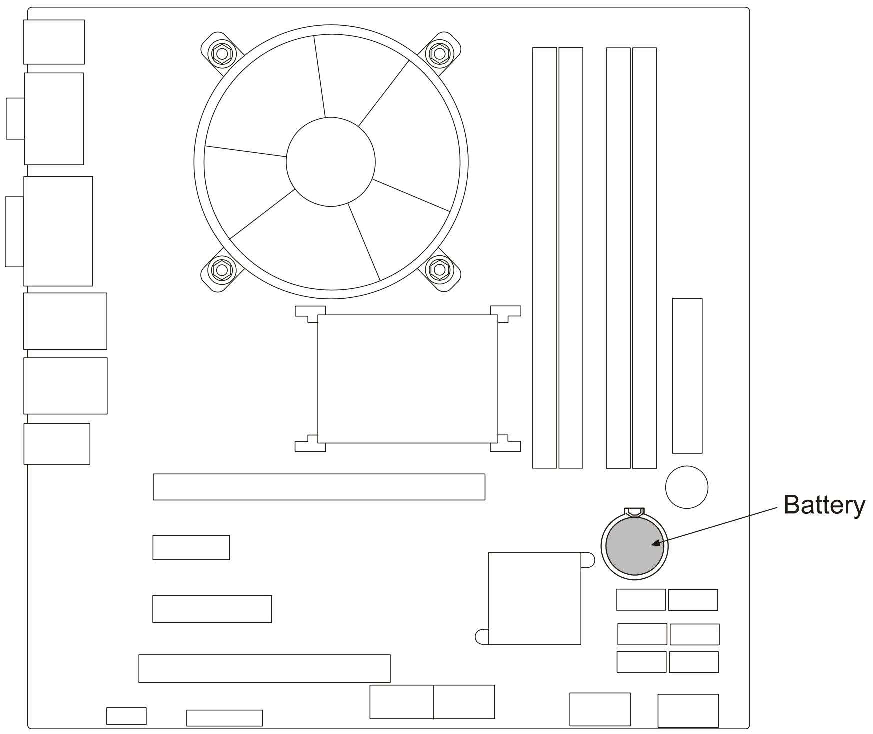


Figure 5.62 Location of Lithium Battery on Mk 2 version Processor

3.3.10 Removing Modules from the Base Enclosure (Mark 1 Version)

WARNING! – LETHAL VOLTAGE HAZARD

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 MODULES. TO MAKE THE UNITS SAFE IT IS NECESSARY TO ISOLATE THEM FROM THE MAINS SUPPLY. IT IS NOT ADEQUATE TO TURN THE UNIT OFF; THERE ARE HIGH VOLTAGES PRESENT AT ANY POWER SUPPLY THAT IS NOT MAINS ISOLATED.

CAUTION – Electrostatic Sensitive Devices (ESSDs)

The PCI/O and DC/DC Converter contain Electrostatic Sensitive Devices (ESSDs). Take care not to damage these devices by discharge of electrostatic voltages.

Figure 5.63 shows a plan view of the Mark 1 version of the base enclosure with the line replaceable modules and their attaching parts annotated.

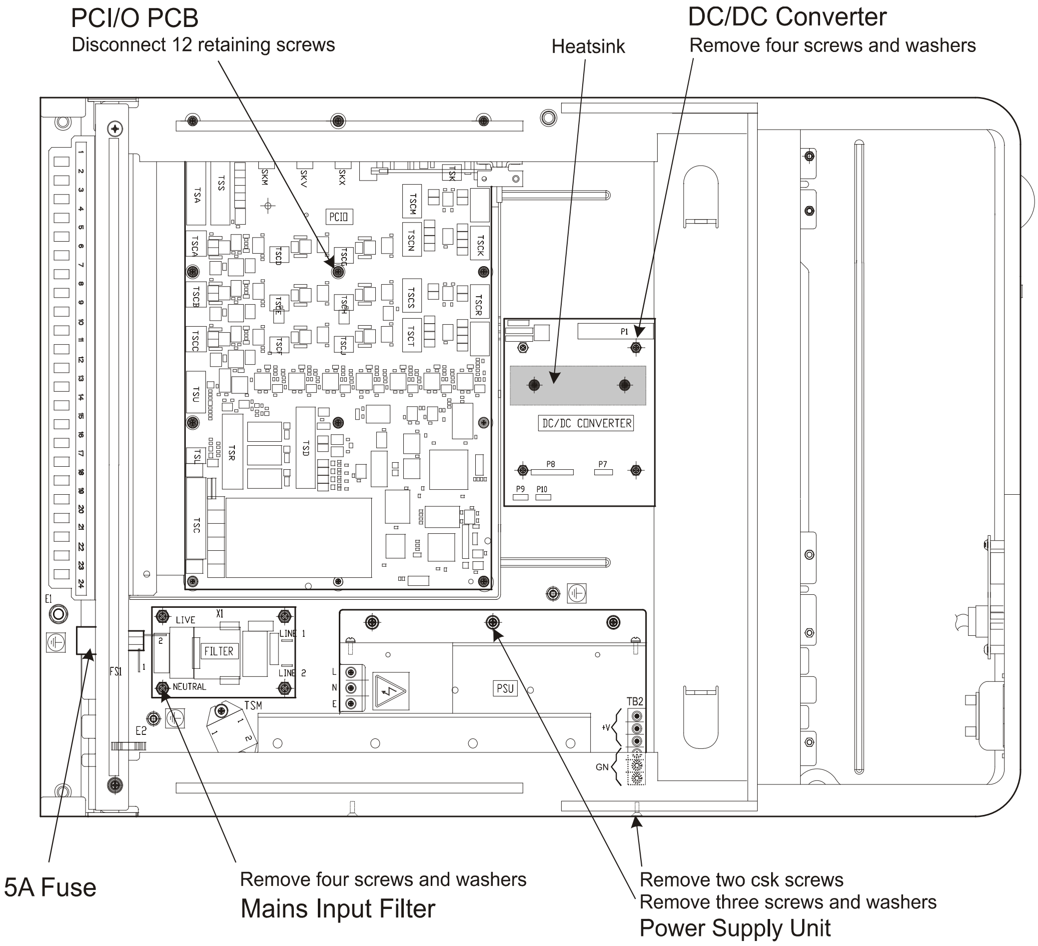


Figure 5.63 Removing Base Enclosure Modules - Mk 1 version

3.3.10.1 Replacing the PCI/O PCB

1. To disconnect incoming cables to the PCI/O PCB, from the rear of the enclosure remove the five M4 countersunk screws securing the cable clamp top plate.
2. Disconnect cable tie wraps, earthing tags and internal cable connections from the PCI/O PCB.
3. With all cables disconnected from the PCI/O PCB, remove fastener securing the 9-way ribbon power cable to the PCB shield and disconnect cable from the PLP terminal.
4. Unscrew the 12 retaining screws and remove the PCB from the enclosure.
5. Remove the compass PCB from the main PCB.
6. Replacing the PCI/O PCB is a reversal of removal.

3.3.10.2 Replacing the DC/DC Converter

1. Disconnect all incoming cables to the DC/DC Converter board.

2. Remove the four attaching M3 screws and M3 washers and remove the DC/DC Converter from the enclosure.

Note: *There will be a certain amount of resistance when removing the converter board, this is due to compound bonding the underside of the board to the heatsink.*

3. Before replacing the DC/DC Converter apply an adequate amount of fresh bonding compound to the heatsink.

3.3.10.3 Replacing the Mains Input Filter

1. Disconnect the mains power leads coming into the input filter and disconnect the leads going out to the PSU.
2. Remove the four M4 screws and M4 crinkle washers and remove the mains input filter from the enclosure.
3. Replacing the mains input filter is a reversal of removal.

3.3.10.4 Replacing the Power Supply Unit

1. Disconnect all incoming cables to the Power Supply Unit (PSU).

Note: *Because of limited access it is easier to remove and re-fit the cables to the TB2 terminal after PSU removal and before final installation.*

2. From the side of the enclosure chassis, remove the two M3 countersunk screws.
3. Remove the three M4 screws and M4 washers which secure the PSU bracket to the enclosure chassis.
4. Carefully manoeuvre the PSU out of the enclosure by lifting the unit up from the side attached to the bracket.
5. Remove the cables from the TB2 terminal.
6. Before replacing the PSU, re-connect the cables to the TB2 terminal.

3.3.10.5 Replacing the 5A Fuse

Unscrew the fuse holder at the rear of the enclosure chassis, remove fuse and replace.

3.3.11 Removing Modules from the Base Enclosure (Mark 2 Version)

WARNING! – LETHAL VOLTAGE HAZARD

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 MODULES. TO MAKE THE UNITS SAFE IT IS NECESSARY TO ISOLATE THEM FROM THE MAINS SUPPLY. IT IS NOT ADEQUATE TO TURN THE UNIT OFF; THERE ARE HIGH VOLTAGES PRESENT AT ANY POWER SUPPLY THAT IS NOT MAINS ISOLATED.

CAUTION – Electrostatic Sensitive Devices (ESSDs)

The PCI/O contains Electrostatic Sensitive Devices (ESSDs). Take care not to damage the device by discharge of electrostatic voltages.

Figure 5.64 shows a plan view of the Mark 2 version of the base enclosure with the line replaceable modules and their attaching parts annotated.

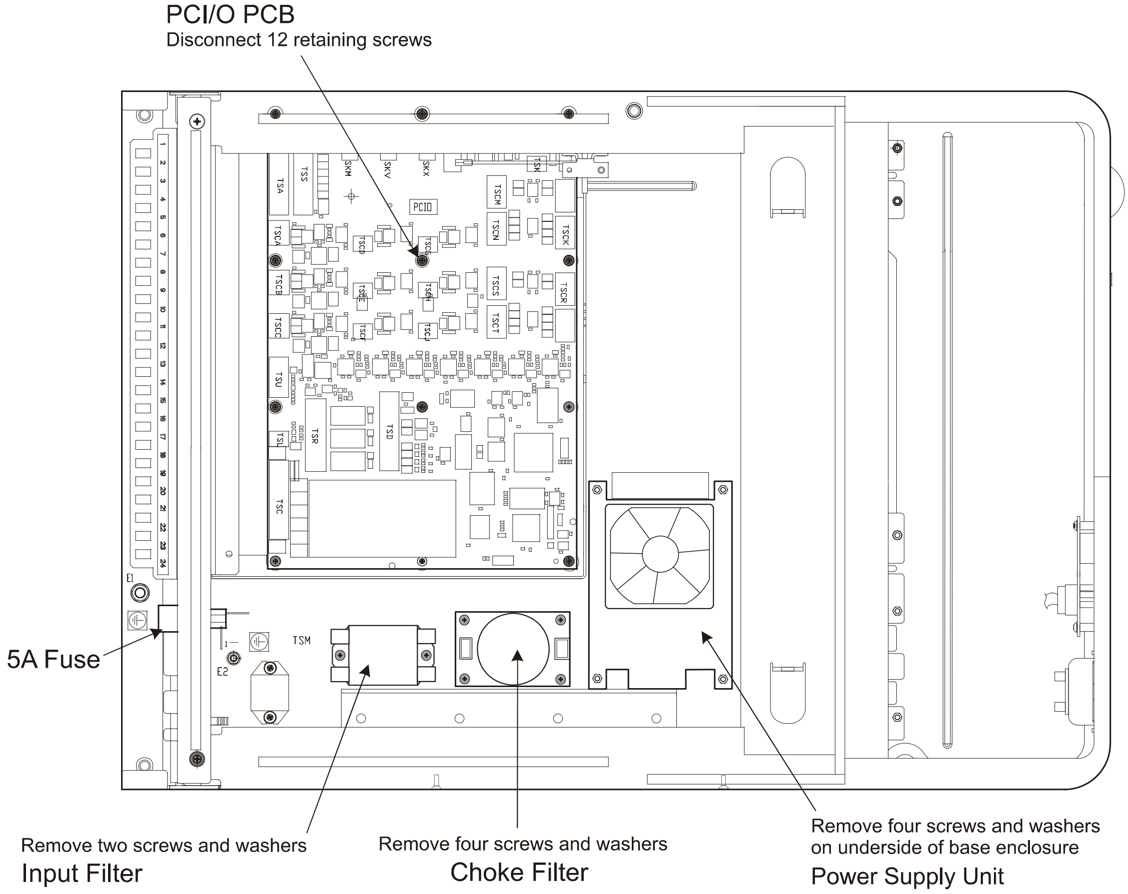


Figure 5.64 Removing Base Enclosure Modules - Mk 2 version

3.3.11.1 Replacing the PCI/O PCB

Replace the PCI/O PCB as described in Section 3.3.10.1.

3.3.11.2 Replacing the Input Filter and Choke Filter

Replace the Input Filter and Choke Filter as described in Section 3.3.10.3. The Input Filter has two attaching screws; the Choke Filter has four attaching screws.

3.3.11.3 Replacing the Power Supply Unit

1. Disconnect all incoming cables to the Power Supply Unit (PSU).
2. From the underside of the enclosure chassis, remove the four pan head screws and washers that attach the PSU to the base.
3. The top plate and fan can be detached from the PSU by removing the four attaching nuts after removal of the assembly.

3.3.11.4 Replacing the 5A Fuse

Unscrew the fuse holder at the rear of the enclosure chassis, remove fuse and replace.

3.4 Console Assemblies (deck mounted and tabletop kit versions)

3.4.1 Monitor Unit - Replacement

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

1. Shut down the system from the VisionMaster FT application, and when fully powered down, switch the On/Off switch located on the underside of the Control Panel to OFF.
2. Switch the Monitor power switch to OFF, if not switched off from main On/Off switch.
3. Remove the four M6 screws securing the monitor to the display chassis.
4. Attach the two M8 extraction screws to the upper holes of the monitor (marked as 'A' in Figure 5.65) and use these to pull the monitor forward until it rests on the edge of the control panel.
5. From the underside of the monitor, disconnect the mains power cable, video cable and two earth tags (one from the pedestal and one from the display chassis). Remove Monitor from chassis.
6. Attach the M8 screws to the upper holes of the replacement monitor and gently lower the monitor into the chassis.
7. Attach the power cable, video cable and earth tags to the monitor.
8. Secure replacement monitor using the four M6 screws.

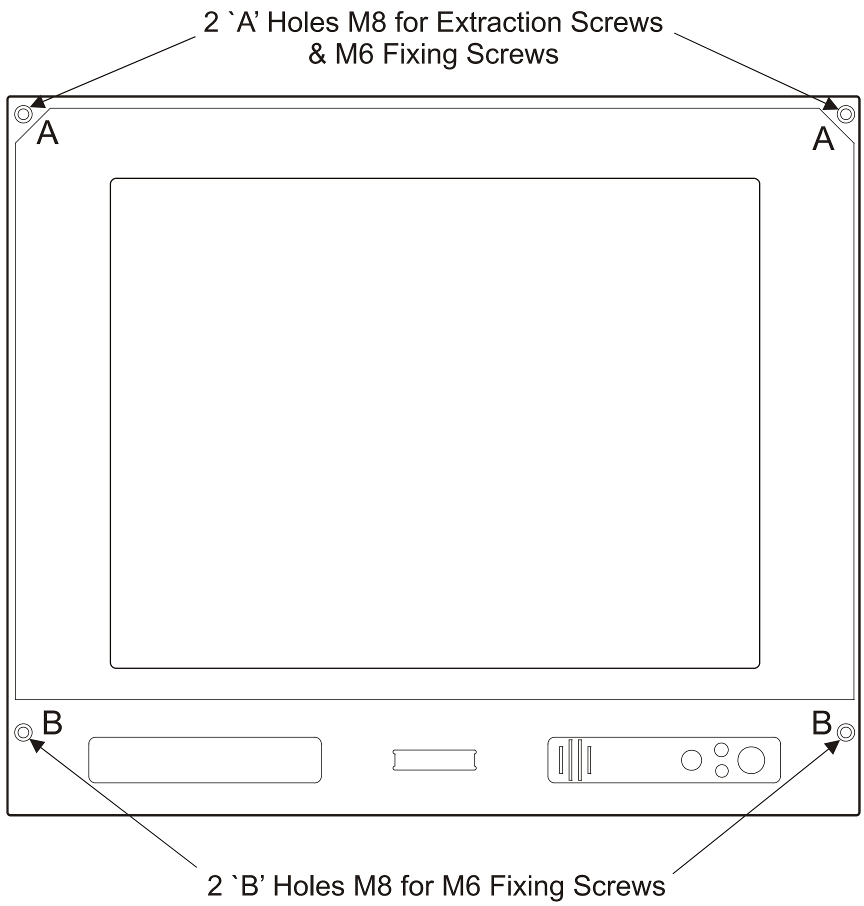


Figure 5.65 Monitor Unit

3.4.2 Control Panel Assembly

WARNING! – LETHAL VOLTAGE HAZARD

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 MODULES TO MAKE THE UNITS SAFE IT IS NECESSARY TO ISOLATE THEM FROM THE MAINS SUPPLY. IT IS NOT ADEQUATE TO TURN THE UNIT OFF: THERE ARE HIGH VOLTAGES PRESENT AT ANY POWER SUPPLY THAT IS NOT MAINS ISOLATED.

The Control Panel Assembly is supplied in two versions:

1. With control panel keyboard, see Figure 5.66.
2. Without control panel keyboard and with separate USB connector module, see Figure 5.67.

Before replacing any control panel assembly modules shut down the system from the VisionMaster FT application, and when fully powered down, switch the On/Off switch located on the underside of the Control Panel to OFF.

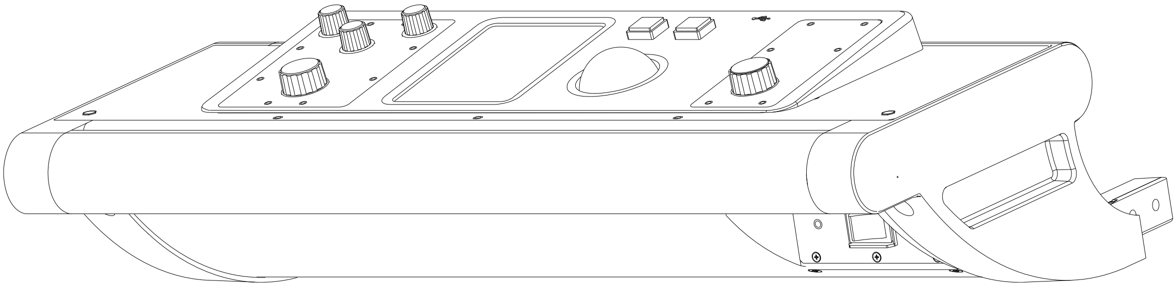


Figure 5.66 Control Panel Assembly with keyboard

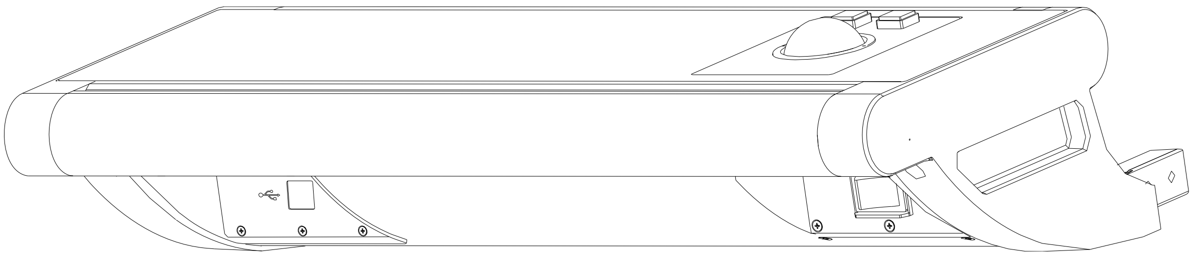


Figure 5.67 Control Panel Assembly without keyboard

3.4.2.1 Replacing the Control Panel assembly with Keyboard

The following procedure describes the replacement of a complete control panel. For instructions on replacing the individual control panel modules, refer to Figure 5.68 below and sections 3.4.1.1 to 3.4.1.4.

1. From the Processor unit disconnect the control panel USB cable and the two trackball cables.
2. Remove the module mounting plate from control panel housing by unscrewing the two M5 cap head screws and three M4 nuts, these are located on the underside of the control panel housing.
3. Dislodge the mounting plate by pulling the plate forward and uncliping it from the back of the control panel tray.
4. Unscrew the two M5 pan head screws securing the control panel to the mounting plate and the two M5 nuts holding the mounting strap to the mounting plate.
5. With the control panel removed, unscrew the two M5 pan head screws securing the control panel to the mounting strap.
6. Assembly of a replacement control panel is a reversal of the removal procedure.

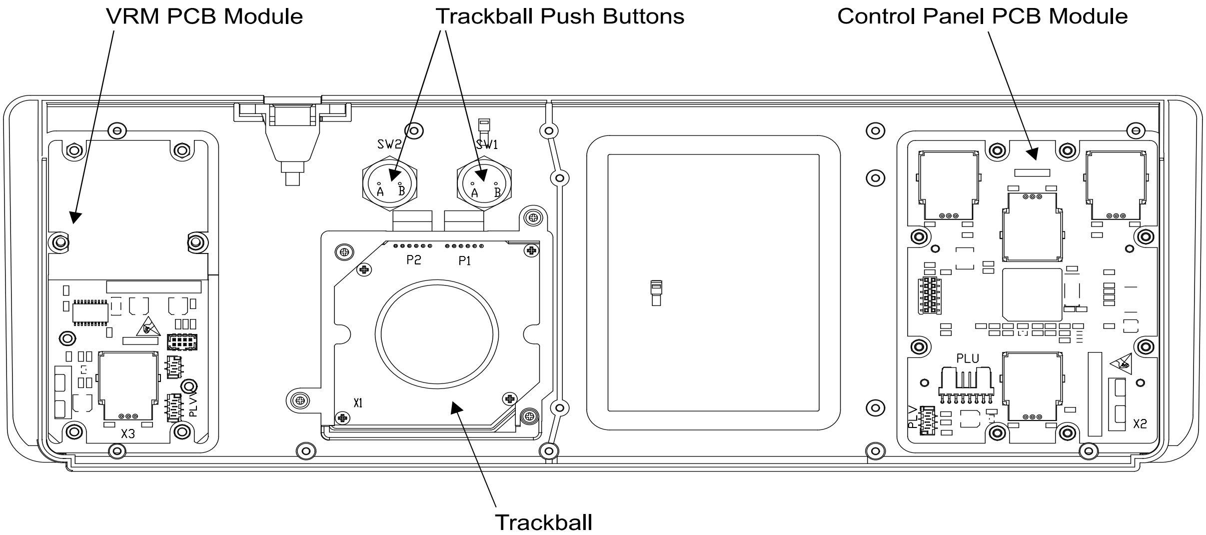


Figure 5.68 Control Panel with rear cover removed

Replacing the Control Panel PCB Module

1. Remove the EBL knob and three gain knobs from the front of the control panel.
2. Remove the rear cover from control panel by unscrewing the ten self-tapping screws.
3. With the rear cover removed, disconnect the USB cable from the module and disconnect the internal cable connecting the module to the VRM module.
4. Unscrew the eight nuts and washers securing the module to the control panel housing.
5. Carefully remove the module from the control panel housing.
6. Replacing the control panel module is a reversal of the removal procedure.

Replacing the VRM Panel PCB Module

1. Remove the VRM knob from the front of the control panel.
2. Remove the rear cover from control panel by unscrewing the ten self-tapping screws.
3. With the rear cover removed, disconnect the internal cable connecting the module to the control panel module.
4. Unscrew the six nuts and washers securing the module to the control panel housing.
5. Carefully remove the module from the control panel housing.
6. Replacing the VRM module is a reversal of the removal procedure.

Replacing the Control Panel I/O Module

A control panel for a Client/Server Radar will include an additional I/O module, mounted onto the control panel PCB, see Figure 5.69.

1. With the rear cover and cable clamps removed disconnect the cable at terminal PLM connecting the I/O module to the monitor and the USB cable at terminal PLUU.
2. Remove the four nuts and washers connecting the I/O module to the control panel PCB.
3. Remove the I/O module from the control panel.
4. Replacing the I/O module is a reversal of the removal procedure.

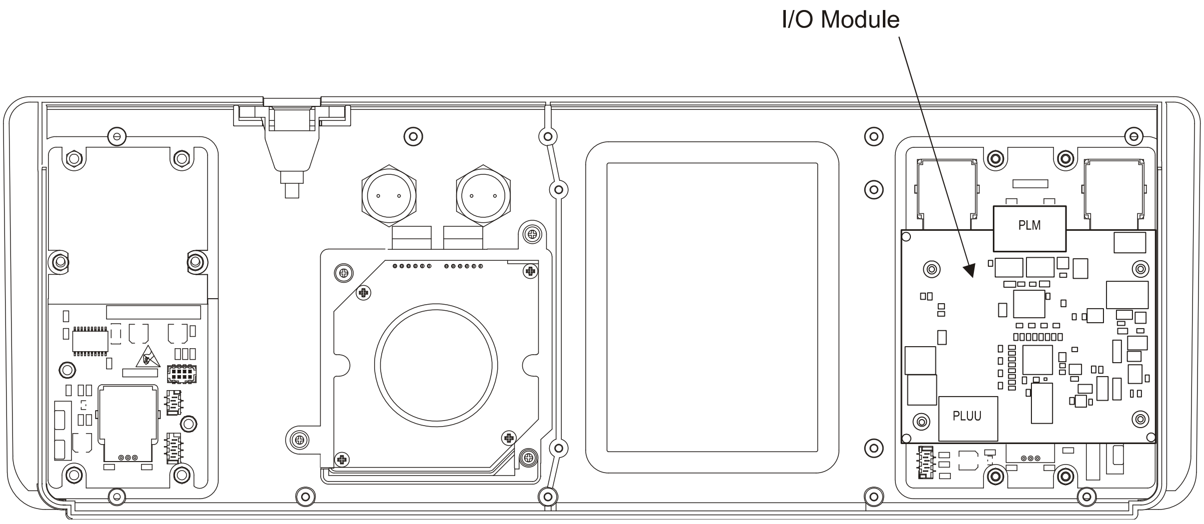


Figure 5.69 Control Panel with I/O Module

Replacing the Trackball

1. With the rear cover removed, disconnect the PS2 cable from P2.
2. Disconnect the cable from P1 which connects the left and right push buttons.
3. Remove the four self-tapping screws from the trackball clamp.
4. Remove the trackball and clamp from the control panel housing.
5. Before inserting a new trackball set the DIP switches as shown on Figure 5.70.

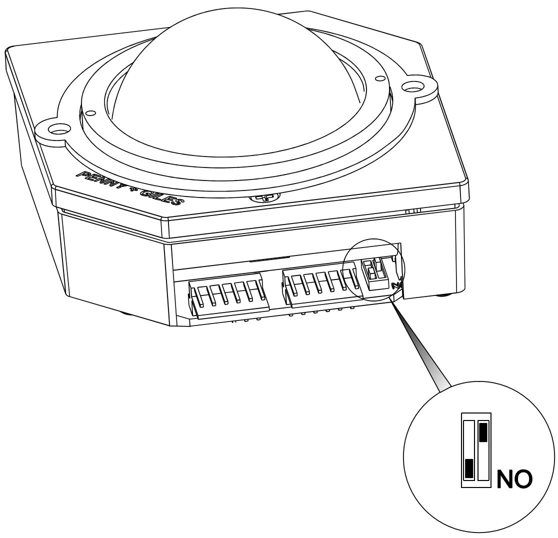


Figure 5.70 Setting the Trackball DIP switches

Replacing the Trackball Buttons

1. Disconnect the cables from the left and right trackball push buttons.
2. From the underside of the control panel unscrew the nuts securing the two push buttons.
3. Insert replacement push buttons and secure with the two nuts. Reconnect the cables from the trackball to the push buttons.

3.4.2.2 Replacing the Trackball on assembly without Keyboard

1. From the Processor unit disconnect the trackball cable.
2. Remove the module mounting plate from control panel by unscrewing the two M5 cap head screws and three nylon inserts, these are located on the underside of the control panel housing.
3. Unscrew the four M4 nuts securing the existing trackball and remove nuts S/C washers and trackball from mounting plate.
4. Secure replacement trackball to the mounting plate with the four M4 nuts and S/C washers. Coat the trackball mounting plate screw threads with screwlock provided.
5. Connect the cable to trackball P2 plug.
6. Place assembled trackball and mounting plate into the control panel housing and secure the mounting plate with the two M5 cap head screws and three nylon inserts.

3.4.2.3 Replacing the Power Control Switch

1. With the module mounting plate removed (see Section 3.4.2.2), remove the cable tie and disconnect the switch cable and associated earth lead from the rear of the power switch unit.
2. Unscrew and remove the five M3 countersunk screws securing the existing power control switch to the bracket and remove the unit.
3. Secure replacement power control switch to the bracket with the five M3 countersunk screws. Coat the screw threads with screwlock provided.
4. Connect the cable from the PCIO unit to the rear of the switch unit, connect the earth lead on the cable assembly to the earth stud between the two plain washers.
5. Secure cable with tie wrap assembled through two slots on the rear of the switch bracket.

3.4.2.4 Replacing the USB Connector on assembly without Keyboard

1. Disconnect the dual USB cables from the front of the Processor unit.
2. With the module mounting plate removed (see Section 3.4.2.2), unscrew and remove the five M3 countersunk screws securing the existing USB connector assembly to the bracket and remove the unit.
3. Secure replacement USB connector assembly to the bracket with the five M3 countersunk screws. Coat the screw threads with screwlock provided.
4. Connect the dual USB cables from the USB connector board to the front of the Processor unit.

3.4.3 Processor Unit

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

CAUTION – Electrostatic Sensitive Devices (ESSDs)

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

Before replacing the processor Scan Converter (SC) PCB or the lithium battery, shut down the system from the VisionMaster application, and when fully powered down, switch the On/Off switch to OFF.

3.4.3.1 Replacing the Scan Converter PCB

1. Turn the On/Off switch at the rear of the processor unit to Off.
2. From the front of the processor unit disconnect the two USB cables from the control panel USB port.
3. Remove the four screws and washers securing the Processor shelf to the console frame. Pull the Processor and shelf forward and lever the unit down to access the rear cables.
4. From the rear of the Processor disconnect the following two cables (the remaining cables to the Processor do not need to be disconnected):
   a. power cable from the PCIO unit;
   b. video/data cable from the PCIO unit.
5. Unscrew the nine pan head screws securing the top cover of the Processor unit.
6. Unscrew the one pan head screw securing the SC PCB to the processor frame (the SC PCB is positioned to the left of the processor box looking forward).

Note: *The Processor unit used for a Dual Radar system will include two SC cards, one for each channel. The slots that the cards are installed in are dependant on the version of Processor. Viewed from the rear of the processor looking from the right an ISIC P43 (with an SC3 card) will use the first and third slot positions, an ISIC G43 (with an SC4 card) will use the fourth and fifth slot positions, and an*

ISIC 965 unit will use the first and fifth slot positions. For a dual radar the remove/install procedures and switch settings for both SC cards are the same as described for standard systems.

7. Carefully disengage the SC PCB from the main processor PCB and remove from the processor box.
8. Before installing a new SC PCB verify that the six switches seen through the mounting plate are set such that switch 1 and 2 are off and switch 3 to 6 are on, see Figure 5.71.
9. Also, on an SC3 card verify that the six switches seen through the mounting plate are set such that switch 2 is off and switch 1 and switches 3 to 6 are on, see Figure 5.72.
10. When installing a new SC PCB ensure that the version used for replacement is wherever possible either the same version, or if you are upgrading your system, a later version. Installation of a replacement SC card is a reversal of removal.

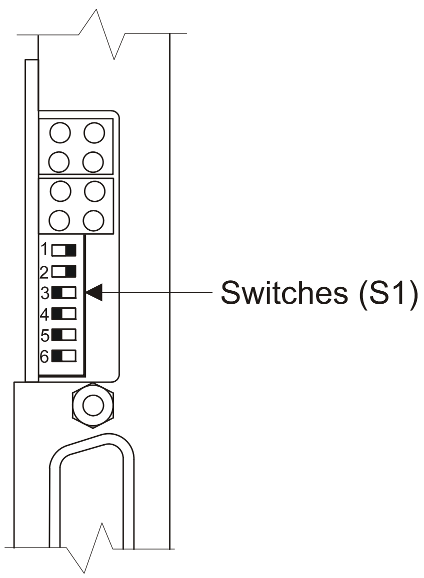


Figure 5.71 Location of S1 switches on front edge of SC PCB

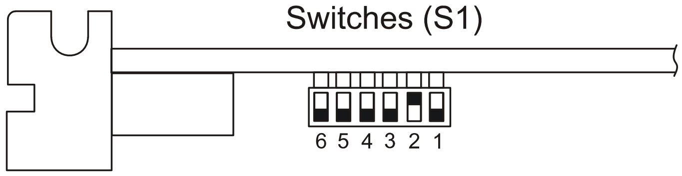


Figure 5.72 Location of S1 switches on top left of SC PCB

3.4.3.2 Replacing the Processor Battery

Figure 5.73 shows the location of the CR2032 lithium battery on the Processor motherboard.

The battery is removed by releasing the battery holder catch.

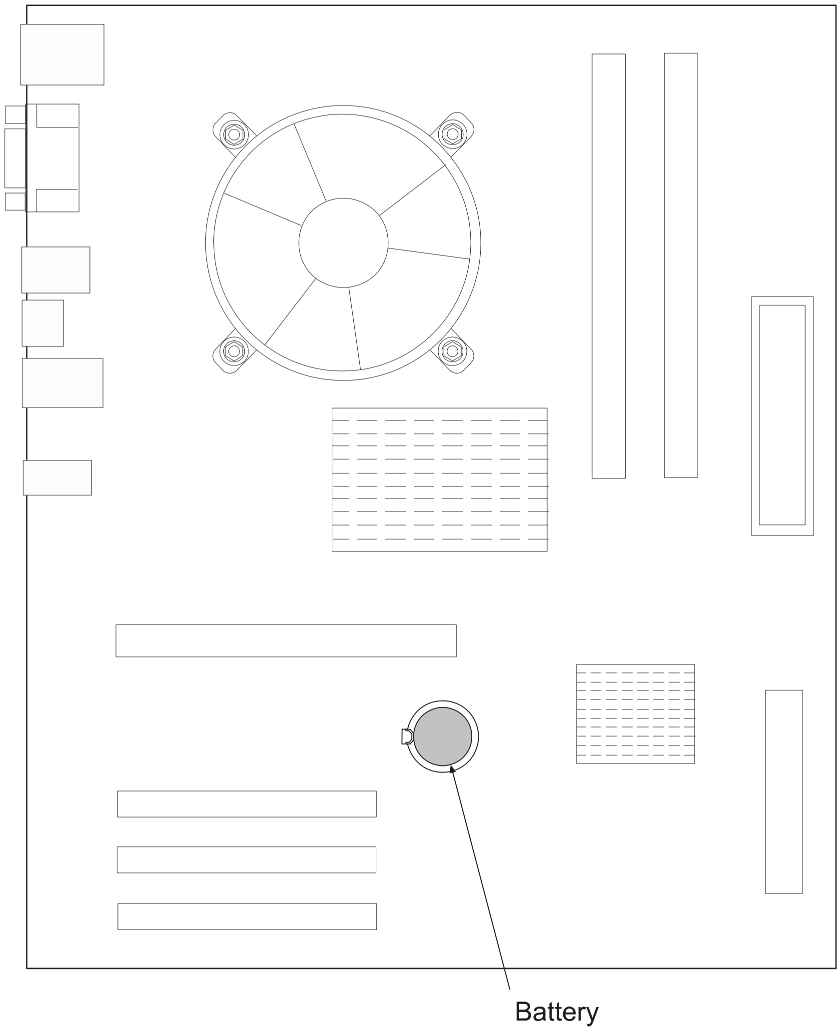


Figure 5.73 Location of Lithium Battery on Processor

3.4.4 Server Processor Unit

The following procedure details the removal and replacement of an Network Front End (NFE) PCB from a Server Processor Unit in a Client/Server Radar (CSR) System.

When replacing an NFE PSB in a Server processor it is not necessarily required to power down the VisionMaster application on the Client PCs or other Servers prior to removal.

3.4.4.1 Replacing the NFE PCB

1. Turn the On/Off switch at the rear of the Server unit to Off.
2. If you have access to the rear of the Server disconnect the following cables:
   a. power cable from the PCIO unit;
   b. video/data cable from the PCIO unit;
   c. network cable to the Server Ethernet switch.
4. If you do not have access to the rear of the Server, or sufficient clearance behind it, remove the M6 screws attaching the Server unit and four AV mounts to their mounting shelf. Withdraw the unit from the Server rack and disconnect the cables.
5. Unscrew the nine pan head screws securing the top cover of the Server unit.
6. Unscrew the one pan head screw securing the NFE PCB to the processor frame.
7. Carefully disengage the NFE PCB from the main processor PCB and remove from the processor box.
8. Before installing a new PCB verify that the six switches seen through the mounting plate are set such that switch 1 and 2 are off and switch 3 to 6 are on, see Figure 5.71.
9. Also, on an SC3 card verify that the six switches seen through the mounting plate are set such that switch 2 is off and switch 1 and switches 3 to 6 are on, see Figure 5.72.

3.4.5 PCIO Unit

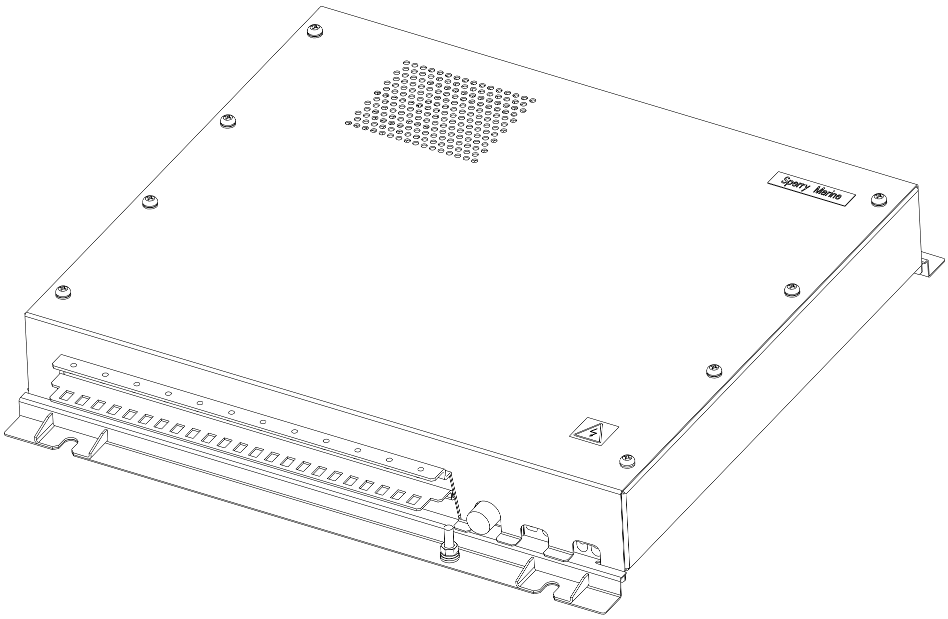


Figure 5.74 PCIO Unit

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

CAUTION – Electrostatic Sensitive Devices (ESSDs)

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

Before replacing the serviceable modules in the PCIO unit shut down the system from the VisionMaster FT application, and when fully powered down, switch the On/Off switch located on the underside of the Control Panel to OFF.

Before disconnecting cables and removing modules within the PCIO unit note the polarity and orientation of all components.

3.4.5.1 Removing the PCIO Unit

Although completely removing the PCIO unit from its support shelf is not always necessary when replacing individual modules, it may be preferable, depending on ease of access for servicing. If the preference is for removing the PCIO refer to step 5 below.

1. Remove the four screws and washers securing the PCIO support shelf to the pedestal chassis. Disengage the self rear locators and slide the PCIO unit shelf forward until all the top of the unit is accessible.
2. Remove the eight M5 pan head screws, S/C washers and plain washers securing the PCIO unit cover. Carefully lift and remove the top cover away from the unit.
3. To disconnect incoming cables from the rear of the unit remove the five M4 countersunk screws securing the cable clamp top plate.
4. Disconnect cable tie wraps, earthing tags and internal cable connections from the PCIO modules.
5. With all external cable connections disconnected remove the four M8 bolts, S/C washers, plain washers and nuts securing the PCIO unit to the support shelf. Carefully lift and remove the PCIO unit away from the pedestal assembly.

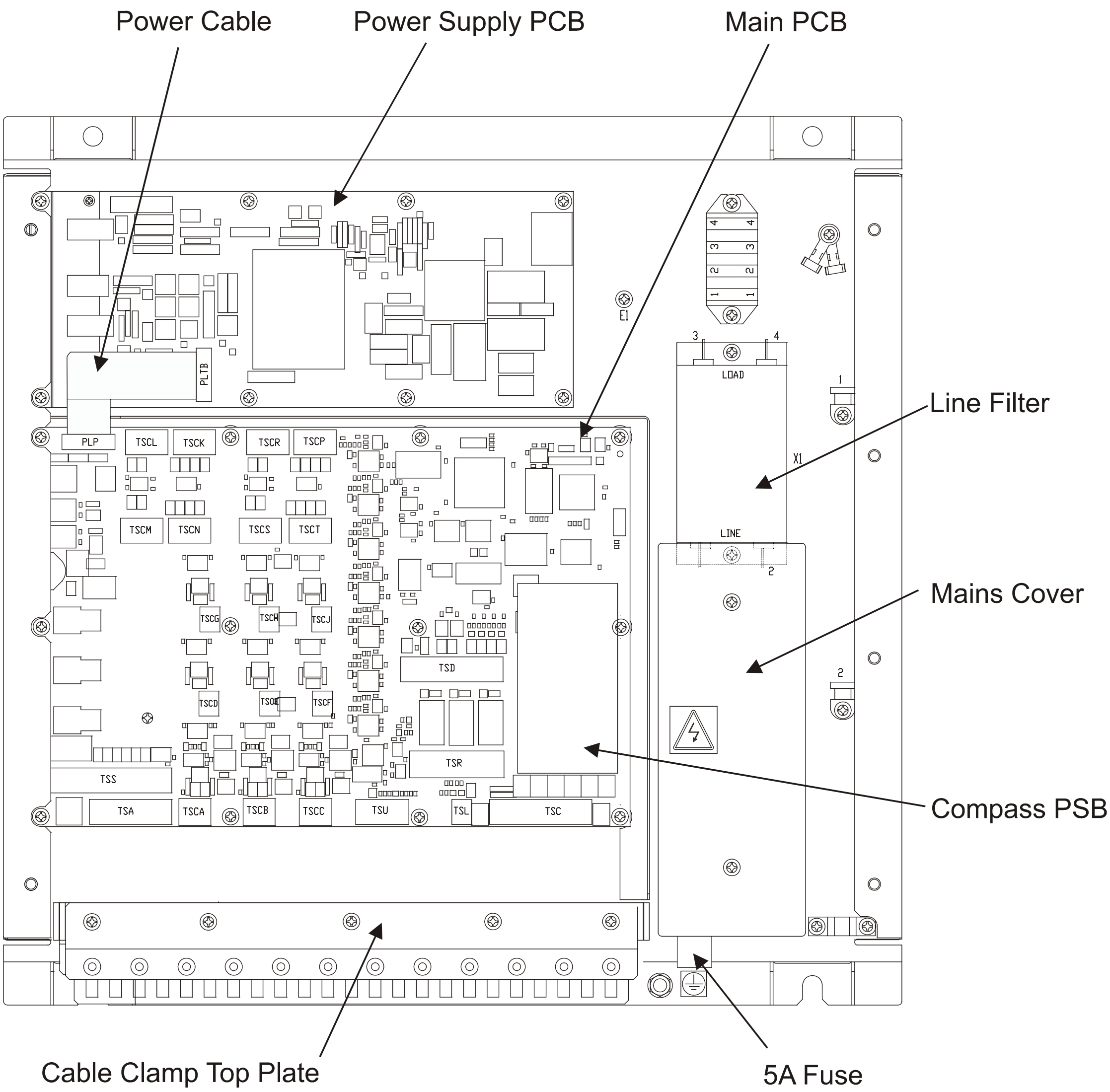


Figure 5.75 PCIO Unit with top cover removed

3.4.5.2 Replacing the Main PCB

1. With all cables disconnected from main PCB, remove fastener securing the 9-way ribbon power cable to the PCB shield and disconnect cable from the PLP terminal.
2. Unscrew the 12 PCB retaining screws and remove the PCB from the unit.
3. Remove the compass PCB from the main PCB.
4. Replacing the main PCB is a reversal of removal.

3.4.5.3 Replacing the Power Supply PCB

1. Disconnect the cable from the 4-way terminal block to the power supply PLTA terminal.
2. Disconnect the 9-way ribbon cable from the main PSB to the power supply PLTB terminal.
3. Unscrew the six power supply PCB retaining screws and remove the PCB from the unit.
4. Replacing the power supply PCB is a reversal of removal.
5. For a circuit diagram of the Power Supply PCB see Figure 5.78.

3.4.5.4 Replacing the Compass PCB

The compass board PCB is attached to the main PCB by a 20 pin connector at PLS terminal and an eight pin connector at PLR terminal.

To remove lift the compass PCB on either side to disengage the connectors from the main PCB.

3.4.5.5 Replacing the Line Filter

1. To access one of the two attaching screws for the line filter remove the two pan head screws, S/C washers and spacers securing the mains cover.
2. Disconnect the live and neutral connectors to the line filter terminals 3 and 4 from the TSE terminal block.
3. Disconnect the live, neutral and earth connectors to the line filter terminals 1 and 2 from the TSB terminal block.
4. Remove the two pan head screws and S/W washers securing the line filter to the PCIO unit.
5. Replacing the line filter is a reversal of removal.

3.4.5.6 Replacing the 5A Fuse

Unscrew the fuse holder on the side of the main box, remove fuse and replace.

3.4.6 Auxiliary PCIO Unit

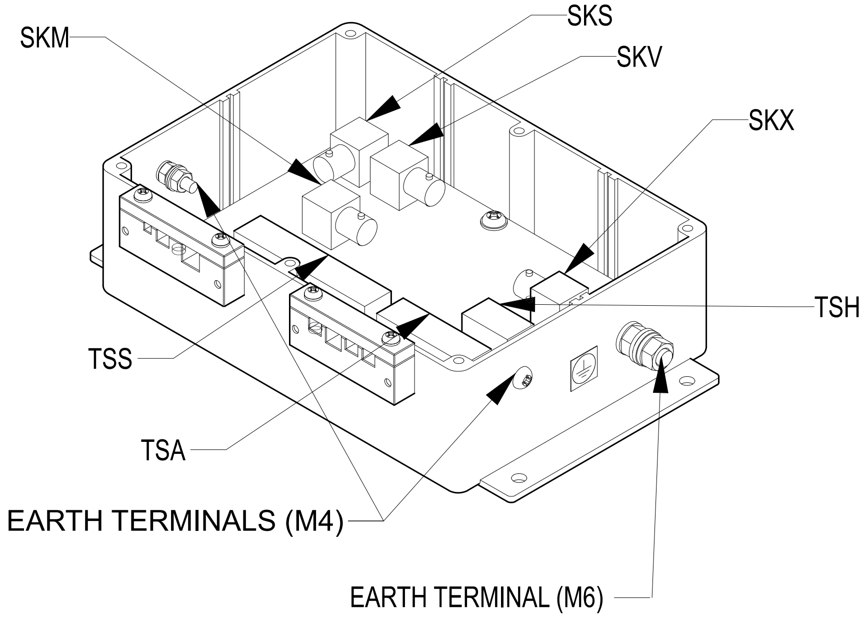


Figure 5.76 Auxiliary PCIO Unit

	WARNING! – LETHAL VOLTAGE HAZARD
	LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

Before replacing the Auxiliary PCIO unit shut down the system from the VisionMaster FT application, and when fully powered down, switch the On/ Off switch located on the underside of the Control Panel to OFF.

Before disconnecting cables and removing the unit note the polarity and orientation of all components.

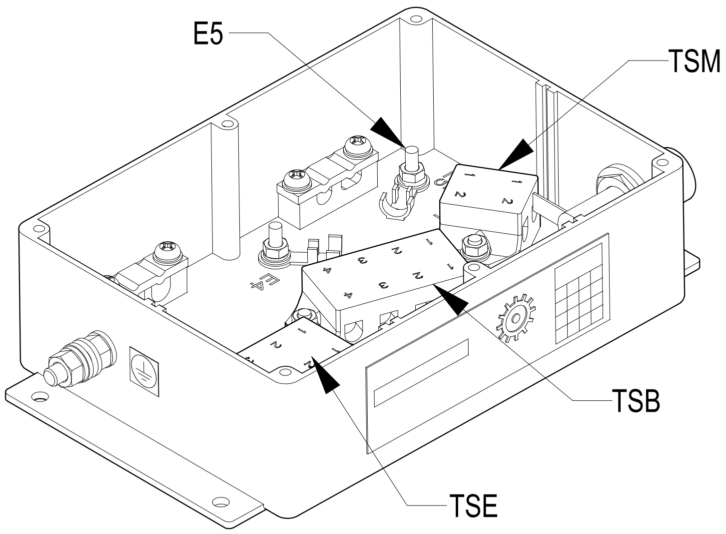
3.4.6.1 Removing and Replacing the Auxiliary PCIO Unit

1. Remove the four screws securing the cable clamp bars to the 3-way and 4-way cable clamps.
2. Disconnect cable 65900520 earth strap from PCIO box and disconnect the coax cable to SKS terminal.
3. Remove cable 65900520 from the 15-way TSS terminal.
4. Disconnect cable 65900548 earth strap and remove cable from the four-way TSH terminal.

5. Disconnect the Video In coax cable to SKV terminal.
6. Disconnect the MIST In coax cable to SKM terminal.
7. If your system does not use an Interswitch, disconnect the MIST Out coax cable to SKX terminal.
8. With all cables removed from the Auxiliary PCIO PCB remove the four pan head screws, plain washers and spring washers which secure the Auxiliary PCIO box to the pedestal mounting plate.
9. If your Auxiliary unit is attached to a tabletop remove the four woodscrews that secure the unit.

The installation of a replacement Auxiliary PCIO Unit is a reversal of removal.

3.4.7 Mains Distribution Unit



VIEW WITH COVER REMOVED

Figure 5.77 Mains Distribution Unit

WARNING! – LETHAL VOLTAGE HAZARD

LETHAL VOLTAGES MAY BE EXPOSED WHEN ACCESS COVERS ARE REMOVED. ONLY QUALIFIED PERSONS SHOULD WORK ON THE EQUIPMENT WHEN POWER IS APPLIED. ALWAYS ISOLATE THE UNIT FROM THE MAINS SUPPLY WHEN REMOVING OR REPLACING COVERS.

Before replacing the Mains Distribution Unit (MDU) shut down the Client PC from the VisionMaster FT application, and when fully powered down switch the On/Off switch located on the underside of the Control Panel to OFF.

Remove mains power to the MDU by switching the Isolating switch to OFF.

Before disconnecting cables note the colour of the wire connections and orientation of components.

3.4.7.1 Removing and Replacing the Mains Distribution Unit

1. Remove the six screws securing the top cover of the mains distribution unit (MDU).
2. Remove the two screws securing the two clamp bars to the 2-way mains cable clamp.
3. Disconnect the mains cable to the 2-way TSM terminal.
4. Remove the two screws securing the cable clamp bar to the 2-way filter cable clamp.
5. Disconnect the earth strap and remove the power cables that go to the Client PC and Monitor from the 4-way terminal block TSE and 4-way terminal block TSB.
6. Disconnect the earth strap and remove cable 65900522 that goes to the On/Off switch from the 4-way TSB terminal.
7. With all cables removed from the MDU remove the four pan head screws, plain washers and spring washers which secure the unit to the mounting plate.
8. If your MDU is attached to a tabletop remove the four woodscrews that secure the unit.

The installation of a replacement MDU is a reversal of removal.

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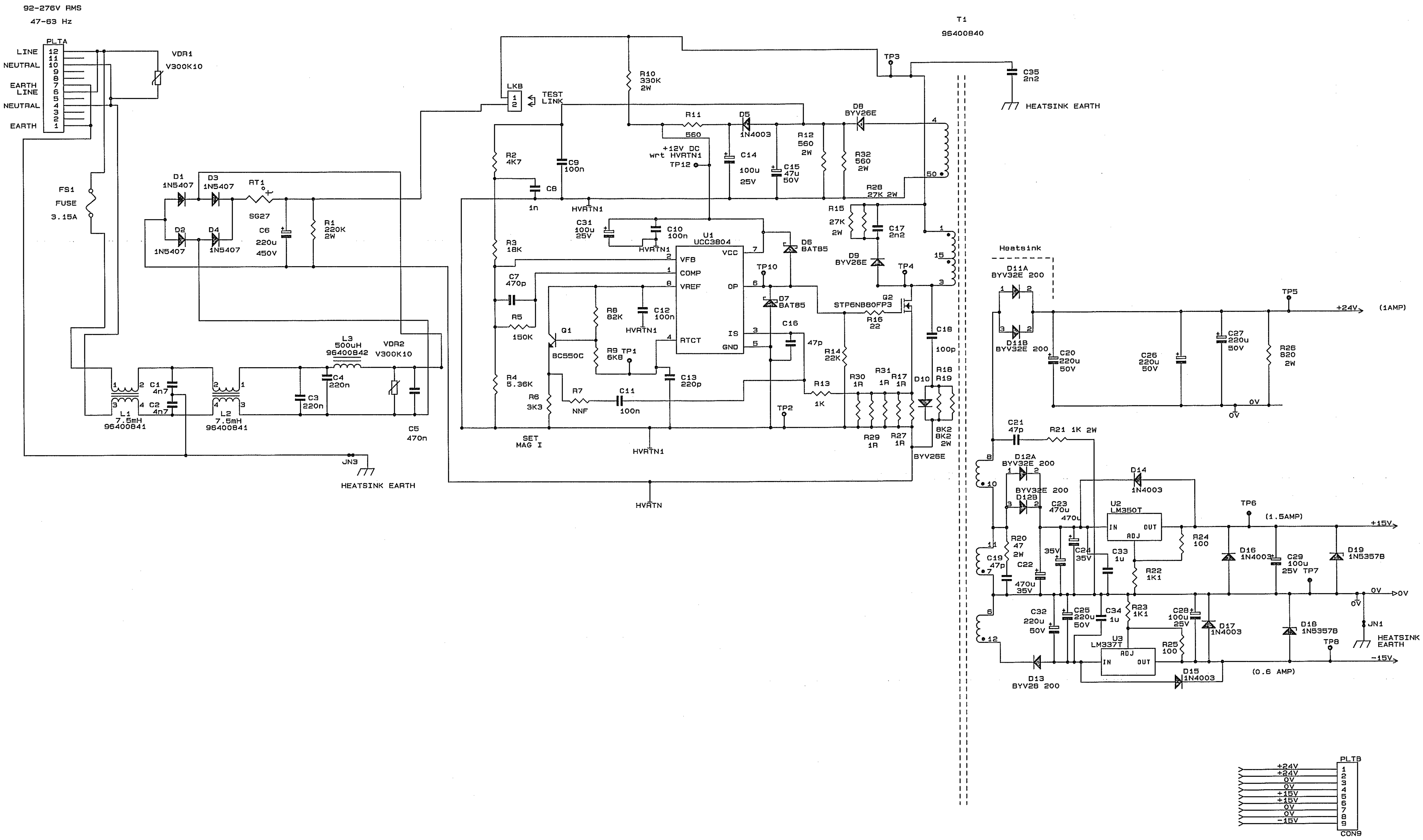

Figure 5.78 Power Supply PCB - circuit diagram

4 Limited Spares List for Field Replacement

4.1 19” Integrated Tabletop

Module	Part Number (Mk 1)	Part Number (Mk 2)
LCD assembly	T65919608	T65920608
Processor plate assembly (Mk 1)	T65919602	
Processor/Chassis assembly (Mk 2)		T65920602
Control Panel (trackball only)	T65919669	T65919669
Control Panel (trackball and keyboard)	T65919667	T65919667
DVD Writer	TRA00002873	TRA00002873
LED and Buzzer Panel PCB	T65919801	T65919801
PCI/O PCB	T65900800	T65900800
Power Supply Unit	TRA00002857	TRA00010298
DC/DC Converter	T65919800	T65920800
Mains Input Filter	T65919822	TRA00010306
Mains Input Choke Filter		T65920803
Fuse 5 A (External)	2180413	2180413
Fan Cable Assembly	65919508	
Brilliance POT Control Cable	65919510	

4.2 250mm & 340mm Console Assemblies

Module	Part Number
Hatteland Monitors	
19” Monitor Kit	65817G
19” Monitor Desktop	65919T
19” Monitor Deckstand	65919C
23.1” Monitor Kit	65823A
23.1” Monitor (Desktop or Deckstand)	65923C
27” Monitor Kit	65927C
Melford Monitors	
23.1” Monitor (Desktop or Deckstand)	65923E
25.5” Monitor Deckstand	65926E

Module	Part Number
ISIC Monitors 25.5" Monitor Deckstand (Radar only) 25.5" Monitor Deckstand	 65926K 65926L
Processor Unit (with SC2 Card) Processor Unit (no SC Card) Processor Unit (with SC3 Card) Processor Unit (with dual SC4 Card) Processor Unit Client (no SC Card) Processor Unit Server (with NFE Card)	65901AR 65901AN 65901AT 65901AE 65901AC 65901AS
PCIO Unit (standard compass) PCIO Unit (special compass)	65900AA 65900AB

4.2.1 Processor Unit

Assembly	Part Number
SC2 Card PCB	T65900810
SC3 Card PCB	T65900812
SC4 Card PCB	T65900814
Graphics Card Kit*	65900725

*. RequiresVisionMaster FT software version 5.3 or later.

4.2.2 PCIO Unit

Assembly	Part Number
Main PCB	T65900800
Power Supply PCB	T65900801
SC Cable	T65900520
Compass Standard PCB	T65800831
Compass Special PCB	T65800832
Line Filter	1585800
Fuse 5 A (External)	2180413
Fuse 3.15 A (Internal)	2162326

4.2.3 Auxiliary PCIO Unit

Assembly	Part Number
Auxiliary PCIO Unit	T65940AA

4.2.4 Control Panel Modules

Assembly	Part Number
Control Panel	T65900667
Control Panel module	T65900660
VRM Panel module	T65900661
Trackball	TRA00000919
I/O Board PCB	T65900807
Trackball assembly	T65900614
USB Ports	T65900635
On/Off Switch	T65900625

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 Client/Server Radar Spares

Assembly	Part Number
NFE Card PCB	T65900813
Mains Distribution Unit	65900685
Network Switches	RA00009746
24V PSU (50W)	RA00010744

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 Section 4 in Chapter 8 '*Additional Features*'.

In the tables below replace "xx" with 10 or 25 as appropriate. (e.g 658xxA becomes 65825A or 65810A), and"yy" with suffix as described in Chapter 2 *'System Identification'* (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
MAINS FILTER PCB ASSEMBLY	T91005228
FUSE	MA00007245
FAN – AXIAL 80x80x25 24VDC (MASTHEAD Tx/Rx)	T65830656
THERMAL SWITCH (FOR FAN – MASTHEAD Tx/Rx)	MA00007765
ROTATING JOINT ASSEMBLY	T65830642

*. 65801804 can be replaced with T65801813
65801813 must be replaced with T65801813

4.6.1.1 S-band Motors/Gearboxes

Motor	Part Number	Gearbox Housing Assy
MOTOR 110/120V AND 220/240V 1ϕ Normal Speed	T91003757	T65830665
MOTOR 110/120V AND 220/240V 1ϕ High-Speed	T91003759	T65830667
MOTOR 220/240V AND 380/440V 3ϕ Normal Speed	T91003751	T65830645
MOTOR 110/120V 3ϕ Normal Speed	T91003752	T65830645
MOTOR 220/240V AND 380/440V 3ϕ High-Speed	T91003753	T65830646
MOTOR 110/120V 3ϕ High-Speed	T91003754	T65830646

4.6.2 Standard X-band Turning Units and Transceivers

65825E, 65825G, 65825H, 65825Lyy, 65825Myy, 65825Pyy, 65825Wyy, 65925Myy, 65925Pyy, 65925Wyy

65810E, 65810G, 65810H, 65810Myy, 65810Pyy, 65810Wyy, 65910Myy, 65910Pyy, 65910Wyy.

Assembly	Part Number
TRIGGER PCB ASSEMBLY (STANDARD)	T65801801
TRIGGER PCB ASSEMBLY (FOR UNITS PART No. 658xxG, 658xxPyy, 65925Pyy)	T65801822
INPUT PCB ASSEMBLY (TURNING UNIT)	T65801813
INPUT PCB ASSEMBLY (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. 658xxE)	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

Assembly	Part Number
LIMITER ASSEMBLY (10kW) (FOR UNITS PART No. 65810E, 65810G, 65810Myy, 65810Pyy, 65910Myy, 65910Pyy	T91005221
LIMITER (10KW) (FOR UNITS PART No. 65810H, 65810Wyy, 65910Wyy	T91003431
LIMITER ASSEMBLY (25KW) FOR UNITS PART No. 65825E, 65825G, 65825Lyy, 65825Myy, 65825Pyy, 65925Myy, 65925Pyy	T91005226
LIMITER 25KW FOR UNITS PART No. 65825H, 65825Wyy, 65925Wyy	T91005210
MAGNETRON (10kW)	T91003582
MODULATOR PCB ASSEMBLY (25kW) STANDARD	T65825812
MODULATOR PCB ASSEMBLY (25Kw HIGH PRF) FOR UNITS PART No. 65825G, 65825Pyy, 65925Pyy.	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

Chapter 6

Routine Maintenance

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1 Introduction

The VisionMaster FT 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 and maintenance tasks referred to in the plan.

Information on the removal and replacement of components listed in the maintenance plan is given in Section 3 '*First-line Servicing*' of Chapter 5 '*Fault Reporting and First Line Servicing*'.

2 Maintenance Plan

WARNING! – LETHAL VOLTAGE HAZARD

BEFORE THE FOLLOWING MAINTENANCE TASKS ARE STARTED (EXCEPT THE 3 MONTHLY ACTIONS AND THE FIRST TWO SIX MONTHLY ACTIONS), THE EQUIPMENT MUST BE ISOLATED FROM THE MAINS SUPPLY. NO COMPONENTS OR ASSEMBLIES SHOULD BE TOUCHED FOR AT LEAST FIVE MINUTES AFTER ISOLATION. THIS IS TO MAKE SURE ANY HIGH-VOLTAGE CAPACITORS HAVE DISCHARGED.

Interval	Action	Notes
3 Monthly	Check the Monitor screen for dirt.	Use a soft cloth to clean the screen. If available, use an anti-static spray. Water, isopropyl, alcohol and similar non-abrasive cleaning fluids may also be used to clean the screen. **Solvents must not be used as a cleaning agent**.
3 Monthly	Clean the Processor Unit fan filter. Note that in a dusty environment the fan filter should be cleaned more frequently than every 3 months.	For good reliability, air must continuously circulate inside the Processor unit. To avoid dust build up on the air intake clean the fan filter. To access the filter remove the plastic cover.

Interval	Action	Notes
6 Monthly	Adjust the monitor’s brightness by doing a brightness check.	For information refer to Section ‘*Appendix A ECDIS Calibration Procedure*’ in Chapter 4 ‘*Installing Consoles & Displays*’. Or ‘*Brightness Check* ‘in the Brilliance chapter of the Radar/ECDIS User Guides.
6 Monthly	Check colour diagram when making adjustments to monitor brightness and contrast.	For information refer to ‘Chart Symbols’ in the Brilliance chapter of the Radar/ECDIS User Guides.
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.

Interval	Action	Notes
6 Monthly	In the S-band Scanner Unit check for oil leaks in the gearbox (Rehfuss or Zurrer). In the X-band Scanner Unit check for condition of the drive belt.	For information on checking for oil leaks on a Rehfuss or Zurrer gearbox refer to section Section 3.1 '*S-Band Gearbox - Oil Leak Checks*'. For information on replacing an X-band drive belt refer to Section 3.2.19 '*Drive Belt – Replacement*' Chapter 5 'Fault Reporting and First Line Servicing'.

Interval	Action	Notes
6000 hours (Approx 8 months)	Replace Magnetron	The magnetron's operational life is dependent on the condition of the drive and pulse length usage. For information on replacing a magnetron for S-Band and X-Band Scanner Units, refer to the relevant sub section in Section 3 '*First Line Servicing*' in Chapter 5 'Fault Reporting and First Line Servicing'.

Interval	Action	Notes
1 year	Check oil level in the S-band gearbox (Rehfuss or Zurrer).	The Rehfuss gearbox is a sealed unit and the oil level cannot be viewed. The Zurrer gearbox oil level can be viewed through a oil level window. If an oil leak is detected then top up can be done for emergency purposes only before replacement (see section Section 3.2 '*S-Band Gearbox - Oil Level Checks*' .
	Check lubrication of S-band turning unit main gear under high ambient temperatures.	If a turning unit is operating at high ambient temperatures for extended periods of time the main gear should be inspected and re-lubricated if dry of grease, as described in Section 3.4 '*S-Band Turning Unit - Main Gear Lubrication*'.

Interval	Action	Notes
2 yearly	Check lubrication of S-band turning unit main gear under normal operating conditions.	The turning unit should be inspected and re-lubricated if dry of grease every two years, as described in Section 3.4 '*S-Band Turning Unit - Main Gear Lubrication*'.

Interval	Action	Notes
5 yearly	Replace battery in Processor	For information on replacing the battery refer to the following sections in Chapter 5 '*Fault Reporting and First Line Servicing*' 1. To replace batteries in the 19" Integrated Display refer to Section 3.3.8.1 '*Replacing the Processor Battery*'. 2. To replace batteries in the Processor used in deck mounted or tabletop kit versions refer to Section 3.4.3.2 '*Replacing the Processor Battery*'
5 yearly	Replace S-band gearbox assembly (Rehfuss or Zurrer).	For information on replacing the S-band gearbox assembly refer to the following sections in Chapter 5 '*Fault Reporting and First Line Servicing*'. 1. To remove the gearbox refer to Section 3.1.16 '*Motor/Gearbox - Removal*'. 2. To install a new gearbox refer to Section 3.1.17 '*Motor/Gearbox - Replacement*'.
5 yearly	Replace rotating joint assembly in S-Band turning unit	For information on replacing the rotating joint assembly refer to Section 3.1.15 '*Rotating Joint Assembly - Replacement*' in Chapter 5 '*Fault Reporting and First Line Servicing*'.

If damage to any of the items being checked during routine maintenance is observed, either replace the item, or call for a service repair.

3 Maintenance Tasks

3.1 S-Band Gearbox - Oil Leak Checks

The following sub sections describe how to observe for oil leaks on the S-Band gearbox.

3.1.1 Oil Leak Checks - Rehfuss Gearbox

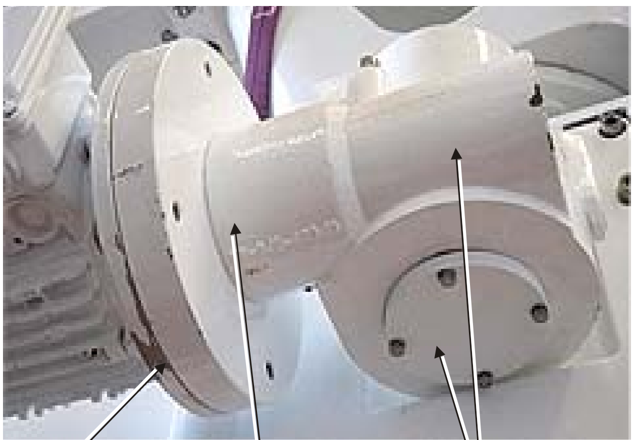
On the Rehfuss gearbox oil leaks can be observed from the lower breather hole on the gearbox input flange, see Figure 6.1. If there is an oil leak the oil will drip from the breather hole.

Lower Breather Hole

Figure 6.1 Rehfuss Gearbox - lower breather hole location

3.1.2 Oil Leak Checks - Zurrer Gearbox

On the Zurrer gearbox oil leaks can be observed either on the gearbox input and output seals, or by observing seepage through the motor/gearbox sealing gasket lowest point, see Figure 6.2.



Oil seepage
(Motor/Gearbox gasket)

Input oil seal
(Input shaft)

Output oil seals
(upper & lower Output shaft)

Figure 6.2 Zurrer Gearbox - Input and Output Seals

If an oil leak has been observed in either a Ruhfuss or Zurrer gearbox then the unit should be replaced when the ship is at the next port of call. For information on replacing an S-band gearbox refer to Section 3.1.17 ‘*Motor/ Gearbox - Replacement*’.

If an oil leak has been observed while at sea the oil level in the gearbox should be checked weekly and topped up when necessary, see Section 3.3 ‘*Top Up Gearbox Oil Level*’.

3.2 S-Band Gearbox - Oil Level Checks

The Rehfuss gearbox is a maintenance-free sealed unit and therefore has no way of viewing the oil level. If the Rehfuss gearbox has an oil leak then the gearbox can be topped up with oil as described in the following section.

The oil level of the Zurrer gearbox can be viewed through the oil level window and topped up if the level has fallen below the halfway level as seen from the window, see Figure 6.3.

Figure 6.3 Zurrer Gearbox - Oil Level Window

3.3 Top Up Gearbox Oil Level

If an oil leak has been discovered, or the oil level has dropped below the miniumum (as described in Section 3.2) then the gearbox oil must be topped up as described below.

1. If at sea, top up the gearbox with the following oil:
   a. Rehfuss - use Castrol Tribol 800/150
   b. Zurrer - use Shell Omala
2. If neither oil type is available then any synthetic gearbox oil on board will suffice.

3. To top up a Rehfuss gearbox use a 5mm Allen Key to unscrew the Filler/Level plug at the front of the gearbox, see Figure 6.4. Top up until oil flows from the plug hole.

Figure 6.4 Rehfuss Gearbox - Filler/Level Plug

4. To top up a Zurrer gearbox unscrew the breather/filler plug with a 14mm A/F spanner (see Figure 6.5) and top up until the level is halfway up the oil level window.

Figure 6.5 Zurrer Gearbox - Breather/Filler Plug

3.4 S-Band Turning Unit - Main Gear Lubrication

The main S-band turning unit gear is made from Tufnol, while the pinion is made from steel. Both gears are lubricated in the factory with Molykote Long Term 2 black grease which is spread using a paint brush over the teeth of the main gear, its viscosity is such that it remains attached to the gear teeth during rotation.

It is however recommended that after 2 years the gears should be visually inspected and, if necessary, re-greased with the correct grease.

If the turning unit has been operating at high ambient temperatures for long periods of time the grease will tend to congeal and dry out more rapidly. Therefore it is recommended that in these circumstances the gears should be visually inspected and, if necessary, re-greased with the correct grease every year.

To lubricate the turning unit main gear:

1. Unscrew the four M6 screws securing the performance monitor (PM) cover (this is the cover pointing towards the bow, see Figure 6.6) and remove the cover from the turning unit.

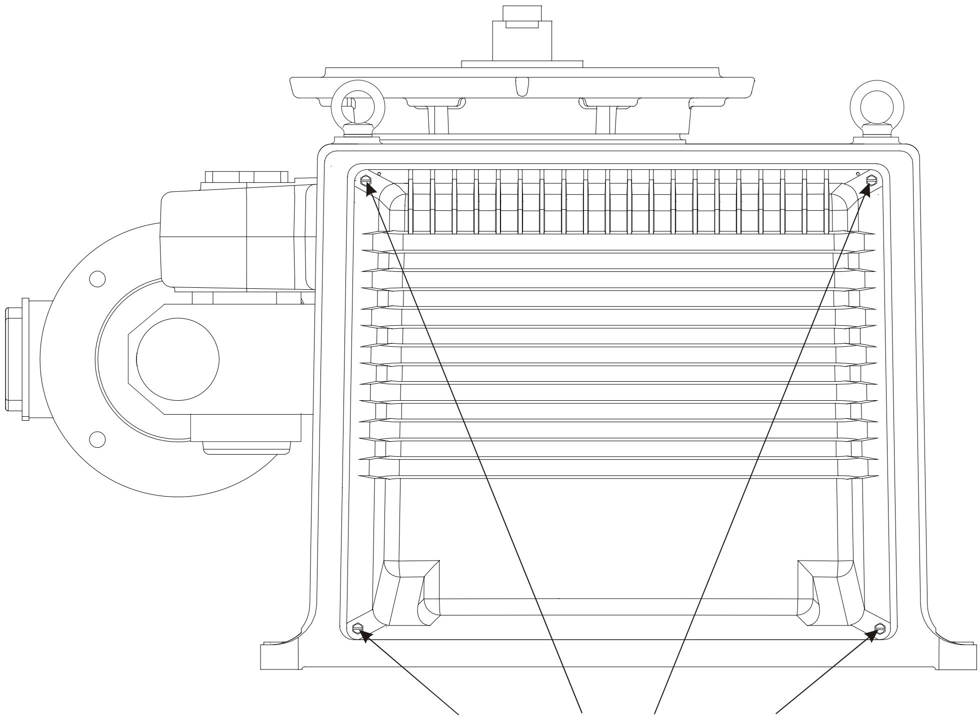


Figure 6.6 Removing the Performance Monitor Cover (facing bowards)

2. With the main gear exposed, using a paintbrush apply the lubrication grease to the main gear teeth, as shown in Figure 6.7.

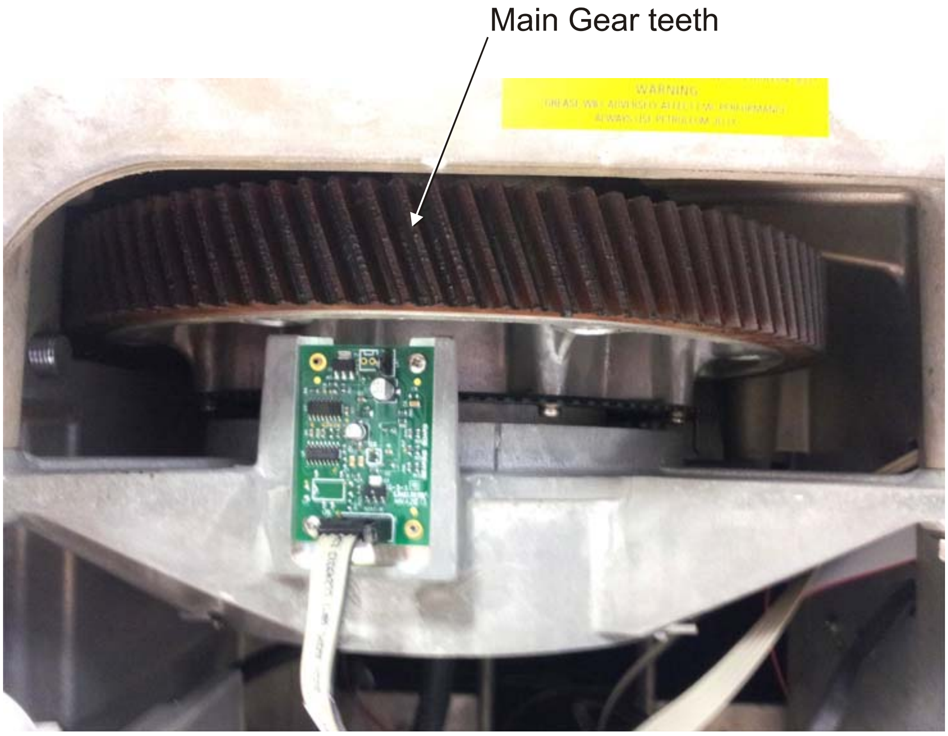


Figure 6.7 Location of Main Gear

3.5 Lubricating Covers

Whenever a cover is removed for maintenance procedures always ensure that the sealing faces of the covers are clean before replacement.

It is also recommended that petroleum jelly is applied to the sealing faces every time a cover is removed, this is done in order to maintain a good environmental seal.

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CHAPTER 7

INTERSWITCH UNITS

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1 Interswitch Units - General View

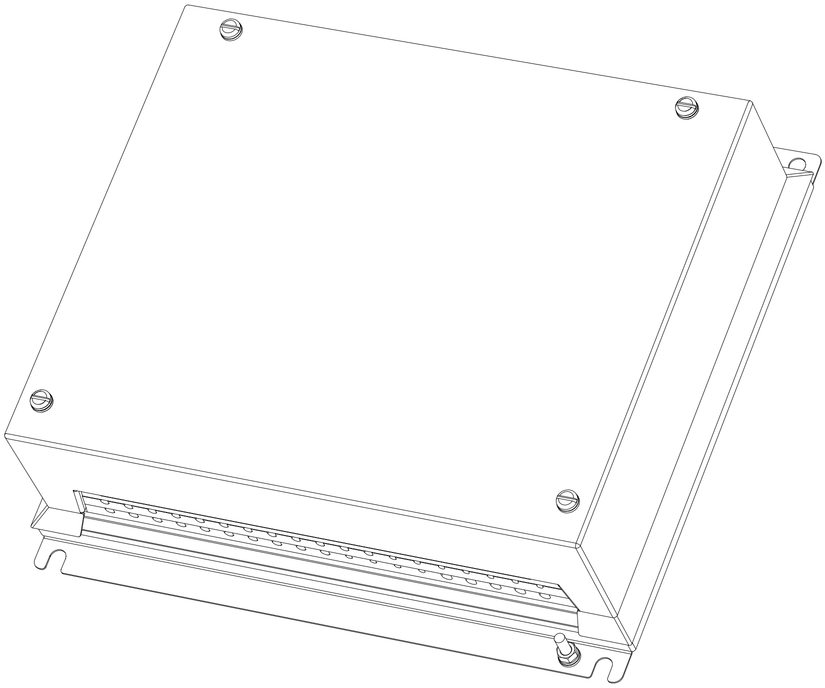

Figure 7.1 2-Way Interswitch Unit 65842A – General View

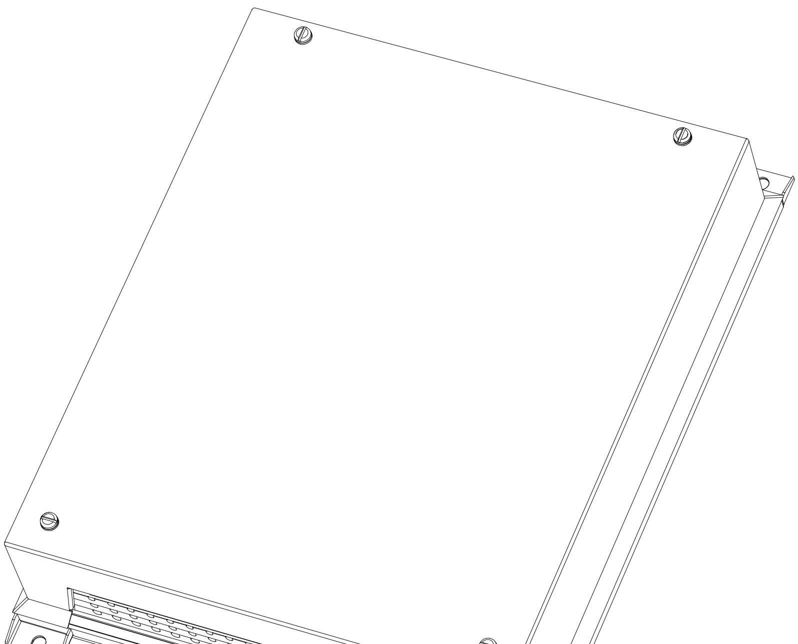

Figure 7.2 6-Way Interswitch Unit 65846A – General View

2 Interswitch Units - General Description

The Interswitch Units are used as part of a Marine Radar System for installation in ships' bridges and wheelhouses.

An Interswitched system comprises more than one radar combined so that the whole system can be controlled and configured from any display position. This is often desirable when only one operator is on duty, as it gives the choice of selecting a particular radar for a particular condition, i.e, S-Band in heavy rain and open waters, or X-Band for high definition in congested areas. It also permits multiple display operation when required and allows for standby radars to be immediately operational in the event of a failure.

Note: *The Interswitch Units work directly with the BridgeMaster E Series range of Scanner Units and VisionMaster FT range of Displays, but requires compatibility units for interfacing with the original BridgeMaster or Master Series units in hybrid systems. For information on compatibility units, refer to the Ancillary Units and Radar Systems manual, 65800012.*

The 2-Way Interswitch allows one or two Transceivers to be connected to up to four Displays.

The 6-Way Interswitch Unit allows a combination of up to 6 Displays with up to 6 Transceivers.

The Interswitch Unit is housed in a purpose designed enclosure with the electronic circuitry contained on a single PCB. Surface mount devices are used throughout the design. A separate Bypass PCB houses the bypass and distribution connectors.

Connectors are fitted to the Bypass PCB to enable manual bypassing of the Interswitch control logic in the event of an Interswitch failure. The Bypass PCB enables the logic PCB to be removed for servicing without affecting the bypass function.

Power for the Interswitch Unit is derived from the System Display or Display Compatibility units, with any display capable of powering the Interswitch Unit.

The following Despatch Kits contain all necessary fixings and connectors:

- for 2-Way Interswitch Despatch Kit, 65842600
- for 6-Way Interswitch Despatch Kit, 65846600

Refer to Chapter 3, Installation for typical system installation details.

3 System Configuration

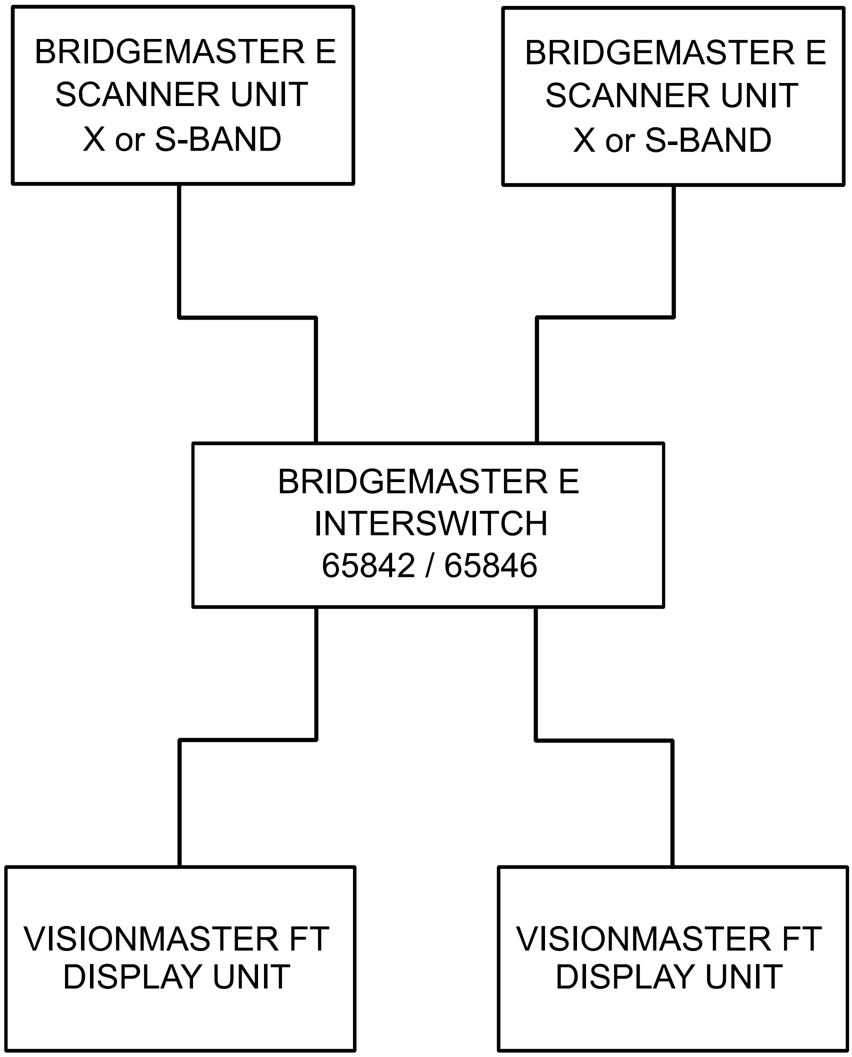

Figure 7.3 Placement of Interswitch Unit in typical VisionMaster System

4 Installation and Commissioning

4.1 Siting Considerations

The maximum separation between the Interswitch and an operating VisionMaster FT PCIO unit should not exceed 30 metres. (i.e. if only one VMFT display in the system may be functioning, and the other displays are turned off; the distance between the interswitch and the display that is functioning must not exceed 30 metres).

4.2 Interswitch Hardware Configuration

4.2.1 Dil Switches

In order to indicate which Displays and Transceivers are connected to the Interswitch, set the appropriate switches to the 'off' position.

On the 2-Way Interswitch PCB board there are two 4-way DIL switches. SW1 selects Display Units while SW2 selects Transceivers.

On the 6-Way Interswitch PCB board there are two 6-way DIL switches. SW1 selects Display Units while SW2 selects Transceivers.

Table 1: Link Settings 1 & 2

Mode	Link	Setting
Global	LK1	2-3
Local	LK1	1-2
Normal	LK2	1-2
Reset Defaults	LK2	2-3

Link 1 selects LOCAL or GLOBAL setting. If the system is in the Local Mode, a Display Unit can only change the Transceiver to which it is connected and select either master or slave mode.

To set a Transceiver to Slave only, the system must be temporarily set to Global mode when a VisionMaster display is connected to the system. If a BME display is connected the display can completely re-configure the entire system in Globel mode.

Inserting Link 2 at position 2-3 loads the default settings at power-up. For a 2-way Interswitch that is fully populated, the default state will be as shown below:

- DUA master to TXA DUB master to TXB
- DUC slave to TXA DUD slave to TXA

For a 6-way Interswitch the default setting will be one to one connection.

Links 3 & 4 are for test and diagnostic purposes only.

Table 2: Link Settings 3 & 4

Link Settings	
LK3	Factory set 1-2
LK4	Not fitted

Table 3: 2-Way Link Settings 5 to 8 (factory set to 75 Ω termination)

Link Settings		50 Ω	75 Ω
LK5	DUA Video	1-2	2-3
LK6	DUB Video	1-2	2-3
LK7	DUC Video	1-2	2-3
LK8	DUD Video	1-2	2-3

Table 4: 6-Way Link Settings 7 to 12 (factory set to 75 Ω termination)*

Link Settings		50 Ω	75 Ω
LK7	DUA Video	1-2	2-3
LK8	DUB Video	1-2	2-3
LK9	DUC Video	1-2	2-3
LK10	DUD Video	1-2	2-3
LK11	DUE Video	1-2	2-3
LK12	DUF Video	1-2	2-3

* LK5 and LK6 link 2-3 not used

4.2.2 Installation Drawings

For installation of the 2-Way Interswitch and 6-Way Interswitch, refer to Figure 7.4 and Figure 7.5.

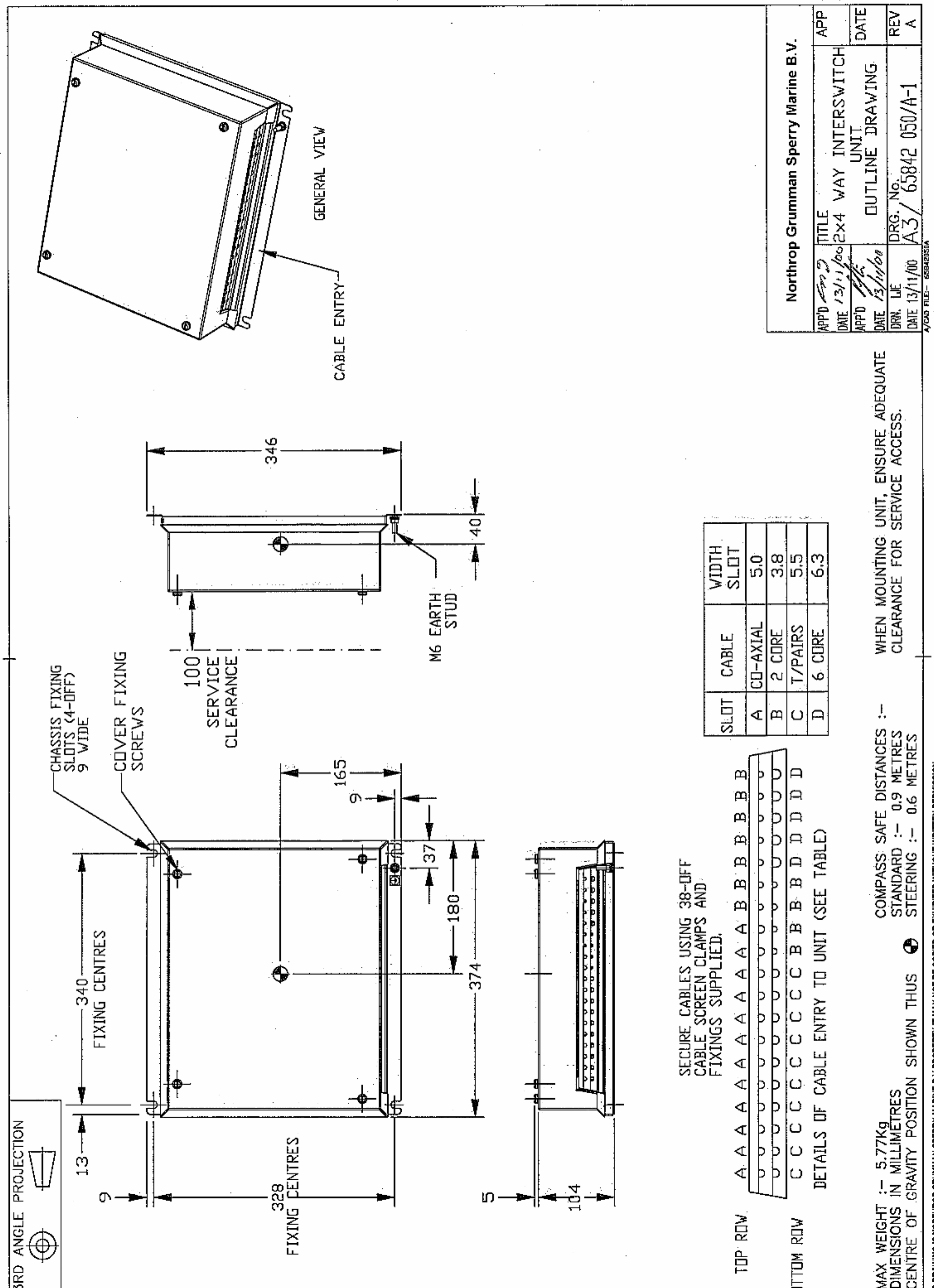

Figure 7.4 2-Way Interswitch Unit – Installation Drawing

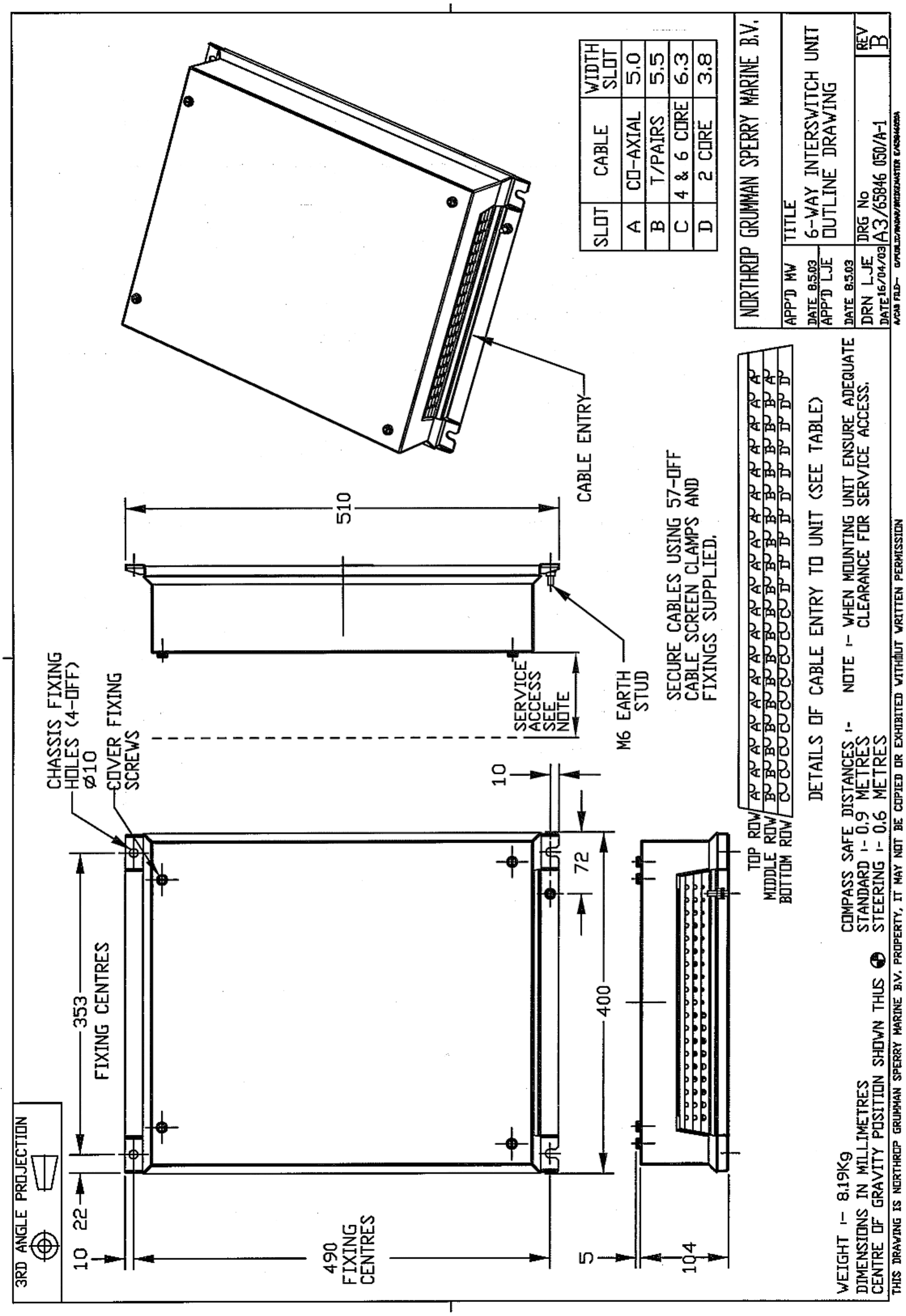

Figure 7.5 6-Way Interswitch Unit – Installation Drawing

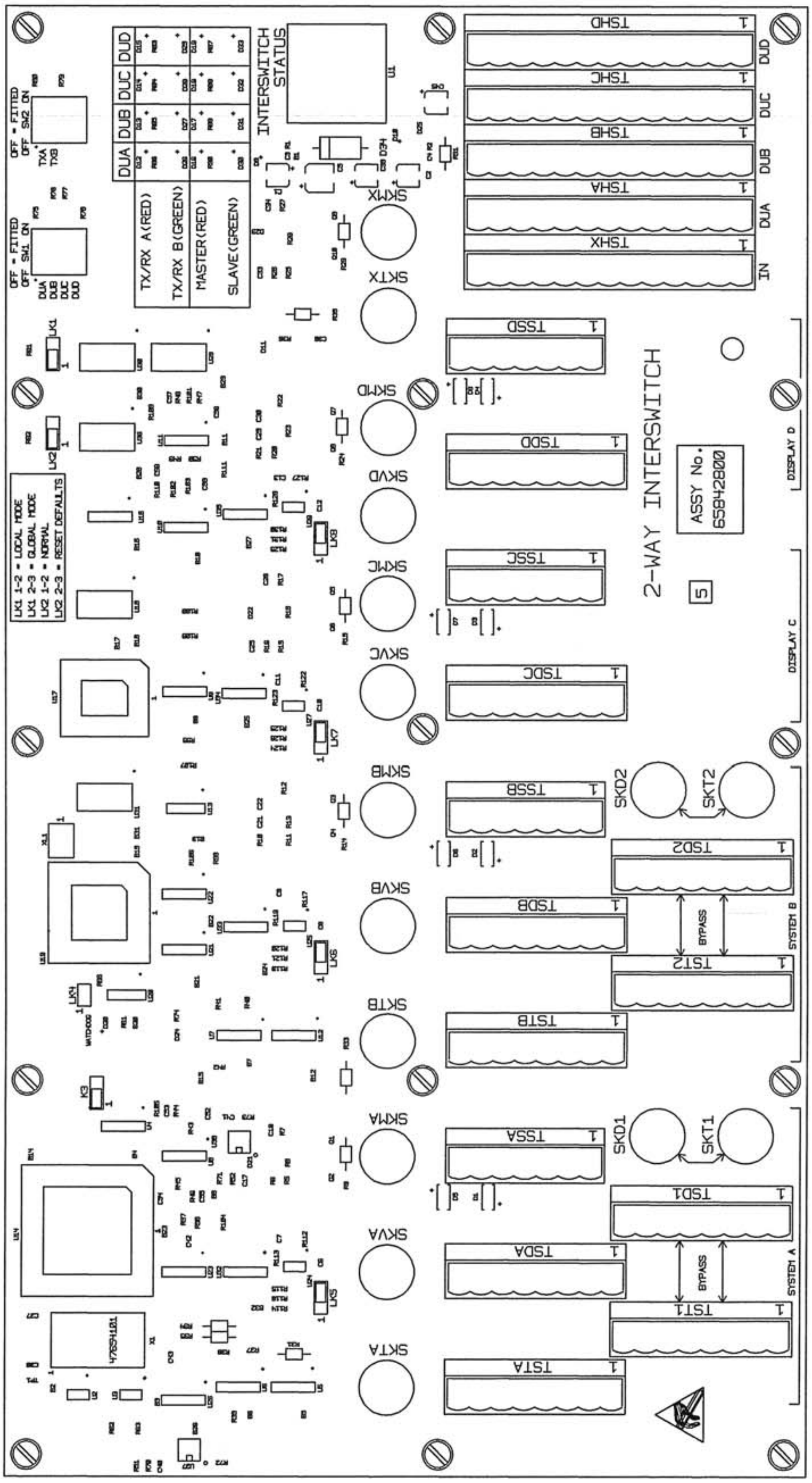

Figure 7.6 2-Way Interswitch PCB Assembly 65842800

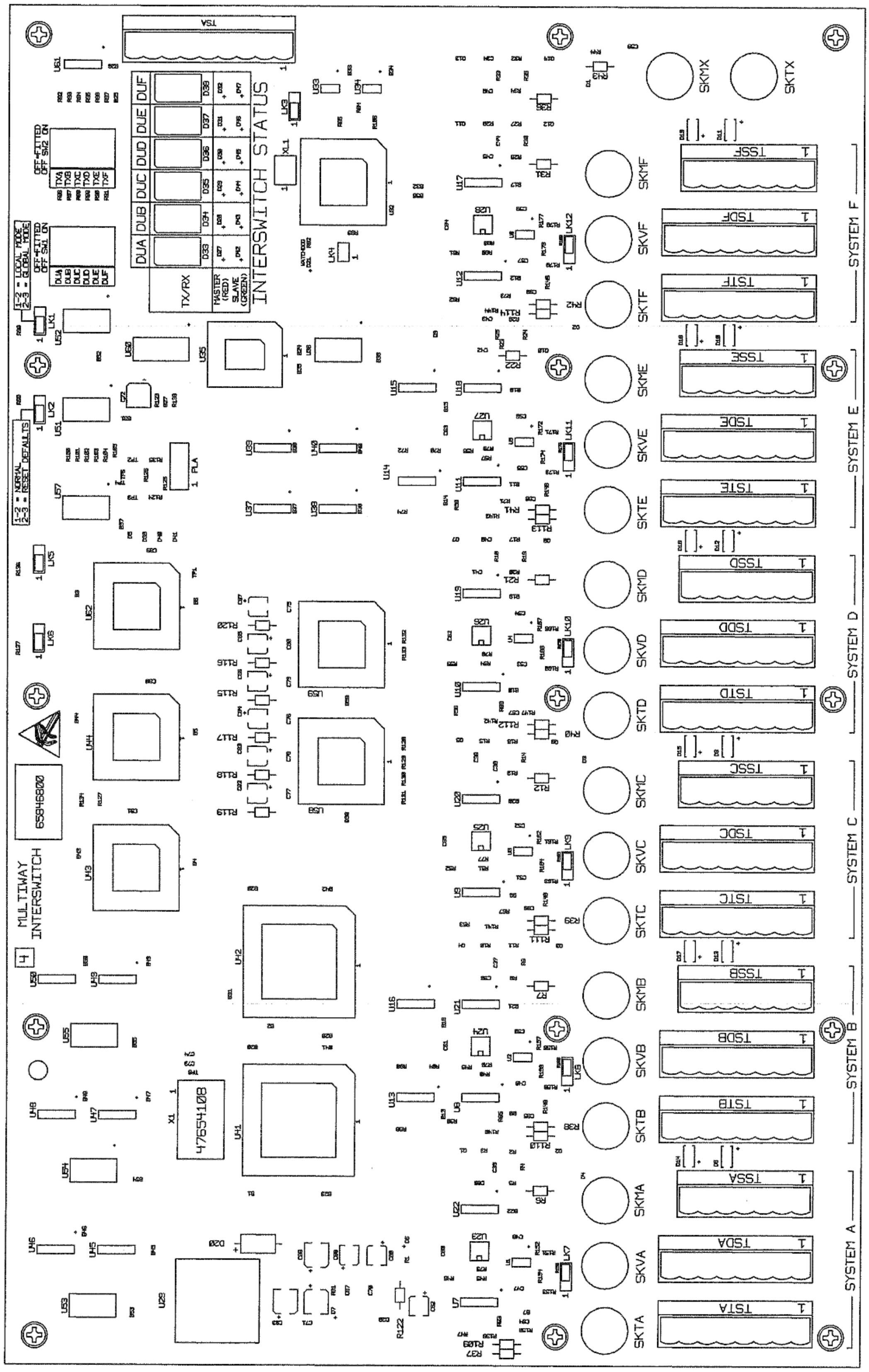

Figure 7.7 6-Way Interswitch PCB Assembly 65846800

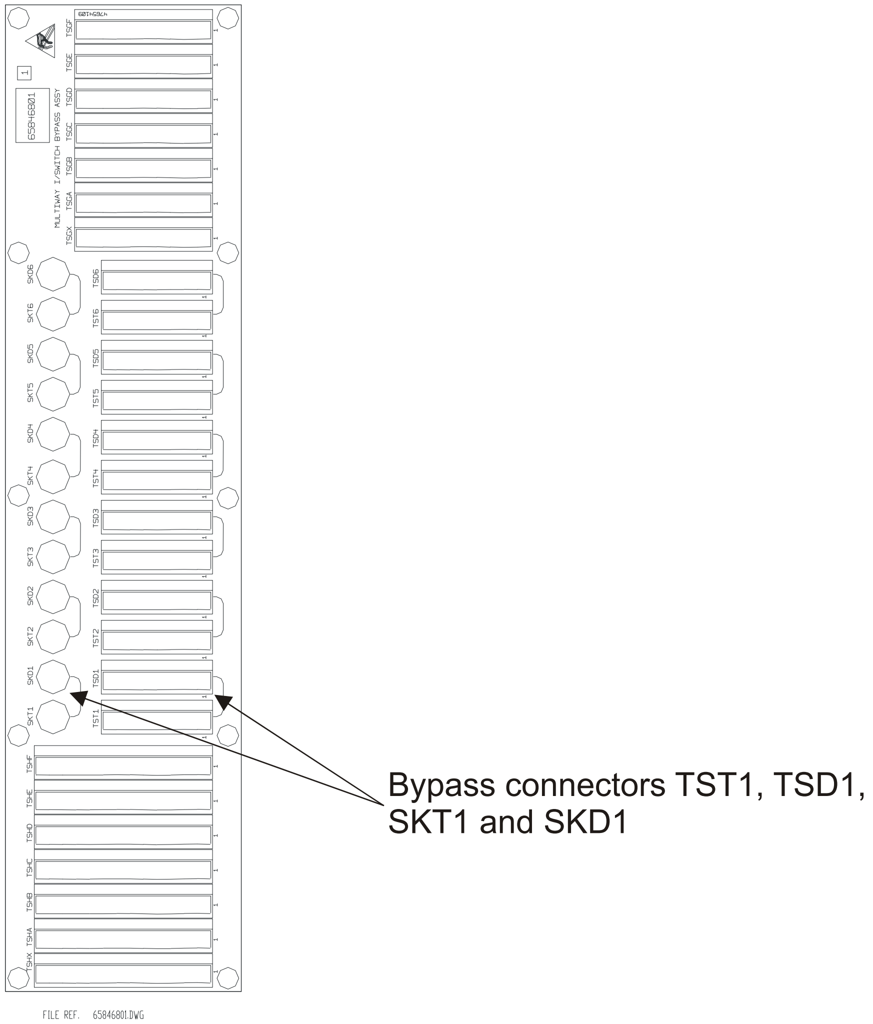

Figure 7.8 6-Way Interswitch Bypass PCB Assembly 65846801

4.2.3 Interface to Transceiver and Display Unit

There is a bi-directional serial port to send and receive signals between the display unit and the transceiver. The signals sent and received are RS422 differential. One receives the configuration requests from the display, the second one returns acknowledge and configuration signals back from the Transceiver to the display unit.

Trigger, Video and SART video are sent down separate cables. The Trigger and SART video are also received as RS422 differential signals. The video is received via a coaxial cable.

Two additional twisted pair cables bring in the power supply to the Interswitch Unit from the display or Display Compatibility Unit.

Table 5: Radar Video Input

Parameter	Values
Peak amplitude	2.5V to -5.5V
Shoulder noise	-0.25V minimum
Input Impedance	75 Ω ± 10%

4.2.4 Bypass Connections for 2-Way Interswitch

On the Interswitch PCB, additional connectors are provided. These allow a display to be connected to a Transceiver, bypassing the Interswitch. This permits TXA to be connected to one Display and TXB to be connected to another of the 4 possible Displays. 2 displays will be therefore out of action.

Note: *MIST will not be available to any Display in Bypass Mode.*

4.2.5 Bypass Connections for 6-Way Interswitch

On the Bypass PCB, 65846801, additional connectors are provided. These allow each display to be connected to one Transceiver, bypassing the Interswitch logic PCB 65846800. This precludes any slave Transceiver operation.

To bypass the Interswitch Unit in the event of an Interswitch Unit failure:

1. Remove the transceiver cables from TSTA and SKTA on Interswitch PCB Assembly 65846800 and connect them to TST1 and SKT1 on the Interswitch Bypass PCB assembly. This can be repeated for each transceiver using TST**, and SKT** (where ** can be 1, 2, 3, 4, 5or 6)
2. Remove the cables for the display that it is required to connect to the transceiver from TSD* and SKD* on the Interswitch PCB assembly (where * can be A, B, C, D, E or F), and connect them to TSD1 and SKD1 on the Interswitch Bypass PCB assembly.

This can be repeated for the other displays by using TSD** and SKD** (where ** can be 1, 2, 3, 4, 5, or 6).

Note: *MIST will not be available to any Display in Bypass Mode.*

4.2.6 General Distribution Connectors

These enable LOG, COMPASS, NAV I/P etc to be distributed to all the display units via parallel connected terminal blocks. The parallel terminal blocks on the interface PCB comprise:

- For the 2-Way Interswitch: 1 input terminal block and 4 output terminal blocks.
- For the 6-Way Interswitch: 1 input terminal block and 6 output terminal blocks.

4.2.7 System Status for the 2-Way Interswitch

Visual indication of the system status is provided by green and red LEDs which show whether a display is connected to Transceiver A or Transceiver B. Additional green and red LEDs show whether the Display Unit is master or slave to the Transceiver. If a Display has not been configured, then the associated LEDs will not be illuminated.

Table 6: Typical Examples of Status Panel Read-Outs for 2-Way

Displays	A	B	C	D
Tx/Rx A (Red) Tx/Rx B (Green)	🔴	🟢	🔴	🟢
Master (Red) Slave (Green)	🔴	🔴	🟢	🟢

🔴 Red LED

🟢 Green LED

4.2.8 System Status for the 6-Way Interswitch

Visual indication of the system status is provided by seven segment displays which indicate which Transceiver (A to F) is connected to which display unit. Additional green and red LEDs show whether the display unit is Master or Slave to the Transceiver. If a Display is not configured, then the associated LEDs will not be illuminated.

Table 7: Typical Examples of Status Panel Read-Outs for 6-Way

Displays	A	B	C			D
Transceiver	A	C	C	A	E	F
Master (Red) Slave (Green)	🔴	🔴	🟢	🟢	🔴	🔴

🔴 Red LED

🟢 Green LED

4.2.9 Mutual Interference Suppression Trigger (MIST)

There is one input from an external source which is mixed with the triggers from each Transceiver. The combined signal is fed out as an external display MIST. Each Display is supplied with this composite trigger excluding the trigger from the Transceiver that the Display is currently connected to.

4.2.10 Interconnections

All connections to the Interswitch physically plug directly into the Interswitch logic PCB.

The cables to the Turning Units/Transceivers consist of a quad twisted pair cable with overall screen for Trigger, SART Video and the bi-directional serial data, and a co-ax cable for Video.

The cables to the Display Units consist of two quad twisted pair cables. One provides the Transceiver signals for Trigger, SART Video, bi-directional serial data, bi-directional interswitch control data, positive and negative power. The Transceiver video input and output are via co-ax cables, as is the output MIST.

The Interswitch Unit has one External Transceiver MIST co-ax input, one External Display MIST co-ax output. The 2-Way Interswitch has four co-ax Display MIST outputs; the 6-Way six co-ax Display MIST outputs.

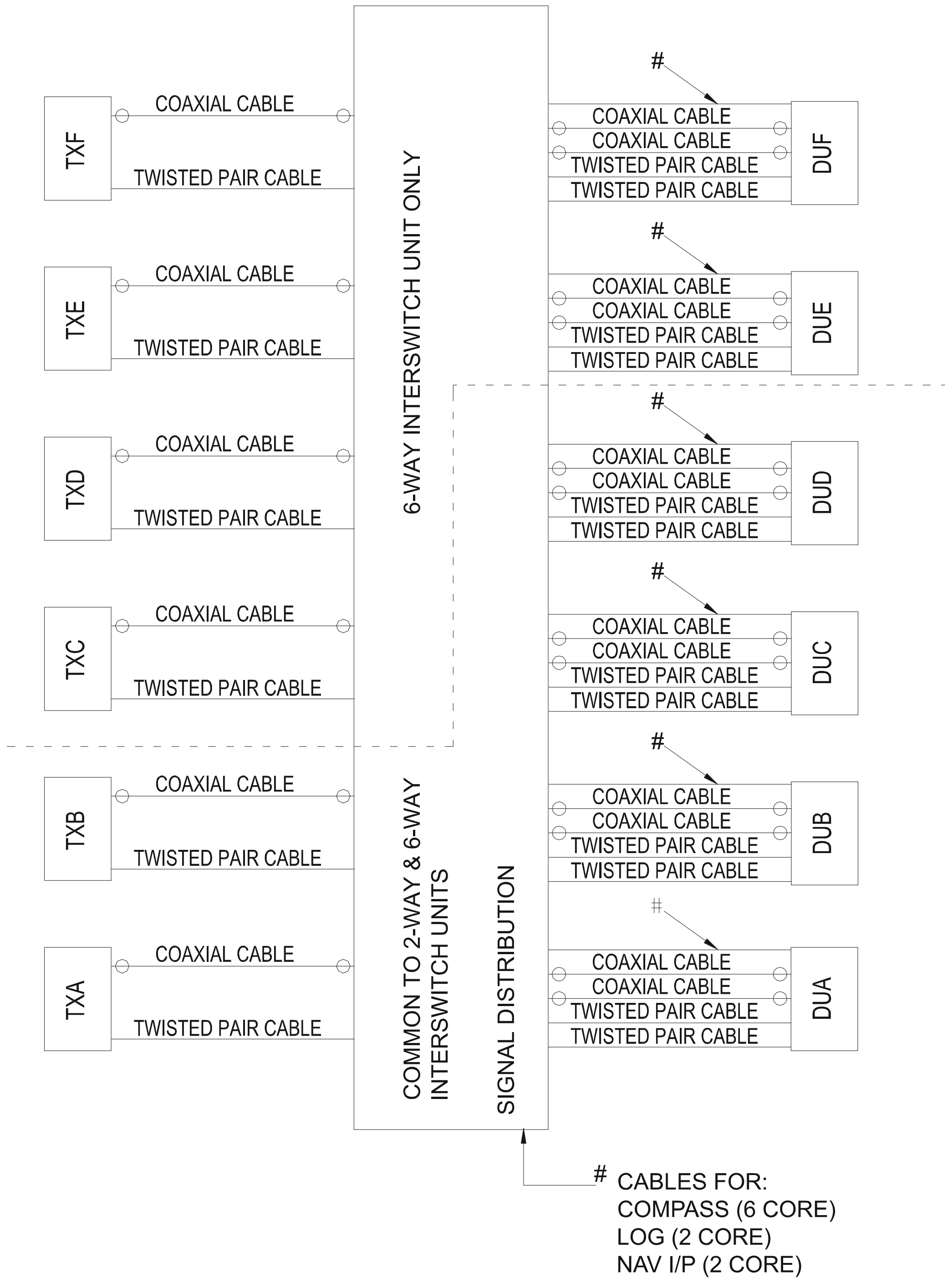

Figure 7.9 Block Diagram – Interswitched System

5 Technical Specification

5.1 Interswitch Power Supply

Each Display Unit supplies +12V (+15V) & -12V (-15V) to the Interswitch.

The +12V (+15V) inputs are diode OR'd to produce ≈ +11V (+14V).

The -12V (-15V) inputs are diode OR'd to produce ≈ -11V (+14V).

An on-board regulator produces +5V for the logic.

For the 6-Way Interswitch a second regulator produces -5V.

5.2 Interswitch Unit Hardware Description

An 89C52 microcontroller with on-board Flash memory running at 12 MHZ communicates with the Display Units via bi-directional serial links. The data transferred includes status i.e. Display is master or slave, which Transceiver is connected to which Display. A watchdog facility is also provided.

For a 2-Way Interswitch one Quad UART is used for the bi-directional serial communication with the Display Units or Compatibility Unit. For a 6-Way Interswitch two Quad UARTs are used for the bi-directional serial communication with the Display Units.

Received data generates interrupts for the microcontroller which reads the data from the UART and acts upon that data. A message is then returned with the new status. Any change of status is stored in an EEPROM allowing the Interswitch to return to the current status in the event of a power failure.

For the 2-Way Interswitch Logic multiplexers are used to route the signals between the Display Units and Transceivers and analogue 'T' switches route the video.

For the 6-Way Interswitch CPLDs are used to route the signals between the Display Units and Transceivers and analogue Cross-point switches are used to route the video.

The microcontroller also drives the LED status display.

6 Environmental Specification

6.1 Temperature

Operating -15°C to +55°C

Storage -25°C to +70°C

6.2 Relative Humidity

95% at 40°C (non condensing)

6.3 Weights and Dimensions

	Height (mm)	Depth (mm)	Width (mm)	Nominal Weight (kg)
2-Way Interswitch Unit 65842A	346	109	374	5.0

	Height (mm)	Depth (mm)	Width (mm)	Nominal Weight (kg)
6-Way Interswitch Unit 65846A	510	109	400	7

6.4 Compass Safe Distances

	Standard	Steering
2-Way & 6-Way Interswitch Units	0.9 m	0.6 m

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CHAPTER 8

ADDITIONAL FEATURES

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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 (transmission inhibit control). Selectable for RS422, RS423 voltage levels, and on later units closing contact input.
- Antenna Rotation in Standby Input (X-band only)
- Remote selection of high and normal rotation rates for antenna.
- 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 '*Technical Specification*'.

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

Table 1: Heading Marker 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. w.r.t. true heading
Adjustment Increment	0.088°
Reference	Leading edge
Sense	Selectable to be rising or falling edge

Output 2

Table 2: Heading Marker Output 2

Parameter	Value
Output Type	RS422 (differential)
Output Drive	To drive 120ohm twisted pair
V_{out} high	2.0V min. Isource -20mA
V_{out} low	0.5V max. Isink 20mA
Closure Duration	20° approx.
Adjustment Range	±10° approx. w.r.t. true heading
Adjustment Increment	0.088°
Reference	Leading edge
Sense	Selectable to be rising or falling edge

2.3 Pulse Bearing Output

Output 1

Table 3: Pulse Bearing 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

Table 4: Pulse Bearing Output 2

Parameter	Value
Output Type	RS422 (differential)
Pulses per Revolution	4096
Output Drive	To drive 120ohm twisted pair
V_{out} high	2.0V min. Isource -20mA
V_{out} 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.

The standard synchros that are available are:

11CX4c

Table 5: Synchro 11CX4c Outputs

Parameter	Value
Type	Control transmitter
Ratio	1:1
Reference Voltage	115V rms
Output Voltage	90V rms line to line
Frequency	400Hz

11CDX4b

Table 6: Synchro 11CDX4b Outputs

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

The standard resolver that is available is:

11M6P1

Table 7: Resolver 11M6P1 Outputs

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

Table 8: Pre-trigger Outputs

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

Table 9: RS422 Inputs

Parameter	Value
Input Type	RS422 (differential)
Response Time	Within 1 PRI
Input Impedance	120 ohms

Closing Contact

Table 10: Closing Contact Inputs

Parameter	Value
Input Type	Uncommitted closing contact
Voltage on Open Contact	6V max
Sink Current Through Closed Contact	4mA max
Response Time	Within 1 PRI
Sense	Selectable

RS423

Table 11: RS423 Inputs

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

Table 12: External Trigger Inputs

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

An isolated closing contact can be connected to an X-band turning unit to force the antenna to rotate when it is in standby mode. Rotation is forced when the contact is closed.

Note: This function cannot be used in conjunction with the remote speed change option. They are mutually exclusive.

Table 13: Forced Antenna Rotation

Parameter	Value
Input Type	Uncommitted closing contact
Voltage Applied to Open Contact	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

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 are used to preset the rotation speed to normal or high speed.

Note: This function cannot be used in conjunction with the Forced Antenna Rotation in Standby feature.They are mutually exclusive.
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.

Table 14: Antenna Speed Selection

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 28rpm Open contacts select 45rpm
Voltage Applied to Open Contact	< 5.5V DC
Sink Current Through Closed Contact	<500µA

3 Installation and Interconnections

3.1 General

To make use of the 'additional features', extra cables need to be fitted to the Turning Unit or Transceiver.

To help with fitting the extra cables, the Turning Units are supplied with additional cable glands.

For details see Figure 8.1 and Figure 8.2.

3.2 Interconnections

Only the extra connections needed for 'additional features' are listed in this section. For all other connections see Chapter 2 *'System Identification'*.

3.2.1 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		

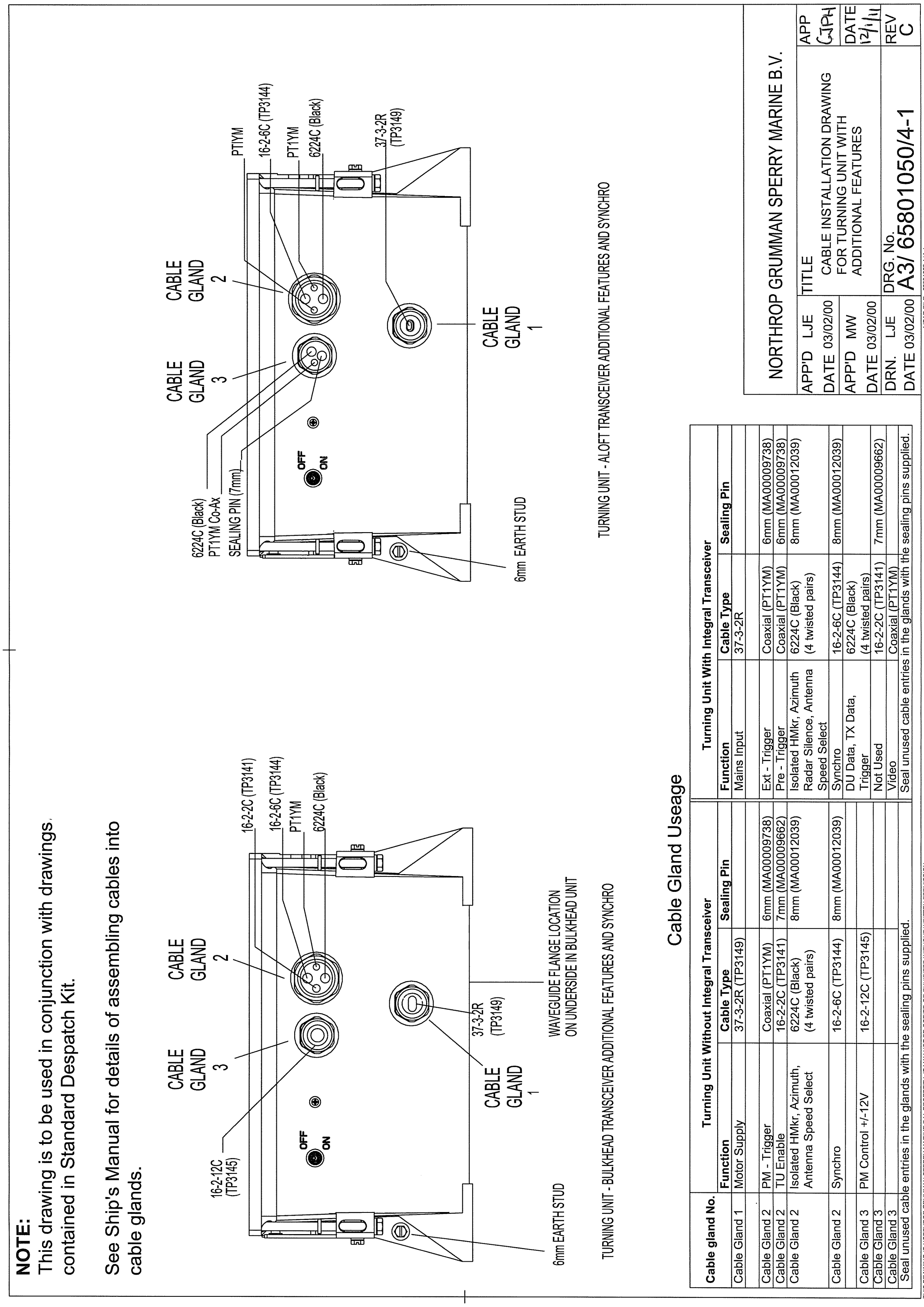
* Cable gland is designed to fit 8-core cable type 6224C (MA00007419). Any alternative cable should have similar dimensions to 6224C.

3.2.2 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		



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.		

Figure 8.1 X-band Turning Unit Cable Entry Installation Drawing

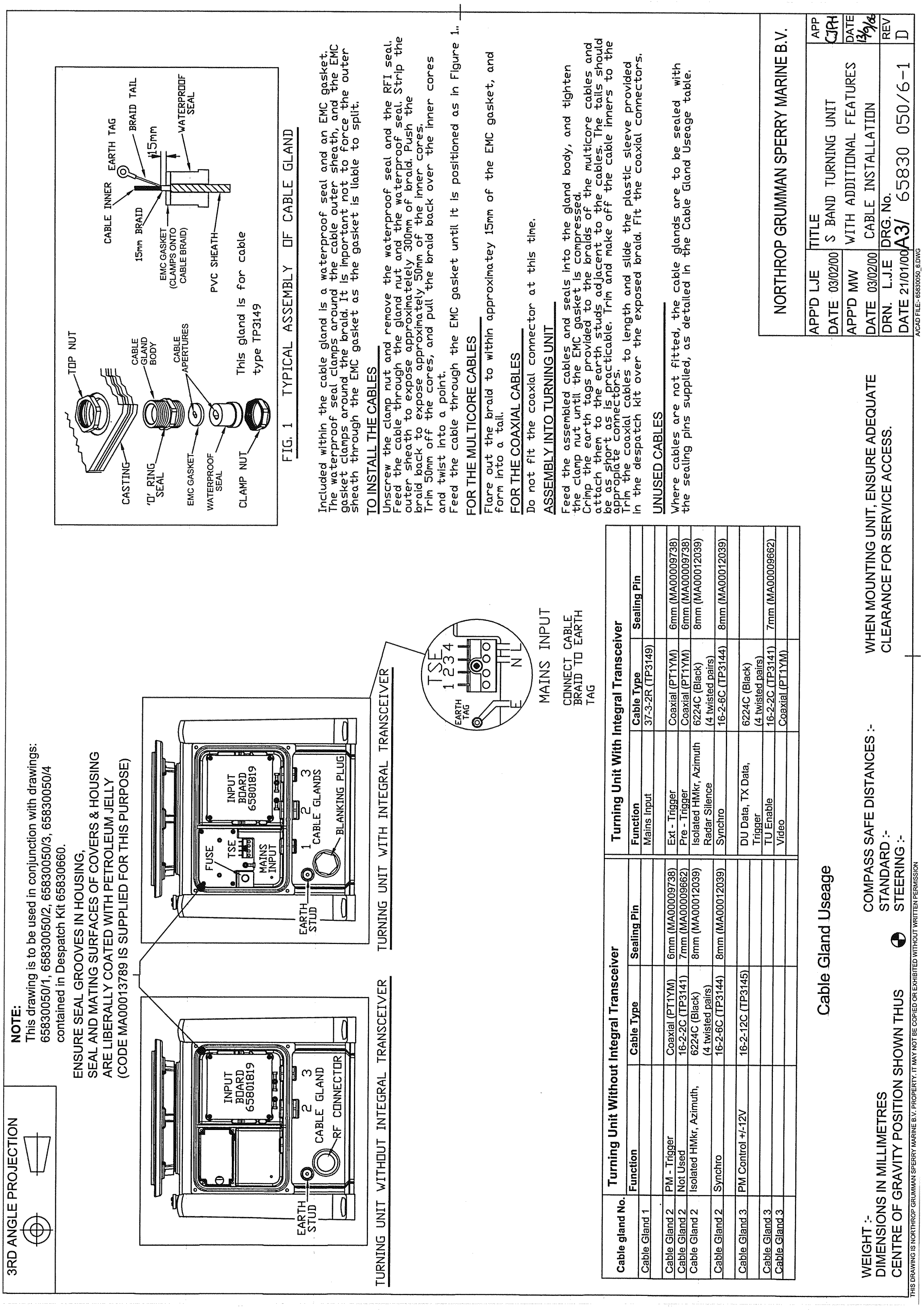


Figure 8.2 S-band Turning Unit Cable Entry Installation Drawing

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

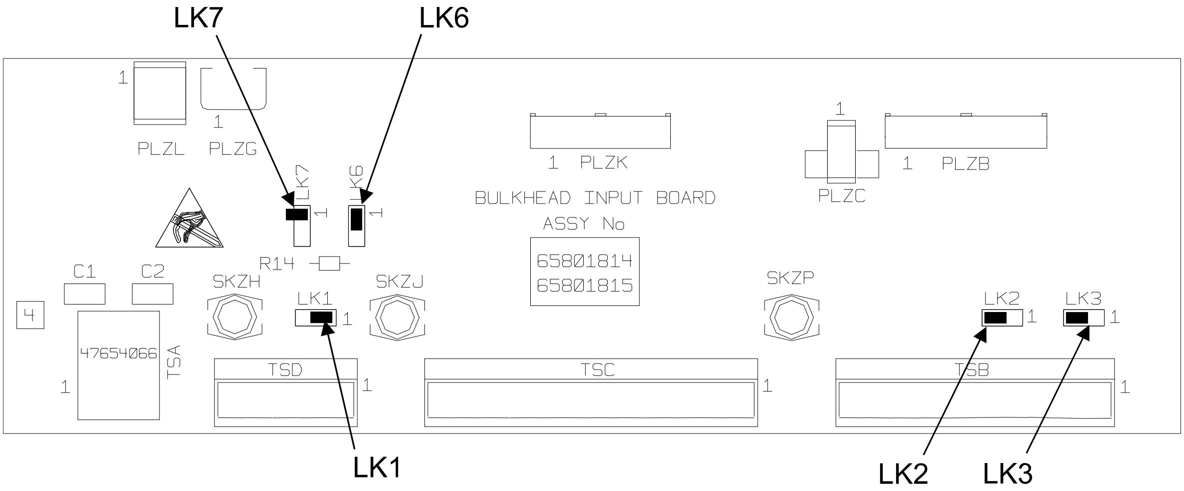


Figure 8.3 Input PCB Assembly 65801815

3.3.1.1 Default Settings

Table 15: Default Settings for Input PCB Assembly

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

3.3.1.2 LK1, LK6 and LK7: Radar Silence

These links let the radar silence input be configured for different signal types.

When LK6 is fitted in position 2–3 a 120 ohm terminating resistor is connected across the input. If a termination is not required (for example, for daisy-chained inputs) fit the link in position 1–2.

3.3.1.3 Input types

RS422

LK1	not fitted or parked on pin 1 (in other words, 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 (in other words, 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 (in other words, 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-band and X-band Turning Units

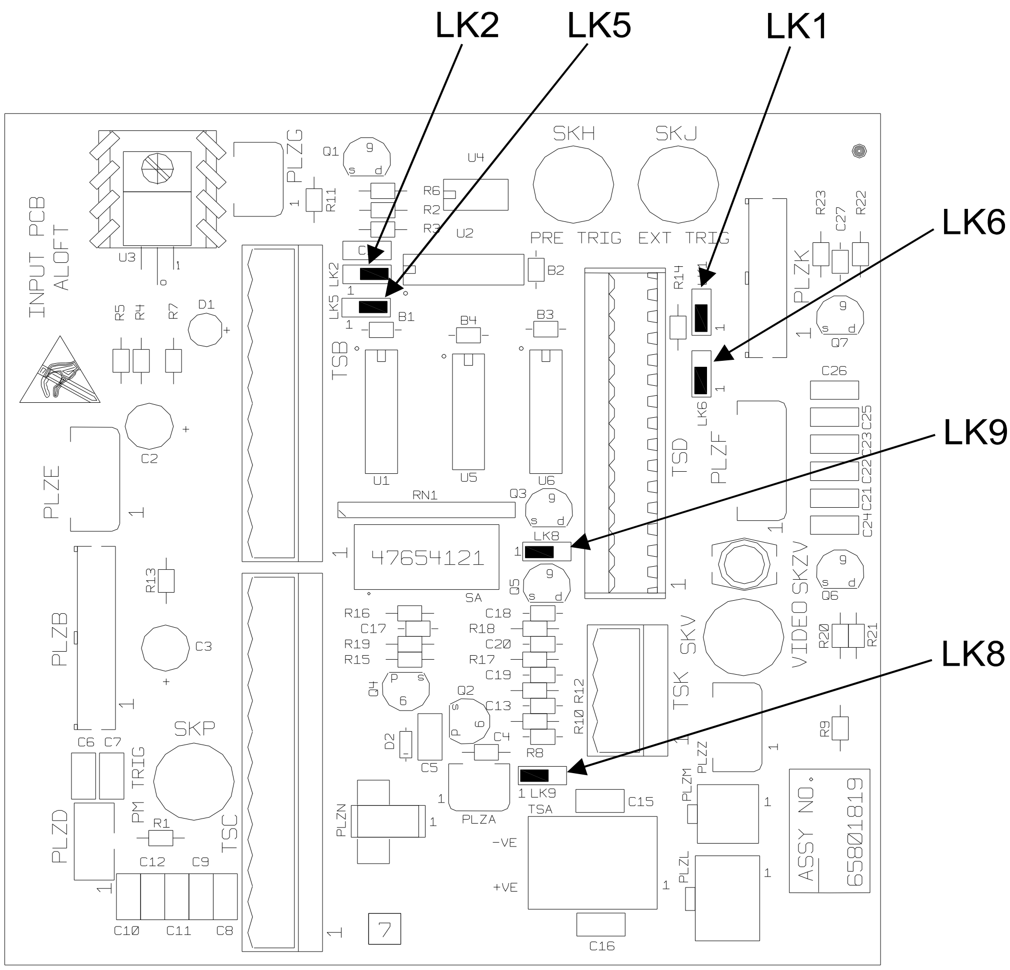


Figure 8.4 Input PCB Assembly 65801819

3.3.2.1 Default Settings

The default setting for Turning Units 65801Cxx, 65901Cxx, 65825Nxx, 65925Nxx, 65825Txx, 65925Txx, 65810Nxx, 65910Nxx, 65810Txx and 65910Txx is for high-speed rotation.

To select normal speed rotation link TSK1 to TSK2.

Table 16: Default Settings for Input PCB Assembly 65801819

Unit Type	LK1	LK2	LK5	LK6	LK8	LK9
65801CAx 65901CAx	x*	2–3	2–3	x	1–2	2–3
65810Nxx 65910Nxx	1–2	2—3	2–3	1–2	1–2	2–3
65810Txx 65910Txx	1–2	2–3	2–3	1–2	1–2	2–3
65825NAx 65925NAx	1–2	2–3	2–3	1–2	1–2	2–3
65825TAx 65925TAx	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' doesn't matter for this unit.

Remote selection of antenna rotation speed is not available on turning unit type: 65825Lxx, 65830Cxx, 65830Nxx.

3.3.2.2 LK1, LK6 and LK 8: Radar Silence

Only applicable to Turning Unit Types 65810Nxx, 65910Nxx, 65810Txx, 65910Txx, 65825Nxx, 65925Nxx, 65825Txx, 65925Txx, 65830Nxx and 65830Txx.

These links let the radar silence input be configured for different signal types.

When LK6 is fitted in position 2–3 a 120 ohm terminating-resistor is connected across the input. If a termination is not required (for example, daisy-chained inputs) fit the link in position 1–2.

3.3.2.3 Input Types

RS422

LK1	not fitted or parked on pin 1 (in other words, not linking two pins.)
LK6	fitted 2–3
LK8	fitted 1–2

Transmission is inhibited when the input at TSD10 is positive with respect to 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 (in other words, 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 (in other words, 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)

3.3.2.4 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 TSD8 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 TSD8 and TSD7.

3.3.2.5 LK5: Fixed/Adjustable Heading Marker Selection

This link lets you select 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 achieved 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.

3.3.2.6 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

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 (in other words, not linking two pins)

LK9: Forced Antenna Rotation

Only applicable to Turning Unit Types 65825LAR, 65801Cxx, 65901Cxx, 65810Nxx, 65910Nxx, 65810Txx, 65910Txx, 65825Nxx, 65925Nxx, 65825Txx and 65925Txx.

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(in other words, 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.

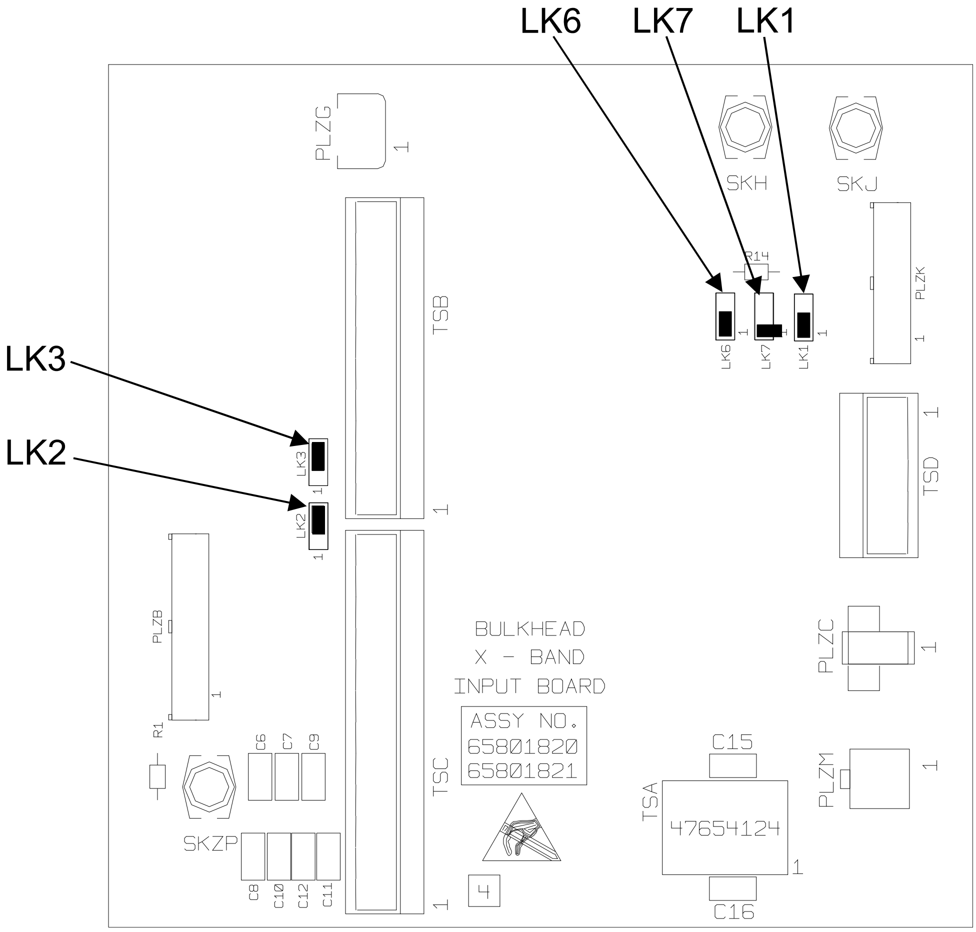


Figure 8.5 Input PCB Assembly 65801821

3.3.3.1 Default Settings

Table 17: Default Settings for Input PCB Assembly 65801821

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

3.3.3.2 LK1, LK6 and LK7: Radar Silence

These links let you configure the radar silence for different signal types.

When LK6 is fitted in position 2–3 a 120 ohm terminating resistor is connected across the input. If a termination is not required (for example, for daisy-chained inputs) fit the link in position 1–2.

3.3.3.3 Input Type

RS422

LK1	not fitted or parked on pin 1 (in other words, 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 polarity 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 X-Band Turning Unit types 65801Cxx, 65901Cxx, 65810Nxx, 65910Nxx, 65810Txx, 65910Txx, 65825Nxx, 65925Nxx, 65825Txx, 65925Txx.

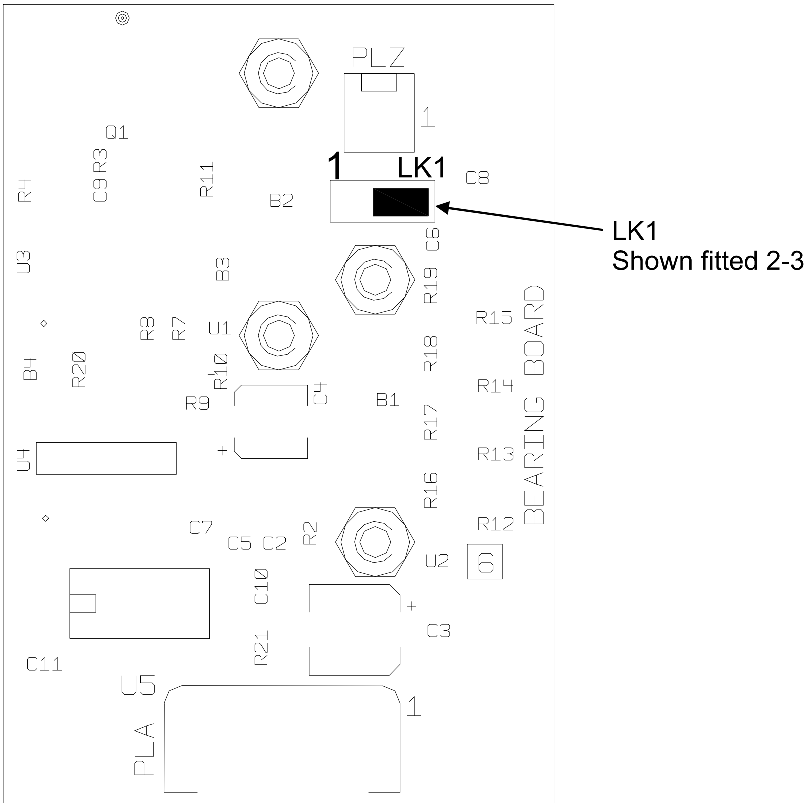


Figure 8.6 Pulse Bearing PCB Assembly 65801826

3.3.4.1 LK1: Speed Select

Normal Speed Selected

LK1 fitted 1–2

High-Speed Selected

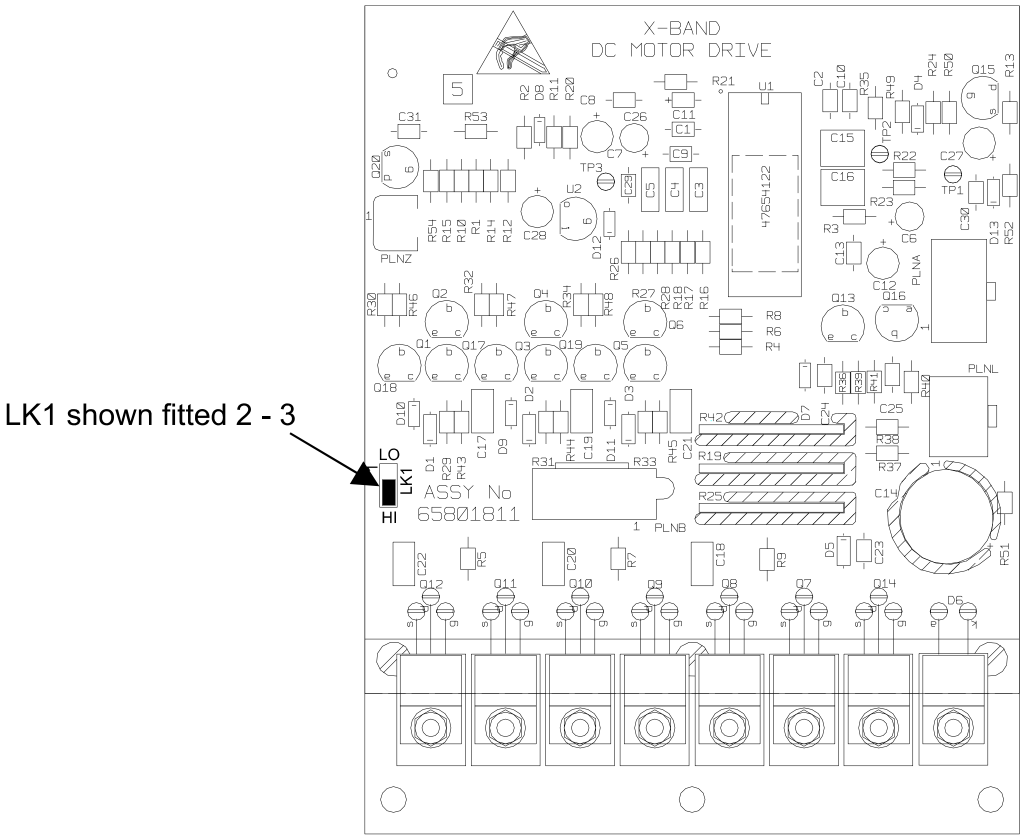
LK1 not fitted or parked on pin1 (in other words, not linking two pins)

Selectable Speed Selected

LK1 fitted 2–3

3.3.5 Motor Drive Board 65801827

Fitted to X-band Turning Unit types 65801Cxx, 65901Cxx, 65810Nxx, 65910Nxx, 65810Txx, 65910Txx, 65825Nxx, 65925Nxx, 65825Txx, 65925Txx.



file ref:65801811.wmf

Figure 8.7 Motor Drive PCB Assembly 65801827

3.3.5.1 LK1: Speed Select

Normal Speed Selected

LK1	fitted 1–2

High-Speed Selected

LK1	not fitted or parked on pin1 (in other words, 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 may be modifications to some of the PCBs. As a general rule the PCBs fitted to later units can be 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 120 ohm resistor between input terminals on the tagstrip.

4.1 X-band Turning Unit (Masthead Transceiver)

Table 18: X-band Turning Unit (Masthead Transceiver) Spares

Description	Spare Part Number		
Turning Unit Type	65810Nxx, 65825Nxx, 65910Nxx, 65925Nxx,	65810Txx, 65910Txx, 65825Txx 65925Txx	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

* 65801806 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 120 ohm resistor between TSD10 and TSD11

4.2 S-band Turning Unit (Masthead Transceiver)

Table 19: S-band Transceiver (Masthead Transceiver) Spares

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 120 ohm resistor between TSD1 and TSD2.

4.3 X-band Turning Unit (for use with Bulkhead Transceiver)

Table 20: X-band Turning Unit (Bulkhead Transceiver) Spares

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)

Table 21: X-band Turning Unit (Bulkhead Transceiver) Spares

Description	Spare Part Number
Input Board	T65801819

4.5 X-band Bulkhead Transceiver 65810F, 65810L, 65825F, 65825L

Table 22: Transceiver 65810F, 65810L, 65825F, 65825L Spares

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 120 ohm resistor between TSD1 and TSD2.

4.6 X-band Bulkhead Transceiver 65810B, 65810T, 65825B, 65825T

Table 23: Transceiver 65810B, 65810T, 65825B, 65825T Spares

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 120 ohm resistor between TSD1 and TSD2.

4.7 S-band Bulkhead Transceiver Unit 65831B

Table 24: Transceiver Unit 65831B Spares

Description	Spare Part Number
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 120 ohm resistor between TSD1 and TSD2.

5 Circuit Diagrams

This sections includes circuit diagrams for the Input PCBs, for the main unit schematic diagrams see Chapter 5 '*Fault Reporting and First Line Servicing*'.

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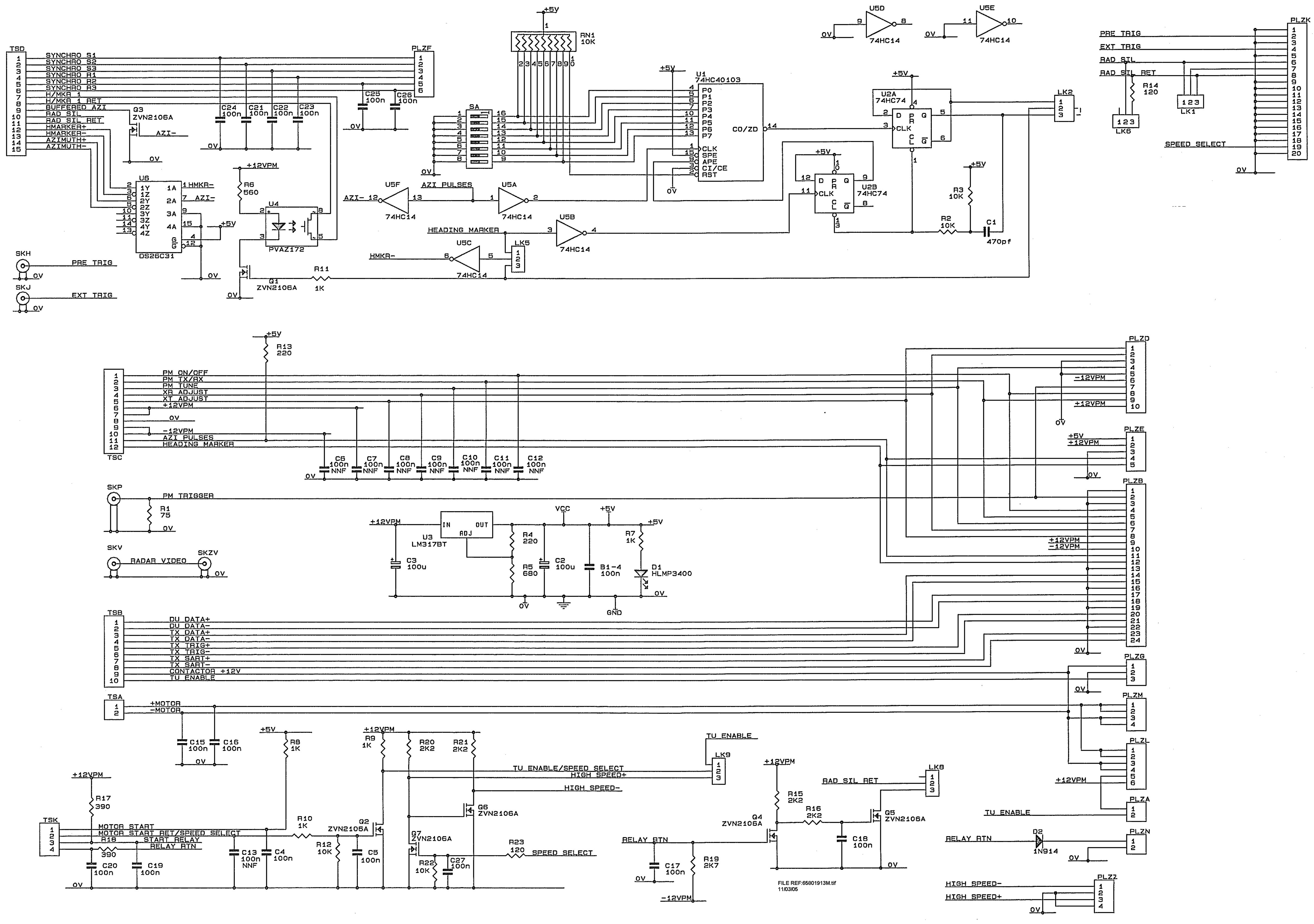

Figure 8.8 Circuit Diagram Input PCB 65801819

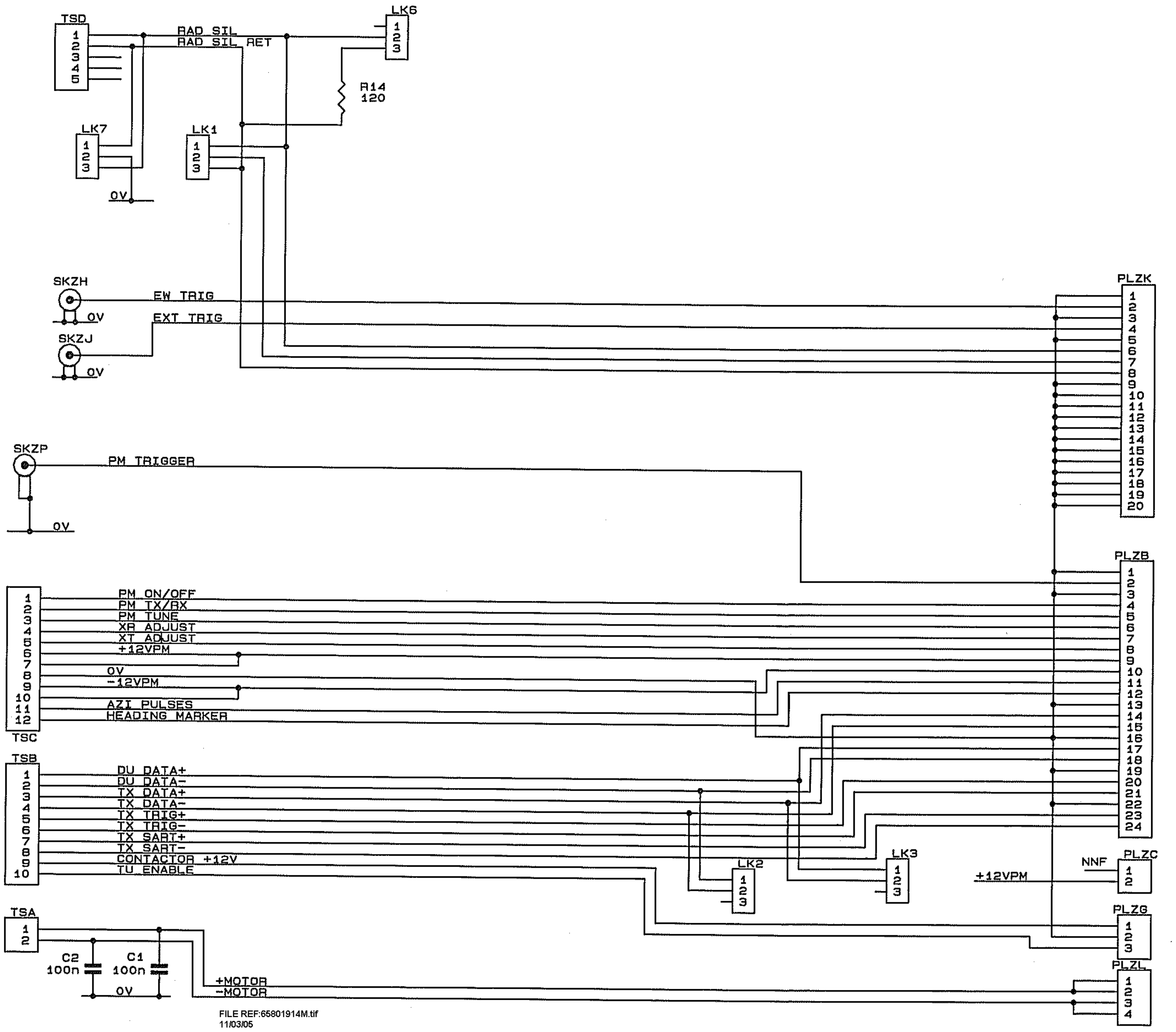

Figure 8.9 Circuit Diagram Input PCB 65801815

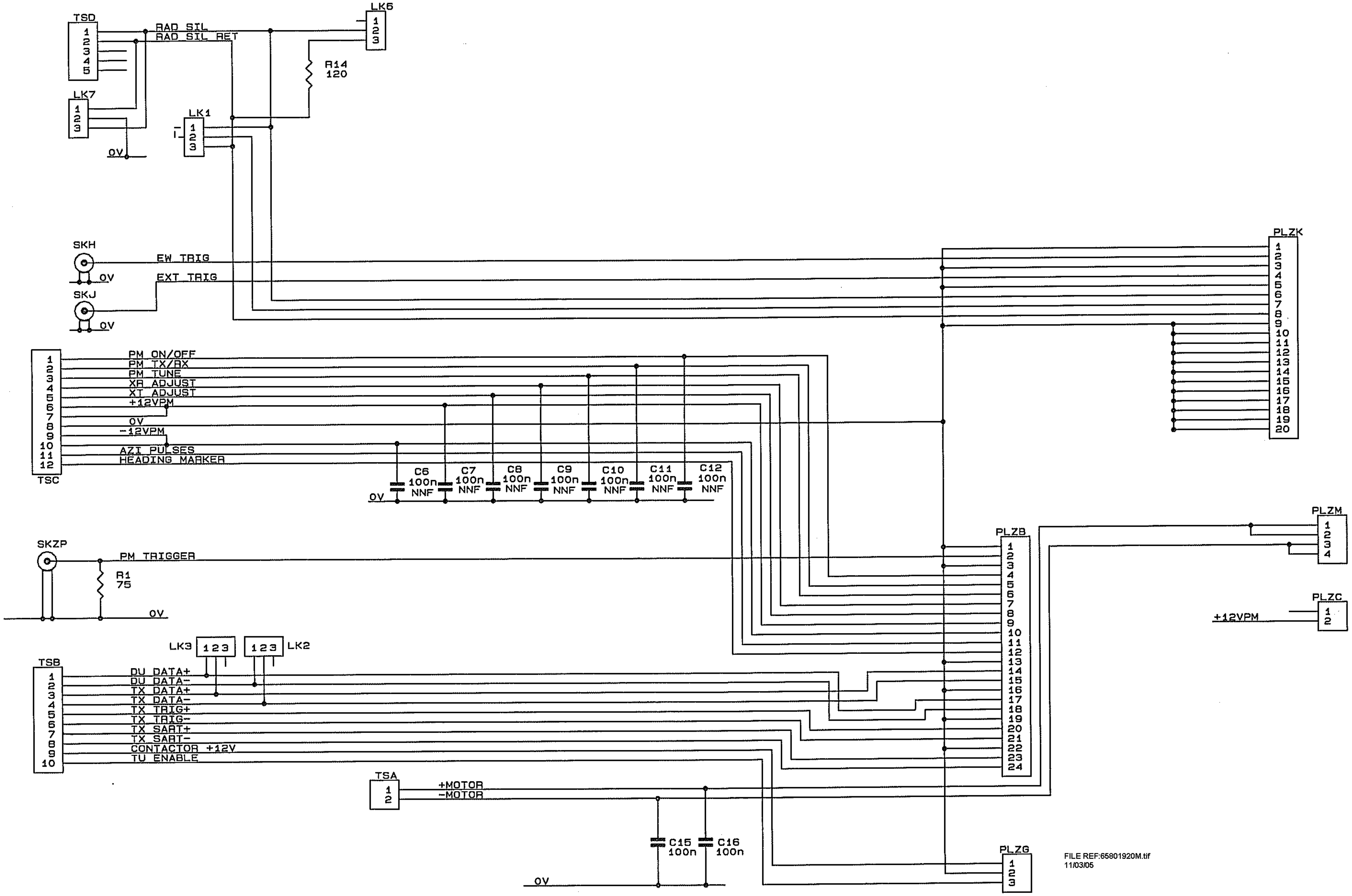

Figure 8.10 Circuit Diagram Input PCB 65801821

GLOSSARY

Glossary of Terms

A

Acquisition Zone	An area on the video circle that has been defined by the operator. Any target that enters this zone is automatically acquired and tracked.
Activated Target	A symbol representing the automatic or manual activation of a sleeping target for the display of additional graphically presented information including: a vector (speed and course over ground); the heading; and ROT or direction of turn indication (if available) to display actually initiated course changes.
Automatic Identification System (AIS)	A system capability which enables ships and shore stations to obtain identifying and navigation information about other ships at sea, using an automated transponder.
Antenna	Slotted waveguide array for transmitting and receiving microwave signals. 10cm S-band (9 or 12ft aperture) or 3cm X-band (4, 6 or 8 ft aperture)
Anti-clutter	Removal of unwanted reflections on the radar screen caused by rain, sleet etc. (*see* Clutter).
Azimuth	The number of degrees from North (or other reference direction) that a line runs, measured clockwise.
ARCS	Admiralty Raster Chart Service. A service of British Admiralty, suppliers of electronic charts with world coverage, in the HCRF data format.
Azimuth Pulse	Azimuth (AZ): The number of degrees from North (or other reference direction) that a line runs, measured clockwise.

B

Backup Navigator Alarm	The Backup Navigator Alarm is affected by activating a commissioned PCIO relay output by way of an active alarm
BSB Electronic Charts	A supplier of raster-format electronic charts. Electronic charts based on the paper charts supplied by NOAA or CHS are available in the data format established by BSB.
Bulkhead Transceiver	Transmitter/Receiver mounted below decks with microwave or co-axial connection to the Turning Unit.

C

Chart Database	Structured collection of chart data sufficient for safe and efficient navigation on an ECDIS or Chart Radar system
Chart Format	The industry standard the defines the structure of a chart database (e.g. the ENC chart database uses the S-57 format)

C-MAP	C-Map Cartographic Service. Commercial supplier of vector-format navigational charts, which are not fully compliant with ECDIS standards as defined by IMO.
Consistent Common Reference Point (CCRP)	The CCRP is a location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge.
Checksum	A numeric value used to verify the integrity of a block of data. When data is transmitted from point to point in a packet, the sending computer counts the bytes and adds a check digit at the end of the packet. The receiving computer calculates the bytes received and compares the sender's count with the receiver's count to determine if there is any change that might indicate tampering with the information.
Clearing Lines	Clearing lines are bearing lines or range lines used to approximate a position where a danger to own ship lies.
Clutter	Unwanted reflections on a radar screen, commonly from rain, snow or sleet.
CM93v3	CMAP's proprietary and unofficial chart format.
Conning Info Display	A Conning Info Display (CID) page is a collection of numeric and graphical readouts (also known as CID elements) that display various types of information useful during navigation.
Cross-Track Error	The distance by which the ship's actual position deviates left or right from the Route Plan track.
Course-up	Stabilised display – the ship’s bearing is shown at the top of the video circle with 000° elsewhere on the circle (representing True North).

D

Datum	Any point, line, or surface used as a reference for a measurement of another quantity.
Dead Reckoning	A method of estimating the position of a ship without astronomical observations, as by applying to a previously determined position the course and distance traveled since.
Denso Paste	Soft brown petrolatum primer containing moisture-displacing corrosion-inhibiting compounds. Apply using a stiff brush or gloved hand.

DGPS	Differential GPS (see also GPS). Position sensor intended for precise commercial navigation in coastal waters. The DGPS employs an additional receiver for the reception of correction signals from a land-based transmitter to be applied to the satellite-based GPS position information.
Digitized Chart	A data format for electronic charts that are made using a digitizer device with paper navigational charts. On ships equipped to make digitized charts, these charts can be used for operating in areas for which electronic charts from official or commercial sources are not available. Digitized charts do not conform to any standards for chart display.
Display Unit	A Display Unit includes a Monitor, Processor and Control Panel.
Distance To Go (DTG)	Distance to next action, such as a turn, while running a Voyage Plan.
DnV	Det norske Veritas. Independent maritime organization performing classification, certification, quality-assurance and in-service inspection of ships and mobile offshore units with the objective of safeguarding life, property and the environment.
Dongle	A small hardware device that, when plugged into a computer, enables a specific program to run on that computer. The program is disabled, or operates in a degraded mode if the device is not present.
Dual Radar	A dual radar can connect to two scanner units at the same time, enabling the overlay of radar video from both scanners to form a composite display. Each radar video source is known as a ‘Channel'.
Dynamic Brake	Braking is accomplished by electrically switching motors to act as generators that convert motion into electricity instead of electricity into motion.

E

Electronic Bearing Line	An EBL control is used to show the relative or true bearing of a target on the display. The EBL is moved with the cursor, and the bearing is read of the screen in degrees. One end is always anchored, either at the center of the screen or at a operator-defined point on the video circle.
ECDIS	Electronic Chart Display and Information System. A standard of the International Maritime Organization (IMO), governing electronic navigational systems.

ENC	Electronic Nautical Chart. Chart data conforming to specification published in IHO Special Publication No. 57 (S57). Charts complying with this specification are available from various suppliers.
ENC (C-MAP)	Official S-57 encrypted charts converted to CMAP's proprietary chart database format.

F

Flyback Converter	Power supply switching circuit. During the first half of the switching period, the transistor is on and energy is stored in a transformer primary. During the second half period, this energy is transferred to the transformer secondary and the load.

G

Gain	The ratio of the signal output of a system to the signal input of the system expressed in dB. A gain of 10 would imply that the signal power had increased by a factor of 10. There are two general usages of the term in radar: (a) antenna gain (or gain factor) is the ratio of the power transmitted along the beam axis to that of an isotropic radiator transmitting the same total power; and (b) receiver gain (or video gain) is the amplification given a signal by the receiver.
GGA	NMEA sentence which provides the GPS current fix data.
Greenwich Mean Time (GMT)	The international time standard, based on local standard time at longitude 0º 0' 0" (in Greenwich, England). Also called Coordinated Universal Time (UTC).
Global Positioning System (GPS)	A system by which receivers anywhere on earth can obtain accurate position data. The term "GPS" is also used to refer to the receiver device.
Great Circle	A circle drawn around the Earth such that the center of the circle is at the center of the Earth. Following such a circle plots the shortest distance between any two points on the surface of the Earth.
Guard Zone	An adjustable zone around the vessel. Once a guard zone is set, any target that enters the guard zone will trigger an alarm.

H

H-264	A video coding format for defining the compression of audio and visual (AV) digital data.

Head-up (H UP)	Stabilised or Unstabilised display – the ship's heading marker is always shown vertically upwards indicating straight ahead movement.
HCRF	Hydrographic Chart Raster Format. Electronic format used for BA-ARCS charts.
Heading Line	Line that projects forward showing where own ship is headed relative to the targets seen on the video circle.
Heading Marker	A heading marker on the display provides an important reference to direction. When the antenna is pointing ahead, it sends a pulse to the radar display that causes a line to show on the screen that represents the vessel's head. You can refer echoes displayed on the screen to your vessel's head and get the relative bearing of the echo. If the heading marker is not pointing exactly ahead, relative bearings will be wrong. You can quickly check for any such mistake by heading toward a small prominent visible object and see if the radar echo appears under the heading marker.
Heatsink	Device used to conduct away and disperse the heat generated by electronic components.
HSC	Heading-to-Steer Command. Heading order sent to an autopilot from an external electronic navigation aid, such as the ECDIS.

I

International Hydrographic Office (IHO)	The IHO has developed an ENC product specification as the standard for ECDIS data, and has published this specification in its Special Publication No. 57 (S-57).
International Maritime Organization (IMO)	An agency of the United Nations, responsible for improving maritime safety and preventing pollution from ships. The governing body responsible for SOLAS regulations and ECDIS specifications.
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.
I/O Interface	The collection of components that define the hardware, protocols, and formats used to communicate with an interfaced device. This will include a set of I/O Ports (in most cases, this will be a set of one).
I/O Port	A logical channel through which data is transferred, which may handle protocols needed to pass the data, but functions with no cognizance of the meaning of the data involved. A common example is a serial (RS-232) communications port.

L

Local Time Offset	Offset between local time and UTC.
Lock-o-seal	Two piece seal element (rubber ‘O’-ring with a metal backup ring) designed specially for bolts, studs and other fasteners.
Lost Target	A target representing the last valid position of a target before its data was lost. The target is displayed by a "lost target" symbol.

M

Magnetron	Device that is comprised of an electric circuit inside a strong but variable magnetic field, designed to generate coherent microwaves.
Master Display	A Master Display has complete control over a Transceiver. A Transceiver can only have one Master Display. A Master Display can only have one Transceiver.
Modulator	A modulator is a circuit or device that combines two different signals in such a way that they can be pulled apart later.
Monitor	The viewing unit, a Flat Panel Monitor (FPD), also known as a LCD (Liquid Crystal Display).
MPEG-4	A video coding format for defining the compression of audio and visual (AV) digital data.
Multi-Function Workstation	A workstation that has been configured to be displayed in a number of presentation options (i.e. Chart Radar, ECDIS or CID).
Multi-Node system	A number of workstations, linked by a LAN, which have been configured as specific product types.
Multi-target Tote	A display panel showing details of multiple acquired targets.

N

NAVTEX	Enables access to coastal marine safety information transmitted from NAVTEX stations to ships with a NAVTEX receiver.
NIMA	National Imagery and Mapping Agency. An agency of the United States government, supplying navigational charts to the United States Navy.
Nautical mile (NM)	The nautical mile is closely related to the geographical mile which is defined as the length of one minute of arc on the earth's equator. By international agreement, the nautical mile is now defined as 1852 meters (1.15 standard miles).

National Marine Electronics Association (NMEA)	An association of manufacturers that has published widely used standards for navigation and other marine sensor communication. Their published standards include NMEA 0183, Standard for Interfacing Marine Electronic Navigational Devices, Version 1.5, December 1987, and Version 2.0, January 1992. This standard is commonly referred to as simply "NMEA 0183." The ECDIS is designed to use messages from any navigation, weather, or machinery sensor that conforms to this standard.
NOAA	National Oceanic and Atmospheric Administration. Agency of the US government, supplying navigational charts. NOAA charts are available in the BSB electronic format.
North-up (N UP)	Stabilised display – the bearing scale shows 000° at the top of the video circle (assumed to be True North). The ship's heading marker is shown at the appropriate bearing.

O

Opto-coupler	A component capable of optically transferring an electrical signal between two circuits and, at the same time, electrically isolating these circuits from each other. It consists of an infrared LED emitting section at its input, and a silicon photodetector, at its output, with other circuitry sometimes included as part of the device.

P

Parallel Index Lines	A set of parallel lines placed on the video circle to aid navigation.
Parity	An error-checking procedure in which the number of 1s must always be the same – either even or odd – for each group of bits transmitted without error.
Past Position Dots	Equally time-spaced past position marks of a tracked or reported target and own ship. The co-ordinates used to display past positions may be either relative or true.
PBN: Fuel Navigator	An optional feature that allows route optimisation, weather overlay location, and ship reporting data to be displayed on an ECDIS
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).
Product types	A small set of defined products, any one of which the VisionMaster application can function as. Product types apply to individual nodes.

Pulse Repetition Frequency	The number of radar pulses transmitted each second. The pulse transmission rate is automatically lengthened for longer ranges.

R

Random Access Memory	Memory used in computer systems. RAM is volatile memory, which does not hold data when the power is turned off
Range Rings	A set of concentric circles labeled by distance from the central point, useful for judging distance (especially from own ship).
Relative Motion – Relative Trails	Own ship is shown at a fixed point in the video circle (normally the centre). All target trails are shown relative to own ship’s movement. This means stationary targets will have trails if own ship is moving.
Relative Motion – True Trails	Own ship is shown at a fixed point in the video circle (usually the centre). Target trails show their direction. Staionary targets do not produce trails.
Resolver	A type of rotary electrical transformer that is used for measuring the angle of a rotating machine such as an antenna platform. The primary winding of the transformer, fixed to the rotor, is excited by a sinusoidal electric current, which by electromagnetic induction causes currents to flow in two secondary windings fixed at right angles to each other on the stator. The relative magnitudes of the two secondary currents are measured and used to determine the angle of the rotor relative to the stator.
Rhumb Line	A line on a sphere that cuts all meridians at the same angle; the path taken by a ship or plane that maintains a constant compass direction.
Route	A set of waypoints that define the intended path of travel.

S

S-band	The S-band, or 10 cm radar short-band, is the part of the microwave band of the electromagnetic spectrum ranging roughly from 1.55 to 5.2 GHz.
S57	Internationally accepted standard for electronic charts in the ENC vector-format. ENC data is standardized according to ECDIS specifications published in IHO Special Publication No. 57. Charts complying with this specification are available from various suppliers.
S57 PIN	Is used to generate a 16-character string which represents the encrypted hardware ID portion of the S-57 User Permit.

S63 Chart permit file	A file generated by the data manufacturer that is used, in conjunction with an S63 permit code to decrypt chart data for a particular set of ARCS charts or S57 cells.
S63 permit code	A code that identifies a license for using S57 charts. This is sometimes referred to as the S57 User Permit.
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.
System Electronic Navigational Chart (SENC)	SENC is a database resulting from the transformation of the ENC by ECDIS, updates to the ENC by appropriate means, and other data added by the mariner. It is this database that is accessed by ECDIS for the display generation and other navigational functions, and is the equivalent to an up-to-date paper chart. The SENC may also contain information from other sources.
Sentence	A self contained line of data
SevenCs	A chart engine format
Slave Display	Display that is used to observe a radar image. It has limited functionality.
Sleeping Target	A target symbol indicating the presence and orientation of a vessel equipped with AIS in a certain location. No additional information is presented until activated thus avoiding information overload.
SOLAS	Safety of Life At Sea. A set of conventions adopted by the IMO and all of its signatory countries in 1974. These conventions regulate many of the features of ships used in international trade, including navigation equipment and its functionality
Sperry security block	A dongle used to identify a VM system (through a PIN), and identify permits for charts that are licensed on a system-by-system basis.
Standard Display (STD)	The standard set of chart objects (buoy information, conspicuous landmarks, etc.) specified for ECDIS display, in compliance with IMO standards.
Stern Line (SL)	A line, drawn across the video circle, showing the stern's direction. A stern line can be useful when ownship is backing into port or harbour.
Synchro	A motorlike device containing a rotor and a stator and capable of converting an angular position into an electrical signal, or an electrical signal into an angular position.
System PIN	Personal Identification Number that uniquely identifies a system.

T

TotalTide	Enables VisionMaster to obtain tidal data from the UKHO TotalTide application, including the ability to view tide heights and tidal currents from tidal stations around the world.
Target	Object of interest on a radar display. Targets can be labelled (acquired) and tracked.
Trial Manoeuvre	Facility used to assist the operator to perform a proposed manoeuvre for navigation and collision avoidance purposes, by displaying the predicted future status of all tracked and AIS targets as a result of own ship's simulated manoeuvres.
Trigger PCB	A control board housed in the Transceiver. It controls the Modulator, Magnetron and sends signals to the Display to indicate when the magnetron has fired a pulse.
True Motion	Own ship moves across the video circle. Stationary targets do not produce trails.
TTMG	Track To Make Good. In the context of the ECDIS, TTMG denotes a temporary plan which may be activated at any time, and which by default consists of a 500 nm track line on present heading.
Turning Unit	Contains the Antenna rotation motor, the microwave rotary joint, and may contain an integral Transceiver.

U

Universal Time Coordinated (UTC)	The international standard of time, kept by atomic clocks around the world. Formerly known as Greenwich Mean Time (GMT), local time at zero degrees longitude at the Greenwich Observatory, England. UTC uses a 24-hour clock.

V

Variable Range Marker	An adjustable range ring used to measure the distance to a target. When the VRM is adjusted over the leading edge of a return with the cursor control, the distance to the object is shown on the screen.
Vector	Direct connection between two points, either given as two sets of coordinates (points), by direction and distance from one given set of coordinates (True Vector), or a point in a vector space defined by one set of coordinates relative to the origin of a coordinate system (Relative Vector).
Video Circle	The area on the Display that shows the radar image.
Vigilance Alarm	A system alarm generated when the operator fails to give evidence of fitness.

W

Watch Alarm	The purpose of a watch alarm system is to monitor bridge activity and detect operator disability which could lead to marine accidents. The system monitors the awareness of the Officer of the Watch (OOW) and automatically alerts the Master or another qualified OOW if for any reason the OOW becomes incapable of performing theOOW's duties. This purpose is achieved by a series of indications and alarms to alert first the OOW and, if he is not responding, then to alert the Master or another qualified OOW. Additionally, the watch alarm may provide the OOW with a means of calling for immediate assistance if required. The watch alarm should be operational whenever the ship's heading or track control system is engaged, unless inhibited by the Master.
Waveguide	Hollow rectangular, oval or round tube used to convey microwave RF energy from one point to another in a radar transmitter or receiver.
Waypoint	A geographical location (for example, latitude and longitude) on a route indicating a significant event on a vessel's planned route (for example, course alteration point, calling in point, etc.).
WGS-84	World Geodetic System 1984. Chart datum specified in accordance with the IMO ECDIS standard.
Wheel-over	The geographic location, represented by a line where rudder movement should be activated to accomplish a planned turn. The wheel-over line may be displayed perpendicular to the approaching track or parallel to the departing track of each turn.
Wobbulation	Low frequency modulation of the Pulse Repition Frequency (PRF) to help suppress interference.

X

X-band	The X-band (3 cm radar spot-band) of the microwave band of the electromagnetic spectrum roughly ranges from 5.2–10.9 GHz. The relative short wavelength at X-band frequencies makes possible high-resolution imaging radars for target identification and target discrimination.

Glossary of Abbreviations

Symbols

μA	Microamp (0.000001 amps)
μs	Microsecond (0.000001 seconds)
Ω	Ohms
ϕ	Phase

A

A	Ampere
AC	Alternating Current
ADC	Analog to Digital Converter
AFC	Automatic Frequency Control (fine tuning)
AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid – a system wherein radar targets are automatically acquired and tracked and collision situations computer assessed and warnings given.
AZ	Acquisition Zone

B

BA	British Admiralty.
BCR	Bow Crossing Range
BCT	Bow Crossing Time
BIST	Built-In Self-Test
BITE	Built-In Test Equipment
BSH	German Federal Maritime and Hydrographic Agency (BSH) that provide type approval to EC Council Directives

C

CAM	Central Alarm Manager
CD ROM	Compact Disk Read-Only Memory
CDX	Control differential transmitter
CHS	Canadian Hydrographic Service
COG	Course Over Ground
CPA	Closest Point of Approach [to own ship]

C UP	Course-up
CRT	Constant Radius Turn
CSE	CourSE [through water]
CX	Control transmitter
D	
dB	Decibel.
DC	Direct Current
E	
EBL	Electronic Bearing Line
EMC	Electromagnetic Compatibility
EPA	Electronic Plotting Aid
ERBL	Electronic Range and Bearing Line
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
F	
ft	Foot or feet
FPD	Flat Panel Display
G	
GMT	Greenwich Mean Time
GPS	Global Positioning System
GZ	Guard Zone
H	
HDG	Heading
HL	Heading Line
HO	Hydrographic Office.
H UP	Head-up
Hz	Hertz (unit of Frequency)
HT	High tension (meaning high voltage)
I	
in	Inch

I/O	Input/Output
K	
Km	Kilometre
kt	Knot (one nautical mile per hour – 1.15 mph)
kV	Kilovolt (1000 Volts)
kW	Kilowatt (1000 Watts)
L	
LAN	Local-Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNFE	Low Noise Front End
LP	Long Pulse (available from 3 NM and upwards)
M	
m	Metre
mA	Milliamp (0.001 Amps)
MHz	Megahertz (1000000 Hertz)
MIS TRIG OUT	Mutual Interference Suppression Trigger Out – trigger used to suppress the video for 12µs to inhibit interference from other radars.
MMSI	Maritime Mobile Service Identity
MOB	Man overboard
Mod Trigger	Modulator Trigger
MP	Medium Pulse (available in the 0.5 NM to 24 NM range)
N	
NDI	Nautical Data International. Licensed distributor of CHS charts in the BSB electronic format.
NM	Nautical Mile
NMEA	National Marine Electronic Association
NNF	Not Normally Fitted
ns	nanosecond (0.000000001 seconds)
N UP	North-up

P

PCB	Printed Circuit Board
PCIO	PC Imput/Output
PEU	Processor Electronics Unit
PFC	Power Factor Correction
PFN	Pulse Forming Network
PIP	Picture In Picture (Video mode)
PM	Performance Monitor
PPI	Plan Position Indicator
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
PSU	Power Supply Unit

R

RAIM	Receiver Autonomous Integrity Monitoring
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RM(R)	Relative Motion – Relative Trails
rms	Root mean square (AC voltage that equals DC voltage that will do the same amount of work)
RM(T)	Relative Motion – True Trails
RNS	Raster Navigational Chart
ROT	Rate of Turn
rpm	Revolutions per minute
RR	Range Rings
RVAP	Radio Video Adaptive Processor

S

SART	Search and Rescue Transponder
SCU	Scanner Control Unit
SIC	Station In Control
SL	Stern Line

sm	Statute mile – A mile as measured on land, 5,280 feet or 1.6 kilometers. Distances at sea are measured in nautical miles.
SOG	Speed Over the Ground
SP	Short Pulse (available below 3 NM)
STW	Speed Through Water
T	
T BRG	Target Bearing/True Bearing
TCPA	Time to Closest Point of Approach [to own ship]
TLB	Target Label
TM	True Motion
TRP	Temporary Route Plan
TTD	Tracked Target Data
TTG	Time To Go. Time to next action, such as a turn, while running a Route Plan.
TTM	Tracked Target Message
Tx/Rx	Transmitter/Receiver (Transceiver)
TX BIST	Transceiver Built-In Self Test
TX COMMS	Transceiver Communications
U	
UTC	Universal Time Coordinated
V	
V	Volt
VA	Volt amperes
VMS	Voyage Management System
VRM	Variable Range Marker
W	
W	Watts
X	
XTE	Cross-Track Error

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