SIMRAD

PRO SERIES

ARGUS RADAR X-Band

Technical User Manual

ENGLISH

ARGUS RADAR

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RECORD OF CHANGES

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OVERVIEW OF CHAPTERS

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WARNINGS

IMPORTANT NOTE
For correct operation, please, read this instruction manual carefully before operating the equipment.

HIGH VOLTAGE

Radar equipment includes areas with high voltage, which can cause injury or loss of life. Danger exists only when the units are opened, exposing internal circuits. You do not face any danger during normal operation. The ARGUS X-Band Radar System has been carefully designed to protect personnel from possible injury from high voltages at normal operation.

When inspecting or servicing the equipment, nevertheless, it is recommended that the Line Switch is left open, as an added protection.

As every effort has been made to eliminate danger to personnel, no responsibility is accepted for any injury or loss of life suffered in connection with the equipment.

RADIO-FREQUENCY RADIATION

Harmful effects (particularly to the eyes) may be caused by exposure of any part of the human body to radio-frequency power densities. Hazard distances at which power densities of 100 W/m², 50 W/m² and 10 W/m² exist, are given in the following table:

Configuration	Distance to 100 W/ m² point [m]	Distance to 50 W/ m² point [m]	Distance to 10 W/ m² point [m]
12 kW Transceiver + 6' X-Band Antenna	-	0,15	0,6
12 kW Transceiver + 9' X-Band Antenna	-	-	0,5
12 kW Transceiver + 12' X-Band Antenna	-	-	0,35
25 kW Transceiver + 6' X-Band Antenna	0,1	0,2	1,3
25 kW Transceiver + 9' X-Band Antenna	-	0,1	1,0
25 kW Transceiver + 12' X-Band Antenna	-	0,05	0,9

Note: 12 KW transceiver: SRT/12-002 - SRT/12-003.

25 KW transceiver: SRT/25-002 - SRT/25-003 or SRT/PED-001

The system, however, is designed to always disable the microwave radiation when the antenna is not rotating.

The pedestals have also been prepared for the installation of an external safety switch, which can be mounted on, or near the platform. This switch disconnects the power from the Pedestal eliminating the possibility of accidental operation during servicing.

Whenever it is necessary to disconnect the waveguide system from a radar transmitter for maintenance purpose, the transmitter output should be terminated in a matched load, when possible. If this is not possible, care should be taken to avoid standing in front of an open-ended waveguide from which power is being radiated.

NEVER look down a waveguide from which power is being radiated.

X-RAY RADIATION

This unit does not generate X-RAY radiation.

SAFETY SWITCH

The Radar Unit is provided with a safety switch, which disables the antenna movement during maintenance and avoids high voltage damage. Always turn the safety switch off, whenever advised in this manual (for instance, before performing any maintenance or installation procedure). Ignoring safety switch operation may produce hazard of electrocution as well as other severe injuries.

SAFETY PRECAUTIONS

Purpose

Safety precautions described in this paragraph are applicable to the ARGUS X-Band Radar System. Depending upon the type of advice, the following attention signs are used in the technical manual:

DANGER

IF THIS OPERATING PROCEDURE, MAINTENANCE PROCEDURE, PRACTICE, CONDITION OR STATEMENT IS NOT STRICTLY FOLLOWED, IT COULD RESULT IN SEVERE INJURY OR DEATH OF PERSONNEL

WARNING

IF THIS IS OPERATING PROCEDURE, MAINTENANCE PROCEDURE, PRACTICE, CONDITION OR STATEMENT IS NOT STRICTLY FOLLOWED, IT COULD RESULT IN DAMAGE, OR DESTRUCTION OF UNIT, OR LOSS OF EMISSION EFFECTIVENESS.

CAUTION

IF THIS IS OPERATING PROCEDURE, MAINTENANCE PROCEDURE, PRACTICE, CONDITION OR STATEMENT IS NOT STRICTLY FOLLOWED, IT COULD RESULT IN INJURY OF PERSONNEL OR PROPERTY DAMAGE .

NOTE

Advice of an essential operating procedure, maintenance procedure, condition or statement, which must be followed.

Whenever a precaution relating specific part of the technical manual is needed, precaution information is given in the relevant part of the manual. Warning and Caution Signs precede applicable text.

Safety Operations

During normal operation (unit closed), the unit can be quickly disconnected from the main power line, switching OFF the main circuit breaker located on the electric switchboard.

During maintenance (unit opened), it is possible to turn on the unit, by linking P1 on SRT Power Board (Chapter 9, Figure 9.1.10, pos. 1). This link forces the unit main power to be ON. During normal operation P1 on SRT Power Board must be OPEN.

NOTE

The main power line is always present on the terminal board

Safety Summary

The following general safety precautions are not related to any specific procedure and therefore do not appear elsewhere in this technical manual. These are recommended precautions that all personnel must understand and apply during all phases of operation and maintenance.

KEEP AWAY FROM ANY LIVE CIRCUITS!
(Do not touch any circuits during operation!)

Operating personnel must at all times observe all safety regulations.

Do not replace components or make adjustments inside the unit with the high voltage supply turned ON. Under certain conditions, dangerous potentials may exist even when the power breaker is in OFF position, due to charges retained on capacitors. To avoid danger and casualties, always remove power and discharge to ground a high voltage circuit before touching it!

DO NOT SERVICE OR ADJUST BY YOURSELF!

Under no circumstances should any person initiate servicing or adjusting the unit except in the presence of authorized personnel.

RESUSCITATION

Personnel working with or near high voltage should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery or equivalent.

Warning Information

The following warning signs appear in this technical manual. To point out their importance, they are repeated here for emphasis:

WARNING

USE EXTREME CARE WHEN WORKING ON THE UNIT ONCE THE COVER HAS BEEN OPENED. THE MAGNETRON ASSEMBLY OPERATES AT HIGH VOLTAGES THAT MAY CAUSE FATAL INJURIES

WARNING

BE AWARE OF HIGH VOLTAGE CAPACITORS! IT IS NECESSARY TO SHORT-CIRCUIT THEIR LEADS BEFORE PERFORMING ANY MAINTENANCE ACTION ON THEM.

WARNING

ON THE ELECTRIC SWITCHBOARD, SET THE POWER BREAKER DEDICATED TO THE PRESENT EQUIPMENT TO “OFF”, AND ATTACH A SIGN, READING: “WORK IN PROGRESS! DO NOT SWITCH ON! ”

WARNING

USE EXTREME CARE, WHEN WORKING ON THE EQUIPMENT, ONCE THE UNIT HAS BEEN OPENED. THE MAGNETRON ASSEMBLY OPERATES AT HIGH VOLTAGES THAT MAY CAUSE FATAL INJURIES!

WARNING

SET MAIN LINE BREAKER TO OFF BEFORE REPLACING ANY FUSE. FUSES ARE AT VOLTAGE LEVELS, WHICH MAY CAUSE FATAL INJURIES!

CHAPTER 1
DESCRIPTION AND MAIN CHARACTERISTICS

1.1 Introduction

1.1.1 Manual Applicability

The present technical manual provides information, data, and procedures relevant to general description, operation, functional description, scheduled maintenance, troubleshooting, corrective maintenance and replaceable parts list of the ARGUS X-Band RADAR scanners consisting of 12 kW or 25 kW pedestal and 6, 9, or 12 feet antenna.

For brevity of description, reference to the equipment in this manual, can also be made by means of the Manufacturer code name:

ARGUS X-Band RADAR SYSTEMS with 12 or 25 kW Pedestal with 6, 9, or 12 Feet Antennas (Chapter 9,.Figure 9.1.4 pos. 8).

The contents of the present technical manual are arranged in 10 Chapters as follows:

1.1.2 The purpose of the equipment (scanner)

The ARGUS X-Band Radar scanners, when connected to a Core Unit (not described in this manual), performs the following functions:

- It receives the radar control signals from the Core Unit.
- It generates and receives the RF pulses.
- It processes the RF pulses.
- It sends the radar data and control signals to the Core Unit.

The equipment's power supply, 48 VDC comes from the Core Unit or from the SRT Adapter Box from the Ship Main Line.

1.1.3 List of Abbreviations

All measurement abbreviations are according to the MIL STD-12. Other terms and abbreviations, used in the manual are listed in Table 1.1.1 - List of abbreviations.

Table 1.1.1 - List of abbreviations

ABBREVIATION	MEANING
AC	Alternating Current
AZ	Antenna Azimuth Pulse
dB	Decibel
dBm	Decibel referred to 1 milli-Watt
DC	Direct Current
HL	Heading Line
HV	High Voltage
IF	Intermediate Frequency
LED	Light Emitting Diode
LO	Local Oscillator
LNFE	Low Noise Front End
LV	Low Voltage
MTBF	Mean Time Between Failures
MDS	Minimum Detectable Signal
PRF	Pulse Repetition Frequency
TXRX	Radar Transceiver
RF	Radio Frequency
RC	Resistor - Capacitor
RPM	Revolution per Minute
STC	Sensitivity Time Control
TTL	Transistor-Transistor Logic
VCO	Voltage Controlled Oscillator
WG	Waveguide

1.2 Configuration Table

Pedestal	Antenna	Transceiver	Output Power	Rotational Speed
Argus 12U	6 Ft. X P	Included in Pedestal	12 KW	Standard
Argus 12U	9 Ft. X P	Included in Pedestal	12 KW	Standard
Argus 12U	12 Ft. X P	Included in Pedestal	12 KW	Standard
Argus 25U	6 Ft. X P	Included in Pedestal	25 KW	Standard
Argus 25U	9 Ft. X P	Included in Pedestal	25 KW	Standard
Argus 25U	12 Ft. X P	Included in Pedestal	25 KW	Standard
Argus 12U	6 Ft. X P	Included in Pedestal	12 KW	HSC
Argus 12U	9 Ft. X P	Included in Pedestal	12 KW	HSC
Argus 25U	6 Ft. X P	Included in Pedestal	25 KW	HSC
Argus 25U	9 Ft. X P	Included in Pedestal	25 KW	HSC
SRT/PED-001	ANT6X-001	09N-009	25 KW	Standard
SRT/PED-001	ANT9X-001	09N-009	25 KW	Standard
SRT/PED-001	ANT12X-001	09N-009	25 KW	Standard
SRT/PED-002	ANT6X-001	09N-009	25 KW	HSC
SRT/PED-002	ANT9X-001	09N-009	25 KW	HSC

1.3 Physical Description

The Small Radar Transceiver - SRT 12 and 25 kW ARGUS X-Band Radar scanner is composed of (Figure 9.1.2):

- The Antenna: 6, 9 or 12 feet (Figure 9.1.2, pos. 3)
- The Pedestal: 12 or 25 kW (Figure 9.1.2, pos. 2)
- Optional equipment: Heater, Encoder, SRT Adapter Box

All units are designed for maximum resistance to the severe environmental conditions in which they are to operate.

Table 1.3.1- Equipment, Accessories and Documents Supplied

Description	Configuration	Code	Width (mm)	Height (mm)	Depth (mm)	Weight (Kg)
SRT 12 or 25 kW X-Band Radar System	Upmast	SRT/12-002 / SRT/12-003 or SRT/25-002 / SRT/25-003	**364***	**391***	**546**	**35***
	with Antenna	ANT6X-001 (**) or ANT9X-001 (***) or ANT12X-001 (````)	**1800**** **2650***** **3618****	**466**** **466***** **466****		**40**** **44***** **49****
Technical manual		988-10186-003	N.A.	N.A.	N.A.	N.A.

- (*) Without Antenna
- (**) With 6´ Antenna
- (***) With 9´ Antenna

  (````) With 12´ Antenna

1.3.1 Antenna

The Antennas available are:

- 6 feet: X-band - 9 feet: X-band
- 12 feet: X-band (tested only to IEC 60945)

The Antenna (Figure 9.1.2 pos. 3) is fixed to the Pedestal (Figure 9.1.2 pos. 1) by means of four (4) screws (Figure 9.1.2 pos. 1)

The antenna consists of

- end feeded slotted waveguide of 6, 9, or 12 feet lengths
- a waveguide feeding the slotted waveguide from the rotary joint. The connection to the rotary joint is through a choke flange without screws
- a polarisator to radiate only in horizontal polarization
- an antenna horn consisting of upper and lower side to form the vertical beam
- A plastic external cover for weather protection

The antenna is mounted on the pedestal by the antenna support structure with 4 screws. This support structure makes the antenna more rigid against wind and vibration.

1.3.2 Pedestal

The Pedestal cabinet (Figure 9.1.3 pos. 1), is cast aluminum, treated with anticorrosive paint to make it saline atmosphere resistant. The cabinet has a cover (Figure 9.1.4 pos. 2) fixed to the cabinet by four screws (Figure 9.1.4 pos. 1); the hinged cover can be opened to allow easy access to the internal components.

At the hinged end of the cabinet (Figure 9.1.3 pos. 2), the following items are located:

- the screw for connecting the Unit to the ship's ground/structure (Figure 9.1.4 pos. 4)
- the main connector (Figure 9.1.4 pos. 3) for the connecting cable to the Core Unit.

When the cover is open, it is possible to access the following internal parts (Figure 9.1.4):

- Connecting Terminal Board
- Electronics Rack (Figure 9.1.4 pos. 4)
- Brushless Motor Controller (Figure 9.1.4 pos. 5)
- Motor Unit (Figure 9.1.4 pos. 6)
- RF Head (Figure 9.1.28)

1.3.2.1 Main Connector

The Main Connector (Figure 9.1.3 pos. 3), is mounted at the bottom of the Pedestal cabinet (Figure 9.1.3 pos. 1). This main connector allows the connection between the Core Unit (or the optional SRT Adapter Box), and the Pedestal Unit (including the Motor Unit and Electronics Rack).

On the Main Connector the following signals can be located:

- Combined Video,
- Power supply,
- Safety Switch.

1.3.2.2 SRT Electronics parts

The ARGUS X-BAND RADAR Pedestal contains advanced high speed electronic circuits for transmission, reception and processing the RF echoes.

Table 1.3.2 – SRT X-Band 12 and 25 kW Composition lists the main assemblies of the unit and their position inside the cabinet.

Table 1.3.2 – SRT X-Band 12 and 25 kW Composition

DESCRIPTION	POSITION
RF HEAD	Chapter 9, Figure 9.1.4, pos. 7
Electronic Rack	Chapter 9, Figure 9.1.4, pos. 4
Bearing Reader Board	Chapter 9, Figure 9.1.30, pos. 2
Brushless motor controller Board	Chapter 9, Figure 9.1.4, pos. 5
Brushless motor	Chapter 9, Figure 9.1.4, pos. 6

Table 1.3.3 - RF HEAD

DESCRIPTION	POSITION
Magnetron	Chapter 9, Figure 9.1.27, pos. 1
Circulator	Chapter 9, Figure 9.1.28, pos. 4
Limiter	Chapter 9, Figure 9.1.28, pos. 2
RF_Amplifier Assy	Chapter 9, Figure 9.1.28, pos. 1
Noise Diode	Chapter 9, Figure 9.1.28, pos. 3
Power Diode	Chapter 9, Figure 9.1.28, pos. 5

Table 1.3.4 - Electronics Rack

DESCRIPTION	POSITION
SRT_Control	Chapter 9, Figure 9.1.6, pos. 2
SRT_MOS	Chapter 9, Figure 9.1.6, pos. 3
SRT_Power	Chapter 9, Figure 9.1.6, pos. 1

The Electronics Rack is connected to:

- the Bearing Reader Board Read-out by a connector (Figure 9.1.17 pos. 2) on the SRT Control Board.
- the Brushless Motor Controller Board (Figure 9.1.17 pos. 3).
- the RF HEAD (Figure 9.1.17 pos. 4 and Figure 9.1.15 pos. 1)
- the Display Unit, through the Main Connector (Figure 9.1.3 pos. 3).

1.3.2.3 Motoreducer Assy

The Motoreducer Assy is composed of (Figure 9.1.5):

- the Motor unit (Figure 9.1.5 pos. 1) provides power for the antenna rotation
- the Gearbox (Figure 9.1.5 pos. 2) reduces the motor speed and increases torque
- the final gear (Figure 9.1.5 pos. 3) transfers the motion provided by the Gearbox to the Antenna
- the Optical Read-out (Figure 9.1.30, pos. 2) generates the Heading Line (HL) pulse and the pulses indicating the Antenna position (AZ)
- the Rotary Joint Figure 9.1.31, pos. 1) connects the Waveguide of the Antenna to the internal one
- The Motoreducer Assy is connected to the Brushless Controller by means of a cables provided with connectors for the Electric Motor supply and a cable provided with connector for the Optical Read-Out signals.

1.4 Functional Description

The SRT 12 kW and 25 kW X-BAND Radar scanners are divided into a Receiver and a Transmitter section, both connected to a solid state controlled modular RF HEAD.

The Transmitter generates the RF energy in the X-Band range and pulses modulated with a peak power of 12 or 25 kW. The length and PRF of the pulses are in accordance with the range scale selected. The transmission pulses can be: Short, Medium and Long.

The Receiver enables reception of echoes and subsequent amplification in the RF Head (Figure 9.1.4 pos 7).

The Electronics Rack unit also includes power supply circuits for the various functions (Figure 9.1.9).

The function of the Antenna unit is to:

1) Transmit the RF pulses within the specified (see Table 1.4.1) vertical and horizontal lobes with horizontal polarization.
2) Receive the reflected R.F. echo signals and guide them towards the RF HEAD.

1.5 Technical Characteristics

In Table 1.4.1. the Technical Data Sheet of the ARGUS X-Band Radar scanners with 12 and 25 kW pedestal and 6, 9, and 12 feet antennas are given:

Table 1.4.1. ARGUS X-Band Radar scanners technical Data Sheet:

	1 General Description
	In this configuration a sturdy and splash proof antenna pedestal houses the following sub-assemblies: • Built-in, X-band, solid state controlled Transceiver • Transceiver DC Power Supply and external AC/DC converter box • Antenna Motoreducer Assy • High performance plastic gear wheel • RF rotary joint • Proximity switch for antenna data transmission (azimuth and heading line) or encoder with 1024 pulses • End Feed Slotted Waveguide antenna type • Selectable antenna rotation speed The interface with the radar console is through a single connector and it is not necessary to open the transceiver cabinet during installation. All analog adjustments are made remotely from the Argus console. The pedestal with built-in 12 kW or 25 kW transceiver supports 6´/ 9´/ 12´ antennas. Both Transceiver and motor are powered from a 48 VDC supplied from the core unit, an external transformer is required for 115/220 VAC 50/60 Hz power supply The Transceiver features new compact electronics with a high integration level derived from a well-tested design. Main features: • Modular and solid state construction • Electronic Modulator based on MOSFET technology; • Long life 3rd/4rth generation magnetron (10/12 kW and 25 kW) • Low Noise Amplifier providing a reduced overall Noise Figure (4.0 dB nominal) • Microcomputer controlled operations • Serial link with telemetry and remote control for adjustments • Built-in test facilities for power supply and modulator parameters • PRF jittering removing any possible ambiguity due to multiple-time-around echoes
	• Two different Blanking Sectors to be set at time of installation • Performance Monitor • Rotation: 20 and 40 RPM selectable

2. Antenna & Driver - Technical Specifications			
Antenna model	**6X**	**9X**	**12X**
Antenna Unit Type I/N	6 ft. X P	9 ft. X P	12 ft. X P
Driver & Transceiver I/N	SRT/12-002 SRT/25-002 SRT/12-003 SRT/25-003	SRT/12-002 SRT/25-002 SRT/12-003 SRT/25-003	SRT/12-002 SRT/25-002
Antenna type	End-feed-slotted wave guide		
Antenna length (feet / cm)	6' / 180	9' / 265	12' / 362
Antenna swing circle (cm)	180	265	362
Frequency (MHz)	9325 - 9425		
Polarization	Horizontal		
Gain (dB)	29	31	32,5
Horizontal beam width at -3 dB	1,35°	0,9°	0,7°
Vertical beam width at -3 dB	22°	22°	22°
Horizontal side lobes ('dB):			
- within 10°	- 27	- 26	- 26
- outside 10°	- 30	- 30	- 30
VSWR	Better than 1.20		
PPR	128 / 1024 with encoder		
Nominal Rotation speed (RPM)	> 40		> 20
Nominal Wind resistance (KT)	100		

3. X-Band Transceiver - Technical Specifications		
Nominal peak power (KW):	**12/10 (*)**	**25**
Transceiver I/N:	Argus 12U	Argus 25U
Operating frequency (MHz):	9375 ± 30 or 9410 ± 30 (X Band)	
Pulse length (nsec.):	60 - 250 - 800	
PRF (Hz):	3000-1500-750	
Modulator:	MOSFET Solid state	
IF amplifier:	Logarithmic	
IF dynamic (dB)	100 (+30 pre STC)	
IF center frequency (MHz)	60	
IF bandwidth (MHz): - short pulse - medium pulse - long pulse	 20 4,8 1,5	
Overall noise figure (nominal dB)	≤ 5	
MDS on long pulse (dBm)	≤ -110	
- Overall at receiver level	≤ -100	
- At IF level	≤ -110	

(*) EEV 4^{rth} generation magnetron is 10.5 kW, NJRC is 12 kW

4. Environmental features	
Operating temperature	-25°C / +55°C As in IEC 60945
Storage temperature	-25°C / +70°C As in IEC 60945
Relative humidity	Up to 95% at +40° As for IEC 60945
Vibrations	As for IEC 60945
Water proof according to	IP 66
Wind resistance (KT)	100

5. Dimensions (mm)	
Width	364
Depth	546
Height	391

6. Weights (kg)			
Antennas (6X / 9X / 12X)	5	9	14
Pedestal with Transceiver	35		

7. Required Power Supply	
Standard configuration	24 VDC or 115/220 VAC
Power consumption:	Ca 350 W Peak at maximum wind load

8. Options	
Different PRF set	Upon Customer request
Heaters	For very cold environments (< -25° C)
Encoder 1024 pulses	Upon Customer request

CHAPTER 2
OPERATION

2.1 Introduction

2.1.1 Purpose

The present chapter provides the operating instructions, information and procedures required in order to enable operating personnel to efficiently and effectively operate the ARGUS X-BAND Radar System.

The Chapter is divided into:

Paragraph 2.2 Controls and Indicators
Paragraph 2.3 Semi-operative Controls

The Unit does not require personnel on steady watch conditions, but requires general monitoring during normal operating conditions. Since the unit has no operating controls, paragraph 2.2 is not applicable. All semi-operative controls are located inside the unit.

2.2 Controls and Indicators

Since the unit has no operating controls, this paragraph is not applicable.

2.3 Semi-operative Controls

The unit is fitted with some semi-operative controls, which are accessible, when the unit is open.

Table 2.3.1 - Semi-Operative Controls Location of TXRX Cabinet

Fig.	Pos.	Code (Ref. Assy)	Type	Function
Figure 9.1.4	9	S1 (Electronics Rack)	Interlock	TXRX cover interlock switch for disabling the High Voltage generation

Table 2.3.2 - Semi-Operative Controls Location of Electronic Rack

Fig.	Pos.	Code	Type	Function
Figure 9.1.17	5	S1	10 position rotary switch	It selects the TXRX unit operation mode as follow: Pos. Function 0 SRT under external control 1 1 SRT under external control 2 2 SRT in local stand-by 3 SRT in local with short pulse 4 SRT in local with medium pulse 5 SRT in local with long pulse 9 SRT in local with long pulse and performance monitor with auto tuning and antenna rotation
Figure 9.1.10	2	DL1	LED green	+24 VDC OK
Figure 9.1.10	3	DL2	LED green	+5 VDC OK
Figure 9.1.10	4	DL3	LED red	High Voltage OK

Table 2.3.3 - Semi-Operative Controls Location of Brushless Motor Controller

Fig.	Pos.	Code	Type	Function
Figure 9.1.32	1	DL1	LED green	+50 VDC OK
Figure 9.1.32	2	DL2	LED red	It indicates the status of the controller: Light on = motor in OFF or controller in protection Light off = motor in rotation

2.4 I/O Requirements

In this paragraph are reported the minimum and maximum values of input and output related to the Argus X-Band Radar System. The table has been divided into 3 columns:

- **SIGNAL NAME**: Type of Signal analyzed;
- **TYPE**: Identifies the type of signal being analyzed;
- **DESCRIPTION TYPE**: Reference values that should appear during the measurement (in case of correct operation).
-

Table 2.4.1 I/O Requirements (for Upmast configuration)

Signal name	Type	Description type
VDOUT	POLARITY	Positive
	AMPLITUDE	1 to 4 Vpp adjustable
	LOAD	Terminated 75 Ω (always present on PCB)
	BANDWIDTH	2 - 5 - 24 MHz (-3 db)
	DC LEVEL	0 V
TROUT	POLARITY	Positive
	AMPLITUDE	TTL to 8 V
	LOAD	Terminated 75 Ω (always present on PCB)
	PRF	3000 – 1500 – 750 Hz
	PULSE WIDTH	1,28 µS (min.)
	FUNCTIONALITY	Trigger point at low-to-high transition
	RISE TIME	≤ 180ns (10-90 %)
Programmable pretrigger output: PTROUT	POLARITY	Positive
	AMPLITUDE	TTL @ 50 Ω / @ 75 Ω 0 ÷ 15v @ ∞ (high impedence)
	LOAD	50 Ω to ∞
	PULSE WIDTH	640 ÷ 10240 ns
	PULSE ADVANCE	0 ÷ 40 µs
	RISE TIME	≤ 180ns (10-90 %)
Serial interface: SEROUT / TX ± SERIN	SIGNAL STANDARD	RS232 terminated 3 KΩ RS422 terminated 120 Ω (selectable) Baud rate 4800
Position data: ACP ACPIN	AMPLITUDE	4 to 11 V high level 128/1024/4096 pulses per antenna revolution
	LOAD	Load: ≥ 2 kΩ
	PULSE WIDTH	> 80 µs
ANTENNA reference: ARP ARPIN	AMPLITUDE	4 to 11 V high level One pulse for revolution
	LOAD	≥ 2 KΩ
	PULSE WIDTH	> 80 µs
Antenna start: ANTS	LOAD	Open collector output 100mA Antenna rotating when ANTS is shorted to ground
Position data: UA1 / NUA1	AMPLITUDE	RS 422 balanced output

Signal name	Type	Description type
Antenna reference: UA0 / NUAO	AMPLITUDE	RS 422 balanced output
Power on: PWON	AMPLITUDE	From 3 V to 30 V to power up transceiver electronics
Antenna speed control: SPD	AMPLITUDE:	From 2V to 5V

2.5 NMEA Transfer Protocol

2.5.1 Abbreviations

RDC **Radar Display Console**
TXRX **Transceiver (TX/RX)**
CRC **Checksum Field**

Field Type

Field type	*Symbol*	*Definition*
Status	A	A = Yes, data valid, warning flag clear. V = No, data invalid, warning flag set.
Variable Numbers	x.x	Variable length integer or floating numeric field. Optional leading and trailing zeros. The decimal point and associated decimal fraction are optional if full resolution is not required (example: 73.10 = 73.1 = 073.1 = 73).
Fixed HEX field	hh-	Fixed length HEX number only, MSB on the left.
Variable text	c—c	Variable length valid character field.
Fixed alpha field	aa-	Fixed length field of upper-case or lower-case alpha characters.
Fixed number field	xx-	Fixed length field of numeric characters.
Fixed text field	cc-	Fixed length of valid characters.

- NOTE ¹ Spaces shall only be used in variable text fields.
- NOTE ² A negative SIGN "-" (HEX 2D) is the first character in a field if the value is negative. When used, this increases the specified size of fixed length fields by one. The sign is omitted if the value is positive.

2.5.2 DATA TRANSMISSION FROM RDC TO TXRX (OR INTERFACES)

2.5.2.1 OPERATIONAL CONTROL SENTENCE 2

$PCO2,x,a,aa,aaa,a,a,a,a,hh,a*hh<CR><LF>

- **x** = Selected Transceiver Number **(¹)**
- **a** = **M =** Request Master of Transceiver, **S** = Slave **(²)**
- **aa** = Transceiver control **(³)**
- **aaa** = **Rxx =** Antenna Rotating ON with xx RPM (01 ÷ 60) else NULL (OFF)
- **a** = **J =** Jitter ON else NULL (OFF)
- **a** = **P =** Performance Monitor ON else NULL (OFF)
- **a** = **V =** Video test else NULL (OFF)
- **a** = **M =** Manual Tuning, **A** = Automatic Tuning
- **a** = Tuning adjust (min 00H, max FFH). If Automatic don't care.
- **hh** = MGN Heater: **W =** warm, **C** = cold else **NULL (AUTO)**

Notes:

(¹) Transceiver Number: 1, 2, 3, 4 **(SPARE in stand alone TXRX)**

(²) Master/Slave request **(SPARE in stand alone TXRX and single equipment)**

(³) Transceiver control:

Field type	*Field Descriptions*
SB	Stand By
SH	Short pulse, High frequency
SM	Short pulse, Medium frequency
SL	Short pulse, Low frequency
MM	Medium pulse, Medium frequency
ML	Medium pulse, Low frequency
LL	Long pulse, Low frequency

2.5.2.2 SECTOR BLANKING SENTENCE

$PSE2,a,xxx.x,xxx.x,xxx.x,xxx.x*hh<CR><LF>

- **a** = **D** = Sector Blanking Values, **R** = Sector Blanking Request **(²)**
- **xxx.x** = Start Sector 1 **(¹)**
- **xxx.x** = End Sector 1 **(¹)**
- **xxx.x** = Start Sector 2 **(¹)**
- **xxx.x** = End Sector 2 **(¹)**

Notes:

(¹) Start & End Sector units are degree. Es: 90.6.
This value will be rounded depending from the position sensor used

(²) If Sector Blanking Request, don't care

2.5.2.3 TIMERS INITIALIZATION

$PTIM,x,x,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh<CR><LF>

- Status 1 (¹)
- Status 2
- Status 3
- Timer Standby
- Timer S-Pulse High Freq.
- Timer M-Pulse Medium Freq.
- Timer L-Pulse Low Freq. (²)
- Timer S-Pulse Medium Freq.
- Timer S-Pulse Low Freq.
- Timer M-Pulse Low Freq.

Notes:

(¹) Command 1: 1 = Request for transmission of actual values
2 = Initialization of values .
3 = Reset of values.
Command 2: Spare
Command 3: Spare

(²) Timers : Integer value to pre-set the operated time. LSB is equal to 1 hour.

If Command 1 = 1 or Command 1 = 3 don't care.

2.5.2.4 DIGITAL POTENTIOMETERS

$PDPC,a,x,x*hh<CR><LF>

- R = potentiometer value Request, F = potentiometer Factory preset else NULL(¹) A = auto adjust (°)
- Potentiometer ID (²)
- Potentiometer increment signed value (³)

Notes:
(¹) Factory preset is available for latest TX/RX versions.
(²) Pot. ID

#Potentiometer to be upgraded:
0 PRE-STC AMPLITUDE
1 PRE-STC SLOPE
2 P.M. OPEN
3 P.M. DISTANCE (Power Level)
4 TUNING INTICATION
5 TUNE OFFSET
6 NOISE DIODE CURRENT

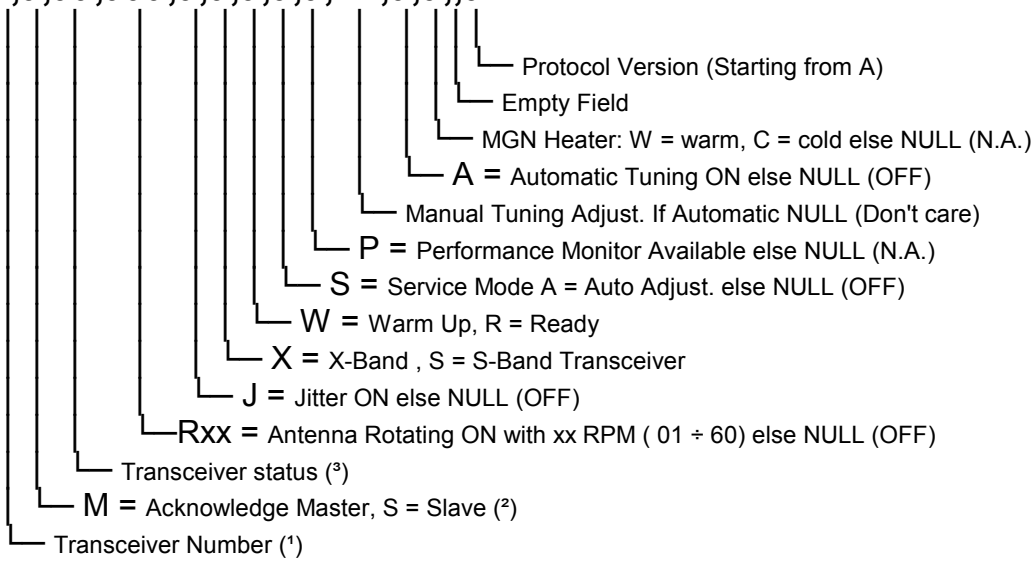
(³) Increment or decrement to apply (range ±7). (NEVER SEND 0)
(°) If “A” with pot id, adjust only the correspondent Pot. (not yet).
If “A” without pot id (,,), adjust all the auto adjustable (Tune offset for now).

Sentence should be sent under operator request only. Application of value is immediate but storage of this one (not volatile memory) will take place after 20 seconds from last change i.e. from last DPC sentence reception.

2.5.3 DATA TRANSMISSION FROM TXRX TO RDC

2.5.3.1 STATUS SENTENCE 2

$PST2,x,a,aa,aaa,a,a,a,a,a,hh,a,a,,a*hh<CR><LF



Notes:

- **(¹)** Transceiver Number: 1, 2, 3, 4 **(NULL in stand alone TXRX)**
- **(²)** Master/Slave acknowledge **(NULL in stand alone TXRX)**
- **(³)** Transceiver status:

Field type	*Field Descriptions*
SB	Stand By
SH	Short pulse, High frequency
SM	Short pulse, Medium frequency
SL	Short pulse, Low frequency
MM	Medium pulse, Medium frequency
ML	Medium pulse, Low frequency
LL	Long pulse, Low frequency

2.5.3.2 DATA SENTENCE

$PDAT,hh,hh,hh,xxx,xx,xxx,x*hh<CR><LF>

- Software Revision (From A to Z)
- Warm Up time (²)
- Txrx Program Software Version (> 80)
- Inner transceiver temperature (¹)
- Magnetron Peak Current (Range 00H ± FFH).
- Main Bang Amplitude (Range 00H ± FFH).
- Power Level (Range 00H ± FFH).

Notes:
(¹) Transceiver temperature: From -99 to 99 Celsius degree (signed value).
(²) Warm Up time: calculated in seconds, when null becomes TXRX READY.

Value of power level, main bang and magnetron peak current during sector blanking are frozen.

2.5.3.3 TIMERS INFORMATION

$PTIM,c--c,x.x,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,a*hh<CR><LF>

- Timers validity: A = valid V = invalid
- System timer (^{4})
- Timer M-Pulse Low Freq.
- Timer S-Pulse Low Freq.
- Timer S-Pulse Medium Freq.
- Timer L-Pulse Low Freq. (^{3})
- Timer M-Pulse Medium Freq.
- Timer S-Pulse High Freq.
- Timer Standby
- Status 3
- Status 2 (^{2})
- Status 1 (¹)

Notes:

Status 1 (¹) : Magnetron Type label
Status 2 (^{2}) : Integer value indicating the magnetron end of life, from 0 to 999, > 100 mean end of life.
Status 3 : Spare

(^{3})Timers : Integer value indicating the operated time. LSB is equal to 1 hour.
(^{4})System : Integer value indicating lifetime of transceiver LSB is equal to 1 hour

2.5.3.4 DIGITAL POT. INFORMATION

$PDPI,xx,xx,xx,xx,xx,xx,xx*hh<CR><LF>

- Pot ID #6, PM Noise diode current
- Pot ID #5, Tuning Offset
- Pot ID #4, Video Level
- Pot ID #3, Performance Monitor Amplitude
- Pot ID #2, Performance Monitor Opening
- Pot ID #1, STC Slope
- Pot ID #0, STC Amplitude

Notes:

Potentiometer decimal Value : Range 0 ÷ 99.

2.5.3.5 SECTOR BLANKING SENTENCE

$PSE2,,x.x,x.x,x.x,x.x*hh<CR><LF>

- **End Sector 2**
- **Start Sector 2**
- **End Sector 1**
- **Start Sector 1**

} **(¹)**

Notes:
(¹) Start & End Sector units are degree. Es: 90.6.

2.5.3.6 WRONG COMMAND RETURN (NACK)

$PNAC,x,aaa,xx,xx*hh<CR><LF>

- Wrong field **(³)**
- Error Code **(²)**
- Refused Sentence (if recognized) **(¹)**
- Transceiver Number (as sentence **STS** or **NULL in stand alone TX/RX**)

Notes:

(¹) See list of accepted sentences

(²) Numeric value, from 0 to 99, command dependent (see list below)

(³) Field number. Incremental from 1 after sentence code.

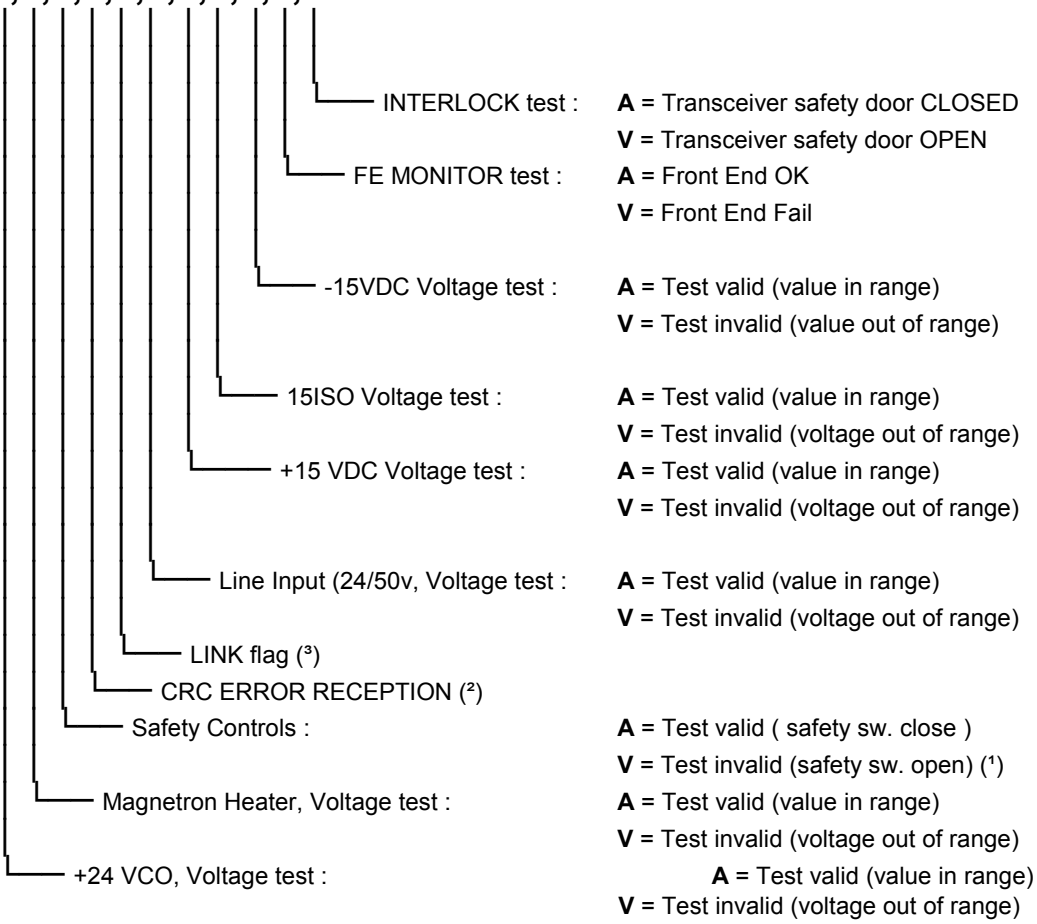
Es. 1: **$PNAC,2,COP,01,05*hh<CR><LF>**
Meaning: feedback on error inside COP command for transceiver 2 through TXRX Interface, error type #01, field #05 (wrong JITTER field)

Es. 2: **$PNAC,,COP,01,37*hh<CR><LF>**
Meaning: same feedback error directly from TXRX

-

2.5.3.7 HEALTH SENTENCE 2

$PHT2,a,a,a,a,a,a,a,a,a,a,a,a*hh<CR><LF>

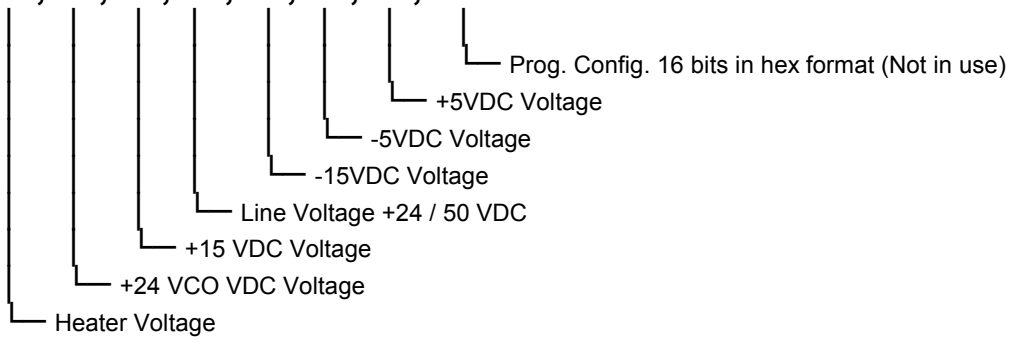


Notes:

LINK flag: Valid if Rx data are received.
Invalid if Rx data are NOT received. (time-out)
CRC ER: Invalid each time a crc error in Rx data will be found.

2.5.3.8 DATA SENTENCE 3

$PDT3,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,hhhh*hh<CR><LF>



Each value of voltage is integer and millivolt.

2.5.4 GENERAL NOTES

1) Rates:

Data transmission rate to **TXRX** should be:
Sentence **CO2** 1 Hz normally, or when is necessary
Sentence **SE2** when is necessary upgrade Sector Blanking
Sentence **TIM** every time is necessary timers information or reset values
Sentence **DPC** every time is necessary digital potentiometer information or value upgrade
Sentence **CFG** only for first setup
Sentence **SPD** only for first setup and when the motor controller is changed

Rate shall be not faster than 50 ms between two consecutive sentences.

Data transmission rate from **TXRX** are:
Sentence **ST2** 1 Hz normally
Sentence **DAT** connection depending : 1 Hz (Interfaces) or 150 ms (TXRX).
Sentences **DPI, SE2** on request
Sentences **TIM,** on request and each 30 minutes of interval after power on.
Sentence **NAC** when necessary
Sentences **HT2** 1 Hz normally
Sentences **DT3** 1 Hz normally
Sentences **CFG** on request.
Sentences **SPD** on request.

2) Error Code:

MESSAGE	ERROR CODE	MEANING
CO2	00	CRC ERROR
	01	Field not in compliance with specification
	02	Missing transceiver control
SEC	00	CRC ERROR
	01	Field not in compliance with specification
	02	Wrong sector value
TIM	00	CRC ERROR
	01	Field not in compliance with specification
	02	Missing command type
	03	Initialization value outside limits
DPC	00	CRC ERROR
	01	Field not in compliance with specification
	02	Wrong potentiometer ID
	03	Potentiometer value outside limits
CFG	00	CRC ERROR
	01	Field not in compliance with specification

CHAPTER 3
FUNCTIONAL DESCRIPTION

3.1 Introduction

This chapter provides the functional and detailed description of the main functions and operations performed by the ARGUS X-BAND RADAR SYSTEM.

Functional diagrams are used to depict signal processing, whilst the text is used to support diagrams as necessary for explanation purposes.

The descriptions are structured in paragraphs as described in what follows:

Paragraph 3.2 - Functional Description, provides a general functional description, functional areas identification and main interconnections. This allows highlighting the main functions relationship and unit performance. As a functional area, it comprises a group of circuits, or other devices, which operate together to accomplish a well defined function. Each of the major functions of the unit shown in the functional block diagram (Chapter 9, Figure 9.1.7 and Figure 9.1.8) is described in details on separate functional block diagrams, with the following descriptions:

Paragraph 3.2.1 Electronics Rack

Paragraph 3.2.2 RF HEAD

Paragraph 3.2.3 Brushless Motor Controller

Paragraph 3.2.4 Motor Unit

Paragraph 3.2.5. Optional Unit: SRT Adapter Box

Paragraph 3.2.6. Optional Unit: Heater

Paragraph 3.2.7. Optional Unit: Encoder

Functional block diagrams show the development of a function from input to output in detail. Main assemblies and subassemblies (modules and cards) are shown and identified by code name and part number (P/N).

Hardware blocks are used in the signal paths to describe the processing functions performed. For a better understanding, the signal functions on circuit blocks are tagged by letters whose meanings are described in the list of abbreviations Table 1.1.1 - List of abbreviations.

Signal flows are mainly laid down from left to right and from top to bottom therefore subassemblies can be illustrated more than once to ensure logical signal flow. Signals, on functional block diagram, appear with their official code name as indicated on the manufacturer electric schematic diagrams and tabular interconnection lists.

Comments for explanation purpose on signal paths are within parenthesis; this sometimes identifies their operational accomplishment. Timing diagrams and word-code bit structure figures are also given as necessary for a better understanding of the described function. Logic terms and principles used in this technical manual comply with standard engineering practices.

Logic symbols (gates) are used, if they represent more appropriately, in a simplified form, the logic function performed even by complex parts of hardware.

Where necessary, functional description of power supplies and minor assemblies are referred to schematic diagrams.

NOTE

The schematic block diagrams of Chapter 3 show all the functions that the boards' hardware could potentially support, while the related functional description refers only to the functions implemented in the present customized configuration.

3.2 Functional Description

On the basis of the ARGUS X-BAND RARAR SYSTEM functional block diagram shown in Chapter 9, Figure 9.1.7, the equipment can be subdivided into the following main assemblies:

- Electronics Rack
- RF Head
- Brushless Motor Controller
- Motor Unit

There are also a number of optional functions, which are described below as:

- SRT Adapter Box
- Heaters
- Encoder

3.2.1 Electronics Rack

The Electronics Rack block diagram is shown in Chapter 9, Figure 9.1.7 and Figure 9.1.8. Each block represents a functional area, which is described in detail in the following chapter (paragraphs 3.3 through 3.7). The blocks indicated by dotted lines represent circuits assembled on the equipment chassis.

The Electronics Rack includes the following functions:

- it generates the power supply voltages required for the unit's functioning
- it generates the R.F. pulses which will be radiated by the Antenna; the pulses, in X-band wave length (9375 ±30 MHz for NJRC or 9410 ±30 MHz for EEV Magnetrons) and with 12 (10 for EEV Magnetrons) or 25 kW peak nominal power, can be selected among the following:

Pulse Type	Duration	PRF
SHORT PULSE	nominal 60 ns	3000 Hz
MEDIUM PULSE	nominal 250 ns	1500 Hz
LONG PULSE	nominal 800 ns	750 Hz

- it receives the echoes reflected from targets, and it converts and amplifies them
- it monitors the functionality of the unit

3.2.1.1 SRT Power Board

The SRT Power (Chapter 9, Figure 9.1.11) is divided into 2 units, LVPS and HVPS; it generates all the voltage sources needed for the electronics rack from the original 50 VDC (40-60).

The SRT Power unit is equipped with protection circuits (Figure 9.1.12) to avoid wrong polarity connection, over current and over voltage spikes. A voltage sensor is connected with microprocessor interrupt request input to provide save state function in case of voltage fall under 40 VDC and to safely perform system shut down without data loss.

3.2.1.2 SRT Power - Low Voltage Power Supply

The LVPS's function (Chapter 9, Figure 9.1.13) is to generate the low DC voltages, necessary to supply the SRT electronic circuits. As input, the circuit receives 50 VDC. This voltage filtered and stabilized by suitable solid state components outputting:

- +5 V, -5 V, +15 V, -15 V, +15 V Iso, +24V to supply all the other electronic circuits
- VFIL, Magnetron Heather in accordance with selected Pulse and magnetron type.

3.2.1.3 SRT_Power - High Voltage Power Supply

The H.V.P.S. Generator Circuit's function (Chapter 9, Figure 9.1.14) is to generate the high voltage (700 V) for the pulse transformer and to the Magnetron for transmission. The signals used in this circuit are:

- 50 VDC (VMOD)
- HVON from Gate Array of SRT Control Board
- LPA (Long Pulse Adjustment), MPA (Medium Pulse Adjustment) and SPA (Short Pulse Adjustment) from Gate Array of SRT Control Board

- HVSTOP from SRT MOS board.

The H.V.P.S. (High Voltage Power Supply) starts up when the signal output from the COMPARATOR is active. And the signal is active when:

- the signal HVON, from the Gate Array of SRT Control Board, is LOW. This signal is forced to high (inactive), when:
  - 3 min. period isn't yet passed since TXRX has been turned on
  - TXRX is in standby mode
  - safety switch or interlock is open.
  - +15V is ≤ 14V or ≥ 16V
  - VFil (6.3V) is ≤ 5V or ≥ 7V
- input voltage supply is over 40 VDC
- signal HVSTOP is Low, which disables the functioning of the circuit when the +15 ISO voltage is absent
- HVPS Generator Circuit generates the correct high voltage value

When the high voltage is generated, the COMPARATOR sends the signal HVOK to the Gate Array of the SRT_Control board and the red LED DL3 (HVOK), mounted on the SRT_Power lights-up.

The VMOD is applied to the primary of the HVPS TRANSFORMER which, driven by the MOSFET, generates the required high voltage (700 V).

The MOSFET drive is controlled by a circuit, which also protects the MOSFET itself.

The circuit is composed by the blocks COMPARATOR, POTENTIOMETER and FLYBACK CONTROLLER. When the COMPARATOR recognizes HVON signal to be low, it enables the FLYBACK CONTROLLER that in turn drives the MOSFET output. In the feedback loop another comparator assures that the high voltage value is stable and correct. The voltage is set and controlled by potentiometers and LPA, MPA and SPA signals. In this way, it is possible to precisely control the Magnetron output power.

HVPS unit generates an additional 150 V voltage for a neon lamp performance monitor, for future use.

3.2.1.4 SRT_Mos Board

Two configurations are available, one for 12 KW and one for 25 KW. The number of MOSFET transistors differ in these two versions.

Basically the SRT_Mos board (Chapter 9, Figure 9.1.16) performs the following main function: High Voltage Pulses generation for Magnetron.

The Pulse Circuit Generator's function is to generate the necessary high voltage supplying the Magnetron, according to the previous selections.

The Input Pushing Trigger is TRPUSH and the input Pulling Trigger is TRPULL. Both signals come from SRT_CONTROL Board. The Pulse Circuit Generator is supplied with 700 V from the HVPS Generator Circuit.

To one terminal of the primary windings of the PULSE TRANSFORMER 700 V is applied, whilst the second terminal is connected to the MOSFET (push and pull).

The PULSE TRANSFORMER will now generate 6 kV from the secondary windings, which is fed to the MAGNETRON.

For the Magnetron to function, it also requires a 6.3 V Filament Voltage. This voltage differs slightly depending on the magnetron installed, EEV or NJRC and 12 and 25 kW. The filament, VFIL is applied to a section of the secondary windings of the PULSE TRANSFORMER. As result, the signal FIL. sent to the Magnetron, has a potential 6.3 V greater than the K potential.

While the SRT is Transmitting, the CURRENT TRANSFORMER generates the signal MCUR which:

- is used in this circuit to block high voltage to magnetron when current absorbed by magnetron is too high
- is sent to the Gate Array of the SRT_Control Board
- is sent to the Microprocessor of the SRT_Control Board

3.2.1.5 SRT_Control Board

The SRT_CONTROL Board (Chapter 9, Figure 9.1.18) is located in the Electronic assy, and his function is to control all SRT operations.
The SRT_CONTROL Board is divided in the following main circuits:

- Microprocessor and Gate Array
- System monitor
- Performance Monitor
- Input and Output Interface

3.2.1.6 Microprocessor and Gate Array

3.2.1.6.1 General Description

PCB

The heart of the SRT_Control Board, is an advanced 32 Bit MCU (Micro-controller Unit) (Chapter 9, Figure 9.1.18), with highly sophisticated, on chip, peripheral capabilities performing the function of:

- managing all functions of the SRT unit on the basis of commands/data from the Display Unit
- preparing the feed-back signals to be sent out to the Indicator unit
- executing all internal processing to assure the SRT units control and monitoring

The Microprocessor (MCF5211) used in the board has these characteristics:

- 16 KB SRAM
- 128 KB Flash Memory
- Two UARTs
- Queued serial peripheral interface (QSPI) with four peripheral chip selects
- Four 32-bit timer channels with DMA capability
- Four 16-bit timer channels for capture, compare and pulse width modulation (PWM)
- Four - channel 16-bit/8-channel 8-bit PWM generator
- Two periodic interrupt timers (PITs) for alarm and countdown timing
- Eight - channel 12-bit ADC
- System integration (PLL, SW watchdog)
- Up to 33 general-purpose I/O

The SRT unit management is performed by the Microprocessor which includes sufficient memory capacity to store the Operative Program. It is using an external U30 EEPROM, (Chapter 9, Figure 9.1.17 pos.7) for storing transmitting parameters. The necessary clock pulse of 50 MHz is generated by the crystal oscillator.

In Chapter 9, Figure 9.1.19 shows the Microprocessor and Gate Array general configuration, the main sub-systems and how they relate to the pins of the MCU.

3.2.1.6.2 Functions Performed

The main functions performed by the Microprocessor with the Gate Array (Chapter 9, Figure 9.1.20 and Figure 9.1.21), on the basis of commands and selections, Remote, (from Display Unit) or Local, (Through the Selector), are:

- to initialize the TXRX operations
- to generate the trigger pulse for SRT MOS Board and the trigger (TR) pulse for the Display Unit and the P.M. function
- to generate the PRESTC waveform for the RF Detector Assy (STC) and the selection commands for band-width of Receiver
- to generate:
    - the VCO forwarded to Mixer
    - the control signals forwarded to SRT MOS and SRT Power Boards
- to receive the signals controlling the Antenna rotation
- to perform the processing of various sensor signals in order to monitor the correct operations of the TXRX unit

3.2.1.6.3 Microprocessor Output Signals

PCB

TR	Transmission Trigger.
CS0, CS1, SCK, SO	Serial Gate Array and EEprom management signals
TX	Asynchronous serial transmission
/RES	Asynchronous Reset

3.2.1.6.4 Microprocessor Input Signals

PCB

VDLEVEL	Main bang Video signal level the value is send, in serial mode, to the Display Unit
PWLEVEL	Information about the Power Level; the value is send, in serial mode, to the Display Unit
MCUR	Magnetron cathode current pulse sample the value is send, in serial mode, to the Display Unit
VFIL M	VFil Voltage value
24 VCO M	+24 Vco Voltage value.
12 VT	40 to 60 VDC Main Power Voltage value
15 M	+15 V Voltage value.
TEMP	Temperature value; the value is send, in serial mode, to the Display Unit
+5 V M	+ 5 V Voltage value.
- 5 V M	- 5 V Voltage value.
- 15 V M	- 15 V Voltage value.
Monitor M	Information about the L.N.F.E. status.
AZ	Antenna azimuth pulse
HL	Antenna ship reset pulse
RX	Asynchronous serial receive
IRQ	Video data Reception/Transmission Interrupt.
NMI	Power supply line absence.
CK10	50 MHz clock
SCK, SI	Serial Gate Array management signals

3.2.1.6.5 Gate Array Input Signal

PCB	
CK50	Input for the 50 MHz clock.
ANTBLK	High voltage generation and antenna rotation disabling from the Safety Switch.
SLK	High voltage generation and antenna rotation disabling from the interlock.
LINE	Main power supply voltage
HV OK	High voltage supply feedback
HV Stop	Feedback from SRT MOS board for +15Iso presence
MPLC	Magnetron transmission current.
P1 and P2	Links for the board configuration.
S1 selector	4 bit for the selector position.
TR	Transmission Trigger.
CS1, SCK, SO	Serial Gate Array management signals
TRSTC	Pre-trigger for the STC generation.
RXCOMB	Serial reception of the combined video.

3.2.1.6.6 Gate Array Output Signal

PCB	
DATA BUS	Bit DB0-DB7 of the Data Bus.
NMI	Power supply line absence.
IRQ	Video data Reception/Transmission Interrupt.
CK10	10 MHz clock
CS0-CS7	Digital potentiometer chip select.
U/D, INC	Digital potentiometer control signals.
SWFIL1-2-3	Magnetron filament voltage control signals.
ANTS	Antenna switch on signal.
SPA, MPA, LPA	HVPS circuit control signals.
HVON	HVPS circuit switch on signals.
SWB1-SWB2	Signals for the control of the NIFB bands.
TRPS	Trigger PUSH for the transmission pulse generation.
TRPL	Trigger PULL for the transmission pulse generation.
/TR Out	Trigger for the display
/GSTC	Gate for the STC signal generation.
TXCOMB	Serial transmission of the combined video.
DIS TX	Disabling for the combined transmission on the video.
TUNEN and /TUNEN	Tuning detectors at transmission frequency
PM Out	
SCK, SO	Serial Gate Array management signals

3.2.1.6.7 Gate Array Pulse Length Generator

The Pulse Length Generator Function (Chapter 9, Figure 9.1.21) provides the length of the generated pulse in accordance with the previous selections.

This function is performed by the Gate Array, which generates the signals TRPS and TRPL when:

- the signal TR is active
- the signal HVOK is low
- the 50 MHz clock is present
- the signal RESET is high
- the signal LINE is true
- the signal SLK is high
- the signal ANTBLK is high
- Main Line ≥ 40 VDC

The signals TRPS and TRPL are applied to the DRIVER, which generates the signals TRPUSH and TRPULL for the Pulse Generator circuit of the SRT_Mos Board.

3.2.1.7 System Monitor Functions

System state monitor (Chapter 9, Figure 9.1.22) is performed by this unit. Unit is composed of :

- Voltage Monitor
- Temperature Monitor
- SLK
- Safety switch

Voltage monitor performs monitoring of power supply voltage level. It receives its inputs from the Voltage sensor of the SRT_Power Board.

Temperature monitor detects temperature values to be processed by the microprocessor, which via the Gate Array switches on the fan if the temperature goes too high.

SLK is a signal from the switch that disables transmission and antenna rotation when the cabinet cover is open.

The safety switch disables the radar unit from hazardous power supply. The safety switch must be set to off when the radar unit is under maintenance to prevent high voltage hazard for operators.

3.2.1.8 Performance Monitor Functions

The Performance Monitor’s function is to monitor Transmission Power, Tuning and Noise Figure as a Noise Ring presentation on PPI and for ensuring peak power value on TXRX DATA.

In the related circuit there is a diode inside the RF Head, operating as a revelator when the magnetron is transmitting or as noise generator when the signal PM_Out is available.

When the diode is operating as revelator, it is synchronized with the transmission, and the revelator circuit can detect the power present at the diode. This circuit is always active. And the measurement is done for each trigger. The measured value is available on TXRX data.

When the command PMON, Performance Monitor ON, is set**,** the power value and the tuning value will change PM_Out signal parameters. The scope of this circuit is to introduce a noise ring on the PPI. This noise ring changes its distance by the variation of the transmitting power and its thickness by the variation of the tuning.

A neon lamp is fitted to the monitor arm extending from the antenna pedestal. The lamp is powered by 150 V from the POWER MOS Board and is exited at each antenna rotation by the radiated RF pulse.

With the Performance Monitor switched on and the neon lamp is exposed to the TX power, the RF energy causes a current variation in neon lamp and the RM signal. A revelator circuit will detect this variation and interrupts the Noise Ring.

This function adds to a general verification of the transmitted power.

3.2.1.9 Input and Output interface

The Input interface of the SRT_Control board receives input signals from SRT Power, SRT MOS, RF Detector, Safety Switch, interlock and sends them to the microprocessor and to the gate array. Signal conditioning and level shifting operation is accomplished by buffers, level translators and peak hold devices.

Azimuth (AZ-in) and Heading Line (HL-in) input signals are processed as well and forwarded to the microprocessor and the gate array (AZ, HL)

The Output interface sends processed signals from the Gate array, RF Detector, Safety Switch and from the TX pin of the microprocessor to the Display, the RF detector and the brushless motor controller.

3.2.1.10 Azimuth (AZ) and Heading Line (HL) Signal Circuit Generator

The Antenna Unit must constantly forward its Azimuth position and Heading Line to the Display Unit. The function of this circuit (Chapter 9, Figure 9.1.30) is to process the incoming signals AZIN and HLIN and forward them to the Microprocessor the signal AZ and HL for the blanking function.

The output signal AZOUT and HLOUT are used on the Display Unit.

3.2.2 RF HEAD

The RF Head (Chapter 9, Figure 9.1.23) consists of a solid state controlled MAGNETRON stage connected to a CIRCULATOR and ending with a flange to be connected to a waveguide in order to transfer the RF PULSE to the Antenna for it to be radiated. In the 25 kW system there is also a Band Pass FILTER inserted between the magnetron and the circulator to filter out spurious frequency emissions.

The opposite end of the CIRCULATOR is fitted with a LIMITER and RF_Amplifier (L.N.F.E + RF_Detector). The L.N.F.E (Low Noise and Front End) is composed of: the IMAGE REJECTION FILTER, the LOW NOISE AMPLIFIER, two-BALANCED MIXER and the LOCAL OSCILLATOR. The RF_Detector is the final amplification stage and it is of the logarithmic kind.

The RF Head is designed to generate RF pulses in the X-Band range up to 12 or 25 kW and to receive echoes from targets.

During transmission, the MAGNETRON receives high voltage trigger pulses and generates high power RF pulses in the X-Band range. The pulse length (short/medium/long) is determined by the operator settings on the display.

The RF energy generated is sent to the CIRCULATOR, and from there to the waveguide, which sends the energy to the Antenna.

The CIRCULATOR is a 3-way microwave device used either as a RF switch or to send the transmission pulses to the Antenna or to apply the received echoes to the Receiver.

The second function carried out by the RF HEAD unit is to convert the received R.F. energy, reflected from targets, into intermediate frequency, (I.F.) and amplify it. This is provided by the R.F. HEAD block mainly consisting of:

- Limiter
- Circulator
- Noise Diode
- Power Diode
- Integrated RF Amplifier composed of:
    - Low Noise Front End (Low Noise Amplifier, Mixer, LO)
    - RF Detector

The echo signal received by the Antenna arrives, through the Limiter and the Low Noise Amplifier, to the Mixer where it is mixed with the signal forwarded by the Local Oscillator. The resulting beat is the 60 MHz IF signal, which is forwarded to the RF_Detector. The Limiter is used to avoid an output above a scheduled value. A higher output would cause a short-circuit.

The Low Noise Amplifier and the Image Rejection Filter are used to amplify the echo signal in order to improve the noise figure of the receiver. The Local Oscillator is integrated directly into the LNFE. It can be tuned to the Magnetron transmission frequency by the VCO voltage level.

The RF Detector Assy's function (Chapter 9, Figure 9.1.24 and Figure 9.1.25) is to amplify the echo signals delivered by the RF HEAD Assy. It is composed of a

Group Amplifier stages, cascade connected, with specific components to obtain a logarithmic dynamic characteristic. The central frequency is 60 MHz and the bandwidth is 1.8 MHz for Long Pulse, 4.5 MHz for Medium Pulse, 24 MHz for Short Pulse.

To maintain the target echo signals free from any possible external induction that can degrade the performance of the Unit, the DC power supply voltages and the band switching commands are applied to the module by means of a FILTER.

3.2.3 Brushless Motor Controller

The speed controller board sets the brushless motor rotation speed by means of variable voltage signal VEL coming from the SRT_Control Board. A 5 V control signal (start) is produced for safety purpose. Turning the safety switch to off, results in preventing the motor from rotating (Chapter 9, Figure 9.1.26).

3.2.4 Motor Unit

The Motor Unit, for rotating the 6, 9 and 12 feet X-Band Antennas, is equipped with a brushless Motor powered by the Brushless Motor Controller board (Chapter 9, Figure 9.1.5).

The motion is transferred to the ANTENNA through 2 GEARBOX, with a total reduction ratio of 60:1 for 6 and 9 feet, and 120:1 for 12 feet. The ANTENNA nominal angular speed can be ≥ 40 rpm.

Mounted on the Antenna shaft is the OPTICAL READ-OUT group that generates the pulses used to determine the Antenna position (Azimuth) and the Heading Line.

The OPTICAL READ-OUT group is composed from a disk rotating with the Antenna shaft and an optical sensor with two slotted optical switches. When in front of the optical sensor passes a hole of the disk, a pulse is generated by the Photo-transistor. The pulse is sent to the INTERFACE block of the Electronics Rack through the SIGNAL CONDITIONER circuit, which adapts the amplitude of the pulses from the Optical Read-out

The Heading Line pulses are obtained by means of another optical sensor, equal to the previous one, which generates a pulse when a deeper hole passes through the sensor.

An external SAFETY SWITCH connection is fitted on the SRT_Control board. When the switch is open, it disables power supply to the MOTOR unit and inhibits RF emission, thus achieving a safety condition for maintenance and repair. The wiring from the external switch enters the equipment through the smaller stuffing tube. The installation is often compulsory and it is recommended to install the switch at the bottom of the mast stairs giving access to the Unit.

NOTE

Before performing any service on the Antenna, SWITCH OFF the Safety Switch.

3.2.5 Optional Equipment: SRT Adapter Box

It is possible to connect TRTX units to the Core unit with cable lengths of up to 360 m. To ensure adequate signal levels at this distance, the SRT Adapter Box has been introduced. The SRT Adapter Box has the following functions:

- Ensure adequate Power supply level of 50 VDC for the TRTX.
  The 480 W AC/DC power supply has a universal input range from 85 VDC to 250 VDC
- The safety switch location to prevent antenna rotation during maintenance
- The Adapter PCB within the adapter box ensures correct signal buffering and adjustment of signal levels (amplification) compensating for cable losses
- Decode the combined video, and if needed, convert older types of protocol (as Mastermate) to new combined video protocol standards.
  The decoding logic extracts the serial data packets, the trigger and bearing signals from the combined video and translated them in standard levels (e.g. 232/422 for serial lines)

Figure 9.1.33 shows the SRT Adapter Box PCB layout.
LED D9 is a dual red / green LED. When red the board receives from the core unit. When green, transmitting to the core unit.
LED D10 is also a dual red/ green LED. When green, there is a proper signal decoding going on. When red, there is a parity error at decoding.
This latter LED works when the decoding function is enabled.

3.2.6 Optional Equipment: Heaters

Heaters are introduced for extreme cold environments, when the ARGUS Radar System is expected to operate down to –40° C. The heater system consists of cylindrical heater resistors mounted inside two cavities on the top part of the transceiver. The heaters warm the inside electronics and the gearbox.
A controller PCB stops the heating when temperature is more than 0° C.

3.2.7 Optional Equipment: Encoder

The function of the Encoder is to increase the angular resolution of the azimuth and heading signal to 1024 pulses for revolution.

CHAPTER 4
PREVENTIVE MAINTENANCE

4.1 Introduction

This chapter provides the necessary information to perform preventive maintenance operations, which must be carried out in order to ensure the ARGUS X-BAND Radar System's full efficiency.

The maintenance procedures are described in tabular form (Card). Each card lists the operations which must be performed, their interval, the personnel required, the materials and the time required for each task.

4.2 Preventive Maintenance Procedure

The preventive Maintenance procedures are given by means of cards. Each card, besides indicating the operations to be performed during the maintenance execution, lists the following indications:

- INTERVAL: it is an alphanumeric code to identify the maintenance action described. The following symbols are used to indicate the maintenance intervals:
  - M: Monthly
  - S: Semi-annual
  - A: Annually
  - WR: When Required
- PERSONNEL: it indicates the number and the typology of the personnel able to perform the maintenance operations; by making the assumption that the qualification, knowledge, experience and skill needed to fulfill the task assigned are proportional to the ranks. The following abbreviations are used:
  - ST: is a qualified person with no less than ten years of experience on the job
  - JT: is a qualified person with more than four years of experience on the job
  - R: is a young technician with less than four years of experience on the job. He can be either qualified or undergoing qualification
- REQUIRED INSTRUMENTS: it indicates the tools or the instruments which are used in the card operations: Table 4.2.1 - List of Recommended Tools and Instruments lists the tools, the instruments and the material required to perform the Preventive Maintenance operations.
- REQUIRED TIME: it indicates the total time required to perform the card operations
- SAFETY PRECAUTIONS: it indicates the precaution to be followed in order to ensure a safe Preventive Maintenance operation execution

Table 4.2.2 - List of the Preventive Maintenance Cards, for each of them, indicates the interval and the required time.

Table 4.2.1 - List of Recommended Tools and Instruments

Pr.	Description	Type	Note
1	Set of screwdrivers	USAG	Insulated handle
2	Set of combination wrenches	USAG	
3	Set of socket wrenches	USAG	
4	Set of socket hexagonal	USAG	
5	Set of socket torxs	USAG	
6	Set of hexagonal wrenches	USAG	
7	Set of allen wrenches with end ball	USAG	
8	Set of torx wrenches	USAG	
9	Set T-handle wrenches with swivelling hexagon sockets	USAG	
10	Set T-handle wrenches with swivelling hexagonal sockets	USAG	
11	Circlip pliers	USAG	For shaft from Ø3 to Ø100 (mm)
12	Set of communication tools		
13	30 W welders		
14	Electric Solder Iron		
15	Desoldering tool	SILVERSTAT	
16	Vacuum cleaner		
17	Digital multimeter	CHAUVIN ARNOUX CPA 9651 (3:5)	or equivalent
18	Oscilloscope	Tektronix	

Table 4.2.2 - List of the Preventive Maintenance Cards

Card	Operation	Periodicity	Required Time
1	Check the External Preservation Status	S1	15'
2	Internal Inspection and General Cleaning	S2	15'
3	Replacement of the Magnetron	WR1-8000 h	30'

WARNING

HIGH VOLTAGE IS PRESENT INSIDE THE UNIT. DO NOT OPEN THE CABINET COVER BEFORE THE MAIN LINE BREAKER HAS BEEN TURNED TO OFF POSITION. ALL WORK PERFORMED ON THE TXRX MUST BE RECORDED IN THE UNIT LOG BOOK.

WARNING

BEFORE STARTING ANY MAINTENANCE WORK, IT IS MANDATORY THAT, FOR THE SAFETY OF PERSONNEL, ALL HIGH-VOLTAGE CAPACITORS BE SHORT-CIRCUITED BY MEANS OF A WELL INSULATED SCREWDRIVER OR OTHER SUITABLE TOOL. BEFORE CONNECTING INSTRUMENTATION USED FOR PERFORMING MEASUREMENTS INSIDE THE UNIT, IT IS ADVISABLE TO SWITCH OFF THE POWER SUPPLY. DO NOT ALTER THE SETTING OF THE SEMIOPERATIVE CONTROLS UNLESS A SPECIFIC ADJUSTAMENT IS REQUIRED AND THE NECESSARY TEST EQUIPMENT IS AVAILABLE

CARD 1

UNIT	OPERATION	INTERVAL
SRT 12/25 KW X-BAND	Check of external preservation status	S1
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1R	None	15 minutes

SAFETY PRECAUTIONS
On the electric switchboard, set to OFF the Main Line Breaker relevant to the unit, and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
1.	Check that no parts of the plastic covering the Antenna have been painted.
2.	Check the casing preservation state.
3.	Unscrew and grease the 4 fastening screws of the cover (Chapter 9, Figure 9.1.4, pos. 1) to avoid corrosion and facilitate future inspections.
4.	If paint has been scratched off at any point, proceed as follows: - Carefully degrease the part to be painted - Smooth lightly with emery paper - Clean with dry brush - Apply a coat of anticorrosive - When the applied anticorrosive is dry, paint with a brush or, better still, by spraying
5.	On the electric switchboard, set to ON the power breaker relevant to the unit and remove the warning placard.

CARD 2

UNIT	OPERATION	INTERVAL
SRT 12/25 KW X-BAND	Internal inspection and general cleaning	S2
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1R	Set of screwdrivers, Electro Contact Cleaner, Soft brush, Primer, Paint, Emery paper, Soft cloth	15 minutes

SAFETY PRECAUTIONS
On the electric switchboard, set to OFF the Main Line Breaker relevant to the unit and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
	Preliminary Operations
1.	Position the Antenna as shown in Chapter 9, Figure 9.1.1.
2.	Unscrew and remove the four screws (Chapter 9, Figure 9.1.4, pos. 1) locking the cover (pos. 2) and open the former.
	Internal Multipin Connectors and Cables Inspection
3.	Check the conditions of each connector electric contacts (pins and plugs), connector packing and of its cable. Clean contacts by using Electro Contact Cleaner. Repair or replace, if necessary, any defective part.
	Mechanical Checks
4.	Check the gear integrity. Add grease if the gear shows lack of lubrication.
5.	Check, carefully, that all cabinet internal screws are not loose.
6.	Replace or tighten firmly as necessary.
	General Cleaning
7.	Cleaning is necessary only when layers, often dark layers, can be clearly seen on some areas. If these layers are visible, they must be removed with a dry cloth. Only if really necessary, repeat the procedure with cloth dampened in carbon tetrachloride. A special brush for cleaning, of appropriate size, may also be used. If and when necessary use an air-brush to remove dust from inside the pedestal.
8.	By using a soft brush and alcohol, remove dust, ash and grease from the internal components.
9.	Dry the surfaces by using a soft cloth.
10.	By using a soft brush and alcohol, remove dust, ash and grease from the external surfaces of the cabinet.
11.	Dry the surfaces by using a soft cloth.
	Final Operations
12.	Close the equipment cover by following the reverse procedure.
13.	Grease the fastening screws to avoid corrosion and facilitate future inspections and fix the cover.
14.	On the electric switchboard, set to ON the power breaker relevant to the unit and remove the warning placard.

CARD 3

UNIT	OPERATION	PERIODICITY
SRT 12/25 kW X-BAND	Replacement of the Magnetron	WR1 (8000 hours)
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1JT	Set of screwdrivers, Set of socket hexagonal, set of allen wrenchs, set T-Handle wrenches with swivelling hexagon sockets, set T-Handle wrenches with swivelling hexagonal sockets, Electric Soldering Iron, silicone grease compound 340	30 minutes

SAFETY PRECAUTIONS
On the electric switchboard, set to OFF the Main Line Breaker relevant to the unit and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
	Preliminary Operations
1.	Position the Antenna as shown in Chapter 9, Figure 9.1.1.
2.	Unscrew and remove the four screws (Chapter 9, Figure 9.1.4, pos. 1) locking the cover (Chapter 9, Figure 9.1.4 pos. 2) and open the former.
	Removal
3.	Unscrew the 4 bolts holding protection shield (Chapter 9, Figure 9.1.6, pos. 4)
4.	By means of the proper screwdriver, remove the Magnetron wires from the terminal (Chapter 9, Figure 9.1.15 pos.1) tacking note of their disposition: • Unplug yellow and green cables loosing the 2 bolts • Unplug the yellow-green earth cable
5.	By performing the operations of paragraph 6.2.8, remove the Electronics Assy
6.	By performing the operations of paragraph 6.2.7, remove the RF Head
7.	By means of the proper screwdriver, remove the 4 torxs screws (Chapter 9, Figure 9.1.27, pos. 2) fixing the Magnetron
8.	Remove the Magnetron.
	Installation
9.	Before fastening the Magnetron to the proper seat, spread a layer of silicone grease on Magnetron surface which is in contact with the alloy in order to increase the Magnetron heating surface dissipation.
10.	In order to install the new Magnetron, perform the removal operations in reverse order.
	Calibration
	WARNING IN ORDER TO PREVENT ANY ACCIDENTAL ROTATION OF THE ANTENNA, DISCONNECT THE MOTOR UNIT FROM THE BRUSHLESS CONTROLLER BOARD AND UNPLUG THE 5 PIN CONNECTOR.
11.	On the electric switchboard, set to ON the Main Line Break relevant to the unit and remove the warning placard.
12.	Position the selector S1 of SRT Control Board (Chapter 9, Figure 9.1.17 pos. 5) on position 2.
13.	Perform the following operations: - on the SRT_Power board, made a link P1 (Chapter 9, Figure 9.1.10, pos. 1), - before switching on, wait for 30 minutes.
14.	By following the procedures of display manual, perform the VCO calibration.
	Final Operations
15.	Perform the following operations: - on the SRT_Power remove the link P1 (Chapter 9, Figure 9.1.10, pos. 1), - on SRT Control Board, position S1 (Chapter 9, Figure 9.1.17 pos. 5) on 0 (zero).
16.	Unlock and close the equipment cover by following the reverse procedure.

CHAPTER 5
TROUBLESHOOTING

5.1 Introduction

5.1.1 General

This chapter provides the procedures to be followed in order to locate the faulty component or part when a problem arises in the 12/25 KW ARGUS X-BAND RADAR SYSTEM.

5.1.2 Organization

The troubleshooting procedures are described by means of flow charts. When the faulty component is located, refer to Chapter 6 for its replacement.

5.1.3 Personnel

The personnel involved in the troubleshooting procedures must be of a skilled technician type and must have a good knowledge of the equipment.

5.1.4 Tools and Instruments

To perform the troubleshooting procedures, besides common tools (screwdrivers, pliers, etc.), the following instruments are required:

Table 5.1.1- List of Recommended Instruments

Pos.	Description	Type	Note
1	Digital Multimeter	CHAUVIN ARNOUX CPA 9651 (3:5)	or equivalent
2	Oscilloscope	Tektronix	or equivalent

5.2 Troubleshooting Procedures

5.2.1 Safety Precautions

WARNING

SET THE SAFETY SWITCH TO OFF AND HANG UP A CARD READING “WORK IN PROGRESS DO NOT SWITCH ON”

WARNING

OPERATE WITH CARE ON THE TXRX UNIT BECAUSE OF HIGH VOLTAGES AND HIGH POWER

5.2.2 Troubleshooting Operations

Table 5.2.1 - List Of Main Possible Failures, describes the failures that may be observed during the operation of the equipment. If any type of failure occurred that is not listed, please contact a Simrad Product Expert.

Table 5.2.1 - List Of Main Possible Failures

TXRX does not turn on	Transmitter can't be controlled	Antenna data can't be controlled	Transmitter performance is low	Sector Blanking is not working	Antenna does not rotate	There is no current to magnetron	Transmitter does not generate RF	Antenna rotates, but rotation speed cannot be controlled	Potential Cause	Check	Remedy
x									Power supply is missing or polarity is inverted	Check DL1 Led status and measure voltage on TB2 of PCB SRT_Power	Connect the 24VDC voltage to the transmitter properly
x									Power_ON signal is missing	Close P1 link on PCB SRT_Power and make sure the Led DL2 lights on properly	Replace SRT Control Board
x									Voltage supply is too low	Check DL1 Led Status and measure voltage on TB2 of SRT_Power Board	Connect the 24VDC voltage to the transmitter properly
x	x	x			x				BNC video cable is interrupted	Check electrical continuity and insulation from GND	
	x	x							Video signal is low	Check video signal and data signal amplitude on TP1 (VD Out) of REI 2K Board	Adjust amplitude properly
			x			x			Magnetron exhausted	Check magnetron transmission hours and current Need check on console	Replace magnetron
					x		x		The safety switch is open	Check switch position and continuity	Close the safety switch or replace it
						x	x		High voltage generator is damaged	Disconnect 700V cable from TB3 of SRT_Power Board, disconnect motor cables, turn S1 of the SRT Control Board on position 3 and make sure DL3 is off.	Replace SRT_Power Board
		x		x					Cable between Bearing Reader and SRT Control boards is interrupted	Check electrical continuity of the cables	Replace cable

TXRX does not turn on	Transmitter can't be controlled	Antenna data can't be controlled	Transmitter performance is low	Sector Blanking is not working	Antenna does not rotate	There is no current to magnetron	Transmitter does not generate RF	Antenna rotates, but rotation speed cannot be controlled	Potential Cause	Check	Remedy
		x		x					Circuits are damaged	Check input and output azimuth signals on SRT Control board	Replace the damaged board
			x						High voltage is too low	Check magnetron current and 700VDC voltage value	Adjust high voltage values on SRT_Power Board
					x				Motor power supply is missing	Check if 24VDC voltage value on Brushless Motor Controller ends is low or missing	Connect the 24VDC voltage to the controller properly
					x				Motor power supply is missing	Check Brushless if Motor Controller enable signals are missing	Replace SRT Control Board
					x				Motor power supply is missing	Check Brushless if Motor Controller enable signals are present	Replace the Brushless Motor Controller
						x	x		Modulator is damaged	Disconnect 700V cable from TB3 of SRT_Power Board, disconnect motor cables, turn S1 of the SRT Control Board on position 3 and make sure DL3 is off.	Replace SRT_Mos Board
								x	Brushless Motor Controller is not enabled properly	Check Brushless Motor Controller Signals	Replace SRT Control Board

CHAPTER 6
CORRECTIVE MAINTENANCE

6.1 General

6.1.1 Introduction

This chapter provides the procedure, which must be followed in order to replace a faulty component of the ARGUS X-BAND transceiver according to the troubleshooting procedures of Chapter 5.

6.1.2 Safety Precautions

If not otherwise specified in the procedures, during the corrective maintenance operations, the following safety rules must be followed:

- each maintenance operation must be carried out only after the equipment switching off
- before removing any component, be sure the spare part is available
- verify the integrity of the spare part and, if possible, perform a functional test

WARNING

SET THE MAIN BREAKER OF THE EQUIPMENT TO OFF AND HANG UP A CARD READING <<WORK IN PROGRESS DO NOT SWITCH ON>>

6.1.3 Personnel

The replacement operations must be carried out exclusively by skilled personnel with a good knowledge of the equipment.

6.1.4 Required Tools and Instruments

To carry out the replacement operations described in this chapter, only normal workshop tools (as screwdrivers, wrenches etc.) are required.

The tools required to perform the troubleshooting operations are:

- Set of screwdrivers
- Set of combination wrenches
- Set of socket wrenches
- Set of socket hexagonal
- Set of socket torxs
- Set of hexagonal wrenches
- Set of allen wrenches with end ball
- Set of torx wrenches
- Set T-handle wrenches with swivelling hexagon sockets
- Set T-handle wrenches with swivelling hexagonal sockets
- Circlip pliers
- Set of communication tools
- 30 W welders
- Electric Solder Iron
- Desoldering tool
- Vacuum cleaner
- Digital multimeter
- Oscilloscope

6.2 Corrective Maintenance Procedures

6.2.1 General

This paragraph provides a detailed description of the operations to be carried out in order to replace a damaged component Table 6.2.1 - List of Corrective Maintenance Procedures.

Table 6.2.1 - List of Corrective Maintenance Procedures

Paragraph	Component to be replaced
6.2.2	Antenna Replacement
6.2.4	Replacement of Motoreducer Assy
6.2.4.2	Replacement of the Brushless Motor Controller
6.2.6	Replacement of the Magnetron
6.2.7	Replacement of the RF Head
6.2.8	Removal / Installation of Electronics Assy
6.2.9	Replacement of the Bearing Reader Board
6.2.10	Replacement of the Performance Monitor

6.2.2 Antenna Replacement

a) Required Tools

- Set of combination wrenches
- Set of screwdrivers
- Set of socket wrenches

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"
2. Using the proper open wrench, loose and remove the bolts (Chapter 9, Figure 9.1.2, pos. 2) fixing the Antenna (Chapter 9, Figure 9.1.2, pos. 3) to the Pedestal (Chapter 9, Figure 9.1.2, pos. 1)

c) Installation

1. Check for the integrity of the new Antenna
2. In order to install the Antenna, perform the removal operations in reverse order

6.2.3 Opening/Closing of the TXRX Cover

a) Required Tools

- Set of hexagonal wrenches
- Silicone grease compound 340

b) Opening

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"
2. By hands, rotate the Antenna (Chapter 9, Figure 9.1.2 pos. 3) orthogonally with respect to the cover opening direction as shown in Chapter 9, Figure 9.1.1
3. Unscrew the four screws (Chapter 9, Figure 9.1.4 pos. 1) locking the cover (Figure 9.1.4 pos. 2) and open it carefully

c) Closing

1. Check for the integrity of the cover seal (Figure 9.1.4 pos. 3) and eventually replace it
2. Unlock the cover by releasing the locking device and close the cover
3. Grease the fastening screws and fix the cover
4. On the electric switchboard, set to ON the power breaker relevant to the unit and remove the warning card

6.2.4 Replacement of the Motoreducer Assy

a) Required Tools

- Set of combination wrenches
- Set of hexagonal wrenches
- Set of allen wrenches with ends ball
- Set T-Handle wrenches with swiveling hexagonal sockets
- Silicone grease compound 340

The Motoreducer assy is composed of:

- a Motor Unit (Chapter 9, Figure 9.1.5, pos.1)
- a Gearbox (Chapter 9, Figure 9.1.5, pos. 2).

6.2.4.1 Replacement of the Motor Unit

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"
2. By following the procedures of paragraph 6.2.3, open the TXRX the Cover. Take note of connections displacement in order to be able to reconnect the cables in the proper positions. Unscrew contacts and power supply from brushless motor driver.
3. Holding the Motor Unit with the Gearbox, remove the 4 screws (Chapter 9, Figure 9.1.5, pos. 4) fixing the group (Chapter 9, Figure 9.1.5, pos.1 + pos. 2) to the support and remove the group.
4. To separate the Motor Unit from the Gearbox, using the proper hexagonal wrench, loose and remove the 4 screws (Chapter 9, Figure 9.1.5, pos.5) and loose the screw (Chapter 9, Figure 9.1.5, pos.6).

c) Installation

1. Check for the integrity of the new Motor
2. In order to install the Motor Unit with the Gearbox, perform the removal operations in reverse order
3. Close the cover following the procedures of paragraph 6.2.3

6.2.4.2 Replacement of the Gearbox

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"
2. By following the procedures of paragraph 6.2.3, open the TXRX the Cover. Take note of connections displacement in order to be able to reconnect the cables in the proper positions. Unscrew contacts and power supply from brushless motor driver.
3. Holding the Gearbox with the Motor Unit, remove the 4 screws (Chapter 9, Figure 9.1.5, pos. 4) fixing the group (Chapter 9, Figure 9.1.5, pos.1 + pos. 2) to the support and remove the group.
4. To separate the Gearbox from the Motor Unit, using the proper hexagonal wrench, loose and remove the 4 screws (Chapter 9, Figure 9.1.5, pos.5) and loose the screw (Chapter 9, Figure 9.1.5, pos.6).

c) Installation

1. Check for the integrity of the new Gearbox.
2. In order to install the Gearbox with the Motor Unit, perform the removal operations in reverse order.
3. Close the cover following the procedures of paragraph 6.2.3

6.2.5 Replacement of the Brushless Motor Controller

a) Required Tools

- Set of screwdrivers;
- Set of combination wrenches;
- Silicone grease compound 340
- Set of torx wrenches.

b) Removal

1. By following the procedures of paragraph 6.2.3, open the TXRX Cover
2. Disconnect the Brushless Motor Controller (Chapter 9, Figure 9.1.4 pos. 5) cables, taking note of their disposition
3. By means of the proper socket wrench, unscrew the 4 screws (Figure 9.1.4 pos. 10) fixing the Brushless Motor Controller to the mechanical frame
4. Remove the Brushless Motor Controller.

c) Installation

1. Check for the integrity of the new Brushless Motor Controller
2. In order to install the Brushless Motor Controller, perform the removal operations in reverse order without closing the cover
4. Close the cover following the procedures of paragraph 6.2.3

6.2.6 Replacement of the Magnetron

a) Required Tools

- Set of screwdrivers,
- Set of allen wrenches with ends ball,
- Set of combination wrenches,
- Set of torx wrenches,
- Set T-Handle wrenches with swiveling hexagon sockets,
- Set T-Handle wrenches with swiveling hexagonal sockets,
- Silicone grease compound 340.

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON"
2. By following the procedures of paragraph 6.2.3, open the TXRX Cover
3. Unscrew the 4 bolts holding protection shield (Chapter 9, Figure 9.1.6, pos. 4)
4. By means of the proper screwdriver, remove the Magnetron wires from the terminal (Chapter 9, Figure 9.1.15 pos.1) tacking note of their disposition:
    - Unplug yellow and green cables loosing the 2 bolts
    - Unplug the yellow-green earth cable
5. By performing the operations of paragraph 6.2.8, remove the Electronics Assy
6. By performing the operations of paragraph 6.2.7, remove the RF Head
7. By means of the proper screwdriver, remove the 4 torxs screws (Chapter 9, Figure 9.1.27, pos. 2) fixing the Magnetron
8. Remove the Magnetron.

c) Installation

1. Before fastening the Magnetron to the proper seat, spread a layer of silicone grease on Magnetron surface which is in contact with the alloy in order to increase the Magnetron heating surface dissipation.

2. In order to install the new Magnetron, perform the removal operations in reverse order
3. IN ORDER TO PREVENT ANY ACCIDENTAL ROTATION OF THE ANTENNA, DISCONNECT THE MOTOR UNIT FROM THE BRUSHLESS CONTROLLER BOARD AND UNPLUG THE 5 PIN CONNECTOR.
4. On the electric switchboard, set to ON the Main Line Break relevant to the unit and remove the warning card.
5. Position the selector S1 of SRT Control Board (Chapter 9, Figure 9.1.17 pos. 5) on position 2.
6. On the SRT_Power board, made a link P1 (Chapter 9, Figure 9.1.10, pos. 1)

   before switching on, wait for 30 minutes.
7. By following the procedures of display manual, perform the VCO calibration.
8. Perform the following operations:
   - on the SRT_Power remove the link P1 (Chapter 9, Figure 9.1.10, pos. 1),
   - on SRT Control Board, position S1 (Chapter 9, Figure 9.1.17 pos. 5) on 0 (zero).
9. Unlock and close the equipment cover by following the reverse procedure.

6.2.7 Replacement of the RF Head

a) Required Tools

- Set of screwdrivers,
- Set of allen wrenches with ends ball,
- Set of combination wrenches,
- Set of torx wrenches,
- Silicone grease compound 340,
- Set T-Handle wrenches with swiveling hexagon sockets,
- Set T-Handle wrenches with swiveling hexagonal sockets.

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON "
2. By following the procedures of paragraph 6.2.3, open the TXRX Cover
3. Unscrew the 4 bolts holding protection shield (Chapter 9, Figure 9.1.6, pos. 4)
4. By means of the proper screwdriver, remove the Magnetron wires from the terminal (Chapter 9, Figure 9.1.15 pos.1) tacking note of their disposition:
   - Unplug yellow and green cables loosing the 2 bolts
   - Unplug the yellow-green earth cable

5. Disconnect the RF Head (Chapter 9, Figure 9.1.28) cabling, taking note of its disposition
6. By performing the operations of paragraph 6.2.8, remove the Electronics Assy
7. Using the proper allen wrenches with ends ball, loose 4 screws (Chapter 9, Figure 9.1.34, pos. 2)
8. Holding the RF Head, remove the 2 screws (Chapter 9, Figure 9.1.34, pos. 1) with proprer allen wrenches with ends ball
9. Extract the RF Head (Chapter 9, Figure 9.1.28) from the cover.

6.2.7.1 Replace RF Amplifier

1. By performing the operations of paragraph 6.2.7, remove the RF Head
2. Holding the RF Amplifier (Chapter 9, Figure 9.1.28, pos. 1), remove the 4 torx screws (Chapter 9, Figure 9.1.35, pos. 1) with proprer torx wrenches
3. Remove the RF Amplifier

6.2.7.2 Replace Limiter and Noise Diode

1. By performing the operations of paragraph 6.2.7, remove the RF Head, after that the RF Amplifier
2. Holding the Limiter (Chapter 9, Figure 9.1.28, pos. 2) and Noise Diode (Chapter 9, Figure 9.1.28, pos. 3), remove the 4 screws (Chapter 9, Figure 9.1.35, pos. 2) with proprer wrenches holdin 3 bolt (Chapter 9, Figure 9.1.35, pos. 3)
3. Remove the Limiter and the Noise Diode

6.2.7.3 Replace Circulator

1. By performing the operations of paragraph 6.2.7, remove the RF Head, after that the RF Amplifier, Limiter and Diode Noise
2. By performing the operations of paragraph 6.2.6, remove the Magnetron
3. Holding the Circulator (Chapter 9, Figure 9.1.28, pos. 4), remove the 4 screws (Chapter 9, Figure 9.1.35, pos. 4) with proprer wrenches
4. Remove the Circulator

6.2.7.4 Replace Power Diode

1. By performing the operations of paragraph 6.2.7, remove the RF Head
2. Holding the RF Head, remove the 4 screws (Chapter 9, Figure 9.1.35, pos. 4) with proprer wrenches
3. Remove the Power Diode

c) Installation

1. Check for the integrity of the new part installed
2. In order to install the new part installed, perform the removal operations in reverse order without closing the SRT X-Band cover
3. By following the procedures of display manual, perform the VCO calibration
4. Close the Pedestal cover following the procedures of paragraph 6.2.3

6.2.8 Removal/Installation of the Electronics Assy

a) Required Tools

- Set of screwdrivers,
- Set of combination wrenches,
- Set of hexagonal wrenches,
- Set of allen wrenches with ends ball,
- Set of torx wrenches,
- Set T-Handle wrenches with swiveling hexagon sockets,
- Set T-Handle wrenches with swiveling hexagonal sockets,
- Silicone grease compound 340

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON".
2. By performing the operations of paragraph 6.2.3, open the SRT cover
3. Unscrew the 4 screws holding protection shield (Chapter 9, Figure 9.1.6, pos. 4)
4. By means of the proper screwdriver, remove the Magnetron wires from the terminal (Chapter 9, Figure 9.1.15 pos.1) tacking note of their disposition:
    1. Unplug yellow and green cables loosing the 2 bolts
    2. Unplug the yellow-green earth cable
5. Remove the Electronics Rack cabling connectors, taking note of their position. Table 6.2.2 - Connectors of the Electronics Rack describes connectors to be removed and their position in the Pedestal Unit.
6. By means of the proper screwdriver, unscrew the four screws (Chapter 9, Figure 9.1.29, pos. 1) fixing the Electronics Rack to the SRT cover
7. Extract the Electronics Rack from the cover paying attention to the cables and to the Waveguide joint Chapter 9, Figure 9.1.31, pos. 1)

Replace SRT CONTROL (Chapter 9, Figure 9.1.6, pos. 2)

1. Remove the 4 torx screws (Chapter 9, Figure 9.1.6, pos. 5) using the proper torx wrenches and disconnect the cabling connectors, taking note of their position.

Replace SRT MOS (Chapter 9, Figure 9.1.6, pos. 3)

1. Remove the 7 torx screws (Chapter 9, Figure 9.1.6, pos. 6) using the proper torx wrenches and disconnect the cabling connectors, taking note of their position.

Replace SRT PWR (Chapter 9, Figure 9.1.6, pos. 1)

1. Remove the 11 torx screws (Chapter 9, Figure 9.1.6, pos. 7) using the proper torx wrenches and disconnect the cabling connectors, taking note of their position.

c) Installation

1. Before installing the new electronics assy, remove the EEPROM U30 from the SRT Control Board of the old Electronics Rack and replace it in the SRT Control Board of the new one. If this operation is skipped, then the unit must be set up manually from blank to recover values and settings stored in the old board EEPROM
2. In order to install the Electronics Rack, perform the Removal operations in reverse order

Table 6.2.2 - Connectors of the Electronics Rack

Board	Connector	Purpose
SRT_Control	J4	BNC, Video Signal output
SRT_Control	P2	Terminal board for the signal to/from the Display Unit
SRT_Control	TB1	Safety Switch input
SRT_Control	J12	Cable for the Optical Read-Out connection
SRT_Control	J1	Small BNC, Video Signal input
SRT_Control	J2	Small BNC, Tune Signal input
SRT_Control	P1	RF_Amplifier controls
SRT_Control	TB3	Terminal Board for the Brushless Motor Controller
SRT_Power	TB2	Main Power input
SRT_Mos	A – K – Fil	Magnetron terminals

WARNING

WHEN THE ELECTRONICS RACK IS INSERTED ON THE FIXING BOLTS, PAY FULL ATTENTION NOT TO DAMAGE THE WAVEGUIDE JOINT (Chapter 9, Figure 9.1.31, pos.1)

6.2.9 Replacement of the Bearing Reader Board

a) Required Tools

- Set of screwdrivers,
- Set of allen wrenches with ends ball,
- Set of torx wrenches,
- Silicone grease compound 340.

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON".
2. By following the procedures of paragraph 6.2.3, open the TXRX the Cover
3. Disconnect the Bearing Reader Board cables (Chapter 9, Figure 9.1.30, pos. 2).
4. By means of the proper screwdriver, unscrew the 2 screws (Chapter 9, Figure 9.1.30, pos. 1) fixing the Bearing Reader mechanical frame
5. Remove the Bearing Reader Board

c) Installation

1. Check for the integrity of the new Bearing Reader Board
2. In order to install the Bearing Reader Board, perform the removal operations in reverse order
3. Close the cover following the procedures of paragraph 6.2.3

6.2.10 Replacement of the Performance Monitor

a) Required Tools

- Set of hexagonal wrenches
- Silicone grease compound 340,
- Set of combination wrenches.

b) Removal

1. On the electric switch board, set the Main Line Breaker relevant to the unit to OFF and hang up a card reading "WORK IN PROGRESS - DO NOT SWITCH ON".
2. Using the appropriate wrenches remove the 4 screws (Chapter 9, Figure 9.1.3, pos. 5).
3. Remove the Performance monitor (Chapter 9, Figure 9.1.3, pos. 6).

c) Installation

1. Check for the integrity of the new Performance Monitor
2. In order to install the Performance Monitor, perform the removal operations in reverse order

CHAPTER 7
PARTS LIST

7.1 Introduction

This chapter provides the list of the SRT 12/25 kW X-BAND replaceable parts.

7.1.1 Parts List

The parts' list is divided into major assemblies. All parts attached to the assemblies are listed in Part List Tables. The Parts' List Tables consist of eight columns as follows:

- Column 1: POS. (Position): the column indicates the replaceable parts position in the reference figure
- Column 2: DESCRIPTION: the column includes the descriptive identification data of the replaceable part
- Column 3: SPECIFICATION NUMBER OR TYPE: the column reports the specification number or the type of the replaceable part assigned by the supplier
- Column 4: REQUIRED QUANTITY (N): the column indicates, for each replaceable part, how many of them are assembled on the equipment

7.1.2 Part Location Illustration

Figures of Chapter 9 provide the location of the components. The position numbers of the items shown in the figure are referenced in the related Parts List Tables.

7.2 Parts List Tables

Table 7.2.1- List of items of Chapter 9

FIG./POS.	Description	Drawing Specification Number or Type	Required Quantity (N)
Figure 9.1.2	6' Antenna X-Band	000-10324-001	1
“	9’ Antenna X-Band	000-10325-001	1
“	12’ Antenna X-Band	TBD	1
Figure 9.1.5	12&25 kW Motor	000-10683-001	1
Figure 9.1.5	12&25kW Gear Reducer	000-10682-001	1
Figure 9.1.4, pos.5	12&25 kW Brushless Controller Assy	000-10684-001	1
Figure 9.1.27, pos.2	12 kW Magnetron JRC MSF1425A	000-10676-001	1
“	25 kW Magnetron JRC MSF1475A	000-10677-001	1
Figure 9.1.28	12&25 kW RF Detector Assy w/LNFE	000-10675-001	1
Figure 9.1.6	12 kW SRT Electronic Assy	000-10669-001	1
“	25 kW SRT Electronic Assy	000-10670-001	1
Figure 9.1.2	12&25 kW Performance Monitor Arm	000-10668-001	1

CHAPTER 8
INSTALLATION

X-Band Antenna Group including 6, 9 or 12 feet Antenna and Pedestal with 12 / 25 kW Transceiver up-mast

TABLE OF CONTENTS

8.1 Introduction

This chapter of the Technical manual can be used as a self-contained Installation Manual for the ARGUS X-Band Radar System including 6, 9 or 12 feet Antenna and Pedestal with 12kW or 25 kW Transceiver up-mast. It contains necessary information, pictures and drawings of how to handle, assemble and install this unit as a part of the complete Radar Equipment. Actions how to prepare this unit for the Radar Equipment Setup Procedure are also described.

8.1.1 Unpacking

The unit parts are placed in cardboard boxes covered with a plastic sheet. Each box includes a protecting polyurethane box shaped for the contained parts.

- The following rules should be observed:
- Units must be transferred on board still packed into their boxes

When the units are removed from their boxes they must be left in their protective plastic cover until installation

It is advisable to keep the packing material for possible future use the plastic sheet in which the unit is wrapped can be used to protect it during installation and maintenance procedures.

In addition to the various main parts forming the unit (se par. 8.3.2 below) there is further materiel included in the delivery. Those additional things are:

- Technical User Manual and Installation Manual included
- Installation Kit (Terminals, clamps, connectors etc.)
- Standard Spare Part Kit (Fuses etc.)

The Installation Kit and the Spare Part Kit is necessary for the installation and operation of the equipment, and must be kept by them who perform the installation work. Contents of the Kits should be checked immediately after unpacking, using the materials list contained in the box. The manufacturer will not accept claims for missing items unless presented immediately after unpacking.

8.1.2 Storage

After the parts contained in the boxes have been inspected in the presence of the customer, and it has been verified that no damage has occurred, the unit shall be stored in its original packing until the time of installation. The storage premises must be dry and well protected.

If the units must be kept in storage for more than one month, it is advisable to insert hygroscopic substances, such as silicone gel salts, in the crates. See para. 8.2 Specifications (Environmental Conditions).

8.1.3 Handling

The antenna and the pedestal must be brought up the mast separately and then assembled.

The pedestal is lifted by crane. Use slings attached to the eyebolts fitted on top of the pedestal.

Minimum angle at the base is 60º. See Figure 1 (Lifting by crane)

The pedestal contains delicate electronic components - handle accordingly.

The antenna surface is sensitive to impacts and pressure. Any deformation of the antenna surface can reduce the radar performance. Lift the antenna in slings, carefully preventing it from slipping.

8.2 Specifications

8.2.1 Dimensions and weights (See also Out-line Drawings)

Length	**546 mm**
Width	**364 mm**
Height	**391 mm**
Weight with 6 ft antenna	**35 + 5 kg**
Weight with 9 ft antenna	**35 + 9 kg**
Weight with 12 ft antenna	**35 + 14 kg**
Swing circle with 6 ft antenna	**183 cm**
Swing circle with 9 ft antenna	**274 cm**
Swing circle with 12 ft antenna	**366 cm**

8.2.2 Required power

Standard configuration	115-220 V / 50-60 Hz
Peak Power consumption 12 kW /25 kW under 100 KN winds	250 W / 380 W
Medium Power consumption (from minimum configuration 12 kW / 6X to 25 kW / 9X HSC	75 W /130 W

8.2.3 Environmental Data

Operating temperature	-25°C / +55°C Note: With Heater -40°C
Storage temperature	-25°C / +70°C
Relative humidity	Up to 95% at +40°C
Water resistance, Salt spray, Vibrations etc	As per IEC 60945

8.3 Installation

8.3.1 Installation Principles

In order to obtain the best radar performance and accessibility, the following precautions should be used:

- Space for the antenna to swing freely. See par. 8.2 (Specifications; Antenna type)
- Safety and easy access for maintenance purposes. It is preferable to use a platform on the ship's mast.
- Figure 2 (Suggested Masthead Antenna mounting)
- The antenna to be accessible in all directions
- Avoid exposure to exhaust fumes from the funnel
- Avoid strong vibrations
- Avoid interference between two antennas
- Avoid obstacles in the radar beam, especially ahead of midship

If two radar sets are installed, their antennas should be installed on different levels.

The antennas can be mounted, either on a single mast construction, so they are on top of each-other, as illustrated in Figure 2 (Suggested Masthead Antenna mounting) or the antennas can be mounted on a platform, Figure 3 (Suggested Antenna mounting), one on portside and one on starboard side.

The following formula and drawing, as illustrated in Figure 4 (Antenna Positions), will help you to determine the correct distance and height between the two radar antennas. The 45° angle on the drawing is the actual vertical beam-width with a safety margin included.

Example:

"H = L",

H = height between the two antennas

L = the distance between the two antennas

If the distance L is 6 m, then the height should be = 6 m.

Blind sectors towards the bow and within a few degrees on port and/or starboard side caused by the structure of the ship must be avoided with great care. In case of a blind sector at the bow in mid-ships' position, it is advisable to mount the antennas on the starboard side of the ships' keel-line.

When obstacles are sufficiently far from the antenna, they will result in a blind sector on the radar display with approximately the same amplitude as observed by the human eye, but these obstacles can produce false echoes. An echo produced by an obstacle close to the antenna, can be suppressed by reflecting the antenna-beam skywards by mounting a reflector made of metal, as also illustrated in Figure 2 (Suggested Masthead Antenna mounting). This solution however, does not eliminate the blind sector, but will reduce false echoes

produced by the obstacle. The best position for the reflector can be found by testing out different positions.

The Installation consists of the following basic steps:

- Mount the SRT unit without the Antenna on the mast
- Make relevant connector
- Install and connect the Performance Monitor (optional) arm
- Install the Safety Switch, if required
- Mount the Antenna on the SRT unit

NOTE

The transceiver should be installed so that the performance monitor arm is not facing funnels or other major obstructions. Sector blanking is enabled to prevent false echoes caused by funnels and/or constructions (see above). If the performance monitor arm is positioned, within this blanking area, the pedestal must be turned because the radar performance monitor is not working where there is no transmission in the sector of its sensor

Installation of Safety Switch CHANGE: IT IS ON THE DC CORE OR ADAPTER BOX OR OPTIONAL FOR THE ADAPTER BOX EXTERNAL is compulsory. It is recommended to be installed at the bottom of the stairs giving access to the Antenna Pedestal. The waterproof switch is supplied by manufacturer, but a connection cable (2x2,5 mm^2) should be provided by the shipyard.

The Antenna assembly must be covered by plastic sheet during any painting performed after the installation.

NOTE

Under no circumstances should the Antenna be used to hoist the Pedestal up the mast

8.3.2 Mechanical installation

The ARGUS X-BAND RADAR SYSTEM consists of the following units and type designations:

Pedestal with 12/25 kW transceiver:	**Argus 12U / 25U**
6 feet antenna:	**6 Ft. X P**
9 feet antenna:	**9 Ft. X P**
12 feet antenna:	**12 Ft. X P**
Optional:	**External optional safety switch**

8.3.2.1 Unit (pedestal + transceiver)

Prepare the platform for mounting the pedestal. Hole diameters and distances are shown in Figure 5 (Dimension Drawing).

The pedestal should be mounted with its lid hinges pointed forward and cable glands pointed astern. However, the antenna swinging plane must be horizontal in all directions when ship is upright on even keel. Consider giving ample space for service, especially astern of the scanner. If such space cannot be achieved, contact manufacturer for installation alternatives.

NOTE

The waveguide protection covers on the antenna and pedestal must not be removed until when mounting the antenna. The waveguide joints are to be covered when the antenna is not mounted.

NOTE

The fixing materials to fasten the antenna pedestal to the ship's platform are not provided by the manufacturer. Assuming a platform plate thickness of 20 mm, four M10 stainless steel bolts of 65 mm length, with related nuts and washers, must be used. The tightening torque is 44 Nm.

8.3.2.2 Antenna

The antenna and the pedestal must be brought up the mast separately and then assembled. The TXRX should not be lifted with the antenna already mounted.

The mounting procedure of the antenna to the pedestal consists of following steps:

- Remove the waveguide protections on the antenna and pedestal.
- Mount the antenna over its support, check that the waveguide connections are on the same side. The antenna assumes the right position following two reference plugs.
- Rest the antenna on the pedestal and tighten the 4 bolts holding the antenna (Chapter 9, Figure 9.1.2 pos. 1). The tightening torque is 22 Nm

8.3.2.3 Safety Switch (External is optional)

The Radar CORE unit and the optional SRT adapter box both feature a safety switch. However, for some installations it may be compulsory to have an external safety switch.

It is recommended to place the optional safety switch at the bottom of the stairs that are giving access to the radar mast. The switch must be mounted with the cable glands pointing down. Connect the cable as described in 8.3.3 Electrical installation.

8.3.2.4 Performance Monitor Arm

To install the P.M. Arm proceed as follows:

- Connect the P.M. Arm for the radiation monitor on the SRT (pedestal). The arm shall be angled upwards

8.3.3 Electrical installation

The electrical installation of the SRT consists of cabling and connection to terminals, Figure 6 (SRT Pedestal Schematic blocks), as described below:

8.3.3.1 Multicore Cable

Also see par. 8.5 (Multicore Cabling and Termination Principles)

NOTE

Use the installation materials for the Multicore cable which are delivered by the manufacturer to ensure proper connection

Normally the cable (4 twisted pair + 2 Coax + 8 wire), is delivered in a length of 15, 30 or 60 m. The Multicore cable includes wires for Power, Video, Trigger and Antenna data. These cables should therefore be handled with particular care.

The scanner end of the multicore cable shall be connected to the Main Connector, see Figure 7 and Figure 8.

8.3.3.2 Safety Switch (optional)

The safety switch is available from the manufacturer, but does not include cable for connection to the Core unit (must be purchased separately).

- Check that the Safety Switch is placed as described in par. 8.3.2.3 Mechanical Installation
- Connect the two poles of the safety switch, on TB1 of the Core unit
- The cable gland not in use must be properly sealed
- Carefully make sure that the switch is closed in “1” (On) position and open in “0” (Off) position.

8.3.3.3 Grounding

Connect a tinned braided copper wire (>25 mm^2) between the GROUND TERMINAL on the pedestal and the radar mast.

8.3.4 Pre Setup Procedures

This paragraph provides information concerning the preliminary controls and procedures to be done as a completion of the electrical installation and before supplying the unit with power and before performing the System Setup.

Procedure:

- Carry out a careful visual inspection of the installed components referring to the layouts of the unit and to the interconnection drawings
- Carefully check the integrity of the fuses

NOTE
Powering the Radar System is not included in the Pre Setup Procedure

8.3.4.1 Ship power Voltage

- The unit must is connected to ship main voltage through the Core unit or through the SRT adapter box.
- Cable section shall be ≥ 4 mm to support a 15 A current.

8.3.4.2 Compass Safe Distance

Every unit should be located outside the minimum magnetic compass safe distance according to the following table:

Unit	Safe distance to the standard magnetic compass (m)	Safe distance to the steering magnetic compass (m)	Reduced Safe distance to the standard magnetic compass (m)	Reduced Safe distance to the steering magnetic compass (m)
12.5 or 25 kW X-Band SRT Transceiver	**1.35**	**0.85**	**0.85**	**0.55**
SRT Adapter Box	**1.20**	**0.50**	**0.75**	**0.30**

8.4 Installation Figures and Drawings

The following figures and drawings are included after this page:

Figure 1 (Lifting by crane)

Figure 2 (Suggested Masthead Antenna mounting)

Figure 3 (Suggested Antenna mounting)

Figure 4 (Antenna Positions)

Figure 5 (Dimension Drawing)

Figure 6 (SRT Pedestal Schematic blocks)

Figure 7 (Main Connector Drawing)

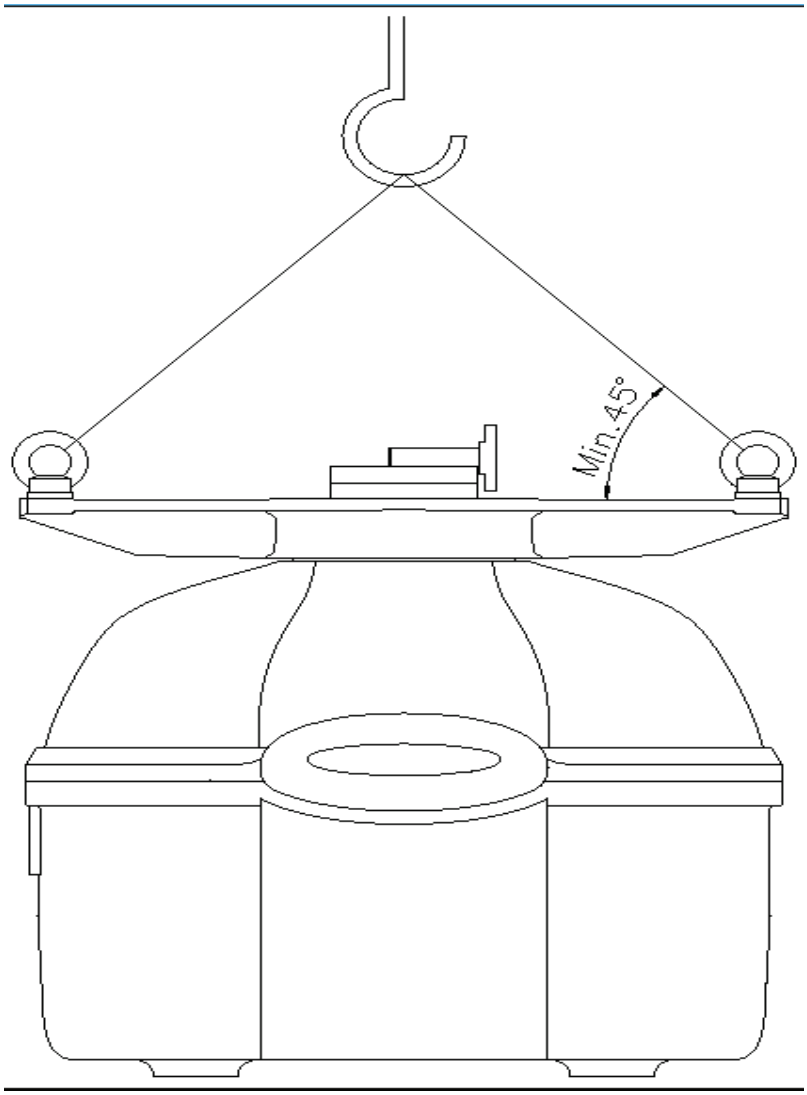
Figure 8 (Cable termination)

Figure 9 (SRT Pedestal Control Board)

Figure 10 (SRT Control Board - Service switch)

Figure 11 (Safety Switch (optional)

Fig 1 Lifting by crane



WARNING: Never pass or stay under any lifted object!

Fig 2 Suggested Masthead Antenna mounting

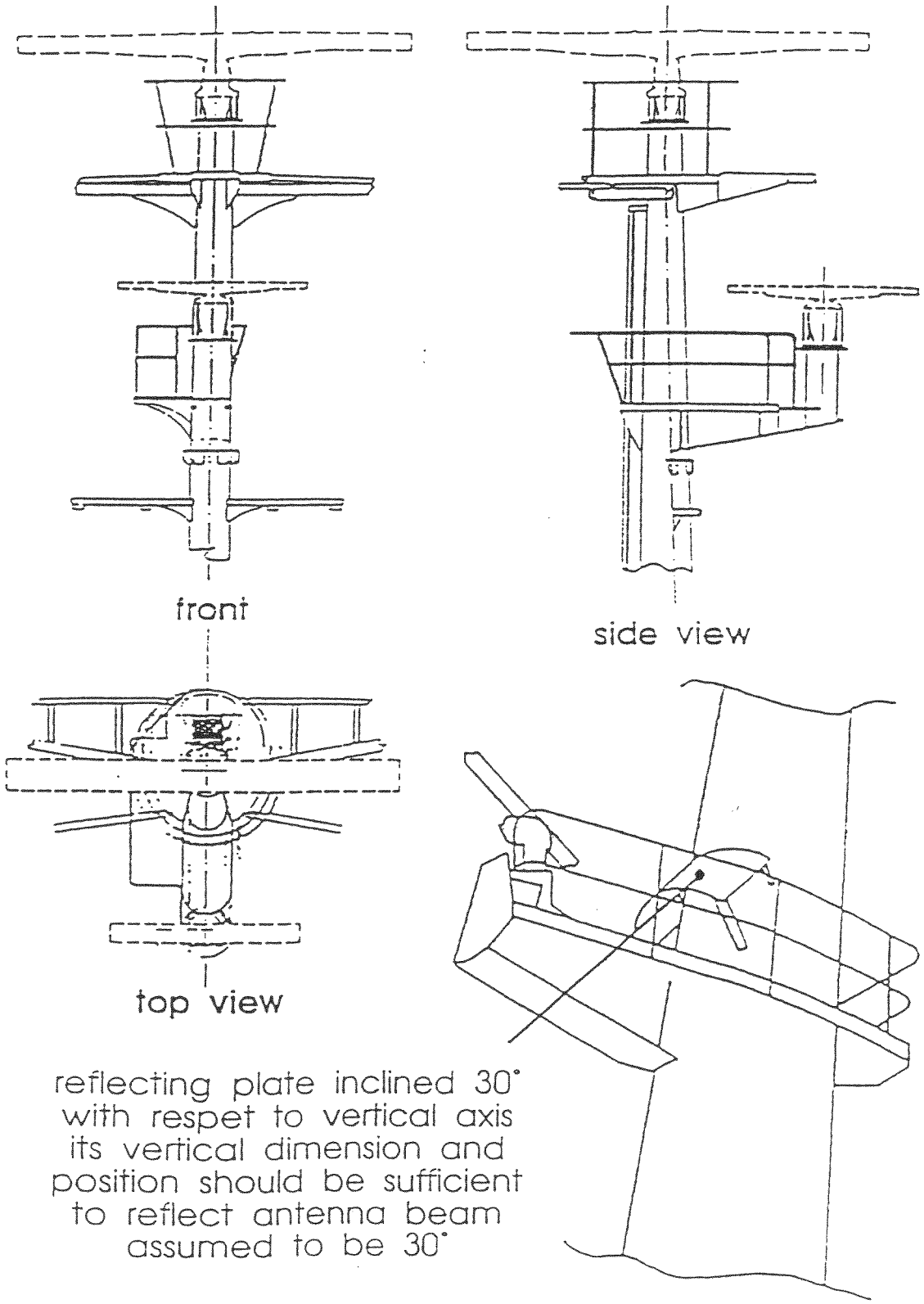


Fig 3 Suggested Antenna mounting

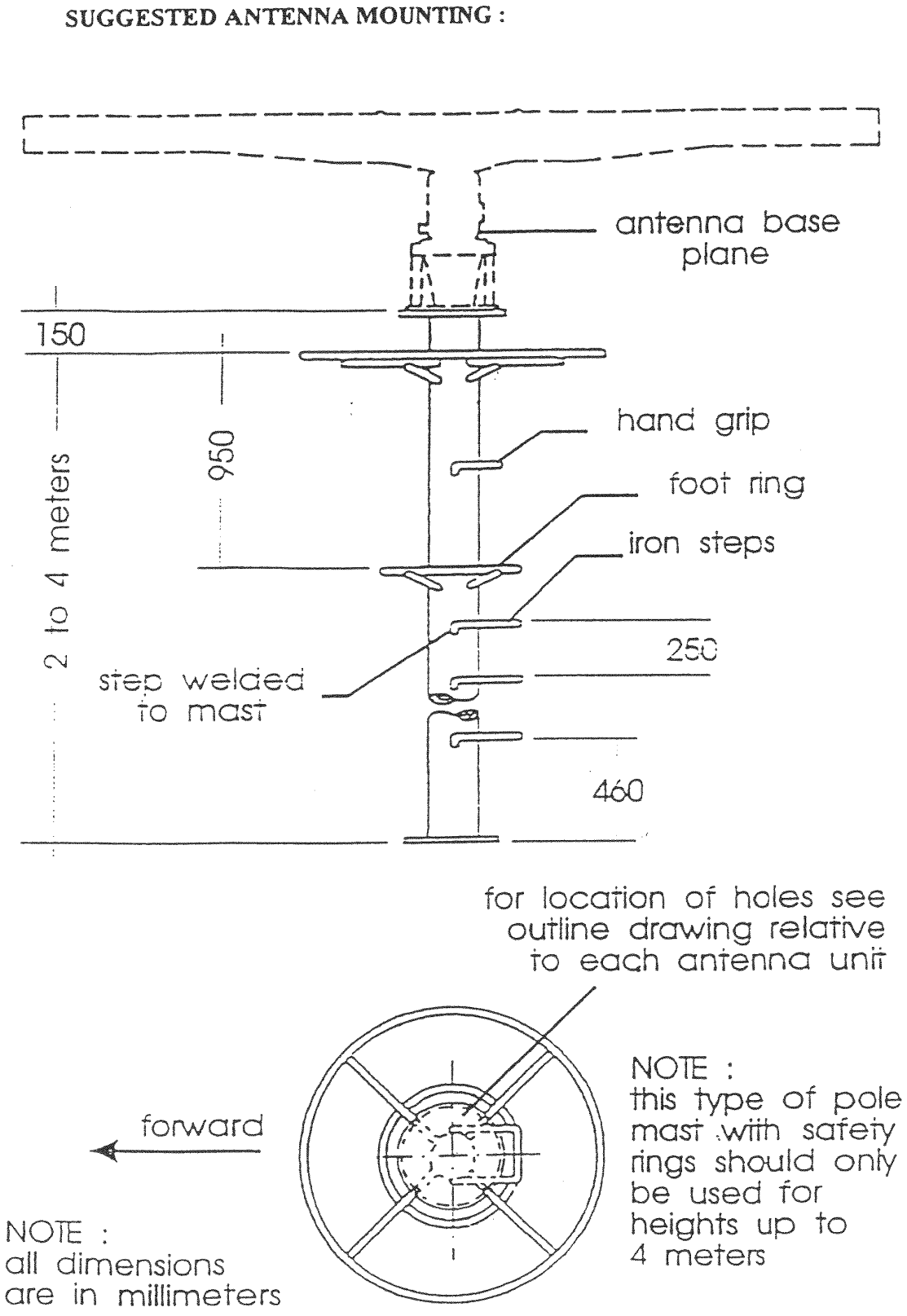
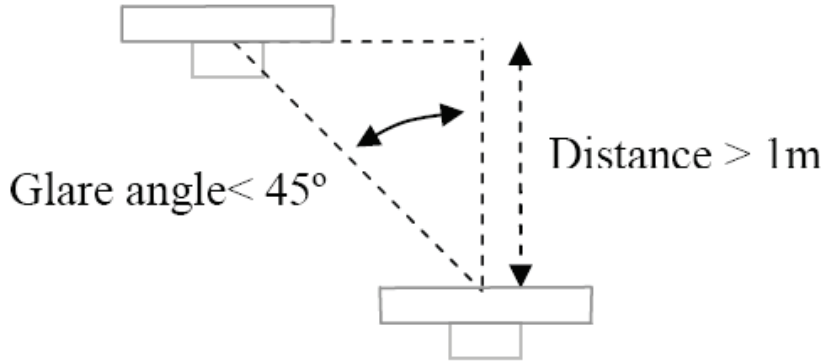


Fig 4 Antenna Positions



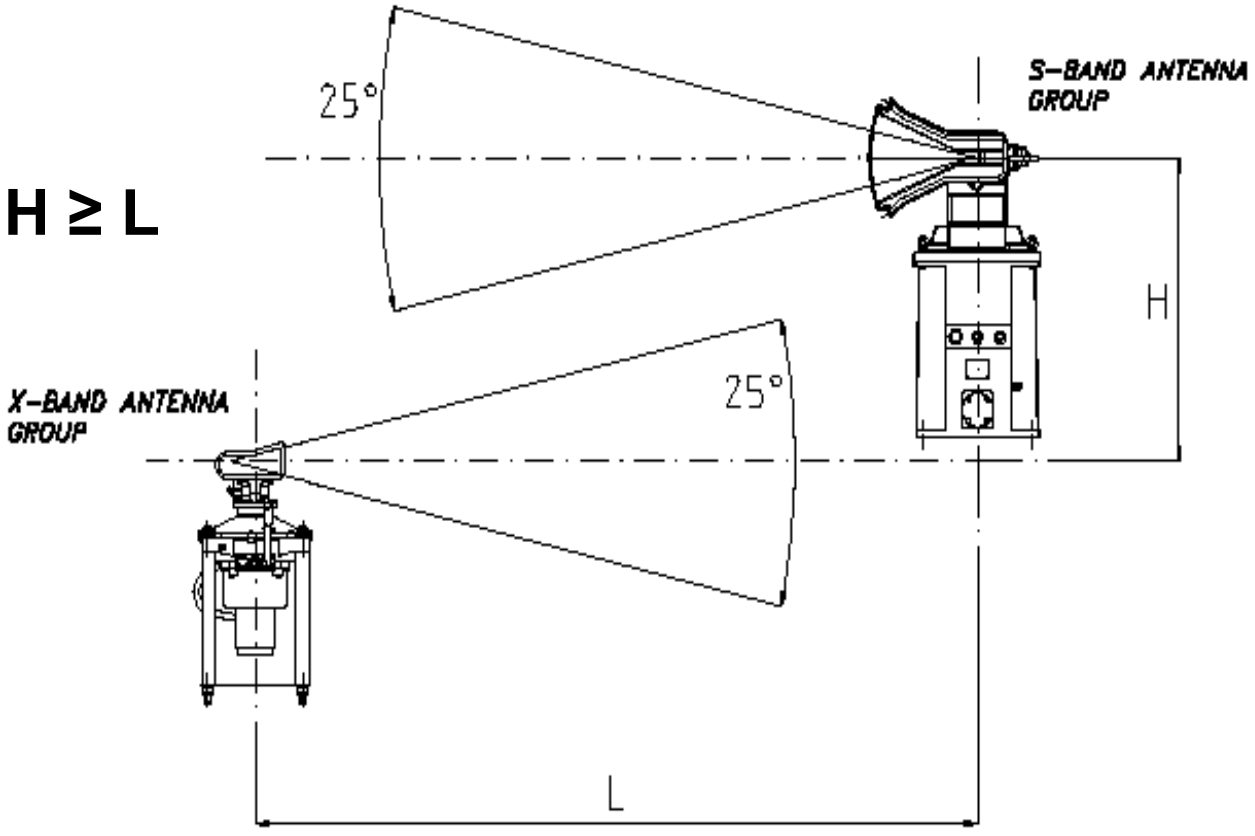
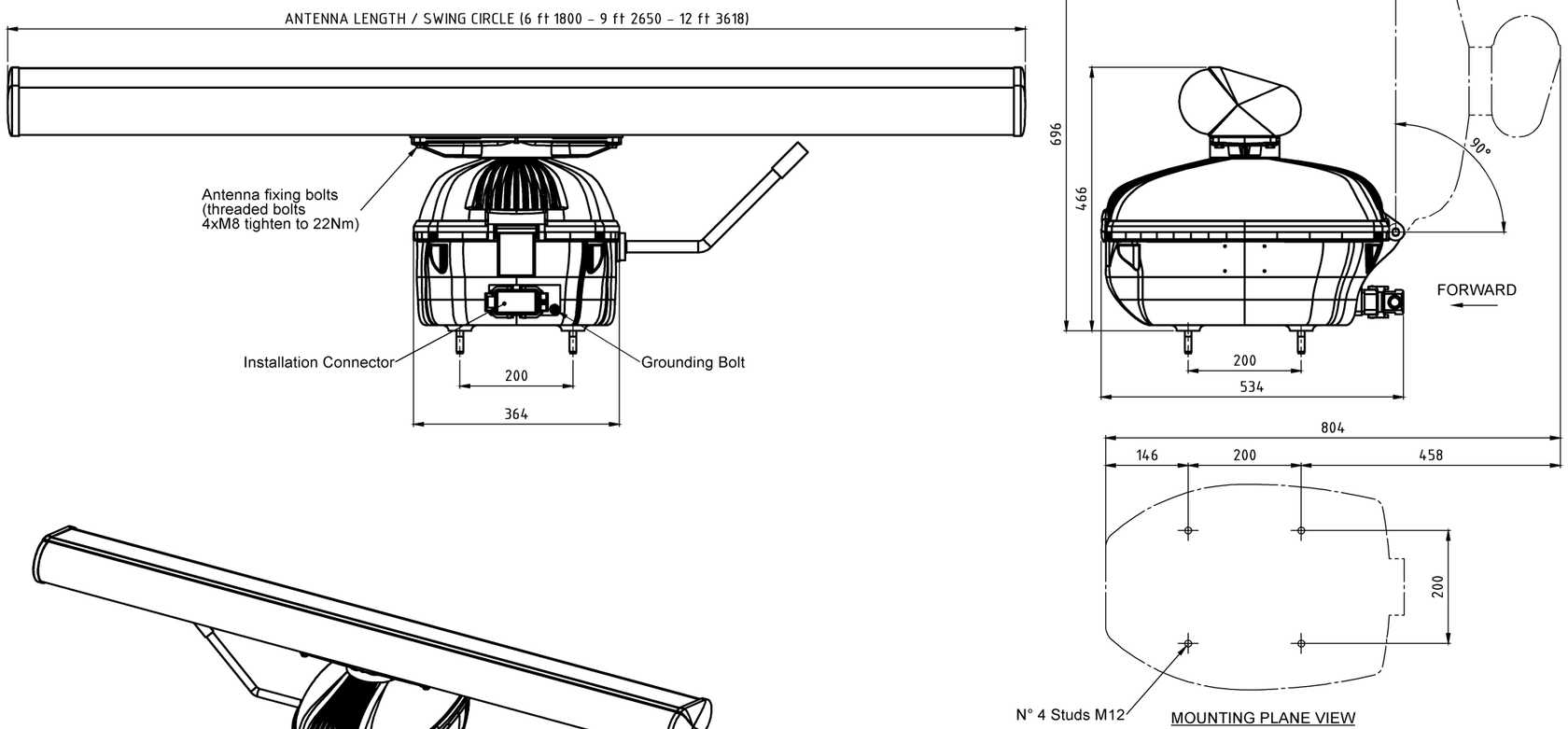


Fig 5 Dimension Drawing



UNIT	IP	WEIGHT
SRT & Antenna 6 Ft	65	40Kg
SRT & Antenna 9 Ft	65	44Kg
SRT & Antenna 12 Ft	65	49Kg

Fig 6 SRT Pedestal Schematic blocks

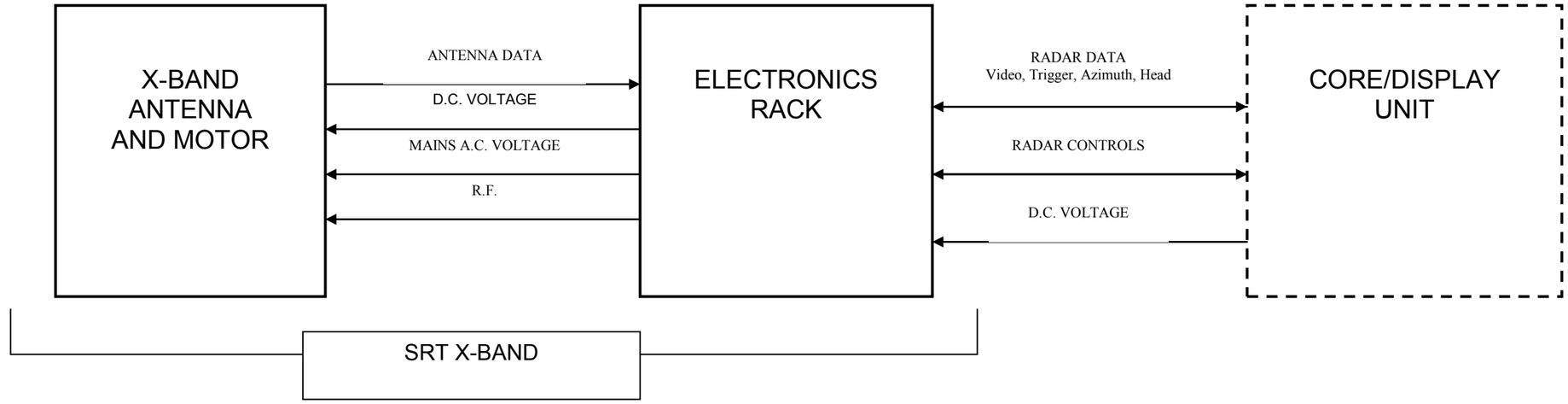


Fig 7 Main Connector Drawing

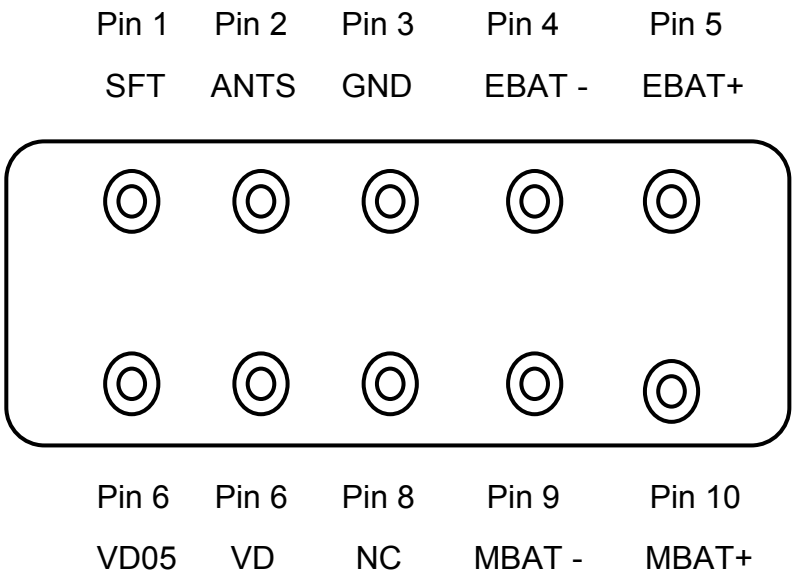


Fig 8 Cable termination

Cable connector in 12/25 kW X-band Up-mast transceiver

1

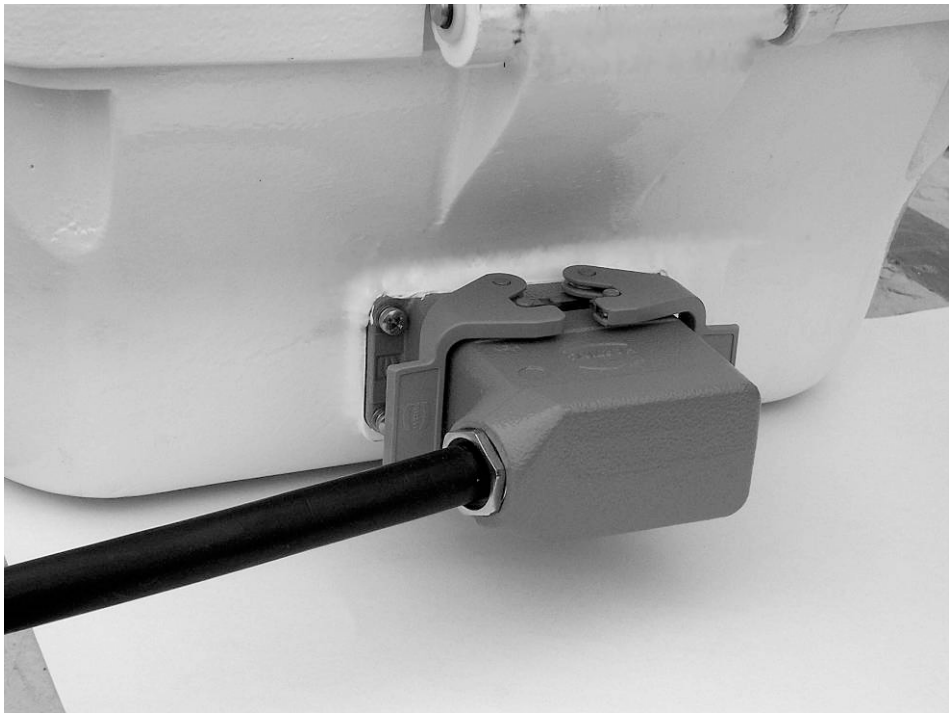


Fig 9 SRT Pedestal Control Board

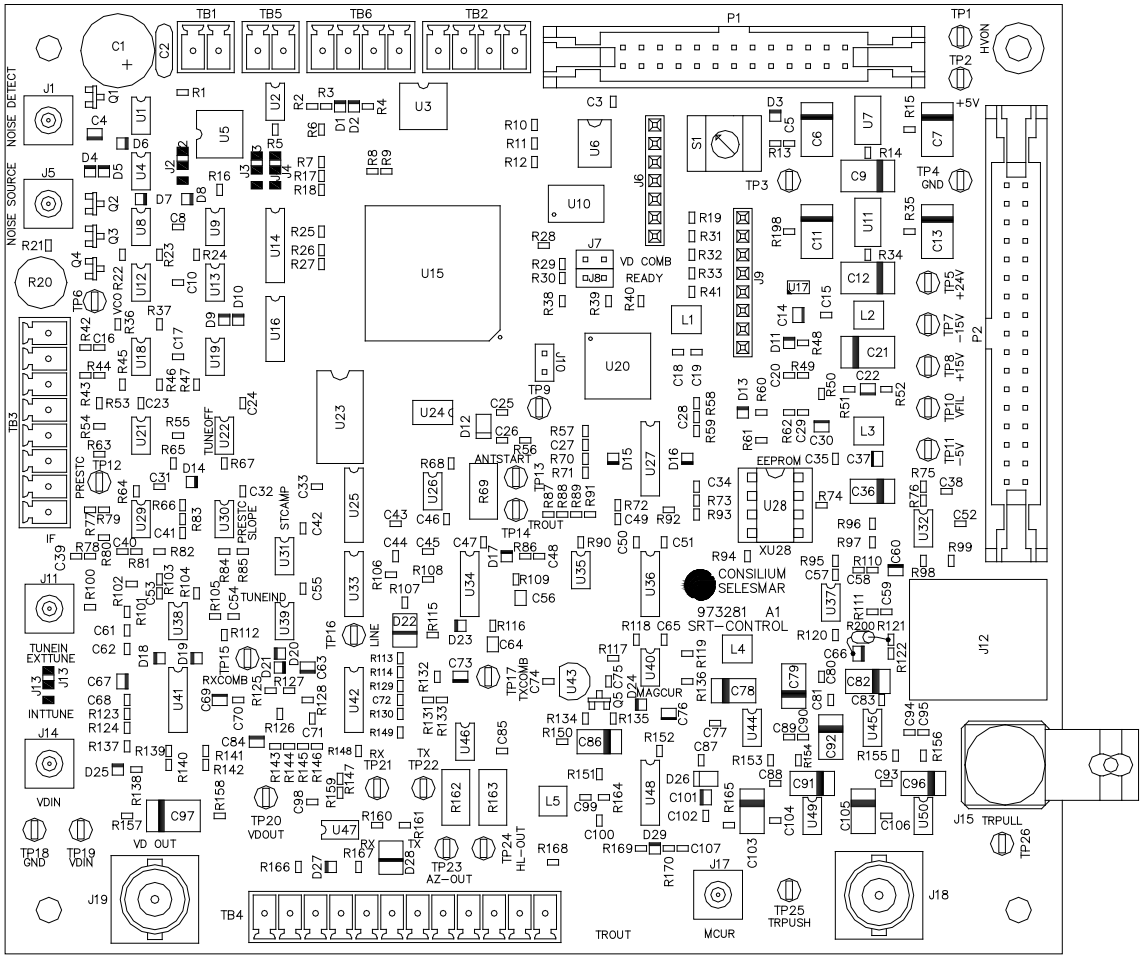


Fig 10 SRT Control Board - Service switch

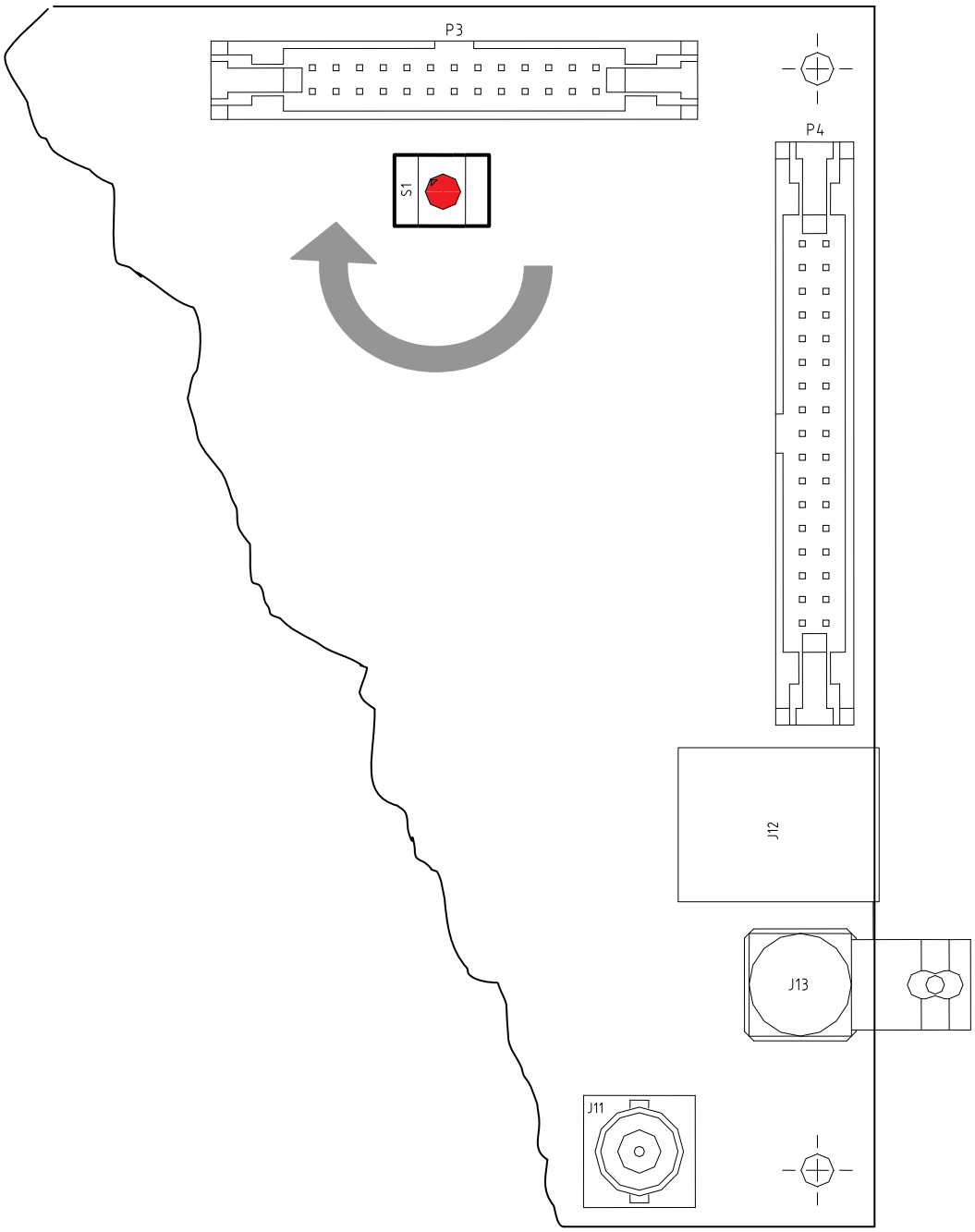
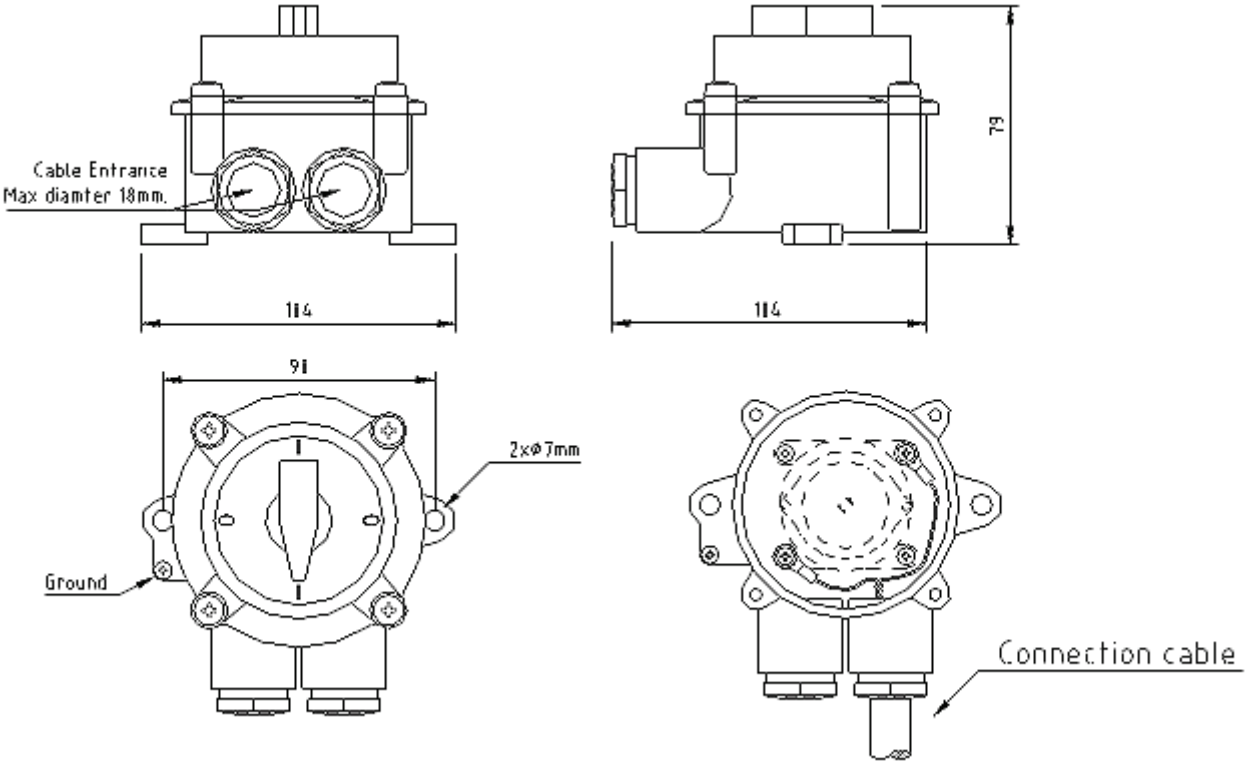


Fig. 11 Safety Switch (optional)



8.5 Multicore Cabling and Termination Principle

Special extensive illustrated instructions are included in this paragraph

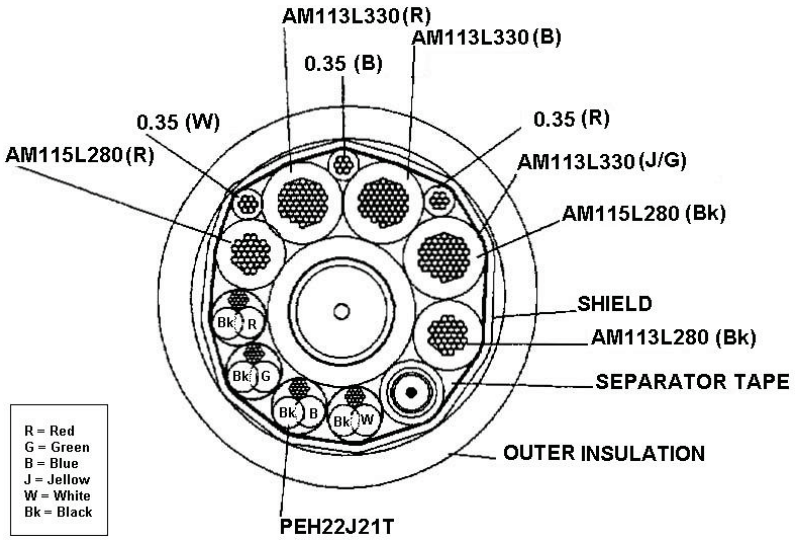
55X456P001
MULTI CORE CABLING
AND TERMINATION PRINCIPLES
FOR

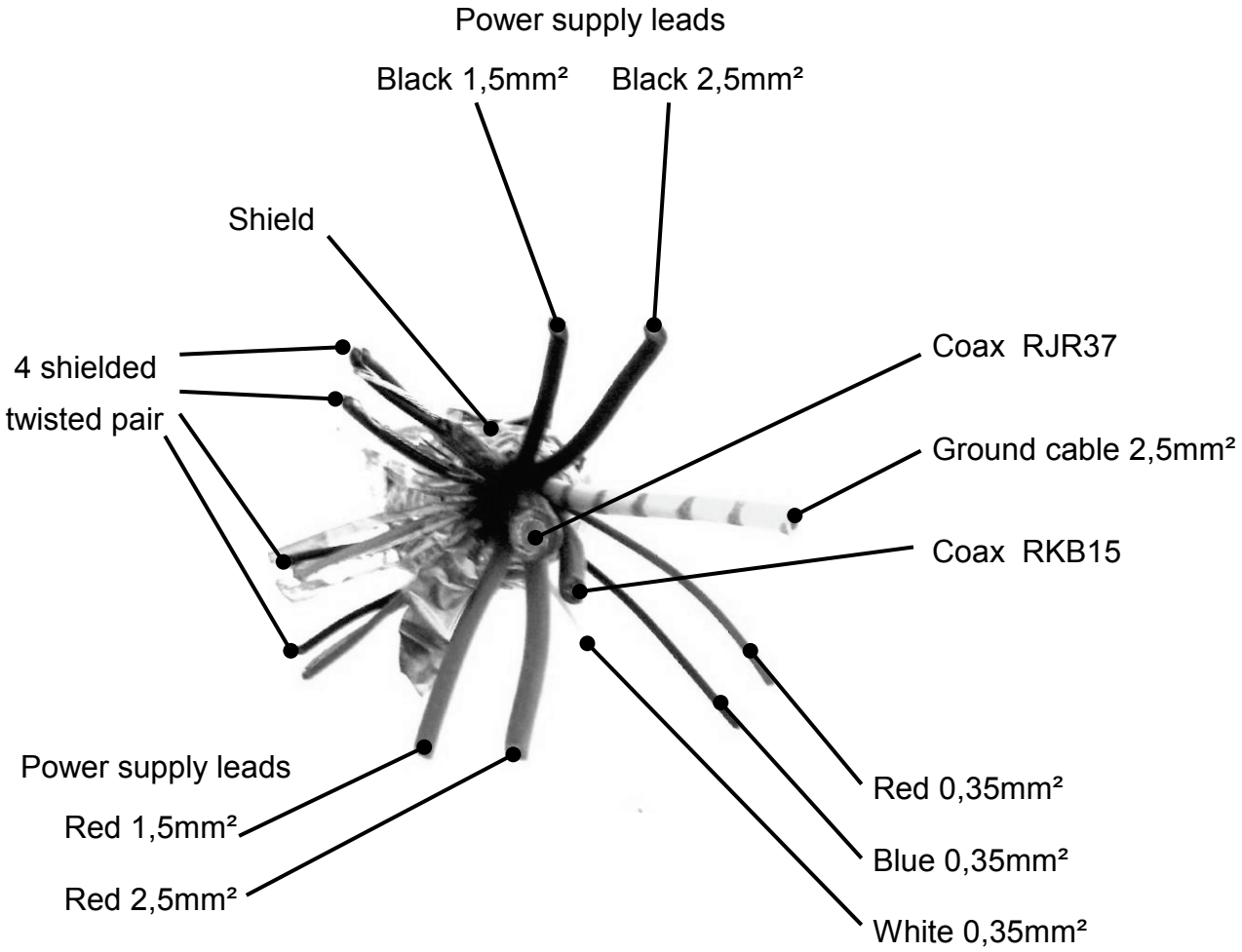
- SRT X-Band Antenna Group including 6, 9 or 12 feet Antenna and Pedestal with 12 kW Transceiver Upmast
- SRT X-Band Antenna Group including 6, 9 or 12 feet Antenna and Pedestal with 25 kW Transceiver Upmast

Installation Instructions

Multicore Cable Technical Specification

Core overview of Multicore Cable:





Cable handling

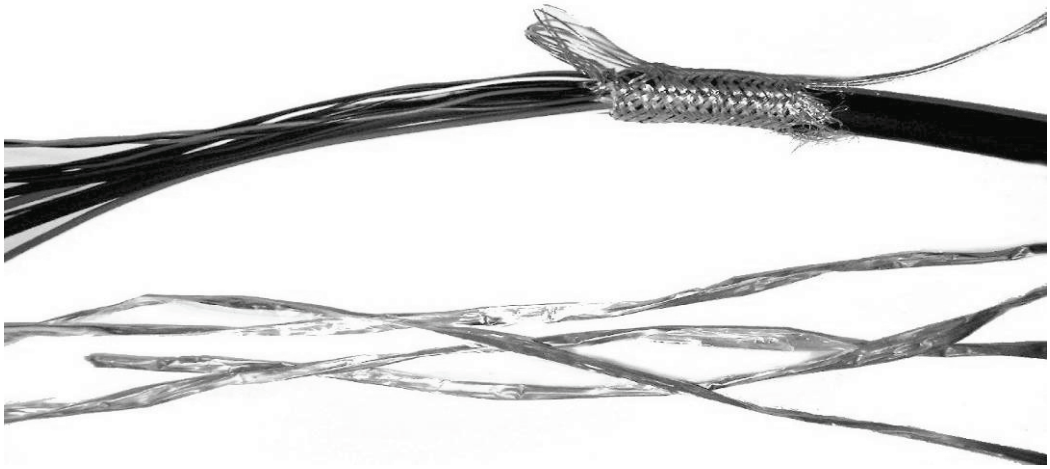
- Remove 60 cm of the outer insulation of the cable.

- Remove most of the shield, down to 5 cm, as indicated:

- Remove the main protective film and pull the shield over the cable outer isolation, as illustrated:

Main Shield and inner shields handling

- Remove the metallic film from each twisted pair cables and pass the 4 ground wires through the, turned, shield.



0.35 mm² cores

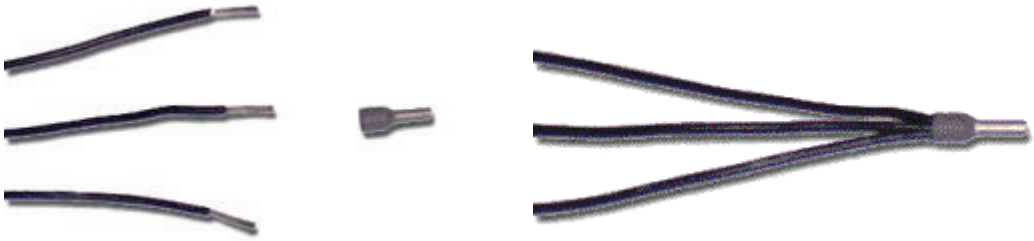
- Cut the core to the required length and dismantle the core for 10 mm:

- Insert and crimp the blue-end terminal:

Note: End terminals should always be used.

- Double connection in one terminal (yellow terminal):

- Triple connection in one terminal (grey terminal):



1,5 and 2,5 mm² cores

- Cut the core to the required length and dismantle the core for 10 mm:

Note: End terminals should always be used.

RG coaxial cables

Mechanical details of BNC connector:

Cut the cable to the required length.

Dismantle the outer insulation of the RG coaxial cable without damaging the shield, and fit the related parts of the BNC connector as below:

Details related to the ring of the BNC connector.

Take back the shield on the ring and trim exceeding shield:

Dismantle the outer insulation of the centre core without damaging the centre core and be sure that the shield is not shorted with the centre core:

Solder the centre core with the BNC pin.

Be careful not to damage the insulation (i.e. burned) during the solder process:

Mount the BNC connector as below:

CHAPTER 9
FIGURES

The following figures and drawings are included after this page:

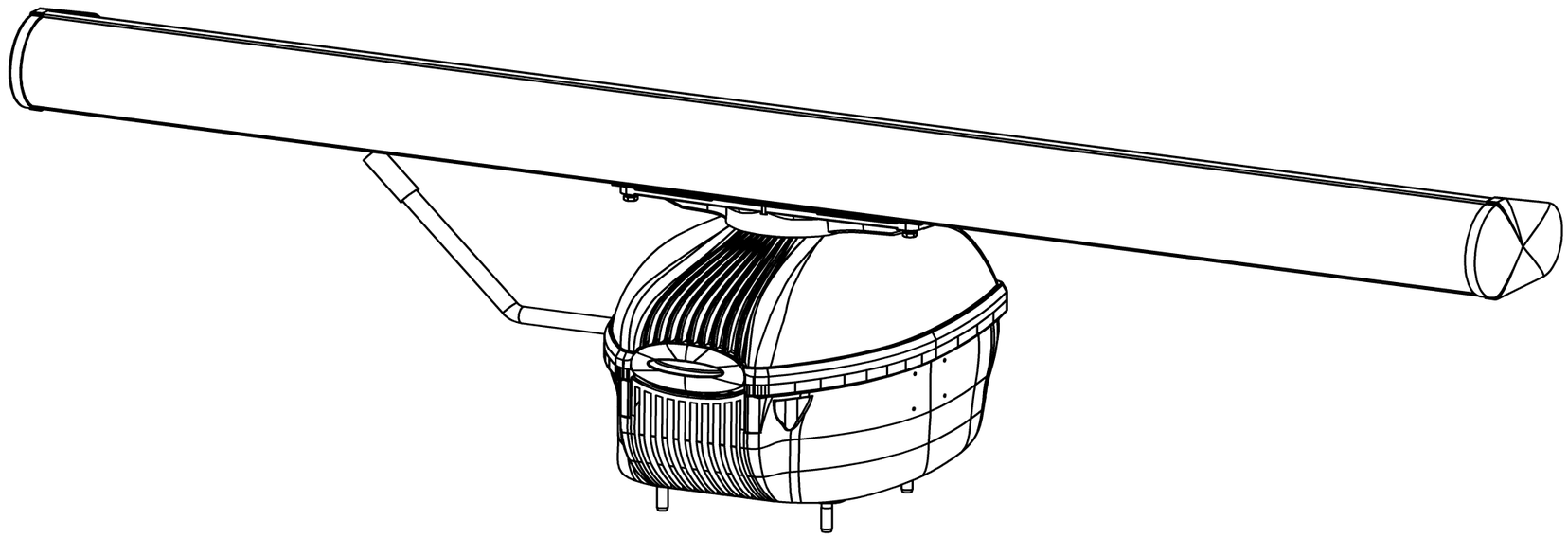


Figure 9.1.1 SRT Up mast General View

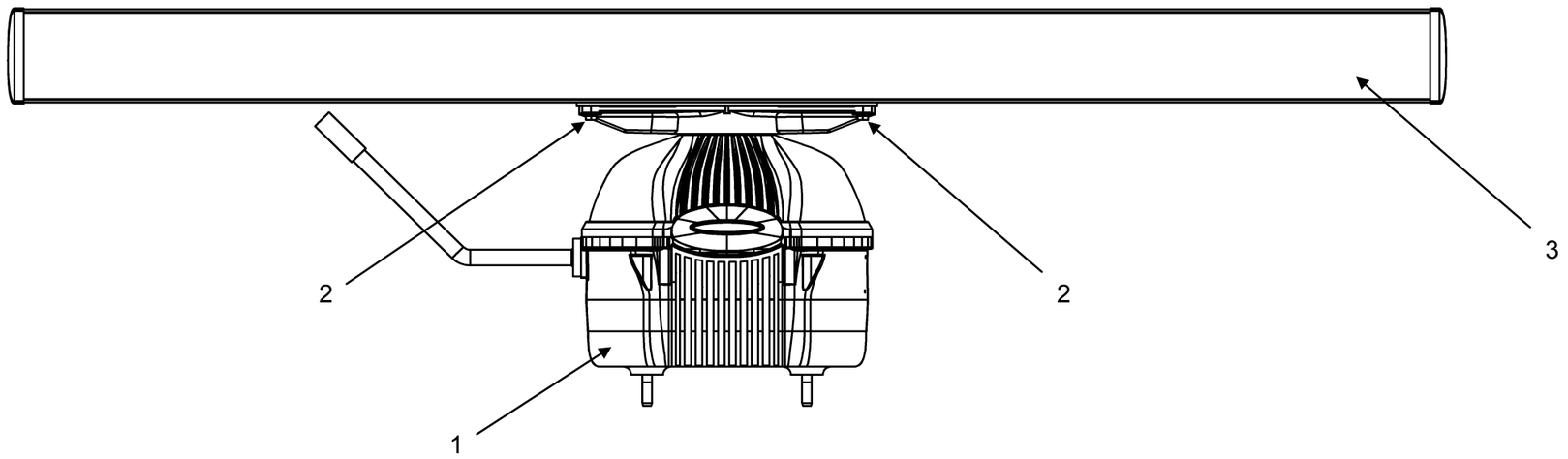


Figure 9.1.2 SRT Up mast– External view

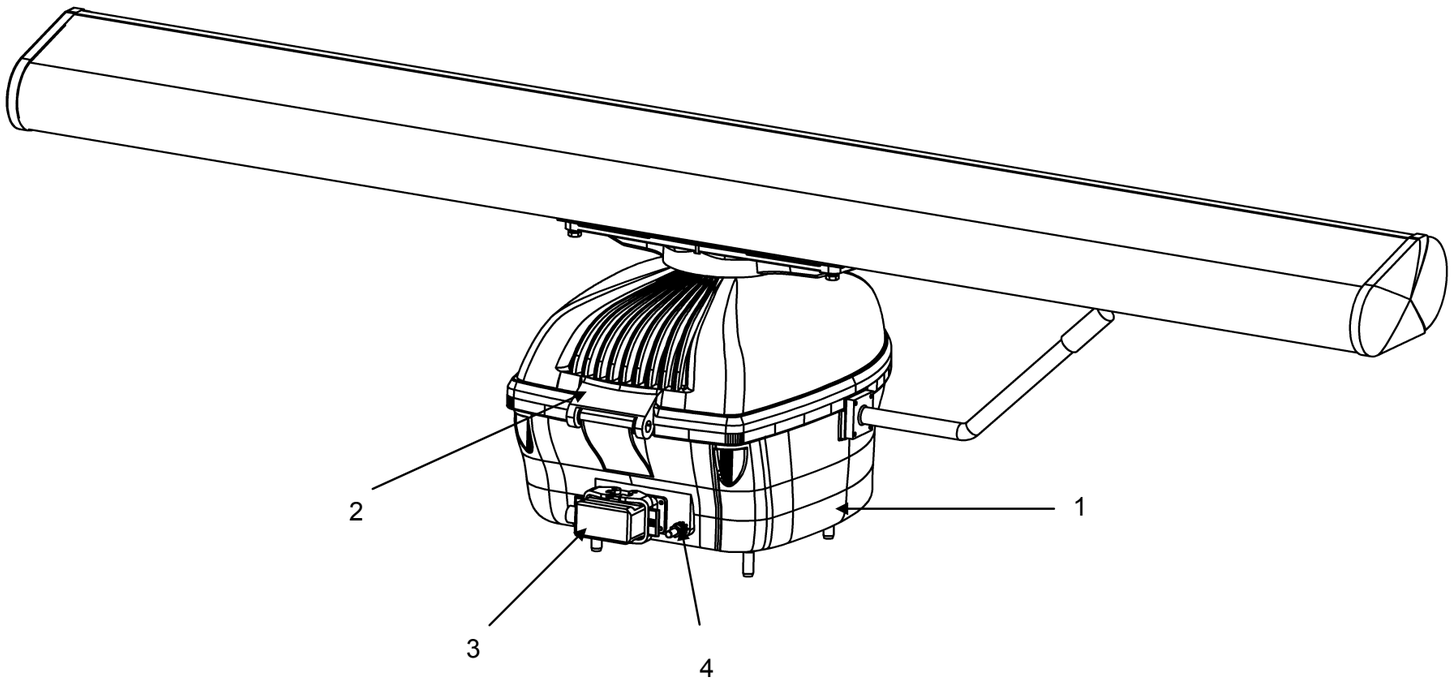


Figure 9.1.3 X-Band Pedestal External View

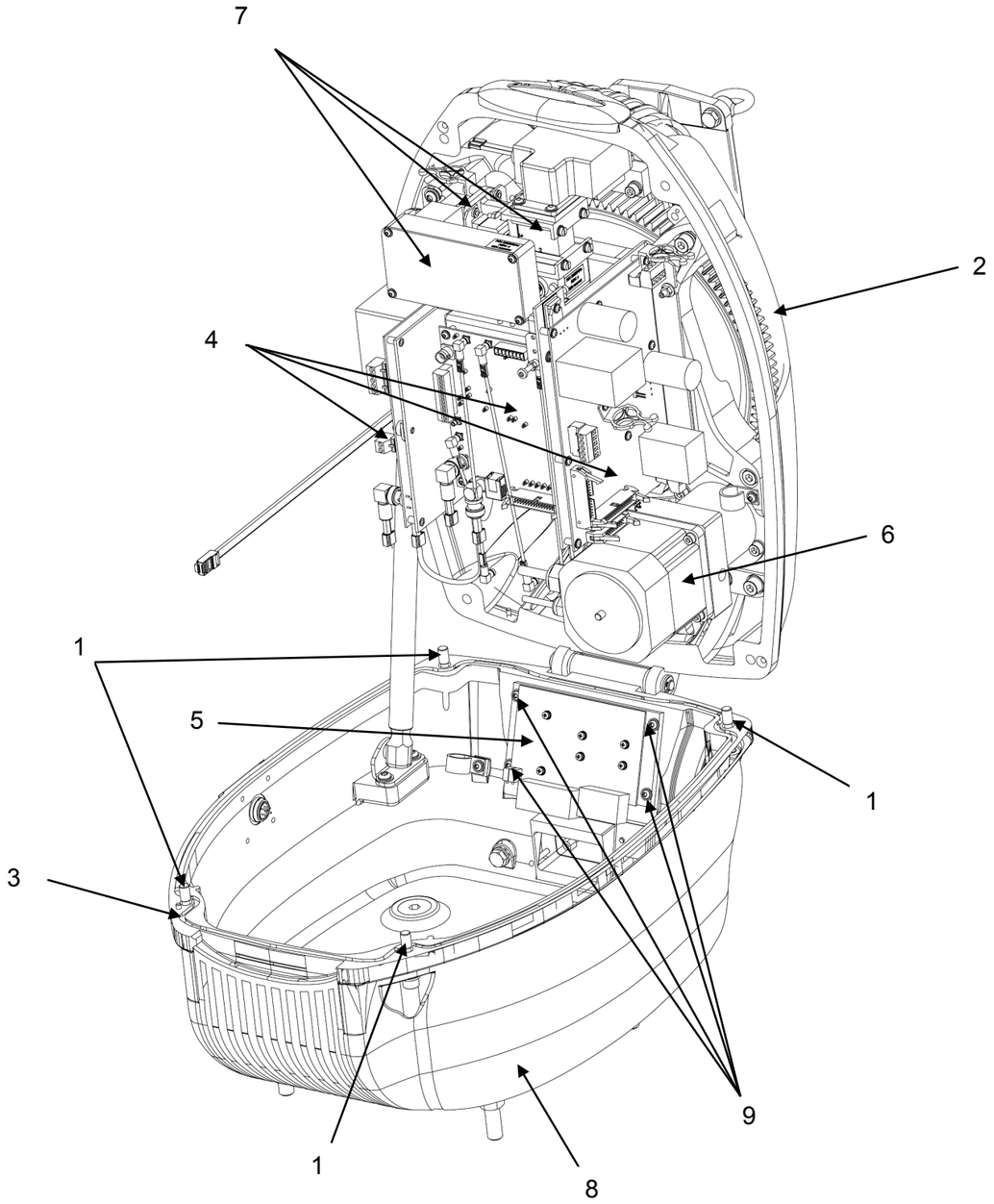


Figure 9.1.4 X-Band Pedestal Internal View

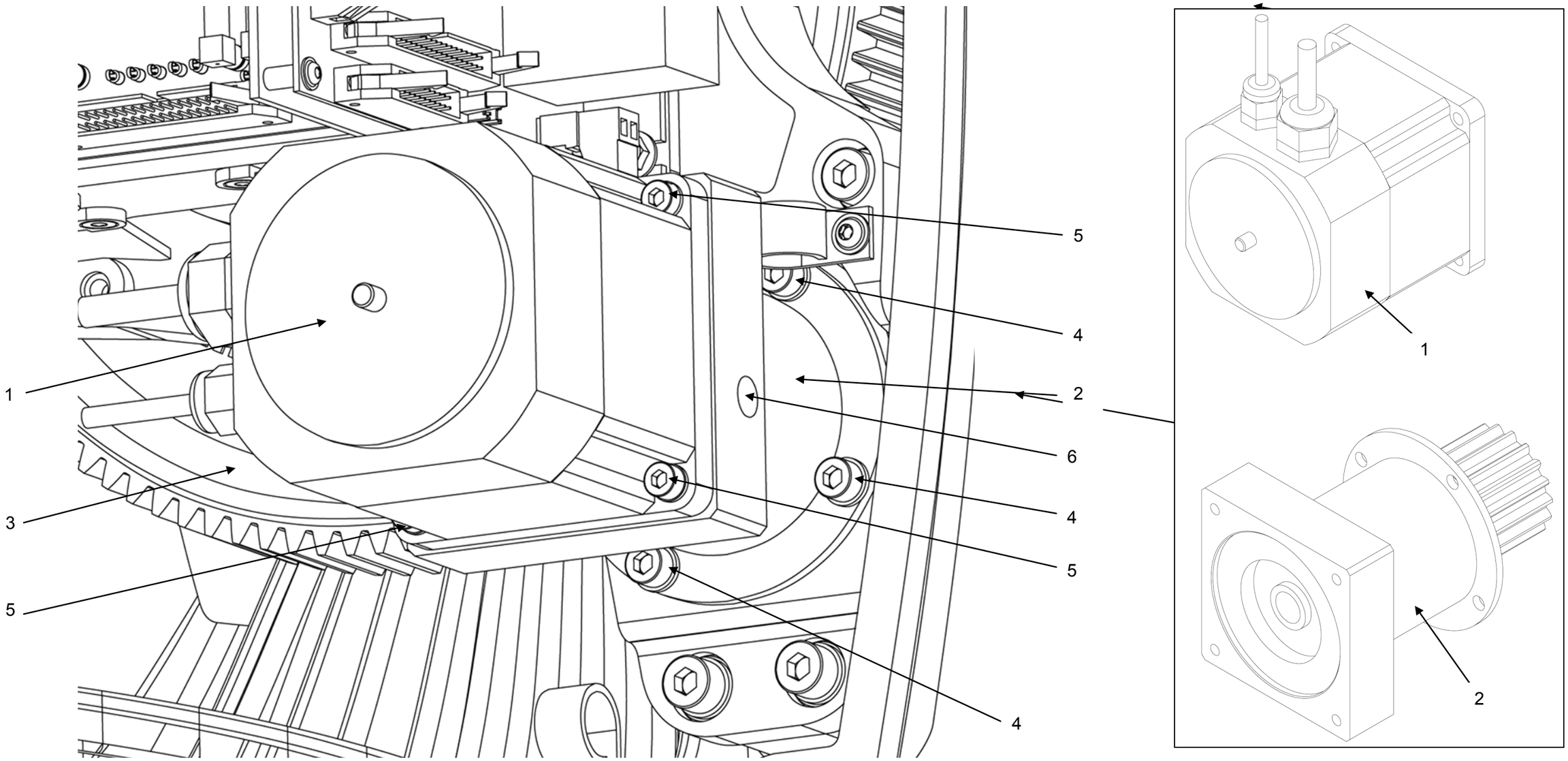
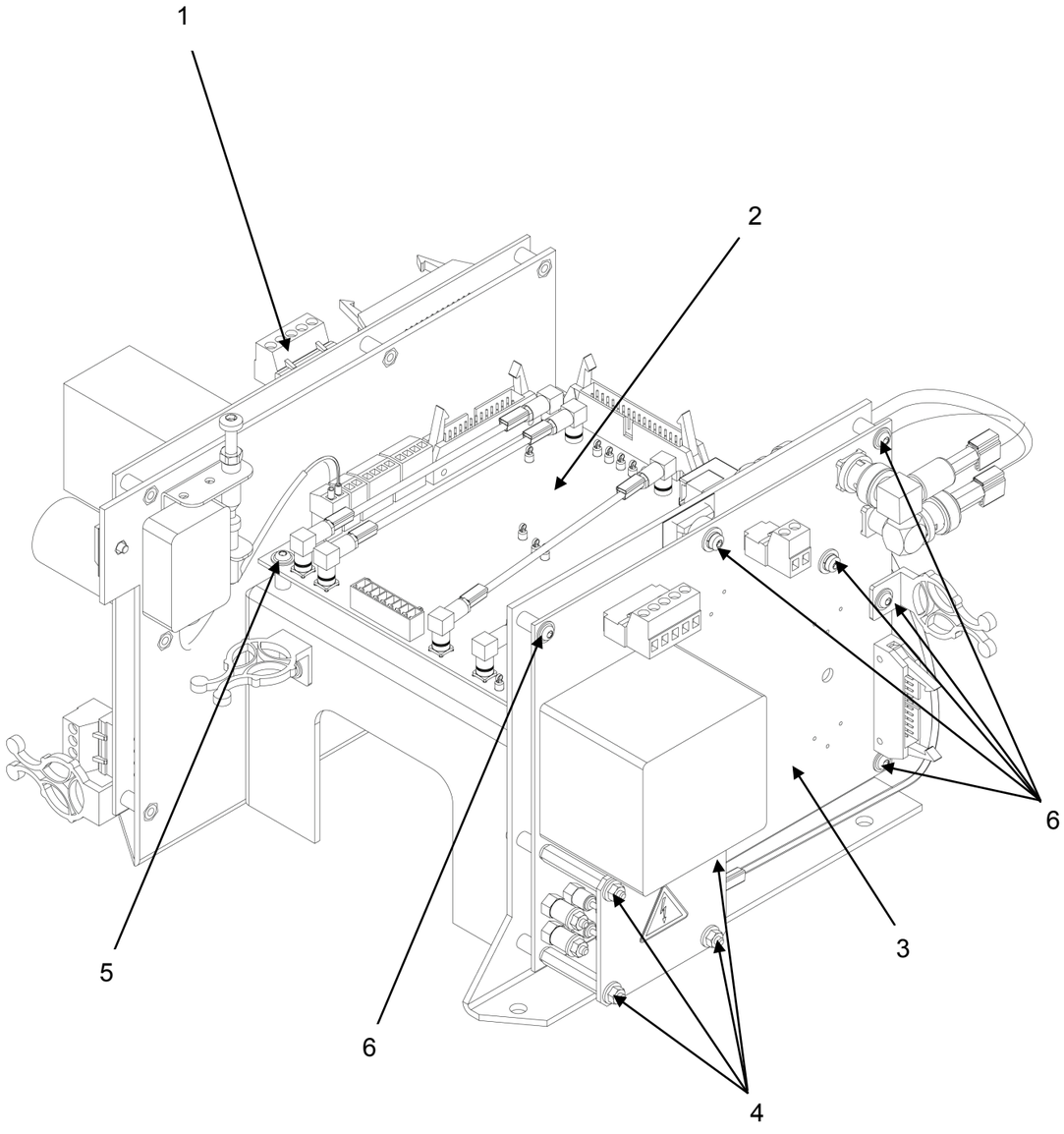


Figure 9.1.5 Motoreducer assy



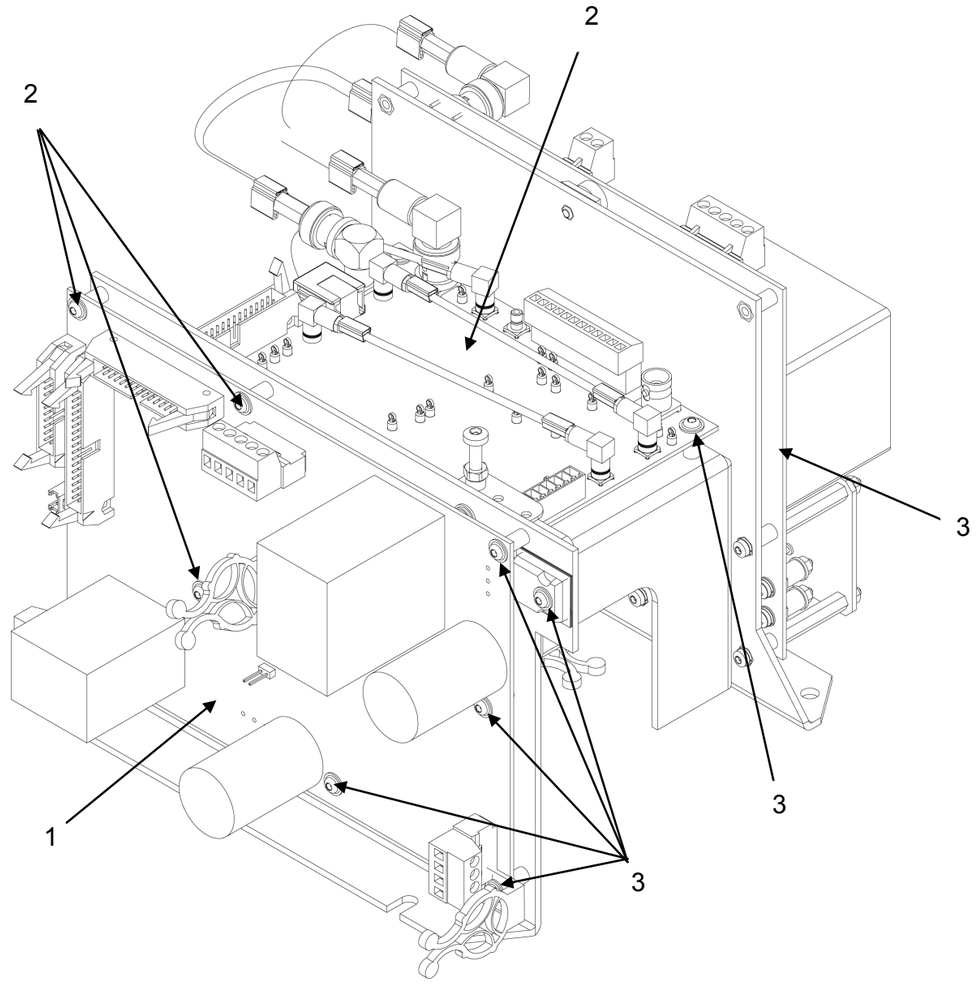


Figure 9.1.6 Electronics Rack

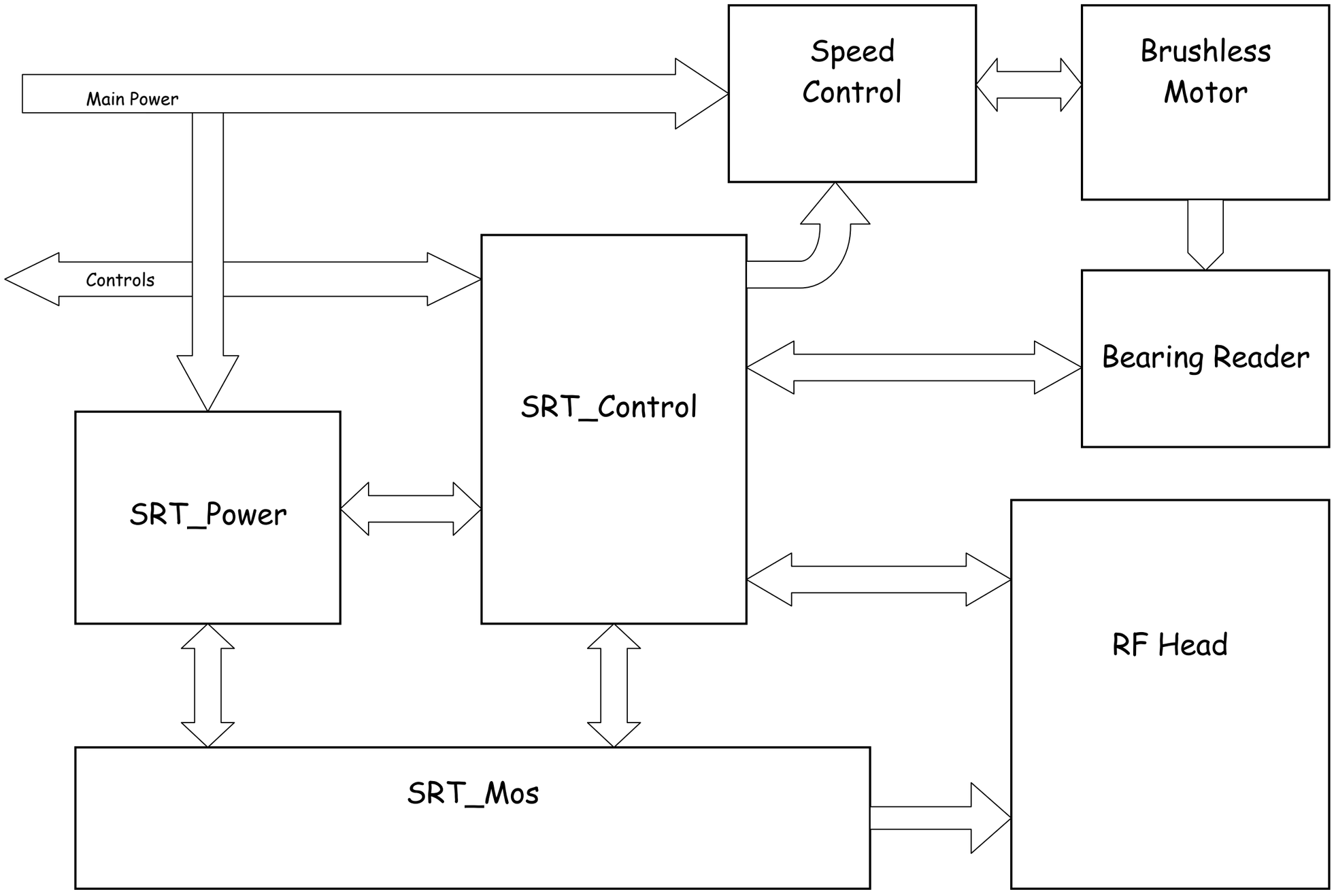


Figure 9.1.7 SRT Functional Block Diagram for 6’ Antenna

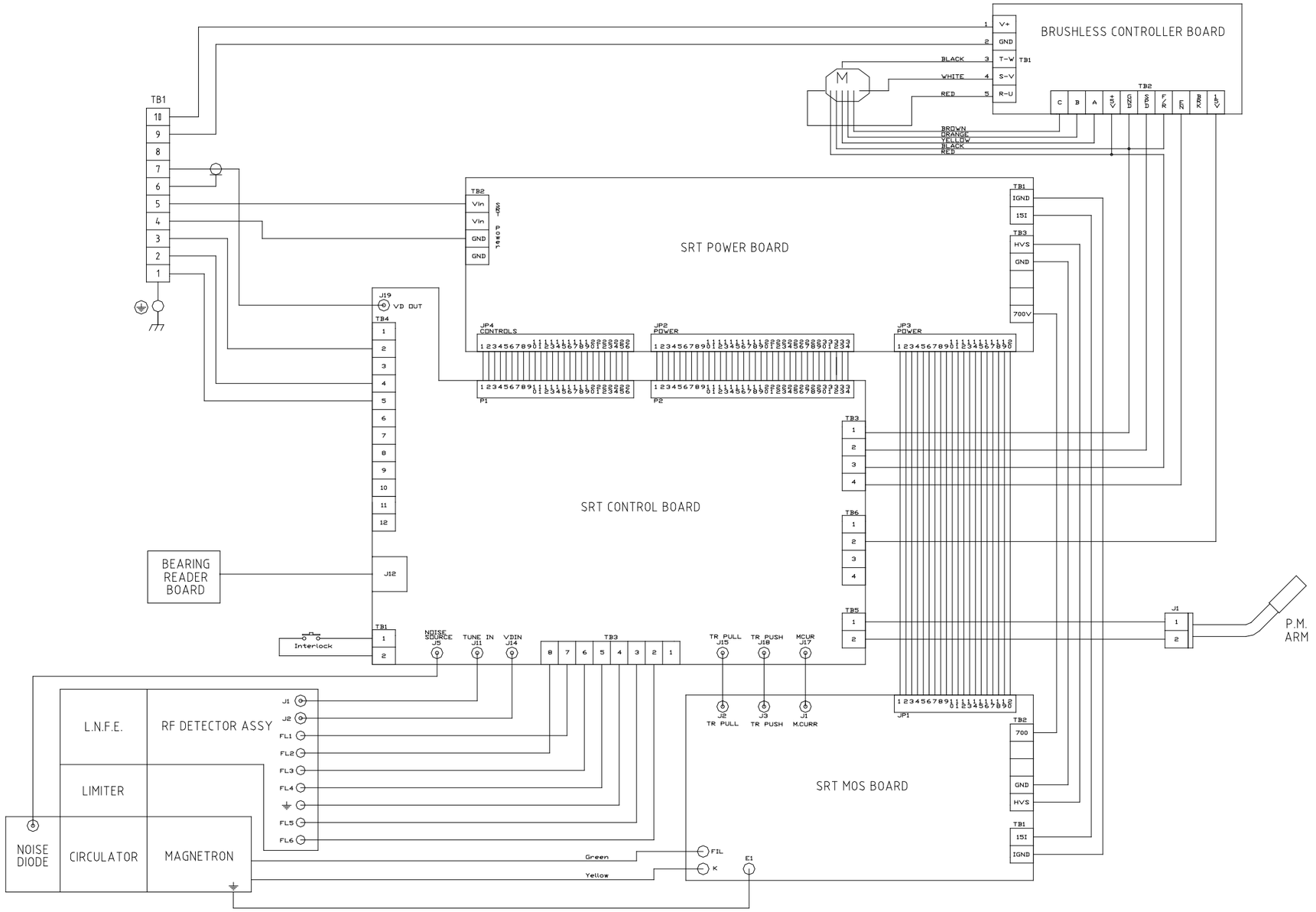


Figure 9.1.8 SRT Internal Connection

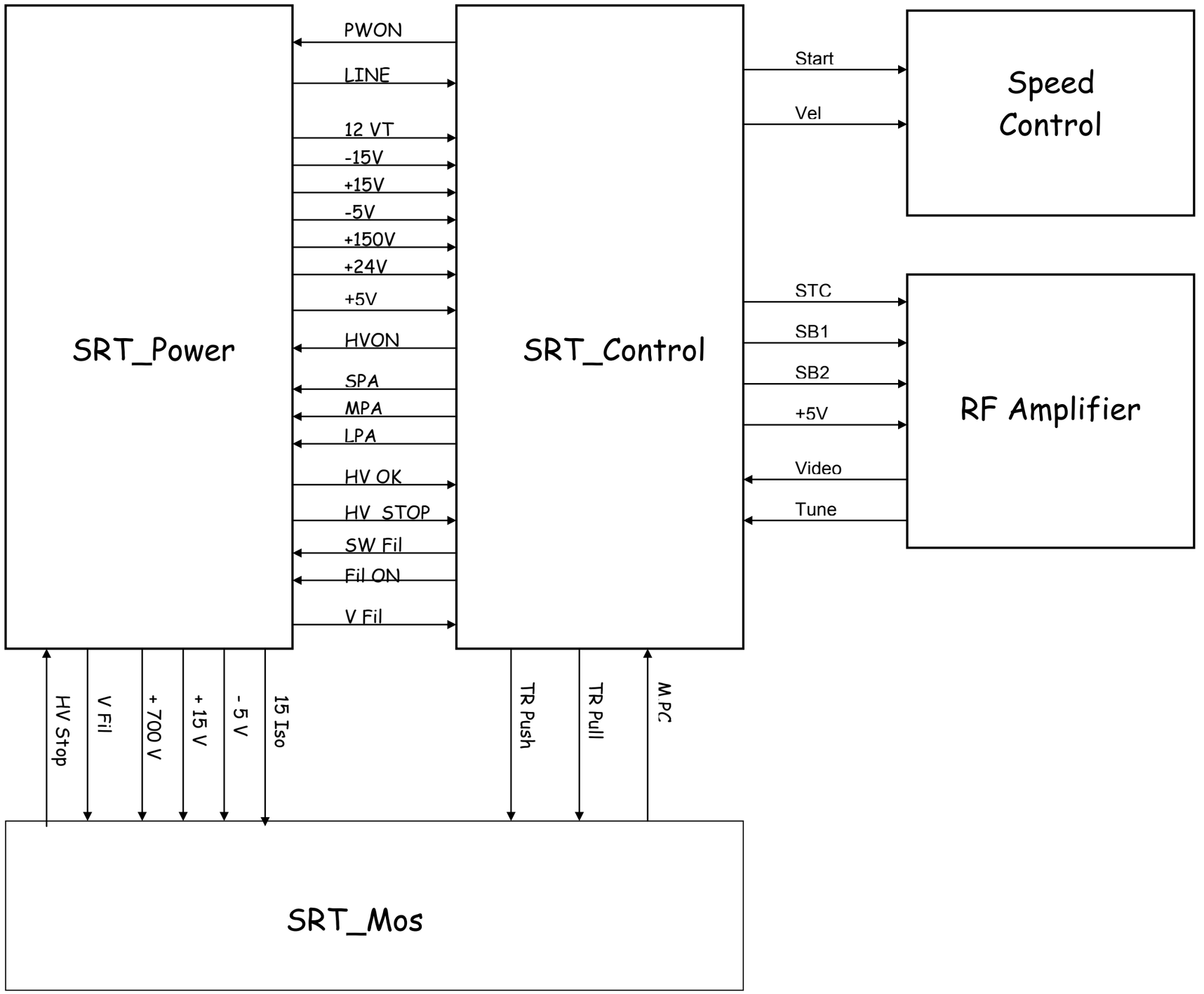


Figure 9.1.9 SRT Internal voltage and signals

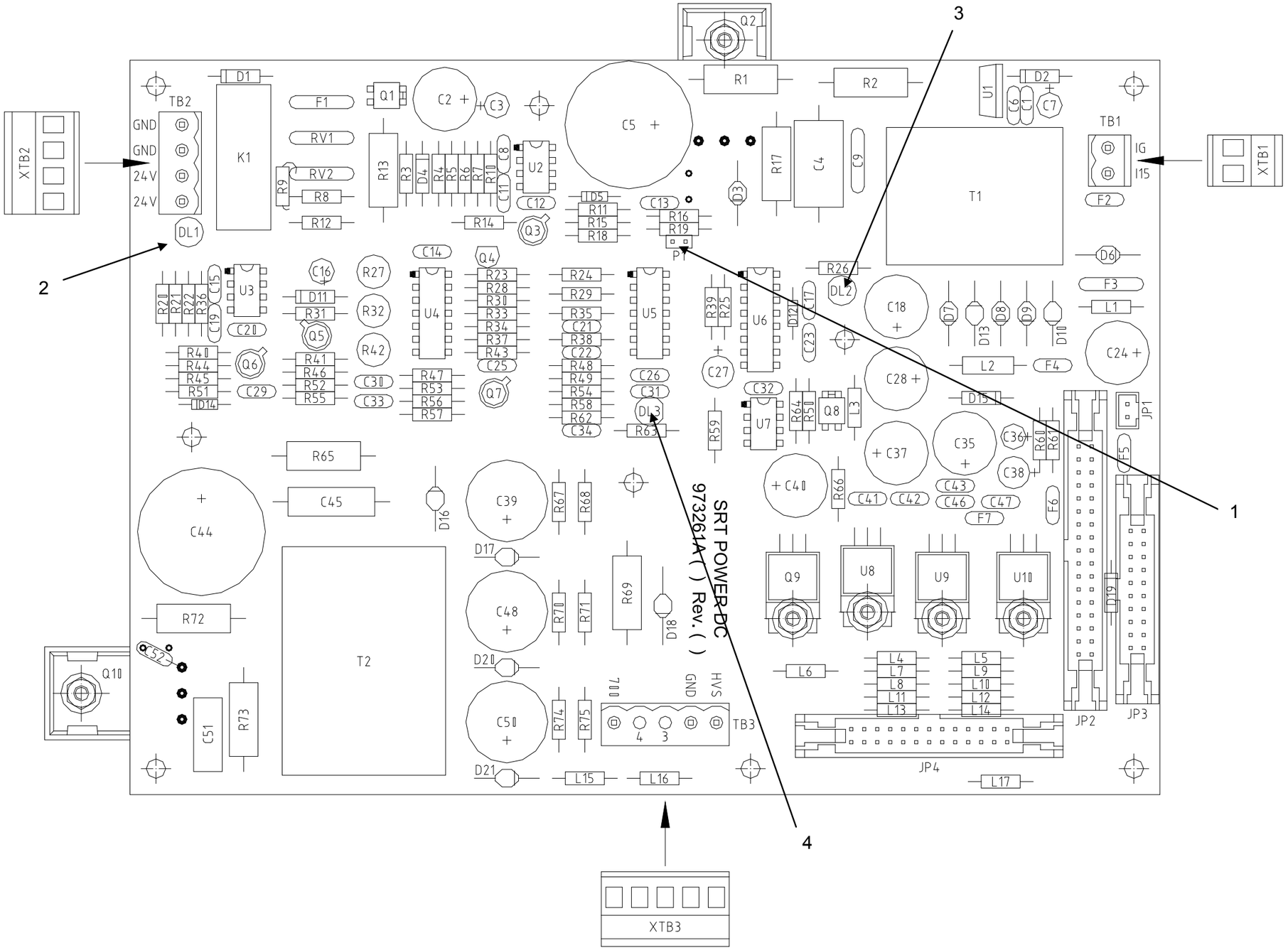
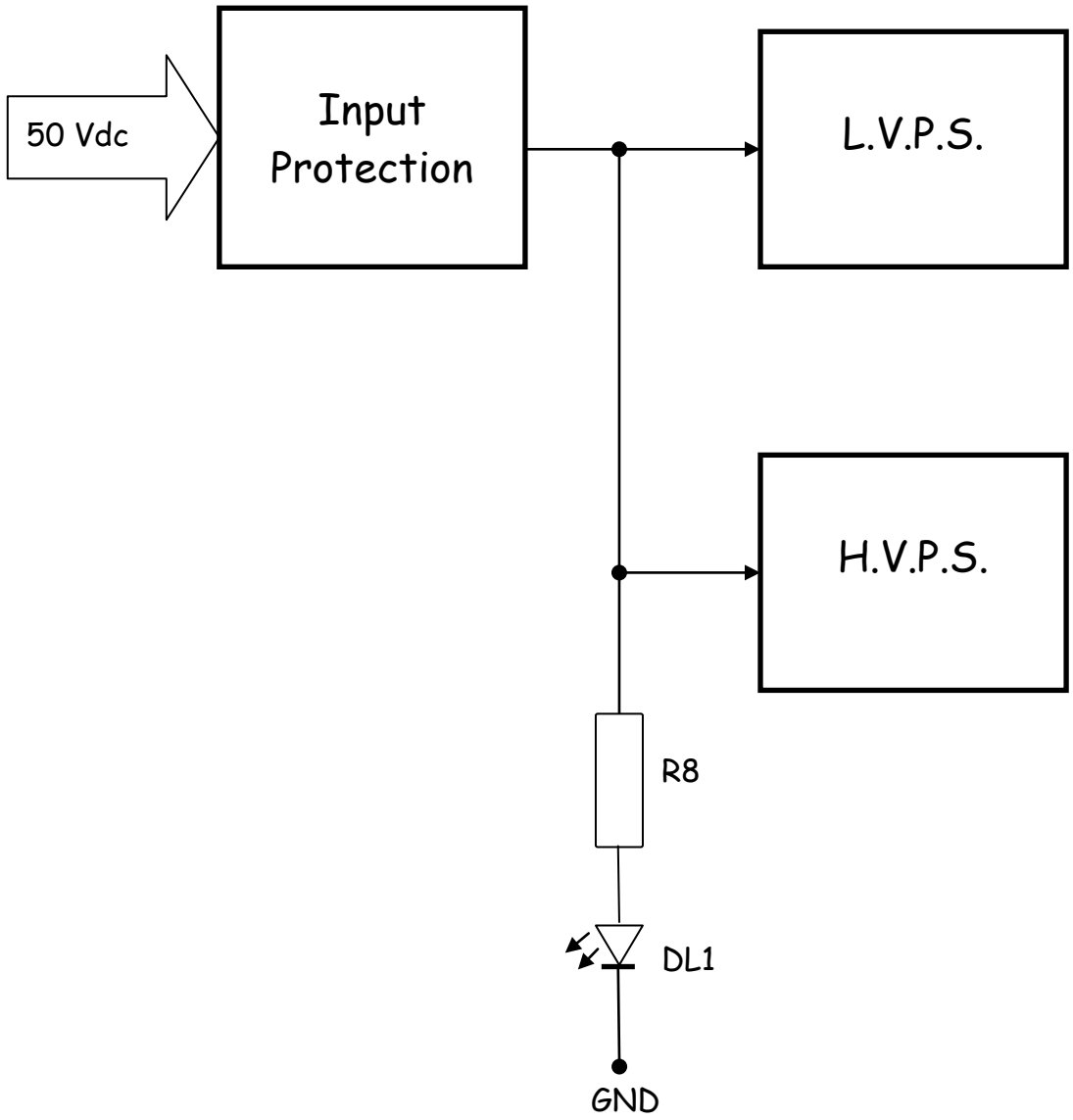


Figure 9.1.10 SRT_POWER - Board

Figure 9.1.11 SRT-Power-General Block



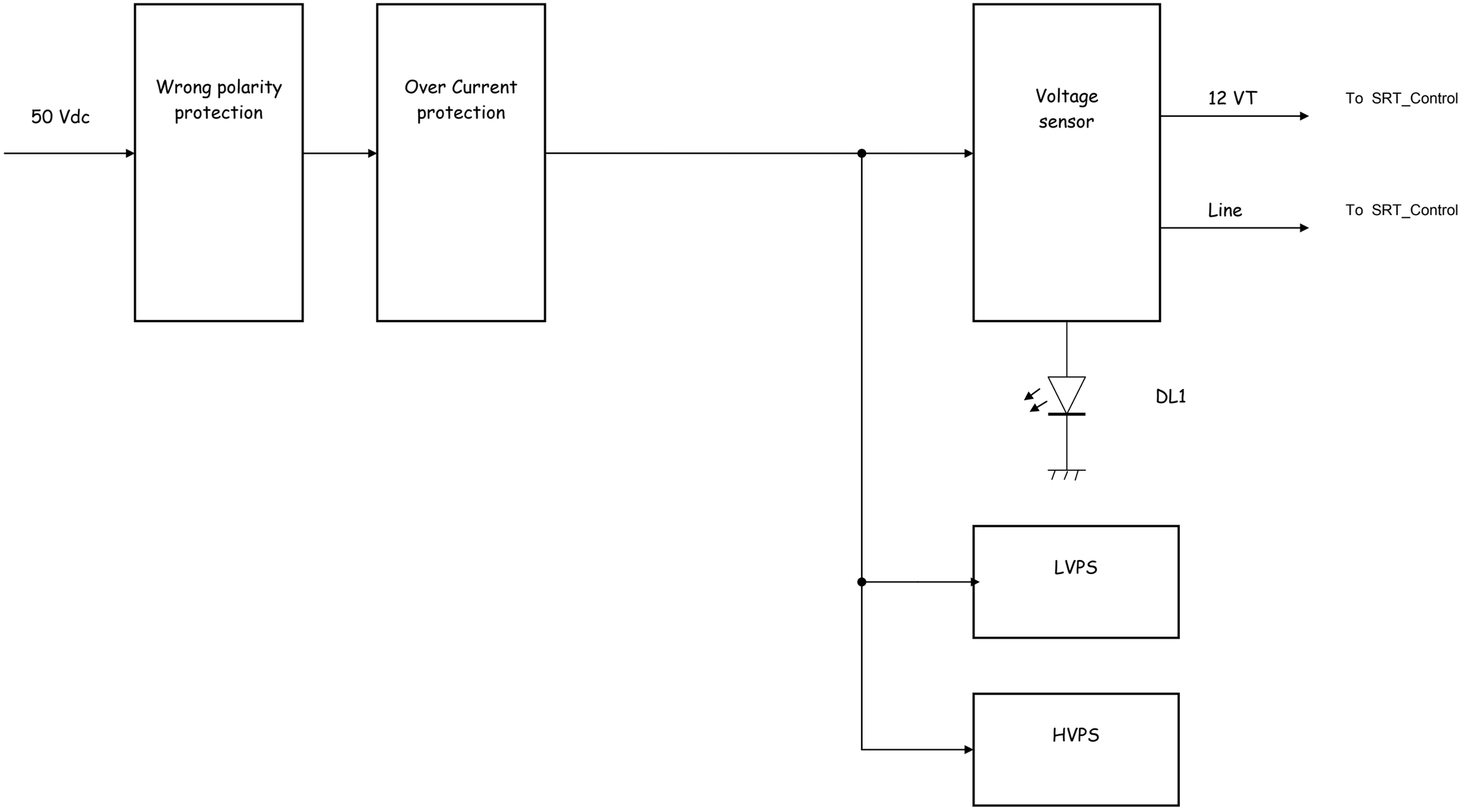


Figure 9.1.12 SRT_POWER – Protection circuits

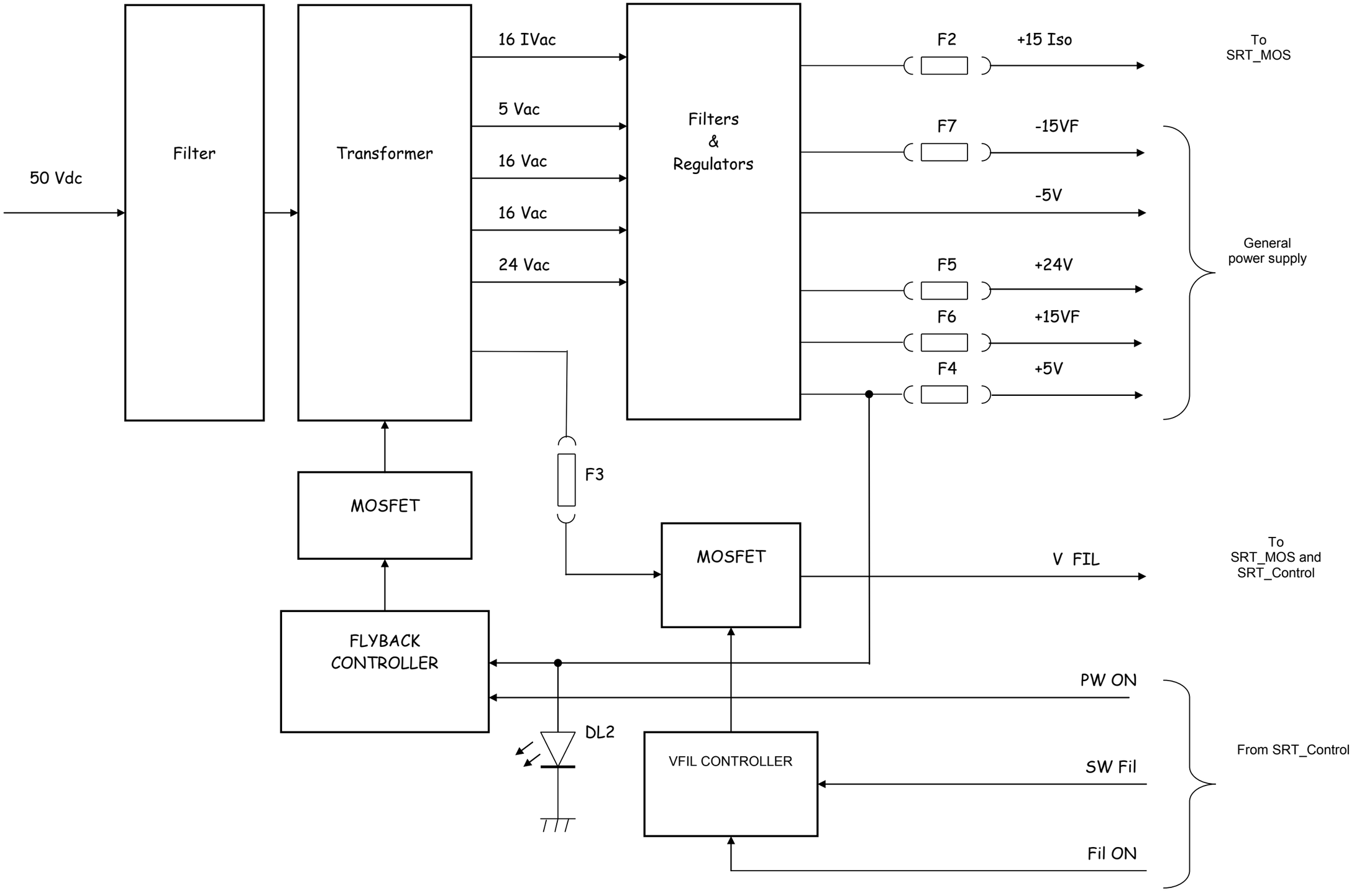


Figure 9.1.13 SRT_POWER – LVPS circuits

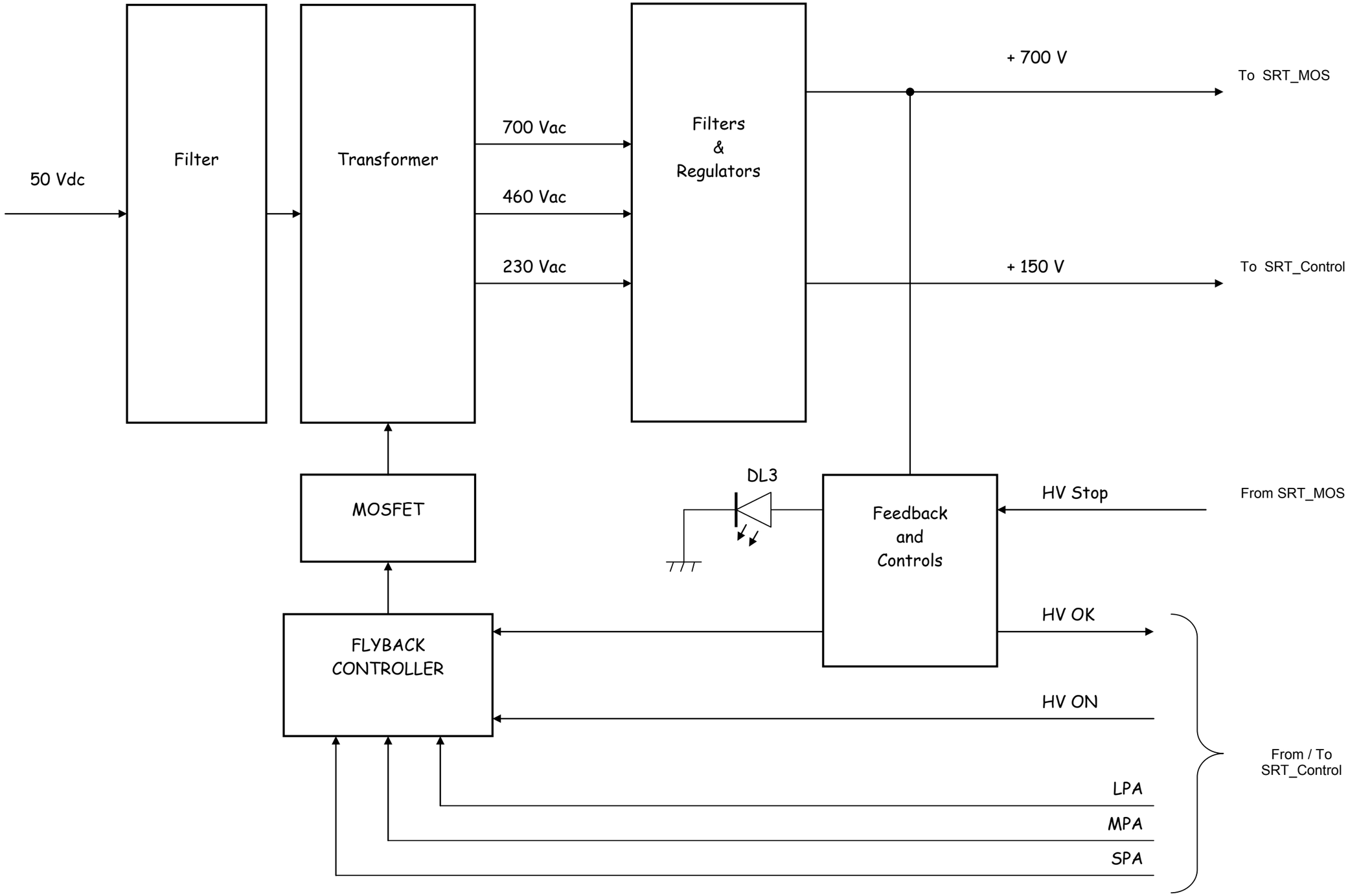


Figure 9.1.14 SRT_POWER – HVPS circuits

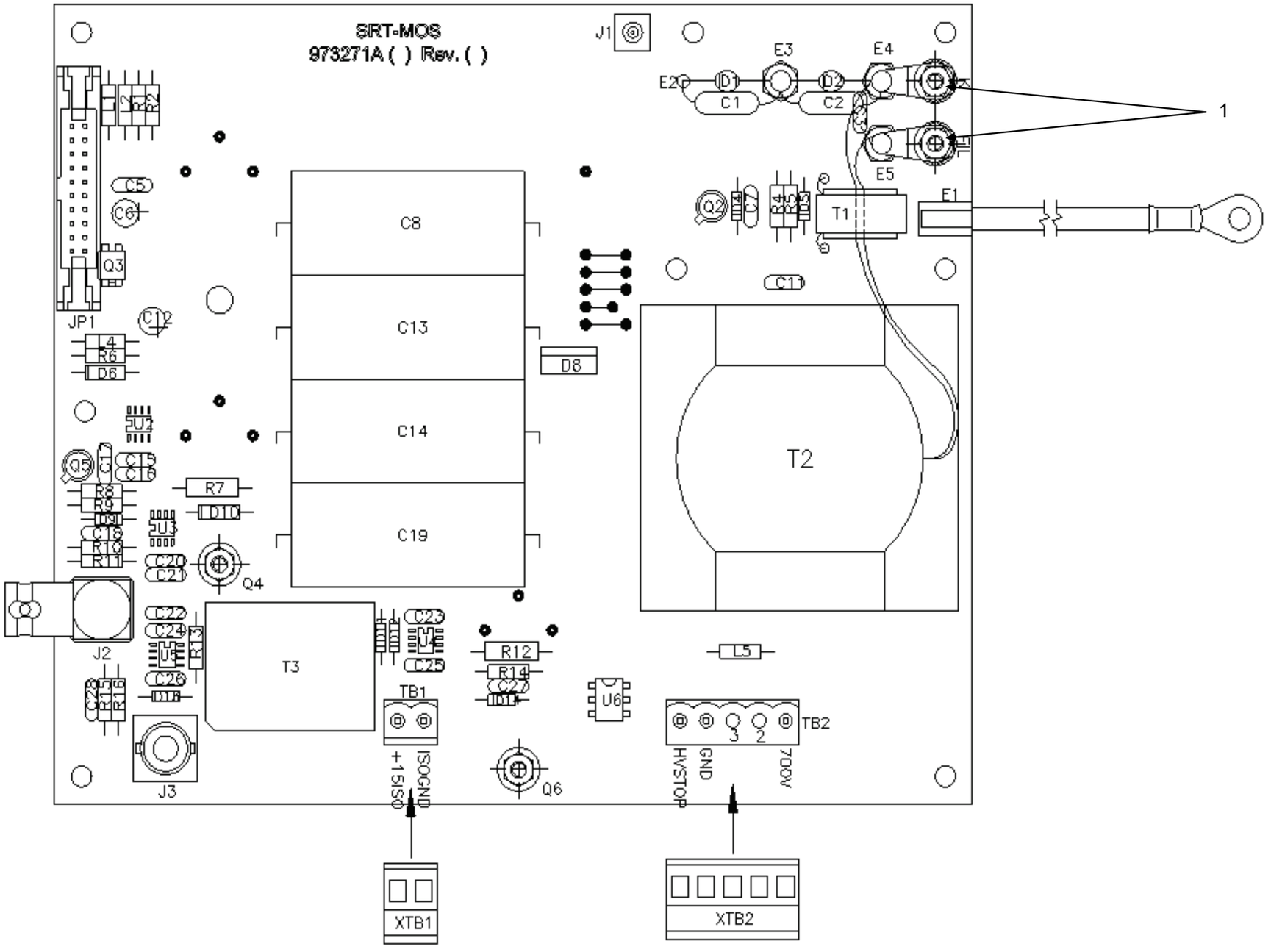


Figure 9.1.15 SRT_MOS – Board

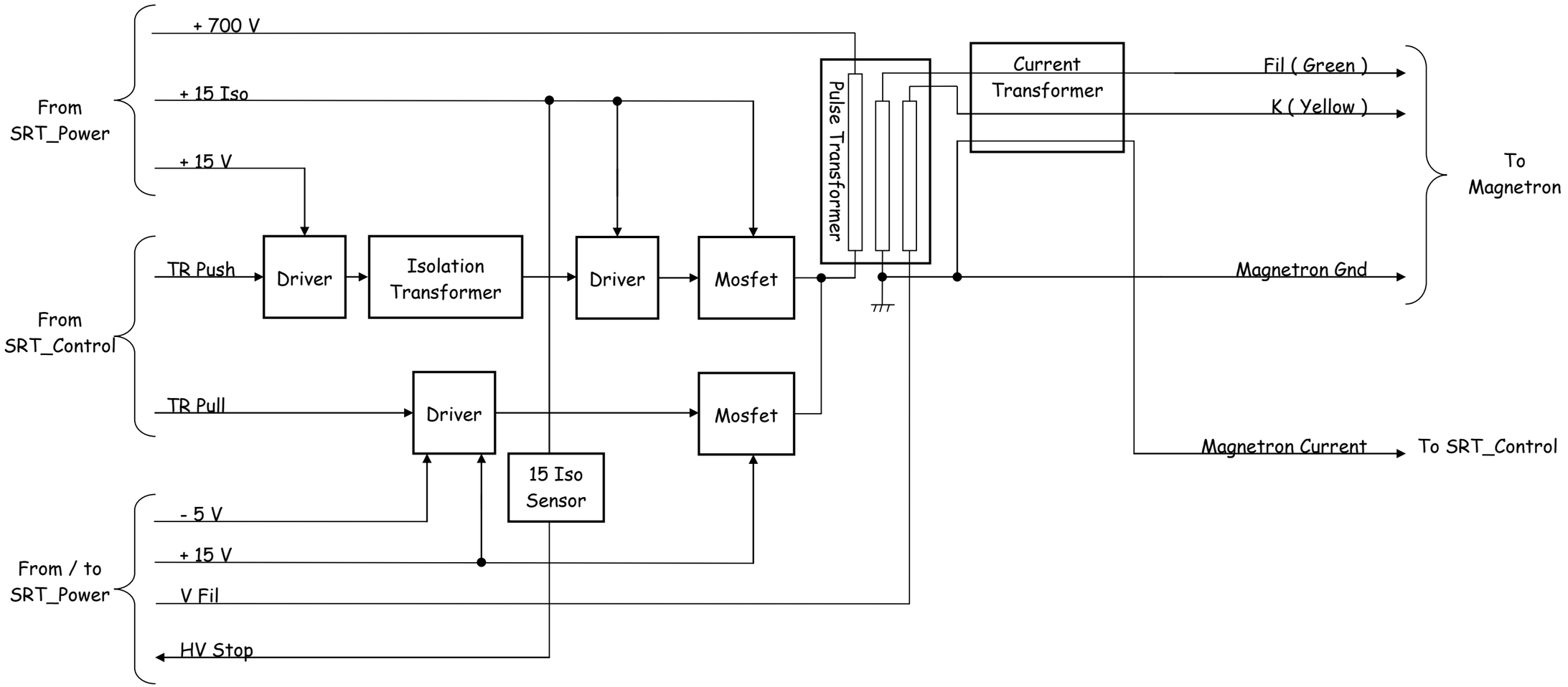


Figure 9.1.16 SRT_MOS – Block diagram

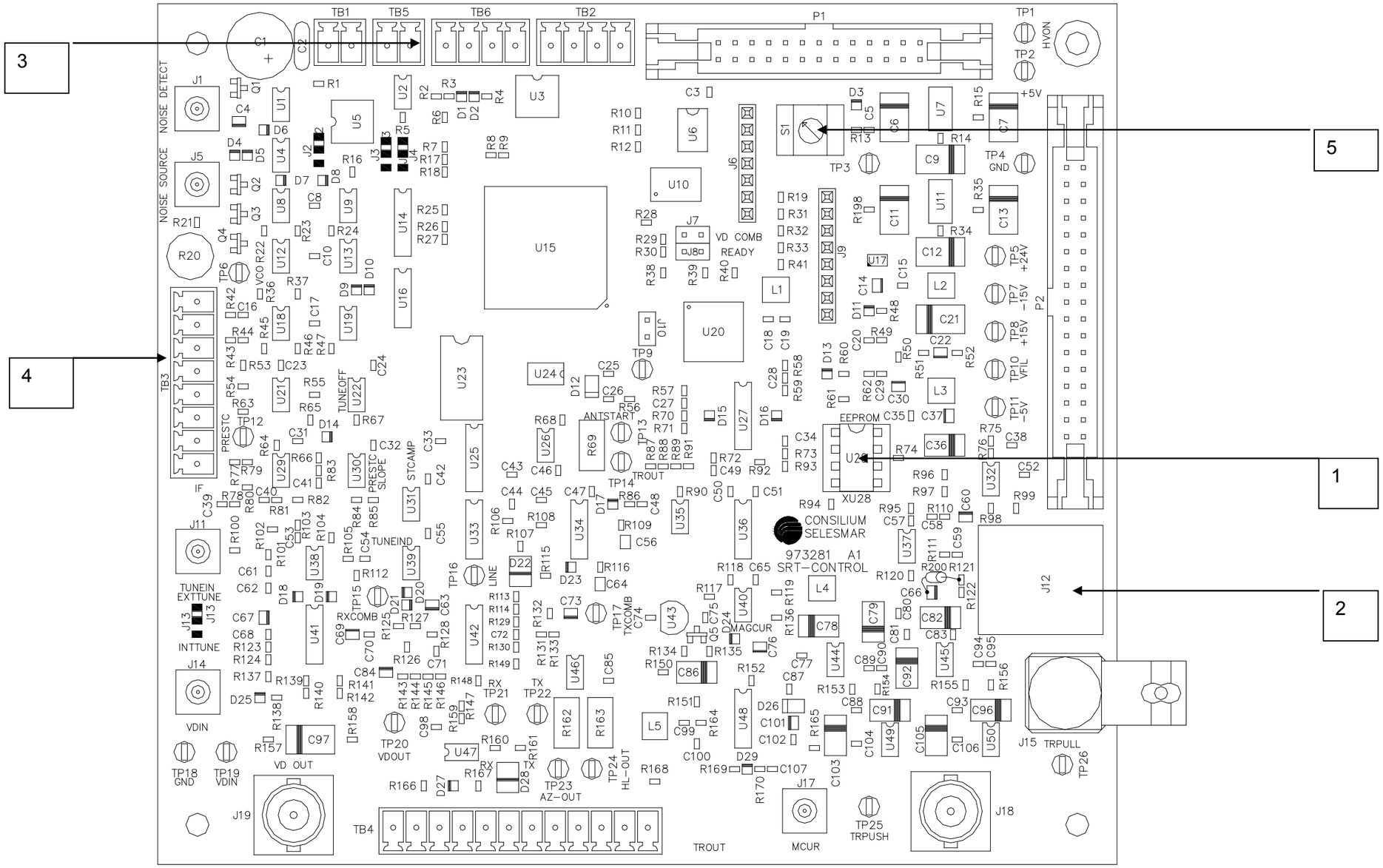


Figure 9.1.17 SRT_CONTROL Board

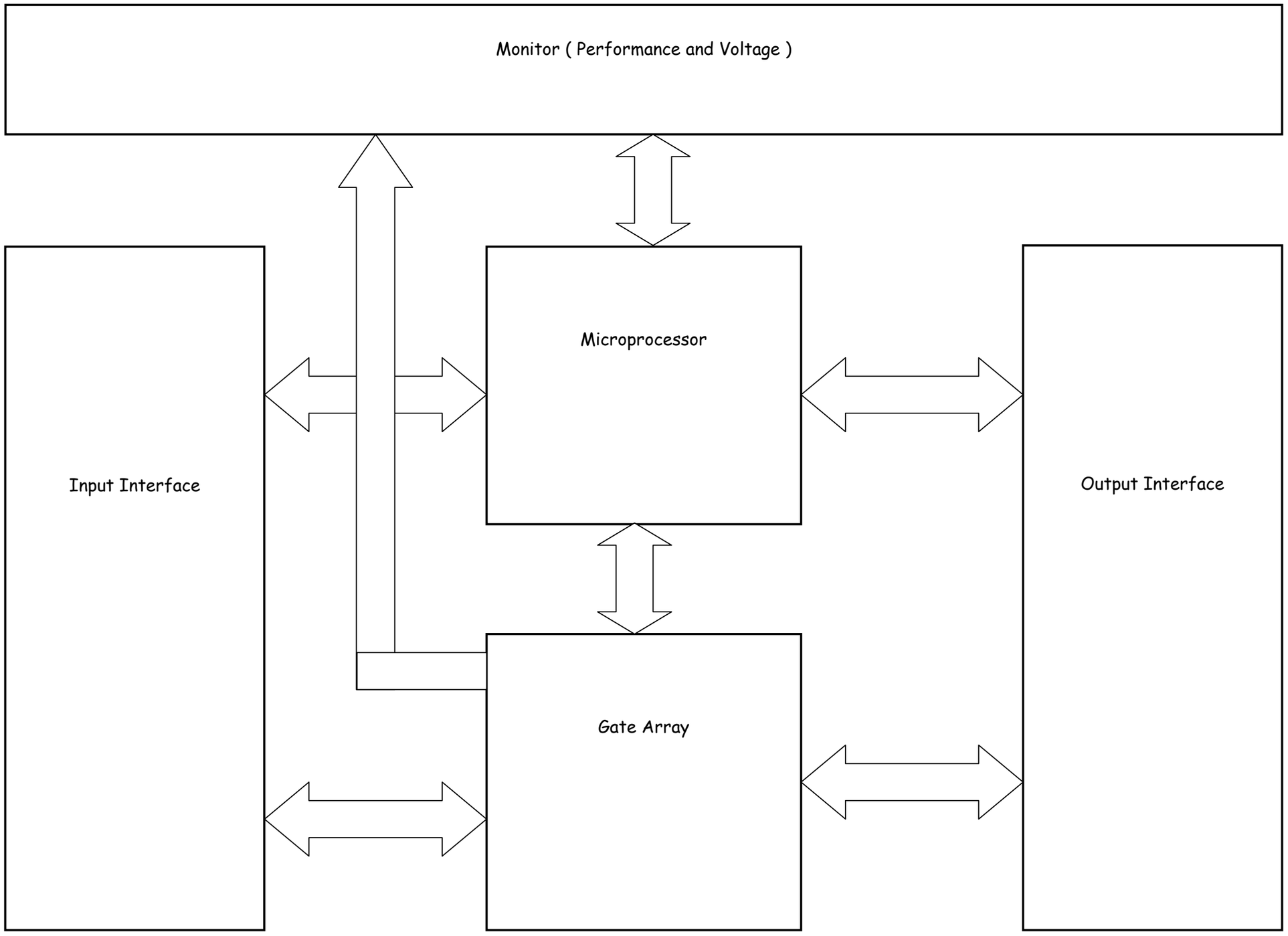


Figure 9.1.18 SRT_CONTROL – Blocks

Figure 9.1.19 SRT_CONTROL – Microprocessor and Gate Array

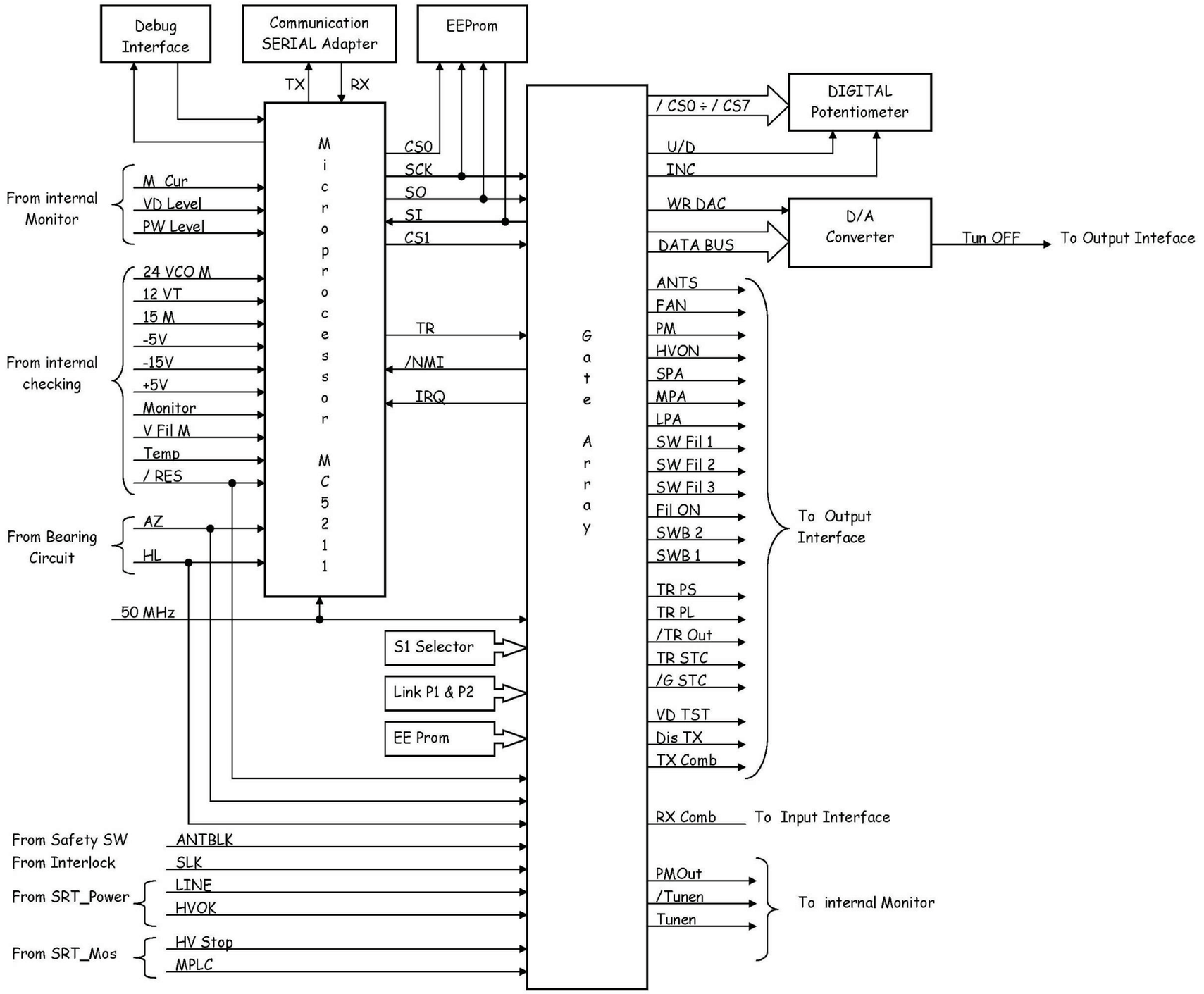
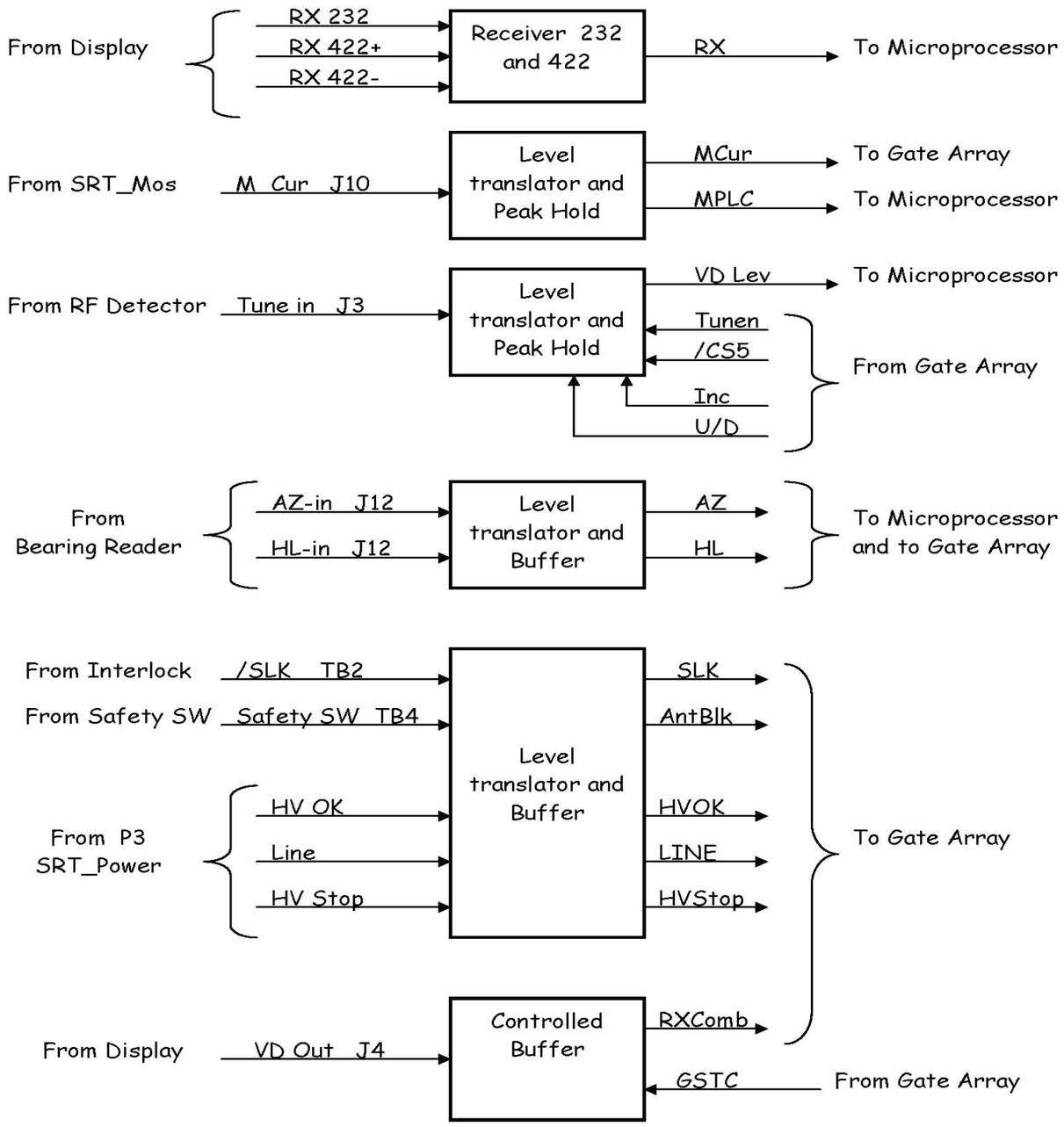


Figure 9.1.20 SRT_CONTROL – Input interface



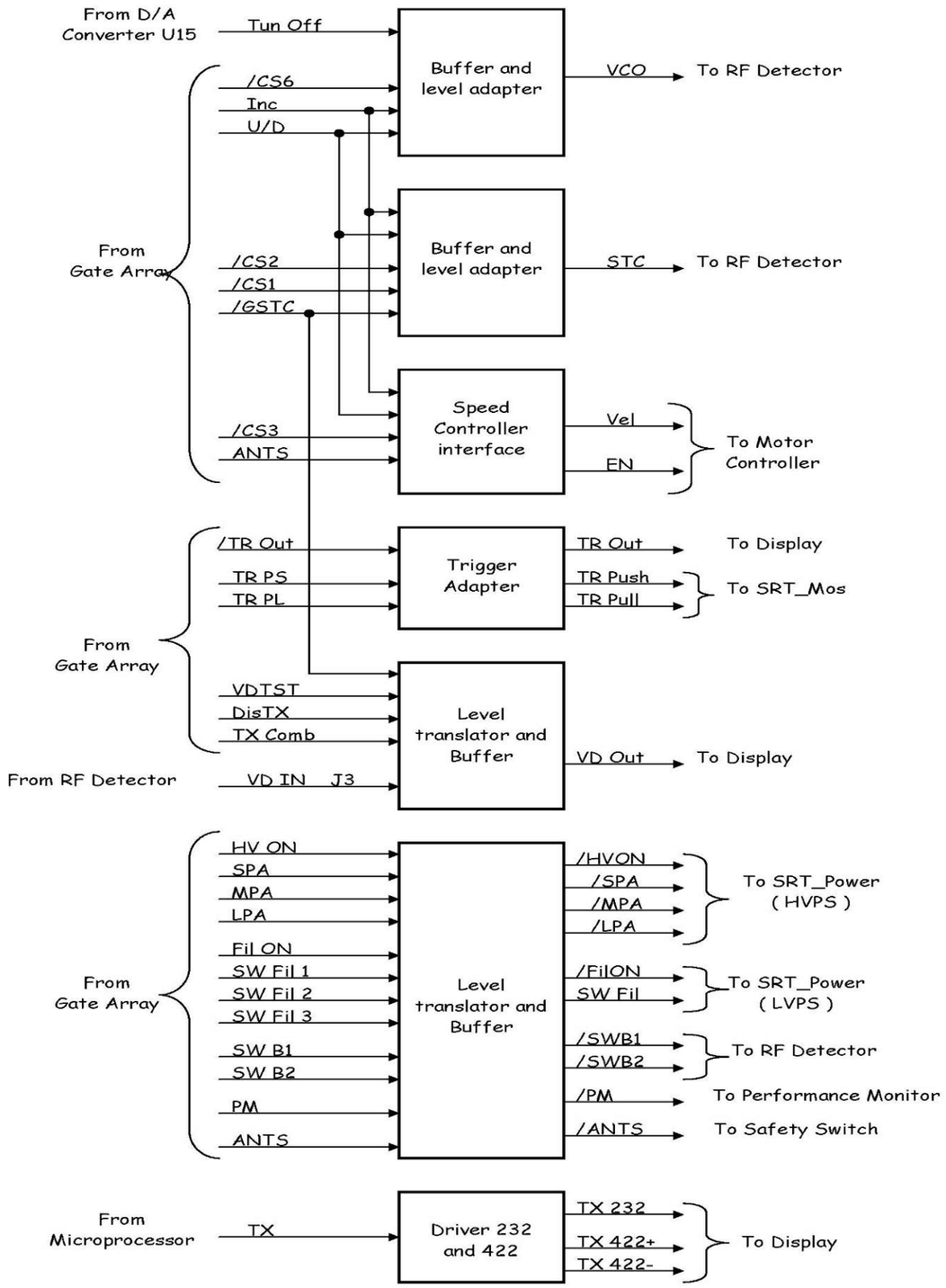


Figure 9.1.21 SRT_CONTROL – Output interface

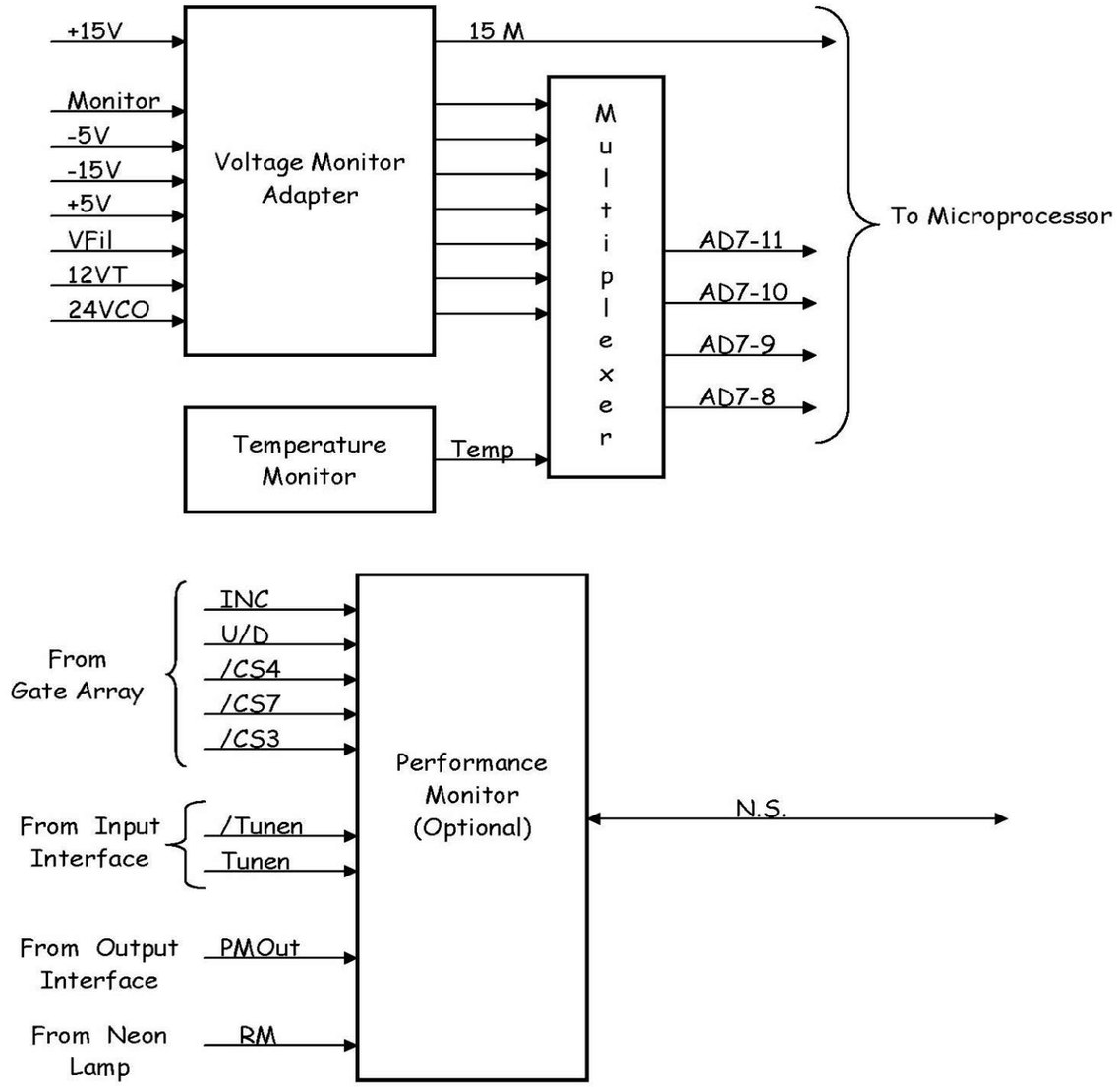


Figure 9.1.22 SRT_CONTROL – Monitor

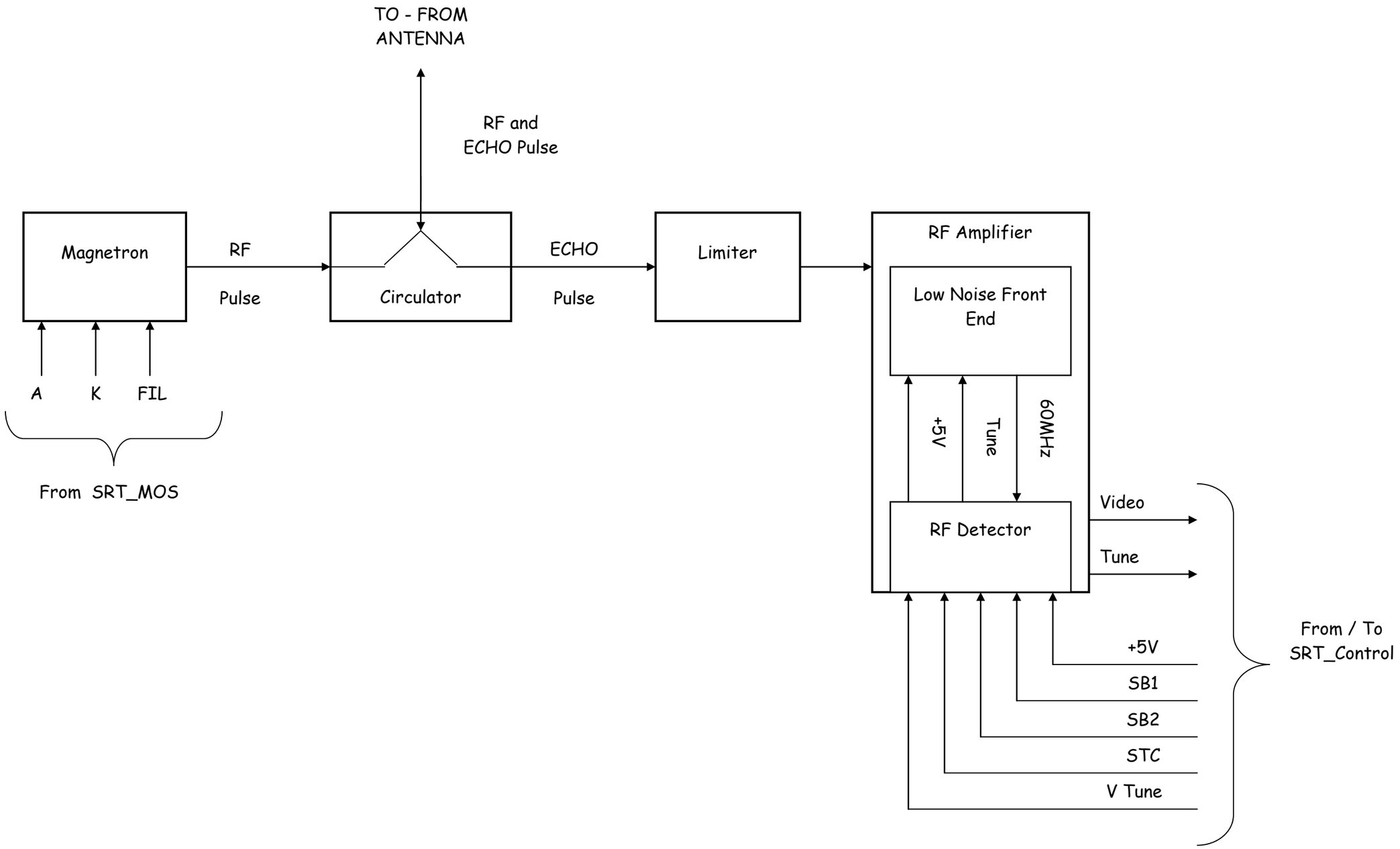


Figure 9.1.23 SRT RF HEAD – Functional block diagram

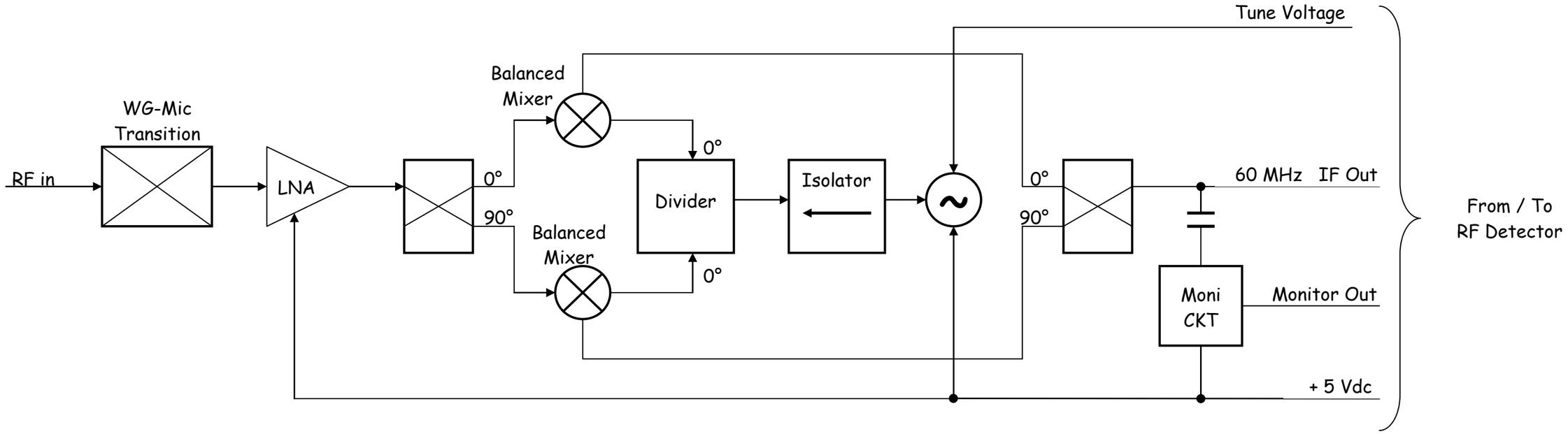


Figure 9.1.24 SRT RF HEAD – L.N.F.E.

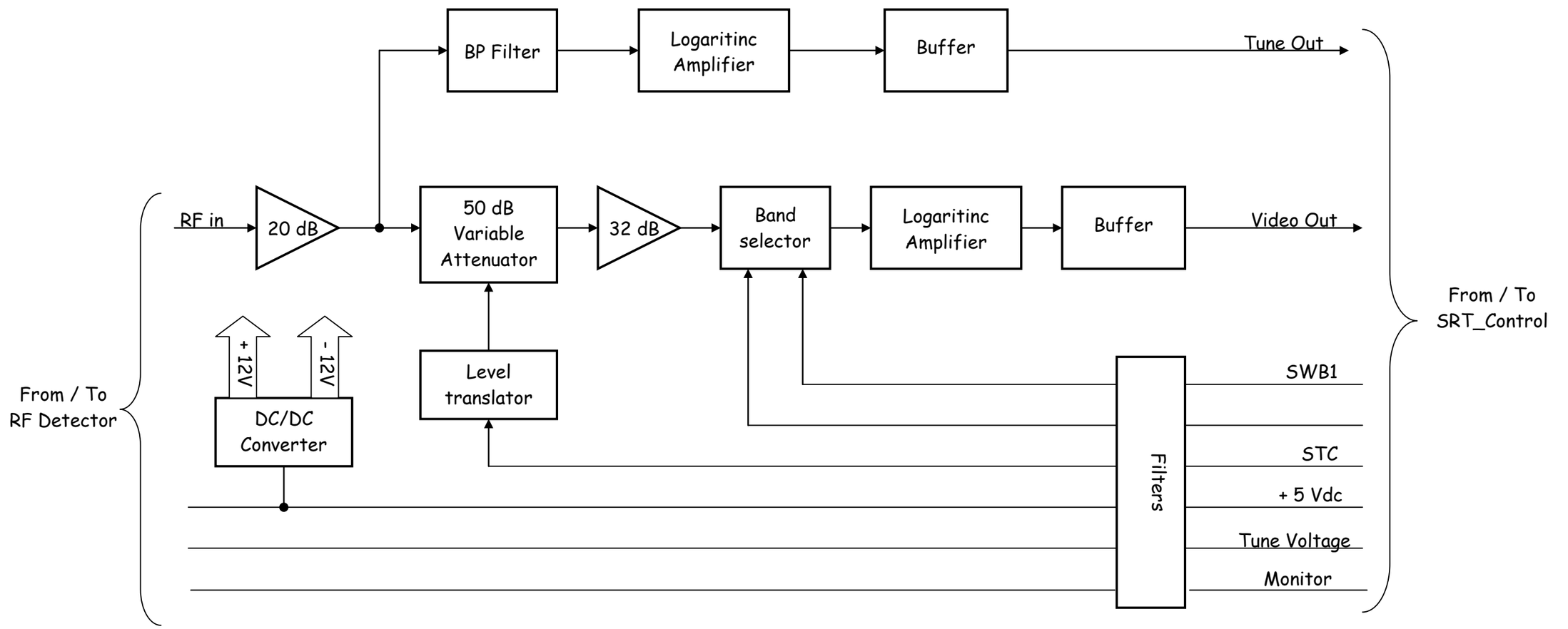


Figure 9.1.25 SRT RF HEAD – RF Detector

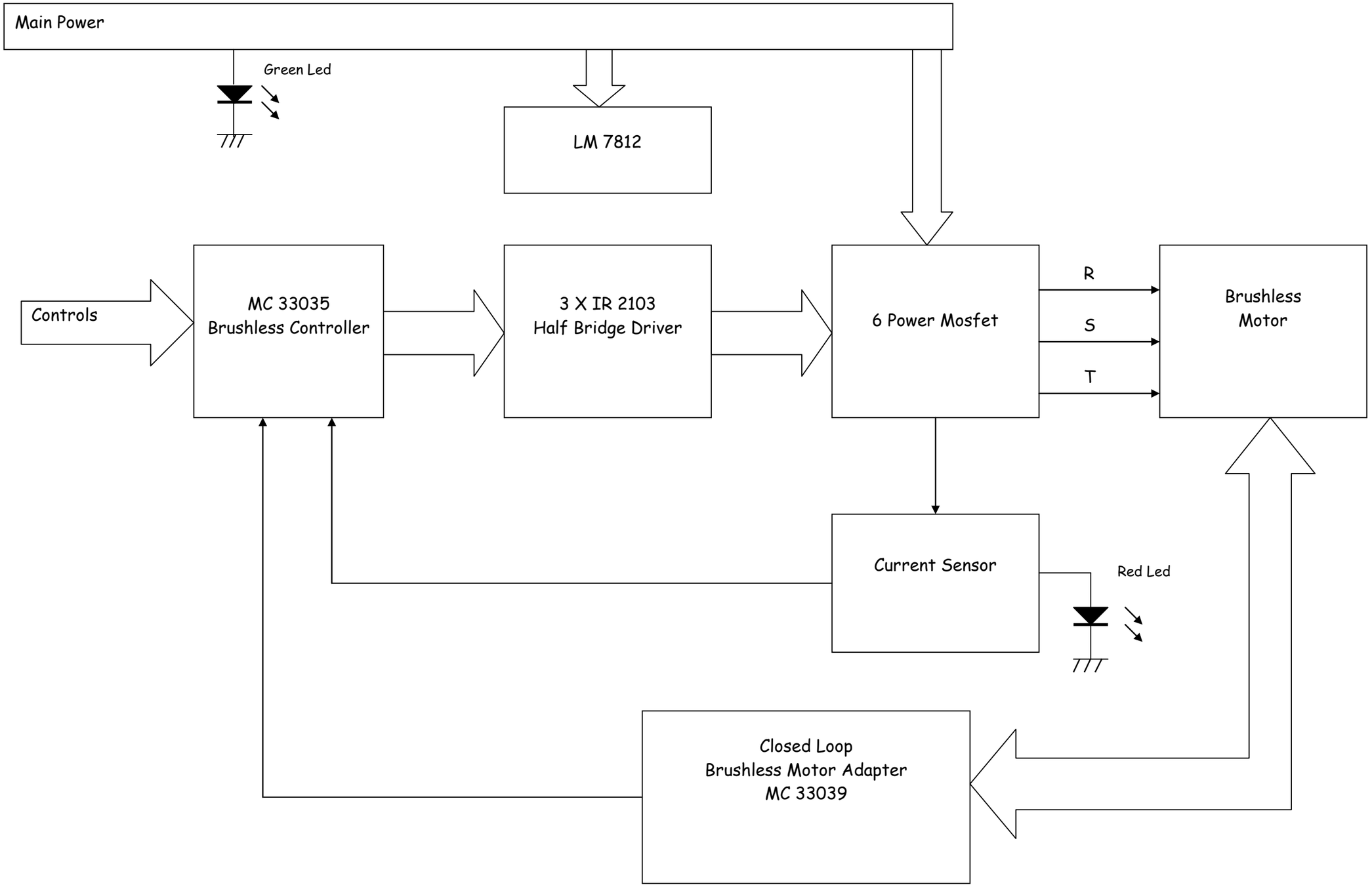


Figure 9.1.26 BRUSHLESS CONTROLLER – Functional blocks

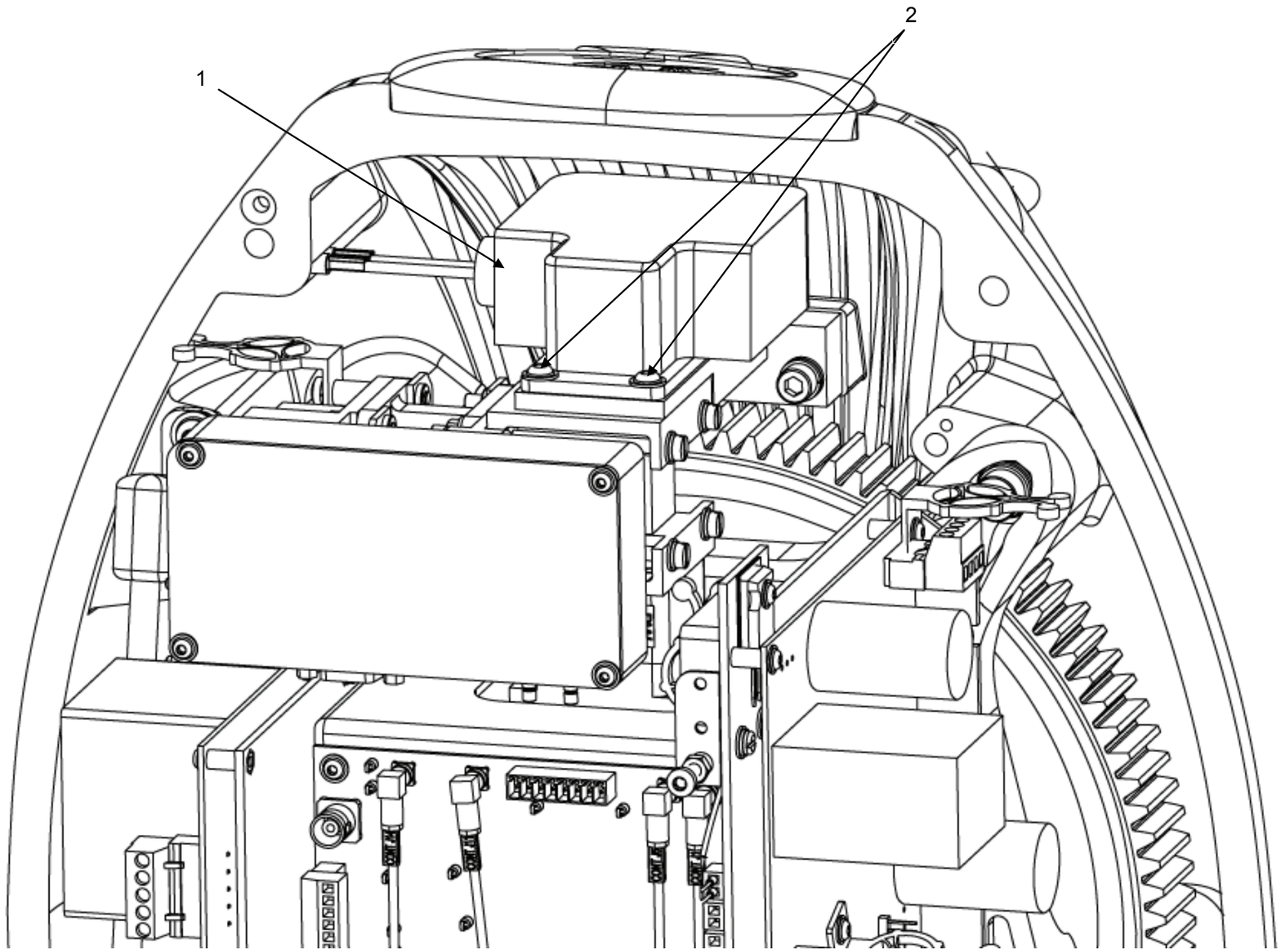


Figure 9.1.27 Electronics Rack – Particular of the RF Head

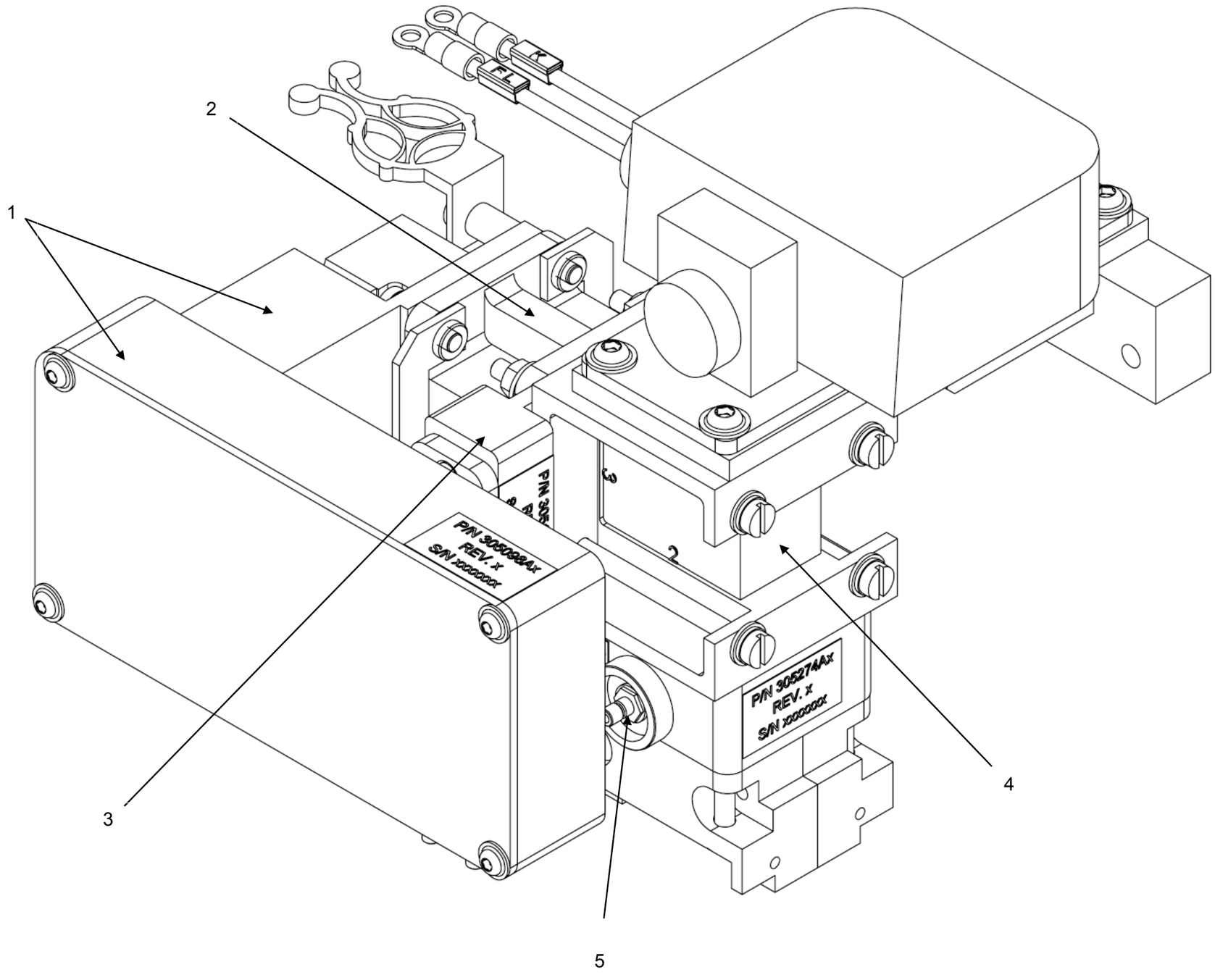


Figure 9.1.28 RF Head

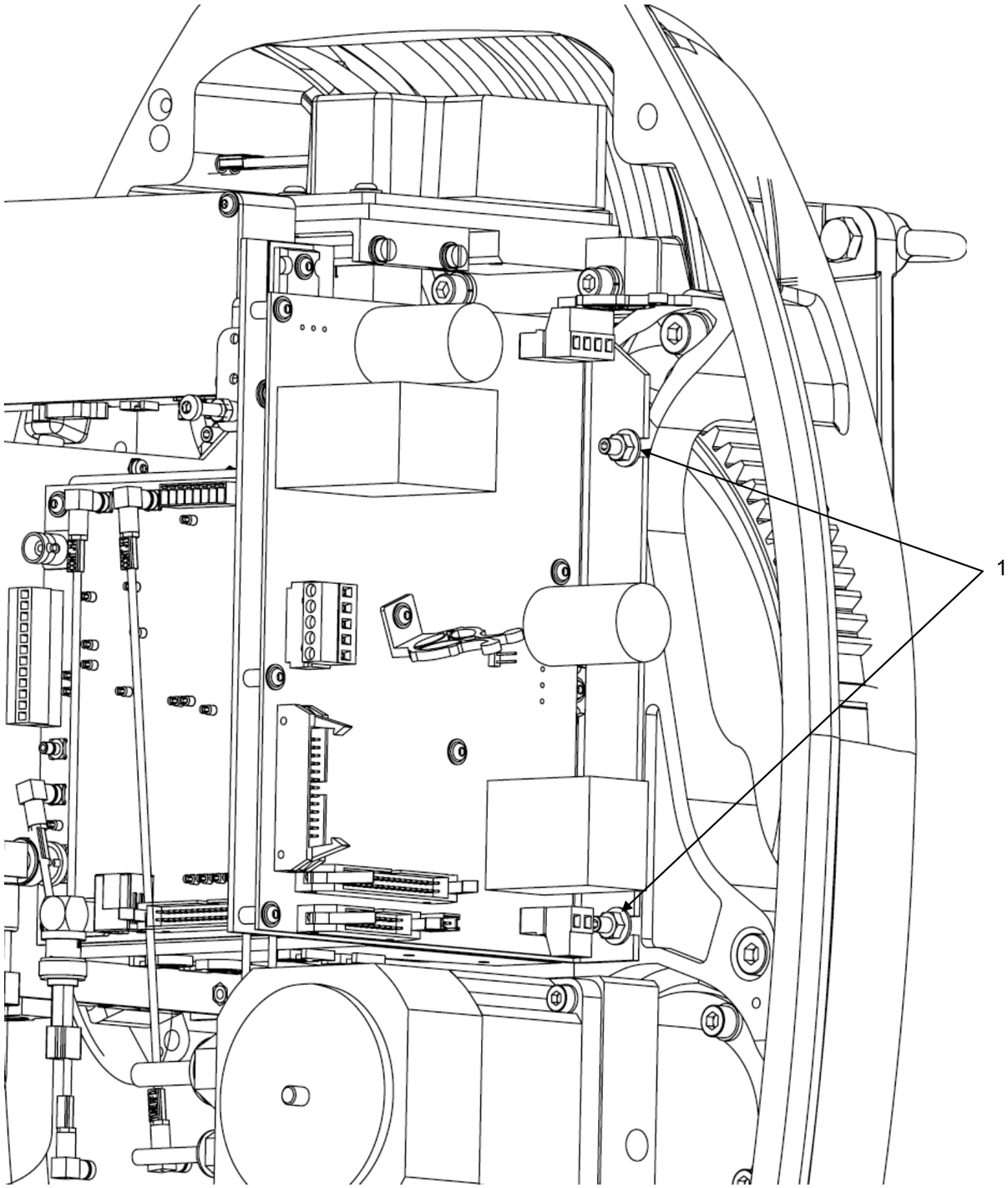


Figure 9.1.29 Electronics rack

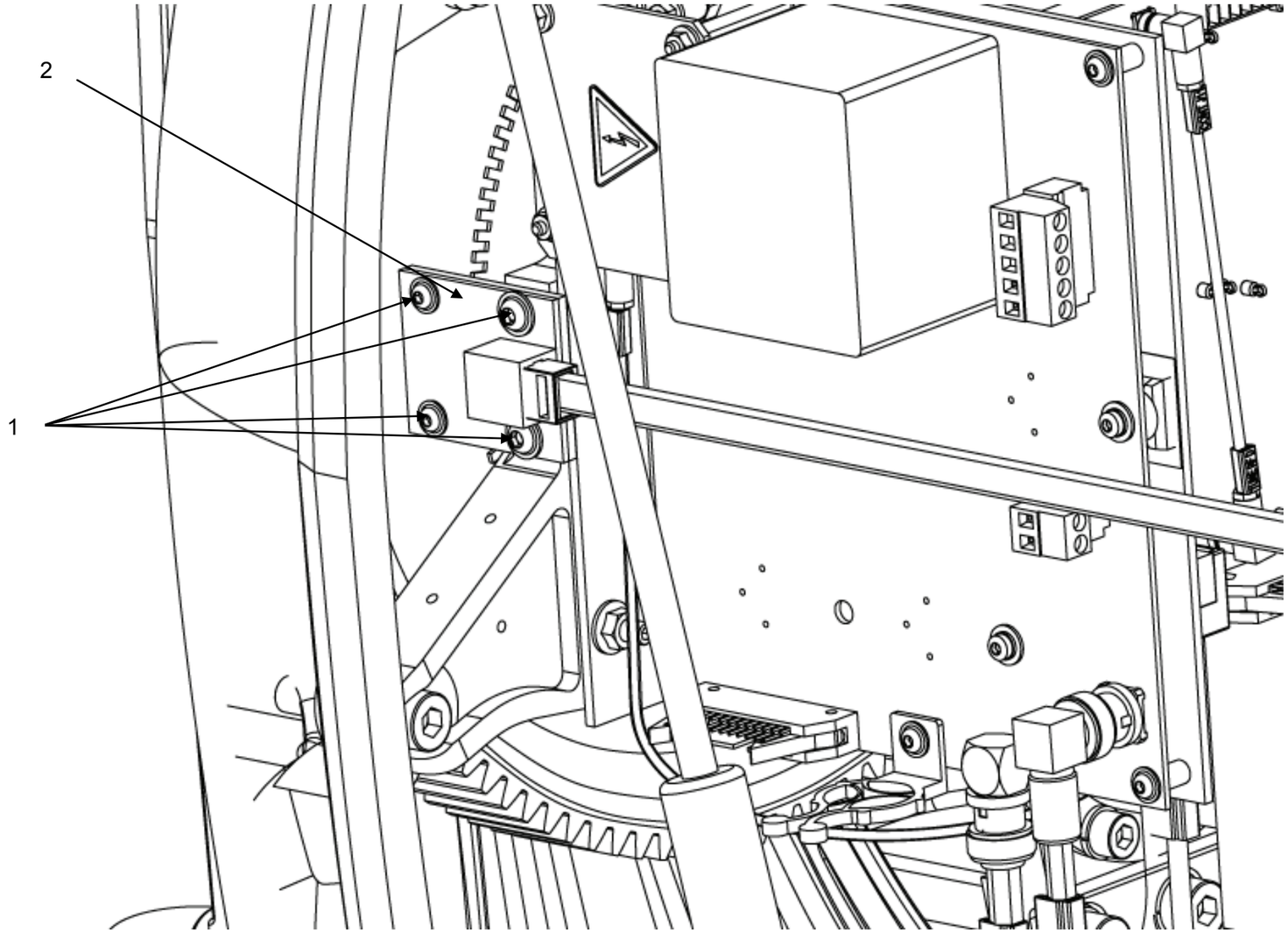


Figure 9.1.30 Bearing reader board

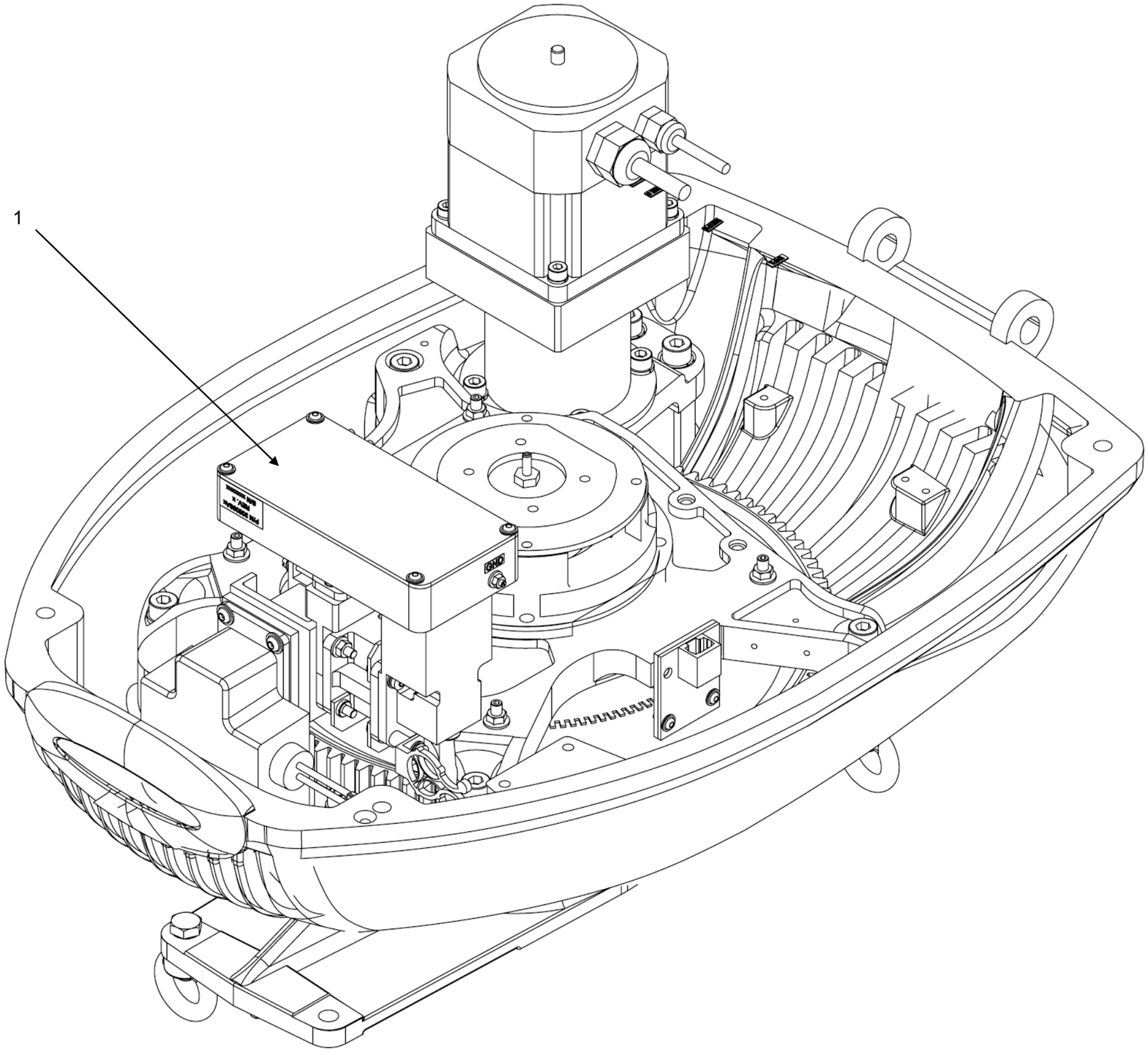


Figure 9.1.31 Rotary joint

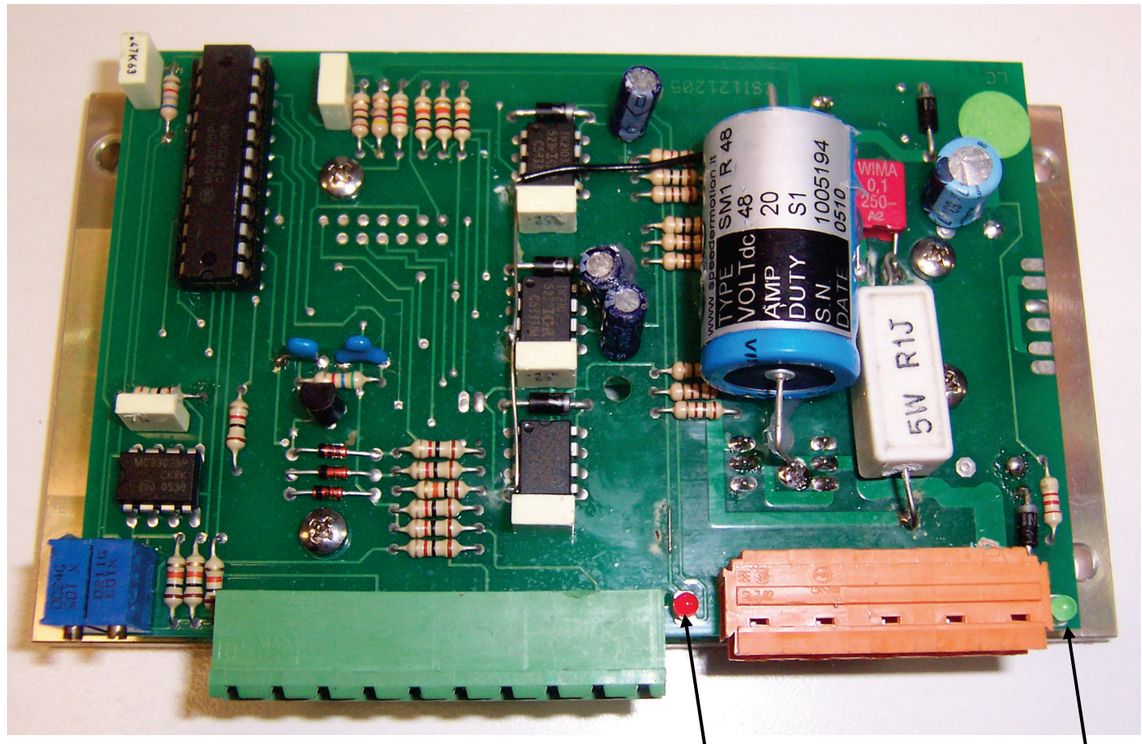


Figure 9.1.32 Brushless Motor Controller

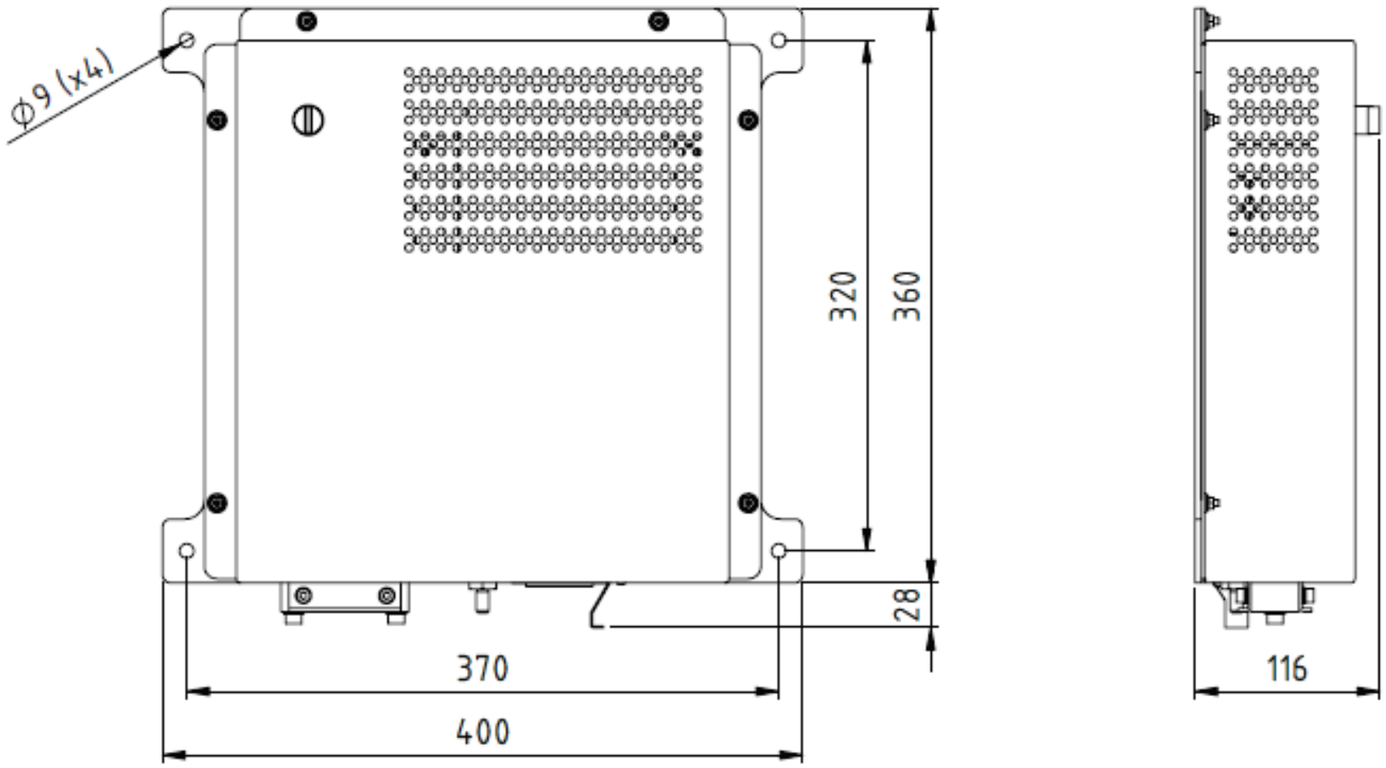


Figure 9.1.33 SRT Adapter Box

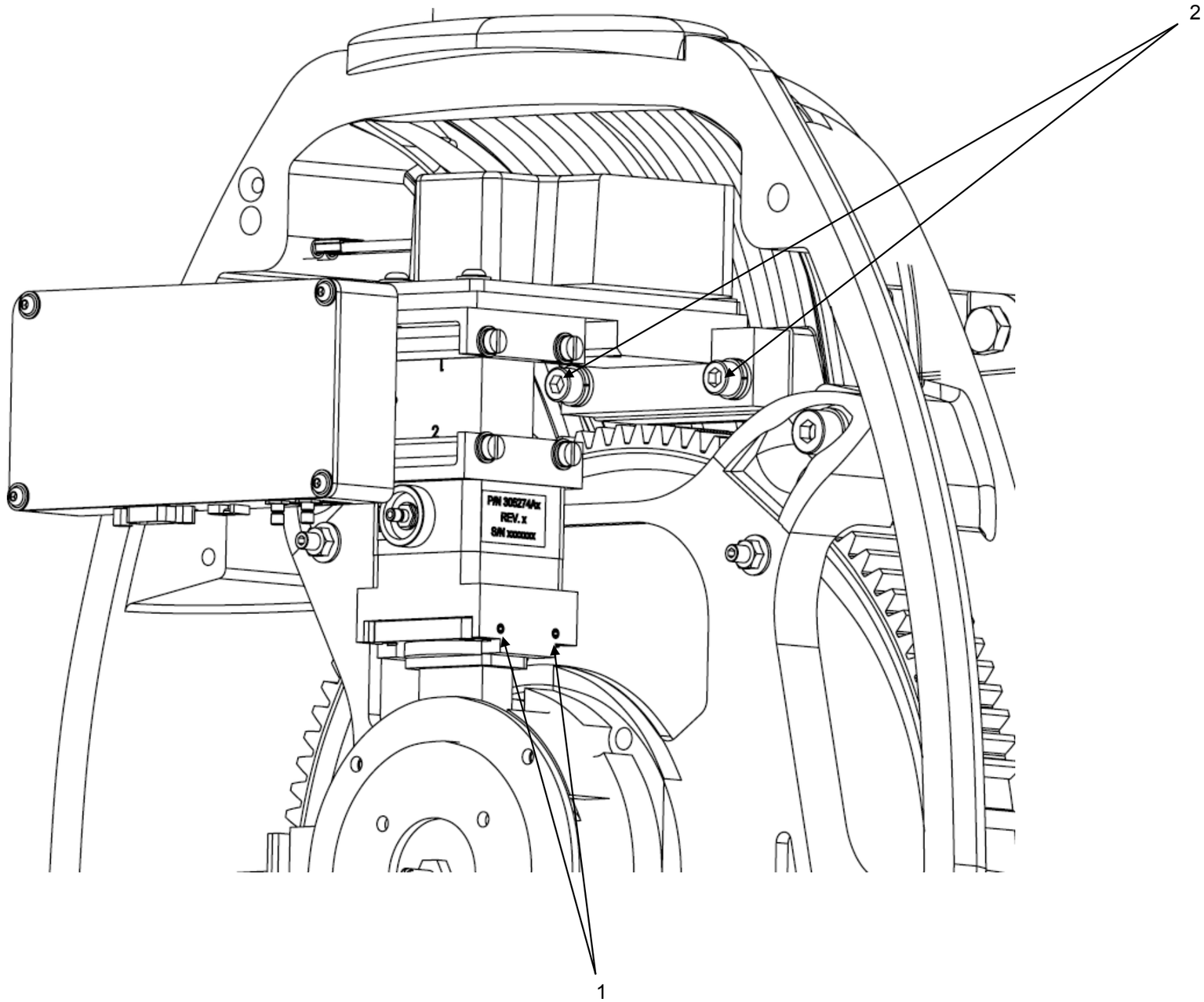
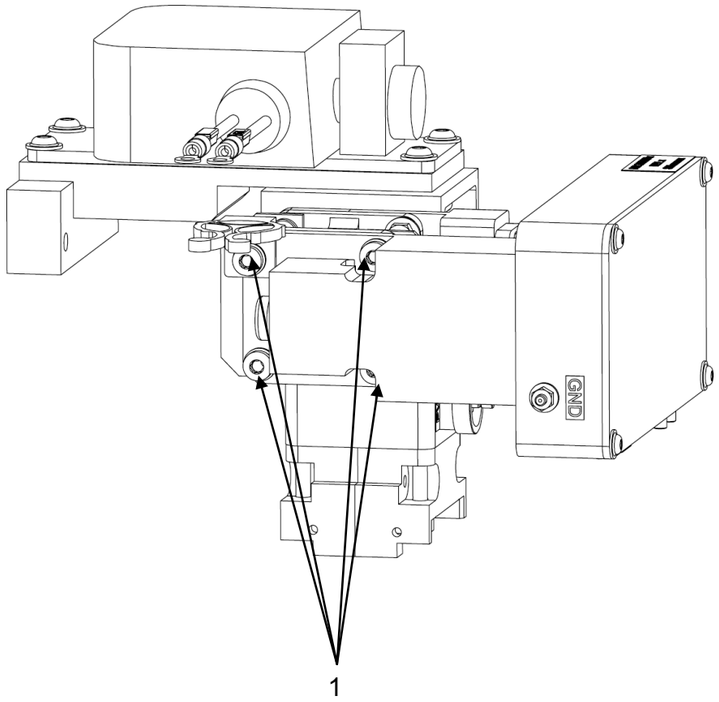
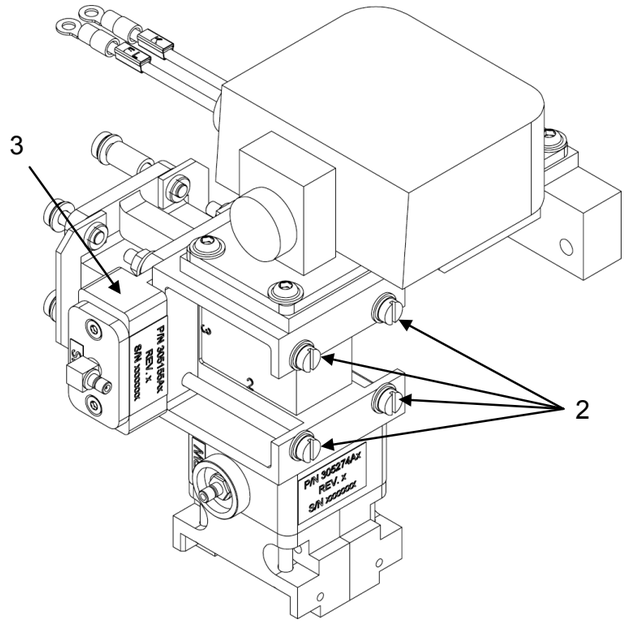


Figure 9.1.34 Replace Magnetron





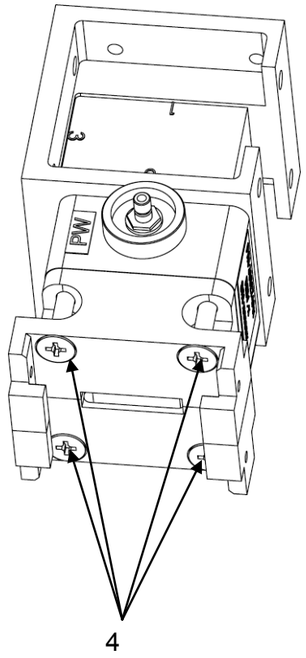


Figure 9.1.35 **Replace RF Amplifier, Limiter, Noise & Power Diode and Circulator**

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