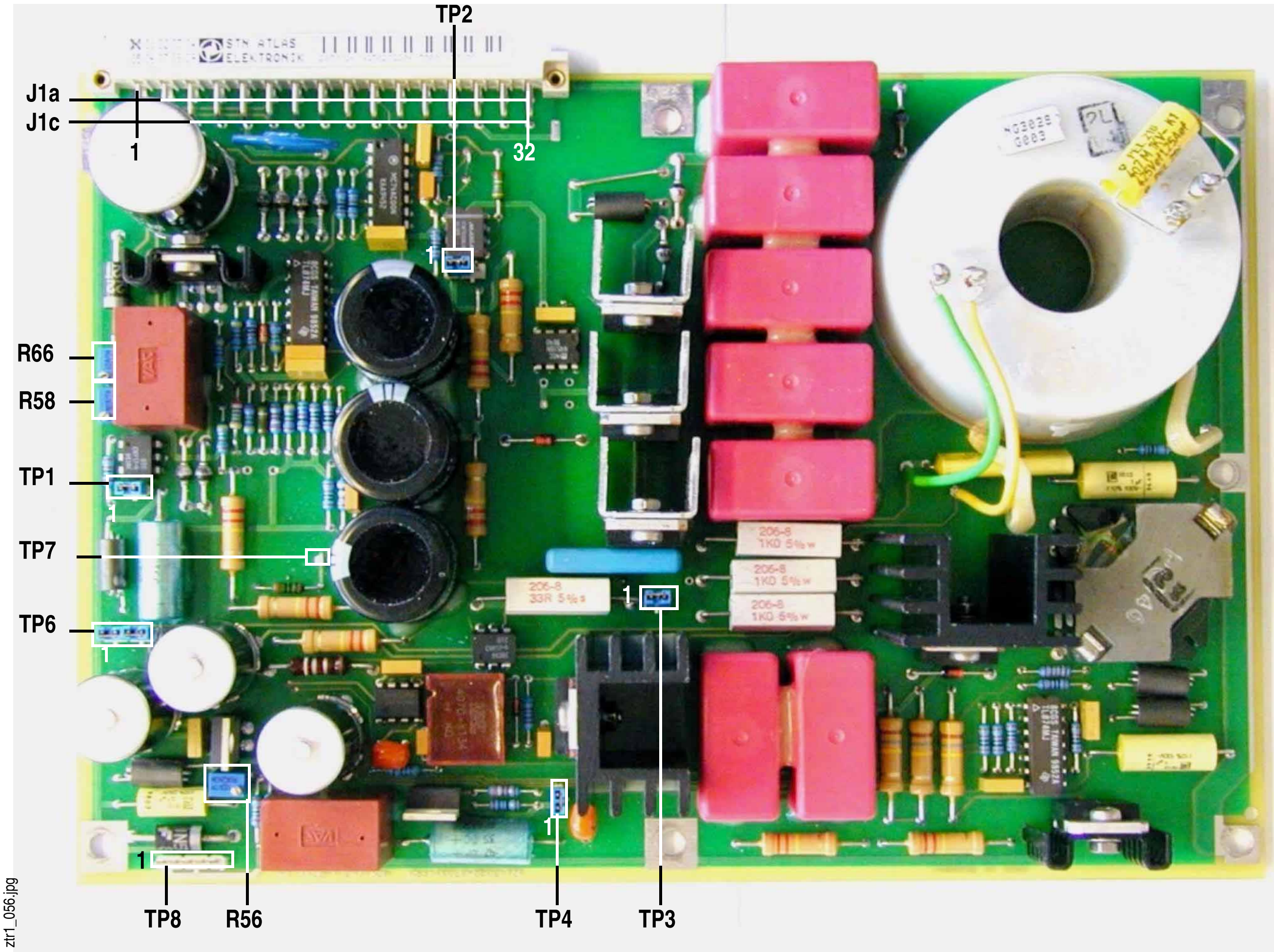
4.4 Transceiver

4.4.1 Modulator NG 3028 G 203 / NG 3028 G 206

WARNING
For the use of the different revisions of the Modulator some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.



ztr1_056.jpg

Fig. 4-20 Modulator NG 3028 G 206 (≤Rev. 01; NG 3028 G 203, Rev. - with different components)

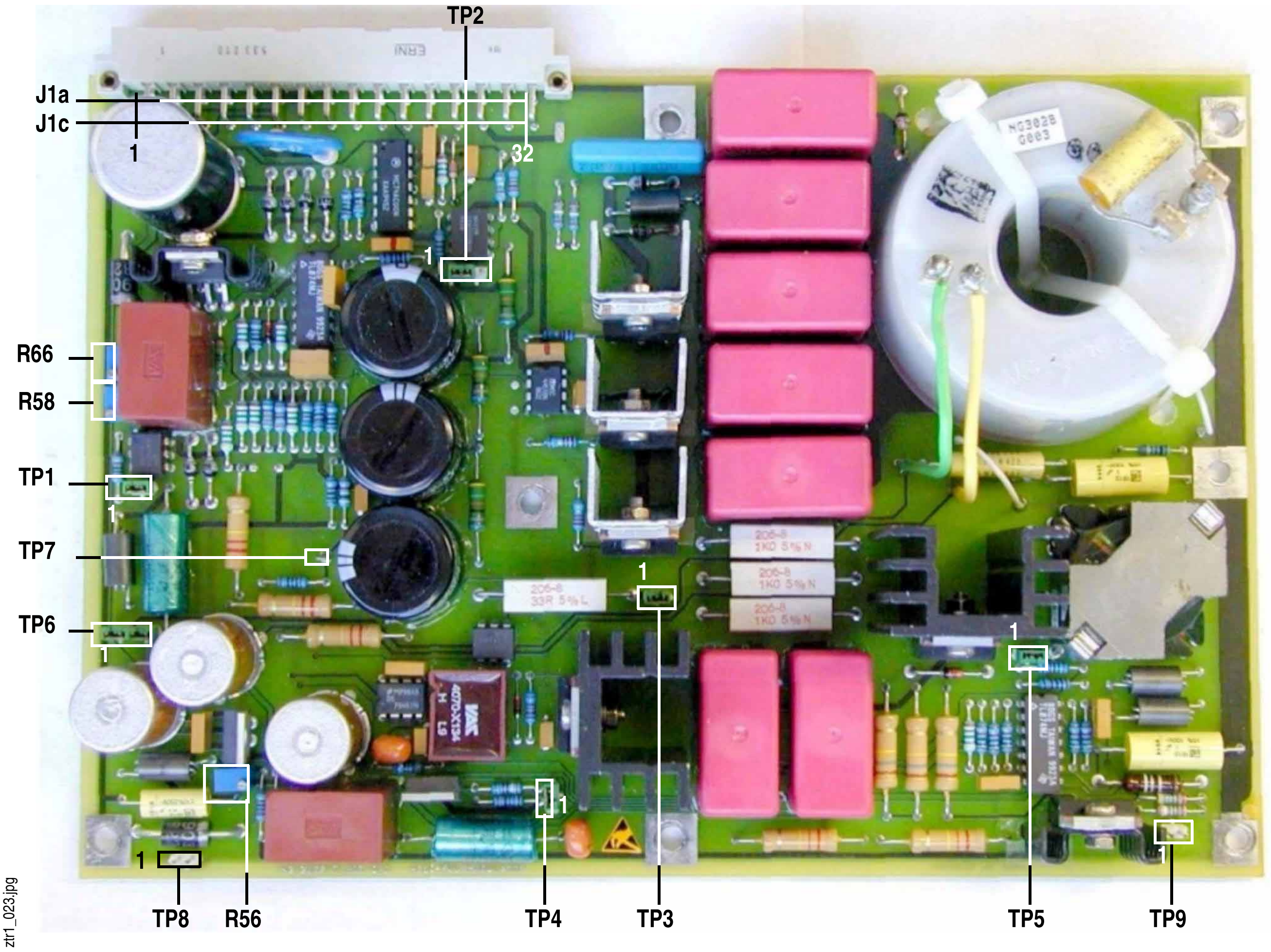


Fig. 4-21 Modulator NG 3028 G 206 (≥Rev. 02; NG 3028 G 203, ≥Rev. 01 with different components)

Connectors / Jumpers / Test Pins

TP1	Function
1	Jumper on 1/2 = **reduction of heating voltage** No jumper on 1/2 = no reduction of heating voltage [1]
2	

[1] The reduction of the heating voltage is necessary for the magnetrons M1302L/M5020 (S-Band), M1475A (X-Band, 25 kW). See Section 4.4.1.1.

TP2	Function
1	Jumper on 1 and 2 = 25/30 kW Modulator NG 3028 G 206 Jumper on 2 and 3 = 12.5 kW Modulator NG 3028 G 203
2	
3	

TP3	Function
1	Jumper on 1/2 = default, do not remove
2	

TP4	Function
1	Jumper on 1/2 = Power Supply MIC4451
2	

TP 5 is available for NG 3028 G 203 ≥Rev. 01 and NG 3028 G 206 ≥Rev. 02 only:

TP5	Function
1	Jumper on 1/2 = NG 3028 G 206 No jumper on 1/2 = NG 3028 G 203
2	

TP6	Function
1	Jumper, HEATER_P, for manufacturer's use, do not remove
2	
3	Jumper, bias current, for manufacturer's use, do not remove
4	

TP7	Function
1	IMAGNETRON

TP8	Function	
	G 203 Rev. - and G 206 ≤Rev. 01	G 203 ≥Rev. 01 and G 206 ≥Rev. 02
1	GND	HEATER_N
2	HEATER_N	HEATER_P
3	HEATER_P	-
4	Bias current +	-
5	Bias current -	-

TP 9 is available on NG 3028 G 203 ≥Rev. 01 and NG 3028 G 206 ≥Rev. 02 only:

TP9	Function
1	Bias current +
2	Bias current -

Potentiometers

	Function	
	G 203 Rev. - and G 206 ≤Rev. 01	**G 203 ≥Rev. 01 and G 206 ≥Rev. 02**
R56	**Bias adjust**. Switch the Transmitter into the stand-by mode. The bias current must be adjusted with R56. The voltage on TP8 4/5 must be 110 mV ± 5%.	**Bias adjust**. Switch the Transmitter into the stand-by mode. The bias current must be adjusted with R56. The voltage on TP9 1/2 must be 110 mV ± 5%.
R58	**Heater voltage reduction adjust (see Section 4.4.1.1 for instructions)**	
R66	**Heater adjust (see Section 4.4.1.1 for instructions)**	

4.4.1.1 Adjustment of Magnetron Heating Voltage

Mode: **Transmitter in stand-by mode**
Test pins: **NG 3028 G 203 Rev. - and NG 3028 G 206 ≤Rev. 01: TP8/2 and TP8/3**
NG 3028 G 203 ≥Rev. 01 and NG 3028 G 203 ≥Rev. 02: TP8/1 and TP8/2

Transceiver	Magnetron	Potentiometer	Adjustments (Testpins TP8)	Comment
X-Band				
12.5 kW	EEV MG5245	R66	Set DC voltage to 6.7 V ± 0.1 V	The measured heating voltage values are 0.4 V higher than displayed in the Maintenance Manager.
	NJRC MSF1425A			
25.0 kW	EEV MG5459	R66	Set DC voltage to 6.7 V ± 0.1 V	
	NJRC M1475A	R66, R58 (reduction)	1. Transceiver in stand-by mode. Adjustment: Set DC voltage at TP8 by means of R66 to 6.7 V ± 0.1 V 2. Transceiver ON and in 24 NM range. Adjustment: Set DC voltage at TP8 by means of R58 to 5.8 V ± 0.1 V	
S-Band				
	EEV M5020	R66, R58 (reduction)	1. Transceiver in stand-by mode. Adjustment: Set DC voltage at TP8 by means of R66 to 7.3 V ± 0.1 V 2. Transceiver ON and in 24 NM range. Adjustment: Set DC voltage at TP8 by means of R58 to 6.3 V ± 0.1 V	The measured heating voltage values are 1.0 V higher than displayed in the Maintenance Manager.
	EEV MG5223			
	NJRC M1302L			

4.4.1.2 Functional Description

The Modulator transforms the TTL pulses from the TCU into power pulses to trigger the Magnetron, which generates the RF transmission pulses with the adjusted length, power and frequency.

The modulator pcb is delivered in two versions for the 12.5 kW Transceiver (NG 3028 G 203) and for the 25/30 kW Transceiver (NG 3028 G 206). The versions differ only in a few components.

The adjustment of the control voltage for the magnetron is divided into the preadjustment by means of Q1 and a fine adjustment by means of Q5.

The DC voltage at J1ac32 and J1ac28 is set by Q1 to a value which can be defined on J1a18 by the TCU by means of IMAG1. For this purpose, a clock signal is used which is generated by IC103, amplified by IC302 and transformed by T1 to the source potential of Q1 (the clock signal which is generated by IC103 can be interrupted from the TCU (ENABLE) by means of IC102). By means of CR2, C6 and R7, a gate voltage is generated from this, and the output voltage at TP3 increases, until the output voltage, which has been reduced by a bleeder consisting of R13, R9 and R41, is higher than the value that is set on J1a18. Then the clock signal is interrupted by IC102, and Q1 is blocked by means of IC402.

The operating voltage P850V for the transistors Q3, Q4 and Q5 is adjusted by the TCU at J1c6 by Q5 by means of IMAG2 via IC1 and Q6. With the value of P850V which has been reduced by a bleeder consisting of R18, R19 and R21, the voltage P850V is adjusted by IC1.

The magnetron is connected to the signals HEATER_MAGN and CATHODE, and to ground. For generating the trigger pulse for the magnetron, a TTL pulse is given on J1a22. IC102 and IC306 control the power MOSFET's Q2, Q3 and Q4 which generate a negative pulse at the primary of T2. The pulse is transformed by T2 with a ratio of 1:11 and triggers the magnetron.

The magnetron current is first led through an integrating circuit consisting of C30 and R51, then decoupled by IC202 and led to the TCU via J1c18 for further processing.

The heating voltage for the magnetron is generated by the switching regulator IC8 of a zero potential 12 V AC voltage on J1a10 and J1c10 and led via a bifilar winding of T2 to the magnetron. If a magnetron is used whose heating voltage has to be reduced during operation, a jumper must be set on TP1 1 and 2.

The premagnetizing of T2 is performed by the alternating current of 12V on J1a12 and J1c12 by the switching regulator IC7. The current can be adjusted with R56.

The operating voltage for the power transistor driver IC306 is created by IC4. From this voltage, the operating voltage for IC102 is generated via R37 and CR1.

The magnetron heating voltage is led via IC202 at J1a4 and the bias current is led via IC1 at J1c4 to the TCU.

4.4.1.3 Pulse Length and PRF

The modulator repetition rates in relation to the range and the pulse length are shown in the following table:

<table>
<tr><td>Scanner rotation frequency</td><td colspan="10">23/28 rpm</td></tr>
<tr><td>Range (NM) [1)]</td><td>0.25</td><td>0.50</td><td>0.75</td><td>1.5</td><td>3</td><td>6</td><td>12</td><td>24</td><td>48</td><td>96</td></tr>
<tr><td>Short pulse
Pulse length (µs)</td><td colspan="3">0.08</td><td>0.15</td><td>0.30</td><td>0.50</td><td colspan="4">1.00</td></tr>
<tr><td>PRF (Hz)</td><td colspan="3">2000</td><td colspan="3">1000</td><td colspan="4">500</td></tr>
<tr><td>Long pulse
Pulse length (µs)</td><td colspan="3">0.15</td><td>0.30</td><td>0.50</td><td colspan="5">1.00</td></tr>
<tr><td>PRF (Hz)</td><td colspan="5">1000</td><td colspan="5">500</td></tr>
</table>

[1)] All values of the 0.25 NM range are also valid for the 250 m/500 m ranges

<table>
<tr><td>Scanner rotation frequency</td><td colspan="10">46/56 rpm</td></tr>
<tr><td>Range (NM) [1)]</td><td>0.25</td><td>0.50</td><td>0.75</td><td>1.5</td><td>3</td><td>6</td><td>12</td><td>24</td><td>48</td><td>96</td></tr>
<tr><td>Short pulse
Pulse length (µs)</td><td colspan="3">0.08</td><td>0.15</td><td>0.30</td><td colspan="5">0.50</td></tr>
<tr><td>PRF (Hz)</td><td colspan="3">2000</td><td colspan="7">1000</td></tr>
<tr><td>Long pulse
Pulse length (µs)</td><td colspan="3">0.15</td><td>0.30</td><td colspan="6">0.50</td></tr>
<tr><td>PRF (Hz)</td><td colspan="10">1000</td></tr>
</table>

[1)] All values of the 0.25 NM range are also valid for the 250 m / 500 m ranges

Depending on the range and the pulse length the magnetron current is set for the different pulse lengths by a D/A converter.

4.4.2 Microwave Unit

The Microwave Unit consists of the magnetron, the circulator, the limiter and the receiver. These components are different for the X- and S-Band versions of the Radar. See Section 9.2 for technical data.

4.4.2.1 X-Band Microwave Unit

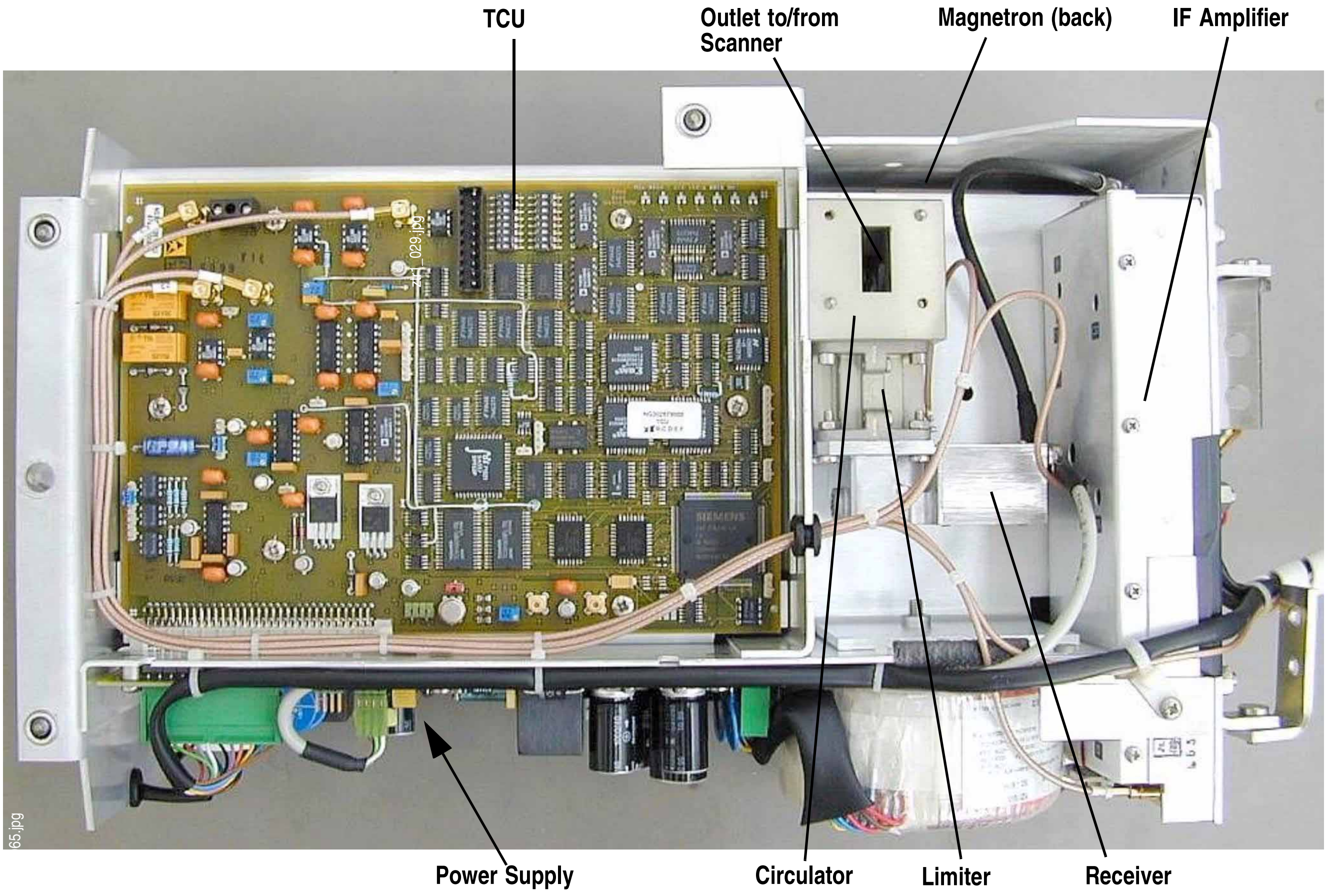


Fig. 4-22 X-Band Microwave Unit

The Microwave Unit consists of the magnetron, the controllable limiter with circulator, and the microwave receiver.

The magnetrons (MG5459 or M1475A) are pulse magnetrons which, as the transmitter output stage, release the pulse power to the Scanner. They work with a frequency of 9375 MHz, with a peak output power of 12.5/25 kW.

At the instant of transmission the diode limiter, together with the circulator, protects the receiver against the transmission pulse.

The Microwave Receiver Unit receives the echo pulses and transforms them into the IF frequency of 60 MHz.

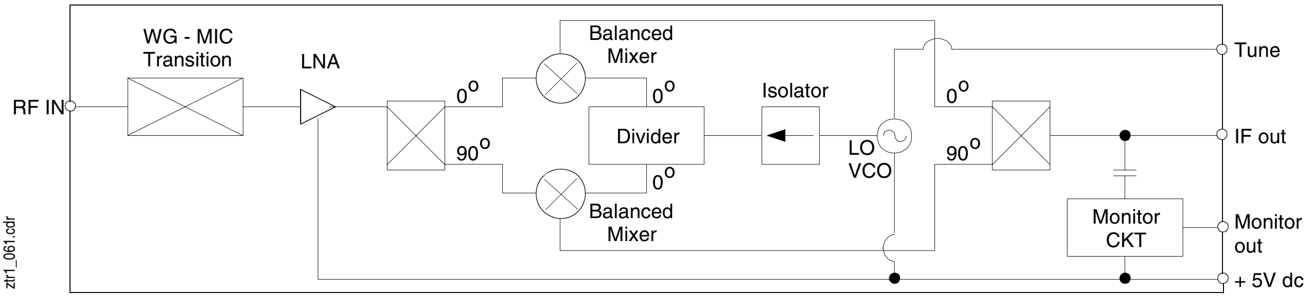


Fig. 4-23 Block diagram of the X-Band Microwave Receiver

Heating Voltages of the Magnetrons

See Section 4.4.1.1 on page 91 for the adjustment of the heating voltage.

4.4.2.2 S-Band Microwave Unit

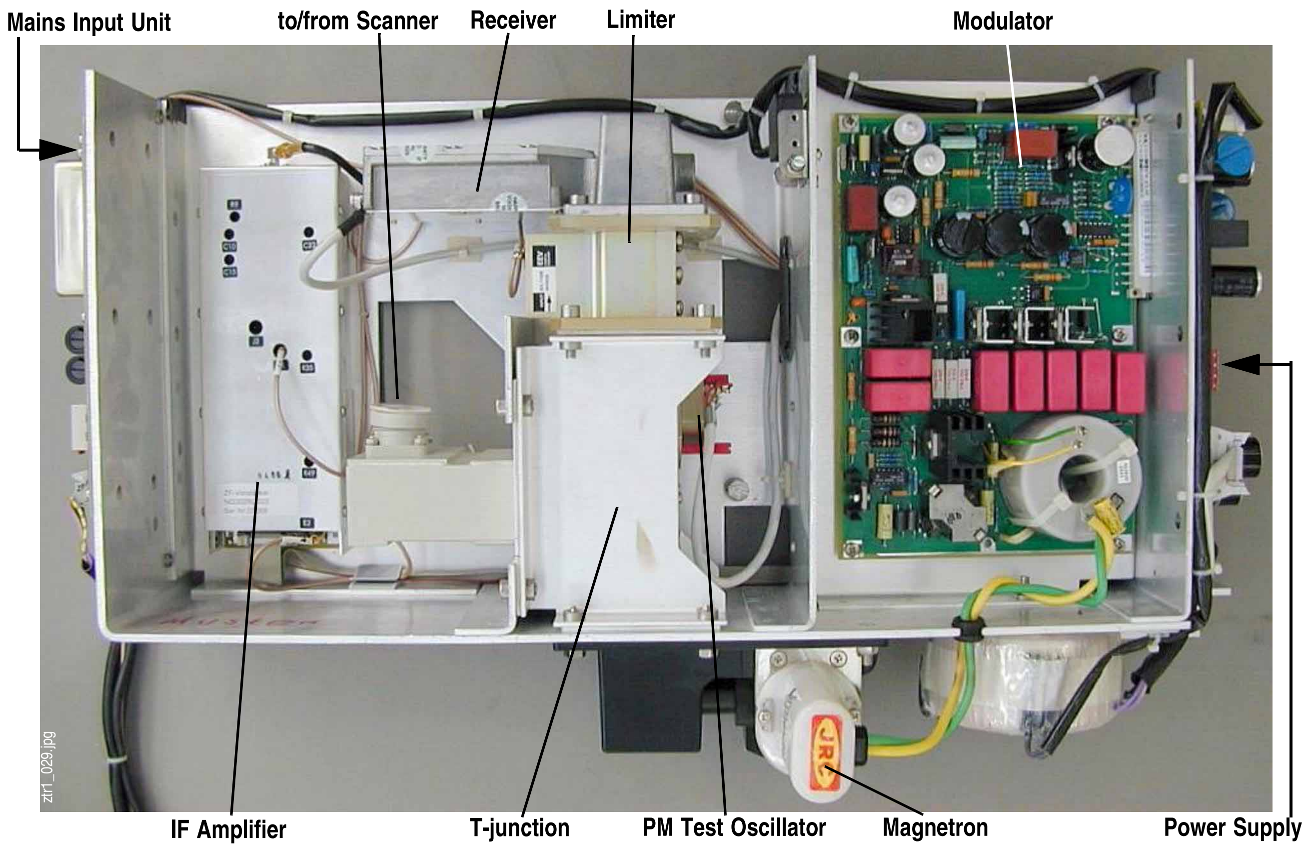


Fig. 4-24 S-Band Microwave Unit

The Microwave Unit consists of the magnetron, the T-junction, the controllable S-Band limiter and the microwave receiver.

The magnetrons M1302L/MG5223 are fixed band pulse magnetrons which, as the transmitter output stage, release the pulse power to the Scanner. They work with a frequency of 3050 MHz and with a peak output power of 30 kW.

Different versions of the Limiter are in use. See the label on the Limiter for the type.

At the instant of transmission, the controllable S-Band limiter protects the microwave receiver against the transmission pulse.

The Microwave Receiver Unit receives the echo pulses and transforms them into the IF frequency of 60 MHz.

Heating Voltages of the Magnetrons

See Section 4.4.1.1 on page 91 for the adjustment of the heating voltage.

4.4.3 IF Amplifier NG 3028 G 022

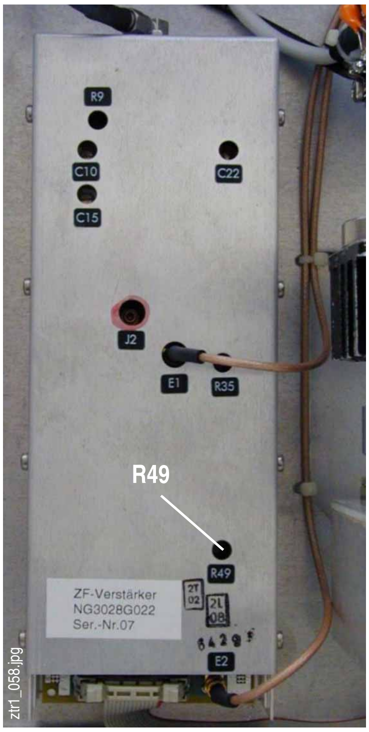


Fig. 4-25 IF Amplifier

The IF Amplifier combines a logarithmic and an IF preamplifier. The IF Amplifier prepares the incoming receiver signal for the TCU, where it is processed to form the combined video signal (TCU).

The video amplitude can be adjusted with R49 to -2 V at 75 Ω load (set radar to long pulse without SEA (STC)). Further adjustments are not necessary.

If the cable length of the TVA cable between the Transceiver and the Display Electronics Unit is longer than 150 m, it could be possible that the video amplitude cannot be adjusted to -2 V. In this case, the potentiometer R49 on the pcb NG 3013 G 212 must be exchanged. If a 500 Ω potentiometer is installed, it must be replaced by a 2 kΩ potentiometer (order No. 5102258).

In the case of a defect, the IF Amplifier must be exchanged.

4.4.4 Transmitter Control Unit (TCU) NG 3028 G 201

DIP Switch S1/1...3, Transceiver Number on=closed=0; off=open=1	Switch No. 3	2	1
Sets Radar Transceiver No. to 1	Off	Off	Off
Sets Radar Transceiver No. to 2	Off	Off	On
Sets Radar Transceiver No. to 3	Off	On	Off
Sets Radar Transceiver No. to 4	Off	On	On
Sets Radar Transceiver No. to 5	On	Off	Off

DIP Switch S1/4....8	**Function**	
	On	**Off**
4	External trigger-mode on	Internal trigger (default)
5	Not permissible, set to Off	Default
6	12.5 kW Transceiver	25/30 kW Transceiver
7	X-Band Transceiver	S-Band Transceiver
8	Service Mode on	Normal operation (default)

TP53	**Function**
1	Jumper on 1/2 = **termination of CAN0** (Radar Bus), 120 Ω
2	No jumper on 1/2 = CAN0 not terminated at this pcb

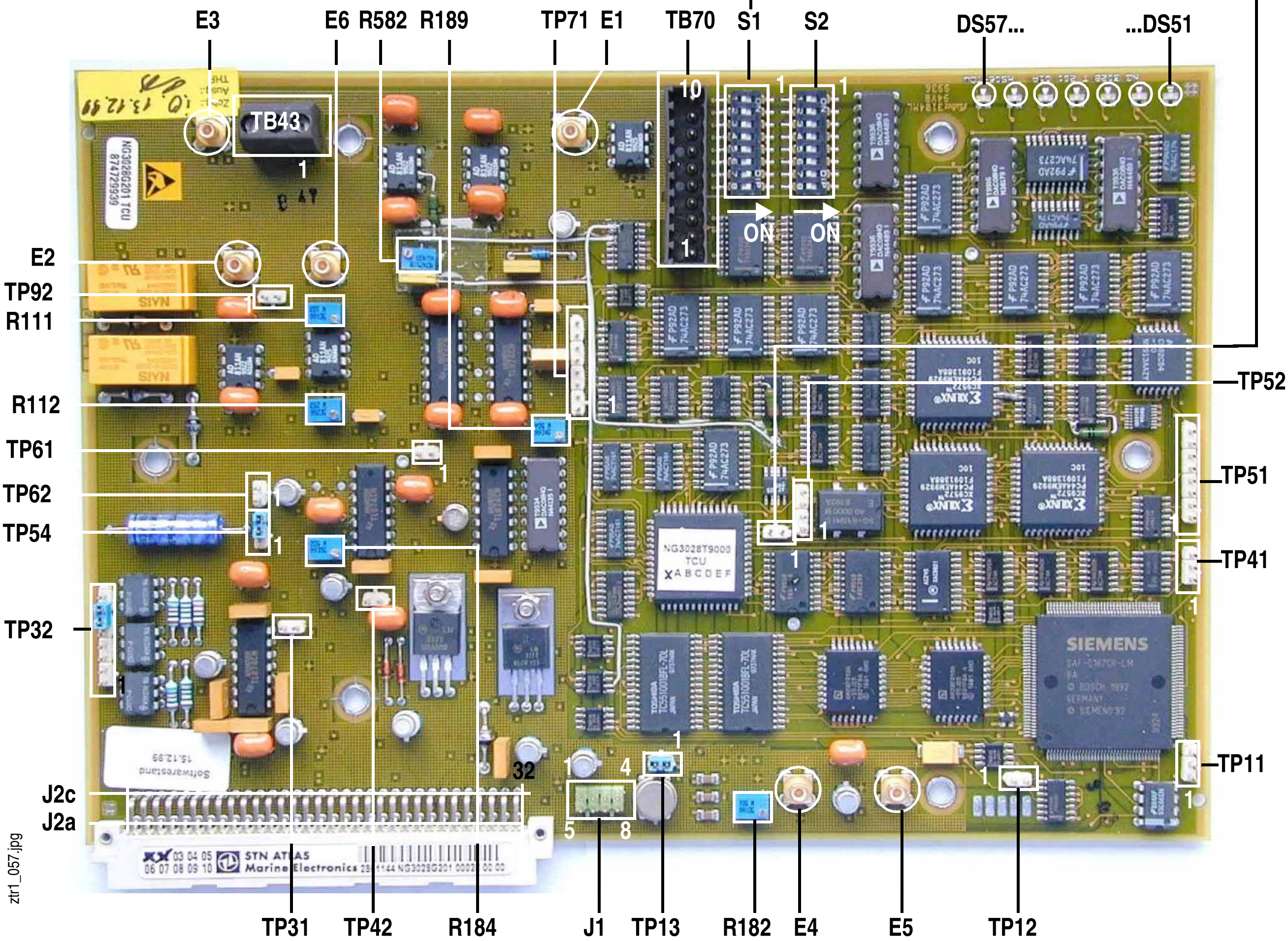


Fig. 4-26 Transmitter Control Unit (TCU), Rev. 04

DIP Switch S1/1...3, Transceiver Number on=closed=0; off=open=1	Switch No.		
	3	2	1
Sets Radar Transceiver No. to 1	Off	Off	Off
Sets Radar Transceiver No. to 2	Off	Off	On
Sets Radar Transceiver No. to 3	Off	On	Off
Sets Radar Transceiver No. to 4	Off	On	On
Sets Radar Transceiver No. to 5	On	Off	Off

TP53	Function
1	Jumper on 1/2 = **termination of CAN0** (Radar Bus), 120 Ω
2	No jumper on 1/2 = CAN0 not terminated at this pcb

DIP Switch S1/4....8	Function	
	On	Off
4	External trigger-mode on	Internal trigger (default)
5	Not permissible, set to Off	Default
6	12.5 kW Transceiver	25/30 kW Transceiver
7	X-Band Transceiver	S-Band Transceiver
8	Service Mode on	Normal operation (default)

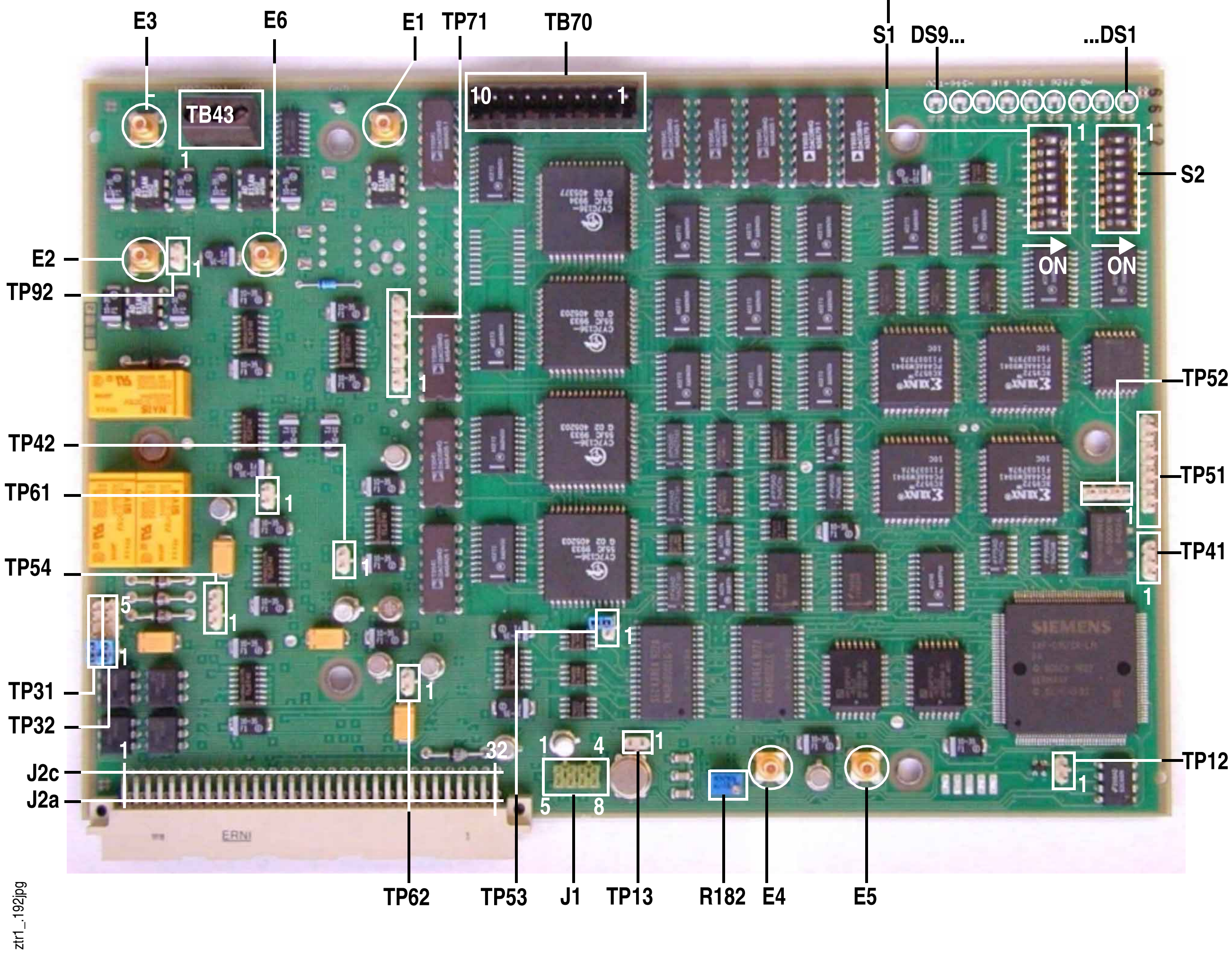


Fig. 4-27 Transmitter Control Unit, Rev. 05

WARNING
For the use of the different revisions of the TCU some prerequisites must be fulfilled. See **Section 7, Revision Overview** **for further information.**

Connectors / Jumpers / Test Pins

Coaxial connectors	Function	
	≤Rev. 04	≥Rev. 05
E1	VIDEO_IN	VIDEO_IN
E2	IF_STC	IF_STC
E3	TVA1	TVA1
E4	No function	EXT_TRIG_IN
E5	PRETRIG_OUT	PRETRIG_OUT
E6	RF_STC	RF_STC

J1	Function
1	AGND
2	GND
3	GND
4	GND
5	VIDOUT
6	HMOUT
7	SYNOUT
8	TRIGOUT

TB43	Function
1, 2	TVA2
3, 4	AGND

TB70	Function
1	GND, serial interface (option)
2	DVTxD, serial interface (option)
3	DVRxD, serial interface (option)
4	n.c.
5	GND, debug interface RS232, or boot interface for jumper on 9/10
6	VTxD, debug interface RS232, or boot interface for jumper on 9/10
7	VRxD, debug interface RS232, or boot interface for jumper on 9/10
8	n.c.
9	BOOT, debug interface RS232, or boot interface for jumper on 9/10
10	GND, debug interface RS232, or boot interface for jumper on 9/10

TP12	Function
1	RESET IN
2	GND

TP13	Function	
	≤Rev. 04	≥Rev. 05
1	Jumper on 1/2 = manufacturer's setting, do not modify.	Jumper on 1/2 = external trigger is negative No jumper on 1/2 = external trigger is positive
2		

TP31	Function	
	≤Rev. 04	≥Rev. 05
1	IMAG1	Jumper on 1/2 for manufacturer's use
2	AGND	SYN_A
3	-	Jumper on 2/3 for manufacturer's use
4	-	Jumper on 4/5 for manufacturer's use
5	-	

TP32	Function	
	≤Rev. 04	≥Rev. 05
1	SYN_A	Jumper on 1/2 for manufacturer's use
2	Jumper on 1/2 for manufacturer's use	HMA
3	Jumper on 3/4 for manufacturer's use	Jumper on 2/3 for manufacturer's use
4		Jumper on 4/5 for manufacturer's use
5	Jumper on 5/6 for manufacturer's use	
6	HMA	-
7	Jumper on 6/7 is default setting, do not remove	-
8		-

TP42	Function	
	≤Rev. 04	≥Rev. 05
1	IMAG2	IMAG1
2	AGND	IMAG2

TP54	Function	
	≤Rev. 04	≥Rev. 05
1	28 VB	Jumper on 1/2 = 28 VB No jumper on 1/2 = 24 VB (default)
2	TUNVIN, jumper on 2/3 = default	TUNVIN
3	24 VB	Not connected

TP61	Function
1	MAGIND B
2	AGND

TP62	Function	
	≤Rev. 04	≥Rev. 05
1	TUNEV	TUNEV
2	AGND	PM_TUNE

TP71	Function	
	≤Rev. 04	≥Rev. 05
1		PMA
2	ASTC	ASTC
3	TUNEI	TUNEI
4	PMV	PMV
5		
6		VIDOK
7		HEV
8	PMA	BIV

TP92	Function	
	≤Rev. 04	≥Rev. 05
1	IF-STC	IF_STC
2	AGND	RF_STC

DIP Switches

For DIP Switch S1 see Figure 4-26 on page 97 and Figure 4-27 on page 98.

DIP Switch 2 [1)]	Function	
Switch No.	On	Off
1 (for ≤Rev. 04)	Not permissible, set to Off	Default
1 (for ≥Rev. 05)	Reduction of heating voltage (Magnetron) on	Reduction of heating voltage (Magnetron) off
2 (for ≤Rev. 04)	Not permissible, set to Off	Default
2 (for ≥Rev. 05)	Enables the indication of heating voltage and BIAS current at the Indicator. Permissible only with: NG 3028 G 201 ≥Rev. 05 (TCU) and NG 3028 G 202 ≥Rev. 03 (Power Supply Unit) and NG 3028 G 203 ≥Rev. 01 (Modulator 12.5 kW) or NG 3028 G 206 ≥Rev. 02 (Modulator 25/30 kW)	Set to off, if the pcbs do not have the revision No. shown in the column on the left. The menu items for the indication of heating voltage and BIAS current are not displayed in the Maintenance Manager menus.
3	For software version ≤2.4.5: Not permissible, set to Off For software version ≥2.4.6: must be toggled to the other position after every exchange of Magnetron or Modulator	For software version ≤2.4.5: Default For software version ≥2.4.6: must be toggled to the other position after every exchange of Magnetron or Modulator
4	Not permissible, set to Off	Default
5	Not permissible, set to Off	Default
6	Not permissible, set to Off	Default
7	Azimuth simulation on	Azimuth simulation off (default)
8	Magnetron current control on (default)	Magnetron current control off

1) on=closed=0; off=open=1

LED's

DS	Colour	Function
DS51 ≤Rev. 04 DS1 ≥Rev. 05	Red	Error - On if at least one error is present
	Green	External Trigger - On if an external trigger is present. The brightness depends on the frequency of the external trigger
DS52 ≤Rev. 04 DS2 ≥Rev. 05	Red	Head Marker - Toggling with each head marker pulse
	Green	Azimuth - On if antenna pulses are detected
DS53 ≤Rev. 04 DS3 ≥Rev. 05	Red	Stand-by Heating - On in stand-by mode, flashing while the magnetron is heating up
	Green	On if Transceiver is in normal operation mode
DS54 ≤Rev. 04 DS4 ≥Rev. 05	Red	CAN TXD - Alight while transmitting CAN telegrams
	Green	CAN RXD - Alight while receiving CAN telegrams
DS55 ≤Rev. 04 DS5 ≥Rev. 05	Red	Self-check - System is processing a self-check
	Green	Not used
DS56 ≤Rev. 04 DS6 ≥Rev. 05	Red	Not used
	Green	Flashing at 1 Hz (program running)
DS57 ≤Rev. 04 DS9 ≥Rev. 05	Red	PRF control - PRF processor is working
	Green	RSTOUT - C167 controller initialization finished

DS7 ≥Rev. 05	Red	Not used
	Green	Not used
DS8 ≥Rev. 05	Red	Not used
	Green	Not used

Potentiometers

	Function
R111 ≤Rev. 04	Adjustment of RF STC length (≤Rev. 04 only)
R112 ≤Rev. 04	Adjustment of RF STC decay (≤Rev. 04 only)
R182 ≥Rev. 05 R182 ≤Rev. 04 R582 ≤Rev. 04	External trigger (amplitude) (≥Rev. 05 only) STC compensation (length) (≤Rev. 04 only) (from ≥Rev. 05 on, the complete adjustment must be performed by means of software adjustments as described in Section 5.9.2.2 on page 195.) STC compensation (amplitude) (≤Rev. 04 only) - Select the 12 NM range. - Set RAIN to 0% - Set SEA to 100% - Switch the Clean Sweep function off. - Generate a strong noise on the screen by means of GAIN. - Turn R182 and R582 clockwise to limit. - Turn R582 counterclockwise until the noise in the STC-affected area is as strong as outside this area. - Turn R182 counterclockwise until there is no dark circle or noise circle visible at the end of the STC-affected area.
R184 ≤Rev. 04	**Performance Monitor tuning**(≤Rev. 04 only) (from ≥Rev. 05 on, the complete tuning must be performed by means of software adjustments as described in Section 5.9.2.1 on page 192.) - Switch on the Performance Monitor. - Tune the receiver. - Connect the oscilloscope to the TVA signal (TB43/1,2). - Adjust the signal by means of R184 to maximum amplitude (~0.7...0.9 V). - Do the **PM Adjust** adjustment as described in Section 5.9.2.1 on page 192. - Check whether the circle has a diameter of 6 NM. - The circle must be displayed strongly reduced if TUNE is modified about ±5%.
R189 ≤Rev. 04	Performance Monitor signal level (PMS) (≤Rev. 04 only).

Service Mode

The Service Mode can be switched on by means of the DIP switch S1/8. The activated Service Mode offers the following functions:

- If the Scanner stops turning, the Transceiver is not switched off.
- If the magnetron current exceeds or falls short of its limits, the Transceiver is not switched off.
- If a communication time-out occurs in the communication with the master indicator, the Transceiver is not switched off.

4.4.4.1 Hardware Description of the TCU

The operating system and the parameters are loaded from the main processor of the Display Electronics Unit into an EEPROM of the TCU. The EEPROM stores these parameters for the radar system.

The TCU coordinates and controls all transmit and receive functions. It coordinates the running of the individual operating modes and generates the required timing signals. The communication with external units (e.g. the Display Electronics Unit) is done via the CAN Bus.

The TCU also generates the combined video signal (TVA) from the receiver's output and the additional trigger signals.

In service operation status, special functions such as parameter adjustment and telediagnostic service can be operated.

The TCU supports the standard pulse repetition frequencies of 2000/1000 and 500 Hz and additionally for future solutions all frequencies in a range of 250 Hz to 4000 Hz (resolution 400 ns). The maximum range for the pulse length is 50 ns to 1 µs (resolution 12.5 ns). These values are available only with the developer's tools.

The TCU generates the trigger signal (TRI) for the start of the transmission.

The Transceiver reports its type (X-Band, S-Band) via CAN Bus to the connected Display Electronics Units.

Self-check of the Transmitter

With each sweep, the magnetron current is measured 120 µs after the trigger and converted by an A/D converter. If the current is different from the value which is expected for the setting of the pulse length, the transmitter stops transmission and must be switched over to stand-by by the Indicator.

Working Hours of the Magnetron

The TCU works as a working time meter for the magnetron. The working hours are added and saved at fixed intervals in the EEPROM. The resolution is 30 minutes.
The maximum count of the meter is $FFFF_{hex}$ * 0.5 h = 32767 h.

The working time meter can be reset by means of the system maintenance menus.

Receiver Control

The signals which have been received by the Scanner are led to the mixer. They are transformed into the intermediate frequency. This signal is processed by the pre- and IF amplifiers to form the video signal.

Tuning Control

The tuning can be performed at the Indicator. The tune-up setting is transmitted to the TCU via the CAN Bus. From this signal, the TCU generates a control voltage to adjust the frequency of the auxiliary oscillator. The tuning can also be done automatically.

STC Control

To generate a time-based amplification characteristic, the preamplifier is supplied with a control voltage. The PROM of the TCU contains 12 predefined STC curves, each consisting of 512 or optionally 1024 bytes.

The suitable curve is selected on the Indicator. The TCU loads the data of this curve into the DPRAM. From this, a time-based attenuation curve is processed whose starting instant can be set by means of an adjustable delay value.

If the STC function is set to automatic, the video signal will be integrated and sent to the microcontroller as an analog signal. The controller filters the measured values in a software integrator. The integrator's output sets the start instant of the STC curve.

Transformation of Scanner Data

The Gearbox contains a Headmarker, which generates a square pulse for each turn. The Headmarker cannot be adjusted mechanically. The adjustment to 0° has to be done by means of an offset which has to be set on the Indicator. The resolution of the offset is 0.1° from 0° to 360°.

The number of pulses per rotation can be set by means of the system maintenance menu depending on the pulser type. To adapt the azimuth angle to the trigger repetition rate, the azimuth angle data between two pulses of the shaft encoder is interpolated by a synchronously running timer via software. In this way, for each transmission pulse a new azimuth angle can be calculated.

Processing the TVA Signal

The transmission trigger, the received video signal and the azimuth signal are combined to form the TVA (combined video) signal.

The microcontroller pushes the azimuth data into a 16-bit shift register, which mixes the 16-bit word into the video about 100 µs before the end of the transmission cycle with a baud rate of 200 kHz. The time for the start of the mixing is triggered by a timer. To simplify the decoding of the azimuth information from the TVA signal, a synchronisation pulse (AZS = Azimuth Start) with an amplitude of -4 V is set before the azimuth data. The azimuth data have an amplitude of -2 V. An example for the TVA signal is shown in Section 4.5.4.1, RSC Adjustments on page 120.

Own Trigger and External Trigger

In the external trigger mode, there are two different cases:

1. External trigger with transmission (master mode)
2. External trigger without transmission (slave mode)

If the TCU is set to external trigger, the trigger repetition frequency is measured continuously. Depending on the measured value, the timing and all values depending on the timing are checked.

The external trigger defines the starting instant but not the width of the pulse. Depending on the measured external PRF, a suitable PRF from an internal stored table is chosen. The TCU supports trigger repetition frequencies between 300 Hz and 4 kHz. If the external frequency is higher than 2 kHz, the TCU tries to divide it by two to get a suitable frequency (transmission with every second trigger signal only). An external trigger PRF with more than 4 kHz causes a warning.

The external trigger is measured and checked constantly. If the measured values vary by more than 10% from the adjusted value, a warning is generated.

The external trigger functions can be configured in the indicator's maintenance menu.

Sector Blanking Definition

During one turn of the Scanner, the transmission can be stopped in up to four sectors. In these sectors, the transmitter power supply is switched off by means of a special control input.
It is possible to overlap two sectors. The sector blanking can be handled by means of the maintenance menus.

Motor Control

The Scanner can start to turn only if the Transceiver is switched on. If the Gearbox is equipped with a dual speed motor, it is possible to switch the motor into two different speeds, which depend on the mains frequency. The Scanner rotation frequency is measured continuously and a warning is generated if the rotation frequency is too low.

Performance Monitor Control

The Performance Monitor is part of the Gearbox; it measures the strength of the transmitted signal of the receiver. The functionality of the Performance Monitor is controlled by the TCU.

For a description of the Performance Monitor hardware see Section 4.3.2.9, page 86.

On-Line Test

The on-line test periodically checks the basic functions of the unit and the connected periphery. In case of faults, the corresponding operation is started.

Headmarker Control
: The absence of a Headmarker signal is recognised during the measurement of the rate of turn of the Scanner. In this case a warning is generated.

Scanner Control
: The rate of turn of the Scanner is constantly measured and checked. If the measured value lies outside a defined tolerance, a warning is generated. If the scanner stops turning, the transmission is interrupted and the TCU has to be switched to stand-by mode from the Indicator.

Power Supply Monitoring
: The supply voltages +5 V, ± 15 V and +24 V are checked. If the measured values lies outside the tolerance limits, a warning is generated.

Display Electronics Unit On-Line Test
: All Display Electronics Units that are linked to a Transceiver are checked every 6 s by this Transceiver via a CAN Bus telegram. Absence of an acknowledge of the Display Electronics Unit, an unauthorized transmission of data by the Display Electronics Unit or an error of the verification of the reply telegram leads to a warning message. In the case of an error the Indicator loses its master mode or gets no permission for the master mode.

Off-Line Self-Test

The TCU contains an integrated off-line self-test system with which the components of the TCU unit can be checked. These components are:

- External RAM
- DPRAM
- EEPROM
- ROM
- A/D converter
- CAN controller

The TCU is equipped with an additional serial interface for test purposes. With the help of this interface it is possible to perform tests and parameter settings via terminal software. The state of the system after an off-line test is undefined.

Frequency Deviation

In the case of multiple radar installations, there is a risk of the reception of reflected signals which have been transmitted by a different Transceiver. These signals are usually received only in one sweep and can be filtered by a comparison with previous sweeps. To prevent permanent synchronization of this effect, the PRF of the single transmitters can be varied with an offset of ±5%.

4.4.4.2 Software Description of the TCU

The TCU software has the following functions:

- The Transceiver is operated by the Display Electronics Unit via the CAN Bus. The TCU provides the CAN Bus interface for the Transceiver.
- Debug function via an additional interface
- Storage of all Transceiver parameters in an EEPROM
- Storage of all system parameters in an EEPROM

The TCU contains the control software for the Transceiver. The orders are sent via CAN Bus from the Display Electronics Unit to the TCU. The software starts to run itself when "power-on" of the Transceiver occurs. If the system is switched over to the service mode, a remote diagnosis and adjustment routines are available. The service parameters determined are stored in a non-volatile memory.

4.4.5 Power Supply Unit NG 3028 G 202

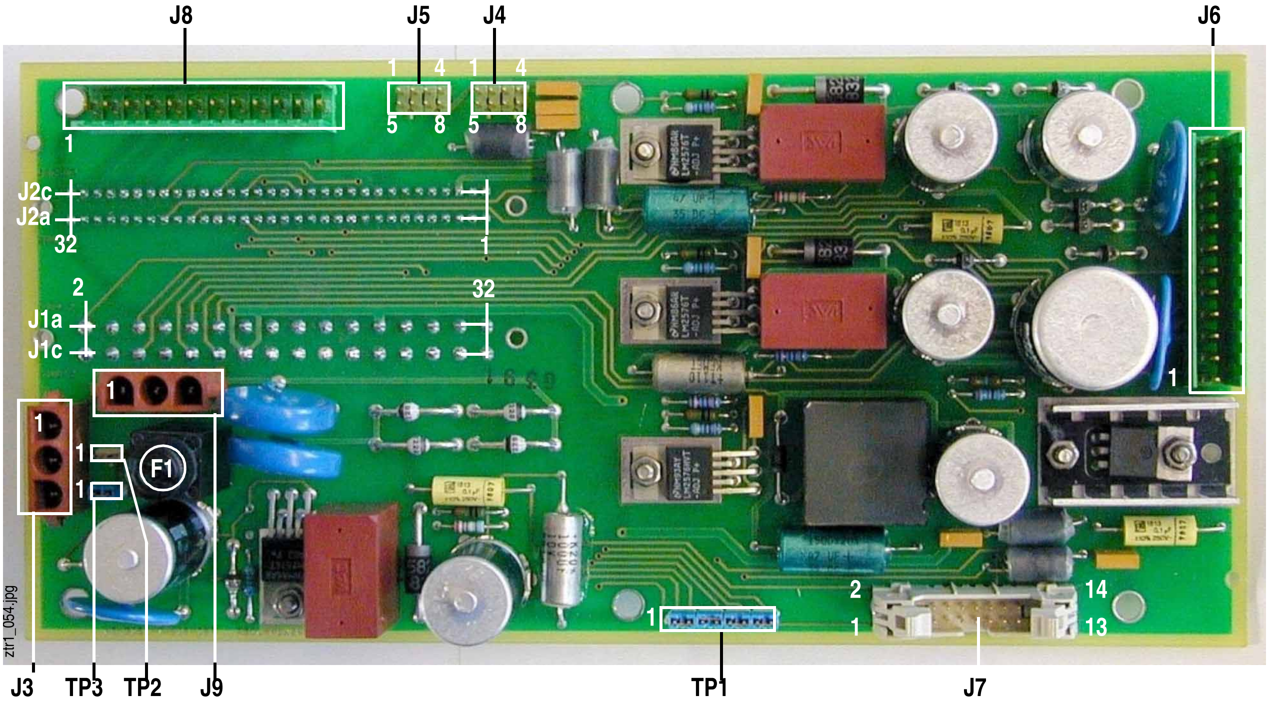


Fig. 4-28 Power Supply Unit

WARNING
For the use of the different revisions of the Power Supply Unit some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.

Connectors / Jumpers / Test Pins

Connectors	Function
J1	To modulator
J2	To TCU
J3	To transformer
J4	To RF front-end
J5	To test-oscillator
J6	To transformer
J7	To IF/log. amplifier
J8	To Connection Board
J9	To HV Supply Switch (Interlock)

TP1	Function
1	Jumper 1/2 for +5 V, for test purposes
2	
3	Jumper 3/4 for +15 V, for test purposes
4	
5	Jumper 5/6 for -15 V, for test purposes
6	
7	Jumper 7/8 for +24 V, for test purposes
8	

TP2	Function
1	**Jumper on 1/2 = 12.5 kW modulator**
2	

TP3	Function
1	**Jumper on 1/2 = 25/30 kW modulator**
2	

Fuse

F1	For the fuse see page 251.

The Power Supply Unit generates all voltages for the Transceiver Electronics Unit and all connected units (Performance Monitor, Azimuth Pulse Generator, Headmarker, IF Amplifier).

All extra-low voltages are continuously measured. The Power Supply Unit generates a status signal depending on the result of the measurements. This signal is controlled by the processor, which generates an alarm if an error occurs.

4.4.6 Mains Input Unit (TPS) NG 3028 G 204

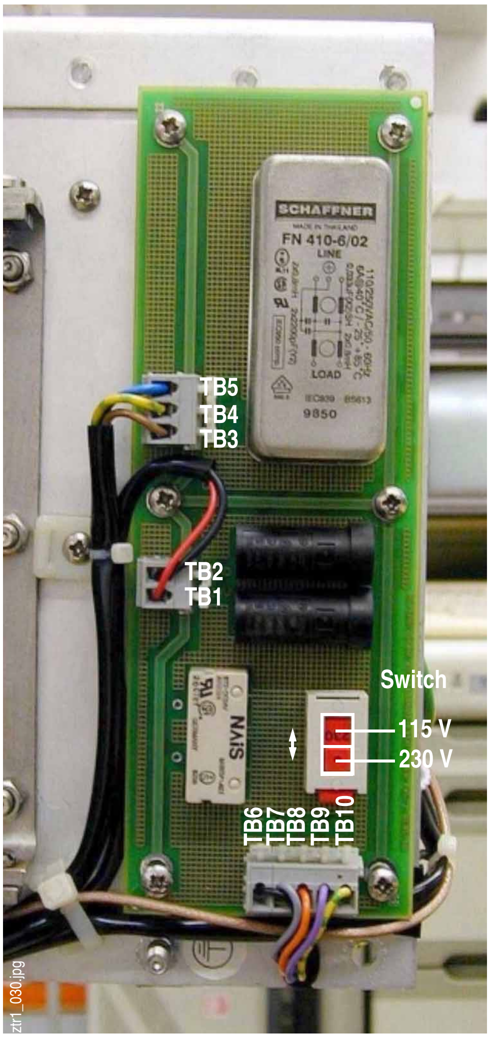


Fig. 4-29 Mains Input Unit

The Mains Input Unit is connected to a transformer. The transformer is switched on by a "power on" signal (24V ON/OFF) from the Display Electronics Unit. The "power on" signal is connected to a relay, which switches the transformer on or off. The AC outputs of the transformer are connected to the power supply and the modulator.

The Mains Input Unit consists of the following components:

- Mains input
- Fuses
- Mains filter
- Power-on relay
- Transformer
- Terminals for the cabling of mains filter, fuses, relay

Fuses

For the fuses see page 251.

Voltage Selector

The voltage selector switch must be set corresponding to the ship's mains (supply) voltage.

Terminals

The wires of terminals TB6..TB10 must not be changed! The transformer's primary is connected via these wires. The wires have to be disconnected only for the exchange of the pcb or the transformer.

Terminal	Function
TB1	24V ON/OFF ONP
TB2	24V ON/OFF ONN
TB3	L1
TB4	PE
TB5	N

Terminal	Function
TB6	Black
TB7	Grey
TB8	Orange
TB9	Violet
TB10	Green/yellow

4.5 Display Electronics Unit

4.5.1 System

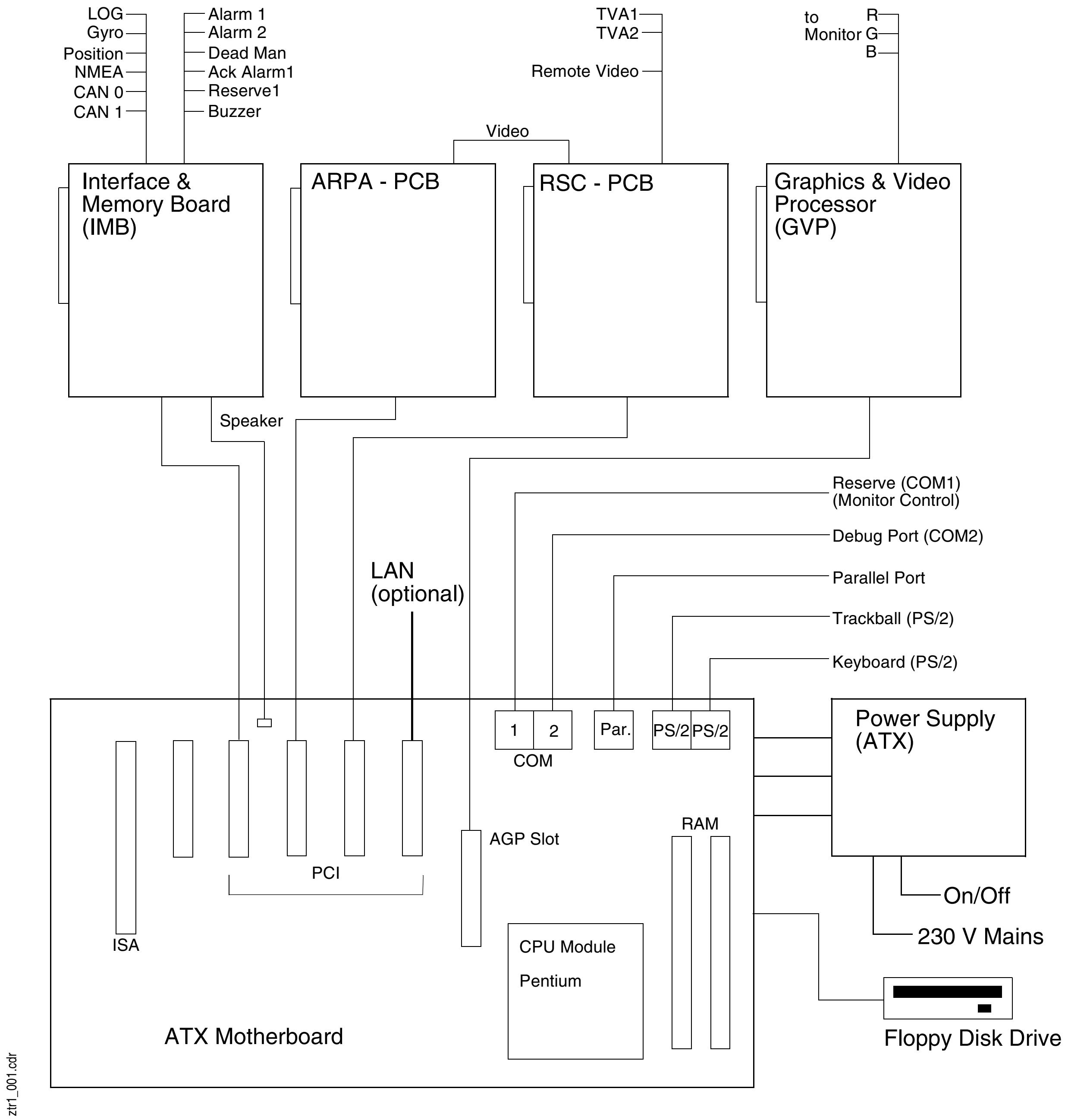


Fig. 4-30 Block diagram of the Display Electronics Unit GE 3044

The block diagram does not show the correct order of the pcb's. This order depends on the type of Motherboard which is used in the radar. See Section 4.5.3 for further information.

The Display Electronics Unit contains the following components:

- Pentium Mother Board (PMB)
- Radar Scan Converter (RSC)
- ARPA electronics (ARPA)
- Graphic and Video Processor (GVP)
- Interface and Memory Board (IMB)
- Power Supply
- Interconnection Board
- RGB Buffer (optional)

The Monitors are not dealt within this manual. Separate technical manuals are available for all types which can be serviced. The Monitors can be connected to the Display Electronics Unit or to the RGB buffer.

The Display Electronics Unit has to process the radar video and to act as the interface to the user together with the Operating Unit and the Monitor. The functions are described in detail in the following chapters.

4.5.2 Housing

The components of the Display Electronics Unit GE 3044 are mounted in a metal housing. There are two versions of the housing for the different Power Supplies. See Section 4.5.9 on page 138 for further information.

4.5.3 Pentium Motherboard (PMB)

CAUTION
The motherboard shown and described below is only an example (version S3ZX-A). It is likely that the radar will be equipped with different Motherboards in accordance with technical progress.

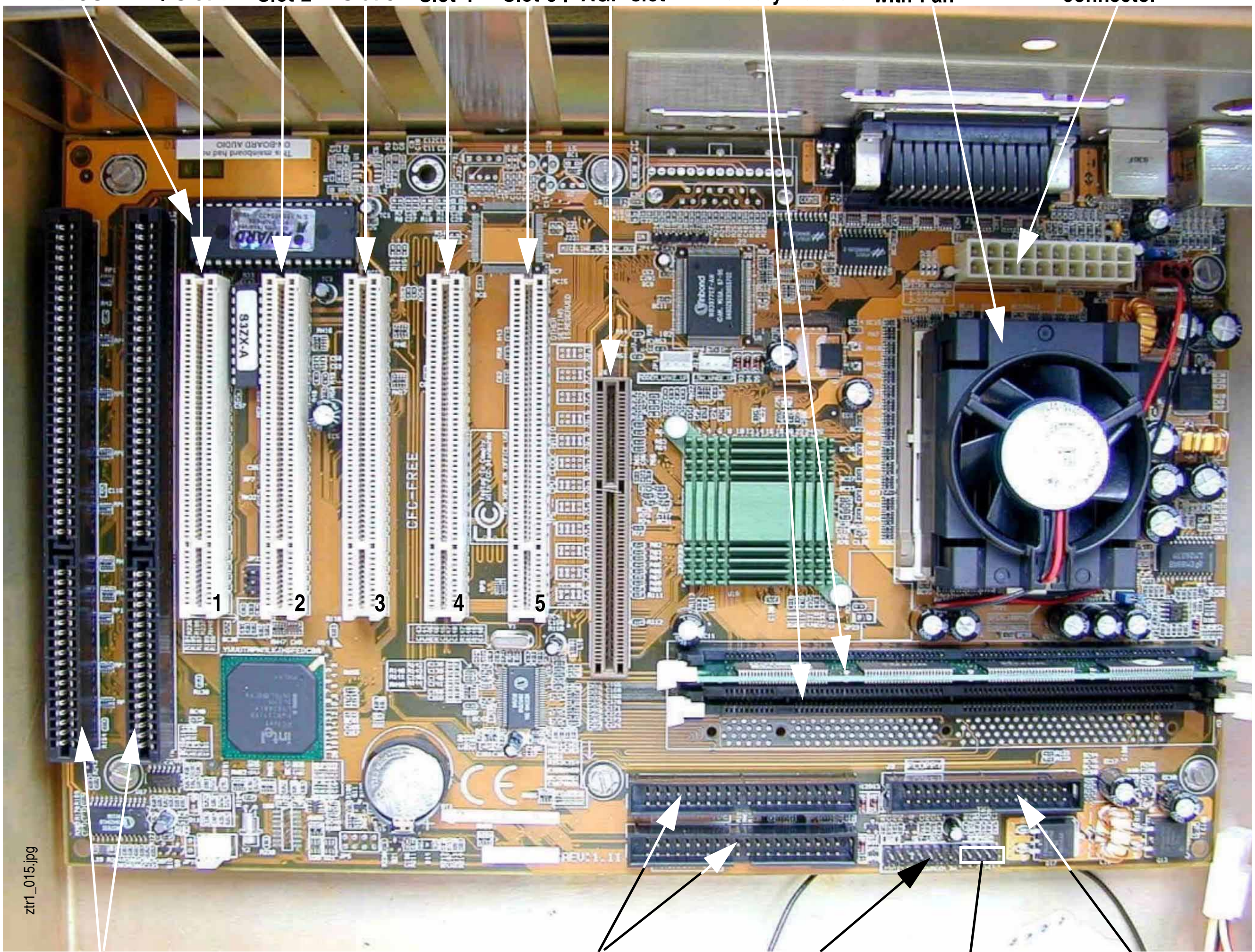


Fig. 4-31 Example of a Pentium Celeron Motherboard (ATX) in the Display Electronics Unit

WARNING
Do not modify the jumper settings of the Motherboard. The jumpers are set ex works.

WARNING
For the use of the different Motherboards, some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.

4.5.3.1 Hardware Description

The main processor of the radar is the Pentium processor on the Motherboard. The Motherboard is a PC board of ATX standard with sockets for CPU, BIOS, RAM, ISA cards and PCI cards.

The interfaces of the Motherboard are shown in the block diagram in Figure 4-30. An example of the position of the connectors is shown in Figure 4-32. The location and the number of connectors depend on the version of the Motherboard. For the sequence of the pcb's in the PCI slots see Section 4.5.3.2 on page 114.

Types of Motherboards

The radar is equipped with different Motherboards in accordance with technical progress. The different versions of the Motherboards can be recognized by means of the number of PCI/ISA slots and some labels of the manufacturer.

Type of Motherboard	Number of ISA slots	Number of PCI slots	Position of the manufacturer's label
Tekram S3ZX-A	2	5	- next to the primary IDE connector and - on one of the ISA slots
DFI CA61	3	4	- on the housing of the parallel interface and - printed on the pcb next to the memory slot
DFI CB61	3	4	- on one of the ISA slots - on the pcb next to the memory slot
DFI CA64	1	5	- on the housing of the parallel interface

4.5.3.2 Position of the Pcb's in the Motherboard's Slot

The pcb's which are described in the following sections have to be plugged in at a defined PCI slot. It is not permissible to change the position of the pcb's on the Motherboard. If a pcb has been plugged in at the wrong PCI slot, then unforeseen faults will probably occur.

CAUTION
For the slot numbers, see Figure 4-31 on page 113. The numbers printed on the Motherboard pcb may be different and are not valid. Start to count from the ISA slots onwards in direction of the Processor as shown in Figure 4-31. The number of ISA and PCI slots depends on the Motherboard type.

	PCI Slot No. [1]		
PCB	Tekram S3ZX-A	DFI CA61/CB61	DFI CA64
Ethernet Module (optional)	5 [2]	1	2
Interface and Memory Board (IMB)	2	2	3
Radar Scan Converter (RSC)	3	3	4
ARPA Pcb (optional)	4	4	5

[1] The slot numbers printed on the PCB are not valid! See Figure 4-31 on page 113 for the correct sequence.
[2] The Ethernet Module has been plugged into slot 1 ex works. **It is definitely advisable to change its position to slot 5 to prevent problems during Ethernet Network problems.** See also Section 8.4.3 on page 241 for further information.

4.5.3.3 Connectors at the Rear of the Display Electronics Unit

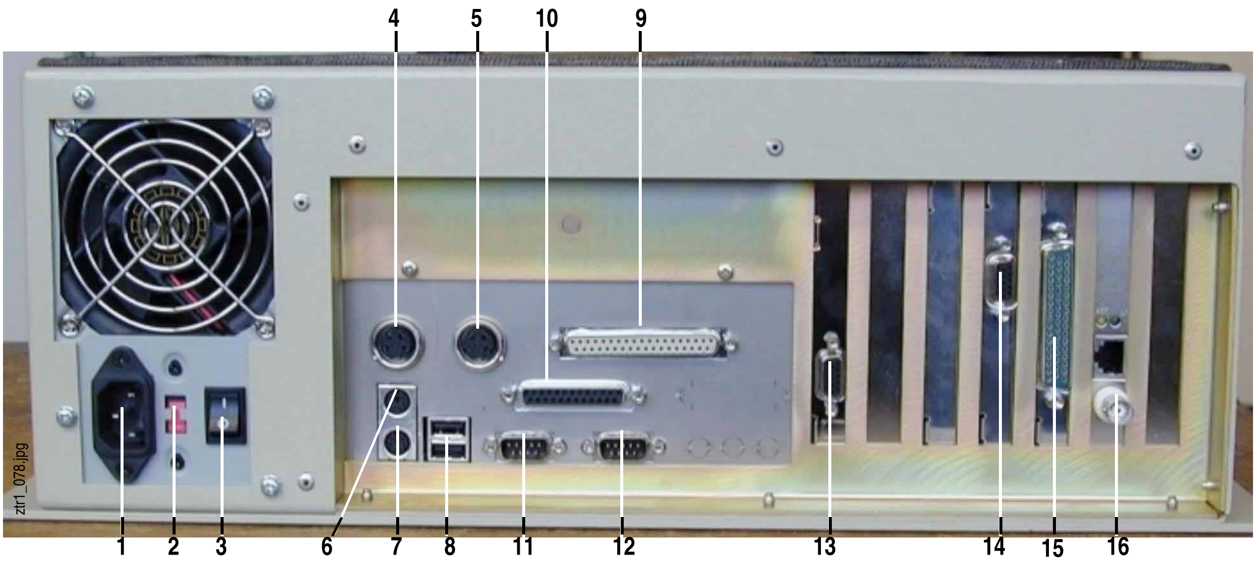
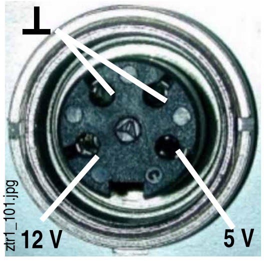


Fig. 4-32 Interface connectors at the rear of the Display Electronics Unit

No. of Contact	Function
1	Mains connector
2	Voltage selector (115/230 V), if not existing, the Power Supply Unit adapts automatically to the mains supply voltage.
3	Mains switch (**Important:** The radar must be switched on / off by means of the monitor mains switch!)
4	Supply connector for diskette drive or Operating Unit (= 5)
5	Supply connector for diskette drive or Operating Unit (= 4)
6	Trackball connector
7	Keyboard connector
8	USB connector, not used
9	Diskette drive data cable
10	Parallel port, not used
11	Serial port, for monitor on-screen display adjustments (depending on monitor type)
12	Serial port, not used
13 [1)]	VGA connector for Monitor
14 [1)]	VGA connector for RSC input
15 [1)]	IMB connector
16 [1)]	Ethernet Module (optional)

[1)] The positions of the connectors depend on the Motherboard type. See Section 4.5.3.2.



The Display Electronics Unit needs no hard disk for the radar functions. The diskette drive is used for SW updates, for service purposes or for the exchange and back-up of user data.

The connectors for the supply of power to the keyboard and the diskette drive are similar. Figure 4-33 shows one of the connectors at the rear of the Display Electronics Unit. The 12 V supply is not needed.

Fig. 4-33 Power supply connector for keyboard / diskette drive

4.5.4 Radar Scan Converter (RSC) GE 3044 G 201

Test Pins

TP11	Function
1	Input signal TVA1 or TVA2
2	Video/azimuth signal without trigger
3	n.c.
4	n.c.
5	Auto FTC video
6	AZIMUTHSTART active low
7	AZIMUTHDATA active low
8	Transmitter trigger
9	Test TVA signal, internal test generator
10	Analog GND

Potentiometers

R201	Function
TVA1	Adjustment of TVA1 video signal amplitude. See Section 4.5.4.1, RSC Adjustments on page 120.

R202	Function
TVA2	Adjustment of TVA2 video signal amplitude. See Section 4.5.4.1, RSC Adjustments on page 120.

R203	Function
Video Offset	Adjustment of the TVA signal offset. See Section 4.5.4.1, RSC Adjustments on page 121.

LED's

	Function
DS1 green	On = video overflow (video offset adjustment)
DS1 red	On = no azimuth data

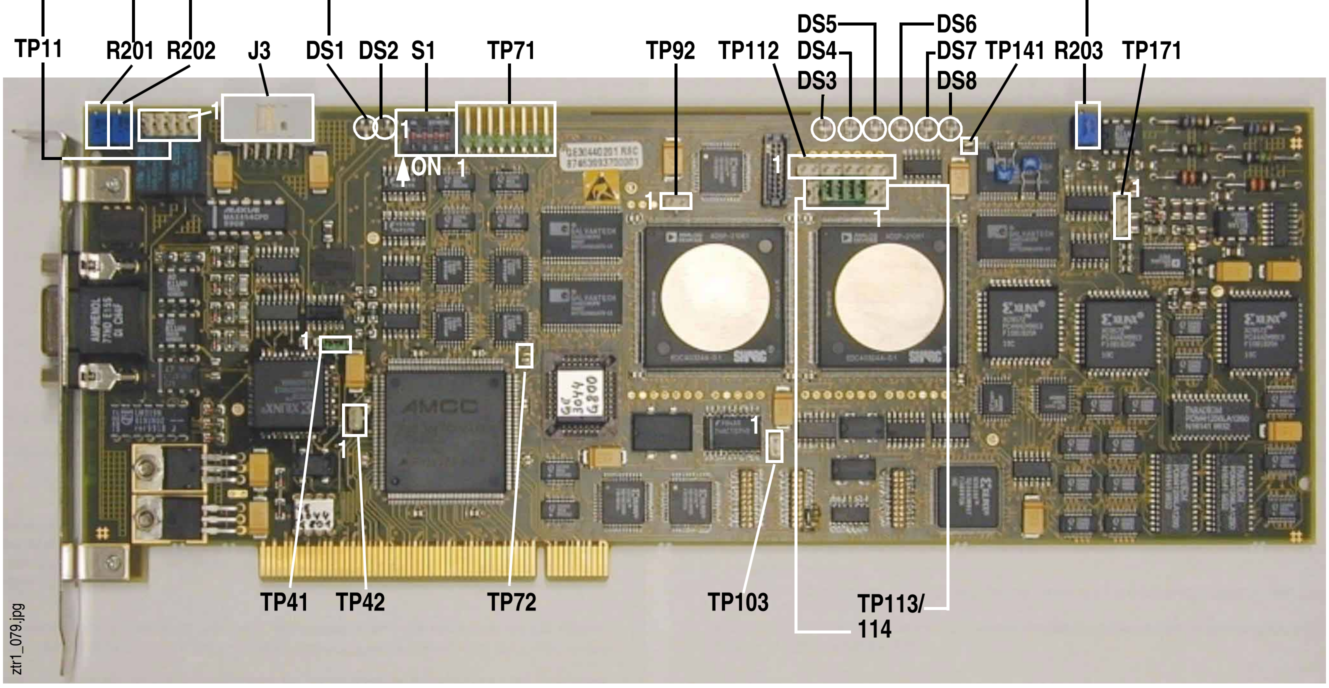


Fig. 4-34 RSC PCB

WARNING
For the use of the different revisions of the RSC, some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.

Connectors / Jumpers / Test Pins

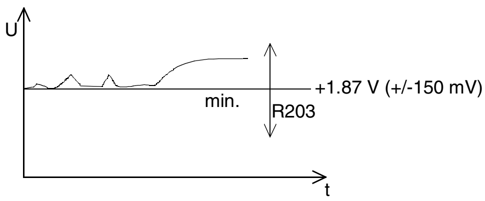
	Function
J3	ARPA video output

TP41	Function
1	Jumper on 1/2 = default No jumper on 1/2 = 8.5 µs azimuth signal
2	

TP42	Function
1	Jumper on 1/2 = default
2	No jumper on 1/2 = PCI controller floating. Manufacturer’s setting

TP72	Function
1	GND

TP141	Function
141	GND

<table>
<tr><th>TP171</th><th colspan="2">Function</th></tr>
<tr><td>1</td><td rowspan="2" colspan="2">

Video offset for A/D converter.
Video from +1.9 V to +3.1 V
Set range to 12 NM and SEA (STC) to 100% for the adjustment with R203. The signal must be completely above ≈1.87 V. It is advisable to adjust the video offset by means of the LED indication as described in Section 4.5.4.1.

WARNING
Do not short circuit the Pins 2 and 3 of TP171. This will destroy the RSC. It is advisable to adjust the video offset by means of the LED indication (DS1). See the description in Section 4.5.4.1 on page 120.</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td>Rev. ≤03: Analog GND</td><td>Rev. ≥04: Not connected</td></tr>
</table>

DIP Switch

S1 [1]	Function	
	On	**Off**
1	Default = on, manufacturer's setting	Not permissible
2	Default = on, manufacturer's setting	Not permissible
3	Default = on, manufacturer's setting	Not permissible
4	Default = on, manufacturer's setting	Not permissible

[1] on=close=0; off=open=1

LED's

	Function
DS1 green	On = video overflow (video offset adjustment)
DS1 red	On = no azimuth data
DS2 green	On = no azimuth start
DS2 red	On = no trigger
DS3 green	On = DSP2_Post_Failure
DS3 red	On = DSP1_Post_Failure
DS4 green	On = Antenna toggle
DS4 red	On = Headmarker toggle
DS5 green	On = DSP2_COMM toggle
DS5 red	On = DSP1_COMM toggle
DS6 green	On = DSP2_Stand by, off = DSP2_RADAR_MODE_ON
DS6 red	On = DSP1_Stand by, off = DSP2_RADAR_MODE_OFF
DS7 green	On = "SWEEP"-FiFo's reset (signal "~IFRES" = active)
DS7 red	On = "PCI"-FiFo's reset (signal "~RES_FIF" = active)
DS8 green	DSP wait (signal "ACK" active)
DS8 red	For manufacturer's use

4.5.4.1 RSC Adjustments

TVA Amplitude

TVA1 can be adjusted by means of R201 and TVA2 by means of R202. Adjust the TVA trigger +2 V (minimum), the maximum amplitude of the video signal to -2 V, the azimuth start to -4 V and azimuth data to -2 V, see Figure 4-35. The TVA signal can be measured at TP11/1. In single installations, only TVA1 is used.

Important:
In dual installations, the second Transceiver must be selected at the Indicator to get the TVA2 signal.

In systems with more than 2 Transceivers, the adjustments must be performed at the Interswitch. Only TVA1 is used. Nevertheless, the signal should be checked.

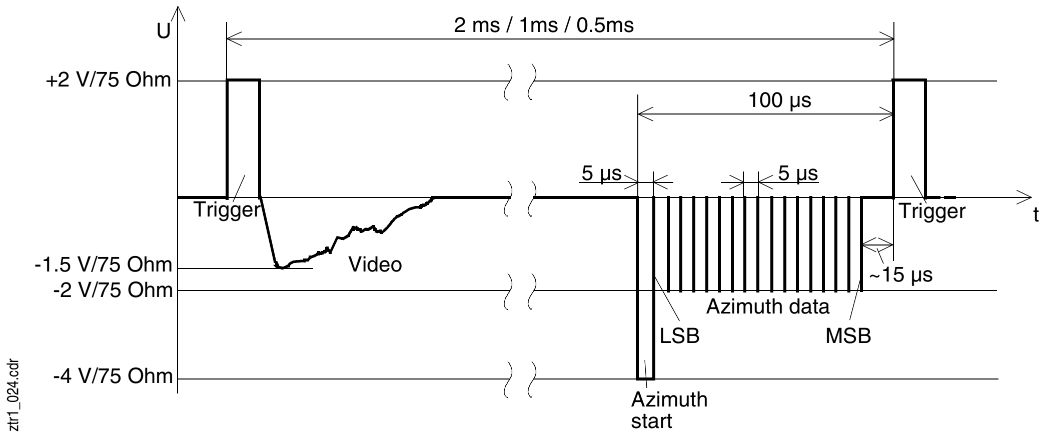
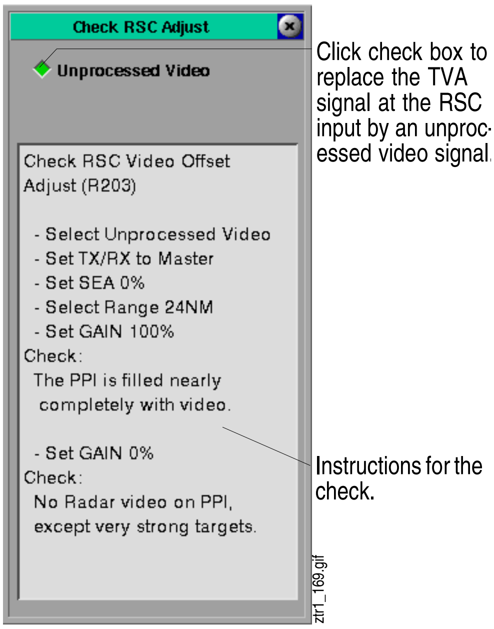


Fig. 4-35 The TVA signal

Video Offset

Select the 24 NM range and set SEA (STC) to maximum for the adjustment. Turn R203 counterclockwise until DS1 green lights up. Turn R203 clockwise until DS1 green flashes. Then slowly turn R203 in the same direction until DS1 green is off.



Open the dialogue box **Check RSC Adjust** (Maintenance > Service > Radar Indicator > Check RSC Adjust; see Section 5.3 on page 153 for information about the System Maintenance Manager).

1. Click on the button to feed the RSC with an unprocessed video signal (already switched on if the Check RSC Adjust window is opened).
2. Set TX /RX to Master
3. Set SEA (STC) to 0%
4. Select the 24 NM range.
5. Set GAIN to 100%.
6. Check the result in the PPI. The PPI must be filled (yellow) almost completely (see Figure 4-37).
7. Set GAIN to 0%.
8. Check the result in the PPI. No radar video is displayed in the PPI except very strong targets (see Figure 4-37).

Fig. 4-36 Check RSC Adjust

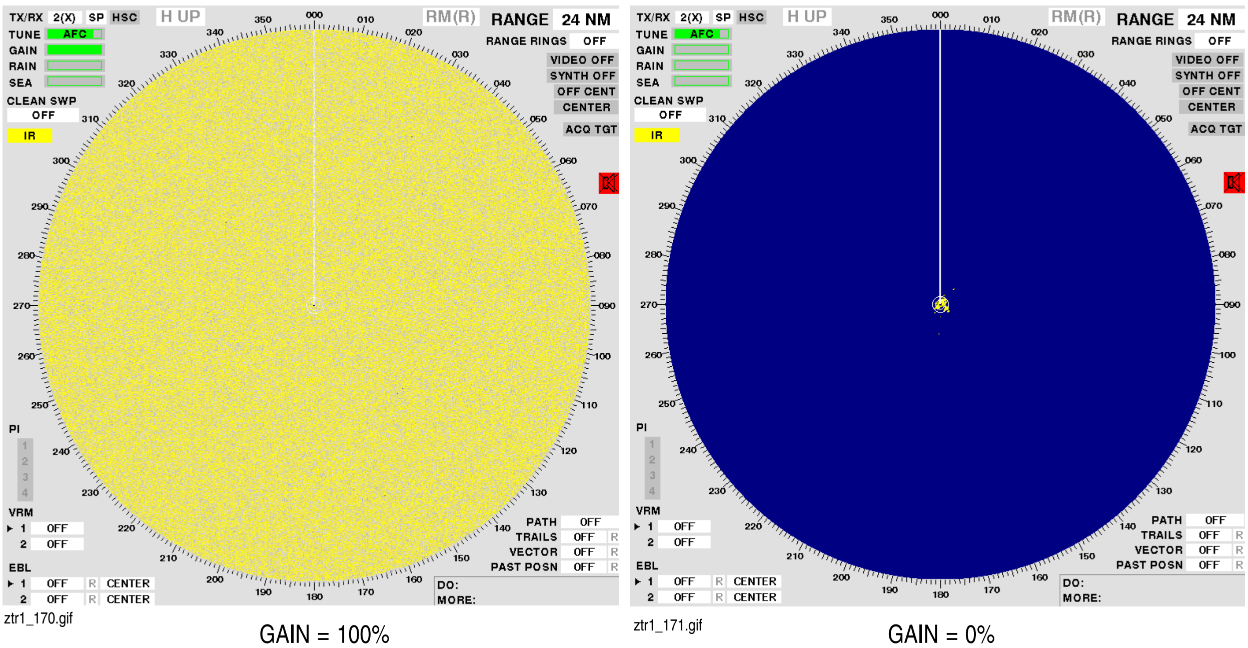


Fig. 4-37 Check RSC Adjust (Gain 100% and GAIN 0%)

4.5.4.2 Hardware Description

The RSC Unit consists of the following components:

- TVA1 and TVA2 Input with video selector (Interswitch)
- Remote video and ARPA video outputs
- Video A/D converting with 10-bit (8-bit NOB) quantization
- Input-FIFO
- Two DSP's for video processing and transformation of coordinates.
- 1 MB sweep memory and 1 MB X/Y-memory in SRAM version
- PCI / DMA interface (master) to the Graphics Processor.
- PCI Interface (slave) to Main Processor.

The RSC Unit transfers the processed radar video via the PCI bus with at least 15 Hz to the Graphics and Video Processor (GVP).
The DSP software includes the functions Range Scale, North Up Stabilization and True Motion Stabilisation.
The video processing includes gain adjustment, Rain (FTC), Auto Rain, Interference Rejection, Direct Video, Video Enhancement (if **Clean Sweep** is switched on) and turn by turn correlation.

4.5.4.3 Software Description

The software of the RSC runs on a dual DSP system and has the following functions:

- Reception of the radar video as sweep data from the video digitizing stage.
- Turn-by-turn correlation
- Auto and manual RAIN function
- Detection of the noise threshold and the noise reduction
- Gain function
- Transformation of data from polar coordinates to X/Y data including:
  - sweep-filling
  - target-enhancing and
  - generating of the offset in TM mode
- Transfer of the X/Y data via PCI bus to the Graphics Video Processor (GVP)

From Rev. 04 on, the software of the RSC is updated automatically during the software update of the radar. See Section 8.5 on page 245 for further information.

4.5.5 ARPA Pcb (ARPA10T) GE 3044 G 202

For the installation of a retrofit kit see Section 5.12.

Test Pins

TP11	Function
1	Jumper on 1/2 = 50 Ω input No jumper on 1/2 = 75 Ω input, default
2	
3	TVA signal test point. Trigger=+2 V, Video=-2 V, AZIMUTHSTART=-4 V, AZIMUTHDAT=-2 V, adjustable with R101, see Section 4.5.5.1 on page 125 and Figure 4-35 on page 120.
4	Test-TVA signal, internal test generator

Potentiometers

R101	Function
TVA	TVA Gain, see Section 4.5.5.1 on page 125.

R102	Function
Video Offset	Adjust according to the description in Section 4.5.5.1 on page 125.

LED's

	Function
DS4 green	Flashing = DSP Interrupt
DS4 red	Video Offset Adjustment, see Section 4.5.5.1.

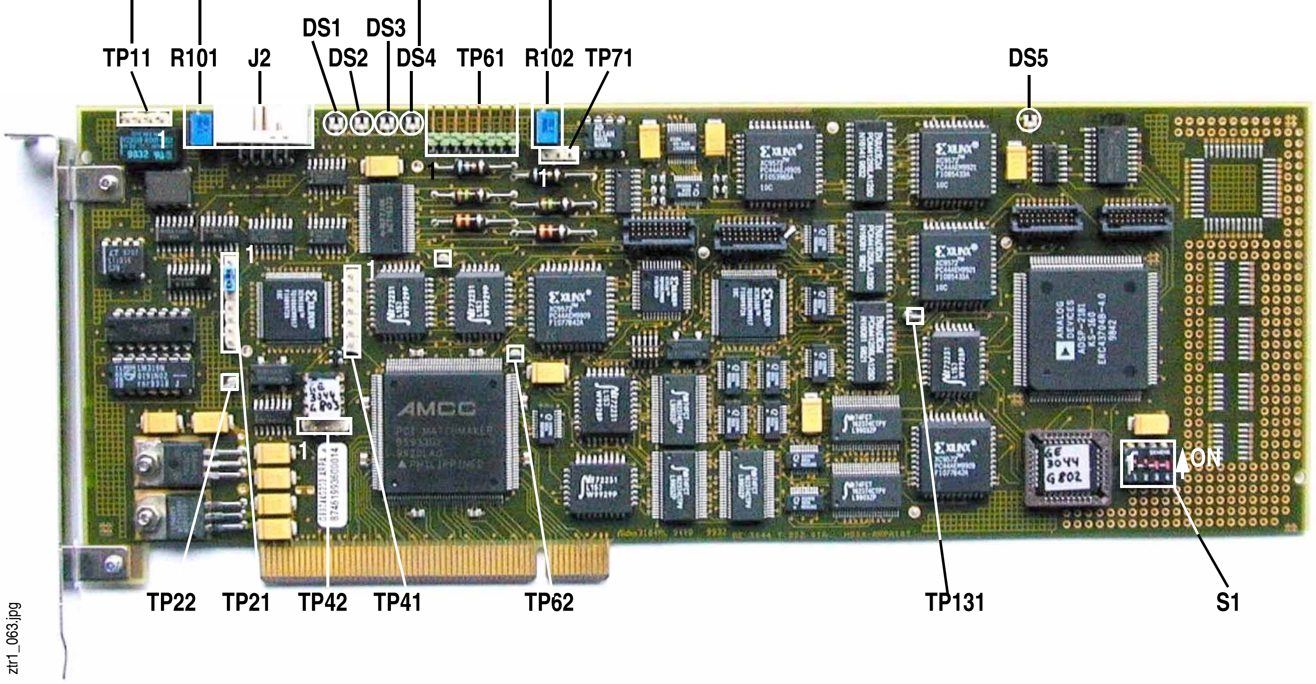


Fig. 4-38 ARPA PCB

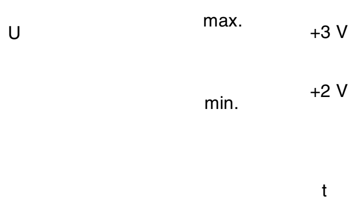
Connectors / Jumpers / Test Pins

J2	Function
	Input for TVA signal from RSC

TP21	Function
1	
2	Jumper on 2/3 = default No jumper on 2/3 = 8.5 µs azimuth signal
3	

TP22	Function
1	Analog GND

TP62	Function
1	GND

TP71	Function
1	 **Video signal** test point. Adjust amplitude between +2 V (lower peaks of the noise) and +3 V with R102 (video offset, A/D converter). See Section 4.5.5.1 on page 125 for an easier way to adjust the video offset.
2	**DC offset** test point, about 0.7 V
3	Analog GND

TP131	Function
1	GND

DIP Switch

S1 [1)]	Function	
	On	**Off**
1	Default	Not permissible, set to On
2	Default	Not permissible, set to On
3	Not permissible, set to Off	Default
4	Not permissible, set to Off	Default

1) on=close=0; off=open=1

LED’s

	Function
DS1 green	On = no azimuth start
DS1 red	Off = no trigger
DS2 green	Flashing = north up
DS2 red	TVA signal level indication, see Section 4.5.5.1.
DS3 green	Flashing = video DMA (state changes for every 64 sweeps received)
DS3 red	On = video DMA error
DS4 green	Flashing = DSP Interrupt
DS4 red	Video Offset Adjustment, see Section 4.5.5.1.
DS5 green	No function
DS5 red	Flashing = DSP O.K.

4.5.5.1 ARPA Adjustments

Preparations

1. Turn the potentiometer R101 clockwise as far as it will go.
2. Open the dialogue box **ARPA Adjust** (Maintenance > Service > Radar Indicator > ARPA Adjust, see Section 5.3 on page 153 for information about the System Maintenance Manager).

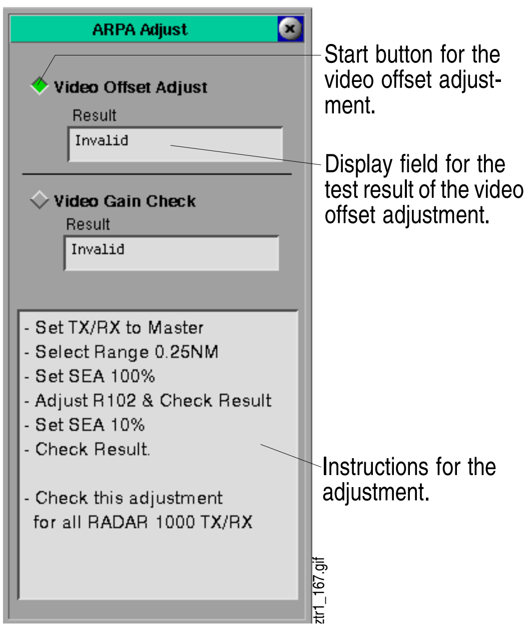


Fig. 4-39 ARPA adjust, video offset

Video Offset Adjustment

1. Start the video offset adjust by clicking the start button.
2. Set TX/RX to Master.
3. Set SEA (STC) to 100%.
4. Select the 0.25 NM range.
5. Turn R102 clockwise until the display field shows the message: "Error: Offset too low" or DS4 red lights up.
6. Turn R102 slowly counterclockwise until the display field shows "OK" or DS4 red is off again. Leave R102 in this position.
7. Set SEA (STC) to 10% and check the result in the display field. The result must be "OK" and DS4 red must be off.

(For an alternative adjustment of the video offset by mean s of an oscilloscope see the description of TP71.)

The display field can show the following messages:
- Error: Offset too high
- Error: Offset too low (DS4 red on)
- OK (DS4 red off)
- Invalid (switch TX/RX on and set it to Master)

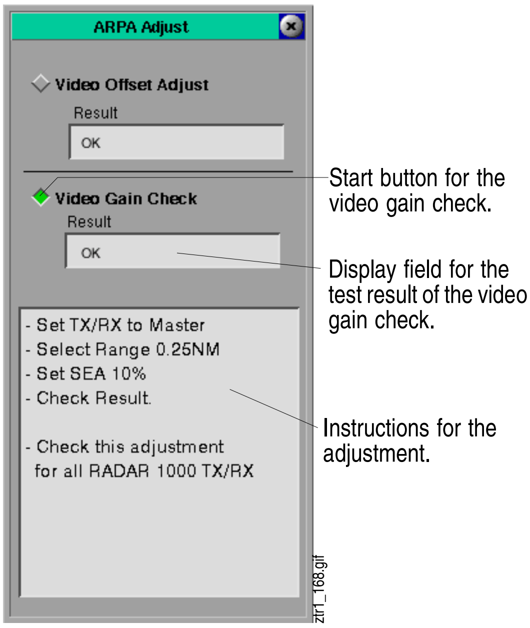


Fig. 4-40 ARPA adjust, video gain

TVA Gain Adjustment

1. Start the video gain check by clicking the start button.
2. Set TX/RX to Master.
3. Select the 0.25 NM range.
4. Set SEA (STC) to 10%.
5. The display field must contain the message "OK". If the LED DS2 red is on, or if the message is "Check TVA Video", measure the TVA signal at TP11/3. If the amplitudes are too high (see the values in the description of TP11/3 and the signal description in Section 4.5.4.1 on page 120) they must be adjusted by means of R101.
   If the message "Check TVA Video" stays in the display field, it is permissible to reduce the amplitude of the azimuth start signal to -3.8 V.

The display field can show the following messages:
- OK
- Check TVA Video
- Invalid (switch TX/RX on and set it to Master)

4.5.5.2 Functional Description of the ARPA PCB

In spite of its name, the ARPA pcb is not responsible for the complete ARPA functionality. The ARPA processing (acquisition, tracking, zone control, display of tracked targets) is done by the main processor on the Motherboard (PMB).

The ARPA pcb prepares the combined video signal of the RSC unit and transfers it via the PCI bus to the main processor in the following way:

The azimuth signal is split from the sweep in the first stage. The gyro is added to generate a north-stabilized heading. All subsequent processes have to use this azimuth.

The video is sent through a low-pass filter (switchable for pulse length 80/300/1000 ns) into the A/D converter. For the range resolution of 6 m the sampling frequency is 25 MHz (40 ns).

Up to three sweeps can be stored in the memories RAM1...3. The output of the memory is connected to an interference and signal processing stage. Basically this stage compares the sweeps, and filters signals which occur only in one sweep (interference rejection). Via an interface buffer and the PCI controller, the data are transferred with the azimuth and a time to the main memory of the main processor. The buffer can store at least 90° of a turn even with the maximum PRF, which means that it must be able to store about 500 sweeps (the actual capability is 1024 sweeps).

The DSP 2181 has to calculate the detection threshold for all 50 tracked targets and search for signals whose amplitude is higher than the threshold in the automatic target acquisition area. The DSP has to bundle up these signals as a possible new target and send them to the main processor. The DSP does not work with a resolution of 6 m. To reduce the amount of data, the resolution is decreased to 24 m. This resolution is sufficient for the DSP’s accuracy. The DSP data are transferred to the main processor independently of the sweep data.

4.5.6 Graphics and Video Processor (GVP) GE 3044 G 203

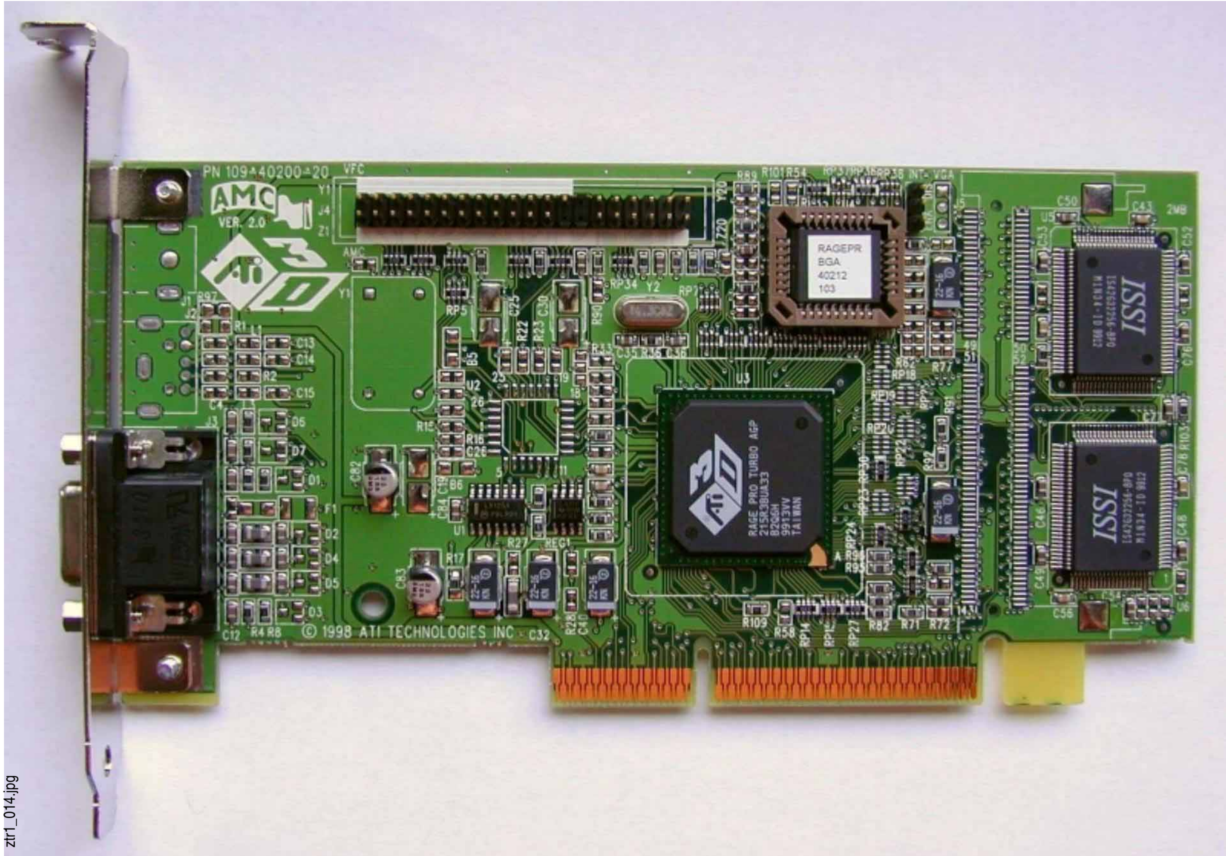


Fig. 4-41 GVP pcb

The Graphics and Video Processor is a standard video adapter card with the following specifications:

- AGP bus interface
- 8 MB video RAM
- Video output with VGA connector, synchronisation coupled to green signal or separate signals
- QNX-qualified

The main processor’s software controls the overlay of the MMI graphics, the line graphics of the PPI area, the ARPA/plot graphics and the radar video (generated by the RSC Unit), by the use of "intelligent" copy commands to the Graphics Processor of the GVP Unit.

The function **Centered Display** and the calculation of the afterglow lines of the trails and targets are performed by software from the main processor and the GVP.

4.5.7 Interface and Memory Board (IMB) GE 3044 G 205

DIP Switch S1/1...4, Indicator Number On=closeed=0; off=open=1	**Switch No.**			
	4	**3**	**2**	**1**
Sets Radar Indicator No. to 1	On	On	On	On
Sets Radar Indicator No. to 2	On	On	On	Off
Sets Radar Indicator No. to 3	On	On	Off	On
Sets Radar Indicator No. to 4	On	On	Off	Off
Sets Radar Indicator No. to 5	On	Off	On	On
ID6: not admissible	On	Off	On	Off
ID7: not admissible	On	Off	Off	On
ID8: not admissible	On	Off	Off	Off
ID9: not admissible	Off	On	On	On
ID10: not admissible	Off	On	On	Off
ID11: not admissible	Off	On	Off	On
ID12: not admissible	Off	On	Off	Off
ID13: not admissible	Off	Off	On	On
ID14: not admissible	Off	Off	On	Off
ID15: not admissible	Off	Off	Off	On
ID16: not admissible	Off	Off	Off	Off

DIP Switch S1/5...8	**Function**	
	ON	**OFF**
Software Version ≥2.0		
5	Boot from IMB flash memory (default)	Boot from diskette drive (the software update routine is started while booting). See also Section 5.1.
6	Monitor resolution 1024x768	Monitor resolution 1280x1024
7	Monitor frequency 72 Hz	Monitor frequency 60 Hz
8	Normal operation (default)	Service Mode On [1]
Settings for Software Version 1.3: see page 130		

1) See section Service Switch on page 131.

Settings for the different Monitor Types (valid for Software Version ≥2.0)		
Monitor	**S1/6** (ON = resolution 1024x768, Off = resolution 1280x1024)	**S1/7** (ON = frequency 72 Hz, OFF = frequency 60 Hz)
AZ 3040, 29"	Off	Off
AZ 3054, 29"	On	Off
AZ 3053, 21" [1] AZ 3063 TFT AZ 3056 TFT	Off	On
AZ 3058, 21" [1]	Off	On

1) Recommended settings. These Monitors are "multisync" types and can be operated with all other settings, too.

TP161	**Function**
1	Jumper on 1/2 = termination resistor connected to CAN0 (Radar Bus)
2	No jumper on 1/2 = no termination resistor connected to CAN0

TP162	**Function**
1	Jumper on 1/2 = termination resistor connected to CAN1 (Navigation Bus)
2	No jumper on 1/2 = no termination resistor connected to CAN1

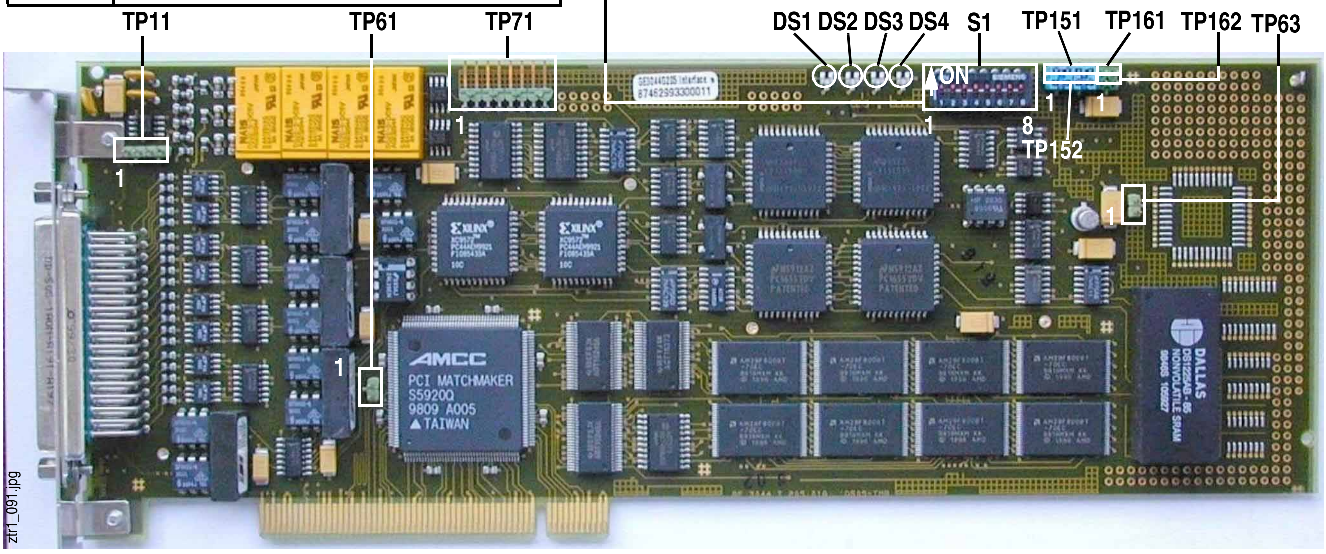


Fig. 4-42 IMB PCB

WARNING
For the use of the different revisions of the IMB, some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.

Connectors/Jumpers/Test Pins

TP11	Function
1	Connection of the Motherboard's speaker output (cable is included in the delivery)
2-4	n.c.

TP151	Function
1	Jumper on 2/3 = alarm input 1 suitable for 20 mA current loop (optocoupler driver input) Jumper on 1/2 and 3/4 = zero potential input (switch)
2	
3	
4	

TP152	Function
1	Jumper on 2/3 = alarm input 2 suitable for 20 mA current loop (optocoupler driver input) Jumper on 1/2 and 3/4 = zero potential input (switch)
2	
3	
4	

LED's

g = green, r = red

Status	From left to right							
	DS1r	DS1g	DS2r	DS2g	DS3r	DS3g	DS4r	DS4g
UART 0 ON = interrupt in process, OFF = interrupt finished	X							
UART 1 ON = interrupt in process, OFF = interrupt finished		X						
UART 2 ON = interrupt in process, OFF = interrupt finished			X					
UART 3 ON = interrupt in process, OFF = interrupt finished				X				
CAN0 ON = interrupt in process, OFF = interrupt finished					X			
CAN1 ON = interrupt in process, OFF = interrupt finished						X		
Not used							X	
Toggle on every interrupt entry								X

DIP Switch Settings for Software Version 1.3

DIP Switch S1/5...8	Function	
	ON	**OFF**
Settings for Software Version 1.3. Invalid for Software Version 2.0!		
5	Boot from IMB flash memory (default)	Boot from diskette drive (the software update routine is started while booting)
6	Boot from IMB flash memory (default)	Boot from diskette drive (the software update routine is started while booting)
7	No diskette drive installed	Diskette drive is installed
8	Normal operation (default)	Service Mode On [1)]

1) For a description in detail see section Service Switch on page 131.

Functional Description of the IMB PCB:

The IMB contains inputs for the connected sensors and outputs for alarms. The following interfaces are available:

- 4 serial interfaces RS422 for the standard sensors
- 2 CAN Bus interfaces (Radar Bus and Nav Bus)
- 4 alarm outputs (incl. 1 dead man alarm) and 2 alarm inputs

It is advisable to use the serial interfaces as shown in Section 3.2.4, page 68 and in the cabling documents.

Hardware components:

- PCI slave interface
- Flash PROM with 8 MB for the file system and the data storage
- Serial EEPROM for configuration data
- 2 CAN controllers for the Radar/Nav Bus
- 4 UART's for the 4 RS422 interfaces
- DIP/LED interface for settings and display
- Line driver for RS422 interface and CAN Bus

Alarm Contacts

The alarm outputs are:
1. Radar alarm
2. Dead man alarm trigger
3. ARPA alarm
4. Chart alarm

The alarm inputs are:
1. Audio Alarm Acknowledge
2. Not used

The outputs are relays contacts. The maximum load is 24 V/0.3 A.

The inputs can be switched by means of TP151 and TP152 to zero potential inputs (switch, relays) or suitable for 20 mA current loop (optocoupler driver input).

PCI Bus interface

The PCI bus interface handles the address organisation and the interrupt handling of the IMB. All interrupts that are generated in the IMB are bundled up to form one interrupt which is sent to the system via the PCI Bus. To mark the interrupt's source, a corresponding item of data is stored in an internal register.

Configuration Memory

The configuration memory consists of a serial EEPROM. It stores the address system with which single components can be called.

After a reset of the complete system, the configuration data are transferred to the PCI controller and can be read by the control software.

Data Memory

The configuration memory consists of a flash EEPROM. The memory is non-volatile. It is used to store data or to build up a file system.

Serial Interface

The serial interfaces consist of two UART's. Usually they are used for the connection of log, gyro, position sensor and other interfaces.

The electrical isolation is provided by optocouplers. The voltage transformer is used to supply the hardware on the decoupled side. The interfaces are RS422-conformal.

CAN Bus

The Radar Bus and Navigation Bus are provided by two CAN Bus controllers. The data transfer follows the CAN 2.0 specification.

Service Switch

The service switch (S1/8) offers the following functions:
- Acquire targets without gyro data (to test ARPA functions).
- Acquire targets without Radar Bus data.
- Display the radar video even although the Radar Bus is not working correctly.

The maintenance menus can be entered and used without the use of the service switch. The switch offers the additional functionalities described above, especially for the setting-to-work phase.

4.5.8 Analog Interface GE 3044 G 207

For the installation of a retrofit kit see Section 5.12.

TB	Function
10	AIS RxD N
11	AIS RxD P
12	do not connect!
13	do not connect!
14	AIS TxD N
15	AIS TxD P
16	AIS GND
(≥Rev 03 only)	

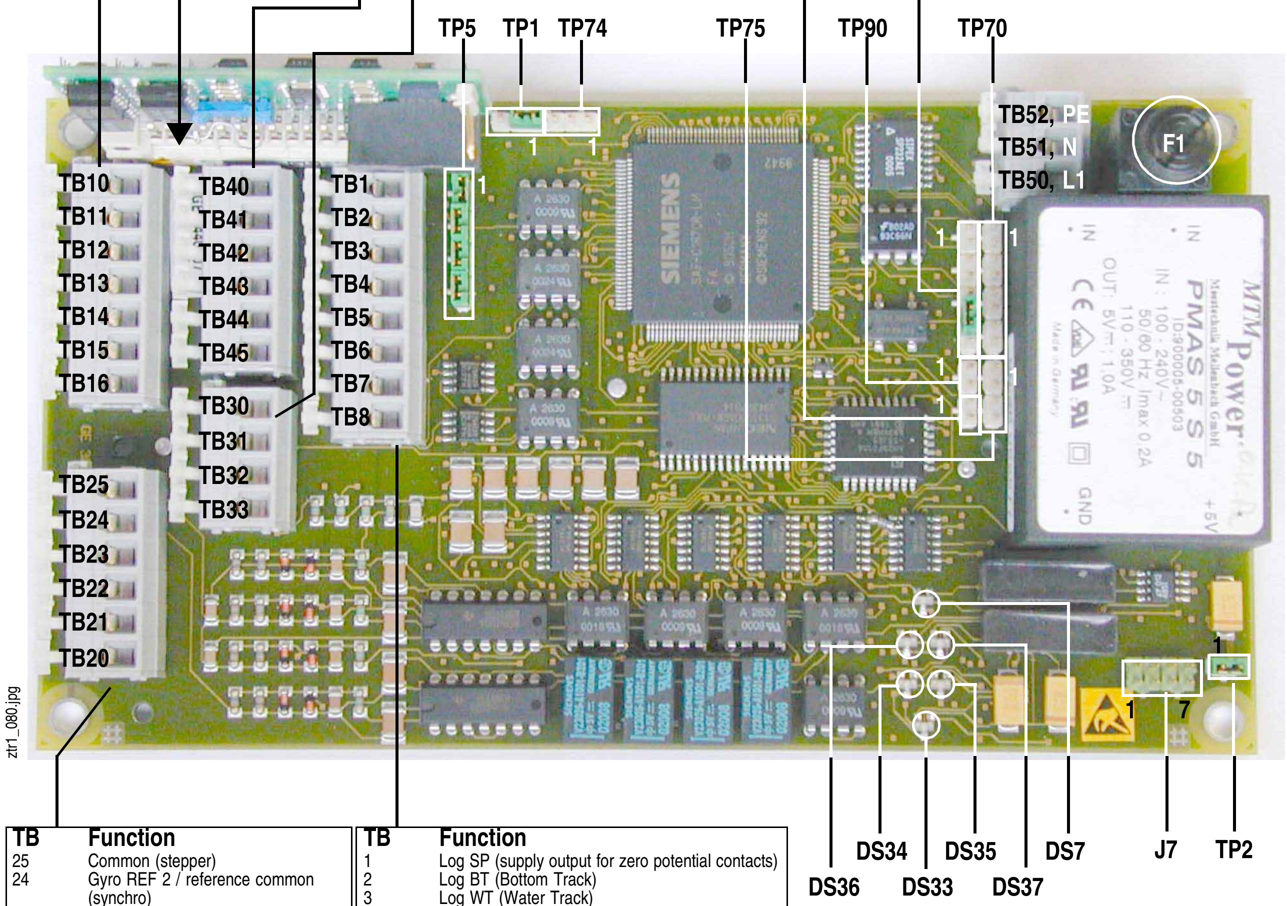
J1	RS422 Interface
Connector for SH 3014 G 203, RS422 interface (≥Rev 03 only)	

TB	Function
40	Alarm out 1, make
41	Alarm out 1, center
42	Alarm out 1, break
43	Alarm out 2, make
44	Alarm out 2, center
45	Alarm out 2, break

TB	Function
30	ST1 status input for gyro
31	ST1 status input for gyro
32	ST2 status input for log
33	ST2 status input for log

TP78	Termination
Jumper on 1/2 = termination of CAN1 (Navigation Bus). No Jumper on 1/2 = CAN1 is not terminated at this pcb.	

TP99	Addresses
Set jumper on 7/8 to address Analog Interface No. 1 Set jumper on 6/7 to address Analog Interface No. 2 (for systems with two Analog Interfaces)	



TB	Function
25	Common (stepper)
24	Gyro REF 2 / reference common (synchro)
23	Gyro REF 1 (synchro)
22	Gyro T
21	Gyro S
20	Gyro R

TB	Function
1	Log SP (supply output for zero potential contacts)
2	Log BT (Bottom Track)
3	Log WT (Water Track)
4	Log XPM (+/- longitudinal speed)
5	Log YPM (+/- transversal speed (drift))
6	Log VX (speed)
7	Log VY (speed transversal (drift))
8	Log GND

Fig. 4-43 Analog Interface, ≥Rev. 03

Connectors / Jumpers / Test Pins

TP1	Function
1	1 = VCC, 2 = LM, 3 = SPA_LOG Set jumper on 1/2 to supply log outputs (zero potential) with voltage. Set jumper on 2/3 to supply log outputs with external voltage.
2	
3	

TP2	Function
1	VCC, jumper must be set (default ex works)
2	

TP5	Function
1	Jumper on 2/3 = ST1 (status input 1) signal as optocoupler driver, 20 mA Jumper on 1/2 and 3/4 = ST1 signal as zero potential contact
2	
3	
4	
5	Jumper on 6/7 = ST2 (status input 2) signal as optocoupler driver, 20 mA Jumper on 5/6 and 7/8 = ST2 signal as zero potential contact
6	
7	
8	

TP70	Function
1	n.c.
2	n.c.
3	n.c.
4	GND for serial interface, for manufacturer’s use
5	TXD, manufacturer’s use
6	RXD, manufacturer’s use
7	Activate bootstrap loader, active low, for manufacturer’s use
8	GND for bootstrap loader, manufacturer’s use

TP90	Function
1	RESET IN
2	GND

J7	Function
1	CAN1 A to J5, Interconnection Board
2	CAN1 A to J5, Interconnection Board
3	CAN1 B to J5, Interconnection Board
4	CAN1 B to J5, Interconnection Board
5	5/6 connected
6	
7	7/8 connected
8	

LED's

	Function
DS7 green	C167 controller initialization finished
DS7 red	Flashing at 0.25 Hz = normal operation (only second Analog Interface) Flashing at 1 Hz = normal operation (active Analog Interface, if two Analog Interfaces installed) Flashing at 5 Hz = at least one error is active (highest priority)
DS33 green	Gyro signal: DS34 = R, DS35 = S, DS33 = T, the LED's show the direction and the polarity of the incoming signal. Green = positive wave, red = negative wave. 1-2 LED's must be on. If no LED's or all of them are on, the incoming signal is not correct. See Section 5.8.7 for the configuration of the **Analog Gyro System** and Figure 4-44 on page 135 for the connection of a gyro and a log.
DS33 red	
DS34 green	
DS34 red	
DS35 green	
DS35 red	
DS36 green	Reference voltage for DC stepper with half wave. Green = positive wave, red = negative wave
DS36 red	
DS37 green	Reference voltage for AC gyro. Green = positive wave, red = negative wave
DS37 red	

Fuse

Fuse	
F1	For the fuses see page 251.

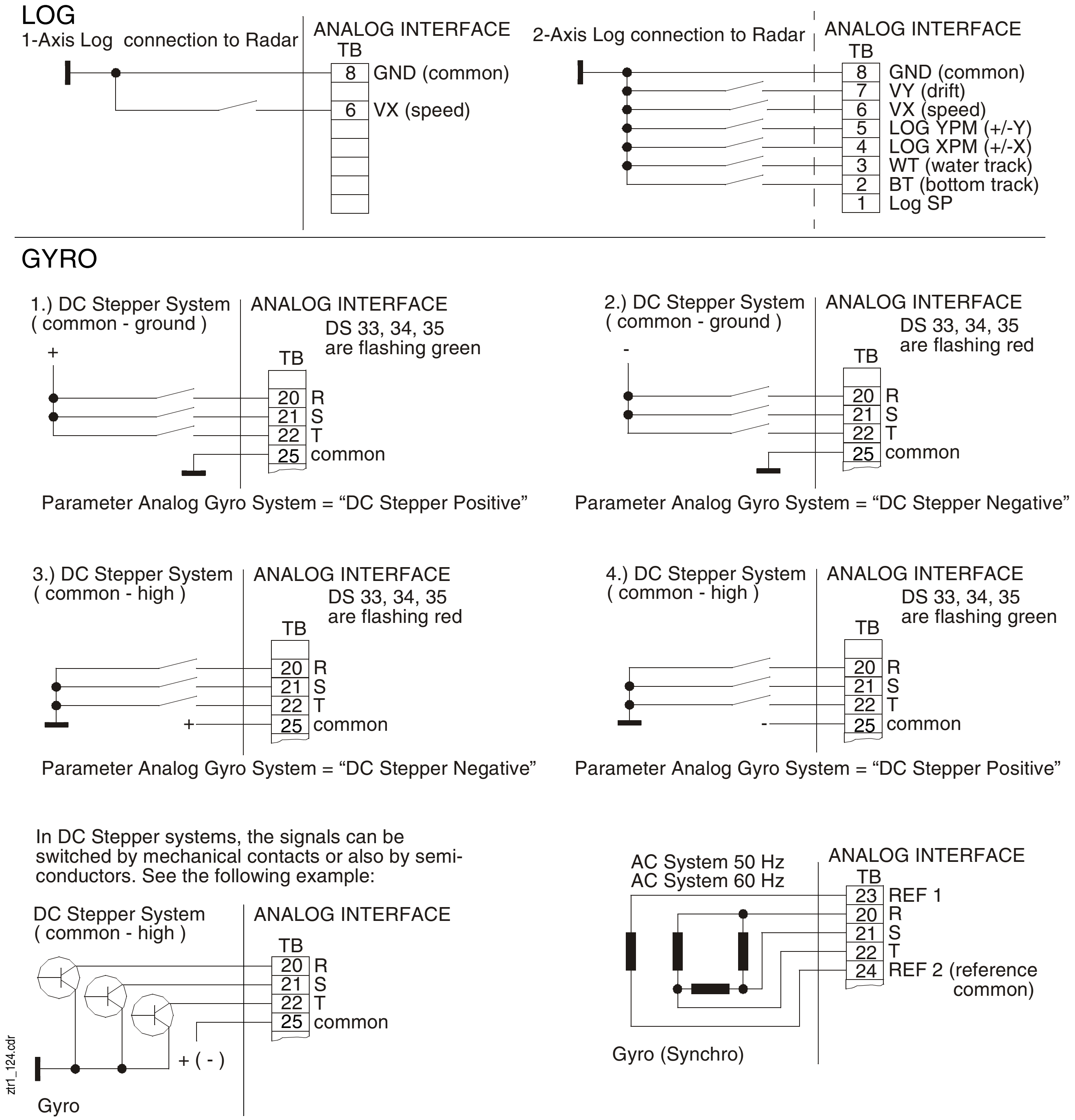


Fig. 4-44 Connection of log and gyro

The interfaces have to be configured by means of the System Maintenance Manager. See Section 5.8.7 on page 180 for further information.

Functional Description

The IMB of the radar is equipped with 4 serial interfaces for the connection of the ship's navigation sensors. If no sensors with serial outputs are available, the Analog Interface must be used. Two Analog Interfaces can be connected for redundancy purposes. For the correct installation, see the description of the jumper settings.

The AIS Interface (TB10...16, J1) is available from Rev. 03 on.

The interfaces for an analog gyro (AC gyro or DC stepper) and a pulse log are described in Section 9.3, External Interfaces on page 284.

If two Analog Interfaces are used in one system, they must be addressed by means of TP99.

4.5.8.1 Analog Gyro

By the detection of the inputs R,S and T, every change in the gyro state can be recognized. The detected bit combination is coded in Gray code. The direction of the turn can be calculated by means of a comparison with the value measured before. The measured difference of bearing is added or subtracted to/from a defined start value. The typical resolution (changeable by parameterization) is 1/6°.

The actual gyro value is written to the CAN Bus (Nav Bus) as a 16 bit item of datum. If the values does not change, it is transmitted to the CAN Bus every 300 ms. New values are transmitted at least every 20 ms.

Gyro-sensors, whose R,S,T detection is synchronized by a reference signal have a reference timeout control.

The gyro interface is equipped with a status input ST1, which can be used as an external error input. If no signal is measured at the status input, no error is recognized.

4.5.8.2 Pulse Log

The ship's speed can be processed from the pulse log signal. The Analog Interface measures the time between two rising edges of the signal. By means of the formula v = s/t (t = measured time, s = distance per pulse (parameter)) the speed can be calculated.

Inversion of the following signals is possible: BT, WT, XPM, YPM, VX, VY

The pulse log interface has the following additional status inputs:

Input	Function
XPM	X-axis, speed direction. For zero potential contact. Polarity and internal (20 mA)/external voltage can be configured in the maintenance menus.
YPM	Y-axis, speed direction. For zero potential contact. Polarity and internal (20 mA)/external voltage can be configured in the maintenance menus.
BT	Bottom track. For zero potential contact. Polarity and internal (20 mA)/external voltage can be configured in the maintenance menus.
WT	Water track. For zero potential contact. Polarity and internal (20 mA)/external voltage can be configured in the maintenance menus.
ST2	External input for log error. Can be configured for zero potential contact or 20 mA optocoupler input by jumper settings.

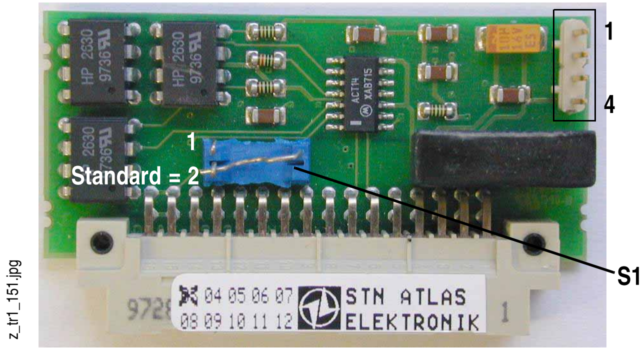
4.5.8.3 AIS Connection, RS422 INT Assembly SH 3014 G 203 - RS422 Interface

This assembly is used for signal matching (hardware) to input-signals complying with the RS422 standard. An integrated circuit is used which converts the input signal to TTL level. It can be inserted in Analog Interfaces ≥Rev. 03.

This assembly processes input signals in accordance with the RS422 standard.

S1	Output Signal
Position 1	With Handshake
Position 2	Without Handshake

In the normal case, set position 2 - without handshake. The inputs are terminated by R1, R2 with 270 Ω.



Pin 1, 2:
not connected

Pin 3, 4:
Default is no jumper on 3/4. Set a jumper on 3/4, to connect the ground of the signal source and the ground of the radar. See Figure 4-46.

Fig. 4-45 SH 3014 T 203

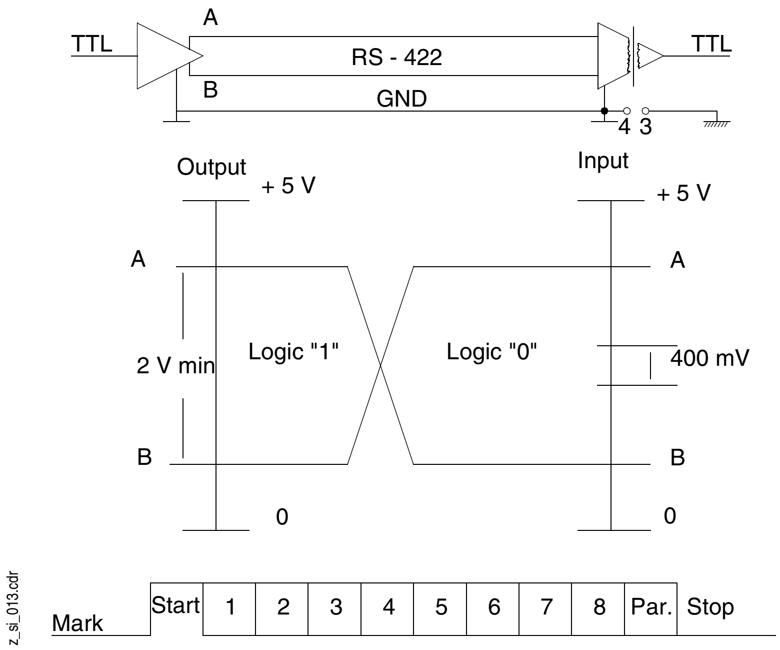


Fig. 4-46 RS422 signals

4.5.9 Power Supply

Fig. 4-47 Power Supply

The power supply for the Display Electronics Unit is a standard PC power supply corresponding to the ATX specification. It supplies the following voltages:

- +3.3 V
- +5 V
- +12 V
- -12 V
- -5 V
- +5 V stand-by

There are two different versions of the Power Supply Unit.

WARNING
For the use of the different Power Supply Units, some prerequisites must be fulfilled. See Section 7, Revision Overview for further information.

4.5.10 Ethernet Module GE 3044 G 011 (optional)

For the installation of a retrofit kit see Section 5.12.

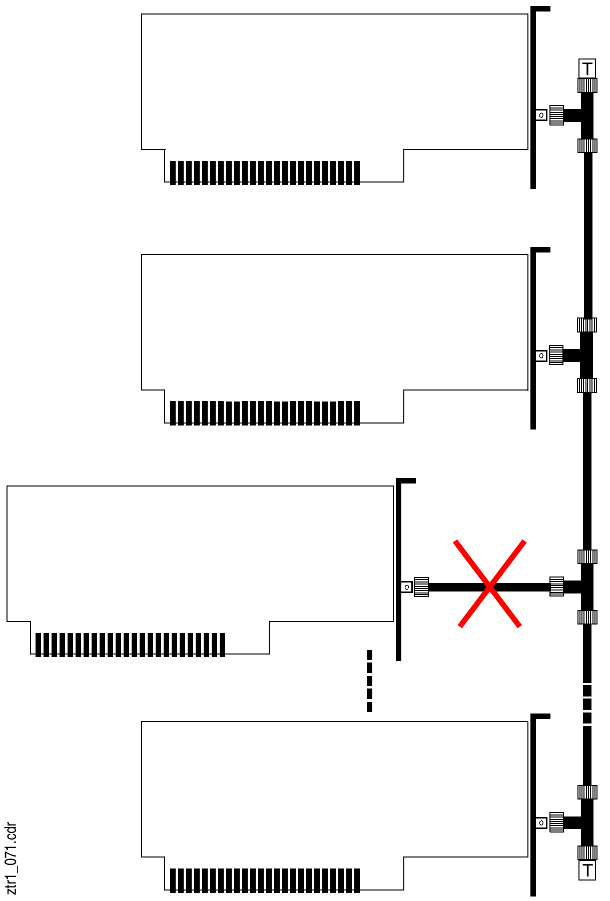


Fig. 4-48 Principle of wiring for LAN Network

The Ethernet Network Adapter is needed for the integration of the radar into a NACOS system. It is not needed for a single, dual or multiple radar installation.

The network adapter is plugged into the motherboard slot. The wiring must be done following Figure 4-48 with 50 Ω coaxial cable (for example inside the enclosures, RG 58, for ship's cabling RG 213 / U, see cabling diagrams). The network is a 10 Mbit network with Thin Ethernet wiring.

The BNC-T plugs must be connected directly into the Ethernet Module. It is not admissible to connect the T-plug and the network adapter by means of a coaxial cable.

The proper termination with a 50 Ω BNC-termination plug at both ends of the Ethernet line is very important.

It is not permissible to use cable with a characteristic impedance different from 50 Ω.

No settings or adjustments have to be made on the Ethernet Module.

NOTE:
If the Ethernet Network Adapter is not used, it must be removed from the Electronics Unit. It must be replaced by a slot cover with the order No. 5582688.

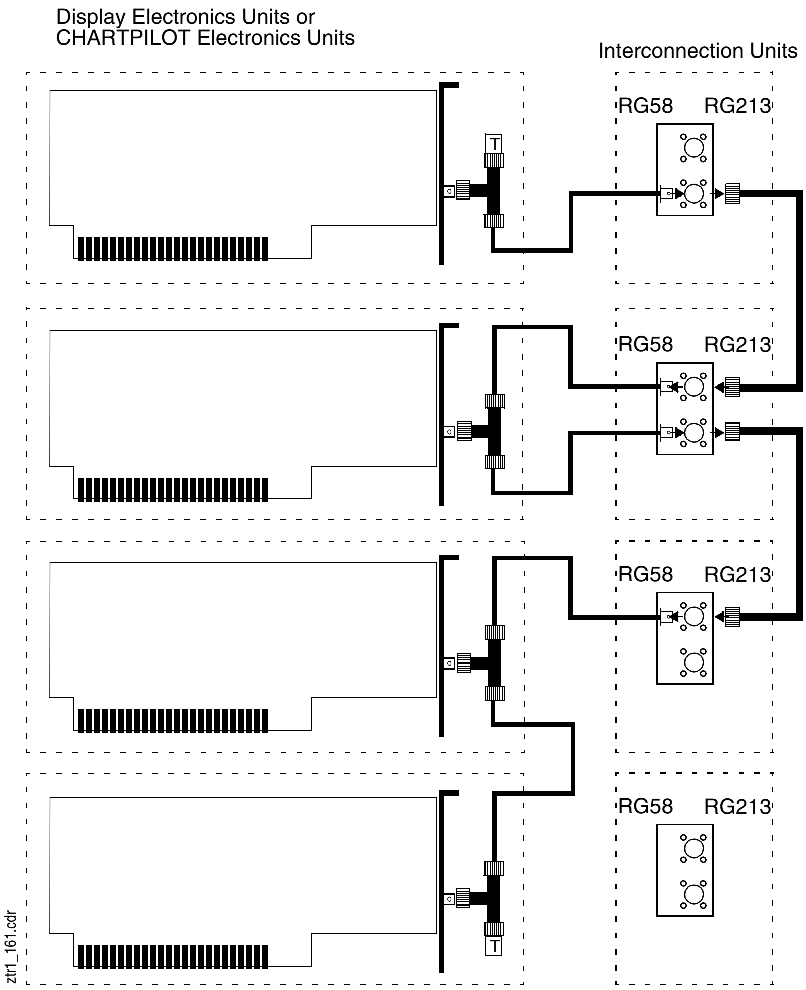
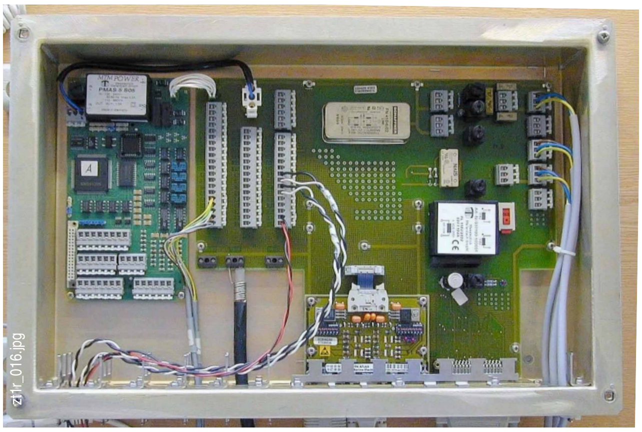


Fig. 4-49 LAN Ethernet wiring of a quadruple system

Figure 4-49 shows the various possibilities of wiring for the LAN Ethernet. **It is not admissible to connect RG213/U coaxial cable directly to the Ethernet Module.** The cabling has to be converted into RG58C/U by means of the adapter bracket in the Interconnection Unit and the RG58C/U coaxial cable which must be used between the adapter bracket and the T-plug on the LAN Network Adapter pcb. Direct wiring with RG58C/U cable is possible if the cables are routed inside the console housings.

4.5.11 Interconnection Box VS 3034 O 000 (GE 3044 O 000 with Display Electronics Unit)



The Interconnection Box provides the terminals for the connection of the ship's cables and for the internal wiring to components of the Display Electronics Unit.

The Interconnection Box is a passive unit and also contains components for power supply and the system's power switch. The pcb is named GE 3044 G 206.

If the Interconnection Box is mounted on the Display Electronics Unit this complete unit is named GE 3044 O 000.

Fig. 4-50 Interconnection Box with RGB Buffer and Analog Interface

The main signals which have to be connected via the Interconnection Box are:

- TVA video
- Remote video
- 4 serial interfaces
- 2 CAN Buses
- Alarm signals (input and acknowledge)
- Reserve
- Mains supply
- Power on/off switch signals

The optional RGB Buffer and Analog Interface must be mounted in the Interconnection Box. Suitable bolts are provided.

Connectors and Terminals of the Interconnection PCB

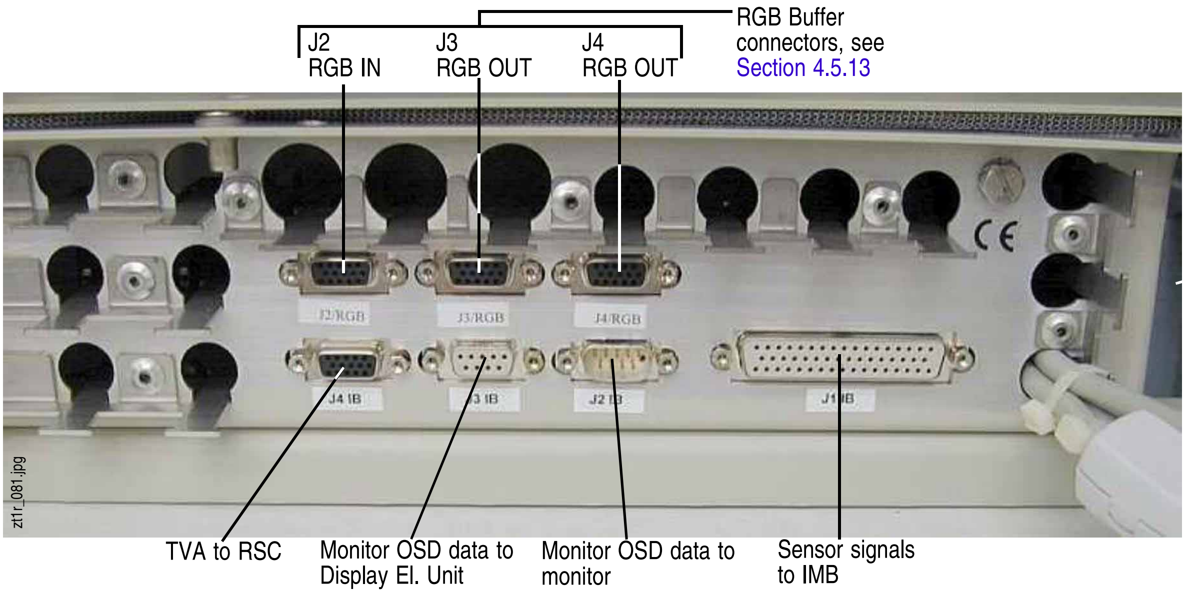


Fig. 4-51 Connectors at the rear of the Interconnection Box

Pins or terminals that are not mentioned are not connected. J3 is connected to a standard COM port of the Motherboard. For J6 see Section 4.5.13. K1 switches the power supply for the Display Electronics Unit and an optional slave monitor. It is switched by the signal 24V ON/OFF. For the fuses see page 251

TB2	Function
Not used:	
16	AL_ACK2 M
15	AL_ACK2 P
Audio Alarm Ack.:	
14	Alarm Ack. M
13	Alarm Ack. P
Chart Alarm:	
12	AL_out4 make
11	AL_out4 center
10	AL_out4 break
ARPA Alarm:	
9	AL_out3 make
8	AL_out3 center
7	AL_out3 break
Dead Man Alarm Trig:	
6	AL_out2 make
5	AL_out2 center
4	AL_out2 break
Radar Alarm:	
3	AL_out1 make
2	AL_out1 center
1	AL_out1 break

TB 2, Alarm Contacts
The alarm contacts are provided by the IMB. See the IMB description for technical data.

TB14	Function
6	GND, n.c.
5	+5 VDC, n.c.
4	GND, n.c.
3	+5 VDC, n.c.
2	GND, n.c.
1	+5 VDC, n.c.

J7	Function
1	L1
2	N
3	PE

TB3	Function
15	24V ON/OFF ONN
14	24V ON/OFF ONP
13	24V ON/OFF ONN
12	24V ON/OFF ONP
11	CAN0_A (IN)
10	CAN0_B (IN)
9	CAN1_A (IN)
8	CAN1_B (IN)
7	CAN0_A (OUT)
6	CAN0_B (OUT)
5	CAN_GND
4	CAN1_A (OUT)
3	CAN1_B (OUT)
2	24V ON/OFF ONN
1	24V ON/OFF ONP

IN and OUT for the CAN-Bus are identical.

TB7	Function
1	L1 out, spare
2	N out, spare
3	PE out, spare

TB6	Function
1	L1 to Interf. Expander
2	N to Interf. Expander
3	PE to Interf. Expander

TB12	Function
1	L1 slave Monitor
2	N slave Monitor
3	PE slave Monitor

TB5	Function
1	L1 spare
2	N spare
3	PE spare

TB4	Function
1	L1 in
2	N in
3	PE in

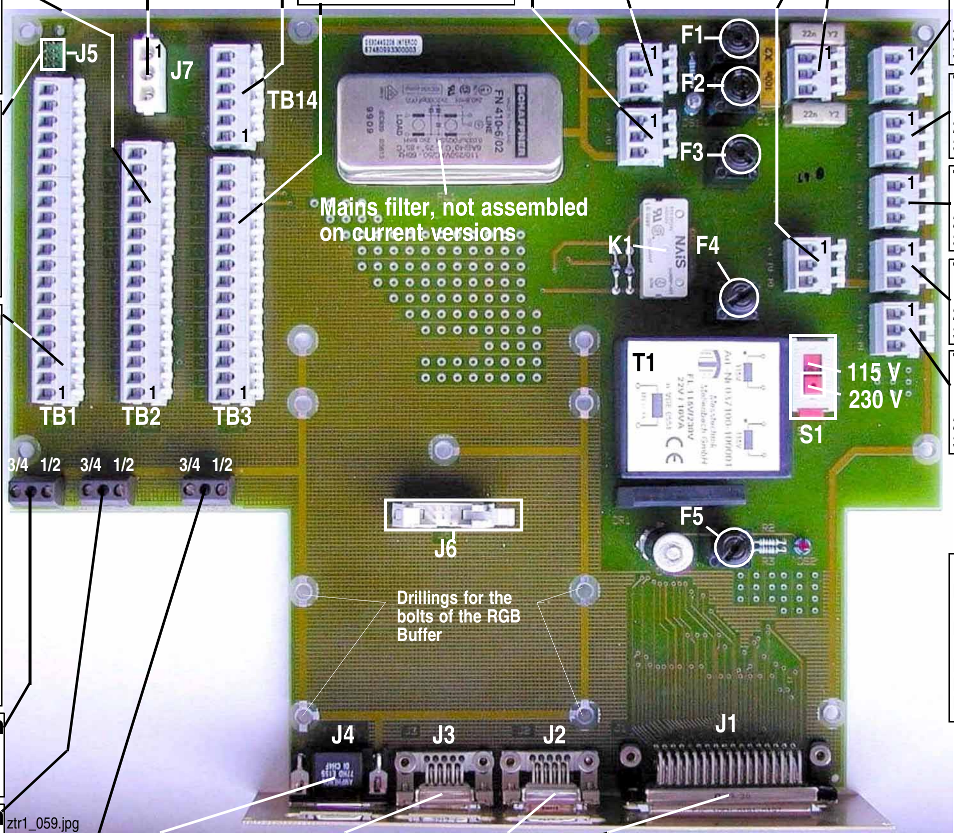
TB9	Function
1	L1 out spare
2	N out spare
3	PE out spare

TB10	Function
1	L1 out, to Monitor
2	N out, to Monitor
3	PE out, to Monitor

TB11	Function
1	L1 out, Displ. El.
2	N out, Displ. El.
3	PE out, Displ. El.

TB13	Function
1	L1 in, switched by Monitor
2	N in, Monitor
3	PE in, Monitor

J5 CAUTION
If the Analog Interface is not connected, the following jumpers must be set to enable TB3 for the CAN Bus:
- J5 1/2
- J5 3/4
- J5 5/6
- J5 7/8



TB1	Function
20	GND
19	TXD4-
18	TXD4+
17	RXD4-
16	RXD4+
15	GND
14	TXD3-
13	TXD3+
12	RXD3-
11	RXD3+
10	GND
9	TXD2-
8	TXD2+
7	RXD2-
6	RXD2+
5	GND
4	TXD1-
3	TXD1+
2	RXD1-
1	RXD1+

Fuses	
F1	System's Mains Fuse
F2	System's Mains Fuse
F3	Mains Fuse Monitor
F4	Mains T1
F5	24V ON/OFF Signal

TB17	Function
1/2	TVA1 out
3/4	Screen

TB16	Function
1/2	TVA2 in
3/4	Screen

TB15	Function
1/2	TVA1 in
3/4	Screen

J4	Function
1	TVA1
2	TVA2
3	
4	
5	
6	GND
7	GND
8	GND
9	
10	
11	
12	
13	
14	
15	GND

J3	Function
1	n.c.
2	COM1_RXD
3	COM1_TXD
4	COM1_DTR
5	COM1_GND
6	COM1_DSR
7	COM1_RTS
8	COM1_CTS
9	n.c.

J2	Function
1	LKAP (Beeper)
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	LKAM (Beeper)

J1	Function
1	RXD1+
2	RXD1-
3	TXD1+
4	TXD1-
5	GND
6	RXD2+
7	RXD2-
8	TXD2+
9	TXD2-
10	GND
11	RXD3+
12	RXD3-
13	TXD3+
14	TXD3-
15	GND
16	RXD4+
17	RXD4-
18	AL_out1 break
19	AL_out1 center
20	AL_out1 make
21	AL_out2 break
22	AL_out2 center
23	AL_out2 make
24	AL_out3 break
25	AL_out3 center
26	AL_out3 make
27	AL_out4 break
28	AL_out4 center
29	AL_out4 make
30	+5 V
31	TXD4+
32	TXD4-
33	GND
34	GND
35	LKAP (Beeper)
36	LKAM (Beeper)
37	CAN0_A
38	CAN0_B
39	CAN1_A
40	CAN1_B
41	CAN_GND
42	VGND2
43	V12R
44	VGND1
45	V12M
46	n.c.
47	Audio Alarm Ack. P
48	Audio Alarm Ack. N
49	Alarm-ACK2 P

Fig. 4-52 Terminals on the Interconnection Board

4.5.12 Operating Unit BD 3027

zt1r_18.jpg

Fig. 4-53 Standard Operating Unit, integrated in Desktop Housing or Console Housing

The complete Operating Unit consists of four parts:

- Trackball BD 3028
- Radar Keyboard
- Trackpilot Keyboard
- Keyboard Controller

The three parts can be mounted separately. All Operating Units are equipped with the Trackball as standard. The Radar Keyboard and the Trackpilot Keyboard can be mounted as add-ons or ordered ex works.

The keyboard is mounted in the Console Housings or in the Desktop housing or it can be delivered separately for shipyard installation purposes.

The keyboards have only one common keyboard controller, which is installed ex works. Depending on the version, the Operating Unit’s housing offers space for a 3.5" diskette drive. The wiring for the diskette drive (data and power supply) is completely independent of the Operating Unit’s wiring and runs directly into the Interconnection Box.

The Operating Unit contains no parts that require servicing.

4.5.12.1 Trackball BD 3028

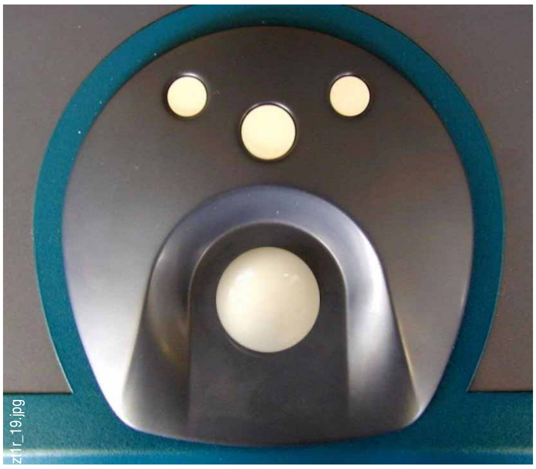


Fig. 4-54 Trackball

The Trackball consists of a ball and three function keys. The function keys correspond in their purpose to the function keys of a PC-mouse.

The interface of the Trackball Unit is a PS/2 interface, which is common for PC's.

The Trackball is connected to the Display Electronics Unit by means of a cable of length 3 m with a standard PS/2 connector. The electronics unit of the Trackball cannot be serviced. The setting of the jumpers must not be modified.

PS/2 connector pinning:

Pin	Function
1	Data
2	-
3	GND
4	+5V
5	Clock
6	-

4.5.12.2 Radar Keyboard

Fig. 4-55 Radar Keyboard

The Radar Keyboard is connected to an electronics unit (Keyboard Controller) in the Operating Unit's housing. The Trackpilot Keyboard is connected to the same electronics unit. The keyboard electronics unit offers a PS/2 interface for the connection to the Display Electronics Unit. This interface combines the Radar Keyboard and the Trackpilot Keyboard.

The keyboard requires a separate DC supply for the back lighting. The back lighting can be adjusted together with the back lighting of the Trackpilot Keyboard.

4.5.12.3 Trackpilot Keyboard

Fig. 4-56 Trackpilot Keyboard

The Trackpilot Keyboard is connected to an electronics unit (Keyboard Controller) in the Operating Unit's housing. The Radar Keyboard is connected to the same electronics unit. The keyboard electronics unit offers a PS/2 interface for the connection to the Display Electronics Unit. This interface combines the Trackpilot Keyboard and the Radar Keyboard.

The keyboard requires a separate DC supply for the back lighting. The back lighting can be adjusted together with the back lighting of the Radar Keyboard.

4.5.12.4 Keyboard Electronics

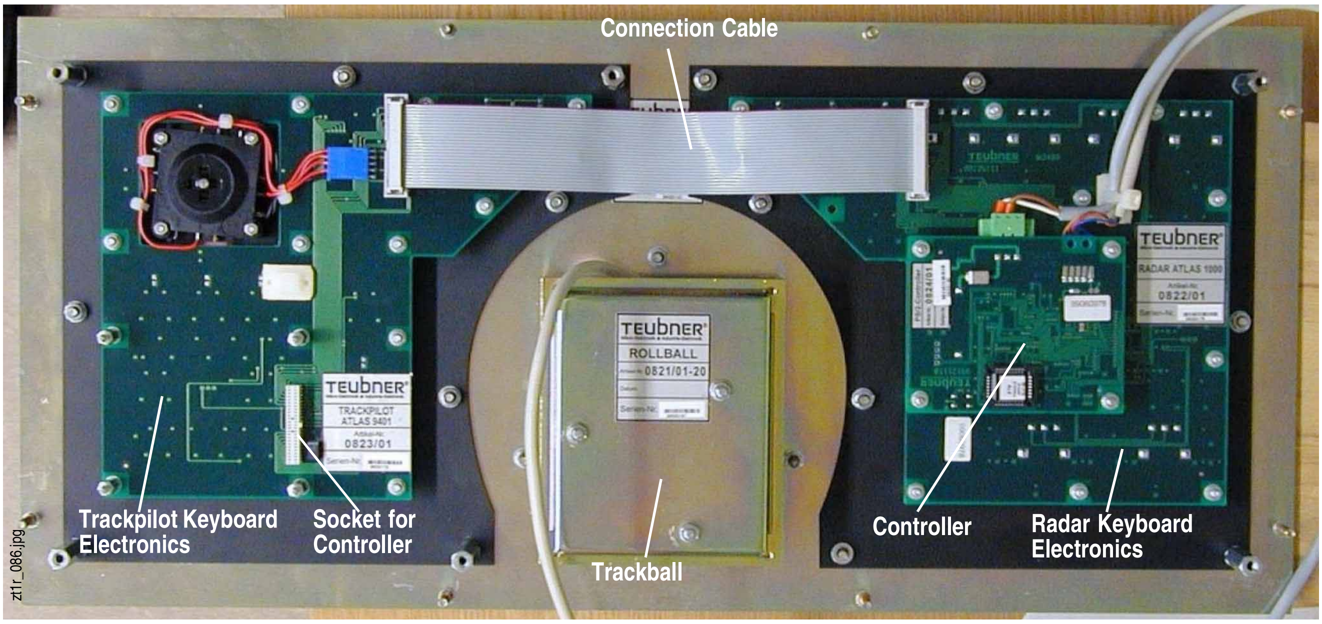


Fig. 4-57 Keyboard electronics with Controller 0824/01

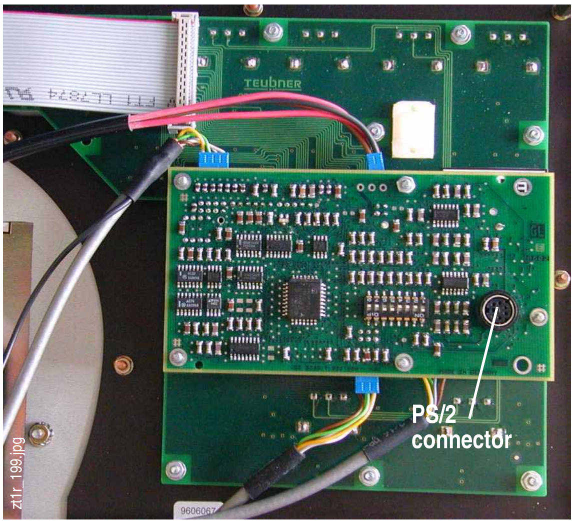


Fig. 4-58 Controller GE 3048 G 200

Figure 4-57 shows the back of an opened Operating Unit. It is equipped with the Trackball and both keyboards. The Keyboard Controller can be connected on both keyboard electronics units. The connection cable transfers the signals from one board to the other.

The keyboards are connected to the Display Electronics Unit by means of a cable of length 3 m with a standard PS/2 connector.

From March 2002 on, the Keyboard Controller 0824/01 has been replaced by the GE 3048 G 200. The controller has the same functionality. The controller GE 3048 G 200 must be used for remote or slave installations. It is equipped with a PS/2 connector for the connection of an ASCII keyboard. The shield cover has a drilling for the connector.

PS/2 connector pinning:

Pin	Function
1	Data
2	-
3	GND
4	+5 V
5	Clock
6	-

The keyboards' illumination is supplied with power via a separate cable.

4.5.13 RGB Buffer GE 3044 G 208 (VIDBR, optional)

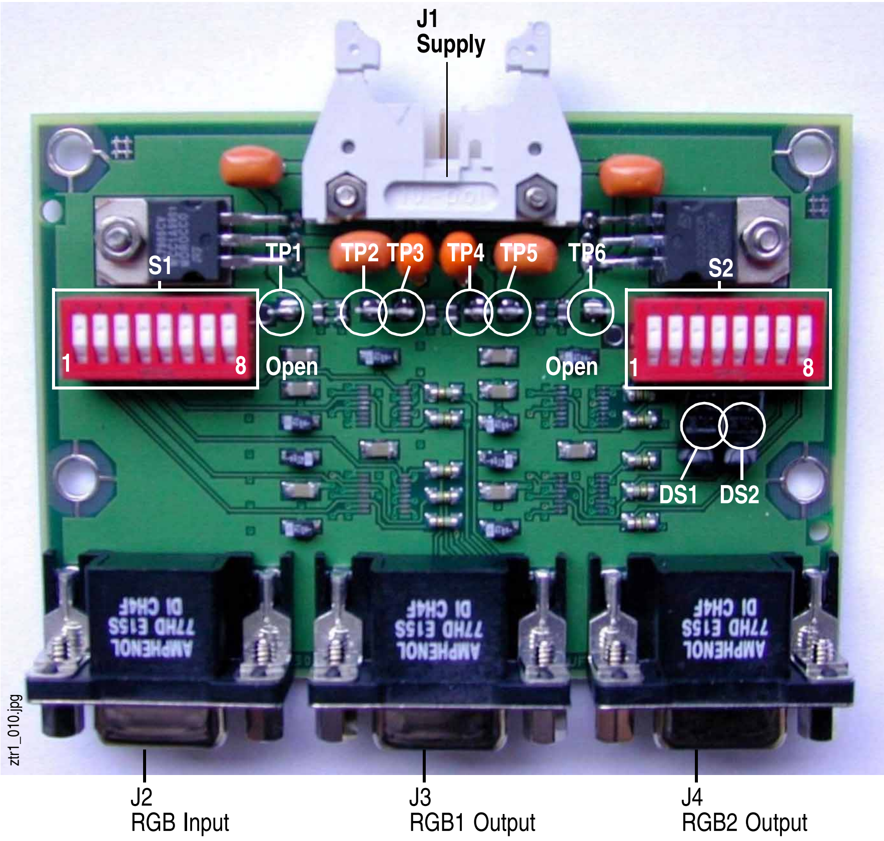


Fig. 4-59 RGB Buffer

For the installation of a retrofit kit see Section 5.12.

The RGB Buffer supplies two monitors with the incoming signal of the Graphics and Video Processor (GVP).

The RGB Buffer receives the video signals (RGB) and the synchronization signals (HSYNC, VSYNC) via the interface J2. The Monitors must be connected to the 15-pin HD-Sub connectors J3 and J4. The decoupling and amplification of the signals are performed by two circuits per video channel with five outputs each. The RGB Buffer circuits work with a constant amplification of 2 (+6 dB) and are optimized for back-terminated Monitors.

The maximum cable length between the RGB Buffer and the monitor inputs is 50 m if an RGB coaxial cable is used via an additional adapter. The cable must be terminated. Usually, the Monitors have an input impedance of 75 Ω, which is suitable for the RGB Buffer. For other cases the DIP switches S1_1 and S2_1 offer a 75 Ω resistor for the termination.

The RGB buffer must be supplied with +/-12 V via the connector J1. The voltage regulators IC1 and IC2 generate an internal supply voltage of +/-5 V.

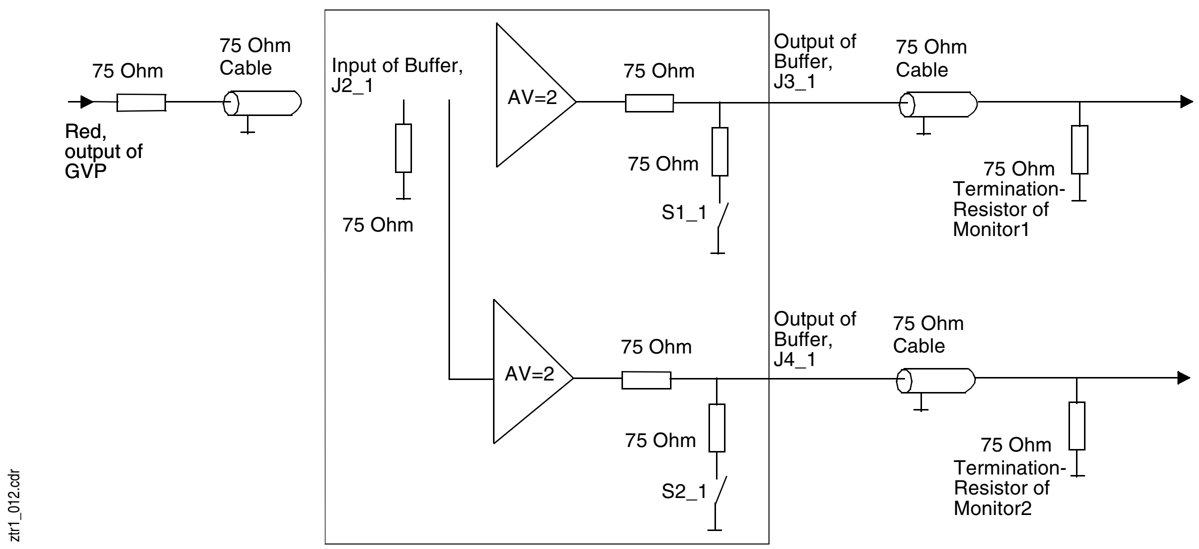


Fig. 4-60 Block diagram showing one channel (red) of the RGB Buffer as an example

Switches

S1 for Monitor 1

S1	On	Off
S1_1	Red output terminated	Red output not terminated
S1_2	Green output terminated	Green output not terminated
S1_3	Blue output terminated	Blue output not terminated
S1_4	Horizontal sync. output terminated	Horizontal sync. output not terminated
S1_5	Vertical sync. output terminated	Vertical sync. output not terminated
S1_6	Inactive	
S1_7	Inactive	
S1_8	Inactive	

(Termination = 75 Ω to AGND)

S2 for Monitor 2

S2	On	Off
S2_1	Red output terminated	Red output not terminated
S2_2	Green output terminated	Green output not terminated
S2_3	Blue output terminated	Blue output not terminated
S2_4	Horizontal sync. output terminated	Horizontal sync. output not terminated
S2_5	Vertical sync. output terminated	Vertical sync. output not terminated
S2_6	Inactive	
S2_7	Inactive	
S2_8	Inactive	

(Termination = 75 Ω to AGND)

LEDs

	On	**Off**
DS1	+5V V_{CC} on	+5V V_{CC} off
DS2	-5V V_{BB} on	-5V V_{BB} off

Connectors

J1, Power Supply

Pin	Function
1	-12 V
2	-12 V
3	GND
4	GND
5	+12 V
6	+12 V
7	GND
8	GND
9	n.c.
10	n.c.

J2, Video Input

Pin	Function
1	RED
2	GREEN
3	BLUE
4	AGND
5	AGND
6	AGND
7	AGND
8	AGND
9	n.c.
10	AGND
11	AGND
12	n.c.
13	Horizontal sync.
14	Vertical sync.
15	n.c.

J3, Output Monitor 1 and J4, Output Monitor 2

Pin	Function
1	RED
2	GREEN
3	BLUE
4	AGND
5	AGND
6	AGND
7	AGND
8	AGND
9	n.c.
10	AGND
11	AGND
12	n.c.
13	Horizontal sync.
14	Vertical sync.
15	n.c.

Test Pins

Pin	Function	Signal
TP1	V_{GND} (In)	0 V
TP2	V_{BB} (Out)	-5 V
TP3	V_{12M} (In)	-12 V
TP4	V_{12P} (In)	+12 V
TP5	V_{CC} (Out)	+5 V
TP6	AGND (Out)	0 V