

Description

Antenna Tuning Unit

ASG 6861

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Antenna Tuning Unit ASG 6861

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1 DESCRIPTION

1.1 General Information

1.1.1 Designation

The assembly bears the designation "Antenna Tuning Unit ASG 6861".

1.1.2 Applications

The antenna tuning unit, Model ASG 6861, is an assembly which is part of the field radiotelephone, Model SE 6861/12, a portable HF transceiver unit with an RF output power of 20 W.

In the transmitting mode, the antenna tuning unit, Model ASG 6861, automatically matches the 50 Ω output of the 20-watts amplifier to an antenna impedance other than 50 Ω . The ASG 6861 is used in the same way to match the input impedance of the RF assembly to a different antenna impedance. Using the antenna tuning unit, ASG 6861, a VSWR (voltage standing wave ratio) of equal to 1.5 can be obtained when using different antenna types and operating at different frequencies.

The Model ASG 6861 can be used with all types of antennas such as:

- whip antennas,
- long-wire antennas, and
- wide-band antennas.

1.1.3 General Description

The assembly consists of a cast metal enclosure which contains five plug-in PCB assemblies that are connected to a common motherboard. All supply voltages and control signals are distributed through a 14-pin connector. During tuning and transmitting operations, the RF signals are applied through two RF connectors. The RF output signal is brought out through a male RF connector. The cover of the enclosure is also used to hold the plug-in PCB assemblies in their position.

1.2 Scope of Delivery

1.2.1 Standard Version

Item	Qty	Designation	Part No.
1	1	Antenna tuning unit, Model ASG 6861	52.6861.100.00
2	1	Manual for Model ASG 6861	5X.0172.227.97

1.2.2 Special Accessories

Special accessories are not required.

1.2.3 Spare Parts

No provisions are made for spare parts intended to be used for maintenance at level 1. Refer to Appendix 9 for recommended spare parts.

1.3 Specifications

1.3.1 Electrical

The specifications related to electrical functions apply for ambient temperature of $+25\text{ }^{\circ}\text{C} \pm 15\text{ }^{\circ}\text{C}$.

Frequency range	1.5 to 30 MHz
RF input power	20 W PEP, 10 W continuous
Useable antenna types	– rod antennas with a length of 3 m (9.8 ft) minimum – wide-band antennas – wire antennas with a length of more than 10 m (32.8 ft)
Tuning accuracy	VSWR of better than 1.5 referred to 50 Ω
Tuning speed	1 s typical, 3 s maximum
Protection circuits	thermal switch for power reduction at overtemperatures
Frequency range information	LOW-level for $f > 8.3\text{ MHz}$ HIGH-level for $f \leq 8.3\text{ MHz}$
RF input power during tuning operations	10 mW
Control	by NSC 800 microprocessor
Power requirements	14.5 VDC
Power consumption	less than 4.5 W (only during tuning operations)

1.3.2 Environmental

Since the antenna tuning unit, Model ASG 6861, is always used as integral part of a transceiver SE 6861 unit, refer to Section 1.3 of the transceiver's instruction manual.

1.3.3 Dimensions and Weight

	Width	Height	Depth	Weight
	70 mm 2.76 in	67.5 mm 2.66 in	122 mm 4.80 in	0.625 kg 1.38 lbs
Installation depth	—	—	135 mm (5.31 in)	—

1.4 Technical Description

In the transmitting mode, the antenna tuning unit, Model ASG 6861, is used to automatically match the 50- Ω output of the 20-watts amplifier to an antenna impedance other than 50 Ω . The ASG 6861 is used in the same way to match the input impedance of the RF assembly to a different antenna impedance. Through the use of the antenna tuning unit, Model ASG 6861, a VSWR of equal to 1.5 can be obtained when using different antenna types and operating at different frequencies.

The electrical circuitry of the antenna tuning unit is comprised of the PCB assemblies listed below:

- coil PCB assembly
- relay PCB assembly
- sensor 1 PCB assembly
- sensor 2 PCB assembly
- CPU PCB assembly (central processing unit which performs control functions)
- motherboard PCB assembly.

In the antenna tuning unit, the impedance of the transmitter output is stepped down from 50 to 12.5 Ω by transformer TR 1 having a step-down ratio of 4:1. The resulting impedance represents the lowest real component value of practical antenna impedances.

The step-down transformation of the antenna impedance to 12.5 Ω is achieved by using a digitally switchable LC low-pass tuning network. The tuning network consists of a binary inductance bank whose elements can be connected in series and of a binary capacitance bank stepped whose elements can be connected in parallel.

A 12.5- Ω directional coupler connected between the tuning network and transformer TR 2 is used to continuously measure the momentary impedance at the tuning network input during tuning operations. The automatic impedance-matching procedure is controlled by the CPU which uses a search algorithm that is resident within the program memory. During the program run, the inductance and capacitance values are varied using a number of relays until a VSWR of 1.5 is obtained. When the search procedure is in progress, the minima of the family of curves are determined which are passed at constant capacitance and variable inductance values.

At the same time, the CPU checks whether or not the requirement of VSWR being equal to or less than 1.5 is already met. The optimum LC combination is typically found within 1 s, making the transceiver, Model SE 6861, ready for transmitting operation.

During the tuning procedure, the tuning level is approx. 10 mW whereas the power output to the antenna does not exceed 3 mW (mute tuning).

Tuning is always required when a VSWR exceeding 1.9 is being measured. Variations of the VSWR may result from frequency changes, antenna replacement or from a defective antenna. The decision whether or not a new tuning procedure should be initiated, is made approx. 75 ms after transmitter keying by depressing the PTT (push-to-talk) button. Whenever the PTT button is depressed which causes the transmitter to be turned on, also the antenna tuning unit is turned on by a signal applied to control input "13.5 VDC ASG tuning". Over at least 100 ms, the antenna tuning unit will remain turned on to check for sufficient matching between the impedances of the transmitter output and the antenna. Should a new tuning sequence be required, the termination of the tuning procedure is signaled through control output "ASG back indication" of the organizer assembly of the SE 6861 transceiver.

The D-bit control output provides an output signal whenever the transmitting frequency is below or above 8.3 MHz. This frequency information is required by the CPU to be capable of running the search program.

Control output "13.5 VDC ASG voltage" provides the analog and digital circuitries of the ASG 6861 with operating power whereas almost all relays of the antenna tuning unit are connected to the 14.5 VDC output.

The CPU receives the measurement values mentioned below (that are required for search operations) through an analog-to-digital converter:

- forward and reflected voltage from the directional coupler,
- the phase difference between forward and reflected voltage, and
- the value of the ambient temperatures as measured on the sensor 1 PCB assembly.

Since the antenna tuning unit, Model ASG 6861, is always used as integral part of the field radiotelephone, Model SE 6861, refer to Section 2 of the SE 6861 instruction manual.

3 MAINTENANCE AND REPAIR BY OPERATING PERSONNEL

3.1 Maintenance

Refer to Section 3.2.

3.2 Repair by Operating Personnel

No provisions are made for maintenance or repair of the assembly by operating personnel. Since the assembly is always part of a transceiver SE 6861 unit, refer to Section 3 of the transceiver's instruction manual.

3.3 Recommendations for Conservation During Extended Storage Periods

No special measures are to be taken for conservation of the assembly during extended storage periods. The assembly does neither contain components that might alter their electrical or physical properties nor self-consuming components. The assembly should, however, be stored in a dry and dust-free room where risks of contamination are excluded. Otherwise, the assembly should be protected by special packing material (e.g. by welding in packing foil).

4 REPAIR BY SKILLED PERSONNEL

4.1 Special Tools, Measuring and Test Equipment

Refer to Section 4.4.4.1.

4.2 Mode of Operation

Refer to the circuit diagrams included in Appendices 2 to 6.

The electrical circuitry of the antenna tuning unit, ASG 6861, consists of the six separate PCB subassemblies listed below:

- motherboard PCB assembly
- coil PCB assembly
- relay PCB assembly
- sensor 1 PCB assembly
- sensor 2 PCB assembly
- CPU PCB assembly.

4.2.1 Motherboard PCB Assembly (refer to Appendix 2)

The motherboard of the antenna tuning unit contains only the connectors for the interconnection of the remaining PCB assemblies. The antenna tuning unit is connected to the motherboard of the SE 6861 transceiver through connector BU 1 on the sensor 1 PCB assembly.

4.2.2 Tuning Network PCB Assembly (refer to Appendix 3)

The tuning network consists of two assemblies that are electrically and physically connected together. These assemblies are:

- the coil PCB assembly with connector plate, and
- the relay PCB assembly.

The major portion of the impedance-matching network consisting of inductors and capacitors with corresponding relays is contained on the tuning network PCB assembly. The remaining reactances of the impedance-matching network are contained on the sensor 1 PCB assembly.

The inductances and capacitances of the impedance-matching network have binary-stepped values, i.e. the reactances of successive components have a ratio of 1:2. The smallest inductance step is 50 nH, the greatest step width is 20 μ H. The smallest capacitance step is 5 pF and the greatest is 780 pF. This set of reactance values allows optimum impedance matching to all in section 1.1.2 mentioned, commonly used antenna types.

To meet the requirements for minimum stray capacitances, the inductors are divided into three groups:

- group 1: L 1 thru L 6 on the sensor 1 PCB assembly,
- group 2: L 1 thru L 4 on the tuning network dual PCB assembly, and
- group 3: L 5 thru L 10 on the tuning network dual PCB assembly.

Stray capacitances reduce the tunable impedance range of an antenna. By disabling inductor groups 1, 2 or 3, the stray capacitances of the ferrite-core inductors affecting the tuning network can be minimized. Switching of the inductor groups is performed using relays RS 1 and RS 5. The relay PCB assembly contains 15 relays with double-throw contacts that are used to switch between tuning network elements. To halve the number of relay control lines, groups of two relays are paralleled through decoupling diodes. The appropriate relays are energized through two bus lines, "Strobe L" and "Strobe C".

Tuning network inductors L 1 thru L 10 are contained on the coil PCB assembly and are attached to a heat sink to improve heat dissipation. Two thermal switches, S 1 and S 2, are mounted to the heat sink and reduce the transmitter output power to 2 W through the OTL (overtemperature line) output whenever the temperature of the heat sink exceeds 90 °C.

Resistor R 1 insures that even rod antennas with extremely small real components at low frequencies can be matched to the RF output of the SE 6861 transceiver obtaining a VSWR of equal to or less than 1.8.

4.2.3 Sensor 1 PCB Assembly (refer to Appendix 4)

The sensor 1 PCB assembly contains the following components:

- power input with tuning network elements
- tuning input with directional coupler
- evaluation electronics for the signals received from the directional coupler,
- a temperature measuring circuitry for digital temperature compensation, and
- the interface to the motherboard of the SE 6861 transceiver.

On the sensor 1 PCB assembly, relay RS 1 is energized by signal "13.5 VDC tuning" derived from the PTT signal generated in the organizer of the SE 6861 transceiver. RS 1 connects the directional coupler to the LC low-pass tuning network. The tuning level is passed to the tuning network through RF input ST 2. This is accomplished by R 1 that supplies the current for a switching diode on the RF assembly through connector ST 2. Directional coupler TR 3 measures the voltage of the tuning signal that is reflected by the tuning network.

By switching RS 8, the forward and the reflected voltage at the directional coupler can be measured successively. Signals V_{wd} and V_{refl} received from the directional coupler are amplified by RF wide-band amplifier stage IS 2 and then rectified for evaluation by the CPU. The resulting DC voltages to be measured are applied to pin 52 of BU 2.

The CPU calculates the reflection coefficient (r) by dividing the value of V_{refl} by the value of V_{wd} . A high-speed comparator, IS 1, converts the sinusoidal signals received from the directional coupler into square pulses which are then applied to phase detector M 1. The output of M 1 supplies a linear ramp signal that is proportional to the phase of the reflection coefficient. This DC voltage is again applied to the CPU through pin 54 of connector BU 2.

The ambient temperature of the sensor 1 PCB assembly is measured using the voltage divider comprised of resistor R 25 and R 26. The measurement value is made available at pin 51 of connector BU 2. The temperature-dependent errors of the phase and magnitude signals are automatically compensated by the CPU depending on the measured value, TK. The corresponding correction values are stored in the program memory of the CPU as correction tables.

Inductors L 1 thru L 6 contained in the tuning network are air-core coils that are switched by relays with double-throw contacts such as those on the relay PCB assembly. Capacitors C 9 and C 10 compensate the residual inductance when all inductors are deselected.

When a tuning sequence is terminated, relay RS 1 is deenergized. In its normal position, relay RS 1 connects the tuning network to the 20-watts power output of the transmitter through transformer TR 1.

4.2.4 Sensor 2 PCB Assembly (refer to Appendix 5)

The sensor 2 PCB assembly contains the following circuitries:

- the sensor measuring amplifier
- relay drivers with serial-to-parallel converter, and
- the power supply.

The sensor measuring amplifier (IS 8 and IS 9) amplifies the analog signals from the sensor 1 PCB assembly that represent the phase and the magnitude of the reflection coefficient. The gain is selected to keep the amplitudes of the signals to be measured within the input voltage range (0 to 5.5 VDC) of the analog-to-digital converter on the CPU PCB. The reference voltage at input terminal 3 of integrated circuit IS 8 is adjusted to 2.75 VDC since the signal representing the phase angle of the reflection coefficient can have either positive or negative polarity. Multiplexer IS 10 applies the three measurement values (phase angle, magnitude and temperature) to the input of the analog-to-digital converter (pin 49 of connector BU 1).

Relay drivers IS 1 thru IS 4 energize and deenergize the double-throw contact relays contained on the sensor 1 and the relay PCB assemblies. The relay drivers receive their control signals in parallel format as supplied by serial-to-parallel converters IS 6 and IS 7. Control lines "Strobe C" and "Strobe L" are pulled to 14.5 VDC through transistors TS 1 and TS 2.

The power supply is comprised of transistor TS 4 and integrated circuits IS 11 and IS 12. TS 4 is used to enable the 13 and 5.5 VDC supply voltages. This transistor is turned on by the organizer of the SE 6861 transceiver through the "13.5 VDC tuning" control input (pin 9 of connector BU 1). Voltage regulator IS 11 is adjusted with potentiometer R 35 to provide an output voltage of exactly 5.5 VDC. IS 12 supplies a reset signal for the CPU whenever the supply voltage of nominally 5.5 VDC drops below 4.8 V. This avoids ambiguous logic states of the CPU that might occur at CPU supply voltages below 4.5 VDC.

Integrated circuit IS 5 with its input 6 and its output 10 translates the 5. VDC CMOS levels to 13.5 VDC.

The antenna tuning unit is turned on by applying a control signal to input "13.5 VDC tuning" (pin 9 of connector BU 1). The ASG 6861 signalizes the termination of the tuning sequence through the "ASG answer-back indication" output (pin 10 of connector BU 1).

4.2.5 CPU PCB Assembly (refer to Appendix 6)

The sequence of a tuning cycle is controlled by the logic section (CPU) of the antenna tuning unit.

The actual control section is the NSC 800 microprocessor (IS 3). The frequency of the external clock signal (2.5 MHz) is determined by oscillator crystal Q 1. This frequency is divided by two in a frequency divider (IS 3) that is contained on the CPU PCB assembly. The microprocessor is consequently clocked with a 1.25 MHz signal.

After the supply voltage of 5.5 VDC has been enabled, the microprocessor generates its actual RESET signal through an internal reset circuitry. The reset signal must have a duration period exceeding the settling time of crystal Q 1. The resulting reset signal is used to reset or initialize the NSC 800 and the NS 810 input/output device (IS 4).

The program for the control of the tuning sequence is permanently stored in the 27C32 EPROM (erasable programmable read-only memory), IS 2. Address bits A0 thru A7 are applied to the EPROM through buffer memory IS 1. This is necessary because address bits A0 thru A7 are also output through the data bus of the microprocessor. The distinction between data and addresses is made with the use of control signal ALE (address latch enable).

Control signals are output and input by the microprocessor through the NS 810 input/output device. IS 4 contains also a 128-Byte RAM (read-and-write memory) that is used as a data memory and an stack pointer. After 3.3 s, an internal timer contained in IS 4 supplies a control signal that is used to abort a tuning sequence.

The CPU PCB assembly contains an analog-to-digital converter that is controlled by the CPU and is used to process the various DC voltages to be measured that are supplied by the sensor 2 PCB assembly. Since the analog-to-digital converter has only one input available, the measurement points must be sequentially scanned by a multiplexer contained on the sensor 2 PCB assembly. The output signals of the multiplexer are then applied to the input of the analog-to-digital converter.

The microprocessor outputs a serial data stream to the sensor 2 PCB assembly through the NSC 810 input/output device. The data stream contains the information that is used to energize or deenergize the relays. The sensor 2 PCB assembly contains a 2 x 8 bit shift register that temporarily stores the data stream received from the microprocessor. All capacitors and inductors required for antenna impedance matching are then selected simultaneously by signals "Strobe L" and "Strobe C". The current setting of the tuning network is stored in the RAM contained in integrated circuit IS 4.

4.2.6 Tuning Procedure (refer to Appendix 7, Flow Chart "Fundamental Tuning Procedure")

Whenever the PTT of the portable radio-telephone, SE 6861, is depressed, its organizer provides the "13.5 VDC tuning" control signal and the constant tuning level of 10 mW to the antenna tuning unit for a least 100 ms. Subsequently, the program described below is run in the antenna tuning unit:

- the reset pulse generated by the microprocessor initializes the latter and the input/output device.
- The "13.5 VDC tuning" control signal causes the tuning level to be switched to the current tuning network configuration through the directional coupler.
- The logic level of the D-bit control line is read (0 V = transmitting frequency of equal to or greater than 8.3 MHz, 13 V = transmitting frequency of less than 8.3 MHz). If the transmitting frequency is equal to or greater than 8.3 MHz, the high-value inductors are inhibited from being switched into the tuning network to avoid self resonance.

At the same time, the "13.5 VDC tuning" control signal is recognized by the CPU as the tuning command. This results in the "ASG back indication" control line to be pulled up to 13.5 VDC. In addition, the timer is triggered to generate a delay time of 3.3. s while the DC voltage is read which is to be measured and is received from the temperature transducer on the sensor 1 PCB assembly.

- Subsequently, the DC voltages to be measured that have been derived from the directional coupler's output voltages, i.e. V_{fwd} and V_{refl} , are read and corrected depending on the ambient temperature as described above.
- From the measured values of V_{fwd} and V_{refl} , the CPU determines whether or not the VSWR is equal to or less than 1.9 (threshold for retuning operations).

VSWR equal to or less than 1.9: Retuning is not required. the "ASG back indication" control line is set to 0 V, causing the control voltages for the antenna tuning unit received from the organizer of the SE 6861 transceiver to be disabled.

The actual tuning sequence, i.e. the determination and selection of the LC combination yielding a VSWR of equal to or less than 1.5, is controlled by the SUCHLC subroutine.

Run of SUCHLC Search Program, Fundamentals (Appendix 8, Flow Chart)

- At the beginning of the search program run, all inductors and capacitors contained in the tuning network are deselected.
- The UMESS subroutine calculates the magnitude of the reflection coefficient from the temperature-dependent measurement values, V_{fwd} and V_{refl} , that have previously been corrected as described above.
- The calculated value for the phase angle of the reflection coefficient is then checked for its correlation to an impedance on or within, or outside of a boundary circle. This circle comprises those impedance values that could theoretically be transformed to a point corresponding with a VSWR of 1. The values of the boundary circle line are stored in the program memory in a table format.

Phase angle within the boundary circle:

The binary capacitance values are incremented until the boundary circle is reached or exceeded.

Phase angle on or outside of the boundary circle:

In this case, the portion of the search program that determines the selection of the inductors contained in the tuning network (L search program) is started immediately.

- During the run of the L search program, the inductance value is determined that results in a minimum of the reflection coefficient when combined with the capacitance previously selected. The step width used during the run of the L search program is a function of the reflection coefficient. The L step width is reduced with decreasing reflection coefficient.
- The minimum found for the reflection coefficient is then checked for correspondence with a VSWR of equal to or less than 1.5 (i.e. a reflection coefficient r of equal to or less than 0.2). If the aforementioned condition is not met, the achieved value of r is defined as new value r_{opt} and the corresponding tuning network configuration parameters are temporarily stored.

When the tuning sequence is started, r_{opt} is set to 1.0 during the initialization phase.

- The phase angle corresponding with the minimum found for the reflection coefficient is measured.
- Another check is made whether or not the phase angle is within or on, or outside of the boundary circle.

Phase angle within or on the boundary circle:

The capacitance value of the tuning network configuration is increased. Subsequently, another L search is started during which the inductance values are successively reduced until another minimum of the reflection coefficient is obtained. This sequence is repeated until the VSWR is equal to or less than 1.5.

Phase angle outside of boundary circle:

In this case, a check is performed first, whether or not all inductors have already been selected.

L equal to L_{max} : By running a C search, a minimum of the reflection coefficient is found. Subsequently, the L value is decreased. The tuning sequence is then continued by running the SUCHLC program.

L less than L_{max} : In this case, the C value of the tuning network configuration is decreased. Another L search is then started during which the L values are successively increased until another minimum of the reflection coefficient is found. This sequence is repeated until a VSWR of equal to or less than 1.5 is obtained.

If no minimum reflection factor of equal to or less than 0.2 (corresponding with a VSWR of equal to or less than 1.5) is found within 3.3 s after the start of a SUCHLC program run, the tuning sequence is aborted. The tuning network configuration parameters corresponding with the r_{opt} value are recalled and used to configure the tuning network, terminating the tuning sequence.

4.3 Troubleshooting

Troubleshooting is described in Section 4.4.4, "Testing".

4.4 Repair

4.4.1 Assembly Removal

The removal of the assembly is described in Sections 3.2.3 and 3.2.3.1.3 of the instruction manual for the field radio-telephone, Model SE 6861. To reinstall the assembly, follow the steps for assembly removal in reverse order.

4.4.2 Disassembly

4.4.2.1 Removal of PCB Assemblies

Loosen the four screws from the cover of the antenna tuning unit and remove the cover. Remove the coil PCB assembly and the relay PCB assembly (these two PCB assemblies are electrically and physically connected to make up the tuning network) after having:

- loosened the four screws at the sides of the antenna tuning unit, and
- disconnected the RF line to the RF output of the antenna tuning unit from the relay PCB assembly.

The remaining PCB assemblies containing sensors 1 and 2 and the CPU can be pulled out of the enclosure of the antenna tuning unit making use of the corresponding pull-out openings. The motherboard can be removed after loosening four screws. Reinstall in reverse order.

4.4.3 Cleaning

Remove dust from the assembly enclosure using a soft, clean and lint-free cloth or a soft, clean brush. Remove heavy contaminations by cleaning the enclosure using a spirit-damped cloth. Clean contacts with non-aggressive agent.

4.4.4 Testing

4.4.4.1 Special Tools, Measuring and Test Equipment

- (1) (*) Power attenuator, 30 W, $30 \geq 0.2$ dB, 50Ω , 0 to 100 MHz
- (2) Thermal power meter with measuring head, 0.1 Mhz to 100 MHz, 100 mW
- (3) Rod dummy antenna, part no. 52.6866.040.00)
- (4) RF millivoltmeter with 50Ω feed-through measuring head, 10 kHz to 100 MHz, 10 V rms

4.4.4.2 Preparations for Testing

The antenna tuning unit, Model ASG 6861, should be tested when installed in the field radio-telephone, Model SE 6861, with which it is normally used. The tests require a hand-set to be connected to the SE 6861 transceiver unit.

4.4.4.2.1 RF Output Voltage

- Connect the rod dummy antenna (3, Section 4.4.4.1) to the rod-antenna connector of the SE 6861 transceiver.
- Connect the feed-through measuring head of the RF millivoltmeter (4) directly to the test output of the rod dummy antenna and terminate the remaining connector of the measuring head with 50Ω .

Set the SE 6861 transceiver for A1A transmissions and for an RF output power of 20 W. A tuning sequence will be performed whenever the PTT button at the hand-set is depressed. The table below lists the frequency settings and the minimum RF output voltages to be measured using the RF millivoltmeter:

Frequency (in MHz)	Minimum RF output voltage (in V rms)
1.5	≈ 0.433
5.0	≈ 1.460
10.0	≈ 2.170
20.0	≈ 2.830
29.9	≈ 3.210

4.4.4.2.2 RF Output Power at 50Ω and Tuning Time

- Disconnect the rod dummy antenna. Connect the power attenuator (1, Section 4.4.4.1) to the BNC-type antenna connector using an RF cable having a maximum length of 0.5 m (1.6 ft).
- Connect the measuring head of the thermal power meter (2) to the output of the power attenuator (1).

Set the SE 6861 transceiver for A1A transmissions at an RF output power of 20 W. A tuning sequence will be performed whenever the PTT button at the hand-set is depressed. The table below lists the frequency settings and the minimum RF power levels that should be measured using the power meter. The RF power levels read from the power meter must be multiplied by the attenuation factor of the power attenuator to obtain the RF power levels available at the RF output of the SE 6861 transceiver unit.

(*) When measuring and test equipment is mentioned in the following text, these several numbers are also stated..

Frequency (in MHz)	Minimum RF output power (in W)
1.5	IV 4
2.0	IV 5
4.0	IV 10
8.0	IV 10
16.0	IV 10
29.9	IV 10

The time required for a tuning sequence must not exceed 3 s.

4.4.5 Troubleshooting

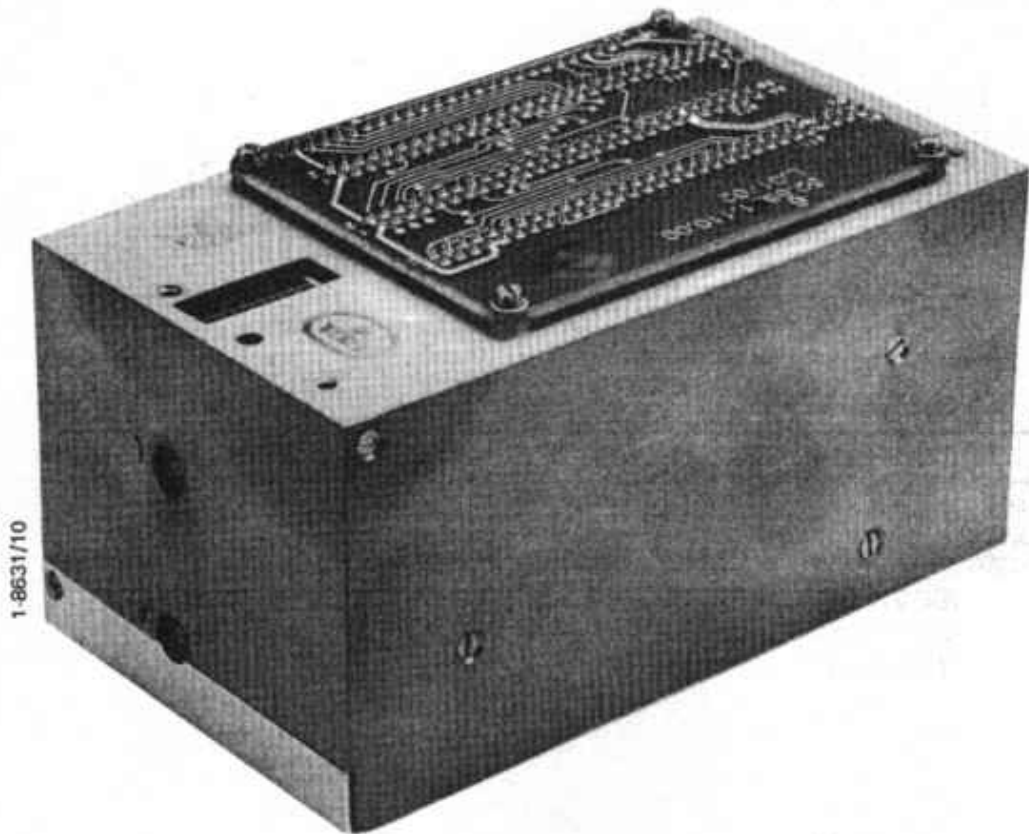
Perform troubleshooting of the antenna tuning unit assembly, Model ASG 6861, following the general rules and methods applying for troubleshooting of similar assemblies containing digital and analog circuitry.

Because of the complexity of the circuitry and of the large number of different fault types that might be encountered, a strictly defined and generally valid troubleshooting method cannot be recommended.

Faults in an ASG 6861 assembly detected to be defective can relatively quickly be located by successively replacing the PCB assemblies by PCB assemblies of a functioning ASG 6861 assembly. PCB assemblies of the same type can be interchanged between different ASG 6861 assemblies as desired.

The information contained in Section 4.2, "Mode of Operation", in conjunction with the circuit diagrams, component layouts and connector pin assignment tables should be sufficient for being capable of tracing faults down to the component level.

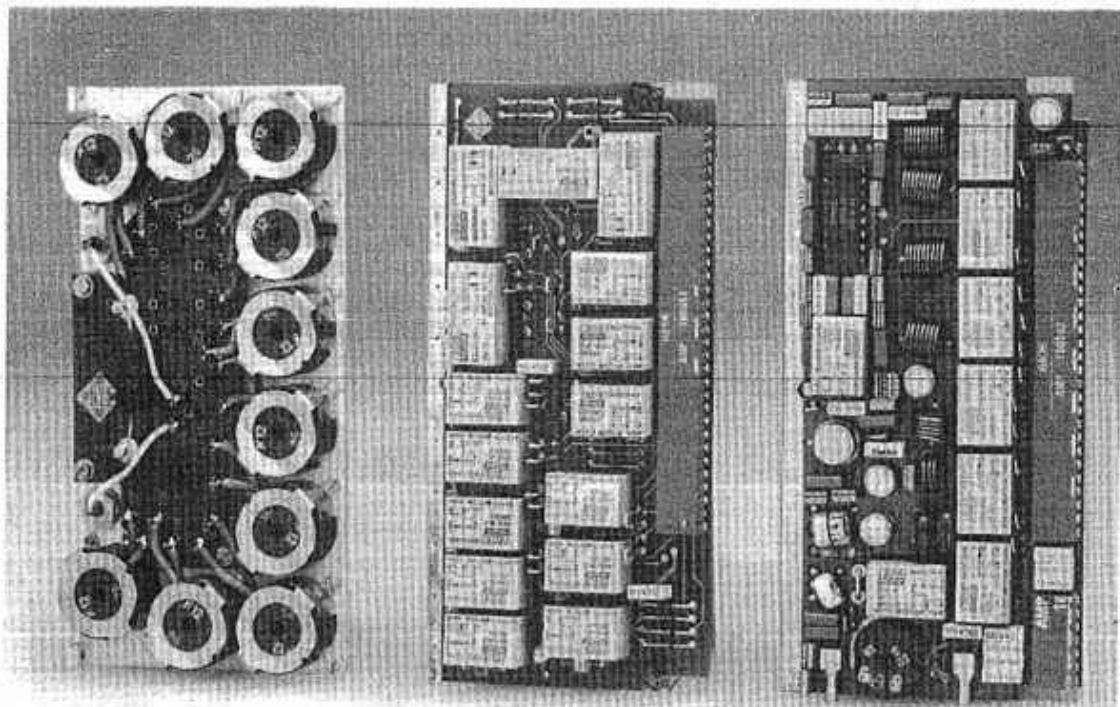
No soldering should be attempted on PCB assemblies except on solder terminals or solder straps since the protection varnish is damaged by overheating which might affect reliable operation of the antenna tuning unit.



1-8631/10

Fig. 1 Antenna Tuning Unit ASG 6861
(View of Motherboard)

1-8631/8



1-8631/9

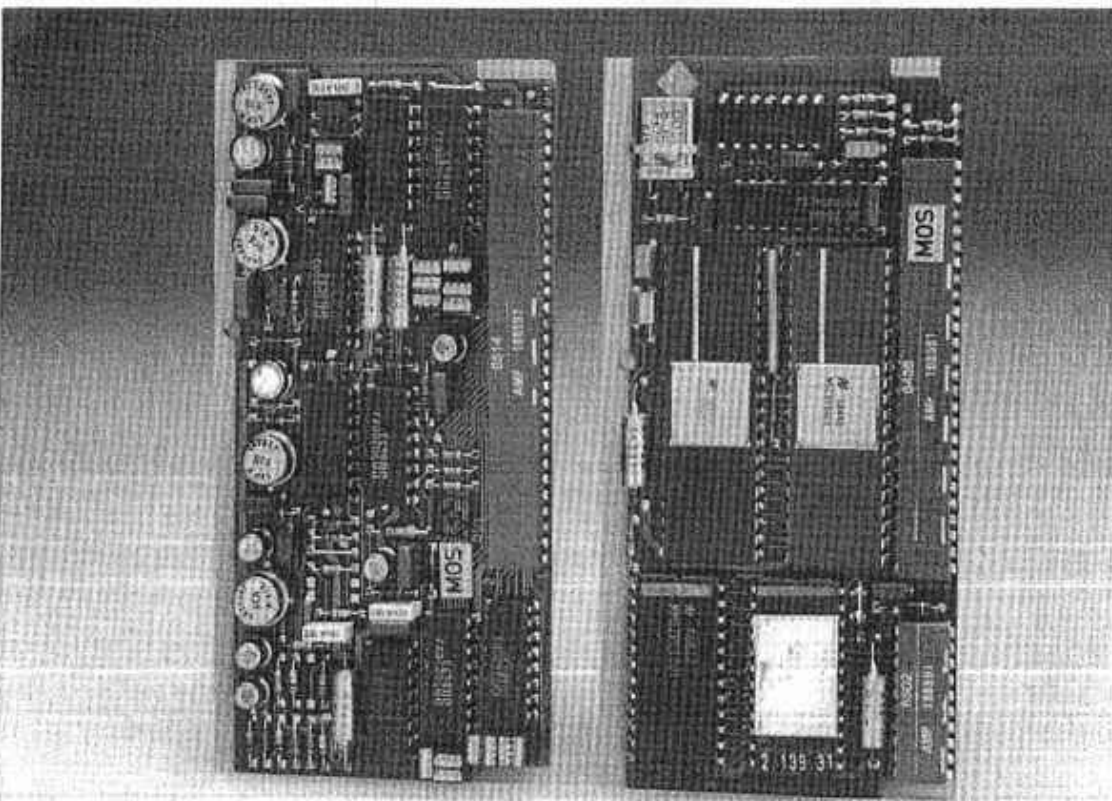


Fig. 2 Antenna Tuning Unit ASG 6861
(Printed-Circuit Boards)

ITEM	DESCRIPTION	PART NUMBER	ELECTRICAL VALUES	REMARKS
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4.6 LISTS OF COMPONENTS

4.6.1 MOTHER CARD 52.6861.110.00

ST	1		EDGE CONNECTOR	5L.4561.024.86	62POL CUSN6 NI AU POLYEST. GV TYP 3-826658-1
ST	2		EDGE CONNECTOR	5L.4561.024.89	56POL CUSN6 NI AU POLYEST. GV TYP 2-826658-8
ST	3		EDGE CONNECTOR	5L.4561.024.87	58POL CUSN6 NI AU POLYEST. GV TYP 2-826658-9
ST	4		EDGE CONNECTOR	5L.4561.024.88	26POL CUSN6 NI AU POLYEST. GV TYP 2-826648-6

4.6.2 COIL ASSEMBLY 52.6861.120.00

L	1		COIL	52.0501.697.00	S1-1362
L	2	...	COIL	52.0501.698.00	S1-1363
L	5	...	COIL	52.0501.699.00	S1-1364
R	1		RESISTOR WIREWOUND	5M.5112.222.68	OHM 2,2 +- 5 % 3 W/350GRD RM 69 V 2K2
S	1	...	SWITCH THERMAL	5M.4671.220.30	FEST M24236/19-CRC (-183)

4.6.3 RELAY ASSEMBLY 52.6861.125.00

BU	1		SOCKET STRIP	5L.4551.013.07	62POL 3 A 250V B2 NI AU POLYEST. GV TYP 3-166 592-1
BU	2		CONTACT SOCKET	5L.4423.002.55	FUER STIFT 1,020 L 5,8 CU AU TYP 450-1801-01-03-00
C	1	...	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MK05
C	3		CAPACITOR CERAMIC	5L.5224.032.47	PF 5,1 +- 0,5 PF 500 V ATC100B-AW/C17.
C	4		CAPACITOR CERAMIC	5L.5224.032.48	PF 10 +- 5 % 500 V ATC100B-AW/C17.
C	5		CAPACITOR CERAMIC	5L.5224.032.49	PF 20 +- 5 % 500 V ATC100B-AW/C17.
C	6		CAPACITOR CERAMIC	5L.5224.032.50	PF 43 +- 5 % 500 V ATC100B-AW/C17.
C	7		CAPACITOR CERAMIC	5L.5224.032.51	PF 91 +- 5 % 500 V ATC100B-AW/C17.
C	8		CAPACITOR CERAMIC	5L.5224.032.52	PF 180 +- 5 % 300 V ATC100B-AW/C17.
C	9	...	CAPACITOR CERAMIC	5L.5224.032.53	PF 390 +- 5 % 200 V ATC100B-AW/C17
C	12	...	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MK05
GP	1	...	SI-DIODE	5L.5532.101.66	1N 4448 1N 914 B
RS	1		RELAY	5L.4742.002.19	12 VGS 2X21 2 A 250VWS 400/400 OHM TYP DS2E-ML2-DC12V
RS	2	...	RELAY	5L.4742.002.20	12 VGS 1X21 2 A 250VWS 400 OHM TYP DS1E-ML2-DC12V
RS	5	...	RELAY	5L.4742.002.19	12 VGS 2X21 2 A 250VWS 400/400 OHM TYP DS2E-ML2-DC12V
RS	8	...	RELAY	5L.4742.002.20	12 VGS 1X21 2 A 250VWS 400 OHM TYP DS1E-ML2-DC12V

4.6.4 SENSOR 1 52.6861.130.00

BU	1		SOCKET STRIP	5L.4551.008.23	14POL 3 A 250V B2 NI1,3 AU0,8 POLYEST. GV TYP 166 592-7
BU	2		SOCKET STRIP	5L.4551.008.25	56POL 3 A 250V B2 NI1,3 AU0,8 POLYEST. GV TYP 2-166 592-8
C	1	...	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MK05
C	7	...	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85
C	9	...	CAPACITOR MICA	5L.5231.016.25	PF 51 +- 5 % 500 V Tk -100 +100 BF 48-10
C	11	...	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MK05

ITEM	DESCRIPTION	PART NUMBER	ELECTRICAL VALUES	REMARKS
C 14	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 18	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MKK05	
C 20	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 21	KONDENSATOR			
C 22	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 26	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MKK05	
C 28	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 30	CAP. PLASTIC FILM	5L.5241.055.50	UF 0,022 +-10 % 63 V MKS 2 /MKT1,68/1,85/MKK05	
GR 1	SI-DIODE	5L.5532.101.66	1N 4448 1N 914 B	
GR 15	SI-DIODE	5L.5532.102.36	1N 5711 5082-2800/AZS800/BAW28	
IS 1	SEMICONDUCTOR CIRC	5L.5441.023.99	SP 9687 KOMPARATOR	
IS 2	SEMICONDUCTOR CIRC	5L.5443.003.22	SL 610 C/CM HF/ZF-VERSTAERKER	
L 1	COIL	52.0500.996.04		
L 2	COIL	52.0500.993.73		
L 3	COIL	52.0500.993.74		
L 4	COIL	52.0500.993.75		
L 7	CHOKE	52.0500.992.17		
L 8	CHOKE	5L.5053.003.02	UH 0,18 +-10 % 1,105A 0,1 OHM TYP M575083-4	
M 1	INTEGR. CIRCUIT	5L.5422.003.89	TFM-3-N DOPPEL-BALANCE-MISCHER	
R 1	FILM RESISTOR	5L.5105.021.43	OHM 560 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 2	FILM RESISTOR	5L.5105.021.19	OHM 56 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 3	VARIABLE RESISTOR	5L.5135.004.02	OHM 20 +-20% 0,5 W LIN TYP 3329H-1-200/CT170/170-50	
R 4	FILM RESISTOR	5L.5105.021.27	OHM 120 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 6	FILM RESISTOR	5L.5105.021.09	OHM 22 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 8	FILM RESISTOR	5L.5105.021.13	OHM 33 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 10	FILM RESISTOR	5L.5105.021.71	KOHM 8,2 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 12	FILM RESISTOR	5L.5105.021.23	OHM 82 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 13	FILM RESISTOR	5L.5105.021.33	OHM 220 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 14	SCHICHTWIDERSTAND			
R 16	FILM RESISTOR	5L.5105.021.33	OHM 220 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 17	FILM RESISTOR	5L.5105.021.17	OHM 47 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 18	VARIABLE RESISTOR	5L.5135.004.11	KOHM 5 +-20% 0,5 W LIN TYP 3329H-1-502/CT170/170-50	
R 19	FILM RESISTOR	5L.5105.021.67	KOHM 5,6 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 20	FILM RESISTOR	5L.5105.021.55	KOHM 1,8 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 21	FILM RESISTOR	5L.5105.021.29	OHM 150 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 22	FILM RESISTOR	5L.5105.021.01	OHM 10 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 23	VARIABLE RESISTOR	5L.5135.004.11	KOHM 5 +-20% 0,5 W LIN TYP 3329H-1-502/CT170/170-50	
R 24	FILM RESISTOR	5L.5105.021.67	KOHM 5,6 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 25	FILM RESISTOR	5L.5105.021.57	KOHM 2,2 +- 2 % 0,5 W 526-0 TK+-100PPM	
R 26	RESISTOR PTC	5L.5172.001.51	KOHM 1 +- 1% 0,75W TYP KTY 83 B1	
R 27	VARIABLE RESISTOR	5L.5135.004.09	KOHM 2 +-20% 0,5 W LIN TYP 3329H-1-202/CT170/170-50	
RS 1	RELAY	5L.4759.003.06	12 VGS 1x21 3 A 250VWS 360 OHM TYP DS1E-M-DC12V	
RS 2	RELAY	5L.4742.002.20	12 VGS 1x21 2 A 250VWS 400 OHM TYP DS1E-ML2-DC12V	
RS 8	RELAY	5L.4759.003.06	12 VGS 1x21 3 A 250VWS 360 OHM TYP DS1E-M-DC12V	
ST 1	CONNECTOR PLUG RF	5L.4521.003.86	NANO 355201-40002/31.1520.002 2- 50 TEFLON WINKELIG LEITERPLATTE	

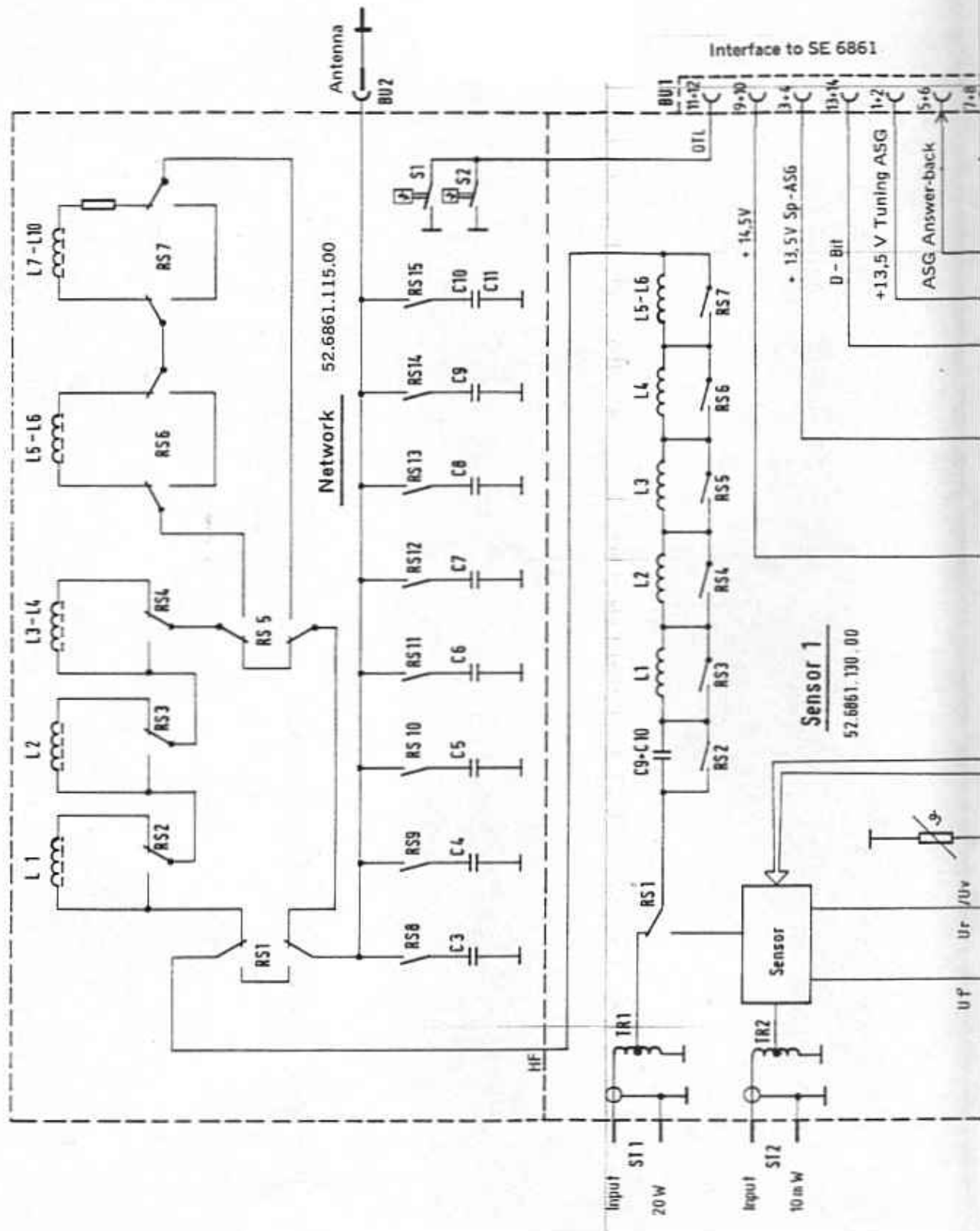
ITEM	DESCRIPTION	PART NUMBER	ELECTRICAL VALUES	REMARKS
TR 1	UEBERTRAEGER	52.0501.669.00	T3-C907	
TR 2	UEBERTRAEGER	52.0501.668.00	T3-C905	
TR 3	UEBERTRAEGER	52.0501.671.00	T3-0942	
4.6.5	SENSOR 2	52.6861.135.00		
BU 1	SOCKET STRIP	5L.4551.013.08	58POL 3 A 250V B2 NI AU POLYEST. GV TYP 2-165 592-9	
C 1	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 8	CAPACITOR CERAMIC	5M.5224.220.52	PF 1000 +-10 % 200 V CK 05 BX 102 K	
C 10	CAP. PLASTIC FILM	5L.5245.001.64	UF 0,1 +-10 % 50 V MKS 2 /MKT1,68/1,85	
C 11	CAPACITOR TANTALUM	5M.5271.021.47	UF 15 +-20% 20 V M39003/01-2290 (CSR13)	
C 12	CAPACITOR CERAMIC	5M.5224.220.11	PF 100 +-10 % 200 V CK 05 BX 101 K	
C 13	CAPACITOR CERAMIC	5M.5221.238.28	PF 56 +-10 % 200 V CK 05 BX 560 K	
C 14	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MMK05	
C 15	CAPACITOR TANTALUM	5M.5271.021.47	UF 15 +-20% 20 V M39003/01-2290 (CSR13)	
C 16	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MMK05	
C 17	CAPACITOR TANTALUM	5M.5271.023.37	UF 22 +-20% 15 V M39003/01-2272 (CSR13)	
C 18	CAP. PLASTIC FILM	5L.5241.055.71	UF 0,01 +-10 % 63 V MKS 2 /MKT1,85/1,68/MMK05	
GR 1	REFERENCE DIODE	5L.5532.205.22	Z- 62X 55/C 20 ZPD 20	
GR 3	SI-DIODE	5L.5532.101.66	1N 444B 1N 914 B	
IS 1	SEMICONDUCT. COMB.	5L.5412.001.49	ULS2003 H /56..J TRANSISTOR-ARRAY DARLINGTON	
IS 6	SEMICONDUCTOR CIRC	5L.5442.003.23	4094 /CD...BF/CD...BMJ -MOS- SCHIEBEREGISTER	
IS 8	SEMICONDUCTOR CIRC	5L.5444.001.04	CA 3130 T -MOS- OPERATIONSVERST.	
IS 9	SEMICONDUCTOR CIRC	5L.5444.001.01	CA 3130 AT -MOS- OPERATIONSVERST.	
IS 10	SEMICONDUCTOR CIRC	5L.5444.001.45	4066 /CD...BF/MC1...BAL/CD...BMJ -MOS- ANALOG-SCHALTER	
IS 11	SEMICONDUCTOR CIRC	5L.5443.001.47	723 /...HM/PM...T/CA...T/LM...H SPANNUNGSFUEGLER	
IS 12	SEMICONDUCTOR CIRC	5L.5444.001.04	CA 3130 T -MOS- OPERATIONSVERST.	
R 1	FILM RESISTOR	5L.5105.021.83	KOHM 27 +- 2 % 0,5 W 526-0 TK+-100PPH	
R 8	FILM RESISTOR	5M.5102.051.05	KOHM 27 +- 5 % 0,125W RC 05 GF 273 J	
R 11	FILM RESISTOR	5L.5105.021.83	KOHM 27 +- 2 % 0,5 W 526-0 TK+-100PPH	
R 13	FILM RESISTOR	5M.5102.051.05	KOHM 27 +- 5 % 0,125W RC 05 GF 273 J	
R 15	FILM RESISTOR	5L.5105.021.83	KOHM 27 +- 2 % 0,5 W 526-0 TK+-100PPH	
R 16	FILM RESISTOR	5M.5102.002.59	OHM 270 +- 5 % 0,25 W RC 07 GF 271 J	
R 18	FILM RESISTOR	5M.5102.942.36	KOHM 33 +- 5 % 0,125W RC 05 GF 333 J	
R 19	FILM RESISTOR	5M.5102.050.96	KOHM 12 +- 5 % 0,125W RC 05 GF 123 J	
R 20	FILM RESISTOR	5M.5102.223.62	KOHM 10 +- 5 % 0,125W RC 05 GF 103 J	
R 21	VARIABLE RESISTOR	5L.5135.004.11	KOHM 5 +-20% 0,5 W LIN TYP 3329H-1-502/CT170/170-50	
R 22	FILM RESISTOR	5M.5102.050.25	OHM 10 +- 5 % 0,125W RC 05 GF 100 J	
R 23	FILM RESISTOR	5M.5102.051.24	KOHM 220 +- 5 % 0,125W RC 05 GF 224 J	
R 24	FILM RESISTOR	5M.5102.050.25	OHM 10 +- 5 % 0,125W RC 05 GF 100 J	
R 25	FILM RESISTOR	5M.5102.051.26	KOHM 270 +- 5 % 0,125W RC 05 GF 274 J	
R 26	FILM RESISTOR	5M.5102.942.36	KOHM 33 +- 5 % 0,125W RC 05 GF 333 J	
R 27	FILM RESISTOR	5L.5105.021.83	KOHM 27 +- 2 % 0,5 W 526-0 TK+-100PPH	
R 33	FILM RESISTOR	5M.5102.223.58	KOHM 1 +- 5 % 0,125W RC 05 GF 102 J	
R 34	FILM RESISTOR	5M.5102.050.69	OHM 680 +- 5 % 0,125W RC 05 GF 681 J	
R 35	VARIABLE RESISTOR	5L.5135.004.09	KOHM 2 +-20% 0,5 W LIN TYP 3329H-1-202/CT170/170-50	
R 36	FILM RESISTOR	5M.5102.050.80	KOHM 2,2 +- 5 % 0,125W RC 05 GF 222 J	

ITEM	DESCRIPTION	PART NUMBER	ELECTRICAL VALUES	REMARKS
R 37	FILM RESISTOR	5N.5102.051.01	KOHM 18 +- 5 % 0,125W RC 05 GF 183 J	
R 38 ... 39	FILM RESISTOR	5M.5102.042.36	KOHM 33 +- 5 % 0,125W RC 05 GF 333 J	
R 40 ... 41	FILM RESISTOR	5N.5102.051.16	KOHM 100 +- 5 % 0,125W RC 05 GF 104 J	
R 42	FILM RESISTOR	5N.5102.050.25	OHM 10 +- 5 % 0,125W RC 05 GF 100 J	
R 43	FILM RESISTOR	5M.5102.223.58	KOHM 1 +- 5 % 0,125W RC 05 GF 102 J	
R 44	FILM RESISTOR	5M.5102.223.62	KOHM 10 +- 5 % 0,125W RC 05 GF 103 J	
R 45	FILM RESISTOR	5N.5102.051.16	KOHM 100 +- 5 % 0,125W RC 05 GF 104 J	
R 46	SCHICHTWIDERST.			
R 47	FILM RESISTOR	5N.5102.051.03	KOHM 22 +- 5 % 0,125W RC 05 GF 223 J	
R 48	FILM RESISTOR	5N.5102.051.24	KOHM 220 +- 5 % 0,125W RC 05 GF 224 J	
R 49	FILM RESISTOR	5M.5102.223.62	KOHM 10 +- 5 % 0,125W RC 05 GF 103 J	
R 50	FILM RESISTOR	5N.5102.051.05	KOHM 27 +- 5 % 0,125W RC 05 GF 273 J	
R 51 ... 52	SCHICHTWIDERST.			
TS 1 ... 2	SI-PNP-TRANSISTOR	5L.5512.102.20	2N 2907 A	
TS 3	SI-NPN-TRANSISTOR	5L.5512.202.92	BCY 59 IX	
TS 4	SI-PNP-TRANSISTOR	5L.5512.102.20	2N 2907 A	
TS 5	SI-NPN-TRANSISTOR	5L.5512.202.92	BCY 59 IX	

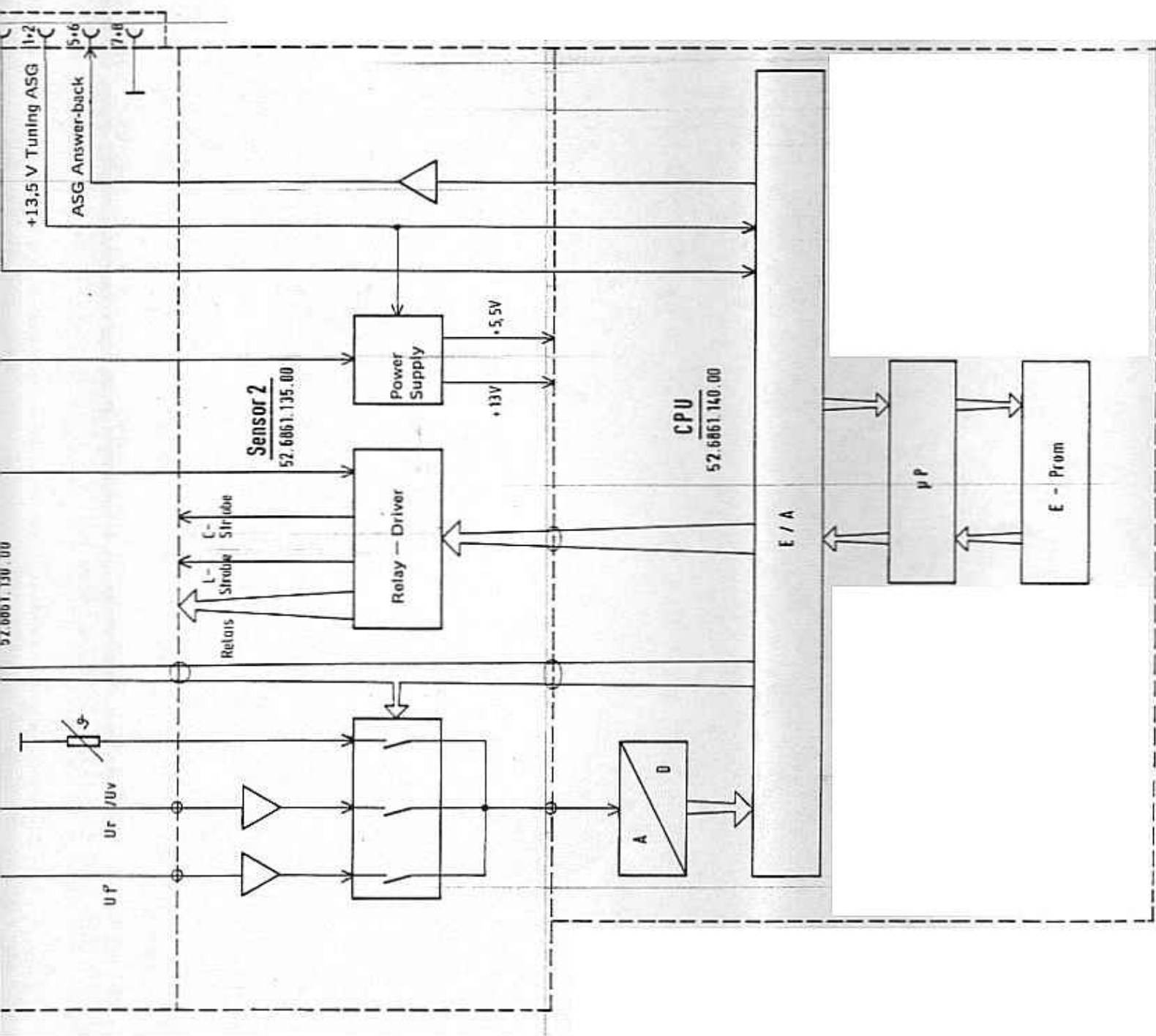
4.6.6 CPU

52.6861.140.00

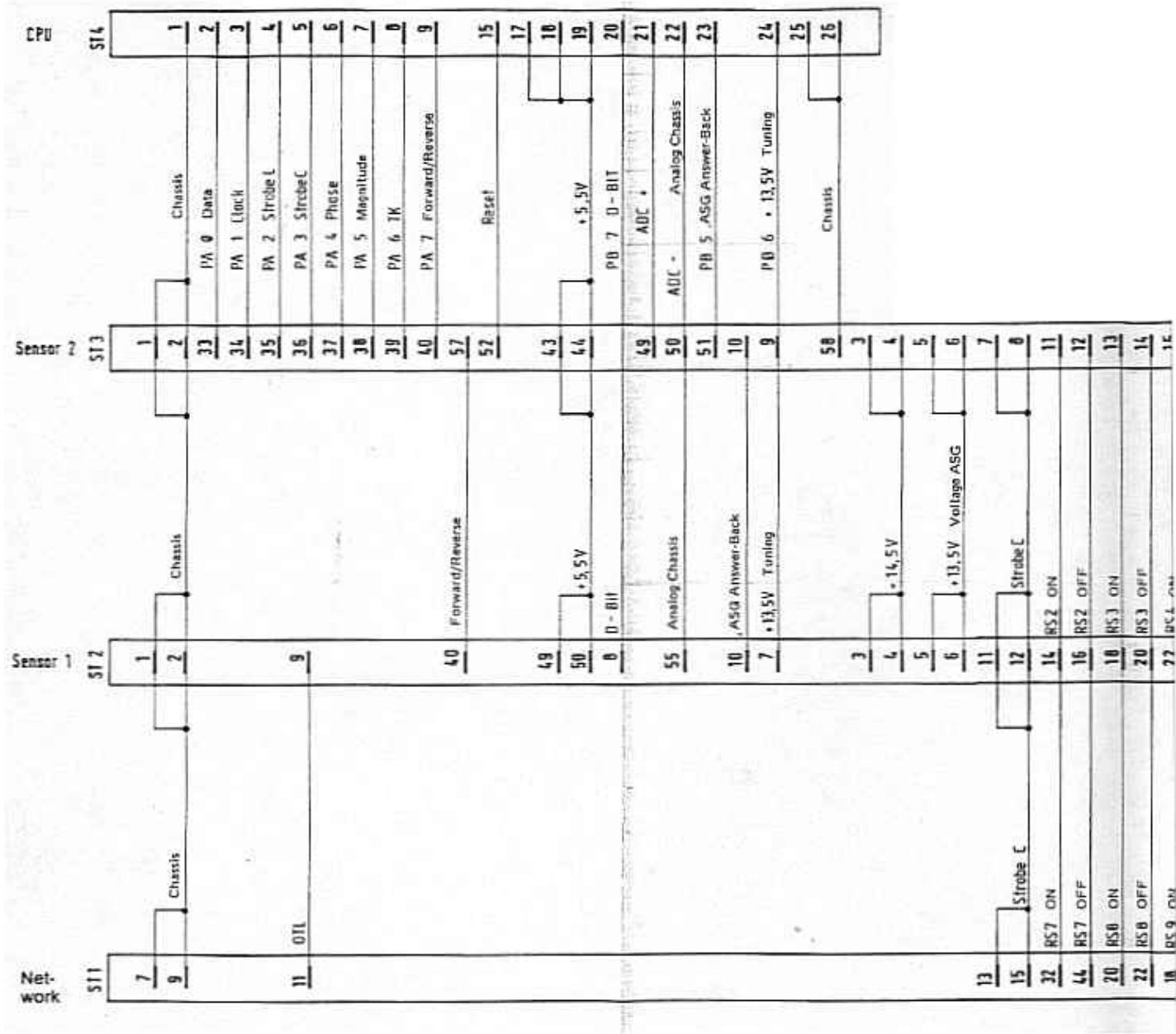
BU 1	SOCKET STRIP	5L.4551.002.80	26POL 2 A 250V B2 NI AU POLYEST. GV TYP 2-166 591-6	
BU 2	SOCKET STRIP	5L.4551.002.75	10POL 2 A 250V B2 NI1,3 AUC,6 POLYEST. GV TYP 1-166 591-0	
C 1	CAPACITOR TANTALUM	5N.5271.019.47	UF 10 +-20% 20 V M39003/01-2287 (CSR13)	
C 2	CAPACITOR CERAMIC	5L.5224.003.05	PF 22 +- 5 % NF 0 5 X5 100 V 8123-141/CLC904	
C 3	CAPACITOR CERAMIC	5L.5224.003.11	PF 68 +- 5 % NF 0 5 X5 100 V 8123-141/CLC905	
C 4	CAPACITOR CERAMIC	5N.5224.001.08	UF 0,1 +-10 % 50 V CK 05 BX 104 K	
C 5	CAPACITOR TANTALUM	5N.5271.019.47	UF 10 +-20% 20 V M39003/01-2287 (CSR13)	
C 6	CAPACITOR CERAMIC	5L.5224.003.15	PF 150 +- 5 % NF 0 5 X5 100 V 8123-141/CLC905	
C 7	CAPACITOR CERAMIC	5M.5224.220.56	UF 0,01 +-10 % 100 V CK 05 BX 103 K	
C 8	CAPACITOR CERAMIC	5N.5224.001.08	UF 0,1 +-10 % 50 V CK 05 BX 104 K	
GR 1	SI-DIODE	5L.5532.101.66	1N 4448 1N 914 B	
GR 2	SI-DIODE	5L.5532.102.36	1N 5711 50B2-2800/A25800/BAK2B	
IS 1	SEMICONDUCTOR CIRC	5L.5453.003.21	MM B2PC12 J1 -MOS- EIN/AUSGABE-BAUST.	
IS 2	SEMICONDUCT_STORE	52.9544.139.31		
IS 2/1	SEMICONDUCT_STORE	5L.5452.002.95	NMC 27032 QE-45 UNPROGRAMMIERT -MOS- PROM 4KX8 T5	
IS 3	SEMICONDUCTOR CIRC	5L.5453.003.22	NSC 800 J1 -MOS- MIKROPROZESSOR	
IS 4	SEMICONDUCTOR CIRC	5L.5453.003.39	NSC 810 AJ1 -MOS- RAM-1/0-TIMER	
IS 5	SEMICONDUCTOR CIRC	5L.5446.001.53	ADC 0804 LCD /ADC..LCD -MOS- A/D-WANDLER 8 BIT	
IS 6	SEMICONDUCTOR CIRC	5L.5442.004.11	4011 / CD ..BF/RC1..BAL/HCC..BF/ CD..BMJ -MOS- GATTEP	
L 1	CHOKE	5L.5053.003.23	UH 10 +-10 % 0,13 A 3,7 OHM TYP M575064-12	
Q 1	CRYSTAL QUARTZ	5L.5561.004.06	MHZ 2,4576 +-50 X10-6 +25GRD ATB -0/+70 HC-18/U	
R 1	FILM RESISTOR	5N.5102.051.38	KOHM 820 +- 5 % 0,125W RC 05 GF 824 J	
R 3	R COMBINATION	5L.5413.004.10	7x KOHM 10 +- 2 % 0,19W TYP CSN08AD11036/4608P-101-103/L-08-	
R 4 ... 8	FILM RESISTOR	5M.5102.223.62	KOHM 10 +- 5 % 0,125W RC 05 GF 103 J	
R 9	SCHICHTWIDERSTAND			
R 10	FILM RESISTOR	5N.5102.050.92	KOHM 6,8 +- 5 % 0,125W RC 05 GF 682 J	
R 11	FILM RESISTOR	5M.5102.223.62	KOHM 10 +- 5 % 0,125W RC 05 GF 103 J	

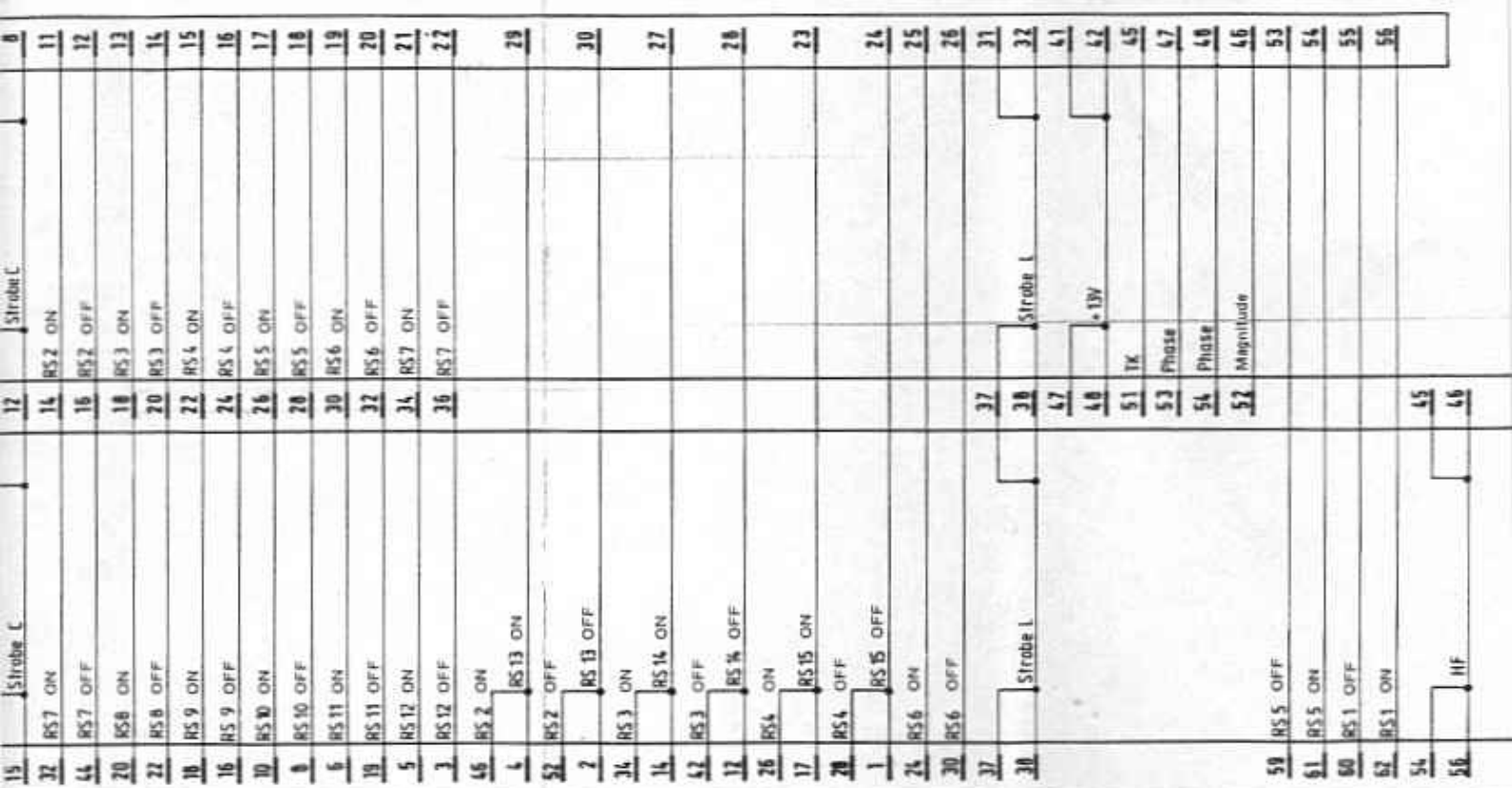


52.6861.100.00 (EL) USP (01)
 ASG 6861

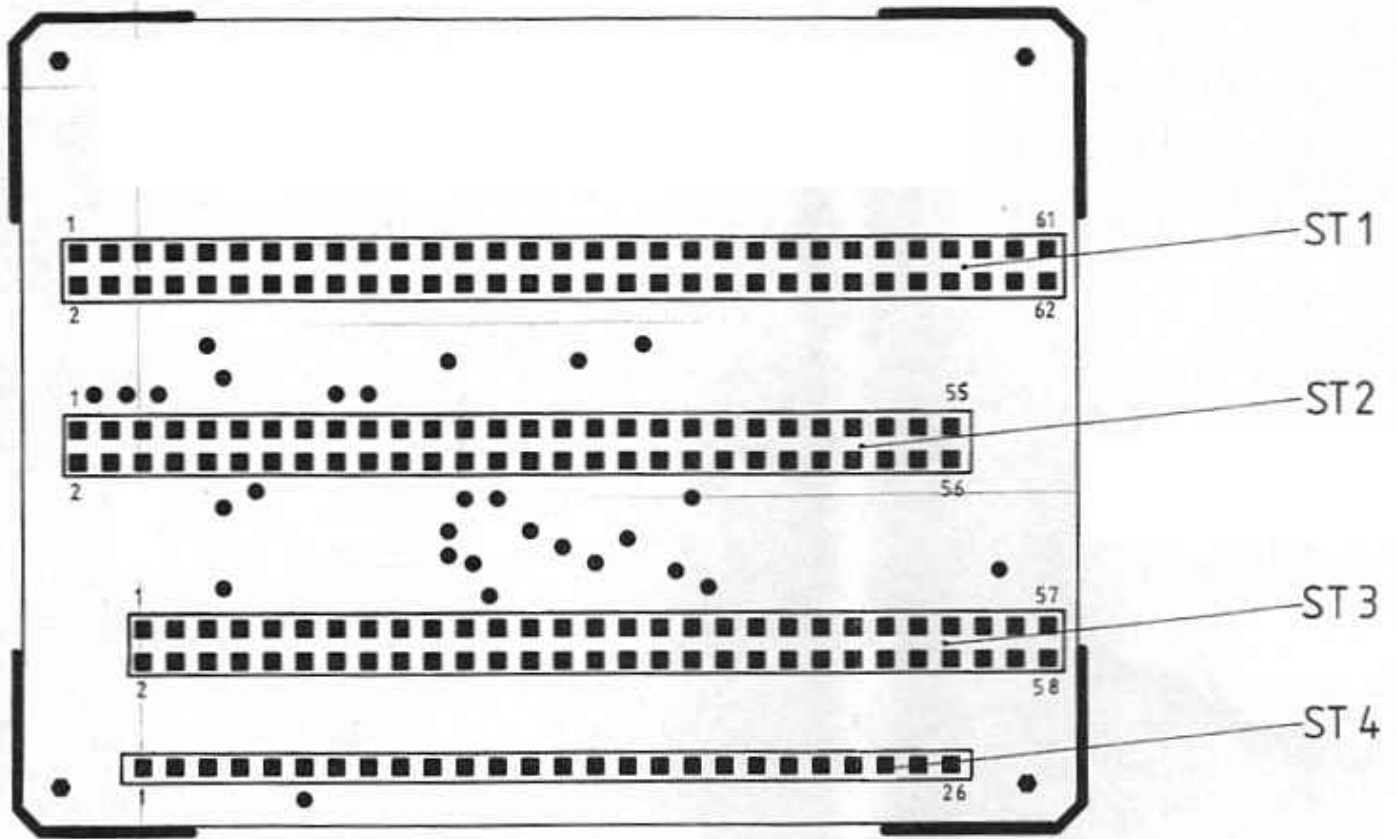


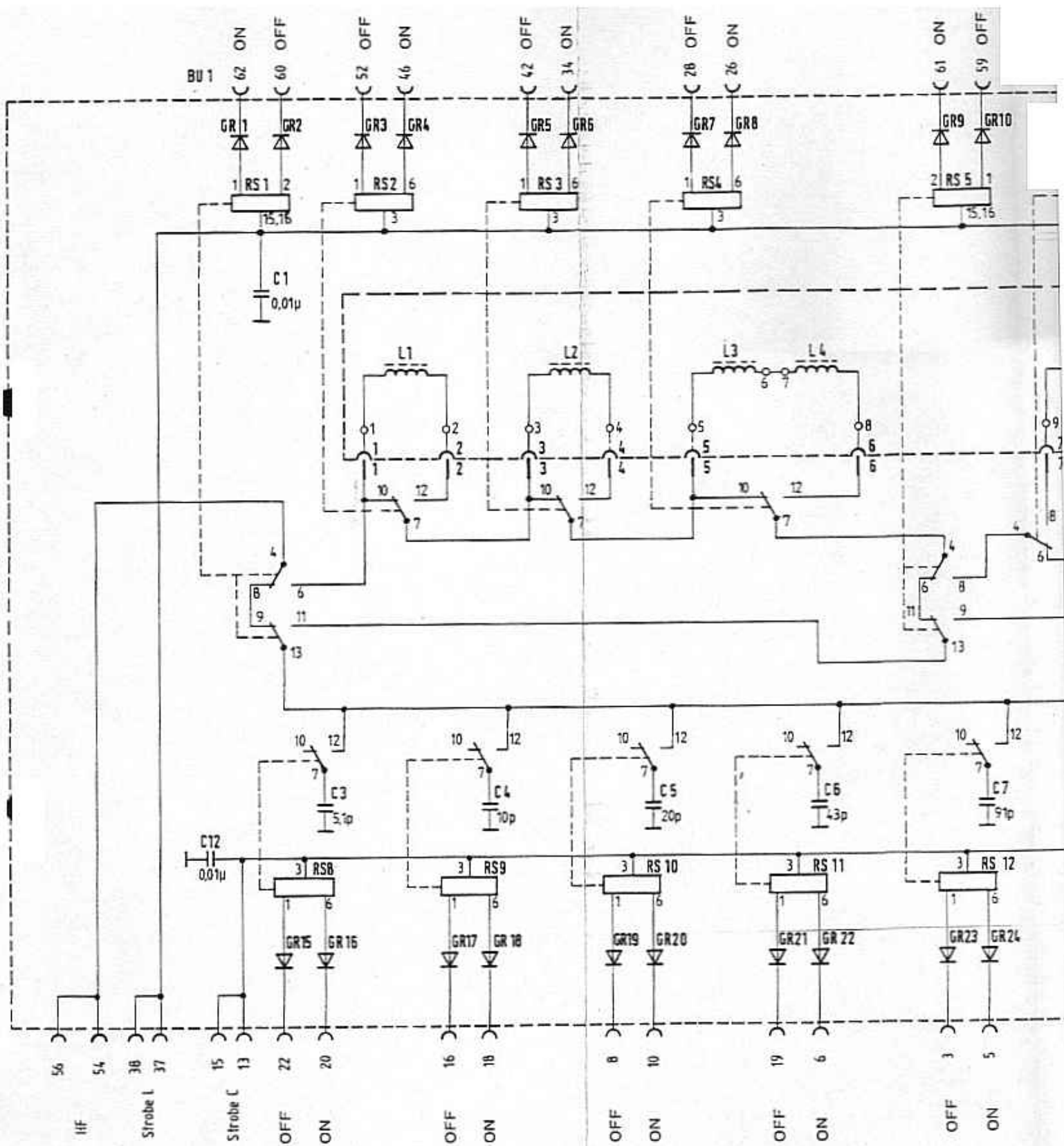
General circuit diagram
Antenna Tuning Unit ASG 6861
Annex 1

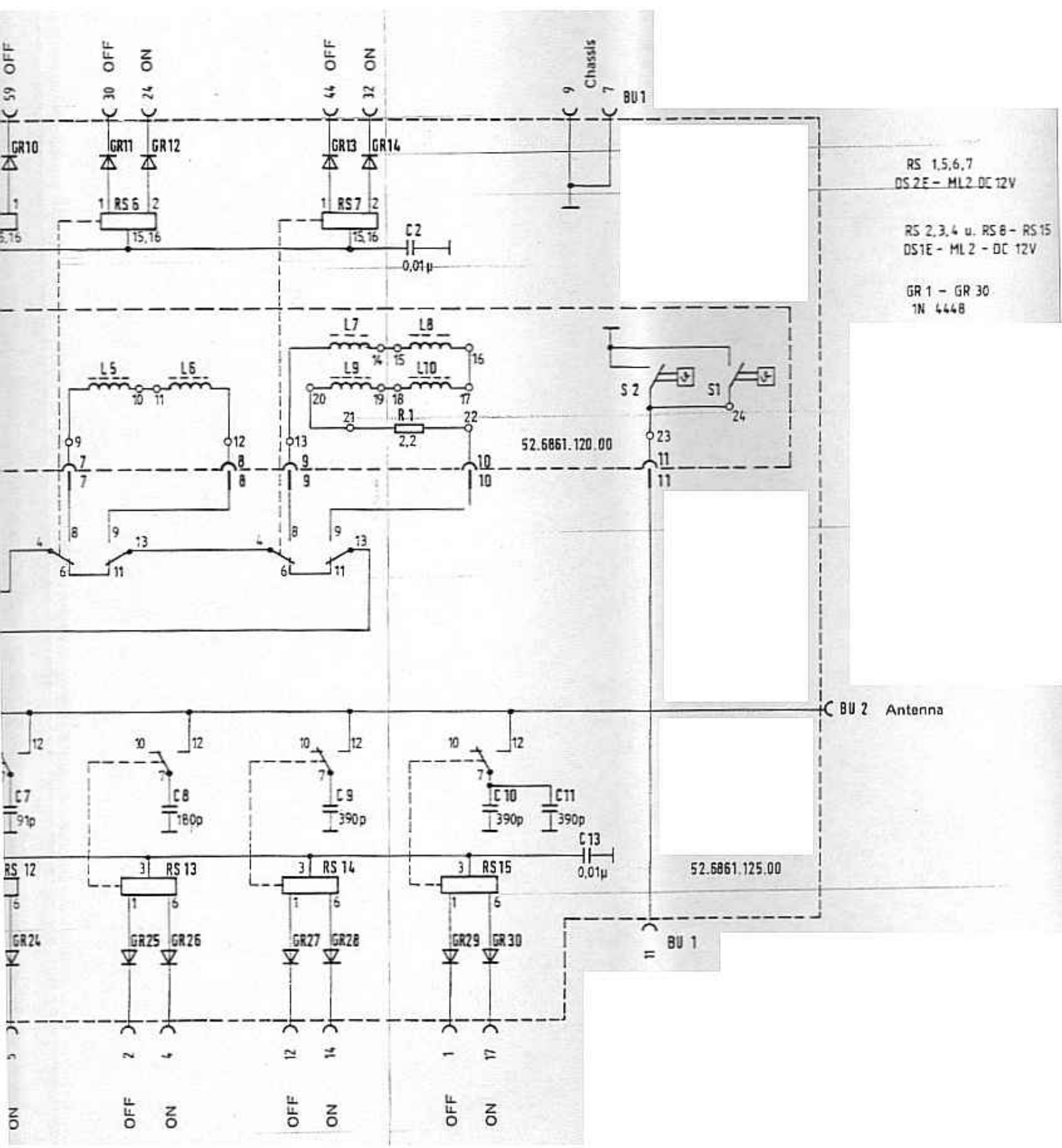




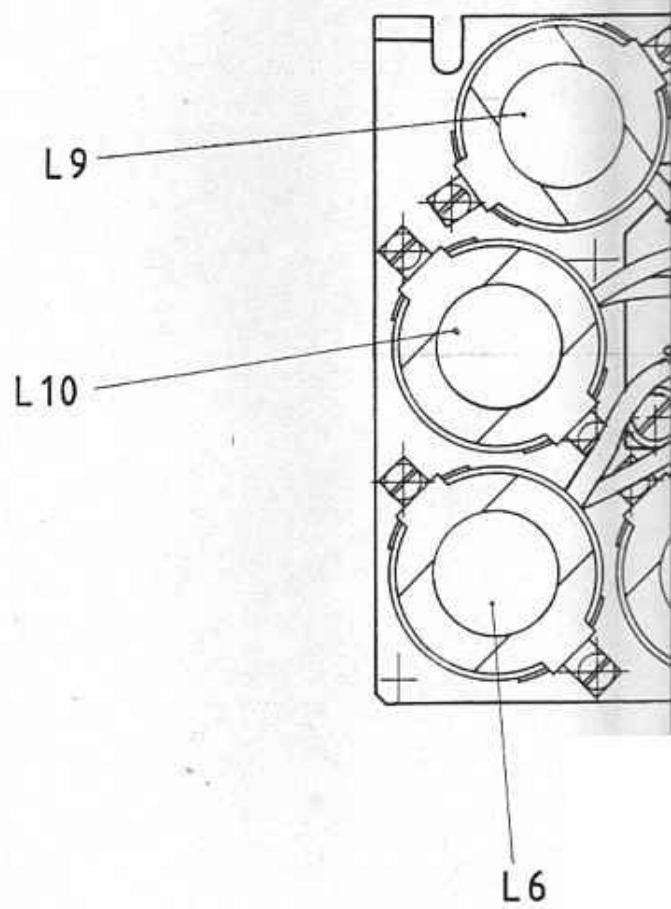
Circuit diagram
Motherboard
Annex 2, Sheet 1





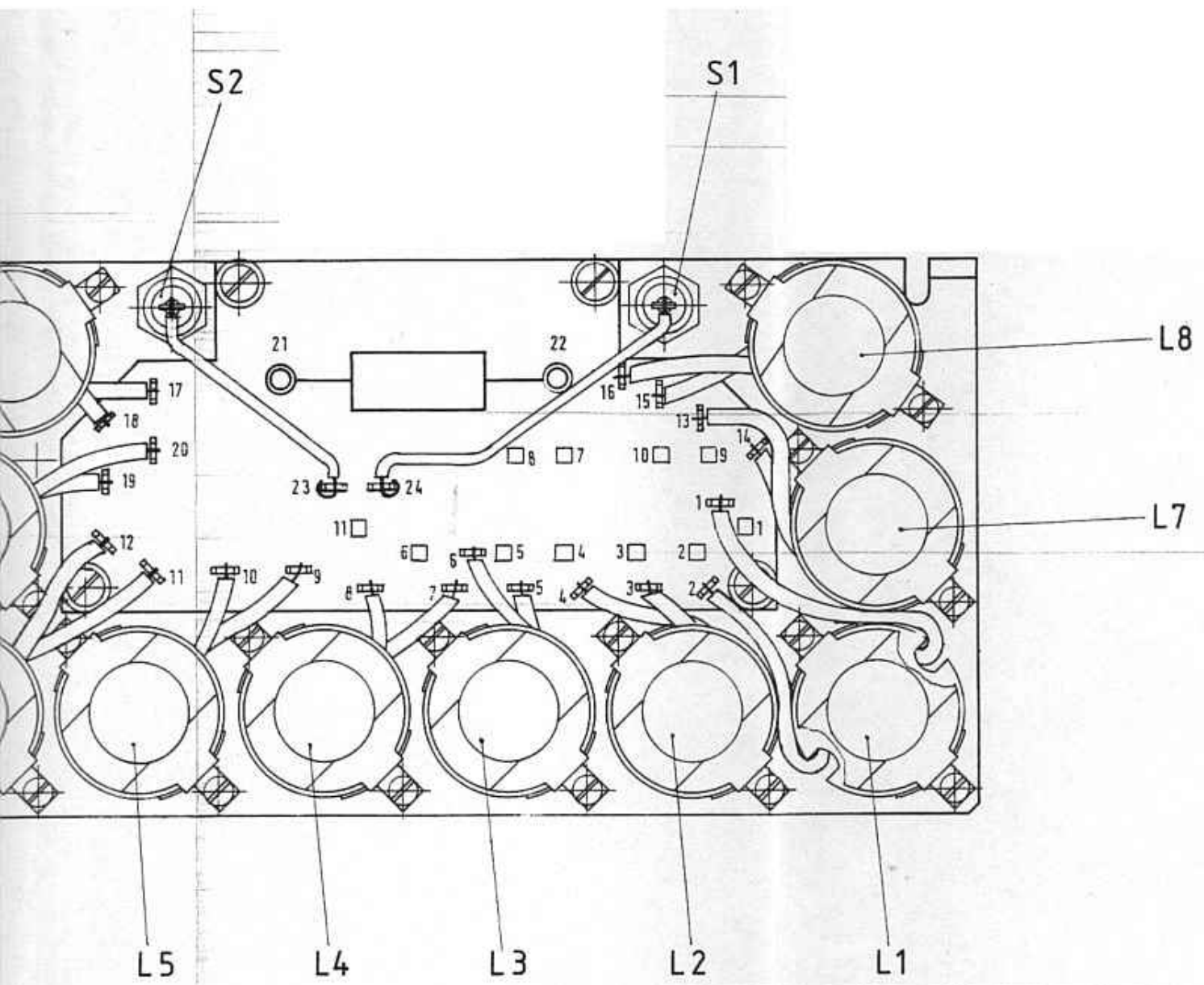


Circuit diagram
Network
Annex 3, Sheet 1

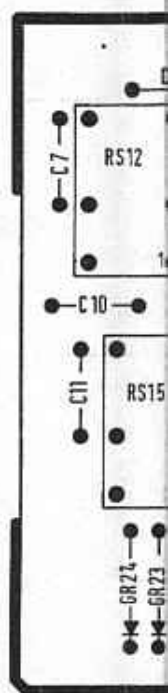


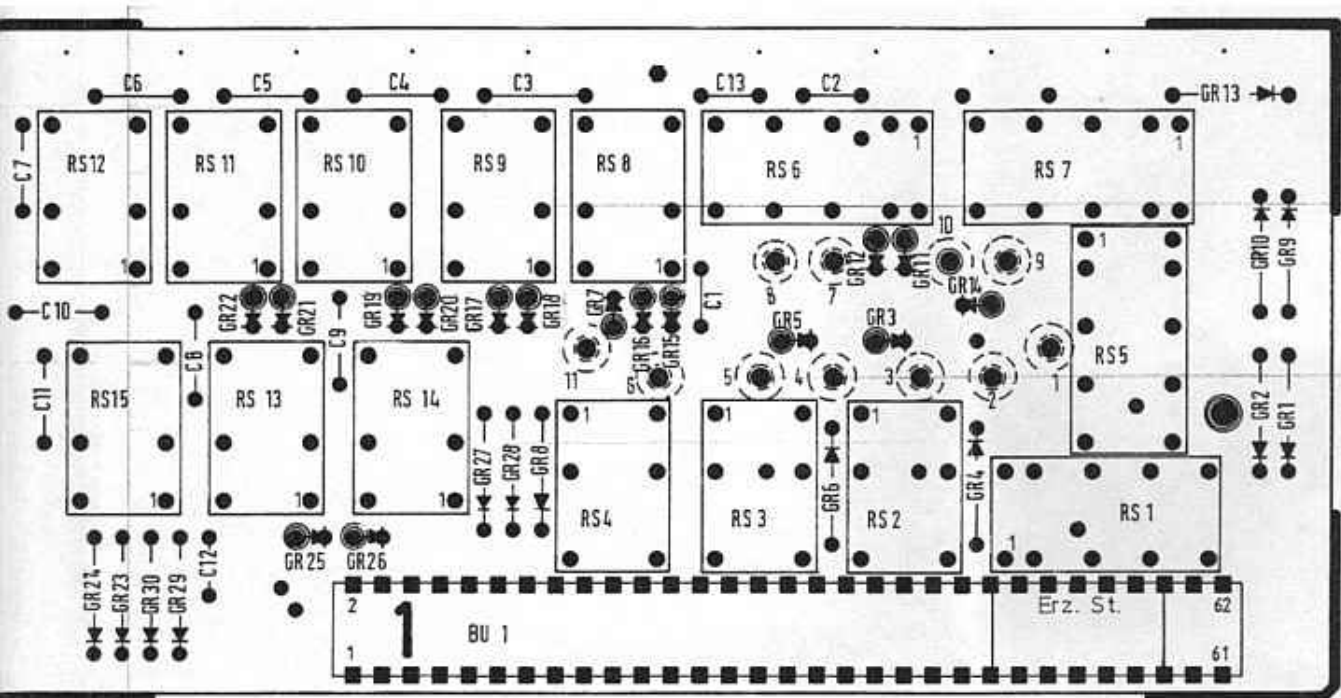
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Components layout diagram
 Coil Board
 Annex 3, Sheet 2





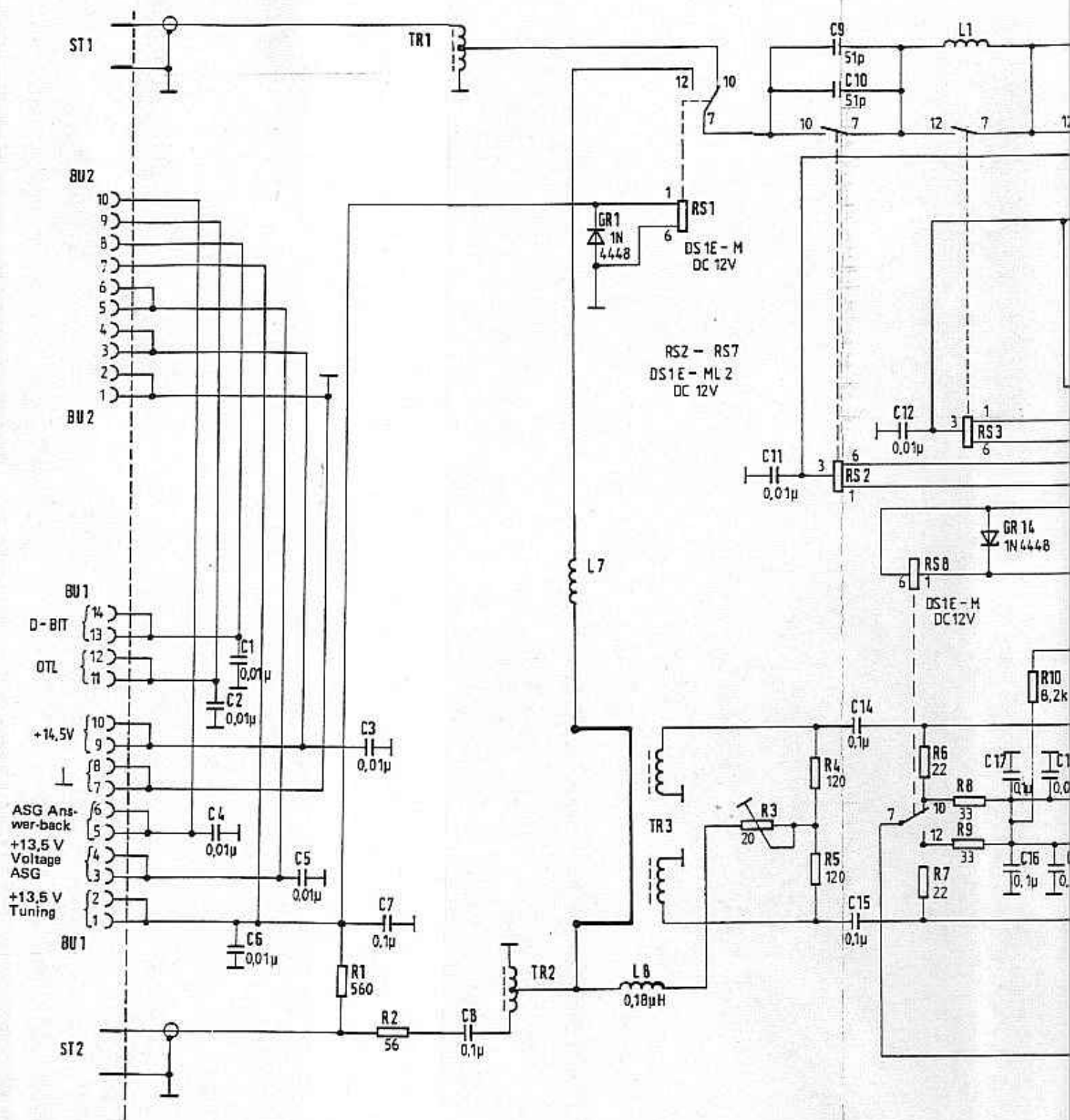
Components layout diagram
 Relay Board
 Annex 3, Sheet 3

Contact No.	I/O	Connection	Level, Explanation
1	I	RS 15 OFF	0 V (o. c.) for energized relay
2	I	RS 13 OFF	0 V (o. c.) for energized relay
3	I	RS 12 OFF	0 V (o. c.) for energized relay
4	I	RS 13 ON	0 V (o. c.) for energized relay
5	I	RS 12 ON	0 V (o. c.) for energized relay
6	I	RS 11 ON	0 V (o. c.) for energized relay
7		Chassis	0 V
8	I	RS 10 OFF	0 V (o. c.) for energized relay
9		Chassis	0 V
10	I	RS 10 ON	0 V (o. c.) for energized relay
11	O	OTL	0 V for > 90 °C
12	I	RS 14 OFF	0 V (o. c.) for energized relay
13	I	Strobe C	+14.5 V (o. c.) for energized relay
14	I	RS 14 ON	0 V (o. c.) for energized relay
15	I	Strobe C	+14,5 V (o. c.) for energized relay
16	I	RS 9 OFF	0 V (o. c.) for energized relay
17	I	RS 15 ON	0 V (o. c.) for energized relay
18	I	RS 9 ON	0 V (o. c.) for energized relay
19	I	RS 11 OFF	0 V (o. c.) for energized relay
20	I	RS 8 ON	0 V (o. c.) for energized relay
21		free	
22	I	RS 8 OFF	0 V (o. c.) for energized relay
23		free	
24	I	RS 6 ON	0 V (o. c.) for energized relay
25		free	
26	I	RS 4 ON	0 V (o. c.) for energized relay
27		free	
28	I	RS 4 OFF	0 V (o. c.) for energized relay
29		free	
30	I	RS 6 OFF	0 V (o. c.) for energized relay
31		free	
32	I	RS 7 ON	0 V (o. c.) for energized relay
33		free	
34	I	RS 3 ON	0 V (o. c.) for energized relay
35		free	
36		free	
37	I	Strobe L	+14,5 V (o. c.) for energized relay
38	I	Strobe L	+14,5 V (o. c.) for energized relay
39		free	
40		free	
41		free	
42	I	RS 3 OFF	0 V (o. c.) for energized relay

continued on page 5

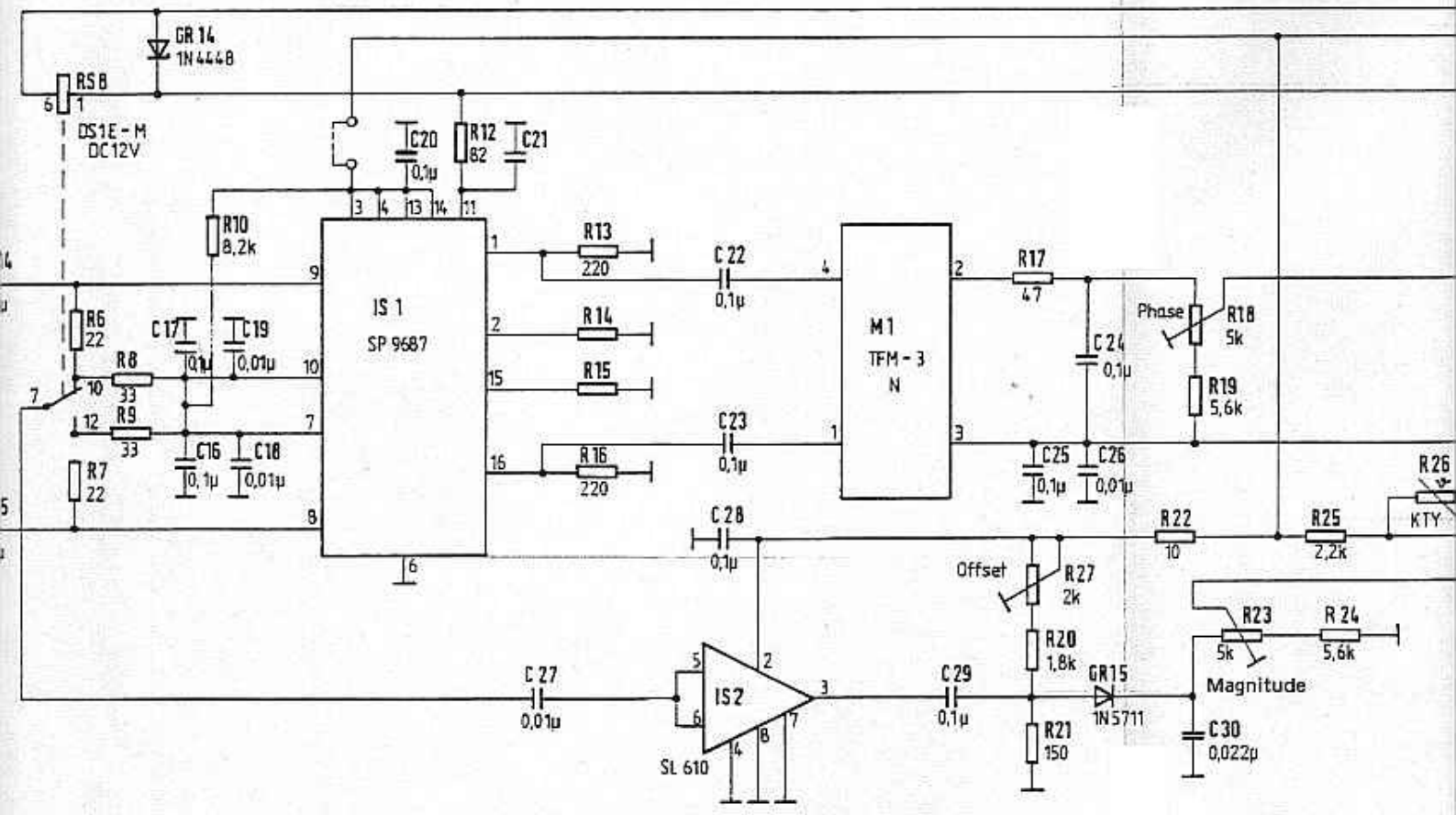
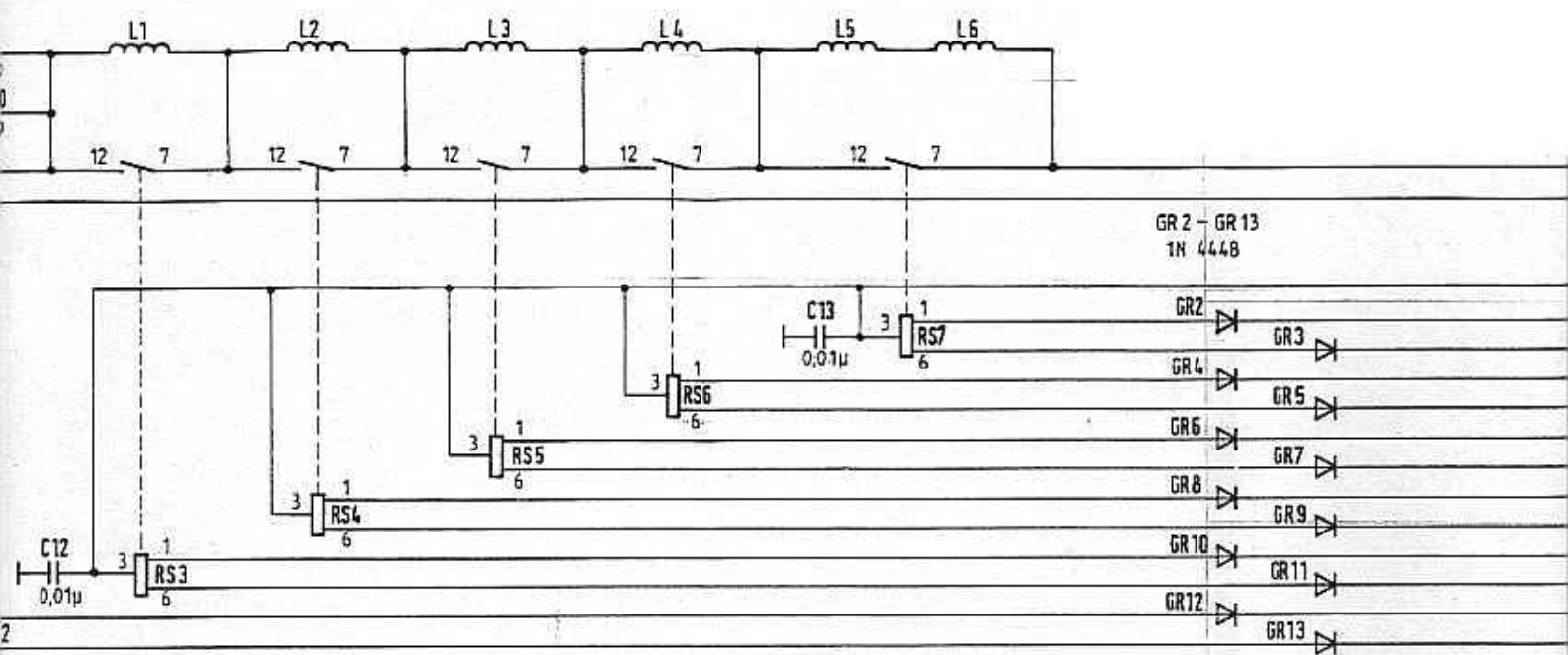
Contact No.	I/O	Connection	Level, Explanation
43		free	
44	I	RS 7 OFF	0 V (o. c.) for energized relay
45		free	
46	I	RS 2 ON	0 V (o. c.) for energized relay
47		free	
48		free	
49		free	
50		free	
51		free	
52	I	RS 2 OFF	0 V (o. c.) for energized relay
53		free	
54	I	RF	1.26 (eff) RF current
55		free	
56	I	RF	1.26 (eff) RF current
57		free	
58		free	
59	I	RS 5 OFF	0 V (o. c.) for energized relay
60	I	RS 1 OFF	0 V (o. c.) for energized relay
61	I	RS 5 ON	0 V (o. c.) for energized relay
62	I	RS 1 ON	0 V (o. c.) for energized relay

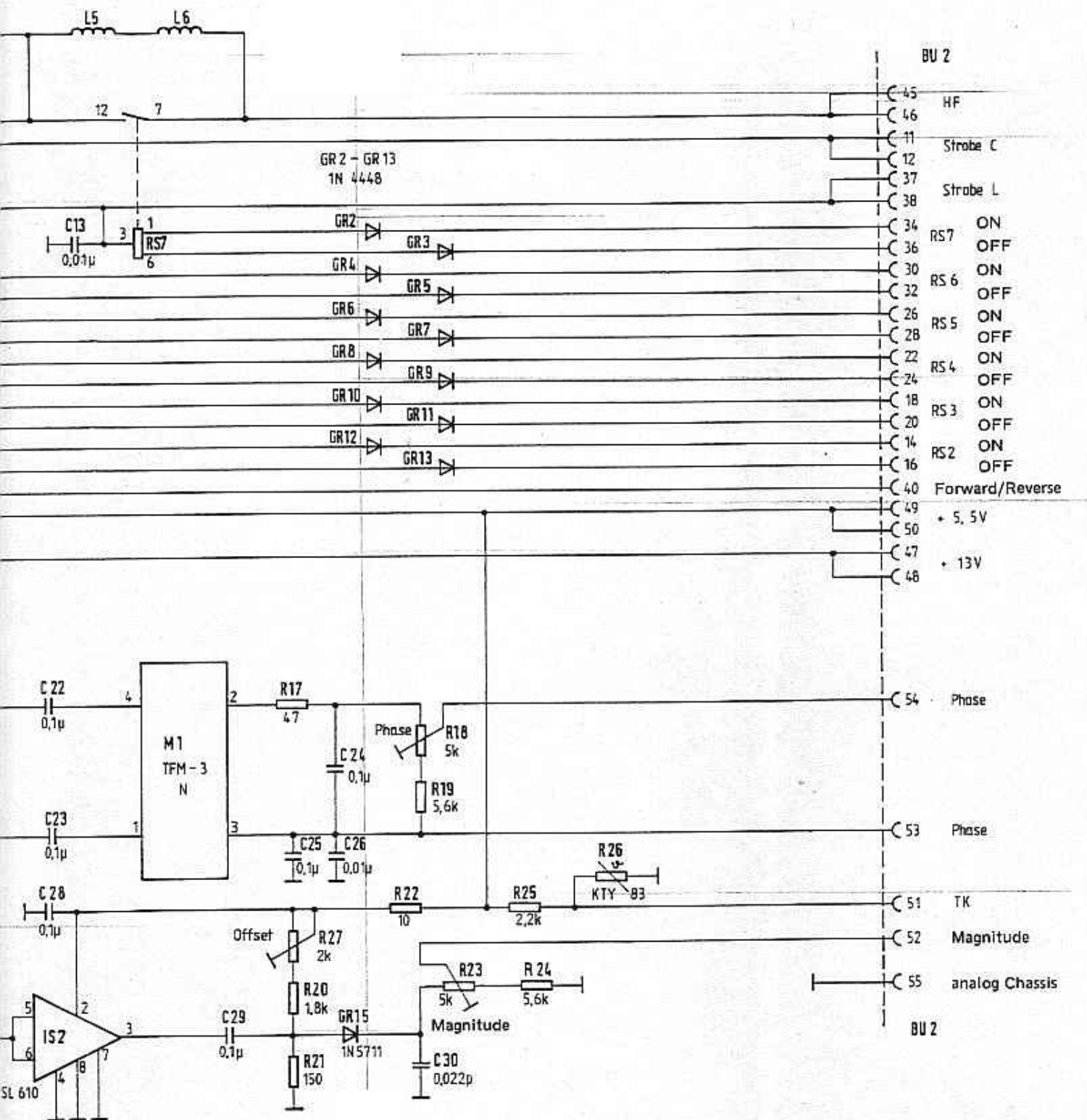
I = Input
 O = Output
 o. c. = open collector



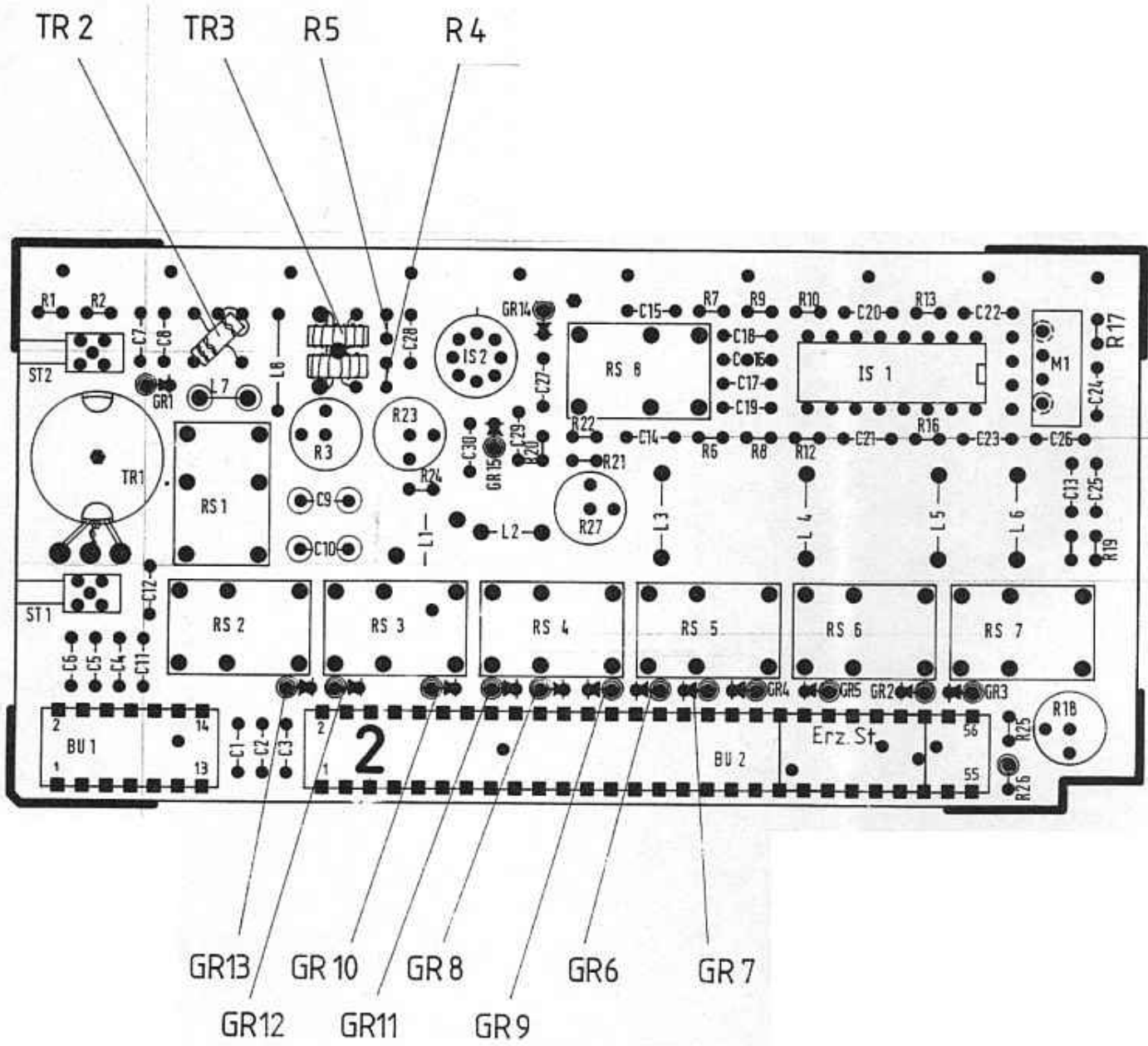
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Circuit diagram
Sensor 1
Annex 4, Sheet 1



Components layout diagram
 Sensor 1
 Annex 4, Sheet 2

Contact No.	I/O	Connection	Level, Explanation
1	I	+13.5 V Tuning	13.5 V during tuning process
2	I	+13.5 V Tuning	13.5 V during tuning process
3	I	+13.5 V Voltage ASG	13.5 V during tuning process
4	I	+13.5 V Voltage ASG	13.5 V during tuning process
5	O	ASG-Answer-Back	+13.5 V (o. c.), 0 V during tuning process
6	O	ASG-Answer-Back	+13.5 V (o. c.), 0 V during tuning process
7		Chassis	
8		Chassis	
9	I	+14.5 V	14.5 V service voltage
10	I	+14.5 V	14.5 V service voltage
11	O	OTL	0 V for $> 90^{\circ}\text{C}$
12	O	OTL	0 V for $> 90^{\circ}\text{C}$
13	I	D-Bit	CMOS
14	I	D-Bit	CMOS
			0 V $\hat{=}$ transmission frequency ≥ 8.3 MHz
			13.5 V $\hat{=}$ transmission frequency < 8.3 MHz

I = Input
 O = Output
 o. c. = open collector
 OTL = overtemperature line

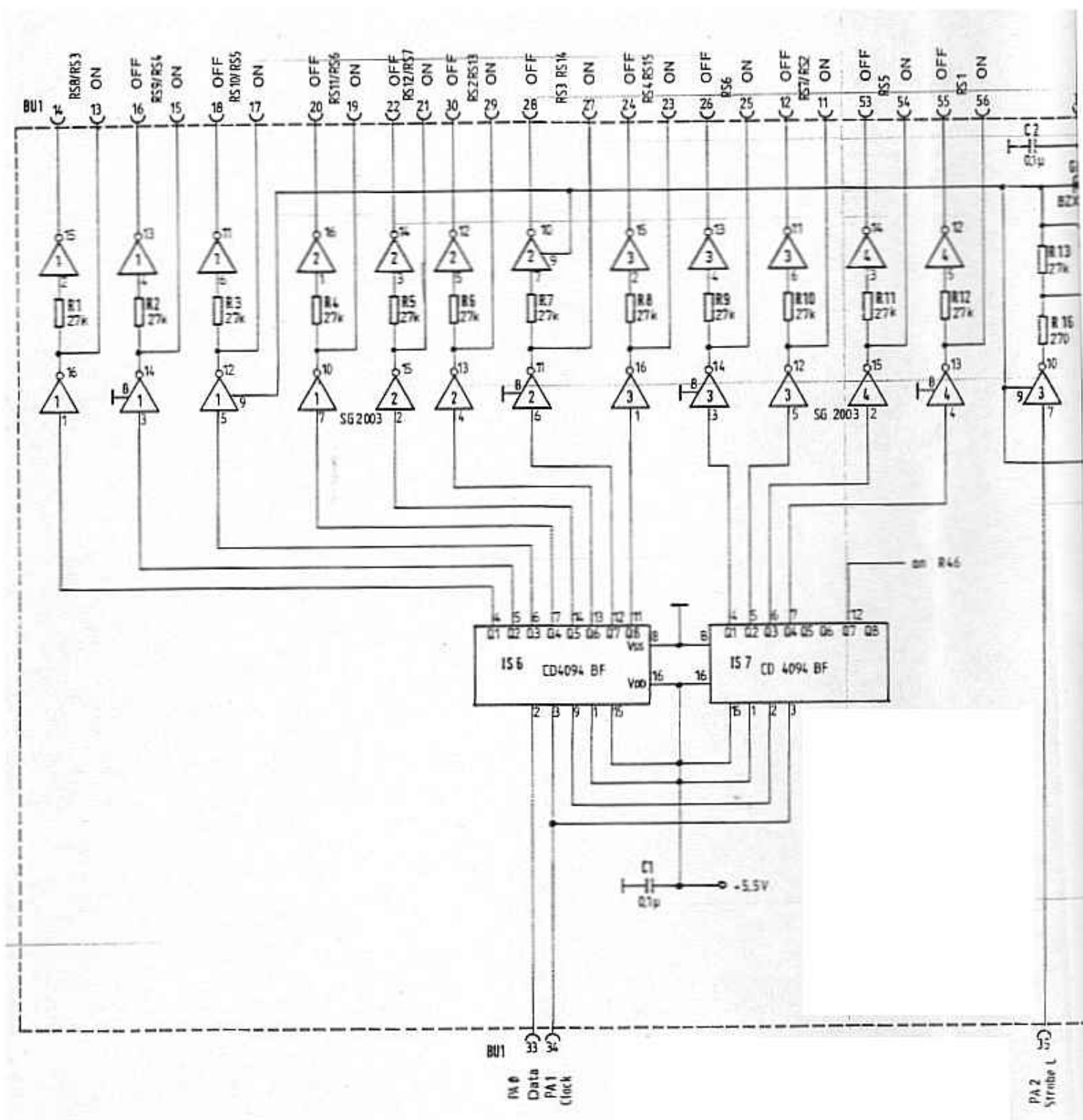
Contact No.	I/O	Connection	Level, Explanation
1		Chassis	0 V
2		Chassis	0 V
3	I	+14.5 V	+14.5 V service voltage
4	I	+14.5 V	+14.5 V service voltage
5	I	+13.5 V Voltage ASG	+13.5 V during tuning process
6	I	+13.5 V Voltage ASG	+13.5 V during tuning process
7	I	+13.5 V Tuning	+13.5 V during tuning process
8	I	D-Bit	13.5 V CMOS
9	O	OTL	0 V, active low for > 90 °C
10	O	ASG-Answer-Back	+13.5 V (o. c.)
11	I	Strobe C	+14.5 V (o. c.) for energized relay
12	I	Strobe C	+14.5 V (o. c.) for energized relay
13		free	
14	I	RS 2 ON	0 V (o. c.) for energized relay
15		free	
16	I	RS 2 OFF	0 V (o. c.) for energized relay
17		free	
18	I	RS 3 ON	0 V (o.c.) for energized relay
19		free	
20	I	RS 3 OFF	0 V (o. c.) for energized relay
21		free	
22	I	RS 4 ON	0 V (o. c.) for energized relay
23		free	
24	I	RS 4 OFF	0 V (o. c.) for energized relay
25		free	
26	I	RS 4 OFF	0 V (o. c.) for energized relay
27		free	
28	I	RS 5 OFF	0 V (o. c.) for energized relay
29		free	
30	I	RS 6 ON	0 V (o. c.) for energized relay
31		free	
32	I	RS 6 OFF	0 V (o. c.) for energized relay
33		free	
34	I	RS 7 ON	0 V (o. c.) for energized relay
35		free	
36	I	RS 7 OFF	0 V (o. c.) for energized relay
37	I	Strobe L	+14.5 V (o. c.) for energized relay
38	I	Strobe L	+14.5 V (o. c.) for energized relay
39		free	
40	I	Forward/Reverse	0 V (o. c.)
41		free	
42		free	

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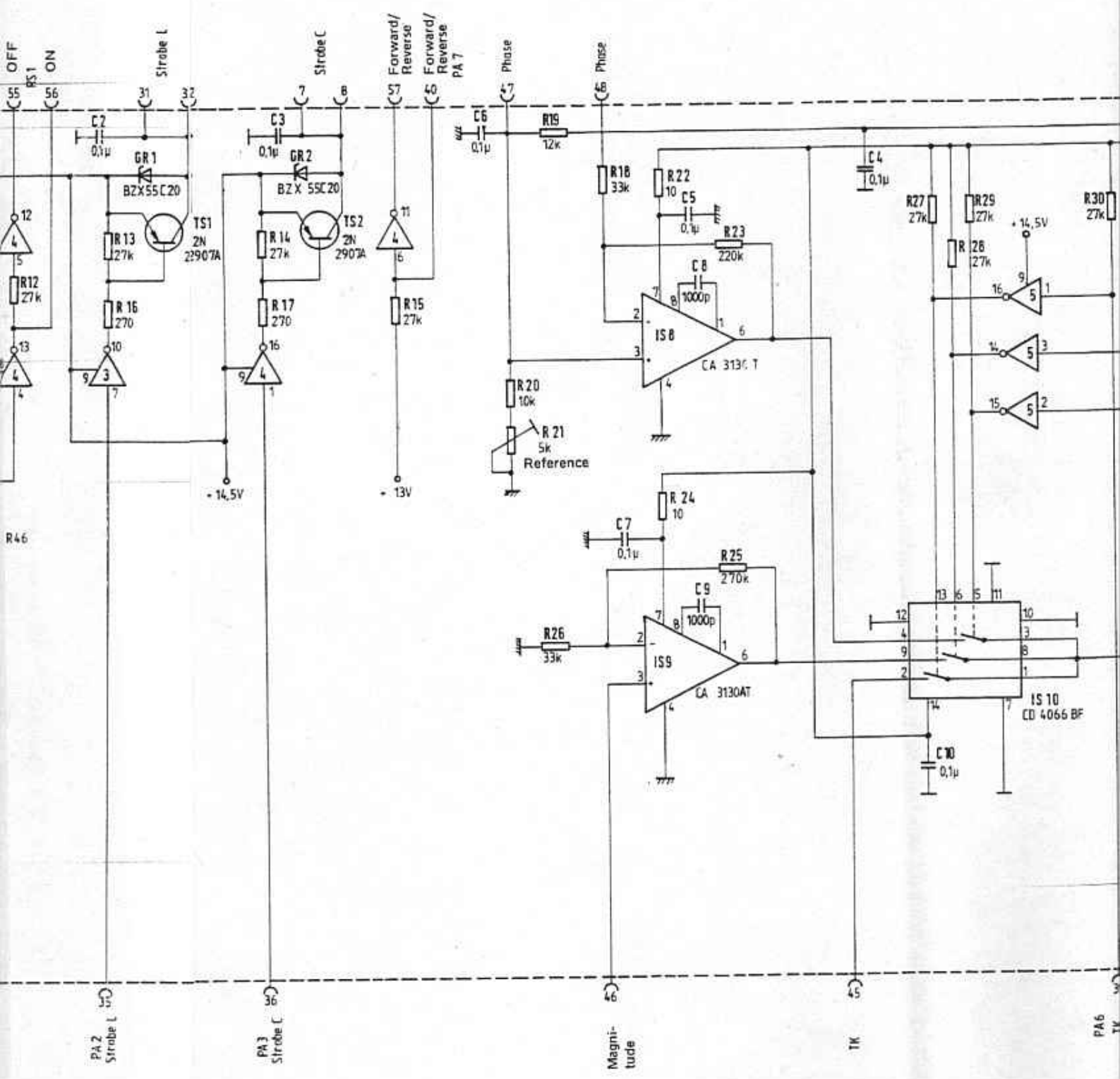
Contact functions list
 Jack BU 2, Sensor 1
Annex 4, Sheet 4

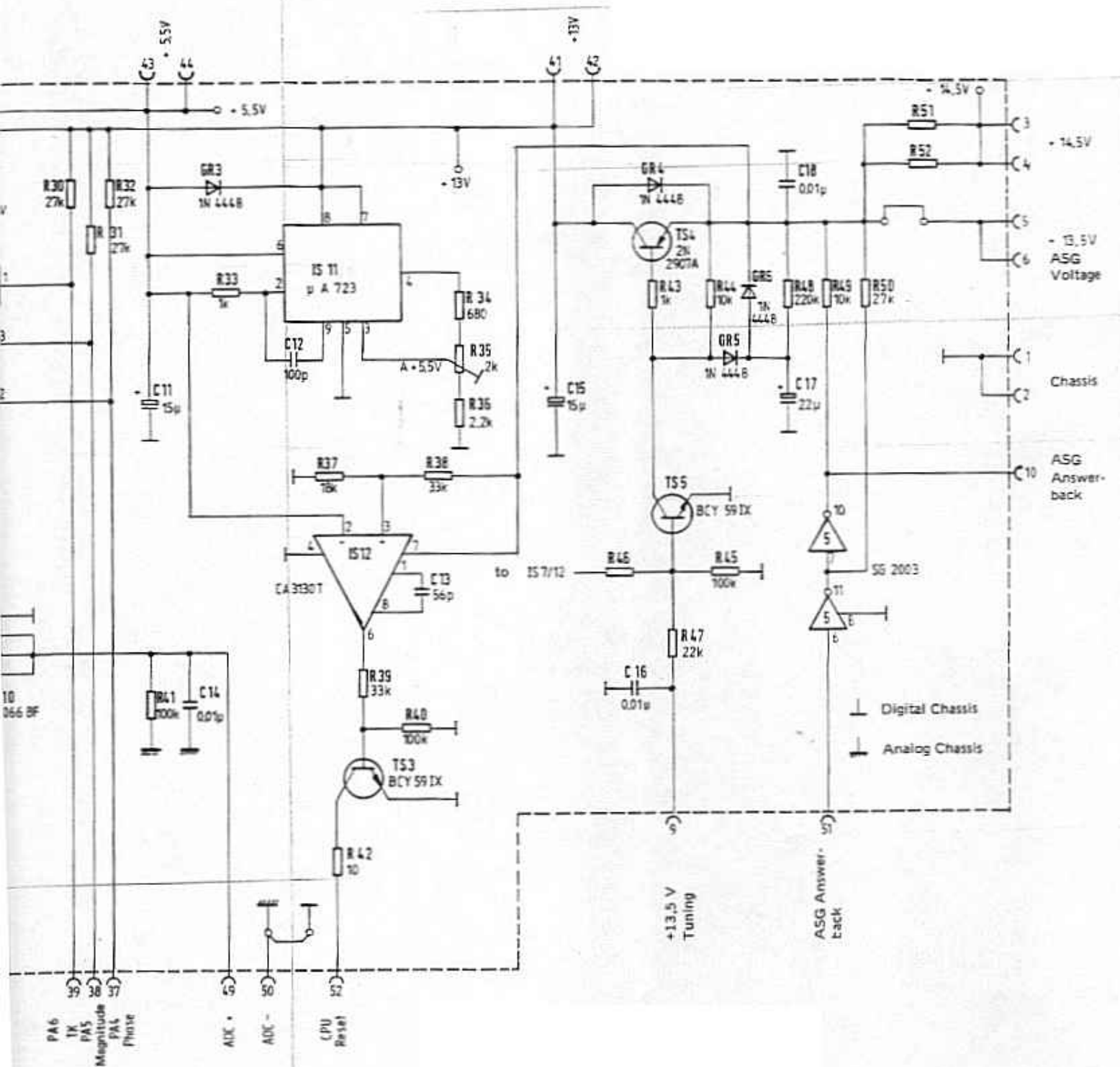
Contact No.	I/O	Connection	Level, Explanation
43		free	
44		free	
45	O	RF	1.26 A (eff) RF current
46	O	RF	1.26 A (eff) RF current
47	I	+13 V	+13 V service voltage
48	I	+13 V	+13 V service voltage
49	I	+5.5 V	+5.5 V service voltage
50	I	+5.5 V	+5.5 V service voltage
51	O	TK	0 to +5.5 V
52	O	Magnitude	0 to +500 mV
53	I	Phase	2.75 V
54	O	Phase	2.55 to +2.95 V
55	O	Analog Chassis	0 V
56		free	

I = Input
 O = Output
 o. c. = open collector
 TK = temperature compensation
 RS = relay

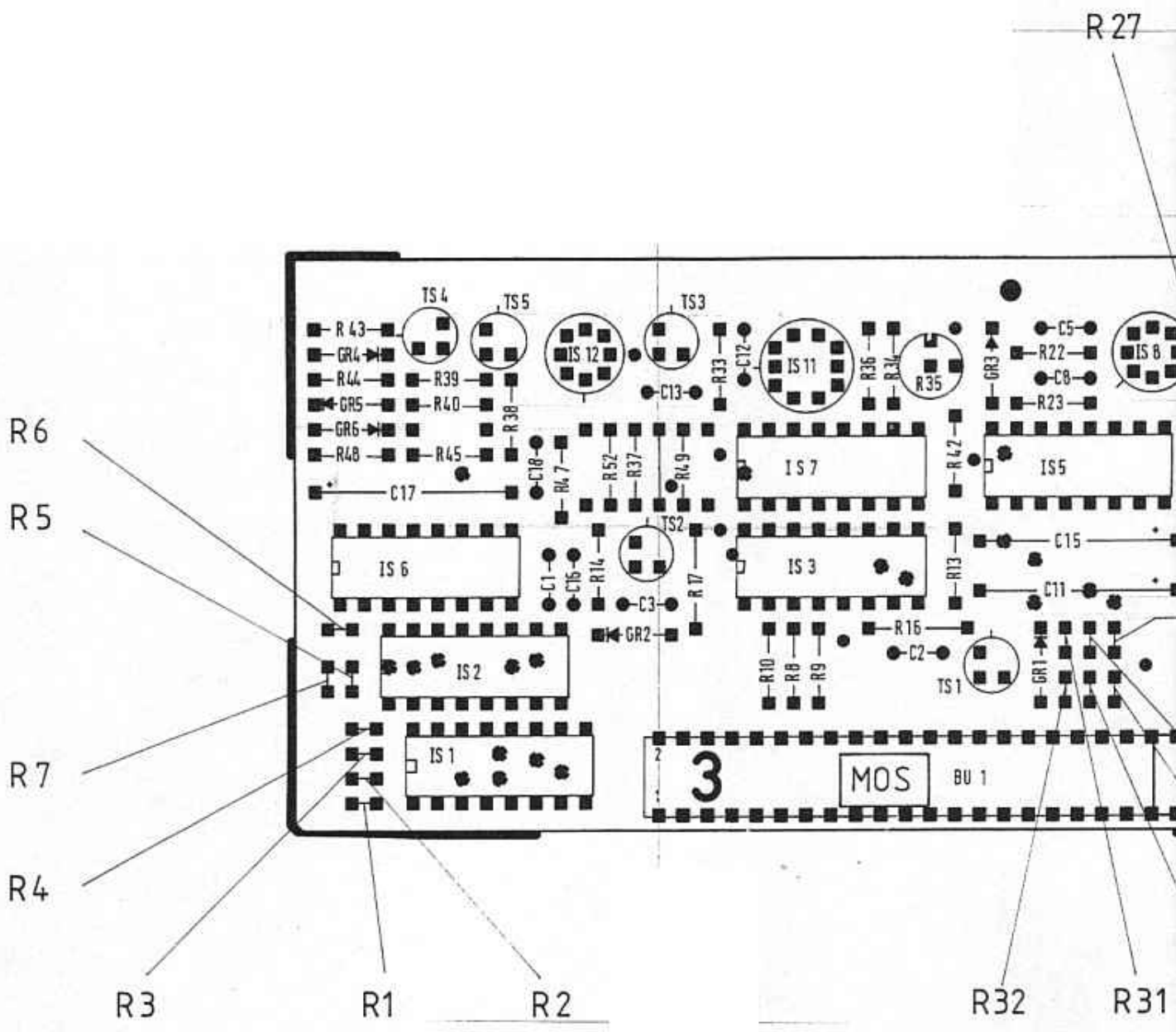


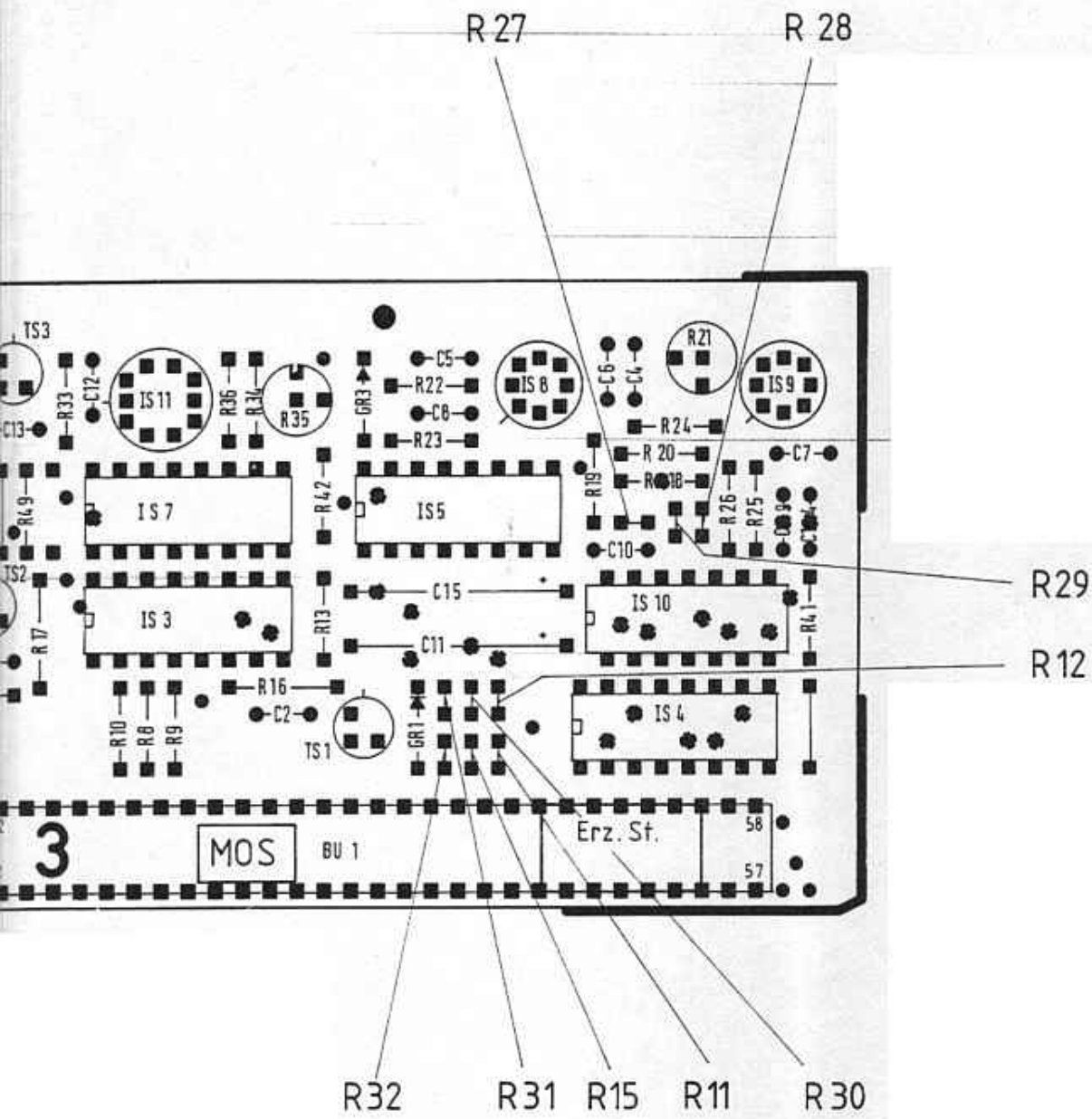
52.6861.135.00 (EL) STR (01)
 ASG 6861





Circuit diagram
Sensor 2
Annex 5, Sheet 1





Components layout diagram
 Sensor 2
 Annex 5, Sheet 2

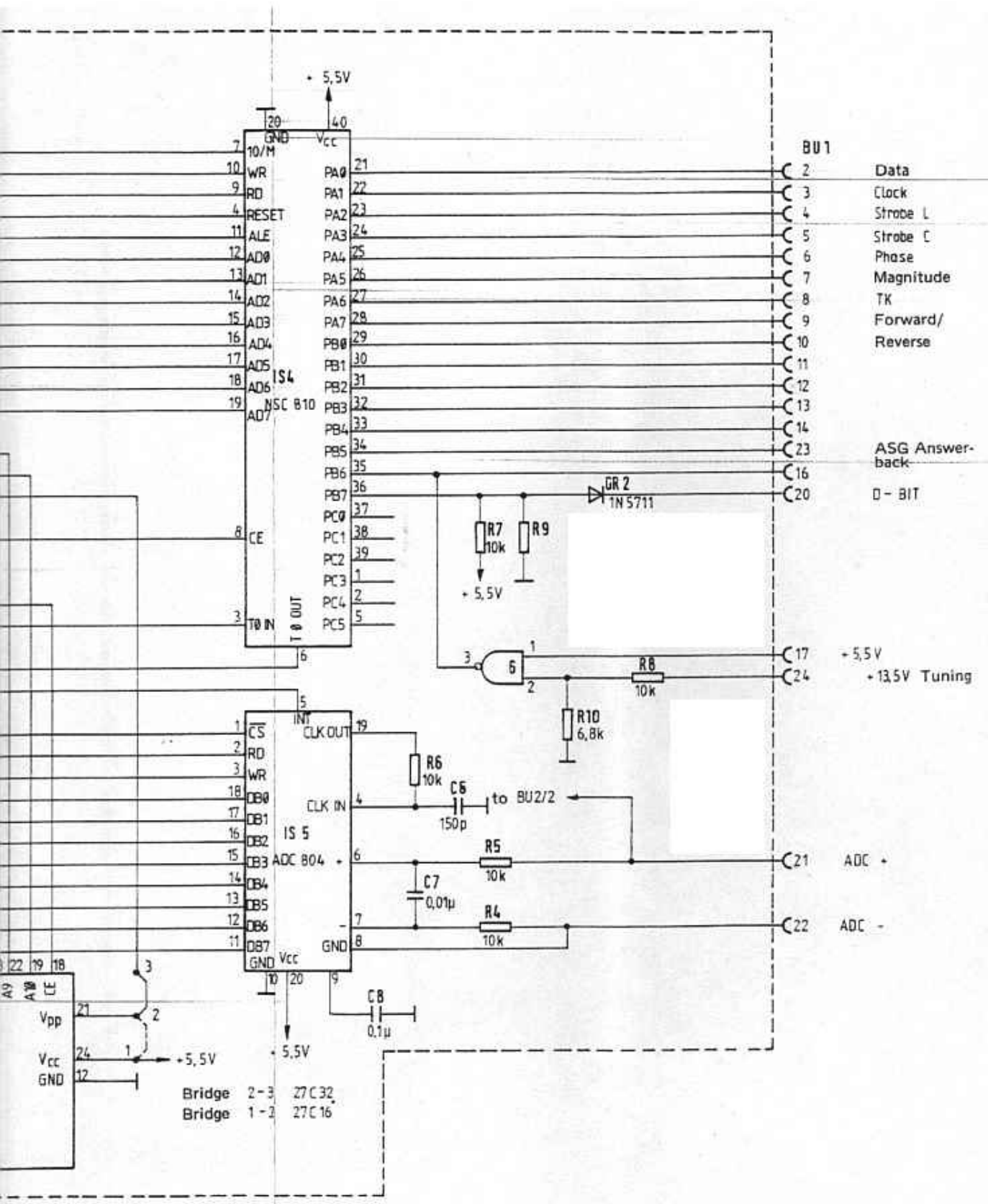
Contact No.	I/O	Connection	Level, Explanation
1		Chassis	0 V
2		Chassis	0 V
3	I	+14.5 V	+14.5 V service voltage
4	I	+14.5 V	+14.5 V service voltage
5	I	+13.5 V Voltage ASG	+13.5 V during tuning process
6	I	+13.5 V Voltage ASG	+13.5 V during tuning process
7	O	Strobe C	+14.5 V for energized relay
8	O	Strobe C	+14.5 V for energized relay
9	I	+13.5 V Tuning	0 V during tuning process (o. c.)
10	O	ASG-Answer-Back	+13.5 V (o. c.)
11	O	RS 7/RS 2 ON	0 V (o. c.) for energized relay
12	O	RS 7/RS 2 OFF	0 V (o. c.) for energized relay
13	O	RS 8/RS 3 ON	0 V (o. c.) for energized relay
14	O	RS 8/RS 3 OFF	0 V (o. c.) for energized relay
15	O	RS 9/RS 4 ON	0 V (o. c.) for energized relay
16	O	RS 9/RS 4 OFF	0 V (o. c.) for energized relay
17	O	RS 10/RS 5 ON	0 V (o. c.) for energized relay
18	O	RS 10/RS 5 OFF	0 V (o. c.) for energized relay
19	O	RS 11/RS 6 ON	0 V (o. c.) for energized relay
20	O	RS 11/RS 6 OFF	0 V (o. c.) for energized relay
21	O	RS 12/RS 7 ON	0 V (o. c.) for energized relay
22	O	RS 12/RS 7 OFF	0 V (o. c.) for energized relay
23	O	RS 4/RS 15 ON	0 V (o. c.) for energized relay
24	O	RS 4/RS 15 OFF	0 V (o. c.) for energized relay
25	O	RS 6 ON	0 V (o. c.) for energized relay
26	O	RS 6 OFF	0 V (o. c.) for energized relay
27	O	RS 3/RS 14 ON	0 V (o. c.) for energized relay
28	O	RS 3/RS 14 OFF	0 V (o. c.) for energized relay
29	O	RS 2/RS 13 ON	0 V (o. c.) for energized relay
30	O	RS 2/RS 13 OFF	0 V (o. c.) for energized relay
31		Strobe L	+14.5 V (o. c.) for energized relay
32		Strobe L	+14.5 V (o. c.) for energized relay
33	I	PA 0 Data	5.5 V CMOS
34	I	PA 1 Clock	5.5 V CMOS
35	I	PA 2 Strobe L	5.5 V CMOS
36	I	PA 3 Strobe C	5.5 V CMOS
37	I	PA 4 Phase	5.5 V CMOS
38	I	PA 5 Magnitude	5.5 V CMOS
39	I	PA 6 TK	5.5 V CMOS
40	I	PA 7 Forward/ Reverse	5.5 V CMOS
41	O	+13 V	+13 V service voltage
42	O	+13 V	+13 V service voltage

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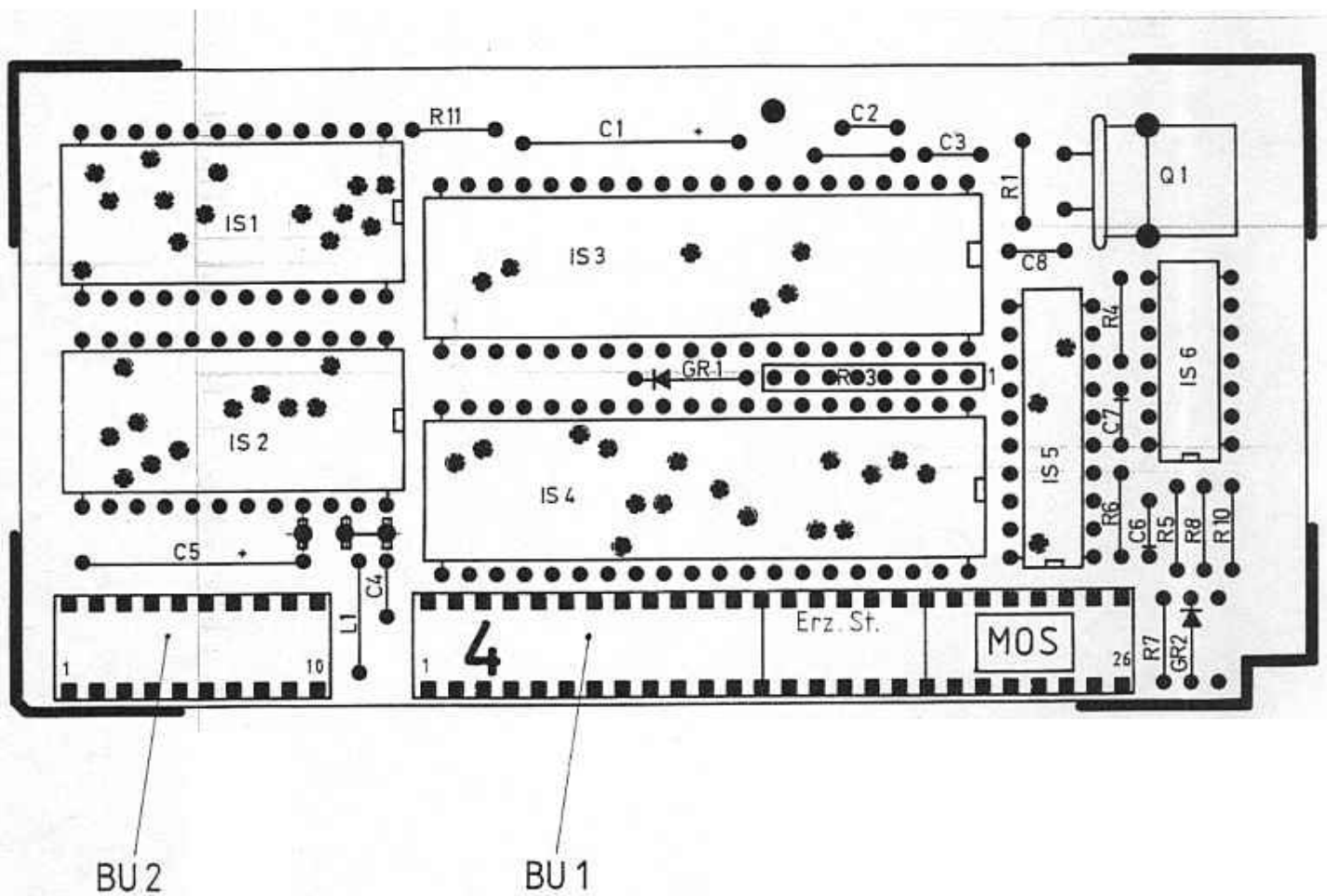
Contact functions list
Jack BU 1, Sensor 2
Annex 5, Sheet 3

Contact No.	I/O	Connection	Level, Explanation
43	O	+5.5 V	+5.5 V service voltage
44	O	+5.5 V	+5.5 V service voltage
45	I	TK	0 to +5.5 V
46	I	Magnitude	0 to +500 mV
47	I	Phase	+2.55 V to +2.95 V
48	O	Phase	+2.75 V
49	O	ADC +	0 to +5.5 V
50	O	ADC -	0 V
51	I	ASG-Answer-Back	5.5 V CMOS
52	O	CPU Reset	o. c.
53	O	RS 5 OFF	0 V (o. c.) for energized relay
54	O	RS 5 ON	0 V (o. c.) for energized relay
55	O	RS 1 OFF	0 V (o. c.) for energized relay
56	O	RS 1 ON	0 V (o. c.) for energized relay
57	O	RS 1 ON	0 V (o. c.) for energized relay
58		free	

I = Input
 O = Output
 TK = temperature compensation
 o. c. = open collector



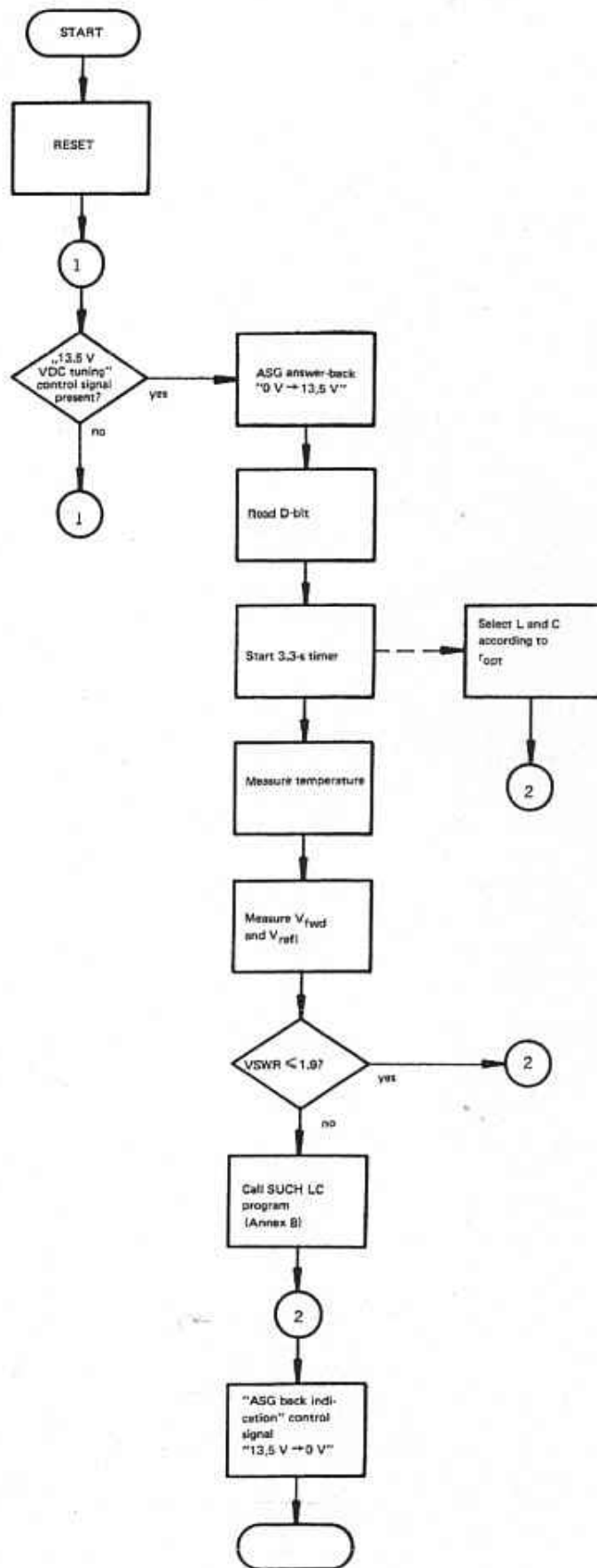
Circuit diagram
CPU
Annex 6, Sheet 1

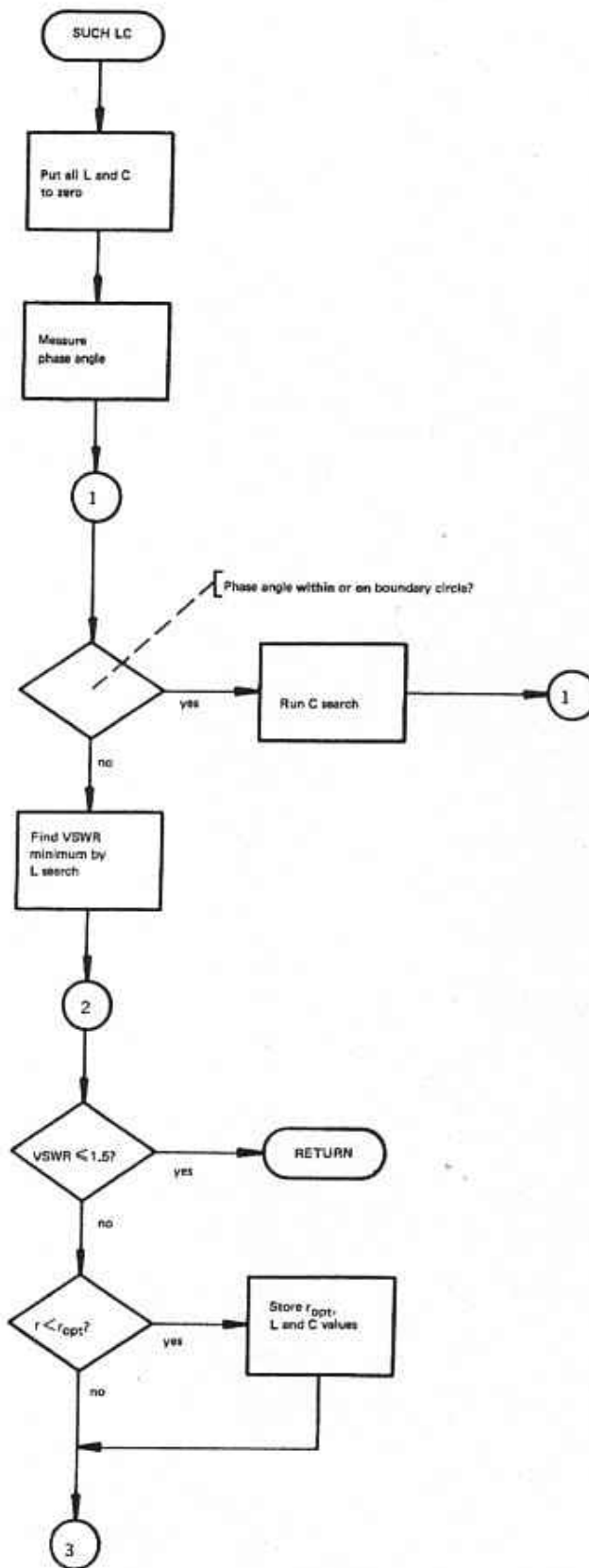


Components layout diagram
CPU
Annex 6, Sheet 2

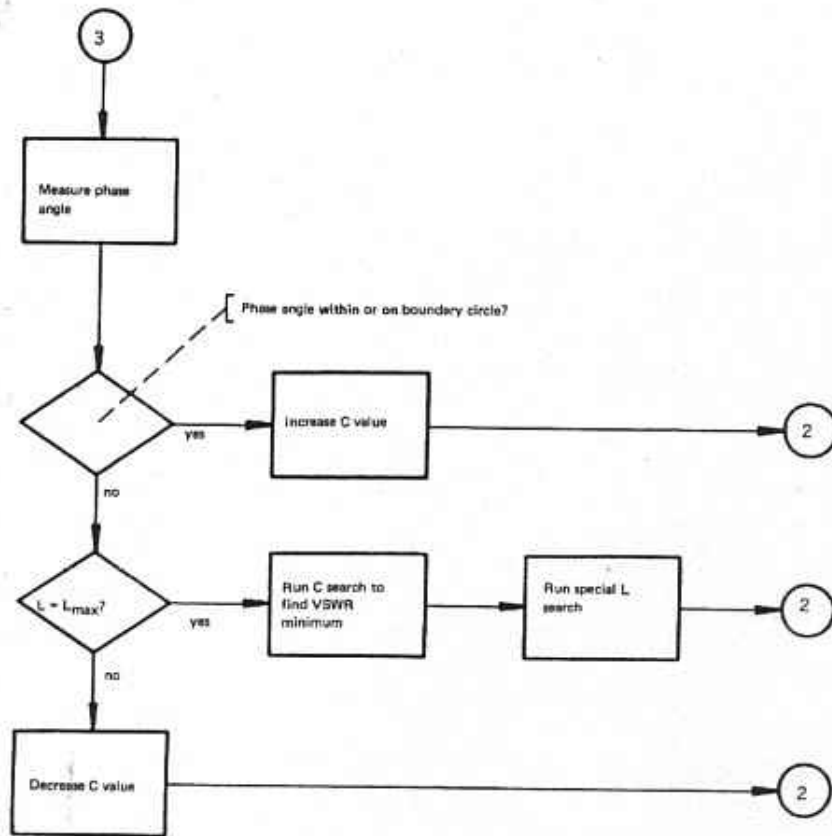
Contact No.	I/O	Connection	Level, Explanation
1		Chassis	
2	O	Data	5.5 V CMOS
3	O	Clock	5.5 V CMOS
4	O	Strobe L	5.5 V CMOS
5	O	Strobe C	5.5 V CMOS
6	O	Phase	5.5 V CMOS
7	O	Magnitude	5.5 V CMOS
8	O	TK	5.5 V CMOS
9	O	Forward/Reverse	5.5 V CMOS
10		PB 0	5.5 V CMOS
11		PB 1	5.5 V CMOS
12		PB 2	5.5 V CMOS
13		PB 3	5.5 V CMOS
14		PB 4	5.5 V CMOS
15	I	Reset	5.5 V CMOS
16		PB 6	5.5 V CMOS
17	I	+5.5 V	+5.5 V service voltage
18	I	+5.5 V	+5.5 V service voltage
19	I	+5.5 V	+5.5 V service voltage
20	I	D-Bit	13.5 V CMOS
21	I	ADC +	0 to +5.5 V
22	I	ADC - (Chassis)	0 V
23	O	ASG-Answer-Back	5.5 V CMOS
24	I	+13.5 V Tuning	+13.5 V service voltage
25		Chassis	0 V
26		Chassis	0 V

I = Input
 O = Output
 TK = temperature compensation
 PB = microprocessor port
 ADC = A/D converter test port





Flow chart
 SUCHLC Search Program, Fundamentals
Annex 8, Sheet 1



Flow chart
 SUCHLC Search Program, Fundamentals
Annex 8, Sheet 2

Pos.	Qty (*)	Description	Part No.
1	1	Mother Board	52.6861.110.00
2	1	Sensor 1	52.6861.130.00
3	1	Sensor 2	52.6861.135.00
4	1	CPU	52.6861.140.00
5	4	Flat Head Screw	5N.3025.003.14
6	1	Network	52.6861.115.00
		consisting of:	
6.1	1	Coil Board	52.6861.120.00
6.2	1	Relay PCB	52.6861.125.00

(*) = For one unit

Recommended spare parts
Antenna Tuning Unit ASG 6861
Annex 9