ROHDE&SCHWARZ

Instruments
Division

Service Manual

LEVEL METER
URV35

1020.0002.02
1020.0002.03
1020.0002.63

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Introduction

The present service manual describes calibration and repair of level meter URV35. It is included in service kit URV35-S1 (part no. 1029.2608.02) containing all instrument-specific accessories.

A list of the other measuring instruments and accessories is to be found in sections 6.2.1 (calibration) and 7.2.1 (troubleshooting).

Components of Service Kit URV35-S1:

- The present service manual providing calibration instructions, circuit diagrams, a detailed circuit description and hints for troubleshooting (part no. 1020.0960.24).
- A special adapter, which is connected for calibration instead of the normal measuring head (Cal adapter, part no. 350.7818.02).
- A $5^1/_4$" floppy disk (1.2 MB) for IBM-compatible computers containing the calibration program and utilities for troubleshooting (part no. 1029.2650.00):
  CALURV.BAS (calibration program)
  URVFEHL.BAS (plain-text error readout of the URV35)
  URVSER.BAS (URV35 in service mode)
- A modified firmware for the URV35 (service EPROM, part no. 1029.2666.00) for individually setting all analog switches and the selective call of the internal testing routines (→ 7.2.3).

6 Repair of Complete Instrument

(see complete circuit diagram 1020.0002.01S, function circuit diagram Fig. 7-7 and block diagram 1020.0502.01S sheet 1)

6.1 Function Description of Complete Instrument

Level Meter URV35 consists of the basic instrument with the main board, power supply and front panel with display and a measuring head. The measurement is made via an integrating A/D converter. Processing and filtering of the measurement results is almost exclusively performed in the microprocessor.

Since, to make the instrument reliable and easy to service, neither the main board nor the measuring head contain adjustable components, all tolerances of the Level Meter are taken into account using a special algorithm. The correction values for the main board are stored in a protected area of the battery-backed RAM, which cannot be overwritten in normal operation; the characteristics of the measuring head are stored in a read-only memory integrated into the connector housing of the measuring head.

The function circuit diagram (Fig. 7-7) permits to follow the processing path of a signal:

The **measuring head** provides at its output a DC voltage corresponding to the input RF voltage. Depending on the measuring head used, it may be bipolar or unipolar referred to the circuit ground. Depending on the RF level, the output voltage is either proportional to the input power (square-law range with RMS weighting up to approx. 22 mV_{eff} or 10 µW) or to the input voltage (linear range of the rectifier diode as of approx. 1 V_{eff} or 20 mW). The area in between is the so-called transition area with an exponent between 1 and 2 of the output voltage referred to the input power.
In order to prevent linearity errors in spite of the wide dynamic range of the RF rectifier, the diode characteristic is stored in a data memory together with other characteristics, which is inseparably connected with the measuring head. By taking into account the diode characteristics with respect to input level (linearity), test frequency (frequency response) and ambient temperature, a correct indication of the input level is always ensured automatically. For temperature compensation, all measuring heads URV5-Z.../NRV-Z... are provided with a temperature sensor installed in the measuring head.

The output DC voltage of the measuring head is amplified in the **AC probe amplifier** (all AC voltage and power sensors) or in the **DC probe amplifier** (only DC probe URV5-Z1) to such an extent that it can be taken via a **multiplexer** to the **A/D converter**.
In the microprocessor, the measurement result is processed considering all correction data (RF diode and probe amplifier) and an appropriate PWM signal for driving the **pointer instrument** or the **analog output** is generated.

Via a customer-specific circuit (D600), the processor also causes the **supply voltages of the measuring head** to be switched on and off. If the data memory contents is read out, + 5 V are applied to the appropriate terminals. If a passive measuring head is identified, the supply voltage is switched off again, whereas an active measuring head is supplied with ± 12 V after reading out is terminated.

(Controlled by the microprocessor) D600 also permits to switch over the serial data interface and the clock pulse between the measuring head and the **remote control interface**.

The serial RS-232-C interface permits virtually all functions which can be operated via the keyboard to be performed by a controller via remote control. Likewise, the measured values can be fetched via this interface and taken to the controller for further processing.
The basic instrument URV35 is available for **battery operation** (model 02) or for **AC-supply operation** from 115-V or 230-V supplies (model 03).

6.2 Calibration

Calibration and testing of the Level Meter URV35 are performed using a DC voltage calibrator. The measuring head interface is connected via a calibration adapter.

The complete procedure can be performed either automatically via the RS232 interface of the URV35 by a program (→ 6.2.5) or manually in single steps (→ 6.2.6). Computer-controlled calibration of the URV35 using the calibration program on the service floppy disk requires an IBM-compatible computer (e.g. R&S controller of the PSA family). A printer (e.g. PDN from R&S) permits to print out a test/calibration report and an error report (→ Fig. 6-1).

The program supports three of the most often used DC voltage calibrators:

- Analogic (Data Precision) 8200
- Datron 4000
- Fluke 5700.

The use of other calibrators which are not supported by the calibration program is described in section 6.2.3.

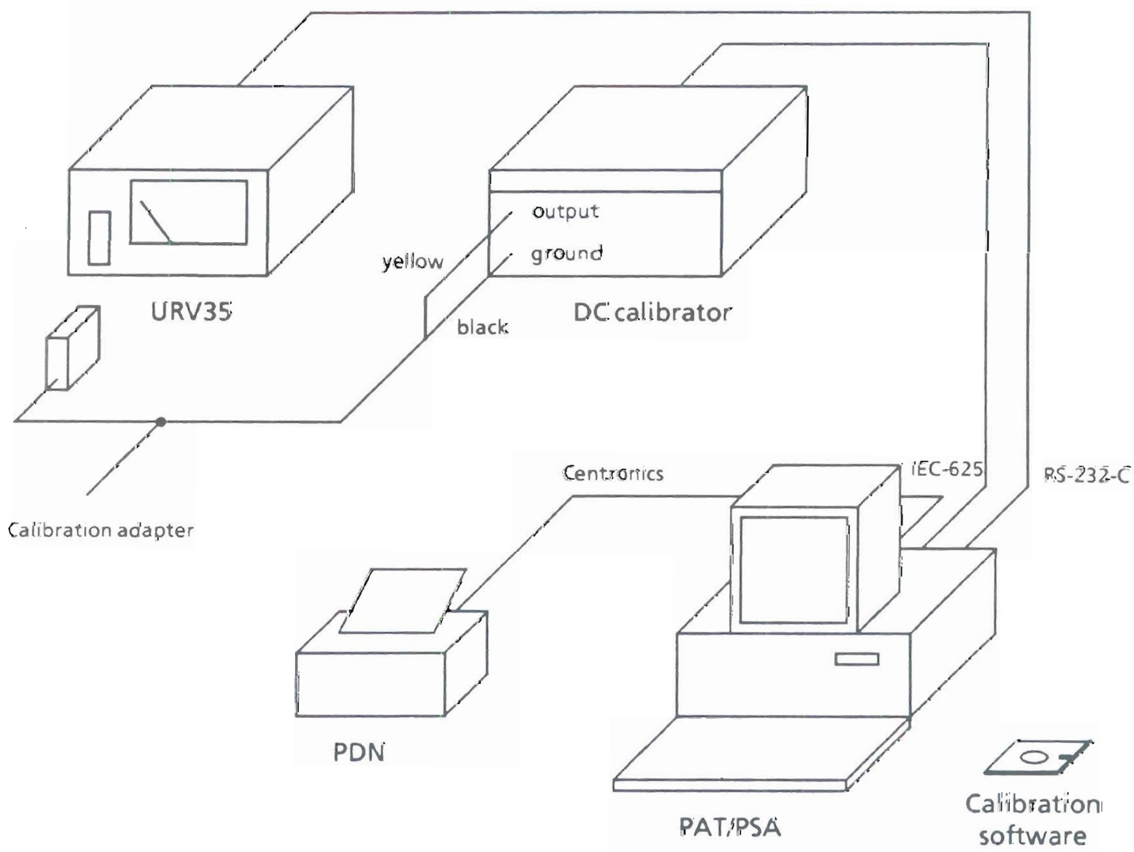


Fig. 6-1 Test setup for testing/calibrating the URV35

6.2.1 Required Measuring Equipment and Auxiliary Means

Device	Required Specifications	Appropriate instrument	R&S order no.
Cal adapter		in URV35-S1	350.7818.02
DC calibrator [1)	±0,01/0,0195/0,05 V ±0,1/0,195/0,5 V ± 1/1,95/5/10/19,5 V (0,005 %)		
Digital multimeter [2)	1 MΩ ±0,015 % [3)	UDS5	349.1510.02
Controller with RS-232-C and IEC-bus interface		PAT/PSA-Familie	
Printer		PDN	351.4512
BNC cable			
Adapter, female BNC connector on banana plug			
IEC-bus cable		PCK	292.2013
RS-232-C cable, 9-contact	Pins 2/3 crossed, 7/8 connected [4)		
Connection cable for Centronics interface (36-contact)			

1) Further characteristics of the calibrator and hints for adapting the supplied software are given in section 6.2.3.

2) The digital multimeter is required for adjusting a resistor in the cal adapter. If no UDS5 is available, the 1-MΩ resistor should be checked or adjusted without program control (→ 6.2.6.1). Adapting the supplied software to another multimeter is not worth it, since this is only needed for adjusting the 1-MΩ resistor and not for the instrument calibration proper.

3) in the restricted temperature range 23 ± 1 °C

4) for cable configuration → 3.6.1.1 in the Operating Manual

6.2.2 General Remarks on Instrument Calibration

This section briefly deals with the method of measurement used for manual verification/calibration in single steps and for the program-controlled procedure.

Since all measuring heads for the URV35 provide the basic instrument with DC voltages or DC currents, the measuring head amplifiers are also checked and calibrated with DC voltages or currents. For the AC voltage probes and power sensors, a DC voltage amplifier with 11 measurement ranges and an input for measuring the output voltage of the temperature sensor are available. For the DC Probe URV5-Z1, the basic instrument is equipped with a current/voltage converter with 4 measurement ranges.

Table 6-1 shows the individual function blocks or circuits which are to be calibrated:

Table 6-1 Instrument functions

To be calibrated:		Command
Pointer linearization		CA3
Pointer acceleration		CA3
AC probe amplifier +	(11 ranges)	CA5
AC probe amplifier −	(11 ranges)	CA5
DC probe amplifier	(4 ranges)	CA6
Temperature sensor input	100 µA	CA1
Temperature sensor input	1 mA	CA1
DC-FREQ input		CA7
DC-LEV output		CA8

For calibration of the measuring head interface (functions CA1, CA5, CA6), the voltage provided by the DC voltage calibrator is applied to the various test inputs using the cal adapter. To this end, the cal adapter contains two relays which are set by the basic instrument according to the function (→ circuit diagram of cal adapter 350.7818.01S). Table 6-2 lists the required voltages for the individual measurement ranges. The voltage/current conversion for the DC probe amplifier is performed by a variable resistor in the cal adapter (→ 6.2.5.4 and 6.2.6.1).

Table 6-2 Calibration voltages

CAL voltage V	Meas. range	Perm. offset voltage ± V	Perm. meas. range error ± %	CAL function
±0.01	1	0.00005	0.12	AC probe amplifier
±0.0195	2	0.00005	0.12	
±0.05	3	0.00005	0.12	Cal function
±0.10	4	0.00005	0.12	**CA5**
±0.195	5	0.00005	0.12	
±0.50	6	0.0002	0.12	
±1.00	7	0.0002	0.12	
±1.95	8	0.0005	0.12	
±5.00	9	0.001	0.12	
±10.0	10	0.002	0.12	
±19.5	11	0.005	0.12	
+0.10	1	0.0005	0.12	DC probe amplifier
+1.0	2	0.0005	0.12	Cal function
+10.0	3	0.005	0.12	**CA6**
+40.0	4	0.05	0.12	
−0.3	---	0.001	0.10	Input for temp. sensor Cal. function
−3.0	---	0.005	0.10	**CA1**
+10.0	---	0.005	0.12	DC-FREQ Cal-function **CA7**

As illustrated by Table 6-2, a positive and a negative voltage are required for calibration of the AC probe amplifier for each measurement range. This is due to the fact that the probe amplifier is designed as instrument amplifier with two external inputs and a separate divider is assigned to each input. One input is provided with positive, the other with negative rectified voltages (against ground) by the measuring heads. As a result of component tolerances, the division factors of the two input dividers slightly vary for voltages of positive and negative polarity and must therefore be tested and calibrated separately. The measuring heads URV5-Z2/-Z4/-Z7 and NRV-Z3/-Z4/-Z5 provide a bipolar voltage, whereas all other measuring heads provide a unipolar voltage.

In order to prevent the verifications/calibrations from being affected by offset voltages, the DC voltage calibrator is set to zero prior to each step of calibration; if possible, this should be done in the output voltage range in which the cal voltage is also set. Then the offset specific to this setting of calibrator and basic instrument is determined by the basic instrument and taken into account in the calibration and verification.

Almost the complete calibration of the analog section can be performed automatically. The only exception is the calibration of the pointer instrument, since in this case visual checking of the pointer deflection is necessary. With the aid of the calibration program supplied with the service kit, this adjustment can be performed in interactive mode.

The correction factors determined in the calibration are stored in a write-protected area of the battery-backed RAM. To cancel the write protection, the shorting jumper on connector X717 must be reconnected to the indicated position before calibration (→ Fig. 6-2).

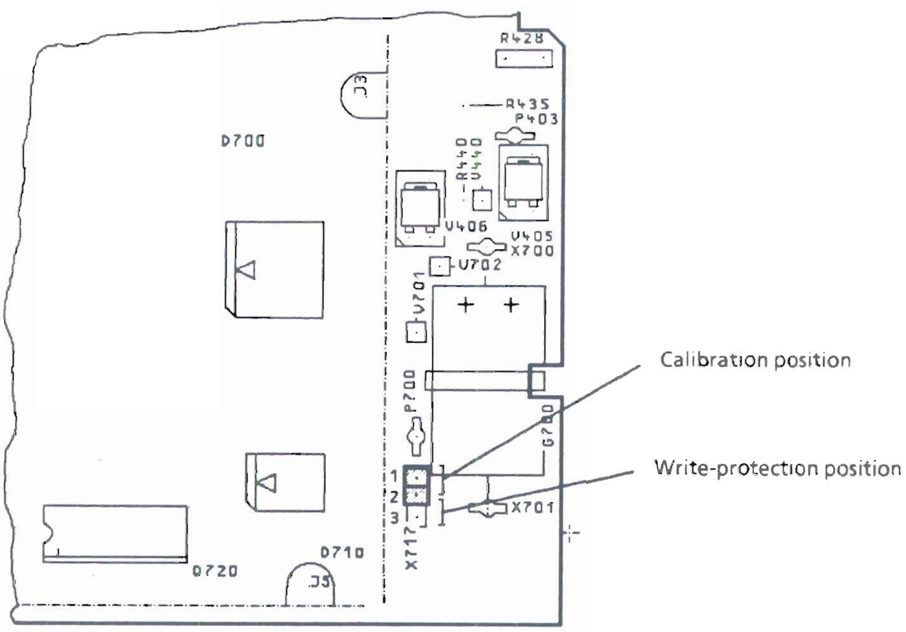


Fig. 6-2 Position of calibration connector X717

6.2.3 Requirements Placed on the DC Voltage Calibrator

The verification/calibration program for the URV35 has been written for the following DC voltage calibrators:

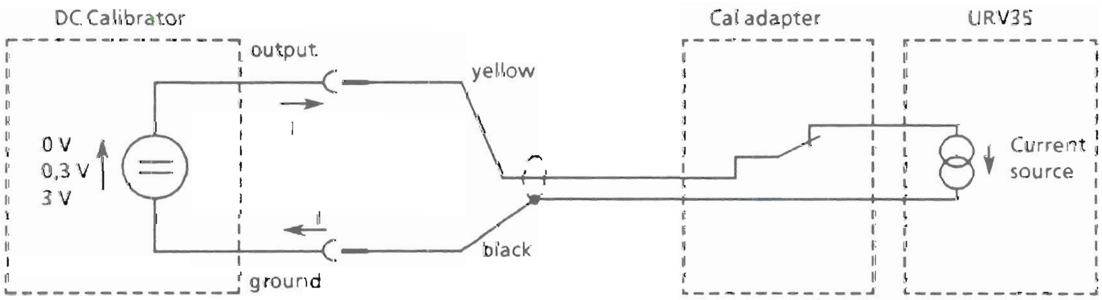
Analogic (Data Precision) 8200
Datron 4000
Fluke 5700

When using other calibrators, check whether the requirements given below are met. Besides, the software is to be adapted.

- It must be possible to set the calibrator to the voltages specified in Table 6-2.
- It must be possible to set the calibrator to zero in the output voltage range relevant to the current cal voltage (offset measurement, see the relevant remarks in section 6.2.2).
- The calibrator must act as a current sink (a few mA) for the output voltages -3 V / -0.3 V / 0 V. For further details see below.
- The output terminals must be floating (otherwise, the measurements may be impaired by current loops).
- It must be possible to change the polarity without having to reconnect the cal adapter.
- The calibrator must be remote-controllable via the IEC bus.

The cal voltages up to 0.1 V must be tapped at the rear 100-mV output in the case of model 8200. During the program-controlled verification/calibration run, the user is requested via the screen to reconnect the cal adapter.

With the basic unit connected, the cal adapter generally acts on the DC voltage calibrator as a resistive load of 1 to 10 MΩ. Only when testing or calibrating the temperature sensor input does the basic unit operate as a source, providing a current of max. 2 mA (→ Fig. 6-3). However, the output voltage of the calibrator must not be changed by this. It is to be checked whether the calibrator used still provides the set voltage at its output terminals in this operating mode. In general, this is guaranteed in the case of modern calibrators with a bipolar output stage.



Calibration range	Current	
−0,3 V	100 µA	during the calibration phase and during offset measurement
−3,0 V	1 mA 2 mA	during the calibration phase during offset measurement

Fig. 6-3 Current flow during calibration of the temperature sensor input

Software adaptation:

Lines 2040 to 2570 (variables for calibrator ...) list the string constants for the three DC calibrators supported by the program. In order to use a different calibrator, one of these fields of constants is to be rewritten.
In addition, enter the name of the calibrator in lines 8900 to 9120 (Select Calibrator) if required and make sure that the rewritten block of variables is selected in lines 990 to 1030 (reading in of the calibrator variables).

An IEC-bus address that has been changed need not be corrected in the program listing. A check is made in the program run to determine whether a remote-controllable device can be addressed under this address.

6.2.4 Requirements Placed Upon the Controller

- R&S Controller PAT/PSA or IBM-PC/XT/AT/386/486
- Graphic card Hercules/EGA/VGA.
- IEC-bus card and driver PAT-B1, Id.-Nr. 1007.1150.02
  (compatible in terms of function with the PCIIA card from National).
- Serial interface (COM1:) for controlling the URV35.
- Parallel interface (LPT1:) for printer connection.

If the controller used is equipped with a Hercules card, the command "hercsup" must be entered from the MS-DOS level before starting the program in order to make sure that the R&S BASIC provides correct graphics support. When using the other graphic cards, not presetting is required.

6.2.5 Program-controlled Calibration/Verification

6.2.5.1 General

The test setup can be seen from Fig. 6-1. The printer can be dispensed with if no documentation of the calibration or verification results is necessary. If no Digital Multimeter UDS5 is available, the cal adapter is to be adjusted or checked according to section 6.2.6.1.

Make sure that, for calibration, all devices used are allowed for a warm-up time of at least one hour and the ambient temperature lies within the range of 23 ± 1 °C. The AC supply voltage should not deviate by more than ± 10 % from the nominal value, the relative humidity should lie below 80 %.

6.2.5.2 Loading and Starting of the Programs

The calibration program on the floppy disk is assigned the name **CALURV.BAS** and is written in the programming language R&S BASIC. It can be run immediately under the R&S BASIC interpreter **basic.com** which is also supplied.

The floppy disk also contains the required BASIC drivers for controlling the IEC-bus and the RS-232-C interface. The program **basinst.exe** handles the complete BASIC installation. A subdirectory "\rs-driv" is created on the hard disk for the device drivers required by BASIC, and the files "config.sys" and "autoexec.bat" are extended accordingly. The already existing files config.sys and autoexec.bat are saved in the subdirectory \rs-driv.
The "basic.com" file proper is loaded into the root directory by the installation program with the aid of the DOS prompt C: **>**.

Starting the installation program

- Insert floppy disk into drive A:.
- Enter **A**: (change to drive A:).
- Enter **BASINST** (start installation program).
- After the installation is finished, remove the floppy disk from drive A and restart the controller (**Ctrl + Alt + Del = Strg + Alt + Entf**). This restart is necessary to enable the controller to configure the required interfaces.

Copying the calibration and service programs to the hard disk:

- Create subdirectory (e.g. c:\urv35).
- Insert floppy disk into drive A:.
- Copy the files **calurv.bas**, **urvfehl.bas** and **urvser.bas** from the floppy disk to the subdirectory.

After termination of this procedure, all required programs are contained in the subdirectory c:\urv35.

Loading the calibration program into the main memory:

- Start BASIC: Enter the command basic from the MS-DOS level (subdirectory \urv35) and acknowledge using the ENTER key.
- Press function key F5 and add **CALURV** to the Load command that appears or enter **LOAD:CALURV**. Then press the Enter key.

Starting the calibration program:

- Press function key **F2** or
- enter **RUN** via the keyboard and acknowledge using the Enter key.

6.2.5.3 Input/Output Menus

After the program start, the program heading with the version number (e.g. 1.0) appears for about 1.5 s. Then the following menu can be seen on the screen:

```
                Main Menu

     Cal-Adapter Adjustment      <A>
     URV35 Verification          <V>
     URV35 Calibration           <C>
     Calibration Factors         <F>
     Calibration Dates           <D>

     End of Program              <E>


   Ensure: Baudrate 9600 and no Parity
```

The order in the menu is not arbitrary but reflects the recommended timing sequence:

- Before calibrating the instrument, make sure that the variable resistor in the cal adapter lies within the permissible tolerances. Menu item "Cal-Adapter Adjustment <A>" is used for checking this and for the adjustment, if necessary (for greater details refer to section 6.2.5.4).

- To determine the drift since the last calibration it is recommended to perform a verification prior to the calibration. This serves to prevent that a faulty instrument may be "repaired" by the calibration (menu item "URV35 Verification <V>", see also section 6.2.5.5).

- Then perform the instrument calibration proper (menu item "urv35 Calibration <C>", see section 6.2.5.6).

- The calibration factors determined during the last calibration can be quickly checked using menu item "Calibration Factors <F>". The factors stored in the URV35 are read out under program control and output on the screen or on a printer.

- The menu item "Calibration Dates <D>" permits to interrogate the dates of calibration of the individual function blocks. It can be called up before or after a calibration. If this item is called up following a complete calibration, the current date is output for all function blocks. Besides, the information whether a complete (C) or only a partial (P) calibration has been performed is also given.

In order for the data transfer between controller and URV35 to function properly make sure that the interface parameters (baud rate and parity check) comply with each other:

Setting on the URV35:

- Press the SPEC key.
- Press the right menu key repeatedly until **RS232** appears above the left menu key.
- Press the left menu key.
- Select the message **Baud** by pressing the left menu key.
- Set 9600 bauds and confirm by pressing the right menu key (STO).
- Press the SPEC key.
- Press the right menu key repeatedly until **RS232** appears above the left menu key.
- Press the left menu key.
- Press the right menu key (arrow).
- Select the message **Parity** by pressing the left menu key.
- Select **none** (parity) using the cursor keys and acknowledge using the right menu key (STO).

The controller is automatically set by the individual programs. The BASIC command for remote control of the URV35 reads as follows:

OPENO# 2,"COM1:9600,N,8,1,10000,13,C,M"

For reading in measured values or status data from the URV35 into the controller, the interface is set as follows:

OPENI# 1,"COM1:9600,N,8,1,10000,13,C,M"

6.2.5.4 Adjustment of Cal Adapter under Program Control

After entry of "A" in the main menu, the test setup required is displayed on the screen (→ Fig. 6-4).

Insert cal adapter into the measuring head receptacle of the URV35 and connect to the input of the UDS5 (connect yellow banana plug with **INPUT HI**, black one with **INPUT LO**). Upon reception of the command "calibration" and the date, the URV35 sets the cal adapter such that the 1-MΩ resistance can be measured via the connectors (yellow/black). For this purpose, remove the cal adapter from the URV35 when requested to do so. The measured value is displayed on the screen:

```
Call-Adapter Adjustment
--------------------------------
999.95 <  1000.02  < 1000.05
Return to Main-Menu with R
```

Adjust the trimming resistor in the cal adapter (→ Fig. 6-4) such that the value lies within the specified interval. Terminate the program item by pressing the key "**R**" (return to main menu).

Caution: ***The accuracy of the UDS5 in the 1-MΩ measurement range considerably affects the adjustment! Check whether the UDS5 used has been calibrated within the last year.***

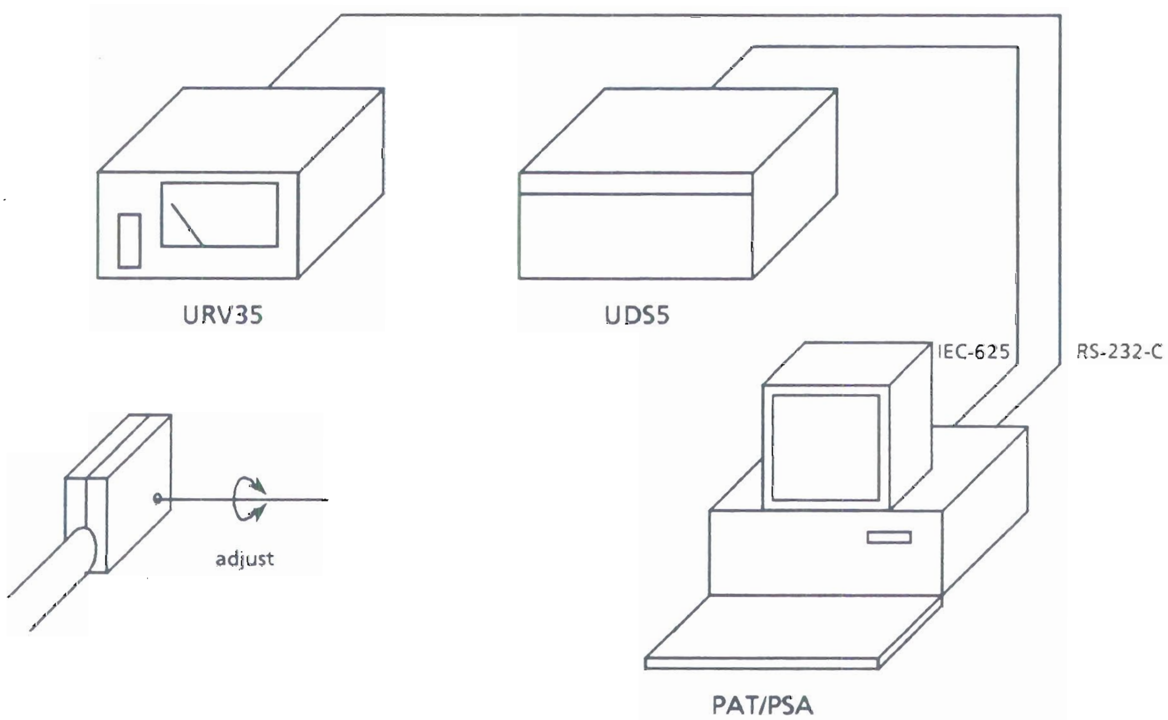


Fig. 6-4 Adjustment of cal adapter

6.2.5.5 Verification

By pressing the key "V" in the main menu, a mere verification run can be started. This test does not change the calibration data in the RAM. However, the jumper X717 has to be configured nevertheless like for the calibration (→ Fig. 6-2). The verification checks all measurement ranges of the measuring head amplifiers and the function of the temperature sensor input, DC-FREQ input and DC-LEV output. In interactive mode, the user is also requested to check the pointer instrument (in the case of the measuring functions, this involves checking of the permissible tolerances).

After termination of the verification run, the result can be output either on the screen or on a printer (→ 6.2.5.7). When a limit value is exceeded, the measured value is marked by an asterix both in the measurement run and in the verification report. The measured values found to be faulty can be indicated in the error report. Besides, the message "**URV35 out of tolerance**" appears in the verification report below the table with the measured values. If the URV35 lies within the tolerances, "**URV35 is ok**" is displayed.

Before performing a calibration, a verification should be started at any rate in order to record the actual status of the URV35. This permits to determine the drift since the last calibration, and prevents a faulty instrument from being repaired by calibration.

After entry of "V" in the above main menu the following appears on the screen:

```
        URV35 Verification
Date (dd.mm.yy)             ?23.02.92
Tested by (Name)            ?
URV35 Serial No.            ?
URV35 Variant  1020.0002.   ?
```

The date is taken as a default from the real-time clock of the controller. All entries can be responded at will or just acknowledge using <RETURN>. Then the setup according to Fig. 6-1 is displayed on the screen. The program requests to acknowledge the error message "Err CAL" and/or "Err DTA" that may appear on the URV35 display via the instrument keyboard:

```
if >Err CAL< or >Err DTA<
 appears on display:
 press →MEAS until
 >read PRB< appears
press <SPACE> when ready
```

This manual acknowledgement on the instrument is necessary, since the URV35 cannot clear this kind of error messages via the interface and, therefore, cannot be remote-controlled. Besides, the instrument has not yet read out the data memory of the measuring head at this point in time. Thus the URV35 is not yet informed on whether the required cal adapter is inserted in the receptacle or not. After acknowledgement using the <SPACE> key, the calibration program initializes the serial RS-232-C interface, checks the position of the jumper on X717 (write protection) and, if necessary, requests the user to enable the protected RAM area by reconnection. Then the connected adapter is checked.

Subsequently, the program shows the three calibrators supported:

```
        Select Calibrator:
Analogic (Data Precision) 8200   <1>
Datron 4000                      <2>
Fluke 5700                       <3>
```

When the user has selected a special calibrator, its IEC-bus address can be entered. In the program the following addresses have been preassigned and can be immediately used if necessary:

- Analogic (Data Precision) 8200 → IEC adress 20
- Datron 4000 → IEC adress 26
- Fluke 5700 → IEC adress 04

However, the addresses can be adapted to the device used in interactive mode. Immediately after acknowledgement of the entry, the controller checks whether a device can be addressed via the IEC bus under the specified address. If this is not the case, an acoustic signal sounds and the program expects a new entry.

After termination of these entries, the calibration menu is displayed on the screen of the controller.

```
          Select Verification
Moving Coil Instrument             <0>
AC Sensor Amplifier                <1>
DC Probe Amplifier                 <2>
Temperature Sensor Input           <3>
DC FREQ Input                      <4>
DC Output                          <5>
complete URV35                     <6>
     Return to Main Menu with R
```

As can be seen from the menu, the program permits to check the listed functions individually (<0> to <5>). By selecting menu item <6>, a complete verification is performed.

After at least one instrument function has been checked (which can be simultaneously observed on the screen), the controller screen displays the different possible reports:

```
Verification Report                <1>
Error Report                       <2>
Calibration Factors                <3>

Return to Verification Menu        <R>
End of Program                     <E>
```

The calibration program thus offers three different reports, which can be output on the screen or on a connected printer (→ 6.2.5.7). The respective prompt is made immediately after one of the menu items has been selected.

If the user can do without the output of reports, since other instrument functions have to be calibrated before, the program permits to return directly to the verification menu. Likewise, the program can be terminated at this point without having to run through the previous menus.
When the calibration program is terminated, the user is requested to restore the write protection for the calibration data by reconnecting the jumper on X717.

6.2.5.6 Calibration

By pressing the key "C" in the main menu, calibration of the URV35 is selected. During the complete calibration run, the instrument is calibrated in all measuring head amplifier ranges and analog functions and then a new measurement is made with the aid of the new calibration factors. The program requests the user to establish the necessary connections for calibration and remeasurement of the DC-FREQ input and the DC-LEV output. During a complete calibration run, the lower edge of the screen shows a bar which is filled in as the calibration progresses, providing an overview of the current state of calibration.

If recalibration becomes necessary outside the usual calibration cycle, e.g. because of a repair, the program permits to specifically calibrate only the section involved. Thus it is possible to calibrate the pointer instrument or the DC voltage output (DC LEV) without the DC calibrator required for the other functions having to be available.

In the case of a partial calibration of the URV35, the screen display showing the measured values remains preserved after termination of this calibration until the <SPACE> key is pressed. This permits to visually check the measured values without the need to hurry. During a complete calibration, no screen stop is provided in view of a fully automatic run.

6.2.5.7 Reports

The program provides the following outputs:

- Calibration report after the calibration or verification report after the verification on the screen or printer
- Error report on the screen or printer
- Calibration factors on the screen or printer

For generation of a printer report, the first Centronics interface referred to as "LPT1:" is used (channel →3 is reserved for data transfer).
The calibration program intentionally does not use any printer-specific control sequences so that every printer equipped with the standard IBM character set can be used.

In addition to the measured data proper, the **calibration report** and the **verification report** also contain the date of calibration, the measuring equipment used and space for the person in charge to sign. Fig. 6-5 shows the calibration report, Fig. 6-6 the verification report:

Calibration Report

LEVEL METER URV35 1020.0002.02 Serial No.: 101887/001
DC Calibrator: Analogic (Data Precision) 8200

Function	Range	Nominal/V	Tolerance/%	Measured/V	Deviation/%
Moving Coil Instrument				Next Calibration:	05.94
AC AMP				Next Calibration:	05.94
	1	10E-3	0.12	+1.0000E-2	+0.00
	1	-10E-3	0.12	-9.9999E-3	-0.00
	2	19.5E-3	0.12	+1.9500E-2	-0.00
	2	-19.5E-3	0.12	-1.9500E-2	-0.00
	3	50.0E-3	0.12	+5.0000E-2	-0.00
	3	-50.0E-3	0.12	-4.9999E-2	-0.00
	4	100.0E-3	0.12	+1.0000E-1	-0.00
	4	-100.0E-3	0.12	-9.9999E-2	-0.00
	5	195.0E-3	0.12	+1.9500E-1	+0.00
	5	-195.0E-3	0.12	-1.9500E-1	+0.00
	6	500E-3	0.12	+5.0001E-1	+0.00
	6	-500E-3	0.12	-4.9999E-1	-0.00
	7	1.000E-0	0.12	+9.9998E-1	-0.00
	7	-1.000E-0	0.12	-9.9998E-1	-0.00
	8	1.950E-0	0.12	+1.9500E0	+0.00
	8	-1.950E-0	0.12	-1.9500E0	-0.00
	9	5.000E-0	0.12	+5.0000E0	+0.00
	9	-5.000E-0	0.12	-5.0000E0	-0.00
	10	10.00E-0	0.12	+1.0000E1	+0.00
	10	-10.00E-0	0.12	-1.0000E1	+0.00
	11	19.50E-0	0.12	+1.9500E1	+0.00
	11	-19.50E-0	0.12	-1.9500E1	-0.00
DC AMP				Next Calibration:	05.94
	1	100.0E-3	0.12	+9.9993E-2	-0.01
	2	1.000E-0	0.12	+1.0000E0	+0.00
	3	10.00E-0	0.12	+1.0000E1	+0.00
	4	40.00E-0	0.12	+4.0000E1	-0.00
Temperature Sensor Input				Next Calibration:	05.94
		-300.0E-3	0.10	-2.9995E-1	-0.02
		-3.000E-0	0.10	-2.9986E0	-0.05
DC FREQ Input				Next Calibration:	05.94
		10.00E-0	0.12	+1.0000E1	-0.00
DC FREQ Output				Next Calibration:	05.94
		3.00E-0		+2.9995E0	-0.02

Result: URV35 is ok

Tested by	Date	Signature
Kuefner	12.05.92	

Fig. 6-5 Calibration report

Verification Report

LEVEL METER URV35 1020.0002.02 Serial No.: 101887/001
DC Calibrator: Analogic (Data Precision) 8200

Function	Range	Nominal/V	Tolerance/%	Measured/V	Deviation/%
Moving Coil Instrument				Last Calibration:	11.05.92
AC AMP				Last Calibration:	27.04.92
	1	10E-3	0.12	+1.0000E-2	+0.00
	1	-10E-3	0.12	-1.0000E-2	+0.00
	2	19.5E-3	0.12	+1.9500E-2	+0.00
	2	-19.5E-3	0.12	-1.9500E-2	+0.00
	3	50.0E-3	0.12	+5.0001E-2	+0.00
	3	-50.0E-3	0.12	-5.0000E-2	-0.00
	4	100.0E-3	0.12	+1.0000E-1	-0.00
	4	-100.0E-3	0.12	-9.9998E-2	-0.00
	5	195.0E-3	0.12	+1.9501E-1	+0.00
	5	-195.0E-3	0.12	-1.9500E-1	+0.00
	6	500E-3	0.12	+5.0002E-1	+0.00
	6	-500E-3	0.12	-4.9999E-1	-0.00
	7	1.000E-0	0.12	+1.0000E0	+0.00
	7	-1.000E-0	0.12	-9.9998E-1	-0.00
	8	1.950E-0	0.12	+1.9499E0	-0.00
	8	-1.950E-0	0.12	-1.9499E0	-0.01
	9	5.000E-0	0.12	+4.9998E0	-0.00
	9	-5.000E-0	0.12	-4.9999E0	-0.00
	10	10.00E-0	0.12	+9.9997E0	-0.00
	10	-10.00E-0	0.12	-9.9997E0	-0.00
	11	19.50E-0	0.12	+1.9500E1	-0.00
	11	-19.50E-0	0.12	-1.9500E1	-0.00
DC AMP				Last Calibration:	23.04.92
	1	100.0E-3	0.12	+1.0002E-1	+0.02
	2	1.000E-0	0.12	+1.0000E0	+0.00
	3	10.00E-0	0.12	+1.0000E1	+0.00
	4	40.00E-0	0.12	+3.9999E1	-0.00
Temperature Sensor Input				Last Calibration:	23.04.92
		-300.0E-3	0.10	-2.9988E-1	-0.04
		-3.000E-0	0.10	-2.9984E0	-0.05
DC FREQ Input				Last Calibration:	23.04.92
		10.00E-0	0.12	+1.0000E1	+0.00
DC FREQ Output				Last Calibration:	23.04.92
		3.00E-0		+3.0003E0	-0.01

Result: URV35 is ok

Tested by	Date	Signature
Kuefner	12.05.92	

Fig. 6-6a Verification report (URV35 is o.k.)

Verification Report

LEVEL METER URV35 1020.0002.02 Serial No.: 101887/001
DC Calibrator: Analogic (Data Precision) 8200

Function	Range	Nominal/V	Tolerance/%	Measured/V	Deviation/%
Moving Coil Instrument				Last Calibration:	11.05.92
AC AMP				Last Calibration:	27.04.92
	1	10E-3	0.12	+1.0000E-2	+ 0.00
	1	-10E-3	0.12	-1.0000E-2	+ 0.00
	2	19.5E-3	0.12	+1.9500E-2	- 0.00
	2	-19.5E-3	0.12	-1.9500E-2	+ 0.00
	3	50.0E-3	0.12	+4.9998E-2	- 0.00
	3	-50.0E-3	0.12	-4.9998E-2	- 0.00
	4	100.0E-3	0.12	+9.9997E-2	- 0.00
	4	-100.0E-3	0.12	-9.9996E-2	- 0.00
	5	195.0E-3	0.12	+3.6824E-2 *	-81.12
	5	-195.0E-3	0.12	-1.9500E-1	- 0.00
	6	500E-3	0.12	+5.0000E-1	- 0.00
	6	-500E-3	0.12	-4.9999E-1	- 0.00
	7	1.000E-0	0.12	+1.0000E0	+ 0.00
	7	-1.000E-0	0.12	-8.0081E-2 *	-91.99
	8	1.950E-0	0.12	+1.9499E0	- 0.01
	8	-1.950E-0	0.12	-1.9498E0	- 0.01
	9	5.000E-0	0.12	+4.9998E0	- 0.00
	9	-5.000E-0	0.12	-4.9998E0	- 0.00
	10	10.00E-0	0.12	+9.9998E0	- 0.00
	10	-10.00E-0	0.12	-9.9997E0	- 0.00
	11	19.50E-0	0.12	+1.9500E1	- 0.00
	11	-19.50E-0	0.12	-1.9500E1	- 0.00
DC AMP				Last Calibration:	23.04.92
	1	100.0E-3	0.12	+5.7120E-2 *	-42.88
	2	1.000E-0	0.12	+1.0003E0	+ 0.03
	3	10.00E-0	0.12	+1.0000E1	- 0.00
	4	40.00E-0	0.12	+3.2517E1 *	-18.71
Temperature Sensor Input				Last Calibration:	23.04.92
		-300.0E-3	0.10	-2.9976E-1	- 0.08
		-3.000E-0	0.10	-2.9983E0	- 0.06
DC FREQ Input				Last Calibration:	23.04.92
		10.00E-0	0.12	+6.0000E5 *	-99.99
DC FREQ Output				Last Calibration:	23.04.92
		3.00E-0		+3.0002E0	-0.01

Result: URV35 is out of tolerance

Tested by	Date	Signature
Kuefner	12.05.92	

Fig. 6-6b Verification report (URV35 is out of tolerance)

In the **error report**, a detected error is documented for every range of a function marked by the nominal value of the corresponding cal voltage. A distinction is made between offset measurement and measurement of the cal voltage (→ Fig. 6-7). The measured offset voltage is compared with the permissible value and, if it exceeds this value, identified as an error. If an offset measurement is out of tolerance, first check whether the zero voltage of the calibrator used is too high (if applicable, a respective adjustment is required). After measuring the cal voltage and subtracting the previously determined offset voltage, the calibration factor is calculated. If this value lies outside the range from 0.95 to 1.05, an error is signalled and entered into the column Measured/V in the error report. If there is no error, the message ok appears for the individual device functions (e.g. **AC AMP ok** for the amplifier for the AC voltage probes).

Error Report

LEVEL METER URV35 1020.0002.02 Serial No.: 101887/001
DC Calibrator: Analogic (Data Precision) 8200

Function: AC AMP

Range	Nominal/V	+Offset	+Voltage	-Offset	-Voltage
1	0.01				
2	0.0195				
3	0.05				
4	0.10				
5	0.195		+3.682E-2		
6	0.50				
7	1.00				-8.008E-2
8	1.95				
9	5.00				
10	10.00				
11	19.50				

Function: DC AMP

Range	Nominal/V	+Offset	+Voltage
1	0.1		+5.712E-2
2	1.0		
3	10.0		
4	40.0		+3.252E1

Function: Temperature Sensor Input
T Sens is ok

Function: DC FREQ Input

Nominal/V	+Offset	+Voltage
10.0	+2.580E0	+6.000E-5

Function: DC LEV Output
DC LEV is ok

Result: URV35 is out of tolerance

Tested by	Date	Signature
Kuefner	12.05.92	

Fig. 6-7 Error report

The **calibration factors** are the quotients from actual value and nominal value and are about 1. They are used for internal display correction.
They can be polled at any time via the RS-232-C interface using the command "SI" (or "CASI" if the URV35 is in calibration mode) and, in addition to the correction factors, they also contain a validity statement ("OK" or "ER" in case the tolerance is exceeded). Fig. 6-8 lists the complete calibration factor set by way of example.

```
                                        Calibration Factors
_____________________________________________________________

LEVEL METER URV35                 1020.0002.02          Serial No.: 101887/001

AC+ RANGE  1  OK CF=0.996461
AC- RANGE  1  OK CF=0.996490
AC+ RANGE  2  OK CF=1.000361
AC- RANGE  2  OK CF=1.000392
AC+ RANGE  3  OK CF=1.001758
AC- RANGE  3  OK CF=1.001793
AC+ RANGE  4  OK CF=1.001778
AC- RANGE  4  OK CF=1.001816
AC+ RANGE  5  OK CF=1.001992
AC- RANGE  5  OK CF=1.002053
AC+ RANGE  6  OK CF=0.996696
AC- RANGE  6  OK CF=0.997957
AC+ RANGE  7  OK CF=0.999015
AC- RANGE  7  OK CF=1.000291
AC+ RANGE  8  OK CF=1.000082
AC- RANGE  8  OK CF=1.001389
AC+ RANGE  9  OK CF=1.003242
AC- RANGE  9  OK CF=1.004459
AC+ RANGE 10  OK CF=1.003163
AC- RANGE 10  OK CF=1.004790
AC+ RANGE 11  OK CF=1.001188
AC- RANGE 11  OK CF=1.001953

DC  RANGE  1  OK CF=1.006891
DC  RANGE  2  OK CF=1.002802
DC  RANGE  3  OK CF=1.002004
DC  RANGE  4  OK CF=1.002804

TEMP 0.1MA    OK CF=1.003511
TEMP 1  MA    OK CF=1.004188

DC_FREQ<-     OK CF=0.996955
DC_LEV-> (G)  OK CF=1.003233
DC_LEV-> (O)  OK CF=1.002891

DEF LIN   0  OK CF=0.994119
DEF LIN  10  OK CF=0.997298
DEF LIN  30  OK CF=0.994278
DEF LIN  50  OK CF=0.994013
DEF LIN  70  OK CF=0.993165
DEF LIN  90  OK CF=0.992476
DEF LIN 100  OK CF=0.991893

DEF ACCEL    OK CF=1.000000


Tested by                      Date                       Signature

Kuefner                        12.05.92
```

Fig. 6-8 Calibration factors of the URV35

6.2.6 Manual Calibration

he complete calibration of the analog section can also be performed in single steps using the cal adapter. This will be explained in greater detail in the following section. The BASIC program from paragraph 6.2.5 can be reconstructed in this case. This section also permits a partial calibration if not all functions are to be calibrated. For example, after its replacement only the pointer instrument needs recalibration.

Make sure that, for calibration, all devices used are allowed for a warm-up time of at least one hour and the ambient temperature lies in the range of 23 ± 1 °C. The AC supply voltage should not deviate by more than ± 10 % from the nominal value, the relative humidity should be smaller than 80 %.

For the measuring functions, the calibration runs according to the following pattern:

User		URV35
Call up the desired calibration function	→	Hardware setting
Enter nominal value and polarity of the cal voltage V_C	→	Range setting
Apply 0 V		
Trigger the offset measurement	→	Offset measurement V_0
Apply the calibration voltage		
Trigger the calibration measurement	→	Calibration measurement V_M
	→	Calculation of cal factor K
		$K = \frac{U_C}{(U_M - U_0)}$

$K = \frac{V_C}{V_M}$ for the calibration function CA1. V0 is only checked to make sure that it lies within the tolerance limits, otherwise it is not taken into account.

Extracts from the calibration procedure for the AC probe amplifier are listed by way of example. The actions are represented in chronological order from the top left to the bottom right in the table.

User actions	Entry on controller	URV35 display
	CALIBRATION dd.mm.yy (Calibration date)	Date? CALMODE no PRB
Insert cal adapter	 CA5	readPRB CALMODE ACAMP
Set DC calibrator to 0 V	CARB0.01 CAL	OFFSET RUN DC 0.01
Set DC calibrator to 0.01 V	CAL	RUN AC AMP
Set DC calibrator to 0 V	CARB-0.01 CAL	OFFSET RUN DC -0.01
Set DC calibrator to -0.01 V	CAL	RUN
Set DC calibrator to 0 V	CARB0.02 CAL	OFFSET RUN DC 0.02
Set DC calibrator to 0.0195 V	CAL	RUN AC AMP
⋮	CAE1	CALMODE
⋮	CALEND	Cal PRB

After termination of the calibration, reconnect the jumper on X717 to the write protection position (connect pins 2 and 3).

6.2.6.1 Adjustment of Cal Adapter

For calibration and testing of the DC probe amplifier, the cal adapter contains a variable precision resistor which directly influences the calibration or measurement uncertainty. Its value should be checked regularly and readjusted if required (1.0000 MΩ).

The resistance can be measured via the two cal adapter connectors. For this purpose, the two relays in the cal adapter must first be set accordingly:

- Switch off URV35.
- Remove rear-panel feet and lower instrument cover.
- Plug jumper on X717 to the calibration position (→ Fig. 6-2).
  Caution: Do not short-circuit the RAM voltage!
- Switch on URV35.
- Insert cal adapter into the receptacle of the measuring head.
- Send "calibration" via the RS-232-C interface.
- Send the current data via the RS-232-C interface.
- Remove the cal adapter from the instrument.
- Measure and, if necessary, adjust the resistor using the UDS5 or an equivalent device.

Caution: The accuracy of the device for the resistance measurement considerably affects the adjustment! Check whether the accuracy conditions according to section 6.2.1 are met.

For calibrating the measuring functions

AC probe amplifier
DC probe amplifier
Temperature sensor input

connect the DC calibrator to the URV35 via the cal adapter.

6.2.6.2 AC Probe Amplifier

The AC probe amplifier is to be calibrated according to the above pattern with the voltages and polarities given in Table 6-3.

Table 6-3 Calibration of AC probe amplifier

Cal function	Polarity	Nominal value V_{in}/V	Range
CA5	+ and –	0.01 *)	1
		0.0195*)	2
		0.05*)	3
		0.1*)	4
		0.195	5
		0.5	6
		1.0	7
		1.95	8
		5.0	9
		10.0	10
		19.5	11

*) DC calibrator 8200 in the 100-mV range

6.2.6.3 DC Probe Amplifier

The DC probe amplifier is to be calibrated according to the above pattern with the voltages given in Table 6-4.

Table 6-4 Calibration of DC probe amplifier

Cal function	Polarity	Nominal value V_n/V	Range
CA6	+	0.1 1.0 10.0 40.0	1 2 3 4

6.2.6.4 Temperature Sensor Input

The temperature sensor input is to be calibrated according to the above pattern with the voltages given in Table 6-5.

Table 6-5 Calibration of temperature sensor input

Cal function	Polarity	Nominal value V_n/V	Range
CA1	–	0.30 3.00	--- ---

6.2.6.5 DC-FREQ Input

Procedure:

Connect DC calibrator via BNC cable with the DC-FREQ input.

Using the calibration function "CA7", the DC-FREQ input is calibrated according to the above pattern with the voltage given in Table 6-6.

Table 6-6 Calibration of DC-FREQ input

Cal function	Polarity	Nominal value V_n/V	Range
CA7	+	10.0	---

6.2.6.6 DC-LEV Output

Procedure:

Connect DC output via BNC cable with the DC-FREQ input.

After sending the command "CA8", the routine for calibration of the DC voltage output runs automatically.

6.2.6.7 Pointer Instrument

Linearity:

- Set the URV35 to LOCAL mode.
- Enter "**SPEC → CAL → LIN**" via the keyboard.

The URV35 then provides a voltage which is to cause a pointer deflection to zero.
Set the pointer deflection properly using the keys ↑ ↓.
The same applies to 10/30/50/70/90 and 100% full-scale deflection.
Store the settings using "STO".

Caution: ***The pointer linearization performed as described above is only temporarily valid. Therefore, it must be explicitly transferred to the calibration data memory using the calibration function "CA3".***

Acceleration:

- Set the URV35 to LOCAL mode.
- Enter "**SPEC → CAL → ACCEL**" via the keyboard.

The URV35 alternately causes a 20% and 80% full-scale deflection of the pointer. Using the ↑ ↓ keys, the pointer acceleration must be set such that there is neither considerable overshooting nor creeping to the final value.
Store the setting using "STO".

Caution: ***The pointer acceleration performed as described above is only temporarily valid. Therefore, it must be explicitly transferred to the calibration data memory using the calibration function "CA3".***

After calibration, the instrument should be switched off and on again in order to check the function of the lithium cell which permits the storage of the calibration data in the RAM. If it does not function properly (e.g. too low cell voltage) or if the calibration has been faulty, "Err CAL" is read out on the display.

Caution: ***After calibration, reconnect the jumper on X717 to the write protection position in order to ensure that the calibration data are protected (→ Fig. 6-2).***

6.3 Troubleshooting

Before starting a specific troubleshooting procedure, check the supply voltages (→ 7.3.1).

If the instrument does no longer respond to actuation of the "ON/STBY" key during battery operation or if it switches off immediately, the dry or storage batteries will most probably be discharged.

If replacing of the battery or charging (→ 2.1.3 of the Operating Manual) is not successful, measure the voltage fed into the URV35 at connector X500.1. At least 5.9 V must be measured with the instrument switched on.
If this value is not achieved, check the connection of the dry or storage batteries to the main board and the current consumption, if necessary (→ 7.3.1).

In the case of a total failure without "Err" display, it is advisable to check the computer function first with the instrument operated via the plug-in power supply (→ 7.1.2).

For isolating the fault further, the following diagnostic means (automatic error indication or utility routines in the instrument) can be used. For locating the fault exactly, the circuit diagram is used.

6.3.1 Overview of Available Diagnostic Means

- Automatic error indication "Err.xxx" or error poll via the RS-232-C interface using the commands **SE0** to **SE3** (→ 6.3.2).
- Testing of display, keyboard and serial interface using simple routines available via the normal instrument operation (→ 6.3.3).
- Detailed troubleshooting in the analog section using the service commands SEVx and comparison of the faulty test voltages with the specified tolerances (→ 6.3.4 and 7.2).
- Modified firmware (Service EPROM) for the selective call of internal testing routines and setting of analog switches. *not applicable for version 63!*

6.3.2 Error Diagnosis using Automatic Error Indication

When a measuring head is connected, the URV35 carries out a complete function test on switch-on and cyclically checks a few hardware functions during operation. If errors occur during these tests, they are indicated in the display by appropriate messages (→ Table 6-6 and section 3.3.2 of the Operating Manual).

Table 6-6 Error messages in the URV35 display

Error message	Cause	Measure
Err CAL	Calibration data missing or faulty	Perform recalibration (→ 6.2)
Err DTA	Faulty checksum (→ Operating Manual 3.3.2)	Delete using →MEAS
Err PTY Err FRM	Parity error no stop bit received	Test the serial interface (→ Operating Manual 4.2.4)
Err PRB	Probe data faulty	Connect other probe; check the probe interface if Err PRB appears again (→ 7.1.2.4)
Err HRD	Hardware error	Locate the fault more exactly via error status registers (→ 6.3.4)

6.3.3 Testing the Display, Keyboard and Serial Interface

Liquid crystal display:	Check control of all segments via special function **SPEC → TESTS → LCD**
Pointer instrument:	Check position of pointer deflection and dynamic response using the functions **SPEC → CAL → LIN** and **SPEC → CAL → ACCEL**
Backlighting:	Check switching on and off using **SPEC → ILLUM**
Keyboard:	Check key functions using special function **SPEC → TESTS → KEYB**
Serial interface:	Proper functioning of transmitter and receiver can be checked using special function **SPEC → TESTS → RS232**

For the functioning of the individual circuits refer to the detailed description in section 7.

6.3.4 Error Detection Using Automatic Test Routines

Possible hardware errors are filed in the error status register according to their causes and can be read out via the RS-232-C interface using the command SE1 (information on the RS232 commands SE0, SE2 and SE3 → 3.6.5 in the Operating Manual).

The error status register contains 8 bytes, each bit being assigned to a particular hardware error.
The output is made in hexadecimal format; by counting the set bit(s) the hardware error displayed can be easily determined.

To facilitate this task, the floppy disk enclosed with this manual contains the program "URVFEHL.BAS", which provides the error message(s) in plain text after entry of SE1. Likewise, the error messages are decoded in plain text with SE0, SE2 and SE3.

Example of an error message:

Output: 00 80 00 00 01 00 03 00 (HEX)

A detailed description of the meaning of the individual error bits is to be obtained from section 7.2. The decoding of the example given here is also be be found in this section.

7 Testing and Repair of the Function Blocks

7.1 Function Description

(see also Fig. 7-7 at the end of section 7)

7.1.1 Analog Section

(see circuit diagram 1020.0502.01S, sheet 1)

The analog section mainly consists of amplifiers for the various measuring heads, an A/D converter with pre-connected multiplexer and a circuit for generating the various supply voltages for the measuring heads. Address decoder D716 is used for driving the hardware latches, which cause the setting of the measuring amplifiers and the D/A converters for the automatic offset adjustments in the analog section. The data bus permits access to the various registers included in the customer-specific circuit D600 (L5A8803S), which contain the result of an A/D conversion, the internal setting of the D600 or the status of the probe detector. The probe detector consists of an RS flip-flop, which is set on removal of a measuring head from the basic instrument.

An additional serial multiplexer in the D600 is used to operate the RS-232-C interface, read out the data memory of the measuring head and provide the necessary clock.
Fig. 7-1 shows the internal circuitry of the D600 in simplified form. It illustrates the individual functions regarding A/D conversion, serial data transmission to the remote control interface or the measuring head, measuring head detection, applying of a clock to the measuring head, I/O interface and control of the probe supply voltages.

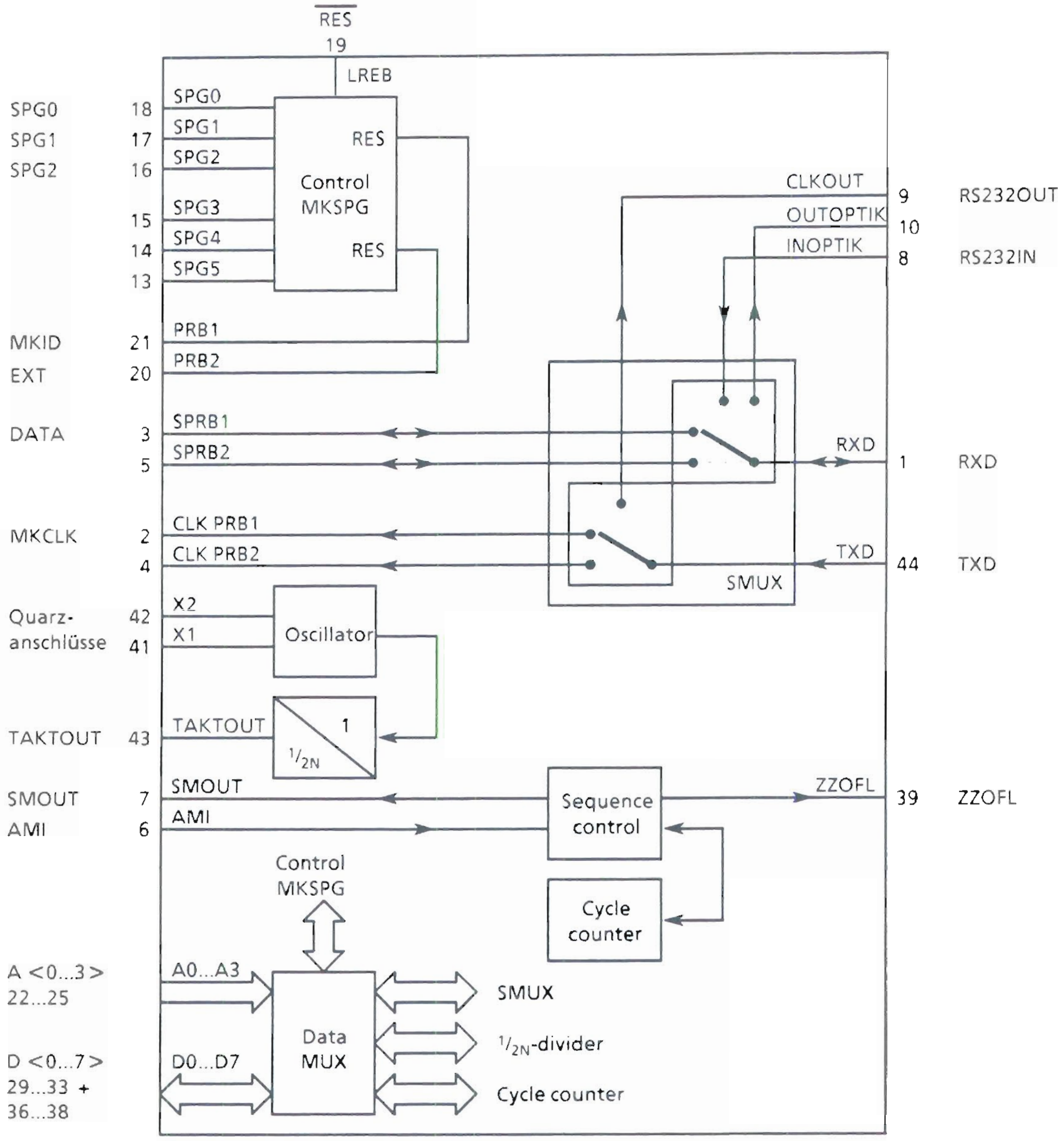


Fig. 7-1 Simplified internal circuitry of the D600

7.1.1.1 AC Probe Amplifier

(see circuit diagram 1020.0502.01S, sheet 2)

This module amplifies the output signal of AC voltage probes and power sensors to such an extent that it can be taken to the A/D converter. Depending on the measuring head, the output signal is positive, negative or bipolar referred to circuit ground. Because of the square-law characteristic of the rectifier with low input voltages, the amplifier must cope with a wide dynamic range of the rectified voltage. For input voltages of 200 μV_{rms} to 20 V_{rms} (2 mV_{rms} to 100 V_{rms} with the 100-V insertion units), the output voltage of the measuring heads is 700 nV to 15 V.

The gain can be switched in 11 steps.

In the five most sensitive ranges, the signal is applied to the instrument amplifier without being divided and is further amplified there. In the other measurement ranges, it is first divided by approx. 34 dB in the dividers. The total gain is composed as follows:

Table 7-1 Amplification ranges of the AC probe amplifier

Measurement range	g total	Divider	Gain
1	268	× 1	268
2	122	× 1	122
3	55.9	× 1	55.9
4	25.9	× 1	25.9
5	12.0	× 1	12.0
6	5.79	× 0.0216	268
7	2.64	× 0.0216	122
8	1.21	× 0.0216	55.9
9	0.559	× 0.0216	25.9
10	0.259	× 0.0216	12.0
11	0.122	× 0.0216	5.64

The gain is switched using the analog multiplexers D202/D204 and the FETs V228, V229, V237, V238, V239, V241, V243 and V244. For offset measurement, the two amplifier inputs are cyclically applied to ground via V237/V238 in the six less sensitive measurement ranges. In the other five measurement ranges, the polarity of the input voltage is cyclically reversed using the FETs V243/V244/V228/V229 and a bridge chopper is simulated by subtraction of subsequent measurement results.

The FETs V240/V242 limit the input signal for the multiplexer to max. ± 2 V without loading the rectifier circuit.

Using the FETs V234/V235/V236, the discharge resistance can be reduced from approx. 10 MΩ (R202/R204/R268/R297) to approx. 0.5 MΩ for the rectifier. In particular with large input voltages, in which case the rectifier works as a peak-value meter, the measurement speed can thus be considerably increased. The discharge circuit is actuated for a few milliseconds prior to every measurement in the ranges with cut-in divider.

The instrument amplifier consists of a low-noise FET input stage (V226) and a highly amplifying operational amplifier (N202). N201-A is used to keep the drain currents of V226 constant. In order to prevent the dynamic range of the amplifier from being resticted by too large offset voltages of V226 in the most sensitive measurement range, the offset voltage can be adjusted via D203 in 128 steps of 400 µV each. The adjustment is performed when the instrument is switched on, i.e. after successive approximation. Besides, the offset voltage is monitored during the measurement and, if necessary, corrected in steps up or down.

7.1.1.2 DC Probe Amplifier

(see circuit diagram 1020.0502.01S, sheet 3)

Together with the precision resistor of the DC probe (9 MΩ), this module constitutes an inverting amplifier. The gain can be set in four steps via D323:

Table 7-2 Amplification ranges of the DC probe amplifier

Measurement range	1	2	3	4
Gain	2,028	0,203	0,0203	0,00203

The multiplexers D321 and D322 permit to select the DC input, the frequency correction input (DC-FREQ) or the circuit ground via R308/R309 or R315. The three currently unused inputs are connected to ground via R313/R314/R318 at low impedance. Thus, a high crosstalk attenuation is obtained between the multiplexer positions. R308/R309 permits to record the offset with each measurement. D324 is used to set the input current of the circuit in 128 steps with an accuracy of typ. 10 pA. The adjustment is made when the instrument is switched on, i.e. after successive approximation. Besides, the input current is monitored during the measurement and, if required, corrected in steps up or down. The input current can be determined by the microprocessor from the difference between the offset voltages with different input connections. In one case, the inverting input of N305 is connected to circuit ground via R308/R309 (9 MΩ), in the other case via R315 (4.75 kΩ).

7.1.1.3 Multiplexer

(See circuit diagram 1020.0502.01S, sheet 4)

Analog switch HEF4051 (D400) permits to apply various voltages to the A/D converter in order to measure the input voltage and investigate the level at specific points of the circuit for servicing purposes.

Apart from applying the output voltages of the AC and DC probe amplifier and the voltage drop of the temperature sensor to the multiplexer, it is also possible to monitor the voltages -12 V, -5 V and -6 V. Besides, the applied battery voltage V_B is checked in order to request the user in time to replace or charge the batteries.

The voltage selected by means of the control lines C0 to C2 is applied to the A/D converter via the operational amplifier N400-A, which is connected up as a buffer.

7.1.1.4 A/D Converter

(See circuit diagram 1020.0502.01S, sheet 6)

The circuit consists of the two modules pulse-width modulator (N400, N610, D610) and count or evaluate logic (D600). The A/D conversion is accomplished such that first the input DC voltage (P400) is converted into a pulse-width-modulated squarewave signal (SMOUT), whose pulse width is measured in the counting circuit. The counting clock is 12 MHz. The pulse-width-modulated signal results from a control process during which the duty factor is varied until the sum of the current at the inverting input of N400 disappears. N400 is connected up as integrator, three currents being applied to its inverting input:

1. Input current (R611), linearly depending on the input DC voltage

2. Reference pulse current (R618), proportional to the reference voltage (N611.6) and the duty factor of the pulse-width-modulated squarewave signal.

3. Driver current 6 kHz (C610) for generating a triangular output signal (N400.7).

The voltage curves of the A/D converter are to be seen in Fig. 7-2.

As long as the average value of the sum of the three currents is different from zero, the triangular output signal is shifted in the positive or negative direction, thus varying the time difference between the zero crossings of this signal. Comparator N610, which detects these zero crossings, thus changes the duty factor of its output signal. After synchronization with the counting clock, this output signal is the pulse-width-modulated squarewave signal, which in turn varies the reference pulse current via D610 such that the average input current of the integrator disappears. As soon as a disequilibrium is produced by variation of the input voltage, the duty cycle will change until the reference pulse current compensates for the input current again.

The integration time of the A/D converter can be set in steps of 167 µs and is selected depending on the desired resolution or measurement speed. The entire process is controlled by the microprocessor, which simultaneously reads out the measurement result via the data bus.

The clock of the D600 also serves as clock for the microprocessor (D700).

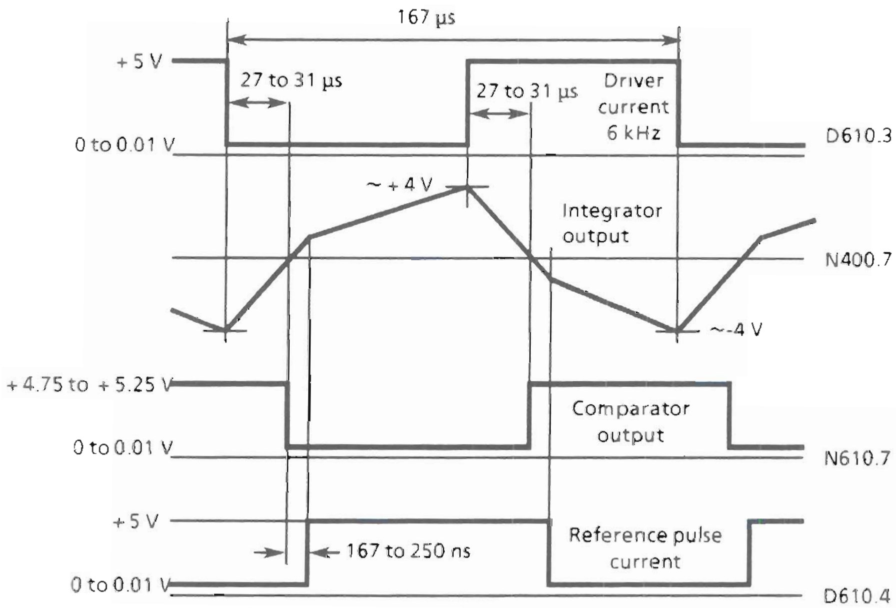


Fig. 7-2 Voltage curves of the A/D converter

7.1.2 Digital Section

The digital section mainly consists of the processor unit, the serial remote control interface, the D/A converters, processing of the probe supply voltages and the circuit for display illumination of the URV35.

The latter circuit only consists of transistor V103, which is reverse-biased by the level on the line "ILLUM" or operates as current source, applying a current of approx. 65 mA to the display illumination.

The control signal "ILLUM" is directly derived from processor port P1.5.
Transistor V104 is exclusively used for protection of V103 in the case of a short-circuit.

7.1.2.1 Processor Unit

(see circuit diagram 1020.0502.01S, sheet 7)

The core of the processor unit is a CPU of the type 80C51 (D700) with storage devices D710 (EPROM 512 kbits) and D720 (RAM 256 kbits). Bus latch D705 is used for generation of the least significant address byte A0 to A7.

Address A15 is used for selecting the RAM, gate D715-D implementing a protection against inadvertent writing during the reset phase.

Besides, this chip-select line is linked with the $\overline{WR}$ and $\overline{RD}$ signal so that the RAM is only selected when it is to be accessed. This serves to keep the current-carrying period as short as possible.

The write pulse for the RAM must still pass gate D715-C, which, in combination with D717, makes sure that in normal measurement mode the calibration data (most significant kbyte of the address range) cannot be overwritten. For this purpose, the write pulse is disabled via D715 if an illegal address is applied.

To write to the upper address range for calibration purposes, jumper X717 must be reconnected manually. If pins X717.1 and X717.2 are connected (i.e. inputs D727.1/D717.2/D717.11 connected to ground), the disabling function of D715 does not work and the write pulse is taken on to the RAM even with the upper addresses set.

D716 produces the latch enable signals for the bus latches (D100/D101/D203/D324), which perform the hardware settings. In order to prevent collisions with the available address range, the addresses to be set are additionally linked with the write signal.

The chip-select signals for the D600, the LCD and the keyboard are addressed as memory address, D714 being used.

Inverter D615-D inverts the interrupt signal of the keyboard provided in positive logic for the processor. The second interrupt input (INT1) is driven by D600 via the line "ZZOFL", which provides a logic 1-0 transition when the main cycle counter indicates an overflow and thus the end of a measurement.

Using the two terminals "RXD" and "TXD", the processor operates the RS-232-C interface and the data memory of the measuring head with D600 as multiplexer.

The remaining ports 1 and 3 are used as control lines, the individual assignments being indicated in Table 7-3:

Table 7-3 Assignment of ports

Port	Signal	Meaning
1.0	GAUS	switches off URV35
1.1	DTR	RS232 ready for use
1.2	SHUTDOWN	Shutdown for RS-232-C interface
1.3	$\overline{\text{RE}}$	Reset for LCD driver
1.4	SYNC	Synchronization for LCD driver
1.5	ILLUM	Illumination control
1.6	P1.6	PWM for meter
1.7	P1.7	PWM for analog output
3.4	READY	Acknowledge signal of LCD drivers
3.5	INSTREIN	Meter voltage on/off

Table 7-4 shows the address assignment.

Table 7-4 Address assignment

Address	Signal/Meaning	Access
0000H to FFFH	EPROM	PSEN
0000H to 7FFFH	RAM	$\overline{\text{RD}}$/$\overline{\text{WR}}$
7C00H to 7FFFH	protected RAM area	accessible via X717
8400H	$\overline{\text{CS KEY}}$	$\overline{\text{RD}}$
8800H	$\overline{\text{CS}_2\text{ LCD}}$	$\overline{\text{RD}}$/$\overline{\text{WR}}$
9000H	$\overline{\text{CS}_1\text{ LCD}}$	$\overline{\text{RD}}$/$\overline{\text{WR}}$
A000H	$\overline{\text{LE}}_0$	$\overline{\text{WR}}$
A001H	$\overline{\text{LE}}_1$	$\overline{\text{WR}}$
A002H	$\overline{\text{LE}}_2$	$\overline{\text{WR}}$
A003H	$\overline{\text{LE}}_3$	$\overline{\text{WR}}$
C000H to C00CH	$\overline{\text{CEVOLC}}$	$\overline{\text{RD}}$
C000H to C006H	$\overline{\text{CEVOLC}}$	$\overline{\text{WR}}$

For illustration of the sequences in the processor unit, Table 7-5 indicates the interrupt assignment of the URV35 and the appropriate priorities.

Table 7-5 Interrupt assignment URV35

Source	activ	Request bit	Priority	Meaning/function
$\overline{\text{INT0}}$	1 → 0	IE0	0	Keyboard interrupt
$\overline{\text{INT1}}$	1 → 0	IE1	0	Termination A/D conversion

The microprocessor derives its clock directly from the D600 via the "CLOCK" line.

The two diodes V701 and V702 cause the supply voltage for the RAM to be automatically switched to the built-in lithium battery when the URV35 is switched off in order to save the stored RAM contents. Thus, the calibration data are preserved even when the instrument is switched off.

7.1.2.2 Serial Remote Control Interface
(see circuit diagram 1020.0502.01S, sheet 6)

The URV35 contains an RS-232-C interface, which serves two purposes:
On the one hand, it permits calibration of the basic instrument under processor control, on the other hand it makes the URV35 system-compatible.

The serial data transmission is handled exclusively by the processor via the terminals TXD (transmit) and RXD (receive) (details on transfer protocol → 3.5.1 in the Operating Manual). A hardware interface is connected between processor and connector for level matching.

Chip D605 is used as transmitter, controlled via the connector "CLKOUT" by D600. If the URV35 has no message or measured values to be sent to a controller, D605 can be set to a current-saving idle state using the line "SHUTDOWN" (port 1.2). The output network C621/R622/C620 protects the output in the case of a short-circuit on the connection cable and improves the electromagnetic compatibility EMC.

Since the URV35 is equipped with a LOCAL key and, unlike RS232 devices (e.g. printers), not with a REMOTE key, it cannot be addressed by a controller if the interface chip D605 remains in the idle state. Therefore, D605 does not use the receiver, but is externally implemented. For this purpose, Schmitt trigger inverter D615-A is used, so that the URV35 can always be remote-controlled when it is switched on. The input circuitry protects the instrument against the relatively high voltages (up to ± 25 V) occurring on the line, even when it is switched off but still connected to the controller via the cable.

7.1.2.3 D/A Conversion
(see circuit diagram 1020.0502.01S, sheet 4)

7.1.2.3.1 Generation of the Instrument Voltage

The control voltage for the meter, which indicates the measured value in an analog way as pointer deflection, is obtained from the reference voltage and its negative counterpart. To this end, the PWM output port 1.6 of microprocessor D700 is used, which provides a squarewave signal, whose duty cycle is set proportional to the desired pointer deflection. With the aid of analog switch D420, a bipolar voltage is produced, whose accuracy corresponds to that of the reference voltage. A duty cycle of 50 % corresponds to the output voltage 0 V. The period of the PWM signal is approximately 20 ms and is somewhat dependent on the calibration of the pointer acceleration.

By increasing the duty cycle required for the pointer deflection by the factor 2 (within a defined period of time), an electronic pointer acceleration is achieved, which results in considerably faster settling of the analog display when the measured value has been varied.

The control line "INSTREIN" permits the microprocessor to cut off the control signal for the instrument in order to prevent the pointer from being at full-scale deflection as long as no valid PWM signal is available yet.

The operational amplifier N426-B is used to set the gain factor necessary for full-scale deflection. Since the meter is to be provided with a current, the serial/parallel circuit consisting of R428/R435/R31 (the latter is on the display board) converts the output voltage of the N426-B to the necessary control current. The NTC resistor R428 compensates for the temperature dependence of the copper winding of the pointer instrument.

7.1.2.3.2 DC Voltage Output

For generating a DC voltage analogous to the pointer deflection, a pulse-width-modulated signal from the microprocessor is used (port 1.7). This signal controls the analog switch D420, which, depending on the duty cycle, switches between the reference voltage and the resulting -5 V. The subsequent lowpass filter with Bessel characteristic integrates the bipolar squarewave voltage and provides a DC voltage proportional to the measured value with the following features:

Resolution = 750 µV
Output voltage range = 0 to +3,00 V

7.1.2.4 Measuring Head Control

(see circuit diagram 1020.0502.01S, sheets 1, 4 and 6)

7.1.2.4.1 Voltage Supply

The circuit in the URV35 is capable of producing three different states at the appropriates terminals V_{CC} and R_{GND}/V_{EE}:

a) V_{CC} = 0 V / V_{EE} = 0 V: This corresponds to normal measurement mode with a passive measuring head.

b) V_{CC} = 5 V / V_{EE} = 0 V: In this state, the calibration data of the measuring head can be read out.

c) V_{CC} = 12 V / V_{EE} = -12 V: This corresponds to normal measurement mode with an active measuring head.

The individual measuring head supply voltages are controlled via the D600, the respective control voltages being only generated when a measuring head is found to be connected. Otherwise, all voltages are applied to 0 V for safety reasons.

For switching the measuring head supply voltages, P-channel VMOSFETs are used. In order to obtain a sufficient voltage difference between gate and source of the FETs at +5V_{DIG} for the measuring head (case b), V405/V406 are driven with -12 V. The analog switch S100-C is used for this purpose. The combination of the control signals SPG0 and SPG1 by D405-C and R440/V440 prevents V404 and V405/V406 to be simultaneously forward-biased because of faulty control.

Analog switches S100-A/B/C cause the switchover of the ground reference for the AC probe amplifier and the supply with -12 V with active measuring head.

7.1.2.4.2 Temperature Sensor

The output voltage of all AC probes and power sensors depends on the temperature. To obtain a high measuring accuracy, it is necessary to measure the ambient temperature and take it into account in the evaluation of the measurement results. A sensor in the measuring head is used for this purpose. A current is applied to the sensor via the line "MKTEMP" and the voltage drop across the sensor is measured. Depending on the measuring head, currents of 100 µA or 1 mA can be fed in with V401 or V402, respectively.

The comparators N401-C/D cause a level conversion of the logic control signal from the bus latch D101.

Via pin 5 of the multiplexer (D400), the voltage drop across the temperature sensor can be measured. It is approx. -0.3 V with a 100-µA sensor or -3 V with a 1-mA sensor.

7.1.2.4.3 Measuring Head Detection

Via terminal "MKID", the D600 is informed on whether a measuring head is connected. If this is not the case, all supply voltages to the measuring head connector are switched off via a logic function within the D600 (SPG0 to SPG5 to 0 V). If a measuring head is connected, the line "MKID" is set to logic low level, which the processor can recognize by reading out a status register in the D600. The processor then causes a supply voltage of V_{CC} = +5 V to be applied to the measuring head and reads out its data memory bit by bit.

The read clock is applied via line "MKCLK", the data bits are read in via "DATA".

If the processor recognizes a passive measuring head by means of the head data, the supply voltage V_{CC} is switched off after reading out. In the case of an active measuring head, a symmetrical supply voltage of ± 12 V is applied.

7.1.3 Display/Keyboard

(see circuit diagram 1020.0702.01S)

The front panel serves four different purposes in the URV35:

1. It contains the controls of the instrument
2. Via the pcb, the control signals are transmitted from the microprocessor to the display.
3. It connects the inserted measuring head with the main board
4. It seals the instrument at the front to ensure electromagnetic compatibility.

To fulfil the last-mentioned task, all lines connecting the front panel with the main board are decoupled via lowpass filters, and the printed circuit itself is designed such that virtually all components and copper tracks are located on the inside of the instrument. In addition, the pcb is completely copper-coated on the outside. This side is fully connected with the front frame via spring contacts in order to ensure maximum ground connection. Thus, minimum RF leakage and high immunity to interference are ensured.

7.1.3.1 Display

The display of the URV35 is a complete module consisting of an analog pointer instrument and the LCD behind, which contains a 7-digit 14-segment display in addition to a 5 1/2-digit 7-segment display.

In addition, the LCD permits to display a variable scale. Thus, inconvenient calculation of the correct measured value from pointer deflection and selected range which was necessary for pointer instruments in the past can be dispensed with. In the basic setting of the URV35, the optimum indication range is automatically selected.

The pointer instrument is a moving-coil instrument with a sensitivity of 250 µA for full-scale deflection. The meter is provided with overaperiodic damping so that the pointer can be accelerated electronically without overshooting.

The display is connected with the front panel via connector X2, via which it also receives the supply voltage, ground and the control signals of the processor. Besides, the current is taken to the analog meter via this connector.

Control is effected via the parallel 8-bit data bus, the two $\overline{LE}$ signals being used to decide which of the two LCD control chips (which both supply the LCD) is selected. Via the READY line, the display tells the processor when it will again be able to accept further commands.

To ensure that the two control chips always operate with time synchronization, they must be coupled by a pulse on the "SYNC" line during initialization.

At the back of the LCD scale, the display contains an LED illumination, which permits proper reading of the measured values even with low ambient light. For switching on/off, the control signal "ILLUM" from the processor is used. FET V103 and bipolar transistor V104 constitute a current source which provides approx. 65 mA to the LEDs.

7.1.3.2 Keyboard

The URV35 is equipped with only 8 keys, ensuring clear and comfortable operation of the instrument even without learn phase.

The "ON/STBY" key is an exceptional key, since it is not part of the keyboard electronics. It is used to connect the Set input of the D flip-flop D500 with the supply voltage and thus switch on or off the URV35 depending on the level at the data input (pin 5 of the D500). Pressing of this key does not cause an interrupt (→7.1.5).

The remaining 7 keys are incorporated into an electronic circuit, which consists of D1/D2/D3 and sends an interrupt to the processor each time a key is pressed. For this purpose, the gates of D1 and D2 constitute an 8-fold NAND gate, whose output (D1.11) provides a positive edge to the clock input of latch D3, which is used as key memory each time a key is pressed. At the same time, this pulse constitutes the interrupt signal for the microprocessor (INT0).

Using this edge, D3 transfers the applied keyboard information and stores it so that the controller can request it using a latch-enable signal at pin 1 of D3. This read-out signal is produced by the ORing of KEY and the read pulse $\overline{RD}$ in D1-B. The KEY signal represents the keyboard chip-select.

Network R41 to R47 and C15 to C21 is used for debouncing the keys S2 to S8.

The key code which is set is to be obtained from the following table:

Table 7-6 Key code of the URV35

Key	Meaning	Data word								Code in Hex
		D7	D6	D5	D4	D3	D2	D1	D0	
S2	ZERO	1	0	1	1	1	1	1	1	BF
S3	MEAS → REF	1	1	0	1	1	1	1	1	DF
S4	→MEAS	1	1	1	0	1	1	1	1	EF
S5	CORR	1	1	1	1	0	1	1	1	F7
S6	SPEC	1	1	1	1	1	0	1	1	FB
S7	SCALE	1	1	1	1	1	1	0	1	FD
S8	UNIT	1	1	1	1	1	1	1	0	FE

7.1.4 Current Supply and Reset Generation

(see circuit diagrams 1020.0502.01S, sheet 5 and 1020.1021.1S)

The **URV35 model 02** permits different possibilities of supply:

- Supply from internal dry batteries.
- Supply from internal NiCd batteries.
- Feeding in an external voltage via connector X500 (also parallel to installed cells)

If dry batteries are installed, they are automatically disconnected on connection of an external supply in order to prevent damage due to unintentional charging. To this end, cable W10 must be connected with connector X501. With each plug-in on X500, the current supply is shortly interrupted so that the URV35 is reset and performs an instrument initialization.

If the URV35 is equipped with NiCd batteries, cable W10 must be connected with plug X502. Thus, the cells are automatically charged when the instrument is operated from an external supply. Besides, a non-interrupting current supply is ensured even if the external supply is connected or disconnected in the meantime.

When the URV35 is operated via an external voltage supply, the internal cells (dry batteries or storage batteries) can also be removed. For external supply, the power supply unit UZ-35 available as an option is recommended. It provides a DC voltage of approx. 8.5 V at its output with a max. current of 250 mA. This serves to prevent built-in NiCd batteries from being overcharged.

By polling line "EXT", the processor is able to recognize via the PRB2 terminal of D600 whether the URV35 is supplied internally or externally. In the case of interal supply, the terminal is set to logic high with the pull-up resistor R533. By connecting the power supply unit UZ-35, the terminal "EXT" is set to low level, because the detection line is pulled to ground via the forward-biased diode V507 and connector X500.3/4.

The URV35 model 03 (with built-in power supply unit) only permits to be operated externally from the AC voltage supply (115 V/230 V). To this end, a voltage of V_B = +6 V is generated on the power supply board (1020.1015.02), which is taken to the main board via cable W20. The two different possibilities of connection are dispensed with in this case. W20 is always to be connected to connector X502 on the main board.

In the URV35, the following voltages are generated from V_B:

Table 7-7 Internally generated voltages

Voltage	Test point	Use
+5 V −5 V	X505.6 X505.7	Operating voltage for the digital chips in the analog section
+6 V −6 V	X505.4 X505.5	Operating voltage for MUX and offset correction
+12 V −12 V	X505.2 X505.8	Supply voltage of operational amplifiers
V_{REF} (+5 V)	X505.3	Reference voltage for A/D converter
+5 V_{Dig}	X505.1	Current supply digital section/display

All voltages generated in the instrument are referred to instrument ground.

For generating the +12 V for the amplifiers, an upward switching regulator N501 is used, which receives the input voltage (5.4 to 8.5 V) via storage choke L500. Using the combination V505/V506/C506/C510, the -12 V are generated from the internally generated squarewave voltage of the 50-kHz generator contained in N501. Since this voltage is obtained by means of a doubler circuit, the -12 V are relatively high-impedance and virtually unstabillized.

The reference voltage V_{REF} is generated by the reference voltage source N505 from the + 12 V.

The linear voltage regulator N504 reduces the voltage V_B to + 5 V. The double operational amplifier N506 whose two halves are switched as inverters, converts the reference voltage into the -6 V and -5 V.

The + 6 V are also obtained from the reference voltage, since they serve for offset correction together with the -6 V and therefore must feature minimum noise. To this end, operational amplifier N503-B is used, whose output is buffered by transistor V530 for better correction of voltage spikes.

Chip N500 is a low-power linear regulator with a very low drop-out voltage and is used for generating the + 5 V_{DIG}. When the instrument is switched on or if the input voltage is too low, it also generates a reset signal, whose length is determined by the time constant R503/R504/C507 and is approx. 55 ms. To obtain clear edges, Schmitt trigger inverters are series-connected, whose outputs provide the RES or $\overline{RES}$ signal.

7.1.5 Switching On and Off the URV35

(see circuit diagram 1020.0502.01S, sheet 5)

The URV35 is electronically switched on and off via the P-channel VMOSFETs V501/V508 (the two series-connected FETs protect the electronic circuit when an input voltage with reversed polarity is applied). To this end, D flip-flop D500 is used, whose clock input is controlled by the Q-output of that part of the D flip-flop which is connected up as Schmitt trigger. By pressing the "ON/STBY" key, a positive edge is applied to the input, and the output of D500-A changes to ground potential. Thus, the FETs V501/V508 obtain a voltage which is negative compared with the source and are forward-biased. By pressing the "ON/STBY" key again, another pulse is applied to the clock input of D500-A. Since the $\overline{Q}$-potential is returned to the data input of D500-A, the Q-output again changes back to high potential. Since the D flip-flop is directly supplied from the battery voltage, the voltage difference between gate and source is then virtually 0 V (in any case, it is below the threshold voltage of the FETs), V501/V508 are reverse-biased and the URV35 is switched off.

D500-B, which is connected up as a Schmitt trigger, causes debouncing of the ON/STBY key.

Using the signal "GAUS", the microprocessor is able to switch off the instrument. This is the case with automatic switch-off during battery operation. A high level at the Set input also causes the Q-output to become high, and the URV35 is switched off.

Lowpass R500/C502 causes the "GAUS" signal to be delayed in order to give the processor enough time to pull this line to low again on switching on after reset, otherwise the instrument might switch off again.

For constantly monitoring the battery, the input voltage V_B is taken via a voltage divider to the input of multiplexer N400 and cyclically measured via the A/D converter.

If V_B falls below 6.15 V, a meter is shown at the bottom right of the display, indicating that the battery is almost completely discharged.

When this symbol appears, the user still has enough time to finish his measurements before the cells are discharged to such an extent that the URV35 automatically switches off. This time depends on whether dry or storage batteries are fitted and may lie between a few minutes (with NiCd batteries) and up to 15 hours (with dry batteries). This large range results from the different discharge curves which vary from manufacturer to manufacturer and are also temperature-dependent.

7.2 Troubleshooting

Most errors can be isolated using the internal diagnostic means according to section 6.3. The errors can be exactly located using the circuit diagram.

At the beginning of troubleshooting, the operating voltages should be checked according to section 7.3.1 and the clock frequency for the microprocessor according to section 7.3.3.

7.2.1 Measuring Instruments and Auxiliary Means

Table 7-8 Required measuring instruments

Item-No.	Instrument	Specifications	Appropriate R&S device
1	Digital voltmeter	DC, 0 ... 300 V ±0,05 %, 0 ... 2 A	UDS5
2	Oscilloskope	DC ... 100 MHz	
3	Controller with RS-232-C interface		PSA-Familie
4	Frequency counter	10 Hz ... 30 MHz	

7.2.2 General Hints on Troubleshooting

By observing the following connections, the detection of an error can be facilitated:

- High load (e.g.short-circuit) at the -5 V or -6 V causes the -12 V to collapse also. If the -5 V or -6 V and the -12 V are found to be faulty, it is advisable to focus troubleshooting on the -5 and -6 V.
- With a faulty reference voltage, several error messages usually occur, which have all the same cause. In the case of several error messages, always measure the reference voltage.
- The same applies analogously to the failure of the +12 V, because V_{REF} as well as -12 V are derived from this voltage.
- Since the data traffic on the bus is impaired, the occurring error cannot exactly be foreseen in the case of a short-circuit on the +5 V and depends on the point when it has occurred!

7.2.2.1 Error in Display and Keyboard

Checking the display:

Call up LCD test routine (SPEC → TESTS → LCD). All LCD segments are displayed at the same time. In the case of an error, first check the plug-in connection W2 between display and front panel. If no error can be detected on the front panel (e.g. open circuit) and connection W1 (main board/front panel) is also okay, continue troubleshooting in the function block processor unit.

Pointer indication:

A fault in the pointer indication may produce different effects:

a) No deflection.

b) Pointer is at lefthand or righthand full-scale deflection.

c) If the measured value is changed, the pointer overshoots heavily or slowly creeps towards its final position.

d) Displayed digital value and pointer deflection do not comply with each other.

In cases a) and b), it is recommended to check the plug-in connection W2 between display and front panel first. Further troubleshooting comprises the control unit on the main board with operational amplifier N425 and the series-connected temperature compensation.

If the pointer is always at full-scale deflection, check the pulse-width modulator with microprocessor (D700) and analog switch (D420) or check the connection UINSTR (X10.21) for a short-circuit to a voltage-carrying lead.

In cases c) and d) (faulty pointer dynamics or deflection), check the calibration. The following two tests are used for this purpose:

- The key sequence SPEC → CAL → ACCEL permits to check the pointer acceleration. The URV35 alternately drives the pointer with 20 % and 80 % of full-scale deflection. The dynamic response permits to find out whether the calibration of the pointer acceleration is correct. There must not be any considerable overshooting or creeping towards the final position. Otherwise, the pointer acceleration needs recalibration (→ 6.2).

- The key sequence SPEC → CAL → LIN permits to check the pointer linearity. The URV35 successively controls the pointer with 0 %, 10 %, 30 %, 50 %, 70 %, 90 % and 100 % of full-scale deflection. If the pointer deflection complies with the percentage indicated in the digital display, the current setting is stored by pressing the menu key designated as STO. Otherwise, the pointer linearity needs recalibration (→ 6.2).

After replacement of the display, recalibration is usually necessary, since the new display features other dynamic characteristics. For this purpose, set jumper X717 to the Cal position on the main board.

Backlighting:

Switch illumination on and off (SPEC → ILLUM). In the case of very uneven brightness, the illumination in the display is faulty. Since it constitutes a separate module, the complete display need be replaced in the case of an error. If this is of no help, continue troubleshooting on the main board, first checking the functioning of the current source with V103, V104 and N401.

Keyboard:

Call up the key test routine (SPEC → TEST → KEYB). The test is performed as described in section 3.4.16 in the operating manual: Press the keys one after the other, an appropriate reading must be indicated on the display with each key. The test routine is abandoned by pressing the same key twice. In the case of malfunctions, start troubleshooting on the front panel (C15 to C21, D1 to D3, R40 to R47, S2 to S8). In the case of a total failure of the keys, also check the function block Processor unit.

7.2.2.2 Error on the RS-232-C Interface

Call up the RS-232-C test routine (SPEC → TESTS → RS232) (see section 3.4.27 of the Operating Manual).

Receiver faulty:

There is no or a faulty feedback on the command sent by the controller on the URV35 display. Likewise, the acknowledgement returned to the controller is faulty or missing.

This diagnosis does not yet permit to make a statement on the proper functioning of the RS-232-C transmitter. When this error occurs, the receiver should be repaired first (D615-A with input connection and D600).

Transmitter faulty:

The command sent by the controller is indicated on the display of the URV35, the returned acknowledgement is however faulty or missing. Troubleshooting comprises the D600 and the D605 with output circuitry.

7.2.3 Diagnostic Means (Service Functions)

If a hardware error occurs in the URV35, the error detected by the basic instrument by means of internal test routines can be read out by transmitting the service command SE1 via the remote-control interface. Each error is assigned an error bit in encoded form. By transmitting the service command SEVx, x corresponding to the error bit, the faulty test voltage value is fetched by the URV35. Exact assignment of the hardware errors to the error bits, reading out of the error and evaluation of the internal test measurement are described in detail in section 7.2.4.

Troubleshooting hints with evaluation of the error message:

- The floppy disk enclosed with the service manual for the URV35 contains not only the program for complete calibration of the instrument, but also routines for detection of the error bit(s) by the controller. Using these routines, the detected error is read out in plain text on the screen of the controller.
- In the case of several error messages, it is generally recommended to read out the A/D converter zero with SEV26 and check the reference voltage. If errors are already found, they are to be eliminated first, the other error messages being ignored at the moment, since faulty interpretations may be involved.
- In the case of errors on the multiplexer output, again several error messages may occur, which have all the same cause. By remeasuring the individual voltages, these faults can be traced back to the multiplexer of the A/D converter.

The Service Kit URV35-S1 also includes a special service EPROM with a few additional service routines, which make troubleshooting much easier in many cases.

The service EPROM is to be inserted instead of the normal EPROM into the appropriate slot on the main board. For this purpose, the lower instrument panel and the screening cover must be removed (→ 7.4).

Caution:

Make sure not to produce a short-circuit on the RAM voltage (battery G700) when replacing the EPROMs, since the calibration data would be lost in this case!

7.2.4 Meaning of the Error Bits

Error decoding can be illustrated using the example from section 6.3.4:

`00 80 00 00 01 03 00` (HEX)

The two zeroes to the right constitute the LS byte (= bits 0 to 7), the zeroes to the left constitute the MS byte (= bits 56 to 63).

The third character from the left is a "8", i.e. the 55th bit is set. According to Table 7-9, this is the global error bit, which is always set when an error has been detected, since it represents an ORing of the individual error bits.

The third character from the right contains a "3". In order to find out which error is indicated proceed as follows:

`00000011 00000000:` This is the binary notation of the 4 characters from the right of the error message given above (0300).

Thus bits 8 and 9 are set. According to Table 7-9, this indicates a faulty offset voltage in ranges 9 and 10 of the AC probe amplifier.

According to Table 7-10, ranges 9 and 10 of the AC probe amplifier are those with a gain of g = 0.559 and g = 0.259.

Likewise, it is possible to determine the "1" additionally set as bit 24 in the above example. This means that an error has also been found during internal monitoring of the -6 V.

In addition to the assignment of the error status to the hardware, Table 7-9 also contains information on the instrument status in which the individual settings or measurements have been made.

Table 7-9 Hardware error status

Error bit	Meaning	Test phase
0 to 4	reserved	
5 to 10	Offset voltage AC probe amplifier Range 6 to 11 Range x ↔ Bit x-1	Initialization, (Measurement)
11, 12	reserved	
13	Deviation 100-µA sensor	(Initialization), Measurement
14	Offset 1-mA sensor	(Initialization), Measurement
15	Thermal meas. voltage 100-µA sensor	(Initialization), Measurement
16	Thermal meas. voltage 1-mA sensor	(Initialization), Measurement
17 to 20	Offset voltage DC probe amplifier Range 1 to 4 Range x ↔ Bit 16 + x	Initialization, (Measurement)
21	Offset current DC probe amplifier	Initialization, Measurement
22	Supply voltage -12 V	Initialization
23	Supply voltage -5 V	Initialization
24	Supply voltage -6 V	Initialization
25	reserved	
26	Offset A/D converter (D600)	Initialization, Measurement
27 to 46	reserved	
47	Timeout A/D converter (D600)	Initialization, Measurement
48	Setting Offset-DAC ACAMP	Initialization, Measurement
49	Setting Offset-DAC DCAMP	Initialization, Measurement
50 to 54	reserved	
55	global error bit (ORing bits 0 to 54)	Initialization, Measurement
56	reserved	
57	Below warning threshold for battery (V_B <6,15 V)	Initialization, Measurement
58	reserved	

The error bits referred to as "reserved" do not contain any data relevant to error detection.

For troubleshooting, it is very helpful to know whether a circuit detected via the error bit has failed completely or whether its output signal has just slightly exceeded the permissible tolerance range. For this purpose, just compare the measured value which has caused the error message with the values given in Table 7-10.

Table 7-10 Tolerance ranges for internal test routines

Error bit	Description		Tolerance range/V	Settings
5	Offset voltage AC, range	6	- 0.48 to + 0.48	6. 12. 14. 27
6		7	- 0.23 to + 0.23	7. 12. 14. 27
7. 48*)		8	- 0.075 to + 0.075	8. 12. 14. 27
8		9	- 0.064 to + 0.064	9. 12. 14. 27
9		10	- 0.04 to + 0.04	10. 12. 14. 27
		11	- 0.03 to + 0.03	11. 12. 14. 27
13	Deviation	100-µA sensor	+ 0.10 to + 5.00	16. 32
14	Offset	1-mA sensor	- 0.10 to + 0.10	16. 32
15	Test voltage	100-µA sensor	- 0.41 to - 0.19	17. 32
16	Test voltage	1-mA sensor	- 3.54 to - 2.42	18. 32
17	Offset voltage DC, range	1	- 0.50 to + 0.50	19. 25. 31
18		2	- 0.05 to + 0.05	20. 25. 31
19		3	- 0.01 to + 0.01	21. 25. 31
20		4	- 0.01 to + 0.01	22. 25. 31
21. 49*)	Offset current DC × 3 GΩ		- 0.075 to + 0.075	20. 26. 31
22	- 12 V		- 0.21 to - 0.88	34
23	- 5 V		- 0.524 to - 0.467	30
24	- 6 V		- 0.617 to - 0.572	33
26	Offset A/D converter		- 0.25 to + 0.25	28
48	Offset adjustment AC AMP			8, 12, 27
49	Offset adjustment DC AMP			20, 26, 31
57	Battery voltage <6.15 V		>3.04	29

*) With these settings, the offset adjustment is performed.

Note the following:
With the AC probe amplifier the offset is determined against ground, whereas, when measuring the offset current in the DC probe amplifier, the voltage difference of the amplifier output is measured referred to the setting of error bit 18.

The column "Settings" in Table 7-10 represents the hardware settings made for the internal measurements in encoded form.

Table 7-11 illustrates the connection between the code numbers and the appropriate circuits:

Table 7-11 Hardware setting codes

Setting code	Meaning		Remark
1	AC gain	× 268	⌉
2		× 122	|
3		× 55,9	without divider
4		× 25,9	|
5		× 12,0	|
6		× 5,79	⌋
7		× 2,64	⌉
8		× 1,21	|
9		× 0,559	with divider
10		× 0,259	|
11		× 0,122	⌋
12	Meas. mode AC	Offset	Input to ground
13		normal	Input to Measuring head
14	Discharge circuit	off	Normal measurement
15		on	when range is changed
16	Test current	off	⌉
17		100 µA	Temperature sensor
18		1 mA	⌋
19	DC gain	× 2,028	
20		× 0,203	
21		× 0,020	
22		× 0,002	
23	Meas. mode DC	DCINP	Input DC probe
24		DCFREQ	Input frequency correction
25		GND	internal R = 9 MΩ
26		OFFS ADJ	internal R = 4,75 kΩ
27	Multiplexer	AC	INP1
28		GND	Measurement reference A/D converter
29		U_B	Battery voltage
30		-5 V	
31		DC	INP2
32		TEMP	Temperature sensor
33		-6 V	
34		-12 V	

By transmitting service command SEVx, the measured value found to be faulty in the internal test routine can be read out with its permissible tolerance limits. The x in the above example corresponds to the detected error bit.

Example:

During measurement operation, "Er HRD" is read out as error message on the URV35 display. Which error has occurred is determined by transmission of command SE1. Error bit 5 is assumed to be set. After transmitting the service command SEV5, the URV35 sends the following string:

```
"-0.48V    2.1032    +0.48V".
```

Error bit 5 indicates that the offset voltage of the AC probe amplifier has been found to be faulty in range 6. In the response of the URV35 to SEV5, the values to the left and the right are the permissible tolerance limits of ± 0.48 V, whereas the value in the middle specifies the measured offset voltage with 2.1032 V.

7.3 Testing and Adjustment

7.3.1 Testing the Operating Voltages and the Operating Current

(see circuit diagram 1020.0502.01S, sheets 5 and 7)

The following table lists the voltages generated on the main board and their permissible tolerances:

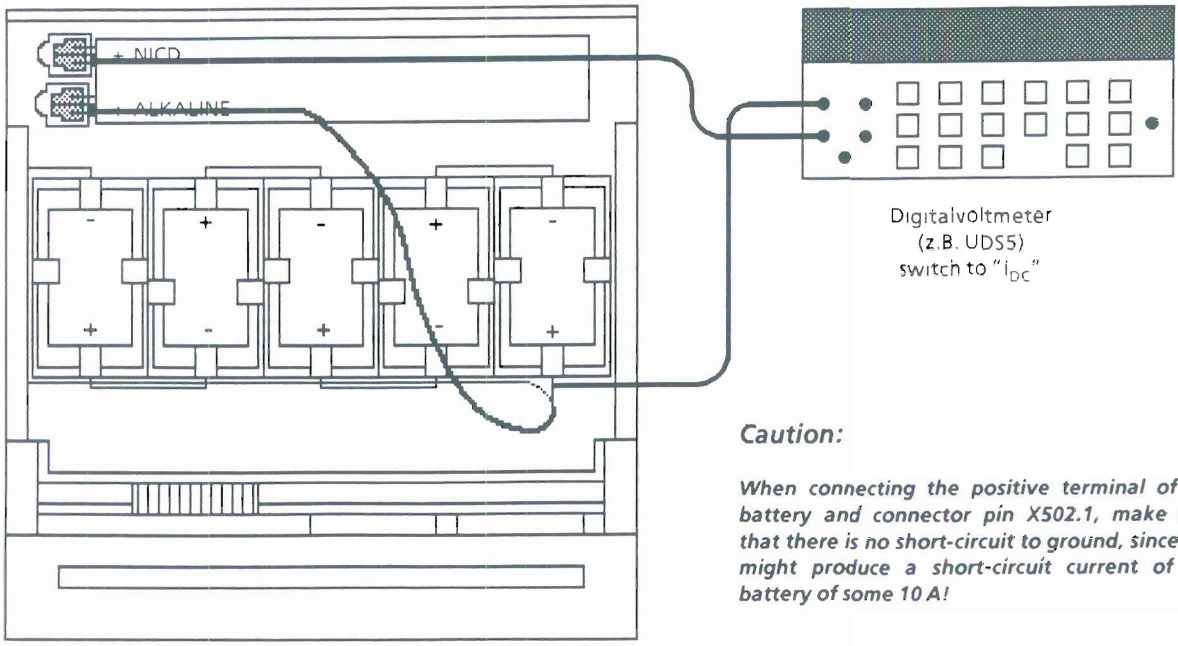
Table 7-12 Supply voltages in the URV35

Connector pin	Nominal voltage	perm. range	supplied chips
X505.1	+ 5 V_{DIG}	4.92 to 5.08 V	D405, D600, D615, D705, D710, D714, D716, D717, N610, S100
X505.2	+ 12 V	11.4 to 12.6 V	N201, N202, N305, N400, N401, N425, N426, N503, N505, N506, S100
X505.3	U_{REF}	4.95 to 5.05 V	D610
X505.4	+ 6 V	5.88 to 6.12 V	D203, D324, D400
X505.5	− 6 V	− 5.93 to − 6.07 V	D400
X505.6	+ 5 V	4.90 to 5.10 V	D100, D101, D201, D202, D204, D321, D322, D323, D420
X505.7	− 5 V	− 4,85 to − 5,15 V	D202, D204, D321, D322, D323, D420
X505.8	− 12 V	− 9 to − 12 V	N201, N305, N400, N401, N425, N426, N503, N506, S100
X700	U_{RAM}	3,2 to 3,7 V	D715, D720
---	U_B	5,8 to 8,5 V	

In measurement mode, the URV35 requires a current of typ. 60 mA with an input voltage of about + 6 V and with the illumination switched off (typ. 70 mA in the status "no PRB", since the idle mode of the processor cannot be used in this case). This is only a rough value, which depends on the input voltage. The most convenient way to measure the current consumption of the instrument is to connect an ammeter between the positive terminal of the upper cell (cable connector W10) and the connector X502 pin 1 (see Fig. 7-3).

Procedure:

- Plug cable connector W10 to position ALKALINE.
- Disconnect external supply.
- Connect ammeter between the positive terminal of the supply voltage and connector X502 pin 1.
- Push away spring contact using non-conducting object.
- Read off the current consumption of the URV35 on the UDS5.



Caution:

When connecting the positive terminal of the battery and connector pin X502.1, make sure that there is no short-circuit to ground, since this might produce a short-circuit current of the battery of some 10 A!

Fig. 7-3 Measurement of URV35 current consumption

7.3.2 Testing the Display Illumination

The illumination can be switched on and off by selecting the appropriate menu item (SPEC, ILLUM). The voltage that is set is to be checked at pin X100.19.

Table 7-13 Voltage drop across R105

Illumination	Voltage
on	+ 0.54 to + 0.66 V
off	− 0.1 to + 0.1 V

This corresponds to a current of 50 to 70 mA.

Using the test setup shown in Fig. 7-3, the current consumption of the display illumination can be measured very conveniently:

- Insert cable W10 into X501 (ALKALINE)
- Switch on URV35.
- Switch off illumination.
- Do not connect the UZ-35 with the current supply, insert the hollow connector into X500 as far as possible.
- The UDS5 indicates the current consumption of the URV35 with the illumination switched off.
- Set the readout to zero by pressing the offset key on the UDS5.
- Switch on illumination.

The UDS5 then indicates the illumination current:

Hint: *Perform the measurement with the measuring head disconnected in order to obtain a stable current display.*
When the measuring head is connected, the pulsating current of the processor unit (idle mode) causes heavy fluctuation of the display.

7.3.3 Testing the Clock Frequency for the Micro Processor

For measurement, connect a frequency counter to pin D600.42 via a 10:1 probe.
Measure clock frequency: 11.988 to 12.012 MHz

7.4 Disassembly and Assembly

7.4.1 Terminology Used

Screening cover	Sheet metal covering the two chambers on the main board
Display	Pointer instrument with LCD scale behind including the control electronics and connection cable W2 (referred to as P1 in the complete diagram 1020.0002.01S).
Display module	Complete unit consisting of front panel with keyboard and display (to be recognized as A1 + P1 in diagram 1020.0002.01S).
Identification plate	Paint-coated sheet metal at the front of the URV35 containing the name of the instrument, the company logo, the key inscription etc.
Front sheet	2-mm thick sheet with appropriate openings for leading through the keys. It is also used to support the display.
Front panel	Printed circuit at the front of the URV35 containing the measuring head receptacle, the complete keyboard and the connections to the display including the connection cable W1 and the ground contact springs.
Mainboard	Main printed circuit board of the URV35 containing the current supply, the analog and digital unit.
Power supply board (model 03)	Printed circuit in the upper isntrument chamber containing the power transformer, the power outlet for non-heating appliances with integrated line filter, the AC voltage selector and the electronics for generating the URV35 supply voltage. It is connected with the main board via cable W10.

7.4.2 Removal and Replacement of the Main Board

- Remove the two rear-panel feet and the two instrument panels.
- Disconnect connection cable from the batteries to the main board (accessible from the top of the instrument).
- Remove the 4 Phillips screws (2 of them are on the rear panel) (see Fig. 7-4).
- Disconnect 34-way connection to the display module.
- Slightly lift the main board at the front, push towards the front of the instrument and remove.

Be careful when handling the main board!

After removal of the main board, various circuits are still applied to the lithium backup battery.

For replacement, carefully proceed in the reverse order. When fastening the rear panel feet with screws, firmly press the two instrument panels together.

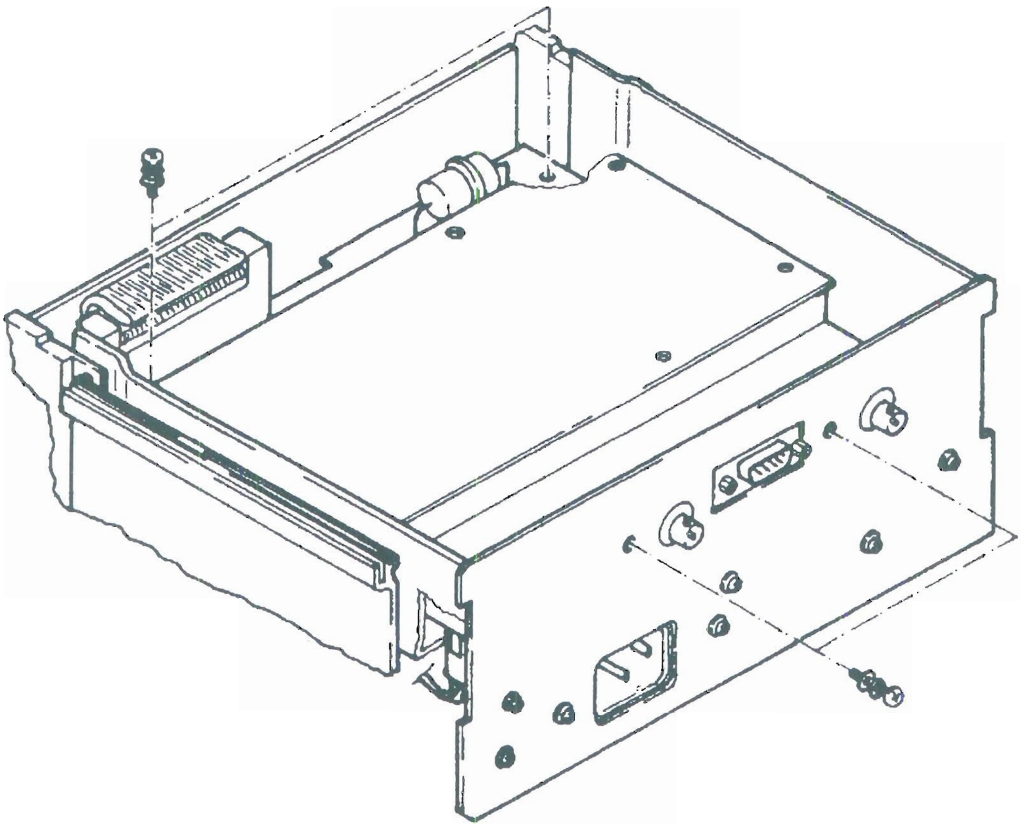


Fig. 7-4 Fastening points of the main board

7.4.3 Putting the Main Board to the Service Position

For servicing, the main board of the URV35 can be placed in a fixed upright position so that the individual components and test points are accessible from both sides (see Fig. 7-5).

For this purpose, the pcb is removed from the instrument according to section 7.4.2 and screwed to the flatter insert nut in the middle of the intermediate sheet through the screening panel. The upper screening cover must be removed before (→ 7.4.4).

The current supply cable is taken through a hole protected with a rubber bush and connected to the printed circuit.

Be careful not to load the connection cable to the display module too much by twisting the main board!

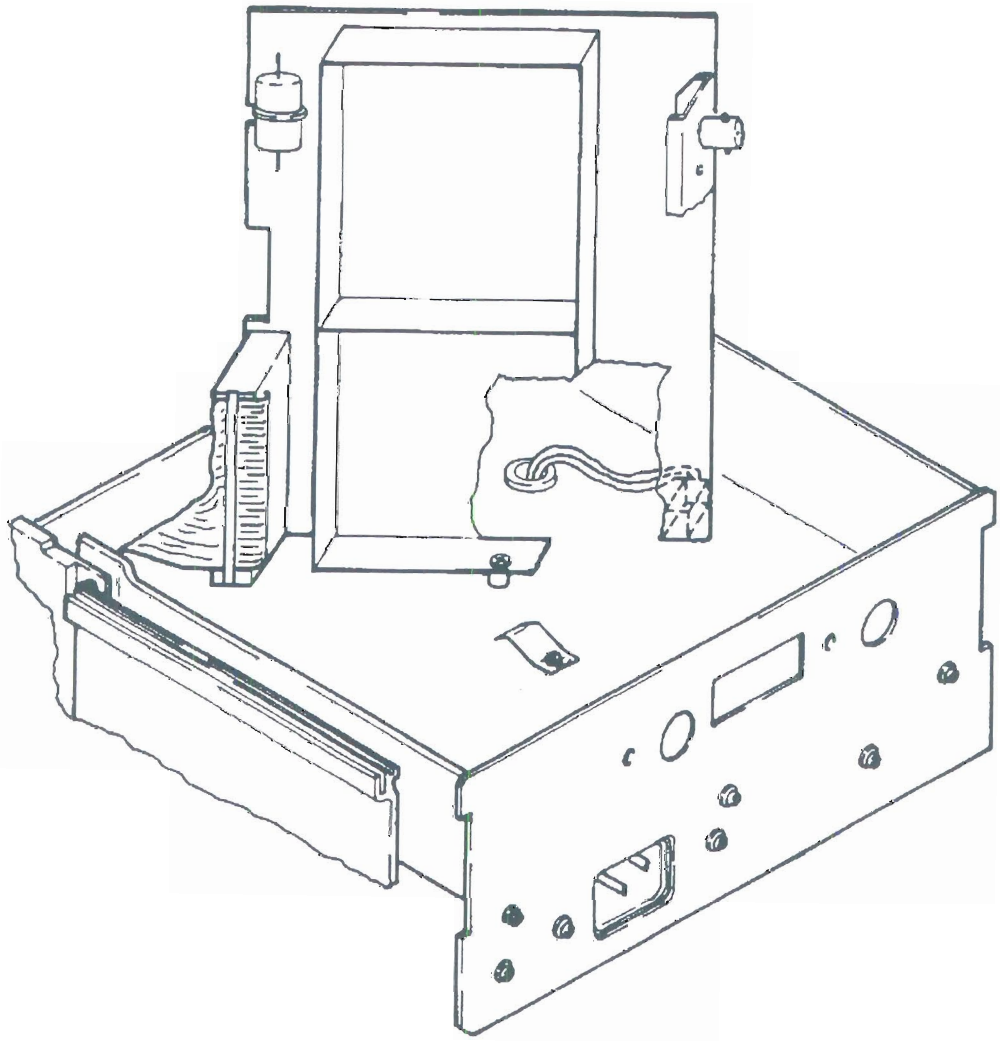


Fig. 7-5 Main board in service position

7.4.4 Removing the Screening Cover on the Main Board

In order to make the components on the main board accessible from both sides for repair, the screening cover must be removed.

To this end, loosen the 6 Phillips screws and take off the cover.

7.4.5 Removal and Replacement of the Display Module

- Remove the 2 rear panel feet and the lower instrument panel.
- Disconnect the 34-way connection to the main board.
- Remove the 4 Phillips screws on the front of the instrument.
- Remove the display module with the identification plate towards the front from the frame.

For replacement, proceed in the reverse order. Make sure that the contact springs attached around the display module are slightly prestressed.

7.4.6 Removing the Front Sheet

Although most components are located on the solder side of the front panel, it may be necessary for troubleshooting to reach the the component side also.

For removing the display, it is also necessary to take off the front sheet, which supports the display.

After loosening 4 Phillips screws and carefully removing the measuring head receptacle, the sheet can slightly be lifted off the printed circuit. The measuring head receptacle can be loosened from the front sheet by bending up the retaining clips. To remove completely, cable W2 connecting the front panel with the display must be disconnected.

For removal of the complete display module from the instrument, which must be done first, see section 7.4.3.

7.4.7 Replacing the Display

In order to remove the display, the front sheet is to be unscrewed according to section 7.4.6.

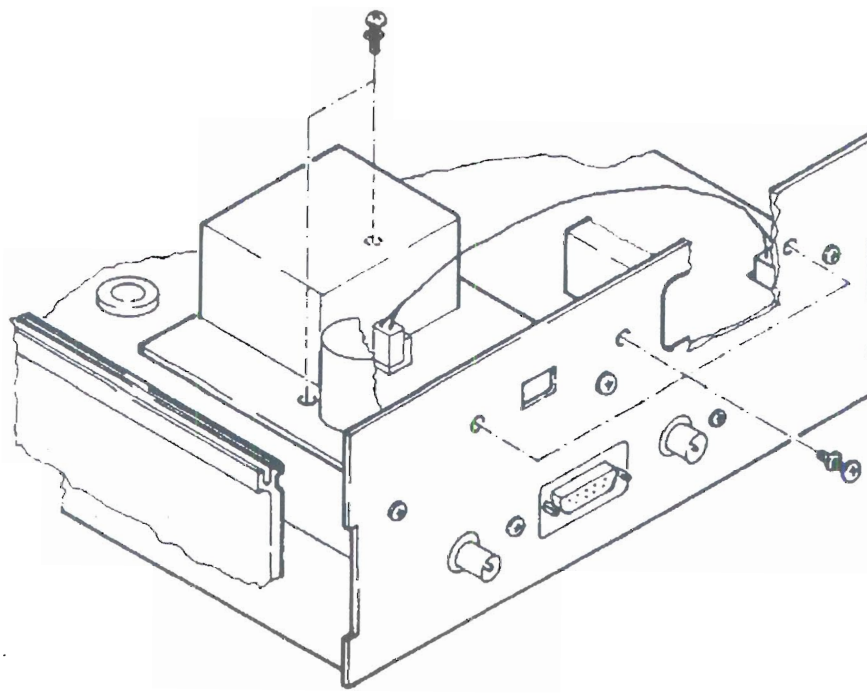
Then loosen the 3 supporting springs fastened with Phillips screws, and the complete display can be detached from the front sheet.

For replacing the display, proceed in the reverse order.

7.4.8 Removal and Replacement of the Power Supply Board (Model 03)

- Remove the 2 rear panel feet and the upper instrument panel.
- Disconnect cable W20 from the power supply board to the main board.
- Loosen the 3 Phillips screws on the rear of the instrument.
- Remove the 2 Phillips screws on the printed circuit (see Fig. 7-6).
- Take the power supply board out of the instrument, together with the metal clamp supporting the AC voltage selector and the line filter.

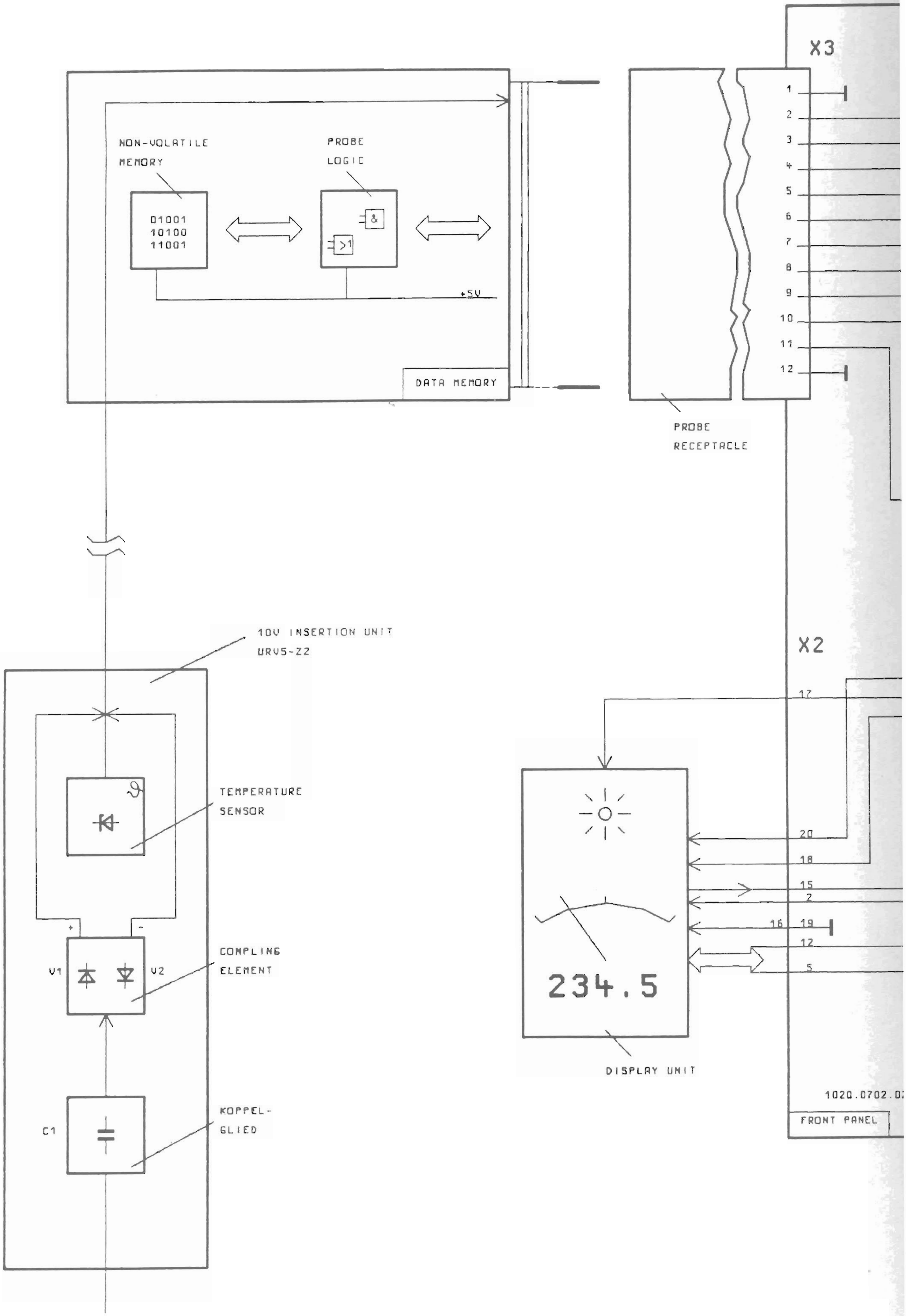
Caution: ***When replacing voltage regulator V2, make sure to mount it insulated from the metal sheet.***



Fastening points of the power supply board

7.5 Interfaces

Pin	Name	Input/output	Origin destinatio	Value range	Signal description
X100.1	EIN	input	R532	0 to 8,0 V	Signal for ON
X100.2	KEY	output	D714.11	0/ + 5 V	CS keyboard
X100.3	$\overline{RD}$	output	D700.19	0/ + 5 V	READ signal
X100.4	TASTINT	input	D615.9	0/ + 5 V	Interrupt
X100.5	D0	input/output	D700.43	0/ + 5 V	Data bus
X100.6	D1	input/output	D700.42	0/ + 5 V	Data bus
X100.7	D2	input/output	D700.41	0/ + 5 V	Data bus
X100.8	D3	input/output	D700.40	0/ + 5 V	Data bus
X100.9	D4	input/output	D700.39	0/ + 5 V	Data bus
X100.10	D5	input/output	D700.38	0/ + 5 V	Data bus
X100.11	D6	input/output	D700.37	0/ + 5 V	Data bus
X100.12	D7	input/output	D700.36	0/ + 5 V	Data bus
X100.13	$\overline{CS}1$	output	D714.6	0/ + 5 V	CS for LCD driver
X100.14	$\overline{CS}2$	output	D714.8	0/ + 5 V	CS for LCD driver
X100.15	READY	input		0/ + 5 V	Acknowledge of LCD driver
X100.16	$\overline{RE}$	output	D700.5	0/ + 5 V	LCD Reset
X100.17	SYNC	output	D700.6	0/ + 5 V	Synchronization LCD
X100.18	$\overline{WR}$	output	D700.18	0/ + 5 V	Write signal
X100.19	ILLUM	output	V103	65 mA	Illumination
X100.20	U_E	output	D500.14	0 to 8,0 V	Voltage for ON
X100.21	U_{INSTR}	output	R428	0 to 0,3 V	Control voltage for instrument
X100.22	GND			0 V	Ground
X100.23	GND			0 V	Ground
X100.24	+ 5 V_{DIG}	output	N500.1	+ 5 V	Voltage supply for display
X100.25	DATA	input/output	R625	0/ + 5 V	Serial data for probe
X100.26	V_{CC}	output	V404/406	0/ + 5/ + 12 V	Voltage supply for probe
X100.27	MKID	input	D600.21		Probe identification
X100.28	MKCLK	output	R626	0/ + 5 V	Probe clock
X100.29	MKRESET	output	D101.12	0/ + 5 V	Probe reset
X100.30	MKTEMP	input/output	D400.5	0/ + 0,3/ + 3 V	Temperature sensor
X100.31	DCINP	input	D321/322	0 to 300 V	Measuring input
X100.32	RGND/V_{EE}	input	S100.2	0/-12 V	Voltage supply for probe
X100.33	− INP	input	R253	0 to 10 V	Measuring input
X100.34	+ INP	input	R252	0 to 10 V	Measuring input
X320.1	DCFREQ	input	R131	0 to + 1 V	Frequency corrrection input
X500.1	U_{IN}	input	L501	5,4 to 8,5 V	Voltage supply for URV35
X500.2	BATT	output	X500.1	5,4 to 7,5 V	Battery terminal
X500.3	GND			-0,25 V...	Ground
X500.4	GND			+ 5,25 V	Ground
X620.2	RS232IN	input	R619	± 3 to ± 25 V	Remote control input
X620.3	RS232OUT	output	R622	± 5 to ± 7,5 V	Remote control input
X620.4	DTR	output	R631	0/ + 5 V	RS-232 control
X620.5	RS232GND			0 V	Ground


X3
NON-VOLATILE
MEMORY
PROBE
LOGIC
01001
10100
11001
&
>1
+5V
DATA MEMORY
PROBE
RECEPTACLE
1
2
3
4
5
6
7
8
9
10
11
12
10V INSERTION UNIT
URV5-Z2
TEMPERATURE
SENSOR
COUPLING
ELEMENT
V1
V2
+
-
KOPPEL-
GLIED
C1
X2
17
20
18
15
2
16
19
12
5
234.5
DISPLAY UNIT
FRONT PANEL

0.0002.02

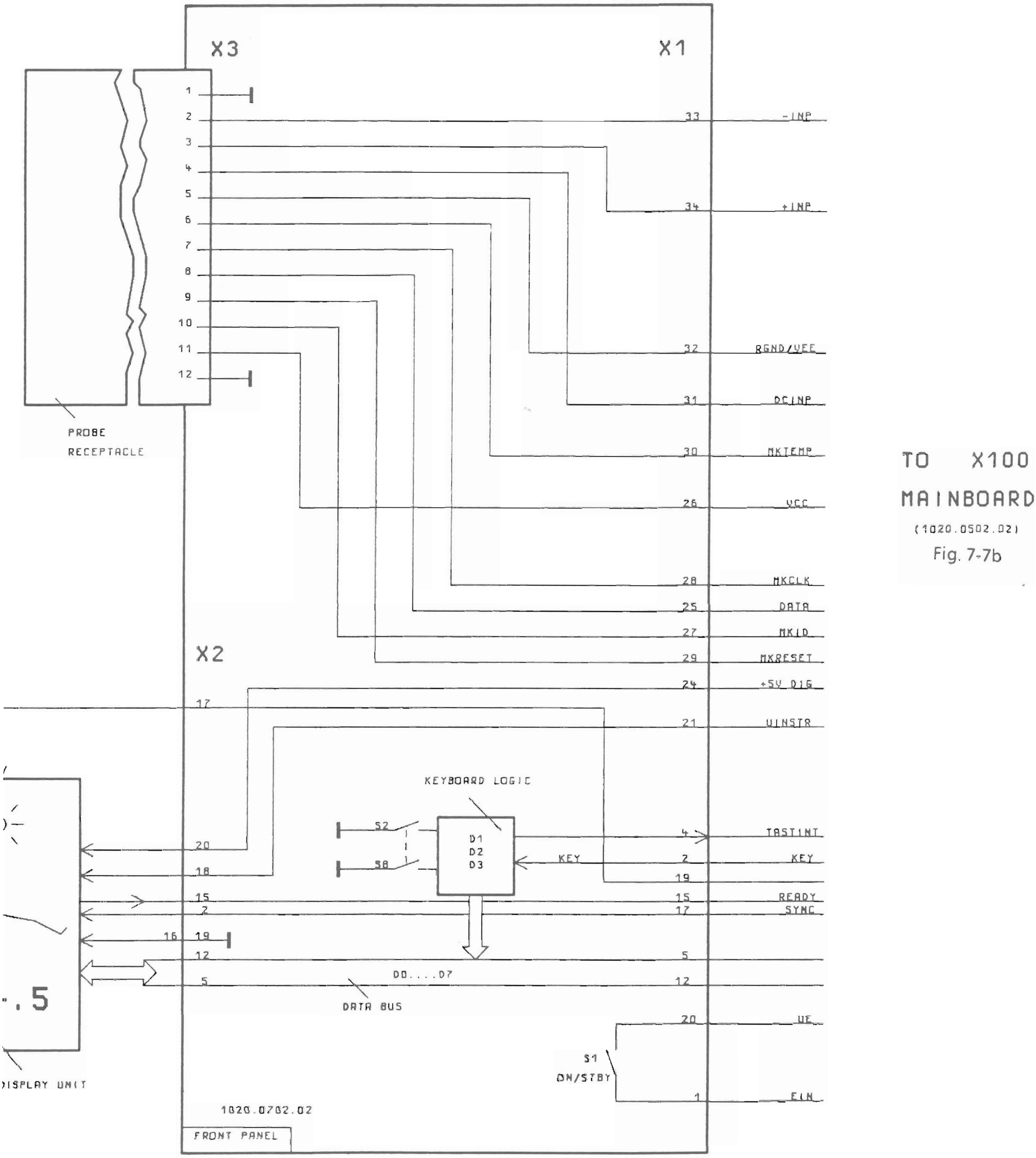
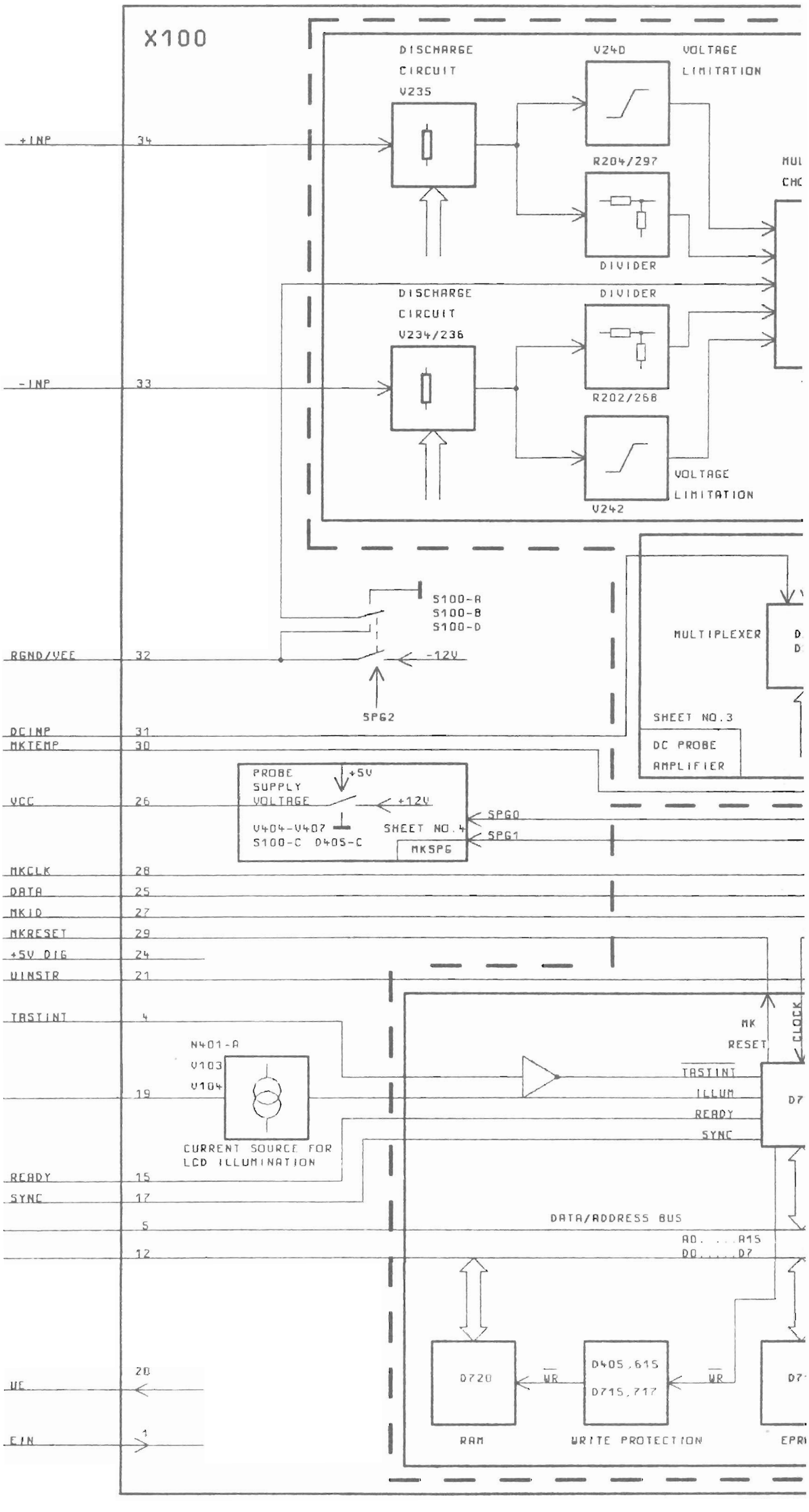
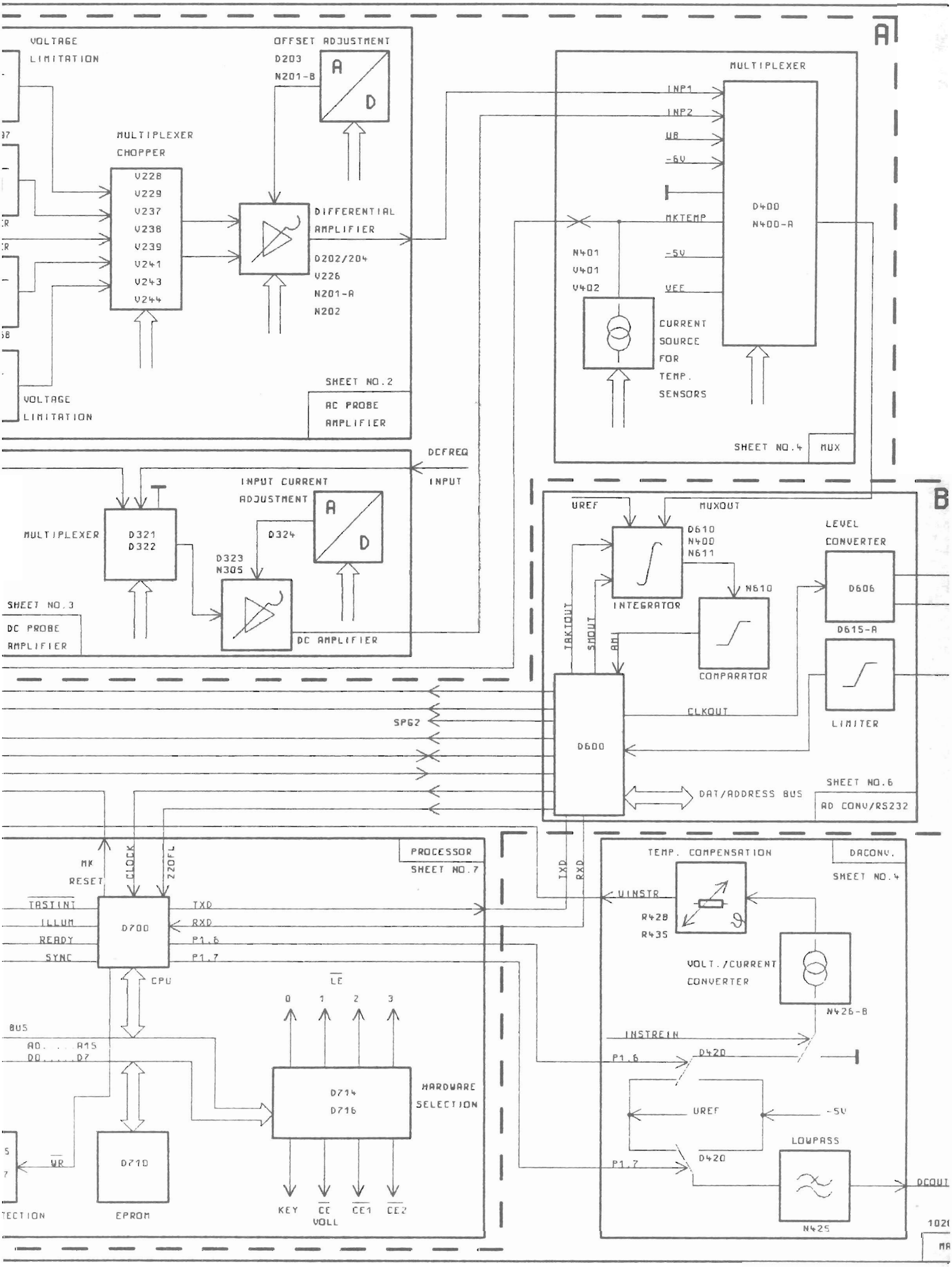


Fig. 7-7a Function circuit diag



TO X1
FRONT PANEL
(1020.0702.02)
Fig. 7-7a



A
B
VOLTAGE LIMITATION
OFFSET ADJUSTMENT
D203
N201-B
MULTIPLEXER CHOPPER
V228 V229 V237 V238 V239 V241 V243 V244
DIFFERENTIAL AMPLIFIER
D202/204
V226
N201-A
N202
SHEET NO.2
AC PROBE AMPLIFIER
MULTIPLEXER
INP1 INP2 UB -6V
MKTEMP
-5V
VEE
D400
N400-A
N401 V401 V402
CURRENT SOURCE FOR TEMP. SENSORS
SHEET NO.4
MUX
DCFREQ INPUT
INPUT CURRENT ADJUSTMENT
D321 D322
D324
D323 N305
SHEET NO.3
DC PROBE AMPLIFIER
DC AMPLIFIER
UREF
MUXOUT
D610 N400 N611
N610
INTEGRATOR
COMPARATOR
LEVEL CONVERTER
D606
D615-A
LIMITER
TAKTOUT
SMOUT
AN
CLKOUT
D600
SPG2
DAT/ADDRESS BUS
SHEET NO.6
AD CONV/RS232
PROCESSOR SHEET NO.7
MK RESET
CLOCK
220FL
TASTINT
ILLUM
READY
SYNC
D700
TXD
RXD
P1.6
P1.7
CPU
BUS
A0....A15
D0.....D7
LE
0 1 2 3
D714 D716
HARDWARE SELECTION
WR
D710
EPROM
KEY
CE VOLL
CE1
CE2
TECTION
TEMP. COMPENSATION
DACONV.
SHEET NO.4
UINSTR
R428 R435
VOLT./CURRENT CONVERTER
N426-B
INSTREIN
D420
UREF
-5V
LOWPASS
N425
DCOUT

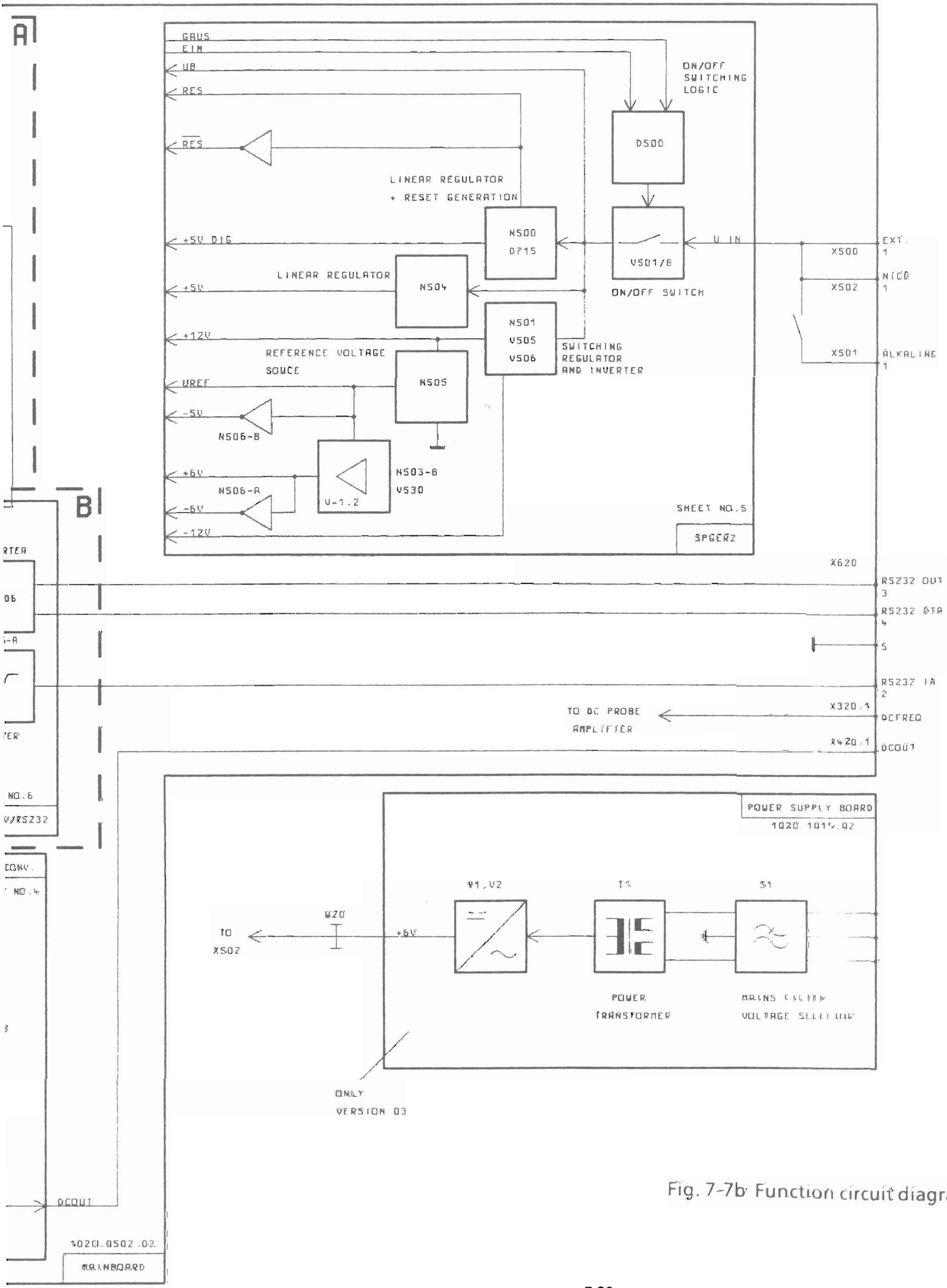
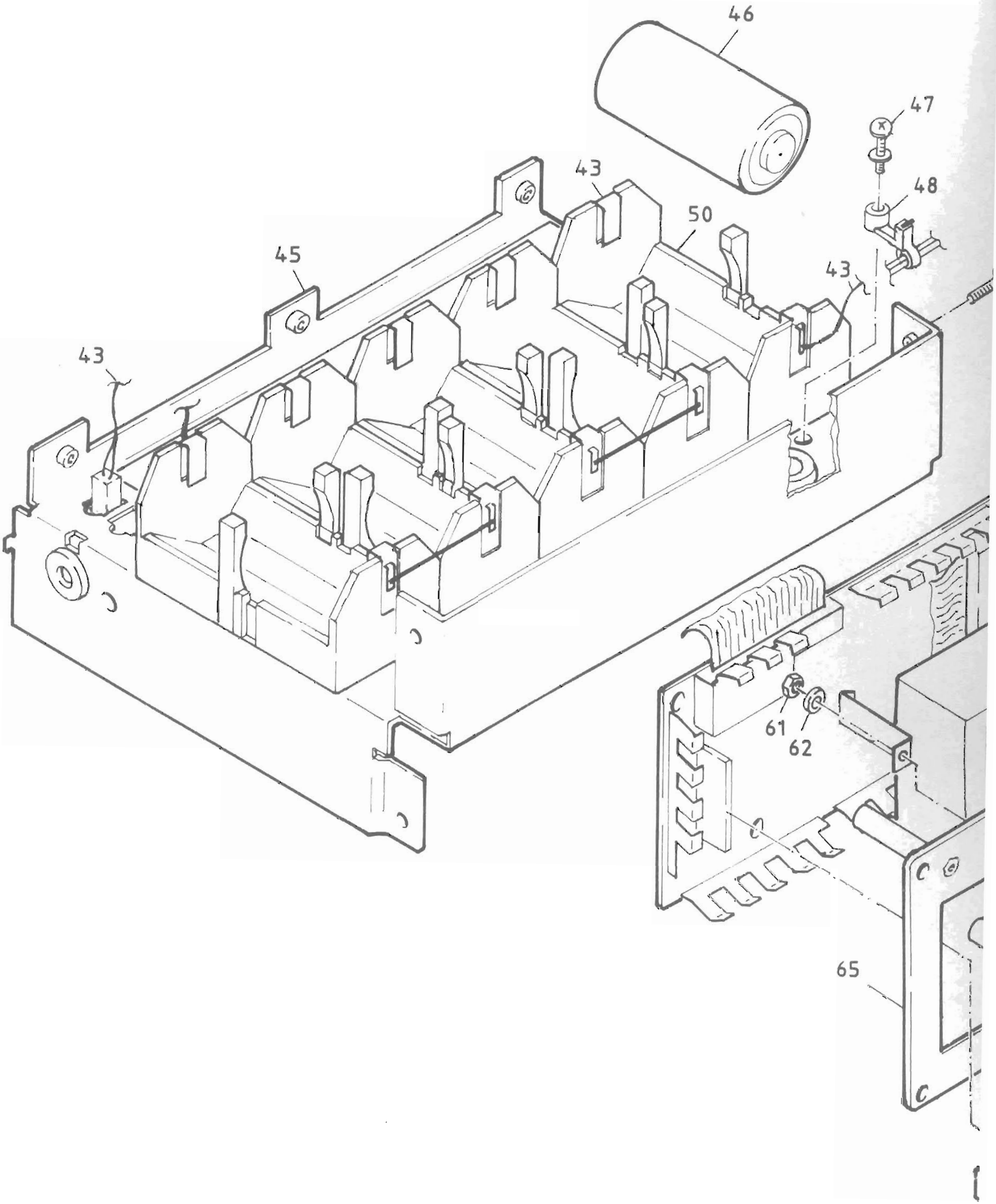


Fig. 7-7b: Function circuit diagram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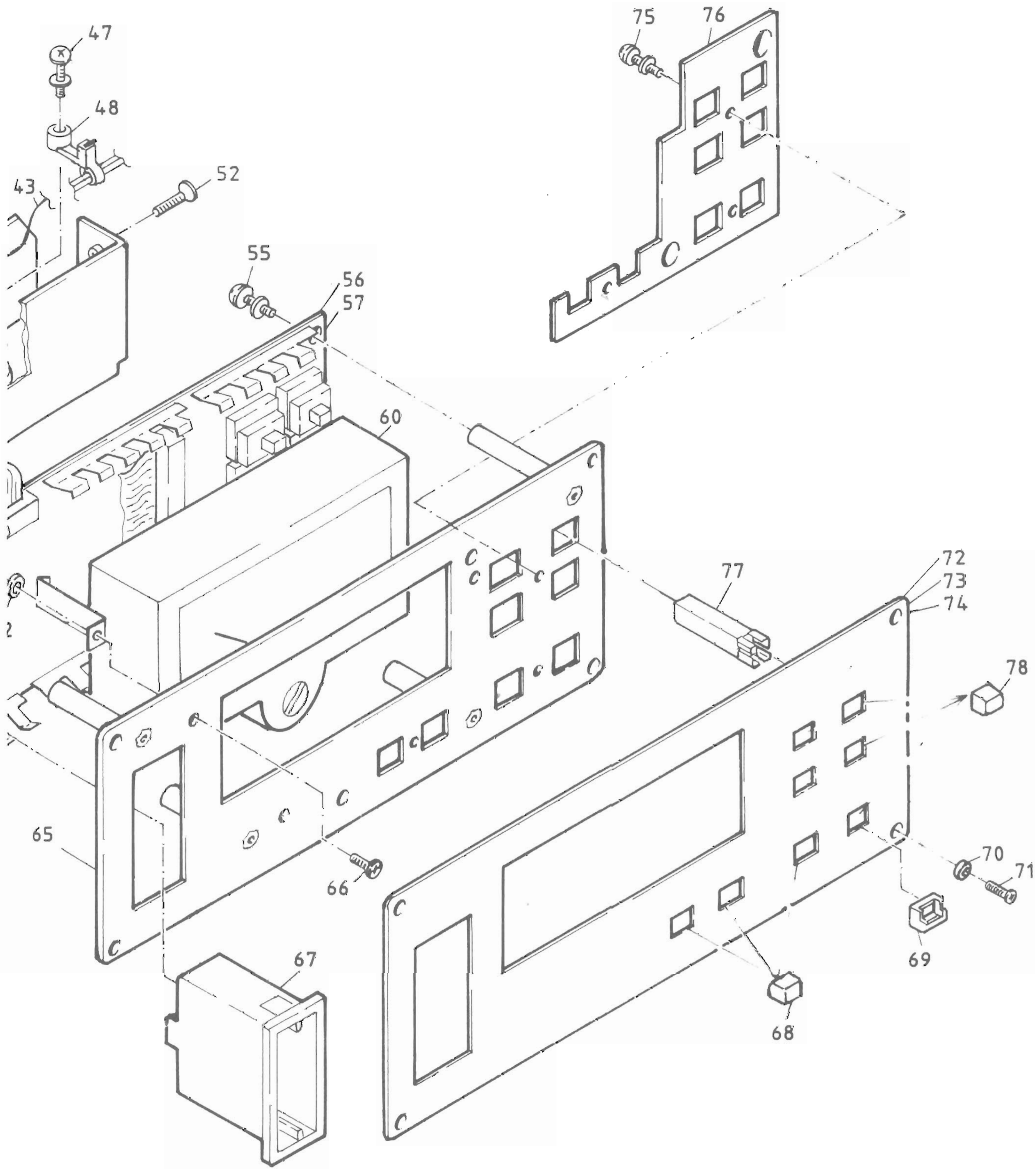
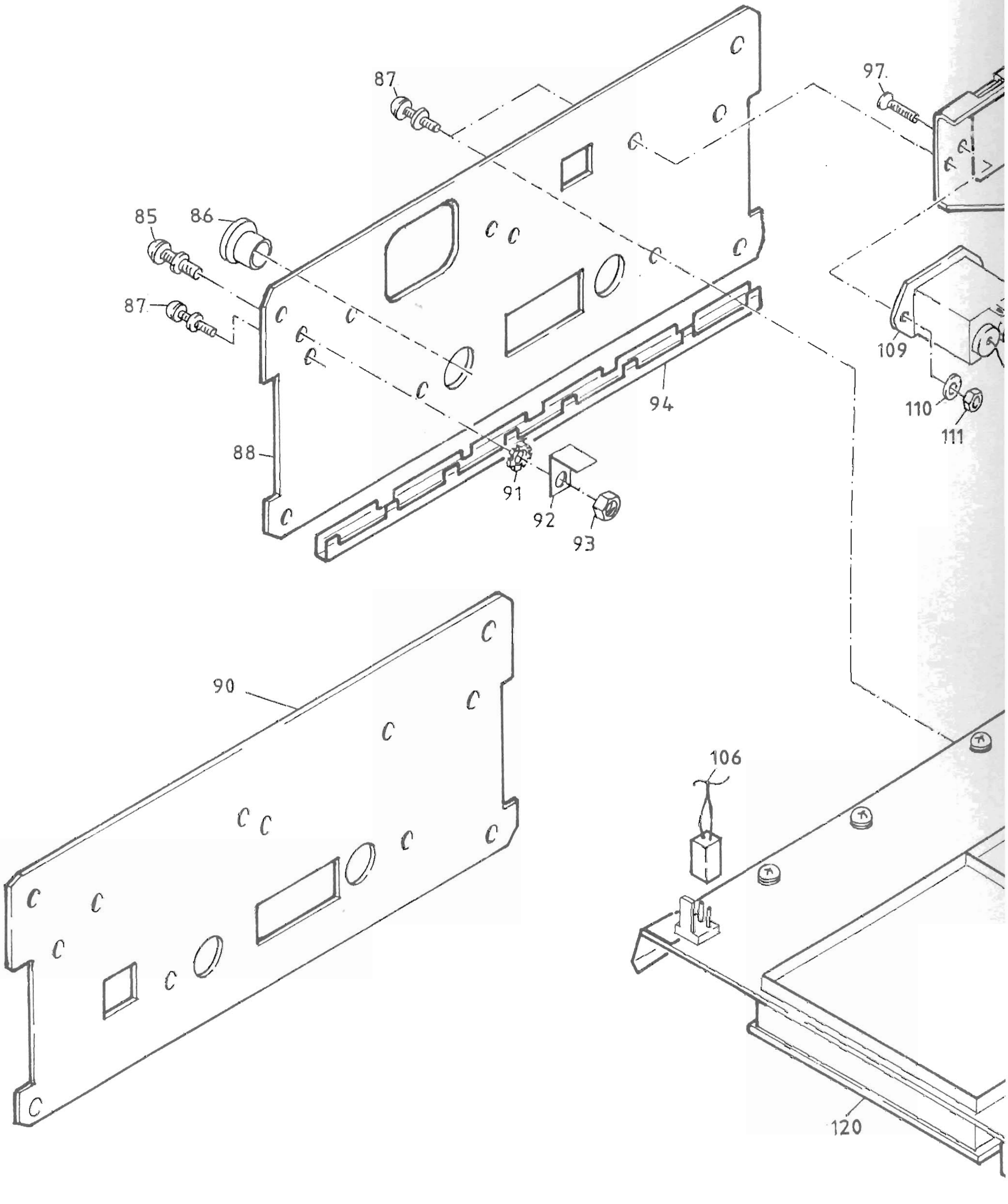


Bild 6
Fig. 6


87
97
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109
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111
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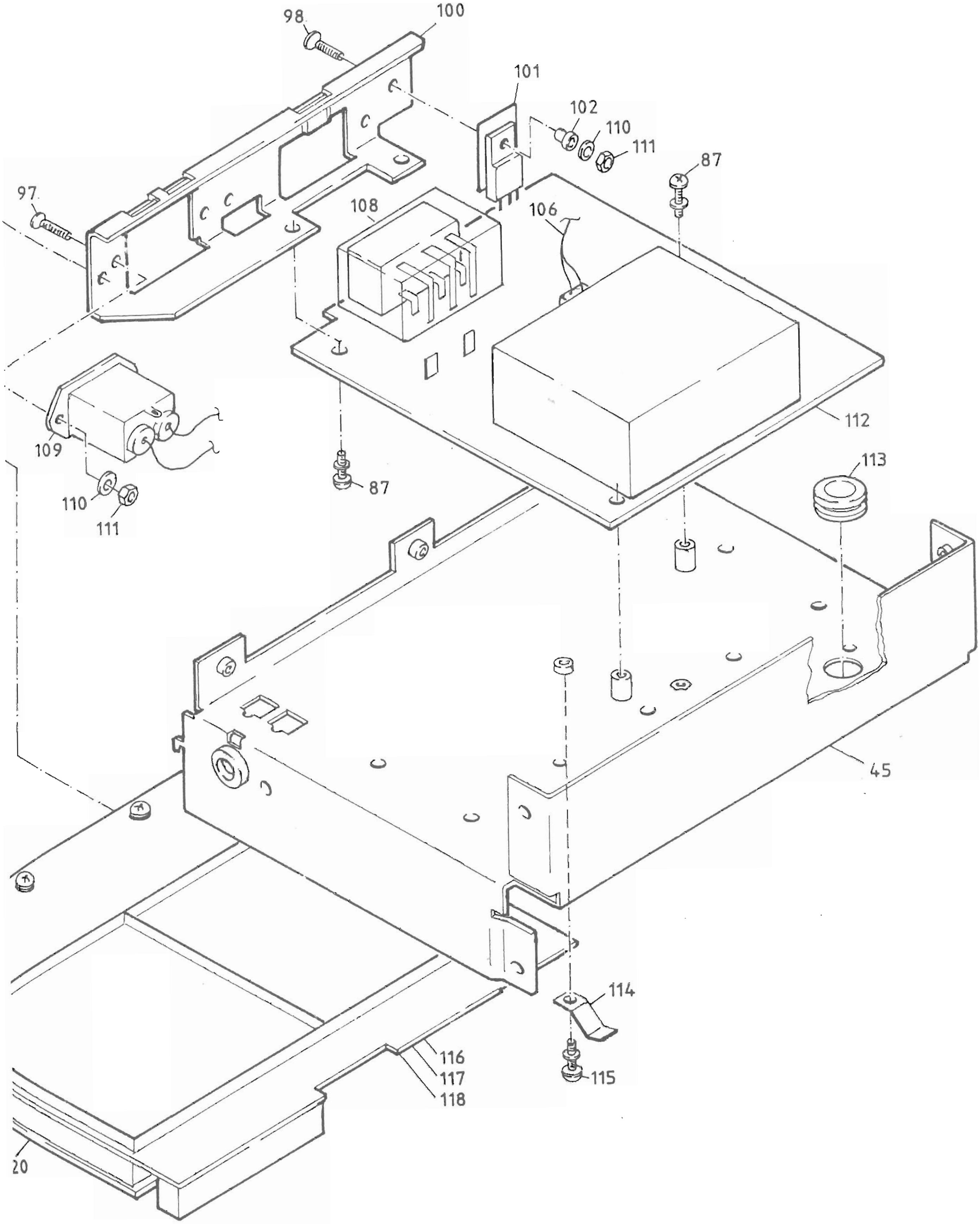
92
93
90
106
120


98
100
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110
111
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112
109
110
111
87
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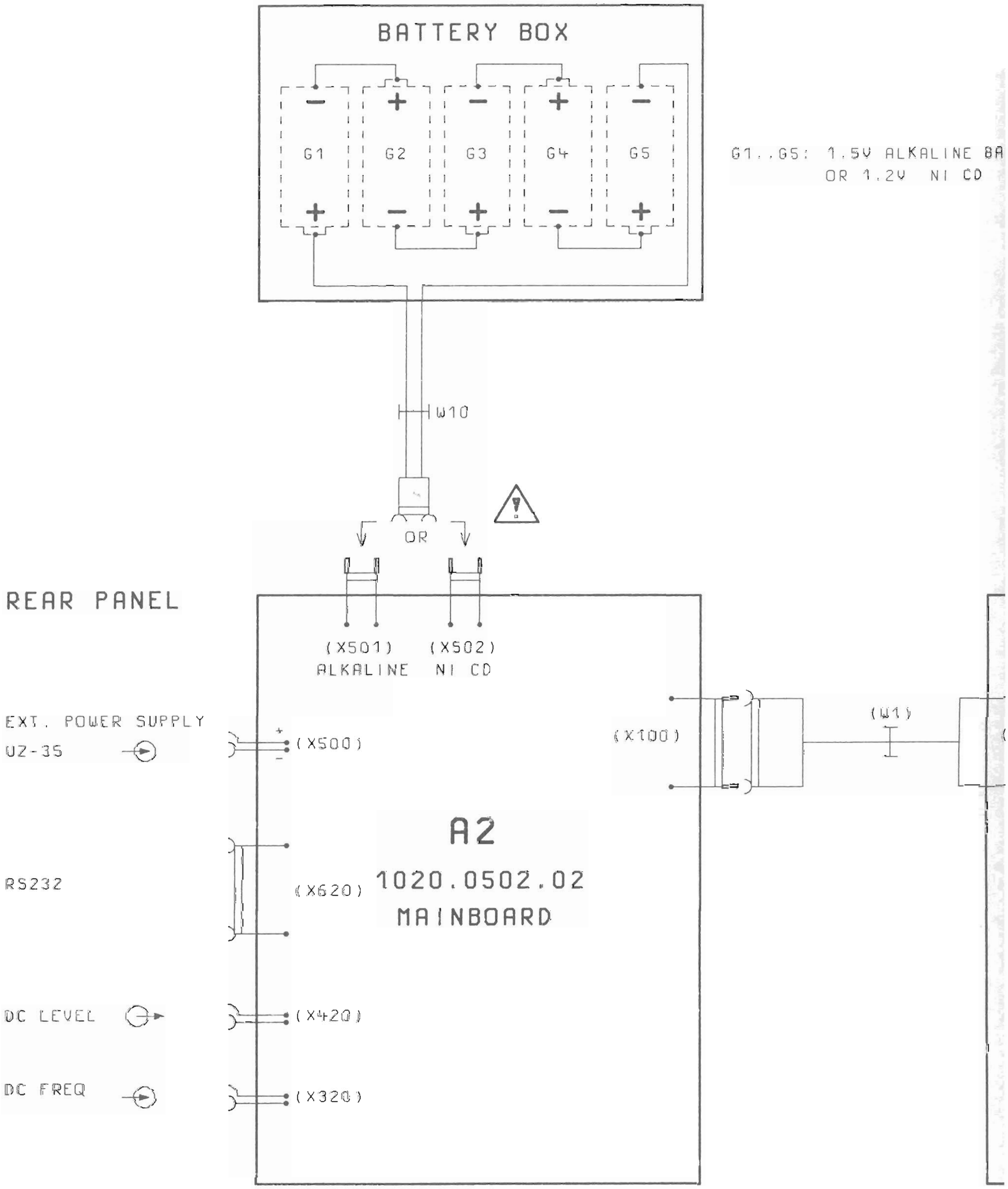
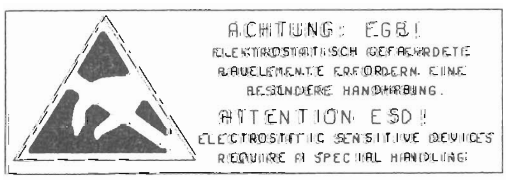
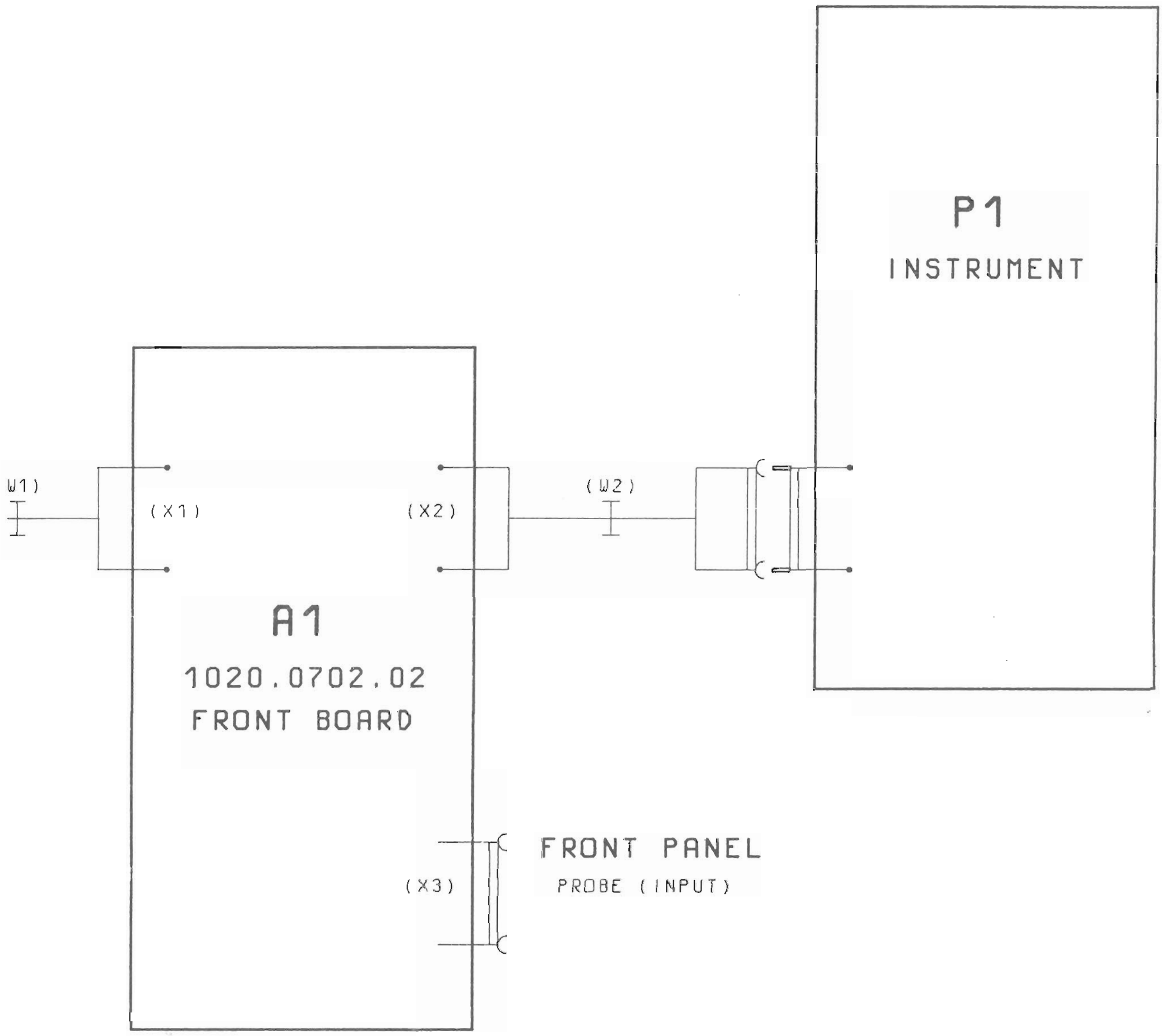
45
114
116
117
118
115
20

Bild 6
Fig. 6


BATTERY BOX
G1
G2
G3
G4
G5
G1..G5: 1.5V ALKALINE BA
OR 1.2V NI CD
W10
OR
REAR PANEL
(X501)
ALKALINE
(X502)
NI CD
EXT. POWER SUPPLY
UZ-35
(X500)
(X100)
(W1)
A2
1020.0502.02
MAINBOARD
RS232
(X620)
DC LEVEL
(X420)
DC FREQ
(X320)


ACHTUNG: EGB!
ELEKTROSTATISCH GEFÄHRDETE
BAUELEMENTE ERFORDERN EINE
BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES
REQUIRE A SPECIAL HANDLING

ALKALINE BATT. SIZE R20
2V NI CD BATT. TYPE KR35/62



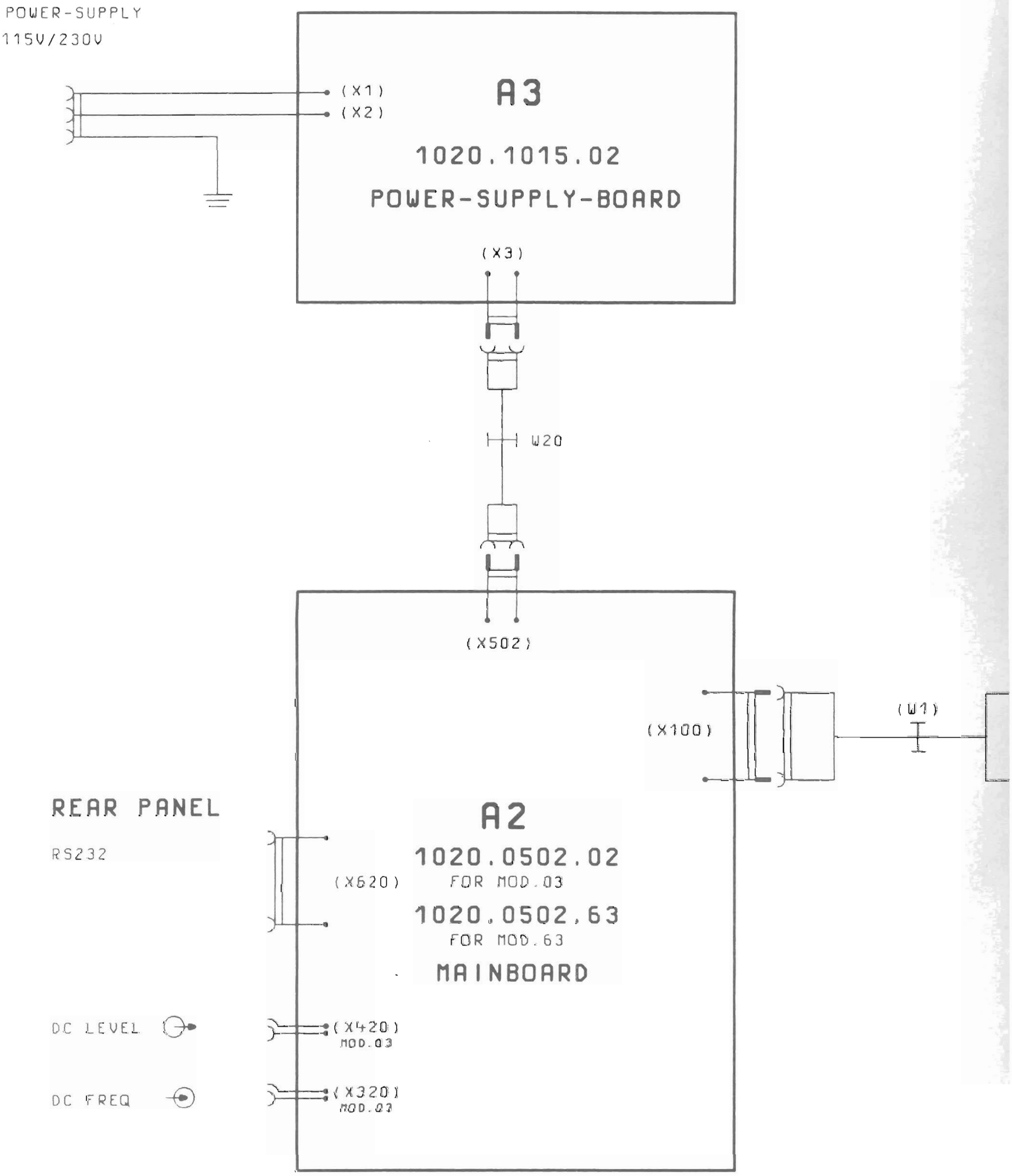
STROMLAUF GILT FUER VAR.02

CIRCUIT DIAGRAM IS VALID FOR MOD.02

!!
EHRDETE
RN EINE
UNG.
D!
E DEVICES
NDLING

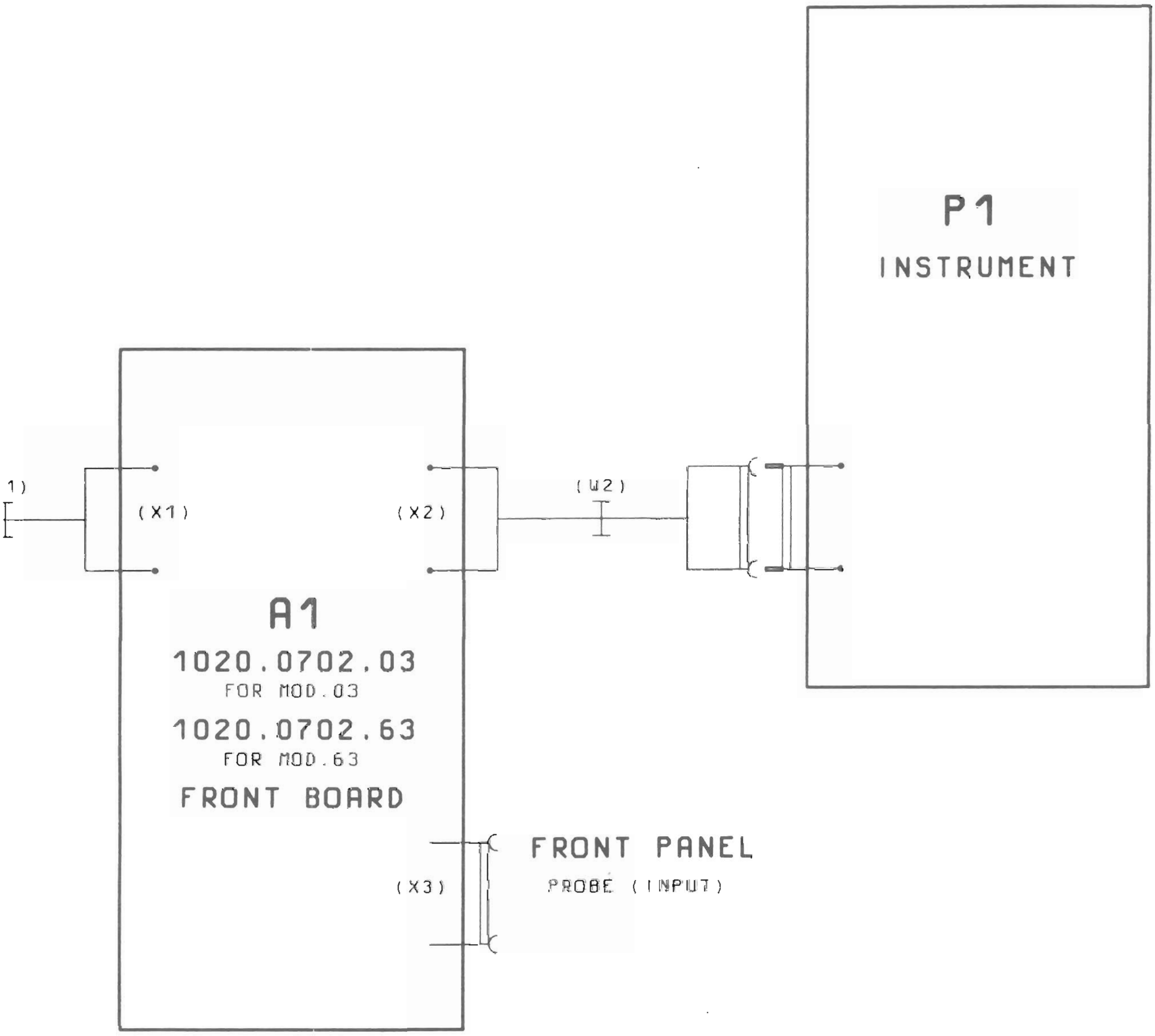
02/00	45805	04.92	SR	1KGU	TAG	NAME	BENENNUNG
				BEARB.		SR	URV35
				GEPR.		SR	LEVEL METER
				NORM			
				PLOTT	02.04.92		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0002.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET URV35			REG.I.V. 1020.0002

BLATT-NR. 1
V. 2 BL.
ERSTE Z. 000.0000



ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

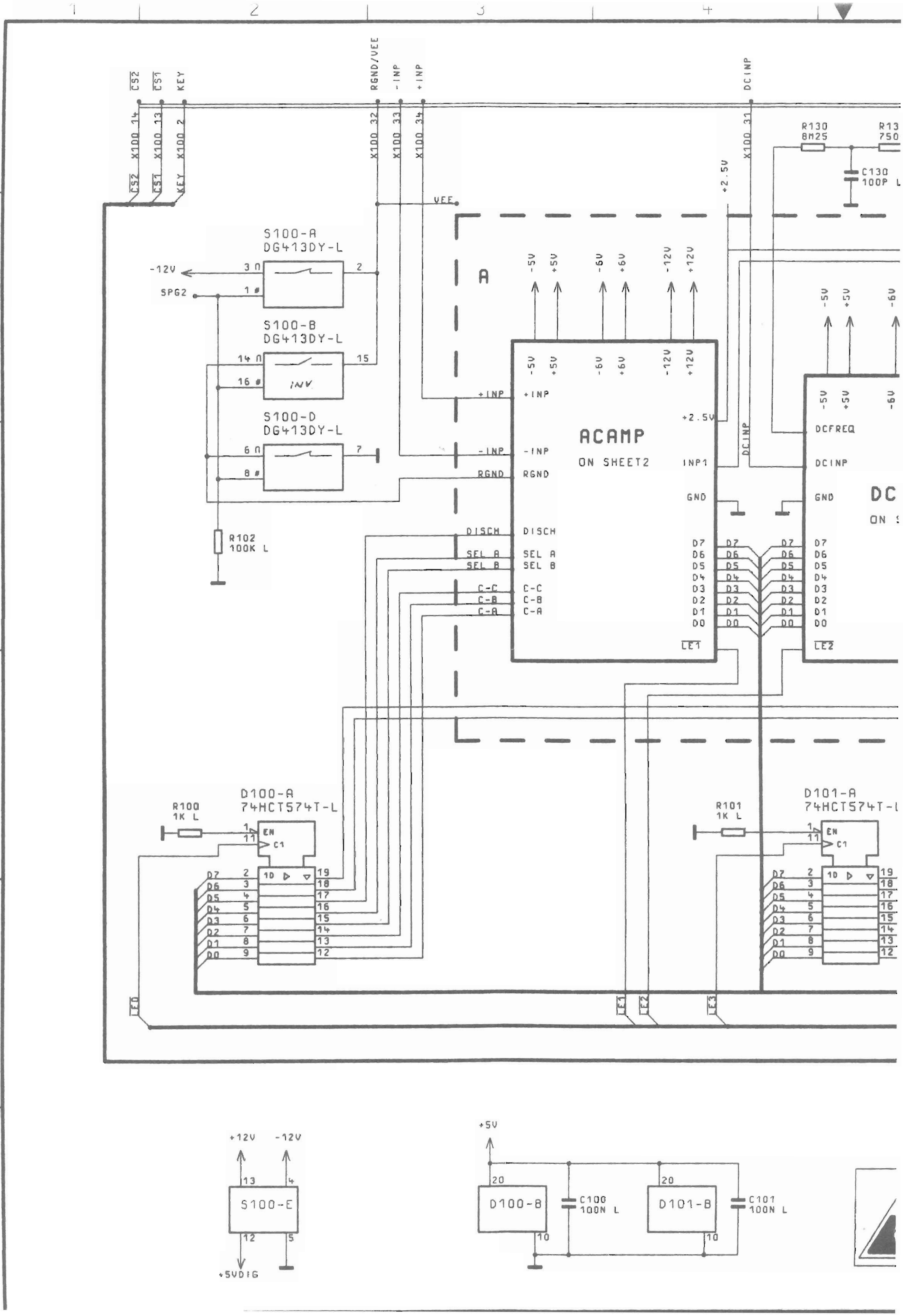


STROMLAUF GILT FUER VAR.03/63

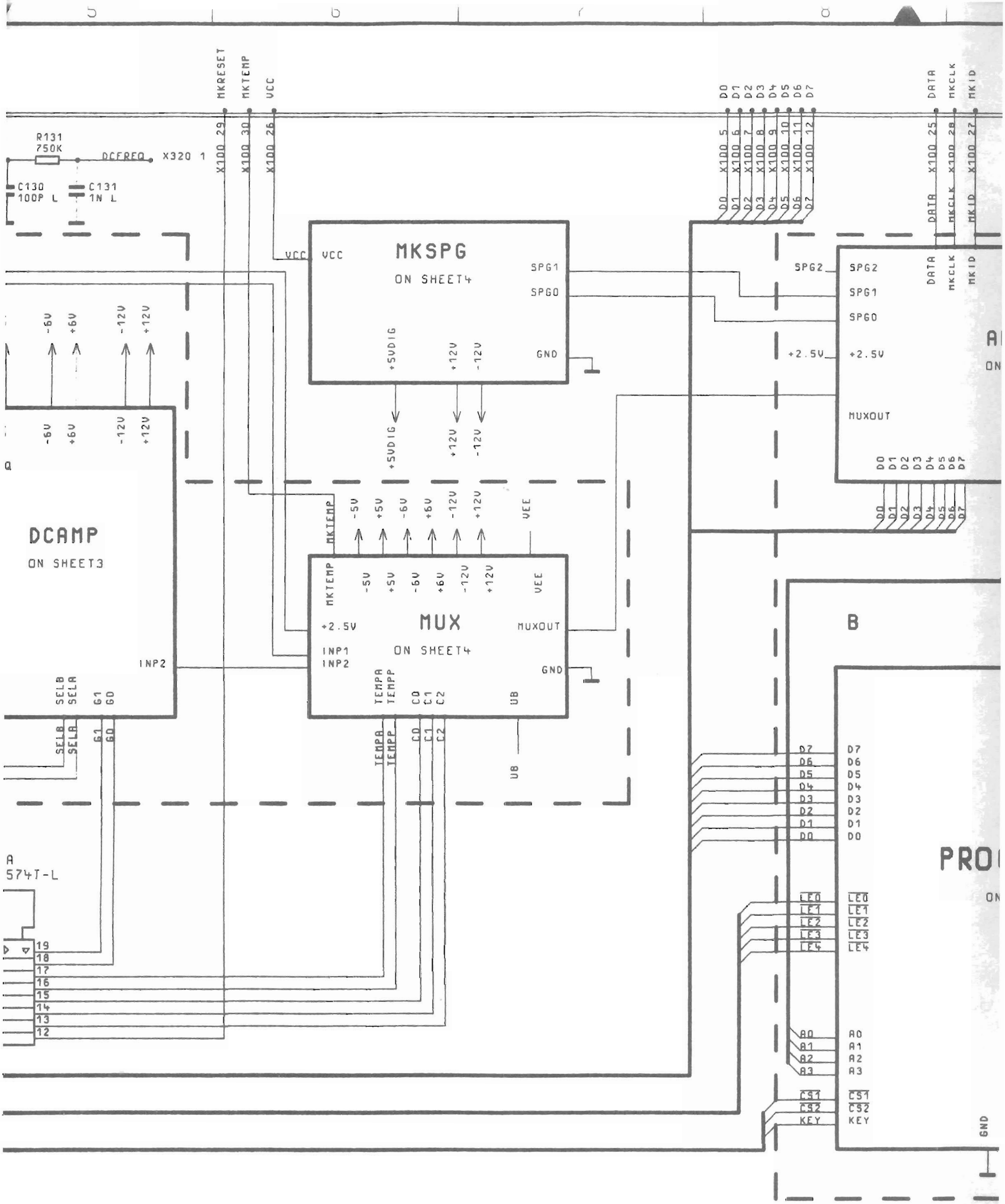
CIRCUIT DIAGRAM IS VALID FOR MOD.03/63

02/00	45805	04.92	SR	1KGU	TAG	NAME	BENENNUNG
				BEARB.		SR	URV35
				GEPR.		SR	LEVEL METER
				NORM			
				PLOTT	02.04.92		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0002.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET URV35			ZUS.T.V. 1020.0002 ERSTE Z. 000.0000

BLATT-NR. 2 v. 2 BL.



1
2
3
4
F
E
D
C
B
A
CS2
CS1
KEY
X100 14
X100 13
X100 2
RGND/VEE
-INP
+INP
X100 32
X100 33
X100 34
DCINP
X100 31
+2.5V
R130
8M25
R13
750
C130
100P L
VEE
S100-A
DG413DY-L
-12V
3
2
SPG2
1
S100-B
DG413DY-L
14
15
16
INV
S100-D
DG413DY-L
6
7
8
R102
100K L
A
-5V
+5V
-6V
+6V
-12V
+12V
+INP
-INP
RGND
DISCH
SEL A
SEL B
C-C
C-B
C-A
ACAMP
ON SHEET2
+2.5V
INP1
GND
D7
D6
D5
D4
D3
D2
D1
D0
LE1
DCFREQ
DCINP
DC
ON
LE2
D100-A
74HCT574T-L
R100
1K L
EN
C1
1D
19
18
17
16
15
14
13
12
D101-A
74HCT574T-L
R101
1K L
LE0
LE1
LE2
LE3
+12V
-12V
13
4
S100-E
12
5
+5VDIG
+5V
20
D100-B
10
C100
100N L
D101-B
C101
100N L



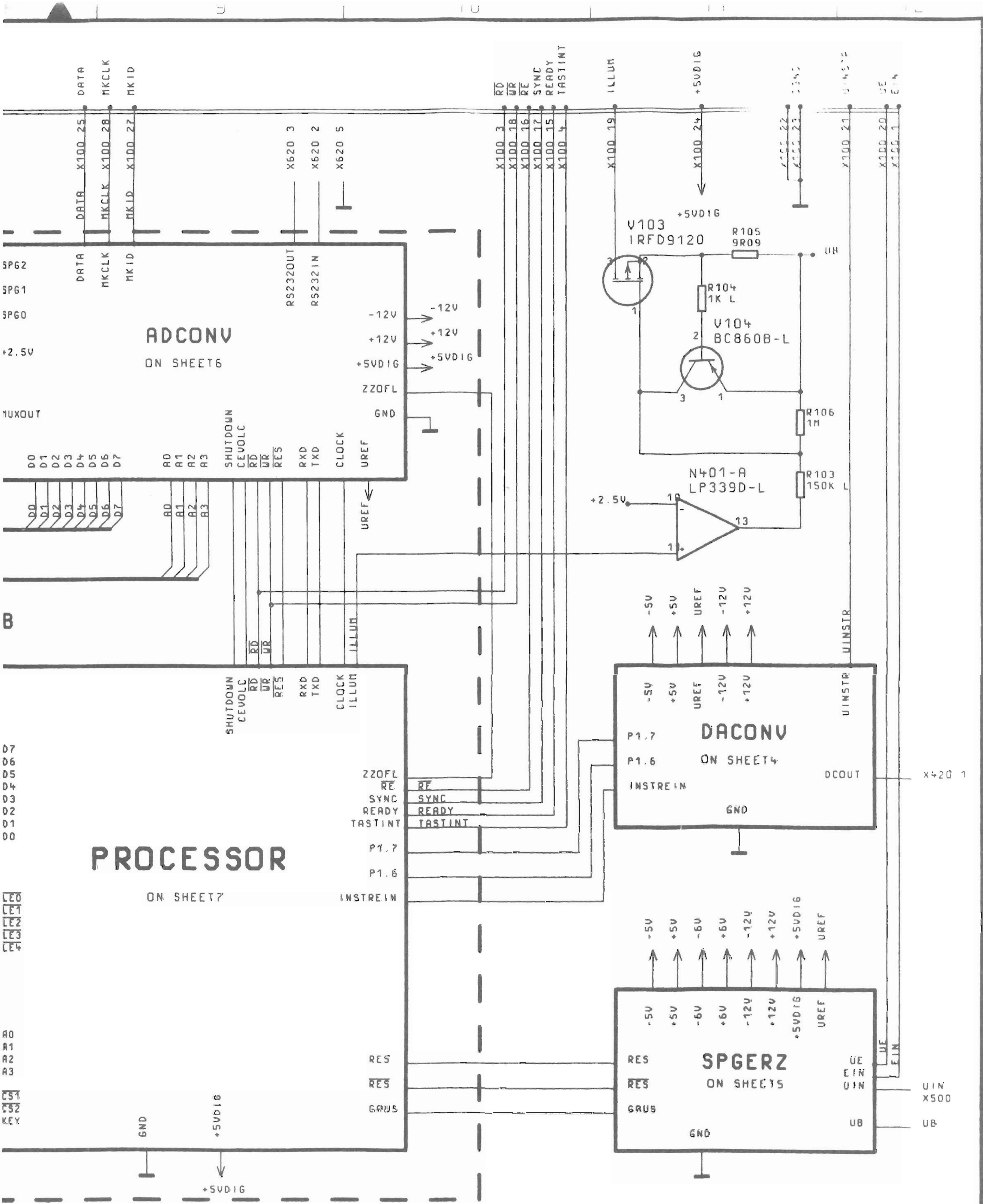
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

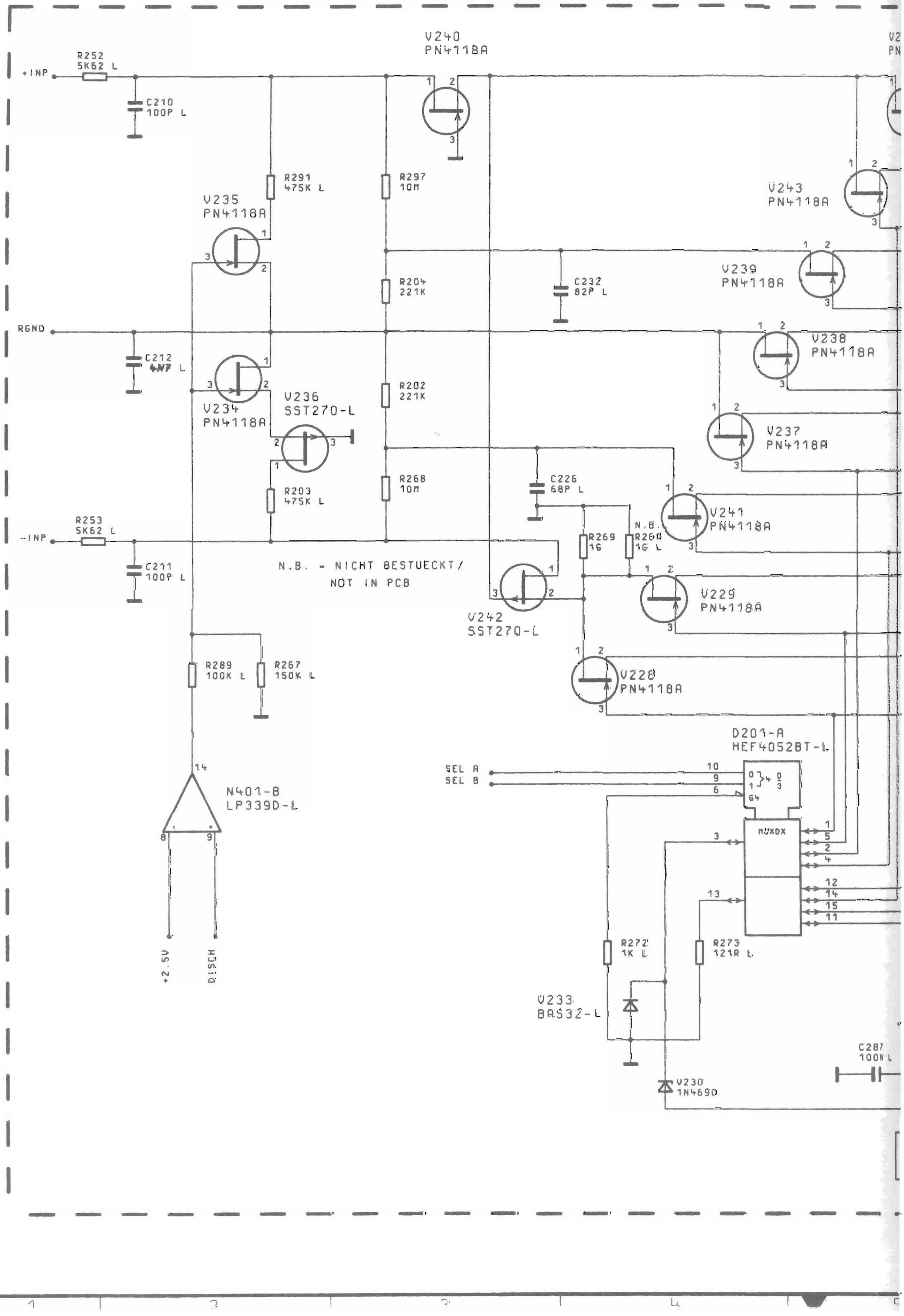
STROMLAUF GILT FUER VAR.02/03/63

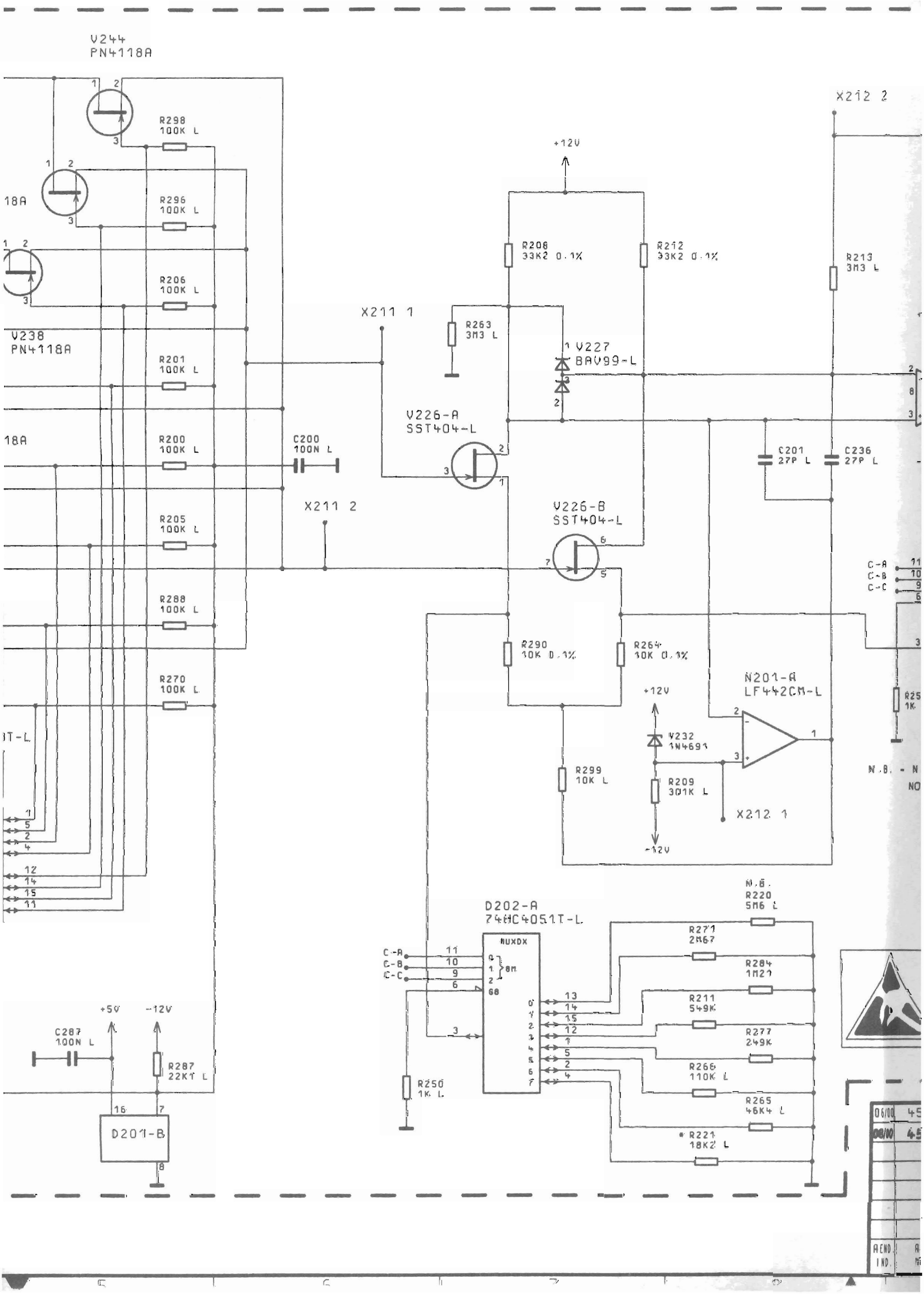
CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

06/00	458
AEND. IND.	AEN MIT

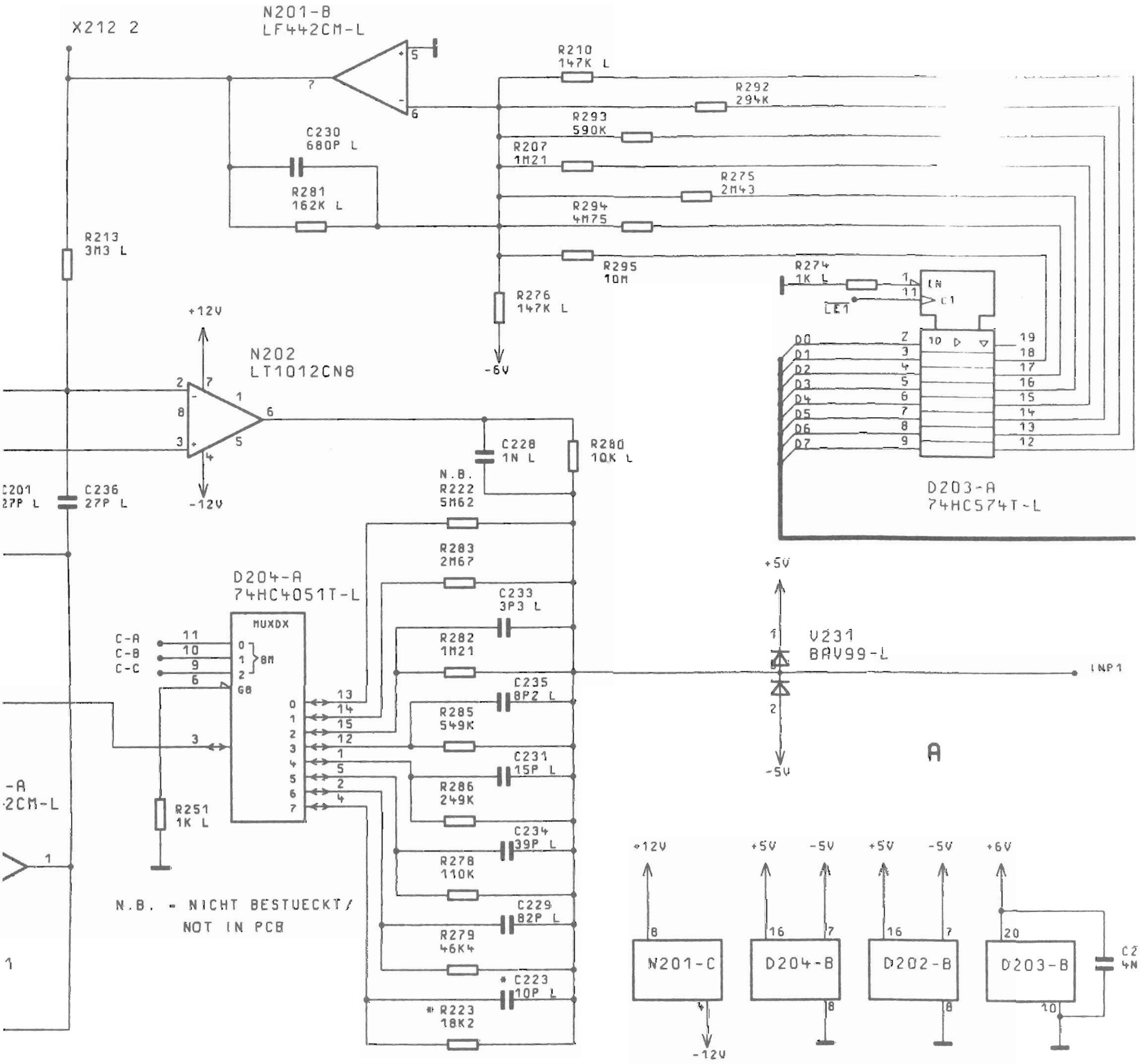


06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG	
				BEARB.		SR	MAINBOARD	
				GEPR.		SR		
				NORM				
				PLOTT	28.10.91			
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S	BLATT-NR. 1
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	URV35		RTG Z.V. 1020.0002	FASTI Z 1020.0002


V240
PN4118A
R252
5K62 L
+INP
C210
100P L
R291
475K L
R297
10M
V235
PN4118A
V243
PN4118A
V239
PN4118A
R204
221K
C232
82P L
RGND
V238
PN4118A
C212
4N7 L
R202
221K
V236
SST270-L
V234
PN4118A
V237
PN4118A
R203
475K L
R268
10M
C226
68P L
V241
PN4118A
R253
5K62 L
-INP
R269
1G
N.B.
R260
1G L
C211
100P L
N.B. - NICHT BESTUECKT/
NOT IN PCB
V242
SST270-L
V229
PN4118A
V228
PN4118A
R289
100K L
R267
150K L
D201-A
HEF4052BT-L
SEL A
SEL B
N401-B
LP339D-L
MUXDX
+2.5V
DISCH
R272
1K L
R273
121R L
V233
BAS32-L
C287
100N L
V230
1N4690



V244
PN4118A
R298
100K L
R296
100K L
R206
100K L
V238
PN4118A
R201
100K L
R200
100K L
C200
100N L
R205
100K L
R288
100K L
R270
100K L
X211 1
X211 2
+12V
R208
33K2 0.1%
R212
33K2 0.1%
R263
3M3 L
V227
BAV99-L
V226-A
SST404-L
V226-B
SST404-L
R290
10K 0.1%
R264
10K 0.1%
R299
10K L
+12V
V232
1N4691
R209
301K L
-12V
N201-A
LF442CM-L
X212 1
X212 2
R213
3M3 L
C201
27P L
C236
27P L
C-A
C-B
C-C
N.B.
R220
5M6 L
D202-A
74HC4051T-L
MUXDX
R271
2M67
R284
1M21
R211
549K
R277
249K
R266
110K L
R265
46K4 L
R221
18K2 L
R250
1K L
C287
100N L
+5V
-12V
R287
22K1 L
D201-B



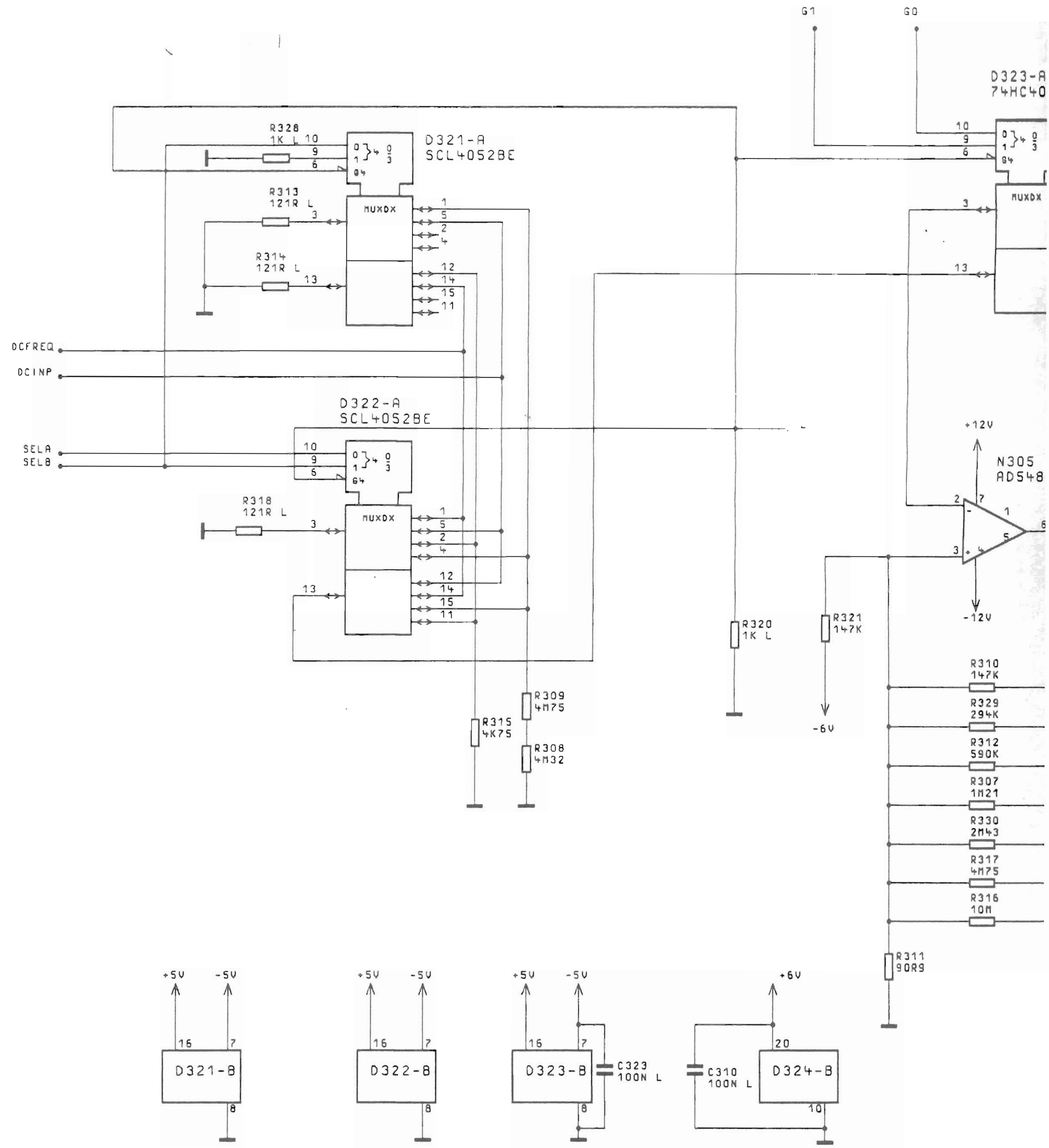
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.02/03/63

CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG
08/00	45805	02.92	SR	BEARB.		SR	ACAMP MAINBOARD
				GEPR.		SR	
				NORM			
				PLOTT	28.10.91		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	URV35		REG I.V. 1020.0002 / BLATT-NR. 2 v. 2 BL. / 1020.0002



ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

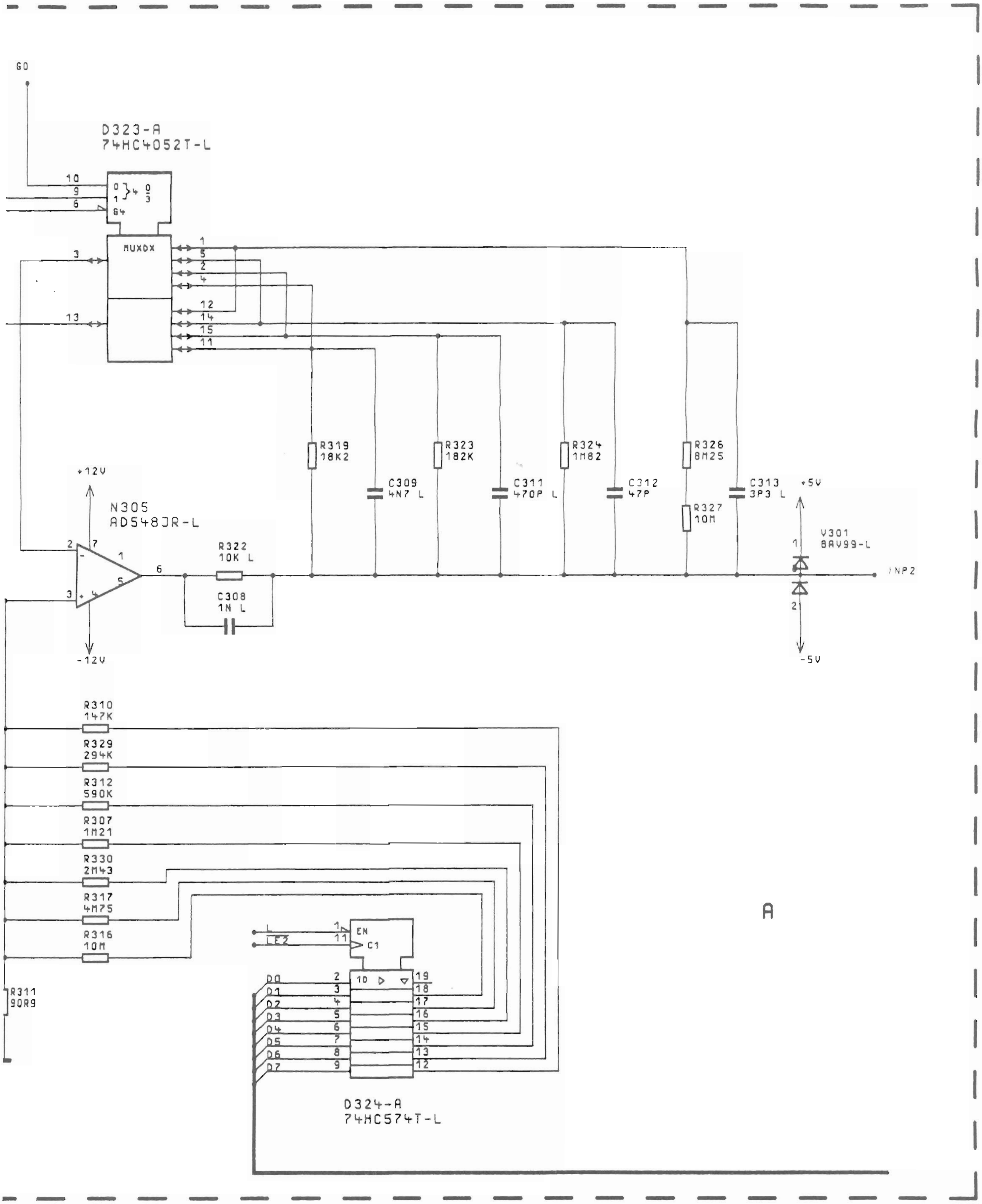
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.02/03/63

CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

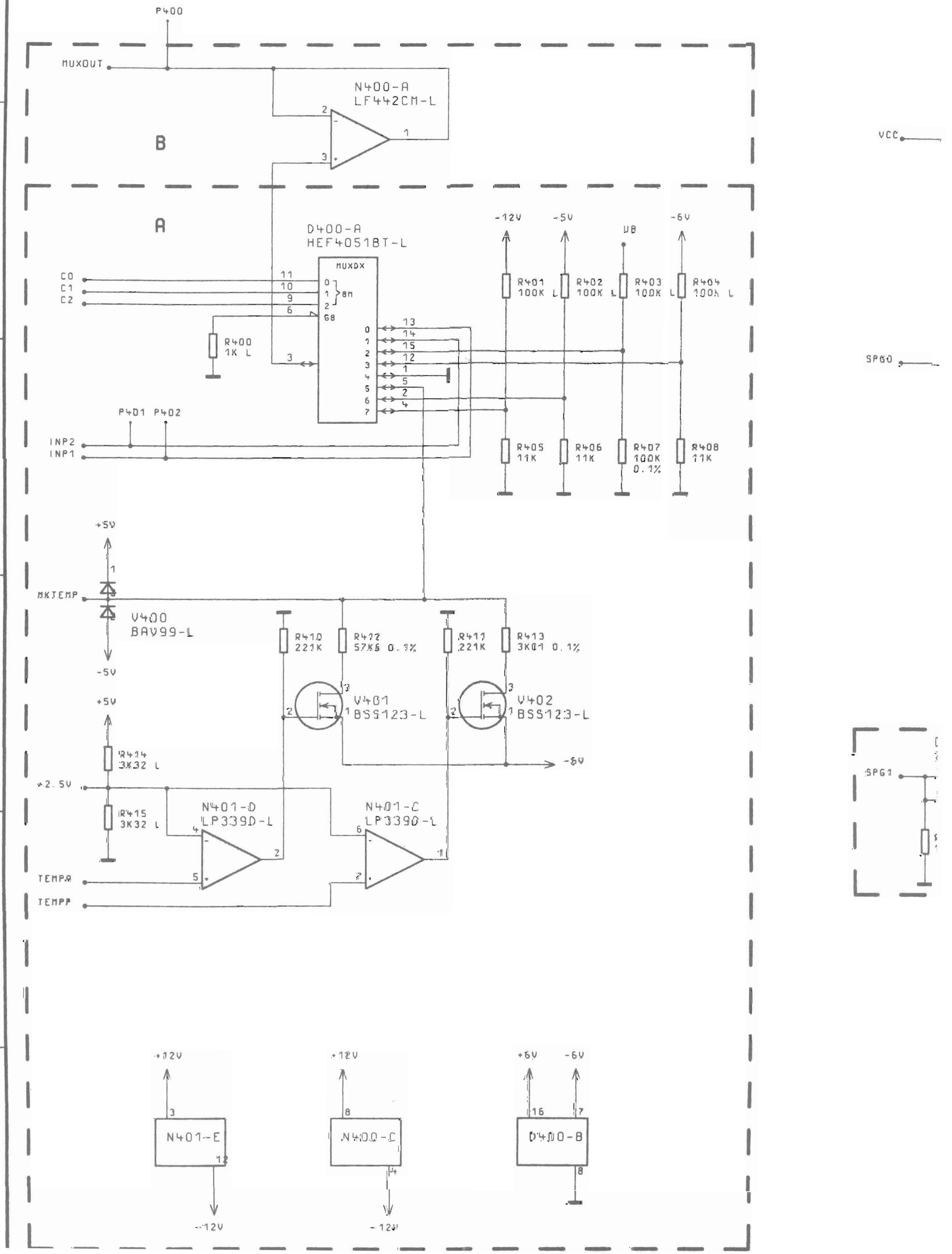
06/00

AEND.
IND.



06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG
				BEARB.		SR	DCAMP
				GEPR.		SR	MAINBOARD
				NORM			
				PLOTT	28.10.91		
							ZEICHN.-NR. 1020.0502.01S
							BLATT-N 3 / V. 7
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			
				ZU GERAET	URV35	REG.I.V. 1020.0002	ERSTE Z. 1020.0002

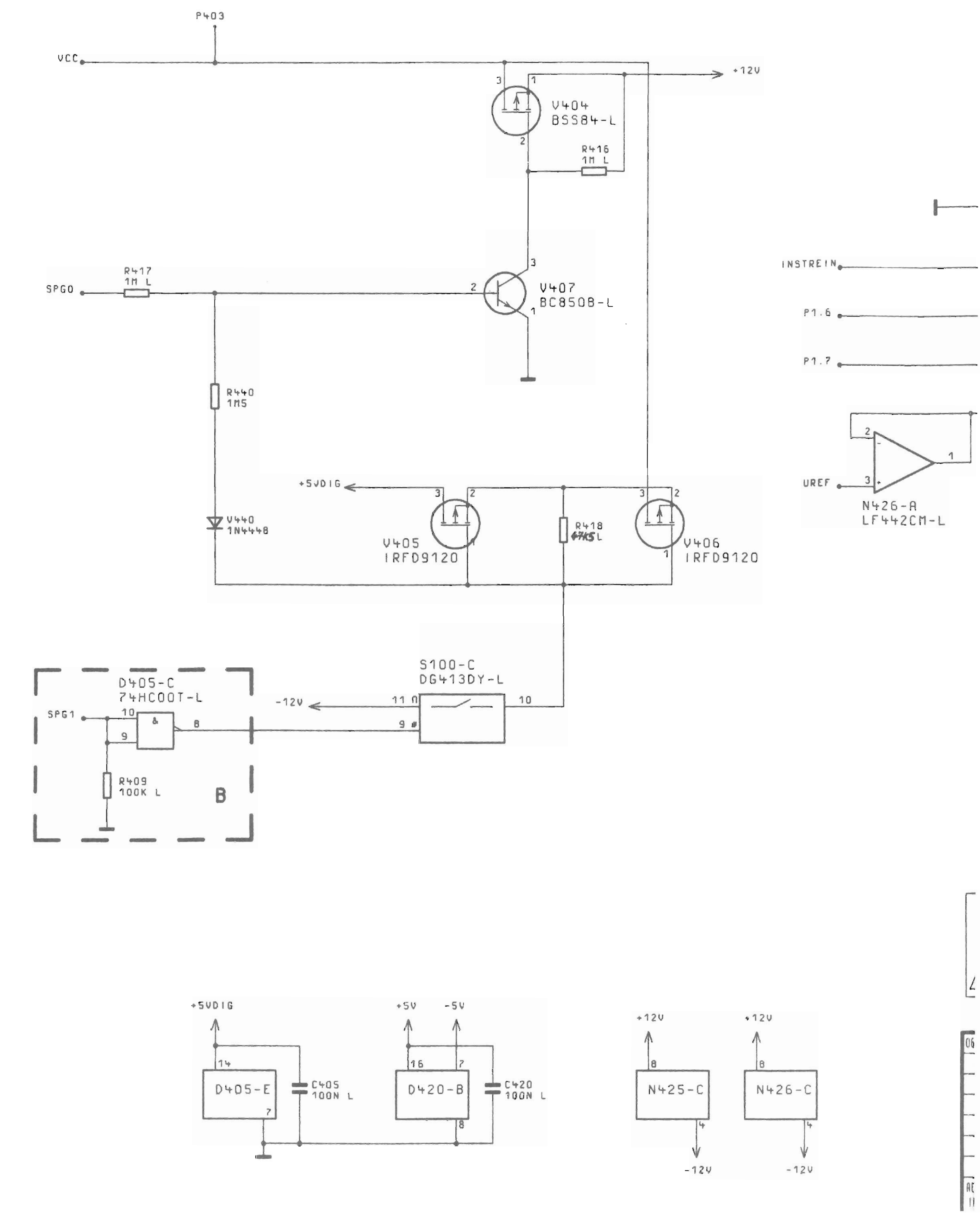
MUX



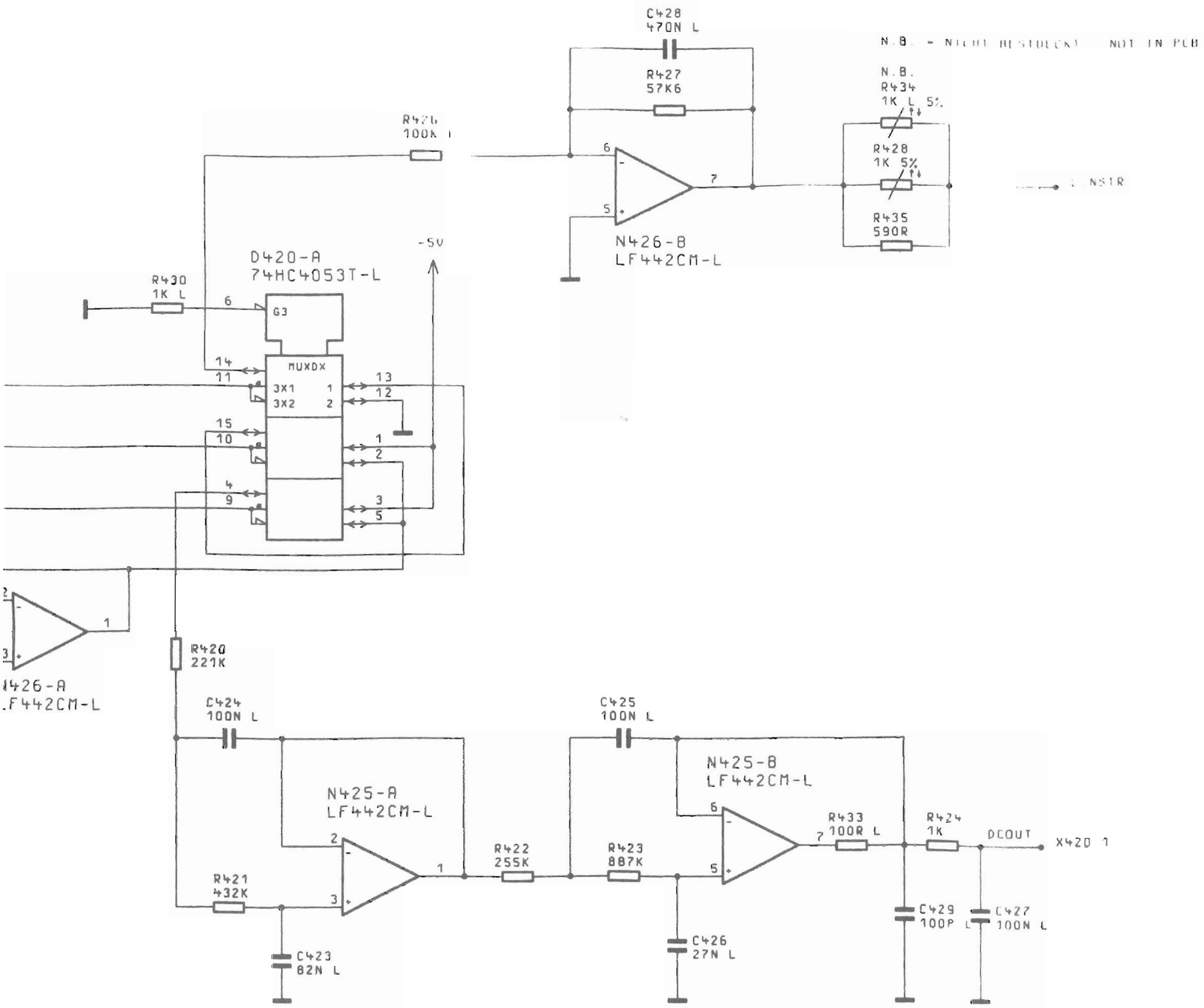
P400
MUXOUT
N400-A
LF442CM-L
B
A
D400-A
HEF4051BT-L
MUXDX
C0
C1
C2
R400
1K L
R401
100K L
R402
100K L
R403
100K L
R404
100K L
R405
11K
R406
11K
R407
100K
0.1%
R408
11K
-12V
-5V
UB
-6V
P401 P402
INP2
INP1
+5V
MKTEMP
V400
BAV99-L
-5V
R410
221K
R412
57K6 0.1%
R411
221K
R413
3K01 0.1%
V401
BSS123-L
V402
BSS123-L
R414
3K32 L
R415
3K32 L
+2.5V
N401-D
LP339D-L
N401-C
LP339D-L
TEMPA
TEMPF
N401-E
N400-C
D400-B
+12V
-12V
+6V
-6V
VCC
SPG0
SPG1

5 6 7 8

MKSPG


P403
VCC
+12V
V404
BSS84-L
R416
1M L
INSTREIN
R417
1M L
SPG0
V407
BC850B-L
P1.6
P1.7
R440
1M5
UREF
N426-A
LF442CM-L
+5VDIG
V440
1N4448
R418
47K5 L
V405
IRFD9120
V406
IRFD9120
S100-C
DG413DY-L
D405-C
74HC00T-L
-12V
SPG1
R409
100K L
B
+5VDIG
D405-E
C405
100N L
+5V
-5V
D420-B
C420
100N L
+12V
N425-C
-12V
+12V
N426-C
-12V

DACONV



ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

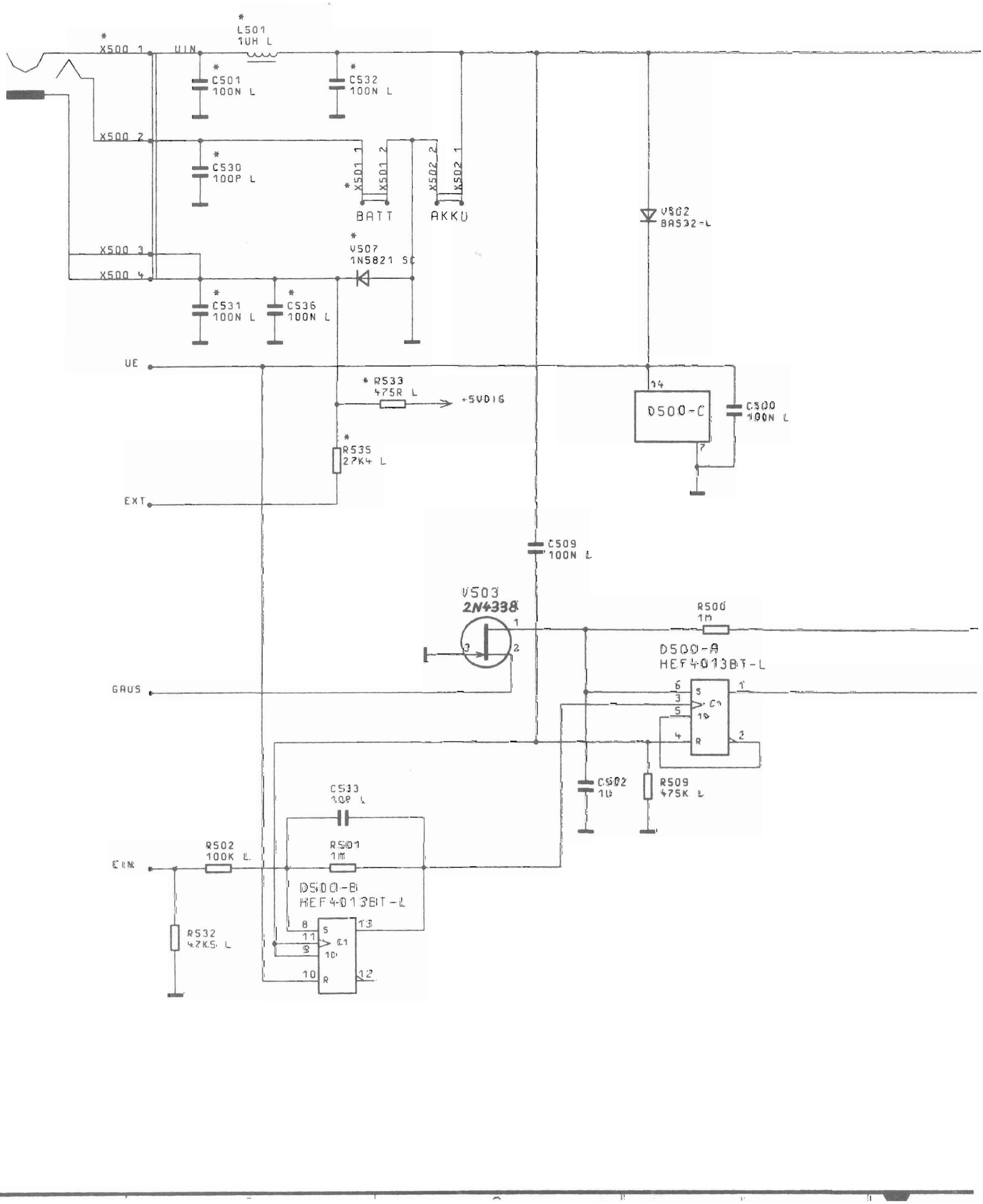
STROMLAUF GILT FUER VAR.02/03/63

CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

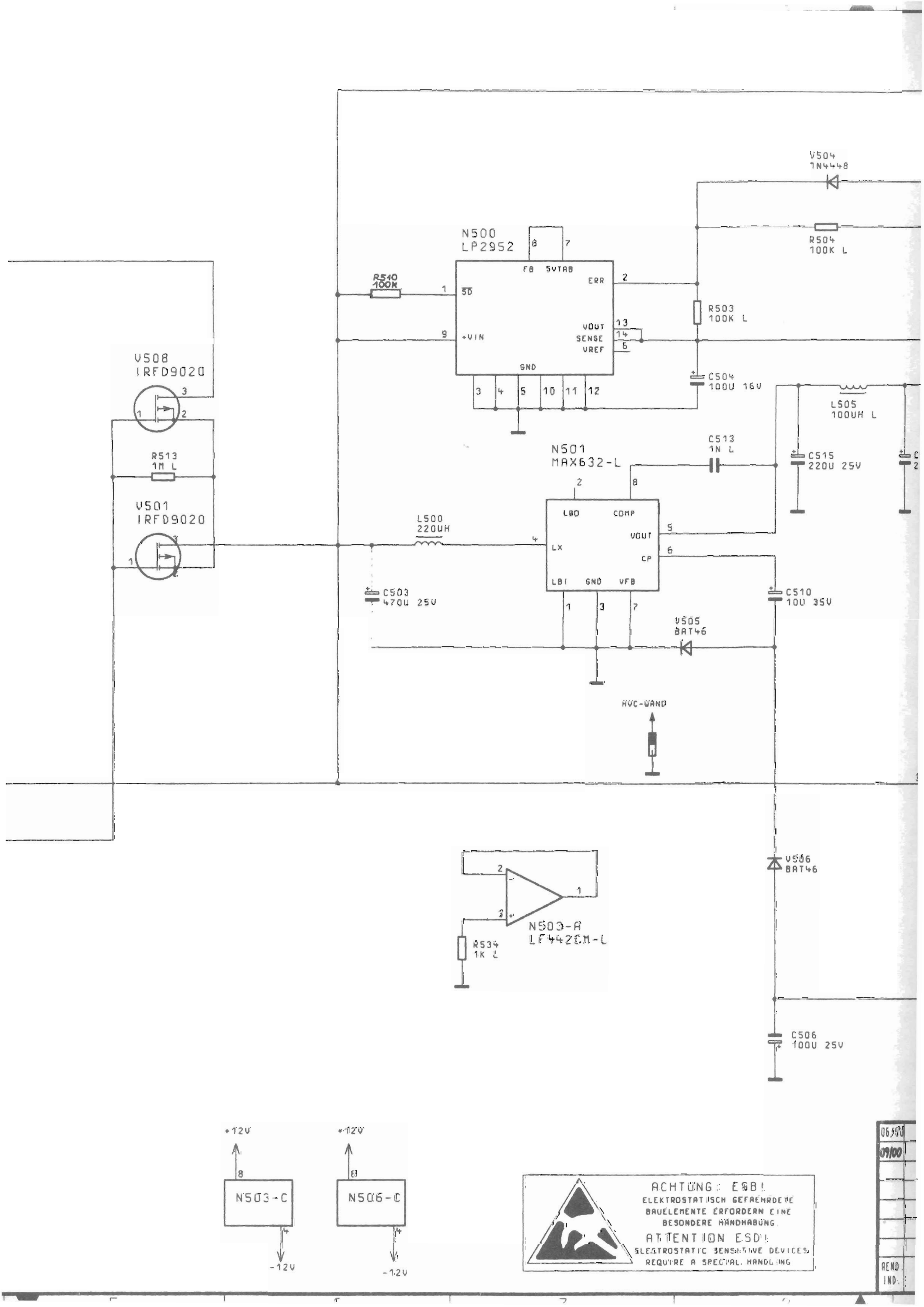
06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG
				BEARB.		SR	MAINBOARD
				GEPR.		SR	
				NORM			
				PLOTT	28.10.91		
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S
				ZU GERAET	URV35		REG.T.V. 1020.0002 — 1020.0002

BLATT-NR. 4
v. 7 BL.

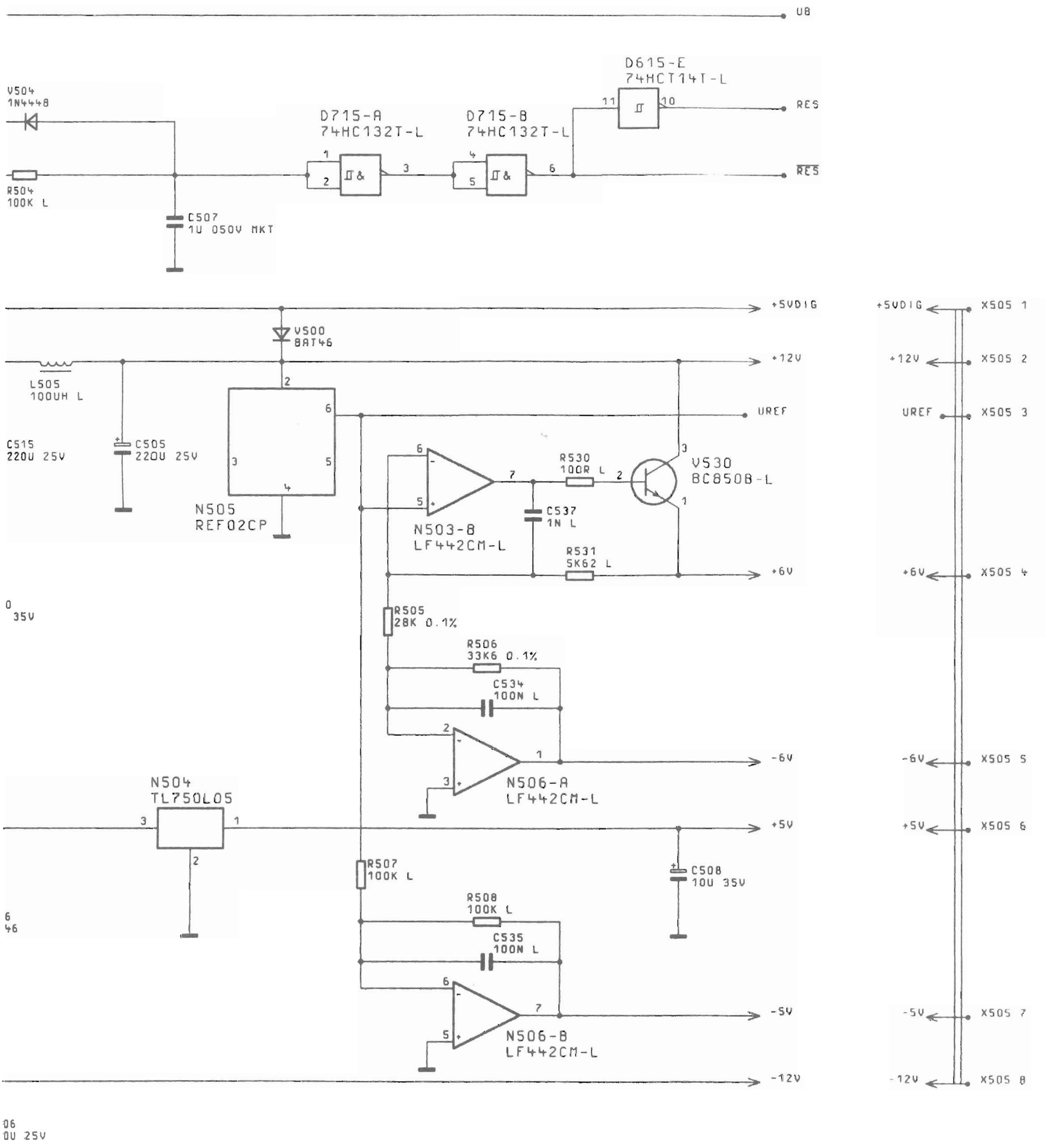
* - ONLY VAR.02



X500 1
UIN
L501
1UH L
C501
100N L
C532
100N L
X500 2
C530
100P L
X501 1
X501 2
X502 2
X502 1
BATT
AKKU
V502
BAS32-L
X500 3
X500 4
V507
1N5821 SC
C531
100N L
C536
100N L
UE
R533
475R L
+5VDIG
D500-C
C500
100N L
R535
27K4 L
EXT
C509
100N L
V503
2N4338
R500
1M
D500-A
HEF4013BT-L
GAUS
C502
1U
R509
475K L
C533
10P L
R502
100K L
R501
1M
EIN
D500-B
HEF4013BT-L
R532
47K5 L



V504
1N4448
R504
100K L
N500
LP2952
8
7
FB
SVTAB
ERR
2
R510
100K
1
SD
R503
100K L
VOUT
SENSE
VREF
13
14
6
9
+VIN
GND
C504
100U 16V
3
4
5
10
11
12
L505
100UH L
V508
IRFD9020
R513
1M L
V501
IRFD9020
N501
MAX632-L
C513
1N L
C515
220U 25V
LBO
COMP
VOUT
LX
CP
LBI
GND
VFB
L500
220UH
C503
470U 25V
C510
10U 35V
V505
BAT46
HVC-WAND
V506
BAT46
N503-A
LF442CM-L
R534
1K L
C506
100U 25V
+12V
-12V
N503-C
N506-C
ACHTUNG: EGB!
ELEKTROSTATISCH GEFÄHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING
09/00
AEND.
IND.



STROMLAUF GILT FUER VAR.02/03/63

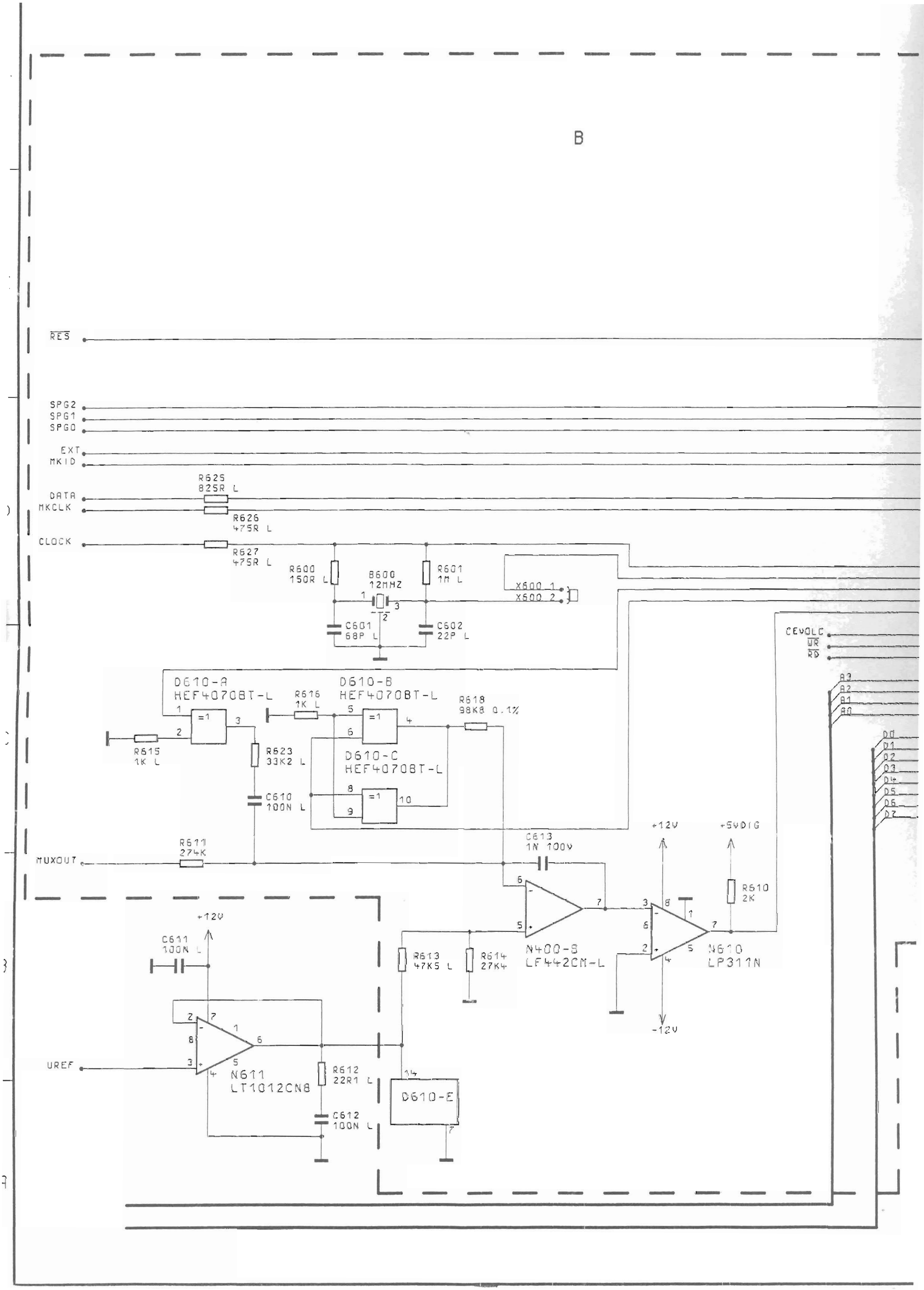
CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG
09/00	45805	04.92	SR	BEARB.		SR	SPGERZ
				GEPR.		SR	MAINBOARD
				NORM			
				PLOTT	29.10.91		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	URV35		REG.I.V. 1020.0002

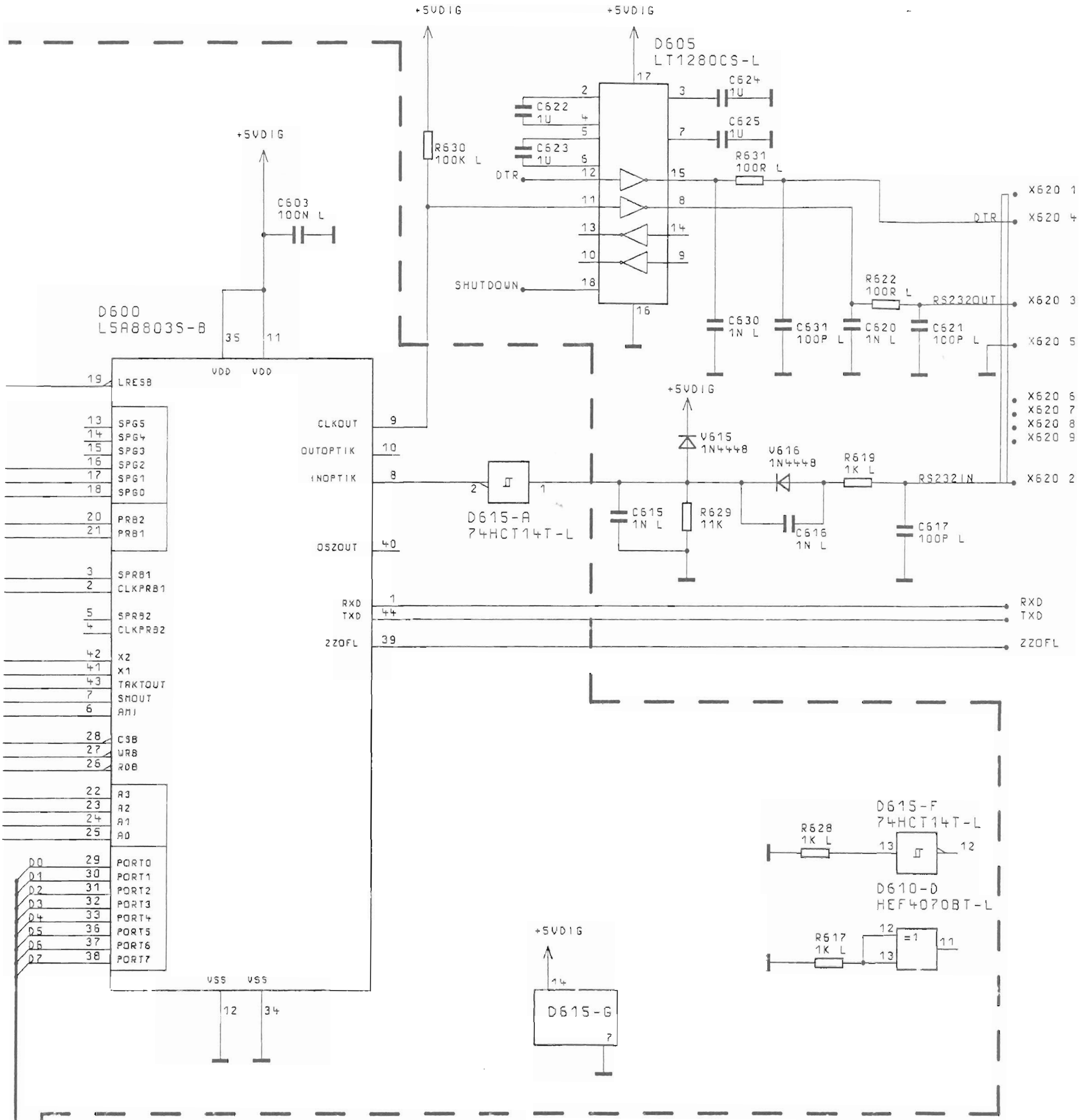
BLATT-NR. 5

V. 7 BL.

1020.0002



B
RES
SPG2
SPG1
SPG0
EXT
MKID
DATA
MKCLK
CLOCK
R625 825R L
R626 475R L
R627 475R L
R600 150R L
B600 12MHZ
R601 1M L
X600 1
X600 2
C601 68P L
C602 22P L
CEVOLC
WR
RD
A3
A2
A1
A0
D0
D1
D2
D3
D4
D5
D6
D7
D610-A HEF4070BT-L
D610-B HEF4070BT-L
D610-C HEF4070BT-L
R616 1K L
R618 98K8 0.1%
R615 1K L
R623 33K2 L
C610 100N L
MUXOUT
R611 274K
C613 1N 100V
+12V
+5VDIG
R610 2K
N400-B LF442CM-L
N610 LP311N
-12V
R613 47K5 L
R614 27K4
C611 100N L
UREF
N611 LT1012CN8
R612 22R1 L
C612 100N L
D610-E



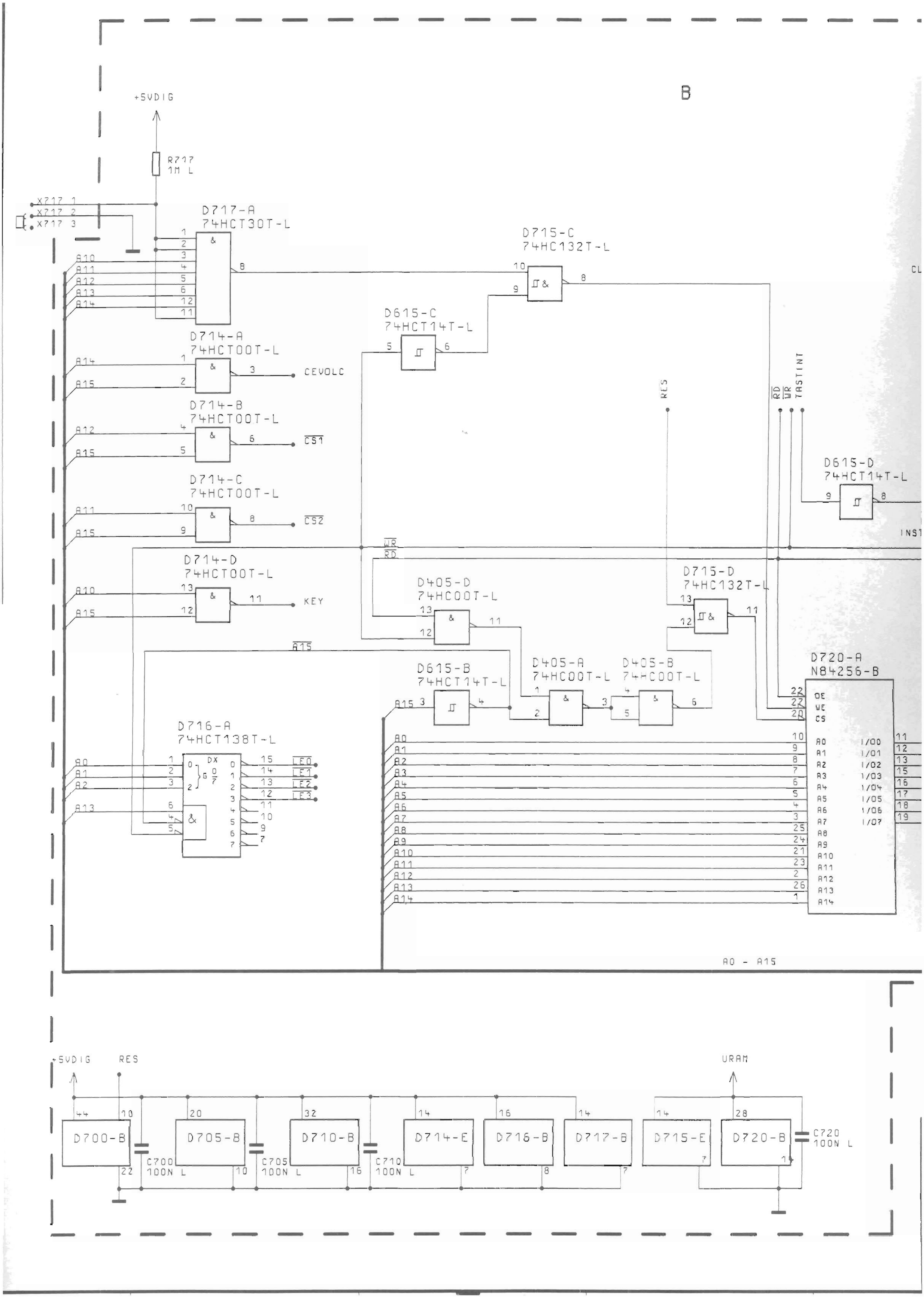
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

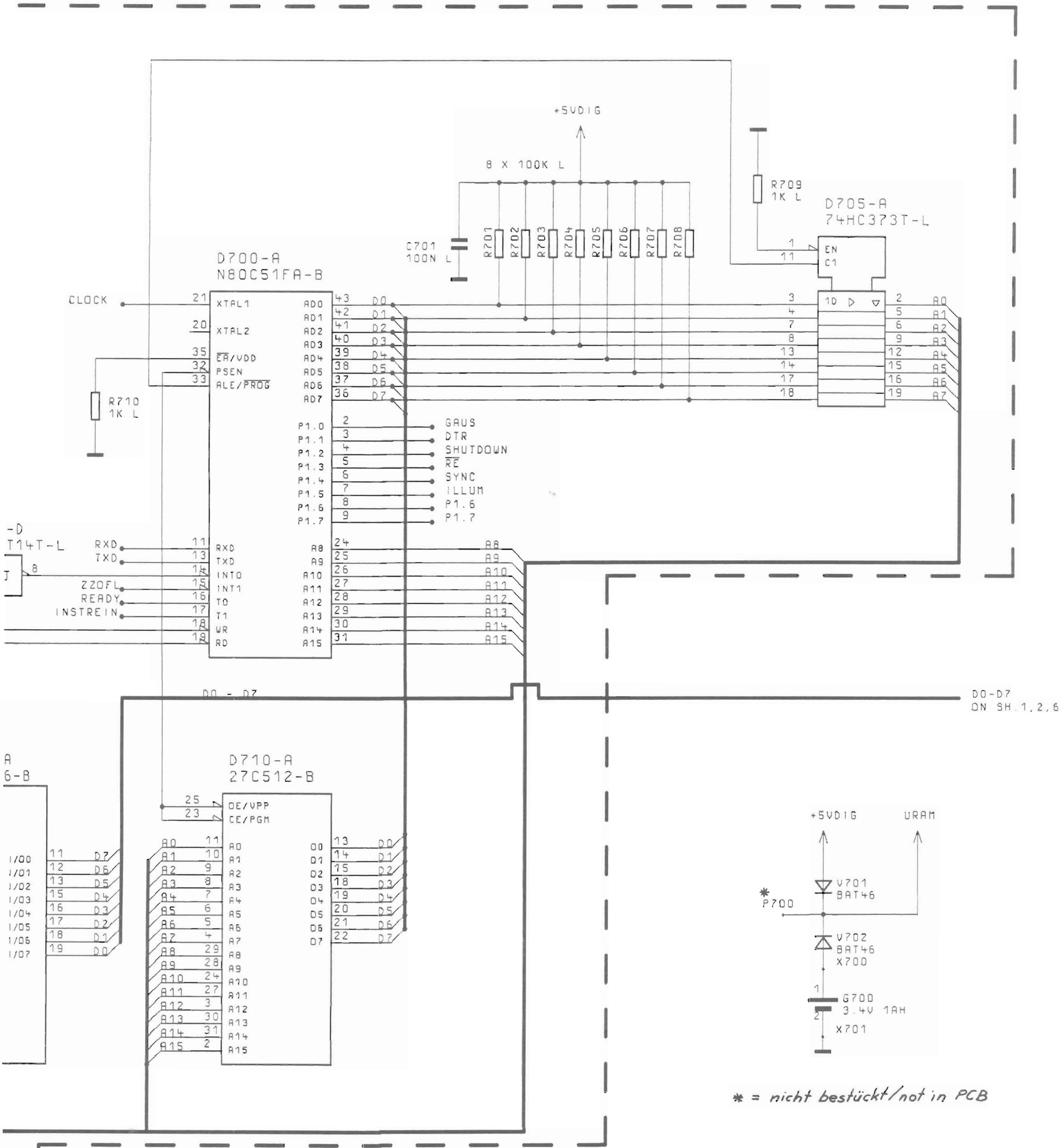
STROMLAUF GILT FUER VAR.02/03/63

CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

06/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG ADCONV / RS232 MAINBOARD
				BEARB.		SR	
				GEPR.		SR	
				NORM			
				PLOTT	28.10.91		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S / BLATT-NR. 6 V. 7 BL.
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET URV35			REG.I.V. 1020.0002 / ERSTE Z. 1020.0002



B
+5VDIG
R717
1M L
X717 1
X717 2
X717 3
D717-A
74HCT30T-L
D715-C
74HC132T-L
D615-C
74HCT14T-L
D714-A
74HCT00T-L
CEVOLC
D714-B
74HCT00T-L
CS1
D714-C
74HCT00T-L
CS2
D714-D
74HCT00T-L
KEY
RES
RD
WR
TASTINT
D615-D
74HCT14T-L
INST
CL
D405-D
74HC00T-L
D715-D
74HC132T-L
A15
D615-B
74HCT14T-L
D405-A
74HC00T-L
D405-B
74HC00T-L
D720-A
N84256-B
OE
WE
CS
I/O0
I/O1
I/O2
I/O3
I/O4
I/O5
I/O6
I/O7
D716-A
74HCT138T-L
LE0
LE1
LE2
LE3
A0 - A15
+5VDIG
RES
URAM
D700-B
D705-B
D710-B
D714-E
D716-B
D717-B
D715-E
D720-B
C700
100N L
C705
100N L
C710
100N L
C720
100N L



* = nicht bestückt/not in PCB

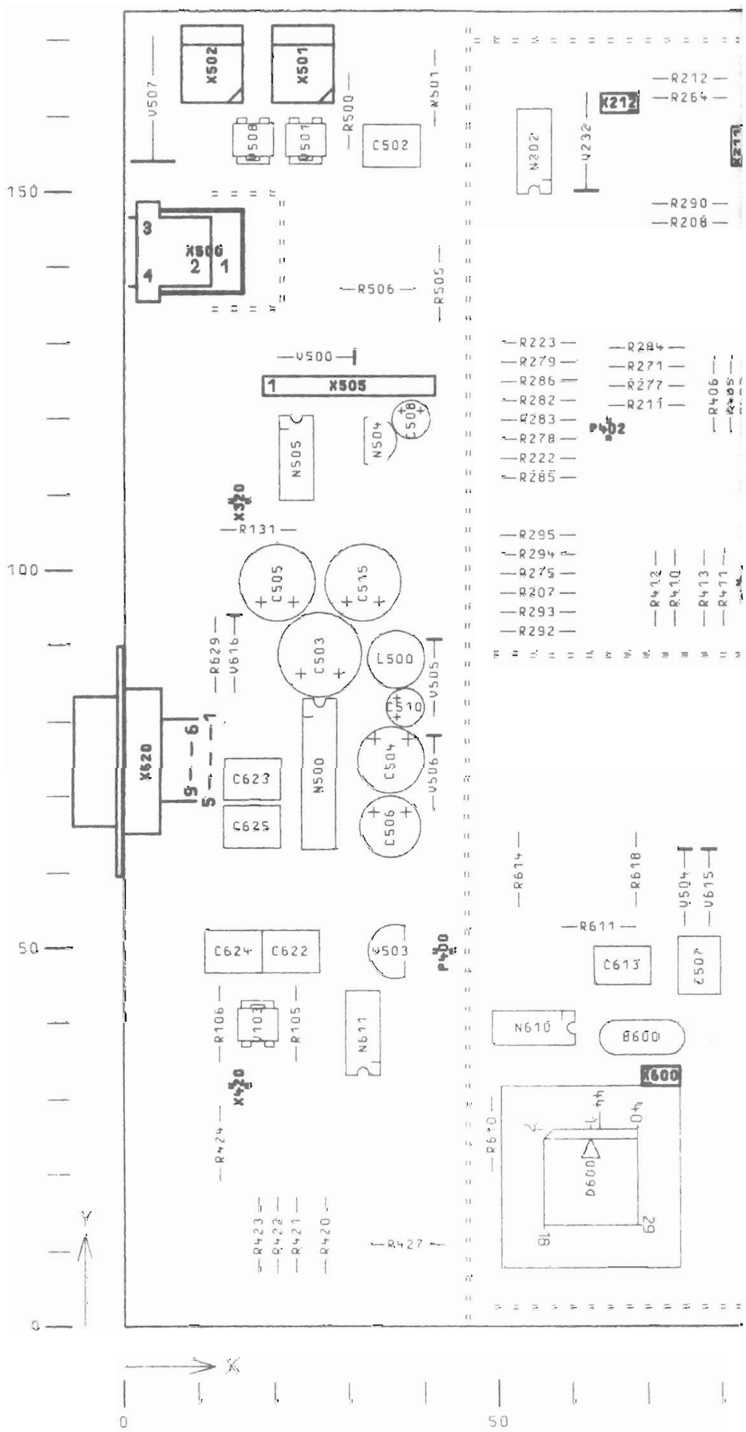
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.02/03/63

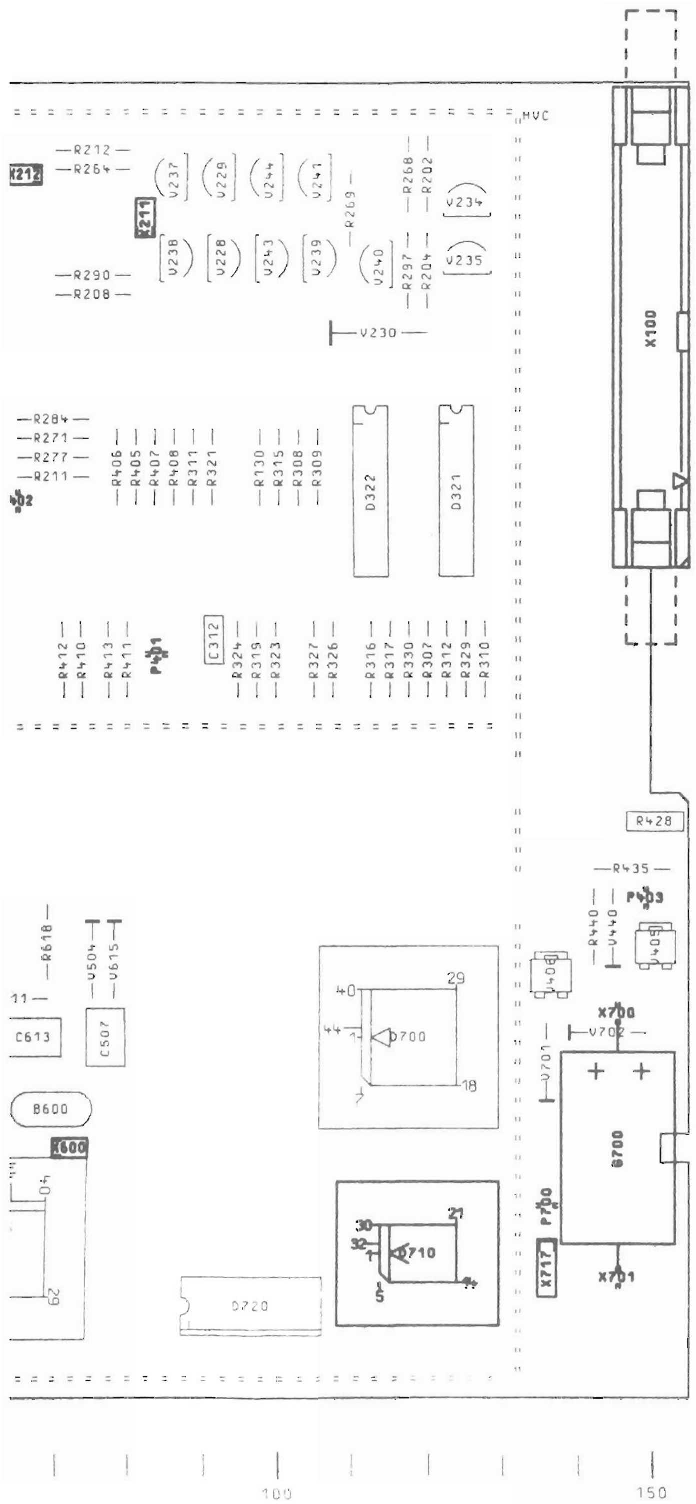
CIRCUIT DIAGRAM IS VALID FOR MOD.02/03/63

							BENENNUNG
06/00	45805	09.91	SR	1KGU	TAG	NAME	
08/00	45805	04.92	SR	BEARB.		SR	PROCESSOR MAINBOARD
				GEPR.		SR	
				NORM			
				PLOTT	28.10.91		
				ROHDE&SCHWARZ			ZEICHN.-NR. 1020.0502.01S — BLATT-NR. 7 v. 7 BL.
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	URV35		REG.I.V. 1020.0002 — ERSTE Z. 1020.0002



DARSTELLUNG SEITE B

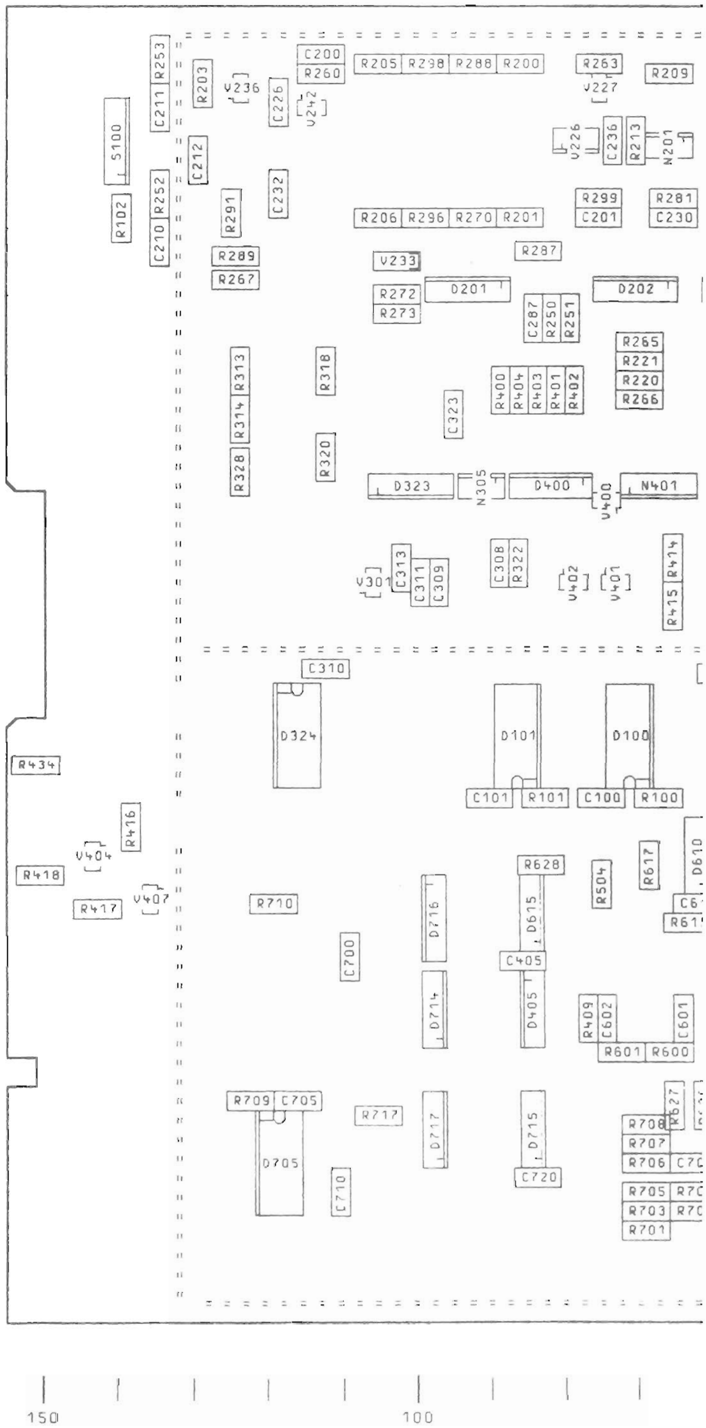
VIEW ON SIDE B



08/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG	
				BEARB		SR	MAINBOARD	Z
				GEPR.		SR		
				NORM				
				PLOTJ	29.10.91			
AEND. IND	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			ZEICHN.-NR 1020.0502.01 ED	1+
				ZU GERAET	URV35			

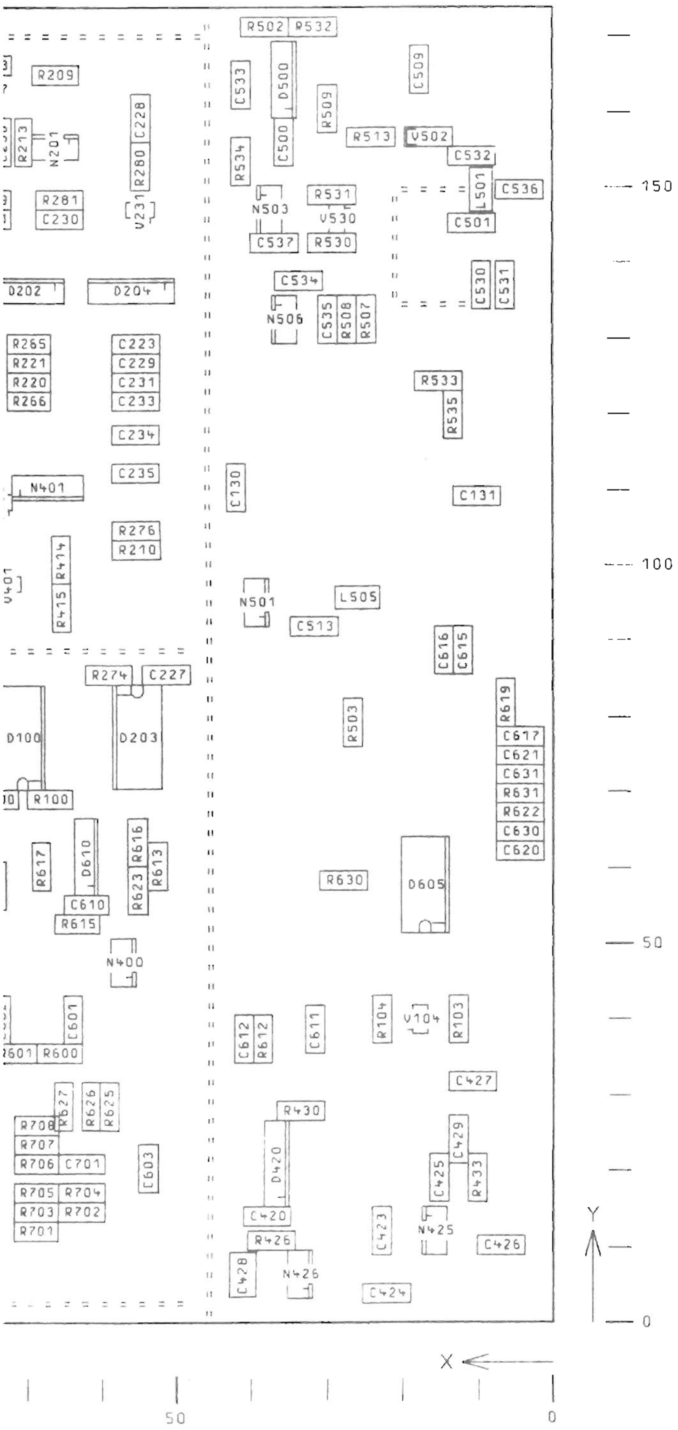
VERKLEINERUNG

0 1 2 3 4 5



DARSTELLUNG SEITE A

VIEW ON SIDE A

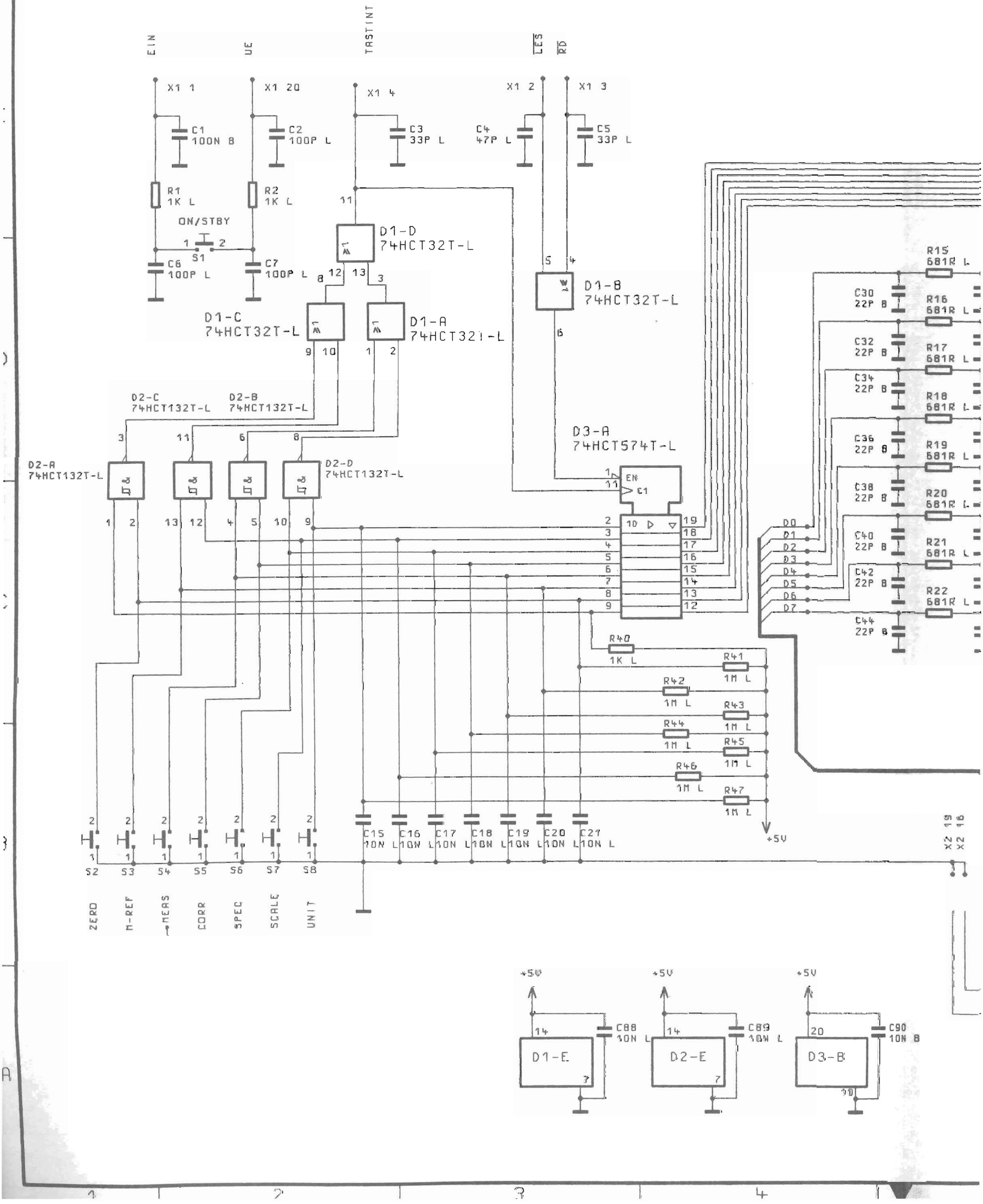


08/00	45805	09.91	SR	1KGU	TAG	NAME	BENENNUNG
				BEARB		SR	MAINBOARD
				GEPR.		SR	
				NORM			
				PLOTT	29.10.91		ZEICHN. NR. 1020.0502.01 ED
AEND IND	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			BLATT-NR. 2+
				ZU GERAET URV35			

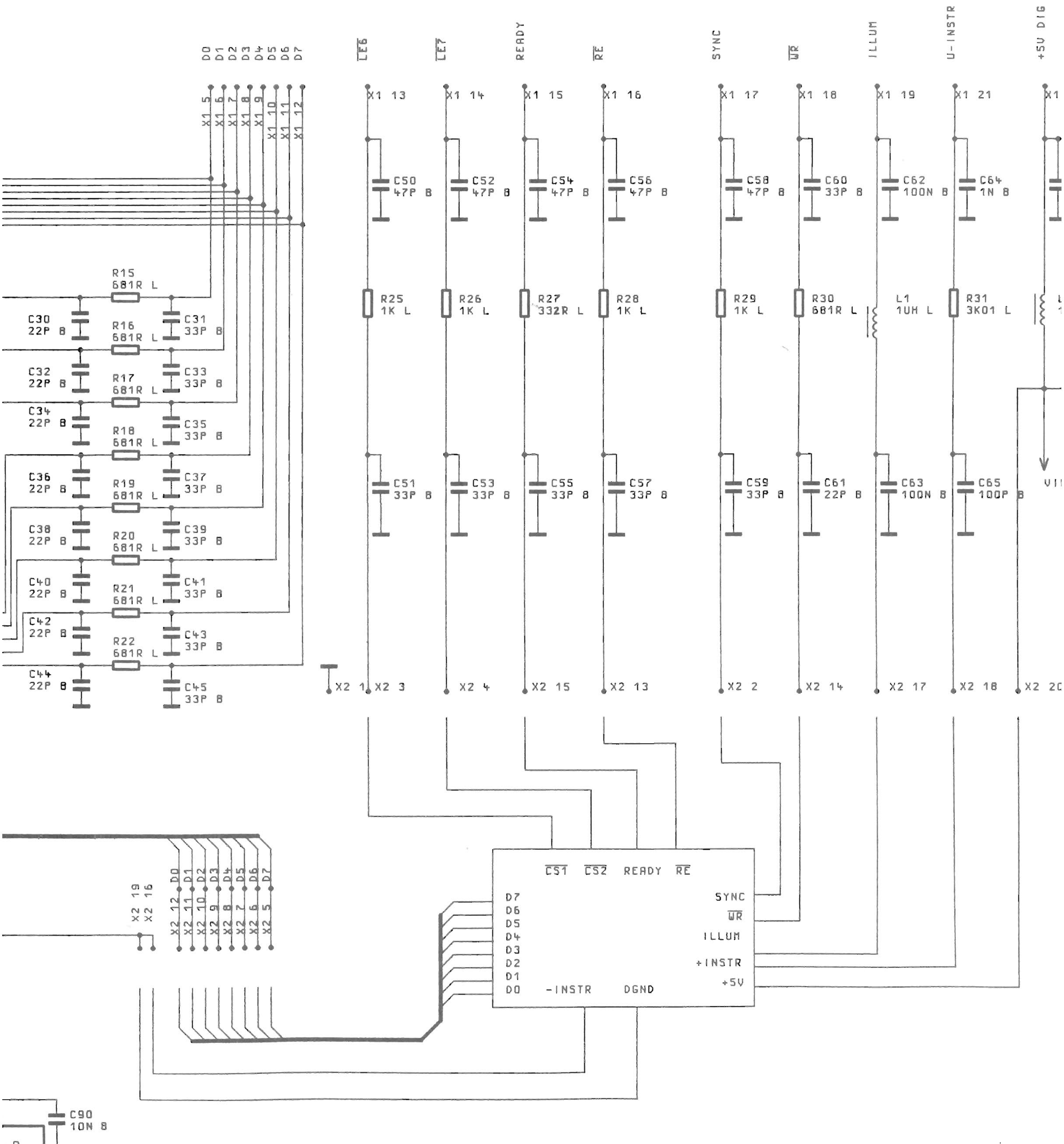
Z

VERKLEINERUNG

0 1 2 3 4 5



EIN
UE
TASTINT
LES
RD
X1 1
X1 20
X1 4
X1 2
X1 3
C1 100N B
C2 100P L
C3 33P L
C4 47P L
C5 33P L
R1 1K L
R2 1K L
ON/STBY
S1
C6 100P L
C7 100P L
D1-D 74HCT32T-L
D1-C 74HCT32T-L
D1-A 74HCT32T-L
D1-B 74HCT32T-L
D2-C 74HCT132T-L
D2-B 74HCT132T-L
D2-A 74HCT132T-L
D2-D 74HCT132T-L
D3-A 74HCT574T-L
EN
C1
R15 681R L
R16 681R L
R17 681R L
R18 681R L
R19 681R L
R20 681R L
R21 681R L
R22 681R L
C30 22P B
C32 22P B
C34 22P B
C36 22P B
C38 22P B
C40 22P B
C42 22P B
C44 22P B
D0
D1
D2
D3
D4
D5
D6
D7
R40 1K L
R41 1M L
R42 1M L
R43 1M L
R44 1M L
R45 1M L
R46 1M L
R47 1M L
+5V
C15 10N L
C16 10N L
C17 10N L
C18 10N L
C19 10N L
C20 10N L
C21 10N L
S2
S3
S4
S5
S6
S7
S8
ZERO
M-REF
MEAS
CORR
SPEC
SCALE
UNIT
X2 19
X2 16
+5V
C88 10N L
C89 10N L
C90 10N B
D1-E
D2-E
D3-B



ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.

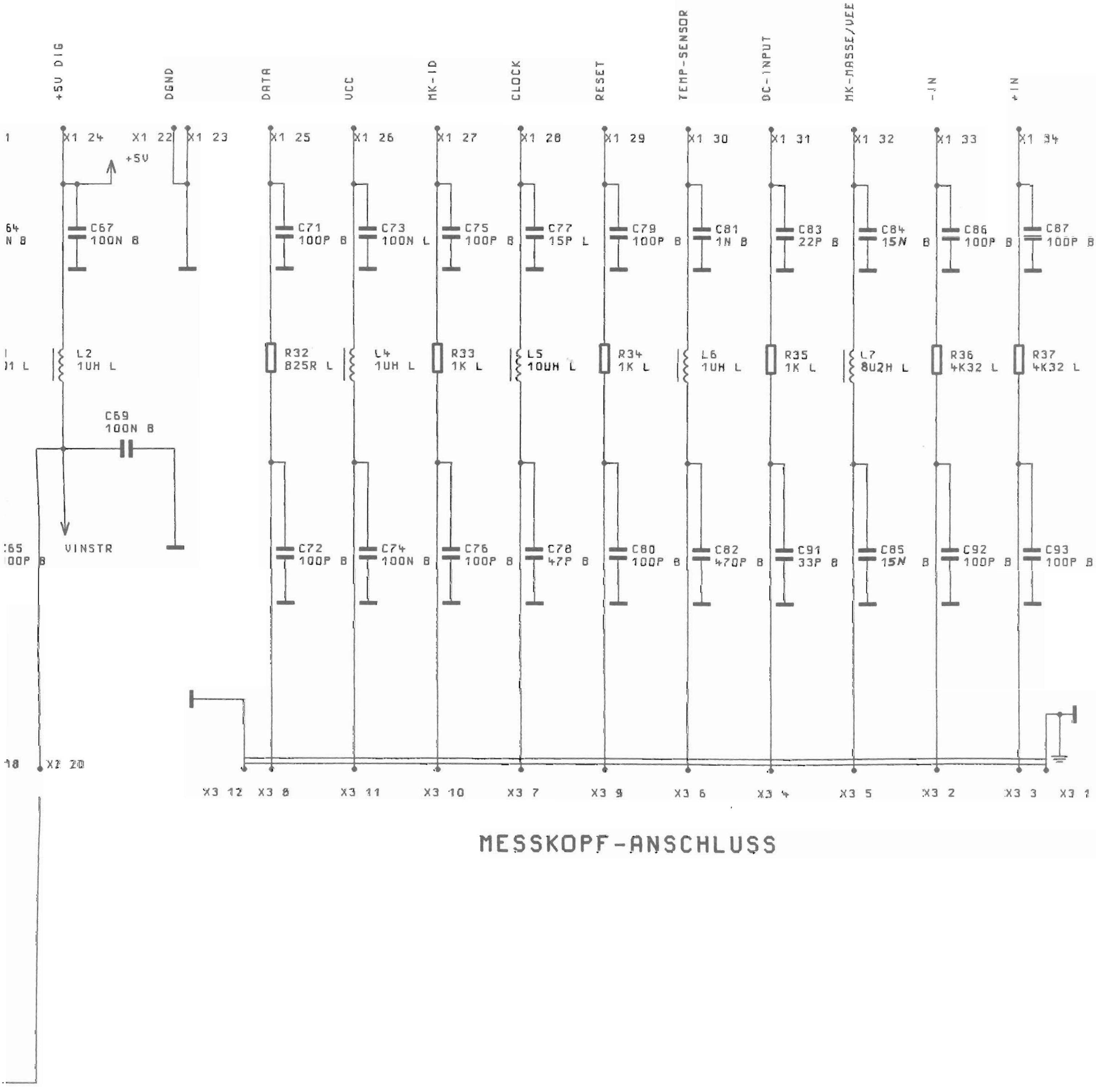
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.02/

CIRCUIT DIAGRAM IS VALID FOR MOD.02/

.02

ID.02



04	45805	02.92	SR		TAG	NAME
				BEARB.		L1
				GEPR.		L1
				NORM		
				PLOTT	4. 2.91	*
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ		
				ZU GERAET	URV35	

BENENNUNG

FRONTPLATTE

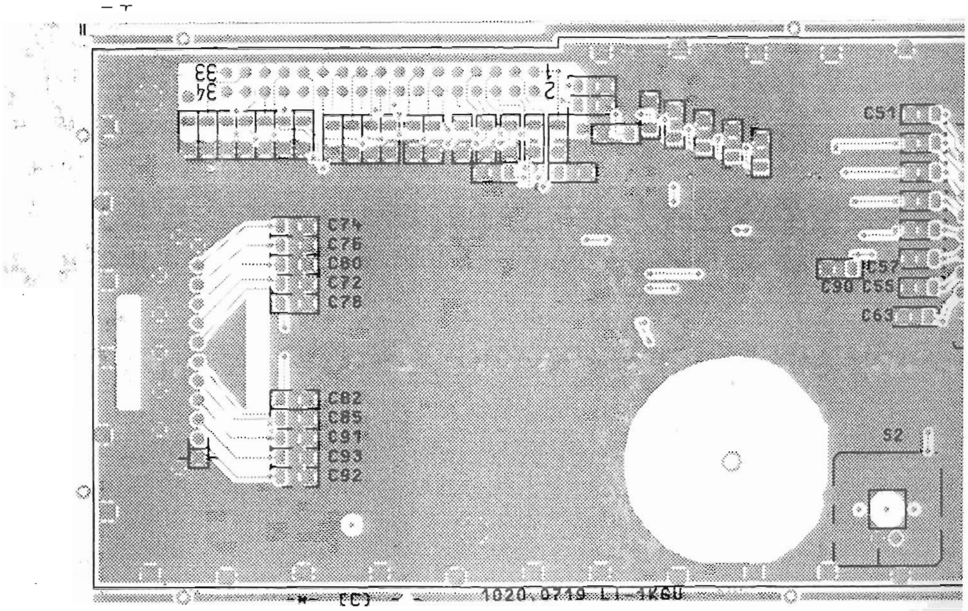
FRONT BOARD

ZEICHN.-NR. **1020.0702.015**

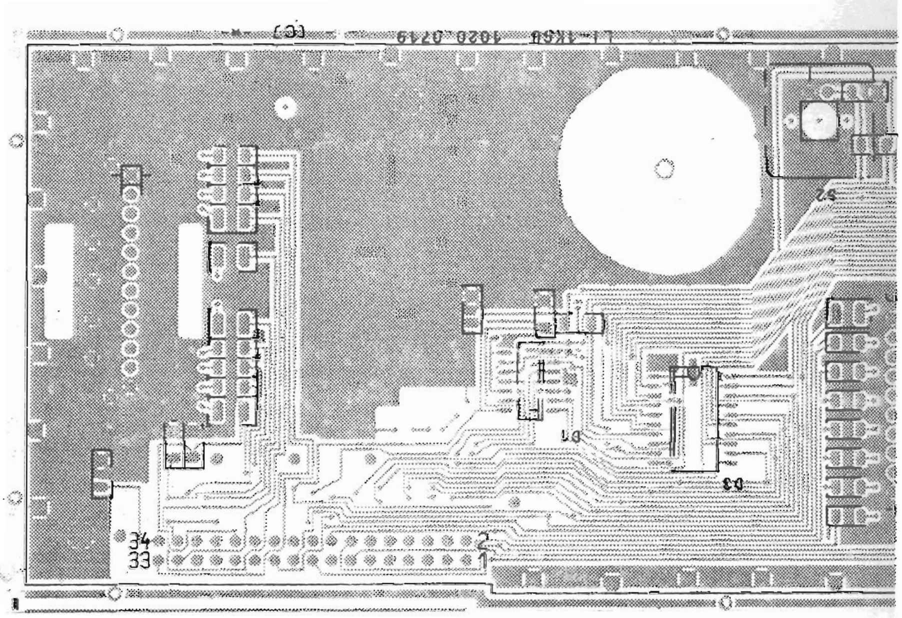
BLATT-NR. 1 v. 1 BL.

REG.N.V. 1020.0002

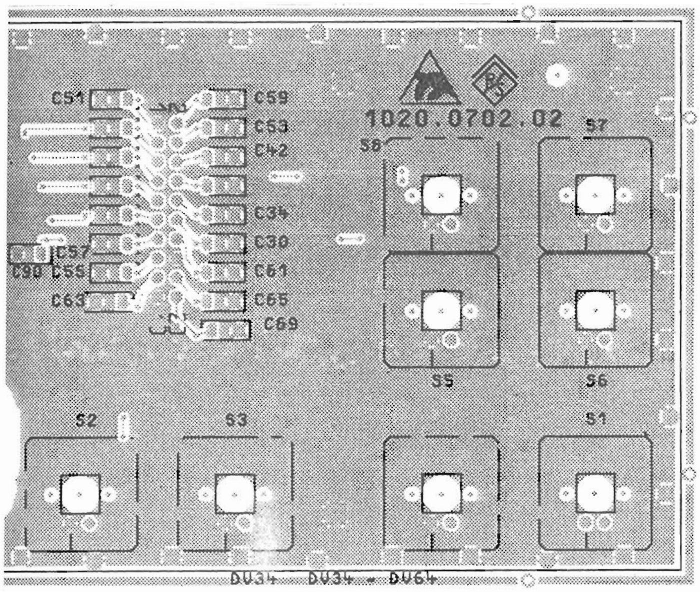
ERSTE Z.

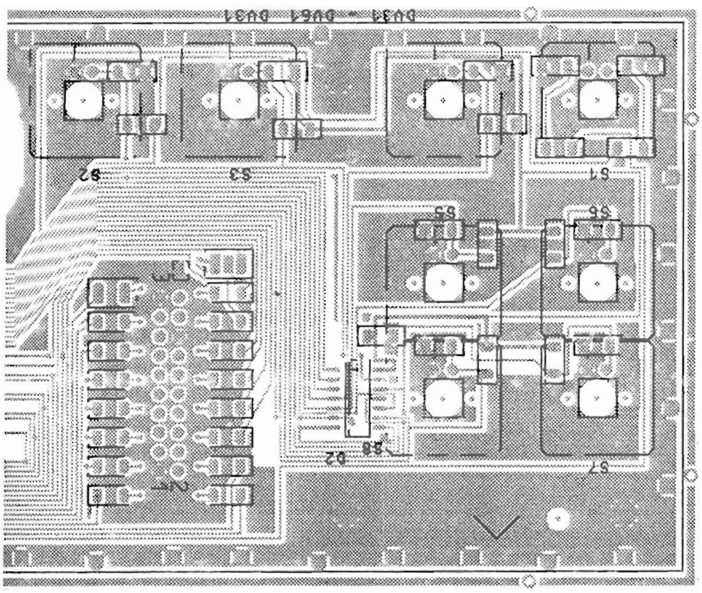


Ansicht und Leitungsfuehrung Bauteilseite
View of tracks on component side



Ansicht und Leitungsfuehrung Loetseite
View of tracks on solder side

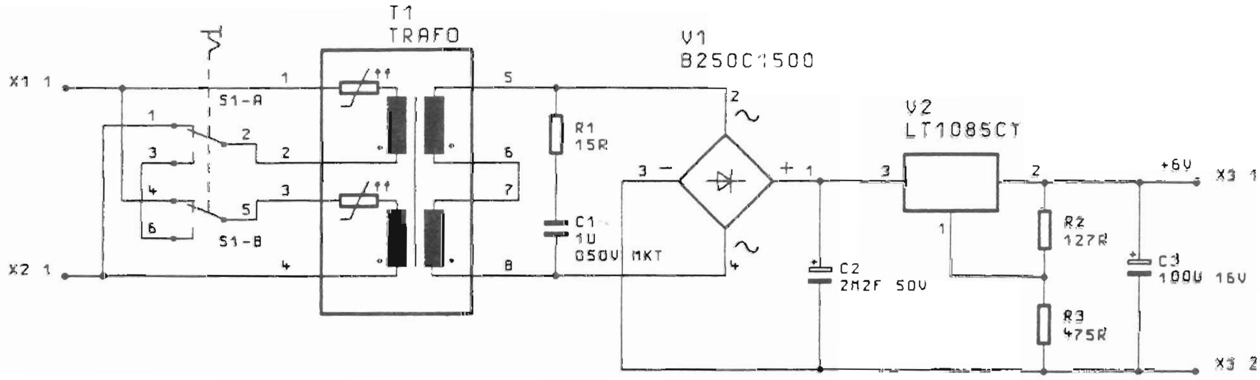




Änd. Zust.	Änderungs-Mitteilung	Tag	Name	Maße ohne Toleranzangabe			Maßstab 1 : 1	
							Halbzeug, Werkstoff	
				1KGU	Tag	Name	Benennung	
				Bearb.	12.90	LI	ED FRONTPLATTE FRONTBOARD	Z
				Gepr.				
				Norm				
				ROHDE & SCHWARZ			Zeichn.-Nr. 1020.0702	Blatt-Nr. 3 v 3 B
				zu Gerät URV35			reg. i. V. 1020.0002 V	erste Z.

5 6 7 8 11.6107

URV35-NETZTEIL



ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
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STROMLAUF GILT FUER VAR.02
CIRCUIT DIAGRAM IS VALID FOR MOD.02

01				IKGU	TAG	NAME	BENENNUNG
				BEARB.		FW	NETZTEILPLATTE
				GEPR.		FW	POWER SUPPLY BOARD
				NORM			
				PLOTT	29.07.91		
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCHWARZ			ZEICHN.-NR. 1020.1015.01S
				ZU GERAET	URV35		REG.I.V. 1020.0002 ERSTE Z..

BLATT-NR. 1
V. 1 BL..

ZEICHN.-NR.