ROHDE&SCHWARZ

Additional Information to the Service Documents Concerning the Digital Modulation of the SME

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5 DQPSK spectrum at the output CODAM (X80A.9, motherboard, 50Ohm load) of the module DSYN with the data sequence "0111".

1 Paper for the service training at the 27.04.93

One can find the copy of the paper in the appendix 1.
In the following are some important comments to the paper:

1.1 Some basics about the various digital modulations

The pictures on page 2 to 8 describe the basic principles of the various digital modulation types.

The constellation diagram (ger.: Zustandsdiagramm) showes the graph of the q signal (quadrature signal) over the i signal (inphase signal).
The eye pattern (ger.: Augendiagramm) is the oscilloscoped demodulated signal (FM respectively i and q signal for DQPSK), triggered by the clock of the digital data signal.

One will find more informations about the basics of digital modulation in the following literature:
- "Einstieg in die digitalen Modulationsverfahren", Sonnde/Hoeckstein, Franzis-Verlag München, 1992.

- "Digitale Modulationsverfahren", Rudolf Mäusel, Dr. Alfred Hüthig Verlag Heidelberg, 1988.

1.2 The modules DIGITAL SYNTHESIS and DM-CODER

Page 9 of the paper shows a simplified functional circuit diagram of the modules DIGITAL SYNTHESIS (DSYN), SUMMING LOOP (SUM) and OUTPUT UNIT (OPU). The detailed functional circuit diagrams are in the service manual.

The module option DM-CODER (DCOD) is a submodule of DSYN and is the source of all the digital modulations.

For DQPSK modulation, the AM-Signal comes in analog form via the motherboard to the module OPU (OUTPUT UNIT), to controle there the AM loop
(0V-->normal level, 1V-->level off, -1V-->double level).

The FM-signal comes in a digital parallel form to the DDS gatearray (DDS-GA) on the module DSYN (DIGITAL SYNTHESIS). The DDS-GA generates a digital FM modulated sinewave between 14.1 and 15.6MHz. The clock has the frequency of 50MHz and comes from the module REFERENCE/STEP SYNTHESIS (REFSS). DCOD is also clocked by this signal. After DA converting and lowpassfiltering, the analog FM-Signal goes to the phase detector of the module SUM (SUMMING LOOP), where it is converted to the octave 750...1500MHz by a phase locked loop with a step recovery sampler. The bandwith of this loop is switched between 200kHz and 2MHz depending of the bandwith of the digital modulation.
On DSYN its possible to lead the FM signal via a so called BUFFER LOOP, to filter nonharmonic spurious from the DDS. In cw mode, the bandwith is switched to 1kHz. In case of 4FSK and FFSK

modulation, the bandwith is 100kHz. For all other dig. modulations, the loop is switched off.

After the N divider on SUM, the frequency varies from 93.7 to 1500MHz. The output level and the AM is then controlled by the AM loop on OPU, which has a bandwith of about 500kHz.

1.3 Measurements to test, if the SME meets the data sheet

The table on page 10 gives an overview on all the important measurements.
The measurement of the clock frequency at the plug CLOCK, spectral measurements, deviation meas., phase and vector error measurements are described in the service manual. Additional measurement methodes are described in the following section.

Page 11 and 12 of the paper showes typical spectral maesurements and eye patterns for GFSK and DQPSK modulation. For DQPSK the raised cosinus filter (not the default square root raised cosinus filter) is activated to simulate the receiver filter, so the points of intersection are focused.

2 Measurements, which are not described in the service manual

2.1 The constellation diagram (ger.: Zustandsdiagramm)

Appendix 2 shows the measurement assembly with the iq demodulator module MIQA-10D from MINI CIRCUITS (MCL). Appendix 3 showes the data sheet of this module. Cause the SME has no coherent carrier output like the SMHU.58 (unmodulated carrier with the same frequency like the modulated carrier), the 10MHz reference signal is used and the carrier frequency is set to 10MHz. The i and q lowpass filters with 1MHz 3dB frequency remove the summing products at 20MHz. The bandwith of the DQPSK modulation for the standards ADC and JDC is about 24kHz so this signals pass the lowpass filters without distortion.

The constellation diagram allows a qualitative test of the vector error of DQPSK modulation, which should be <2.5%RMS according to the SME data sheet. The exact measurement, described in the service manual, is possible with the HP-70000-System, which is expensive and often not present.
According to the EIA Document IS-54, the vector error is the RMS (radian mean square) value of the differnce between the measured "constellation point" and the demanded constellation point (eight points on a circle with 45° offset) in the sampling times related to the amplitude of the carrier when the modulation is switched off. One has to average over 162 symbols of one slot. A constant amplitude , i ,q , phase and frequency offset is allowed and should be substracted.

To make a qualitative test of the vector error with the oscilloscoped constellation. diagr., one should set the SME as follows:

+ DIG MOD - DQPSK - SOURCE - DATA
- FILTER/ROLL OFF - COS/0.35

+ Edit with the LIST EDITOR a 324 Bit long pseudorandom data sequence.

+ Set the carrier frequ. to 10MHz + 5.9Hz (frequency offset caused by calculation errors of the digital signal processing).

One should see a standing picture like that on page 12 of the paper.
The curve should go through eight points on a circle with a phase difference of 45°. A constant phase offset is possible, cause the phase between modulated signal and coherent carrier is not defined. This eight points should be close focused. The thickness of the points is a qualitative estimate of the RMS vector error.

If a pseudorandom sequence is used, which is longer than 324 Bit, for example the internal 9 Bit PRBS Sequence, one will see a jitter in the phase. The jitter is rising with the length of the sequence and is caused by accumulated frequency errors of the dig. sign. proc.

If the picture is rotating around the zero point, there is a frequency error, which should be about -5.9Hz, when the frequ. is set to exact 10MHz.

If the eight points on the scope are not focused, the vector error is increased and that can have following causes:

+ the filter is not set to COS (nyquist filter) but to the default filter SQR COS.

+ The DQPSK calibration (Delay between FM and AM path) is not correct. To correct the calibration, set the SME to UTILITIES - CALIB - DQPSK - CLIBRATION DATA and adjust the time, until the spektrum in the neighbour channels (+-30kHz) is symmetrically (see page 12 of the paper).
An other criteri to adjust the time is the constelation diagram with the data sequence "0111" (+-135°-sequence). The curve should run on a line, when the calibration is correct. Otherwise it runs on a eight formed line like in the picture on page 13 of the paper (1.5us deviation from the optimal value).
Note, that the optimal delay can change with the carrier frequency. To adjust the delay with the above methode at the frequency around 850MHz for the standards ADC and JDC, it is necessary to mix down the modulated signal (RF signal) from 850MHz to 10MHz bye a mixer.

+ The bandwith of the AM loop isn't set to AUTO or 500kHz.

+ Bad frequency characteristic of the SUMMINGLOOP PLL or the AM loop.

+ Defect in the ALIASING FILTER on the module DSYN.

2.2 Eye pattern (ger.: Augendiagramm)

For all FSK Modulations (GMSK, GFSK, 4FSK ...), one gets the eye pattern by FM demodulating the RF signal and measuring by a oscilloscope, which is triggered by the CLOCK signal of the digital data signal (output CLOCK). On page 6 of the paper you find the eye pattern of 4FSK Modulation for example.
In the eye pattern all possible state transitions of the for states (levels) are visible.
The eye pattern of GMSK and GFSK have only two states and are plotted on page 5 and 11 of the paper.
The 3db bandwidth of the demodulator must be 3MHz/1MHz/20kHz for GFSK/GMSK/4FSK modulation. So its only possible to measure 4FSK with the FMB, whose bandwidth is limited to 100kHz.

For DQPSK modulation one gets the two eye patterns by ocilloscoping the i and the q signal, triggering with the CLOCK signal (page 8 of the paper). You will find five states per eye pattern and focused points of intersection, when the nyquist filter COS/0.35 is switched on.

If the points of intersection are not focused, or if one can see overschooting in the eye pattern, then the frequency characteristic of the SUMMINGLOOP PLL isnt't correct.
(for example groupdelay distortion, which isn't visible in the spectrum).

For GFSK modulation, an error in the pattern of 20kHz/288kHz=7% is allowed.
The allowed error for GMSK modulation is defined as a phase error of <3°peak, which cannot be estimated by the eye pattern. The exact error can be measured by the radio communication tester CMTA94 like described in the service manual or with the HP-70000-system.

2.3 Test of all the different standards by the Modulationanalyser FMB

With the modulation analyzer FMB it's possible to test all the different standards rawly but quick and to test whether the correct baseband filter in the eproms is switched on.

The newly implemented standards CT2, CT3, CDPD, MC9 and MOBITEX 1200 (REV >2) are also listed.

Settings:

- Basic settings of the SME: FREQUENCY 900MHz, LEVEL 0dBm, DIGITAL MOD, GFSK, SOURCE DATA, DIFF ENCODER OFF

- Insert N times "1" and N times "0" by the list editor. N is listed in the following table (for example when N=4, "11110000" is to edit).

- Further settings of the SME and the FMB LP filter setting is listed below. The FMB HP filter is to set to 10Hz. DIFF ENCODER should be set to OFF, after every change of the standard at the SME.

- The FM peak deviations in the table should be measured. The difference to the nominal deviation comes from overschooting of the FMB LP filter.

- For DQPSK modulation the data pattern "0111" is to use (+-135°-sequence). After selecting the standard TFTS, DIFF ENCODER should be set to ADC to get the +-135°-sequence.

SME-settings Modul./ SEL. STAND.	FMB bandw. in kHz	N	deviation in kHz +-3%	modulation frequ. in kHz +-1%
GFSK / DECT	100	32	352	18
GFSK / CT2	100	4	18.25	9
GFSK / USER BITRATE: 72kbps FIL./DEV: 0.5/202kHz	100	4	200.5	9
GFSK / CT3	100	20	195	16
GMSK / GSM	no Filter	4	67.7	33.85
GMSK / CDPD	100	4	4.9	2.4
GMSK / MC9	23	4	2	1
GMSK / MOBITEX-8000	23	4	2	1
FSK / CITYRUF-1200		Bitrate 270,83		0.6
FSK / POCSAC-2400		100 4 67,7 ? 76,8 ? 33,85		1.2
FSK / USER BITRATE: 20kbps HUB: 100kHz	1(	Diff. encoder	%	10
DQPSK / ADC	1(			12.15
DQPSK / JDC	100	0111	33.4	10.5
DQPSK/TFTS (D.E. ADC)	100	0111	34.6	11.05
DQPSK / TETRA	100	0111	28.6	9.0
4FSK / ERMES	100	0111	1.64	1.5625

- To test the AM modulation of DQPSK/ADC-modulation, insert with the list editor the data "0111" to get the +-135° sequence and set the FMB to AM demodulation and switch on the 100kHz LP Filter.

- The modulation index should be 50+-2% (nearly a sinewave signal) and the modulation frequency 24.3kHz.

2.4 Measurements at the outputs of the module DSYN

With the carrier frequency set to 1350.2MHz, the freqency at the output FDDS (X89) is 14.351MHz. The level at FDDS should be 1.5dBm+-1.5dB.

For all FSK modulations, the spectrum at FDDS should be nearly identical with the spectrum at the RF output for offset frequencies below 2MHz (+-1dB deviation between the two outputs).

For DQPSK/ADC modulation with AM-modulation, the spectrum at FDDS is for offset frequencies greater 12.15kHz different to the RF output, because the AM-modulation does not exist there. The spectrum must look like the plot in appendix 4, when PRBS sequence is on.

The AM signal comes via the output X80A.9 to the motherboard. With a load of 50Ohm (normal spectrum analysator), the spectrum must look like the plot in appendix 5, when the data sequence "0111" is sent.

appendix 1

(page 1 - 13)

ROHDE&SCHWARZ

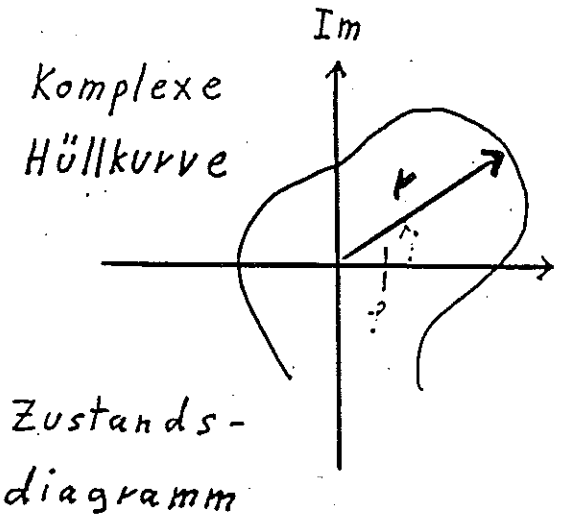
The Digital Modulation of the Signalgenerator SME

(1) Some basics about the various digital modulations.

(2) The modules DIGITAL SYNTHESIS and DM-CODER.

(3) Measurements to test, if the SME meets the data sheet.

Digitale Modulation allgemein :

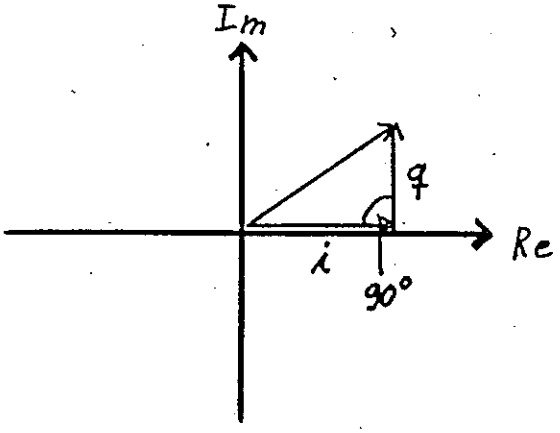


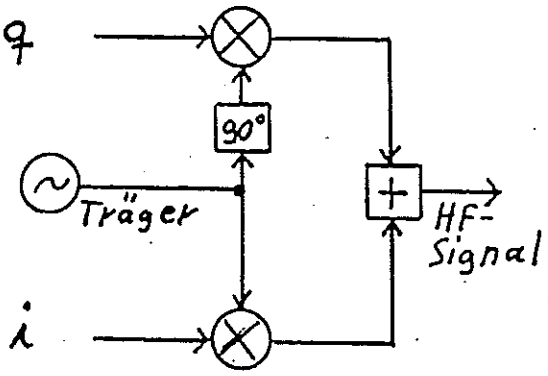
Amplitudenmodulation (AM)

Phasenmodulation (PM)

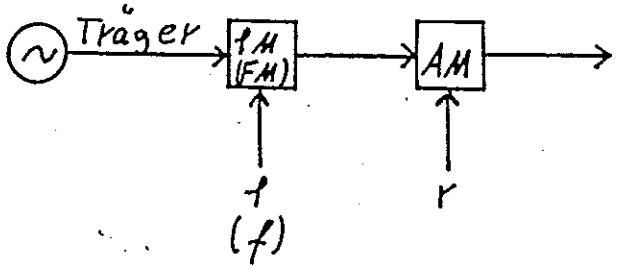
Frequenzmodulation (FM)

IQ-Modulator : SMHU.58





PM (FM) + AM : SME



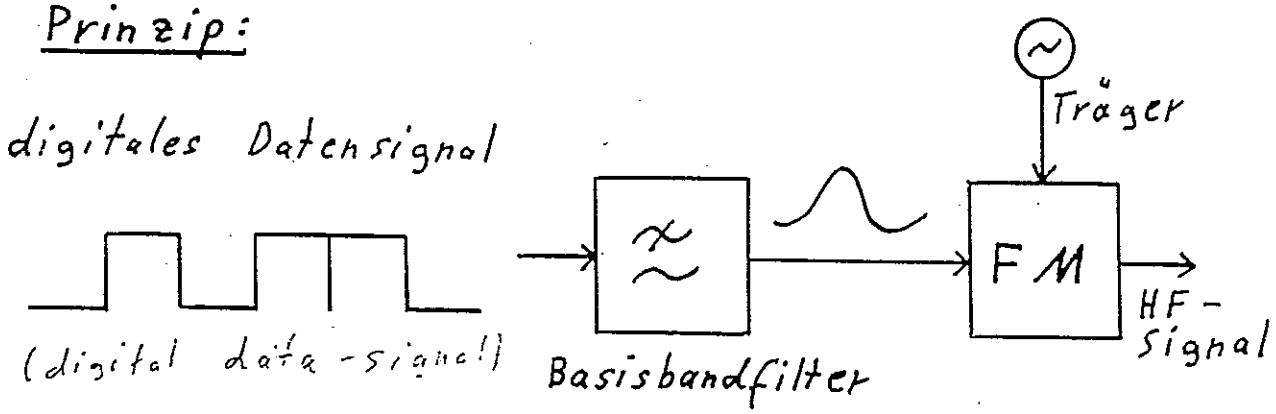
Modulationsarten beim SME:

- Gruppe der FSK-Modulationen
  (GMSK, GFSK, FSK)
  (Gaussian - Minimum / Frequency - Shift - keying)
- 4FSK (4-Level - Frequency-Shift-keying)
- FFSK (Fast - Frequency-Shift-keying)
- $\frac{\pi}{4}$-DQPSK ($\frac{\pi}{4}$ - Differential - Quadrature - Phase - Shift - keying)

Gruppe der FSK-Modulationen:

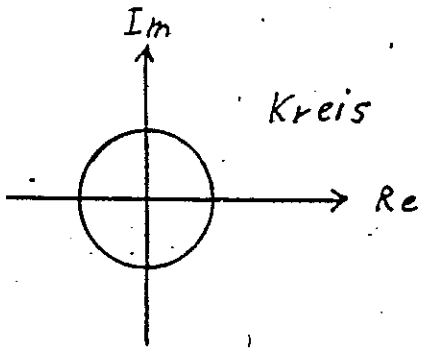
(GMSK, GFSK, FSK)

Prinzip:



Zustandsdiagramm:

(constellation-diagram)



Netze:

(standards)

GSM, DCS 1800, DECT, POCSAC

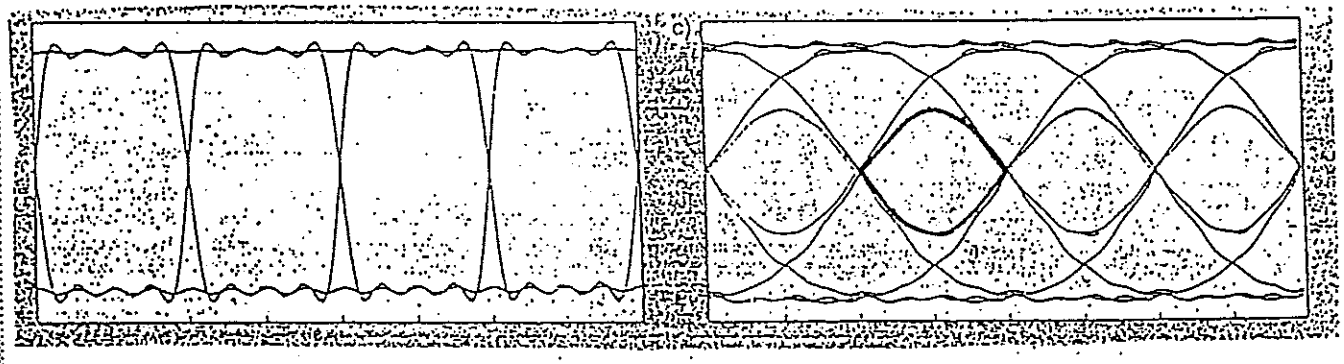
Basisbandfilter:

Gauß – Tiefpaß

Augendiagramm:
(eye-pattern)

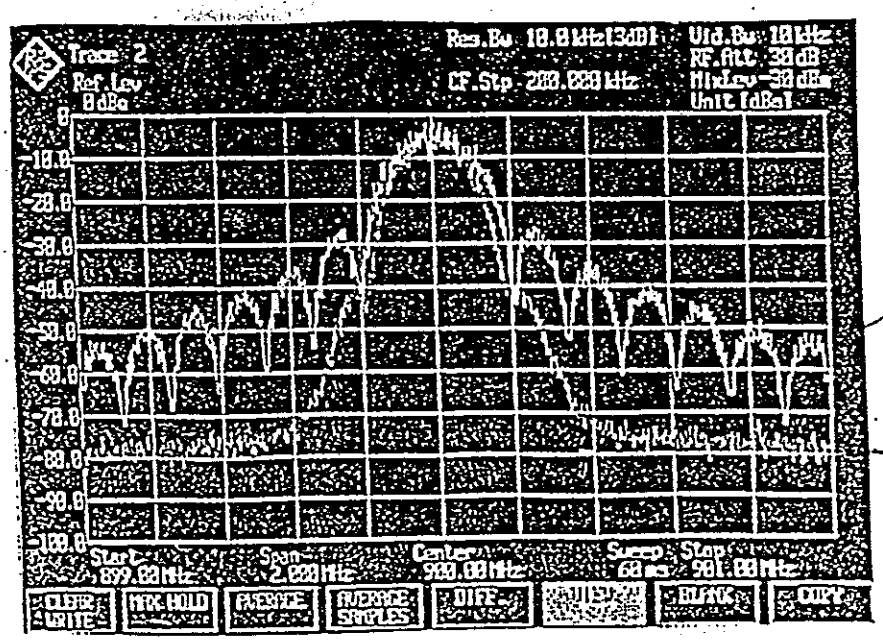
MSK

GMSK , BT = 0,3



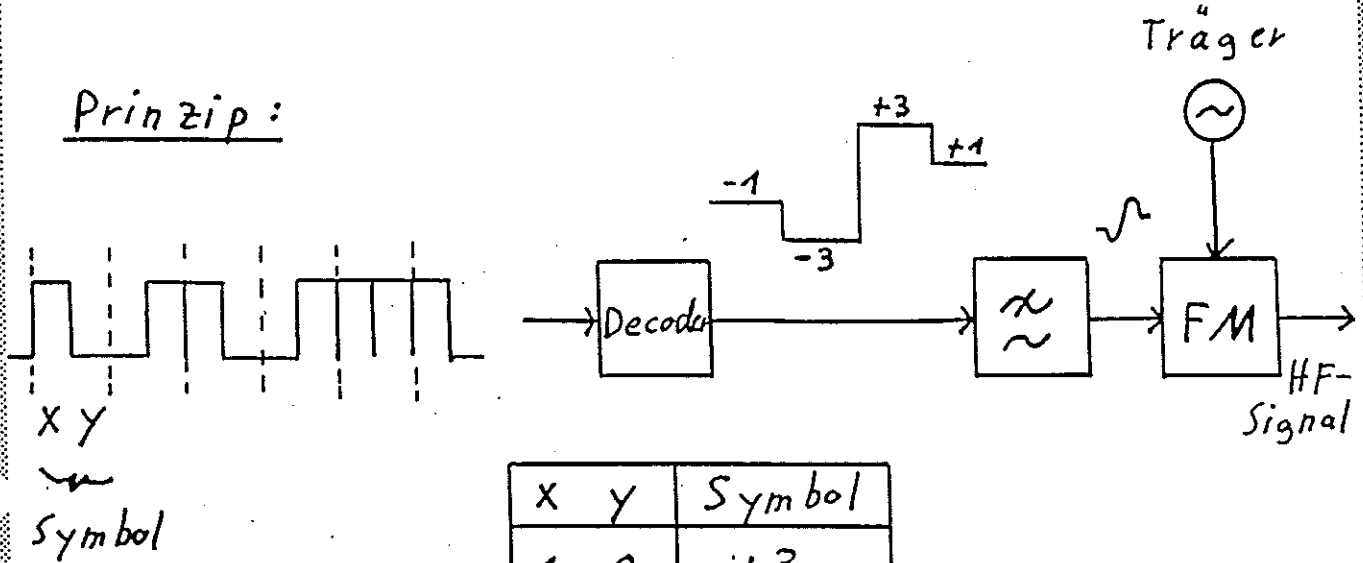
Auge geöffnet

HF-Spektrum:



4FSK:

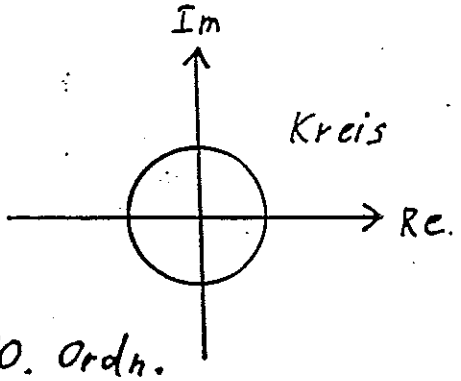
Prinzip:



x	y	Symbol
1	0	+3
1	1	+1
0	1	-1
0	0	-3

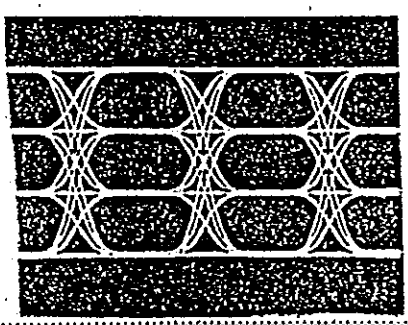
Netze: ERMES

Zustandsdiagramm:



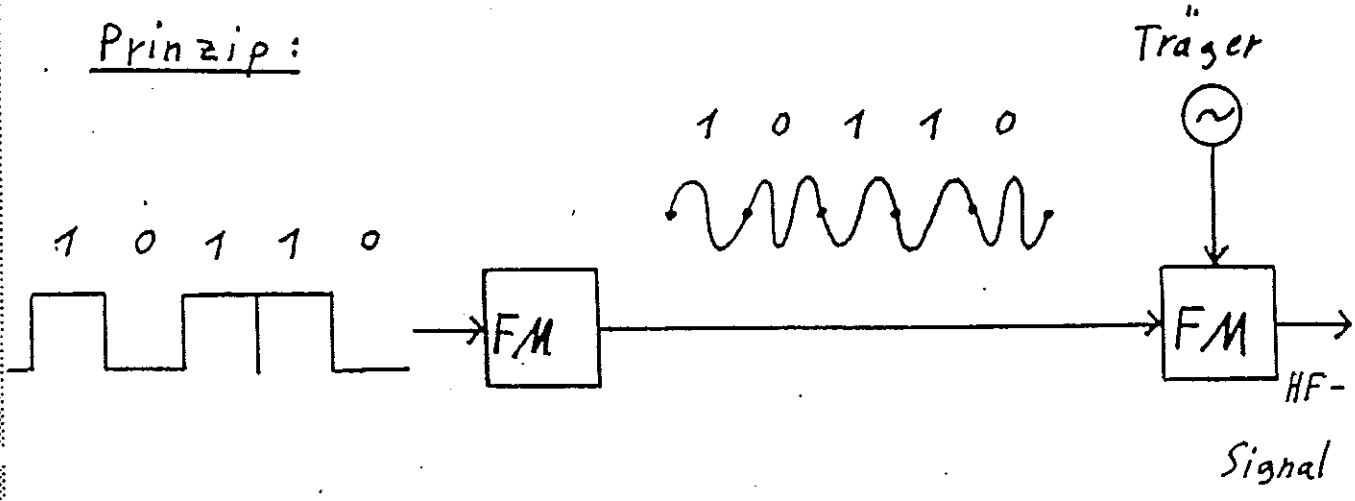
Basisbandfilter: Bessel-Tiefpaß 10. Ordn.

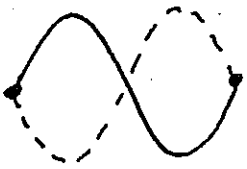
Augendiagramm:



FFSK :

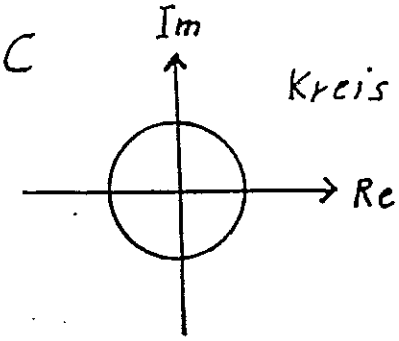
Prinzip :



0		1800 Hz $1\frac{1}{2}$ Perioden
1		1200 Hz 1 Periode

Netze : CITYRUF, POCSAC

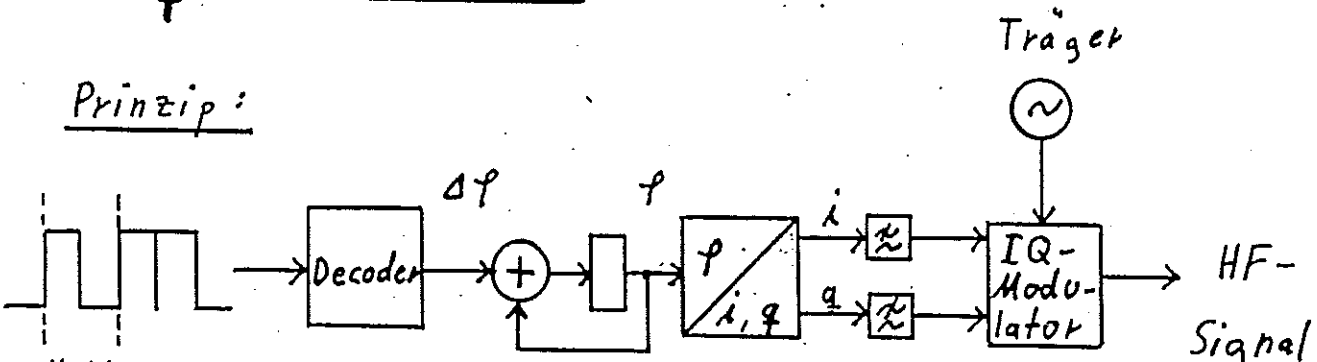
Zustandsdiagramm :

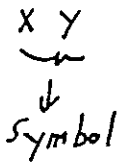


Basisbandfilter : keines

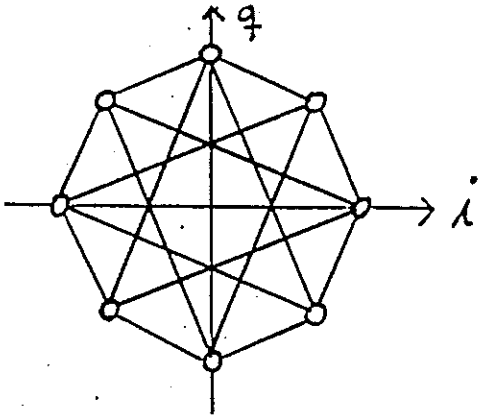
$\frac{\pi}{4}$ - DQPSK

Prinzip:





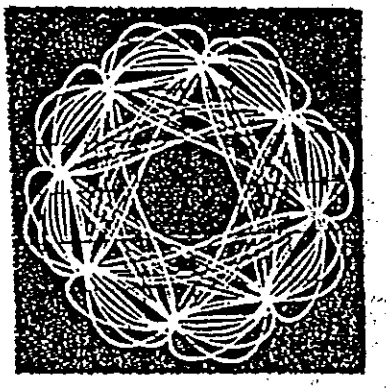
XY	Δφ
0 0	45°
0 1	135°
1 0	-45°
1 1	-135°



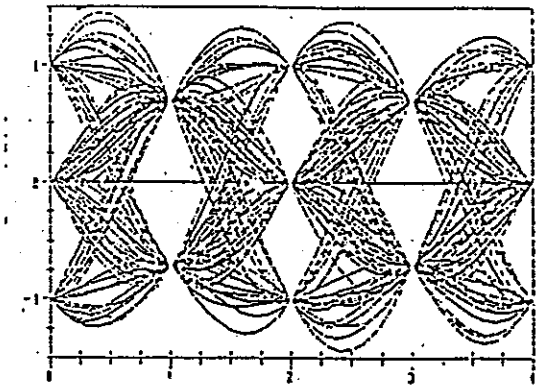
Netze: ADC, JDC, TFTS, TETRA

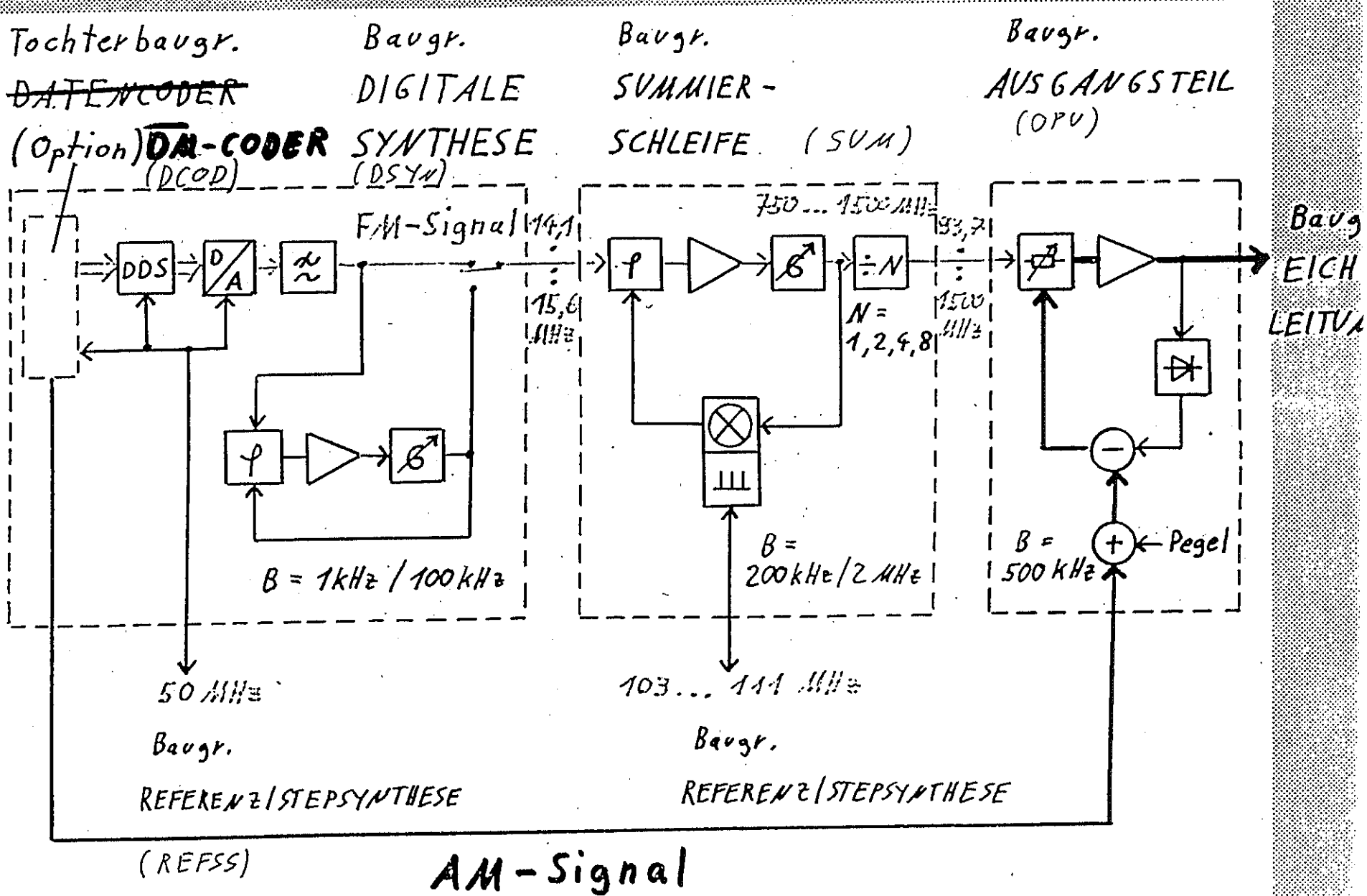
Basisbandfilter: Raised Cosinus

Zustandsdiagramm:



Augendiagramm:

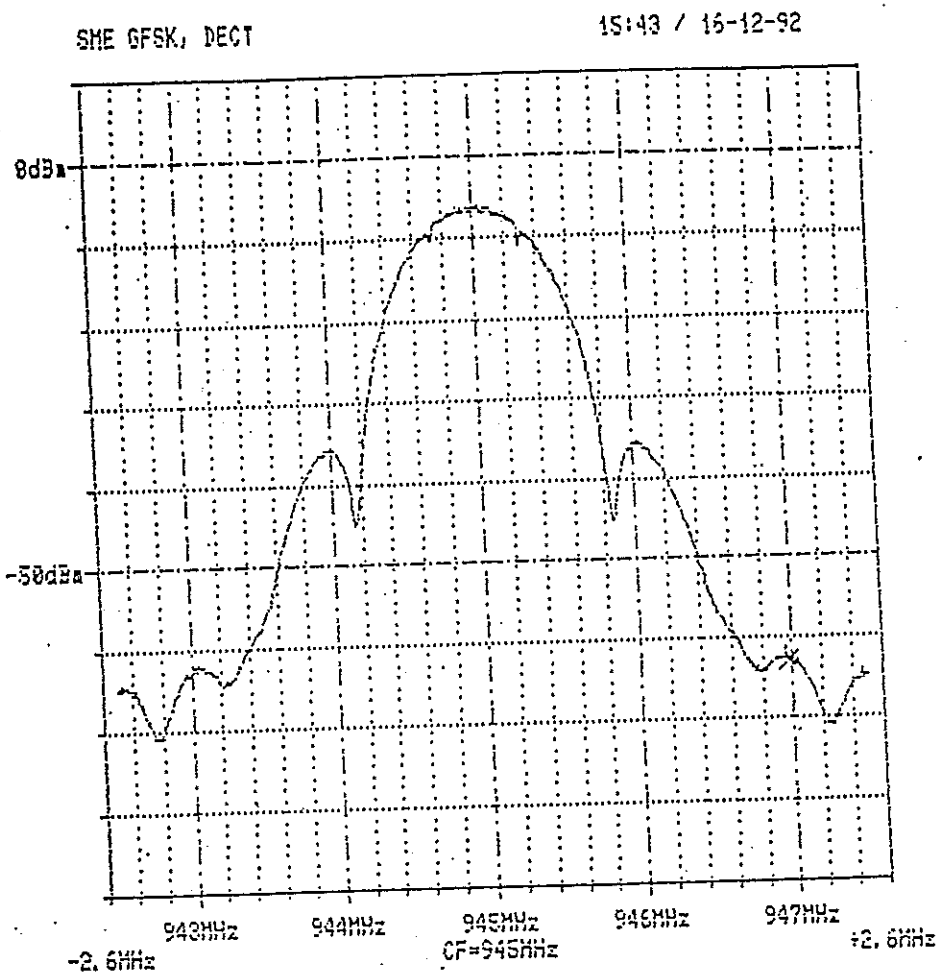



Tochterbaugr.
DATENCODER
(Option) DM-CODER
(DCOD)
Baugr.
DIGITALE
SYNTHESE
(DSYN)
Baugr.
SUMMIER-
SCHLEIFE (SUM)
Baugr.
AUSGANGSTEIL
(OPU)
DDS
D/A
FM-Signal
14,1
15,6 MHz
750 ... 1500 MHz
93,7
1500 MHz
N = 1,2,4,8
B = 1kHz / 100kHz
B = 200kHz/2MHz
B = 500 kHz
Pegel
50 MHz
Baugr.
REFERENZ/STEPSYNTHESE
(REFSS)
103 ... 111 MHz
Baugr.
REFERENZ/STEPSYNTHESE
AM-Signal

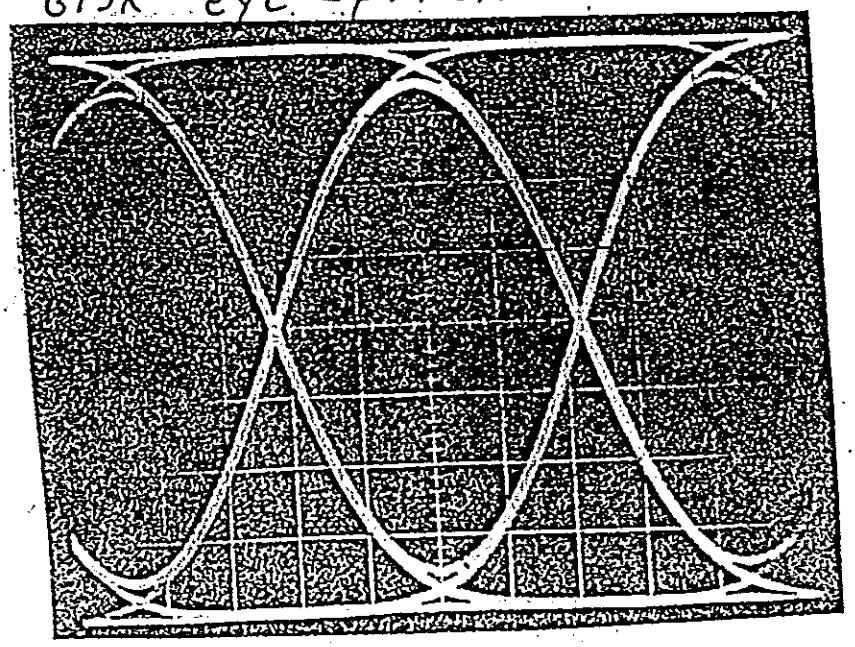
③ Measurements to test, if the SME meets the data sheet.

modulation	measurement	measurement device
all	clock frequency (CLOCK-output)	frequency-counter
all	spectrum	spectrum-analysator
GMSK	phase error	CMTA 94, HP 70 000
GFSK	eye-pattern	fm demodulator, scope (≈ 3 MHz band with) Folie
DQPSK	vector error constellation-diagram eye-pattern	HP 70 000 iq-demodulator, scope Folie iq-demod., scope
FSK, 4FSK	peak deviation eye-pattern	modulation-analysator fm demod., scope
FFSK	peak deviation identification-frequencies	modulation-analys. modulation-analys.

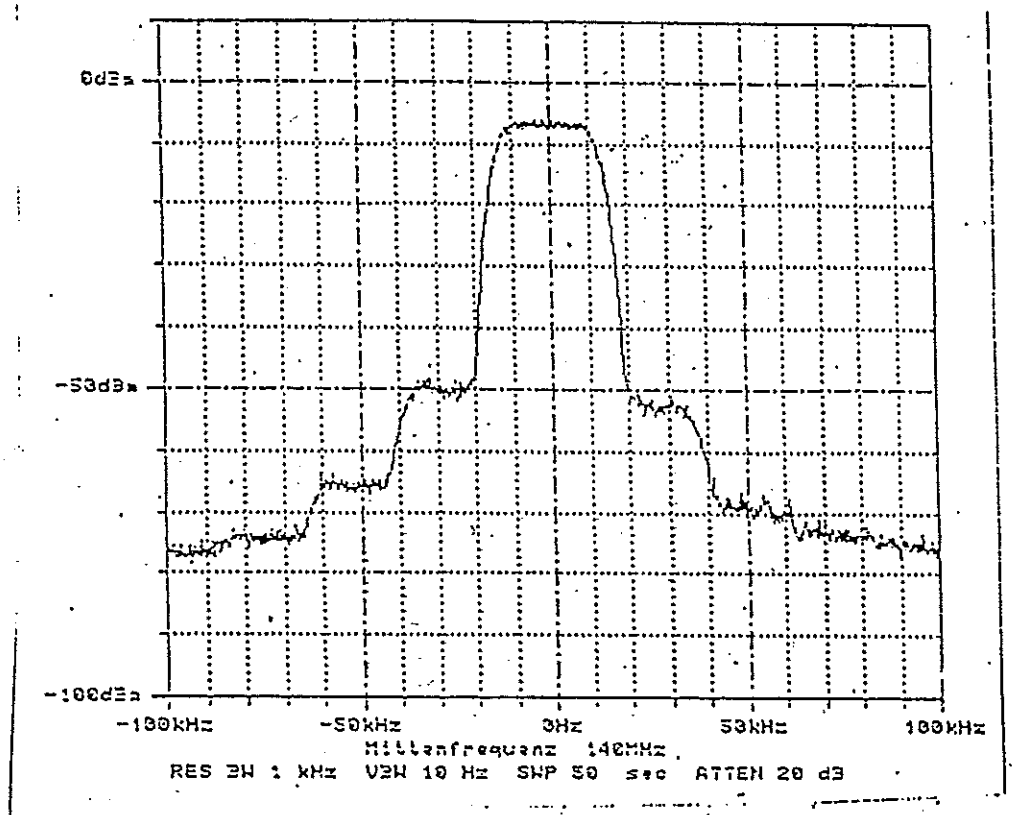
GFSK - spectrum



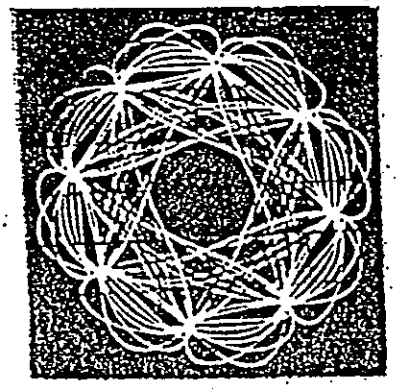
GFSK eye-pattern



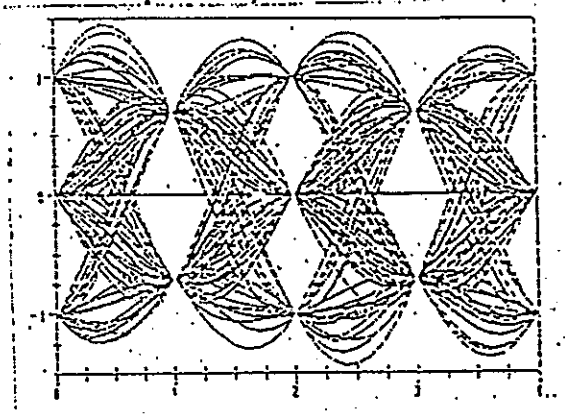
$\frac{\pi}{4}$-DQPSK - spectrum



constellation - diagram

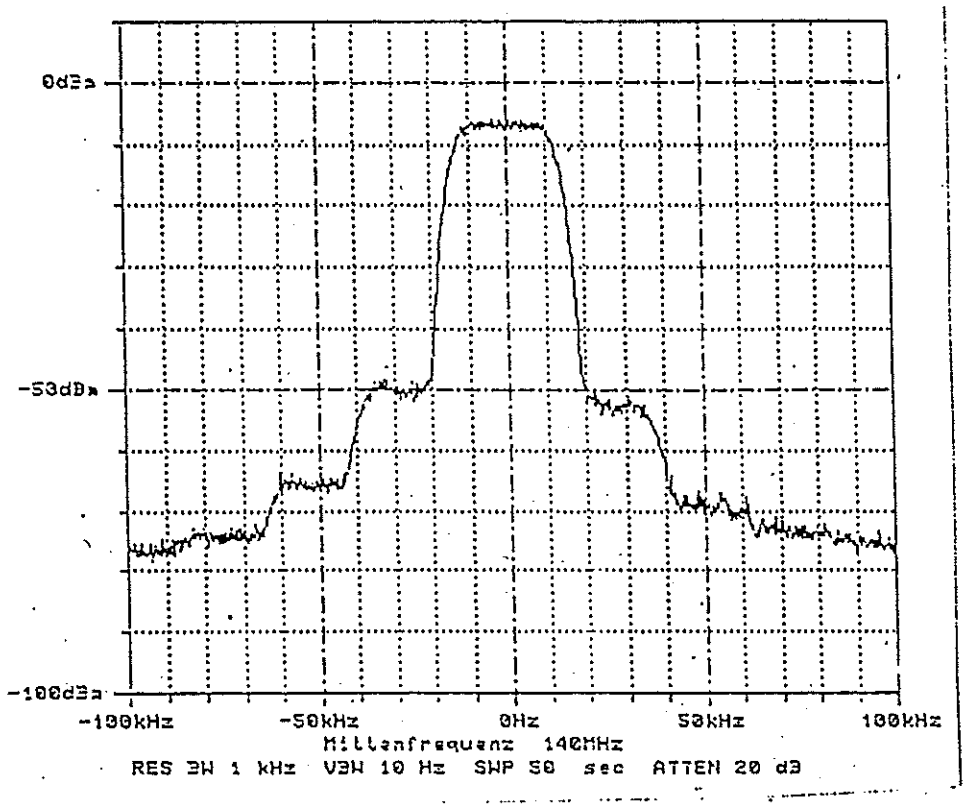


eye - pattern

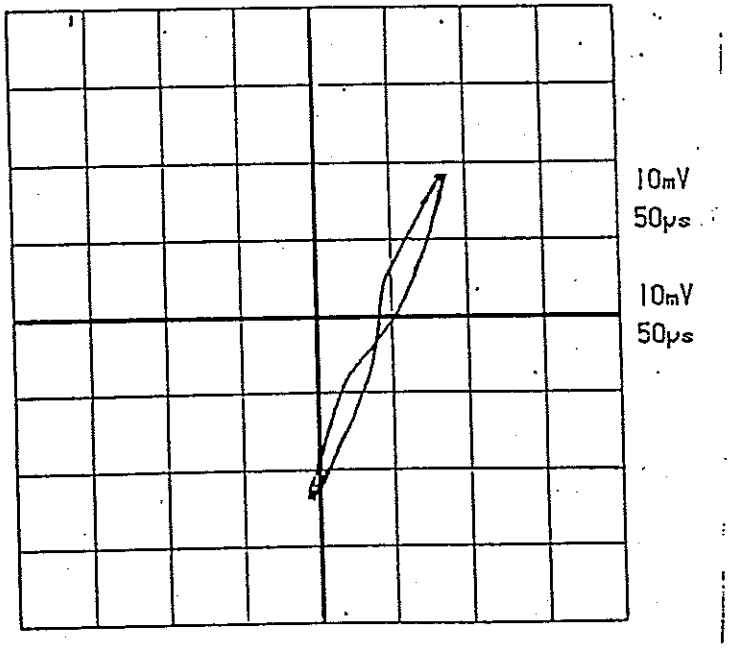


cos - Filter

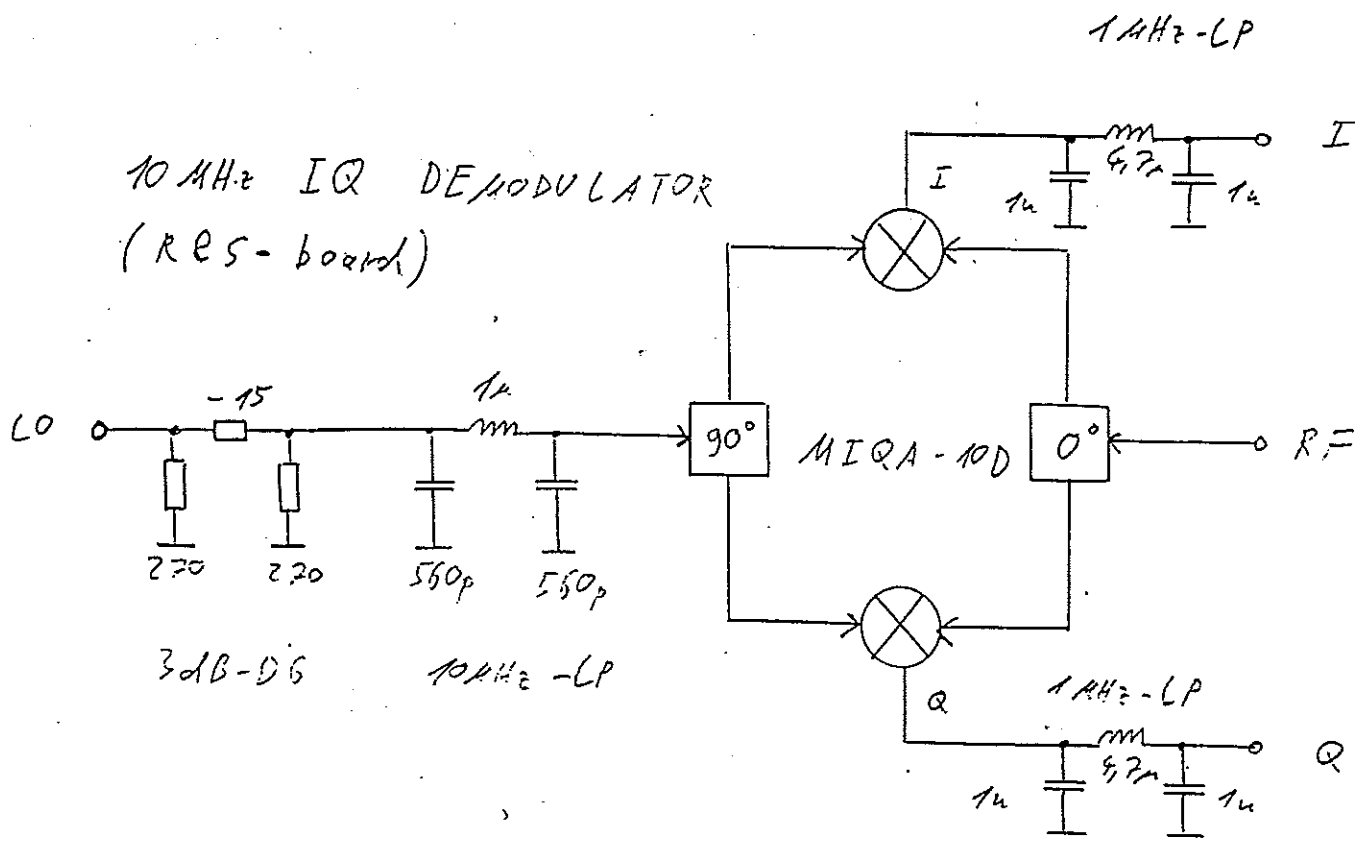
$\frac{\pi}{4}$-DQPSK-Modulation, Pseudorandomfolge

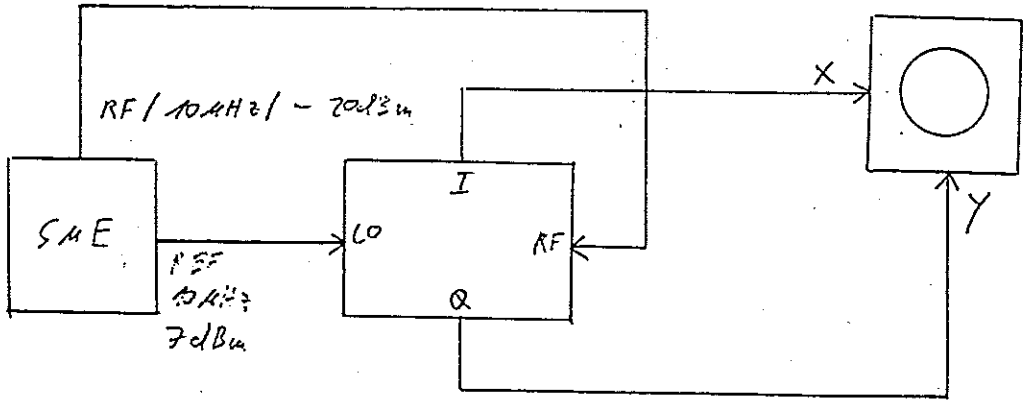


+135°/-135°-Folge, 1,5 µs Laufzeit-differenz



appendix 2:


1MHz-LP
10 MHz IQ DEMODULATOR
(RES-board)
I
1µ
4,7µ
1µ
LO
-15
1µ
90°
MIQA-10D
0°
RF
220
220
560p
560p
3dB-DG
10MHz-LP
Q
1MHz-LP
Q
1µ
4,7µ
1µ


RF / 10MHz / -20dBm
X
SME
I
LO
RF
Q
Y
15dBm
7dBm

ROHDE&SCHWARZ

SERVICEUNTERLAGEN

Option DM-Coder SME-B11

1036.8720.02

Inhaltsverzeichnis

7. Prüfen und Instandsetzen der Baugruppe

Bei der Erstellung dieser Unterlage wurde grundsätzlich vorausgesetzt, daß der DATENCODER mindestens den Hardwarezustand VAR4/REV1 und die Firmware mindestens den Stand 1.80 hat. Im Abschnitt 7.4 werden auch Meßwerte älterer Hardwarezustände angegeben, wenn diese sich geändert haben.

7.1 Funktionsbeschreibung

Die Baugruppe DATENCODER (kurz DCOD) ist eine Tochterbaugruppe der Baugruppe DIGITALE SYNTHESE (kurz DSYN) und kann optional eingebaut werden.
DCOD liefert über die Schnittstelle FMDAT0...13 ein digitales FM-Modulations-Signal in paralleler Form an das DDS-Gatearray auf DSYN. Das Strobesignal kommt über die Leitung LOADM.

Außer bei QPSK kommen alle Modulationsarten mit der digitalen Frequenzmodulation (FM) aus. Bei QPSK liegt zusätzlich auch Amplitudenmodulation (AM) vor. Das AM-Signal hierzu ist analog und gelangt über die Leitung CODAM und über das MOTHERBOARD zur Baugruppe AUSGANGSTEIL (kurz OPU), auf der es als Führungswert die AM-Regelschleife steuert.

Die gesamte digitale Signalverarbeitung wird vom Gatearray DMCODER im Zusammenspiel mit EPROM durchgeführt. Ansonsten befinden sich noch auf DMCODER die Zähler für die TAKTSYNTHESE und der DATENGENERATOR. Das Blockschaltbild des Gatearrays DMCODER ist auf Blatt 4 bei den Stromläufen zu finden.

Bei allen Modulationsarten sind die beiden Modi INTERN und EXTERN zu unterscheiden. Im Modus INTERN kommt das Datensignal DATA und das Taktsignal DATACLK vom internen DATENGENERATOR und der internen TAKTSYNTHESE. Im Modus EXTERN werden die beiden Signale an den Gerätebuchsen DATA und CLOCK eingespeist und gelangen über die Leitungen DATA und DATACLK auf DCOD.

7.1.1 TAKTSYNTHESE

Die TAKTSYNTHESE erzeugt die für die verschiedenen Netze notwendigen Taktsignale. Die Taktfrequenz reicht von 50Hz bis zu 1.9MHz.
Die verschiedenen Taktfrequenzen werden in einer PLL (VCO: 6.4...11.7MHz) mit nachgeschalteten Teilern erzeugt. Die Teiler sind im Gatearray DMCODER integriert und so aufgeteilt, daß sie den für die digitale Signalverarbeitung notwendigen Oversamplingtakt (OS), Bittakt (BIT) und Symboltakt (SYMB) der verschiedenen Netze generieren können.
Im Modus INTERN ist die Referenzfrequenz des Phasendetektors von der internen 50MHz-Referenz abgeleitet. Im Modus EXTERN werden alle Taktfrequenzen von dem an der Buchse CLOCK eingespeisten Bit- oder Symboltakt abgeleitet.

Die Abstimmspannung vom VCO wird vom INTERRUPT-DETECTOR überwacht und bei asynchroner PLL wird die Fehlermeldung "data coder clock unlocked" ausgelöst.

7.1.2 DATENGENERATOR

Der DATENGENERATOR kann entweder ein Pseudorandom-Signal liefern (Modul PRBS) oder aus dem 8kx4Bit großen DATA-RAM eine Datensequenz zyklisch oder einmalig auslesen. Das DATA-RAM kann vom Rechner geladen werden. Die Länge der Sequenz ist einstellbar.

Parallel zum Daten-Signal können auch die Signale LSWI (Levelswitch) und BURST im DATA-RAM eingelesen und synchron mit DATA ausgelesen werden. Das LSWI-Signal wird zur Baugruppe OPU geführt, wo es zwischen zwei Führungswerten also zwei Pegeln umschaltet. Das BURST-Signal wird über eine Gerätebuchse herausgeführt und kann als Trigger- oder Synchronisationssignal herangezogen werden. DATA, LSWI und BURST sind unabhängig voneinander im Listen-Editor editierbar.

7.1.3 Digitale Signalverarbeitung

Die digitale Signalverarbeitung der Modulationen ohne AM ist relativ einfach, da nur eine Filterung (Basisbandfilter) durchgeführt werden muß. Es handelt sich immer um FIR-Filter, die mit Schieberegistern und EPROM realisiert sind (SHIFT2, SHIFT6, GMSK-EPROM, GFSK-EPROM). Die Ausgänge aller EPROM sind parallelgeschaltet und gehen auf FMDAT0...13, der Schnittstelle zu DSYN. Es ist immer nur ein EPROM aktiv. Die Ausgänge der restlichen werden in den Tristate-Zustand geschaltet.

Die digitale Signalverarbeitung für QPSK ist wesentlich aufwendiger. Die FIR-Filterung erfolgt im Multiplexbetrieb im BF-EPROM. Das gefilterte I- und Q-Signal wird durch Quadrieren und Radizieren in das AM-Signal umgewandelt. Die Phase ergibt sich durch Dividieren und durch die ARCTAN-Funktion. Die Wurzel- und die ARCTAN-Funktion sind als Tabelle im ARCTAN-EPROM abgelegt. Aus der Phase wird schließlich durch Differenzieren die Frequenz gewonnen. Das Strobe-Signal für das DDS_GA auf DSYN wird im COUNTER1 0...15 Master-Clock-Takte verzögert. FIFO und COUNTER1 zusammen ermöglichen einen elektronischen Laufzeitabgleich des FM-Signales. Im Menü UTILITIES-CALIB-QPSK kann die Verzögerung vom Benutzer zur Optimierung der spektralen Reinheit in den Nachbarkanälen korrigiert werden.

Das digitale AM-Signal CODAM wird vom DAC und dem ALIASING-FILTER in ein analoges umgewandelt und der Baugruppe OPU zugeführt. Mit dem Abgleichpunkt LEVEL kann der Pegel am Gesamtgerät so abgeglichen werden, das bei abgeschalteter Modulation der Ausgangspegel minimal wird, daß also der Nullpunkt der AM richtig ist.
Mit dem Schalter STROBE-MUX wird der COUNTER1 umgangen, wenn keine QPSK-Modulation vorliegt.

7.2 Meßgeräte und Hilfsmittel

- Servicekit 1039.3520
- Zweikanaloszilloskop (0...250MHz)
- 100:1 HF-Tastkopf (5kΩ/50Ω)
- Spektrumanalysator 1...20MHz (z.B. FSA)
- Frequenzzähler 500Hz...1.2MHz (im FSA enthalten)
- Signalgenerator 100Hz...1.2MHz (z.B. SMG)
- Rechteckgenerator 100Hz...1.2MHz (z.B. ADS)
- Modulationsanalysator (z.B. FMA)
- Multimeter (z.B. UDL33)

7.3 Fehlersuche

Datenübertragung fehlerhaft (siehe 7.4.2).	Prüfe SERBUS-D2 (D112) auf DSYN, den SERBUS-BUFFER (D50) und das Schieberegister D300.
Taktsignal an P13 außer Toleranz (siehe 7.4.3).	Prüfe CLOCK-AMPLIFIER (V260).
Kein Taktsignal an P14 (siehe 7.4.4).	Prüfe den Inverter D330, das DMAP-FPGA (D80) und den OSCILLATOR (V235, V236, V237, V240).
Taktsynthese fehlerhaft (siehe 7.4.5).	Prüfe DMCODER-Signale UP und DOWN (Ausgänge des digitalen Phasendetektors), DMAP-FPGA (D80), CONTROL-AMPLIFIER (N200, N210) und den OSCILLATOR (V235, V236, V237, V238, V240).
GFSK-Modulation fehlerhaft (siehe 7.4.8.1).	Prüfe DMCODER-Gatearray, Strobesignal an P5 (11.52MHz-Rechtecksignal), GFSK-EPROML (D50) und GFSK-EPROMH (D60).
QPSK-Modulation fehlerhaft (siehe 7.4.8.2).	Prüfe DMCODER-Gatearray, Strobesignal an P5 (Rechtecksignal mit der fünfzehnfachen Bitfrequenz), DMAP-FPGA (D80), BF-EPROM (D30), ARCTAN-EPROM (D40), DAC (D280) und ALIASING-FILTER (N280, N290, N295).
GMSK-Modulation fehlerhaft (siehe 7.4.8.3).	Prüfe DMCODER-Gatearray, Strobesignal an P5 (4.333MHz-Rechtecksignal) und GMSK-EPROM (D70).
FFSK-Modulation fehlerhaft (siehe 7.4.8.4).	Prüfe DMCODER-Gatearray, Strobesignal an P5 (76.8kHz-Rechtecksignal) und GMSK-EPROM (D70).

4FSK-Modulation fehlerhaft (siehe 7.4.8.5).	Prüfe DMCODER-Gatearray, Strobesignal an P5 (93.75kHz-Rechtecksignal), GMSK-EPROM (D70), BF-EPROM (D30), DMAP-FPGA (D80), SHIFT6 (D85).
Kein Strobesignal an P5.	Prüfe DMCODER-Gatearray, Inverter D330, COUNTER1 (D305) und den Multiplexer STROBE-MUX (D335).
Es erscheint die Fehlermeldung "Data coder clock unlocked".	Prüfe Phasenregelschleife (Abst.sp. an X215 zw. 1V und 7V), DMCODER-Gatearray, CONTROL-AMPL. N200, N210), OSCILLATOR, DMAP-FPGA (D80) und den INTERRUPT-DETECTOR (N220, V220).

7.4 Prüfen und Abgleichen

Zum Servicebetrieb wird der obere Deckel der Mutterbaugruppe DIGITALE SYNTHESE (DSYN) abgeschraubt, anstelle der Baugruppe wird der Serviceadapter in den Steckplatz eingesetzt und anschließend die Baugruppe auf den Adapter gesteckt. Nachdem die HF-Verbindungen hergestellt worden sind, ist die Baugruppe DSYN und die Option DATENCODER (DCOD) wieder betriebsbereit.

Bei allen Angaben zur Einstellung des Gerätes wird zu Beginn jedes Abschnittes davon ausgegangen, daß das Gerät im PRESET-Zustand ist.

7.4.1 Prüfung der Stromaufnahme und verschiedener Spannungen

- **Einstellung:** **FREQUENCY 1000MHz**
  DIGITAL MOD - GFSK - SOURCE PRBS

▶ Die Stromaufnahme der Baugruppe kann geprüft werden, indem anstelle der Spulen L350, L351 und L352 ein Ampermeter eingeschleift wird. Es sind hierzu die vier Schrauben, die DCOD mit DSYN verbindet, zu lösen, da die Spulen auf der Lötseite von DCOD sind. Die Sollwerte zu den jeweiligen Versorgungsspannungen befinden sich in Kap. 7.6.

▶ Verschiedene Spannungen: **P8:** 10.3+-1V
P12: -4.3+-1V

7.4.2 Prüfen der Datenübertragung

- Die Verschraubung von DCOD lösen und DCOD hochklappen, damit der Baustein D300 zugänglich wird.

Einstellung	D300 Pin 4	5	6	7	14	13	12	11	P10	
DIG.MOD-QPSK-SOURCE PRBS, UTILITIES-CALIB-QPSK-										
DELAY = 2620ns	0	0	0	0	x	x	x	x	1	
DELAY = 2580ns	1	0	0	0	x	x	x	x	1	
DELAY = 3900ns	0	1	0	0	x	x	x	x	1	
DELAY = 3700ns	0	0	1	0	x	x	x	x	1	
DELAY = 3360ns	0	0	0	1	x	x	x	x	1	
DIG.MOD-GFSK-SOURCE-PRBS	x	x	x	x	x	0	0	0	1	
DIG.MOD-QPSK-SOURCE-PRBS	x	x	x	x	x	1	0	0	1	
DIG.MOD-QPSK-SOURCE-OFF	x	x	x	x	x	x	x	x	0	
DIG.MOD-4FSK-SOURCE-OFF	x	x	x	x	x	0	1	1	1	gilt nur bis VAR2/REV6

7.4.3 Prüfung des Taktsignales zum DMCODER-Gatearray:

- An P13 über einen 100:1-HF-Tastkopf ein Oszilloskop (50Ω-Abschluß) anschließen.
- Es muß ein periodisches 50MHz-Signal mit HIGH-Pegel >4V und LOW-Pegel <1V zu messen sein. Die Spannung muß >7ns über 2.5V und >7ns unter 2.5V bleiben.

7.4.4 Abgleich vom OSCILLATOR und Pegelprüfung:

- Einstellung: **DIGITAL MOD - GFSK - SOURCE PRBS**
- Steckbrücke X215 ziehen und Gleichspannung an X215.2/3 einspeisen.
- Frequenzzähler an P14 anschließen.

▶ Den Oszillator nach folgender Tabelle wechselweise abgleichen:

Bis VAR2/REV1:

Spang. X215	Abgleichpunkt	Sollfrequenz an P14
2V	OSZ1 (C230)	7.5+-0.1MHz
7V	OSZ2 (C231)	12+-0.1MHz

Ab VAR2/REV2:

Spang. X215	Abgleichpunkt	Sollfrequenz an P14
0.9V	OSZ1 (C230)	6.4+-0.1MHz
7V	OSZ2 (C231)	11.7+-0.1MHz

- An P14 über einen 100:1-HF-Tastkopf ein Oszilloskop anschließen.

▶ Es muß für U(X215)= 2V (ab VAR2/REV2: 0.9V) und 7V eine periodische Rechteckspannung mit der Maximalspannung über 4V und der Minimalspannung unter 1V zu messen sein. Die Spannung muß >15ns über 2.5V und >15ns unter 2.5V bleiben.

- Steckbrücke X215 wieder aufstecken.

7.4.5 Prüfung der TAKTSYNTHESE (PLL) im INT-Modus

- An den CLOCK-Ausgang ein Oszilloskop und einen Frequenzzähler anschließen (1MΩ).
- An X215.2 ein Voltmeter anschließen oder Diagnosepunkt 301 einschalten.

▶ Am Oszilloskop muß ein Rechtecksignal mit HC-Pegel zu sehen sein.

- Einstellung: **DIGITAL MOD - ... - SOURCE PRBS**

Einstellung	Taktfrequenz am CLOCK-Ausgang in kHz+-1% (CLK MODE SYMB)	Spang.an X215.2 od. Diag.301 in V+-0.5V		
		ab VAR2/ REV0	ab VAR2/ REV2	ab VAR4/ REV1
GMSK/STANDARD GSM/PCN	270.8333	3.3	3.4	3.4
GFSK/STANDARD DECT	1152	6.3	6.7	6.7
QPSK/STANDARD ADC	24.3	6.5	7.0	7.0
QPSK/STANDARD PDC	21	4.7	4.9	4.9
QPSK/STANDARD TFTS	22.1	5.2	5.4	5.4
QPSK/STANDARD TETRA	18	3.3	3.4	3.4
FSK/STANDARD POCS-1200	1.2	3.8	4.0	4.0
FSK/STANDARD POCS-512	0.512	2.8	2.9	2.9
4FSK/STANDARD ERMES	3.125	2.0	2.2	5.2

- Einstellung: **DIGITAL MOD - QPSK - SELECT STANDARD ADC**
  CLOCK MODE - SYMBOL

▶ Am DATACLK-Ausgang muß ein Rechtecksignal mit der Frequenz 24.3kHz+- 1% zu messen sein.

7.4.6 Prüfung der TAKTSYNTHESE im EXT-Modus

- An die CLOCK-Buchse ein Rechtecksignal mit HC-Pegel und der Frequenz 1152kHz anschließen.

- Einstellung: **DIGITAL MOD - GFSK - SOURCE EXT**

▶ An X215.2 muß eine Gleichspannung mit 6.3+-1V (ab VAR2/REV2: 6.7V) zu messen sein.

- An die CLOCK-Buchse ein Rechtecksignal mit HC-Pegel und der Frequenz 1.2kHz anschließen.

- Einstellung: **DIGITAL MOD - FFSK - SOURCE EXT**

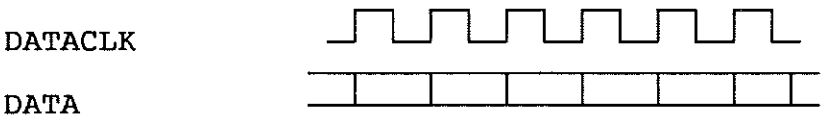
▶ An X215.2 muß eine Gleichspannung mit 3.8+-0.5V (ab VAR2/REV2: 4.0V, ab VAR4/REV1: 3.6V) zu messen sein.

7.4.7 Prüfung des Datengenerators

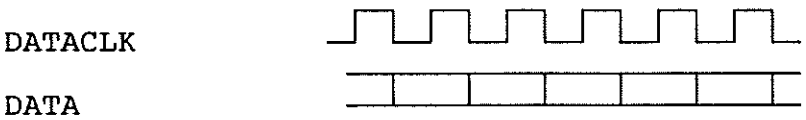
▶ An die CLOCK- und DATA-Buchse ein zweikanaliges Oszilloskop anschließen (1MΩ).

- Einstellung: **DIGITAL MOD - FSK - SOURCE PRBS**

▶ An der CLOCK-Buchse muß ein Taktsignal und an der DATA-Buchse ein Pseudorandom-Datensignal mit der Frequenz 1200Hz+-1% und HC-Pegel zu messen sein.
Das Datensignal muß sich mit der steigenden Flanke vom Taktsignal ändern.



- Einstellung: **- CLOCK EDGE NEG**

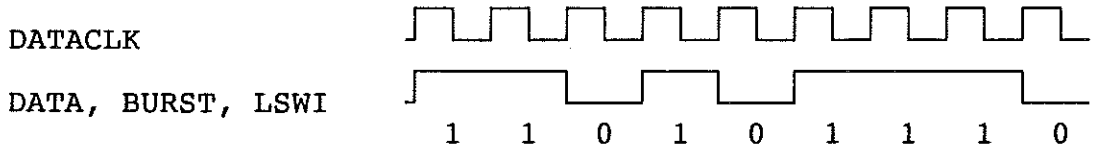


▶ Das Datensignal muß sich nun mit der fallenden Flanke vom Taktsignal ändern.

- Ein zweikanaliges Oszilloskop an die CLOCK-Buchse und DATA-Buchse bzw. BURST-Buchse bzw. X80.32 (LSWI) anschließen.

- Einstellung:
  - FILL-LIST DATA "110101110"
  LEV SWCH "110101110"
  BURST "110101110"
  - SOURCE DATA

▶ Es muß an der DATA-Buchse, BURST-Buchse und an X80.32 das Datensignal "110101110" periodisch wiederholt zu messen sein. Zur fallenden Flanke von DATACLK müssen die Datensignale stabil sein.



• Einstellung: **MODE SINGLE**
EXECUTE SINGLE MODE

▶ Nach dem setzen von EXECUTE muß das Datensignal "110101110" an den drei Ausgängen einmalig als Burst erscheinen.

7.4.8 Prüfung der verschiedenen digitalen Modulationen

7.4.8.1 GFSK-Modulation (DECT)

• Einstellung: **FREQUENCY 835MHz**
DIGITAL MOD - GFSK - SOURCE PRBS
- PRBS 23 BIT

• Spektrumanalysator an X89 (FDDS) anschließen und Center=15MHz, Span=10MHz, Res.Bw.=30kHz, Vid.Bw.=30Hz einstellen.

▶ Es muß ein kontinuierliches Spektrum zu sehen sein. Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
200	-1.7+-0.5
400	-5.7+-0.5
700	-20.5+-2
1000	-30.8+-3
1500	-53+-3
2850	-68+-3
4800	-72+-3

• Am Spektrumanalysator Span=4MHz einstellen.

• Einstellung: **FILTER ...**

▶ Je nach FILTER muß der relative Signalpegel bei 1000kHz Offset-Frequenz folgendermaßen aussehen:

FILTER B*T	DEVIATION	Pegel in dB
B*T=0.4	DEV=288 kHz	-33.8+-2
B*T=0.5	DEV=288 kHz	-30.8+-2
B*T=0.6	DEV=288 kHz	-28.9+-2
B*T=0.5	DEV=317 kHz	-28.4+-2

- Einstellung: **- SELECT STANDARD - CT3 (ab VAR2/REV2)**

▶ Es muß ein kontinuierliches Spektrum zu sehen sein. Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
111	-1.7+-0.5
222	-5.7+-0.5
389	-20.5+-2
556	-30.8+-3
833	-56+-3

7.4.8.2 QPSK-Modulation (ADC, JDC, TFTS, TETRA)

- Einstellung: **FREQUENCY 835MHz**
  DIGITAL MOD - QPSK - SOURCE PRBS
  - PRBS 23 BIT

- Spektrumanalysator an X89 (FDDS) anschließen und Center=15MHz, Span=300kHz, Res.Bw.=3kHz, Vid.Bw.=10Hz einstellen.

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
21	-19+-2
30	-19+-2
44	-28+-3
67	-37+-3
100	-46+-3

- Am Spektrumanalysator Span=60kHz und 2dB/Div. einstellen.

- Einstellung: **FILTER / ROLL OFF laut Tabelle**
  BITRATE laut Tabelle

▶ Je nach FILTER müssen folgende Bilder und Pegel zu sehen sein:

FILTER /ROLL OFF	BITRATE in kHz	Offset-Frequ. in kHz	Pegel in dB
SQR(COS) / 0.35	48.6	15	-8.6+-2
COS / 0.35	48.6	15	-10.6+-2
SQR(COS) / 0.40	44.2	18	-17.5+-2
SQR(COS) / 0.50	42.0	15	-12.0+-2

- Einstellung: **SOURCE DATA**
  SELECT STANDARD ADC
  FILL LIST DATA "0111"

▶ Spektrumanalysator an X80.9 (CODAM) anschließen (50Ω) und Center=125kHz, Span=250kHz, Res.Bw.=1kHz, Vid.Bw=100Hz und DC-Kopplung einstellen.

▶ Der absolute Signalpegel bei 24.3kHz muß -6+-2dBm sein. Bezogen auf diesen Pegel müssen die Pegel der folgenden Tabelle zu messen sein:

Absolut-Frequ. in kHz	Pegel in dB
2 * 24.3	-17.3+-2
3 * 24.3	-29.0+-2
4 * 24.3	-38.0+-2
5 * 24.3	-47.0+-2
6 * 24.3	-53.7+-2
7 * 24.3	-65.5+-2

7.4.8.3 GMSK-Modulation (GSM)

- Einstellung: **FREQUENCY 835MHz**
  DIGITAL MOD - GMSK - SOURCE PRBS
  - PRBS 23 BIT

- Spektrumanalysator an X89 (FDDS) anschließen und Center=15MHz, Span=1MHz, Res.Bw.=10kHz, Vid.Bw.=10Hz einstellen.

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
50	-2+-1
100	-8+-2
150	-20+-3
220	-36+-3
300	-52+-3
450	-75+-3

- Einstellung: **FILTER B*T ...**

▶ Je nach FILTER muß der relative Signalpegel bei 250kHz Offset-Frequenz folgendermaßen aussehen:

B*T	Pegel in dB
0.2	-56.5+-3
0.3	-40.0+-3
0.5	-30.7+-3

- Einstellung: **- SELECT STANDARD - MOBITEX-8k (ab VAR2/REV2)**

- Am Spektrumanalysator Span=20kHz, Res.Bw.=100Hz, Vid.Bw.=10Hz einstellen.

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
1.48	-2.0+-1
2.95	-8.6+-2
4.43	-20+-3
6.50	-36+-3
8.86	-52+-3

- Einstellung: **- SELECT STANDARD - MD36N (ab VAR2/REV5)**

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
0.666	-2.0+-1
1.3275	-8.6+-2
2.0	-20+-3
2.925	-36+-3
4.0	-52+-3

7.4.8.4 FFSK-Modulation (POCSAG)

- Einstellung: **FREQUENCY 835MHz**
  DIGITAL MOD - FFSK - SOURCE PRBS
  - PRBS 23 BIT

- Spektrumanalysator an X89 (FDDS) anschließen und Center=15MHz, Span=50kHz, Res.Bw.=3kHz, Vid.Bw.=30Hz einstellen.

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
3	-0.9+-0.5
5	-6.6+-0.5
10	-31.7+-3
15	-52.0+-3
25	-69.0+-3

- Einstellung: **- SOURCE DATA**
  - FILL-LIST DATA "1"

- Einen Modulationanalysator (z.B. FMB) an X89 (FDDS) anschließen und FM-Demodulation mit der Demodulationsbandbreite 23kHz einschalten.

▶ Es muß eine sinusförmige FM mit dem Spitzenhub von 4kHz+-1% und der Modulationsfrequenz von 1200Hz+-1% zu messen sein. Der Klirrfaktor muß unter 1% liegen.

7.4.8.5 4FSK-Modulation (ERMES)

- Einstellung: **FREQUENCY 835MHz**
  DIGITAL MOD - 4FSK - SOURCE PRBS
  - PRBS 23 BIT

- Spektrumanalysator an X89 (FDDS) anschließen und Center=15MHz, Span=50kHz, Res.Bw.=1kHz, Vid.Bw.=3Hz einstellen.

▶ Der Signalpegel bezogen auf den Pegel bei 15MHz in Abhängigkeit von der Offsetfrequenz muß folgendermaßen aussehen:

Offset-Frequ. in kHz	Pegel in dB
2.5	-0.7+-0.5
5	-7.6+-2
10	-35+-3
15	-56+-4

- Einstellung: **- SOURCE DATA**
  - FILL-LIST DATA "1000"

- Einen Modulationanalysator (z.B. FMB) an X89 (FDDS) anschließen und FM-Demodulation mit der Demodulationsbandbreite 23kHz einschalten.

▶ Es muß eine FM (Rechtecksignal ohne Überschwingen) mit dem Spitzenhub von 4.6875kHz+-1% und der Modulationsfrequenz von 1562.5Hz+-1% zu messen sein.

7.4.9 Prüfung von COUNTER1 (DELAY)

- Einstellung: **DIGITAL MOD - QPSK - SOURCE PRBS**
  UTILITIES CALIB QPSK DELAY=2620ns

- An P5 (LOADM) und P6(FMDAT13) ein Oszilloskop anschließen und auf positive Flanke vom Signal an P6 triggern (2.5V Schwellspannung).

▶ An P5 muß ein um 7*85.7ns+10ns=610ns+-20ns gegenüber der positiven Flanke an P6 verzögerter Puls mit der Pulsdauer von 87.5ns+-10ns zu messen sein.

▶ Die Verzögerung muß gemäß folgender Tabelle von DELAY abhängig sein:

DELAY/ns	Verz. in ns +-20ns
2620	7*85.7+10=610
2580	6*85.7+10=524
3900	5*85.7+10=439
3700	3*85.7+10=267
3360	15*85.7+10=1296

7.4.10 Prüfung der Interrupt-Funktion

- Einstellung: **DIGITAL MOD - GMSK - SOURCE PRBS**

- Steckbrücke X215 abziehen.

▶ Es muß die Fehlermeldung "Data coder clock unlocked" kurz erscheinen und es muß die Anzeige ERROR permanent angezeigt werden. Wenn die ERROR-Taste gedrückt wird, muß die Fehlermeldung in der Fehlerliste stehen.

- Die Steckbrücke wieder stecken. Die Anzeige ERROR muß verschwinden.

- Einstellung: **- SOURCE OFF**

▶ Beim Abschalten der Modulation darf keine Fehlermeldung erscheinen.

7.4.11 Prüfung der Diagnose

- Einstellung: **DIGITAL MOD - GFSK - PRBS**
  UTILITIES - DIAG - TPOINT

TPOINT	Meßpunkt	Faktor	Sollspannung
301	STEUERSPANNUNG DCOD-VCO	3	6.3+-1V
302	OSZILLATORPEGEL DCOD-VCO	1	0.5...1.5V

7.4.12 Prüfung der verschiedenen Netze mit dem Modulationanalysator FMB

Die mit dem Änderungszustand VAR2/REV2 neu hinzugekommenen Netze CT2, CT3, CDPD, MC9, MOBITEX-8000, CITYRUF und POCSAC lassen sich mit dem FMB überprüfen. Eine Prüfung des Spektrums der neuen Netze ist nicht notwendig, da keine neuen Eproms hinzugekommen sind.

- Einstellung: **FREQUENCY 900MHz**
  LEVEL 0dBm
  DIGITAL MOD - GFSK - SOURCE DATA
- Modulationsanalysator FMB an X89 (FDDS) anschließen und FM-Demodulation einschalten.
- Mit dem Listeneditor sind im DATA-Kanal N mal "1" und N mal "0" einzugeben (z.B. bei N=4 "11110000"):
- Einstellung: **FILL-LIST DATA "1...10...0"**
- Den Hochpaßfilter des FMB (HP) auf 10Hz setzen. Der DIFF ENCODER muß beim SME immer auf OFF gesetzt bleiben. Weitere Einstellungen sind in der Tabelle aufgeführt.
- Bei QPSK-Modulation sollte das DATA-Muster "0111" editiert werden (+-135°-Folge). Bei dem Netz TFTS muß DIFF ENCODER auf ADC gestellt werden.

▶ Der gemessene Spitzenhub und die Modulationsfrequenz sollte den Werten in der Tabelle entsprechen. Die Abweichung vom Nominalhub kommt vom Überschwingen des FMB-Tiefpaßfilters.

▶ Rechts in der Tabelle ist aufgeführt, ab welcher Variante und Revision der zu prüfende Standard realisiert ist.

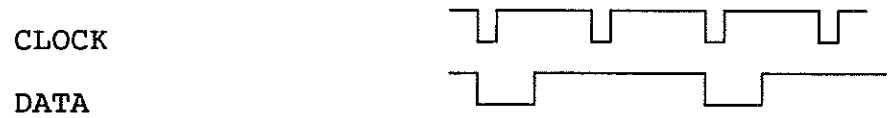
Einstellung: Modul./ SEL. STAND.	FMB LP-bandbr. in kHz	N/ DATA	FM-Hub in kHz +-3%	Mod.-frequ. kHz+-1%	VAR	REV
GMSK / GSM	100	N=4	77	33.85	2	1
GMSK / CDPD	100	N=4	4.9	2.4	2	2
GMSK / MC9	23	N=4	2.0	1.0	2	2
GMSK / MOBITEX-8000	23	N=4	2.0	1.0	2	2
GMSK/MD36N	3	N=4	0.92	0.45	2	5

GMSK/BITR.1M /BT=0.4	100	N=32	304	15.625	2	5
GMSK / DSRR	23	N=4	4.03	2.0	2	5
GFSK / DECT	100	N=32	352	18.0	2	1
GFSK / CT2	100	N=4	18.25	9.0	2	2
GFSK / USER BITRATE: 100kbps FIL./DEV: 0.5/20kHz	100	N=4	21 .1	12.5	4	1
GFSK / CT3	100	N=20	195	16.0	2	2
QPSK / ADC	100	0111	37.1	12.1	2	1
QPSK / PDC	100	0111	33.4	10.5	2	1
QPSK/TFTS (D.E. ADC)	100	0111	34.6	11.0	2	1
QPSK / TETRA	100	0111	28.6	9.0	2	1
QPSK / APCO25	23	0111	5.68	2.4	2	5
QPSK / INMARSAT	23	0111	2.76	2.0	4	1
QPSK / MSAT	23	0101	.517	3.375	4	1
QPSK / USER MOD TYPE: PI/4 QPSK BITRATE: 14kbps FILTER: SQR-COS/0.5 CODING: TFTS	100	11010010	3.59	7.0	4	1
FSK / CITYRUF-1200	23	N=1	4.15	0.6	2	2
FSK / POCSAG-2400	23	N=1	4.63	1.2	2	2
FSK / USER BITRATE: 20kbps HUB: 200kHz FILTER: OFF	100	N=1	247+-10%	10.0	2	1
FSK / FLEX-3200	23	01	4.86	1.6	4	1
4FSK / ERMES	100	0111	1.64	1.5625	2	1
4FSK (C4FM) / APCO25	23	01011111	2.83	1.2	2	5
4FSK / FLEX-6400	23	0010	4.86	1.6	4	1
4FSK / MODACOM	23	01011111	2.5	1.2	4	1
FFSK / POCSAG	3	1111	4.0	1.2	2	1
FFSK / USER BITRATE: 90kbps DEVIATION: 4.5kHz	100	1111	4.8	90	4	1

7.4.13 Prüfung der Mappingkorrektur (erst ab VAR2/REV3 funktionsfähig)

• Einstellung: **DIGITAL MOD - QPSK - SOURCE EXT**

• An die CLOCK- und DATA-Buchse folgende periodische Signal mit der Periodendauer 82.3us für DATA einspeisen: (Datenfolge "0111", Datenübernahme bei steigender Flanke)



(Als Daten- und Taktquelle kann auch ein SME mit der Option DM--CODER mit der Einstellung DIGITAL MOD - QPSK - SOURCE DATA verwendet werden. Mit dem Listeneditor muß die Datenfolge "0111" eingegeben werden. Die Signale liegen dann an den Buchsen CLOCK und DATA an.)

▶ An X215.2 muß eine Gleichspannung mit 6.9+-0.5V zu messen sein. (Diagnosepunkt 301)

• An X600 (FDDS) einen Spektrumanalysator anschließen (50OHm).

▶ Es muß am Spektrumanalysator bei 12.5MHz ein Träger mit Seitenlinien bei +-12.15kHz zu sehen sein, deren Pegel 1.3+-0.2dB über dem Träger liegt.

7.5 Zerlegung und Zusammenbau

Nach dem Öffnen des Gerätes, dem entriegeln der Baugruppe und dem Lösen der HF-Verbindungen X81 und X89 kann die Mutterbaugruppe DSYN aus ihrem Steckplatz entnommen werden.
Nach dem Abschrauben des Schirmdeckels auf der Bauelementeseite ist die Baugruppe Option DATENCODER zu sehen. Nach dem Lösen von vier Schrauben und drei Steckern, kann DCOD herausgenommen werden.

7.6 Externe Schnittstellen

Pin	Name	Ein/Ausgang	Herkunft/Ziel	Wertebereich	Signalbeschreibung
W3.A17	+5V	Eingang	A8,DSYN	+4.5...+5.5V 150...250mA 250...400mA	Versorgungsspannung bis VAR2/REV6 ab VAR4/REV1
W3.A16	+15V	Eingang	A8,DSYN	13.5...16.5V 40...60mA	Versorgungsspannung
W3.A18	-15V	Eingang	A8,DSYN	-13.5V...-16.5V 25...40mA	Versorgungsspannung
W1.A1	DCOD50	Eingang	A8,DSYN	50MHz, 5+-1dBm	Referenz-Signal
W3.A5	DATACLK	Eing./Ausg.	A8,DSYN	HCT-Pegel	Datentakt (zur Buchse CLOCK)
W3.A7	DATA	Eing./Ausg.	A8,DSYN	HCT-Pegel	Datensignal (zur Buchse DATA)
W3.A1	BURST	Eing./Ausg.	A8,DSYN	HCT-Pegel	Steuersignal vom DATA-RAM
W3.A3	LSWI	Ausgang	A8,DSYN	HC-Pegel	Pegelumschalt-Signal für OPU
W1.A18 ... W1.A4	FMDAT0 ... FMDAT13	Ausgang ... Ausgang	A8,DSYN ... A8,DSYN	HC-Pegel HC-Pegel	14bit Parallelport für die FM-Modulationsdaten zu DSYN
W1.A20	LOADM	Ausgang	A8,DSYN	HC-Pegel	Strobe zum Parallelport
W3.A19	CODAM	Ausgang	A8,DSYN	-1V...+1V	AM-Signal für QPSK-Modulation
W2.A5	IR1	Ausgang	A8,DSYN	HC-Pegel	Interrupt-Signal
W2.A1	DIAG1	Ausgang	A8,DSYN	0...+5V	Diagnose-Spannung
W2.A2	DIAG2	Ausgang	A8,DSYN	0...+5V	Diagnose-Spannung
W2.A14	CLOCK1	Eingang	A8,DSYN	HC-Pegel	Serbustakt
W2.A3	SCHREIB1	Eingang	A8,DSYN	HC-Pegel	Serbusstrobe
W2.A18	CLOCK2	Eingang	A8,DSYN	HC-Pegel	Serbustakt
W2.A16	SCHREIB2	Eingang	A8,DSYN	HC-Pegel	Serbusstrobe
W2.A20	SEROUT	Eingang	A8,DSYN	HC-Pegel	Serbusdaten
W3.A9	MCLK	Ausgang	A8,DSYN	HC-Pegel	DCOD-Mastertakt
W3.A11	KSTR	Ausgang	A8,DSYN	HC-Pegel	Strobesignal
W2.A6 ... W2.A13	PD0 ... PD7	Ausgang ::: Ausgang	A8,DSYN ::: A8,DSYN	HC-Pegel ::: HC-Pegel	Baugr.-Codierung Baugr.-Codierung

ROHDE&SCHWARZ

SERVICE INSTRUCTIONS

Option DM-Coder SME-B11

1036.8720.02

Contents

7. Checking and Repair of the Module

This document basically assumes, that the hardware revision is at least VAR4/REV1 and the firmware revision is at least 1.80. Measurementdata of older hardware revisions are indicated in section 7.4 when they have changed.

7.1 Functional Description

The DATA CODER module (DCOD for short) is a subassembly of the DIGITAL SYNTHESIS module (DSYN for short) and can be installed as an option.
Via the interface FMDAT0...13, DCOD provides a digital FM modulation signal in parallel form to the DDS gate array on DSYN. The strobe signal is provided via line LOADM.

Except for QPSK, all modulation modes manage on digital frequency modulation (FM). In the case of QPSK, amplitude modulation (AM) is also used. The analog AM signal is taken via the CODAM line and the motherboard to the OUTPUT UNIT (OPU for short), where it serves as a reference value for the AM control loop.

The total digital signal processing is performed by the gate array DMCODER in conjunction with the EPROM. Besides, the DMCODER also accommodates the counters for the CLOCK SYNTHESIS and the DATA GENERATOR. The block diagram of the gate array DMCODER is to be found on sheet 4 of the circuit diagrams.

All types of modulation make a distinction between INTERNAL and EXTERNAL mode. In the INTERNAL mode, the data signal DATA and the clock signal DATACLK are provided by the internal DATA GENERATOR and the internal clock synthesis. In the EXTERNAL mode, the two signals are applied to the instrument sockets DATA and CLOCK and taken via the lines DATA and DATACLK to DCOD.

7.1.1 CLOCK SYNTHESIS

The CLOCK SYNTHESIS generates the clock signals required by the various networks. The clock frequency ranges from 50 Hz to 1.9MHz.

The different clock frequencies are generated in a PLL (VCO: 6.4 to 11.70 MHz) with series-connected dividers. The dividers are integrated in the gate array DMCODER and designed such as to be able to generate the oversampling clock (OS), bit clock (BIT) and symbol clock (SYMB) required by the various networks for digital signal processing.
In INTERNAL mode, the reference frequency of the phase detector is derived from the internal 50-MHz reference. In the EXTERNAL mode, all clock frequencies are derived from the bit or symbol clock applied at the CLOCK socket.

The tuning voltage of the VCO is monitored by the INTERRUPT DETECTOR, and the error message "data coder clock unlocked" is indicated in the case of an asynchronous PLL.

7.1.2 DATA GENERATOR

The DATA GENERATOR can either provide a pseudorandom signal (module PRBS) or read out a data sequence cyclically or once from the 8kx4bit DATA RAM. The DATA RAM can be loaded by the controller. The length of the sequence can be set.

Parallel to the data signal, the signals LSWI (level switch) and BURST can be read into the DATA RAM and read out synchronously with DATA. The LSWI signal is taken to the OPU module, where it is used to switch between two reference values, i.e. two levels. The BURST signal is brought out via an instrument socket and can be used as trigger or sync signal. DATA, LSWI and BURST can be edited in the list editor independently of each other.

7.1.3 Digital Signal Processing

Digital signal processing of the modulations without AM is relatively easy, requiring only one filtering (baseband filter) to be performed. FIR filters are always used which are implemented with shift registers and EPROMs (SHIFT2, SHIFT6, GMSK-EPROM, GFSK-EPROM). The outputs of all EPROMs are connected in parallel and taken to FMDAT0...13, which is the interface to DSYN. Only one EPROM is active at a time. The outputs of the remaining EPROMs are set to tri-state.

Digital signal processing for QPSK is considerably more expensive. The FIR filtering is done in multiplex mode in the BF EPROM. The filtered I and Q signal is converted into the AM signal by squaring and root extraction. The phase is obtained by division and by means of the ARCTAN function. The root and the ARCTAN function are stored in tabular form in the ARCTAN EPROM. The frequency is finally obtained by differentiation from the phase. The strobe signal for the DDS_GA on DSYN is delayed by 0 to 15 master clocks in COUNTER1. FIFO and COUNTER1 together enable an electronic delay adjustment of the FM signal. The menu UTILITIES-CALIB-QPSK-CALIBRATION DATA permits the user to correct the delay for optimizing the spectral purity in the adjacent channels.

The digital AM signal CODAM is converted into an analog signal by the DAC and the ALIASING FILTER and taken to the OPU module. The trimmer LEVEL permits the level to be adjusted on the complete instrument such that the output level is reduced to minimum with the modulation deactivated so as to obtain a correct zero point of the AM (menu UTILITIES-CALIB-QPSK-AMPLITUDE TRIM-ON).
The switch STROBE-MUX is used to bypass COUNTER1 if no π/4-QPSK modulation is involved.

7.2 Measuring Instruments and Accessories

- Service kit 1039.3520
- Dual-channel oscilloscope (0 to 250 MHz)
- 100:1 RF probe (5 kΩ/50 Ω)
- Spectrum analyzer 1 to 20 MHz (e.g. FSA)
- Frequency counter 500 Hz to 1.2 MHz (included in FSA)
- Signal generator 100 Hz to 1.2 MHz (e.g. SMG)
- Squarewave generator 100 Hz to 1.2 MHz (e.g. ADS)
- Modulation analyzator (e.g. FMA)
- Multimeter (e.g. UDL33)

7.3 Troubleshooting

Data transmission faulty (see 7.4.2).	Check SERBUS-D2 (D112) on DSYN, the SERBUS BUFFER (D50) and shift register D300.
Clock signal at P13 out of tolerance (see 7.4.3).	Check CLOCK AMPLIFIER (V260).
No clock signal at P14 (see 7.4.4).	Check inverter D330 the DMAP-FPGA (D80) and the OSCILLATOR (V235, V236, V237, V240).
Clock synthesis faulty (see 7.4.5).	Check DMCODER signals UP and DOWN (outputs of digital phase detector), DMAP-FPGA (D80), CONTROL AMPLIFIER (N200, N210) and OSCILLATOR (V235, V236, V237, V238, V240).
GFSK modulation faulty (see 7.4.8.1).	Check DMCODER gate array, strobe signal at P5 (11.52-MHz squarewave signal), GFSK-EPROML (D50) and GFSK-EPROMH (D60).
QPSK modulation faulty (see 7.4.8.2).	Check DMCODER gate array, strobe signal at P5 (squarewave signal with 15 times the bit frequency), DMAP-FPGA (D80), BF-EPROM (D30), ARCTAN-EPROM (D40), DAC (D280) and ALIASING FILTER (N280, N290, N295).
GMSK modulation faulty (see 7.4.8.3).	Check DMCODER gate array, strobe signal at P5 (4.333-MHz squarewave signal) and GMSK-EPROM (D70).
FFSK modulation faulty (see 7.4.8.4).	Check DMCODER gate array, strobe signal at P5 (76.8-kHz squarewave signal) and GMSK-EPROM (D70).
4FSK modulation faulty (see 7.4.8.5).	Check DMCODER gate array, strobe signal at P5 (93.75-kHz squarewave signal), GMSK-EPROM (D70), BF-EPROM (D30), DMAP-FPGA (D80), SHIFT6 (D85)

No strobe signal at P5.	Check DMCODER gate array, inverter D330, COUNTER1 (D305) and multiplexer STROBE-MUX (D335).
The error message "Data coder clock unlocked" is displayed.	Check phase-locked loop (tuning voltage at X215 between 1 V and 7 V), DMCODER gate array, CONTROL AMPL. (N200, N210), OSCILLATOR, DMAP-FPGA (D80) and INTERRUPT DETECTOR (N220, V220).

7.4 Checking and Adjustment

For service operation, unscrew the upper cover of the motherboard DIGITAL SYNTHESIS (DSYN), insert the service adapter into the location instead of the module and then plug the module onto the adapter. After restoring the RF connections, the DSYN module and the DATA CODER (DCOD) option are again ready for use.

The specifications for setting given at the beginning of each paragraph assume that the instrument is in the PRESET status.

7.4.1 Testing the Current Consumption and Various Voltages

- **Setting:** **FREQUENCY 1000MHz**
  DIGITAL MOD - GFSK - SOURCE PRBS

▶ The current consumption of the module can be checked by replacing coils L350, L351 and L352 by an ammeter. For this purpose, loosen the four screws connecting DCOD with DSYN, the coils being situated on the solder side of DCOD. The nominal values for the respective supply voltages are to be obtained from section 7.6.

▶ Various voltages: P8: 10.3 +-1 V
P12: -4.3 +-1 V

7.4.2 Testing the Data Transmission

- Loosen the screws of DCOD and tilt it up so that D300 becomes accessible.

Setting	D300 Pin 4	5	6	7	14	13	12	11	P10	
DIG.MOD-QPSK-SOURCE PRBS, UTILITIES-CALIB-QPSK-										
DELAY = 2620ns	0	0	0	0	x	x	x	x	1	
DELAY = 2580ns	1	0	0	0	x	x	x	x	1	
DELAY = 3900ns	0	1	0	0	x	x	x	x	1	
DELAY = 3700ns	0	0	1	0	x	x	x	x	1	
DELAY = 3360ns	0	0	0	1	x	x	x	x	1	
DIG.MOD-GFSK-SOURCE-PRBS	x	x	x	x	x	0	0	0	1	
DIG.MOD-QPSK-SOURCE-PRBS	x	x	x	x	x	1	0	0	1	
DIG.MOD-QPSK-SOURCE-OFF	x	x	x	x	x	x	x	x	0	
DIG.MOD-4FSK-SOURCE-PRBS	x	x	x	x	x	0	1	1	1	up to VAR2/REV6

7.4.3 Testing the Clock Signal to the DMCODER Gate Array

- Connect an oscilloscope to P13 via a 100:1 RF probe (50-Ω termination).
- A periodic 50-MHz signal with HIGH level >4 V and LOW level <1 V must be measured. The voltage must remain >7 ns above 2.5 V and >7 ns below 2.5 V.

7.4.4 Adjusting the OSCILLATOR and Testing the Level

- Setting: **DIGITAL MOD - GFSK - SOURCE PRBS**
- Remove jumper X215 and apply DC voltage to X215.2/3.
- Connect frequency counter to P14.

▶ Alternately adjust the oscillator according to the following table:

up to VAR2/REV1:

Voltage X215	Trimmer	Nom. frequency at P14
2V	OSZ1 (C230)	7.5+-0.1 MHz
7V	OSZ2 (C231)	12+-0.1 MHz

for revision VAR2/REV2 and larger:

Voltage X215	Trimmer	Nom. frequency at P14
0.9V	OSZ1 (C230)	6.4+-0.1 MHz
7V	OSZ2 (C231)	11.7+-0.1 MHz

- Connect an oscilloscope to P14 via a 100:1 RF probe.

▶ A periodic squarewave voltage with the maximum voltage above 4 V and the minimum voltage below 1 V must be measured for V (X215)= 2 V (for VAR2/REV2 and larger: 0.9V) and 7 V. The voltage must remain >15 ns above 2.5 V and >15 ns below 2.5 V.

- Replace jumper X215.

7.4.5 Testing the CLOCK SYNTHESIS (PLL) in the INT Mode

- Connect an oscilloscope and a frequency counter to the CLOCK output (1 MΩ).
- Connect a voltmeter to X215.2.

▶ The oscilloscope must show a squarewave signal with HC level.

- Setting: **DIGITAL MOD - ... - SOURCE PRBS**

Setting	Clockfrequ. at CLOCK-output in kHz+-1% (CLK MODE SYMB)	Voltg.at X215.2 or diag.301 in V+-0.5V		
		VAR2/ REV0 and larger	VAR2/ REV2 and larger	VAR4/ REV1 and larger
GMSK/STANDARD GSM/PCN	270.8333	3.3	3.4	3.4
GFSK/STANDARD DECT	1152	6.3	6.7	6.7
QPSK/STANDARD ADC	24.3	6.5	7.0	7.0
QPSK/STANDARD PDC	21	4.7	4.9	4.9
QPSK/STANDARD TFTS	22.1	5.2	5.4	5.4
QPSK/STANDARD TETRA	18	3.3	3.4	3.4
FSK/STANDARD POCS-1200	1.2	3.8	4.0	4.0
FSK/STANDARD POCS-512	0.512	2.8	2.9	2.9
4FSK/STANDARD ERMES	3.125	2.0	2.2	5.2

- Setting: **DIGITAL MOD - QPSK - SELECT STANDARD ADC**
  CLOCK MODE - SYMBOL
- A squarewave signal of the frequency 24.3kHz+-1% must be measured at the DATACLK-output.

7.4.6 Testing the CLOCK SYNTHESIS in the EXT Mode

- Apply a squarewave signal with HC level and the frequency 1152 kHz to the CLOCK socket.
- Setting: **DIGITAL MOD - GFSK - SOURCE EXT**

▶ A DC voltage of 6.3+-1 V must be measured at X215.2 (VAR2/REV2 and larger: 6.7V).

- Apply a squarewave signal with HC level and a frequency of 1.2 kHz to the CLOCK socket.
- Setting: **DIGITAL MOD - FFSK - SOURCE EXT**

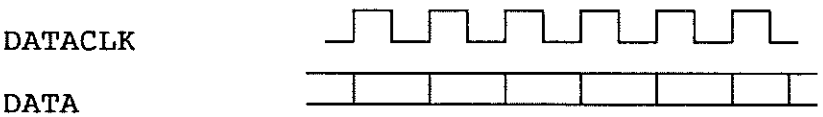
▶ A DC voltage of 3.8 +-0.5 V (VAR2/REV2 and larger: 4.0V, VAR4/REV1 and larger: 3.6V) must be measured at X215.2.

7.4.7 Testing the Data Generator

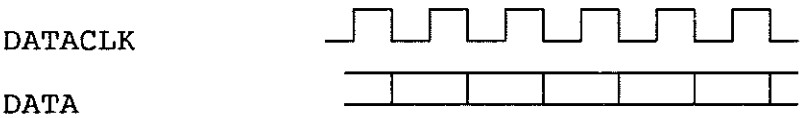
▶ Connect a dual-channel oscilloscope to the CLOCK and DATA socket (1 MΩ).

- Setting: **DIGITAL MOD - FSK - SOURCE PRBS**

▶ It must be possible to measure a clock signal at the CLOCK socket and a pseudorandom data signal at the DATA socket with the frequency 1200 Hz +-1 % and HC level.
The data signal must vary with the rising edge of the clock signal.



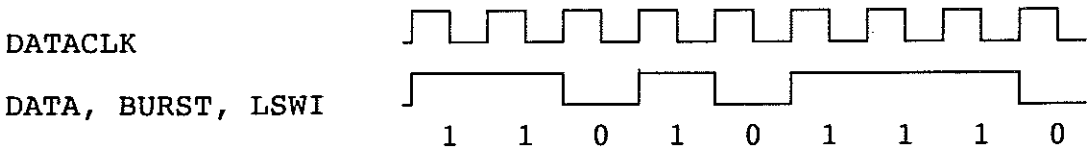
- Setting: **- CLOCK EDGE NEG**



▶ The data signal must vary with the falling edge of the clock signal.

- Connect a dual-channel oscilloscope to the CLOCK socket and DATA socket or BURST socket or X80.32 (LSWI).
- Setting:
  - FILL-LIST DATA "110101110"
  LEV SWCH "110101110"
  BURST "110101110"
  - SOURCE DATA

▶ The data signal "10101110" must be measured with periodic repetitions at the DATA socket, BURST socket and at X80.32. The data signals must be stable with the falling edge of DATACLK.



• Setting: **MODE SINGLE**
EXECUTE SINGLE MODE

▶ After EXECUTE has been set, the data signal "110101110" must appear once as burst at the three outputs.

7.4.8 Testing the Various Digital Modulations

7.4.8.1 GFSK Modulation (DECT)

• Setting: **FREQUENCY 835MHz**
DIGITAL MOD - GFSK - SOURCE PRBS
- PRBS 23 BIT

• Connect spectrum analyzer to X89 (FDDS) and set Center=15 MHz, Span=10 MHz, Res.Bw.= 30kHz, Vid.Bw.=30 Hz.

▶ A continuous spectrum must be seen. The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
200	-1.7+-0.5
400	-5.7+-0.5
700	-20.5+-2
1000	-30.8+-3
1500	-53+-3
2850	-68+-3
4800	-72+-3

• Set Span=4 MHz on the spectrum analyzer.

• Setting: FILTER ...

▶ Depending on FILTER, the relative signal level at 1000 kHz offset frequency must be as follows:

FILTER B*T	DEVIATION	Level in dB
B*T=0.4	DEV=288 kHz	-33.8+-2
B*T=0.5	DEV=288 kHz	-30.8+-2
B*T=0.6	DEV=288 kHz	-28.9+-2
B*T=0.5	DEV=317 kHz	-28.4+-2

- Setting: **- SELECT STANDARD - CT3 (VAR2/REV2 and larger)**

▶ A continuous spectrum must be seen. The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
111	-1.7+-0.5
222	-5.7+-0.5
389	-20.5+-2
556	-30.8+-3
833	-56+-3

7.4.8.2 OPSK Modulation (ADC, JDC, TFTS, TETRA)

- Setting: **FREQUENCY 835MHz**
  DIGITAL MOD - QPSK - SOURCE PRBS
  - PRBS 23 BIT

- Connect spectrum analyzer to X89 (FDDS) and set Center=15 MHz, Span=300 kHz, Res.Bw.=3 kHz, Vid.Bw.=10 Hz.

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
21	-19+-2
30	-19+-2
44	-28+-3
67	-37+-3
100	-46+-3

- Set Span=60 kHz and 2 dB/div. on the spectrum analyzer.

- Setting: **FILTER / ROLL OFF acc. to table**
  BITRATE acc. to table

▶ Depending on FILTER, the following must be indicated:

FILTER /ROLL OFF	BIT RATE in kHz	Offset frequ. in kHz	Level in dB
SQR(COS) / 0.35	48.6	15	-8.6+-2
COS / 0.35	48.6	15	-10.6+-2
SQR(COS) / 0.40	44.2	18	-17.5+-2
SQR(COS) / 0.50	42.0	15	-12.0+-2

- Setting: **SOURCE DATA**
  SELECT STANDARD ADC
  FILL LIST DATA "0111"

▶ Connect spectrum analyzer to X80.9 (CODAM) (50 Ω) and set Center=125 kHz, Span=250 kHz, Res.Bw.=1 kHz, Vid.Bw=100 Hz and DC coupling.

▶ The absolute signal level at 24.3 kHz must be -6+-2 dBm. The levels of the following table must be measured referred to this level:

Absolute frequ. in kHz	Level in dB
2 * 24.3	-17.3+-2
3 * 24.3	-29.0+-2
4 * 24.3	-38.0+-2
5 * 24.3	-47.0+-2
6 * 24.3	-53.7+-2
7 * 24.3	-65.5+-2

7.4.8.3 GMSK Modulation (GSM)

- Setting: **FREQUENCY 835MHz**
  DIGITAL MOD - GMSK - SOURCE PRBS
  - PRBS 23 BIT

- Connect spectrum analyzer to X89 (FDDS) and set Center=15 MHz, Span=1 MHz, Res.Bw.=10 kHz, Vid.Bw.=10 Hz.

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
50	-2+-1
100	-8+-2
150	-20+-3
220	-36+-3
300	-52+-3
450	-75+-3

- Setting: **FILTER B*T ...**

▶ Depending on FILTER, the relative signal level at 250 kHz offset frequency must be as follows:

B*T	Level in dB
0.2	-56.5+-3
0.3	-40.0+-3
0.5	-30.7+-3

- Setting: **- SELECT STANDARD - MOBITEX-8k (VAR2/REV2 and larger)**

- Set spectrum analyzer to Span=20 kHz, Res.Bw.=100 Hz, Vid.Bw.=10 Hz.

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
1.48	-2.0+-1
2.95	-8.6+-2
4.43	-20+-3
6.50	-36+-3
8.86	-52+-3

- Setting: **- SELECT STANDARD - MD36N (VAR2/REV5 and larger)**

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
0.666	-2.0+-1
1.3275	-8.6+-2
2.0	-20+-3
2.925	-36+-3
4.0	-52+-3

7.4.8.4 FFSK Modulation (POCSAG)

- Setting: **FREQUENCY 835MHz**
  DIGITAL MOD - FFSK - SOURCE PRBS
  - PRBS 23 BIT

- Connect spectrum analyzer to X89 (FDDS) and set Center=15 MHz, Span=50 kHz, Res.Bw.=3 kHz, Vid.Bw.=30 Hz.

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
3	-0.9+-0.5
5	-6.6+-0.5
10	-31.7+-3
15	-52.0+-3
25	-69.0+-3

- Setting: **- SOURCE DATA**
  - FILL-LIST DATA "1"

- Connect a modulation analyzer (e.g. FMB) to X89 (FDDS) and activate FM demodulation with the demodulation bandwidth 23 kHz.

▶ A sinewave FM with a peak deviation of 4 kHz+-1% and a modulation frequency of 1200 Hz+-1% must be measured. The distortion factor must be below 1%.

7.4.8.5 4FSK Modulation (ERMES)

- Setting: **FREQUENCY 835MHz**
  DIGITAL MOD - 4FSK - SOURCE PRBS
  - PRBS 23 BIT

- Connect spectrum analyzer to X89 (FDDS) and set Center=15 MHz, Span=50 kHz, Res.Bw.=1 kHz, Vid.Bw.=3 Hz.

▶ The signal level referred to the level at 15 MHz as a function of the offset frequency must be as follows:

Offset frequ. in kHz	Level in dB
2.5	-0.7+-0.5
5	-7.6+-2
10	-35+-3
15	-56+-4

- Setting: **- SOURCE DATA**
  - FILL-LIST DATA "1000"

- Connect a modulation analyzer (e.g. FMB) to X89 (FDDS) and activate FM demodulation with the demodulation bandwidth 23 kHz.

▶ An FM (squarewave signal without overshooting) with a peak deviation of 4.6875 kHz+-1% and a modulation frequency of 1562.5 Hz+-1% must be measured.

7.4.9 Testing COUNTER1 (DELAY)

• Setting: **DIGITAL MOD - QPSK - SOURCE PRBS**
UTILITIES CALIB QPSK DELAY=2620ns

• Connect an oscilloscope to P5 (LOADM) and P6(FMDAT13) and trigger on the positive edge of the signal at P6 (2.5 V threshold voltage).

▶ A pulse delayed by 7*85.7 ns+10 ns=610 ns+-20 ns compared to the positive edge at P6 with a pulse duration of 87.5 ns+-10 ns must be measured at P5.

▶ The delay must depend on DELAY according to the following table:

DELAY/ns	Delay in ns +-20 ns
2620	7*85.7+10=610
2580	6*85.7+10=524
3900	5*85.7+10=439
3700	3*85.7+10=267
3360	15*85.7+10=1296

7.4.10 Testing the Interrupt Function

• Setting: **DIGITAL MOD - GMSK - SOURCE PRBS**

• Remove jumper X215.

▶ The error message "Data coder clock unlocked" must briefly appear and the ERROR message must be permanently displayed. When pressing the ERROR key, the error message must be contained in the error list.

• Replace the jumper. The ERROR indication must disappear.

• Setting: **- SOURCE OFF**

▶ When deactivating the modulation, there must not be any error message.

7.4.11 Testing the Diagnosis

• Setting: **DIGITAL MOD - GFSK - PRBS**
UTILITIES - DIAG - TPOINT

TPOINT	Test point	Factor	Nom. voltage
301	CONTROL VOLTAGE DCOD-VCO	3	6.3+-1 V
302	OSCILLATOR LEVEL DCOD-VCO	1	0.5...1.5 V

7.4.12 Test of the different Standards with the Modulation Analysator FMB

The new realized standards CT2, CT3, MC9, MOBITEX-8000, CITYRUF and POCSAC, implemented in the DM-CODER with the revision VAR2/REV2 can be tested with the FMB. A test of the spectrum is not necessary, because no new eproms are added.

- Setting: **FREQUENCY 900MHz**
  LEVEL 0dBm
  DIGITAL MOD - GFSK - SOURCE DATA
- Connect the modulation analyzer FMB to X89 (FDDS) and activate FM demodulation.
- Edit with the list editor N times "1" und N times "0" (e.g. for N=4 "11110000"):
- Setting: **FILL-LIST DATA "1...10...0"**
- Set the highpass filter of the FMB (HP) to 10Hz. The DIFF ENCODER must be off. Additional settings are listed in the table below.
- For QPSK-Modulation the DATA-pattern should be "0111" (+-135-sequence). For the standard TFTS, the DIFF ENCODER must be set to ADC.

▶ The measured peak deviation should meet the values in the table. The diverge to the nominal deviation comes from overshooting of the FMB lowpass filter.

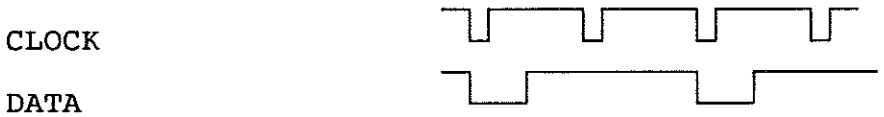
▶ On the right hand side in the table is indicated, from which revision the standard is realized.

Einstellung: Modul./ SEL. STAND.	FMB LP-bandbr. in kHz	N/ DATA	FM-Hub in kHz +-3%	Mod.-frequ. kHz+-1%	VAR	REV
GMSK / GSM	100	N=4	77	33.85	2	1
GMSK / CDPD	100	N=4	4.9	2.4	2	2
GMSK / MC9	23	N=4	2.0	1.0	2	2
GMSK / MOBITEX-8000	23	N=4	2.0	1.0	2	2
GMSK/MD36N	3	N=4	0.92	0.45	2	5
GMSK/BITR.1M /BT=0.4	100	N=32	304	15.625	2	5
GMSK / DSRR	23	N=4	4.03	2.0	2	5
GFSK / DECT	100	N=32	352	18.0	2	1
GFSK / CT2	100	N=4	18.25	9.0	2	2
GFSK / USER BITRATE: 100kbps FIL./DEV: 0.5/20kHz	100	N=4	21 .1	12.5	4	1
GFSK / CT3	100	N=20	195	16.0	2	2
QPSK / ADC	100	0111	37.1	12.1	2	1
QPSK / PDC	100	0111	33.4	10.5	2	1
QPSK/TFTS (D.E. ADC)	100	0111	34.6	11.0	2	1
QPSK / TETRA	100	0111	28.6	9.0	2	1
QPSK / APCO25	23	0111	5.68	2.4	2	5
QPSK / INMARSAT	23	0111	2.76	2.0	4	1
QPSK / MSAT	23	0101	0.517	3.375	4	1
QPSK / USER MOD TYPE: PI/4 QPSK BITRATE: 14kbps FILTER: SQR-COS/0.5 CODING: TFTS	100	11010010	3.59	7.0	4	1
FSK / CITYRUF-1200	23	N=1	4.15	0.6	2	2
FSK / POCSAG-2400	23	N=1	4.63	1.2	2	2
FSK / USER BITRATE: 20kbps HUB: 200kHz FILTER: OFF	100	N=1	247+-10%	10.0	2	1
FSK / FLEX-3200	23	01	4.86	1.6	4	1

4FSK / ERMES	100	0111	1.64	1.5625	2	1
4FSK (C4FM) / APCO25	23	01011111	2.83	1.2	2	5
4FSK / FLEX-6400	23	0010	4.86	1.6	4	1
4FSK / MODACOM	23	01011111	2.5	1.2	4	1
FFSK / POCSAG	3	1111	4.0	1.2	2	1
FFSK / USER BITRATE: 90kbps DEVIATION: 4.5kHz	100	1111	4.8	90	4	1

7.4.13 Test of the mapping correction (for VAR2/REV3 and larger)

- Setting: **DIGITAL MOD - QPSK - SOURCE EXT**
- Following priodic signals must be connected to plug CLOCK and DATA. The DATA-signal has the periodic time of 82.3us. (pattern "0111"; data are latched in with the positiv edge of the clock):



(A SME with option DM-CODER can be used as signal source. With the setting DIGITAL MOD - QPSK - SOURCE DATA and the DATA-pattern "0111", the signals at the DATA- and CLOCK-plug can be used.)

▶ At X215.2 the dc-voltage of 6.9+-0.5V should be measured (testpoint 301).

- Connect a spectrum analyzer at X600 (FDDS, 50Ohm).

▶ On the left and the right side of the carrier at 12.5MHz, two signals with a level of 1.3+-0.2dB above the carrier should be measured.

7.5 Removal and Assembly

After opening the instrument, unlocking the module and loosening the RF connections X81 and X89, the motherboard DSYN can be removed from its location.
After unscrewing the screening cover on the component side, the DATA CODER option can be seen. DCOD can be removed after loosening four screws and three connectors.

7.6 Interface Description

Pin	Name	Inp./Output	Origin/Destination	Value range	Signal description
W3.A17	+5V	Input	A8,DSYN	+4.5...+5.5V 150...250mA 250...400mA	Supply voltage up to VAR2/REV6 for VAR4/REV1 and larger
W3.A16	+15V	Input	A8,DSYN	13.5...16.5V 40...60mA	Supply voltage
W3.A18	-15V	Input	A8,DSYN	-13.5V...-16.5V 25...40mA	Supply voltage
W1.A1	DCOD50	Input	A8,DSYN	50MHz, 5+-1dBm	Reference signal
W3.A5	DATACLK	Inp./Outp.	A8,DSYN	HCT level	Data clock (to CLOCK socket)
W3.A7	DATA	Inp./Outp.	A8,DSYN	HCT level	Data signal (to DATA socket)
W3.A1	BURST	Inp./Outp.	A8,DSYN	HCT level	Control signal from DATA RAM
W3.A3	LSWI	Output	A8,DSYN	HC level	Level switching signal for OPU
W1.A18 FM... W1.A4	FMDAT0 ... FMDAT13	Output ... Output	A8,DSYN ... A8,DSYN	HC level HC level	14bit parallel port for the modulation data to DSYN
W1.A20	LOADM	Output	A8,DSYN	HC level	Strobe to parallel port
W3.A19	CODAM	Output	A8,DSYN	-1V...+1V	AM signal for QPSK modulation
W2.A5	IR1	Output	A8,DSYN	HC level	Interrupt signal
W2.A1	DIAG1	Output	A8,DSYN	0...+5V	Diagnostic voltage
W2.A2	DIAG2	Output	A8,DSYN	0...+5V	Diagnostic voltage
W2.A14	CLOCK1	Input	A8,DSYN	HC level	Serbus clock
W2.A3	SCHREIB1	Input	A8,DSYN	HC level	Serbus strobe
W2.A18	CLOCK2	Input	A8,DSYN	HC level	Serbus clock
W2.A16	SCHREIB2	Input	A8,DSYN	HC level	Serbus strobe
W2.A20	SEROUT	Input	A8,DSYN	HC level	Serbus data
W3.A9	MCLK	Output	A8,DSYN	HC level	DCOD master clock
W3.A11	KSTR	Output	A8,DSYN	HC level	Strobe signal
W2.A6 ... W2.A13	PD0 ... PD7	Output ::: Output	A8,DSYN ::: A8,DSYN	HC level ::: HC level	Module coding Module coding

ROHDE&SCHWARZ

Schaltteillisten
numerisch geordnet
Part lists
in numerical order
Listes des pièces détachées
par numéros de référence

(R 29500 Bl 1)
095 1000 Bl 1

Kennz. Comp. No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
C10	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C20	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C21	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C22	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C24	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C30	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C34	CC 10PF+-0,25 50VNPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8480.00	MURATA	GRM42-6C0G 100 C50PT	
C40	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C45	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C50	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C60	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C65	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C70	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C80	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C90	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C200	CC 10NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0099.8521.00	MURATA	GRM42-6X7R103K 50PT	
C201	CC 10NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0099.8521.00	MURATA	GRM42-6X7R103K 50PT	
C205	CC 22PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8396.00	MURATA	GRM42-6C0G 220F 50PT	
C208	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C209	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C211	CC 180NF+-10%50V X7R 1210 CERAMIC CHIP CAPACITOR	CC 0007.7452.00	PHILIPS_CO	2222 592 16644	
C212	CC 680NF+-10%50V X7R 2220 CERAMIC CHIP CAPACITOR	CC 0007.7517.00	PHILIPS_CO	2222 595 16652	
C213	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C215	CC 10NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0099.8521.00	MURATA	GRM42-6X7R103K 50PT	
C230	CT 13P-50P 4,5X4 OR SMD CERAMIC CHIP TRIMMER	CT 0008.1264.00	PANASONIC	ECR-JA050M12	
C231	CT 13P-50P 4,5X4 OR SMD CERAMIC CHIP TRIMMER	CT 0008.1264.00	PANASONIC	ECR-JA050M12	
C232	CC 470PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8515.00	PHILIPS_CO	2238 863 18471	
C233	CC 22PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8396.00	MURATA	GRM42-6C0G 220F 50PT	
C235	CC 470PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8515.00	PHILIPS_CO	2238 863 18471	
C236	CC 470PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8515.00	PHILIPS_CO	2238 863 18471	
C237	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C238	CC 2,2PF+-0,25 50VNP01206 CERAMIC CHIP CAPACITOR	CC 0007.8171.00	MURATA	GRM42-6C0G 2R2 C50PT	
C240	CC 1NF+-1% 50V NPO 1206 SMD CERAMIC CAPACITOR	CC 0007.7398.00	PHILIPS_CO	2222 863 *8102	
C245	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C247	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C255	CC 10NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0099.8521.00	MURATA	GRM42-6X7R103K 50PT	
C258	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C279	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C280	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	

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Kennz. Comp. No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
C281	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C282	CC 470PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8515.00	PHILIPS_CO	2238 863 18471	
C283	CC 680PF+-1% 50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0007.7375.00	PHILIPS_CO	2222 863 18681	
C284	CC 22PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8396.00	MURATA	GRM42-6C0G 220F 50PT	
C285	CC 100PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8415.00	MURATA	GRM42-6C0G 101F 50PT	
C286	CC 1NF+-1% 50V NPO 1206 SMD CERAMIC CAPACITOR	CC 0007.7398.00	PHILIPS_CO	2222 863 *8102	
C287	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C288	CE 10UF +-10% 25V 7343 TANTALUM SMD-CAPACITOR	CE 0007.7246.00	KEMET	T491D106K025AS	
C289	CC 22PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8396.00	MURATA	GRM42-6C0G 220F 50PT	
C290	CC 1PF+-0,25 50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8667.00	PHILIPS_CO	2238 863 15108	
C291	CC 22PF+-1%50V NPO 1206 CERAMIC CHIP CAPACITOR	CC 0099.8396.00	MURATA	GRM42-6C0G 220F 50PT	
C305	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C308	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C311	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C330	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C331	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C350	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C351	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C352	CC 100NF+-10%50V X7R 1206 CERAMIC CHIP CAPACITOR	CC 0007.5237.00	PHILIPS_CO	2238 581 55649	
C355	CC 1UF+-10% 50V X7R 2220 CERAMIC CAPACITOR	CC 0520.6873.00	AVX	2220 5C 105 KAT**A(F	
C356	CC 1UF+-10% 50V X7R 2220 CERAMIC CAPACITOR	CC 0520.6873.00	AVX	2220 5C 105 KAT**A(F	
C357	CC 1UF+-10% 50V X7R 2220 CERAMIC CAPACITOR	CC 0520.6873.00	AVX	2220 5C 105 KAT**A(F	
D10	BG L5A8843 DMCODER ASIC IC GATE ARRAY	1039.1262.00	LSI_LOGIC	R&S-NR.	
D20	BC TC55417J-25 16KX4 SRAM SRAM 16KX4	1012.9633.00	MATRA-HARR	HMU65789H-5	
D30	HS BF-EPROM (D30)	1036.8795.00			
D40	HS ARCTAN-EPROM (D40)	1036.8808.00			
D45	BL PC74HCT4066T 4XASWITCH ANALOG SWITCH	BL 0007.6862.00	PHILIPS	(PC)74HCT4066(T)	
D50	HS GFSKL-EPROM	1036.8814.00			1036.8850.00
D60	HS GFSKH-EPROM	1036.8820.00			1036.8850.00
D65	BL PC74HCT4066T 4XASWITCH ANALOG SWITCH	BL 0007.6862.00	PHILIPS	(PC)74HCT4066(T)	
D70	HS GMSK-EPROM (D70)	1036.8837.00			
D80	HS DMAP D80	1076.1040.00			
D90	BL PC74HCT14T 6XINV.SCHM INV. SCHMITT-TRIGGER	BL 0007.6204.00	PHILIPS_SE	(PC)74HCT14(D/T)	
D210	BS DG419DY 1XUM ANALOGSCH ANALOG SWITCH	0746.0322.00	SILICONIX	DG419DY	
D280	BJ AD568JQ 1X12B-DAC D/A-CONVERTER	1002.5206.00	ANALOG_DEV	AD568JQ	
D300	BL PC74HCT4094T 8ST.SHREG SHIFT REGISTER	BL 0007.6885.00	PHILIPS	(PC)74HCT4094(D)	
D305	BL PC74HCT161T BIN.COUNT. BINARY COUNTER	BL 0007.6427.00	PHILIPS_SE	(PC)74HCT161(D/T)	
D315	BL PC74HCT4094T 8ST.SHREG SHIFT REGISTER	BL 0007.6885.00	PHILIPS	(PC)74HCT4094(D)	
D330	BL 74ACT14SC 6XINV.SCHM IC HEX SCHMITTTRIGGER	BL 1036.9479.00	HARRIS	CD74ACT14M	
D335	BL 74ACT153SC 2X 4-IN MUX IC DUAL 4INP MULTIPLEX	BL 1012.9404.00	HARRIS	(CD74)ACT153(M)	
L230	LD 22UH 10% 0,14A 1210 SMD-INDUCTOR	LD 0520.7886.00	SIEMENS	B82422-A1223-J(K)100	

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Kennz. Comp. No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
L231	LD 22UH 10% 0,14A 1210 SMD-INDUCTOR	LD 0520.7886.00	SIEMENS	B82422-A1223-J(K)100	
L232	LD 3,3UH 5% OR85 0,285A CHOKE	0067.3260.00	DELEVAN	1025-32	
L258	LD 1UH 10% 0,38A 1210 SMD-INDUCTOR	LD 6006.0130.00	SIEMENS	B82422-A1102-J(K)100	
L350	LD 10UH 10% 0,18A 1210 SMD-INDUCTOR	LD 0007.9255.00	SIEMENS	B82422-A1103-J(K)100	
L351	LD 1UH 10% 0,38A 1210 SMD-INDUCTOR	LD 6006.0130.00	SIEMENS	B82422-A1102-J(K)100	
L352	LD 10UH 10% 0,18A 1210 SMD-INDUCTOR	LD 0007.9255.00	SIEMENS	B82422-A1103-J(K)100	
N200	BO OP97FS LP PREC OPAMP OPAMP	1036.4390.00	PMI	OP97F(S)	
N210	BO OP97FS LP PREC OPAMP OPAMP	1036.4390.00	PMI	OP97F(S)	
N220	BO LM2903D 2XLP COMPAR DUAL	0520.7734.00	SIGNETICS	LM2903(D)	
N280	BO NE5534D OPAMP OPERATIONAL AMPLIFIER	0815.7555.00	SIGNETICS	NE5534(D)	
N290	BO NE5534D OPAMP OPERATIONAL AMPLIFIER	0815.7555.00	SIGNETICS	NE5534(D)	
N295	BO NE5534D OPAMP OPERATIONAL AMPLIFIER	0815.7555.00	SIGNETICS	NE5534(D)	
P5	VL LOETSTIFT	0078.1540.00	PRYM-WERKE		
..14					
P40	VL LOETSTIFT	0078.1540.00	PRYM-WERKE		
R20	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R22	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R28	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R30	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R40	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R50	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
..55					
R70	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R85	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R90	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R200	RG 10,0KOHM+-1%TK100 1206	RG 0007.0793.00	PHILIPS_CO	RC02	
..205	RG CHIP RESISTOR				
R208	RG 475 OHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5695.00	ROEDERSTEI	D25	
R209	RG 10,0 OHM+-1%TK100 1206 CHIP -RESISTOR	RG 0006.8649.00	PHILIPS_CO	RC02	
R210	RG 2,74KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5766.00	PHILIPS_CO	RC02	
R211	RG 1,62KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.9997.00	ROEDERSTEI	D25	
R212	RG 3,01KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5772.00	ROEDERSTEI	D25	
R213	RG 3,01KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5772.00	ROEDERSTEI	D25	
R215	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R218	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R220	RG 20,0KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5866.00	ROEDERSTEI	D25	
R221	RG 10,0KOHM+-1%TK100 1206 RG CHIP RESISTOR	RG 0007.0793.00	PHILIPS_CO	RC02	
R222	RG 100,0KOH+-1%TK100 1206 CHIP RESISTOR	RG 0007.1948.00	ROEDERSTEI	D25	
R223	RG 68,1KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0007.1902.00	ROEDERSTEI	D25	
R224	RG 82,5KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0007.1925.00	ROEDERSTEI	D25	
R225	RG 0-OHM WIDERSTAND-CHIP RESISTOR CHIP 0-OHM	RG 0007.5108.00	DRALORIC	CR 1206	

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Kennz. Comp. No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
R237	RG 68,1 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8849.00	ROEDERSTEI	D25	
R238	RG 182 OHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5595.00	ROEDERSTEI	D25	
R239	RG 47,5KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5950.00	ROEDERSTEI	D25	
R242	RG 10,0KOHM+-1%TK100 1206 RG CHIP RESISTOR	RG 0007.0793.00	PHILIPS_CO	RC02	
R243	RG 10,0KOHM+-1%TK100 1206 RG CHIP RESISTOR	RG 0007.0793.00	PHILIPS_CO	RC02	
R244	RG 10,0KOHM+-1%TK100 1206 RG CHIP RESISTOR	RG 0007.0793.00	PHILIPS_CO	RC02	
R245	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R247	RG 3,32KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5789.00	ROEDERSTEI	D25	
R248	RG 221 OHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5614.00	ROEDERSTEI	D25	
R249	RG 10,0KOHM+-1%TK100 1206 RG CHIP RESISTOR	RG 0007.0793.00	PHILIPS_CO	RC02	
R251	RG 15,0KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5843.00	ROEDERSTEI	D25	
R256	RG 68,1 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8849.00	ROEDERSTEI	D25	
R257	RG 6,81KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0007.0758.00	ROEDERSTEI	D25	
R258	RG 221 OHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5614.00	ROEDERSTEI	D25	
R264	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R272	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R273	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R279	RG 82,5 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8861.00	PHILIPS_CO	RC02	
R280	RG 909 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.7265.00	ROEDERSTEI	D25	
R282	RG 2,74KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5766.00	PHILIPS_CO	RC02	
R283	RG 3,32KOHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5789.00	ROEDERSTEI	D25	
R284	RG 1,62KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.9997.00	ROEDERSTEI	D25	
R285	RG 5,62KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0007.0735.00	ROEDERSTEI	D25	
R286	RG 6,81KOHM+-1%TK100 1206 CHIP RESISTOR	RG 0007.0758.00	ROEDERSTEI	D25	
R288	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R289	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R294	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R295	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R296	RG 243 OHM+-1%TK100 1206 RESISTOR CHIP	RG 0007.5620.00	ROEDERSTEI	D25	
R297	RS 0,3W500 OHM+-10%CERMET DEPOS-CARBON POTENTIOMET	RS 0086.7738.00	BOURNS	3296P-001-501	
R299	RG 0-OHM WIDERSTAND-CHIP RESISTOR CHIP 0-OHM	RG 0007.5108.00	DRALORIC	CR 1206	
R300	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R305	RG 100 OHM+-1%TK100 1206 CHIP RESISTOR	RG 0006.8884.00	PHILIPS_CO	RC02	
R306	RG 1,0 KO +-1%TK100 1206 CHIP RESISTOR	RG 0006.7271.00	PHILIPS_CO	RC02	
R335	RG 0-OHM WIDERSTAND-CHIP RESISTOR CHIP 0-OHM	RG 0007.5108.00	DRALORIC	CR 1206	
V208	AE BZV55/10V 0,5W ZDI ZENER DIODE	AE 0006.9880.00	PHILIPS_SE	BZV55C10	
V209	AE BZV55/10V 0,5W ZDI ZENER DIODE	AE 0006.9880.00	PHILIPS_SE	BZV55C10	
V210	AE HSMS2800 SCHOTTKY DIODE	AE 0836.8421.00	HEWLETT_PA	HSMS-2800(#L31)	

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Kennz. Comp. No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
V220	AM BSS123 N-E 100V MOSF FET	0815.7961.00	SIEMENS	BSS 123 E-6327	
V230	AE BB212 2X500/22PF CDI TUNNING DIODE	0373.6901.00	PHILIPS_SE	BB212	
V235	AK BC850B N 45V 200MA TRANSISTOR	AK 0007.7969.00	VALVO	BC850B	
V236	AK BC850B N 45V 200MA TRANSISTOR	AK 0007.7969.00	VALVO	BC850B	
V237	AK BC850B N 45V 200MA TRANSISTOR	AK 0007.7969.00	VALVO	BC850B	
V238	AK BCX71J P 45V 200MA TRANSISTOR	AK 0007.2096.00	VALVO	BCX71J GEGURTET	
V239	AE HSMS2800 SCHOTTKY DIODE	AE 0836.8421.00	HEWLETT_PA	HSMS-2800(#L31)	
V240	AK BCX71J P 45V 200MA TRANSISTOR	AK 0007.2096.00	VALVO	BCX71J GEGURTET	
V260	AK BFS17 N 30V 50MA TRANSISTOR	AK 0010.6460.00	VALVO	BFS17	
W1	DY KABEL	1036.8789.00			
W2	DY KABEL	1036.8789.00			
W3	DY KABEL	1036.8789.00			
X215	FP STIFTL.WIN 36P.R2,54 ANGLE PIN CONNECTOR 3-POLIG/3 PINS	FP 0243.3578.00	BINDER	742-5-11-0187-00-36	
X290	FP STIFTL.WIN 36P.R2,54 ANGLE PIN CONNECTOR 2-POLIG/2 PINS	FP 0243.3578.00	BINDER	742-5-11-0187-00-36	

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ROHDE&SCHWARZ

XY-Liste

XY List

Erklärung der Spaltenbezeichnungen:

Part:	Bauelement-Kennzeichen.
Side:	Leiterplatten-Seite, auf der sich das Bauelement befindet.
X/Y:	Koordinaten (Millimeter) des Bauelementes auf der Leiterplatte bezogen auf den Nullpunkt.
SQR, PG:	Planquadrat und Seite des Schaltbildes für das jeweilige Bauelement.

Explanation of column designations:

Part:	Identification of instrument part.
Side:	Side of the PC board on which instrument part is positioned.
X/Y:	Coordinates (millimeter) of the component on the PC board in reference to zero point.
SQR, PG:	Square and page of the diagram for the respective instrument part.

Nicht-Service-Relevante Bauteile / Non-Service-Relevant Components

Part	Side	X	Y	Sqr	Pg
1	B	73	51		
C10	A	46	88		
C20	A	34	98		
C21	A	69	70		
C22	A	79	86		
C24	A	70	102		
C30	A	37	60		
C34	A	127	105		
C40	A	68	120		
C45	B	13	92		
C50	A	98	97		
C60	A	104	116		
C65	A	105	43		
C70	A	103	64		
C80	A	37	117		
C90	A	11	112		
C200	A	10	62		
C201	A	17	64		
C202	A	11	56		
C205	A	15	50		
C208	B	8	59		
C209	B	24	49		
C211	A	14	43		
C212	A	11	38		
C213	B	21	42		
C215	A	12	24		
C230	B	55	29		
C231	B	56	20		
C232	B	68	19		
C233	B	60	24		
C235	B	56	15		
C236	B	46	12		
C237	B	44	21		
C238	B	39	12		
C240	B	36	16		
C245	B	25	28		
C247	B	24	11		
C255	A	88	113		
C258	A	77	109		
C279	A	65	51		
C280	A	86	52		
C281	A	79	52		
C282	A	44	45		
C283	A	47	51		
C284	B	51	51		
C285	A	55	41		
C286	A	58	49		
C287	B	67	50		
C288	B	56	44		
C289	B	60	51		
C290	B	76	37		
C291	B	79	48		
C292	A	76	41		
C305	A	128	72		
C308	A	127	96		
C311	B	128	53		
C330	A	108	65		
C331	A	127	85		
C336	A	99	86		
C350	A	130	42		
C351	A	127	39		
C352	A	130	36		
C355	A	106	34		
C356	A	117	40		
C357	A	117	34		
D10	B	57	70		
D20	B	30	95		
D30	B	39	62		
D40	B	69	112		
D45	A	8	90		
D50	B	98	97		
D60	B	100	116		
D65	B	109	41		
D70	B	106	66		
D80	B	25	121		
D90	B	10	114		
D210	B	11	38		
D280	B	86	62		
D300	A	118	72		
D305	A	118	85		
D315	B	119	53		
D330	A	99	66		
D335	A	118	97		
L230	B	68	10		
L231	B	64	10		
L232	B	52	30		
L258	A	70	105		
L292	A	70	41		
L350	A	124	41		
L351	A	124	37		
L352	A	124	34		
N200	B	18	53		
N210	B	18	46		
N220	B	30	41		
N280	B	48	43		
N290	B	60	43		
N295	B	75	39		
P5	B	127	108		
P6	B	119	122		
P7	B	4	48		
P8	B	8	55		
P9	B	34	33		
P10	B	27	33		
P11	B	50	17		
P12	B	28	55		
P13	B	90	105		
P14	B	102	57		
P15	B	53	55		
P16	B	100	57		
P17	B	97	57		
P18	B	126	66		
P19	B	30	20		
P30	B	123	113		
P31	B	91	71		
P32	B	126	64		
P33	B	126	61		
P34	B	126	58		
P35	B	126	56		
P40	B	105	57		
R20	A	45	95		
R22	A	15	131		
R26	A	79	83		
R28	A	121	108		
R30	A	36	74		
R40	A	70	112		
R50	A	60	74		
R51	A	62	83		
R52	A	62	77		
R53	A	50	85		
R54	A	66	74		
R55	A	65	70		
R70	A	111	82		
R85	A	30	123		
R90	A	8	107		
R200	A	13	64		
R201	A	21	67		
R202	A	10	59		
R203	A	17	62		
R204	A	17	59		
R205	A	18	53		
R208	A	6	63		
R209	A	22	51		
R210	A	7	50		
R211	A	11	50		
R212	A	7	42		
R213	A	13	46		
R215	A	5	24		
R218	A	37	37		
R220	A	20	43		
R221	A	23	39		
R222	A	20	46		
R223	A	34	45		
R224	A	30	43		
R225	A	34	39		
R237	B	39	25		
R238	B	43	16		
R239	B	39	18		
R242	B	19	20		
R243	B	20	14		

ROHDE & SCHWARZ	-I	Datum Date	XY-Liste für XY-list for	Sach-Nummer Stock-Nr	Blatt Page
	01	16.05.94	ED DATENCODER DM-CODER	1036.8737.01 XY	1+

Part	Side	X	Y	Sqr	Pg
R244	B	13	9		
R245	B	30	23		
R247	B	24	9		
R248	B	24	17		
R249	B	49	22		
R251	B	37	23		
R256	A	80	113		
R257	A	83	110		
R258	A	77	106		
R262	B	128	76		
R263	B	128	78		
R264	B	128	81		
R265	B	128	86		
R270	B	128	83		
R271	B	128	91		
R272	B	128	88		
R273	B	128	93		
R279	A	65	49		
R280	A	53	51		
R282	A	44	51		

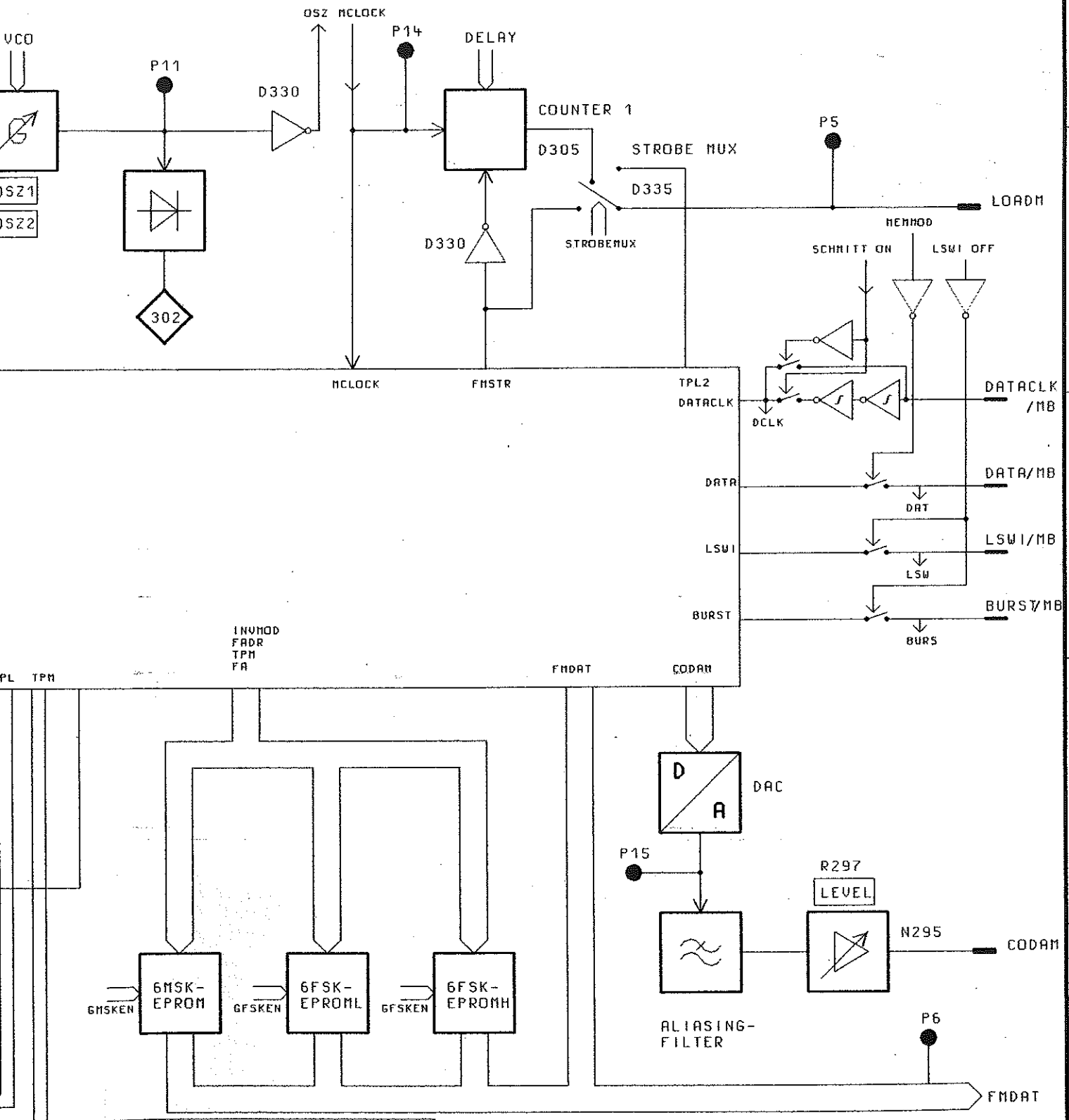
Part	Side	X	Y	Sqr	Pg
R283	A	51	42		
R284	A	52	48		
R285	A	58	45		
R286	A	60	43		
R287	A	66	35		
R288	B	55	41		
R289	B	71	47		
R292	A	66	37		
R293	B	41	6		
R294	B	72	36		
R295	B	80	34		
R296	B	80	32		
R297	B	31	6		
R298	B	69	40		
R299	A	67	44		
R300	B	124	69		
R302	A	126	49		
R305	B	128	69		
R306	A	116	96		
R335	A	103	84		

Part	Side	X	Y	Sqr	Pg
R336	A	103	81		
V208	A	4	59		
V209	A	30	51		
V210	B	15	36		
V220	A	27	38		
V230	B	69	23		
V235	B	50	12		
V236	B	59	15		
V237	B	32	17		
V238	B	18	10		
V239	B	30	12		
V240	B	15	16		
V260	A	89	110		
W1	B	132	126		
W2	B	132	93		
W3	B	132	61		
X215	B	6	27		
X290	B	87	34		

ROHDE&SCHWARZ

Stromläufe
Bestückungspläne
Circuit diagrams
Components plans
Schémas de circuit
Plans des composants

(R 29500 BU 4)
095.1800 BL 4



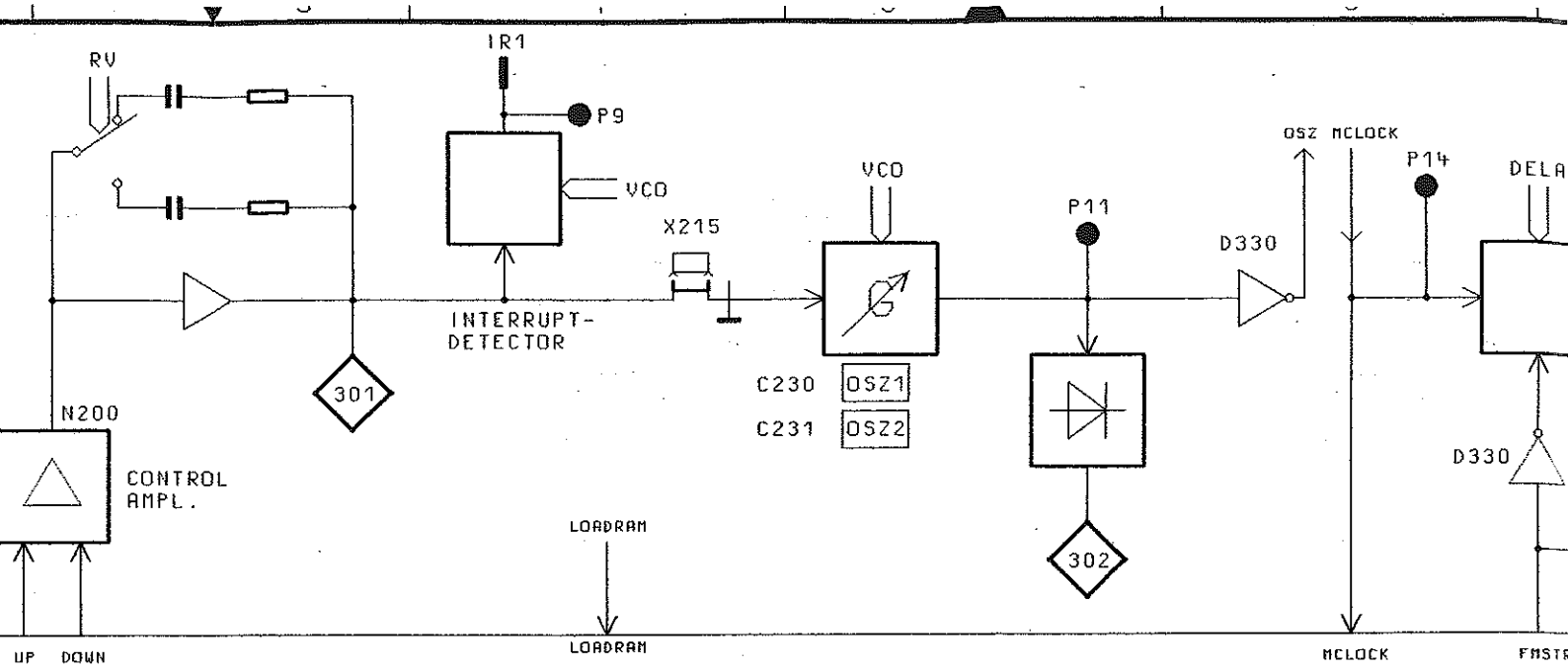
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.04

CIRUIT DIAGRAM IS VALID FOR MOD.04

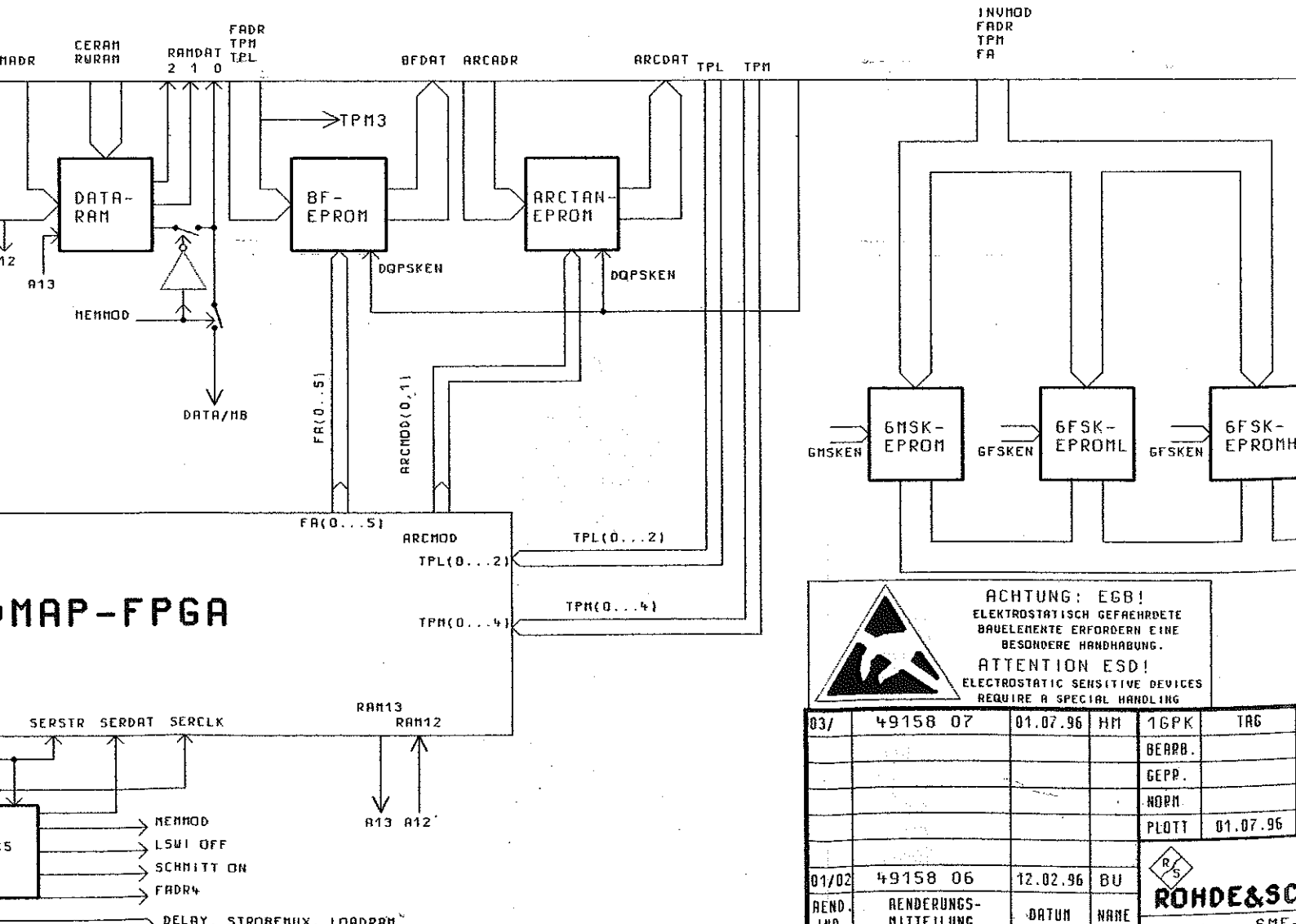
03/	49158 07	01.07.96	HM	1GPK	TAG	NAME	BENENNUNG
				BEARB.		JN	DATENCODER
				GEPR.			DM-CODER
				NORM			
				PLOTT	01.07.96		
01/02	49158 06	12.02.96	BU	ROHDE&SCHWARZ			ZEICHN.-NR. 1036.8737.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	SME-B11	REG.I.V.	1036.8720

BLATT-NR. 1+ V. BL. ERSTE Z.



DMCODER

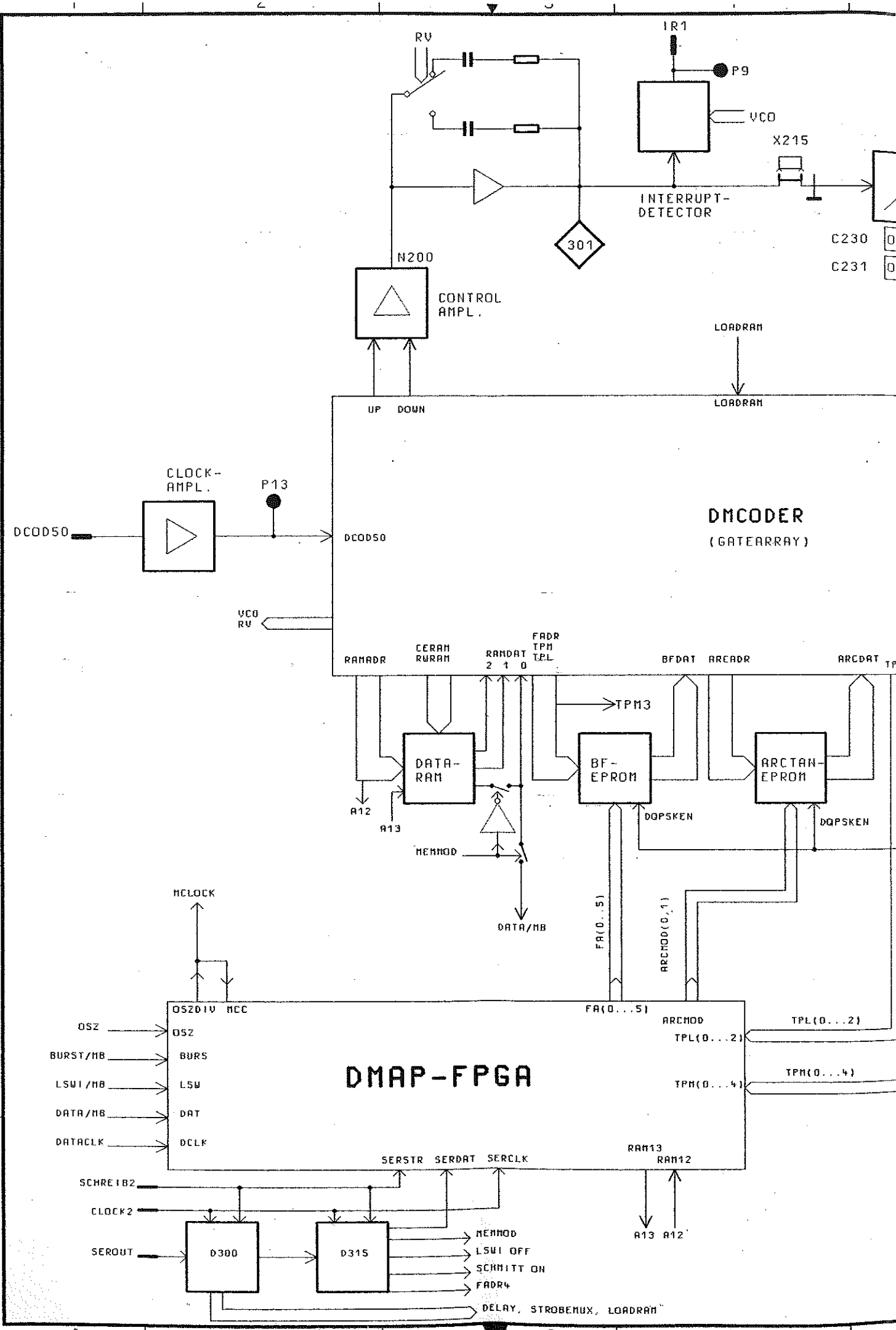
(GATEARRAY)



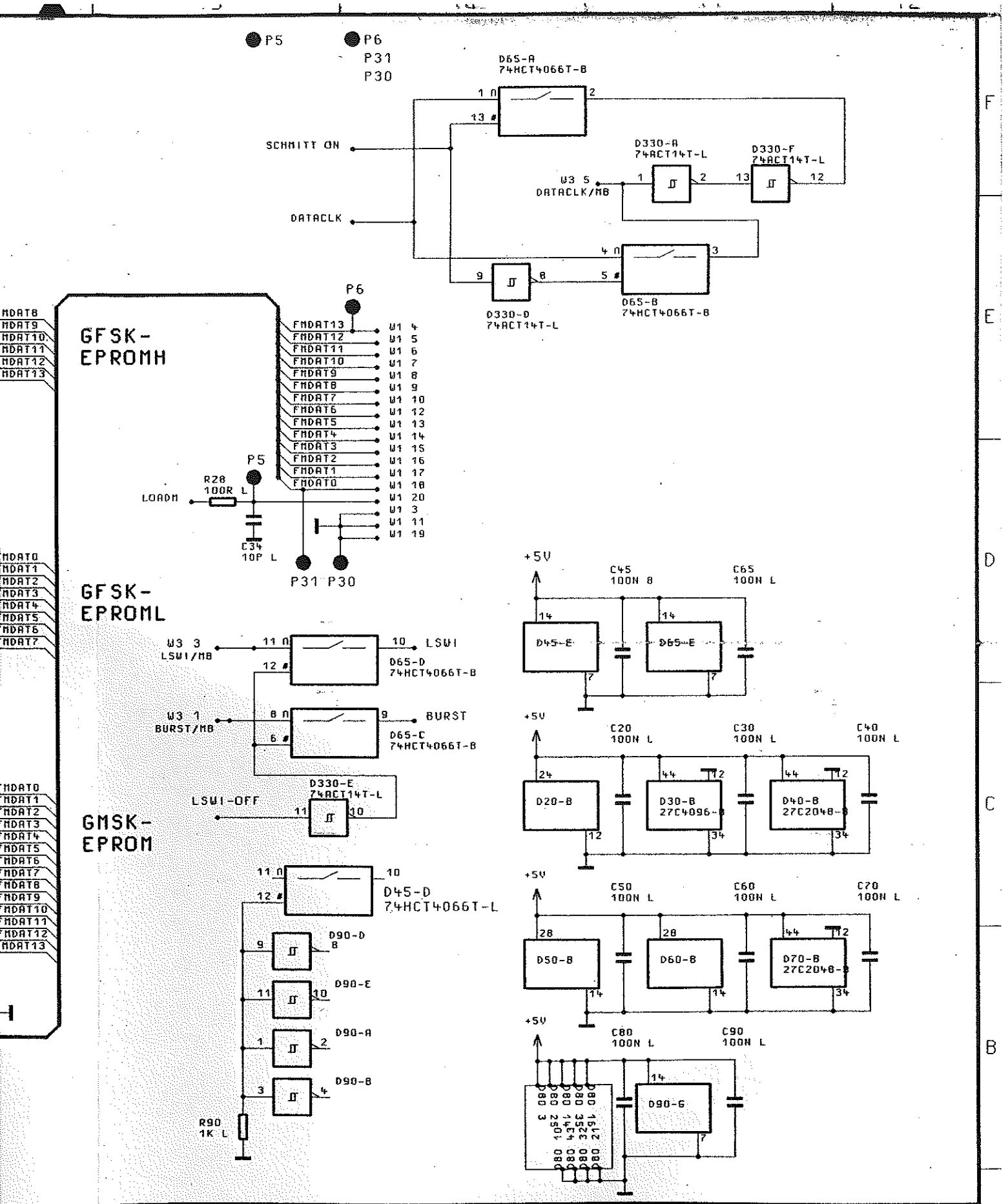
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

03/	49158 07	01.07.96	HM	1GPK	TAG
				BEARB.	
				GEPR.	
				NORM	
				PLOTT	01.07.96
01/02	49158 06	12.02.96	BU		
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	SME-

ROHDE&SC



FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR



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				BEARB.		JN	DATENCODER
				GEPR.			DM-CODER
				NORM			
				PLOTT	01.07.96		
01/02	49158 06	12.02.96	BU	ROHDE&SCHWARZ			ZEICHN.-NR. 1036.8737.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	SME-B11		BLATT-NR. 2+
				REG.I.V.	1036.8720		ERSTE Z. V. BL.

P32
P33
P34
P35

P5

P6
P31
P30

SCHMITT ON

DATACLK

D60-A
27HC641

D50-A
27HC641

D70-A
27C2048-B

GFSK-
EPROMH

GFSK-
EPROML

GMSK-
EPROM

P6

P5

P31 P30

R28
100R L

C34
10P L

LOADM

U3 3
LSWI/MB

LSWI

D65-D
74HCT4066T-B

U3 1
BURST/MB

BURST

D65-C
74HCT4066T-B

LSWI-OFF

D330-E
74ACT14T-L

D45-D
74HCT4066T

D90-D
8

D90-E

D90-A

D90-B

R90
1K L

DCODSON

+5V

C22
100N L

MCLOCK

R26
100R L

NOT FITTED

R70
1K L

GFSKEN

SCHREIB2

CLOCK2

LOADRAM

SEROUT

BURST

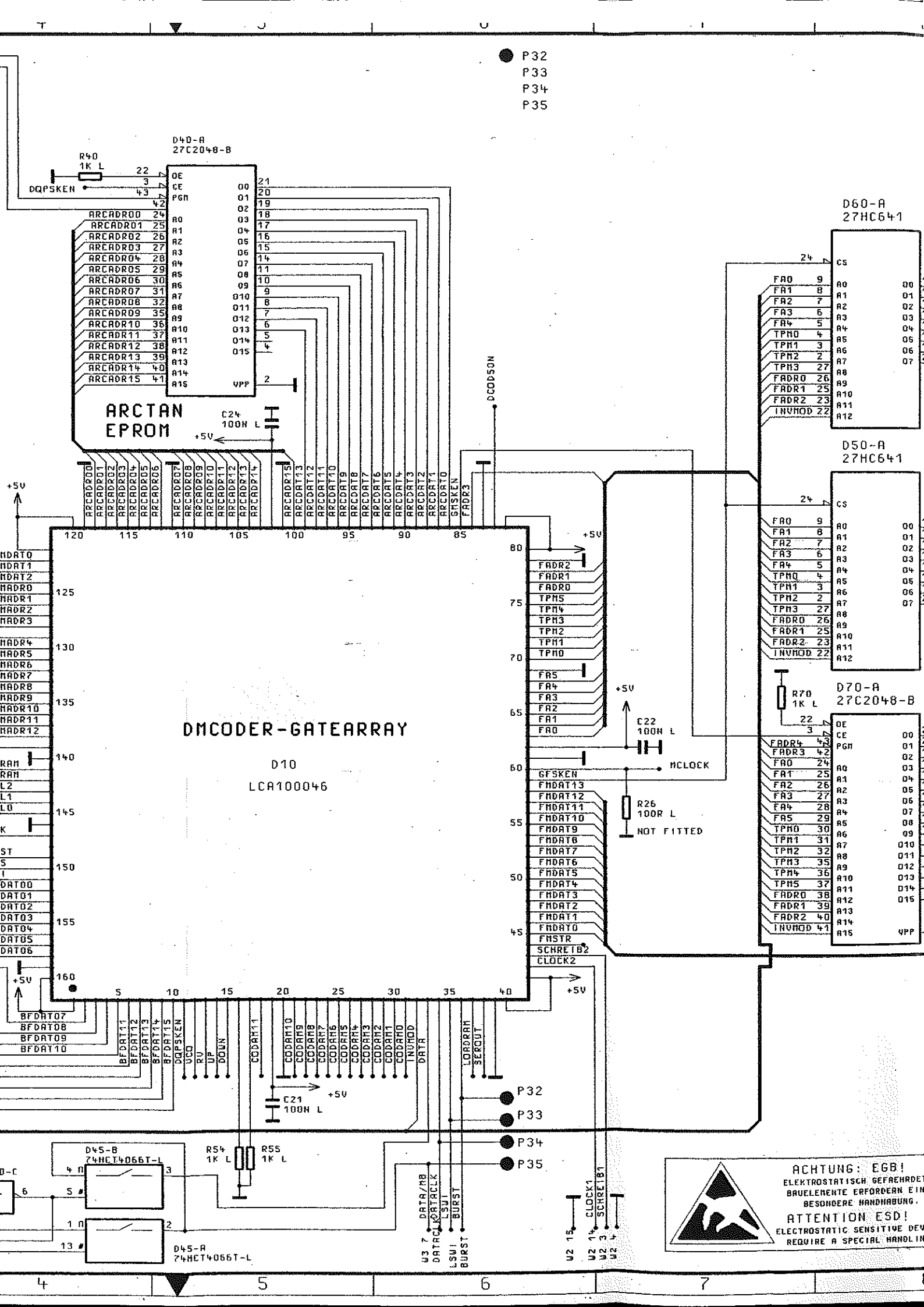
CLOCK1

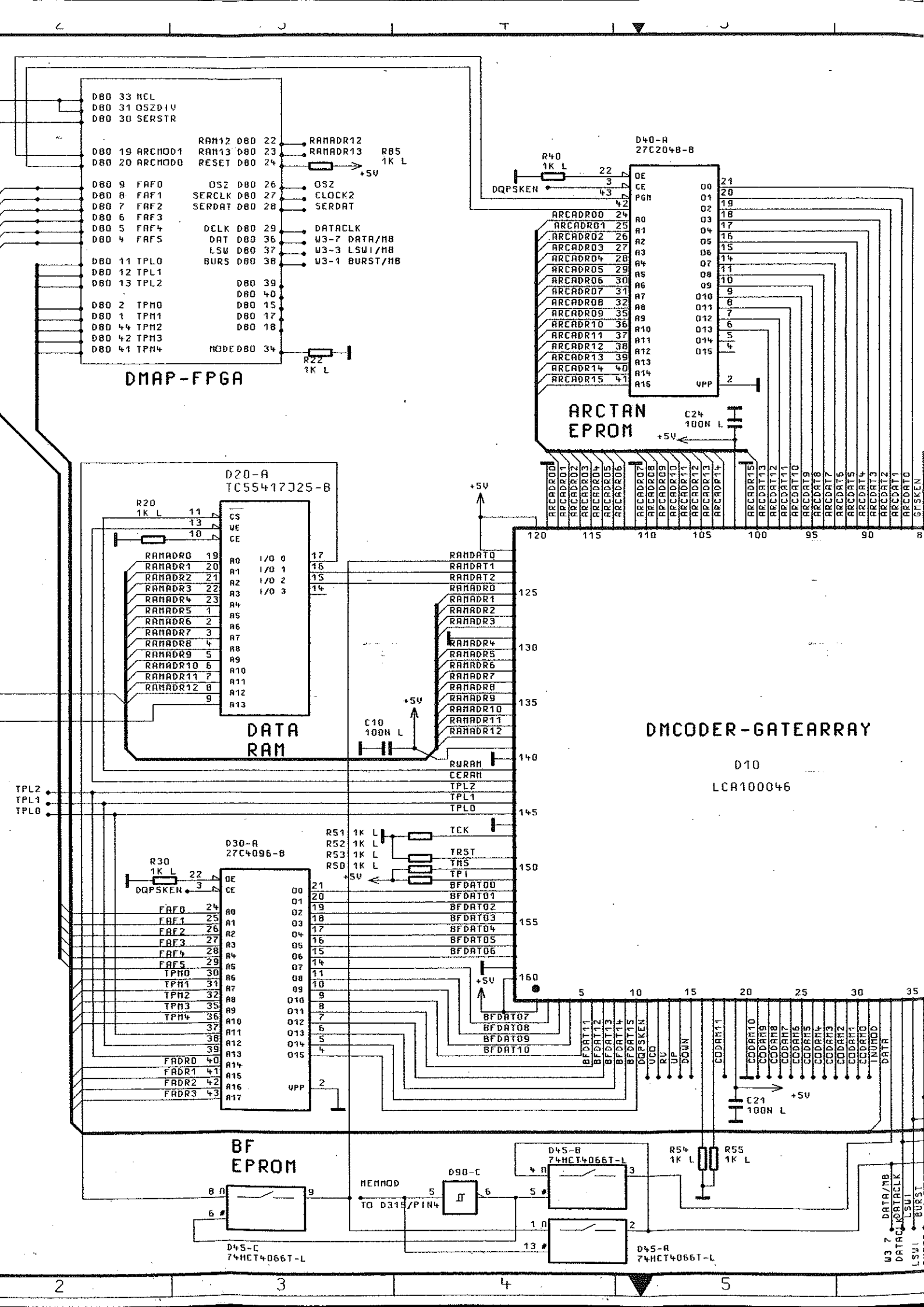
SCHREIB1

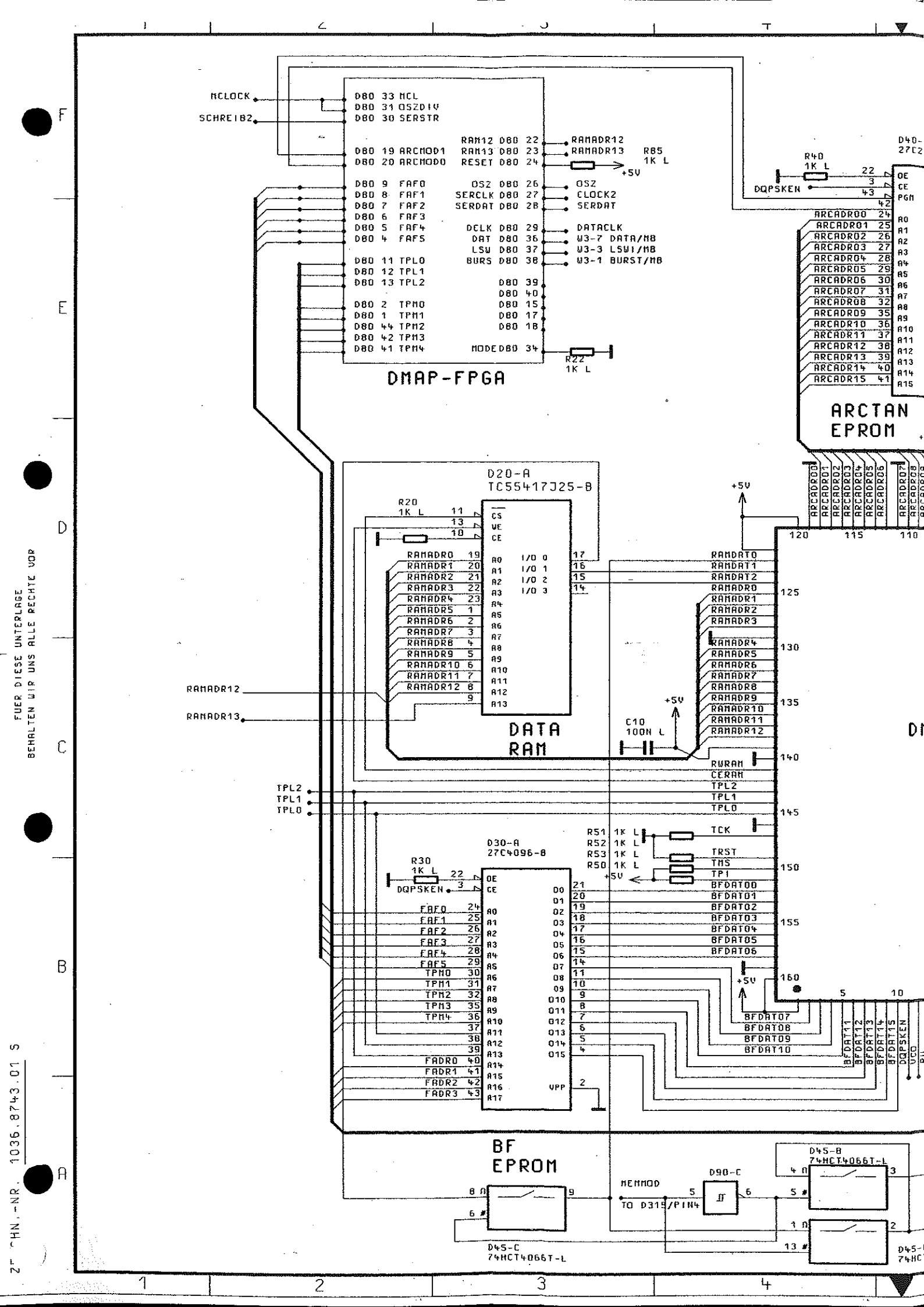
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE
BAUELEMENTE ERFORDERN EINE
BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES
REQUIRE A SPECIAL HANDLING

03/	49158 07	01.07.96	HM	1GPK	TAG
				BEARB.	
				GEPR.	
				NORM	
				PLOTT	01.07.96
01/02	49158 06	12.02.96	BU		
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SCH	
				ZU GERAET	SME-B

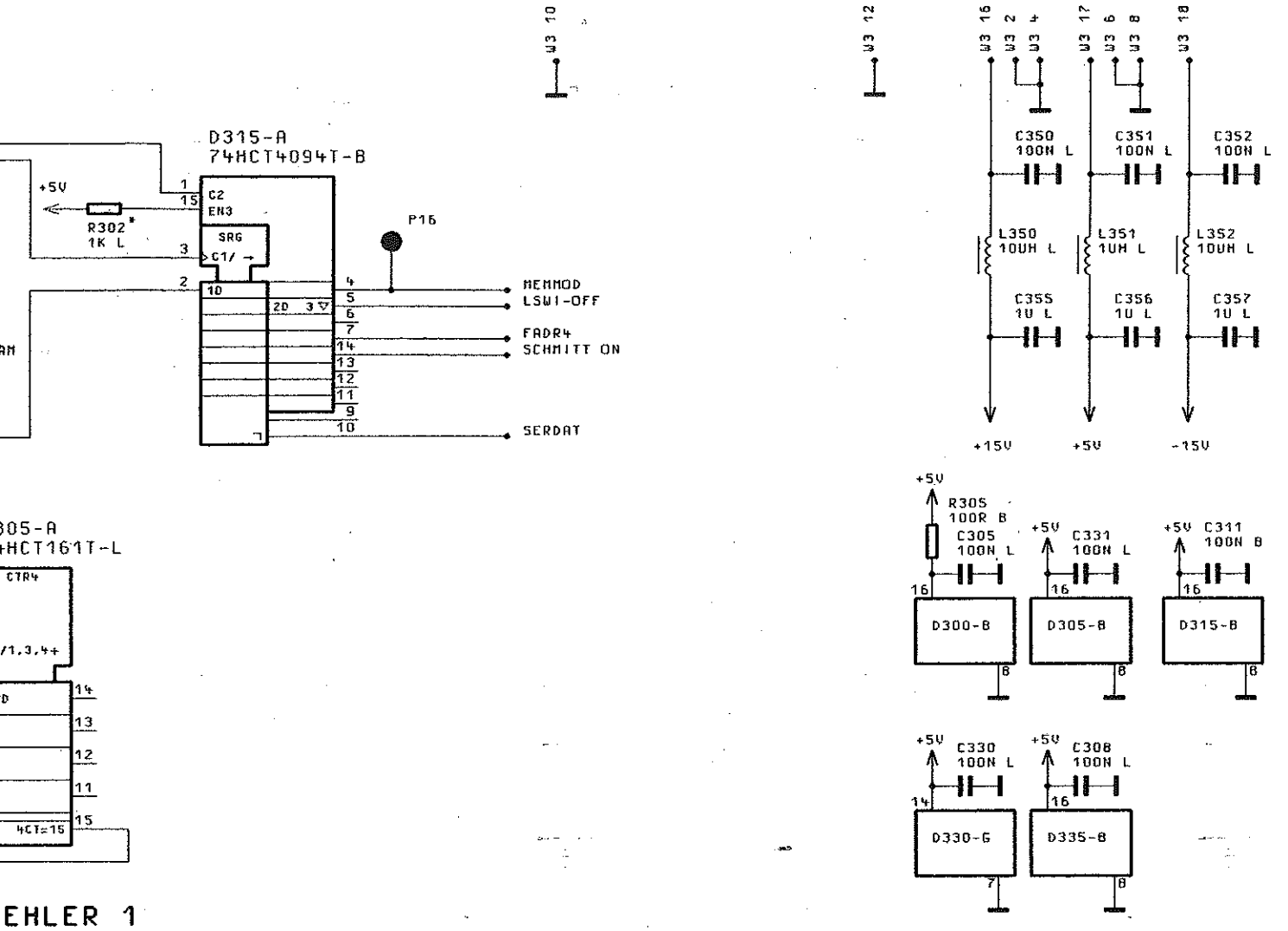
6 7 8 9 10


P32
P33
P34
P35
D40-A
27C2048-B
R40
1K L
DQPSKEN
ARCADR00
ARCADR01
ARCADR02
ARCADR03
ARCADR04
ARCADR05
ARCADR06
ARCADR07
ARCADR08
ARCADR09
ARCADR10
ARCADR11
ARCADR12
ARCADR13
ARCADR14
ARCADR15
ARCTAN
EPROM
C24
100N L
+5V
DCODSON
D60-A
27HC641
D50-A
27HC641
D70-A
27C2048-B
R70
1K L
C22
100N L
MCLOCK
R26
100R L
NOT FITTED
DMCODER-GATEARRAY
D10
LCA100046
GFSKEN
FMDAT13
FMDAT12
FMDAT11
FMDAT10
FMDAT9
FMDAT8
FMDAT7
FMDAT6
FMDAT5
FMDAT4
FMDAT3
FMDAT2
FMDAT1
FMDAT0
FMSTR
SCHREIB2
CLOCK2
C21
100N L
D45-B
74HCT4066T-L
D45-A
74HCT4066T-L
R54
1K L
R55
1K L
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE
BAUELEMENTE ERFORDERN EIN
BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEV
REQUIRE A SPECIAL HANDLIN


DMAP-FPGA
ARCTAN EPROM
D40-A 27C2048-B
DMCODER-GATEARRAY
D10
LCA100046
DATA RAM
D20-A TC554170325-B
BF EPROM
D30-A 27C4096-B
D45-B 74HCT4066T-L
D45-C 74HCT4066T-L
D45-A 74HCT4066T-L
D90-C
DQPSKEN
MEMMOD
TO D315/PIN4
+5V
C24 100N L
C10 100N L
C21 100N L
R40 1K L
R22 1K L
R20 1K L
R30 1K L
R51 1K L
R52 1K L
R53 1K L
R50 1K L
R54 1K L
R55 1K L
RAMADR12
RAMADR13
RB5
OSZ
CLOCK2
SERDAT
DATACLK
W3-7 DATA/MB
W3-3 LSWI/MB
W3-1 BURST/MB
RWRAM
CERAM
TPL2
TPL1
TPL0
TCK
TRST
TMS
TPI
DATA/MB
DATACLK
LSWI
BURST


DMAP-FPGA
ARCTAN EPROM
DATA RAM
BF EPROM
D20-A
TC55417J25-B
D30-A
27C4096-8
D45-B
74HCT4066T-L
D45-C
74HCT4066T-L
D90-C
MCLOCK
SCHREIB2
DQPSKEN
RAMADR12
RAMADR13
TPL2
TPL1
TPL0
TCK
TRST
TMS
TPI
MEMMOD
TO D315/PIN4
FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR
1036.8743.01 S

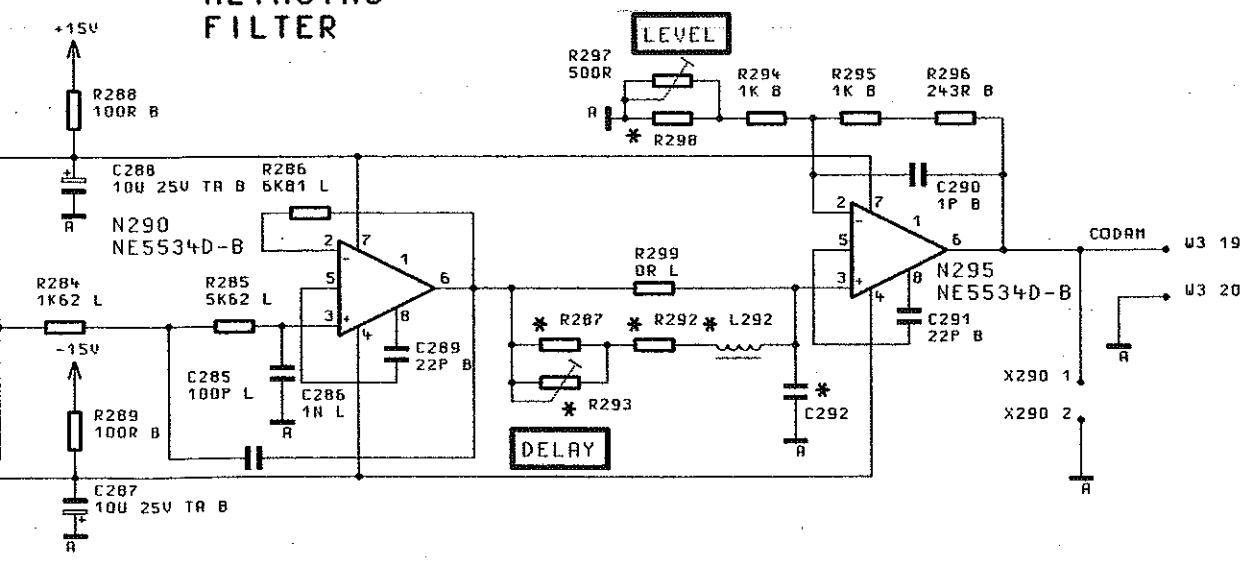
P16 R293 R297



305-A
+HCT161T-L
CTR4
/1,3,4+
4CT=15

EHLER 1
OUNTER 1

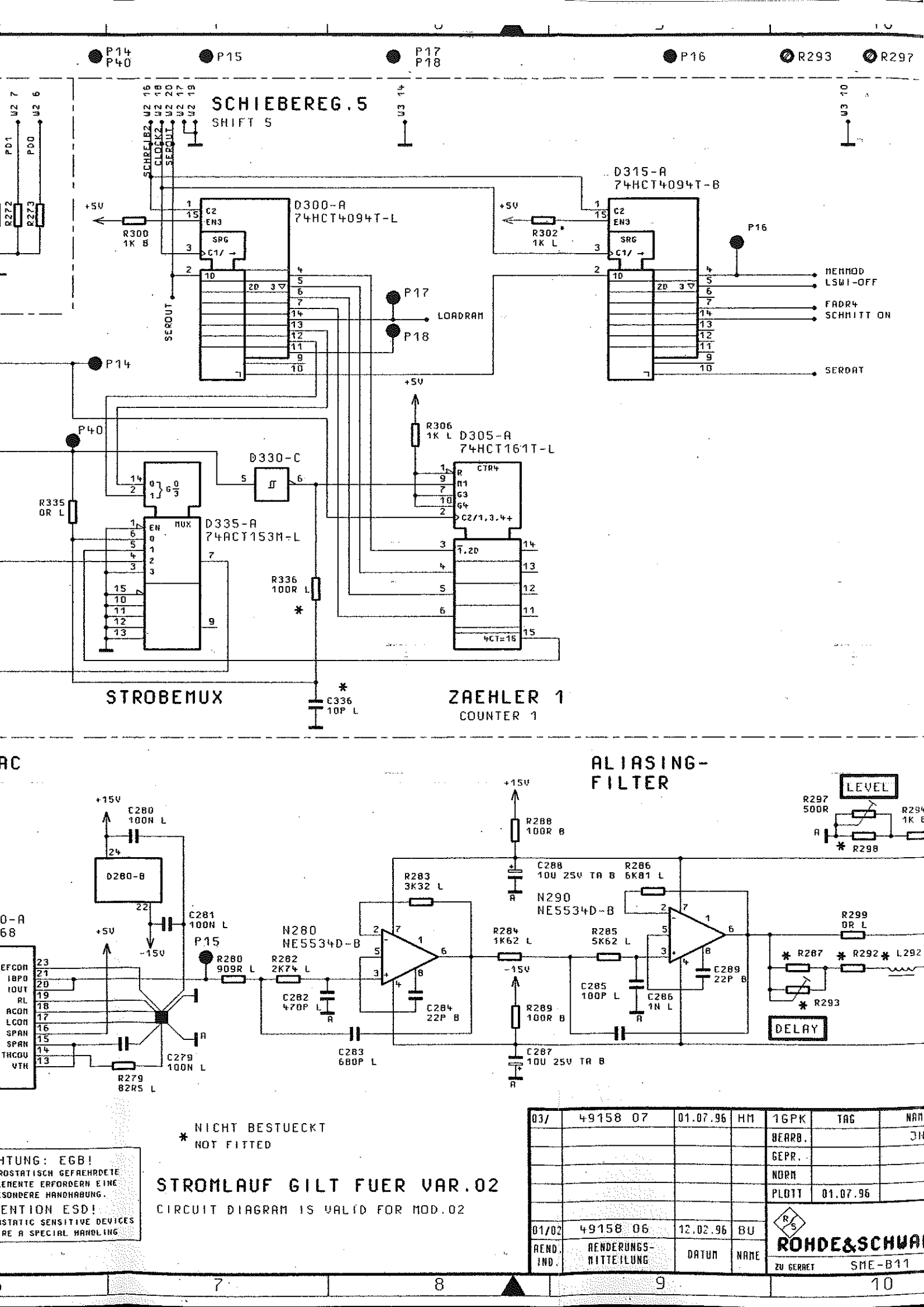
ALIASING-FILTER



03/	49158 07	01.07.96	HM	1GPK	TAG	NAME	BENENNUNG
				BEARB.		JN	DATENCODER
				GEPR.			DM-CODER
				NORM			
				PLOTT	01.07.96		
01/02	49158 06	12.02.96	BU	ROHDE&SCHWARZ			ZEICHN.-NR. 1036.8737.01S
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET SME-B11			REG.I.V. 1036.8720 ERSTE Z.

BLATT-NR. 3 V. BL.

02



* NICHT BESTUECKT
NOT FITTED

STROMLAUF GILT FUER VAR.02

CIRCUIT DIAGRAM IS VALID FOR MOD.02

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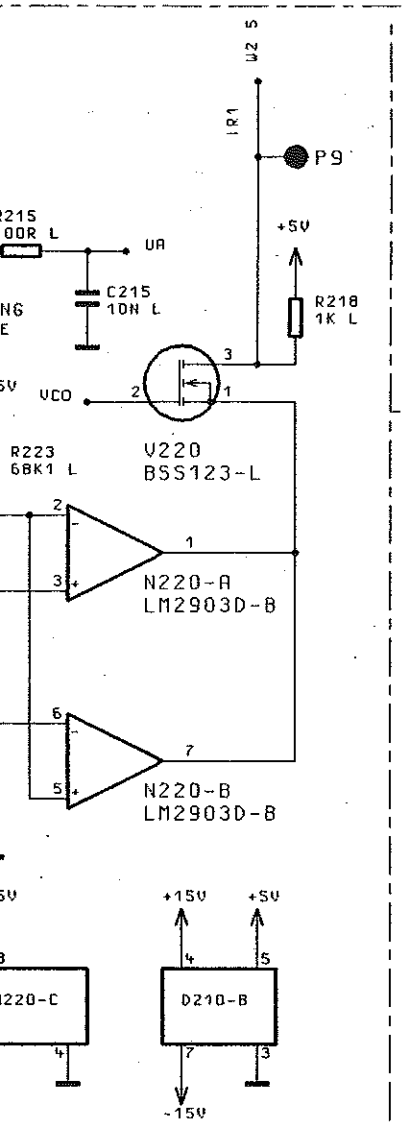
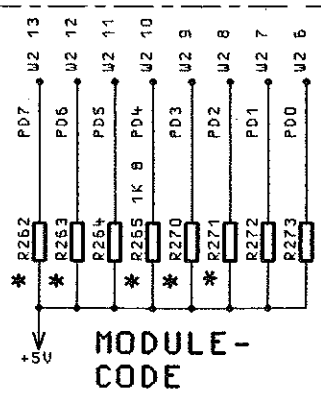
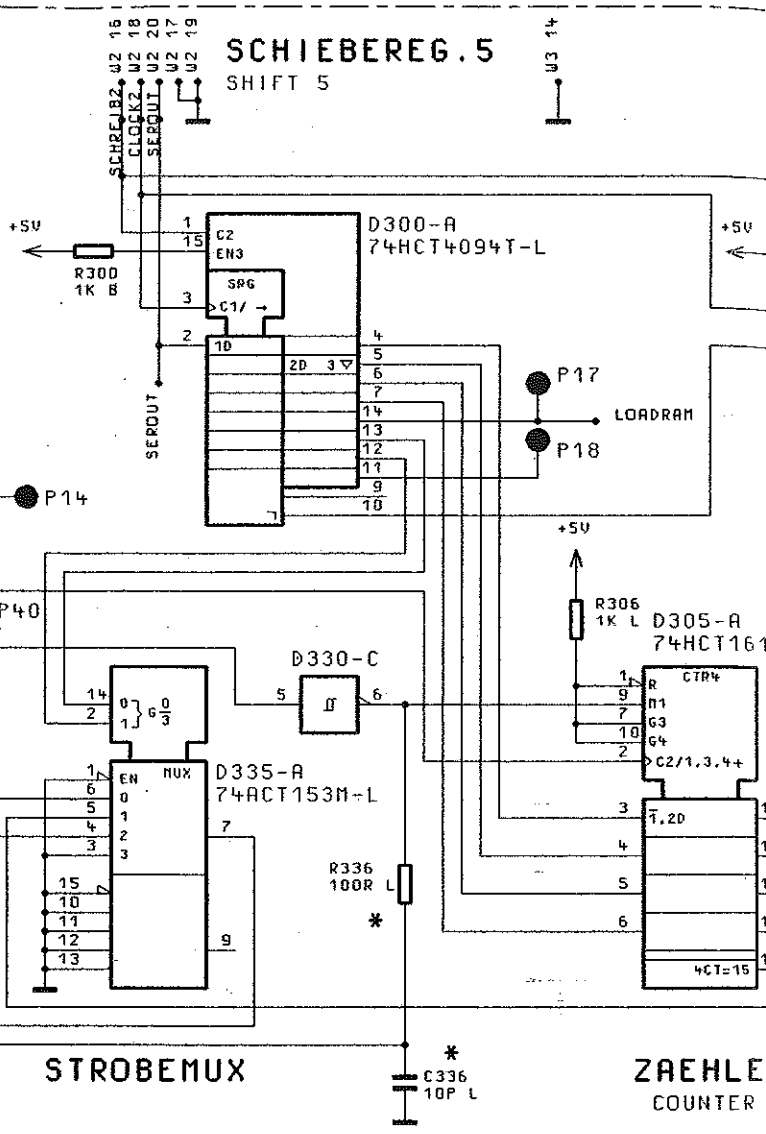
				BEARB.		JH
				GEPR.		
				NORM		
				PLOTT	01.07.96	
01/02	49158 06	12.02.96	BU			
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ZU GERAET	SME-B11	

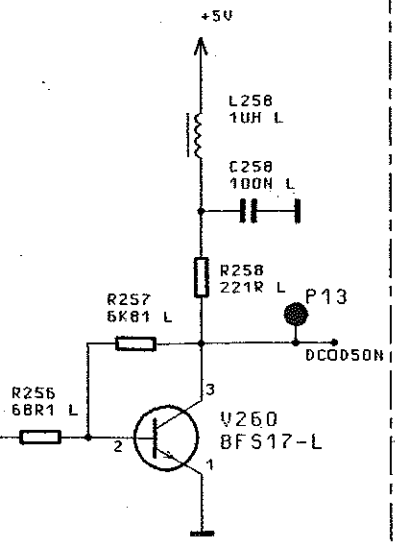
ROHDE&SCHWA

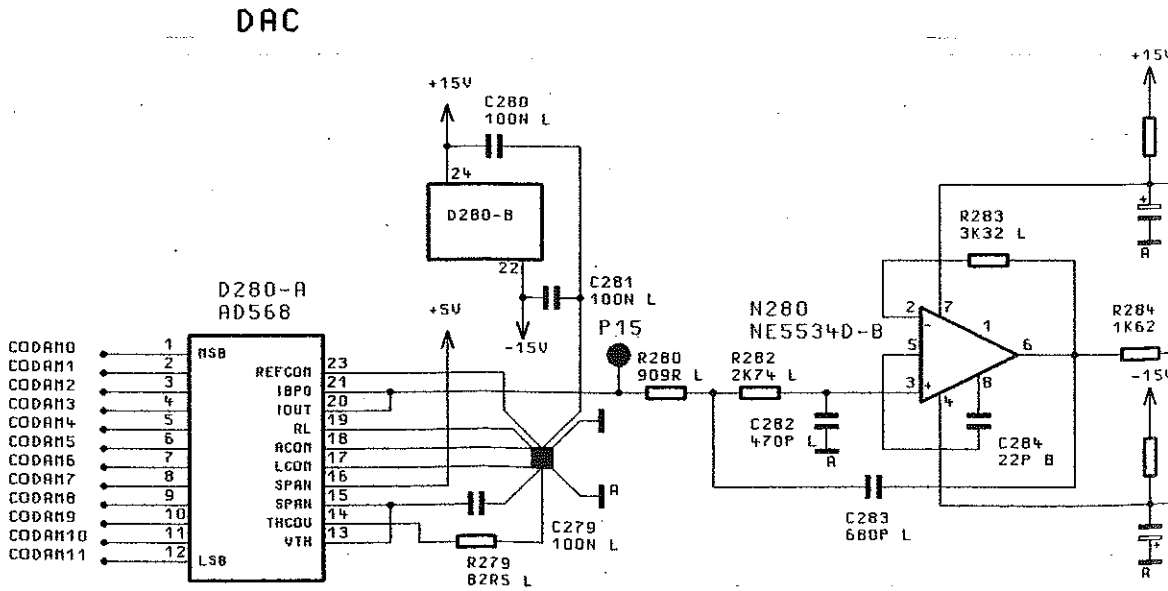
HTUNG: EGB!
ROSTATISCH GEFAEHRDETE
EMENTE ERFORDERN EINE
SONDERE HANDHABUNG.
ENTION ESD!
STATIC SENSITIVE DEVICES
RE A SPECIAL HANDLING











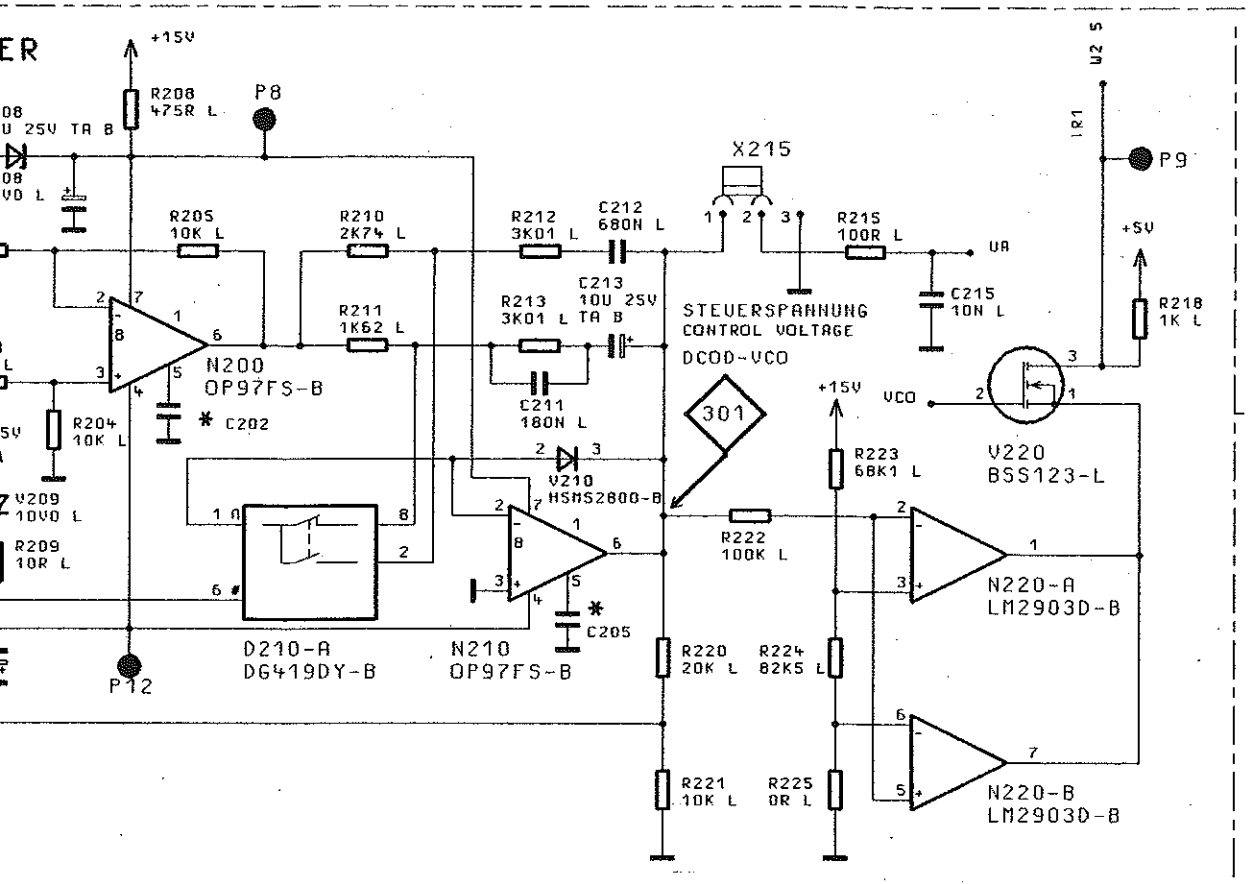
* NICHT BESTUECKT
NOT FITTED

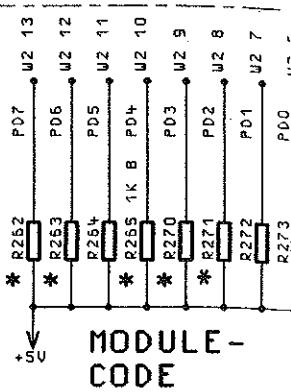
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

STROMLAUF GILT FUER VAR.02

CIRCUIT DIAGRAM IS VALID FOR MOD.02

C231 P12 P8 P11 P19 P9 P13



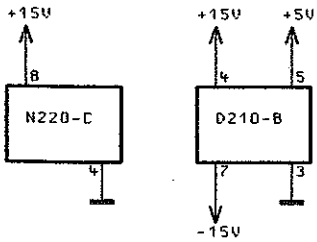


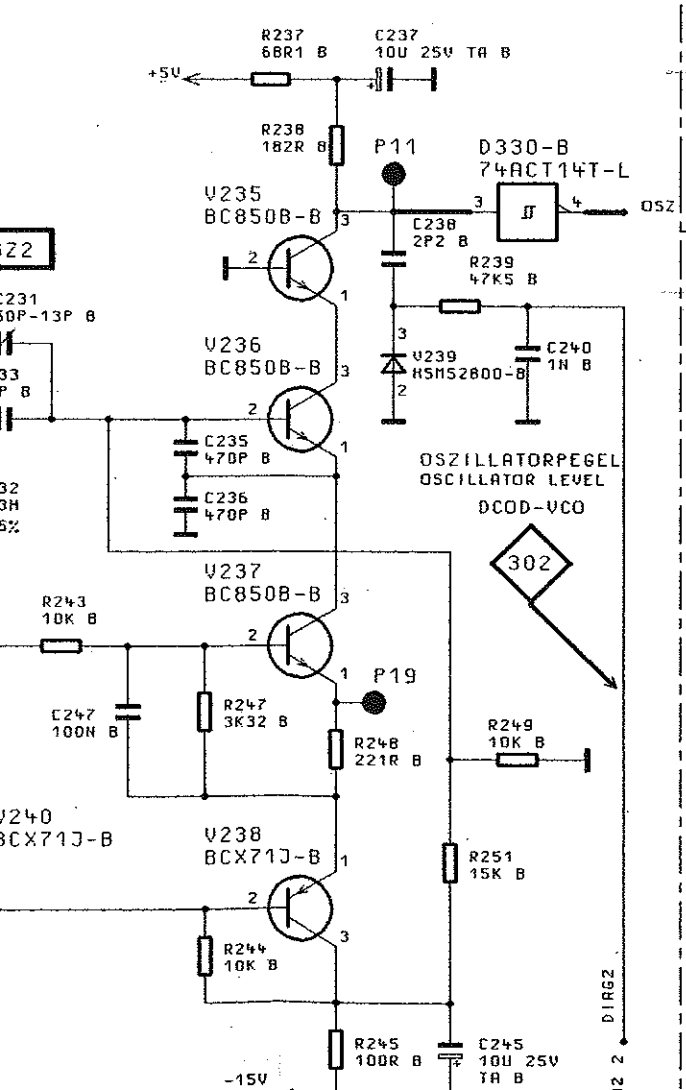
MCLOCK

FMSTR

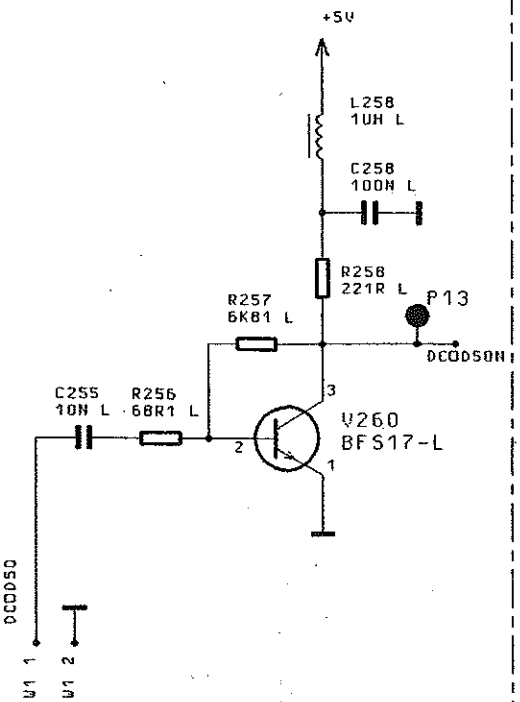
TPL2

LOADM

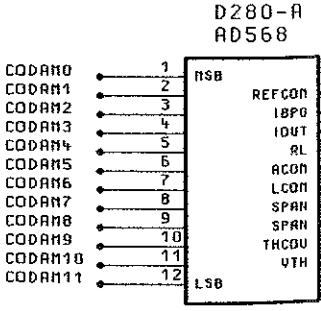


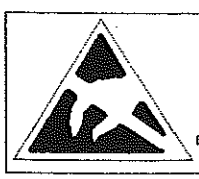


TAKT VERSTAERKER
CLOCK AMPLIFIER



DAC



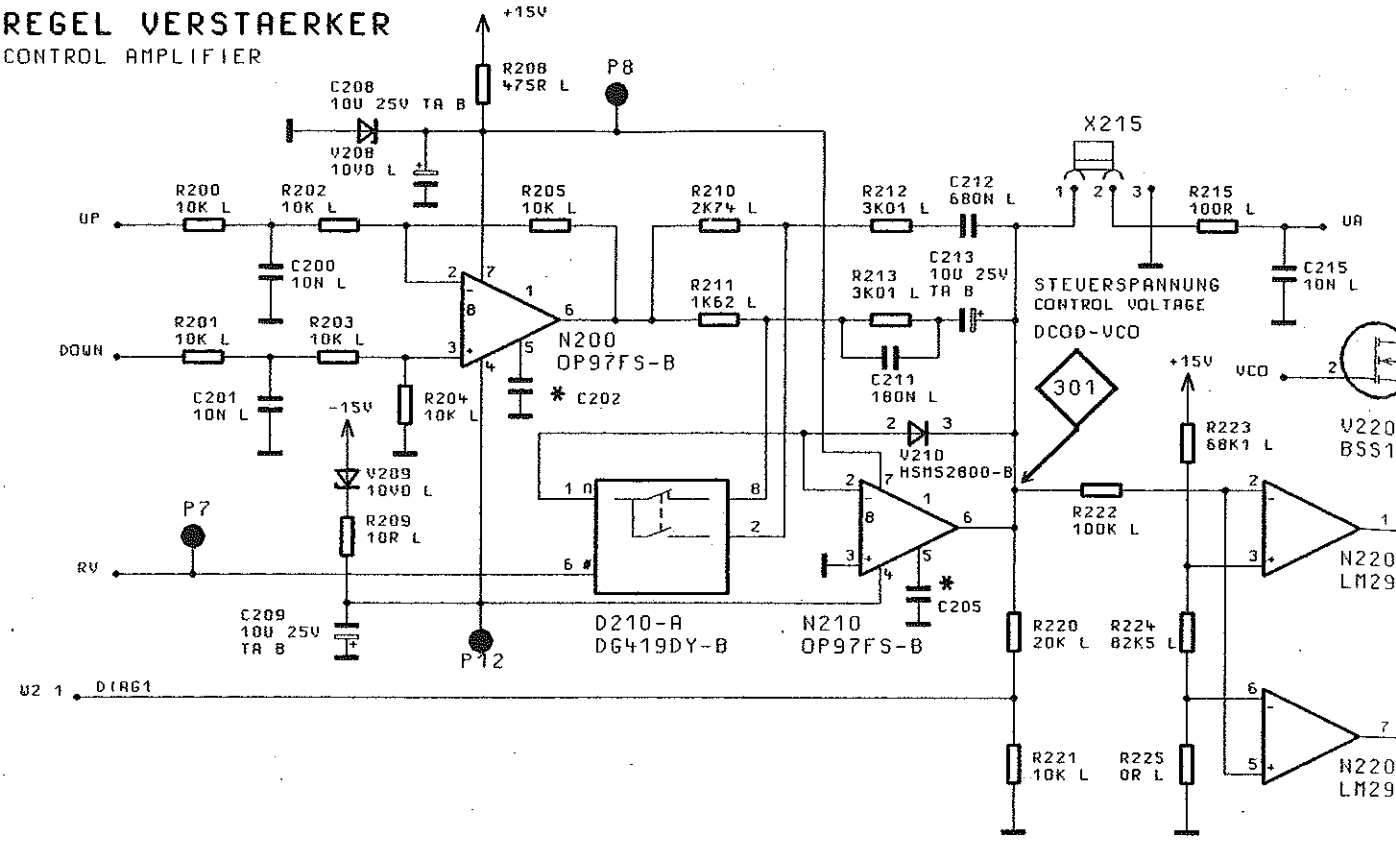


ACHTUNG
ELEKTROSTATI
BAUELEMENTE
BESONDERE
ATTENTI
ELECTROSTATIC
REQUIRE A SI

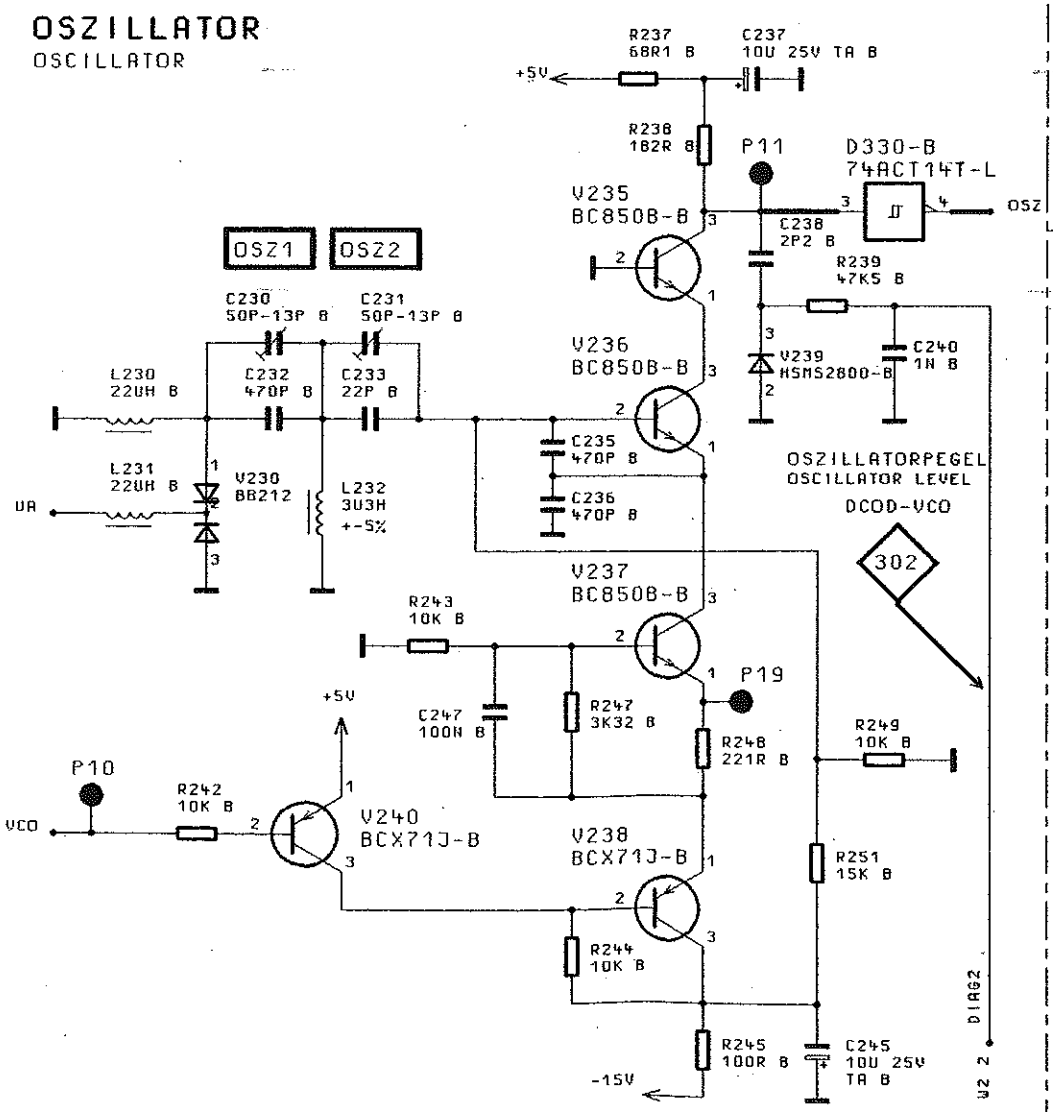
3 4 5 6

P10 P7 C230 C231 P12 P8 P11 P19

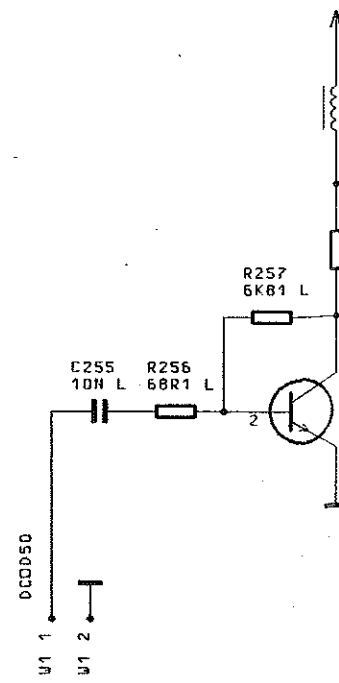
REGEL VERSTAERKER
CONTROL AMPLIFIER



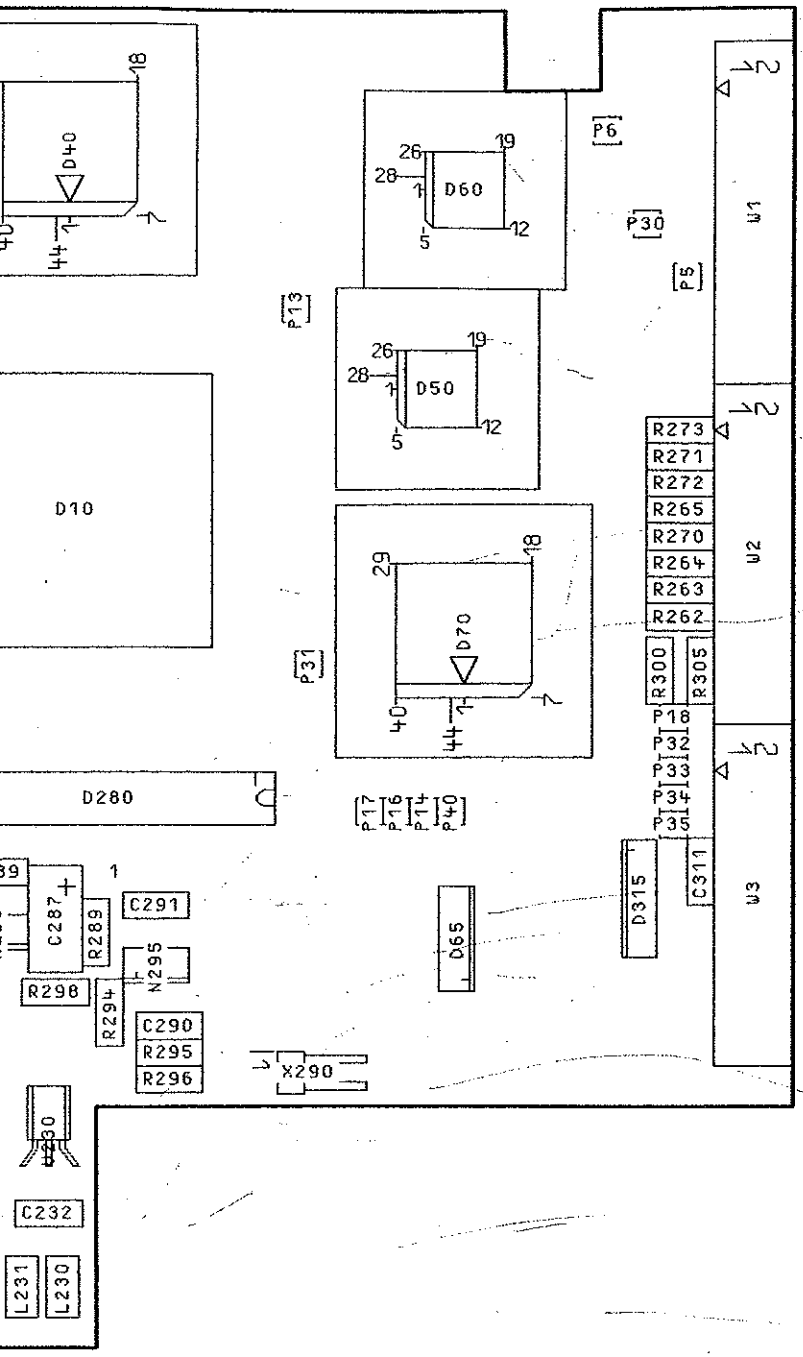
OSZILLATOR
OSCILLATOR



TAKT VERSTA
CLOCK AMPLIFIER



FUER DIESE UNTERLAGE
BEHALTEN WIR UNS ALLE RECHTE VOR



100 150

01/				1GPK	TAG	NAME	BENENNUNG
				BEARB.		JN	DATENCODER
				GEPR.			DM-CODER
				NORM			
				PLOTT	16.05.94		
/							
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME				

ROHDE&SCHWARZ

ZU GERAET SME-B11

ZEICHN.-NR. 1036.8737.01 ED

REG.I.V. 1036.8720

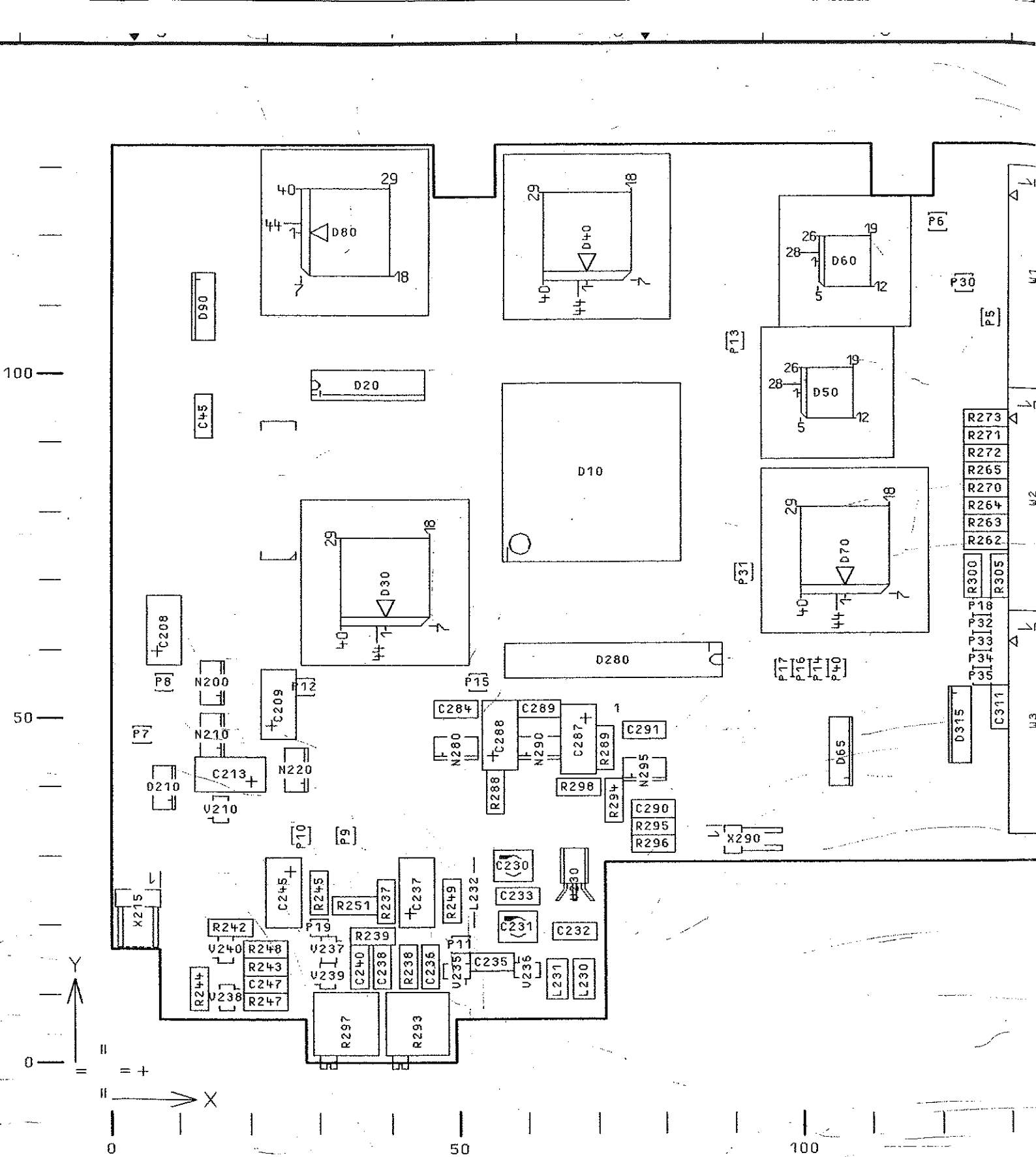
BLATT-NR. 1+

V. BL.

ERSTE Z.

Z

5 6 7 8



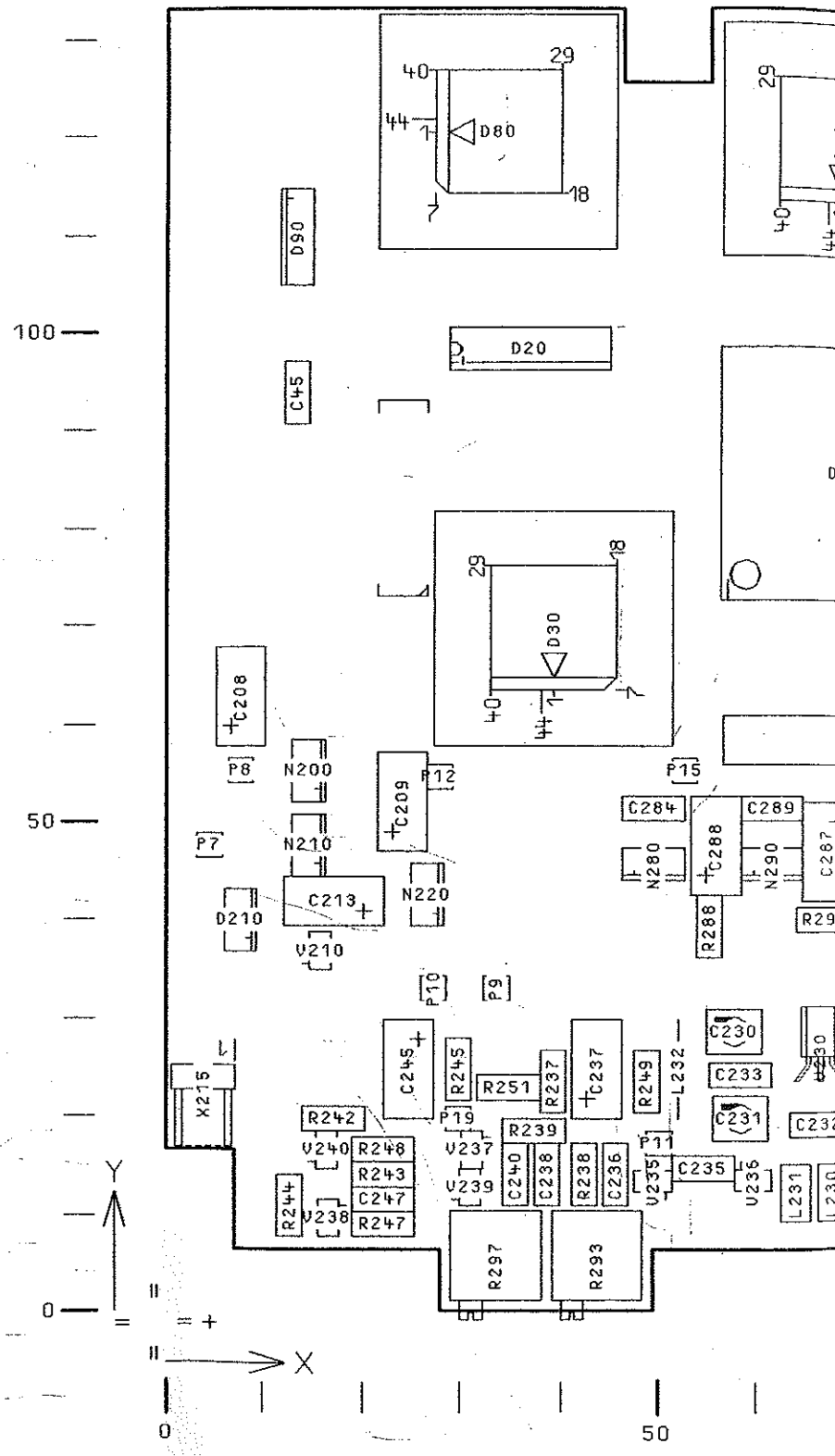
ACHTUNG: EGB!
ELEKTROSTATISCH GEFAEHRDETE BAUELEMENTE ERFORDERN EINE BESONDERE HANDHABUNG.
ATTENTION ESD!
ELECTROSTATIC SENSITIVE DEVICES REQUIRE A SPECIAL HANDLING

BINDENDE ANGABEN UEBER VARIANTEN, TRIMMWERTE, BAUTEILWERTE UND NICHT BESTUECKTE BAUTEILE SIEHE SR.

FOR BINDING INFORMATION ON MODELS, TRIMMING AND COMPONENTS VALUES AND NONFITTED COMPONENTS SEE PARTS LIST.

01/				1GPK	TAG
				BEARB.	
				GEPR.	
				NORM	
				PLOTT	16.05.94
/					
AEND. IND.	AENDERUNGS-MITTEILUNG	DATUM	NAME	ROHDE&SC	
				ZU GERAET	SME-

DIESE ZEICHNUNG IST EIN RECHNERAUSDRUCK, RENDERUNGEN KOENNEN NUR DURCH RENDERN DES DATENSATZES ERFOLGEN
FUER DIESE ZEICHNUNG BEHALTEN WIR UNS ALLE RECHTE VOR



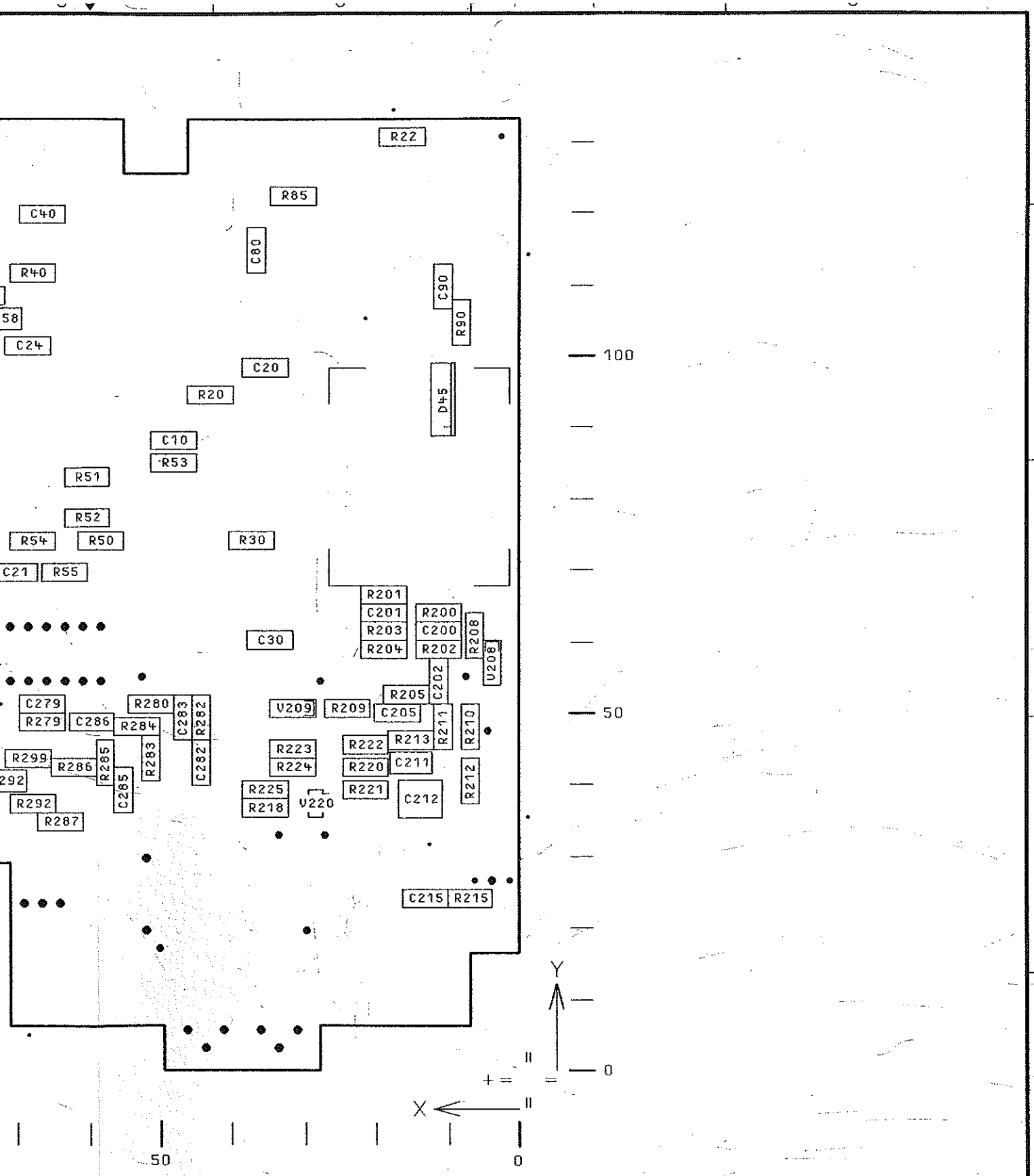
DARSTELLUNG SEITE B

VIEW ON SIDE B

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

BINDENDE ANGABEN UEBER VARIANTEN, TRIMMWERTE, BAUTEILWERTE UND NICHT BESTUECKTE BAUTEILE SIEHE SA.

FOR BINDING INFORMATION ON MODELS, TRIMMING AND COMPONENTS VALUES AND NONFITTED COMPONENTS SEE PARTS LIST.



01/				1GPK	TAG	NAME	BENENNUNG	
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				GEPR.			DM-CODER	
				NORM				
				PLOTT	16.05.94			
				ROHDE&SCHWARZ			ZEICHN.-NR. 1036.8737.01 ED	BLATT-NR. 2-
				ZU GERAET	SME-B11		REG.T.V. 1036.8720	ERSTE Z.
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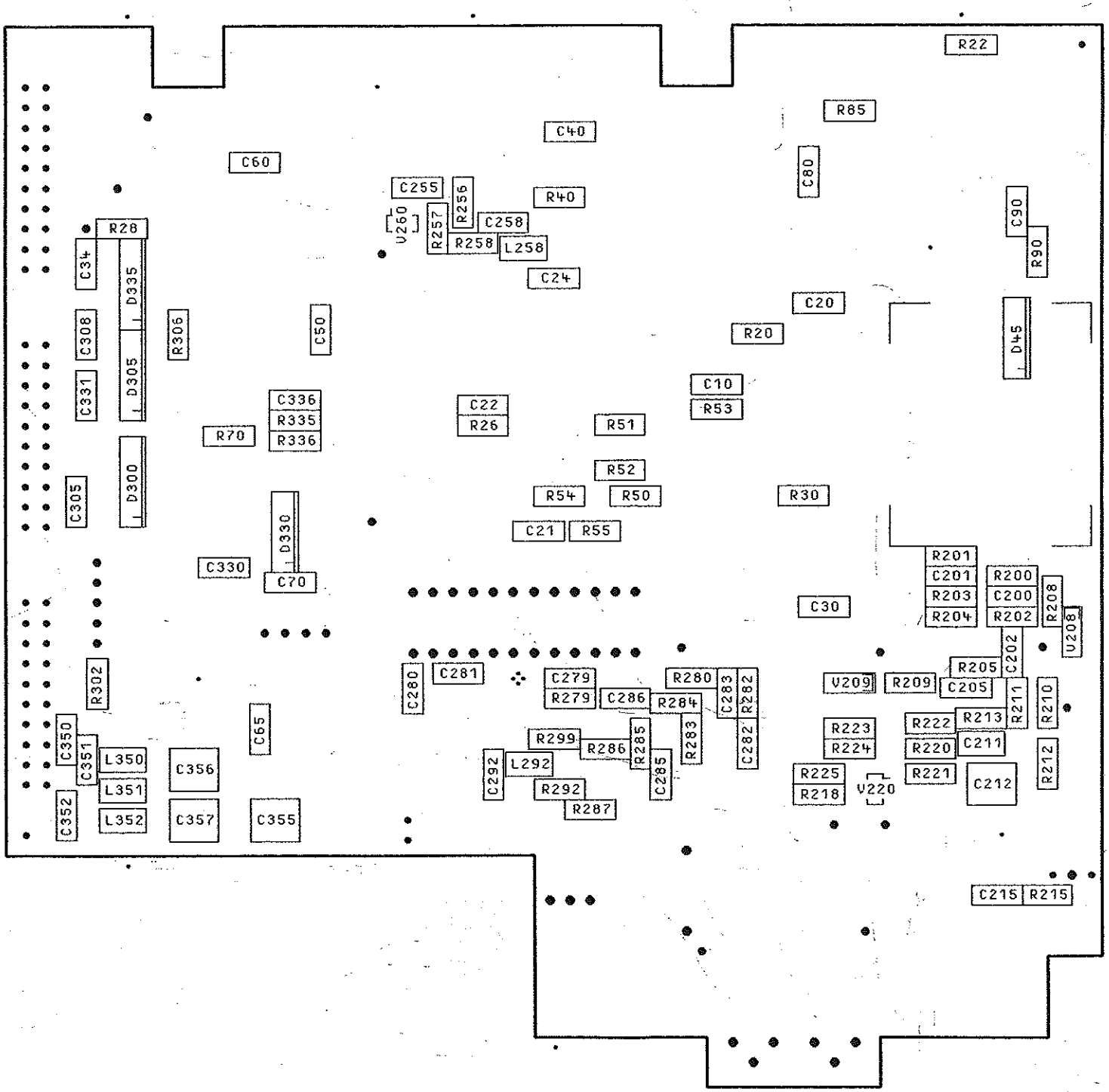

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				BEARB.		JN
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				ZU GERAET	SME-B11	

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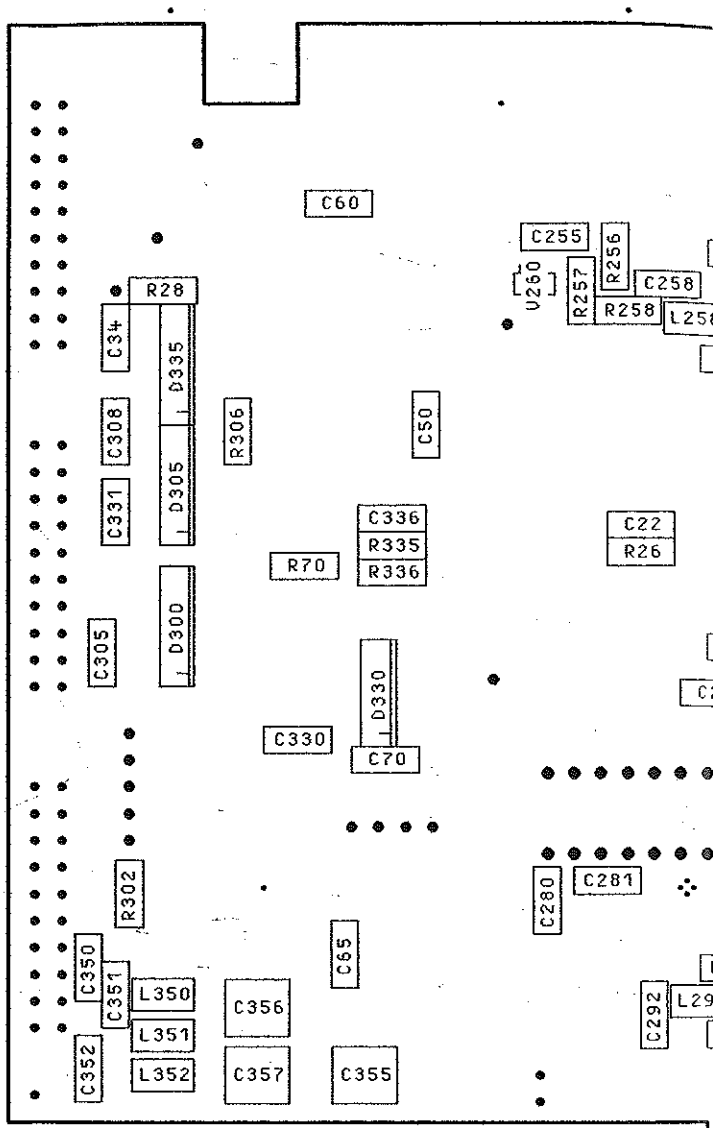

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7. Prüfen und Instandsetzen der Baugruppe

7.1 Funktionsbeschreibung

7.1.1 Überblick

Die gleichgerichtete, gesiebte Netzspannung wird mit einem Pulssteller auf eine Zwischenkreisspannung von ca. 140V herabgesetzt. Diese Zwischenspannung wird anschließend von einer Gegentaktstufe zerhackt und speist den Hauptübertrager T1, aus dessen Sekundärwicklungen durch Längsregler und Schaltregler 7 von 8 Ausgangsspannungen erzeugt werden. Die Standbyspannung sowie die internen Hilfsspannungen werden aus einem separaten primärgetakteten Wandler gewonnen.
Die Einstellung des Gerätes auf den Wert der Netzspannung (115/230V) erfolgt automatisch. Am Netzeingang befindet sich ein Entstörfilter zur Unterdrückung von leitungsgebundenen Störungen. Die sichere Netztrennung wird durch Verwendung von Transformatoren zur Leistungsübertragung und VDE-Optokopplern zur Signalübertragung erreicht.
Die sekundärseitigen Ausgänge sind gegen Überlast und Überspannung geschützt. Zur Kühlung des Gerätes wird ein temperaturgesteuerter Lüfter eingesetzt, der seine maximale Drehzahl erst bei höherer Umgebungstemperatur erreicht.

7.1.2 Hilfs-und Standbykreis

Der Standbywandler wird direkt aus der gleichgerichteten Netzspannung versorgt, er ist also in Betrieb, solange die Netzspannung anliegt und der Netzschalter eingeschaltet ist. Der Wandler arbeitet in freischwingender Betriebsart. Die Schwingungserzeugung erfolgt durch die Bauteile um den Schalttransistor V116 und den Standbytrafo T2. Die Regelung übernimmt der Operationsverstärker N17 nach der Gleichrichtung und Siebung der Spannung UH1 aus der Sekundärwicklung N4 des Standbytrafos. UH1 wird auf 12.8V ausgeregelt.
Aus den übrigen 2 Ausgangswicklungen von T2 werden die internen Hilfsspannungen UH4 (+12.8V, primär) sowie UH3 (+30V, sekundär) jeweils durch Gleichrichtung und kleine Längsregler erzeugt. Die +12.8V Hilfsspannung auf der Sekundärseite wird in einem weiteren Längsregler auf 12.0V abgesenkt (Transistor V98), auf ca. 1A strombegrenzt und als Standbyspannung (Ausgang 6) am 50-poligen Stecker ausgegeben. Um im Strombegrenzungsfall eine Überlastung des Regeltransistors zu verhindern, wird bei Überlast für ca. 2 Sekunden die Ausgangsspannung ganz abgeschaltet.

7.1.3 Primär-Leistungsteil

Nach dem Vorfilter mit L32 und C29 gelangt die Netzspannung über einen Leistungswiderstand R75 (zur Einschaltstrombegrenzung) zum Gleichrichter V45 und wird anschließend in den Elkos C31, C32, C23 gepuffert. Zwischen Gleichrichter und Elkos ist ein weiteres Filter mit L2, C22, C33, L28 und C95 angeordnet. Von den Elkos ausgehend wird die Gleichspannung dem Pulssteller, bestehend aus Transistor V28, Drossel L1 und Kommutierungsdiode V64 zugeführt. Die Schaltfrequenz des Pulsstellers von ca. 70kHz wird mit dem Komparator N15 erzeugt. Die Ausgangsspannung ist proportional zum Tastverhältnis des Signals, mit dem der Schalttransistor angesteuert wird. Das Tastverhältnis wird durch die Vorgabe des Hauptreglers über Optokoppler U4 und Stromkomparator N15 abhängig von Ausgangsleistung und Eingangsspannung eingestellt. Die Maximalleistung des Pulsstellers wird durch das höchste erreichbare Tastverhältnis bestimmt und liegt bei ca. 300W. Die resultierende Zwischenspannung (Ausgangsspannung des Pulsstellers) von ca. 140V wird mit einer Halbbrücke zerhackt und der Primärwicklung N1 des Hauptübertragers T1 zugeführt. Die Transistoren V131, V132 der Brücke werden über den Ansteuertrafo T3 mit ebenfalls 70kHz versorgt. Der hier beschriebene Hauptregelkreis wird durch den Regler N18 geschlossen, er hält die Sekundärspannung der Wicklung N2/N3 des Haupttrafos UGR+16 auf konstant 15.8V. Mit dem Optokoppler U2 wird der Pulssteller im Standby-Modus abgeschaltet, ebenso durch das Signal WSP aus der Primär-Steuerung bei Netz-Unterspannung.

7.1.4 Primär-Steuerung

Die Primär-Steuerung generiert die Funktionsabfolge beim Einschalten des Netzteils. Nach dem Anlegen der Netzspannung muß zunächst die Hilfsspannung UH4 auf ca. 10V ansteigen, damit durch die Hilfsspannungsüberwachung mit den Transistoren V22, V23 die weitere Steuerung freigegeben wird. Anschließend wird durch den Komparator N1 die Höhe der Netzspannung ausgewertet. Wenn nach ca. 100ms (R8, C6, C7 an N1) die Höhe der Netzspannung den 230V-Bereich noch nicht erreicht hat, zieht das Relais K1 an, um durch Kaskadierung der Eingangselkos C31, C32 eine Spannungsverdoppelung zu erreichen. Wenn innerhalb der 100ms die Netzspannung den 230V-Bereich erreicht, geht N1 in Selbsthaltung. Damit bleibt das Relais K1 abgefallen und es wird vermieden, daß beim Ausfall der Netzspannung auf den 115V-Modus zurückgeschaltet wird und dabei ein hoher Einschaltstromstoß auftritt.
Nachdem die Spannung an den Eingangselkos auf 240V angestiegen ist, startet die Unterspannungserkennung mit N2 ein Zeitglied (N1, C4, R8, R9) welches nacheinander erst den Widerstand zur Einschaltstrombegrenzung R75 durch K2 Überbrückt und dann über das Steuersignal WSP den Hauptwandler freigibt. Die Unterspannungserkennung N2 ist mit einer Hysterese versehen, damit wird der Hauptwandler erst wieder gesperrt, wenn die gleichgerichtete Netzspannung unter 160V abgesunken ist.

Beim Absinken der gleichgerichteten Netzspannung informiert N2 über den Optokoppler U3 die Auswerteschaltung für das ACFAIL-Signal auf der Sekundärseite.

7.1.5 Sekundär-Leistungsteil

Die vom Primär-Leistungsteil an den Sekundärwicklungen des Haupttrafos bereitgestellten Spannungen werden separat gleichgerichtet und gesiebt. Aus den Wicklungen N2/N3 werden die Oberspannungen UGR+16 für +15.3V, UGR+8 für +7.7V und UGR-16 für -15.3V entnommen. N4/N5 liefert UGR+13 für +12V, N6 die Oberspannung für -30V und N7 liefert UGR38 für den Schaltregler der 24.5/30V. Alle diese Spannungen werden gleichgerichtet und gesiebt, bevor sie den einzelnen Nachreglern zugeführt werden. Die Spannungen für die Ausgänge +15.3V, -15.3V, +12V und -30V werden durch Längsregler nachstabilisiert. Jeder Längsregler besteht aus einem Leistungs-MOSFET als Stellglied mit Strommeßwiderstand und zugehörigem Komparator zur Überwachung der Strombegrenzung.
Die Ausgangsspannung 5.2V wird aus den UGR+16 durch einen Schaltregler nachgetaktet, dessen Schaltfrequenz mit der des Hauptwandlers synchronisiert ist.
Die Ausgangsspannung 24.5V / 30V wird durch einen freischwingenden Schaltregler auf einem eigenen Modul erzeugt. Die Ausgangsspannung dieses Reglers ist durch externe Beschaltung des Signals COD am Ausgangsstecker des Netzteils einstellbar, dabei wird der Spannungsteiler des Regel-Operationsverstärkers N3 umgeschaltet. COD offen: 24.5V, COD mit GND verbunden: 30V.
Die Ausgangsspannung 2 (7.7V) bleibt ungeregelt, da die Anforderungen an die Konstanz gering sind.

7.1.6 Referenzspannungen

Allen Reglern steht eine gemeinsame Referenzspannung REF1 von +5.2V zur Verfügung, welche mit dem integrierten Spannungsregler N18 erzeugt und mit dem Potentiometer R209 abgeglichen wird. Für die Regler der negativen Ausgangsspannungen wird zusätzlich eine Referenz mit dem halben Wert, also +2.6V (REF3) durch Spannungsteilung aus REF1 gewonnen. Die zur Überwachung der +5.2V auf Unterspannung benötigte Referenz von +4.94V (REF5) wird durch N19 gebildet und mit R223 abgeglichen.

7.1.7 Strombegrenzungen / Überspannungsschutz

Wichtigstes Element der Strombegrenzungen und des Überspannungsschutzes ist das sogenannte IREG-Signal. Dieses Signal wirkt direkt auf den Hauptregler ein und kann die Gesamt-Ausgangsleistung des Netzgerätes durch steigendem Pegel reduzieren oder sperren, mit Ausnahme der Standbyspannung. Im IREG-Signal sind die Ausgänge der einzelnen Strombegrenzungen und Überspannungs-Detektoren zusammengefasst.

- Strombegrenzung:
Die Regler der Ausgangsspannungen +5.2V und 24.5 / 30V besitzen jeweils eine unabhängige Strombegrenzung, welche bei Überlast eine Konstantstrom-Charakteristik aufweist.
Das Strombegrenzungsverhalten der Standbyspannung ist im entsprechenden Abschnitt beschrieben.
Die restlichen Ausgänge sind einzeln auf Überstrom überwacht. Dazu wird an einem im jeweiligen Strompfad liegenden Meßwiderstand die abfallende Spannung durch einen Komparator mit einer Referenzspannung verglichen. Übersteigt der Ausgangsstrom den vorgesehenen Wert, wird der Komparator aktiv und legt das IREG-Signal auf high-Potential. Damit wird die Leistung des Hauptwandlers heruntergefahren.

- Überspannungsschutz:
Um bei versehentlichen Kurzschlüssen zwischen den Ausgangsspannnungen Schäden an den Verbrauchern zu vermeiden, wird bei Überspannung an den Ausgängen der Hauptwandler abgeschaltet.
Dazu sind die Ausgangsspannungen +7.7V, +15.3V, 24.5/30V, -15.3V und +12V jeweils über Zener-Dioden auf einen gemeinsamen Arbeitswiderstand R221 gegen Masse gelegt. Überspannung an einem Ausgang führt zu einem Strom in der entsprechenden Zenerdiode und damit zu einem Spannungsabfall an R221. Der Komparator N16 stellt dies fest und schaltet daraufhin das IREG-Signal auf high und sperrt so den Hauptwandler. Siehe auch Hickup-Modus. Der Ausgang -30V wird nicht überwacht. Bei Überspannung an 5.2V wird ein Thyristor gezündet, der die Ausgangsspannung kurzschließt.
Um das Hochlaufen der Ausgangsspannungen bei internen Defekten zu verhindern, wird die Sekundärspannung UGR+16 des Hauptregelkreises separat durch den Komparator N25 überwacht und bei Überschreiten von 17V der Hauptwandler abgeschaltet.

- Hickup-Modus:
Um die interne Schaltung und die angeschlossenen Verbraucher vor hoher Dauerbelastung durch Überstrom/Überspannung zu schützen, wird beim Ansprechen des IREG-Signals ein Zeitglied N26 gestartet, welches den Hauptwandler für einige Sekunden sperrt. Dadurch wird bei dauernder Störung die Ausgangsleistung im Mittel auf unschädlichen Werten gehalten. Siehe auch 1.8 Sekundärlogik.

7.1.8 Sekundär-Logik

- Standbyschalter:
Die mehrfache RC-Beschaltung am Eingang von STANDBY/ON, D2 ermöglicht den Anschluß von Leistungsschaltern und Signalschaltern und dient zur Entprellung des Schalters. Die Schalterstellung wird über den Optokoppler U2 auf die Primär-Seite gemeldet und schaltet direkt den Hauptwandler und den Lüfter.

- ACFAIL# und SYSRESET#:
Die NAND-Gatter aus D3 generieren die Signale ACFAIL# und SYSRESET#.
ACFAIL# wird beim Einschalten des Netzgerätes logisch high, sobald die 5.2V-Ausgangsspannung 4.94V erreicht hat und die 15.3V auf 14.5V angestiegen sind. Bei Netzausfall wird ACFAIL# von der Primär-Steuerung über Optokoppler U3 auf logisch low gesetzt.
SYSRESET# wird beim Einschalten des Netzgerätes gegenüber ACFAIL# durch das RC-Glied R324, C108 um ca. 300ms verzögert. Bei Netzausfall wird SYSRESET# auf logisch low gesetzt, sobald die 5.2V auf 4.94V abgefallen sind.

- Hickup-Modus:
Der bei der Strombegrenzung angesprochene Hickup-Modus beinhaltet folgende Funktionen:
Beim Einschalten des Gerätes wird der Hauptwandler zunächst vom Timer N26 über den Optokoppler U2 freigegeben. Falls nach 2 Sekunden die Ausgangsspannung +15.3V noch nicht auf 14.5V angestiegen ist, wird der Hauptwandler für 6 Sekunden gesperrt und anschließend für einen neuen Zyklus wieder freigegeben. Bei Strombegrenzung oder Überspannung bricht die Ausgangsspannung +15.3V auf Werte unter 14.5V zusammen, es wird der selbe Vorgang ausgelöst.

7.1.9 Sonstiges

Der NTC R248 steuert über V143 die Lüfterdrehzahl abhängig von der Temperatur im Geräteinneren. Bis zu Temperaturen von 50°C wird der Lüfter mit ca. 7V betrieben, diese Spannung steigt bis 60° auf maximal 10V und bleibt dann konstant. Mit dem NTC R184 wurde eine Temperaturabschaltung realisiert, die ab 75°C den Hauptwandler abschaltet.

7.2 Meßgeräte und Hilfsmittel

Regel-Trenntrafo mit mindestens 500VA,
Labornetzgerät mit Gleichspannungsausgang 0..40V,
Gleichspannungsmeßgerät (Digital-Multimeter).

7.3 Fehlersuche

- Achtung:
Arbeiten am offenen Gerät düfen nur von Fachpersonal durchgeführt werden. Zur Stromversorgung muß ein Trenntrafo verwendet werden. Es ist zu beachten, daß Teile der Schaltung Netzspannung führen und der Eingangsteil wegen geladener Eingangselkos auch nach der Unterbrechung der Stromzufuhr noch ca. 2 Minuten berührungsgefährliche Spannung führt !

Zur Erleichterung der Fehlersuche sollten die Ausgangsspannungen des Netzgerätes mit Digitalvoltmetern überwacht werden. Bei der Beschreibung der Fehlerursachen werden meist mehrere mögliche Bauteildefekte aufgezeigt, die zum entsprechenden Fehlerbild führen können. Diese Bauteile sind zu prüfen und ggf. zu tauschen. Es sind dabei die in den Stücklisten angegebenen Typen zu verwenden.

Fehler: Eingangssicherung spricht bei Anlegen der Netzspannung an.
Ursachen:
- Schalttransistor V28 des Pulsstellers defekt,
- Freilaufdiode V64 defekt,
- Diode V63 defekt,
- Gleichrichter V45 defekt.

Fehler: keine Ausgangsspannung vorhanden, Lüfter läuft nicht.
Ursachen:
- Sicherungswiderstand R211 defekt,
- Schalttransistor V116 des Standbywandlers defekt.

Fehler: Nur Standbyspannung vorhanden.
Ursachen:
- Unterbrechung der Zuleitung vom Standbyschalter,
- Unterbrechung oder Kurzschluß auf dem Signalweg vom Anschluß des Standbyschalters über die Entprellschaltung vor D2, über Optokoppler U2 zum Pulssteller,
- Pegel des WSP-Signals im Pulssteller hat 0V: Defekt in der Primärlogik,
- Pegel des IREG-Signals größer 0V: Quelle suchen, siehe Fehler Ausgangsspannungen im Hickup-Modus.

Fehler: Ausgangsspannungen im Hickup-Modus.
Ursachen:
- Defekt einer Strombegrenzung oder in der Überspannungsschutzschaltung.
Alle einspeisenden Komparatoren sind über Dioden voneinander entkoppelt und können daher einzeln untersucht werden. Es kommen haupsächlich die Komparatoren der Strombegrenzung der Analogregler in Frage, welche nachfolgend aufgelistet sind:

+15.3V : N22 Pin 1,
+7.7V : N17 Pin 1,
-30V : N21 Pin 1,
-15.3V : N20 Pin 7,
+12V : N14 Pin 7,
Überspannung: N16 Pin 7.

- Eine Fehlfunktion der Stromkomparatoren kann auf eine Unterbrechung des Strommesswiderstandes oder einen fehlerhaften Widerstand im Spannungsteiler am Eingang des Komparators zurückzuführen sein.
- Eine Fehlfunktion durch die Überspannungserkennung kann durch einen kurzgeschlossenen Regeltransistor oder durch einen fehlerhaften Widerstand im Regler-Spannungsteiler hervorgerufen werden.

Fehler: Eine Ausgangsspannung fehlt.
Ursachen:
- Unterbrechung der Wicklung des Trafos,
- Defekt von Gleichrichterdioden,
- Defekt von Längsregler-Transistoren,
- unterbrochener Strommeßwiderstand,
- fehlerhafter Widerstand im Regler-Spannungsteiler.

7.4 Inbetriebnahme

Die Netzspannung wird über einen Regeltrafo zugeführt. Spannung auf 110V hochdrehen, Gerät schaltet ein. Am Gerät ohne Last mit R209 die Ausgangsspannung 1 auf 5.20V einstellen. Mit R223 die Spannung an Pin 1 des 50-poligen Steckers 4.94V einstellen. Netzspannung auf 230V hochdrehen, Gerät schaltet auf 230V-Betrieb um (internes Relais fällt hörbar ab) und läuft weiter. Alle Ausgangsspannungen müssen jetzt entsprechend der Beschreibung der externen Schnittstellen vorhanden sein. Zur Prüfung der Funktion des Überspannungsschutzes wird bei laufendem Gerät mit einem Labornetzgerät von außen Überspannung simuliert. Betroffen sind +5.2V, +7.7V, +15.3V, -15.3V, +12V und 24.5/30V. Dazu wird an den jeweiligen Ausgang eine ca. 25% über dem Nennwert liegende Spannung angelegt, das Netzgerät muß dann sofort abschalten.

7.5 Zerlegung und Zusammenbau

Zerlegung:
6 Schrauben umlaufend an der Haube lösen, Haube nach hinten abziehen.
4 Schrauben an der Front des Gerätes lösen, Steckker des Lüfteranschlusses und der Verbindung vom Netzanschluß zur Leiterplatte abziehen.
Es sind jetzt alle wichtigen Punkte für Messungen zugänglich.
Zusammenbau:
Nachdem darauf geachtet wurde, daß die Leiterplatten-Isolierungen vorhanden sind, erfolgt der Zusammenbau in genau der umgekehrten Reihenfolge wie die Zerlegung.

7.6 Externe Schnittstellen über die 50-polige SUB-D-Buchse

PIN-Nr.	Bezeichnung	Ein/Aus	Bemerkung
1	REF3	A	interne Referenz 2.6V
17	STANDBY/ON	E	Aktivierungseingang LOW (GND) = NT ein
33	SYSRESET#	A	System-Reset, HCT-Pegel
50	ACFAIL#	A	NMI-Interrupt, HCT-Pegel
16	COD	E	24.5/30V-Umschaltung, offen: 24.5V, Verbindung m. GND: 30V
32	-	-	frei
49	TSENSE	A	Temperaturfühlerausgang 100kOhm-NTC gegen GND
31	+12V STANDBY	A	11.65 .. 12.35VDC / 0.4A
48	-30V	A	-31 .. -29VDC / 0.1A
15	GND	-	Netzteilmasse
30, 47	+12V	A	11.65 .. 12.35VDC / 2A
13, 14	GND	-	Netzteilmasse
12, 28	-15.3V	A	-15.75 .. -14.85VDC / 2.6A
29, 46	GND	-	Netzteilmasse
7, 8, 9, 24, 25, 41, 42	+5.2V	A	5.15 .. 5.25VDC / 10A
10, 11, 26, 27, 43, 44, 45	GND	-	Netzteilmasse
5, 22, 39	+7.7V	A	7.45 .. 7.95VDC / 3.5A
6, 23, 40	GND	-	Netzteilmasse
3, 19, 36, 37	+15.3V	A	14.85 .. 15.75VDC / 5.2A
4, 20, 21, 38	GND	-	Netzteilmasse
18	24.5/30V	A	23.75 .. 25.25VDC / 0.6A, bzw. 29 .. 31VDC / 0.5A
2	GND	-	Netzteilmasse
34,35	-	-	Testpins, unbeschaltet

Power Supply Unit IN 1039.1304.00

This module is a subsupplied part. Thus the documentation does not contain the usual R&S identifications. In the case of complaint, we recommend to replace it by a new module or an exchange module.

Order designation:	New part:	IN 1039.1304.00
	Exchange part:	IN 1039.1304.98

Documents of the manufacturer are attached to our documentation.

Repair work at the module may only be executed by trained staff, observing the safety standards applying to works at electronic circuits.

In order to avoid the destruction of ICs due to static charge, antistatic methods (ESD measures) always have to be observed.

In the case of repair down to component level, only original parts may be used. The use of non-original components or the inappropriate execution of repair work might violate safety provisions and lead to liability claims to be refused.

Modules can be obtained directly via the appropriate R&S representative or via Rohde & Schwarz, Zentralservice München.

Address:

Rohde & Schwarz GmbH & Co. KG
Zentralservice 3MSL
Mühldorfstr. 15
81614 München

Tel.: 0049-89-41 29 28 60
Fax.: 0049-89-41 29 33 06

1998-03-20

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7. Checking and Repair of the Module

7.1. Function Description

7.1.1 Overview

The rectified, filtered AC supply voltage is down-converted to an intermediate voltage of approx. 140 V using a pulse controller. This intermediate voltage is subsequently chopped by a push-pull stage and applied to the main transformer T1, the secondary windings of which generate 7 out of 8 output voltages by means of series regulators and switching regulators. The standby voltage as well as the internal auxiliary voltages are derived from a separate transformer clocked on the primary side.
The instrument is automatically set to the AC supply voltage value (115/230 V). A filter for suppression of conducted interference is provided at the input. Reliable isolation is achieved by using transformers for power conversion and VDE optocouplers for signal conversion.
The outputs of the secondary circuit are protected against overload and overvoltage. Cooling of the instrument is provided by a thermostat-controlled fan, which achieves its maximum speed only at high ambient temperatures.

7.1.2 Auxiliary and Standby Circuit

The standby transformer is directly operated from the rectified AC supply voltage, i.e. it is in operation as long as the AC supply voltage is applied and the power switch is switched on. The transformer operates in a freely oscillating mode. The oscillations are generated by the components arranged around switching transistor V116 and standby transformer T2. The control is performed by operational amplifier N17 following rectification and filtering of the voltage UH1 from the secondary winding N4 of the standby transformer. UH1 is adjusted to 12.8 V.
The remaining two output windings of T2 are used to generate the internal auxiliary voltages UH4 (+12.8 V, primary) as well as UH3 (+30 V, secondary) by means of rectification and using small series regulators. The +12.8-V auxiliary voltage of the secondary winding is reduced to 12.0 V in a further series regulator (transistor V98), current-limited to approx. 1 A and output as standby voltage (output 6) at the 50-contact connector. In order to prevent the variable transistor from being overloaded in the case of current limiting, the output voltage is totally cut off for approx. 2 seconds in the case of overload.

7.1.3 Primary Power Unit

After the preliminary filter with L32 and C29, the AC supply voltage is taken via a power resistor R75 (for inrush current limiting) to rectifier V45 and is subsequently buffered in the electrolytic capacitors C31, C32, C23. A further filter with L2, C22, C33, L28 and C95 is connected between rectifier and electrolytic capacitors. The DC voltage is applied from the electrolytic capacitors to the pulse controller consisting of transistor V28, choke L1 and commutation diode V64. The switching frequency of the pulse controller of approx. 70 kHz is produced by means of comparator N15. The output voltage is proportional to the pulse duty factor of the signal applied to the switching transistor. The pulse duty factor is set by the main regulator via optocoupler U4 and current comparator N15 depending on the output power and input voltage. The maximum power of the pulse controller is determined by the highest possible pulse duty factor and lies at approx. 300 W. The resulting intermediate voltage (output voltage of the pulse controller) of approx. 140 V is chopped by means of a half-bridge and applied to the primary winding N1 of main transformer T1. Transistors V131, V132 of the bridge are also supplied with 70 kHz via control transformer T3. The main control loop described here is closed by regulator N18, which maintains the secondary voltage of winding N2/N3 of the main transformer UGR+16 at a constant voltage of 15.8 V. Using the optocoupler U2, the pulse controller is switched off in standby mode; the same is achieved by the signal WSP from the primary control in the case of undervoltage.

7.1.4 Primary Control

The primary control generates the sequence of functions when the power supply unit is switched on. After the AC supply voltage has been applied, the auxiliary voltage UH4 must first increase to approx. 10 V so that the further control is enabled by the auxiliary voltage monitoring circuit with transistors V22, V23. Then the AC supply voltage value is evaluated by comparator N1. If the AC supply voltage value has not yet reached the 230-V range after approx. 100 ms (R8, C6, C7 at N1), relay K1 switches in order to achieve doubling of the voltage by cascading the input electrolytic capacitors C31, C32. If the AC supply voltage reaches the 230-V range within 100 ms, N1 remains locked in. Thus, relay K1 remains dropped out, avoiding that the 155-V mode is selected again when the AC supply voltage fails, which would involve a high current inrush.
After the voltage at the input electrolytic capacitors has increased to 240 V, the undervoltage sensing circuit N2 activates a timer (N1, C4, R8, R9) which first short-circuits the resistor R75 for inrush current limiting via K2 and then enables the main transformer via the control signal WSP. The undervoltage sensing device N2 is provided with a hysteresis so that the main transformer is only disabled again when the rectified AC supply voltage has fallen below 160 V.

When the rectified AC supply voltage decreases, N2 informs the evaluation circuit for the ACFAIL signal in the secondary circuit via optocoupler U3.

7.1.5 Secondary Power Unit

The voltages provided by the primary power unit at the secondary windings of the main transformer are separately rectified and filtered. The windings N2/N3 deliver the high-end voltages UGR+16 for +15.3V, UGR+8 for +7.7V and UGR-16 for -15.3V. N4/N5 provides UGR+13 for +12 V, N6 provides the high-end voltage for -30 V and N7 UGR38 for the switching regulator of the 24.5/30 V. These voltages are all rectified and filtered before being applied to the subsequent regulators.
The voltages for the outputs +15.3 V, -15.3 V, +12 V and -30 V are subsequently stabilized by series regulators. Each series regulator consists of a power MOSFET as regulating element with shunt and associated comparator for monitoring the current limiting. The 5.2-V output voltage is regulated by a switching regulator from the UGR+16, the switching frequency of which is synchronized with that of the main transformer.
The output voltage 24.5 V/30 V is generated on a separate module by a freely oscillating switching regulator. The output voltage of this regulator can be set by external connection of the signal COD at the output connector of the power supply, the voltage divider of the variable operational amplifier N3 being switched over. COD open: 24.5 V, COD connected to GND: 30 V.

The output voltage 2 (7.7 V) is not regulated, since only low requirements are placed on stability.

7.1.6 Reference Voltages

All regulators are provided with a common reference voltage REF1 of +5.2 V, which is generated by means of the integrated voltage regulator N18 and adjusted using potentiometer R209. For the regulators of the negative output voltages, a reference with half the value, i.e. +2.6 V (REF3) is additionally obtained from REF1 by voltage division. The reference voltage of +4.94 V (REF5) required for monitoring the +5.2 V with respect to undervoltage is formed by N19 and adjusted by means of R223.

7.1.7 Current Limiting / Overvoltage Protection

The so-called IREG signal constitutes the core of current limiting and overvoltage protection. This signal directly acts on the main regulator, reducing or disabling the total output power of the power supply by increasing the level; this is not true for the standby voltage. The IREG signal combines the outputs of the individual current limitations and overvoltage detectors.

- Current limiting:
The regulators of the output voltages +5.2 V and 24.5/30 V are provided with an independent current limiting facility each that features a constant-current characteristic in the case of overload.
The response of the standby voltage to current limiting is described in the respective section.
The remaining outputs are separately monitored with respect to overcurrent. For this purpose, the voltage dropping across a shunt in the respective current path is compared with a reference voltage by a comparator. If the output current exceeds the predetermined value, the comparator is activated, applying the IREG signal to high potential and thus reducing the power of the main transformer.

- Overvoltage protection:
In order to avoid damage to the loads in the case of accidental short-circuits between the output voltages, the main transformer is deactivated in the case of overvoltage at the outputs.
To this end, the output voltages +7.7 V, +15.3 V, 24.5/30 V, -15.3 V and +12 V are each applied via zener diodes to a common load resistance R221 and grounded. Overvoltage at an output causes a current flow in the appropriate zener diode and thus a voltage drop across R221. As a result of this, comparator N16 switches the IREG signal to high, disabling the main transformer. See also hickup mode. The -30-V output is not monitored. In the case of overvoltage at 5.2 V, a thyristor is triggered, short-circuiting the output voltage.

In order to prevent rising of the output voltages in the case of internal faults, the secondary voltage UGR+16 of the main control loop is separately monitored by comparator N25 and the main transformer deactivated when 17 V are exceeded.

- Hickup mode:
In order to protect the internal circuit and the connected loads from high continuous load due to overcurrent/overvoltage, a timer N26 is started when the IREG signal responds, disabling the main transformer for a few seconds. Thus the output power is maintained at acceptable values on average in the case of continuous disturbance. See also 1.8 Secondary Logic.

7.1.8 Secondary Logic

- Standby switch:
The multiple RC connection at the input of STANDBY/ON, D2 permits to connect power switches and signal switches and is used for debouncing the switch. The switch position is signalled to the primary side via optocoupler U2 and directly acts on the main transformer and the fan.

- ACFAIL# and SYSRESET#:
The NAND gates consisting of D3 generate the signals ACFAIL# and SYSRESET#.

ACFAIL# goes logic high after switching on of the power supply as soon as the 5.2-V output voltage has achieved 4.94 V and the 15.3-V output voltage has increased to 14.5 V. On power failure, ACFAIL# is set to logic low by the primary control via optocoupler U3.
When the power supply unit is switched on, SYSRESET# is delayed by approx. 300 ms by the RC section R324, C108 compared with ACFAIL#. On power failure, SYSRESET# is set to logic low as soon as the 5.2-V voltage has decreased to 4.94 V.

- Hickup mode:
The hickup mode mentioned in connection with current limiting includes the following functions:
When the unit is switched on, the main transformer is first enabled by timer N26 via optocoupler U2. If the +15.3-V output voltage has not yet increased to 14.5 V after 2 seconds, the main transformer is disabled for 6 seconds and subsequently enabled again for a new cycle. In the case of current limiting or overvoltage, the +15.3-V output voltage collapses to values below 14.5 V, and the same process is released.

7.1.9 Miscellaneous

The NTC R248 controls the fan speed via V143 depending on the temperature inside the instrument. At temperatures below 50°C, the fan is operated with approx. 7 V, this voltage increases to maximally 10 V at temperatures up to 60° and then remains constant. Using the NTC R184, an overtemperature protection has been implemented that deactivates the main transformer at more than 75°C.

7.2 Measuring Instruments and Auxiliary Equipment

Variable isolating transformer with at least 500 VA,
Laboratory power supply with DC voltage output 0 to 40 V,
DC voltmeter (digital multimeter).

7.3 Troubleshooting

- Note:
Repair work on the open instrument may only be carried by trained personnel. An isolating transformer must be used for current supply. Note that the circuit includes live parts and that, due to charged electrolytic capacitors, the input section carries dangerous contact voltages for approx. another 2 minutes even after the current supply has been interrupted!

To facilitate troubleshooting, the output voltages of the power supply should be monitored using digital voltmeters. The description of the causes of faults in most cases indicates several possible faults of components which may be responsible for the respective error symptom. Check these components and replace, if necessary, using the types of components indicated in the part lists.

Fault: Input fuse is blown when AC supply voltage is applied.
Causes:
- Switching transistor V28 of pulse controller faulty,
- Free-running diode V64 faulty,
- Diode V63 faulty,
- Rectifier V45 faulty.

Fault: no output voltage, fan does not run.
Causes:
- Fusing resistor R211 faulty,
- Switching transistor V116 of standby transformer faulty.

Fault: Only standby voltage provided.
Causes:
- Open circuit in the lead from the standby switch,
- Open or short circuit in the signal path from the terminal of the standby switch via the debouncing circuit preceding D2, via optocoupler U2 to the pulse controller,
- Level of WSP signal in the pulse controller is 0 V: Fault in the primary logic,
- Level of IREG signal exceeds 0 V: Find the source, see fault output voltages in hickup mode.

Fault: output voltages in hickup mode.
Causes:
- Fault in current limiting or overvoltage protection circuit.
All feeding comparators are decoupled from each other via diodes and can therefore be investigated separately. The comparators of the current limitation of the analog regulators are the main possible causes; they are listed in the following:

+15.3V : N22 pin 1,
+7.7V : N17 pin 1,
-30V : N21 pin 1,
-15.3V : N20 pin 7,
+12V : N14 pin 7,
Overvoltage: N16 pin 7.

- A faulty function of the current comparators may be due to an open circuit in the shunt or a faulty resistor in the voltage divider at the input of the comparator.
- A faulty function due to overvoltage sensing can be caused by a short circuit in the variable transistor or a faulty resistor in the regulator voltage divider.

Fault: Missing output voltage.
Causes:
- Open circuit in the winding of the transformer,
- Faulty rectifier diodes,
- Faulty series regulator transistors,
- Open circuit in shunt,
- Faulty resistor in regulator voltage divider.

7.4 Putting into Operation

The AC supply voltage is delivered via a variable transformer. Increase the voltage to 110 V, the instrument is activated. Use R209 to set the output voltage 1 to 5.20 V on the instrument without load connected. Use R223 to set the voltage at pin 1 of the 50-contact connector to 4.94 V. Increase the AC supply voltage to 230 V, instrument switches over to 230-V operation (switching of internal relay can be heard) and continues running. All output voltages must then be provided according to the description of the external interfaces. To check proper functioning of the overvoltage protection, an overvoltage is simulated from outside using a laboratory power supply with the instrument running. The involved voltages are +5.2 V, +7.7 V, +15.3 V, -15.3 V, +12 V and 24.5/30 V. For this purpose, apply a voltage that is approx. 25% above the rated value to the respective output, the power supply must shut down immediately.

7.5 Disassembly and Assembly

Disassembly:
Loosen 6 screws on the circumference of the cover, pull off the cover towards the rear.
Loosen 4 screws at the front of the instrument, remove the connector of the fan terminal and of the connection from the power terminal to the printed circuit board.
The major test points are then accessible.
Assembly:
Check that the printed circuit boards are properly insulated.
For the assembly, proceed in the reverse order.

7.6 External Interfaces via the 50-contact SUB-D Connector

PIN No.	Designation	Input/ Output	Remark
1	REF3	O	Internal reference 2.6V
17	STANDBY/ON	I	Activating input LOW (GND) = NT on
33	SYSRESET#	O	System reset, HCT level
50	ACFAIL#	O	NMI Interrupt, HCT level
16	COD	I	24.5/30V switchover, open: 24.5V, Connection to GND: 30V
32	-	-	vacant
49	TSENSE	A	Temperature sensor output 100kohm NTC against GND
31	+12V STANDBY	O	11.65 .. 12.35VDC / 0.4A
48	-30V	O	-31 .. -29VDC / 0.1A
15	GND	-	Ground of power supply
30, 47	+12V	O	11.65 .. 12.35VDC / 2A
13, 14	GND	-	Ground of power supply
12, 28	-15.3V	A	-15.75 .. -14.85VDC / 2.6A
29, 46	GND	-	Ground of power supply
7, 8, 9, 24, 25, 41, 42	+5.2V	A	5.15 .. 5.25VDC / 10A
10, 11, 26, 27, 43, 44, 45	GND	-	Ground of power supply
5, 22, 39	+7.7V	A	7.45 .. 7.95VDC / 3.5A
6, 23, 40	GND	-	Ground of power supply
3, 19, 36, 37	+15.3V	A	14.85 .. 15.75VDC / 5.2A
4, 20, 21, 38	GND	-	Ground of power supply
18	24.5/30V	A	23.75 .. 25.25VDC / 0.6A, or 29 .. 31VDC / 0.5A
2	GND	-	Ground of power supply
34,35	-	-	Test pins, not connected

ROHDE&SCHWARZ

Schaltteillisten
numerisch geordnet
Part lists
in numerical order
Listes des pièces détachées
par numéros de référence

(R 29500 Bl 3)
095.1000 Bl 3

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.21*.00-01	C	6	CE-120U/16V-64	E5_v	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	C	7	CK-47P/1000V-70	E2_v	KERKO 47P 1000V 10% RAU	ROEDERSTEIN	CERAMIC DISC CAPACITOR RAU470KBACRA(RC,LA,LC)K OR RAU470KBACFOK
AP-238.21*.00-01	C	8	CF-1N/250V-62	D3_v	FOKO 1N 250V 20% FKS2	WIMA	POLYESTER FILM CAPACITOR FKS2 1N- 250VDC/160VAC 20% TAPED
AP-238.21*.00-01	C	9	CE-120U/16V-64	E3_v	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	C	10	CK-470P/1000V-R8	E2_v	KERKO 470P 1000V 20% RAZ	ROEDERSTEIN	CERAMIC DISC CAPACITOR RAZ471MBACRA(RC,LA,LC)K OR RAZ471MBACFOK
AP-238.21*.00-01	C	11	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.21*.00-01	C	13	CF-1N/100V-33	E4_v	FOKO 1N 100V 2.5% KP1830	ROEDERSTEIN	POLYPROPYLENE FILM CAPACITOR KP 1830 2.5% - 210/01 3 W
AP-238.21*.00-01	C	16	CE-120U/16V-64	E4_v	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	C	22	CY-4N7/400V-95	H5_h	Y-KOPPL 4N7 400V 20% WKP	ROEDERSTEIN	CERAMIC DISC CAPACITOR CLASS Y WKP600 4N7 400V 20% - WKP472MCPEJOK
AP-238.21*.00-01	C	23	CE-220U/400V-NA	G3_v	ELKO 220U 400V 31X37 KMH	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR KMH-VN-220U/400V-M-30X35
AP-238.21*.00-01	C	24	CM-1U/100V-W7	G4_v	MEKO 1U 100V 20% MKS2-I	WIMA	METALL. POLYESTER FILM CAPACITOR MKS2-I 1U/100V 20% TAPED
AP-238.21*.00-01	C	25	CM-1U/100V-W7	F4_v	MEKO 1U 100V 20% MKS2-I	WIMA	METALL. POLYESTER FILM CAPACITOR MKS2-I 1U/100V 20% TAPED
AP-238.21*.00-01	C	28	CM-2U2/250V-50	F3_h	MEKO 2U2 250V 20% MKT1822	ROEDERSTEIN	METALL. POLYESTER FILM CAPACITOR MKT1822-522/25 6
AP-238.21*.00-01	C	33	CY-4N7/400V-95	H5_h	Y-KOPPL 4N7 400V 20% WKP	ROEDERSTEIN	CERAMIC DISC CAPACITOR CLASS Y WKP600 4N7 400V 20% - WKP472MCPEJOK
AP-238.21*.00-01	C	43	CE-1500U/25V-64	B4_h	ELKO 1500U 25V 13X31 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1500 12.5X30
AP-238.21*.00-01	C	44	CE-1500U/25V-64	A2_h	ELKO 1500U 25V 13X31 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1500 12.5X30
AP-238.21*.00-01	C	45	CE-1000U/10V-64	B3_h	ELKO 1000U 10V 10.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF10VB-1000 10X20 TPA OR WITHOUT TPA
AP-238.21*.00-01	C	52	CE-100U/50V-65	A1_h	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.21*.00-01	C	59	CE-100U/50V-65	C3_h	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.21*.00-01	C	69	CE-220U/25V-64	E5_v	ELKO 220U 25V 8.5X16 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF25VB-220 8X15 TPA3.5 OR WITHOUT TPA
AP-238.21*.00-01	C	70	CV-1N/63V-C2		SMD-VIELKO 1N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 1NF/63V X7R 10% - 2222 581 16614
AP-238.21*.00-01	C	71	CK-2N2/500V-35	D6_h	KERKO 2N2 500V 10% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 K2000 2N2 10% 500V TAPED - 2222 655 53222
AP-238.21*.00-01	C	72	CM-100N/400V-40	D6_v	MEKO 100N 400V 20% MKT1.60	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.60 MI 3100 AA 00 M
AP-238.21*.00-01	C	73	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.21*.00-01	C	74	CV-470P/63V-C1		SMD-VIELKO 470P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 470PF/63V NP0 5% - 2222 863 15471
AP-238.21*.00-01	C	75	CE-820U/16V-64	B3_h	ELKO 820U 16V 10.5X26 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 16 VB-820 10X25
AP-238.21*.00-01	C	79	CM-100N/63V-20	E5_v	MEKO 100N 63V 20% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 DC 3100 191/201 M
AP-238.21*.00-01	C	80	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.21*.00-01	C	81	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.21*.00-01	C	82	CV-47N/63V-C2		SMD-VIELKO 47N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 47NF/63V X7R 10% - 2222 581 16636
AP-238.21*.00-01	C	83	CE-220U/35V-74	C4_h	ELKO 220U 35V 8.5X22 PL	NICHICON	ELECTROLYTIC CAPACITOR UPL1V221MPH
AP-238.21*.00-01	C	84	CE-330U/25V-64	C3_h	ELKO 330U 25V 8.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF25VB-330 8X20 TPA3.5 OR WITHOUT TPA
AP-238.21*.00-01	C	85	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.21*.00-01	C	86	CE-220U/35V-74	B4_h	ELKO 220U 35V 8.5X22 PL	NICHICON	ELECTROLYTIC CAPACITOR UPL1V221MPH
AP-238.21*.00-01	C	87	CE-120U/16V-64	B5_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	C	88	CE-22U/50V-30	B5_h	ELKO 22U 50V 5.5X12 RLL	PHILIPS COMPONENTS	ELECTROLYTIC CAPACITOR RLL 22U/50V - 2222 116 11229
AP-238.21*.00-01	C	89	CV-100P/63V-C1		SMD-VIELKO 100P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100PF/63V NP0 5% - 2222 863 15101
AP-238.21*.00-01	C	90	CV-1N/63V-C2		SMD-VIELKO 1N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 1NF/63V X7R 10% - 2222 581 16614
AP-238.21*.00-01	C	91	CV-1N/63V-C2		SMD-VIELKO 1N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 1NF/63V X7R 10% - 2222 581 16614
AP-238.21*.00-01	C	92	CK-47P/1000V-70	B5_v	KERKO 47P 1000V 10% RAU	ROEDERSTEIN	CERAMIC DISC CAPACITOR RAU470KBACRA(RC,LA,LC)K OR RAU470KBACFOK
AP-238.21*.00-01	C	93	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.21*.00-01	C	94	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.21*.00-01	C	95	CV-10N/500V-C7		SMD-VIELKO 10N 500V 10% X7R 1210	VITRAMON	CERAM. MULTILAYER CHIP CAPACITOR 10NF/500V X7R 10% - VJ1210Y103KXET
AP-238.21*.00-01	C	96	CV-10N/500V-C7		SMD-VIELKO 10N 500V 10% X7R 1210	VITRAMON	CERAM. MULTILAYER CHIP CAPACITOR 10NF/500V X7R 10% - VJ1210Y103KXET
AP-238.21*.00-01	C	97	CE-120U/16V-64	B5_v	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	C	98	CE-120U/16V-64	B5_v	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.21*.00-01	D	1	D-4001BCM-C2		SMD-NOR 2INP 4-FACH SO14	NATIONAL SEMICOND.	QUAD 2-INPUT NOR CD4001BCM
AP-238.21*.00-01	D	2	D-4013BCM-C2		SMD-D-FLIP-FLOP 2-FACH SO14	NATIONAL SEMICOND.	DUAL D-FLIP-FLOP CD4013BCM
AP-238.21*.00-01	D	3	D-4013BCM-C2		SMD-D-FLIP-FLOP 2-FACH SO14	NATIONAL SEMICOND.	DUAL D-FLIP-FLOP CD4013BCM
AP-238.21*.00-01	E	1	AP-238.212.00-01		SMDM-BLP TYP A	PULS MÜNCHEN	
AP-238.21*.00-01	E	1	AP-238.213.00-01	E6_h	SMDM-ALP TYP A	PULS MÜNCHEN	
AP-238.21*.00-01	E	1	EP-238.215.00-10		SMDM-LP 208X131X1.6 35U 2LAG	WALTER	
AP-238.21*.00-01	E	4	ES-STEZU3-10		STECKZUNGE 2.8X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 2.8X0.8 - 03785A/0.8 BZ SN OR MS SN
AP-238.21*.00-01	E	5	ES-STEZU3-10		STECKZUNGE 2.8X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 2.8X0.8 - 03785A/0.8 BZ SN OR MS SN
AP-238.21*.00-01	E	16	WI-238.810.00-10	B2_h	KABEL BL 1.34QMM STEHU6 240MM ELH	MD ELEKTRONIK	
AP-238.21*.00-01	E	18	XF-212.780.00-20	B1_h	STECKER 7POL MIT KABEL UND ELH	MD ELEKTRONIK	
AP-238.21*.00-01	E	23	WI-238.820.00-10	B2_h	KABEL RT 1.34QMM STEHU6 100MM ELH	MD ELEKTRONIK	
AP-238.21*.00-01	E	28	WI-238.870.00-10	I4_h	KABEL RT 0.86QMM STEHU6 70MM ELH	MD ELEKTRONIK	
AP-238.21*.00-01	E	29	WI-238.870.01-10	I4_h	KABEL BL 0.86QMM STEHU6 70MM ELH	MD ELEKTRONIK	
AP-238.21*.00-01	F	31	ES-RM254-61	F2_h	DRAHTBRÜCKE RM25.4 DM0.52 ISOLIERT	QUICK-OHM	WIRE JUMPER INSULATED RM25.4 DM0.52 - DB052-2540G

1039.1304.00 SA
Bl. 1+
AI: 01

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-239.21*.00-01	E	32	ES-RM254-80	F3_h	DRAHTBRÜCKE RM25.4 DM0.6 ISOLIERT	BAYKRA	WIRE JUMPER RM25.4 X SL2.9(AB BT-UK) X DM0.60 INSULATED PVC105C
AP-239.21*.00-01	E	33	AH-238.670.00-01	E6_v	KÜHLBLECH BESTÜCKT STANDBY	PULS MÜNCHEN	
AP-239.21*.00-01	E	34	ES-RM356-82	A2_v	DRAHTBRÜCKE RM35.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM35.6 X 4 X 1.00MM INSULATED
AP-239.21*.00-01	E	36	ES-RM356-82		DRAHTBRÜCKE RM35.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM35.6 X 4 X 1.00MM INSULATED
AP-239.21*.00-01	L	1	LB-33U/A5-10	D3 v	HF-DROSSEL 33UH 0A5 4X9.2 B78108	SIEMENS	HF-CHOKE 33UH 0.5A - B78108-S1333-K
AP-239.21*.00-01	L	2	LY-2X6M8/2A-10	H6_v	STROMKOMP.DR 2X6M8H 2A 31X18X33	SIEMENS	CURRENT COMPENSATED CHOKE 2X6.8MH/2A - B82724-J2202-N1
AP-239.21*.00-01	L	3	LE-238.550.00-20	G2_v	E42/15-DROSSEL 130UH 9A	EGSTON	
AP-239.21*.00-01	L	25	LB-10U/A68-10	C4_v	HF-DROSSEL 10UH 0A68 4X9.2 B78108	SIEMENS	HF-CHOKE 10UH 0.68A - B78108-S1103-K
AP-239.21*.00-01	L	26	LB-10U/A68-10	C4_v	HF-DROSSEL 10UH 0A68 4X9.2 B78108	SIEMENS	HF-CHOKE 10UH 0.68A - B78108-S1103-K
AP-239.21*.00-01	L	27	LB-10U/A68-10	B4_v	HF-DROSSEL 10UH 0A68 4X9.2 B78108	SIEMENS	HF-CHOKE 10UH 0.68A - B78108-S1103-K
AP-239.21*.00-01	L	28	LB-192.550.00-10	G4_h	STABKERNDROSSEL 1U1H 7A 4X13.3	HAGN	
AP-239.21*.00-01	N	4	N-431CLP-13	E4_v	SPG.REF 2V495 0A1 1% TO92	MOTOROLA	VOLTAGE REFERENCE TL431CLPRA - SELECTED UNDER 936.014.01
AP-239.21*.00-01	N	15	N-339D-C1		SMD-KOMP 4-FACH 36V 5MV 6MA SO14	MOTOROLA	QUAD COMPARATOR LM339D
AP-239.21*.00-01	N	17	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-239.21*.00-01	N	18	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-239.21*.00-01	N	19	N-431CLP-13	B4_v	SPG.REF 2V495 0A1 1% TO92	MOTOROLA	VOLTAGE REFERENCE TL431CLPRA - SELECTED UNDER 936.014.01
AP-239.21*.00-01	R	29	RM-1R00-10	E2_h	MET.WID 1R00 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R00 1% TK100 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	30	RM-4K22-10	E3_h	MET.WID 4K22 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 4K22 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	31	RM-10R0-10	E2_h	MET.WID 10R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 10R0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	32	RM-249R0-10	E3_v	MET.WID 249R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 249R0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	33	RM-20R5-C1		SMD-METWID 20R5 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 20R5
AP-239.21*.00-01	R	34	RW-0R050/2W4-L2	F2_h	DRAHTWID 0R050 1% 2.4W +TK75 LVR3	DALE	WIRE-WOUND RESISTOR LVR-3 0.050R 1%
AP-239.21*.00-01	R	35	RM-51R1-10	E3_v	MET.WID 51R1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 51R1 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	36	RW-330R/1W-40	E3_v	M-OXIDWID 330R 5% 1.0W TK200 WK4	ROEDERSTEIN	METALOXIDE RESISTOR WK4 330R J B
AP-239.21*.00-01	R	37	RM-3K83-C1		SMD-METWID 3K83 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K83
AP-239.21*.00-01	R	38	RM-825K0-10	F3_h	MET.WID 825K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 825K0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	39	RM-787K0-10	F3_h	MET.WID 787K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 787K0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	40	RM-4K42-10	F3_h	MET.WID 4K42 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 4K42 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	41	RM-348R0-10	E3_v	MET.WID 348R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 348R0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	42	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-239.21*.00-01	R	43	RM-3K83-C1		SMD-METWID 3K83 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K83
AP-239.21*.00-01	R	44	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.21*.00-01	R	45	RM-14K7-C1		SMD-METWID 14K7 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 14K7
AP-239.21*.00-01	R	46	RM-1K87-C1		SMD-METWID 1K87 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K87
AP-239.21*.00-01	R	47	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.21*.00-01	R	48	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.21*.00-01	R	49	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-239.21*.00-01	R	50	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.21*.00-01	R	51	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.21*.00-01	R	52	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-239.21*.00-01	R	53	RM-22K6-C1		SMD-METWID 22K6 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 22K6
AP-239.21*.00-01	R	69	RW-0R012-D2	F4_h	WIDERST.DRAHT 0R012 1.0X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM1.0 RM15.24 SL=4.4 - 16633
AP-239.21*.00-01	R	70	RM-8R25-C1		SMD-METWID 8R25 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 8R25
AP-239.21*.00-01	R	71	RK-8R2-10	F4_h	KOHLE.WID 8R2 5% 0.33W +TK200 CR25	PHILIPS COMPONENTS	CARBON FILM RESISTOR CR25 8R2 TAPED - 2322 211 73828
AP-239.21*.00-01	R	72	RM-8R25-C1		SMD-METWID 8R25 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 8R25
AP-239.21*.00-01	R	73	RW-0R012-D2	E4_v	WIDERST.DRAHT 0R012 1.0X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM1.0 RM15.24 SL=4.4 - 16633
AP-239.21*.00-01	R	74	RK-8R2-10	F5_h	KOHLE.WID 8R2 5% 0.33W +TK200 CR25	PHILIPS COMPONENTS	CARBON FILM RESISTOR CR25 8R2 TAPED - 2322 211 73828
AP-239.21*.00-01	R	80	RM-1M00-C1		SMD-METWID 1M00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1M00
AP-239.21*.00-01	R	201	RM-332R0-C1		SMD-METWID 332R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 332R
AP-239.21*.00-01	R	202	RM-26K1-10	F6_h	MET.WID 26K1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 26K1 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	203	RM-205R0-10	D4_v	MET.WID 205R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 205R0 1% TK50 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	204	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-239.21*.00-01	R	205	RM-1R00-10	F5_h	MET.WID 1R00 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R00 1% TK100 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	206	RM-1R21-10	E5_h	MET.WID 1R21 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R21 1% TK100 300V 0.6W/70C TAPED
AP-239.21*.00-01	R	207	RM-1M5-R8	G5_h	MET.GL.WID 1M5 5% 0.25W 1600V VR25	PHILIPS COMPONENTS	METALLIZED CERAMIC RESISTOR VR25 1M5 5% TAPED - 2322 241 13155
AP-239.21*.00-01	R	208	RM-1M5-R8	G5_h	MET.GL.WID 1M5 5% 0.25W 1600V VR25	PHILIPS COMPONENTS	METALLIZED CERAMIC RESISTOR VR25 1M5 5% TAPED - 2322 241 13155
AP-239.21*.00-01	R	209	RM-1M0-R8	G5_h	MET.GL.WID 1M0 5% 0.25W 1600V VR25	PHILIPS COMPONENTS	METALLIZED CERAMIC RESISTOR VR25 1M0 5% TAPED - 2322 241 13105
AP-239.21*.00-01	R	210	RM-11K0-C1		SMD-METWID 11K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 11K0
AP-239.21*.00-01	R	211	RY-4R7-10	G5_v	DEFDURWID 4R7 5% 0W3 +TK200 SKS2	ROEDERSTEIN	FUSIBLE RESISTOR SKS2 4R7 5% TAPED - SS204R7JR
AP-239.21*.00-01	R	212	RM-11K0-C1		SMD-METWID 11K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 11K0

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.21*.00-01	R	213	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.21*.00-01	R	214	RM-825R0-C1		SMD-METWID 825R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 825R
AP-238.21*.00-01	R	215	RM-383K0-C1		SMD-METWID 383K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 383K
AP-238.21*.00-01	R	216	RM-3K32-C1		SMD-METWID 3K32 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K32
AP-238.21*.00-01	R	217	RM-825R0-10	A5 h	MET.WID 825R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 825R0 1% TK50 300V 0.6W/70C TAPED
AP-238.21*.00-01	R	218	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.21*.00-01	R	219	RM-2K15-C1		SMD-METWID 2K15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K15
AP-238.21*.00-01	R	220	RM-464K0-C1		SMD-METWID 464K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 464K
AP-238.21*.00-01	R	221	RM-10K5-C2		SMD-METWID 10K5 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 10K5
AP-238.21*.00-01	R	222	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.21*.00-01	R	223	RM-464R0-C1		SMD-METWID 464R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 464R
AP-238.21*.00-01	R	224	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.21*.00-01	R	225	RM-205R0-C1		SMD-METWID 205R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 205R
AP-238.21*.00-01	R	226	RM-14K7-C1		SMD-METWID 14K7 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 14K7
AP-238.21*.00-01	R	227	RM-16K2-C1		SMD-METWID 16K2 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 16K2
AP-238.21*.00-01	R	228	RM-11K0-C1		SMD-METWID 11K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 11K0
AP-238.21*.00-01	R	229	RM-909R0-10	B4_v	MET.WID 909R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 909R0 1% TK50 300V 0.6W/70C TAPED
AP-238.21*.00-01	R	230	RM-274R0-10	A5_h	MET.WID 274R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 274R0 1% TK50 300V 0.6W/70C TAPED
AP-238.21*.00-01	R	231	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.21*.00-01	R	232	RM-51R1-C1		SMD-METWID 51R1 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 51R1
AP-238.21*.00-01	R	233	RM-11K0-C1		SMD-METWID 11K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 11K0
AP-238.21*.00-01	R	234	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.21*.00-01	R	235	RM-196R0-C1		SMD-METWID 196R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 196R
AP-238.21*.00-01	R	236	RM-3K65-C1		SMD-METWID 3K65 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K65
AP-238.21*.00-01	R	237	RM-1R00-C1		SMD-METWID 1R00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1R00
AP-238.21*.00-01	R	238	RM-3K65-C1		SMD-METWID 3K65 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K65
AP-238.21*.00-01	R	239	RM-3K65-C1		SMD-METWID 3K65 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K65
AP-238.21*.00-01	R	240	RM-46R4-C1		SMD-METWID 46R4 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 46R4
AP-238.21*.00-01	R	241	RM-27K4-C1		SMD-METWID 27K4 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 27K4
AP-238.21*.00-01	R	242	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.21*.00-01	R	243	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.21*.00-01	R	244	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-238.21*.00-01	R	245	RM-46R4-C1		SMD-METWID 46R4 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 46R4
AP-238.21*.00-01	R	246	RM-205R0-C1		SMD-METWID 205R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 205R
AP-238.21*.00-01	R	247	RM-100K0-C1		SMD-METWID 100K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100K
AP-238.21*.00-01	R	248	RT-10K-20	A5_h	MESS-NTC 10K 10% 0W75 K164	SIEMENS	NTC K164/10%/10K - B57164-K103-K TAPED OR UNTAPED
AP-238.21*.00-01	R	249	RM-487R0-C1		SMD-METWID 487R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 487R
AP-238.21*.00-01	R	250	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-238.21*.00-01	R	251	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-238.21*.00-01	R	252	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-238.21*.00-01	R	253	RM-2K37-C1		SMD-METWID 2K37 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K37
AP-238.21*.00-01	R	254	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-238.21*.00-01	R	255	RM-100K0-C1		SMD-METWID 100K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100K
AP-238.21*.00-01	T	1	TE-238.590.00-20	C2_v	ETD44-ÜBERTRAGER	EGSTON	
AP-238.21*.00-01	T	2	TE-238.530.00-20	C5_v	ETD24-ÜBERTRAGER (STANDBY)	EGSTON	
AP-238.21*.00-01	T	3	TE-238.580.00-20	F5_h	EF16-ÜBERTRAGER (ANSTEUERUNG)	EGSTON	
AP-238.21*.00-01	U	1	U-SFH617G2-16	C4_v	OPTOKO 5K3V 60-70%=BL 10MA 70V DIP4	SIEMENS	OPTOCOUPLER SFH617G2 - Q62703-N128-X1 - SELECTED UNDER 936.011
AP-238.21*.00-01	U	2	U-SFH617G2-16	C3_v	OPTOKO 5K3V 60-70%=BL 10MA 70V DIP4	SIEMENS	OPTOCOUPLER SFH617G2 - Q62703-N128-X1 - SELECTED UNDER 936.011
AP-238.21*.00-01	U	3	U-SFH617G2-16	C4_v	OPTOKO 5K3V 60-70%=BL 10MA 70V DIP4	SIEMENS	OPTOCOUPLER SFH617G2 - Q62703-N128-X1 - SELECTED UNDER 936.011
AP-238.21*.00-01	U	4	U-SFH617G2-16	C4_v	OPTOKO 5K3V 60-70%=BL 10MA 70V DIP4	SIEMENS	OPTOCOUPLER SFH617G2 - Q62703-N128-X1 - SELECTED UNDER 936.011
AP-238.21*.00-01	V	22	VD-BAV103-C1		SMD-DIODE 250V 0A25 SOD80	PHILIPS COMPONENTS	RECTIFIER DIODE BAV103 SOD80C - 9336 993 60115 (REEL 7")
AP-238.21*.00-01	V	23	VD-BAV103-C1		SMD-DIODE 250V 0A25 SOD80	PHILIPS COMPONENTS	RECTIFIER DIODE BAV103 SOD80C - 9336 993 60115 (REEL 7")
AP-238.21*.00-01	V	24	VT-FMMT591-C1		SMD-PNP-TRANS 80V 1A 0W3 SOT23	ZETEX	PNP-TRANSISTOR FMMT591 SOT23 TAPED - FMMT591TA
AP-238.21*.00-01	V	25	VD-SB140-10	F5_h	SCHOTTKY 40V 1A 0V5 DO41	GENERAL INSTRUMENTS	SCHOTTKY DIODE SB140 TAPED
AP-238.21*.00-01	V	26	VD-SB140-10	F5_h	SCHOTTKY 40V 1A 0V5 DO41	GENERAL INSTRUMENTS	SCHOTTKY DIODE SB140 TAPED
AP-238.21*.00-01	V	27	VT-FMMT591-C1		SMD-PNP-TRANS 80V 1A 0W3 SOT23	ZETEX	PNP-TRANSISTOR FMMT591 SOT23 TAPED - FMMT591TA
AP-238.21*.00-01	V	28	VM-2SK1723-1F	E2_h	N-MOSFET 600V 0R65 150W CA.TO247	TOSHIBA	POWER MOS-FET 2SK1723
AP-238.21*.00-01	V	29	VZ-BZX79C15-10	E2_h	Z-DIODE 15V 6% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX 79-C15 TAPED - 9331 1783 0113
AP-238.21*.00-01	V	30	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	31	VT-FMMT491-C1		SMD-NPN-TRANS 80V 1A 0W3 SOT23	ZETEX	NPN-TRANSISTOR FMMT491 SOT23 TAPED - FMMT491TA

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.21*.00-01	V	32	VT-FMMT591-C1		SMD-PNP-TRANS 80V 1A 0W3 SOT23	ZETEX	PNP-TRANSISTOR FMMT591 SOT23 TAPED - FMMT591TA
AP-238.21*.00-01	V	33	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	34	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	35	VT-FMMT591-C1		SMD-PNP-TRANS 80V 1A 0W3 SOT23	ZETEX	PNP-TRANSISTOR FMMT591 SOT23 TAPED - FMMT591TA
AP-238.21*.00-01	V	36	VD-BA159GP-10	E2 v	DIODE 1000V 0A5 500NS DO41	GENERAL INSTRUMENTS	RECTIFIER DIODE BA159GP TAPED
AP-238.21*.00-01	V	37	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	38	VT-FMMT491-C1		SMD-NPN-TRANS 80V 1A 0W3 SOT23	ZETEX	NPN-TRANSISTOR FMMT491 SOT23 TAPED - FMMT491TA
AP-238.21*.00-01	V	39	VD-BAV103-C1		SMD-DIODE 250V 0A25 SOD80	PHILIPS COMPONENTS	RECTIFIER DIODE BAV103 SOD80C - 9336 993 60115 (REEL 7")
AP-238.21*.00-01	V	40	VT-FMMT491-C1		SMD-NPN-TRANS 80V 1A 0W3 SOT23	ZETEX	NPN-TRANSISTOR FMMT491 SOT23 TAPED - FMMT491TA
AP-238.21*.00-01	V	41	VD-BAV103-C1		SMD-DIODE 250V 0A25 SOD80	PHILIPS COMPONENTS	RECTIFIER DIODE BAV103 SOD80C - 9336 993 60115 (REEL 7")
AP-238.21*.00-01	V	42	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	43	VT-BC856B-C1		SMD-PNP-TRANS 80V 0A1 0W2 SOT23	PHILIPS COMPONENTS	PNP-TRANSISTOR BC856B SOT23 - 9335 897 30215 (REEL 7")
AP-238.21*.00-01	V	44	VT-BC856B-C1		SMD-PNP-TRANS 80V 0A1 0W2 SOT23	PHILIPS COMPONENTS	PNP-TRANSISTOR BC856B SOT23 - 9335 897 30215 (REEL 7")
AP-238.21*.00-01	V	57	VT-FMMT491-C1		SMD-NPN-TRANS 80V 1A 0W3 SOT23	ZETEX	NPN-TRANSISTOR FMMT491 SOT23 TAPED - FMMT491TA
AP-238.21*.00-01	V	59	VD-BAS21-C1		SMD-DIODE 250V 0A2 SOT23	SIEMENS	RECTIFIER DIODE BAS21 - Q62702-A79 (TAPE:E6327)
AP-238.21*.00-01	V	61	VD-BAS21-C1		SMD-DIODE 250V 0A2 SOT23	SIEMENS	RECTIFIER DIODE BAS21 - Q62702-A79 (TAPE:E6327)
AP-238.21*.00-01	V	62	VT-FMMT491-C1		SMD-NPN-TRANS 80V 1A 0W3 SOT23	ZETEX	NPN-TRANSISTOR FMMT491 SOT23 TAPED - FMMT491TA
AP-238.21*.00-01	V	63	VZ-15KE200-10	F3_h	SUPPRESSOR 200V/1MA 5W DO201	GENERAL INSTRUMENTS	SUPRESSOR DIODE 1.5KE200
AP-238.21*.00-01	V	64	VD-MUR860-1F	F2_h	DIODE 600V 8A 60NS TO220	MOTOROLA	RECTIFIER DIODE MUR860
AP-238.21*.00-01	V	78	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	79	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	80	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	81	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	82	VD-MBR2030CTL-1E		SCHOTTKY 30V 2X10A 0V52 TO220	MOTOROLA	SCHOTTKY DUAL DIODE MBR2030CTL
AP-238.21*.00-01	V	83	VD-S10SC4MR-1E		SCHOTTKY 40V 2X5A 0V55 TO220	SHINDENGEN	SCHOTTKY DUAL DIODE S10SC4MR
AP-238.21*.00-01	V	84	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	85	VD-USD945-1E		SCHOTTKY 45V 16A 0V6 TO220	MICROSEMI CORP.	SCHOTTKY DIODE USD945
AP-238.21*.00-01	V	86	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	87	VD-USD945-1E		SCHOTTKY 45V 16A 0V6 TO220	MICROSEMI CORP.	SCHOTTKY DIODE USD945
AP-238.21*.00-01	V	97	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	98	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	99	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	100	VD-BYS21/45-10	C1_h	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.21*.00-01	V	110	VT-BD139/16-19	E5_h	NPN-TRANS 100V 1A5 12W5 TO126	PHILIPS COMPONENTS	NPN-TRANSISTOR BD139-16 - 9332 6975 0127
AP-238.21*.00-01	V	111	VZ-BZX79B13-13	D5_v	Z-DIODE 13V 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B13 TAPED - 9331 669 00113
AP-238.21*.00-01	V	112	VD-UF4004-10	D4_h	DIODE 400V 1A 50NS DO41	GENERAL INSTRUMENTS	RECTIFIER DIODE UF4004 TAPED
AP-238.21*.00-01	V	113	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.21*.00-01	V	114	VZ-BZX79C12-10	E5_v	Z-DIODE 12V 6% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX 79-C12 TAPED - 9331 1781 0113
AP-238.21*.00-01	V	115	VZ-BZX79C5V1-10	F6_h	Z-DIODE 5V1 6% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX 79-C5V1 TAPED - 9331 1772 0113
AP-238.21*.00-01	V	116	VM-2SK1643-15		N-MOSFET 900V 2R8 125W TO220	TOSHIBA	POWER MOS-FET 2SK1643
AP-238.21*.00-01	V	117	VD-BA159GP-10	D5_v	DIODE 1000V 0A5 500NS DO41	GENERAL INSTRUMENTS	RECTIFIER DIODE BA159GP TAPED
AP-238.21*.00-01	V	118	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.21*.00-01	V	119	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.21*.00-01	V	120	VZ-BZX79C56-10	G5_h	Z-DIODE 56V 6% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX 79-C56 TAPED - 9331 179 70113
AP-238.21*.00-01	V	124	VD-LL4149-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	125	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.21*.00-01	V	126	VM-BSS110-10	A4_v	P-MOSFET -50V 10R 0W63 TO92	SIEMENS	SIPMOS SMALL-SIGNAL TRANSISTOR BSS110 TAPED - Q62702-S500
AP-238.21*.00-01	V	127	VD-1N4149-10	B5_h	DIODE 75V 0A15 4NS DO35	PHILIPS COMPONENTS	RECTIFIER DIODE 1N4148 TAPED - 9330 8399 0113
AP-238.21*.00-01	V	131	VM-IRFP250-19	F4_v	N-MOSFET 200V 0R085 180W TO247	HARRIS	POWER MOSFET IRFP250
AP-238.21*.00-01	V	132	VM-IRFP250-19	G4_v	N-MOSFET 200V 0R085 180W TO247	HARRIS	POWER MOSFET IRFP250
AP-238.21*.00-01	V	133	VD-S10SC4M-1E		SCHOTTKY 40V 2X5A 0V55 TO220	SHINDENGEN	SCHOTTKY DUAL DIODE S10SC4M
AP-238.21*.00-01	V	135	VD-BYV27/150-10	C4_v	DIODE 150V 2A 25NS SOD57	PHILIPS COMPONENTS	RECTIFIER DIODE BYV 27/150 TAPED - 9335 4351 0113
AP-238.21*.00-01	V	136	VD-UF4004-10	C4_v	DIODE 400V 1A 50NS DO41	GENERAL INSTRUMENTS	RECTIFIER DIODE UF4004 TAPED
AP-238.21*.00-01	V	137	VZ-BZX79B18-13	B4_v	Z-DIODE 18V 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B18 TAPED - 9331 669 30113
AP-238.21*.00-01	V	138	VT-ZTX450-10	B5_v	NPN-TRANS 60V 1A 1W TO92E	ZETEX	NPN-TRANSISTOR ZTX450 STOA OR ZTX450 STZA
AP-238.21*.00-01	V	139	VZ-BZX79C5V6-10	F3_h	Z-DIODE 5V6 6% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX 79-C5V6 TAPED - 9331 1773 0113
AP-238.21*.00-01	V	140	VZ-BZX79B16-13	D4_v	Z-DIODE 16V 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B16 TAPED - 9331 669 20113
AP-238.21*.00-01	V	141	VT-BDX54-29	A5_v	PNP-DARL 45V 8A 60W TO220	SGS-THOMSON	PNP-DARLINGTON TRANSISTOR BDX54
AP-238.21*.00-01	V	143	VT-FMMT591-C1		SMD-PNP-TRANS 80V 1A 0W3 SOT23	ZETEX	PNP-TRANSISTOR FMMT591 SOT23 TAPED - FMMT591TA
AP-238.21*.00-01	V	144	VZ-ZY3V9-12	A6 h	Z-DIODE 3V9 6% 2W 58A2	ITT	Z-DIODE ZY3.9 5% TAPED

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SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.21*.00-01	X	2	XM-2X8G-A8	B6_h	ST.LEISTE 2X8P GER RM2.54 1A AU	ASSMANN ELEKTRONIK	CONNECTOR RM2.54 STRAIGHT - AWHW 16G-0202
AP-238.21*.00-01	X	3	XM-1X8G-R9	H4_v	ST.LEISTE 1X8P GER RM2.54 3A AU 6.8	RATIOPLAST	PIN HEADER SERIES 010 1X8P 0.63X0.63 - 010 02 25 112 008
AP-238.21*.00-01	X	4	XM-1X2G-90	A6_h	ST.LEISTE 1X2P GER RM2.54 2A5 SN 7.5	MOLEX	PIN HEADER SERIES 6410 2PIN 2.54 0.64X0.64 - 22-27-2021
AP-238.22*.00-01	C	29	CY-470N/250V-20	I5_v	X2-KO 470N 250V 10% F1772	ROEDERSTEIN	X2-CAPACITOR 470N 250V - F1772-447-2900(-2901) OR -2000
AP-238.22*.00-01	C	31	CE-470U/200V-N2	J3_h	ELKO 470U 200V 23X42 KMH	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR KMH-VN-470U/200V-M-22X40
AP-238.22*.00-01	C	32	CE-680U/200V-NA	J2_h	ELKO 680U 200V 26.4X42 KMH	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR KMH-VN-680U/200V-M-25.4X40
AP-238.22*.00-01	C	55	CM-470N/63V-20	G3_h	MEKO 470N 63V 20% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 DC 3470 191/201 M
AP-238.22*.00-01	C	56	CM-1N5/100V-10	B6_v	MEKO 1N5 100V 5% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 EC 1150 191/201 J
AP-238.22*.00-01	C	57	CM-1U/50V-15	F4_v	MEKO 1U 50V 10% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 CC 4100 191/201 K
AP-238.22*.00-01	C	58	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	59	CE-120U/16V-64	D1_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	60	CE-120U/16V-64	D2_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	61	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	62	CK-100P/100V-10	G5_v	KERKO 100P 100V 2% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 NP0 100P 2% 100V TAPED - 2222 679 34101
AP-238.22*.00-01	C	63	CK-68P/100V-10	A5_v	KERKO 68P 100V 2% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 NP0 68P 2% 100V TAPED - 2222 679 10689
AP-238.22*.00-01	C	64	CV-1N/63V-C2		SMD-VIELKO 1N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 1NF/63V X7R 10% - 2222 581 16614
AP-238.22*.00-01	C	65	CE-1000U/25V-64	G2_h	ELKO 1000U 25V 13X26 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1000 12.5X25
AP-238.22*.00-01	C	66	CE-100U/50V-65	E2_h	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	67	CE-330U/25V-64	D2_h	ELKO 330U 25V 8.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF25VB-330 8X20 TPA3.5 OR WITHOUT TPA
AP-238.22*.00-01	C	68	CE-1500U/10V-64	F2_h	ELKO 1500U 10V 10.5X31 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 10 VB-1500 10X30
AP-238.22*.00-01	C	69	CK-220P/100V-15	C4_v	KERKO 220P 100V 10% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 K2000 220P 10% 100V TAPED - 2222 630 53221
AP-238.22*.00-01	C	70	CE-1000U/10V-64	B2_h	ELKO 1000U 10V 10.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF10VB-1000 10X20 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	71	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	72	CM-2N2/100V-10	D3_v	MEKO 2N2 100V 5% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 EC 1220 191/201 J
AP-238.22*.00-01	C	73	CE-1000U/10V-64	F1_h	ELKO 1000U 10V 10.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF10VB-1000 10X20 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	74	CE-120U/16V-64	C4_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	75	CE-1000U/25V-64	C1_h	ELKO 1000U 25V 13X26 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1000 12.5X25
AP-238.22*.00-01	C	76	CE-1000U/25V-64	C1_h	ELKO 1000U 25V 13X26 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1000 12.5X25
AP-238.22*.00-01	C	77	CK-68P/100V-10	C3_v	KERKO 68P 100V 2% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 NP0 68P 2% 100V TAPED - 2222 679 10689
AP-238.22*.00-01	C	78	CK-68P/100V-10	C3_h	KERKO 68P 100V 2% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 NP0 68P 2% 100V TAPED - 2222 679 10689
AP-238.22*.00-01	C	79	CE-2U2/50V-30	C2_h	ELKO 2U2 50V 5.5X12 RLL	PHILIPS COMPONENTS	ELECTROLYTIC CAPACITOR RLL 2U2/50V - 2222 116 11228
AP-238.22*.00-01	C	80	CF-6N8/250V-62	B1_v	FOKO 6N8 250V 20% FKS2	WIMA	POLYESTER FILM CAPACITOR FKS2 6N8 250VDC/160VAC 20% TAPED
AP-238.22*.00-01	C	81	CY-68N/250V-70	H1_v	X2-KO 68N 250V 20% MKT1.47	ARCOTRONICS	X2-CAPACITOR MKT1.47 68N 250V 20% ABM.6X12X18 - R47LI26800060M
AP-238.22*.00-01	C	82	CE-100U/50V-65	G2_h	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	83	CE-1000U/25V-64	G2_h	ELKO 1000U 25V 13X26 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF 25 VB-1000 12.5X25
AP-238.22*.00-01	C	84	CE-1000U/10V-64	F2_h	ELKO 1000U 10V 10.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF10VB-1000 10X20 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	85	CV-220N/63V-C3		SMD-VIELKO 220N 63V 10% X7R 1210	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220NF/63V X7R 10% - 2222 582 16645
AP-238.22*.00-01	C	86	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	87	CE-120U/16V-64	D3_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	88	CE-120U/16V-64	D3_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	89	CE-120U/16V-64	D3_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	90	CE-120U/16V-64	D3_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	91	CE-120U/16V-64	D3_h	ELKO 120U 16V 6.8X12.5 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF16VB-120 6.3X11.5 TPA2.5 OR WITHOUT TPA
AP-238.22*.00-01	C	92	CS-220U/10V-30	F2_h	SELKO 220U 10V 10X10.5 OS-CON	SANYO	ALU.SOLID ELECTROLYTIC CAPACITOR OS-CON - 10SA220M
AP-238.22*.00-01	C	93	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	94	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	95	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	96	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	97	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	98	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.22*.00-01	C	99	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	100	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	101	CE-1000U/10V-64	B3_h	ELKO 1000U 10V 10.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF10VB-1000 10X20 TPA OR WITHOUT TPA
AP-238.22*.00-01	C	102	CE-330U/25V-64	B4_h	ELKO 330U 25V 8.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF25VB-330 8X20 TPA3.5 OR WITHOUT TPA
AP-238.22*.00-01	C	103	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	104	CM-1U/50V-15	F6_h	MEKO 1U 50V 10% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 CC 4100 191/201 K
AP-238.22*.00-01	C	106	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	107	CV-22N/63V-C2		SMD-VIELKO 22N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 22NF/63V X7R 10% - 2222 581 16632
AP-238.22*.00-01	C	108	CM-1U/50V-15	F5_h	MEKO 1U 50V 10% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 CC 4100 191/201 K
AP-238.22*.00-01	C	110	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641

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AP-238.22*.00-01	C	111	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	112	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	113	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	114	CV-47N/200V-10	B1_v	VIELKO 47N 200V 10% X7R C330	KEMET	CERAMIC MULTILAYER CAPACITOR C330C473K2R5CA TAPED
AP-238.22*.00-01	C	115	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	116	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.22*.00-01	C	117	CE-330U/25V-64	D2_h	ELKO 330U 25V 8.5X21 LXF	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR LXF25VB-330 8X20 TPA3.5 OR WITHOUT TPA
AP-238.22*.00-01	C	119	CV-47N/63V-C2		SMD-VIELKO 47N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 47NF/63V X7R 10% - 2222 581 16636
AP-238.22*.00-01	D	1	D-4001BCM-C2		SMD-NOR 2INP 4-FACH SO14	NATIONAL SEMICOND.	QUAD 2-INPUT NOR CD4001BCM
AP-238.22*.00-01	D	2	D-4093BCM-C2		SMD-NAND SCH.TRIG 2INP 4-FACH SO14	NATIONAL SEMICOND.	QUAD 2-INPUT NAND SCHMITT TRIGGER CD4093BCM
AP-238.22*.00-01	D	3	D-4093BCM-C2		SMD-NAND SCH.TRIG 2INP 4-FACH SO14	NATIONAL SEMICOND.	QUAD 2-INPUT NAND SCHMITT TRIGGER CD4093BCM
AP-238.22*.00-01	E	1	AP-238.222.00-01		SMDM-BLP SEKUNDÄR	PULS MÜNCHEN	
AP-238.22*.00-01	E	1	AP-238.223.00-01	F6_h	SMDM-ALP SEKUNDÄR	PULS MÜNCHEN	
AP-238.22*.00-01	E	1	AP-238.224.00-10		SMDM-WLP SEKUNDÄR	WALTER	
AP-238.22*.00-01	E	1	EP-238.225.00-10		SMDM-LP 238X133X1.6 70U 2LAG	WALTER	
AP-238.22*.00-01	E	5	ES-RM406-82	E2_h	DRAHTBRÜCKE RM40.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM40.6 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	6	ES-STEZU4-10		STECKZUNGE 6.3X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 6.3X0.8 - 03866A BZ SN OR MS SN
AP-238.22*.00-01	E	7	ES-STEZU4-10		STECKZUNGE 6.3X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 6.3X0.8 - 03866A BZ SN OR MS SN
AP-238.22*.00-01	E	28	WI-238.880.00-10	J5_h	KABEL BL 0.86QMM STEHU4 80MM ELH	MD ELEKTRONIK	
AP-238.22*.00-01	E	29	WI-238.880.00-10		KABEL BL 0.86QMM STEHU4 80MM ELH	MD ELEKTRONIK	
AP-238.22*.00-01	E	30	ES-STEZU4-10		STECKZUNGE 6.3X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 6.3X0.8 - 03866A BZ SN OR MS SN
AP-238.22*.00-01	E	31	ES-STEZU4-10		STECKZUNGE 6.3X0.8 STEH/GER 2PIN	VOGT AG SCHWEIZ	TAB FLAT 6.3X0.8 - 03866A BZ SN OR MS SN
AP-238.22*.00-01	E	32	ES-RM254-82	C2_h	DRAHTBRÜCKE RM25.4 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM25.4 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	33	ES-RM406-82	E2_h	DRAHTBRÜCKE RM40.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM40.6 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	34	ES-RM254-82	C2_h	DRAHTBRÜCKE RM25.4 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM25.4 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	35	ES-RM152-10	B3_h	0R-BRÜCKE RM15.2 0R010 2A5 Z25	ASJ ELECTRONICS	0R-RESISTOR Z25 TAPED
AP-238.22*.00-01	E	36	ES-RM406-82	C4_h	DRAHTBRÜCKE RM40.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM40.6 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	37	ES-RM254-82	D4_v	DRAHTBRÜCKE RM25.4 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM25.4 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	38	ES-RM406-82	C4_h	DRAHTBRÜCKE RM40.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM40.6 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	39	ES-RM203-72	C5_h	DRAHTBRÜCKE RM20.3 DM1.0 ISOLIERT	HÜTTLINGER	WIRE JUMPER RM20.3 DM1.0 SL2.9(AB BT-UK) INSULATION PVC105C - 17083
AP-238.22*.00-01	E	40	ES-RM254-82	D4_v	DRAHTBRÜCKE RM25.4 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM25.4 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	41	ES-RM203-72	D4_v	DRAHTBRÜCKE RM20.3 DM1.0 ISOLIERT	HÜTTLINGER	WIRE JUMPER RM20.3 DM1.0 SL2.9(AB BT-UK) INSULATION PVC105C - 17083
AP-238.22*.00-01	E	44	ES-RM305-82	E3_h	DRAHTBRÜCKE RM30.5 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM30.5 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	45	ES-RM406-82	F3_h	DRAHTBRÜCKE RM40.6 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM40.6 X 4 X 1.00MM INSULATED
AP-238.22*.00-01	E	46	ES-RM102-10	F3_h	0R-BRÜCKE RM10.2 0R010 2A5 Z25	ASJ ELECTRONICS	0R-RESISTOR Z25 TAPED
AP-238.22*.00-01	E	47	ES-RM102-10	F4_v	0R-BRÜCKE RM10.2 0R010 2A5 Z25	ASJ ELECTRONICS	0R-RESISTOR Z25 TAPED
AP-238.22*.00-01	E	48	EW-238.990.00-10		SCHIRMBLECH	ROHDE & SCHWARZ	
AP-238.22*.00-01	E	49	ES-RM102-30	C2_h	DRAHTBRÜCKE RM10.2 DM0.71 BLANK	POLYTRONIK	WIRE DM0.71 TAPED D=65MM - 7530102
AP-238.22*.00-01	E	50	ES-RM102-30	C2_h	DRAHTBRÜCKE RM10.2 DM0.71 BLANK	POLYTRONIK	WIRE DM0.71 TAPED D=65MM - 7530102
AP-238.22*.00-01	E	51	ES-RM152-8A	A4_h	DRAHTBRÜCKE RM15.2 DM1.0 ISOLIERT	BAYKRA	WIRE JUMPER RM15.2 X SL2.9(AB BT-UK) X DM1.00 INSULATED PVC105C
AP-238.22*.00-01	F	2	FV-S14K320-10	J6_v	VARISTOR 320V/420V 0W6 16.5X6.3	SIEMENS	ZNO-VARISTOR SIOV S14K320 - Q69-X4327
AP-238.22*.00-01	K	1	K-A/12V/8A-40	H2_h	REL 1XAK 12V/480R 8A 20X11X10	NATIONAL MATSUSHITA	RELAY DSP1A-12V
AP-238.22*.00-01	K	2	K-U/13V/16A-1A	I3_v	REL 1XUM 12V5/170R 16A 29X13X25	FEME	RELAY MZP A 001 44 16 / TU125C
AP-238.22*.00-01	L	19	LB-192.530.01-10	A5_v	STABKERNDROSSEL 3UH 4A5 4X13.3	HAGN	
AP-238.22*.00-01	L	20	LB-3U9/A85-10	F5_v	HF-DROSSEL 3U9H 0A85 4X9.2 B78108	SIEMENS	HF-CHOKE 3.9UH 0.85A - B78108-S1392-K
AP-238.22*.00-01	L	21	LB-192.530.01-10	B5_v	STABKERNDROSSEL 3UH 4A5 4X13.3	HAGN	
AP-238.22*.00-01	L	22	LE-238.570.00-10	D4_v	EF16-DROSSEL 7UH 5A	BHR-ELEKTRONIK	
AP-238.22*.00-01	L	23	LE-238.570.00-10	B4_v	EF16-DROSSEL 7UH 5A	BHR-ELEKTRONIK	
AP-238.22*.00-01	L	24	LE-238.540.00-20	B2_v	ETD24-DROSSEL 13UH 10A	EGSTON	
AP-238.22*.00-01	L	25	LB-192.540.00-10	B2_h	STABKERNDROSSEL 500NH 14A 4X13.3	HAGN	
AP-238.22*.00-01	L	26	LB-192.540.00-10	D2_h	STABKERNDROSSEL 500NH 14A 4X13.3	HAGN	
AP-238.22*.00-01	L	27	EM-D1-10		F-DÄMPFUNGSPERLE 3.5X3	PHILIPS COMPONENTS	SCREENING BEAD 3.5X3.0 FXC3B1 - 4312 020 31051
AP-238.22*.00-01	L	28	LB-150U/A28-10	C5_h	HF-DROSSEL 150UH 0A28 4X9.2 B78108	SIEMENS	HF-CHOKE 150UH 0.28A - B78108-S1154-J
AP-238.22*.00-01	L	29	LE-238.570.00-20	A4_v	EF16-DROSSEL 7UH 5A	EGSTON	
AP-238.22*.00-01	L	30	LB-3U9/A85-10	G2_h	HF-DROSSEL 3U9H 0A85 4X9.2 B78108	SIEMENS	HF-CHOKE 3.9UH 0.85A - B78108-S1392-K
AP-238.22*.00-01	L	31	LB-192.540.00-10	D2_v	STABKERNDROSSEL 500NH 14A 4X13.3	HAGN	
AP-238.22*.00-01	L	32	WI-238.880.00-10		KABEL BL 0.86QMM STEHU4 80MM ELH	MD ELEKTRONIK	
AP-238.22*.00-01	N	13	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	14	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	15	N-431CLP-10	G2_h	SPG.REF 2V495 0A1 2.2% TO92	MOTOROLA	VOLTAGE REFERENCE TL431CLPRA

1039.1304.00 SA
Bl. 6+
AI: 01

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.22*.00-01	N	16	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	17	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	18	N-431CLP-10	E6_v	SPG.REF 2V495 0A1 2.2% TO92	MOTOROLA	VOLTAGE REFERENCE TL431CLPRA
AP-238.22*.00-01	N	19	N-431CLP-10	E6_v	SPG.REF 2V495 0A1 2.2% TO92	MOTOROLA	VOLTAGE REFERENCE TL431CLPRA
AP-238.22*.00-01	N	20	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	21	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	22	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	23	N-358M-C2		SMD-OPAMP 2-FACH 32V 7MV 10MA SO8	NATIONAL SEMICOND.	DUAL OPERATIONAL AMPLIFIER LM358M
AP-238.22*.00-01	N	24	N-393D-C1		SMD-KOMP 2-FACH 36V 5MV 6MA SO14	MOTOROLA	DUAL COMPARATOR LM393D
AP-238.22*.00-01	N	25	N-324D-C1		SMD-OPAMP 4-FACH 32V 7MV 10MA SO14	MOTOROLA	QUAD OPERATIONAL AMPLIFIER LM324D
AP-238.22*.00-01	N	26	N-C555CN-20	F6_h	C-MOS TIMER 1-FACH 15V DIP8	NATIONAL SEMICOND.	C-MOS-TIMER LMC555CN
AP-238.22*.00-01	R	75	RW-39R/5W-A1	I5_v	DRAHTWID 39R 5% 5.0W +TK120 A1	MODULOHM	WIRE-WOUND RESISTOR 39R-5W-A1
AP-238.22*.00-01	R	76	RW-0R15/2W-70	I4_v	M-BANDWID 0R15 10% 2.0W TK200 MPC70	FAB.FUKUSHIMA FUTUBI	METAL-FOIL RESISTOR MPC70 0.150R
AP-238.22*.00-01	R	77	RW-75K/1W-40	I4_v	M-OXIDWID 75K 5% 1.0W TK200 WK4	ROEDERSTEIN	METALOXIDE RESISTOR WK4 075K J B
AP-238.22*.00-01	R	78	RW-75K/1W-40	J4_v	M-OXIDWID 75K 5% 1.0W TK200 WK4	ROEDERSTEIN	METALOXIDE RESISTOR WK4 075K J B
AP-238.22*.00-01	R	79	RW-0R15/2W-70	J4_v	M-BANDWID 0R15 10% 2.0W TK200 MPC70	FAB.FUKUSHIMA FUTUBI	METAL-FOIL RESISTOR MPC70 0.150R
AP-238.22*.00-01	R	81	RM-121K0-10	I5_h	MET.WID 121K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 121K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	82	RM-121K0-10	I4_v	MET.WID 121K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 121K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	179	RM-22R6-10	G3_h	MET.WID 22R6 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 22R6 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	180	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	181	RM-100R0-10	G3_h	MET.WID 100R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 100R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	182	RM-237R0-C1		SMD-METWID 237R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 237R
AP-238.22*.00-01	R	183	RM-169R0-C1		SMD-METWID 169R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 169R
AP-238.22*.00-01	R	184	RT-100K-20	F5_h	MESS-NTC 100K 10% 0W75 K164	SIEMENS	NTC K164/10%/100K - B57164-K104-K TAPED OR UNTAPED
AP-238.22*.00-01	R	185	RT-100K-20	D3_h	MESS-NTC 100K 10% 0W75 K164	SIEMENS	NTC K164/10%/100K - B57164-K104-K TAPED OR UNTAPED
AP-238.22*.00-01	R	186	RM-6K49-C1		SMD-METWID 6K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K49
AP-238.22*.00-01	R	187	RM-100R0-10	B6_v	MET.WID 100R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 100R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	188	RM-100R0-10	B6_v	MET.WID 100R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 100R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	189	RM-6K49-C1		SMD-METWID 6K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K49
AP-238.22*.00-01	R	190	RM-51K1-10	A6_h	MET.WID 51K1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 51K1 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	191	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.22*.00-01	R	192	RM-6K49-C2		SMD-METWID 6K49 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 6K49
AP-238.22*.00-01	R	193	RW-0R032-D6	B4_v	WIDERST.DRAHT 0R032 0.6X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM0.6 RM15.24 SL=4.2 - 15002
AP-238.22*.00-01	R	194	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	195	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.22*.00-01	R	196	RM-6K49-C2		SMD-METWID 6K49 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 6K49
AP-238.22*.00-01	R	197	RM-1R50-10	F4_v	MET.WID 1R50 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R50 1% TK100 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	198	RM-1K00-10	[illegible]_v	MET.WID 1K00 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K00 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	199	RM-147R0-C1		SMD-METWID 147R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 147R
AP-238.22*.00-01	R	200	RW-0R074-D4	E4_v	WIDERST.DRAHT 0R074 0.4X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM0.4 RM15.24 SL=4.1 - 15463
AP-238.22*.00-01	R	201	RM-1R50-10	F4_v	MET.WID 1R50 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R50 1% TK100 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	202	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	203	RM-11K0-C1		SMD-METWID 11K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 11K0
AP-238.22*.00-01	R	204	RM-75K0-C1		SMD-METWID 75K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 75K0
AP-238.22*.00-01	R	205	RM-2M15-C1		SMD-METWID 2M15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2M15
AP-238.22*.00-01	R	206	RM-100K0-C1		SMD-METWID 100K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100K
AP-238.22*.00-01	R	207	RM-100K0-C1		SMD-METWID 100K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100K
AP-238.22*.00-01	R	208	RM-237R0-C1		SMD-METWID 237R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 237R
AP-238.22*.00-01	R	209	RA-1K0-21	E6_v	TRIMMPOT 1K 10% 15G TYP 3006P	BOURNS	CERMET POTENTIOMETER TYP3006P 1K - 3006P-EX2-102
AP-238.22*.00-01	R	210	RM-2K49-10	E6_v	MET.WID 2K49 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 2K49 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	211	RM-3K16-10	E6_v	MET.WID 3K16 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 3K16 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	212	RM-6K49-C2		SMD-METWID 6K49 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 6K49
AP-238.22*.00-01	R	213	RM-6K49-C2		SMD-METWID 6K49 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 6K49
AP-238.22*.00-01	R	214	RM-5K11-C1		SMD-METWID 5K11 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5K11
AP-238.22*.00-01	R	215	RM-5K11-C1		SMD-METWID 5K11 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5K11
AP-238.22*.00-01	R	216	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	217	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	218	RM-34K8-C1		SMD-METWID 34K8 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 34K8
AP-238.22*.00-01	R	219	RM-464R0-C1		SMD-METWID 464R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 464R
AP-238.22*.00-01	R	220	RM-34K8-C1		SMD-METWID 34K8 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 34K8

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.22*.00-01	R	221	RM-332R0-C1		SMD-METWID 332R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 332R
AP-238.22*.00-01	R	222	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.22*.00-01	R	223	RA-1K0-21	E6_v	TRIMMPOT 1K 10% 15G TYP 3006P	BOURNS	CERMET POTENTIOMETER TYP3006P 1K,- 3006P-EX2-102
AP-238.22*.00-01	R	224	RM-2K61-C1		SMD-METWID 2K61 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K61
AP-238.22*.00-01	R	225	RM-2K87-C1		SMD-METWID 2K87 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K87
AP-238.22*.00-01	R	226	RM-51K1-10	B5_v	MET.WID 51K1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 51K1 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	227	RM-20K5-10	D5_v	MET.WID 20K5 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 20K5 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	228	RM-10K5-C1		SMD-METWID 10K5 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K5
AP-238.22*.00-01	R	229	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.22*.00-01	R	230	RM-34K8-C2		SMD-METWID 34K8 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 34K8
AP-238.22*.00-01	R	231	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	232	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	233	RM-1R33-10	F5_v	MET.WID 1R33 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R33 1% TK100 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	234	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	235	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	236	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.22*.00-01	R	237	RM-64K9-C1		SMD-METWID 64K9 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 64K9
AP-238.22*.00-01	R	238	RM-681R0-10	G5_v	MET.WID 681R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 681R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	239	RM-12K1-C1		SMD-METWID 12K1 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 12K1
AP-238.22*.00-01	R	240	RM-2K15-C1		SMD-METWID 2K15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K15
AP-238.22*.00-01	R	241	RM-16K9-C1		SMD-METWID 16K9 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 16K9
AP-238.22*.00-01	R	242	RM-261R0-10	B4_v	MET.WID 261R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 261R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	243	RW-0R024-D6	B4_v	WIDERST.DRAHT 0R024 0.6X10.16	HÜTTLINGER	ZERO OHM RESISTOR DM0.6 RM10.16 SL=4.2 - 15464
AP-238.22*.00-01	R	244	RM-51K1-10	A5_v	MET.WID 51K1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 51K1 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	245	RM-16K9-C1		SMD-METWID 16K9 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 16K9
AP-238.22*.00-01	R	246	RM-261R0-10	B5_v	MET.WID 261R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 261R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	247	RM-475K0-10	G5_h	MET.WID 475K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 475K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	248	RM-16K9-C1		SMD-METWID 16K9 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 16K9
AP-238.22*.00-01	R	249	RM-1K05-C1		SMD-METWID 1K05 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K05
AP-238.22*.00-01	R	250	RW-0R012-D1	D1_h	WIDERST.DRAHT 0R012 1.0X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM1.0 RM15.24 SL=3.4 - 16569
AP-238.22*.00-01	R	251	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	252	RM-9K53-C1		SMD-METWID 9K53 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 9K53
AP-238.22*.00-01	R	253	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	254	RM-9K53-C1		SMD-METWID 9K53 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 9K53
AP-238.22*.00-01	R	255	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	256	RM-6K49-C1		SMD-METWID 6K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K49
AP-238.22*.00-01	R	257	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	258	RM-6K49-C1		SMD-METWID 6K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K49
AP-238.22*.00-01	R	259	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	260	RW-0R012-D1	B5_h	WIDERST.DRAHT 0R012 1.0X15.24	HÜTTLINGER	ZERO OHM RESISTOR DM1.0 RM15.24 SL=3.4 - 16569
AP-238.22*.00-01	R	261	RM-154K0-10	C4_h	MET.WID 154K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 154K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	262	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	263	RM-7K50-C1		SMD-METWID 7K50 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 7K50
AP-238.22*.00-01	R	264	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	265	RW-0R005/2W4-L2	B3_h	DRAHTWID 0R005 1% 2.4W +TK300 LVR3	DALE	WIRE-WOUND RESISTOR LVR-3 0.005R 1%
AP-238.22*.00-01	R	266	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	267	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	268	RM-36K5-C1		SMD-METWID 36K5 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 36K5
AP-238.22*.00-01	R	269	RM-10K0-10	C3_h	MET.WID 10K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 10K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	270	RM-7K50-10	C3_v	MET.WID 7K50 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 7K50 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	271	RM-10K0-10	C4_v	MET.WID 10K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 10K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	272	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	273	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	274	RM-3R48-C1		SMD-METWID 3R48 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R48
AP-238.22*.00-01	R	275	RM-3R48-C1		SMD-METWID 3R48 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R48
AP-238.22*.00-01	R	276	RM-5K11-10	C3_v	MET.WID 5K11 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 5K11 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	277	RM-100K0-C1		SMD-METWID 100K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100K
AP-238.22*.00-01	R	278	RM-2K15-C1		SMD-METWID 2K15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K15
AP-238.22*.00-01	R	279	RM-19K6-C1		SMD-METWID 19K6 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 19K6
AP-238.22*.00-01	R	280	RM-19K6-C1		SMD-METWID 19K6 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 19K6

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.22*.00-01	R	281	RM-750R0-10	E5_v	MET.WID 750R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 750R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	282	RM-3R16-C1		SMD-METWID 3R16 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R16
AP-238.22*.00-01	R	283	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	284	RM-332R0-C1		SMD-METWID 332R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 332R
AP-238.22*.00-01	R	285	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	286	RM-3R48-C1		SMD-METWID 3R48 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R48
AP-238.22*.00-01	R	287	RM-3R48-C1		SMD-METWID 3R48 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R48
AP-238.22*.00-01	R	288	RM-1K62-10	C2_v	MET.WID 1K62 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K62 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	289	RM-4R75-10	C2_v	MET.WID 4R75 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 4R75 1% TK100 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	290	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	291	RM-15R0-10	C3_v	MET.WID 15R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 15R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	292	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	299	RM-3R16-C1		SMD-METWID 3R16 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3R16
AP-238.22*.00-01	R	300	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	301	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	302	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	303	RM-511K0-10	I5_v	MET.WID 511K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 511K0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	304	RM-750R0-C1		SMD-METWID 750R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 750R
AP-238.22*.00-01	R	305	RM-316R0-C1		SMD-METWID 316R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 316R
AP-238.22*.00-01	R	306	RM-316R0-C1		SMD-METWID 316R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 316R
AP-238.22*.00-01	R	307	RM-1K33-C1		SMD-METWID 1K33 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K33
AP-238.22*.00-01	R	308	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	309	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	310	RM-287K0-C1		SMD-METWID 287K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 287K
AP-238.22*.00-01	R	311	RM-12K1-C1		SMD-METWID 12K1 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 12K1
AP-238.22*.00-01	R	312	RM-133R0-C1		SMD-METWID 133R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 133R
AP-238.22*.00-01	R	313	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	314	RM-2M15-C1		SMD-METWID 2M15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2M15
AP-238.22*.00-01	R	315	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-238.22*.00-01	R	316	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-238.22*.00-01	R	317	RM-105K0-C1		SMD-METWID 105K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 105K
AP-238.22*.00-01	R	318	RM-12K1-C1		SMD-METWID 12K1 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 12K1
AP-238.22*.00-01	R	319	RM-6K81-C1		SMD-METWID 6K81 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K81
AP-238.22*.00-01	R	320	RM-6K81-C1		SMD-METWID 6K81 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K81
AP-238.22*.00-01	R	321	RM-6K81-C1		SMD-METWID 6K81 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 6K81
AP-238.22*.00-01	R	322	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	323	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	324	RM-511K0-C1		SMD-METWID 511K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 511K
AP-238.22*.00-01	R	325	RM-750K0-C1		SMD-METWID 750K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 750K
AP-238.22*.00-01	R	326	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.22*.00-01	R	327	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	328	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.22*.00-01	R	329	RM-5K23-C2		SMD-METWID 5K23 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 5K23
AP-238.22*.00-01	R	330	RM-19K6-C2		SMD-METWID 19K6 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 19K6
AP-238.22*.00-01	R	331	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	332	RM-100R0-C1		SMD-METWID 100R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 100R
AP-238.22*.00-01	R	333	RM-287K0-C1		SMD-METWID 287K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 287K
AP-238.22*.00-01	R	334	RM-1K00-C1		SMD-METWID 1K00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K00
AP-238.22*.00-01	R	335	RM-487K0-C1		SMD-METWID 487K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 487K
AP-238.22*.00-01	R	336	RM-2K15-C1		SMD-METWID 2K15 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K15
AP-238.22*.00-01	R	337	RM-226K0-C1		SMD-METWID 226K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 226K
AP-238.22*.00-01	R	338	RM-2K15-10	E5_v	MET.WID 2K15 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 2K15 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	339	RM-24K9-C1		SMD-METWID 24K9 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 24K9
AP-238.22*.00-01	R	340	RM-237R0-10	E4_v	MET.WID 237R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 237R0 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	341	RM-11K0-C2		SMD-METWID 11K0 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 11K0
AP-238.22*.00-01	R	342	RM-19K6-C2		SMD-METWID 19K6 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 19K6
AP-238.22*.00-01	R	343	RM-6K49-10	G5_v	MET.WID 6K49 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 6K49 1% TK50 300V 0.6W/70C TAPED
AP-238.22*.00-01	R	345	RM-1K69-C1		SMD-METWID 1K69 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K69
AP-238.22*.00-01	R	346	RM-1K69-C1		SMD-METWID 1K69 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K69
AP-238.22*.00-01	R	347	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-239.22*.00-01	R	348	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-239.22*.00-01	R	349	RM-2K61-C1		SMD-METWID 2K61 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K61
AP-239.22*.00-01	R	350	RM-3K40-C2		SMD-METWID 3K40 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 3K40
AP-239.22*.00-01	R	351	RM-0R0-C1		SMD-METWID 0R0 MAX.0R02 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204 BL 0R0
AP-239.22*.00-01	R	352	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-239.22*.00-01	R	353	RM-5R62-C1		SMD-METWID 5R62 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 5R62
AP-239.22*.00-01	R	354	RM-46K4-C1		SMD-METWID 46K4 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 46K4
AP-239.22*.00-01	R	355	RW-100R/W25-90		K-MASSEWID 100R 10% 0.25W CB	ALLEN BRADLEY	HOT-MOLDED RESISTOR CB 1011
AP-239.22*.00-01	R	356	RW-100R/W25-90		K-MASSEWID 100R 10% 0.25W CB	ALLEN BRADLEY	HOT-MOLDED RESISTOR CB 1011
AP-239.22*.00-01	R	357	RW-100R/W25-90		K-MASSEWID 100R 10% 0.25W CB	ALLEN BRADLEY	HOT-MOLDED RESISTOR CB 1011
AP-239.22*.00-01	V	45	VB-KBU6J-10	J5_v	BR-GLEICHR 420VAC/600VDC 6A	GENERAL INSTRUMENTS	BRIDGE RECTIFIER KBU6J
AP-239.22*.00-01	V	93	VT-BC307B-10	G3_v	PNP-TRANS 50V 0A1 0W3 TO92E	ZETEX	PNP-TRANSISTOR BC307BP STOA
AP-239.22*.00-01	V	94	VS-S0325R-19	G2_v	THYRISTOR 30V 25A 30MA TO220	TECCOR	THYRISTOR S0325R
AP-239.22*.00-01	V	95	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	96	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	97	VZ-ZMM16-C1		SMD-Z-DIODE 16V 5% 0W5 0204	ITT	Z-DIODE MINI-MELF ZMM16-SB00014 (TAPED ON REEL "7")
AP-239.22*.00-01	V	98	VT-BD240A-29	E3_v	PNP-TRANS 70V 2A 30W TO220	SGS-THOMSON	PNP-TRANSISTOR BD240A
AP-239.22*.00-01	V	99	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	100	VT-BC546B-10	F4_h	NPN-TRANS 80V 0A1 0W5 TO92E	ZETEX	NPN-TRANSISTOR BC546BP STOA
AP-239.22*.00-01	V	101	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	102	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	103	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	104	VT-BC307B-10	F4_v	PNP-TRANS 50V 0A1 0W3 TO92E	ZETEX	PNP-TRANSISTOR BC307BP STOA
AP-239.22*.00-01	V	105	VM-ZVN2110A-10	H3_v	N-MOSFET 100V 4R 0W7 TO92E	ZETEX	DMOS FET ZVN2110A STOA
AP-239.22*.00-01	V	106	VZ-BZX79B27-13	G3_v	Z-DIODE 27V 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B27 TAPED - 9331 669 70113
AP-239.22*.00-01	V	107	VZ-BZX79B5V6-13	G3_h	Z-DIODE 5V6 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B5V6 TAPED - 9331 668 20113
AP-239.22*.00-01	V	108	VZ-BZX79B9V1-13	F3_h	Z-DIODE 9V1 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B9V1 TAPED - 9331 668 60113
AP-239.22*.00-01	V	109	VZ-BZX79B5V6-13	F3_h	Z-DIODE 5V6 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B5V6 TAPED - 9331 668 20113
AP-239.22*.00-01	V	110	VZ-BZX79B8V2-13	F3_h	Z-DIODE 8V2 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B8V2 TAPED - 9331 668 50113
AP-239.22*.00-01	V	111	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	112	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	113	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	114	VZ-BZX79B18-13	G4_v	Z-DIODE 18V 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B18 TAPED - 9331 669 30113
AP-239.22*.00-01	V	115	VT-BD139-16-10	H4_v	NPN-TRANS 100V 1A5 12W5 TO126	PHILIPS COMPONENTS	NPN-TRANSISTOR BD139-16 - 9332 6975 0127
AP-239.22*.00-01	V	116	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	117	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	118	VZ-ZMM16-C1		SMD-Z-DIODE 16V 5% 0W5 0204	ITT	Z-DIODE MINI-MELF ZMM16-SB00014 (TAPED ON REEL "7")
AP-239.22*.00-01	V	119	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	120	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	121	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	122	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	123	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	124	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	125	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	126	VT-ZTX750-10	C2_h	PNP-TRANS 60V 2A 1W TO92E	ZETEX	PNP-TRANSISTOR ZTX750 STOA OR ZTX750 STZA
AP-239.22*.00-01	V	127	VT-ZTX650-10	C2_h	NPN-TRANS 60V 2A 1W TO92E	ZETEX	NPN-TRANSISTOR ZTX650 STOA OR ZTX650 STZA
AP-239.22*.00-01	V	128	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	129	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	130	VD-SB140-10	A1_h	SCHOTTKY 40V 1A 0V5 DO41	GENERAL INSTRUMENTS	SCHOTTKY DIODE SB140 TAPED
AP-239.22*.00-01	V	131	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	132	VD-LL4148-C1		SMD-DIODE .75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-239.22*.00-01	V	133	VD-BAS21-C1		SMD-DIODE 250V 0A2 SOT23	SIEMENS	RECTIFIER DIODE BAS21 - Q62702-A79 (TAPE:E6327)
AP-239.22*.00-01	V	134	VD-BAS21-C1		SMD-DIODE 250V 0A2 SOT23	SIEMENS	RECTIFIER DIODE BAS21 - Q62702-A79 (TAPE:E6327)
AP-239.22*.00-01	V	135	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	136	VM-IRFZ44-1E		N-MOSFET 60V 0R028 150W TO220	INTERNAT.RECTIFIER	HEXFET IRFZ44
AP-239.22*.00-01	V	137	VD-SB140-10	B1_h	SCHOTTKY 40V 1A 0V5 DO41	GENERAL INSTRUMENTS	SCHOTTKY DIODE SB140 TAPED
AP-239.22*.00-01	V	138	VT-ZTX750-10	C2_h	PNP-TRANS 60V 2A 1W TO92E	ZETEX	PNP-TRANSISTOR ZTX750 STOA OR ZTX750 STZA
AP-239.22*.00-01	V	139	VT-ZTX650-10	C2_h	NPN-TRANS 60V 2A 1W TO92E	ZETEX	NPN-TRANSISTOR ZTX650 STOA OR ZTX650 STZA
AP-239.22*.00-01	V	140	VT-ZTX650-10	C2_h	NPN-TRANS 60V 2A 1W TO92E	ZETEX	NPN-TRANSISTOR ZTX650 STOA OR ZTX650 STZA
AP-239.22*.00-01	V	141	VZ-ZMM5V6-C1		SMD-Z-DIODE 5V6 5% 0W5 0204	ITT	Z-DIODE MINI-MELF ZMM5V6-SB00014 (TAPED ON REEL "7")

1039.1304.00 SA
Bl. 10+
AI: 01

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.22*.00-01	V	142	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.22*.00-01	V	143	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	144	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	145	VT-BC307B-10	C2_h	PNP-TRANS 50V 0A1 0W3 TO92E	ZETEX	PNP-TRANSISTOR BC307BP STOA
AP-238.22*.00-01	V	146	VZ-ZMM16-C1		SMD-Z-DIODE 16V 5% 0W5 0204	ITT	Z-DIODE MINI-MELF ZMM16-SB00014 (TAPED ON REEL "7")
AP-238.22*.00-01	V	147	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	149	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	150	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	151	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	152	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	153	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	154	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	155	VT-BC856B-C1		SMD-PNP-TRANS 80V 0A1 0W2 SOT23	PHILIPS COMPONENTS	PNP-TRANSISTOR BC856B SOT23 - 9335 897 30215 (REEL 7")
AP-238.22*.00-01	V	156	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	157	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	158	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	159	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	160	VT-BC856B-C1		SMD-PNP-TRANS 80V 0A1 0W2 SOT23	PHILIPS COMPONENTS	PNP-TRANSISTOR BC856B SOT23 - 9335 897 30215 (REEL 7")
AP-238.22*.00-01	V	161	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	V	162	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.22*.00-01	W	2	WR-238.760.00-10	C4_h	FLACHBANDKABEL KONFEKTIONIERT 16-POL.	MD ELEKTRONIK	
AP-238.22*.00-01	X	3	XF-SUBD50E-F8		SUBD-STECKVERB 50POL EINPRESS 250V	FCT	D-SUB CONNECTOR NO.2/DIN41652 50PIN - F50S9-K49
AP-238.22*.00-01	X	4	XM-1X7G-J8	B5_v	ST.LEISTE 1X7P GER RM3.96 7A SN 11	JST DEUTSCHLAND	PIN HEADER VS 7PIN - B7P-VS
AP-238.22*.00-01	X	5	XM-1X8G-R9	D4_v	ST.LEISTE 1X8P GER RM2.54 3A AU 6.8	RATIOPLAST	PIN HEADER SERIES 010 1X8P 0.63X0.63 - 010 02 25 112 008
AP-238.22*.00-01	X	6	XM-1X5G-R9	H4_v	ST.LEISTE 1X5P GER RM2.54 3A AU 6.8	RATIOPLAST	PIN HEADER SERIES 010 1X5P 0.63X0.63 - 010 02 25 112 005
AP-238.23*.00-01	C	1	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.23*.00-01	C	2	CV-220P/63V-C1		SMD-VIELKO 220P 63V 5% NP0 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220PF/63V NP0 5% - 2222 863 15221
AP-238.23*.00-01	C	3	CV-47N/63V-C2		SMD-VIELKO 47N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 47NF/63V X7R 10% - 2222 581 16636
AP-238.23*.00-01	C	4	CV-220N/63V-C3		SMD-VIELKO 220N 63V 10% X7R 1210	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220NF/63V X7R 10% - 2222 582 16645
AP-238.23*.00-01	C	5	CV-10N/63V-C2		SMD-VIELKO 10N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 10NF/63V X7R 10% - 2222 581 16627
AP-238.23*.00-01	C	6	CV-220N/63V-C3		SMD-VIELKO 220N 63V 10% X7R 1210	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220NF/63V X7R 10% - 2222 582 16645
AP-238.23*.00-01	C	7	CV-220N/63V-C3		SMD-VIELKO 220N 63V 10% X7R 1210	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 220NF/63V X7R 10% - 2222 582 16645
AP-238.23*.00-01	C	8	CV-100N/63V-C2		SMD-VIELKO 100N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 100NF/63V X7R 10% - 2222 581 16641
AP-238.23*.00-01	C	9	CV-1N/63V-C2		SMD-VIELKO 1N 63V 10% X7R 1206	PHILIPS COMPONENTS	CERAM. MULTILAYER CHIP CAPACITOR 1NF/63V X7R 10% - 2222 581 16614
AP-238.23*.00-01	E	1	EP-238.235.00-10		SMDM-LP 47X 46X1.6 35U 2LAG	WALTER	
AP-238.23*.00-01	N	1	N-339D-C1		SMD-KOMP 4-FACH 36V 5MV 6MA SO14	MOTOROLA	QUAD COMPARATOR LM339D
AP-238.23*.00-01	N	2	N-339D-C1		SMD-KOMP 4-FACH 36V 5MV 6MA SO14	MOTOROLA	QUAD COMPARATOR LM339D
AP-238.23*.00-01	R	2	RM-1M00-C1		SMD-METWID 1M00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1M00
AP-238.23*.00-01	R	3	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.23*.00-01	R	4	RM-4K75-C1		SMD-METWID 4K75 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K75
AP-238.23*.00-01	R	5	RM-1M00-C1		SMD-METWID 1M00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1M00
AP-238.23*.00-01	R	6	RM-115R0-C1		SMD-METWID 115R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 115R
AP-238.23*.00-01	R	8	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.23*.00-01	R	9	RM-4K64-C1		SMD-METWID 4K64 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K64
AP-238.23*.00-01	R	10	RM-22K6-C1		SMD-METWID 22K6 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 22K6
AP-238.23*.00-01	R	11	RM-3K32-C1		SMD-METWID 3K32 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 3K32
AP-238.23*.00-01	R	12	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-238.23*.00-01	R	13	RM-1K54-C1		SMD-METWID 1K54 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1K54
AP-238.23*.00-01	R	14	RM-22K6-C1		SMD-METWID 22K6 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 22K6
AP-238.23*.00-01	R	15	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.23*.00-01	R	16	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.23*.00-01	R	17	RM-27K4-C1		SMD-METWID 27K4 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 27K4
AP-238.23*.00-01	R	18	RM-1M00-C1		SMD-METWID 1M00 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 1M00
AP-238.23*.00-01	R	19	RM-511K0-10	A2_v	MET.WID 511K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 511K0 1% TK50 300V 0.6W/70C TAPED
AP-238.23*.00-01	R	20	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.23*.00-01	R	21	RM-4K22-C1		SMD-METWID 4K22 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 4K22
AP-238.23*.00-01	R	22	RM-11K5-C2		SMD-METWID 11K5 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 11K5
AP-238.23*.00-01	R	23	RM-13K3-C1		SMD-METWID 13K3 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 13K3
AP-238.23*.00-01	R	24	RM-2K49-C1		SMD-METWID 2K49 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 2K49
AP-238.23*.00-01	R	27	RM-12K7-C2		SMD-METWID 12K7 0.25% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 0.25% BL 12K7

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SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.23*.00-01	R	28	RM-10K0-C1		SMD-METWID 10K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10K0
AP-238.23*.00-01	R	29	RM-287K0-C1		SMD-METWID 287K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 287K
AP-238.23*.00-01	R	30	RM-226K0-C1		SMD-METWID 226K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 226K
AP-238.23*.00-01	R	31	RM-287K0-C1		SMD-METWID 287K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 287K
AP-238.23*.00-01	R	32	RM-226K0-C1		SMD-METWID 226K0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 226K
AP-238.23*.00-01	R	33	RM-10R0-C1		SMD-METWID 10R0 1% W25 TK50 0204	BEYSCHLAG	METAL FILM RESISTOR MINI-MELF MMA0204-50 1% BL 10R0
AP-238.23*.00-01	V	1	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.23*.00-01	V	4	VZ-BZX79B5V6-13	A1_h	Z-DIODE 5V6 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B5V6 TAPED - 9331 668 20113
AP-238.23*.00-01	V	5	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	6	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	8	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	9	VZ-BZX79B9V1-13	B2_v	Z-DIODE 9V1 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B9V1 TAPED - 9331 668 60113
AP-238.23*.00-01	V	11	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	12	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	13	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	15	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.23*.00-01	V	16	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.23*.00-01	V	17	VD-LL101A-C1		SMD-SCHOTTKY 60V 0A01 0V41 0204	ITT	SCHOTTKY DIODE MINI-MELF LL101A-TAPE
AP-238.23*.00-01	V	18	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.23*.00-01	V	19	VD-LL4148-C1		SMD-DIODE 75V 0A15 4NS 0204	ITT	RECTIFIER DIODE MINI-MELF LL4148-SB00014
AP-238.23*.00-01	V	20	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.23*.00-01	V	21	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.23*.00-01	V	22	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.23*.00-01	V	23	VT-BC846B-C1		SMD-NPN-TRANS 80V 0A1 0W3 SOT23	PHILIPS COMPONENTS	NPN-TRANSISTOR BC846B SOT23 - 9335 895 60215 (REEL 7")
AP-238.23*.00-01	V	24	VD-D1F60-C1		SMD-DIODE 600V 0A75 CHIP	SHINDENGEN	RECTIFIER DIODE CHIP D1F60 TAPED (D<=25)
AP-238.23*.00-01	X	3	XF-1X8L-90	B2_h	BUCHSENLEISTE 1X8P LÖTPIN 3A	MOLEX	FEMALE CONNECTOR SERIES 90148 8POL 2.54 HORIZ. - 90148-1208
AP-238.23*.00-01	X	4	XF-1X5L-90	A1_h	BUCHSENLEISTE 1X5P LÖTPIN 3A	MOLEX	FEMALE CONNECTOR SERIES 90148 5POL 2.54 HORIZ. - 90148-1205
AP-238.243.00-01	1	0	AP-238.243.00-01	A2_h	BLP SEKUNDÄRMODUL 1	PULS MÜNCHEN	
AP-238.24*.00-01	C	1	CE-100U/50V-65	B1_v	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.24*.00-01	C	2	CE-100U/50V-65	C2_v	ELKO 100U 50V 10.5X16 SXE	NIPPON CHEMICON	ELECTROLYTIC CAPACITOR SXE 50 VB-100 10X15 TPA OR WITHOUT TPA
AP-238.24*.00-01	C	3	CM-100N/63V-20	A2_h	MEKO 100N 63V 20% MKT1.85	ARCOTRONICS	METALL. POLYESTER FILM CAPACITOR R.85 DC 3100 191/201 M
AP-238.24*.00-01	C	4	CK-220P/100V-15	C2_v	KERKO 220P 100V 10% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 K2000 220P 10% 100V TAPED - 2222 630 53221
AP-238.24*.00-01	C	5	CK-220P/100V-16	C1_v	KERKO 220P 100V 10% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM2.5 K2000 220P 10% 100V TAPED - 2222 630 51221
AP-238.24*.00-01	C	8	CK-68P/100V-10	C2_h	KERKO 68P 100V 2% EGPU	PHILIPS COMPONENTS	DISC CAPACITOR EGPU RM5 NP0 68P 2% 100V TAPED - 2222 679 10689
AP-238.24*.00-01	E	1	EP-238.245.00-10	B3_h	LEITERPLATTE 70X 48X1.6 35U 2LAG	WALTER	
AP-238.24*.00-01	L	4	LE-238.560.00-20	B2_v	EF20-DROSSEL 1M9H 0A6	EGSTON	
AP-238.24*.00-01	N	3	N-392N-10	C2_h	OPKOMP 1-FACH 32V 5MV 10MA DIP8	NATIONAL SEMICOND.	OPERATIONAL AMPLIFIER / VOLTAGE COMPARATOR LM392N
AP-238.24*.00-01	R	1	RM-178R0-10	B2_h	MET.WID 178R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 178R0 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	2	RM-475K0-10	C2_v	MET.WID 475K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 475K0 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	3	RM-19K6-10	A2_v	MET.WID 19K6 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 19K6 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	4	RM-5K23-65	A2_v	MET.WID 5K23 0.25% 0.6W TK50 MBB	BEYSCHLAG	METAL FILM RESISTOR MBB0207-50/0.25%/5K23/0.6W
AP-238.24*.00-01	R	5	RM-18K7-10	A2_v	MET.WID 18K7 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 18K7 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	6	RM-1R00-10	C2_v	MET.WID 1R00 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R00 1% TK100 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	7	RM-1R00-10	C1_v	MET.WID 1R00 1% 0.6W TK100 300V		METAL FILM RESISTOR DIN0207 1R00 1% TK100 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	8	RM-1K00-10	C1_h	MET.WID 1K00 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K00 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	9	RM-10K0-10	A2_v	MET.WID 10K0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 10K0 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	10	RM-274R0-10	B2_h	MET.WID 274R0 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 274R0 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	11	RM-1K00-10	C1_h	MET.WID 1K00 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K00 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	13	RM-51K1-10	C2_v	MET.WID 51K1 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 51K1 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	14	RM-1K00-10	B2_h	MET.WID 1K00 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K00 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	16	RM-12K7-10	C2_v	MET.WID 12K7 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 12K7 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	17	RM-64K9-10	C2_h	MET.WID 64K9 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 64K9 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	R	18	RM-1K00-10	B2_h	MET.WID 1K00 1% 0.6W TK50 300V		METAL FILM RESISTOR DIN0207 1K00 1% TK50 300V 0.6W/70C TAPED
AP-238.24*.00-01	V	1	VT-ZTX750-10	B2_h	PNP-TRANS 60V 2A 1W TO92E	ZETEX	PNP-TRANSISTOR ZTX750 STOA OR ZTX750 STZA
AP-238.24*.00-01	V	2	VD-BYS21/45-10	B2_v	SCHOTTKY 45V 1A 0V55 3X5	SIEMENS	SCHOTTKY DIODE BYS21-45 TAPED
AP-238.24*.00-01	V	3	VZ-BZX79B5V6-13	A2_v	Z-DIODE 5V6 2% 0W5 DO35	PHILIPS COMPONENTS	Z-DIODE BZX79B5V6 TAPED - 9331 668 20113
AP-238.24*.00-01	V	4	VT-BC546B-10	B2_h	NPN-TRANS 80V 0A1 0W5 TO92E	ZETEX	NPN-TRANSISTOR BC546BP STOA
AP-238.24*.00-01	V	6	VD-BAT43-10	C2_v	SCHOTTKY 30V 0A2 1V DO35	SGS-THOMSON	SCHOTTKY DIODE BAT 43 TAPED
AP-238.24*.00-01	X	2	XF-1X8L-90	A2_h	BUCHSENLEISTE 1X8P LÖTPIN 3A	MOLEX	FEMALE CONNECTOR SERIES 90148 8POL 2.54 HORIZ. - 90148-1208
AP-238.490.00-01	C	1	CY-470P/400V-95		Y-KOPPL 470P 400V 20% WKP	ROEDERSTEIN	CERAMIC DISC CAPACITOR CLASS Y WKP600 470P 400V 20% - WKP471MCPEFOK

1039.1304.00 SA
Bl. 12+
AI: 01

SUBASSEMBLY	P	OS	PARTNUMBER	PLAN	DESCRIPTION	MANUFACTURER	ORDERCODE
AP-238.490.00-01	C	2	CY-470P/400V-95		Y-KOPPL 470P 400V 20% WKP	ROEDERSTEIN	CERAMIC DISC CAPACITOR CLASS Y WKP600 470P 400V 20% - WKP471MCPEFOK
AP-239.490.00-01	E	1	WI-238.792.02-10		KABEL SW 0.86QMM STEHU4 120MM ELH	MD ELEKTRONIK	
AP-239.490.00-01	E	2	WI-238.792.02-10		KABEL SW 0.86QMM STEHU4 120MM ELH	MD ELEKTRONIK	
AP-239.490.00-01	E	3	EP-238.495.00-10		LEITERPLATTE 170X 64X1.6 35U 2LAG	WALTER	
AP-239.490.00-01	L	1	EM-D2-10		F-DÄMPFUNGSPERLE 3.5X7.5	PHILIPS COMPONENTS	SCREENING BEAD 3.5X7.5 FXC3B1 - 4312 020 31331
AP-239.490.00-01	R	1	RK-100R-10		KOHLE.WID 100R 5% 0.33W -TK300 CR25	PHILIPS COMPONENTS	CARBON FILM RESISTOR CR25 100R TAPED - 2322 211 73101
xy-239.790.00-01	1	0	XY-GS10FD/SS-80		GERÄTEEINB.STECK+FD+SS 250V/10A LO+ST	OTTO HEIL	COMPACT-CONNECTOR PART-NO. 6765.01.1802.1102
XY-239.790.00-01	5	0	FD-T6A3-10		G-SICH T 6A3 1500A 5X20 IEC127/2/5		FUSE LINK IEC127/2 BL.5 6.3A
ya-238.770.00-10	1	0	YA-12VDC/Q15-10		AX.LÜFTER 12VDC 15.5L/S 80X80X25.4	PAPST	AXIAL VENTILATING FAN MULTIFAN 80X80X25 12VDC - 8412

ROHDE&SCHWARZ

Stromläufe
Bestückungspläne
Circuit diagrams
Components plans
Schémas de circuit
Plans des composants

(R 29500 BJ 4)
0995 1000 BJ 4