

Brüel & Kjær

Phase Indicator

Type 2976

Valid from serial no. 889821

037- 654



Service

Phase Indicator

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Valid from serial no. 889821

037--654

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Trouble Shooting

If any faults should occur please check the instrument according to the Adjustment Procedure.

When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested to make sure that all basic functions are operative.

The tolerances given in these notes are intended for use as guide for adjustments.

Before correcting any apparent deviation make sure that the measuring instrument has tolerances small enough not to affect the measurement.

Modifications

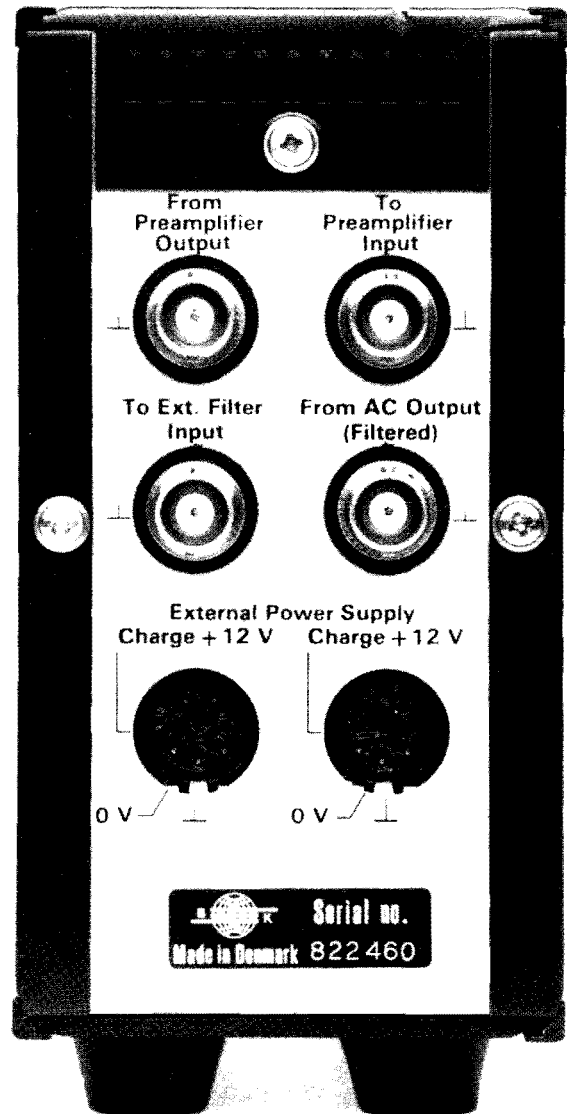
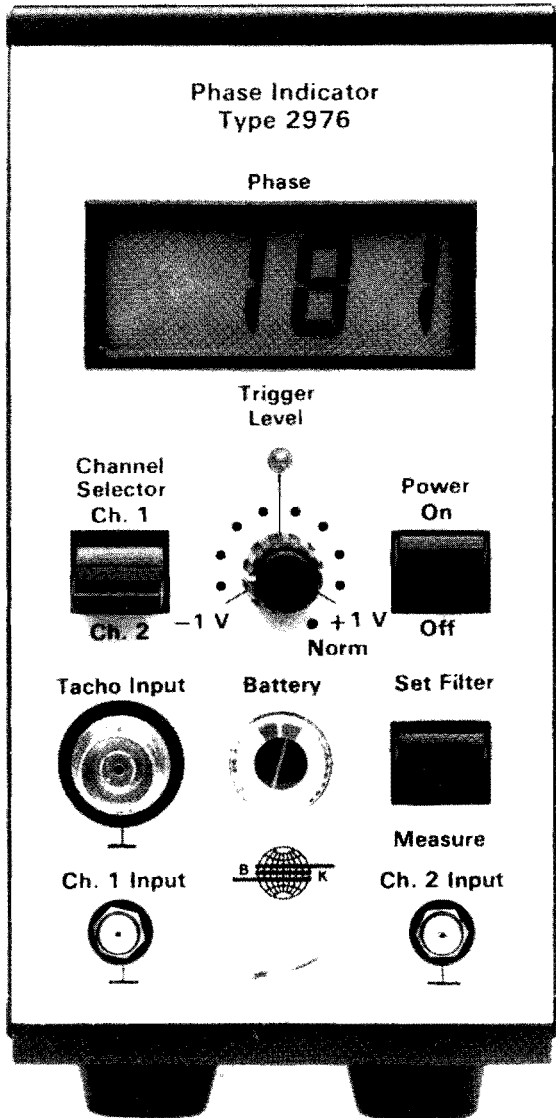
Due to the constant technical progress the instrument will be modified from time to time in order to provide continuously improved performance.

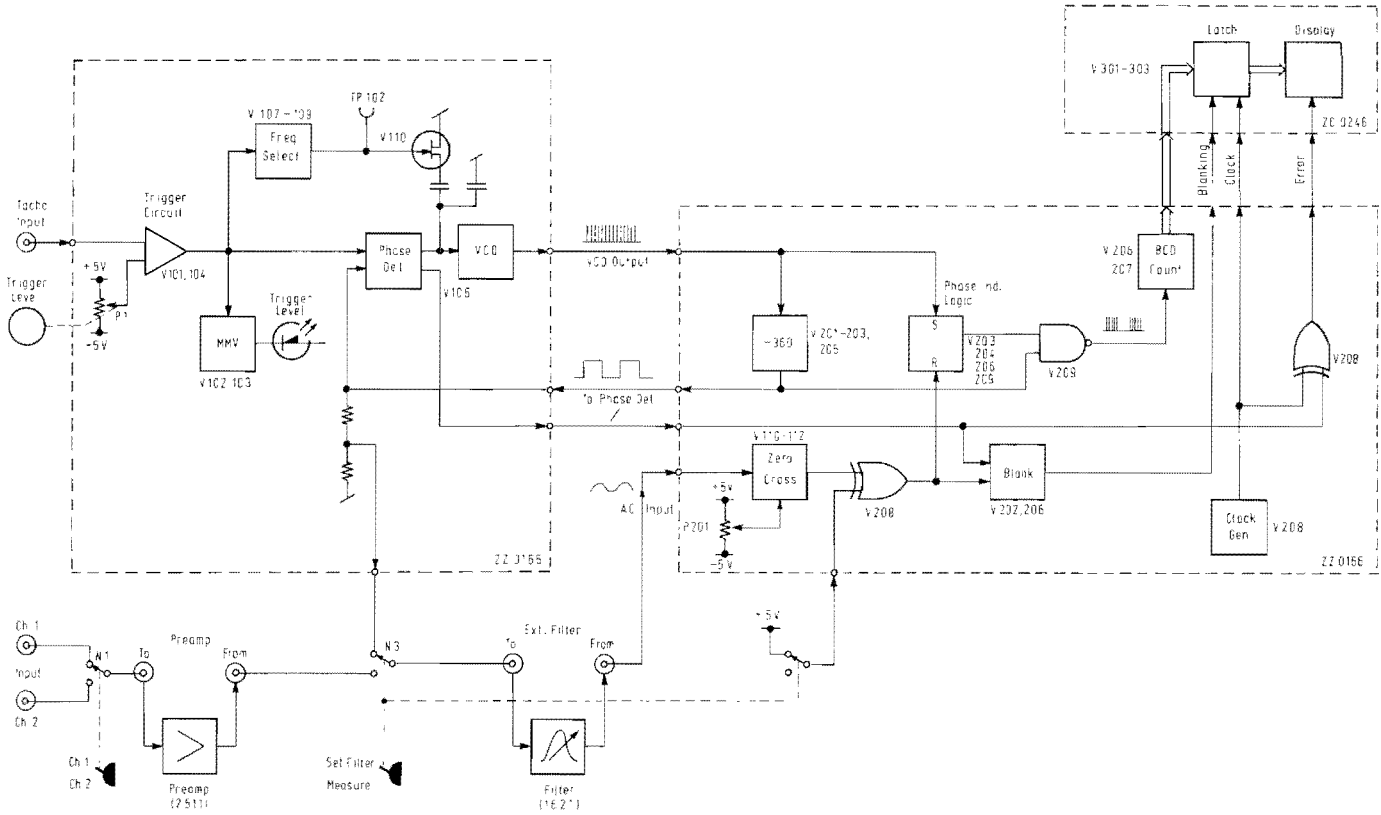
For this reason there may be small differences between the instrument and the Service Instruction.

However, the local Service Representative is in possession of all information regarding the modifications that have been made.

Spare Parts

Please state type and serial number of the instrument when ordering spare parts.





The principle of the Phase Indicator is as follows:

The input to the "Tacho Input" is taken from a Photoelectric Probe or a Magnetic Transducer. This signal is fed to the Trigger Circuit where the Trigger Level is selected. Then the signal is fed through a Phase Detector to a VCO*. The VCO output is then divided by 360 and fed to the Phase Detector the output of which controls, together with the Tacho Input, the VCO.

The output of the 360 Divider is also fed to a Set Reset FF in the Phase Indicating Logic as set.

* The output of the Phase Detector is integrated and controls the frequency of the VCO.

The input from the "From AC output" socket feeds a Zero Cross Circuit the output of which is a square wave having the same frequency as the input signal. This signal goes to the Set Reset FF as reset.

When the Set Reset FF is set it opens the NAND Gate and pulses from the VCO go to the Counter and to the Latch. When the FF is reset the NAND Gate close and the number of pulses to the Latch is shown on the Display

The maximum number of pulses which will be shown on the Display is 360 corresponding to 360°.

The Set Reset FF can only work when a clock from the Display Delay circuit occurs. This means that a new display reading only takes place approx. every second.

a. Trigge

Att
PO
SE
N1
N1
N1
TR
TR
TR

b. Offse

TR
Att
Att

c. Phase

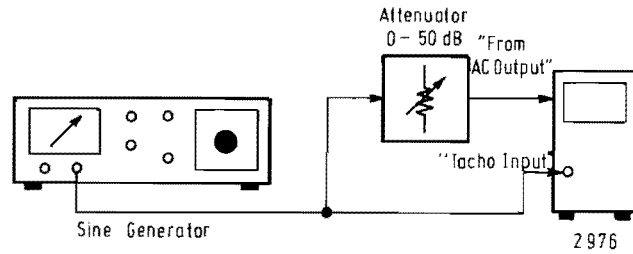
Att

d. Set F

SE
Att

e. Error

SE



a. Trigger Level

Attenuator: 0 dB
POWER: "On"
SET FILTER/MEASURE: "Measure"
N101*: "DC"
N102*: "Dir."
N103*: "Slope 2"
TRIGGER LEVEL: "-1 V"

TRIGGER LEVEL to "+1 V"

TRIGGER LEVEL to "Norm"

* Remove the bottom plate to get access to the switches N101-103.

Input frequency: 200 Hz
Increase the input voltage until the yellow lamp light up, and stable display appears.
Check the input voltage: $0.7\text{ V} \pm 0.2\text{ V}$

Proceed as above: $0.7\text{ V} \pm 0.2\text{ V}$

Proceed as above: $55\text{ mV} \pm 10\text{ mV}$.

b. Offset

TRIGGER LEVEL to "+1 V"

Attenuator to "40 dB"

Attenuator to "50 dB"

Input voltage: Approx. 3 V.

Check the display: 10—20. Note displayed value.

Check that the display has the same value as above.
If necessary adjust P201 (ZZ 0166)

Check that the display is blanked.

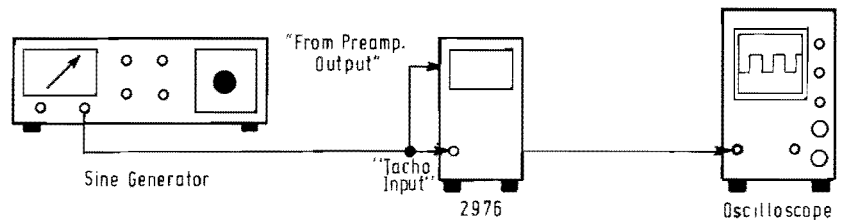
c. Phase Lock

Attenuator to "0 dB"

Connect an oscilloscope to TP102 (ZZ 0165)

Vary the input frequency between 30—70 Hz.

Check that the Phase Lock system is changing at approx. 55 Hz when the input frequency is increased and at 45 Hz when it is decreased.



d. Set Filter Output

SET FILTER/MEASURE to "Set Filter"

Attenuator to "0 dB"

Input signal: 3 V, 200 Hz.

Check the signal on "To Ext. Filter Input": $220\text{ mVpp} \pm 20\text{ mV}$.

e. Error Function

SET FILTER/MEASURE to "Measure"

Input signal: 3 V, 200 Hz

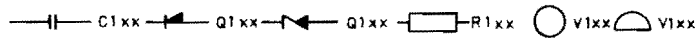
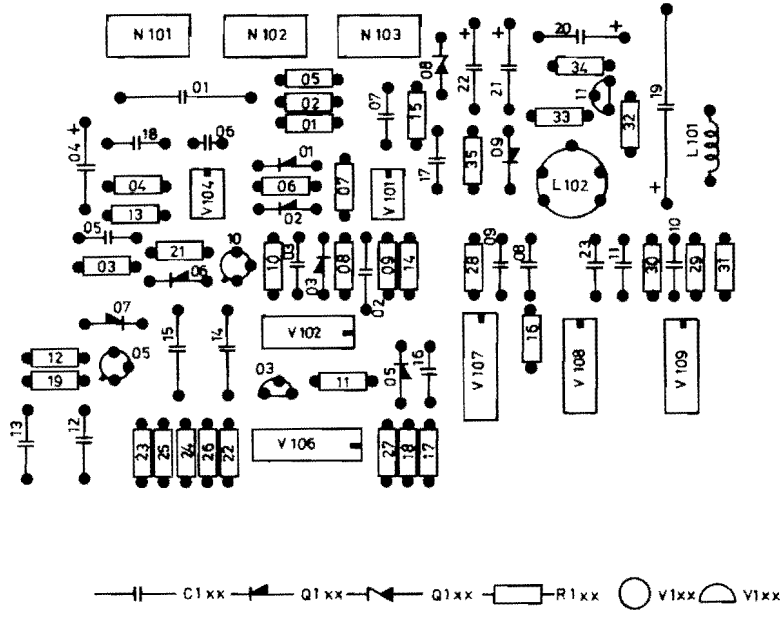
Remove the signal to "Tacho Input" and check that the digits are blank and a "E" for error is displayed on the Display.

JZ 0037

J 401,402	"Ext. Power Supply" socket		JJ 0717
	Printed Circuit Board		XC 1802
C 1-3	Ceramic	47 nF / 16 V	CK 4471
C 4-7	-	0,1 μ F / 16 V	CK 5103
J 1	"Ch. 1 Input"		JJ 0031
J 2	"Ch. 2 Input"		JJ 0031
J 3	"Tacho Input"		JJ 0315
J 4	"To Ext. Filter"		JJ 0130
J 5	"From Preamplifier Output"		JJ 0130
J 6	"From AC-Output"		JJ 0130
J 7	"To Preamplifier Input"		JJ 0130
N 1-3	Switch		NN 0113
P 1	TRIGGER LEVEL	10 k Ω	PS 3105
	Flat cable with plugs		AY 1640
	Battery indicator		IM 0011
	Battery Plug , male		JF 0015
	- - , female		JF 0016
	Socket for Fuse		JS 0007
	Battery , rechargeable		QB 0024
	Knob		SN 1025
	Fuse 200 mA		VF 0012

Furthermore 2976 includes the following subassemblies the details of which will be found under the respective numbers.

Trigger Circuit		ZZ 0165
Phase Measuring Circuit	ZD 0246 +	ZZ 0166

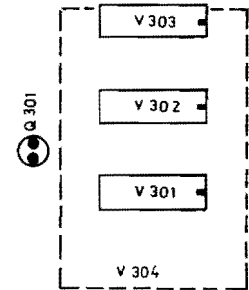
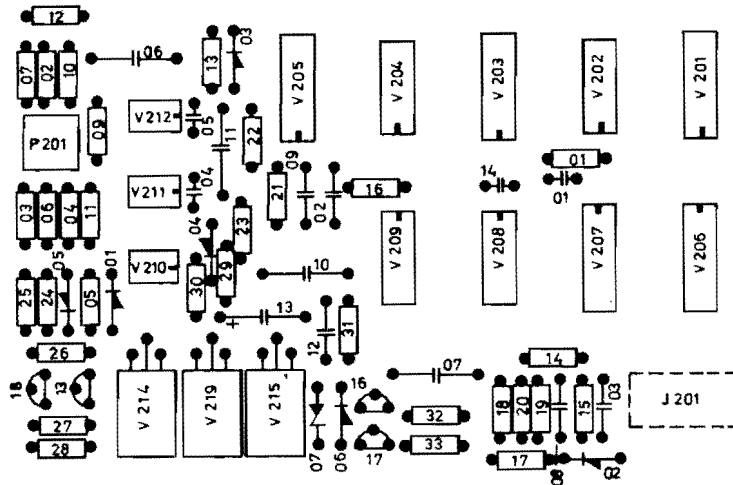


Viewed from the component side

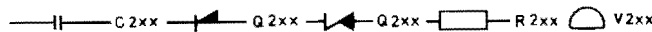
C 101	Polycarbonate		6,8 μ F / 63 V	CS 0397	R 109,110	Carbon	1/4 W	5%	1,0 M Ω	RB 6100
C 102	Polystyrene		1,5 nF / 63 V	CT 1151	R 111	-	-	-	12 k Ω	RB 4120
C 103	Polyester		68 nF / 250 V	CS 0406	R 112	-	-	-	560 Ω	RB 2560
C 104	Electrolytic		22 μ F / 25 V	CE 2002	R 113	Metal	-	1%	20,0 k Ω	RF 4200
C 105	Polyester		0,1 μ F / 100 V	CS 0436	R 114	Carbon	-	5%	12 k Ω	RB 4120
C 106	Ceramic		30 pF / 400 V	CK 0105	R 115	-	-	-	1,0 M Ω	RB 6100
C 107	Polyester		0,1 μ F / 100 V	CS 0436	R 116	-	-	-	10 k Ω	RB 4100
C 108,109	-		10 nF / 400 V	CS 0430	R 117	Metal	-	1%	22,1 k Ω	RF 4221
C 110	-		0,1 μ F / 100 V	CS 0436	R 118	-	-	-	1,05 k Ω	RF 3105
C 111	-		10 nF / 400 V	CS 0430	R 119	Carbon	-	10%	200 M Ω	RH 0005
C 112	Polystyrene	1%	2,0 nF / 63 V	CT 1123	R 120	Metal	-	1%	7,68 k Ω	RF 3768
C 113	-	1%	120 pF / 630 V	CT 1137	R 121	Carbon	-	5%	1,0 M Ω	RB 6100
C 114	Polycarbonate		2,2 μ F / 63 V	CS 0349	R 122	-	-	-	150 k Ω	RB 5150
C 115	Polyester		0,22 nF / 250 V	CS 0405	R 123	-	-	-	1,0 M Ω	RB 6100
C 116-118	-		0,1 μ F / 100 V	CS 0436	R 124	Metal	-	1%	10,0 k Ω	RF 4100
C 119	Electrolytic		470 μ F / 40 V	CE 0417	R 125	-	-	-	1,00 M Ω	RF 6100
C 120-122	-		22 μ F / 25 V	CE 2002	R 126	Carbon	-	5%	12 k Ω	RB 4120
C 123	Polyester		0,1 μ F / 100 V	CS 0436	R 127	-	-	-	4,7 k Ω	RB 3470
					R 128	-	-	-	10 k Ω	RB 4100
					R 129	Metal	-	1%	121 k Ω	RF 5121
L 101	Coil		100 μ H	LJ 0021	R 130	-	-	-	1,00 M Ω	RF 6100
L 102	Converter Coil			LB 0947	R 131	Carbon	-	5%	1,0 k Ω	RB 3100
					R 132	-	-	-	68 k Ω	RB 4680
					R 133	-	-	-	15 k Ω	RB 4150
N 101-103	Switch			NN 0032	R 134	-	-	-	47 Ω	RB 1470
					R 135	-	-	-	820 Ω	RB 2820
Q 101-107	Si.	1N4148	75 V / 75 mA	QV 0216						
Q 108	Ze	ZPD5,1	4,8-5,4 V / 0,25 W	QV 1339	V 101	Op. Amp.			LM308	VE 0046
Q 109	Si.	1N4148	75 V / 75 mA	QV 0216	V 102	4 \times Exclusive OR			4030B	VD 2019
					V 103	Silicon NPN			BC182	VB 0055
					V 104	Op. Amp.			LM308	VE 0046
					V 105	FET N			2N4393	VB 1056
					V 106	Phase-Locked Loop			4046B	VD 2071
					V 107	2 \times J-K M/S Flip-Flop			4027B	VD 2016
					V 108	4 \times 2 Input NAND			4011B	VD 2004
					V 109	4 \times Exclusive OR			4030B	VD 2019
					V 110	FET N			2N4393	VB 1056
					V 111	Silicon NPN			BC182	VB 0055

Printed Circuit Board

XC 1803

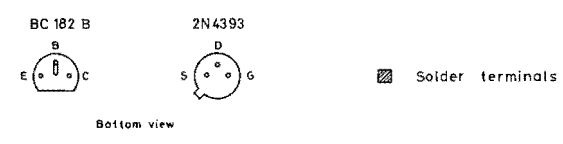
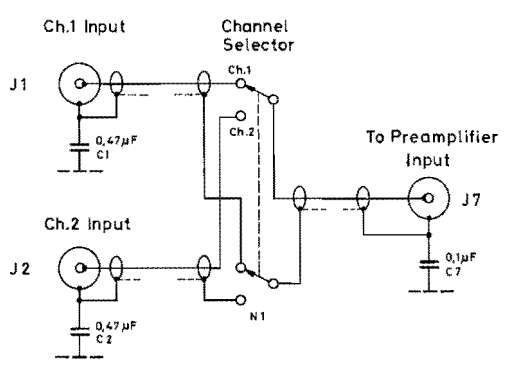
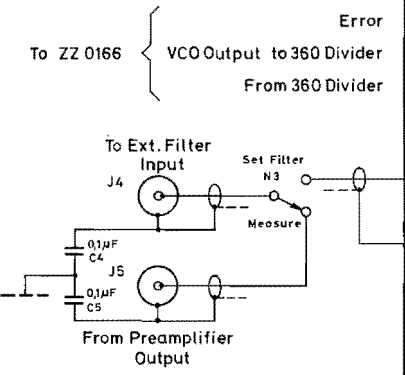
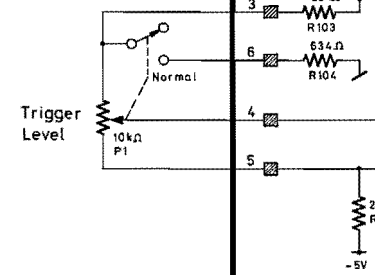
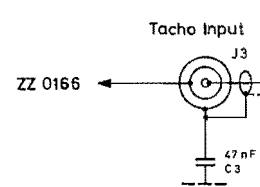
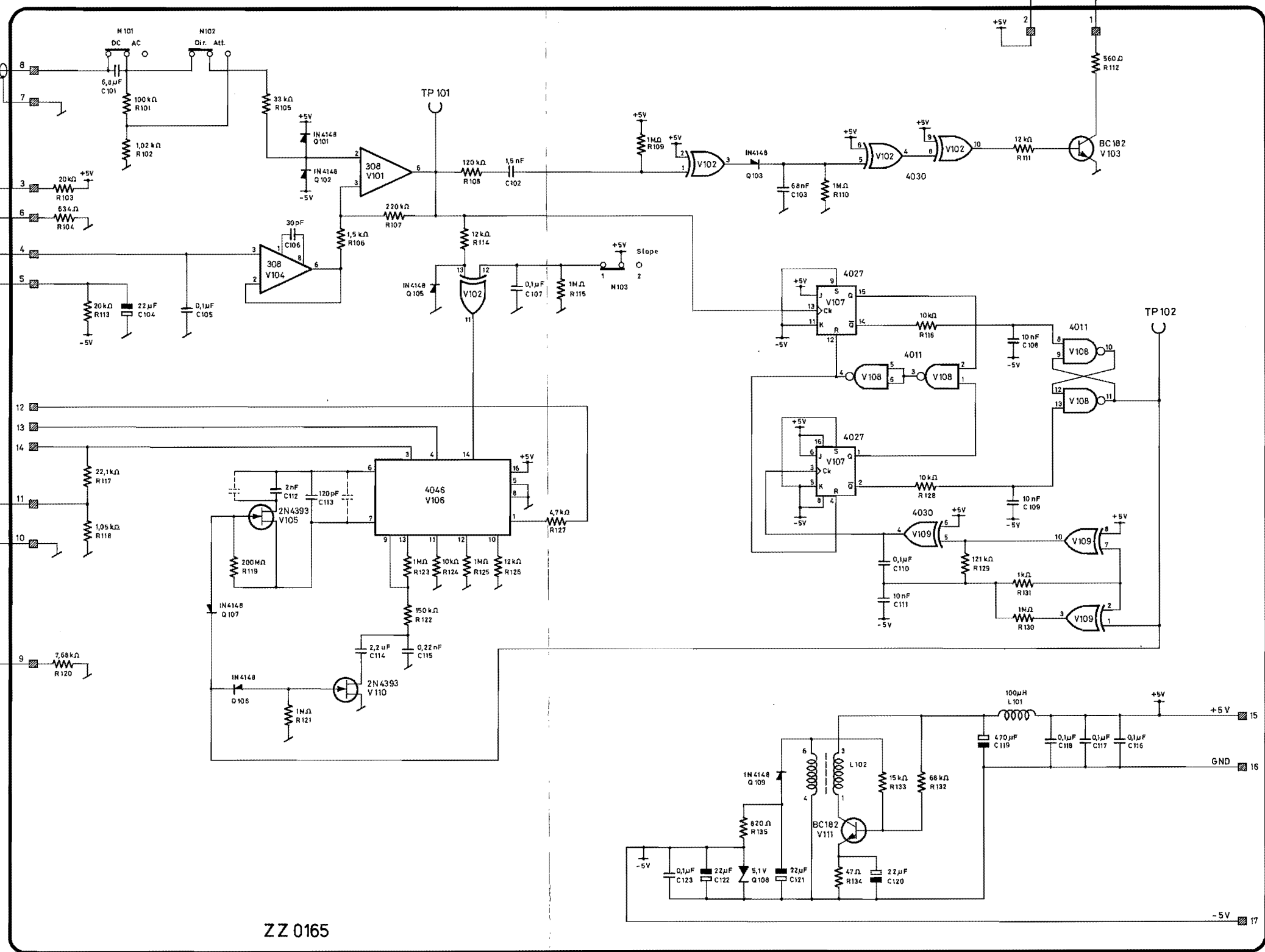
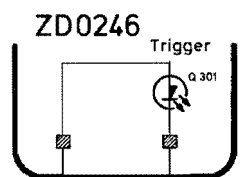


Viewed from the component side

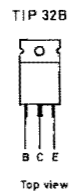
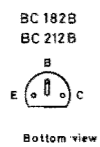
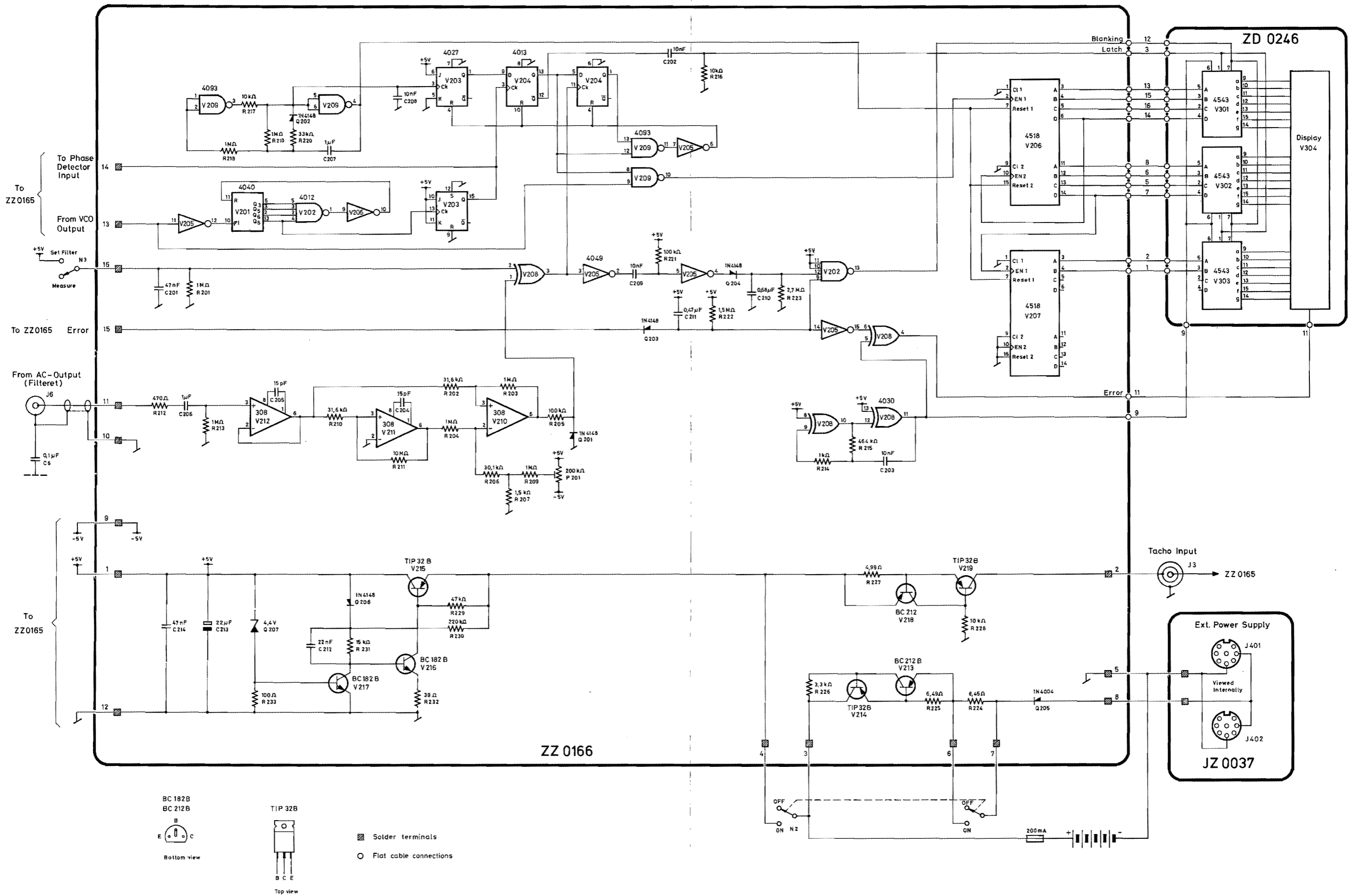


Viewed from the component side

C 201	Ceramic	47 nF/ 16 V	CK 4471	R 223	Carbon	1/4 W	10%	2,7 MΩ	RB 6270
C 202,203	Polyester	10 nF/400 V	CS 0430	R 224	Metal	-	1%	8,45 Ω	RF 0845
C 204,205	Ceramic	15 pF/400 V	CK 1150	R 225	-	-	-	6,49 Ω	RF 0649
C 206,207	Polycarbonate	1 μF/100 V	CS 0384	R 226	Carbon	-	5%	3,3 kΩ	RB 3330
C 208,209	Polyester	10 nF/400 V	CS 0430	R 227	Metal	-	1%	4,99 Ω	RF 0499
C 210	Polycarbonate	0,68 μF/100 V	CS 0388	R 228	Carbon	-	5%	10 kΩ	RB 4100
C 211	-	0,47 μF/100 V	CS 0412	R 229	-	-	-	47 kΩ	RB 4470
C 212	Polyester	22 nF/400 V	CS 0432	R 230	-	-	-	220 kΩ	RB 5220
C 213	Electrolytic	22 μF/ 25 V	CE 2002	R 231	-	-	-	15 kΩ	RB 4150
C 214	Ceramic	47 nF/ 16 V	CK 4471	R 232	-	-	-	39 Ω	RB 1390
				R 233	-	-	-	100 Ω	RB 2100
P 201	Cermet	200 kΩ	PG 4208	V 201	12-Stage Bin./Counter			4040B	VD 2100
Q 201-204	Si.	1N4148	75 V/75 mA	QV 0216	V 202	2 × 4 Input NAND		4012B	VD 2005
Q 205	-	1N4004	400 V/1 A	QV 0237	V 203	2 × J-K M/S Flip-Flop		4027B	VD 2016
Q 206	Si.	1N4148	75 V/75 mA	QV 0216	V 204	2 Set/Reset D Flip-Flop		4013B	VD 2006
Q 207	Ze.	ZF4,3	4,0-4,6 V/0,25 W	QV 1110	V 205	6 × Buffer/Conv. (invert.)		4049UB	VD 2024
R 201	Carbon	1/4 W	5%	1,0 MΩ	RB 6100	V 206,207	2 × BCD Cont./Div.	4518B	VD 2036
R 202	Metal	-	1%	31,6 kΩ	RF 4316	V 208	4 × Exclusive OR	4030B	VD 2019
R 203,204	-	-	-	1,00 MΩ	RF 6100	V 209	4 × 2 Input NAND	4093B	VD 2081
R 205	Carbon	-	5%	100 kΩ	RB 5100	V 210-212	Op. Amp.	LM308	VE 0046
R 206	Metal	-	1%	30,1 kΩ	RF 4301	V 213	Silicon PNP	BC212	VB 0049
R 207	-	-	-	1,50 kΩ	RF 3150	V 214,215	- PNP	TIP32B	VB 0107
R 209	-	-	-	1,00 MΩ	RF 6100	V 216,217	- NPN	BC182B	VB 0055
R 210	-	-	-	31,6 kΩ	RF 4316	V 218	- PNP	BC212	VB 0049
R 211	Carbon	-	10%	10 MΩ	RB 7100	V 219	- PNP	TIP32B	VB 0107
R 212	-	-	5%	470 Ω	RB 2470				
R 213	Metal	-	1%	1,00 MΩ	RF 6100				
R 214	-	-	-	1,00 kΩ	RF 3100				
R 215	-	-	-	464 kΩ	RF 5464				
R 216	Carbon	-	5%	10 kΩ	RB 4100				
R 217	Metal	-	1%	10,0 kΩ	RF 4100				
R 218,219	-	-	-	1,00 MΩ	RF 6100				
R 220	Carbon	-	5%	33 kΩ	RB 4330				
R 221	Metal	-	1%	100 kΩ	RF 5100				
R 222	Carbon	-	5%	1,5 MΩ	RB 6150				
						ZD 0246			
						Q 301	LED		QV 4011
						V 301,303	BCD-7 Seg. Latch Dec.Driv.	4543B	VD 2075
						V 304	Display		VU 1001
							16-pin Socket		JJ 1622
							20-pin Socket		JJ 2012
							Printed Circuit Board		XC 1805



To ZZ 0166



- Solder terminals
- Flat cable connections