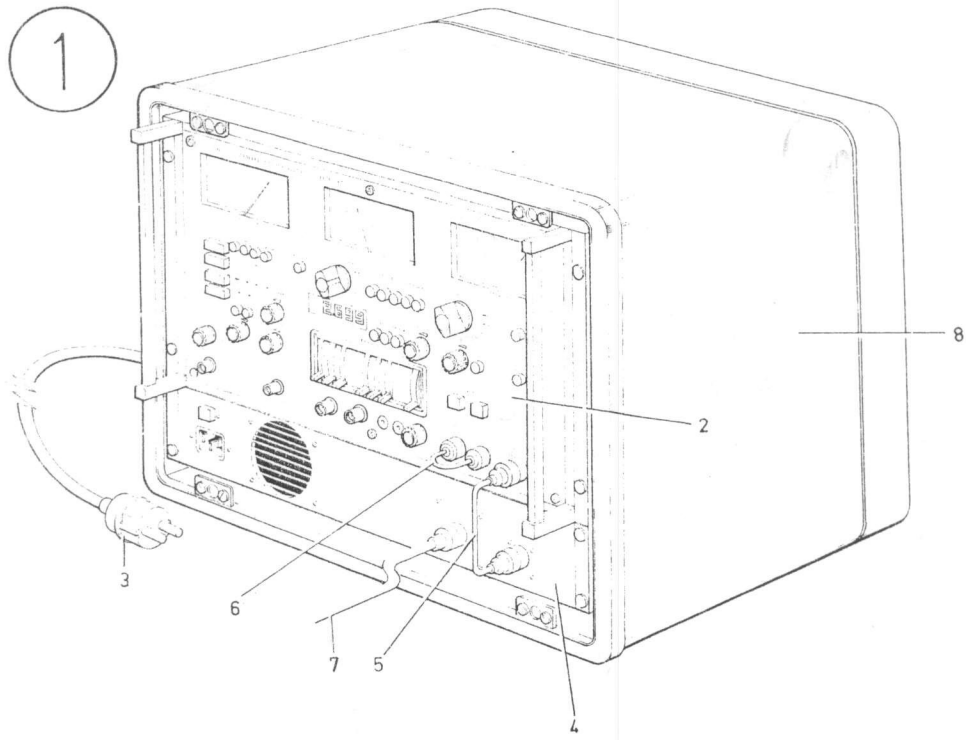

Pos	Ant	Förrådsbeteckning	Förrådsbenämning	Ursprungsbenämning	Ursprungsbeteckning
1	1	M3743-558011	Radioprovare 558 MT		
2	1	M3743-558010	.Radioprovare 558	Stabilock Funkgeräte Messplatz	SCHIN-STABILOCK 4011S
	1	M3743-558109	..Beskrivning handhav		
	1	M3743-558119	..Beskrivning service		
3	1	M1812-127020	..Nätkabel		
Tillbehör:					
4	1	M3437-558149	.Högeffektdämpare		SCHIN-40110
5	1	M3743-558169	.Övergångsbygel		SCHIN-380398
6	1	M3743-558159	.Övergångsbygel		SCHIN-380615
7	1	M3743-558189	.Mätkabel		
8	1	M3743-558199	.Transportlåda		SCHIN-770060

DATA

Mottagarmätningar	
Frekvensområde:	0,01...479,9999 MHz
Frekvensinställning:	Digital
Frekvensonoggrannhet:	1 x 10^{-7} efter 10 min vid 20°C
Frekvensdrift:	1 x 10^{-8}/24t efter 8 veckor uppv
Utspänning:	0,025 uV...19 mV EMK
	Direktutgång 0,5 uV...380 mV EMK
Impedans:	50 ohm
LF-oscillator:	0,3/0, 4/1/2,7/3/4,8 och
	0,03...10 kHz
Amplitudmodulering:	0...100 %
Frekvensmodulering:	0...20 kHz
Fasmodulering:	0...5 rad
LF-voltmeter:	0...30 V
Frekvensområde;	30 Hz...20 kHz
Mätonoggrannhet:	± (5 % + 1,5 % av fsk) vid 1 kHz
Distorsionmeter:	
Frekvens:	1 kHz ± 1 %
Mätområde:	0...20 %
Inspänning:	10 mV...30 V
Mätonoggrannhet:	± (12 % + 1,5 % av fsk) + egendis.
Egendistorsion:	< 0,5 %
SINAD-meter:	
Frekvens:	1 kHz + 1 %
Mätområde:	6,12 och 20 dB markeringar
Inspänning:	10 mV...30 V
Mätonoggrannhet	6 dB: ± 1 dB, 12 dB: ± 2 dB, 20 dB: ± 3 dB
CCITT-filter:	Inkopplingsbart vid deviations- eller LF-mätning
Sändarmätningar	
Effektmeter:	
Frekvensområde:	1,5...480 MHz
Mätområde:	0,2...100 W
Mätonoggrannhet:	± (7 % + 0,5 % av fsk) 4...200 MHz. Frekvensgång < ± 3 % inom 1,5...480
	inom 1,5...480 MHz
Moduleringsmeter AM:	
Moduleringsfrekvens:	30 Hz...10 kHz
Mätområde:	0...100 %
Mätosäkerhet:	± (5 % + 1,5 % av fsk) vid 1 kHz
Moduleringsmeter FM:	(även fasmodulering 0...5 rad)
Frekvensområde:	20...479,9999 MHz
Deviation:	0...20 kHz
Moduleringsfrekvens:	30 Hz...20 kHz
Mätosäkerhet:	± (3 % + 1,5 % av fsk) vid 1 kHz
Störddeviation:	< 9 Hz (CCITT)
CCITT-filter:	Inkopplingsbart vid deviations- eller LF-mätning

DATA

Övrigt	
Strömförsörjning:	Nät 220 V -15...+ 10 %. 50 VA Yttre batteri + 12 V/ca 4,5 A I drift: + 5...+ 40° C
Dimensioner:	534 x 450 x 460 mm (inkl militär låda)
Vikt:	31 kg

SERVICE INSTRUCTIONS

STAGE LOCATIONS

1. Immediate access is provided to the following stages subsequent to screwing off the covers without any further disassembly (figs. 1 and 2, page 4/8):

Oscillator Stage	213 016 / 213 017	l. h. instrument side
Decade Stage	211 021	instrument top
Output Stage	230 025	r. h. instrument side
Supplementary Oscillator Stage on 4011	213 014	instrument bottom

A 6 mm Allen key is required to open up these stages.

2. The Power Supply 204 022 is located directly on the inside of the instrument rear panel (fig. 3).
Use test points recommended in fig. 3 for checking supply voltages. These test points as well as the fuse for the power supply of the Channel Selector Type 4932 are accessible subsequent to removal of the instrument bottom cover. To facilitate repair work on the Power Supply the instrument rear panel can be hinged open after having removed the 4 Phillips head screws connecting the bottom and top frame.

Should the Power Supply need to be operated in the hinged open position the connector St 8 (to mains switch fig. 3) must be disconnected and a two pole short-circuiting link (HNK 898 030) used instead of the mains switch.

3. The Control and Display Unit 209 021 contains the following assemblies apart from the control and display components (see fig. 4):

Modulation Selector	Board 361 088
AF Unit	Board 361 154
Receiver/Transmitter Test Changeover	Board 361 086
Frequency Counter	Circuit diagram 237 002
Modulation Generator	Circuit diagram 208 025/026
Diode Probe	Circuit diagram 229 006

All calibrating controls of Boards 361 088 and 361 154 are accessible from above after removing the outer covers with the aid of a long calibrating screwdriver.

The location of the calibrating controls is shown in fig. 5, the arrangement of the calibrating components of all other stages being indicated in the corresponding chapters. The Control and Display Unit can be separated from the rear instrument unit to carry out major repairs on the AF Unit or on the Modulation Selector which is, however, not necessary for repairs to be carried out on the Modulation Generator, Frequency Counter and Diode Probe.

Instructions for removing the Control and Display Unit from the rear instrument section (see fig. 6):

1) Remove all four cover sheets
2) Screw off adjustment knob for step attenuator
3) Loosen jack 22 (see fig. 4) after having removed the lock screw on the jack.
4) Disconnect plugs St 20 and St 32 (fig. 4)
5) Disconnect jack Bu 8 (see also fig. 3)
6) Disconnect two cable clamps
7) Disconnect cable from jack Bu 13
8) Remove 4 x 2 slotted head screws on case frame
9) Pull two instrument halves apart

4. Modulation Generator 208 025/026 (fig. 4)

All calibrating controls are accessible from the bottom of the instrument after having removed the floor cover. For location of calibrating components see drawing 361 087 chapter 4.
To remove the modulation generator take off front panel by removing six Phillips head screws and pulling off all control knobs.
After having removed the 3 central mounting nuts on the controls of the modulation generator the latter can be removed from the rear.

5. Should the Frequency Counter 237 002 (fig. 4) need to be removed for instrument repairs, front panel must also be removed (see instructions for 4. above).
Three screws remain to be loosened after having removed a spacing piece to the printed circuit board 361 154 located above, the three screws being necessary to mount the counter to the assembly plate. Depending on the serial number of the instrument these screws are accessible either from the front or rear of the assembly plate. In the latter instance disassembly of the counter is considerably facilitated when the rear panel of the instrument (power supply) is previously removed (necessitating removal of 8 screws).

6. Diode Probe 229 006 (fig. 1)

Remove by screwing off front panel (see 4) and loosening the two assembly plate screws together with a further screw connecting the bottom frame having previously screwed off plug St 12.

7. Crystal Stage 214 022 (fig. 3)

The crystal stage can be removed from underneath after having loosened the 4 Phillips head screws in the instrument rear panel.

8. 10 x 10 dB Step Attenuator 370 014 (fig. 3)

To remove the step attenuator take off the rear panel (necessitating removal of 8 Phillips head screws connecting bottom and top frame) and then remove adjustment knob and screening can (2 or 3 slotted head screws).
The step attenuator can then be removed after having disconnected the cable connections.

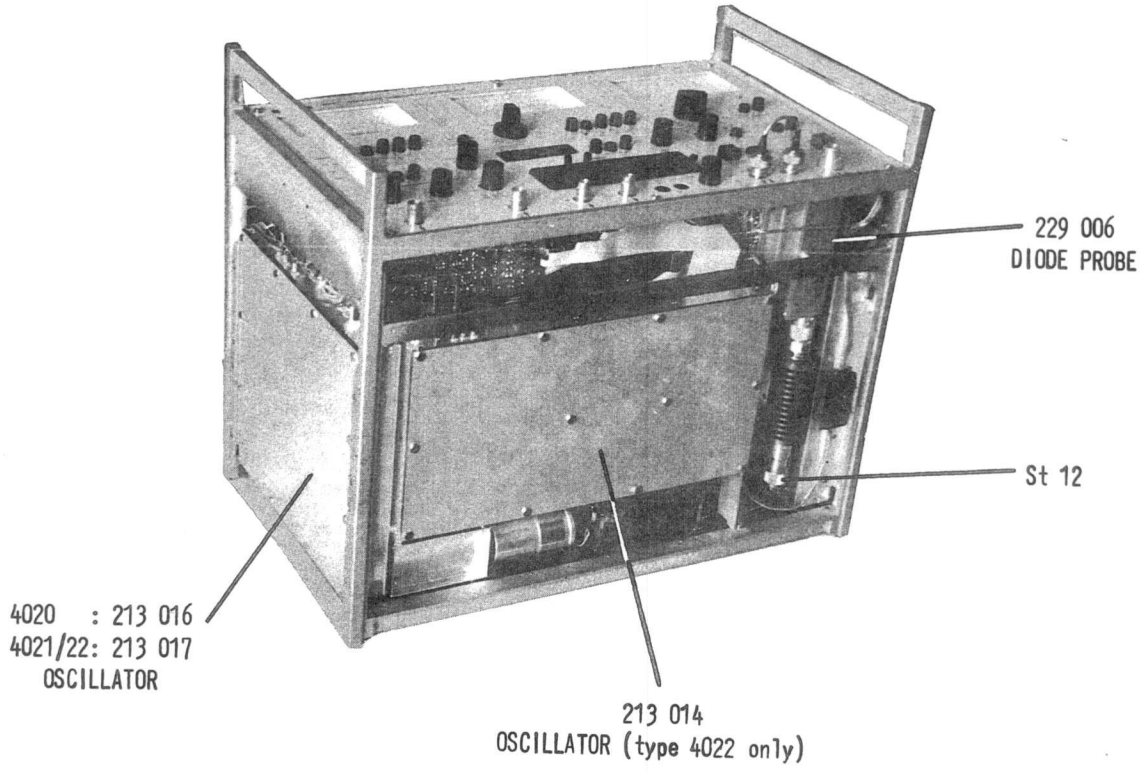
229 006
DIODE PROBE
St 12
4020 : 213 016
4021/22: 213 017
OSCILLATOR
213 014
OSCILLATOR (type 4022 only)

FIG. 1

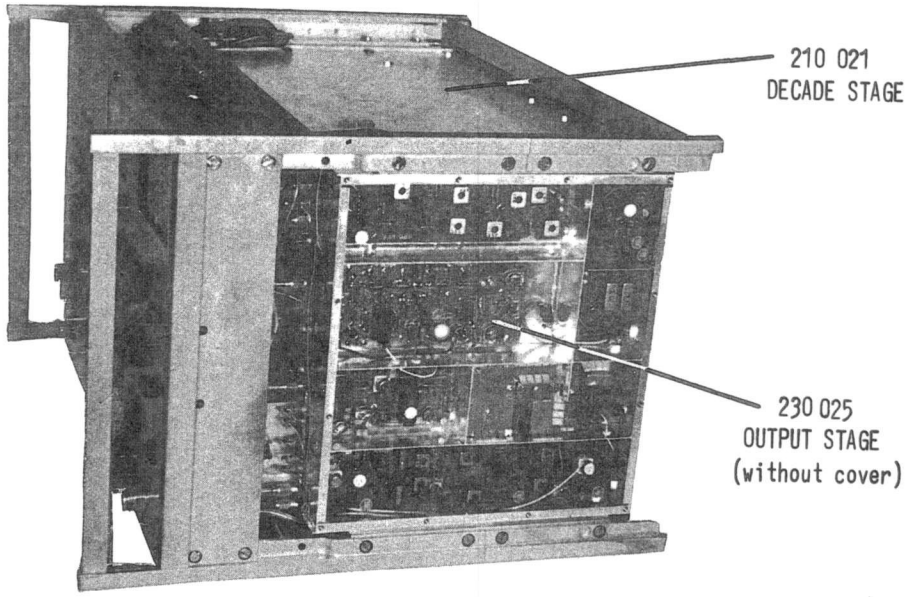
210 021
DECADE STAGE
230 025
OUTPUT STAGE
(without cover)

FIG. 2

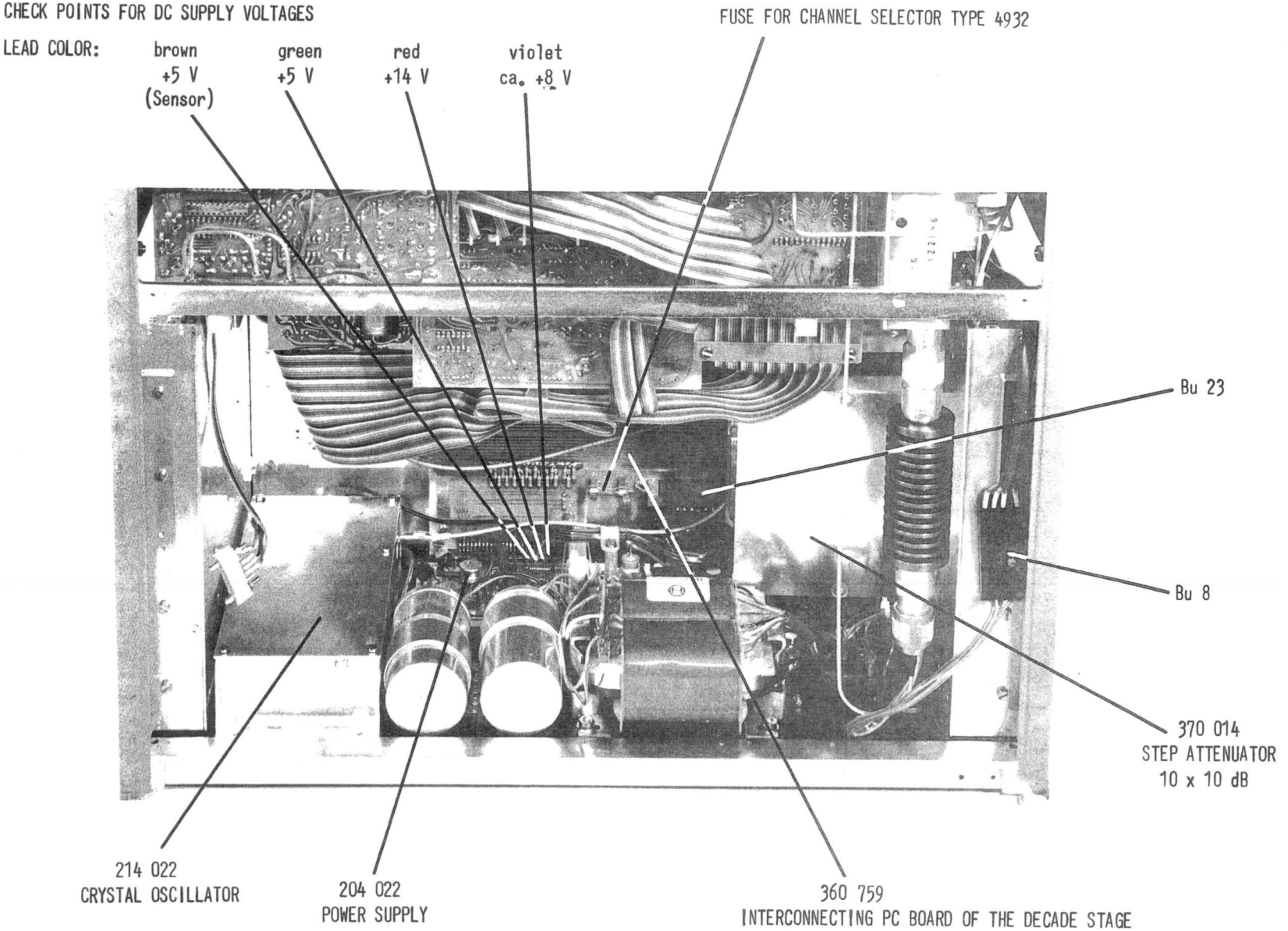

FIG. 3: BOTTOM VIEW

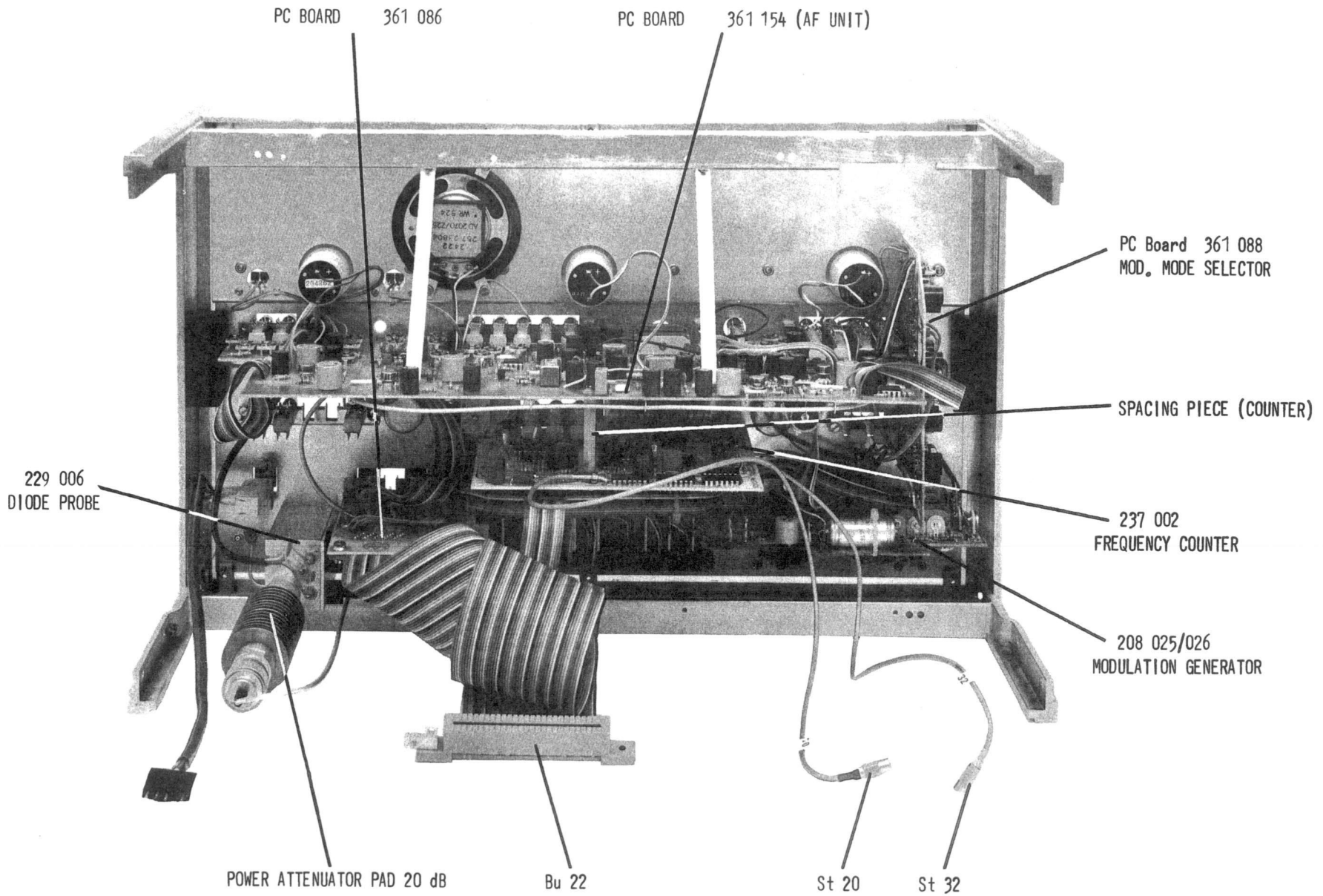

FIG. 4: CONTROL AND DISPLAY UNIT

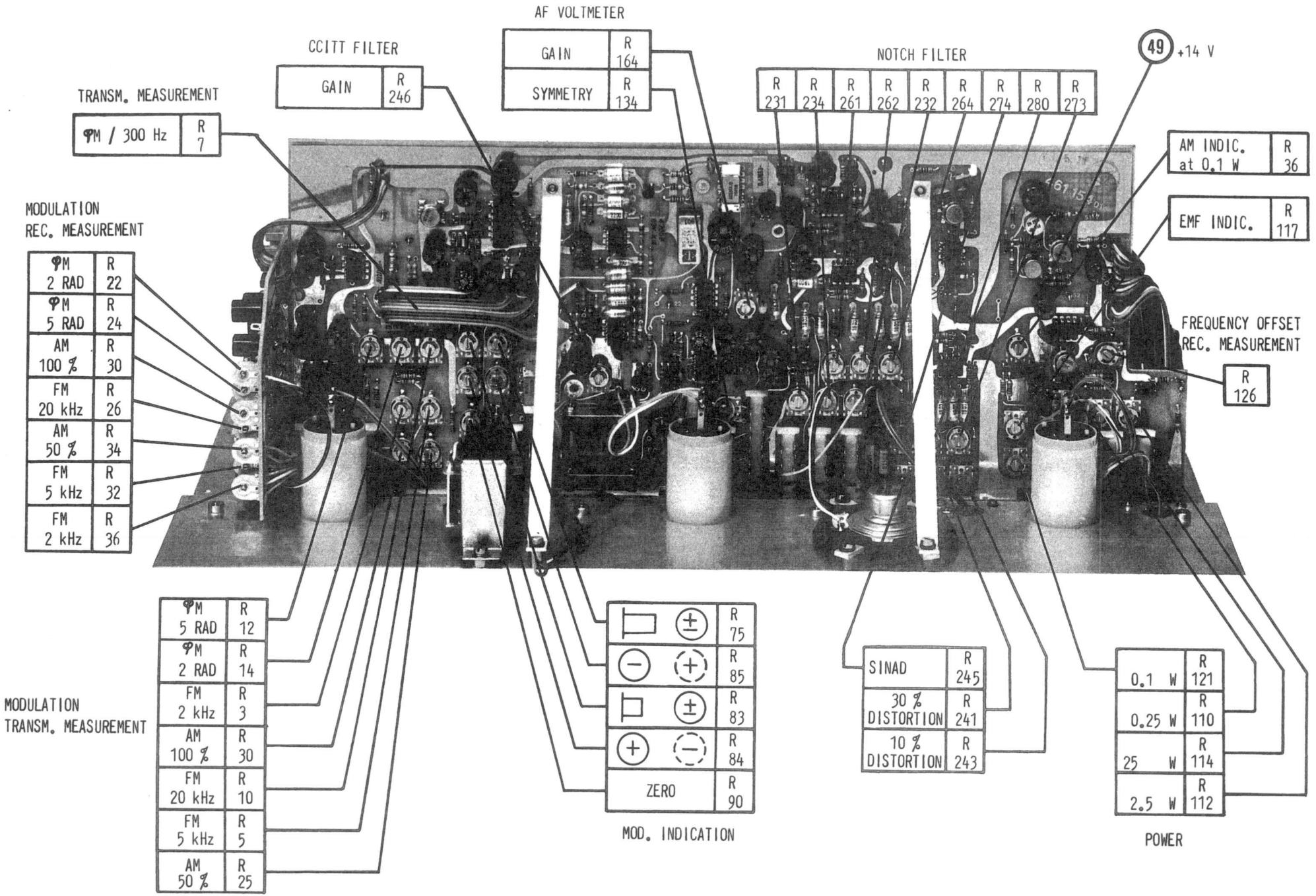

FIG. 5: ADJUSTMENT LOCATIONS OF THE CONTROL AND DISPLAY UNIT

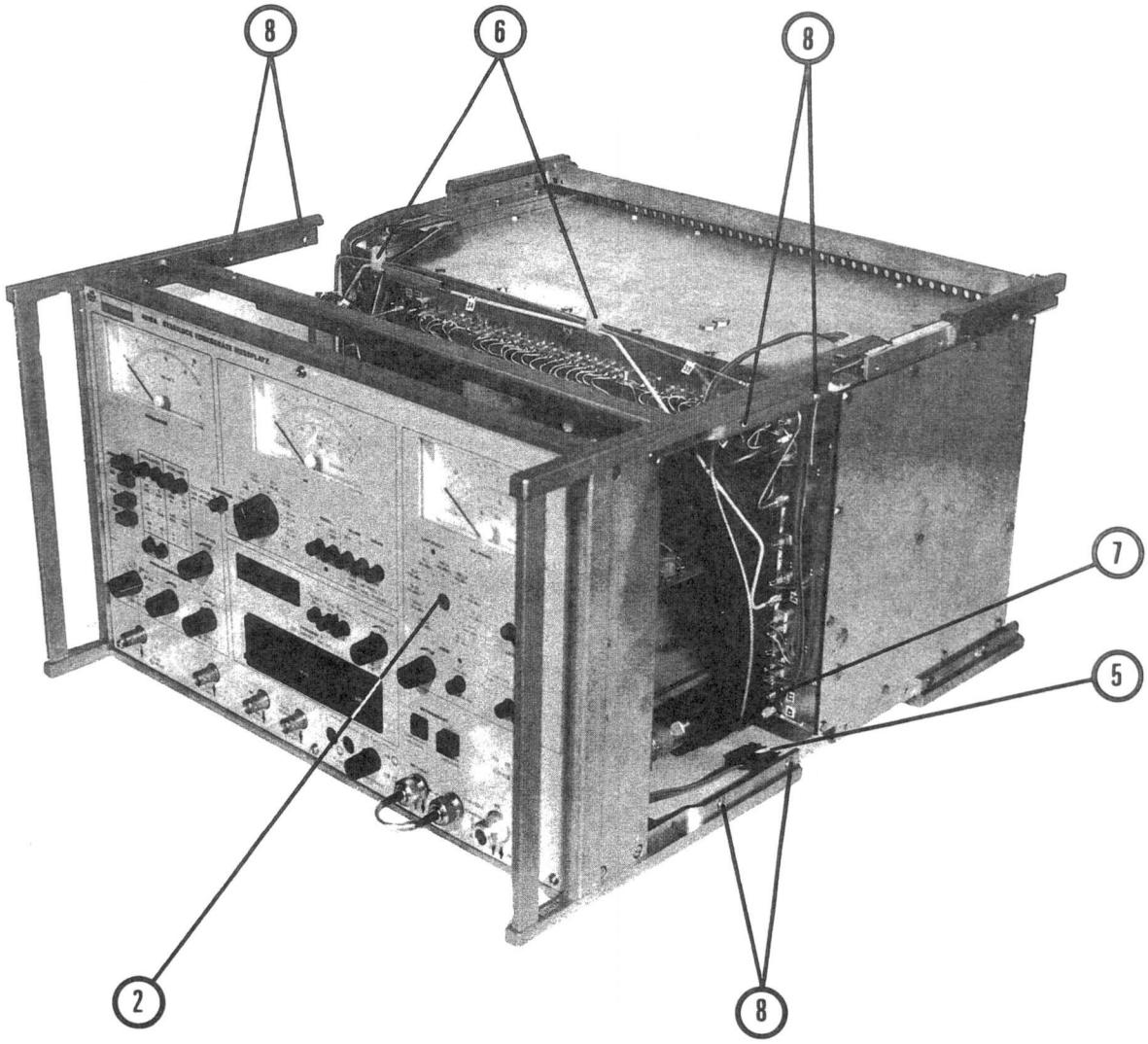

FIG. 6: REMOVING THE CONTROL AND DISPLAY UNIT

POWER SUPPLY
204 022 S

MAINS
110, 120, 133 V
220, 230, 240 V
+5V
+KV
Batt.

DIODE PROBE
229 006 S

FM(DC) AM(DC)
Bu 21
RF
20 dB 25W
FM/TR (AC)
AF
0...10 kHz
0...30 kHz
ALC
AM Range
AM
FM, ΦM Ranges
FM
ΦM
Deemph.
300 Hz
+20 dB
FM, ΦM
Rec.

MOD.GENERATOR
208 025 S

fmod
Level
G
0,03... 10 kHz
fmod. ext.
Modulation
Unmod

CONTROL AND DISPLAY UNIT
209 021 S 4020/4021/4022

Rec.
ALC
1 kHz
10%,30% Sinad
Distortion Sinad
AF-Level
CCITT
pos. peak
neg. peak
rms
AF
Frequency
Digit. Frequency Control (DC)
Modulation
Noise Mod.
AM, FM Ranges
ΦM Ranges
Preemph.
Loudness
Automatic
FM, ΦM, AM-Average
AM-Peak
25/25W
Transm.
Receiver
RF-Level
EMF
+6 dB
+6 dB (DC)
EMF (DC)
fmod TRANSM.
AM (AC)
FM (AC)
TR/Rec. (DC)

FREQUENCY COUNTER
237 002 S

Δf (AC)
40...480 MHz 1600
≷40 MHz (DC)
250 kHz
RF-ALC (DC)
± Δf (AC)
f Offset
f MOD
f TRANSM.
f Trans.
f mod
÷7/1
÷5/1
÷n/1
÷2
< 40 MHz, Rec.
12,5 MHz
50 MHz
1/4/8,9/10 Hz
4 Hz
-10V
+KV
Counter
Display
Logic
Reset
Overflow
Latch
Frequ. Offset
Δf (DC)
Δf Rec. (DC)
TR Frequ. (DC)

sw BLACK	bl BLUE								
br BROWN	vi VIOLET								
rt RED	gr GREY								
ro ROSE	ws WHITE								
ge YELLOW	tr TRANSPARENT								
gn GREEN									
						norm.			
						gepr.			
—	9096.67	28.5.79	Kr.			bearb.	23.5.79	Kr.	
Ausg.	Änderung	Datum	Name			1979	Datum	Name	
Nr.		DATE	NAME				DATE	NAME	

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 60

STABILOCK
RADIOTELEPHONY TEST SET
BLOCK DIAGRAM

102 820 B Bl. 2
Typ: 4020, 4021, 4022

EXT. QUARTZ SYNCHRONISATION
10 MHz >0,3 V
10MHz 0,4 V EMK EMF
Bu 2 150Ω
Bu 3 50Ω

214 022 S
10 MHz-Quarz-Stufe
CRYSTAL STAGE

Bu 4
St 4
10MHz TLL K4
St4.1
Bu 4

K43 2MHz (ZF) TTL
K42 10MHz TTL
St 43
St 42
Bu 43
Bu 42

230 025S
Ausgangs-Stufe
OUTPUT STAGE

St 13 Bu 13 K13 50Ω St 13 Bu 13
EMK 2 Vmax
EMF 0,25 W max
K50
St 12 Bu12
K 12

0,01...480MHz
HF RF
0,2 V max 25W max
Bu 10 Bu 11 St 11 B1 20dB Bu 12 St 12

229 006 S
Diodenmeßkopf
DIODE PROBE

Bu34 50Ω St 34 380 691 K 34 St 34.1 Bu 34
20...500MHz ca 8dBm
Bu35 50Ω St 35 K35 St 35.1 Bu 35
60...480MHz +8dBm

213 016 S(4020)
213 017 S(4021)
OSCILLATOR

Df 12 or Df40
AFC/APC +2..+12V

Bu40 St 40 K40 St 40.1 Bu 40
40...480MHz ca-5dBm

St 42.1 St 43.1
Bu 42 Bu 43

210 021 S
Dekaden-Stufe
DECADE STAGE

Bu 103 Bu105
St103 St105
K103 K105
St103 St105
Bu 103 Bu105

213 014 S
OSCILLATOR
(nur 4022 ONLY)

Bu20 Bu 32
St 20 St 32
f/1600 K20 K32 250kHz

237 002 S
Frequenzzähler
FREQUENCY COUNTER

0,03...20kHz MOD.EXT ca.1V Bu18
0,03...20kHz MOD.GENERATOR 0...ca.6V Bu17
(208 025S)
208 026S *
MOD.GENERATOR

* ab L 1928

K 17

0,03...20kHz f MOD. TRANSMITTER 1V max. Sender Bu15
0,03...20kHz f NF/AF 0,1mV...30V Bu16
0,03...20kHz f Ablage OFFSET f MOD 2V max. Bu 14

209 021 S
Anzeige-u.Bedienungseinheit
CONTROL AND DISPLAY UNIT

K 34
Diodenschalter/DIODE SWITCH
Ausg. Stufe OUTPUT ST.
Gl 1 BA 244 Gl 3 BA 244 Gl 2 BB 121
OSCILLATOR
360 854 (460 854)

sw BLACK	bl BLUE					norm			
br BROWN	vi VIOLET					gepr			
rt RED	gr GREY	01	9096.101	14.9.78	Eiler				
rs ROSE	ws WHITE	–	8028.76	10.10.78		bearb.	10.10.78	Ge.	
ge YELLOW	tr TRANSPARENT	Ausg. ISS	Ä-Mittlg. MODIF	Datum DATE	Name NAME		Datum DATE	Name NAME	
gn GREEN									

Schlumberger o/s
Meßgerätebau u Vertrieb GmbH
8 München 46

STABILOCK
Funkgeräte Meßplatz
RADIOTELEPHONY TEST SET

201220S/201221S/201222 S
Typ : 4020/4021/4022

(See block circuit diagram 102 820 B for total instrument)

1. RF Level

On receiver measurements the potentiometer voltage required for vernier adjustment of the EMF is indicated on the meter, the signal light (see also output stage) lighting up when the level is increased by +6 dB.

On transmitter measurements the DC provided by the diode probe is provided directly to the meter through the range selector (25 W/ 2,5 W). Peak rectification is included only when indicating AM peak power. The switch-over to transmitter measurement mode can also be performed automatically, when the transmitter exceedes 50 mW.

In duplex operation the EMF adjustment and all other functions of the instrument are the same as for receiver measurements with the exception that the power indication corresponds to that of transmitter measurement. The signal lamp for transmitter measurement is lighting.

2. Modulation

On receiver measurements the AF provided by the modulation generator is provided for the meter indication to a positive or negative peak rectifier through the continuous modulation adjustment. This AF is also provided through various range and type modulation switches to the AM modulator in the output stage "AM(AC)" or to the FM modulator in the oscillator stage "FM(AC)". On phase modulation the amplitude of the low frequencies is reduced by 6 dB per octave in the preamphasis circuit.

On transmitter measurements the AF signal provided by the demodulators (see also probe or output stage) is passed through various range and modulation type selectors and rectified and indicated as for receiver measurements. In addition, use can also be made of a more sensitive interference modulation indication with RMS rectifier and CCIT weighting filter (see operating instructions 4.15). Two special circuit arrangements require particular mention:

a) Automatic level control (ALC) on AM

The mean DC provided at the output of the diode probe is used to control the intensity of a luminous diode in an optocoupler and thus the resistance of a photo resistor in the LF input attenuator. This control maintains the mean DC output constant despite fluctuations of the input level thus ensuring that the LF amplitude is directly proportional to the AM depth of modulation.

b) φM-deemphasis and 300 Hz high pass filter

Contrary to the preemphasis circuit the amplitude of low frequencies is increased by 6 dB per octave in the deemphasis circuit. An active 300 Hz high pass filter eliminates any disturbances due to the frequencies elevated <300 Hz.

3. Distorsion Meter

The distorsion meter is provided with the demodulation signal on transmitter measurements or the AF voltmeter signal on receiver measurements, the output amplitude being maintained constant in an ALC circuit (same as on AM measurements) employing an optocoupler and LF rectifier. Due to the selective suppression of the 1 kHz fundamental in the following, 3-stage 1 kHz band stop filter (active notch filter) merely the distorsion and noise components remain which subsequent to range switching and RMS rectification are indicated directly as distorsion or SINAD ratio. The insertable CCITT filter is explained in detail in the operating manual (4.15).

4. AF Voltmeter

The AF voltmeter operates together with the range switches and operation amplifiers in the usual way, the meter indication comprising elements of the distorsion meter such as CCITT filter and rectifier.

Sensitivity is automatically 20 dB down on receiver measurements and φM/FM modulation.

5. Digital Frequency Adjustment

The decade stage is introduced to the positions of the decade switches. On REMOTE CONTROL mode the frequency must be set to 600 MHz (see operating manual 3.7).

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
02	0028. 29	27.3.1980	Morasch
01	9C23. 32	5. 10.79	Morasch

CONTROL AND DISPLAY UNIT 4020 series

209 021 A

Sheet 1/12

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM	The Control and Display Unit must be connected to the other units of the instrument. Modulation Generator (208 025/26), Diode Probe (229 006) and Frequency Counter (237 002) must be completely adjusted (see concerning chapters) and mounted to the Control and Display Unit. For fault locations, it can be useful, to place the electrically connected Counter outside of the instrument. Check mechanical zero deflection of the indicating instruments I1 (MODULATION), I 2 (AF) and I 3 (RF-LEVEL).					.....ok
	1. Rail Voltages 209 021 S Bl. 2 + 3	(40) (49) Counter	DC	——	+ 13,95 ...+14,05 V	+.....V
		Bu 45/11	DC	——	" "	
		Bu 45/ 4	DC	——	+ 4,95...+ 5,05 V	+.....V
	2. Signal Lamps Lamp: RECEIVER — Depressed push buttons: RM (= RECEIVER MEASUREMENT) Lamp: TRANSMITTER — TM (= TRANSMITTER MEASUREMENT) RM + TM Lamp: + 6 dB — + 6 dB + RM Lamp: +20 dB — RM + FM /φM + VOLTMETER Dist. 10%, 30%, SINAD				Approx. same brightness, appropriate to depressed push buttons	.....ok

Issue	Alteration No.	Date	Name
02	0028.29	27.3.1980	Morasch
01	3028:32	5.10.79	Kamm

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	3. Countor Display Decade switch 600 MHz f OFFSET Knob FREQUENCY OFFSET depressed " " " pulled	Display	—	—	blinking + ... kHz - ..... kHz	.....ok
	4. Frequency Setting Push buttons RM and $f_{TRANSM.}$ pressed Check 100 kHz to 100 MHz Decade 0, 1, 2,...9, (within specified 4020 frequency ranges)	"	0,1 ...479,9 MHz	—	correct frequency	
	Connect 10 MHz output on rear panel to RF DIRECT socket on front panel. Depress TM + f_{OFFSET} push buttons Check 10,0000 to 10,0999	"	+ 0...+99,9 kHz	—	Counter displays offset frequency to 10 MHz	.....ok
	Decade switch to 900 (> 800) MHz	Remote control socket on rear panel	DC	—	DC level between pins 47 and 49 0 V	
	" " " 0 (<800) MHz	"	DC	—	+ 5 V	.....ok
	5. Control Lines to RF Section Only for fault locations Depressed push buttons TM	Bu 22 pin 14	—	—	+ 5 V	
	RM	" "			0 V	
	TM / + 6 dB	pin 16			+ 14 V	
	RM	" "			0 V	
	TM	" "			0 V	
	TM / $f_{TRANSM.}$	pin 21			+ 5 V	
	RM / f_{OFFSET}	pin 22			0 V	
	TM / "	" "			+ 5 V	.....ok

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
02	0028.29	27.3.1980	Marasch
01	9028.25	5.10.73	Yarnu

4020 series
CONTROL AND DISPLAY UNIT

209 021 A

Sheet 3/12

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	6. Control Lines within the Control and Display Unit					
	Depressed push buttons: RM	(40) PCB 088	DC	—	< 0 V L	
	TM / $f_{TRANSM.}$	(3) PCB 088	"	—	+ 5 V H	
	TM	K25/R171	"	—	+ 5 V H	
	7. EMF Indicating Instrument			EMF Control Knob on front panel:		
	push button RM depressed	Bu 22/15	DC	R 3 fully clockwise	+ 9,6 ... +10,5 V	
		"	"	R 3 fully anti-clockw.	+ 1,7 ... + 2,2 V	
		"	"	set to →	+ 9,50 ± 0,01 V	
		I_3	—	and R 117 →	full scale deflection ≙ 19 mV EMF	.....ok
	8. FREQUENCY OFFSET Control on REC. MEASUREMENT					
	(Potentiometer R 5 on front panel)					
	R 5 fully clockwise, pulled	Bu 22/7	DC		+ 10,7 V (= +7+3,7)	
	" " " , pressed	" "	"		+ 3,3 V (= +7-3,7)	
	" fully anti-clockwise, pressed	" "	"	R 126 →	+ 6,85V (= +7-0,15)	
	" " " " , pulled	" "	"		+ 7,15V (= +7+0,15)	.....ok
	All potentials must be symmetrical with respect to + 7 V Repeat test.					
	9. Peak Responding Rectifier for Modulation Indication					
	push button RM, UNMOD, ⊕, 20 kHz depressed	(15)	AC	—	0 V	
	" " " " " , " "	I_1	DC	R 90 →	I_1 = 0 } alternating	
	" " " " ⊖, " "	"	"	" →	I_1 = 0 }	.....ok
	Mod. Generator 1 kHz, RM, FM, f MOD	(15)	1 kHz	R 1 ("Modulation") →	1 V ± 1 mV	
	push button RM, FM, ⊕, 20 kHZ " f MOD	I_1	—	R 85 →	I_1 = full scale deflection	
	" " " " ⊖, " "	"	—	R 84 →	" " " "	
	" " " " ⊕ ⊖, " "	"	—	R 83 →	" " " "	
	" " " " 20 kHz pressed ⊕ ⊖ not pressed	"	—	R 75 →	" " " "	.....ok

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch
3028.77		5.10.79	Karau

Replacement for 209 021 A

4020 series CONTROL AND DISPLAY UNIT

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
AF - Generator	**10. RM Modulation Ranges**					
	Modulation generator 1 kHz	⑮	1 kHz	R 1 ("Modulation") →	1 V ± 1 mV	
	push button RM, FM, 20 kHz	Bu 22/8	"	R 26 →	3 V ± 20 mV	
	" " " " 5 kHz	"	"	R 32 →	750 mV ± 4 mV	
	" " " " 2 kHz	"	"	R 36 →	300 mV ± 2 mV	
	" " " φM, 5 Rad	"	"	R 24 →	750 mV ± 4 mV	
	" " " " 2 Rad	"	"	R 22 →	300 mV ± 2 mV	
	" " " AM, 100 %	Bu 22/11	"	R 30 →	3 V ± 20 mV	.....ok
	" 50 %	"	"	R 34 →	1.5 V ± 10 mV	
	11. RM Modulation Frequency Response	Output stage St 49/pin 5 or				
	4020 Settings (RM)					
	AM, m = 80 % (I_1), f = 1 kHz	Bu 22/11	1 kHz	—	2,35 --- 2,45 V	2, ...V
	" " " f = 50 Hz	"	50 Hz	—	as on 1 kHz ± 0,1 V	2, ...V
	" " " f = 10 kHz	"	10 kHz	—	" " " ± 0,1 V	2,.....V
		Oscillator stage St 51/1				
	φM, 3 Rad (I_1), f = 0,3 kHz	or Bu 22/8	0,3 kHz	—	133 ... 137 mV	.....mV
	" " " f = 1 kHz	"	1 kHz	—	445 ... 455 mV	.....mV
	" " " f = 6 kHz	"	6 kHz	—	2,67...2,73 V	2, ...V
	FM, Dev. = 16 kHz (I_1), f = 1 kHz	"	1 kHz	—	2,35...2,45 V	2, ...V
	" " " f = 50 Hz	"	50 Hz	—	as on 1 kHz ± 0,2 V	2, ...V
	" " " f = 300 Hz	"	300 Hz	—	" " " ± 0,1 V	2, ...V
	" " " f = 10 kHz	"	10 kHz	—	" " " ± 0,1 V	2, ...V
	" " " f = 20 kHz	"	20 kHz	—	" " " ± 0,2 V	2, ...V
	AF - Generator appr. 0.8 V on EXT. Input:	"	1 kHz	→	reading 16 kHz	
	FM, Dev. = 16 kHz (I_1), f = 1 kHz	"	1 kHz	—	2,35...2,45 V	2, ...V
	" " " f = 50 Hz	"	50 Hz	—	as on 1 kHz ± 0,2 V	2, ...V
	" " " f = 300 Hz	"	300 Hz	—	" " " ± 0,1 V	2, ...V
	" " " f = 10 kHz	"	10 kHz	—	" " " ± 0,1 V	2, ...V
	" " " f = 20 kHz	"	20 kHz	—	" " " ± 0,2 V	2, ...V

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch

4020 series
CONTROL AND DISPLAY UNIT

209 021 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	12. TM Modulation Ranges Disconnect the FM/TR(AC) signal from the Output Stage (230 025 S Bl. 1/green wire DF 8 → St 49/5) and replace it by the output signal of the Mod. Generator					
	4020-push buttons actuated: FM, 20 kHz, ⊕ ⊖	Level on St 59/pin 5 or Bu 22/2: 1 V	I_1	"	R 10 →	full scale deflection
	" 5 kHz, " "	250 mV	"	"	R 5 →	full scale deflection
	" 2 kHz, " "	200 mV	"	"	R 3	full scale deflection .....ok
	φM, 5 Rad ⊕ ⊖	250 mV	"	"	R 12 →	full scale deflection
	" 2 Rad " "	100 mV	"	"	R 14 →	full scale deflection
	φM 5 Rad ⊕ ⊖	75 mV	"	0,3 kHz }	R 7 →	4,8 ... 5,2 Rad
	" " " " "	100 mV	"	0,4 kHz }		
	" " " " "	250 mV	"	1 kHz	—	4,9 ... 5 Rad
	" " " " "	750 mV	"	3 kHz	—	4.9 ... 5 Rad
	" " " " "	2,5 V	"	10 kHz	—	4,8 ... 5 Rad .....ok

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch

4020 series
CONTROLAND DISPLAY UNIT

229 021 A

Replacement for

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Millivoltmeter AF Generator	13. TM Modulation Frequency Response					
	4020 Settings (TM) / AF Generator level on St 59/5 or Bu 22/2					
	FM, Δf 2 kHz ⊕⊖ — 100 mV	I 1	1 kHz	—	2 kHz	..... kHz
	FM " ⊕⊖ — "	"	20 kHz	—	1.85 ... 2 kHz	..... kHz
	" " ⊕⊖ — "	"	30 kHz	—	1.85 ... 2 kHz	..... kHz
	" 20 kHz ⊕⊖ — 1 V	Bu 15	1 kHz	—	1 V ± 10 mV	..... ok
	φM 5 Rad ⊕⊖ — 75 mV	I 1	0.3 kHz	R 24 →	4.8 ... 5.2 Rad	
	" " ⊕⊖ — 100 mV	"	0.4 kHz			
	" " ⊕⊖ — 250 mV	"	1 kHz	—	4.9 ... 5 Rad	
	" " ⊕⊖ — 750 mV	"	3 kHz	—	4.9 ... 5 Rad	
	" " ⊕⊖ — 2.5 V	"	10 kHz	—	4.8 ... 5 Rad	..... ok

Schlumberger

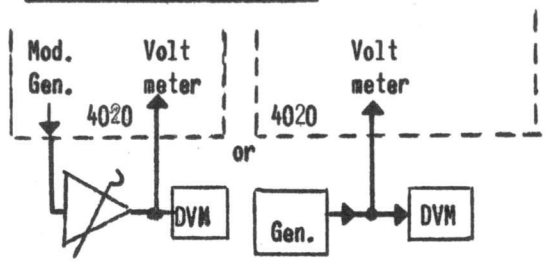
Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
-	01	10.8.77	0028.29	27.3.1980	Morasch
		5.10.79	Varny

4020 series
CONTROL AND DISPLAY UNIT

209 021 A

Sheet 7/12

REQUIRED TEST EQUIPMENT	PROCEDURE	DVM	Voltm. Range	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	14. AF Millivoltmeter + CCITT 							
	AF, UNMOD VOLTMETER	775 mV 775 mV	0 dB 0 dB	I 2 (23)	1 kHz "	R 164 →	0 dB 775 mV ± 30 mV	..... mV
	AF, UNMOD	24,5 V	+ 30 dB	I 2	1 kHz	—	0 dB ± 0,4 dB	.....dB
		7,75 V	+ 20 dB	"	"	—	" "	.....dB
		2,45 V	+ 10 dB	"	"	—	" "	.....dB
		775 mV	0 dB	"	"	—	" ± 0,2 dB	.....dB
		245 mV	- 10 dB	"	"	—	" ± 0,4 dB	.....dB
		77,5 mV	- 20 dB	"	"	—	" "	.....dB
	40 dB Attenuation pad on the AF in put	24,5 mV	- 30 dB	"	"	—	" "	.....dB
		7,75mV	- 40 dB	"	"	—	" "	.....dB
		2,45 mV	- 50 dB	"	"	—	" "	.....dB
		0,775mV	- 60 dB	"	"	—	" "	.....dB
	AF, RM, FM	775 mV	- 20 dB	"	"	" + 20 dB "	Indication 0 dB ± 0,4 dB	.....dB
	AF, RM, φM	"	- 20 dB	"	"	" + 20 dB "	Indication " "	.....dB
	AF, RM, AM	"	0 dB	"	"	—	" "	.....dB
	AF, TM, FM	"	0 dB	"	"	—	" "	.....dB
	AF, TM, FM	245 mV	- 10 dB	"	0,03 kHz	—	- 0,5 dB } related	.....dB
		"	0 dB	"	0,3 kHz	—	± 0,2 dB } to	.....dB
		"	0 dB	"	10 kHz	—	± 0,2 dB } 1 kHz	.....dB
		"	0 dB	"	20 kHz	—	- 0,5 dB	.....dB
	AF, RM, UNMOD, CCITT	775 mV	0 dB	"	0,8 kHz	R 264 →	0dB	
		"	0 dB	"	0,225 kHz	—	- 16 ... - 20 dB	..... dB
		"	0 dB	"	0,4 kHz	—	- 5,3 ... - 7,3 dB	..... dB
		"	0 dB	"	1 kHz	—	0 ... + 2 dB	..... dB
		"	0 dB	"	3 kHz	—	- 6 ... - 8 dB	..... dB
		"	- 10 dB	"	4 kHz	—	- 13 ... - 17 dB	..... dB

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch

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4020 series
CONTROL AND DISPLAY UNIT

REQUIRED TEST EQUIPMENT	PROCEDURE		MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Balance Adjustment						
	AF, RM, UNMOD (without CCITT)		I 2	1 kHz	R 134	> 60 dB	..... dB
	Readjust R 164			1 kHz	R 164	0 dB	
	775 mV at voltmeter input			20 kHz	—	> 40 dB	..... dB
	balance ⟷ unbalance			50 kHz	(C 48)	> 60 dB	..... dB
	Voltmeter button MOD pressed : RM, FM 19 kHz		I 1/I 2	1 kHz	—	0.9 ... 1 V	 V
	15. Distortion Meter						
AF Analyser with a Beat Frequency Oscillator e.g. Radiometer FRA 3	All alignments on the 1 V range of the AF millivoltmeter, and on RM, UNMOD, without CCITT	AF signal on Bu 16			R 261, 264, 262, R 231, 232, 234, R 273, 274, 280 preset to mid-position		
	Check out of autom. level control:	1.2 V	(28)	1 kHz	—	690 ... 810 mV	..... mV
		0.15 to 1.2 V	"	"	—	ΔV ≤ 10 mV	..... mV
	Notchfilter pressed: fMOD + fTRANSM	approx. 0.5 V	(27) (C 100)	6 kHz	Adjust sensitivity of analyser to	+ 10 dBm Indication	
	1) Adjust 3 potentiometers at a time alternatively in small increments for every attenuation pole frequency.	"	"	1000 ± 1 Hz	R 261, 264, 262,	< - 75 dBm	
		"	"	985 ± 1 Hz	R 231, 232, 234,	"	
		"	"	1010 ± 1 Hz	R 273, 274, 280	"	.....ok
	2) Repeat adjustment, if result is bad.	"	"	975...1015 Hz	—	< - 40 dBm	- .....dBm
		"	"	982...1013 Hz	—	< - 55 dBm	- .....dBm
						clear to recognize: 3 poles at 985/1000/1010 Hz	.....ok
Two Tone AF Gen. e.g. AF 40 S	Adjusting Ranges	Two tone signal 1 kHz / 3 kHz					
	RM, 30 %:	999 mV	259 mV	I 2	1 + 3 kHz	R 241 →	25 %
	" Sinad :	"	"	"	"	R 245 →	- 12 dB
	" 10 %:	"	70 mV	"	"	R 243 →	7 % .....ok
	" "	ca. 1 V 1 kHz, Dist. < 0,3 %		"	1 kHz	—	< 0,6 %

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch

4020 series
CONTROL AND DISPLAY UNIT

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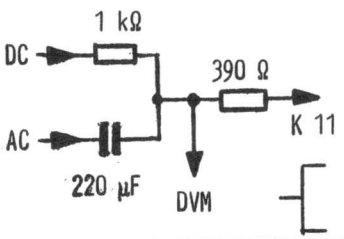
Sheet 9/12

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Transmitter 0 ... 25 W 120 MHz capable of being AM modulated, Dist. < 1 %	On TRANSMITTER MEASUREMENT mode Replace discriminator signal from ouput stage (St 49/pin 5 or Bu 22/2) by a two tone AF generator. 4020 - Setting | 1 kHz | 3 kHz TM, 10 % Dist., without CCITT | 999 mV | 70 mV	I 2	1 + 3 kHz	—	6.8 ... 7.2 %	..... %
	16. Power Meter + AM Automatic Level Control  DC = + 3.5 ...+ 11 V	(30) "	DC "	— =	6.8 ... 7.2 V ΔU < 10 mV	
	Linearity, Power Measurement Ranges DC level 0.25 W Range: + 3.8 V 0.25 W Range: + 3.16 V 0.25 W Range: + 3.32 V 2.5 W Range: + 5.53 V 25 W Range: + 11 V	I 3 " " " "	DC " " " "	alterna- R 110 tively R 121 — R 112 R 114	250 mW reading 10 mW reading 40 ± 1.2 mW 2.5 W reading 25 W reading	..... mW ..... ok ..... ok

REQUIRED TEST EQUIPMENT	PROCEDURE 4020	AC level	DC level	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	AM							
	TM, AM, 100 % (+)(-)	1.5 V	5.65 V ≙ 2.74 W	I 1	1 kHz	R 36 →	Same AM reading appr. 80 %	.... ok
	" " " (+)(-)	0.3 V	3.53 V ≙ 0.11 W	"	"			
	TM, AM, 100 % (+)(-)	1.5 V	5.65 V ≙ 2.74 W	"	"	R 30 →	80 %	.... ok
	" " 50 % (+)(-)	0.75 V	5.65 V ≙ 2,74 W	"	"	R 25 →	40 %	.... ok
	TM, AM, 100 % (+)(-)	1.5 V	5.65 V ≙ 2.74 W	"	30 Hz	—	72 ... 84 %	.... %
	" " " (+)(-)	"	" "	"	0.3 kHz	—	76 ... 84 %	.... %
	" " " (+)(-)	"	" "	"	1 kHz	—	" "	.... %
	" " " (+)(-)	"	" "	"	10 kHz	—	" "	.... %
	Inherent AM Distortion							
	TM, AM, 50 % (+)(-) DIST - 10 %	0.03 V	3.53 V ≙ 0.11 W	I 1	1 kHz	—	7.5 ... 8.5 % (AM)	
	TM, AM, 50 % (+)(-) DIST - 10 %	"	" "	I 2	1 kHz	—	< 1 % (DIST)	.... %
				(28)	1 kHz	—	690 ... 810 mV	.... ok
	Peak Power Indication							
	TM, 25 W, AM, Peak	2.23 V	7.0 V ≙ 6.25 W	I 3	1 kHz	—	18.5 ... 21.5 W	.... W
	" " " "	"	" "	"	30 Hz	—	" "	.... W

Adjustment and Test Procedure

Schlumberger

Issue	Alteration No.	Date	Name
01	0028.29	27.3.1980	Morasch
–	9028.32	5.10.79	Harms

4020 series
CONTROL AND DISPLAY UNIT

209 021 A

10/12 Sheet

Replacement for

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028. 29	27.3.1980	Morasch

Replacement for

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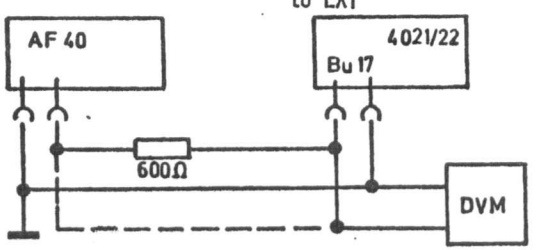
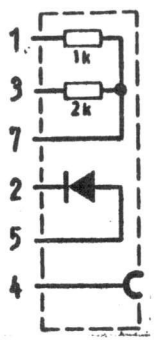
4020 series
CONTROL AND DISPLAY UNIT

11/12 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
30 kHz Distortion Meter	17. Modulation Generator Output RM					
	Check output level and distortion with the own millivoltmeter			Set level to		
	Load — Ro < 6 Ω — Ro = 50 kΩ	I 2	1 kHz	" 0 ... 30 mV "	0 ... > 30 mV	
	— < 6 Ω 50 kΩ	"	"	" 0 ... 2 V "	0 ... > 2 V	..... ok
	— " "	"	"	2 V	5 V Dist. < 1 %	..... %
	— 600 Ω "	"	"	—	4.976 V " < 1 %	..... ok
	— 600 Ω 600 Ω	"	"	—	25 V ±40 mV " < 1 %	..... ok
	200 Ω < 6 Ω 50 kΩ	"	"	—	5 V " < 1 %	..... ok
	200 Ω < 6 Ω 50 kΩ	"	50 Hz	—	5 V (< 5 %)	 V
	Test for ungroundet output	Bu 17	DC	—	> 1 MΩ across output contacts and ground	..... ok
4021/22	Return Loss Mod. Generator Level = 0 V S 27 / 600 Ω Frequency control to EXT  EMF check out	Bu 17 S 1	100 Hz 1 kHz 10 kHz 100 kHz	1 V	0,5 V ± 75 mV = 16,5 dB	.....mV

Schlumberger

Adjustment and Test Procedure

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	18. Loudspeaker Pull and turn up control knob for loudness until sound overdriving becomes audible. Press knob, but do not turn.	 LS 1 Bu 14	 1 kHz 1 kHz	 — —	 sufficient loudness > 2 V	 ..... ok
Test plug	19. RM / TM Automatic Test plug RM + TM not pressed  Appr. 100 mV at 20 kHz FM	 I 3 I 1/I 2	 DC 1 kHz	 — —	 Power reading appr. 10 W if the test plug is connected to socket "RF PROBE/AUX OUTPUTS"	 ..... ok

Issue	Alteration No.	Date	Name
0028.29		27.3.1980	Morasch

Replacement for

209 021 A

4020 series

CONTROL AND DISPLAY UNIT

0,01...480MHz
HF RF
0,2Vmax 25Wmax
Bu10
Bu11
St11
20dB B1
St12
229 006 S
Diodenmeßkopf
DIODE PROPE
K11
Bu12
K12
K50
EMK EMF
2V max 0,25W max
Bu13
K13
St13
230 025 S
Ausgangstufe
OUTPUT STAGE
MODULATION
NF/IF
HF-Pegel / HF-LEVEL
J1
J2
J3
Empf. Messg. RECEIV. MEASUR.
Send. Messg. TRANSM. MEASUR.
Gl3
Gl4
5082-4480
bl2 vi2 bl1 gn1 gr vi1
K1
K2
K3
K4
209 021 S Bl.2
(361 088)
Modulationswähler
MOD. MODE SELECTION
209 021 S Bl.2...4
(361 154)
NF-Teil
AF-UNIT
0,03...20KHz
MOD. EXT.
ca 1V
Bu18
R10
56
C1
100
K5
K15
+5V
K17
K16
K14
Ls1
0,03...20KHz
MOD. GENERATOR
0..ca. 6V
Bu17
Tr1
L2
C2
1n
L3
R13
590
S27
C15
220µ
K7
R1
1K
208 026 S
(208 025S)
MOD. GEN.
MODULATION
S2
R16
1,5K
Gl1
5082-4480
+20dB
EMF
R3
1K
Gl5
R14
120
Gl2
R15
1,5K
x2+6dB
S4
S3
AM Spitze
AM PEAK
R5
500
S5
Frequenzablage
FREQU. OFFSET
C3
1n
S26
R17
604
0,03...20KHz
NF/AF
0,1 mV...30V
Bu16
L7
L8
C6
1n
C7
390
C8
390
0,03... 20 KHz
Mod. Sender
TRANSMITTER
1V max
Bu15
L5
C5
1n
0,03...20KHz
Ablage
OFFSET
MOD
2V max
Bu14
L4
C4
4,7n
R12
100
Netz
POWER
S1
K8
St8
204 022 S
Netzteil
POWER SUPPLY
237 002 S
Frequenzzähler
FREQUENCY COUNTER
Bu45
St45
K45
K20
St20
K32
St32
f/1600
250 KHz
210 021 S
Dekadenstufe
DECADE STAGE
S6
10MHz
1MHz
100KHz
10KHz
1KHz
100 Hz
S10a
S10b
S10c
S10d
S10e
S10f
S10g
26 25 24 23
30 29 28 27
31 32 33 34
35 36 37 38
39 40 41 42
43 44 45 46
47 48 49 50

* ab L1928
208 026S

11 10 9 8 7 6

6 5 4 3 2 1

K 12 K 23 K 24 K 25 K 26

Send. Messg. TRANSM. MEASUR.

Gl4 5082-4480 gr vi

Ls1 ws2 gr2 br sw2 vi2

S6

+14V

+5V

Gl3 1N4148 R1 120

Rls1 Rls2

Gl4 ZPD 10

R3 10K

R2 47

R6 500

Lautstärke LOUDNESS

361 086
461 086

Automatische Umschalt. → Sender
Autom. switsch Rec. → Trans

Gl1 1N4148 Gl2 1N4148

T1 BC 182B T2

S 20

R4 1K R6 390K C1 100 R5 10K R10 33K R11 100K

D1 SG 311M

D2 CD 4066A

Empfängermessung RECEIVER MEASURING

Sendermessung TRANSMITTER MEASURING

K 22 Bu22

DISKRIMINATOR
Zähler + Lautsprecher
+14V COUNT+SPEAK.
+14V NF-Teil
AF-UNIT
Ablagepot OFFSET POT
FM-Modulator
40 MHz
AM-Modulator
+5V
Sendermessung TRANSM-MEASURING
10dB Regler/CONTR.
+6dB Ein/ON
+ Vorzeichen
– POLARITY
OVERRANGE
Ablage/OFFSET
Senderfrequ. Messg. TRANSM. FR. MEASUR.
Empfänger Ablage RECEIVER OFFSET

800 400 200 100 80 40 20 10 1 2 4 8 100 200 400 800 10 20 40 80 1 2 4 8 0,1 0,2 0,4 0,8

MHz KHz

K 45

K 21

Ausgangstufe OUTPUT STAGE 230 025 S

FM DC AM DC SWITCH SENSOR +14V +5V Bu 21

C11 C12 C13 C14 1n

sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME
05	9028.54	9.8.79	Eiler
04	9028.21	24.3.78	Hey

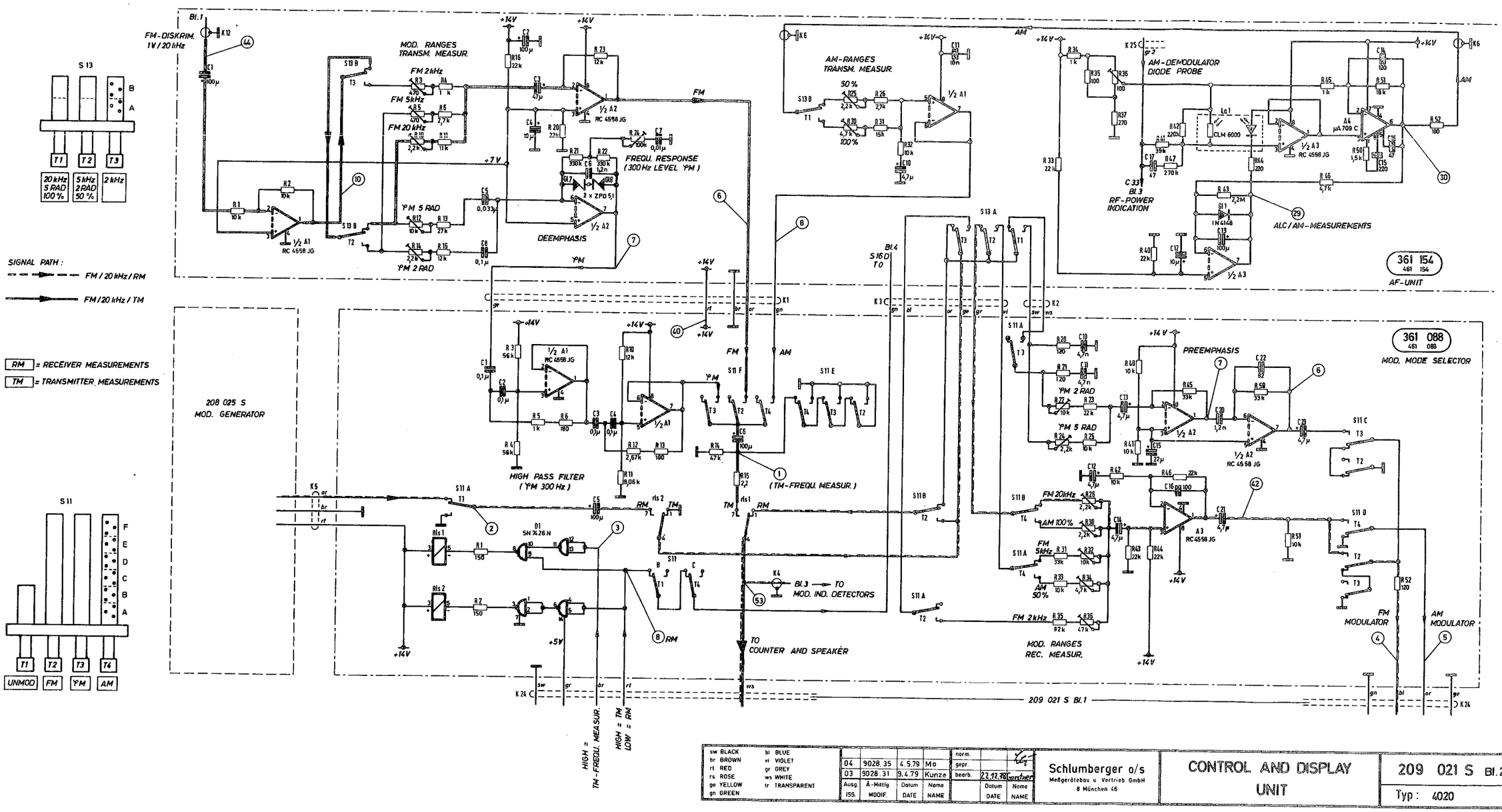
	Datum DATE	Name NAME
norm.		
gepr.		
bearb.	22.1.79	Ge.

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

CONTROL AND DISPLAY UNIT

209 021 S Bl.1

Typ : 4020



sw BLACK	bl BLUE								
br BROWN	vi VIOLET								
rt RED	gr GREY								
rs ROSE	ws WHITE								
ge YELLOW	tr TRANSPARENT								
gn GREEN									
		04	9028.35	4.5.79	Mo	norm.			
		03	9028.31	9.4.79	Kunze	gepr.			
		Ausg. ISS.	Å-Mittlg MODIF.	Datum DATE	Name NAME	bearb.	22.12.78 Gerstner	Datum DATE	Name NAME

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CONTROL AND DISPLAY UNIT

209 021 S Bl. 2

Typ : 4020

MODULATION

J1

see Bl.1

RF LEVEL

J3

see Bl.1

+14V

MOD. PEAK DETECTORS

1V at fsd

S2 see 209 021 S Bl.1

MOD. ± ADJ

MOD. IND. ADJ

ZERO ADJ

MOD. ± ADJ

PEAK DETECTOR

A12 µA741C

A10 SG 3111M

R41 Bl.2

SPEAKER AMPLIFIER

A11 µA741C

T1 2N1711

T2 2N2905

RANGE 0,25 W

POWER IND. ADJ

RANGE 2,5 W

RANGE 25 W

S17 B

S3 see Bl.1

EMF

POWER 0,1 W

POWER EMF

(+14V)

361 086

S6

LS 1

see Bl.1

R6

S5

R5

Frequ. Offset Symm.

S17

2,5W

25W

EMF (R3) see Bl.1

K4 Bl.2

rls 1 MOD. Bl.4

MOD. DIST. MEAS.

A6 µA741C

Bu 15 Bl.1 f MOD. TRANSM.

361 154

sw BLACK	bl BLUE					norm.				
br BROWN	vi VIOLET	01	9028.27	26.2.79	Mo	gepr.		Schlumberger o/s	CONTROL AND DISPLAY UNIT	209 021 S Bl.3
rt RED	gr GREY	–	9028.7	17.1.79	Mo	bearb.	22.12.78 Gerdauer	Meßgerätebau u. Vertrieb GmbH		
rs ROSE	ws WHITE	Ausg.	Ä.-Mittlg.	Datum	Name		Datum Name	8 München 46		Typ: 4020
ge YELLOW	tr TRANSPARENT	ISS	MODIF.	DATE	NAME		DATE NAME			
gn GREEN										

Bl. 2
K3 gn
K25
ws2
CCITT
GI 5 / Bl. 1
+ 20 dB
GI 1 / Bl. 1
R6
sw
ws
+5V
R 136
120
S14 B
T1
S 16 D
T2
R143
120
R144
22k
HIGH = TM
LOW = RM
S 16 B
T0
T3
BC 182 B
+14V
R146
100k
20 dB
SWITCH
T4
BF 247 A
R150
2k
C51
47
R151
18k
S15a
10V (1o)
R154
46,4k
C52
10
R155
100k
R153
11k
R161
11k
R162
46,4k
C53
10
R163
68k
R164
47k
22
23
SYMM.
R134
470
R135
8,2k
R140
464
R147
4,7
R137
270
R138
5,6
S15 b 1
GI 12
GI 13
1N4148 (2x)
½ A13
RC 4558 JG
R141
46,4k
300 mV
30mV
10V (1o)
30V
1mV
S15b
C47
100µ
½ A13
R152
10k
C50
22µ
+14V
R145
3,3k
½ A14
RC 4558 JG
R156
10k
+14V
R160
100k
½ A14
R165
10k
C54
10µ
DISTORT.
SINAD
VOLTMETER
COUNTER
C40
33
C43
47
S15 a 1
R148
220
R149
2,2
R142
6,8k
R132
27k
R133
22k
C41
10µ
C42
10µ
C44
10µ
C45
10µ
C48
4,7µ
S16
A
C
B
A
B
T2
T2
T2
T1
T1
S16
A
C
T0
T0
C46
1
MOD. GEN.
gn
bl
br
rt
K16
K17
SIGNAL PATH :
AF DISTORTION MEASUREMENT
10 %, 30 mV RANGE
S16
C
B
A
S14
B
A
T0
T1
T2
T3
T4
T5
MOD
VOLT METER
MOD GEN
K30%
K10%
SINAD
CCITT Filter
R172
150
R170
100k
T5
BC 182 B
R171
18k
HIGH = TM
LOW = RM
+14V
ws
sw
rt
ge
K25
Bl. 3
C21
MOD.
RM
TM
rls 1
Rls 1
R177
22k
+14V
C62
4,7µ
R181
6,8k
½ A15
RC 4558 JG
R190
47k
C70
100
R180
100k
C63
1µ
Lu 2
CLM 6000
R182
680
25
C71
1µ
R191
348k
½ A15
R192
69,8k
R193
1,2k
R183
820
+14V
+7V
C64
220µ
R184
820
C74
4,7µ
AL.C ON
T3
VOLTMETER
COUNTER
C56
500
R176
220k
+14V
R173
10k
R174
180k
C60
1n
C55
2,7n
½ A20
RC 4558 JG
R185
10k
C66
R186
180k
C65
4,7n
2,7n
C73
390
R194
470k
C72
2,2n
R195
220k
C80
1n
½ A20
R175
100k
R196
100k
C61
22µ
209 021 S Bl. 1
sw BLACK
br BROWN
rt RED
rs ROSE
ge YELLOW
gn GREEN

weich gelötet

aus 361 154 (K3)

aus 361 154 (K2)

or gr sw ws

or ge gn bl vi gr sw ws

384 187 (K5)

889 099 bei C20

501026
M 2,5×5 DIN 84
701332
J 2,7 DIN 6797
706 106

(C15)

(C23)

br rt or

786 009 (9x)

384 620 (K1)

aus 361 154 (K4)

786 009 (1x)

7,2

gr ws sw br rt or ge gr bl

gr bl

aus 361 086 (K24)

461088

C15 C13 C12 C5 C20 C14 C23 C21 C6 C2 C1 C3 C4 C11 C22 C16

R40 R41 R44 R50 R46 R42 R43 R45 R14 R51 R15 R3 R4 R5 R6 R10 R13 R12 R11 R52 R1 R2 R20 R21 R22 R24 R25 R23 R30 R34 R36 R26 R32 R33 R31 R35

A1 A2 A3

D1

Ris 1 Ris 2 Ris

br rt or ge gn

T1 T2 T3 T4

S11

= Kontrollmaß

10				Material	Maßstab	Schlumberger o/s	
09						Meßgerätebau Vertrieb GmbH	
08							
07							
06				Werkstoff	±0,2	2:1	Bestückte Leiterplatte
05	9028.41	28.6.78	Eiler				
04	9028.31	10.4.79	Kunze				
03	9028.15	21.3.79	Mo				
02	9028.9	6.2.78		Oberfläche			
01	9028.94	16.10.78					
Ausgabe	Änd.-Mitteilg	Datum	Name				

	Datum	Name
gez	10.10.	R. Gerstner
bearb		

361 088

Schaltplanpositionierung ≙ 209 021 S

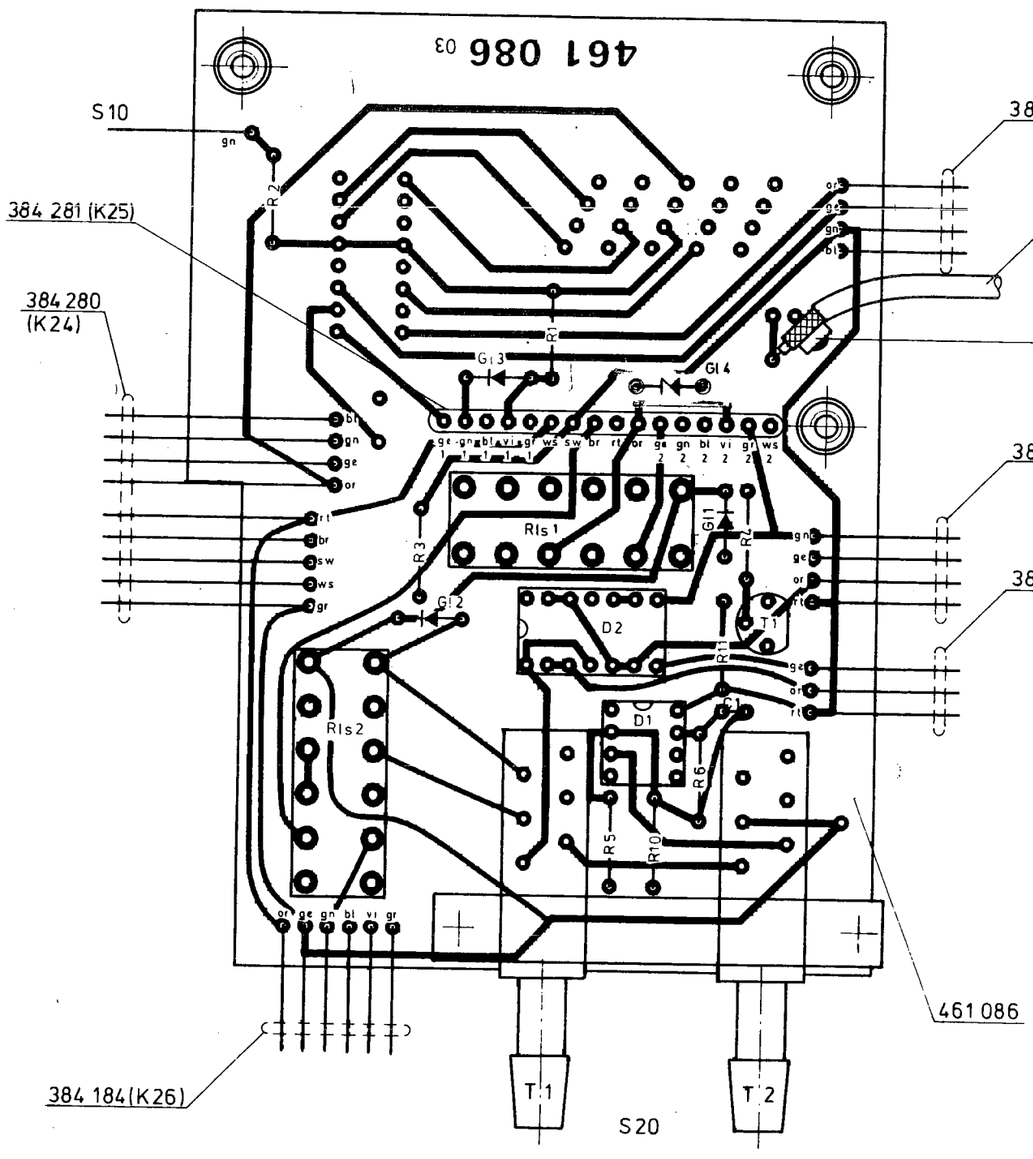
verwendet in: 209 021

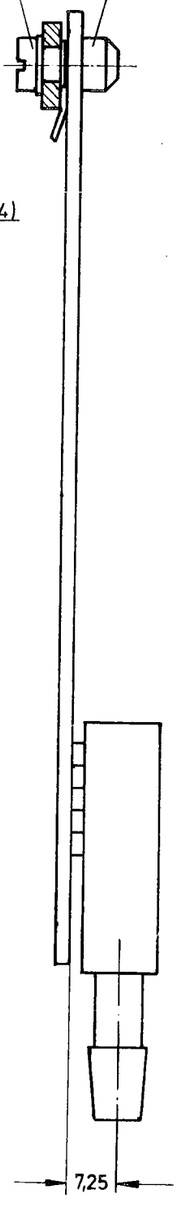
Gerät: 4020

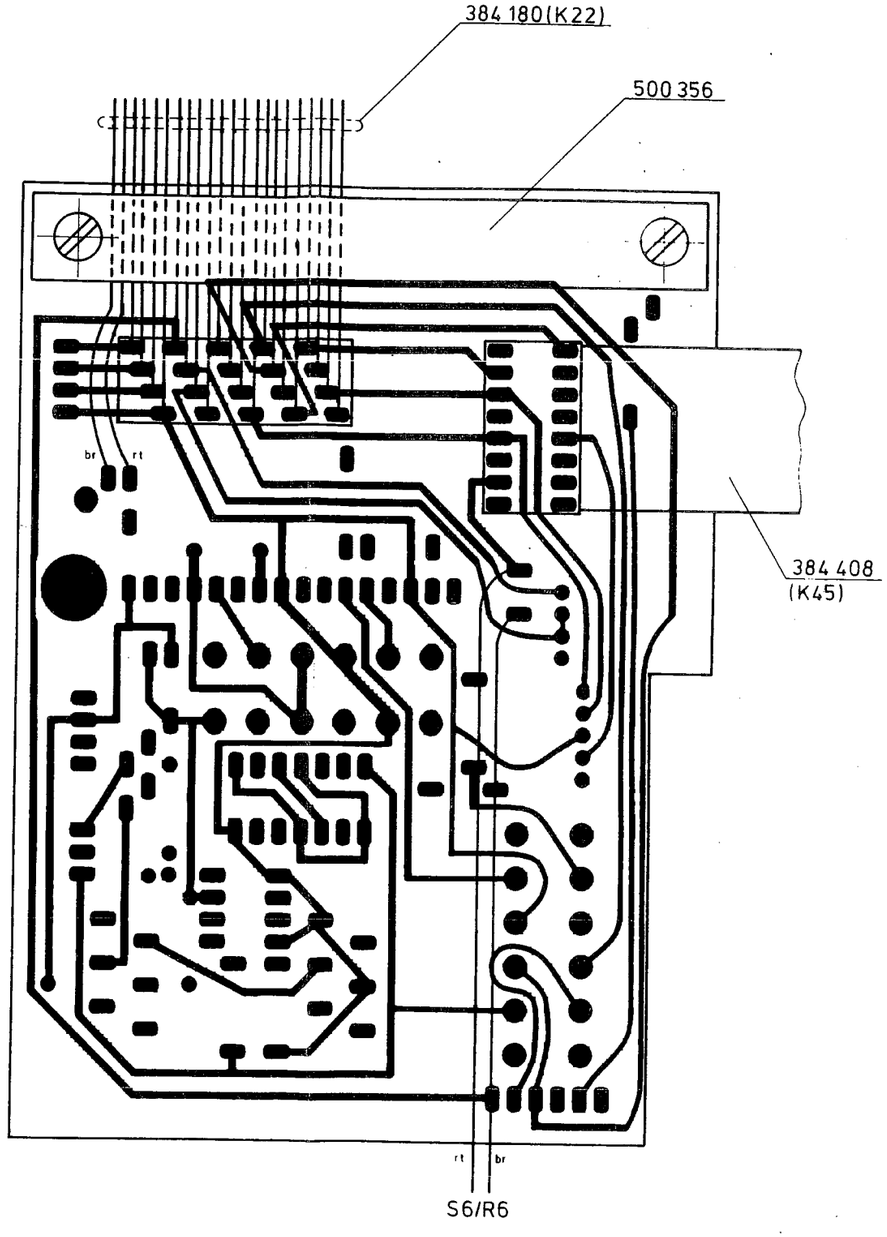
2 x M 3x8 DIN 84
701 146
B 3 DIN 127
706 324
787 033

423 004 (3x)
Nietmutter nur durchgesteckt u.weich gelötet.

weich gelötet







Kontrollmaß

9028.27 26.2.79 Mo 8028.9 2.2.79 Mo 8028.96 21.12.78 gl. 8028.81 18.12.78 gl.		0,2	2:1	Schlumberger o/s
		78 18.12. Gerstner 18.12.		Bestückte Leiterplatte
				361 086

Schaltplanpositionierung - 209 021 S / 361 086 Sa

verwendet in: 209 021

Gerät: 4020

K1 (384 620)
aus 361 088

841 120
500 868
841 122
500 706 (5×)
841 254
501 293
M 2×4 DIN 84
701 113
A 2 DIN 137
706 205
2×
841 119
K 6
380 746
786 009 (19×)
841 103
7,25
52
875
786 009 (6×)
461 154
770 140 (4×)
M 2×5 DIN 84
701 114
A 2 DIN 137
706 205

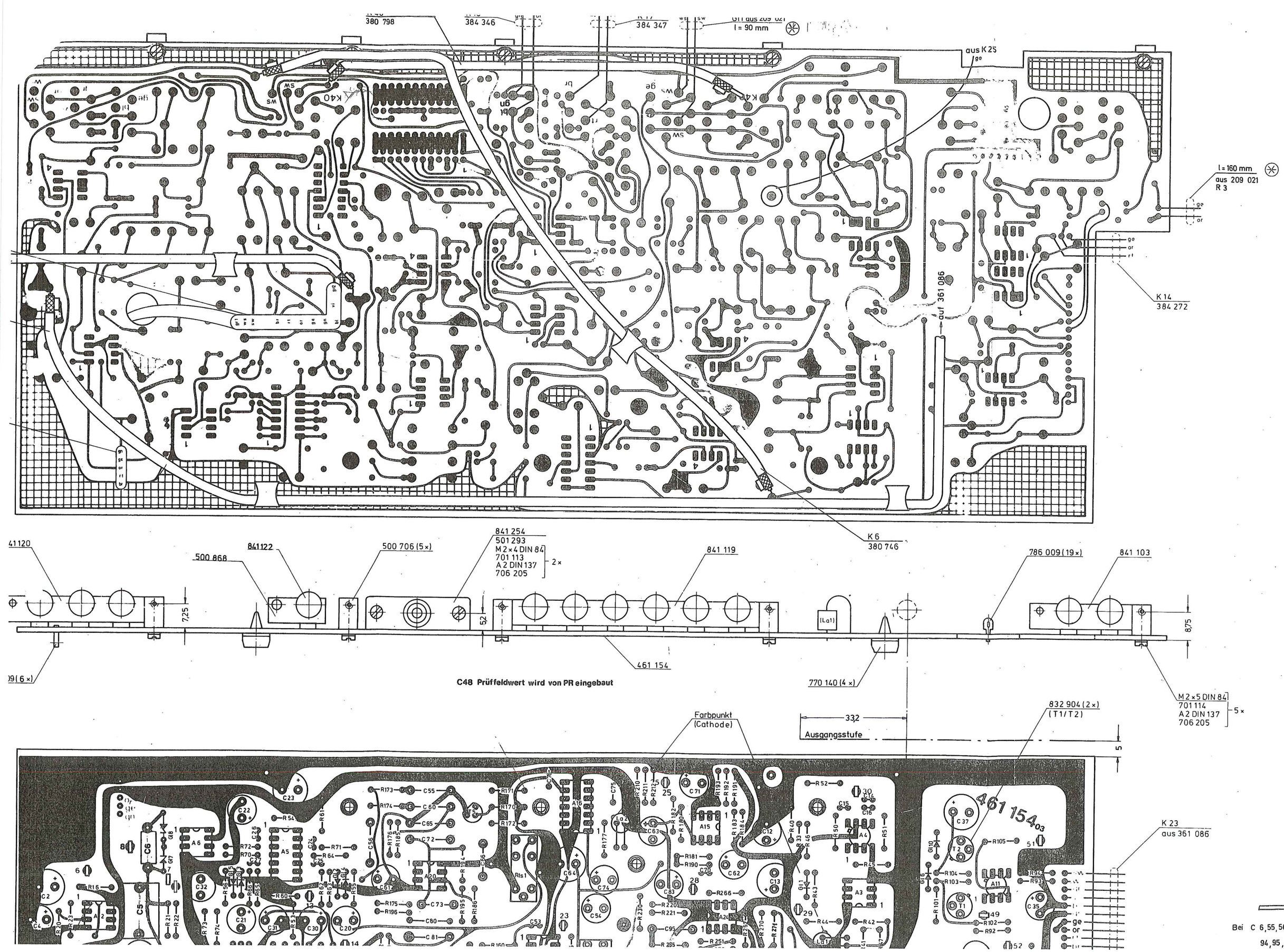
C48 Prüffeldwert wird von PR eingebaut

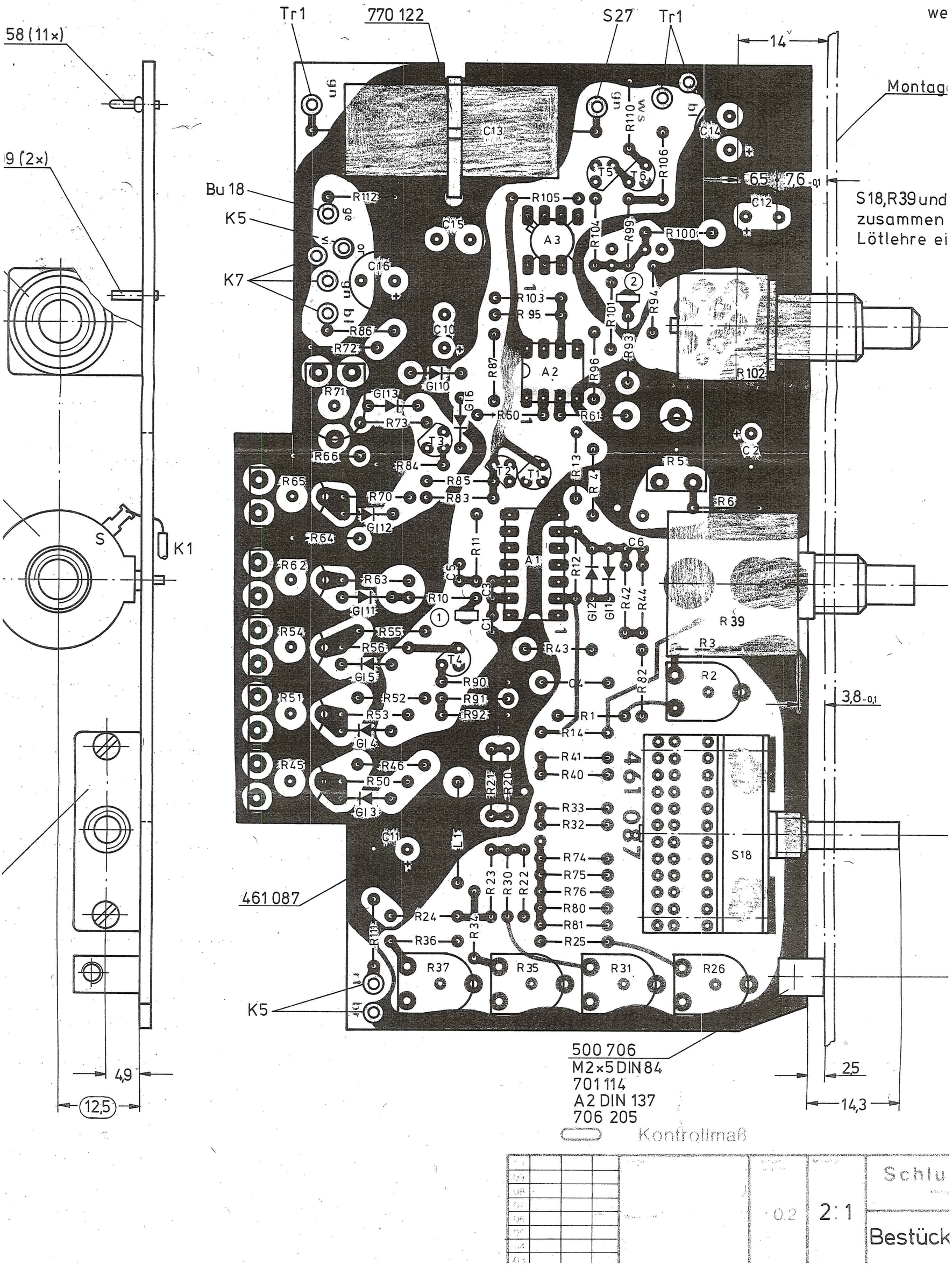
Farbpunkt
(Cathode)
332
Ausgangsstufe
832 904 (2×)
(T1/T2)
5
461 154 03
K 23
aus 361 086

384 279/K3
384 372/K2

J1
l = 90 mm
J2
ws/gr l = 100 mm
Gl 5
l = 75 mm
786 004 (2×)
880 168 (2×)
l = 110 mm
(unten) sw
(oben) sw
21,7
14,5
770 064
für Bauteile gesperrte Zone
(Welle - Dämpfungsglied)
K 25
aus 361 086
57,2
22

verw. in: 209 021
Schaltplanposition ≙ 209 021 S
Gerat: 4020


380 798
384 346
384 347
GY1 aus 209 021
l = 90 mm
aus K 25
ge
l = 160 mm
aus 209 021
R 3
ge
or
K 14
384 272
ge
or
rt
auf 361 086
K 6
380 746
841 120
500 868
841122
500 706 (5×)
841 254
501 293
M 2×4 DIN 84
701 113
A 2 DIN 137
706 205
2×
841 119
786 009 (19×)
841 103
7,25
5,2
8,75
461 154
770 140 (4×)
M 2×5 DIN 84
701 114
A 2 DIN 137
706 205
5×
C48 Prüffeldwert wird von PR eingebaut
Farbpunkt
(Cathode)
33,2
Ausgangsstufe
832 904 (2×)
(T1/T2)
5
461 154 03
K 23
aus 361 086
Bei C 6,55,56,60,65,72,73
94,95,102,103,104



				0,2	2:1

Schlu

Bestück

(see block circuit diagram 102 820 B for total instrument)

The frequency of the ramp generator is dictated by restistors for switching and vernier adjustment. An operation amplifier the feedback of which is a function of signal level converts the ramp signal into a low distorsion sinusoidal signal. The external output level can be continuously adjusted in two ranges.

Besides internal modulation also external or simultaneous internal and external modulation is possible. The external modulation depends on the level of the external AF generator.

The source impedance of the symmetrical transformer output can be switched to 600 Ω or < 6 Ω.

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	9022.28	25.10.71	Vinny
5028.82		11.8.72	Schuh

Replacement for

208 026 A

4020 series
MODULATION GENERATOR

1/2 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Preset all adjustment potentiometer to middle position apply + 14 V ± 10 mV to the rail pin. Select Ro < 6 Ω, terminate with 600 Ω.					
DVM Oscilloscope	1. <u>Integrator + Schmitt - Trigger</u> S 18 : 1 kHz (S 18 = Frequ. range switch)	(1)	approx. 1 kHz	———	⩘ 6,5 ± 0,5 V_{pp}	..... V_{pp}
	For troubleshooting only: S 18 : Ext. connect + 14 V to S 18 slider (T1/C4)	(1) A 1/Pin 2 (1) A 1/Pin 2	——— ——— ——— ———	——— ——— ——— ———	0..... + 2 V + 12.....+ 14 V 0..... + 2 V	.....ok
	2. <u>Sinus Shaping Network</u> S 18 : 1 kHz " " , R 102 fully clockwise, S 2 pressed	FM,AM-output Mod.Gen.-output	approx. 1 kHz "	——— ———	approx. 4 V distorted "	.....ok
Counter	3. <u>Frequency Adjustment</u> (+ 14 V ± 10 mV !) S 18 : 6 kHz " 3 kHz " 2,7 kHz " 1 kHz " 0,4 kHz " 0,3 kHz	FM,AM output " " " " "	6 kHz 3 kHz 2,7 kHz 1 kHz 0,4 kHz 0,3 kHz	R 26 → R 31 → R 35 → R 37 →	6 kHz 3 kHz 2,7 kHz 1 kHz ± 0,5 % 0,4 kHz 0,3 kHz	.....kHz .....kHz .....kHz .....kHz .....kHz .....kHz

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		5.10.73	Harm

4020 series
MODULATION GENERATOR

208 025 A

Sheet 1/2

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Preset all adjustment potentiometer to middle position apply + 14 V ± 10 mV to the rail pin. Select Ro < 6 Ω, terminate with 600 Ω.					
DVM Oscilloscope	**1. Integrator + Schmitt - Trigger** S 18 : 1 kHz (S 18 = Frequ. range switch)	①	approx. 1 kHz	———	⩘ 6,5 ± 0,5 V_{pp}	..... V_{pp}
	For troubleshooting only: S 18 : Ext. connect + 14 V to S 18 slider (T1/C2) ▪ ▪ ▪ ▪ ▪ ▪ 0 V ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪	① A 1/Pin 2 ① A 1/Pin 2	——— ——— ——— ———	——— ——— ——— ———	0..... + 2 V + 12.....+ 14 V ▪ ▪ 0..... + 2 V	.....ok
	2. Sinus Shaping Network S 18 : 1 kHz ▪ ▪ , R 102 fully clockwise, S 2 pressed	FM,AM-output Mod.Gen.-output	approx. 1 kHz ▪	——— ———	approx. 4 V distorted ▪	.....ok
Counter	**3. Frequency Adjustment** (+ 14 V ± 10 mV !) S 18 : 6 kHz ▪ 3 kHz ▪ 2,7 kHz ▪ 1 kHz ▪ 0,4 kHz ▪ 0,3 kHz	Mod. Gen. output ▪ ▪ ▪ ▪ ▪	6 kHz 3 kHz 2,7 kHz 1 kHz 0,4 kHz 0,3 kHz	R 26 → R 31 → R 35 → R 37 →	6 kHz 3 kHz 2,7 kHz 1 kHz 0,4 kHz 0,3 kHz ± 0,5 %	.....kHz .....kHz .....kHz .....kHz .....kHz .....kHz

Issue	Alteration No.	Date	Name
	SC28.7	3.1.78	Kaunz
		5.10.76	

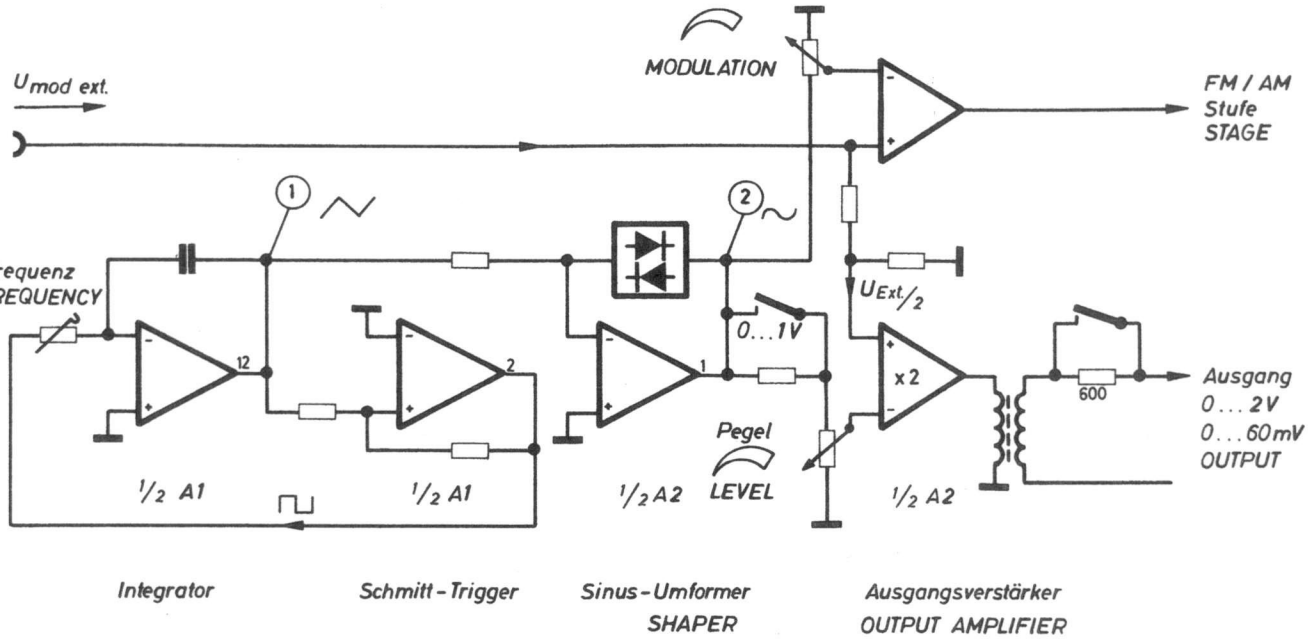
Adjustment and Test Procedure

4020 series
MODULATION GENERATOR

208 025 A

Sheet 2/2

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	4. Distortion Factor Adjustment					
AF Analyser (e.g. Radiometer FRA 3) Distortion-Analyser hp 333 A	S 18 : 1 kHz	①	1 kHz (2 kHz)	R 5	second harmonic < 1 mV	0,.....mV
	S 18 : 1 kHz, R102 fully clockwise, S2 pressed	Mod.Gen. output	1 kHz	R 45 + R 71 R 51 + R 65 R 54 + R 62 in couples repeated R 2		
	S 18 : 1...3 kHz R 39 min. frequency	"	780...900 Hz		Dist. < 0,35 %	.....%
					"	.....%
	S 18 : 30...100 Hz R 39 min. frequency	"	< 30 Hz	——	Dist. < 3 %	.....%
	" : 3... 10 kHz R 39, 10 kHz	"	10 kHz	——	Dist. < 3 %	.....%
Dist. Analyser used as a level meter	**5. Output Level**					
	S 18 : 1 kHz	FM,AM-output	1 kHz	——	1,65...1,85 V	V
	Mod.Gen. output loaded with 220 Ω S 18 : 1 kHz R 102 fully clockwise, S 2 pressed	Mod.Gen.-output	"	——	2 ...2,3 V	V
	" " " " , S 2 pulled	"	"	——	30 ... 35 mV	.....mV
	" 30 Hz ...100 Hz, R 39 min. frequency R 102 fully clockwise, S 2 pressed	"	< 30 Hz	——	1,7 ...2,3 V	V
AF Generator 1 kHz 1 V	**6. Ext. Mod - Input**					
	S 18 : ext. 1 kHz, 1 V applied to the ext Mod input	FM,AM-output	1 kHz	——	1 V (= input level)	.....ok
	7. Checkout of the 10 turn control potentiometer					
Oscilloscope	S 18 : 0,3...1 kHz	FM,AM-output	0,3 ... 1 kHz	turn R 39 slowly over the whole range	no frequency jumping from 0,3 to 1 kHz	..... ok



Bereich RANGE	Frequenz FREQUENCY
2	0,3 kHz
3	0,4 kHz
4	1,0 kHz
5	2,7 kHz
6	3,0 kHz
7	6,0 kHz
8	0,03 ... 0,1 kHz
9	0,1 ... 0,3 kHz
10	0,3 ... 1,0 kHz
11	1,0 ... 3,0 kHz
12	3,0 ... 10,0 kHz
1	EXT. MOD.

361 087
461 087

/ AM
fe
GE

gang
2V
60mV
PUT

Abgleich
ADJUST.
SYM.
2.HARM.→0

Abgleich Klirr
ADJUST. DIST.

Frequenz
FREQUENCY

R45, R51, R54, R62, R65, R71
Abgleich Klirrfaktor
ADJUST. DISTORTION FACTOR

Pegel
LEVEL

OUTPUT
MOD. GEN.
0... 60 mV
0... 2 V

EXT.

RM - MOD.

MODULATION

S18

S

sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME
–	9028.7	16.1.79	Mo
1978			

	Datum DATE	Name NAME
norm.		
gepr.		
bearb.	16.10.78	Kr.

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

MODULATIONS GENERATOR

208 025 S
Typ: 4020

(See block circuit diagram 102 820 B for total instrument)

The fully integrated counter provides direct drive of the display in conventional Strobe method, for which it requires merely the counting frequency , the reset pulse, the transfer pulse (transfer of the counter status into the readout store) and the flashing frequency. Its negative feed voltage is generated by a DC/DC converter from +5 V.

The frequency of the reset transfer pulse and flashing frequency is derived by frequency deviders from a 250 kHz signal having crystal accuracy and switching in accordance with the nature of the counting frequency. The flashing frequency is provided to the counter only when the RF amplitude in the oscillator stage ("RF-ALC") is too low or on overflow readout, i. e. >9999.

The counting frequency is conditioned by various means depending on the mode of operation:

1. The modulation frequency f_{MOD} or the input frequency of the voltmeter is quadrupled by an input amplifier having automatic level control in 2 frequency doublers. Thus attaining a faster counter readout, (4 times/sec) for 1 Hz resolution.

2. The offset frequency "Δf (AC)" is presented directly. (Depending on resolution, the reset frequency is 10 or 1 Hz.)

3. When establishing transmitter frequencies or indicating synthesizer frequency > 40 MHz the frequency $\frac{40...480\ \text{MHz}}{1600}$ is presented divided by 7 as the counter frequency.

   When indicating the synthesizer frequency <40 MHz the frequency $\frac{140...180\ \text{MHz}}{1600}$ is de-mixed using a D Flip Flop analogous to de-mixing in the output stage and in the counter stage also.

Schlumberger	Function Description	237 002 F	Sheet 1/1
	Type: 4020/21/22	Frequency Counter	Date 0979

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01		8.10.79	Kamm
		12.5.78	Schuh

Replacement for 237 002 A

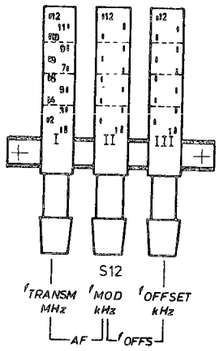
4020 (4010) series
Frequency Counter

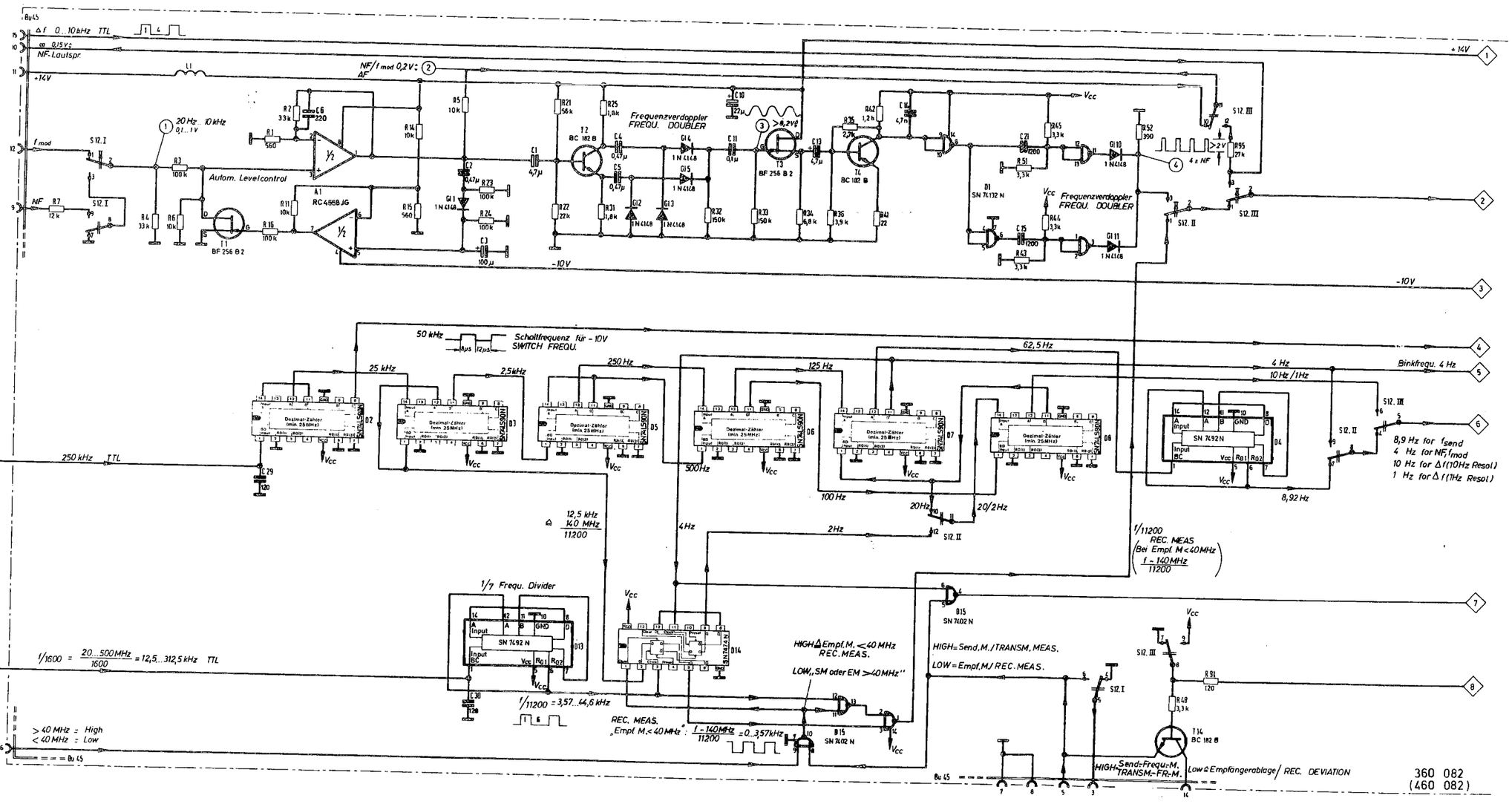
1/1 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	REQUIRED VALUE	MEASURED VALUE
4021 (4010 A) Dig. Voltmeter (Oscillescope for trouble shooting)	For carrying out the test procedure, the counter can be placed outside of the instrument. Connect Bu 35, St 32 and St 20 to the instrument. Caution! MOS-Counter D 9 is highly sensitive against electrostatic potentials. Exercise normal MOS handling procedures.		
	Check negative Supply Potential	-9.....-11 V on (5) 360 082	-.....V

Counter Functions

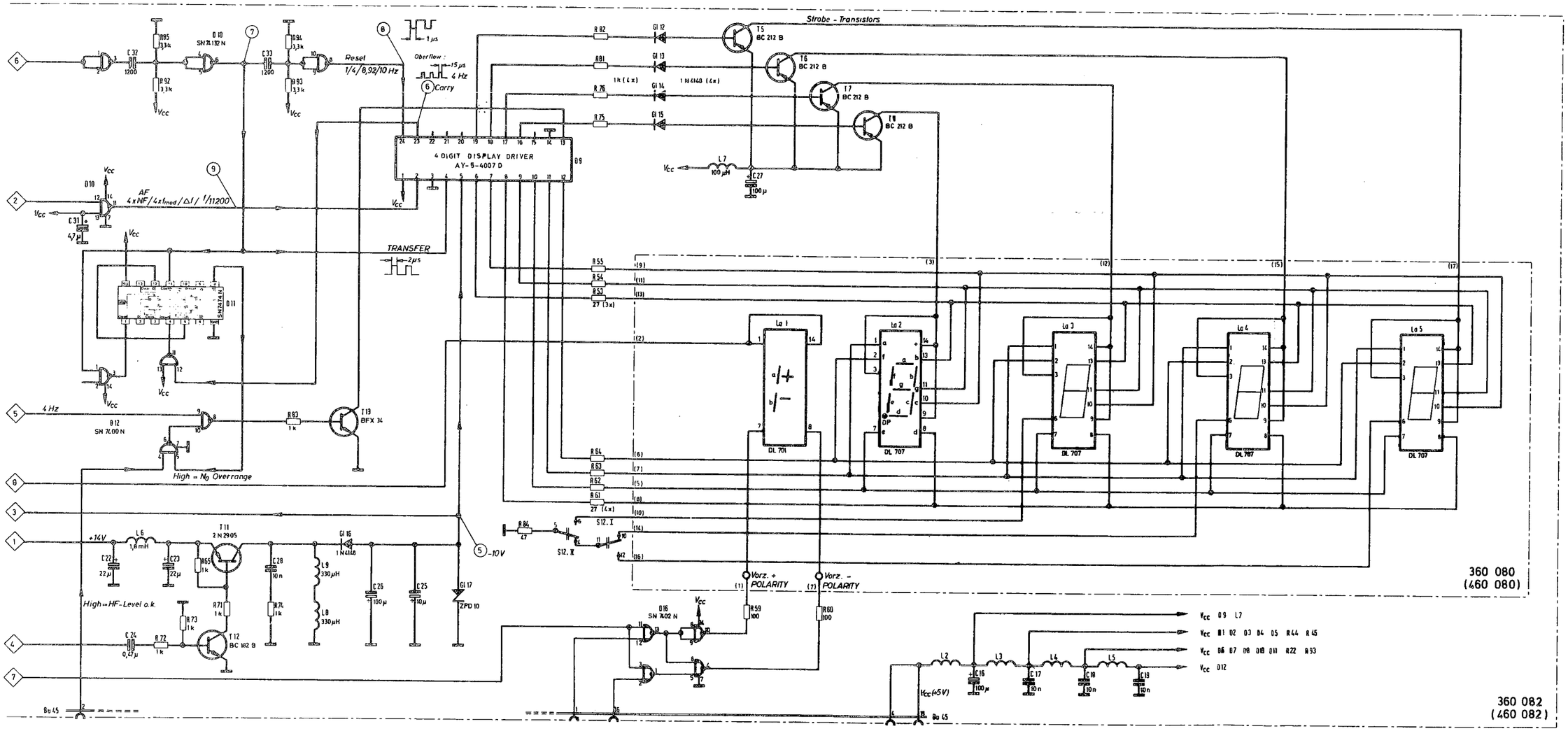
	RECEIVER MEASUREMENT	TRANSM. MEASUREM.	Frequ. Setting	f_{TRANSM}	f_{MOD}	$f_{Abt.}$	Counter indication	Loud Speaker	MEASURED VALUE
Mod. Generator switched to ext. AF Voltmeter range in 1 mV position button UNMOD pressed	X X X X		020,0000 MHz 140,0000 MHz 479,0000 MHz 600,0000 MHz	X X X X			020,0 140,0 479,0 000,0 blinks	Noise " " "	.....ok
10 MHz Output on rear panel connected to HF DIRECT socket AF Voltmeter range in 1 mV position		X X X X X	---- 010,1010 010,0010 " 009,9990	X	 X X	 X X X X	010,0 -01,00 blinks -01,00 -1,000 +1,000	Noise 10,1 kHz 1 kHz 1 kHz 1 kHz	.....ok
f_{OFFSET} Control fully pressed anti-clockwise pulled (+,- sign blinks) pulled	X X X		009,9990 " "		 X	X X X	+00,2.. -00,2.. - 0,2..	appr.250Hz " "	.....ok
FM, Range 5 kHz, Deviation 0,5 kHz Modulationgenerator 30 Hz 1 kHz 9,9 kHz 10,1 kHz	X X X X		009,9990 " " "		X X X X		0,030 1,000 9,900 0,100 blinks	30 Hz 1 kHz 9,9kHz 10,1kHz	.....
Mod. mode switch to UNMOD, Modul. Generator output connected to AF Millivoltmeter input f_{AF}, Range = 1 mV Signal: 1 kHz, appr. 0,2 mV	X		009,9990	X	X		1,000	1 kHz	.....ok





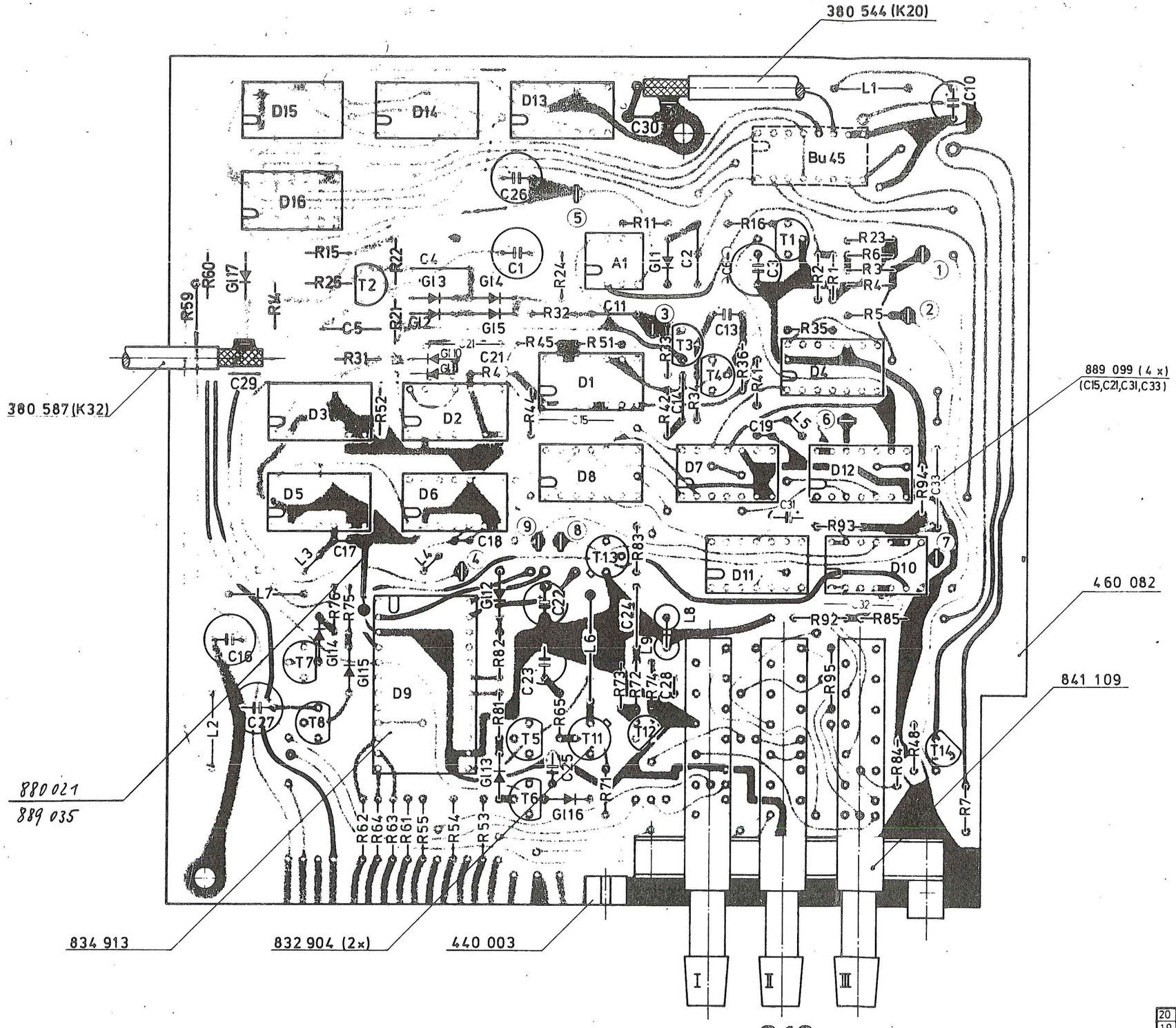
sw BLACK	bl BLUE	11	7028.96	21.1277	Wn	norm			Schlumberger o/s	Frequenzzähler	237 002 S Bl. 1
br BROWN	vi VIOLET					gepr			Meßgerätebau u. Vertrieb GmbH	FREQUENCY COUNTER	
rt RED	gr GREY	12	8028.5	9.1.78	Kc	baorb.	26.2.75	Kr.	8 München 46		Typ: 4010
rs ROSE	ws WHITE	Ausg.	Ä.-Mittlg.	Datum	Name	1975	Datum	Name			
ge YELLOW	tr TRANSPARENT	ISS	MODIF	DATE	NAME		DATE	NAME			
gn GREEN											

360 082
(460 082)

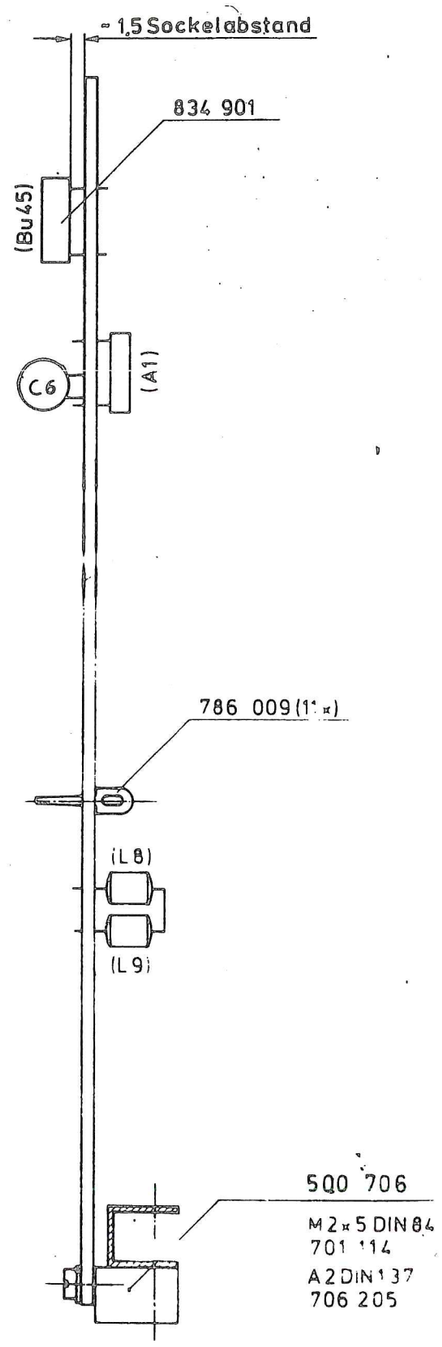


sw BLACK	bl BLUE	05	8028.62	2.6.78	Kr.	norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	Frequenzzähler FREQUENCY COUNTER	237 002 S Bl. 2
br BROWN	vi VIOLET	04	5028.95	16.10.75	Kr.	gepr.					
rt RED	gr GREY	03	5028.93	30.9.75	Kr.	bearb.	26.2.75	Kr.			Typ: 4010
rs ROSE	ws WHITE	Ausg.	Ä.-Mitteilg.	Datum	Name	1975	Bebeus	Name			
ge YELLOW	ir TRANSPARENT	185.	MEMF	DATE	NAME		DATE	NAME			
gn GREEN											

weich gelötet



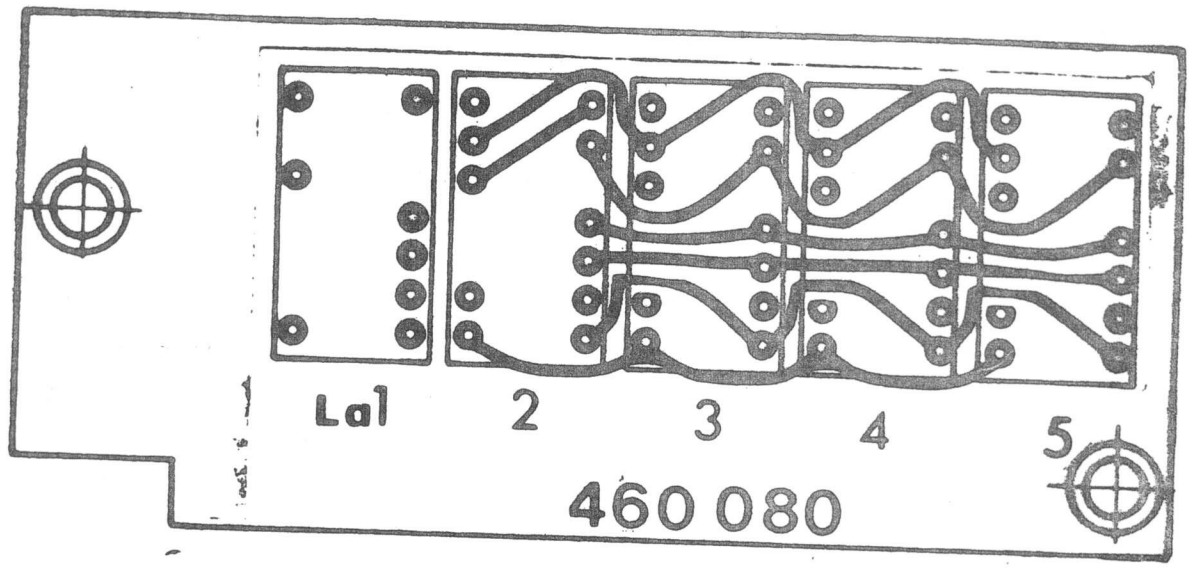
S12

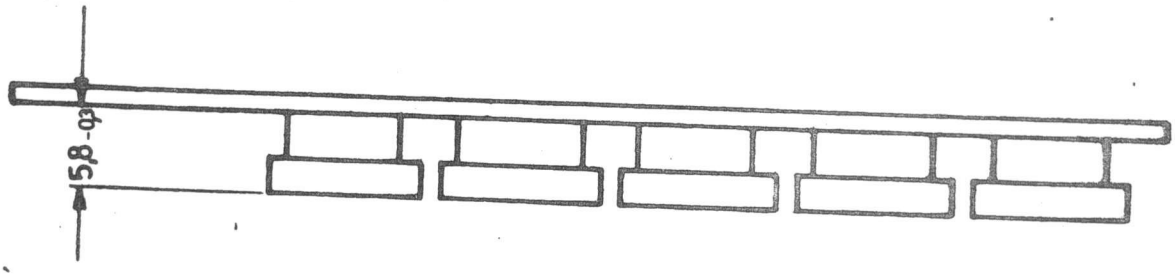


Kontrollmaß

20					1:1	Schlumberger o/s
19						
18						Bestückte Leiterplatte
17	9028.54	9.8.79	Eiler			
16	8028.62	2.6.78				
15	8028.5	5.1.78				
14	7028.84	30.11.77	Eiler			360 082
13	7028.78	26.1.77				
12	7028.2	14.4.76				
11	5028.108	21.11.75	Eiler			

Schaltplanpositionierung · 237 002 S/360 082 Sa | verwendet in: 237 002 | Gerät: 4010





Schaltplanpositionierung ≙ 360 080 Sa / 237 002 S

09	Benennung	Freimaß toleranzen	Maßstab 2:1	Schlumberger o/s Meßgerätebau Vertrieb GmbH 8 München 45
08				
07				
06				
05	Werkstoff			Bestückte Leiterplatte
04				
03				
02				
01	Oberfläche	% Datum Name gez 21.1 bearb		360 080
Ausgabe / Änderung / Datum / Name				

(See block circuit diagram 102 820 B for total instrument)

1. Type survey

Instrument ser. number	Type of oscillators	Frequency ranges	Number of sub oscillators
4010 | 4020			
012801 to 052850	213 012	60 ... 100 MHz	2
		140 ... 180 MHz	2
		420 ... 480 MHz	1 (3 subranges)
062801 to ...062899	213 015	60 ... 100 MHz	2
		140 ... 180 MHz	2
		420 ... 480 MHz	1 (3 subranges)
072801 to 072882	213 025	60 ... 100 MHz	2
072883 to ...	213 016	140 ... 180 MHz	2
		400 ... 480 MHz	1 (2 subranges)
4010 A | 4021			
052801 to 062899	213 013	40 ... 200 MHz	9
		420 ... 480 MHz	1 (3 subranges)
072801 to 072882	213 023	40 ... 200 MHz	9
072883 to...	213 017	400 ... 480 MHz	1 (2 subranges)
4011 | 4022			
062801 to...062899	213 013	see 4010 A	
	and 213 014	200 ... 420 MHz	11
072801 to...	213 017	see 4010 A / 4021	
	and 213 014	see above	

3. Oscillators

The frequency of the LC or power circuit can be tuned by at least 22 MHz by means of the varactor diodes, the necessary automatic phase control voltage from the decade stage controlling the oscillator frequency to the required value. Due to this very slow frequency control the FM modulation - and also the internal interference modulation - is not eliminated.

By means of additional varactor diodes each oscillator can be frequency modulated by the AF signal "FM(AC)". The adjustable coupling of the FM diode and the APC DC voltage compensates the RF response of the FM sensitivity.

The RF signal is provided to the output amplifier through to the buffer amplifer, harmonic low pass filter and the combination circuitry. To generate 40 ...60 MHz using a single oscillator circuit a double oscillator frequency of 80...120 MHz is generated and devided at the output by 2.

The oscillator frequency of the 420...480 MHz oscillator is adjusted by the switching diodes in 3 sub ranges (420...440, 440...460, 460... 480 MHz).

2. Oscillator Selection

The digital frequency setting commands of the 10 MHz and 100 MHz decade are (after slightly code modification in the decade stage) applied to the oscillator selector, this supplying only the corresponding oscillator with +14 V. The switching diodes too of the RF combination are then either reversed or forward.

In the "transmitter frequency measurement" mode no oscillator is oscillating and the RF combination passes the transmitter signal rereived from the output stage to the output amplifier.

4. Output Amplifier

The RF rectifier in the amplifier output controls the constant output amplitude using the pindiode attenuator pad on the amplifier input.

The ALC control voltage exceeds the normal voltage range should the RF amplitude not be sufficient causing the counter to flash through the RF-ALC (DC) line.

The output amplifier has 2 RF outputs: for the output stage with frequency response and high level and for the decade stage with higher frequency response and low level.

Schlumberger

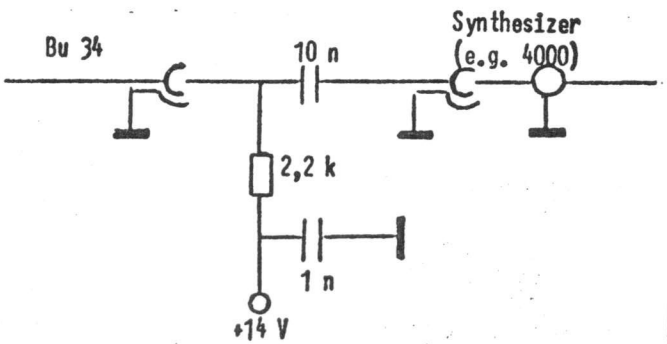
Adjustment and Test Procedure

Issue	Alteration No.	Date	Name

4021 (4010 A)
Oscillator

213 017 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM	**Oscillator Selector (PCB 360 884)** Check, that only the oscillator appropriate to the frequency setting on front panel and to the following list is switched on. Frequency setting 40... 49,99 MHz 50... 59,99 MHz 60... 79,99 MHz 80... 99,99 MHz 100...119,99 MHz 120...139,99 MHz 140...159,99 MHz 160...179,99 MHz 180...199,99 MHz	St 102/1 " /16 " /14 " /5 " / 3 " /15 " /13 " /2 " /12			on* " " " " " " " " * on = < 1,7 V off = > 2,5 V	

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Synthesizer (60...520 MHz) DVM Power Meter RF Analyser	RF Amplifier (360 885) Connect the Synthesizer to Bu 34 by use of the following coupling circuit. Thus the RF signal is provided through a diode switch on PCB 360 887 to the RF amplifier.  To avoid excessive frequency response keep leads short.					

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	RF Amplifier (360 885) - continued Output Level on Bu 35					
Synthesizer (60...520 MHz)	P_{IN} = -7 dBm on Bu 34	Bu 35	60...400 MHz		P_{out} = +7,8...+9 dBm P_{out} = +8,8...+10 dBm	
DVM	P_{IN} = -5 dBm on Bu 34	Bu 35	400...480 MHz		P_{out} = +8 ...+10 dBm P_{out} = +10....+12 dBm	
Power Meter	DVM connected to DF 10	DF 10	60...480 MHz		VDC < + 11 V	
	Automatic Level Control					
	P_{IN} = +2 .... -12 dBm	Bu 35	60 MHz		P_{out} = +7,8...+9 dBm P_{out} = +8,8...+10 dBm	
	P_{IN} = +2 .... - 6 dBm	Bu 35	500 MHz		P_{out} = +8 ...+10 dBm P_{out} = +10 ...+12 dBm	
	Command Line : "RF present" "RF lacking"	DF 10	60...500 MHz		VDC < 11,5 V VDC > 11,5 V	
	Output Level on Bu 40					
	P_{IN} = -5 dBm on Bu 34 For this measurement a 50 Ω load must be connected to Bu 35	Bu 40	20... 60 MHz 60...100 MHz 100...480 MHz		- 2 ... - 16 dBm - 2 ... - 12 dBm - 2 ... - 10 dBm	
RF Analyser	Harmonic Output	Bu 35	20...500 MHz		> 30 dBc	

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Issue | Alteration No. | Date | Name

Adjustment and Test Procedure

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	1. Oscillator Selector (PCB 360 889)					
DC-Multimeter	Set frequency 400 MHz and check supply voltage at L1	L1	400 MHz		> 4 VDC	
	Set 440 MHz and check at L1	L1	440 MHz		0 V	
	Set 440 MHz and check at L21	L21	440 MHz		> 4 VDC	
	Set 480 MHz and check at L21	L21	480 MHz		0 V	
	2. Frequency Alignment					
	Set 439,9 MHz. Press the TRANSMITTER MEASUREMENT button.					
	Adjust C12, C32, R14, R34 to mid-position					
	Adjust C7 to get 11,4 V on the U_R-Line (AFC)	U_R-Line	439,9 MHz	C7	11,4 VDC	
	Set 400 MHz and check AFC again	"	400 MHz		> 2 VDC	
	Set 479,9 MHz and adjust C27	U_R-Line	479,9 MHz	C27	11,4 VDC	
	Set 440 MHz and check again	"	440 MHz		> 2 VDC	

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		21.6.76	Schl

Replacement for

213 017 A

4021 (4010 A)
Oscillator

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REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Modulation meter Multimeter	FM-Sensitivity Adjustment (PCB 360 089)					
	Set approx. 10 kHz frequency deviation.					
	Set 400 MHz and note deviation on the modulation meter.	Mod.meter	400 MHz		10 kHz dev. appr.	
	Set 439,9 MHz and adjust C12 to get equal deviation as at 400 MHz	"	439,9 MHz	C12	exact value as above	
	Adjust R10 to exact 10 kHz deviation Check deviation at 2 MHz frequency spacing	"	400...439,9MHz	R10	10 khz ± 5 %	
	Set 440 MHz and note deviation on the modulation meter.	"	440 MHz		10 kHz dev. appr.	
	Set 479,9 MHz and adjust C32 to get equal deviation as at 440 MHz.	"	479,9	C32	exact value as above	
	Adjust R34 to exact 10 kHz deviation Check deviation at 2 MHz frequency spacing	"	440... 479,9MHz	R34	10 kHz ± 5 %	

Schlumberger

Issue | Alteration No. | Date | Name

Adjustment and Test Procedure

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	RF-Level					
Multimeter	Check DC-level on R39 (PCB 360 885)	R39	DC		< 6 VDC	
	Tip: To get an lower DC-level, pull C25, C5 towards transistor					
	Oscillating conditions					
	Interrupt the AFC-line (U_R) and replace it by + 0,5 VDC. Chance FET if no oscillation occurs under this condition.					
	Noise deviation					
Modulation meter	Check unwanted FM- and φM-deviation		439,9 MHz 479,9 MHz		< 8 Hz/9 mRad	

4021 (4010 A)
Oscillator

213 017 A

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Mod. Meter Distortion Analyser	FM-Distortion Check FM distortion at 20 kHz deviation and 1 kHz f_{mod}		400... 479 MHz		< 1,5 %	
AF Voltmeter	AF-Frequency Response Check frequency response at 10 kHz deviation		1 kHz f_{mod} 10 kHz f_{mod}		≙ 0 % < 2 %	

4021 (4010 A)
Oscillator

213 017 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
Counter DVM	2. 2 MHz Frequency Offset on TRANSM. MEASUREMENT					
	Depress: TRANSM. MEASUREMENT and f_{MOD}					
	(When checking without the Control and Display Unit, connect pin 21 of St 22 and DF 7 of the Decade Stage to ground).					
	Set decade switch to 49,999	RF DIRECT or Bu 35	51,999		$V_{AFC} \leq 11,5$ V	
	59,999		61,999			
	79,999		81,999			
	99,999		101,999			
	119,999 MHz		121,999 MHz			
	139,999		141,999			
	159,999		161,999			
	179,999		181,999			
	199,999		201,999			
	Check the "RF present" line at the same frequencies.	DF 10	as above		< 10,5 V	
Noise Deviation Meter	3. Noise Deviation					
	FM	RF DIRECT or Bu 35	40...199,99 MHz		Noise Dev. < 8 Hz CCITT weighted	
	φM:	"	"		Phase Dev. < 0,01 RAD CCITT weighted	

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM Adjustable Power Supply 0...12 V	Oscillator 40...200 MHz (360 887) - continued 4. Oscillating conditions Interrupt the automatic frequency control by disconnecting St 31. Connect an adjustable DC potential to the AFC-line (grey lead to 360 887) and find the smallest DC potential at which oscillating occurs. Caution: Don't reconnect St 31 until the Power Supply is disconnected. Frequency setting 40 MHz 50 " 60 " 80 " 100 " 120 " 140 " 160 " 180 "	RF DIRECT or Bu 35	< 40 MHz < 50 " < 60 " < 80 " < 100 " < 120 " < 140 " < 160 " < 180 "	-------	$\leq$ 1,2 V on AFC-line	

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
AF Generator DVM (Deviation Meter calibrated by means of the Bessel function)	Oscillator 40...200 MHz (360 887) - continued					
	5. FM Sensitivity depending on Carrier Frequency					
	f_{mod} = 1 kHz V_{mod} = 3 ± 0,05 V_{rms} on St 51/1 or on DF 11					
	40...50 MHz Band					
	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	40,0 MHz 49,999 MHz	R 2 → R 12 → alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 1 MHz steps. If necessary, adjust R 2 for equal positive and negative deviation accuracy.	"	40...49,999 MHz	R 12 →	Accuracy ± 3%	
	If adjusting to the specified accuracy ± 3% is not possible across entire band, the oscillator tuning (L 1) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	40 MHz	L 1 →	V_{AFC} ≤ 2,5 V	
	TRANSMITTERMEASUREMENT		49,9 MHz	L 1 →	V_{AFC} ≤ 11,5 V	
		(AFC-line = grey lead)				

Issue	Alteration No.	Date	Name
A4	8028/85	21.6.88	Schulz

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	50...60 MHz Band					
Dev. Meter AF Generator DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	50,0 MHz 59,9 MHz	R 72 → R 63 → alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 1 MHz steps. If necessary, adjust R 72 for equal positive and negative deviation accuracy.	"	50...59,9 MHz	R 72 →	Accuracy $\pm$ 3%	
	If adjusting to the specified accuracy $\pm$ 3% is not possible across entire band, the oscillator tuning (L 11) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	50,0 MHz	L 11 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT		59,9 MHz	L 11 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line= grey lead)				

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	60...80 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	60,0 MHz 79,9 MHz	R 172 ⟶ R 182 ⟶ alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 2 steps. If necessary, adjust R 172 for equal positive and negative deviation accuracy.	"	60...79,9 MHz	R 172 ⟶	Accuracy $\pm$ 3%	
	If adjusting to the specified accuracy $\pm$ 3% is not possible across entire band, the oscillator tuning (L43) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT TRANSMITTERMEASUREMENT	RF DIRECT and AFC-line	60,0 MHz 79,9 MHz	L 43 ⟶ L 43 ⟶	$V_{AFC} \leq 2,5$ V $V_{AFC} \leq 11,5$ V	
		(AFC-line= grey lead)				

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		21.6.76	Sch

Replacement for 213 017 A

4021 (4010 A) Oscillator

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REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	80...100 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	80,0 MHz 99,9 MHz	R 231 ⟶ R 222 ⟶ alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 2 steps. If necessary, adjust R 231 for equal positive and negative deviation accuracy.	"	80...99,9 MHz	R 231 ⟶	Accuracy $\pm$ 3%	
	If adjusting to the specified accuracy $\pm$ 3% is not possible across entire band, the oscillator tuning (L 55) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	80,0 MHz	L 55 ⟶	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT		99,9 MHz	L 55 ⟶	$V_{AFC} \leq 11,5$ V	
		(AFC-line= grey lead)				

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360887) - continued					
	100...120 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	100,0 MHz 119,9 MHz	R 233 → R 243 → alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 2 MHz steps. If necessary, adjust R 233 for equal positive and negative deviation accuracy.	"	100...119,9 MHz	R 233 →	Accuracy ± 3%	
	If adjusting to the specified accuracy ± 3% is not possible across entire band, the oscillator tuning (L 61) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	100,0 MHz	L 61 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT	AFC-line	119,9 MHz	L 61 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line-grey lead)				

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		21. 6. 76	Schuh

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	120...140 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	120,0 MHz 139,9 MHz	R 292 → R 283 → alternatively	$\Delta f = 20$ kHz $\Delta f = 20$ kHz	
	Check deviation across whole band in 2 MHz steps. If necessary, adjust R 292 for equal positive and negative deviation accuracy.	"	120...139,9 MHz	R 292 →	Accuracy $\pm$ 3%	
	If adjusting to the specified accuracy $\pm$ 3% is not possible across entire band, the oscillator tuning (L 65) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	120,0 MHz	L 65 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT		139,9 MHz	L 65 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line-grey lead)				

Replacement for 213 017 A

4021 (4010 A) Oscillator

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	140...160 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	140,0 MHz 159,9 MHz	R 114 → R 123 → alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 2 MHz steps. If necessary, adjust R 114 for equal positive and negative deviation accuracy.	"	140...159,9 MHz	R 114 →	Accuracy $\pm$ 3%	
	If adjusting to the specified accuracy $\pm$ 3% is not possible across entire band, the oscillator tuning (L 33) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	140,0 MHz	L 33 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT	AFC-line	159,9 MHz	L 33 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line= grey lead)				

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	160...180 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	160,0 MHz 179,9 MHz	R 165 → R 161 → alternatively	Δf = 20 kHz Δf = 20 kHz	
	Check deviation across whole band in 2 MHz steps. If necessary, adjust R 165 for equal positive and negative deviation accuracy.	"	160...179,9 MHz	R 165 →	Accuracy $\hat{=}$ 3%	
	If adjusting to the specified accuracy $\hat{=}$ 3% is not possible across entire band, the oscillator tuning (L 41) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	160,0 MHz	L 41 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT		179,9 MHz	L 41 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line-grey lead)				

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		21.6.76	Schuh

Replacement for 213 017 A

4021 (4010 A) Oscillator

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
	180...200 MHz Band					
Dev. Meter Counter DVM	Adjust deviation at both ends of the band	RF DIRECT or Bu 35	180,0 MHz 199,9 MHz	R 81 → R 91 → alternatively	Δ f = 20 kHz Δ f = 20 kHz	
	Check deviation across whole band in 2 MHz steps. If necessary, adjust R 81 for equal positive and negative deviation accuracy.	"	180...199,9 MHz	R 81 →	Accuracy ± 3%	
	If adjusting to the specified accuracy ± 3% is not possible across entire band, the oscillator tuning (L 25) must be changed. Simultaneously the AFC-potential must be observed and kept within limits.					
	Setting: RECEIVERMEASUREMENT	RF DIRECT and AFC-line	180,0 MHz	L 25 →	$V_{AFC} \leq 2,5$ V	
	TRANSMITTERMEASUREMENT		199,9 MHz	L 25 →	$V_{AFC} \leq 11,5$ V	
		(AFC-line-grey lead)				

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 40...200 MHz (360 887) - continued					
Deviation Meter Distortion Meter	6. Modulation Distortion					
	f_{mod} = 1 kHz					
	V_{mod} = 1,5 V_{rms} on St 51/1 or on DF 11	RF DIRECT or Bu 35	40...199 MHz	------	Dist. < 1,5 % at Δf = 10 kHz	
RF Analyser 1200 MHz	7. Harmonics	a	40...199 MHz	------	> 30 dBc	

Adjustment and Test Procedure

	Issue	Alteration No.	Date	Name
			2.6.76	Schuh

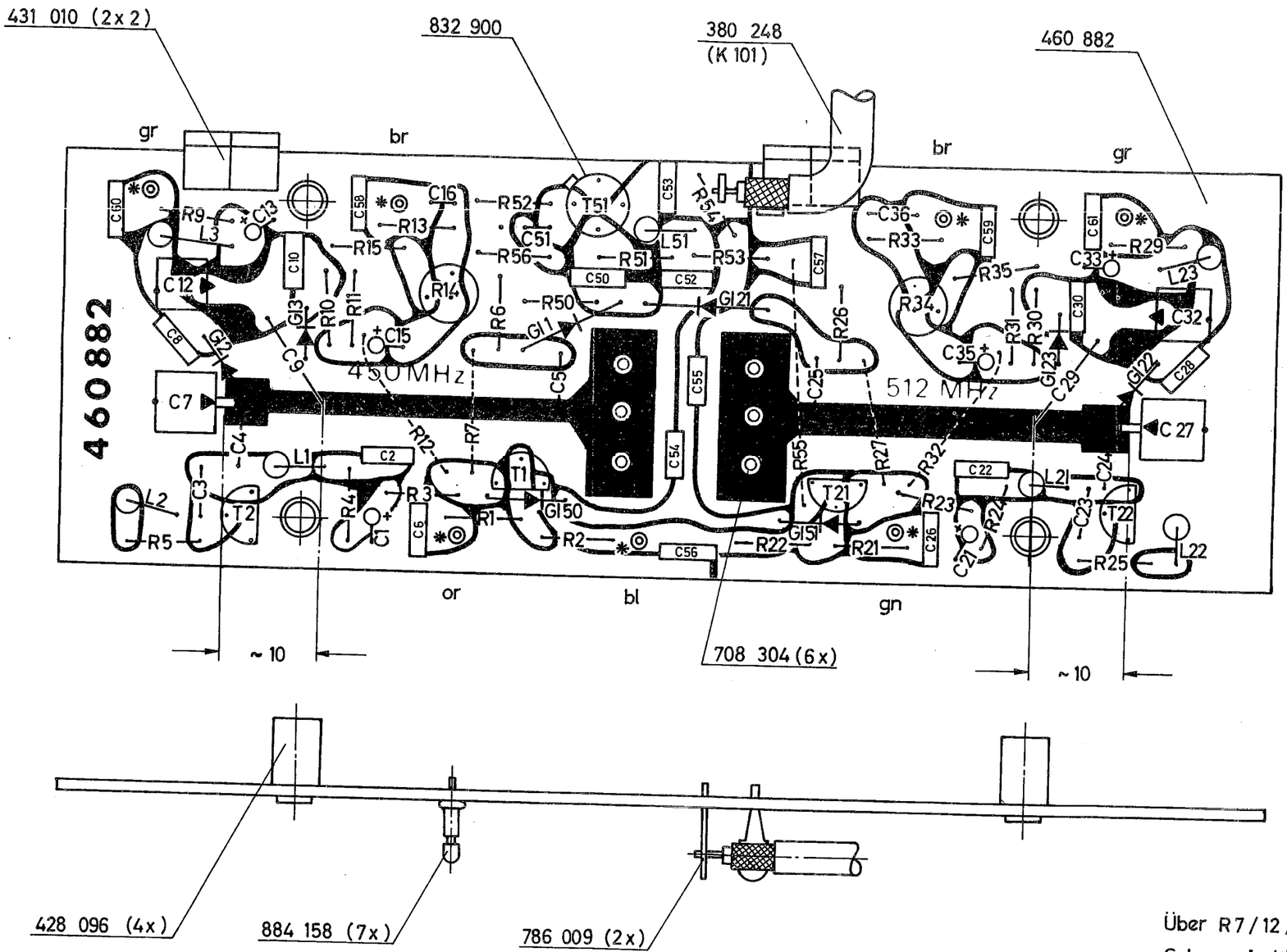
Replacement for

213 017 A

4021 (4010 A)
Oscillator

19/19 Sheet

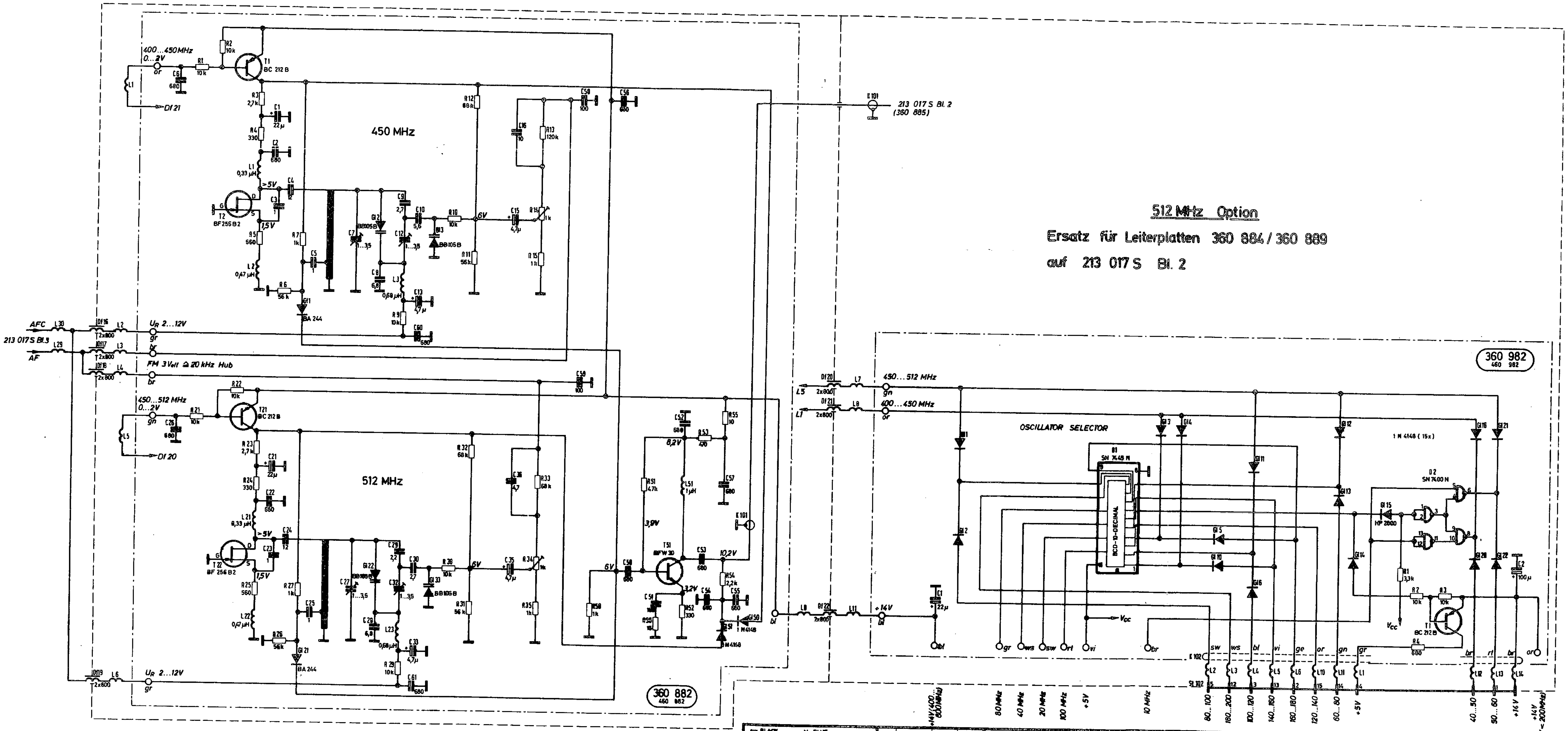
weich gelötet
C7/C12/C27/C32
◀ = Farbpunkt



* = Farbpunkt

Über R 7 / 12 / 27 / 32 / 55
Schrumpfschlauch 787 029 aufgeschrumpft

Schaltplanpositionierung ≙ 213 016/017 S/360 882 Sa	verwendet in : 375 200/211	Gerät : 4010/4010A/4011	2:1	Schlumberger o/s
				Bestückte Leiterplatte
		1977 4.4.77 Kringelis		360 882

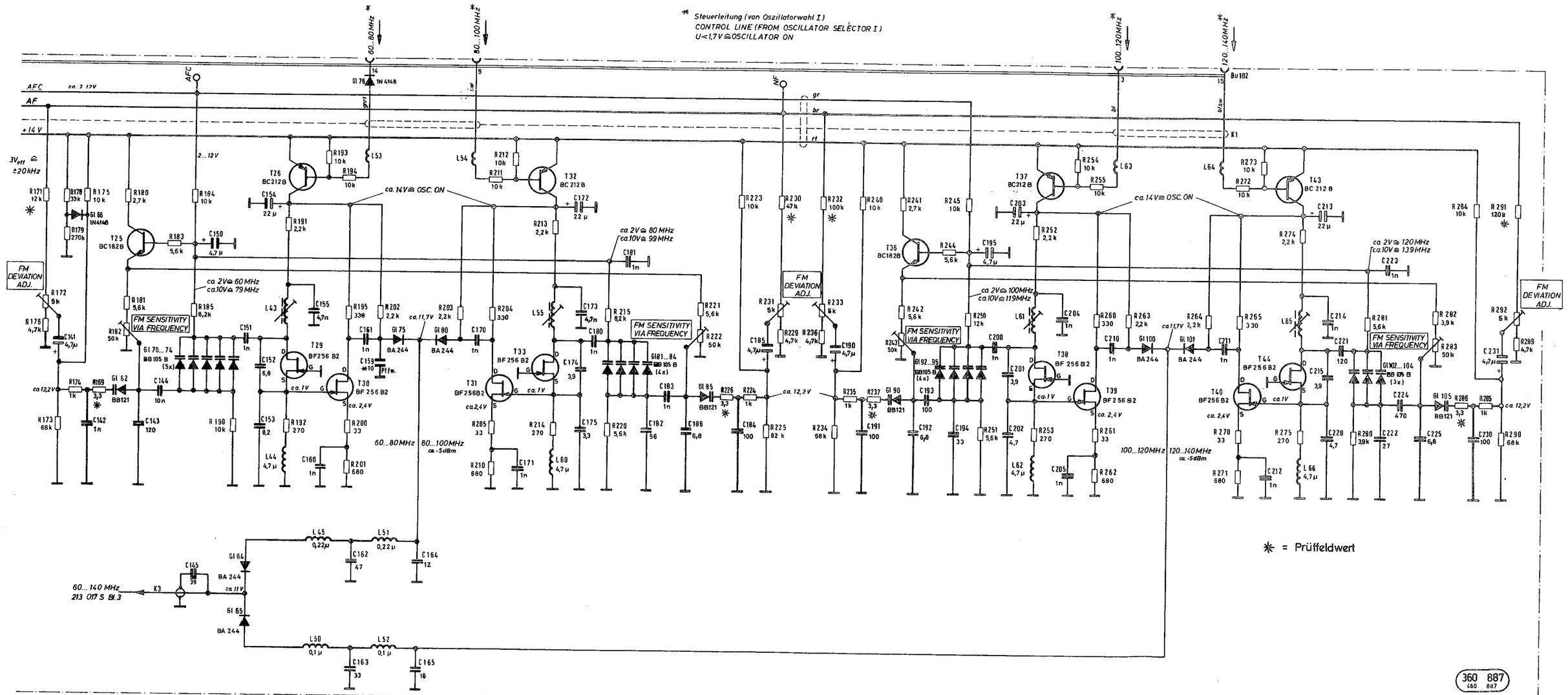


512 MHz Option

Ersatz für Leiterplatten 360 884 / 360 889

auf 213 017 S Bl. 2

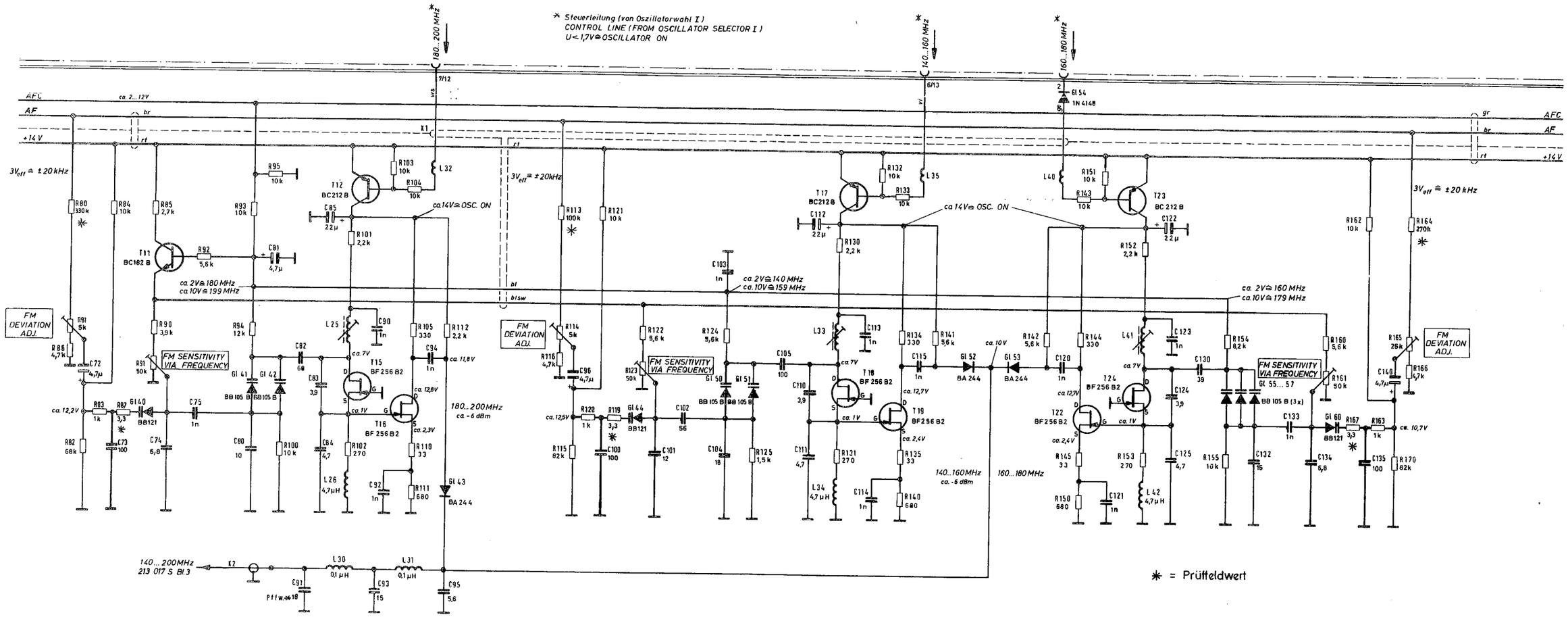
sw BLACK	bl BLUE						norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	OSCILLATOR (512 MHz Option)	213 017 S Bl. 6
br BROWN	vi VIOLET						gepr.					
rt RED	gr GREY						bearb.	31.3.77	Kr.			Typ : 4010 A / 4011
rs ROSE	ws WHITE						1977	Datum DATE	Name NAME			
ge YELLOW	tr TRANSPARENT	Ausg. ISS.	Ä.-Mitteil. MODIF.	Datum DATE	Name NAME							
gn GREEN												



* = Prüffeldwert

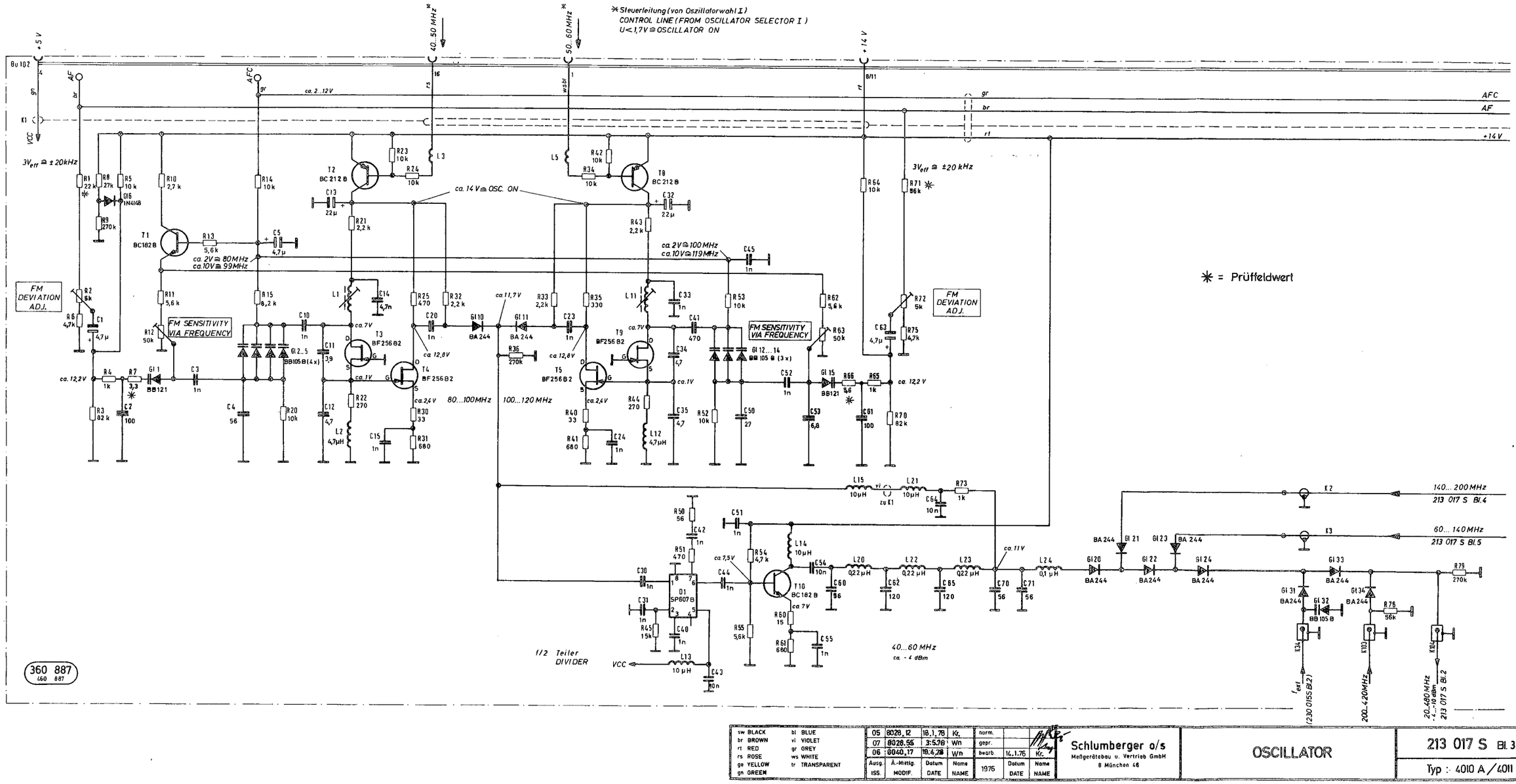
360 887
460 887

sw BLACK	bl BLUE					norm.			Schlumberger o/s	OSCILLATOR	213 017 S Bl. 5
br BROWN	vi VIOLET					gepr.			Meßgerätebau u. Vertrieb GmbH		
rt RED	gr GREY					bearb.	14.1.76	Kr.	8 München 45		Typ: 4010 A / 4011
rs ROSE	ws WHITE	06	8028.56	8.5.78	Wn						
ge YELLOW	tr TRANSPARENT	Ausg.	Ä.-Mittlg.	Datum	Name	1976	Datum	Name			
gn GREEN		ISS.	MODIF.	DATE	NAME		DATE	NAME			



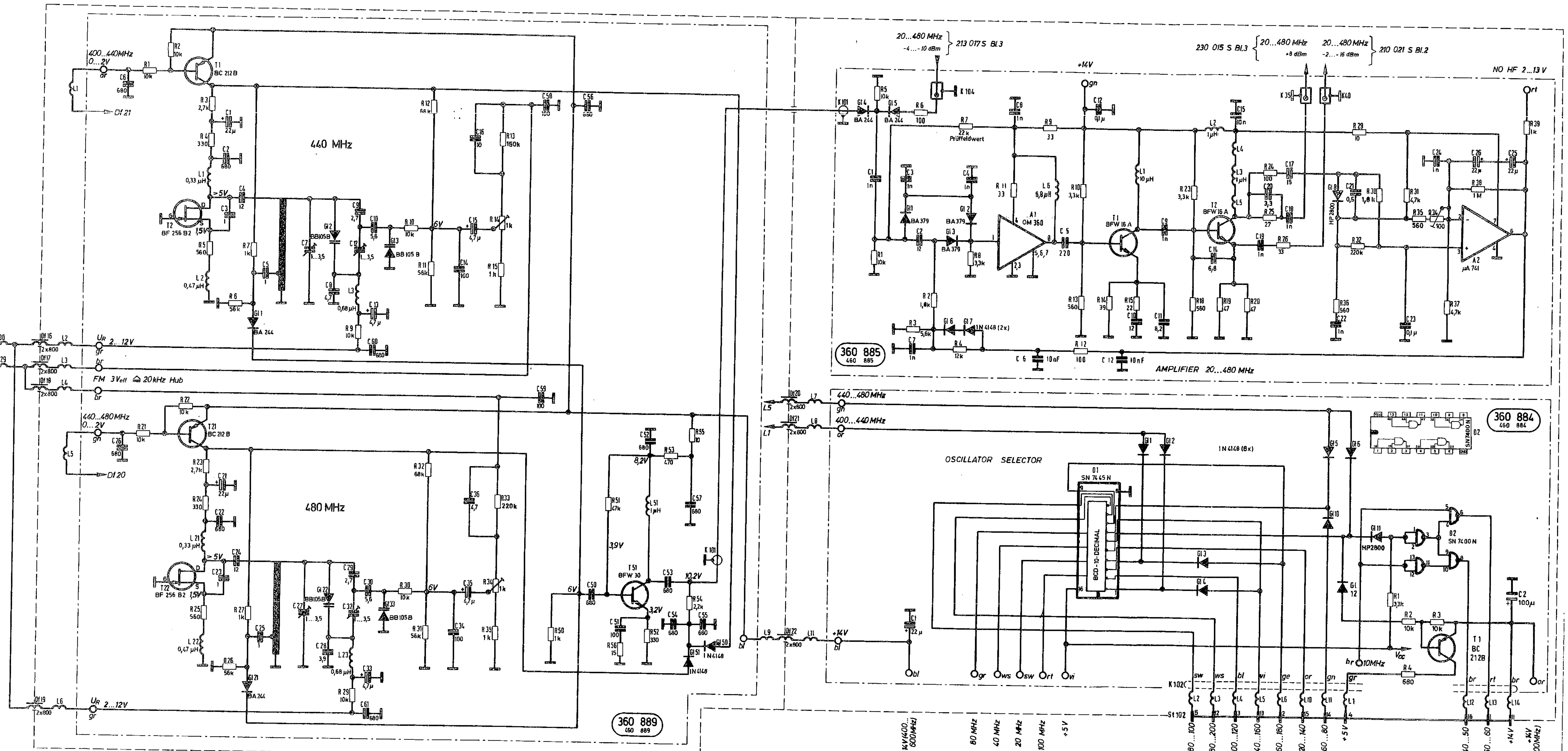
360 887
460 887

sw BLACK	bl BLUE					norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	OSCILLATOR	213 017 S Bl. 4
br BROWN	vi VIOLET					gepr.					
rt RED	gr GREY	08	9028.76	16.10.78	Eller	bearb.	14.1.76	Kr.			Typ: 4010 A/4011
rs ROSE	ws WHITE	Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME	1976	Datum DATE	Name NAME			
ge YELLOW	tr TRANSPARENT										
gn GREEN											



360 887
460 887

sw BLACK	bl BLUE	05	8028.12	18.1.78	Kr.	norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	OSCILLATOR	213 017 S Bl. 3
br BROWN	vi VIOLET	07	8028.56	3:5.78	Wn	gepr.					Typ : 4010 A / 4011
rt RED	gr GREY	06	8040.17	18.4.78	Wn	bearb.	14.1.76	Kr.			
rs ROSE	ws WHITE	Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME	1976	Datum DATE	Name NAME			
ge YELLOW	tr TRANSPARENT										
gn GREEN											



sw BLACK	bl BLUE				
br BROWN	vi VIOLET				
rt RED	gr GREY				
rs ROSE	ws WHITE				
ge YELLOW	tr TRANSPARENT				
gn GREEN					

				norm.			
				gepr.			
07	9028.48	23.7.79	Pi	bearb.	14.1.76	Kr.	
Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME	1976	Datum DATE	Name NAME	

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

OSCILLATOR

213 017 S Bl. 2

Typ: 4010 A / 4011

OSCILLATOR
400...480 MHz
360 889
(Option)
(400...512 MHz)
(360 882)

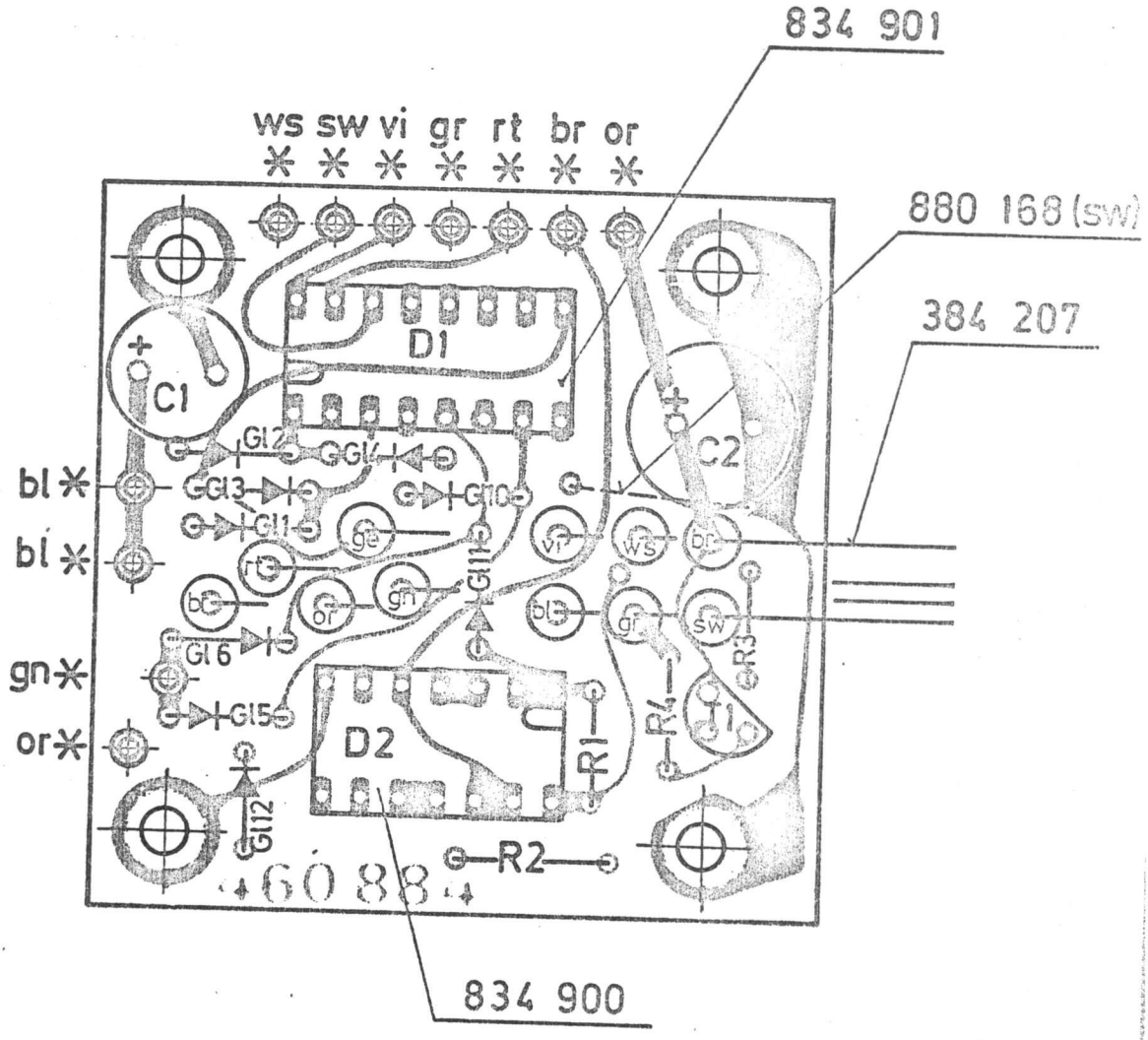
OSC SELECTOR
360 884
(Option)
(360 982)

+14 V (400...600 MHz)
40 MHz
20 MHz
+5 V
80 MHz
100 MHz
10 MHz
+14 V (< 200 MHz)
+14 V
20...480 MHz (512 MHz Option)
-2...-16 dBm
(210 021 S Bl 2)
20...480 MHz (512 MHz Option)
+8 dBm
(230 015 S Bl 3)
MO HF 2 13V
200...400 MHz
K 531 (nur mit Oszillator 213 014 erforderlich)
AMPLIFIER 20...480 MHz (512MHz Option)
360 885
20...500 MHz
200...420 MHz
FM mod
APC/AFC
APC
OSCILLATOR
40...200 MHz
360 887
DECADE STAGE
(210 021 S Bl 1)
OSZILLATOR
(213 014 S)

sw BLACK	bl BLUE			norm			
br BROWN	vi VIOLET			gepr			
rt RED	gr GREY	03 9028.63 12.9. Hi		Freigab 14.1. Kr	Schlumberger o s	OSCILLATOR	213 017 S Bl 1.
ro ROSE	ws WHITE	Ausg Änderung Datum Name		76 Datum Name			Typ 4010 A, 4011
ge YELLOW	tr TRANSPARENT	ISS MODIF DATE NAME		DATE NAME			
gn GREEN							

verwendet in 375 200 / 375 211 | Gerät 4010 / 4011 / 4020

weich gelötet



* = Farbpunkt

Schaltplanpositionierung ≙ 213 016 S / 213 017 S 360 884 Sa

Aus gabe	Änderg Mitteig	Datum	Name
09			
08			
07			
06			
05	8028.93	21.12.78	Mo
04	6028.47	22.6.76	Eiler
03			
02			
01			

Rohteil

Werkstoff

Oberfläche

Freimaß toleranzen: ±0,2

Maßstab: 2:1

	Datum	Name
1976		
gez	22.6.	Eiler
bearb	24.6.	
gepr		

Schlumberger o/s
Meßgerätebau u Vertrieb GmbH
8 München 45

Bestückte Leiterplatte

360 884

weich gelötet

884 158 (2x)

L3

Gl 4 u. 5

821 700 (2x)
L4 / L5

428 124 (6x)

786 019 (4x)

gn

K 101

K 104

832 904 (2x)

rt

880 021
l = 15 mm

= Kontrollmaß

Schaltplanpositionierung ≙ 213 016S/017S / 360 885Sa

verw. in:
Gerät : 4010/4020

Ausgabe	Änderung	Datum	Name
15	9028.50	26.7.79	Mo

Rohteil
Werkstoff
Oberfläche

Freimaß Toleranzen

Maßstab 2:1

	Datum	Name
1979		
gez	26.7.79	Morasch
bearb		
gepr		

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
München

Bestückte Leiterplatte

360 885

Ersatz für

Erich Feucht, München 12 6126 77

R1/23/24/34/42/45/74/103/115/132/133/143
151/160/171/193/194/211/212/232/254/255
272/273
stehend eingelötet

884 158 (4x)

R178; 179; Gl 66
auf Leiterunterseite gelötet

786 002

428 124 (6x)

786 009 (8x)

880 021

460 887

834 901

834 902

br

gr

(Gl 15)
(R66)

gr

br

(R7)
(Gl 1)

R8/R9 u. Gl 6
stumpf aufgelotet

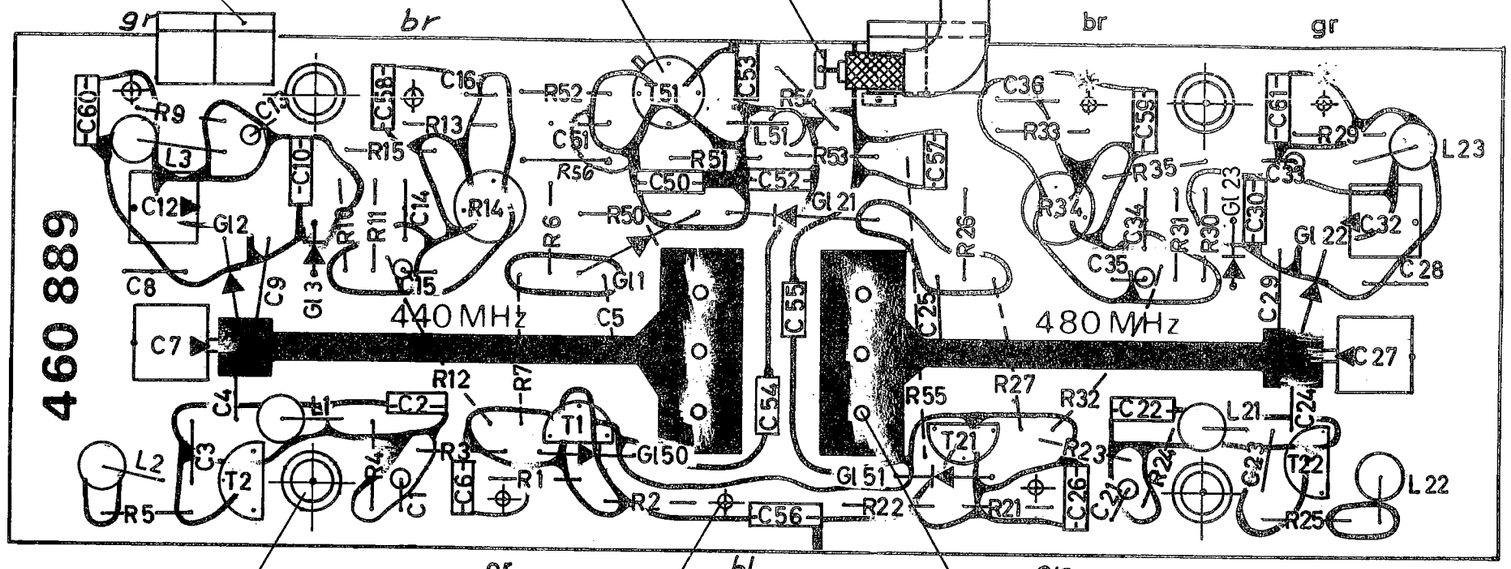
weich gelötet
C 7, C 12, C 27, C 32 : ◁ ≙ Farbpunkt
Bauteile auf Unterseite mit Schrumpfschlauch 787 029 versehen

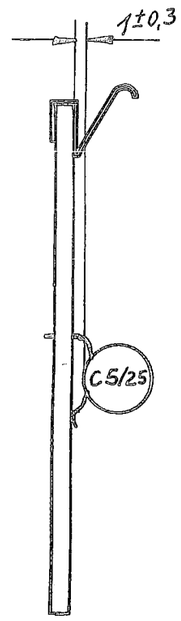
431 010

786 009 (2x)

832 900

380 248
K 101





428 096 (4x)

884 158 (7x)

708 304 (6x)

= Kontrollmaß

213 017 S
Schaltplanpositionierung ≙ 213016S/ 360889 Sa

10			Rohteil	Freimaß Toleranzen	Maßstab 2:1
09					
08					
07					
06			Werkstoff		
05					
04	902838 21.5. Hj				
03	9028.19	Lg			
02	6028.28 2.4.76 Eiler		Oberfläche	1975 Datum	Name
01	6028.2 12.1.76			gez. 4.12.	Berger
Ausgabe	Änderung	Datum Name		gepr. 5.12.	

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
Mannheim

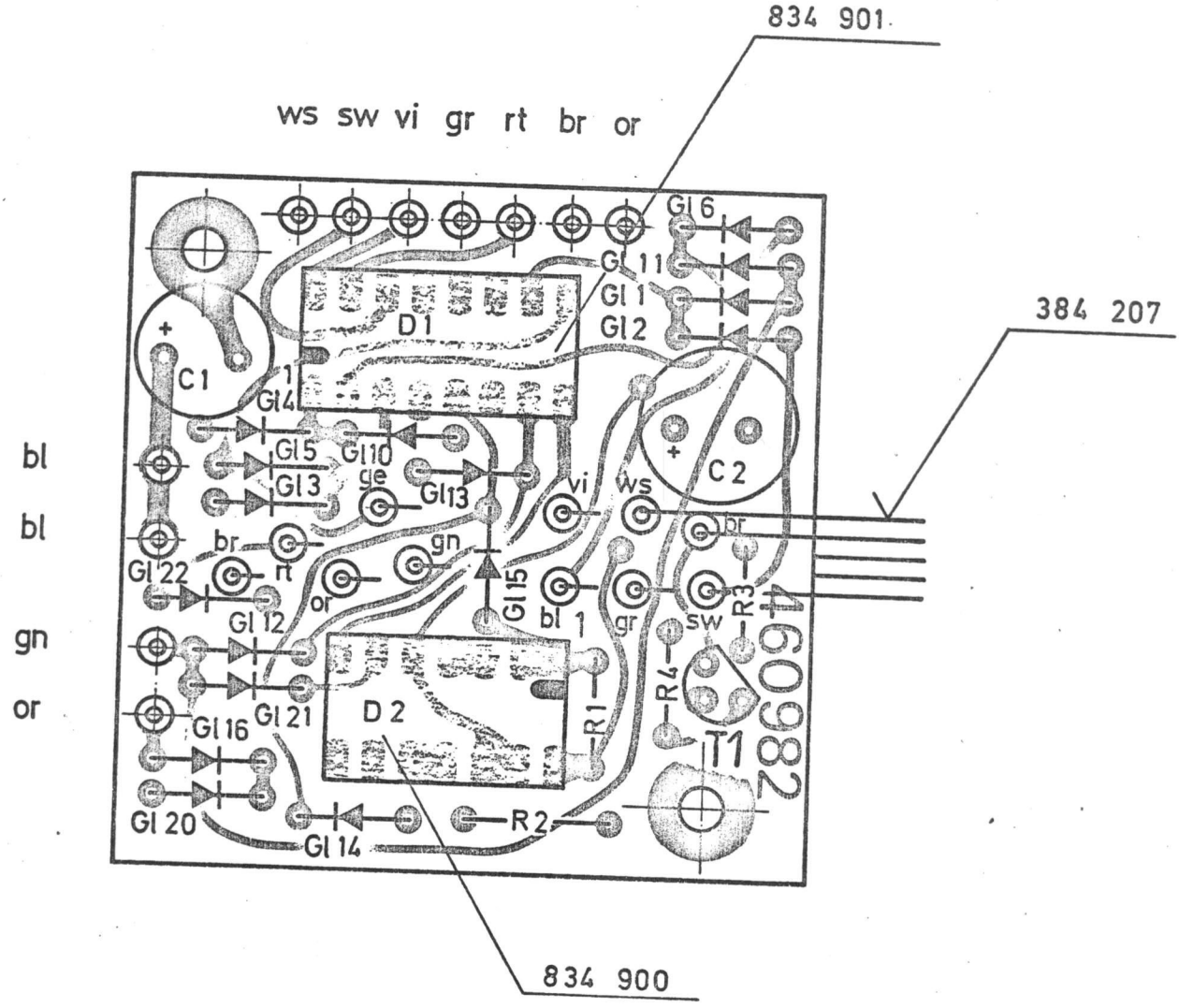
Bestückte Leiterplatte

360 889

Ersatz für

verwendet in: 375 200/375 211 | Gerät 4010 / 4011 / 4020

weich gelötet



Schaltplanpositionierung ≙ 213 016 / 213 017S / 360 884 Sa

09				Rohteil	Freimaß-toleranzen: –	Maßstab: 2:1
08						
07						
06						
05				Werkstoff		
04						
03						
02	9024 4712.12.79					
01				Oberfläche		
Aus-gabe	Änderung / Meldg.	Datum	Name			

	Datum	Name
gez.	13.12.79	Morasch
gepr.		
Norm		

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 45

Bestückte Leiterplatte

360 982

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		5.10.79	Varner

4022 (4011)
Oscillator

213 014 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM Mulimeter	1. <u>Oscillator Selector (PC Boards 360 870, 871, 872)</u> Set Frequency 210 MHz and check supply Voltage at L 41 (360 870) Chance frequency in 20 MHz steps and check voltage at corresponding points of the other sub oscillators.	L 41 "	210 MHz 230 MHz 250 MHz 410 MHz		> 5 VDC > 5 VDC " "	
	2. <u>Switch-over to 213 017 oscillator (360 873)</u> Check DC-voltage at the middle conducter of the RF-cable K 103 (R 10 on 360 873)		200- 419,9 MHz < 200 MHz > 420 MHz		> 10 VDC < 1 VDC < 1 VDC	
	3. <u>Low pass filter change over (360 873)</u> Set 200 MHz, and check potential of Emitter of T 2. Change frequency	T2/Ermitter " "	200 MHz 300 MHz 400 MHz		> 10 VDC < 1 VDC < 1 VDC	
	4. <u>Frequency Alignment (360 870, 71, 72)</u> Adjust trimmer capacitors C 12, C32 ... C 62 to mid-position. Select the RECEIVER MEASUREMENT mode. Set 219, 999 MHz and adjust C 47 to get 10 V on the U_R-Line (AFC).	① on 360 872	219,999 MHz	C 47 / 360 870	10 VDC	
	Change frequency in steps of 20 MHz and adjust trimmer capacitors of the other sub oscillators in the same way.	"	239,999 MHz ⋮ 419,999 MHz	C 47 / 360 871 ⋮ c 7 / 360 872	10 VDC 10 VDC	

Schlumberger

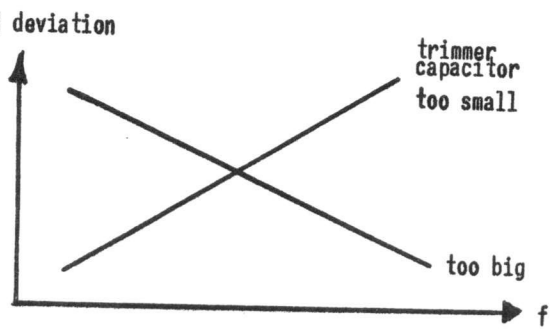
Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	602810	5.10.73 26. 2. 76	Warm! Schuh

4022 (4011)
Oscillator

213 014 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Check AFC-potential at other ends of the frequency sub ranges.	① on 360 872	200 MHz 220 240 ⋮ 400 MHz	- - - ⋮ -	> 2,2 VDC > 2,2 " > 2,2 " ⋮ > 2,2 VDC	
4000, 4901 or other Modulation Meter	5. FM-Sensitivity adjustment (360870, 71, 72) Adjust C 52 in order to get the same deviation at both ends of the frequency sub ranges. Adjust R 54 to get 20 kHz FM deviation.	RF-out	200...219,999MHz 220...239,999	C 52 / R 54 C 52 / R 54		
			400...419,999MHz	C 12 / R 14		



Schlumberger

Adjustment and Test Procedure

	Issue	Alteration No.	Date	Name
01				
602810				
26. 2. 76			5.10.79	Schuh

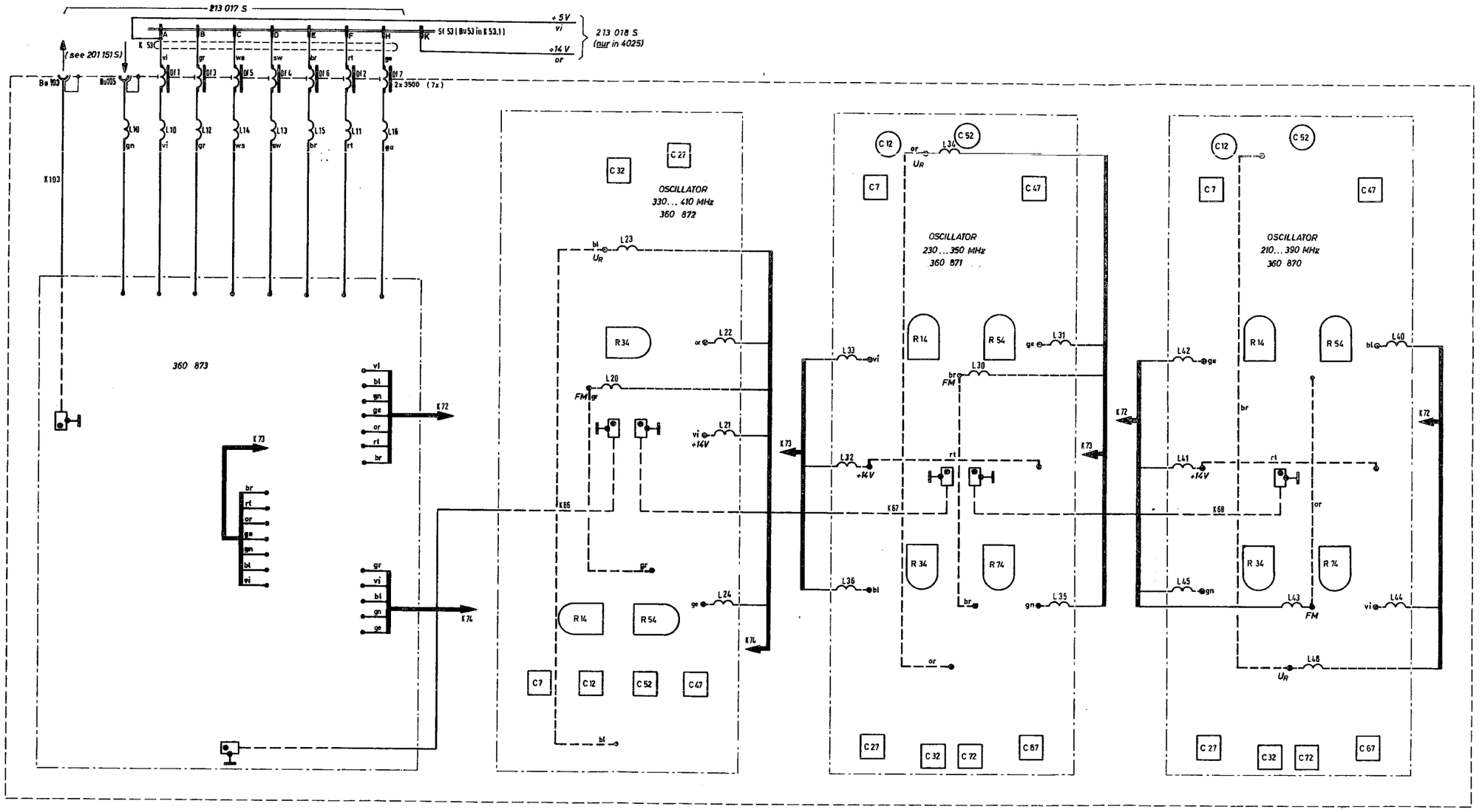
4022 (4011) Oscillator

213 014 A

Replacement for

Sheet 3/3

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	6. Modulation Distortion					
4000, 4901 or other Modulation Meter and Distortion Analyser	f_{mod} = 1 kHz FM-Deviation 20 kHz	RF	200 to 419,9 MHz	-	Dist. < 1 %	
	7. Unwanted Noise Deviation					
	Phase deviation	"	"	-	< 8m Rad	
	Frequency deviation	"	"	-	< 7 Hz	
	8. Modulation Frequency Response	"	" f_{mod} = 300 Hz to 10 kHz	-	< ± 3 %	
RF-Analyser	9. RF-Harmonics	"	200 to 419,9 MHz	-	< 34 dB c	



sw BLACK	bl BLUE	02	6028.20	9.3.76	Wn	norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	OSCILLATOR	213 014 S Bl.1
br BROWN	vi VIOLET	04	9028.63	12.9.77	Hf	gepr					Typ : 4011
rt RED	gr GREY	03	6028.80	25.10.76	Kr.	bearb.	10.11.75	Kr.			
rs ROSE	ws WHITE	Ausg.	Ä.-Mittlg.	Datum	Name	1975	Datum	Name			
ge YELLOW	tr TRANSPARENT	ISS.	MODIF.	DATE	NAME		DATE	NAME			
gn GREEN											

213 017 S

213 018 S (nur in 4025)

+5V

+14V

St 53

K 53

K 103

K 105

Bu 103

Bu 105

L 16

L 10 L 11 L 12 L 13 L 14 L 15 L 16

Df 1 Df 2 Df 3 Df 4 Df 5 Df 6 Df 7

2 x 3500 (7x)

R 1 22k

R 2 3,9k

R 3 2,2k

R 33 33k

T 1 BC182B

R 4 2,2k

C 1 10n

D 1 SN 74141 N

C 2 22µ

T 2 BC182B

R 5 47k

R 6 1k

T 3 BC182B

R 7 10k

Gl 1 1N4148

Gl 2 1N4148

360 873 460 873

K 72

K 73

K 74

K 66

C 3 470

R 10 2,2k

C 4 470

R 11 10

R 12 330

R 13 10

C 5 1

C 6 3,3

C 10 0,5

C 11 5,6

C 12 1

C 13 3,3

L 1 0,1

L 2 0,1

R 20 47

R 14 15k

R 15 15k

R 16 15k

Gl 15 Gl 16 Gl 20 Gl 21 Gl 22 Gl 23

R 22 27

C 16 470

A 1 OM 335

R 23 10k

Gl 26 BA 379

C 18 100

R 26 1k

R 24 1k

R 25 100

Gl 24 Gl 25 hpa 2811

R 21 1k

T 4 BC 212B

C 14 470

C 15 470

C 17 47µ

Gl 15,16,20,21,22,23 = BA 244

Bl. 3

FM

UR

$3V_{eff}$ ≙ 20kHz Hub

L 20 L 21 L 22 L 23 L 24

360 872 460 872

* Prüffeldwert

330 MHz

+14V

R 21 10k

R 22 10k

T 21 BC 212 B

13,8V

* R 23 2,2k

C 21 22µ

R 24 68

C 22 470

5,5...9V

L 21 0,68

T 23 BF 256 B2

C 23 2,2

1,2...1,6V

* R 25 820

L 22 0,47

C 24 0,2

R 27 1k

C 25 2,7

R 26 56k

7V

Gl 21 BA 244

C 26 2,7

C 27 1...3,5

C 28 5,6

C 29 2,7

C 30 1

Gl 22 BB 105 B

C 32 1...3,5

L 23 0,68µ

Gl 23 BB 105 B

C 33 4,7µ

R 29 10k

R 30 10k

6V

C 35 4,7µ

R 31 56k

C 34 100

R 32 68k

R 33 33k

R 34 10k

R 35 4,7k

370 MHz

+14V

R 41 10k

R 42 10k

T 41 BC 212 B

13,8V

* R 43 3,3k

C 41 22µ

R 44 68

C 42 470

5,5...9V

L 41 0,68

T 42 BF 256 B2

C 43 2,7

1,2...1,6V

* R 45 1k

L 42 0,47

C 44 15

R 47 1k

C 45 1

R 46 56k

7V

Gl 41 BA 244

C 47 1...3,5

C 48 4,7

C 49 2,7

C 50 1,5

Gl 42 BB 105 B

C 52 1...3,5

L 43 0,68µ

Gl 43 BB 105 B

C 53 4,7µ

R 49 10k

R 50 10k

6V

C 55 4,7µ

R 51 56k

C 54 100

R 52 68k

R 53 82k

R 54 10k

R 55 4,7k

R 60 56k

Gl 45 Gl 46

BA 244 (2x)

K 67

Bl. 3

sw	BLACK
br	BROWN
rt	RED
rs	ROSE
ge	YELLOW
gn	GREEN
bl	BLUE
vi	VIOLET
gr	GREY
ws	WHITE
ir	TRANSPARENT

08 902a 63 12.9.			norm	
07 7028.7	24.2.77	Wn	gepr	
Ausg.	Ä.-Mittlg.	Datum	Name	bearb 5.8.75
155.	MODIF	DATE	NAME	Datum / DATE — Name / NAME

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

OSCILLATOR

213 014 S Bl. 2

Typ: 4011

13 12 11 10 9 8

Bl. 2 K72

K73 Bl. 2

3 Veff ≙ 20 kHz Hub

br L30 FM

ge L31

rt L32 +14V

vi L33

270 MHz

T1 BC 212 B 13,8 V

R1 10k · R2 10k · *R3 2,2k · C1 22µ · R4 68 · C2 470 · 5,5...9 V · L1 1,8 µH · T2 BF 256 B 2 · C3 3,3 · C4 68 · 1,2...1,6 V · *R5 1k · L2 1µH · R6 56k · R7 1k · C5 4,7 · Gl1 BA244

C6 6,8 · C7 1..3,5 · C8 15 · Gl2 BB105B · C9 2,2 · L13 0,68µ · C10 2,7 · C12 1,4..5,5 · Gl3 BB105B · C13 4,7µ · R9 10k · R10 10k · R11 56k · C14 100 · 6V · C15 4,7µ · R12 68k · R13 68k · R14 10k · R15 4,7k

*Prüffeldwert

360 871 460 871

+14V

230 MHz

R42 10k · R41 10k · T41 BC 212 B 13,8 V · *R43 2,2k · C41 22µ · R44 68 · C42 470 · 5,5...9 V · L41 1,8 µH · T42 BF 256 B 2 · C44 68 · C43 2,7 · 1,2...1,6 V · *R45 1k · L42 3,9µH · R47 1 k · C45 8,2 · R46 56k · Gl41 BA244

C46 8,2 · C47 1..3,5 · C48 18 · L43 0,68µ · Gl42 BB105B · C49 3,3 · C50 2,7 · C52 1,4..5,5 · Gl43 BB105B · C53 4,7µ · R49 10k · R50 10k · R51 56k · R52 68k · 6V · C55 4,7µ · C54 100 · R53 56k · R54 10k · R55 4,7k

2,1...11,2V

L34 UR

3 Veff ≙ 20 kHz Hub

gn L35

bl L36

350MHz

T21 BC 212 B 13,8 V

R21 10k · R22 10 k · +14V · *R23 3,3k · C21 22µ · R24 68 · C22 470 · 5,5...9 V · L21 0,68µH · T22 BF 256 B 2 · C23 2,7 · C24 18 · 1,2...1,6 V · *R25 1k · L22 0,47µH · R26 56k · R27 1k · C25 2,7 · Gl21 BA244

C26 3,3 · C27 1..3,5 · C28 5,6 · L23 0,68µ · Gl22 BB105B · C29 3,9 · C32 1..3,5 · C30 1 · C33 4,7µ · R29 10k · R30 10k · R31 56k · C34 100 · 6V · C35 4,7µ · R32 68k · R33 68k · R34 10k · R35 4,7k

2,1...11,2V

310 MHz

R61 10k · R62 10 k · +14V · T61 BC 212 B 13,8 V · *R63 2,2k · C61 22µ · R64 68 · C62 470 · 5,5...9 V · L61 1,8 µH · T62 BF 256 B 2 · C64 15 · C63 2,2 · 1,2...1,6 V · *R65 1k · L62 0,47µH · R67 1 k · C65 5,6 · R66 56k · Gl61 BA244

C66 5,6 · C67 1..3,5 · C68 8,2 · L63 0,68µ · Gl62 BB105B · C69 3,9 · C70 1 · C72 1..3,5 · Gl63 BB105B · C73 4,7µ · R69 10k · R70 10k · R71 56k · R72 68k · 6V · C75 4,7µ · C74 100 · R73 56k · R74 10k · R75 4,7k

Bl. 2 K67 · Gl70 BA244 · R80 56k

or vi gn bl rt ge br

K72

bl L40 rt L41 +14V

ge L42

250 MHz

R1 10k · R2 10k · +14V · T1 BC212B 13,8V

*R3 2,2k · C1 22µ · R4 68 · C2 470 · 5,5...9V · L1 1,8µH · T2 BF256B2 (G D S) · C4 68 · C3 3,3 · 1,2...1,6V · *R5 820 · L2 1µH · R7 1k · C5 8,2 · R6 56k · Gl1 BA244

C6 10 · C7 1...3,5 · C9 2,2 · Gl2 BB105B · C10 2,2 · C12 1,2...6 · C8 18 · L13 0,68µH · C13 4,7µ · R9 10k

R10 10k · Gl3 BB105B · R11 56k · 6V · C15 4,7µ · C14 100 · R12 68k · R13 39k · R14 10k · R15 4,7k

3Veff ≙ 20kHz Hub

+14V · R42 10k · R41 10k · T41 BC212B 13,8V

210 MHz

*R43 2,2k · C41 22µ · R44 68 · C42 470 · 5,5...9V · L41 1,8µH · T42 BF256B2 (G D S) · C44 100 · C43 3,9 · 1,2...1,6V · *R45 680 · L42 3,9µH · R47 1k · C45 10 · R46 56k · Gl41 BA244

C46 12 · C47 1...3,5 · C49 2,2 · Gl42 BB105B · C50 2,7 · C52 1,2...6 · C48 27 · L43 0,68µH · C53 4,7µ · R49 10k

R50 10k · Gl43 BB105B · R51 56k · 6V · C55 4,7µ · C54 100 · R52 68k · R53 27k · R54 10k · R55 4,7k

or

360 870 / 460 870

*Prüffeldwert

2,1...11,2V

3Veff ≙ 20kHz Hub

or L43 FM

vi L44

gn L45

390MHz

R22 10k · +14V · R21 10k · T21 BC 212 B 13,8V

*R23 2,7k · C21 22µ · R24 68 · C22 470 · 5,5...9V · L21 0,47µH · T22 BF256B2 (G D S) · C24 8,2 · C23 2,2 · 1,2...1,6V · *R25 1k · L22 0,47µH · R27 1k · C25 1 · R26 56k · Gl21 BA244

C27 1..3,5 · C29 3,9 · Gl22 BB105B · C30 1 · C32 1..3,5 · C28 3,9 · L23 0,68µ · C33 4,7µ · R29 10k

R30 10k · Gl23 BB105B · R31 56k · 6V · C35 4,7µ · C34 100 · R32 68k · R33 100k · R34 10k · R35 4,7k

br L46 UR

2,1...11,2V

R61 10k · R62 10k · +14V · T61 BC212B 13,8V

290MHz

*R63 2,2k · C61 22µ · R64 68 · C62 470 · 5,5...9V · L61 1,8µH · T62 BF256B2 (G D S) · C64 15 · C63 2,2 · 1,2...1,6V · *R65 1k · L62 0,47µH · R67 1k · C65 2,7 · R66 56k · Gl61 BA244

C66 8,2 · C67 1...3,5 · C69 3,9 · Gl62 BB105B · C70 1 · C72 1...3,5 · C68 12 · L63 0,68µ · C73 4,7µ · R69 10k

R70 10k · Gl63 BB105B · R71 56k · 6V · C75 4,7µ · C74 100 · R72 68k · R73 27k · R74 10k · R75 4,7k

K68

sw	BLACK	bl	BLUE
br	BROWN	vi	VIOLET
rt	RED	gr	GREY
rs	ROSE	ws	WHITE
ge	YELLOW	tr	TRANSPARENT
gn	GREEN		

09	9024.15	26.1.78	Kr.	norm
08	7028.61	5.10.77	Wn	gepr
07	7028.7	24.2.77	Wn	bearb 6.8.75
Ausg	A-Mittlg	Datum	Name	Datum Name
ISS	MODIF	DATE	NAME	DATE NAME

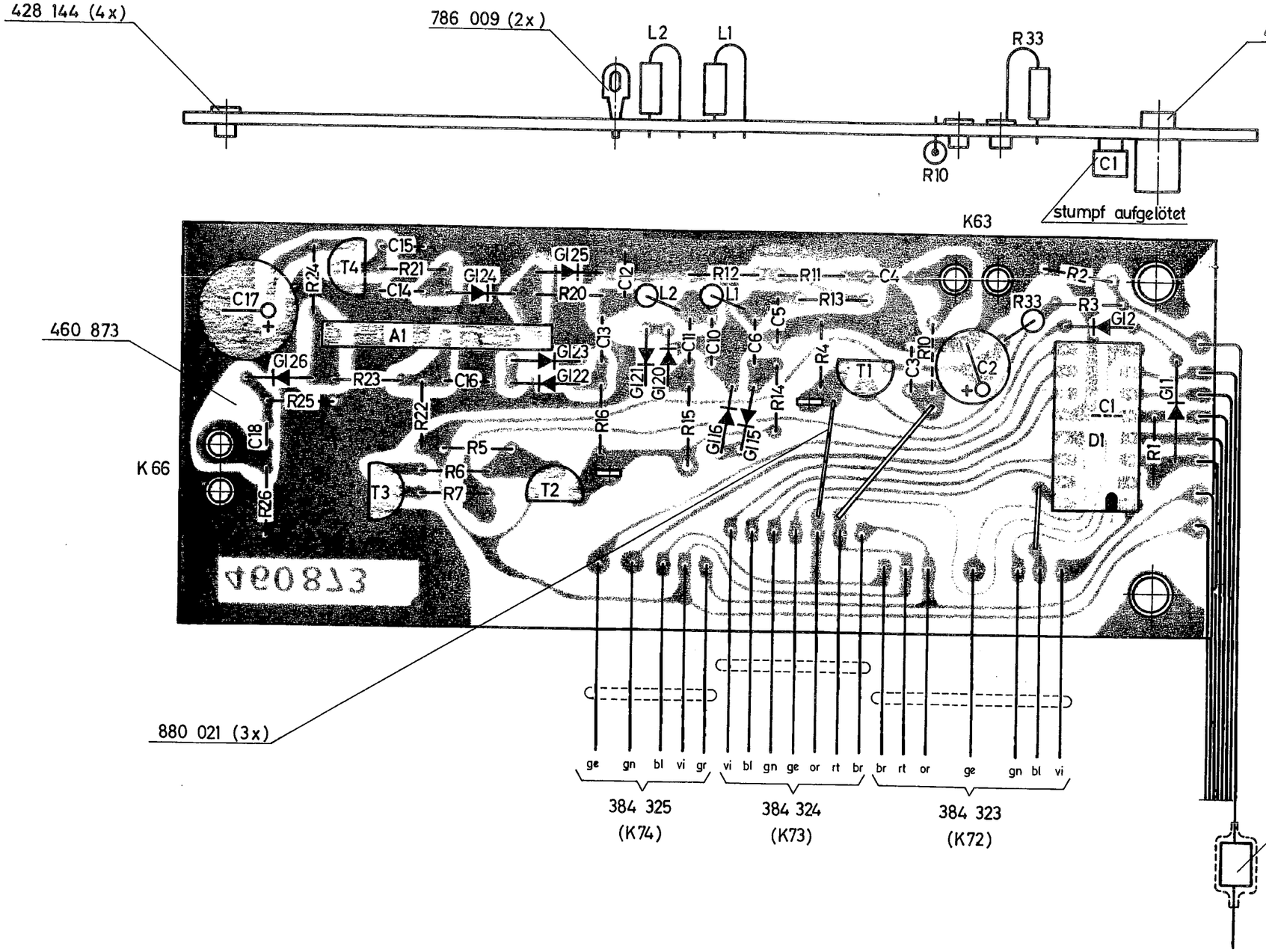
Schlumberger o/s
Meßgerätebau u Vertrieb GmbH
8 München 46

OSCILLATOR

213 014 S Bl. 3

Typ: 4011

weich gelötet



gn	l =	90 mm
ws	l =	90 mm
sw	l =	90 mm
vi	l =	100 mm
gr	l =	80 mm
rt	l =	80 mm
br	l =	60 mm
ge	l =	75 mm

Schaltplanpositionierung ≙ 213 014 S / 360 873 Sa | verwendet in : 375 217 | Gerät : 4011

Änderungsindex	Datum	Name
04	9024,25 15.2.79	Kr.
03	6028.83 26.10.76	Kr.

Rohteil

Werkstoff

Oberfläche

Format

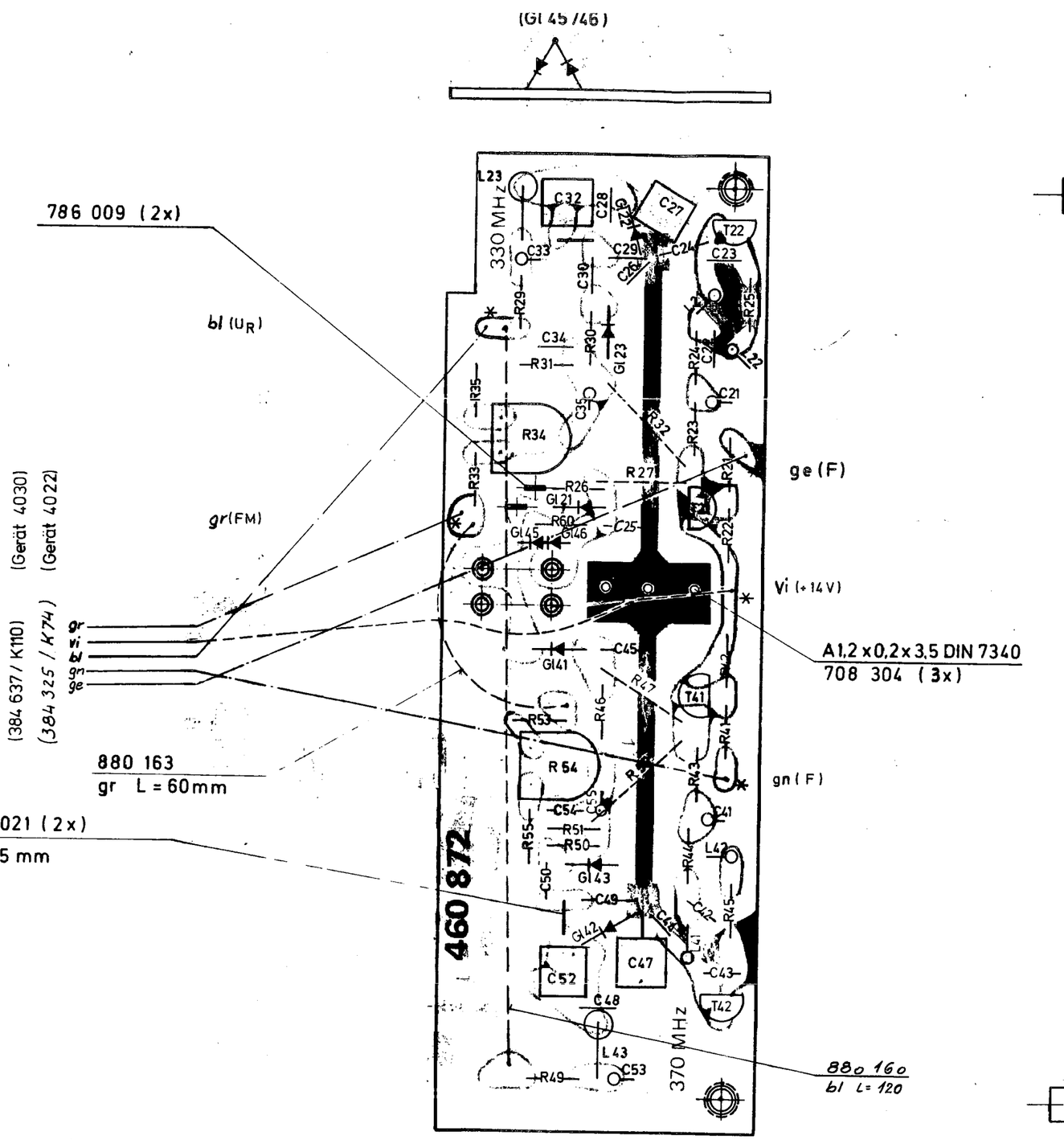
Maßstab 2:1

1976 26.10.76 Kringelis

Schlumberger o/s

Bestückte Leiterplatte

360 873



weich gelötet

C27 / C17
Farbpunkt an Leiterzug

C32 / C52
Farbpunkt an Brücke

Drahtenden von R27, R32, R47 und R52 mit 889 035 überzogen

L21, L22, L23, L41 L42, L43
C17, C27 C32, C52
auf der Leiterplatte aufliegend.

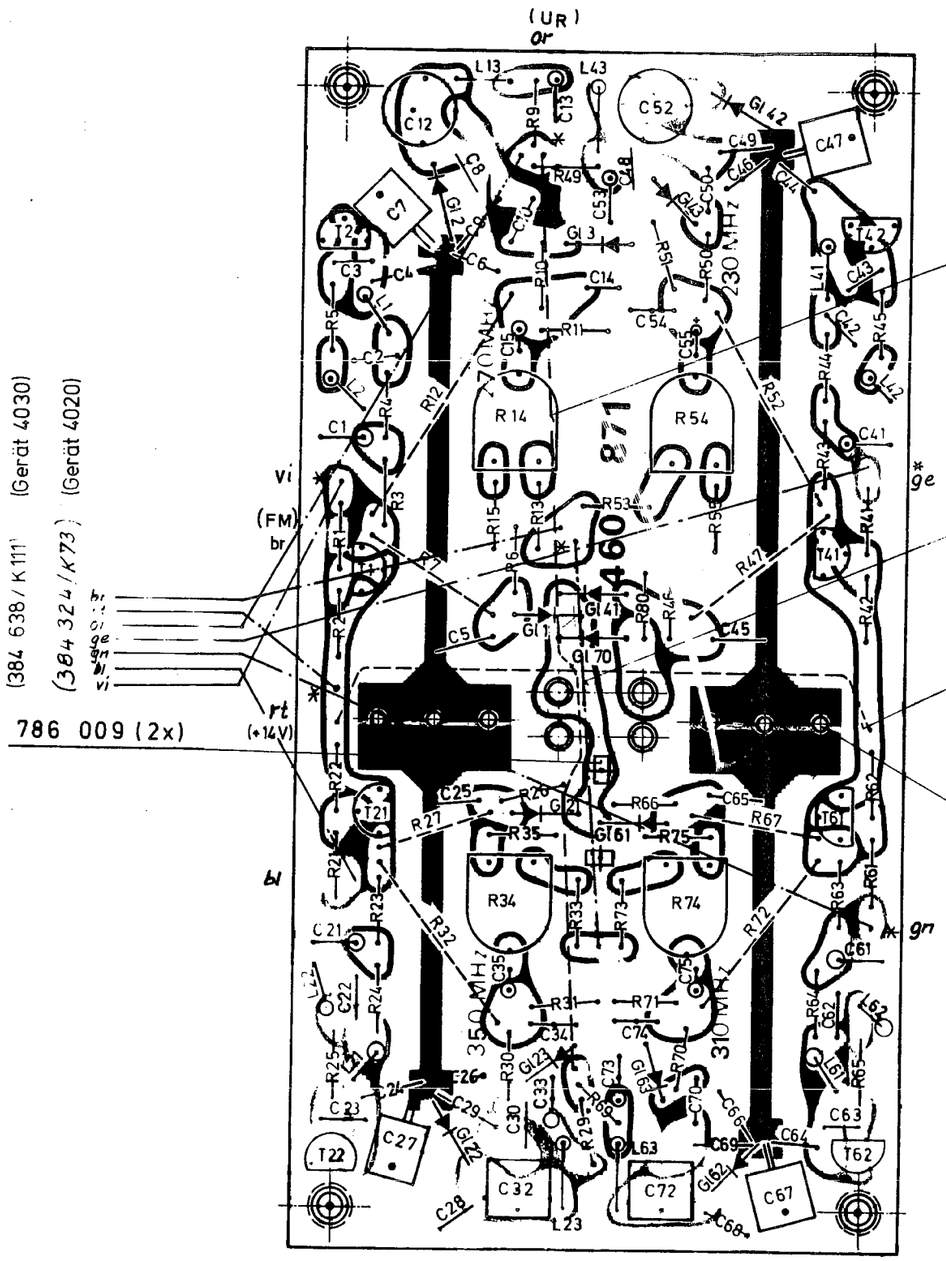
* = Kabelbaumanschluß
⬭ = Kontrollmaß

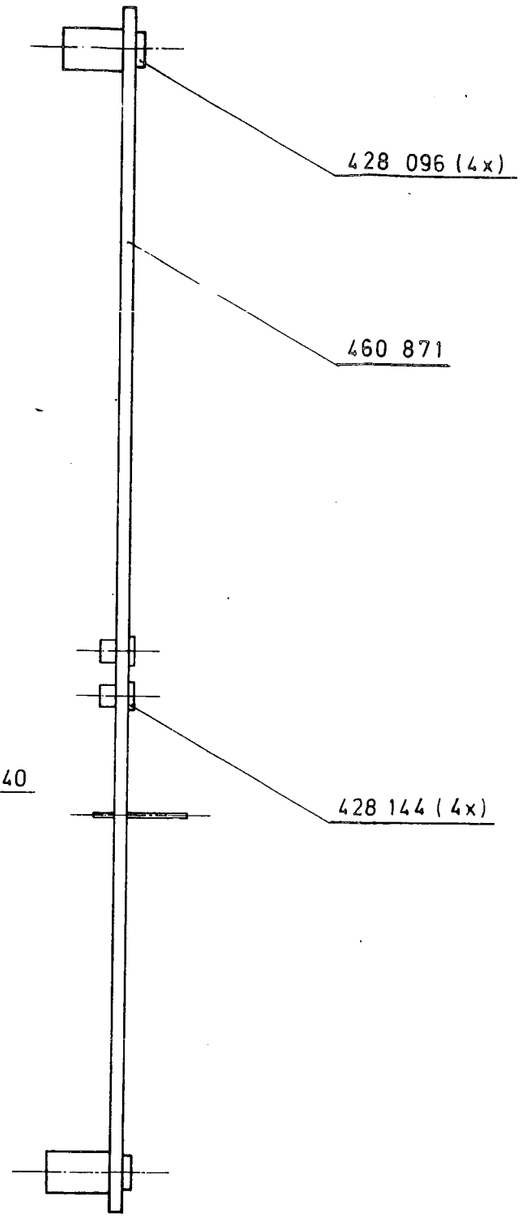
Schaltplanpositionierung ≙ 213 014 S / 360 872 Sa

verwendet in: 375 217

Gerät: 4011

20				Rohteil	Freimaß tolerieren	Maßstab	Schlumberger o/s
19							Meßgerätebau – Vertrieb GmbH
18							8 München 47
17							
16				Werkstoff	±0,2	2:1	Bestückte Leiterplatte
15							
14							
13							
12				Oberfläche		Datum	Name	360 872
11	9094 35	19.4.79	Eiler		gez			
Ausgabe	Änderung	Datum	Name		bearb	8.9.75		
					gepr			Ersatz für





weich gelötet

C7 / C27 / C47 / C67
Farbpunkt an Leiterzug

C32 / C72
Farbpunkt an C30 bzw. C70

Drahtenden von R7, R12, R27, R32, R47, R52, R67 und R72 mit 889 035 überzogen

L1, L2, L13, L21, L22, L23
L41, L42, L43, L61, L62, L63
C7, C27, C32, C47, C67, C72
auf der Leiterplatte aufliegend.

* = Kabelbaumanschluß

Kontrollmaß

10	9028.34	4 5.79	Eiler					
09	9094.14	19.2.79	Kr.					
08	8028.79	13 10 78	Eiler					
07	8028.65	6.6.78	Eiler					
06	6028.88	29.10.76	Bit					
05	6028.68	5.3.76						
04	6028.7	30.1.76	Kr.					
03	6028.4	14.1.76						
02	5028.105	24.11.75	Eiler					
01	5028.100	27.10.75						

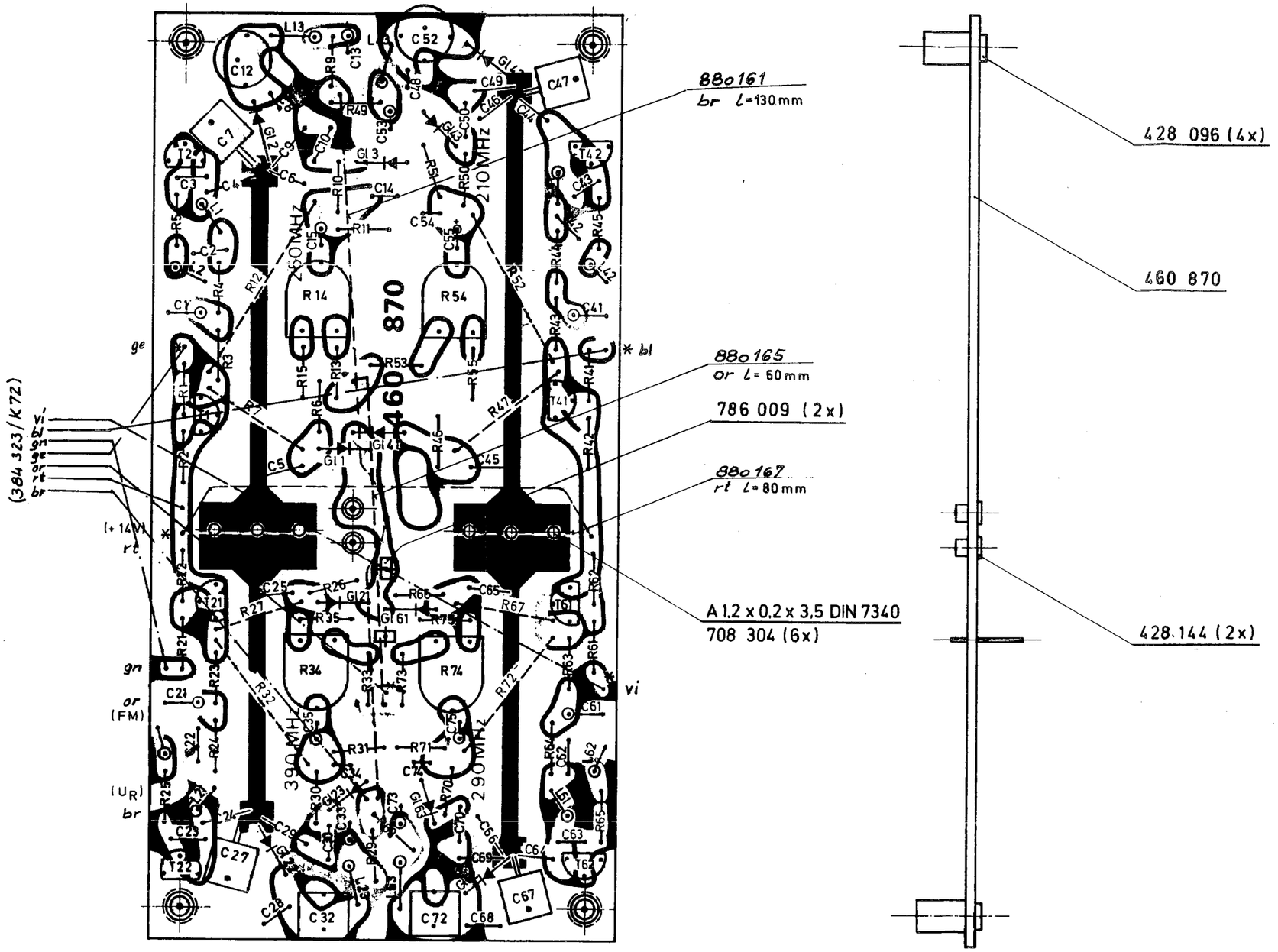
±0,2 | 2:1 | Schlumberger o/s

Bestuckte, Leiterplatte

1975 20.8. Eiler 8.9.

360 871

Schaltplanposition: 213 014 S / 360 871 Sa | verwendet in: 375 217 | Gerät: 4011



weich gelötet

C7 / C27 / C47 / C67
Farbpunkt an Leiterzug

C32 / C72
Farbpunkt an Brücke

Drahtenden von R7, R12, R27, R32, R47, R52, R67 und R72 mit 889 035 überzogen

L1 / L2 / L13 / L21 / L22 / L23
L41 / L42 / L43 / L61 / L62 / L63
C7 / C27 / C32 / C47 / C67 / C72
auf der Leiterplatte aufliegend.

* = Kabelbaumanschluß

Kontrollmaß

	9028.76	8.5.76	Eiler				
	8028.79	13.10.75	Eiler				
	8028.63	6.6.75	Eiler				
DF	601888	29.10.74	Pöll				
DF	6028.49	5.3.74					
04	6028.7	30.1.76					
	6028.4	14.1.74					
	6028.106	24.11.75	Eiler				
01	5028.40	27.10.73					
Änderungsgrund		Änderungs-Mitteilung	Datum	Name			

	:0.2	2:1	Schlumberger o/s
			Bestückte, Leiterplatte
19 75	Datum	Name	360 870
20 8		Eiler	
8.9.			

Schaltplanpositionierung 213 014 S / 360 870 Sa | verwendet in: 375 217 | Gerät: 4011

(See block circuit diagram 102 820 B for total instrument)

1. 0.1 kHz/1kHz decade (final stage)

The oscillator frequency is crystal stabilized by means of a variable frequency divider and a phase bridge. The BCD requency adjustment of the 100 Hz and 1kHz decade results in the dividing ratio of 4000... 4099, thus permitting digital adjustment of the oscillator frequency between 12.5 and 12.8125 MHz increments of 100 x 3.125 kHz.

2. Vernier offset

The control line "Δf Rec(DC)" permits the choice of three functions:

a) Provision of the final decade frequency with and without division and without offset

b) Establishing the frequency offset with respect to 2 MHz IF. The IF of approx. 2 MHz provided by the output stage is compared to a 2 MHz signal having crystal accuracy in a mixer and frequency discriminator, the former providing the absolute offset frequency in the form of "Δf(AC)" to the counter. The digital frequency discriminator generates TTL pulses on one of the two "$\pm\Delta$f (AC) lines depending on whether the offset is positive or negative for the $\pm$ display of the counter

c) Generating a frequency with continuously adjustable offset to final decade frequency.

The 1/5 devided oscillator frequency is provided to the mixer and frequency discriminator. The reference frequency of approx. 2 MHz at the other mixer input is derived through the frequency devider and multiplier from the final decade. The mixer and discriminator output signals are used for counter displays (same as on IF comparison). These output signals are simultaneously converted into a DC voltage which is a measure for the frequency offset.
This DC voltage is stabilized by the automatic frequency control loop to a set point value which is provided through "Δf(DC)" from the potentiometer control.
The 1/8 devided oscillator frequency is then routed to the intermediate decade instead of the final decade frequency.

3. 10 kHz/100 kHz decade (intermediate decade)

The APC loop operates as for the final decade, the 1/100 divided final decade frequency - with or without offset - being included in an additional mixer in the APC loop of the intermediate decade.

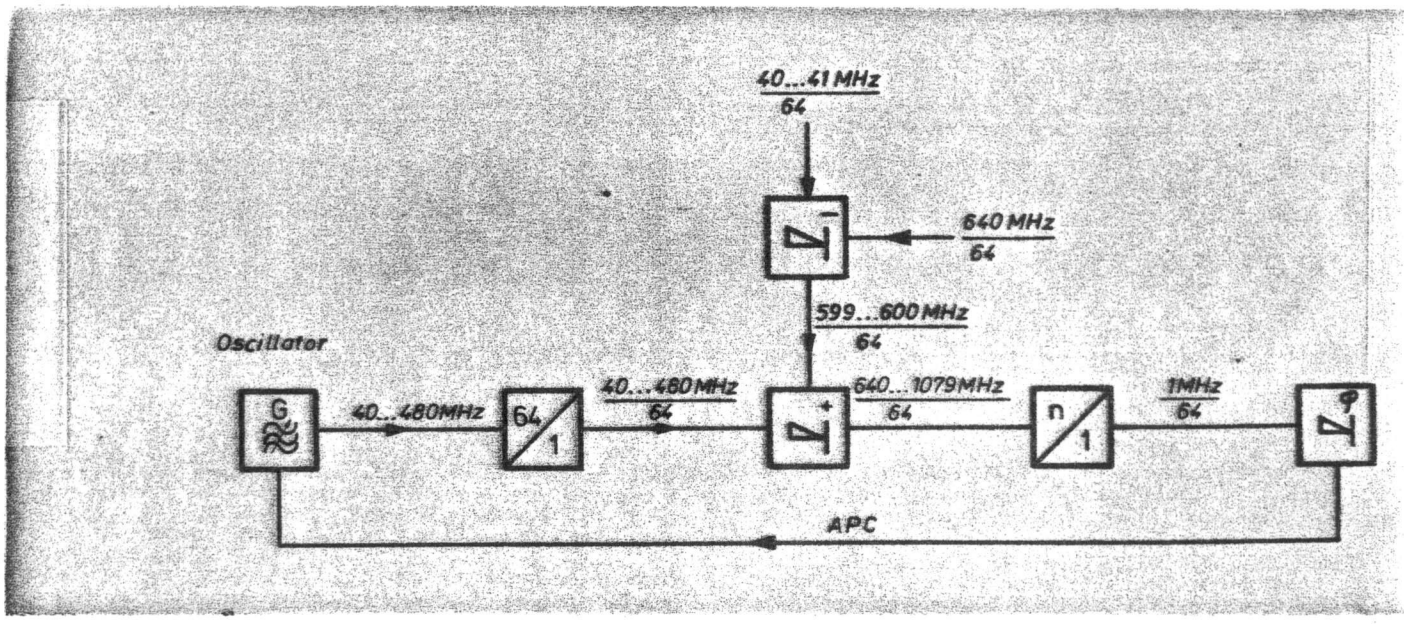
This arrangement permits digital adjustment of the oscillator frequency between 12.5 and 12.8125 MHz in increments of 10 000 (with a vernier offset of ± approx. 100 increments).

4. 1/10/100 MHz decade (main control loop)

The RF signal provided by the oscillator stage is devided 1/32 down stream of the limiting amplifier. This is followed by three 1/2 frequency dividers in parallel each with an output low pass filter. Depending on the frequency range only one branch is operative to obtain a signal free of harmonics for the subsequent mixer.

Independent of the above arrangement a 1/50 frequency divider provides the $\frac{40...480}{1600}$ signal for counter frequency readout.

The following simplified block circuit diagram is meant to simplify understanding the mixed frequencies and adjustable frequency divider:



The output of the intermediate decade is included in the main control loop by two mixers, each of which is followed by band pass filters to suppress unwanted mixer products. The division ratio of the subsequent frequency divider is dictated by the slightly modified digital frequency adjustment of the 1-, 10- and 100 MHz decade. Indipendent of this the division ratio is increased by 2 (automatic IF offset) on transmitter measurements using the control line "TR Rec (DC)".

The output frequency of the divider is roughly controlled by a frequency control and with crystal accuracy using a phase control: if operation is still non sync the beat frequency at the output of the digital frequency discriminator (see frequency discriminator in vernier offset stage) provides control of a counter to cause the counter to count up or down depending on whether the frequency offset is positive or negative. The DC voltage change is accordingly subsequent to the digital analogue converter and controls the RF oscillator frequency to minimum frequency offset through the APC loop until the phase bridge operating in parallel is able to take over the remainder of the control.

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Issue	Alteration No.	Date	Name
01	8028.9	13.1.78	

Adjustment and Test Procedure

4020 (4010) series
DECADE STAGE

210 021 A

Replacement for

1/11 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	The Decade Stage can be pre-checked as an independent unit up to 95 %.					
Power Supplies + 5 V / 2 A + 14V / 0,2 A	Supply Voltages 210 021 S Bl. 1: connect + 5 V to St 23	◇8	—	—	4,95 ... 5,05 V 0,8 ... 1 A	.....A
Dig. Voltmeter	" + 14 V to St 23	◇2	—	—	13,95 ... 14,05 V 90 ... 110 mA	.....mA
10 MHz-Crystal oscillator with TTL - output	Frequency Divider 210 021 S Bl. 3: apply 10 MHz TTL to Bu 42					
Counter	(Frequency measurements up to approx. 30 MHz can be carried out, by using the probe of an oscilloscope in connection with a high sensitivity counter)	Bu 32 ◇56 vi	250 kHz 3,125 kHz	— —	250 kHz 3,125 kHz	.....ok
Power Supply 0 ... 3 V	Final Decade Stage 210 021 S Bl. 7: apply + 0,60 V to ⑦	①	—	—	Digitalvoltmeter + 5,7 ... + 6,6 V	V
		◇62 ge	2,5 MHz	L 12 →	2,5 MHz	.....ok
Oscilloscope	Sample-Hold-Detector disconnect 10 MHz from Bu 42	⑤	3,125 MHz	—	12 ... 14 V	.....ok
	connect + 0,60 V to ⑦			—	Puls width at + 6 V 0,2 ... 0,3 µs	.....µs
	apply 10 MHz to Bu 42	⑥	"	—	+3 ... +4 V 0 ... +0,2 V 	.....ok
	Disconnect the Power Supply from ⑦	◇62 ge	2,5 MHz	—	2,5 MHz	
		⑦	—	(L 12)	+ 0,60 V	

Schlumberger

Adjustment and Test Procedure

4020 (4010) series

DECADE STAGE

Issue	Alteration No.	Date	Name
C1	8028.9	13.1.78	K
		12.5.78	Schuh

Replacement for 210 021 A

Sheet 2/11

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Decade switch, wired as shown on 209 001 S Bl.1 (S 10/Bu 22) - Replacement for Frequency Control switch on front panel when the Decade Stage is adjusted without use of the Control and Display Unit.	<u>Final Decade Stage - Frequency Control 210 021 S Bl.7 and Bl. 1:</u> Decade switch connected to St 22 (or to Bu 5/Bl.1) Frequency setting 000 0000	62 / 7	2,50		+ 0,60 V	
	32		2,52		+ 0,80 ... 0,90 V	
	64		2,54		+ 1,00 ... 1,20 V	
	96		2,56		+ 1,20 ... 1,40 V	
	99		2,561875		+ 1,25 ... 1,45 V	1, ... V
	Further settings, needed only for localizing of faults: 1 step = 625 Hz					
	01		2,500625			
	02		1250			
	03		1875			
	04		2500			
	05		3125			
	06		3750			
	07		4375			
	08		5000			
	09		5625			
	10		2,50625			
	20		1250			
	30		1875			
	40		2500			
	50		3125			
	60		3750			
	70		4375			
	80		5000			
	90		5625			

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		12.5.78	Shuh

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Power Supply 0 ... 3 V Dig. Voltmeter	<u>Intermediate Decade - Oscillator 210 021 S Bl. 5 and Bl.1:</u> + 0,60 V on (7)	(1) (53) er	— 1,25 MHz	— L 12 →	Digital-Voltmeter + 5,7 ... + 6,6 V 1,25 MHz	.....V .....
	<u>Mixer</u>					
Decade switch Oscilloscope	Decade switch to St 22 Frequency setting: 000 0000	(2) (3)	12,5 MHz 125 kHz	— —	60 ... 100 mV pp 60 ... 100 mV pp	.....mV pp .....mV pp
	R 4 fully anti-clockwise and - 0,2 V connected to (7)	(53) (7)	1,2125 MHz	DC level on (7) →	1,2125 MHz	
	(Resolution 200 kHz) Analys. to Bu 1	Bu 1	12,2 MHz	L 5 → P max at 12,125 MHz	- 34 ... - 38 dBm	.....dBm
	approx. + 0,60 V on (7)	(53) Bu 1	1,25 MHz 12,5 MHz	DC level on (7) → R 4 → P min at 12,5 MHz (appr. middle)	1,25 MHz - 70 ... - 90 dBm	
	(Mixture product 12,5 - 0,125 = 12,375 MHz)	Bu 1	12,375 MHz	—	- 46 ... - 50 dBm Lower mixture product > 1,5 dB higher level than upper mixt.product	.....dBm .....ok
	approx. + 1,6 V on (7)	Bu 1	12,80 MHz	—	- 52 ... - 56 dBm Lower mixture product > 1,5 dB higher level than upper mixt.product	.....dBm .....ok
	Oscilloscope with probe to (4) er	(4)	12,80 MHz	—	1,7 ... 2,8 V pp (FM)	.....ok
	Analyser with probe to (4) + 0,4 ... + 1,4V to (7)	(4)	12,3 ... 12,8 MHz	—	Spurious products > 3,5 dB below	> .....dB

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	8028.9	13.1.78	X
		12.5.75	Stuh

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

Sheet 4/11

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Oscillescope	Sample - Hold - Detector 210 021 S Bl. 5:					
Power Supply	Remove 10 MHz from Bu 42 + 0,60 V on (7)	(5)	3,125 kHz	—	12 ... 14 V_{pp} Puls width at + 6 V 0,2 ... 0,3 µs	.....ok .....µs
	10 MHz to Bu 42 + 5 V on ◇26◇ ("NO OFFSET" Command)	(6)	—	—	+3 ... +4 V 0 ... +0,2 V	 .....ok
	Disconnect Power Supply from (7)	(7)		(L 12)	+ 0,60 V	
	Frequency Control	◇53◇	1,25 MHz	—	1,25 MHz	.....ok
	Connect decade switch to St 22					
	Setting: 000 0000	◇53◇ (7)	1,25 MHz		+ 0,60 V	
	3200		1,26		+ 0,80 ... 0,90 V	
	6400		1,27		+ 1,00 ... 1,20 V	
	9600		1,28		+ 1,20 ... 1,40 V	
			1,28122		+ 1,25 ... 1,45 V	1, ...V
	Further settings, needed only for localizing of faults					
	1 step = 312,5 Hz 0100		1,2503125			
	0200		06250			
	0400		12500			
	0800		25000			
	1000		1253125			
	2000		56250			
	4000		62500			
	8000		75000			

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
04	3028.9	13.9.78	K

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

Sheet 5/11

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Synthesizer 20...520MHz Counter 0...20 MHz	RF / 32 - Divider 210 021 S Bl. 2: approx. 0 dBm on Bu 40 : 10 MHz 20 MHz 32 MHz 160 MHz 320 MHz 400 MHz 480 MHz 520 MHz	Output vi		——	TTL: 0,3125 MHz 0,625 1 5 10 12,5 15 16,25	....ok
	Same procedure at +10 dBm on Bu 40 from 10 to 520 MHz -10 dBm on Bu 40 from 15 to 500 MHz (from 400 to 500 MHz in 10 MHz-steps)		15 ... 500 MHz		0,46875 ... 15,625 MHz	.....ok .....ok
	$f_{/50}$ - Divider ——— approx. 0 dBm on Bu 40: 20 MHz 160 MHz 520 MHz	Bu 20			TTL: 12,5 kHz 100 " 325 "	.....ok
	$f_{/2}$ - Divider ———					
Decade switch Spectrum Analyser 0...110 MHz	Input frequency appr. 0 dBm on Bu 40: 200 MHz; Decade switch setting: 200 MHz; Checking control lines gr (51): 0; ge (52): L	Analyser 50 Ω - in shunt with K 33		L 13 → min.Level at 9,375 MHz (3. Harmonic)	- 30...- 40 dB	.....ok
Oscilloscope	200...520 / 200 / 0 / L 100...200 / 100 / L / 0 40...100 / 40 / 0 / 0	Oscillo-scope to K 33	3,125...8,125MHz 1,625...3,125 " 0,625...1,625 "	—— —— ——	40... 60 V_{pp}	.....ok
	200...520 / 200 / 0 / L 100...200 / 100 / L / 0 64...100 / 60 / 0 / 0 40... 64 / 40 / 0 / 0	Analyser 50 Ω - in shunt with K 33	3,125...8,125MHz 1,625...3,125 " 1 ...1,625 " 0,625...1 "	—— —— —— ——	Harmonics > 20 dBc Harmonics > 10 dBc	 .....ok

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	3028.3	13.1.78	X
		12.5.78	Schuh

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

Sheet 6/11

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	MHz - Decades, Mixer D 7 210 021 S Bl. 3:					
Decade switch	. Frequ. Setting 000 0000	②	10 MHz	——	40 ... 60 mV_{pp}	
Oscilloscope		①	625 kHz	——	80 ... 120 mV_{pp}	.....ok
Spectrum Analyser with probe	Analyser via probe →	④	9,375 MHz	R 11 → middle pos. L 1, L 3, L 4 → max. level at 9,375 MHz		.....ok
	Analyser via probe →	⑤	" "	L 4 → max. level		
		"	9,375/10 MHz	R 11 → min. level at 10 MHz		
	Oscilloscope via probe →	④	9,375 MHz	——	150 ... 250 mV_{pp}	.....mV_{pp}
	" " " →	⑤	" "	——	50 ... 100 mV_{pp}	.....mV_{pp}
	Mixer D 10					
Synthesizer	Analyser via probe on → ⑥					
	approx. 0 dBm on Bu 40 / Decade switch setting					
	0 MHz / 0	⑥	9,375 MHz	R 15 → min. level	ca. - 70 dBc	
	40 MHz / 40	"	8,75 MHz	L 6 → min. level	"	
	144 MHz / 144	"	7,125 MHz	L 5 → min. level	"	
	480 MHz / 480	"	16,85 MHz	L 7 → max. level	ca. - 30 dBc	
	approx. 58...480 MHz / 58...480		10,3...16,85 MHz	——	spurious products ≤ > 20 dBc	>.....dB
	40... 60 MHz / 40... 60	"	10 ...10,3 MHz	——	> 14 dBc	>.....dB
	(perhaps correction by L 4) Oscilloscope on ⑥					
	40...480 MHz / 40...480	"	10 ...16,85 MHz	——	1,5 ... 2,5 V_{pp}	>.....V_{pp}
	0 MHz / 0	"	9,375	R 15	< 0,1 V_{pp}	>.....V_{pp}

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
0.1	8028.9	13.4.78	K
		12.5.78	Schu

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

Sheet 7/11

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Frequency Divider and Frequency Comparison 210 021 Bl. 3:					
Synthesizer	520 MHz approx. 0 dBm on Bu 40	54	15,625 kHz	—	Puls width 210 ... 270 ns	.....ns
	Frequency setting 520 0000	7	" "	—	13 ... 19 µs	.....µs
	(When the OSCILLATOR sub unit is not used, connect 10 kΩ between pin 6 of Bu 5 and +5 V rail)					
	Decade switch setting 520 ... 40 MHz (disconnected yellow lead 57) Change setting stepwise to smaller values. Stepwise increasing of output frequency must result.	7	15,625 kHz to 27,344	—	15,625 ... 27,344	.....ok
	Oscilloscope simultaneously (altern.) on 57 58					
	Frequ. setting 400 0000 400 MHz, 0 dBm on Bu 40	57 ge	—	—	TTL = Output L or 0 (L=appr. 4 V) (0=appr. 0 V)	
		58 br	—	—	0 or L	
	464 MHz, 0 dBm on Bu 40	57 ge	—	—	L	
		58 br	1,000 kHz	—	1 kHz	.....ok
	336 MHz, 0 dBm on Bu 40	57 ge	1,000 kHz	—	1 kHz	
		58 br	—	—	L	
	400 MHz, 0 dBm on Bu 40 Decade setting 410 ... 419 MHz	57 ge	—	—	L continuous response	.....ok

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Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
0.4	8028.9	13.1.78	X
		12.5.78	Schuh

4020 (4010) series
DECADE STAGE

210 021 A

Replacement for

8/11 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Frequ. Offset/TRANSM. MEASUREMENT 210 021 S Bl. 6:					
Counter	10 MHz TTL on Bu 42					
Oscilloscope	"NO OFFSET" on REC. MEASUREMENT = 5 V on St 22/22 = (26)	360 234 D 1/5 = or	10,000 MHz	——	TTL 10 MHz	
		360 236 D 2/6 = ge	2,000 MHz	——	TTL 2 MHz	.....ok
Synthesizer	2 MHz TTL on Bu 43	360 234 (1)	" "	——	" Puls 120...160 ns	.....ok
	2,01 MHz TTL on Bu 43	(29) br (28) ws	10 kHz ——	(L 3 with tuning slug) ——	TTL 10 kHz +3,5 ... 5 V	
		360 234 R 3 = vi	10 kHz	——	1,5 ...4,5 V_{pp}	.....ok
	1,99 MHz TTL on Bu 43	(28) ws	——	——	+3,5 ... 5V	
		(29) br	10 kHz	——	TTL 10 kHz	
		R 3 = vi	10 kHz	——	1,5 ...4,5 V_{pp}	.....ok
	Frequency Multiplier					
	"OFFSET ON" on REC. MEAS. = St. 22/22 resp. (26) connected to ground	(26) gr	——	——	0 V	
	Decade switch: 000 0050	(62) ge	2,53125 MHz	——	2,53125 MHz	.....ok
		(3)	5,0625 MHz	L 2 → max.level	4 ... 8 V_{pp}	
		(4)	10,125 MHz	L 3 → max.level	5,5 ... 7 V_{pp}	.....ok
		D 2/6 = ge	2,025 MHz	——	TTL 2,025 MHz	.....ok

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	8028.3	13.4.78	X
		12.5.78	Schuh

4020 (4010) series
DECADE STAGE

210 021 A

Replacement for

9/11 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Oscillator 210 021 S Bl. 6:					
	+5 V on ②	①	10,04 MHz	L 5 →	10,04 MHz	
		D 5/6 or	10,04 MHz	—	approx.10,04 MHz	
		◇61 or	1,255 MHz	L 5 →	1,255 MHz	.....ok
	+3,2 V on ②	①	8,6 ... 9,2 "	—	8,6 ... 9,2 MHz	.....ok
	+9 V on ②	①	10,8...11,5 "	—	10,8 ... 11,5 MHz	.....ok
	Mixer					
	◇26 (grey) to ground ◇25 (white) disconnected					
	Decade switch: 000 0050					
	+3,2 V on ② }	R 3 = vi	approx. 200 kHz	L 3 → max.level symmetrical	2 ... 3,5 V_{pp}	.....Vpp
	+9 V on ② }					.....V_{pp}
	Vernier Offset on RECEIVERMEASUREMENT					
	R 34/ R 24 middle position					
Power Supply 14 V Potentiometer 10 kΩ Oscilloscope Counter DVM	+2 V on ◇25 ws	◇27 vi	—	—	High or Low	
	increase DC level on ◇25 slowly, until f on ◇27	◇27 vi	10 ... 14 kHz	—	10 ... 14 kHz	
		◇25 ws	—	—	+2,5 ... +3,3 V	
	12 V on ◇25 ws	◇27 vi	—	—	High or Low	
	decrease DC level on ◇25 slowly, until f on ◇27	◇27 vi	10 ... 14 kHz	—	10 ... 14 kHz	
		◇25 ws	—	—	+11 ... +11,5 V	.....ok

Schlumberger

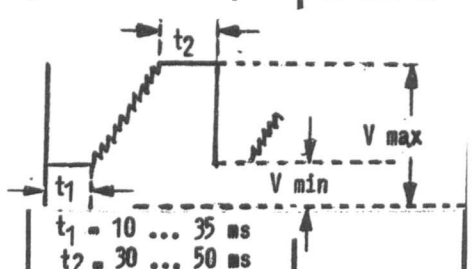
Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
C1	8028.9	13.1.78	X
		12.5.75	Schuh

Replacement for 210 021 A

4020 (4010) series
DECADE STAGE

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Continued					
	1. + 7 V on ◇25 ws	◇27 vi	0 Hz	R 34	0 Hz	
	2. + 3,5 V " " "	"	10 kHz	R 5	10 kHz	
	+ 3,3 V " " "					
	3. + 10,7 V " " "	"	10,5 ... 12,5kHz	R 24 → equal frequency	10,5 ... 12,5 kHz Δf < 0,2 kHz	
	4. Repeat 2. and 3.					
	5. + 6,85 V on ◇25 ws	"	210 ... 270 Hz	—	210 ... 270 Hz	
	+ 7,15 V " " "				Δf < 5 Hz	
	Repeat adjustment if 5. is off limits.					
	Check if level at ◇25 ws is also available at rear panel Bu 3.					
	Autom. Frequency Control (AFC) 210 021 S Bl. 4:					
Decade switch	100 MHz appr.- 3 dBm on Bu 40	Decade switch setting				
		140 MHz	①	—	—	+ 3,8 ... 4,8 V ..... ok
Oscilloscope		30 MHz	①	—	—	+ 3,8 ... 4,8 V
		40 MHz	①	—	—	0 ...+0,4 V ..... ok
	Disconnect ◇55 ws	199 MHz	⑤	7,5 Hz ($\frac{199-100\ MHz}{64 \times 800 \times 256}$)		Saw tooth with 256 steps step amplitude rising: < 15 mV decreasing: < 200 mV V min: < 0,1 V V max: +1,4... +1,8 V ..... ok
	Re-connect ◇55 ws	199 MHz	T 11 Coll	"		



Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	8282.9	13.1.78	X
		12.5.75	Schuh

Replacement for 210 021 A

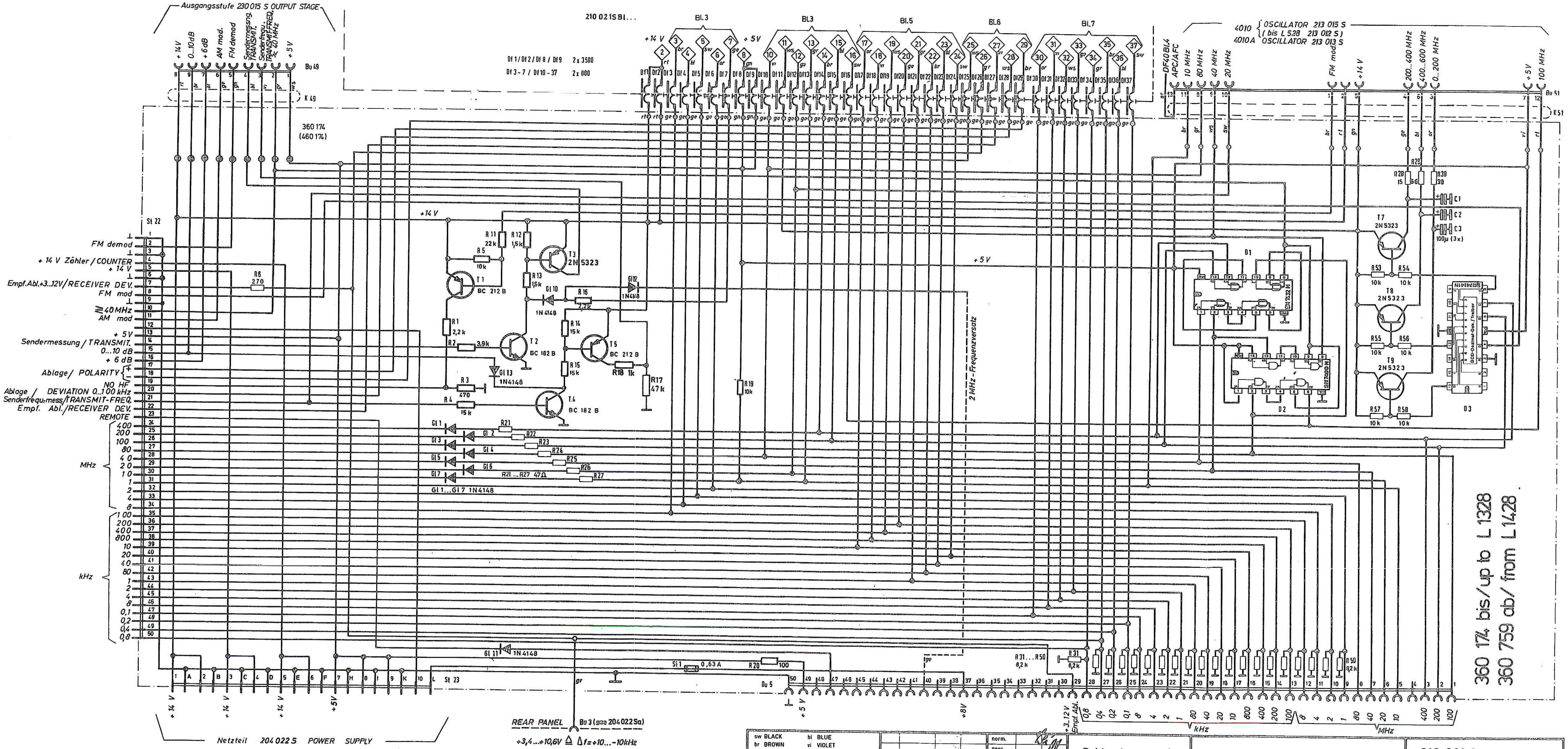
4020 (4010) series
DECADE STAGE

11/11 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE		MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Sample - Hold - Detector (APC)	Decade switch setting					
			(2)	250 kHz	—	Saw tooth V min: 1 ... 2 V_{pp} V max: 8 ...10 V_{pp}	.....ok
	100,1 MHz on Bu 40 (-3 dBm)	100,1 MHz	(3)	15,625 kHz	—	12 ...14 V_{pp} Puls width at 7V 0,3 ... 0,4 µs	.....ok
	100 MHz on Bu 40 (-3 dBm)	100,1 MHz	(4)	appr. 36 Hz	—	Same shape as on (2) V min: + 3,5 ... 5 V V max: + 9 ... 13 V	.....ok
	Control Amplifier						
DVM Counter	Connect 1 kΩ between Df 40 and ground	102 MHz	Df 40	$\frac{102 - 100}{64 \times 703 \times 256}$ = appr. 0,2 Hz	—	0,2 Hz saw tooth: + 1 ... 1,4 V = V min + 12 ... 13 V = V max	.....ok
	Connect Oscillator sub unit	40 ... 480 MHz	Bu 35	corresp. to osc.ranges	—	Synchronisation catching time: < 3 S typical: < 1 S	.....ok .....ok .....ok
	(It can be useful to carry out the synchronisation test, when the total instrument is available).						

Note: The function of the interconnecting PC board 360 174 has to be checked on the complete instrument at the following operation modes:

Frequency settings RECEIVER MEASUREMENT
Transmitter frequency measurement
Offset frequency measurement
} at different Frequencies



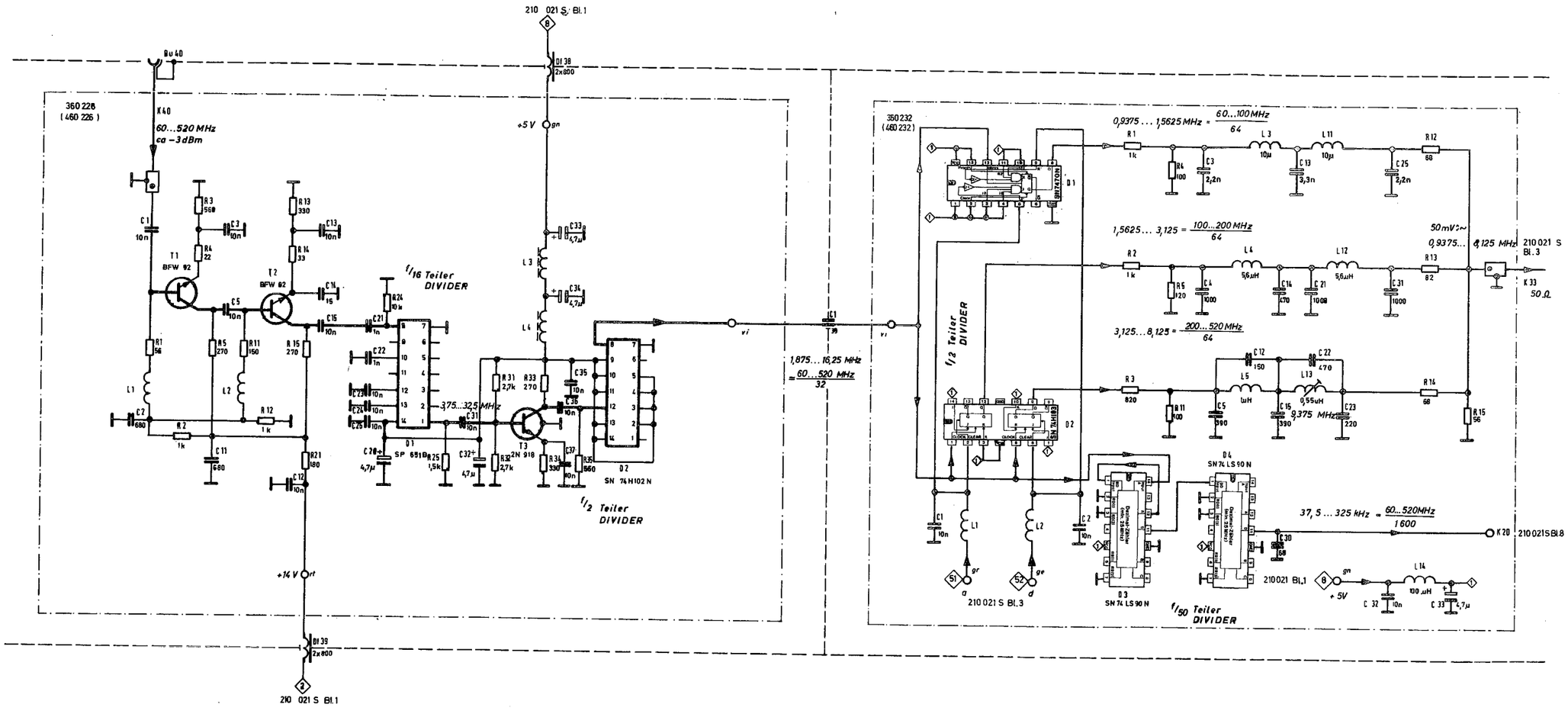
sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

				norm.		
				gepr.		
20	7020.69	27.10.77	Kr.	bearb.	9. 1. 74.	Neu.
Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME		Datum DATE	Name NAME

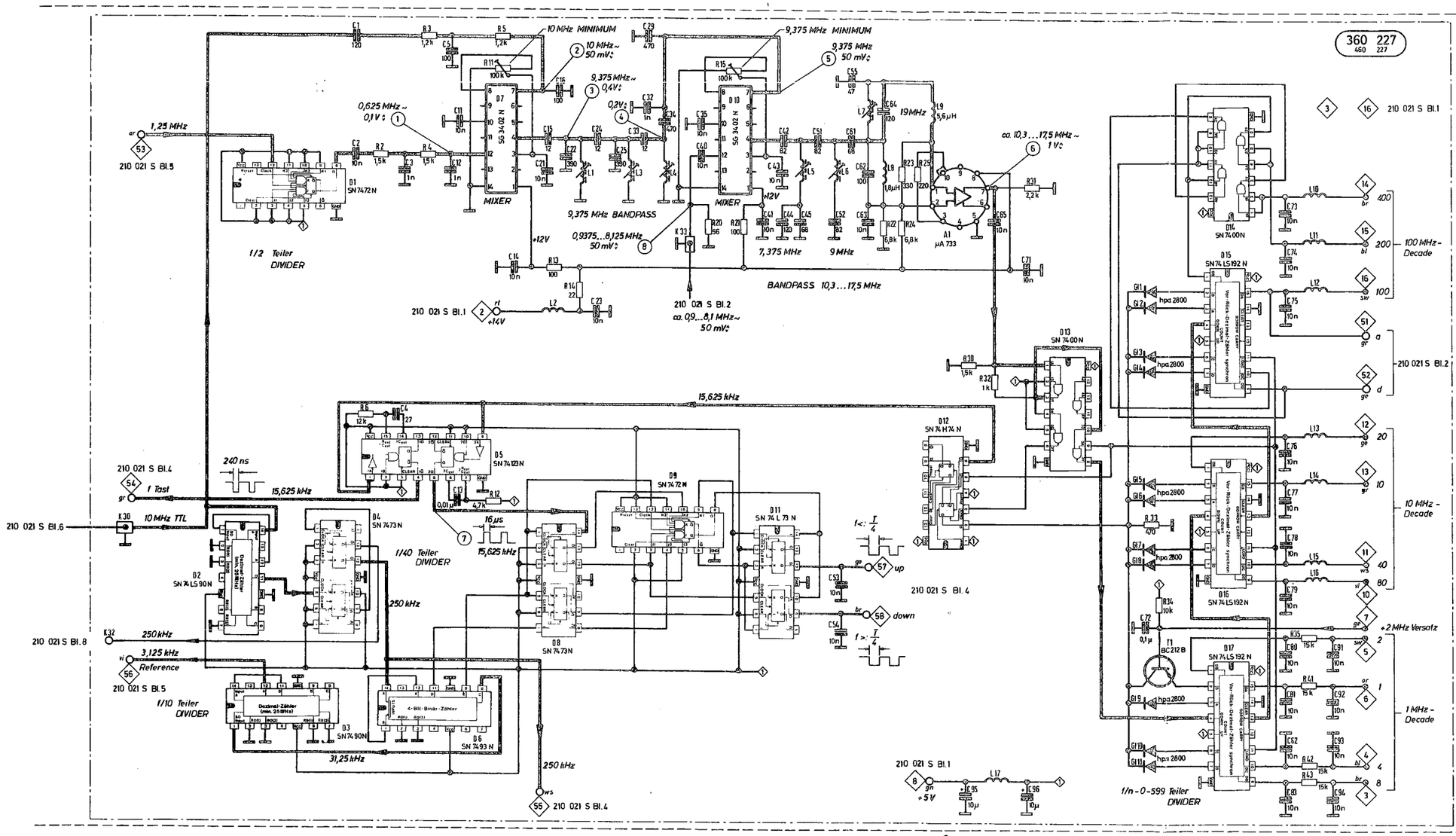
Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Dekaden-Stufe
DEKADE-STAGE

210 021 S Bl. 1
Typ: 4010



sw BLACK	bl BLUE					norm.			Schlumberger o/s	Dekaden-Stufe	210 021 S Bl.2 | 03
br BROWN	vi VIOLET	07	9028.67	25.9.75	Eiler	gepr.			Meßgerätebau u. Vertrieb GmbH	DEKADE-STAGE	Typ 4010
rt RED	gr GREY	06	6028.100	11.11.76	Wn	bearb.	11.10.73	Neu	8 München 45		
rs ROSE	ws WHITE	Ausg. ISS.	Ä-Mittlg. MODIF.	Datum DATE	Name NAME		Datum DATE	Name NAME			
ge YELLOW	tr TRANSPARENT										
gn GREEN											



sw BLACK	bl BLUE		
br BROWN	vi VIOLET		
rt RED	gr GREY		
rs ROSE	ws WHITE		
ge YELLOW	tr TRANSPARENT		
gn GREEN			

13	802.8.88	17.11.78	Ge.	norm.	
12	7028.62	13.10.77	Kr.	gepr.	
Ausg. ISS.	Ä-Mittlg. MODIF.	Datum DATE	Name NAME	bearb. 1977	13.10.77 Kr.
				Datum DATE	Name NAME

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Dekaden-Stufe 1 MHz Dekaden
DECADE STAGE 1 MHz DECADES

210 021 S Bl. 3
Typ : 4010

AUTOMATIC FREQUENCY CONTROL (AFC)

360 228
(460 228)

210 021 S Bl.1

gn ⑧ +5V

L1 +C1 10µ C2 10n

br ⑱ DOWN

210 021 S Bl.3

ge ⑰ UP

f ≧ / f < / f > / f ≦ (T/4)

D1 SN74 LS 132 N

HIGH = DOWN
LOW = UP

① f ≧ ca.+3,8V
f ≦ ca.+0,2V

D3 SN74 LS 191 N

D4 SN74 LS 191 N

Vor-Rück-Dezimal-Zähler synchr. erweit.

HIGH = DOWN

R22 100k R24 220k R32 56k R33 27k

R44 8,2k R45 15k R54 47k R55 2,2k

⑤ 0...1,5V

R60 1,2k

T11 BC 182 B

R59 56

210 021 S Bl.1

rt ② +14V

L2 C3 10n 330µH C11 100µ

R4 100

R12 10k

R23 10

R51 1,5k

R53 56

C22 4,7µ

C24 100µ

210 021 S Bl.3

gr ⑭ 15,625 kHz

C4 220

R13 3,9k

T4 BC 212 B

Gl4 hpa 2800 R57 100k Gl5 hpa 2800

C12 100µ

Gl2 1N4148 R11 4,7k

C13 10n T3 BC 182 B

R21 3,9k

0,3µs Sample Puls 13V

C21 1n R15 1M ③

R58 1,8k C25 100µ

T8 BC 212 B

R52 3,3k

T9 BC 182 B

T7 BC 212 B

R5 22k

Gl3 1N4148

T5 BF 247A

R25 10k

T6 BF 256B2

④ 3,5...10V

Gl6 1N4148

T10 BC 182 B

Gl1 1N4148

210 021 S Bl.3

ws ⑮ 250 kHz

C5 150 R1 10k R3 330

T1 BC 182 B

T2 BC 212 B

R2 2,2k

C14 150

② C15 10n 250 kHz C23 10n

+8V ±2V

R14 1k

R56 2,2k

or

Df40 Bl.8

SAMPLE HOLD DETECTOR (APC)

sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

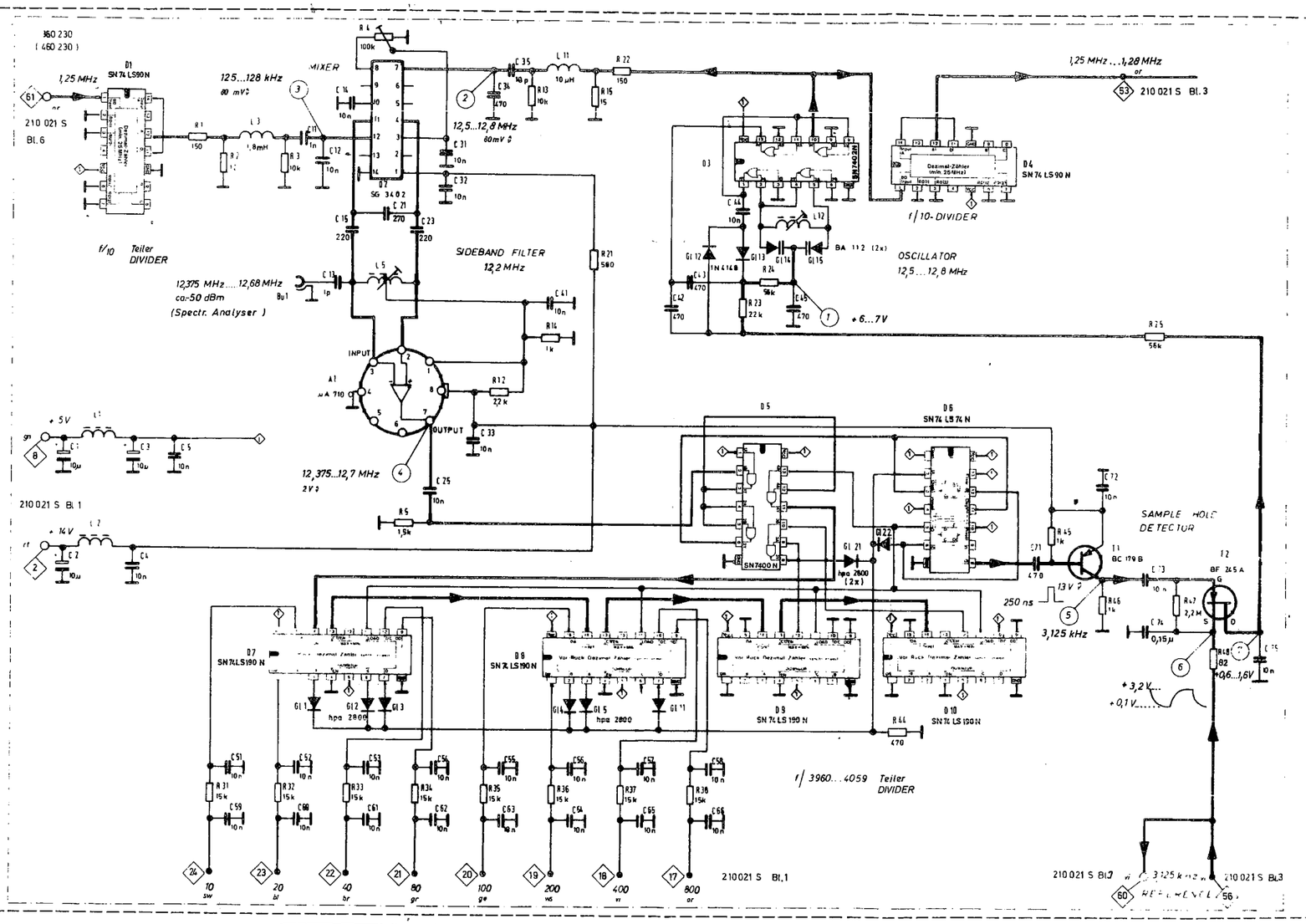
15	8028.67	14.7.78	Kr.	norm.
14	7028.52	12.10.77	Wn	gepr.
13	7028.52	5.9.77	Kr.	bearb. 21.12.73 Neu.
Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME	Datum DATE / Name NAME

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

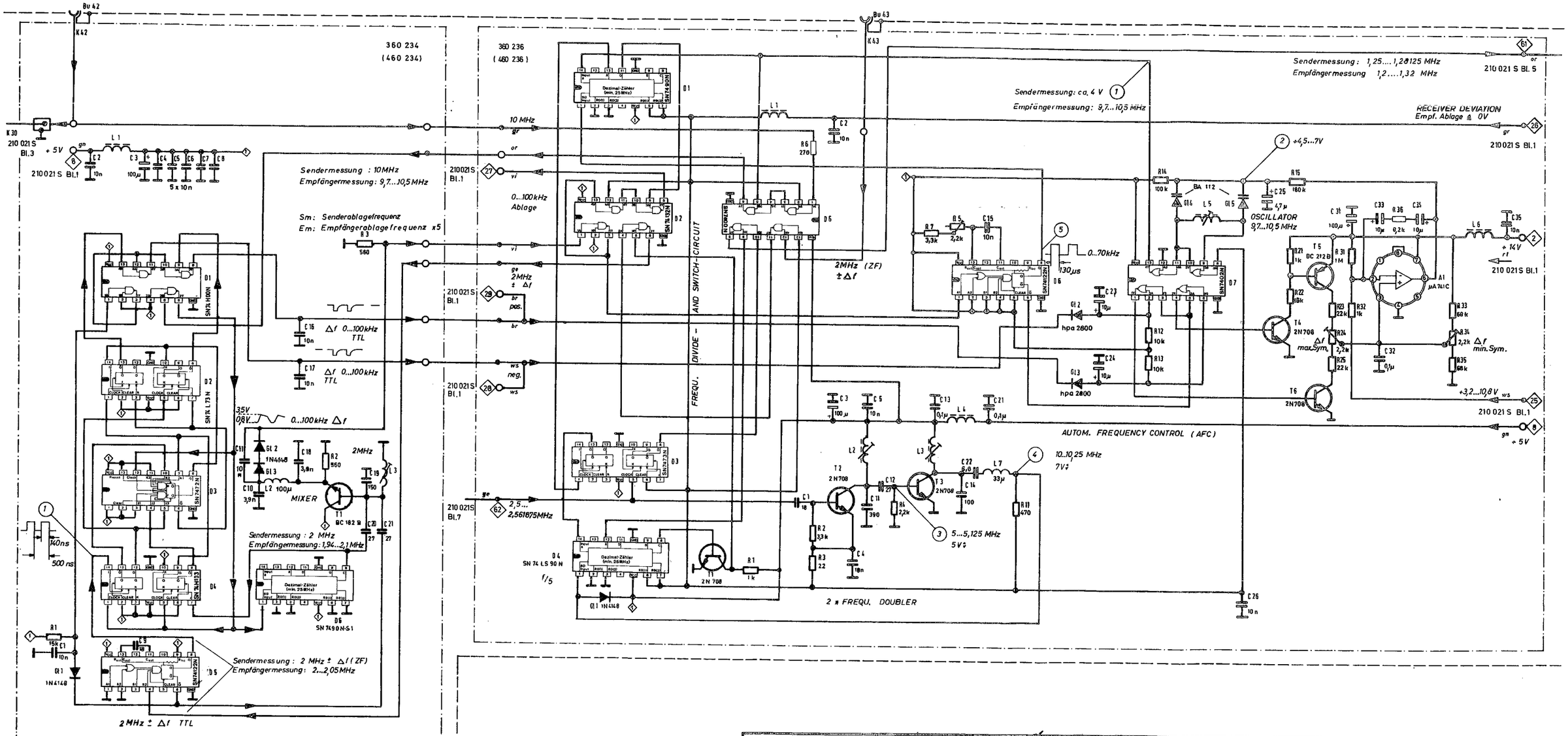
Dekaden-Stufe
DEKADE-STAGE

210 021 S Bl. 4 | 03

Typ: 4010

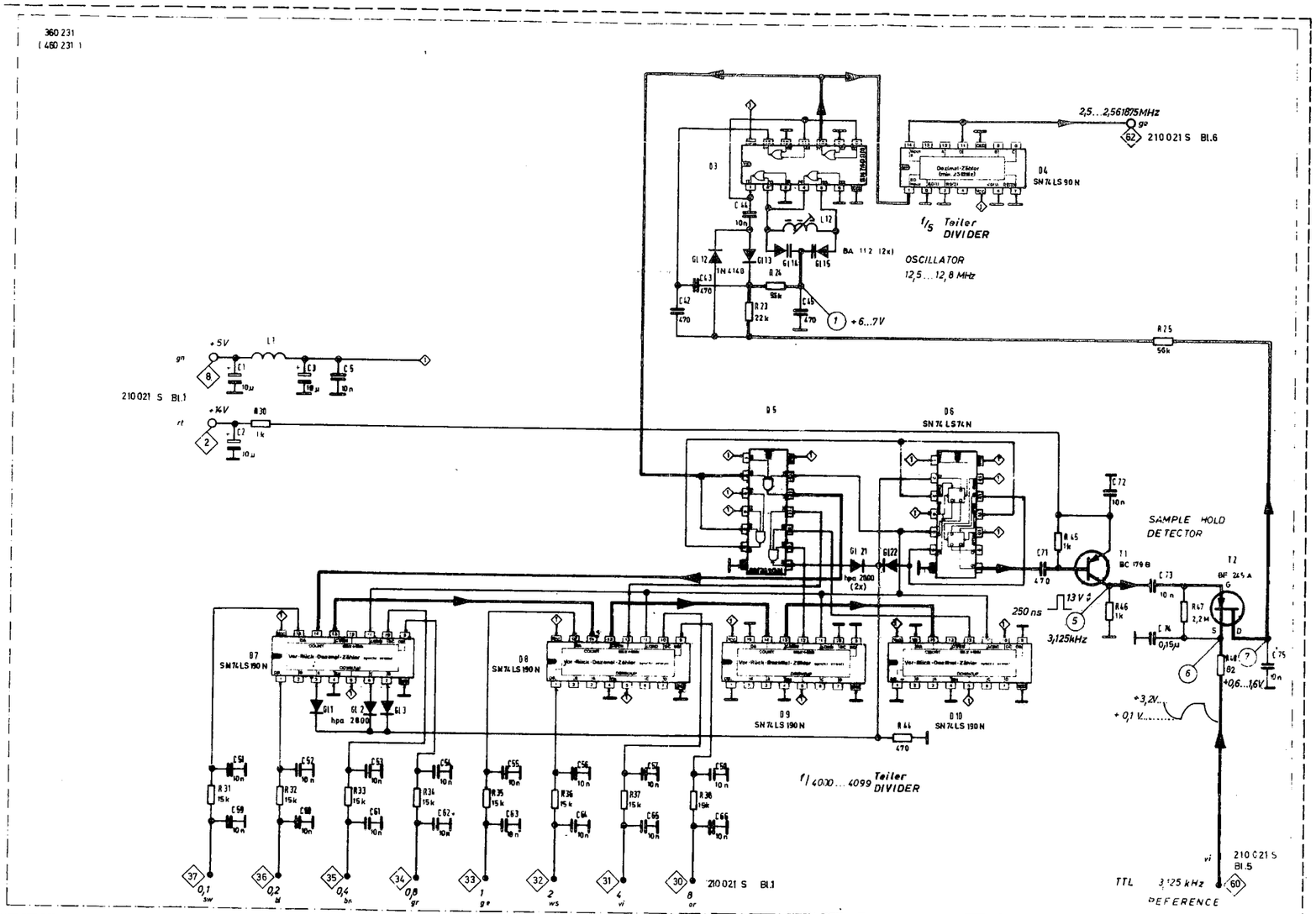


sw BLACK	bl BLUE	09	8028.27	23.2.78	Wn	norm		Schlumberger o/s	Dekaden-Stufe Zwischendekaden	210021 S Bl. 5	03
br BROWN	vi VIOLET	08	6028.8	3.2.76	Kr.	gepr		Meßgerätebau u. Vertrieb GmbH			
rt RED	gr GREY	07	4028.121	16.11.74	Kr.	bearb	20.9.73. Ned.	8 München 46	DEKADE STAGE MIDDLE DECADES	Typ: 4010	
rs ROSE	ws WHITE	Ausg.	A-Mittlg	Datum	Name		Datum Name				
ge YELLOW	tr TRANSPARENT	ISS.	MODIF	DATE	NAME		DATE NAME				
gn GREEN											



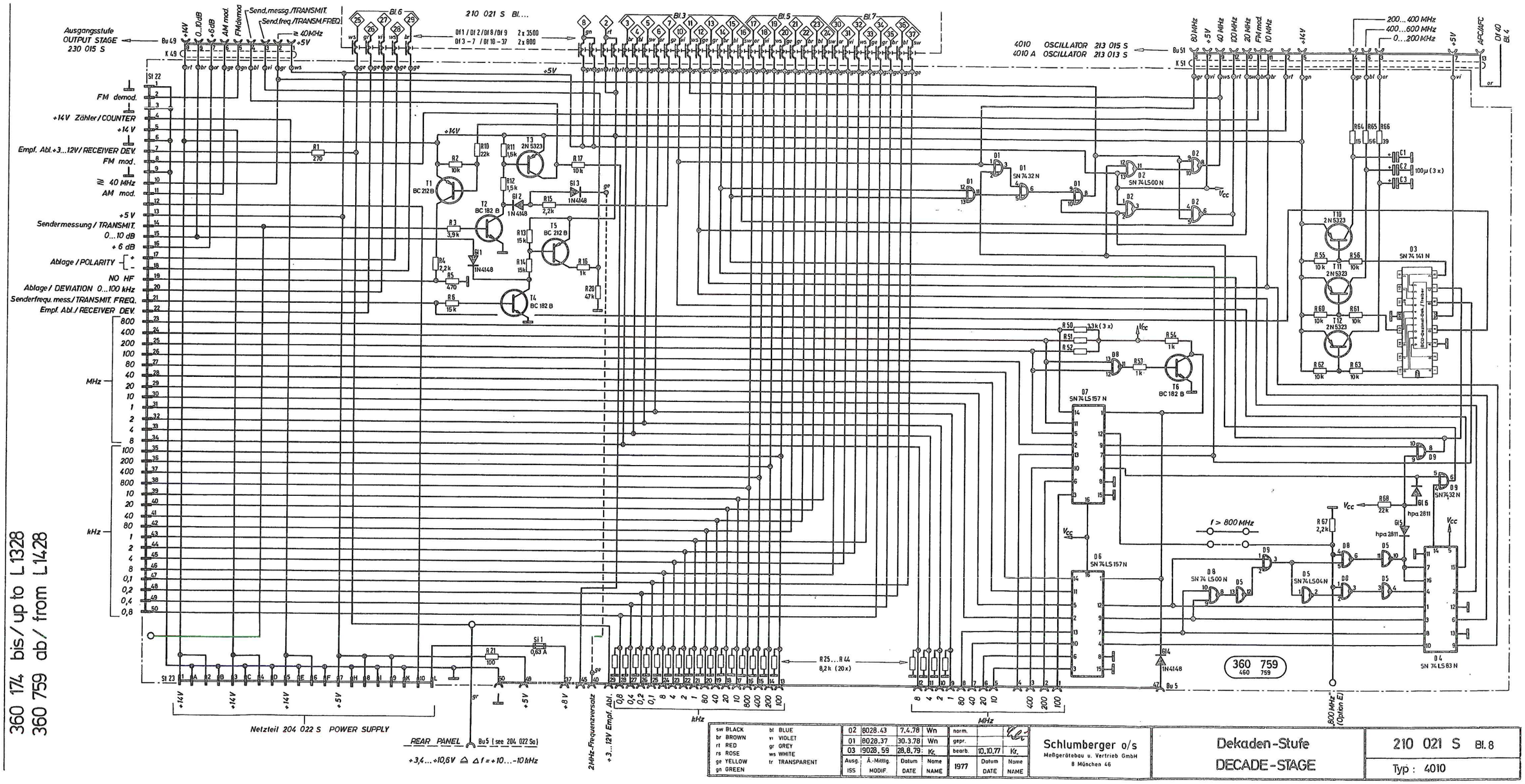
sw BLACK	bl BLUE					norm.			Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 45	Dekaden-Stufe DEKADE-STAGE	210 021 S Bl. 6	03
br BROWN	vi VIOLET					gepr.						
rt RED	gr GREY	21	8028	8	17-12-73	bearb.	17.12.73	Neu.			Typ: 4010	
rs ROSE	ws WHITE	Ausg.	Ä.-Mittg.	Datum	Name		Datum	Name				
ge YELLOW	tr TRANSPARENT	ISS.	MODIF.	DATE	NAME		DATE	NAME				
gn GREEN												

360 231
(460 231)



sw BLACK	bl BLUE	08	8028.27	23.2.78	Wn	norm			Schlumberger o/s	Dekaden-Stufe Enddekaden	210 021 S Bl. 7	03
br BROWN	vi VIOLET	06	5028.78	18.8.75	Wn	geor			Meßgerätebau u. Vertrieb GmbH	DEKADE STAGE LASTDECADES	Typ: 4010	
rt RED	gr GREY	07	6028.8	3.2.76	Kr.	bearb	20.9.73	Neu!	8 München 46			
rs ROSE	ws WHITE	Ausg.	Ä.-Mitteilg.	Datum	Name		Datum	Name				
ge YELLOW	tr TRANSPARENT	ISS	MODIF.	DATE	NAME		DATE	NAME				
gn GREEN												

Skjema ej bra!



sw BLACK	bl BLUE		
br BROWN	vi VIOLET		
rt RED	gr GREY		
rs ROSE	ws WHITE		
ge YELLOW	tr TRANSPARENT		
gn GREEN			

02	8028.43	7.4.78	Wn	norm.
01	8028.37	30.3.78	Wn	gepr.
03	19028.59	28.8.79	Kr.	bearb. 10.10.77 Kr.
Ausg. ISS	Ä-Mittg. MODIF	Datum DATE	Name NAME	1977 Datum DATE / Name NAME

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Dekaden-Stufe
DECADE-STAGE

210 021 S Bl. 8
Typ : 4010

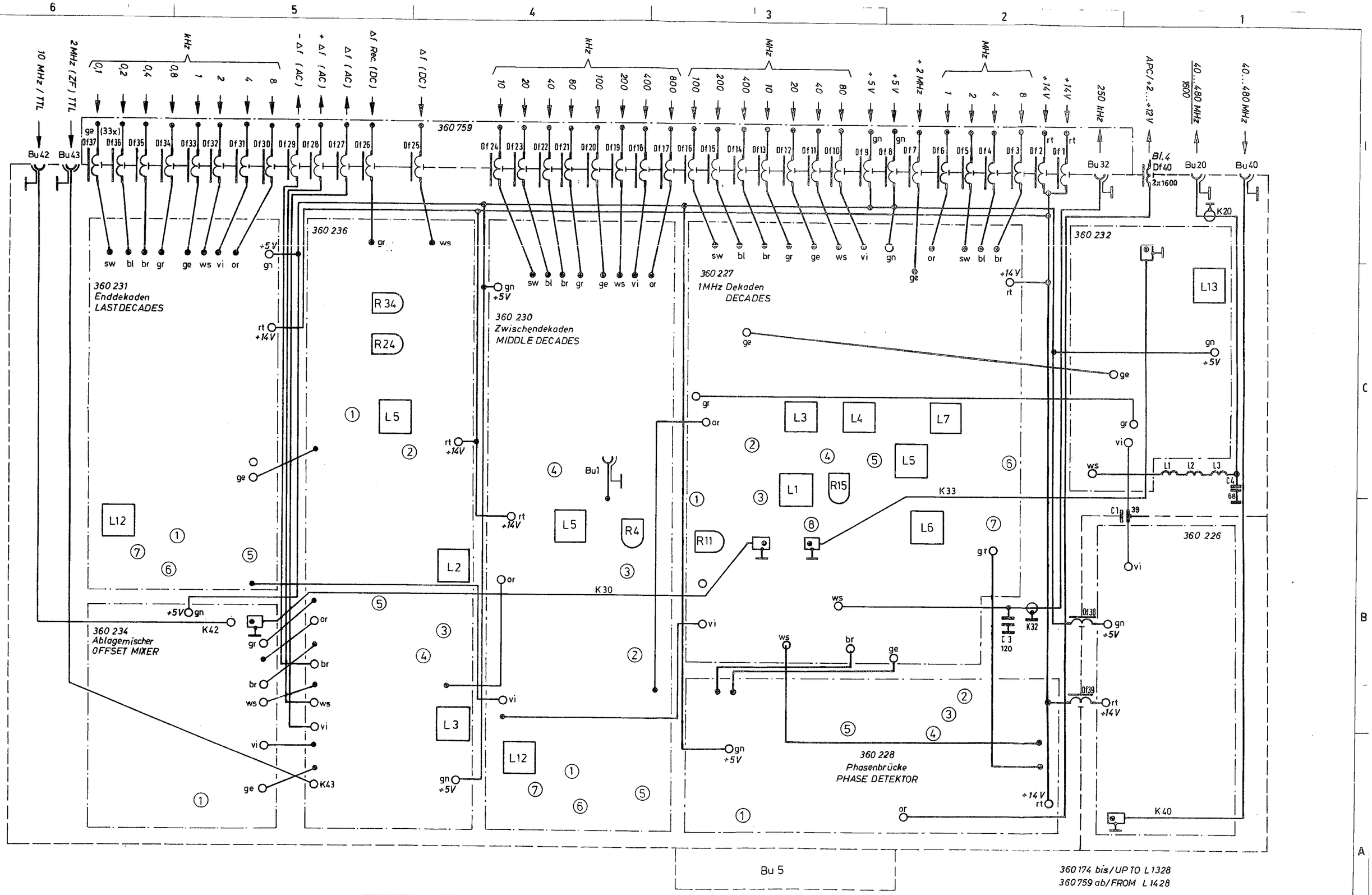
360 174 bis/ up to L 1328
360 759 ab/ from L 1428

D7/13.
kill ½
ok. på skjema!

3.2k. D7/12
D8/4.

D8/1.. 7

Skal vara jord



sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

Ausg.	Ä.-Mittlg.	Datum	Name
ISS.	MODIF.	DATE	NAME
12	7028.69	27.10.77	Kr.
11	7028. 62	11.10.77	Wn

norm.			
gepr.			
bearb.	3.4.74		
	Datum	Name	
	DATE	NAME	

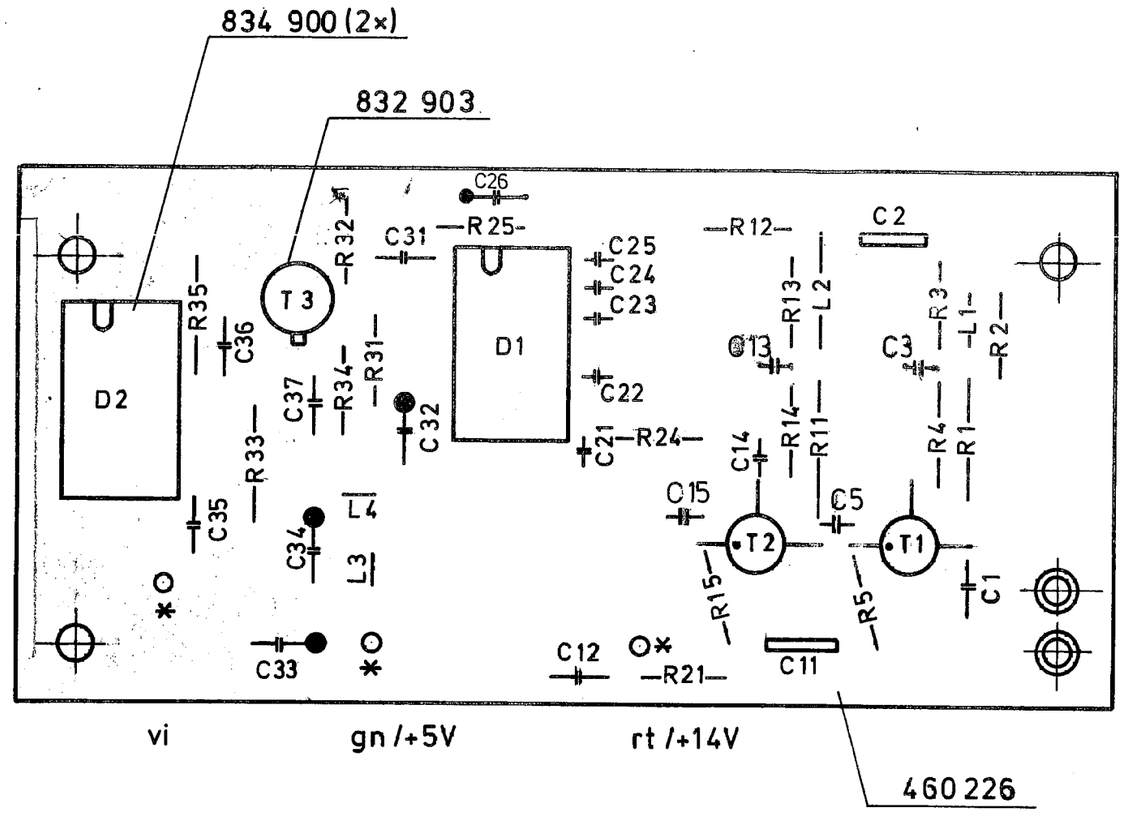
Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

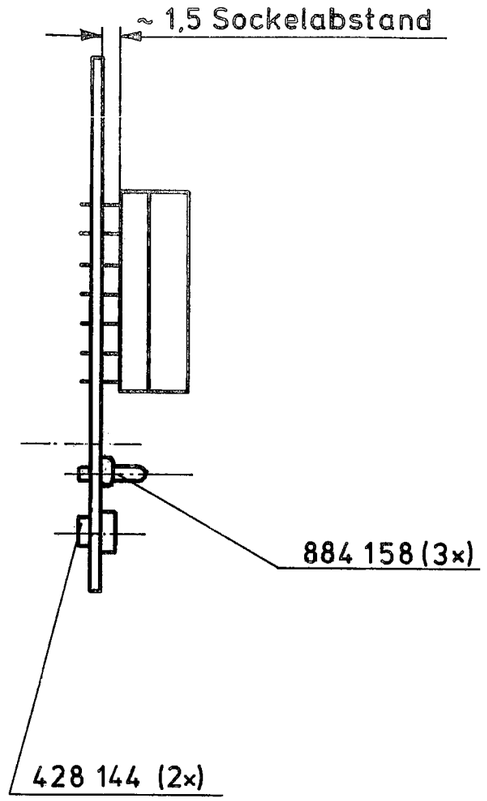
Dekaden-Stufe
DECADE-STAGE

210 021 S Bl. 9

Typ: 4010

weich gelötet





✱ = Farbpunkt

⬭ = Kontrollmaß

04	3028.67 25.9.79 Eiler	Kontrolle	FormaB Nabenzirkel	Maßstab 2:1
03	3028.92 13.12.78 Mo	Werkstoff		
02	5028.21 21.3.75 Le. P.	Oberflächen		
01	4028.116 26.10.74 Eiler			
Ausgabe	Änderung Meldg. Datum Name		Datum Name	
			gez 8.1.74 Tabenbauer	
			bearb Kei	
			gepr	

Schlumberger o/s
Meßgerätebau + Vertrieb GmbH
München 46

Bestückte Leiterplatte

360 226

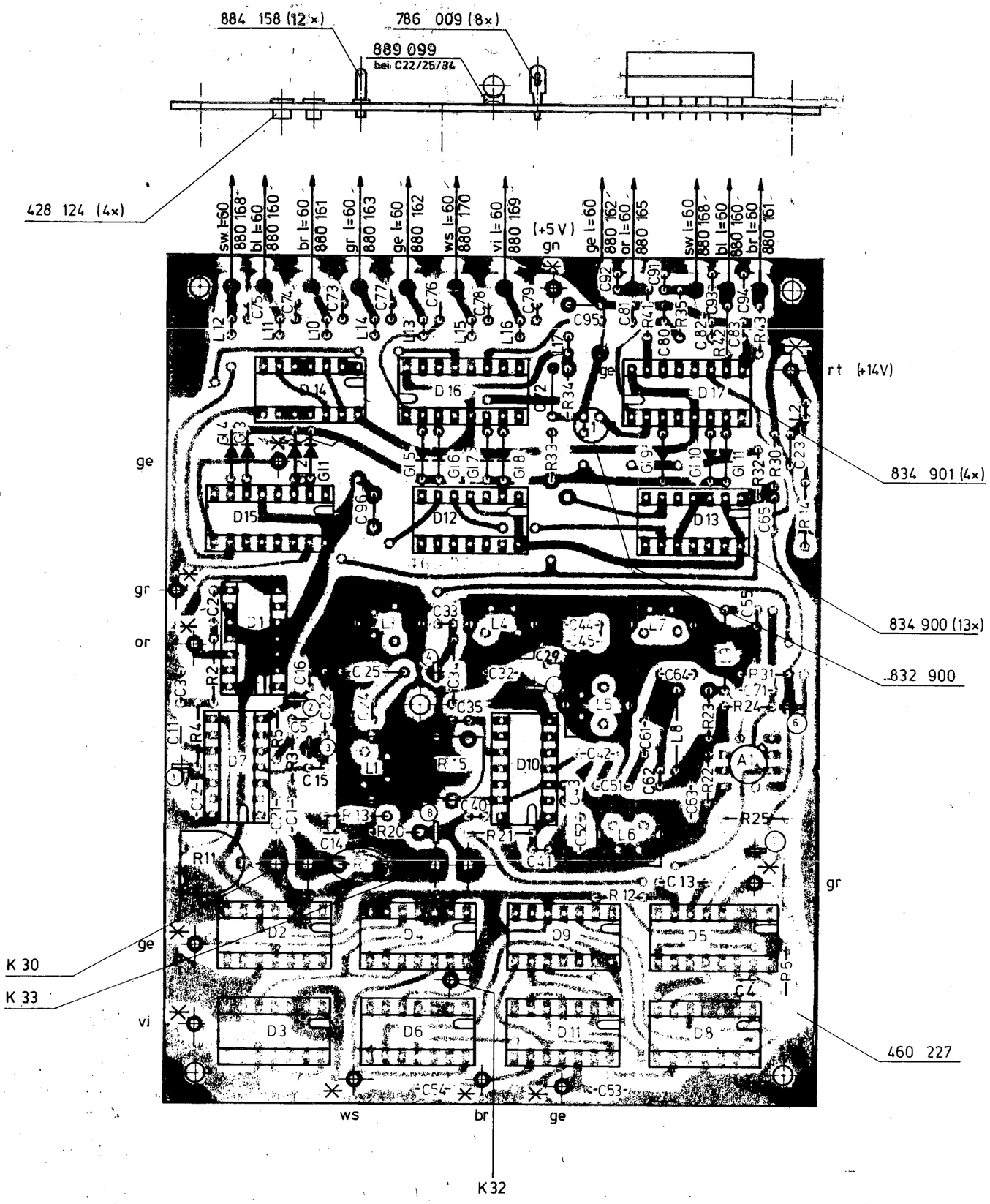
Ersatz für

Schaltplanpositionierung ≙ 210 021 S / 360 226 Sa

Gerät: 4010 / 4020

weich gelötet

(A1) nur bei 4709 erforderlich



Für C 22 ; C25 und C34
Vorschrift 099 067 V

✳ = Farbpunkt

⬭ = Kontrollmaß

		0,2	2:1	Schlumberger o/s
				Bestückte Leiterplatte
				360 227

Schaltplanpositionierung 210 020 S / 360 227 Sa

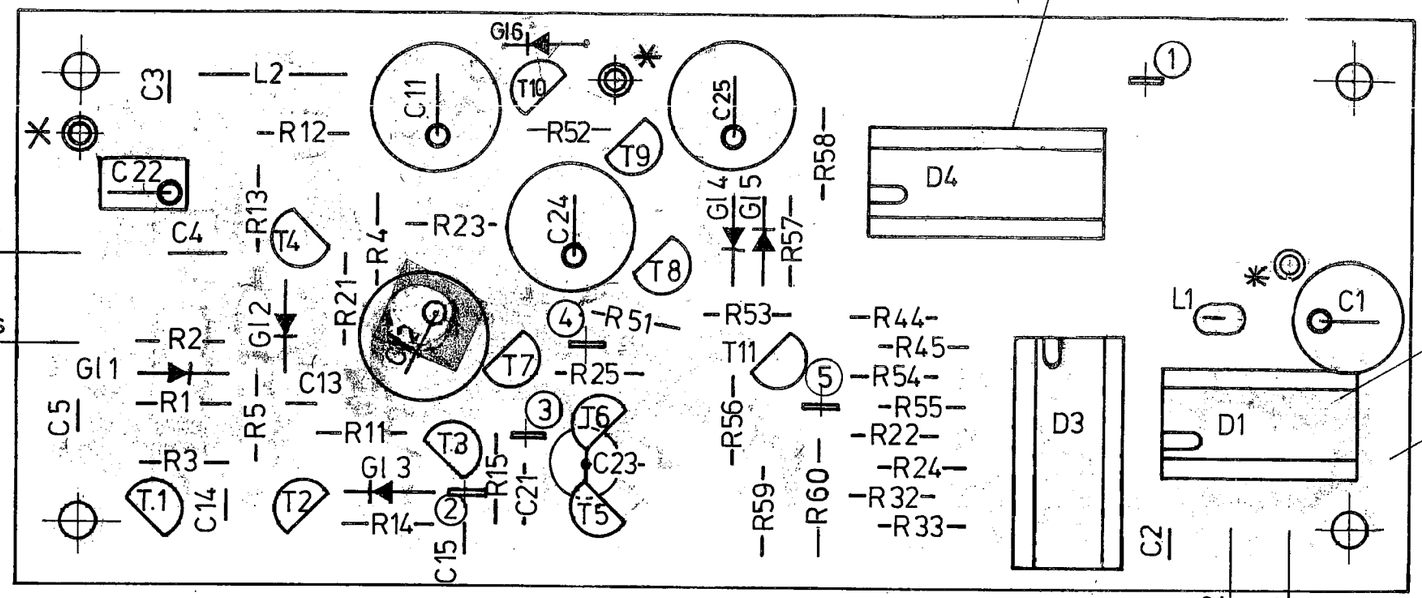
verwendet in: 375 167

Gerät: 4 700 / 40.20

weich gelötet

834 901 (2x)

or



Öse gebogen und
weich gelötet

(C23)

(T6.T5)

884 158 (3x)

786 009 (5x)

✳ = Farbpunkt

Aus gabe	Änderg Mittlg	Datum	Name
10			
09			
08			
07			
06			
05			
13	9028.53	6.8.79	Eiler
12	8028.92	13.12.78	Mo
11	9028.67	14.7.78	Kig.

Rohteil

Werkstoff

Oberfläche

Freimaß Toleranzen

Maßstab 2:1

	Datum	Name
gez	18.4.74	LE P
bearb		
gepr		

Schlumberger o/s

Meßgerätebau u. Vertrieb GmbH
8 München 45

Bestückte Leiterplatte

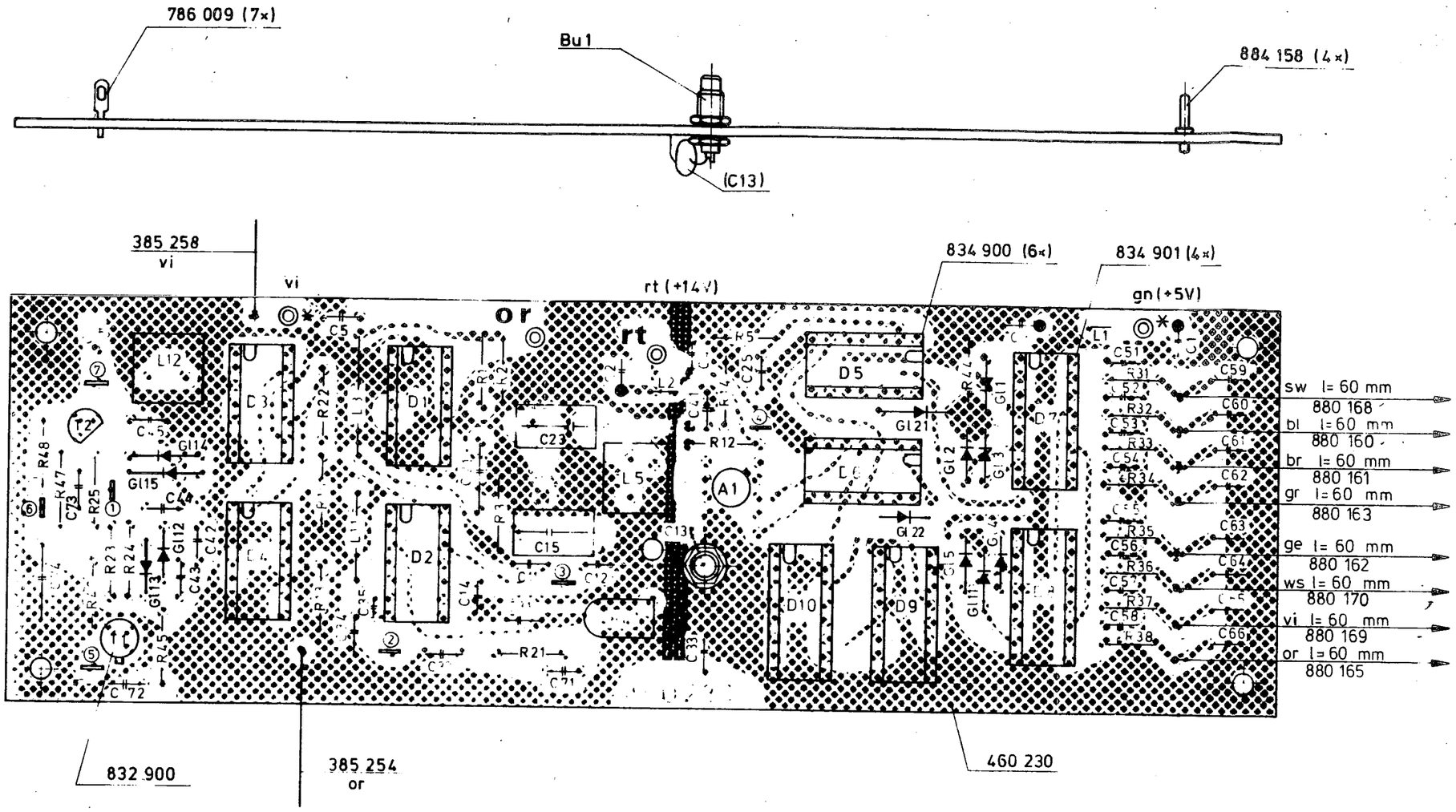
360 228

Ersatz für

Schaltplanpositionierung ≙ 210 021 S / 360 228 Sa

Gerät: 4010/4020

weich gelötet



* = Farbpunkt

Kontrollmaß

10	9028.53	6.8.79	Eiler				
09	8028.92	13.12.78	Mo				
08	6080.52	22.11.78	Ca				
07	6028.8	3.2.76	Hans				
06	4028.106	13.10.74	EILER	Werkstoff		2:1	Schlumberger o/s
05	4028.70	19.6.74	Tschl				Bestückte Leiterplatte
04	4049.21	4.4.74	Ca				
03	4028.14	12.2.74	Hau				
02	6847.1	3.1.74	FARRER	Oberfläche			360 230
01	3041.01	30.10	Ca		Datum	Name	
Ausgabe	Änderg Mitlg	Datum	Name		gez 11.9.73	Tschl	
					bearb 29.10.73	Ca	
					gepr		Ersatz für

Schaltplanpositionierung ≙ 210 020 S / 210 021 / 360 230 Sa

weich gelötet

884 158 (4×)

786 009 (4×)

gn (+5V)

rt (+14V)

832 900

or ge

385 268

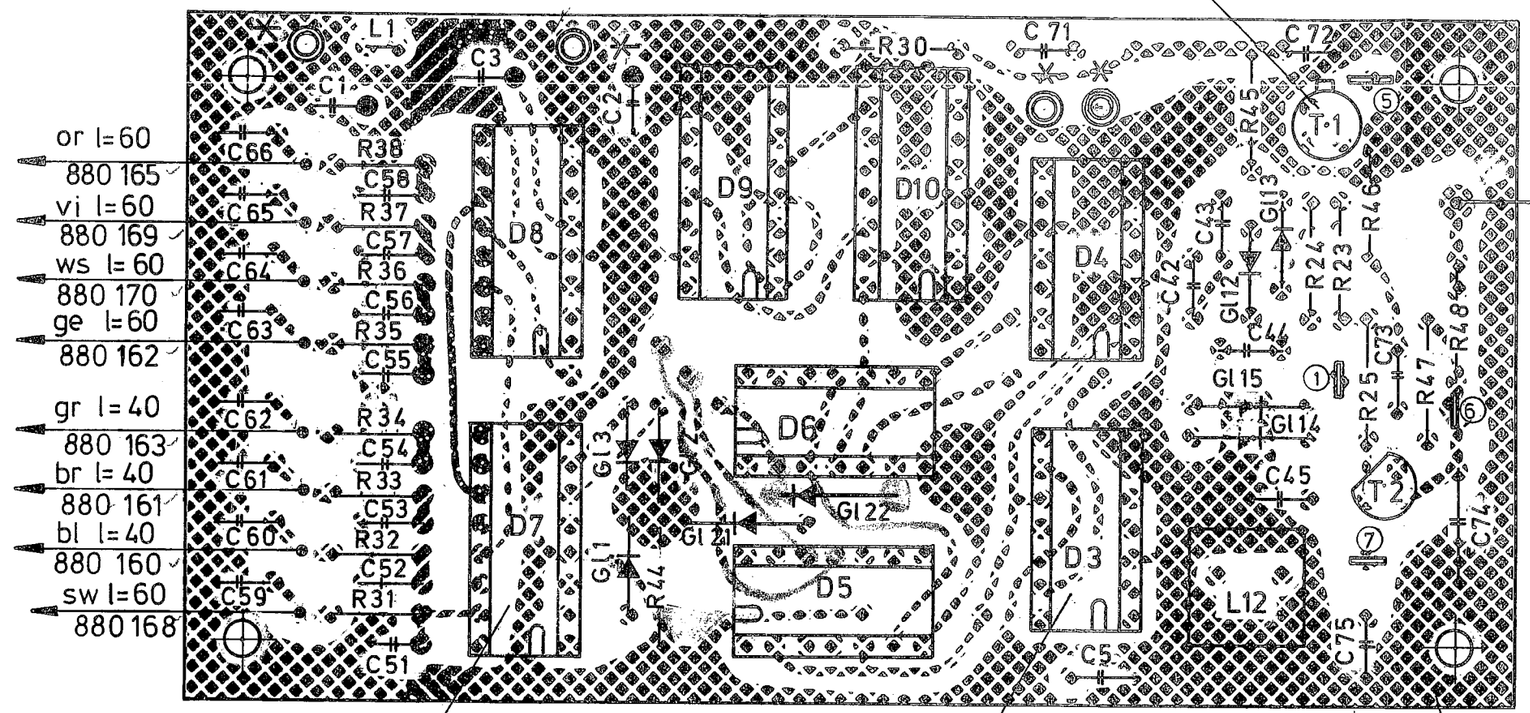
vi

834 901 (4×)

834 900 (4×)

460 231

or l=60
880 165
vi l=60
880 169
ws l=60
880 170
ge l=60
880 162
gr l=40
880 163
br l=40
880 161
bl l=40
880 160
sw l=60
880 168



* = Farbpunkt

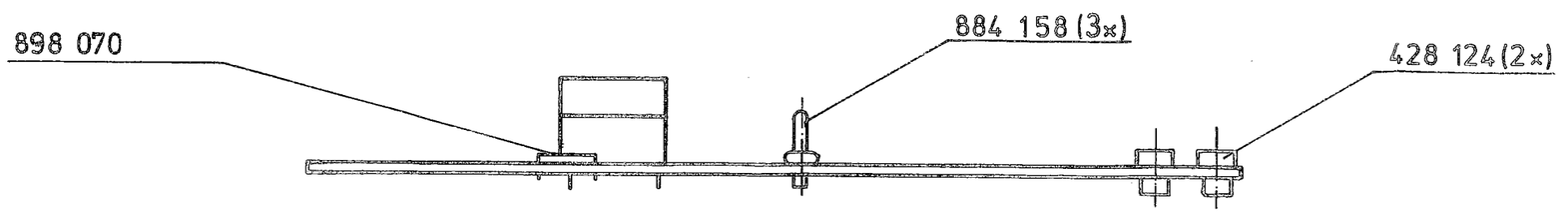
Kontrollmaß

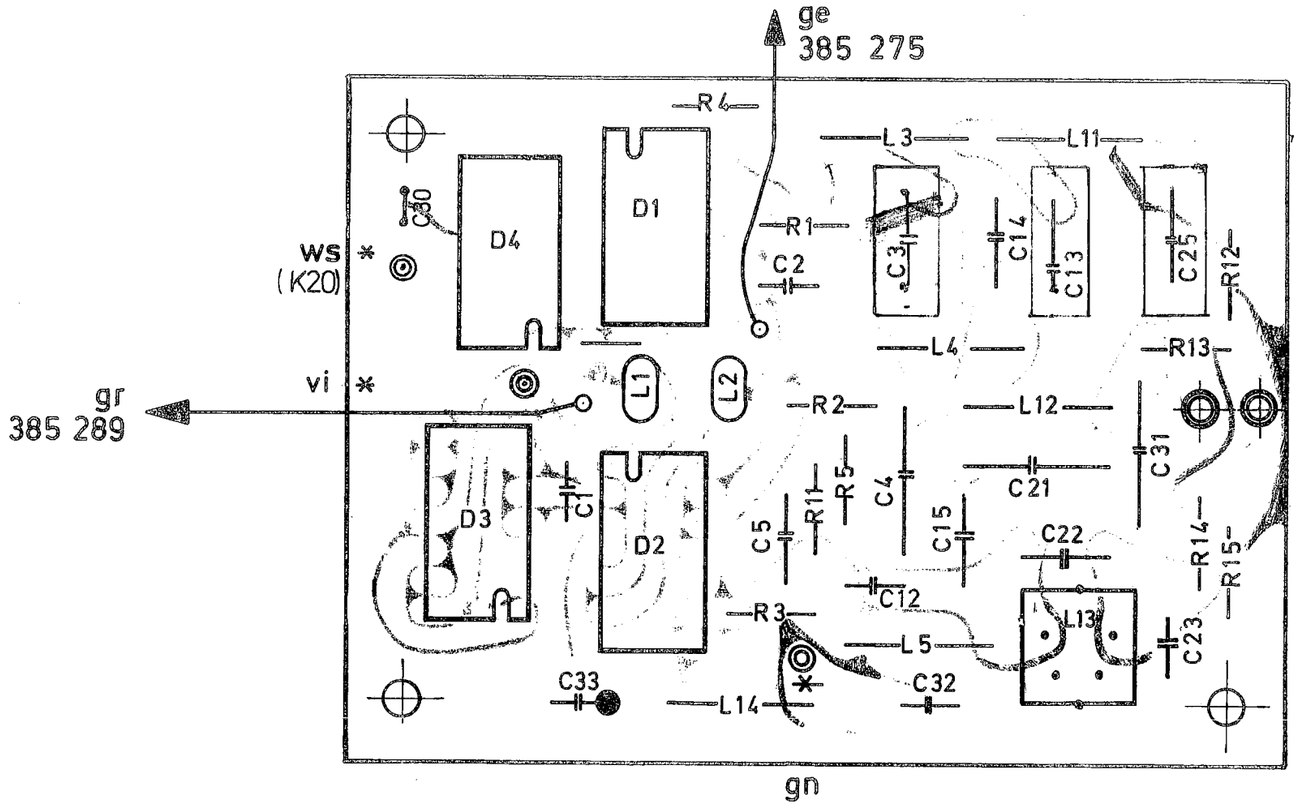
10 9028.53 6.8.79 Eiler 09 8028.92 13.12.78 Mo 08 6028.8 2.2.76 Hosse 07 5028.46 14.5.75 Eiler 4026.106 131074 EILER 4028.93 9.9. Ka 4028.48 4.4.74 B=h 4047.11 18.2.74 Fahrnb 4047.1 3.1.74 FAHRNB. 3041.11 29.10. Ka			2:1	Schlumberger o/s Bestückte Leiterplatte 360 231
		9.10.73 Fahrnbauer 26.10.73 Ka		

Gerät: 4010/4020

Schaltplanpositionierung · 210 020 S / 210 021 S / 360 231 Sa

weich gelötet





Kontrollmaß

✳ = Farbpunkt

verwendet in: 210 021 Gerät: 4010 / 4020

Schaltplanpositionierung ≙ 210 021 S / 360 232 Sa

10				
09	8028.92	13.12.78	Mo	
08	7028.88	30.11.77	Eiler	
07	6028.90	11.11.76	Eiler	
06	6028.28	2.4.76	Eiler	
05	6028.7	2.2.76	Eiler	
04	5028.106	25.11.75	Eiler	
03	5028.97	23.10.75	Eiler	
02	5028.2	22.1.75	Eiler	
01	40 28.104	11.10.74	Eiler	
Ausgabe	Änderg. Mitteig.	Datum	Name	

Benteil

Werkstoff

Oberfläche

Maßstab: 2:1

	Datum	Name
gez.	22.7.74	Fahrenbach
gepr.	8.2.	Eiler

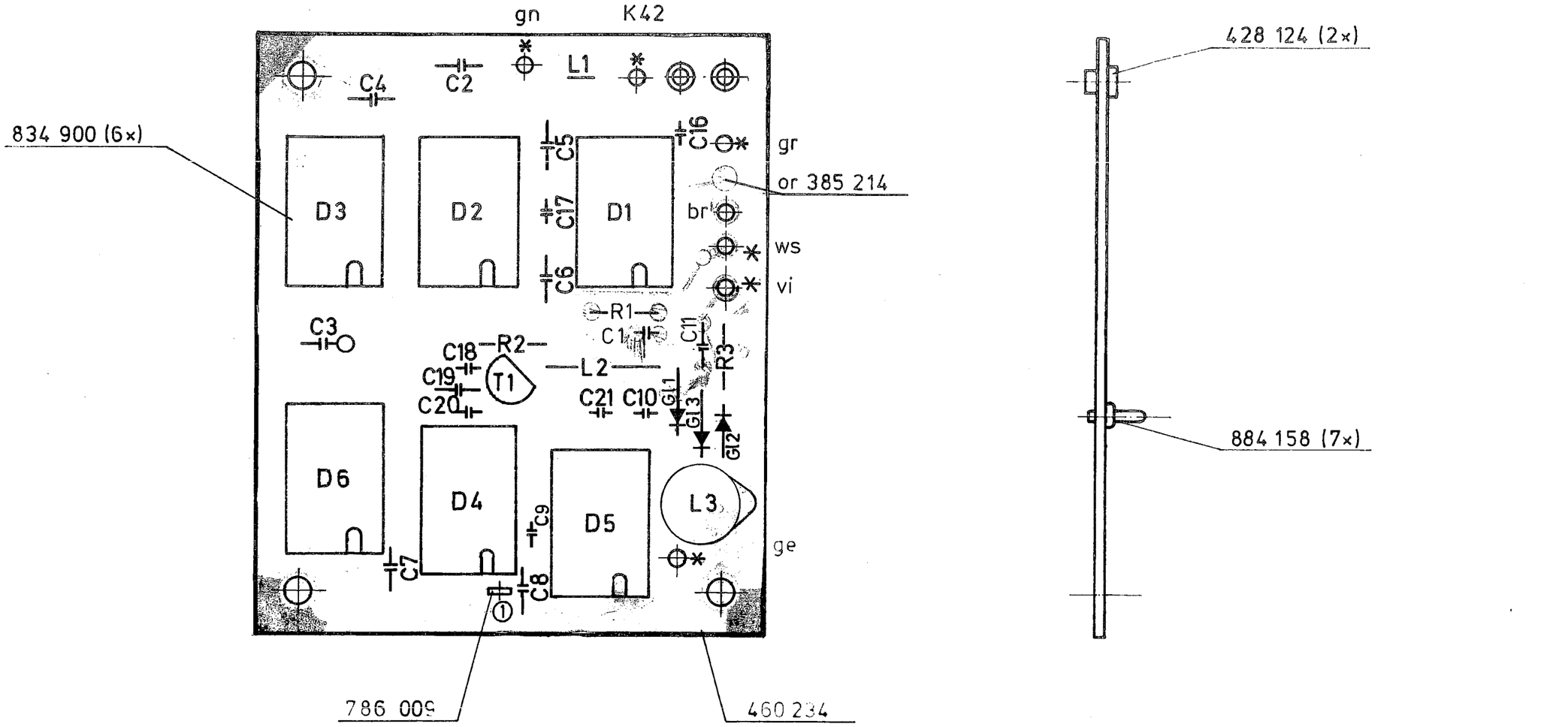
Schlumberger o/s
Meßgerätebau - Vertrieb GmbH
4 München 1F

Bestückte Leiterplatte

360 232

Ersatz für

weich gelötet



Kontrollmaß

✳ = Farbpunkt

05	9028.53	6.8.79	Eiler
04	8028.92	13.12.78	Mo
03	5028.24	26.3.75	Le P.
	4028.100	15.10.74	Selg
	4028.48	4.4.74	

2 : 1

Schlumberger o/s

Bestückte Leiterplatte

Typ: Ablagemischer

360 234

6.2.74 Fabrikation

Schaltplanpositionierung 210 021S/360 234 Sa

Gerät: 4010/4020

weich gelötet

385 215 ge
385 218 vi
385 220 ws
385 212 br
385 224 or
385 219 gr
385 215 ge

(K46)

vi ws br or

D2 D3 D6 D7 D4 D5 D1

Gl1 Gl2 Gl3 Gl4 Gl5

R1 R2 R3 R4 R5 R6 R7 R11 R12 R13 R14 R15 R21 R22 R23 R25 R31 R32 R33 R35 R36

C1 C2 C3 C4 C5 C11 C12 C13 C14 C15 C21 C22 C23 C24 C25 C26 C31 C32 C33 C34 C35

L1 L2 L3 L4 L5 L6 L7

T1 T2 T3 T4 T5 T6

A1

gr l=60 880 163

ws l=60 880 170

gn / +5V

rt /+14V

834 900 (7×)

460 236

832 903 (5×)

884 158 (7×)

786 009 (5×)

(R5)

✳ = Farbpunkt

20				
19				
18				
17				
16				
15				
14				
13				
12	9028.53	6.8.79	Eiler	
11	9094.43	9.5.79	Eiler	
Ausgabe	Ändg-Mittlg	Datum	Name	

Rohteil

Werkstoff

Oberfläche

Freimaß toleranzen

Maßstab 2:1

	Datum	Name
gez	16.4.74	LE P
bearb		
gepr		

Schlumberger o/s
Meßgerätebau u Vertrieb GmbH
8 München 46

Bestückte Leiterplatte

360 236

Ersatz für

Schaltplanpositionierung ≙ 210 021S / 360 236Sa

Gerät: 4010 / 4020

NZ-Vordruck Niedernhausen/Ts

weich gelötet

884 207
M 2x5 DIN 84
701 114
J 2,2 DIN 6797
706 102
2 x

Bu 5

26

ge 40

R25 ... R44 stumpf auf
Massebahn gelötet

G14

R44

15 +1

428 096 (6 x)

385 005
bei f > 800 MHz

R1

1

D7

T6

D8

R67

R54

R53

R50

R51

R52

D9

St 22

D3

G16

G15

R68

D5

D6

D4

8

7

1

R63

R61

T12

R62

T11

R60

T10

R56

R55

C3

C2

C1

R66

R64

R65

D1

D2

br
rt
or
ge
gn
bl
vi
gr
ws
sw
br
rt
or

Df 40
375 214

15 14 13 12 11 10 9 8 7 6 5 4 3 2 Df1

880 164 gn
l = 30 mm
(2 x)

880 167 rt
l = 30 mm
(2 x)

460 759

889 035 (4 x)
l = 10 mm

(R61/63)

426 093 (3 x)
eingeklebt mit Technicoll
nach 099 041 V

17

834 900 (5 x)

~1,5 Sockelabstand

834 901 (4 x)

9028,59 28.8.79 Kr.
7028,85 24.11.77 Kr.
7028,69 27.10.77 Kr.

2:1

Schlumberger o/s

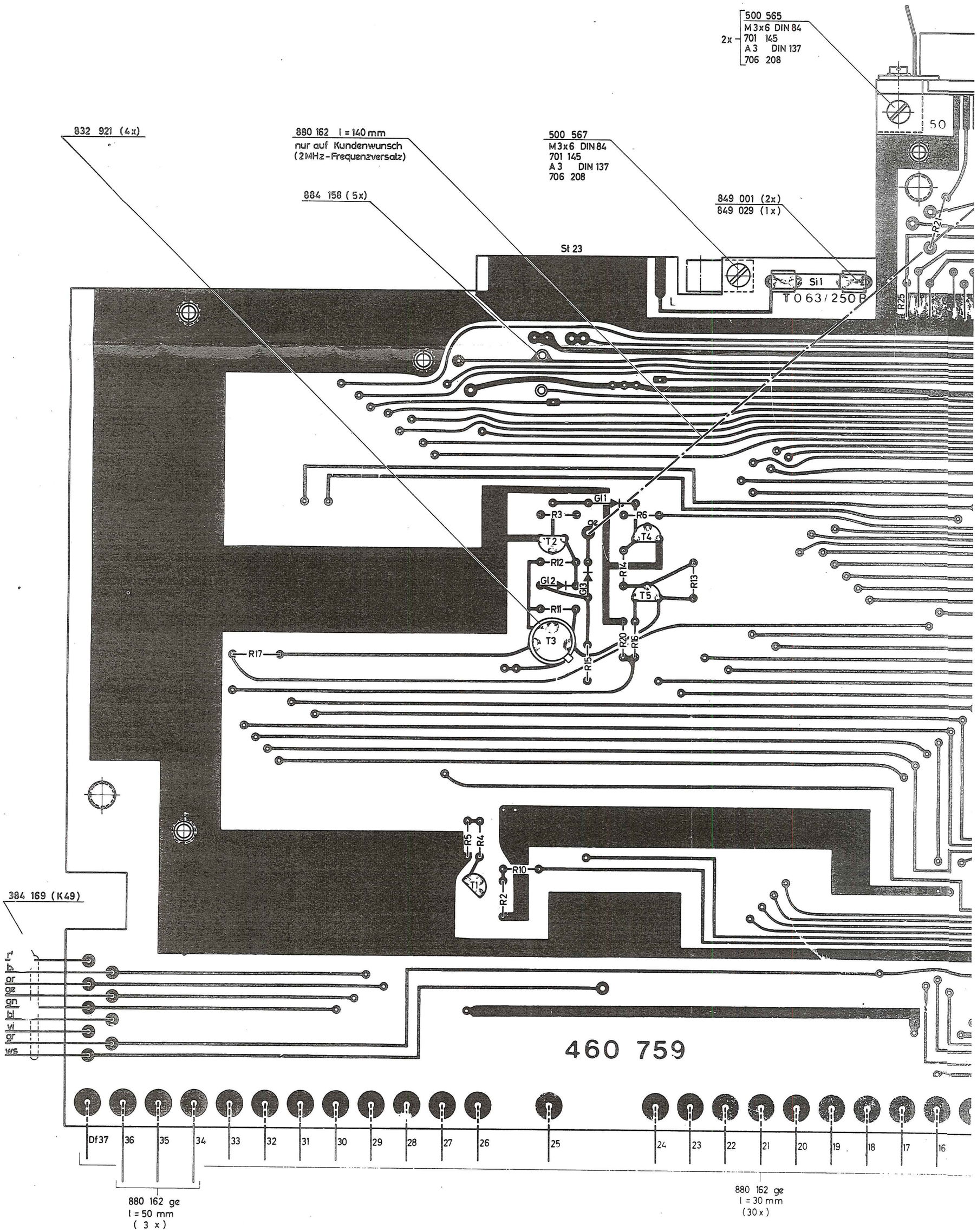
Bestückte Leiterplatte

1977 26.10.77 Kringelis

360 759

et in : 375 214

Gerät : 4010



Schaltplanpositionierung ≙ 210 021 S / 360 759 Sa verwendet

(See block circuit diagram 102 820 B for total instrument)

1. Receiver Measurement

The RF signal arriving from the oscillator stage is routed to the "RF direct" output through a AM modulator with AL F control and 2 variable attenuators for adjusting the EMF.

A mixer is included for the frequency range 0....40 MHz.

1.1 AM Modulator

Here, an auxiliary modulator which provides a signal level sufficient for satisfactory rectification is amplitude modulated in the usual way by means of the differential amplifier and feedback through "AM(AC)". This ideally modulated signal is then presented to a reference rectifier through a voltage attenuator, the former having the same properties as the EMF rectifier. The signals from the reference rectifier and the EMF rectifier than are applied to a differential amplifier, which controls a pin diode attenuator. This results in compensating non-linearities and temperature effects occurring during rectification of small RF levels.

The modulator output level is automatically controlled in non-modulated operation also and can be elevated by +6 dB by increasing reference level.

1.2 EMF Adjustment

The EMF level is adjusted by means of a mechanically switchable attenuator pad in 10 dB steps. For fine adjustment the DC voltage "EMF(DC)" controls a pin diode attenuator pad through a linearizing network according to the meter indication +2....-10 dB.
A 16 dB UHF amplifier is inserted when the 2 V EMF range is selected.

1.3 0.....40 MHz Mixer

The fixed LO frequency of the ring mixer 140 MHz is derived directly from the crystal frequency by means of a frequency multiplier.
The amplitude controlled synthesizer signal of 140...180 MHz is switched by a relais at the linear input, the de- mixed product being routed through a low pass filter and a RF amplifier to compensate the attenuation caused by the mixer.

2. Transmitter Measurements

The AM Modulator and the EMF vernier control are adjusted to maximum level by the control and display unit to enable the subsequent IF mixer to fully present the synthesizer frequency. The transmitter signal for the other mixer input must be previously controlled to a suitable mixer input level in the input amplifier with its large difference in level (from 1 mV to 3.5 V). In this automatic level control circuit the rectifier diode on the amplifier output controls the input pin diodes, an additional control being provided for higher performance.

The ALC controlled transmitter signal is routed through the control line "TR Frequ. (DC)" to the oscillator stage when measuring transmitter frequency. Switching diodes, placed inside of the connecting cable are also controlled by these means to eliminate cross-talk in other modes of operation.

2.1 The Intermediate Frequency

The mixed product is presented to the FM discriminator through various band filters and limiting amplifiers. A DC coupled discriminator output is led to the front panel socket AUX OUTPUTS. The active 20 kHz low pass filter at the output end supplies the demodulated signal "FM TR (AC)" through the decade stage to the meter circuitry. The squelch provided at the output end of the first limiting amplifier is provided with 2 chain inverters in parallel having different threshold levels. The chain inverter having the high sensitive threshold voltage provides a 2 MHz TTL signal even at low level input for frequency display through the decade stage. The chain inverter having low threshold sensitivity presents the IF to the following band pass filter once the level is sufficiently high to eliminate a noisy erroneous indication of modulation.

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
-	0028, 29	27.3.80	Morasch

Replacement for

230 025 A

4020 series
OUTPUT STAGE

1/7 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Frequency Multiplier 10140 MHz 230 025 S Bl. 4					
DVM	Frequency setting: ⟨ 40 MHz	Bu 4	10 MHz	-----	10 MHz TTL	
Power Meter		1	DC	L 4	appr. 7,1 V	
Frequency Analyser	(50Ω) Analyser to Bu 1	Bu 1	140 MHz	-----	Suppression of Spurious ⟩ 65 dB	
	Power Meter to Bu 1	Bu 1	140 MHz	-----	-3 to + 3 dBm	

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
-	0028.29	26.3.1980	Morasch

Replacement for 230 025 A

4020 series
OUTPUT STAGE

2/7 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM	EMF and Power Indication Meter. Check out of mechanical zero setting Adjust Pointer to full-scale deflection by aid of the EMF control knob on the front panel and check potential at	Df 3	DC	meter I 3 R 306 on 360 154	zero deflection 9,5 VDC	.....ok
Power Meter	Pre-set all trimmer potentiometers on 360 761 and 360 762 to mid-position, except R 34. R 34 adjust to 2/3 fully anti-clockwise. Pre-set C 9 to minimum capacity. Flatness of RF Signal Adjust EMF-indikation by front panel controls to +83 dBµV (+83 dBµV ≙ -30 dBm)	RF output (N-socket)	40 to 200 MHz	R 42 / 360 761 R 72 / 360 762 Don't change R 42 if level is below -30 dBm	- 30 dBm ± 0,4 dB	.....ok .....dB
			400 to 479 MHz	R 21	- 30 dBm ± 0,4 dB	.....dB

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
-	0028.29	27.3.80	Morasch

Replacement for

230 025 A

4020 series
OUTPUT STAGE

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Modulation Meter Dist. Analyser	AM Distortion Adjustment (Negative AM swing)	RF-socket (front panel) or RF DIRECT	f_{mod} 479,99 MHz = 1 kHz	R 34 / 360 762 to minimum distortion at 95 % AM depth	< 2 % typical 1 %	.....%
	Check RF Flatness again	"	39...479,9 MHz	R 72	- 30 dBm ± 0,4 dB	.....dB
(Signal Generator 140...180 MHz) RF Power Meter 0,01 ... 40 MHz (or RF Analyser)	Mixer (140...180) - 140 = 0,..40 MHz RECEIVERMEASUREMENT Set EMF step attenuator to + 80 dBµV, Frequency setting 0,1 MHz " " 0,01...39,9 MHz	 Bu 13 "	 C 6 mid-pos. 0,1 MHz 10 kHz...39,9MHz	 R 2 C 6	 - 30 dBm minimum Flatness (Notice low frequency cutoff of the Power Meter)	
Analyser	Set EMF control knob to 10 mV indication Pay attention to the following spurious signals, which can be expected: Signals with variable distance, passing the carrier at 28 MHz and at 35 MHz. 60 MHz signal, occuring when the carrier is set to 40 MHz.				Non harmonic Spurious Signals 0...25 MHz: > 63 dBc 25..40 MHz: > 53 dBc Harmonic Signals > 30 dBc	 >.....dBc >.....dBc >.....dBc
	EMF + 6 dB Switch over	RF-socket	150 MHz	R 35 / 360 761	+ 6 dB ± 0,4 dB	.....dB
	Press and depress "+ 6 dB push button"		40 to 479,9 MHz	------	+ 6 dB ± 0,4 dB	.....ok
AC-DVM	AM Depth Adjustment at 70 % depth and f mod 1 kHz	Df 6	1 kHz	Control knob MODULATION to 70 % AM Indication	2,1 VAC ± 1 %	 V
Modulation Meter		Socket RF or RF DIRECT	100 kHz..479,9 MHz	R 44 (360 761)	70 % + 5 % AM DEPTH	..... %

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	0028.32	11.4.1980	Mo
-	0028.29	27.3.1980	Morasch

4020 series
OUTPUT STAGE

230 025 A

Sheet 4/7

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
RF Power meter	Linearization of EMF Setting Set attenuator on front panel to + 80 dBµV and EMF Control to indication					
	+ 3 dB	RF-socket	180 MHz	R 72	- 30 dBm	
	- 2 dB	"	"	R 65	- 35 dBm	
	+ 3 dB	"	"	Test	- 30 dBm	
	- 7 dB	"	"	R 63	- 40 dBm	
	- 2 dB	"	"	Test	- 35 dBm	
	+ 4 dB	"	"	R 45	- 29 dBm	
	+ 3 dB	"	"	Test	- 30 dBm	
	19 mV	"	"	R 53	9,5 mV into 50 Ω	
	+ 2 dB	"	"	R 53	- 28 dBm	
	15 mV	"	"	Test	7,5 mV into 50 Ω	
					Error < 0,1 dB	.....ok
	Power Flatness at meter deflections - 7 and + 5 dB Attenuator setting to + 80 dBµV EMF meter deflection - 7 dB	"	40 ... 479,9MHz	check	- 40 dBm ± 0,8 dB	.....dB
	+ 5 dB	"	"	"	- 28 dBm ± 0,8 dB	.....dB
	Auxiliary Modulator (360 761)	230 025 S Bl. 3		R 35, 42, 44 — Middle position		
	Disconnect the counter	(2)	20 MHz	L 1	— 20 MHz ± 100kHz	
	" + 6 dB " not pressed	(3)	-	L 3	Minimum of the AGC voltage + 1 .....1,5 V	+ V

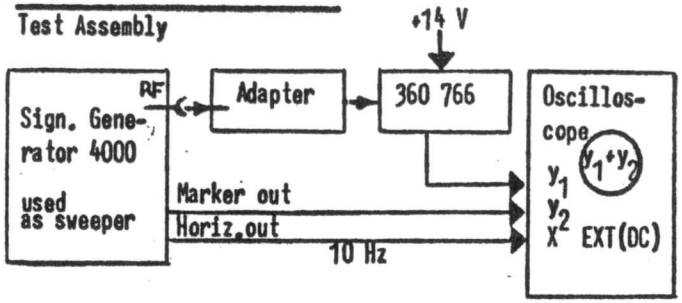
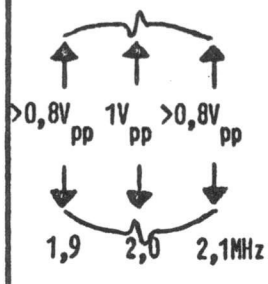
Issue	Alteration No.	Date	Name
-	0028.29	27.3.1980	Morasch

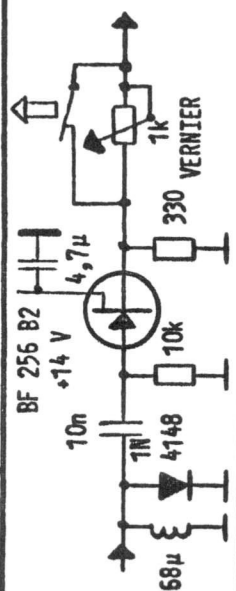
Replacement for 230 025 A

4020 series

OUTPUT STAGE

Adjustment and Test Procedure

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Signal Generator/ Sweep Generator (e.g. Type 4000) Oscilloscope Adapter	IF-Amplifier 230 015 S Bl. 2 Test Assembly  Sweep Generator: f = 2 MHz, Δf = ± 100 kHz (4000) Sweep Rate = 10 Hz EMF = 2 V RF Output Attenuator = 53...68 dB	(7)	1,9...2,1 MHz	L1/L2 → max. level 4000 → Min. EMF (Sweeper)	 	.....ok V



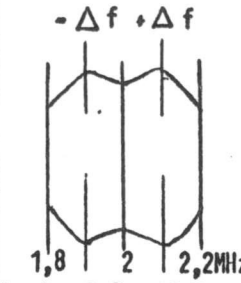
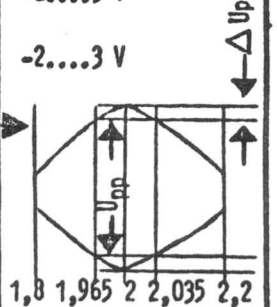
Schluetersen

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
-	0028.29	27.3.1980	Morasch

Replacement for 230 025 A

4020 series
OUTPUT STAGE

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	IF Limiter Amplifier (360 766)					
	4000: 1 MHz, 2 V EMF, Attenuator = 0 dB Sweep Deviation ± 100 kHz, Sweep Rate = 10 Hz (Due to its high input level, the adapter is operating as a frequency doubler now. Available sweep deviation is increased to ± 200 kHz.)	(2)	0,9...1,1 MHz (1,8...2,2 MHz)	L5, L11 → Max.level (360 766)	 Max.Level=7...10 V_{pp} ±Δf symmetrical ± 40...± 70 kHz	.....V_{pp} .....kHz
	IF Discriminator (360 766)					
	Set R 46 to mid position 4000: 1,85...2,15 MHz, 2 V EMF, 0 dB, UNMOD	(3)	2 MHz	L12/L13 → Max.RF level	7....9 V_{pp}	
	without SWEEP	(5)	1,85MHz	L14 → Max. DC	+2....3 V	
	Vernier adjustment:	(6)	2,15 MHz	L15 → Max. DC	-2....3 V	
	4000: 1 MHz, 2 V EMF, 0 dB, UNMOD, SWEEP ± 100 kHz	(3)	1,8....2,2,MHz	L12/L13 →	 Max.Level=7,5...8,5 V_{pp} ΔU_p from 1,965 MHz up to 2,035 MHz < 0,1 V_p	.....V_{pp} 0,.....V_p
	4000: 1,85...2,15 MHz, 2 V EMF, 0 dB, UNMOD, without SWEEP	(5)	1,85 MHz	L14 → Max.DC	+ 2,4....2,8 V	+2.....V
		(6)	2,15 MHz	L15 → "	- 2,4....2,8 V	-2.....V
		(4)	2 MHz		VDC_0 = 0 ... ± 0,2 V	0.....V
				L14 → $VDC_0/2$		
				L15 → VDC_0=0 V		.....ok

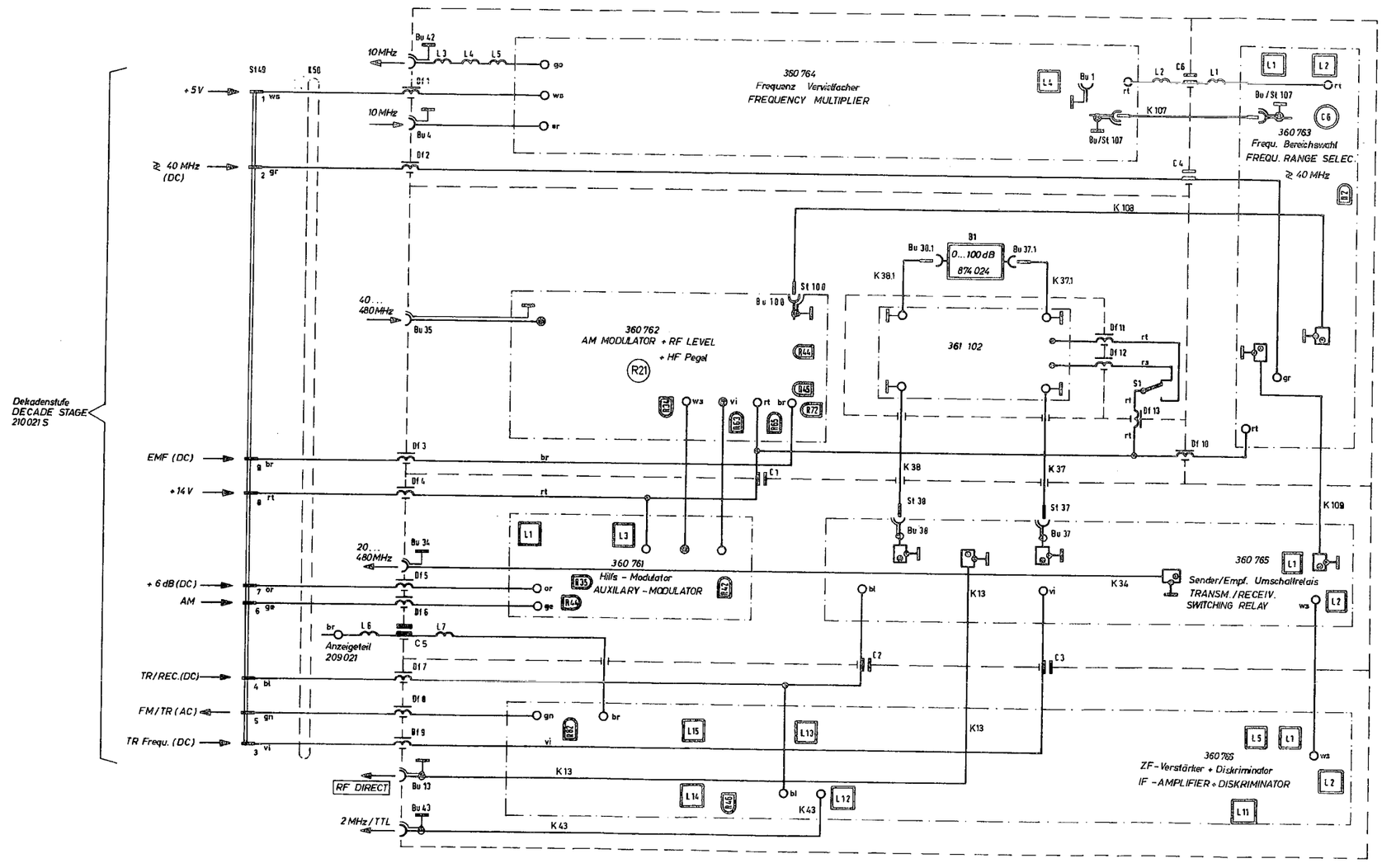
Issue	Alteration No.	Date	Name
-	0028.29	27.3.1980	Morasch

Adjustment and Test Procedure

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	f_{mod} Amplifier (360 766) Calibrate precisely the frequency deviation 20 kHz at f_{mod} = 1/10/20 KHz of the signal generator (4000) before the following procedure.					
	4000: 2 MHz, 2 V EMF, 0 dB , FM: Δf = 20 kHz	DF 8	f_{mod} = 1 kHz	R 82 →	1,00 V AC	
		"	" = 20 kHz	C 69 →	0,93 V AC	
			" 1 to 10 kHz	---	0,97.....1,03 V AC	V
			"10 to 20 kHz	---	0,9 .....1,1 V AC	V
		"	f_{mod} = 1 kHz	---	Distortion < 0,7% (CCITT weighted)	0.....%
	Squelch Test assembly as on sheet 5/7 Signal Generator 4000: 2 MHz, 2 V EMF Output attenuator 53 ... 68 dB Select and adjust SWEEP MODE	DF 8		R 18	10 to 13 V_{pp} (Squelch ON)	

Replacement for 230 025 A

4020 series
OUTPUT STAGE



sw BLACK	bl BLUE					norm.		Kö	Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	Ausgangsstufe OUTPUT-STAGE	230025 S Bl.1
br BROWN	vi VIOLET	04	9028.56	20.8.76	Eller	gepr.					
rt RED	gr GREY	03	9028.50	27.7.76	Eller	bearb.	28.9.76	Bichlm.			Typ: 4020
rs ROSE	ws WHITE	Ausg.	Ä-Mittlg.	Datum	Name		Datum	Name			
ge YELLOW	tr TRANSPARENT	ISS	MODIF.	DATE	NAME		DATE	NAME			
gn GREEN											

+14V = Sendermessung
TRANSMITTER - MEASURING

Senderfrequenzmessung = +14V
TRANSMITTER FREQU.MEASURING

360 765
460 765

360 766
460 766

ZF-Begrenzerverstärker
IF-LIMITER AMPLIFIER

ZF-DISKRIMINATOR

Frequenzgang/FREQUENCY RESPONSE (20kHz)

f_{mod} Verstärker
AMPLIFIER

U max
+2,5V bei 1,85 MHz

U_{max}
2,6V
bei 2,15 MHz

ca 200 kHz

ca 8V ~ 2MHz

ca 1,5V 2MHz

>1mV 2MHz

f_{mod} ± 20kHz Hub ≙ 1V$_{eff}$

Empfänger
Sender

sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

Ausg. ISS.	Ä-Mitlg. MODIF.	Datum DATE	Name NAME
03	9028.42	3.7.79	Eiler

	Datum DATE	Name NAME
norm.		
gepr.		
bearb.	20.9.78	Bchim.
1978		

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Ausgangsstufe
OUTPUT-STAGE

230 025 S Bl.2
Typ: 4020

360 761
(460 761)

A 1
CA 3028

OSCILLATOR

Hilfs-Modulator
AUXILARY MODULATOR

MOD. GRAD
AM DEPTH

HF-Pegel
RF-LEVEL

360 762
(460 762)

AM-MODULATOR

60....520 MHz
-3dBm

AM-NEGATIV

SG 38 23 N

SG 3823 N

SN 72558P

Linearisierung
LINEARIZATION

0...-10 dB Pegel / HF-LEVEL

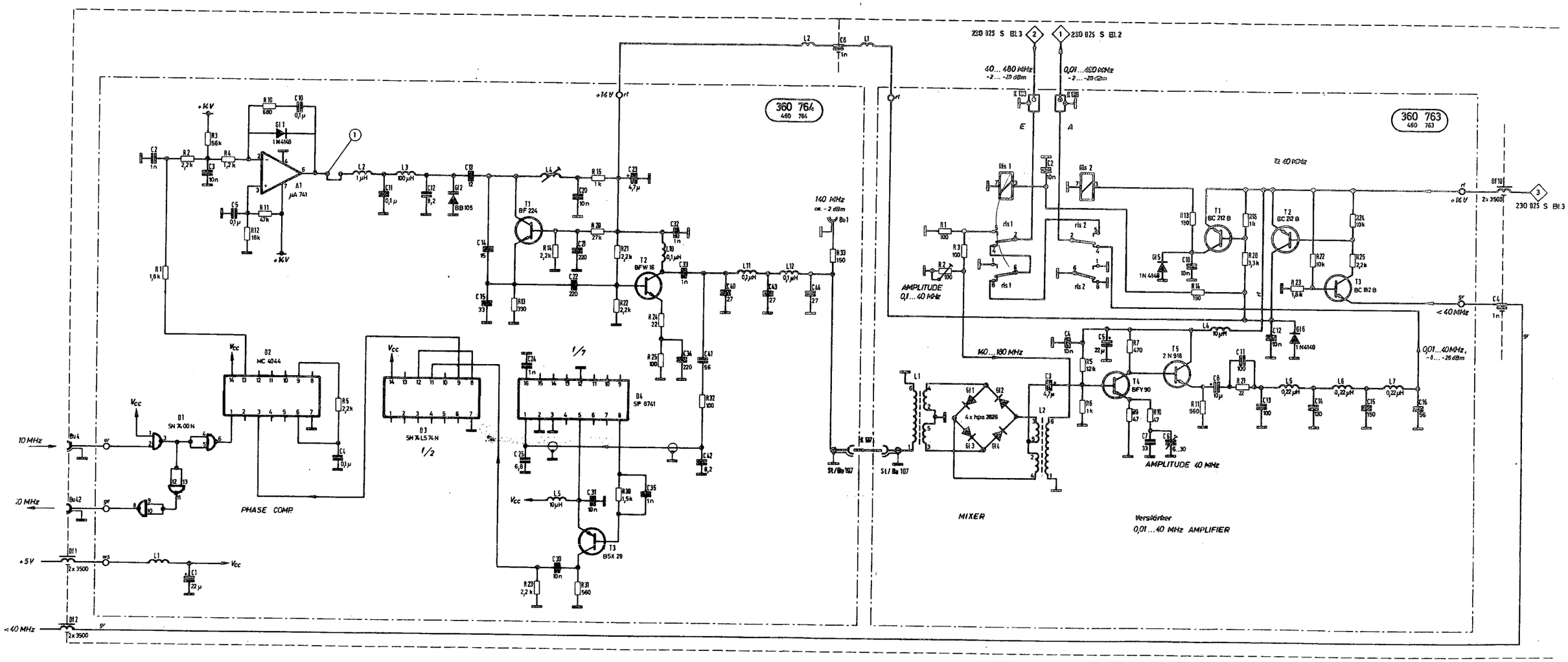
+ 2,24... + 9,5V ≙ 22,4....95 mV HF

-2...-20 dBm

230 025S Bl.4

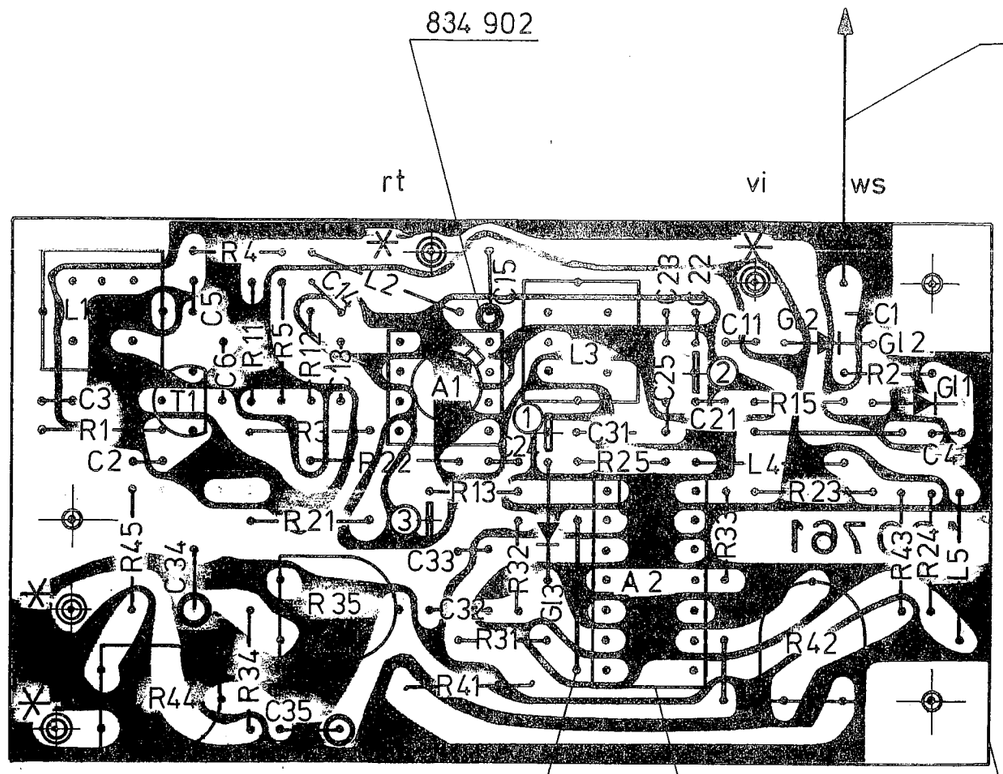
sw BLACK	bl BLUE			norm		Schlumberger o/s	Ausgangsstufe	230 025 S Bl. 3
br BROWN	vi VIOLET			gepr		Meßgerätebau u. Vertrieb GmbH	OUTPUTSTAGE	Typ 4020
rt RED	gr GREY			bearb	11.10.78 Ge.	8 München 46		
rs ROSE	ws WHITE							
ge YELLOW	tr TRANSPARENT							
gn GREEN								
		Ausg	A-Mittlg	Datum	Name	Datum	Name	
		ISS	MODIF	DATE	NAME	DATE	NAME	

390 55.



sw BLACK	bl BLUE	05				norm		Schlumberger o/s	Ausgangsstufe	230 025 S Bl. 4
br BROWN	vi VIOLET	04				gepr		Meßgerätebau u. Vertrieb GmbH	OUTPUT - STAGE	Typ : 4020
rt RED	gr GREY	03	9028.58	20.8.75	Eiler	bearb	28.9.78 Bichler	8 München 46		
rs ROSE	ws WHITE	Änderg.	A-Nummer	Datum	Name	FERT	Datum Name			
gb YELLOW	tr TRANSPARENT	ISS	INDEX	DATE	NAME		DATE NAME			
gn GREEN										

weich gelötet



834 902

385 230

1,5 +0,5 max. Überstand aller Lötenden

884 158 (4×)

786 009 (3×)

880 021 (3×)

834 900

460 761

= Farbpunkt

= Kontrollmaß

10			Rontei	Freimaß Toleranzen	Maßstab 21
09					
08					
07					
06			Werkstoff		
05					
04					
03	802889	5.12.78 Mo			
02	4028.127	27.11.74 Eiler	Oberfläche		
01	4028.111	24.10.74 Eiler			
Ausgabe	Änderung Mitteilung	Datum Name			

Schlumberger o/s

Meßgerätebau Vertriebsgesellschaft mbH

Bestückte Leiterplatte

360 761

Ersatz für

	Datum	Name
gez	1.2.74	LE P.
bearb		
gepr		

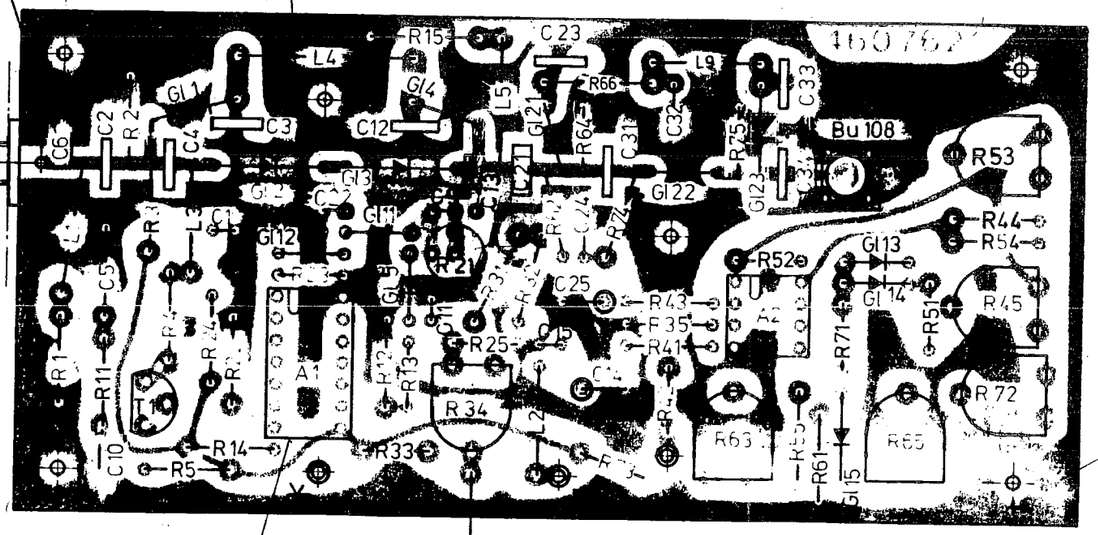
verw. in: 375 205/216 / 226

Gerät: 4010/4020

Schaltplanpositionierung ≙ 230 015 S / 025 S / 360 761 Sa

C6 stumpf aufgelötet

428 164 (2×)



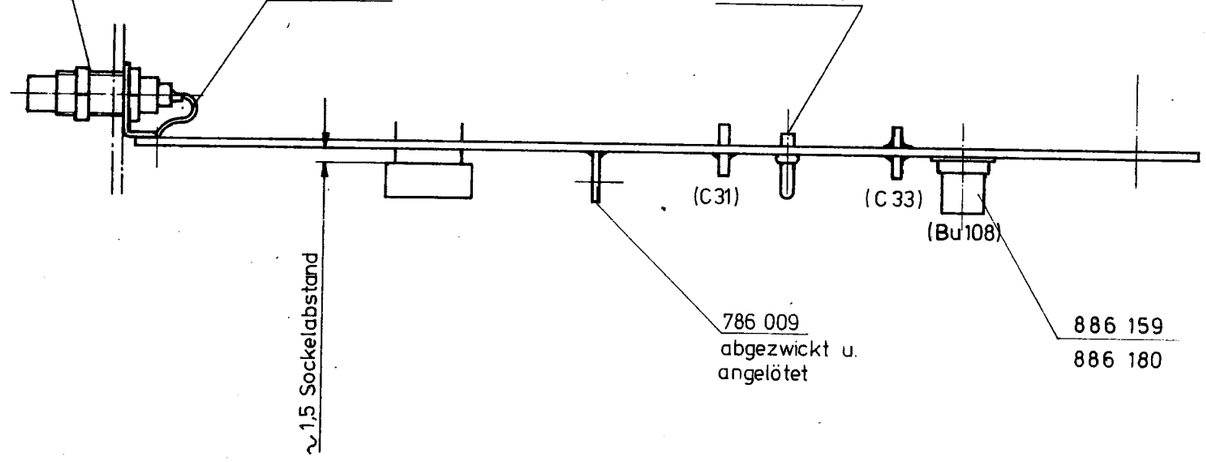
898 026

834 900

385 218

l = 30 mm

884 158 (3×)



786 009
abgezwickt u.
angelötet

886 159
886 180

✳ = Farbpunkt

⬭ = Kontrollmaß

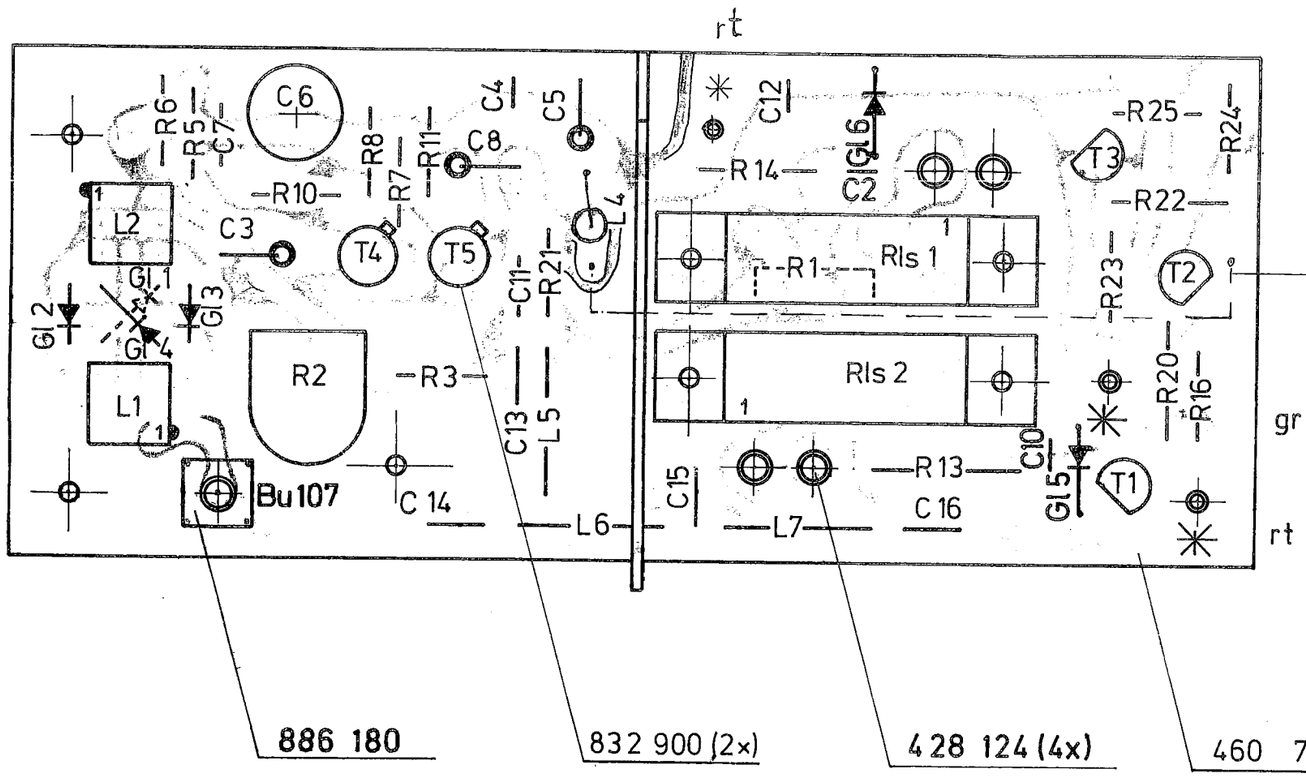
Schaltplanpositionierung ≙ 230 025 S
230 015 S / 360 762 Sa

verwendet in: 375 205/216/226

Gerät: 4010/4020

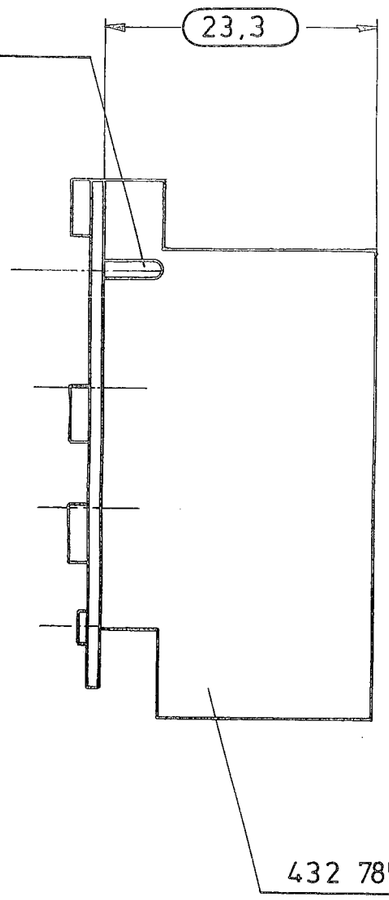
12 9028 50 27 7.78 Eiler Oberha		2:1	Schlumberger o/s
11 8026 89 5 12 78 Mo			Bestückte Leiterplatte
Änd. Mittg. Name	Datum 31.1.74 Name LE P		360 762

weich gelötet



884 158 (3x)

880 064 l = 60mm



✳ = Farbpunkt

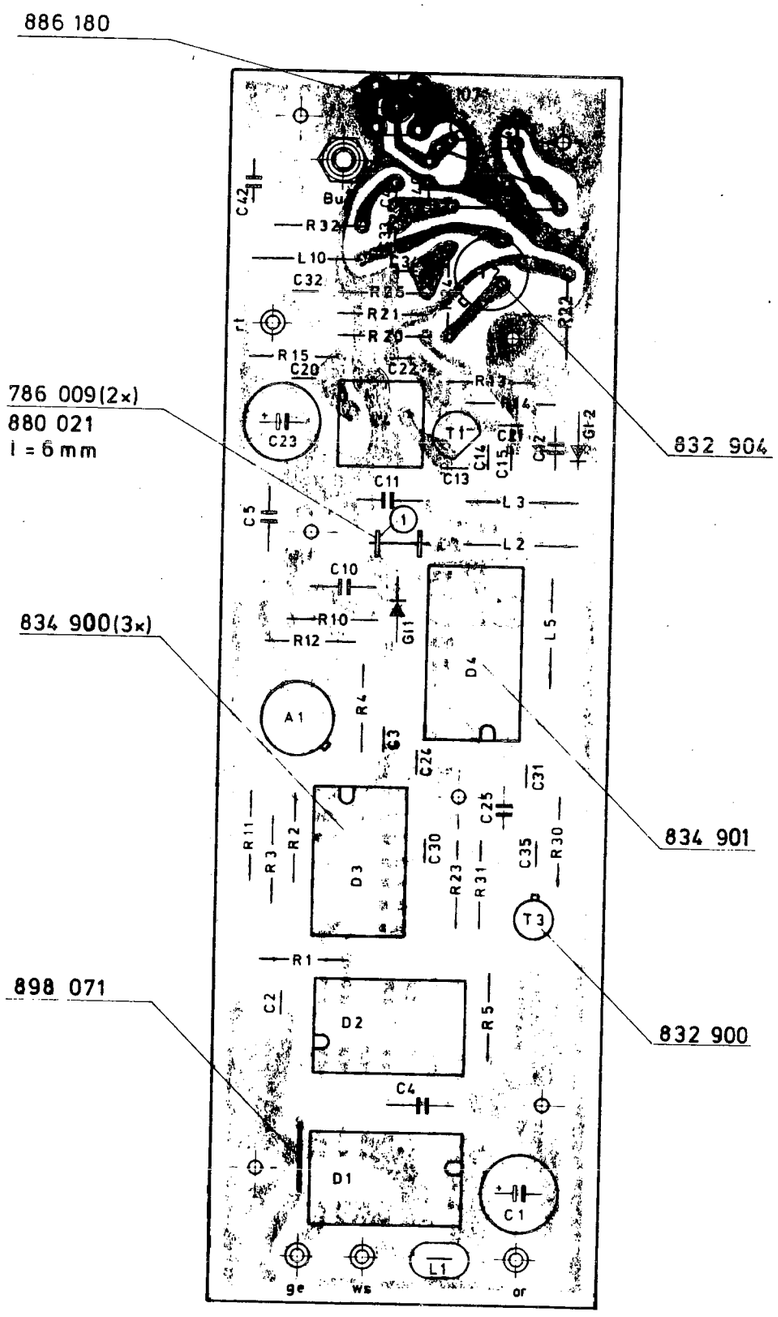
Kontrollmaß

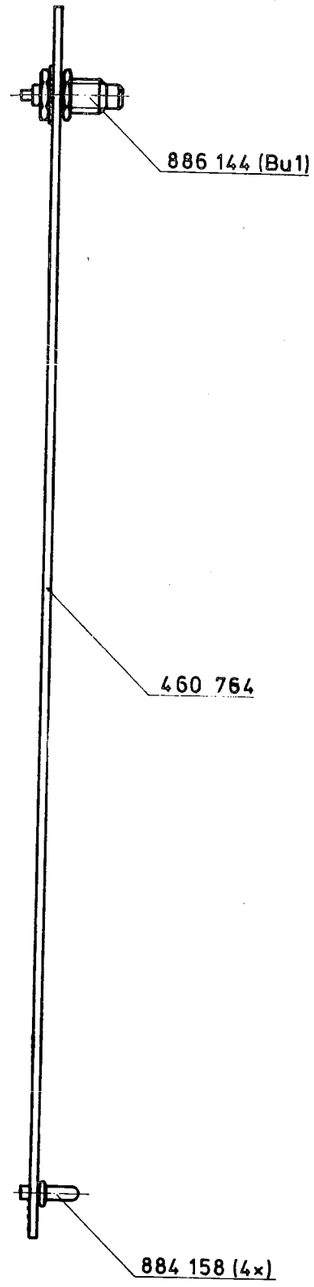
verwendet in: 375 205/216/226 Gerät: 4010/4020

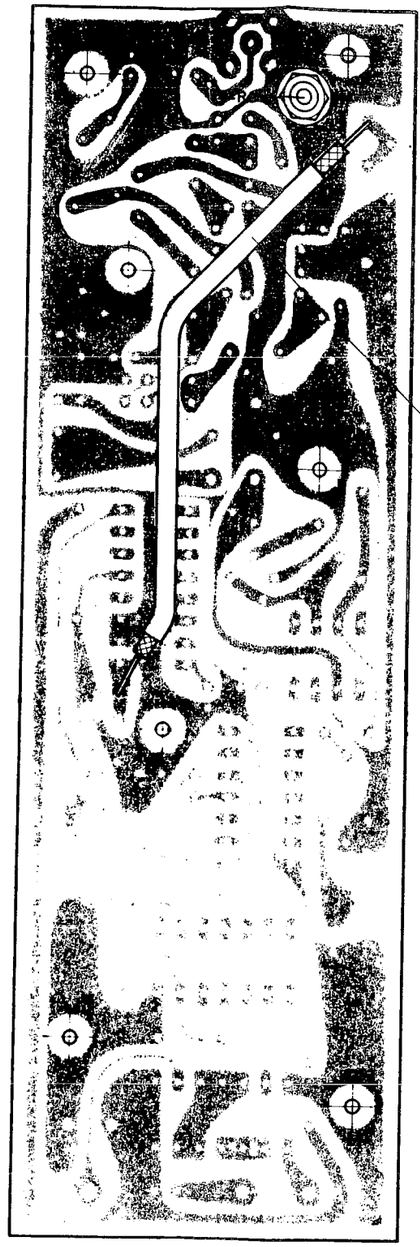
Schaltplanpositionierung ≙ 230 015 S/025 S / 360 763 Sa

2 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1		± 0,2	2:1	Schlumberger o/s
1 9028.58 20.8.79 Eiler		Datum / Name: 12.3.75 AE P; 13.3.75		Bestückte Leiterplatte
				360 763

weich gelötet







⬭ = Kontrollmaß

10				Rohteil	Freimaß-toleranzen	Maßstab	Schlumberger o/s	
09							Meßgerätebau u. Vertrieb GmbH	
08							8 München 45	
07	9028.58	20.8.79	Eiler	Werkstoff		2:1	Bestückte Leiterplatte	
06	9028.37	18.5.79	Eiler					
05	802889	5.12.78	Mo					
04	802870	25.7.78		Oberfläche			360 764	
03								
02								
01								
Ausgabe	Änderungsmitteilg	Datum	Name				Ersatz für	

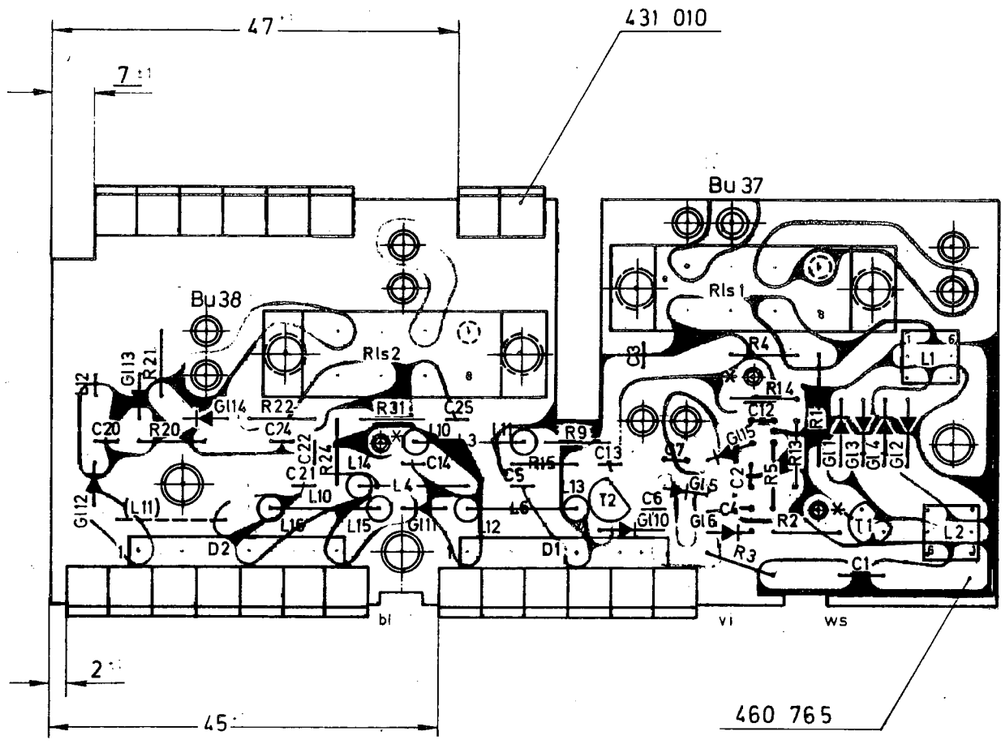
Diese Zeichnung ist unser Eigentum. Vervielfältigung, unbefugte Verwertung, Mitteilung an andere ist strafbar und schadenersatzpflichtig.

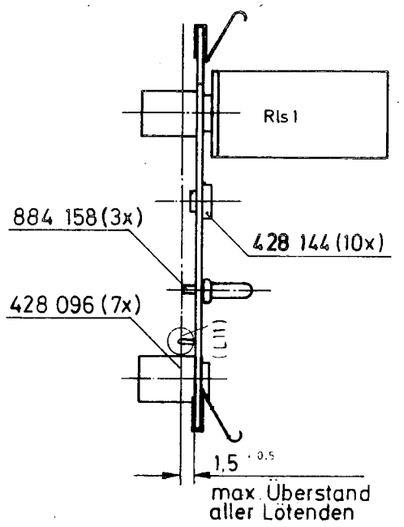
Schaltplanpositionierung ≙ 230 015S/025S / 360 764 Sa

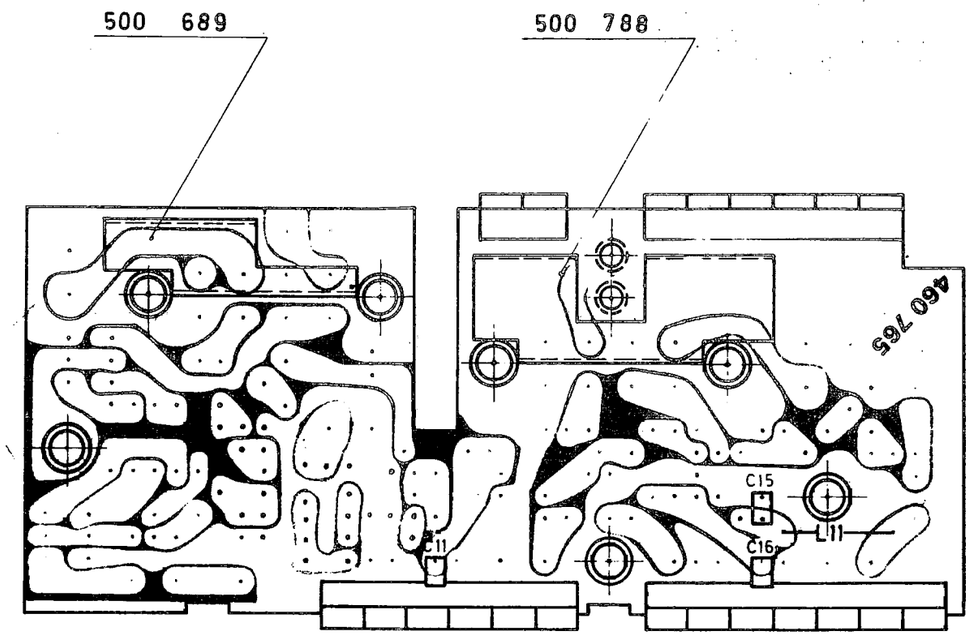
verwendet in: 375 205/ 216/ 226

Gerät: 4010 / 4020

weich gelötet







* = Farbpunkt

10	9028 42	3.7.79	Eiler			
09	8028 75	26 9 78	Eiler			
08	4028 47	23.6.76	Eiler			
07	5028 37	18 4 75	Eiler			
06	5028 22	25 3 75	Eiler			

	±	2.1	Schlumberger G S
			Bestückte Leiterplatte
25 3 75	EILER		360 765
2.4.75			

230 025 S
230 018 S
≙ 230 015 S / 360 765 Sa

375 226
375 205
: 375 216

4020 / 21 / 22
4710 A
erat: 4010

weich gelötet

880 162 ge
L = 95 mm

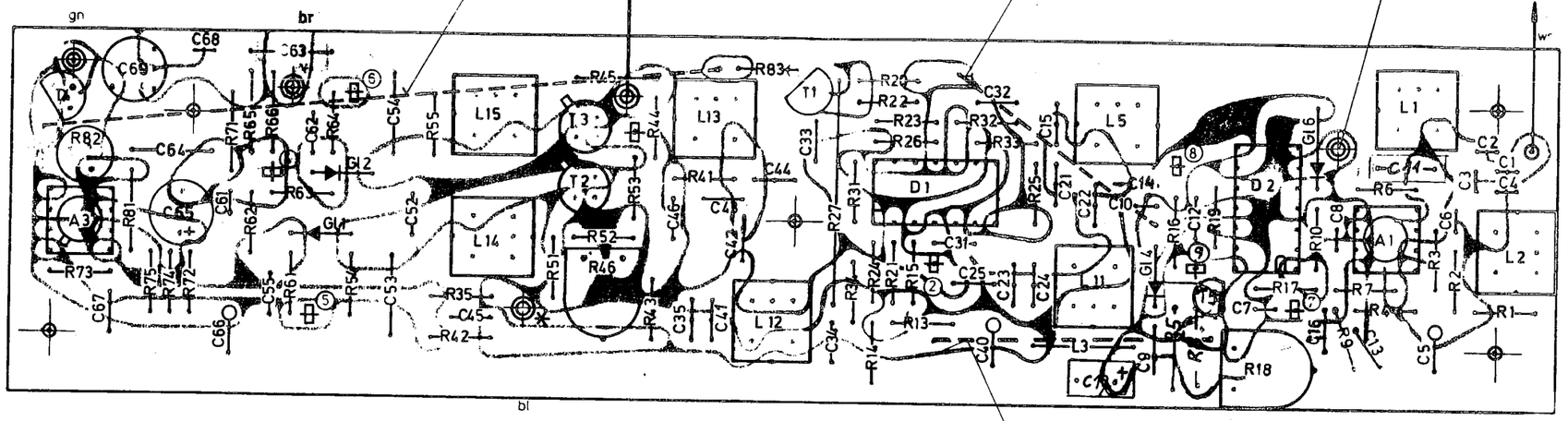
880 162 ge
L = 40 mm

(230 015 S)
Bu 43

(230 018 S)
Bu 43

385 230

460 766



884 158 (5x)

786 009 (9x)

880 162 ge
L = 40 mm

Kontrollmaß

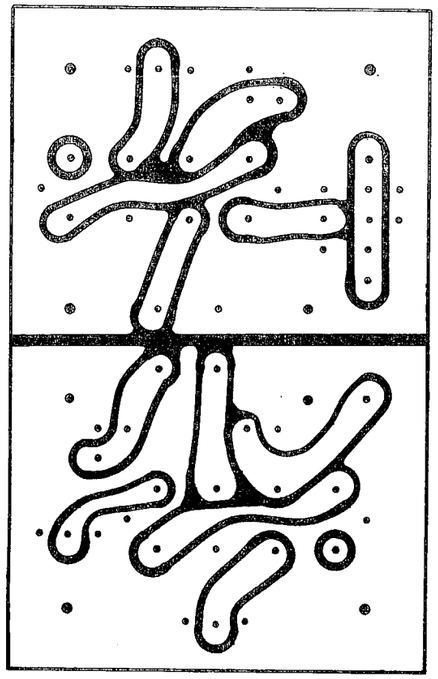
15 9028.20 7.79 Ka		0.2	1:1	Schlumberger a/s
14 802803 9.6.12.78 Mo				
13 [illegible]				Bestückte, Leiterplatte
12 802244 4.4.78 Ka				
11 7028.25 4.5.77 Ki.		1975	Name	360 766
Änd.-Ind. / Änderung		gez. 14.5.75	EILER	
		Maßst.		
		gepr.		

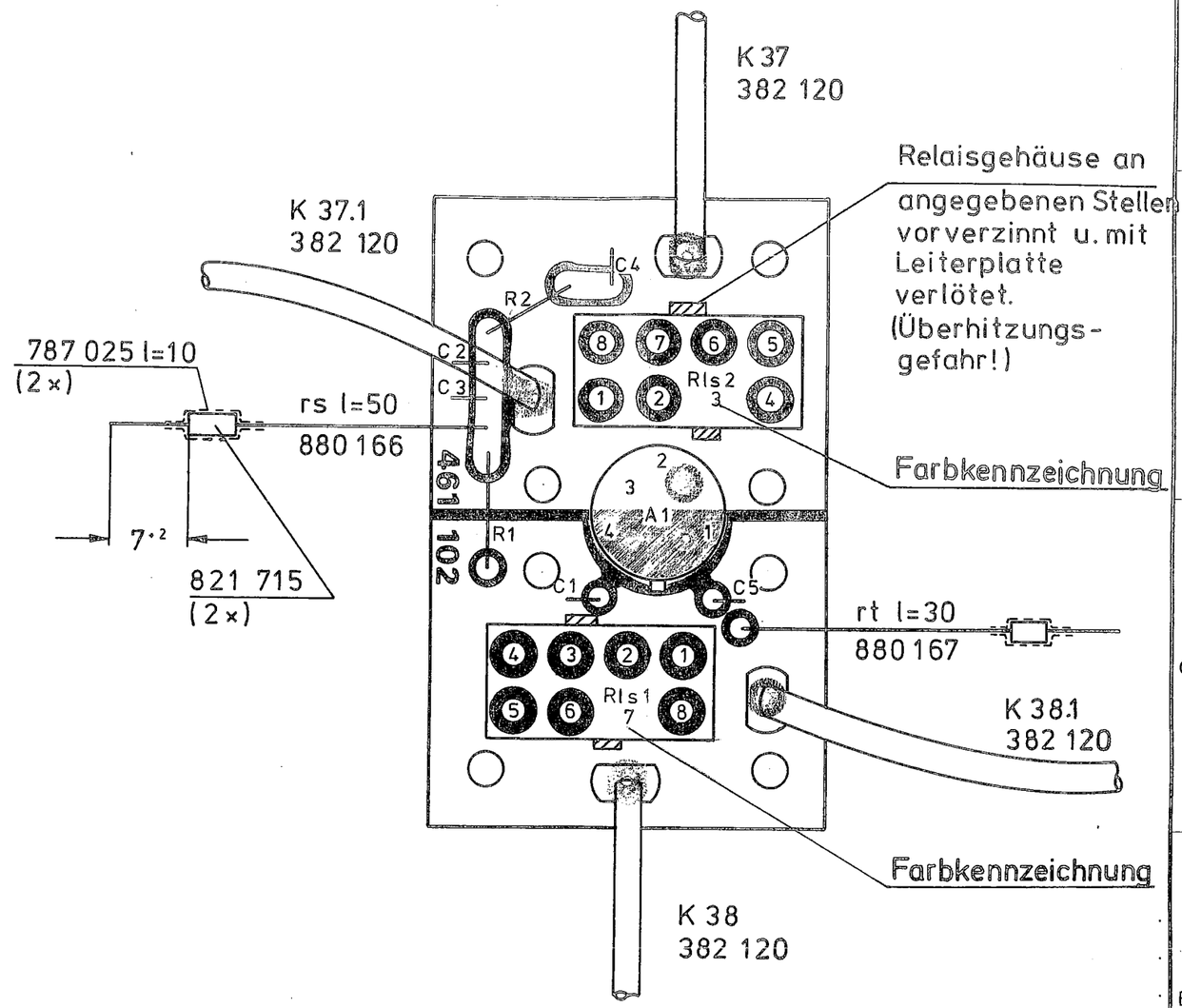
230 024 S
230 018 S / 230 025 S

Schaltplanpositionierung 230 015 S / 360 766 Sa

verwendet in: 375 216 / 375 205/225/162 Gerät 4010 / 4710A / 4028

weich gelötet





= Kontrollmaß

verw. in: 375 223

Schaltplanpositionierung ≙ 230 025 S

Gerät : 4020

Aus-gabe	Änd.-Mittlg	Datum	Name
03	9028.41	28.6.79	Eiler
02	7024.32		Le
01	8028.83	19.10.78	Gr

Richtlinie

Werkstoff

Oberfläche

Einmaß

Maßstab: 2:1

78 Datum Name

gez 19.10. R. Gerstner

gepr 19.10.

Ersatz für

Schlumberger o/s

Meßgerätebau u. Vertrieb GmbH

Bestückte Leiterplatte

361 102

(See block circuit diagram 102 820 B for total instrument)

An insulated pipe is inserted into the throughput coaxial to achieve a wide band, low impedance RF decoupling of the low reflection transmitter power to the rectifier diode. The fast rectification (provided by the AF feedback to the input capacity) permits demodulation of amplitude modulated signals. The symetrical design of the amplifier suppresses temperature influences. The level-dependant negative feedback of the output amplifier compensates the lack of linearity of the rectifier diode under small RF level conditions.

Schlumberger

Adjustment and Test Procedure

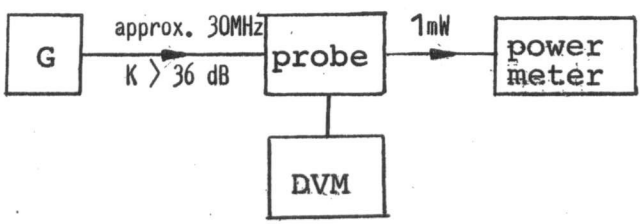
Issue	Alteration No.	Date	Name
03	9023.83	24.1.80	

4020 (4010) series from L 82851 Diode Probe

4901 from L 449

Replacement for: 229 006 A, 229 009 A

Sheet 1/2

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	1. Visual Inspection Solder joints, screws, coaxial internal conductors etc. (screw on cover not earlier than 5.)			R 3 → centre C 3 → Cmin		
Reflection test set e.g. ZWA 50 Ω precision termination	2. Reflection measurement Test set-up and procedure see operating instructions. If the VSWR values can only be maintained to 500 MHz, probe to be stamped: "Unsuitable for > 500 MHz, 4024, 4025"		100 ...1000 MHz	without test obj. (merely 50Ω termin.)	VSWR < 1,02 ≙ a_R > 40 dB	1,0.... .... dB
		Bu 10/11	100 ... 500 MHz	with probe +50 Ω termination	VSWR < 1,04 ≙ a_R > 34 dB	1,0.... .... dB
		Bu 10/11	800 ... 960 MHz	with probe + 50 Ω termination	VSWR < 1,06 ≙ a_R > 31 dB	1,0.... .... dB
+ 14 V power supply precision DVM	3. Zero and Linearity at Low Power + 14 V (± 4 mV) into DF 1 If +3 V not adjustable, compare DC values with serviceable probe. Caution: If required, only replace Gl 1, Gl2, Gl 3 together (Trio or quartet with same diode characteristic)	DF 2	DC	for R 3 → 0 mW R 3 →	U max. > +3,02 V U min. < +2,98 V	+ 3 ... V + 2,9 ... V
RF generator e.g. FS 30 or equivalent (1 mW calibration socket of hp power meter 335 A also possible)	 Accuracy requirement of 1 mW level is ± 0.2 dB		for > 3,02 V remove R 7 = 1,5 MΩ	for 1 mW R 3 → for 0 mW	+ 3,050 V 2,980 ...3,020 V Note: The difference to +3 is proportional to the non-linearity up to approx. 10 W	..... ok V
	4. Limiting the LM 308 Apply +14 V via 10 kΩ across A 1/pin 3 or 30 W RF	DF 2	DC	----------	U_- -11,3...11,8 V	11,..... V

Schlumberger

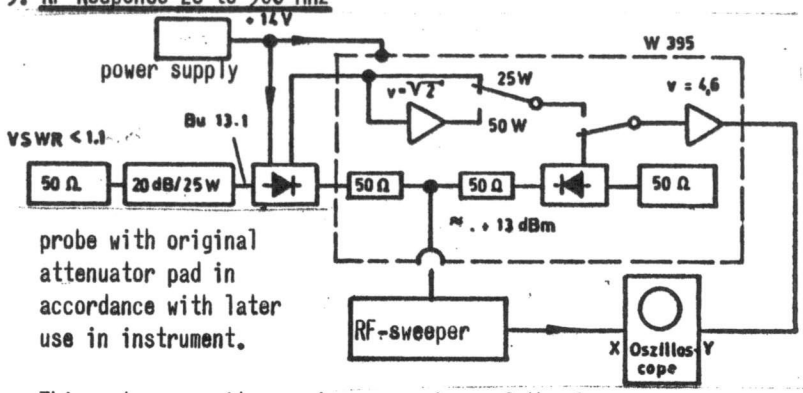
Adjustment and Test Procedure

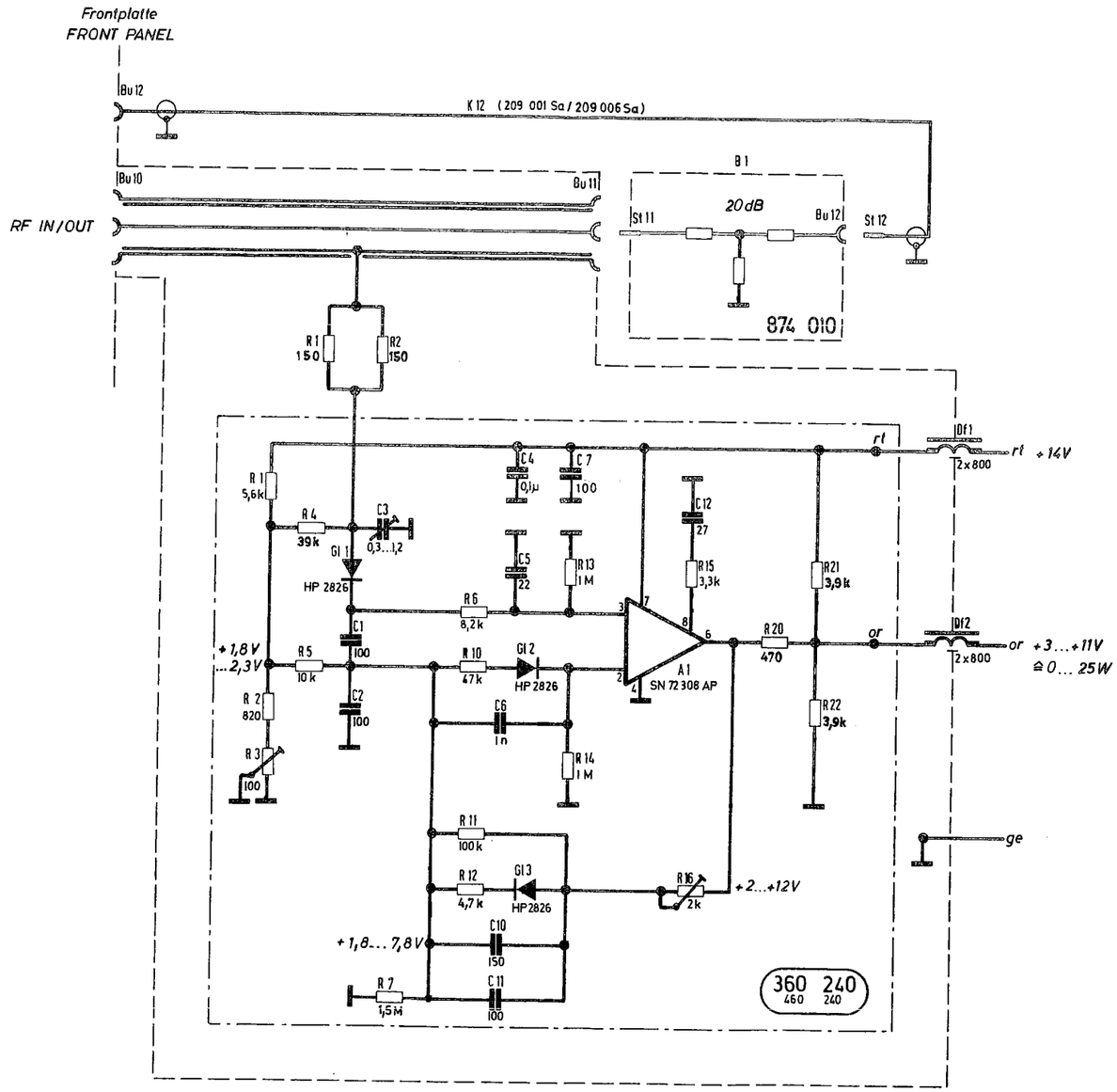
Issue	Alteration No.	Date	Name
03	9028, 93	24.1.80	

Replacement for: 229 006 A, 229 009 A

4020 (4010) series from L 82851 Diode Probe 4901 from L 449

Sheet 2/2

REQUIRED TEST EQUIPMENT	PROCEDURE	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
RF sweeper e.g. Wiltron 610 B (freq.limit < 1 dB) Oscilloscope Calibration aid W 395 with integral power splitter (hp 11667 A), 50 Ω termination (spinner 65 N50-O-11), reference probe with optimum frequency response special DC chopper DVM 14 V power supply	5. RF Response 20 to 960 MHz  probe with original attenuator pad in accordance with later use in instrument. This set-up permits precise comparison of the frequency response of a known probe with an unknown. Absolute calibration is of no use with this small RF level. The absolute deviation independant from frequency is compensated by a potentiometer control in W 395. The FET chopper provides alternate switching of both outputs at approx. 5 kHz, thus rendering the long-term drift of the complete test set-up unimportant. Since both probes have the same configuration, faulty measurements due to RF distortion, temperature fluctuations, VSWR error etc. are compensated by initial approximation. The mechanical balance of both probes to the power splitter (same N-N adapter) is important for measurement accuracy, the requirement being precise calibration of the reference probe in a special test set-up. The test set-up can be switched by the push/pull switch on the potentiometer 25 W (pressed) to 50 W (pulled) probe power rating.	20 to 960 MHz swept, unmodulated, sweep-time approx. 0.01 sec. With poor frequency response from 800 to 960 MHz stamp probe: "Unsuitable for > 500 MHz, 4024, 4025" The cause can be in the probe or in the power attenuation pad. Ensure that a sufficient number of combinations result which are also suitable for 960 MHz.	RF = approx. 13dBm (=+7 dBm on probe) W 395 pot C 3	ΔU → Min. (wideband) 20 to 200 MHz ΔU < 2,5 mV (≙ ΔP = 1%) 200 to 500 MHz ΔU < 5 mV (≙ ΔP = 2%) 800 to 960 MHz ΔU < 15 mV (≙ ΔP = 6%)	



sw BLACK	bl BLUE
br BROWN	vi VIOLET
rt RED	gr GREY
rs ROSE	ws WHITE
ge YELLOW	tr TRANSPARENT
gn GREEN	

Ausg. ISS.	Ä.-Mittlg. MODIF.	Datum DATE	Name NAME
04	8028.19	3.2.78	Kr.
03	7028.68	27.10.77	Wn
1976			

norm.			
gepr.			
bearb.	16.3.76		Kr.
	Datum DATE		Name NAME

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Diodenmeßkopf
DIODE PROBE

229 006 S

Typ: 4010/4010A/4011/4011S/4710A

weich gelötet

431 010
weich gelötet

21,5 +0,5

880 167
l = 30 mm
Df 1
rt

880 165
l = 20 mm
or
Df 2

880 021

460 240

428 081 (2x)

C7 C3 C6 C4 A1 R1 R5 R4 R6 G11 C1 R10 G12 R15 R21 R2 C2 C10 R12 R11 G13 C11 R7 R16 R13 C5 R14 C12 R20 R22 R3

(C3) (R4) (G1) (C4)

Gl1 und R4 so kurz
wie möglich angelötet

Kontrollmaß

10					Rohteil	Freimaß toleranziert	Maßstab	Schlumberger o/s	
09								Meßgerätebau u. Vertrieb GmbH	
08								8 München 46	
07							4:1		
06					Werkstoff			Bestückte Leiterplatte	
05									
04	8028.19	1.2.78	Ke						
03	7049.15	10.8.77	Eiler						
02	6049.32	10.9.76	Ke		Oberfläche	1976	Datum	Name	360 240
01	6028.46	16.6.76	Eiler			gez	16.6.	EILER	
Ausgabe	Änderg Mitteig	Datum	Name			bearb		Ke	
						gepr			Ersatz für

Schaltplanpositionierung ≙ 229 006 S verwendet in: 300 435 Gerät: 4010 / 4901

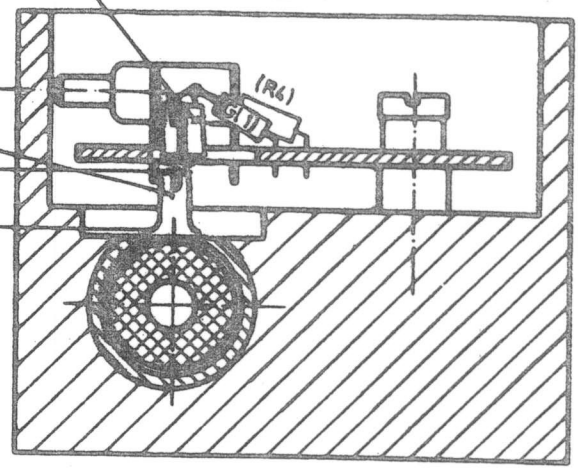
verwendet in: 229 006 | Gerät: 4010 / 4901

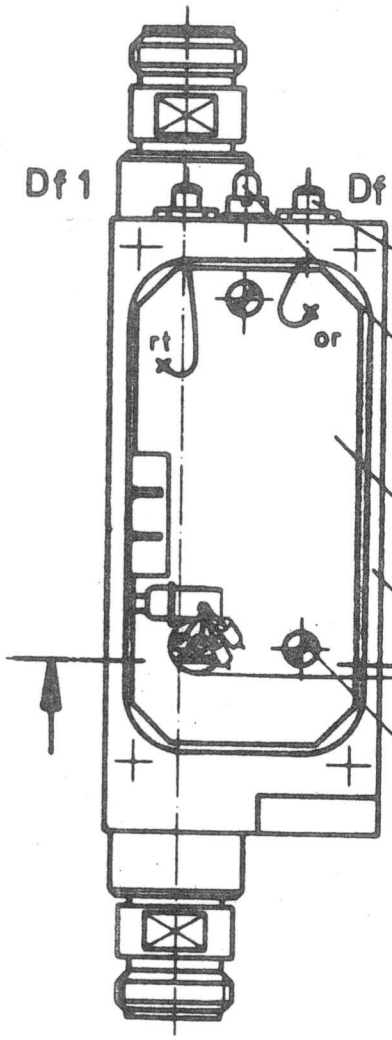
800 154 (2x) R1 / R2
Widerstand und Diode so kurz wie möglich angelötet

weich gelötet

786 009
abgewinkelt und gekürzt

M 2:1



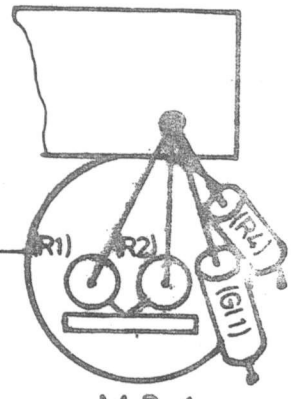


816 044 (2x)

786 004
M3x4 DIN 84
701 143
J 3,2 DIN 6797
706 105

360 240

300 430



M 2:1

M2,5 x 8 DIN 84
701 334
J 2,7 DIN 67 97
706 106
2x

Schaltplanpositionierung ≙ 229 006 S

09				Rohteil
08				
07				
06				
05				Werkstoff
04				
03	8947.2	20.4.78	Eiler	
02	8028.2	13.2.78	Mo	
01	4088.4	14.6.76	Eiler	Oberfläche
-	8028.2	16.3.76		
Aus-gabe	Änderung	Datum	Name	

Freimaß-toleranzen: ±0,2

Maßstab: 1:1 (M 2:1)

	Datum	Name
gez	30.1.78	
beerb		

Schlumberger o/s
Meßgerätebau u. Vertrieb GmbH
8 München 46

Diodenmeßkopf
Typ: 4010 / 4901

300 435

(see block circuit diagram 102 820 B for total instrument)

Due to the oscillator frequency, changing as a function of temperature the complete oscillator including the buffer amplifier and the temperature control circuit has to be accommodated in an oven ensuring constant temperature. Especially the crystal must be located thermally as close as possible to the heating transistor T 1 since this is the component most sensitive to temperatures in all the circuitry. The temperature resistances between the heater, sensor, outer wall, and the crystal must be calibrated so that a more or less balanced heat link results as far as this is possible with the relatively high thermal resistance of the crystal.

The NTC resistor R 1 is part of a resistance bridge upstream of a differential amplifier A 1 through which the heating current is controlled through T 1. The heating current is instantly corrected for even a slight change of temperature of R 1 in 360 770 to retrieve the balance of the resistance bridge. T 5 serves to limit the current when heating up (approx. 0.85 A). T 4 disables the heating current should no supply voltage be applied to A 1. T 1 would otherwise draw full current up to thermal death of the circuit.

The output signal of the oscillator is buffered through D 1 so that a change of load at both Bu 3 and Bu 2 influences the oscillator frequency by $<10^{-9}$. A back-acting location of phase at the oscillator due to external influences alters the oscillator frequency in inverse proportion to the operational Q of the oscillator.

Coarse tuning (to a few tenths of a Hertz) is carried out by means of trimmer C 12, fine tuning (to a few hundredths of a Hertz) involving a change of varactor voltage (Gl 1) is achieved by means of R 1 in 360 767. A change in frequency due to aging can be corrected up to 10 Hz using R 1. If optimum frequency stability is needed, it is recommended never to switch off the oscillator,

since renewed aging always occurs every time operation is interrupted, all the more so, the longer the crystal is out of circuit. In addition, shock and impact are to be avoided. The oscillator can be referenced to an external frequency through Bu 2 as long as this is not more than approx. 7 Hz off the oscillator frequency. In this case, the oscillator crystal acts as a filter.

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	9028.5	8.1.79	Steub
		2.11.77	Urban

4020 (4010) series
10 MHz Crystal Oscillator

214 022 A

Replacement for

1/4 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	1. Heating current					
	Apply ammeter between C1 and Df1					
Ammeter	Disconnect red + 14V lead from C16, apply + 5V	Ammeter	DC	-------	< 100 mA	
	Insert red lead (apply + 14V)	"	DC	-------	800mA....1000mA	
	Leave ammeter on during the following measurements:					
Oscilloscope	2. Oscillator					
		MP 1	approx.10MHz	R 14	2.5 V_{p-p} (min. 2 V_{p-p})	
	Set oscilloscope to DC coupled to D1/Pin1	MP 1	DC	------	Valley < +0.5 V Peak > +2.2 V	
		R16/R20	approx.10MHz	------	0.6 ... 0.9 V_{p-p}	
	3. Output buffer amplifier					
		Bu 4	approx.10MHz	-------	TTL	
	Terminate Bu 3 with 50 Ω	Bu 3	approx.10MHz	-------	0.8...1.5 V_{p-p}	
	4. Synchronizer buffer amplifier					
	10 MHz; 0.6 V_{p-p} across Bu 2	C10/R10	10 MHz	-------	Valley < +0.5 V Peak > +2.2 V	
	Test at white lead/C 2	C 2	"	-------	> 2.5 V_{p-p} (amplitude shiver can be ignored)	

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		8.11.72	Erbes

4020 (4010) series

10 MHz Crystal Oscillator

214 022 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
DVM	5. Varactor voltage Turn R1 from stop to stop	Df 2	DC	———	$\Delta V > 2$ V between +5.6 and +8.8V	...
	Set R1 to U_{min} + 1 V					
	6. Checking heating current Heating current must be < 750 mA after 6 minutes.running.					
Ammeter		Ammeter	DC	———	750 mA	
Standard,oscilloscope, synthesizer	7. Fine tuning frequency Synchronize a 10MHz synthesizer (1Hz resolution) with a standard frequency (stability better than 10^{-8}). Use synthesizer output signal to externally trigger the oscilloscope. Connect oscilloscope to Bu 3 Fully turn up trimmer C 12 as for as it will go. Offset the synthesizer until the scope display freezes.					
	$f_{synth.}$ -10 MHz -> 40 = Δf	Bu 3	10 MHz + Δf	C 12	$\Delta f > 40$ Hz	

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
		2.11.72	Kraus

4020 (4010) series
10 MHz Crystal Oscillator

214 022 A

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Return C 12 as far as it will go and offset synthesizer to again freeze the oscilloscope display.					
	10 MHz - $f_{synth.}$ > 40 Hz = Δf	Bu 3	10MHz - Δf	C 12	Δf > 40 Hz	
	Return synthesizer to precisely 10MHz and more or less freeze the display using C12.	"	10MHz $\pm\Delta f$	C 12	Δf 0	
	R 1 to anti-clockwise stop	"	10MHz - Δf	R 1	Δf > 8 Hz	
	R 1 to clockwise stop	"	10MHz + Δf	R 1	Δf > 8 Hz	
	Set R 1 to freeze display	"	10MHz $\pm\Delta f$	R 1	$\Delta f \rightarrow 0$	
	If tuning range can not be established, change C 14 (tubular C). Reference value: approx. 1 pF/10Hz					
DVM	8. Synch. test	MP 2	DC	------	< + 0.4 V	
	Apply synthesizer through distributor to Bu 2 and ext.					
	Apply scope trigger input					
	Apply 10MHz less 7 Hz to Bu 2/0.6 V p-p	Bu 3	10 MHz - 7 Hz	------	Display must freeze (no shiver)	
	To test, reduce frequency until display rolls.					
	Apply 10MHz + 7 Hz to Bu 2/0.6 V_{p-p}	Bu 3	10 MHz + 7 Hz	------	Display must freeze (no shiver)	
	By way of test, increase frequency until display rolls.					

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
01	9012.5	8.4.75	X

4020 (4010) series
10 MHz Crystal Oscillator

214 022 A

Replacement for

4/4 Sheet

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Temperature gauge	9. <u>Oven temperature</u> Apply temperature sensor directly alongside T 1 on mounting plate					
	At R 4 = 2 kΩ	(T 1)	------	-------	73°C ± 4°C	
	At R 4 = 2.49 kΩ	(T 1)	------	-------	67°C ± 4°C	
	10. Reassemble the oscillator chassis, solder the supply leads an note date on the chassis Apply 8 weeks minimum aging time.					
Frequency Difference Meter (Tracor) and XY Recorder	11. <u>Medium frequency stability</u> Apply voltage to test set up and the corresponding test object through a mains voltage stabilizer. Plot for 1 hour in range 10^{-8}/cm at 10 min/cm chart speed. Take a 10% sample from production batch for a frequency stability record overnight (20 min/cm).	Bu 3	------	-------	Transient frequency peaks $< \pm 4 \cdot 10^{-9}$	
	12. <u>Final Test</u> Plot temperature coefficient against ΔT = 40°C in oven or cabinet.	Bu 3	-------	-------	TK $< 15 \cdot 10^{-8}$/40 K Aging $< -5 \cdot 10^{-9}$/ 16 h	
	13. After 3 hours turn-on time at room temperature turn R 1 to mid position	Bu 3	10 MHz	C 12	10 MHz accuracy $\pm 3 \cdot 10^{-8}$	

300 516

10MHz-OSCILLATOR

FACT.ADJ.

BUFFER AMPLIFIER

VARACTOR BIAS

TEMPERATURE CONTROL ($T_{th} \approx 70°C$ AT R4=21k)

BUFFER AMPLIFIER

D1 SN74LS04N

TO 204 022S / 204 023S (360 002 / 360 940)

+5V

+14V

Df1 2x800

Df4 2x800

10MHz TTL

10MHz >0dBm

EXT.SYNC. 0,6Vpp IN TO>1kΩ

+5V

≈2...2,5Vpp / 10MHz

2,5...4,5Vpp / 10MHz

VARACTOR BIAS

+8...8,8V

+1,3...1,5V

ca +4,3V

ca +6,4...8,5V

Nur bei AT Q1: 853 047 (THOMSON-CSF) ONLY

360 770 460 770

360 767 460 767

360 768 460 768

204 022S/204 023S Bu23

* Siehe Tabelle SEE TABLE

bei Q1 = Metallquarz		bei Q1 = Glasquarz	ab L 1728
Umkehrpunkt INVERSION TEMP.	R4	* R4=2,1k	Q1 = Glasquarz R4 = 2,1 k
60 ... 61,5°C	2,67 k		
61,6 ... 65,0°C	2,49 k		
65,1 ... 67,0°C	2,37 k		
67,1 ... 68,5°C	2,21 k		
68,6 ... 70,5°C	2,10 k		

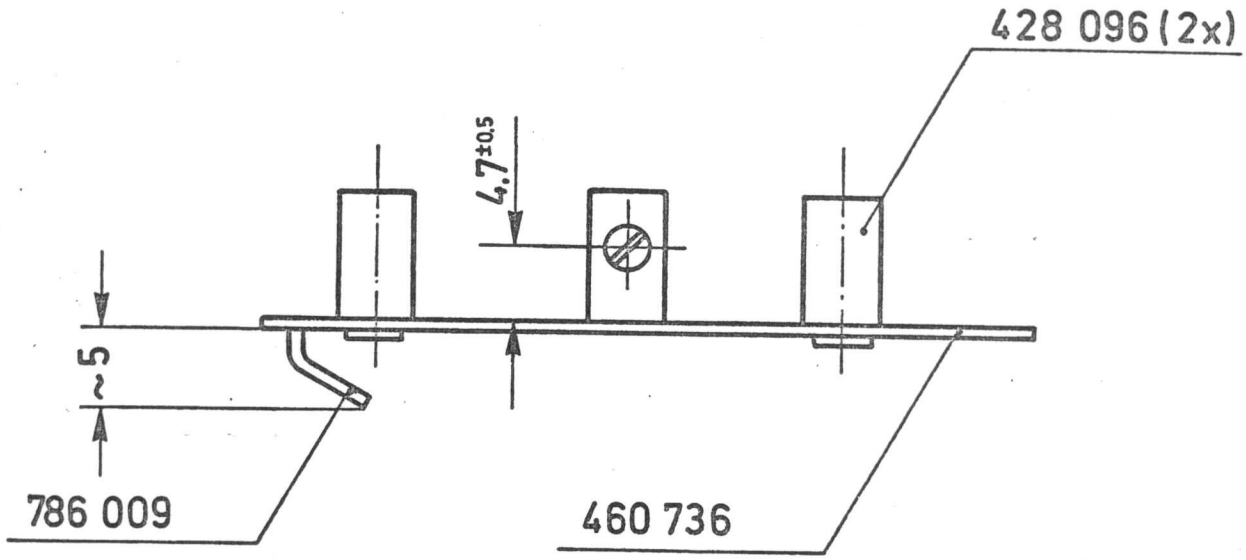
sw BLACK	bl BLUE						norm.				
br BROWN	vi VIOLET	10	9096.80	12.7.79	Mo		gepr				
rt RED	gr GREY	09	9096.12	17.1.79	Eiler		bearb	27.7.77			
rs ROSE	ws WHITE	Ausg.	Ä-Mittlg.	Datum	Name			Datum	Name	Schlumberger o/s Meßgerätebau u. Vertrieb GmbH 8 München 46	10MHz CRYSTAL OSCILLATOR
ge YELLOW	tr TRANSPARENT	ISS.	MODIF	DATE	NAME			DATE	NAME		
gn GREEN											

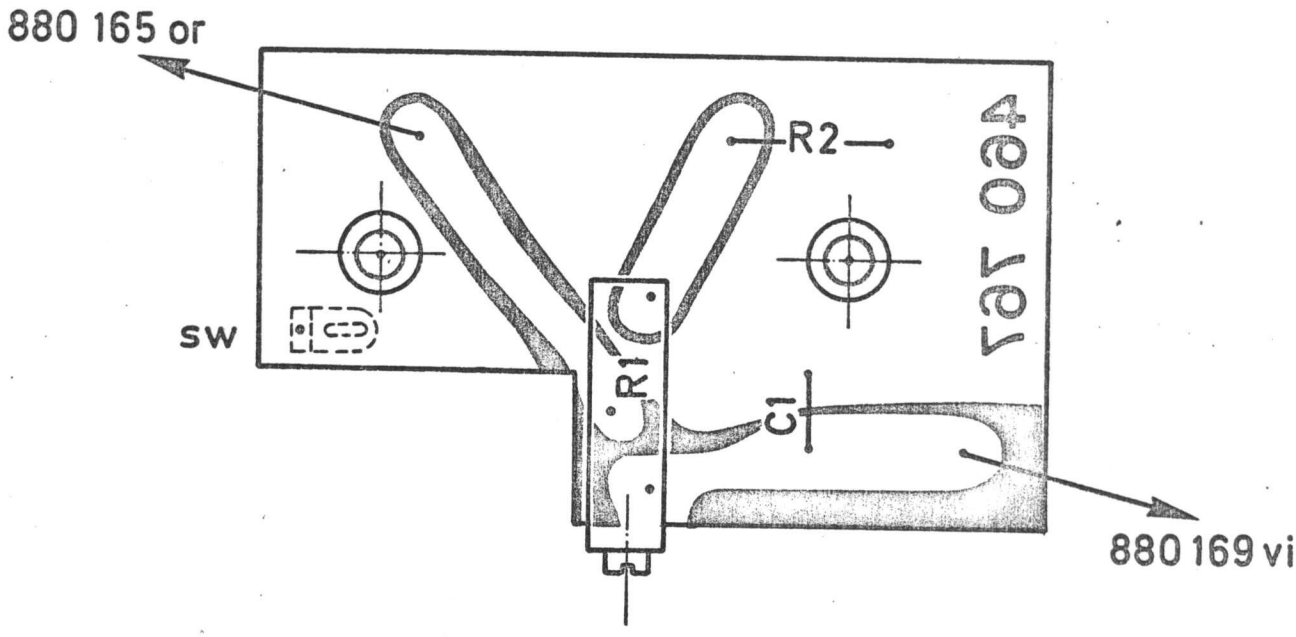
214 022 S

Typ: 4010/4011/4710

verwendet in: 375 222	Gerät: 4010

weich gelötet

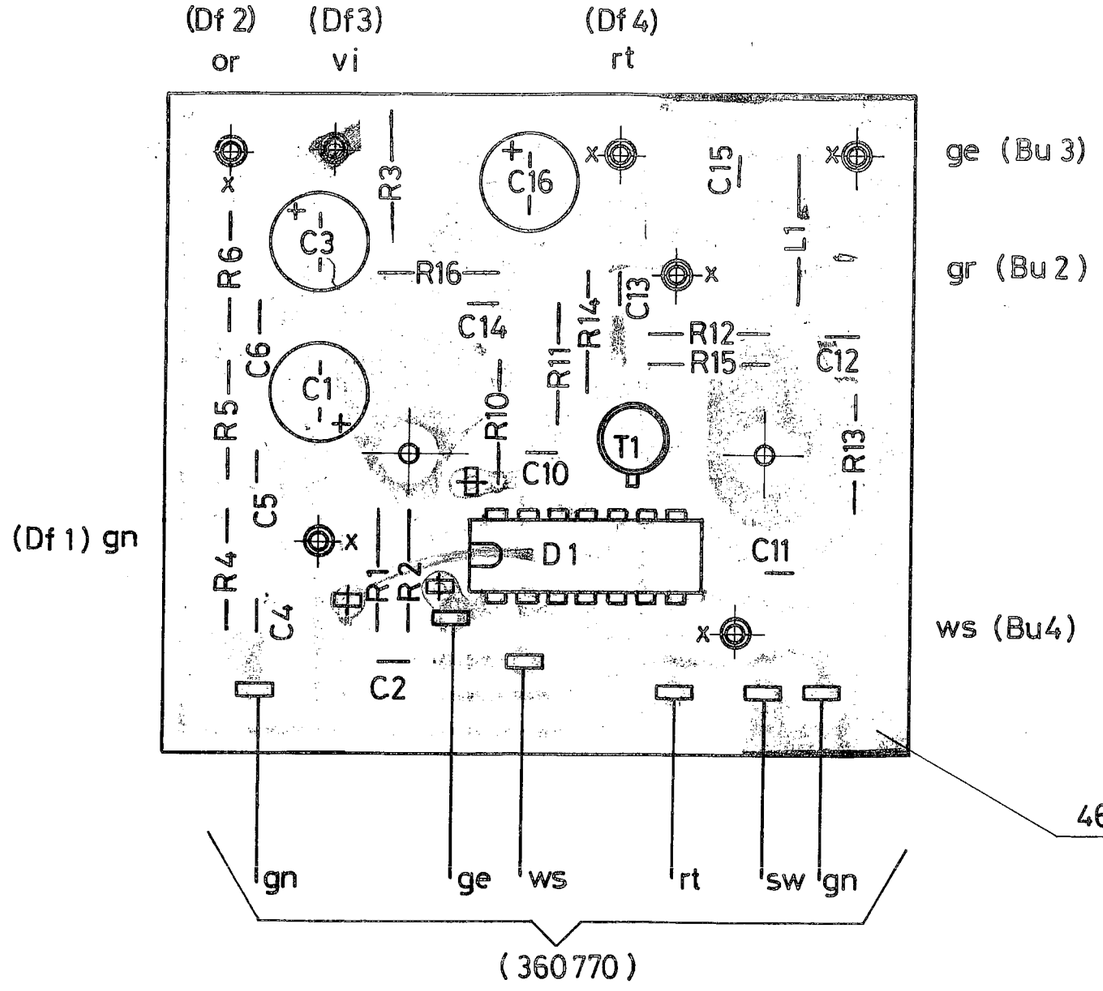


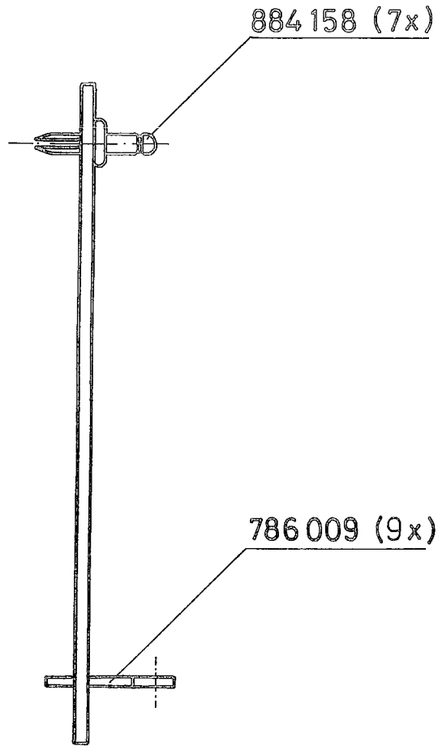


Schaltplanpositionierung ≙ 214 022 Sa / 360 767 Sa

09				Rohteil	Freimaß-toleranzen	Maßstab	Schlumberger o/s		
08							Meßgerätebau u. Vertrieb GmbH, München 45		
07									
06									
05				Werkstoff	—	2 : 1	Bestückte Leiterplatte		
04									
03									
02									
01	9028.89	12.12.79	Eiler	Oberfläche	1979	Datum	Name		
						12.12.	EILER	360 767	
Änd.-Index	Änderung Mittg.	Datum	Name		Prüfer				

weich gelötet





x = Farbpunkt

verwendet in: 375 222

Schaltplanpositionierung: 214022S / 360768Sa

4020

Gerät: 4010 / 4011 / 4710

802890 8.12.78 Mo
8028.11 18.1.78 Eiler
7028.47 27.7.77 Kn

	2:1	Schlumberger o/s
		Bestückte Leiterplatte
1977 26.7 Knobloch 27.7.		360 768

880 021 / l = 65 mm
889 035 / l = 40 mm

24,2 — 24,2

Markierungsstrich an Masse

L1

(Q1)

C12 · C14 · C13 · C10 · R11 · L1 · C3 · C15 · C16 · T1 · T4 · T5 · C2 · R32 · R33 · R34 · R31 · R24 · R4 · C5 · C6 · R1 · C1 · C21 · Gl 2 · R10 · R20 · R6 · R5 · A1 · R3 · R13 · R15 · R16 · R25 · T3 · R26 · R12 · C11 · R14 · C23

E { ws / (T1) { br / B } l = 70 mm (2 x)

(R1) { sw / sw }

abhängig von Q1
siehe 300 515

gn	sw	rt	ws	ge	gn
l = 110 mm	l = 85 mm	l = 85 mm	l = 85 mm	l = 85 mm	l = 85 mm
880 001 / 889 016		880 001 / 889 019		880 001 / 889 017	880 001 / 889 018

(360 768)
(361 040)

4,5 +0,2

Löhlehre verwenden

C12

426 128
geklebt mit Technicoll

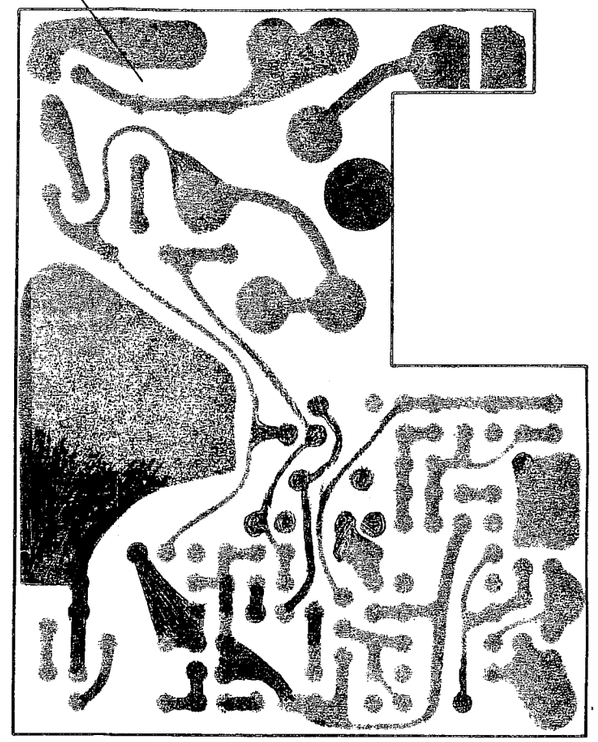
786 009 (2 x)

440 007 (5 x)

2,5 · 1 · 10

max. Bauteilhöhe

460 770



weich gelötet

786 043 (17 x) unter
R5 / R6 / R10 / R15
R2 / R1 / R21 / R31
R32 / R33 / R34 / R16
R25 / R26 / R3 / R13
R12

6 ± 1

889 035 (2 x)
l = 5 mm

880 021
l = 20 mm

880 021
l = 25 mm

= Kontrollmaß

10	9020.12	20.2.79		
09				
08				
07				
06				
05				
12				
11	9096.80	12.7.79	Mo	
Aus-gabe	Ändg.-Mittlg	Datum	Name	

Rohteil
Werkstoff
Oberfläche

Freimaß-toleranzen

Maßstab 2:1

Schlumberger o/s
Meßgerätebau u Vertrieb GmbH
8 München 46

Bestückte Leiterplatte

360 770

Ersatz für

	Datum	Name
1977		
gez	28.3.77	Kringelis
bearb	29.3.	
gepr		

Schaltplanpositionierung ≙ 214 022 S / 360 770 Sa

verwendet in: 300 515

Gerät: 4010/4011/4710/6900

(See block circuit diagram 102 820 B for total instrument)

On AC power supply 4 primary windings of the mains transformer are connected to a voltage selector switch in accordance with the incoming mains voltage. The secondary voltages are rectified and stabilized by conventional means, current limiting being of the "fold back" type with heavily reduced maximum current under short circuit conditions. The unstabilized +8 V voltage serves to supply the external channel selector. The fusible wiresafeguard is located in the decade stage.

On external 12 V battery operation the battery voltage is made use of through a buffer diode directly as the upper voltage of the +5 V control circuit. For the +14 V control circuit the battery voltage is first of all elevated accordingly by means of a DC/DC concerter. A resonant chopper circuit permits conversion of the battery voltage. An additional protective circuit ensures that the chopper transistors are not ruined by short circuit or non-oscillatory conditions.

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
04	8028.44	1.4.78	X
		8.10.79	Maurer

4020 (4010) series
POWER SUPPLY

204 022 A

Sheet 1/2

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
Adapter with mains switch, or short circuit termination HNK 898 033 Dummy Loads Voltmeter Amperemeter Variable mains transformer	Crystal Stage (214 022) disconnected. Mains switch adapter or short circuit termination HNK 898 033 connected to Bu 8 (see 209 021 (209 001) S B1. 1) Dummy Loads (+ 5 V : 2,2 Ω/11 W = 2,27 A and simultaneously + 14 V : 14 Ω/14 W = 1 A) connected to Bu 23 (see 204 022 S) and Sensor (Bu 23, Pin 7) connected to rail (Pins 8/9). St 1 connected to variable mains transformer.					
	Regulation Characteristics					
	variable transformer slowly from 0 to 242 V	Bu 8	—	—	Current consumption 220 ... 290 mA	.....mA
	variable transformer slowly from 0 to 220 V	Bu 23/B1	—	—	from 0 to + 14 V	
	" to 220	" /B8	—	—	from 0 to + 5 V	
	"	" /B1	—	R 23 →	+ 14,02 V	
	"	" /B8	—	R 22 →	+ 5,05 V	
	"	" /A10	—	—	+ 8... + 9 V	+ V
AF Analyser	" 187...242 V	" /B1	—	—	Δ V < 20 mV DC	.....mV
	"	" /B8	—	—	Δ V < 20 mV DC	.....mV
	"	" /B1	Ripple (100 Hz)	—	V_{AF} < 200 µV rms	.....µV
	"	" /B8	" "	—	V_{AF} < 50 µV rms	.....µV
	Current Limiting					
	adjustable load 0...14 Ω to + 14 V output	Bu 23/B1	—	R load	Maximum available current: 1,4 ... 1,8A	.....A
	" " " " "	"	—	R load = 0 Ω	Short circuit current: 0,1 ... 0,3 A	.....A
	" 0...2,2 Ω to + 5 V output	Bu 23/B8	—	R load	Maximum current available: 2,8 ...4,0A	.....A
	" " " " "	"	—	R load = 0 Ω	Short circuit current: 0,3 ... 0,85 A	.....A

Schlumberger

Adjustment and Test Procedure

Issue	Alteration No.	Date	Name
0.3	8028.44	8.10.75	Kamm
02	6028.51	1.4.78	K
04	5028.30	18.9.78	Kr.

4020 (4010) series
POWER SUPPLY

204 022 A

Sheet 2/2

REQUIRED TEST EQUIPMENT	PROCEDURE	MEASURE POINT	FREQUENCY	ADJUST	REQUIRED VALUE	MEASURED VALUE
	Mains Selector					
	Before changing Mains Selector position, mains must be switched off.					
	Variable transformer and Mains Selector to 230 V	Bu 23/A10	—	—	+ 8 ... + 9 V	
	110 V	"	—	—	"	
	240 V	"	—	—	"	
	120 V	"	—	—	"	
	130 V	"	—	—	"	.....ok
	220 V	"	—	—	"	
	Switch mains selector to the required position.					
6 A - Power Supply	**DC - DC - Converter**					
	Switch off mains + 10,8...15,6 V to St 2	Bu 23/B1	—	—	+ 14 V/ΔV < 20 mV	.....mV
		Bu 23/B8	—	—	+ 5 V/ΔV < 30 mV	.....mV
	Current consumption hereby ($V_{batt.}$ = 12 V) (without crystal oscillator) Set load current exactly to 2,27 A at 5 V and simultaneously to 1 A at 14 V.	St 2/Power Supply	—	—	+ 4,0 ... 4,7 A	.....A
	Check start condition of the DC-converter: Switch power OFF → ON	Bu 23/B1	—	—	+ 14 V	
	(Note: DC-Converter does not start oscillating, when the mains voltage is increased slowly)					

Quarzstufe 214 022 S
CRYSTAL UNIT

Dekadenstufe/DECADE STAGE 210021S Bl.1

360 002
(460 002)

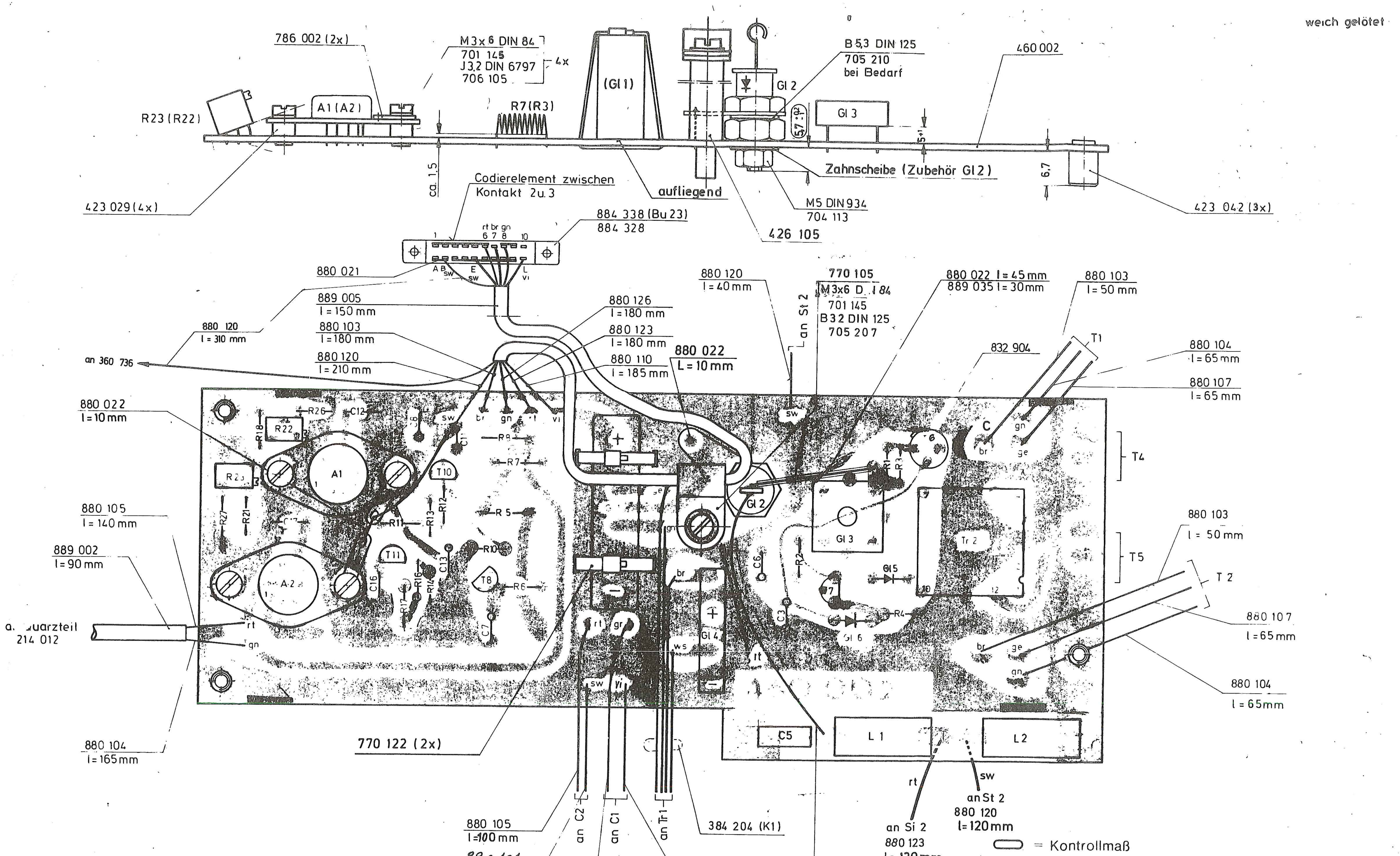
EXT. BATTERIE
12V/5A

240/230/220/130/120/110V~

Netzschalter
POWER SWITCH

Spannungen gemessen bei 14V mit 1A Last
VOLTAGES MEASURED AT 5V WITH 2,2A LOAD CURRENT

sw BLACK	bl BLUE	09	8040.17	19.4.78	Wn	norm.			Schlumberger o/s	Netzteil POWER SUPPLY	204 022 S
br BROWN	vi VIOLET	08	8028.30	10.3.78	Wn	gepr.			Meßgerätebau u. Vertrieb GmbH		
rt RED	gr GREY	07	7028.57	229.77	Mo	bearb.	14.4.75		8 München 46		Typ: 4010 A / 4011
rs ROSE	ws WHITE	Ausg. ISS.	Ä.-Mitteilg. MODIF.	Datum DATE	Name NAME		Datum DATE	Name NAME			
ge YELLOW	tr TRANSPARENT										
gn GREEN											



10				
09				
08				
16	8028.50	18.4.79	Eiler	
15	8028.45	10.4.78	Eiler	
14	8028.33	30.3.78		
13	7028.59	3.10.77	Mo	
12	7028.57	24.9.77	Mo	
11	7030.15	13.5.77	Eiler	
Ausgabe	Ä-Mitt.	Datum	Name	

Werkstoff

Oberfläche

0,2

Maßstab 2 : 1

75	Datum	Name
gez	15.4.	
bearb.		

Schlumberger o/s

Meßgerätebau + Vertrieb

Bestückte Leiterplatte

360 002

Schaltplanpositionierung ≙ 204 022 S / 360 002 Sa.

verwendet in: 204 022

Gerät: 4010A / 4011