Bargraph Display

Contents

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REFERENCE

This manual refers to the following units:

Dual Bar Graph PPM	1.913.111
Dual Bar Graph VU	1.913.112
8 Channel Bar Graph PPM	1.913.411
8 Channel Bar Graph VU	1.913.412

1. Technical Description

The output meter, whatever it may be called, is one of the most important tools in audio engineering. Wherever audio signals are being processed, it is an essential, because the output level is an important criterion. On the one hand, maximum output level is needed for achieving the best signal-to-noise ratio, on the other hand the reference level should not be exceeded, particularly in digital recordings, otherwise distortion will increase dramatically.

Two types of output meters with different dynamic characteristics have proven themselves useful in recording studios:

Volume Unit Meter (VU)

The most frequently used instrument for measuring audio frequency signal levels is the VU-meter. In the ANSI standard (American National Standards Institute, Inc.), the mechanical and electrical behavior of the VU-meter was already defined in 1954. The rule is that the indication shall be 99% of the ultimate value (0 VU) when a signal of 0.3 s (300 ms) duration is applied. The overshooting of the indication shall be between 1...1.5%. The rise and decay time are identical in the VU-meter.

In the conventional version a VU-meter consists of a suitable moving coil instrument and a full-wave rectifier connected to the input.

Peak Program Meter (PPM)

The PPM is a more recent instrument. Its behavior is defined in the applicable DIN or IEC standards. The principal difference to the VU-meter is in the integration time: the PPM is a quasi peak value instrument with a long release time. A peak value will be indicated even for very short peaks in a music program.

If a sine wave voltage is applied for 10 ms that yields a level of 0dB, the indication should be -1dB. A release time of 1.7 s is desired for levels down to -20dB (IEC).

Instrument Types

An advanced alternative to electromechanical analog displays are the gas discharge bargraph displays. Neon gas that is induced to glow between two glass plates emits visible light. The plasma display has some decisive advantages over all the other displays. For example: large reading angle and high contrast combined with low power consumption and long life. Its disadvantages are: high anode voltage (250 V), high price, and sophisticated electronic circuitry. Despite these drawbacks this excellent type of display has become the de-facto standard in professional studio applications.

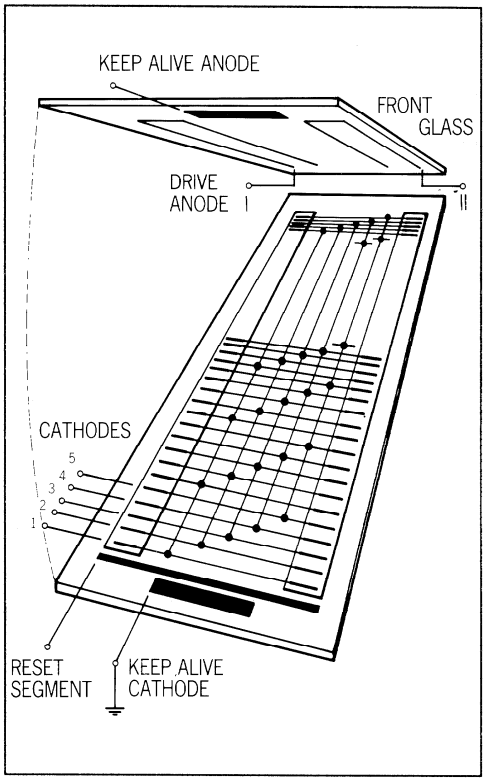
Implementation of the Studer Bargraph Output Meters

The design specifications for a precision metering instrument that would not be too costly but still have a modular design resulted in the following arrangement; two individual circuit boards, one for the two-channel signal processing paths and one for the digital section with the switching power supply. In this way it became feasible to achieve a modular design: four signal modules for eight channels but only one digital module.

The operating principle of the individual elements that make up the bargraph display is depicted in the following picture:

Plasma Tube

After the 250 VDC supply voltage has been applied, a continuous glow discharge is triggered between the pre-ionization anode and cathode. Since the area around the pre-ionization segment is not physically isolated from the neighboring segments, the charge carriers diffuse into the area of the reset cathode. When the latter is energized first, a glow discharge occurs also here. The same effect causes the first segment to light up (ignite), if the reset cathode is switched off while cathode 1 is switched on. Although each 5th segment is electrically interconnected, only the lowest one glows because sufficient charge carriers are located in its vicinity.
The cathodes 1-2-3-4-5 / 1-2-3-4...etc. are now controlled in this order. The glow discharge migrates segment by segment to the last segment. A new cycle is then initiated by means of the reset segment.



Plasma tube

The length of the bargraph is controlled by the power-on duration of the corresponding anode while the cathodes are controlled cyclically in the dark segment. This design requires only 8 connections or driver stages (2 anodes, 1 reset cathode and 5 write cathodes) for controlling the 2 x 200 segments. In order to create a flicker-free bargraph the refresh rate must be at least 70 Hz. Unnoticeable to the viewer is, however, that only one segment glows at any one moment!

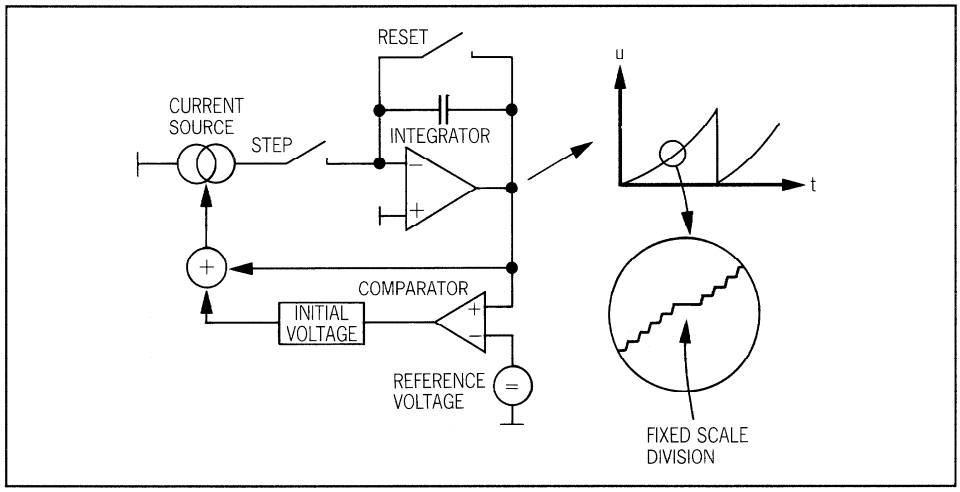
Analog Electronics

The audio section is shown in the block diagram (see p.12). The isolated AF signal is taken to the level stage; the large working range permits the connection of almost any level. For very small levels a +20 dB amplifier is provided. The low-pass filter of the 3rd order attenuates frequencies of over 20 kHz. This circuit is followed by a sophisticated rectifier stage that compensates very carefully with respect to the offset voltages.

For the VU representation, the rectified signal is fed to a filter that duplicates the characteristic of mechanical moving coil instruments. For the PPM representation, the peak value of the rectified signal is formed.

Digital Electronics

The digital section performs various functions. Not only does it process the signals for the plasma tube, it also is responsible for generating the ramp. A totally new approach has been selected for the ramp generation. Normally the audio signal is converted to logarithmic characteristic in an amplifier in order to achievedB representation. The resulting signal is subsequently compared with a time-linear ramp. However, the same can be accomplished by comparing the linear AF signal with an exponential ramp, without the typical problems of a logarithmic circuit (temperature dependence, offset). In addition, more instruments can be controlled by means of a ramp (in the digital section); no logarithmic circuits are required.



Ramp generator

While a capacitor is charged with a constant current, the terminal voltage rises linearly. If this source is equipped with a positive feedback that converts the continually rising voltage to a continually increasing current, we obtain an exponentially progressing terminal voltage.
If the capacitor is discharged after a while, the initial voltage for starting the cycle is missing. A control circuit is available that prepares the initial voltage in such a way that a reference value is achieved after a certain time.
For inserting fixed scale divisions, the capacitor charging is interrupted during three cycle units. As a result the corresponding segment glows three times longer and consequently appears to be brighter.

By disconnecting the above mentioned positive feedback, the linear ramp is again obtained for representing VU values or representable DC values.
The ramp oscillator also supplies the input signal for a binary counter that increments until reset. The outputs of the counter are address lines for an EPROM which generates the 5-phase signal and a reset signal for creating the fixed scale divisions as well as a reset signal for the counter. With the two remaining address lines it is possible to insert different scale divisions.

Future Application

The new bargraph instrument also features a LED column for indicating limiter or compressor gain reduction signals. With the externally controllable selection of VU or PPM characteristic it is also possible to display DC voltages on linear or logarithmic scale. The built-in switching power supply supports a large range of DC supply voltages.

For PCM recordings a faster response time (t = 0.1 ms) may be selected by a switch.

2. Technical Data

PEAK PROGRAM METER SPECIFICATION

Reference Indication 0 dB = 0 dBu .... + 15 dBu

Indicating Range + 5 dB .... - 40 dB

Error ± 0.2 dB (± 2 segments) within + 5 dB and - 40 dB

Frequency Response ± 0.5 dB between 31.5 Hz and 16 kHz at 0° C .... 50° C

Dynamic Response according to IEC publication 268-10 1974:

SINGLE BURST	FREQUENCY	DEFLECTION SLOW VALUE	TOLERANCE	DEFLECTION FAST
10 ms	3 kHz	- 1 dB	± 0.5 dB	-0,3 dB
5 ms	3 kHz	- 2 dB	± 1 dB	-0,6 dB
3 ms	3 kHz	- 4 dB	± 1 dB	-0,8 dB
0.4 ms	10 kHz	- 15 dB	± 3 dB	-1,0 dB

Overswing none

Return Time 0 dB .... - 20 dB: 1.7 ± 0.3 seconds

VU-METER SPECIFICATION

Reference Indication 0 VU = - 4 dBu .... + 11 dBu

Indicating Range + 3 VU .... - 20 VU, voltage linear

Frequency Response + 1.0/- 0.0 dB at 0 VU and 31.5 Hz; Temperature range 0° C .... 50° C

Response Time 207 ms (± 30 ms) to - 1 VU of reference indication

Overswing 1 ... 1.5 %

Return Time 207 ms (± 30 ms).

DC METER SPECIFICATION

Display Range

INDICATION	NORMAL			REVERSE
TOP END	0 V	0 V	- 1 V	+ 1 V
BOTTOM	+ 10 V	+ 6 V	+ 6 V	- 10 V

There is mutual influence between the alignment of 'Top End' and 'Bottom' indication. The values in the row 'Normal' are ment to be examples for possible settings.

GENERAL SPECIFICATIONS

Input Impedance > 10 kOhm

Source Impedance < 1 kOhm

Reversibility Error < 0.5 dB

Temperature Range error ± 0.5 dB in the range - 10° C .... + 60° C
(reference: 1 kHz at 25° C)

Supply Voltage 24 V ... 34 V (or ± 15 V)

Power Consumption dual unit: 3.5 W typ., 5.0 W max.
8 channels: 9.5 W typ., 14.5 W max.

Mechanical Dimensions dual unit: 40 mm(W) x 170 mm(H) x 130 mm(D)
8 channel unit: 160 mm(W) x 170 mm(H) x 130 mm(D)

Weight dual unit: 640 g
8 channel unit: 1600 g

GR METER SPECIFICATION

Input Range ± 2 V .... ± 5 V for + 20 dB indication

3. Alignments and Settings

Note: The Analog Print 1.913.117 contains two channels, so each adjustment pot exists twice. All adjustments have to be performed on all channels.

The Digital Print 1.913.118 exists only once per unit, be it a two or eight channel device.

3.1 Adjustments

Level Setting

For adaptation to different line levels only the folllowing adjustment is necessary:

- Feed reference level 1 kHz (e.g. +6 dBu)
- adjust 0 dB indication on bargraph with R 5 (R 105) Potentiometer is marked **AUDIO GAIN**

Complete Adjustment

In case of part exchange a full adjustment procedure may be necessary. In this case proceed in the following steps:

AC Input: Set unit to "PPM", "+20 dB off", and "Not fast" (see below)

- Disconnect input, terminate input with 200 Ohm
- adjust minimal level (0 ±1 mV) at pin 7 of IC 6 (internal potentiometer)

- Feed reference level 1 kHz (e.g. +6 dBu)
- adjust 0 dB indication on bargraph with R 5 (R 105).

Potentiometer is marked **AUDIO GAIN**

- Feed 20 dB below reference level 1 kHz (e.g. -14 dBu)
- adjust -20 dB indication with R 64 (potentiometer on digital print; do not readjust after the first channel has been properly adjusted)

- Feed 30 dB below reference level 1 kHz (e.g. -24 dBu)
- adjust -30 dB indication with R 30 (R 130). Potentiometer is marked **AUDIO OFFSET**

- Repeat all steps until all indications are correct.

DC Iput: Set unit to "DC" and adjust the wanted input phase configuration (see below).

- Feed maximum DC voltage.
- Adjust maximum indication with R 55 (R 155). Potentiometer is marked **DC GAIN**

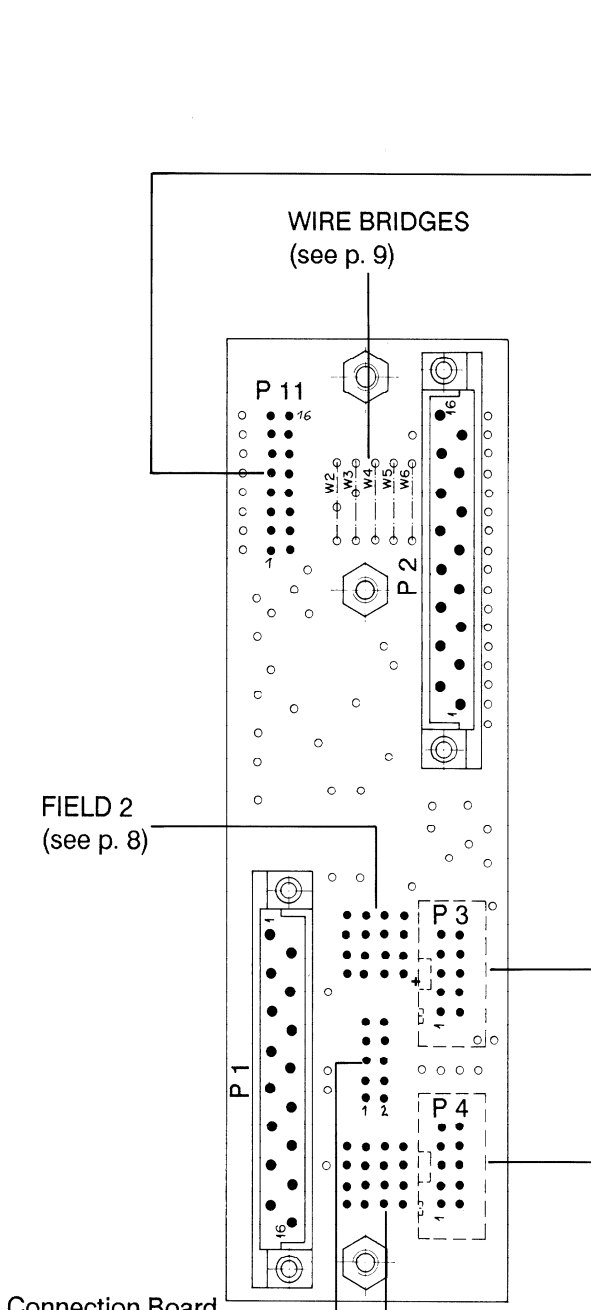
- Feed minimum DC voltage
- Adjust minimum indication with R 63 (R 163). Potentiometer is marked **DC REF**

- Repeat all steps until all indications are correct.

GRM Input:

- Feed level 1 kHz required for a indication of +20 dB on the gain reduction meter.
- Adjust indication with R 60 (R 160). Potentiometer is marked **GRM**

3.2 Connections



FLAT CABLE 4 plug P11 (option)
(control signals)

1,2	0 Volt; DC ground
3,4	Switch "+20 dB"
5,6	Switch "FAST"
7,8	Switch "DOT"
9,10	
11,12	Switch "LIN"
13,14	Switch "AC/DC"
15,16	Switch "USER"

FLAT CABLE 2 plug P3
(right instrument)

1	GRM 2 a
2	+ DC supply
3	GRM 2 b
4	0 Volt analog*
5	INPUT R a
6	- DC supply
7	INPUT R b
8	0 Volt logic*
9	
10	-6 Volt*

FLAT CABLE 1 plug P4
(left instrument)

1	GRM 1 a
2	+ DC supply
3	GRM 1 b
4	0 Volt analog*
5	INPUT L a
6	- DC supply
7	INPUT L b
8	0 Volt logic*
9	
10	-6 Volt*

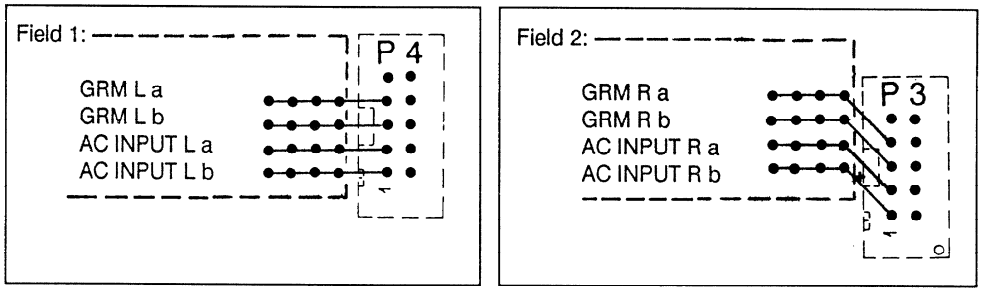
FLAT CABLE 3 plug P9 (option)
(DC input)

1	DC input R
2	
3	DC input L
4	
5	DC phase switch (see below)
6	
7	DC ground
8	

If the unit is powered by an unstabilized DC supply, an additional C may be installed (1000 μF, 40 Volt, Order No. 59.22.6102).

Signals marked with an asterisk (*) are not required for the bargraph.

The lines carrying the AC bargraph input and the GRM input signals may also be soldered to the unit (instead of feeding those signals via the flat cables; especially useful for operation outside STUDER mixers). The connection points are:



DC Supply

DC can be fed either via flat cable 1 or 2 or directly to the pins marked "+" and "–".

3.3 Function Settings

Some functions can be set both by wire bridges and by external switches. Do not duplicate!

Wire Bridges

BRIDGE	ON	OFF	
W2	■		INSTRUMENT ATTACK TIME 0.1 ms
		■	STANDARD ATTACK TIME (10 ms in PPM mode)
W3	■		GRM INDICATION AS SINGLE DOT
		■	GRM INDICATION AS BAR
W4			(reserved for future use)
W5		■	PPM INDICATION
W6		■	
W5	■		VU INDICATION
W6		■	
W5		■	DC LOG INDICATION
W6	■		
W5	■		DC LIN INDICATION
W6	■		

External Switches

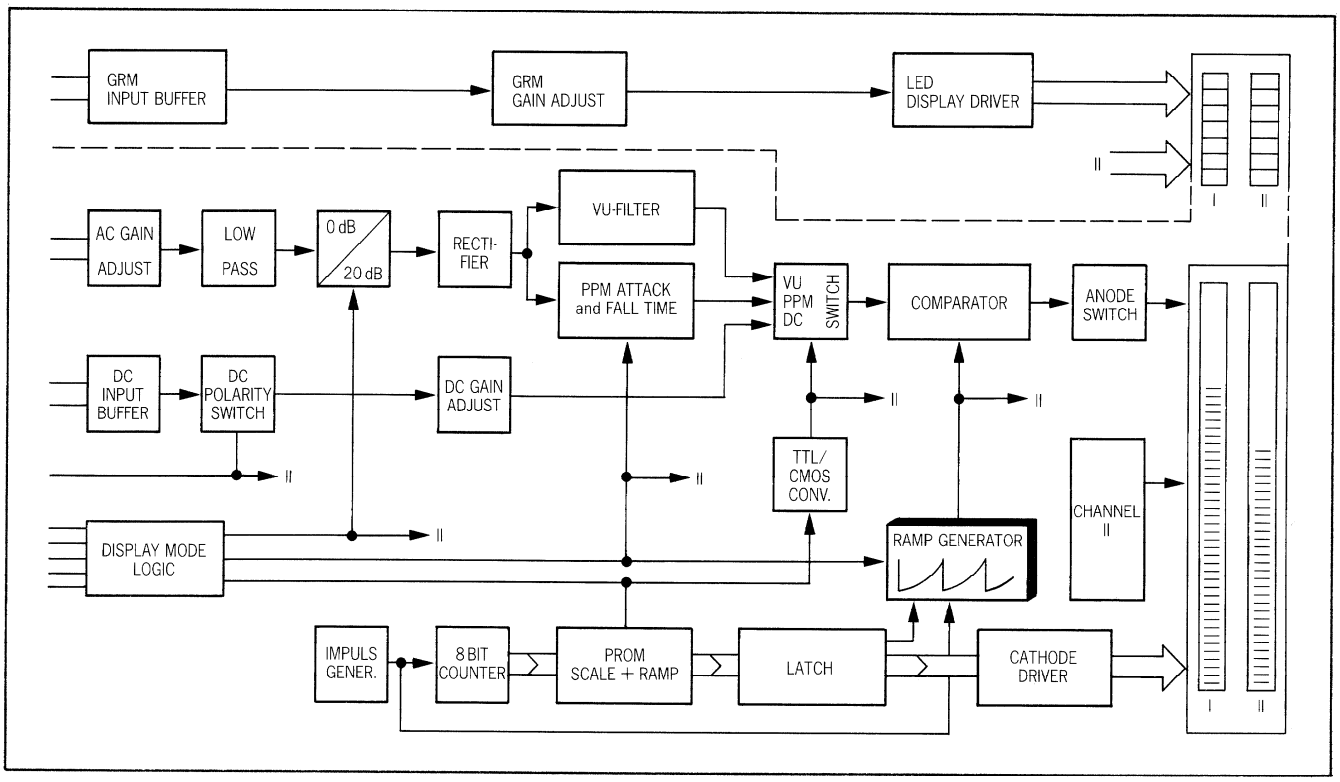
"ON" means that either the pin is connected to ground (pin 1/2) or that a TTL low level is connected. "OFF" means that either the switch is open (internal pull-up resistor) or that a TTL high level is connected.

All external switches are connected via flat cable 4 (see above).

PIN	ON	OFF	
1,2			0 VOLT
3,4	■		AC GAIN +20 dB
		■	AC GAIN 0 dB
5,6	■		INSTRUMENT ATTACK TIME 0.1 ms
		■	STANDARD ATTACK TIME (10 ms in PPM mode)
7,8	■		GRM INDICATION AS SINGLE DOT
		■	GRM INDICATION AS BAR
11,12	■		LIN INDICATION (if DC selected), VU INDICATION (if AC selected, see 13/14)
		■	LOG INDICATION (if DC selected), PPM INDICATION (if AC selected, see 13/14)
13,14	■		DC
		■	AC
15,16	■		USER SWITCH: LED ON FRONT PLATE ON
		■	LED ON FRONT PLATE OFF

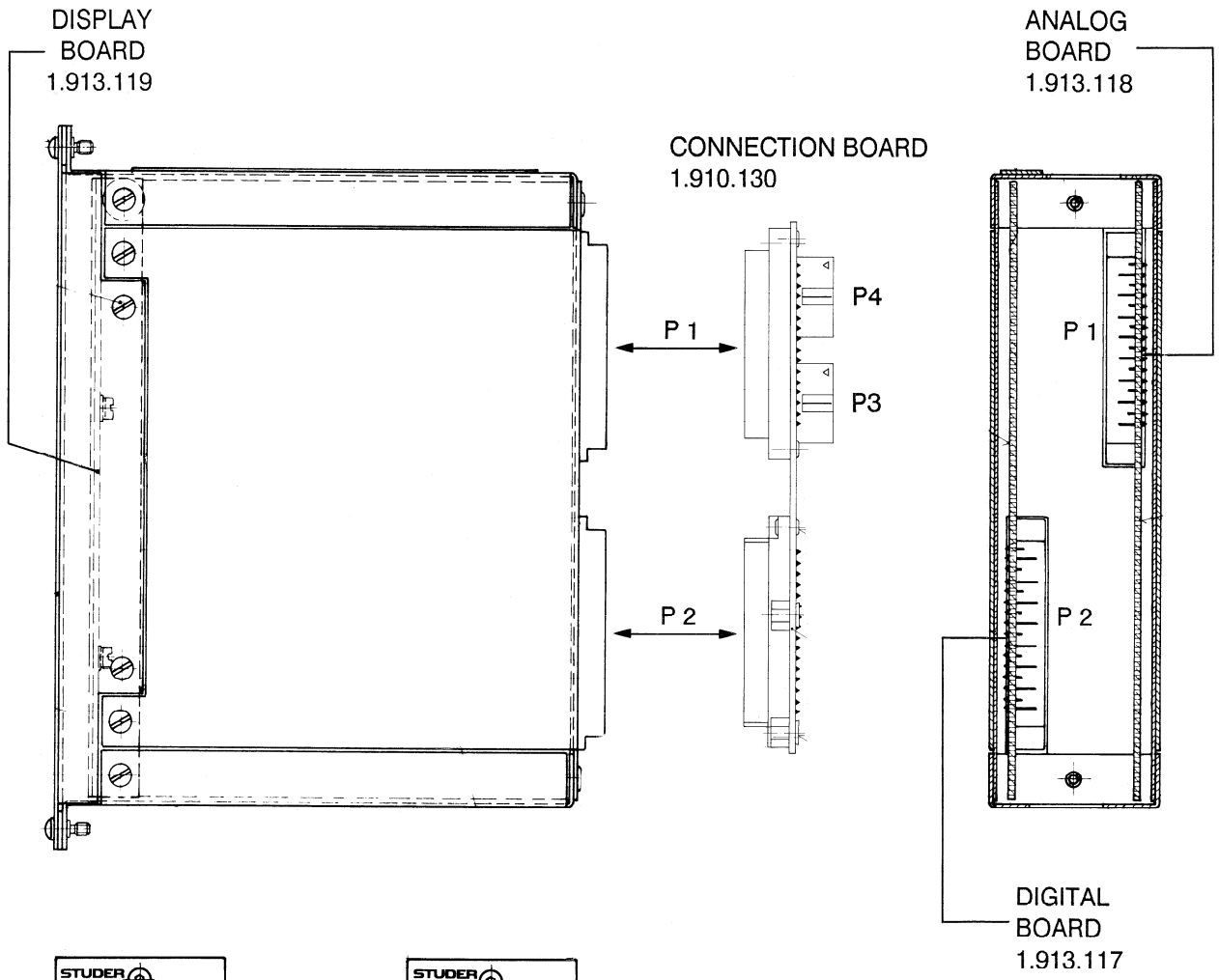
4. Block Diagram

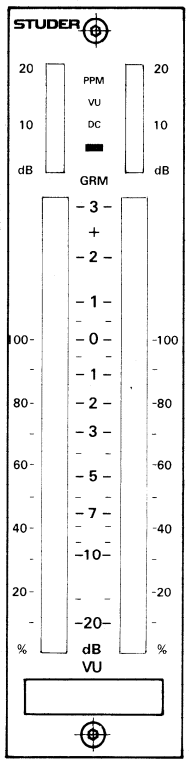
Block Diagram for Channel I

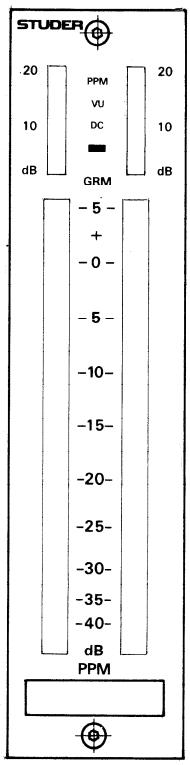


5. SCHEMATICS

Bargraph 1 Unit (PPM or VU) 1.913.111.81 / 112.81

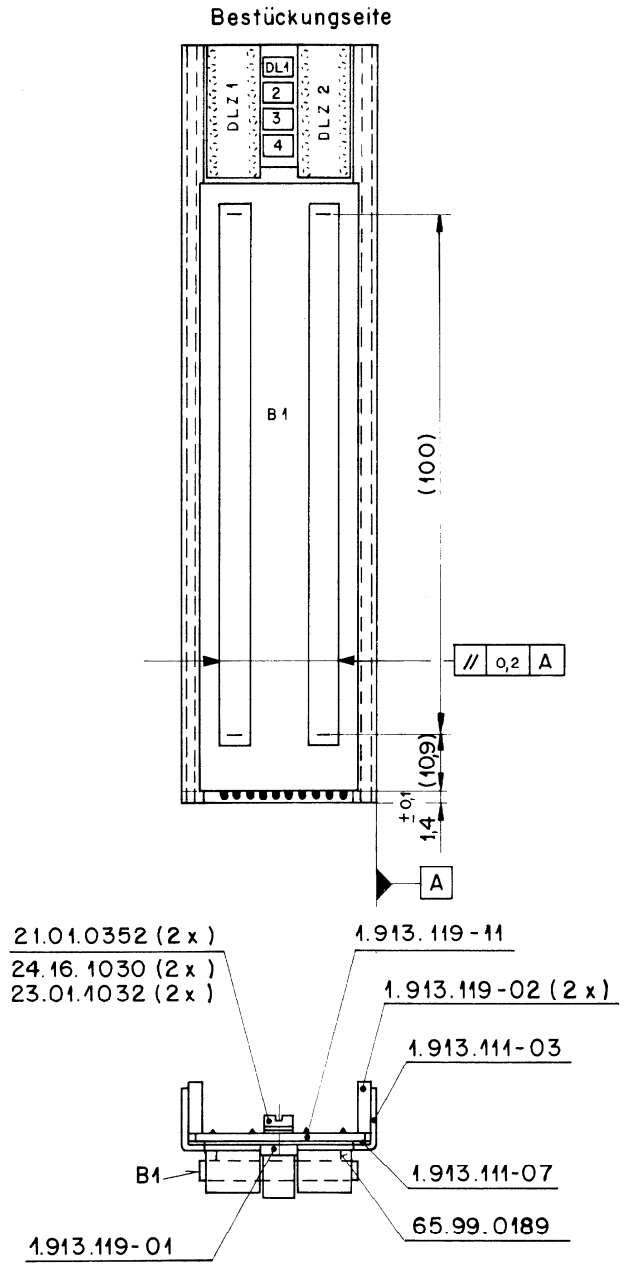


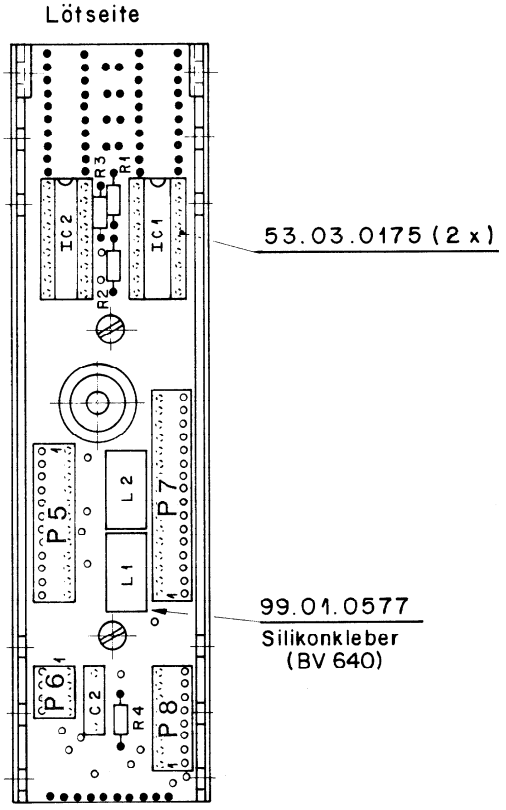




BARGRAPH

Display Board 1 Unit 1.913.119.00





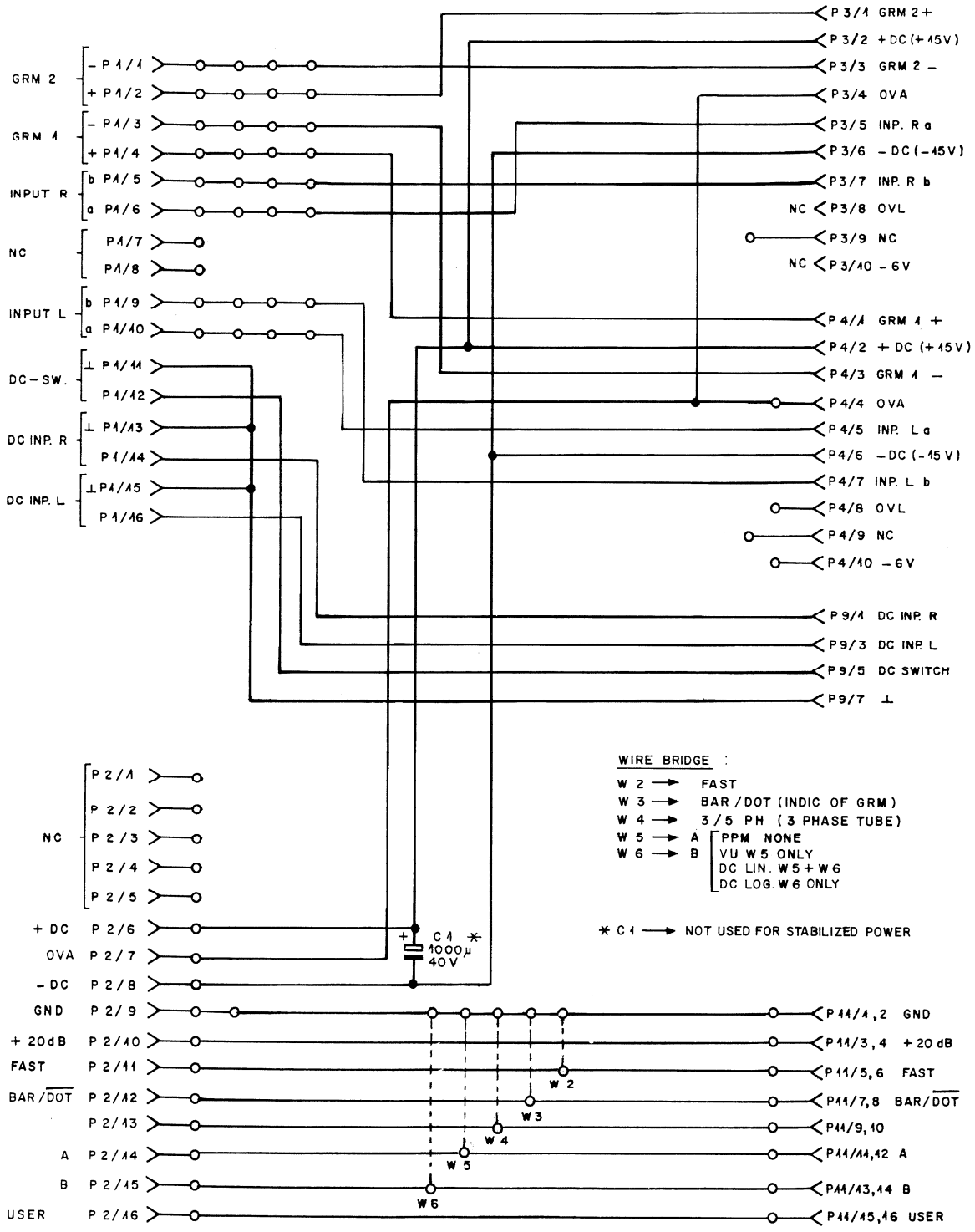
IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	B.....1	89.01.4800		PLASMA-BAR-GRAPH 200 BARS, 5 PHASES	
	C.....1		not used		
	C.....2	59.31.8333	33 nF	+-5% 400V MPC	
	C.....3		not used		
	DL....1	50.04.2119	MV57124	red	
	DL....2	50.04.2119	MV57124	red	
	DL....3	50.04.2119	MV57124	red	
	DL....4	50.04.2119	MV57124	red	
	DLZ...1	50.04.2150		led bar-graph red	
	DLZ...2	50.04.2150		led bar-graph red	
	IC....1	50.11.0119	LM3914N	led bar driver linear	NS
	IC....2	50.11.0119	LM3914N	led bar driver linear	NS
	L.....1	62.03.0005	250uH	coil	
	L.....2	62.03.0005	250uH	coil	
	MP....1	53.03.0175	2 pcs	IC-sockel 18 pin	
	MP....2	1.913.119.11	1 pcs	Print	
	MP....3	1.913.111.03	1 pcs	Chassis 1E	0
	MP....4	1.913.111.07	1 pcs	Isolation 1E	
	MP....5	21.01.0352	2 pcs	Zylinderschrauben M3*4	
	MP....6	24.16.1030	2 pcs	Schnorr M3	
	MP....7	23.01.1032	2 pcs	Unterlagsscheiben M3	
	P.....5	54.01.0215		Cis Stecker 12 Pol	
	P.....6	54.01.0241		Cis Stecker 4 Pol	
	P.....7	54.01.0294		Cis Stecker 16 Pol	
	P.....8	54.01.0289		Cis Stecker 8 Pol	
	R.....1	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....2	57.11.3242	2.4 kOhm	5% 0.25W	
	R.....3	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....4	57.11.3105	1 MOhm	5% 0.25W	

IND. POS.NO. PART NO. VALUE SPECIFICATIONS / EQUIVALENT MANUF.

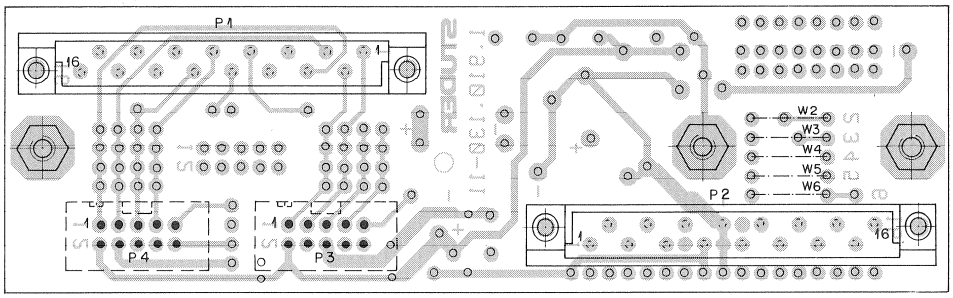
MANUFACTURER: Bu=Burndy, Ex=Exar, Fc=Fairchild, GI=General Instrument
HP=Hewlett Packard, ITT=Intermetall, Mot=Motorola, Nat=National
(Matsushita), NS=National Semiconductors, Ph=Philips,
Ra=Raytheon, Sig=Signetics, Six=Siliconix, St=Studer,
TI=Texas Instrument, Sie=Siemens, Is=Intersil, Un=Unitrode

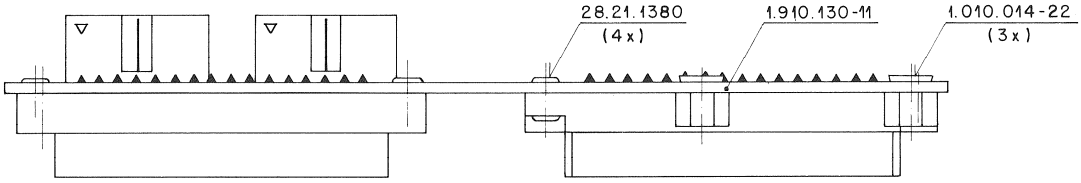
ORIG 87/11/24

Bargraph Connection Board 1 Unit 1.913.130.00



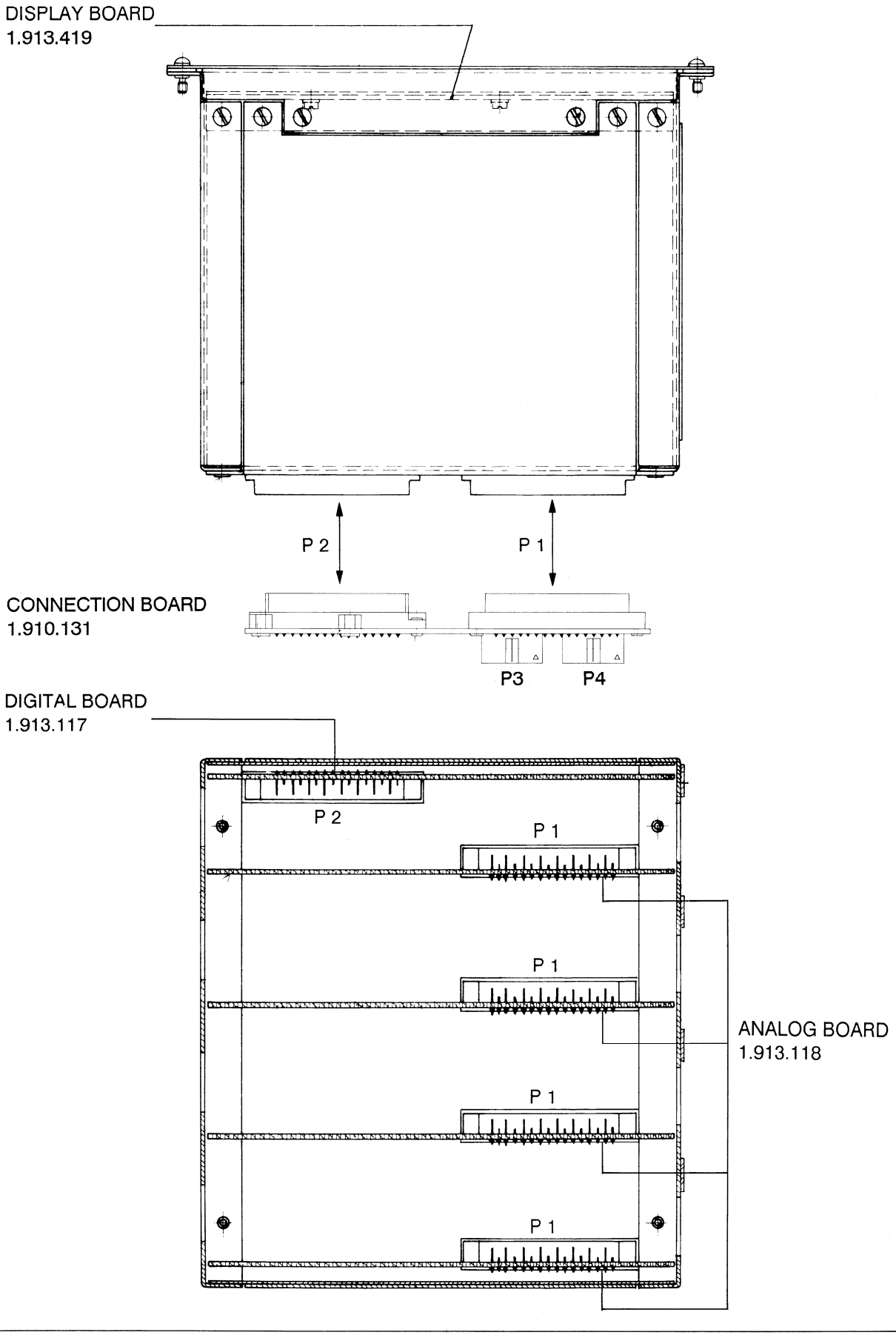
Bargraph Connection Board 1 Unit 1.913.130.00





W2 bis W6 nach Angabe Studio-Projektierung

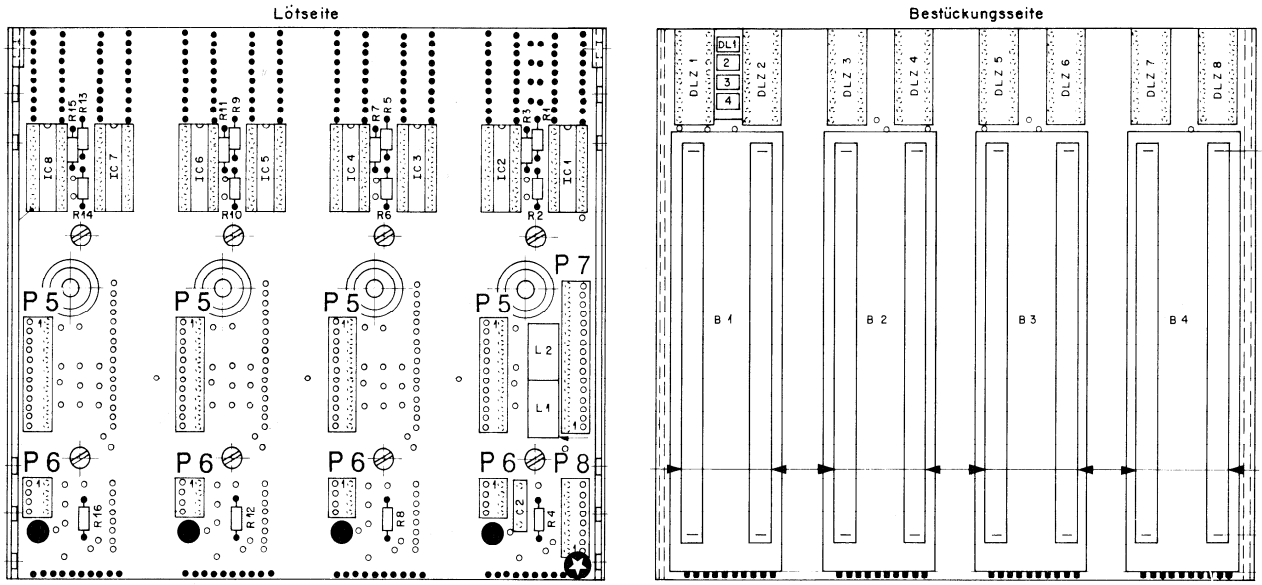
Bargraph 4 Units (PPM or VU) 1.913.411.81 / 412.81



BARGRAPH

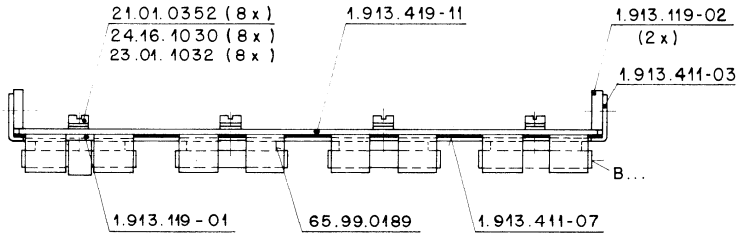
Display Board 4 Units 1.913.419.00

The Display Board 4 Units is adequate to four display boards for one unit each.
For details see schematic number 1.913.119.



● ANALOG BOARD
1.913.118

✪ DIGITAL BOARD
1.913.117



Bargraph Connection Board 4 Units 1.910.131

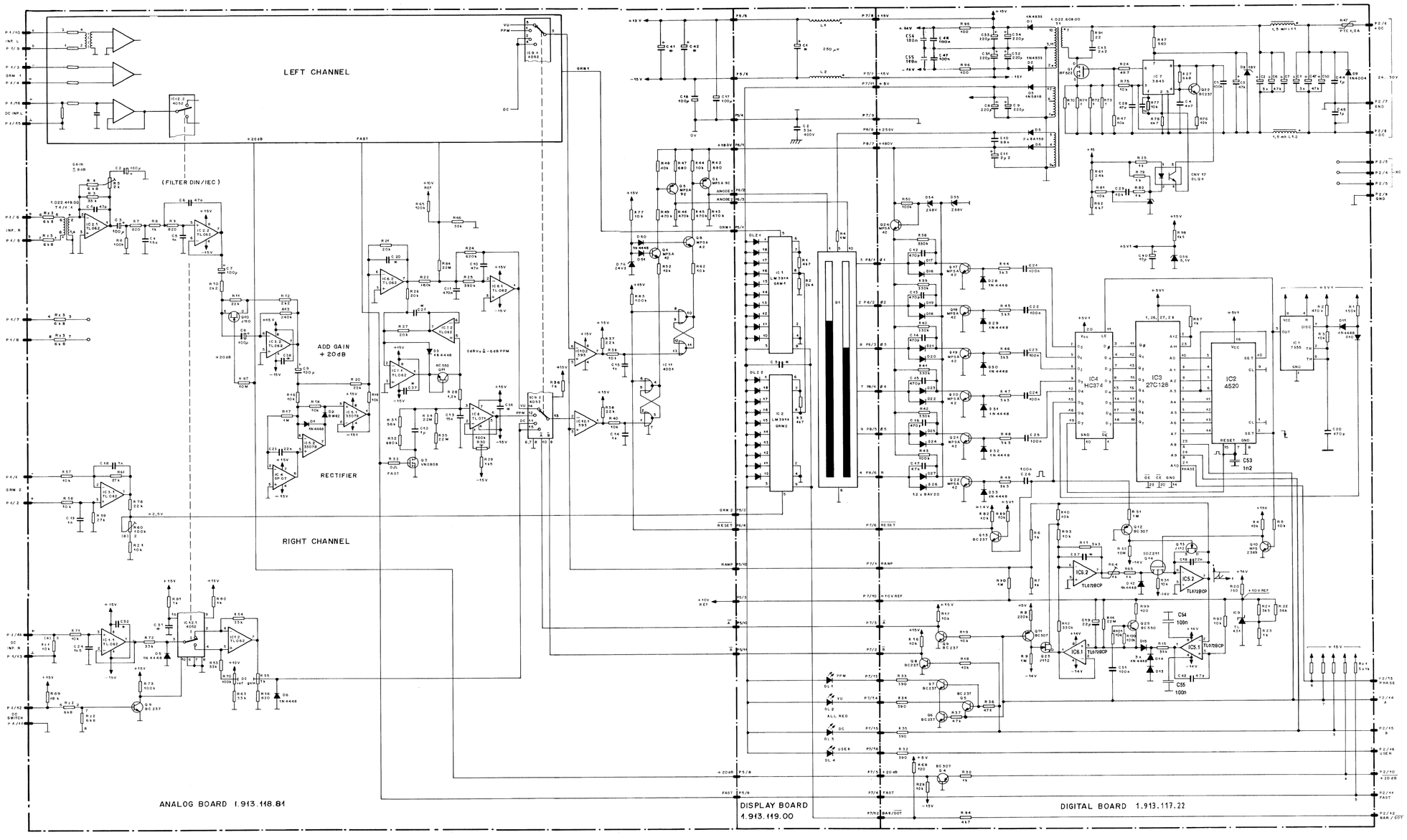
This Board combines four connection boards for one unit on a single print.
For details please see 'Connection Board 1 Unit 1.910.130'.

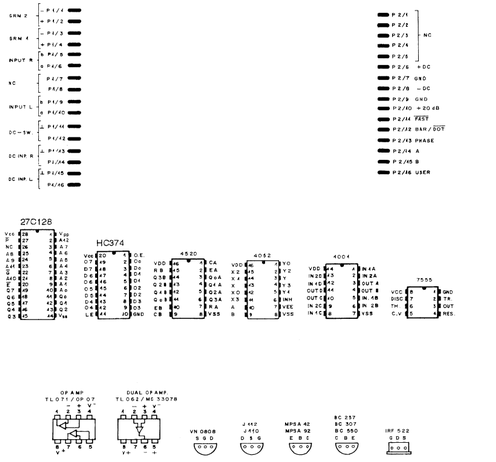
IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	B.....1	89.01.4800		PLASMA-BAR-GRAPH 200 BARS, 5 PHASES	
	B.....2	89.01.4800		PLASMA-BAR-GRAPH 200 BARS, 5 PHASES	
	B.....3	89.01.4800		PLASMA-BAR-GRAPH 200 BARS, 5 PHASES	
	B.....4	89.01.4800		PLASMA-BAR-GRAPH 200 BARS, 5 PHASES	
	C.....1		not used		
	C.....2	59.31.8333	33 nF	+-5% 400V MPC	
	C.....3		not used		
	DL....1	50.04.2119	MV57124	red	
	DL....2	50.04.2119	MV57124	red	
	DL....3	50.04.2119	MV57124	red	
	DL....4	50.04.2119	MV57124	red	
	DLZ...1	50.04.2150		led bar-graph red	
	DLZ...2	50.04.2150		led bar-graph red	
	DLZ...3	50.04.2150		led bar-graph red	
	DLZ...4	50.04.2150		led bar-graph red	
	DLZ...5	50.04.2150		led bar-graph red	
	DLZ...6	50.04.2150		led bar-graph red	
	DLZ...7	50.04.2150		led bar-graph red	
	DLZ...8	50.04.2150		led bar-graph red	
	IC....1	50.11.0119	LM3914N	led bar driver linear	NS
	IC....2	50.11.0119	LM3914N	led bar driver linear	NS
	IC....3	50.11.0119	LM3914N	led bar driver linear	NS
	IC....4	50.11.0119	LM3914N	led bar driver linear	NS
	IC....5	50.11.0119	LM3914N	led bar driver linear	NS
	IC....6	50.11.0119	LM3914N	led bar driver linear	NS
	IC....7	50.11.0119	LM3914N	led bar driver linear	NS
	IC....8	50.11.0119	LM3914N	led bar driver linear	NS
	L.....1	62.03.0005	250uH	coil	
	L.....2	62.03.0005	250uH	coil	
	MP....1	53.03.0175	8 pcs	IC-sockel 18 pin	
	MP....2	1.913.419.11	1 pcs	Print	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	MP....3		1 pcs	Chassis 4E	
	MP....4		1 pcs	Isolation 4E	
	MP....5	21.01.0352	2 pcs	Zylinderschrauben M3*4	
	MP....6	24.16.1030	2 pcs	Schnorr M3	
	MP....7	23.01.1032	2 pcs	Unterlagsscheiben M3	
	P.....5	54.01.0215		Cis Stecker 12 Pol	4 Stueck
	P.....6	54.01.0241		Cis Stecker 4 Pol	4 Stueck
	P.....7	54.01.0294		Cis Stecker 16 Pol	1 Stueck
	P.....8	54.01.0289		Cis Stecker 8 Pol	1 Stueck
	R.....1	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....2	57.11.3242	2.4 kOhm	5% 0.25W	
	R.....3	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....4	57.11.3105	1 MOhm	5% 0.25W	
	R.....5	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....6	57.11.3242	2.4 kOhm	5% 0.25W	
	R.....7	57.11.3472	4.7 kOhm	5% 0.25W	
	R.....8	57.11.3105	1 MOhm	5% 0.25W	
	R.....9	57.11.3472	4.7 kOhm	5% 0.25W	
	R....10	57.11.3242	2.4 kOhm	5% 0.25W	
	R....11	57.11.3472	4.7 kOhm	5% 0.25W	
	R....12	57.11.3105	1 MOhm	5% 0.25W	
	R....13	57.11.3472	4.7 kOhm	5% 0.25W	
	R....14	57.11.3242	2.4 kOhm	5% 0.25W	
	R....15	57.11.3472	4.7 kOhm	5% 0.25W	
	R....16	57.11.3105	1 MOhm	5% 0.25W	

MANUFACTURER: Bu=Burndy, Ex=Exar, Fc=Fairchild, GI=General Instrument
HP=Hewlett Packard, ITT=Intermetall, Mot=Motorola, Nat=National
(Matsushita), NS=National Semiconductors, Ph=Philips,
Ra=Raytheon, Sig=Signetics, Six=Siliconix, St=Studer,
TI=Texas Instrument, Sie=Siemens, Is=Intersil, Un=Unitrode

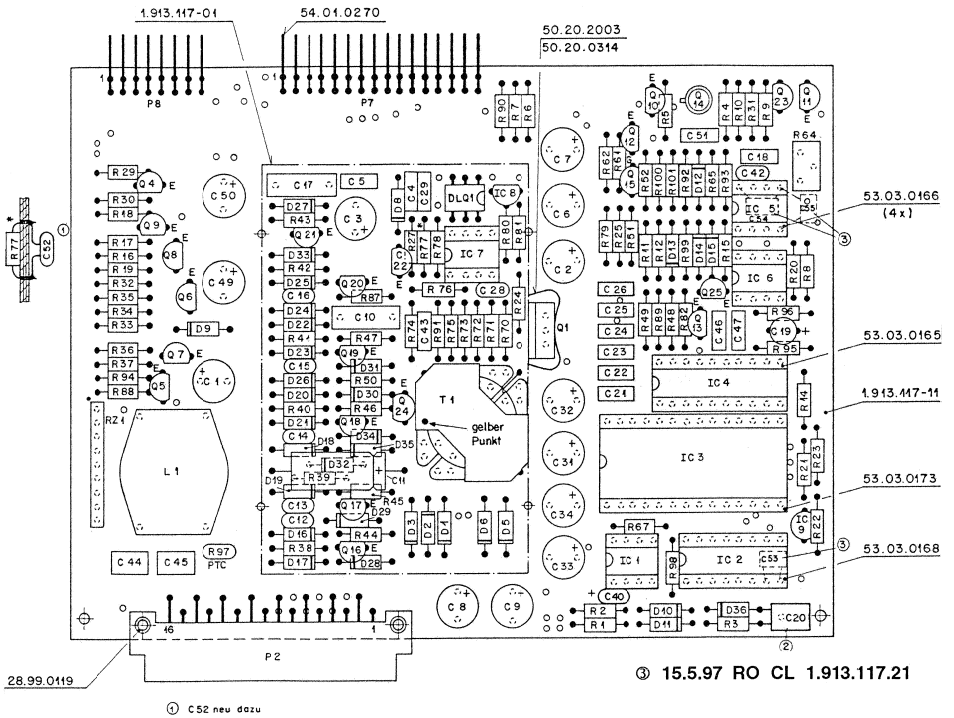
ORIG 87/11/24





⑥ 8.9.99 Ri	④ 21.6.96 Ro.	② 15.5.97 RO	
STUDER REGENSDORF ZURICH	DUAL BAR GRAPH PPM DUAL BAR GRAPH VU	SC 1.913.111.81 SC 1.913.112.81	

Bargraph Digital Board 1.913.117.21



① C52 neu dazu

③ 15.5.97 RO CL 1.913.117.21

Idx.	Pos.	Part No.	Qty.	Type/Val.	Description
0	C 1	59.22.6470		47u	EL 40V 20% RM5
0	C 2	59.22.6470		47u	EL 40V 20% RM5
0	C 3	59.22.6470		47u	EL 40V 20% RM5
0	C 4	59.06.0472		4n7	PETP, 63V, 10%, RM5
0	C 5	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 6	59.22.6470		47u	EL 40V 20% RM5
0	C 7	59.22.6470		47u	EL 40V 20% RM5
0	C 8	59.22.4221		220u	EL 16V 20% RM5
0	C 9	59.22.4221		220u	EL 16V 20% RM5
0	C 10	59.31.6683		68n	MPETP, 10%, 100V
0	C 11	59.25.8229		2u2	EL 250V 20% axial
0	C 12	59.32.1471		470p	CER 10%, 400V
0	C 13	59.32.1471		470p	CER 10%, 400V
0	C 14	59.32.1471		470p	CER 10%, 400V
0	C 15	59.32.1471		470p	CER 10%, 400V
0	C 16	59.32.1471		470p	CER 10%, 400V
0	C 17	59.02.5473		47n	MPC, 5%, 250V
0	C 18	59.06.5223		22n	PETP, 63V, 5%, RM5
0	C 19	59.22.6220		22u	EL 35V 20% RM5
0	C 20	59.34.5471		470p	CER 63V, 5%, N1500
0	C 21	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 22	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 23	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 24	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 25	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 26	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 28	59.34.2470		47p	CER 63V, 5%, N150
0	C 29	59.06.5223		22n	PETP, 63V, 5%, RM5
0	C 31	59.22.4221		220u	EL 16V 20% RM5
0	C 32	59.22.4221		220u	EL 16V 20% RM5
0	C 33	59.22.4221		220u	EL 16V 20% RM5
0	C 34	59.22.4221		220u	EL 16V 20% RM5
0	C 40	59.26.1100		10u	SAL 10V 20%
0	C 42	59.34.2470		47p	CER 63V, 5%, N150
0	C 43	59.06.5222		2n2	PETP, 63V, 5%, RM5
0	C 44	59.06.0105		1u0	PETP, 50V, 10%, RM5
0	C 45	59.06.0105		1u0	PETP, 50V, 10%, RM5
0	C 46	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 47	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 49	59.22.6470		47u	EL 40V 20% RM5
0	C 50	59.22.6470		47u	EL 40V 20% RM5
0	C 51	59.06.5104		100n	PETP, 63V, 5%, RM5
0	C 52	59.32.4102		1n0	CER , 20%, 50V
0	C 53			not used	1n2 CER 10%, 50V
0	C 54	59.06.0104		100n	PETP, 63V, 10%, RM5
0	C 55	59.06.0104		100n	PETP, 63V, 10%, RM5
0	D 1	50.04.0508		1N4935	D 1 N 4935 .. 1 N 4937
0	D 2	50.04.0508		1N4935	D 1 N 4935 .. 1 N 4937
0	D 3	50.04.0512		1N5818	D 1N 5818, 1N 5819,
0	D 5	50.04.0513		BA159	D BA 159 , SI
0	D 6	50.04.0513		BA159	D BA 159 , SI
0	D 8	50.04.1122		18V	Zener, 5%, 0.5W, DO-35
0	D 9	50.04.0105		1N4004	1A, DO 41
0	D 10	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 11	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 12	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 13	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 14	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 15	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 16	50.04.0133		BAV20	D BAV 20 , SI
0	D 17	50.04.0133		BAV20	D BAV 20 , SI
0	D 18	50.04.0133		BAV20	D BAV 20 , SI
0	D 19	50.04.0133		BAV20	D BAV 20 , SI
0	D 20	50.04.0133		BAV20	D BAV 20 , SI
0	D 21	50.04.0133		BAV20	D BAV 20 , SI
0	D 22	50.04.0133		BAV20	D BAV 20 , SI
0	D 23	50.04.0133		BAV20	D BAV 20 , SI
0	D 24	50.04.0133		BAV20	D BAV 20 , SI
0	D 25	50.04.0133		BAV20	D BAV 20 , SI
0	D 26	50.04.0133		BAV20	D BAV 20 , SI
0	D 27	50.04.0133		BAV20	D BAV 20 , SI
0	D 28	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 29	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 30	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 31	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 32	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 33	50.04.0125		1N4448	75V, 150mA, 4ns, DO-35
0	D 34	50.04.1166		68V	Zener, 5%, 0.5W, DO-35
0	D 35	50.04.1166		68V	Zener, 5%, 0.5W, DO-35
0	D 36	50.04.1112		5V1	Zener, 5%, 0.5W, DO-35
0	DLQ 1	50.04.3200		CNY17-2	Optc-coupler
0	IC 1	50.07.0036		7555	IC ICM 7555 IPA ,A
0	IC 2	50.07.0520		4520	Dual 4bit binary counter
0	IC 3	1.913.999.22			SW BAR-GRAPH DIGITAL BOARD ,A
0	IC 4	50.17.1374		74HC374	IC ... 74 HC 374 ., ,A
0	IC 5	50.09.0121		TL072B	IC TL 072 BCP ,A
0	IC 6	50.09.0121		TL072B	IC TL 072 BCP ,A
0	IC 7	50.10.0113		3843	IC IP 3843 N
0	IC 8	50.10.0106		TL431	Shunt regulator
0	IC 9	50.10.0106		TL431	Shunt regulator
0	L 1	62.03.0100		1.5mH	2A Toroid Chocke compensated
0	MP 1	1.913.117.12	1 pce		BAR-GRAPH DIGITAL PCB
0	MP 2	1.913.117.04	1 pce		NR.-ETIKETTE 5 * 20
0	MP 3	43.01.0108	1 pce	Label	ESE-WARNSCHILD
0	MP 4	1.101.001.22			TEXT-ETIK. 5*20 HARDWARE -22
0	MP 5	1.913.117.01	1 pce		ABSCHIRMHAUBE
0	MP 6	28.99.0119	2 pcs		ROHRNIETE D 2.5*0.15* 9
0	MP 7	50.20.0314	1 pce	TO126	Glimmerscheibe, zu Clip
0	MP 8	50.20.2003	1 pce		Montageclip zu TO 220, N/ISOL.
0	MP 9	53.03.0165	1 pce	20p	DIL-socket 0.3"
0	MP 10	53.03.0166	4 pcs	8p	DIL-socket 0.3"
0	MP 11	53.03.0168	1 pce	16p	DIL-socket 0.3"
0	MP 12	53.03.0173	1 pce	28p	DIL 0.6", lot, gerade
0	P 2	54.11.2007		2*8p	EU-BK 2* 8 a1,b2 male
0	P 7	54.01.0270	2 pcs	8p	Stecker CIS parallelsteck
0	P 8	54.01.0270	1 pce	8p	Stecker CIS parallelsteck
0	Q 1	50.03.1502		IRF522	N-VMOS-FET 100V, 7A
0	Q 4	50.03.0515		BC307B	PNP 100mA 45V
0	Q 5	50.03.0436		BC237B	NPN 100mA 45V
0	Q 6	50.03.0436		BC237B	NPN 100mA 45V
0	Q 7	50.03.0436		BC237B	NPN 100mA 45V
0	Q 8	50.03.0436		BC237B	NPN 100mA 45V
0	Q 9	50.03.0436		BC237B	NPN 100mA 45V
0	Q 10	50.03.0508		MPS2369	MPS 2369 NPN
0	Q 11	50.03.0515		BC307B	PNP 100mA 45V
0	Q 12	50.03.0515		BC307B	PNP 100mA 45V
0	Q 13	50.03.0436		BC237B	NPN 100mA 45V
0	Q 14	50.11.0106		SD214	Analog Switch
0	Q 15	50.03.0350		J112	JFET N-Channel
0	Q 16	50.03.0484		MPSA42	MPS A 42
0	Q 17	50.03.0484		MPSA42	MPS A 42
0	Q 18	50.03.0484		MPSA42	MPS A 42
0	Q 19	50.03.0484		MPSA42	MPS A 42
0	Q 20	50.03.0484		MPSA42	MPS A 42
0	Q 21	50.03.0484		MPSA42	MPS A 42
0	Q 22	50.03.0436		BC237B	NPN 100mA 45V
0	Q 23	50.03.0350		J112	JFET N-Channel
0	Q 24	50.03.0484		MPSA42	MPS A 42
0	Q 25	50.03.0407		BC550C	BC 550 C
0	R 1	57.11.3154		150k	MF, 1%, 0207
0	R 2	57.11.3474		470k	MF, 1%, 0207
0	R 3	57.11.3103		10k	MF, 1%, 0207
0	R 4	57.11.3103		10k	MF, 1%, 0207
0	R 5	57.11.3103		10k	MF, 1%, 0207
0	R 6	57.11.3102		1k0	MF, 1%, 0207
0	R 7	57.11.3102		1k0	MF, 1%, 0207
0	R 8	57.11.3224		220k	MF, 1%, 0207
0	R 9	57.11.3105		1M0	MF, 1%, 0207
0	R 10	57.11.3103		10k	MF, 1%, 0207
0	R 11	57.11.3332		3k3	MF, 1%, 0207
0	R 12	57.11.3334		330k	MF, 1%, 0207
0	R 14	57.11.6226		22M	MF, 10%, 0207
0	R 15	57.11.3333		33k	MF, 1%, 0207
0	R 16	57.11.3103		10k	MF, 1%, 0207
0	R 17	57.11.3103		10k	MF, 1%, 0207
0	R 18	57.11.3103		10k	MF, 1%, 0207
0	R 19	57.11.3103		10k	MF, 1%, 0207
0	R 20	57.11.3751		750R	MF, 1%, 0207
0	R 21	57.11.3332		3k3	MF, 1%, 0207
0	R 22	57.11.3363		36k	MF, 1%, 0207
0	R 23	57.11.3102		1k0	MF, 1%, 0207
0	R 24	57.11.3479		4R7	MF, 1%, 0207
0	R 25	57.11.3102		1k0	MF, 1%, 0207
0	R 27	57.11.3682		6k8	MF, 1%, 0207
0	R 29	57.11.3103		10k	MF, 1%, 0207
0	R 30	57.11.3102		1k0	MF, 1%, 0207
0	R 31	57.11.3103		10k	MF, 1%, 0207
0	R 32	57.11.3391		390R	MF, 1%, 0207
0	R 33	57.11.3391		390R	MF, 1%, 0207
0	R 34	57.11.3391		390R	MF, 1%, 0207
0	R 35	57.11.3391		390R	MF, 1%, 0207
0	R 36	57.11.3473		47k	MF, 1%, 0207
0	R 37	57.11.3473		47k	MF, 1%, 0207
0	R 38	57.11.3334		330k	MF, 1%, 0207
0	R 39	57.11.3334		330k	MF, 1%, 0207
0	R 40	57.11.3334		330k	MF, 1%, 0207
0	R 41	57.11.3334		330k	MF, 1%, 0207
0	R 42	57.11.3334		330k	MF, 1%, 0207
0	R 43	57.11.3104		100k	MF, 1%, 0207
0	R 44	57.11.3332		3k3	MF, 1%, 0207
0	R 45	57.11.3332		3k3	MF, 1%, 0207
0	R 46	57.11.3332		3k3	MF, 1%, 0207
0	R 47	57.11.3332		3k3	MF, 1%, 0207
0	R 48	57.11.3332		3k3	MF, 1%, 0207
0	R 49	57.11.3332		3k3	MF, 1%, 0207
0	R 50	57.11.3104		100k	MF, 1%, 0207
0	R 51	57.11.3105		1M0	MF, 1%, 0207
0	R 52	57.11.5106		10M	MF, 5%, 0207
0	R 61	57.11.3243		24k	MF, 1%, 0207
0	R 62	57.11.3472		4k7	MF, 1%, 0207
0	R 64	58.01.8102		1k0	Cermet, 10%, 0.5W, horizontal
0	R 65	57.11.3102		1k0	MF, 1%, 0207
0	R 67	57.11.3102		1k0	MF, 1%, 0207
0	R 70	57.11.3109		1R0	MF, 1%, 0207
0	R 71	57.11.3109		1R0	MF, 1%, 0207
0	R 72	57.11.3109		1R0	MF, 1%, 0207
0	R 73	57.11.3109		1R0	MF, 1%, 0207
0	R 74	57.11.3103		10k	MF, 1%, 0207
0	R 75	57.11.3103		10k	MF, 1%, 0207
0	R 76	57.11.3103		10k	MF, 1%, 0207
0	R 77	57.11.3103		10k	MF, 1%, 0207
0	R 78	57.11.3472		4k7	MF, 1%, 0207
0	R 79	57.11.3102		1k0	MF, 1%, 0207
0	R 80	57.11.3102		1k0	MF, 1%, 0207
0	R 81	57.11.3103		10k	MF, 1%, 0207
0	R 82	57.11.3103		10k	MF, 1%, 0207
0	R 87	57.11.3561		560R	MF, 1%, 0207
0	R 88	57.11.3220		22R	MF, 1%, 0207
0	R 89	57.11.3103		10k	MF, 1%, 0207
0	R 90	57.11.3105		1M0	MF, 1%, 0207
0	R 91	57.11.3220		22R	MF, 1%, 0207
0	R 92	57.11.3103		10k	MF, 1%, 0207
0	R 93	57.11.3103		10k	MF, 1%, 0207
0	R 94	57.11.3471		470R	MF, 1%, 0207
0	R 95	57.11.3101		100R	MF, 1%, 0207
0	R 96	57.11.3101		100R	MF, 1%, 0207
0	R 97	57.92.7003		1.0A	PTC
0	R 98	57.11.3152		1k5	MF, 1%, 0207
0	R 99	57.11.3101		100R	MF, 1%, 0207
0	R 100	57.11.3104		100k	MF, 1%, 0207
0	R 101	57.11.3103		10k	MF, 1%, 0207
0	RZ 1	57.88.4102		1k0	8*R Resistor-Netw 2% SIP9
0	T 1	1.022.608.00			SCHALTTRAFO ZU BAR-GRAPH

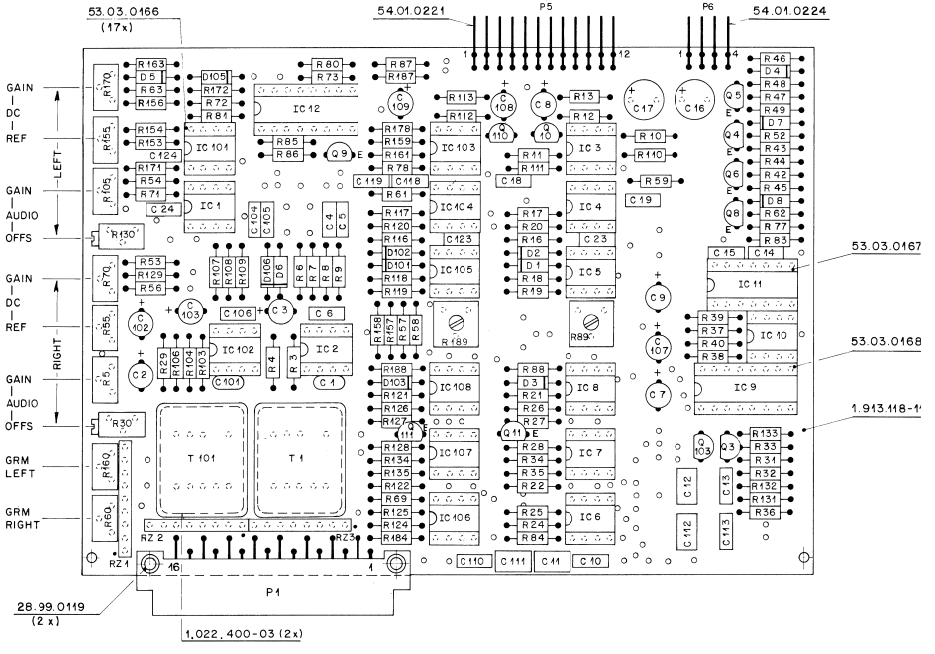
End of List

Comments:

[23] IC3 same SW, but shifted in address-range

BARGRAPH

Bargraph Analog Board ESE 1.913.118.81



IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	IC....7	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC....8	50.09.0103	TL 071	single op. amp.	Ra/NE
	IC....9	50.07.0024	4052	analog multi-/demultiplexers	
	IC....10	50.05.0083	LM 393 P	dual voltage comparator	Ra/NE
	IC....11	50.07.0006	4001	quad 2-input Nor Gate	
	IC....12	50.07.0024	4052	analog multi-/demultiplexers	
	IC.101	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC.102	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC.103	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC.104	50.09.0116	OP 07	single op. amp.	Ra.
	IC.105	50.09.0117	MC33078P	dual op. amp.	Motorola
	IC.106	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC.107	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC.108	50.09.0103	TL 071	single op. amp.	Ra/NE
	Q....3	50.03.1505	VNO808	V-MosFET	Fe/Six
	Q....4	50.03.0484	MPSA42	NPN	any
	Q....5	50.03.0485	MPSA92	PNP	any
	Q....6	50.03.0485	MPSA92	PNP	any
	Q....8	50.03.0484	MPSA42	NPN	any
	Q....9	50.03.0436	BC 237	NPN	any
	Q....10	50.03.1130	J 110	N-JFET	NS/Mot/Six
	Q....11	50.03.0497	BC 550	NPN	any
	Q.103	50.03.1505	VNO808	V-MosFET	Fe/Six
	Q.110	50.03.1130	J 110	N-JFET	NS/Mot/Six
	Q.111	50.03.0497	BC 550	NPN	any
	R....3	57.11.3333	33 kOhm	5% 0.25W MF	
	R....4	57.11.3682	6.8 kOhm	5% 0.25W MF	
	R....5	58.01.9202	2 kOhm	10% 0.5 W PGM trimming resistor	
	R....6	57.11.3104	100 kOhm	5% 0.25W MF	
	R....7	57.11.3821	820 Ohm	1% 0.25W MF	
	R....8	57.11.3102	1 kOhm	1% 0.25W MF	
	R....9	57.11.3821	820 Ohm	1% 0.25W MF	
	R....10	57.11.3222	2.2 kOhm	1% 0.25W MF	
	R....11	57.11.3223	22 kOhm	1% 0.25W MF	
	R....12	57.11.3222	2.2 kOhm	1% 0.25W MF	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	R....13	57.11.3244	240 kOhm	5% 0.25W MF	
	R....16	57.11.3103	10 kOhm	1% 0.25W MF	
	R....17	57.11.3105	1 MOhm	5% 0.25W MF	
	R....18	57.11.3103	10 kOhm	1% 0.25W MF	
	R....19	57.11.3103	10 kOhm	1% 0.25W MF	
	R....20	57.11.3203	20 kOhm	1% 0.25W MF	
	R....21	57.11.3203	20 kOhm	1% 0.25W MF	
	R....22	57.11.3164	160 kOhm	1% 0.25W MF	
	R....24	57.11.3624	620 kOhm	1% 0.25W MF	
	R....25	57.11.3394	390 kOhm	1% 0.25W MF	
	R....26	57.11.3203	20 kOhm	1% 0.25W MF	
	R....27	57.11.3203	20 kOhm	1% 0.25W MF	
	R....28	57.11.3122	1.2 kOhm	1% 0.25W MF	
	R....29	57.11.3152	1.5 kOhm	1% 0.25W MF	
	R....30	58.05.0104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R....31	57.11.3563	56 kOhm	5% 0.25W MF	
	R....32	57.11.3684	680 kOhm	1% 0.25W MF	
	R....33	57.11.3000	0 Ohm		
	R....34	57.11.6226	22 MOhm	10% 0.25W MF	
	R....35	57.11.6226	22 MOhm	10% 0.25W MF	
	R....36	57.11.3102	1 kOhm	5% 0.25W MF	
	R....37	57.11.3223	22 kOhm	5% 0.25W MF	
	R....38	57.11.3223	22 kOhm	5% 0.25W MF	
	R....39	57.11.3103	10 kOhm	5% 0.25W MF	
	R....40	57.11.3103	10 kOhm	5% 0.25W MF	
	R....42	57.11.3681	680 Ohm	5% 0.25W MF	
	R....43	57.11.3474	470 kOhm	5% 0.25W MF	
	R....44	57.11.3103	10 kOhm	5% 0.25W MF	
	R....45	57.11.3474	470 kOhm	5% 0.25W MF	
	R....46	57.11.3474	470 kOhm	5% 0.25W MF	
	R....47	57.11.3681	680 Ohm	5% 0.25W MF	
	R....48	57.11.3103	10 kOhm	5% 0.25W MF	
	R....49	57.11.3474	470 kOhm	5% 0.25W MF	
	R....52	57.11.3103	10 kOhm	5% 0.25W MF	
	R....53	57.11.3333	33 kOhm	5% 0.25W MF	
	R....54	57.11.3333	33 kOhm	5% 0.25W MF	
	R....55	58.01.9102	1 kOhm	10% 0.5 W PMG trimming resistor	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	C....1	59.34.2470	47 pF	CER	
	C....2	59.22.3101	100 uF	ALU 10V	
	C....3	59.22.3101	100 uF	ALU 10V	
	C....4	59.06.5153	15 nF	PE 5%	
	C....5	59.06.5102	1 nF	PE 5%	
	C....6	59.06.5473	47 nF	PE 5%	
	C....7	59.22.3101	100 uF	ALU 10V	
	C....8	59.22.3101	100 uF	ALU 10V	
	C....9	59.22.3101	100 uF	ALU 10V	
	C....10	59.06.5473	47 nF	PE 5%	
	C....11	59.06.5474	470 nF	PE 5%	
	C....12	59.06.5105	1 uF	PE 5%	
	C....13	59.06.5153	15 nF	PE 5%	
	C....14	59.06.5102	1 nF	PE	
	C....15	59.06.5102	1 nF	PE	
	C....16	59.22.5101	100 uF	ALU 25V	
	C....17	59.22.5101	100 uF	ALU 25V	
	C....18	59.06.5102	1 nF	PE	
	C....19	59.06.5102	1 nF	PE	
	C....20			not used	
	C....21			not used	
	C....23	59.06.5223	22 nF	PE 5%	
	C....24	59.06.5152	1.5 nF	PE	
	C....31			not used	
	C....32			not used	
	C....33			not used	
	C....34			not used	
	C....35			not used	
	C....36			not used	
	C....37			not used	
	C....38			not used	
	C....39			not used	
	C....40			not used	
	C....41			not used	
	C....42			not used	
	C..101	59.34.2470	47 pF	CER	
	C..102	59.22.3101	100 uF	ALU 10V	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	C...103	59.22.3101	100 uF	ALU 10V	
	C...104	59.06.5153	15 nF	PE 5%	
	C...105	59.06.5102	1 nF	PE 5%	
	C...106	59.06.5473	47 nF	PE 5%	
	C...107	59.22.3101	100 uF	ALU 10V	
	C...108	59.22.3101	100 uF	ALU 10V	
	C...109	59.22.3101	100 uF	ALU 10V	
	C...110	59.06.5473	47 nF	PE 5%	
	C...111	59.06.5474	470 nF	PE 5%	
	C...112	59.06.5105	1 uF	PE 5%	
	C...113	59.06.5153	15 nF	PE 5%	
	C...118	59.06.5102	1 nF	PE	
	C...119	59.06.5102	1 nF	PE	
	C...120			not used	
	C...123	59.06.5223	22 nF	PE 5%	
	C...124	59.06.5152	1.5 nF	PE 5%	
	D....1	50.04.0125	1N4448		
	D....2	50.04.0132	BAW 62		
	D....3	50.04.0125	1N4448		
	D....4	50.04.1120	4.3 V	z-diode	
	D....5	50.04.0125	1N4448		
	D....6	50.04.0125	1N4448		
	D....7	50.04.0125	1N4448		
	D....8	50.04.0125	1N4448		
	D..101	50.04.0125	1N4448		
	D..102	50.04.0132	BAW 62		
	D..103	50.04.0125	1N4448		
	D..105	50.04.0125	1N4448		
	D..106	50.04.0125	1N4448		
	IC....1	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC....2	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC....3	50.09.0119	TL 062	dual op. amp.	Ra/NE
	IC....4	50.09.0116	OP 07	single op. amp.	Ra.
	IC....5	50.09.0117	MC33078P	dual op. amp.	Motorola
	IC....6	50.09.0119	TL 062	dual op. amp.	Ra/NE

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	R....56	57.11.3821	820 Ohm	5% 0.25W MF	
	R....57	57.11.3103	10 kOhm	1% 0.25W MF	
	R....58	57.11.3103	10 kOhm	1% 0.25W MF	
	R....59	57.11.3273	27 kOhm	1% 0.25W MF	
	R....60	58.01.9104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R....61	57.11.3273	27 kOhm	1% 0.25W MF	
	R....62	57.11.3103	10 kOhm	5% 0.25W MF	
	R....63	57.11.3333	33 kOhm	5% 0.25W MF	
	R....69	57.11.3183	18 kOhm	5% 0.25W MF	
	R....70	58.01.9104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R....71	57.11.3103	10 kOhm	5% 0.25W MF	
	R....72	57.11.3333	33 kOhm	5% 0.25W MF	
	R....73	57.11.3104	100 kOhm	5% 0.25W MF	
	R....77	57.11.3103	10 kOhm	5% 0.25W MF	
	R....78	57.11.3223	22 kOhm	5% 0.25W MF	
	R....80	57.11.3102	1 kOhm	5% 0.25W MF	
	R....81	57.11.3102	1 kOhm	5% 0.25W MF	
	R....83	57.11.3104	100 kOhm	5% 0.25W MF	
	R....84	57.11.6226	22 MOhm	5% 0.25W MF	
	R....85	57.11.3683	68 kOhm	5% 0.25W MF	
	R....86	57.11.3303	30 kOhm	5% 0.25W MF	
	R....87	57.11.5106	10 MOhm	5% 0.25W MF	
	R....88	57.11.5106	10 MOhm	5% 0.25W MF	
	R....89	58.01.8104	100 kOhm	5% 0.5W PGM trimming resistor	
	R..103	57.11.3333	33 kOhm	5% 0.25W MF	
	R..104	57.11.3682	6.8 kOhm	5% 0.25W MF	
	R..105	58.01.9202	2 kOhm	5% 0.5W PGM trimming resistor	
	R..106	57.11.3104	100 kOhm	5% 0.25W MF	
	R..107	57.11.3821	820 Ohm	1% 0.25W MF	
	R..108	57.11.3102	1 kOhm	1% 0.25W MF	
	R..109	57.11.3821	820 Ohm	1% 0.25W MF	
	R..110	57.11.3222	2.2 Ohm	1% 0.25W MF	
	R..111	57.11.3223	22 kOhm	1% 0.25W MF	
	R..112	57.11.3222	2.2 Ohm	1% 0.25W MF	
	R..113	57.11.3244	240 kOhm	5% 0.25W MF	
	R..116	57.11.3103	10 kOhm	1% 0.25W MF	
	R..117	57.11.3105	1 MOhm	5% 0.25W MF	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	R..118	57.11.3103	10 kOhm	1% 0.25W MF	
	R..119	57.11.3103	10 kOhm	1% 0.25W MF	
	R..120	57.11.3203	20 kOhm	1% 0.25W MF	
	R..121	57.11.3203	20 kOhm	1% 0.25W MF	
	R..122	57.11.3164	160 kOhm	1% 0.25W MF	
	R..124	57.11.3624	620 kOhm	1% 0.25W MF	
	R..125	57.11.3394	390 kOhm	1% 0.25W MF	
	R..126	57.11.3203	20 kOhm	1% 0.25W MF	
	R..127	57.11.3203	20 kOhm	1% 0.25W MF	
	R..128	57.11.3122	1.2 kOhm	1% 0.25W MF	
	R..129	57.11.3152	1.5 kOhm	1% 0.25W MF	
	R..130	58.05.0104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R..131	57.11.3563	56 kOhm	5% 0.25W MF	
	R..132	57.11.3684	680 kOhm	1% 0.25W MF	
	R..133	57.11.3000	0 Ohm		
	R..134	57.11.6226	22 MOhm	10% 0.25W MF	
	R..135	57.11.6226	22 MOhm	10% 0.25W MF	
	R..153	57.11.3333	33 kOhm	5% 0.25W MF	
	R..154	57.11.3333	33 kOhm	5% 0.25W MF	
	R..155	58.01.9102	1 kOhm	10% 0.5 W PMG trimming resistor	
	R..156	57.11.3821	820 Ohm	5% 0.25W MF	
	R..157	57.11.3103	10 kOhm	1% 0.25W MF	
	R..158	57.11.3103	10 kOhm	1% 0.25W MF	
	R..159	57.11.3273	27 kOhm	5% 0.25W MF	
	R..160	58.01.9104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R..161	57.11.3273	27 kOhm	5% 0.25W MF	
	R..163	57.11.3333	33 kOhm	5% 0.25W MF	
	R..170	58.01.9104	100 kOhm	10% 0.5 W PMG trimming resistor	
	R..171	57.11.3103	10 kOhm	5% 0.25W MF	
	R..172	57.11.3333	33 kOhm	5% 0.25W MF	
	R..178	57.11.3223	22 kOhm	5% 0.25W MF	
	R..184	57.11.6226	22 MOhm	5% 0.25W MF	
	R..187	57.11.5106	10 MOhm	5% 0.25W MF	
	R..188	57.11.5106	10 MOhm	5% 0.25W MF	
	R..189	58.01.8104	100 kOhm	10% 0.5 W PMG trimming resistor	
	RZ....1	57.88.4103	10 kOhm	5% resistor network	

IND.	POS.NO.	PART NO.	VALUE	SPECIFICATIONS / EQUIVALENT	MANUF.
	RZ....2	57.88.2682	6.8 kOhm	5% resistor network	
	RZ....3	57.88.2682	6.8 kOhm	5% resistor network	
	T.....1	:.022.419.00		input trafo 1:1	STUDER
	T...101	:.022.419.00		input trafo 1:1	STUDER

CER=Ceramic, PE=Polyester, SAL=Solid Aluminium
MF=Metal Film, PMC=Cermet

MANUFACTURER: Fa=Ferranti, NE=Nippon Electronic Corp. Ra=Raytheon,
Sig=Signetics, Six=Siliconix

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