OLTRONIX

OLTRONIX-ELECTRONICS: Regulated Power Supplies - Oscillators - Specially Designed Electronic Equipment

INSTRUCTION MANUAL

DC POWER SUPPLY

MODEL C40-1

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REGULATED LOW VOLTAGE POWER SUPPLIES

C 40-1 group

GENERAL

The Oltronix C40-1 group consists of well regulated D.C. Power Supplies for general lab use. They are available as bench models in single, dual and tripple units and as a 19" Rack model in a dual unit.

METERS, CONTROLS & TERMINALS

Each supply is fully metered i.e. one volt- and one amp-meter for each output. The output voltage is continuously variable from 0 to 40 V by a coarse and a fine control, the latter providing an output change of approximately 5 mV per degree of rotation.

The current limit control may be set from 110% to 10% of the rated current. Binding posts are provided on the front panel of all models. All output terminals are isolated from the chassis and may be individually connected to the ground terminal. In addition the Rack model has a connector at the rear. Remote programming and sensing are available on the front and at the rear connector of the Rack model.

ADJ. CURRENT LIMIT – CONSTANT CURRENT

These units feature a continuously adjustable current limit which protects both the load and the power supply. When current limiting takes place the function is actually that of a constant current source.

SERIES & PARALLEL OPERATION

Several supplies can be connected in series as long as the maximum voltage to the chassis does not exceed 500V D.C. The current limiting feature makes parallel connection possible without internal switching, but one of the supplies must always remain in the voltage regulating mode, regardless of the current swing.

REMOTE PROGRAMMING & SENSING

The output voltage from 2C40-1R can be controlled externally by a resistor. The programming constant is 500 ohms per volt.

2C40-1R permits sensing of load variations at the load terminals, rather than at the Power Supply terminals. This compensates for any regulation loss which might result from IR drops in load leads.

C40-1	0-40V	1A	Bench type
2C40-1	2 x 0-40V	1A	" "
3C40-1	3 x 0-40V	1A	" "
2C40-1R	2 x 0-40V	1A	19" Rack

INPUT VOLTAGE ..... 220 V 50-400 Hz may fluctuate between 200 and 240 V.

LINE REGULATION ... 0,03% or 6 mV for a 10% line voltage variation.

LOAD REGULATION .. Better than 25 mV for no load to full load change.

RIPPLE ..... Less than 250 uV r.m.s.

RECOVERY TIME .... 40 usec. for full load change.

OUTPUT IMPEDANCE. Less than 50 mohm up to 10 kHz at 200 kHz 0,5 ohm.

LONG TERM STABILITY..... Less than 40 mV per 8 hours after warm up and at constant ambient temperature.

TEMP. COEFFICIENT. approximately 0,03% per °C.

AMBIENT TEMP..... max. +40° C.

DIMENSIONS & WEIGHT

	C40-1	2C40-1	3C40-1	2C40-1R
Height	228 mm	228 mm	228 mm	132 mm
Width	120 mm	234 mm	352 mm	19"
Depth	280 mm	280 mm	280 mm	280 mm
Weight	5 kgs	10 kgs	15 kgs	13 kgs

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OPERATION INSTRUCTIONS

Controls and terminals.

ON — is the line power switch. When the power is on the pilot light glows.

0-40 V; FINE.
0-60 V; FINE. — Coarse and fine voltage controls.

50-500 mA.
0,1-1 A. — The control of the current limiting device.

- — +. — The floating output. Either terminal may be connected to the chassis ground.

METERS. — These read simultaneously output voltage and current.

VOLTM. 10V or 14V. (B40-1, B60-1). When pressing the button the voltmeter range is 10V or 14V full scale.

SET CONSTANT CURRENT:(B40-1,B60-1). When pressing the button the supply will be shorted with a 5 ohms resistor.

500mA. 1A. — The line fuse at the rear of the instrument.

220 V 50 Hz. — The power line socket at the rear of the instrument.

Operation.

1. Using the current limiting device.

a) Set the output voltage to about 10 V.
b) Short the supply with a wire and for B type press the SET CONSTANT CURRENT pushbutton and set the output current as desired with the current control.
c) Disconnect the wire and set the output voltage as desired.
Depending on the load the instrument is maintaining either a constant current or a constant voltage.

2. Connecting two or more instruments in parallell.

The circuit makes it possible to parallell serveral units without internal changes. The parallelling of units permits a higher current together with a stable voltage. When two units are parallelled one must maintain a constant current and the other a constant voltage. Therefore

a) set the output voltage of the "current" unit to slightly higher voltage than that of the "voltage" unit.
b) divide the current between the units to about equal in such a way that the 'voltage' unit is set to higher current-limit (or at maximum) than the "current" unit.
c) if the voltage decreases when the load is connected correct this by increasing the current limit of the 'voltage" unit and, if necessary, also of the "current" unit.

3. Connecting two or more units in series.

When series connecting two or more units the current limiting controls should also be checked. Since the current through the units will be identical a voltage drop may take place, if the current limit is set too low.

CIRCUIT DESCRIPTION.

The transformer supplies A.C. voltages to the main and auxiliary supplies. The main supply consists of the full wave rectifier Z1, the filter capacitor C4 and the series regulator transistors T7 - T8.

The auxiliary supplies consist of the rectifiers Z2, Z3, Z4 and their filtering capacitors C1, C2 and C7 respectively. These supplies provide reference and bias voltages for the regulating transistors.

The reference voltage is obtained from D1 and D2. The output voltage is compared with the reference voltage and is set with the potentiometers P1 and P2 . The transistors T7 and T8 act as a series resistance and conduct more current when their base goes more negative with respect to the emitter. The transistor T8 controls the current through R13 and thus serves the purpose of optimizing the distribution of the power losses between the power dissipating units T7, T8 and R13. The T7 base is controlled by the emitter followers T6 and T5. The emitter followers in turn are controlled by the differential amplifier consisting of the transistors T1 and T2, which are fed by a near constant current by means of the transistor T3 (B models only). The differential amplifier compares the output voltage with the reference by means of the potential divider R19-P1-P2.

The current limiting device consists of the transistor T4 and the potentiometer P5. T4 controls the base of T5 but is normally cut off. If the voltage across R2-P3 exceeds that of P5, T4 will come on and take over the control from T2. Thus the current limit is set with the potentiometer P3 and controlled by the transistor T4.

In the B60-1 the relay K1 switches the transformer output to a higher step when the output voltage of the supply exceeds around 30 Volts. K1 is operated by the Smith´s trigger T9-T10 which is set to trigger at the proper voltage by means of P4.

MAINTENANCE AND SERVICE.

Cover removal.

The cover is removed by unscrewing the two screws one at the top and one at the bottom of the instrument and sliding the chassis backwards.

Removal and replacement of parts.

There are no parts which require regular maintenance. The circuit reference obtained from the schematic diagram is used to identify the corresponding component in the spare parts list. Most parts used in the Oltronix´instruments are standard parts obtainable from any well equipped parts distributor. Parts are also available from us at current net prices.

One exception is the classification of transistors. In the diagrams two designations are used for each transistor, one is the manufacturer standard type designation and the other is our code indicating the voltage the transistor is supposed to withstand and the gain. L means low gain (below 50) and H high gain. For small transistors the following colour marking is used: Brown: L25, yellow: L50, white: L75, red: H25, green: H50, violet: H75. Our code is marked on each transistor after its evaluation in our curve tracer and is a guarantee that the transistor will function properly. For replacement purposes a transistor with the manufacturer designation only has about 80% chance to work satisfactorily.

Service.

If any trouble should occur, trouble shooting will be easier by following this service instruction. A table of characteristic voltages for a normally functioning supply and a check list follows.

The voltages are measured under the following conditions:

No load: 40 and 60V output (respectively). The current limiting potentiometer turned fully clockwise.

Full load: 40 and 60V (respectively), maximum rated output current.

All transistor voltages are measured with respect to the emitter.

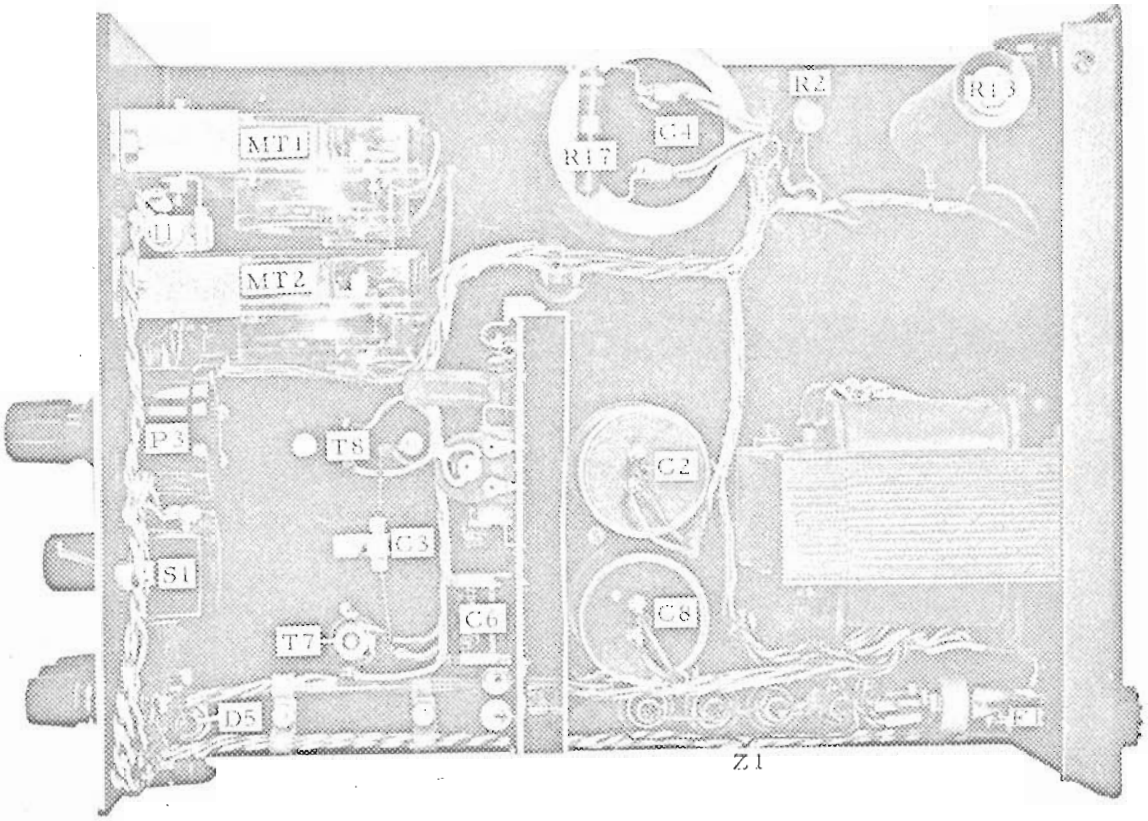
The method used when trouble shooting depends largely on the indication of failure. It is usually recommendable to use a variac with ammeter and start with about 5-10% of normal line voltage. This prevents burning and possible damage inside the instrument. With the low input voltage connected all voltages across the filtering capacitors are checked. There should be a small D.C. voltage and the effect of the capacitor may be noticed when it is shorted.

After all the filtered D.C. voltages have been checked the variac is slowly increased while the line ammeter is watched for jumps in the current. It is also necessary to check now if any component shows abnormal temperature. If this is not the case the input voltage can be raised to normal.

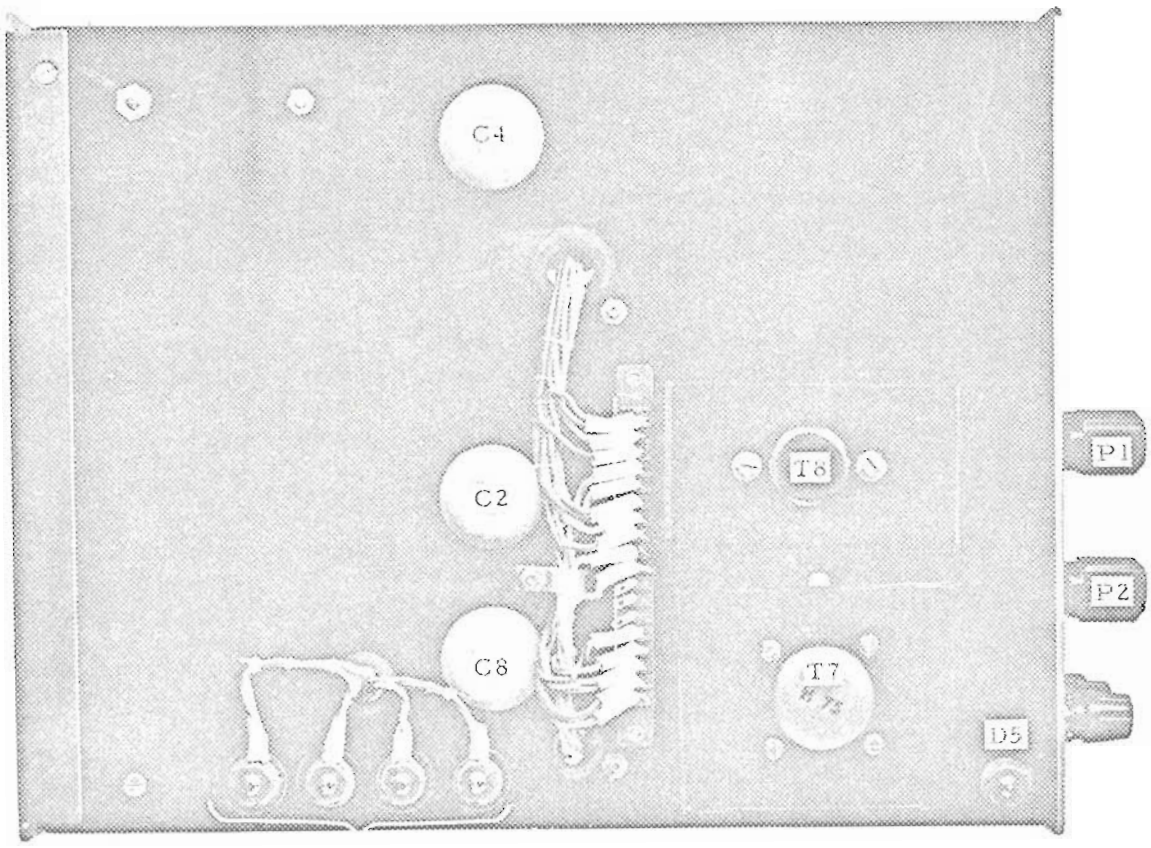
Starting with the filter capacitors and the reference voltage all figures in the following list may now be checked. There are, of course, thousands of combinations which can not be listed here. Too high output voltage can be caused by a short in T7 or in T6 and T5 but also by interruption in T2, T3 or P1 or P2. Too low voltage may be caused by interruption in T7, T6 or T5 or a short in T2 etc. High ripple and poor regulation may be caused by low gain in any of the transistors T1, T2, T5, T7. It may, of course, also indicate a defective reference voltage.

VOLTAGE LIST

		No load		Full load	
C1		11	V	10	V
C2		21	V	22,5	V
C4		69	V	54	V
D2		6,8	V	6,8	V
T1	base	-0,1	V	-0,1	V
	collector	-40	V	-40,5	V
T2	base	-0,14	V	-0,14	V
	collector	-40	V	-40	V
T4	base	+1,9	V	+0,22	V
	collector	-40	V	-41,5	V
T5	base	-0,1	V	-0,11	V
	collector	-9,3	V	-5,7	V
T6	base	-0,15	V	-0,2	V
	collector	-9,5	V	-6	V
T7	base	-0,1	V	-0,3	V
	collector	-27	V	-8	V
T8	base	+15,5	V	-0,35	V
	collector	-1,3	V	-2,3	V


MT1
MT2
R17
C4
R2
R13
P3
T8
C2
C3
S1
C6
C8
T7
D5
P1

Z1


C4
C2
C8
T8
T7
P1
P2
D5

Z1

MODEL C

Oltronix transistor identification code

To assure that the transistors in the Oltronix power supplies have good enough data for their actual application, all transistors are tested in a Tektronix Curve Tracer before they are mounted in any instrument. Certain transistors e.g. power transistors and transistors for high voltage use pass a more complete test after which a classification mark is applied. This mark is a letter-number combination on the power transistors and a colour dot on the smaller transistors.

The letter indicates high "H" or low "L" current amplification. The number shows the maximum working voltage.

The test conditions are:

Test	Power transistors TO-3 and TO-36	Other transistors TO-5 and similar
Current amplification	I_c=2A V_{CE}=10V	I_c=1mA V_{CE}=10V
	High if h_{FE} ≥50	High if h_{FE} ≥50
	Low if h_{EE} <50	Low if h_{FE} <50
	Transistors with extremely high or extremely low h_{FE} are refused.	
Voltage	I_c=400mA	I_c=1mA
	R_{BE}=100ohms	R_{BE}=1,5k

The colour code is:

Class	Colour	Class	Colour
L25	Brown	L100	Silver
H25	Red	H100	Black
L50	Yellow	L125	Silver and brown
H50	Green	H125	Black and red
H65	Blue	L150	Silver and yellow
L75	White	H150	Black and green
H75	Violet	L175	Silver and white
		H175	Black and violet

To get TO-36 power transistors distributed in the voltage and amplification classes in a way suiting our program, transistors of the types 2N442, 2N443, 2N1099 and 2N1100 are used. These transistors come from the same production line, but are classified by the manufacturer. Because of our special requirements these transistors are reclassified at the Oltronix factory. Transistors of different types and from different manufacturers thus can replace each other if they have identical Oltronix classification.

SPARE PARTS LIST C40-1

Abbreviations

Cer.	ceramic	p	uu or 10^{-12}
EMC	electrolytic, metal case	PT	paper tubular
F	farad	W	Watt
K	Kilo or 10^3	WW	wire wound
M	meg or 10^6		
u	micro or 10^{-6}		

Capacitors

C1	250 uF	EMC	12V	-20%+50%	F&T
C2	2000 uF	"	25V	"	Rifa
C3	2 uF	"	70V	"	"
C4	2500 uF	"	70V	"	"
C5	0,01 uF	PT	400V	± 20%	Rifa
C6	1 uF	"	250V	± 10%	"
C8	1000 uF	EMC	70V	-20%+50%	"
C9	250 uF	"	6V	"	F&T

Fuse

F1	1A				

Bulb

I 1	8034D	10V 0, 2A			Philips

Meters

MT1	Voltage	EW 16	50V		Kyoritsu
MT2	Ampere	EW 16	1A		"

Potentiometers

P1	25 Kohm	Type CL43	WW	Spec. design	Clarostat
P2	1 Kohm	"	WW	"	"
P3	20 ohm G	CLR 3001/11			Colvern
P5	5 Kohm	P4 1/4W	Carbon	± 20%	Vitrohm

Resistors

R1	100 Kohm	1/3W	Carbon	± 10%	Beyschlag
R2	2 ohm	3W	WW	± 5%	Vitrohm
R3	390 ohm	1/3W	Carbon	±5%	Beyschlag
R4	680 ohm	1/3W	"	"	"
R5	10 Kohm	1/3W	"	±10%	"
R7	270 ohm	1/3W	"	"	"
R8	270 ohm	1/3W	"	"	"
R9	33 Kohm	1/3W	"	"	"
R10	150 ohm	1/3W	"	"	"
R11	1, 2 Kohm	1/3W	"	"	"
R12	51 ohm	1/3W	"	"	"
R13	37, 5 ohm	40W	WW	±5%	Erie
R14	10 Kohm	1/2W	Carbon	± 10%	Beyschlag
R15	3 Kohm	2W	WW	±5%	Vitrohm
R16	56 Kohm	1/3W	Carbon	±10%	Beyschlag
R17	5 Kohm	3W	WW	"	Vitrohm

R18	1 Kohm	1/3W	Carbon	± 10%	Beyschlag
R19	4 Kohm	2W	WW	± 5%	Vitrohm

Switch

S1		Type 132			Marquardt

Transistors

T1	ACY 17 2S302		L75		Mullard, Texas
T2	ACY 17 2S302		L75		" "
T4	ACY 17 2S302		L75		" "
T5	ACY 19		H25		"
T6	ACY 19		L25		"
T7	2N 1099		H75		RCA
T8	OC29, TI3029		H50		Mullard, Texas

Rectifiers

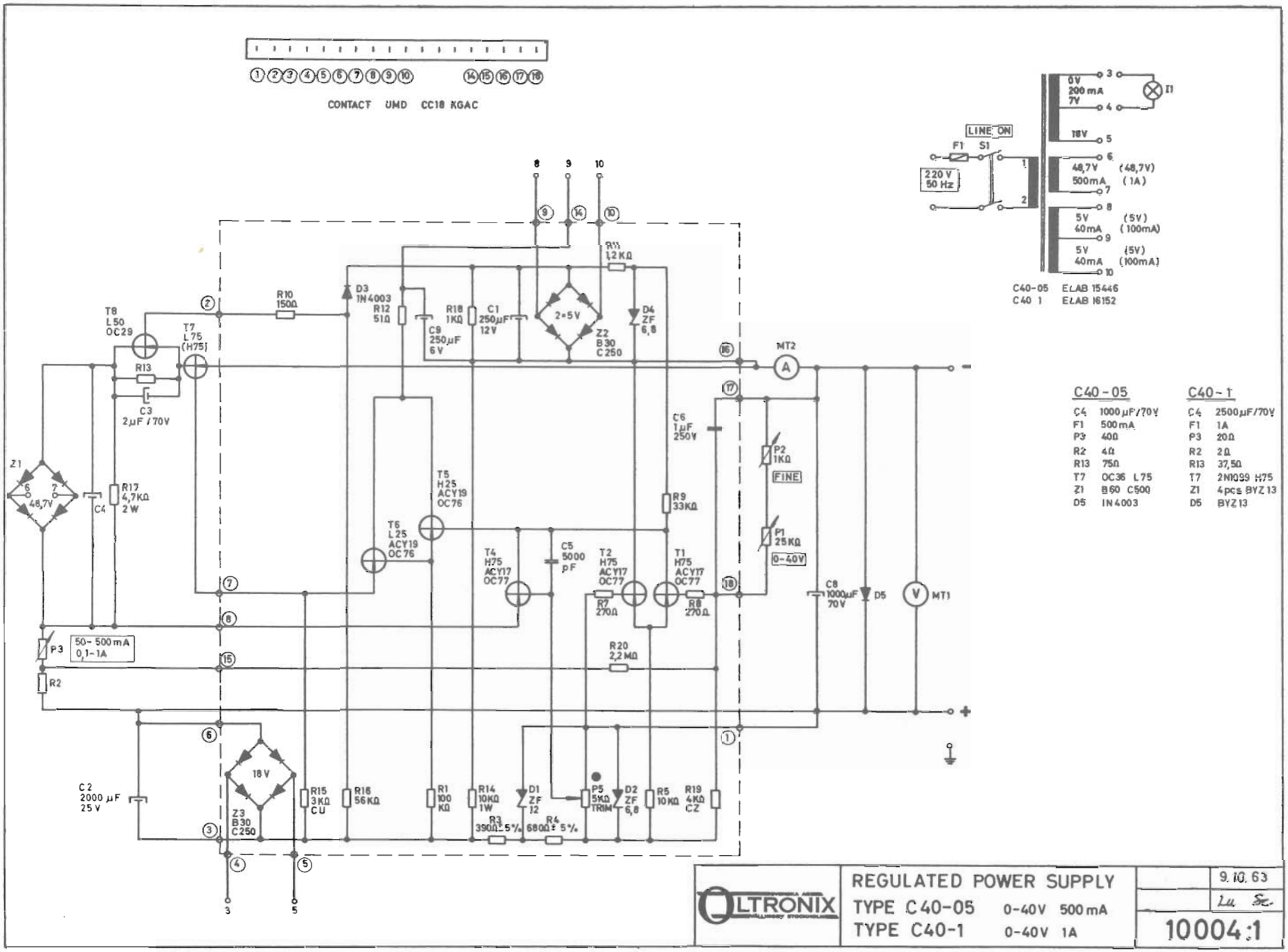
Z1 4pcs	BYZ13	200V PIV	6A		"
Z2	B30 C250				Siemens
Z3	B30 C250				"

Diodes

D1	ZD12	11,9-12,3V	12,4-12,6V		Intermetall
D2	ZF 6,8	6,6-6,8V	6,9-7,1V		"
D3	IN 4003	200V PIV	750 mA		Motorola
D4	ZF 6,8	6,6-6,8V			Intermetall
D5	BYZ 13	200V PIV	750 mA		Mullard

Transformer

E	16152				Elab



C40-05		C40-1	
C4	1000 µF/70V	C4	2500 µF/70V
F1	500 mA	F1	1A
P3	40Ω	P3	20Ω
R2	4Ω	R2	2Ω
R13	75Ω	R13	37,5Ω
T7	OC36 L75	T7	2N1099 H75
Z1	B60 C500	Z1	4 pcs BYZ 13
D5	IN4003	D5	BYZ13

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REGULATED POWER SUPPLY
TYPE C40-05 0-40V 500 mA
TYPE C40-1 0-40V 1A

9.10.63
Lu Sc.
10004:1