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M450B
PROGRAM/SUMMING AMPLIFIER

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WARD-BECK SYSTEMS LTD.

841 PROGRESS AVENUE, SCARBOROUGH, ONTARIO M1H 2X4

TELEX: 065-25399

TELEPHONE: 416/438-6550

M450B

PROGRAM/SUMMING AMPLIFIER

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M450B PROGRAM/SUMMING AMPLIFIER

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W A R R A N T Y

All Ward-Beck Systems Ltd., products are warranted against defective materials and workmanship for a period of one year from the date of shipment.

Ward-Beck Systems Ltd., will repair or replace, at its option and without charge, all said products or parts thereof which upon factory inspection prove to be defective during the warranty period, provided that:

- 1) the original serial numbers are intact and have not been tampered with,
- 2) the purchaser shall return any equipment or parts thereof to Ward-Beck Systems Ltd., only after obtaining prior authorization and shipping instructions from the factory (Ward-Beck Systems Ltd., reserves the right to inspect or repair equipment on the purchaser's premises), and
- 3) the purchaser assumes the obligation for all expenses incurred in connection with the shipping and return of such goods, once authorization has been obtained.

This warranty does not cover items normally considered expendable, such as fuses and lamps.

This warranty does not cover damages caused by misuse, accident, neglect, unauthorized alteration, repair by unauthorized personnel, or damage caused by act of God, war, or civil insurrection.

In no event shall Ward-Beck Systems Ltd., be liable for consequential damages. Ward-Beck Systems Ltd., shall have the right to final determination as to the applicability of this warranty.

Ward-Beck Systems Ltd., reserves the right, at any time and without notice, to make changes in its equipment, component specifications, or designs, as may be warranted by progress in state-of-the-art or technology.

The warranty set forth herein is in lieu of all other warranties, expressed or implied, including the warranties of merchantability and fitness.

TECHNICAL DATAM450B PROGRAM/SUMMING AMPLIFIER

	<u>Used as PROGRAM AMPLIFIER</u>	<u>Used as SUMMING AMPLIFIER</u>
Gain:	24 to 40 dB.	Unity, with external pair of 15k ohm resistors.
Noise: (20 Hz to 20 kHz)	-68 dBm (at 40 dB gain).	-82 dBm (at unity gain).
Input Impedance:	5K ohms.	30k ohms (with external pair of 15k ohm resistors).
Input Isolation:	(not applicable).	90 dB or better from 30 Hz to 20 kHz.
Maximum Input Level:	-10 to +6 dBm.	+30 dBm.

Used as PROGRAM or SUMMING AMPLIFIER

Frequency Response:	+/- 0.25 dB from 20 Hz to 20 kHz.
Harmonic Distortion:	Less than 0.2% THD from 20 Hz to 20 kHz.
Source Impedance:	600 ohms maximum, balanced.
Maximum Output Level:	+30 dBm into 600 ohm load, balanced.
Output Impedance:	Less than 35 ohms, balanced.
Load Impedance:	600 ohms minimum.
Phasing:	Low number terminals of input and output are in phase.
Power Requirements:	+/- 25 volts dc, 40 mA quiescent current. 100 mA at +30 dBm output into 600 ohms.
Ambient Temperature:	0 to 60 degrees Celsius.
Dimensions:	1.1" wide X 3.5" high X 7.0" deep (28 mm X 89 mm X 178 mm)

CIRCUIT DESCRIPTION

M450B PROGRAM/SUMMING AMPLIFIER

The M450B is a direct replacement for the M450 dual purpose Program/ Summing Amplifier.

When used as a summing amplifier, the balanced input signal is applied via external summing resistors to pins 3 and 5. In the program amplifier mode, the input signal is applied to pins 4 and 6 of the edge connector and proceeds via R1 and R2 to the pre-amplifiers, thus presenting an input impedance of approximately 5k ohms to the source.

The input connects to two preamplifiers, one consisting of Q1 through Q3, the other Q4 through Q8.

From the output of the upper inverting amplifier, the signal proceeds to the input of the lower amplifier via R10, R11 and C6.

R10 serves as a differential control to equalize any small gain differences between the two amplifier sections, resulting in optimum common mode rejection.

When used as a summing amplifier, the M450B is normally operating at unity gain, whereas in the program amplifier mode the gain may be adjusted anywhere between 24 and 40 dB. All gain changes are achieved by external resistance strapping on pins 9, 10 and 11 on the module connector, affecting the feedback loop within the lower preamplifier.

C10 couples the output of the preamplifier to the output section. Z2, Q13, Q14, Q15 and Q16 represent the lower half of the output amplifier.

A 12 dB/octave low-pass filter consisting of R22, R23, R24, C11, C13 and C14 limits the bandwidth beyond the audio passband.

One half of the output signal is derived from the lower half of the output amplifier and is brought out to pin 13 via C24, L2 and R56.

The input signal for the second output amplifier half is routed via R35 to pin 2 of Z1, followed by Q9 through Q12. C23, L1 and R55 couple the output of this part of the amplifier to pin 12.

The actively balanced output of the unit, appearing at pins 12 and 13, is capable of delivering 1 watt into a 600 ohm load.

CIRCUIT DESCRIPTION

M450B PROGRAM/SUMMING AMPLIFIER

The bipolar ± 25 volt supply voltages applied to pins 1, 8 and 15 are coupled via isolation diodes CR5 and CR6 to C25 and C26. Additional filter networks reduce the supply voltage to ± 18 and ± 16 volts to operate the preamplifiers as well as the integrated circuits.

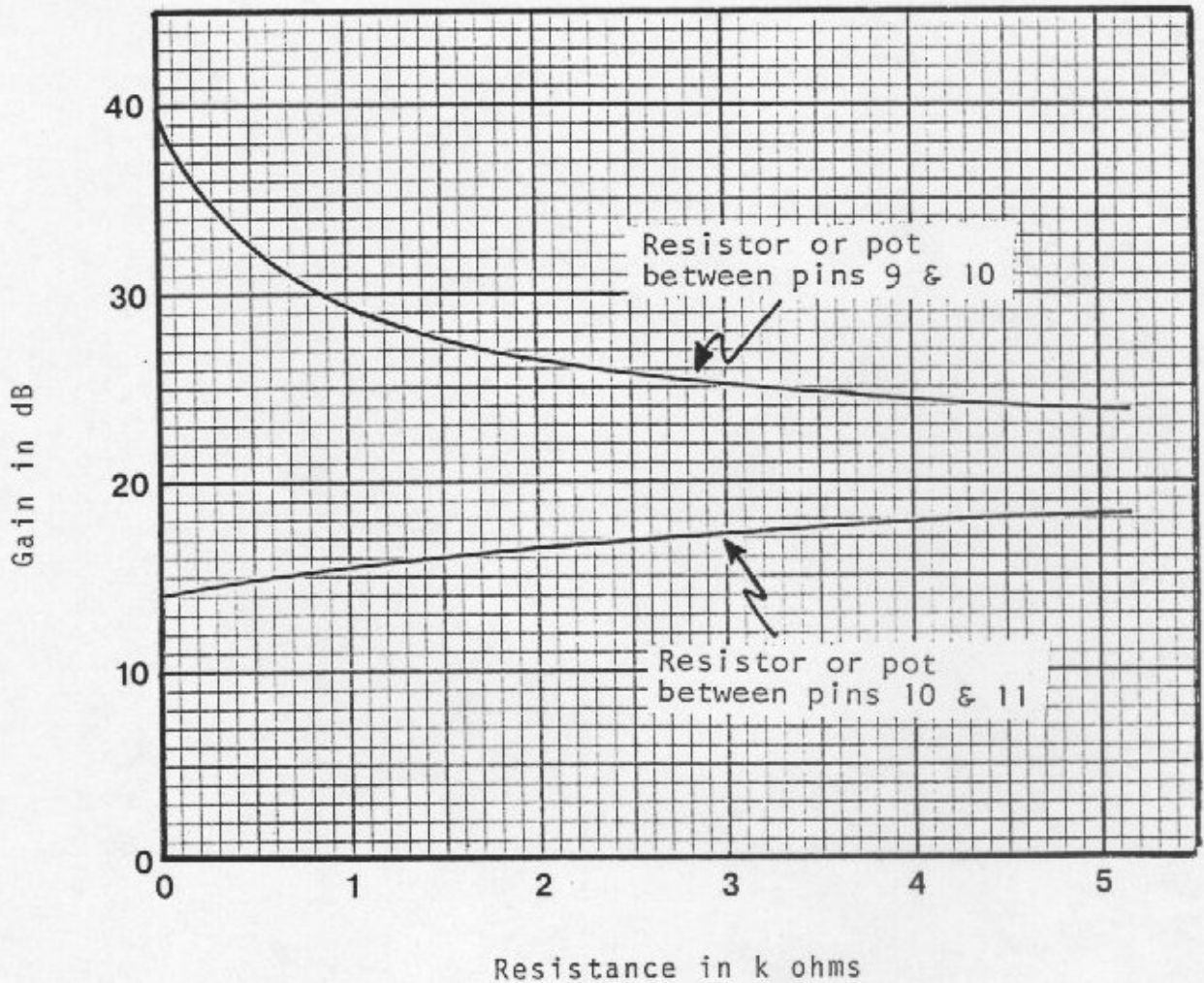
As a result of the symmetry of the circuit, the dc voltages at the collector of Q3, as well as the junctions R20/R21, R44/R45 and R32/R33 will be at a potential of 0 volts ± 0.5 volt.

In the quiescent state, the amplifier requires a current of approximately 40 mA, rising to 80 to 100 mA at full output, delivering +30 dBm into a 600 ohm load.

GAIN ADJUSTMENT

M450B PROGRAM/SUMMING AMPLIFIER

A. Used as a PROGRAM AMPLIFIER



B. Used as SUMMING AMPLIFIER

A 500 ohm trim pot connected between pins 10 and 11 will cause the amplifier to operate at unity gain with a trim adjustment of ± 1 dB.

PARTS LISTM450B PROGRAM/SUMMING AMPLIFIER

<u>PART</u>	<u>DESCRIPTION</u>		<u>MFG</u>	<u>MFG PART NUMBER</u>
C1	Capacitor	330 uF/6 V	Kemet	T390F337M006AS
C2	"	"	"	"
C3	"	delete		
C4	"	47 pF	Philips	2222-638-70479
C5	"	3.3 pF	"	2222-638-09338
C6	"	56 pF	"	2222-638-70569
C7	"	delete		
C8	"	delete		
C9	"	3.3 pF	"	2222-638-09338
C10	"	33 uF/10 V	Kemet	T390D336M010AS
C11	"	2200 pF	Aselco	CQ92-MC-222M
C12	"	10 pF	Philips	2222-638-10109
C13	"	33 pF	"	2222-638-58339
C14	"	220 pF	"	2222-630-03221
C15	"	33 pF	"	2222-638-58339
C16	"	22 pF	"	2222-638-58229
C17	"	10 uF/25 V	Kemet	T390C106M025AS
C18	"	10 pF	Philips	2222-638-10109
C19	"	33 pF	"	2222-638-58339
C20	"	"	"	"
C21	"	22pF	"	2222-638-58229
C22	"	10 uF/25 V	Kemet	T390C106M025AS
C23	"	220 uF/10 V	"	T390F227M010AS
C24	"	"	"	"
C25	"	22 uF/25 V	Philips	426ETF22
C26	"	"	"	"
C27	"	"	"	"
C28	"	"	"	"
C29	"	10 uF/25 V	Kemet	T390C106M025AS
C30	"	"	"	"
C31	"	33 pF	Philips	2222-638-58339
C32	"	0.68/35	"	T390A684M035AS
C33	"	0.68/35	"	"
CR1	Diode		Fairchild	1N4148
CR2	"		"	"
CR3	"		"	"

PARTS LISTM450B PROGRAM/SUMMING AMPLIFIER

<u>PART</u>	<u>DESCRIPTION</u>		<u>MFG</u>	<u>MFG PART NUMBER</u>
CR4	"		"	"
CR5	"		Motorola	1N4003
CR6	Diode		Motorola	1N4003
L1	Choke	100 uH	WBS	WBS 23-001
L2	"	"	"	"
Q1	Transistor		National	2N4401
Q2	"		"	"
Q3	"		"	PN3645
Q4	"		"	2N4401
Q5	"		"	"
Q6	"		"	PN3645
Q7	"		"	PN3569
Q8	"		"	PN3645
Q9	"		"	PN3569
Q10	"		"	2N3645
Q11	"		Texas	TIP29B
Q12	"		"	TIP30B
Q13	"		National	PN3569
Q14	"		"	2N3645
Q15	"		Texas	TIP29B
Q16	"		"	TIP30B
R1	Resistor 1/4W 5%	2K7	Philips	
R2	"	2K7	"	
R3	"	15K	"	
R4	"	15K	"	
R5	"	8K2	"	
R6	"	47K	"	
R7	"	15K	"	
R8	"	22	"	
R9	"	2K7	"	
R10	Trim Pot	2K	Piher	PT 10v 2K
R11	Resistor 1/4W 5%	7K5	Philips	
R12	"	3K3	"	
R13	"	220	"	
R14	"	4K7	"	
R15	"	47K	"	

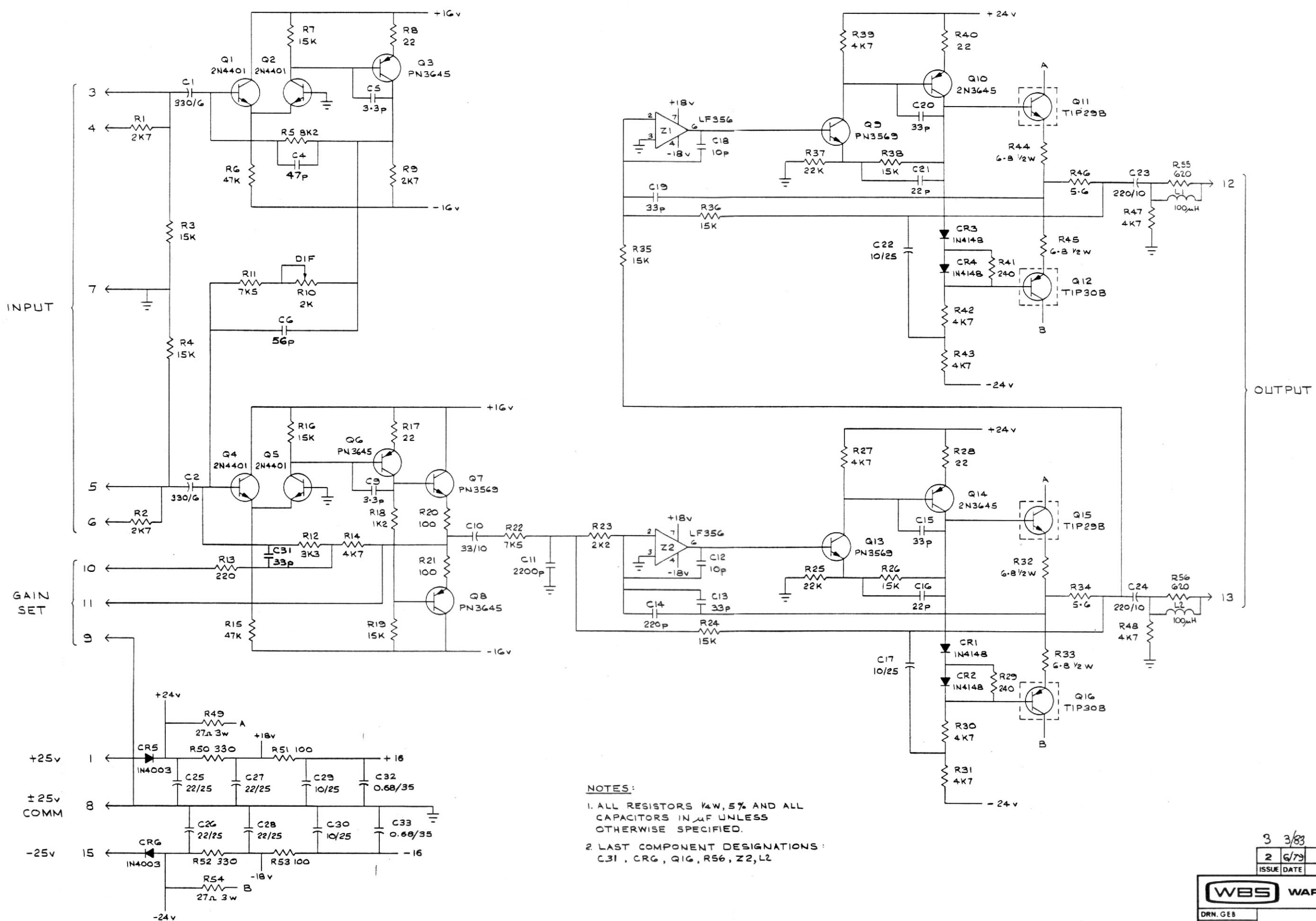
PARTS LISTM450B PROGRAM/SUMMING AMPLIFIER

<u>PART</u>	<u>DESCRIPTION</u>		<u>MFG</u>	<u>MFG PART NUMBER</u>
R16	Resistor 1/4W 5%	15K	Philips	
R17	"	22	"	
R18	"	1K2	"	
R19	"	15K	"	
R20	"	100	"	
R21	"	100	"	
R22	"	7K5	"	
R23	"	2K2	"	
R24	"	15K	"	
R25	"	22K	"	
R26	"	15K	"	
R27	"	4K7	"	
R28	"	22	"	
R29	"	240	"	
R30	"	4K7	"	
R31	"	4K7	"	
R32	Resistor 1/2 W 5%	6.8	"	
R33	"	6.8	"	
R34	Resistor 1/4 W 5%	5.6	"	
R35	"	15K	"	
R36	"	15K	"	
R37	"	22K	"	
R38	"	15K	"	
R39	"	4K7	"	
R40	"	22	"	
R41	"	240	"	
R42	"	4K7	"	
R43	"	4K7	"	
R44	Resistor 1/2W 5%	6.8	"	
R45	"	6.8	"	
R46	Resistor 1/4W 5%	5.6	"	
R47	"	4K7	"	
R48	"	4K7	"	
R49	Resistor 3.75W 5%	27	Dale	CW-2B
R50	Resistor 1/4W 5%	330	Philips	

PARTS LISTM450B PROGRAM/SUMMING AMPLIFIER

<u>PART</u>	<u>DESCRIPTION</u>		<u>MFG</u>	<u>MFG PART NUMBER</u>
R51	Resistor 1/4W 5%	100	Philips	
R52	"	330	"	
R53	"	100	"	
R54	Resistor 3.75W 5%	27	Dale	CW-2B
R55	Resistor 1/4W 5%	620	Philips	
R56	"	620	"	
Z1	Integrated Circuit		National	LF356N
Z2	"		"	"

WBS recommends the use of replacement parts made by the specified manufacturers for continued optimum equipment performance.

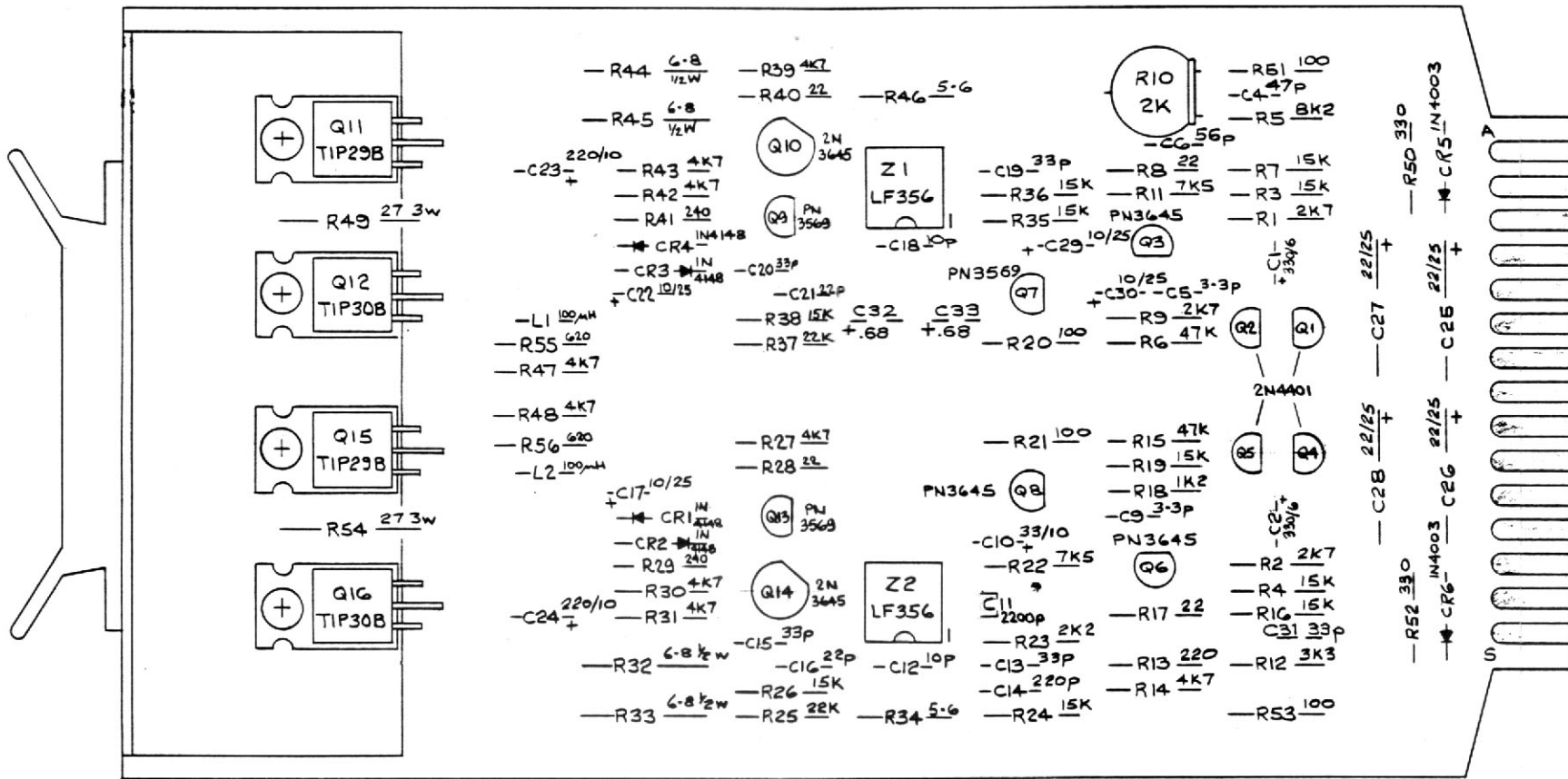


NOTES:

1. ALL RESISTORS 1/4W, 5% AND ALL CAPACITORS IN μ F UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT DESIGNATIONS: C31, CR6, Q16, R56, Z2, L2

3	3/83	4038	TR
2	6/79	3640	PM
ISSUE	DATE	REVISION	APP.

WBS WARD-BECK SYSTEMS	
DRN. GEB	M450B
ENG. MRW 4/78	PROGRAM/SUMMING AMPLIFIER
CKD. <i>R. Miller</i>	SCHEMATIC
APP.	
SCALE	B
	450-02-003
	ISSUE 3



4	3/83	4038	T.R.
3	6/79	3643	PM
2	6/79	3640	PM
ISSUE	DATE	REVISION	APP.

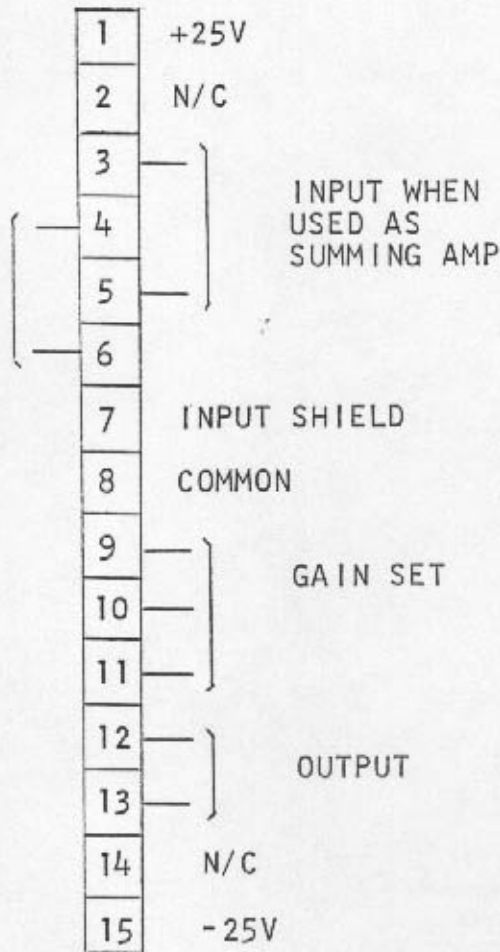
WBS WARD-BECK SYSTEMS


DRN. GEB
 ENG. MRW 4/78
 CKD. *Ruler*
 APP.

M450B
 PROGRAM/SUMMING AMPLIFIER
 COMPONENT LAYOUT

SCALE **B** 450-06-003 ISSUE **4**

INPUT WHEN
USED AS
PROGRAM AMP



 WARD-BECK SYSTEMS LTD.		M450, M450A, M450B PROGRAM/SUMMING AMPLIFIER CONNECTOR REAR VIEW		ISS. 2
		450-04-001		
DRN. GEB	DATE JUNE 76	CKD. <i>Relle</i>	SCALE	TOLS. ^{XX} XXX
MAT'L.		FINISH		
ISS. MOD. CKD.	USED ON			