Validyne ENGINEERING CORPORATION

INSTRUCTION MANUAL

CARRIER DEMODULATOR

MODEL CD19

8626 CONDELLO STREET · NORTHRIDGE, CALIF. 91324 · (213) 886-2336

MODEL CD19

SECTION 1

General Description

1.1 Description

The Model CD19 is a high-gain carrier demodulator plug-in module to the Validyne Engineering Corporation's MC1 Module Case. It is used to amplify and demodulate the output of strain gage bridges and transducers, variable reluctance transducers, and differential transformers (LVDT). The CD19 will operate with full-bridge or half bridge signals delivering 10 volts DC output for 1 mv/v AC input. A six (6) position gain switch and a ten (10) turn gain potentiometer allow the use of inputs up to 100 mv/v. Screwdriver adjusted R and C balance controls are provided, with a Hi and Low range switch for 10 to 1 balance range expansion. A calibration circuit allows four (4) different levels of plus and minus calibration voltage to be injected into the input.

Output frequency response is controlled by a low pass active filter, and is switch selectable to 10, 50, 200, and 1000Hz. The CD19 requires 5V RMS at 3KHz and ± 15 VDC from the MC1 Module Case.

1.2 Electrical Specifications

Plug-In Module Model CD19

Input Sensitivity for 10V DC output:	1, 2.5, 5, 10, 25 and 50 mv/v - Switch Selectable 0 to 100% - 10 turn vernier potentiometer
Output Voltage:	Output A, ±10VDC, Output B ± 5MV DC
Output Current:	Output A, ±10ma, Output B ±0.5ma
Output Impedance:	10 ohms short circuit proof
Frequency Response:	0 to 10, 50, 200 and 1000Hz - flat ±10% Switch Selectable
Temperature Range:	0°F to 160°F
Zero Shift:	.005%/°F
Span Shift:	.01%/°F

Balance Range:

	Low	Hi
"R"	2mv/v	20mv/v
"C"	1mv/v	10mv/v

Front Panel Controls:	15 Turn R Balance screwdriver adjust 15 Turn C Balance screwdriver adjust 6 position gain switch 10 turn calibrated gain potentiometer 9 position calibration switch White test point (undemodulated carrier) Black test point (system ground)
Behind the Panel Circuit Board Mounted Controls:	2 arm - 4 arm switch Balance range switch Hi-Low Output frequency response selector switch

1.3 Input and Output Connections:

Transducers are connected to the CD19 by means of the WK-4-32S connector on the back of the MC1 Module Case.

Pin 1 5 Volt 3KHz carrier

2 Input signal from transducer

3 Input signal from transducer

4 5 Volt 3KHz carrier

CD19 output A and B come from separate XLR-3 connectors on the back of the MC1. Pin connections are the same on both outputs.

Pin 1 Output

2 System Ground

3 Chassis Ground

1.4 Mechanical Specifications:

Width: 1.6 inches

Height: 3.7 inches

Weight: Less than 7 ounces

Plugs into Validyne Engineering Corporation's MC1 Module Case.

18819 NAPA STREET, NORTHRIDGE, CALIFORNIA 91324 ——— (213) 886-8488

SECTION 2

INSTALLATION AND OPERATION

2.1 Installation and Operation:

Model CD19 may be plugged into or out of the MC1 Module Case, while power is on.

2.1.1(A.) Half Bridge 2 arm operation

(B.) Connect transducer as shown in Fig. 1A. S1 (2 arm - 4 arm switch) should be in the 2 arm position (white dot not showing). If transducer is a high output type; such as, variable reluctance, the balance range switch S2 should be in the Hi position (white dot not showing). For a low output device; such as, a strain gage bridge, S2 should be in the Low position (white dot showing).

(C.) R and C control adjustment

To balance the bridge connect an AC voltmeter (3 volt range) or an Oscilloscope (1 V/cm range) to the front panel test points. With the gain switch in the 50mv/v position adjust the R and C controls alternately to reduce the amplitude of the 3KHz sine wave signal. Increase the gain with the gain switch, as the amplitude of the 3KHz sine wave decreases, until the signal is nulled out with the gain switch in the 1mv/v position. A complete null in this position is not necessary. The gain switch is then turned to a position appropriate to the requirement of the transducer being used. A final adjustment of the R control may be necessary to bring the DC output signal of the CD19 to zero.

(D.) Gain Switch and 10 Turn Gain Control

With the 10 turn gain control fully clockwise the gain switch reads in millivolts per volt input necessary to obtain 10 volts DC output. The 10 turn gain control reduces the gain below this value to

(D) Gain Switch and 10 Turn Control (Cont.)

accommodate signals larger than that marked on the gain switch setting, but below that required by the next gain switch position. The maximum input signal for a particular gain switch setting should not be more than will produce 10 Volts output with the 10 turn gain control turned no lower than a dial reading of 300 (fully clockwise is a reading of 1000). This corresponds to an input 3 1/3 times that of the gain switch setting (33 mv/v on the 10 mv/v range or 166mv/v on the 50 mv/v range).

2.1.2 Full Bridge 4 arm operation

Connect bridge circuit as shown in Fig. 1B. S1 (2 arm - 4 arm switch) should be in the 4 arm position (white dot showing). If the bridge is a high output type, the balance range switch, S2, should be in the Hi position (white dot not showing). For low output bridge circuits, S2 should be in the Low position (white dot showing). Operation steps (C) and (D) also apply to 4 arm operation.

2.1.3 LVDT Operation

Connect LVDT as shown in Fig. 2A or B. S_1 (2 arm-4 arm switch should be in 2 arm position (white dot not showing). If the LVDT is a high output type, the balance range switch, S_2, should be in the Hi position (white dot not showing) for a balance range of ± 20 mv/v. For Low output units, the balance range switch, S_2, may be used in the low position (white dot showing) for a balance range of ± 2 mv/v. Operating Steps 2.1.2-A through D apply. With LVDT Transducers, the residual signal at null may be more than with other transducers. This residual signal may be up to 10% of the full-scale signal, as observed at the CD19 Test Point, with no significant effect on the demodulated output.

2.2 Filter Selection

The CD19 has a 4 position filter selection switch located behind the front panel on the printed circuit board. The 4 low pass filters are selected by turning the knob until the dot is opposite the number 10, 50, 200, or 1000 Hz.

2.3 Calibration Resistor Selection

The calibration switch on the CD19 front panel selects any one of 4 internal calibration resistors. The switch provides for plus or minus output from any of the resistors. The 4 resistors are to be mounted on the numbered bifurcated terminals located behind the CD19 front panel.

The transducer simulation for a given calibration resistor is approximately:

$E_o = \frac{500}{2+Rc}$ where E_o is the transducer output in MV/v and Rc is the calibration resistor in K ohms.

The Rc required for a particular Mv/v output is:

$Rc = \frac{500-2E_o}{E^\circ}$

2.4 Long Cable Operation

The CD19 Demodulator will operate with over 1,000 feet of cable between each transducer and its demodulator. The carrier supply is virtually unaffected by capacitance loading to above one microfarad, and may be shorted for an indefinite period with no damage. It will then recover to normal within a few seconds after removal of the short.

CD19 (6)

SECTION 3

PRINCIPLES OF OPERATION

3.1 CD19 Demodulator

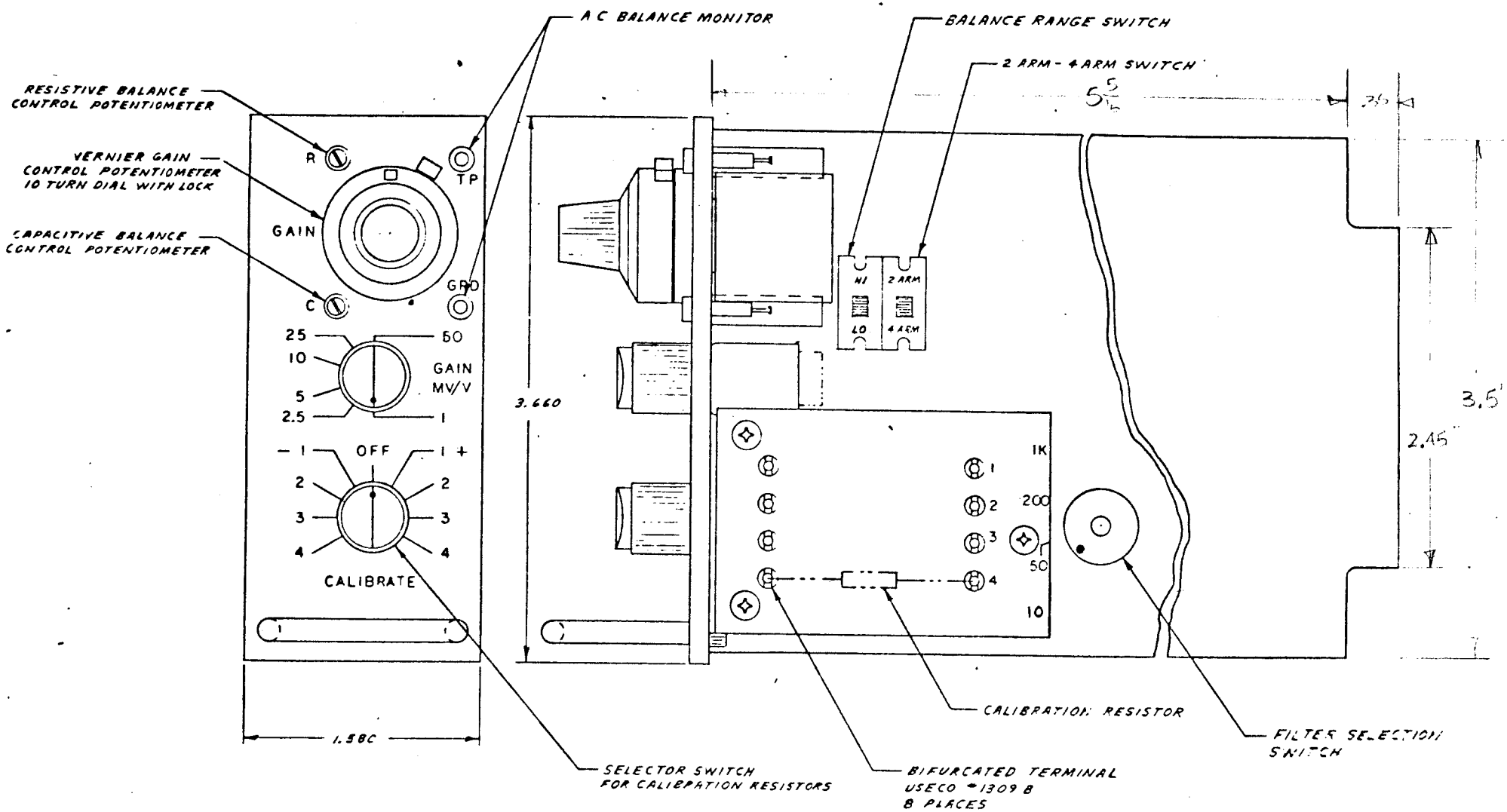
The output from a transducer is fed into a high gain differential amplifier, one side of which is shorted for 2 arm single ended operation by the 2 arm - 4 arm switch. Any residual output from the transducer may be nulled out by the R and C balance controls, which sum a small amount of carrier signal into the differential amplifier. The gain of the differential amplifier is controlled by a 6 position switch in the negative feedback loop. The output of this amplifier goes to the 10 turn gain potentiometer, the output of which through a buffer amplifier feeds the demodulator. The demodulator routes the transducer signal on one half of the carrier cycle to the inverting input of a second differential amplifier and to the noninverting input on the other half of the carrier cycle. This second differential amplifier is connected as a unity gain low pass active filter to remove more of the carrier ripple and to determine the output frequency response. The frequency response is controlled by a 4 position switch, mounted on the circuit board.

The calibration circuit operates by summing carrier signal through the calibration resistor into the input differential amplifier. This signal is demodulated in the same manner as a transducer signal. The output polarity depends on which carrier lead the cal resistor is switched to.

Principles of Operation (Cont.)

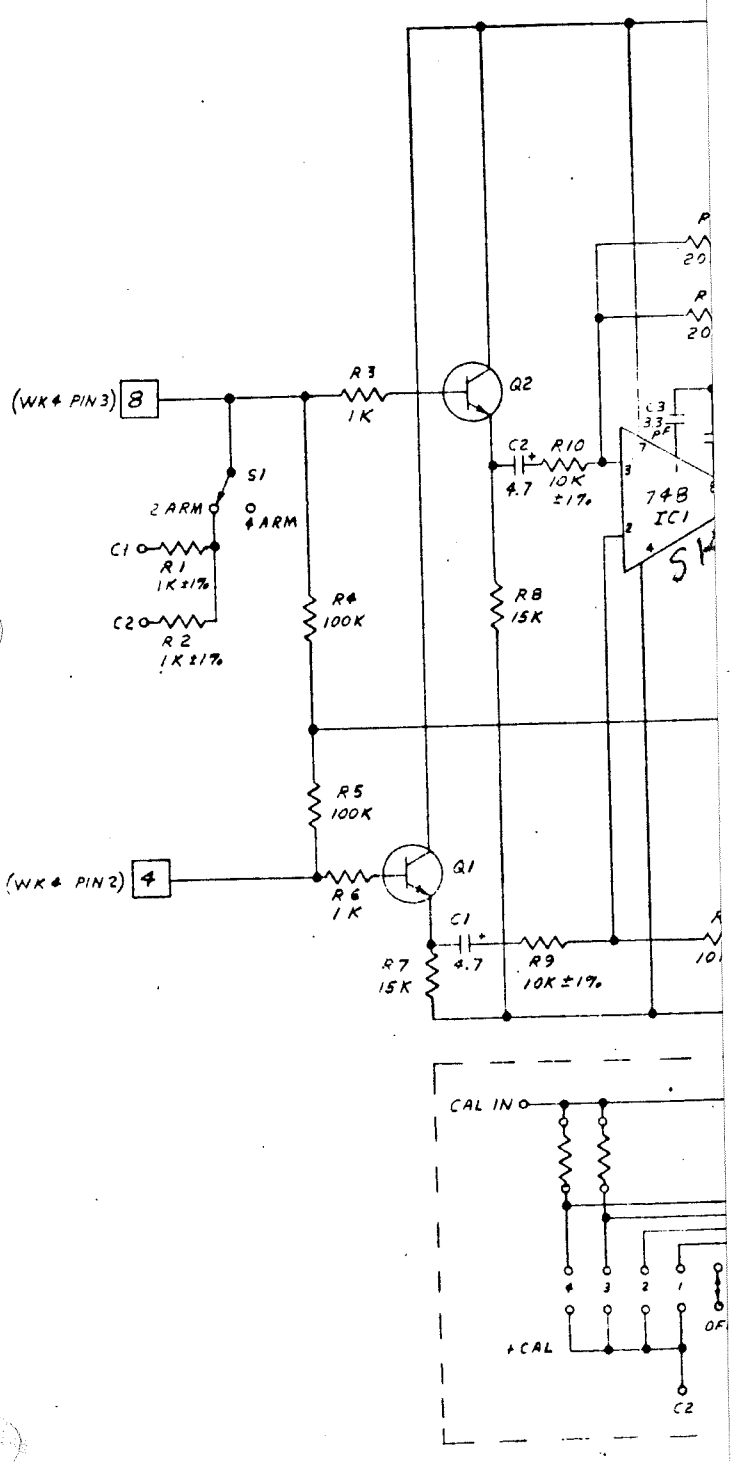
The front panel test point monitors the output of the first amplifier to facilitate nulling residual outputs from the transducer. This point is affected by the gain switch but not by the 10 turn gain potentiometer. For large input signals, the operation of the CD19 will be linear as long as the signal at the test point shows no clipping and the DC output of the demodulator is no more than 10 volts.

REVISIONS				
SYM		DESCRIPTION	DATE	APPROVED
A		ADDED BALANCE RANGE & 2 ARM-4 ARM SWITCH	3-9-70	



TOL. UNLESS NOTED ± .010	SCALE 2/1	Validyne ENGINEERING CORPORATION
.XX ± .02	DRWN	MODEL
FRAC. & DEC. .XX ± .010	CK'D	MATL
ANGLES ± 1°	APPD	FINISH
DIAMETERS WITH SAME ℄ SHALL BE CONCENTRIC WITHIN .005 TIR		
SURFACES MUST BE FLAT WITHIN .002		
PER IN		
MAX FILLET .045 UNLESS NOTED		
ENDS BY ENDS ± .1 UNLESS NOTED		
SURFACE FINISH 63 UNLESS NOTED		
EMBOSSED INSIDE THE PLAN AREA ONLY		

TITLE: CARRIER [illegible]



INDICATES CIRCUIT BOARD CONNECTOR PIN NUMBERS.

TRANSISTORS ARE 2N3859

CAPACITOR VALUES ARE IN MICROFARADS

RESISTOR VALUES ARE IN OHM, ± 10%, 1/4 WATT

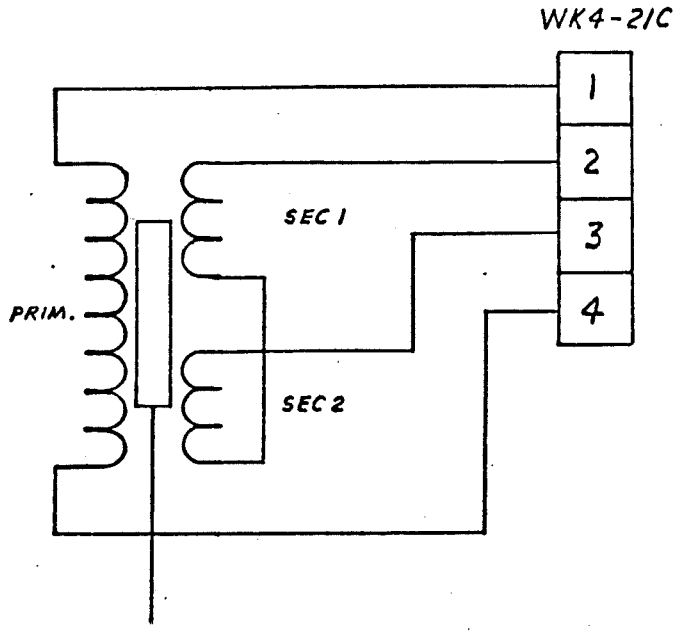


FIG. 2A

LVDT Connection for use with CD19 when output of LVDT is less than ± 166 mv/v.

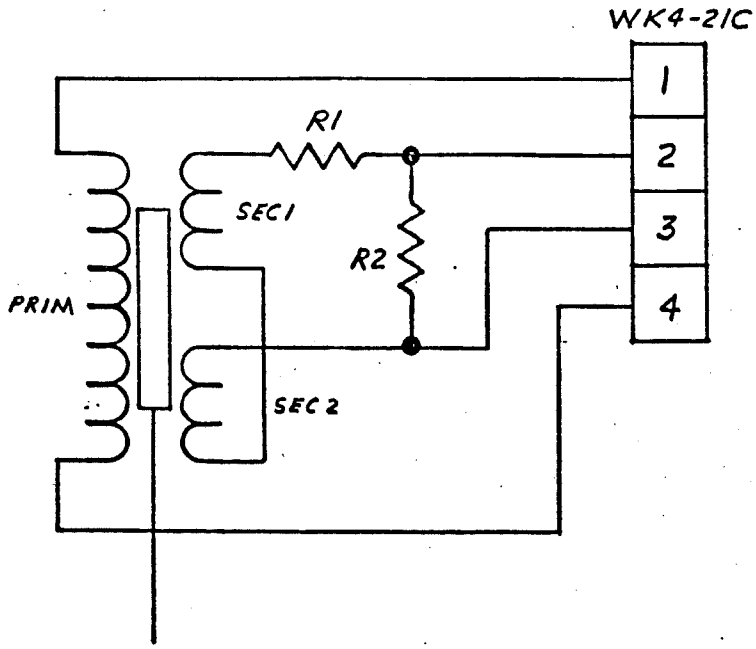


FIG. 2B

LVDT connection for use with CD19 when output of LVDT is greater than 166 mv/v.

$$R_1 = \frac{(Eo-166)\ R_2}{166}$$

Where Eo is LVDT output in mv/v, and R_2 is 10K ohms. Use metal film or wire wound resistors.

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IC1	748 , SK3641
IC2	741
IC3	741

Q1 - Q10 2N3859

CR1, CR2 1N914

C1	4.7 μf
C2	4.7 μf
C3	3.3 pf
C4	3.3 pf
C5	500 pf
C6	47 μf 6 v
C7	4.7 μf
C8	4.7
C9	.033
C10	.033
C11	500 pf
C12	1500 pf
C13	1000 pf
C14	2500 pf
C15	.1
C16	.1
C17	2500 pf
C18	100 pf
C19	.1
C20	.022
C21	.0082
C22	.012
C23	.047
C24	.0082
C25	2000 pf
C26	100 pf

S1 - SPDT <2 ARM / 4 ARM

S2 - SPDT - HI, LO

S3 - SP6T
GAIN SWITCH

S4
10 HZ, 50 HZ, 200 HZ, 1 KHZ

R1	1K ±1%
R2	1K ±1%
R3	1K
R4	100K
R5	100K
R6	1K
R7	15K
R8	15K
R9	10K ±1%
R10	10K ±1%
R11	20K ±1%
R12	20K ±1%
R13	15K
R14	1 MEG
R15	10K ±1%
R16	15K
R17	2K ±1%
R18	15K
R19	499Ω ±1%
R20	4.02K ±1%
R21	9.09K ±1%
R22	49.9K ±1%
R23	10K ±1%
R24	30.1K ±1%
R25	49.9K ±1%
R26	100K ±1%
R27	301K ±1%
R28	1K ±1%
R29	4.7K
R30	15K
R31	10K pot, R BAL
R32	10K pot, C BAL
R33	1K
R34	10K pot, GAIN
R35	10K
R36	1K
R37	33K
R38	15K
R39	4.99K ±1%
R40	4.99K ±1%
R41	15K ±1%
R42	8.2K
R43	24.9K ±1%
R44	15K
R45	3.3K
R46	10K ±1%
R47	100K ±1%
R48	33K
R49	100K ±1%
R50	49.9K ±1%
R51	100K ±1%
R52	100K ±1%
R53	100K ±1%
R54	301K ±1%
R55	47Ω
R56	20K ±1%
R57	10Ω ±1%

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