INSTRUCTION MANUAL

CD173
Carrier Demodulator

Validyne
ENGINEERING CORP.

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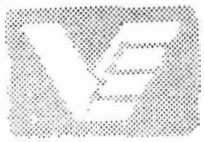
Carrier Demodulator



Validyne ENGINEERING CORPORATION

MODEL CD173

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General Description

1.1 Description

The Model CD173 is a high-gain carrier demodulator plug-in module to the Validyne Engineering Corporation's MC170 High Density Multi-channel, Modular Transducer Control System. It is used to amplify and demodulate the output of strain gage bridges and transducers, variable reluctance transducers, and differential transformers (LVDT). The CD173 will operate with full-bridge or half-bridge signals delivering 10 volts DC output for AC input sensitivities of 1mV/V to 50mV/V (switch selectable). A six (6) position Gain Switch and a Gain Vernier potentiometer, continuously variable from 10 to 110% of gain step, allow use of inputs up to 100mV/V. Screwdriver adjusted "R" and "C" balance controls are provided, with a "HI" and "LO" range switch for 10 to 1 balance range expansion, and "2-Arm" switch for adapting the circuit for operation with 2 active arm or 4 active arm bridge transducers.

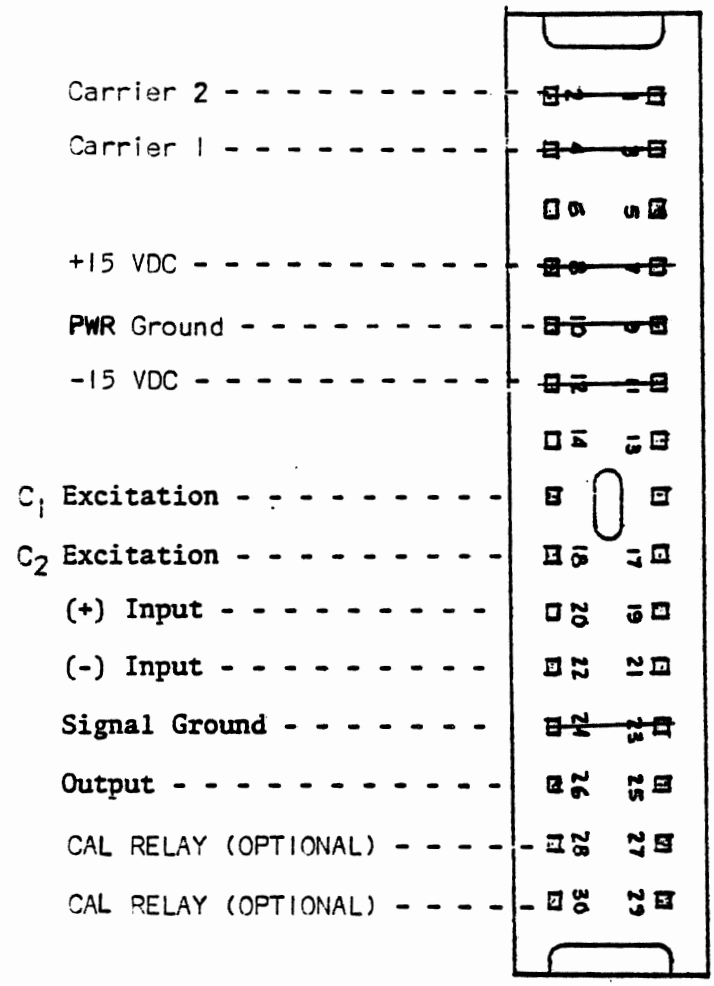
Output frequency response is controlled by a low pass active filter, and is switch selectable to 10, 50, and 200Hz.

1.2 Electrical Specifications

PLUG-IN MODULE MODEL CD173

Input Sensitivity:	1mV/V, 2.5mV/V, 5mV/V, 10mV/V, 25mV/V, and 50mV/V, Switch Selectable
Gain Vernier:	Continuously Variable, 10 to 110% of Gain Step
Bridge Excitation:	5V RMS, 3KHz Carrier
Bridge Configuration:	2- and 4-Arm Variable Reluctance and Strain Gage Transducers and LVD Transformers
Input Impedance:	Half-Bridge, 100K Ohms; Full-Bridge 200K Ohms
Balance Range:	LOW / HI "R" 2mV/V / 20mV/V "C" 2mV/V / 20mV/V
Reference Phase Adjust:	±90°, Single Turn Screwdriver Phase Adjustment
Output Voltage:	±10V DC, Maximum 14 Volts
Output Current:	±2ma
Frequency Response:	Switch Selectable Low Pass Filter of 10Hz, 50Hz, and 200Hz
Temperature:	Operating Range - 0°F to 150°F Zero Shift - 0.005%/°F Span Shift - 0.01%/°F
Power Requirements:	5V RMS, 3KHz, and +15V DC Supplied from MC170 Module Case Power Supply
Controls Accessible From Front:	Gain Switch, Gain Vernier, "R" Balance Pot., "C" Balance Pot., Filter Switch, Reference Phase Adjust
Controls Not Accessible From Front:	Hi-Lo Balance Switch (S_1) 2-Arm, 4-Arm Switch (S_2)

1.3 Input and Output Connections: (Accessible through Printed Circuit Board Connector at Rear of MC170 Module Case.)



Printed Circuit Board Connector

As Viewed from Rear of
MC170 Module Case

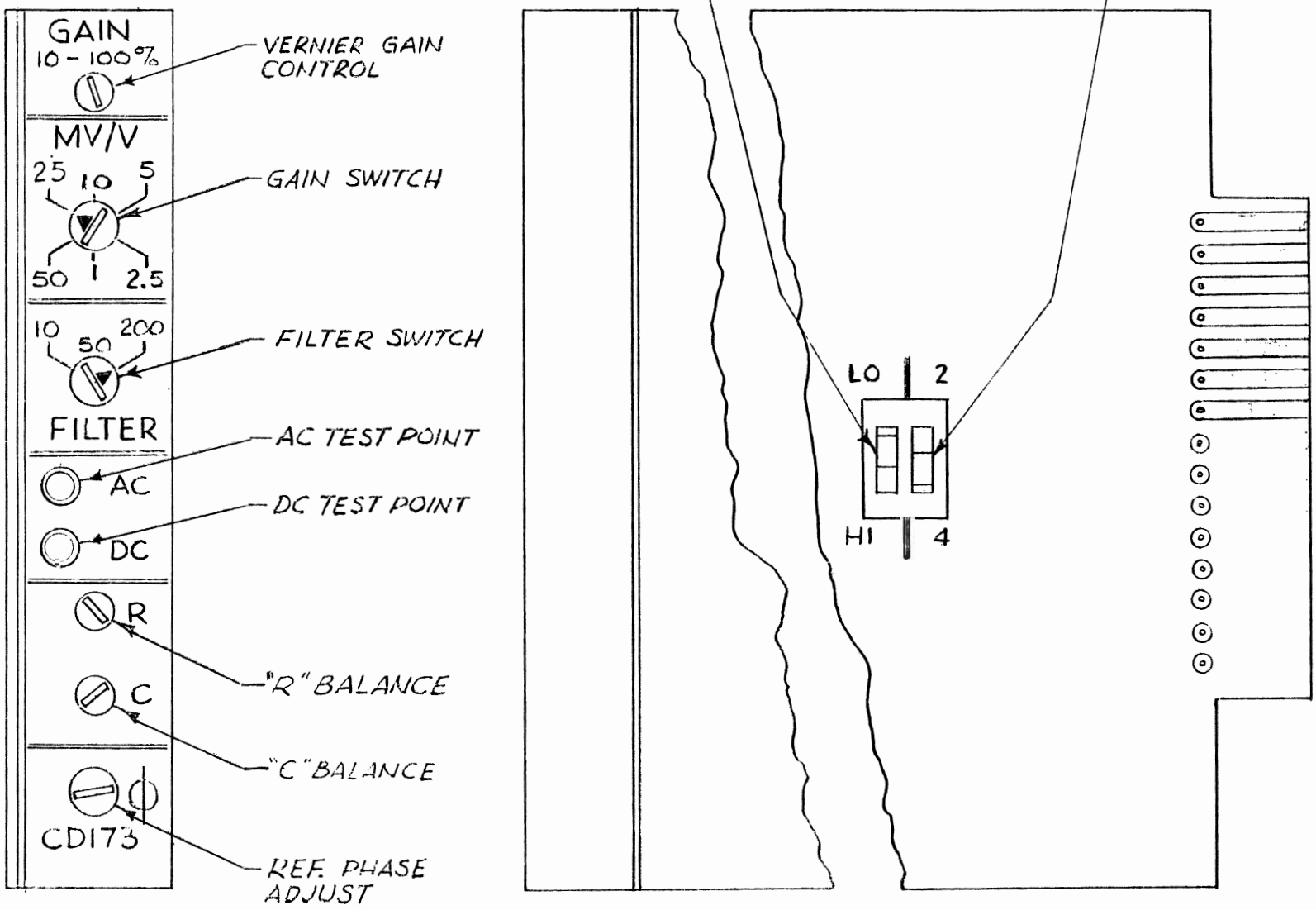


FIGURE I

Validyne ENGINEERING CORPORATION

1.4 Mechanical Specifications

Width: 0.45"
Height: 2.76"
Weight: 80 grams (3 oz. Avdp.)

1.5 Adjustments, Controls, and Test Points

Figure 1 shows the location of available controls and test points on the front panel and circuit board for the CD173.

1.5.1 Front Panel Controls:

A) Vernier Gain Control: The Vernier Gain Control is a screwdriver actuated 20-turn (nominal) adjustment potentiometer. Gain increases with clock-wise rotation of the potentiometer leadscrew.

B) Gain Switch: The Gain Switch is a 6-position, screwdriver actuated rotary switch. Switch position is indicated by a black arrow on the slotted adjustment screw head. (NOTE: There are no internal stops in the rotary switch to indicate beginning or end of rotation, therefore, position of the switch is determined by the position of the arrow relative to the indexing lines on the front panel).

C) Filter Switch: The Filter Switch is also a 6-position switch; however, only 3 positions are used, as marked on the front panel (10, 50, and 200Hz). If the selector switch is adjusted to any other unmarked position, the frequency response will be 200Hz.

D) "R" Balance: The "R" adjustment is a 20-turn (nominal) screwdriver actuated trimming potentiometer for use in balancing the in-phase component of the input signal.

E) "C" Balance: The "C" adjustment is a 20-turn (nominal) screwdriver actuated trimming potentiometer for use in balancing the quadrature component of the input signal.

F) Reference Phase Adjust: The Reference Phase Adjust is a screwdriver actuated single-turn potentiometer provided to correct for phase shift due to long line and reactive source operation. Full CCW rotation corresponds to -90°, full CW +90°, and with the screwdriver slot in a horizontal position, 0°.

1.5.2 P.C. Board Mounted Controls:

A) Switches S_1, (HI-LO Balance), and S_2 (2-ARM, 4-ARM):

S_1 and S_2 are contained in a dual-in-line, 2 position SPST rocker actuated switch assembly located as shown in Figure 1. (NOTE: Position indications used elsewhere in the text of this manual, i.e., "HI" or "LO", "2- or 4-ARM" position, etc. refer to the markings on the printed circuit board). Balance Range Switch, S_1, is used to adjust the available bridge balance range from ±20mV/V in the "HI" position for use with high output devices, to 2mV/V in the "LO" position.

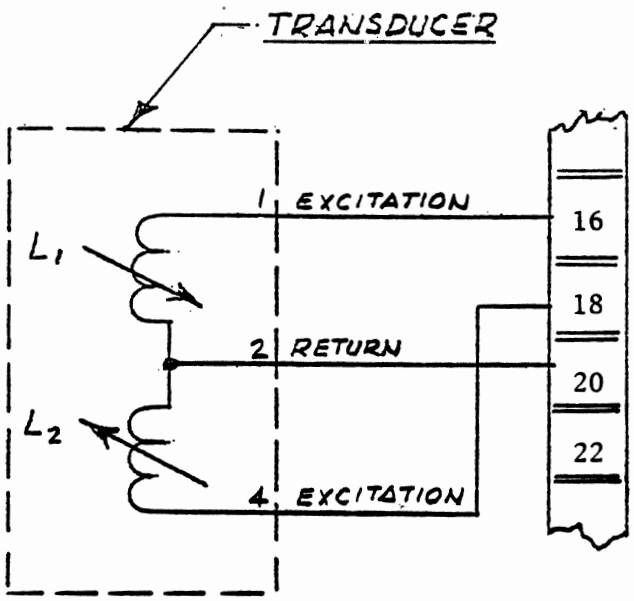
The "2-Arm, 4-Arm" switch (S_2) provides selection of a bridge completion network for use with 2 active arm devices (switch in "2" position) or direct signal input to the differential amplifier section ("4" position) when used in conjunction with 4 active arm, or full bridge, devices.

1.5.3 Front Panel Test Points:

A) "AC": The "AC" test jack and the "GND" jack on the front panel of the PS176 power supply module, allows connection of an AC voltmeter or oscilloscope for balancing of the bridge circuit.

B) "DC": The "DC" test jack and "GND" jack on the front panel of the PS176 power supply provide a means of monitoring the analog DC output of the CD173 from the front of the MC170 system.

MC170 P.C. BOARD CONNECTOR:

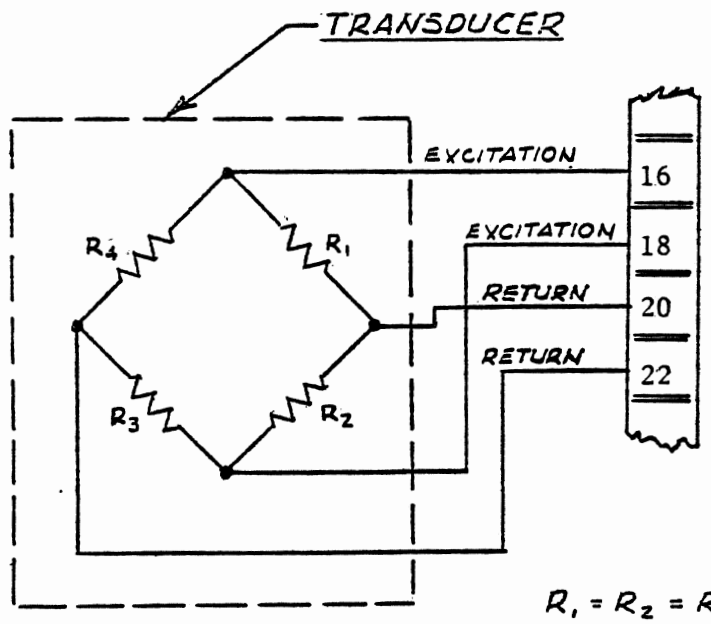


L_1 DECREASES
L_2 INCREASES
FOR PLUS OUTPUT

HALF-BRIDGE VARIABLE RELUCTANCE TRANSDUCER

FIGURE 2A

MC170 P.C. BOARD CONNECTOR:



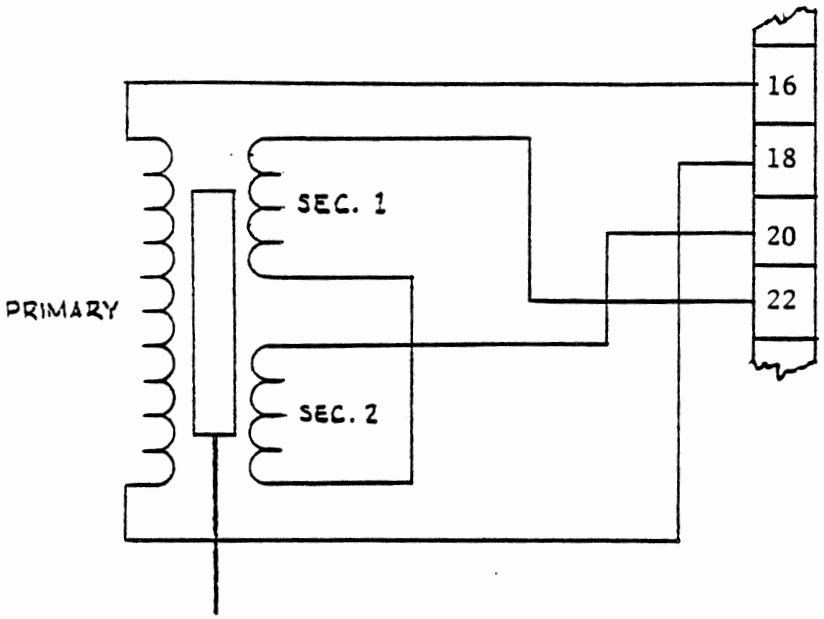
R_1 OR R_3 DECREASES
R_2 OR R_4 INCREASES
FOR PLUS OUTPUT

$R_1 = R_2 = R_3 = R_4 \geq 50\ \Omega$

FULL-BRIDGE STRAIN GAGE TRANSDUCER

FIGURE 2B

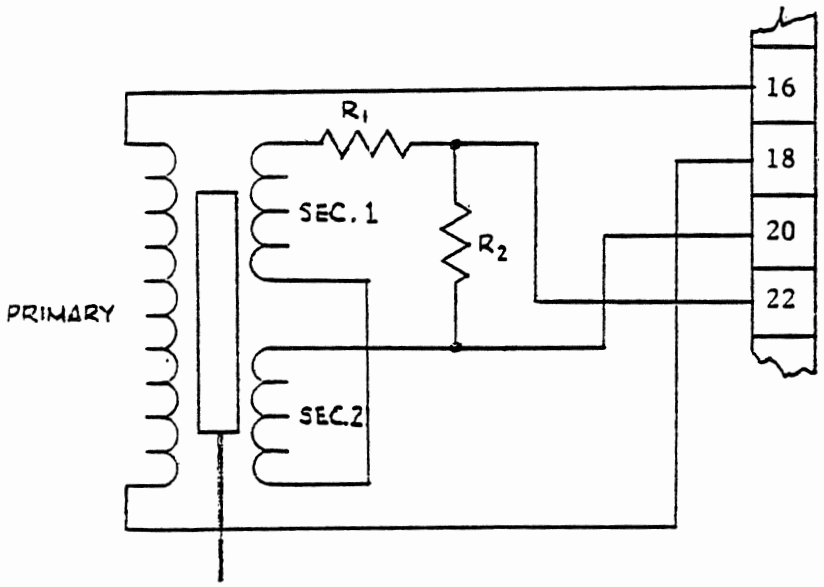
MC170 P.C. BOARD CONNECTOR:



LVDT Connection for use with CD173 when output of LVDT is less than ± 166 mv/v.

FIG. 3A

MC170 P.C. BOARD CONNECTOR:



LVDT connection for use with CD173 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.

FIG. 3B

SECTION 2

Installation and Operation

2.1 Transducer Connection

The Model CD173 may be plugged into or out of the MC170 Module Case, while power is on.

2.1.1 Half-Bridge (2-Arm) Operation:

Connect transducer as shown in Fig. 2A. S_2 (2-Arm, 4-Arm Switch) should be in the "2" position. If transducer is a high output type such as variable reluctance, the Balance Range Switch S_1 should be in the "HI" position. For a low output device, such as a strain gage bridge, S_1 should be in the "LO" position.

2.1.2 Full-Bridge (4-Arm) Operation:

Connect bridge circuit as shown in Fig. 2B. S_2 (2-Arm, 4-Arm Switch) should be in the "4" position. If the bridge is a high output type, the balance range switch, S_1, should be in the "HI" position. For low output bridge circuits, S_1 should be in the "LO" position.

2.1.3 LVDT Operation:

Connect LVDT as shown in Fig. 3A or B. S_2 (2-Arm, 4-Arm Switch) should be in "2" position. If the LVDT is a high output type, the balance range switch, S_1, should be in the "HI" position for a balance range of ±20mV/V. For low output units, S_1 may be used in the "LO" position for a balance range ±2mV/V. With LVDT Transducers, the residual signal at null may be more than with other transducers. This residual signal may be up to 50% of the full-scale signal, as observed at the CD173 Test Point, with no significant effect on the demodulated output.

2.2 Calibration/Adjustment

2.2.1 "R" and "C" Control Adjustment:

To balance the bridge, connect an AC voltmeter (3 volt range) or an oscilloscope (1V/cm range) to the front panel "AC" test point and the "GND" jack on the MC170 power supply module. 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.

2.2.1 "R" and "C" Control Adjustment (Cont.):

As the amplitude of the 3KHz sine wave decreases, increase the gain with the Gain Switch until the signal is minimized with the Gain switch in the lmV/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 CD173 to zero.

2.2.2 Gain Switch and Gain Vernier Control:

The Gain Vernier Control is used in conjunction with the Gain Switch to accommodate a wide range of input sensitivity levels to produce up to ±10VDC output.

The Gain Vernier Control is a continuous resolution, screwdriver-actuated trimming potentiometer with nominally 20 turns of adjustment to provide approximately 10 to 110% adjustability of the gain step selected.

With the Gain Switch set to a range appropriate to the transducer to be used and the Gain Vernier in the full CW position, the DC output with full scale input to the transducer, should be at least 10 volts. If the output is less than 10 volts, set the Gain Switch to the next higher setting until a minimum of 10 volts is produced.

The Gain Vernier is then turned in a CCW direction until the output as measured at the "DC" Test Point on the front panel, or the Output Connector on the rear of the MC170 Case is ±10VDC corresponding to ±100% of full scale, or to a lesser value for scaling to appropriate engineering units.

2.2.3 Reference Phase Adjust:

The screwdriver adjust Reference Phase Adjust Control is provided to correct for phase shift due to long line and reactive source operation. Adjustment is made by application of a less than full scale input to the transducer and monitoring the DC output for maximum reading while varying the control position.

2.3 Filter Switch

The CD173 has a 3-position Filter Selection Switch accessible through the front panel on the printed circuit board. The 3 low pass filters are selected by turning the knob until the arrow points to the desired frequency value (10, 50, or 200Hz).

2.4 Long Cable Operation

The CD173 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.

SECTION 3

Maintenance and Repair

3.1 Maintenance and Repair

The Model CD173, as a function of its basic design, does not require periodic re-calibration or maintenance, as such. If abnormalities in performance occur which cannot be corrected by the calibration and adjustment procedures outlined in SECTION 2, the unit should be returned to the factory, transportation PREPAID, for evaluation and repair.

A brief statement as to the malfunction or abnormal performance noted should be included with the returned unit to facilitate the evaluation.

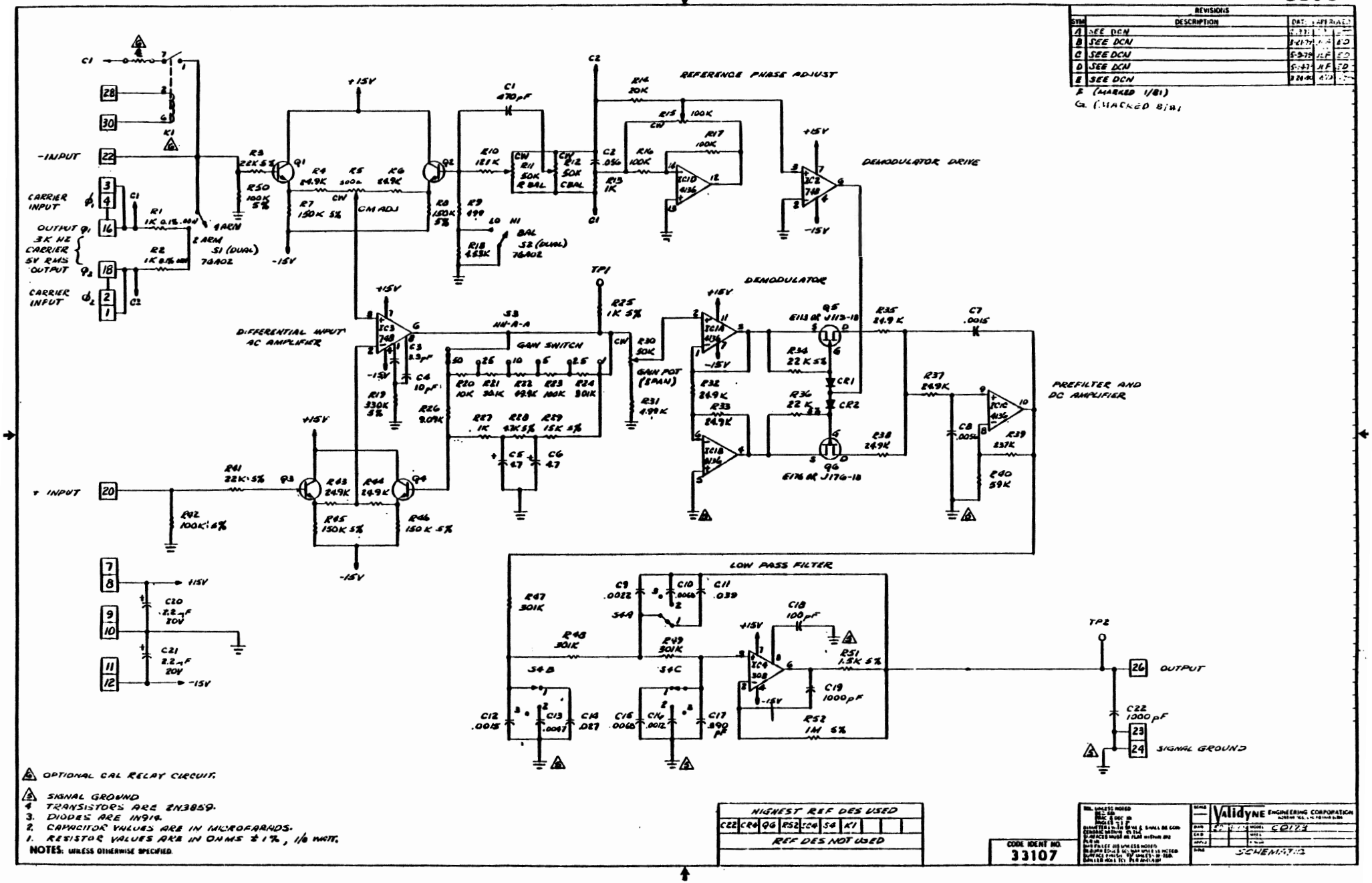
An estimate of repair costs, if applicable, will be provided prior to commencement of work, if requested.

Address all shipments and correspondence regarding returned units to:

VALIDYNE ENGINEERING CORP.
8626 Wilbur Avenue
Northridge, CA 91324

Attn: Customer Service Dept.

8500


REVISIONS
SYM DESCRIPTION DATE APPROVED
A SEE DCN
B SEE DCN
C SEE DCN
D SEE DCN
E SEE DCN
F (MARKED 1/81)
G (MARKED 8/81)
REFERENCE PHASE ADJUST
DEMODULATOR DRIVE
DEMODULATOR
DIFFERENTIAL INPUT AC AMPLIFIER
GAIN SWITCH
GAIN POT (SPAN)
PREFILTER AND DC AMPLIFIER
LOW PASS FILTER
-INPUT
+ INPUT
CARRIER INPUT
OUTPUT 3K HZ CARRIER 5V RMS OUTPUT
CARRIER INPUT
OUTPUT
SIGNAL GROUND
+15V
-15V
CM ADJ
BAL
TP1
TP2
S1 (DUAL) 76A02
S2 (DUAL) 76A02
S3 HI-A-A
S4
S4A
S4B
S4C
Q5 E113 OR J113-18
Q6 E176 OR J176-18
CR1
CR2
OPTIONAL CAL RELAY CIRCUIT.
SIGNAL GROUND
4. TRANSISTORS ARE 2N3859.
3. DIODES ARE IN914.
2. CAPACITOR VALUES ARE IN MICROFARADS.
1. RESISTOR VALUES ARE IN OHMS ±1%, 1/8 WATT.
NOTES: UNLESS OTHERWISE SPECIFIED.
HIGHEST REF DES USED
C22 CR4 Q6 RS2 TC4 S4 K1
REF DES NOT USED
CODE IDENT NO. 33107
Validyne ENGINEERING CORPORATION
SCHEMATIC