CD257
Carrier Demodulator Module

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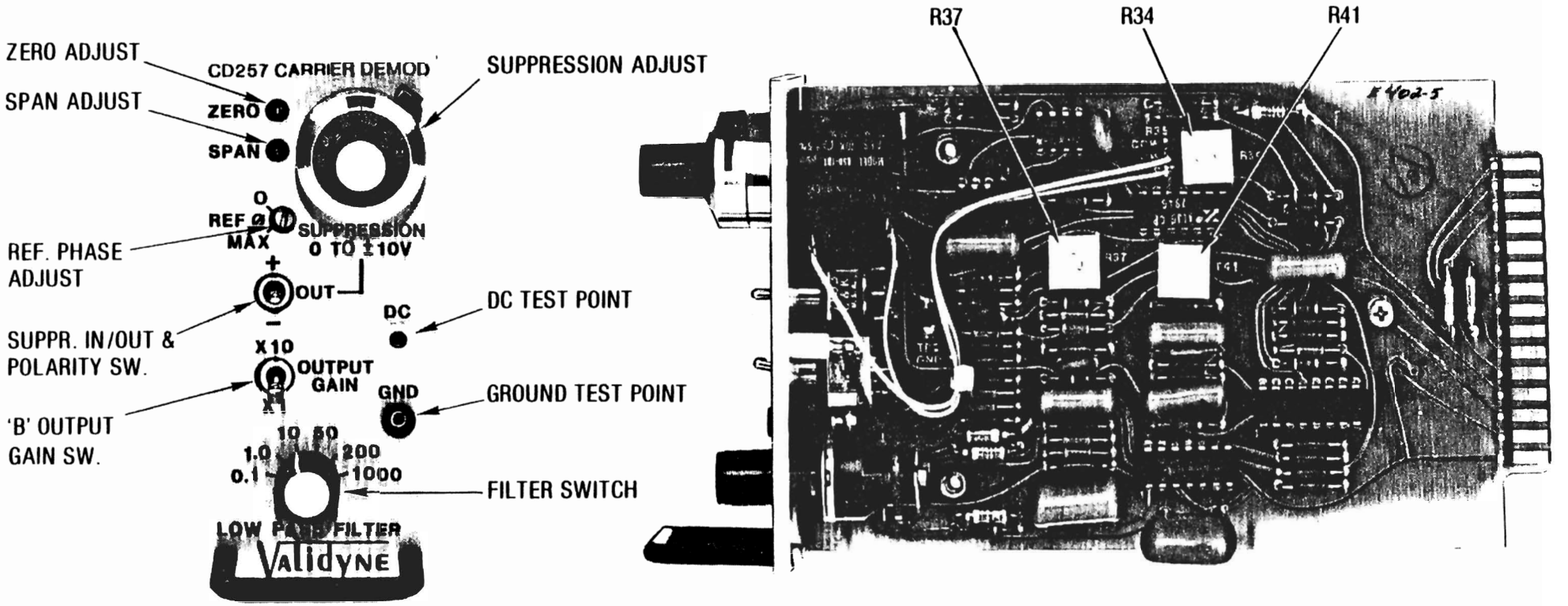


FIGURE 1-1 CD257 CONTROLS, ADJUSTMENTS AND TEST POINTS

SECTION I
DESCRIPTION

1-1. INTRODUCTION.

This manual contains installation and operation instructions for the Model CD257 Carrier Demodulator Module manufactured by Validyne Engineering Corporation, Northridge, California.

1-2. PURPOSE AND USE.

The CD257 is a plug-in signal conditioning module for use in the Model MC1 series of Modular Multi-channel Transducer Signal Conditioning Systems manufactured by Validyne. It is used to convert the AC signal from a variable reluctance transducer or from a linear or rotary variable differential transformer into two high-level DC outputs which can be used for indicating, recording, or control purposes. Convenient front panel controls are available for adjusting and scaling the outputs to any amplitude between 0 to ±10 Vdc full scale. One of the outputs has a zero suppression control and additional gain capability for use in measuring dynamic variations about a high-level static signal. Input and output connections to the CD257 are made at connectors on the rear panel of the MC1 system module case.

1-3. PHYSICAL DESCRIPTION.

See Figure 1-1 for an illustration of the CD257 and its controls. The module plugs into any signal conditioning slot in the MC1-3, MC1-10 or MC1-20 module case, which supplies the module operating power and provides the internal interconnections to the input and output connectors on the case.

1-4. Table 1-1 describes the CD257 controls and their functions. Where A and B outputs are mentioned, these refer to the two output connectors on the MC1 case.

TABLE 1-1 CD257 CONTROLS

ITEM	DESCRIPTION
Front Panel Access:	
ZERO	A 20-turn screwdriver potentiometer for zero-balancing the transducer input signal.
SPAN	A 20-turn screwdriver potentiometer for adjusting the full scale output span.
REF Ø	A single-turn screwdriver potentiometer for adjusting the phase reference between the transducer and carrier demodulator when a long transmission line is used.
+/OUT/- SWITCH	A 3-position toggle switch for selecting no zero suppression control (OUT position) or selecting + or - suppression.
SUPPRESSION 0 to ±10V	A 10-turn calibrated dial for adjusting the B output zero suppression from 0 to ±10 Vdc, with polarity determined by position of suppression toggle switch; clockwise rotation increases suppression; does not affect A output.
OUTPUT GAIN SWITCH	A 2-position toggle switch for selecting X1 or X10 gain for the B output only; does not affect A output.

TABLE 1-1 CD257 CONTROLS (Con't.)

ITEM	DESCRIPTION
LOW PASS FILTER	A 6-position switch for selecting the low-pass frequency response (in Hz) of the output signal; controls both A and B outputs.
DC TEST POINT	A Pin-jack for monitoring A output voltage; used with GND test point.
GND TEST POINT	A pin-jack for circuit ground reference.
Circuit Board Access:	
R34	An internal factory adjustment for the +10 Vdc full scale suppression voltage.
R37	An internal factory adjustment for the -10 Vdc full scale suppression voltage.
R41	An internal factory adjustment for the B output balance.

1-5. FUNCTIONAL DESCRIPTION

The CD257 utilizes the 5Vrms 3kHz carrier from the MC1 power supply to excite the transducer. The transducer input voltage is summed with an adjustable zero-balance voltage and fed thru the SPAN control and input amplifier stage to an integrated circuit switching type carrier demodulator which inverts the negative phase of the carrier signal and combines it with the positive phase to produce a full-wave rectified DC output. The demodulator is driven from the same 3kHz supply as is used to excite the transducer. If a long transmission line causes a phase shift between the input signal and demodulator drive, a reference phase adjustment is available for phase synchronization.

1-6. The demodulator output is fed through an adjustable active low-pass filter stage and a buffer amplifier to become output A, which is ±10 Vdc full scale for a ±15 mV/V minimum transducer signal.

1-7. To obtain the B output, the A output is fed thru a summing amplifier with a selectable X1 or X10 gain. The input to this amplifier is the sum of the A output and the DC zero suppression voltage, which is obtained by rectifying, filtering and amplifying the 3kHz carrier. A calibrated suppression span control ("SUPPRESSION") allows precise application of 0 to ±10 Vdc, with a mode switch for selecting suppression activation and polarity. Applying the zero suppression and added gain to the B output allows this output to be used for suppressing the A output to zero and expanding the output scale for monitoring small dynamic variations about the A output level.

1-8. TECHNICAL CHARACTERISTICS

The Technical Characteristics for the CD257 are given in Table 1-2.

TABLE 1-2 CD257 SPECIFICATIONS

ITEM	CHARACTERISTICS
Input Sensitivity:	15 mV/V minimum for ±10 Vdc FS output
Bridge Excitation:	5V rms, 3 kHz from a precision center-tapped transformer
Bridge Configuration:	2-arm variable reluctance transducer or LVDT transducer
Input Impedance:	94 kΩ
Zero Control:	±10 mV/V referred to input
Span Control:	0 to 100%; controls both A & B outputs
Output A:	±10 Vdc at 10 mA
Output B:	±10 Vdc at 10 mA, with ±10 Vdc suppression and X1 or X10 gain selection
Linearity:	±0.05% FS maximum
Output Noise:	Less than 10 mV rms at 10 Vdc
Suppression:	10-turn calibrated dial for 0 to ±10 Vdc B output suppression; Mode switch selects suppression, plus/minus, or out (off); B output gain switch can expand suppressed output X1 or X10
Frequency Response:	6-position low-pass filter switch selects cutoff frequencies of 0.1, 1.0, 10, 50, 200 or 1000 Hz

TABLE 1-2 CD257 SPECIFICATIONS (Con't.)

ITEM	CHARACTERISTICS
Reference Phase Adjust:	0 to 90°; provides phase compensation for long transmission line applications and LVDT inputs.
Temperature Range, Operating:	0° to 160°F
Thermal Effect on Zero:	0.005%/°F
Thermal Effect on Span:	0.01%/°F
Power Requirements:	5 V rms, 3 kHz and ±15 Vdc, supplied by MC1 Module Case

SECTION II
INSTALLATION & OPERATION

2-1. INSTALLATION

The CD257 may be plugged into or out of any signal conditioning channel of the MC1 module case with power on without damage or effect on other channels. All necessary operating controls are available at the front panel.

2-2. Connections for Variable Reluctance Input. Signal input connections are made at the WK-4-32S transducer input connectors on the rear panel of the MC1 case. For half-bridge (two-arm) variable reluctance input connections, see Figure 2-1.

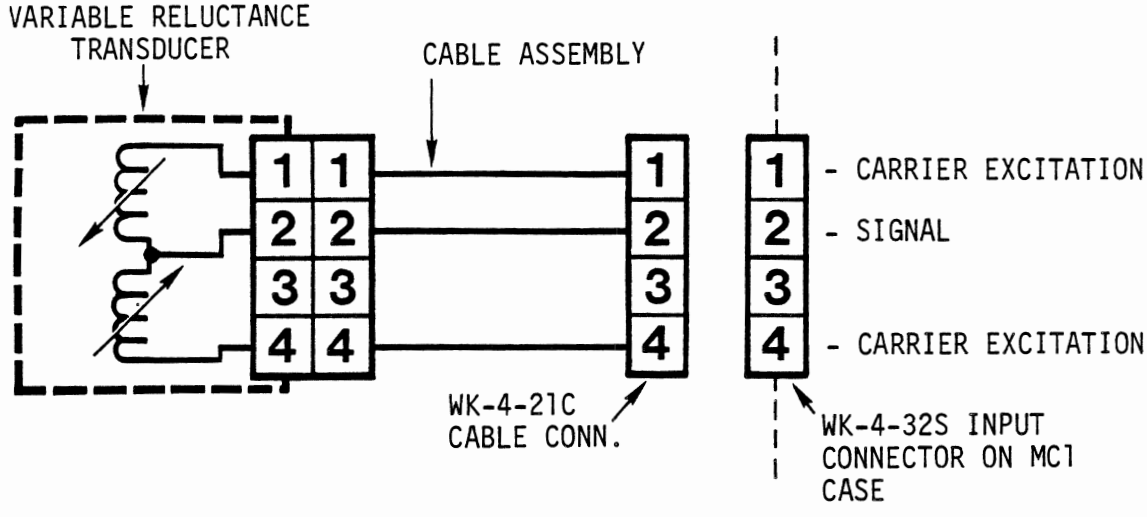
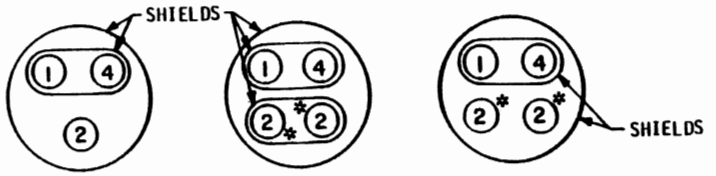
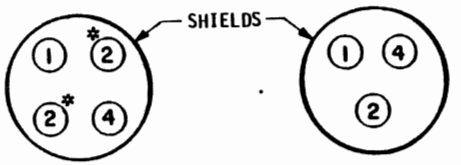


Figure 2-1 Input Connections - Half-Bridge Transducer



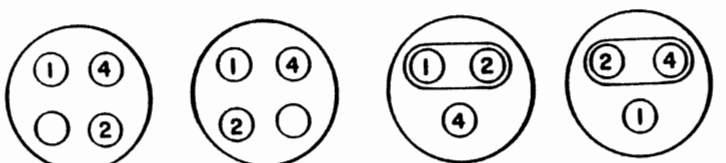
PREFERRED CABLE TYPES & ARRANGEMENTS

(Lengths to 1,000 ft. or more)



ACCEPTABLE CABLE TYPES & ARRANGEMENTS

(Lengths to approx. 100 ft.)

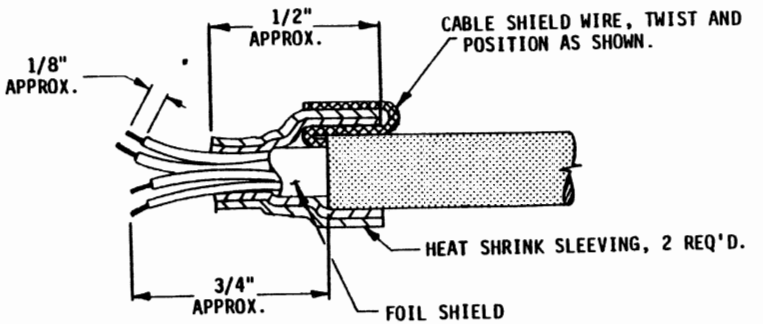


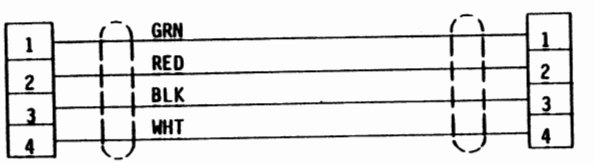
Unequal distance between signal lead and each carrier lead - capacitive unbalance

One carrier lead and signal lead in common shield - large capacitive unbalance

NOT RECOMMENDED

FIGURE 2-2 TRANSDUCER CABLING





NOTES:

1. Cable shield should make contact with connector at cable clamps.
2. Leads for pins 1 and 4 should be in one shielded pair; signal leads 2 and 3 in the other shielded pair (provided two pairs are used).

FIGURE 2-3 CABLE FABRICATION

2-3. Use of the proper type of cabling between the transducer and MCl module case is important in order to minimize capacitive unbalance between the signal lead and carrier leads. Figure 2-2 illustrates both recommended and non-recommended types of cable.

2-4. Figure 2-3 provides information on fabrication of transducer cable. For use with the MCl system and a Validyne transducer, the cable connectors are Cannon WK-4-21C or equivalent. Cable shields should be connected to the connector shells. However, in cases where the transducer body is grounded, the shield connection at the transducer end should be left open in order to eliminate electrical noise from possible ground currents.

2-5. Standard transducer cables with two shielded pairs and WK-4-21C connectors wired per Figure 2-3 are available from Validyne.

2-6. Connections for LVDT or RVDT Inputs. Variable differential transformers, either linear or rotary-position types, are high output devices. The actual output voltage in mV/V of the LVDT/RVDT can be determined by multiplying the sensitivity by the displacement in thousands of an inch.

Output Voltage = Sensitivity x Displacement

(mV/V) (obtained from mfg. data sheet) (obtained from mfg. data sheet)

2-7. To avoid saturation of the CD257 input amplifier, two different methods of connection will be described in the following sections. The first method is for LVDT/RVDT output voltages less than 50 mV/V and the second method is for output voltages greater than 50 mV/V.

2-8. For an LVDT or RVDT with a full-scale output of 50 mV/V or less, the transducer connections should be per Figure 2-4.

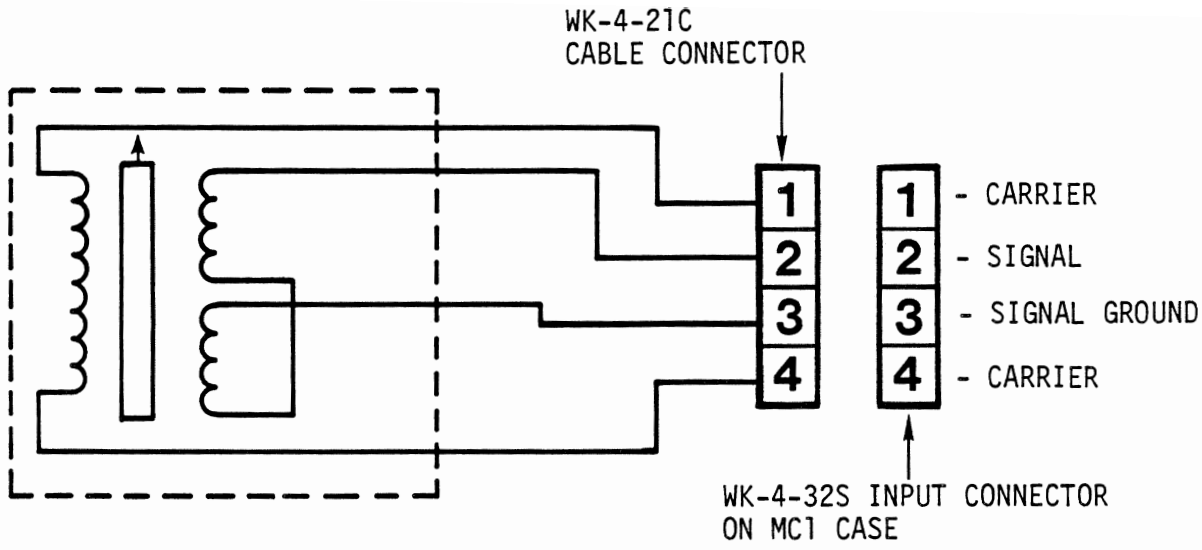


Figure 2-4 LVDT Connections for Input ≤50 mV/V

2.9 For an LVDT or RVDT with a full scale output of more than 50 mV/V, the transducer connections should be per Figure 2-5. The values of R1 and R2, which form a voltage-divider across the LVDT output, can be calculated as follows:

$$R_1 = \frac{E_o - 50}{50} R_2$$

Where E_o = full scale LVDT output in mV/V $R_1 + R_2$ should be within 10k to 20k ohms.

EXAMPLE:

An LVDT with a full scale output of 200 mV/V is to be used for measurement of linear deflection. This means that the LVDT output should be attenuated by a factor of 4 before input to the CD257 - i.e., the voltage across R_2 will be ¼ of the LVDT output voltage across R_1+R_2. Selecting the value of R_2 as 5k ohms, $R_1 = \frac{200-50}{50}(5k) = 15k$ ohms.

R_1 and R_2 should be stable metal-film or wire-wound 1/8 watt resistors. These can be mounted at the transducer or in the cable connectors.

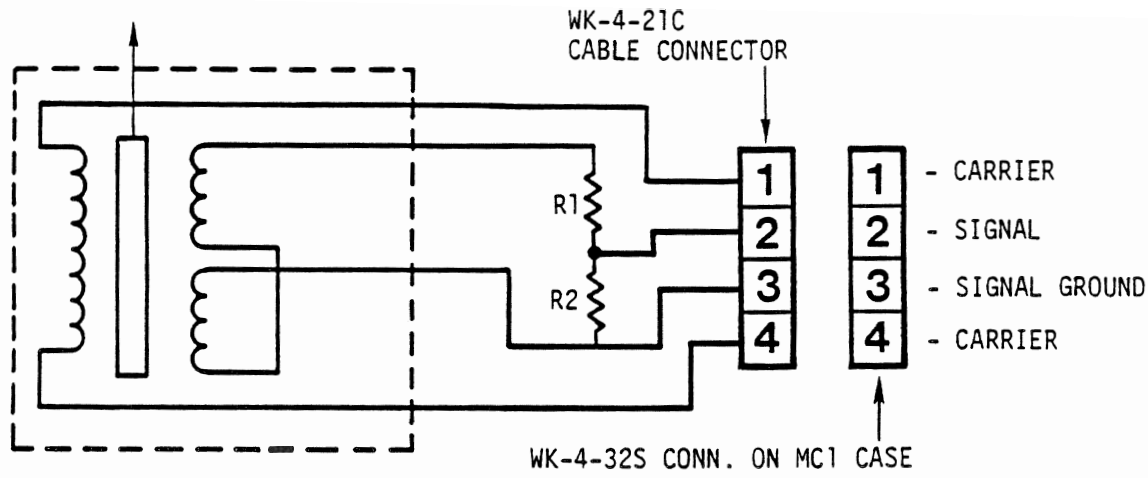


Figure 2-5 - LVDT Connections for Input > 50 mV/V

2-10. Although resistive attenuation is the most convenient method of reducing a high signal input, the following alternate methods can be used:

A. A step-down transformer between the carrier excitation and the LVDT primary.

B. A large capacitor (e.g., 1 mfd) across the signal input.

2-11. Output Connections. Output connections are made to the XLR-3-32S output connectors on the rear panel of the MC1 module case. Two output connectors are available, one for output A and the other for output B. Pin identifications for both connectors are:

Pin	Function
1	Signal Output
2	Signal Ground
3	Chassis Ground

The chassis ground is isolated from the signal ground and may be used for cable shield ground connection.

2-12. OPERATION

2-13. Operation, Variable Reluctance Input:

A. Connect the transducer as shown in Figure 2-1. Connect a

2-13. Operation, Variable Reluctance Input (Con't.):

DC digital voltmeter to front panel test points DC and GND. Set low pass filter switch to 200Hz. Turn MC1 case power on.

B. With no stimulus applied to the transducer, adjust the front panel ZERO control for a DVM reading of 0.000±0.005 Vdc.

C. Apply full scale stimulus to the transducer, and adjust the front panel SPAN control for a DVM reading of 10 Vdc or the desired full scale output signal. Adjust the front panel REF ϕ control for maximum output before final SPAN adjustment.

D. Set the LOW PASS FILTER switch to the frequency response desired; the numbers show the high-frequency cutoff point - e.g., a setting of 100 indicates a passband of 0 to 100 Hz.

NOTE: The front panel DC test point monitors only the A output. As the SUPPRESSION and OUTPUT GAIN controls affect only the B output, monitoring of the B output must be done at the B output connector on the MC1 case. To set the zero suppression and gain, proceed as follows.

E. Connect the DVM to pin 1(+) and pin 2 (GND) of the B output connector.

F. Set suppression switch to OUT (center) position, and OUTPUT GAIN switch to X1 position. The B output zero reading should be the same, within ±0.005 Vdc, as that for the A output.

G. Rotate the SUPPRESSION dial to a reading of 000 and set the mode switch to the + position. The B output should remain within ±0.005 Vdc of that obtained in Step F.

H. Rotate the SUPPRESSION dial clockwise (increasing) to the amount of zero suppression desired. The dial is linearly calibrated to provide 10 Vdc suppression at a reading of 1000, or 1 Vdc per 100 counts; it should not be used to indicate percentage of full scale suppression unless the full scale A output is 0 to 10 Vdc. With the suppression mode switch in the + position, increasing the suppression voltage will change the B output in a negative direction. With the mode switch in the - position, increasing the suppression voltage will change the B output in a positive

2-13. Operation, Variable Reluctance Input (Con't.)

direction. A +10 Vdc A output can be suppressed to 0 Vdc B output, or a -10 Vdc A output can be elevated to 0 Vdc B output.

J. Set the OUTPUT GAIN switch to the X10 position. This will amplify the B output by a factor of 10, BUT ONLY IF THE A OUTPUT VOLTAGE LESS THE SUPPRESSION DOES NOT EXCEED 1.1 Vdc. This prevents saturation of the B output amplifier stage in the X10 gain position.

K. The suppression mode switch, suppression adjustment, and output gain switch have no effect on the A output. When the A and B outputs have been adjusted per the foregoing procedures, the CD257 is ready for operation. Lock the suppression dial to prevent inadvertant changes.

2-14. Operation, LVDT Input. Setting up the CD257 for operation with LVDT/RVDT inputs is the same as that described in Section 2-5 for variable reluctance inputs, except that the LVDT/RVDT input should be connected per Figure 2-4 or 2-5. However, it may be necessary to mechanically adjust the position of the LVDT actuating shaft to obtain a zero balance. The following procedure can be used for this.

A. Connect an AC voltmeter (3 Vac range) or an oscilloscope (0.5 V/cm range) across pins 2 and 3 (signal input) of the transducer input connection to the MC1. Turn MC1 power on to excite the transducer.

B. Mechanically adjust the position of the LVDT actuating shaft to obtain the minimum AC output level on the voltmeter or scope. After setting the mechanical null, remove the voltmeter or scope and follow the procedures of Section 2-6.

SECTION III
MAINTENANCE & REPAIR

3-1. MAINTENANCE.

If a periodic maintenance test schedule is in effect, the following procedures can be used to verify that the CD257 is properly operational. For these tests the following equipment is required:

Validyne Model TS234 - Transducer Simulator
Validyne Model 7616-2 - Module Extender Card
DC Digital Voltmeter

A. Insert the module extender into an MC1 signal conditioning slot. Connect the CD257 to the module extender. This provides access to the internal adjustments with the CD257 operational.

B. Connect the transducer simulator to the MC1 Input Connector for the channel being used. This provides an adjustable input signal to the CD257.

C. Connect the DVM to the DC output and GND test points on the CD257 front panel. Adjust the REF ϕ control fully counter-clockwise.

D. Set the simulator output switch (% FS) to 0% and adjust the CD257 ZERO control for 0.000 ±0.005 Vdc.

E. Set the simulator percent switch to 100%, the Polarity switch to +, and adjust the Range dial for a simulator output of 15 mV/V (a dial reading of 150). Adjust the CD257 SPAN control for an output of 10.000 ±0.005 Vdc. This checks the CD257 input sensitivity.

F. Connect the DVM to pins 1(+) and 2 of the B output connector on the MC1. Set the CD257 OUTPUT GAIN switch to X1 and suppression mode switch to OUT. Set simulator switch to 100%. Adjust R41 (internal) for a B output voltage of 10.000 ±0.005 Vdc. This aligns the A and B outputs. (See Figure 1-1 for location of controls and adjustments).

3.1 MAINTENANCE (Con't.)

G. With simulator switch set at 100%, set the suppression mode switch to +, the suppression control dial to a reading of 1000, and adjust R37 (internal) for a B output of 0.000 ±0.005 Vdc.

H. Set simulator Polarity switch to -, simulator percent switch to 100%, suppression mode switch to -, and adjust R34 (internal) for a B output of 0.000 ±0.005 Vdc. Recheck Step G, and repeat G & H if necessary. These steps calibrate the suppression voltages.

J. Set suppression mode switch to OUT, simulator Polarity switch to +, and simulator switch to 0%, 25%, 50%, 75% and 100%. Output readings should be within ±0.005 Vdc from a straight line between the outputs at 0 and 100%. This checks the CD257 linearity.

K. Set the simulator Polarity switch to -. The 100% output reading should be within ±0.01 Vdc of that for Step J. This checks the symmetry between + and - outputs.

L. Set the simulator output to 40 mV/V at the 100% switch position and adjust the CD257 SPAN control for a B output of 10.0 Vdc. Set the simulator dial for an output of 4 mV/V (B output reading of 1.00 Vdc). Place the CD257 OUTPUT GAIN switch to the X10 position. Output should be 10.0 Vdc. This checks the B output gain.

3-2. REPAIR.

The CD257 is tested, burned-in and retested before shipment to assure reliability and long life. Should malfunction occur, Validyne recommends that the unit be returned to the factory for prompt repair or replacement in accordance with the Validyne warranty.

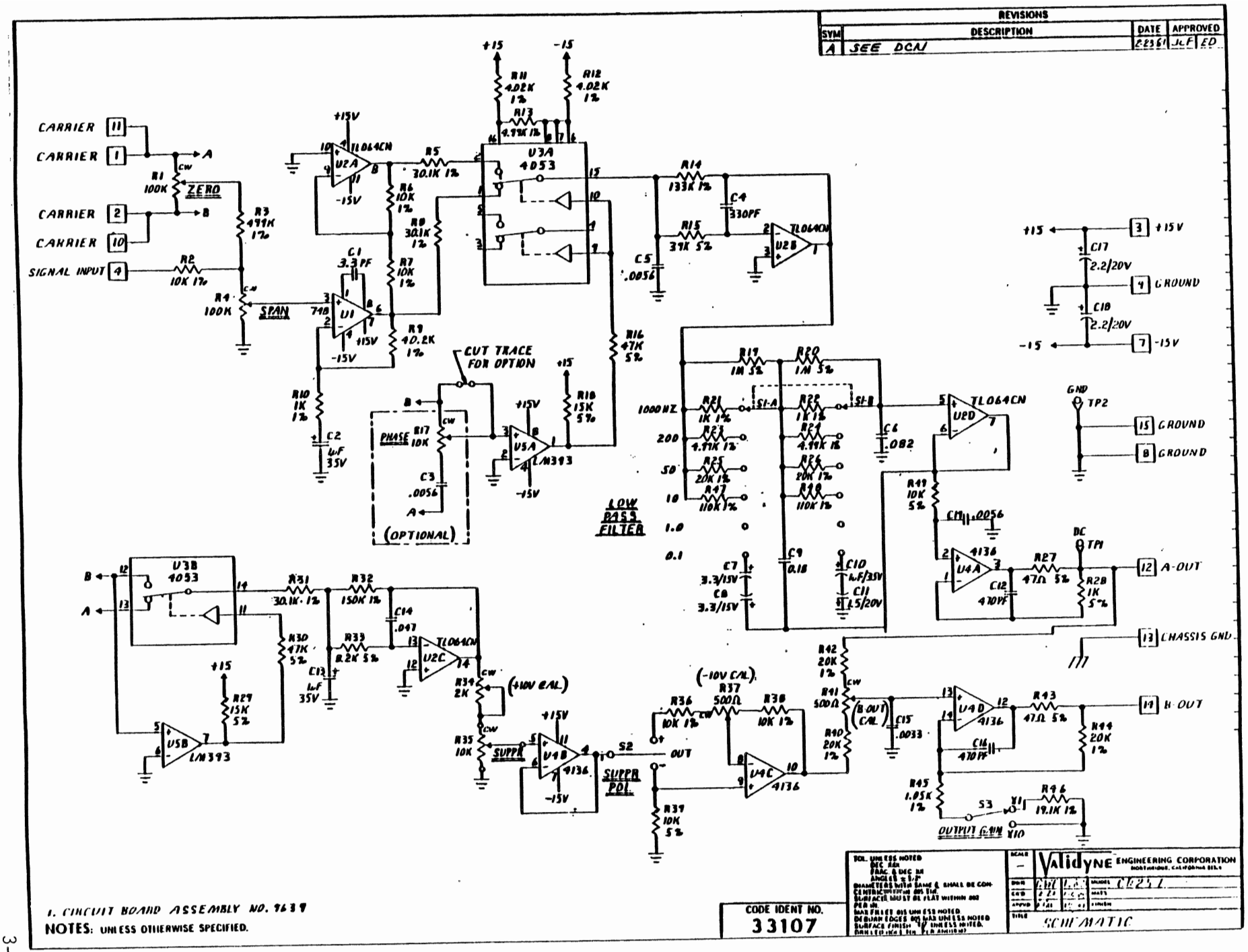


FIGURE 3-1, CD257 SCHEMATIC

WARRANTY

VALIDYNE ENGINEERING CORPORATION warrants equipment of its own manufacture to be free from defects in material and workmanship under normal conditions of use and service.

VALIDYNE will rework or replace any item found to be defective on as return to VALIDYNE within the time specified below:

1. Pressure Transducers and Pressure Transmitters (including transducers supplied as part of Digital Manometer Systems) within three (3) years of its original purchase.

2. Electronics products (Transducer Indicators, Carrier Demodulators, plug-in SignalCondioners, Module Cases, etc.) within one (1) year of its original purchase.

3. OEM Transducers within one (1) year of its original purchase.

Buyer is requested to secure authorization of VALIDYNE, and to describe defect prior to return of equipment under warranty. Shipment to VALIDYNE shall be at Buyer's expense, with return at VALIDYNE's expense. NON-VERIFIED problems or malfunctions, whether warranty or not, are subject to a $100.00 evaluation charge.

The warranty carries no liability, either expressed or implied, beyond our obligation to rework or replace, at VALIDYNE's option, the unit which carries the warranty to the original purchaser. Prices, specifications, and designs are subject to change without notice. This warranty is void if the product is subjected to misuse, accident, neglect, or improper application or operation.

Out of Warranty Rework

Units returned to VALIDYNE for rework which are out of warranty will be subject to the following conditions:

1. A description of the problem or malfunction shall accompany the unit returned for rework, or be communicated to VALIDYNE prior to shipment. Otherwise there will be a minimum evaluation and/or calibration charge of $100.00.

2. Unit will be reworked automatically if the charge is less than 65% of current list price, unless other specific instructions are received. Above 65% VALIDYNE will request authorization by Buyer.

3. If a quotation is required before proceeding with rework, unit should be accompanied by a document so stating, or communicated to VALIDYNE prior to shipment. A $100.00 evaluation charge will be invoiced for this service.

4. Shipping charges in both directions are the responsibility of the Buyer for all out of warranty returns.

Warranty on Rework

Warranty coverage on rework is 90 days on work done, or to the end of the original warranty period, whichever is longest.

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