

**CD19A
High Gain
Carrier Demodulator
Module**

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| 10/86 | 3-7 | Added more details to B-output dividers | RB |

SECTION I DESCRIPTION

1-1. INTRODUCTION.

This technical manual contains installation and operating instructions for a Model CD19A Carrier Demodulator Plug-In Module for a multi-channel transducer control system. The Module is manufactured by Validyne Engineering Corporation, Northridge, California, 91324.

1-2. PURPOSE AND USE.

The Model CD19A (see Figure 1-1) is a high-gain demodulator, plug-in module for use in Validyne Engineering Corporation's MC1 family of module cases. It provides transducer excitation, and amplifies and demodulates the output of carrier-excited strain gage bridges and transducers, variable reluctance transducers, potentiometric transducers, and linear and rotary variable differential transformers (LVDT/RVDT).

1-3. PHYSICAL DESCRIPTION (SEE FIGURE 1-1).

The CD19A will operate with full-bridge or half-bridge transducers delivering 10 volts DC output for inputs ranging from 1 mV/V to 166 mV/V. A six-position GAIN MV/V switch and either a ten-turn vernier GAIN ADJ potentiometer or a trim pot (depending on the option selected) allows the use of inputs up to 166 mV/V. Screwdriver adjusted "R" and "C" balance controls are provided on the front panel, and a HI/MED/LO jumper is provided on the circuit board for balance range expansion. A calibration input (CAL R) located on the front panel is used for inserting a calibration resistor into the input circuit. The CAL +/- switch determines polarity of the calibration signal. On some models, a phase ADJ potentiometer is accessible at the front panel to accommodate phase shifts which may occur when long cables are used between the transducer and the CD19A.

1-4. Output frequency response is controlled by a low-pass active filter, and is switch selectable from 1, 10, 50, 200, and 1 KHz by a rotary LOW PASS FILTER switch on the front panel. (On some models, the 1 Hz position has been changed to 0.1 Hz.) The CD19A power requirements of 5 V rms at 3 kHz or 5 kHz carrier and ± 15 Vdc are supplied from the MC1 series Module Case.

1-5. FUNCTIONAL DESCRIPTION (SEE FIGURE 1-2).

The output from a transducer is fed into a high-gain differential amplifier, one side of which is terminated for two-arm single-ended operation by the 2-ARM/4-ARM jumper. Any residual output from the transducer may be nulled out by the "R" and "C" balance controls, which sum a small amount of the carrier signal into the differential amplifier.

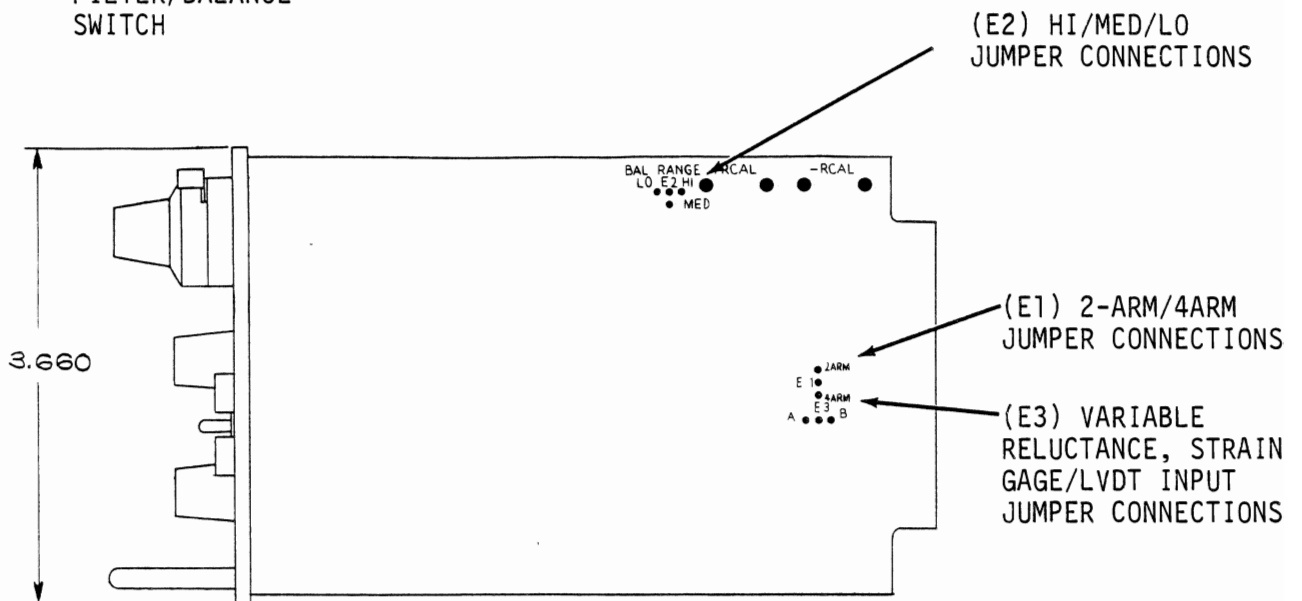
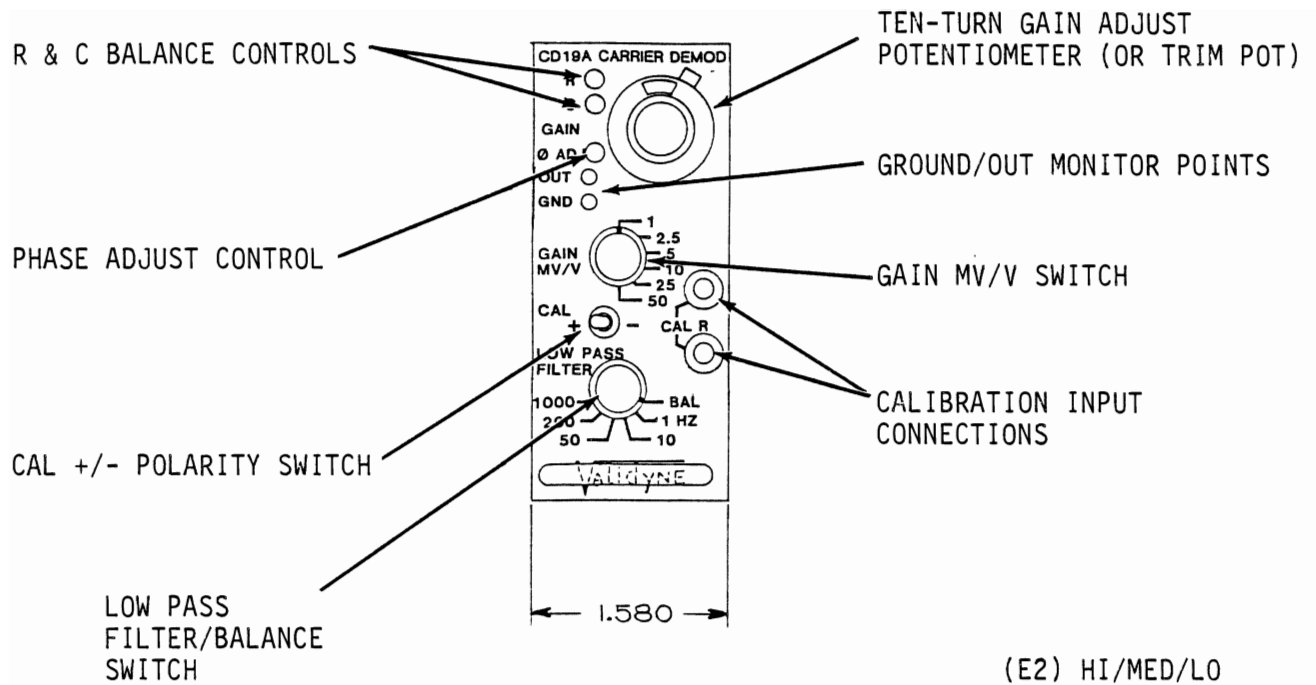


Figure 1-1. Model CD19A Carrier Demodulator Plug-In Module.

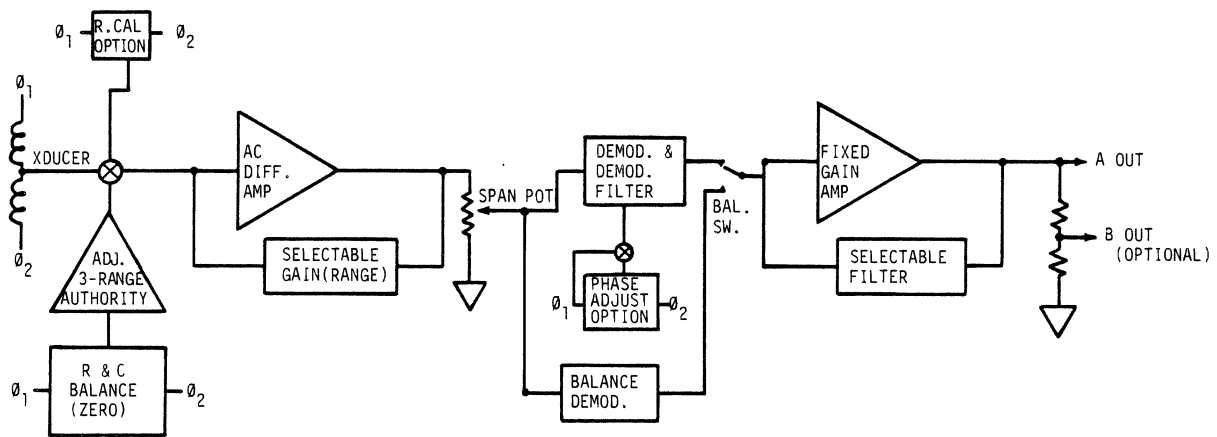


Figure 1-2. Functional Block Diagram.

1-6. The gain of the differential amplifier is controlled by a six-position GAIN MV/V switch in the negative feedback loop. The output of this amplifier goes to the GAIN ADJ potentiometer, whose buffered output 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 smooth out the dc signal from the demodulator. A gain-of-four, fixed 1.5 KHz low pass filter stage feeds the selectable low pass filter output stage. The frequency response is controlled by a five-position filter selector switch (LOW PASS FILTER) located on the front panel. This switch provides a BAL mode to simplify R and C balance adjustment.

1-7. The calibration circuit operates by summing part of the 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 upon which carrier lead the calibration resistor is switched to.

1-8. OPTIONS.

The CD19A is available with several options which are described in the following paragraphs. The model number identification, marked on the circuit board, indicates the options included in a particular model. Model Number identification information is listed in Table 1-1.

1-9. Remote Calibration

Units with the Remote Calibration option have additional components, including a Remote Cal relay, a diode and four bifurcated terminals for connecting a calibration resistor. This option allows calibration of the system from a remote location. The Remote Cal option enables remote operation of a relay which in turn engages a user-selected calibration resistor into the input circuit.

1-10. Phase Adjustment

The Phase Adjustment option provides a phase control for the system. It consists of a variable resistor accessible from the front panel and a capacitor mounted inside. Adjusting the Phase ADJ control compensates for long cable lengths between the transducer and the CD19A. The demodulator phase can be adjusted locally to agree with the received signal phase.

1-11. Front Panel Gain Control

The Front Panel Gain Control is available with either a trim potentiometer or a ten-turn dial potentiometer. Both provide the same function except the ten-turn dial potentiometer has a calibrated dial providing a visual readout for gain settings.

1-12. Output

The system is available with either a single output wired to both A and B outputs, or a standard A output plus an attenuated B output. On standard units the A and B outputs are tied together. On units with the Attenuated B output option, user selected resistors may be installed to control output at the B terminal.

1-13. 0.1 Hz Low Pass Filter Position

The system is available with five standard filter positions: 1 Hz, 10, 50, 200 and 1000. On units with 0.1 Hz Low Pass Filter Option, the 1 Hz position has been replaced with a 0.1 Hz position and is so marked on the front panel of the instrument.

Table 1-1. Options List.

MODEL NO. CD19A — X — X — X — X — X

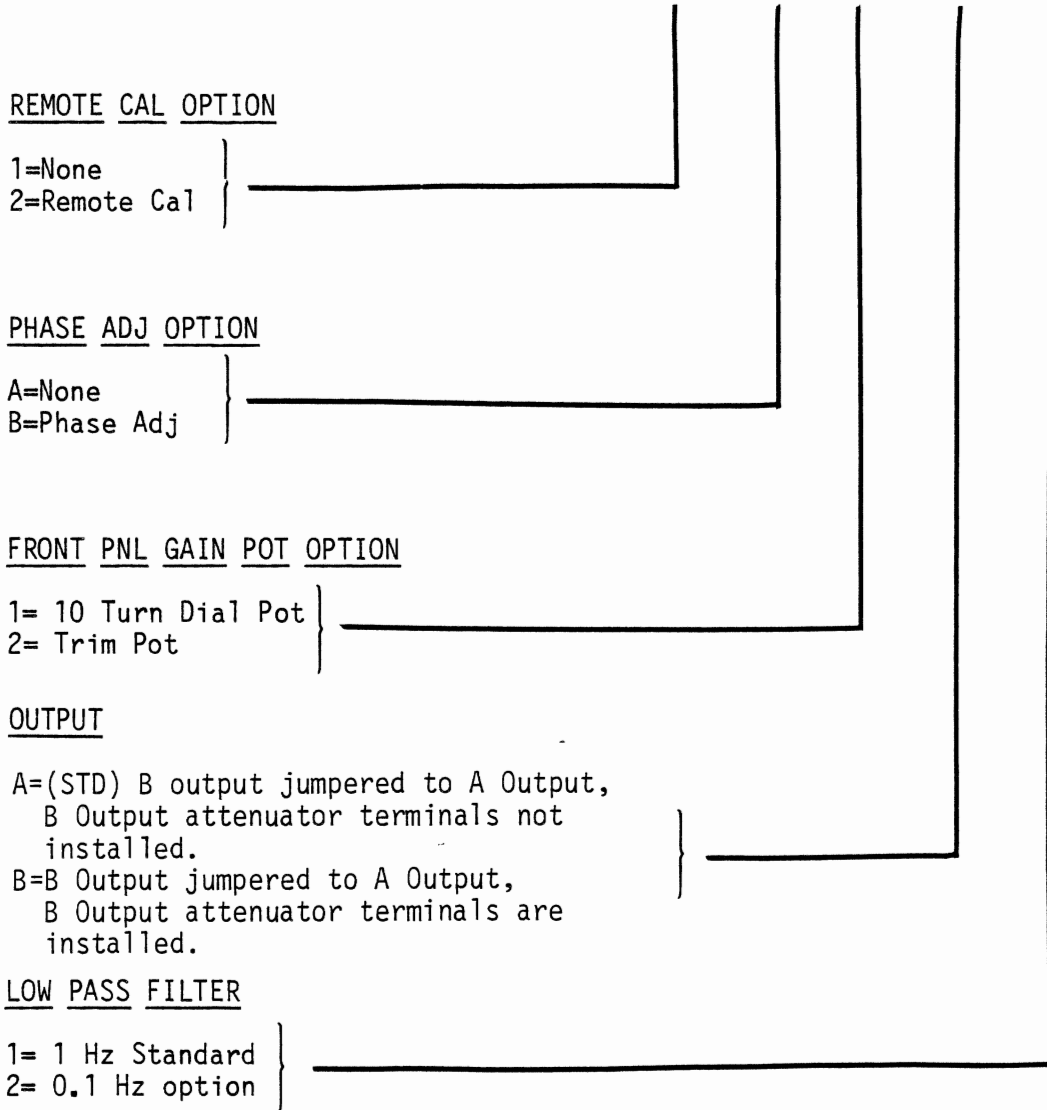


Table 1-2. Technical Characteristics (Continued).

| Item | Characteristic |
|--|--|
| <p>Front Panel Controls: (see Figure 1-1 for locations)</p> <p>Behind the panel circuit board mounted controls: (see Figure 1-1 for locations)</p> <p>PHYSICAL</p> <p>Dimensions:</p> <p>Weight:</p> | <p>15-turn resistive balance control (R). Screwdriver adjustment.</p> <p>15-turn capacitive balance control (C). Screwdriver adjustment.</p> <p>6-position GAIN MV/V switch.</p> <p>Ten-turn calibrated GAIN vernier potentiometer or trim-pot GAIN adjustment.</p> <p>5-position LOW PASS FILTER switch plus BAL mode.</p> <p>CAL +/- switch.</p> <p>GND/OUT Monitor Points.</p> <p>CAL R resistor input connection, miniature banana jacks.</p> <p>2-ARM/4-ARM jumper (E1).</p> <p>HI/MED/LOW balance range jumper (E2).</p> <p>Variable reluctance, strain gage/LVDT input jumper (E3).</p> <p>1.6" Wide x 3.7" High x 7.0" Deep.</p> <p>Less than 7 ounces.</p> <p>Plugs into Validyne Engineering Corporation MC1 series Module Case.</p> |

SECTION II INSTALLATION

2-1. INSPECTION.

On receipt of order, inspect CD19A for any damage in shipment. The equipment has been thoroughly inspected and tested before leaving the factory. Any damage should be reported to your carrier immediately. Remove any foreign matter, such as packing material from the instrument.

2-2. INSTALLATION.

Slide CD19A into an available channel of MC1 Module Case. The Model CD19A may be plugged into or removed from any channel of the MC1 Module Case while power is on without damage and without affecting the adjacent channels.

2-3. Transducer Connections.

Transducers are connected to the CD19A through either a terminal strip or a connector on the back of the MC1 Module Case, depending on the version of the MC1 Case you are using. The CD19A A and B outputs come from separate XLR-3-32S connectors or a terminal strip on the back of the MC1 Module Case.

Table 2-1 describes the input/output connections at the MC1 Case when using the terminal strip version of the Module Case. Table 2-2 describes the input connections to the standard MC1 Case which uses PT02A-10-6P input connectors. Table 2-3 describes the input connections to the special 1924 version of the MC1 Module Case which uses WK-4-32 input connectors. Table 2-4 describes the output connections from the MC1 Module Case which uses XLR connectors instead of a terminal strip. Figure 2-1 illustrates the suggested cabling method of connecting the transducer to the MC1 input connections. Figure 2-2 illustrates the cable types (both acceptable and unacceptable) for half-bridge transducer connections. Cable shields should be connected to the shells of the mating connectors. Where the transducer body is grounded, the shield connection at the transducer end should be left open to eliminate noise from possible ground currents.

Table 2-1. MC1-10T, MC1-20T Input/Output Pin Connections
(Terminal Strip Version).

| TERMINAL | SIGNAL | CD19A PIN |
|----------|---------------|-----------|
| 1 | Excitation + | 11 |
| 2 | + Signal In | 4 |
| 3 | - Signal In | 8 |
| 4 | Excitation - | 10 |
| 5 | Output A | 12 |
| 6 | Signal Ground | 9 |
| 7 | Output B | 14 |

Table 2-2. Standard MC1-3, -10, -20 Interface Connections.

| CONNECTOR PTO2A-10-6P | SIGNAL | CD19A PIN |
|--------------------------|---------------|-----------|
| A | Excitation + | 11 |
| B | + Signal In | 4 |
| C | - Signal In | 8 |
| D | Excitation - | 10 |
| E | No Connection | |
| F | No Connection | |

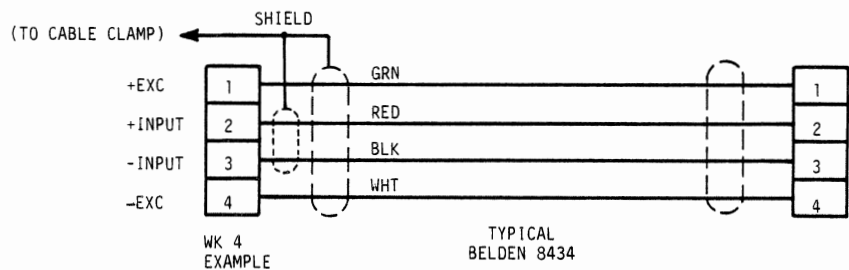
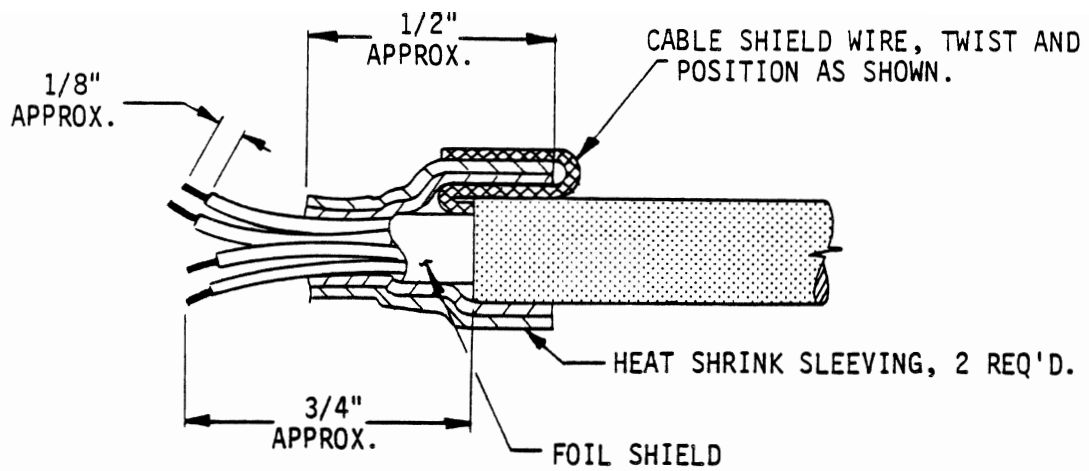
Table 2-3. Special No. 1924 MC1-3-1924, -10-1924, 20-1924 Interface Connections.

| CONNECTOR WK4-32 | SIGNAL | CD19A PIN |
|---------------------|--------------|-----------|
| 1 | Excitation + | 11 |
| 2 | + Signal In | 4 |
| 3 | - Signal In | 8 |
| 4 | Excitation - | 10 |

Table 2-4. MC1 Transducer Output Connections.

| CONNECTOR XLR | FUNCTION |
|------------------|----------------|
| 1 | Output |
| 2 | Circuit Ground |
| 3 | Chassis Ground |

NOTE: Pin connections are the same for both Output A and B.



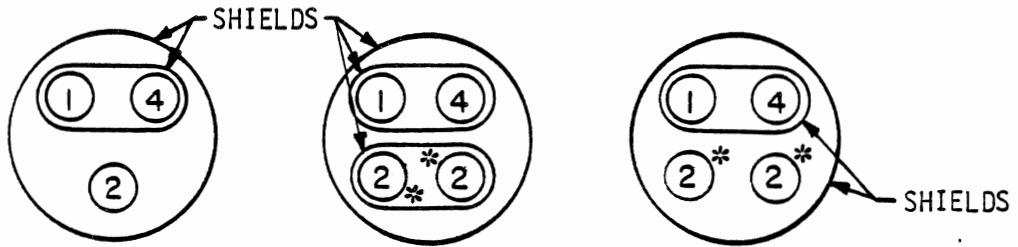
NOTES:

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 2-1. Fabrication of Transducer Cable.

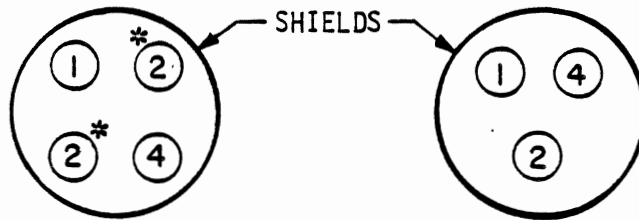
LEAD IDENTIFICATION: 1 - CARRIER EXCITATION
 2 - OUTPUT SIGNAL
 4 - CARRIER EXCITATION

*Signal lead can be either lead shown



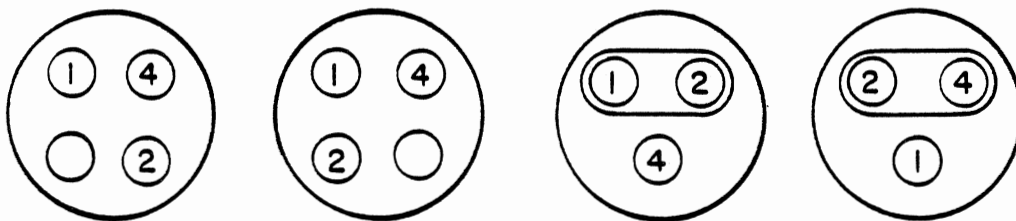
PREFERRED CABLE TYPES & ARRANGEMENTS

(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.

NOTE

Figures 3-1 through 3-3 describe the different methods of connecting the variable reluctance, strain gage, LVDT/RVDT and potentiometer transducers to the MC1 input connector.

2-4. LONG CABLE OPERATION.

The CD19 will operate with more than 1000 feet of Belden 8434 cable between each transducer and its demodulator. The carrier supply is unaffected by capacitance loading to above one microfarad, and may be shorted for an indefinite period without damage. The amplifier output will recover (return to normal) within a few seconds after removal of the short.

2-5. Cables longer than 1000 feet may be used if they are a low capacitance type. The transducer carrier excitation should be routed in a single shielded pair while the transducer output signal should be routed in a separate shielded pair. However, sometimes all four wires can be installed within the same shield. When cables with all four wires are installed in the same shield, the most critical factor is capacity balance between the output leads and each of the carrier leads. If a cable with a separate shield for the transducer output is used, the critical factor is total capacitance to ground. The transducer source impedance is inductive, or resistive; increasing the capacity causes the transducer output to increase up to the point where the capacity and the series inductance resonate. Increasing the capacity still further causes the output to decrease and produces an excessive phase shift.

NOTE

For optimum sensitivity, calibration should be accomplished with the actual cable to be used because length variations can affect calibration.

SECTION III INSTALLATION

3-1. OPERATION. (See Figure 1-1 for switch and component locations.)

3-2. Half-Bridge (Two-Arm Operation)--Variable Reluctance Transducers.

A. Connect transducer as shown in Figure 3-1. Position jumper E1 (2-ARM/4-ARM jumper) to the 2-ARM position and jumper E3 (VAR REL, STR. GAGE/LVDT INPUT jumper) to the A position.

B. If transducer is a high output type (between 20-166 mV/V), jumper E2 (HI/MED/LO jumper) should be in either the MED or HI position to balance transducer output for system operation. If transducer is a low output type (between 1 and 20 mV/V), output can usually be balanced to zero with E2 in the LO position.

NOTE

In the HI balance range position, approximately ± 21 mV/V of "R" is provided; in the MED position approximately ± 7 mV/V of "R" is provided; and in the LO position ± 2.1 mV/V or "R" balance range is provide.

C. To balance the bridge with input device connected, proceed as follows:

1. Place LOW PASS FILTER switch to the BAL position and GAIN MV/V Switch to 5 mV/V range.

2. If system has a Phase Adjust option, adjust PHASE ADJ pot fully clockwise.

3. While monitoring dc output at the output test point, alternately adjust "R" and "C" controls on the front panel until output is nulled at 0.000 ± 0.5 Vdc.

4. Set LOW PASS FILTER switch to 200 and GAIN MV/V switch to 1; Readjust "R" pot for an output null. Do not adjust "C" pot after step 3.

3-3. Potentiometric Transducers--General

Potentiometric transducers, either rotary or linear-position types, are high output devices producing essentially one volt output per volt of excitation (1 V/V) if used over the complete active area of the potentiometer element.

A. For compatibility with the CD19A, place jumper E3 (VAR REL. STR. GAGE/LVDT INPUT jumper) in the B position and jumper E1 (2-ARM/4-ARM jumper) in the 2-ARM position.

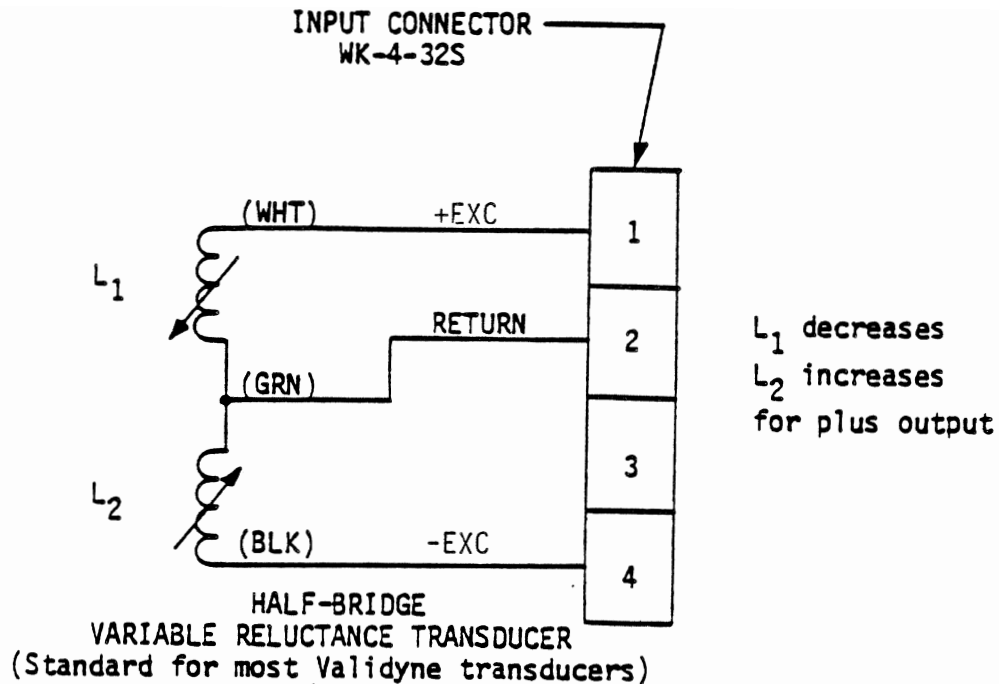


Figure 3-1. Transducer Connections for Two-Arm Operation.

B. Balance and null the transducer as described in paragraph 3-2 B and C.

3-4. Full-Bridge (Four-Arm Operation)--Strain Gage Bridges and Transducers.

A. Connect transducer as shown in Figure 3-2. Position jumper E1 (2-ARM/4-ARM jumper) to the 4-ARM position and jumper E3 (VAR REL. STR. GAGE/LVDT INPUT jumper) to the A position.

B. Balance and null the transducer as described in paragraph 3-2 B and C.

3-5. LVDT/RVDT Transducers--General.

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

$$\begin{array}{l} \text{Output Voltage} = \text{Sensitivity} \quad \times \quad \text{Displacement} \\ \text{(mV/V)} \qquad \qquad \text{(obtained} \quad \quad \quad \text{(obtained} \\ \qquad \qquad \qquad \text{from mfg.} \quad \quad \quad \text{from mfg.} \\ \qquad \qquad \qquad \text{data sheet)} \quad \quad \quad \text{data sheet)} \end{array}$$

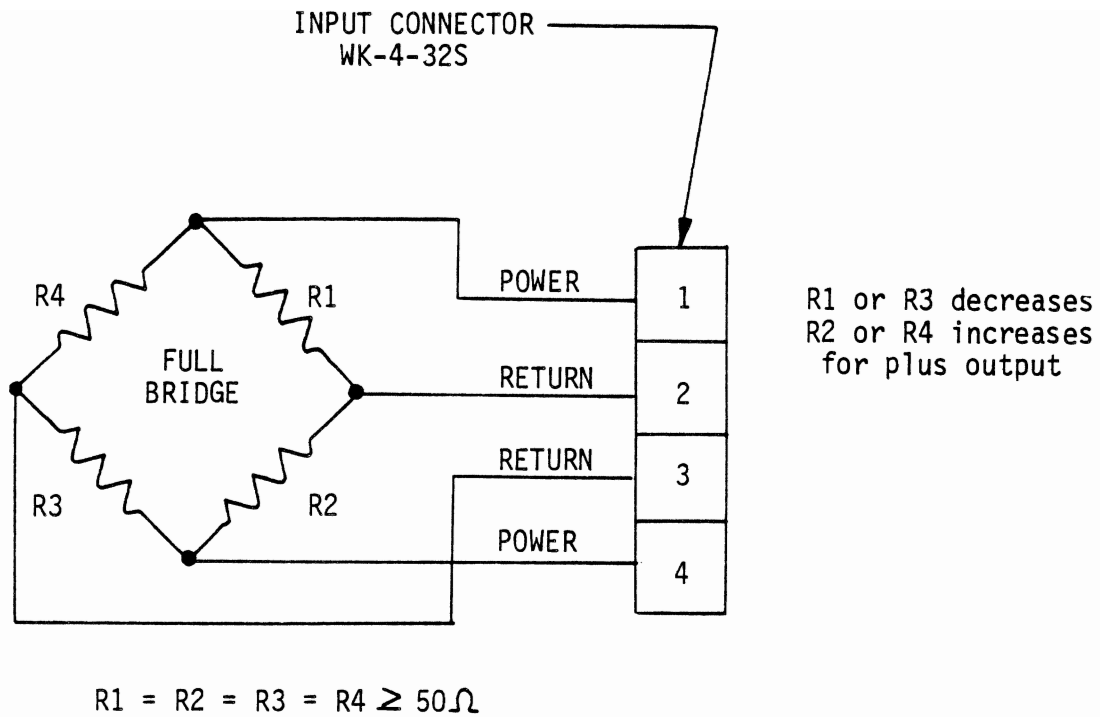


Figure 3-2. Transducer Connections for Full-Bridge, Four-Arm Operation.

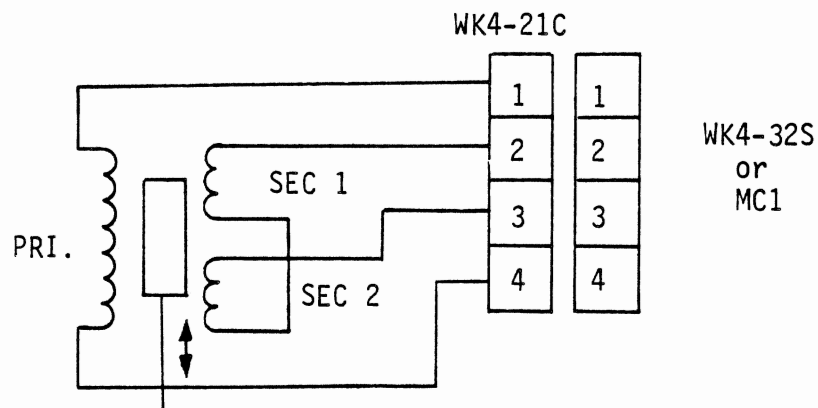


Figure 3-3. Transducer Connections for LVDT Operation.

A. Connect transducer as shown in Figure 3-3. Position jumper E1 (2-ARM/4-ARM jumper) to the 2-ARM position. If output voltage is greater than 166 mV/V, place jumper E3 (VAR REL. STR. GAGE/LVDT INPUT jumper) in the B position. For inputs less than 166 mV/V place jumper E3 in the A position.

B. Balance and null the transducer as described in paragraph 3-2 B and C.

3-6. GAIN ADJUST (See Figure 3-4).

With the GAIN adjust control fully clockwise, system gain is 1.3 times the range selected on the GAIN MV/V switch. The GAIN adjust pot reduces the gain below this value to accommodate signals larger than that marked on the GAIN MV/V switch setting, yet below the level required by the next GAIN MV/V switch position. In systems with 10-turn dial pot option, stops limit the gain range. The control can be turned no lower than a dial reading of 300 (fully clockwise is a reading of 1300). This corresponds to an input 3.33 to 0.77 times that of the GAIN MV/V switch setting (166 mV/V input to 38 mV/V on the 50 mV/V range). Figure 3-4 shows the procedure for setting the digital dial vernier GAIN control (option).

3-7. FILTER SELECTION.

The CD19A has a six-position switch on the front panel for selecting any one of five different low pass filters. Select the desired filter by turning the LOW PASS FILTER selector switch until the dot on the knob is opposite the number 1 Hz (or 0.1 Hz), 10, 50, 200 or 1000. The use of filters is desirable when you wish to ignore signal fluctuations above certain frequency ranges. This switch should only be in the BAL position during zero calibration.

3-8. CALIBRATION RESISTOR SELECTION.

If desired, a calibration signal may be simulated by inserting a resistor into the CAL R inputs on the front panel. The CAL +/- switch on the front panel determines the polarity of the calibration signal.

3-9. When a calibration resistor is inserted into the system, part of the carrier voltage is algebraically added to the transducer input signal to provide a predetermined input voltage change. If the transducer output voltage is zero (no pressure stimulus), the calibration signals may be used to simulate known pressure inputs. If the transducer output voltage is not zero (pressure applied) the calibration signal will simulate a pressure change (either positive or negative) as determined by the position of the CAL +/- switch.

3-10. The value of a calibration resistor to simulate any desired input signal change may be determined by the following:

$$R_c = 1/2 \left(\frac{500 - E_i}{E_i} \right)$$

Where: E_i = Signal change in mV/V
 R_c = Calibration resistance in K Ohms

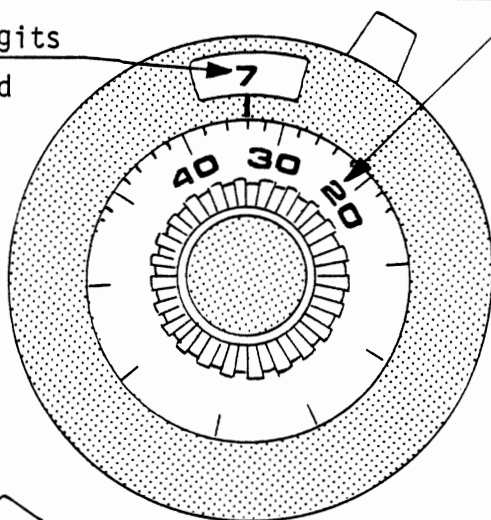
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X X ! X X

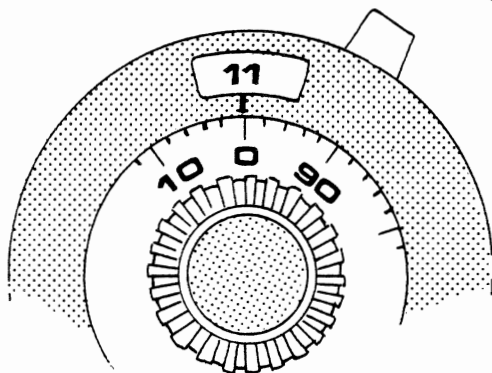
Least significant digits 00 thru 98 marked

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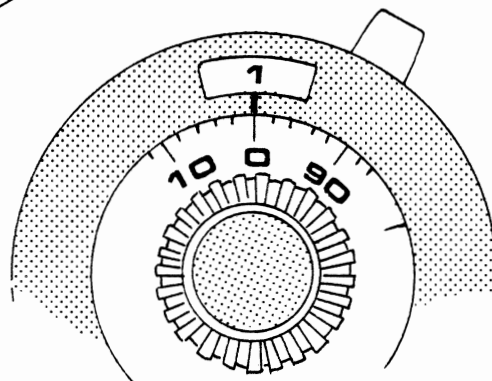
reads 0-10 when used
with 10-turn
potentiometer.



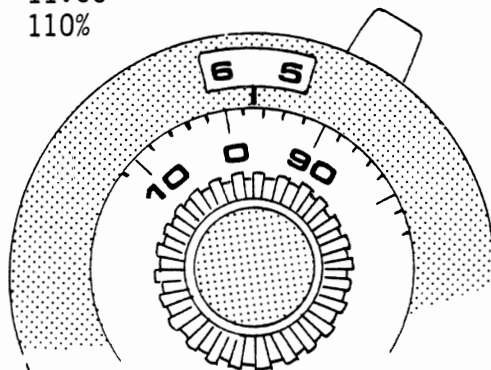
Reading = 734
or 7.34
or 73.4%



Reading = 1100
or 11.00
or 110%



Reading = 100
or 1.00
or 10%



Reading = 597
or 5.97
or 59.7%

Figure 3-4. Procedure for Setting GAIN Adjust Control.

Example:

Find the value of calibration resistance to simulate a 50% full-scale output change for a variable reluctance pressure transducer with a full-scale output of 40 mV/V.

$$50\% = 1/2 \left(\frac{500 - 20}{20} \right) = 12K \text{ Ohms}$$

Conversely, the calibration input voltage for any value of a calibration resistor can be found by:

$$E_i = \frac{500}{2R_c + 1}$$

Where: E_i = Calibration input in mV/V
 R_c = Calibration resistance in K Ohms

3-11. REMOTE CALIBRATION.

For systems with the Remote Calibration option installed, install a resistor between the bifurcated terminals on the remote cal circuit board to give the desired calibration voltage. The position of the installed resistor determines + or - polarity. Paragraph 3-10 describes the method of selecting the proper value resistors.

$$R_c = 1/2 \left(\frac{500 - E_i}{E_i} \right) \quad E_i = \text{mV/V}$$

By grounding pin 5 (on the circuit board) with a remote switch, relay K1 is pulled in, connecting the remote cal resistor into the circuit.

3-12. PHASE ADJUST.

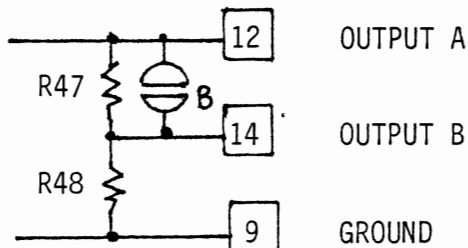
For systems with the Phase Adjust option, phase can be adjusted as follows:

A. With transducer connected to MC-1 Case, apply full scale pressure to the transducer.

B. adjust the PHASE ADJ pot on the front panel for maximum reading on the output meter.

3-13. DUAL OUTPUTS (A & B).

Normally systems have the A and B outputs tied together. Systems with the attenuated B output option have bifurcated terminals where resistors may be connected to change the amount of B output. The output current from both A and B outputs should not exceed 10 mAdc. That is, the output current available from the output amplifier is limited to 10 mAdc.



To provide an attenuator between A and B outputs, install resistor R47 and R48. Note that solder bridge "B" must be open for R47 to reduce the voltage at the output B.

To select R47 and R48 values follow these rules:

1. R47 and R48 must not overload the A-output, choose their values such that the output current through pin 12 (A-output) and through R47 do not exceed 10 mA total.

2. The no load voltage at output B, when (A-output is +10 Vdc) is:

$$\left(\frac{R48}{R47 + R48} \right) 10 \text{ Vdc} = \text{B-Output}$$

3. The output (source) resistance at the B-output is:

$$\frac{(R48) R47}{R47 + R48}$$

4. Use precision resistors, such as RN55DXXXXF, $\pm 1\%$, for R47 and R48.

EXAMPLE: To obtain a 1 Vdc output at B-output with source resistance of 500 Ohms or less: Choose R48 = 499 Ohms (standard RN55 value) solve equation (2) above:

$$\frac{499}{R47 + 499} (10 \text{ Vdc}) = 1 \text{ Vdc}, \quad R47 \text{ approximately } 4.53\text{K Ohms} \text{ (closest standard value)}$$

Check output resistance from equation (3) above:

$$\frac{499 (4.53\text{K})}{499 + 4.53\text{K}} = 449.5 \text{ Ohms } (< 500 \text{ Ohms})$$

Check rule (1) above:

$$\frac{10\text{V}}{R47 + R48} \quad 1.99 \text{ mA } (< 10 \text{ mA total})$$

SECTION IV MAINTENANCE

4-1. GENERAL.

Under normal operation, the CD19A should not require any maintenance. Components are all solid-state and have been selected for long life and reliability.

4-2. TROUBLESHOOTING PROCEDURES.

If the CD19A fails to operate, perform the troubleshooting checks described in Table 4-1.

Table 4-1. Troubleshooting Procedures.

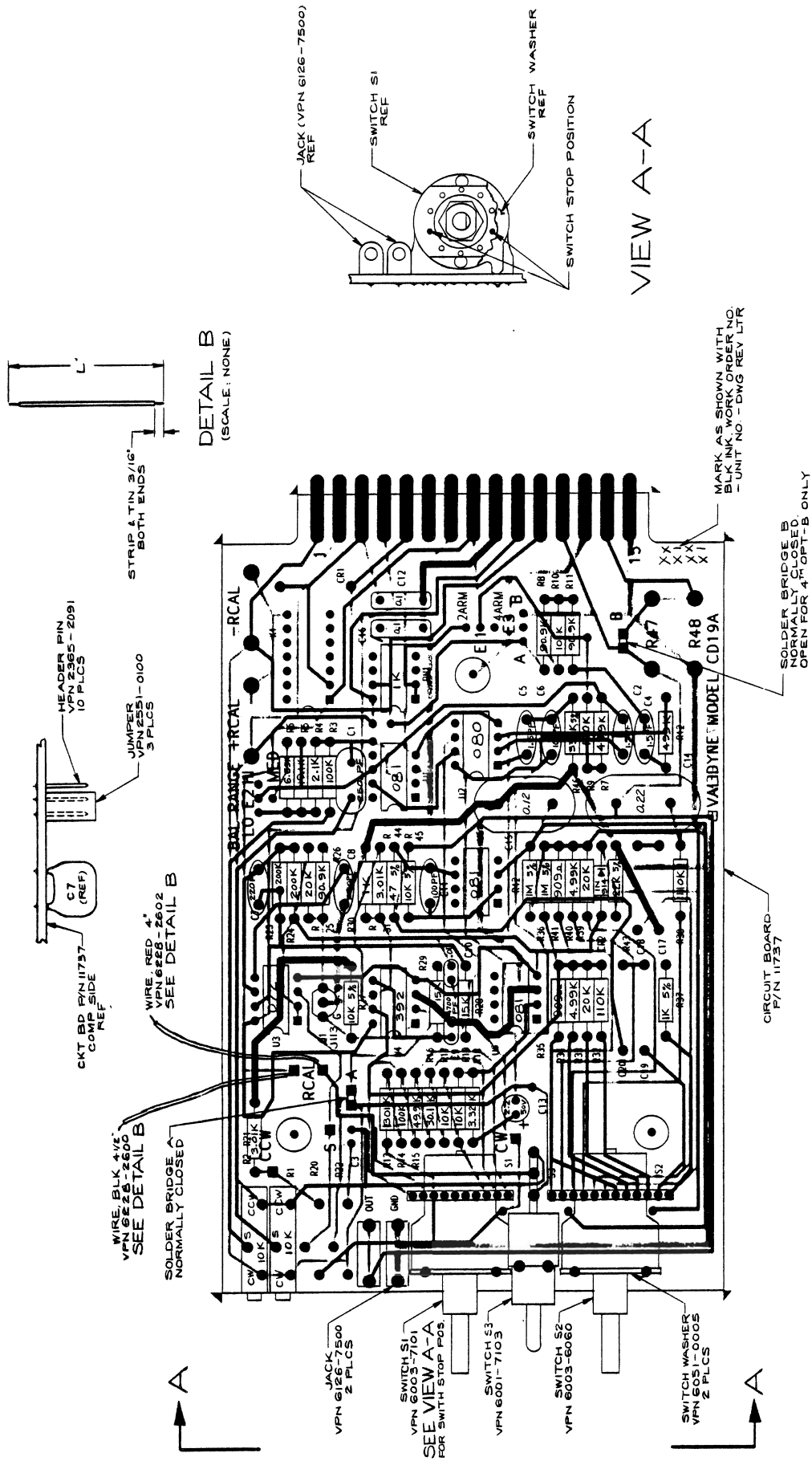
| <u>Problem</u> | <u>Possible Cause</u> | <u>Remedy</u> |
|---|---|---|
| Will not operate or operates erratically. | Cables improperly connected between transducer and MC1 Case, or defective cables. | Check cables and connect properly. Replace or repair cables if defective. |
| | CD19A Module not seated properly in MC1 Case. | Push module all the way back until it engages with the connectors inside the MC1 Case. |
| | Defective Transducer. | Replace with a transducer known to be good to determine if replaced transducer was defective. |
| | MC1 Module Case not plugged in. | Apply power to MC1 Case and make sure system is turned on. |
| | 2-ARM/4-ARM jumper in wrong position. | Verify proper position of E1 jumper. |

4-3. REPAIR.

Figure 4-1 is the schematic diagram for the CD19A Module and figure 4-2 is the circuit board assembly. Figure 4-3 shows the printed circuit board pin functions. It is recommended that if the CD19A should fail for any reason it should be returned to the factory for repair. The CD19A is covered by the Validyne Warranty and Repair Policy in this manual. Equipment returned for repair should be shipped prepaid to:

Validyne Engineering Corporation
8626 Wilbur Avenue
Northridge, CA 91324
Attn: Customer Service

You will be advised of any repair costs before they are made.



- 4. □ INDICATES PIN 1.
 - 3. RESISTOR VALUES ARE IN OHMS 1/4, 1/8 WATT
 - 2. CAPACITOR VALUES ARE IN MICROFARADS
 - 1. SCHEMATIC NO. 11755
- NOTES: UNLESS OTHERWISE SPECIFIED.

DETAIL B
(SCALE: NONE)

VIEW A-A

| | |
|--|---|
| THE FOLLOWING INFORMATION APPLIES TO THIS DRAWING: DRAWING NO. 33107 REV. 1 DATE 10/17/55 DESIGNED BY SC 2731 CHECKED BY SC 2731 APPROVED BY SC 2731 TITLE CARRIER DEMODULATOR PROJECT 11755 | VALDYNE ENGINEERING CORPORATION 3110 W. 10TH AVE. DENVER, COLORADO 80202 PHONE 733-1111 TELETYPE 733-1111 |
|--|---|

CODE IDENT NO. **33107**

Figure 4-2. Model CD19A Carrier Demodulator, Circuit Board Assembly.

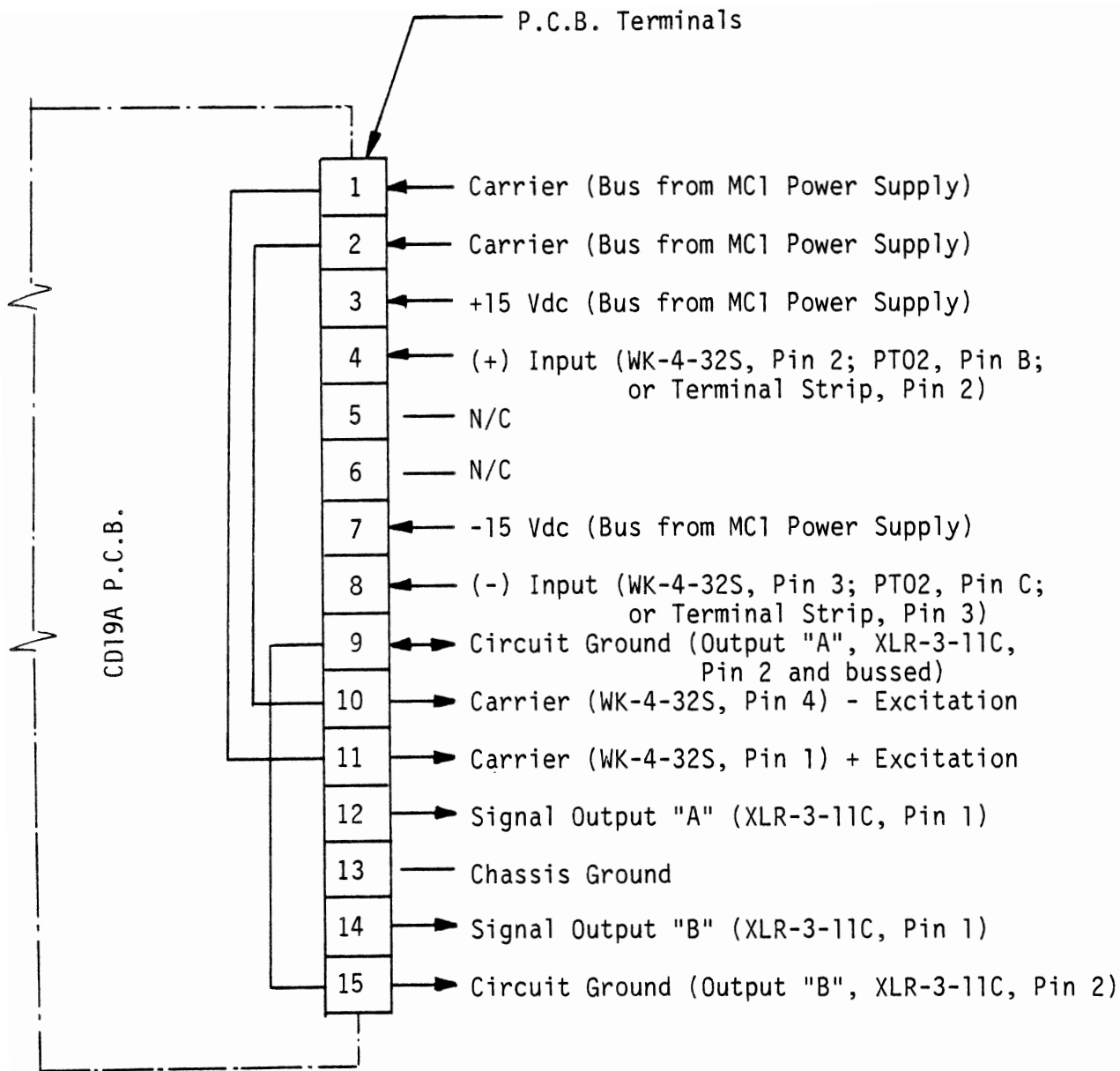


Figure 4-3. Printed Circuit Board Pin Functions.

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 repair or replace any component found to be defective on its 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. Electronic products (Transducer indicator, carrier demodulators, plug-in signal conditioners, module cases, etc.) 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 \$80.00 evaluation charge.

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

REPAIR POLICY

Units returned to VALIDYNE for repair which are not under warranty will be subject to the following conditions.

1. A description of the problem or malfunction shall accompany the unit returned for repair, or be communicated to VALIDYNE prior to shipment. Otherwise there will be a minimum evaluation and/or calibration charge of \$80.00.
2. Unit will be repaired automatically if 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 quotation is required before proceeding with repairs, unit should be accompanied by paper so stating, or information communicated to VALIDYNE prior to shipment.
4. Buyer is to secure authorization and shipping method from VALIDYNE prior to return of equipment or shipment will be rejected. (Applies to Canada only)

REPAIR WARRANTY

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



VESC120-8/88 REVISED

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TOLL FREE (800) 423-5851 (AK/CA use (818) number)
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