

INSTRUCTION MANUAL

200/400 SERIES

PDR-C-1B

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9/5/79

MKS INSTRUMENTS, INC.

WARRANTY

MKS Instruments, Inc. (MKS) warrants that all equipment manufactured by MKS shall be free from defects in materials and workmanship for a period of one year from date of shipment. For the period commencing with the date of shipment of the equipment and ending one year later, MKS will, at its option, either repair or replace any part which is defective in materials or workmanship without charge to the purchaser. The foregoing shall constitute the sole remedy of the purchaser for any breach by MKS of this warranty.

The purchaser, before returning any equipment covered by this warranty, which is asserted to be defective by the purchaser, shall make specific written arrangements with respect to the responsibility for shipping the equipment and handling and other incidental charges, with the MKS sales representative or distributor from which the equipment was purchased, or in the case of a direct purchase, from MKS home office in Burlington, Massachusetts, USA.

The warranty does not apply to any equipment which has not been used in accordance with the specifications recommended by MKS for the proper and normal use of the equipment. MKS shall not be liable under any circumstances for consequential or incidental damages in connection with, or arising out of the sale, performance or use of, the equipment covered by this warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES BY MKS, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY, WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND WARRANTIES AGAINST INFRINGEMENT OF ANY PATENT.

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SPECIFICATIONS

MECHANICAL

Package: Cabinet style or rack mount.

Weight: 4 Lbs.

ENVIRONMENTAL

Max. Operating Temperature: 50° C (122° F)

INTERFACE

All input connections and power supply outputs are available on a rear mounted terminal block. The relay outputs and latch controls are available on two circular connectors on the rear panel. The DC output is available through a rear mounted phono jack.

ELECTRICAL

Power Consumption: 20 Watts

Power Supply Outputs: ± 15 Volts @ 200 MA. Max Ripple <10MV.

Set Point Configuration: Dual—one low, one high.

Relay Configuration: The LOW relay is energized when the input exceeds the LOW set point.*

The HIGH relay is energized when the input is below the HIGH set point.*

*Can be modified by user, see appendix.

Contact Configuration: Double Pole Form C brought out to the rear panel for each set point.

Contact Ratings: 5 Amps @ 28VDC, 120VAC resistive.
1½ Amps @ 240VAC resistive.

Analog DC Output: 0-10VDC, into 10K Ω or greater load.

Display: 4½ place, 7 segment planar LED-RED.

Meter Accuracy: 0.01% of reading ± 1 digit.

Input Impedance: 900K Ω

Control Accuracy: $\pm 0.5\%$ of Set Point $\pm 0.05\%$ of F.S.**

**Can be modified by user, see appendix.

Range of Zero Adjust: $\pm 1.5\%$ Full Scale.

Range of Set Point Adjust: 100% Full Scale (Coarse & Fine).

Optional BCD Outputs: Tri State Parallel Line BCD. (1 TTL Load each). TTL and CMOS compatible.

SECTION 1

GENERAL DESCRIPTION

The PDR-C-1B is a rack/cabinet mounted digital readout which contains dual set points and a power supply that is capable of providing power to a remote pressure gauge.

The power supply provides $\pm 15\text{VDC}$ @ 200 MA and is capable of supplying the input power for one MKS Baratron® Type 221, 221A, 222, 222A, 223A, 422A, 400, or any electronic manometer with similar input requirements.

Each set point controls a double pole form C relay whose contacts are available at a rear mounted connector. Adjustment of the set point is done with a Coarse & Fine adjustment which covers the entire range of the gauge in use. The status of the relay is indicated by a front panel lamp which is illuminated when the relay is energized. The relay can be latched on or off via connections at the relay output connector.

The readout is a $4\frac{1}{2}$ place digital panel meter which indicates the output of the attached gauge and electronics. The meter also reads the value of the set point when the switch on the front panel is switched to that set point.

SECTION 2

INSTALLATION & OPERATION

For information regarding the installation of the pressure gauge, refer to the manual for that specific instrument.

INSTALLATION

THE PDR-C-1B MUST BE MOUNTED IN SUCH A MANNER AS TO PROVIDE ADEQUATE AIR CIRCULATION ABOUT THE UNIT.

PDR-C-1Bs that are supplied with pressure gauges are shipped with the cables pre-wired to the rear of the PDR-C-1B. In some cases the gauge simply connects to the cable via a connector, while in other cases the gauge may have a terminal block which must be connected to bare wires at the end of the cable. In the latter case, refer to the manual for that specific gauge for a guide to the proper connection.

Should it be necessary to reconnect a cable, MKS has a standard color code for the power cables.

+15VDC Power Input	Green
-15VDC Power Input.....	White
DC Signal*	Red
Power Ground (Return)	Black
Signal Ground (Return)	Black
Chassis (Case)	Black (large)

*At the gauge connector this signal is referred to as the DC Output while at the PDR-C-1B connector it is labeled DC in.

GROUNDING:

The PDR-C-1B has a three ground system which allows for the separation of the power supply return (P Gnd.) and the DC Output Signal return (S Gnd.) and the chassis ground. This is done primarily for use with the 221 & 221A gauges to keep these grounds separate in the power cable. When used with gauges that have only a two ground system (220, 222, 222A, 223A, etc.) then connect the P Gnd & S Gnd to that gauge's common ground and then connect the two chassis grounds together.

FIGURE A

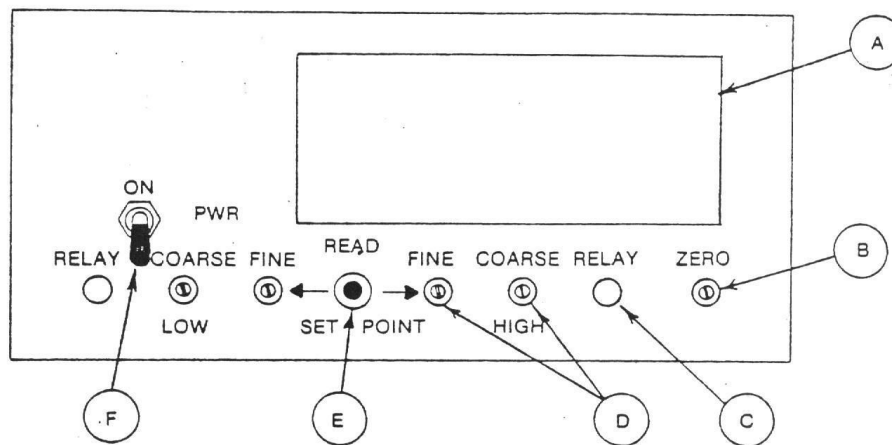
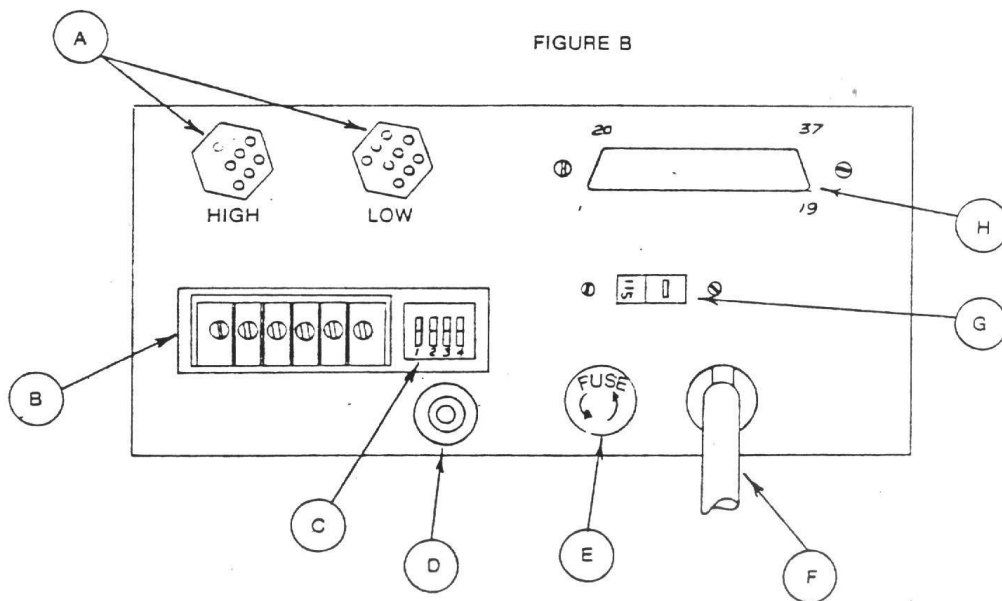


FIGURE B



REAR PANEL CONNECTIONS & CONTROLS (SEE FIG. B)

RELAY OUTUTS & LATCH CONTROL (A)

These connectors, one for each set point, provide access to the relay contacts and the latch controls as shown below:

Pin Letter	Description
A	Relay 1 — Common
B	Relay 1 — N.O.
C	Relay 1 — N.C.
D	Latch — OFF
E	Relay 2 — Common
F	Latch — ON
H	Relay 2 — N.O.
J	Relay 2 — N.C.
K	Latch — Common

PRESSURE GAUGE CONNECTOR (B)

Provides connection to the pressure gauge. Supplies power and receives the pressure signal from the gauge.

DECIMAL POINT SELECTOR (C)

This 4 pole slide switch is used to select the placement of the decimal point in the front panel digital display as follows:

GAUGE PRESSURE	SWITCH SELECTION			
	1	2	3	4
1MM	ON	OFF	OFF	OFF
10MM	OFF	ON	OFF	OFF
100MM	OFF	OFF	ON	OFF
1000MM	OFF	OFF	OFF	ON

DC OUTPUT JACK (D)

This phono jack provides an accessory DC output voltage which corresponds to the pressure indicated on the front panel meter. This voltage is capable of driving a load of 10K ohms or greater.

FUSE (E)

Line fuse to protect internal circuitry. The "High Side" of the line is fused.

Fuse Values: ¼ A.S.B. @ 115VAC
 ¼ A.S.B. @ 230VAC

LINE CORD (F)

Provides 115 or 230VAC to the PDR-C-1B. The proper input voltage is selected by the line switch. (See item G.)

LINE VOLTAGE SWITCH (G)

This slide switch sets the power transformer to receive 115 or 230VAC. The value of the line voltage that the unit is set to is visible in the cutout.

BCD OUTPUT CONNECTOR (H) — OPTIONAL

When the BCD option has been provided, this connector provides the BCD outputs from the meter. See the appendix for the pin assignments.

FRONT PANEL CONTROLS (SEE FIG. A)

DIGITAL READOUT (A)

Displays the pressure signal from the gauge. Also displays the value of whichever set point the Read Switch is switched to.

ZERO CONTROL (B)

This control is used as a fine zero for the pressure gauge. The pressure gauge must be pumped down below its resolution before this adjustment can be made. The zero control on the pressure gauge is used as a coarse zero.

RELAY LAMP (C)

Each set point has a relay lamp which is illuminated when the relay for that set point has been energized.

SET POINT ADJUST — COARSE & FINE (D)

Each set point has these two controls which are used in conjunction to set the desired set point.

READ SET POINT SWITCH (E)

This switch connects the digital readout to the DC output when it is in the center position. When it is switched toward a set point it connects the meter to the set point buffer amplifier to read the value of the set point. The switch is spring loaded to return to the center position when released.

POWER SWITCH (F)

This switch controls the power to the PDR-C-1B as well as the pressure gauge connector.

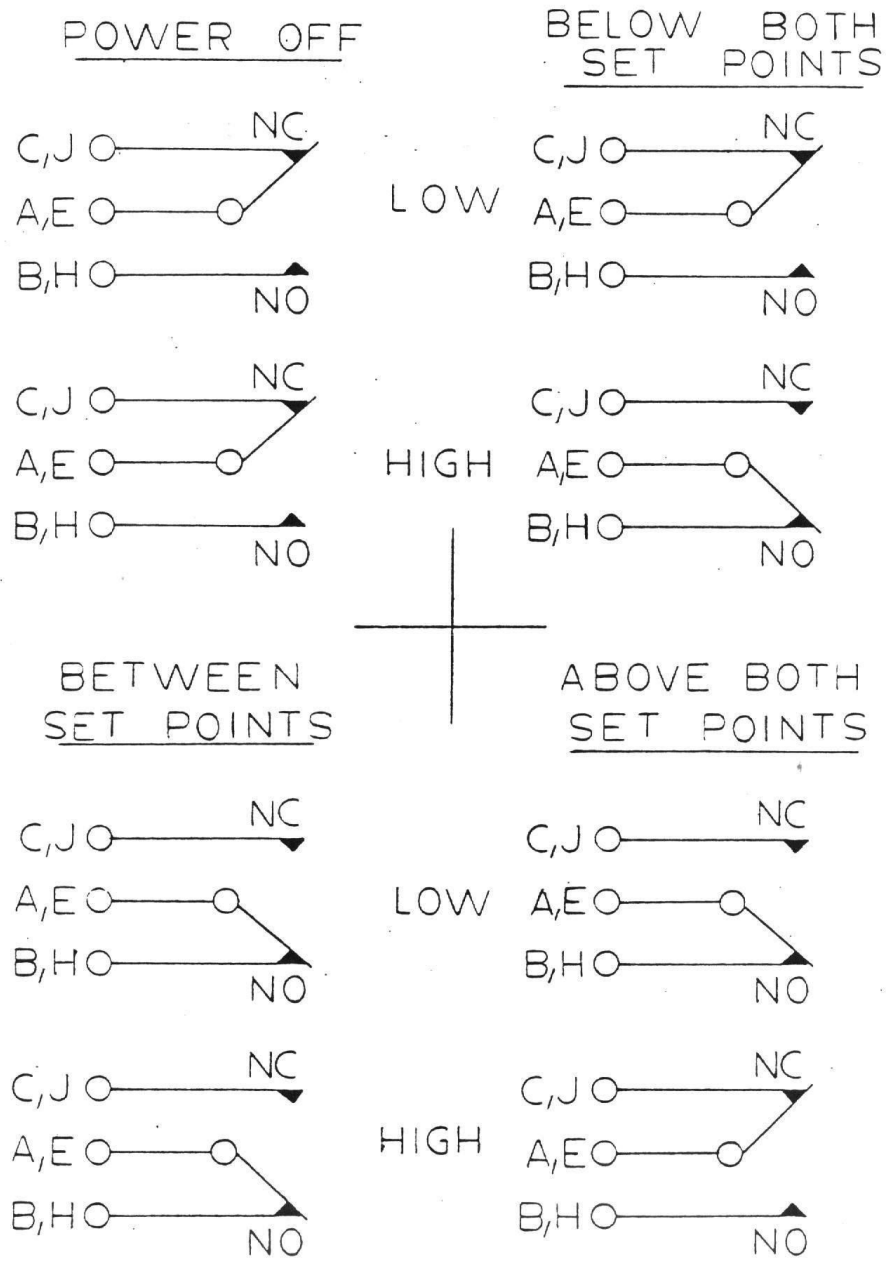
RELAY OUTPUTS

Each set point controls a double pole form C relay which is brought out to the rear panel via a connector. (See Fig. B, item A.) Fig. C indicates the relay conditions under all possible pressure conditions.

Relay Latch Commands:

Each set point relay may be latched on or off in the following manner:

FIGURE C



Latch OFF (Connect K to D). Application of this latch to a relay that is in the OFF state prevents the relay from being energized. When applied to a relay that is already energized the latch does not become effective until the relay de-energizes.

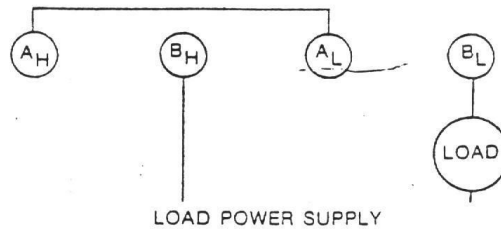
Latch ON (Connect K to F). Application of this latch to a relay that is in the ON state locks the relay on. When applied to a relay in the OFF state the latch does not become effective until the relay becomes energized.

START UP

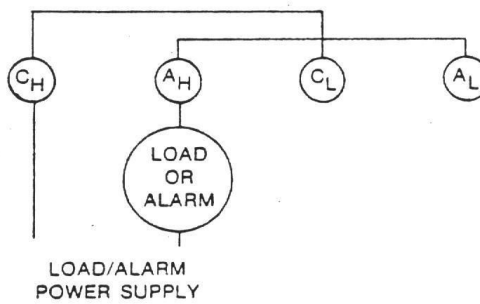
Since both set points are de-energized when the power is OFF it may be necessary to remove some latching jumpers to allow the set points to assume the proper state when power is first applied.

CONTROL CONFIGURATIONS

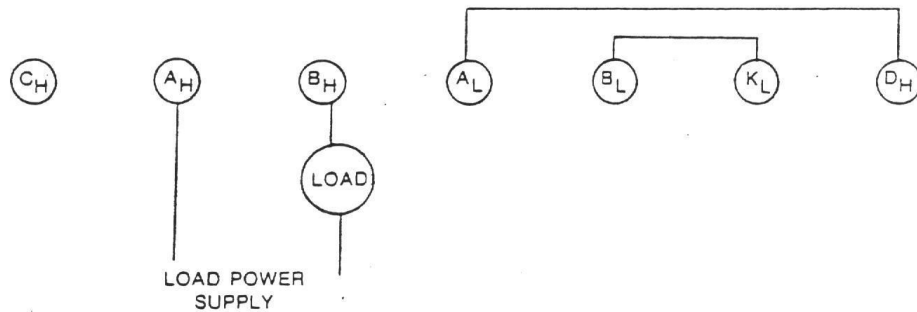
Several common control methods are shown in the following illustrations. Since the high and low set points are brought out on identically lettered connectors the subscript L will be used to identify the low set point while H will be used to identify the high set point.



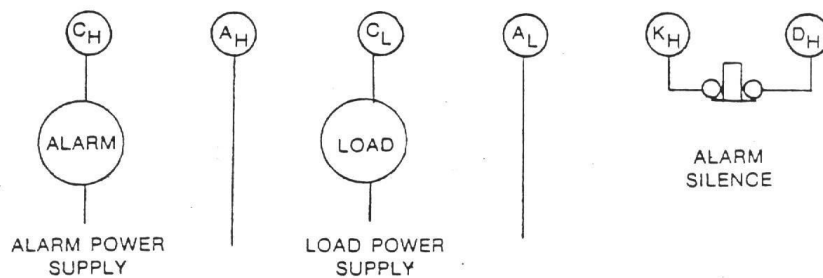
Load is energized when pressure is between the set points, off when above High set point or below Low set point.



Load or Alarm energized when the pressure is above High set point or below Low set point, off when the pressure is between the set points.



Load will cycle from one set point to the other. Differential is adjusted by settings of the two set points. To reverse the operation, connect load to terminal C_H rather than B_H.



OPERATION

1. Connect the PDR-C-1B to the pressure gauge that is to be used. Refer to that gauge's instruction manual for the proper input connections.
2. Wire the relay connectors for the desired mode of control.
3. After the system is properly connected, apply power to the PDR-C-1B and select the proper decimal point with the rear panel switch. (Fig. B, item C)
4. Pump the pressure gauge below its resolution and check the zero. Correct if necessary with the zero control on the PDR-C-1B. (Fig. A, item B)
5. Switch the Read Set Point switch to the Low set point and adjust the set point controls (Fig. A, item D) for the proper set point as displayed on the readout.
6. Repeat step 5 for the high set point.

The system is now ready for use.

Note: When the PDR-C-1B is connected to pressure gauges with full scale values less than 1000MM, the readout will "over range" if the gauge is exposed to atmospheric pressure and will read +1 ----.

SECTION 3

THEORY OF OPERATION

Refer to Fig. D.

PRESSURE SIGNAL:

The signal is received from the pressure gauge and applied to the input amplifier where the fine zero correction is applied. The output from this amplifier is applied to the following points:

1. The DC Output Jack.
2. The input of the comparators.
3. The digital display via S101.

ZENER REFERENCE:

This temperature compensated zener reference is powered from the +15 volt supply. The output of this reference provides the input voltage to each set point circuit. The zener reference prevents the set point from changing value due to power supply fluctuations due to load or temperature.

SET POINTS:

The set point level is adjusted by the fine and coarse panel controls, then buffered and applied to the comparator and to the display via S101 when the switch is activated.

COMPARATORS:

At the comparators the pressure signal is compared against the level of the set points. When the pressure exceeds the set point the output of the comparator goes positive. Pressure below the set point forces the output of the comparator negative.

RELAY DRIVE & LATCH CIRCUITS:

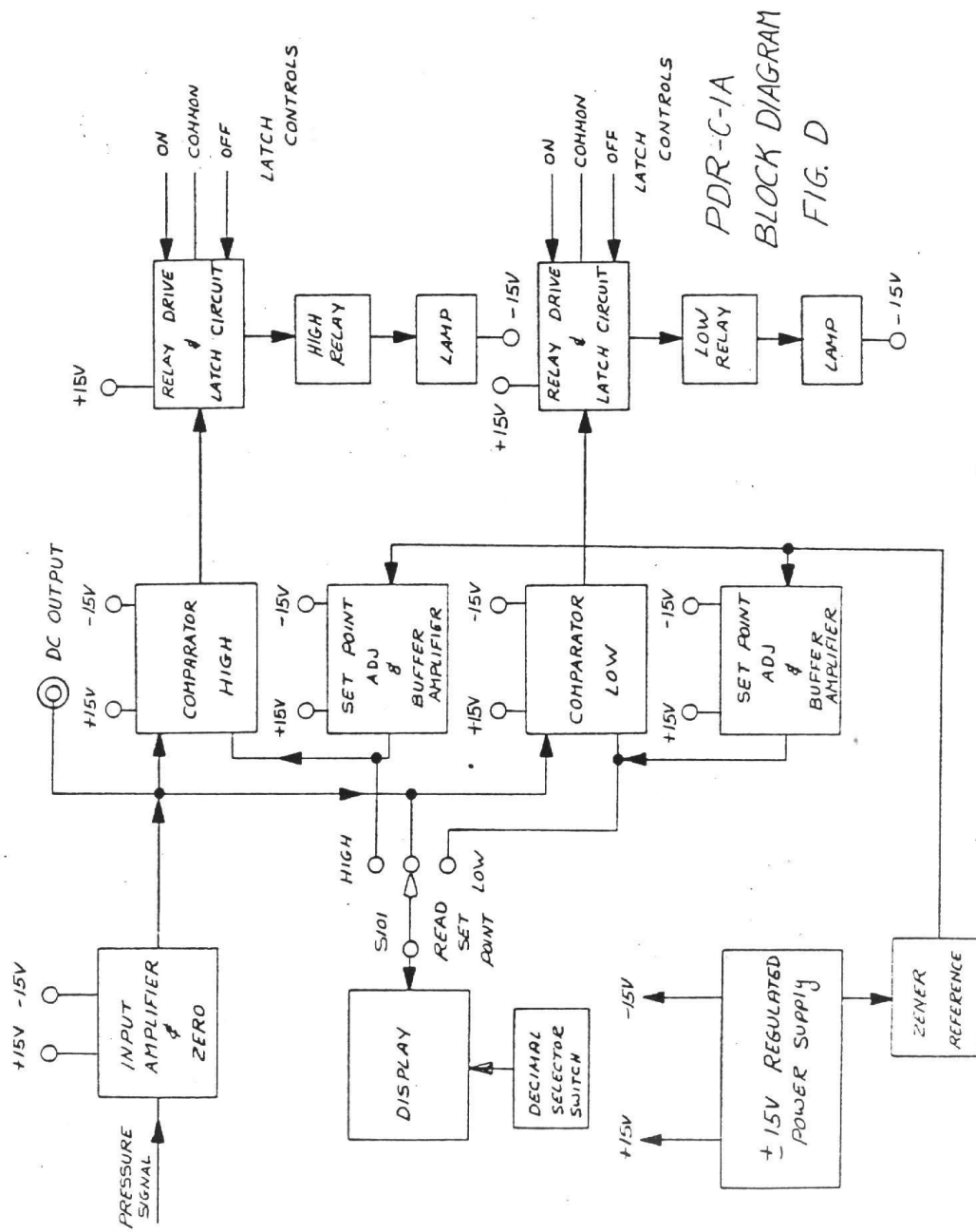
These circuits provide drive and latching capability to the relay. The LOW relay is energized when the relay drive circuit receives a POSITIVE signal from the comparator. The HIGH relay requires a NEGATIVE signal to the relay drive circuit to energize. Either relay can be latched ON or OFF by a connection between the common and the ON or OFF latch control.

POWER SUPPLIES:

These supplies provide power to the PDR-C-1B as well as power for the attached pressure gauge. They are identical supplies with current limiting to prevent damage from over loads.

DISPLAY & DECIMAL SELECTOR:

The display receives either the pressure signal or the set point level depending upon the position of S101. The display is a 4½ place digital panel meter with decimal points that are programmed with a 4 pole slide switch. In the event of any overload, any voltage $\geq +11.5$ volts, the four least significant digits are blanked.



SECTION 4

MAINTENANCE

GENERAL:

MKS Instruments recommends that any instrument that is still covered by the Warranty be returned to the factory for repair and recalibration. If this is not possible, contact the MKS factory for assistance.

Should it become necessary to attempt repair in the field, the first step is to isolate the source of the problem, the pressure gauge or the PDR-C-1B. Any repair to a pressure gauge will usually require a recalibration. The PDR-C-1B may be repaired without recalibration as long as none of the calibration adjustments inside the panel meter has been tampered with.

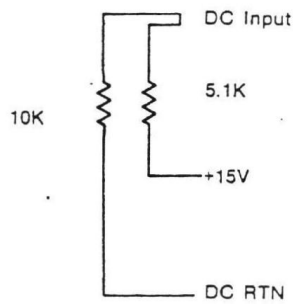
Isolation:

1. Measure the ± 15 Volt supplies on the pressure gauge connector. (Reference to power return.) The voltages should be within the range of 14.85 to 15.15 volts and the AC ripple should be less than 10 MV.
2. Should the voltages be incorrect then disconnect the pressure gauge. If the voltages are then correct, the problem is likely in the pressure gauge. If they are not, the problem is most likely in the PDR-C-1B.
3. If the voltages measure correctly then measure the voltage at the input terminal of the PDR-C-1B. If this voltage closely tracks the voltage that is displayed on the meter of the PDR-C-1B but is still in error then the problem is most likely in the pressure gauge.
4. If the two voltages differ greatly then the problem is most likely in the PDR-C-1B.

Troubleshooting the PDR-C-1B:

1. Disconnect the cable that runs to the pressure gauge.

2. At the pressure gauge connector, connect a 10K and a 5.1K 5% resistor in the following manner:



This produces an input voltage between +9.6 to +10.3 volts. To produce a zero input, simply short out the 10K resistor.

3. Now switch the Read switch to the Low set point and adjust that set point to 5.00 volts.
4. Repeat for the High set point.
5. This establishes an input of approximately +10 volts with set points at 5.00 volts. These are the conditions for which the voltage measurements on the following schematic were taken. With these readings the defective stage should be easy to locate.

Note: In the event that the IC regulator is replaced in either supply it is necessary to re-adjust the supply to $15V \pm 0.2\%$ (14.97 to 15.03 volts).

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SECTION 5

APPENDIX BCD OPTION

This option provides a latched and buffered BCD output at the rear panel. This BCD information is enabled or disabled by five control lines. When these lines are tied together and connected to digital ground all of the BCD information is present at the rear connector and can be read when the NOT BUSY line goes high. When these control lines are connected to a high level (+5V) then all of the BCD outputs are open. This is done when several meters are connected in parallel to a common bus. Each meter is strobed for a reading by grounding these control lines and then when the reading has been taken the lines are forced high again and the outputs are open. The connections to the rear panel connector are shown below:

BCD DATA	BCD CONNECTOR	BCD DATA	BCD CONNECTOR
1 } Digit 1	29	1K } Digit 4	22
2 }	7	2K }	4
4 }	5	4K }	6
8 }	3	8K }	10
Enable Digit 1	20	Enable Digit 4	11
10 } Digit 2	21	10K } Digit 5	32
20 }	23	20K }	14
40 }	25	Overrange }	17
80 }	8	Polarity }	16
Enable Digit 2	30	Enable Digit 5	12
100 } Digit 3	27	Busy	13
200 }	26	Digital Ground	15,33,34
400 }	24	Not Busy (Busy)	36
800 }	1	+5V	35
Enable Digit 3	2	Spare	31

