MOORE INDUSTRIES

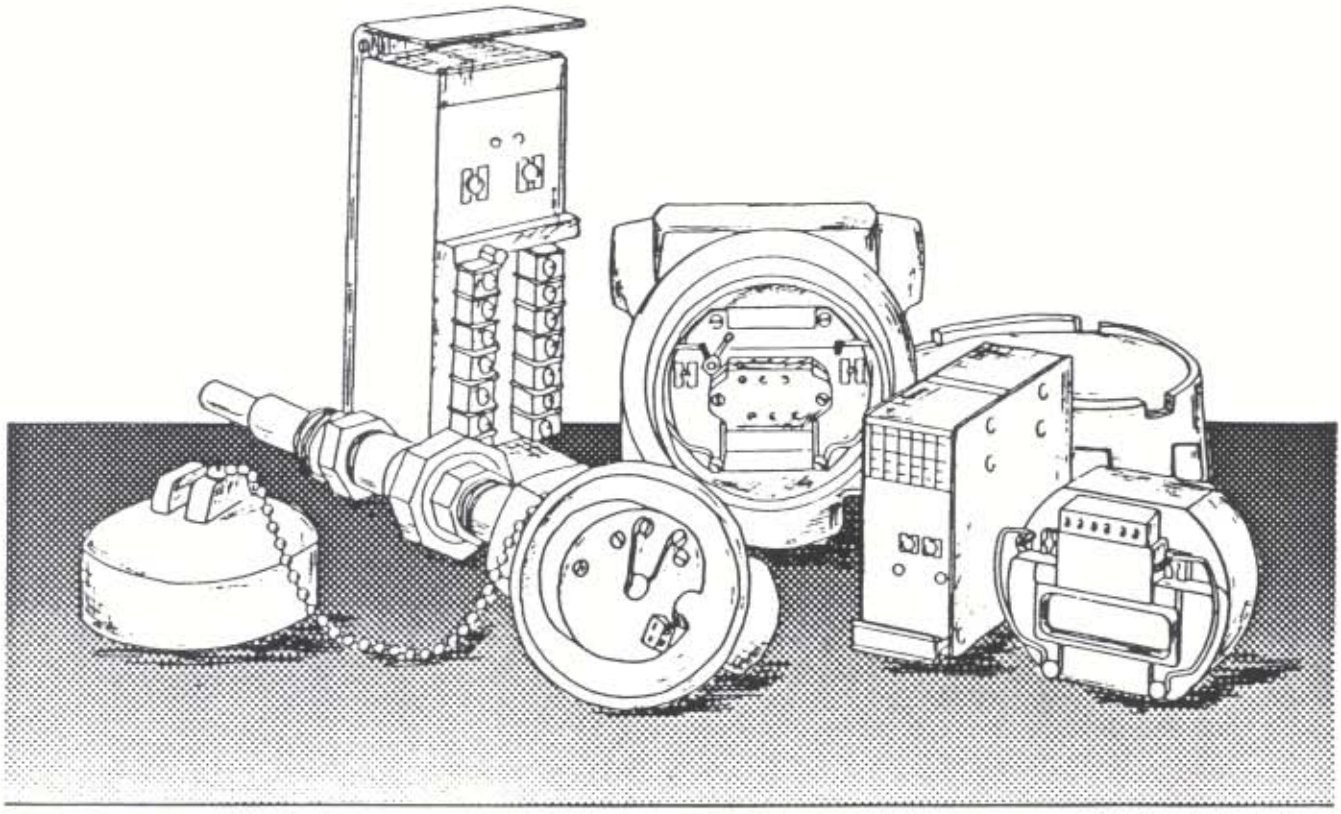
INSTRUCTION MANUAL

DVX

Current-to-Digital
Display Indicator

Form 178-701-00F

August 1988



GENERAL INFORMATION

1.0 SCOPE OF MANUAL

This manual contains calibration, installation, and maintenance information for Moore Industries' current-to-digital display indicator (DVX). This information is presented in the following six sections:

Section 1. General Information, contains the physical and functional configuration of the unit. Also, includes a model number explanation.

Section 2. Calibration Procedures, contains information necessary for adjustment and calibration of the unit. This section also lists the test equipment and tools necessary for calibrating the DVX. A calibration setup diagram is also presented.

Section 3. Installation and Operation, this section contains installation information that includes recommended wiring practices and electrical connections.

Section 4. Theory of Operation, describes the circuit operation principles based on a simplified block diagram.

Section 5. Maintenance and Troubleshooting, gives step-by-step procedures for maintaining and troubleshooting the DVX.

Section 6. Unit Documentation, contains schematic diagrams, assembly drawings, and outline drawings for DIN and hockey-puck (HP) units.

The terms **NOTE**, **CAUTION**, and **WARNING** have the following definitions where used in this manual:

A **NOTE** contains additional information that makes it easier to perform a particular task. Failure to follow a note may result in some inconvenience or needless expense, but the unit will not be damaged, nor is the instrument technician likely to be injured.

A **CAUTION** stresses important details to follow when making electrical connections or cleaning PC board contacts. Failure to heed a caution may damage the unit, void the Moore Industries warranty, or cause minor physical injury to the instrument technician.

A **WARNING** contains vital safety information that MUST NOT be ignored. Warnings deal with proper grounding of equipment, use of solvents, etc. Ignoring warnings may damage the unit, and risk personal injury, or even death, of the instrument technician.

1.1 DESCRIPTION

The DVX is a loop-powered, current-to-digital display indicator. It accepts either 4-20mA or 10-50mA current and activates corresponding digits of a liquid crystal digital display (LCD) of 0.35-inch black numerals.

The DVX is functionally based on a 2000-count, dual-slope, integrating analog-to-digital converter designed to reject interference signals normally found in industrial measurement environments.

The DVX is available in either a compact hockey-puck (HP) enclosure or a DIN rail mount housing for high density installations.

1.2 SPECIFICATIONS

Table 1-1 is a listing of DVX specifications. This table contains information on inputs, outputs, performance capabilities, and housing and electrical options.

1.3 MODEL NUMBER EXPLANATION AND USE

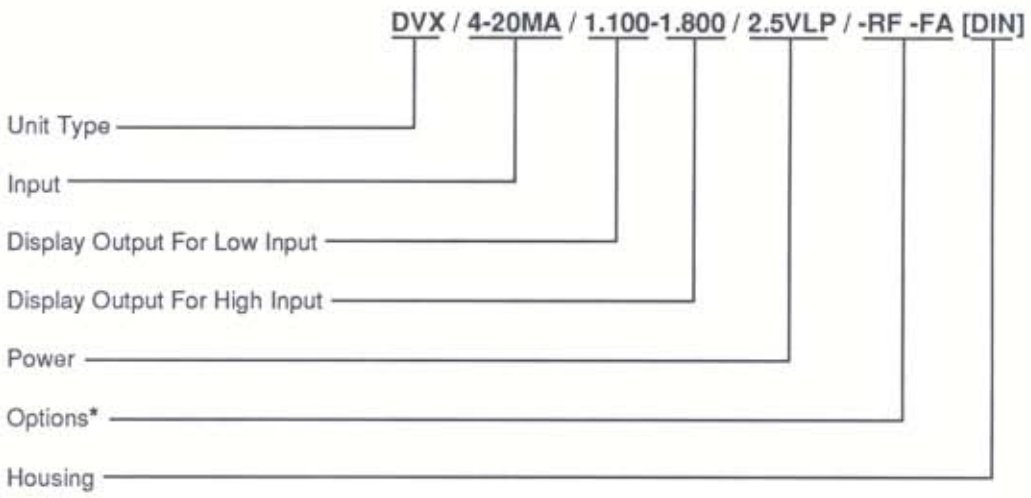
Moore Industries model numbers identify the instrument type, functional characteristics, operating parameters, and any configuration options the unit contained when it was initially shipped. If the documentation is missing, the model number can be used to obtain technical information on the unit. See the DVX model number example following table 1-1.

For HP units, the model number is stamped on a stainless steel tag fastened to the front of the module. For DIN units, the model number is located at the lower edge of the front panel.

Table 1-1. DVX Specifications

Characteristic	Specification
Input	**Current:** 4-20mA or 10-50mA, jumper selectable **Voltage Drop:** 2.5 volts, maximum **Protection:** Maximum forward current overload: 0.2 amps Maximum reverse current: 1.0 amps Surge current: 2 amps for 2 microseconds, maximum, non-repetitive **Common Mode Rejection Ratio (to case):** 120dB **Common Mode Voltage:** 500 volts **Normal Mode Rejection (@ 50/60 Hz):** 46dB
Display	**Type:** LCD, 0.35-inch high black digits over reflective background **Format:** 3.5 active digits with selectable trailing dummy zero for scaling purposes **Range:** +1999 to –1999 (plus dummy zero as least significant digit) **Decimal Points:** 3 positions, jumper selectable **Overrange:** 3 least significant active digits blank out **Rate:** 2.5 readings per second **Zero Offset:** Zero may be offset by –2500 to +2500 counts (including dummy zero) **Span Range:** Can display any Zero Offset and Span to a maximum of 3.5 digit resolution (2000 counts); continuously adjustable up to 2000 counts from Zero Offset (*Example:* If Zero Offset is –250, Span can range from –250 to +1750)
Power	Input power obtained from the signal input current loop
Adjustments	**ZERO and SPAN:** Front panel adjustable with multi-turn potentiometers (used in conjunction with jumper selectable OFFSET and SPAN Range to set operating configuration)
Operating Temperature	**Range:** –40°C to +85°C (–40°F to +185°F) **Effect:** ±0.005% of span/°C, maximum
Weight	454 grams (1 lbs)
Performance	**Calibration Capability:** ±0.1% of reading, ±1 count

DVX MODEL NUMBER EXAMPLE



* -FA option required on DIN units

SERIAL NUMBER USE AND LOCATION

Moore Industries maintains a complete history on every unit it ships. This historical information is tracked by the unit serial number. If replacement of a unit is required, or if historical data is needed, it will be necessary to provide the factory with the serial number and model number of the unit. The serial number is usually located adjacent to the model number.

CALIBRATION PROCEDURES

2.0 CALIBRATION PROCEDURES

This section contains adjustment and calibration information for the DVX. Each unit is adjusted and checked at the factory for proper performance prior to shipment. However, input and output values for each unit should be checked, on site, before the equipment is placed into service. Refer to paragraph 1.3 and table 1-1, section 1.0, for minimum and maximum input and output values.

2.1 GENERAL INFORMATION

After unpacking the DVX, general operating level checks are recommended using the calibration procedures described in this section.

2.2 CONTROL DESCRIPTION AND LOCATION

ZERO and SPAN adjustments are located on the front panel of the DVX. The external controls are multi-turn potentiometers that are adjusted with a slotted screwdriver.

CAUTION

Use of a screwdriver having a head width greater than 2.54mm (0.1 in.) may permanently damage the potentiometer mounting. When adjusting a RF-optioned unit, a screwdriver with a plastic shank must be used. A metal shank tool can circumvent the RF immunity and compromise the adjustment.

2.3 TEST EQUIPMENT AND TOOLS REQUIRED

The test equipment and tools required for calibrating the DVX are listed in table 2-1. These items are not supplied with the unit, and therefore must be furnished by the user.

2.4 CALIBRATION SETUP

Figure 2-1 illustrates the calibration setup for the DVX. Terminal connections are shown on the outline drawing in section 6, and are identifiable on the actual unit.

2.5 JUMPER CONFIGURATIONS

To access the field selectable jumpers on a HP unit, you must first; remove the four (4) screws from the front panel of the module, and then; lift out the front panel display, along with the two attached printed circuit boards. (see figure 2-2) The HP unit has 90-degree angle pin connectors for jumper settings.

To access the field selectable jumpers on a DIN unit, remove the six (6) screws from the right-side panel. (see figure 2-2) The DIN unit has standard straight pin connectors for jumper settings.

There are 9 jumpers that may be installed in any of 24 positions on 2 connector blocks. For both the HP and the DIN units, one connector block has a single row of pins; the other connector block has a double row of pins. The single row connector block accepts jumpers that select a decimal point position, a trailing dummy zero, and a minus sign. The double row connector block accepts jumpers that select input current, display count range, display count sensitivity, and zero offset range.

For the single row connector blocks, the jumpers are stored by plugging them into one pin only, as shown in figure 2-3.

For the double row connector, the jumpers are stored on one pin, as shown in figure 2-4.

For the single row connector block, the active functions are selected by installing jumpers as shown in figure 2-5.

NOTE

Only one decimal position jumper should be in an active position at any one time.

For the double row connector block, the active functions are selected by installing jumpers as shown in figures 2-6A and 2-6B. (Note: All possible active positions are shown in these figures, but no more than six of these positions are ever used at any one time.)

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Equipment	Characteristic	Purpose
Blade Screwdriver	Blade not wider than 2.5mm (0.1 inch)	To adjust ZERO and SPAN pots
Adjustable Precision Current Source	0 to 50mAdc accurate to within ±.05% or better with V_c not less than 2.5Vdc	To provide input signal

*V_c = compliance voltage

Table 2-1 Test Equipment and Tools Required

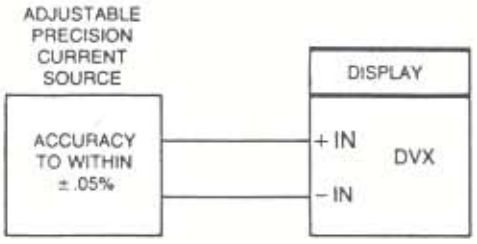


Figure 2-1 Test Set-Up

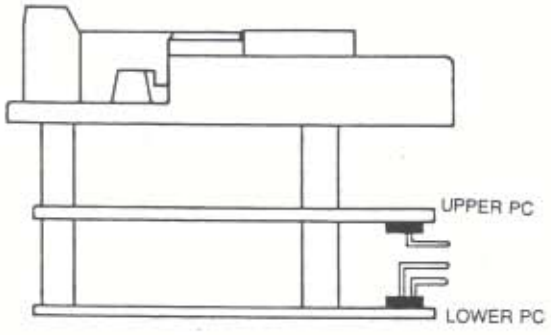
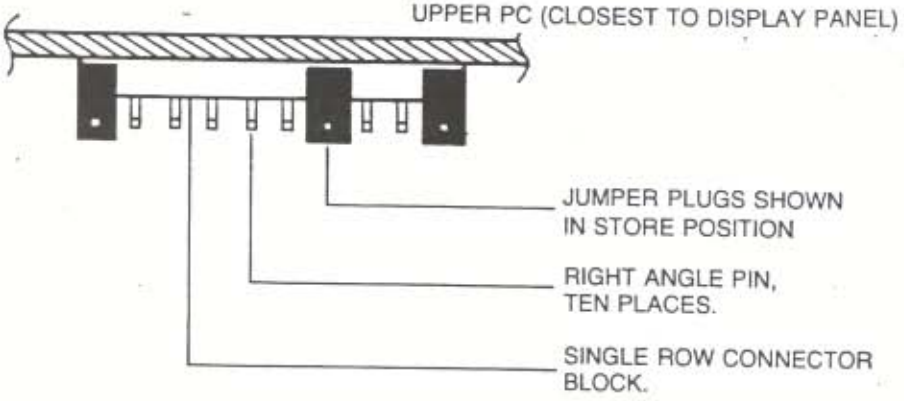
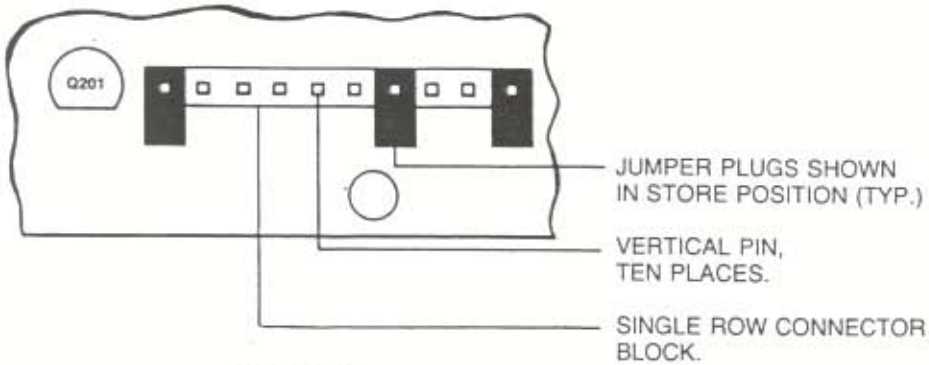


Figure 2-2
DVX Unit Disassembly

SIDE VIEW
(for clarity)

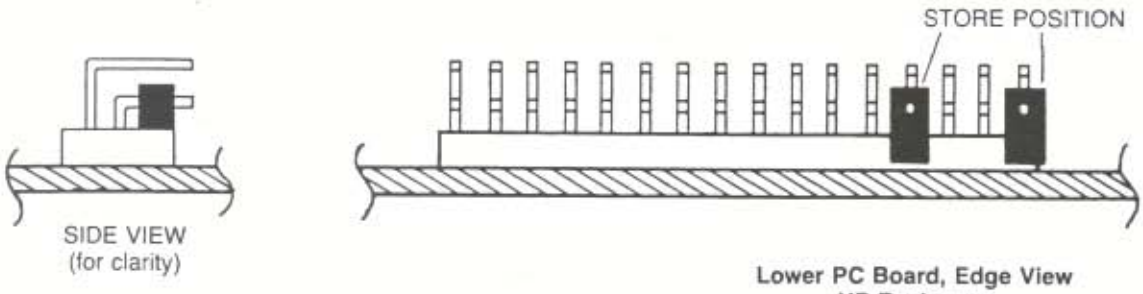


HP Enclosure, Upper PC Board

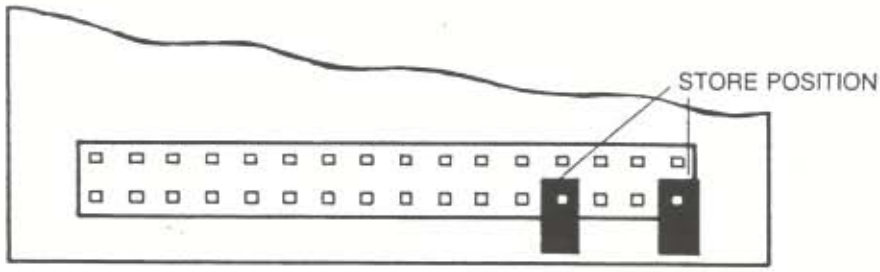


DIN Enclosure, Face View

Figure 2-3
Jumper Storage Positions For Single Row Connector

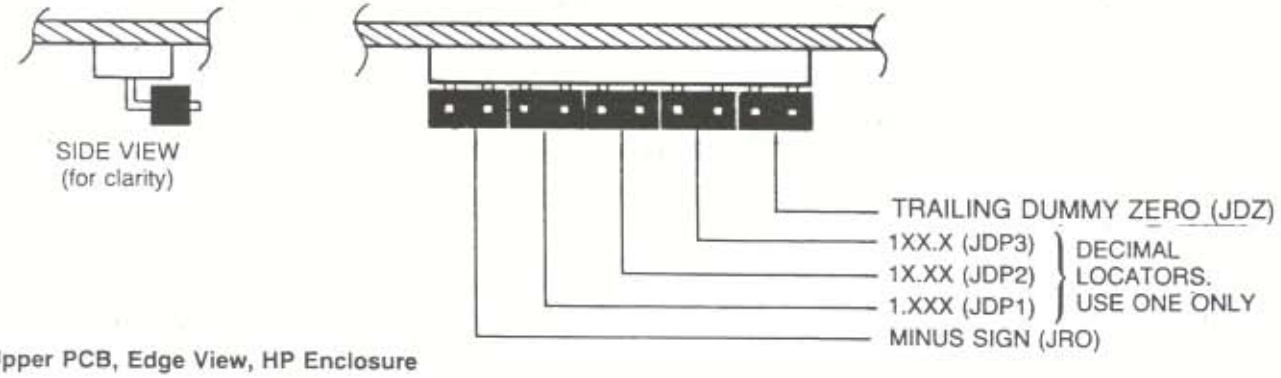


Lower PC Board, Edge View
HP Enclosure

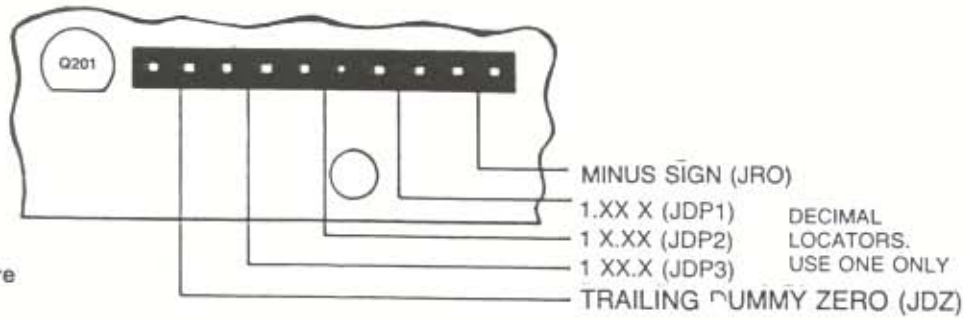


PC1, Face View - DIN Enclosure

Figure 2-4
Jumper Storage Positions for
Double Row Connectors



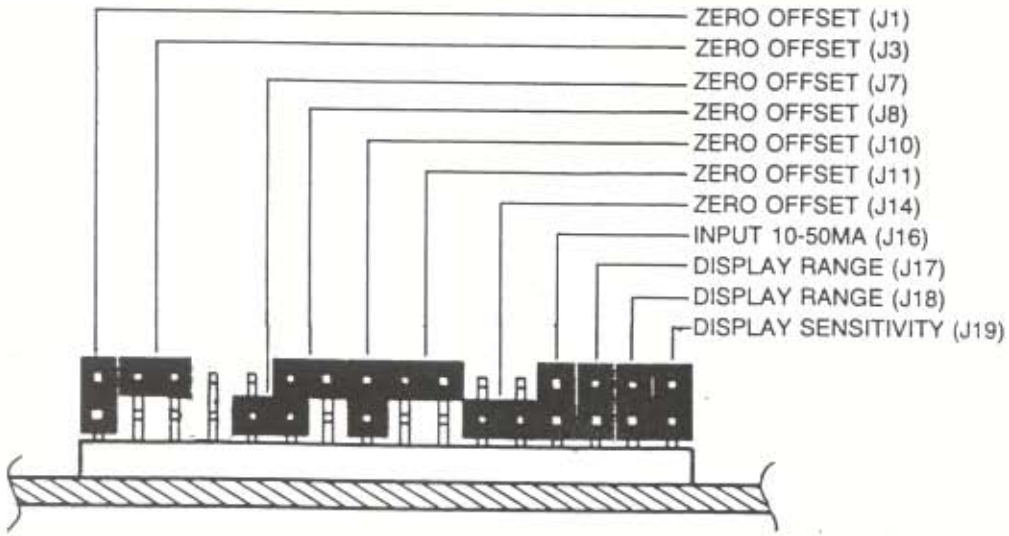
Upper PCB, Edge View, HP Enclosure

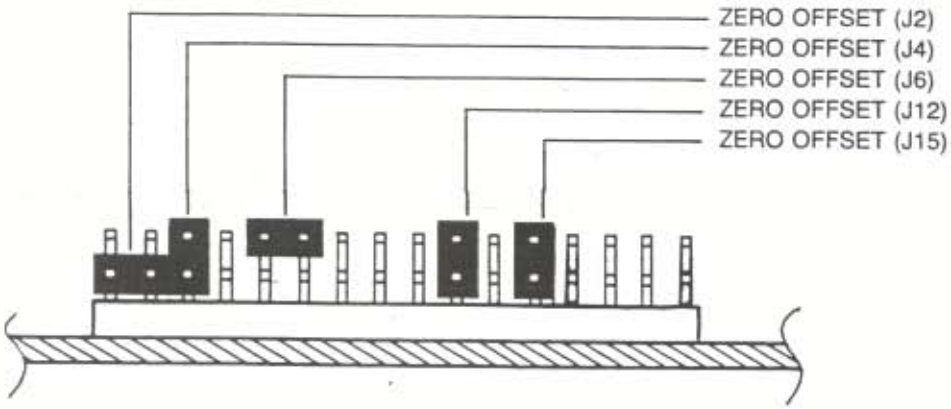


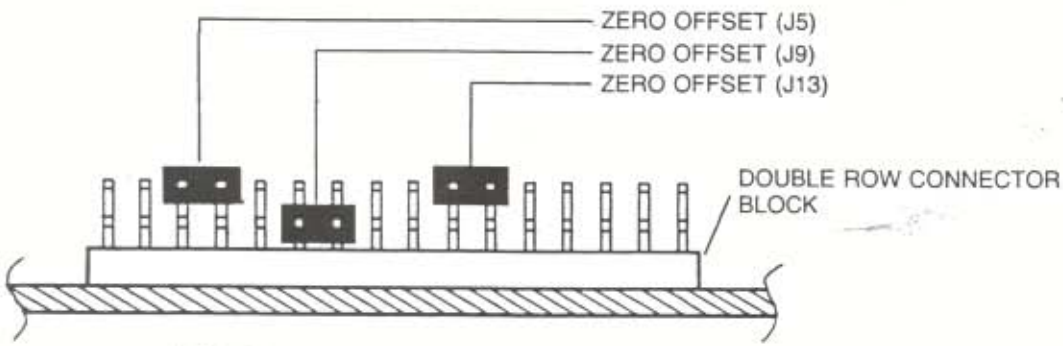
PC2, Face View, DIN Enclosure

Figure 2-5
Single Row Connector, Jumper Positions For Active Functions

Lower PC Board, Edge View



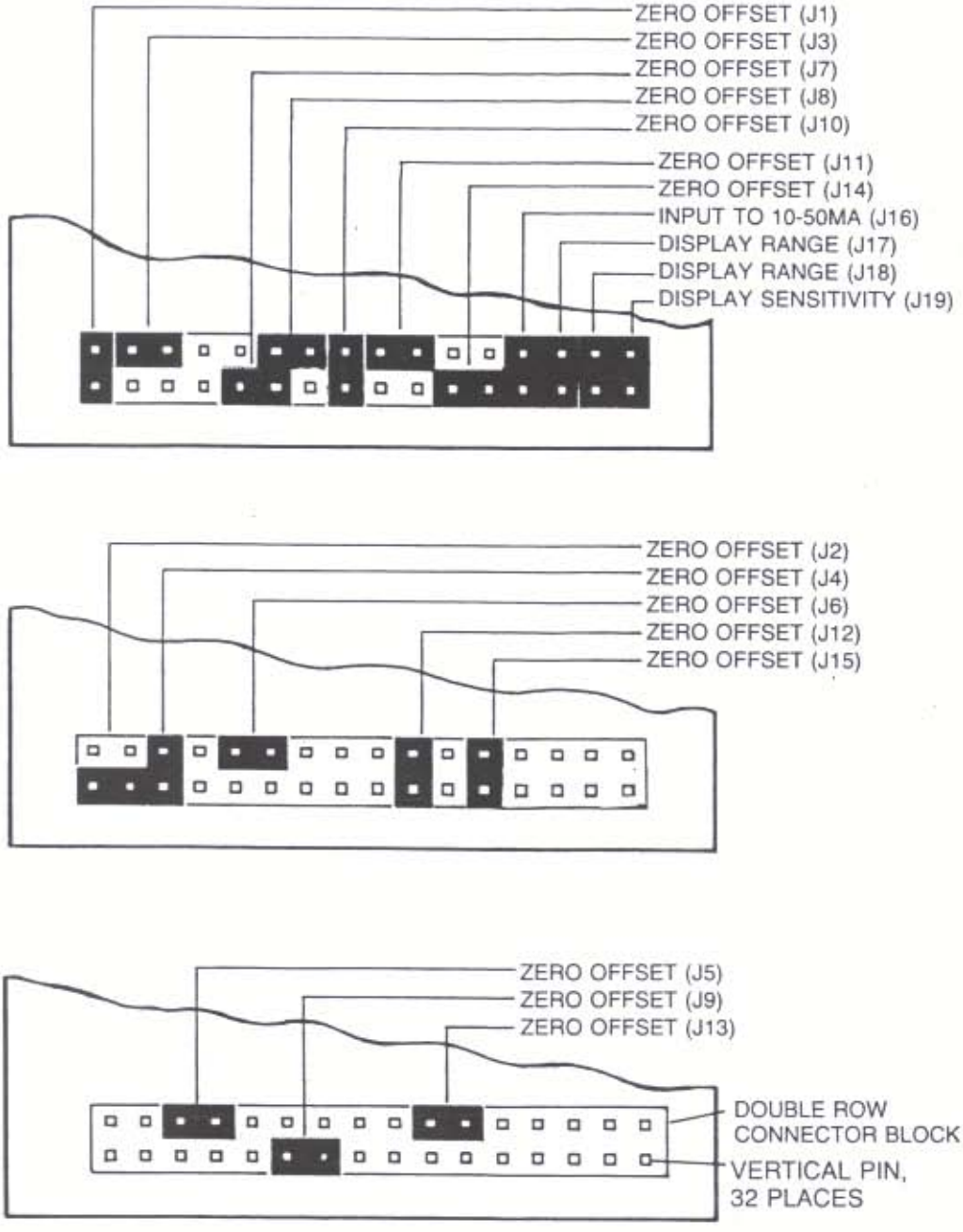




NO MORE THAN SIX JUMPER PLUGS ARE EVER USED IN THE ACTIVE POSITION AT ANY ONE TIME ON THIS BOARD.

Figure 2-6A
Double Row Connector, Jumper Positions For Active Functions, HP Enclosure

Lower PC Board, Edge View



NO MORE THAN SIX JUMPER PLUGS ARE EVER
USED IN THE ACTIVE POSITION AT ANY ONE TIME ON THIS BOARD.

Figure 2-6B
Double Row Connector, Jumper Positions
For Active Functions, DIN Enclosure

2.5.1 INPUT JUMPER CONFIGURATION

If the input is to be a 4-20mA loop, remove jumper J16. If the input is a 10-50mA loop, install J16.

2.5.2 SENSITIVITY JUMPER CONFIGURATION

1. Determine range of current to be measured (i.e., $I_{max} - I_{min}$).

2. Determine the minimum and maximum counts to be displayed. (The total display range is –1999 to +1999; the minimum and maximum display counts plus any added offset must fall within the range of these figures.)

3. Determine sensitivity required of the DVX.

   If: $A = I_{max} - I_{min}$, AND
   B = (max display count) – (min display count), then the sensitivity required is: C = B/A.

   Several different actions are required, depending on the value of C:

   If C is negative, install jumper JRO. See figure 2-5.

   If absolute value of C is 125 or less, remove jumper J19. Otherwise install J19.

   If absolute value of C is 125 or less and B (display range) is less than 1000 or absolute value of C is greater than 125 and B is less than 2000, install J17 and remove J18. Otherwise, remove J17 and install J18 (jumpers J17 and J18 select sensitivity ranges).

Zero Offset Jumper Configuration

The ZERO potentiometer allows for a 1000 count adjustment of the display. The offset jumper selection must therefore be such that the desired display count at minimum current falls within the adjustable range at the ZERO potentiometer.

First find the display adjustment required. With no offset the display would read:

D = display count
$D = (I_{min}) \times C$,
where I_{min} is the minimum current and C is the value obtained in 2.5.2, step 3.

This reading must now be offset to obtain the desired reading.

If the desired display count at I_{min} is X, then the jumper selection must be such that an offset of E = X – D is introduced.

If jumper J19 has been installed, this value of E should be multiplied by 2.

The jumper selections may be obtained from tables 2-7 and 2-8 (use table 2-7 if C is positive and 2-8 if C is negative).

Example:

Assume a 4-20mA loop with 4mA corresponding to a display of 0, and 20mA corresponding to a display of 1200;

1. For a 4-20mA loop, remove J16

2. Current range A = 20 – 4 = 16

3. Display range B = 1200 – 0 = 1200

4. Sensitivity C = B/A = 1200/16 = 75

   C is less than 125 and B is greater than 1000; therefore, remove J17 and install J18. Also, since C is less than 125, J19 should be removed.

5. D = 4 x 75 = 300
   E = X – 300

2.5.3 DECIMAL LOCATION

To select a decimal point location, install jumper JDP1, 2, or 3 as shown in figure 2-5.

2.5.4 TRAILING DUMMY ZERO

For a trailing dummy zero in the display, install jumper JDZ as shown in figure 2-5.

2.6 ZERO AND SPAN ADJUSTMENT

1. Set the input current to 0%. Adjust the ZERO potentiometer to read the desired minimum value on the display.

2. Set the input current to 100%. Adjust the SPAN potentiometer to read full scale engineering units on the display. Verify that the polarity and decimal point indications are correct.

3. Repeat steps 1 and 2 until no further adjustments are necessary.

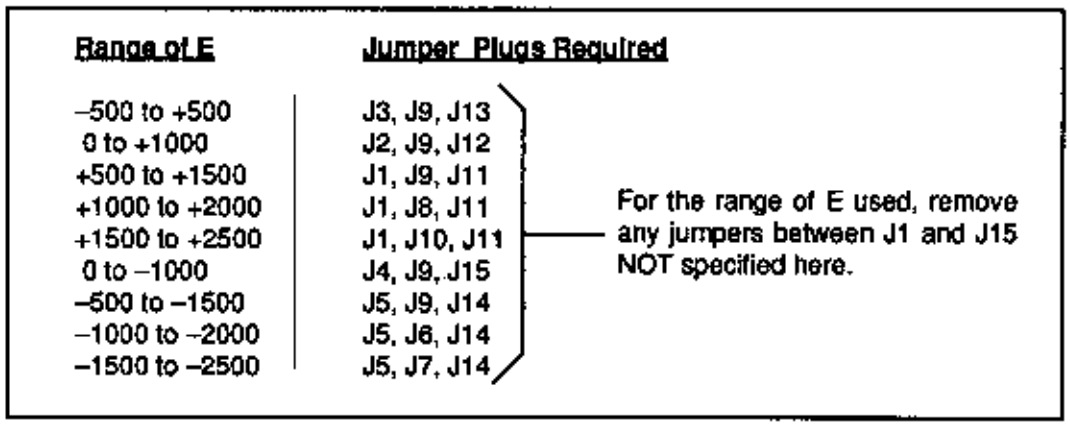


Figure 2-7
For use when C is POSITIVE

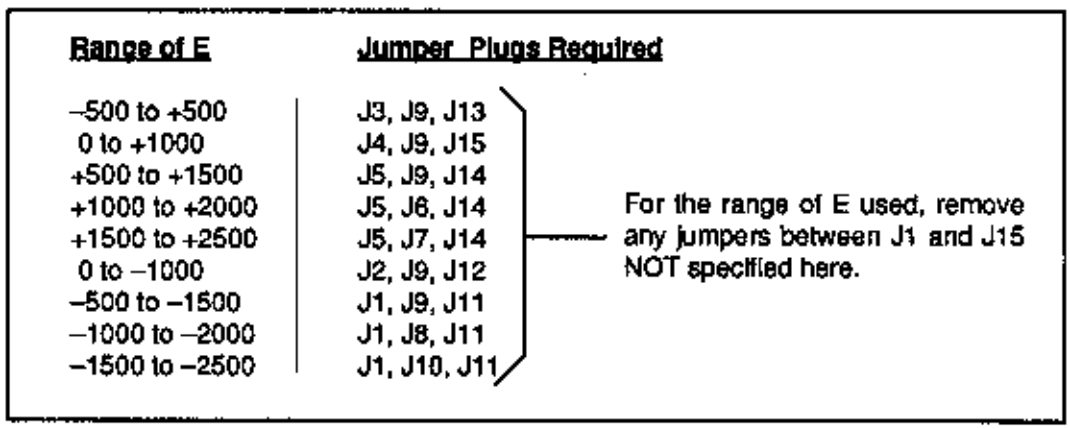


Figure 2-8
For use when C is NEGATIVE

INSTALLATION & OPERATION

3.0 INSTALLATION & OPERATION

The DVX is available in two types of housings; the hockey-puck (HP) and the DIN rail-mount. Section 6 contains the outline dimension drawings for both HP- and DIN-type units. Refer to these drawings when preparing for installation of the DVX.

3.1 MECHANICAL INSTALLATION

Select the the applicable outline dimension drawing in section 6. Review the drawing carefully, along with any accompanying notes, to ensure a thorough understanding of installation criteria.

Although the DVX is designed for convection cooling, it is advisable to mount the unit on a surface that will aid in the dissipation of heat. Also, the unit should be installed in an area where it will be protected from dust, moisture, and corrosive elements.

3.2 ELECTRICAL CONNECTIONS

The connections for the two inputs (+IN and –IN) required to drive the DVX are shown in the outline dimension drawing in section 6, and are clearly marked on the unit itself. For both HP and DIN units the connections are made on the front of the unit where indicated.

No special wire or cable is required to complete the power loop. It is recommended however, that #20 AWG wire be used when connecting to the compression screw terminals of the DVX. No terminal lugs are necessary for this type of terminal. To secure the connections to the DVX, strip the insulation from the end of the wire, tin the ends with 60/40 solder, insert the wire in the designated terminal socket, and tighten the associated screw.

3.3 OPERATION

For proper operation, the DVX needs a minimum of 2.5Vdc from the current loop. Once installed and operating, it is unlikely that further adjustments will be necessary. Reading the visual display is the only user intervention required. Because the DVX utilizes highly reliable solid-state components, the unit should operate maintenance free for extended periods of time.

THEORY OF OPERATION

4.0 THEORY OF OPERATION

This section briefly describes the theory of operation for the DVX, based on the block diagram in figure 4-1. The purpose of this description is to show how signals are processed through the unit should it become necessary to troubleshoot the loop. Section 6 contains detailed schematic diagrams for both the HP and DIN units.

4.1 OPERATION

The current input signal to the DVX is measured as the voltage across a current sense resistor in series with the "–IN" terminal. The voltage is doubled to approximately 5 volts by the power supply. The offset circuit uses ±1.2V references to provide different offset voltages. The input signal and offset voltage are applied to the analog-to-digital converter, which generates the display signals for the liquid-crystal, digital display.

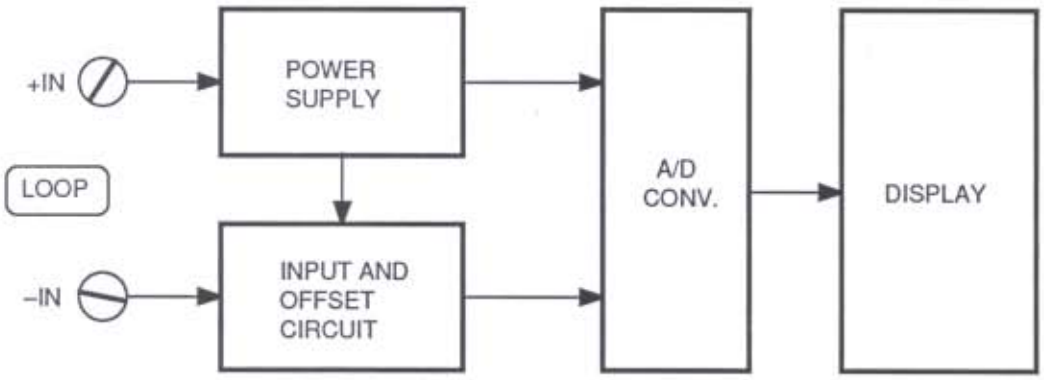


Figure 4-1
DVX Block Diagram

MAINTENANCE & TROUBLESHOOTING

5.0 MAINTENANCE AND TROUBLESHOOTING

5.1 MAINTENANCE

The design of the DVX limints maintenance primarily to keeping the input and output terminals and conductors clean and tight, while maintaining a good heat conduction path to a suitable heat sink. This is best accomplished by initially tinning the ends of all hook-up wires, as described in section 3.0. It is recommended that the user check the terminations every six months of service.

5.2 TROUBLESHOOTING

If a problem is suspected with the DVX, check the following procedures:

1. If the relationship between the input and the output (display) changes, readjust the SPAN and ZERO potentiometers (see paragraph 2.6).

2. Verify that the input terminals are clean and tight.

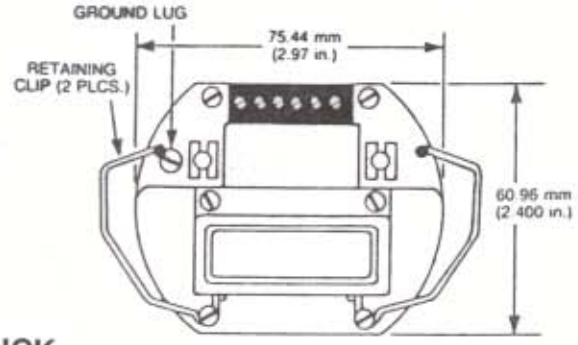
3. Verify that the selected jumpers are properly installed, in accordance with paragraph 2.5.

If these steps fail to restore normal performance to the DVX, the unit may be defective and should be returned to the factory in accordance with the instructions on the back cover of this manual.

UNIT DOCUMENTATION

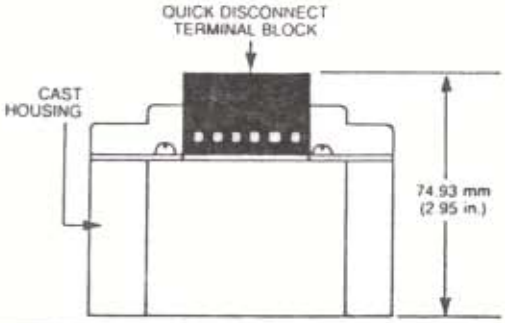
6.0 UNIT DOCUMENTATION

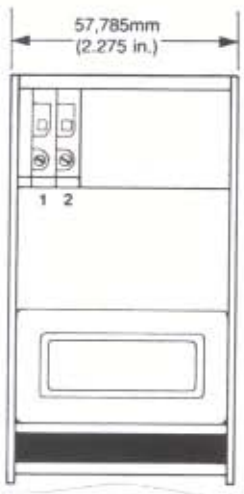
This section contains schematic diagrams, assembly drawings, and outline dimension drawings for both the HP and the DIN units. These illustrations may be helpful when calibrating and installing the DVX.

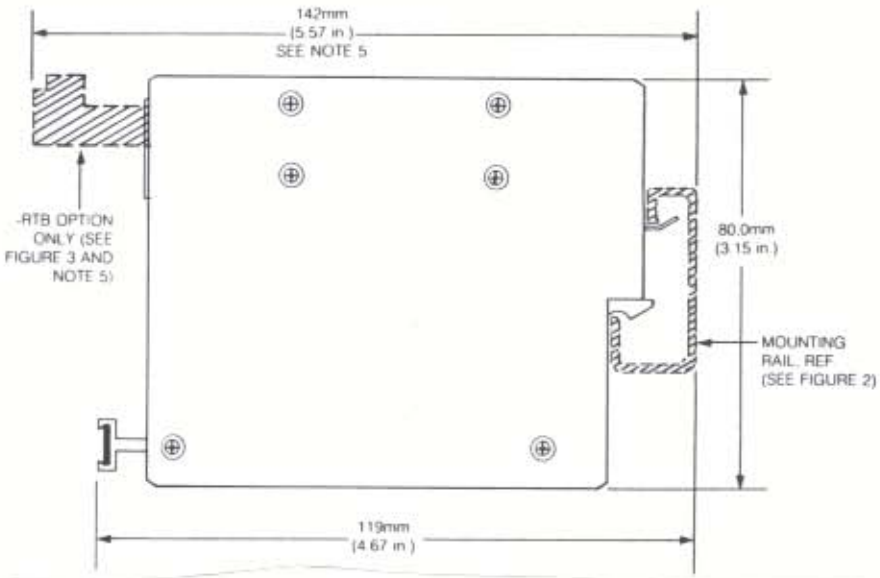


TOP VIEW

HOCKEY-PUCK HOUSING







DIN HOUSING

MOORE INDUSTRIES
16650 Schoenborn Street
Sepulveda, California 91343

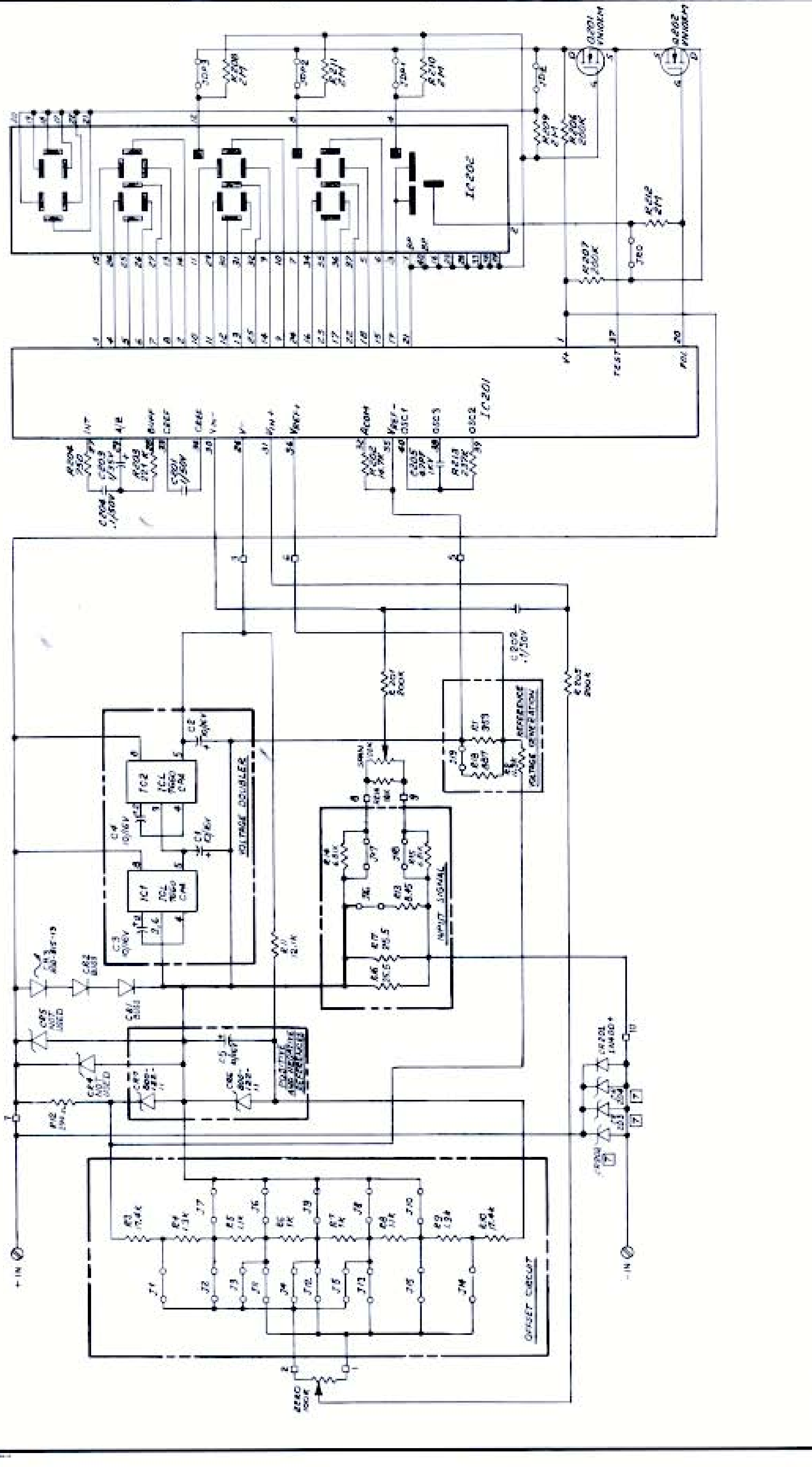
DO NOT SCALE DRAWING

TOLERANCES UNLESS NOTED	
.X	±.1
.XX	±.03
.XXX	±.010
ANGLES	±30'

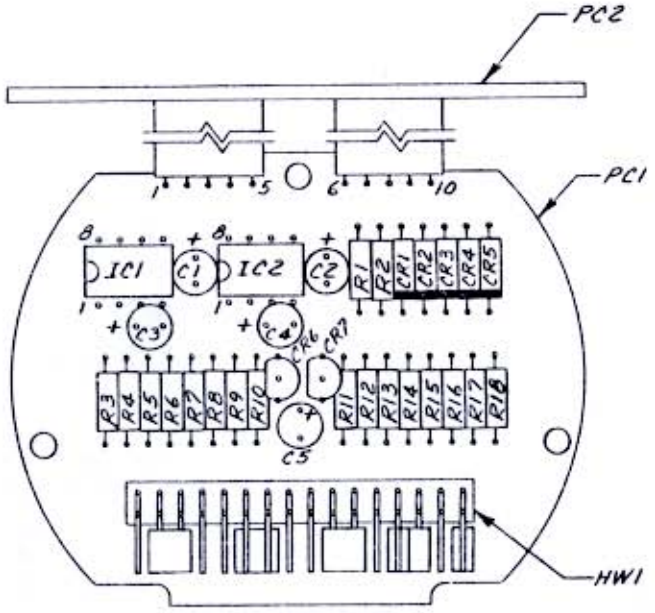
DRAWN: Ron Kelley
CHECKED:
ENGINEER: J. GOUGH
SCALE:

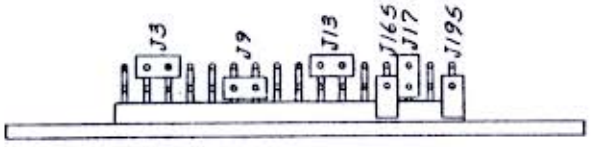
DVX-HP
PC1 & PC2

DRAWING NUMBER: 178-401-00
REVISION: E
CATEGORY: SCHEMATIC
REVISED BY: ECO 6391
DATE: Oct/87



NOTES: UNLESS OTHERWISE SPECIFIED.
1. RESISTANCE IN OHMS, CAPACITANCE IN MICROFARADS.
2. RESISTORS ARE METAL FILM (RN55C) ±1%, 1/8 W.
3. SPAN & ZERO ARE MOUNTED ON PC2.
4. □ PC1/PC2 INTERCONNECT POSITION.
5. Ⓐ SCREW TERMINAL POSITION ON FRONT PANEL.
6. JUMPERS ARE PLUG-ON, FIELD SELECTABLE.
7. CR203,204 & 205 NOT USED.





JUMPER POSITIONS

2. J3, J9, J13, J16S, J17 & J19S ARE PLUG-ON JUMPERS. PLUG ON TO POSITIONS SHOWN.
1. ALL LEADS TO BE SOLDERED TO PADS, FAR SIDE.

NOTES: UNLESS OTHERWISE SPECIFIED

MOORE INDUSTRIES
16650 Schoenborn Street
Sepulveda California 91343

DO NOT SCALE DRAWING

TOLERANCES UNLESS NOTED
X ± 1
XX ± .03
XXX ± .010
ANGLES ±30

DRAWN K. Kelley 3/84
CHECKED
TOLERANCE
ISSUE 2-1

DVX
PC1

DRAWING NUMBER 178-501-00
SHT 1 OF 2
SIZE C

DESCRIPTION PC ASSEMBLY
REVISED BY ECO 6000
DATE 2/84
BY DVM
APPROVED

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Sepulveda, California 91343

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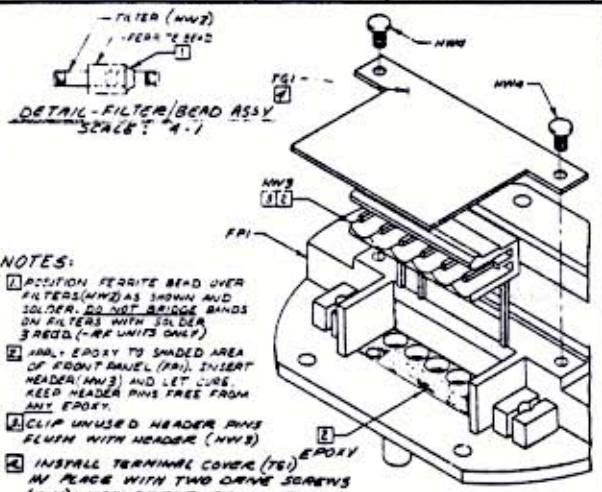
.XX ±.03
.XXX ±.010
ANGLES ±30'

DRAWN P. Kelley 7/1/86
CHECKED
ENGINEER
SCALE 2-1

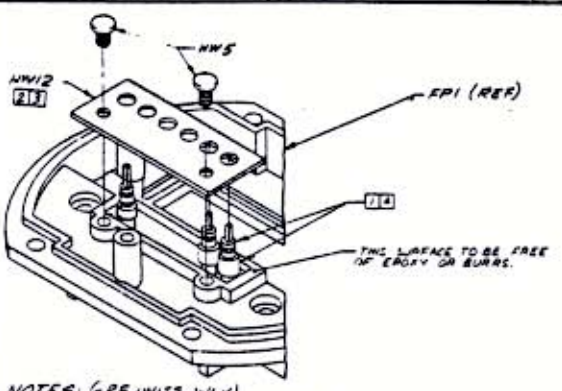
FRONT PANEL
DVX-HP
& PC1

DRAWING NUMBER 178-501 00 SHT 1 OF 2 REVISION C
CATEGORY ASSEMBLY, P.C.
REVISED BY ECO 6000 DATE 2/20/86 BY JVN APPROVED



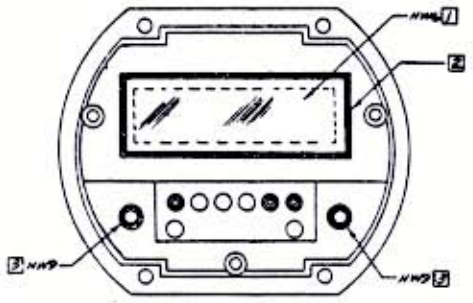
NOTES:
1. POSITION FERRITE BEAD OVER FILTERS (HW2) AS SHOWN AND SOLDER. DO NOT BRIDGE BANDS ON FILTERS WITH SOLDER 3 REQD. (-RF UNITS ONLY)
2. ABBL EPOXY TO SHADED AREA OF FRONT PANEL (FPI). INSERT HEADER (HW3) AND LET CURE. KEEP HEADER PINS FREE FROM ANY EPOXY.
3. CLIP UNUSED HEADER PINS FLUSH WITH HEADER (HW3)
4. INSTALL TERMINAL COVER (TC) IN PLACE WITH TWO DRIVE SCREWS (HW4). USE ARBOR PRESS TO INSERT DRIVE SCREWS

STEP ONE



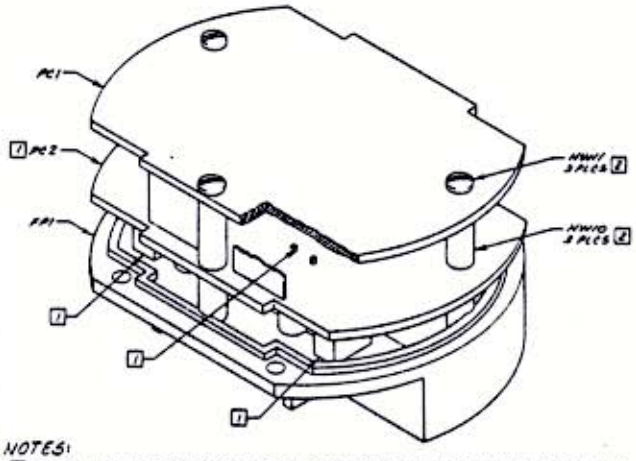
NOTES: (-RF UNITS ONLY)
1. SLIDE FILTER ASSEMBLIES (FROM STEP ONE) DOWN TO BASES OF (3) HEADER PINS.
2. SLIDE GROUND PLANE (HW6) OVER FILTERS, TO REST FLUSH AGAINST FPI.
3. SECURE (HW6) TO (FPI) WITH 2 DRIVE SCREWS (HW5) USE ARBOR PRESS TO INSERT DRIVE SCREWS. USE CAUTION AGAINST FILTER BREAKAGE.
4. SOLDER FERRITE BEADS TO FILTERS AND GROUND PLANE SOLDER FILTER END TO HEADER PIN ENDS WITH MINIMUM SOLDER.
5. HI-POT TEST FILTER ASSY.

STEP TWO



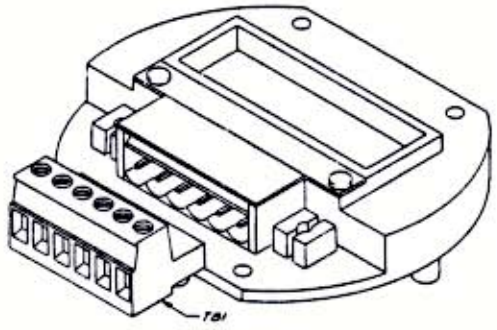
NOTES:
1. POSITION WINDOW (HW6) INTO FRONT PANEL (FPI)
2. IF UNIT HAS "-RF" OPTION, FILL GROVE AROUND WINDOW WITH CONDUCTIVE EPOXY (800-862-96). IF UNIT DOES NOT HAVE -RF OPTION, USE EPOXY (800-861-96).
3. APPLY SILICON GREASE (800-861-96) SPARINGLY TO INSIDE OF O-RINGS (HW5) THEN INSERT O-RINGS INTO FPI.

STEP THREE



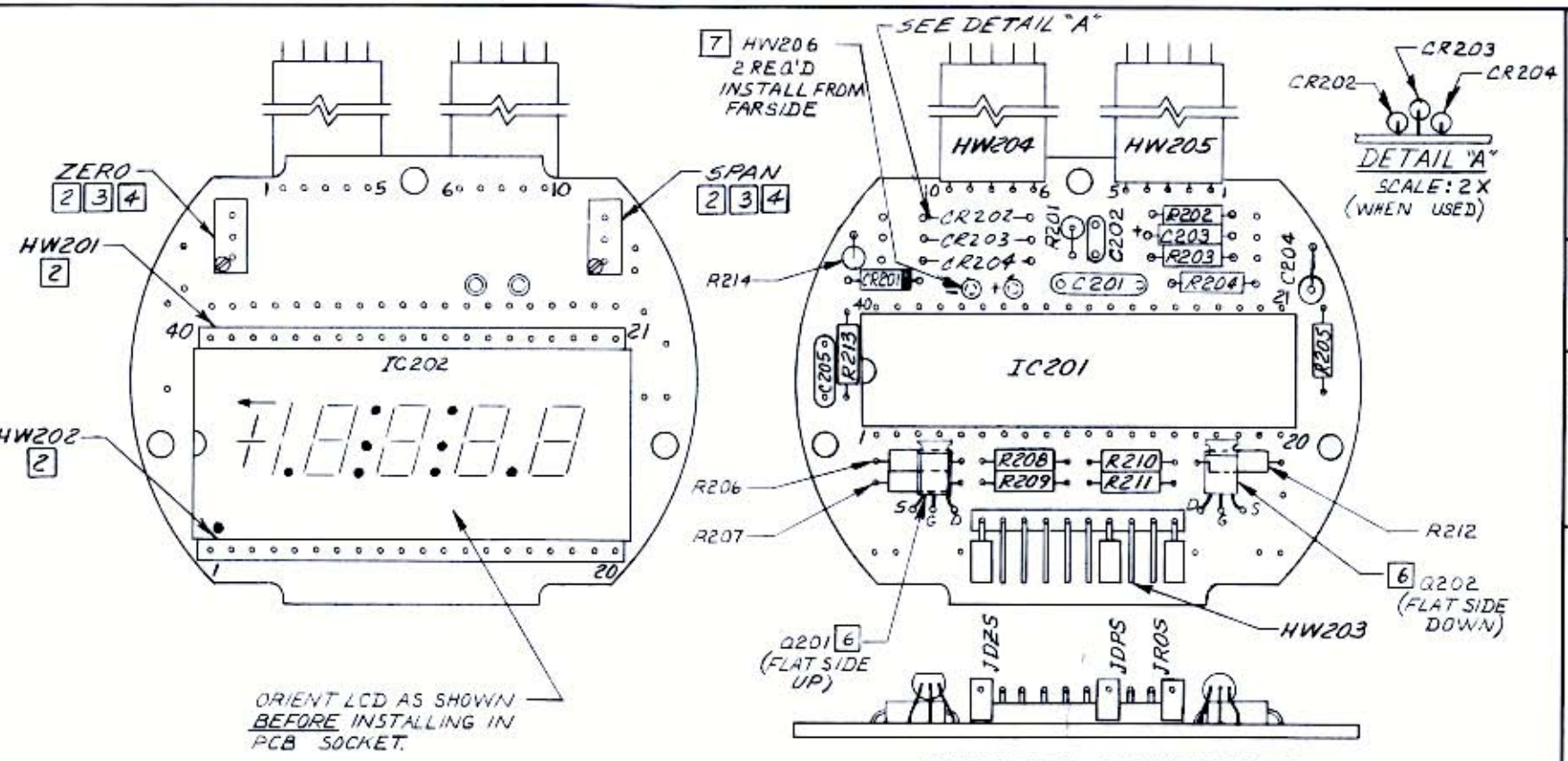
NOTES:
1. GENTLY SLIDE PC2 OVER HEADER PINS WHILE ALSO LINING UP "SPAN" & "ZERO" POT SHAFTS INTO O-RINGS. POSITION PC2 OVER PC1 BEND COMPONENTS THAT INTERFERE TO ALLOW BOARDS TO FIT TOGETHER PROPERLY
2. SECURE PC1 & PC2 TO FRONT PANEL 3 PLACES WITH STANDOFFS (HW10) AND SCREWS (HW11)

STEP FOUR



NOTES:
1. DELETED
2. PLUG IN TB1 TERMINAL BLOCK.

STEP FIVE



JUMPER POSITIONS

7. SOCKET OPENING TO BE FREE OF SOLDER.
6. SLEEVE Q201 & Q202 .062 BEYOND METAL TAB, THEN BEND OVER, MAKING SURE THE TABS DO NOT TOUCH LEADS OF IC201.
5. JDZS, JDPS & JROS ARE PLUG-ON JUMPERS, PLUG ON POSITIONS SHOWN.
4. USE TOOLING FIXTURE 178-202-01 TO HOLD ZERO & SPAN WHILE SOLDERING.
3. ZERO & SPAN MUST SIT FLAT ON & PERPENDICULAR TO P.C. BOARD.
2. INSTALL ZERO, SPAN, HW201 & HW202 BEFORE ANY OTHER COMPONENTS.
1. ALL LEADS TO BE SOLDERED TO PADS.

NOTES: UNLESS OTHERWISE SPECIFIED.

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X ±1
XX ±.03
XXX ±.010
ANGLES ±30

DRAWN R. Kelley
CHECKED
ENGR J. GOUGH
MFG 2-1

DVX
PC2

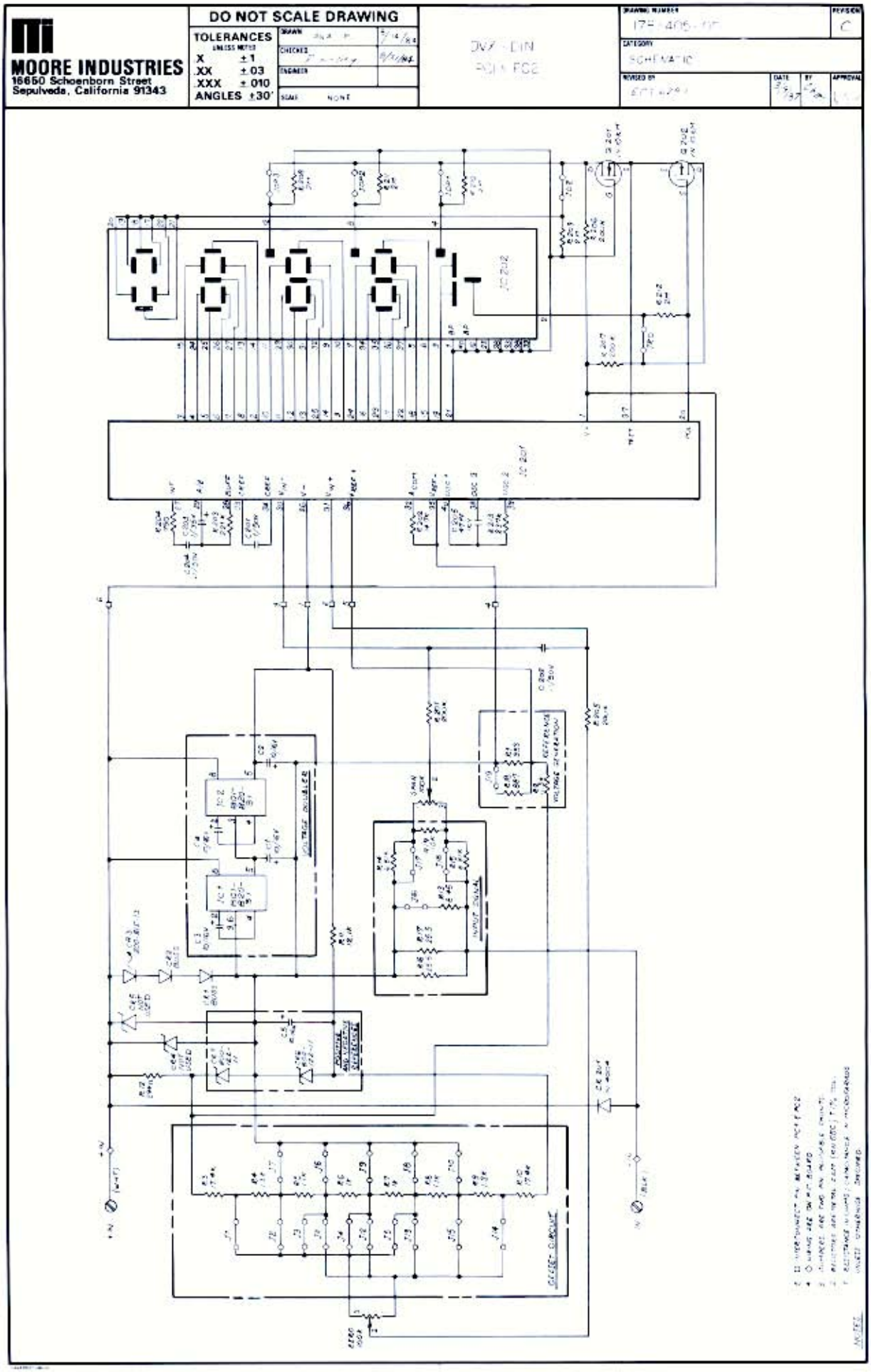
SCHEMATIC PC ASSEMBLY

DRAWING NUMBER 178-502-00

REVISED BY ECO 6391

REVISION D

6017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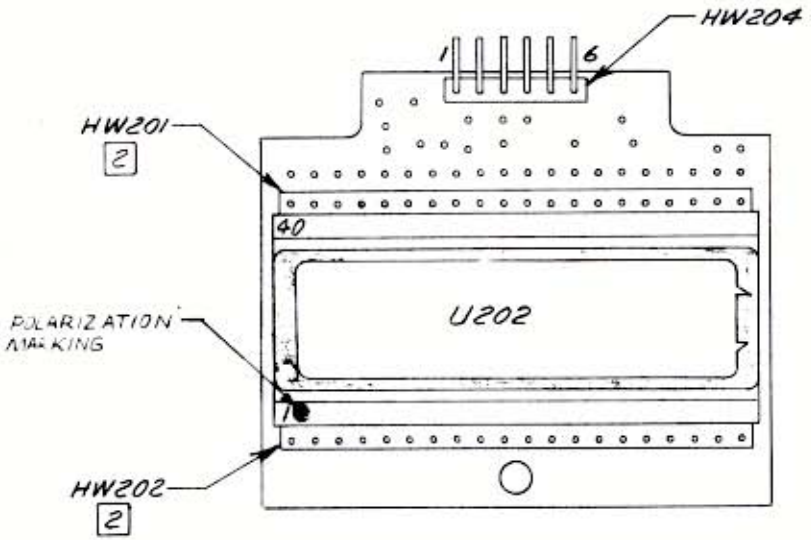
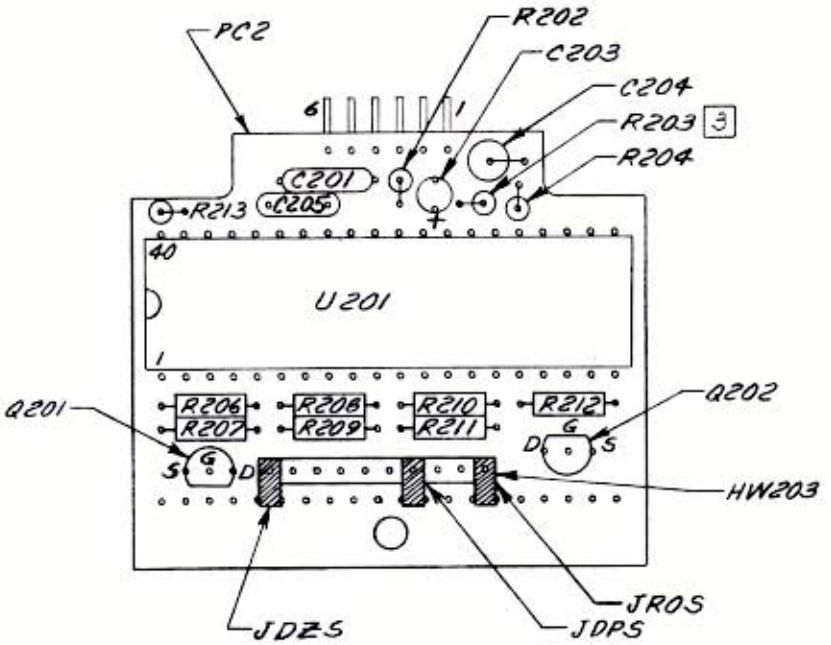
DO NOT SCALE DRAWING
TOLERANCES
UNLESS NOTED
X ±1
.XX ±03
.XXX ±010
ANGLES ±30'
SCHEMATIC
REVISION
C





4. JUMPERS PLUG ON TO HW203 IN POSITIONS SHOWN.
3. SLEEVE LEADS OF ALL STAND-UP COMPONENTS.
2. INSTALL HW201 & HW202 BEFORE OTHER COMPONENTS.
1. ALL LEADS TO BE SOLDERED TO PADS.

NOTES: UNLESS OTHERWISE SPECIFIED.

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DO NOT SCALE DRAWING

TOLERANCES (UNLESS NOTED)
X ±1
XX ±.03
XXX ±.010
ANGLES ±30'

DRAWN R. Kelley 8/84
CHECKED
ENGINEER
SCALE 2-1

DVX-DIN
PC2

DRAWING NUMBER 178-506-00
CATEGORY PC ASSEMBLY
REVISED BY ECO 5876
REVISION B
DATE
BY
APPROVED

ECO 5991

MOORE INDUSTRIES
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Sepulveda, California 91343

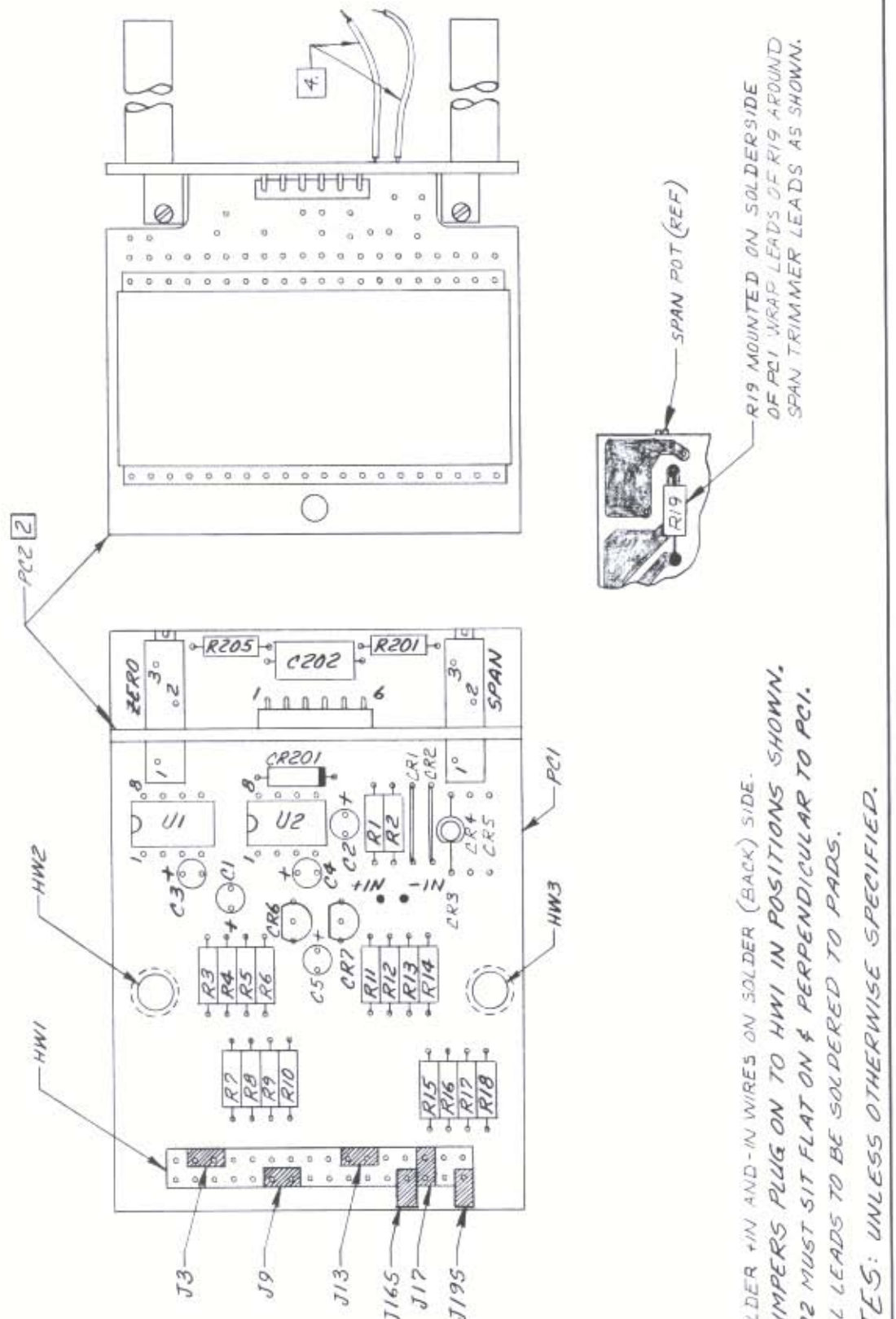
DO NOT SCALE DRAWING

TOLERANCES (UNLESS NOTED)
X ±.1
XX ±.03
XXX ±.010
ANGLES ±30°

DRAWN R. Kelley 9/84
CHECKED
ENGINEER
SCALE 2-1

DVX-DIN PC1

DRAWING NUMBER 178-505-00 REVISION C
CATEGORY PC ASSEMBLY
REVISED BY ECO 6290 DATE 9/12/89 BY CMW APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL LEADS TO BE SOLDERED TO PADS.
2. PC2 MUST SIT FLAT ON & PERPENDICULAR TO PC1.
3. JUMPERS PLUG ON TO HW1 IN POSITIONS SHOWN.
4. SOLDER +IN AND -IN WIRES ON SOLDER (BACK) SIDE.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

MOORE INDUSTRIES

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