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TECHNICAL MANUAL

MODEL DGC III Digital Ion Gauge Control

Part No. 617602

PERKIN ELMER

Physical Electronics Division
6509 Flying Cloud Drive
Eden Prairie, MN 55344

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Subject to the conditions hereinafter stated, the Manufacturer (Perkin-Elmer) warrants its equipment for a period of one year from the date of shipment. This warranty extends only to the original owner of the equipment and is limited to repair or replacement (at Manufacturer's option) of any part or parts which are returned to the Manufacturer.

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OPERATOR SAFETY SUMMARY

All PHI systems have been designed to assure operator safety. As with all other sophisticated instruments, however, continual operator safety depends on the proper use of system components. Such use is described in the manuals supplied with each unit.

LISTED BELOW ARE WARNINGS APPLICABLE TO THIS EQUIPMENT. ALL PEOPLE INVOLVED IN THE OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST FULLY UNDERSTAND THE WARNINGS AND THE PROCEDURES BY WHICH THE HAZARD IS TO BE REDUCED OR ELIMINATED.

WARNING

THE PRODUCT(S) COVERED IN THIS MANUAL HAS BEEN DESIGNED TO FUNCTION SAFELY WITH THE REQUIRED DEGREE OF PRECISION WHEN USED IN THE DESCRIBED MANNER.

WE DO NOT RECOMMEND THAT THIS EQUIPMENT BE MODIFIED FOR ANY NON-STANDARD APPLICATION SINCE HAZARDOUS CONDITIONS MAY RESULT. BECAUSE THE PHYSICAL ELECTRONICS DIVISION OF PERKIN-ELMER HAS NO CONTROL OVER CUSTOMER MODIFICATIONS TO PHI PRODUCTS SHIPPED, IT DISCLAIMS RESPONSIBILITY FOR ANY MALFUNCTIONS OR ACCIDENTS THAT MAY RESULT!

DANGER
ELECTRICAL SHOCK HAZARD

HIGH VOLTAGES ARE PRESENT IN THE SYSTEM WHEN THE SYSTEM POWER INPUT LINES ARE CONNECTED. DISCONNECT INPUT POWER AT THE WALL BEFORE MAKING ANY ADJUSTMENTS. REFER SERVICING TO PEOPLE WHO HAVE BEEN TRAINED AND HAVE WORKING EXPERIENCE WITH VOLTAGES IN EXCESS OF 50 VOLTS.

ALL ELECTRICAL CABLES ASSOCIATED WITH THE UNITS IN A SYSTEM ARE WELL SHIELDED. TAKE CARE, HOWEVER, NEVER TO COME IN CONTACT WITH ANY ASSOCIATED TERMINALS WHEN THE POWER IS ON. SOME OF THESE LEADS CARRY POTENTIALLY LETHAL HIGH VOLTAGES. OTHER LEADS MAY CARRY SUFFICIENT RF POWER TO INFLICT SEVERE BURNS.

RF INTERFERENCE

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO-FREQUENCY ENERGY, AND IF NOT INSTALLED AND USED ACCORDING TO THE INSTRUCTION MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. OPERATING THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE, AND USERS WILL BE REQUIRED TO TAKE THE NECESSARY MEASURES TO CORRECT THE INTERFERENCE AT THEIR OWN EXPENSE.

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SECTION I
INTRODUCTION

1.0 GENERAL INFORMATION

This manual is intended to assist users in the installation, operation, and maintenance of the Perkin-Elmer Digital Gauge Control (DGC) III. This manual is divided into five sections. Section I contains a brief description and the specifications of the unit. Section II explains installation, Section III describes operation, and Section IV outlines the theory of operation. Calibration and maintenance procedures are discussed in Section V.

1.1 GENERAL DESCRIPTION

The DGC III is a fourth generation, solid state, microprocessor-controlled, digital ionization gauge controller. The basic unit, Model 605-0600, can control two standard Bayard-Alpert, wide-range or UHV (nude), tubes. The gauge automatically operates over the pressure range of 2×10^{-11} Torr to 9.9×10^{-2} Torr while adjusting the emission current. A display of Torr or Pascal units may be selected as well as gas correction constants for several common gases.

The DGC III contains safety circuits that shut OFF the tube filament if emission current is lost or if the upper pressure limit of the gauge is exceeded. Degas is automatically turned off by the gauge to prevent damage to the tube. A leak detector function is included to assist the technician in locating vacuum leaks. An audible alarm warns the operator of error conditions, signals keystrokes and indicates leaks in the leak detector mode. The DGC III operates on 100, 120, 200, or 240 volts AC with either 50 or 60 Hz power.

The DGC III can be customized to the user's own requirements through the addition of several option kits. These option kits allow the gauge to control two thermistor tubes, operate four digital setpoints, interface to a computer, output a log report on a printer, control the vacuum system pressure via a piezoelectric valve, automatically cross between the thermistor and ion gauge tubes as the pressure changes, protect the UHV pump from backing pump failures by monitoring the foreline pressure and output BCD and analog pressure information.

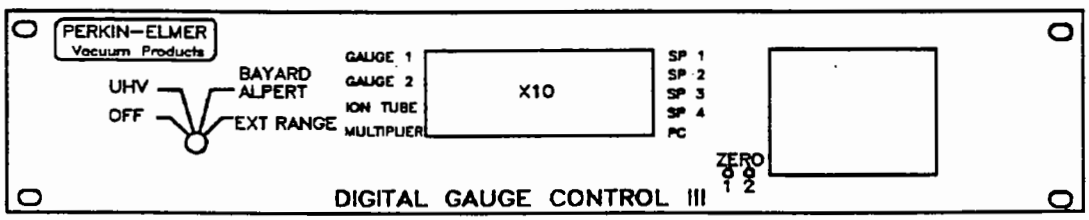


Figure 1-1. Digital Gauge Control III (Front Panel).

1.2 SPECIFICATIONS

Gauge Tube Types:	Compatible with Bayard-Alpert type ion gauge tubes (standard glass encapsulated, wide range and nude) and thermistor tubes (optional)
Number of Gauges:	Ion - 2; thermistor - 2 (optional)
Digital Display:	4-digit LED which indicates pressure and status
Display Units:	Torr/Pascal
Degas:	Electron bombardment - 55 W maximum
Gas Constants:	Hydrogen, helium, water vapor, methane, nitrogen, argon, and xenon

Operating Range

Thermistor Tube:	9.9×10^{-1} to 1×10^{-3} Torr
Bayard-Alpert Ion Gauge Tubes	
Wide Range:	1×10^{-1} to 3×10^{-10} Torr
Standard Glass Encapsulated:	1×10^{-2} to 3×10^{-10} Torr
Nude:	1×10^{-3} to 2×10^{-11} Torr

Ion Gauge

Grid Voltage:	+180 V DC
Filament Bias:	+24 V DC
Emission:	Automatic selection of decade. 0.1, 1, or 10 mA for Bayard-Alpert standard glass encapsulated and wide range tubes (user adjustable); 0.04, 0.4, or 4 mA for nude tubes (user adjustable).
Collector Voltage:	Ground potential
Filament On/Off	
Local:	Selected by front panel push-button
Remote:	External connections (requires BCD option)
Automatic:	Automatically switches between thermistor gauge tube and ion gauge tube (auto cross feature)
Computer Controlled:	RS-232 (requires computer interface option)
Zero:	Automatically zeros when filament is turned ON (thermistor, manual zero)

Set Points (Optional)

Number:	4
Range:	9.9×10^{-1} to 2×10^{-11} for Torr; 9.9×10^{-2} to 1.0×10^{-11} for Pascal and correction constant
Adjustment:	By keyboard or optional computer interface
External Circuits:	Four independent SPDT relays, 115 V AC, 1 A maximum inductive or 28 V DC, 1 A maximum resistive. The relay energizes when the pressure falls below the setpoint.
Indication:	Setpoint read on digital display, status lights indicate state of relay contacts, also available through computer interface options.

Leak Detector

Indication:	Audible and L.E.D. display
Sensitivity:	Full scale of leak detector = 0.1 x full scale of the display

BCD (Optional)

Parallel 5 V CMOS, with strobe-output. Mantissa and exponent in positive true BCD logic. Also includes gauge number, filament on and multiplier information.

Analog Output:	Impedance 10,000 ohms. Mantissa and exponents on separate outputs. (Output is from a D/A converter.) Outputs can be summed with an optional resistor to create a pseudo-log output.
Remote Filament On/Off:	CMOS inputs with pull-up resistor

Pressure Control (Optional)

Valve Type:	Piezoelectric leak valve
Control Voltage:	0 to 100 V
Range:	999 milliTorr to 2×10^{-5} (depending upon pumping speed and gas inlet pressure)

Computer Control (Optional)

Interface:	RS-232 Serial ASCII, 150, 300, 600, 1200, 2400, 4800, or 9600 baud
Functions:	Controls all gauge keyboard functions (except display multiplier), remote control and automatic logging with terminal, printer or computer

Electrical Requirements

User changeable without tools. All units shipped for 120 V AC.

Standard:	120 V AC (+/-10%), 50/60 Hz
Optional:	100, 220, 240 V AC (+/-10%), 50/60 Hz
Power Dissipation:	250 watts maximum (during degas)

Environmental Conditions

Operating Temperature:	0° to 40° C (32° to 104° F)
Humidity:	10 to 80% (non-condensing)

Size

Weight:	20 lbs
Dimensions:	483 mm x 89 mm x 356 mm (19 inches W x 3.5 inches H x 14 inches D)

1.3 OPTIONAL/ACCESSORY EQUIPMENT

The following list contains the model numbers and descriptions of various products that are used in conjunction with the DGC III.

605-0601 - Thermistor Option Board
Operates either one or two thermistors. Requires 605-0120 thermistor cable and 605-7675 thermistor tube. Shipping weight - 0.5 kg (1 lb.).

605-0602 - Computer Interface Option Board
May be used with an RS-232 ASCII compatible computer or 605-0609 and 605-0610 logging printer or 605-0611 and 605-0612 CRT terminal and cable. Shipping weight - 0.5 kg (1 lb.).

605-0603 - Process Control Option Board
Four digital setpoints. Shipping weight - 0.5 kg (1 lb.).

605-0604 - BCD Option Board
CMOS BCD output, analog output and remote filament on/off. Shipping weight - 0.5 kg (1 lb.).

605-0608 - Pressure Control Option Board
Requires 809-2000 valve and 809-2001 cable. Shipping weight - 0.5 kg (1 lb.).

605-7000 - Ion Gauge Tube
Standard range 0.75 inch Kovar tube without flange. Glass encapsulated. Requires cable 605-0104. Shipping weight - 1 kg (2 lbs.).

605-7152 - Ion Gauge Tube
Standard range. 2.75 inch OD CF flange. Glass encapsulated. Requires cable 605-0104. Shipping weight - 1 kg (2 lbs.).

605-7153 - Wide Range Ion Gauge Tube
2.75 inch OD CF flange. Glass encapsulated. Requires cable 605-0104. Shipping weight - 1 kg (2 lbs.).

605-7154 - Wide Range Ion Tube
1 inch Kovar tube without flange. Glass encapsulated. Requires cable 605-0104. Shipping weight - 1 kg (2 lbs.).

605-7672 - Nude Tube
Dual thoria coated filaments on 2.75 inch OD CF flange (can survive occasional high pressure exposure). Requires cable 605-0113. Shipping weight - 2 kg (4 lbs.).

605-7673 - Nude Tube
Dual tungsten filaments on 2.75 inch OD CF flange. Requires cable 605-0113. Shipping weight - 2 kg (4 lbs.).

605-7675 - Thermistor Tube
Used with 605-0601. Requires cable 605-0120. Shipping weight - 0.5 kg (1 lb.).

605-0104 - Non-Bakeable Ion Gauge Cable
Used to connect glass tubes to 605-0600. 10 feet long. Shipping weight - 1 kg (2 lbs.).

605-0113 - Bakeable Ion Gauge Cable
Used to connect nude tubes to 605-0600. 10 feet long. Shipping weight - 1 kg (2 lbs.).

605-0120 - Thermistor Cable (RF shielded)
Used to connect 605-7675 to 605-0601. 10 feet long. Shipping weight - 0.5 kg (1 lb.).

809-2000 - Piezoelectric Valve
For use with 605-0608. Requires cable 809-2001. Shipping weight - 0.2 kg (5 lbs.).

809-2001 - Cable
Connects 809-2000 to 605-0608. Shipping weight - 1 kg (2 lbs.).

SECTION II
INITIAL CHECKOUT AND INSTALLATION

2.0 GENERAL INFORMATION

The DGC III can either be mounted in a standard 19 inch rack or used as a free standing unit. In either case, a free flow of air should be provided around the instrument. Ambient temperature should be maintained between 0 degrees C and 40 degrees C. Humidity should be less than 80% non-condensing. The maximum power required (during degas) is 250 watts.

The DGC III is shipped in a special packing case which should be saved if reshipment is anticipated. In unpacking, avoid marring the painted surfaces or otherwise damaging the unit. All items of the shipment should be inspected for evidence of damage. If damage is found, a claim should be filed with the carrier and a copy forwarded to Perkin-Elmer Physical Electronics Division. If the equipment is to be returned for inspection or repair, authorization must be obtained from Perkin-Elmer Physical Electronics Division prior to return. Instructions will be forwarded.

Check the equipment received against the packing list enclosed to insure that all items shipped have been received. If there are any shortages, notify the carrier and Perkin-Elmer. Save all packaging material for inspection.

2.1 INSTALLATION PROCEDURE

Installation consists of changing the input power voltage selector and fuse if necessary (all units are shipped from the factory for 120 V AC), mounting the instrument in the rack or setting it on a bench, and making power and signal connections to the rear panel. A three-wire power cable is supplied. The customer must furnish connections to the BCD option, the computer interface option and the setpoint option. Mating connectors for the BCD option, setpoint option, and the computer interface option are supplied.

Order a non-bakeable cable for the wide range and standard gauge tube or a bakeable cable for the nude type ion tubes. Refer to Section 1.3 of this manual for part numbers.

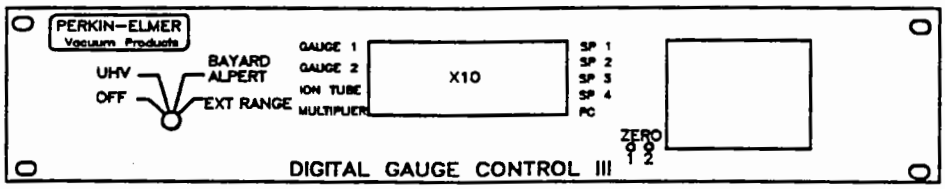


Figure 2-1. DGC III Front Panel.

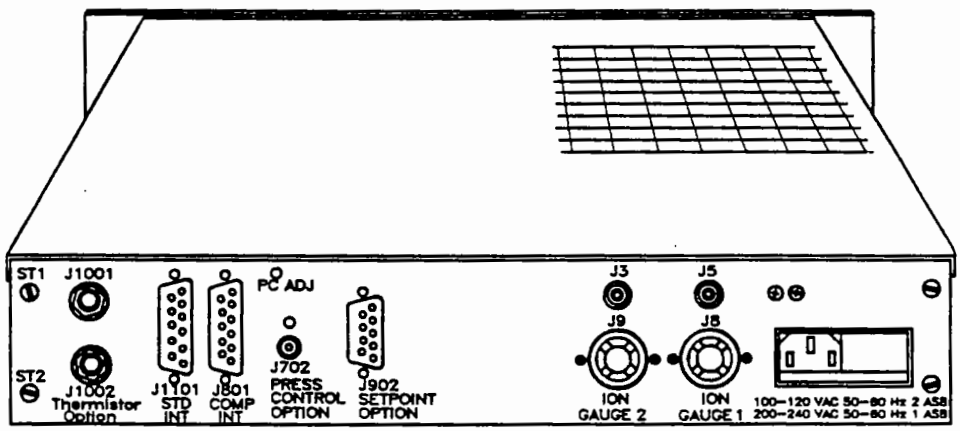


Figure 2-2. DGC III Rear Panel.

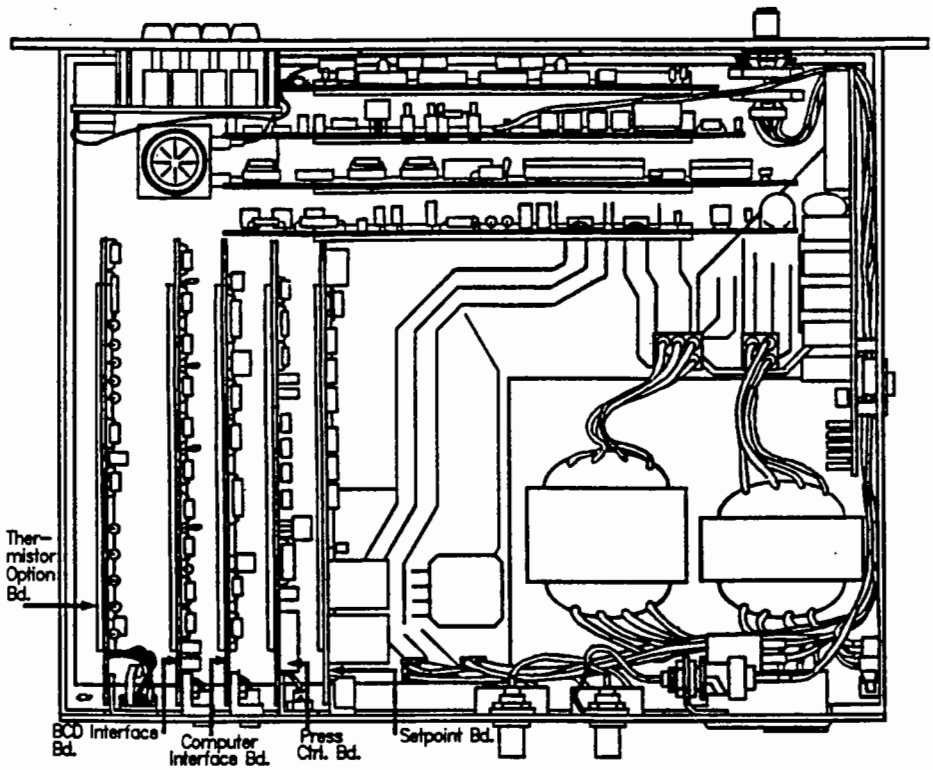


Figure 2-3. DGC III With Top Cover Removed.

Use the following procedure to change the voltage setting. Refer to Figures 2-1 and 2-2.

1. On the front panel of the DGC III, turn the power switch OFF.

2. Remove the line cord from the rear of the DGC III. Slide the plastic guard over the power connector. The input voltage setting is visible just below the the left side of the fuse. If this value is correct, no change is necessary.

3. Remove the fuse by pulling on the "fuse pull" lever. Save the fuse for future use. Pull out the circuit board located beneath the fuse. (It may be necessary to hook a wire through the hole or to use a pair of pliers.)

4. Align the circuit board so that the correct voltage is on top at the left-hand side of the board. Reinsert the board. The correct voltage should be visible after the board is in place.

5. Push in the "fuse pull" lever. In 120 volt applications, replace the fuse with a 2 amp slow-blow fuse. In 240 volt applications use a 1 amp fuse. Always replace the fuse with one of the correct value. Failure to do so will void the warranty and may present a fire hazard.

6. Slide the plastic guard over the fuse card and reconnect the line cord.

WARNING

VOLTAGES AS HIGH AS 780 VOLTS ARE USED IN THE DGC III. A SAFETY INTERLOCK HAS BEEN PROVIDED TO SHUT OFF THE POWER TO THE GAUGE WHEN THE TOP COVER IS REMOVED. DO NOT DEFEAT THIS INTERLOCK. IF SERVICING IS REQUIRED, HAVE IT DONE BY QUALIFIED PEOPLE.

WARNING

VOLTAGES AS HIGH AS 520 VOLTS MAY BE PRESENT AT THE ION TUBE. WHEN MAKING CONNECTIONS BETWEEN THE DGC III AND AN ION TUBE, ALWAYS TURN THE DGC III OFF. EVEN IF THE ION TUBE FILAMENT IS TURNED OFF, HIGH VOLTAGES ARE STILL PRESENT! IF THE ION TUBE CABLE BECOMES DAMAGED, EITHER REPAIR OR REPLACE THE CABLE TO PREVENT THE POSSIBILITY OF SHOCK.

WARNING

AS WITH ALL ELECTRICAL EQUIPMENT, DO NOT OPERATE THE DGC III WITHOUT A PROPER ELECTRICAL GROUND. DO NOT OPERATE NEAR WATER. THE DGC III IS INTENDED FOR OPERATION IN A LABORATORY ENVIRONMENT. THE UNIT MAY BE DAMAGED AND ITS ELECTRICAL SAFETY REDUCED IF IT IS OPERATED OUTSIDE OF ITS SPECIFICATIONS (SEE SECTION 1.2).

Before making connections to the DGC III, be sure that the controller is turned OFF. To connect an ion tube, plug the 4-pin connector at one end of the cable into the socket on the rear panel labeled GAUGE 1 or GAUGE 2. Refer to Figure 2-4. (If only one ion tube has been installed, the tube should be connected to GAUGE 1.) Connect the BNC connector which comes out of the connector to the mating connector on the rear panel. Connect the other end of the cable to the ion tube. If a wide range tube is being used, be sure to use the correct cable that grounds the outer shield. Connect additional options (if any) by referring to Section 2.2.

The gauge controller is now ready for operation.

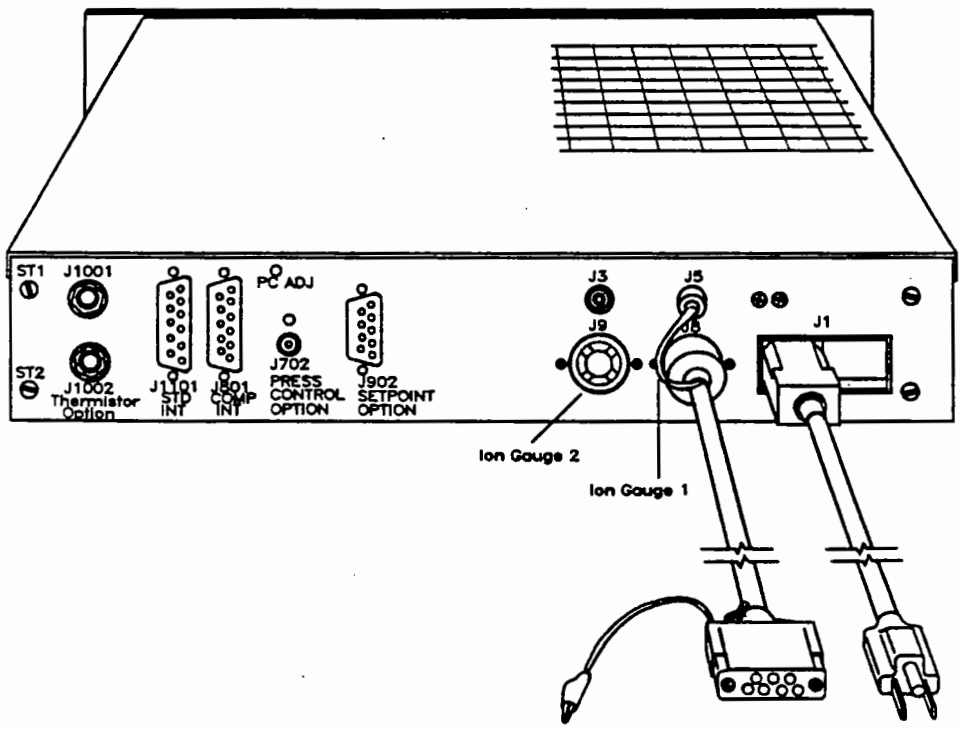


Figure 2-4. DGC III Connections.

2.2 OPTION BOARD INSTALLATION

The DGC III option boards may be installed either at the factory or by the user. If the options have been installed at the factory, this section will be useful for making the proper external electrical connections to the options. If the options are to be installed by the user, the detailed installation instructions in this section should be followed.

USERS MUST READ THIS ENTIRE SECTION BEFORE PROCEEDING WITH THE OPTION INSTALLATION!

Following are installation procedures that apply to all option boards. Refer to Figures 2-1 through 2-3.

1. On the front panel of the DGC III, turn the power switch OFF. Remove all connectors from the rear of the unit.

2. Remove the DGC III from the rack (if applicable).

3. Using a medium size flat blade screwdriver, remove the four screws attaching the top cover of the unit to the chassis. Remove the cover.

4. Loosen the two screws holding the rear panel in place on the left hand side. (The screws are located on the side furthest away from the power connector and are labeled ST1 and ST2 in Figure 2-2.) Loosen the screws as much as possible without actually removing them. This allows easier insertion of the option boards.

CAUTION

ALL OF THE BOARDS USED IN THE DGC III CONTAIN ELECTRONIC COMPONENTS THAT ARE SENSITIVE TO STATIC ELECTRICITY. THESE DEVICES MAY BE DAMAGED OR DESTROYED BY EVEN A SMALL STATIC DISCHARGE. TO AVOID DAMAGING THE BOARDS, THE USER MUST BE GROUNDED TO A SUITABLE ELECTRICAL GROUND BEFORE HANDLING THE BOARDS. AVOID TOUCHING ANY OF THE ELECTRICAL CONTACTS, AND DO NOT RUB THE BOARD AGAINST ANY INSULATOR THAT MAY BUILD UP A STATIC CHARGE.

5. Notice that there are five 86-pin connectors at the rear of the DGC, as shown in Figure 2-3. Each of these connectors is designed to hold a specific option board. The mother board (the main board on which these connectors are mounted) identifies which option occupies a connector. The options, as viewed from the rear of the DGC III from left to right, are the thermistor, BCD, computer interface, pressure control, and setpoint. Refer to Figure 2-3.

6. Install the option board in the proper socket with its electrical components facing the left hand side of the chassis. Place the board over the center of the connector and press down evenly on both ends. Only a moderate amount of force will be required. Install the board carefully so that the mating connector does not get damaged.

7. After the board has been installed, make sure that the electrical contacts on the mother board connector line up with the plated contacts on the option board.

8. Reassemble the DGC III by reversing steps 3 and 4.

This completes the mechanical installation of the option. The following sections give additional information for installing specific option boards.

2.2.1 Setpoint Board Installation (Model 605-0603)

To install the Setpoint Option Board, shown in Figure 2-5, refer to Section 2.2. Electrical connections are made via a 15-pin female subminiature "D" type connector. Table 2-1 lists the electrical contacts and their function.

The setpoint relays are designed for a maximum of 1 amp at 115 V AC inductive or 1 amp at 28 V DC resistive load. These maximum limits should never be exceeded. To increase relay life, run the relays at lower currents.

The relays will be in the NC position, that is C connected to NC, whenever the setpoints are disabled or the pressure is above the setpoint. When the pressure falls below the setpoint, C will switch to the NO contact. For additional operating information, refer to Section 3.3.3.

Table 2-1. Setpoint Board Electrical Connections.

Pin	Function
1	SP1 NO
2	SP1 NC
3	SP2 NO
4	SP2 NC
5	SP3 NO
6	SP3 NC
7	SP4 NO
8	SP4 NC
9	SP1 C
11	SP2 C
13	SP3 C
15	SP4 C

NO = Normally Open
NC = Normally Closed
C = Common
SP = Setpoint

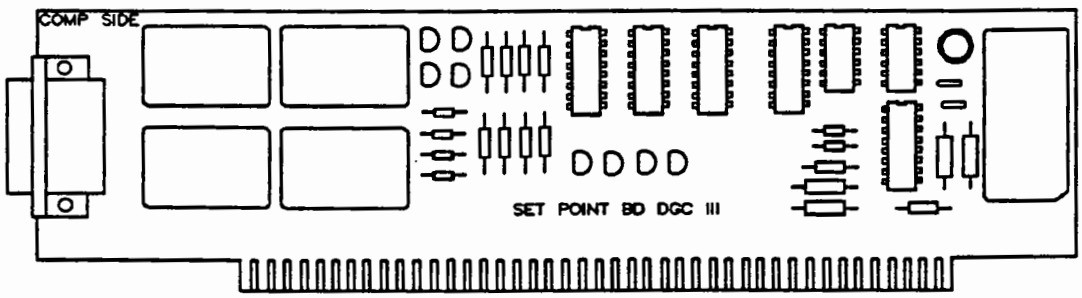


Figure 2-5. Setpoint Board.

2.2.2 Pressure Control Board Installation (Model 605-0608)

Figure 2-6 illustrates the Pressure Control Option Board. This board is installed as described in Section 2.2 except that a cable must be installed between the pressure control board and the power supply board. This provides +180 V to the pressure control board to power the leak valve. Install this cable between J701 on the pressure control board and J601 on the power supply board. The connectors are of the push-on type. Route the cable along the component side of the pressure control board and over to the power supply board.

The pressure control valve is connected to the option board with cable number 809-2001. R720, the potentiometer that can be adjusted from the rear panel, sets the gain of the pressure control electronics. If the gain is too high, the pressure will oscillate about the setpoint. If the gain is too low, it will take a long time to reach the setpoint or to respond to pressure changes in the vacuum system. The tendency to oscillate will be more pronounced at lower pressures in systems with low pumping speeds and when the thermistor tube is used (because of its slow response time). For operating information on the pressure control option, refer to Section 3.3.5.

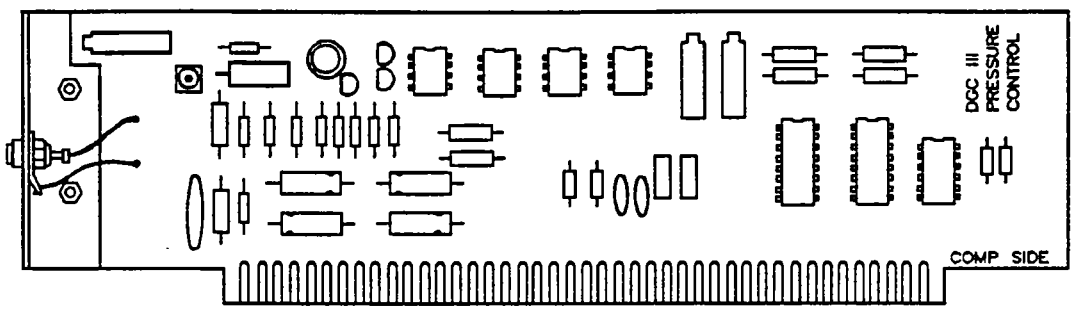


Figure 2-6. Pressure Control Board.

2.2.3 Computer Interface Board Installation (Model 605-0602)

Refer to Section 2.2 for details on installing the Computer Interface Option Board. The computer interface communicates via an RS-232 serial ASCII interface at 300 baud (30 characters per second). Transmission rates other than 300 baud may also be selected. To select a different rate, look at the component side of the computer interface board. Locate the speed selection between U802 and U803. Turn all switches OFF except for the switch corresponding to the desired rate. Available rates are 150, 300, 600, 1200, 2400, 4800, and 9600 baud.

A Read Only Memory (ROM) is provided with this option. It contains all the necessary software to drive the computer interface. This ROM is plugged into U106 of the processor board. Pin 1, identified by a notch or a dot on the ROM, should be installed closest to the top of the board. Be careful not to bend the pins excessively when installing the ROM in the socket. After installation, make sure that all of the pins are properly seated.

Electrical connection is made via a 25-pin male subminiature "D" type connector. The electrical connections are shown in Table 2-2. In normal operation only pins 1, 2, and 3 will be used. If the computer interface is connected to a printer and RX data is not used, pin 3 should be connected to pin 10. The +12 and -12 signals should not be used as a power source since damage to the DGC III may result.

The data format is as follows:

8 data bits
1 stop bit
no parity

RTS is driven true when data is transmitted. CTS is normally ignored. CTS can be enabled by moving jumper J802 on the option. If this is done, the DGC III will only transmit when CTS is true. By holding CTS false, it is possible to overflow the DGC's transmit buffer if a second block of data is sent. Therefore, CTS should only be false for short periods of time (such as 100 m sec or less). DCD is ignored by the DGC III.

Any character which is transmitted to the DGC III is echoed back. This permits the host computer to verify that the data was received properly. A command should not be sent to the DGC III until the output generated by a previous command has been sent; otherwise, data may be sent to the DGC III at any time since the input is buffered.

All commands must be terminated with a carriage return (CR) character. A line feed character (LF) will be echoed in addition to the CR. If the input buffer overflows, a question mark (?) will be echoed and the buffer will be cleared.

Table 2-2. Computer Interface Connections.

Pin	Function
1	Signal ground
2	TX data
3	RX data
4	RTS
5	CTS
7	Ground
8	DCD
9	+12
10	-12

For operating information on the computer interface, refer to Section 3.3.6.

2.2.4 BCD Interface Board Installation (Model 605-0604)

Refer to Section 2.2 for instructions on installing the BCD Interface Option Board, which is illustrated in Figure 2-7. An additional internal cable must be installed between the BCD board and the display board. To install this jumper cable, follow these steps:

1. Remove the display board (the one closest to the front panel) by pulling up on it at the corners. Refer to Figure 2-8. Do not completely remove the board since there are other electrical connections to this board.

2. Locate the two 16-pin connectors on the right side of the board, as shown in Figure 2-8. The keyboard will be connected to the leftmost connector, J202, with a ribbon cable similar to the one that is to be installed.

3. Install the ribbon cable in J203 so that the small arrow is on top and the cable extends out from the right of the connector. Be careful not to bend any of the pins while inserting the connector. Make sure all 16 pins have mated with the socket and that the connector is properly seated.

4. In a similar manner, install the other end of the cable in J203 of the BCD board. The small arrow should be on top with the cable coming out of the left hand side of the connector. It will be necessary to fold the cable as it comes out of the connector to direct it towards the front of the chassis.

5. Carefully reinstall the display board. Feed the ribbon cables around the keyboard, ensuring that they do not hang up on anything.

6. Plug the BCD board into the mother board.

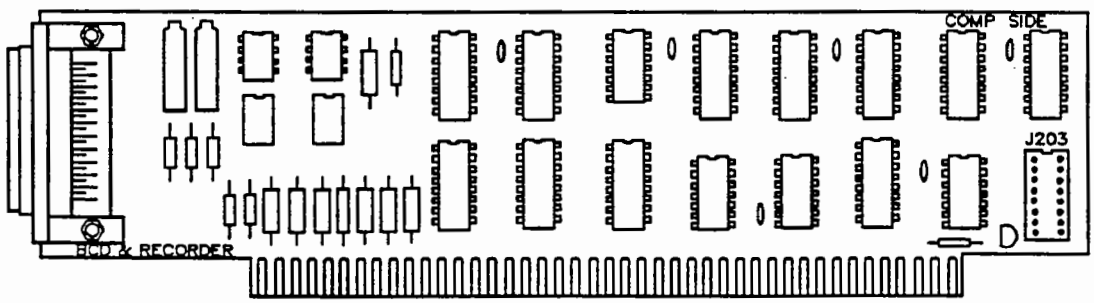


Figure 2-7. BCD Interface Board.

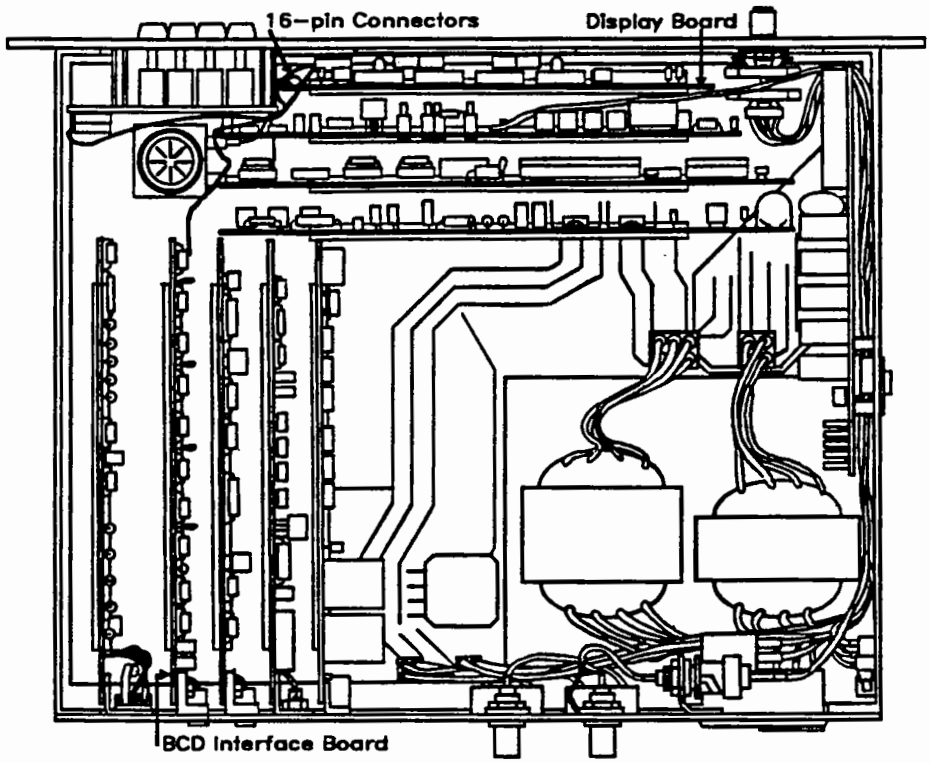


Figure 2-8. BCD Interface Installation.

The digital outputs are from standard "B" series CMOS devices. These devices are capable of driving two low power TTL loads, one low power Schottky TTL load, or two HTL loads. In addition, the devices can drive a standard CMOS operating at 5 volts. For additional interfacing information, consult the data books on the various logic families.

The input signals are CMOS inputs pulled to +5 volts through a 10K ohm resistor. These inputs may be driven by 5 volt CMOS or TTL circuits. An alternate means of driving the inputs is to ground them through a relay or a push button. The analog outputs are buffered by 741 type op-amps. The input impedance of any device connected to these outputs should not be less than 1000 ohms to insure maximum accuracy. Table 2-3 lists the electrical connections and their functions.

Table 2-3. BCD Interface Connections.

Pin	Function
1	Signal ground
3	Mantissa analog output
4	Exponent analog output
11	Filament ON input
20	Filament OFF input
16	Gauge 1 ON
19	Gauge 2 ON
18	Filament ON
17	Display multiplier ON
14	BCD1-1
6	BCD1-2
2	BCD1-4
15	BCD1-8
7	BCD2-1
9	BCD2-2
5	BCD2-4
8	BCD2-8
21	BCD3-SIGN
22	BCD3-1
13	BCD4-1
25	BCD4-2
12	BCD4-4
10	BCD4-8
23	DATA VALID FALSE
24	DATA VALID TRUE

The BCD data should be latched on the falling edge of DATA VALID FALSE or the rising edge of DATA VALID TRUE. Gauge 1, gauge 2, filament status, and the display multiplier may be sampled at any time. Note that if gauge 1 and gauge 2 are false for more than 1 second, the DGC III is not reading pressure but is in a mode such as setpoint setting. The input signals may be strobed at any time. If the filament is on and a "filament on" command is issued, there will be no change. This eliminates the need for contact debounce on these inputs.

The mantissa analog output will range between 0 volts (corresponding to a display of 0.0) and 0.099 volts (corresponding to a display 9.9). The exponent will range between 0 volts (corresponding to an exponent of -11) and 1.3 volts (corresponding to an exponent of +2). A pseudo-log output may be generated by summing the two outputs. This is done by adding a 100 K 1% resistor at R1116.

The summed output is then taken from the exponent analog output. When this is done, the voltage will range from 0.010 at 1.0×10^{-11} Torr to 1.399 at 9.9×10^{2} Torr. For example, 2.7×10^{-6} Torr would be 0.527 volts and 7.1×10^{-5} Torr would be 0.671 volts.

The output gain may be changed by altering the feedback resistors on U1114 and U1116. Calculate the new value of the mantissa output resistor, R1110, using the formula:

$$R = G \times 1000$$

where R is the resistance in ohms and G is the gain. A gain of 5, for example, would produce a full scale voltage of 0.099 x 5 or 0.495 volts.

Similarly, the gain of the exponent resistor, R1120, may be changed by applying the formula:

$$R = G \times 10{,}000$$

For example, a value of 20,000 ohms would produce a voltage of 1.342 volts at 7.1×10^{-5} Torr if the outputs are summed. The gain values should be selected so that output voltage never exceeds 10 volts, otherwise inaccurate readings may result.

These modifications should only be performed by a qualified electronic technician.

NOTE

The maximum voltage from the pseudo-log output is 9 volts.

Calibration of BCD Pseudo Log (100 mV/dec only)

1. Remove the setpoint board during calibration.
2. Place a DVM on pin 6 of U1113. (Use pin 1 on the BCD board for ground.)
3. Set the display to 0.0 x 10^{-1} by pressing the **SETPOINT** key and the 1 key.
4. Adjust R1112 for 0.00 MV on the meter.
5. Place the meter on pin 6 of U1115.
6. Set the display to read 1.0 x 10^{-11} by pressing and holding the **DOWN** arrow key.
7. Adjust R1118 for 0.00 MV on the meter.
8. Place the DVM between pin 1 and pin 4 of BCD connector. Adjust R1112 for 10.0 mV,
9. Set the display to 9.9 x 10^{+2}. The meter reading should be 1.399 V + /-20 mV.
10. Set the display to 0.0 x 10^{-1} by pressing the **SETPOINT** key twice. Then press the 2 key. The meter should read 1.00 V + /-20 mV.
11. Reinstall the setpoint board.

2.2.5 Thermistor Option Installation (Model 605-0601)

Install the Thermistor Option Board by following the procedures in Section 2.2. There are two electrical connectors for the two possible thermistor tubes. Gauge 1 is the connector on top and gauge 2 is below, as shown in Figure 2-9. Either one of two thermistors may be connected to the board. A cable, Model 605-0120, is used to connect the DGC III to the thermistor, Model 605-7675. It is recommended that both the thermistor and the cable be ordered from Perkin-Elmer. The cable contains temperature compensation circuitry that has been matched to the thermistor tube's characteristics. For operating information, refer to Section 3.3.1.

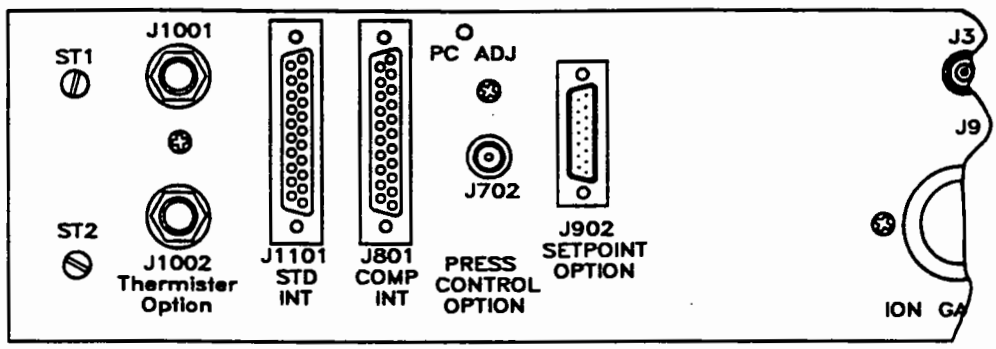


Figure 2-9. Thermistor Option Connectors.

SECTION III
OPERATION

3.0 GENERAL INFORMATION

This section describes the function of the various controls and indicators on the DGC III and outlines operating procedures. Read this entire section before operating the DGC III.

NOTE

The pressure is measured in Torr (nitrogen). The gauge automatically selects the emission current multiplier. The emission will either be x 1, x 0.1, or x 0.01 of the maximum emission.

3.1 CONTROLS AND INDICATORS

Refer to Figure 3-1.

POWER KNOB. Turns ON power to the gauge and selects the type of ion gauge in use. The knob selects the following tube parameters:

Tube Type	Cutoff Pressure	Emission (Max.)
UHV	9.9 X 10^{-3}	4 mA
STD	9.9 X 10^{-3}	10 mA
EXT	9.9 X 10^{-2}	10 mA

ZERO. Zeroes the thermistor gauges. The ion gauges are zeroed automatically.

KEYPAD. Used to command the gauge. Keypad functions are shown below.

SETPOINT. Commands the gauge to set either a setpoint or the pressure control. After the SETPOINT key is pressed, the 1, 2, 3, 4, PRES CNTL, or LEAK DET key must be pressed to determine which function will be set.

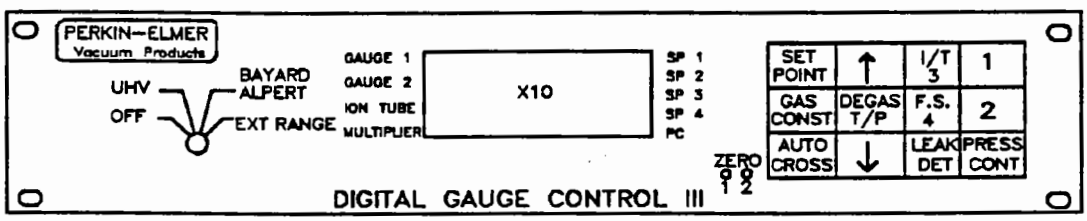


Figure 3-1. DGC III Front Panel.

UP & DOWN. These arrow keys are used for setting a setpoint or the pressure control. After the second key in a setpoint set operation has been pressed, the current value of the setpoint (1, 2, 3, 4, PC, emission) will be displayed. Pressing the **UP** key will increase the value while pressing the **DOWN** key will decrease the value. Pressing the **UP** or **DOWN** key momentarily will change the reading by 0.1 units. A larger change may be accomplished by holding the key down longer. After the key has been held down long enough to change the reading ten times, the increment will change to 1.0 units. Pressing any key other than the **UP** or **DOWN** key will lock in the change and return the DGC III to normal operation. When a key is pressed to lock in the setpoint, the function normally assigned to that key will not be executed. The **UP** and **DOWN** keys are also used for adjusting the gas correction constant.

I/T (Ion/Thermistor). This key alternates between the ion gauge tubes (1 or 2) and the appropriate thermistor tube. If the gauge is monitoring ion gauge 2 when **I/T** is pressed, the gauge will switch to thermistor gauge 2. This key also selects setpoint #3 when the gauge is in the setpoint mode.

1 & 2. These keys are used to select which gauge tube (thermistor or ion) the gauge is to monitor. For example, if the DGC III is monitoring thermistor gauge #1 when **2** is pressed, the DGC III will switch to thermistor gauge #2. These keys are also used to select setpoints 1 and 2 while in the setpoint set mode.

AUTO CROSS. This key enables the gauge to automatically switch between the ion tube and the thermistor tube. If the pressure rises above the maximum pressure for the ion tube in use, the gauge will automatically switch to the thermistor tube as if the operator had pressed the **I/T** key. Likewise, as the pressure drops below 1×10^{-2}, the gauge will select the ion tube. The tube number (1 or 2) will not change. Pressing **AUTO CROSS** a second time will turn the function off. **AUTO CROSS** is ON if the GAUGE 1 or GAUGE 2 LED on the display is flashing.

PRES CNTL. The pressure control option is activated with this key. When pressure control is turned ON, the DGC III will adjust the piezoelectric valve to maintain the vacuum system at a selected pressure. The pressure control is turned OFF (and the valve forced closed) by pressing **PRES CNTL** a second time. This key is also used to set the pressure control setpoint while in the setpoint set mode.

GAS CONST. The sensitivity of the ion and thermistor gauge tube changes as a function of the type or types of gases in the vacuum system. A gas correction factor is entered into the gauge by pressing **GAS CONST.** The mass number of the selected gas is then displayed and can be adjusted with the **UP** and **DOWN** arrow keys. Valid mass numbers are 2 (hydrogen), 4 (helium), 16 (methane), 18 (water), 28 (nitrogen or air), 40 (argon), and 99 (xenon). The selected gas is locked in by pressing any key other than **UP** or **DOWN**. When a gas constant other than nitrogen (28) is selected, the multiplier LED will light.

T/P (Torr/Pascal). This key selects Torr or Pascal as the unit of display. While the gauge is in the set gas constant mode (see above), pressing the **T/P** key will alternate between Torr and Pascal. The display will show an "A" for Pascal or "C" for Torr. Whenever Pascal is selected, the MULTIPLIER LED will be lit.

DEGAS. Pressing the **DEGAS** key initiates a timed degas of the ion tube that is operating. The display will count up to 9.9, then shut off the degas power. A "d" will be displayed to inform the operator that the DGC III is in the degas mode. The degas may be shut OFF before the end of the cycle by pressing the key again. The cycle will also be aborted if the emission current falls out of regulation. The degas command will be rejected if an ion tube is not turned ON or if the pressure is too high.

F.S. (Foreline Sentry). The Foreline Sentry function is turned on by pressing **F.S.** Its operation may be verified by observing the display. The display will flash "FS" every five seconds. To turn the foreline sentry OFF, press the **F.S.** key again.

LEAK DET. This key turns the leak detector function ON and OFF. It is also used in conjunction with the **SETPOINT** key to control the emission mode.

3.2 OPERATING PROCEDURES

3.2.1 Ionization Gauge Pressure Measurement

1. Turn ON the DGC III by rotating the gauge selection knob to the type of ion gauge that has been connected to the DGC III. When the DGC comes on, it will be set to thermistor #1 (this mode is equivalent to ion tube off), and the display multiplier will be set for nitrogen and Torr.

2. To turn ion gauge #1 on, press the I/T key. The ION TUBE lamp will light.

3. After auto-ranging has been completed, the display will show the pressure in Torr corrected for nitrogen (air). Note that if the DGC III cannot obtain sufficient emission to run the tube, or if it senses a pressure that is too high, it will shut down the gauge tube and return to the thermistor. When this occurs, 10 rapid beeps will sound.

4. If a second ion tube has been installed, it may be selected by pressing the 2 key. The DGC III will turn off tube #1, switch to tube #2 and auto-range again. Pressing the 1 key will return the DGC III to tube #1.

5. The ion tube is shut OFF by pressing I/T to switch to the thermistor tube. If the thermistor option has not been installed, the display reading will be meaningless.

3.2.2 Degassing the Ion Tube

The DGC III uses Electron Bombardment (EB) degas. Electrons from the tube filament are accelerated toward the grid. The kinetic energy of the electrons is converted to thermal energy when they strike the grid. This effect also occurs during normal tube operation, but with much lower power levels. During degas the power is 460 volts x 0.120 amps, which is equal to 55 watts. During normal tube operation the maximum power is 180 volts x 0.010 amps, which equals 1.8 watts. Before a tube can be degassed, the pressure in the tube must be low enough so that the tube is not damaged. The DGC III will not permit a tube to be degassed if the pressure is 1×10^{-5} or higher. After degas has started, the DGC III will stop the degas if it is unable to maintain the degas emission current. This may be due to an old filament, a poor connection or insufficient vacuum inside the tube.

To degas a tube, follow these steps:

1. Select the tube to be degassed and allow the controller to auto-range. (Note: A thermistor cannot be degassed.)

2. Press the **DEGAS** key. The gauge will display a lower case "d" in the exponent. The mantissa will count from 0.0 to 9.9.

3. When the count reaches 9.9, which will occur in about 6 minutes, the degas will shut OFF and the DGC III will return to the status it was in before **DEGAS** was pressed. An alarm (10 short beeps in a row) will sound if:

- degas cannot be entered after **DEGAS** was pressed because the pressure was too high or an ion tube was selected.
- emission was lost during the degas cycle.
- another key is pressed while the degas cycle is running.
- the degas cycle finished normally.

3.2.3 Display Multiplier

The ionization tube and the thermistor tube have different sensitivities for different gases. When the gauge is first turned ON, a correction constant for nitrogen (or air) is used. (This correction constant is 1.00 since the tubes are calibrated to air.) If a gas other than air is the predominant gas in the system, it is possible to alter the correction constant for that gas. A list of correction constants available on the DGC III is given in Table 3-1.

To change the gas constant, use the following procedure:

1. Press the **GAS CONST** key. The mass number of the selected gas will be displayed along with a "C" or an "A".

2. To change the gas constant, press either the **UP** or **DOWN** arrow key. The mass number will run up and down through the range of available gases. When the desired gas appears, press **GAS CONST** again to lock in the setting. After the setting is locked in, the DGC III will return to the state it was in before **GAS CONST** was first pressed.

Table 3-1. Gas Correction Constants.

Mass	Gas	Ion	Mult. Factor Thermistor
2	hydrogen	1.830	0.769
4	helium	6.040	1.000
16	methane	0.700	0.625
18	water	0.800	0.833
28	nitrogen (air)	1.000	1.000
40	argon	0.713	1.670
99	xenon	0.326	3.120

NOTE

The correction constant for oxygen is the same as that of nitrogen, 1.00. Therefore, if oxygen is the predominant gas in the system, set the gas correction constant to mass 28.

While in the set gas constant mode, it is also possible to change the display units from Torr to Pascal (Torr reading x 133 = Pascal). To do this, press the **T/P** (Torr/Pascal) key. The display will alternate between "C" for Torr and "A" for Pascal every time **T/P** is pressed. Lock in the desired setting by pressing **GAS CONST** a second time.

Whenever the display unit is Pascal or a correction constant other than nitrogen (mass 28) is in effect, the MULTIPLIER LED will be lit. This is a warning to the operator that the display is being modified and the operator should be aware of the modification. To check the correction constant and the display units, simply press the **GAS CONST** key, observe the status and press the **GAS CONST** key again.

3.2.4 Leak Detector

The leak detector is based on the principle that the ionization and thermistor tubes have different sensitivities for different species of gas. A leak generally consists of air entering the system. The gauge will be displaying the pressure within the vacuum system which will consist mostly of air plus some background gases. If the leak site is probed with a gas, such as helium, the probe gas will replace air as the major gas in the system. The gas will be different but the pressure will be the same. Since the ion tube has 1/6 the sensitivity for helium that it has for air, the displayed pressure reading will drop. This assumes that the pumping speed for helium is the same as that of air; however, this is usually not the case. This means that other system characteristics, such as pumping speed, must be considered when selecting a probe gas. A little experimentation on the system with a controlled leak may be helpful. The leak detector sensitivity cannot be generalized.

To operate the leak detector, use the following procedure:

1. Allow the system pressure to stabilize.

2. Press the **LEAK DET** key. The DGC III will sample the system pressure and refer to this value as the base pressure. The letters "ld" will be displayed in the exponent to indicate that the gauge is in the leak detector mode. The mantissa will display the absolute value of the difference in pressure between the base value and the current value mulltiplied by 10 (using the exponent from the base value as the reference). The larger this reading becomes, the more often the beeper will sound.

3. Probe the suspect area of the vacuum system while observing the audio and/or visual indicators. If an increase in the indication is noticed, the leak may have been located. Remove the probe gas, check if there is a decrease in the reading, and repeat the procedure.

4. To exit the leak detector mode press the **LEAK DET** key a second time. It may be necessary to hold the key down for a few seconds until the leak detector finishes beeping. Note that as the system pressure drifts, this will have the effect of increasing the reading. It may be necessary to exit and then re-enter the leak checking mode to re-establish a new value for the base pressure. To do this simply press the **LEAK DET** key twice.

3.2.5 Emission Current Control

The DGC III's microprocessor automatically selects the emission current for a particular pressure. The maximum emission current is either 4 mA for a nude tube or 10 mA for a glass tube. As the pressure increases, it is necessary to reduce the emission current to keep the gauge tube in a linear range. The basic emission current is multiplied by 1.0, 0.1, or 0.01, depending on the pressure, to arrive at the actual emission current.

If automatic emission control is not desired, it can be fixed using computer interface commands or the keyboard. To use the keyboard press the **SETPOINT** key and then the **LEAK DET** key. The display will read "0.0 x 10 -E" and can be adjusted using the **UP** and **DOWN** arrows. Table 3-2 lists the various possible values and the emission modes. 0.0 is the full automatic mode, 0.1 fixes it at x 0.01, 0.2 fixes it at x 0.1 at 10^{-5} Torr and lower and 0.3 fixes it at x 1.0 at 10^{-7} Torr and lower. The value may be locked in by pressing **SETPOINT** a second time.

Depending on the mode, the actual emission current can be determined from Table 3-3 as follows:

1. Set the DGC III to Torr, mass 28. The multiplier light will be off.

2. Determine whether the pressure is rising or falling. As the pressure is falling, the emission current change will occur at 6.9 in a given decade. For example, if the pressure is falling and the emission is x 0.01, the emission will change to x 0.1 at 6.9×10^{-7}.

3. If the pressure is rising, it will switch to the next lower emission at 1.0 in the given decade. For example, if the emission is x 0.01 and the pressure is rising from 5.0×10^{-7}, the emission will switch to x 0.01 at 1.0×10^{-4}. When the pressure is rising, the emission will never increase.

The automatic emission selection provides hysteresis to prevent emission change oscillations.

Table 3-2. Emission Control Modes.

Display	Computer Interface Cmd	Mode	Glass Tube Current	Nude Tube Current
0.0	MA	automatic	max = 10 mA	max = 4 mA
0.1	ML	x 0.01	0.1 mA	0.04 mA
0.2	MM	x 0.1	1 mA below 10^{-4}	0.4 below 10^{-4}
0.3	MH	x 1.0	10 mA below 10^{-6}	4.0 mA below 10^{-6}

Table 3-3. Emission Modes.

	AUTOMATIC		FIXED		
Pressure	Falling	Rising	x 0.01	x 0.1	x 1.0
10^{-2}	0.01	0.01	0.01	0.01	0.01
10^{-3}	0.01	0.01	0.01	0.01	0.01
10^{-4}	0.01	0.01	0.01	0.01	0.01
10^{-5}	0.01	0.1	0.01	0.1	0.1
10^{-6}	0.01	0.1	0.01	0.1	0.1
10^{-7}	0.1	1.0	0.01	0.1	1.0
10^{-8}	0.1	1.0	0.01	0.1	1.0
10^{-9}	1.0	1.0	0.01	0.1	1.0
10^{-10}	1.0	1.0	*	0.1	1.0
10^{-11}	1.0	1.0	*	*	1.0

* Pressure reading may be inaccurate due to insufficient electrometer current.

3.3 OPTIONS OPERATING PROCEDURES

3.3.1 Thermistor Option

The thermistor option permits the measurement of pressures from 1 x 10^{-3} to 9.9 x 10^{-1} Torr. Either one of the two separate thermistor tubes may be used. The Thermistor Option Board, Model 605-0601, must be installed in order to use the thermistor option.

The thermistors operate whenever the DGC III is first turned on. Selection between the ion and thermistor tubes is made with the I/T key. Refer to Section 3.1 for additional information. Since the thermistors must warm up before a reading can be taken, allow a warm-up period of five minutes after the DGC III is turned ON. The two thermistors are selected with the 1 and 2 keys.

To zero a thermistor tube, pump the tube to below 5 x 10^{-4} Torr. Select the correct thermistor for display. Use a small screwdriver to adjust either ZERO 1 or ZERO 2, whichever is applicable; turn the control counterclockwise until the display indicates a zero reading. Then turn the adjustment clockwise until 1.0 x 10^{-3} appears on the display. Turn the adjustment counterclockwise just enough so that 0.0 x 10^{-3} appears again. The thermistor is now zeroed. It may be necessary to check the thermistor zero from time to time as the system environment changes.

NOTE

Since thermistors are temperature sensitive devices, greater thermistor stability will be obtained if the thermistors are shielded from drafts and their temperature is held relatively constant.

3.3.2 Auto Cross

Auto cross enables the DGC III to automatically switch between the thermistor and ion gauge tubes as the pressure rises and falls. The thermistor option must be installed in order to use this feature. If the wide range tube is operating and the auto cross is activated, the DGC III will switch to the thermistor when the pressure rises above 9.9 x 10^{-2} Torr (1.3 Pa). The switchover point for the standard and nude tubes is 9.9 x 10^{-3} Torr (1.3 Pa). When the switchover occurs, the gauge number (1 or 2) will not change. For this reason if the use of the auto cross function is anticipated, it is recommended that thermistor 1 and ion gauge 1 be placed close together and that thermistor 2 and ion gauge 2 be placed close together. When the pressure drops below 1.0 x 10^{-2} Torr (1.3 Pa), the DGC III will switch to the ion tube.

Auto cross is activated by pressing the AUTO CROSS key. If the GAUGE 1 or GAUGE 2 LED is flashing, the feature has been activated. The auto cross feature is deactivated by pressing the AUTO CROSS key a second time.

Auto cross will only work on rising pressures if the pressure rise is slow enough to be recognized by the electronics. For this reason, Auto cross should not be used as a substitute for turning the ion gauge OFF manually before venting the system. It is also recommended that the "Bayard Alpert" front panel switch position be used for wide range gauge tubes since a thermistor will give better readings above 2 x 10^{-2} Torr.

3.3.3 Set Point Option

Four digital setpoints are available when the Setpoint Option Board has been installed. All four setpoints are continuously compared against the displayed pressure value. If the display value is less than the setpoint, the appropriate setpoint relay is energized, and the status lamp on the front panel is lit. If the pressure is higher than the setpoint, the setpoint is not active; if there is an overflow condition (the pressure is too high for the DGC III), the setpoint is turned off.

The setpoint board contains a CMOS memory circuit and rechargeable battery to maintain the value of the setpoints when the gauge is turned off. The battery will power the memory circuits for at least two weeks when fully charged. The battery is charging whenever the DGC III is ON. It takes about 48 hours to completely charge a dead battery. The charging circuit is automatic so there is no danger of over charging the battery. The battery is of a special long life design and should not require replacement.

The setpoints are initially set to 0.0 x 10^{-1}. The setpoints will also revert back to this value should the battery become discharged. The mantissa of 0.0 indicates that the setpoint value is invalid and prevents the relay from energizing regardless of the display value. Once adjusted, the setpoints cannot be returned to this value unless the battery discharges.

To adjust a setpoint, press the **SET POINT** key. This will take the DGC III out of the operating mode and place it into the setpoint set mode. If an ion tube is on at the time, it will be shut off. Foreline sentry operation will be temporarily suspended, the pressure control valve closed and the setpoint relay status frozen. The particular setpoint is then selected by pressing the **1, 2, 3, or 4** key. The DGC III will display the value of the setpoint, and the selected setpoint LED will light to indicate which setpoint is being examined or modified. To adjust the setpoint, press either the **UP** arrow or the **DOWN** arrow key to raise or lower the value. The value will initially change by 0.1 units every half second. After ten continuous value changes, the increment will change to 1.0 units. To lock the value of the setpoint in, press the **SET POINT** key.

To simply examine a setpoint without changing its value, press the **SET POINT** key, enter the setpoint number, read the value, and press **SET POINT** again. The DGC III will return to the operating condition it was in before the setpoint mode was entered.

NOTE

The setpoint values are always compared with the pressure value that is shown on the display except when foreline sentry is activated (see Section 3.3.4). This is true regardless of whether the ion or thermistor gauge tubes are in use. Also keep in mind that if a multiplication constant is applied to the display (see Section 3.2.3), this will effectively alter the absolute value of the setpoints since the constant applies only to the display and not to the setpoints.

3.3.4 Foreline Sentry Option

The Foreline Sentry Option allows users to protect their vacuum systems from a backing pump failure. Foreline sentry functions when setpoint 1 is dedicated to thermistor 1. The thermistor is typically located in the foreline to the high vacuum pump. If the backing pump fails, the pressure in the foreline will rise above setpoint 1 and shut the setpoint off. The setpoint may be wired to shut the pump off and close the vacuum pump isolation valve to protect the system. In order to use the foreline sentry feature, both the thermistor and setpoint options must be installed.

When the foreline sentry option is in operation, setpoint number 1 is dedicated to thermistor number 1. The three other setpoints behave as they normally would, comparing against the display (refer to Section 3.1). Approximately every five seconds, the DGC III pauses from whatever it is doing in the normal operating mode, samples the thermistor, sets or resets setpoint 1 as appropriate, and then returns to normal gauge operation. When the DGC III is sampling the thermistor, the display will show "FS" in the mantissa. The sample period is only about half a second. Foreline sentry will not affect the operation of the pressure control or similar functions, but it can only be used while the DGC III is operating (i.e., not in the setpoint set mode). Thermistor 1 can be examined anytime, whether the foreline sentry is operating or not.

The foreline sentry feature is activated by pressing the **F.S.** key. The "FS" symbol will flash on the display approximately every five seconds to show that the feature has been activated. The first time that this occurs, setpoint number 1 will set or reset as appropriate for foreline sentry operation. The feature is turned off by pressing **F.S.** a second time. Within a few seconds, setpoint 1 will return to normal operation.

3.3.5 Pressure Control Option

The Pressure Control Option allows the DGC III to maintain a preselected pressure in a vacuum system. A leak valve, Model 809-2000, is plumbed into the system and is electrically connected to the DGC III.

To adjust a pressure control setpoint, press the **SET POINT** key. This will take the DGC III out of the operating mode and place it in the setpoint mode. If an ion tube is on at the same time, it will be shut off. Foreline sentry operation will be temporarily suspended, the pressure control valve closed, and the setpoint relay status frozen. The particular setpoint is then selected by pressing the **PRESS CONT** key. The DGC III will display the value of the selected setpoint that is being examined or modified. Adjust the value by pressing the **UP** or **DOWN** arrow key to raise or lower the value. Once the desired value is reached, press **SET POINT** again to lock in the value.

The pressure control is activated by pressing the **PRESS CONT** key. The PC LED will light to show that the pressure control is operating. The feature is shut off by pressing **PRESS CONT** a second time. Once the function is turned off, the leak valve will close rapidly, generally within 10 milliseconds. The valve is of the fail-safe type. If there is an electrical failure or an open connection to the valve, the valve will close.

When the pressure control is first activated, it must open a certain distance before any gas is admitted to the system. This may take up to one minute, depending on the setpoint and the vacuum system. The pressure control will go into a special mode which will open the valve faster if the system pressure control setpoint is in the 10^{-5} Torr range or less (10^{-3} Pa) and the pressure control setpoint is in the 10^{-3} Torr (0.1 Pa) range or higher. This will considerably reduce the time necessary to open the valve.

The gain of the pressure control system is adjusted by R720 on the rear panel of the DGC III. If the gain is too low, it will take the DGC III a long time to respond to changes in the pressure of the system. If the gain is too high, the pressure will oscillate with large excursions above and below the setpoint. It is generally a good idea to adjust R720 for optimum performance whenever the DGC III is installed on a vacuum system. This is best done by running the pressure control system and adjusting R720 with a small flathead screwdriver for minimum response time without oscillations.

The minimum pressure that can be maintained will depend on a number of factors including the pumping speed of the vacuum pump, the volume of the chamber, and the location of the pump, valve, and vacuum sensor within the system. In general, the best pressure control performance will be obtained when the pumping speed is greater than 60/sec, the pressure control point is above 1×10^{-4} Torr (1.3×10^{-2} Pa), and an ion tube is used as the sensing element.

The leak valve is not bakeable. The operating and storage temperature range is +10 to + 60 C. Certain reactive gases should not be used since the valve contains some organic materials including viton. The maximum input pressure to the leak valve is 5 psi. For more information on the valve, refer to the instruction sheet that is supplied with the valve.

3.3.6 Computer Interface Option

The Computer Interface Option is a multipurpose device. It can be used as an automatic log generator when connected to a printer, for remote control of the DGC III over long distances and telephone lines (when used with modems), and for computer control of the DGC III. All keyboard functions, except for the display multiplier and the leak detector, may be controlled from the computer interface.

The computer interface communicates via an industry standard RS-232 serial interface using ASCII characters. The host device should be fully buffered on its input to prevent the loss of data from the DGC III. Upon power-up, the DGC III will enter the autolog mode until a command is received. When this occurs, the autolog function is turned off until the DGC III is turned off and then on again, or an autolog on command is issued.

The DGC III computer interface commands fall into several categories: set setpoint, read information, change mode, and autolog commands. The setpoint setting command is in the format

NMMM (+, -, 1)E (carriage return)

where N is the setpoint number 1 through 4 or P for the pressure control setpoint, MM is the mantissa missing the decimal point between the two digits, (+, -, 1) indicates the selection of sign for the exponent or 1 for -10 or -11 (the - is assumed when a 1 is entered), and E is the last digit of the exponent (0-9).

Logging control commands control the autolog feature. Initially the DGC III is set to generate a RS (read status) output every five minutes with exception reporting enabled. With the exception reporting enabled, an RS output will be generated whenever a status change occurs as defined by a change of one or more of bits 0 through 7 in Table 3-4 or a change in a setpoint. The date and time is initialized to zero when the DGC III is turned on. Autolog is shut off whenever a non-logging command is entered. This is to prevent unrequested output when the option is used as a computer interface. The autolog commands are in the format of LNX, where N is a number from 1 through 6 to specify the command and X is data which may be required depending on the command. The logging commands are summarized in Table 3-4. Mode changing commands are in the format of MN where N is a number from 1 through 6 which specifies the command.

Table 3-4. DGC III Status Bits.

Bit	True Condition If Bit Is 1 (Opposite If 0)
0	Over-range
1	Degas ON
2	Tube number 2 ON
3	Ion tube ON
4	No meaning
5	No meaning
6	Leak detector ON
7	Auto cross ON
8-12	Always 0
9	Keyboard disabled
13	Foreline Sentry enabled
14	In standby mode
15	Pressure control ON

Table 3-5. Computer Interface Commands.

Format	Command
1MM(+,-,1)E	Set Setpoint 1
2MM(+,-,1)E	Set Setpoint 2
3MM(+,-,1)E	Set Setpoint 3
4MM(+,-,1)E	Set Setpoint 4
PMM(+,-,1)E	Set pressure control setpoint
R1	Read setpoint 1
R2	Read setpoint 2
R3	Read setpoint 3
R4	Read setpoint 4
RP	Read pressure control setpoint
RS	Read gauge status and pressure
M1	Go to gauge 1
M2	Go to gauge 2
M3	Alternate between thermistor and ion tubes
M4	Degas
M5	Turn auto cross ON/OFF
M6	Turn pressure control ON/OFF
M7	Foreline sentry ON/OFF
M8	Keyboard ON/OFF
L1	Logging off
L2TT	Set logging timer (TT=01-99 minutes)
L3	Enable timed reporting
L4	Enable exception reporting
L5	Enable both timed and exception reporting (autolog)
L6DDHHMMSS	Set day (DD=00-99) and time (HHMMSS=000000-235959)
MA	Automatic emission mode
ML	X0.01 emission mode
MM	X0.1 emission mode
MH	X1.0 emission mode

The read command is in the format of RX where X is 1 through 4 to read the value of the setpoints of P for the pressure control setpoint and S for the gauge status.

The output format for the setpoints is X.X(+,-)EYY where X.X is the mantissa as would be read on the front panel, (+,-) is the sign of the exponent and YY is the value of the exponent.

The gauge status is in the format:

DDHH:MM:X.X(+,-)EYY(GGU)FFFFP

where DD is the day (00-99), HH:MM:SS is the time of day with a 24-hour clock, X.X(+,-)EYY is the front panel pressure reading as described above, GG is the mass number of the correction constant (see Section 3.1) and U is either T for Torr or P for Pascal units of display, FFFF is the gauge status and P is the status of the process control setpoints.

To interpret the gauge status, FFFF, each digit (which is hexadecimal - base 16) must be converted to binary at which point each binary bit may be analyzed to determine the gauge status. Table 3-6 lists the hexadecimal digits and their binary equivalents.

Table 3-6. Hexadecimal Numbers and Their Binary Equivalents.

Hex	Binary	Hex	Binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

The four hex digits are thus converted to 16 binary digits. The binary digits are numbered from left to right starting with 0. The meaning of each bit is given in Table 3-4. For example, the status code for ion tube on, auto cross on and the foreline sentry enabled is 1104.

The process control setpoints are interpreted in a similar fashion except that only one hex digit is used. Table 3-7 indicates the various setpoints. If an invalid command is entered, the DGC III will respond with a question mark (?). If a command is entered that requires a response, the response will be printed, otherwise an asterisk (*) will be output to indicate that the command was executed.

Table 3-7. Setpoint Status Bits.

Bit	Setpoint
0	4
1	3
2	2
3	1

3.3.7 BCD Interface Option

The Standard Interface Option consists of three main sections: a BCD output, remote filament on/off, and analog outputs.

The BCD outputs can be used for several purposes. If they are being considered for interfacing the DGC III to a computer, the computer interface option (see Section 3.3.6) should be considered first. The BCD outputs contain the Binary Coded Decimal equivalents of the displayed value on the front panel as well as gauge number, filament status and the display multiplier LED's. For more information refer to the installation procedure in Section 2.2.4.

Note that the BCD data is only valid while the DATA VALID signal is true. DATA VALID will normally be true except when the display is updated. This occurs about three times a second for about 20 microseconds. Table 3-8 gives a list of BCD numbers and their decimal equivalents. A O is a logical false or low output while a 1 is a logical true or a high output. BCD1 is the most significant digit of the mantissa while BCD2 is the least significant. BCD3 is the most significant digit of the exponent and BCD4 is the least significant.

There are two analog outputs: one for the mantissa and one for the exponent. The analog outputs are essentially D/A converters reading the BCD outputs. The mantissa ranges from 0 to 0.100 volts for full scale. The exponent ranges from 0(10-11) to 1.3 volts in steps of 0.100 volts as the decade increases. A resistor may be installed to sum these two outputs to generate a pseudo-log output.

Table 3-8. BCD Numbers and Their Decimal Equivalents.

Decimal Equiv.	BCDX-8	BCDX-4	BCDX-2	BCDX-1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

SECTION IV
THEORY OF OPERATION

4.0 GENERAL INFORMATION

Refer to the schematic diagrams provided as a supplement to this manual in order to clearly understand the following discussion.

4.1 DISPLAY BOARD

Refer to schematic drawing No. 1002733.

The display board contains the 7-segment LED displays, the 9 individual LED's which are used to display gauge and setpoint status, the beeper, and the interface to the keyboard. The display board interfaces to the other DGC III circuits via the 86-pin bus. The interface to the keyboard is accomplished with a 16-pin ribbon cable. The display requires +5 and +12 volt supplies.

The display board interfaces with the microprocessor with an MC6821 Parallel Interface Adaptor (PIA) at U201. All user I/O pins on U201 are configured for output with the exception of PB5-7.

The beeper is driven by CB2 of U201. CB2 drives the base of 2201 which is a 2N6427 darlington transistor. (Any general purpose NPN darlington transistor could be used in this position if a 2N6427 is not readily available. Current rating should be at least 200 mA.) Base current limiting is achieved with R201. R202 is used to assure that Q201 is shut off when CB2 is tri-stated.

The status LED's DS201-DS204 are driven by PB0-PB3 of U201. The outputs of U201 in turn drive the LED driver transistors Q202-Q205. The base resistors R203-R206 are sued for current limiting. The LED's contain an internal resistor (approximately 300 ohms) so that a collector resistor is not necessary. The LED's display GAUGE 1 (DS201), GAUGE 2 (DS202), ION TUBE ON (DS203), and MULTIPLIER (DS204).

The 7 segment displays U203, U207, and U209 are driven by display drivers U202, U204, U206, and U208 respectively. The drivers contain an integral latch, HEX to 7 segment decoder and display drivers. The drivers use a constant current source of 20 mA to drive each segment, thus eliminating the need for current limiting resistors. The hexadecimal data is transmitted to the drivers by PAO-PA3 of U201. The driver which is to receive the hexadecimal number is selected by strobing the appropriate latch enable PA4-PA7 on U201. Refer to Table 3-6 for hexadecimal number representations.

The keyboard consists of a 3 x 4 array of keys. A depressed key is found by rotating a logical 0 on the four input lines to the keyboard while observing the three output lines. When one of the three output lines goes low, the key can be determined by knowing which input line is low and which of the three output lines went low. To eliminate the problem of key bounce, once a depressed key is found, the keyboard is scanned again a few milliseconds later. If the same key is found to be depressed, it will be accepted as a valid key. A minimum dead time (no key depressed) is required once the key has been released before another key can be accepted.

4.2 PROCESSOR BOARD

Refer to schematic drawing No. 1002157.

The heart of the DGC III is the processor board. This board contains the 6802 microprocessor, Read Only Memory (ROM), address select logic and the power on reset circuitry. The processor board interfaces to the rest of the DGC's circuitry via the 86-pin bus connector. Required power supplies are +5, +12, and -12. The board contains a -5 volt regulator which also supplies power to other DGC III boards.

The 6802 Micro-Processing Unit (MPU) contains a complete microprocessor as well as Random Access Memory (RAM) and clock circuitry. The RAM is used to store temporary information required by the DGC III. This information is lost whenever the DGC is turned OFF. The clock uses a 2.4756 mHz crystal. This frequency is divided internally to obtain the 614.4 kHz used as the main MPU clock. This frequency

was selected to provide a convenient source for the baud rate clock used on the Computer Interface board. Internal software timing loops also require that this frequency be used. (Note that in some cases if the crystal is defective or removed, the clock will still oscillate, but at the wrong frequency.)

The Read Only Memory (ROM) is used to store the DGC III program. These devices cannot be interchanged.

The board has positions for four ROM's. Only one is used in the standard DGC III, position "F", U103. The ROM must be inserted in the correct sockets. The remaining sockets are used for service aids and additional options. The ROM's, as with all devices on the 6802 bus, are enabled with a select signal. This signal enables the ROM's tri-state output buffers. Only one device on the bus should be enabled for output at any given time.

The address select logic generates device enable signals. A12-A15 are used to generate a 1 of 16 signal. Each signal represents a 4096 byte block of memory. Refer to the memory map for a list of devices and their location in memory. VMA bar and the phase 2 clock are used to enable the 1 of 16 decoder (U102) to assure that a device select is generated only at the proper time in a read/write cycle.

The reset logic is used to initialize the DGC III electronics to a given pre-determined state whenever power is turned on. R101 and C104 is used to determine the length of the reset signal. CR101 quickly discharges the timing capacitor whenever power is shut off. This is necessary to generate a proper reset whenever power is momentarily interrupted. The reset signal (output of U107 pin 10) should be low at power-on and remain low until all logic power supplies have stabilized.

4.3 ELECTROMETER

Refer to schematic drawing No. 1004602.

The electrometer board consists of an A/D converter, an electrometer and an interface to the microprocessor. The electrometer amplifies the ion tube collector current, processes the signal, converts it into a digital format and outputs the data to the microprocessor.

The current from the ion tube is first amplified by a high impedance low bias current op-amp U305. The actual input current depends on several factors. The current is a function of the emission current and the pressure inside the ion tube. Depending upon these factors, the microprocessor will select the proper gain for the electrometer. The relays K301 and K304 are driven by the four analog switches of U304. The interface to the microprocessor is accomplished via PAO-PA2 and PA5 of the PIA U301. The signal, once amplified by the first stage, is then amplified again by another op-amp U306. The gain of this stage is electrically selected by two analog switches of U308. These devices interface to PA3-PA4 of PIA U301. The resulting signal is fed to an analog multiplexer U303. The analog multiplexer input is determined by PA6 of PIA U301, and may either be from the electometer or from the analog output of the thermistor option board. The output of U303 then drives the input of the A/D converter U302. The 2.000 V reference is generated by a 2.500 V band-gap reference U307 and the appropriate resistor divider network R302-R303. U302 is an integrating dual slope converter with multiplexed outputs. The BCD information is output on DS1-DS4, the digit select is output on QO-Q3, and EOC (end of conversion) and DU (display update) form the handshaking. The microprocessor demultiplexes the output of the A/D in software and uses this information for pressure display and gauge control. Q307 drives the ion tube selection relay.

4.4 EMISSION CONTROL

Refer to schematic drawing No. 1002173.

The emission control board is responsible for ion tube filament control. This includes turning the filament on and off as well as regulating the emission current. The emission control circuits consist of a feedback loop where the emission is sensed and the output is controlled to maintain the emission as specified by the microprocessor.

The control information from the microprocessor is latched in a 4042 (U401) 4-bit latch. The input information consists of FIL ON/OFF, E x 0.1, E x 1,

and DEGAS. When FIL ON/OFF is high, the output of the board is forced off. If FIL ON/OFF is low, the amount of emission current is determined by the remaining three signals. If neither E x 0.1 or E x 1 is low, then the emission will be E x .01 (0.01 times the pre-set emission). If DEGAS is low the emission will be set to approximately 120 mA, and the grid voltage will be increased from the standard 180 volts to about 460 volts. This generates about 55 watts (0.12 x 460) of electron bombardment degas. When using the nude tube emission setting, this value will be somewhat lower. U407 serves to decode the address select and R/W signals from the microprocessor board to enable the latch and output buffers (U405) at the proper time. OUT1-OUT4 of U405 buffers the output of U401. OUT5-OUT6 are tri-state outputs which relay certain status information to the microprocessor when they are enabled. OUT5 returns the status of the 33 emission regulation (high if in regulation, low if not). This information is used to shut off the filament of the ion tube if emission is out of regulation for a given period of time.

During normal operation, the ion tube filaments are biased at about +24 volts by CR409, a 24 volt zener. CR409 returns the center tap of the filament transformer to ground, thus biasing the entire circuit.

Filament short circuit protection, accomplished by passing the current from the low side of the filament to the center tap, is routed through R427. The voltage (and thus the filament current) across R427 is placed across the emitterbase junction of Q401. If this voltage becomes too large, Q401 begins to conduct which turns on Q406. Q406 in turn conducts, pulling pin 2 of U403 below ground. This forces U403 OFF, which results in the shut-down of the circuit. (The operation of U402 will be explained later.)

The current flowing through CR409 is the emission current. This current is converted to a voltage by passing it through a resistor to ground. The resistor (or resistor combination) is changed by the microprocessor to arrive at the desired emission multiplication factor (1, 0.1, 0.01, degas). This voltage is also compared with that of the emission adjustment potentiometer to arrive at an error voltage in U403. If the error voltage is too large, Q408 is turned on and loss of emission is indicated to the microprocessor. This signal is compared to a reference ramp in U402 to turn on the filament for the appropriate duty cycle.

The reference ramp is generated from a reference sine wave taken from a power transformer secondary. The sine wave is rectified by CR403 and CR404 to form a 120 hz (100 hz for 50 hz units) positive wave form. This signal is then limited to +0.6 volts by R407, R408, and CR405. This signal is compared to a reference signal derived from R409 and R410. The result is a square wave at pin 6 of U404. R411 is used for hysteresis. R415, CR407, CR408, R413 and Q404 form a constant current source. This current is used to charge capacitor C406. C406 is rapidly discharged when the output of U404 goes high and Q403 conducts. The result is a saw-toothed waveform synchronized to the AC line. This sawtooth is compared against the emission error signal to determine the point at which the filaments are to turn on in the AC cycle. The more emission current that is needed, the sooner they must be turned on.

The output of U402 triggers the PUT, Q402. Q402 conducts through T401, generating a short current spike which triggers the triacs Q409 and Q410. Thus current is provided to the high side of the filament. The filament is disabled by placing a high signal at the base of Q405. This causes Q405 to conduct, shorting T401 pin 1 to ground. As a result of this, when Q402 is turned on, no current can be generated since both sides of T401 are at ground. Q409 and Q410 do not trigger, and the filament is held off.

The emission current for the nude type tubes is adjusted by R437. Likewise, the current for tubulated gauges is adjusted by R436. The appropriate resistor is selected by the front panel switch. The signal is routed to pin 3 of U406. TP1 may be used to monitor the selected current (5 volts = 10 mA).

SECTION V
CALIBRATION AND MAINTENANCE

5.0 GENERAL INFORMATION

The DGC III and its options require no regularly scheduled maintenance. The DGC III is, however, a complex electronic device and should always be operated within its environmental specifications. Contamination, high humidity, or heat as well as shock and vibration should be avoided. In the event that repair is necessary, the user has several options:

1. Return the unit to the factory for repair. This is the preferred method of repair since the factory maintains a complete line of specially designed test equipment for use in the repair and calibrating of the gauge. Highly trained technicians will test the entire DGC III as a system, calibrate it and return it promptly. Because of the level of training of the technicians and the test equipment they have at their disposal, less time is required for factory repair than any other method. This translates into the lowest cost for the user. All warranty repairs are handled at the factory.

2. Board substitution can be used where speed of repair is of the utmost importance. This method is usually economical only when there are a large number of DGC's at one site. Since the DGC's functions are broken down into several modular printed circuit boards, repairs can often be made quite quickly with a minimum of test equipment. For additional information on ordering spare boards and on the factory repair of boards, contact the factory.

3. Component level repair. This should only be attempted by persons with training and experience in the repair of microprocessor based products and analog circuitry. The user is cautioned that component level servicing of the DGC III and its options may void the warranty.

WARNING

VOLTAGES AS HIGH AS 780 VOLTS ARE USED IN THE DGC III. A SAFETY INTERLOCK SWITCH HAS BEEN PROVIDED TO SHUT OFF THE POWER TO THE GAUGE WHEN THE TOP COVER IS REMOVED. DO NOT DEFEAT THIS INTERLOCK. THE INTERLOCK MAY BE BYPASSED FOR SERVICING BY PULLING UP ON THE SWITCH. THE INTERLOCK WILL RESET AUTOMATICALLY WHEN THE COVER IS RE-INSTALLED.

5.1 TROUBLE SHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE
Display does not light when the DGC III is turned on. Unit is completely dead.	• Power not connected to unit. • Incorrect power setting. See Section II. • Fuse blown. • Cover removed-check interlock switch. • Power supply board. • Transformer T1.
Display lights, but unit will not respond to the keyboard.	• Keyboard unplugged or not plugged in properly. • A board in the wrong connector or not seated properly. • Processor board. • Display board. • Power supply board.
When ion gauge is turned on, filament does not light. DGC III sounds alarm and turns ion tube off.	• Ion gauge cable not connected. • Wrong gauge number selected. • Defective ion gauge cable. • Filament burned out. • Relay K1. • Emission control board.
Filament lights but DGC III sounds alarm and turns ion tube off.	• Pressure too high. • Check ion tube selector knob. • Bad ion tube filament. • Low line voltage or wrong voltage selected. • Emission control board. • Electrometer board. • Power supply board. • Transformer T2.
Filament lights, but the reading is obviously wrong.	• Display multiplier in effect. See Section III. • In setpoint mode. See Section III. • Pressure control valve operating.
Filament lights, but the reading is obviously wrong or fluctuates considerably.	• Gaseous tube or vacuum system. Degas or bake out. • Ion gauge collector not connected. Check both tube and DGC III. • Bad filament. • Ion gauge cable. • Emission control board. • Electrometer board.

Ion tube will not degas.	• Pressure too high. • Ion tube too gaseous: pressure is rising during degas. Wait for tube to pump-down. • Bad filament. • Too much resistance in the ion tube cable. • Power supply board. • Emission control board.
Thermistor reading is wrong.	• Zero thermistor. See Section III. • Bad cable. • Contaminated thermistor. • Thermistor board. • Electrometer board.
BCD board dead. No BCD, wrong analog output. Filament ON/OFF doesn't work.	• Cable to display board improperly installed, missing, or defective. • BCD board. • Display board.
Computer interface not not operating.	• Interface not properly made to host device. • ROM not installed. • Wrong baud rate. Check both DGC III and host device. • Computer interface board.
Computer interface autolog shuts off.	• Command transmitted to the DGC III. • RX DATA not properly terminated.
Setpoint relays don't transfer.	• Setpoints not programmed. • In setpoint mode. • Pressure too high. • Setpoint board.
Setpoints are lost when the DGC III is turned off and back on again.	• Battery not charged. Charge for 24 hours by leaving gauge ON. Then program setpoints. • Unit has been serviced. • Setpoint board.

Display
F.F x10 T|F • Computer not running
O.F x10 +|E • ~~Electrometer~~ reading overrange

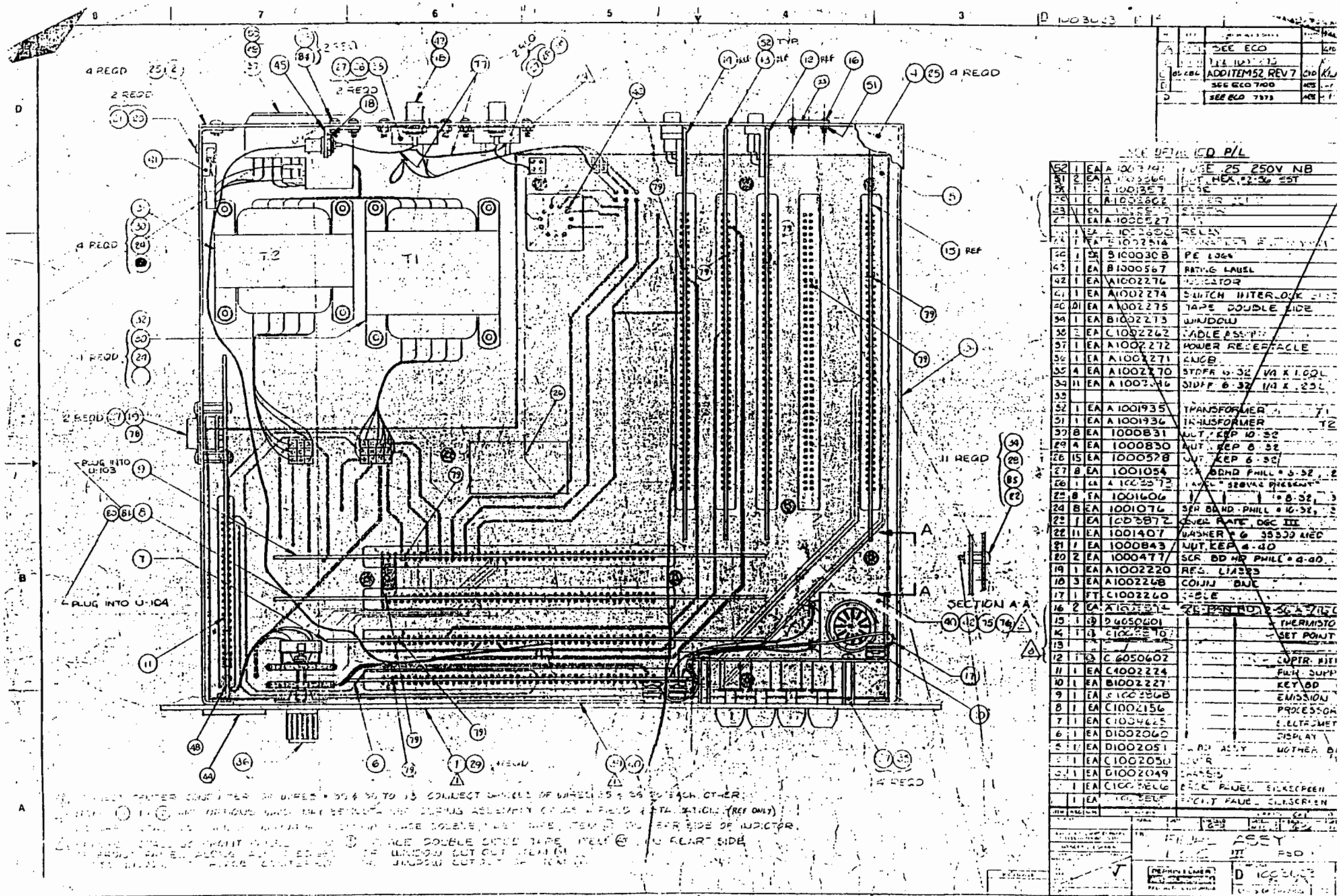
Pressure control valve fails to open.	• Pressure control not on. • Pressure control setpoint not set. • Pressure too high. • Valve not connected. • Defective cable. • Pressure control board not connected to the power supply board. • Pressure control board.
Pressure control oscillates.	• Setpoint too low for the pumping speed of the system. • Using thermistor tube for pressure measurement--ion tube preferred. • Gauge tube or valve placement poor. • Pressure control gain adjusted too high.
Display flashes every five seconds.	• Foreline Sentry feature enabled.

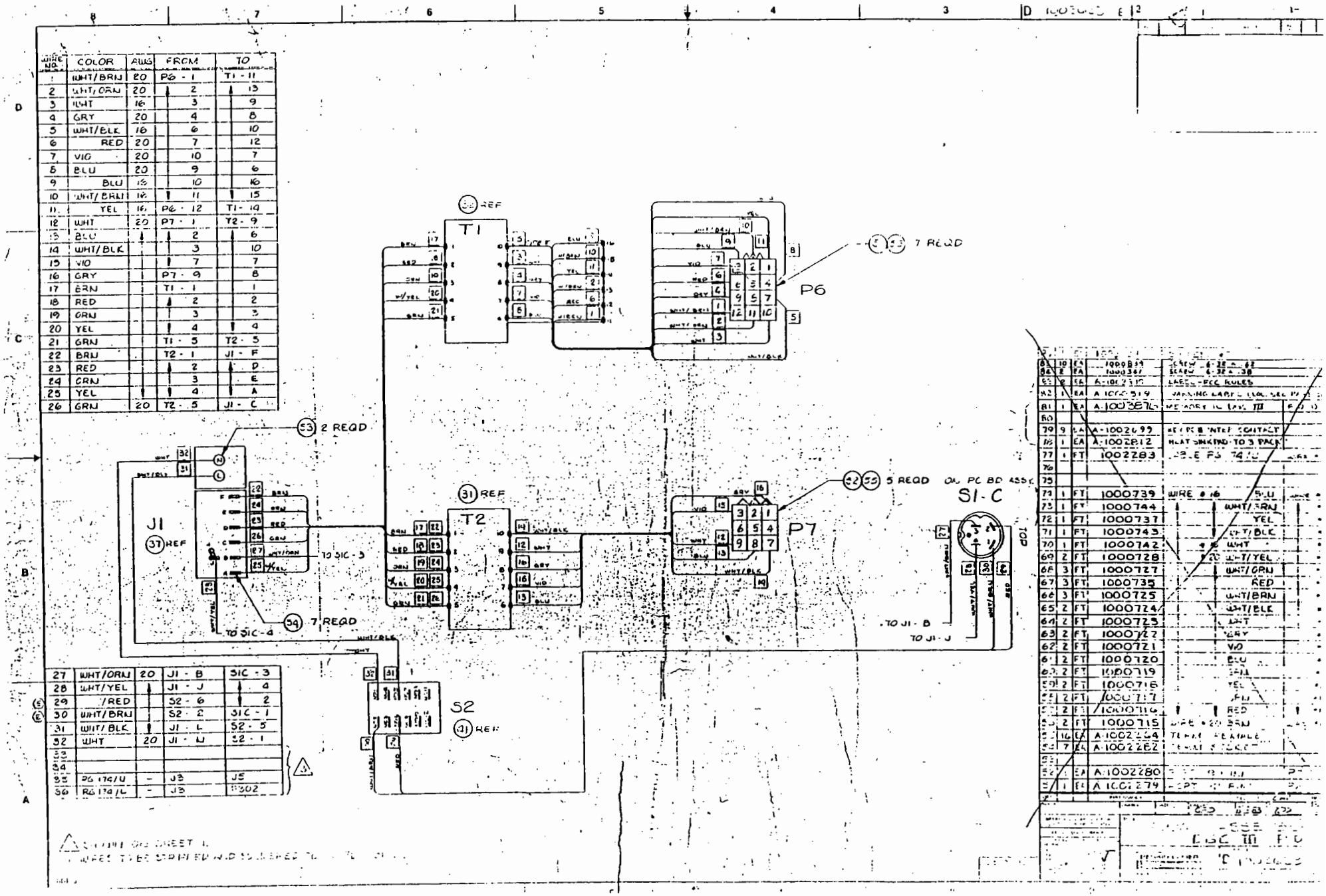
PERKIN-ELMER
PHYSICAL ELECTRONICS DIV

CABLE INTERCONNECT DATA
COMPUTER GENERATED

JOB: NAME: MODEL: DGC III DRAWING NO: 615445 REV: A SHEET 2 OF 2

		FROM:					TO:						
ITEM	PART NO	MODEL	A NO	IDENT	J NO	CONN	MODEL	A NO	IDENT	J NO	CONN	OPTION	REMARKS
1	601942	DGC	47	COLL	5	BNC	40-X00		COLL		BNC		
2	275074	DGC	47	ION GAUGE	8	4M	40-X00		ION GAUGE		7F		
3	609012	DGC	47	COLL	5	BNC	40-700		COLL		LEAD		DON'T LABEL
4	609012	DGC	47	ION GAUGE	8	4M	40-700		FILA/GRID		3LEAD		DON'T LABEL ITEM 3&4 IS 1 CABLE
5	611517	DGC	47	SET POINT	902	15F	18-030	10	ION GAUGE	2	M7M		SET POINT #1
6	~~611517~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	AUTO VALVE	118	DIG	5	M4M		SET POINT #2 ITEM 5 HAS 5 ENDS
7	~~611517~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	32-095	79	PRESS INTLK	2	M4M		SET POINT #3 ITEM 5 HAS 5 ENDS
8	~~611517~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	OVEN CONT	117	PRESS INPUT	1	BNC		SET POINT #4 ITEM 5HAS 5 ENDS
9	609096	DGC	47	SET POINT	902	15F	PWR SPLY	133-2	INTL PWR	18	F2F		SET POINT #1
10	~~609096~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	AUTO VALVE	118	DIG	5	M4M		SET POINT #2 ITEM 9 HAS 5 ENDS
11	~~609096~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	32-095	79	PRESS INTLK	2	M4M		SET POINT #3 ITEM 9 HAS 5 ENDS
12	~~609096~~	~~DGC~~	~~47~~	~~SET POINT~~	~~902~~	~~15F~~	OVEN CNTL	133-1	PRESS INPUT	4	F2F		SET POINT #4 ITEM 9 HAS 5 ENDS
13	375038	DGC	47	PWR		3F			PWR		3M		POWER CORD
14													
15													
16													

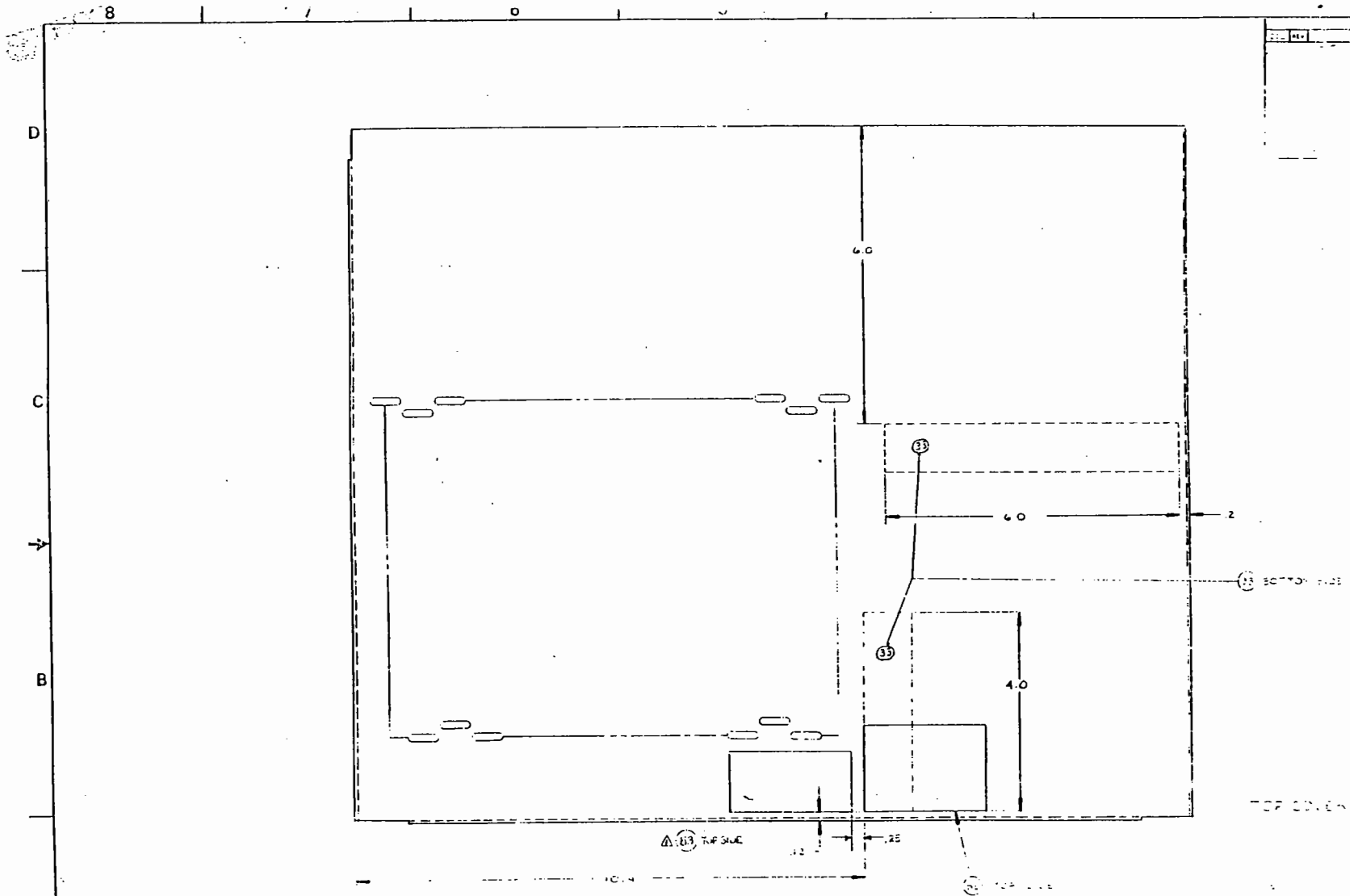

T2
T1
SECTION A-A
PLUG INTO U-103
PLUG INTO U-104
4 REQD
2 REQD
11 REQD
TYP
REF



WIRE NO.	COLOR	AWG	FROM	TO
1	WHT/BRN	20	P6 - 1	T1 - 11
2	WHT/ORN	20	2	13
3	WHT	16	3	9
4	GRY	20	4	8
5	WHT/BLK	16	6	10
6	RED	20	7	12
7	VIO	20	10	7
8	BLU	20	9	6
9	BLU	16	10	16
10	WHT/BRN	16	11	15
11	YEL	16	P6 - 12	T1 - 14
12	WHT	20	P7 - 1	T2 - 9
13	BLU		2	6
14	WHT/BLK		3	10
15	VIO		7	7
16	GRY		P7 - 9	8
17	GRN		T1 - 1	1
18	RED		2	2
19	ORN		3	3
20	YEL		4	4
21	GRN		T1 - 5	T2 - 5
22	BRN		T2 - 1	J1 - F
23	RED		2	D
24	ORN		3	E
25	YEL		4	A
26	GRN	20	T2 - 5	J1 - C

27	WHT/ORN	20	J1 - B	SIC - 3
28	WHT/YEL		J1 - J	4
29	/RED		S2 - 6	2
30	WHT/BRN		S2 - 2	SIC - 1
31	WHT/BLK		J1 - L	S2 - 5
32	WHT	20	J1 - U	S2 - 1
33				
34				
35	RG 174/U	-	J3	J5
36	RG 174/U	-	J3	P302

80				
79	9	EA	A-1002699	KEYPCB INTERF CONTACT
78	1	EA	A-1002812	HEAT SINK-TO-3 PACK
77	1	FT	1002283	WIRE #26 TEFLON
76				
75				
74	1	FT	1000739	WIRE #16 SIU
73	1	FT	1000744	WHT/BRN
72	1	FT	1000737	YEL
71	1	FT	1000743	WHT/BLK
70	1	FT	1000742	WHT
69	2	FT	1000728	WHT/YEL
68	3	FT	1000727	WHT/ORN
67	3	FT	1000735	RED
66	3	FT	1000725	WHT/BRN
65	2	FT	1000724	WHT/BLK
64	2	FT	1000725	WHT
63	2	FT	1000722	GRY
62	2	FT	1000721	VIO
61	2	FT	1000720	BLU
60	2	FT	1000719	GRN
59	2	FT	1000718	YEL
58	2	FT	1000717	ORN
57	2	FT	1000716	RED
56	2	FT	1000715	WIRE #20 BRN
55	16	EA	A-1002264	TERM RECEPTACLE
54	7	EA	A-1002262	TERM SOCKET
53				
52	1	EA	A-1002280	CONT PIN
51	1	EA	A-1002279	CONT PIN
50				
49	10	EA	1000839	SCREW 6-32 x .62
48	8	EA	1000367	SCREW 6-32 x .38
47	2	EA	A-1012315	LABEL-PCB RULES
46	1	EA	A-1002519	WARNING LABEL (ON SEC IV)
81	1	EA	A-1003676	MEMORY IC (ON SEC III)
80				



REVISIONS

REV	DESCRIPTION	DATE	APPR

PERKIN-ELMER

FINAL ASSY
DGC III

D 100362

ITEM	PA NO.	QTY	UM	DESCRIPTION	DRAWING NO.	REFERENCE	EFF DATE FROM	TO
0001	1003865	1.000	EA	SILKSCREEN-PSD DGC FR PAN				
0002	1003866	1.000	EA	SILKSCREEN-PSD DGC REAR PANEL				
0003	1002049	1.000	EA	CHASSIS-DGC,PUNCH DETAIL				
0004	1002050	1.000	EA	COVER-TOP DGC III				
0005	1002051	1.000	EA	PCB-ASSY MOTHER DGC III				
0006	1002060	1.000	EA	PCB ASSY-DISPLAY DGC III				
0007	1004625	1.000	EA	PCB ASSY-ELECTROMETER,HI-SENS.				
0008	1002156	1.000	EA	PCB-PROCESSOR ASSY DGC III				
0009	1003868	1.000	EA	PCB ASSY-EMISSION CONTROL PSB				
0010	1002227	1.000	EA	PCB-ASSY,KEY DGC III				
0011	1002224	1.000	EA	PCB-ASSY,PWR SPLY DGC III				
0012	6050602	1.000	EA	ASSY-COMPUTER INTERFACE				
0014	1003870	1.000	EA	PCB ASSY-SETPOINT OPTION PSD				
0015	6050601	1.000	EA	ASSY-THERMISTER GAUGE DGC 111				
0016	1003874	2.000	EA	SCREW-PNH, 2-56X .312,SST,SLTD				
0017	1002260	1.000	EA	CABLE ASSY KEY BOARD DGC III				
0018	1002268	3.000	EA	CONN-COAX,BHD BNC RCPT, 31-236				
0019	1002220	1.000	EA	IC-V RGLTR,POS 5V,3A, LM323K				
0020	1000477	2.000	EA	SCREW-BDGH, 4-40X .250,SST,PHH				
0021	1000843	1.000	EA	NUT-KEP, 4-40,HEX,PLD STL				
0022	1001407	11.000	EA	WSHR-FLAT, #6,SST				
0023	1003872	1.000	EA	COVER PLATE-PSD DGC				
0024	1001076	8.000	EA	SCREW-PNH,10-32X .375,SST,PHH				
0025	1001606	8.000	EA	SCREW-BDGH, 8-32X .375,SST,SLT				
0026	1003873	1.000	EA	LABEL-520 VAC PRESENT				
0027	1001054	8.000	EA	SCREW-PNH, 6-32X .250,SST,PHH				
0028	1000528	15.000	EA	NUT-KEPS, 6-32,HEX,PLD STL				
0029	1000830	4.000	EA	NUT-KEPS, 8-32,HEX,PLD STL				
0030	1000831	8.000	EA	NUT-KEPS,10-32,HEX,PLD STL				
0031	1001936	1.000	EA	XFMR,ISOLATION,STPUP		T2		
0032	1001935	1.000	EA	XFMR-STPDN,120V,40VAC,.05A		T1		
0033	1003791	1.000	EA	FUSE-3AG, .25A,250V,NORM BLO				
0034	1003646	11.000	EA	STDF-HES,6-32 X .25L,AL OR BRS				
0035	531316	4.000	EA	SPACER-HEX THD 6-32X1.00 BRASS			100687	
0036	1002271	1.000	EA	KNOB-IND,.710D,.75H,.25SFT,BLK				
0037	1002272	1.000	EA	FILTER-CONN,V SEL,6A 6J4				
0038	1002262	2.000	EA	CABLE ASSY-INTERNAL ION GUAGE				
0039	1002273	1.000	EA	WINDOW-PANEL, DGC III				
0040	1002275	.001	EA	TAPE-DBL-SIDED,FOAM,.03THK,1"W				
0041	1002274	1.000	EA	SW-INTERLOCK,7.5A,125/250VAC		S2		
0042	1002276	1.000	EA	SIGNAL-AUDIBLE,6-20VDC X20F24				

NOTES:

PERKIN-E ER PHYSICAL ELEC. DIV.	TITLE SHEET: 2 10/14/87 DGC III,FSD MODEL	PART NUMBER 1003623	ENG. DWG NO/REV 1E	EFF DATE FROM TO

ITEM	PART NO.	QTY	UM	DESCRIPTION	DRAWING NO.	REFERENCE	EFF DATE FROM	EFF DATE TO
0043	1000567	1.000	EA	LABEL-RATING,ION PUMPS				
0044	1000308	1.000	EA	NAMEPLATE,.75X2.12				
0045	1002415	1.000	EA	BODY & STUD WELD'T-5LS SIEMANS				
0046	1002600	1.000	EA	RELAY-3PDT,12VDC,5A/120V,				
0047	1000527	1.000	EA	LUG-SLDR,.87LG,.017T,3/8 STUD				
0048	1000970	1.000	EA	SCREW-BDGH, 6-32X .310,SST,SLT				
0049	1002602	1.000	EA	CORD-EXT,18/3,10A/125V, 9.8FT				
0050	1001857	1.000	EA	FUSE-3AG,2.5A,250VAC,SLO BLOW				
0051	1002279	1.000	EA	CONN-RCPT,12S 03-09-1126		P6		
0052	1002280	1.000	EA	CONN-RCPT,9S 03-09-1094		P7		
0053	1003369	2.000	EA	NUT-HEX,2-56,SST				
0054	1002282	7.000	EA	TERM-SKT,.045 SQ, 02-05-1105				
0055	1002264	16.000	EA	TERM-SKT,CRIMP, 02-09-1103				
0056	1000715	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,BR				
0057	1000716	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,R				
0058	1000717	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,O				
0059	1000718	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,Y				
0060	1000719	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,GR				
0061	1000720	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,BL				
0062	1000721	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,V				
0063	1000722	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,GY				
0064	1000723	2.000	FT	WIRE-STRD,#20,PVC,600V/105C,W				
0065	1000724	2.000	FT	WIRE-STRD,#20,PVC,600V,WHT/BLK				
0066	1000725	3.000	FT	WIRE-STRD,#20,PVC,600V,WHT/BRN				
0067	1000735	3.000	FT	WIRE-STRD,#16,PVC,600V/105C,R				
0068	1000727	3.000	FT	WIRE-STRD,#20,PVC,600V,WHT/ORN				
0069	1000728	2.000	FT	WIRE-STRD,#20,PVC,600V,WHT/YEL				
0070	1000742	1.000	FT	WIRE-STRD,#16,PVC,600V/105C,W				
0071	1000743	1.000	FT	WIRE-STRD,#16,PVC,600V,BLK/WHT				
0072	1000737	1.000	FT	WIRE-STRD,#16,PVC,600V/105C,Y				
0073	1000744	1.000	FT	WIRE-STRD,#16,PVC,600V,BRN/WHT				
0074	1000739	1.000	FT	WIRE-STRD,#16,PVC,600V/105C,BL				
0077	1002283	1.000	FT	CABLE-COAX,50 OHM,RG 174/U				
0078	1002812	1.000	EA	INSULATOR-MTG PAD,TO-3 CASE				
0079	1002699	9.000	EA	KEY-PLZN,NYLON, AMP#530687-1				
0081	1003876	1.000	EA	IC-PRGM,2532 DGCIII F		U103		
0082	1000519	1.000	EA	LABEL-DANGER HIGH VOLTAGE				
0083	1003990	2.000	EA	RELAY-PCB,120V,3A,SPDT				
0084	1000341	2.000	EA	SCREW-PNH, 6-32X .375,SST,PHH				
0085	1000839	10.000	EA	SCREW-PNH, 6-32X .620,SST,PHH	NO DOC			

*** END OF REPORT ***

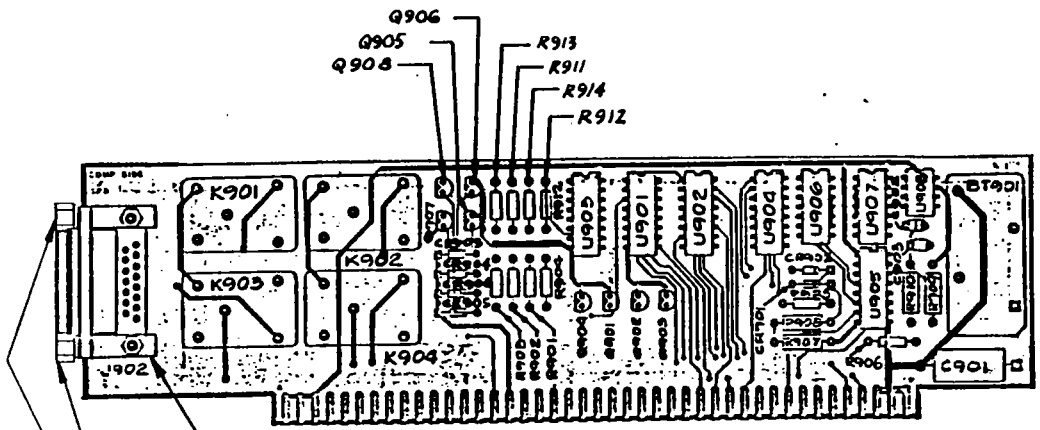
PERKIN[illegible]MER PHYSICAL [illegible]EC. DIV.	TITLE SHEET: 1 10/29/87 ASSY-SET POINT.OPTION.DSC III	PART NUMBER 6050603	ENG. DWG NO/REV 1L	DATE FROM	DATE TO

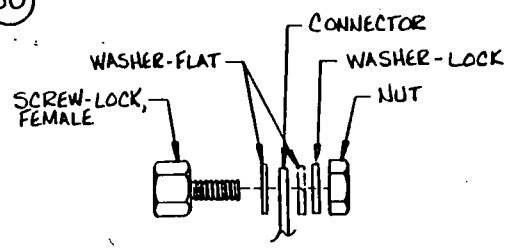
ITEM	PART NO.	QTY	UM	DESCRIPTION	DRAWING NO.	REFERENCE
0001	1002329	.000	EA	SCHEMATIC-SET POINT DGC III		
0002	1001947	1.000	EA	PCB-SET POINT.FAB DGC 3		U901.902
0003	1002330	2.000	EA	IC-CMOS.64B(16X4)R/W RAM.74C89		U903,904
0004	1002193	2.000	EA	IC-CMOS.QUAD D LCH. CD4042BE		U905
0005	1002331	1.000	EA	IC-CMOS.INV BUFFER. 4049UB		U906,907
0006	1002332	2.000	EA	IC-CMOS.DUAL 4 INP NAND. 4012B		U908
0007	1002333	1.000	EA	IC-OP AMP.DIP FORM TO 5. 31305		CR901,903,904,905,
0008	1000711	5.000	EA	DIODE-RECT. 50V. 1AMP. 1N4001		906.907.908
0009	1002334	1.000	EA	DIO-ZENER. 5.6V.5%..5W.1N5232B		CR902
0010	1002160	8.000	EA	RES- 100K OHM..25W. 5%. RC07		R901.902.903.904. 911.912,913,914
0011	1002064	1.000	EA	RES- 1K OHM..25W. 5% .RC07		R905
0012	1002335	1.000	EA	RES- 200 OHM..25W. 5% RC07		R906
0013	1002113	1.000	EA	RES-3.01K OHM..25W. 1%.RN60D		R909
0014	1002184	2.000	EA	RES-49.9K OHM..25W 1%. RN60D		R907,908
0015	1002105	1.000	EA	RES-4.99K OHM..25W. 1%.RN60D		R910
0016	1002061	2.000	EA	CAP- .1 UF. 50V.DP CERM.RDL		C902,903
0017	1002159	1.000	EA	CAP- 10 UF. 50V.ELCTLT.AXL		C901
0018	1002066	8.000	EA	XSTER-NPN.DARL. 2N6427		Q901,902,903,904, 905.906.907.908. INSTALL AFTER FLOW SOLDER
0019	1003500	4.000	EA	RELAY-SPDT.28VDC/125VAC.3A.PCB		K901,902,903,904, INSTALL AFTER FLOW SOLDER
0020	1001937	1.000	EA	BATTERY-3.6V.NKL CAD. DS3GT		BT901.INSTALL AFTER FLOW SOLDER
0021	1002338	1.000	EA	CONN-SUBMIN "D".15P.RTANG		J902.INSTALL AFTER FLOW SOLDER
0022	1001067	1.000	EA	BAR-7IP THCK.4X4X4 MTG		
0023	1001296	2.000	EA	SCREW-FLH. 4-40X .375.SST.PHH		
0024	542104	2.000	EA	NUT-HEX.SMALL PATTERN.4-40 SST		81887
0025	1002800	1.000	EA	SCR-LOCK ASSY.FEM.AMP-205817-1		J902,INSTALL AFTER FLOW SOLDER
0026	1002802	1.000	EA	SCR-RETAINER.MALE.AMP-205980-1		PACKAGE WITH ITEMS 27.28 & 29 AND SHIP SEPERATELY
0027	1002810	1.000	EA	CLAMP-CA.SIZE 2. AMP-207470-1		PACKAGE WITH ITEMS 26.28 & 29 AND SHIP SEPERATELY

PERKIN-ELMER PHYSICAL ELEC. DIV.	TITLE SHEET: 2 10/29/87 ASSY-SET POINT.OPTION.DSC III	PART NUMBER 6050603	ENG. DWG NO/REV 1L	

ITEM	PART NO.	QTY	UM	DESCRIPTION	DRAWING NO.	REFERENCE	EFF DATE FROM	EFF DATE TO
0028	1002807	1.000	EA	CONN-SUBMIN"D",15 SKT.205205-2		PACKAGE WITH ITEMS 26.27 & 29 AND SHIP SEPERATELY		
0029	1002803	15.000	EA	TERM-SKT.SLDR CUP..041D.PH BR2		PACKAGE WITH ITEMS 26.27 & 28 AND SHIP SEPERATELY		
0030	1002325	2.000	EA	WSHR-FL.# 4..253X.115.NYL				
0031	512004	2.000	EA	WASHER-FLAT.#4. .250 OD.SST			81887	
0032	542204	2.000	EA	WASHER-SPLIT LOCK.# 4 SST			81887	
0033	541805	2.000	EA	SCREW-PNH. 4-40X .312.SST PHH			81687	
				** END OF REPORT **				

REVISIONS				
ECO NO.	REV	DESCRIPTION	DATE	APPROVED
444	A	ITEM 17 WAS 1002336	4-29-81	MBI/C
589	B	DWG # WAS 1002328	7-1-81	MBI/MF
949	C	ADD ITEMS 25-29 & NOTE 5	10-22-81	MBI/MF
1480	D	DELETE ITEMS 22, 23 & 24	10-20-82	AW/RJF
85-0016	E	ADD ITEMS 23 & 24		
860736	F	Delete 1002337 Add 1003500	5-6-86	K E W
870251	G	SWITCH R906 and 909	9-23-86	K E W
870361	H	Add ITEM 30, NOTE 4	10-24-86	K E W
68165	J	SEE ECO	5-18-87	C-P
7177	K	SEE ECO	10-5-87	GPD
	L	SEE ECO # 7395	11-5-87	GPD





DETAIL A
ENLARGED VIEW

SEE DETACHED PARTS LIST

	ITEM	SZ	PART NUMBER	QTY	U/M	DESCRIPTION
	30	A	1002325	2	EA	WASHER NYLON #4
—	29	A	1002803	15	EA	CONTACT-SOLDER CUP, SOCKE
—	28	A	1002807	1	EA	CONN-RECEPTACLE HD20/15P
—	27	A	1002810	1	EA	SHIELD & CABLE CLAMP ASSY 15
—	26	A	1002802	1	EA	SCREW RETAINER ASSY - MALE
J902	25	A	1002800	1	EA	SCREW LOCK ASSY - FEMALE
—	24	A	1000843	2	EA	NUT-KEPS #4-40 CAP PLATE
—	23	A	1001296	2	EA	SCREW-FLH #4-40 x .38 PHIL
—	22	A	1001067	1	EA	BAG - ZIP LOCK
J902	21	A	1002338	1	EA	CONNECTOR DAP-15P PIN TYP
BT901	20	A	1001937	1	EA	BATTERY
K901-K904	19	A	1003500	4	EA	RELAY MSG4-931
Q901-Q908	18	A	1002006	8	EA	TRANSISTOR 2NG427
C901	17	A	1002159	1	EA	CAPACITOR 10 Mfd 20V
C902, C903	16	A	1002061	2	EA	CAPACITOR .1 Mfd
R910	15	A	1002105	1	EA	RESISTOR 4.99 KΩ 1/4W 1%
R907-R908	14	A	1002184	2	EA	RESISTOR 49.9 KΩ 1/4W 1%
R909	13	A	1002113	1	EA	RESISTOR 3.01 KΩ 1/4W 1%
R906	12	A	1002338	1	EA	RESISTOR 200Ω 1/4W 5%
R905	11	A	1002064	1	EA	RESISTOR 1 KΩ 1/4W 5%
R901-R904, R911-R914	10	A	1002160	8	EA	RESISTOR 100 KΩ 1/4W 5%
CR902	9	A	1002334	1	EA	DIODE 1N5232 5.6V
CR901, CR903-CR906	8	A	1000711	5	EA	DIODE 1N4001
U908	7	A	1002333	1	EA	IC 3130
U906, U907	6	A	1002332	2	EA	IC 4012
U905	5	A	1002331	1	EA	IC 4049
U903, U904	4	A	1002193	2	EA	IC 4042
U901, U902	3	A	100 2330	2	EA	IC 74C89
—	2	C	1001947	1	EA	PC BOARD FAB
—	1	D	1002329	—	—	SCHEMATIC

(5) CONNECTOR MOUNTED WITH SCREW HEAD ON COMP SIDE OF BD.

(4) INSTALL AFTER FLOW SOLDER

(3) PACKAGE AND SHIP SEPARATELY

2. WAS ULTEK NUMBER C221-712-700

1. SQUARE PADS INDICATE + SIDE OF CAPS, CATHODE OF DIODES AND PIN 1 OF IC'S.

NOTES:

THIS DRAWING CONTAINS PROPRIETARY INFORMATION AND ANY REPRODUCTION DISCLOSURE OR USE OF THIS DRAWING IS EXPRESSLY PROHIBITED EXCEPT AS PERKIN-ELMER VACUUM DEPARTMENT MAY OTHERWISE AGREE TO IN WRITING.

TOLERANCING AND DIMENSIONING PER ANSI Y14.5 - 1982

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES
X ± ____ ANGLES ± 0°30'
.XX ± ____ MACH ____
.XXX ± ____ SURF 63
REMOVE ALL BURRS AND BREAK SHARP EDGES ____ .02 MAX

DRN	WCK	DATE 10-15-85
CKD	MK	DATE 11-5-85
APPD	SLM	DATE 11-5-85
APPD		DATE
APPD		DATE
MATERIAL	—	
FINISH	—	

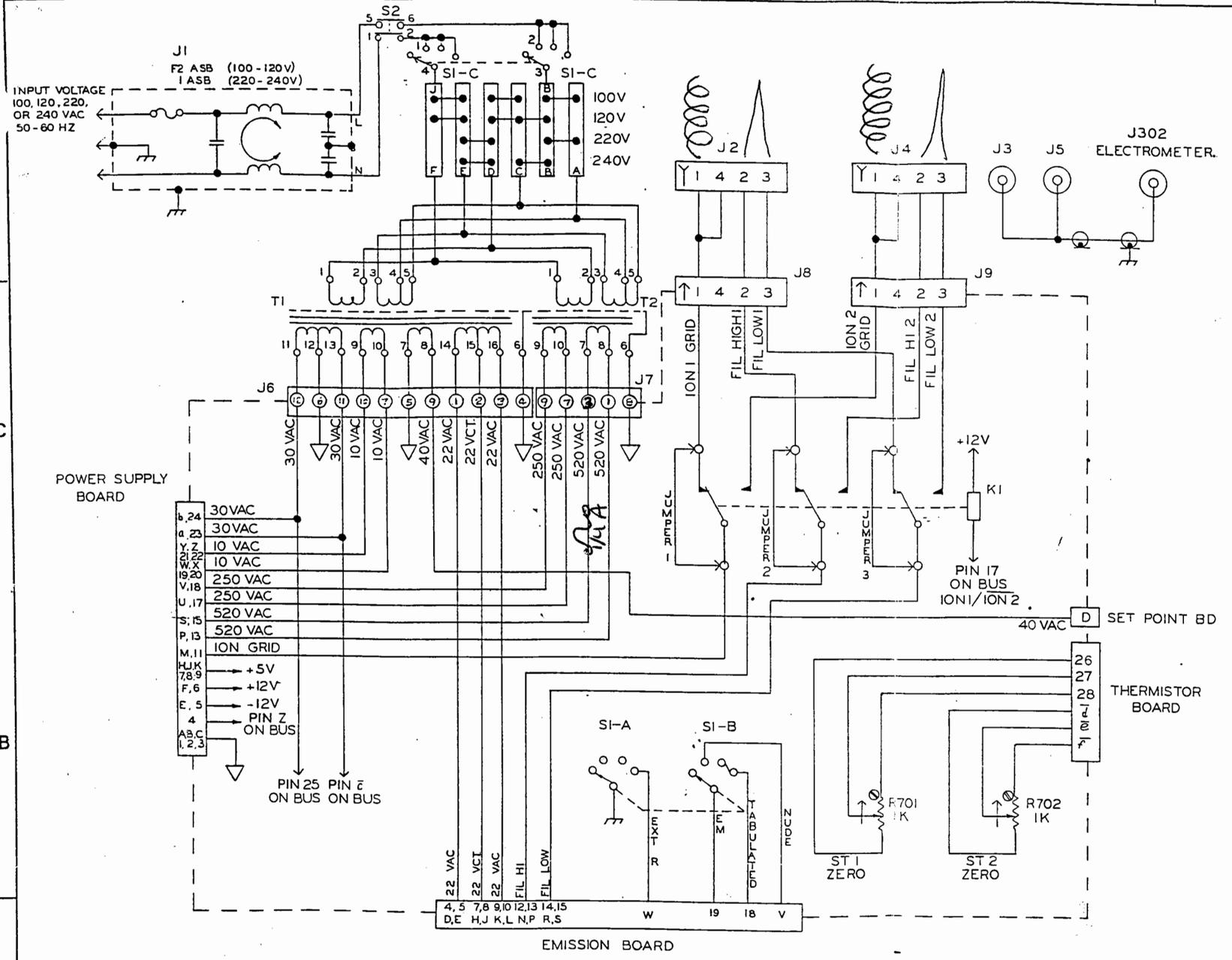
PERKIN-ELMER
Vacuum Products • Eden Prairie, Minn. 5534

TITLE
PC BOARD ASSY-SET POIN
DGC III OPTION

SIZE	DRAWING NO	
C	6050603	
SCALE FULL	WEIGHT	SHEET 1 OF

1002223 A

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	[illegible]	4-26-83	RJF



	DISPLAY	PROCESSOR	ELECTROMETER	EMISSION	SET POINT	PRESSURE CONT.	COMPUTER INT.	BCD & RECORDER	THERMISTOR
1 +5V	X	X	X	X	X	X	X	X	
2 +5V	X	X	X	X	X	X	X	X	
3 +5V	X	X	X	X	X	X	X	X	
4 $\overline{\text{HALT}}$		X		Δ					
5 $\overline{\text{RESET}}$	X	X	X	Δ		X	X		
6 R/W	X	X	X	X	X	X	X		
7				Δ					
8				Δ					
9				Δ					
10				Δ					
11 -12V		X	X	X		X		X	X
12 ION1/$\overline{\text{ION2}}$	X		X	Δ					
13 SP4	X			Δ	X				
14 SP3	X			Δ	X				
15 SP2	X			Δ	X				
16 +12V	X	X	X	X	X	X	X	X	X
17 ION1/$\overline{\text{ION2}}$			X						
18				Δ					
19 -5V		X		Δ			X		X
20 $\overline{\text{BXXX}}$		X					X		
21 $\overline{\text{AXXX}}$		X			X	X	X		
22 $\overline{\text{9XXX}}$		X		X					
23 $\overline{\text{8XXX}}$	X	X							
24									
25 30 VAC				X					
26									Δ
27									Δ
28									Δ
29 D1	X	X	X	X	X	X	X		
30 D5	X	X	X	X	X	X	X		
31 D0	X	X	X	X	X	X	X		
32 D4	X	X	X	X	X	X	X		
33 A15		X							
34 A12		X							
35 A11	X	X	X		X	X	X		
36 A8		X					X		
37 A7		X					X		
38 A4		X					X		
39 A3		X			X		X		
40 A0	X	X	X		X		X		
41 GND	X	X	X	X	X	X	X	X	X
42 GND	X	X	X	X	X	X	X	X	X
43 GND	X	X	X	X	X	X	X	X	X

	DISPLAY	PROCESSOR	ELECTROMETER	EMISSION	SET POINTS	PRESSURE CONT.	COMPUTER INT.	BCD & RECORDER	THERMISTOR
A +5V	X	X	X	X	X	X	X	X	
B +5V	X	X	X	X	X	X	X	X	
C +5V	X	X	X	X	X	X	X	X	
D $\overline{\text{IRQ}}$		X		Δ		X			
E $\overline{\text{NMI}}$	X	X		Δ		X			
F VMA		X							
H				Δ					
J Ø2	X	X	X	Δ		X			
K				Δ					
L				Δ					
M -12V		X	X	X		X		X	X
N				Δ					
P BA		X		Δ					
R MR		X		Δ					
S SP1	X			Δ	X				
T +12V	X	X	X	X	X	X	X	X	X
U ST2/$\overline{\text{ST1}}$			X						X
V PC	X			Δ	X				
W -5V		X		Δ		X			X
X RE		X							
Y THERMISTOR			X						X
Z $\overline{\text{DEGAS}}$				X					
a $\overline{\text{8XXX}}$		X	X						
b									
c 30 V AC				X					
d									Δ
e									Δ
f									Δ
h D3	X	X	X	X	X	X	X		
j D7	X	X	X		X	X	X		
k D2	X	X	X	X	X	X	X		
l D6	X	X	X		X	X	X		
m A14		X							
n A13		X							
p A10	X	X	X		X	X	X		
r A9		X				X	X		
s A6		X					X		
t A5		X					X		
u A2		X			X		X		
v A1	X	X	X		X		X		
w GND	X	X	X	X	X	X	X	X	X
x GND	X	X	X	X	X	X	X	X	X
z GND	X	X	X	X	X	X	X	X	X

TABLE I MOTHER BD BUS CONNECTOR
X SHOWS WHERE EACH LINE IS USED
Δ SHOWS CONNECTIONS NOT ON THE COMMON BUS, BUT ARE SHOWN SEPERATLY ON THIS DRAWING

THIS DRAWING CONTAINS PROPRIETARY INFORMATION AND ANY REPRODUCTION, DISCLOSURE OR USE OF THIS DRAWING IS EXPRESSLY PROHIBITED EXCEPT AS PERKIN-ELMER VACUUM DEPARTMENT MAY OTHERWISE AGREE TO IN WRITING.

TOLERANCING AND DIMENSIONING PER ANSI Y14.5-1973

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
.X ± .030 ANGLES ± 0° 30'
.XX ± .010 MACH. 63
.XXX ± .005 SURF. ▽
REMOVE ALL BURRS AND BREAK SHARP EDGES ___ MAX.

	DATE
DRN. MRT	
CKD. [illegible]	DATE
APPD. RJF	DATE 4-27-83
APPD.	DATE
APPD.	DATE

MATERIAL

FINISH

NEXT ASS'Y | USED ON

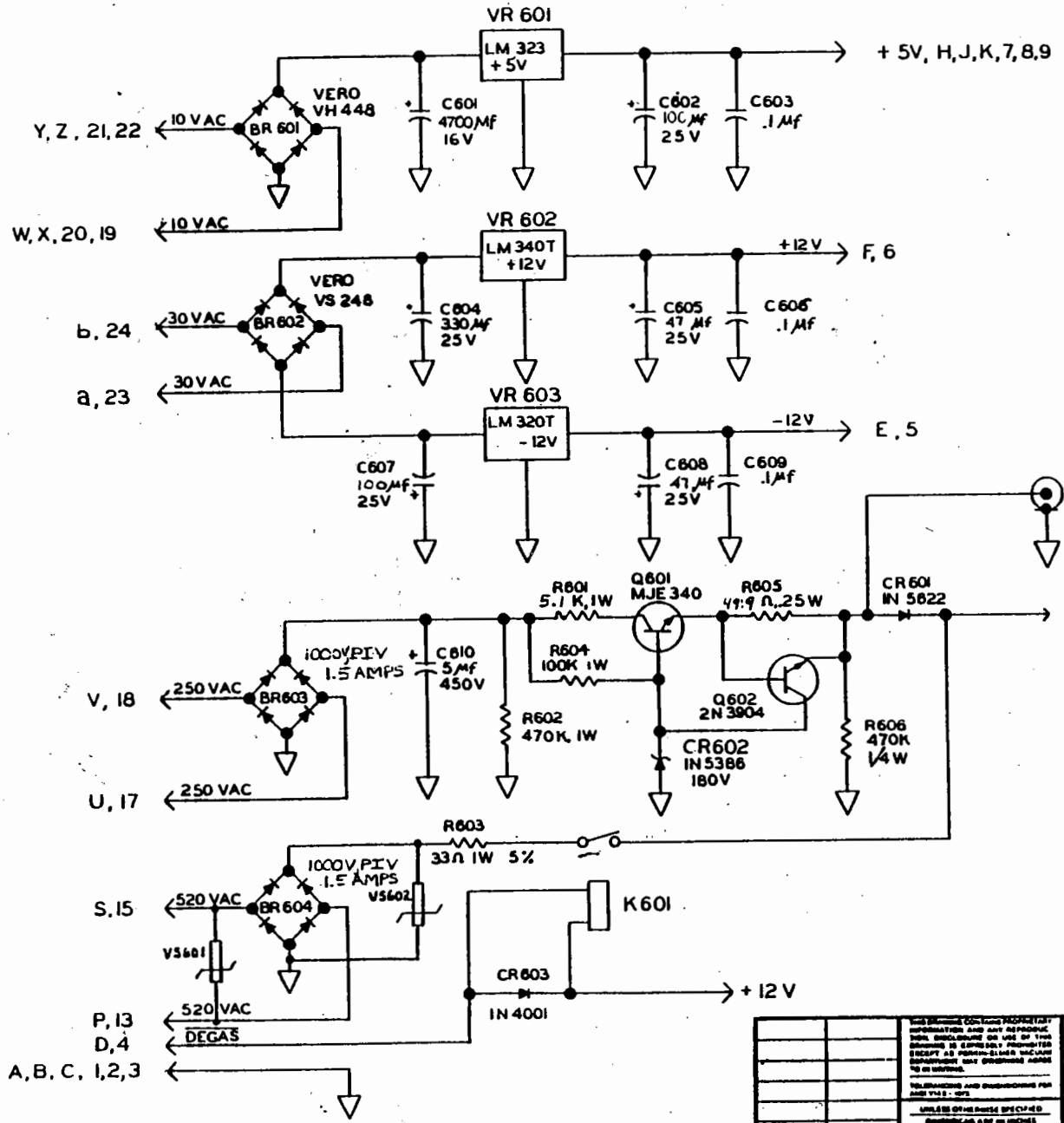
PERKIN-ELMER
Vacuum Department • Eden Prairie, Minn. 55344

TITLE
SCHEMATIC, MOTHER BOARD
DGC III

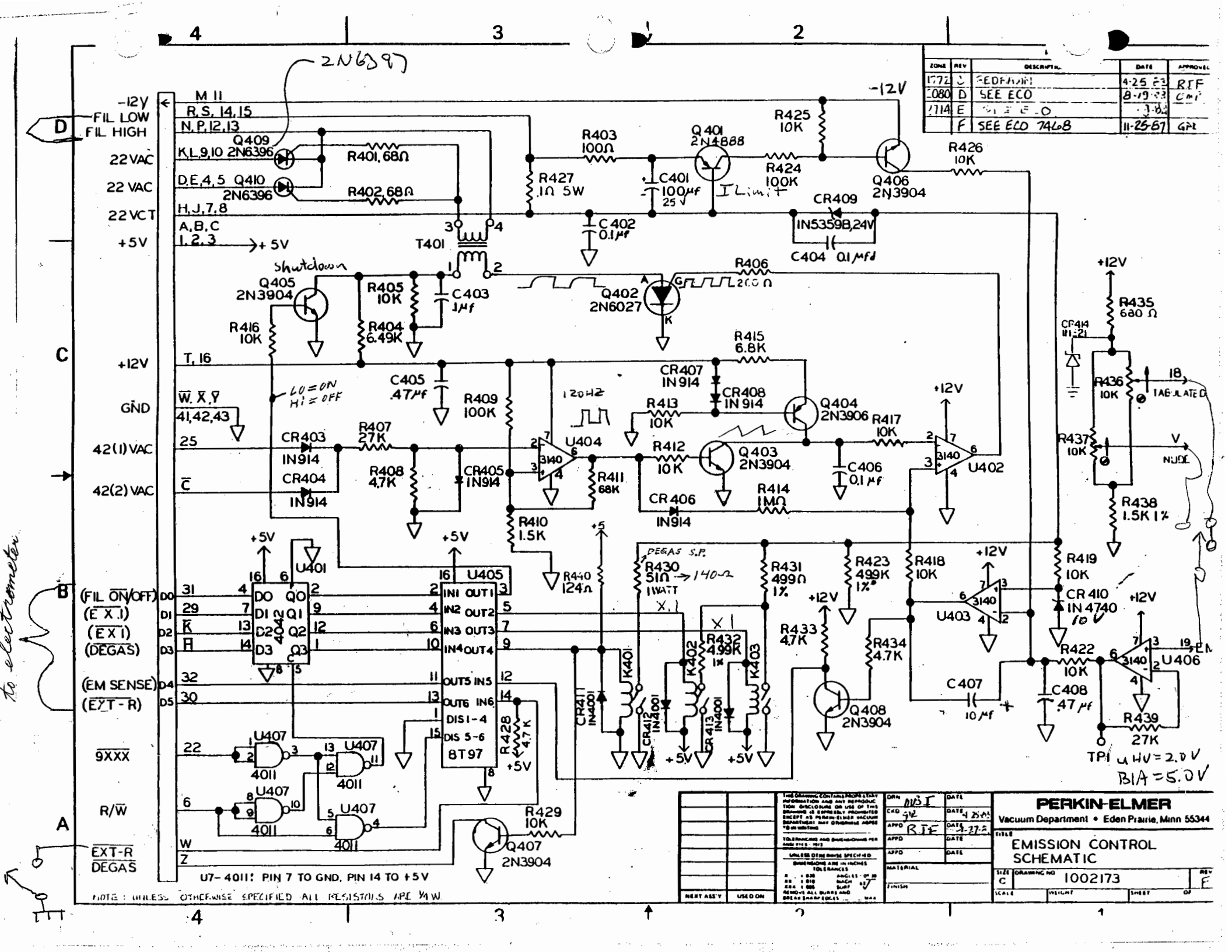
SIZE D | DRAWING NO. 1002223 | REV. A

SCALE: | WEIGHT | SHEET 1 OF 1

ZONE	REV	DESCRIPTION	DATE
1773	B	REDRAWN SEE	4-25-83
		SEE ECO	1-31-84
851335	E	REV RG01, 1 RG05	5-22-85



DRN	MBI	DATE	PERKIN-ELMER	
CKD	[illegible]	DATE 4-25-83	Vacuum Department • Eden Prairie, Minn. 5534-	
APPD	RJF	DATE 4-27-83	TITLE	SCHEMATIC POWER SUPPLY BD DGC III
APPD		DATE	SIZE C	DRAWING NO 1002203
APPD		DATE	SCALE	WEIGHT
MATERIAL			SHEET 1 OF 1	
FINISH				
NEXT ASSY	USED ON			



ZONE	REV	DESCRIPTION	DATE	APPROVED
1772	C	REDRAWN	4-25-67	RIF
2080	D	SEE ECO	8-19-67	GMP
1714	E	SEE ECO	10-6-67	
	F	SEE ECO 7460B	11-25-67	GMP

D1002329

REV	ECO	DESCRIPTION OF CHANGE	DRAWN BY	APPD	DATE
A	445	CHG 22MF TO .10 MF	MBI	[illegible]	[illegible]
B	S-00230	MADE CHG ON U903-U909		[illegible]	[illegible]
C	87-251	SWITCH R904 AND R909	[illegible]	[illegible]	[illegible]
D		SEE ECO # 7910		[illegible]	[illegible]

U902 74C89 RAM

U901 74C89 RAM

U904 4042

U903 4042

U905 4049

U906 4012

U907 4012

U908 3130

Vcc STDBY

+5V

+12V

R901 100KΩ

R902 100KΩ 1/4W

R903 100KΩ 1/4W

R904 100KΩ 1/4W

R905 1K, 1/4W

R906 200Ω 1/4W

R907 49.9K 1%

R908 49.9K

R909 3.01K 1%

R910 4.99K 1%

R911 100KΩ 1/4W

R912 100KΩ 1/4W

R913 100KΩ 1/4W

R914 100KΩ 1/4W

CR901 IN4001

CR902 IN5232 (5.6V)

CR903 IN4001

CR904 IN4001

CR905 IN4001

CR906 IN2001

C901 10MF 20V

C902 .1MF

C903 .1MF

BT901 3.6V 100W

Q901 MPS-D04 (B REQD)

Q902

Q903

Q904

Q905

Q906

Q907

Q908

K901

K902

K903

K904

J902

SP1

SP2

SP3

SP4

NC

C

NO

4. WAS ULTEK NUMBER 0221-712-500
3. CONNECT PIN 14 OF U907 TO +5V; PIN 7 TO GROUND.
2. CONNECT PIN 14 OF U906 TO Vcc STDBY; PIN 7 TO GROUND.
1. CONNECT PIN 8, 9, 11 AND 14 OF U905 TO GROUND.

ITEM	REQ.	PART NUMBER	DESCRIPTION
		1002328	

DRAWN MBI 4-16-81 | CHECKED DMT 4-21-81 | APPROVED [illegible]

BREAK ALL SHARP CORNERS UNLESS OTHERWISE NOTED

DO NOT SCALE DRAWING

TOLERANCES UNLESS OTHERWISE SPECIFIED

SURFACE FINISH IN MICROINCHES

SCALE NONE

TITLE SCHEMATIC SETPOINT OPTION DEC II

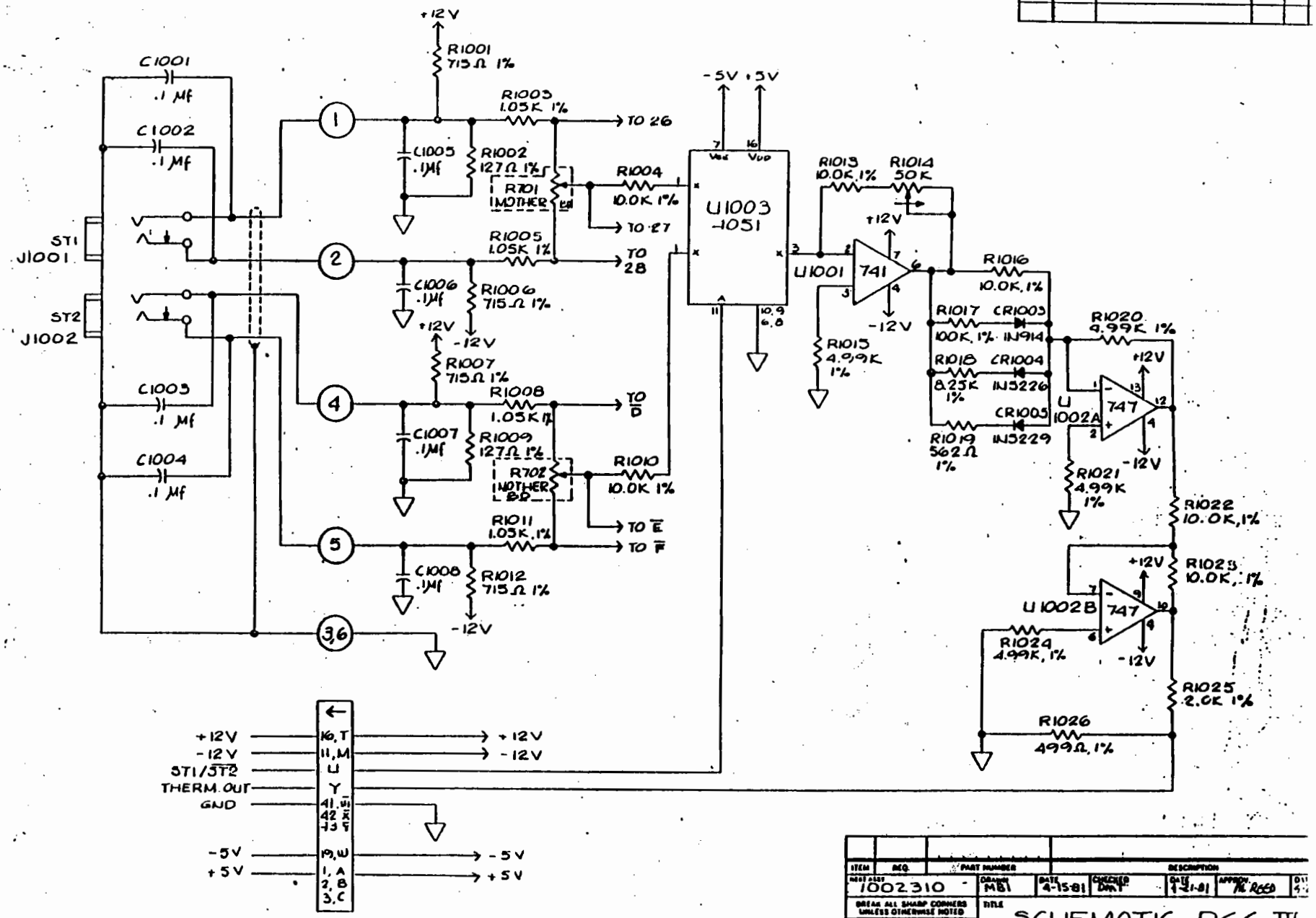
PERKIN ELMER

PALO ALTO, CALIFORNIA

DRAWING NO D 1002329

CLASS OF DRAWING [illegible]

C1002311



2. WAS ULTEK NUMBER (221-713-700)
1. LAST R1026, C1008, U1003, CR1005

NOTES:

ITEM	REQ.	PART NUMBER	DESCRIPTION
NEXT ASSY 1002310		DRAWN MBI 4-15-81	CHECKED DMT 4-21-81 APPROVED TK REED

BREAK ALL SHARP CORNERS UNLESS OTHERWISE NOTED
DO NOT SCALE DRAWING
TOLERANCES UNLESS OTHERWISE SPECIFIED
SCALE NONE

TITLE: SCHEMATIC DGC III THERMISTOR GAUGE

PERKIN-ELMER ULTEK PALO ALTO, CALIFORNIA

DRAWING NO. C 1002311

CLASS OF DRAWING D

THE INFORMATION ON THIS DRAWING IS PROPRIETARY INFORMATION AND MAY NOT BE USED OR THE DRAWING REPRODUCED WITHOUT THE WRITTEN PERMISSION OF THE PERKIN ELMER CORP.

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
1777	D	REDRAWN (WAS ON SEPIA)	4-26-83	RJF
2277	E	See ECO	10-19-83	

① Rev A Boards w/ TMS2716 (Triple P/s) have -5V at U103, 104, 105, 106 pin 21

U101-19 connects to (4) Rom-20 + $\overline{P}$

U102-14, 15, 16, 17 connect to each ROM-18

U101-20 = N/C

② Rev A Boards have different Reset CKT. Functions OK w/ New EPROM Pos. (+5

Note: Boards w/ TMS2716 (Triple P/s) have -5V at U103, 104, 105, 106 pin 21 Y101 2.4756 MHZ C101 27 Pf C102 27 Pf Input +12 at pin 19. Remove both at large traces on rear of P/C Bd.

U101 MC6802 — VCC 35 → +5V; 8 → +5V; C103 10Mf 20V; VSS 1, 21; A0–A15, D0–D7, E, R/W, VMA, NMI, IRQ, RESET, BA, HALT, MR, RE

RN1 C104 U101-40

U103 2716/2532 ROM 3 Fxxx — U104 2716/2532 ROM 2 Exxx — U105 2716/2532 ROMØ Cxxx — U106 2716/2532 ROM 1 Dxxx — A0–A11, D0–D7, CS, VPP, +5V

U102 74LS154 — A, B, C, D, G1, G2

U107 74C04

R101 3.3K, CR101 IN914, C104 10Mf 20V

R102 3.3K, R103 3.3K, R104 3.3K, R105 3.3K, R106 3.3K

LM320T-5 U108 IN OUT GND — C105 10Mf 20V, C106 10Mf 20V

C107 10Mf 20V, C108 10Mf 20V

+12V, GND, +5V, -12V, -5V

$\overline{\text{Ø2}}$ VMA

U107 74C04 or 74C04N Hex Inverter

1003771 Computer Int'c ROM 2532 (RT Socket)

1003772 Main ROM 2532

NOTE:
PLACE A .1μf CAP. BETWEEN +5 AND GROUND ON EACH IC; C111-C116.

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES .X ± .03, .XX ± .010, .XXX ± .005, ANGLES ± 0° 30', FINISH ✓, REMOVE ALL BURRS AND BREAK SHARP EDGES MAX.

	ORN.	DATE
	MBI	
	CKD.	DATE 4-26-83
	APPD. RJF	DATE 4-29-83
	APPD.	DATE
	APPD.	DATE

MATERIAL

NEXT ASSY | USED ON

PERKIN-ELMER
Vacuum Department • Eden Prairie, Minn. 55344

TITLE: PROCESSOR BOARD SCHEMATIC DGC III Rev C

SIZE D | DRAWING NO. 1002157 | SCALE: | WEIGHT | SHEET

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	[illegible]	[illegible]	RJF

MOUNTED ON CHASSIS

+12V

AUDIBLE ALARM

Q201 MPS-U04

DS201 DS202 DS203 DS204 HP5082-4860 4 PLCS

Q202 Q203 Q204 Q205 2N3904 4 PLCS

R201 1K

R202 10K

R203 3.3K R204 3.3K R205 3.3K R206 3.3K

P201

C210 18µf 15V

HP 5082-4860 5PLCS DS205 DS206 DS207 DS208 DS209

C201 .1µf

U201 MC 6821

R209 10K 1/4W

R210 10K 1/4W

R211 10K 1/4W

J203

PB4 IS NOT USED

C202 .1µf

U202 F9368

U203 5086-7760

R207 180Ω

C204 .1µf

U204 F9368

U205 5082-7760

C206 .1µf

R208 180Ω

U206 F9368

U207 5082-7756

C208 .1µf

U208 F9368

U209 5082-7760

J202

S501 "SET PT" S502 S503 "I/T" S503 "1" S505 "GAS CT" S506 "DEGAS" S507 "FS" S508 "2" S509 "AUTO CROSS" S510 "1" S511 "LEAK DET" S512 "PRESS CONT"

FRONT PANEL KEY BD REF ONLY

UNLESS OTHERWISE SPECIFIED RESISTORS ARE IN OHMS, 1/4W, ±5%

THIS DRAWING CONTAINS PROPRIETARY INFORMATION AND ANY REPRODUCTION, DISCLOSURE OR USE OF THIS DRAWING IS EXPRESSLY PROHIBITED EXCEPT AS PERKIN-ELMER VACUUM DEPARTMENT MAY OTHERWISE AGREE TO IN WRITING.

TOLERANCING AND DIMENSIONING PER ANSI Y14.5-1973

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES
.X ± .030 ANGLES ± 0° 30'
.XX ± .010 MACH 63
.XXX ± .005 SURF
REMOVE ALL BURRS AND BREAK SHARP EDGES ____ MAX

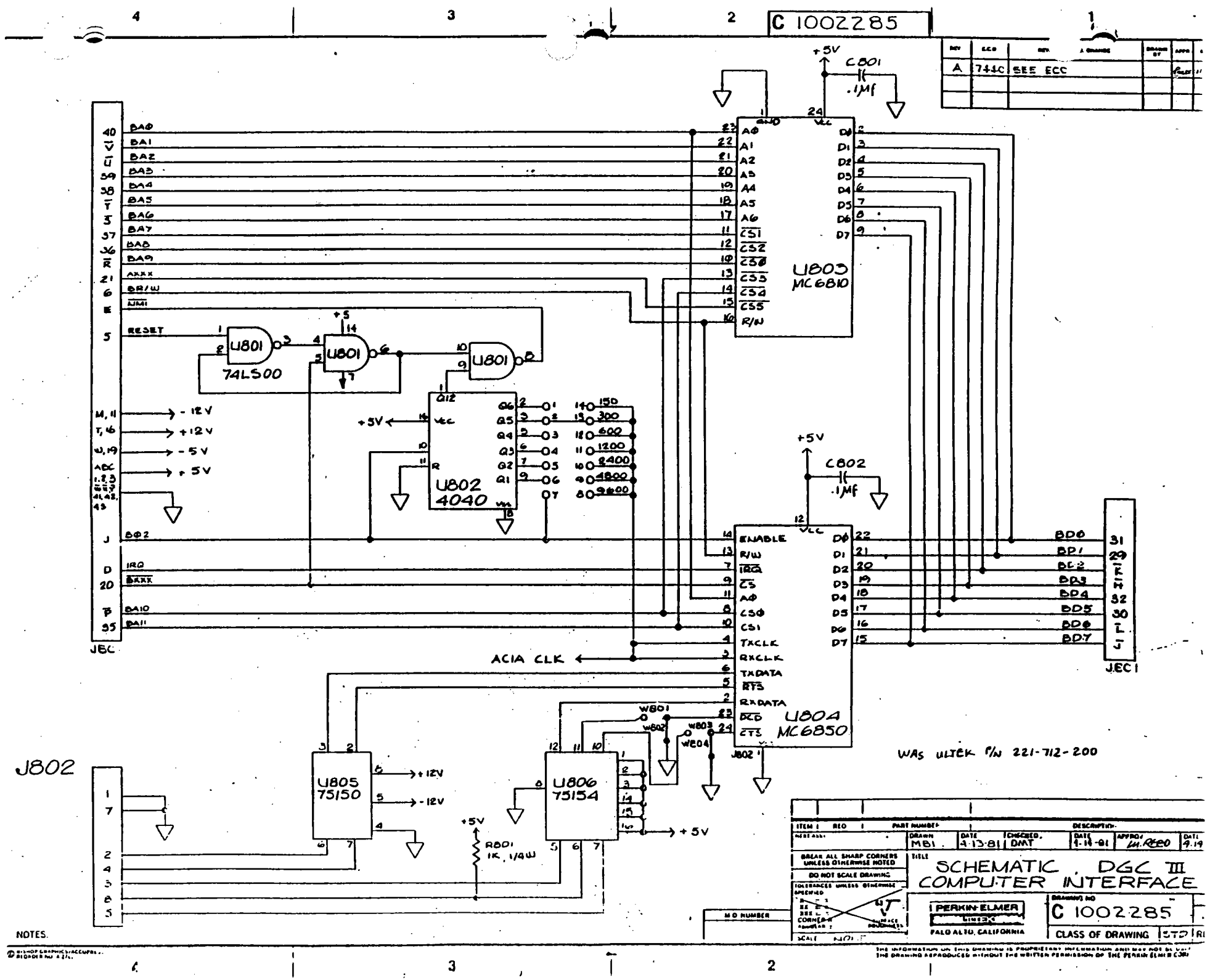
NEXT ASSY | USED ON

DRN.	MP.I	DATE
CKD.		DATE
APPD.	RJF	DATE 4-27-83
APPD.		DATE
APPD.		DATE
MATERIAL		
FINISH		

PERKIN-ELMER
Vacuum Department • Eden Prairie, Minn. 55344

TITLE
DISPLAY BOARD SCHEMATIC

SIZE	DRAWING NO.	REV.
D	1002733	-
SCALE	WEIGHT	SHEET OF


C 1002285
+5V
C801
.1Mf
U803
MC6810
U801
74LS00
U802
4040
C802
.1Mf
U804
MC6850
ACIA CLK
U805
75150
U806
75154
R801
1K, 1/4W
J802
JEC
JEC1
- 12 V
+12 V
- 5 V
+ 5 V
+12V
-12V
+5V
WAS ULTEK P/N 221-712-200
SCHEMATIC, DGC III
COMPUTER INTERFACE
PERKIN-ELMER
PALO ALTO, CALIFORNIA
C 1002285
CLASS OF DRAWING STD
NOTES.

10⁻³ = K 301
10⁻⁴ =
10⁻⁵ =
10⁻⁶ =
10⁻⁷ = V302
10⁻⁸ = ~~V303~~

DWG NO. 1004602 | -1 | REV.

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED

MC6821
U301

MC14433
U302

4051
U303

P301
R/W
(A11)
(A10)
(8 MHz)
Ø2
D7
D6
D5
D4
D3
D2
D1
D0
RESET
(A1)
(A0)
Emulation Board

ION 1/ION 2
W, 19
-5V
C309 10µF
ION 1/ION 2
R307 10K
Q307 2N6427
CR305 IN4001
+12V

ST 2/ST 1
THERMISTOR
12V
-12V
+5V
A,B,C
C313 10µF
GROUND
41,42,43 W, X, Y
TP-303

J302
I/G INPUT

3 stacked

1 2 3

R300 150 K
C302 .1µF
C303 .1µF
C304 .1µF
C301 .1µF
R301 470K
C305 1 FILM
C306 .1µF
C307 .1µF
R312 R305 R304 R311 620 X 4
+12V
-12V
C314 .1µF
U304
AD7510
C315 .1µF
U307 MC1403
R302 249Ω 1%
R303 1K 1%
C312 .1µF
C308 .01 MF
TP-301 (center)
TP-302 (Left side)
R306 10K 1%
R308 10M 1%
R309 100K 1%
R310 10⁹ 1%
C310 560 PF
CR304 CR303 CR302 CR301
K304 K301 K302 K303
C311 .47 FILM
R319 1M 1%
R313 10K
CR306
R315 3.3K
U305 AD515
C317 .1µF
R318 10K
R314 10K Zero center
C316 .1µF
R320 100K 1%
R321 10K 1%
U306 3140
R330 10K
R316 10K (-12)

NOTES
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS 1/4 W ± 5%, CAPACITORS IN MICROFARADS.
2. PLACE A .1µF CAPACITOR BETWEEN GROUND AND POWER LINES ON EACH I.C.

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TOLERANCING AND DIMENSIONING PER ANSI Y14.5-1973

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES
.X ± .030 ANGLES ± 2°
.XX ± .010 MACH. ~~63~~ 32
.XXX ± .005 SURF
REMOVE ALL BURRS AND SHARP EDGES

	NAME	DATE
DRN.	J. RYAN	11/5/82
CKD.		
APPD.		
APPD.		
APPD.		

MATERIAL
FINISH
NEXT ASSY | USED ON

PERKIN-ELMER
Vacuum Department • Eden Prairie, Minn. 55344

TITLE
SCH-ELECT DGC III HI SENS.

SIZE D | DRAWING NO. 1004602 | REV.
SCALE | WEIGHT | SHEET 1 OF 1

See sheet in your Sonstd electro

REV.	E.C.O.	DESCRIPTION OF CHANGE	ORIGINATOR	APPR.	DATE
A	28066	R1116 WAS R112U ADD R111L R112L CR1 SEE NOTES 2 & 3			

J1103

J1101

+5V

R1102 10K 1/4W

R1103 10K, 1/4W

R1101 10K 1/4W

Q1101 3904

U1007

U1101 4042a

U1102 4042

U1103 4042

U1104 4042

U1105 4042

U1106

U1108

R1104 (X8) 10K 2% 16 PIN DIP

R1105 (X8) 100K 2% 16 PIN DIP

R1106 (X8) 10K 1% 16 PIN DIP

U1109

U1111

U1112

U1110

R1107 26.7K 1%

4011 4001 4030 4050

PB5 PB0 PB1 PB2 PB3 PA4 PA1 PA2 PA3 PA5 PA6 PA7

FIL ON
FIL OFF
GAUGE 1
GAUGE 2
FIL STA
MULT
BCD1-1
BCD1-2
BCD1-4
BCD1-8
BCD2-1
BCD2-2
BCD2-4
BCD2-8
BCD4-1
BCD4-2
BCD4-4
BCD4-8
BCD3-1
BCD3-SIGN
DATA VALID
DATA VALID

R1108 1.62K 1%

R1109 10K 1%

R1110 1K, 1%

U1113 714

U1114 741

R1111 1.5K

R1112 10K

R1113 1K, 5%

R1116 100K 1% FOR OPTION ONLY

R1114 1.62K 1%

R1115 10K 1%

U1115 741

U1116 741

R1117 1.5K 5%

R1118 10K

R1119 4.7K 5%

+12V -12V +5V

A,B,C 1,2,3 T,16 4,11 D,E,F H,J,K 4,5

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 5%

ITEM	REQ	PART NUMBER	DESCRIPTION
NEXT ASSY		D-1002316	

DRAWN MBI 8-6-81 | CHECKED LMT 8-21-81 | APPROVED W. Reed 8-21-81

BREAK ALL SHARP CORNERS UNLESS OTHERWISE NOTED
DO NOT SCALE DRAWING
TOLERANCES UNLESS OTHERWISE SPECIFIED

M.C. NUMBER

SCALE NONE

TITLE SCHEMATIC BCD AND RECODER DGC III

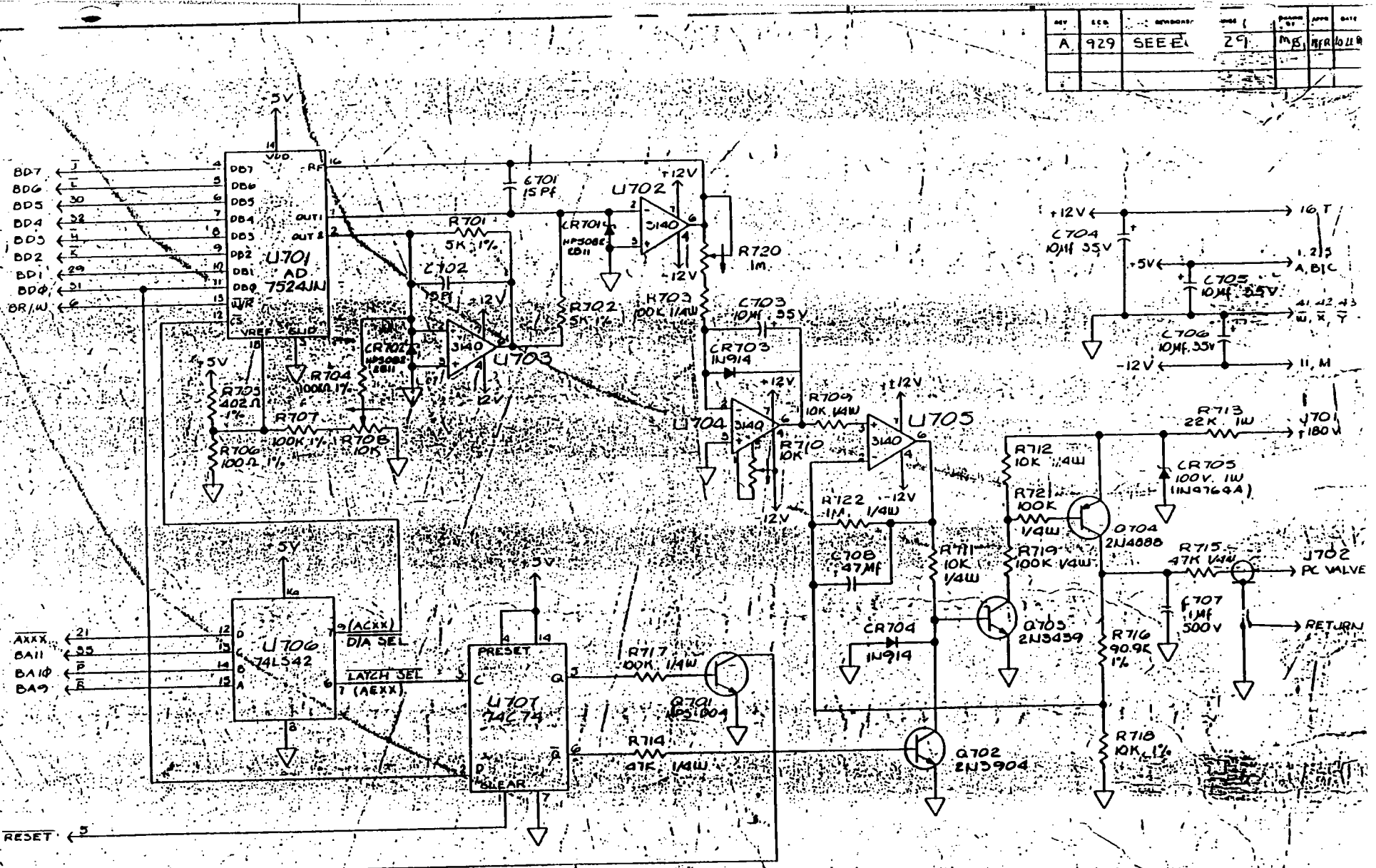
PERKIN ELMER PALO ALTO, CALIFORNIA

DRAWING NO. D 1002317

CLASS OF DRAWING STD REV.

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REV	ECO	DESCRIPTION	PAGE OF	APPD	DATE
A	929	SEE E	2	MB	10 11 8

5. WAS ULTEK NUMBER C221-704-300
4. ALL CAPS. ARE IN MICRO FARAD
3. ALL RESISTORS ARE IN OHMS, 1/4 W, ± 5%
2. U707 UNUSED INPUTS, PIN 10, 11, 12, 13 ARE CONNECTED TO GROUND
1. CR701, 702 ARE HP5082-2811 SCHOTTKY DIODES.

NOTES: UNLESS OTHERWISE SPECIFIED

ITEM	REQ	PART NUMBER	DESCRIPTION
MATERIAL 01002294			

DRAWN MB1 | DATE 4-15-81 | CHECKED DIAT | DATE 9-16-81 | APPROVED M. REED | DATE 9/17

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TITLE: DGC III SCHEMATIC PRESSURE CONTROL

PERKIN ELMER / PHI ULTEK DIV
PALO ALTO, CALIFORNIA

DRAWING NO. C1002295 A

CLASS OF DRAWING 3RD

M.O. NUMBER

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