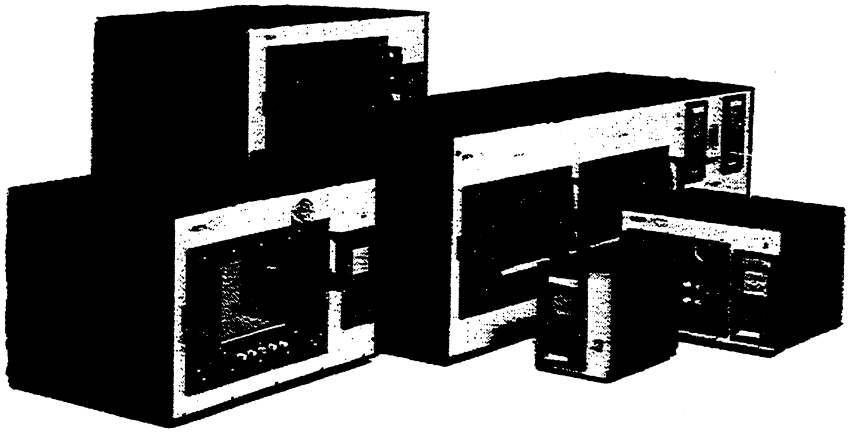
INSTRUCTIONAL MANUAL
9000 SERIES TEMPERATURE CHAMBERS
SERIAL NUMBER_____



9000 SERIES ENVIRONMENTAL TEST CHAMBERS

ENVIRONMENTAL CONTROL EQUIPMENT FOR RESEARCH AND INDUSTRY
5775 KEARNY VILLA ROAD SAN DIEGO, CALIFORNIA 92123

PRINTED IN U.S.A.
9000 SERIES-1187

WARRANTY

Delta Design, Inc., warrants all products it manufactures and sells against defective material and workmanship for a period of 90 days from the date of our shipment. Temperature chambers and electronics are warranted for one year from the date of our shipment. All contactor assemblies are warranted for a period of 90 days or 1/2 million cycles.

Obligation under this warranty is limited to repair at the factory (5775 Kearny Villa Rd., San Diego, CA 92123), or one of our authorized service stations, or at our option, replacement of any product Delta Design determines to be defective or not in accord with stated specifications. All replacement parts will be invoiced and credit issued upon acceptance of defective part.

Delta Design will not accept responsibility for any defect caused by improper use, nor will Delta Design assume liability for any unauthorized repairs or modifications to its products or materials, even though defective or not in accord with the specifications. In no case will responsibility extend to products, materials, or equipment not manufactured by Delta Design.

All products to be returned to Delta's plant for warranty repair must have prior approval from from Delta Design, Inc. Delta Design will not accept liability for any unauthorized returns. Transportation for the return of the repaired equipment to the customer shall be prepaid by Delta Design. Delta Design will not allow any credit for repairs or alterations to its products, and Delta Design shall in no event assume any responsibility for repairs or alterations made other than by Delta Design. Any products repaired or replaced under this Warranty will be warranted for the balance of the warranty period remaining with respect to the original purchased product.

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No liability will be accepted for any damages to customer's materials and equipment due to the use or misuse of Delta's products, nor for any loss of profits or other special damages.

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Specifications remain subject to change to allow the introduction of design improvements.

FOREWORD

Delta Design, Inc., 9000 Series Temperature Chambers offer a wide choice of temperature ranges and capacities, in addition to their smart electronics. The Delta family of precision chambers range in test volume from 1/3 cubic foot to 5-3/4 cubic feet. All deliver a temperature range of -73 degrees Centigrade to +315 degrees Centigrade, precisely controlled by advanced electronic circuitry, and each chamber is equipped with an adjustable over-temperature protection device.

With the exception of the Model 9080 Dual Chamber Shock System, all chambers are temperature expandable to -184 degrees Centigrade, utilizing optional LN2 cooling. Standard chamber coolant is 1050 psi LCO2. Models 9059 and 9064 have a 1-1/4" diameter access port on the left side. Model 9076 has three 7/8" diameter access ports in the rear.

Model 9080, the Dual Chamber Shock System, is an ideal instrument for moderate volume thermal cycling and shock testing of electronic components, particularly tests requiring many combinations of temperatures and soak times. This unique system features dual chambers which operate independently, but are interconnected by a transfer cage that moves between them (transfer time is 5 seconds). The chambers can be programmed for short or long time spans or any combination, with automatic cycle counting and shutdown control.

Typical Standard Features:

Model 9010 Controller, thermometer, CO2 hose/filter, 1050 psi CO2 valve.

Typical Standard Specifications:

Temperature Accuracy -- Setpoint to actual
+/-1.0 degrees C
Temperature Deviation -- After stabilization
+/-0.1 degrees C
Resettability -- +/-0.25 degrees C
Line Voltage Stabilization --
+/-0.25 degrees C for 105-125 VAC
or 220-240 VAC line voltage change
Failsafe -- Adjustable over-temperature

9010 TEMPERATURE CONTROLLER

DELTA DESIGN CHAMBERS

ENVIRONMENTAL CONTROL EQUIPMENT FOR RESEARCH AND INDUSTRY
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PRINTED IN U.S.A.

ADDENDUM FOR THE SOFTWARE VERSION

LIST OF DEFAULTS:

Setpoint	25.0 degrees
High Temp Limit	315.0 degrees
Low Temp Limit	-73.0 degrees
GPIB Address	27
RS-232 Baud	9600
Calibration Points	none
Rate Program:	
Set Temp #1	-55.0 degrees
Set Temp #2	50.0 degrees
Set Temp #3	105.0 degrees
Set Temp #4	210.0 degrees
All other parameters	0.0

Gains:

TYPE	PGAIN	IGAIN
9023	6	3
9028	6	4
9039	7	4
9059	7	5
9064	7	5
9076	7	5
9080	7	5
9145	7	5

OPERATIONAL CHANGES

The SW1-2 modes can now be entered thru the front panel by pressing both the FCN and UP keys while all segments are on after power-up. If Full Access is allowed by SW1-3, all Rate Programmer parameters will be available from the front panel. If Full Access is inhibited, the controller will come up in Normal Access but with the Rate Programmer temperature list selectable as set-points.

The LCD will blink the message "LOP" three times on power-up if there has been a loss of parameters. This can happen if the battery backup has failed, or deliberately by holding in the FCN, UP and DOWN keys at power-up. Loss of parameters means that the default values have been loaded after clearing all of RAM.

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CHAPTER 1
SAFETY AND GENERAL INFORMATION

1.1 SAFETY

Before attempting to operate any of the 9000 Series Environmental Temperature Chambers, personnel should become familiar with the contents of this manual. Particular attention should be given to warnings and cautions, which are essential to personnel and equipment safety. The following paragraphs define warnings, cautions, and notes as they are used in this manual.

WARNING

Identifies a procedure or condition which, if not strictly observed, could result in serious injury or death.

CAUTION

Identifies a procedure or condition which, if not strictly observed, could result in serious damage to or destruction of equipment.

NOTE

Clarifies or elaborates upon material supplied in the text.

1.2 SCOPE

This manual provides information necessary to operate, maintain, and repair the Delta 9000 Series Environmental Temperature Chambers, also referred to as the chamber.

1.3 FUNCTIONAL DESCRIPTION

1.3.1 Each chamber is a precision environmental temperature chamber having a stainless steel interior, aluminum outer case, and fiberglass insulation.

1.3.2 Each chamber is equipped with a Model 9010 Temperature Controller. Closed air circulation is provided by one to four 140 CFM blowers, depending on chamber model ordered (reference Figure 1-1). The chamber is heated by applying full wave power to bobbin wound nichrome heating elements via the UP and DOWN arrows on the Controller (press until desired

setpoint temperature is displayed on LCD display screen). (Refer to Section 5 for 9010 Temperature Controller operation.) The chamber is cooled by injecting liquid CO2 (or liquid nitrogen in LN2 models) into the air stream through an expansion nozzle. A solenoid valve controlled by the COOL solid state switch, meters coolant flow.

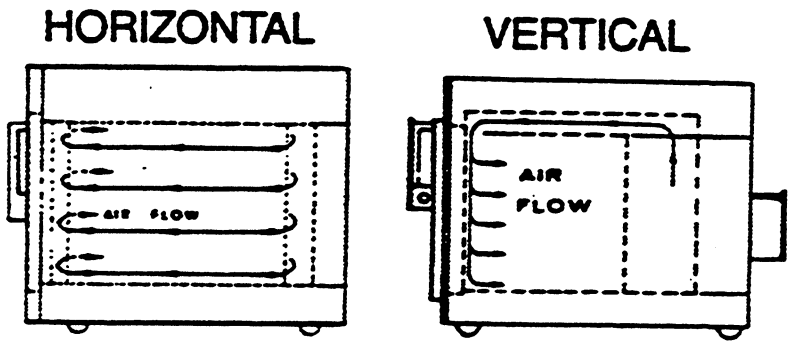


Figure 1-1. Chamber Air Flow Pattern

1.4 REFERENCE DATA

General chamber specifications and other reference data are provided in Table 1-1.

TABLE 1-1. CHAMBER SPECIFICATIONS AND REFERENCE DATA

	9023	9028	9039
TEST VOLUME	0.37 cubic ft (10.5 liters)	0.45 cubic ft (12.7 liters)	0.92 cubic ft (26.05 liters)
INTERNAL DIMENSIONS	8" H x 10" W x 8" D (20.32 x 25.40 x 20.32 cm)	7" H x 16" W x 7" D (17.78 x 40.64 x 17.78 cm)	10" H x 16" W x 10" D (25.40 x 40.64 x 25.40 cm)
OVERALL DIMENSIONS	12-3/4"H x 17-1/2"W x 20-3/4"D (32.38 x 44.45 x 52.70 cm)	12-1/4"H x 28-3/4"W x 20-7/8"D (31.11 x 73.02 x 53.02 cm)	17-7/8"H x 27-1/2"W x 24"D (46.40 x 69.85 x 60.96 cm)
TEMPERATURE RANGE	-73 deg C to +315 deg C or -100 deg F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2	-73 deg C to +315 deg C or -100 def F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2	-73 deg C to +315 deg C or -100 deg F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2
HEAT-UP TIME	Ambient to +217 deg C (+425 deg F) 8 minutes	Ambient to +217 deg C (+425 deg F) 9-3/4 minutes	Ambient to +217 deg C (+425 deg F) 15 minutes
COOL-DOWN TIME	Ambient to -53 deg C (-65 deg F) 2-1/2 minutes	Ambient to -53 deg C (-65 deg F) 3-1/2 minutes	Ambient to -53 deg C (-65 deg F) 2-3/4 minutes
LCO2 CONSUMPTION	5.6 lbs/hr at -53 deg C (-65 deg F)	6.5 lbs/hr at -53 deg C (-65 deg F)	7 lbs/hr at -53 deg C (-65 deg F)
AIR CIRCULATION	Vertical air flow pattern	Horizontal air flow pattern	Vertical air flow pattern
POWER REQUIREMENTS	120 VAC, 50 or 60 Hz, single phase, 1800w 208 VAC, 50 or 60 Hz, three wire, single phase, 1800w 208 VAC, 50 or 60 Hz, four wire, single phase, 1800w 240 VAC, 50 or 60 Hz, single phase, 1800w	120 VAC, 50 or 60 Hz, single phase, 1800w 208 VAC, 50 or 60 Hz, three wire, single phase, 1800w 208 VAC, 50 or 60 Hz, four wire, single phase, 1800w 240 VAC, 50 or 60 Hz, single phase, 1800w	120 VAC, 50 or 60 Hz, single phase, 1800w 208 VAC, 50 or 60 Hz, three wire, single phase, 1800w 208 VAC, 50 or 60 Hz, four wire, single phase, 1800w 240 VAC, 50 or 60 Hz, single phase, 1800w
NET WT (approx)	47 lbs (21.3 Kg)	55 lbs (24.9 Kg)	85 lbs (38.6 Kg)
SHIP. WT (aprx)	60 lbs (27.2 Kg)	70 lbs (31.8 Kg)	100 lbs (45.4 Kg)

TABLE 1-1 (CONTINUED). CHAMBER SPECIFICATIONS AND REFERENCE DATA

	9059	9064	9076
TEST VOLUME	1.85 cubic ft (52.4 liters)	2.2 cubic ft (62.3 liters)	5.78 cubic ft (163.7 liters)
INTERNAL DIMENSIONS	11" H x 19-1/2" W x 15" D (27.94 x 49.53 x 38.10 cm)	12" H x 20" W x 16" D (30.48 x 50.80 x 40.64 cm)	20" H x 20" W x 25" D (50.80 x 50.80 x 63.50 cm)
OVERALL DIMENSIONS	17-1/4"H x 32"W x 25"D (43.82 x 81.28 x 63.50 cm)	21-1/2"H x 32-7/8"W x 30"D (54.61 x 83.66 x 76.20 cm)	36-1/4"H x 38-1/4"W x 37-1/2"D (92.08 x 97.16 x 95.3 cm)
TEMPERATURE RANGE	-73 deg C to +315 deg C or -100 deg F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2	-73 deg C to +315 deg C or -100 def F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2	-73 deg C to +315 deg C or -100 deg F to +600 deg F OPTION -184 deg C (-300 deg F) with optional LN2
HEAT-UP TIME	Ambient to +217 deg C (+425 deg F) 20 minutes	Ambient to +217 deg C (+425 deg F) 28 minutes	Ambient to +217 deg C (+425 deg F) 24 minutes
COOL-DOWN TIME	Ambient to -53 deg C (-65 deg F) 7 minutes	Ambient to -53 deg C (-65 deg F) 4-1/2 minutes	Ambient to -53 deg C (-65 deg F) 8 minutes
LCO2 CONSUMPTION	9.62 lbs/hr at -53 deg C (-65 deg F)	11.6 lbs/hr at -53 deg C (-65 deg F)	15 lbs/hr at -53 deg C (-65 deg F)
AIR CIRCULATION	Horizontal air flow pattern	Vertical air flow pattern	Horizontal air flow pattern
POWER REQUIREMENTS	120 VAC, 50 or 60 Hz, single phase, 1800w 208 VAC, 50 or 60 Hz, three wire, single phase, 1800w 208 VAC, 50 or 60 Hz, four wire, single phase, 1800w 240 VAC, 50 or 60 Hz, single phase, 1800w	120 VAC, 50 or 60 Hz, single phase, 1800w 208 VAC, 50 or 60 Hz, three wire, single phase, 3600w 208 VAC, 50 or 60 Hz, four wire, single phase, 3600w 240 VAC, 50 or 60 Hz, single phase, 1800w	208 VAC, 50 or 60 Hz, three wire, single phase, 4800w 208 VAC, 50 or 60 Hz, four wire, single phase, 4800w 240 VAC, 50 or 60 Hz, single phase, 4800w
NET WT (approx)	98 lbs (44.5 Kg)	115 lbs (52.2 Kg)	232 lbs (105.9 Kg)
SHIP. WT (aprx)	105 lbs (47.6 Kg)	235 lbs (106.6 Kg)	413 lbs (188.5 Kg)

TABLE 1-1 (CONTINUED). CHAMBER SPECIFICATIONS AND REFERENCE DATA

	9080	9039 FHT *
TEST VOLUME	Transfer Cage 0.29 cubic ft (8.2 liters)	0.92 cubic ft (26.05 liters)
INTERNAL DIMENSIONS	Transfer Cage 5" H x 11" W x 9" D (12.70 x 27.94 x 22.86 cm)	10" H x 16" W x 10" D (25.40 x 40.64 x 25.40 cm)
OVERALL DIMENSIONS	21-7/8" H x 61" W x 21-3/4" D (55.72 x 154.94 x 55.25 cm)	17-7/8" H x 27-1/2" W x 24" D (46.40 x 69.85 x 60.96 cm)
TEMPERATURE RANGE	-73 degrees C to +315 degrees C or -100 degrees F to +600 degrees F	-73 degrees C to +150 deg C
HEAT-UP TIME	Ambient to +217 degrees C (+425 degrees F) 15 minutes	-55 degrees C to + 125 deg C 2.5 minutes
COOL-DOWN TIME	Ambient to -53 degrees C (-65 degrees F) 3 minutes	+125 degrees C to -55 deg C 1.5 minutes
LCO2 CONSUMPTION	11 lbs/hr at -53 degrees C (-65 degrees F)	7 lbs/hr at -53 degrees C (-65 degrees F)
AIR CIRCULATION	Vertical air flow pattern	Vertical air flow pattern
POWER REQUIREMENTS	208 VAC, 50 or 60 Hz, three wire, single phase, 4800w 240 VAC, 50 or 60 Hz, single phase, 4800w	240 VAC, 50 or 60 Hz, 1 phase, 5000w
NET WT (approx)	260 lbs (117.9 Kg)	85 lbs (38.6 Kg)
SHIP. WT (aprx)	405 lbs (183.7 Kg)	100 lbs (45.4 Kg)

* Model 9039 FHT (Fast Heat-up Time) is designed to accommodate Engineering or QC labs where small lots of components are tested under thermal shock conditions as described in MIL-STD-883, five minute recovery time.

APPLICATION EXAMPLES:

1. 5 lbs of plastic TO-220 devices with heatsink: -55 deg C to +125 deg C 4 min 50 sec
   +125 deg C to -55 deg C 3 min 12 sec

2. 2 lbs of plastic 9 lead SIP devices w/heatsink: -55 deg C to +125 deg C 4 min 40 sec
   +125 deg C to -55 deg C 4 min 20 sec

3. 4 lbs of ceramic 22 lead DIP devices: -55 deg C to +125 deg C 4 min 40 sec
   +125 deg C to -55 deg C 3 min 30 sec

4. 5 lbs of solid T6 aluminum: -55 deg C to +125 deg C 3 min 45 sec
   +125 deg C to -55 deg C 3 min 50 sec

CHAPTER 2
INSTALLATION

2.1 UNCRATING AND LOCATION

Remove all shipping tiedowns and protective packing. Place chamber in area which allows sufficient airflow.

CAUTION

Chamber malfunction or damage may result if chamber is operated without enough clearance to allow airflow from the bottom of the chamber.

2.2 ELECTRICAL CONNECTION

CAUTION

CHAMBER MUST BE CONNECTED TO EARTH GROUND.

2.2.1 Standard input power required for the chambers is 120 VAC, 50/60 Hz, single phase, 15 Amps, for all but models 9039 FHT, 9076 and 9080 (9039 FHT operates on 240 VAC only, 9076 and 9080 on 208 or 240 VAC). (Optional 208 VAC is also available; please refer to Table 1-1, in Chapter 1.) The optional 240V configuration requires 240 VAC, 50/60 Hz, single phase, 7.5 Amps.

2.2.2 The coolant valve solenoid operates off of 24V. The heater circuit operates on the same voltage as the chambers.

2.3 LIQUID COOLANT

Liquid carbon dioxide (LCO2) at 900 psi is the standard system. Optional systems are LCO2 at 300 psi, or liquid nitrogen (LN2) at 100 psi.

2.3.1 LIQUID CARBON DIOXIDE (900 psi)

2.3.1.1 Supply

A siphon-type liquid CO2 bottle is recommended. Test the bottle before use, as follows.

1. Release a small amount of liquid CO2 into a white handkerchief. Examine the handkerchief for the following:

   a. Any brown stain indicates rust which would clog the filter and valve in the chamber.

   b. A wet handkerchief indicates the presence of water which would either freeze in the valve or clog the injector nozzle.

2. Crack the liquid CO2 valve on the cylinder open and observe the spray, which should be a dense, white cloud. The spray will look thin and gray when the tank is almost empty. An almost empty tank will not give proper cooling and should not be used.

2.3.1.2 Connection

Connect the liquid CO2 supply as follows.

1. Connect the tank of liquid CO2 to the rear of the chamber with the high-pressure hose and fittings which are supplied (reference Figure 2-1).

CAUTION

DO NOT let any sealing compound enter the valve inlet on the rear of the chamber.

2. Place a small amount of sealing compound on the threads of the male fitting to prevent leakage.

3. Open the bottle and check for leaks, which show as frosty spots on the hose and fittings.

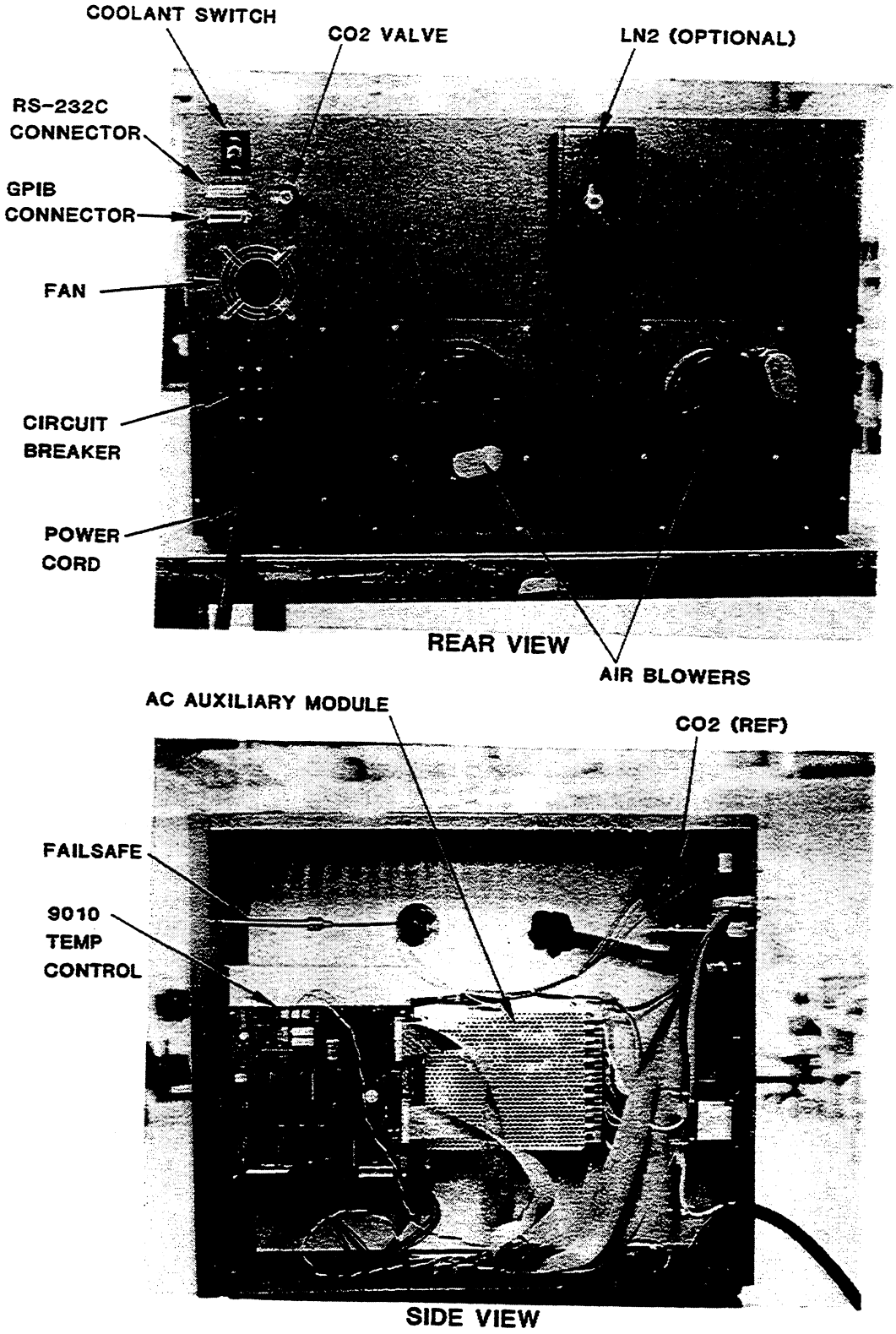


Figure 2-1. Connection Locations

2.3.2 LIQUID CARBON DIOXIDE (300 psi)

2.3.2.1 Supply

When the in-plant use of liquid CO2 exceeds approximately 1000 pounds per month, a bulk liquid storage system is recommended to reduce coolant cost. Chambers operated with this type of system must be fitted with a different CO2 valve and injector, than used on a 900 psi system. Contact the Delta Design, Inc., customer service department for information concerning valve replacement.

NOTE

A recirculating type, bulk storage system is recommended. If not, the supply should be located as close as possible to the chamber to minimize gas formation in the supply line. This is particularly important in low volume usage systems, as insulation and fluid flow prevent boiling of CO2 in the supply line. Gaseous CO2 is not an effective coolant.

2.3.2.2 Connection

Blow out all lines, valves and connecting hoses before the chamber is connected. Water is very troublesome, and often present in low-pressure refrigerated supplies. If lines are opened to bleed off excessive pressure at shutdown, close them again after bleeding to prevent system contamination by condensed moisture. This will help keep ice from forming in the control valve.

2.3.3 LIQUID NITROGEN

WARNING

Oxygen in the air surrounding the chamber inner liner, and in the insulation, can liquify at low temperatures. This could cause a fire hazard in the form of an oxygen-rich atmosphere surrounding the heater area. In addition, any mixture of oil and liquid oxygen can be explosive. Therefore, use extreme care during operation at very low temperatures.

NOTE

The chamber tends to be self-purging, as the nitrogen displaces the usual atmosphere.

2.3.3.1 Supply

A 100 psi valve and stainless steel injector assembly is used for liquid nitrogen applications (refer to Figure 2-2). Liquid CO2 from a tank will not operate properly in a chamber equipped for LN2.

2.3.3.2 Connection

Using an insulated transfer line, connect a liquid nitrogen withdrawal container to the LN2 input of the chamber. The line should include a relief valve with a relief pressure between 60 and 100 psi for a 2700 cubic foot, 50 psi liquid withdrawal container.

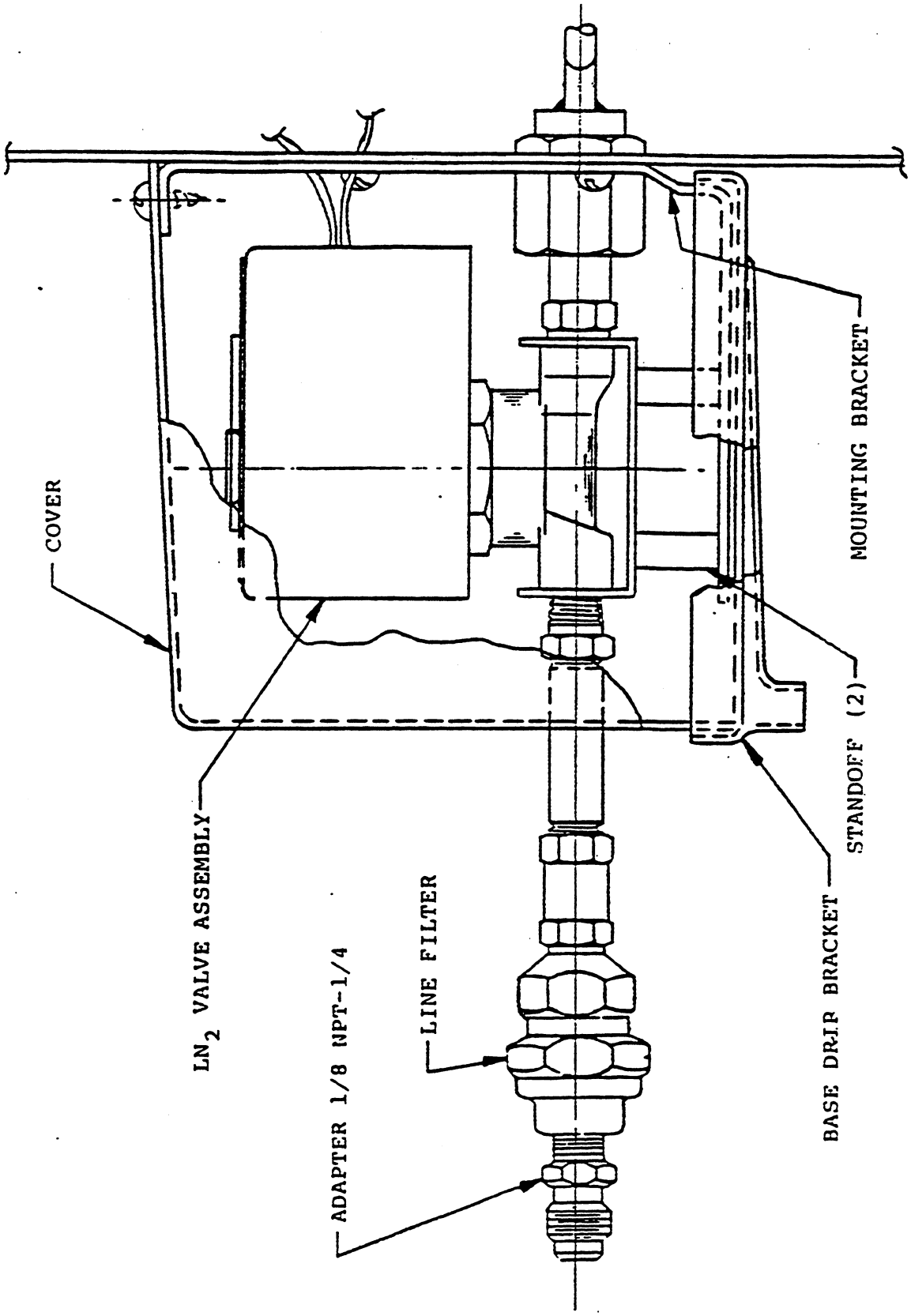


Figure 2-2. LN2 Valve Assembly

CHAPTER 3
OPERATION

3.1 PRECAUTIONS

3.1.1 Unplug the chamber from all sources of power before attempting to service or remove the controller chassis.

CAUTION

Chamber malfunction or damage may result if chambers are operated without enough clearance to allow airflow from the bottom of the chamber.

3.1.2 DO NOT block the chamber sides or outlet.

3.1.3 Ensure that the correct coolant supply source is connected to the chamber before operating.

3.1.4 Operate the chamber at a temperature of 200 degrees Centigrade for an hour after prolonged operation at low temperatures. This restores the insulation efficiency by driving out condensed moisture.

WARNING

Liquid oxygen may be formed in the insulation when the chamber is operated at low temperatures. Any mixture of oil and liquid oxygen can be explosive.

3.1.5 If oil contamination is suspected, bake the empty chamber at 200 degrees Centigrade for three hours before taking it to extremely low temperatures.

3.1.6 DO NOT leave liquid nitrogen trapped in a line (lines closed at both ends). Nitrogen expansion could cause high pressures as the liquid absorbs heat and becomes gas.

NOTE

DRAWINGS AND PHOTOS IN THIS SECTION ARE OF A GENERIC NATURE. PHOTOS ACTUALLY SHOW A MODEL 9039. HOWEVER, THE SAME COMPONENTS CAN BE FOUND ON ALMOST ALL THE CHAMBERS, JUST DIFFERENT LOCATIONS AND DIFFERENT QUANTITIES.

3.2 CONTROLS AND INDICATORS

Chamber controls and indicators are shown in Figure 3-1. Operation of the chamber is programmed using the 9010 Temperature Controller. Instructions for controller use are provided in Chapter 5 of this manual. The Model 9080 chamber has a separate manual.

3.3 FAILSAFE ADJUSTMENTS

Adjust high temperature protection unit (located on chamber front above controller) as follows.

3.3.1 Rotate the slotted FAILSAFE control counterclockwise to raise the trip temperature. Rotate the control clockwise to lower the trip temperature (reference Figure 3-1 for location).

3.3.2 The failsafe setting is preset to 210 degrees Centigrade at the factory. If a lower failsafe temperature setting is desired, operate the chamber at that temperature, and adjust the FAILSAFE until it trips. If a higher failsafe setting is desired, raise the temperature until it DOESN'T trip off to temperature desired.

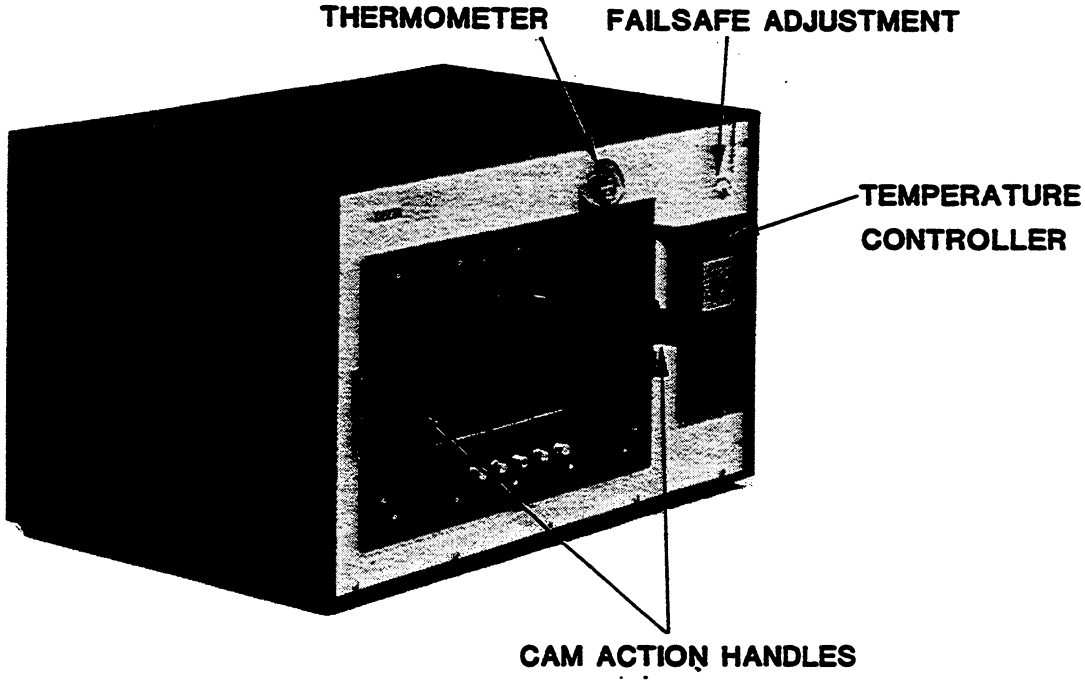


Figure 3-1. Chamber Controls and Indicators

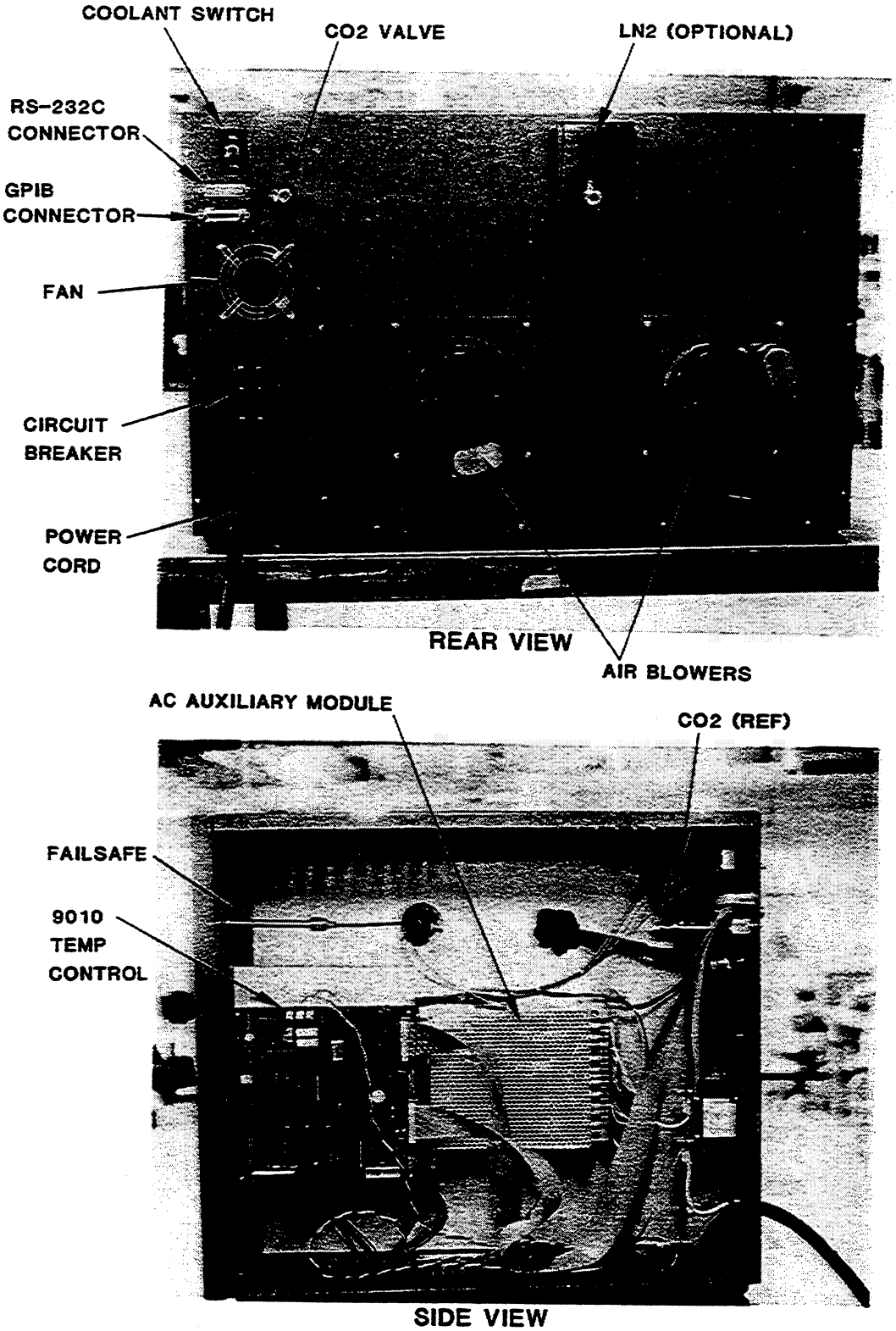


Figure 3-2. Component Locations

3.4 OPENING CHAMBER DOOR

The chamber door is equipped with cam-action handles. The handle levers must be pulled to the full down position to release the door.

3.5 COMPONENT REMOVAL (reference Figure 3-3)

NOTE

THESE INSTRUCTIONS COVER MOST CHAMBER MODELS. SOME COMPONENTS MAY BE LOCATED OTHER THAN HOW THEY ARE REFERENCED IN THESE INSTRUCTIONS, SO PLEASE REFER TO ASSEMBLY DRAWINGS IN CHAPTER 7 OF THIS MANUAL TO VERIFY POSITION.

3.5.1 To remove the Blower Motors, do the following:

1. Unplug chamber power cord.
2. DO NOT remove rear panel.
3. Remove 4 screws and lay grill aside.
4. Remove wire nuts connecting motor to chamber power.
5. Remove two screws that mount motor to chamber.
6. Pull motor straight back to remove.
7. Reinstall in reverse order.

3.5.2 To remove the Heaters, do the following:

1. Unplug chamber power cord.
2. Remove and lay rear panel horizontally behind chamber.
3. Unpack fiberglass to expose heaters.
4. Remove wires from each heater unit.
5. Remove mounting screws.
6. Pull out heater assembly.
7. Reinstall in reverse order.

3.5.3 To remove the CO2 valve (internally mounted), do the following:

1. Unplug chamber power cord.
2. Remove screws from right side cover.
3. Place right side cover on top of chamber.
4. Unscrew wire nuts.
5. Remove screws and take out CO2 valve.
6. Reinstall in reverse order.

3.5.4 To remove the LN2 package, do the following:

1. Unplug chamber power cord.
2. Remove screws holding cover on valve assembly.
3. Remove screws holding valve to standoffs.
4. Remove nut joining inlet tubing to valve.
5. Pull valve away from chamber rear panel and remove wire nuts.
6. Reinstall in reverse order.

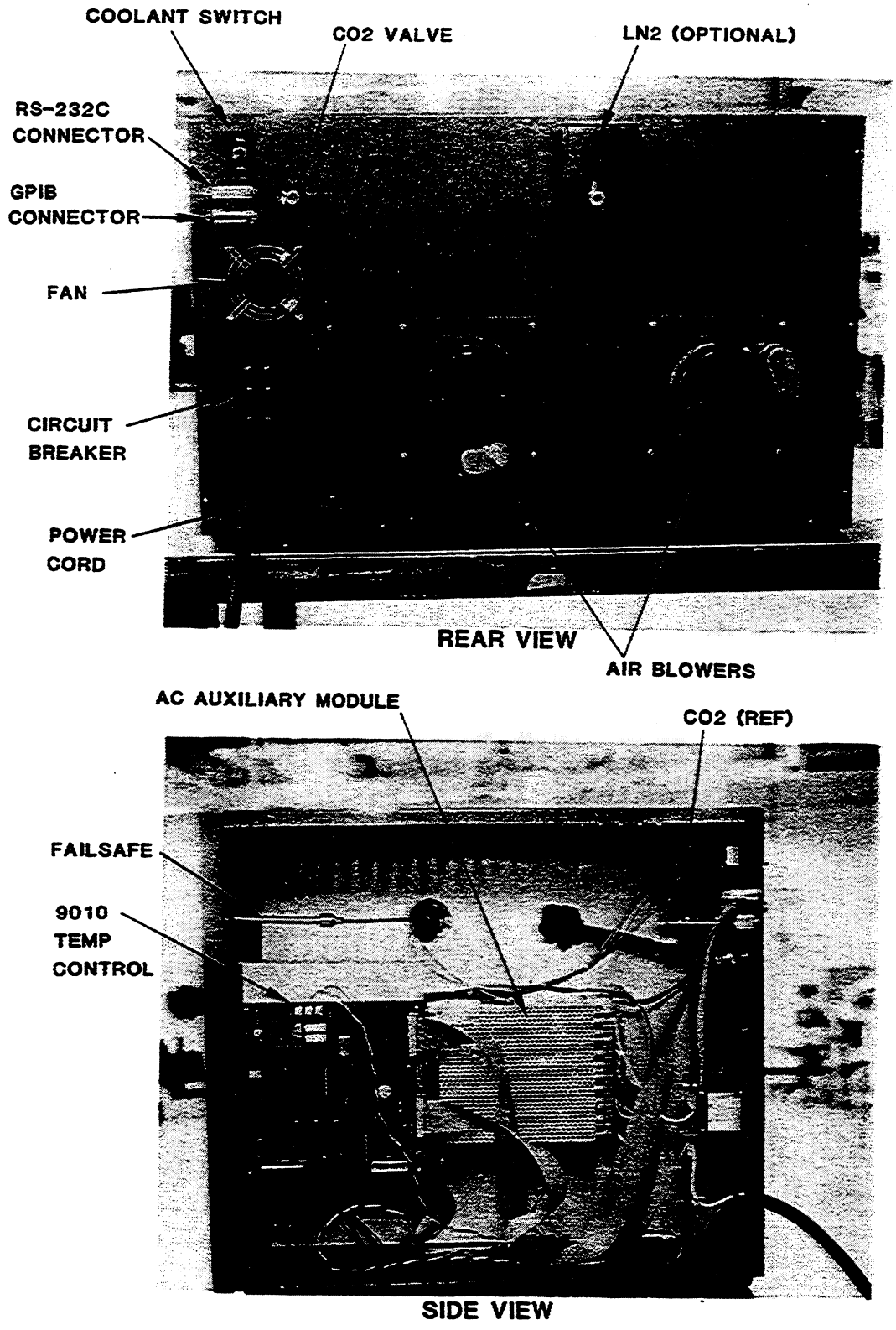


Figure 3-3. Component Removal

CHAPTER 4
OPERATOR MAINTENANCE

4.1 INSPECTION

Periodically inspect the chamber for dust and debris build-up, oils and other contaminants, which might cause damage or injury to the equipment or personnel operating the equipment.

4.2 CLEANING

The chamber should be cleaned periodically to prevent accumulation of dust, debris, or other contaminants that could interfere with chamber accuracy, performance, or safe use.

Wipe areas using a clean cotton swab or lint-free cloth dampened with isopropyl alcohol.

WARNING

If oil residues from the isopropyl alcohol are not removed with Freon TF, when cleaning parts located in or near the environmental chamber, liquid oxygen formed in the chamber during low-temperature operation could combine with residual oil and explode.

Final clean using another clean swab or cloth dampened with Freon TF or equivalent, and immediately dry, using clean, dry compressed air at low velocity.

4.3 TROUBLESHOOTING

Troubleshooting should be performed only by authorized technicians familiar with the electrical and mechanical operation of the Delta Design, Inc., 9000 Series Chambers. Detailed troubleshooting procedures are unavailable at this time. Any problems or questions which can not be resolved by your service technicians should be referred to the Delta Design Customer Service Department.

CHAPTER 5
9010 TEMPERATURE CONTROLLER

5.1 GENERAL DESCRIPTION

The Delta Design, Inc., 9010 Temperature Controller has been specifically designed for use with the Delta 9000 Series Environmental Chambers. It works in conjunction with the Auxiliary Module that is part of the 9000 Series chambers.

The 68008 microprocessor-based controller uses a platinum RTD sensor circuit to convert the chamber temperature first to resistance, then to voltage, and then to a digital value that the program can use. That temperature value is then compared to a setpoint temperature entered by way of the front panel or via the remote interfaces.

The two values, the measured chamber temperature, and the desired temperature or setpoint, are usually displayed on the LCD of the front panel. It is the difference between these two values, however, that drives the thermal system with heated or cooled air to bring the chamber temperature to the setpoint. How it drives the system depends on several parameters which may be changed by the user. Some of the features of the 9010 are listed in Table 5-1.

TABLE 5-1. SPECIFICATIONS AND FEATURES

TEMPERATURE RANGE	-184 to +315 degrees C
RESOLUTION	0.1 degree C or F
REPEATABILITY	+/- 0.25 C (4 hr min.)
ACCURACY	+/- 0.4 degrees C
CALIBRATION PERIOD	6 months minimum

TABLE 5-1. SPECIFICATIONS AND FEATURES (Continued)

1. Rate of temperature change controllable from 0.1 degree C per minute up to the chamber maximum.

2. Continuous setpoint entry with 0.1 degree resolution or selection from a list of up to ten programmed temperatures.

3. Ten Step Program that can be repeated up to 9999 times. Each step consists of temperature, time at temperature, and rate to get to temperature. Soak time up to 100 hours.

4. Built in test features.

5. Three interfaces: front panel, RS-232 and IEEE-488. A terminal on the RS-232 can be used simultaneously with either front panel operation or computer control via the IEEE-488.

6. Seven point temperature correction curve can be entered thru all three interfaces to correct the measured temperature over the full temperature range.

7. Programmable upper and lower temperature limits set the window of operation. No setpoints are accepted outside the window. Heat and Cool turned off when five degrees C outside of the window.

8. Front panel interface can be in Celsius or Fahrenheit.

9. LCD is backlit and protected by a polycarbonate cover with an anti-glare surface for good visibility under all lighting conditions.

10. A Platinum RTD is used with a dual range circuit of precision components, that is autoswitched by the program, to provide good measurement resolution over the large temperature range of 500 degrees C, while maintaining good accuracy at the extremes.

5.2 9010 COMMUNICATION

There are three ways to communicate with the 9010:

1. User direct thru the front panel.

2. Dumb terminal via the RS-232.

3. Computer control via the GPIB or RS-232.

Front panel operation requires no additional equipment. Operation can be tailored for a particular installation. Access to some parameters can be restricted.

Terminal operation requires a terminal or a computer programmed to appear as a terminal. Using the command list, parameters may be displayed or changed with a few keystrokes. The user has access to all parameters.

Computer control via the GPIB permits great flexibility in test setup. Chamber control and monitoring can be combined with data acquisition via test instruments on the DUT.

Remote operation by terminal or computer will be discussed in the next chapter.

5.2.1 FRONT PANEL OPERATION (Figure 5-1)

In addition to the FCN, UP and DOWN keys, the dip switches of SW1 in Figure 5-1 affect the operation thru the front panel. All four switches are set to OFF when a 9010 is delivered in a chamber.

Figure 5-2, Normal Access, is one of four drawings that attempt to show the operation flow for all key sequences. They will be referred to in the discussion following this general introduction.

There are three levels of front panel access: NORMAL, EXTENDED, and FULL ACCESS.

5.2.1.1 NORMAL

Allows entering a setpoint and turning on and off the heat and cool control. The Rate Program can be started and stopped as well.

If no keys are pressed after startup, this is what one gets - NORMAL access. If the UP key is pressed during the time all the LCD is on, after startup, then the access is EXTENDED.

5.2.1.2 EXTENDED

In addition to the normal functions, some other less frequently changed parameters can be accessed.

5.2.1.3 FULL

Access to the remaining parameters can be made more difficult so that they are not accidently changed by an unknowledgeable operator.

5.2.1.4 FRONT PANEL FUNCTIONAL ACCESS

The parameters accessible are outlined below. NOTE: How SW1-2 is used to change the parameters that are accessible from the front panel.

5.2.1.4.1 If (Neither FCN nor UP key pressed during startup), NORMAL ACCESS:

```
* Heat and Cool control.
   If (SW1-2 OFF)
*       Continuous Setpoint.
  Else
*       List of Setpoints.
   If (SW1-2 ON and Program Repeats not zero)
*       Start/Stop Rate Program.
```

5.2.1.4.2 Else if (UP key pressed during startup - when LCD on), EXTENDED Access:

It adds:
* GPIB address.
* RS-232 baud rate.
* High Temperature Limit.
* Low Temperature Limit.
* Control Rate.

5.2.1.4.3 Else if (FCN key pressed during startup and SW1-3 OFF), FULL Access:

It adds:
* Proportional Gain.
* Integral Gain.
  If (SW1-2 OFF)
* Calibration Points.
* Check analog circuit.
  Else
* Rate Programmer Steps.
* Program Repeats.

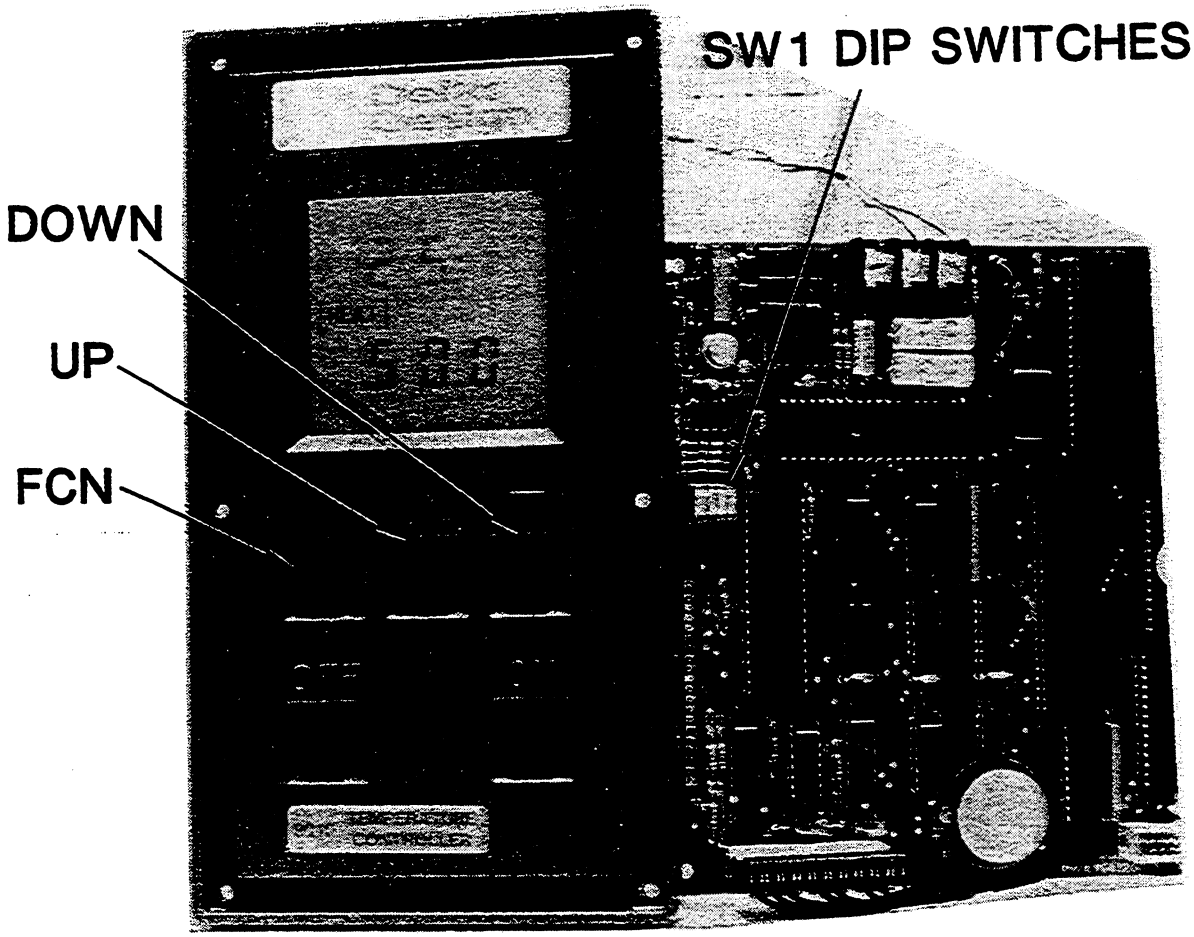


Figure 5-1. 9010 Front Panel Controls

5.3 NORMAL ACCESS MODE (Figure 5-2)

This mode is entered if the user simply powers up the chamber by pushing the "ON" button. The LCD (Liquid Crystal Display) will show all the possible display segments for two seconds during startup, and then two four digit numbers momentarily before going to the main display labeled "A" on the drawing. The top number is the chamber selected by the dip switches on the front panel board, and the bottom number is the program version (given as year and week of year). DIP switch #4 on the main board selects whether degrees C or F will be used by the front panel interface. Holding down the DOWN key on startup will switch the degree type until the next startup.

5.3.1 DIP SWITCH SETTINGS ON SW1

In the following, it is assumed that the SW1 dip switches on the main board are set as shown on the drawing so that:

1. 1 is OFF: "TEST" mode is not selected (described later in this chapter).

2. 2 is OFF: Rate Program not selected.

3. 3 is OFF: Front panel FULL access allowed.

4. 4 is OFF: Default degrees Celsius selected.

5.3.2 MAIN DISPLAY

Display "A" shows the measured temperature on the top and the desired temperature on the bottom. The 9010 will revert to this display if the keyboard becomes inactive for more than 15 seconds.

5.3.3 HEAT AND COOL CONTROL

On startup, HEAT and COOL control will always be disabled. When it is enabled, the main display shows which control line is ON and for how long, by turning on the HEAT and COOL words. To enable control, the FCN key (unlabeled) is first pressed to get to display "B", and then the UP and DOWN keys are used to toggle the HEAT and COOL words in this display. When the words are ON, returning to the main display by pressing the FCN key, will enable the selected control.

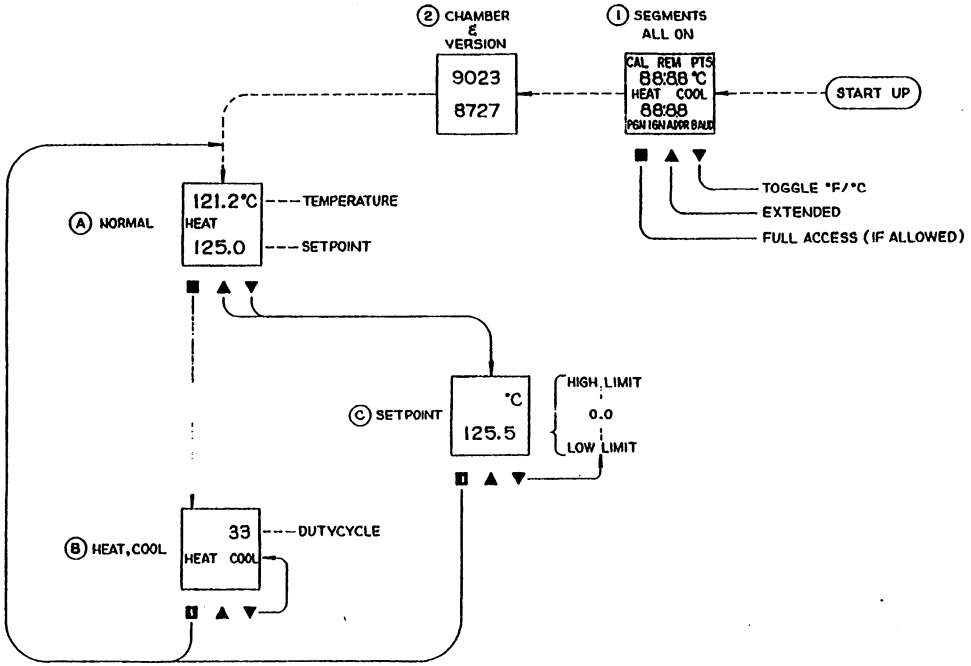
5.3.4 DUTYCYCLE

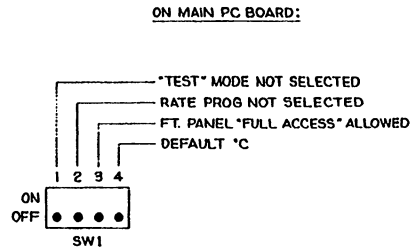
The Dutycycle number that is shown in display "B" is for information only. It is the percent of the control cycle that either HEAT or COOL is on; a negative number indicates cooling.

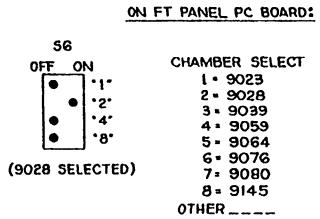
5.3.5 SETPOINT TEMPERATURE

Once back in the main display, the setpoint temperature can be changed by first pushing either the UP or DOWN buttons to get to display "C". The drawing indicates that the setpoint can be set to any temperature between two limits. Trying to go outside this range will cause "wraparound" through the other limit. These two limit points are initially set at -60 and 220 degrees C. They can be changed in the EXTENDED or FULL ACCESS operational modes.

The UP and DOWN keys operate in 3 "speeds". Single key presses will make changes in tenths of a degree. Holding the key down will start auto-change by one degree for a few seconds and then shift to auto-change by ten degrees. As mentioned before, no parameter change will actually take place until the FCN key is pressed moving on to the next display.







⚠ FINISH (IF APPLICABLE)
—/—

⚠ MATL (IF APPLICABLE)
—/—

OTES: UNLESS OTHERWISE SPECIFIED

Figure 5-2. Normal Access

5.4 EXTENDED ACCESS MODE (Figure 5-3)

This mode has all the functions of NORMAL mode. In addition, both the high and low temperature limits can be changed, as well as the GPIB address and the RS-232C baud rate. To operate in this mode, the UP key must be pressed sometime during the Startup, when all the segments are turned on.

As the drawing shows, the five additional displays (labeled D, E, R, F and G) are entered after leaving the Setpoint display "C". To get to the temperature limit displays "D" and "E", the Setpoint display "C" must have been entered with the UP key.

5.4.1 HIGH AND LOW TEMPERATURE LIMITS

The High Temp and the Low Temp have their limits as noted in the drawing. The three speed operation of the UP and DOWN change keys is the same as for the Setpoint. Again, the change does not take effect until leaving the display with the FCN key.

5.4.2 CONTROL RATE

Display "R" shows the default value of 0.0 indicating that the rate is not being controlled. All other values from 0.1 to 36.0 must be entered on power up. This feature permits heating and cooling at rates from 0.1 degree C per minute, up to the chamber maximum.

5.4.3 GPIB ADDRESS

If the Setpoint display had been entered with the DOWN key, then, on leaving display "C", display "F" will appear. The address that the 9010 will use to communicate on the IEEE-488 bus can now be selected. The UP and DOWN keys operate in two speeds to cover just the range of addresses shown on the drawing.

5.4.4 RS-232 BAUD

On leaving display "F", display "G" will appear. A baud rate for communicating over the RS-232C link can be selected from a list of possible rates, as shown on the drawing. Pressing the FCN key will cause the main display to reappear.

Turning the 9010 off and on again will return the mode to NORMAL with all parameters saved by the battery backed-up memory.

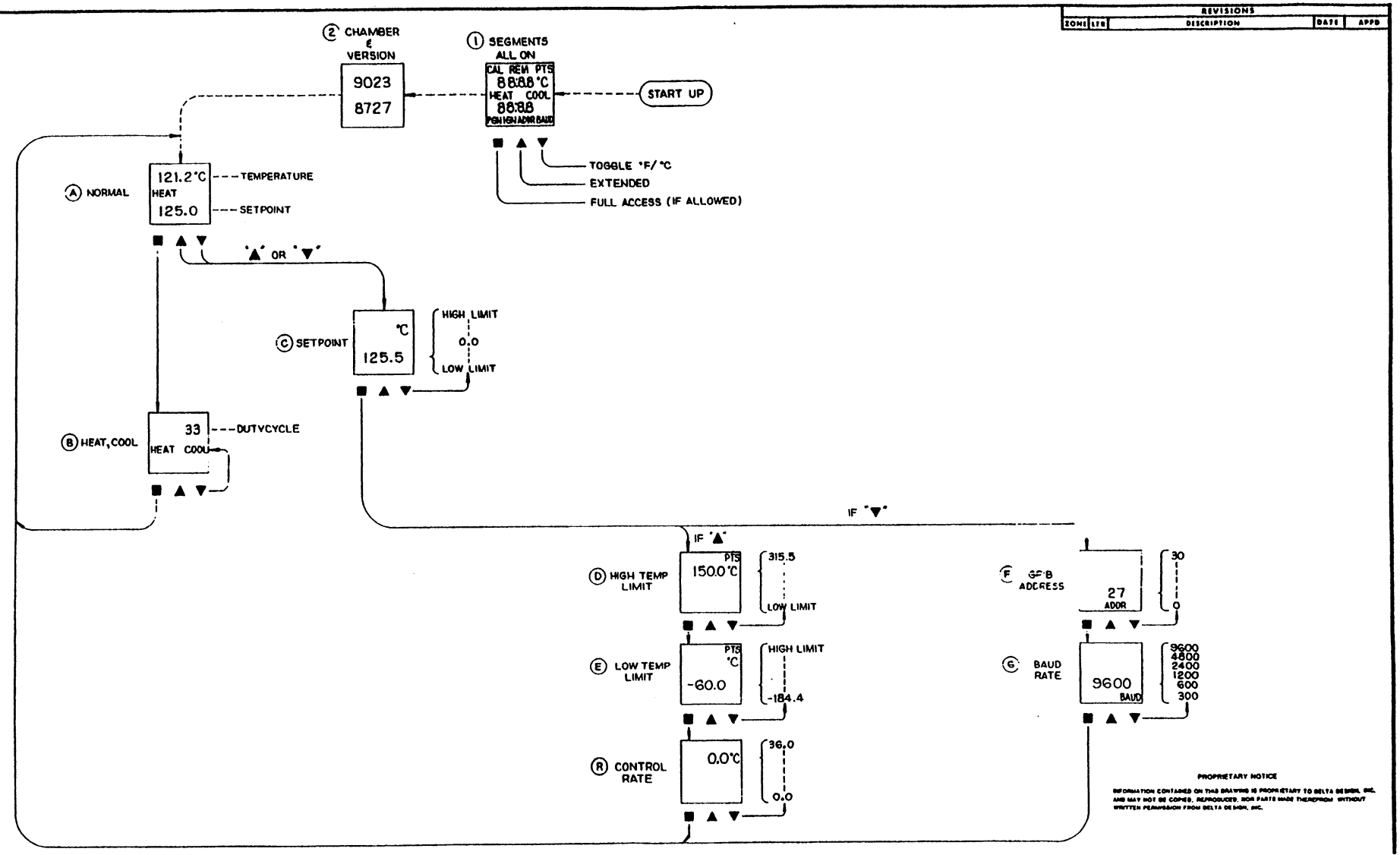


Figure 5-3. Extended Access

5.5 FULL ACCESS MODE (Figure 5-4)

This mode should only be accessed to change the chamber control dynamics or for calibration. In addition to the functions of EXTENDED mode, it allows changing the control gains and adding a temperature correction curve.

To enter this mode, press the FCN key during startup, when all the display segments are ON. If Full Access is not disallowed by DIP switch #3 on the main circuit board, the mode will be entered. Refer to the drawing for the following descriptions.

5.5.1 PGN and IGN

Entry to this series of displays is made by going to the setpoint display via the UP key, when in the FULL ACCESS mode.

The two gains (proportional and integral) determine the dynamics of control around the setpoint. They should be matched to the particular chamber in which the 9010 is used. Permissible values, as shown alongside display drawings "H" and "I", are 0 thru 9. Selecting a chamber with the dip switches on the front panel board, sets the default values for that chamber. Any changes to those values will be remembered. Determining the gains is somewhat of an art. The default values should not need to be changed, but if they are, NOT radically.

5.5.2 ANALOG CIRCUIT CHECK

The first display "J" is somewhat unusual. It shows what resistance the analog circuit is measuring at its three terminal connector. The Platinum Resistance Temperature Detector is connected there. Pressing the UP key will, however, switch-in a precise 124 ohm resistor and switch the dual range measuring circuit to the HIGH range. Pressing the DOWN key will show how the LOW range measures the 124 ohm resistor. The two readings should agree within 0.2 ohms. Pressing the UP and DOWN in turn several times may bring the readings closer. If they are still in poor agreement, there is a problem with the analog circuit. See the maintenance section for more information.

Pressing the FCN key will switch the RTD back in the circuit and go on to the calibrate displays.

Display "J" is the only one that will not revert to the main display after 15 seconds. The FCN key must be pressed to exit this display.

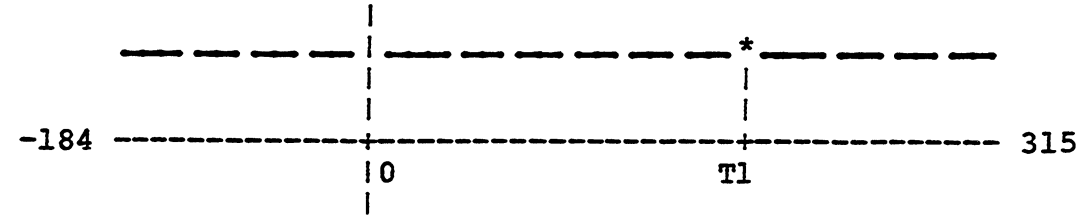
5.5.3 CALIBRATION POINTS

The "K" displays are the currently entered points that determine the correction curve. (The drawing shows three, but there may be 0 to 7.) The "K" displays are ordered by temperature, with the lowest temperature first. Looking at display "K1" on the drawing, the temperature of point #1 is -35.4 and the correction is 1.2 degrees. That means that a temperature that would have been reported as -35.4 before, will now be reported as -35.4 + 1.2 = -34.2 degrees. The UP and DOWN keys will only toggle the correction to a P.O. (for Point Out) display and back. Exiting a display while P.O. is selected will delete the point from the list. Going to the next point display "K2", shows a temperature of 20.0 and correction of 0.8 degrees. Temperatures that fall between -35.4 and 20.0 will get an interpolated correction applied to them. Temperatures that fall outside the points entered will get the correction of the outside point.

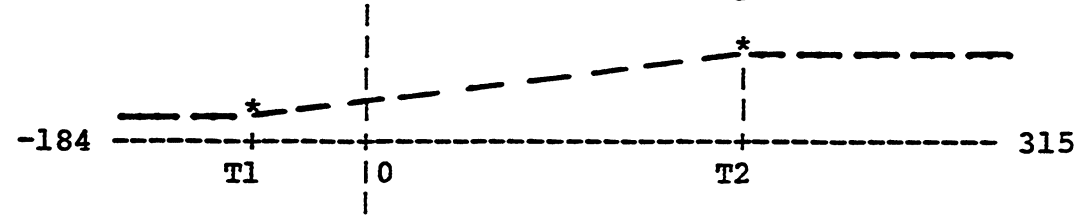
When exiting the last of the current points (here "K3"), display "L" appears. Display "L" and "M" allow entering a new correction point into the list. After entering the temperature of the point, using the UP and DOWN keys in display "L", go on to display "M" and enter the correction for that temperature. The correction range is -5.5 to 5.5 Celsius degrees. The temperature can be any within the full range of the controller, -184.4 to 315.5 degrees.

The procedure for entering the correction curve should be to first run the chamber without corrections, stopping at several setpoints that span the operational temperature range of interest. Record the readings of a dependable temperature standard in the chamber at the setpoints. Subtract the setpoint from the reading to get the correction to enter at the temperature equal to that setpoint. Enter the correction points and make a few checks with the temperature standard to confirm that all is well. See example below:

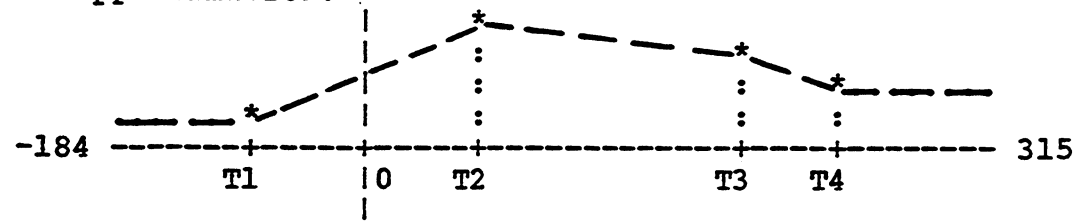
Entering one calibration point will shift all temperatures by the correction:



Entering two calibration points will extend the two corrections to the outer limits. For temperatures between the two points, the correction is interpolated:



Adding more calibration points (up to seven) will refine the approximation:



Notice that the points are reordered as points are added.

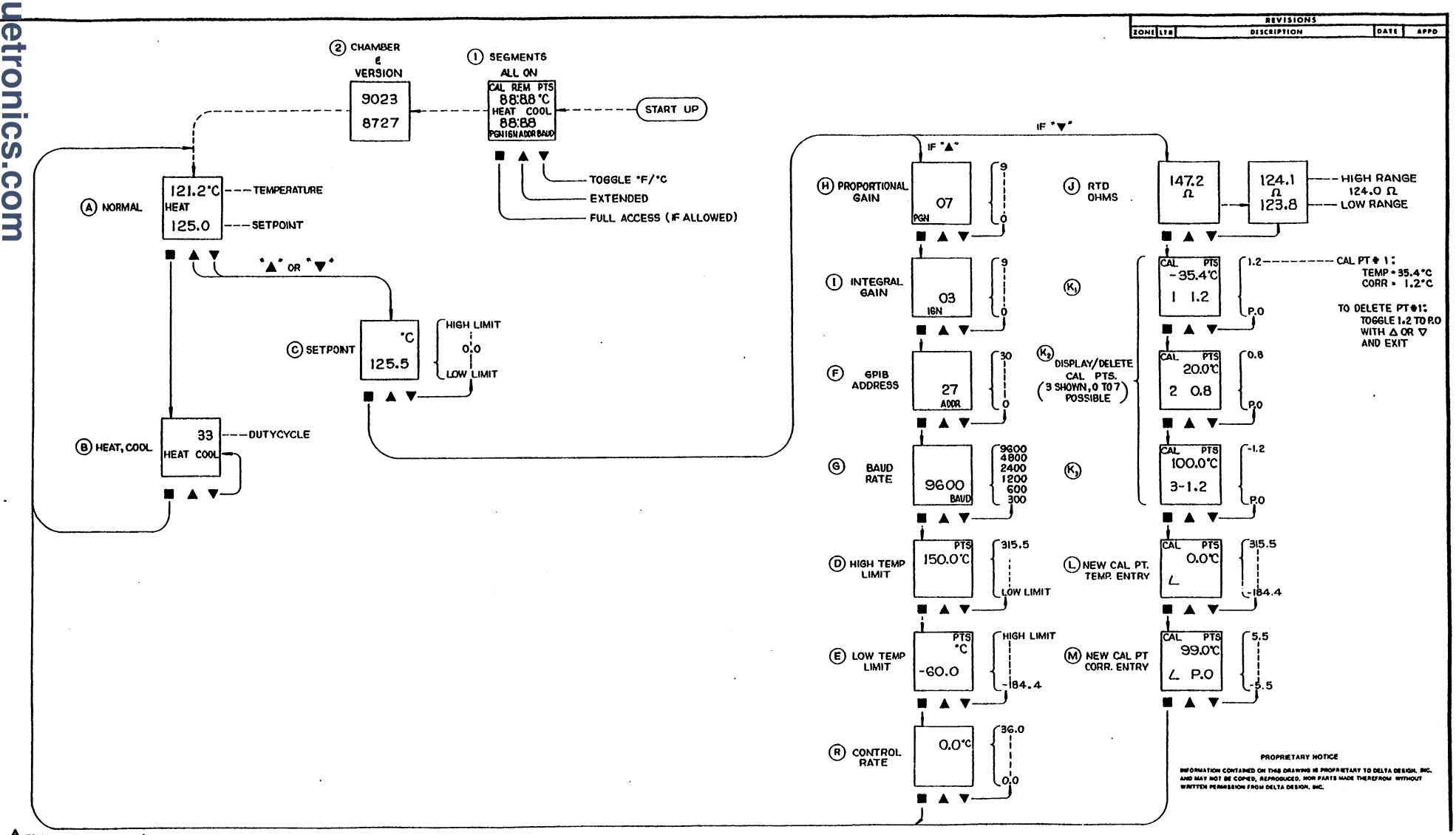


Figure 5-4. Full Access

5.6 FULL ACCESS, SW1-2 ON (Figure 5-5)

Switching SW1-2 to ON changes the access and operation so that either a list of setpoints or a rate program can be used. Front panel FULL access is used to enter the parameters, then any access level may be used to select from the list of setpoints, or start and stop the rate program.

5.6.1 LIST OF SETPOINTS

When the chamber is usually operated at a restricted number of temperatures, it may be more convenient to use this mode of operation. The setpoints that may be selected in display "C", are those that have been entered as part of the ten step rate program, that fall within the upper and lower temperature limits entered in "D" and "E". The list may be made secure, if necessary, by switching SW1-3 to ON. This disables FULL access from the front panel.

5.6.2 RATE PROGRAMMER

Figure 5-5 shows that the key sequence to get to the rate program step parameters (temperature, soaktime, rate) from the main display "A", is DOWN to "C", then FCN to S1. The figure shows just two, but as many as ten steps may be entered. The step number is shown in the lower left corner.

A new step can be entered after keying thru the existing list. A new step is added to the list when in display "V", the P0 is keyed out with the UP and DOWN keys, and the control rate entered.

When the program step parameters are all entered, the number of program repeats or passes may be entered in display "X". Rate program operation is enabled by making the number of program repeats greater than zero.

5.6.3 RATE PROGRAM OPERATION

Once the rate program is enabled by entering a non-zero value for the number of program repeats, the rate program can be started by keying down from display "A" to "B", and then to "P", with the FCN key. "P" will show the number of entered program repeats on the top, and 00 for the number of program passes so far completed on the bottom of the display. Pressing UP or DOWN to make the Omega sign appear and then exiting the display with the FCN key, will start the rate program at

step one.

The chamber temperature should be fairly stable and the HEAT and COOL enabled before starting the rate program. The chamber temperature at rate program start, will be used as the starting temperature which will be periodically incremented, so as to "walk" the temperature up to step one's target temperature. When the temperature reaches within one degree C of the set temperature, soak timing will begin. The set temperature will be replaced by the elapsed soak time in the main display "A".

At the end of the programmed soak time, signalled by the main display switching in the next step set temperature for the elapsed time, the chamber will be rate controlled to that new temperature.

If it were the last step in the rate program, the number of passes completed would be incremented and step one used as the next step. The display EOP signals that the last pass of the program has been completed. HEAT and COOL is turned off. It is necessary to go to display "P" and toggle off the Omega symbol to get out of the rate program completely.

5.6.4 RATE PROGRAM NOTES

If a step has a soak time of zero, control will switch to the next step as soon as the chamber temperature reaches within one degree C of the set temperature. This can be useful to go part way to a temperature at some rate, and then the rest of the way at some other rate of temperature change.

If a step has a rate of zero, NO rate control will be in effect for that step and the chamber will go to the set temperature at its maximum rate. Permissable values for rate are 0.1 to 36.0 degrees C per minute. Actual chamber maximums vary, depending mainly on the model.

Once the rate program has been started, no changes can be made except to turn on and off the HEAT and COOL, and to stop the program. All other parameters may be viewed as the access level selected allows.

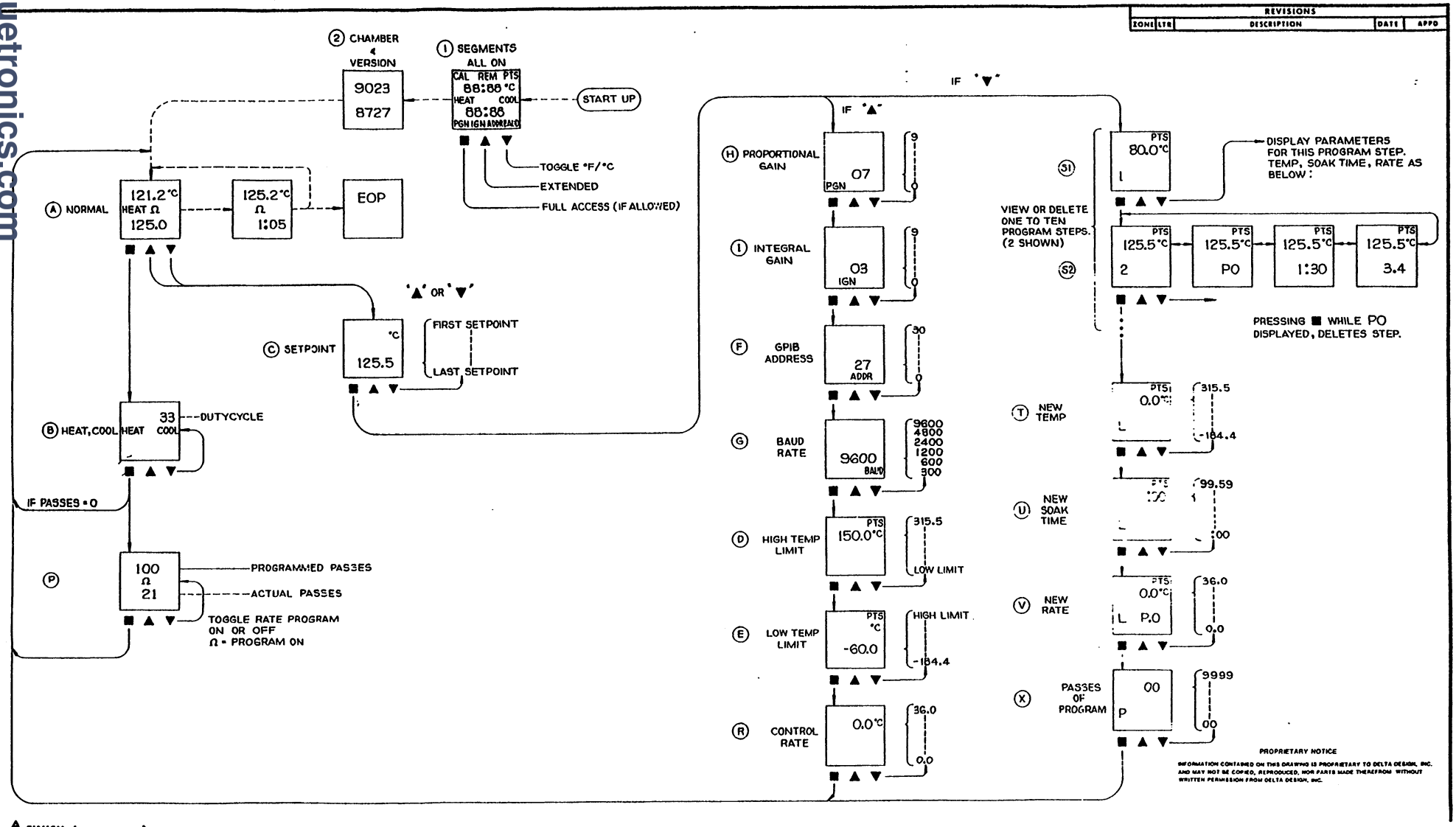


Figure 5-5. Full Access, SW1-2 ON

5.7 REMOTE OPERATION OF THE DELTA 9010

Operation of the 9010 can be done remotely using the two connectors on the rear of the chamber. One connector is for the IEEE-488 interface bus (commonly called the GPIB), and the other is for the RS-232C serial interface.

5.7.1 GPIB CONNECTION

A 9000 series chamber with a 9010 Temperature Controller may be part of a GPIB connected test system in which up to 15 instruments are controlled by a program in a GPIB control computer. A simple system consisting of the chamber remotely controlled by a Hewlett-Packard HP-85 will be discussed.

The command strings recognized by the 9010 are listed in Table 5-2. A short HP-85 program best illustrates how they are used.

```
100 Z = 727                    !THE ADDRESS OF THE 9010
                               ! INITIALLY IS 27.
150 CLEAR Z                    !HP TELLS THE 9010 TO
                               ! START FRESH.
200 OUTPUT Z; "S 123.4, HEAT ON"  !HP SENDS SETPOINT
                                  ! OF 123.4 DEGREES
                                  ! AND ENABLES THE
                                  ! HEAT CONTROL.
250 OUTPUT Z; "TEMP?"          !HP ASKS FOR THE TEMPERATURE.
300 ENTER Z; T1                !HP STORES THE 9010'S REPLY
                               ! IN VARIABLE T1.
350 OUTPUT Z; "Duty?,ST?"      !HP ASKS FOR THE DUTYCYCLE
                               ! AND STATUS.
400 ENTER Z; D1, S1            !HP STORES THE TWO VALUES.
450 WAIT 1000                  !PAUSE 1 SECOND.
500 DISP T1; D1; S1            !DISPLAY TEMPERATURE,
                               ! DUTYCYCLE, STATUS.
550 GOTO 250                   !LOOP FOREVER
999 END
```

1. Notice that there may be several commands in one line, as long as neither the command line nor the reply line exceed 132 characters.

2. A comma must separate the individual commands.

3. Case may be upper, lower or mixed. The commands may be shortened as noted in the list.

4. All commands that elicit a reply from the 9010 end with a question mark. The replies are always numbers, either integer or real.

5. While a GPIB program, for example the above, is running, the REMOTE annunciator on the front panel LCD will be on. It signals that front panel changes are inhibited while still allowing display of the parameters.

6. All remote temperature messages are in degrees C. Switching to Fahrenheit only affects the front panel interface.

5.7.2 RS-232C CONNECTION

The chamber has a standard 25 pin female connector with the following signals:

```
9010 Xmitr  -------> pin 3
9010 Rcvr   <------- pin 2
Always High -------> pin 6
Signal Gnd  -------- pin 7
```

The RS-232 expects data with 8 bits, no parity, 2 stop bits. The rate is selectable from the front panel. Initially, it is 9600 baud.

Command of the 9010 thru the RS-232 can be either by terminal or by computer. On power-up, the 9010 is in the computer mode. In this mode there is no echoing of commands and no prompting. The program should send commands from the list as in the GPIB example, and be able to handle the replies. If the computer serial interface is compatible with the above signals (as is, for instance, the IBM PC), then a straight-thru connecting cable can be used.

Operating directly with a terminal only requires that the terminal be setup for duplex operation, with a baud rate matching the 9010. On power-up of the 9010, type in the letter "M" and press "return". The 9010 prompt of "MON>" will appear indicating that the mode has been toggled from computer to terminal. Commands from the list may be typed in, and are sent when the "return" key is pressed. The backspace key can be used to make corrections in the command line.

An example session using a terminal follows:

```
Type M <cr>          ... Puts 9010 in the terminal mode.

MON>                 ... The prompt appears.

MON>callen?<cr>      ... Send the command to get the number of
                             pts in list.
   3                 ... Reply is length of list - 3 pts.
MON>                 ... Prompt reappears after each command
                             is completed.

MON>Set 123.4<cr>    ... Send command to change the setpoint.
MON>                 ... No reply, prompt reappears.

MON>heat on, cool on,Temp? <cr> ... Send 2 action commands
                                        and 1 query.
   88.8              ... Reply is temperature in C.

MON>HISET? <cr>      ... Send misspelled command.
?! ?                 ... Command not recognized.
MON>                 ... 9010 ignores misspelled command.
```

TABLE 5-2
LIST OF REMOTE COMMANDS AND QUERIES

Version?	Program version - year and week of year.
Setpoint ddd.d	Setpoint temperature to tenth degree C.
Setpoint?	Get the setpoint temperature.
Temperature?	Current measured temperature.
Heat ON <OFf>	Enable <disable> the heat control.
Cool ON <OFf>	Enable <disable> the cool control.
HIghset ddd.d	High temperature limit to tenth degree C.
HIghset?	Get the High temperature limit.
LOwset ddd.d	Low temperature limit to tenth degree C.
LOwset?	Get the Low temperature limit.
Dutycycle?	Current Dutycycle in percent.
CORrection?	Calibration correction for current temp.
STatus?	9010 status word - a three digit number.
Xrate dd.d	Control rate to tenth degree C / min.
Xrate?	Get the Control rate. 0.0 to 36.0
Pgain n	Proportional gain number. 0 to 9
Pgain?	Get the Proportional gain number.
Igain n	Integral gain number. 0 to 9
Igain?	Get the Integral gain number.
Mon	Toggle RS-232, terminal or computer mode.
Output ON <OFf>	Turn on <off> Out3 at J10-1.
CALpts T1,C1 <,T2,C2>	Enter one <or list> of calibration points.
CALpts?	Get the list of calibration points.
CALClear	Clear all cal points on the list.
CALDelete n	Delete from the list the nth cal point.
CALLength?	The number of valid cal pts in the list.
REMote	Front panel changes disabled.
LOCal	Return control to the 9010 front panel.
New Warm <Cold>	Reset. Zero <do not zero> the Saved RAM.
DEgrees Celcius <Fahrenheit>	Front panel degree select.

TABLE 5-2 (CONTINUED)
RATE PROGRAMMER COMMANDS

STEp n,ttt.t,ssss,rr.r	Enter temp, soaktime and rate for step n.
STEp? n	Get temp, soaktime and rate for step n.
STEMp n, ttt.t	Enter the temperature for step n.
STEMp? n	Get the temperature for step n.
SSoak n, ssss	Enter the soaktime in minutes for step n.
SSoak? n	Get the soaktime for step n.
SRate n, rr.r	Enter the control rate for step n.
SRate? n	Get the control rate for step n.
STEPClear	Clear list to one setpoint.
STEPCOunt?	Get the number of valid steps in the list.
STEPNumber?	Get the current step in the program.
STATE?	Get the rate program state. 0 - 3
SOAktime?	Get the current time soaking in minutes.
PAsscount nnnn	Enter the number of rate program repeats.
PAsscount?	Get the number of rate program repeats.
PASsnumber?	Get the current pass being executed.
PROGram Begin <End>	Begin from step 1 <stop> the rate program.

TABLE 5-3
THE COMMAND LIST

COMMAND	
Version?	Get version number (year,week), ie: 8727. This is the same number that appears on the LCD at power-up.

The ^s (carets) highlight the necessary command characters, the other letters are optional. In this case the simple command "V?" would suffice. "VERSION?", "Ver?" and "v?" are also acceptable. "Ver ?" and "Version" are not acceptable and will be ignored. The question mark is required and cannot be spaced from the command word.

In response to this query, the 9010 will send back a number such as "8727". This number identifies the program version with the date: the 27th week of the year 1987.

Note that ALL replies to queries are numbers, either integer or real in the form of a string of ascii characters terminated by CR and LF characters. This is true whether communicating thru the RS-232C via a dumb terminal or by computer, or thru the IEEE-488 interface.

COMMAND	
Setpoint ddd.d	Set setpoint temperature (Lowset to Highset). The setpoint must be within the limits to be accepted.
Setpoint?	Get the setpoint temperature.
Temperature?	Get temperature (-200 to 327.5 deg C). This is the temperature after correction by the curve formed by the calpoints.
Heat ON	Enables the heat control.
Heat OFf	Disables the heat control.

TABLE 5-3 (CONTINUED)

COMMAND		
Cool	ON	Enables the cool control.
Cool	OFf	Disables the cool control.

A short program using the above commands will illustrate their use. If an HP-85 computer were loaded with this HP Basic program and connected via the GPIB to the 9010 temperature controller, the following would occur: The REMOTE word turns on at the top of the LCD as soon as the program is started. The setpoint display changes to 123.4 and the HEAT word turns on in the LCD. Assuming the chamber was at room temperature, it will heat up while the computer monitors the temperature. When the temperature exceeds 100 degrees C, the Heat is turned off and the program ends. REMOTE goes off and control is returned to the front panel.

```
100 OUTPUT 727;"SET 123.4"          !GPIB address = 27.  Set-
                                    ! point temp = 123.4 deg C.
110 OUTPUT 727;"Heat ON, Cool ON"   !Enable heat and cool
                                    ! control.
120 OUTPUT 727;"Temp?"              !Request the current
                                    ! temperature.
130 ENTER 727; T1                   !Get it, save in real
                                    ! variable.
140 WAIT 1000                       !Pause 1 second.

150 IF T1 < 100 THEN GOTO 120       !Loop til temp reaches 100
                                    ! deg C.
160 OUTPUT 727;"H off, C off"       !Then disable the heat and
                                    ! cool.
170 END
```

The command in statement 100 could have been "S 123" as one space is required, but more are allowed between the command word and the associated numberic. An integer may be used and will be treated as 123.0. Here the setpoint value is imbedded in the string, but it may be necessary to extract the ascii from a program variable. In BASIC for instance, the command might be:

CMD$ = "Setpoint " + STR$(stemp) where the STR$ function converts the setpoint variable to ascii.

TABLE 5-3 (CONTINUED)

Similarly it may be necessary to convert the number reply from ascii to real. HP Basic does it in the ENTER statement but other GPIB implementations may only get the reply as a string variable.

In statements 110 and 160 two commands separated by a comma were sent. Any number of commands and queries may be so combined, as long as the command string and the reply string elicited, does not exceed 132 characters. The replies will be separated by commas in the order of the queries.

COMMAND	
HIghset ddd.d	Set high temp limit (LOWSET to 315.5 deg C). This sets the upper setpoint limit. Also, at temperatures 5 deg C above the Highset, both heat and cooling will be turned off.
HIghset?	Get high temp limit. This sets the lower setpoint limit. Also, at temperatures 5 deg C below the Lowset, both heat and cooling will be turned off.
LOwset ddd.d	Set low temp limit (-184.4 to HIGHSET).
LOwset?	Get low temp limit.
Dutycycle?	Get the dutycycle (-100 to 100). Cooling full on is indicated by -100, while -40 would mean it is cooling with 40% of full on.
CORrection?	Get correction for current temperature. Subtracting this value from the temperature will give the raw temperature reading.

TABLE 5-3 (CONTINUED)

COMMAND		
STatus?		Get the status word, a 3 digit number: sta.
	s: 0	Dutycycle less than 100% and error less than 2 degrees C.
	1	Error greater than 2 degrees C.
	2	Dutycycle at 100%.
	3	Error greater than 2 degrees C and Dutycycle at 100%.
	t: 0	Temp within the High and Low Limits.
	1	Temp greater than High Limit.
	2	Temp less than Low Limit.
	3	A/D Converter underranged.
	4	A/D Converter overranged.
	a: 0	Both Heat and Cool are enabled.
	1	Heat is disabled.
	2	Cool is disabled.
	3	Both Heat and Cool are disabled.
Xrate dd.d		Control rate from 0.0 to 36.0 degrees C per minute. When not zero, the 9010 will try to step up to the setpoint at that rate. When the rate is 0.0, no rate control is in effect.
Xrate?		Get the Control rate.
Pgain n		Set the proportional gain number (0 to 9). Increasing numbers double the gain.
Pgain?		Get proportional gain number.
Igain n		Set integral gain number (0 to 9). Increasing numbers double the gain.
Igain?		Get integral gain number.

TABLE 5-3 (CONTINUED)

COMMAND	
Mon	Toggle RS-232 mode, terminal or computer. Used mainly to switch to terminal mode after power-up.
Output ON	Causes the open collector line at J10-1 on the main PC board to go to GND.
Output OFf	Causes the open collector line at J10-1 on the main PC board to be not GND.
CALpts ttt.t, c.c	Insert points (temp,corr) in the list of 7. One or more points can be entered until the list has 7 entries. No further entries will be accepted until the list is cleared or a point deleted. The list is ordered by temp.
CALpts?	Get all points in the list. The reply is a list of 14 values separated by commas. All after the number of points entered (given by CALLen below) will be 0.0, 0.0 .
CALClear	Clear all points in the list. Set the number of points to zero and zero all the points.
CALDelete n	Delete from list the nth point. Take out the nth point and reorder the list.
CALLen?	Get the number of points in the list. Returns the number of valid points in the list.

TABLE 5-3 (CONTINUED)

COMMAND	
REMote	Put the 9010 in the remote mode.
LOCal	Return control to the front panel.
New Warm	Reset, clear all RAM except the parameters.
New Cold	Reset, clear all RAM and the parameters. Load the initial values of parameters.
DEgrees Celcius	Select the front panel interface to be in C.
DEgrees Fahrenheit	Select the front panel interface to be in F. (The remote communications is still in C.)

5.8 RATE PROGRAMMER COMMANDS

The following commands are used to program a ten step program that may be repeated 9999 times. Each step consists of a target setpoint, the time that the chamber will be held at that setpoint, and the rate at which the temperature changes from the current temperature to the setpoint.

Once a passcount is entered. the program may be started.

5.8.1 SETPOINT LIST

The list of temperatures in the rate program can be used for setpoint selection from the front panel. If only a few specific setpoints are normally used, this may be a preferred mode of operation. Dip switch SW1-2 on the main 9010 PC board must be ON to use this list.

TABLE 5-4
RATE PROGRAMMER SETPOINT LIST

COMMAND	
STEp n,ttt.t,ssss,rr.r	Enter temp, soaktime and rate for step n. Time in minutes, rate in degrees C / min.
STEp? n	Get temp, soaktime and rate for step n. The reply string is "ttt.t, ssss, rr.r".
STEMp n, ttt.t	Enter the temperature for step n.
STEMp? n	Get the temperature for step n.
SSoak n, ssss	Enter the soaktime in minutes for step n.
SSoak? n	Get the soaktime for step n.
SRate n, rr.r	Enter the control rate for step n.
SRate? n	Get the control rate for step n.
STEPClear	Clear list to one setpoint. All ten steps are zeroed with the exception of step 1. The temperature value in step 1 is saved.
STEPCOunt?	Get the number of valid steps in the list. Reply is a number from 1 to 10.
STEPNumber?	Get the current step in the program. Zero (0) until the rate program is running.
STATE?	Get the rate program state. 0: Program not running. 1: Running to the setpoint temp. 2: Soaking at the setpoint temp. 3: Program has ended.

TABLE 5-4 (CONTINUED)

COMMAND	
SOAktime?	Get the current time soaking in minutes. Zero (0) while not at the step setpoint.
PAsscount nnnn	Enter the number of rate program repeats. 1 to 9999 repeats must be entered before the program can be started.
PAsscount?	Get the number of rate program repeats.
PASsnumber?	Get the current pass being executed. Zero (0) while program not runnings.
PROGram Begin	Begin the rate program from step 1. Heat and cool are enabled, the set-point from step 1 as well as the control rate is entered. The OMEGA sign appears on the LCD to indicate that the 9010 is running the rate program.
PROGram End	Stop the rate program. Both heat and cool are disabled, the OMEGA sign goes off.

5.9 MAINTENANCE

5.9.1 TEST MODE

This mode should only be activated by maintenance personnel. When DIP switch SW1-1 on the main board is in the ON position, none of the previous modes apply; a special test program runs instead.

NOTE

During this test all output lines are toggled. To avoid cool solenoid chatter and heat turn on, temporarily disconnect J9 and J10 and J4 on the Aux Module PCB.

On startup the LCD will show all the annunciators (the non-digits) and either "7777" or "----" for both the four digit displays. The "7777" indicates that the RAM test passed; "----" that it failed. The test program does not use the RAM. Pressing the UP key will cause all digits to step up thru the "B" code (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, -, E, H, L, P). Pressing the DOWN key steps down thru the "B" code. Pressing the other key will toggle the annunciators off and on.

Connecting a terminal (set for 9600 baud) permits further testing. On start up "ROM only 1/87" appears on the terminal, followed by a report on the RAM test. Pass or fail the program then goes into an endless loop sending ".+.+.+.+.+.+.+.+.+.+...." to the terminal until the program is stopped. The "+" will be replaced by any printable key pressed on the terminal, to check both directions of communication over the RS-232C lines. In addition, the four output lines are toggled independently.

5.9.2 ANALOG CIRCUIT

It was mentioned in Section 5.5.2 that display "J", that appears just before the calibration displays, could be used to investigate the health of the RTD sensor circuit. It shows the resistance in ohms of the 3-wire platinum RTD connected at TB1.

The RTD is 100.0 ohms at 0 (zero) degree C and 138.5 ohms at 100 degrees. The can measure between 20 and 220 ohms connected from TB1-1 to 2 with a jumper from TB1-2 to 3.

Pushing the UP and DOWN keys switches in a test

resistor and switches into either the High or Low range of the sensor circuit. The 124 ohm test resistor falls in the overlapping portion of the two ranges. The High reading and the Low reading of the test resistor should agree within 0.2 ohms, and neither should differ more than 0.2 ohms from 124.0.

If pressing UP and DOWN again makes the High and Low closer, but they are still too far from the 124.0 value, the bridge circuit has probably become unbalanced. The trimpot R4 is set at the factory and should not need periodic adjustment.

The "J" display can only be exited by pressing the FCN key. The sensor circuit will then be switched back to normal.

5.9.3 CLEARING ALL RAM

The back-up circuit and three volt lithium battery keep the low power CMOS Random Access Memory alive when power is off. On power-up, this RAM is cleared to zeros except for a portion in which the operating parameters are saved.

If for some reason this section gets polluted, there is a way to clear all of RAM to zero, and then load in nominal initial values for the parameters. At the front panel, with the power off, hold down the FCN, UP and DOWN keys with one hand and press the ON key. The display will blank out until the three keys are released, then it will go thru its normal start-up sequence.

If the battery back-up fails, a similar sequence will be seen during start-up.

5.9.4 -HI- OR -LO- DISPLAYED

These two displays indicate trouble in the analog section. The RTD, the sensor circuit or the A/D converter are suspect.

CHAPTER 6
OPTIONS

6.1 MODEL 9020 PROGRAMMER

The Model 9020 Programmer is a microprocessor based unit which provides the automatic sequencing required in temperature testing and temperature dependent processing. The temperature program parameters controlled are Rate of Temperature Change, Soak Time (time at a specified temperature), Temperature Setpoint and Deviation Limits, and the Number of Passes. Additionally, three relays are provided for turning external devices on and off. The state of the three relays is programmable for each segment.

Program parameters are entered by front panel buttons, with data displayed on a custom Liquid Crystal Display (LCD) of two 4-digit numbers and several indicators. The program is stored in a battery-backed memory in the even of a power loss, and retrieved when power is restored. The program may have up to 30 segments and may be repeated up to 9999 times before being automatically shut down.

A program review function is provided to allow the operator to sequentially step through all program parameters. In the RUN mode, all parameters for the current segment may be displayed without disturbing the operation. Setpoint can range from -184 degrees C to +315 degrees C, with a temperature resolution of 0.1 degree C; soak time from 1 minute to 99 hours, 59 minutes; rate of 99.9 degrees/minute maximum and process deviation limits of 2 degrees to 99.9 degrees or no limits.

The programmer incorporates a settable process deviation limit alarm, with a front panel indicator and alarm output at the rear panel. A "program lock" position is provided with a removable key to safeguard the entered program.

6.2 MODEL 9911 TEMPERATURE MONITOR

The monitoring of temperature excursions between two preset limits is provided by the 9911 Temperature Monitor. If limits are exceeded, power to the monitored unit is removed, a warning lamp is illuminated, and an audible alarm is activated. When temperature is again within limits, the monitor may be reset for continued operation. A combination pyrometer scale provides reading at a glance with both

Fahrenheit and Centigrade ranges.

6.3 OTHER OPTIONS

When ordering any options for your chamber please list an entry for each category, separated by a dash (0000-0-0-0-0, where the first 4 digits are the chamber model number, the next digit is the door option, the next is the coolant option, the next is the voltage option, and the last is for Fast Heat-Up Option only). For example: 9039-1-2-1-__ would mean you have ordered a Model 9039 Chamber, door option 1, coolant option 2, and voltage option 1. These numbers correspond to the numbers listed below for each option. In the case of the Fast Heat-Up version of Model 9039, enter the numeral "1" as the last entry on the right, so it would look like: 9039-1-2-__-1.

6.3.1 HORIZONTAL/VERTICAL OPTION

Selection of horizontal or vertical air circulation depends on the configuration and arrangement of the items to be tested. For example, if large horizontal areas within the chamber are to be occupied by shelving, horizontal circulation may be most suitable. Where lowest gradients are desirable, vertical air flow is utilized to allow wall losses to be absorbed by a blanket of air surrounding the wall space.

6.3.2 DOOR OPTIONS

Delta offers a wide variety of doors to fit all standard chamber models. When ordering a specific door type, please enter the door number (as assigned below) in the order indicated. If you do not want a door, please enter "0".

1. Blank with Tray. Available for Models 9023, 9028, and 9039.

2. Blank -- No Tray. Available for Models 9059, 9064, and 9076*. *Enter number 6 in the order form for a Model 9076 window door.

3. Ten 3/8" Dia Ports with Tray. Available for Models 9023, 9028, and 9039.

4. Window and Five 3/8" Dia Ports with Tray. Available for Models 9023, 9028, and 9039.

5. Window and Five 3/8" Dia Ports -- No Tray. Available for Models 9059 and 9064.

6. Window Door for Chamber Model 9076.

7. Glass Window Doors (2) for Model 9080.

6.3.3 COOLANT OPTIONS

Coolant options can be ordered in the numerical order listed.

1. LCO2 Cooling -- High Pressure (900 psi) (not available on Model 9080).

2. LCO2 Cooling -- Low Pressure (300 psi) (not available on Model 9080).

3. LN2 Cooling -- (not available on Model 9080).

4. Dual Cooling -- LN2 & High Pressure (900 psi) LCO2.

5. Dual Cooling -- LN2 & Low Pressure (300 psi) LCO2.

6.3.4 VOLTAGE OPTIONS

Voltage options can be ordered in the numerical order listed.

1. 120 VAC, 50/60 Hz, single phase (not available on 9076 or 9080).

2. 208 VAC, 50/60 Hz, three wire, single phase.

3. 208 VAC, 50/60 Hz, four wire, single phase.

4. 240 VAC, 50/60 Hz, single phase *. *The Fast Heat-Up Model 9039 must use this voltage option only (number 1 for order entry).

CHAPTER 7
DRAWINGS AND PARTS LISTS

7.1 HOW TO USE

This chapter provides assembly drawings, associated parts lists, and schematics for the chambers, subassemblies and options. The drawings, parts lists, and kits are arranged in order of appearance in the following table. There are no Top Assembly drawings available for the chambers at this time, however, the top assembly Parts List for each chamber has been provided. Unique items and common items will be listed with a reference as to where used. The information presented enables a technician to locate and identify parts to the extent necessary to obtain replacements.

Use the parts lists to locate the item number called out on an assembly drawing. When ordering parts, list the part number, applicable dash number (-001, -002, etc.), description, and quantity required. For more information, call or write the Delta Design Customer Service or Sales Department.

Delta Design, Inc.
5775 Kearny Villa Road
San Diego, CA 92123

(619) 292-5000
TWX: (910) 335-1215

TABLE 7-1. DRAWINGS AND PARTS LISTS

UNIQUE ASSEMBLIES/PART NUMBERS

TABLE 7-1. (CONTINUED)

COMMON ASSEMBLIES/PART NUMBERS

PART NUMBER	DESCRIPTION	WHERE USED	PAGE
1663049-001	9010 Temperature Controller	ALL chambers	7-5
1661866-501	PWA, 9010 Front Panel	ALL chambers	7-6
1661863-000	Schematic, 9010 Front Panel	REF	7-6
1661250-501	PWA, 1 Channel Temp. Control	ALL chambers	7-6
1661247-000	Schem., 1 Channel Temp Cont.	REF	7-6
1663618-001	AC Auxiliary Module Assembly	ALL chambers	7-6
1663783-000	Wiring Diagram, Aux. Module	REF	7-6
1661916-501	PWA, Auxiliary Module	ALL chambers	7-7
1661913-000	Schematic, Auxiliary Module	REF	7-7
1663765-001	Terminal Block Assy, Aux. Mod.	ALL chambers	7-7
1664861-001	Cable Assembly, Aux. Module	ALL chambers	7-7
1663921-001	Valve Assembly, 24 VAC	Cooling Kits	7-7
1663921-002	Valve Assembly, 24 VAC	Cooling Kits	7-7
1663922-001	Valve Assembly, LN2, 24 VAC	Cooling Kits	7-7
2618020	Hose Assembly, CO2	Cooling Kits	7-8
1663916-001	Cooling Kit, CO2 Low	9023/9076	7-8
1663917-001	Cooling Kit, CO2 Low	9023/9059/ 9076	7-8
1663917-003	Cooling Kit, CO2 Low	9039/9064	7-8
2618004-001	Injector Assembly	9023/9059/ 9076	7-8
2619067-001	Injector Assembly, LN2	9028/9076	7-8
1663872-001	Blower Motor Assembly, CW	9023/9028/ 9039/9064/ 9076	7-8
1663872-002	Blower Motor Assembly, CCW	9039/9059	7-9
2622524-001	Heater Assembly	9039/9059/ 9064	7-9
1664574-005	Cable Assembly, GPIB 20"	9023/9028	7-9
1664574-055	Cable Assembly, RS232 20"	9023/9028	7-9
1664574-010	Cable Assembly, GPIB 30"	9039/9059/ 9064/9076	7-9
1664574-060	Cable Assembly, RS232 30"	9039/9059/ 9064/9076	7-9

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2605110003
DESCRIPTION: 9023 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2631670001	INNERLINER ASSY		1
002	2600032001	PANEL, BOTTOM		1
004	2600034001	PANEL, RIGHT		1
005	1602971101	PANEL, FRONT		1
006	1634083101	PANEL, LEFT		1
007	1634084101	PANEL, TOP		1
008	1663870101	COVER PLATE, CONN		1
012	1602967	PLATE, VENT		1
013	2400063	GASKET, RUBBER		1
014	1640309001	GUIDE TUBE, CHAMBER		1
015	2600033002	PANEL, REAR		1
016	1635605101	DOOR KEEPER		2
017	1663872001	BLWR MTR ASSY, CW		1
018	1663049001	9010-TEMP. CONTROLLER		REF
019	1600004102	COVER, BLOWER MOTOR		1
020	1500416	FOOT, MTG. RUBBER		4
021	1664574005	CABLE ASSY, GPIB 20"		1
022	1664574055	CABLE ASSY, RS232 20"		1
023	2602503	SWITCH, FAILSAFE	S1	1
024	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS & DETENT		1
025	1400569	PIN, TERMINAL, FEMALE		7
026	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
027	2622521	HTR. ASSY, 9023	HR1	1
028	1663594101	SCD RTD PROBE, CHAMBER		1
030	2600002002	BEZEL ASSY		1
031	1500033	GROMMET, RUBBER, 5/8"		1
034	2635393002	PARTITION ASSY		1
035	1663618001	AC AUX MODULE ASSY		1
036	1500188	NUT, WIRE, SMALL #72B	E1-E4, E7, E8	6
038	1500041	LUG, RING, BLUE 14-16 WIRE, #6 STUD		6
039	3600081	PLUG, BUTCH, 1/2"		1
041	4100697	SPACER, 1/2"		4
042	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
043	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1
044	1640100	FLEX DRIVE		1
045	1500062	LUG, RING, YELLOW 12-10 AWG, #6 STUD		2
046	1500055	LUG, SPADE, #6 RED		1
047	1500047	LUG, RED, QUICK-DISC.		2
051	1500256	PLUG, 1"		1
065	1500002	CLAMP, CABLE 3/8"		2
068	1500735	NUT, SWITCH, PANEL		1
069	4100003	BUSHING		1
071	1400577	JUMPER, TERM. BLK	TB1	1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 3605110003
DESCRIPTION: 9023 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
073	1500077	STRAIN RELIEF,BLACK		1
074	2000135	PLUG,125 V,15 A	P1	1
081	1400008	CKT. BKR,20A,250V	CB1	1
087	1500071	LUG,RING,BLUE,INSULA 16-14 AWG,#10 STUD		5
090	1663916001	COOLING KIT,CO2 HIGH 9023,9076		1
091	1663917001	COOLING KIT,CO2 LOW 9023,9059,9076		1
092	1663918001	COOLING KIT,LN2 9023		1
093	1663919001	COOLING KIT,DUAL HI. 9023		1
094	1663920001	COOLING KIT,DUAL LOW 9023		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918001
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG		1
002	1663922001	VALVE ASSY, LN2, 24VAC		1
003	2619066001	INJ. ASSY, LN2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919001
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
003	2618004001	INJECTOR ASSY. CO2 HIGH PRESSURE SINGLE STEM		1
004	1643404	BRACKET, LN2 MTG		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
006	2619066001	INJ. ASSY, LN2		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1
014	1400192	SWITCH		1

DELTA DESIGN

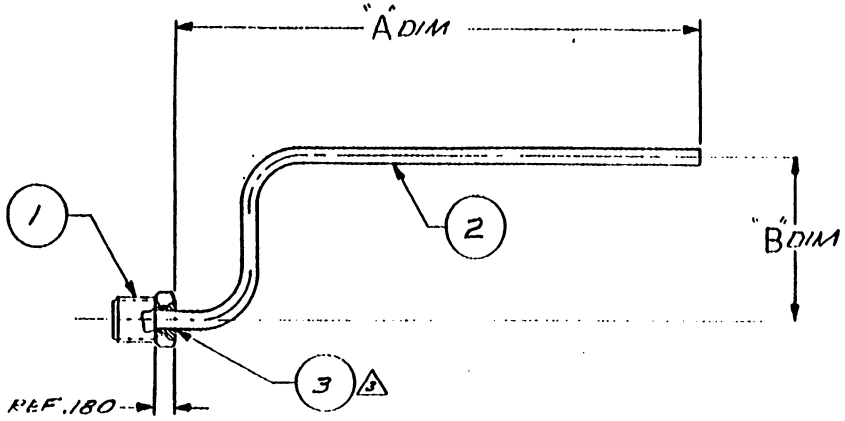
PARTS LIST BY ITEM
ASSEMBLY: 1663920001
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
003	1647842107	TUBE, CO2 INJ, 11" 300 PSI		1
004	1643404	BRACKET, LN2 MTG.		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
006	2619066001	INJ. ASSY, LN2		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		1
015	1400192	SWITCH		1

CAGE FILE COMP IRVINE CA HANGER EPHYR

26 19066

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	PER ECN M430 R Bimola 11-06-73 REVISED & REDRAWN		
	B	PER ECN 3881 CHG'D REV TO MATCH P/L	9-4-3	[illegible]



DASH NO.	A DIM	B DIM-REF
-001	4.56	1.41

PARTS LIST IS A SIZE

3. AFTER SILVER SOLDERING, REMOVE ALL FOREIGN MATTER FROM ITEM 2 INSIDE DIA.

4. FINISH (IF APPLICABLE)

5. MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
001	1	D2639165	2300
001	1	D1643453	2300

APPLICATION | SERIAL NO. | DATE EFF | DWG REV | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCED ON DECIMALS .XX ±.03 .XXX ±.010 ANGLES 0°30'

HOLE TOLERANCES

MATERIAL 1

FINISH 4

ENGINEERING ACTIVITY L-3

DESIGN	R Bimola 11-6-73
DRAFTED	RB'onilo 11-1-73
CHECKED	
APPROV	Harris 11-14-73
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONU INC.
SAN DIEGO, CA. 92138

TITLE: INJECTOR ASSY, LN_2

SIZE B | CODE IDENT | 2619066 REV B

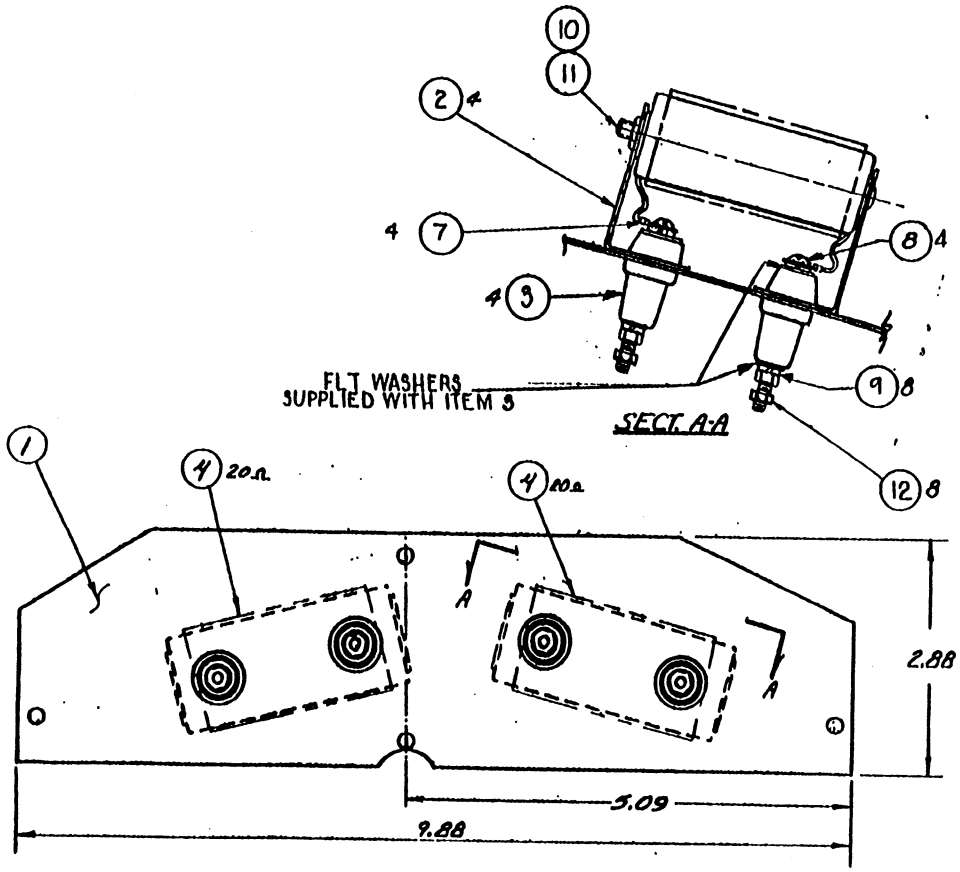
SCALE FULL | SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2619066001
DESCRIPTION: INJ. ASSY, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1618012003	PIPE PLUG, MOD		1
002	1619068003	TUBE, LN2, INJ.		1

REVISIONS				
ZONE	LTR.	DESCRIPTION	DATE	APPROVED
	A	PER ECN 1340 2-20-78 BGM INCORPERATED TCN X492 ; SEE OBSOLETED NO REV. DWG FOR WAS CONDITION	3-1-78	
	B	PER ECN M261B JHAMES 9-29-81 ADDED ITEMS 10 & 11	10-8-81	
	C	PER ECN 4877 CHG'D ITEMS 10, 11 ON P/L 1-4-84 RAY	1-6-84	
	D	PER ECN 5003 ADDED TERMINAL LUGS DN	2-2-84	
	E	PER ECN 6081 ADDED ITEM # 12 BASIC 10-25-84	10-26	
	F	ECN 6784	7/11/85	WCD



P/L "A" SIZE

QTY. REQ'D	NOMENCLATURE OR DESCRIPTION	CODE IDENT.	IDENTIFYING NUMBER	SPECIFICATION	MATERIAL OR NOTE	ITEM NO

	8014			
2603110	2300			
NEXT ASSY.	USED ON	SERIAL NOS.	DATE EFF.	DWG. REV. LTR.
APPLICATION		EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED THE FOLLOWING APPLIES: BREAK ALL SHARP EDGES .005 MAX. SURFACE ROUGHNESS 125 RMS ENDS, INT. CL. 25 EXT. CL. 32 DIMENSIONS TO BE FINISHED AFTER PLATING
FRACTIONS ± 1/32 ANGLES ± 1°
DECIMALS .XX ± .010 .XXX ± .005

MATERIAL:

FINISH:

	BY	DATE
DESIGN		
DRAFTED	KNAPP	5-9-72
CHECKED	Nanni	7-6-72
APPROV.	L. ELLIS	7-6-72

DO NOT SCALE DRAWING

PART NO. 2635877

DELTA DESIGN INC.
8000 FLETCHER PKWY.
LA MESA, CALIF. 92041
TEL: A/C (714) 465-4141

L-3

TITLE: HEATER ASSY

SIZE	CODE IDENT. NO.	DRAWING NO.	REV LTR
C		2622521	F

SCALE FULL SHEET 1 OF 1

NOTES:
1. ALL DIM. REF ONLY

7-11

BLUE CAR

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY 3622521
DESCRIPTION: HTR. ASSY, 9023
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1635871	PLATE, HEATER, 5253-1		1
002	1635868	STANDOFF, HEATER		4
003	1500327	INSULATOR		4
004	2200005	HEATER, 20.0 OHM		2
007	1500039	LUG, HI-TEMP, #8 STUD		4
010	1655875101	SCREW, MODIFIED		2
012	6708320001	NUT, 8-32, S.S.		8

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2635402002
DESCRIPTION: 9028 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2635382	INNERLINER		1
004	1635395	PANEL, LEFT		1
005	2635396	PANEL, RIGHT		1
006	2635397001	PANEL, BOTTOM		1
007	1635398	PANEL, TOP		1
008	1600526	PANEL, FRONT		1
009	2635401	BEZEL ASSY		1
010	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS & DETENT		1
011	1400569	PIN, TERMINAL, FEMALE		7
012	1602967	PLATE, VENT		1
013	2400063	GASKET, RUBBER		1
014	1640309001	GUIDE TUBE, CHAMBER		1
015	2400126	RUBBER STRIP		4
016	1640100	FLEX DRIVE		1
018	1600091	SHIM, KEEPER		REF
019	1635605101	DOOR KEEPER		2
020	1500416	FOOT, MTG, RUBBER		4
021	2400025	INSUL, FIBER-GLASS NOT STOCKED-SEE PRODUCTION		
022	2400026	INSULATION TAPE, CORK 1/8"X 2"X 30'		
023	2602503	SWITCH, FAILSAFE	S1	1
024	1663925102	CAN ASSY BLW MTR CW		1
025	1600004102	COVER, BLOWER MOTOR		1
027	2622520	HTR. ASSY, 9028		1
030	1400577	JUMPER, TERM. BLK		1
031	1500608	RING. RETAINING		1
032	1643276002	PARTITION ASSY		1
033	1663594101	SCD RTD PROBE, CHAMBER	R1	1
036	1500188	NUT, WIRE, SMALL #72B	E1-E4, E7, E8	6
037	1500026	GROMMET, RUBBER, 3/8"		1
038	3600082	PLUG, BUTCH, 3/8"		1
039	3600081	PLUG, BUTCH, 1/2"		1
040	1700142	PLUG, BUTCH, 1-1/4"		1
041	4100003	BUSHING		1
042	1500735	NUT, SWITCH, PANEL		1
043	1663872001	BLWR. MTR. ASSY, CW		1
044	1648658101	SUPPORT BLOCK		2
046	4100697	SPACER, 1/2"		4
047	1663618001	AC AUX MODULE ASSY		1
048	1664574005	CABLE ASSY, GPIB 20"		1
049	1664574055	CABLE ASSY, RS232 20"		1
050	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
051	1500033	GROMMET, RUBBER, 5/8"		2
054	263539402	PANEL ASSY, REAR		1
056	1663049001	9010-TEMP CONTROLLER		REF
057	1663870101	COVER PLATE, CONN.		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2635402002
DESCRIPTION: 9028 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
068	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
074	1500077	STRAIN RELIEF, BLACK		1
075	2000135	PLUG, 125 V, 15 A.	P1	1
076	1500394	CABLE, PWR, 14/3		
082	1400008	CKT BKR, 20A, 250V	CB1	1
087	1500071	LUG, RING, BLUE, INSULA 16-14 AWG, #10 STUD		5
091	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1
095	1663916002	COOLING KIT, CO2 HIGH 9028		1
096	1663917002	COOLING KIT, CO2 LOW 9028		1
097	1663918002	COOLING KIT, LN2 9028		1
098	1663919002	COOLING KIT, DUAL HI. 9028		1
099	1663920002	COOLING KIT, DUAL LOW 9028		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663916002
DESCRIPTION: COOLING KIT, CO2 HIGH
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
004	2618004010	INJECTOR ASSY CO2 HIGH PRESSURE SINGLE STEM		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663917002
DESCRIPTION: COOLING KIT, CO2 LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
004	3600197	CONNECTOR, MALE		1
005	1647842115	TUBE, CO2 INJ, 28" 300 PSI		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918002
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG		1
002	1663922001	VALVE ASSY, LN2, 24VAC		1
004	2619067001	INJ. ASSY, LN2		1
008	4200009	COVER, VALVE, LN2		1
		PER DWG# 1643455		
009	4200010	BASE, LN2 DRIP		1
		PER DELTA #1643456		
010	3600104	CONNECTOR, MALE		1
		1/8"PIPE, 1/4"TUBE		
013	1400110	FILTER, CO2		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919002
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
004	1643404	BRACKET, LN2 MTG.		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1
014	1400192	SWITCH		1
015	2618004010	INJECTOR ASSY. CO2 HIGH PRESSURE SINGLE STEM		1
020	2619067001	INJ. ASSY, LN2		1

DELTA DESIGN

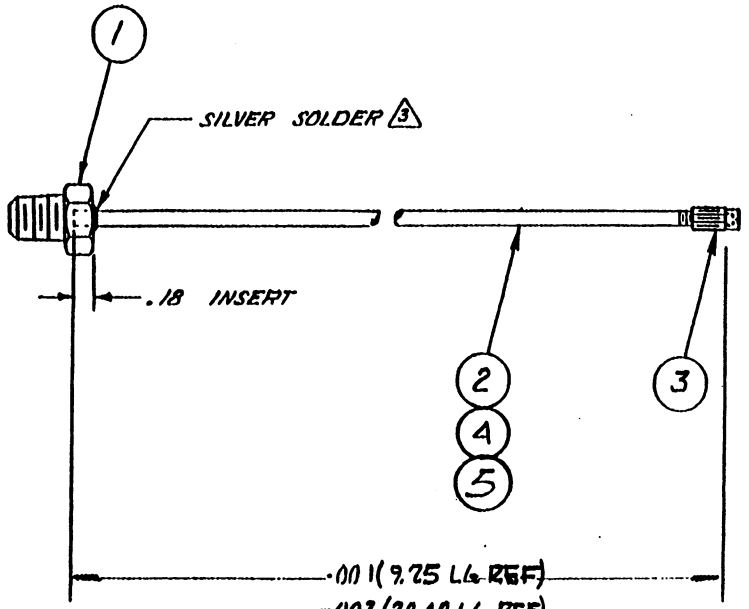
PARTS LIST BY ITEM
ASSEMBLY: 1663920002
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
004	1643404	BRACKET, LN2 MTG.		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		1
015	1400192	SWITCH		1
016	1647842115	TUBE, CO2 INJ, 28" 300 PSI		1
017	2619067001	INJ. ASSY, LN2		1

BASIC FILE COPY IRVINE CA HANDLER SPHERE

26 18004

REVISIONS				
ZONE	LTR	DESRIPTION	DATE	APPD
	B	INITIAL RELEASE ECN M239 KNAPP	7-31-72	
	C	PER ERN 3845 INITIAL RELEASE	3-30-73	
	D	PER ECN 4338, ADDED -010 ASSY (ITEM 5)	7-29-73	



4 MULTIPLE STD USAGE - SEE P/L FOR APPLICATION

5 REMOVE OBSTRUCTIONS FROM ID AFTER SOLDERING

4 FINISH (IF APPLICABLE)

4 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON

APPLICATION

SERIAL NO.	DATE EFF	DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .05, .XXX ± .010 ANGLES ±30'

HOLE TOLERANCES

MATERIAL 4

FINISH 4

ENGINEERING ACTIVITY 3845 L-3

DESIGN	
DRAFTED	KNAPP 3-28-73
CHECKED	[illegible] 4-6-73
APPROV	Harris 4-6-73
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF COHU INC.
9739 KIRAWY VILLA RD SAN DIEGO, CA. 92123 - TEL (714) 292-5000

TITLE: INJECTOR ASSY, CO_2 SINGLE STEM

SIZE	CODE IDENT	
B		2618004

SCALE ~ SHEET 1 OF 1

7-20

DELTA DESIGN

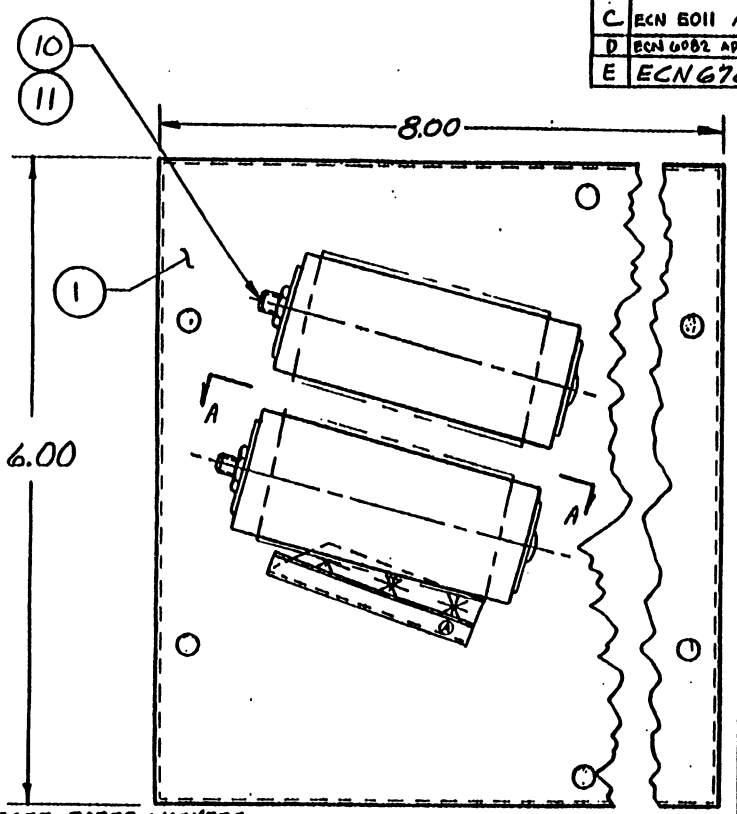
PARTS LIST BY ITEM
ASSEMBLY: 2618004010
DESCRIPTION: INJECTOR ASSY.
REF/DES:

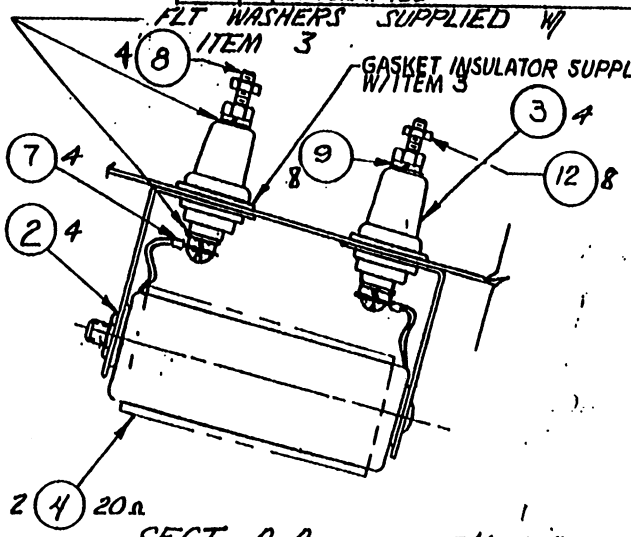
ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
003	4100039	TIP, INJECTOR, CO2 .020 ORIFICE		1
005	1618011115	TUBE, CO2, INJ.		1

EAST FILE CORP. IRVINE, CA. HANDER EFH22

2622520	

ZONE	LTR.	REVISIONS DESCRIPTION	DATE	APPROVED
	A	PER ECN M685 RB...KS 5-28-74 ADDED BRACKET, PICTURE CHANGE ONLY	5-28-74	W. Rudd 5-29-74
	B	PER ECN M2618 THAMES 9-27-74 ADDED ITEM 10 & 11 REMOVED ITEM 6 & TCN X436	10-8-74	
C	ECN 5011 ADDED 7 ON 2-2-84			
D	ECN 6082 ADDED #12 EFF 11/13/84			
E	ECN 6784 7/17/85			





SECT. A-A

P/L "A" SIZE

QTY. REQ'D	NOMENCLATURE OR DESCRIPTION	CODE IDENT.	IDENTIFYING NUMBER	SPECIFICATION	MATERIAL OR NOTE	ITEM NO
1	6503711	2850A				
1	2635402	2850				

⚠2 DISCARD PAPER WASHERS SUPPLIED WITH ITEM NO. 3. REPLACE WITH ITEM NO. 5.

1. ALL DIM. REF ONLY

NOTES:

UNLESS OTHERWISE SPECIFIED THE FOLLOWING APPLIES:
TAK ALL SHARP EDGES .005
SURFACE ROUGHNESS 125 RMS
MATL. CL. 30, HRT. CL. 2A

NEXT ASSY.	USED ON	SERIAL NOS.	DATE EFF.	DWG. REV. LTR.

APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 ANGLES ± ½° DECIMALS .XX ±.010 .XXX ±.005

MATERIAL:

FINISH:

	BY	DATE
DESIGN		
DRAFTED	KNAPP	5-2-74
CHECKED	Hamin	7-6-73
APPROV.	L.ELLIS	7-6-73

DO NOT SCALE DRAWING

PART NO. 2635876

DELTA DESIGN INC.
8000 FLETCHER PKWY.
LA MESA, CALIF. 92041
TEL: A/C (714) 469-4141

L-3

TITLE: HEATER ASSY.

SIZE	CODE IDENT. NO.	DRAWING NO.	REV. LTR.
B		2622520	E

SCALE FULL — SHEET 1 OF 1

BLUE CARD

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: B622520
DESCRIPTION: HTR. ASSY, 9028
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1635870	PLATE, HEATER, 5252-0		1
002	1635868	STANDOFF, HEATER		4
003	1500327	INSULATOR		4
004	2200005	HEATER, 20.0 OHM		2
007	1500039	LUG, HI-TEMP, #8 STUD		4
010	1655875101	SCREW, MODIFIED		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2636283002
DESCRIPTION: 9039 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2636288002	INNER LINER 9039		1
002	1603080	PANEL FT		1
003	1663870101	COVER PLATE, CONN.		1
004	1600118	PANEL TOP		1
005	2600116	BOT PANEL		1
006	2636287	PANEL ASSY, RIGHT		1
007	1636286	PANEL LEFT		1
008	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
009	2600100	BEZEL ASSY		1
010	1602967	PLATE, VENT		1
011	2400063	GASKET, RUBBER		1
012	1640309001	GUIDE TUBE, CHAMBER		1
013	1635605101	DOOR KEEPER		2
014	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1
015	1635880001	SHAFT, MODIFIED M/F 1500452		1
016	1500455	FLEXDRIVE		1
017	2300011	THERM, 8", .162"DIA. -100 TO +600 DEG F		1
018	1600136	THERMOMETER CUP 3900/6400		1
019	2630571002	PANEL ASSY - REAR		1
020	1600004102	COVER, BLOWER MOTOR		2
021	4100697	SPACER, 1/2"		8
022	1500419	FOOT, RUBBER, MTG		4
023	2400025	INSUL, FIBER-GLASS NOT STOCKED-SEE PRODUCTION		
024	2400026	INSULATION TAPE, CORK 1/8"X 2"X 30'		
025	1500511	PLUG, BUTCH, 1-3/8"		2
026	3600081	PLUG, BUTCH, 1/2"		2
027	2400126	RUBBER STRIP		
029	1400008	CKT BKR, 20A, 250V		1
030	2602503	SWITCH, FAILSAFE	S1	1
031	1663594101	SCD RTD PROBE, CHAMBER		1
034	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
035	1663049001	9010-TEMP CONTROLLER		REF
036	2622524001	HTR. ASSY, 39/59/64/80		2
037	1664574010	CABLE ASSY, GPIB 30"		1
038	1664574060	CABLE ASSY, RS232 30"		1
039	1400577	JUMPER, TERM. BLK		1
040	2636290002	PANEL ASSY- PARTITION		1
041	1663872001	BLWR. MTR. ASSY, CW		1
042	1663872002	BLWR. MTR. ASSY, CCW		1
043	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS &		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 3636283002
DESCRIPTION: 9039 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
		DETENT		
044	1400569	PIN, TERMINAL, FEMALE		14
046	1663618001	AC AUX MODULE ASSY		1
047	1500188	NUT, WIRE, SMALL		6
		#72B		
048	1500032	GROMMET, RUBBER		1
052	4100003	BUSHING		1
053	1500735	NUT, SWITCH, PANEL		1
054	3601091	PLUG		1
058	1648659101	BLOCK		2
073	1500026	GROMMET, RUBBER, 3/8"		2
075	2400003	SEALANT, RED		
		RTV-106, 6 OZ		
077	1500387	WIRE		
079	1500062	LUG, RING, YELLOW		2
		12-10 AWG, #6 STUD		
080	1500047	LUG, RED, QUICK-DISC.		2
081	1500055	LUG, SPADE, #6 RED		1
094	1500077	STRAIN RELIEF, BLACK		1
095	1500394	CABLE, PWR, 14/3		REF
096	2000135	PLUG, 125 V, 15 A.		1
097	1500071	LUG, RING, BLUE, INSULA		4
		16-14 AWG, #10 STUD		
098	1500056	LUG, SOLDER, 1413-6		1
099	1500376	WIRE 12		
100	1663916003	COOLING KIT, CO2 HIGH		1
		9039		
101	1663917003	COOLING KIT, CO2 LOW		1
		9039, 9064		
102	1663918003	COOLING KIT, LN2		1
		9039		
103	1663919003	COOLING KIT, DUAL HI.		1
		9039		
104	1663920003	COOLING KIT, DUAL LOW		1
		9039		

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663916003
DESCRIPTION: COOLING KIT, CO2 HIGH
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
006	2618003001	INJECTOR ASSY, CO2 DUAL STEM, 900 PSI		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918003
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG		1
002	1663922001	VALVE ASSY, LN2, 24VAC		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643453		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1
013	1400110	FILTER, CO2		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919003
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
004	1643404	BRACKET, LN2 MTG		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1
014	1400192	SWITCH		1
016	2618003001	INJECTOR ASSY, CO2 DUAL STEM, 900 PSI		1
022	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1

DELTA DESIGN

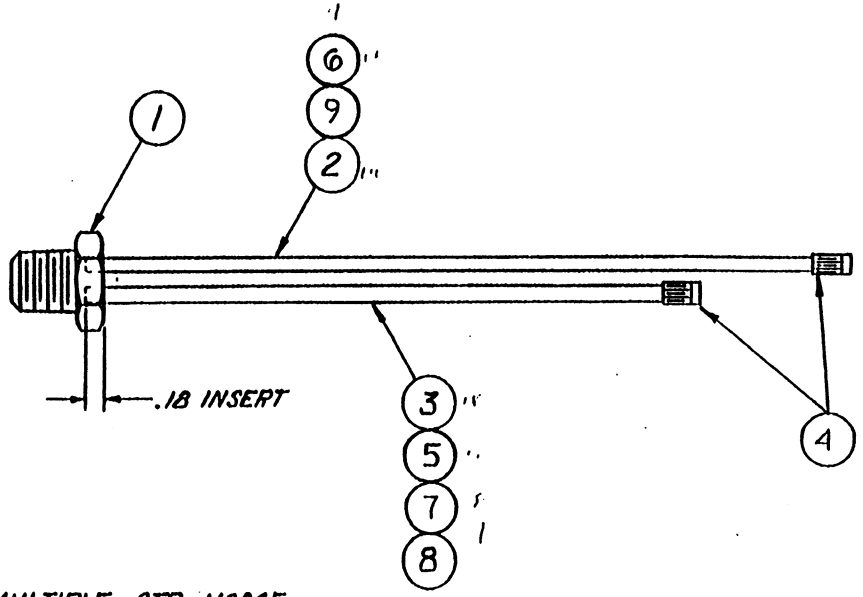
PARTS LIST BY ITEM
ASSEMBLY: 1663920003
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
004	1643404	BRACKET, LN2 MTG		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		1
015	1400192	SWITCH		1
018	1647842108	INJECTOR ASSY, CO2 16.5", 300 PSI		1
027	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1

BASI PAS CHAP IRVINE CA HANGER EPMED

26 18003

REVISIONS				
ZONE	LTR	DESRIPTION	DATE	APPD
	A	REDRAWN FOR DWG CLARITY ECN M239 (KNAPP) 3-28-73	7-31-78	
	B	PER ECN M2327 THAMES 3-27-81 RE-RELEASE ADDED DASH 4 MODEL TABLE REVISED ADDED 5,6,7,8,9 ITEMS	9-9-81	



DASH	MODEL	DASH	MODEL	DASH	MODEL
-001	3900	-011			
-002		-012			
-003		-013			
-004		-014			
-005	6400				
-006					
-007	8000				
-008					
-009	8000				
-010					

4 MULTIPLE STD USAGE - SEE P/L FOR APPLICATIONS

3 REMOVE OBSTRUCTIONS FROM ID OF INJECTOR TUBES AFTER SOLDERING

4 FINISH (IF APPLICABLE)

4 MATL (IF APPLICABLE)

P/L "B SIZE"

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0°30'

HOLE TOLERANCES

MATERIAL 3

FINISH 4

ENGINEERING ACTIVITY M2327 L-3

DESIGN	
DRAFTED	KNAPP 3-28-73
CHECKED	MILLER 4.6.73
APPROV	Hansen 4-6-73
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF COMU INC.
9750 KEARNY VILLA RD SAN DIEGO, CA. 92123 • TEL (714) 292-5000

TITLE: INJECTOR ASSY, CO_2 DUAL STEM

SIZE B CODE IDENT

2618003

SCALE ~ SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

7-30

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2618003001
DESCRIPTION: INJECTOR ASSY, CO2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
002	1618011103	TUBE, CO2, INJ.		1
003	1618011104	TUBE, CO2, INJ.		1
004	4100039	TIP, INJECTOR, CO2 .020 ORIFICE		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2635601002
DESCRIPTION: 9059 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2635590	INNERLINER		1
002	1635598	PANEL, FRONT		1
003	2635595	PANEL, RIGHT		1
004	2600086	BEZEL ASSY		1
005	1635594	PANEL ASSY TOP		1
006	1635597	LT PANEL		1
007	1663870101	COVER PLATE, CONN		1
008	2635596	PANEL ASSY		1
009	1640309001	GUIDE TUBE, CHAMBER		1
010	2400063	GASKET, RUBBER		1
011	1602967	PLATE, VENT		1
012	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
013	2635593002	PANEL, REAR		1
014	1600076	BUSHING, THERMOMETER		1
015	1663872002	BLWR. MTR. ASSY, CCW		2
016	1600004102	COVER, BLOWER MOTOR		2
017	2622524001	HTR ASSY, 39/59/64/80		2
018	1663049001	9010-TEMP. CONTROLLER		REF
019	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1
020	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS & DETENT		2
021	1400569	PIN, TERMINAL, FEMALE		14
022	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
024	1663926102	CAN ASSY BLW MTR CCW		2
026	2602503	SWITCH, FAILSAFE		1
027	1634343	COVER, FAIL-SAFE		1
029	2635599002	PARTITION ASSY 5900/4144		1
030	1648659101	BLOCK		2
031	1663618001	AC AUX MODULE ASSY		1
032	1643368	GUIDE TUBE		1
033	1643369	GASKET		1
035	1664574010	CABLE ASSY, GPIB 30"		1
036	1664574060	CABLE ASSY, RS232 30"		1
041	2300011	THERM, 8", .162"DIA -100 TO +600 DEG. F		1
042	2400025	INSUL, FIBER-GLASS NOT STOCKED-SEE PRODUCTION	REF	
043	2400126	RUBBER STRIP		REF
044	1500419	FOOT, RUBBER, MTG		4
045	1635605101	DOOR KEEPER		2
048	1663594101	SCD RTD PROBE, CHAMBER		1
049	1500608	RING. RETAINING		1
050	3600079	PLUG, BUTCH, 7/8"		2
051	3600081	PLUG, BUTCH, 1/2"		2
052	3600080	PLUG, BUTCH, 3/4"		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2635601002
DESCRIPTION: 9059 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
053	1500032	GROMMET, RUBBER		1
058	1500026	GROMMET, RUBBER, 3/8"		2
059	4100697	SPACER, 1/2"		8
061	1500001	CLAMP, CABLE 3/16"		1
062	1500002	CLAMP, CABLE 3/8"		4
100	1500055	LUG, SPADE, #6 RED		1
101	1500047	LUG, RED, QUICK-DISC		2
104	1500066	LUG, RING 16-14 AWG, 1/4" STUD		1
105	1500062	LUG, RING, YELLOW 12-10 AWG, #6 STUD		7
122	1500077	STRAIN RELIEF, BLACK		1
123	1500465	CABLE, PWR, 12/4		
125	1500071	LUG, RING, BLUE, INSULA 16-14 AWG, #10 STUD		4
126	1500056	LUG, SOLDER, 1413-8		1
127	1400008	CKT. BKR, 20A, 250V		1
129	2000135	PLUG, 125 V, 15 A.		1
130	1663916004	COOLING KIT, CO2 HIGH 9059		1
131	1663917001	COOLING KIT, CO2 LOW 9023, 9059, 9076		1
132	1663918004	COOLING KIT, LN2 9059		1
133	1663919004	COOLING KIT, DUAL HI 9059		1
134	1663920004	COOLING KIT, DUAL LOW 9059		1
508	1648298001	HINGE, ARTICULATED 5900 CHAMBER		REF

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663916004
DESCRIPTION: COOLING KIT, CO2 HIGH
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
005	2618004001	INJECTOR ASSY CO2 HIGH PRESSURE SINGLE STEM		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918004
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG.		1
002	1663922001	VALVE ASSY, LN2, 24VAC		1
005	2639145001	INJ. ASSY, LN2, 9059		1
008	4200009	COVER, VALVE, LN2		1
009	4200010	PER DWG# 1643455 BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1
013	1400110	FILTER, CO2		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919004
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
004	1643404	BRACKET, LN2 MTG		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1
014	1400192	SWITCH		1
017	2618004001	INJECTOR ASSY. CO2 HIGH PRESSURE SINGLE STEM		1
018	2639145001	INJ. ASSY, LN2, 9059		1

DELTA DESIGN

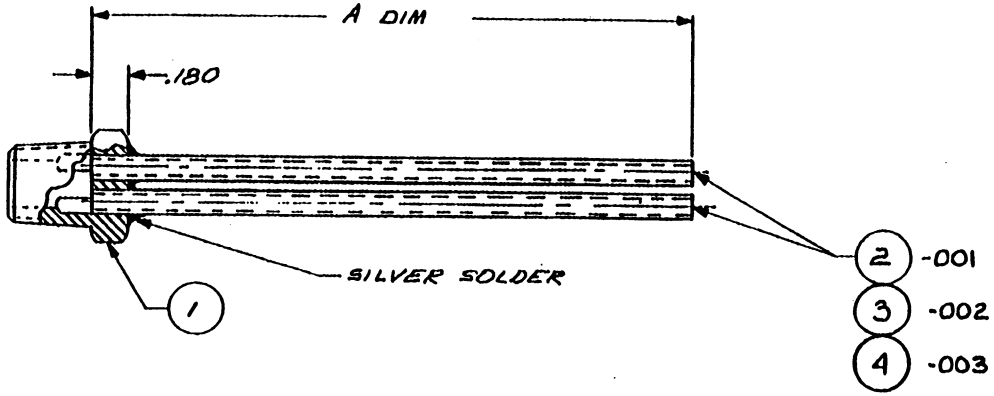
PARTS LIST BY ITEM
ASSEMBLY: 1663920004
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
003	1647842107	TUBE, CO2 INJ, 11" 300 PSI		1
004	1643404	BRACKET, LN2 MTG.		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		1
015	1400192	SWITCH		1
020	2639145001	INJ. ASSY, LN2, 9059		1

BASI FILE COPY IRVINE, CA HANGER 6PH22

16 39145

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ECN M541 KNAPP 3-6-74 1.) ADDED DASH 002 PART	3-15-74	Harris
	B	PER ECN M671 DTD 5-22-74 F.J.O. ADDED "A" DIM (11.00) TO -003 TAB BLOCK. ADDED -003 TO N/A	5-31-74	Harris
	C	PER ECU 3863 ADDED ITEMS 3,4 REVISED DWG		



DASH NO	A DIM
-001	2.82
-002	20.00
-003	11.00
-004	

SEPARATE P/L

3. INSIDE DIA MUST BE FREE OF ALL FOR. FOREIGN MATTER AFTER SOLDERING

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

BSI: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
003	1	D1640199	8073
002	2	D1640075	7601
001	1	D2639168	5900
001	1	D2639144	5900

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

2076-0

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES ± 0°30'

MORE TOLERANCES

.XXX ± .005 .XXX ± .005
.XXX ± .005 .XXX ± .005

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY	L-3	
DESIGN	R Brooks	11-12-73
DRAFTED	R Brooks	11-12-73
CHECKED		
APPROV	Harris	11-14-73
RELEASE		

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF GCHU INC.
SAN DIEGO, CA. 92138

TITLE: INJECTOR ASSY, LN_2

SIZE B | CODE IDENT | 2639145

SCALE 2/1 | SHEET 1 OF 1

BLUE CARD

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2639145001
DESCRIPTION: INJ. ASSY, LN2, 9059
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
002	8000024120	TUBE, SST. .125"OD X.016"WALL		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2636342002
DESCRIPTION: 9064 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
003	1636324	PANEL		1
004	1636325	PANEL TOP		1
005	2636326	PANEL ASSY		1
006	1636327	PANEL LEFT		1
007	2636328	PANEL ASSY		1
008	2636331	BEZEL ASSY		1
009	2636341	INNERLINER		1
010	2636323002	PANEL, REAR		1
011	2636322002	PARTITION ASSY		1
012	1602967	PLATE, VENT		1
013	2400063	GASKET, RUBBER		1
014	1640309001	GUIDE TUBE, CHAMBER		1
015	2400126	RUBBER STRIP		
016	1635605101	DOOR KEEPER		2
018	1600091	SHIM, KEEPER		REF
019	3601091	PLUG		1
021	4100697	SPACER, 1/2"		8
022	1500419	FOOT, RUBBER, MTG.		4
025	1500511	PLUG, BUTCH, 1-3/8"		1
026	3600081	PLUG, BUTCH, 1/2"		2
027	2300011	THERM, 8", .162"DIA. -100 TO +600 DEG. F		1
028	1600136	THERMOMETER CUP 3900/6400		1
029	1600076	BUSHING, THERMOMETER		1
030	2602503	SWITCH, FAILSAFE		1
031	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS & DETENT		2
032	1400569	PIN, TERMINAL, FEMALE		14
033	1663872001	BLWR. MTR. ASSY, CW		2
036	2622524001	HTR. ASSY, 39/59/64/80		2
039	1663618001	AC AUX MODULE ASSY		1
040	1663049001	9010-TEMP. CONTROLLER		REF
041	1663594101	SCD RTD PROBE, CHAMBER		1
042	1663870101	COVER PLATE, CONN.		1
043	1664574010	CABLE ASSY, GPIB 30"		1
044	1664574060	CABLE ASSY, RS232 30"		1
045	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
046	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
047	4100003	BUSHING		1
051	1640100	FLEX DRIVE		1
052	3100623	SHAFT EXTENDER		1
054	1500255	STOPPER, RUBBER 1 1/4" HOLE		1
063	1643369	GASKET		1
064	1643368101	TUBE		1
065	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2636342002
DESCRIPTION: 9064 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
069	1648670101	SUPPORT BLOCK		2
073	1500735	NUT, SWITCH, PANEL		1
075	1500062	LUG, RING, YELLOW 12-10 AWG, #6 STUD		8
076	1500055	LUG, SPADE, #6 RED		1
077	1500028	GROMMET, RUBBER, 1/2"		6
078	1500047	LUG, RED, QUICK-DISC		2
091	1643368	GUIDE TUBE		1
095	1663925104	CAN ASSY BLW MTR CW		2
096	1600004102	COVER, BLOWER MOTOR		2
100	1500032	GROMMET, RUBBER		1
102	1500071	LUG, RING, BLUE, INSULA 16-14 AWG, #10 STUD		4
103	2000135	PLUG, 125 V, 15 A.		1
104	1500056	LUG, SOLDER, 1413-8		1
112	1500394	CABLE, PWR, 14/3		REF
113	1500077	STRAIN RELIEF, BLACK		1
116	1400008	CKT. BKR, 20A, 250V		1
130	1500734	RING, SCROLL INLET		2
131	2635606	SCROLL, BLOWER CHAMBERS		2
135	1663916005	COOLING KIT, CO2 HIGH 9064		1
136	1663917003	COOLING KIT, CO2 LOW 9039, 9064		1
137	1663918005	COOLING KIT, LN2 9064		1
138	1663919005	COOLING KIT, DUAL HI. 9064		1
139	1663920005	COOLING KIT, DUAL LOW 9064		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663916005
DESCRIPTION: COOLING KIT, CO2 HIGH
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
007	2618003005	INJECTOR ASSY, CO2 DUAL STEM, 900 PSI		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918005
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG		1
002	1663922001	VALVE ASSY, LN2, 24VAC		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919005
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
004	1643404	BRACKET, LN2 MTG		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
013	1400110	FILTER, CO2		1
014	1400192	SWITCH		1
019	2618003005	INJECTOR ASSY, CO2 DUAL STEM, 900 PSI		1
022	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1

DELTA DESIGN

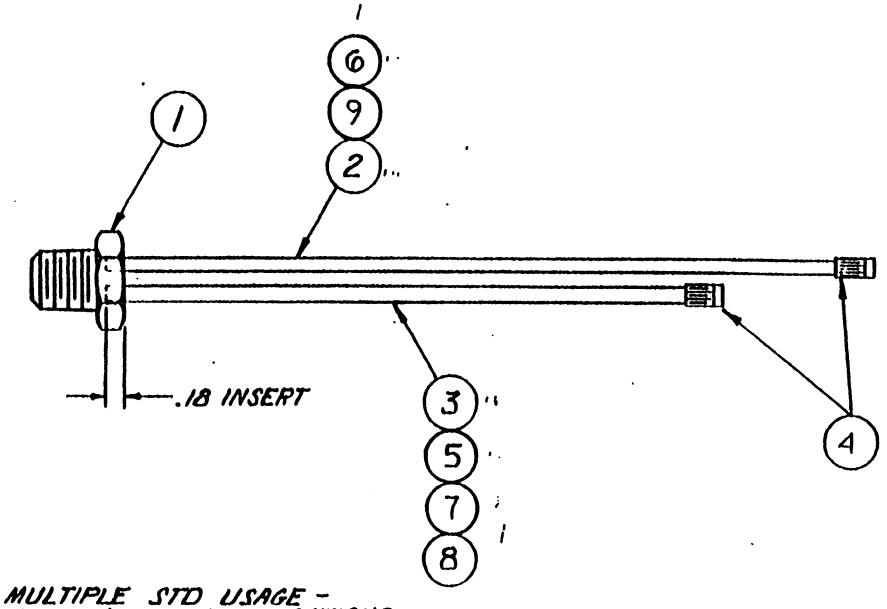
PARTS LIST BY ITEM
ASSEMBLY: 1663920005
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
004	1643404	BRACKET, LN2 MTG.		1
005	1663922001	VALVE ASSY, LN2, 24VAC		1
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		1
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		1
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		1
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		1
015	1400192	SWITCH		1
018	1647842108	INJECTOR ASSY, CO2 16.5", 300 PSI		1
027	3600092	CONN, MALE 3/8"OD TUBE-1/8"PIPE		1

BARI FILE CORP IRVINE CA HANDLER SPHERE

18003

REVISIONS				
ZONE	LTR	DESRIPTION	DATE	APPD
	A	REDRAWN FOR DWG CLARITY ECN M239 (KNAPP) 3-28-73	7-31-78	
	B	PER ECN M2327 THAMES 3-27-81 RE-RELEASE ADDED DASH & MODEL TABLE REVISED ADDED 5,6,7,8,9 ITEMS	4-9-81	



DASH	MODEL	DASH	MODEL	DASH	MODEL
-001	3900	-011			
-002		-012			
-003		-013			
-004		-014			
-005	6400				
-006					
-007	8000				
-008					
-009	8000				
-010					

4 MULTIPLE STD USAGE - SEE P/L FOR APPLICATIONS

3 REMOVE OBSTRUCTIONS FROM ID OF INJECTOR TUBES AFTER SOLDERING

4 FINISH (IF APPLICABLE)

4 MATL (IF APPLICABLE)

P/L "B SIZE"

DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ±.03 .XXX ±.010 ANGLES ±30'

MISC TOLERANCES

MATERIAL 4

FINISH 4

ENGINEERING ACTIVITY M2327 L-3	
DESIGN	
DRAFTED	KNAPP 5-28-73
CHECKED	MILLER 4.6.73
APPROV	Hansen 4-6-73
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONU INC.
8950 KEARNY VILLA RD SAN DIEGO, CA. 92123 • TEL (714) 292-5000

TITLE: INJECTOR ASSY, CO_2 DUAL STEM

SIZE	CODE IDENT	
B		2618003

SCALE ~ SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

7-46

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2618003005
DESCRIPTION: INJECTOR ASSY, CO2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
004	4100039	TIP, INJECTOR, CO2 .020 ORIFICE		2
005	1618011108	TUBE, CO2, INJ.		1
006	1618011109	TUBE, CO2, INJ.		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1655700002
DESCRIPTION: 9076 CHAMBER
REF/DES:

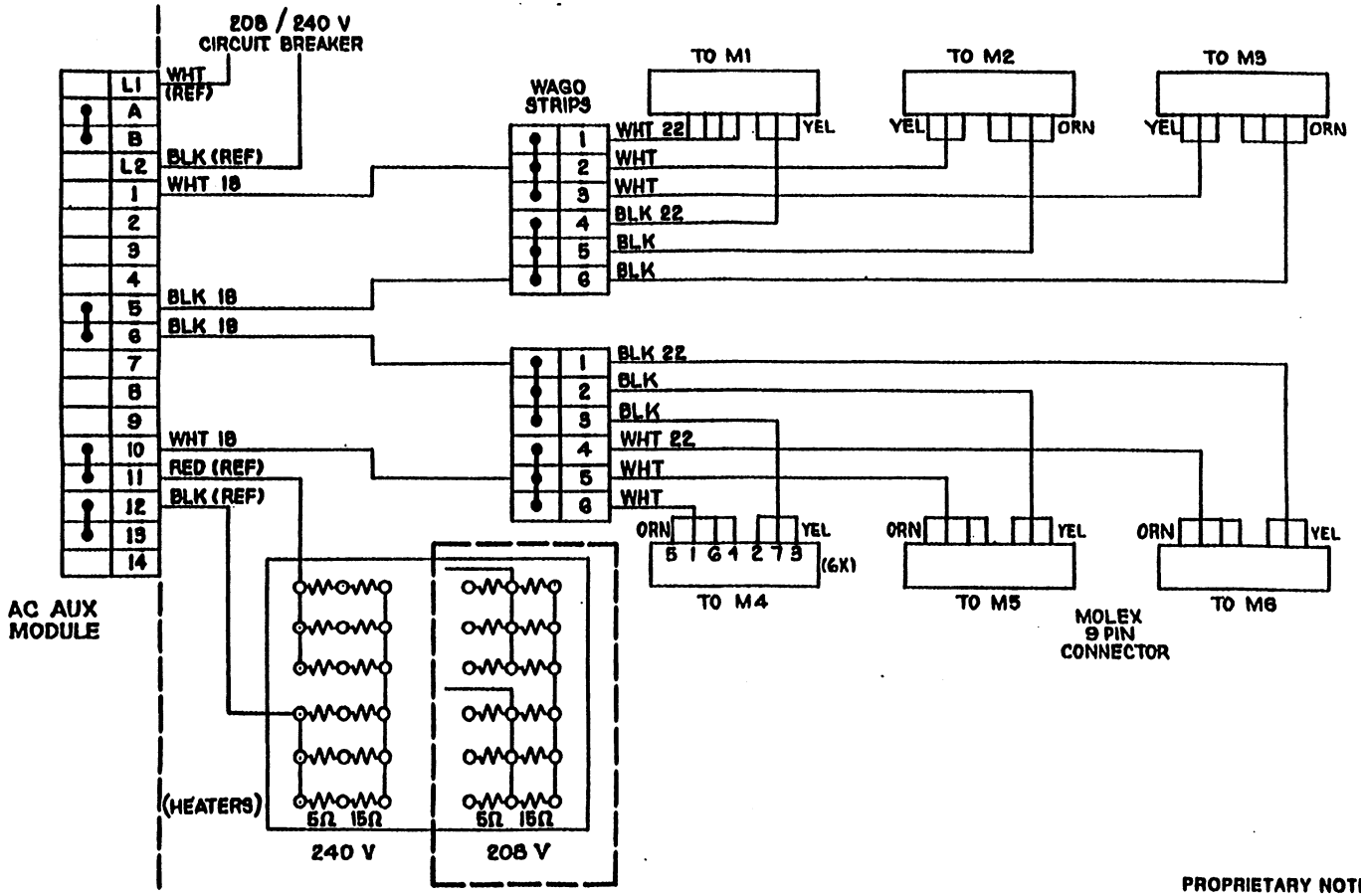
ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
006	1655682101	HINGE HALF		2
007	1652411101	PLATE, BLOWER TRIM		2
008	1655662001	INNERLINER ASSY		1
009	1663049001	9010-TEMP. CONTROLLER		REF
010	1655670002	CHASSIS ASSY ELECT		1
011	1655681101	HINGE PIN		1
012	1655681102	HINGE PIN		1
013	1663870101	COVER PLATE, CONN.		1
014	1655683002	PANEL, FRONT		1
016	1655684102	PANEL, REAR		1
019	1655687101	PANEL, TOP		1
020	1655688001	PANEL, BOTTOM		1
022	1655690101	CO2 COVER		1
023	1655692102	COVER FAILSAFE		1
025	1655693101	COVER		1
026	1655694101	BAFFLER		1
027	1655695101	BAFFLER		1
028	1655696101	DIAPHRAM, VENT.		1
029	1655685102	PANEL, RIGHT		1
030	1655686102	PANEL, LEFT		1
031	1635605101	DOOR KEEPER		1
032	1655689102	FRAME FRONT PANEL		1
033	1663618001	AC AUX MODULE ASSY		1
034	1664574010	CABLE ASSY, GPIB 30"		1
035	1664574060	CABLE ASSY, RS232 30"		1
036	1664861001	CABLE ASSY-AUX MOD TO TEMP CONTROL		1
037	2100769	FAN VANEAXIAL 24 VAC 50/60HZ 29/35CFM 2750/3250RPM		1
038	2100770	FINGER GUARD, 3 INCH SQUARE FAN		1
039	1652411102	COVER BLOWER		2
040	2000465	CONN HOUSING RECEPT 9 CKT W/MTG EARS & DETENT		6
041	1400569	PIN, TERMINAL, FEMALE		42
049	1400008	CKT. BKR, 20A, 250V		1
053	1500419	FOOT, RUBBER, MTG.		6
054	1500077	STRAIN RELIEF, BLACK		1
059	1500032	GROMMET, RUBBER		2
060	1500434	LABEL, ID, "FAIL-SAFE"		1
061	3100623	SHAFT EXTENDER		1
063	1700094	WASHER, FLAT		6
064	1700362	SCR, SET, CUP		2
065	2000136	PLUG, 250 V, 20 A		1
066	1500026	GROMMET, RUBBER, 3/8"		6
073	1663594101	SCD RTD PROBE, CHAMBER		1
076	1500256	PLUG, 1"		2
077	3600081	PLUG, BUTCH, 1/2"		1
078	3600080	PLUG, BUTCH, 3/4"		3
079	4100697	SPACER, 1/2"		16

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1655700002
DESCRIPTION: 9076 CHAMBER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
085	1663916001	COOLING KIT, CO2 HIGH 9023, 9076		1
086	1663917001	COOLING KIT, CO2 LOW 9023, 9059, 9076		1
087	1663918006	COOLING KIT, LN2 9076		1
088	1663919006	COOLING KIT, DUAL HI 9076		1
089	1663920006	COOLING KIT, DUAL LOW 9076		1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	INITIAL RELEASE	7-27-87	WCB
	B	DWG NO. WAS: 1666005; IS: 1666005	9-8-87	WCB



DASH	QTY	NEXT ASSY	USED ON
		MANUAL	

APPLICATION | SERIAL NO. | DATE EFF | DWG REV | EFFECTIVITY

MATERIAL | FINISH

ENGINEERING ACTIVITY

DESIGN	
DRAFTED	E. SAMSON 6/87
CHECKED	ACRocker 7/87
APPROV	WCB 7/27/87
RELEASE	Christine Flores

DO NOT SCALE DWG

Delta Design
5775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

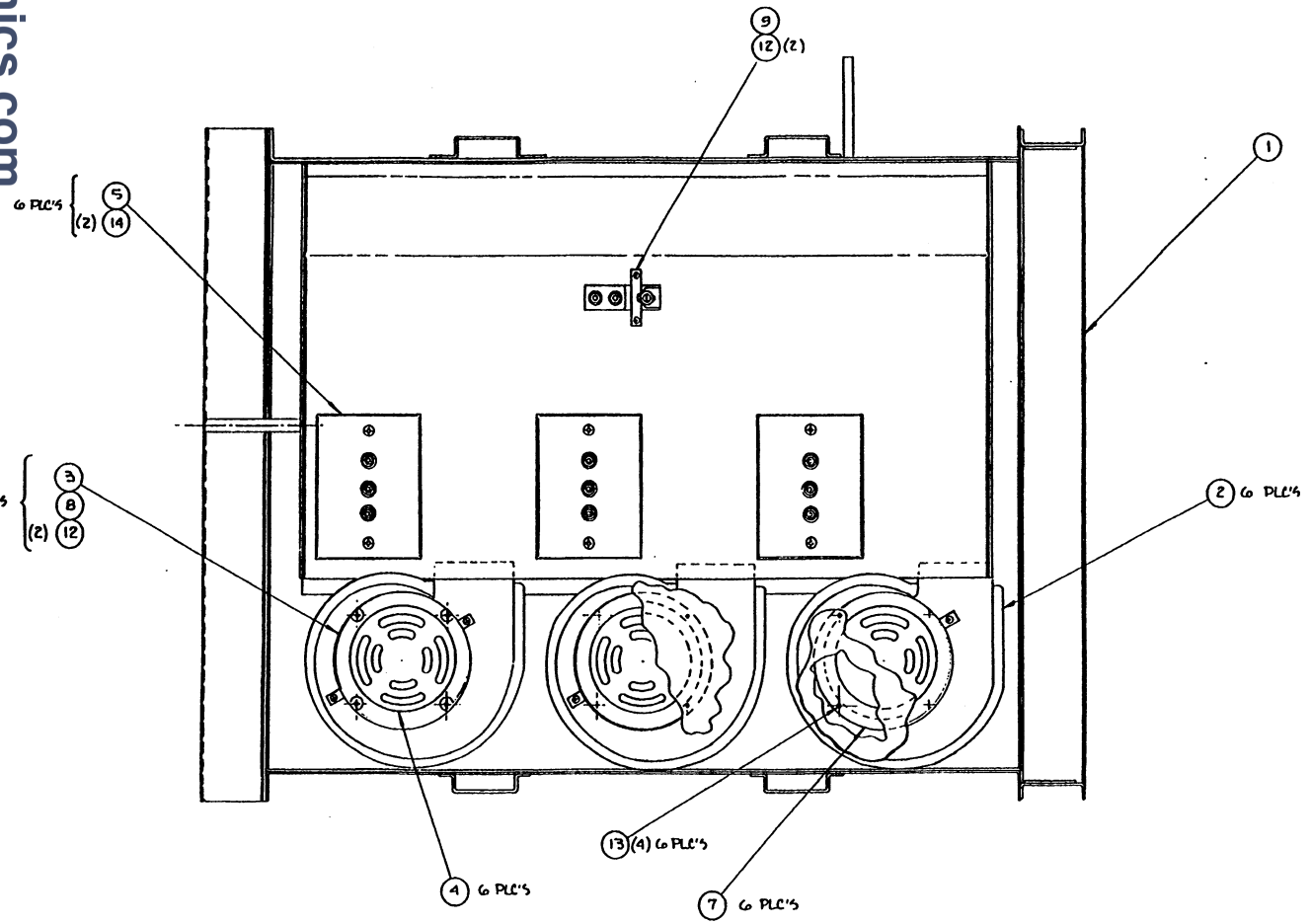
TITLE: 9076 WIRING

SIZE	CODE IDENT		REV
C		1666005	B

SCALE —/— SHEET 1 OF 1

7-50

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD



FRONT OF CHAMBER →

SEE SEPARATE "A" SIZE PARTS LIST, P/L 16556062

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
001	1	16555100	7050

APPLICATION

SERIAL NO. | DATE OFF | DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS .XX ± .03, .XXX ± .010. ANGLES ± 0°30'. HOLE TOLERANCES .XX ±.005 .XXX ±.003 .XX ±.005 .XXX ±.003

MATERIAL ⚠

FINISH ⚠

ENGINEERING ACTIVITY		
ERN 4157	L-3	
DESIGN		
DRAFTED	N.EXANDER	
CHECKED		
APPROV		
RELEASE		

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONTROL DATA CORP.
SAN DIEGO, CA. 92123

TITLE: INNERLINER ASSY, MODEL 7650

SIZE	CODE IDENT	
D		16556062

SCALE 1/2

DEV N/C

SHEET ___ OF ___

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1655662001
DESCRIPTION: INNERLINER ASSY
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1655660001	WELDMENT, INNERLINER		1
002	2635606	SCROLL, BLOWER CHAMBERS		6
003	1663925105	CAN ASSY BLW MTR CW		6
004	1663872001	BLWR. MTR. ASSY, CW		6
005	2622527	HTR. ASSY, 9076		6
007	1500734	RING, SCROLL INLET		6
008	1500026	GROMMET, RUBBER, 3/8"		6
009	1400160	THERMOSWITCH 30002-13		1
010	2400003	SEALANT, RED RTV-106, 6 OZ.		

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663918006
DESCRIPTION: COOLING KIT, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1643404	BRACKET, LN2 MTG.		2
002	1663922001	VALVE ASSY, LN2, 24VAC		2
006	2619067001	INJ. ASSY, LN2		2
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		2
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		2
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		2
013	1400110	FILTER, CO2		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663919006
DESCRIPTION: COOLING KIT, DUAL HI.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
003	2618004001	INJECTOR ASSY CO2 HIGH PRESSURE SINGLE STEM		1
004	1643404	BRACKET, LN2 MTG		2
005	1663922001	VALVE ASSY, LN2, 24VAC		2
006	2619067001	INJ. ASSY, LN2		2
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		2
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		2
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		2
013	1400110	FILTER, CO2		2
014	1400192	SWITCH		1

DELTA DESIGN

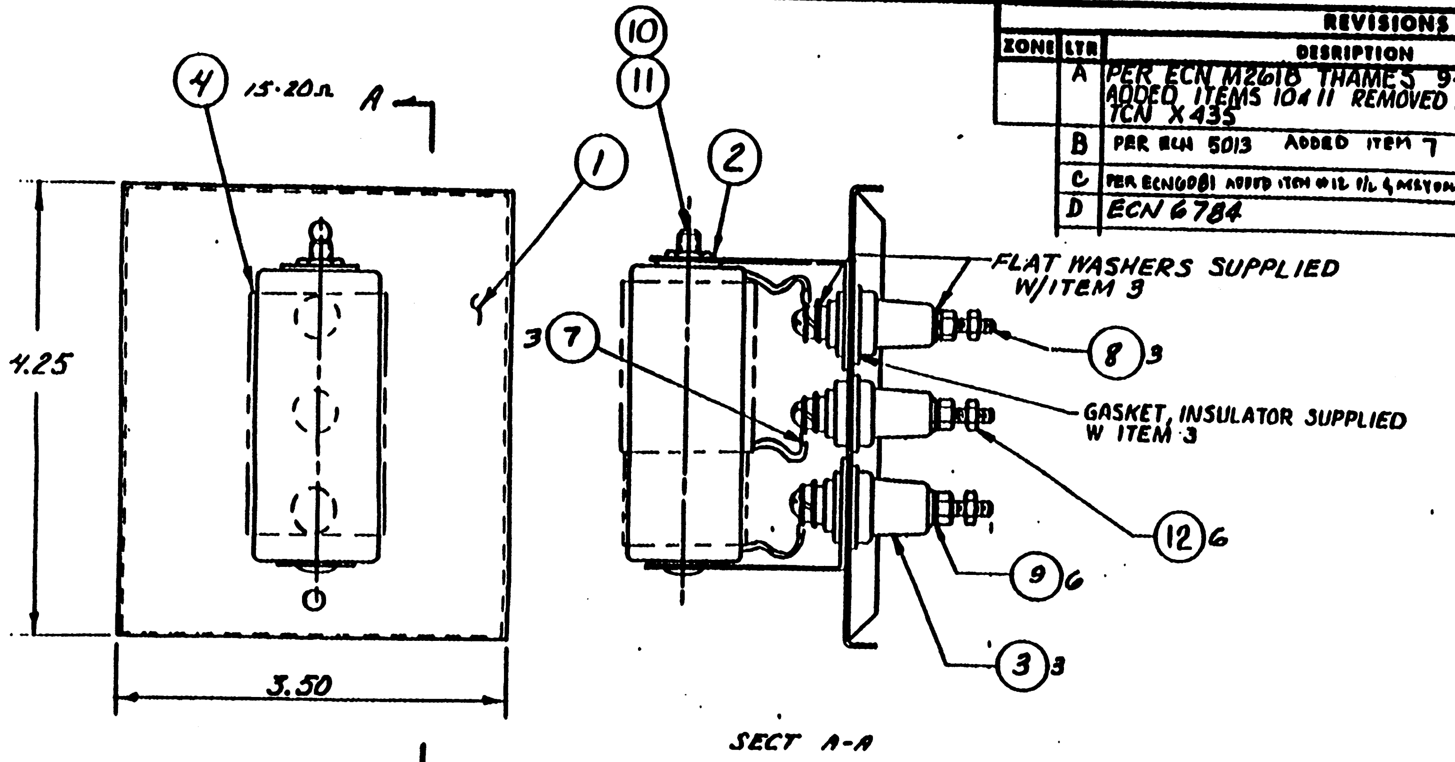
PARTS LIST BY ITEM
ASSEMBLY: 1663920006
DESCRIPTION: COOLING KIT, DUAL LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
003	1647842107	TUBE, CO2 INJ, 11" 300 PSI		1
004	1643404	BRACKET, LN2 MTG.		2
005	1663922001	VALVE ASSY, LN2, 24VAC		2
006	2619067001	INJ. ASSY, LN2		2
007	1606104	TAG, DUAL, LN2/CO2		1
008	4200009	COVER, VALVE, LN2 PER DWG# 1643455		2
009	4200010	BASE, LN2 DRIP PER DELTA #1643456		2
010	3600104	CONNECTOR, MALE 1/8"PIPE, 1/4"TUBE		2
011	3600197	CONNECTOR, MALE		1
014	1400110	FILTER, CO2		2
015	1400192	SWITCH		1

2622527

REVISIONS

ZONE	LTR	DESRIPTION	DATE	APPD
	A	PER ECN M2618 THAMES 9-28-81 ADDED ITEMS 10 & 11 REMOVED ITEM 5 & TCN X435	10-8-81	[illegible]
	B	PER ECN 5013 ADDED ITEM 7	2-2-84	[illegible]
	C	PER ECN6081 ADDED ITEM #12 [illegible]	10-24	[illegible]
	D	ECN 6784	7/15/85	WCD



△ DISCARD PAPER WASHERS SUPPLIED W/ ITEM 3

3 ALL DIM REF ONLY

△ FINISH (IF APPLICABLE)

△ MATL (IF APPLICABLE)

UNLESS OTHERWISE SPECIFIED

.001	2600934	[illegible]	2076-0.28-[illegible]	[illegible]	—
DASH	QTY NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION			EFFECTIVITY		

MATERIAL △ · FINISH △

ENGINEERING ACTIVITY L-3

DESIGN	
DRAFTED	KNAPP 1-3-2[illegible]
CHECKED	
APPROV	[illegible] 10-10-[illegible]
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.

TITLE: HEATER ASSY

SIZE B · DWG 2622527 · REV D

SCALE FULL · SHEET 1 OF 1

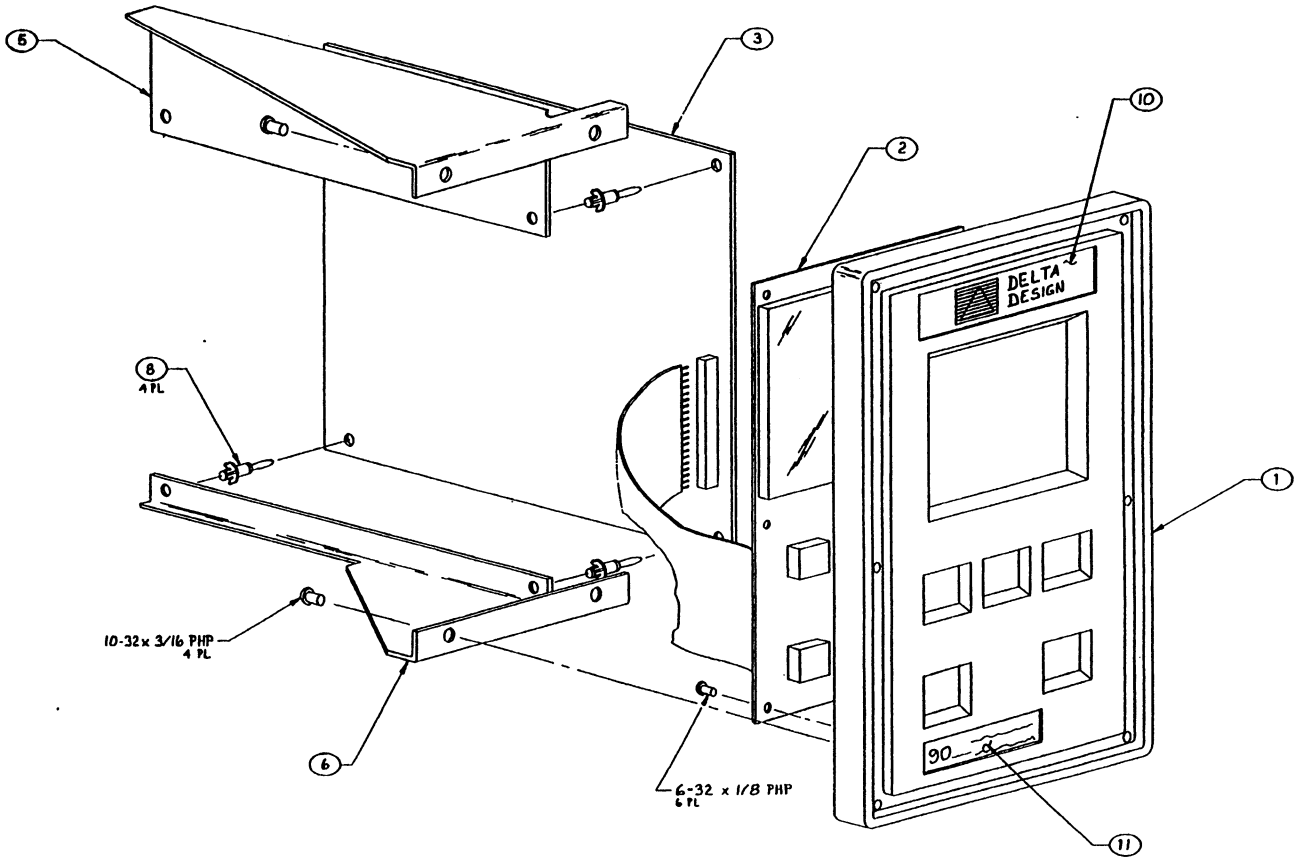
BLUE CARD

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2622527
DESCRIPTION: HTR. ASSY, 9076
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1635873	PLATE, HEATER, 5252-7		1
002	1635868	STANDOFF, HEATER		2
003	1500327	INSULATOR		3
004	2200017	HEATER, 20.0 OHM W/TAP AT 15.0 OHM		1
010	1655875101	SCREW, MODIFIED		1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ERN 7363	11/11/86	WCB



⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .05 .XXX ± .010
ANGLES ± 30'
HOLE TOLERANCES

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY: ERN 7363

DESIGN	
DRAFTED	T.SHEPARD 9-11-86
CHECKED	
APPROV	WCB 11/11/86
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF GCA INC.
SAN DIEGO, CA. 92123

TITLE: TEMPERATURE CONTROLLER ASSY

SIZE	CODE IDENT		REV
D		1663049	B

SCALE 1/1

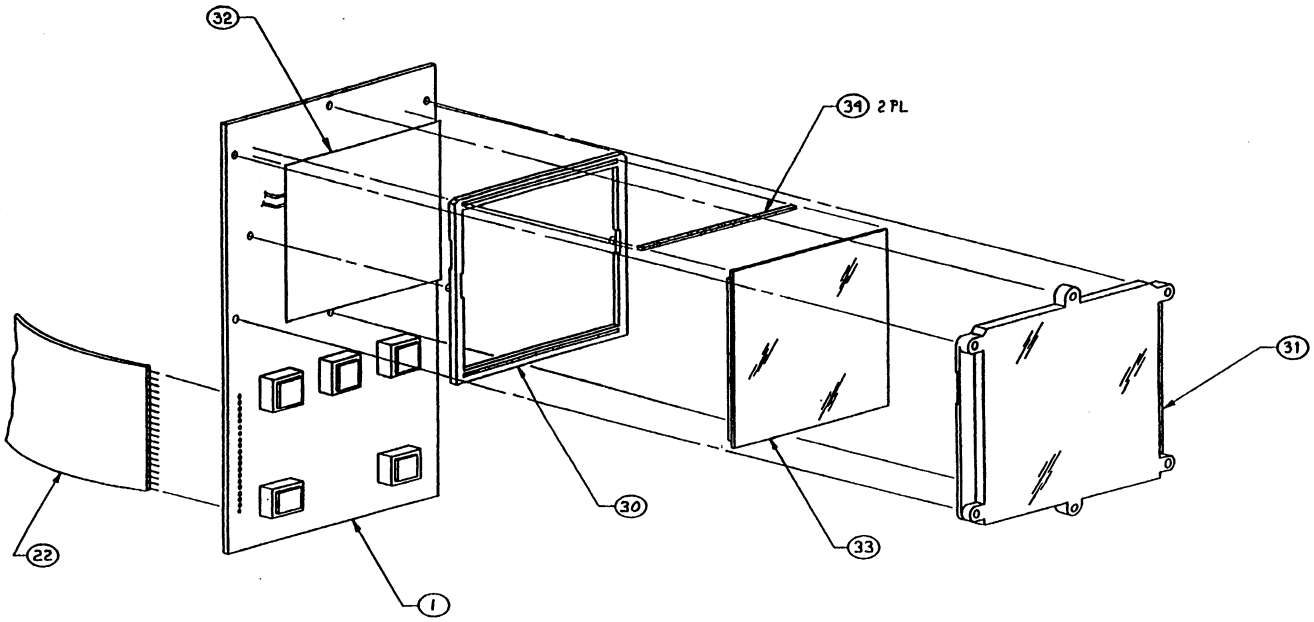
SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663049001
DESCRIPTION: 9010-TEMP. CONTROLLER
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1662651001	BEZEL, PAINTED FRNT. PNL, 9010, 9020		1
002	1661866501	PWA, FRNT. PNL, 9010		1
003	1661250501	PWA, TEMP CONT, 1-CHNL		1
005	1661724101	BRKT, MTG, UPPER		1
006	1661723101	BRKT, MTG, LOWER		1
008	1501865	SUPPORT PCB NYLON LOCK-3/8 SPACE		4
010	1662698101	LABEL "DELTA LOGO"		1
011	1662684101	LABEL, LOGO-9010		1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ERN 7363	12/12/86	WEB
	B	ECN 7397 T.S. 4-15-87	4/15/87	WEB
	C	ECN 7447	9.1.87	WEB



⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON DECIMALS .XX ± .03, .XXX ± .010; ANGLES ± 0°30'; HOLE TOLERANCES

MATERIAL ⚠1

FINISH ⚠2

ENGINEERING ACTIVITY	
	ERN 7363
DESIGN	
DRAFTED	T. SHEPARD 12-22-86
CHECKED	
APPROV	12/22/86
RELEASE	4/7/89
DO NOT SCALE DWG	

Delta Design, A Cohu Company
6778 KEARNY VILLA RD. SAN DIEGO, CA 92123-1111

TITLE: PWA – FRONT PANEL

SIZE	CODE IDENT	REV
D		C

16618666

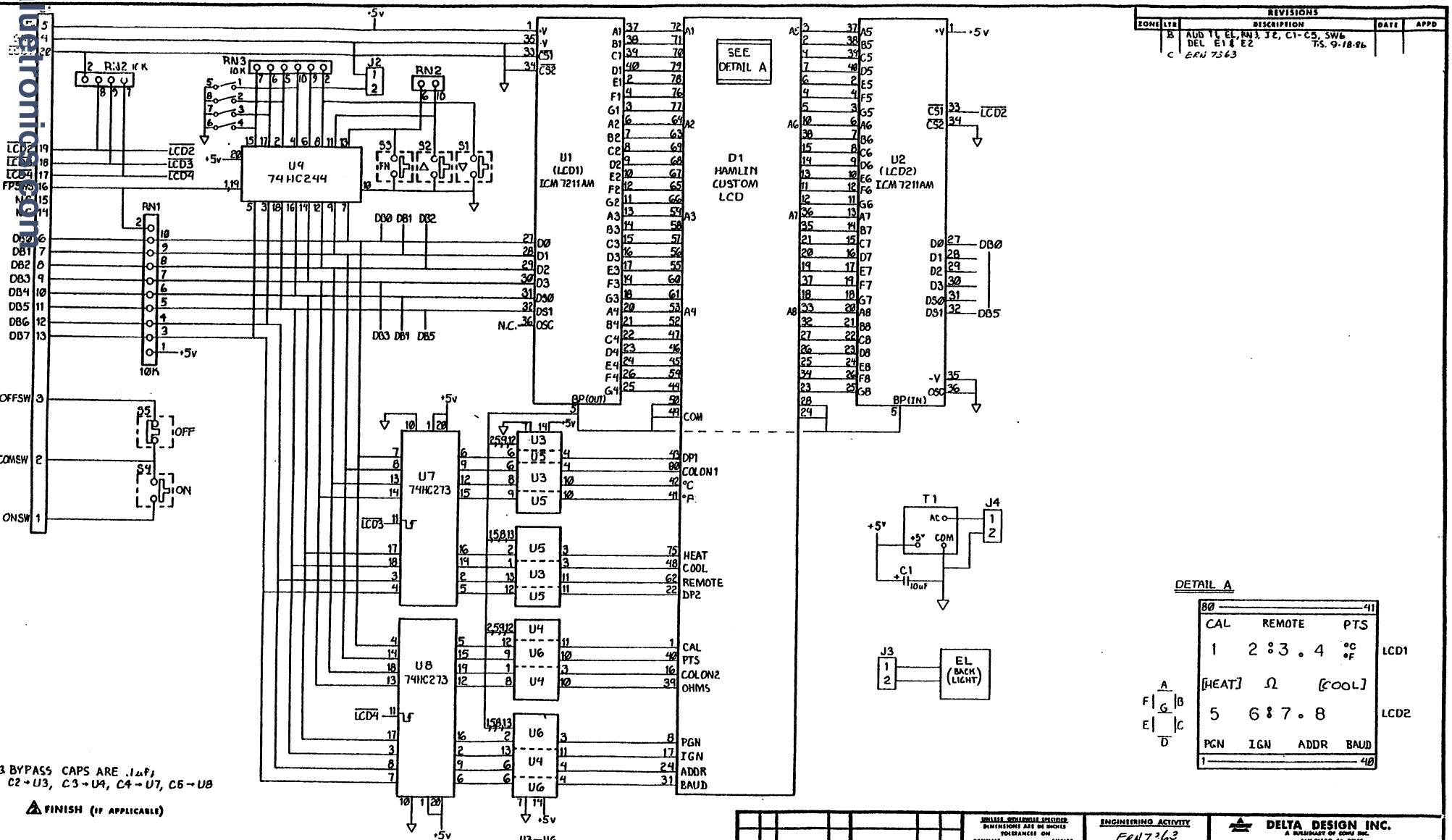
SCALE 1/1

SHEET 1 OF 1

DELTA DESIGN....
<PROCS BMPP206>

SINGLE LEVEL PARTS LIST (BY ITEM) FOR:
1661866-501 <RUN 20> REV: E
PWA.FRNT.PNL.9010

ITEM	PART NO.	DESCRIPTION	REF/DES	F/C	QTY
001	1661865-401	PWB FRONT PANEL 9010.9020		71	1
003	1661863-000	SCHEMATIC-FRONT PNL		41	REF
005	1000581	TEMP CONTR IC 4 DIGIT DISPLAY DECODER DRIVER ICM7211AMIPL	U1.U2	70	2
006	1000580	IC EXCEL/GATE 4070	U3-U6	70	4
007	1000579	IC D-TYPE FLIP-FLOP	U7.U8	70	2
008	1000538	74HC273 IC	U9	70	1
012	0700000	CAP 10MFD 25VDC TANTALUM	C1	70	1
013	0800022	CAP CERAMIC .1MFD 50V 20% RADIAL LEAD	C2-C5	70	4
017	0400100	RES NTWK SIP 10K	RN1-RN3	70	3
020	1401298	SWITCH PB SPDT PCB MTG	SW1-SW5	70	5
021	1401188	SWITCH DIP SPST PCB 4 POS	SW6	70	1
022	1500373	CABLE ASSY FLAT FLEX .100CTR 20 POS JUMPR	J1	70	1
023	2000398	CONN .100 HDR STR 2P	J2-J4	91	3
025	1401320	INVERTER DC-AC 3 TO 6.25VDC,120MA INPUT		70	1
028	1666279-001	CABLE ASSY-BACKLIGHT		62	1
030	1661705-101	RETAINER,LCD CONN.		75	1
031	1661706-101	BEZEL,LCD		75	1
032	1663519-101	BACKLIGHT,LCD		75	1
033	1663520-101	DISPLAY LCD 9010 CONTROLLER		75	1
034	2000434	CONNECTOR LCD(ZEBRA)		70	2



3 BYPASS CAPS ARE .1uF; C2→U3, C3→U4, C4→U7, C5→U8

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

ENGINEERING ACTIVITY	ERN7363
DESIGN	ART HICKOW
DRAFTED	OL. RUESTENS 3/4
CHECKED	
APPROV	10/1/86
RELEASE	
DO NOT SCALE DWG	

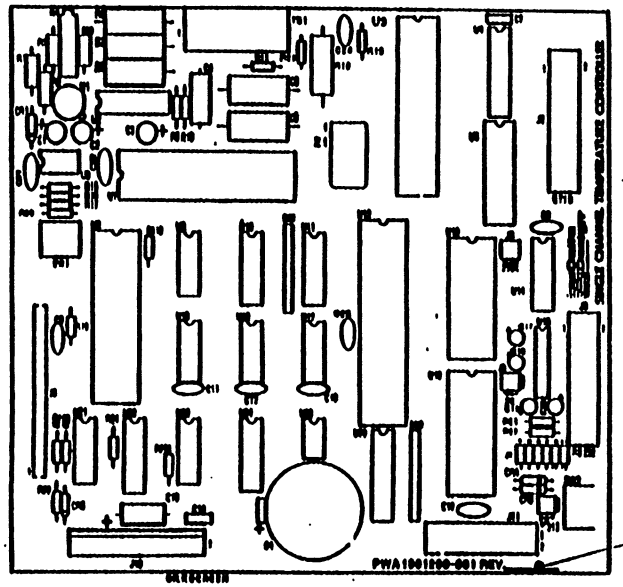
DELTA DESIGN INC.
A SUBSIDIARY OF CONIC INC.
SAN DIEGO, CA. 92123

TITLE: SCHEMATIC — FRONT PANEL TC1

SIZE	CODE IDENT		REV
D		1661863	C

SCALE NONE 7-62 SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION		APPD
	A	REVISED · ADDED Z1 RZ9	T.S. 7-1-86	
	B	ERN 7363		
	C	ECN 7392	T.S 4-6-87	



1

								UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES ± 1°	ENGINEERING ACTIVITY ERN 7363	DELTA DESIGN INC. A SUBSIDIARY OF CONTROL INC. SAN DIEGO, CA. 92123
									DESIGN	TITLE: PWA — SINGLE CHANNEL TEMPERATURE CONTROLLER
									DRAFTED T. SHEPPARD 7-1-86	
									CHECKED	
501	1		PWA1						APPROV [illegible] 7/15/86	SIZE C / ZONE IDENT / 1661250 / REV
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE CTD	DWG REV	MATERIAL 1		RELEASE [illegible] 7/17/87	
APPLICATION				EFFECTIVITY			FINISH 2		DO NOT SCALE DWG	SCALE 1/1 / SHEET 1 OF 1

1 _____ MARK CURRENT REV LEVEL OF ASSY DWG USING BLACK INDELIBLE INK, WHERE SHOWN.

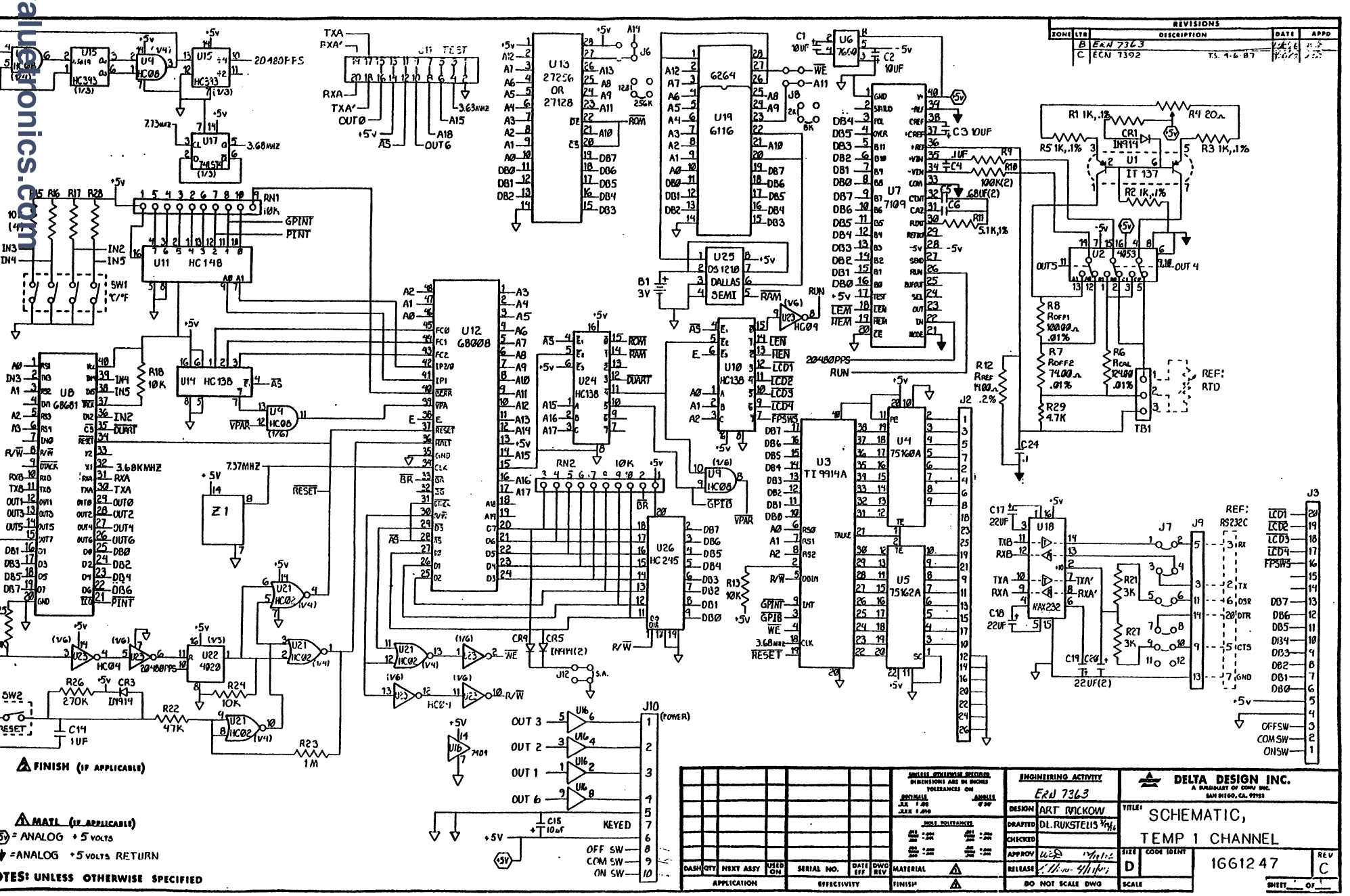
NOTES: UNLESS OTHERWISE SPECIFIED

DELTA DESIGN

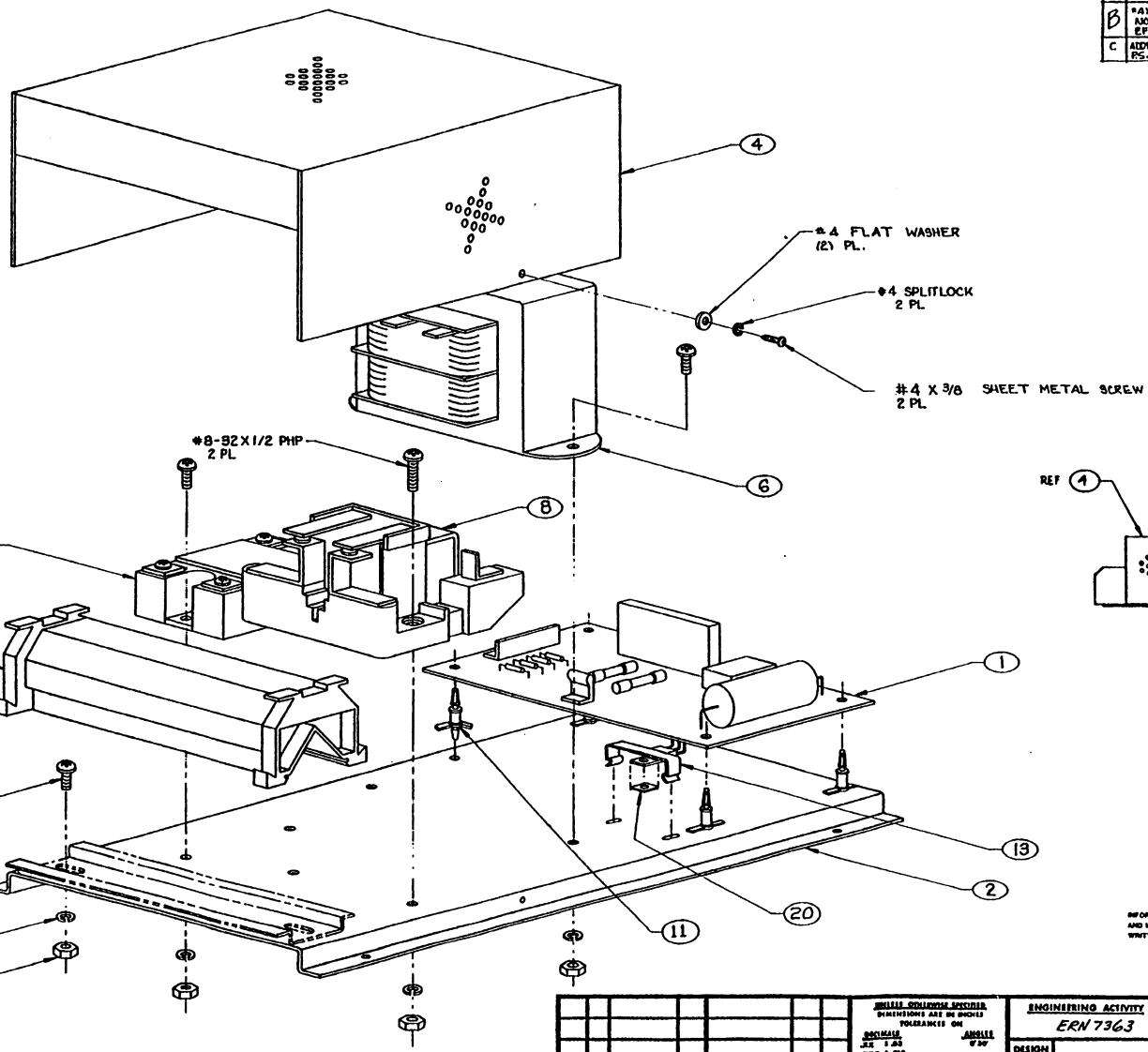
PARTS LIST BY ITEM
ASSEMBLY: 1661250501
DESCRIPTION: PWA, TEMP. CONT, 1-CHNL
REF/DES:

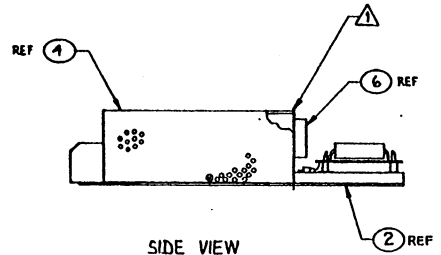
ITEM	PART NO.	DESCRIPTION	REF/DES	QT
001	1661249401	PWB, TEMP CONT 1-CH		1
003	1661247000	SCHEMATIC SGL CHAN TEMP CONTR		REF
005	1206537	XSTR DUAL PNP IT137	U1	1
006	1000577	IC TRIPLE 2-CH ANA MULTIPLEXER/DEMULTI-PLEXER 4053	U2	1
007	1000549	IC GPIB CONTR TMS9914A	U3	1
008	1000547	IC GPIB DRIVER SN75160A	U4	1
009	1000546	ICC GPIB DRVR SN7516 GPIB DRVRX	U5	1
010	1000514	IC ICL7660 CPA	U6	1
011	1000566	IC A/D CONV 12-BIT ICL7109CPL	U7	1
012	1000521	IC 68681	U8	1
013	1000539	IC DECODER 3 LINE TO 8 LINE 74HC138	U10, U14, U24	3
014	1000537	IC ENCODER 8 TO 3 LINE PRIORITY 74HC148	U11	1
015	1000525	IC 68008	U12	1
016	1664605001	IC, PROGRAMMED	U13	
017	1000563	IC DUAL SYNCH BIN COUNTER 74HC393	U15	
018	1000165	IC, SN7407	U16	1
019	1000179	IC SN74LS74A	U17	1
020	1000576	IC +5V DUAL RS-232 XMTR/RCVR MAX 232CPE	U18	1
021	1000565	IC SRAM 150NS UPD4464C-15L	U19	1
022	1000523	IC 74HC02	U21	1
023	1000527	IC CD4020	U22	1
024	1000564	IC HEX INV 74HC04	U23	1
025	1000578	IC NONVOLATILE CON-TROLLER DS1210	U25	1
026	1000562	IC OCTAL BUS XCVR NON INV 74HC245	U26	1
027	1000561	IC AND GATE QUAD 2 INPUT 74HC08	U9	1
030	0701000026	CAP TANTALUM 10MFD 25V	C1, C2, C3	3
031	0800033	CAP METAL POLYPROP .10MF 100V	C4	1
032	0800035	CAP METAL POLYPROP .68MFD 100V	C5, C6	2
033	0800022	CAP CERAMIC .1MFD 50V 20% RADIAL LEAD	C7, C8, C11-13, C16,	10
034	0800032	CAP CERAMIC 1 MFD 100V	C14	
035	0700000	CAP 10MFD 25VDC TANTALUM	C15	1

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
036	0800024	CAP, 22UF, TANT	C17-C20	4
037	0800051	CAP CERAMIC .01MFD 50V 20% RADIAL	C9	1
040	1421100114	RES METAL FILM 1.0 K 1/4W 0.1%	R1-R3, R5	4
041	0500066102	POT, 20 OHM	R4	1
042	0400127	RES PREC WIREWOUND 124 OHM 1/2W .01%	R6	1
043	0400126	RES PREC WIREWOUND 74 OHM 1/2W .01%	R7	1
044	0400125	RES PREC WIREWOUND 100 OHM 1/2W .01%	R8	1
045	0310034500	RES, 100K, 1/4W, 5%	R9, R10	2
046	1421499114	RES METAL FILM 4.99K 1/4W 1%	R11	1
047	0400124	RES PREC WIREWOUND 14 OHMS 1/2W .01%	R12	1
048	0301034500	RES 10K 1/4W 5%	R13, R15-R19, R24, R25,	9
049	1410370184	RES FIXED FILM 3K 1/4W 5%	R21, R27	2
050	1410370212	RES FIXED FILM 47K 1/4W 5%	R22	1
051	1410370244	RES, FIXED FILM 1MEG 1/4W 5%	R23	1
052	1410370230	RES FIXED FILM 270K 1/4W 5%	R26	1
053	0304724500	RES, 4.7K, 1/4W, 5%	R29	1
054	0400100	RES NTWK SIP 10K	RN1, RN2	2
058	1100914	DIODE 1N914	CR1, CR3, CR4, CR5	4
060	1401305	OSC XTAL TTL CLOCK 7.3728 MHZ	Z1	1
063	1401188	SWITCH DIP SPST PCB 4 POS	SW1	1
064	1401295	SWITCH PB PCB	SW2	1
068	1401300	BATTERY LITHIUM 3V	B1	1
072	2000338	CONN, PWB, MALE HEADER	J2, J9	2
073	2000428	CONN RCPT SIP STRIP 20 PIN PCB MTG C10SP	J3	1
074	2000427	CONN HDR STR 156 SP PCB MTG 10 POS 045SQ	J10	1
075	2000348	CONNECTOR, MLE 20 PIN	J11	1
076	2000403	CONN HDR STPLN STR DBL 100	J12	2
077	1400397	TERMINAL BLOCK 3POS PCB MTG SINGLE POST .375 SPACING	TB1	1
080	2500089104	SOCKET, DIP, 16 PIN	XU22	1
081	2500089106	SOCKET, DIP, 20 PIN	XU26	1
082	2500089109	SOCKET, DIP, 28 PIN	XU13	1



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED ERN 7363 T.S. 12-3-86	12/11/86	WLS
	B	#4X3/8 SMS WAS #4-40 X 1/4 PHP. DELETED NOTE 1, ADDED #4 FLAT WASHER. EFFECTIVE NEXT RUN. P.SWOGREN 1-13-87	1/14/87	P/S
	C	ADDED NOTE 2 & ITEM 20. EFF NEXT RUN PS. 10-23-87	10/31/87	P/S





SIDE VIEW
(TO CLARIFY THE POSITIONING OF ITEM 4 & #2 SCREWS)

⚠ FINISH (IF APPLICABLE)

⚠ ~~MATE (IF APPLICABLE)~~ APPLY THERMAL COMPOUND TO ITEM 9

⚠ FLUSH END OF ITEM #4 TO THE END OF ITEM #6 AS SHOWN.

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
001	1		
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0° 30'
HOLE TOLERANCES

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY	
	ERN 7363
DESIGN	
DRAFTED	E. SAMSON
CHECKED	
APPROV	WLS 11/11/86
RELEASE	12/1/86
DO NOT SCALE DWG	

Delta Design, A Cohu Company
6778 NANCY RIDGE RD. SAN DIEGO, CA 92121-1111

TITLE: AC AUX MODULE ASSY

SIZE	CODE IDENT		REV
D		1663618	C

SCALE 1/1

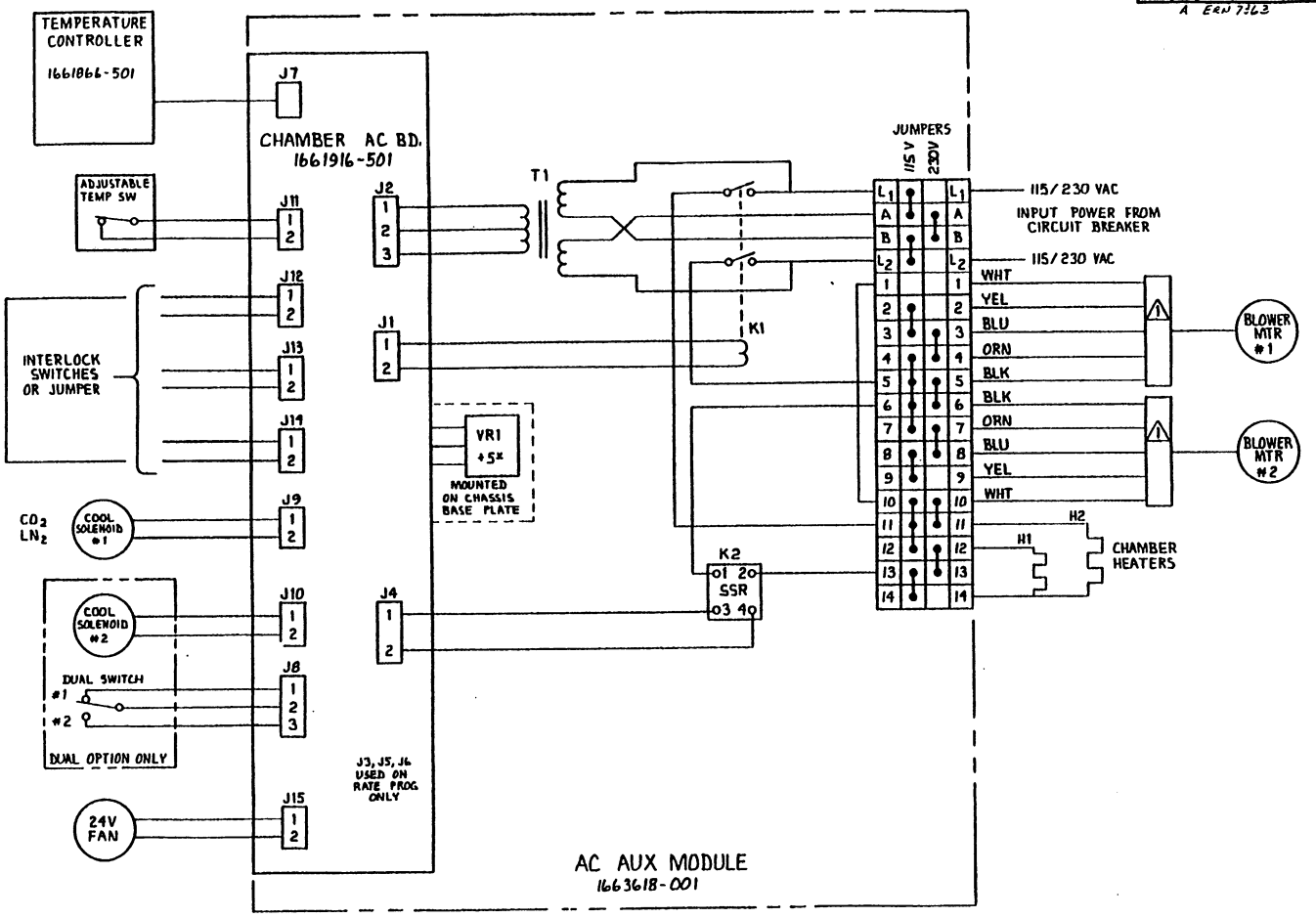
SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663618001
DESCRIPTION: AC AUX MODULE ASSY
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1661916501	PWA, AUX. MODULE		1
002	1662214101	CHASSIS, AC AUX. MOD.		1
003	1663783000	WIRING DIAGRAM-AC AUX MODULE		REF
004	1663607101	COVER, PERFORATED AUX. MODULE		1
006	1663612101	TRANSFORMER POWER 24V 4A	T1	1
008	1400384	RELAY POWER DPST-NO 24VAC 10A	K1	1
009	1400194	RELAY, SOLID STATE 25 AMP, 48-280 VOLT	K2	1
011	1501865	SUPPORT PCB NYLON LOCK-3/8 SPACE		4
013	1400316	CLIP SPRING IC MTG		1
015	1663765001	TERM BLK ASSY, AC AUX		1
019	1500061	LUG, RING, YELLOW 10-12 AWG WIRE, #10		6
020	2400135	PAD THERMAL INSUL TO-220		1
021	1500071	LUG, RING, BLUE, INSULA 16-14 AWG, #10 STUD		2
022	1500055	LUG, SPADE, #6 RED		2
023	2000405	CONN PLG 2P 22G .100	P1, P4	2
024	2000435	CONNECTOR RECT LOCKING 3 PIN 18 AWG 156SP 045 SQ	P2	1
025	1663613001	JUMPER ASSY, INTERLOC		1
026	1663614001	JUMPER ASSY DUAL SW		1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ERN 7363	11-17-86	WJB



⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

BLOWER MOTOR DIRECTION OF ROTATION PROGRAMMED AT THESE CONNECTORS.

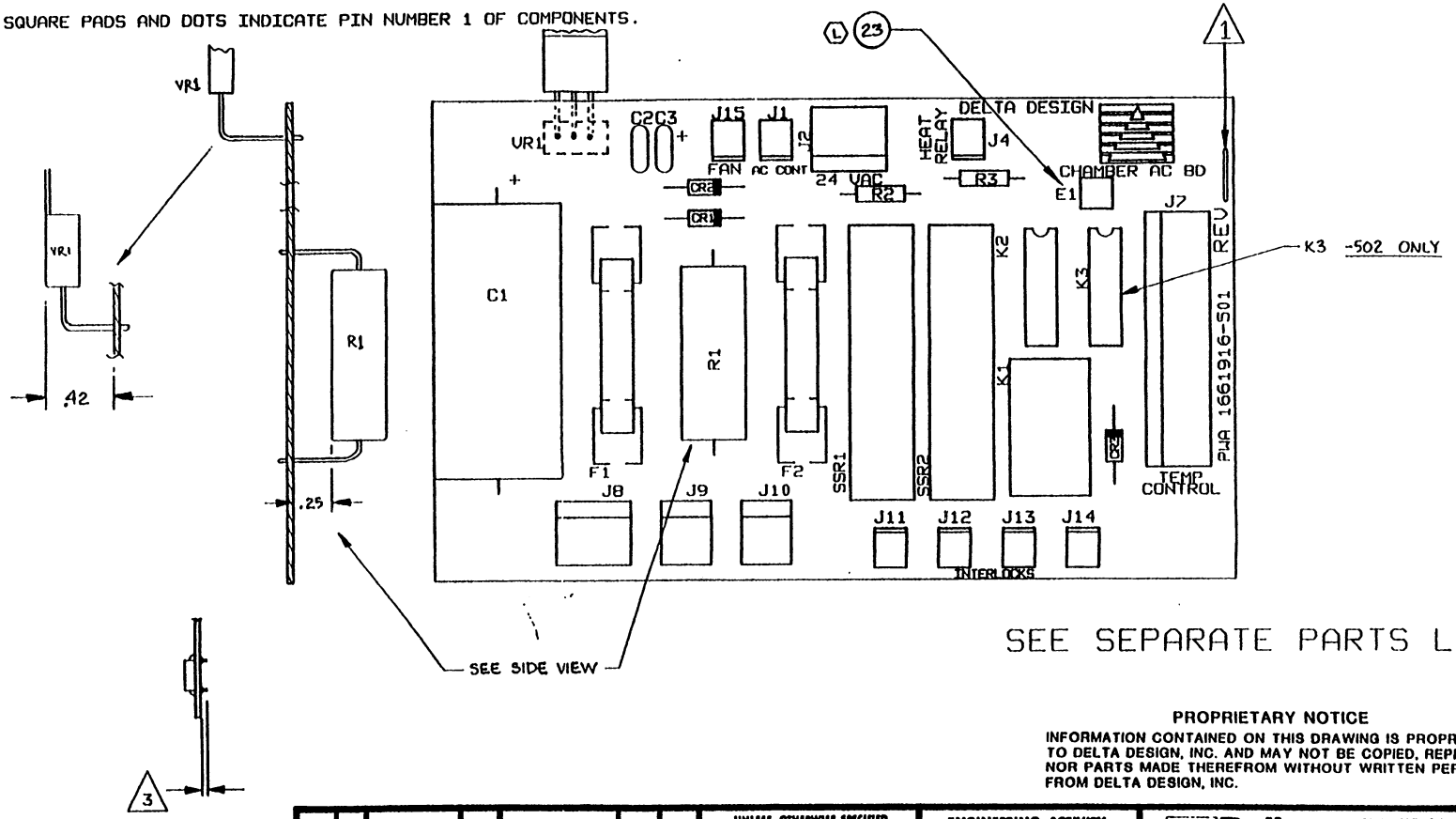
NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠	ENGINEERING ACTIVITY	Delta Design		
APPLICATION				EFFECTIVITY			FINISH ⚠	ERN 7363	9645 KEARNY VILLA RD. SAN DIEGO, CA 92123-1111		
								DESIGN			
								DRAFTED	T. SHEPARD 12-2-86	TITLE: WIRING & JUMPER DIAGRAM — AC AUX MODULE	
								CHECKED			
								APPROV	WJB 11/17/86	SIZE D	CODE IDENT
								RELEASE		1663783	REV A
								DO NOT SCALE DWG		SCALE NONE	SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	H	ECN 9249. REVISED AND REDRAWN. ADDED BATTERY BACKUP MEMORY IMPROVEMENT	1/93	
	J	ECN 0003. K3 DELETED. RELEASE OPTION -502 WITH K3. JB 2-26-93	3/1/93	R.T.
	K	ECN 0531 PL CHANGE ONLY DD 9/93	9/93	CCB
	L	BOM CHG - ADD J3 (CONN.) ECN03690 M.C. 3/95	3/95	CCB

6916

1. STAMP APPLICABLE ASSEMBLY REVISION LTR APPROXIMATELY WHERE SHOWN IN .12 MAX. HIGH CHARACTERS USING A NON-CONDUCTIVE EPOXY BASED INK, COLOR: BLACK.
2. SOLDER COMPONENTS IN ACCORDANCE TO MIL-STD-454, REQT 5.
3. MAXIMUM LEAD PROTRUSION AFTER TRIMMING TO BE .060 INCH.
4. SQUARE PADS AND DOTS INDICATE PIN NUMBER 1 OF COMPONENTS.



SEE SEPARATE PARTS LIST

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
502	1		9XXX			
501	1	1663618	9XXX			
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ±.03 .XXX ±.010
ANGLES 0°30'
HOLE TOLERANCES
.013 THRU .133 +.004 -.001
.031 THRU .500 +.006 -.001
.136 THRU .510 +.001 -.001
.531 THRU .750 +.006 -.001
MATERIAL
FINISH
DO NOT SCALE DWG

ENGINEERING ACTIVITY 7863

DESIGN	A. RACKOW 5/92	
DRAFTED		
CHECKED	A. Rackow 5/16/12	
APPROV	B. PARKER 6/92	
RELEASE	[illegible] 5/12	

Delta Design A Cohu Company
5775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: PWA- CHAMBER AC

SIZE	CODE IDENT		REV
C		1661916	L

SCALE 2:1 SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

LI,200,2.MDATABAS Delta Design, Inc.
WED, JUL 24, 1996, 1:22 PM

BILL OF MATERIAL

AS OF 07/24/96

CLASS CODE GROUP: 1 COMMODITY/CLASS CODE
CLASS CODE: 50 PCB ASSEMBLIES (O)

1661916501 OPCODE: 3 IM REV: L PWA,CHAMBER AC
MODEL: 9000
ECO NO: 03650
DATE OF LAST ECO: 03/20/95

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR
1661915401	PWB,CHAMBER AC	1	K	1	1.000	1.000	EA	B	YY	1.000	0	10	9249 06-15-92 K
1661913000	SCHEMATIC DIAGRAM	0		3	.000	1.000	EA	M	YY	.000	0	10	0000 12-17-86 E
1000586	IC POS VOLT REG 5V	1		5	1.000	1.000	EA	B	YY	1.000	0	10	VR1 0000 11-14-86
0303324500	RES,3.3K,1/4W,5%	1		6	2.000	1.000	EA	B	YY	2.000	0	10	R2,R3 9249 06-15-92
0400128	RES WIREWOUND 2 OHM	1		8	1.000	1.000	EA	B	YY	1.000	0	10	R1 9249 06-15-92
0800053	CAP ALUM ELECTRO	1		9	1.000	1.000	EA	B	YY	1.000	0	10	C1 0000 11-14-86
0800022	CAP CERAMIC .1MFD	1		10	1.000	1.000	EA	B	YY	1.000	0	10	C2 0000 11-14-86
0701000026	CAP TANTALUM 10MFD	1		11	1.000	1.000	EA	B	YY	1.000	0	10	C3 9249 06-15-92
1104002	DIODE,1N4002	1		15	2.000	1.000	EA	B	YY	2.000	0	10	CR1,CR2 9249 06-15-92
1400443	RELAY SOLID STATE	1		18	2.000	1.000	EA	B	YY	2.000	0	10	K2 9249 06-15-92
1400088	FUSE,314004,SLO-BLO	1		20	2.000	1.000	EA	B	YY	2.000	0	10	F1,F2 0000 11-14-86
1400385	FUSE CLIP PC MTG	1		21	4.000	1.000	EA	B	YY	4.000	0	10	XF1,XF2 00 08-04-88
2000403	CONN HDR STPLN STR	1		23	2.000	1.000	PR	B	YN	2.000	0	0	03650
2000398	CONN .100 HDR STR 2P	3		24	7.000	1.000	EA	F	YY	7.000	0	10	J1-J4,11-1

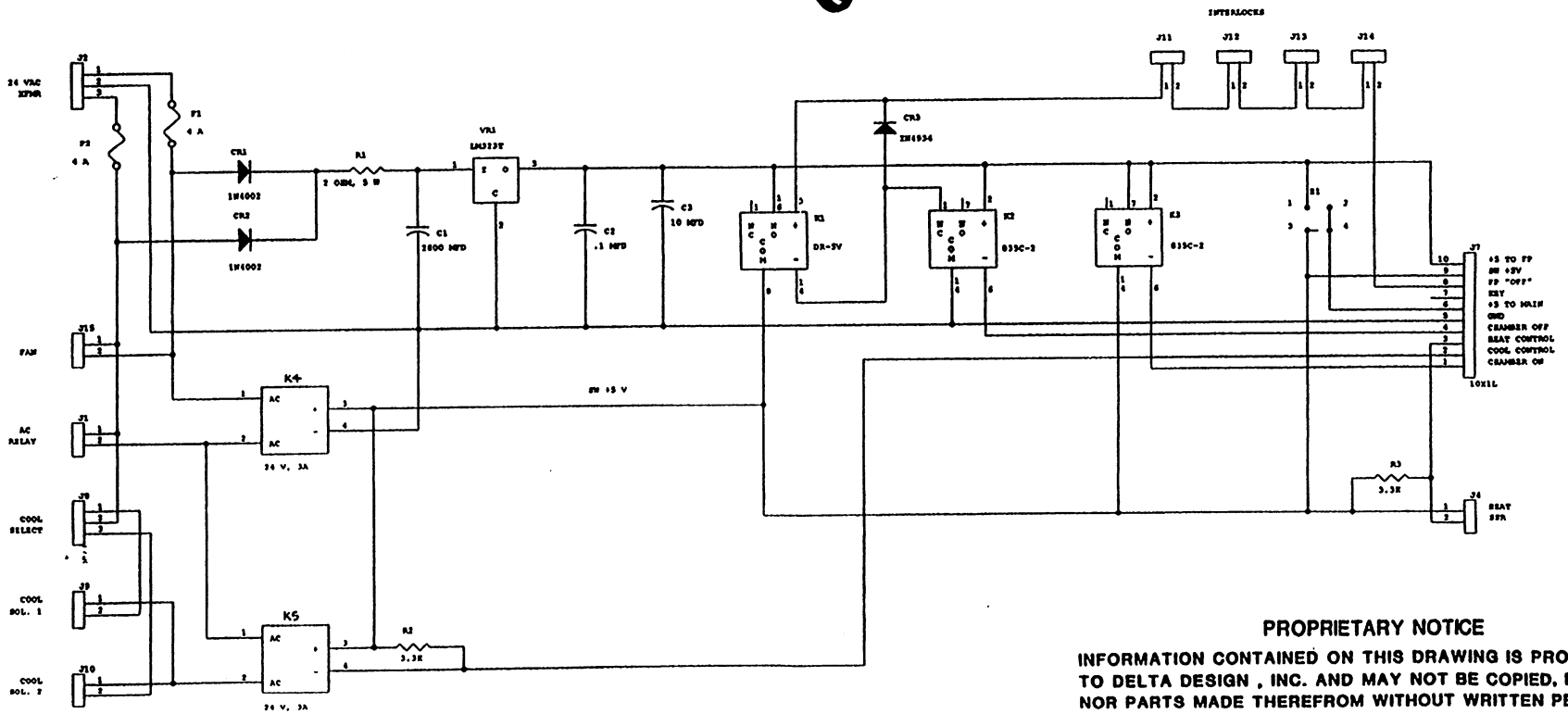
CLASS CODE GROUP: 1 COMMODITY/CLASS CODE
CLASS CODE: 50 PCB ASSEMBLIES (O)

661916501 OPCODE: 3 IM REV: L PWA,CHAMBER AC
MODEL: 9000
ECO NO: 03650
DATE OF LAST ECO: 03/20/95

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REP QF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
2000398	CONN .100 HDR STR 2P	3		24	7.000	1.000	EA	F	YY	7.000	0	10	5 9249 06-15-92		
2000418	CONN .156 HDR STR 2P	3		25	2.000	1.000	EA	F	YY	2.000	0	10	J9,J10 0000 11-14-86		
2000424	CONN .156 HDR STR 3P	1		26	2.000	1.000	EA	B	YY	2.000	0	10	J2,J8 9249 06-15-92		
2000427	CONN .156 HDR STR10P	3		27	1.000	1.000	EA	F	YY	1.000	0	10	J7 0000 11-14-86		
1400390	DIODE FAST RCVY 1A	1		28	1.000	1.000	EA	B	YY	1.000	0	10	CR3 9249 06-15-92		
1401399	RELAY 1A DC 5V DIP	1		29	1.000	1.000	EA	B	YY	1.000	0	10	K1 9249 06-15-92		
1401398	RELAY .5A 30V DIP	1		30	1.000	1.000	EA	B	YY	1.000	0	10	K2 0003 03-01-93		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	H	ECN 9249. REVISED & REDRAWN. JH 5-21-92 BATTERY BACK-UP MEMORY IMPROVEMENT.	5/22/92	ACR



2. ALL CAPS IN MICROFARADS.
1. ALL RESISTORS IN OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
—	REF	1661916	9XXX

APPLICATION | SERIAL NO. | DATE EFF | DWG REV | MATERIAL | FINISH | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03, .XXX ± .010
ANGLES 0° 30'
HOLE TOLERANCES

ENGINEERING ACTIVITY	7363
DESIGN	A. RACKOW 5/92
DRAFTED	
CHECKED	A. Rackow 5/92
APPROV	B. Parker 6/92
RELEASE	R. Wiseman 6/92
DO NOT SCALE DWG	

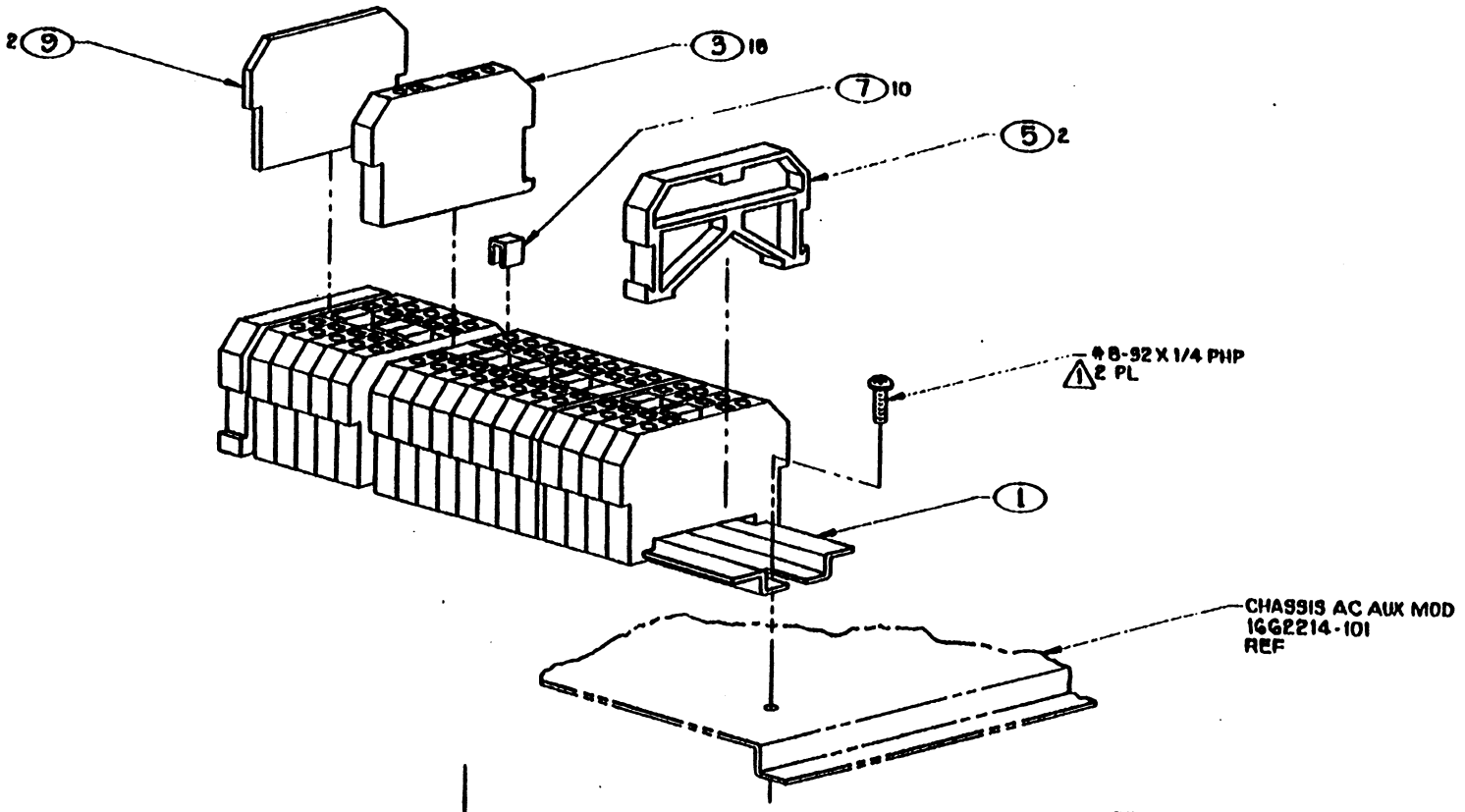
Delta Design
A Cohu Company
6778 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: SCHEMATIC- CHAMBER AC

SIZE		REV.
B	1661913	H

SCALE — SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	RELEASED (ERN 7363) T.S. 12-1-86	12/1/86	[illegible]



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INSTALL BEFORE ASSEMBLING

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE OTY	DWG REV
001	1	1663618				
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON

DECIMALS .XX ± .03 .XXX ± .010

ANGLES ± 1°

HOLE TOLERANCES

MATERIAL

FIN

ENGINEERING ACTIVITY		
ERN 7363		
DESIGN		
DRAFTED	E. SAMSON	
CHECKED		
APPROV	[illegible]	11/11/86
RELEASE	[illegible]	12/1/86

DO NOT SCALE DWG

Delta Design
9778 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: TERMINAL BLOCK ASSY, AC AUX MOD

SIZE	CODE IDENT		REV
C		1663765	A

SCALE 1/1

1 OF 1

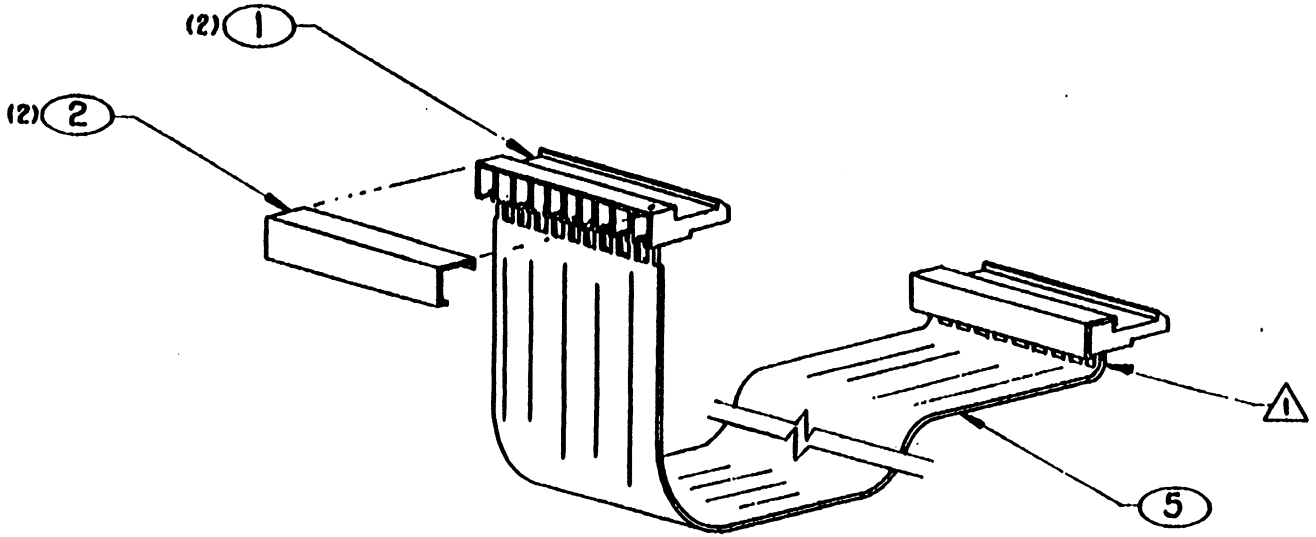
DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663765001
DESCRIPTION: TERM BLK ASSY, AC AUX
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1662704602	RAIL, 5.00"		1
003	1400427	TERMINAL BLOCK 600V 20A AWG 24-12		18
005	1400434	END PLATE TERM BLK		2
007	1400426	JUMPER HORIZONTAL INSULATED 26A		10
009	1400425	END STOP-TERMINAL BLOCK		2

1664861	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ERN 7378	4/23/87	WLS



⚠1 CUT CABLE ENDS IN MIDDLE OF NOTCHES

DASH	QTY	NEXT ASSY	USED ON
001	1	MULTI	CH

APPLICATION | SERIAL NO. | DATE EFF | DWD REV | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON: DECIMALS .XX ± .03, .XXX ± .010; ANGLES ±1°; HOLE TOLERANCES .XXX ± .010 ± .005, .XXX ± .005 ± .003

MATERIAL

FINISH

ENGINEERING ACTIVITY: ERN 7378

DESIGN		
DRAFTED	E. SAMSON 3-87	
CHECKED		
APPROV	WLS	4/23/87
RELEASE	[signature]	4/24/87

DO NOT SCALE DWG

Delta Design — 9770 KEARNY VILLA RD. SAN DIEGO, CA 92126-1111

TITLE: CABLE ASSY- AUX MOD TO 'TEMP. CONT.

SIZE		DWG NO.	REV.
B		1664861	A

SCALE 1/1 SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664861001
DESCRIPTION: CABLE ASSY-AUX MOD
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2000449	CONN RECT LCKNG 10 PIN 156 SP 22 AWG		2
002	2000456	COVER, STRAIN RELIEF 10 CKTS MTA-156		2
005	1664741101	CABLE ROUND COND FLT .156 CTR 10 CKT PRE-NOTICHED 22AWG		15

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663921001
DESCRIPTION: VALVE ASSY, 24 VAC
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1800182	SOLENOID VALVE ; LIQUID CO2 24VAC 60HZ 3164 ORIFICE 1000PSI		1
002	1645008101	BRACKET, CO2		1
003	3601038	NIPPLE, BRASS, 2" LNGTH		1
004	3600102	COUPLING, 1/8NPT		1
005	6808323804	SCR, 8-32X3/8"PHP		1
006	6608010	WASHER, LOCK, #8		1
007	6708320000	HEX NUT		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663921002
DESCRIPTION: VALVE ASSY, 24 VAC
REF/DES:

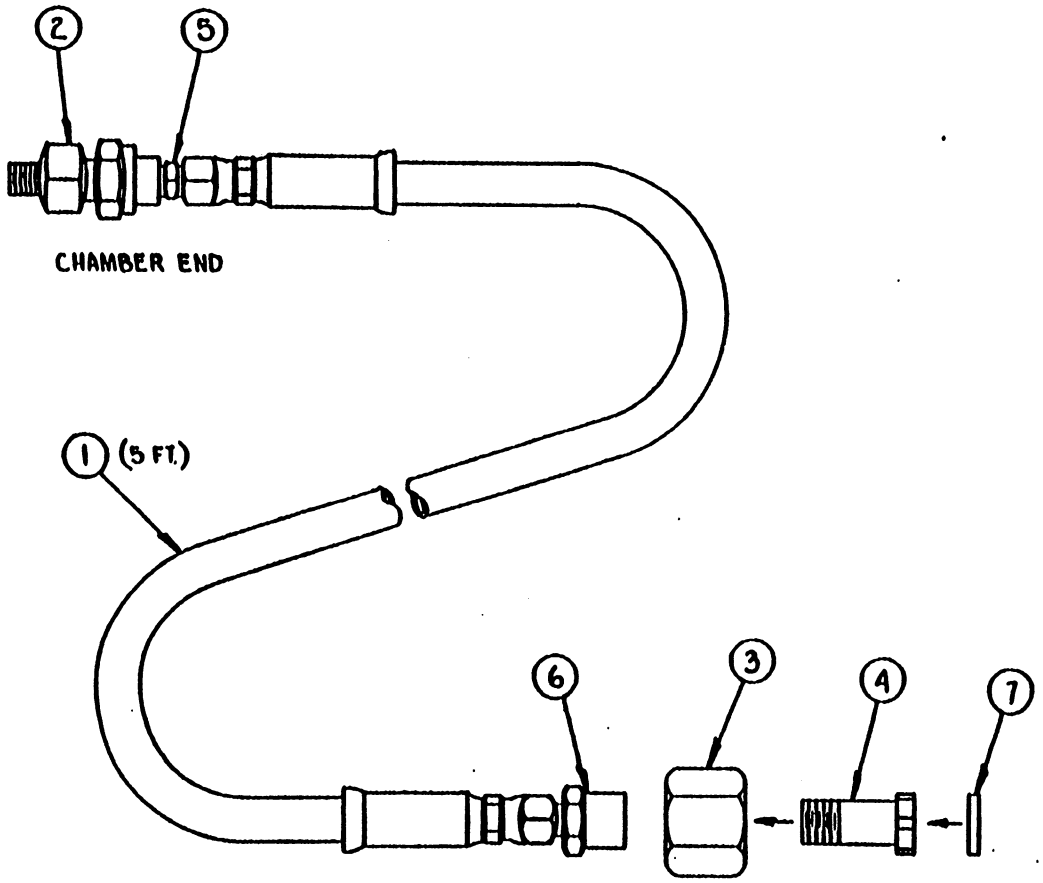
ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
002	1645008101	BRACKET, CO2		1
003	3601038	NIPPLE, BRASS, 2"LNGTH		1
004	3600102	COUPLING, 1/8NPT		1
005	6808323804	SCR, 8-32X3/8"PHP		1
006	6608010	WASHER, LOCK, #8		1
007	6708320000	HEX NUT		1
008	1800181	SOLENOID VALVE LIQ-UID CO2 24VAC 60HZ 3/32 ORIFICE 300PSI		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663922001
DESCRIPTION: VALVE ASSY, LN2, 24VAC
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1800180	SOLENOID VALVE CRYO-GENIC 24VAC 60HZ		1
002	3600163	NIPPLE, REDUCING, ERAS 1/4-1/8		1
003	3600102	COUPLING, 1/8NPT		1
004	3601012	BUSHING, REDUCING 1/4MPT-1/8FPT		1

REVISIONS				
ZONE	LTR	DESCRIPTION	DTE	APPD
	A	PER ECN 4456 CHANGED HOSE TO BRAIDED STAINLESS NYLON	12-8-83	[illegible]
	B	ECN 6238 CHNG ITEM NO.1 P/L ONLY	4-3-84	[illegible]
	C	ADDED TEFLON TAPE TO P/L. EFFECTIVE NEXT RUN. RSWOGREN 9.9.86	9-16-86	[illegible]



DASH	QTY	NEXT ASSY	ITEM NO.
001	1	1650571	1800
001	1		2300
001	1	1640111	8000
001	1		7650
001	1	2636342	6400
001	1	2635601	5900
001	1	2636283	3900
001	1	2635402	2850
001	1	2605110	2300

APPLICATION | SERIAL NO. EFFECTIVITY | DATE EFF | DWG REV | MATERIAL | FINISH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES ± 1° SURFACE FINISH 125 63 32

ENGINEERING ACTIVITY ECN M1622

DESIGN	B MOLSEN 10-2-87
DRAFTED	
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONV INC.
SAN DIEGO, CA. 92123

TITLE: HOSE SHIP KIT

SIZE C | CODE IDENT | 2618020 | REV

SCALE 1/1 | SHEET 1

3. USE TEFLON TAPE ON ALL MALE PIPE THREADS.

NOTES: UNLESS OTHERWISE SPECIFIED

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2618020
DESCRIPTION: HOSE ASSY, CO2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600123	HOSE, CO2, CHAMBER		1
002	1400110	FILTER, CO2		1
003	3600120	NUT, FITTING		1
		CARBON DIOXIDE INLET		
004	3600121	SLEEVE		1
005	3600004	CONNECTOR, MALE		1
006	3600119	ADAPTOR		1
007	3600122	WASHER, FIBER, CO2		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663916001
DESCRIPTION: COOLING KIT, CO2 HIGH
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921001	VALVE ASSY, 24 VAC CO2 HIGH PRESSURE		1
003	2618004001	INJECTOR ASSY. CO2 HIGH PRESSURE SINGLE STEM		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663917001
DESCRIPTION: COOLING KIT, CO2 LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
003	1647842107	TUBE, CO2 INJ, 11" 300 PSI		1
004	3600197	CONNECTOR, MALE		1

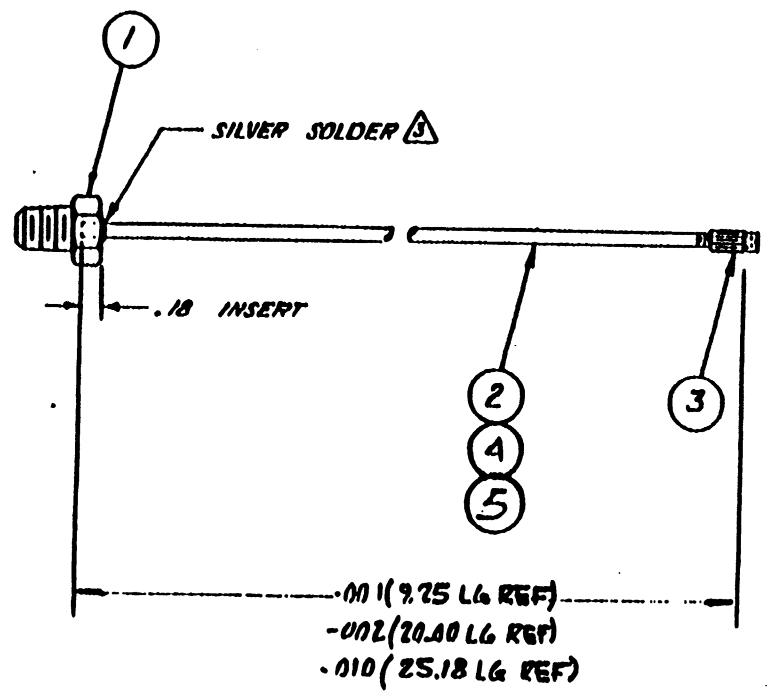
DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663917003
DESCRIPTION: COOLING KIT, CO2 LOW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2618020	HOSE ASSY, CO2		1
002	1663921002	VALVE ASSY, 24 VAC CO2 LOW PRESSURE		1
004	3600197	CONNECTOR, MALE		1
006	1647842108	INJECTOR ASSY, CO2 16.5", 300 PSI		1

26 18004

ZONE	LTR	DESCRIPTION	DATE	APPD
	B	INITIAL RELEASE ECN M239 KNAPP		
	C	PER ENN 3845 INITIAL RELEASE	5-30-3	
	D	PER ECN 4338, ADDED -010 ASSY (ITEM 5)	7-29-3	



NOTES: UNLESS OTHERWISE SPECIFIED

4 MULTIPLE STD USAGE - SEE P/L FOR APPLICATION

5 REMOVE OBSTRUCTIONS FROM ID AFTER SOLDERING

FINISH (IF APPLICABLE)

MATL (IF APPLICABLE)

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF
		4			

APPLICATION — EFFECTIVITY

ENGINEERING ACTIVITY: 3845 L-3

DESIGN:
DRAFTED: KNAPP 5.28.73
CHECKED: 4.1.73
APPROV: 4-6-73
RELEASE:

DO NOT SCALE DWG

DELTA DESIGN INC.

TITLE: INJECTOR ASSY, CO_2 SINGLE STEM

SIZE B

DWG NO: 2618

SCALE ~

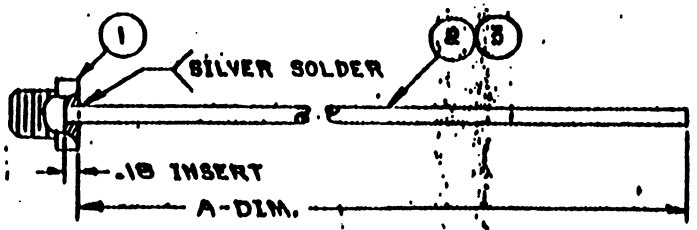
SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2618004001
DESCRIPTION: INJECTOR ASSY.
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
002	1618011101	TUBE, CO2, INJ.		1
003	4100039	TIP, INJECTOR, CO2		1
		.020 ORIFICE		

26 19067	



ZONE	LTR.	DESCRIPTION	DATE	APPROVED
	A	PER ECN M430 FROM 11-7-79 DASH 001 "A" DIM WAS 4.62	11-14-79	[illegible]
	B	PER ECN 3887 CHG'D REV TO MATCH P/L	4-4-83	[illegible]
	C	PER ECN 4223 . CREATED -002	6-22-83	[illegible]

DASH	ITEM NO. 1 DWG. B1618912	ITEM NO. 2 DWG. B1619069	A-DIM.	MODEL
-001	-003	-001	4.00	8850, 7400
-002	-003	-002	8.23	8000

PARTS LIST IS "A" SIZE

QTY. REQ'D	NOMENCLATURE OR DESCRIPTION	CODE IDENT.	IDENTIFYING NUMBER	SPECIFICATION	MATERIAL OR NOTE	ITEM NO

1. AFTER SILVER SOLDER OPERATION, INSP I.D. OF ITEMS 1 & 2 & REMOVE ALL FOREIGN MATTER

NOTES:

NEXT ASSY.	USED ON	SERIAL NOS.	DATE EFF.	DWG. REV. LTR.
	8000			
D2699166	2850			
D1643459	2850			

APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1 .XX ±.030 ± 1° ± 32 .XXX ±.010

MATERIAL: SEE B.M.

FINISH:

PART NO.

	BY	DATE
L-3		
DESIGN		
DRAFTED	C. Arnold	11/8/79
CHECKED	Nanni	11-14-79
APPROV.		

DELTA DESIGN INC.
8000 FLETCHER PKWY.
LA MESA, CALIF. 92041
TEL: A/C (714) 469-4141

TITLE: INJECTOR ASS'Y, -LN2

SIZE	CODE IDENT. NO.	DRAWING NO.	REV LTR
B		B-2619067	C

SCALE

SHT 1 OF 1

BLUE LINE

7-87

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2619067001
DESCRIPTION: INJ. ASSY, LN2
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	3600078	PLUG, PIPE, BRASS, 1/8"		1
002	8000024120	TUBE, SST. .125"OD X .016"WALL		1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663872001
DESCRIPTION: BLWR. MTR. ASSY, CW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1663109101	MOTOR, REVERSIBLE 115/230V 50/60HZ		1
002	2100783	FAN BLADE, COOLING CW ROT FOR FASCO MTR #7162-2298		1
003	1632177	PLATE, BLWR. MTR		1
006	4100173	THERMAL BARRIER BLOWER MOTOR		1
007	1632180	GASKET, BLWR. MTR		1
008	2400003	SEALANT, RED RTV-106, 6 OZ.		
009	2100505	IMPELLER, BLWR. MTR. CLOCKWISE ROTATION	TO BE REPLACED BY:21	1
011	4100696	SPACER, SS 5/16"OD-.194"ID .625 LG		4
012	2000464	CONN HOUSING PLUG 9 CKT W/MTG EARS & DETENT		1
013	1400568	PIN, TERMINAL, MALE		7

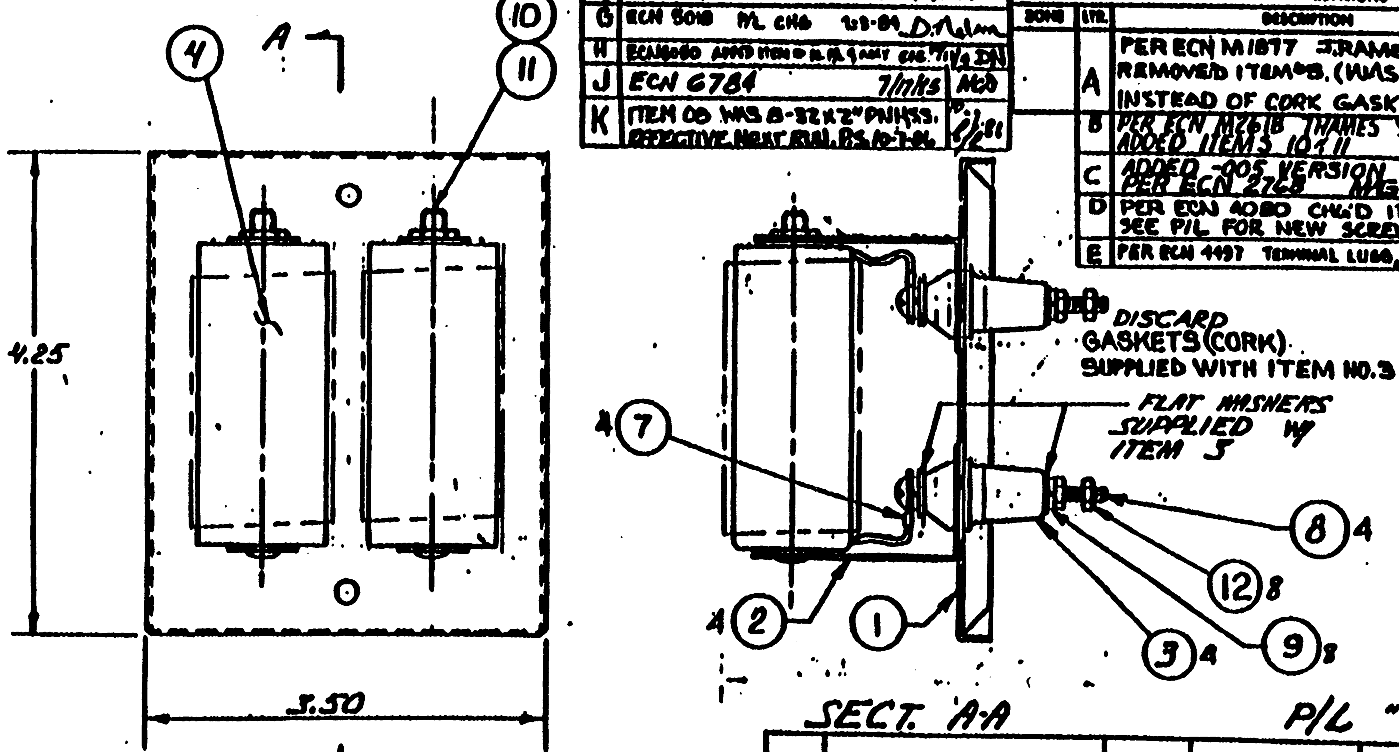
DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663872002
DESCRIPTION: BLWR. MTR. ASSY, CCW
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1663109101	MOTOR, REVERSIBLE 115/230V 50/60HZ		1
002	2100784	FAN BLADE, COOLING CCW ROT FOR EASCO MTR #7162-2298		1
003	1632177	PLATE, BLWR. MTR		1
006	4100173	THERMAL BARRIER. BLOWER MOTOR		1
007	1632180	GASKET, BLWR. MTR		1
008	2400003	SEALANT, RED RTV-106, 6 OZ.		
009	2100503	IMPELLER, BLWR. MTR. CCW ROTATION	TO BE REPLACED BY:21	1
011	4100696	SPACER, SS 5/16"OD-.194"ID .625 LG.		4
012	2000464	CONN HOUSING PLUG 9 CKT W/MTG EARS & DETENT		1
013	1400568	PIN, TERMINAL, MALE		7

26 22524

LTR.	DESCRIPTION	DATE	APPROVED
A	PER ECN M1877 J.RAMER 10-15-79 REMOVED ITEM 6. (WAS ASBESTOS INSTEAD OF CORK GASKET)	10-16-79	
B	PER ECN M2618 THAMES 9-28-81 ADDED ITEMS 10 & 11	10-81	
C	ADDED -005 VERSION PER ECN 2768 MG 12-15-81		
D	PER ECN 4080 CHG'D ITEM 10 SEE P/L FOR NEW SCREW SIZE	11-19-82	
E	PER ECN 4497 TERMINAL LUGS, D.NELSON	10-13-83	D.Nelson
F	PER ECN 4708 PL CHG	11-17-83	
G	ECN 5018 P/L CHG	2-3-84	D.Nelson
H	ECN 5050 ADDED ITEM TO P/L & ASSY CHG.		
J	ECN 6784	7/11/85	MCD
K	ITEM 08 WAS 8-32 X 2" PNHSS. EFFECTIVE NEXT RUN. DS 10-7-86		



SECT. A-A

DASH	NTP RES
-001	8.75 Ω
-002	15.0 Ω
-003	17.5 Ω
-004	20.0 Ω
-005	10.0 Ω

P/L "B" SIZE

QTY. REQ'D	NOMENCLATURE OR DESCRIPTION	CODE IDENT.	IDENTIFYING NUMBER	SPECIFICATION	MATERIAL OR NOTE	ITEM NO

1. ALL DIM. ARE REF ONLY.

NOTES:

MULTIPLE STD USAGE

NEXT ASSY.	USED ON	SERIAL NOS.	DATE EFF.	DWG. REV. LTR.
APPLICATION		EFFECTIVITY		

	BY	DATE
DESIGN		
DRAFTED	KNAPP	5-4-72
CHECKED		7-6-72
APPROV.	L. ELLIS	7-6-72

DO NOT SCALE DRAWING

PART NO. NOTED

DELTA DESIGN INC.
8000 FLETCHER PKWY.
LA MESA, CALIF. 92041
TEL: A/C (714) 465-4141

TITLE: HEATER ASSY

SIZE B | CODE IDENT. NO. | DRAWING NO. 2622524 | REV LTR K

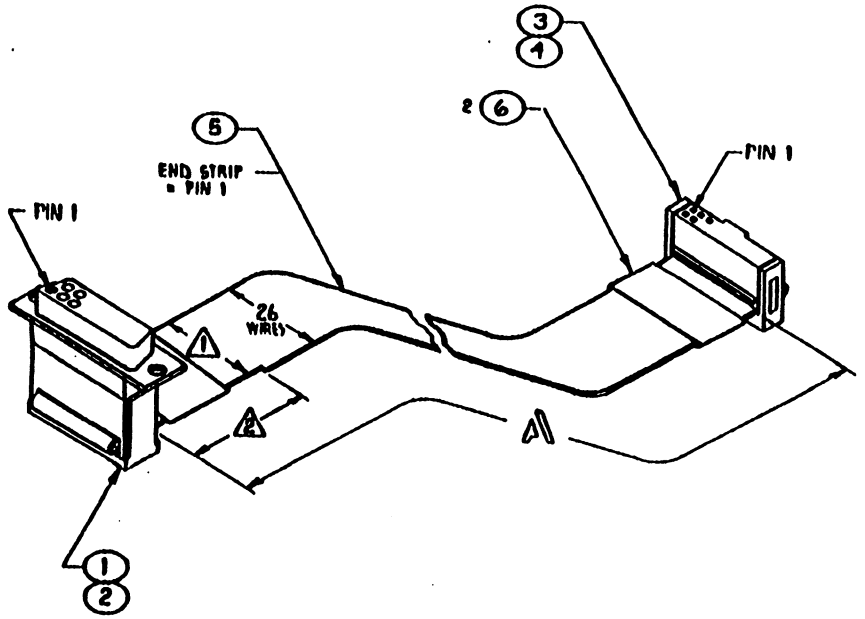
SCALE FULL | SHEET

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 2622524001
DESCRIPTION: HTR. ASSY, 39/59/64/80
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	1635874	PLATE, HEATER		1
002	1635868	STANDOFF, HEATER		4
003	1500327	INSULATOR		4
004	2200003	HEATER, 8.75 OHM		2
007	1500039	LUG, HI-TEMP, #8 STUD		4
010	1655875101	SCREW, MODIFIED	M/F 6810323004	2

DASH NO.	A (IN INCHES)	
001	12	GPIB CONN
002	14	
003	16	
010	30	
020	50	
030	70	
040	90	
050	110	
051	12	RS-232C CONN
052	14	
053	16	
060	30	
070	50	
080	70	
090	90	
095	100	



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	ERN 7378	4/23/87	

▲ WIRE(S) TO BE CUT 1.5 INCHES FROM END OF CABLE.

▲ GPIB USES 24 WIRES AND RS-232C USES 25 WIRES.

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON
		MULTI	

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

MATERIAL

ENGINEERING ACTIVITY: ERN 7378

DESIGN		
DRAFTED	T. SHEPARD 3-2-87	
CHECKED		
APPROV	[illegible]	4/23/87
RELEASE	[illegible]	4/23/87

DO NOT SCALE DWG

Delta Design
9770 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: CABLE ASSY — GPIB / RS-232C

SIZE: C | CAGE IDENT | 1664574 | REV: A

SCALE: NONE

1 OF 1

7-93

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664574005
DESCRIPTION: CABLE ASSY, GPIB 20"
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2000448	CONN RIBBON FEMALE PNL MTG 24 PIN (GPIB)		1
002	1700450	JACK SOCKET ASSY METRIC (GPIB)		2
003	1410111105	CONN, FEMALE, POLARIZE FLAT CABLE, 26 POS.		1
004	1410449105	STRAIN RELIEF FLAT CABLE, 26 POS.		1
005	1410035109	CABLE, FLAT 28 AWG, 26 CONDUCTORS		20
006	1500521	LABEL CABLE MARKING 1 IN X 3-3/4 IN SELF LAMINATING		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664574055
DESCRIPTION: CABLE ASSY, RS232 20"
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2000446	CONN D-STYLE FEMALE 25 SOCKETS (RS-232)		1
002	1700449	JACK SOCKET ASSY REAR PNL MOUNT		2
003	1410111105	CONN, FEMALE, POLARIZE FLAT CABLE, 26 POS.		1
004	1410449105	STRAIN RELIEF FLAT CABLE, 26 POS.		1
005	1410035109	CABLE, FLAT 28 AWG, 26 CONDUCTORS		20
006	1500521	LABEL CABLE MARKING 1 IN X 3-3/4 IN SELF LAMINATING		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664574010
DESCRIPTION: CABLE ASSY, GPIB 30"
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2000448	CONN RIBBON FEMALE PNL MTG 24 PIN (GPIB)		1
002	1700450	JACK SOCKET ASSY METRIC (GPIB)		2
003	1410111105	CONN, FEMALE, POLARIZE FLAT CABLE, 26 POS		1
004	1410449105	STRAIN RELIEF FLAT CABLE, 26 POS.		1
005	1410035109	CABLE, FLAT 28 AWG, 26 CONDUCTORS		30
006	1500521	LABEL CABLE MARKING 1 IN X 3-3/4 IN SELF LAMINATING		2

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664574060
DESCRIPTION: CABLE ASSY, RS232 30"
REF/DES:

ITEM	PART NO.	DESCRIPTION	REF/DES	QTY
001	2000446	CONN D-STYLE FEMALE 25 SOCKETS (RS-232)		1
002	1700449	JACK SOCKET ASSY REAR PNL MOUNT		2
003	1410111105	CONN, FEMALE, POLARIZE FLAT CABLE, 26 POS.		1
004	1410449105	STRAIN RELIEF FLAT CABLE, 26 POS.		1
005	1410035109	CABLE, FLAT 28 AWG, 26 CONDUCTORS		30
006	1500521	LABEL CABLE MARKING 1 IN X 3-3/4 IN SELF LAMINATING		2