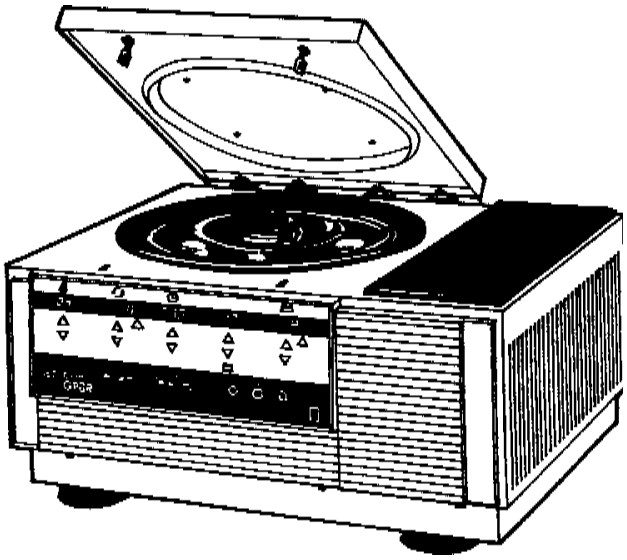
SERVICE MANUAL
SM3121

Revision 1



Centra- GP8
Ventilated Centrifuge
Cat. No. 3121 – For 100/120/220/240 VAC, 50/60 Hz

Centra-GP8R
Refrigerated Centrifuge
Cat. No. 3122 – For 120 VAC, 60 Hz
Cat. No. 3125 – For 220/240 VAC, 50/60 Hz

Centra- GP8(F)
Ventilated Floor Model Centrifuge
Cat. No. 3127 – For 100/120/220/240 VAC, 50/60 Hz

Centra-GP8R(F)
Refrigerated Floor Model Centrifuge
Cat. No. 3128 – For 120 VAC, 60 Hz
Cat. No. 3129 – For 220/240 VAC, 50/60 Hz

Thermo IEC
300 Second Ave.
Needham Heights, MA 02494
Tel. (781) 449-8060
Fax (781) 444-6743
www.thermoiec.com

TABLE OF CONTENTS

1 INTRODUCTION 2

2 INSTALLATION 3
- 2.1 Receiving the Unit 3
- 2.2 Site Preparation 3
  - Clearance Envelope 3
- 2.3 Power Configuration 3
  - Table For Electric Configuration 4
  - Voltage 5
  - Fuses 5
  - Power Cord 6
- 2.4 Moving the Unit 6

3 OPERATION 7
- 3.1 The Front Panel 7
- 3.2 Rotor and Accessories 10
  - Balance 10
  - Vibration 11
  - Rotor Installation/Removal 11
  - Adding Rotors 11
  - Deleting Rotors 12
- 3.3 Starting And Stopping A Run 12
- 3.4 Operating Modes 13
  - Manual Operation 13
  - Rapid Condition (GP8R Only) 13
  - Hold Mode 14
- 3.5 Stored Programs 14
  - Locking/Recall/Add/Change 14
- 3.6 Refrigeration (GP8R Only) 15
- 3.7 Fail-Safe Systems 16

4 ACCESSORIES 17
- 4.1 Speed and Force Tables 17
- 4.2 Derating Table for Dense Samples 23
- 4.3 Chemical Resistance Table 24
- 4.4 Decontamination Table 25
- 4.5 Nomograph 26

5 MAINTENANCE 27
- 5.1 Cleaning 27
- 5.2 Cover Interlock Bypass 29
- 5.3 Calibration 29
- 5.4 Brush Replacement 29
- 5.5 Warranty 30
- 5.6 Condition of Returned Equipment 31
- 5.7 Table of Spare Parts 31
- 5.8 Fuses Not Replaceable By The Operator 32

6 SPECIFICATIONS 33

1 INTRODUCTION

The Centra-GP8 series are general purpose centrifuges designed for use in medical, industrial and scientific laboratories. The Centra-GP8 series is available in the following models.

Benchtop models:	3121 - GP8	100/120/220/240 Vac, 50/60 Hz
	3122 - GP8R	120 Vac, 60 Hz
	3125 - GP8R	200/220/240 Vac, 50/60 Hz
Kneewell models:	3123 - GP8(K)	100/120/220/240 Vac, 50/60 Hz
	3124 - GP8R(K)	120 Vac, 60 Hz
	3126 - GP8R(K)	200/220/240 Vac, 50/60 Hz
Floor Models:	3127 - GP8(F)	100/120/220/240 Vac, 50/60 Hz
	3128 - GP8R(F)	120 Vac, 60 Hz
	3129 - GP8R(F)	220/240 Vac, 50/60 Hz

The Centra-GP8 series can develop a maximum relative centrifugal force (RCF) of 4630 xg using the 822A rotor. The centrifuges will accommodate a range of centrifuge tubes and devices including 750 mL bottles, microplates, cytological slide carriers, and microsample tubes. Maximum sample load is 3 Liters.

Designed for ease of use, the Centra-GP8 has an ergonomic touch pad control panel and bright, easily read LED displays. The unit can be operated in manual mode, hold, or one of 35 programmable operations. Programs can also be modified at run time, offering unlimited run variations. In addition, rotor number entry permits automatic calculation of RCF. Other features include a coast mode and separate acceleration and deceleration controls for maintaining delicate samples such as those with density gradients.

All refrigerated models allow you to select chamber temperatures from -5°C to 40°C and will maintain 2°C at full speed with the 218 rotor. All refrigerated models also offer a Rapid Condition function for pre-cooling or pre-heating the rotor and sample chamber. Repeat runs with precisely the same temperature, speed and time setting can be achieved with the touch of a button.

The internal microprocessor that allows this simplified operation also ensures repeatable results, preventing inadvertent loss of sample, and even alerts operators when periodic maintenance is due.

The Centra-GP8 series rugged steel cabinet and rigid construction provide quiet operation and long-term reliability coupled with impressive safety features. A fail-safe cover interlock prevents the rotor from running unless the cover is closed. It also prevents the cover from being opened until the rotor has slowed to less than 90 RPM, even if the power fails. If a load-imbalance occurs, a sensor shuts the unit down and triggers a warning message.

2 INSTALLATION

2.1 Receiving the Unit

IEC ships the centrifuge in a carton that protects it from shipping hazards. Follow the unpacking instructions on the carton. Be sure to complete the postage-paid warranty card and return it to IEC (U.S. and Canada) or to the local distributor (Export).

2.2 Site Preparation

For benchtop units, place the unit on a smooth, clean, dry surface to ensure that the suction feet grip firmly. The surface must be rigid, stable and level to ensure quiet, vibration-free operation.

Clear the area beneath the unit of debris and loose material such as paper. Allow 8 cm (3 inches) of clearance near the ventilation grill of refrigerated units.

For Kneewell and Floor Model units, make sure that the floor is clean, stable and level, and that the unit has at least 8 cm (3 inches) of clearance for the GP8 and 16 cm (6 inches) of clearance for the GP8R at the rear for ventilation.

Warning: Lock the front wheels before starting a run to avoid dangerous movement. To gain access to the caster locks, pull the centrifuge forward about 15 cm (6 inches) and then swing backwards to swivel the casters to the front.

Section 6 of this manual provides specific dimensions and specifications for each of the Centra-GP8 units.

Clearance Envelope

International Electrotechnical Commission standard 1010 part 2-20 limits the permitted movement of a laboratory centrifuge to 300mm in the event of a disruption. The user should therefore mark the clearance envelope boundary around the centrifuge, or laboratory management procedures should require that no person or any hazardous materials are within such a boundary while the centrifuge is operating.

2.3 Power Configuration

Do not plug in the centrifuge until you have configured the power correctly. For best results, the centrifuges should be used on a dedicated line. Variations in line voltage or frequency will affect the unit's speed and other characteristics. Less than nominal line voltage may prevent the centrifuge from reaching published specifications of speed and/or temperature. Also, power line voltage at some locations may sag when the refrigeration system turns on.
Caution: Configuring the centrifuge incorrectly may damage the equipment and will void your warranty.

Table for Electric Configuration

	Centra-GP8 & GP8(K/F)	Centra-GP8R & GP8R(K/F)	Centra-GP8R & GP8R(K/F)
Voltage (AC)	100/120/220/240	120	200/220/240
Frequency (Hz)	50/60	60	50/60
Model No.	3121, 3123, 3127	3122, 3124, 3128	3125, 3126, 3129
Fuse Requirement (all fuses are 250 V, Slo-Blo Type T glass 5 x 20 mm)	two 16A at { 100 120 V two 6.3A at { 220 240 V	one 20A at 120 V	two 16A at { 200 220 240 V
Power Line Ampacity	10 A	15 A	10 A
Voltage Range	90-110 V; set 100 V 108-132 V; set 120 V 198-242 V; set 220 V 216-264 V; set 240 V	108-132 V	180-220 V; set 200 V 198-242 V; set 220 V 216-264 V; set 240 V

Note: Power line ampacity requirement provides for sufficient current to permit effective performance.

Voltage

Use a volt meter to measure the voltage at your site. For models 3121, 3123, 3125, 3126, 3127 and 3129: Locate the power entry module on the lower left side of the unit. On the right side of the module is the fuse drawer. A small latch on the left holds this drawer in place. Press the latch and slide the drawer out. If the number visible in the window differs from the voltage at your site, remove the square insert, rotate it, and reinstall it so that the correct voltage is displayed through the window.

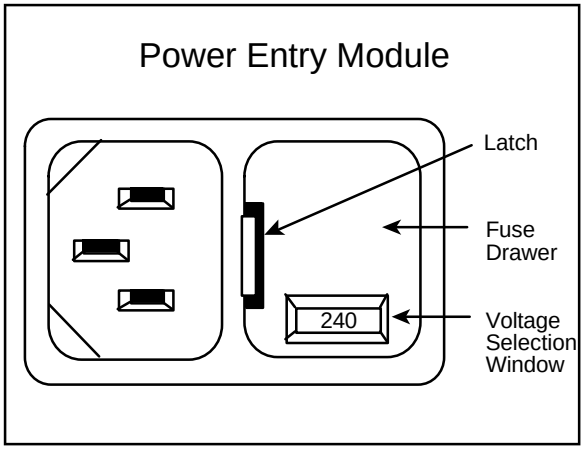
Fuses

Install appropriate fuses for the voltage at your site.
Centra-GP8 & Centra-GP8(K) (model #3121, #3123, #3127):
two 16A fuses for 100/120 V; or two 6.3A fuses for 220/240 V.

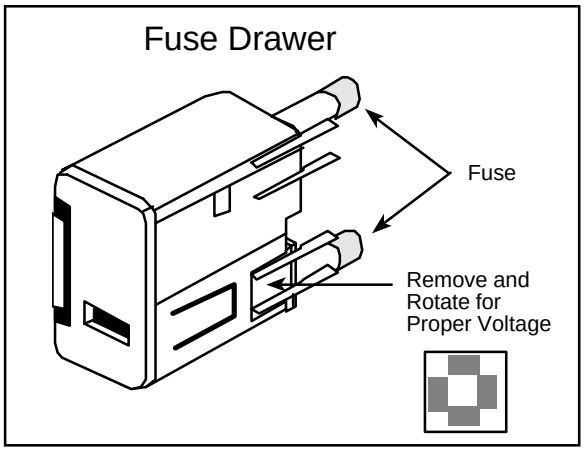
Centra-GP8R & Centra-GP8R(K) (model #3122, #3124, #3128):
These models have no insert or window and are **already configured** for use with 120V, 60 Hz only.

Centra-GP8R & Centra-GP8R(K) (model #3125, #3126, #3129):
two 16A fuses.

Ensuring that the fuses are securely in place, reinstall the entire drawer in the side of the centrifuge.



POWER ENTRY MODULE



FUSE DRAWER

Circuit Breaker

Centrifuges are fitted with either a single pushbutton circuit breaker or a dual pushbutton switch/circuit breaker. The dual pushbutton switch/circuit breaker may be used as an On/Off switch for the centfuge as follows:

The circuit breakers are located in the base of the centrifuge. The dual pushbutton swicth/circuit breaker is identified by the red and green buttons. Pressing the green button connects power and resets the breaker. Power may be disconnected by pressing the red button or by unplugging the power cord from the centrifuge.

Power cord The Centra-GP8R requires a grounded power supply (3-prong power outlet). If your facility does not have properly grounded outlets, arrange for proper grounding.

IEC provides two power cords with each Centra-GP8 and Centra-GP8R. One is suitable for North America, Japan and Korea. The other has bare wires at one end so other plug types can be attached.

Caution: Do not remove the grounding pin from the centrifuge power cord. Do not use the bare wire power cord to attach a power plug that does not have a grounding pin. Use only the appropriate power cord supplied by IEC.

If the bare wire power cord is used, install the selected plug and attach the cord to the receptacle on the lower left side of the centrifuge. Plug into the power outlet.

Warning: The power cord(s) provided with the unit is correctly rated for the highest current demand. This power cord should not be interchanged with cords from equipment with lower current demand. Exchange of power cords between equipment may create a fire hazard.

2.4 Moving the Unit

If you relocate a GP8 series centrifuge to a different power source, please refer to section 2.3 to check the power requirements and, if necessary, reconfigure the power.

Benchtop First, remove the rotor and accessories. Next, release the seal on the suction cups that adhere the Centra-GP8/R to the work surface. Lift the edge of each suction cup to release the seal and insert an object such as a tongue depressor underneath to prevent the cup from resealing. Position the device in its new location and check the cups to ensure they are gripping the benchtop properly.

Kneewell To move the kneewell centrifuge, remove the rotor and accessories. Unlock the front casters and grasp the centrifuge by its side handles and wheel into position. Maneuver it backward to expose the locking casters again. Lock down the casters.

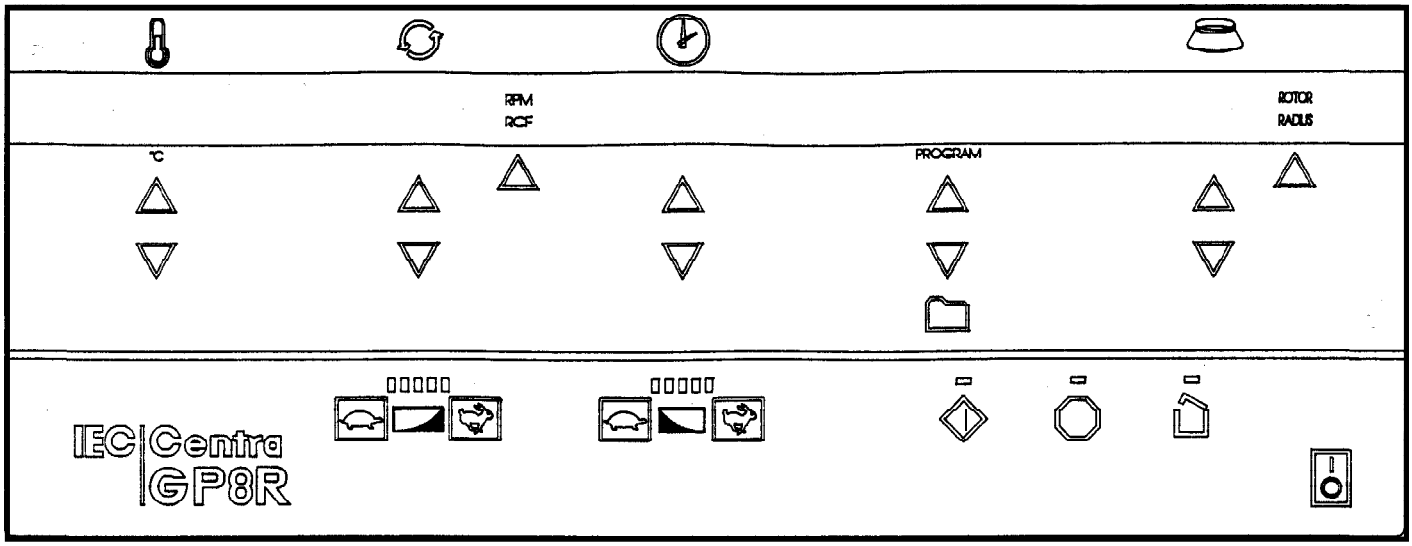
Warning: Lock the front wheels before starting a run to avoid dangerous movement.

Floor Model To move the floor model centrifuge, remove the rotor and accessories. Unlock the front casters and grasp the centrifuge by the corners of the cabinet and wheel into position. Maneuver it backward to expose the locking casters again. Lock down the casters.

Warning: Lock the front wheels before starting a run to avoid dangerous movement.

3 OPERATION

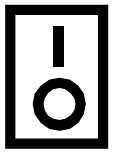
3.1 The Front Panel



FRONT PANEL OF THE CENTRA-GP8R

Run parameters are selected using the touch switches on the control panel. An audible beep signals when a switch has been pressed. The arrow keys are used to select the different parameters.

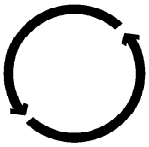
The Digital Display indicates both the actual and set parameters for rotor speed or g-force, run time, chamber temperature, program number and rotor number or rotor radius. The display normally operates at full brightness when indicating actual run conditions. However, the display dims when indicating set conditions, or while the arrow keys are being used to change parameters.



The On/Off button turns on the power to the display and to the refrigeration system (GP8R). The unit must be on to open the lid, or operate the controls.

Arrow keys are used to view or change the desired settings for temperature, RPM/RCF, time or rotor/radius. Pressing an arrow once changes the display momentarily from actual readings to the program settings. Pressing the arrow twice allows you to re-program the run parameters. To raise or lower a setting by one increment, press and release the appropriate arrow key. To adjust in greater increments, hold the arrow key down and the settings will change slowly at first and then accelerate. As you approach the proper setting, release the button and then press it repeatedly to select the exact setting. When a button is released for three seconds, the display returns to actual readings.

The number under this symbol represents temperature in whole degrees Celsius. This can be set between -5 and 40°C in 1° increments. The display range is -9 to 45° C, and the accuracy is ±1°C from 2°C to ambient. If the actual temperature is not within 5° of the set temperature when the run button is pressed, the run will start, a beep will sound for 1.5 seconds to alert the user, and the temperature display will alternate between the set point and the actual temperature until the chamber temperature is within 5° of the setting.



The display under this symbol indicates either the rotor speed (RPM), or the Relative Centrifugal Force (RCF). Speeds are shown in increments of 10 rpm. RCF is shown in 1xg increments below 100xg and 10xg increments above 100xg. Speed can be set between 500 and 6000 rpm in 10 rpm increments. RCF can be set in 1xg increments up to 100xg, and 10xg increments from 100xg to 4630xg. When entering speed, the last digit is fixed at zero and cannot be changed. The accuracy of the speed control is ±10 rpm.

RPM
RCF

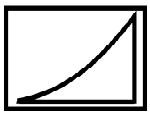
This button toggles between RPM and RCF. When RPM is selected, the speed indicator displays revolutions per minute. When RCF is selected, the speed indicator displays relative centrifugal force, and the rotor/radius indicator displays either the rotor number or the rotor radius. RCF is only indicated when a rotor number has been selected in the rotor/radius display.

Time can be set in 1 second intervals up to 59 seconds, 15 second intervals from 1 to 5 minutes, and 1 minute intervals from 5 to 360 minutes. During a run, the display indicates time remaining in minutes. Below 10 minutes, the time is displayed in minutes and seconds. The run timing accuracy is better than 10 milliseconds.

Two timing modes are available: Acc, for countdown to start at the beginning of acceleration; and SPd, for countdown to start when the rotor has reached 95% of set speed. Press the time down arrow key to scroll below zero. Acc or SPd will appear, indicating the current timing mode. Press and release the time down arrow key to toggle between Acc or SPd. With the correct timing mode in the time display, press the time up arrow key to select the run time. If the time up key is not pressed at this time, the originally programmed time will be retained. Acc and SPd only toggle when the down key is pressed. If a program has been recalled from memory, altered, and not saved, the manual timing mode is the same as the original program.

The rotor/radius display indicates either the selected rotor number or the rotor radius in centimeters. This display illuminates when the rotor is selected. The applicable IEC rotor numbers are supplied in the memory, along with their maximum or most common radius in centimeters. The key under rotor/radius toggles between the two. To select a rotor number, toggle to ROTOR and press an arrow key under the rotor display. To change the radius, toggle to RADIUS, and press an arrow key under the rotor display. Note that the radius cannot be changed to a radius larger than the maximum radius for that rotor. The display changes back to rotor number after three seconds.

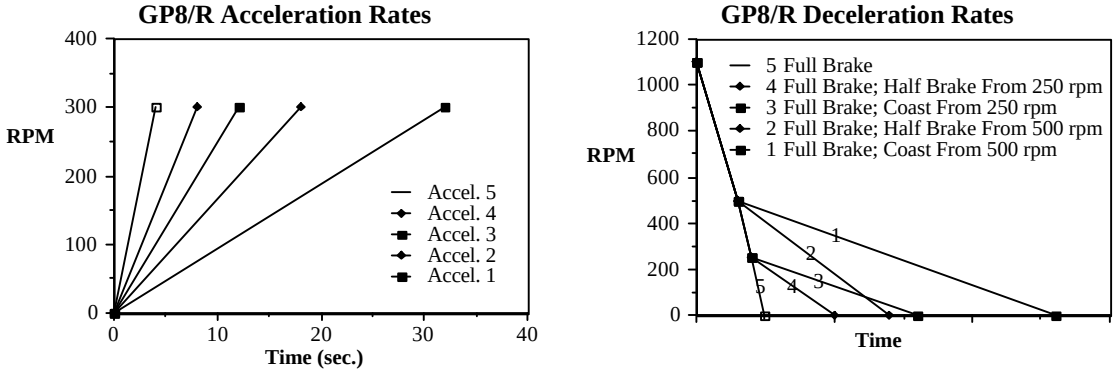
Gentle acceleration and braking can be selected when centrifuging delicate samples. The gentle settings prevent the mixing of density gradients and the breakup of pellets. The yellow acceleration and deceleration mode LED's indicate which rates have been chosen (one LED equals setting of 1-slow; five LEDs equals setting of 5-fast).



The tortoise and hare beside this symbol control rotor acceleration to 300 RPM. After 300 RPM, acceleration is always at maximum rate. Press the tortoise to decrease acceleration, the hare to increase. Five accel. profiles are available, ranging from fast acceleration, when all indicators are lit, to the slowest acceleration, when only one indicator is lit.

The tortoise and hare beside this symbol control rotor braking. Six brake profiles are available. Press the tortoise to decrease braking, the hare to increase. As each level is selected another indicator lights up until all indicators are lit. The sixth profile, coast from set speed, is indicated when all lights are out.

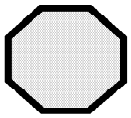
The profiles for acceleration and deceleration are shown in the graphs below. Press the tortoise and hare buttons to select the rates which are most appropriate for your application. For example, for delicate separations, use Accel 1 (slow) and a coast mode.



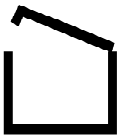
ACCELERATION AND DECELERATION RATES

This button saves the currently displayed setting as stored program 1 through 35. (see section 3.5)

This button starts a run, using the desired settings shown on the display panel. The associated green light blinks while the rotor approaches the set speed. Then the light stays on until the end of the run.



This button stops the run. (A run will also stop when the set time has elapsed.) The associated red light blinks as the rotor decelerates. (It also blinks if an error occurs; see section 3.7) The light stays on when the rotor stops. Three beeps signal that the rotor has stopped.



This button unlocks the cover. The button is inoperative during a run, and the cover will not unlock until the rotor speed is below 90 rpm. The cover must be closed to start a run. The associated yellow light is on whenever the cover is open.

3.2 Rotor and Accessories

Balance

A balanced load is essential for the safe operation of all centrifuges. An unbalanced load produces vibration and can damage the unit. A 2 gram load imbalance, at a speed of 4600 rpm, imparts a force equivalent to 9.1 kg at rest (20 pounds). Therefore, always make sure that the rotor is loaded symmetrically with a full complement of accessories, and with a full (or paired) set of tubes. Tube adapters should also be installed symmetrically.

IEC rotors are dynamically balanced at the factory. IEC matches removable parts (trunnion rings, shields, buckets and carriers) to within 1.0 gram, and stamps the weight on each piece. Check these markings whenever you interchange parts to ensure that opposite parts are matched in weight. The total weight of samples and removable parts loaded in opposing positions must be equal in weight to within 1.0 gram. The position numbers, present on many rotors and adapters, identify opposing tube positions.

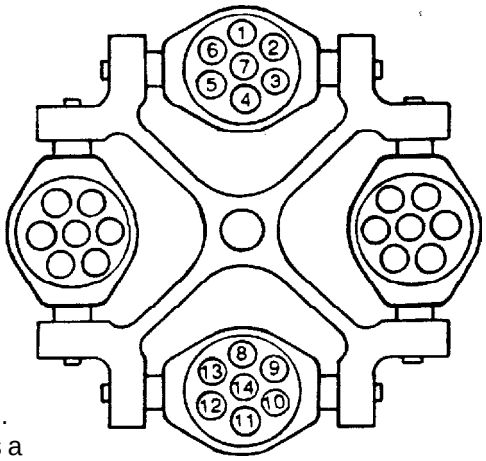
To obtain good dynamic balance, the opposite loads must not only be equal in mass, but must also have the same center of gravity. Opposing containers must be alike in shape, thickness and distribution of glass or plastic. This is especially important for large containers. Tubes loaded into swinging bucket rotors must likewise be symmetrical around the axis of rotation. Verify this by rotating the entire rotor 180° by hand: the loads should be in the same apparent positions (not in the mirror image). In addition, the loads within each bucket must also be symmetrical around the bucket's pivot axis. Verify this by ensuring that each bucket is loaded and doesn't tilt vertically when the rotor is at rest. Maintaining balance within each bucket ensures that the bucket and the tubes swing out horizontally when the rotor reaches operating speed, applying centrifugal force to the bottom of the tubes. Failure to achieve full swing-out causes vibration, premature wear and may resuspend samples.

For example, load tubes in the following manner:

1. Load four tubes.
   Positions 3, 6, 10, 13
   or 2,5,9,12
   or 1,4,8,11

2. Load six tubes.
   Positions 6,7,3,13,14,10
   or 5,7,2,12,14,9
   or 1,7,4,8,14,11

3. Load an odd number of tubes.
   Not recommended (unless a dummy tube is used for balance.)



Samples of different specific gravities may be processed in the same run, provided that the samples of a given type are balanced around the rotor as though they were the only ones in the rotor.

Vibration

All centrifuges have critical speeds at which vibration occurs. As the speed increases beyond the critical speed vibration will cease. This inherent condition also occurs during deceleration. An imbalanced load intensifies these critical vibrations. **Do not operate this centrifuge continuously at observed critical speeds.**

Rotor Installation

The rotors specified for this centrifuge are secured to the drive motor shaft by a hex nut which is tightened or loosened with the IEC Part No. 1787 wrench, which is supplied with the machine. Before placing the rotor onto the shaft, remove the hex nut, then be sure that the tapered hole in the rotor and the taper of the shaft are clean. Taking care not to damage the threads, carefully lower the rotor onto the shaft, then tighten the hex nut to secure the rotor to the motor shaft. **NOTE: Do not use any other tool to tighten the hex nut as overtightening could occur and the threads could be damaged.**

Rotor Removal

Use the IEC Part No. 1787 wrench to loosen the hex nut which holds the rotor to the shaft. Remove the nut by turning it counterclockwise. Use both hands to keep the rotor horizontal and pull the rotor up and off the shaft. Periodic lubrication of the taper with BLC (see Section 5.1) will assure easy rotor removal.

Adding Rotors

As new rotors are released by IEC, the rotor number and radius can be added to the rotor menu. To do so, press the hidden key located behind the “C” in IEC. Prog x.x will appear. Press RPM arrows until "rotor Add" appears. Press the file key and "Rotor" will appear next to the Rotor/ Radius display. Press an arrow key under the rotor display to select the new rotor number. Press the file key. "Radius" appears. Use arrow keys

to select maximum radius. Press file key again. "RPM" will be illuminated. Use the RPM arrow key to select the maximum RPM for the rotor. Push file again. Unit beeps three times to acknowledge addition of rotor. Press "C" in IEC to return to normal operation. Note: Up to five rotors may be added to memory. When the rotor memory is full, the unit displays "FUL" under the rotor symbol.

Deleting Rotors

Push "C" in IEC. Use RPM arrows to scroll to "rotor Add." Use the time arrows to select "dEL" instead of "Add." Press file key. "Rotor" appears. Use rotor arrows to select rotor to be deleted. Press file key to delete. Unit beeps three times to acknowledge deletion of rotor.

3.3 Starting and Stopping a Run

Install as described in Section 2 of this manual. Plug in the power cord. For models with a circuit breaker, ess the green button (see Section 2.3). Read section 3.1 for a general description of the front panel. The desired settings (press arrow key to display momentarily) shown on the front panel always govern the operation of the unit. The number or symbol displayed above the PROGRAM keys describes the operating mode of the unit. It's important that the unit be in the correct mode for the desired operation (see Section 3.4).

Starting A Run

Press the On/Off switch in the lower right corner of the front panel. The Front Panel displays the set parameters for Speed, Time, Temperature (GP8R), Program Number, and Acceleration and Deceleration (brake) settings and rotor number current when the machine was turned off. The stop indicator is illuminated showing that the machine is not running. After 3 seconds the display changes to the actual parameters.

Press the cover button to open the Centra-GP8, and install a rotor per rotor installation instructions. To close the cover, lower the centrifuge cover to approximately 6 inches open. With a slight flick of the wrist, firmly push down the cover so that the resulting momentum engages the latches. Since the GP8 series has a two-point interlock system, both mechanisms must be fully engaged for operation to proceed. If the run button is pressed when only one interlock is engaged, a "Lid" message will appear in the speed display. Should this occur, close the cover again. The yellow lid light turns off when the cover is fully latched.

Press the arrow keys twice to start changing each parameter. The key may be pressed repeatedly or held to increment the parameter. Press the accel or decel key to select the appropriate acceleration and braking rates. Press START. A three beep signal sounds, the start indicator blinks and the display changes to the set parameters. After 1.5 seconds the run starts and the display changes back to the actual run parameters. To view the set parameters for three seconds, press and release any arrow key at any time during a run.

Stopping A Run

A run will end when the set time expires, or press the stop button to end a run and begin deceleration as selected.

3.4 Operating Modes

The PROGRAM symbol can be one of the following *operating modes*:

blank: The unit is set to *manual operation*.

1-35: The unit is under control of the *stored program* with the number shown. (see Section 3.5)

C: The unit is set to *Rapid Condition*.

H: The unit is set to *hold mode*, in which it runs until you stop it.

These digits and symbols appear above the PROGRAM arrows when the arrows are pressed.

Whenever you change the unit's mode of operation, the rest of the front panel assumes the state it was in the last time that mode was selected.

Parameters may be changed during a run in manual mode or HOLD mode. Temperature and acceleration/deceleration settings can be changed during Rapid Condition. The centrifuge will adjust to the new run parameters when the display changes back to run mode 3 seconds after the last key is released.

Manual Operation

Press the PROGRAM keys until the PROGRAM display is blank. Next, select a desired temperature, rpm (or RCF, if rotor number is selected), run time, acceleration, rotor/radius, timing and deceleration modes. Then press START. The spin stops automatically at the end of the desired interval. To manually stop the spin, press the STOP button.

During manual operation, the MINUTES display counts down the remaining time in the current spin.

When the timing mode is ACC, the run time that you specify includes acceleration time and begins when you press the START button. When the timing mode is SPd, count down starts when 95% of set speed is reached. Deceleration begins when the specified time elapses.
You can change the settings during a manual run to affect the run in progress. If you change the time settings, the unit adjusts the display countdown accordingly. If the revised run time is less than the current time remaining, reducing the time setting may end the run. You cannot change the unit's program, rotor/radius, or timing modes during a spin.

Rapid Condition (GP8R Only)

When the chamber temperature is above the set temperature, RAPID CONDITION will run a rotor at 500 rpm to increase air circulation in the chamber to quickly cool the chamber to the set point. When the chamber temperature is below the set temperature, RAPID CONDITION will run the rotor at 3400 rpm to warm the chamber to the set temperature. When the temperature has been reached a three beep signal will sound and the rotor will brake to rest. (Some smaller rotors may not be able to warm the chamber to the higher temperature settings.)

Hold Mode In HOLD mode the centrifuge will run at the current settings for speed and temperature until the STOP button is pressed. The time display will count up until STOP is selected. The run time display is retained until the lid is opened and closed again. HOLD uses the current settings for acceleration and braking. Set parameters can be changed during a run in the HOLD mode.

3.5 Stored Programs

The Centra-GP8 series has an internal memory capable of holding 35 sets of run parameters. Each set, or program, is stored and can be recalled by selecting a program number (1-35). Programs are retained in memory even if the power is turned off. When necessary, a program can be modified for a particular run or changed permanently. You cannot change the unit's program, rotor/radius, or timing modes during a spin.

Locking Programs Programs can be locked from the program lock in the special function menu. Press the "C" in IEC. Use RPM arrows to scroll until "Loc P" is displayed. Use the program arrow keys to select the program to be locked. Pressing the following keys in the following order will lock or unlock a program: Start, Stop, Cover Open, Stop, Start and File (Save). The display will alternate between the program number and an "L" indicating that the values of the program are locked and cannot be changed.

Recall Program Press a program arrow key to select the appropriate program number. The programmed run parameters will be displayed and will become the set parameters. To begin this run, simply press START.

Add/Change Program Select a program number with the program arrow keys. The current program parameters will appear on the display. Modify the desired parameters using the parameter arrow keys, or the ACCEL or BRAKE switches. To make the changes permanent, press the PROGRAM SAVE (file folder) key. The program number will stop flashing, and the new program will be displayed and will remain in memory until further changes are made. To make changes temporary, press START without pressing the PROGRAM SAVE (file folder) key. The program display goes blank to indicate that the values are now stored in the manual program and the instrument is not operating from the program mode at this time. As long as the PROGRAM SAVE (file folder) key is not pressed, the original program remains unchanged.

3.6 Refrigeration (GP8R Only)

Whenever the cover is closed and the unit is switched ON, the rotor chamber is cooled as necessary to maintain the desired temperature setting. However, using the keyboard so that a cold temperature is momentarily displayed (for example, stepping through the stored programs) does not activate refrigeration.

If a temperature higher than ambient is specified, the unit does not heat the rotor chamber except through the normal heating effect of the equipment (i.e. rotor air friction).

If the rotor chamber is not at the temperature specified, it does not abort the spin. However, if the rotor chamber differs by 5°C or more from the specified temperature at the start of a run, the unit sounds an audible alarm. The °C display switches between the actual and programmed temperature until the two temperatures come within 5°C. This shows the reason for the alarm. Press the STOP button if the run should not continue at the actual temperature.

The unit is not designed for use as a refrigerator. The natural fanning action of the rotating horizontal and fixed angle rotors serves to maintain a uniform temperature distribution inside the chamber. Therefore, at zero RPM, set and actual chamber temperatures may be different.

3.7 Fail-Safe Systems

Interlock: Lid cannot be opened when motor is energized or when rotor speed exceeds 90 rpm. The lid latch is a mechanical latch opened by momentary engagement of a solenoid. In the event of a power failure, the door latch can be actuated with a tool for sample recovery.

User Diagnostics: Warning messages will appear in the display and seven beeps will sound to alert the user of conditions that require attention:

bAL This message appears in the time display when an imbalanced rotor is run. The rotor decelerates with full brake to rest. The cover must be opened to reset this warning.

LId This message appears in the time display If the lid is not fully closed when START is pressed.

HEAd This message warns that a run has been started with no rotor in the chamber. The cover must be opened to reset this warning.

PFAIL A power failure was detected during a run. Rotor will be stopped at programmed deceleration when power is restored. This warning is cleared by opening the cover.

bruSh This message appears (every 800 hours of use) at the end of every run if it is time to check or change the brushes.

Error Codes: Software will monitor and provide appropriate control, including front panel error messages in the time display, when any of the following conditions occur:

Error 001: No tachometer
Error 002: Overspeed
Error 003: Runaway
Error 004: Chamber temperature in excess of 45°C.
Error 005: Fail-safe time-out
Error 006: COP Watchdog/Op-Code Trap error
Error 007: Stack error
Error 008: No COP - COP watchdog system not active
Error 009: Undefined interrupt

4 ACCESSORIES

4.1 Speed And Force Tables

ROTOR 216 4-place Swinging Bucket Rotor (includes four Cat. No. 316S buckets)						
No. of Places	Tube Volume (ml)	Adapter Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
148	0.25/0.4	5737	3400	2400	18.6	0.25/0.4 microtubes
148	0.5/0.7	5737	3400	1890	14.6	0.5 microtubes/B-D Microtainers
148	5	5737	3400	2440	18.9	12.4x91
108	1.5	5827	3400	1940	15.0	1.5 microtubes
108	7-10	5827	3400	2440	18.9	14.5x130
76	10-20	5719	3400	2440	18.9	18.0x130
36	15	5719	3400	2440	18.9	Falcon/Corning plastic conical
28	40-50	5707	3400	2440	18.9	29.6x130
28	50	5807	3400	2070-2460	16-19	29.5x115
20	50	5805	3400	2390	18.5	29.6x126
12	15	5703w/7323	3400	2430	18.8	17.4x126
12	50	5703w/323	3400	2460	19.0	29.4x118
8	50	5704	3400	2380	18.4	29.5x125
8	100	5704	3400	2530	19.6	44.8x136
4	140	5780	3400	2460	19.0	63.4x143
4	250	5780	3400	2550	19.7	63.4x138
4	500	5781	3400	2530	19.6	77.1x145
4	750	-	3400	2550	19.7	98.3x138
4	Blood Bags	2039	3400	2520	19.5	Single, double pack bags
4	Micro-plates	5782	3400	2210	17.1	86Wx128L
4	Cyto-slides	5799w/1024	1500	480	19.0	25Wx75L

Rotor 218A 4-place Swinging Bucket Rotor
(includes windshield, cover and four cat. no. 3218 buckets)

No. of Places	Tube Volume (ml)	Adapter Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
148	0.25	5737	4600	3850	16.3	0.25 microtube
148	0.4	5737	4600	4300	18.2	0.4 microtube
148	0.5	5737	4600	4260	18.0	B-D Microtainer
108	1.5	5827	4600	4140	17.5	1.5/2.0 microtube
76	4	5719	4600	4330	18.3	18.0x65
148	3-5	5737	4600	4330	18.3	12.4x118
108	7-10	5827	4600	4330	18.3	14.5x118
76	10-15	5719	4600	4330	18.3	18.0x118
24	15	5719	4600	4330	18.3	18.0x127
48	15	5712	4600	4330	18.3	Falcon/Corning Conical
24	15	5712	4600	4330	18.3	Falcon/Corning Conical
12	12	5703	4600	4330	18.3	Falcon/Corning Conical
12	15	5703	4600	4400	18.6	17.5x126
28	40-50	5707	4600	4330	18.3	29.6x118
20	50	5805	4600	4470	18.9	Falcon/Corning Conical
12	50	5703	4600	4400	18.6	Falcon/Corning Conical
12	40-50	5703	4600	4400	18.6	29.4x118
4	140	5780	4600	4450	18.8	63.4x139
4	200	5780	4600	4470	18.9	63.4x137
4	175/225	5780	4600	4470	18.9	63.4x139
4	250	5780	4600	4550	19.2	63.4x139
4	500	5781	4600	4550	19.2	77.3x145
4	Blood Bags	2077	4600	4470	18.9	Single, double pack
4	750	-	4600	4550	19.2	98.4x140
4	Plates	5784	4000	2650	14.8	86x128
4	Slides	5799	1500	460	18.4	Microscope slides

ROTOR 228 4-place Swinging Bucket Rotor (includes four Cat. No. 377S sealed buckets)						
No. of Places	Tube Volume (ml)	Adapter Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
148	0.25/0.4	5737	3400	2350	18.2	0.25/0.4 microtubes
148	0.5/0.7	5737	3400	1830	14.2	0.5 microtubes/B-D Microtainers
148	5	5737	3400	2390	18.5	12.4x91
108	1.5	5827	3400	1940	15.0	1.5 microtubes
108	7-10	5827	3400	2390	18.5	14.5x130
76	10-20	5719	3400	2390	18.5	18.0x130
36	15	5719	3400	2390	18.5	Falcon/Corning plastic conical
28	40-50	5707	3400	2390	18.5	29.6x130
28	50	5807	3400	2000-2400	16-19	29.5x115
20	50	5805	3400	2340	18.1	29.6x126
12	15	5703w/7323	3400	2380	18.4	17.4x126
12	50	5703w/323	3400	2400	18.6	29.4x118
4	140	5780	3400	2400	18.6	63.4x143
4	250	5780	3400	2500	19.3	63.4x138
4	500	5781	3400	2480	19.2	77.1x145
4	750	-	3400	2500	19.3	98.3x138
4	Blood Bags	2039	3400	2480	19.3	Single, double pack bags
4	Micro-plates	5782	3400	2210	17.1	86Wx128L
4	Cyto-slides	5799w/1024	1500	480	19.0	25Wx75L

ROTOR 269 Swinging Bucket Rotor						
No. of Places	Tube Volume (ml)	Trunnion/ Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
64	5-7	- / 381	3400	2310	17.9	13.6x108
48	10	- / 380	3400	2310	17.9	17.7x108
24	15	366/1013	3600	2470	17.0	16.4x133
8	50	325/320	3800	3200	19.8	30.0x145
8	50	350/323	3700	3030	19.8	29.4x120
8	Slides	- / 1024	1600	425	14.8	Microscope Slides

ROTOR 284 4-place Swinging Bucket Rotor
(Requires four Catalog No. 384S cups, adapters, tubes or l

No. of Places	Tube Volume (ml)	Adapter Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
28	1.5	7228	3800	3080	19.1	1.5 microtube
60	3	7228	3800	3080	19.1	10.9x75
48	5	7226	3800	3080	19.1	12.1x137
40	7-10	7236	3800	3080	19.1	13.3x137
28	7-12	7225	3800	3080	19.1	16.2x137
28	10-15	7224	3800	3080	19.1	16.2x137
16	15	7230	3800	3150	19.5	17.0x130
12	30	7223	3800	3080	19.1	25.5x137
40	50	7231	3800	3080	19.1	29.5x135
4	75	7221	3800	3080	19.1	38.1x137
4	150	7220	3800	3160	19.6	52.2x143
4	140	-	3800	3080	19.1	63.4x138
4	250	-	3800	3200	19.8	63.4x144

ROTOR 811A Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
20	20	306	4600	3950/ 3500	16.7/14.8	17.2x172
20	15	302	5300	4370/ 3425	13.9/10.9	17.2x129
20	10	303	5500	4260/ 3620	12.6/10.7	17.2x114
20	7	356	5600	4000/ 3330	11.4/9.5	17.2x99

ROTOR 822A Fixed Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
12	50	305	4800	4025	15.6	30.0x138
12	50	320	5400	4630	14.2	30.0x118

ROTOR 825A Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
8	100	340	4100	3500	18.6	33.2x195
8	60	341	4700	4420	17.9	33.2x175
8	50	1124	4900	4080	15.2	29.5x133
8	50	323	5100	4190	14.4	29.5x120

ROTOR 831A Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
36	15	302	4600	4090/ 2175	17.3/9.2	17.2x140
36	10	303	5100	4650/ 4100	16.0/14.1	17.2x122
36	7	356	4800	3840/ 2675	14.9/10.4	17.2x102

ROTOR 832A Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
14	100	340	3700	3030	19.8	33.2x165
14	60	341	4400	3980	18.4	33.2x146

ROTOR 838 Angle Rotor (45°)

No. of Places	Tube Volume (ml)	Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
60	15	303	3700	3000/ 1850	19.6/ 7.2	17.2x126
60	10	356	4800	4740/ 3025	18.4/ 11.7	17.2x114

ROTOR 921 Swinging Bucket Rotor						
No. of Places	Tube Volume (ml)	Trunnion/ Shield Number	Maximum Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Max Tube Size O.D. x Length (mm)
48	5-7	- / 381	4400	3250	15.0	13.6x102
36	10	- / 398	3500	2290	16.7	17.7x112
18	15	355/303	3700	2690	17.6	17.2x135
12	50	326/320	4100	3190	17.0	30.0x127
12	50	326/305	3500	2620	19.1	30.0x147
6	50	325/320	4600	4000	17.0	30.0x130
6	50	350/323	4400	3680	17.0	29.4x120
6	50	350/1124	4300	3680	17.8	29.4x133
6	Slides	- / 1024	1800	500	13.8	Microscope Slides

4.2 Derating Table for Dense Samples

The Speed and Force Table lists the maximum speed for each rotor/adapter combination in the Centra-GP8. Faster speeds impose unnecessary wear on the motor and may cause damage to the rotor.

These speeds are guaranteed only with samples whose specific gravity is not greater than:

1.2 for swinging bucket rotors
1.5 for fixed angle rotors

For denser samples, the maximum allowed speed is reduced (derated) by a factor from the table below:

	Derating Factor for:	
Specific Gravity	Swinging Bucket	Fixed Angle
1.2	1	1
1.3	.960	1
1.4	.925	1
1.5	.894	1
1.6	.866	.967
1.7	.839	.939
1.8	.816	.912
1.9	.794	.888
2.0	.774	.866
2.1	.755	.844
2.2	.738	.825
2.3	.721	.807
2.4	.707	.790
2.5	.692	.774
2.6	.678	.758
2.7	.666	.744
2.8	.654	.731
2.9	.642	.719
3.0	.632	.707

Example. An angle rotor rated for 10,000 rpm, used with samples with a specific gravity of 1.6, cannot spin faster than (10,000 x .967 =) 9,670 rpm.

Specific gravities greater than 3.0. This table is based on the formula:

$$\check{s}(s_0/s_a)$$

...where s_0 is the maximum specific gravity allowed before derating (1.2 or 1.5, depending on the type of rotor), and s_a is the actual specific gravity of the sample in question. You can use the same formula to compute derating factors for specific gravities greater than 3.0.

4.3 Chemical Resistance Table

	Plastic										Metal					Other			
	PA	PC	PE	PP	PU	NL	DN	CN	NN	PS	TI	SS	AL	MB	MG	RR	BN	VN	PF
Acids, dilute or weak	E	E	E	E	G	E	F	N	F	E	G	G	F	F	N	F	E	E	E
Acids*, strong or conc.	E	N	E	E	F	N	N	N	N	F	N	N	N	N	N	N	F	G	N
Alcohols, aliphatic	E	G	E	E	F	E	E	E	N	E	E	E	E	E	F	E	E	G	E
Aldehydes	G	F	G	G	G	G	G	G	F	N	E	E	E	E	E	E	N	E	E
Bases	E	N	E	E	N	G	N	G	F	E	E	E	E	E	E	G	G	N	N
Esters	G	N	G	G	N	E	G	G	E	N	E	E	E	E	E	N	N	N	E
Hydrocarbons, aliphatic	G	F	G	G	E	N	E	E	E	N	E	E	E	E	E	N	E	E	E
Hydrocarbons, aromatic	F	N	G	F	N	N	E	E	E	N	E	E	E	E	E	N	N	E	E
Hydrocarbons, halogenated	F	N	F	F	N	N	G	E	G	N	E	E	E	E	N	N	N	F	E
Ketones	G	N	G	G	N	N	E	E	E	N	E	G	G	G	E	N	N	N	E
Oxidizing Agents, strong	F	N	F	F	N	N	N	N	N	N	E	F	N	N	N	N	F	E	E
Salts	E	E	E	E	E	E	E	E	E	E	E	F	F	F	N	E	E	E	E

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER
PC - POLYCARBONATE
PE - POLYETHYLENE
PP - POLYPROPYLENE
PU - POLYURETHANE
NL - MODIFIED PHENYLENE OXIDE (NORYL)
DN - ACETAL HOMOPOLYMER (DELRIN)
CN - ACETAL COPOLYMER (CELCON)
NN - NYLON
PS - POLYSTYRENE

TI - TITANIUM
SS - STAINLESS STEEL
AL - ALUMINUM
MB - MANGANESE BRONZE
MG - MAGNESIUM
RR - RUBBER
BN - BUNA-N
VN - VITON
PF - PHENOLIC FIBER

Classification of Resistance

E= Excellent
G= Good
F= Fair
N= Not Recommended

4.4 Decontamination Table

Compatible Processes For Decontamination																				
Sterilization Methods	Plastic										Metal					Other				
	PA	**PC**	**PE**	**PP**	**PU**	**NL**	**DN**	**CN**	**NN**	**PS**	**TI**	**SS**	**AL**	**MB**	**MG**	**RR**	**BN**	**VN**	**PF**	**PT**
Mechanical																				
Autoclave*	S	M	U	S	M	U	S	S	S	U	S	S	S	S	S	S	S	M	S	M
Ethylene Oxide Gas	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	U	S	S	S
Dry Heat (2Hrs. @ 160°C)	U	U	U	U	U	U	U	U	U	U	S	S	U	S	S	U	U	U	U	U
Chemical																				
Ethanol	S	S	S	S	U	S	S	S	U	M	S	S	S	S	S	S	S	S	S	S
40% Formalin	S	S	S	S	U	S	S	S	S	U	S	S	S	S	S	S	U	S	S	S
Methanol	S	M	S	S	M	S	S	S	U	M	S	S	S	S	S	S	S	U	S	S
2-Propanol	S	S	S	S	M	S	S	S	U	S	S	S	S	S	M	S	S	S	S	S
.5% Sodium Hypochlorite**	S	S	S	S	U	S	U	U	U	S	S	M	U	U	U	S	U	S	S	M
3% Hydrogen Peroxide	S	S	S	S	S	S	M	S	U	S	S	S	S	S	U	S	S	S	S	M
100% Hydrogen Peroxide	S	S	S	S	S	U	U	U	U	S	S	S	S	S	S	U	U	S	S	U
5% Phenol Solution	M	U	U	S	U	U	M	M	U	M	M	M	M	M	M	M	U	S	S	U

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER
PC - POLYCARBONATE
PE - POLYETHYLENE
PP - POLYPROPYLENE
PU - POLYURETHANE
NL - MODIFIED PHENYLENE OXIDE (NORYL)
DN - ACETAL HOMOPOLYMER (DELRIN)
CN - ACETAL COPOLYMER (CELCON)
NN - NYLON
PS - POLYSTYRENE

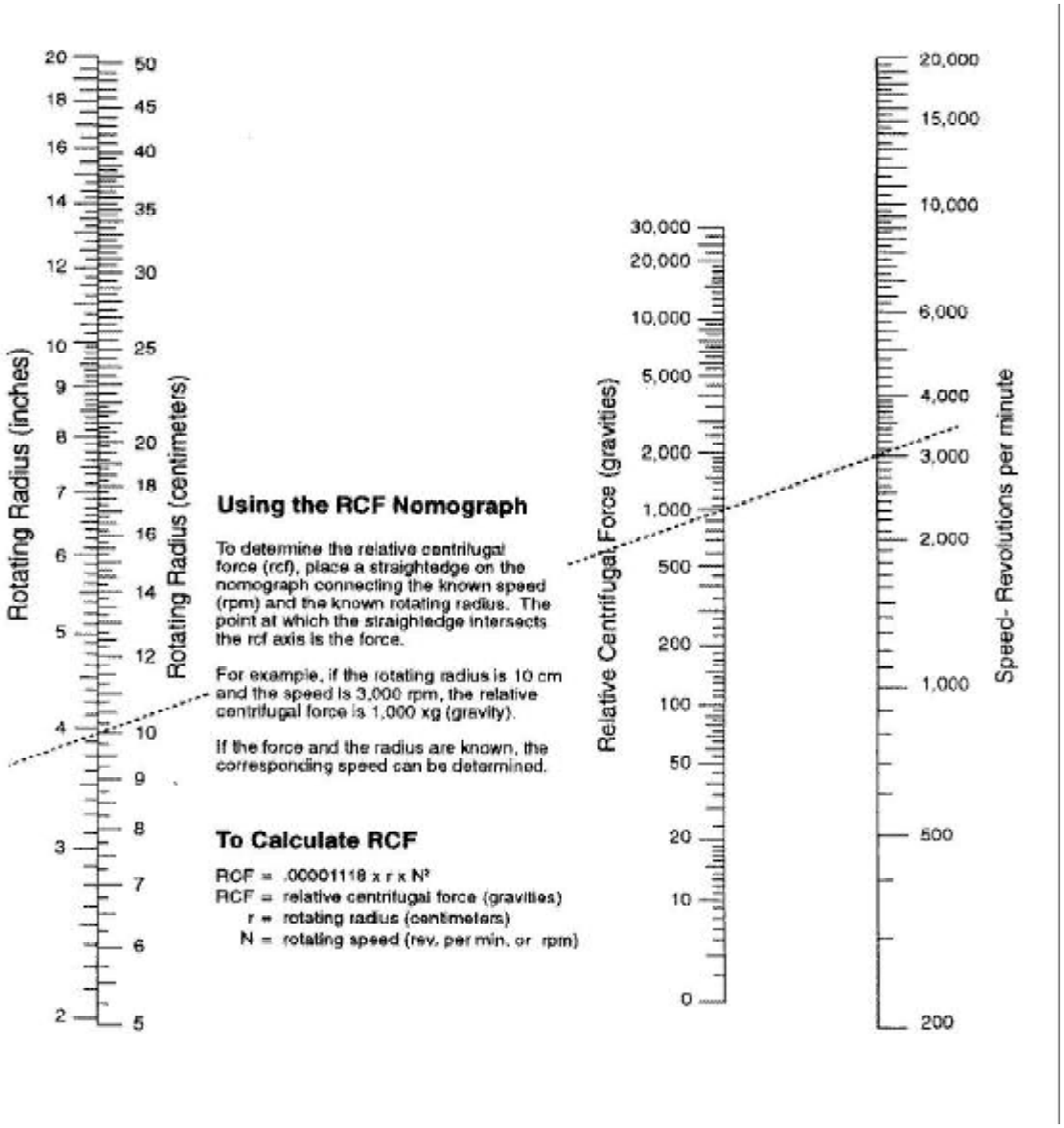
TI - TITANIUM
SS - STAINLESS STEEL
AL - ALUMINUM
MB - MANGANESE BRONZE
MG - MAGNESIUM
RR - RUBBER
BN - BUNA-N
VN - VITON
PF - PHENOLIC FIBER
PT - PAINTED SURFACES

*Autoclaving
121°C for 20 min.
@ 2 ATM (15 PSIG)
**1 to 10 Dilution of
Household Bleach

S=SATISFACTORY
M=MARGINAL
U=UNSATISFACTORY

Warning:
This chart describes the material compatibility of various sterilization methods. It does not specify the adequacy of sterilization. Refer to section 4.4 - **Chemical Resistance Table**, for material compatibility during centrifugation.

4.5 Nomograph



5 MAINTENANCE

5.1 Cleaning

Keep your centrifuge clean to ensure good operation and to extend its life. Clean the entire sample chamber, rotor, and lid at the end of each workday, and also right after any spill.

To clean the sample chamber, use a damp sponge, warm water, and a mild liquid detergent suitable for washing dishes by hand, such as Ivory® liquid. Do not use caustic detergents or detergents that contain chlorine ions, since these attack metals. Remove stubborn stains with a plastic scrub pad. Do not use steel wool, wire brushes, abrasives, or sandpaper, since they create corrosion sites. **Never pour water directly into the centrifuge bowl.** Scrub the rotor's tube cavities with a stiff test-tube brush that has end bristles and a non-metallic tip. After cleaning any part, dry it properly, preferably using a clean, absorbent towel.

If glass breakage occurs, remove all broken pieces immediately. Glass particles, if present in the chamber, will be ground into a fine grey dust during centrifugation. If glass breakage recurs it is recommended that all adapters and cushions be replaced. Particles of broken glass become imbedded in the plastic or rubber accessories. These particles can come in contact with new glass tubes, creating a pressure point which may result in recurring glass breakage.

Cleaning swinging bucket rotors is necessary to ensure that the buckets can pivot freely. Periodically manipulate each bucket; if you feel resistance or hear squeaking, lubricate all buckets with Bonded Lubricant Coating (BLC), IEC Part No. 7133. Use the following cleaning and lubrication procedure:

1. Wipe the old lubricant from all rotor pins and buckets with a soft, clean, lint-free cloth saturated with solvent such as trichloroethylene.

2. Clean the rotor and buckets as described above. The cleaning step is important because BLC only adheres to a clean surface. If you are unable to remove foreign matter in this way, contact an authorized IEC Service Representative.

3. Shake the bottle of BLC vigorously until all the gray sediment at the bottom of the bottle is dispersed.

4. Use the brush applicator cap to apply a light coating of BLC to the bucket slots only. Do not lubricate the pins. Lubricant will move around the pins during a spin.

5. Give the BLC 1 to 2 minutes to dry. Buff the bucket slots vigorously with a soft, clean, lint-free cloth. Continue until no more BLC rubs off onto the cloth. The surface will be a shiny, light gray.

Corrosion

IEC manufactures and finishes rotors and structural accessories to give maximum resistance to corrosion. However, maximum equipment life requires that you continually inspect the rotor cavities for corrosion, especially after using chloride ion solutions, such as sodium chloride (saline), and sodium hypochlorite (household bleach). These solutions attack most metals. Clean the rotor, rotor chamber, and accessories (particularly the sample compartments and bucket cups) thoroughly after each such use. Inspect all surfaces under bright light for corrosion; small crevices will grow deeper and cause failure.

If you see any corrosion, remove it immediately as follows:

1. Follow the cleaning procedure at the start of this section. Soak the part in the mild hand-dishwashing detergent. Scrub the part thoroughly with a stiff test-tube brush having end bristles and a non-metallic tip.

2. Soak the part again in clear warm water for at least an hour.

3. Rinse the part thoroughly in warm water first, then in distilled water.

4. Dry the part thoroughly with a clean, absorbent cloth.

5. **If this procedure does not remove the corrosion, discontinue use of the part.**

Storage

Store parts on a soft surface to avoid damaging finished surfaces. Rotors and other parts should be clean and dry for storage. Store them open to the atmosphere, not in a plastic bag, so that any residual moisture will evaporate. The parts should face downward to avoid retaining moisture in the cavities.

Decontamination

Decontamination is called for if tube breakage occurs and infectious, pathogenic, or radioactive material is released into the unit. Some rotors totally contain the sample tubes. In this case, spillage is usually confined to the rotor. If so, it may be sufficient to decontaminate the rotor. The Decontamination Table lists the sensitivity of various materials to common sterilization procedures. When using a 1-to-10 dilution of household bleach (sodium hypochlorite) to decontaminate the chamber, metal rotors or accessories, follow decontamination by the corrosion cleaning procedure given earlier, since chloride ions attack most metals.

Always decontaminate for the minimum recommended time. If you observe corrosion, remove it as described earlier, discontinue use of the method, and use an alternate decontamination procedure.

Repeated autoclaving will seriously degrade the performance of polycarbonate materials.

5.2 Cover Interlock Bypass

If power fails, the cover remains locked. If you need to remove samples from the unit before power is restored, use the cover interlock bypass after the rotor has come to a stop.

Ensuring that the rotor has stopped, unplug the centrifuge. Locate a hidden plug just below the front panel. Use a screwdriver to remove this plug. Pull the attached cord to release the cover interlock. Listen for both interlocks to release before opening the cover. Reassemble the plug in the hole.

Do not perform this operation routinely. The centrifuge's cover interlock provides operator safety and allows the cover to be opened promptly whenever rotation has stopped.

5.3 Calibration

The built-in, independent digital tachometer in your centrifuge is calibrated by IEC according to standards that are traceable to the U.S. National Institute of Standards and Technology (NIST). The built-in tachometer uses crystal standards that do not drift. Therefore, IEC recommends verifying the RPM indicator once every 24 months. This can be done easily using an optical tachometer through the clear plastic viewport in the lid. If this measurement indicates instrument tachometer failure, please notify IEC Technical Service.

5.4 Brush Replacement

1. Unplug the centrifuge line cord. Remove rotor and accessories. Unscrew the 6 screws retaining the motor boot and remove the boot.

2. Identify both brush caps which are located on the upper sides of the drive motor.

3. Use a screwdriver to remove the brush caps. Be careful not to drop any parts down into the motor chamber.

4. Carefully remove the brushes and inspect them. Each brush is complete with a carbon contactor, a spring, a copper connector wire and an end cap. Brush contactors should be replaced when less than 6mm (1/4 in) long.

Caution: The commutator revolves in a counterclockwise direction as viewed from above. If original brushes are reused, they must be inserted in the same position from which they were removed to assure satisfactory motor operation. The trailing edge of the brush may be identified by the presence of a dark deposit of carbon along the side of the brush adjacent to that edge.

6. Inspect the brush to be installed. Use IEC brushes only (part number 49801). Brushes must not be damaged or have broken copper connector wires. The spring should not be broken. Insert each brush into the holder and align end caps to rectangular slot. Screw in brush caps carefully. Ensure that end caps freely engage the brush holder.

7. Replace the motor boot. Plug in centrifuge line cord.

8. Reset the brush counter. Press the hidden key located behind the "C" in IEC on the front control panel. Use the RPM arrows to scroll through the special functions menu until the word "brush" appears. Also displayed will be a number indicating the hours that have passed since the counter was last reset. Press the file key to reset this to zero. Press the hidden key again to escape the special functions menu and return to normal operation.

Important: When replacing brushes, order a spare set (part number 49801).

5.5 Warranty

IEC wants you to be satisfied with the quality of your Centra-GP8 or Centra-GP8R centrifuge. We guarantee your IEC centrifuge for one year and IEC rotors for seven years. We will repair or replace any of these products that fail, within this period from the date of its delivery, due to defects in material and workmanship, and we will ship you the repaired product or its replacement at our expense. You must use IEC-approved accessories and genuine IEC spare parts. This warranty does not apply to any instrument that has been abused or repaired without authorization.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE, AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BY LAW. THE FOREGOING STATES OUR ENTIRE AND EXCLUSIVE LIABILITY, AND BUYER'S EXCLUSIVE REMEDY, FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION, OR OPERATION. IEC WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE PURCHASE PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. IN SOME INSTANCES, UNITS MAY CONTAIN RECONDITIONED (AS NEW) PARTS.

5.6 Condition of Returned Equipment

Before returning equipment to IEC, you must contact IEC's or your dealer's service department to obtain a return goods authorization (RGA). **All returned units must be decontaminated, free of radioactivity, and free of hazardous and infectious materials.** The RGA paperwork includes a certificate for you to sign indicating that you have performed these steps. IEC will not accept the shipment unless this signed certificate accompanies it.

You must prepay transportation to the service depot.

5.7 Table of Spare Parts

GP8 and GP8(K) -- 3121, 3123 and 3127

50058	Fuse 16A (100, 120 V)
9946	Fuse 6.3A (220, 240 V)
47114	Rotor Locking Nut
1787	Rotor Locking Wrench
7133	Bonded Lubricant Coating (BLC)
49801	Brushes (pair)
43177	Line Cord (Domestic)
43312	Line Cord (International)
65436A	5/16 Magnetic Socket

GP8R and GP8R(K) -- 3122, 3124 and 3128

47114	Rotor Locking Nut
1787	Rotor Locking Wrench
7133	Bonded Lubricant Coating (BLC)
49801	Brushes (pair)
43177	Line Cord
65436A	5/16 Magnetic Socket

GP8R and GP8R(K) -- 3125, 3126 and 3129

50058	Fuse 16A
47114	Rotor Locking Nut
1787	Rotor Locking Wrench
7133	Bonded Lubricant Coating (BLC)
49801	Brushes (pair)
43177	Line Cord (Domestic)
43312	Line Cord (International)
65436A	5/16 Magnetic Socket

5.8 Fuses Not Replaceable By The Operator

Three internal fuses are not replaceable by the operator.
These fuses should only be replaced by qualified service personnel.

F1	12.5A	T	250V
F2	6.3A	T	250V
F3	1A	FAST	125V

6 SPECIFICATIONS

Maximum Speed:	5600 rpm (811A angle rotor) 4600 rpm (218 windshield rotor) 3400 rpm (216 horizontal rotor)
Maximum Force:	4630 xg (822A)
Maximum Capacity:	3000 ml (216/218/228 rotors)
Refrigeration System:	Sealed 1/2 hp compressor to maintain guard bowl at 2°C at full speed with 218 rotor. Refrigerant is R-22.
Heat Output:	GP8 630 Watt (2150 BTU/hr.) (typical) GP8R 880 Watt (3000 BTU/hr.) (typical)
Power Requirements:	100,120, 220, 240VAC +/- 10%, 50/60 Hz

Dimensions:	GP8	GP8R	GP8R(K)	GP8R(F)
a. Cover open:	36 in.	36 in.	45 in.	54 in.
b. Cover closed:	17 in.	17 in.	26 in.	35 in.
c. Width:	23 in.	30 in.	23 in.	23 in.
d. Depth:	24 in.	24 in.	27 in.	27 in.

Shipping Weight:	
GP8	200 lbs.
GP8R	270 lbs.
GP8(K)	240 lbs.
GP8R(K)	280 lbs.
GP8(F)	375 lbs.
GP8R(F)	375 lbs.

Ordering Information:

3121 - GP8 -100/120/220/240 Vac, 50/60 Hz, 10 A
3122 - GP8R -120 Vac, 60 Hz, 15 A
3123 - GP8(K) - 100/120/220/240 Vac, 50/60 Hz, 10 A
3124 - GP8R(K) -120 Vac, 60 Hz, 15 A
3125 - GP8R -200/220/240 Vac, 50/60 Hz, 10 A
3126 - GP8R(K) -200/220/240 Vac, 50/60 Hz, 10 A

Viewport in cover for speed verification

Specifications subject to change without notice.

7 SERVICE

7.1 Warnings and Cautions

Warnings: The following hazards exist in servicing the Centra GP8 and Centra GP8R:

The unit uses AC power, and some of the service procedures require operation with the cabinet or control panel off, exposing power lines. This introduces the risk of electrical shocks. Do not touch exposed wires without first unplugging the unit. **There is no power switch that provides a safe alternative to unplugging the unit.** The On/Off switch on the control panel activates the control panel, and the refrigeration unit of the GP8R. Turning this switch off does not remove power from the circuit board or any other internal components. Some components on the circuit board operate at high voltage. Do not touch components on the board when the power cord is plugged in.

The Centra GP8R uses pressurized refrigerant gases that are potential asphyxiants. All maintenance on the refrigeration unit should be performed in a well-ventilated area. If it becomes necessary to discharge or recharge the refrigeration system, this operation should be performed only by specially trained personnel with proper recovery systems.

Cautions: An additional hazard to the equipment is as follows:

The circuit board contains electronics that can be damaged by static electricity. Persons doing extensive maintenance on the circuit board, or removing individual components from the circuit board, should be grounded (such as by wearing a wrist strap). When shipping a circuit board, always enclose it in a static-protective bag.

7.2 Special Tools

Most service work on these units can be performed with common tools. A multimeter is required to utilize the troubleshooting techniques in this manual.

7.3 Troubleshooting

A microprocessor inside the Centra GP8 and Centra GP8R monitors operation of the unit, including the rotational speed of the rotor. Most frequently, the unit detects trouble and responds with a warning message or error code.

- Alphabetic warning messages indicate improper operation. Normally, the user corrects the improper situation as outlined in the Operator's Manual, clearing the warning. If a warning recurs and there was no improper operation, call your authorized service representative. Warning messages are discussed in Section 3.7.

- Numeric error codes virtually always require that the unit be serviced. Error codes can be cleared by unplugging the unit. If an error code recurs, call your authorized service representative. Error codes are discussed in Section 3.7.

8 CABINET

8.1 Control Panel Removal

After unplugging the unit, removal of the control panel allows access to many internal components. It is easily removed using a Phillips head and a flat screwdriver. The Centra GP8R will have a small panel on the right side which must be removed prior to removal of the main panel. Remove the two screws in the face of the panel using the Phillips head screwdriver. Both lower sides of the panel have slots. Place the flat screwdriver tip in these slots, and gently pull the handle towards you. This frees the pins that hold the bottom of the panel in place. **Take care to avoid cosmetic damage to the unit.** The panel is secured to the top of the unit by 3 pins across the top. To remove it, grasp the panel by its bottom corners and pull toward you.

8.2 Cabinet Housing Removal

Before removing the cabinet housing, the front control panel must first be removed (see Section 8.1) and all the harnesses to it disconnected.

#10 bolts secure the cabinet housing to the base on these units. Along the bottom of each side there are 3, and below the front control panel area, and in the rear, there are 3 on the GP8 and 4 on the GP8R. They are removed using a 5/16 inch wrench. The cabinet housing lifts off of the base taking the cover and interlock assemblies with it.

8.3 Interlock Switches

The interlock switches sense the status of the cover, open or closed, in order to disable the start of a run with the cover open. The switches are part of the interlock assemblies. Service of the switches is required if the **LId** warning message recurs at the start of a run, even though the cover is closed.

To test the switches, unplug the unit and remove the front control panel. (see Section 8.1) The interlock assemblies are enclosed in metal casing located in the top corners of the unit. Follow the interlock harnesses to connector J1 of the circuit board. (labeled LATCH on the board).

Disconnect the harness and measure resistance across pins 1 and 2 (VIO and RED). With the cover open, the circuit should be open. With the cover securely closed, the circuit should have some resistance. Pull the cord to bypass the Cover Interlock (see Section 5.2) and open the cover for testing. If the switch does not exhibit these characteristics one or both of the interlock assemblies may require replacement. To determine which may be bad, disconnect the harnesses at the interlocks (J/P9 and J/P12). Measure the resistance across pins 2 and 6 of each interlock. With the cover open, each circuit should be open, and with the cover closed, there should be some resistance. Replace either interlock if does not exhibit these characteristics.

8.4 Cover Interlock

When the cover is closed, mechanical latches lock it in place. Once the rotor has stopped, pressing the cover open button energizes solenoids which release the latches.

Service of the interlock assemblies are required if the cover will not release, or if the cover can be opened during a run.

Testing

To test the interlocks use the following procedure. It requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1 Cautions)**.

Disconnect the harnesses at the interlock assemblies. Measure voltage across the black and white wires of these connectors (from pins 4 and 5 of J1 labeled LATCH on the board). While inactive, the voltage across these pins should be minimal. If there is excessive voltage (greater than logic voltage of approximately 5 volts DC), the circuit board should be replaced.

Press the COVER OPEN button on the front control panel and measure the voltage. It produces a 170 volt DC peak that can be read with an oscilloscope. If an oscilloscope is not readily available, a voltmeter can also be used. Short together the red and violet wires (pins 1 and 2 of J1 on board) to increase the length of time the voltage is applied. A voltmeter measurement should be approximately 108 volts. If this voltage is not present, replace the circuit board. (Measurements can also be taken with the harness connected, by inserting probes from the back of the connector shell.) If the voltage is present and the cover does not release, replace the interlock assembly.

Replacement

To replace an interlock assembly, remove the front control panel (see Section 8.1) and disconnect the interlock assembly wiring harness. Loosen and remove the two nuts at the top of the assembly. Disconnect the bypass cord at the interlock by cutting it and tying a knot for reuse. Reinstall the nuts using Loctite® 271 on the threads. Tighten the nuts to no more than 10 in-lbs.

8.5 Cover Assembly

Removal of the cover assembly includes removal of the hinges. They are taken off as a unit. Remove all 5 sets of 4 Phillips head screws that hold the hinges to the rear of the cabinet, and lift the assembly off.

If the cover does not close easily, or if it must be pushed down to enable the unit to run, an interlock assembly may be loose, or a cover latch pawl may need adjustment.

To adjust a cover latch pawl, loosen the locking nut that holds it in place. The pawl can be screwed up or down to correct its height for locking. Be sure to lock it back into place using the locking nut. This will prevent it loosening during operation of the unit.

If the cover assembly does not stay up on its own, the hinge tension may need adjustment. The adjustment screws on the hinges are located on the under side of the hinge. Turning the screw clockwise tightens the hinge.

The cover gasket on both the Centra GP8, and GP8R is held in place by a crimp fit. If it becomes loose or the rubber deteriorates over time, replace it. Removal of the cabinet (see section 8.2) may make replacement of this gasket easier.

8.6 Guard Bowl

Any frost which forms in the guard bowl should be removed. Frost does not inhibit refrigeration function, but does inhibit efficient removal of heat from the samples. Simply open the cover of the unit and allow the frost to melt, and then remove the water from the bowl using a sponge.

9 POWER CIRCUIT

9.1 General

Power is applied to the unit through the Power Entry Module, located next to the line cord. This module includes the fuse drawer for fuse configuration. To the right of the power entry module are the circuit breakers. **Power configuration is described in Section 2.3.**

To verify AC power to the board, use connector J3 (labeled PWR IN on the board). The following procedure requires operation of the unit with power applied, and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**.

Remove the front control panel (see Section 8.1) and disconnect J3. Measure the voltage across pins 1 (blue or white) and 2 (black) at J3. It should be 120 volts nominal. Across pins 4 and 5 the voltage should also be 120 volts nominal. On refrigerated models, the voltage across pins 1 and 3 should be 120 volts (domestic models) or 220 volts (high voltage models). If these voltages are not present, use the appropriate wiring diagram (GP8 10846 or GP8R 10844, or 10845) and trace back through the power circuit to find the faulty component (see Section 13 Drawings).

9.2 Circuit Breaker

The Centra GP8 and the high voltage GP8R model have 2 -10 amp circuit breakers, while the Centra GP8R has 2 -15 amp circuit breakers. They are located on the lower left side of each unit, near the line cord. Once tripped, the circuit breaker stops power from being applied to the rest of the unit. It can be reset by pushing the plunger in the center of the circuit breaker back into place. If the circuit breaker continues to trip, follow the troubleshooting procedure outlined in Section 9.3, Blowing Fuses.

To remove a circuit breaker, first unplug the unit and remove the cabinet. (see Section 8.2) The circuit breaker is held in place, from the inside, by a retaining clip. Once the retaining clip is removed, the circuit breaker slides out of the unit. Disconnect the leads, and reassemble in the same manner.

9.3 Blowing Fuses

A short circuit inside the unit, when power is applied to that component, will draw excessive current, blowing a fuse or tripping a circuit breaker. Spare fuses are important to have on hand, as it may require expenditure of good fuses to isolate the problem.

A general location of the short circuit may be made by observing when the fuse blows:

- If a fuse blows **immediately** when the unit is plugged in, the short may be in the main power line, (power entry module, frequency selector, or line filter) or in the circuit board.
- If a fuse blows **approximately 3 seconds after** the unit is plugged in, the short may be in one of the components the microprocessor activates (cooling fans, or board components) after its initial self testing.
- If a fuse blows when the **COVER OPEN button is pressed**, the short may be in one or both of the interlock assemblies.
- If F1 on the circuit board blows when the **RUN button is pressed**, then the short may be in the motor. (refer to Section 10.3, Circuit Board Fuses)
- On the Centra GP8R, if a fuse blows when the **refrigeration is enabled**, the short may be in the condensing unit.

To further localize the short, components may be selectively disconnected, and the unit restarted. The following procedure requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**. To do so:

First unplug the unit, and remove the front control panel (see Section 8.1). Lay the panel face down in front of the unit, so that the electronic components and connectors are visible.

Look inside for loose materials, or bare wires. Gently tilt the unit to one side, and then to the other in order to locate any loose objects. To tilt the unit, it is necessary to break the seal of the suction cup feet. Insert a tongue depressor or similar object under each foot to break the seal. Remove any loose objects, and repair or replace any bare wires.

The circuit board has 8 interface connectors, labelled J1 through J8. Connector J3 brings power to the circuit board. The other connectors distribute power and signals as follows:

J1 Latch
J2 Motor
J4 Refrigeration & Fans
J5 Tachometer
J6 Imbalance & Thermistor

Detach connector J3 from the board and plug the unit in. If a fuse blows, the short circuit is in the power entry module, transformer, or line filter. Unplug the unit and locate the failed component using an ohmmeter.

If a fuse was not blown, unplug the unit, replace connector J3, and disconnect the other connectors (J1, J2, J4, J5, and J6). Plug the unit back in and if a fuse blows, replace the circuit board.

Otherwise, unplug the unit and reconnect one of the connectors, J1 through J6. Plug the unit back in. If a fuse does not blow, reconnect connectors, one at a time, in the above manner until a fuse blows. Search for the short in the last component connected before the fuse blew.

10 CIRCUIT BOARD

10.1 General

The circuit board contains the following devices:

- A microprocessor that senses the control panel input, and activates the various devices in accordance with its programming.
- An EPROM (Erasable, Programmable Read-Only Memory) containing the programming. In special situations, the factory may issue a revised EPROM in order to change the unit's operation.
- A NOVRAM (Non-Volatile Random Access Memory) that stores cumulative information such as elapsed operating hours and brush wear hours. It also stores user settings.
- A keyboard encoder chip that processes signals from the keyboard, and various discrete components that filter or amplify input/output to and from the microprocessor.

IEC Service does not troubleshoot boards to component level. Schematics and parts lists of the boards are included in this manual. (see Section 13) Once a board has been determined to be faulty, replacement is recommended.

10.2 LED's

The circuit board has several LEDs (Light Emitting Diode) on it. They are all labeled, and can be useful in troubleshooting. When an LED is lit, it means that the microprocessor has activated that particular device. If an LED is lit and the device is not functioning, check for power from the board to the device. If power is present, then the component should be replaced. If the device is functioning, and the LED is not lit, then the board should be replaced. Note: The BRAKE LED (if present) is lit when the unit is spinning or coasting, and is off during braking or in standby. LED indicators are present for the following devices:

Latch Solenoid	SOL
Motor Blower	FAN
Compressor (GP8R Only)	COMPR
Forward/Reverse Relay	BRAKE (not on all boards)
Motor Power Relay	RUN

10.3 Fuses

There are two fuses on the circuit board. They are labeled F1 and F2. F2 is to protect the logic circuitry, and F1 is in the motor circuit. A blown F2 fuse will result in no display, while a blown F1 will result in an Error 001 when attempting to start a run. Test the fuses with a meter to determine if replacement is necessary. The fuses are rated as follows:

F1 12.5 A 250 V 5x20mm Slo-Blo
IEC Part No. 9919
F2 2.5 A 250 V 5x20mm Slo-Blo
IEC Part No. 49937

10.4 Special Functions

Special Functions on the GP8 and GP8R can be accessed via a hidden key on the control panel. They can be useful during servicing of the unit. These functions can only be activated when the unit is at rest (not running), and not in an Error Code or Warning Message state. When in the Special Function Mode, the control panel displays and keys assume different functions than in the normal operating state. A run cannot be started while in the Special Functions Mode. The Special Function name is shown in the RPM display, and related information appears in the other displays. The special functions can be scrolled by pressing the RPM selection arrows. The Special Functions Mode is entered and exited by pressing the C in the IEC logo. The following are the names and descriptions of the Special Functions:

Prog — Program Version Number. The currently installed program version number appears in the MINUTES display.

P Loc — Program Lock. Allows user program (1-35) to be locked, i.e. not modifiable from the standard operators interface.

rotor Add/DEL — Rotor Add/Delete. Allows user to add new rotors to the rotor/radius display list.

reSP — Reset User Programs. Allows all user definable programs in the NOVRAM to be reset by pressing the File key under the PROGRAM display. Three short beeps indicate all the programs have been reset.

bruSh	Brush Life Counter. The number of hours running time since the Brush Life Counter was last reset is shown in the MINUTES display. This counter is used to set off the bruSh warning message. When the brushes are changed, the counter should be reset by pressing the File key under the PROGRAM display.
ELAPS	Elapsed Time Counter. Shows the total elapsed hours of running time of the unit in the MINUTES display. If a decimal point appears in the MINUTES display, and any number appears in the PROGRAM display, then the number of hours has exceeded a 3 digit whole number and is represented in scientific notation form. For example, ELAPS 987 indicates 987 hours of running time. On the other hand, ELAPS 6.54 3 indicates 6,540 hours of running time.
SyS C	System Check. The system automatic self tests are accessed from this function. These tests are used at the factory during production. The procedures are time consuming and require several different rotors for execution. This function is not recommended for field use.
RESLT	System Check Results. Display of test values from system check.

10.5 Test Points

The board contains 3 test points. They are as follows:

TACH	Output from tachometer (Hz)
GND	Ground
40 Hz	Frequency

The TACH test point when measured with respect to ground (GND) will reflect the tachometer output, and can be viewed with an oscilloscope or a VOM with frequency capabilities. This output should be 1 Hz/ 5 RPM . 40Hz measured with respect to ground should always be 40 Hz nominal.

11 DRIVE ASSEMBLY

11.1 Motor

Test With the unit unplugged, there are electrical characteristics of the motor that can be checked.

Remove the front control panel (see Section 8.1). Remove connector J2 from the circuit board (labeled MOTOR). Measure the resistance of the motor between pins 1 (white) and 2 (black). It should be 2-4 ohms nominal. If it is outside this range, replace the motor. If it displays an open circuit, check the motor brushes to ensure they are good and making good contact, and check the choke for continuity. The resistance of the choke when isolated (measured at J14) should be 0.3 ý nominal.

Brushes should be replaced once they are about 1/4 of an inch in length. If replacement of the brushes does not eliminate the open circuit, or if the resistance is outside the range, replace the motor. Pins 1 and 2 on connector J2 should read open when measured with respect to ground. Use pin 6 of connector J3 for the ground lead. If resistance is not infinite (open) the motor has a short and must be replaced.

To verify power is being applied to the motor, use the following procedure. It requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**. Use a voltmeter to measure the DC voltage to pins 1 (white) and 2 (black) of J2 (labeled MOTOR on the board). Plug the unit in and verify that a properly loaded rotor is installed. Select an appropriate speed and time, select soft acceleration, and start a run. If voltage is present, and the motor does not run, check the motor. If voltage is not present, and there are no warning messages or error codes displayed, and the RUN LED is lit, replace the board.

Motor brush replacement is described in section 5.4.

Replacement

To replace the motor, open the cover and unplug the unit. Remove the rotor and all accessories.

Locate and remove the 6 screws that secure the motor boot. Remove the motor boot. Remove the foam ring surrounding the motor assembly. Use the magnetic socket, (5/16) supplied with the unit, with a 10 inch extension to remove the 4 bolts that secure the motor mounting plate. They are located down in the motor well. Take care not to drop these bolts into the motor well, as retrieving them can be difficult.

Lift the drive assembly into the guard bowl. Locate and disconnect the 3 wire motor harness connector (red, black and green/yellow). Also disconnect the 3 wire tachometer harness (red, black, and blue). The drive assembly can now be removed.

Replace the drive assembly in the same fashion, reversing the steps (see Section 13 exploded view).

Shaft Adapter

To remove the shaft adapter use a 7/16" Allen wrench. Loosen the screw in the locking collar and pull the adapter up and off. When reinstalling it, ensure that it is as far down onto the motor shaft as it can go before tightening the collar clamp.

11.2 Speed Sensor

The speed sensor uses a magnetic disc and Hall Effect sensor that requires no calibration. Its accuracy can only be verified by strobing the motor shaft through the viewport of the cover. To gain access to the sensor requires removal of the drive assembly (see section 11.1), or at least movement of it up into the guard bowl.

Test

To check the sensor, use a voltmeter to measure its logic voltage across pins 1 and 3 (red and black) of the J5 connector (labeled TACH on the board). It should be approximately 5 volts. If it is not, then the board should be re placed. The output of the sensor is read across pins 2 and 3 (blue and black), and should be 1Hz/5RPM. The output of the sensor can also be measured using the test points on the board (see Section 10.5). If no signal is present, and logic voltage has been verified, check the gap between the sensor and the disc. It should be between 0.03" and 0.07" (.75mm to 1.75mm). (Use a business card placed between the sensor and disc to ensure the gap is good. When rotated one full revolution the disc should not grab or tear the business card.)

Adjust

To adjust the sensor, loosen the locknut and screw the sensor in or out until the proper gap is measured. Be sure to secure the locknut once the sensor is properly in place.

11.3 Imbalance Sensor

The imbalance sensor is a normally closed switch that opens intermittently if an unbalanced load produces excessive vibration of the centrifuge. This will also occur if the unit is not placed on a stable counter or floor. To check for this, move the unit to a stable floor and see if imbalance still occurs.

After setting off an imbalance, the motor may remain in an uncentered position causing recurrent **bAL** warning messages. To reset the motor position, open the lid and grasp the center of the rotor. While standing at the front of the unit, gently move it toward the rear of the unit (12 o'clock). Heavier rotors will reset this automatically.

Test To test the imbalance sensor, remove the front control panel (see Section 8. 1) and locate connector J6 on the circuit board (labeled IMB/THERM).

Trace the black and yellow wires from pins 1 and 2 of this harness to the switch located directly in front of the guard bowl. Disconnect this harness from the circuit board and use an ohmmeter to verify resistance of the 2 leads.

Opening the cover and gently moving the rotor towards the front of the unit should engage the switch and open the circuit. Actuation of the switch is audible when it occurs.

Calibrate To calibrate the sensor, remove the front control panel (see Section 8.1) and locate the sensor adjustment screw directly under the guard bowl. Loosen its locking nut. The screw is turned clockwise to make the sensor more sensitive, and counterclockwise to make it less sensitive. Install the heaviest rotor used, and adjust the screw so that the following conditions are met:

Fully loaded with a 50 gram imbalance - no imbalance indication
Fully loaded with a 75 gram imbalance - imbalance below 2000 rpm

Tighten the adjustment screw locking nut. Calibration is required when the switch is replaced, or if imbalance indication recurs with only a rotor installed.

Replacement **To replace the imbalance switch assembly**, unplug the unit and remove the front control panel (see Section 8.1). The imbalance microswitch assembly is located at the front of the motor enclosure below the guard bowl. Remove the 2 bolts holding the assembly bracket to the base. Remove the assembly and disconnect the wires. Remove the 2 Phillips head screws holding the microswitch to the bracket, and position the new switch in the same fashion and secure it. Connect the wires to the replacement microswitch (black to NC, and yellow to C), and position the assembly in the same manner as the original assembly. (Actuator arm up and roller closest to motor.) Secure the bracket to the base with the 2 bolts.

11.4 Blower

The motor blower is located to the right of the motor, and inside the motor housing. It cools the motor during operation.

To verify power to the blower use the following procedure. It requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**.

Remove the front control panel (see Section 8.1) and locate J4 (labeled REFR/FAN on the board). At J4 use a voltmeter to measure the voltage across pins 3 and 4 (both orange or black). Insert probes from the back of the connector shell. The blower is active while the motor is running or stopping. With a rotor properly installed, select an appropriate speed and start the unit. Once the motor is turning, verify that the blower power should be present by checking the FAN LED. If the LED is lit, approximately 120 Volts AC should be present. If voltage is present and the blower does not operate, check the harness. If the harness is good, replace the blower. If the voltage is not present when the LED is lit, replace the board.

Replacement of the blower is made easier if the unit can be placed between two tables. This allows easy access to the bottom of the unit. The blower is held in place by 4 screws. Remove the 4 screws and fan shroud from below. Remove the drive assembly (see section 11.1). Slide the blower over and remove it up through the guard bowl.

11.5 Brake

The Centra GP8 and GP8R feature six deceleration modes, max. brake (5 LEDs) through min. brake (1 LED), and coast (no brake, no LEDs).

The brake requires service if, with a fully loaded rotor and operating at that rotor's maximum allowable speed, the deceleration time in the brake mode is not less than the deceleration time in coast (no brake).

The brake resistor is mounted to the base of the unit, and is surrounded by a heat sink. The value of the resistor is 10 ý. The resistor is in the motor circuit, so if the motor or brake do not work, check the resistor. To measure the resistance, locate and disconnect J2 from the board. Measure across pins 5 an 6 (both violet). Both leads should read open when measured to ground.

The operation of the braking system can be verified using a voltmeter. The following procedure requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**.

Remove the front control panel (see Section 8.2) and locate connector J2 (labeled MOTOR on the board).

Plug the unit in and verify that a properly loaded rotor is installed. Select an appropriate speed and time, and start a run.

Select a brake setting (1-5 lights), and press the stop button. Use a voltmeter to measure the DC voltage on pins 1 (white) and 6 (violet). The voltage should be above 30 volts at speeds above 2000 rpm. Voltage should remain around 30 volts in the following speed ranges depending on settings.

Brake Setting	Speed Range	Brake Mode
1	500-2000 rpm	Full Brake; Coast from 500 rpm
2	500-2000 rpm	Full Brake; Half Brake from 500 rpm
3	250-2000 rpm	Full Brake; Coast from 250 rpm
4	250-2000 rpm	Full Brake; Half Brake from 250 rpm
5	[3]100-2000 rpm	Full Brake

When voltage is being applied, the RUN LED should be lit, and the BRAKE LED (if present) should not be lit. When the unit goes into coast, the RUN LED will go out, and the BRAKE LED (if present) will come on.

The voltage will be decreasing (half brake) below 500 rpm on setting 2, and below 250 rpm on setting 4. The voltage should drop to 0 (coast) below 500 rpm on setting 1, and below 250 rpm on setting 3. Somewhere below 100 rpm in all modes, both LEDs will go out, and the voltage will drop to 0.

12.0 REFRIGERATION

12.1 General

The refrigeration system of the Centra GP8R features a 1/2 hp (@60 Hz) compressor utilizing 7.5 oz. of R-22 refrigerant, and is capable of maintaining a chamber temperature of 2° C (given appropriate rotor speed and ambient temperature). The condenser dissipates heat from the refrigeration system to the atmosphere. It requires ventilation for proper air flow. To ensure this, clean any dust or dirt from the condenser fins and the ventilation grill, straighten any bent fins, and allow 8 cm (3 inches) clearance on all sides of refrigeration grill. Do not operate the refrigeration system if the fan is not working correctly. Note: There is a thirty second delay before restarting the compressor.

To verify voltage to the condensing unit use the following procedure. It requires operation of the unit with power applied and the front control panel removed. **Use caution to avoid electric shock (see Section 7.1, Cautions)**. Select a lower temperature than ambient, and select the Rapid Cool program. Remove the front control panel (see Section 8.1) and locate connector J4 (labeled REFR/FAN on the board). With a rotor properly installed in the chamber, start a run and use an AC voltmeter to measure voltage to the condensing unit. The voltage can be read across pins 1 (black) and 2***** (white) and should be 120 volts AC on domestic models, and 220 volts AC on international models. If the COMPR LED is lit, and voltage is not present, replace the board. If the voltage is present and the compressor or fan are not functioning, have the condensing unit checked by a qualified refrigeration service person.

*** If no white lead is present here, use J3 pin 1 (neutral)**

12.2 Thermistor

The thermistor is located inside the chamber of the Centra GP8R. Its proper operation can be verified by taking its resistance at various temperatures. To do this, first remove the front control panel (see Section 8.1). Locate connector J6 (labeled IMB/THERM on the board) and disconnect it. Measure the resistance across pin 2 (red) and pin 4 (red). At 25° C (approximately room temperature) the resistance should be 2252 ý. At 0° C (achieved by packing ice around thermistor) the resistance should be 7355 ý. If these values are not verified, or if an open or short circuit are detected, the thermistor should be replaced.

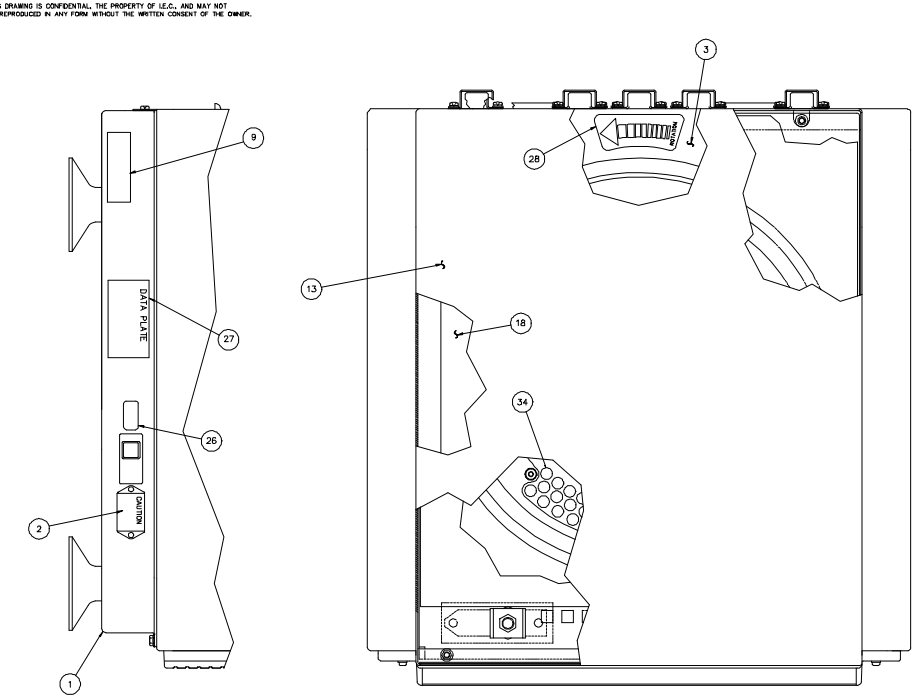
To replace the thermistor, open the cover and remove the front control panel (see Section 8.2). Locate the thermistor inside the bowl, towards the front of the unit. Unscrew and remove the outer plastic housing around the thermistor. Slide the thermistor down through the guard bowl. During production, the thermistor is sealed in place using RTV. To extract the thermistor, this sealant must be removed, using the blade of a small screwdriver or similar tool. Disconnect the harness and install the new thermistor in the same manner. To ensure its proper operation, be sure to reseal the thermistor in place.

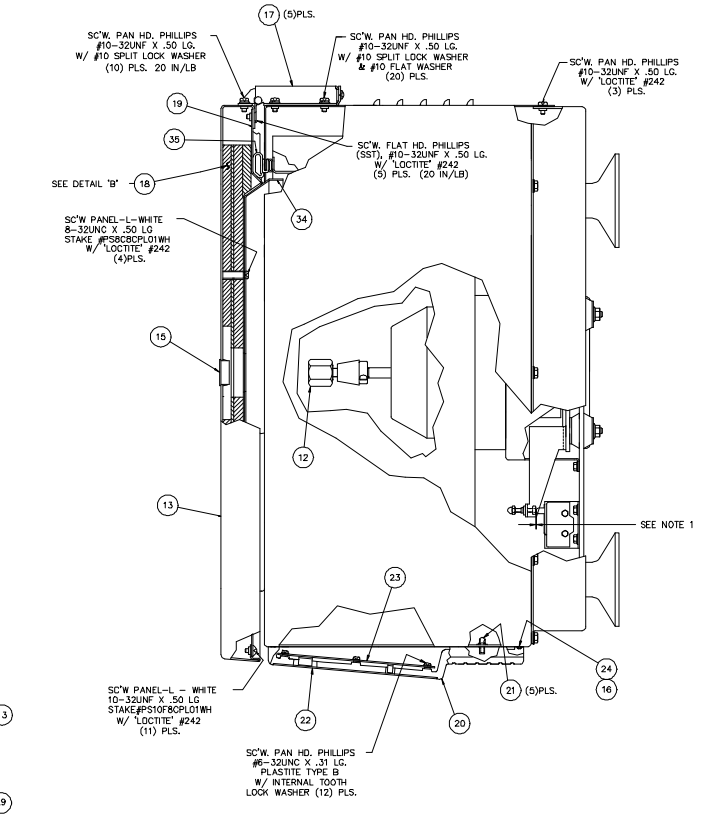
13 DRAWINGS AND DIAGRAMS

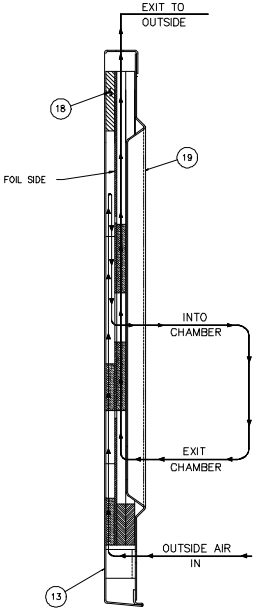
Drawing No.	Description
3121/3122/3125	Benchtop Parts
3123/3124/3126	Kneewell Parts
65527	Drive Assembly
10846	Wiring Diagram/Schematic GP8 (K)
10844	Wiring Diagram/Schematic GP8R (K) - Domestic
10845	Wiring Diagram/Schematic GP8R (K) - High Voltage
10823	PC Board Schematic GP8R (K)
44465	PC Board Layout GP8 (K)
PL-44465	PC Board Parts List GP8
44467	PC Board Layout GP8R (K)
PL-44467	PC Board Parts List GP8R

Note: At the time of publication these drawings and diagrams were accurate. Changes to the units do occur. If you have any questions regarding these drawings and diagrams, please contact IEC Technical Support at (800) 843-1113 ext.2002

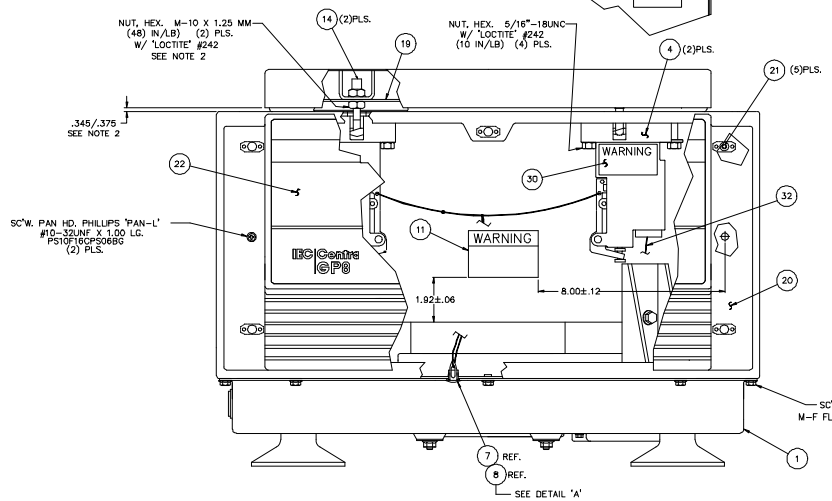
REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
1	—	P.L.	4/7/93	0992	RAD	4/13/93
2	—	P.L.	5/11/03	1062	RAD / LIB	5/20/93
3	—	LTW	7/8/93	2023	RAD	7/10/93
4	—	LTW	9/10/93	2183	RAD	9/11/93
5		P.L.	2/9/94	2394	MM	2/15/94
6		P.L.	10/13/94	2663	RAD	10/28/94
7		P.L.	1/13/95	2887	RAD	1/16/95
8		P.L.	1/30/95	2905	MM	2/1/95
9		P.L.	3/13/95	2994	RAD	3/16/95
10		KFC	3/24/95	3040	KFC	3/24/95
11		P.L.	5/19/95	3116	MF	5/19/95
12		P.L.	6/12/96	3585	PS	6/17/96
13		P.L.	8/12/96	3660	PS	8/23/96
14		P.L.	12/12/96	3816	PS	12/13/96
15		T.M.E.	1/21/97	3851	PS	1/28/97
16		PL	2/3/98	4347	RAD	3/18/98
17		PL	7/15/99	5023	CI	7/23/99
18		PL	2/8/01	5610	RAD	2/16/01

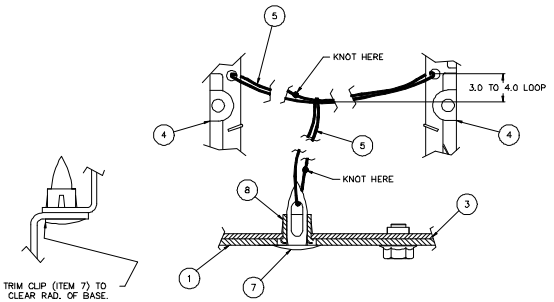






DETAIL 'B'
SHOWING POSITION OF AIR-BAFFLE (ITEM 18) AND DIRECTION OF AIR FLOW.





DETAIL 'A'
(NOT TO SCALE)

NOTES;

1.– SET GAP BETWEEN MICROSWITCH & HEAD OF SCREW AT .030 (USE ORANGE SHIM).
2.– .345/.375 GAP BETWEEN BOTTOM EDGE OF COVER & TOP OF CABINET TO BE SET WHEN ATTACHING COVER TO CABINET. ADJUST BY MOVING HINGE UP OR DOWN.

FINAL ASSY.	GP8		
NEXT ASSY	USED ON		
APPLICATION			
	BY	DATE	
DRAWN	LTW	7/21/92	
CHECKED			
APPROVED	RD	1/22/93	

MATERIAL: SEE P/L
FINISH: SEE P/L
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √
TOLERANCES: 2 PLACE DEC. ±.02; 3 PLACE DEC. ±.005; ANGLES ±½

PARTS LIST. SEE PL: 3121 & 5681

INTERNATIONAL EQUIP. CO.

TITLE: ASSEMBLY – GP8

FILE DISC #:
USER: 24
MASTER:
SCALE: HALF

SIZE: E | DRAWING NO. 3121 | REV. 18

PLOT AT 1=2 | SHEET 1 OF 1

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	USER DISC 24 / MASTER DISC #	PL 3121	REV. 18
TITLE: ASSEMBLY – GP8		PREPARED: LTW 7/21/92	SHEET 1 OF 2	
		CHECKED: —— ——	INITIAL RELEASE	
		APPROVED: RAD 7/21/92	ECO 0836 DATE: 1/5/93	

REVISION	18	10	11	12	13	14	15	16	17	APPLICATION	
SHEET	——	——	——	DWG	——	1&2	2	2	2	USED ON	NEXT ASSY
ECO NO.	5610	3040	3116	3585	3660	3816	3851	4347	5023	GP8	FINAL ASS'Y.
DATE	2/8/01	3/24/95	5/19/95	6/12/96	8/12/96	12/12/96	1/97	1/98	7/15/99		
BY	P.L.	KFC	P.L.	P.L.	PL	PL	T.M.E.	P.L.	P.L.		
APPROVED	RAD	KFC	HJR	PS	PS	PS	PS	RAD	RAD		

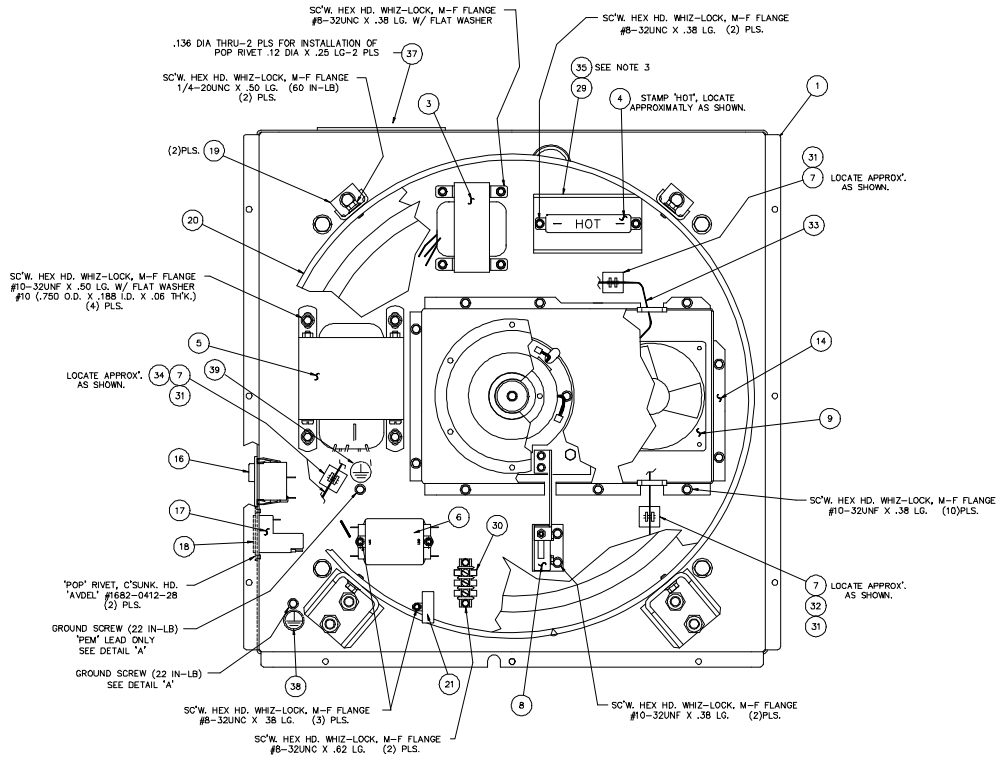
ITEM	QTY	PART NO.	DESCRIPTION	REMARKS
1	1	65471	ASSEMBLY – BASE	
2	1	49996	LABEL VOLTAGE SELECTION	
3	1	65446	DETAIL ASSEMBLY – CABINET	
4	2	43181–A	LATCH, 'TRUMPH'	
5	4'	COML	POLYESTER 50LB. TEST FISHING LINE	
6	——	——	——	——
7	1	COM'L.	ARROW CLIP, NYLON	'HEYCO' #0317
8	1	COM'L.	OPEN/CLOSED BUSHING	'HEYCO' #2865
9	——	——	——	——
10	1	65540	KIT, SPARE PARTS (GP8)	
11	1	65598	LABEL, WARNING	
12	1	47114	SHAFT NUT	
13	1	65461A	DETAIL ASSEMBLY – COVER	
14	2	43181–C	STRIKE, LATCH	
15	1	48116	VIEWPORT	'HEYCO' #1312
16	A/R	COM'L.	ADHESIVE , 'PRISM'	'LOCTITE' # 454
17	5	65479	HINGE	
18	1	65460	DETAIL ASSEMBLY – AIR BAFFLE, COVER	
19	1	65462	LINER, COVER	
20	1	65452	DETAIL ASSEMBLY – BEZEL (TABLE MODEL)	

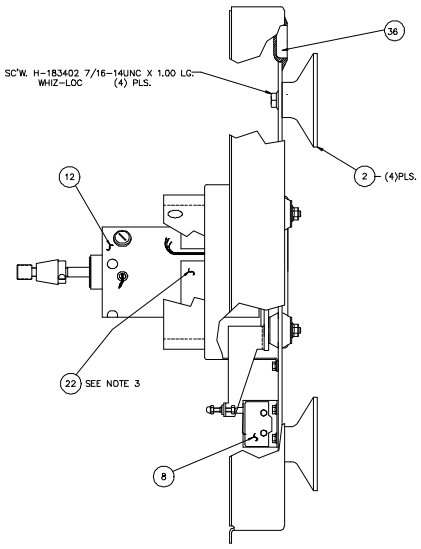
PARTS LIST	INTERNATIONAL EQUIPMENT CO.	PL 3121 SHEET 2 OF 2	REV 18

ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
21	5	COM'L.	BALLSTUD	'TINNERMAN' #P116
22	1	65465	MEMBRANE PANEL	
23	1	44467	ASSEMBLY – PC BOARD	
24	A/R	40003–A	TUBING, 'O'–SEAL (.06 I.D. X .03 WALL)	
25				
26	1	50069	LABEL, FUSE	
27	1	COML	LABEL , DATAPLATE	REF IEC DWG 66001 Y
28	1	48704	LABEL , ROTATION	
29	1	50011	LABEL , CAUTION	
30	1	45996	LABEL , WARNING	
31	——	——	——	——
32	1	50225	WIRING HARNESS, LATCH	
33				
34	1	65571	DEFLECTOR, SHIELD	
35	5.0'	65594	GASKET, COVER	
36				
37				
38				
REF.	——	10846	WIRING DIAGRAM/WIRING SCHEMATIC	
——	1	OM–3121	OWNERS MANUAL	

Tel.: +(781)449-8060 Fax: +(781)455-9749

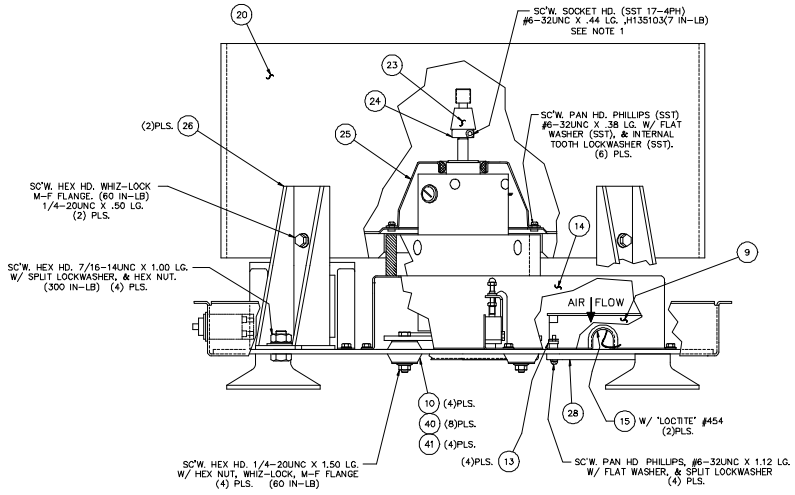
REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	——	P.L.	1/8/93	RELEASED 0836	RAD / LRR	1/28/93
1	——	MPONKO	3/3/93	D981	RAD	4/8/93
2	——	P.L.	6/7/93	1089	RAD / LRR	6/9/93
3	——	LTW	7/22/93	2124	RAD	7/25/93
4	——	LTW	9/8/93	2183	RAD	9/16/93
5		P.L.	4/14/94	2496	RAD	4/14/94
6		P.L.	3/9/95	2721	RAD	2/10/95
7	---	TJS	3/21/95	3040	TJS	3/22/95
8	---	TJS	4/21/95	3086	TJS	4/21/95
9		P.L.	3/13/96	3455	RAD	3/28/96
10		P.L.	8/12/96	3660	PS	8/23/96
11		P.L.	2/19/97	3864	DMM	2/21/97
12		P.L.	6/26/98	4594	CI	7/2/98
13		P.L.	2/15/99	4868	RAD	3/2/99
14		P.L.	2/23/99	5062	RAD	7/14/99
15		P.L.	11/9/99	5194	RAD	11/9/99
16		P.L.	2/16/00	5275	RAD	7/16/00
17		P.L.	2/12/01	5610	RAD	2/16/01
18		P.L.	9/4/02	6177		

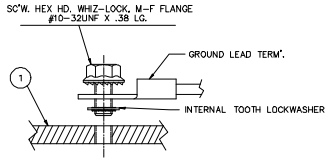




SIDE VIEW

NOTE; ITEMS #19, 20, 25, & 26 ARE NOT SHOWN IN THIS VIEW.





DETAIL 'A'
(GROUND SCREW ASSEMBLY)
(2) PLS.

NOTES:
1- USE SCREW SHOWN IN PLACE OF THE SCREW SUPPLIED WITH THE CLAMP (ITEM 24).
2- INSTALL THE DONUT (ITEM 22) SO THAT THE MOTOR LEADS PASS THRU THE DONUT OPENING.
3- APPLY THERMAL COMPOUND (ITEM 35), BETWEEN HEAT SINK (ITEM 29) & RESISTOR (ITEM 4).

		MATERIAL	SEE P/L
		FINISH:	SEE P/L
3121	GP8	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √	
NEXT ASSY	USED ON		
APPLICATION			
	BY	DATE	
DRAWN	LTW	7/21/92	TOLERANCES: 2 PLACE DEC. ±.02; 3 PLACE DEC. ±.005; ANGLES ±½
CHECKED			
APPROVED	TJS	3/22/95	

PARTS LIST. SEE PL: 65471

INTERNATIONAL EQUIP. CO.

TITLE: ASSEMBLY – BASE

FILE DISC #:	SIZE:	DRAWING NO.	REV.
USER: 23	E	65471	18
MASTER:			
SCALE: HALF	PLOT AT 1=2	SHEET 1 OF 1	

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	USER DISC # 6 / MASTER DISC #	PL 65471	REV. 18
TITLE: ASSEMBLY – BASE GP8		PREPARED: LTW 7/9/92	SHEET 1 OF 2	
		CHECKED:	INITIAL RELEASE	
		APPROVED: RAD 7/9/92	ECO 0836 DATE: 1/5/93	

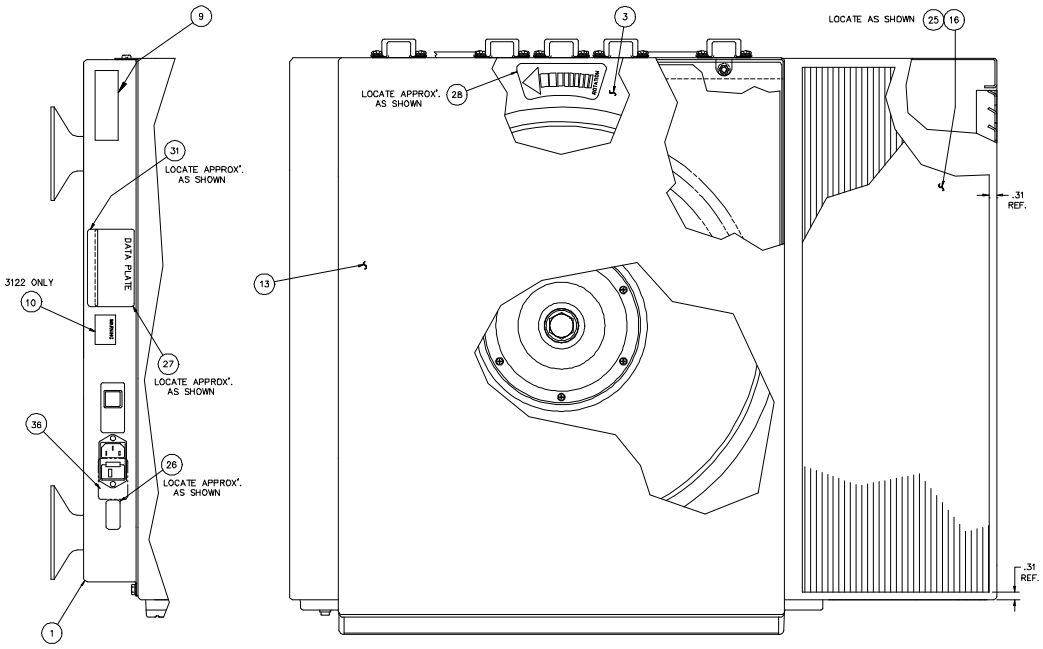
REVISION	18	10	11	12	13	14	15	16	17	APPLICATION	
SHEET	——	——	3	——	——	2	–	1	––	USED ON	NEXT ASSY
ECO NO.	6177	3660	3864	4594	4868	5062	5194	5275	5610	GP8	3121
DATE	9/4/02	8/12/96	2/19/97	6/26/98	2/15/99	2/23/99	11/9/99	2/16/00	2/12/01		
BY	P.L.	P.L.	P.L.	PL	PL	P.L	P.L.	PL	PL		
APPROVED		PS	DMM	CI	RAD	RAD	RAD	RAD	RAD		

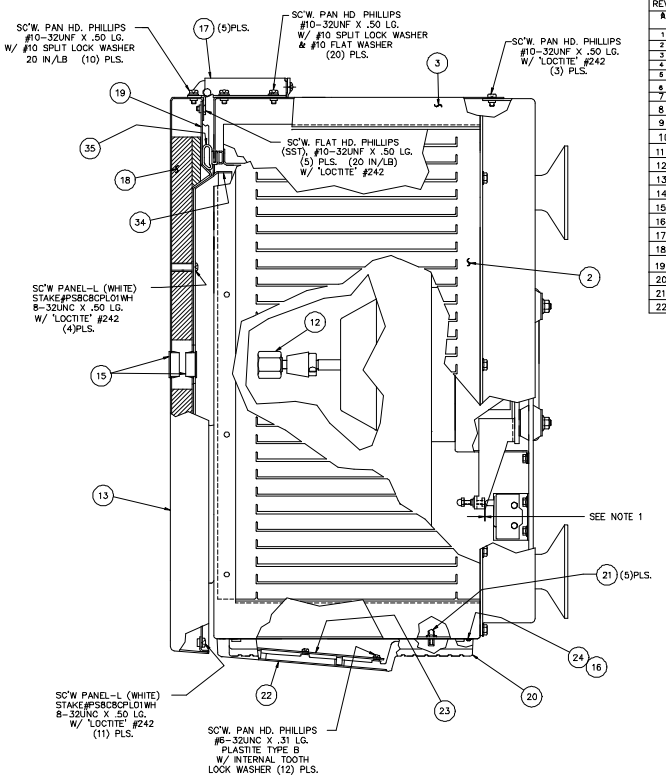
ITEM	QTY	PART NO.	DESCRIPTION	REMARKS
1	1	65449	DETAIL ASSEMBLY – BASE	
2	4	47248	MOUNTING FOOT	
3	1	49548	CHOKE MODIFIED	
4	1	60430–G	RESISTOR	
5	1	65533	AUTOTRANSFORMER	
6	1	62616	LINE FILTER (6 AMPS)	
7	3	COM'L.	CABLE ANCHOR, ADHESIVE BACKING	'PANDUIT' #ABM23–A–D
8	1	65470	ASSEMBLY – MICROSWITCH (IMB'.)	
9	1	65485	FAN	
10	4	51053B	ISOLATOR CORE	
12	1	65527	ASSEMBLY – DRIVE	
13	4	65523	FAN MOUNTING CLIP	'COMAIR/ROTRON' #550113
14	1	D–48060	MOTOR ENCLOSURE	
15	A/R	33065	CHANNEL	#CH–383–6
16	1	51233–A	DUAL PUSH SWITCH/CIRCUIT BREAKER(10A)	
17	1	49945	POWER ENTRY MODULE	
18	1	43173–B	FUSE DRAWER	
19	2	65442	SUPPORT LEG, CONTAINMENT	
20	1	65560	DETAIL ASSEMBLY – GUARD BOWL/FOAM	

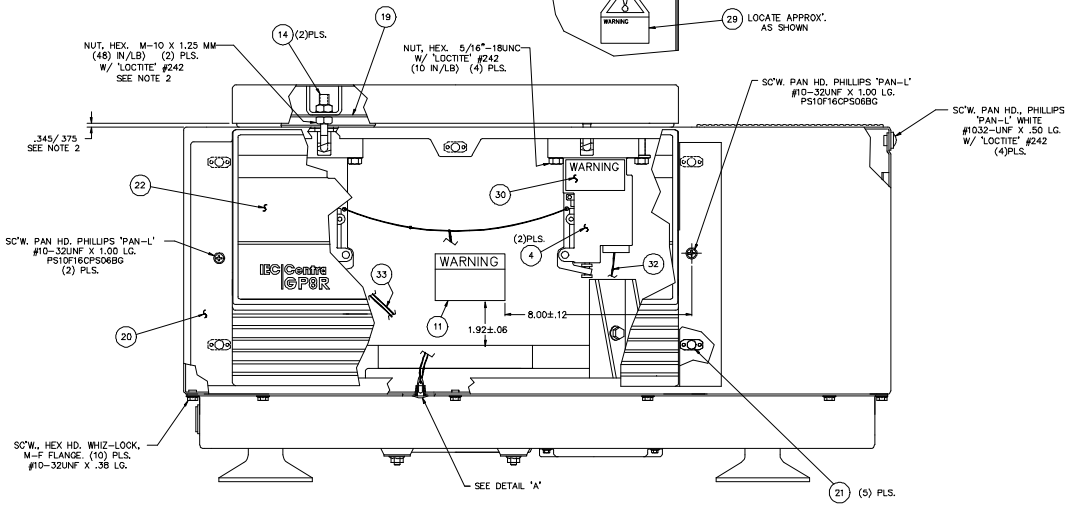
PARTS LIST	INTERNATIONAL EQUIPMENT CO.	PL 65471 SHEET 2 OF 2	REV 18

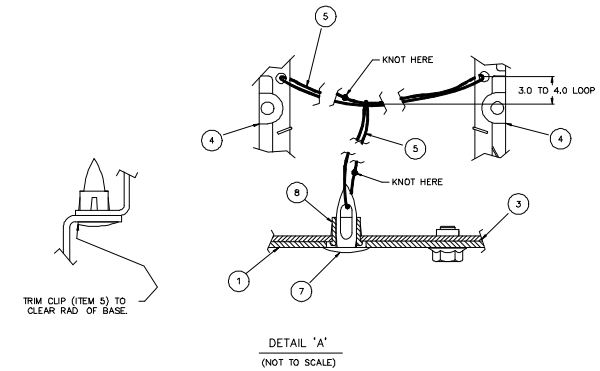
ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
21	1	60611	ASSY CAP	
22	1	42762	DAMPING DONUT	
23	1	48620	ADAPTER, SHAFT	
24	1	48621	CLAMP, SPLIT	
25	1	65522	DETAIL ASSEMBLY – MOTOR BOOT	
26	2	65561	LEG, SUPPORT, CONTAINMENT	
27				
28	1	65508	FAN GUARD	'COMAIR/ROTRON'
29	1	63013	HEAT SINK, BRAKE RESISTOR	#550481
30	1	43357	TERMINAL BOARD	
31	3	COM'L.	TY–WRAP	'TYTON CORP." #T18S
32	1	50224	WIRING HARNESS, MOTOR/FAN	
33	1	50222	WIRING HARNESS, MOTOR/BRAKE, RESISTOR	
34	1	50223	WIRING HARNESS, LINE, PWR'.	
35	A/R	COM'L.	THERMAL COMPOUND	#120–8
36	1	43329	PLUG, FINISHING	HEYCO #4000
——	REF.	10846	WIRING DIAGRAM /SCHEMATIC	
37	1	65689A	COVER PEM & CB	
38	1	50127	LABEL, PROTECTIVE EARTH GRD SYMBOL	
39	1	50128	LABEL, SECONDARY CHASSIS GRD SYMBOL	
40	8	51053A	WASHER ISOLATOR MOUNT	
41	4	51053C	SILICONE MOUNT	

Tel.: +(781)449-8060 Fax: +(781)455-9749









DETAIL 'A'
(NOT TO SCALE)

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
A	——	LTW	5/12/93	ORIGINATED 0836	RAD / LRR	1/13/93
1	——	LTW	4/6/93	0984	RAD / LRR	4/8/93
2	——	P.L.	4/29/93	1030	RAD	4/30/93
3	——	P.L.	5/11/93	1062	RAD	5/11/93
4	——	LTW	7/9/93	2023	RAD	7/11/93
5	——	LTW	9/10/93	2183	RAD	9/15/93
6		P.L.	1/6/94	2344	RAD	1/10/94
7		P.L.	2/8/94	2374	RAD	2/11/94
8		P.L.	10/13/94	2663	RAD	10/25/94
9		P.L.	1/13/95	2887	RAD	1/18/95
10		P.L.	1/30/95	2905	MM	2/1/95
11		P.L.	2/2/95	2906	RAD	2/2/95
12		P.L.	3/14/95	2994	RAD	3/15/95
13		KFC	3/24/95	3040	KFC	3/24/95
14		P.L.	5/22/95	3116	MF	5/31/95
15		P.L.	9/21/95	3260	RAD	9/28/95
16		P.L.	4/1/96	3456	JAB	4/8/96
17		P.L.	6/12/96	3585	PS	6/17/96
18		P.L.	8/14/96	3660	PS	8/23/96
19		T.M.E.	1/21/97	3851	PS	1/28/97
20		PL	2/3/98	4347	RAD	2/18/98
21		PL	7/16/99	5023	CI	7/28/99
22		PL	2/8/01	5610	RAD	2/16/01

NOTES;

1 – SET THE GAP BETWEEN THE MICROSWITCH & HEAD OF SCREW AT .030(USE ORANGE SHIM)

2.– .345/.375 GAP BETWEEN BOTTOM EDGE OF COVER & TOP OF CABINET TO BE SET WHEN ATTACHING COVER TO CABINET. ADJUST BY MOVING HINGES UP OR DOWN.

MATERIAL:	SEE P/L	PARTS LIST. SEE PL:	3125
FINISH:	SEE P/L	INTERNATIONAL EQUIP. CO.	
FINAL ASSY'.	GP8R(DOM.)	TITLE:	ASSEMBLY – GP8R(Hi-V) & REF. FOR GP8R(DOM.)
FINAL ASSY'.	GP8R(Hi-V)		
NEXT ASSY	USED ON		
APPLICATION			
BY / DATE		FILE DISC #:	SIZE: E / DRAWING NO. 3125 / REV. 22
DRAWN LTW 1/7/93		USER: 24	
CHECKED		MASTER:	
APPROVED RAD 1/7/93		SCALE: HALF	PLOT AT 1=2 / SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √

TOLERANCES: 2 PLACE DEC. ±.02 | 3 PLACE DEC. ±.005 | ANGLES ±1/2

Tel.: +(781)449-8060 Fax: +(781)455-9749

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	DISK # 42	3122 REF. DWG. 3125	REV. 22

TITLE: ASSEMBLY – GP8R (DOM)

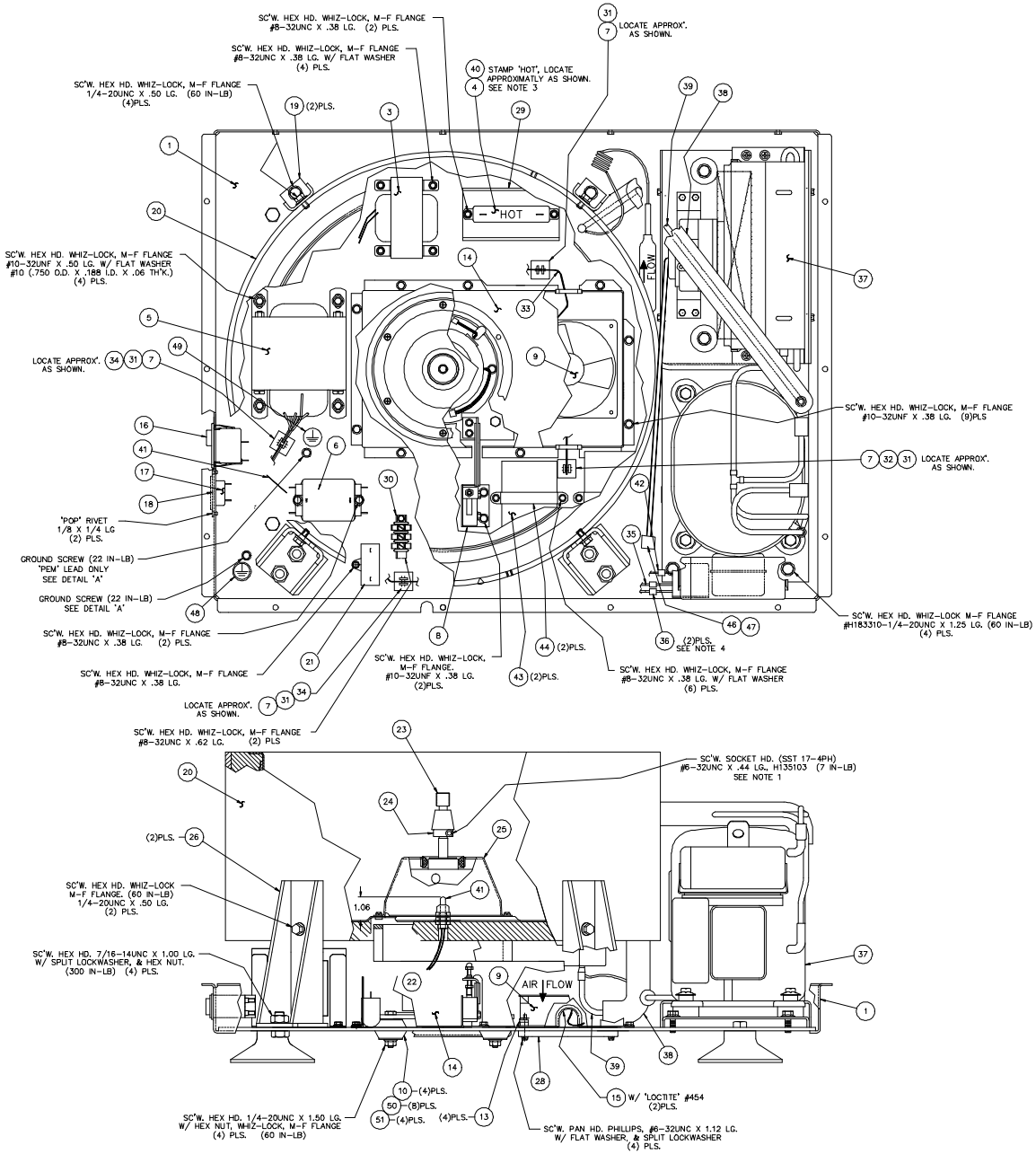
PREPARED	LTW	1/12/93	SHEET 1 OF 2
CHECKED	——	——	INITIAL RELEASE
APPROVED	RAD	1/2/93	ECO 0836 DATE:

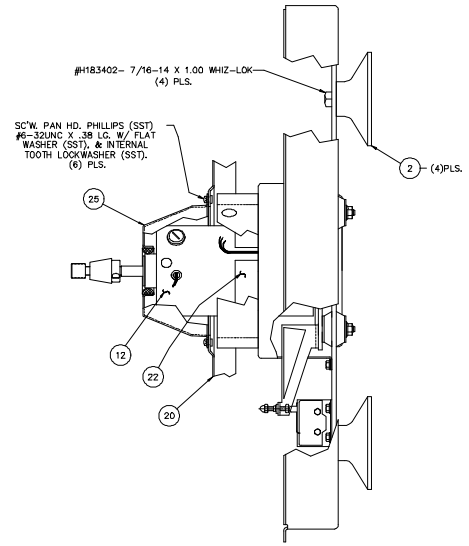
REVISION	18	19	20	21	22	14	15	16	17	APPLICATION	
SHEET	1	1	2	——	——	——	1	1	1	USED ON	NEXT ASSY
ECO NO.	3851	3881	4340	4868	5610	3116	3260	3456	3660	GP8R (DOM)	FINAL ASS'Y.
DATE	1/95	2/13/97	2/27/98	2/22/99	2/8/01	5/25/95	9/21/95	3/13/96	8/96		
BY	T.M.F.	P.L.	TME	PL	PL	PL	P.L.	P.L.	P.L.		
APPROVED	PS	PS	RAD	RAD	RAD	HJR	RAD	JAB	PS		

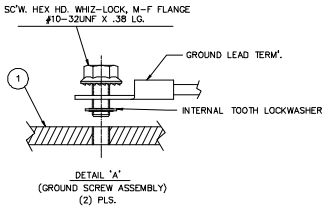
ITEM	QTY	PART NO.	DESCRIPTION	REMARKS
1	1	65473	ASSEMBLY – BASE	
2	1	65466A	ACCESS PANEL, CABINET	
3	1	65509	DETAIL ASSEMBLY – CABINET	
4	2	43181–A	LATCH, 'TRUMPH'	
5	4'	COML	POLYESTER 50LB. TEST FISHING LINE	
6	—	——	——	——
7	1	COM'L.	ARROW CLIP, NYLON	'HEYCO' #0317
8	1	COM'L.	OPEN/CLOSED BUSHING	'HEYCO' #2865
9	—	——	——	——
10				
11	1	65598	LABEL, WARNING	
12	1	47114	SHAFT NUT	
13	1	65461A	DETAIL ASSEMBLY – COVER	
14	2	43181–C	STRIKE, LATCH	
15				
16				
17	5	65479	HINGE	
18	1	50093	FOAM DISC, COVER	
19	1	65518	LINER, COVER	
20	1	65452	DETAIL ASSEMBLY – BEZEL (TABLE MODEL)	

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	PL 3122 SHEET 2 OF 2	REV 22

ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
21	9	COM'L.	BALLSTUD	'TINNERMAN' #P116
22	1	65464	MEMBRANE PANEL	
23	1	44465	ASSEMBLY – PC BOARD	
24	.7'	40003–A	TUBING, '0'–SEAL (.06 I.D. X .03 WALL)	
25	1	27222	MAT, RUBBER	
26				
27	1	COML	LABEL, DATAPLATE	REF. DWG. C–66001W
28	1	48704	LABEL, ROTATION	
29	1	50011	LABEL, CAUTION	
30	1	45996	LABEL, CAUTION	
31	1	66009	LABEL, REFRIGERATION	
32	1	50225	WIRING HARNESS, LATCH	
33	1	50120	WIRING HARNESS, P.C. BD./POWER	
34	1	65572	DEFLECTOR, SHIELD	
35	5.0'	65594	GASKET, COVER	
36				
37				——
38				
REF.	——	10844	WIRING DIAGRAM/WIRING SCHEMATIC	
——	1	OM–3121	OWNER'S MANUAL	
——	1	65542	KIT, SPARE PARTS	







REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	—	LTW	1/4/93	0836	RAD	1/28/93
1	—	P.L.	3/18/93	0922	RAD URI	3/20/93
2	—	LTW	4/7/93	0982	RAD	4/13/93
3	—	P.L.	4/23/93	1009	RAD	4/26/93
4	—	P.L.	4/29/93	1030	RAD	4/31/93
5	—	P.L.	5/4/93	2003	RAD	6/8/93
6	—	LTW	7/23/93	2124	RAD	7/25/93
7	—	LTW	9/8/93	2183	RAD	
8		P.L.	10/21/93	2232	RAD	10/25/93
9		P.L.	1/6/94	2344	RAD	1/7/94
10		P.L.	4/6/94	2442	RAD	4/8/94
11		P.L.	2/10/95	2721	RAD	2/10/95
12		P.L.	4/13/95	3051	RAD	illegible
13		P.L.	3/14/96	3456	JAB	4/9/96
14		P.L.	8/14/96	3660	PS	8/23/96
15		P.L.	2/19/97	3864	DMM	2/21/97
16		P.L.	6/29/98	4594	CI	7/2/98
17		P.L.	2/17/99	4868	RAD	3/2/99
18		P.L.	2/16/00	5275	RAD	3/16/00
19		P.L.	2/9/01	5610	RAD	2/16/01
20		P.L.	2/1/02	6053	CI	2/21/02
21		P.L.	9/11/02	6177		

NOTES:
1.– USE SCREW SHOWN IN PLACE OF THE SCREW SUPPLIED WITH THE CLAMP (ITEM 24).
2.– INSTALL THE DONUT (ITEM 22) SO THAT THE MOTOR LEADS PASS THRU THE DONUT OPENING.
3.– APPLY THERMAL COMPOUND (ITEM 40), BETWEEN HEAT SINK (ITEM 29) AND RESISTOR (ITEM 4).
4.– ATTACH (ITEMS 36) TO COMPRESSOR LEADS. CRIMP PER MANUFACURERS SPECIFICATIONS.

		MATERIAL: SEE P/L	PARTS LIST. SEE PL: 50085
		FINISH: SEE P/L	INTERNATIONAL EQUIP. CO.
		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √	TITLE: ASSEMBLY – BASE GP8R (Hi-V)
E-3125	GP8R(HI-V)		
NEXT ASSY	USED ON		
APPLICATION			FILE DISC #: SIZE: E DRAWING NO. 50085 REV. 21
BY	DATE		USER: 33 MASTER:
DRAWN LTW	1/4/93	TOLERANCES: 2 PLACE DEC. ±.02; 3 PLACE DEC. ±.005; ANGLES ±½	SCALE: HALF PLOT AT 1=2 SHEET 1 OF 1
CHECKED			
APPROVED RAD	1/28/93		

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	PL 65473 SHEET 3 OF 3	REV 13
ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
41	1	45028	DETAIL ASSEMBLY, TEMPERATURE SENSOR	
42	1	50272	WIRE, COMPRESSOR–NEUTRAL	
43	2	60647	CAPACITOR, 370VAC, 30MFD (OVAL)	COMPONENT SALES OF AMERICA INC
44	2	60648	MT'G. BRK'T., CAPACITOR	COMPONENT SALES OF AMERICA INC
45				
46	2	COML	PIN CONN	REF IEC DWG 74001–G
47	1	COML	CONN., PLUG 2 POS	REF IEC DWG 74009–W
——	REF.	10844	WIRING DIAGRAM /SCHEMATIC	
48				
49				
50	8	51053A	WASHER ISOLATOR MOUNT	
51	4	51053C	SILICONE MOUNT	

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	USER DISC # 32 MASTER DISC #	PL 65473 REF. DWG. 50085	REV. 13

TITLE	ASSEMBLY – BASE GP8R (DOM.)	PREPARED	LTW	1/12/93	SHEET 1 OF 3
		CHECKED	——	——	INITIAL RELEASE
		APPROVED	RAD	1/12/93	ECO 0836 DATE: 1/12/93

REVISION	9	10	11	12	13	5	6	7	8	APPLICATION	
SHEET	——	——	——	——	——	——	——	3	ALL	USED ON	NEXT ASSY
ECO NO.	3051	3660	4868	5610	5905	2124	2183	2442	2904	GP8R(DOM.)	3122
DATE	4/13/95	8/13/96	2/17/99	2/12/01	8/8/01	7/26/93	9/8/93	4/6/94	2/22/95		
BY	P.L.	PL	P.L.	P.L.	P.L.	LTW	LTW	PL	TME		
APPROVED	RAD	PS	RAD	RAD	RAD	RAD	RAD	RAD	RAD		

ITEM	QTY	PART NO.	DESCRIPTION	REMARKS
1	1	65507	DETAIL ASSEMBLY – BASE	
2	4	47248	MOUNTING FOOT	
3	1	49548	CHOKE MODIFIED	
4	1	60430–G	RESISTOR	
5	——	——	——	(NOT USED)
6	1	62607	LINE FILTER (20 AMPS)	
7	4	COM'L.	CABLE ANCHOR, ADHESIVE BACKING	'PANDUIT' #ABM23–A–D
8	1	65470	ASSEMBLY – MICROSWITCH (IMB'.)	
9	1	65485	FAN	
10	4	51053B	ISOLATOR CORE	
12	1	65527	ASSEMBLY – DRIVE	
13	4	65523	FAN MOUNTING CLIP	'COMAIR/ROTRON' #550113
14	1	48060	MOTOR ENCLOSURE	
15	A/R	33065	CHANNEL	#CH–383–6
16	1	62718–B	DUAL CIRCUIT BREAKER (15 AMP.)	
17	1	50802	POWER ENTRY MODULE	
18	1	50803	MOUNTING PLATE	
19	2	65442	SUPPORT LEG, CONTAINMENT	
20	1	50088	ASSEMBLY – GUARD BOWL/EVAPORATOR	

PARTS LIST	INTERNATIONAL EQUIPMENT CO.	PL 65473 SHEET 2 OF 3	REV 13
ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
21				
22	1	42762	DAMPING DONUT	
23	1	48620	ADAPTER, SHAFT	
24	1	48621	CLAMP, SPLIT	
25	1	65522	DETAIL ASSEMBLY – MOTOR BOOT	
26	2	65561	LEG SUPPORT, CONTAINMENT	
27				
28	1	65508	FAN GUARD	'COMAIR/ROTRON' #550481
29	1	63013	HEAT SINK, BRAKE RESISTOR	
30	1	43357	TERMINAL BOARD	
31	4	COM'L.	TY–WRAP	'TYTON CORP." #T18S
32	1	50229	WIRING HARNESS, COMPRESSOR/FAN	
33	1	50222	WIRING HARNESS, MOTOR/BRAKE, RESISTOR	
34	1	50121	WIRING HARNESS, LINE, PWR'.	
35	1	65478	GROUND LEAD, COMPRESSOR	
36	2	COM'L.	TERMINAL, FASTON, .250 X .032, 16–14 AWG	'AMP'#3–350819–2 'AMP'#3–350820–2
37	1	49963	CONDENSING UNIT (R–22) 120V.	
38	29"	33432	INSULATION, 'ARMAFLEX' 3/8 I.D. X 3/8 WALL	'ARMSTRONG' # 21/2B
39	1	65733	GP8R/3000 SUCTION LINE	
40	A/R	COM'L.	THERMAL COMPOUND	#120–8

PARTS LIST			INTERNATIONAL EQUIPMENT CO.	PL 50085 SHEET 3 OF 3	REV 21
ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS	
41	1	45028	DETAIL ASSEMBLY, TEMPERATURE SENSOR		
42	1	48121	D'ASSY GROUND LEAD		
43	—	———	———	(NOT USED)	
44	—	———	———	(NOT USED)	
45					
46	2	COML	PIN CONN	REF IEC DWG 74001-G	
47	1	COML	CONN., PLUG 2 POS	REF IEC DWG 74009-W	
48	1	50127	LABEL, PROTECTIVE EARTH GRD SYMBOL		
49	1	50128	LABEL, SECONDARY CHASSIS GRD SYMBOL		
—	REF.	D-10845	WIRING DIAGRAM /SCHEMATIC		
50	8	51053A	WASHER ISOLATOR MOUNT		
51	4	51053C	SILICONE MOUNT		

PARTS LIST		INTERNATIONAL EQUIPMENT CO.	USER DISC # 24 MASTER DISC #	PL 50085	REV. 21
TITLE	ASSEMBLY - BASE GP8R (Hi-V)		PREPARED LTW 1/4/93 CHECKED APPROVED	SHEET 1 OF 3 INITIAL RELEASE ECO 0836 DATE: 1/6/93	

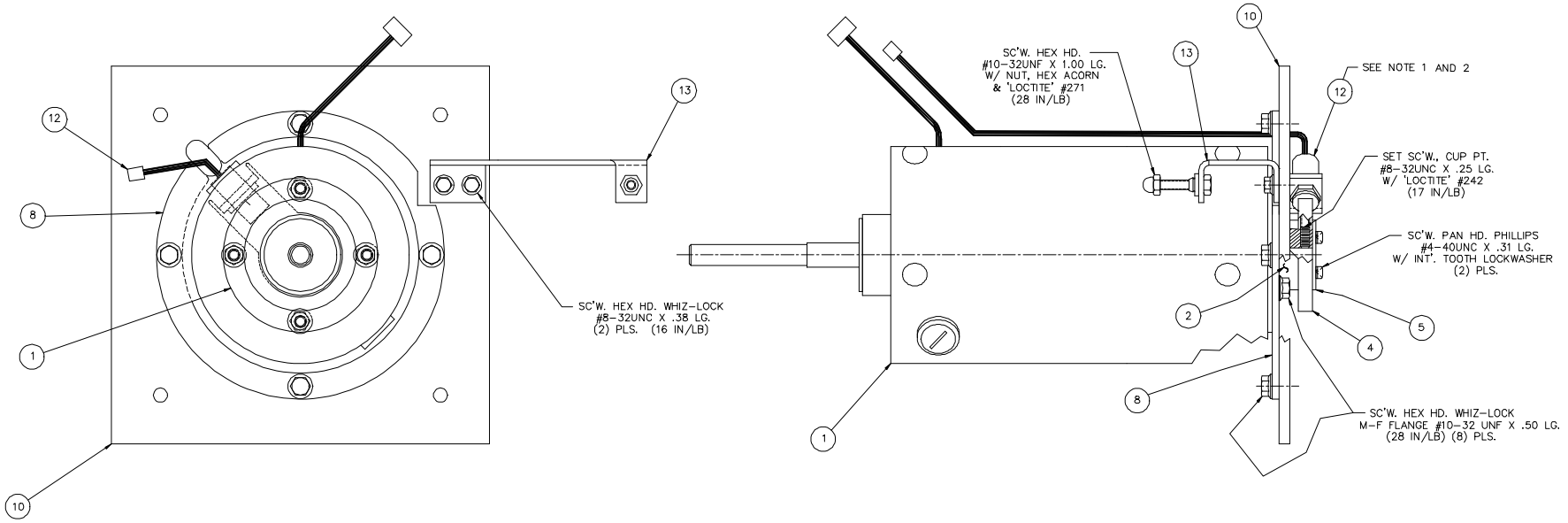
REVISION	19	20	21	13	14	15	16	17	18	APPLICATION	
SHEET	1	2	—	—	—	3	—	1-3	1	USED ON	NEXT ASSY
ECO NO.	5610	6053	6177	3456	3660	3864	4594	4868	5275	GP8R(Hi-V)	3125
DATE	2/9/01	2/1/02	9/11/02	3/14/96	8/14/96	2/19/97	6/29/98	2/17/99	2/16/00		
BY	P.L.	P.L.	P.L.	P.L.	P.L.	PL	PL	P.L.	P.L.		
APPROVED	RAD	RAD		JAB	PS	DMM	CI	RAD	CI		

ITEM	QTY	PART NO.	DESCRIPTION	REMARKS
1	1	65507	DETAIL ASSEMBLY - BASE	
2	4	47248	MOUNTING FOOT	
3	1	49548	CHOKE MODIFIED	
4	1	60430-G	RESISTOR	
5	1	65533-A	AUTOTRANSFORMER	
6	1	62612	LINE FILTER (6 AMP-50/60 HZ)	
7	4	COM'L.	CABLE ANCHOR, ADHESIVE BACKING	'PANDUIT' #ABM23-A-D
8	1	65470	ASSEMBLY - MICROSWITCH (IMB'.)	
9	1	65485	FAN	
10	4	51053B	ISOLATOR CORE	
12	1	65527	ASSEMBLY - DRIVE	
13	4	65523	FAN MOUNTING CLIP	'COMAIR/ROTRON' #550113
14	1	D-48060	MOTOR ENCLOSURE	
15	A/R	33065	CHANNEL	#CH-383-6
16	1	51233-A	DUAL PUSH SWITCH/CIRCUIT BREAKER (10A)	
17	1	49945	POWER ENTRY MODULE	
18	1	43173-K	FUSE DRAWER	
19	2	65442	SUPPORT LEG, CONTAINMENT	
20	1	50088	ASSEMBLY - GUARD BOWL/EVAPORATOR	

PARTS LIST		INTERNATIONAL EQUIPMENT CO.	PL 50085 SHEET 2 OF 3	REV 21
ITEM	QT'Y.	PART NO.	DESCRIPTION	REMARKS
21	1	60611	ASSY CAP	
22	1	42762	DAMPING DONUT	
23	1	48620	ADAPTER, SHAFT	
24	1	48621	CLAMP, SPLIT	
25	1	65522	DETAIL ASSEMBLY - MOTOR BOOT	
26	2	65561	LEG SUPPORT, CONTAINMENT	
27	—	———	———	(NOT USED)
28	1	65508	FAN GUARD	'COMAIR/ROTRON' #550481
29	1	63013	HEAT SINK, BRAKE RESISTOR	
30	1	43357	TERMINAL BOARD	
31	4	COM'L.	TY-WRAP	'TYTON CORP." #T18S
32	1	50311	WIRING HARNESS, COMPRESSOR/FAN	
33	1	50222	WIRING HARNESS, MOTOR/BRAKE, RESISTOR	
34	1	50252	WIRING HARNESS, LINE, PWR'.	
35	1	65478	GROUND LEAD, COMPRESSOR	
36	2	COM'L.	TERMINAL, FASTON, .250 X .032, 16-14 AWG	'AMP'#3-350819-2 'AMP'#3-350820-2
37	1	65595	CONDENSING UNIT (R-22) 230V.	
38	29"	33432	INSULATION, 'ARMAFLEX' 3/8 I.D. X 3/8 WALL	'ARMSTRONG' # 21/2B
39	1	65733	GP8R/3000 SUCTION LINE	
40	A/R	COM'L.	THERMAL COMPOUND	#120-8

Tel.: +(781)449-8060 Fax: +(781)455-9749

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	——	LTW	9/24/92	RELEASED 0590-A	RAD / URI	9/29/92
1	——	LTW	10/30/92	0682	RAD / URI	11/2/92
2	——	P.L.	5/20/93	1062	RAD / URI	5/22/93
3	——	LTW	8/2/93	2131	RAD / URI	8/4/93
4	——	LTW	8/31/93	2164	RAD / URI	9/7/93
5		P.L.	12/28/93	2337	RAD	12/28/93
6	– – –	HJR	11/20/97	4314	RAD	12/23/97
7	——	LTW	3/24/99	4961	RAD	4/2/99



NOTES:

1.–SET GAP BETWEEN SENSOR (ITEM 13), & MAGNETIC ROTOR (ITEM 4), AT .030–.070.

2.–SENSOR WIRES TO EXIT WITH WIRES ON THE "PLATE SIDE".

65471	GP8
65473	GP8R(DOM.)
65556	GP8R(HI–V)
65551	GP8K
65549	GP8RK(DOM.)
50085	GP8RK(HI–V)
NEXT ASSY	USED ON
APPLICATION	

	BY	DATE
DRAWN	LTW	6/26/92
CHECKED		
APPROVED	RAD	11/2/92

MATERIAL: SEE P/L

FINISH: SEE P/L

UNLESS OTHERWISE SPECIFIED.
DIMENSIONS ARE IN INCHS.
DIMENSIONS ARE AFTER FINISH.
REMOVE ALL BURRS & SHARP EDGES.
SURFACE QUALITY √

TOLERANCES: 2 PLACE DEC. ±.02 | 3 PLACE DEC. ±.005 | ANGLES ±1/2

SEE PARTS LIST 65527

INTERNATIONAL EQUIPMENT CO.

TITLE: ASSEMBLY – DRIVE

FILE DISC #: USER: 18 MASTER:

SIZE: D

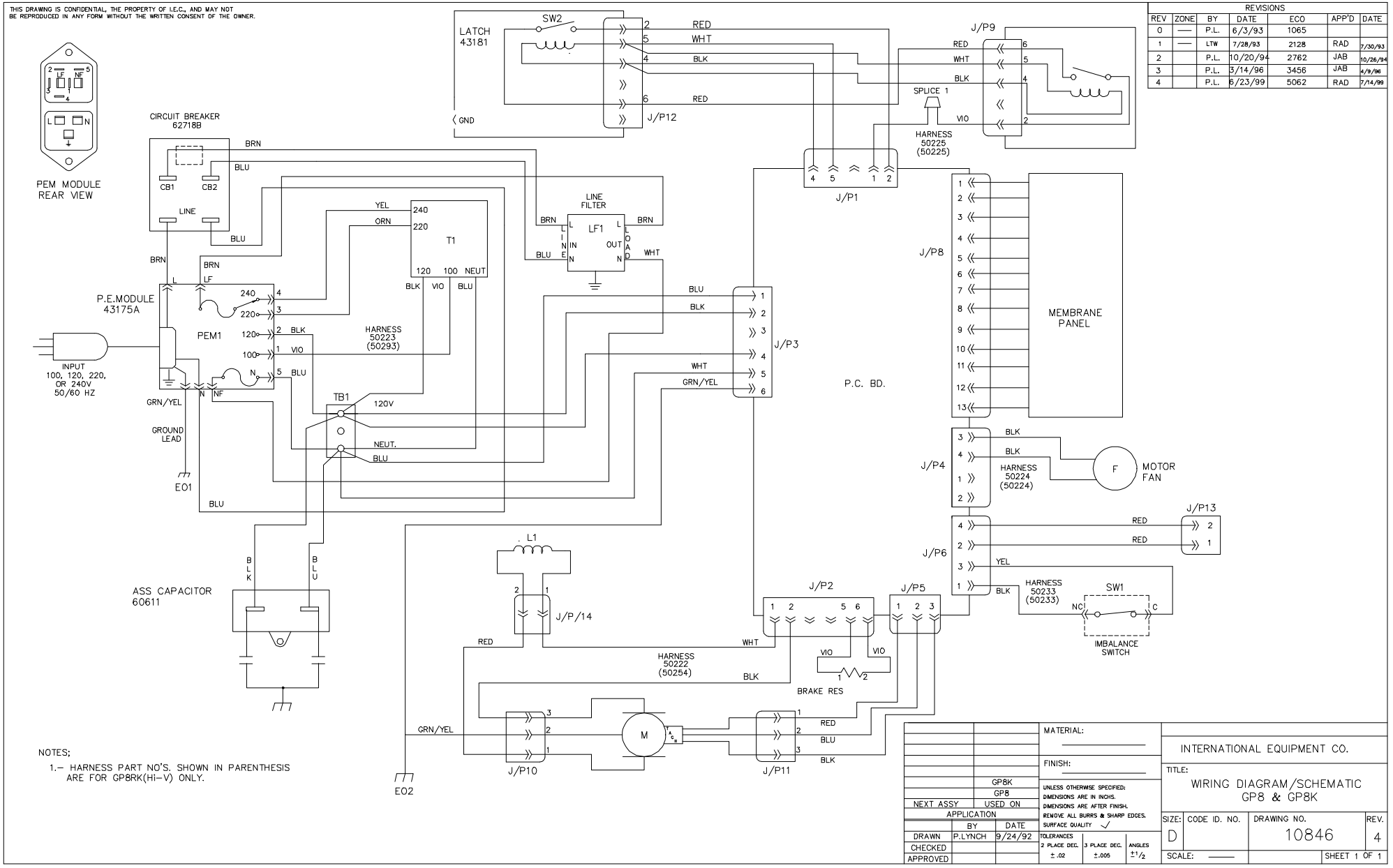
DRAWING NO. 65527

REV. 7

SCALE: FULL

SHEET 1 OF 1

Tel.: +(781)449-8060 Fax: +(781)455-9749



NOTES;

1.– HARNESS PART NO'S. SHOWN IN PARENTHESIS ARE FOR GP8RK(Hi–V) ONLY.

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	—	P.L.	6/3/93	1065		
1	—	LTW	7/28/93	2128	RAD	7/30/93
2		P.L.	10/20/94	2762	JAB	10/26/94
3		P.L.	3/14/96	3456	JAB	4/9/96
4		P.L.	6/23/99	5062	RAD	7/14/99

		MATERIAL:
		FINISH:
	GP8K	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHS. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓
	GP8	
NEXT ASSY	USED ON	
APPLICATION		
	BY	DATE
DRAWN	P.LYNCH	9/24/92
CHECKED		
APPROVED		

TOLERANCES		
2 PLACE DEC.	3 PLACE DEC.	ANGLES
± .02	±.005	±1/2

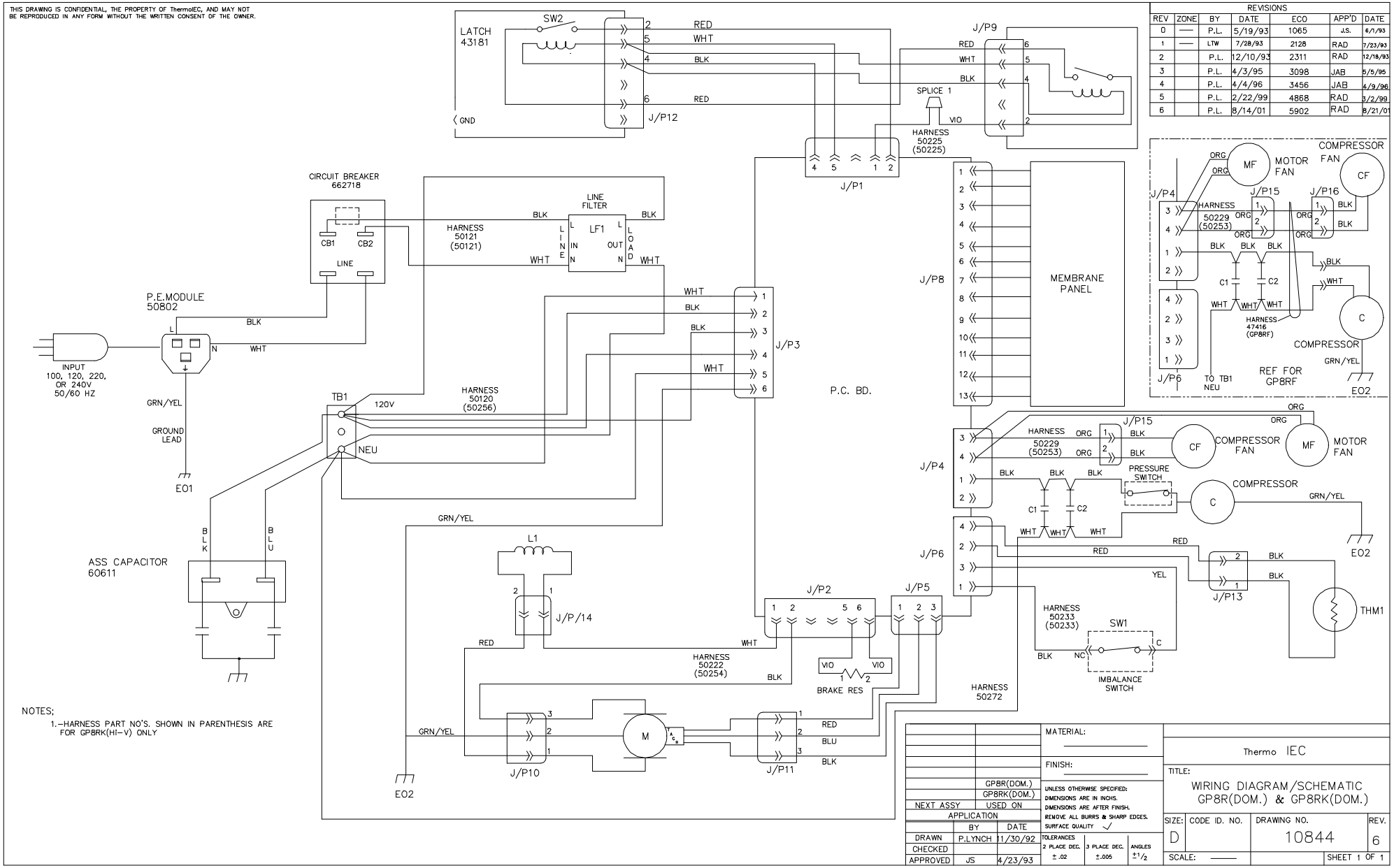
INTERNATIONAL EQUIPMENT CO.

TITLE: WIRING DIAGRAM/SCHEMATIC GP8 & GP8K

SIZE:	CODE ID. NO.	DRAWING NO.	REV.
D		10846	4

SCALE: —— SHEET 1 OF 1

Tel.: +(781)449-8060 Fax: +(781)455-9749



NOTES;
1.–HARNESS PART NO'S. SHOWN IN PARENTHESIS ARE FOR GP8RK(HI–V) ONLY

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	—	P.L.	5/19/93	1065	J.S.	6/1/93
1	—	LTW	7/28/93	2128	RAD	7/23/93
2		P.L.	12/10/93	2311	RAD	12/18/93
3		P.L.	4/3/95	3098	JAB	5/5/95
4		P.L.	4/4/96	3456	JAB	4/9/96
5		P.L.	2/22/99	4868	RAD	3/2/99
6		P.L.	8/14/01	5902	RAD	8/21/01

MATERIAL:		
FINISH:		
GP8R(DOM.)		
GP8RK(DOM.)		
NEXT ASSY	USED ON	
APPLICATION		
	BY	DATE
DRAWN	P.LYNCH	11/30/92
CHECKED		
APPROVED	JS	4/23/93

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHS. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓

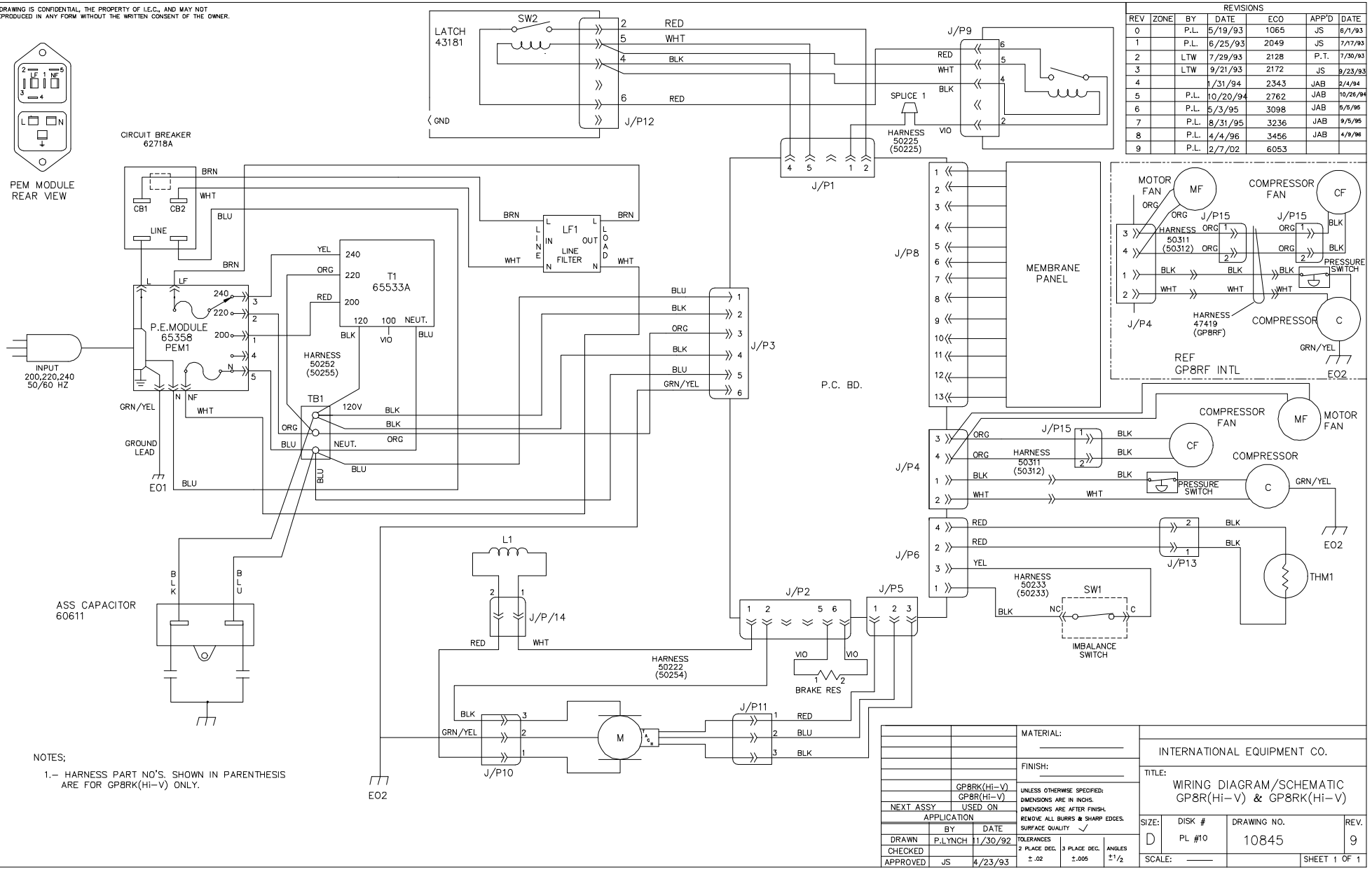
TOLERANCES: 2 PLACE DEC. ± .02 | 3 PLACE DEC. ±.005 | ANGLES ±1/2

Thermo IEC

TITLE: WIRING DIAGRAM/SCHEMATIC GP8R(DOM.) & GP8RK(DOM.)

SIZE:	CODE ID. NO.	DRAWING NO.	REV.
D		10844	6

SCALE: —— SHEET 1 OF 1



REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0		P.L.	5/19/93	1065	JS	6/1/93
1		P.L.	6/25/93	2049	JS	7/17/93
2		LTW	7/29/93	2128	P.T.	7/30/93
3		LTW	9/21/93	2172	JS	9/23/93
4			1/31/94	2343	JAB	2/4/94
5		P.L.	10/20/94	2762	JAB	10/26/94
6		P.L.	5/3/95	3098	JAB	5/5/95
7		P.L.	8/31/95	3236	JAB	9/5/95
8		P.L.	4/4/96	3456	JAB	4/9/96
9		P.L.	2/7/02	6053		

		GP8RK(Hi–V)	
		GP8R(Hi–V)	
NEXT ASSY		USED ON	
APPLICATION			
	BY	DATE	
DRAWN	P.LYNCH	11/30/92	
CHECKED			
APPROVED	JS	4/23/93	

MATERIAL:

FINISH:

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓

TOLERANCES		
2 PLACE DEC.	3 PLACE DEC.	ANGLES
± .02	±.005	±1/2

INTERNATIONAL EQUIPMENT CO.

TITLE: WIRING DIAGRAM/SCHEMATIC GP8R(Hi–V) & GP8RK(Hi–V)

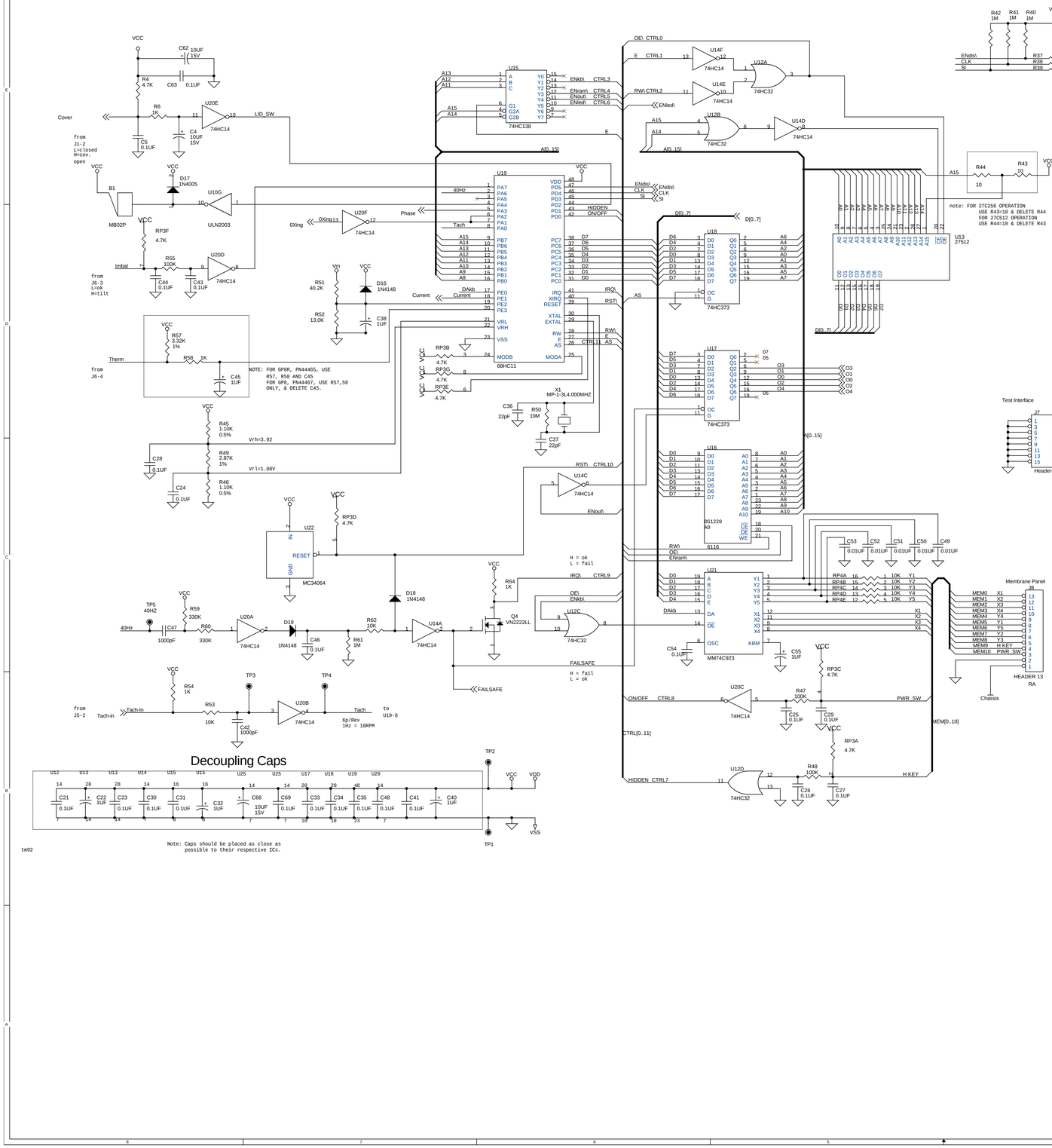
SIZE:	DISK #	DRAWING NO.	REV.
D	PL #10	10845	9

SCALE: —— SHEET 1 OF 1

Tel.: +(781)449-8060 Fax: +(781)455-9749

REVISIONS

REV	BY	ECO	APPD	DATE
3	HJR	2157	JCS	8-23-93
4	JAB	2513	JAB	5-11-94
5	PT	2959	PT	4-18-95
6	DMM	3864	DMM	2-20-97
7	DMM	4510	DMM	4-28-98
8	DMM/CM	4548	DMM/CM	5-22-98
9	RRE	4885	RRE	2-23-99
10	RAE	5398	RAE	5-11-00
11	RAE	5682	RAE	1-23-01



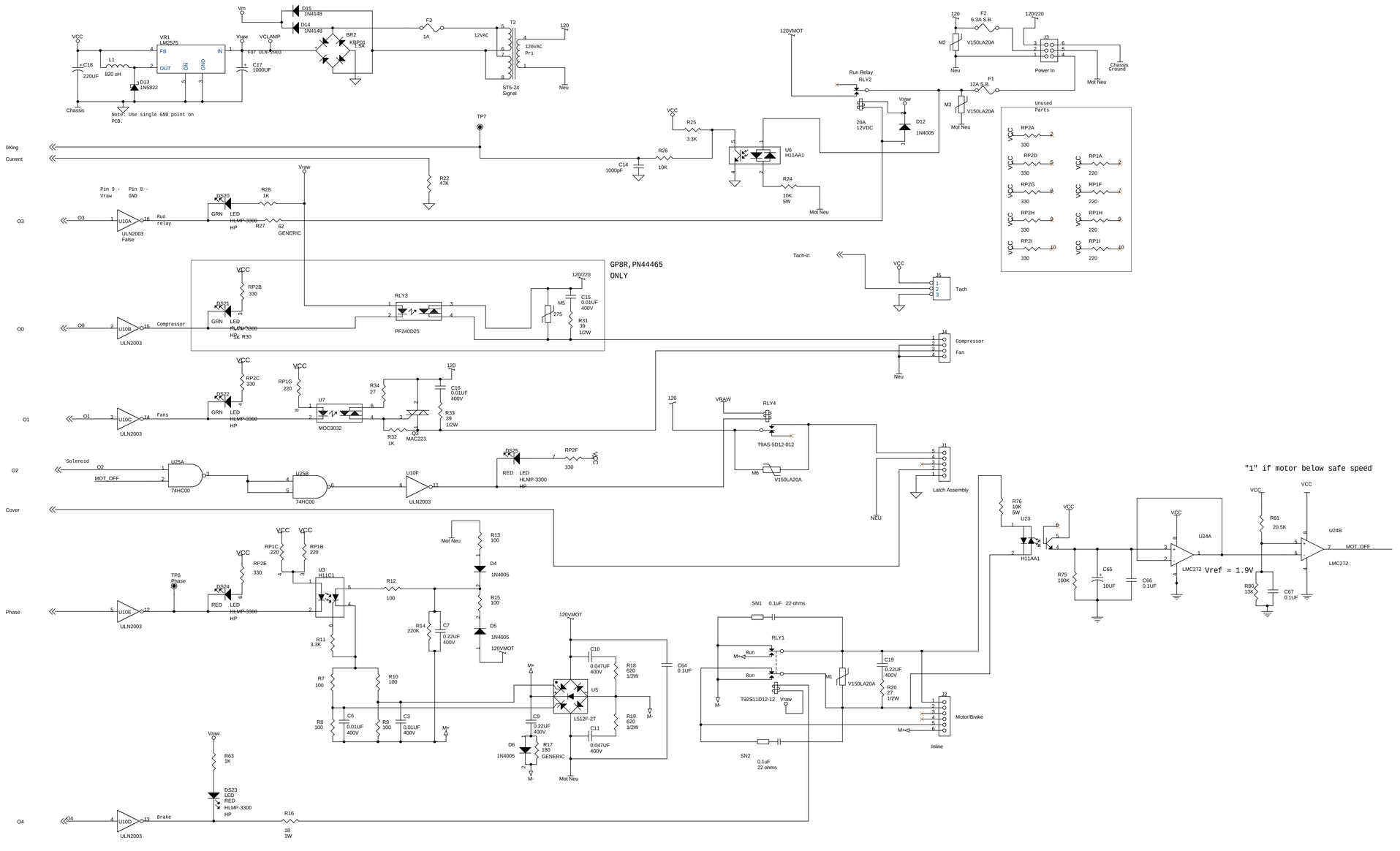
<Core Design>

ThermoIEC
300 SECOND AVE
Needham Heights, MA 02494.

Title: Centra-GP8/8R Logic Schematic

Size: D | Document Number: 10823 | Rev: 11

Date: Monday, January 29, 2001 | Sheet 1 of 3



<Core Design>
ThermoIEC
300 SECOND AVE
Needham Heights, MA 02494.

Title: Centra-GPB/BR Logic Schematic

Size: D | Document Number: 10823 | Rev: 11

Date: Monday, January 29, 2001 | Sheet 2 of 3

GP8R,PN44465
ONLY

RPM

RPM x 10,000 | x 1000 | x 100 | x 10 | x 1

Temp

x 10 | x 1

Note: Signal XDP
connects to 7-segment
displays only.

DS17 DS16 DS15 DS14 DS13 DS19 DS18 — HDSP-H103

Iseg=35mA max

VCC — R74 14.1K 1%

ENdis\
SI — Serial In
CLK — Clock In

U9 — MAX7219

DIN, DOUT, CLK, LOAD, I SET
DIG 0 … DIG 7
SEG A … SEG G, SEG DP

DSA8 … DSA15 → 1A … 1DP

DSA[0..15]

Accel

Decel

Note: "A" suffix indicates alternate mounting locatipn on PCB.

Stop — DS27 — RED
Start — DS28 — GRN
Cover Open — DS26 — YEL

DS36 … DS42 — YEL

DS29 … DS35 — YEL

NOTE: DS29,35,36 AND 42 NOT USED

Time

min | min/sec | min/sec

DS10 DS9 DS8 — HDSP-H103

Program

x 10 | x 1

DS7 DS6 — HDSP-H103

Rotor

x 100 | x 10 | x 1

DS5 DS4 DS3 — HDSP-H103

Iseg=35mA max

VCC — R69 14.1K 1%

U1 — MAX7219

DIN, DOUT, CLK, LOAD, I SET
DIG 0 … DIG 7
SEG A … SEG G, SEG DP

DSB8 … DSB15 → 2A … 2DP

DSB[0..15]

RPM

R71 150 1/4W 5% GENERIC
R72 150 1/4W 5% GENERIC
DS11 — LTL-57173

Rotor

R66 150 1/4W 5% GENERIC
R67 150 1/4W 5% GENERIC
DS1 — LTL-57173

RCF

R70 150 1/4W 5% GENERIC
R73 150 1/4W 5% GENERIC
DS12 — LTL-57173

Radius

R65 150 1/4W 5% GENERIC
R68 150 1/4W 5% GENERIC
DS2 — LTL-57173

FAILSAFE
ENled\ — U14B — 74HC14

U11 — UCN5800A

STROBE, OE, CLR, K
IN1 … IN4 → OUT1 … OUT4
D3, D2, D1, D0

D[0..7]

U1 U1 U9 U9 U11

C56 0.1UF 50V
C57 10UF
C58 0.1UF 50V
C59 10UF
C39 0.1UF 50V

VDD VCC VSS

Note: All pins listed MUST be connected to GND.

Place decoupling caps as close to ICs as possible.

<Core Design>

ThermoIEC
300 SECOND AVE
Needham Heights, MA 02494.

Title	Centra-GPS/BR Logic Schematic	
Size D	Document Number 10823	Rev 11
Date: Monday, January 29, 2001	Sheet 3 of 3	

FSCM	DWG NO.	SH	REV
			C

REVISIONS

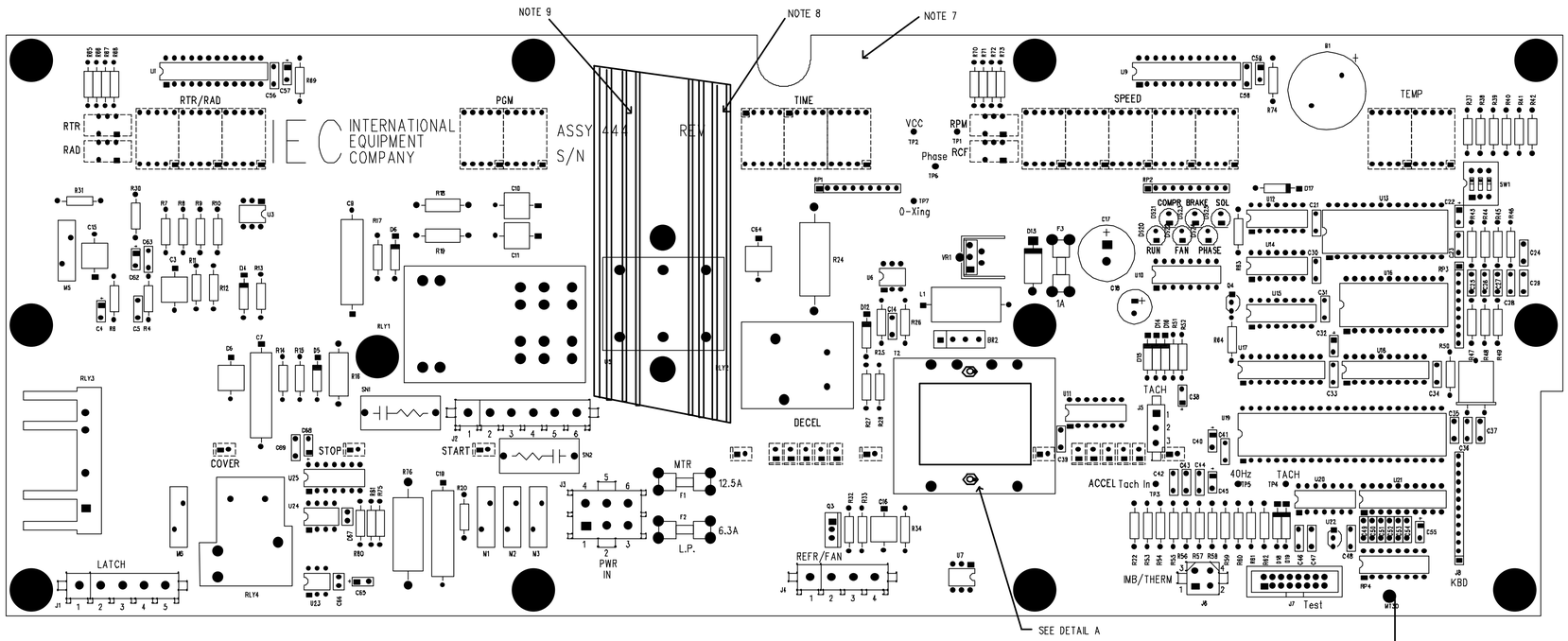
ZONE	REV	BY	DATE		DATE	APPROVED
	22	RAE	05/09/00	5398	05/11/00	RAE
	22	RAE	01/03/01	5682	01/23/00	RAE

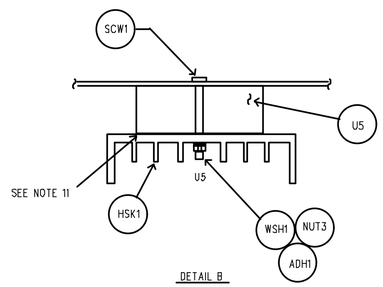
NOTES: UNLESS OTHERWISE SPECIFIED:

1. WORKMANSHIP TO BE EQUAL TO AND COMPLIANT WITH THE REQUIREMENTS OF IPC-A-610.
2. MARK DASH NUMBER AND REVISION NUMBER WHERE SHOWN; USING WHITE EPOXY INK.
3. THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES; STATIC-FREE HANDLING IS REQUIRED.
4. DESIGNATIONS ARE FOR REFERANCE ONLY AND MAY NOT APPEAR AS SEEN ON ACTUAL ASSEMBLY.
5. DIMENSIONS SHOWN SPECIFY MAXIMUM ENVELOPE LIMITS FOR THE FINISHED ASSEMBLY.
6. ORIENTATION OF POLARIZED CAPACITORS IS DENOTED BY A PLUS (+) SIGN. POLARITY IS IDENTIFIED ON THE PART.
7. VENDOR IDENTIFICATION & BD. SERIAL NO. TO BE IN THIS AREA
8. PERMANENTLY MARK APPLICABLE REVISION IN THIS AREA
9. PERMANENTLY MARK ASSY NO. 44465 IN THIS AREA
10. ASSOCIATED DRAWINGS FOR THIS P.C. BD. PACKAGE:
    a) ARTWORK, SOLDERMASK, MARKING, MACHINING - D-44439
    b) SCHEMATIC - D-10823
11. APPLY THERMAL COMPOUND BETWEEN U5 AND HSK1 BEFORE ATTACHING HARDWARE. CAUTION: DO NOT OVER TIGHTEN
12. DS1-DS19, DS26-DS28, DS30-DS34, DS37-DS41 ARE MOUNTED ON SOLDER SIDE. DS3-DS7, DS10, DS13-DS19, DECIMAL PT FACES BOTTOM OF THE BOARD. DS8 AND DS9 DECIMAL PT FACES TOP OF BD.
13. FUSE CLIPS MOUNT STOPTABS AWAY FROM FUSE
14. REMOVE TAPE THAT COVERS VENT HOLE ON TOP OF RLY1 IMEDIATELY AFTER PWB ASSY CLEANING
15. SET DIP SWITCHES, SW1, TO

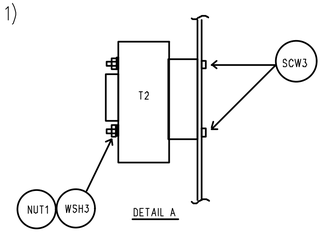
1	2	3
OFF	OFF	OFF

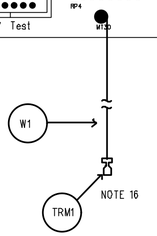
16. CONNECT PCB GND LEAD





COMPONENT SIDE (LAYER 1)





QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
			PARTS LIST	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX- ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN RAE	05/09/00
CHECKED RAE	05/11/00
ISSUED	

CUSTOMER: INTERNATIONAL EQUIPMENT COMPANY

TITLE: ASSEMBLY DRAWING, GP8 LOGIC PCB

SIZE	FSCM NO	DWG NO.	REV
D		44465	23

SCALE | SHEET 1 OF 1

NEXT ASSY	USED ON
APPLICATION	

Part Number: 44465
Revision Level: 23

Part Number	Description	Part Reference	Qty
XFR0001-00	TRANSFORMER,PC MNT,SIZE 5,12VA	T2	1
	Signal ST5-24		
WSH0006-00	WASHER,SS,SPLIT LOCK,#4	WSH1(FOR U5) WSH2(FOR U5) WSH3(FOR T2) WSH4(FOR T2)	4
	GENERIC		
WIR0004-00	20AWG,GRN/YEL, 16"L	W1(GND LEAD)	1
UCN0001-00	IC,MCU,ROMLESS	U19	1
	Motorola MC68HCP11A0P		
TRI0000-00	TRIAC,25A,500V	Q3	1
	Philips BTA140-500		
TPT0000-00	Test Point	TP1 TP2 TP3 TP4 TP5 TP6 TP7	7
	Mill-max 2108-2-00-44-00-07-0		
THR0001-00	THERMAL COMPOUND	FOR U5 HS	1
	GENERIC		
SWT0000-00	SWITCH,DIP,3 POS	SW1	1
	GRAYHILL 78B03		
SOC0002-00	SOCKET,IC,28 PIN DIP,.6 C-C	XU16	1
	CIRCUIT ASSY CA-28MSC-1F		
SOC0001-00	SOCKET,IC,24 PIN DIP,.6 C-C	XU13	1
	CIRCUIT ASSY CA-24MSC-1F		
SOC0000-00	SOCKET,IC,48 PIN,.6C-C	XU19	1
	CIRCUIT ASSY CA-48MS-1F		
SNB0000-00	SNUBBER, RES/CAP, 400V	SN1 SN2	2
	MALLORY 104M06QC22		
SCW0016-00	SCREW,SS,PAN HD,4-40,0.75 LG	SCW1(FOR U5) SCW2(FOR U5)	2
	GENERIC		

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
SCW0009-00	SCREW,NYLON,4-40,1.5LG		SCW3(FOR T2) SCW4(FOR T2)	2
	GENERIC			
RSN0005-00	RES NETWORK,9X220,SIP-10		RP1	1
	Bourns	4310-101-221		
RSN0004-00	RES NETWORK,9X330,SIP-10		RP2	1
	Bourns	4310-101-331		
RSN0003-00	RES NETWORK,9X4.7K,SIP-10		RP3	1
	Bourns	4310-101-472		
RSN0001-00	RES NETWORK,8X10K,DIP-16		RP4	1
	Bourns	4116-001-103		
RLY0014-00	RELAY,SOLID STATE, 25A, 3-15VDC		RLY3	1
	CRYDOM	PF240D25		
RLY0013-00	RELAY, SPDT, 20A, 12V		RLY4	1
	P&B	T9AS-5D12-012		
RLY0012-00	RELAY,SPDT,20A,12VDC		RLY2	1
	AROMAT	JT1AG-DC12		
RLY0011-00	RELAY,DPDT,30A,120VAC		RLY1	1
	P&B	T92S11D12-12		
RES0135-00	RES,CC,620,1/2W,5%		R18 R19	2
	GENERIC			
RES0134-00	RES,CC,62,1/4W,5%		R27	1
	GENERIC			
RES0109-00	RES,CC,47K,1/4W,5%		R22	1
	GENERIC			
RES0101-00	RES,PREC,40.2K,1/8W,1%		R51	1
	GENERIC			

Part Number: 44465
Revision Level: 23

Part Number	Description	Part Reference	Qty
RES0099-00	RES,CC,4.7K,1/4W,5%	R4	1
	GENERIC		
RES0092-02	RES,CC,39,1/4W,5%	R31 R33	2
	GENERIC		
RES0088-00	RES,CC,330K,1/4W,5%	R59 R60	2
	GENERIC		
RES0084-00	RES,3.3K, 1/4W, 5%	R11 R25	2
	GENERIC		
RES0083-02	RES,PREC,3.32K,1/8W,1%	R57	1
	GENERIC		
RES0076-02	RES,CC,27,1/4W,5%	R20 R34	2
	GENERIC		
RES0073-00	RES,CC,220K,1/4W,5%	R14	1
	GENERIC		
RES0065-00	RES,CC,20.5K,1/4W,1%	R81	1
	GENERIC		
RES0062-00	RES,PREC,2.87K,1/8W,1%	R49	1
	GENERIC		
RES0052-02	RES,CC,1M,1/4W,5%	R40 R41 R42 R61	4
	GENERIC		
RES0048-02	RES,CC,1K,1/4W,5%	R6 R28 R30 R32 R54 R58 R63 R64	8
	GENERIC		
RES0047-00	RES,CC,180,1/4W,5%	R17	1
	GENERIC		
RES0046-00	RES,CC,18,1W,5%	R16	1
	GENERIC		

Part Number: 44465
Revision Level: 23

Part Number	Description	Part Reference	Qty
RES0039-02	RES,CC,150,1/4W,5% GENERIC	R65 R66 R67 R68 R70 R71 R72 R73	8
RES0037-00	RES,PREC,14.1K,1/8W,1%,RN55D GENERIC	R69 R74	2
RES0035-00	RES,CC,13K, 1/4 W, 5% GENERIC	R80	1
RES0031-02	RES,PREC,13.0K,1/8W,1% GENERIC	R52	1
RES0029-00	RES,CC,10M,1/4W,5% GENERIC	R50	1
RES0021-00	RES,CC,10K,1/4W,5% GENERIC	R26 R53 R62	3
RES0020-00	RES,WIREWOUND,10K,5W,1% Clarostat SC5E-10K	R24 R76	2
RES0015-02	RES,CC,100K,1/4W,5% GENERIC	R37 R38 R39 R47 R48 R55 R75	7
RES0012-00	RES,CC,100,1/4W,5% GENERIC	R7 R8 R9 R10 R12 R13 R15	7
RES0008-00	RES,CC,10,1/4W,5% GENERIC	R43 R44	2
RES0003-00	RES,PREC,1.10K,1/8W,0.5% GENERIC	R45 R46	2
REG0006-00	IC,SWITCHING REG,5V National LM2575T-5.0	VR1	1
REF10823	SCHEMATIC,PC BD	REF1	1

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
RCT0005-00	POWER MODULE,SCR BRIDGE		U5	1
	Crydom	L512F-2T		
RCT0003-00	DIODE,BRIDGE,1.5A,100V		BR2	1
	GI	KBP01		
PRF0011-00	PERF BD,.062 THK,0.3 X 0.9		XDS30-XDS34 XDS37-XDS41	2
	GENERIC			
PRF0010-00	PERF BD,.062 THK,0.2 X 0.3		XDS26-XDS27	1
	GENERIC			
PRF0009-00	PERF BD,.062 THK,0.6 X 0.7		XDS1-XDS2 XDS11-XDS12	2
	GENERIC			
PRF0008-00	PERF BD,.062 THK,0.8 X 1.1		XDS6-XDS7	1
	GENERIC			
PRF0007-00	PERF BD,.062 THK,0.8 X 2.6		XDS13-XDS17	1
	GENERIC			
PRF0006-00	PERF BD,.062 THK,0.8 X 1.6		XDS3-XDS5 XDS8-XDS10	2
	GENERIC			
OPT0005-00	IC,OPTO-ISOL,AC SWITCH		U6 U23	2
	Motorola	H11AA1		
OPT0004-00	IC,OPTO-ISOL TRIAC,0XING		U7	1
	Marktek	MT303220		
OPT0002-00	IC,OPTO-ISOL,SCR,400V		U3	1
	TI	TLP645G		
NUT0000-00	NUT,SS,4-40 UNC		NUT1(FOR T2) NUT2(FOR T2) NUT3(FOR U5) NUT4(FOR U5)	4
	GENERIC			
MOV0001-00	MOV,275V,115J		M5	1
	GE, EDAL	275LA20A		

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
MOV0000-00	MOV		M1 M2 M3 M6	4
	GE	V150LA20A		
LED0024-00	LED,RED,RND,.1C-C,HI-EFF		DS20 DS21 DS22 DS23 DS24 DS25	6
	HP	HLMP-3300		
LED0008-00	LED,GRN,RECT		DS28	1
	HP	HLMP-T500		
LED0007-00	LED,YEL,RECT		DS26 DS29 DS30 DS31 DS32 DS33 DS34 DS35 DS36 DS37	15
	HP	HLMP-T300	DS38 DS39 DS40 DS41 DS42	
LED0006-00	DISPLAY,8 SEG,RED,C-CATH		DS3 DS4 DS5 DS6 DS7 DS8 DS9 DS10 DS13 DS14 DS15 DS16	15
	HP	HDSP-H103	DS17 DS18 DS19	
LED0005-00	LED,RED,RECT		DS27	1
	HP	HLMP-T200		
LED0003-00	LED,DUAL,RED,RECT		DS1 DS2 DS11 DS12	4
	Ledtronics	LTL-57173HR		
IND0000-00	COIL,AXIAL LEAD,820uHY,1A		L1	1
	Renco	RL1283-820		
ICD0050-00	IC,CMOS,QUAD,2 INPUT OR		U12	1
	Motorola	MC74HC32N		
ICD0049-00	IC,CMOS,3 TO 8 DECODER		U15	1
	Motorola	MC74HC138N		
ICD0040-00	IC,CMOS,EPROM,64KX8		U13	1
	National	NM27C512Q250		
ICD0020-00	IC,CMOS,LATCH,4 BIT		U11	1
	ALLEGRO	UCN5800A		
ICD0019-00	IC,CMOS,KEYB'D ENC R,5X4		U21	1
	National	MM74C923N		

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
ICD0017-00	IC, DUAL OP-AMP, CMOS		U24	1
	National	LMC272N		
ICD0015-00	IC,CMOS,HEX,SCHMITT INV		U14 U20	2
	National	MM74HC14N		
ICD0013-00	IC,RAM,CMOS,NON-VOL,2KX8		U16	1
	Dallas	DS1220AD		
ICD0007-02	IC,CMOS,OCTAL,3-STATE		U17 U18	2
	Motorola	MC74HC373		
ICD0002-00	IC, CMOS, QUAD 2 INPUT NAND		U25	1
	Motorola	MC74HC00N		
ICA0029-00	I.C.,DISP DRVR,8 BNK,8 SEG		U1 U9	2
	Maxim	MAX7219CNG		
ICA0013-00	IC,7-TRANS ARRAY,O-C,NPN		U10	1
	SPRAGUE	ULN2003A		
ICA0010-00	IC,UNDERVOLTAGE SENSE		U22	1
	Motorola	MC34064P-5		
HSK0016-00	HEATSINK, TO-220 CLIP-ON		HSK2(FOR VR1)	1
	AAVID	576802 B04000		
HSK0009-00	HEATSINK,MACHINED		HSK1(FOR U5)	1
FUS0009-00	FUSE,FAST,1A,250V,5X20		F3	1
	Schurter	034.3117		
FUS0008-00	FUSE,SLO-BLO,12.5A,250V,5X20		F1	1
	Schurter	034.3128		
FUS0005-00	FUSE,5 X 20 MM,SLO-BLO,6.3A,250V		F2	1
	Schurter	034.3125		

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
FUS0003-00	FUSE CLIP,PC MNT,TIN PLT		FC1 FC2 FC3 FC4 FC5 FC6	6
	Schurter	0G751.0062		
FET0005-00	MOSFET,N CHANNEL,SWITCHING		Q4	1
	Motorola	VN2222LL		
DIO0009-00	DIODE,SIGNAL		D14 D15 D16 D18 D19	5
	National	1N4148		
DIO0003-00	DIODE,1A,600V		D4 D5 D6 D12 D17	5
	Motorola	1N4005		
DIO0002-00	DIODE,SCHOTTKY,3A,250V		D13	1
	Motorola	1N5822		
CRY0001-00	CRYSTAL,3 PIN		X1	1
	M-Tron	MP-1-3L4.000MHZ		
CON0076-00	TERMINAL,FASTON,18-22 AWG, .250		TRM1(FOR W1)	1
	Amp	2-520183-2		
CON0047-00	CONNECTOR,PC MNT,5 PIN,STRT		J1	1
	Amp	640900-1		
CON0046-00	CONNECTOR,PC MNT,6 PIN,2 X 3		J3	1
	Amp	350827-1		
CON0020-00	CONNECTOR,PC MNT,4 PIN,STRT		J4	1
	Amp	350792-1		
CON0019-00	CONNECTOR,PC MNT,4 PIN,2X2		J6	1
	Amp	640499-2		
CON0018-00	CONNECTOR,PC MNT,3 PIN		J5	1
	Amp	640498-2		
CON0015-00	CONNECTOR,PC MNT,6 PIN,STRT		J2	1
	Amp	641831-1		

Part Number: 44465
Revision Level: 23

Part Number	Description		Part Reference	Qty
CON0001-00	HEADER,PC,MNT,13 PIN,RGT ANG		J8	1
	Amp	1-103325-3		
CAP0120-00			C22 C32 C38 C40 C45 C55	6
	Kemet	T362A105K035AS		
CAP0104-00	TANT,10UF,15V		C4 C57 C59 C62 C65 C68	6
	Kemet	T362A106K015AS		
CAP0086-00	POLY FILM,0.22UF,400V		C7 C9 C19	3
	TRW	601PE-0.22-400V		
CAP0085-00	POLY FILM, 0.1UF, 400V		C64	1
	Panasonic	ECQ-M4104JB		
CAP0083-00	POLY FILM,0.01UF,400V		C3 C6 C15 C16	4
	Nichicon	QXM-2J103K		
CAP0082-00	POLY FILM,0.047UF,400V		C10 C11	2
	TRW	601PE-0.047-400V		
CAP0049-00	MONO CER,22pF,200V		C36 C37	2
	Mallory	M22G220K2		
CAP0048-00	MONO CER,1000pF,50V		C14 C42 C47	3
	Mallory	M22R102M2		
CAP0047-00	MONO CER,0.01UF,50V		C49 C50 C51 C52 C53	5
	AVX	SR215C103KAA		
CAP0042-00	MONO CER,0.1UF,50V		C5 C21 C23 C24 C25 C26 C27 C28 C29 C30 C31 C33 C34 C35 C39 C41 C43 C44 C46 C48 C54 C56 C58 C63 C66 C67 C69	27
	Mallory	M22U104M5		
CAP0016-00	ELECT,220UF,16V		C18	1
	Illinois Cap	227CKR016M		
CAP0015-00	ELECT,100UF,35V		C17	1
	Illinois Cap	108CKR035M		

Part Number: 44465
Revision Level: 23

Part Number	Description	Part Reference	Qty
BPR0000-00	Beeper, Piezo, PC MNT	B1	1
	Piezo Electronics MB02P		
ADH0000-00	LOCTITE, ADHESIVE	ADH1(FOR U5)	1
	LOCTITE 271		
44439	ASSY/MARKING PC	PCB1	1
		J7	1

FSCM	DWG NO.	SH	REV
			C

REVISIONS

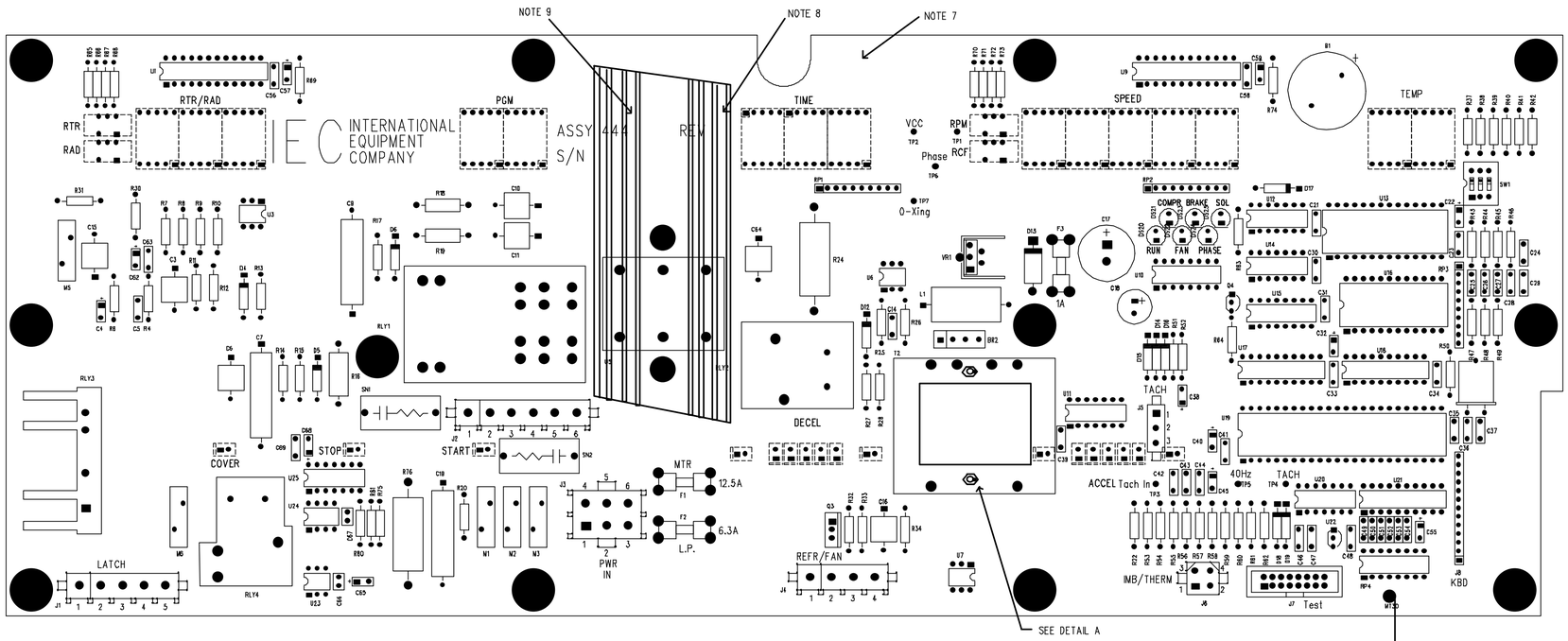
ZONE	REV	BY	DATE	ECO	DATE	APPROVED
	17	RAE	05/09/00	5398	05/11/00	RAE
	18	RAE	01/03/01	5682	01/23/01	RAE

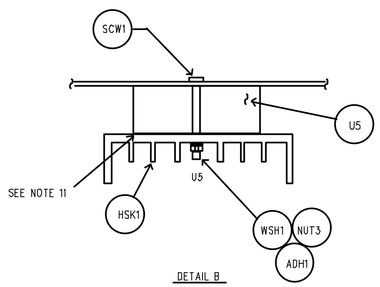
NOTES: UNLESS OTHERWISE SPECIFIED:

1. WORKMANSHIP TO BE EQUAL TO AND COMPLIANT WITH THE REQUIREMENTS OF IPC-A-610.
2. MARK DASH NUMBER AND REVISION NUMBER WHERE SHOWN; USING WHITE EPOXY INK.
3. THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES; STATIC-FREE HANDLING IS REQUIRED.
4. DESIGNATIONS ARE FOR REFERANCE ONLY AND MAY NOT APPEAR AS SEEN ON ACTUAL ASSEMBLY.
5. DIMENSIONS SHOWN SPECIFY MAXIMUM ENVELOPE LIMITS FOR THE FINISHED ASSEMBLY.
6. ORIENTATION OF POLARIZED CAPACITORS IS DENOTED BY A PLUS (+) SIGN. POLARITY IS IDENTIFIED ON THE PART.
7. VENDOR IDENTIFICATION & BD. SERIAL NO. TO BE IN THIS AREA
8. PERMANENTLY MARK APPLICABLE REVISION IN THIS AREA
9. PERMANENTLY MARK ASSY NO. 44467 IN THIS AREA
10. ASSOCIATED DRAWINGS FOR THIS P.C. BD. PACKAGE:
    a) ARTWORK, SOLDERMASK, MARKING, MACHINING - D-44439
    b) SCHEMATIC - D-10823
11. APPLY THERMAL COMPOUND BETWEEN U5 AND HSK1 BEFORE ATTACHING HARDWARE. CAUTION: DO NOT OVER TIGHTEN
12. DS1-DS17, DS26-DS28, DS30-DS34, DS37-DS41 ARE MOUNTED ON SOLDER SIDE. DS3-DS7, DS10, DS13-DS17, DECIMAL PT FACES BOTTOM OF THE BOARD. DS8 AND DS9 DECIMAL PT FACES TOP OF BD.
13. FUSE CLIPS MOUNT STOPTABS AWAY FROM FUSE
14. REMOVE TAPE THAT COVERS VENT HOLE ON TOP OF RLY1 IMEDIATELY AFTER PWB ASSY CLEANING
15. SET DIP SWITCHES, SW1, TO

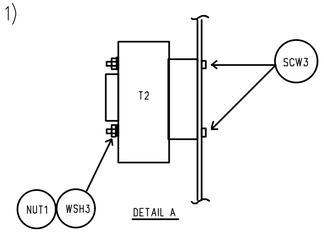
1	2	3
ON	OFF	OFF

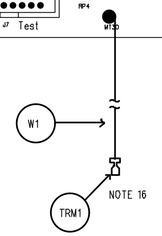
16. CONNECT PCB GND LEAD





COMPONENT SIDE (LAYER 1)





QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
			PARTS LIST	

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN RAE	05/09/00
CHECKED RAE	05/11/00
ISSUED	

CUSTOMER
INTERNATIONAL EQUIPMENT COMPANY

TITLE
ASSEMBLY DRAWING,
GP8 LOGIC PCB

SIZE	FSCM NO	DWG NO.	REV
D		44467	18

SCALE | SHEET 1 OF 1

Part Number: 44467
Revision Level: 18

Part Number	Description	Part Reference	Qty
XFR0001-00	TRANSFORMER,PC MNT,SIZE 5,12VA	T2	1
	Signal ST5-24		
WSH0006-00	WASHER,SS,SPLIT LOCK,#4	WSH1(FOR U5) WSH2(FOR U5) WSH3(FOR T2) WSH4(FOR T2)	4
	GENERIC		
WIR0004-00	20AWG,GRN/YEL, 16"L	W1(GND LEAD)	1
UCN0001-00	IC,MCU,ROMLESS	U19	1
	Motorola MC68HCP11A0P		
TRI0000-00	TRIAC,25A,500V	Q3	1
	Philips BTA140-500		
TPT0000-00	Test Point	TP1 TP2 TP3 TP4 TP5 TP6 TP7	7
	Mill-max 2108-2-00-44-00-07-0		
THR0001-00	THERMAL COMPOUND	FOR U5 HS	1
	GENERIC		
SWT0000-00	SWITCH,DIP,3 POS	SW1	1
	GRAYHILL 78B03		
SOC0002-00	SOCKET,IC,28 PIN DIP,.6 C-C	XU16	1
	CIRCUIT ASSY CA-28MSC-1F		
SOC0001-00	SOCKET,IC,24 PIN DIP,.6 C-C	XU13	1
	CIRCUIT ASSY CA-24MSC-1F		
SOC0000-00	SOCKET,IC,48 PIN,.6C-C	XU19	1
	CIRCUIT ASSY CA-48MS-1F		
SNB0000-00	SNUBBER, RES/CAP, 400V	SN1 SN2	2
	MALLORY 104M06QC22		
SCW0016-00	SCREW,SS,PAN HD,4-40,0.75 LG	SCW1(FOR U5) SCW2(FOR U5)	2
	GENERIC		

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
SCW0009-00	SCREW,NYLON,4-40,1.5LG		SCW3(FOR T2) SCW4(FOR T2)	2
	GENERIC			
RSN0005-00	RES NETWORK,9X220,SIP-10		RP1	1
	Bourns	4310-101-221		
RSN0004-00	RES NETWORK,9X330,SIP-10		RP2	1
	Bourns	4310-101-331		
RSN0003-00	RES NETWORK,9X4.7K,SIP-10		RP3	1
	Bourns	4310-101-472		
RSN0001-00	RES NETWORK,8X10K,DIP-16		RP4	1
	Bourns	4116-001-103		
RLY0014-00	RELAY,SOLID STATE, 25A, 3-15VDC		RLY3	1
	CRYDOM	PF240D25		
RLY0013-00	RELAY, SPDT, 20A, 12V		RLY4	1
	P&B	T9AS-5D12-012		
RLY0012-00	RELAY,SPDT,20A,12VDC		RLY2	1
	AROMAT	JT1AG-DC12		
RLY0011-00	RELAY,DPDT,30A,120VAC		RLY1	1
	P&B	T92S11D12-12		
RES0135-00	RES,CC,620,1/2W,5%		R18 R19	2
	GENERIC			
RES0134-00	RES,CC,62,1/4W,5%		R27	1
	GENERIC			
RES0109-00	RES,CC,47K,1/4W,5%		R22	1
	GENERIC			
RES0101-00	RES,PREC,40.2K,1/8W,1%		R51	1
	GENERIC			

Part Number: 44467
Revision Level: 18

Part Number	Description	Part Reference	Qty
RES0099-00	RES,CC,4.7K,1/4W,5%	R4	1
	GENERIC		
RES0092-02	RES,CC,39,1/4W,5%	R31 R33	2
	GENERIC		
RES0088-00	RES,CC,330K,1/4W,5%	R59 R60	2
	GENERIC		
RES0084-00	RES,3.3K, 1/4W, 5%	R11 R25	2
	GENERIC		
RES0083-02	RES,PREC,3.32K,1/8W,1%	R57	1
	GENERIC		
RES0076-02	RES,CC,27,1/4W,5%	R20 R34	2
	GENERIC		
RES0073-00	RES,CC,220K,1/4W,5%	R14	1
	GENERIC		
RES0065-00	RES,CC,20.5K,1/4W,1%	R81	1
	GENERIC		
RES0062-00	RES,PREC,2.87K,1/8W,1%	R49	1
	GENERIC		
RES0052-02	RES,CC,1M,1/4W,5%	R40 R41 R42 R61	4
	GENERIC		
RES0048-02	RES,CC,1K,1/4W,5%	R6 R28 R30 R32 R54 R58 R63 R64	8
	GENERIC		
RES0047-00	RES,CC,180,1/4W,5%	R17	1
	GENERIC		
RES0046-00	RES,CC,18,1W,5%	R16	1
	GENERIC		

Part Number: 44467
Revision Level: 18

Part Number	Description	Part Reference	Qty
RES0039-02	RES,CC,150,1/4W,5% GENERIC	R65 R66 R67 R68 R70 R71 R72 R73	8
RES0037-00	RES,PREC,14.1K,1/8W,1%,RN55D GENERIC	R69 R74	2
RES0035-00	RES,CC,13K, 1/4 W, 5% GENERIC	R80	1
RES0031-02	RES,PREC,13.0K,1/8W,1% GENERIC	R52	1
RES0029-00	RES,CC,10M,1/4W,5% GENERIC	R50	1
RES0021-00	RES,CC,10K,1/4W,5% GENERIC	R26 R53 R62	3
RES0020-00	RES,WIREWOUND,10K,5W,1% Clarostat SC5E-10K	R24 R76	2
RES0015-02	RES,CC,100K,1/4W,5% GENERIC	R37 R38 R39 R47 R48 R55 R75	7
RES0012-00	RES,CC,100,1/4W,5% GENERIC	R7 R8 R9 R10 R12 R13 R15	7
RES0008-00	RES,CC,10,1/4W,5% GENERIC	R43 R44	2
RES0003-00	RES,PREC,1.10K,1/8W,0.5% GENERIC	R45 R46	2
REG0006-00	IC,SWITCHING REG,5V National LM2575T-5.0	VR1	1
REF10823	SCHEMATIC,PC BD	REF1	1

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
RCT0005-00	POWER MODULE,SCR BRIDGE		U5	1
	Crydom	L512F-2T		
RCT0003-00	DIODE,BRIDGE,1.5A,100V		BR2	1
	GI	KBP01		
PRF0011-00	PERF BD,.062 THK,0.3 X 0.9		XDS30-XDS34 XDS37-XDS41	2
	GENERIC			
PRF0010-00	PERF BD,.062 THK,0.2 X 0.3		XDS26-XDS27	1
	GENERIC			
PRF0009-00	PERF BD,.062 THK,0.6 X 0.7		XDS1-XDS2 XDS11-XDS12	2
	GENERIC			
PRF0008-00	PERF BD,.062 THK,0.8 X 1.1		XDS6-XDS7	1
	GENERIC			
PRF0007-00	PERF BD,.062 THK,0.8 X 2.6		XDS13-XDS17	1
	GENERIC			
PRF0006-00	PERF BD,.062 THK,0.8 X 1.6		XDS3-XDS5 XDS8-XDS10	2
	GENERIC			
OPT0005-00	IC,OPTO-ISOL,AC SWITCH		U6 U23	2
	Motorola	H11AA1		
OPT0004-00	IC,OPTO-ISOL TRIAC,0XING		U7	1
	Marktek	MT303220		
OPT0002-00	IC,OPTO-ISOL,SCR,400V		U3	1
	TI	TLP645G		
NUT0000-00	NUT,SS,4-40 UNC		NUT1(FOR T2) NUT2(FOR T2) NUT3(FOR U5) NUT4(FOR U5)	4
	GENERIC			
MOV0001-00	MOV,275V,115J		M5	1
	GE, EDAL	275LA20A		

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
MOV0000-00	MOV		M1 M2 M3 M6	4
	GE	V150LA20A		
LED0024-00	LED,RED,RND,.1C-C,HI-EFF		DS20 DS21 DS22 DS23 DS24 DS25	6
	HP	HLMP-3300		
LED0008-00	LED,GRN,RECT		DS28	1
	HP	HLMP-T500		
LED0007-00	LED,YEL,RECT		DS26 DS29 DS30 DS31 DS32 DS33 DS34 DS35 DS36 DS37	15
	HP	HLMP-T300	DS38 DS39 DS40 DS41 DS42	
LED0006-00	DISPLAY,8 SEG,RED,C-CATH		DS3 DS4 DS5 DS6 DS7 DS8 DS9 DS10 DS13 DS14 DS15 DS16	15
	HP	HDSP-H103	DS17 DS18 DS19	
LED0005-00	LED,RED,RECT		DS27	1
	HP	HLMP-T200		
LED0003-00	LED,DUAL,RED,RECT		DS1 DS2 DS11 DS12	4
	Ledtronics	LTL-57173HR		
IND0000-00	COIL,AXIAL LEAD,820uHY,1A		L1	1
	Renco	RL1283-820		
ICD0050-00	IC,CMOS,QUAD,2 INPUT OR		U12	1
	Motorola	MC74HC32N		
ICD0049-00	IC,CMOS,3 TO 8 DECODER		U15	1
	Motorola	MC74HC138N		
ICD0040-00	IC,CMOS,EPROM,64KX8		U13	1
	National	NM27C512Q250		
ICD0020-00	IC,CMOS,LATCH,4 BIT		U11	1
	ALLEGRO	UCN5800A		
ICD0019-00	IC,CMOS,KEYB'D ENC R,5X4		U21	1
	National	MM74C923N		

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
ICD0017-00	IC, DUAL OP-AMP, CMOS		U24	1
	National	LMC272N		
ICD0015-00	IC,CMOS,HEX,SCHMITT INV		U14 U20	2
	National	MM74HC14N		
ICD0013-00	IC,RAM,CMOS,NON-VOL,2KX8		U16	1
	Dallas	DS1220AD		
ICD0007-02	IC,CMOS,OCTAL,3-STATE		U17 U18	2
	Motorola	MC74HC373		
ICD0002-00	IC, CMOS, QUAD 2 INPUT NAND		U25	1
	Motorola	MC74HC00N		
ICA0029-00	I.C.,DISP DRVR,8 BNK,8 SEG		U1 U9	2
	Maxim	MAX7219CNG		
ICA0013-00	IC,7-TRANS ARRAY,O-C,NPN		U10	1
	SPRAGUE	ULN2003A		
ICA0010-00	IC,UNDERVOLTAGE SENSE		U22	1
	Motorola	MC34064P-5		
HSK0016-00	HEATSINK, TO-220 CLIP-ON		HSK2(FOR VR1)	1
	AAVID	576802 B04000		
HSK0009-00	HEATSINK,MACHINED		HSK1(FOR U5)	1
FUS0009-00	FUSE,FAST,1A,250V,5X20		F3	1
	Schurter	034.3117		
FUS0008-00	FUSE,SLO-BLO,12.5A,250V,5X20		F1	1
	Schurter	034.3128		
FUS0005-00	FUSE,5 X 20 MM,SLO-BLO,6.3A,250V		F2	1
	Schurter	034.3125		

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
FUS0003-00	FUSE CLIP,PC MNT,TIN PLT		FC1 FC2 FC3 FC4 FC5 FC6	6
	Schurter	0G751.0062		
FET0005-00	MOSFET,N CHANNEL,SWITCHING		Q4	1
	Motorola	VN2222LL		
DIO0009-00	DIODE,SIGNAL		D14 D15 D16 D18 D19	5
	National	1N4148		
DIO0003-00	DIODE,1A,600V		D4 D5 D6 D12 D17	5
	Motorola	1N4005		
DIO0002-00	DIODE,SCHOTTKY,3A,250V		D13	1
	Motorola	1N5822		
CRY0001-00	CRYSTAL,3 PIN		X1	1
	M-Tron	MP-1-3L4.000MHZ		
CON0076-00	TERMINAL,FASTON,18-22 AWG, .250		TRM1(FOR W1)	1
	Amp	2-520183-2		
CON0047-00	CONNECTOR,PC MNT,5 PIN,STRT		J1	1
	Amp	640900-1		
CON0046-00	CONNECTOR,PC MNT,6 PIN,2 X 3		J3	1
	Amp	350827-1		
CON0020-00	CONNECTOR,PC MNT,4 PIN,STRT		J4	1
	Amp	350792-1		
CON0019-00	CONNECTOR,PC MNT,4 PIN,2X2		J6	1
	Amp	640499-2		
CON0018-00	CONNECTOR,PC MNT,3 PIN		J5	1
	Amp	640498-2		
CON0015-00	CONNECTOR,PC MNT,6 PIN,STRT		J2	1
	Amp	641831-1		

Part Number: 44467
Revision Level: 18

Part Number	Description		Part Reference	Qty
CON0001-00	HEADER,PC,MNT,13 PIN,RGT ANG		J8	1
	Amp	1-103325-3		
CAP0120-00			C22 C32 C38 C40 C45 C55	6
	Kemet	T362A105K035AS		
CAP0104-00	TANT,10UF,15V		C4 C57 C59 C62 C65 C68	6
	Kemet	T362A106K015AS		
CAP0086-00	POLY FILM,0.22UF,400V		C7 C9 C19	3
	TRW	601PE-0.22-400V		
CAP0085-00	POLY FILM, 0.1UF, 400V		C64	1
	Panasonic	ECQ-M4104JB		
CAP0083-00	POLY FILM,0.01UF,400V		C3 C6 C15 C16	4
	Nichicon	QXM-2J103K		
CAP0082-00	POLY FILM,0.047UF,400V		C10 C11	2
	TRW	601PE-0.047-400V		
CAP0049-00	MONO CER,22pF,200V		C36 C37	2
	Mallory	M22G220K2		
CAP0048-00	MONO CER,1000pF,50V		C14 C42 C47	3
	Mallory	M22R102M2		
CAP0047-00	MONO CER,0.01UF,50V		C49 C50 C51 C52 C53	5
	AVX	SR215C103KAA		
CAP0042-00	MONO CER,0.1UF,50V		C5 C21 C23 C24 C25 C26 C27 C28 C29 C30 C31 C33 C34 C35 C39 C41 C43 C44 C46 C48 C54 C56 C58 C63 C66 C67 C69	27
	Mallory	M22U104M5		
CAP0016-00	ELECT,220UF,16V		C18	1
	Illinois Cap	227CKR016M		
CAP0015-00	ELECT,100UF,35V		C17	1
	Illinois Cap	108CKR035M		

Part Number: 44467
Revision Level: 18

Part Number	Description	Part Reference	Qty
BPR0000-00	Beeper, Piezo, PC MNT	B1	1
	Piezo Electronics MB02P		
ADH0000-00	LOCTITE, ADHESIVE	ADH1(FOR U5)	1
	LOCTITE 271		
44439	ASSY/MARKING PC	PCB1	1
		J7	1