

# ***Cybortronics Inc.***

## **Model HR3690 Chamber**

The Model HR3690 is a single bay temperature cycling chamber specifically designed for the commercial electronics environment. Specifications for the chamber are as follows:



- *Temperature range of  $-10^{\circ}\text{C}$  to  $80^{\circ}\text{C}$*
- *72,000 BTU Refrigeration System*
  - *Water cooled condenser requires external water cooling tower.*
  - *R-507 Ozone Safe Refrigerant*
  - *Compressor Inhibit if Refrigerant lost*
- *40,000 BTU Heating System*
- *1500 CFM Air Recirculation with Vertical Airflow design*
- *Watlow Model 981 Temperature Controller*
  - *20 step Ramp & Soak profiling*
  - *RS-232 , RS-422, or EIA 485 Communications Interface*
- *Safety Alarms with LED Display and Audible alert*
  - *Over-Temperature*
  - *Blower Failure*
- *Front Panel Display and Control of Alarm Status and UUT Power Control*
- *Triple Pane Glass Doors for product visibility*
- *Brushed Stainless Steel and Granite Grey Powder-Coat Exterior for High-Tech appearance*
- *AC Power requirements of 208 VAC, 3 Phase, 60 Amps*

## Section I

# HR3690 Chamber Functional Description

Following is a functional description of the various elements of the HR3690 Chamber. These elements consist of the Front Panel, the Air Recirculation System, the Heating System, the Cooling System, and the Alarm System. Please see Figure 1.1 for a complete schematic of the electrical components of the HR3690 Chamber. All serviceable component parts with the exception of the blower and the refrigeration components are located under the 'hood' of the chamber. This hood is hinged at the top and has two philips screws in the lower left and right corners to allow access to the Power Control Panel, the CYB20480 Relay Module, and the Watlow Model LV Over-temperature Limit Control.

### Front Panel -

The Front Panel contains the Watlow Model 981 Temperature Controller, the UUT Power Control, and the Alarm Control . Please see Figure 1.3 for the layout of this panel. The Watlow Temperature Controller is the 'brains' of the chamber, controlling all heating and cooling functions. Output 1 (L1) of the controller is connected to the heating circuit. Output 2 (L2) is connected to the cooling circuit. The fourth output (L4) is the RS-232 communications interface. The L4 LED will flash whenever serial data is being sent from the controller. Please see Figure 1.4 for a quick guide to the Watlow operation. All further details of the Watlow can be found in the Watlow 'Series 982 User's Manual'. Data communications interfacing and commands can be found in the 'Data Communications with the Watlow Series 988 Family of Controllers User's Guide'.

The UUT Power Control consists of a switch to control the On/Off state of the AC to the UUT outlets in the optional CYB20440 AC Distribution Panel. See Section III for a description of this unit if this option is installed. An LED shows the status of this switch.

The Alarm Control consists of LED's showing the status of the Over-temp, AC Phase, and Blower alarms. If the associated LED is on, then an alarm condition exists. The Audible switch allows resetting the Over-temp alarm if this alarm condition exists.

## **Air Recirculation System -**

An 1500 CFM blower is powered continuously from 208 VAC through fuses F14 and F15. This blower pulls air vertically up through the product, the refrigeration system's evaporator coil, across the heating coils, and then directs the airflow down the back wall of the chamber.

## **Heating System -**

The heating circuit is comprised of three 4000 watt nichrome heating elements mounted just above the evaporator coil in the top of the chamber. For safety reasons, three Solid State Relays (SSR2, SSR3, SSR4) are used to control these heating elements. Each heater is removable and is fused at 40 amps by fuses FA, FB, and FC. The negative control line to all three SSR's is the L1 output of the Watlow 981 Temperature Controller. If Output 1 (L1) is on, this terminal is grounded and will turn on the SSR's. The positive control line to the three SSR's is a switched +12 VDC line. This line will be opened by the K1 or K2 relays on the CYB20480 module if an Over-temp or Blower alarm condition exists. All three legs of the 208 VAC input power will then be removed upon an alarm condition.

## **Cooling System -**

The cooling circuit consists of an 6 HP Copeland Compressor System with an associated control circuit. The system uses ozone safe R-507 refrigerant. Output 2 (L2) of the Watlow 981 Temperature Controller, when active, will turn on the refrigeration solenoid by grounding the negative side of SSR1. At the same time, relay SP2 on the CYB20480 module is energized which closes the contact to the Off Delay Timer. The timer then applies 115 VAC thru the pressure switches to contactor K2 to turn on the 208 VAC three phase to the compressor. Time delay fuses (F11, F12, F13) of 25 amp capacity are used for the compressor due to the motor start-up current draw. If the compressor has lost refrigerant, the pressure switches will open, disabling contactor K2. The timer will keep the compressor running for a minimum of 3 minutes even if Output 2 has turned off. This extends the life of the compressor by assuring proper separation of the Freon and oil in the compressor. The flow of Freon is controlled by the solenoid valve controlled by SSR1. When the Freon flow is turned off but the compressor is still running, a 'hot gas bypass' valve is opened to allow the Freon to re-circulate.

## **Dry Air Purge System—(Optional)**

A Dry Air Purge System is installed on the rear of the chamber to provide a dry environment in the chamber. This system requires a connection to a dry compressed air supply of 60 PSIG.

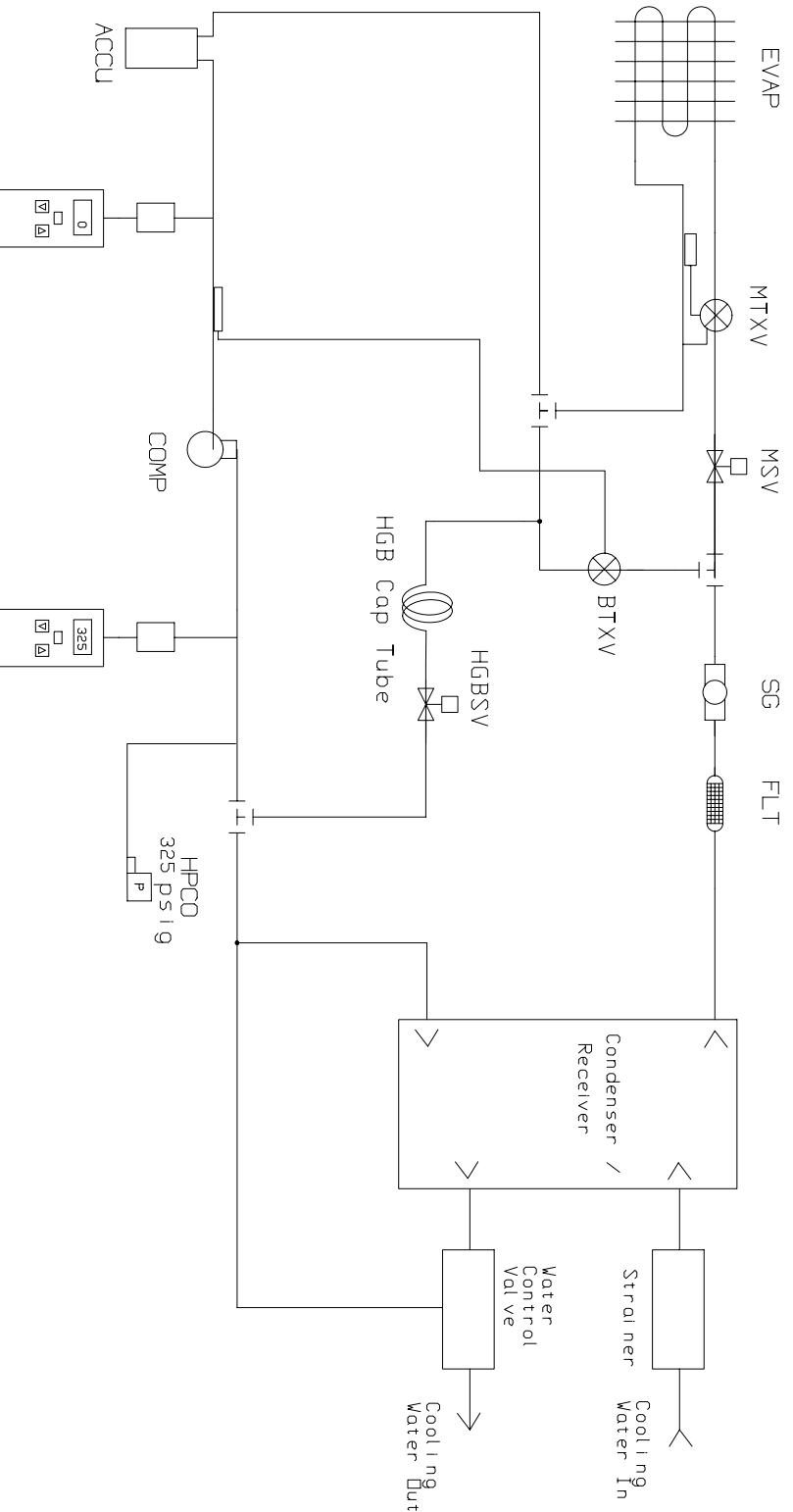
## **Alarm System -**

The AC Phase Alarm , when lit, will disconnect the ground line from the +12 VDC power supply from all circuitry in the chamber . This will inhibit all chamber operation. This alarm indicates that the 208 VAC connected to the chamber is not connected in the proper phase. The compressor used in the refrigeration circuit cannot be operated unless proper phasing of the AC supply is present. Usually just switching two of the phases at the AC source to the chamber will correct this problem. The AC Phase Monitor on the Control Panel will have its LED lit when it detects proper phasing.

The Over-temp Alarm consists of a Watlow Model LV Limit Control that when activated, turns on relay K1 on the CYB20480 module. This in turn will close contacts to turn on the front panel LED indicating an alarm condition and turn on the Sonalert audible device. Another set of contacts will open the +12 VDC line controlling the SSR's used for the heating coils. This switched +12 VDC line is also used in the interface cable to the optional AC Distribution Panel. This will turn off the SSR's in this panel and remove all AC from the UUT's, removing all heat load from the inside of the chamber and protecting the UUT's from damage. The Over-temp Alarm is a latching alarm and will stay active until the problem is resolved and the alarm is manually reset. The reset switch is a momentary rocker switch located below the Alarm Display on the front panel. The chamber is shipped with the Over-temp Alarm set to 80°C. Access to this control is obtained by raising the 'hood' of the chamber.

The Blower Alarm is an air-flow switch which when activated due to a blower failure or slow spin condition, will turn on relay K2 on the CYB20480 module. A set of contacts will then turn on the front panel LED indicating the alarm condition along with the Sonalert sounding. A second set of contacts performs the same functions as the Over-temp Alarm, turning off the heaters and the AC to the UUT's. This alarm is self-resetting.

ACCU - ACCUMULATOR
COMP - COMPRESSOR
COND - CONDENSER
EVAP - EVAPORATOR
FLT - FILTER
HPCO - HIGH PRESSURE CUT OUT
SG - SIGHT GLASS
MSV - MAIN SOLENOID VALVE
MTXV - MAIN THERMOSTATIC EXPANSION VALVE
HGBSV - BYPASS SOLENOID VALVE



# R-507 Refrigerant

Genetron AZ-50  
 Pentafluoroethane -50%  
 1,1,1 Trifluoroethane -50%  
 2:2: UN3163

Ambient Operating Temp. 68-75 F  
 Standard Charge: 8.25 lbs @ 68-75 F

DIGITAL LOW  
 PRES CUTOUT  
 CUT-OUT = 0 PSIG  
 CUT-IN = 20 PSIG

DIGITAL HIGH  
 PRES CUTOUT  
 CUT-OUT = 325 PSIG  
 CUT-IN = 290 PSIG

In Box Temp Pulldown From 70C to -10C:  
 Liquid Side High Pres NTE 350 psig  
 Suction Side Pres NTE 120 psig  
 At -10C Box Temp: Suction Pres = 30 psig  
 By-pass Mode Suction Pressure = 10-30 psig  
 By-pass Mode Suction Temp = 37.5° F nom.

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Refrigeration Schematic

MATERIAL	DRAWING NO: HR3690-RS	REV: A
FINISH	SCALE	DATE 04/29/08
		SHEET 1 of 1

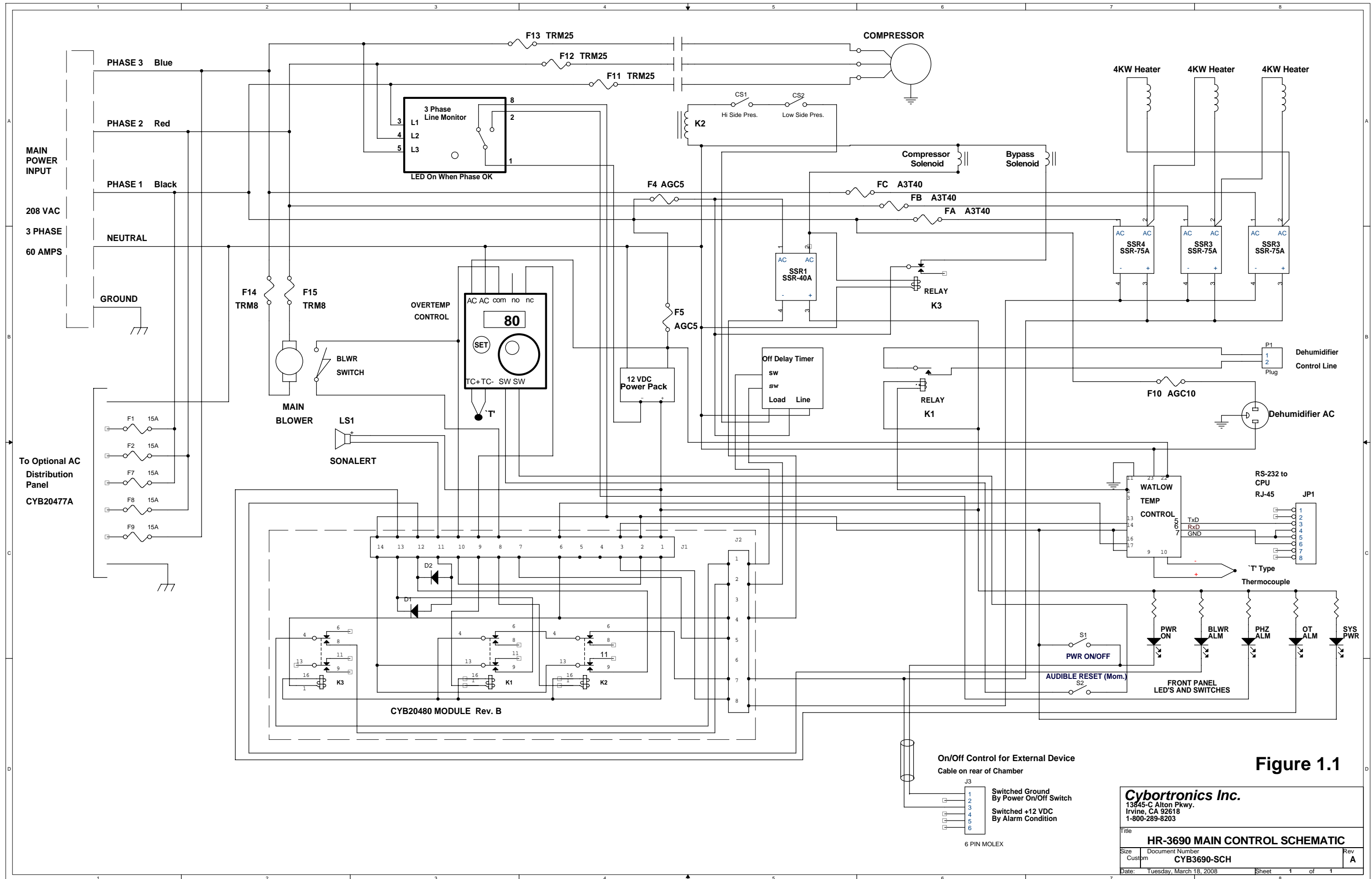


Figure 1.1

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Title: **HR-3690 MAIN CONTROL SCHEMATIC**

Size: Custom Document Number: **CYB3690-SCH** Rev: **A**

Date: Tuesday, March 18, 2008 Sheet 1 of 1