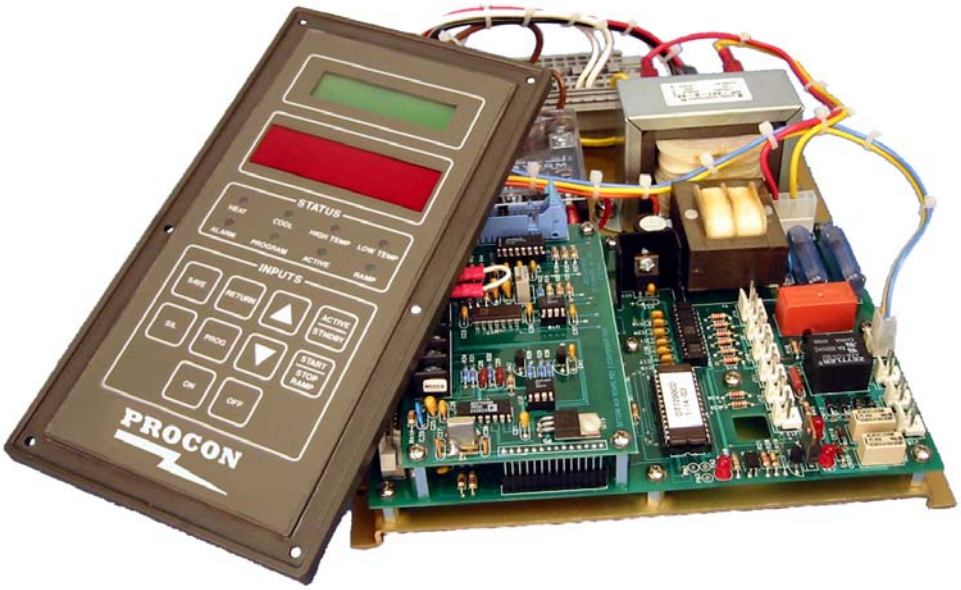
PROCON



MODEL 7200
ENVIRONMENTAL CHAMBER
CONTROL MODULE

12/12/01
Rev 01

PROCON
MODEL 7200
ENVIRONMENTAL CHAMBER CONTROL MODULE

The Model 7200 Environmental Chamber Control Module is a microprocessor based controller designed specifically for environmental test chambers. The controllers' function is to provide the operator control for an environmental chamber system utilizing heating and cooling. The following are some of the features of the 7200 controller.

*PLATINUM RTD, 100 OHM
*16 BIT RESOLUTION ANALOG TO DIGITAL CONVERTER
*TYPE J THERMOCOUPLE HI LIMIT CIRCUITRY
*2 LINES BY 16 CHARACTER LCD MESSAGE CENTER
*BRIGHT LED PROCESS TEMPERATURE DISPLAY
*EEPROM PARAMETER MEMORY (MINIMUM TEN YEAR DATA RETENTION)
*INDEPENDENT PID CONTROL LOOPS FOR HEATING AND COOLING
*TEMPERATURE DEVIATION HI AND LOW ALARMS
*SOFTWARE SELECTABLE CO2 OR N2 COOLING
*GPIB(IEEE.488)AND RS232 COMMUNICATIONS
*POLYCARBONATE GRAPHICS OVERLAY SEALS AGAINST CONTAMINATION

The control monitors temperature utilizing a 100-ohm platinum RTD sensor. The system has two separate three mode (PID) control loops. One loop controls the heating phase and the other loop controls the cooling phase. Each control loop has anti-reset windup with independently settable parameters.

Numerous status, alarm and diagnostic functions are monitored and annunciated by both the audio buzzer and LCD display.

A 2x16 backlit LCD display is utilized for user interface and programming. The display indicates status, alarm, diagnostic and setup information. A six-digit, seven-segment display is used to indicate the chamber temperature. A ten key keypad is incorporated in the face panel to allow for user setup and adjustment of the system. Eight LEDs are provided on the face panel to indicate the immediate status of the chamber outputs. An audio buzzer in the face panel provides an audible tone for both key acknowledgment and alarms.

****

KEYS

****

There are two sets of keys on the face panel of the main control module. The first set consists of eight system keys. Each is a switch that, when pressed, is acknowledged with a short audio tone if valid, or a 'RAZZ' tone if the key function is invalid. (When remote operation is selected through the communication port the keys will not respond with any tone.) The second group of keys contains two power keys that are 'TACTILE FEEL' switches. The following is a listing of each of the keys and their functions:

SAVE - This key is only active in the PROGRAM mode and is used to save the system parameters into the EEPROM. This is a permanent (ten year minimum life) memory that does not require battery backup.

SIL - The SIL key is provided to allow for the elimination of the audio portion of an Alarm or Diagnostic, as well as the elimination of the Alarm Display. If an alarm is silenced, but not cleared, any attempt to start the system will automatically reactive the alarm.

If an Alarm or Diagnostic is no longer present, but has not been silenced, starting the system will automatically silence that alarm, as well as start the system.

Since the system maintains an Alarm/Diagnostic history, the SIL key may be used to review all active Alarms/Diagnostics. Repeatedly, depressing the SIL key will allow the user to sequence through all active Alarms/Diagnostics.

All alarms must be 'ACKNOWLEDGED' with the SIL key after they are 'CLEAR', to be removed from the ALARM stack.

RETURN - This is a multifunction key whose function varies with the current system mode.

ACTIVE MODE - If the system is in the ACTIVE mode, depressing RETURN will place it in the STANDBY mode.

PROGRAM MODE - If the system is in the PROGRAM mode, depressing RETURN will exit the programming stack.

RAMP/SOAK MODE - If the system is in the RAMP/SOAK mode, depressing the RETURN will place it in the STANDBY mode.

PROG - This key is used to change the control to the PROGRAM mode. Once in that mode, depressing this key will advance through the parameters. The control cannot change to PROGRAM mode while in ACTIVE mode or RAMP/SOAK mode.

Two access codes are provided to limit access to various system parameters. Once the PROG key is pressed, the user will be prompted to enter an access code. After the correct Access Code is entered with the UP/DOWN keys, the PROG key is pressed again to enter the desired Programming stack.

UP – In STANDBY mode, depressing this key will increment the setpoint temperature. In the PROGRAM mode, depressing the 'UP' key will increment the displayed parameters value. Depressing the key once and releasing will allow accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid incrementing of the displayed value.

DOWN - In STANDBY mode, depressing this key will decrement the setpoint temperature. In the PROGRAM mode, depressing the DOWN key will decrease the displayed parameters value. Depressing the key once and releasing will allow the accurate setting of the least significant digit. Holding the key down will activate the automatic, rapid decrementing of the display.

ACTIVE/STANDBY - This key is used to run the chamber at the setpoint constant temperature set in the USER stack. When the control is in ACTIVE mode, depressing this key will return the system to the STANDBY mode.

START/STOP RAMP - This key is used to begin and end the RAMP/SOAK program that is set up in the USER setup stack. To help prevent inadvertently beginning a RAMP/SOAK program, this key must be pressed twice to begin the program. When the START/STOP RAMP key is first pressed, the control will acknowledge with four beeps. The key must then be pressed for a second time to begin the program. While running, depressing the RAMP key a third time will end the RAMP/SOAK program. If the RAMP/SOAK parameter in the USER stack is set to ‘NO’, depressing this key will not start the RAMP/SOAK program.

ON - This ‘Tactile Feel’ switch is utilized to turn on the internal electronic latch and master relay. This enables the heat and cooling outputs and turns on the system blowers. The displays will become active at this time.

OFF - This ‘Tactile Feel’ switch is utilized to turn off the internal electronic latch and master relay. The heat and cooling outputs will be disabled and the displays will be turned off.

****

LEDS

****

The system has eight LEDs on the face panel:

HEAT - This LED is illuminated whenever the heater is on. Note that when the unit is near the setpoint, the LED will continually cycle on and off.

COOL - This LED indicates that the COOL solenoid is active. Note that when the unit is near the setpoint, the LED will continually cycle ON and OFF. This LED will light when either of the two cooling outputs is on.

PROGRAM - This LED indicates that the system is in one of the two PROGRAM stacks.

ALARM - The various alarm conditions are activated by many sources and annunciated by both the display and audio tone. This LED will be ON whenever any alarm is active.

HIGH TEMP - This alarm is activated anytime the process temperature exceeds the high alarm setpoint. When activated, it shuts off master relay.

LOW TEMP – This alarm is activated anytime the process temperature drops below the low alarm setpoint. This alarm will shut off the master relay

ACTIVE - This LED indicates that the system is running at the constant temperature setpoint programmed in the USER program stack.

RAMP - This LED indicates that the system is running a RAMP and SOAK program.

****

STANDARD SAFETY INPUTS

****

The standard safety inputs provide direct control over power applied to the chamber blower and heater. There are four switch safety inputs and a single J-type thermocouple safety input. These inputs function independently of the controller software to assure that the maximum safe temperature of the chamber and the heater are not exceeded

********** **SWITCH SAFETY INPUTS** **********

Four external normally closed interlock switches and the ON/OFF electronic latch control the coil voltage of the master relay. The master relay switches the line power to the chamber blower and the heater. The four external interlock inputs are arranged so that all four interlock switches must be closed for the master relay to be energized. The external interlock inputs are wired to switch 24 VAC.

The following is a description of each of the switch safety interlocks:

FAILSAFE LIMIT SWITCH - This input is wired to the adjustable normally closed temperature limit switch. When the switch opens, the master relay is turned off disabling power to the heaters, cooling solenoids and the blower motors. The controller will display an alarm message indicating this condition. This limit switch is always required to maintain safe operating conditions.

INTERLOCK 1 - This input is a general-purpose input. It should be wired to a normally closed switch that will open on a temperature rise. When the switch opens, the master relay will turn off disabling power to the heaters, cooling solenoids and the blower motors. The controller will display an alarm message indicating this condition.

INTERLOCK 2 - This input is a general-purpose input. It should be wired to a normally closed switch that will open on a temperature rise. When the switch opens, the master relay will turn off disabling power to the heaters, cooling solenoids and the blower motors. The controller will display an alarm message indicating this condition.

INTERLOCK 3 - This input is a general-purpose input. It should be wired to a normally closed switch that will open on a temperature rise. When the switch opens, the master relay will turn off disabling power to the heaters, cooling solenoids and the blower motors. The controller will display an alarm message indicating this condition.

******************* THERMOCOUPLE SAFETY INPUT *******************

The thermocouple safety input offers a redundant hardware interlock to limit the heater or chamber maximum temperature. A standard J type thermocouple is place in the chamber or on the heater and connected to the terminal block J22. This allows the Hi Limit circuit to monitor the temperature of the chamber at a critical location. If the temperature of the monitored location rises above the Hi Limit setpoint, the SSR output will be turned off, disabling power to the heater. The cooling solenoids are still operational and the blower motor continues to run. The circuit will reset when the temperature drops ten degrees below the trip point after the Hi Limit has tripped. The thermocouple safety function is independent of the microprocessor, however the controller will display an alarm message when the high limit temperature has been exceeded.

The thermocouple Hi Limit setpoint is adjustable by rotating an adjustment screw on the controller circuit board. The operator cannot adjust the setpoint. The Hi Limit is adjustable from 25°C to 575°C by rotating the adjust screw on the potentiometer (labeled RA1) on the DT7200 controller board. Clockwise rotation of the adjust screw increases the Hi Limit setting. See the drawing Procon DT7200 Wiring Diagram for the adjustment screw location.

****

USER INPUTS

****

The system has three types of user inputs: the face keys, RS232, and GPIB. The keypad located on the face of the controller directly controls system operation and setup. The RS232 and GPIB inputs offer remote operation of the system through a computer or terminal. For further information on the remote capabilities of the system see the communications supplement.

****

PROCESS SENSOR

****

PROCESS SENSOR - The controller senses chamber temperature using a three-wire, 100-Ohm, 0.00385 Ohm/Ohm/°C precision platinum RTD. This is the main process temperature sensor that controls the three-mode control loops. The controller is initially calibrated to provide better than 0.2°C accuracy across the full temperature measurement range.

The CALIBRATE parameter provides a means of adjusting the temperature display for a specific sensor. Since a platinum RTD sensors' temperature response is dependent on the makeup of the alloy used in the sensor, there is typically little variation in the slope of the response curve from sensor to sensor. The largest error is most often an offset due to variations in physical assembly of a particular RTD. This effect of this offset can be reduced or eliminated by changing the value of the CALIBRATE parameter. The value in the CALIBRATE parameter is added to the measured temperature and the resulting corrected temperature is used for both control and display.

****

OUTPUTS

****

The system has seven outputs:

HEATER - This is the output that drives the chamber heaters. It includes a 25 amp solid state relay with built-in zero cross switching to eliminate RFI interference.

BLOWER - This is the output to drive the blower that circulates the air in the chamber.

CO2 VALVE - This output controls the cooling of the chamber. The CO_2 cooling valve can be selected through a software setup parameter.

LN2 VALVE - This output controls the cooling of the chamber. The LN_2 cooling valve can be selected through a software setup parameter.

COOLING BACKUP VALVE - This output controls an optional cooling backup solenoid. This valve output is activated when the chamber is in the ACTIVE or RAMP/SOAK mode.

EXTERNAL AUDIO - An external audio output is used to control an external audio device. This output will drive the audio device with a 50/50 duty cycle when there is an alarm.

AUXILARY - This is an unused output that may be used to drive additional optional devices. This output may be switched by commands through the communication channel.

****

DISPLAY

****

The system generally has five modes of operation - ACTIVE, STANDBY, RAMP/SOAK, ALARM, and PROGRAM. The LCD display gives a continuous indication of the current status of the system, as well as prompting the user for any information that may be necessary.

The six digit seven-segment display continuously displays the chamber temperature, regardless of the system mode.

After system initialization the first line of the LCD display indicates the general mode of the system. The lower line contains the current setpoint for the system.

When the system is in the PROGRAM mode the upper line changes to read 'PROGRAM USER' or 'PROGRAM FACTORY' and the lower line indicates the individual parameter that is being set.

********** INITIAL DISPLAY **********

When the system is first turned on, the commercial screen will appear as follows:

(Your Name Here)
MODEL 7200

While this screen is present, the system is initializing and doing all of its self-diagnostics. The model number will correspond to the system model number programmed in the Factory Program stack.

********** STANDBY DISPLAY **********

When the diagnostic is completed (approximately 5 seconds), the screen will change to the following:

STANDBY MODE
SETPOINT 35.0C

(Note: the temperature indicated is only a typical value).

********** **ALARM DISPLAY** **********

If an alarm occurs, the display will be modified to indicate the specific alarm (See 'Alarms/Diagnostics'). When this alarm has been silenced, the system will return to the following display:

ALARM MODE
SETPOINT 35.0C

********** **ACTIVE DISPLAY** **********

When the system is started, the display will change to the following:

ACTIVE MODE
SETPOINT 35.0C

The display will remain in this configuration unless the user enters a separate function or an alarm condition occurs.

********** **RAMP and SOAK DISPLAY** **********

When the RAMP and SOAK program is started, the display will change to the following:

STP 01 SK   9:30
PA 01 SP 135.0C

The upper line indicates the ramp step number and the remaining soak time. The lower line indicates the remaining passes (not including the current pass) and the setpoint for the ramp step. The ‘STP’ value will change as the program continues through the ramp steps. The ‘SK’ soak time indicates the remaining time for the current step. The ‘PA’ indicates the remaining passes and the ‘SP’ indicates the setpoint temperature for the current step. When ramping to the step setpoint temperature the ‘SP’ value will continuously change.

The display will remain in this configuration, unless the user stops the RAMP/SOAK program, the RAMP/SOAK program finishes, or an alarm condition occurs.

****

ALARMS/DIAGNOSTICS

****

The system continuously monitors for a wide variety of alarm conditions. When an alarm occurs, the status of the system is changed to 'ALARM' and the appropriate alarm message appears on the display. The controller will take the appropriate alarm action as detailed below.

All alarms have a delay period of ten seconds. The alarm must exist for ten consecutive seconds before the unit sounds the alarm.

The following is an example of an active alarm display:

HIGH TEMP
(ACTIVE)

This alarm display will remain on the alarm stack until it is both cleared and reset. The '(ACTIVE)' in the second line indicates the status of the alarm. When the alarm condition has been '(CLEARED)', the display will change to the following:

HIGH TEMP
(CLEARED)

If additional alarms occur, they are automatically stacked and are sequentially viewed as the SIL key is pressed. If the alarm has been cleared, depressing the SIL key will cancel that alarm. If the alarm is still present, depressing the SIL key will silence that alarm audio, but the alarm cannot be cleared until the fault has been cleared. Once the alarms have been silenced, the SIL key may be used to sequence through the alarm messages.

If an attempt is made to go into the ACTIVE or RAMP/SOAK mode, with an active alarm present, the audio portion of the alarm will re-sound.

The following is a listing of the various alarm conditions. These conditions are broken into three general categories. They all will sound an audio signal and place the alarm message in the ALARM stack.

GROUP #1 ALARMS

The first group contains those alarms that are informational only. They will have no operational affect on the system.

LOW DEV TEMP - This is the 'LOW DEVIATION TEMPERATURE' alarm. It is activated if the chamber temperature drops below the setpoint temperature by more than the value set in the 'LOW DEV' parameter.

This alarm is monitored only after the temperature has first risen to the low deviation setpoint. This eliminates false low alarms on startup.

HIGH DEV TEMP - This is the 'HIGH DEVIATION TEMPERATURE' alarm. It is activated if the chamber temperature rises above setpoint temperature by more than the value set in the 'HI DEV' parameter.

This alarm is monitored only after the temperature has first dropped to the high deviation setpoint. This eliminates false high alarms on startup.

These two alarms can only be activated in the ACTIVE or RAMP/SOAK modes. The deviation alarms will not sound in the STANDBY mode. The HI DEV and LOW DEV values are relative to the current setpoint. In the ACTIVE mode, this is the value programmed in the SETPOINT parameter. In the RAMP/SOAK mode, the alarms are relative to the current target temperature while ramping and to the step TEMP setpoint while soaking.

GROUP #2 ALARMS

The second group of alarms are those that deactivate the HEAT, COOL and COOLING BACKUP outputs.

SYSTEM FAILURE - This alarm indicates that the system has detected a malfunction in one of the internal controller circuits (EEPROM, RAM, etc.). This alarm may sound at startup after the power on system tests or after an unsuccessful EEPROM save.

PROCESS SENSOR - This alarm indicates a bad or missing RTD temperature sensor input. When this alarm is active, the displayed temperature will read " ---- ".

LOW ABS TEMP - This is the 'Low Temperature' alarm. It is activated anytime the process temperature falls below the absolute LOW ALARM setting

HIGH ABS TEMP - This is the 'High Temperature' alarm. It is activated anytime the process temperature exceeds the absolute HIGH ALARM setpoint.

AUX 1 – This alarm will activate when the AUX1 input is open. When this alarm is active the display will show 'AUX 1'. The switching device connected to this input must be capable of switching 24 VAC, 20 mA.

AUX 2 – This alarm will activate when the AUX2 input is open. When this alarm is active the display will show 'AUX 2'. The switching device connected to this input must be capable of switching 24 VAC, 20 mA.

GROUP #3 ALARMS

The third group of alarms is those that turn off the master relay or SSR heat output independent of the microprocessor.

The chamber controller has four switch inputs provided for safety interlocks. One of these four is reserved for the failsafe over-temperature device. The other three can be wired to devices such as snap switches and cover interlock switches.

A redundant type J thermocouple circuit has been incorporated into the controller as a secondary protection against a high temperature condition. This circuit is independent of the microprocessor and will turn off the SSR heat output on an over temperature condition or if the sensing thermocouple is open.

For total protection of the chamber an independent thermal snap switch is required. This thermal switch is the adjustable failsafe temperature limit switch

FAILSAFE - This alarm indicates that the temperature limit switch is open.

INTERLOCK 1 - This alarm indicates that the switch wired to this input is open.

INTERLOCK 2 - This alarm indicates that the switch wired to this input is open.

INTERLOCK 3 - This alarm indicates that the switch wired to this input is open.

T/C HI LIMIT - This alarm indicates that the independent Hi Limit circuit has detected an over temperature condition.

OPEN HI LIMIT - This alarm indicates an open or missing type J thermocouple.

The adjustable failsafe limit and interlock inputs are to be connected to normally closed switches. They are internally wired in series with the power supply to the master relay. If any of these switches are open, then the master relay is disabled.

The controller monitors each of these inputs. If the switch opens, it not only turns off the master relay, additionally the appropriate alarm will be displayed in the LCD.

Since these devices are wired in series, it is necessary to place a jumper wire across any input that is not used. The controller cannot detect multiple switch openings because of the series wiring. It will detect one switch opening at a time. If more than one switch opens, the controller will display the alarm message related to the most significant opening and not detect the lesser significant opening until the more significant has closed. However, in all cases the master relay will remain off.

****

PROGRAM

****

The system's function is controlled by a number of programmable parameters. These parameters may be viewed and changed in the PROGRAM mode. The PROGRAM mode is broken into two portions. The first is the USER stack. The second is the FACTORY stack. The stacks are protected by individual access codes.

********** USER STACK **********

The USER stack consists of a number of parameters. This set of parameters is accessed by depressing the PROG key. When the 'ENTER CODE' display appears and the appropriate code is entered with the UP and DOWN keys, a second press of the PROG key will gain entry to the USER stack:

ENTER CODE
XXXX

When entry into the stack is obtained, the following display will appear:

PROGRAM - USER
SETPOINT XXX.XC

The UP and DOWN keys are then utilized to set the viewed parameter. The PROG key is used to sequence through the various parameters. Only the second line in the display will change with the PROG key.

The following items in the stack will appear sequentially and then wrap around:

Display	Description	Range
SETPOINT	Process Setpoint	MIN SPT to MAX SPT
HEAT	Heater Output	On/Off
COOL	Cooling Output	On/Off
UNITS	Temperature Units	Celsius/Fahrenheit
HIGH DEV	High Temp Deviation	0.0 to 25.0 degrees C
LOW DEV	Low Temp Deviation	0.0 to 25.0 degrees C
CALIBRATE	Sensor Calibration	±9.9 degrees C
RS232	RS232 Active	On/Off
BAUD RATE	Baud Rate Select	300 - 19200
GPIB ADDR	GPIB Address	0 to 30
KEY LOCK	Keypad Lockout	On/Off
RAMP/SOAK	Ramp And Soak	No/Yes
RAMP n	Ramp Rate	0.1 TO 36.0 degrees C/min
TIME n	Step Duration	00:00 to 99:59 hrs:min
TEMP n	Step Temperature	MIN to MAX degrees C
TEMP DIF	Temp Differential	0.0 to 25.0 degrees C
PASSES	Number Of Passes	1 to 9999
ACC #1	User Access Code	0 to 9999

SETPOINT – This is the Process Setpoint, it is the target temperature for the three-mode 'PID' algorithm.

HEAT – This parameter enables or disables the heater output. The system does not power up with this parameter set to 'OFF'. It will have the value set when the parameters were saved.

COOL – This parameter enables or disables the cooling output. The system does not power up with this parameter set to 'OFF'. It will have the value set when the parameters were saved.

UNITS – This parameter selects whether the displayed temperature is in Celsius or Fahrenheit. Note that all parameter ranges are shown in Celsius.

HIGH DEV – This is the High Temperature Deviation alarm setpoint. The Process Setpoint plus this value is continually compared with the Process Temperature and if the Process Temperature exceeds this computation, a High Temperature alarm is activated. Setting this parameter to zero will eliminate this alarm.

LOW DEV – This is the Low Deviation Temperature Alarm Setpoint. The Process Setpoint minus this value is continually compared to the Process Temperature. If the Process Temperature falls below this setpoint, once the system has come out of the WARMUP mode, a Low Temperature Alarm will activate.

The WARMUP mode requires that the Process Temperature exceed the Low Alarm Setpoint prior to the alarm being activated. This is to eliminate nuisance alarms on startup. Setting this parameter to zero will eliminate this alarm.

CALIBRATE – This is the digital calibration for the Process Sensor. It provides an offset to the displayed chamber temperature. Changing this parameter will adjust the displayed temperature up or down depending on the value set.

RS232 – This parameter is used to activate or deactivate the RS232 Communications function. When this parameter is set to 'OFF' the 'BAUD RATE' parameter is removed from the program stack and RS232 communications is deactivated. When set to 'ON' all functions of RS232 are activated.

BAUDRATE – This parameter sets the baud rate for the RS232 communications. This parameter may be set to selected standard values from 300 to 19200 baud. Values of 300, 600, 1200, 2400, 4800, 9600 or 19200 may be set.

GPIB ADDR – This parameter selects the talker and listener address for the GPIB communications interface.

KEY LOCK – This parameter allows the activation of a keyboard lockout feature. When set to 'ON', the keyboard will be locked out. The RS232 and GPIB communications will still be active. The power ON and OFF keys are always active.

RAMP/SOAK – This parameter enables or disables the RAMP/SOAK function. There are a total of thirty RAMP, TIME and TEMP parameters that set a program for the Ramp/Soak function. There is one of each type of parameter for a step. They are grouped in set of three parameters, one for each of the ten steps.

RAMP n - This parameter is used to set the rate of change for the step in the RAMP/SOAK function. This value is the desired rate of change of temperature, in degrees per minute, while ramping to the step setpoint temperature. The RAMP parameter is programmed in the current units selected by the UNITS parameter.

TIME n - This parameter determines the duration of this step of the RAMP/SOAK program. This interval is the time (in hours and minutes) that the temperature will be held for the soak portion of this step. There are a maximum of ten steps to any RAMP/SOAK program. Steps with the time set to zero are skipped. The chamber will ramp from the previous non-zero time step to the next non-zero time step at the ramp rate set in the next steps' RAMP parameter.

TEMP n – This parameter sets the temperature of the soak time of the step in the RAMP/SOAK program.

TEMP DIF - This parameter sets a range that will allow the program to begin the timer countdown for the current step. When the process temperature is within the differential setting band around the step temperature the counter will begin to count down the time interval programmed in the Time parameter. When this parameter is set to zero the chamber temperature must be equal to the setpoint. This may result in longer than expected soak times as the chamber temperature may take several minutes to reach the exact step temp after a fast ramp or a large temperature change.

PASSES - This parameter sets the number of times the RAMP/SOAK program is repeated.

ACC #1 - This is the Access Code that must be matched for entry into the USER program Stack. If this number is set to zero, no access code is required.

********** FACTORY STACK **********

The FACTORY stack is entered by depressing the PROG key. The following display will appear:

ENTER CODE
XXXX

Once the correct access code is entered utilizing the UP and DOWN keys, the PROG key is pressed for a second time. If the correct access code has been selected, entry into the FACTORY stack will be allowed. If not, the system will return to its original mode.

When entry into the stack is obtained, the following display will appear:

SETUP - FACTORY
SOFTWARE DT7200XX

The UP and DOWN keys are then utilized to set the viewed parameter. The PROG key is utilized to sequence through the various parameters. Only the second line in the display will change with the PROG key.

The following items in the stack will appear sequentially and then wrap around:

Display	Description	Range
SOFTWARE	Current Software Rev	Software version code (Not Settable)
CHAMBER	Chamber Model Identifier	9023, 9028, 9039, 9059, 9064, 9076, 9080, 9145
MIN SPT	Minimum Setpoint	-184.4 to 315.5 deg. C
MAX SPT	Maximum Setpoint	-184.4 to 315.5 deg. C
HI ALRM	High Absolute Temp.	MIN SPT to MAX SPT
LO ALRM	Low Absolute Temp.	MIN SPT to MAX SPT
PRO BND HT	Proportional Band Heat	0.0 to 25.0 degrees C
RESET HT	Reset (Integral) Heat	0.0 to 25.0 minutes
RATE HT	Rate (Derivative) Heat	0.0 to 25.0 minutes
CYCLE HT	Cycle Rate Heat	1 to 25 seconds
PRO BND CL	Proportional Band Cooling	0.0 to 25.0 degrees C
RESET CL	Reset (Integral) Cooling	0.0 to 25.0 minutes
RATE CL	Rate (Derivative) Cooling	0.0 to 25.0 minutes
CYCLE CL	Cycle Rate Cooling	1 to 25 seconds
COOL OUTPUT	N2 Or CO2	N2/C02
ACC #2	Factory Access Code	0 to 9999

SOFTWARE - The software line is a read only display. It shows the version of the software that the chamber controller has installed.

CHAMBER - This parameter matches the chamber model in which the controller is installed. This value is displayed in the initial screen on system startup.

MIN SPT - This parameter restricts the minimum setting ranges for all of the temperature parameters in the user setup stack. This parameter cannot be set higher than the Max Setpoint parameter's current setting.

MAX SPT - This parameter restricts the maximum setting ranges for all of the temperature parameters in the user setup stack. This parameter cannot be set lower than the Min Setpoint parameter's current setting.

HI ALRM - This is the High Absolute Temperature Alarm setpoint. A High Temperature alarm is activated if the process temperature exceeds this setting.

LO ALRM - This is the Low Absolute Temperature Alarm setpoint. If the Process Temperature falls below this setpoint, a Low Temperature Alarm will activate.

PRO BND HT - The Proportional Band for the heating mode is the parameter that determines the proportioning range for the controller. This band sets the temperature range over which the controller will vary the duty cycle of heating output from 0 to 100%.

RESET HT - The Reset parameter for the heating mode sets the integration time for the second mode in the three-mode control scheme. If this parameter is set to zero the reset function is eliminated for the heating mode.

RATE HT - The Rate function for the heating mode sets the differentiation constant for the third mode of the three-mode control scheme. If this parameter is set to zero the rate function is eliminated for the heating mode.

CYCLE HT - The Cycle Rate Heat sets the time, which the heat output will cycle on and off. The amount of time that the output is on during each cycle is controlled to match the heat requirements of the system.

PRO BND CL - The Proportional Band for the cooling mode is the parameter that determines the proportioning range for the controller. This band sets the temperature range over which the controller will vary the cooling output from 0 to 100%.

RESET CL - The Reset Cooling parameter for the cooling mode sets the integration time for the second mode in the three-mode control scheme. If this parameter is set to zero the reset function is eliminated for the cooling mode.

RATE CL - The Rate function for the cooling mode sets the differentiation constant for the third mode of the three-mode control scheme. If this parameter is set to zero the rate function is eliminated for the cooling mode.

CYCLE CL - The Cycle Rate Cool sets the rate at which the cool output will cycle on and off. The amount of time that the output is on during each cycle is controlled to match the cooling requirements of the system.

COOL OUTPUT - This parameter selects the N2 solenoid or the CO2 solenoid.

ACC #2 - This is the Access Code that must be matched for entry into the Factory program Stack. If this number is set to zero, no access code is required.

****

SAVE

****

When the SAVE key is pressed while in any of the SETUP modes, and any changes have been made, the system automatically enters a 'SAVE' mode. The following display will appear:

```
* SAVE   MODE *
* PLEASE WAIT *
```

This mode writes all of the setup parameters into the EEPROM memory. This is a permanent (ten year minimum life) memory that does not require battery backup. The SAVE routine takes about two to three seconds to complete. This feature provides the OEM with the ability to program in initial condition parameters prior to shipment. It then allows the user to modify the appropriate parameters and permanently save his new parameters all from the keyboard.

****

OPERATION

****

As the system is powered up the controller will be in STANDBY mode. The HEAT and COOL outputs will be disabled although the chamber blower will run. The chamber can be selected to run at a fixed setpoint in the ACTIVE mode or with a programmed time and temperature profile using a RAMP and SOAK program.

ACTIVE - To run the system at a constant temperature, the setpoint is selected through the USER program stack or by using the up and down arrow keys. If necessary, the PID control parameters can also be changed through the FACTORY program stack. Once the correct parameters are entered, depressing the ACTIVE/STANDBY key will start the system. Once the system is started, it can be stopped by either a second depression of the ACTIVE/STANDBY key or with the RETURN key.

RAMP AND SOAK - The RAMP and SOAK feature allows the system to be programmed for up to ten steps for a duration of up to 99:59 HR:MIN and repeated up to 9999 times. Each step is programmed with a ramp rate, a step duration and a step temperature. Steps with a duration set to zero are skipped.

To program a RAMP and SOAK program, the user only needs to enter the desired temperature (TEMP n), the amount of soak time (TIME n), the rate of temperature change (RAMP n), the temperature differential (TEMP DIF), and the number of passes (PASSES). The RAMP/SOAK parameter must be set to 'YES' to allow the program to be started.

After programming the step values the program is started by depressing the START/STOP RAMP key twice. The current chamber temperature is used as a beginning point for the ramp for the first step. Chamber temperature will be changed at the rate set in the RAMP 1 parameter until the TEMP 1 setpoint is reached. When the setpoint is reached (plus or minus the TEMP DIF parameter), the soak time counter will begin to count down. When this timer has elapsed to zero, then the controller will move on to the next step in the RAMP and SOAK program. Steps with a soak time set to zero will be skipped. When the last program step is done the first step is repeated. The PASSES parameter sets the number of repeats for the RAMP and SOAK function.

After the last step of the last pass has been run, the control returns to standby mode. The heater and cooling solenoid outputs are turned off.

The following is a programming example to illustrate the implementation of a specific RAMP and SOAK program. Let's assume that we want to run this program twice and that we want the TEMP DIF setting at 5 Degrees C.

STEP	TEMP (°C)	RAMP (°C/Min)	TIME (hrs:min)
1	200°	10	0:30
2	100°	20	1:00
3	300°	30	0:10
4	---	--	0:00

TEMP DIF = 5°C
PASSES = 2

Figure 1 is a line plot of this RAMP and SOAK program. (Figure 1 is located at the end of this manual)

To begin the RAMP and SOAK function, the user must press the START/STOP RAMP key. The key must be pressed twice to prevent the RAMP and SOAK function from being started accidentally. With the first depression of the key, the controller will respond with a series of four beeps. To abort the RAMP and SOAK, start the return key is pressed. A second depression of the START/STOP RAMP key will start the program. When the RAMP and SOAK function is running, the depression of the START/STOP RAMP key will terminate the program. The heat and cool outputs will be turned off.

The temperature will then change at the rate of ten degrees C. per minute until 195 degrees is reached. The SOAK timer is now started. When the first minute timer reaches zero, then the controller will RAMP to the next temperature at the rate of 20 degrees C. per minute until 105 degrees is reached. Then the Step 2 timer is started. When this timer has elapsed, the controller will ramp the temperature up to 295 degrees, before starting the 3rd step timer.

Since we have two passes programmed, the controller will repeat from step 1. After the second time thru step three, the RAMP and SOAK function will stop. Both heat and cool outputs are turned off at this point. The chamber controller will change to standby mode.

********** TUNING **********

The control scheme used in this controller is a standard PID system. This section will briefly review PID control as it relates to this system. It should be noted that this discussion specifically relates to this device and may be somewhat different than other systems.

The terms 'PID' and 'Three Mode' are interchangeable. These terms describe a control scheme that consists three distinct modes working together to bring the chamber to the desired temperature. The proportional and integral modes work together to eliminate errors in the steady state temperature while the derivative mode works to reduce over-shoot or slow response during rapid changes in temperature.

The first mode of control, proportional, refers to the basic control scheme. The concept is that the controller will determine the percentage of heating or cooling required by the chamber and adjust the average power to the heater the bring the chamber temperature to a stable point. The heater is either fully on or fully off just as the cooling solenoid is either open or closed. The proportioning is obtained by adjusting the ratio of the time the heater (or solenoid) is on to the time it is off. Adjusting this on-off ratio provides the adjustment to the average heater power needed to control the chamber temperature. Proportional control in this application is more correctly termed Time Proportioning.

The cycle rate (CYCLE HT and CYCLE CL) settings are used to determine the rate at which the heater and solenoids are turned on and off. When heating, the proportioning of the output power is accomplished by varying the percentage of time that the heater is on during the cycle period. For example, if CYCLE HT is set to ten seconds then the heater will cycle on and off once every 10 seconds. If the controller has determined that the system requires only half of the full power output of the heater to maintain a specific temperature, the output will be on for five seconds and off for five seconds in a cycle. As the heat requirement increases, this percentage will increase to longer periods on. The opposite is true for decreasing heat load requirements. Thus, when the system is at or near the setpoint, the HEAT LED on the display panel will continually flash to indicate the time proportioning of the heater. The same proportioning will occur as the controller cycles the cooling solenoid to reduce chamber temperature.

To compute the required percentage of on time, the controller utilizes the proportional band parameters (PRO BND HT and PRO BND CL) values as set in the programming mode. It is over this band that the output will vary from 0 to 100%. If for example, the setpoint is at 100°C and the proportional band is set at 10°C, the controller will time proportion the heater from 100% to 0% when the process temperature varies from 90°C to 100°C. When the process temperature is at 90°C and less, the heater will be fully on. Between 90°C and 100°C the output will time proportion from 100% down to 0%. At any temperatures above 100°C, the heater will be fully off and the cooling solenoid will be cycled on and off to provide cooling.

This description of the proportioning control scheme does not include the rate and reset functions. Rate and reset will cause a shifting in the proportional band and vary the percentages just discussed. However, rate and reset do not affect the basic functioning of a proportioning scheme, only the relative position of the proportional band at any moment in time.

By using the preceding example, it can be shown how the proportional band and cycle rate work together. In the example we had a cycle rate of ten seconds with a proportional band of 10°C and a setpoint of 100°C. When the process temperature is 96°, we will note that it is 40 percent into the proportional band. Under these conditions the heater will be on for 40 percent of the time. With the 10-second cycle rate, this means that the heater will be on for four seconds and off for six seconds.

A control with only proportional mode will have a degree of error when at a constant temperature. In the example just given, if only ten percent of the heaters output is required to maintain the desired temperature the heater will cycle one second on and nine seconds off and the temperature will stabilize at 99 degrees. This is not the desired setpoint of 100°C. The difference between the setpoint and the control point is an error inherent in all proportional-only systems.

To remove this error, we need the second control mode working with the proportional mode. This is the integral mode, commonly termed automatic reset mode. The difference between the current process temperature and the desired setpoint is used to adjust (or reset) the proportional band position to compensate for the temperature error. Periodically the integral mode software determines the temperature error and makes an adjustment to the power output by adjusting the setpoint internally. This has the effect of shifting the proportional band. This shift decreases or increases the power to reduce the temperature error. This adjustment to the power output is done at intervals set in the RESET HT and RESET CL parameters.

The reset action must occur only when the temperature is in the proportional band. If the reset mode adjusted the output duty cycle before the chamber temperature was stable, large errors would occur. By preventing the reset action from occurring when the temperature is outside the proportional band such potential errors are eliminated.

The third mode in the PID scheme is the derivative mode, commonly referred to as rate. The function of the rate mode is to reduce overshoot as the temperature is approaching a new setpoint. Rate reduces overshoot of the temperature when fast ramping rates are used by comparing the rate of temperature change to the programmed rate of change. If the actual rate exceeds the programmed rate the heating or cooling duty cycle is temporarily reduced. The interval at which the rate of change is adjusted is set by the RATE HT and RATE CL parameters. When high ramp rates are used this parameter should be set to shorter intervals to reduce overshoot. At lower ramp rates this interval may be increased to allow better control of temperature while ramping. In situations where overshoot is not a problem, the rate mode may be eliminated by setting the rate interval parameter to zero.

****

BACKDOOR CODE

****

A special code has been incorporated into the software to insure factory access to the programming parameters no matter what the customer has done with the access codes. This code is 1357.

MANUAL REVISIONS

Rev #	Model #	Eng. #	Revision Made
Rev 0	DT7200A	DT7200A	Origination
Rev 1	DT7200	DT7200	Misc

****
JPC / FACTORY BACKDOOR CODES
****

The factory TEST mode can be activated by entering the code ‘135’. This allows access to the TEST mode only.

The back door code is 1357. This allows access to the USER stack, the FACTORY stack and the TEST mode.

SPECIFICATIONS

Temperature Range	-184.4 to +315.5 Degrees C -299.9 to +599.9 degrees F
Temperature Resolution	0.1 Degrees C 0.1 Degrees F
Noise Rejection	NMR - 60 db @ 60 HZ CMR -120 db @ 60 HZ
Measuring Time	1/2 Second
Displays	LCD Character Display-2x16, LCD, Backlit Six-Digit Seven-Segment Eight Discrete LEDs (Red and Green)
Annunciator	Audio Tone, ~ 2500 HZ
Setup Memory	EEPROM, All Parameters
Memory Retention	10 Years w/o Power
Temperature Sensor	RTD, 100 Ohm, Platinum (0.00385)
Control	PID Separate Control Loops for Heating and Cooling
Adjustment	Proportional Band: 0.0 - 25.0 Deg C Reset (Integral): 0.0 - 25.0 Min. Rate (Derivative): 0.0 - 25.0 Min. Calibration Offset: $\pm$ 9.9 Deg. C
Operating Range	0 to 50 Degrees C 90% RH, Non Condensing
Storage Range	-40 to 60 Degrees C 90% RH, Non Condensing
Construction	Face - Lexan, Back Printed
Size	Display – 4.800w x 8.900h x 1.75d Maximum Chassis – 11.049w x 8.750h x 2.980d
Weight	<5.5 lbs

PROCON
MODEL DT7200
COMMUNICATIONS SUPPLEMENT

This supplement contains information relating to the communication options for the DT7200 controller. There are two interfaces that the user can use to control the DT7200 controller. The interfaces are IEEE-488 (commonly called GPIB) and RS-232C. The GPIB interface is a parallel interface that conforms to the IEEE-488.1 standard. The RS-232C interface is a serial interface that conforms to RS-232C standard.

The RS-232 serial link has an adjustable baud rate controlled by the 'BAUD RATE' parameter in the user setup stack. The default baud rate is 9600. The serial link is 8 data bits, one start bit and one stop bit, no parity, full duplex operation.

Both interfaces use the same command set and have the same restrictions. Commands may be grouped on one line. Line length cannot exceed 50 characters. This also applies to the reply line length. The line is a string of ASCII characters terminated by a CR (carriage return) and LF (line feed). A semi-colon must separate the individual commands, if on the same line. The commands case may be upper, lower or mixed. All commands that elicit a reply must end in a question mark. Temperature messages are degrees Celsius only, even though the controller is setup to display degrees Fahrenheit. A space is required to separate the command from the data. Multiple spaces are allowed.

The following is a summary of the command set along with a description of the command. The underlined characters are required. The other characters are optional and may be used to document the command. Commands may be shorted to the leading letters that are in upper case. Numeric parameters require only as many digits as needed to express the value required. Ten degrees may be sent as '10' or '10.0'. Parameters that are in integers only cannot be sent with a decimal point. At least one space is required between the command and any parameter. No spaces are allowed between parameters however. Brackets indicate that one value must be selected and set with the command as the only parameter. The parameter may be shorted to the letters in upper case.

COMMAND	DESCRIPTION
Active	Sets the chamber controller to ACTIVE mode.
Cool_[ON, OFf]	Enables or disables the cool output. The equivalent parameter is "COOL".
COUtput_[Co2, N2]	Selects N2 or CO2 output. A value of "N2" selects the N2 cooling valve. A value of "CO2" selects the CO2 cooling valve.
COUtput?	Gets the select cooling output.
CYCool_dd	Sets the "Cycle Rate" for the cool PID algorithm.
CYCool?	Gets the cycle rate for the cooling PID algorithm.
CYHeat_dd	Sets the "CYCLE HT" for the heat PID algorithm.
CYHeat?	Gets the "CYCLE HT" for the heat PID algorithm.
DEgrees_[Celcius, Fahrenheit]	Sets the front panel temperature to be displayed in Celsius or Fahr.
Dutycycle?	Gets the duty cycle (-100 to 100) cooling full on is -100, while -40 indicates cooling on at 40%.
Heat_[ON, OFf]	Enables or disables the heat output. The equivalent parameter is "HEAT".
HIAlarm_ddd.d	Sets the value for the "HI ALRM" alarm.
HIAlarm?	Gets the value of the "HI ALRM" alarm.
HIDev_ddd.d	Sets the "HIGH DEV" alarm setting.

HIDev?	Gets the value of the "HIGH DEV" alarm.
HIghset_ddd.d	Sets the maximum set point. The equivalent parameter is "MAX SPT".
HIghset?	Gets the "MAX SPT" temperature.
LOAlarm_ddd.d	Sets the value of the "LO ALRM" alarm.
LOAlarm?	Gets the value of the "LO ALRM" alarm.
LOCal	Sets the controller for operation from the front panel. The equivalent parameter is "KEY LOCK".
LODev_ddd.d	Sets the "LOW DEV" alarm setting.
LODev?	Gets the value of the "LOW DEV" alarm.
LOwset_ddd.d	Sets the minimum set point. The equivalent parameter is "MIN SPT".
LOwset?	Gets the "MIN SPT" temperature.
Monitor	Set or reset monitor mode (RS232 only)
New_Cold	This command clears all RAM and loads a default set of parameters.
PASSNumber?	Gets the number passes left for the ramp and soak function. Zero while program is not running.
PASSCount_nnnn	Sets the number of ramp and soak repeats. The equivalent parameter is "PASSES".
PASSCount?	Gets the number of ramp and soak passes.
PBCool_dd.d	Sets the value for the "PRO BND CL" for the cool PID algorithm.

PBCool?	Gets the value of "PRO BND CL".
PBHeat_dd.d	Sets the value for the "PRO BND HT" for the heat PID algorithm.
PBHeat?	Gets the value of "PRO BND HT".
PROGram_[Begin, End]	This command begins or ends a ramp and soak program.
RAMp [YEs, NO]	Sets the value for the "RAMP/SOAK" parameter.
RACool_dd.d	Sets the value for the "RATE CL" for the cool PID algorithm.
RACool?	Gets the value of the "RATE CL".
RAHeat_dd.d	Sets the value for the "RATE HT" for the heat PID algorithm.
RAHeat?	Gets the value of the "RATE HT".
RECool_dd.d	Sets the value of "RESET CL" for the cool PID algorithm.
RECool?	Gets the value of "RESET CL".
REHeat_dd.d	Sets the value of "RESET HT" for the heat PID algorithm.
REHeat?	Gets the value of "RESET HT".
REMote	Sets the controller in the remote mode. This locks out operation from the front keypad. The equivalent parameter is "KEYLOCK". This does not lockout on or off keys.
SAVE	This command saves all parameters to the EEPROM.
SEtpoint_ddd.d	Sets the setpoint temperature. The set point temperature must be within the MIN and MAX settings to be accepted. The equivalent parameter is "SETPOINT".

SEtpoint?	Gets the setpoint temperature.
SIL	This command activates the "SIL" key function.
SOAktime?	Get the current time soaking in minutes. Zero while not at the step set point.
SOFtware?	Gets the software identification string. The equivalent parameter is "SOFTWARE".
SRate n,rr.r	Sets the ramp rate of step n. The equivalent parameter is "RAMP".
SRate n?	Gets the ramp rate for step n.
SSoak n,ssss	Sets the soak time for step n. The equivalent parameter is "PERIOD X".
SSoak n?	Gets the soak time for step n.
STATE?	Get the Ramp and Soak state: 0: Program not running 1: Ramping to Step Setpoint 2: Soaking at Step Setpoint 3: Program Completed
STatus?	Gets the current status of the control. A sequence of five numbers, separated by commas, that indicate current alarms control mode, output state and input state. See the detail status information at the end of this section.
STEMp n,ttt.t	Sets the soak temperature for step n. the equivalent parameter is "TEMP X".
STEMp n?	Gets the soak temperature for step n.
STep n,ttt.t,ssss,rr.r	This command programs the step n of the ramp and soak feature. "ttt.t" is the temperature, "ssss" is the soak time and "rr.r" is the ramp rate in degrees Celsius per minute.

STep n?	Gets the temperature, soak time and ramp rate for step n. The reply string is “ttt.t,ssss,rr.r”.
STEPClear	Clears all of the step parameters for the ramp and soak function.
STEPCOunt?	Gets the number of valid steps in the list.
STEPNumber?	Gets the current step in the ramp and soak program.
STANdby	Puts the controller in a standby mode if the controller is active.
TEMPDif tt.t	Sets the Temperature Difference parameter for the Ramp/Soak program.
TEMPDif?	Gets the Temperature Difference parameter.
Temperature?	Gets the process temperature.
Version?	Gets the four-digit date code of the software version in year, week format (YYWW). Year 2000 is returned as “00WW”.

****
INTERPRETING STATUS COMMAND INFORMATION
****

The STATUS? Command returns information about the current operating condition of the chamber. The returned character string contains five numbers, each having one to three digits, in the range of 0 to 255. The numbers are comma separated and do not have any spaces added as padding. Each number represents the current state of the outputs, alarms, operating mode or active LEDs.

The status numbers are returned in the sequence: Output Status, LED Status, Alarm Group 1, Alarm Group 2 and Controller Status. Each number is separated from the next by a single comma. As with all command replies, the number sequence ends with the ASCII carriage return (0Dh) and a line feed (0Ah) characters.

The numbers may be used to determine which outputs are on and which alarms are active. The value returned is the sum of the decimal values for the bit positions of the active alarms or on outputs. Repeatedly subtracting and comparing the bit position value from the status value decodes the individual output or alarm condition. Decimal bit position values are listed below. Bit positions that do not have any function assigned are labeled as 'Unused'. These positions may be set or reset at any time.

Output Status

128	Heat SSR Active
64	Buzzer Active
32	Spare 1 Active
16	External Audio Active
8	Master Relay Active
4	Cool Ready Active
2	Cool Select Active
1	Cool On Active

LED Status

128	Ramp LED On
64	Active LED On
32	Program LED On
16	Alarm LED On
8	Low Temp LED On
4	High Temp LED On
2	Cool LED On
1	Heat LED On

Alarm Group 1

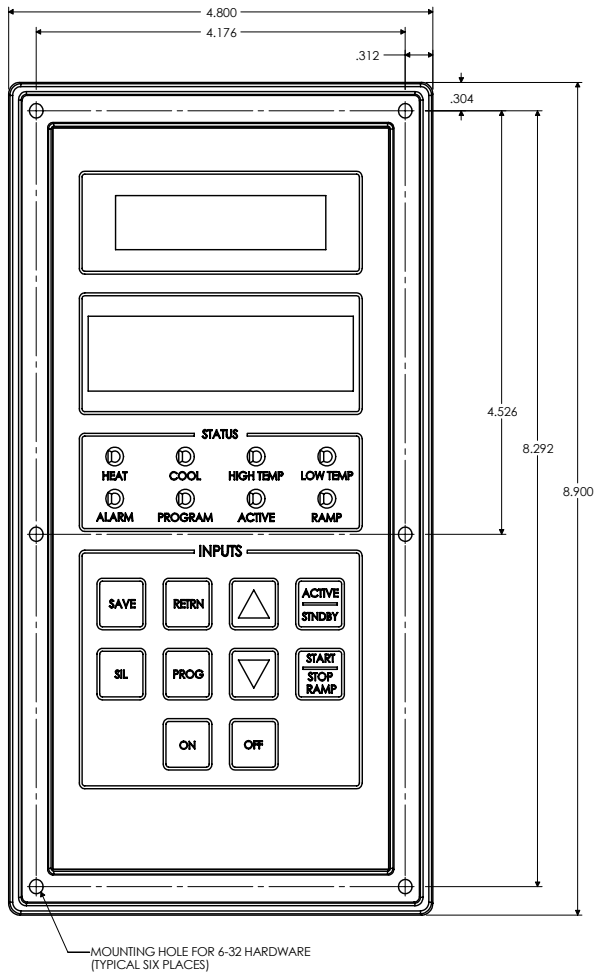
128	Unused
64	High Deviation Temperature Alarm
32	Low Deviation Temperature Alarm
16	High Absolute Temperature Alarm
8	Low Absolute Temperature Alarm
4	Open Process (RTD) Sensor Alarm
2	A/D Read Error Alarm
1	EEPROM Checksum/Verify Error Alarm

Alarm Group 2

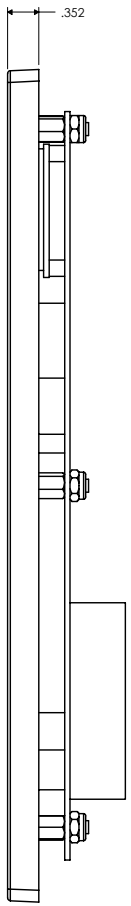
128	High Limit Temperature Alarm
64	Interlock 3 Switch Open Alarm
32	Interlock 2 Switch Open Alarm
16	Interlock 1 Switch Open Alarm
8	Failsafe Switch Open Alarm
4	Open High Limit (TC) Sensor Alarm
2	Aux 2 Open Alarm
1	Aux 1 Open Alarm

Chamber Status

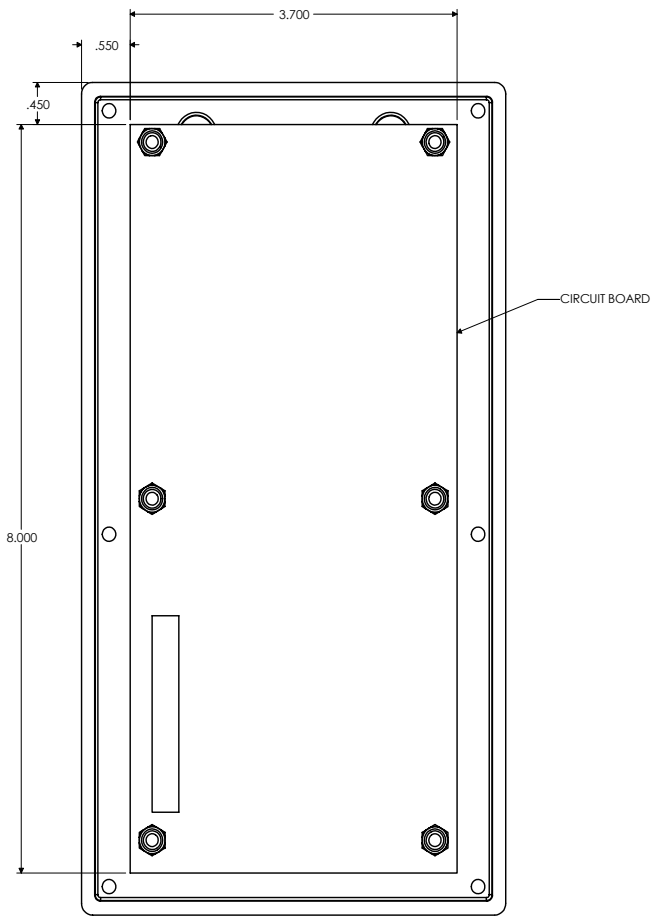
128	Standby Mode
64	Active Mode
32	Ramp Mode
16	Warm-Up Mode
8	Program Mode
4	Alarm Mode
2	Unused
1	Unused



FRONT VIEW

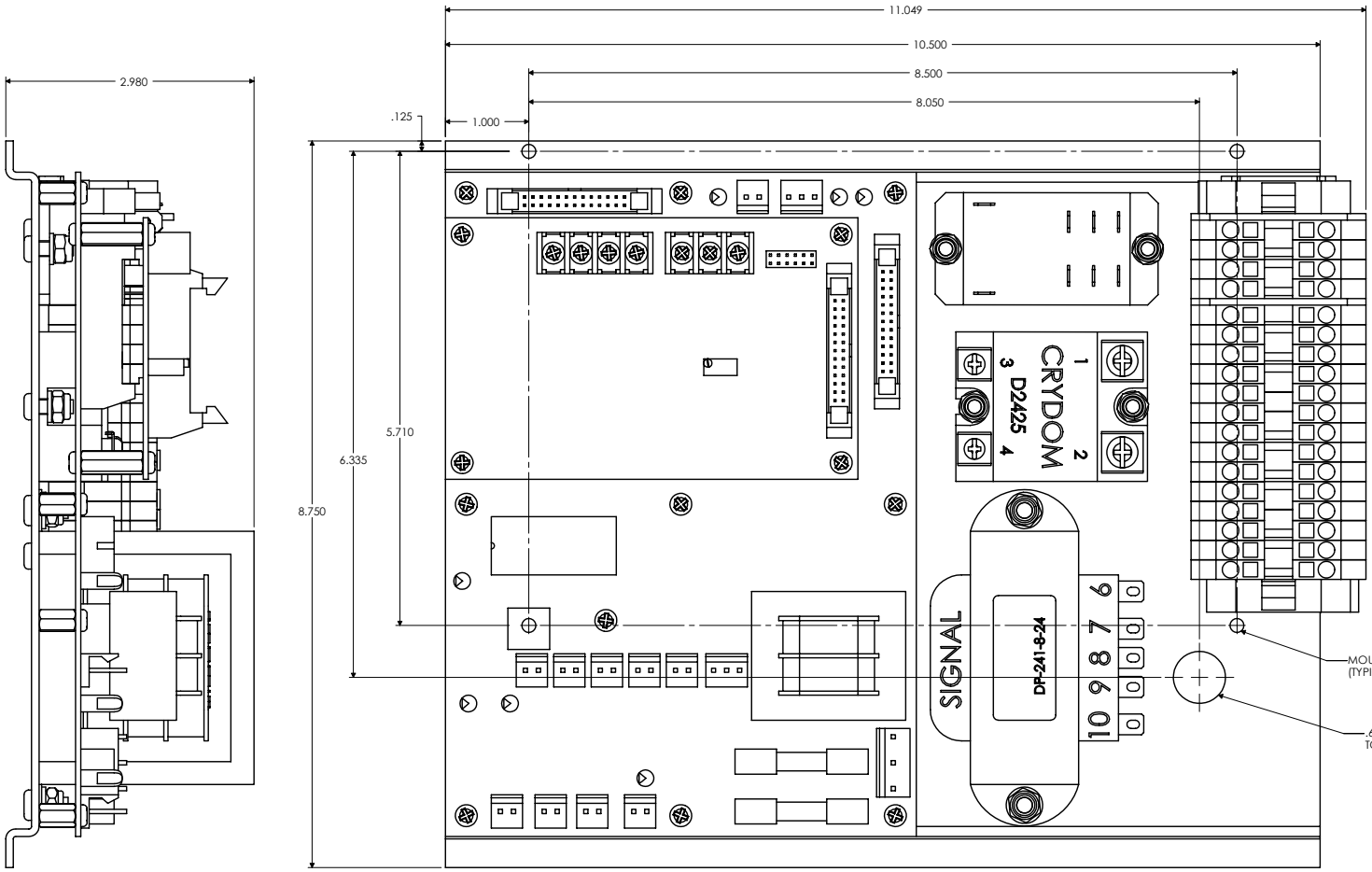


SIDE VIEW



REAR VIEW

TOLERANCES UNLESS OTHERWISE SPECIFIED	JPC CONTROLS	102 COMPASS PT. DR. SUITE D, ST. CHARLES, MO 63301 (636) 946-3300 FAX (636) 724-2492 www.jpccontrols.com					
	DT7200 DISPLAY PANEL PHYSICAL DIMENSIONS						
	APPROVAL		DWN BY MPJ	DATE 2/29/00	SCALE 1=1	CHKD BY	
ALL DIMENSIONS ARE IN INCHES	ENG	DATE	SHEET				
PATH =E:\CC\DT7200\DSPLY0.SLDDRW	QA	DATE	1 OF 1	49	720040	30	00



LEFT SIDE VIEW

FRONT VIEW

TOLERANCES UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE IN INCHES

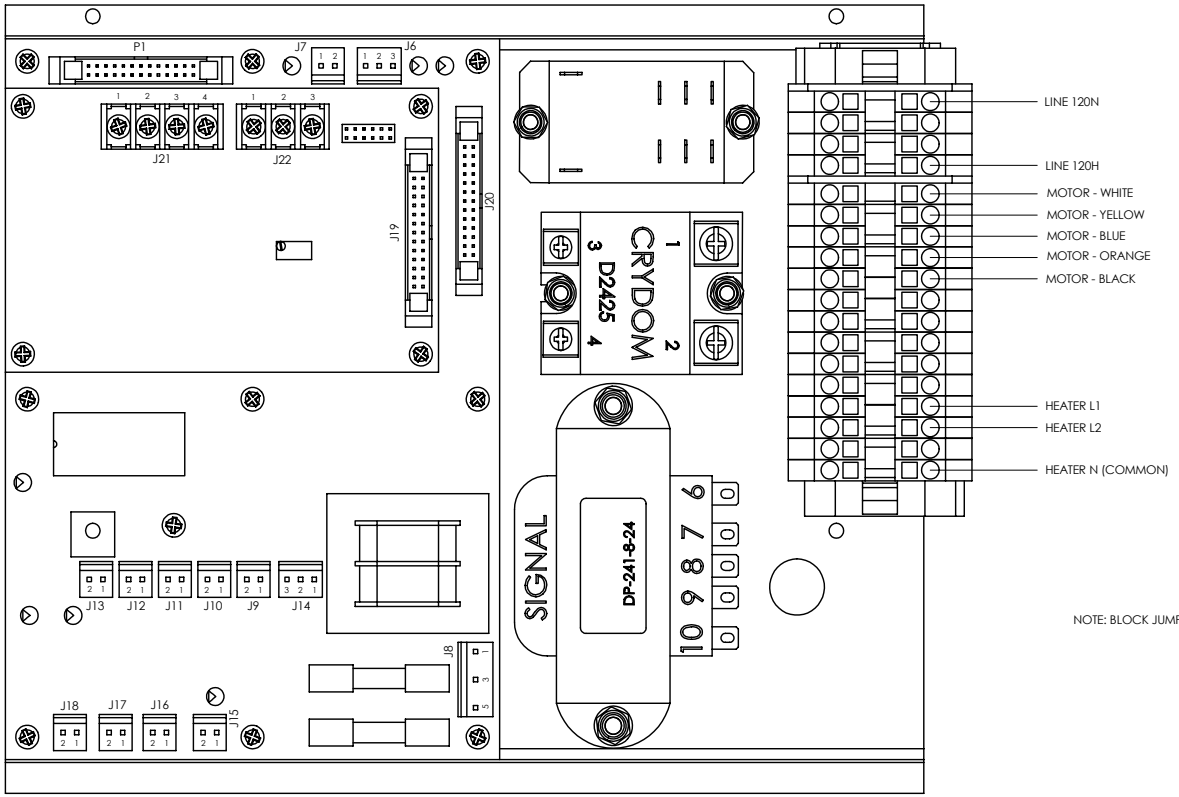
PATH =E:\CC\DT7200\MBCHASP0.SLDDRW

JPC CONTROLS

102 COMPASS PT. DR. SUITE D, ST. CHARLES, MO 63301
(636) 946-3300 FAX (636) 724-2492 www.jpccontrols.com

DT7200 MICRO BOARD PHYSICAL DIMENSIONS

APPROVAL		DWN BY	DATE	SCALE	CHKD BY
ENG DATE		MPJ	2/29/00	1=1	
QA DATE		SHEET 1 OF 1	49	720041	30 00



NOTE: BLOCK JUMPERS SHOWN POSITIONED FOR 120 VAC INPUT.

J6 - AUXILLARY OUTPUTS
1 - EXTERNAL AUDIO OUTPUT
2 - AUX 1 OUTPUT
3 - +8V, 50mA

J7 - SOLID STATE RELAY OUTPUT
1 - SSR OUTPUT
2 - +8V, 50mA

J8 - CONTROLLER POWER
1 - 24 VAC H
2 - NO CONNECTION
3 - 24 VAC C
4 - NO CONNECTION
5 - SAFETY GROUND

J9 - CONTROL COOLING FAN POWER
1 - 24 VAC H'
2 - 24 VAC C'

J10 - FAILSAFE SWITCH INPUT
1 - 24 VAC H'
2 - 24 VAC C'

J11 - INTERLOCK 1 INPUT
1 - 24 VAC H'
2 - 24 VAC C'

J12 - INTERLOCK 2 INPUT
1 - 24 VAC H'
2 - 24 VAC C'

J13 - INTERLOCK 3 INPUT
1 - 24 VAC H'
2 - 24 VAC C'

J14 - AUXILLARY INPUTS
1 - SPARE 1
2 - SPARE 2
3 - 24 VAC C'

J15 - SAFETY RELAY OUTPUT
1 - 24 VAC C'
2 - 24 VAC HS

J16 - LN2 SOLENOID OUTPUT (24 VDC)
1 - COMMON
2 - +24 VDC (UNREGULATED) OUTPUT

J17 - C02 SOLENOID OUTPUT (24 VDC)
1 - COMMON
2 - +24 VDC (UNREGULATED) OUTPUT

J18 - COOLING BACKUP SOLENOID OUTPUT (24 VDC)
1 - COMMON
2 - +24 VDC (UNREGULATED) OUTPUT

J19 - RS232 COMMUNICATION CABLE CONNECTOR
MATING CONNECTOR 3M (3399-7626), T&B (609-2641)

J20 - GPIB COMMUNICATION CABLE CONNECTOR
MATING CONNECTOR 3M (3399-7626), T&B (609-2641)

J21 - RTD INPUT
1 - + SOURCE
2 - + SENSE
3 - - SENSE
4 - - SOURCE

J22 - HIGH LIMIT THERMOCOUPLE (TYPE J)
1 - SHEATH (SAFETY) GROUND
2 - +TC (WHITE)
3 - -TC (RED)

P1 - DISPALY PANEL CABLE CONNECTOR
MATING CONNECTOR - 3M (3399-7626), T&B (609-2641)

TOLERANCES UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE IN INCHES

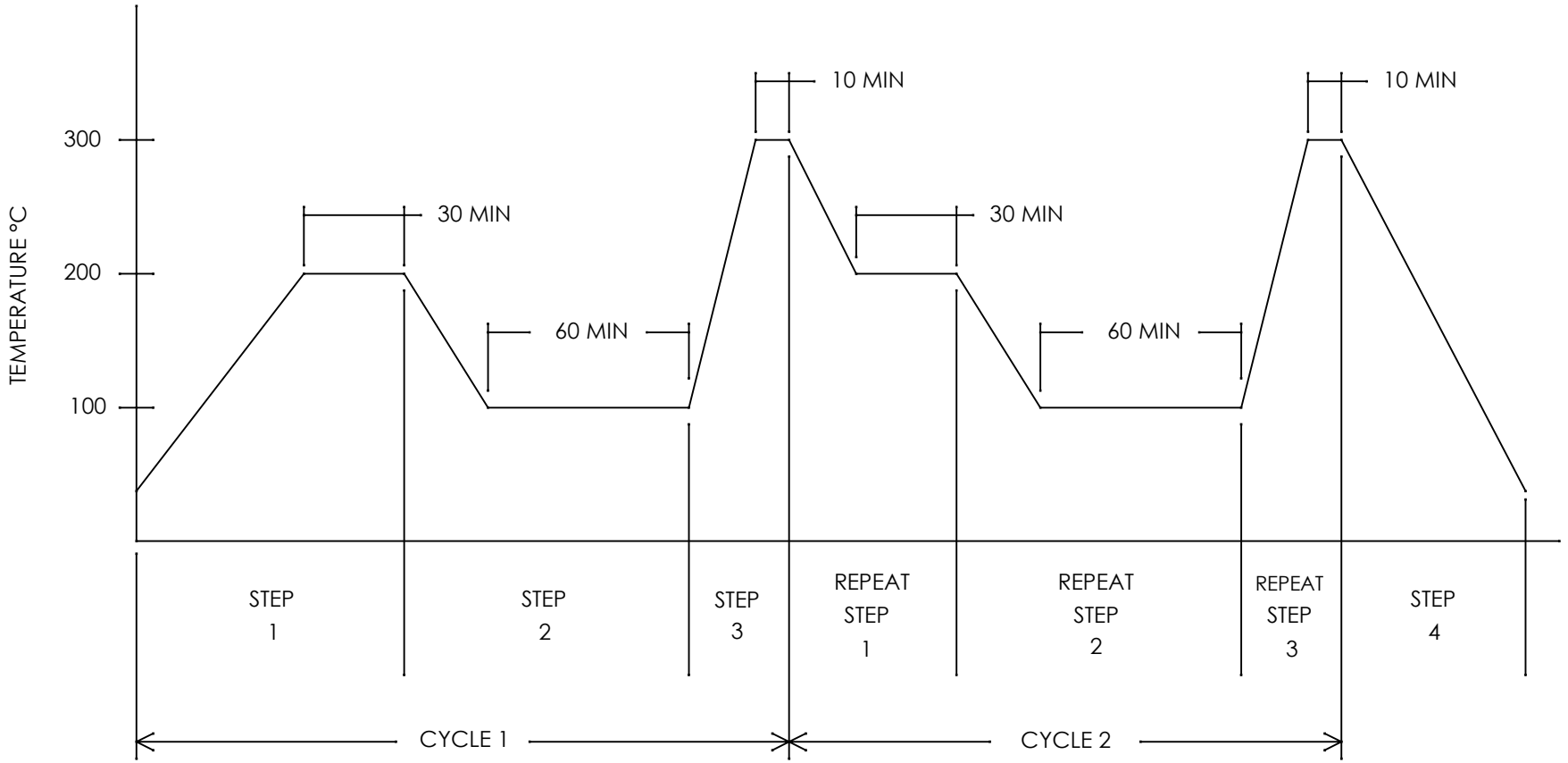
PATH = E:\CC\DT7200\7200W0.SLDDRW

JPC CONTROLS — A DIVISION OF LLOYD INDUSTRIES, INC.
102 COMPASS PT. DR. STE. D ST. CHARLES, MO. 63301 (636) 946-3300

DT7200 WIRING DIAGRAM

APPROVAL		DWN BY MPJ	DATE 2/29/00	SCALE 1=1	CHKD BY
ENG	DATE	SHEET 1 OF 1			
QA	DATE				

12	720042	30	00



TOLERANCES UNLESS OTHERWISE SPECIFIED	JPC CONTROLS	A DIVISION OF LLOYD INDUSTRIES, INC. 102 COMPASS PT. DR. STE. D ST. CHARLES, MO. 63301 (314) 946-3300							
	FIGURE 1 RAMP AND SOAK PROGRAM								
	APPROVAL		DWN BY MPJ	DATE 9/3/99	SCALE NONE	CHKD BY			
ALL DIMENSIONS ARE IN INCHES	ENG	DATE	SHEET 1 OF 1		49	720024	10	00	
PATH = E:\CC\DT7200\CYCLED10.DWG	QA	DATE							