



**ADC DRYER CONTROL OPERATING MANUAL**

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## ADC ADVANCED DRYER CONTROL

The new ADC (Advanced Dryer Control) was introduced for optimum operation of the dryer and is as user friendly as possible. The easy-to-see alphanumeric display indicates all operating parameters and leads the operator through a menu driven program for all settings and information. All fault conditions are shown on the display in a format that is easy to understand.

As with earlier designs, the ADC is driven by thermocouples strategically located in the towers, hoses to the hoppers, and other locations to properly control the operation of the dryer. Other inputs monitor the performance of the dryer for safe and efficient operation.

### FEATURES:

- ▷ Easy setting of process temperature \*
  - ▷ Blower rotation detection
  - ▷ Monitoring of heater current to check heater and relay conditions
  - ▷ Automatic learn mode for heater currents at local voltage
  - ▷ Day and time indication
  - ▷ Set start and stop times daily
  - ▷ Adjustable high temperature alarm \*
  - ▷ Adjustable dewpoint alarm
  - ▷ Battery back-up for time retention
  - ▷ Selection of °F or °C
  - ▷ Display can be remotely mounted
  - ▷ Open thermocouple detection
  - ▷ Process temperature setback to prevent over drying
  - ▷ Closed loop control of valve position
  - ▷ Actual fault indication- no codes to look up
  - ▷ Dewpoint readout down to -45 degrees C
  - ▷ Temperature calibration for ISO 9000
  - ▷ RS 232 or RS 485 ports for remote readout or control
  - ▷ Optional Ethernet output
  - ▷ Library of resins automatically sets process temperature
  - ▷ Event history for easy trouble shooting
  - ▷ Internal temperature's display
  - ▷ Auto restart with power interruption
- \*For both hoppers on dual hopper designs

## **OPERATING IMPROVEMENTS:**

This exclusive ADC Microprocessor Control used in dryer systems manufactured by Dri-Air Industries enables the dryer to achieve numerous operating improvements over other typical PLC controlled systems.

### **A. Greater Energy Efficiency**

The regeneration cycle in dryers can use a substantial amount of energy to remove the moisture from the desiccant. With time-based systems, the regeneration heater is turned on for a preset time with little or no actual control of the regeneration cycle temperature. This wastes energy when the heater continues to run, even after the desiccant is regenerated.

The Dri-Air microprocessor controls this process by monitoring thermocouples located at the bottom and top of each desiccant bed. The lower thermocouple is used to monitor and control the actual regeneration temperature, while the upper thermocouple controls the cool down cycle by monitoring the temperature of the desiccant at the top of the bed.

Controlling the regeneration cycle results in lower energy consumption by heating the beds only long enough to remove the moisture.

### **B. Minimization of Temperature Spikes**

Temperature spikes are the result of incomplete desiccant bed cooling, resulting from the residual internal heat from the desiccant beds being transferred to the hopper. With the ADC microprocessor control, the bed shift is based on the relationship of the operating temperature to the bed temperature to eliminate any spikes. Additionally, an interim stage has been incorporated that preheats the idle regeneration heater, getting it ready for use as a process heater. This reduces the temperature drop that occurs as the result of the time needed for the heater to come up to temperature.

### **C. Heater Fault Detection**

This function has historically caused the most false alarms on competitive systems. Most other systems require a specific amperage to be entered for each heater based on the customer's given voltage. This can lead to false alarms because of variations and fluctuations in voltages at the user's locations (amperage variation is a function of the square of the voltage change). In response to this, the ADC microprocessor uses a unique current monitoring system. Upon initial start up after installation, the unit initiates a learning mode, where the amperages (at the actual operating voltage at the user's location) for each heater are stored into memory. These stored current readings are used to compare to heater current readings while the dryer is in operation to detect heater failures. Once a failure is detected, the unit will shut down and the faulty heater. An alarm, and the faulty heater are displayed on the control panel. The customer can initiate this learning mode if his voltage changes or the location of the dryer is changed.

## DRYER INSTALLATION:

To install the dryer with the ADC control:

The dryer is supplied with all of the necessary fuses for operation. It has been tested at the factory for proper operation and has been configured for your application. Once power is connected, the dryer is ready for operation. You may need to recalibrate the current fault detection feature if your voltage is more than 5% from nominal voltage.

1. Connect incoming power to the top of the disconnect switch located in the right hand side of the panel. **Make sure an earth ground is provided and connected to the ground terminal on the panel.** The ADC control will check the dryer for correct rotation and shut down alerting the operator on the display “Blower Error”. This can be corrected by switching any 2 wires on the input side of the disconnect.
2. For all PDII models and dryers 150 cfm and larger, connect compressed air to the regulator provided. The regulator has been preset to 60 psi at the factory and does not need to be changed. **The dryer will not operate without the compressed air supply in place!**
3. Start the dryer by pressing the start button on the left side of the control panel. The control will initialize itself and complete a diagnostic test before starting the dryer. The display will indicate this test. See Page 5 for more details.

*If the dryer does not continue in operation, the display will indicate either incorrect rotation (covered above) or a current failure. If a current failure is indicated, go to the section pertaining to this feature.*

## CYCLE DEFINITIONS

All DRI-AIR dryers have the same operational cycles. It is important to understand the basic operation of our equipment before trouble shooting a problem. Below are the basic cycles of the dryer as indicated on the display panel while in operation.

### 1. Drying Cycle (indicated as Z1H or Z2H)

The ADC microprocessor control initiates the drying cycle by turning on the regeneration heater located at the bottom of the desiccant bed in regeneration and controls the temperature to between 550 and 600 °F. As the bed heats up, the temperature at the top of the bed is monitored to assure the bed has reached the ideal regeneration conditions. When the top bed temperature reaches the correct temperature, the regeneration heater is turned off and the cooling cycle begins. This procedure maximizes the regeneration of the bed to produce low dewpoints and saves energy over timed regeneration cycles. Only the energy to remove the moisture from the desiccant is used with this logic.

## **2. Cooling Cycle (indicated as Z1C or Z2C)**

The cooling cycle allows the desiccant to cool down from the high regeneration temperatures and for the internal heat to reach the top of the bed. The lower bed temperature will immediately begin to decline as the heater has been turned off. The top temperature will rise as the internal heat is pushed to the top of the bed removing all of the moisture from the bed.

The cooling cycle continues until the top temperature declines to a specified delta from the process temperature. This eliminates any temperature spikes from occurring during bed shifts.

## **3. Idle Heating Cycle (indicated as Z1P or Z2P)**

At this point, the unit initiates the Idle Heat Cycle, where the bed's regeneration heater will cycle on and off simultaneously with the process air heater for a one to two minute interval. This eliminates the fall off in temperature of the process air

That would be caused by the lag time required to heat the tubular element. After this pre-heat cycle, the air valve shifts the air from one bed to the other and the cycle continues for the other bed.

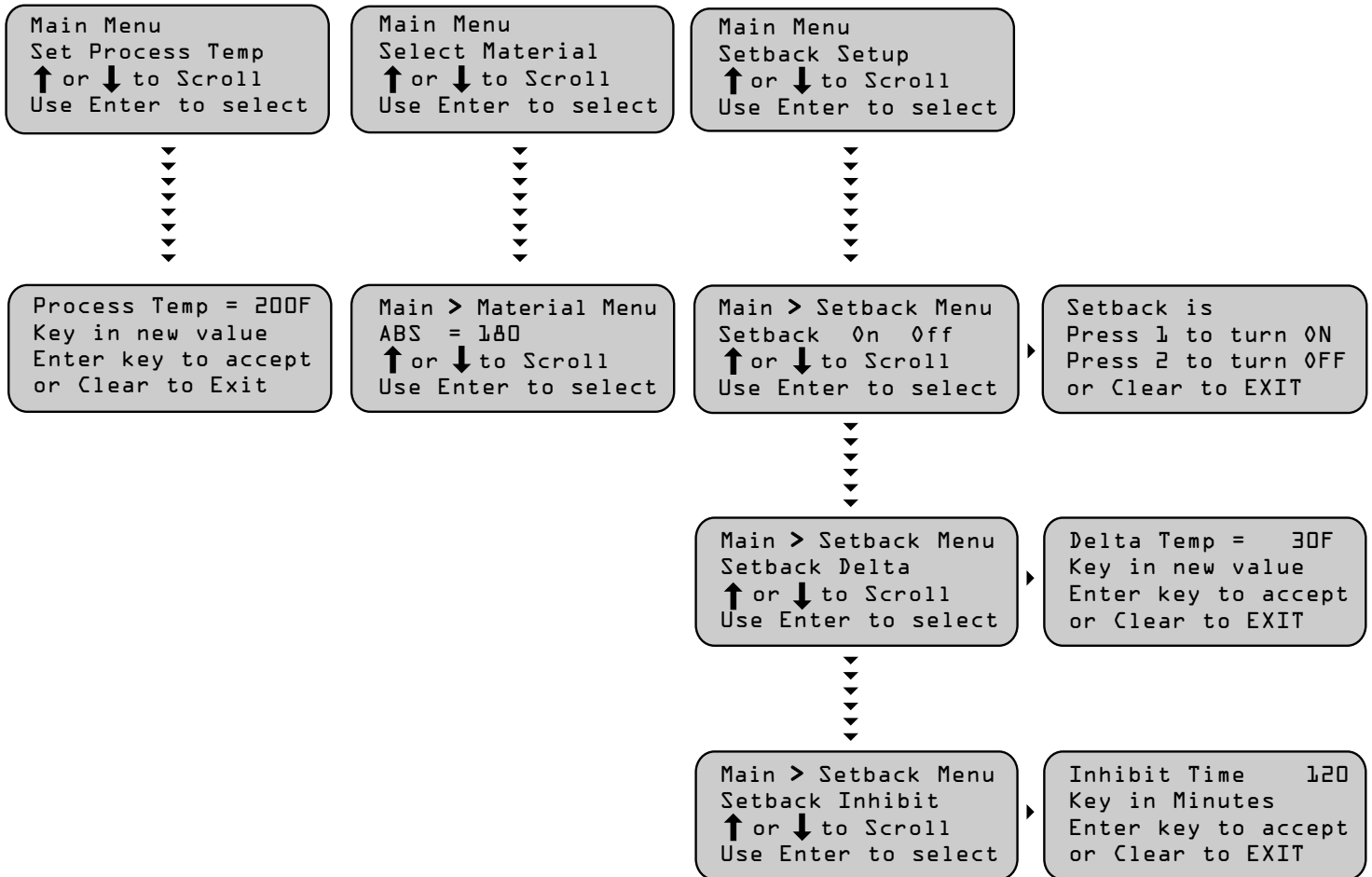




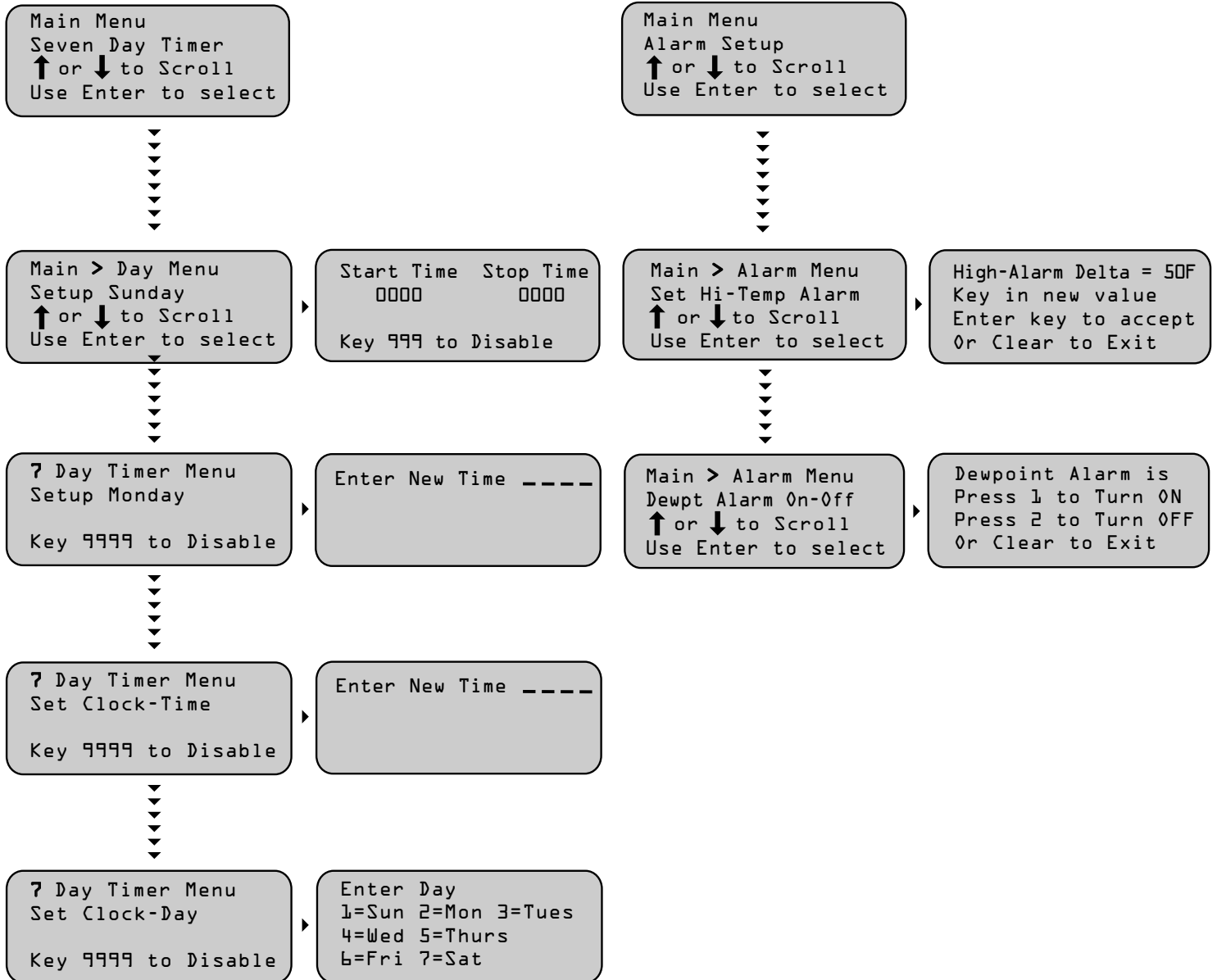




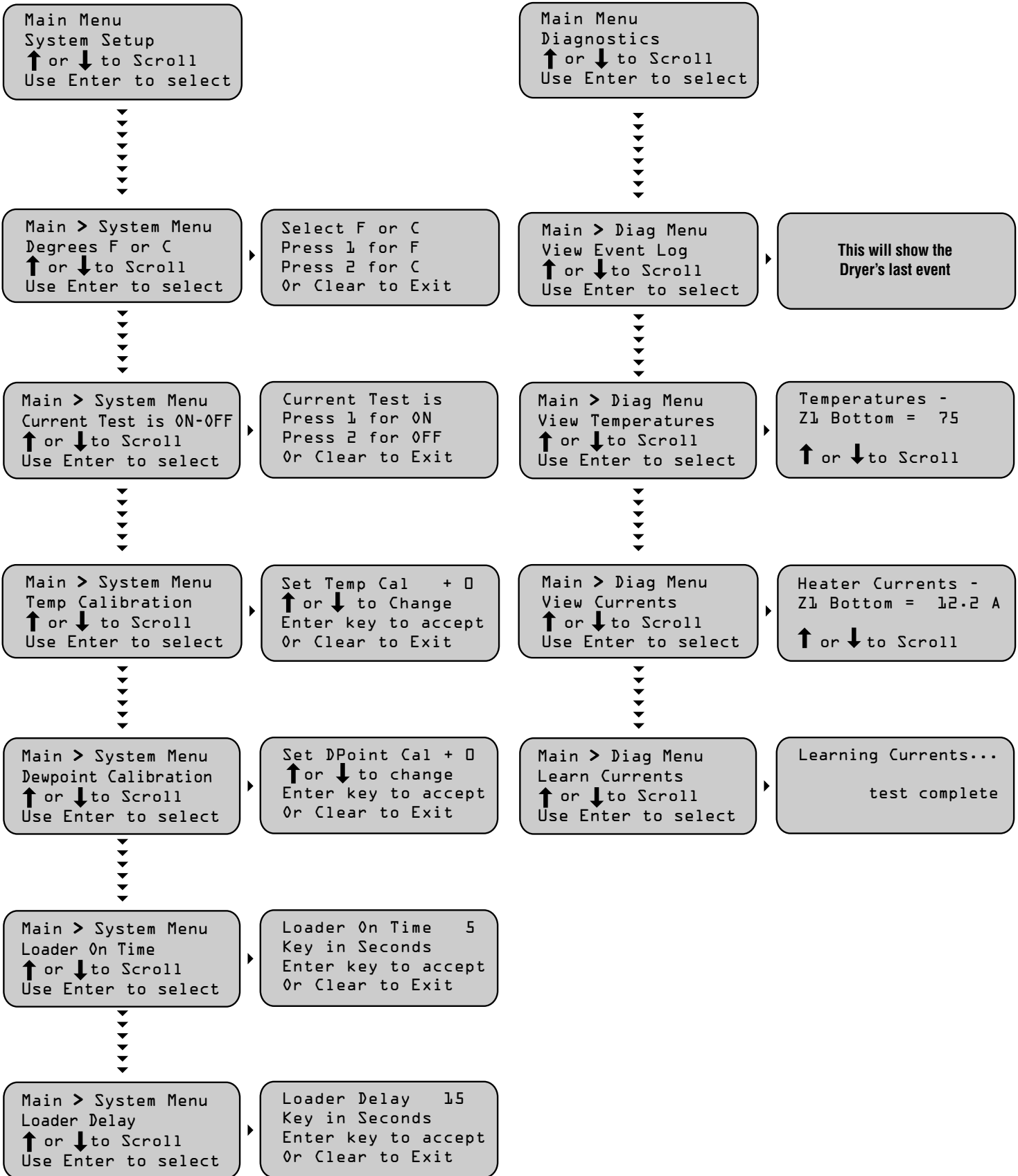
## MAIN MENU SELECTIONS



## MAIN MENU SELECTIONS (con't)



## MAIN MENU SELECTIONS (con't)



## **MENU DEFINITIONS:**

### **1. Set Process Temp**

This screen allows the operator to easily change the process temperature.

### **2. Select Material**

With this screen the process temperature can be set by selecting the material being dried from the material library. Check to make sure the drying temperature listed in the library is the desired temperature. Once the material is selected and the enter button pressed, the process temperature will automatically be set for the new setting.

### **3. Setback Setup**

For those dryers with the setback option, this screen allows the operator to activate the setback option and to enter the setback delta from the process temperature for the setback temperature. Remember this setting is a delta rather than the actual setback temperature. For example, if the process temperature is 250 °F and the delta is set for 30, the actual setback temperature will be 220 °F. This option eliminates over drying of the resin if for any reason the process is interrupted for a period of time.

### **4. Seven-Day TIMER**

The dryer can be automatically started and stopped once per day using this feature. In this menu, the operator can select the day of the week and time of day to turn the dryer on and off. The days of the week are specified as Sunday, Monday, etc and the time is set in Military time. Each day can be set to start and stop, start only, stop only, or have no events. A setting of 9999 means there is no time set.

### **5. Alarm Setup**

The high temperature alarm is factory set for a 50 °F delta above the set temperature. Again, this is a delta setting, so a setting of 50 means the high temperature alarm will activate at 50 ° above the set temperature. While this setting does not normally have to be changed, this screen is used to make changes. The dewpoint alarm can be turned on or off within this menu also. The high temperature alarm also shuts the dryer down and cannot be de-activated.

## 6. System Setup

This section is used to configure the dryer for various parameters.

- Selection of degrees F or C
- Current test on or off
- Temperature offset for calibration
- Dewpoint offset for calibration
- Closed loop loader fill time (With optional closed loop loader)
- Loader dwell time (With optional closed loop loader)

## 7. Factory Setup

This section is reserved for factory settings and can only be accessed by a password. If settings need to be changed in the field, consult one of our servicemen to make the necessary changes.

## 8. Diagnostic Menu

The diagnostic menu is used primarily for trouble-shooting assistance. It allows our servicemen and qualified repair personnel to view a history of events and other pertinent information to locate the problem in a shorter period of time. Z1 indicates Zone 1 and Z2 indicates Zone 2 in all displays.

Included in this section:

- **View Event Log** - The last 128 events are stored in this area and can be reviewed to spot any anomalies of operation. The last event is displayed first with the prior events visible by pressing the down button.
- **View Temperatures** - All internal temperatures can be viewed in this section while the dryer is running. Many factors of operation can be determined based on the various temperatures.
- **View Currents** - All heater currents are stored in memory and used as a reference every time the heater currents are checked. The stored values of current are visible in this section. These values should be checked any time the Learn Current mode is used.
- **Learn Currents** - If the actual voltage is too high or low compared to the nominal voltage, the stored values will not reflect the operational values causing an alarm. The control will replace the stored currents with actual currents at the operational voltage to be used as comparison for current fault reporting. The menu will explain how to activate this mode.

## **OTHER FEATURES:**

### **Blower Error**

If for any reason the phasing of the incoming power is incorrect, the blower will run in the wrong direction causing the dryer to malfunction. If the blower direction is not correct, the dryer will shut down and an error will be displayed. This condition can occur upon installation or when moved within the plant.

### **Automatic Restart**

In the event of a power failure. The dryer will not operate. If the power is restored within 30 seconds, the ADC control will check the status of the dryer and any alarms and restart the dryer if all tests pass. This feature eliminates having to manually start our dryers for a short duration power outage.

### **Loop Break Alarm (indicated as “LOOP” in an alarm)**

This feature checks all actual temperatures compared to their set values to see if they are approaching the set value. If the temperature does not reach its set value, the dryer is shut down and the heater in question is displayed. One of the main reasons for this feature is to locate a problem before it can cause any damage. One such condition would be if the process thermocouple were to be removed from the input port of the hopper resulting in an incorrect temperature and possible melt down of the resin.

### **Open Thermocouple Protection**

All thermocouples are constantly monitored for correct operation. If one should fail, the dryer will stop and an alarm indicating the failed thermocouple will be displayed.

### **Valve Position**

The position of the main air direction valve is fed back to the control to make sure it is in the correct position. If it is not properly positioned, the dryer will be shut down and the valve error displayed.

### **Temperature Setback (optional)**

This option prevents material from being over dried if the process is interrupted for a period of time. When activated, the return temperature is compared to the set temperature. If they are within certain specifications for a period of time, the process temperature will be set back to a level where continued drying will not take place. This setback condition is displayed by ( ) parenthesis around the set temperature on the display.

## **SETTINGS:**

### **Temperature:**

Set the process temperature by either pressing the “TEMP SET” button or “MENU” button.

### **High Temp Alarm Delta:**

Press the “MENU” button and then arrow down to the ALARM MENU. Press enter to access setting. Enter a new delta using the keypad and press ENTER. Remember this setting is a delta above the set temperature and not an actual temperature.

### **Temperature Setback:**

Going to the “SETBACK MENU” and pressing enter can actuate the temperature setback feature. The display will indicate how to turn on or off this feature. The setback delta is factory set for 30 degrees F based on field experience. If this value needs to be changed, go to the “SETBACK MENU” and arrow down to SETBACK DELTA. A new value can then be entered. All other variables are located in the FACTORY SETTINGS and will require assistance by our servicemen to make any changes.

### **Selection Of Degrees F or C:**

This setting is located in the menu section “SYSTEM SETUP”.

### **Seven-Day Timer:**

Select the “SEVEN-DAY TIMER” menu. Press enter to access the days of the week and ENTER again to set the times. Only one start and stop time per day is allowed. All times are in Military time. See the section on menu selection for more detail.

## **ERROR MESSAGES:**

There are a few conditions that will cause an alarm condition. Check the following areas:

- Clean or replace return air filter. **Turn off the dryer while cleaning!**  
Blockage in this area will affect the performance of the dryer and may cause an alarm.
- Check that all hoses are connected and intact. Ground all material conveying hoses with the imbedded copper wire.
- Check the inlet and outlet of the hopper for proper airflow.

### **“Zone 1 Bottom Failed”**

Indicates a heater failure with the location of defective heater. Check heater with a multi-meter for an open condition. If the heater is functional, check the solid state relay associated with the heater in question.

### **“Z1 Bottom TC”**

Is an example of a thermocouple failure. For this failure Z1 indicates Zone one, etc. The normal failure of a thermocouple is an open condition.

Using a multi-meter, check the thermocouple in question to see if it is open. If the thermocouple is functional, check all connections on the thermocouple and connectors. Replace the defective thermocouple with a new one from our parts department. The thermocouple must be a J type and ungrounded. When replacing the lower thermocouples over the heaters, make sure it is tied down to the bottom screen using the stainless steel wire in place. Failure to do so will result in improper operation of the dryer!

### **“Heaters off Failed”**

Indicates there is current to the heaters when there should be none. This indicates that one solid-state relay has probably failed closed.

### **“P1 Hi Temp”**

Indicates the dryer has been shut down because of a high temperature condition of the process heater. Check the airflow to the hopper in question. Check the solid-state relay for operation.

### **“Zone Valve”**

Indicates the valve is not in the correct position. Check all connections to the valve. Remove valve and check gearing, debris in valve body or other obstructions.



**“Safety Error”**

Indicates that the blower overload has tripped. Check the setting of the overload and condition of the blower.

**“Air Pressure”**

Indicates no air pressure for those models that require an air supply. Check to make sure there is air supply to the dryer.

**“Loader Alarm”**

Indicates the optional closed-loop loader has tried 3 times to load the receiver and no material has been loaded. Check to see if the material supply is adequate and all hoses are in the correct location. To reset the alarm after fixing the problem, either satisfy the proximity sensor or turn the main power off and back on.

**“Repair Required”**

Indicates a failed heater or solid-state relay upon startup. Check all heaters and solid-state relays for proper operation.

**FOR PDII MODELS:****“Hoppers Off”**

Indicates that both hoppers are turned off and there is no place for the air from the dryer to go. Go to the menu and select “Hopper Control”. Select the hopper in use and turn it on. The dryer will now operate.

## **PDII ADDENDUM**

The PDII models use most of same operational conditions as our other models with the exception of having two (2) hoppers to control. This addendum highlights the difference in settings for the PDII units.

### **ADC Control:**

The main screen of the ADC control is expanded to allow the operator to see both hopper temperatures along with their status. See the following page for more details.

An additional menu selection is added for the PDII model. This section is called “Hopper Control” and is used to turn on and off each hopper through the control. After selecting this menu item, select the hopper that needs to be changed and press enter for more instructions.

Many of the menu selections refer to the hopper and its control so therefore, an additional line item for selecting the correct hopper is added. This will be titled “Select Hopper”.

An additional alarm is provided:

### **“Hoppers Off”**

This indicates that both hoppers are turned off and the dryer cannot be started. Go to the “Hopper Control” menu and turn on the hopper in use. Restart the dryer.



## TEMPERATURE SETBACK THEORY

The optional temperature setback feature for the ADC control prevents over drying of the material due to excessive residence in a drying hopper at the suggested drying temperatures. This is especially true for Nylon, which can be over dried leading to degradation of the resin resulting in molding problems and brittle parts. It can also be useful in hopper bank applications to dry material to specific moisture levels.

When the temperature setback is actuated, a timer is started allowing the material to dry for a specified time. Once this time has expired, the return temperature from the hopper is compared to the process temperature using a thermocouple located in the return port of the hopper. If the return temperature is within a specified delta from the process temperature, the process temperature is reduced by the programmed setback delta. This indicates that the material has been dried and further drying is not required.

The process temperature is restored to the set temperature when the return temperature reaches 100 °F indicating new material has been added and needs drying. The process temperature will remain at the set temperature until the return temperature again reaches the delta from the setpoint. The process temperature will then be setback by the setback delta.

### DEFINITIONS:

#### Setback Delta

The Setback Delta setting is the amount below the setpoint that the process temperature will be reduced by. If the process temperature is set to 250 °F and the setback delta is set at 30, the setback temperature will be 220 °F. Our experience has shown the factory setting of 30 for the setback delta is ideal for most resins.

***Caution: Do not enter a Setback Delta that will reduce the setback temperature below 140 °F, as the dryer will not maintain temperatures below 140 °F.***

#### Setback Inhibit

The Setback Inhibit setting is the time in minutes to dry the material before the setback can be initiated. The setting has a range of 10 to 360 minutes and is factory set for 120 minutes. The inhibit time is started when the hopper is turned on, a new drying temperature is entered, or the setback option has been selected.

#### Setback Display

Selection of the setback option is shown on the main screen by an asterisk \* prior to the hopper number. Parenthesis around the setpoint temperature indicates the temperature has been setback. The setback temperature is then displayed.