

RTC1000 – Technical Manual

General Description

The series 700 is Bartlett Instrument's seventh generation kiln controller board. New features have been added and old features enhanced. All of the same basic functions for the RTC1000 have been maintained. The RTC1000 kiln controller regulates the temperature in a kiln according to the program set by the artist. The RTC1000 has two basic programming methods, Vary-Fire and Cone-Fire. Both methods have new features that will be discussed. The series 700 can control a single zone or multi-zone kiln. The series 700 is compatible with **KISS (Kiln Interface Software System)**, which allows communication with a person computer for programming, data collection, and graphing.

POWER SUPPLY

The SMT700 requires a 24V center-tap transformer. It connects to the board's bottom 3 quick connects, labeled AC1, CENTER TAP, and AC2. The VA rating of the transformer is dependent on the electrical load of the board and relays. The board requires approximately 80mA at 12V DC and a relay typically requires approximately 140mA at 12V DC. Therefore, a three-relay system will require a transformer with a minimum rating of 6VA. (500mA X 12 V DC = 6 VA)

OUTPUTS

The SMT700 has four 12V DC outputs. The four outputs are given power by a safety transistor. The safety transistor is capacitor coupled to the microprocessor so it only powers the output transistors when the microprocessor is operating correctly. Outputs 1, 2 and 3 respond to their respective thermocouple inputs. Outputs 1, 2, and 3 are capable of driving a 500mA 12 VDC load. Output 4 is an extra output that can be programmed to run a fan, alarm, or extra kiln section. Output 4 can drive on 150mA 12V DC load. The safety output powers on at the beginning of a firing and off at the end of the firing. It is used to drive a safety relay that sends line power to the switching relays on outputs 1, 2, and 3.

Output 4 is controlled by the AOP option. AOP functions differently when in cone fire or ramp hold. In Cone Fire AOP will appear after the hold is set. When set to OFF, output 4 is activated during the cone firing. At the end of firing output 4 shuts off. When AOP is set to ON, then output4 is activated during both cone fire firing and cooling. It shuts off after the kiln has cooled to 150°F (66°C). In ramp hold programs FAn will appear after SEG in programming. Output 4 can be turned on or off for each segment of a ramp hold program.

HIDDEN MENU

The "hidden" menu allows you to program the number of thermocouples, enter a diagnostics routine, set the shut off option for zone control, or set the helper PID parameter. To enter the "hidden" menu, press "ENTER", "0", "0" and "rSet" is displayed. Press "4", "4", "3" and "notC" will appear. Continue to press "MENU" to scroll through the "hidden" options. When the option that you want to set is displayed, press "ENTER".

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Hidden Menu Options

- **notC** Program number of thermocouples
- **dIAG** Used to check if each section is connected to the right output heating.
- **SHtO** For 2 and 3 zone controls when shutoff is “off”, the controller uses the average of all three t/c’s to shut off the kiln. When “on” the kiln turns off when any one of the t/c’s reaches temperature.
- **HLPr** Sets the amount of help section 2 gives section 3 when section 3 is lagging
- **TYPE** Selects the calibration curve for either Type S or K thermocouple, consult factory before changing! Overfires can occur if incorrect thermocouple is used.
- **CYCL** Output cycle time, it is set at the factory according to the type of relays
- **LEd** Turns on all segments of the display
- **ERTF** Recalls the firing time and temperature when last error occurred
- **E-bd** Sets the maximum allowable circuit board temperature
- **dTCT** Factor setting to match the board to the installed current sensor
- **VOLT** Displays no load & full load line voltage
- **REST** Restores the factory programs in all six of the Vary-Fire Program
- **INdF** Turns on an indefinite hold for the final hold segment. The final hold of the program will hold indefinitely
- **TEST** Runs a full test of the amp readings, incoming power, the boards output voltage, and the analog to digital converter on the board
- **AdC** Tests the analog to digital converter on the controller
- **OUTV** Tests the output voltage for each output

PROGRAMMING NUMBER OF THERMOCOUPLES

Selecting the number of thermocouples is the first option in the hidden menu. This allows one controller board to be used for single or multi-zone kilns. To program the number of thermocouples – press “ENTER”, “0”, “0”, “4”, “4”, “3” and “notC” will appear. Press “ENTER” and the current number of thermocouples selected will be displayed. Press the number key representing the number of thermocouples (1, 2, or 3). Now press “ENTER” and “StOP” will be displayed to indicate programming is complete. When programmed for use as a multi=zone board, the display will cycle between t/c X and the temperature, where X indicates which thermocouple’s temperature is being displayed. When programmed as a single zone board, the display will not show the t/c number.

Single Zone. Input T/C 2 is used when the controller is programmed for single zone. All three outputs work in unison so there are two alternatives for connecting the outputs. &You can connect all the relay to output 2 or you can connect one relay to each of the outputs The first method allows direct replacement of

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the present single zone controller without changing wiring. The second method allows easy upgrading to a multi-zone kiln in the future by simply adding thermocouples and reprogramming the number of T/C's.

3-ZONE. Generally T/C 1 is the top thermocouple, T/C 2 is the middle, and T/C 3 is the bottom. Likewise, output 1 drives the top relay, output 2 the middle, and output 3 the bottom. For taller kilns, output 2 can control several middle sections.

2ZONE. When two thermocouples are selected, use inputs T/C 1 and T/C 2 and outputs 1 and 2.

DIAGNOSTICS (dIAG) This option is used to check each of the outputs. It will individually turn on each of the three outputs for one minute and 20 seconds starting with the top. The display will indicate which output is “on” throughout the test. See page 5 for further instructions.

SHUT OFF (SHtO) Shut off is a zone control feature that attempts to make firings more consistent. For 2 and 3 zone controllers, when shut off is “off”, the controller uses the average of all three thermocouples to transition from one segment to the next or to shut off the kiln. When “on the kiln turns off or transitions when any one of the thermocouples reaches temperature. FOR ALL DOWN RAMPS, the controller transitions from one segment to the next as if shut off were turned on, i.e., when any one section reaches the next segment temperature. To select the shut off options, press “ENTER”, “0”, “0”, “4”, “4”, “3”, and “notC” will appear, press “MENU” 2 times and “SHtO” will be displayed. Press “ENTER” and “SHtO” alternating with “OFF” will be displayed. Press the”1” to toggle the option for “OFF” to “ON” then press “ENTER”.

Helper PID (HLPr) In most kilns without elements in the bottom slab, the bottom section is usually the coolest of the sections. The PID option is designed to help speed up the firing when the bottom section is cooler and lagging behind the other sections. When the bottom section is on at full power, that is, it is lagging behind, then output 2 comes on as a percent of output 1. The middle section will fire hotter and help the bottom section catch up. The percent can be set from 0 (zero) to 150. It is factory preset at 65. The top (output 1) is on full power then the center section (output 2) is on as a percent of the top. In this case the PID should probably be decreased or set to zero to even the firing. To set the HLPr percent press “ENTER”, “0”, “0”, “4”, “4”, “3”, and “notC” will appear, press ”MENU” 3 ties and HLPr will be displayed. Press “ENTER” and PCt and the current percentage are displayed. Enter the new percent that you want and press ‘ENTER”

NEW HIDDEN MENU OPTIONS

These features have been added to the hidden menu of the RTC1000 kiln controller since upgrading to the series 700. Following is a short description of each feature and how to use the feature.

THERMOCOUPLE TYPE (TYPE) Read warning below. Type allows changing the thermocouple type. The RTC1000 supports both Type K and Type S thermocouples. To change from Type K to Type S requires changing this software setting to Type S as well as placing a jumper on the circuit board. To change from Type S to Type K requires changing this software

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setting to type K and removing a jumper from the circuit board. **WARNING:** Using a Type S thermocouple and a controller set for Type K will cause a serious over-fire. Using a Type K thermocouple and a controller set for Type S will cause an under-fire. Type S thermocouples must use Type S extension wire. Type K thermocouples must use Type K extension wire. If changing thermocouple type be sure to change the extension wire. Make sure the software and jumper settings match the type of thermocouple and extension wire you are using

CYCLE TIME (CYCL) Sets the output cycle time. The cycle time is the length of time between an output coming on two consecutive times. If the cycle time is set for 14 seconds the output will come on every 14 seconds as needed. Cycle time can be set from 10 seconds to 60 seconds. A cycle time of zero can also be programmed; this option will use a cycle time of 200 milliseconds and can only be used if the kiln uses solid-state relays.

LEDs ON (LEd) Turns all the LEDs on the display to on. Can be used to check that all segments of the display are working.

LAST ERROR RECALL (ERTF) Recalls the firing time and the temperature when the last error occurred.

ERROR BOARD TEMPERATURE (E-BD) Sets the maximum allowable temperature of the circuit board. The default value is 200 degrees Fahrenheit (93 degrees Celsius). If the circuit board temperature exceeds the error board temperature the RTC1000 will terminate the firing. This feature is for people that use their kilns in a small, enclosed space, and need to make sure the kiln room does not exceed a given temperature.

CURRENT DETECTOR SETTINGS (DTCT) Allows the user to change the current detector rating. This option will only be used if the RTC1000 came with the optional current sensor.

VOLTAGE MEASUREMENT (VOLT) Allows the user to measure the kiln's voltage. This option helps to diagnose firing problems when the kiln is not able to reach a programmed temperature. Press ENTER and the display will flash NOLd to indicate the next number displayed is the no load voltage. Press ENTER again and FLLd will be displayed to indicate the next number displayed is the full load voltage. The elements will come on momentarily while the RTC1000 is displaying full load voltage. After four seconds the kiln will return to IDLE. Changing transformers or relays may affect your Voltage calibration (see Voltage Calibration, page 6).

RESTORE DEFAULT USER PROGRAMS (REST) The RTC1000 is preloaded with six Vary-Fire user programs. The restore default user programs feature will overwrite all six Vary-Fire profiles. The six profiles that will be restored to the Vary-Fire profiles are:

- Glass slumping program
- Glass tack fuse program
- Glass full fuse program
- Glass bead annealing program
- Lost-wax burnout program

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- 6. Slow cooling cycle to be added to the end of a cone 6 firing with the 16-segment option. To use this feature program a cone 6 firing and set the 16-segment option to on.

INDEFINITE HOLD (INdF) Turns on an indefinite hold for the final hold segment of the loaded program.

FULL TEST (TEST) Runs a full test of the amperage readings, incoming power with and without a load, output voltages, and AdC reading.

ANALOG TO DIGITAL CONVERTER (AdC) – Checks the amp reading for the analog to digital converter on the board.

OUTPUT VOLTAGE (OUTV) Checks the output voltages for each output on the controller

AMPERAGE DIAGNOSTICS ROUTINE To display the kiln's current draw the optional current sensor must be installed. If the sensor is not installed or it is not installed correctly the controller will display a value near zero amps for all sections of the kiln.

1. Press ENTER key one time. Then MENU twice and "RSET" will be displayed.
2. Type in key sequence 4, 4, 3.
3. "NOTC" will be displayed. Press MENU until the message "DIAG" is displayed.
4. Press ENTER key.
5. "OUTS" will be displayed. Press the ONE key.
6. "AMPS" will be displayed. Press ENTER key.
7. The message "AMP1" will now be displayed and the elements should turn on. The number shown after this message is the amperage for section one of the kiln.
8. The message "AMP2" will now be displayed. The number shown after this message is the amperage for section two of the kiln.
9. The message "AMP3" will now be displayed. The number shown after this message is the amperage for section three of the kiln.

The amperage diagnostics routine is now complete. The controller will return to idle.

VOLTAGE CALIBRATION To display voltage using the RTC1000 kiln controller a calibration must be done. Before calibration make sure the relays and elements are connected.

1. Press ENTER key one time. Then MENU twice and "RSET" will be displayed.
2. Type in key sequence 4, 4, 3
3. "NOTC" will be displayed. Press MENU until "VOLT" is displayed.
4. Press ENTER key. "NOLD" for no load will be displayed for two seconds. After "NOLD", a number will be displayed until either ENTER is pressed or the 443 calibration code is entered. This number is the no load voltage. However, until after calibration this number is meaningless.
5. Type in key sequence 4, 4, 3.
6. "CAL1" will be displayed. Enter your line voltage now using the keypad. This number will be used to calculate no load voltage.
7. Press ENTER key.

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8. "CAL2" will be displayed. Enter your line voltage now using the keypad. This number will be used to calculate full load voltage.
9. Press ENTER key.
10. The voltage calibration routine is now complete. The controller will return to idle.

Technical Specifications

<u>THERMOCOUPLE INPUT</u>	TYPE K (maximum resistance 100 Ohms)
<u>ACCURACY</u>	+/- 10 degrees F
<u>COLD JUNCTION COMPENSATION</u>	ELECTRONIC
<u>POWER INPUT</u>	24V CENTER-TAP TRANSFORMER
<u>OUTPUTS 1 & 3</u>	150mA at 12V; one 12 V relay with 80 Ohm coil per output
<u>OUTPUTS 2 & 4</u>	600mA at 12V; four 12 V relays with 80 Ohm coil
<u>OPERATING TEMPERATURE RANGE</u>	0 TO 125°F or 0 to 52°C

PRECAUTIONS

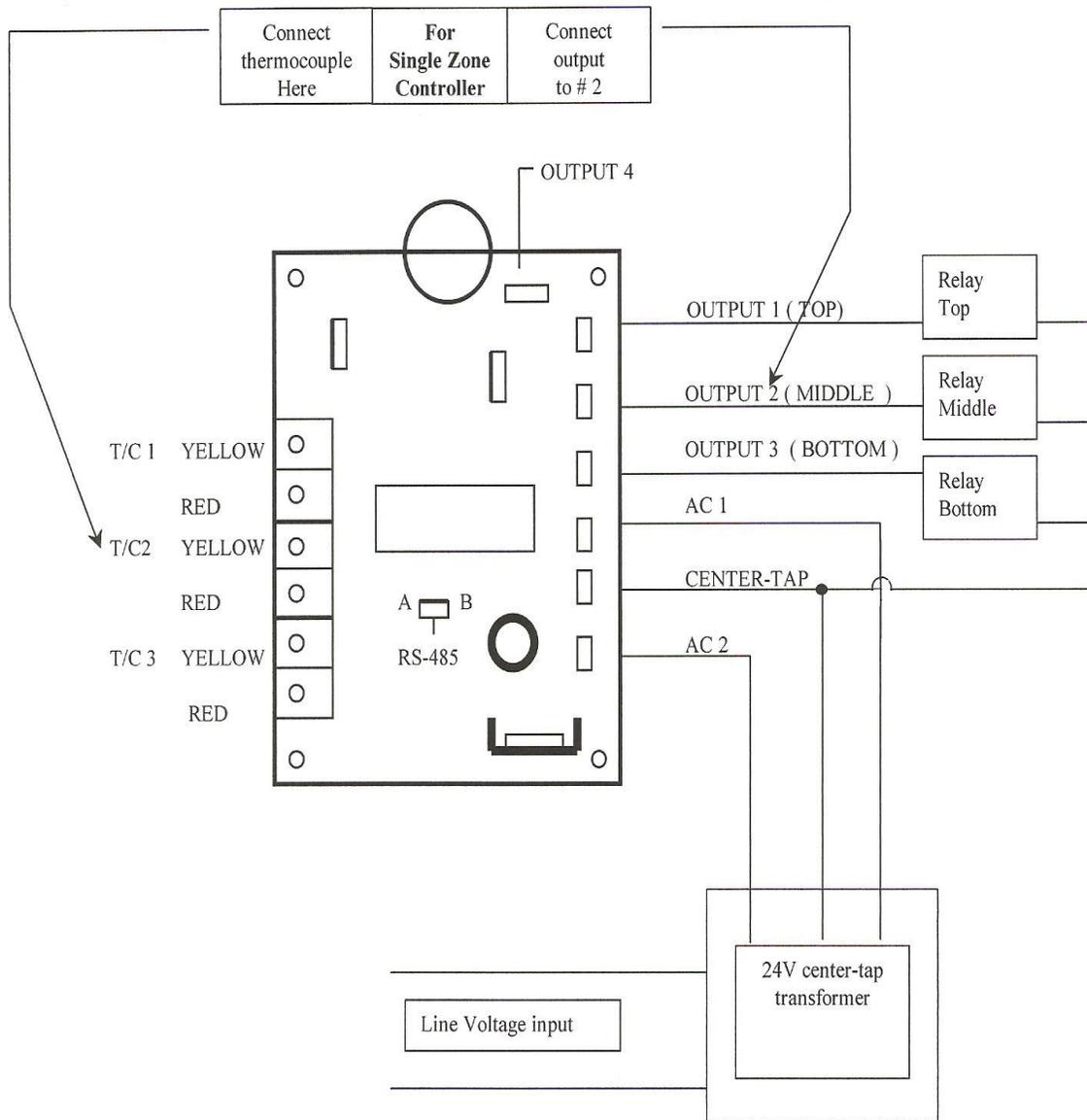
This controller contains static sensitive parts, which can be damaged by static electricity. Use ground strap or touch a grounded object when handling this controller. Pack in anti-static treated material or paper. Do not pack in plastic bags or untreated packing.

This controller is a temperature regulating device not a safety device. You should attend your kiln during firings

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CONNECTION DIAGRAM

(Figure 1)



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KISS

KISS (Kiln Interface Software System) connects up to 50 controllers to a personal computer running Windows 95, or higher. **KISS** is an easy to use interface for programming and monitoring the controller from a computer. During the firing, the status screen will show the current program, current set point, current segment, firing time, and each zone temperature. Firing information can also be collected in a file for later viewing or graphing.

To give your kiln a **KISS**, you need a **KISS** starter kit. For each additional kiln you connect to the network, a **KISS** kiln kit is required. The starter kit includes **KISS** software, a USB opto-isolated converter with power supply, a 25 foot modular cord, and a modular wall jack to connect to the kiln. The kiln kit includes a 25 ft. modular cord, a modular wall jack to connect to the kiln, and a “T” adapter.

