V6-CF - TECHNICAL MANUAL, SERIES 700

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 of the ***V6-CF*** have been maintained. Series 700 upgrades will be noted throughout the text. The ***V6-CF*** kiln controller regulates the temperature in a kiln according to the program set by the artist. The ***V6-CF*** has two basic programming methods, Vary-Fire and Cone-Fire. Both methods have new features that will be discussed. The series 700, like its predecessor, can control a single zone or multi-zone kiln. Many of the new features affect both single and multi-zone operation. Other new features enhance safety options and the diagnostic ability of the ***V6-CF.*** The series 700 is compatible with ***KISS*** (**K**iln **I**nterface **S**oftware **S**ystem), which allows communication with a personal computer for programming, data collection and graphing .

POWER SUPPLY

The series 700 board requires a 24V center-tap transformer, as did its predecessors. It connects to the board's bottom three quick connects, labeled AC1, CENTER TAP, and AC2 (see figure 1, page 8). 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 12V DC = 6 VA).

OUTPUTS

The series 700 board has five 12V DC outputs. Four outputs are given power by a safety transistor, outputs 1, 2, 3, and safety. 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. With the series 700 board, outputs 1, 2, and 3 are capable of driving a 500mA 12 V DC load. Output 4 is an extra output that can be programmed to run a fan, alarm, or extra kiln section. Output 4 can drive one 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. See "hidden" menu for details on the output 4 options.

"HIDDEN" MENU

The "hidden" menu allows programming of options that are normally set at the factory. The 600 series boards had nine options in the hidden menu and the series 700 board has 19. The options are listed in the order they appear in the menu with a short description. Each option is describe in more detail in later sections. The "hidden" menu can be entered by pressing **OTHER** until "rSEt" is displayed. Type in key sequence **4**, **4**, **3**. "notC" will be displayed.

Continue to press **OTHER** to scroll through the "hidden" options. Press the **ALARM** key to move backwards through the menu (new in the series 700).

HIDDEN MENU OPTIONS (BOTH SERIES 600 AND 700)

NOTC Program number of thermocouples, valid entries are 1,2 or 3

OP A Output 4 option for controlling a vent

OP B Output 4 option for controlling a vent

OP C Output 4 option for controlling a vent

PCT Option for controlling lid or floor-element

PID Zone control feature to help speed firings

DIAG Check element function or amperage

SHTO Zone control feature to speed firings

ALR4 Output 4 turns on when the alarm triggers

NEW OPTIONS (SERIES 700)

CYCL Output cycle time, it is set at the factory according to the type of relays

MAX Factory setting that limits the maximum programmable temperature for the kiln

TYPE Selects the calibration curve for either type S or K thermocouple, consult factory before changing! Over-fires can occur if incorrect thermocouple is used

2KEY Makes starting the kiln a two key-press-sequence for greater safety

E-BD Sets the maximum allowable circuit board temperature

REST Restores the factory programs in all six of the Vary-Fire programs

ERTF Recalls the firing time and temperature when last error occurred

COOL Adds a cooling segment to the end of a Cone-Fire program

VOLT Tests the kiln voltage

DTCT Factory setting to match the board to the installed current sensor

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 **OTHER**, **4**, **4**, **3**. When "notC" is displayed, press **ENTER** and the current number of thermocouples selected will be displayed. Press the number key representing the number of inputs (1,2, or 3). Now press **ENTER** and "CPL " 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 message.

SINGLE ZONE (NUMBER OF THERMOCOUPLES IS ONE) Input T/C 2 is used when the series 700 board is programmed for single zone control. All three outputs work in unison so there are two alternatives for connecting the output. All relays can be connected to output 2 or one relay could be connected to each output. The first method allows direct replacement of the current single zone controller without changing wiring. The second method would allow an easy upgrade to a multi-zone kiln in the future by just adding thermocouples and reprogramming the number of T/C's. The second method also allows for better use of the diagnostic routines.

3-ZONE (NUMBER OF THERMOCOUPLES IS THREE) T/C 1 is the top thermocouple, T/C 2 is the middle, and T/C3 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.

2-ZONE (NUMBER OF THERMOCOUPLES IS TWO) When two thermocouples are selected, use inputs T/C1 and T/C2 and outputs 1 and 2.

OUTPUT 4 OPTIONS

Output 4 has three modes for running vent fans (OP A, OP B, and OP C), one mode for running extra elements in the lid or floor of the kiln (PCt) and one mode that uses output 4 to indicate the alarm has triggered (ALr4).

OPTION A (OP A) Used to control a vent. Output 4 can be programmed to be on or off during each segment of a Vary-Fire program. During a Cone-Fire program, output 4 comes on at the beginning of the firing and turns off after the kiln has cooled to 150 F.

OPTION B (OP b) Used to control a vent. Output 4 can be programmed to be on or off during each segment of a Vary-Fire program. Output 4 comes on at the beginning of a Cone-Fire program, off at 1450 F, back on after the firing is complete and the kiln has cooled to 1000F and finally off again when the temperature is below 150F.

OPTION C (OP C) Used to control a vent, an alarm, or other atmospheric control. Output 4 can be programmed to be on or off during each segment of a Vary-Fire program. Output 4 is off during Cone-Fire programs.

PERCENT (PCt) Output 4 can be programmed to be on for a percent of the time output 3 is on. This option is used when output 4 controls floor or lid elements. To ensure output 4 stays off at all times, use this option and set the percentage to zero. The percent can be set from 0 to 150.

ALARM (Alr4) When this option is selected output 4 comes on when the alarm is triggered.

PID (PId) PID is a zone control setting that uses the center section elements to help the bottom section. In most kilns, without elements in the bottom slab, the bottom section is usually the coolest section. 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 full power (it is lagging behind), then output 2 comes on as a percentage of output 1. The middle section will fire hotter and help the bottom section catch up. The percentage can be set from 0 (zero) to 150. It is factory preset at 85%. When the top section is the lagging section, the PID parameter comes into play also. When the top (output 1) is on full power then the center section (output 2) is on as a percentage of the top. In this case the PID should probably be decreased or set to zero to even the firing.

DIAGNOSTICS (dIAG) The improved diagnostics routine has 2 options, "OUTS" or "AMPS". The "OUTS" feature (this is the diag feature of the series 600 board) will turn on each section, starting with the top, for a few seconds. This allows checking to see if all elements are heating. The "AMPS" feature is used to measure the current draw of each section of the kiln (see amperage diagnostics routine, page 6). The diagnostic routines can only control each section separately if the outputs are wired for zone control.

SHUT OFF (SHtO) Shut off is a zone control feature that attempts to make firings more consistent. For 2 and 3 zone controllers, when shutoff 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.

NEW "HIDDEN" MENU OPTIONS

These features have been added to the hidden menu of the V6-CF kiln controller. Following is a short description of each feature and how to use the feature.

CYCL (CYCLE TIME) – 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.

MAX (MAXIMUM KILN TEMPERATURE) – Sets the maximum temperature that can be programmed into a Vary-Fire or Cone-Fire program. The maximum temperature cannot be set above 2400 degrees Fahrenheit (1315 degrees Celsius).

TYPE (THERMOCOUPLE TYPE) – Read warning below. Type allows changing the thermocouple type. The V6-CF 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 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.

2KEY (TWO KEY START) Makes starting the kiln a two-key sequence. The first key is the **Start/Stop** key. The second key is the **Enter** key. The kiln will not start unless these two keys are pressed in the correct order.

E-BD (ERROR BOARD TEMPERATURE) 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 V6-CF 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.

REST (RESTORE DEFAULT USER PROGRAMS) The V6-CF 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:

1. Glass slumping program
2. Glass tack fuse program
3. Glass full fuse program
4. Glass bead annealing program
5. Lost-wax burnout program
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.

COOL (CONE-FIRE COOLING SEGMENT) Allows the user to toggle on or off an optional cooling segment after any Cone-Fire program. When COOL is set to on, the V6-CF will prompt the user to enter a cooling segment while programming a Cone-Fire profile. The user is able to set a cooling ramp rate, a soak temperature, and a hold time just like in a Vary-Fire program. If a rate of zero is programmed the cooling segment will be ignored during a firing. This is only a cooling segment; the soak temperature must be less than the final cone temperature.

VOLT (VOLTAGE MEASUREMENT) 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 V6-CF 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).

DTCT (CURRENT DETECTOR SETTINGS) Allows the user to change the current detector rating. This option will only be used if the V6-CF came with the optional current sensor.

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 **OTHER** key one time. The message "RSET" will be displayed.
2. Type in key sequence **4**, **4**, **3**.
3. "NOTC" will be displayed. Press **OTHER** 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.

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 V6-CF kiln controller a calibration must be done. Before calibration make sure the relays and elements are connected.

1. Press **OTHER** key one time. The message "RSET" will be displayed.
2. Type in key sequence **4**, **4**, **3**
3. "NOTC" will be displayed. Press **OTHER** 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.
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

THERMOCOUPLE INPUT	TYPE K or TYPE S (MAXIMUM RESISTANCE 100 OHMS)
ACCURACY	+/- 10˚F
COLD JUNCTION COMPENSATION	ELECTRONIC
POWER INPUT	24V CENTER-TAP TRANSFORMER
OUTPUTS 1, 2, 3, AND SAFETY	600 mA AT 12V; FOUR 12V RELAYS WITH 80 OHM COIL
OUTPUT 4	150 mA at 12V; ONE 12V RELAY WITH 80 OHM COIL
OPERATING TEMPERATURE RANGE	0˚F TO 125˚F OR 0˚C TO 52˚C

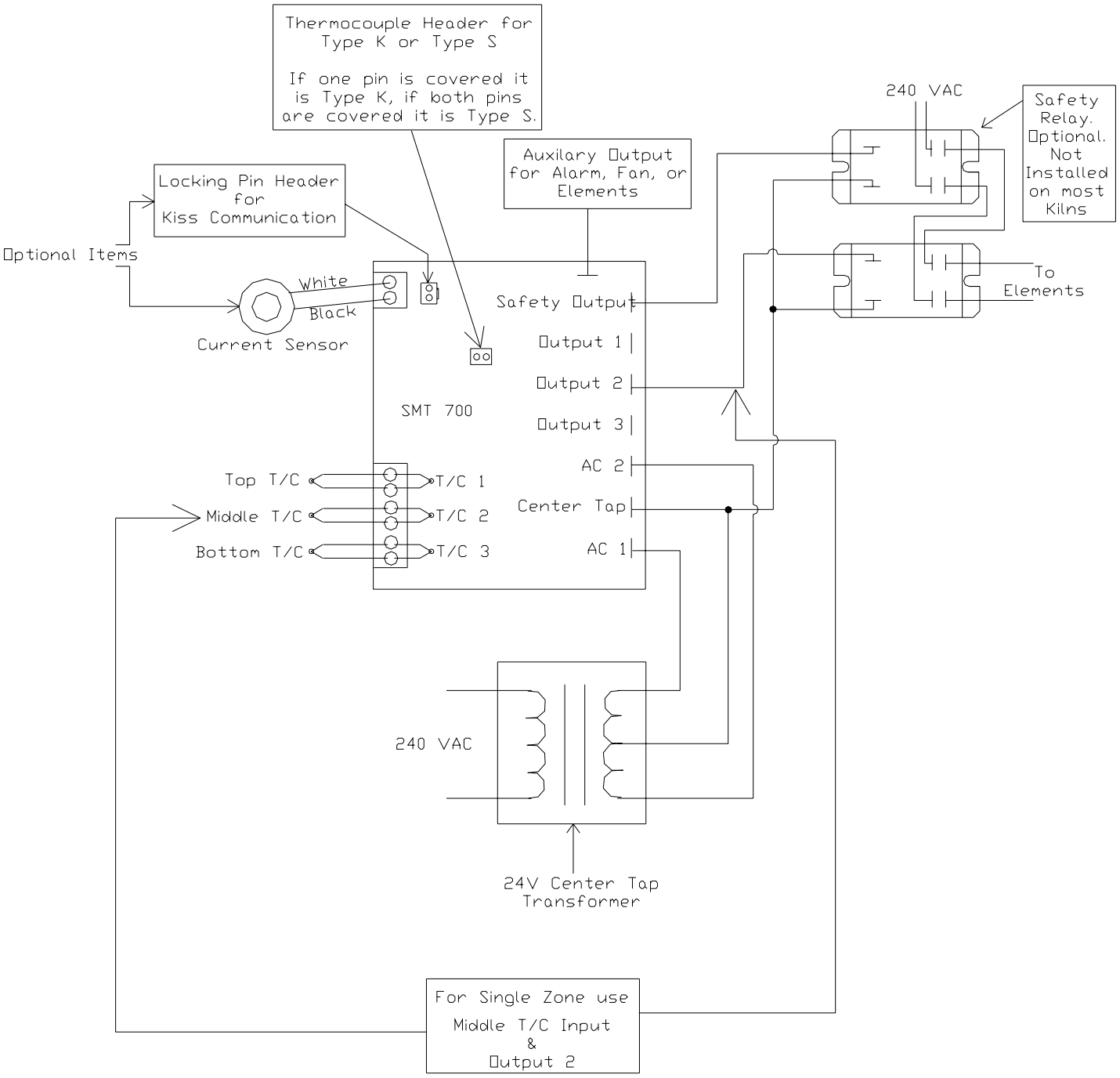
PRECAUTIONS

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.

CONNECTION DIAGRAM

(FIGURE 1)



KISS

KISS (Kiln Interface Software System) connects up to 10 controllers to a personal computer running Windows 95, 98, 2000, ME, and XP. **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, an RS232 to RS485 or USB opto-isolated converter with power supply, a 25 foot modular cord, a modular wall jack to connect to the kiln, and a communications chip (integrated circuit) to insert in the controller circuit board. The kiln kit includes a 25 ft. modular cord, a modular wall jack to connect to the kiln, and a communications chip (integrated circuit), and a "T" adapter.