

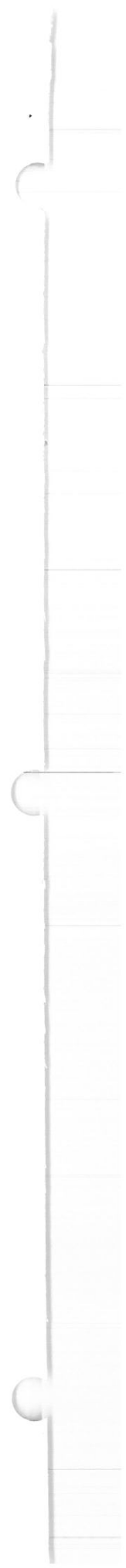


CB120/120E

*Microprocessor based
Burner management control*



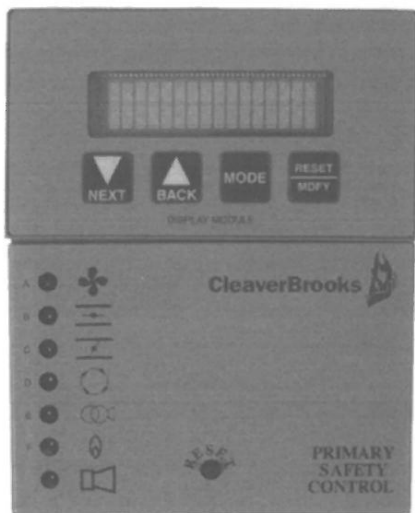
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CB120/CB120E

MICROPROCESSOR BASED
INTEGRATED BURNER MANAGEMENT
CONTROL



DESCRIPTION

The Cleaver Brooks CB120 System is a microprocessor based burner management control system designed to provide the proper burner sequencing, ignition and flame monitoring protection on automatically ignited oil, gas, and combination fuel burners. In conjunction with limit and operating controls, it programs the burner/blower motor, ignition and fuel valves to provide for proper and safe burner operation. Through SMART LED'S, the control provides current operating status and lockout information in the event of a safety shutdown. Optional displays are available that may be either plugged in or mounted remotely to give full language descriptors of current status and diagnostic lockout information. Refer to CB120 PROGRAMMER SELECTION later in this document for the various combinations of programmer and display modules.

A CB120 system includes the chassis equipped with the type of flame amplifier required for the application, appropriate flame detector, plug-in programmer module, and wiring base. Interchangeable programmer modules allow for complete versatility in selection of function, timing and flame failure response times.

CB120E includes all of the above with the addition of an alphanumeric display. Display is required for applications that require ModBus communications configuration or to access special functions. The CB120E alpha-numeric display is made up of 2 lines by 16 characters per line and is available in either vacuum fluorescent (VFD) or liquid crystal (LCD) formats. The advantage of VFD is high brightness and extended temperature range to -40°F . Both displays contain a fully functional keypad allowing the user to easily scroll through the various menus to view the current operating status, review programmer configuration, and lockout history. An advantage of the CB120 control family is the ability to set many of the operating parameters associated with proper and reliable burner operation allowing inventory of various programmer types to be kept to a minimum.

The chassis/flame amplifier module contains mounting screws and blank display module. The display module (883-3149 or 833-3151), if required, must be ordered separately. Interchangeable programmer modules allow for complete versatility in selection of control function, timing, and flame scanning means. Functions such as pre-purge time, recycling or non-recycling interlocks, high fire proving interlock, and trial for ignition timing of the pilot and main flame are determined by the programmer module. The CB120 system can be used with ultra-violet, auto-check infrared, flame rod, self-check ultraviolet flame scanners or direct coupled by choosing the proper chassis/flame amplifier module.

Wiring bases for the CB120 control are available pre-wired with 4 foot lead wires color coded and marked for easy installation or with an integral terminal block capable of accepting up to 2 x 14 AWG wires. The wiring base terminal block is available with knockouts for conduit or open ended for cabinet mounting. The pigtail wiring base is 4" x 5" and the terminal block wiring base is 4" x 7".

Additional functions of the CB120 system include:

- A non-volatile memory which allows the control to remember its history and present position even when power is interrupted.
- A consistent flame signal read-out via display module or 4-20 mA output.
- Read-out of main fuel operational hours and complete cycles via display module.
- Modbus communications via RS485 multi-drop link.
- Proof of fuel valve closure during off cycle.
- Burn-in time of program parameters occurs after 8 hours of main valve on time.
- A run/check switch which allows the operator to stop the program sequence in any of four different positions (Purge, PTFI, MTFI or Auto).
- Remote Display mounting with NEMA 4 protection.
- Remote Reset
- Programmable communication baud rate allows for DCS compatibility.
- Keypad selectable language readout.
- Revert to pilot can increase burner turn down.
- Additional terminals provided for applications requiring additional inputs and outputs.



WARNING: This equipment is a Class B digital apparatus which complies with the Radio Interference Regulations, CRC c.1374.



CAUTION: While programmers are mechanically interchangeable in that they mate with a common chassis/amplifier module, you should select the correct model for your application. Inappropriate application of a control could result in an unsafe condition hazardous to life and property. Selection of a control for a particular application should be made by a competent professional, such as a boiler/burner service technician licensed by a state or other government agency.



CB120 SPECIFICATIONS

Supply Voltage:

Chassis/Amplifier 120 VAC (+10%, -15%) 50/60 Hz

Power Consumption:

25 VA

Temperature Rating:

-40°C (-40°F) to +60°C (140°F)

Protection Category:

Chassis/Amplifier control NEMA 1 (IP00)
 Display, Remote mounted NEMA 4 (IP54)

Unit Dimensions:

Wiring Base 833-3155 4.0" (101 mm) W x 5.0"(127mm) H
 Wiring Base 833-3153 4.0" (101 mm) W x 7.0"(178 mm) H

Shipping Weight:

Chassis/Amplifier Approx. 3.2 lbs. (1.45kg)

OPERATING TEMPERATURE LIMITS

CONTROL	MAXIMUM		MINIMUM	
	°F	°C	°F	°C
Chassis/Amplifier	140°F	60°C	-40°F	-40°C
Programmers	140°F	60°C	-40°F	-40°C
833-3149 VFD Display	140°F	60°C	-40°F	-40°C
833-3151 LCD Display	140°F	60°C	-4°F	-20°C
817-2261, 817-2263, 817-2309	200°F	93°C	-40°F	-40°C
833-2124	200°F	93°C	-40°F	-40°C
817-2261	140°F	60°C	-40°F	-40°C
Flame Rod (Tip 2460°F)	1500°F	816°C	-40°F	-40°C
Humidity: 90% R.H. (Non-condensing)				

LOAD RATINGS:

Terminal	Typical Load	A. Maximum Rating @120V-50/60 Hz	B. Alternate Rating @120V-50/60 Hz
M	Burner/Blower Motor	9.8 F.L.A. *58.8 L.R.A.	240 VA Pilot Duty (Motor Starter Coil)
10-11-12-X	Modulator	125 VA Pilot Duty	
A	Alarm	50 VA Pilot Duty	
Terminal ratings may be selected from either column A or B: (select the rating from the column which best applies to the connected load on that terminal).			
* F.L.A. = full load amps; L.R.A = locked rotor amps			

Combination of fuel and igniter terminals

Combination No.	Pilot Fuel Trm 6	Main Trm 7	Ignition Trm 5	Delayed Valve Trm W
1	C	E	No Load	No Load
2	B	E	No Load	No Load
3	No Load	E	No Load	B
4	E	E	A	No Load
5	No Load	E	A	E
6	D	E	A	No Load
7	D	D	A	D
8	No Load	D	A	No Load

Composition of each combination

A	B	C	D	E
4.5 A Ignition	50 VA Pilot Duty plus 4.5 A ignition	180 VA Ignition plus motor valves with: 660 VA inrush, 360 VA open, 250 VA hold.	2A Pilot Duty	65 VA Pilot Duty plus Motor valves with: 3850 VA inrush, 700 VA open 250 VA hold.

Maximum connected load not to exceed 2000 VA

ELECTRICAL RATINGS

VA ratings (not specified as pilot duty) permit the connection of transformers and similar devices whose inrush current is approximately the same as their running current.

VA Pilot Duty ratings permit the connection of relays, solenoid valves, lamps, etc. whose total operating load does not exceed the published rating and whose total inrush current does not exceed 10 times the rating.

Running and locked rotor ratings are intended for motors. VA and VA Pilot Duty loads may be added to a motor load provided the total load does not exceed the published rating.



CAUTION: Published load ratings assume that no contact be required to handle inrush current more often than once in 15 seconds. The use of control switches, solenoid, relays, etc. which chatter will lead to premature failure. It is important to run through a test operation (with fuel shut off) following the tripping of a circuit breaker, a blown fuse, or any known instance of chattering of any external current consuming devices.

APPROVALS



Underwriters Laboratories Inc.:

- MCCZ File MP1537
- Controls, Primary Safety - Listed
- MCCZ2 File MP1537
- Controls, Primary Safety - Component
- MCCZ7 File MP1537
- Controls, Primary Safety Certified for Canada
- MCCZ8 File MP1537
- Controls, Primary Safety Certified for Canada - Component

Factory Mutual: Approved
Acceptable by: Industrial Risk Insurers (I.R.I.)
UL does not apply to 230 VAC operations

PART NUMBERS AND APPROVALS

Table 1: Agency Approvals

CB120 Chassis/Flame Amp. Module				
PART NUMBER	TYPE			
833-3135	UV	X	X	X
833-3137	UVSC	X	X	X
833-3139	IR	X	X	X
833-3708	IR2	X	X	X
833-3141	RECT			
CB120 Programmer Module				
833-3143	4s FFRT	X	X	X
833-3145	2s FFRT	X	X	X
833-3147	4s FFRT	X	X	X
CB120 Displays				
833-3149	VFD	X	X	X
833-3151	LCD	X	X	X
CB120 Wiring Bases				
833-3155	Pigtail	X	X	
833-3153	Terminal Block	X		X

X = CERTIFICATION IN HAND



WARNING: This equipment generates and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures which may be required to correct the interference.

ORDERING INFORMATION

CB120 Chassis/Flame Amplifier Module	
833-3135	120 VAC input with UV non self-check amplifier
833-3137	120 VAC input with UV self-check amplifier
833-3139	120 VAC input with IR auto-check amplifier
833-3708	120 VAC input with IR2 auto-check amplifier - FGR APPLICATIONS ONLY
833-3141	120 VAC input with flame rectification amplifier

CB120 Programmer Modules	
833-3143	Keypad selectable parameters, non-recycle operation, modulation, open damper proving, 4 second FFRT
833-3145	Keypad selectable parameters, non-recycle operation, modulation, open damper proving, 2 second FFRT
833-3147	Keypad selectable parameters, non-recycle operation, modulation, open damper proving, indefinite pilot hold, revert to pilot from auto, 4 second FFRT

CB120 Displays	
833-3149	Display, 2 line X 16 characters, VFD, with cable, NEMA 4
833-3151	Display, 2 line X 16 characters, LCD, with cable, NEMA 4

CB120 wiring bases	
833-3155	Pigtail wires, 4 foot long, 4"W x 5"H
833-3153	Closed base with terminal block and knockouts, 4"W x 7"H

CB120 Accessories	
833-3156	Kit, remote mounting, CB120 display, 4 ft. cable, provides NEMA 4 protection
833-3157	Kit, remote mounting, CB120 display, 8 ft. cable, provides NEMA 4 protection

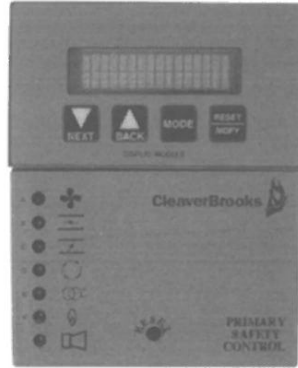
SCANNER SELECTION

CB P/N	DESCRIPTION	USE WITH CHASSIS
817-2261	Infrared 1/2" 90° angle mount 48" (1219mm) flex conduit	833-3139
832-1170	Replacement photo detector	
817-2262	UV 1/2" straight 36" (915mm) flex conduit	833-3135
817-2263	UV 1/2" straight 72" (1830mm) flex conduit	
817-2309	UV 3/8" straight 36"(915mm) flex conduit	
817-4060	Flame rod 12", 1/2" NPT mount	833-3141
817-4061	Flame rod 18", 1/2" NPT mount	
817-4062	Flame rod 24", 1/2" NPT mount	
817-2124	Self-check UV 1" NPT threads, 120VAC	833-3137
817-4063	Replacement UV tube	

CB120 Ordering Information

CHASSIS/AMPLIFIER

120 VAC, 50/60 Hz
833-3135
833-3137
833-3139
833-3708
833-3141



FRONT VIEW



SIDE VIEW (SHOWN WITH PROGRAMMER INSTALLED)

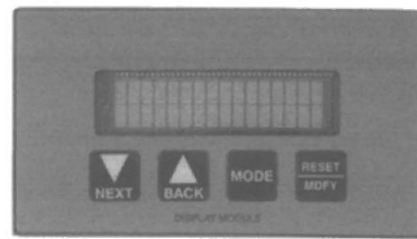
PROGRAMMER MODULE

833-3143
833-3145
833-3147



DISPLAY MODULE

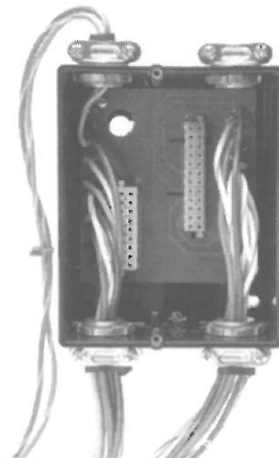
833-3149 - VACUUM FLUORESCENT
833-3151 - LIQUID CRYSTAL



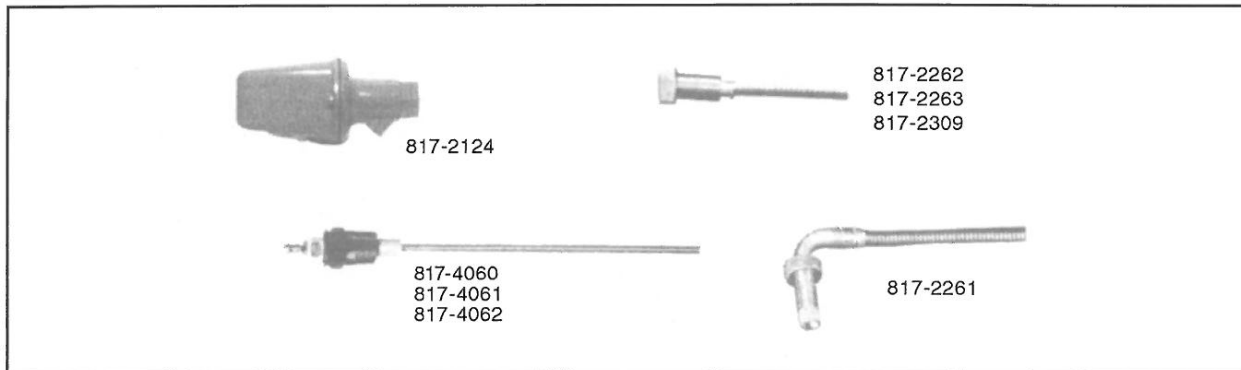
WIRING BASE
833-3153
OPEN BOTTOM
CABINET MOUNT




WIRING BASE
833-3155
PRE-WIRED
4 FOOT
COLOR CODED



FLAME SCANNERS



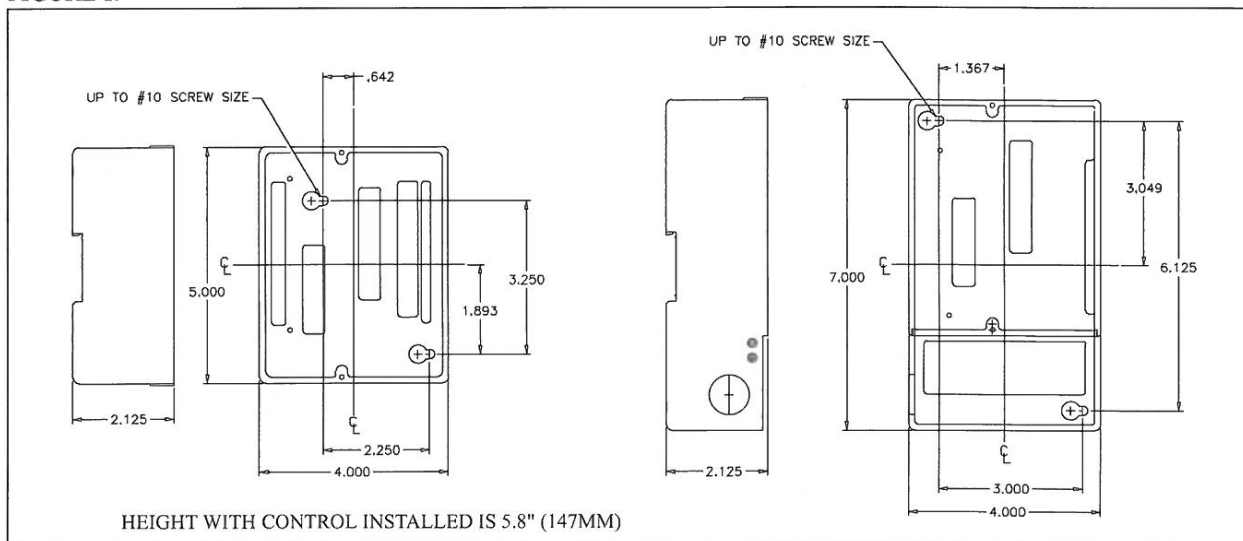
 **CAUTION:** The 817-2262, 817-2263 and 817-2309 flame scanners and associated amplifier module are non-self checking UV systems and should be applied only to burners that cycle often (e.g.: a minimum of once per 12 hours) in order for the safety checking circuit to be exercised. If component checking is required during burner operation for constantly fired burners, utilize the self-checking ultra-violet flame scanners (817-2124) with associated amplifier modules (833-3137), or the infrared flame scanner (817-2261) with associated Auto Check amplifier (833-3139).

INSTALLATION PROCEDURE

Wiring Base

Select either the pre-wired wiring base (833-3155) or terminal block style (833-3153). Either wiring base type can be mounted on a din rail or directly mounted to the cabinet back plate. Refer to Figure 1 for mounting dimensions.

FIGURE 1.



The location should be free from excessive vibration and within the ambient temperature rating.

PRE-WIRED WIRING BASE, P/N 833-3155

Terminal No.	Wire Color	Type	Description	Rating
L1 (Hot)	Black		Line voltage supply	120 VAC (+10%,-15%), 50/60 Hz
L2 (Neutral)	White		Line voltage common	
EARTH	Green	Ground		
S1	Red/Wht		Scanner Input	300 VAC, 3 mA
S2	Blu/Wht		Scanner Input	300 VAC, 3 mA
A	Red	Output	Alarm	120 VAC, 1 A pilot duty
M	Brown	Output	Combustion Blower	120 VAC, 9.8 FLA, 58.8 LRA
3	Yellow	Input	Operating Control	120 VAC, 1 mA
13	Orange	Input	Fuel Valve End Switch, Pre-Ignition Interlock	120 VAC, 1 mA
P	Gray	Input	Running Interlock	120 VAC, 1 mA
D	Wht/Brn	Input	Low Fire Start Switch	120 VAC, 1 mA
8	Wht/Gry	Input	Open Damper Proving Switch	120 VAC, 1 mA
W	Wht/Orn	Output	Delayed Main Valve	See Load Ratings
5	LT Blue	Output	Ignition / Pilot Valve	See Load Ratings
6	Tan	Output	Pilot Valve	See Load Ratings
7	Violet	Output	Main Fuel Valve	See Load Ratings
16	DK Blue	Input	Pilot Valve Hold	120 VAC, 1 mA
21	Pink	Input	Start Input	120 VAC, 1 mA
10	Wht/Red	Output	Modulator Common	120 VAC 75 VA
12	Wht/Yel	Output	Modulator Low Fire	120 VAC 75 VA
X	Wht/Blue	Output	Modulator High Fire	120 VAC 75 VA
11	Wht/Grn	Output	Modulator Auto	120 VAC 75 VA
22	Wht/Vio	Input	Remote Reset	120 VAC, 1 mA
23	Brn/Wht	Input	Spare 2	120 VAC, 1 mA

INSTALLATION PROCEDURE

Wiring Base

Install the wiring base where the relative humidity never reaches the saturation point. The CB120 system is designed to operate in a maximum 90% relative humidity continuous, non-condensing environment. Do not install the CB120 system where it can be subjected to vibration in excess of 0.5G continuous maximum vibration. The CB120 system is not a weather tight enclosure. The standard vertical position is recommended. Allow at least one inch clearance around the control for service and installation.

1. Wiring must comply with all applicable codes, ordinances and regulations.
2. **Wiring must comply with NEC Class 1 (Line Voltage) wiring.**
3. Limits and interlocks must be rated to simultaneously carry and break current to the ignition transformer, pilot valve and main fuel valve(s).
4. Recommended wire routing of lead wires:
 - a. Do not run high voltage ignition transformer wires in the same conduit with any other wires.
 - b. Do not route flame detector lead wires in conduit with line voltage circuits. Use separate conduit where necessary.
5. Maximum wire lengths:
 - a. The maximum lead wire length is 200 ft. (61 meters) to terminal inputs (Operating limits, interlocks, valves, etc.).
 - b. Flame Detector lead wires: see section on flame scanners
 - c. Remote reset: The maximum length of wire is 500 feet (152 meters) to a normally open remote reset push-button, but should remain within sight and sound of the burner.

d. Modbus communications: The maximum cable length of wire is 3200 feet (1000 meters) for RS-485.

A good ground system should be provided to minimize the effects of AC quality problems. A properly designed ground system meeting all the safety requirements will ensure that any AC voltage quality problems, such as spikes, surges and impulses have a low impedance path to ground. A low impedance path to ground is required to ensure that large currents involved with any surge voltages will follow the desired path in preference to alternative paths, where extensive damage may occur to equipment.



WARNING: Controls require safety limits utilizing isolated mechanical contacts. Electronic limit switches may cause erratic operation and should be avoided.

BEFORE INSTALLING THE CB120 CONTROL

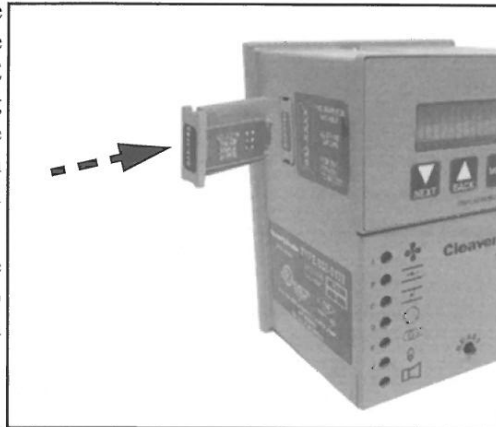


CAUTION: Ensure that electric power is turned off. Be aware that power to some interlocks (operating controls, air flow switches, modulating circuits, etc.) may be derived from sources other than what is controlling the CB120.

INSTALLING THE PROGRAMMER MODULE

The programmer module plugs into the side of the chassis module and can only be installed in one direction. **DO NOT ATTEMPT TO FORCE THE PROGRAMMER INTO THE CHASSIS.** Referring to the illustration on the right, align the holes in the programmer housing with the posts located within the chassis. Push the module into the chassis until the module is flush with the housing.

If it is necessary to remove the programmer module from the chassis, 2 slots are provided on the top and bottom of the housing. A small screwdriver can be used to 'pop' the programmer from the chassis.



ELECTRICAL CHECKOUT

If either a ground or a short circuit is detected, it must be eliminated before the control is plugged into the wiring base and power turned on.

Test the electrical field wiring for short circuits and grounds. The recommended method requires the use of an ohmmeter set on its lowest resistance scale.

6. Touch the meter probes together and calibrate accurately to ensure a reliable test.
7. Disconnect the neutral wire (L2) from the control system at the power source. Clip one meter test lead to the grounded green wire or to terminal E and with the other probe touch each other terminal. At no time should the meters show continuity or read 0 ohms.
8. Reconnect the neutral wire (L2) at the power source. Remove the test probe from the grounded terminal and reconnect it to Terminal L2 in the wiring base. With the other probe, touch each other terminal. It is normal to obtain a resistance reading on the meter at some terminals during this test as there are resistive loads (coils, transformers, lamps, etc.) connected whose normal DC resistance may be less than 5 ohms. However, at no time should the test meter read zero ohms.



CAUTION: Restore power for the following test.

9. With CB120 installed, measure voltage from L2 to all other terminals. Reading should be zero on all terminals except L1.

INSTALL CB120 INTO WIRING BASE


The CB120 chassis/amplifier module contains 2 screws permanently retained into the top and bottom of the housing. The wiring base contains two brass inserts with recessed threads to ease the installation. Line up the printed circuit board spacer located in the chassis/amplifier module with the alignment tabs located in the wiring base. Firmly push the model into the wiring base to assure the connectors mate properly. Tighten the screws into the brass inserts until snug.

CB120 PROGRAMMER SELECTION

The functional operation, flame failure response time, purge timings, firing rate motor circuit, trial for ignition timings, recycling function and display messages are determined by the programmer.

A chart of the most common programmers is found below.

Take note of the programming sequence chart for each programming module for the proper explanation of prepurge timings.



WARNING: THE INAPPROPRIATE SELECTION OR APPLICATION OF A PROGRAMMER MODULE COULD RESULT IN AN UNSAFE CONDITION HAZARDOUS TO LIFE AND PROPERTY. The various programmer modules are interchangeable because they plug into a common chassis. Many parameters are configurable through the keypad display. Care should be taken to insure the proper parameters are set. Refer to the appropriate programmer bulletin for appropriate settings. Selection of the programmer module and setting the various parameters for a particular application should be made by a competent professional, such as a Boiler/Burner technician licensed by a state or government agency, engineering personnel of the burner, boiler or furnace manufacturer (OEM) or in the performance of duties based on the information from the OEM.

PART NUMBER	Pre-purge Programming (Seconds)	Proven High Fire Interlock (M-8)	Proven Low Fire Interlock (MD)	Terminal 6, Interrupted or Intermittent	Early Spark Termination	PTFI (5/6)	MTFI (5/6)	Running Interlock (3-P)	Flame Fail Time (Seconds)	Firing Rate Motor
SETTINGS SHOWN ARE FACTORY DEFAULT										
833-3143	30	YES	YES	INTRP	NO	10/10	10/15	Non-recycle	4	YES
833-3145	30	YES	YES	INTRP	NO	10/10	10/15	Non-recycle	2	YES
833-3147	30	YES	YES	INTRP	NO	10/10	10/15	Non-recycle	4	YES

PTFI*MTFI TIMINGS

The CB120 system provides keypad selectable timings for both PTFI and MTFI. The selections offered can provide 5 or 10 second timing for terminal 5 and 6 or a shortened time for terminal 5, allowing for early spark termination. CB120 also provides selectable interrupted or intermittent operation for terminal 6.

The selections provided for PTFI*MTFI timings are:

Table 2:

SELECTION	PTFI		MTFI		COMMENT
	Term 5	Term 6	Term 5	Term 6	
10/10*10/15	10	10	10	15	
5/5*0/10	5	5	0	10	NO SPARK DURING MTFI
5/5*0/5	5	5	0	5	NO SPARK DURING MTFI
5/5*10/15	5	5	10	15	SHORTENED PTFI
5/5*10/10	5	5	10	10	SHORTENED PTFI
5/10*0/15	5	5	0	15	EARLY SPARK TERMINATION
5/10*0/10	5	10	0	10	EARLY SPARK TERMINATION
10/10*0/10	10	10	0	10	NO SPARK DURING MTFI
10/10*0/5	10	10	0	5	NO SPARK DURING MTFI
10/10*10/10	10	10	10	10	

LED INDICATOR LIGHTS

The CB120 YB control module has seven (7) LED indicator lights to annunciate the operating status of the control, as well as provide the reason for the last lockout condition. The “Open Damper” and “Close Damper” LED's provide easy set-up of the modulating motor end switches. Each LED has a graphic symbol to describe its function (see Table 3).

Table 3:








	FAN	Lights when the blower motor is energized (terminal M) and flashes when the RUN/CHECK switch is in the “CHECK” position during Purge, PTFI, MTFI and AUTO.
	OPEN DAMPER	Will blink when the modulator motor is being driven to the high fire position. (circuit 10-X made). Once the high purge switch closes (M-8), this LED will light constant. This LED provides the status of the high fire purge interlock circuit (M-8). This LED lights anytime the M-8 circuit closes during Pre-purge, PTFI, MTFI, Post Purge.
	CLOSE DAMPER	Will blink when the modulator motor is being driven to the low fire position (circuit 10-12 made). Once the low fire switch closes (M-D), this LED will light constant. This LED provides the status of the low fire start interlock circuit (M-D). This LED lights anytime the M-D circuit closes during Pre-purge, PTFI, MTFI, post purge.
	AUTO	Will light when the control releases to automatic modulating control (circuit 10-11 made).
	IGNITION	Will blink during Pilot Trial For Ignition (PTFI). Will light constant during Main Trial For Ignition (MTFI).

Table 3:

	<p>FLAME</p>	<p>Will light whenever flame is detected by the flame scanner.</p>
	<p>ALARM</p>	<p>In the event of a lockout condition, the Alarm LED will blink, the remaining LED's will light up to indicate the lockout condition. See "Safety Lockout Codes."</p>

Replaceable Fuse

The chassis/amplifier modules are designed with a field replaceable fuse to protect Terminals 5, 6, 7 and W against short circuit loads or mis-wiring. The fuse is located on the printed circuit board below the transformer. In the event the fuse becomes OPEN, the display will indicate CHECK FUSE or the CLOSE DAMPER, AUTO and IGN LED's will light. An open or blown fuse is a result of an overload condition on Terminals 5, 6, 7, or W. To replace the fuse, remove power from the system and remove the control from its wiring base. Using a small screwdriver or a similar tool, install a CB replacement fuse or equivalent 10 amp fuse (e.g. Wickman # 1937-071-K).

DESCRIPTION OF FUNCTIONS OF OPERATING CONTROLS

1. **Operating Controls:** Generally pressure or temperature activated, the operating control closes, causing the burner start-up sequence to begin. When the operating control opens, the burner shuts off. The operating control is connected in the L1-3 circuit on the wiring base.
2. **Limit Switches:** These are generally pressure, water level or temperature activated
 - a. Recycle — when it is desired to stop the burner when the limit switch opens and restart it when the limit switch recloses, they are connected between Terminals L1 and 3.
 - b. Non-Recycle —when it is necessary to stop the burner when the limit switch opens and prevent it from starting until both the limit switch recloses and the manual reset is activated, they are connected between terminals 3 and P.
3. **Fuel Valve End Switch Interlock:** This is generally an integral switch mounted on the main fuel valve and activated by the valve stem. It is connected between Terminal L1 & 13. The fuel valve end switch interlock prevents a burner start-up if the valve stem is not in the “valve closed” position. This interlock must remain closed while in STANDBY and until the start of PTFI.
4. **Purge Interlock:** Generally a firing rate motor linkage position switch or a differential air-pressure switch, that proves a maximum purge air flow rate. It is connected between Terminals M and 8. The purge interlock proves that the air damper is fully open and purge air flow rate is at maximum during the purge.
5. **Running Interlocks:** These generally are air flow switches, high and low fuel pressure switches, oil temperature switches, atomizing media pressure switches, and excess smoke density controls. These interlocks prove proper conditions for normal operation of the burner. They are wired in series and connected between Terminals 3 and P.
6. **Low Fire Start Interlock:** Generally a firing rate motor linkage position switch or a damper position switch, will prove both the linkage and dampers are in their proper positions to begin burner light off. This switch is connected between Terminals M and D.

SETTING PROGRAMMER PARAMETERS

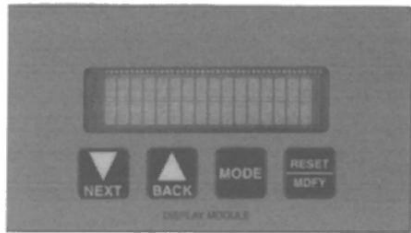
In order to change the factory default parameters stored in the programmer module an optional keypad/display (833-3149 or 833-3151) is required. All configurable parameters are stored within the PROGRAM SETUP sub-menu. The keypad/display module provides tactile feedback keys that are used to access the sub-menus inherent in the CB120 system.

All programmed settings become permanent after 8 hours of main burner (Terminal 7) on time.

The CB120 display consists of 2 lines having 16 characters per line. The default displayed item is the current operating status. This would include the current point in the burner sequence followed by the parameter pertaining to that point in the sequence, such as time or the flame signal level. The bottom line is used to display the current operating status. The CB120 display also provides the historical information stored in the control’s memory such as burner hours, cycles, lockouts and system hours. The remainder of the display items are menus with sub-menus indicated by a right facing arrow. The sub-menus indicate the current value of the selected item and in some cases can be modified to suit the application.

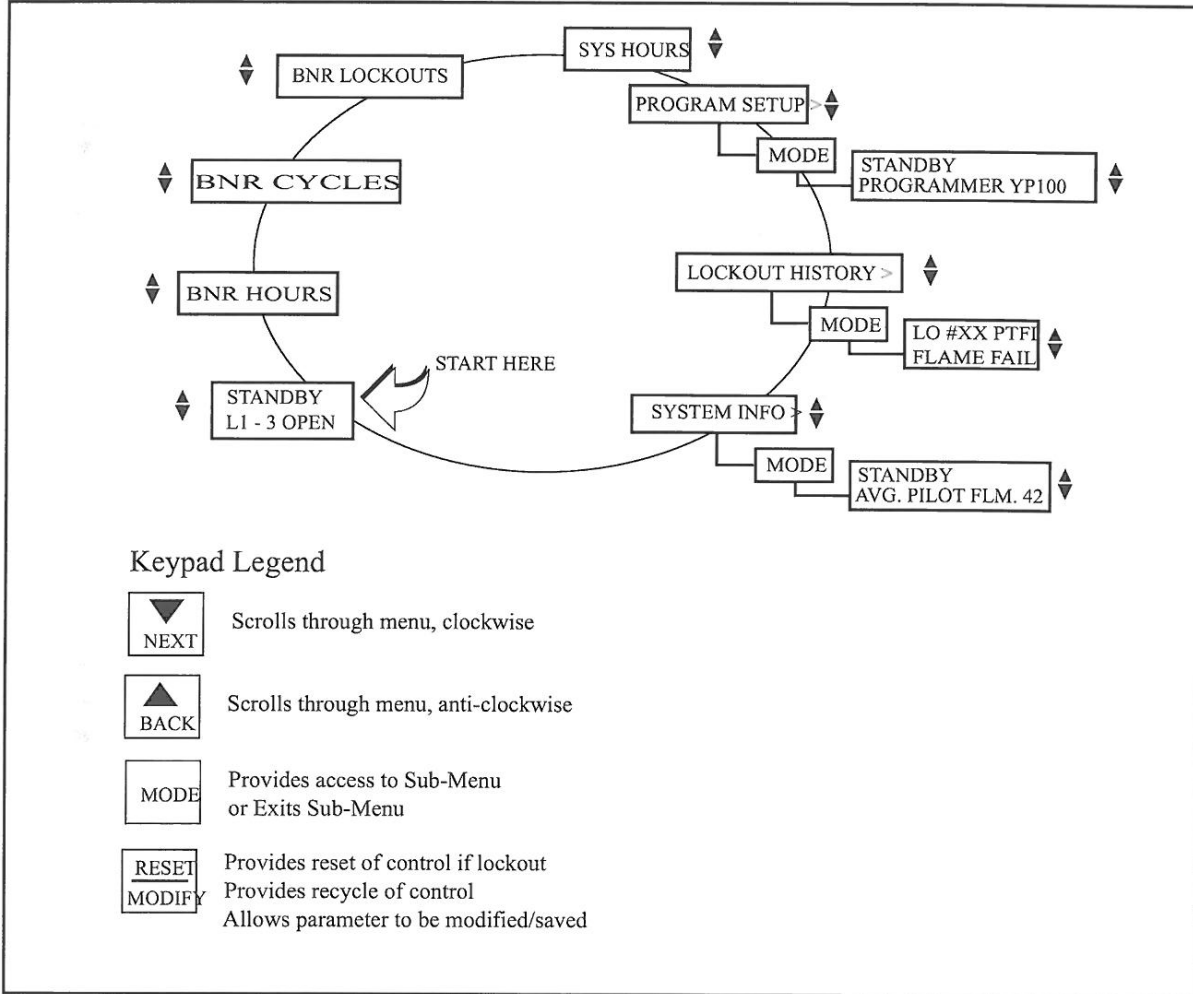
**STANDBY
PROGRAM SETUP >**

Keypad Description



The NEXT key is used to scroll down through the various menus and is also used to increment the value when in the modify mode. The BACK key is used to scroll up through the menus and is also used to decrement the value when in the modify mode. The MODE key is used to enter a sub-menu when the displayed item indicates a sub-menu with a right facing arrow and also to exit the sub-menu and move on to the next main menu item. The RESET/MDFY key is used to reset the CB120 from a lockout condition, force a recycle of the programmer, indicate to the system the value displayed is to be modified or when done with the modification.

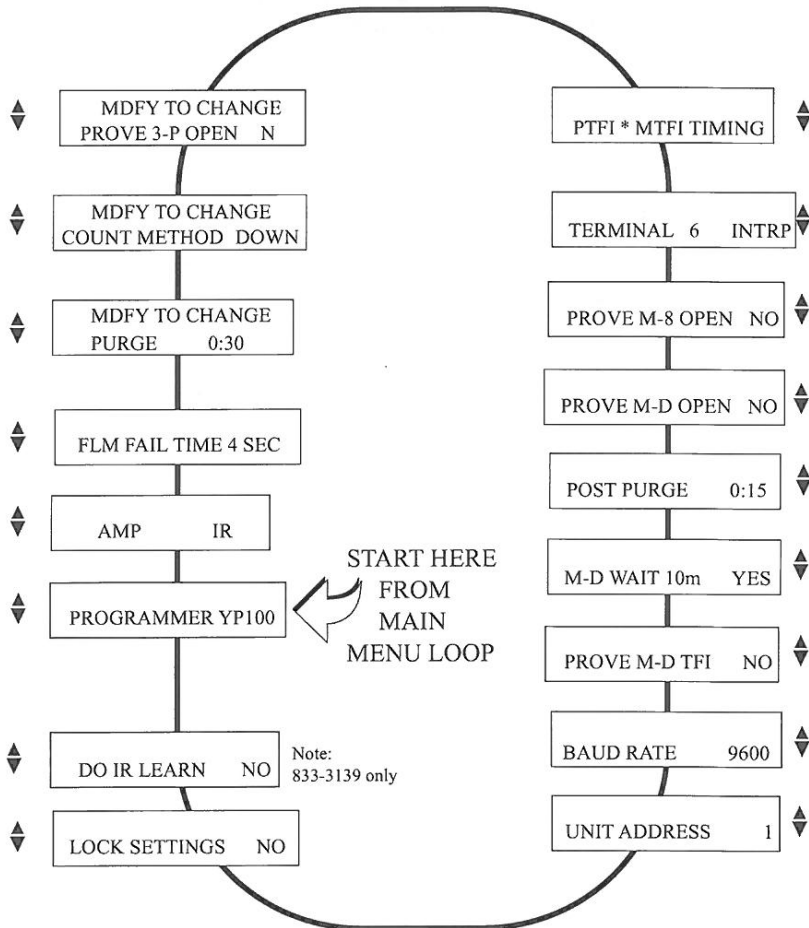
FIGURE 1. CB120 MENU STRUCTURE



PROGRAM SET UP SUB-MENU

The sub-menu "PROGRAM SETUP" allows the user to review the various operational settings of the programmer module (e.g. programmer type, purge timing, etc.) and some instances modify the operational parameters to suit the application requirement. The MODE key is used to enter and exit the sub-menu and the NEXT and BACK keys are used to scroll through the menu as well as changer the operational parameter.

PRESS MODE KEY FROM MAIN MENU LOOP



PRESS MODE KEY AT ANYTIME TO EXIT SUB-MENU

Modifiable parameters located in PROGRAM SETUP MENU

Parameter	Factory Default	Range	Description
Purge time	00:30s	0:30s – 60:00m, 15 second increments. (0:00s - 60:00m in YP3XX)	Applies to open damper purge time.
Count method	DOWN	UP, DOWN	Time counts UP to final value or DWN to zero from starting value. This setting will apply to all timer values.
Prove 3-P open at start	NO	YES, NO	Prevents jumped terminals. Requires the 3-P circuit to be open at the start of a cycle.
PTFI*MTFI timing	10/10*10/15	See chart page 14	Applies to terminals 5 and 6 operation during PTFI and MTFI.
Terminal 6 interrupted or intermittent	INTRP	INTRP, INTMT	Provide interrupted or intermittent operation on terminal 6.
Prove M-8 open	NO	YES, NO	If YES, M-8 must be open at start of open damper purge period.
Prove M-D open	NO	YES, NO	If YES, M-D must be open at end of open damper purge period.
Post purge	0:15	0:15s - 1:00m, 5 second increments.	Selects Post Purge time.
M-D WAIT 10m	YES	YES, NO	Select YES for lockout on M-D open for 10 minutes. Select NO for indefinite wait for M-D to close. This wait time applies to prior to pilot trail for ignition.
PROVE M-D TFI	YES	YES, NO	Select YES to force lockout on M-D opening during PTFI and MTFI select NO to ignore.
Baud rate	9600	4800, 9600, 19200	Sets communication rate.
Unit address	00	00-31	Multi-drop requires unique addressing. Lowest address allowed for modbus is 01.
Lock Settings	NO	YES, NO	Parameters can be stored to memory before automatic 8 hour store.
DO IR LEARN	NO	YES, NO	Select YES to invoke IR LEARN process. See IR operation.

TO VIEW AND MODIFY A PROGRAMMABLE PARAMETER:

Use the NEXT or BACK key to scroll to PROGRAM SETUP. Press the MODE key to enter the sub-menu showing all program setup parameters. Pressing the MODE key while in the sub-menu will exit the sub-menu, and the next main menu item will be displayed. While in the sub-menu, pressing the NEXT key will scroll forward through the sub-menu. Pressing the BACK key will scroll backward through the sub-menu. When a modifiable parameter is displayed, the top line will indicate MDFY TO CHANGE while the bottom line will indicate the current item and its current value. Pressing the RESET/MDFY key will allow the displayed parameter to be modified. The item to be modified will move to the top line while its value will remain on the bottom line. At an infrequent rate, the top line will indicate MDFY TO SAVE. Use the NEXT or BACK keys to select the value to suit the application and when done, press the RESET/MDFY to save the value to memory.

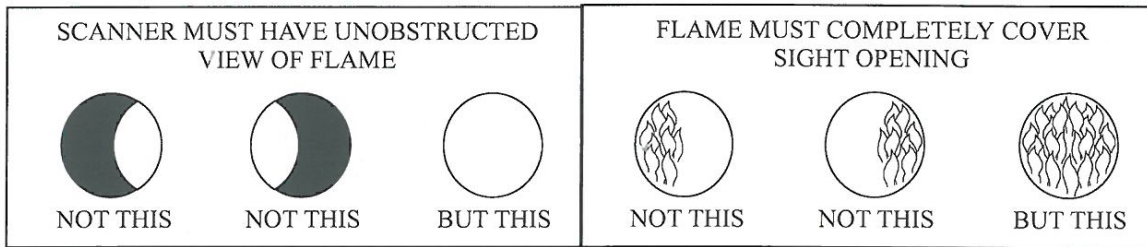


All programmed settings become permanent if the CB120 system has been powered continuously and 8 hours of main burner (terminal 7) on time has been accumulated. If the AC mains is removed prior to accumulating 8 hours of main burner on time, the system burn-in time clock will be reset to zero. It is not necessary for the main burner on time to be continuous. The CB120 accumulates burner on time in seconds. For example, assume power has been applied for 10 hours and the main burner has been on for 4 hours. If the AC mains is removed and then restored the accumulated main burner on time will be reset to 0. If necessary, the programmed settings can be made to become permanent anytime before the required 8 hours of main burner on time through the use of the optional keypad and the LOCK SETTINGS option under the PROGRAM SETUP sub menu.

INSTALLATION - UV SCANNERS

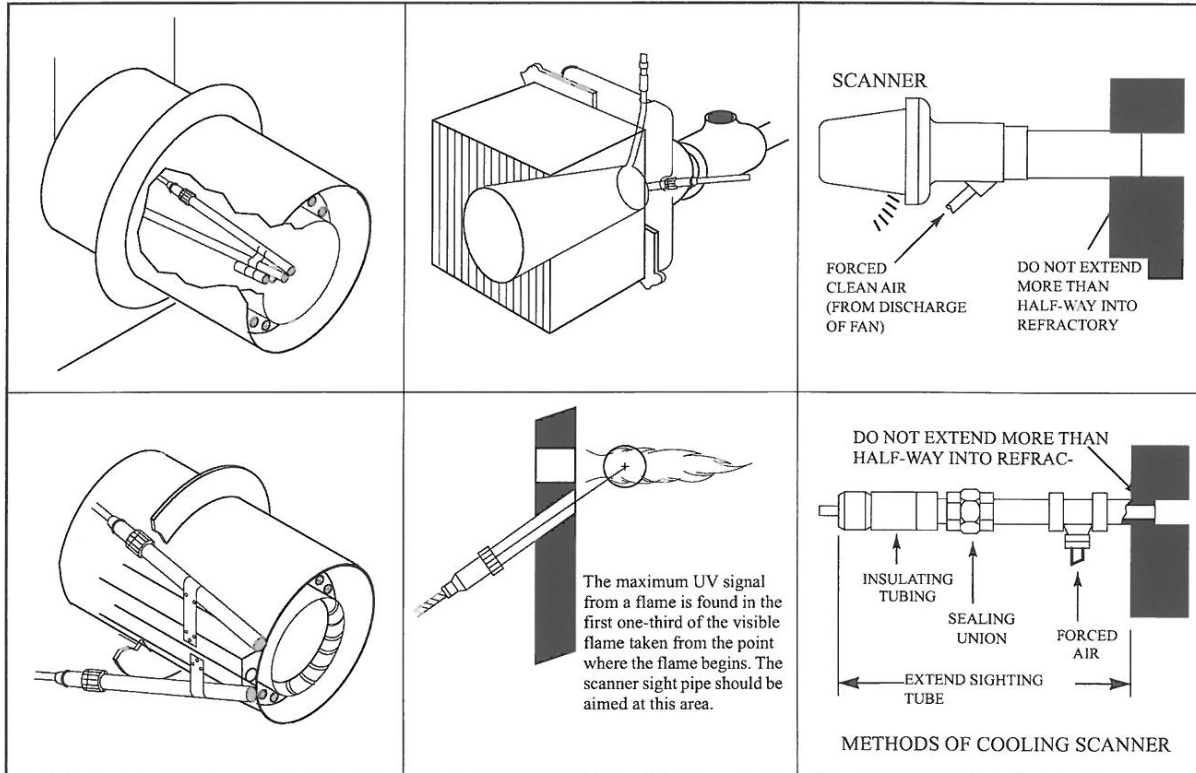
Where possible, obtain the burner manufacturer's instructions for mounting the scanner. This information is available for most standard burners. The scanner mounting should comply with the following general instructions:

1. Position the 817-2262, 817-2263, or 817-2309 scanner within 30 inches of the flame to be monitored; the 817-2124 within 72 inches, closer if possible.
2. Select a scanner location that will remain within the ambient temperature limits of the UV Scanner. If cooling is required, use an insulating coupling (858-1283 for 817-2262 or 817-2263 scanners, 858-1284 for 817-2309) to reduce conducted heat.
3. The 817-2262, 817-2263, and 817-2309 scanners are designed to seal off the sight pipe up to 1 PSI pressure. Higher furnace pressures should be sealed off by using a quartz window coupling (858-1285). For 817-2124 Scanners, use 858-1286 coupling. Add cooling air to reduce the scanner sight pipe temperature.
4. Install the scanner on a standard NPT pipe (817-2262, 817-2263: 1/2", 817-2309: 3/8", 817-2124: 1") whose position is rigidly fixed. If the scanner mounting pipe sights through the refractory, do not extend it more than halfway through. Swivel flanges are available if desired (817-4065 for 817-2662, 817-2263, or 817-2309 scanners, 817-4064 for 817-2124). The sight pipe must permit an unobstructed view of the pilot and/or main flame, and both pilot and main flames must completely cover the scanner field of view



5. Smoke or unburned combustion gases absorb ultraviolet energy. On installations with negative pressure combustion chambers, a small hole drilled in the UV sight pipe will assist in keeping the pipe clean and free from smoke. For positive pressure furnaces, provide clean air to pressurize the sight pipe, if necessary.
6. Two UV scanners may be installed on the burner if it is necessary to view two areas to obtain reliable detection of the flame. They should be wired in parallel. Only one repetitive self-checking 817-2124 scanner may be installed on a burner.
7. To increase scanner sensitivity with UV scanners, a quartz lens permits location of the scanner at twice the normal distance. Use 1/2" x 1 1/2" pipe nipple between 817-2262 or 817-2263 scanners and the coupling. Use 3/8" pipe nipple and a 1/2" x 3/8" bushing on 817-2309 installations.
8. Request the assistance of any Cleaver Brooks field office for recommendations of a proper scanner installation on a non-standard application.

TYPICAL SCANNER INSTALLATIONS



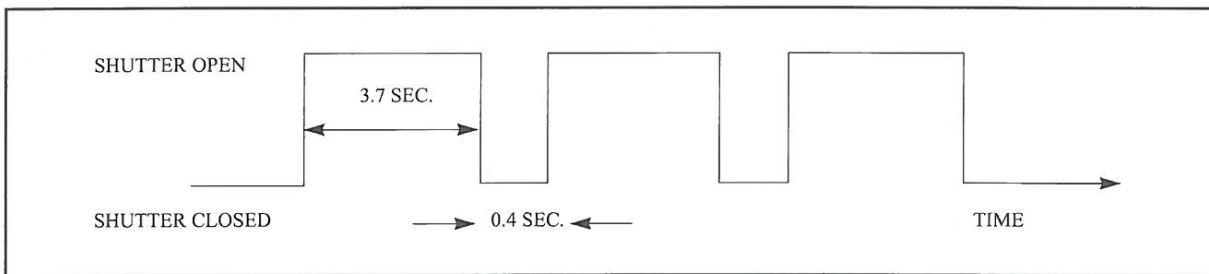
OPERATION —817-2124 SELF-CHECKING UV SCANNER

Self-checking ultraviolet scanners should be used in applications where burner firing operation is continuous or where the burner is on for long periods of time without recycling. In addition, ultraviolet self-checking systems are mandatory in some locations.

The operation of this type of system consists of maintaining the flame scanning capability at all times while also proving that the ultraviolet tube is firing properly. This is done periodically by mechanically closing off the sight of the UV tube and checking to make sure that the flame signal goes away. A shutter assembly in the 817-2124 scanner performs this function. The diagram below explains the process further.

If the shutter assembly in the scanner fails, the tube is faulty, or there is insufficient power to the scanner, the CB120 will LOCKOUT and display the following message LOCKOUT CHECK SCANNER. The ultraviolet tube is replaceable (817-4063).

A lockout will result if a minimum signal is detected for three consecutive shutter closed periods.



WIRING - UV SCANNERS

To connect the scanner to the control, the 817-2262 and 817-2263 scanners are supplied with 36" or 72" of flexible cable, respectively. The 817-2309 is supplied with four 72 lead wires. Install them in a suitable length of flexible armor cable and connect it to the control. A conduit connector is supplied with the scanner. Connect black wires (shutter) to terminals L1, L2; red wires (UV tube) to terminals S1, S2.

If it is necessary to extend the scanner wiring, the following instructions apply:

Scanner wires should be installed in a separate conduit. The wires from several scanners may be installed in a common conduit.

1. Selection of Wire
 - a. Wiring: For extended scanner wiring up to 500 feet, and for shorter lengths to reduce signal loss, use a shielded wire (Belden 8254-RG62 coaxial cable, or equal) for each scanner wire of the UV and each red wire of the 817-2124. The ends of the shielding must be taped and not grounded.
 - b. Asbestos insulated wire should be avoided.
 - c. Multiconductor cable is not recommended without prior factory approval.
2. High voltage ignition wiring should not be installed in the same conduit with flame detector wires.

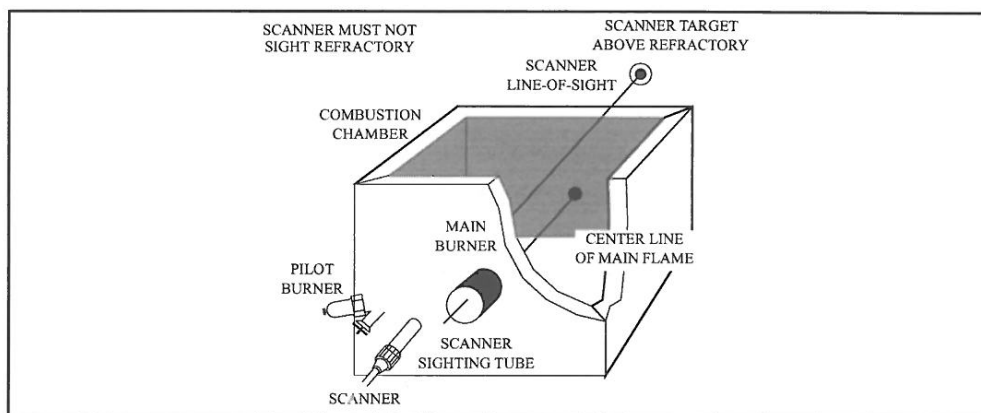
INSTALLATION—INFRARED SCANNER TYPE 817-2261

Where possible, obtain the burner manufacturer's instructions for mounting the scanner, otherwise proceed as follows:

A single scanner is used to detect both pilot and main flames. The sight pipe on which the scanner mounts must be aimed so that the scanner sights a point at the intersection of main and pilot flames.

Proper scanner positioning must assure the following:

1. Reliable pilot flame signal.
2. Reliable main flame signal.
3. A pilot flame too short or in the wrong position to ignite the main flame reliably, must not be detected.
4. Scanner must have an unobstructed view of flame being monitored.
5. Flame being monitored must completely cover the scanner field of view.
6. To avoid nuisance shutdowns, it is important to avoid sighting hot refractory and to keep scanner temperature low (below 140° F) (60°C).
7. When the proper position has been established, drill a hole through the furnace wall and install a 4" to 8" length of threaded 1/2" black iron pipe on which to mount the scanner.
8. When satisfactory sighting position has been confirmed by operating tests, the sight tube should be firmly welded in place.



Wiring

Attach the cable supplied with the scanner to a junction box. Splice the cable wires to a pair of wires not smaller than #18. Install the complete run in a separate conduit to the control. Continuous conduit bonding between scanner and the control is mandatory! Scanner may be located up to 100 feet from control. Do not pass scanner wiring through any junction box containing other wires. Do not run other wires through scanner conduit. Asbestos insulated wire should be avoided.

Operation

The CB120 IR system employs an innovative flame detection method that allows the user to adapt the operation of the amplifier to the actual burner environment and fuel type separately during pilot trial for ignition and the main firing period. That is, the firing characteristics of the fuel provides the CB120 infrared detection system amplitude and radiation levels so that optimum flame on and flame off thresholds can be set during the LEARN process.

'Out of the box', the CB120 IR system is shipped with its sensitivity and thresholds set to detect most firing conditions. The purpose of the LEARN process is to trim the sensitivity, either upward or downward, to the level required for reliable flame detection and most importantly for an overall improvement in detecting a flame out against various background conditions.

The LEARN process allows the CB120 system to better differentiate between real and simulated flame conditions. Simulated flame can usually be caused by burner throat modulation, radiation

from the refractory tiles, or steam atomization. The result of this technique of flame detection assures a positive flame out response under both usual or adverse conditions.

The LEARN process in the CB120 system is initiated through the keypad display module. To take advantage of the CB120 IR technique, it is suggested this be done as part of the installation process or when the 817-2261 scanner is changed. The menu item is located under the PROGRAM SETUP menu and is called DO IR LEARN. Refer to the section titled 'SETTING PROGRAMMER PARAMETERS' for information on setting operational values. Since the default value is NO, the user must modify this value to YES.

**MDFY TO CHANGE
DO IR LEARN YES**

The LEARN process is not subject to the 8 hour burn-in and therefore will always be available.

If the LEARN process is invoked at STANDBY, the LEARN process will involve both pilot and main flame. If the LEARN process is invoked during the main firing period (AUTO) the LEARN process will only involve the main flame learn. That is, during this LEARN process in AUTO, the thresholds for pilot flame are not affected. The advantage of the separate learn is to take into effect the possibility that the characteristics of the main flame might change due to changes in background conditions after a long firing period.

Once a LEARN process is invoked, it cannot be undone. Also, if a LEARN cannot be completed in the subsequent burner cycle due to burner interruptions or a flame fail, the LEARN process will continue to remain active.

During PTFI, the LEARN process takes place during the last 3 seconds of the pilot period and is indicated on the display:

**PTFI 80
LEARNING FLAME**

During AUTO the LEARN process takes place during the first 3 seconds of AUTO and is indicated on the display

**HOLD 80
LEARNING FLAME**

After the LEARN process is completed the flame signal displayed value is normalized to a value of 32.

**AUTO 32
FLAME SIGNAL**

Therefore during the next pilot trail for ignition period the expected value of flame signal should be 32.

**PTFI 32
FLAME SIGNAL**

Any increases or decreases in amplitude or radiation may cause the displayed value to increase or decrease. Should the displayed value continue to decrease, possibly due to changing conditions in the boiler such as a bright background causing a reduction in scanner sensitivity, it is suggested to invoke a new DO IR LEARN during AUTO. Without shutting the burner off, scroll to PROGRAM SETUP and in that sub-menu, modify DO IR LEARN to YES. The LEARN function will be invoked immediately. [Note: The display will continue to indicate YES even though the LEARN process is complete. Pressing the up arrow and then down arrow will indicate the updated state of DO IR LEARN.]

The type of burner and fuel will affect the amplitude and radiation characteristics of the flame. Gaseous flames tend to have low amplitude and radiation whereas oil flames have a high amplitude and

radiation. On burners having the option to fire both gaseous and oil fuels, it is recommended the LEARN process be performed on gas.

An abrupt change in the background radiation (brightness) may be an indication that the firing characteristics of the fuel have changed. In oil fired units this may be caused by a sudden interruption in the oil delivery. The CB120 utilizes this information to make a decision to keep the burner on line or force a shut down. If the background radiation (brightness) changes downward by 20% in a 25 msec period and stays at this level for 1 FFRT, the decision to shut down will be made. Also, if the detected flame signal average falls below 20% of the Learned On value, the burner will also be shut down.

Keeping the Scanner Cool

The Infrared Scanner (Temperature Limit 140° F) should never get too hot to grasp comfortably in the hand. Keep the scanner cool by one or more of the following methods.

1. Use 6" to 8" length of pipe between scanner and hot furnace front plate.
2. Use insulating tube (858-1283) on the end of the iron pipe.
3. Force air into sighting tube. Use Sealing Union (845-1099).
4. Make sure sighting tube does not extend more than halfway into refractory wall.

INSTALLATION - FLAME ROD

The flame rod proves a gas pilot flame and/or main gas flame. It is a spark plug type unit consisting of 1/2" "NPT" mount, a KANTHAL flame rod, a glazed porcelain insulating rod holder and a spark plug connector for making electrical connections. The FLAME ROD is available in 12", 817-4060; 18", 817-4061; or 24", 817-4062 lengths.

The flame rod may be located to monitor only the gas pilot flame or both the gas pilot and main gas flames. It is mounted on a 1/2" "NPT" coupling.

The following instructions should be observed:

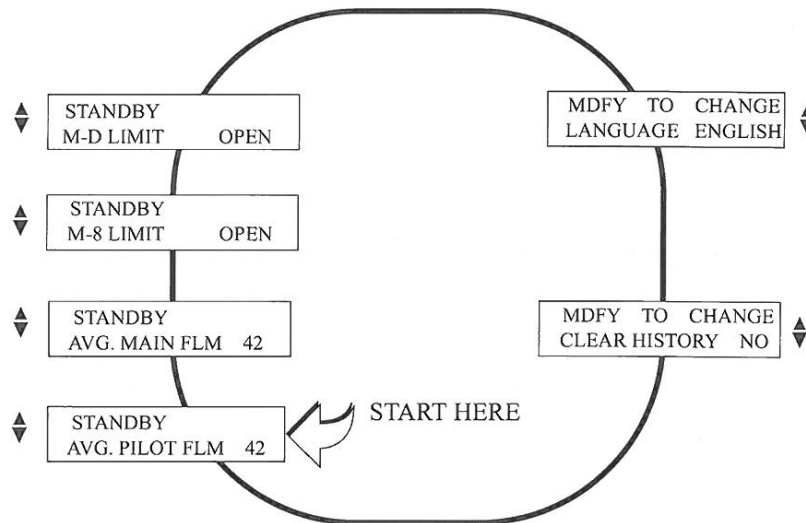
1. Keep flame rod as short as possible.
2. Keep flame rod at least 1/2" from any refractory.
3. Flame rod should enter the pilot flame from the side so as to safely prove an adequate pilot flame under all draft conditions.
4. If the flame is nonluminous (air and gas mixed before burning), the electrode tip should extend at least 1/2" into the flame, but not more than halfway through.
5. If the flame is partly luminous, the electrode tip should extend only to the edge of the flame. It is not necessary to maintain absolutely uninterrupted contact with the flame.
6. It is preferable to angle the rod downward to minimize the effect of sagging and to prevent it from coming in contact with any object.
7. An adequate grounding surface for the flame must be provided. The grounding surface in actual contact with the flame must be at least 4 times greater than the area of the portion of the flame rod in contact with the flame. It is essential to adjust the flame rod and ground area ratio to provide a maximum, signal reading.

Note: Interference from the ignition spark can alter the true signal reading by adding to, or subtracting from it. This trend sometimes may be reversed by interchanging the primary wires (line voltage) to the ignition transformer. This interference can also be reduced by the addition of grounded shielding between the flame rod and ignition spark.

SYSTEM INFO SUB-MENU

The sub-menu "SYSTEM INFO" allows the user to review information pertaining to the operation of the control (e.g. average main flame signal strength, status of the high fire and low fire end switches, etc.). This information can be very helpful when setting the damper linkages on the firing rate motor. The user may also clear the internal burner history (burner hours, cycles and system hours), number of lockouts and stored lockout information. Language choices of English, French, Spanish, Dutch and Swedish are available. The MODE key is used to enter and exit the "SYSTEM INFO" sub-menu, and the NEXT and BACK keys are used to advance through the sub-menu.

PRESS MODE KEY FROM MAIN MENU LOOP



PRESS MODE KEY AT ANYTIME TO EXIT SUB-MENU

SYSTEM OPERATION

The programmer module determines the functional operation of the CB120 control (e.g. purge timing, trial for ignition timings, recycle or non-recycle operation, etc.). For purposes of illustration, we will be looking at the Programmer functions and messages associated with the display module in this bulletin. **Because the messages change depending upon which style programmer is being used, it is necessary to check the bulletin covering the specific programmer for exact details.** Refer to the suggestions shown in this bulletin before proceeding to power the CB120 system. Items such as scanner installation, short circuit tests and safety information should be carefully reviewed.

833-3143 Operating Sequence

Terminal						PTFI	MTFI	AUTO		Post Purge	STANDBY
3	Operating control										
M	Cycle complete										
P	Air flow (terminal P) must close within 10 seconds of HFS (M-8) closing										
	Valve closes in one second										
13 (POC)	Proof of valve closure										
	Don't care state										
X (HI)	Purge Complete										
12 (LO)											
11 (Auto)											
	PTFI/MTFI times keypad selectable										
6 (PV)	15 s										
	10 s										
5 (IGN/PV)	10 s										
W (IGN)	5s										
7 (MV)											
	Programmable time begins (30 sec minimum)										
8 (HFS)											
	LFS must be closed										
	Don't care state										
D (LFS)	30 s LFS										

Start-Up (Normal Cycle)

Note: For direct spark ignited oil burners, substitute the words Main-Oil Valve for Pilot Valve.

1. Constant 120 VAC should be available to the L1-L2 terminals only on the wiring base.
2. The operating control circuits (L1-3) will close, signaling the burner to start its firing sequence. Terminal 13, fuel valve end switch must be closed.
3. The burner/blower motor (terminal M) circuit is energized. The running interlock (limit) circuit (3-P) will close (e.g. all limits, interlocks, etc. are proven).
4. The firing rate motor (Modulator Motor) is driven toward the high purge open damper position (10-X circuit made).



- When the firing rate motor reaches its open damper position, the Hi Purge switch closes (M-8) and the prepurge interval of 30* seconds is initiated. Assuming countdown method, the display will indicate:

PREPRG 00:25
HIGH FIRE PURGE

If the M-8 circuit does not close, the program will hold in this position for ten minutes waiting for it to close. If it does not, the control will lockout. If the M-8 circuit is closed at the start of a cycle, the top line of a display will switch to PURGE 20 seconds.

PURGE 00:19
HIGH FIRE PURGE

If the M-8 circuit is not closed at the beginning of a cycle, the top line of a display will switch to PURGE 10 seconds.

PURGE 00:10
HIGH FIRE PURGE

- When the prepurge is completed, the firing rate motor is driven toward the low purge damper position (10-12 ckt. made). The display will indicate:

PURGE 00:24
LOW FIRE PURGE

- Following the minimum 30 second delay (to permit the firing rate motor to get to the low fire position), the control will wait for the low fire switch (M-D) to close. When it closes, the trial for ignition sequence will start. If after ten minutes, the M-D circuit is not closed, the control will lockout unless selected to wait indefinitely.
- The trial for ignition period begins with Terminals 5, 6 and W being energized simultaneously. This is known as PTFI (Pilot Trial for Ignition). The display will indicate:

PTFI 00:02
IGNITION TIMING

Unless otherwise selected this period is ten seconds in duration. Terminal W will de-energize after 5 seconds. Refer to PTFI*MTFI TIMINGS to determine times selected or timings appropriate for the application. The test meter jacks on the chassis/amplifier will provide an indication of the flame signal strength. The flame signal readout is also available on the alpha-numeric display.

	TEST JACKS	DISPLAY
MINIMUM ACCEPTABLE	6mA	6-16
NORMAL	7.5 -20mA	20-80

PTFI 20
FLAME SIGNAL

- With flame proven at the end of PTFI, the main flame trial for ignition (MTFI) period begins. Terminal 7 is energized. The display: will indicate

MTFI 35
FLAME SIGNAL

Terminal 5 is de-energized 10 seconds later and Terminal 6 is de-energized after another 5 seconds.

10. The firing rate motor is now sent to the automatic modulation position (10-11 ckt made) and is under the command of the proportional controller. The display will indicate:

AUTO 40
FLAME SIGNAL

Normal Shutdown

1. When the operating control circuit (L1-3) opens, the main fuel valve is de-energized. The firing rate motor is driven to the low purge position (10-12 ckt made).
2. Following a 15 second post purge, the burner/blower motor is de-energized.

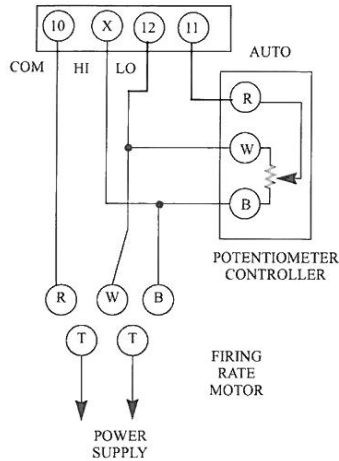
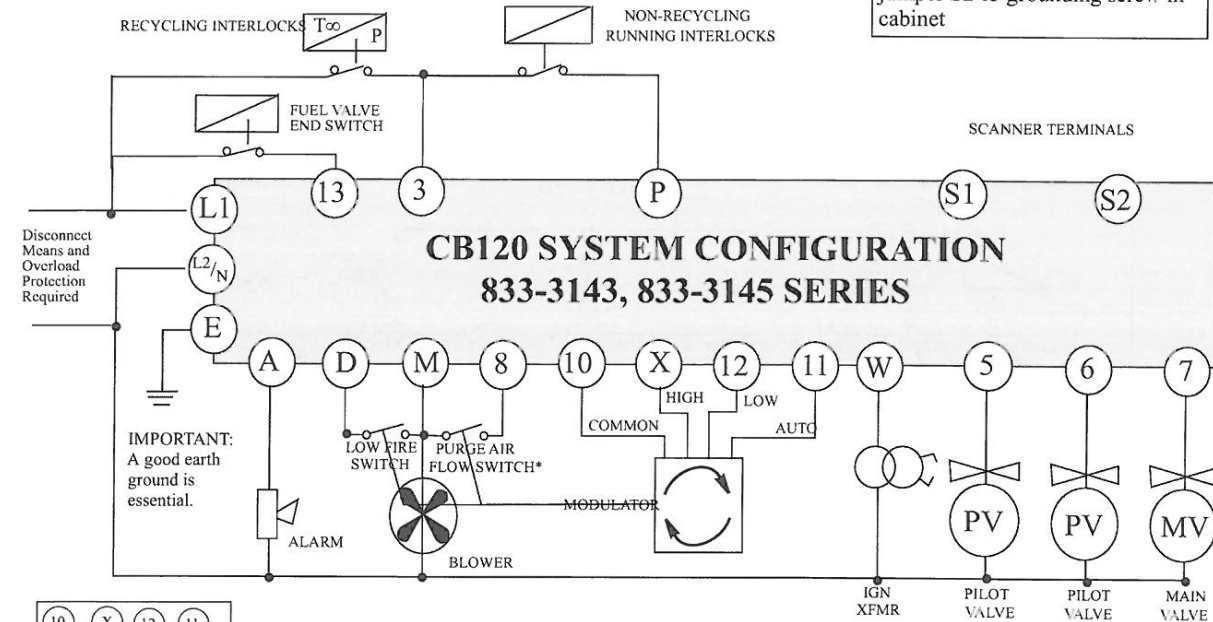
POST PURGE 0:05
CYCLE COMPLETE

3. The burner is now off and the display will indicate:

STANDBY
L1-3 OPEN

SUGGESTED WIRING DIAGRAM FOR 833-3143, 833-3145 PROGRAMMERS

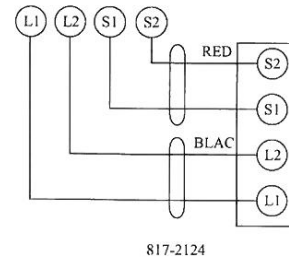
Note: When Flame Rod is used jumper S2 to grounding screw in cabinet



1. Purge air switch from M to 8 not required for 833-3145.
2. 833-3145 programmer recycles on 3-P open.
3. Terminal 6 selectable interrupted/intermittent pilot.
4. Terminal W active first 5 seconds of PTFI (833-3143 Series only).
5. See chart on Table 2 for selectable timings.

Connect terminal E to grounded bonding screw in cabinet.

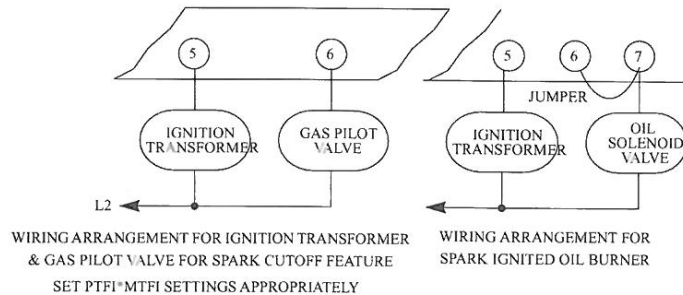
All wiring must comply with NEC Class 1 (Line Voltage) wiring.



817-2124

Caution: All safety limit switches should be approved as limit controls and should be wired directly in the circuit of the Flame Safeguard control. The use of electronic switches to close interlock circuits may cause erratic operation.

TYPICAL WIRING ARRANGEMENT FOR PILOT IGNITE



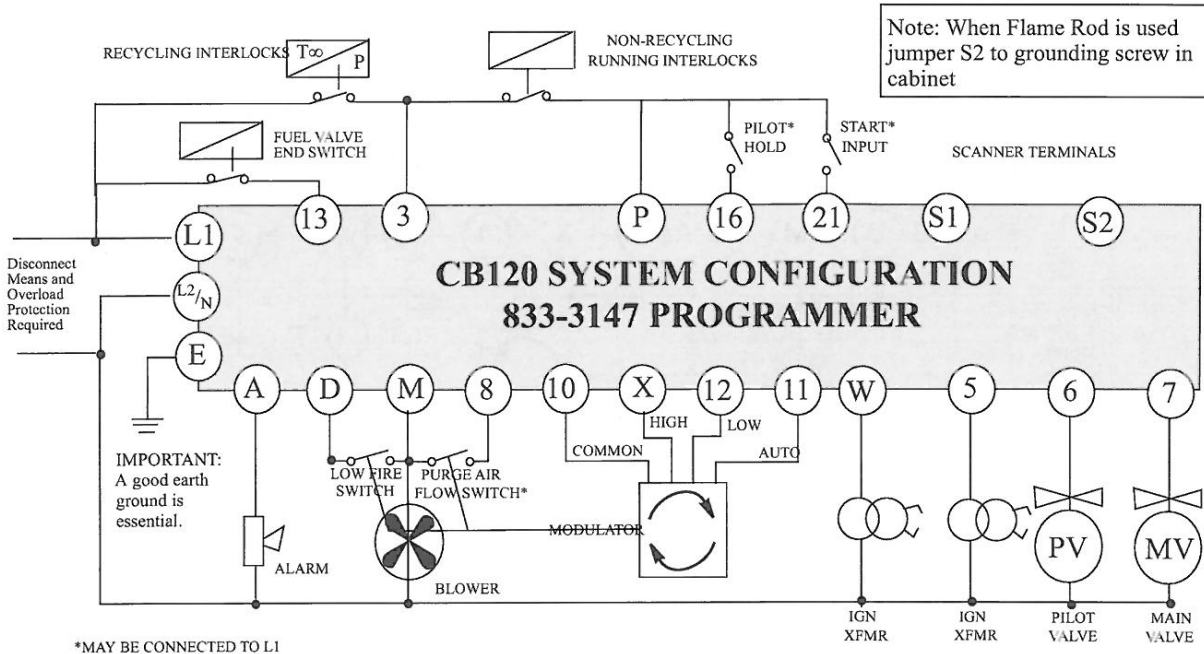
WIRING ARRANGEMENT FOR IGNITION TRANSFORMER & GAS PILOT VALVE FOR SPARK CUTOFF FEATURE
SET PTFI*MTFI SETTINGS APPROPRIATELY

WIRING ARRANGEMENT FOR SPARK IGNITED OIL BURNER

833-3147 Programmer

The 833-3147 programmer offers burner operation similar to the 833-3143 programmer but with extended functions that might enhance burner operation such as increased turndown. The 833-3147 programmer makes use of additional inputs on terminals 16 and 21. Both terminals 16 (PILOT HOLD) and 21 (START INPUT) are line voltage inputs.

SUGGESTED WIRING DIAGRAM FOR 833-3147 PROGRAMMER



Terminal 21 is used to hold the system indefinitely at the end of low fire start and when opened will initiate pilot trial for ignition. Assuming the count method is set for down, at the end of a low fire start period the display will indicate:

HOLD 00:00
T21 INPUT CLOSED

During the AUTO or RUN position, terminal 21 can be used to force the firing motor to the low fire position. In this state the display will indicate:

HOLD T21 42 top line indicates hold mode with flame signal
LOW FIRE SIGNAL

Terminal 16 is used to hold the system in a pilot proving state following the pilot trial for ignition period. After pilot trial for ignition, as determined by the PTFI*MTFI TIMING selection, terminal 5 will be de-energized and terminal 6 will remain energized. During this state the system is in a flame proven state and the display will indicate:

PILOT 42 flame signal displayed
T16 INPUT CLOSED pilot hold period

Once terminal 16 is released or de-activated, the system then proceeds in the MTFI period in accordance with the PTFI*MTFI TIMINGS selection. If selected to be on, terminal 5 with the ignitor will become energized during MTFI.

Terminal 16 is also used to revert the system back to the pilot proving mode from the AUTO or RUN mode. During AUTO, an active state on terminal 16 initiates the steps to revert back to pilot mode. On detection of terminal 16, the firing rate motor is commanded to the low fire position and the system waits for the low fire start switch (M-D) to close. While in this wait mode the display indicates:

HOLD T16	42	while in AUTO, Terminal 16 closes
M-D LIMIT OPEN		wait for low fire interlock to close

Once the low fire start switch is detected as closed, terminal 6 is energized to open the pilot valve. A 20 second time delay is then imposed with both the main valve (7) and pilot valve (6) energized. The display will indicate:

HOLD T16	42	while in AUTO, M-D detected closed
M-D LOW LIMIT		wait 20 seconds in this state

At the end of the 20 seconds, the main valve (7) is de-energized and the ignition terminal (5) is energized for the time specified in PTFI*MTFI TIMINGS. Terminal W is energized for 5 seconds. The display will indicate:

PTFI	42	flame signal displayed
FLAME SIGNAL		

Unlike PTFI, this period is a flame proven state and if flame signal is lost for one FFRT, the system will shutdown and lockout. At the end of the selected PTFI time, terminal 5 is de-energized and the system proceeds to the pilot proving period with terminal 6 energized and flame being proven. The display will indicate:

PILOT	42	flame signal displayed
T16 INPUT CLOSED		pilot hold period

Once terminal 16 is de-energized, the system proceeds into the MTFI period with terminal 7 (main valve energized). If selected to be on, terminal 5 with the ignitor will become energized during MTFI in accordance with the PTFI*MTFI TIMINGS selection. At the conclusion of the MTFI period and as selected by PTFI*MTFI TIMINGS selection and terminal 6 as interrupted/intermittent, terminals 5 and 6 assume their respective states.

Notes on operation:

While in AUTO or RUN mode, once the action initiated by T16 begins, it cannot be reversed by opening T16. At the conclusion of PTFI, if T16 is open, the control will advance through MTFI to AUTO.

If START INPUT (T21) and PILOT HOLD (T16) are both active in AUTO, T16 has priority and revert to pilot will be initiated.



The user shall contact the burner manufacturer to determine if the pilot assembly is rated for intermittent operation.

LOCKOUTS

When a safety shutdown occurs, the control will indicate through the LED's the reason for the lock-out and if equipped will display a lockout message and when in the cycle the lockout occurred. The alarm circuit (Terminal "A") will be energized. The non-volatile memory will remember the status of the control even if a power failure occurs. By momentarily depressing and releasing the reset button on the control or the display keypad, the control can be reset. The button must be held down for one second and then released. Very little force is required to do this. Do not press hard.

Safety Shutdown

1. If the running interlock circuit (3-P) does not close, the control will lockout and the blower motor will be de-energized.

PROVING 3-P CLOSED

On cycle start the CB120 proves the 3-P running interlock circuit closed in the following manner:

1. At cycle start (L1-3 closes), if the M-8 damper switch is closed, the pre-purge period begins and the CB120 will wait up to 20 seconds for the 3-P circuit to close.
 2. At cycle start (L1-3 closes), if the M-8 damper switch is open, the CB120 will wait up to 10 seconds for the 3-P circuit to close after the M-8 circuit closes. Pre-purge timing begins after the M-8 closes circuit closes.
2. If the fuel valve end switch or proof of closure switch connected to Terminal 13 opens during standby or purge, the control will lockout.
 3. If the running interlock circuit (3-P) opens during a start-up or firing period, all fuel valves will be de-energized and the control will lockout.
 4. If the proven high fire circuit (M-8) has not closed after a ten (10) minute "Hold" period at the start of prepurge, the control will lockout.
 5. If the low fire start circuit (M-D) has not closed after a ten (10) minute "Hold" period at the end of prepurge, the control will lockout.
 6.
 - a.) If PROVE 3-P OPEN is selected as YES, and the 3-P circuit is closed at the start of the operating cycle, the control will hold for thirty (30) seconds waiting for the 3-P circuit to open. If, after thirty (30) seconds, the 3-P circuit does not open, the control will lockout.
 - b.) If PROVE M-8 OPEN is selected as YES, and the M-8 circuit is closed at the start of a cycle, the control will hold for thirty (30) seconds for it to open. If, after thirty (30) seconds, the M-8 is still closed, the control will lockout.
 - c.) If PROVE M-D OPEN is selected as YES, and the M-D switch is closed at the end the high fire purge cycle, the control will hold for thirty (30) seconds for it to open. If, after thirty (30) seconds, the M-D is still closed, the control will lockout.
 - d.) If PROVE M-D TFI is selected as YES, the low fire start switch located between terminals M-D must be closed during PTFI and MTFI.
 7. If pilot flame is not detected after the pilot trial for ignition period, the pilot valve and ignition transformer will be de-energized and the control will lockout on safety.
 8. If main flame is not detected during the main flame trial for ignition period for one FFRT, all fuel valves will be de-energized and the control will lockout on safety.
 9. If the main flame fails during a firing cycle, all fuel valves will be de-energized within 1 FFRT and the control will lockout on safety.

ACTION ON FLAME FAIL (833-3143 and 833-3147 only)

The result of a flame fail lockout is the combustion chamber contains 1 flame failure time (4 seconds) of unburned fuel. In order to completely remove the combustion chamber of unburned fuels, the CB120 control will drive the mod motor to the high fire, wait for the damper switch located between terminals M-8 to close and then begin the post purge time. At the end of post purge the CB120 will drive the mod motor back to its low fire or closed position.

10. If flame is detected when the operating control (L1-3) is open, the control will wait sixty (60) seconds and then lockout if flame is still present. If the operating control closes and flame is detected during purge, the control will drop back to Standby position and de-energize the blower motor (Term M). If the flame signal goes away within sixty (60) seconds, the control will proceed with a normal start-up. If flame signal is still present after sixty (60) seconds, the control will lockout.
11. If the fuel valve end switch connected to Terminal 13 is not closed after 5 seconds into post purge, the control will lockout on safety.

DIAGNOSTIC MESSAGES

MESSAGE	POSSIBLE CAUSE	SOLUTION
CHECK PROGRAMMER	No programmer module plugged into chassis/amplifier module	Remove power, insert programmer, press reset to clear fault
	Defective programmer module	Remove power, replace programmer module
CHECK CHASSIS	Relay feedback error caused by bad wiring	Check all wiring, Re-inspect routing of all wires
	Programmer module inserted while power is applied	Cycle power, reset control
	Defective opto-coupler on the chassis/amplifier	Replace chassis/amplifier module
CHECK WIRING	Voltage is detected on terminals at improper time	Check system wiring. Measure voltages on input/output terminals
CHECK SCANNER	Flame signal detected during shutter close time on 817-2124 scanner	Check power on shutter terminals
	Runaway UV tube	Replace UV tube, part number 817-4063
CHECK EXPANSION MODULE	Internal diagnostics within expansion module has detected a problem and ceased communications with BurnerLogix control for 3 minutes.	Check that ED580 cable from expansion module to BurnerLogix is plugged in or not damaged, check routing of cable within burner cabinet or check L1-L2 connections to expansion module. Reset control and check STATUS LED on expansion module. Replace YZ300 or YZ320 expansion module or YB110 chassis/amplifier module.
	Defective or unplugged ED580 cable.	Assure cable is fully inserted in both BurnerLogix control and Expansion module. Check for damage to cable or connectors.
INVALID YP TYPE	Incorrect YP programmer type inserted in BurnerLogix Z control	Only programmer type YP1xx are compatible with BurnerLogix Z model.


RESETTING THE CONTROL








The CB120 systems contain three methods of reset, by push-button located on the YB chassis/amplifier module, by keypad push-button located on the optional keypad/display module, and by normally open push-button connected to Terminal 22. Terminal 22 is a line voltage isolated input. Depressing and releasing the reset button is required.

Note: Manual Reset is required following any safety shutdown.

Note: Depressing and releasing the reset button during a cycle will cause the control to shut the burner down and recycle.

LOCKOUT CODES

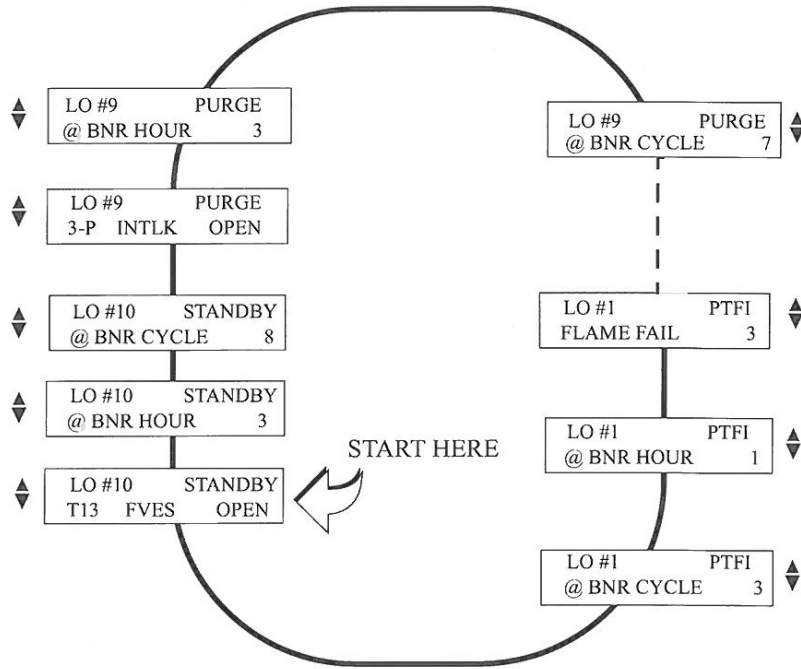
During an alarm condition, the Alarm LED  is made to flash at approximately a twice per second rate. The remaining LED's are illuminated as a coded sequence identifying the reason for the lockout. This remains true if power is removed and then restored in a locked out condition.

LED DISPLAY READOUT						
 = ON						
LOCKOUT MESSAGE	FAN	OPEN-DAMPER	CLOSE DAMPER	AUTO	IGN	FLAME
						
T13 FUEL VALVE END SWITCH OPEN					●	●
M-D LOW FIRE START OPEN				●		●
M-D LOW FIRE START OPEN - PTFI	●			●		●
M-D LOW FIRE START OPEN - MTFI	●	●		●		●
M-D CLOSED			●		●	
M-8 CLOSED			●			●
M-8 HIGH PURGE CIRCUIT OPEN				●		
FALSE FLAME-STANDBY				●	●	
FLAME FAIL PTFI	●			●	●	●
FLAME FAIL - MTFI	●	●		●	●	●
FLAME FAIL AUTO				●	●	●
3-P RUN INTLK OPEN - PRE-PURGE	●		●			
3-P RUN INTLK OPEN - PURGE	●		●			
3-P RUN INTLK OPEN-PTFI	●		●			
3-P RUN INTLK OPEN-MTFI	●	●	●			
3-P RUN INTLK CLOSEDSTANDBY						●
3-P RUN INTLK OPENAUTO			●			
FUEL VALVE STATE CHANGE					●	
CHECK FUSE			●	●	●	
CHECK WIRING			●	●		●
CHECK SCANNER			●		●	●
CHECK PROGRAMMER			●	●		
CHECK CHASSIS		●				
CHECK EXPANSION MODULE			●	●	●	●

LOCKOUT HISTORY SUB-MENU

The sub-menu "LOCKOUT HISTORY" will display the last ten (10) lockouts, along with the burner cycle and burner hour when the lockout occurred. When the MODE key is pressed, the screen will display the most recent lockout condition and the number of that lockout (e.g. LO #10 represents the 10th lockout of that control). The NEXT key will display the Burner Hour, followed by the Burner Cycle when the lockout occurred. The NEXT key will advance to the next lockout, and repeat the sequence listed above. The BACK key can be used to scroll back up through the sub-menu items. The MODE key will exit the sub-menu.

PRESS MODE KEY FROM MAIN MENU LOOP



PRESS MODE KEY AT ANYTIME TO EXIT SUB-MENU

COMMUNICATIONS

The protocol to be used is Modbus RTU. This is implemented by the master (PC, PLC, etc.) issuing a poll to the slave (CB120) and the slave responding with the appropriate message.

A typical format of a poll request is as follows:

DST	FNC	ADR HI	ADR LO	DAT LO	CRC LO	CRC HI
-----	-----	-----------	-----------	-----------	-----------	-----------

DST refers to the logical address of the slave.

FNC is the function being requested. FNC 03 is a read request.

ADR is the message number or register number of the data being requested.

For the CB120 all registers are mapped as HOLDING REGISTERS, FNC 03. Register addresses begin at 40001 but is interpreted as address 00.

DAT is the number of words being requested. A word is an integer consisting of 2 bytes.

The normal response from a slave is as follows:

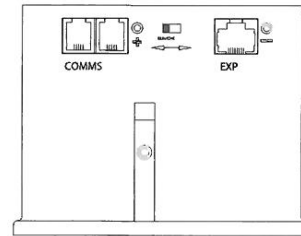
DST	FNC	DBC	DATA.... Hi/Lo	CRC LO	CRC HI
-----	-----	-----	-------------------	-----------	-----------

DBC is the data byte count being returned. It must be two times the DAT number from the poll request.

DATA is the data returned and is always a series of 2 byte integers. If 4 words were requested then DBC would be 8 and there would be 8 data bytes or 4 data words containing the requested data.

The format of the data is N,8,1 meaning no parity, and 1 stop bit. Baud rate is selectable through the keypad / display as 4800, 9600 or 19200 baud. As shipped the baud rate is 9600.

Communication to the CB120 control is made through either of the RJ-12 jacks located on the underside of the control (note figure on right). The jacks are internally wired in parallel to ease multi-dropping of CB120 controls. For each of the RJ-12 connections, the outside contacts are connected together and are designated as "A" or "+" while the inside contacts are connected together and are designated as "B" or "-". Cleaver Brooks supplies the cables in various lengths with RJ-12 plugs on each end. **Do not plug RS-485 cable into EXP jack.**



Below is a table of currently available messages provided by the CB120 programmers, followed by a description where necessary.

HOLDING REGISTER	MESSAGE ADDRESS	WORD REQUESTED	WORD RESPONSE	VALUE
40001	00	1	STATUS	83 (053H) = RUN; 202 (0CAH) = LOCKOUT
40002	01	1	MSGN	Current message being displayed (see Table 5 on page 41)
40003	02	1	GSTAT	Defines Timer Type
40004	03	1	TIMER	Time in seconds
40005	04	1	FLAME	Flame Signal
40006	05	1	LOGSTAT	Current logic module, PURGE, PTFI, AUTO (see Table 4 on page 40)
40007	06	1	INPUTS	Input limits state
40008	07	1	OUTPUTS	Output relays state
40009	08	2	SYSMINS	System on minutes
40011	10	2	BNRMINS	Burner on minutes
40013	12	2	CYCLES	Completed Burner Cycles
40015	14	1	LOCKOUT COUNT	Stored Lockout Count
40016	15	6	LOCKOUT HISTORY Most Recent Lockout Data	Beginning of Last 10 Lockouts
40022	21	6	2nd Most Recent Lockout Data	Returns complete lockout description of stored lockout history. Includes lockout message (1), lockout module (1), @ burner hours (2), and @ burner cycles (2)s
40028	27	6	3rd Most Recent Lockout Data	
40034	33	6	4th Most Recent Lockout Data	
40040	39	6	5th Most Recent Lockout Data	
40046	45	6	6th Most Recent Lockout Data	
40052	51	6	7th Most Recent Lockout Data	
40058	57	6	8th Most Recent Lockout Data	
40064	63	6	9th Most Recent Lockout Data	
40070	69	6	10th Most Recent Lockout Data	
40076	75	4		
⋮	⋮			
40079	78			

HOLDING REGISTER	MESSAGE ADDRESS	WORD REQUESTED	WORD RESPONSE	VALUE
40080	79	11	N/A	Reserved for Cleaver Brooks use
⋮	⋮			
40090	89			

It is suggested that polling intervals not be less than 200 mSec per request. Requesting data such as burner minutes, system minutes and burner cycles should be kept at a minimum due to the amount of processing time required to gather that data.

The MSGN being transmitted is a numerical value and must be interpreted by the communicating device, which actually is an advantage since this can be made to be whatever message text the end user wants. In other words, it allows for programming custom messages without actually changing the message in the programmer. Refer to Table 5 on page 41, for message information.

The CB120 stores its burner on time (7 powered) and system on time (L1 powered) in minutes. For display purposes, the programmer converts this to hours. The information being supplied by Modbus will be the actual time in minutes and it is up to the communicating device to do the conversion. Since the maximum value stored in the CB120 is 9,999,999 minutes, the maximum value in hex therefore is 98967FH and comprises two data words. The maximum cycle count is 999,999 decimal or F423FH, still two data words.

*To convert, multiply high word by 10000H (65536), add to this high byte of low word multiplied by 100H (256) and add to this the low byte of low word. Example: (98H*100H) + (96H*10000H) + 7FH = 98967FH = 9,999,999 minutes.*

As an example, the System on Minutes data is transmitted from the CB120 to the interface as high word / low word as shown below:

ADDRESS 8		ADDRESS 9	
HIGH WORD		LOW WORD	
HIGH BYTE	LOW BYTE	HIGH BYTE	LOW BYTE
0	98H	96H	7FH

All values are represented in a HEX or base 16 format.

GSTAT determines the type of value TIMER represents. TIMER can be a running timer such as is used in purge, a flame signal or meaningless. Only the lower nibble of GSTAT has any value. If this value is 0 then the TIMER value has no meaning. The value in TIMER is a background minute timer in the CB120 and should be ignored. If GSTAT is between 4 and 7, the TIMER represents the current value flame signal. If GSTAT is a 1, 2, or 3 then TIMER represents a running timer value.

The format of the data is 8 data bits, no parity and 1 stop bit. Due to the RS485 format, the communication format is considered half-duplex. That is, only one user is permitted on the communication lines at a time.

The information contained in INPUTS and OUTPUTS represents the status of the interlocks and output relays respectively. For the INPUTS, a 1 in the interlock position defines the interlock as being on or active where a 1 in any bit position in the OUTPUT register signifies the relay as being energized.

INPUTS

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
AC Line	Term D	Term 16	Term 13	Term 21	Term 22	Term 23	Term 8
Ref	Low Fire Start	Pilot Hold	FVES POC	Start Input	Remote Reset	Spare	High Fire Intlck

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Term P	Term 3	Term M	Term 5	Term 6	Term W	Term 7	KS

	Op Cntrl	Blower	Ignition	Pilot Valve	Delayed Valve	Main Valve	Safety Relay
--	----------	--------	----------	-------------	---------------	------------	--------------

A '1' in the opto-coupler position indicates the opto-coupler is on or interlock closed.

OUTPUTS

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
				Term A	Term 12	Term X	Term 11
				Alarm	Low Fire	High Fire	Auto

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	IS	Term W	Term 7	Term M	Term 6	Term 5	
	Internal Safety	Delayed Valve	Main Valve	Blower	Pilot Valve	Ignition	

Note: A "1" in any bit position indicates the output or terminal is on or active.

EXPLANATION OF LOGSTAT

LOGSTAT is an indication of what logic module the control is currently operating in during its cycle and is used for diagnostic purposes only. If a lockout occurs the current value of LOGSTAT is stored as part of the lockout information. The message displayed corresponds to the current logic module.

Table 4:

LOGIC DISPATCHER			
VALUE		MODULE	FUNCTION
DEC	HEX		
1	01H	STANDBY	Idle state
2	02H	BLOWER ON	1/2 second period after operating control closes when blower motor is energized
3	03H	PURGE	Open Damper Purge or waiting for air flow and/or high fire switch to close
4	04H	PURGE	Low Fire Purge
5	05H	PTFI	Pilot Trial for Ignition
6	06H	PTFI	Pilot Trial for Ignition for Recycle programmers
7	07H	PTFI	If PTFI is greater than 5 seconds and early spark termination is not needed
8	08H	PTFI	If PTFI is greater than 5 seconds and early spark termination is needed
9	09H	PILOT	Pilot Hold, 833-3147 only
10	0AH	MTFI	Main Trial for Ignition
11	0BH	MTFI	Main Trial for Ignition with terminal 5 de-energized
12	0CH	AUTO	Delayed valve on
13	0DH	AUTO	AUTO
14	0EH	AUTO	On 833-3147 programmer, hold for 20 seconds with terminals 6 and 7 energized
15	0FH	AUTO	On 833-3147 programmer, when terminal 21 first energized, wait for M-D to close
16	10H	POSTPURGE	Post Purge
17	11H	POSTPURGE	Post Purge period if flame fail lockout
18	12H	POSTPURGE	Idle state if unit is in lockout

Logstat represents the current software module the CB120 is currently executing.

The CB120 outputs the current displayed message as well as the historical lockout messages as numbers. The table below correlates the message number with the actual displayed text message.

Table 5:

DEC	HEX		CB120 MESSAGES
1	1	H	T16M-D LIMIT OPEN - AUTO
2	2	H	HOLD FALSE FLAME- STANDBY
3	3	R	LOW FIRE PURGE
4	4	H	HOLD M-8 LIMIT OPEN- PURGE
5	5	H	See Interlock Annunciation Table
6	6	H	M-D LOW LIMIT - AUTO
7	7	L	LOCKOUT FLAME FAIL - PTFI
8	8	H	T16 INPUT CLOSED
9	9	H	HOLD M-D LIMIT OPEN
10	A	R	IGNITION TIMING - PTFI
11	B	C	CHECK FLAME SIGNAL - MTFI
12	C	R	FLAME SIGNAL - AUTO
13	D	R	CYCLE COMPLETE - POST PURGE
14	E	R	L1-3 OPEN
15	F	H	T21 INPUT CLOSED
16	10	L	LOCKOUT M-D LIMIT OPEN - PTFI
17	11	L	LOCKOUT M-8 LIMIT OPEN
18	12	L	LOCKOUT M-D LIMIT OPEN
19	13	L	LOCKOUT FLAME FAIL - MTFI
20	14	L	LOCKOUT FALSE FLAME
21	15	L	LOCKOUT 3-P INTLK OPEN (PURGE)
22	16	L	LOCKOUT 3-P INTLK CLOSED
23	17	H	HOLD 3-P INTLK CLOSED - STANDBY
24	18	H	HIGH FIRE PURGE
25	19	L	LOCKOUT M-D LIMIT OPEN - MTFI
26	1A	L	LOCKOUT 3-P INTLK OPEN -AUTO
27	1B	L	LOCKOUT 3-P INTLK OPEN - MTFI
28	1C	L	LOCKOUT 3-P INTLK OPEN - PTFI
29	1D	L	LOCKOUT T13 FVES OPEN
30	1E	L	LOCKOUT 3-P INTLK OPEN - PREPURGE
31	1F	C	CHECK FLAME SIGNAL - PTFI
32	20	C	CHECK M-8 HI LIMIT (HI FIRE PURGE)
33	21	C	CHECK M-D LOW LIMIT (LO FIRE START)
34	22	R	FLAME SIGNAL- PTFI
35	23	C	CHECK LOW FIRE SIGNAL - AUTO
36	24	R	FLAME SIGNAL - MTFI
37	25	L	LOCKOUT FLAME FAIL (AUTO)
38	26	H	HOLD 3-P INTLK OPEN - PREPURGE
39	27	L	LOCKOUT FUEL VALVE STATE CHANGE
SYSTEM DIAGNOSTIC MESSAGES			
54	36	L	LOCKOUT CHECK CHASSIS
55	37	L	LOCKOUT CHECK PROGRAMMER
56	38	L	See Interlock Annunciation Table
57	39	L	LOCKOUT CHECK EXPANSION MODULE
58	3A	L	LOCKOUT CHECK WIRING

DEC	HEX		CB120 MESSAGES
59	3B	L	LOCKOUT CHECK FUSE
76	4C	L	LOCKOUT CHECK SCANNER
PURGE INTERLOCK RELATED MESSAGES			
77	4D	H	HOLD M-8 LIMIT CLOSED
78	4E	L	LOCKOUT M-8 LIMIT CLOSED
79	4F	H	HOLD M-D LIMIT CLOSED
80	50	L	LOCKOUT M-D LIMIT CLOSED
81	51		Reserved for future use
82	52		Reserved for future use
83	53	L	LOCKOUT FLAME FAIL - PILOT
84	54	L	LOCKOUT 3-P INTLK OPEN - PILOT
85	55	L	LOCKOUT M-D LIMIT OPEN - PILOT
86	56	L	LOCKOUT T13 FVES OPEN - PILOT
87	57	L	LOCKOUT T13 FVES OPEN - POST PURGE

DEC	HEX	STATE	TERMINAL	INTERLOCK ANNUNCIATOR LOCKOUT MESSAGES
41	29	L	3-43	HIGH WATER
42	2A	L	43-44	LOW WATER
43	2B	L	51-52	HIGH GAS PRESSURE
44	2C	L	50-51	LOW GAS PRESSURE
92	5C	L	52-54	AUX GAS
45	2D	L	47-48	LOW OIL PRESSURE
56	38	L	44-46	HIGH OIL TEMPERATURE
46	2E	L	46-47	LOW OIL TEMPERATURE
47	2F	L	48-50	LOW ATOMIZING MEDIA
48	30	L	54-55	HIGH PRESSURE
49	31	L	55-56	HIGH TEMPERATURE
50	32	L	56-57	AUX #4 LIMIT OPEN
51	33	L	57-58	AUX #5 LIMIT OPEN
52	34	L	58-59	AUX #6 LIMIT OPEN
53	35	L	59-60	AUX #7 LIMIT OPEN
40	28	L	60-P	AIR FLOW OPEN
INTERLOCK ANNUNCIATOR HOLD MESSAGES				
94	5E	H	L1-40	OP CONTROL OPEN
60	3C	H	40-41	L1-3 AUX #1 LIMIT OPEN
61	3D	H	41-42	L1-3 AUX #2 LIMIT OPEN
62	3E	H	42-3	L1-3 AUX #3 LIMIT OPEN
63	3F	H-C	3-43	HIGH WATER
64	40	H-C	43-44	LOW WATER
65	41	H-C	51-52	HIGH GAS PRESSURE
66	42	H-C	50-51	LOW GAS PRESSURE
95	5F	H-C	52-54	AUX GAS
67	43	H-C	47-48	LOW OIL PRESSURE

96	60	H-C	44-46	HIGH OIL TEMPERATURE
DEC	HEX	STATE	TERMINAL	INTERLOCK ANNUNCIATOR HOLD MESSAGES
68	44	H-C	46-47	LOW OIL TEMPERATURE
69	45	H-C	48-50	LOW ATOMIZING MEDIA
70	46	H-C	54-55	HIGH PRESSURE
71	47	H-C	55-56	HIGH TEMPERATURE
72	48	H-C	56-57	AUX #4 LIMIT OPEN
73	49	H-C	57-58	AUX #5 LIMIT OPEN
74	4A	H-C	58-58	AUX #6 LIMIT OPEN
75	49	H-C	59-60	AUX #7 LIMIT OPEN
5	5	H-C	60-P	3-P AIR FLOW OPEN

R = RUN H = HOLD L = LOCKOUT C = CHECK

OPERATION

4-20 mA test jacks

For all amplifier types, the CB120 provides 4-20 mA test jacks to represent the flame signal strength. The test jacks are located on the underside of the chassis/amplifier module (pictured at right). The '+' jack is located next to COMMS port jack and the '-' jack is located next to the EXP port. Use caution so as NOT to plug the '-' jack into the EXP port. The test jacks accept standard plugs having a diameter of 0.078" (2mm). The maximum input impedance allowed is 100 ohms. The chart below correlates the test jack current to the numerical value shown on the display.

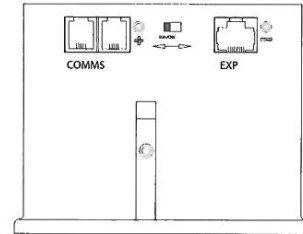
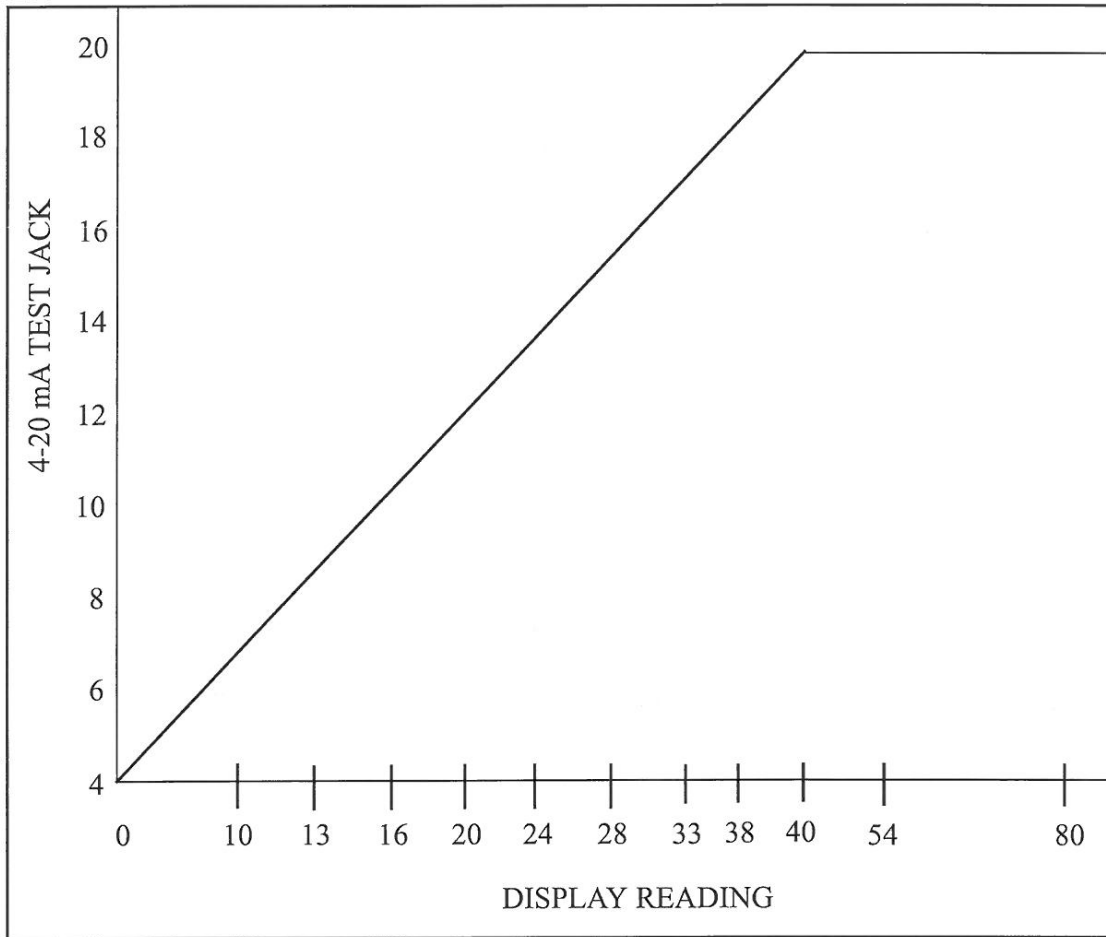


FIGURE 2.

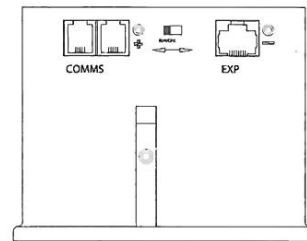


Check-Run Switch

The Check-Run switch is located on the underside of the Chassis Module (note drawing on right) and can be used to stop the control in its firing sequence at any time in the burner sequence. It is designed to aid in set-up, start-up and check-out of the burner and its associated interlocks.

Following are the modes of operation:

1. When power is applied to the control (L1-L2) and the operating control circuit is closed (L1-3), the purge period begins and the firing rate motor is sent to the Hi Purge position. If the Check-Run Switch is moved to the Check position before the open damper 30 second purge period ends, the control will display:



CHECK 00:24
HIGH FIRE PURGE

The control will hold in this position indefinitely to allow the operator to make interlock switch and linkage adjustments. To continue in the cycle, move the Check-Run switch to Run to allow the control to advance.

- If the Check-Run switch is moved to the Check position after the open damper purge period, but before low fire start period ends, the control will display:

CHECK 00:24
LOW FIRE PURGE

The control will hold in this position indefinitely to allow the operator to make interlock switch and linkage adjustments. To continue the cycle, moving the Check-Run Switch to Run will allow the control to advance.

- During the PTFI period, switching to the Check position will stop the program in the PTFI period, allowing for pilot and/or scanner alignment adjustments to be made. The control will display:

CHECK 35
FLAME SIGNAL

It will hold in this position indefinitely as long as the flame signal strength is above the threshold of 10. If it drops below 10 for thirty (30) consecutive seconds, lockout will occur and the message on the display will read Flame Fail PTFI.

- During the MTFI period, switching to the Check position will stop the program in the MTFI period. At this point it may be useful to inspect the position of the main flame at the burner head. Depending on where the switch is placed in check and depending on the selection of PTFI*MTFI TIMING, terminals 5, 6 and 7 could be energized simultaneously. The control will display:

CHECK 35
FLAME SIGNAL

If the unit is left in Check for longer than 2 minutes, the control will automatically advance to AUTO.

- Switching from run to check during the burner on period will drive the modulator circuit to low fire (10-X Closes). This allows for low fire fuel-air adjustments and holding the burner at low fire. Consult your boiler/burner instructions for low fire hold firing recommendations. The control will display:

CHECK 35
LOW FIRE SIGNAL

OPERATIONAL TEST



WARNING: Before testing the control operation on the boiler, close the manual main shut-off fuel valve. Failure to do this may cause injury or property damage.

Close the manual main shut-off fuel valve.

- Recheck all limit circuit wiring for proper operation and correct connection.
- Confirm that the automatic main fuel valves are wired to terminal "7."
- Power the control and electronically check the proper sequence of operation according to the Operation section on page 28 of this bulletin.
- After assuring yourself that all interlocks and valves are properly wired and that the sequence of operation is correct, open the manual main shut-off fuel valve and proceed cautiously through the boiler light off process. Check all safety interlocks for proper shut down of the boiler.

When the installation and all burner adjustments are completed, the entire burner control system should be tested in accordance with the burner manufacturer's instructions. The procedure should verify the correct operation of:

- Each operating control (temperature, pressure, etc.).

2. Each limit switch (temperature, pressure, low water cutoff, etc.).
3. Each interlock switch (airflow switch, high and low fuel pressure or temperature switches, purge and low fire start switches, fuel valve proof of closure interlock, etc.).
4. Pilot flame failure response and lockout.
5. Main flame failure response and lockout.
6. Tight shut off of all fuel valves.



CAUTION: LIVE VOLTAGE IS NECESSARY TO PERFORM THIS TEST.

Voltage Test

A Voltage Check is necessary to identify a potential problem with the supply to the control. This could be caused by an improperly sized or faulty transformer, faulty load coils or low entry voltage. Follow this procedure:

1. Monitor the L1-L2 supply throughout a complete burner cycle. The acceptable voltage range is 102V-132V. At no time during the cycle should the voltage dip below the minimum level.
2. Check other load terminal (M/L2, 5/L2, 6/L2, 7/L2) for voltage at improper times or improper values.

TEST CHECKOUT PROCEDURES

Normal Pilot Flame Test



CAUTION: Before making a pilot flame test, manually shut off the fuel supply to the main burner.

1. At the start of PTFI, place the RUN/CHK switch in the CHK position.
2. Observe the pilot flame signal on the display. If the average signal is below the minimum of 10, readjust the pilot flame or realign the flame detector.
3. During the pilot flame test, if flame is not detected for a continuous 30 seconds, the control will lockout. To re-establish the pilot flame trial for ignition (PTFI), manual reset of the lockout switch is required, and a complete prepurge accomplished.
4. When UV flame detection is used, a test is required to verify that UV radiation from the ignition spark is not being detected. To accomplish this, manually shut off both pilot and main fuels. Initiate a normal start-up, and when the PTFI display comes on, observe the display which should read no signal more than 4. If more than 4 is observed, realign the UV scanner, and/or shield the spark from the scanner's view.
5. With all methods of flame detection, check pilot flame failure response by manually shutting off the pilot fuel and then initiate a normal start-up. With no pilot flame present, the control will de-energize the pilot assembly at the end of the trial for ignition interval, and the control will lockout. Also check to verify that the ignition spark does not cause an electrical interference on infrared or flame rod applications.

Main Flame Test

Note: This test requires an interrupted pilot (a pilot that shuts off after main flame has been established).

1. Proceed through a normal startup. After the pilot flame is shut off, observe the reading on the display. If the signal reading is low, readjust main flame or realign detector.
2. Check main flame failure protection by manually shutting off the main fuel supply. Within 4 seconds after main flame goes out, the fuel valve will be de-energized. The alarm circuit will be energized following safety lockout.

Minimum Pilot Test



CAUTION: The minimum pilot test must be accomplished by a trained and qualified burner technician

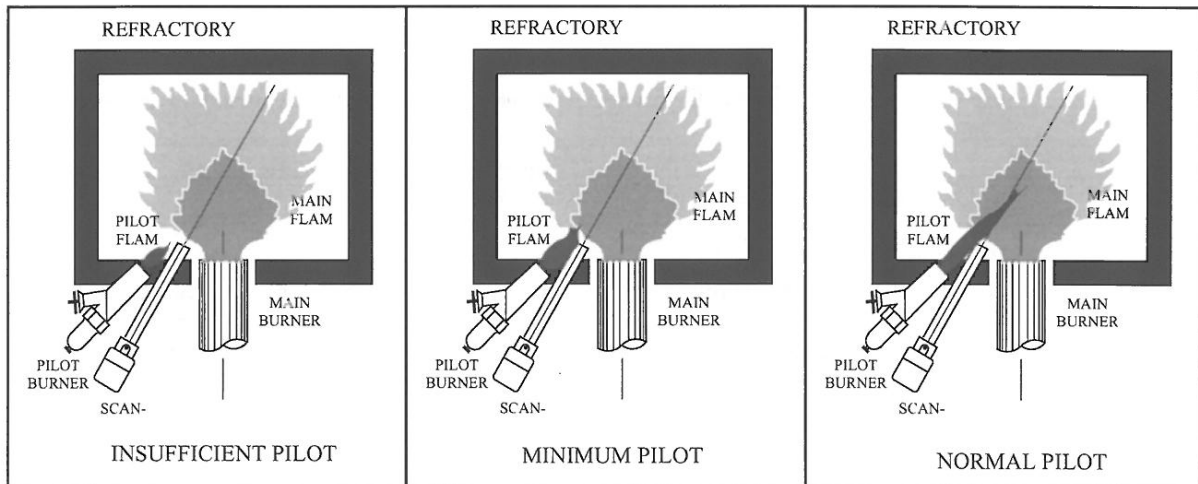
This test assures that the flame detector will not detect a pilot flame too small to reliably light off the main flame. The test should be made on every new installation and following any repositioning or replacement of the flame detector. This procedure should not be used on a direct spark ignited burner.

1. Turn off the main fuel supply manually.
2. At the start of PTFI, place the Check-run switch in the check position.
3. Reduce the fuel supply to the pilot until the display reads below 10.
4. Slowly increase the fuel to the pilot until the display reads 10. This is minimum pilot flame that the flame detector will reliably detect.
5. Place the Check-run switch in the Run position. When the main fuel safety shut-off valve is energized, slowly open the manual main fuel valve.
6. Observe the light-off of the main flame. It must be smooth and normal.



CAUTION: If the main flame does not ignite immediately, shut off the main fuel. Realign the detector to require larger minimum pilot flame

7. Repeat the test until a reliable and smooth light-off occurs with the minimum pilot.
8. After this test is completed, increase the fuel to the pilot to its normal setting.



Scanner Wiring

Care should be taken to see that ignitor cables and scanner cables are routed away from one another on all installations. These cables, when crossed or run together, may interfere with the proper operation of the flame safeguard control.

If you are experiencing erratic operation or inappropriate characters on the display during the trial for ignition period, the cause is likely to be ignitor noise. Check for worn ignitor cable insulation, broken or cut insulation or loose connectors at the electrode and transformers

SUGGESTED GROUNDING RULES

The CB120 system, being microprocessor based, requires a ground system that provides a zero-voltage reference. The voltage measured from L2 to all other terminals except L1 should be 0 volts.

1. The most effective ground is to run the ground wire in the same raceway as the hot and neutral from the main distribution service panel (not intermediate sub-panels) to the burner control panel and insure that this ground wire is well bonded to the control panel.
2. The wiring base of the CB120 must have earth ground providing a connection between the sub-base and the control panel or the burner.
3. The earth ground wire must be capable of conducting the current to blow the 20A fuse in event of an internal short circuit. A number 14 AWG copper conductor is adequate, wide straps or brackets are preferred rather than lead wires.
4. The ground path needs to be low impedance (less than 1 ohm) to the equipment frame which in turn needs a low impedance to earth ground. For a ground path to be low impedance at RF frequencies, the connection must be made with minimum length conductors having maximum surface areas.
5. All connections should be free of nonconductive coatings and protected against rust.
6. Utilizing conduit as a means of providing a ground must be avoided.
7. Installing ground rods at the burner control panel defeats the purpose of a single point ground as described above and could also present a safety hazard.

INSTALLATION

Do not run high voltage ignition transformer wires in the same conduit with flame detection wiring. Do not run scanner wires in a conduit with line voltage circuits. Ensure the frame of the ignition transformer is securely connected to control panel frame or preferably the burner frame.

The CB120 chassis contains a transient suppressing device connected internally across hot and neutral and to earth ground, terminal E. For this to be effective terminal E or the green wire in the pig-tail wiring base must be grounded well.

REMOTE DISPLAY

To locate the display remotely from the CB120 control, mounting kits are available. These are part numbers 833-3156 or 833-3157. Each kit contains a gasket, hardware to mount the display and a 4 or 8 foot cable.

Care must be taken not to route the remote display cable in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires.

COMMUNICATIONS

When interfacing CB controls to a communication system, be it a PLC or other microprocessor based device, ferrite cores should also be utilized. Proper twisted shielded pair cable must be utilized. In a multi-drop system, the shields should be tied together within a cabinet and not to any ground point. The shield at the source end of the cable of the multi-drop connection can then be terminated to ground. Source end is defined as the originating end of the communication system.

Care must be taken not to route communication cables in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires.

SCANNERS

The armored cable supplied with the Ultra-Violet and Infrared scanners should be connected to equipment by means of a good mechanical connection such as a conduit fitting. It may be necessary to utilize heat insulator (858-1283) to isolate the sensing end of the scanner from boiler ground. Care must be taken not to route the scanner cable across the high voltage ignition cable. The high energy ignition cable should be checked periodically for cracking, connections and aging.

In applications using flame rod units, it may be beneficial to route a separate return wire from the S2 terminal to the flame rod assembly. This will minimize the effects of transient currents flowing into the CB120.

In all cases, scanner wires should be routed in separate conduit and not joined with any high voltage AC or ignition cables.

MAINTENANCE

Periodically, the spark electrode should be inspected for proper gapping and cracked ceramics. At ignition time, the high energy from the ignition transformer will attempt to conduct to the point of least resistance and with an improper spark gap, where the conduction takes place will no longer be controlled.

The VA rating of the control transformer must be sized to handle the inrush currents of the pilot solenoid and ignition transformer at PTFI and then the inrush currents of the main fuel valve assembly at MTFI time.

Inspect neatness of wiring in junction boxes and cabinets. It is best to have connections short and direct and also not having wires bunched up and tied off. Also, connections should be periodically inspected for tightness and corrosion.

The viewing area of the scanner must be kept clean. Even a small amount of contamination will reduce the flame signal reaching the detector by a measurable amount. Wipe the viewing area routinely using a soft cloth dampened with concentrated detergent.

Flame Rod

The flame rod and its insulator should be kept clean by washing routinely with soap and water. Rods should be routinely replaced as they oxidize.

Flame Signal Strength

Routine observation of the flame signal strength will forewarn any deterioration in the capability of the flame detector or its application.

Contacts

There are no accessible contacts in the CB120. Where contacts are used, their design assures long trouble-free life when the load circuits are maintained within the published load ratings.

Humidity

In areas of high humidity, the control chassis should be removed and placed in a dry atmosphere when the system is expected to be out of service for an extended period.

Periodic Safety Check

It is recommended that a procedure be established to test the complete flame safeguard system at least once a month. This test should verify the proper operation of all limit switches and safety interlocks as well as flame failure protection and fuel safety shutoff valve tightness.

Rotation

It is recommended that control and scanner units purchased as spares be installed periodically to ensure proper operation.

