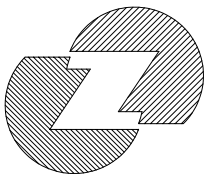


INTELLIGENT STEAM MANAGER

MIURA XJ1

FOR STEAM BOILER



MIURA BOILER CO., LTD.

BRANTFORD, ONTARIO

*** INFORMATION IN THIS MANUAL MAY BE CHANGED WITHOUT NOTICE.**

OWNER SHALL MAINTAIN THIS MANUAL IN LEGIBLE CONDITION FOR FUTURE REFERENCE.

TABLE OF CONTENTS

SECTION 1 General Articles	1
1.1 Definitions and Symbols	1
1.2 Equipment	1
1.3 Environment Specifications	1
SECTION 2 Hardware Configuration	3
2.1 Board configuration	3
2.2 Display & Operating Unit	3
2.2.1 Names and switch layout	3
2.2.2 Functions	4
2.2.3 Display Window	6
2.2.4 Message window	9
2.3 CPU Board	15
2.3.1 DIP Switch settings	15
2.3.2 DIP switch functions	15
2.3.3 Relay Board Operation	16
SECTION 3 Boiler Control	17
3.1 Feed Water Control	17
3.2 Automatic Bottom Blowdown Control (optional)	18
3.2.1 Blowdown Control base on equivalent combustion time	18
3.2.2 Blowdown Control base on High Conductivity Setting	19
3.2.3 Blowdown Control base on High water alarm	20
3.3 Surface Blowdown Control	20
3.3.1 Surface Blowdown Control base on Conductivity setting	20
3.3.2 Surface Blowdown Control base on Blowdown Rate Setting	21
3.4 Flue Gas Re-circulation (FGR) Damper Control	21
3.5 High Water Level (optional)	22
3.6 Automatic Re-Start after Power Failure	22
3.7 Feed Water Control Valve	22
3.8 Chimney Flue Damper (optional)	22
3.9 XJ1 Microcomputer Relay Functions	23
3.10 Operation of the Steam Pressure Control System	23
SECTION 4 Alarms and Cautions	26
4.1 List of Possible ALARMS and CAUTIONS	26
4.1.1 ALARM Conditions	26
4.1.2 CAUTION Conditions	26
4.2 Display and Storage of ALARMS/CAUTIONS	27
4.2.1 ALARM	27
4.2.2 CAUTION	27
4.3 Alarm Conditions	27
4.4 Caution Conditions	29

SECTION 1 GENERAL ARTICLES

1.1 DEFINITIONS AND SYMBOLS

Note, Caution and Danger are used throughout this manual with the following definitions and symbols.

NOTE: indicates an area or subject of special merit, emphasizing either the product capabilities or common errors in installation, operation or maintenance.

CAUTION: indicates possible damage to equipment. It also indicates any condition or practice, which if not observed or remedied could result in damage or destruction of equipment.

DANGER: indicates any condition or practice, which if not observed, could result in personal injury or possible death.

1.2 EQUIPMENT

This specification describes the microcomputer approval by UL for control Miura Steam Boiler.

Name: Boiler Control microcomputer system

Model: XJ1-120.

Components: CPU board assemblies part number XJ1-120-CPU.

Master relay board part number XJ1-120-RY.

Keypad board part number BG1-200-SW.

Display board part number CX-009-E.

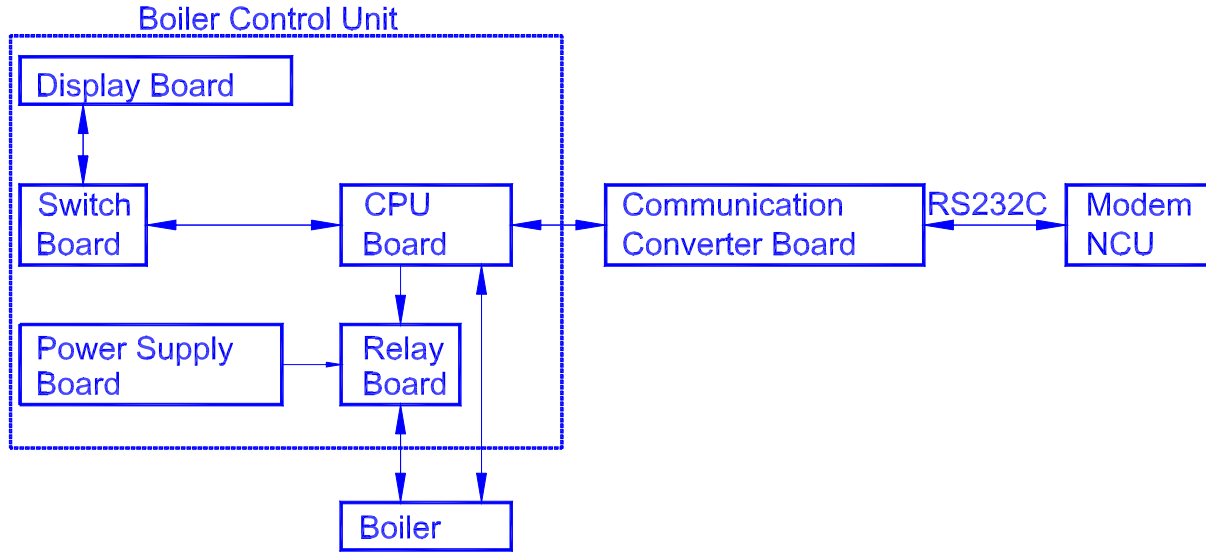
Power supply board part number BG1-200-PW.

1.3 ENVIRONMENT SPECIFICATIONS

- ❖ *Power requirements:* Single phase, 120 VAC, 60 Hz. Supplied by boiler control power circuit.
- ❖ *Allowable voltage variation:* 90 to 132 VAC.
- ❖ *Power failure actions:* For loss of power greater than 0.2 seconds, the power failure sequence program will activate and stop the boiler requiring manual restart. For power failures of less than 0.2 seconds, but greater than 10 milli-seconds, the boiler will automatically re-start. If the power failure is less than 10 milli-seconds, the boiler will continue to run.
- ❖ *Line voltage spike tolerance:* The CPU is tolerant of line voltage spike up to 1500V for 60 seconds or 1800V for 1 second with no affect on CPU. Voltage measured between hot and common (ground) of CPU power supply.

- ❖ *Insulation resistance:* Dielectric resistance is 500MΩ as measure between line and ground when measured by 500VDC Megger.
- ❖ *Electrical noise tolerance:* The equipment will operate without adverse effect when subjected to no more than 2kV voltage spike between power supply lines or between power supply and ground.
- ❖ *Memory backup:* No loss of alarm settings and operating history will occur for up to 240 hours when AC power is lost to the boiler. Time is based on maximum ambient temperature and no backup battery warning at time of loss of power.
- ❖ *Ambient conditions:*
 - Operating temperature (“OPERATION” switch on): 32°F to 140°F.
 - Storage temperature (“OPERATION” switch off): -4°F to 158°F.
 - Humidity: 20% to 90% relative humidity provided that dew or ice do not form on the circuit boards.
- ❖ *Vibration tolerance:*
 - In operation, vibration shall be less than 0.4G with complex amplitude less than 0.5mm peak to peak, frequency less than 20Hz.
 - In transport, vibration shall be less than 2.0G with complex amplitude less than 0.5mm peak to peak, frequency less than 20Hz.

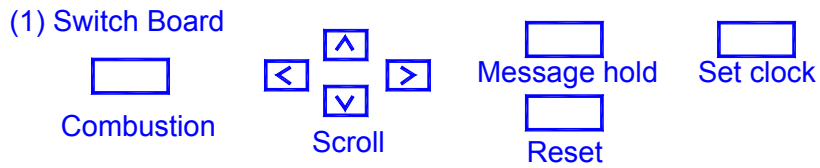
SECTION 2 HARDWARE CONFIGURATION



2.1 BOARD CONFIGURATION

2.2 DISPLAY & OPERATING UNIT

2.2.1 Names and switch layout

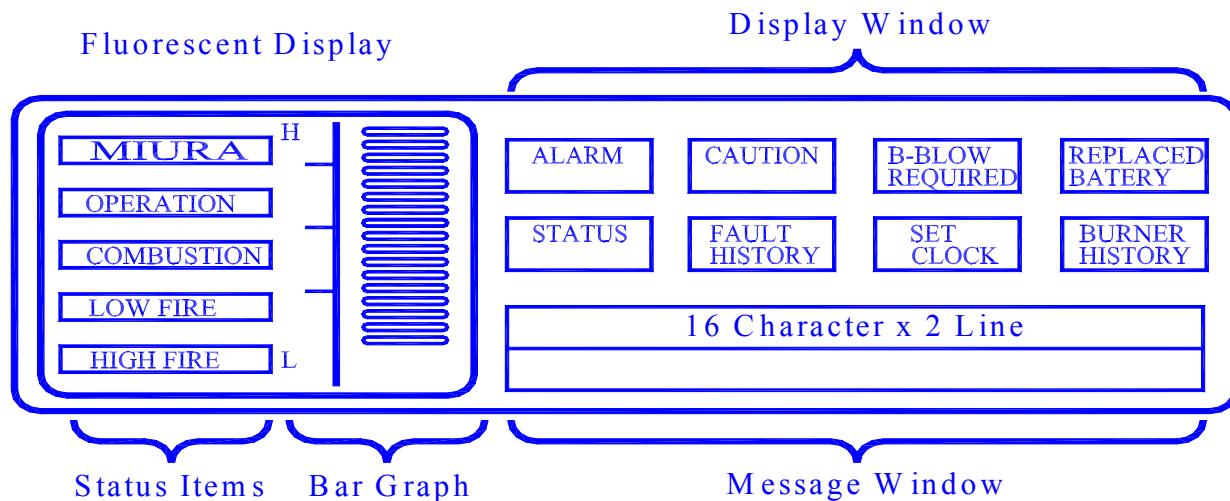


2.2.1.1 SWITCHBOARD



Note: An audible beep sounds when any button is pushed to verify input.

2.2.1.2 DISPLAY BOARD



- Display window : Red (Alarms, Cautions, B(ottom)-Blow Required, Replace Battery)
- : White (Status, Fault History, Set clock, Burner History)
- Message window : White
- Bar Graph : White (Water level)
- Status Messages : White

2.2.2 Functions

1. “OPERATIONAL” Switch
 When “OPERATIONAL” switch is placed in the “ON” position, the boiler control power is supplied to the control circuits. Boiler feed water pump and chemical pump (if used) will operate to prepare the boiler for combustion. The boiler combustion protect relay is energized and starts the 10 second self test routine. When this switch is placed in the “OFF” position, the boiler control circuits are de-energized except for the XJ1 microcomputer.

2. “OPERATION” indicator [White]
This indicator will be illuminated when the OPERATION switch is ON and the boiler control circuit is energized. (Circuit breaker CB5 must be shut.)
3. “COMBUSTION” indicator [White]
This indicator will be illuminated when the COMBUSTION button is pushed to start combustion. The indicator remains on when the boiler is in the STANDBY mode due to steam pressure above the set point, MP1-200 control has ordered the boiler into STANDBY mode or low bubble rod can not detect water.
4. “LOW FIRE” Indicator [White]
This indicator will be illuminated when the boiler has established combustion in the low fire rate.
5. “HIGH FIRE” Indicator [White]
This indicator will be illuminated when the boiler has established combustion in the high fire rate.
6. “COMBUSTION ON/OFF” push button [Red, Momentary type]
Used for starting/stopping combustion cycle. Pushing this button will change the display from “ENABLE” to “STAND-BY” until a call for heat is detected. When call for heat is detected, the combustion sequence will start. When the OPERATION switch is turned “OFF”, the “COMBUSTION ON/OFF” switch will also changes to “OFF.” Unless automatic restart on loss of power is enabled and power is off for less than one minute.
7. RESET push button [Momentary type]
This push button is for clearing the alarm and caution messages. The ALARM message remains on until COMBUSTION button is turned “OFF”, the alarm condition is cleared AND the reset button is pushed. The CAUTION message remains until the caution condition clears and the reset switch is pushed. If the caution condition is cleared, the display will return to normal. The red CAUTION light will remain on until the boiler OPERATION switch is turned “OFF” and then back “ON”. This condition is designed to remind the operator that a problem has occurred, for example the surface blow down strainer is plugged, that requires stopping the boiler to correct safely.
8. MESSAGE HOLD push button [Momentary type]
When the alarm or caution occurs, pushing this button will display the recommend actions to correct the alarm or warning. For example, if the ALARM condition is “LOW GAS PRESS”, pushing the MESSAGE HOLD button will display “OPEN GAS VALVE & RESET SWITCH”
9. SET CLOCK push button [Momentary type]
This button is for adjusting the clock. Push and hold when the date and time are displayed, then change number by using UP/DOWN scroll buttons. Use LEFT/RIGHT scroll buttons to move to the next character in the display. This button is also used to set Conductivity, thermocouple and Blow down settings.

10. Scroll button [Momentary type]

Operate the same as the scroll buttons on a computer keyboard. Used to scroll horizontally to select one of the four menus. The menu choices are:

STATUS FAULT HISTORY SET CLOCK BURNER HISTORY

Operating the up or down buttons will scroll up and down the list of items under the selected menu.

NOTES:

- a) When the alarm or caution condition occurs, the STATUS, FAULT HISTORY, and BURNER HISTORY indicators will not be illuminated.
- b) Any time the buttons are not used for four minutes, the display returns to STATUS and defaults to the first menu item, which is steam pressure. This occurs unless the ALARM or CAUTION condition has not been reset.
- c) When scrolling left or right, the selected menu displays the first item by default. For example, if the operator has scrolled down the STATUS menu to look at conductivity, and then wants to return to indicating steam pressure. The operator can scroll right (or left) and back to STATUS and the display will indicate steam pressure. The operator can also scroll up or down to return to steam pressure. Or the operator can do other tasks for 4 minutes and the display will automatically return to the STATUS menu and display steam pressure.
- d) Some settings have prescribed limits. For example the high fire steam setting cannot be changed to less than 000. Pushing the scroll down button will not have any effect once the lower limit is reached. The operator must use the scroll up button in this example to reach the proper setting.

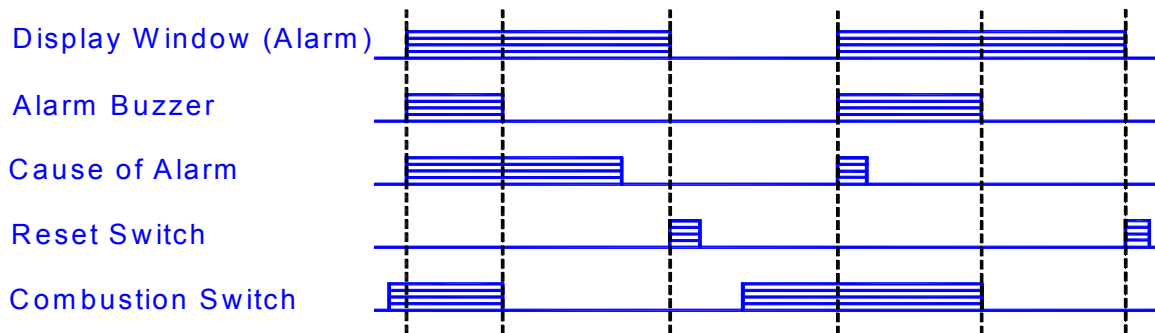
2.2.3 Display Window



2.2.3.1 ALARM INDICATION

The ALARM indicator is turned on when an alarm condition occurs. The indicator remains on until the alarm condition is cleared, the COMBUSTION switch has been pushed to stop the bell, and then, the RESET button is pushed. While the ALARM indicator illuminated, the message windows will state the reason for the alarming condition. For example, if the alarm condition is due to the loss of combustion air, the display will indicate “AIR PRESSURE FAULT”. Pushing the “MESSAGE HOLD” button will display the recommended action for the alarm or warning. In this example, the message is “CHECK AIR SWITCH & PIPE & BLOWER”.

The alarm will continue to ring until the COMBUSTION ON/OFF switch is pushed.

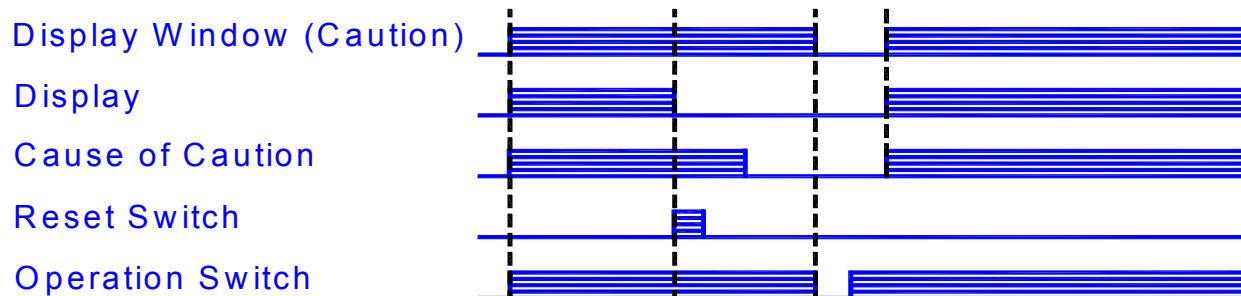


2.2.3.2 CAUTION INDICATION

The CAUTION indicator will be illuminated when a caution condition occurs. The cause of the caution will also be displayed. The display will not return to normal indication until the RESET button is pushed. The CAUTION indicator will remain on until the boiler is stopped and the OPERATION switch is turned off.

If the CAUTION indicator is illuminated, the same caution condition will not cause another warning to be displayed until the RESET button is pushed. However, a different caution condition will be displayed. For example, if the water softener hardness monitor alarms, a CAUTION message will be displayed telling the operator to check the softener. When the condition is corrected, the operator can return to normal operation by pushing the RESET button. If the OPERATION switch is NOT cycled ON – OFF – ON, then a second Hardness alarm will NOT cause an additional CAUTION warning message. But a different warning condition, such as air filter clogged, will be displayed. In this case the display will read “AIR FILTER”, pushing the MESSAGE HOLD button will display “CLEAN & INSPECT AIR FILTER”.

NOTE: Some CAUTION conditions, such as steam pressure sensor fault, will force the boiler into low fire operation and the boiler will cycle ON-OFF in low fire only until the steam pressure sensor problem is corrected, and the boiler OPERATION switch is turned OFF.



2.2.3.3 B-BLOW INDICATION

This indicator will be illuminated when the boiler requires a bottom blow down due to combustion time or auto-bottom blow down valve (option) control timing. It will also display a message “B/DOWN REQUIRED” due to combustion time.

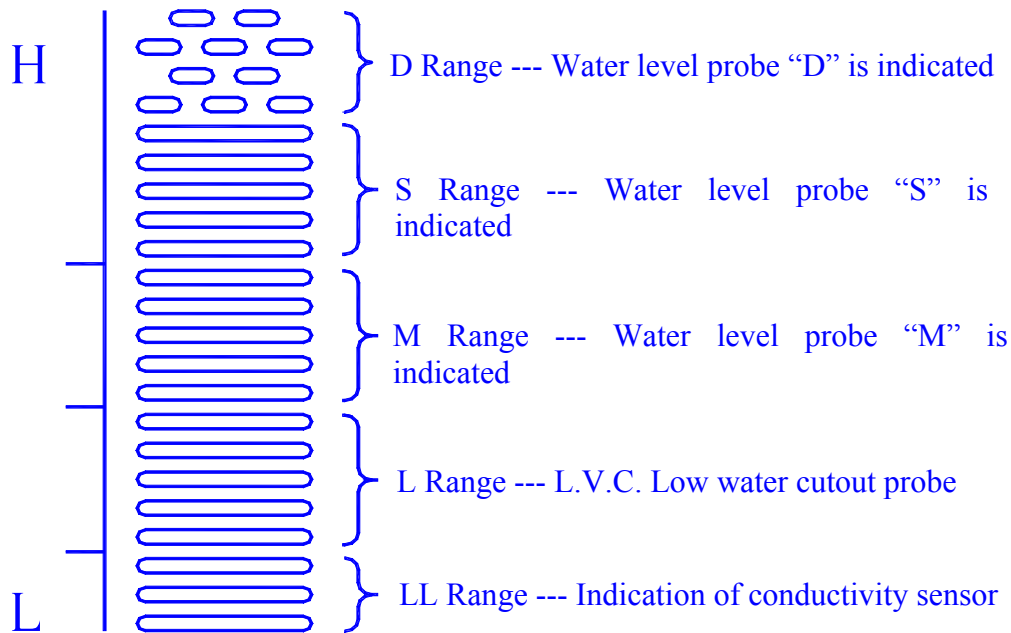
It will also illuminated, if the conductivity reaches the high limit. This latter condition can occur if the automatic surface blow down valve is stuck closed, or the strainer is plugged. In this situation the CAUTION indicator will also illuminated and the display will indicate “CHECK S B/DOWN”.

2.2.3.4 REPLACE BATTERY INDICATION

The indicator will be illuminated when the battery for memory backup requires replacement.

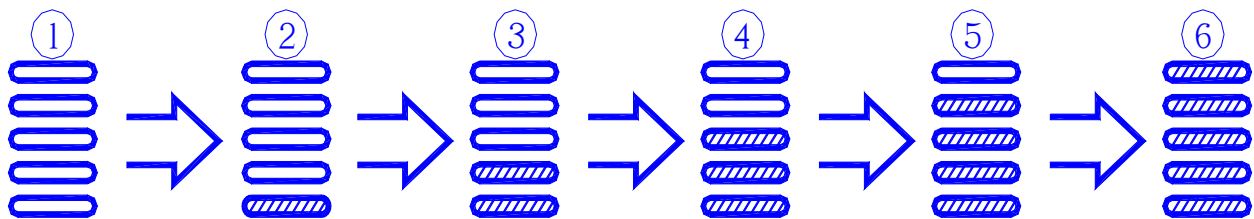
2.2.3.5 BAR GRAPH

When DIP switch 1-1 is ON and the OPERATION switch is ON, the bar graph indicates the simulate water volume inside LVC (not actual in the boiler).



NOTES:

1. The water level indicating bars will be OFF when the boiler is in the "STANDBY" mode. Basically, under any condition other than PRE-PURGE through POST PURGE.
2. In the D, L and LL range, the indicators are switched ON/OFF directly with the associated probe changing from wet to dry. For example, when the boiler is empty, all bars will be off (dark). As the water pump fills the boiler, first the LL range (bottom three bars) will come ON indicating that the conductivity sensor probe is covered (Wet). Then as the boiler water reaches the LWCO probe, the "L" Range lights will come on indicating minimum safe water level. Optional "D" range lights will work with DIP 1-6 is ON.
3. In the "M" and "S" range the bars operate on a time delay. When the "L" electrode is covered by water, the lights are turned ON from bottom to top in 0.5-second intervals. When the "L" electrode is uncovered, or dry, the lights are turned OFF in order top to bottom in 0.5-second intervals.



2.2.4 Message window

The message area is a two lines, sixteen character display. This is the section immediately under the menu lights.

2.2.4.1 STATUS MODE

The status of the control equipment is indicated in the upper section of the display. Each monitored item is indicated on the line below. When the boiler is operating normally, the status messages indicated show the current step in the combustion sequence.

Top line, operating messages displayed

Condition or sequence step to be displayed		Messages		
No.	Status	Normal	Abnormal	
1	OPERATION switch OFF	DISABLE	DISABLE	##,##,##
2	OPERATION switch ON	ENABLE	ENABLE	##,##,##
3	Standing by (waiting for call-for-heat)	STAND-BY	STAND-BY	##,##,##
4	Low Water Level Interlock	LOW WATER	L WATER	##,##,##
5	Pre-Purge	PREPURGE	PREPURGE	##,##,##
6	Trial for Ignition	IGNITION	IGNITION	##,##,##
7	Pilot burner Only	PILOT	PILOT	##,##,##
8	Low Fire	LOW FIRE	LOW FIRE	##,##,##
9	High Fire	HIGH FIRE	HIGH FIRE	##,##,##
10	Post Purge	POSTPURGE	POSTPURGE	##,##,##
11	Low Fire Hold	LOW FIRE HOLD	LF Hold	##,##,##

NOTE:

- “##, ##, ##” indicates the date and time the Alarm or Caution occurred.
- Item #11 time indicates the time the boiler executed the order to remain in low fire. Not the time the switch was placed in low fire hold.

Bottom line, Status indicator on, status messages selectable by UP/DOWN scroll buttons.

No.	Monitored Item	Message
1	Steam Pressure	STEAM 999PSI
2	Scale Monitor Temperature	SCALE MNTOR 999F
3	Overheat Thermocouple Temperature	HIGH LIMIT 999F
4	Flue gas temperature	FLUE GAS 999F
5	Feed water temperature	FEED WATER 999F
6	Flame Voltage	FLAME SIGNAL 5.0V
7	Remaining time to Blow Down	NEXT B/D 999H
8	Surface Blow valve	SFCE B/DOWN ON/OFF
9	Water Conductivity	CONDUCT 9990μS
10	Date and Time	1/10/98 24:00

Example:

PRE PURGE <- operation status (Top line)

STEAM 80PSI <-monitored item (Bottom Line)

NOTE:

1. *Temperature indications:* The range of indicated temperature is -58°F to +932°F (-50°C to +500°C) with increments of 1°F. The accuracy in the range of common use is within ± 4°F (2°C). The temperature over 932°F is indicated as “HH”.
2. When the Steam Pressure Sensor, Conductivity Sensor or a Thermocouple has a detected fault, the indication message is “—“. If the thermocouple output rises over -58°F, the temperature is indicated again.
3. When the steam pressure is less than 0psi, the indicated pressure is 000psi.

2.2.4.2 FAULT HISTORY MODE

The controller maintains the 5 most recent Alarms and Cautions in memory. The fault name, the operating condition at the time of the fault and the time the Alarm/Caution occurred are retained. Use the Left/Right scroll buttons until the FAULT HISTORY menu indicator is illuminated. The display will indicate the most recent fault. Using the Up/Down scroll buttons will display the 5 most recent faults. When all faults have been shown, the top line will indicate “END” and the bottom line will indicate the ROM version of the CPU. If there are no faults, the top line will indicate “NO DATA” and the bottom line will indicate ROM version.

When an ALARM or CAUTION condition occurs, the display will only indicate the name of the condition. To read the message associated, push the MESSAGE HOLD button before pushing the RESET button.

For example, if the ALARM is High Water Level, the display will read:

HIGH WATER LEVEL

Pushing the MESSAGE HOLD button, before pushing the RESET button will display:

CHECK FW CONTROL
& LVC & PROBES

The ALARM/CAUTION message display takes precedence over all other menu selections EXCEPT Clock Set Mode. When in CLOCK Set Mode, if any ALARM or CAUTION occurs the indicator will be illuminated immediately, the operator must exit Clock Set mode by pushing the Clock Set Button and then the ALARM/CAUTION message will be displayed immediately.

ALARM MESSAGE TABLE			
CODE	ITEM	TITLE	MESSAGE
A007	emergency stop	EMERGENCY STOP	EMERGENCY STOP RESET
A010	flame failure (from protect relay)	FLAME FAILURE	INSPECT BURNER & OPEN FUEL VALVE

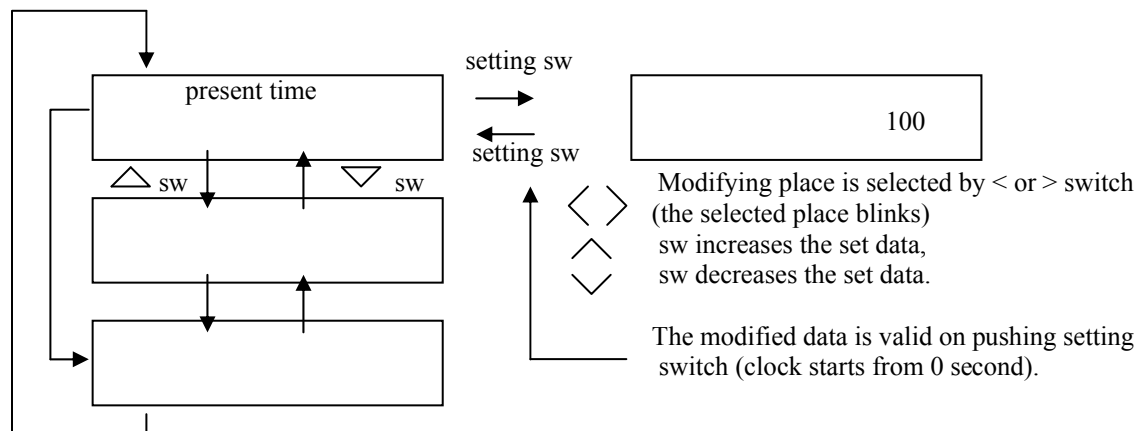
A012	flame detected (from protect relay)	FLAME DETECTED	FLAME IN FURNACE CLOSE FUEL VALVE
A013	air pressure fault	AIR PRESS FAULT	CHECK AIR SWITCH & PIPE & BLOWER
A020	low water level	LOW WATER LEVEL	CLEAN W STRAINER VENT AIR
A029	high water level	HIGH WATER LEVEL	CHECK FW CONTROL & LVC & PROBES
A030	overheat thermocouple working	HIGH W TUBE TEMP	CHECK FW CONTROL & LVC & PROBES
A031	overheat thermocouple fault	O.HEAT T.C.FAULT	CHECK OVER HEAT THERMOCOUPLE
A040	power failure	POWER FAILURE	CHECK POWER RESTART BOILER
A049	FGR damper fault	FGR DAMPER FAULT	CHECK MIC SWITCH
A114	high gas pressure	HIGH GAS PRESS	CHECK GAS PRESS & RESET SWITCH
A152	scale monitor working	SCALE WARNING	CHECK W HARDNESS & TUBE FOR SCALE
A171	economizer differential pressure fault	ECON DIFF PRESS	CHECK SWITCH & INSPECT ECON
A214	low gas pressure	LOW GAS PRESS	OPEN GAS VALVE & RESET SWITCH
A252	scale monitor disconnection	SCALE T.C.FAULT	CHECK SCALE THERMOCOUPLE
A449	flue damper fault	CHIMNEY DAMPER	CHECK MIC SWITCH
A502	low oil pressure	LOW OIL PRESS	CHECK OIL PIPING & OIL PUMP

CAUTION MESSAGE TABLE			
CODE	ITEM	TITLE	MESSAGE
F005	air filter clogged	AIR FILTER	CLEAN & INSPECT AIR FILTER
F021	water level control probe fault	LC PROBE FAULT	CHECK LVC PROBES, CLEAN PROBES
F031	feedwater temperature sensor disconnection	FEED TC FLT	CHECK FEEDWATER THERMOCOUPLE
F032	exhaust gas temperature sensor disconnection	FLUE GAS TC □□□	CHECK FLUE GAS THERMOCOUPLE
F033	high board temperature	HI AMBIENT TEMP.	REDUCE ROOM TEMP
F039	water softener fault	CHECK SOFTNER	CHECK WATER HARDNESS
F044	steam pressure sensor fault	STEAM SENSOR FLT	CHECK STEAM PRES SENSOR

F050	blowdown timing	B/DOWN REQUIRED	PERFORM BLOW DOWN PROCEDURE
F054	low battery	LOW BATTERY	CHANGE BATTERY
F055	concentrated blowdown line trouble	CHECK S B/DOWN	CHECK SURFACE B/DOWN STRAINER
F090	communication error	COMM. ERROR	CALL FOR SERVICE

2.2.4.3 SET CLOCK MODE

Clock, Calendar and Set point data are entered and adjusted in this mode. When this mode is selected by the horizontal Left/Right scroll buttons, the date and time are displayed on the top line. Pushing the SET CLOCK switch can modify the Calendar and set point data. The clock is in 24 military time format.



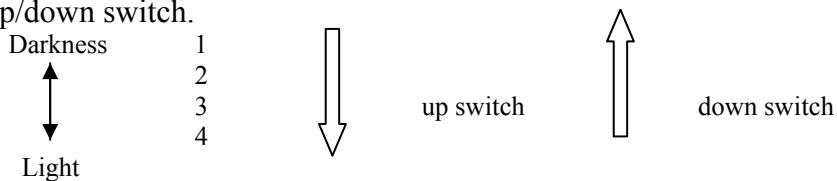
DANGER: Do not change other setting without first consulting your nearest authorized MIURA dealer

NO.	ITEM	MESSAGE	INITIAL VALUE	RANGE	INC.
1	Time set	TIME SET MM/DD/YY HH:MM	1/1/98	-	-
2	Conductivity Set	CONDUCTIVITY SET 9900 μ S	3500	1000-9000	100
3	High Conductivity Set	HI CONDUCTIVITY 9900 μ S	5000	1000-9000	100
4	Blow Down Set Time	B/DOWN SCHEDULE 999HR	10	0-999	1
5	Auto Surface Blow Down Ratio	AUTO BLOW RATE 99%	10	0-20	1
6	Steam Pressure (Low)	STEAM SET LOW 999 PSI	100 (10)	40-500 (5-15)	1
7	Different Steam Pressure	STEAM DIFFER LOW 99 PSI	20 (2)	5-45 (1-5)	1

8	Steam Pressure (High)	STEAM SET HIGH 999 PSI	120 (12)	40-500 (5-15)	1
9	Different Steam Pressure	STEAM DIFFER HI. 99 PSI	20 (2)	5-45 (1-5)	1
10	Scale Monitor (Low Fire)	SCALE MONITOR L 999F	450	250-850	1
11	Scale Monitor (High Fire)	SCALE MONITOR H 999F	450	250-850	1
12	Overheat Thermocouple	OVERHEAT TEMP. 99F	660	250-850	1
13	Equivalent Output Steam	EQUIV.OUTPUT 9990 LB/HR	6900	1000-20000	10
14	Display Brightness Adjustment	BRIGHTNESS ADJ. 3	3	1-4	1
15	Commissioning Date	START UP DATE MM/DD/YY	1/1/98	1/1/98	
16	Date Changed Data	CHANGE DATA DATE MM/DD/YY	1/1/98	1/1/98	
17	Fuel gas temperature	SUPPLY GAS TEMP. 999F	70	0-150	1
18	Supply gas pressure	SUPPLY GAS PRESS. 999IN	138	6-600	
19	Gas meter pulse unit	GAS METER PULSE 999 CFT/PULSE	0	0-300	
20	“S” probe timer setting	S PROBE TIME SET 99 SEC	25	3-30	
21	“M” probe timer setting	M PROBE TIME SET 99 SEC	17	3-30	
22					

NOTE:

- 1) Those numbers in bracket are for the low-pressure boiler (≤ 15 PSIG).
- 2) If the blowdown set time is zero, the blowdown cautions is not indicated by the time.
- 3) The brightness can be tuned in to four pitches, and the status is indicated and modified by up/down switch.



2.2.4.4 BURNER HISTORY

The burner history is indicated on the top line of the display, and each boiler data item is indicated on the lower line.

For Example:

PREPURGE
H FIRE TOT 15924

The available history items are:

ITEM	MESSAGE DISPLAYED	UNIT
Total time of High Fire Burner Operation	H FIRE TOT 99999	Hour
Total time of Low Fire Burner Operation	L FIRE TOT 99999	Hour
Total number of Burner Combustion Start Cycles	CYCLES 999999	Times

Note: time is rounded to nearest whole hour.

2.3 CPU BOARD

CAUTION: These DIP switches have been configure to your application. It is very important not to make any change without first consulting your nearest authorized MIURA dealer

2.3.1 DIP Switch settings.

DIP SW	Function	ON/OFF
DIP 1-1	Indicate water level	yes/no
1-2	FGR Damper present	yes/no
1-3	Automatic restart after power failure < 60 seconds	yes/no
1-4	Automatic bottom blow valve installed	yes/no
1-5	Low pressure boiler (≤ 15 PSIG)	yes/no
1-6	E5 bubble rod	yes/no
1-7	Reserved	
1-8	Reserved	
DIP 2-1	Communication initialize	ON/OFF
2-2	Communication type	Modem/MTU
2-3	Transmit failure messages	yes/no
2-4	Reserved	
2-5	Reserved	
2-6	Reserved	
2-7	Reserved	
2-8	Reserved	

2.3.2 DIP switch functions

1. *Indicating Water Level:* DIP 1-1 ON (up) enable bar graph display for water level.
2. *FGR Damper:* DIP 1-2 ON (up) enable FGR damper control for Flue Gas Recirculation option.
3. *Restart after power failure:* DIP1-3 ON (up) enables automatic boiler re-starts on power failure if less than 60 seconds. This will allow re-start of the boiler without operator intervention IF no ALARMS or CAUTION conditions occur during power outage.
4. *High Conductivity Blow down:* DIP 1-4 ON (up) enable microcomputer to operate the Automatic Bottom Blow down valve if installed as optional equipment.
5. *High/Low pressure boiler:* DIP 1-5 ON (up) enable optional low pressure sensor for low pressure boiler (≤ 15 PSI).
6. *E5 bubble rod:* DIP 1-6 ON (up) enable optional E5 bubble rod in some boiler model.

7. *Communication initialize*: DIP 2-1 ON (up) enables modem communication features. When DIP 2-1 switch is cycled OFF-ON-OFF, online communication features are initialized.
8. *Communication type*: DIP 2-2 ON (up) sets communications on single boiler with modem. Switch OFF (down) sets communication with MTU board is used for multiple boilers installation.
9. *Transmit failure messages*: DIP 2-3 ON (up) enables boiler to call out and report an alarm condition to a central location computer that is running the MIURA Boiler Monitoring software.
10. *Clear switch 1*: This switch resets CPU.
11. *Clear switch 2*: This switch clears RAM, and all setting data are returned to the initial condition. This switch is valid only during operating switch is off.

2.3.3 Relay Board Operation

2.3.3.1 LOW FIRE HOLD TOGGLE SWITCH.

Switch up (ON) disables boiler operation in High Fire for testing and trouble shooting; allows burner combustion to be adjustment at low fire rate.

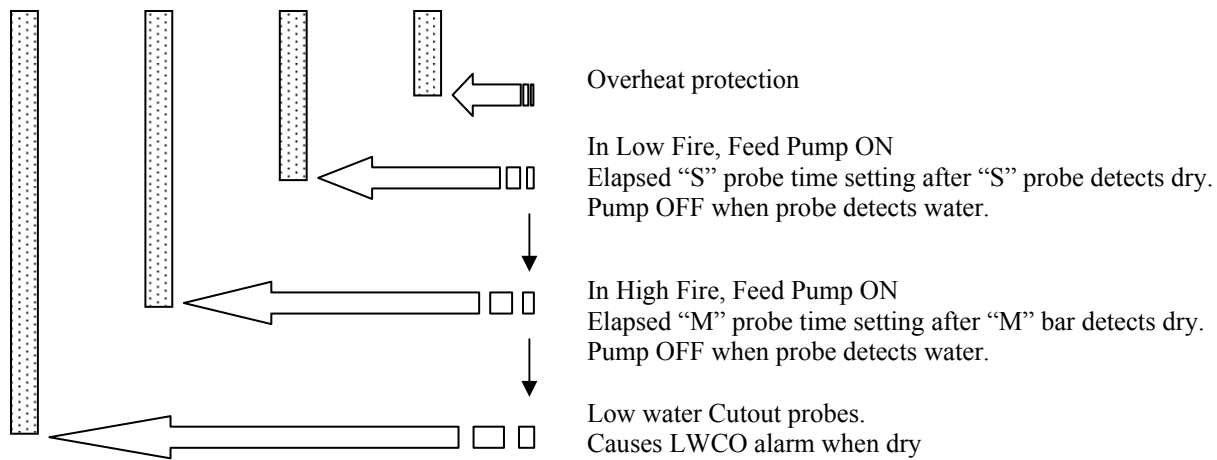
SECTION 3 BOILER CONTROL

3.1 FEED WATER CONTROL

The two-way boiler water volume control is achieved by use of electrodes. Depending on the boiler model and options ordered, the Liquid Volume Control, an external water column, has three electrodes. The electrodes, in order of length, are labeled “L” for LONG, “M” for medium, and “S” for short. The “L” electrode is the Primary Low Water Cutout (LWCO), the “M” or Medium electrode is used to control water volume when the boiler is running on High Fire, and the “S” or Short electrode is used to control water level when operating in Low Fire or Stand-by conditions.

1. Operating Description

L-probe M-probe S-probe D-probe



2. Electrical operation

Measuring point	Resistance range for detecting water (probe wet)
“L” probe to ground	4 ~ 8 KΩ
“M” probe to ground	
“S” probe to ground	7 ~ 15 KΩ
“D” probe to ground	

Note that change in resistance to ground must continue for more than one second to change probe status from WET to DRY or DRY to WET.

3. Connection points.

See applicable electrical schematics.

4. Operation

	Boiler Condition	Feed Pump START Condition	Feed Pump STOP Condition
A	Combustion SW OFF. Boiler in STANDBY POST PURGE PRE PURGE Low Fire	(1) When switching Operation SW from OFF to ON. (2) Elapsed "S" probe time setting after "S" probe becomes DRY (3) "D" probe becomes DRY	(1) "S" probe WET (2) 15 seconds after "D" probe becomes WET
B	High Fire	(1) Elapsed "M" probe time setting after "M" probe becomes DRY (2) "D" probe becomes DRY	(1) "M" probe WET (2) 15 seconds after "D" probe becomes WET

5. Low Water Level Alarm

The Low Water Level ALARM is active ONLY when the Combustion is ENABLED, AND a Call-For-Heat is present AND the "L" Probe is DRY. The "L" probe is monitored by Floatless Switch 33WL1.

If a low water Level condition is present when the OPERATING switch is turned ON, the Feed pump will run. The pump will continue to operate until the normal water volumes are reached. Normal water volume is determined by electrode "S becoming WET. ONLY in the initial start of the boiler, after placing the OPERATING switch in the ON position, will the Low Water Cutout Alarm be ignored and reset automatically. All other occurrences of the condition will be detected and a LOCK OUT will result.

3.2 AUTOMATIC BOTTOM BLOWDOWN CONTROL (OPTIONAL)

There are three types of Automatic Bottom Blowdown available.

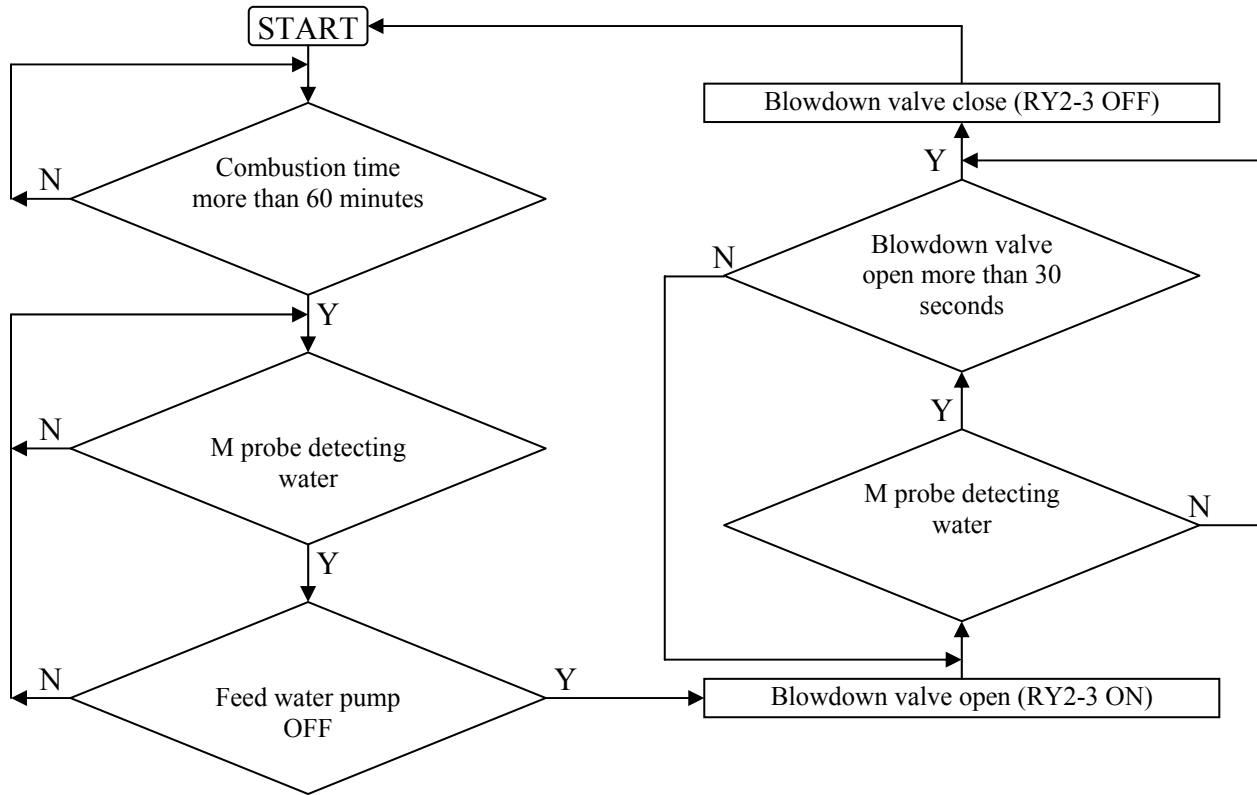
1. Automatic Bottom Blowdown that operated based on equivalent combustion time. Equivalent combustion time is directly related to evaporation, therefore, the number of concentration cycles. This allows performing Bottom Blowdown only when the limiting number of concentration cycles has been reached. The Conductivity sensor also controls the Bottom Blowdown valve.
2. If the conductivity is above the HIGH setting for conductivity, the motor driven Bottom Blowdown Valve is opened.
3. High water alarm (option) and blowdown.

3.2.1 Blowdown Control base on equivalent combustion time

When the timer for equivalent combustion time, plus 60 minutes (clock time, not combustion time) has elapsed, AND the "S" probe is WET (Indicating Normal water Volume). AND the Feed Water pump is OFF. The Motor valve is opened. The Motor operated Bottom Blowdown valve remains open for 30 seconds, OR until the "M" electrode becomes DRY. Then the Motor valve is ordered to shut.

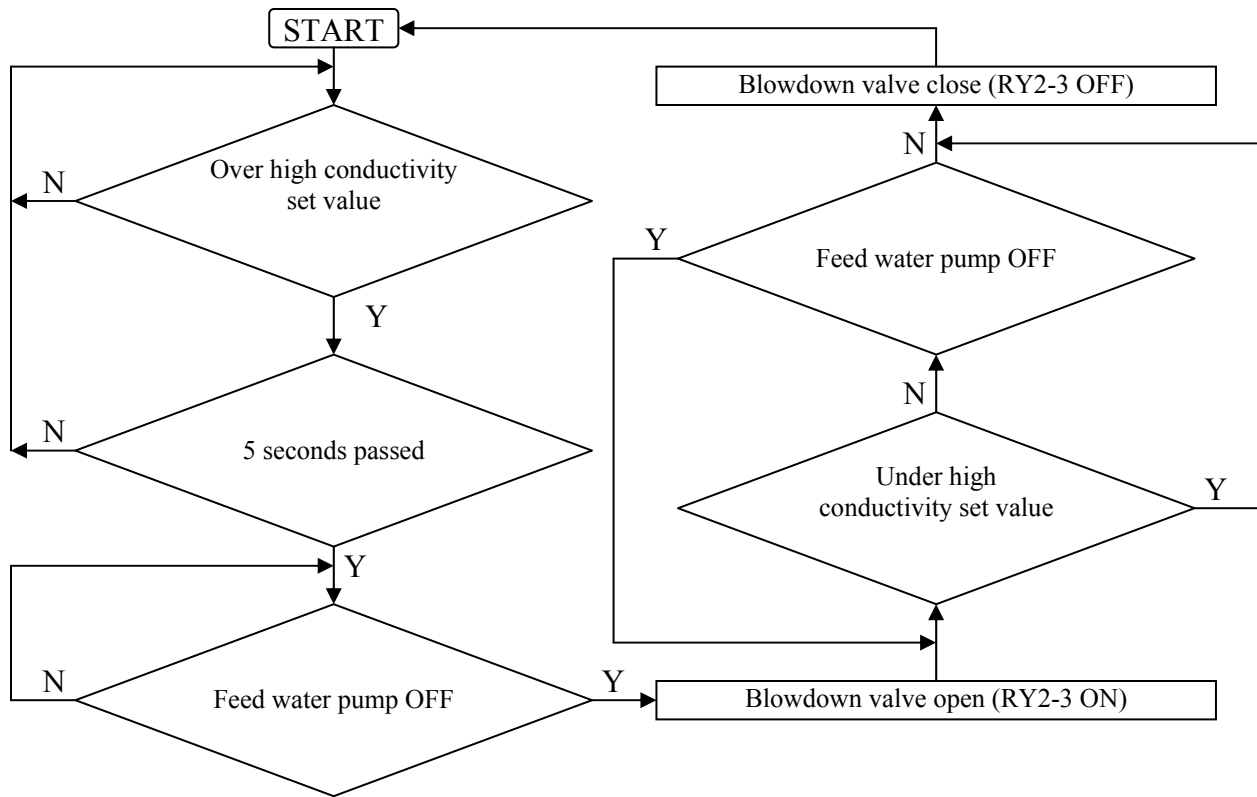
Equivalent combustion time is a calculated value. Time is calculated as ONE hour in continuous High Fire as One hour of equivalent combustion. Two hours in continuous Low Fire is calculated as ONE hour of equivalent combustion time.

When DIP1-4 is UP (ON) and the Blow valve is ON, the Blow indicator in the display window is illuminated. The Blow valve is controlled independent of DIP 1-4.



3.2.2 Blowdown Control base on High Conductivity Setting

When conductivity is above High Conductivity set value for 5 seconds, an automatic Bottom Blowdown Valve will be opened until Conductivity falls below High Conductivity set value. This operation is not performed if a fault is detected in the Conductivity Sensor.



NOTE: The Automatic Bottom Blowdown valve is optional equipment.

3.2.3 Blowdown Control base on High water alarm

When high water alarm (33WH) detects water during operation switch is ON, the auto-bottom blowdown valve will be opened until 33WH become dry.

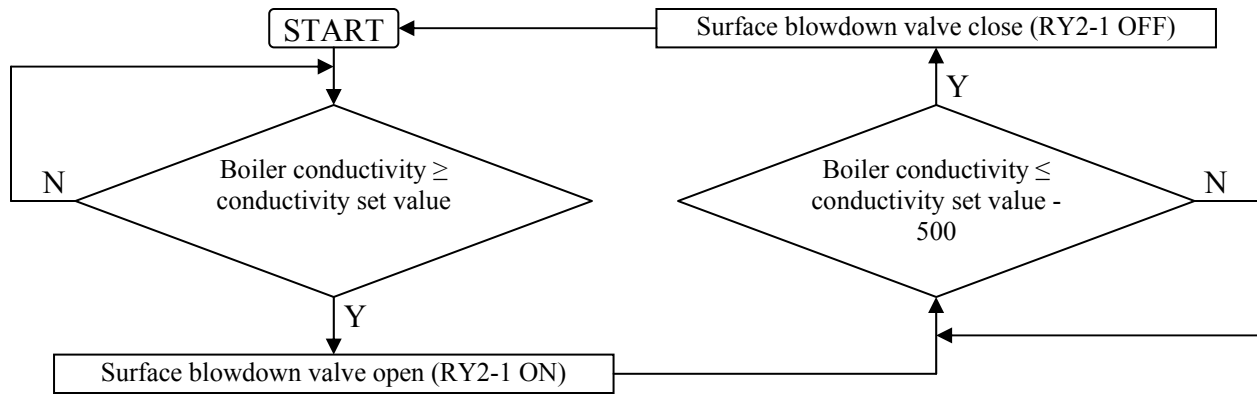
3.3 SURFACE BLOWDOWN CONTROL

There are two types of Surface Blowdown available.

1. Surface Blowdown valve is controlled by the conductivity set valve that is set in the computer and is field adjustable.
2. Surface Blowdown valve is also based on combustion time corrected to high fire time. The valve is controlled by blow rate set valve that is set in the computer and is field adjustable.

NOTE: Blow rate is calculated based on evaporation rate.

3.3.1 Surface Blowdown Control base on Conductivity setting



3.3.2 Surface Blowdown Control base on Blowdown Rate Setting

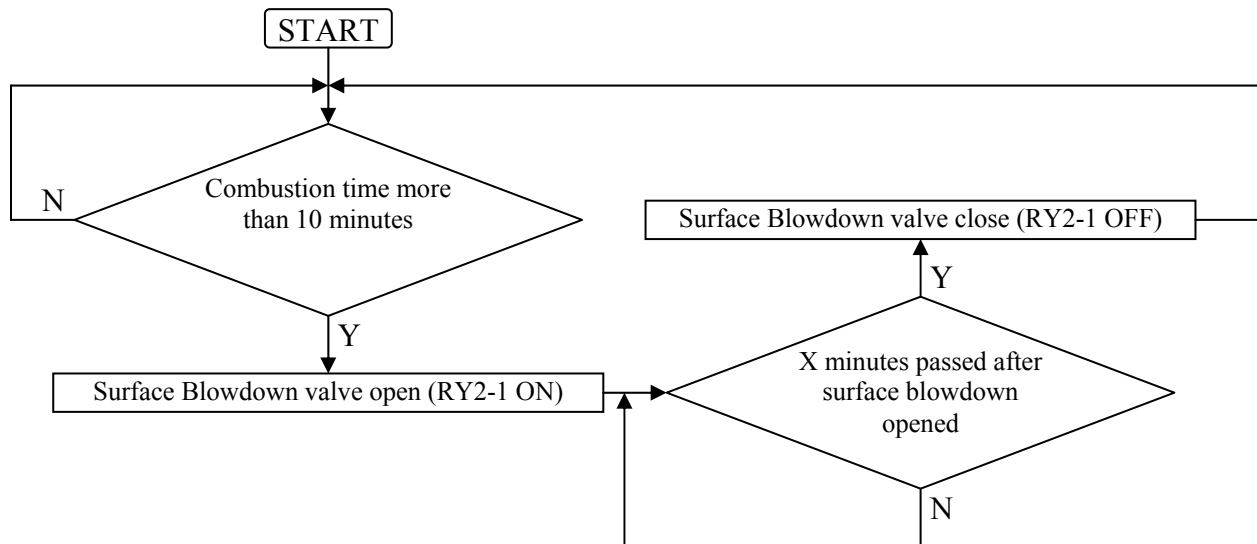
The maximum blowdown rate is 20 % of evaporation rate, with the solenoid valve always open.

Note:

1. The combustion time is corrected to equivalent High Fire time.
2. The opening time X of surface blow valve can be calculated using the following formula:

$$X = 10 \times \text{conductivity rate} / 0.2$$
3. When the following conditions occur, the blowdown rate is automatically changed to 20%, regardless of the set value, until the condition is corrected and the CAUTION condition is re-set:

A Water Softener Fault



3.4 FLUE GAS RE-CIRCULATION (FGR) DAMPER CONTROL

FGR system is active ONLY when DIP 1-2 is up (ON).

For boilers equipped with the low NOx Flue Gas Recirculation option, the boiler will operate as follows:

PREPURGE
PILOT
LOW FIRE

The boiler will remain in low fire until the Flue Gas thermocouple indicates over 90°C (194°F). Then the computer will order the FGR damper to the open position. When the FGR damper micro-switch indicates the FGR damper is open, the computer waits 20 seconds for the flame to stabilize. After the 20 second delay normal operation is resumed and the boiler switches between High and Low fire automatically based on steam pressure.

NOTES:

1. If the FGR damper micro switch does not indicate damper in the open position in 30 seconds, the boiler will lock out and display “FGR DAMPER FAULT”.
2. If the flue gas thermocouple is faulty, the boiler is held in Low Fire until the condition is corrected. The boiler will display a CAUTION message, “FLUE GAS TC FLT” and the action message will read “CHECK FLUE GAS THERMOCOUPLE”.
3. The FGR damper is shut for post purge.
4. If the flue gas does not go over 120°C (248°F), the boiler is placed in low fire hold until the problem is corrected.

3.5 HIGH WATER LEVEL (OPTIONAL)

If the High Water Level option is installed on the boiler, a high water level alarm will result in a lockout. During the High Water Level condition, the message “HIGH WATER LEVEL” is displayed and the Option Automatic Bottom Blowdown valve is opened until the alarm is cleared.

3.6 AUTOMATIC RE-START AFTER POWER FAILURE

The boiler will restart automatically if all of the below listed conditions are satisfied:

1. DIP 1-3 is up (ON) enabling this feature.
2. The power failure occurred with the COMBUSTION switch ON.
3. Elapsed time of power failure is less than 60 seconds.
4. The boiler OPERATING switch remains in the ON position.

3.7 FEED WATER CONTROL VALVE

An external, motor operated feed water control valve option is available. Normal Feed Water control is by standard motor controller installed to operate pump ON/OFF as necessary to maintain water volume in the boiler.

3.8 CHIMNEY FLUE DAMPER (OPTIONAL)

An option flue damper can be installed in the chimney. The damper is externally controlled to open prior to the boiler starting the combustion sequence. The microcomputer verifies the damper is open, before the boiler fan starts, by checking the status of the stack damper micro switch.

3.9 XJ1 MICROCOMPUTER RELAY FUNCTIONS

1. RY1-1 Alarm Bell. Relay ON when an ALARM condition exists and COMBUSTION switch is ON.
2. RY2-1 Surface Blowdown Solenoid. Relay ON when Surface Blowdown is operating. See section 3.3.
3. RY2-2 Feed water pump. Relay ON during call for water. See section 3.1.
4. RY2-3 Bottom Blow. Relay ON for automatic bottom blowdown. See section 3.2.
5. RY2-4 FGR Damper. Relay ON to open FGR damper. See section 3.4
6. RY1-3 Low Fire/High Fire Damper control.

Pilot Valve (Terminal 38)	Main Fuel Valve (Terminal 5)	Condition of RY1-3
OFF	OFF	ON
ON	OFF	OFF
ON	ON	OFF
OFF	ON	ON (After 10 second Low Fire Hold on Main Burner Ignition) ON (For High Fire) OFF (For Low Fire)

NOTE: For steam pressure control operation, see section 3.10

7. RY1-4 Reset relay. Relay ON when RESET button is pushed during the COMBUSTION switch is OFF.
8. RY1-2 Call-For-Heat. Relay ON, if the following conditions are satisfied:
 - a) Terminal 52 input is ON.
 - i. Floatless switch 33WL2 is ON (contact shut)
 - ii. MT1-200 (MI System boiler terminal control) is ON. IF MT1-200 is not installed, the jumper is installed between terminal strip terminals 1 and 2.
 - iii. The external steam pressure switch, 63SH, located above the electrical control box, is ON (switch shut).
 - b) The COMBUSTION switch is ON.
 - c) No Interlock condition exists.
 - d) The protect relay alarm (terminal 32) is OFF.
 - e) The steam pressure is below the STEAM PRESSURE HIGH setting minus the HIGH PRESS DIFFERENTIAL setting.

3.10 OPERATION OF THE STEAM PRESSURE CONTROL SYSTEM

The boiler is equipped with a solid state pressure transmitter. The pressure transmitter measures steam pressure in the boiler. The steam pressure transmitter is connected directly to the XJ1 microcomputer. The microcomputer has four field adjustable settings to control the combustion of the boiler.

In addition, the boiler is equipped with a simple pressure switch. This backup pressure switch, 63SH, is installed to allow operation of the boiler if the pressure transmitter fails. The setting of the switch is field adjustable.

The boiler also has a high pressure limit switch, 63SHA, that requires manual reset if it reaches the high pressure limit setting. This switch is also field adjustable and normally set at the MAWP of the boiler.

Optional equipment available for each boiler is the MIURA MT1-200 Multiple installation control unit for each boiler. This unit accepts boiler operation inputs from the MIURA MP1-200 master Control Panel and overrides the local boiler control system. For details on this optional equipment, please see the Multiple Installation manual or contact your local MIURA representative.

NOTE: The following example pressures are for discussion only.

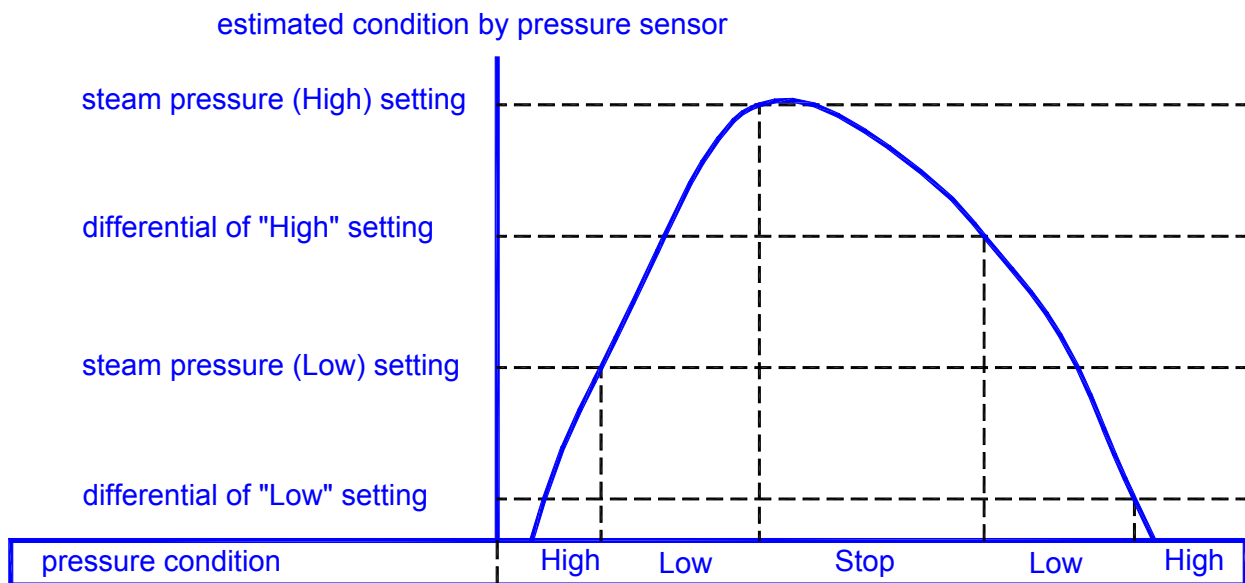
Control	Setting	Function/actions
External High pressure Limit setting (63SHA)	150psi	Lockout requiring manual reset on the pressure switch
External operating control (63SH)	120psi	If the microcomputer pressure transmitter fails, this switch operates the boiler ON/OFF in High Fire only. (Except that the boiler will perform a Low Fire Hold on Main burner Ignition). In this case the boiler is turned OFF (combustion stop) when pressure reaches 120psi.
External operating control differential	10psi	Controls the drop in steam pressure, below the switch set pressure, before the switch will shut. In this case, the boiler will start in Low Fire combustion when pressure drops to 110psi.
Internal STEAM SET HIGH setting	100psi	Boiler turns OFF (combustion stop) when steam pressure reaches this setting.
Internal STEAM DIFFER HIGH setting	10psi	Boiler starts combustion cycle when steam pressure drops to 90psi.
Internal STEAM SET LOW setting	80psi	Boiler changes to low fire when steam pressure is above this setting.
Internal STEAM DIFFER LOW setting	10psi	Boiler changes from Low Fire to High fire when pressure drops to 70psi.

Boiler operation sequence given settings listed in above table.

Sequence assumes that boiler is cold at time of start and that steam outlet valve is shut.

1. Operator starts the boiler by placing OPERATION switch in ON position.
2. Operator pushes COMBUSTION switch to start boiler.
3. Boiler microcomputer starts combustion sequence:
 - a. PREPURGE

- b. PILOT valves open and IGNITION transformer ON.
 - c. 5 seconds later IGNITION transformer OFF.
 - d. 5 seconds PILOT flame verification.
 - e. Main fuel valves open.
 - f. 10 seconds later PILOT valves close.
 - g. 5 seconds Low Fire Hold period to verify Main Flame Established.
 - h. Boiler shifts to High Fire.
4. Boiler operates in High Fire until STEAM pressure reaches 80psi. Then the boiler shifts to Low Fire.
 5. Boiler operates in Low Fire until pressure reaches 100psi.
 6. The boiler shuts Main Fuel Valves and starts POSTPURGE.
 7. Operator opens the steam outlet valve.
 8. Boiler pressure drops below 90psi and the boiler starts in Low Fire.
 9. Boiler steam pressure continues to drop. When pressure reaches 70psi the boiler shifts to High Fire.
 10. The boiler will then shift automatically between High-Fire and Low-Fire to maintain steam pressure between 70 and 100psi depending on the steam demand.



SECTION 4 ALARMS AND CAUTIONS

4.1 LIST OF POSSIBLE ALARMS AND CAUTIONS

4.1.1 ALARM Conditions

Internal flag number	ALARM item
A007	Emergency Stop
A010	Flame Failure
A012	Flamed Detected
A013	Air Pressure Fault
A020	Low Water Level
A029	High Water Level
A030	Overheat Thermocouple
A031	Overheat Thermocouple Fault
A040	Power Failure
A049	FGR Damper Fault
A114	High Gas Pressure
A152	Scale Monitor
A171	Economizer Differential Pressure Fault
A214	Low Gas Pressure
A252	Scale Monitor Fault
A449	Flue Damper Fault
A502	Low Oil Pressure

4.1.2 CAUTION Conditions

Internal Flag Number	CAUTION item
F005	Air Filter Clogged
F021	Water level control probe fault
F031	Feedwater Temperature Sensor Fault
F032	Exhaust Gas Temperature Sensor Fault
F033	High (circuit) Board Temperature
F039	Water Softener Fault
F044	Steam Pressure Sensor Fault
F050	Blow Timing
F054	Low Battery
F055	Surface Blow Line Trouble
F090	Communication Error

4.2 DISPLAY AND STORAGE OF ALARMS/CAUTIONS

4.2.1 ALARM

1. Maximum ALARMS dealt with simultaneously is two. For each ALARM, the corresponding function is performed, but only the first ALARM is indicated. When the first ALARM is reset, the second ALARM is indicated. The RESET switch is valid for the current ALARM only. If there are two different ALARMS, the RESET button must be pushed twice to clear the ALARMS.
2. The ALARMS are dealt with prior to the CAUTIONS. If the ALARM occurs when a CAUTION is indicated on the display, the ALARM interrupts the CAUTION and the ALARM is indicated.
3. The ALARMS are stored in order of occurrence, unless the same ALARM occurs again before the first occurrence is cleared. This is what happens if a LOW GAS PRESSURE ALARM occurs and the operator attempts to clear it while the Low Gas Pressure condition continues.
4. The microcomputer stores the five most recent ALARMS and CAUTIONS that can be recalled for display.

4.2.2 CAUTION

1. The maximum number of CAUTION warnings dealt with simultaneously is five. For each CAUTION, the corresponding action is performed, and each CAUTION message is displayed by turns and rotated every 2 seconds.
2. Pushing the RESET switch once clears all CAUTION conditions. However, the microcomputer will not return to normal operation until the OPERATION switch is turn OFF
3. In the event of the same CAUTION condition occurring twice before the RESET button is pushed, the older CAUTION is ignored.

4.3 ALARM CONDITIONS

1. EMERGENCY STOP: Alarm occurs when there is an error in communication between CPU board and Relay Board. OR if the relay RY1-2 is ON indicating a call for heat and the High Limit pressure switch, 63SHA is open or proof of closure switch on main gas valve (for boiler over 150 BHP) is open before main flame.
2. FLAME FAILURE: Alarm occurs when the Burner Protect Relay indicates a flame failure alarm.
3. AIR PRESSURE FAULT: Occurs in the condition where the combustion air blower is ON and the Air Pressure Switch, 63A, is OFF for greater than 1 second. This occurs at all times EXCEPT for the first 5 seconds after turning the fan ON.
4. LOW WATER LEVEL: See section 3.1. The ALARM occurs any time the COMBUSTION switch is ON and the LVC "L" electrode is dry. Caused by switch 33WL1.
5. OVERHEAT THERMOCOUPLE: Occurs when the OPERATION switch is "ON" and the Overheat thermocouple measures a temperature above the set value or over 932°F for greater than 2 seconds.

6. OVERHEAT THERMOCOUPLE FAULT: Occurs when the thermocouple measures less than -122°F for more than 2 seconds. This indicates an open circuit on the thermocouple.
7. SCALE MONITOR: Occurs when the temperature of the Scale Monitor thermocouple is above the associated High Fire/Low Fire setting for more than 10 seconds.

NOTES:

- a) If a pressure sensor fault has occurred, the temperature is compensated using a pressure of 284 PSI. For low-pressure boiler, it will not be compensated if the pressure sensor fault has occurred.
 - b) Under Low Fire Hold, the setting for Low Fire is used as the ALARM set point.
 - c) When shifting from Low Fire to High Fire, or High Fire to Low Fire, the temperature comparison function is on hold for 40 seconds to allow temperature to stabilize.
 - d) The microcomputer will perform the temperature evaluation only when pressure is above 71.1 PSI and the measured temperature will be compared to set temperature adjusted for measured pressure. This will not apply for low-pressure boiler.
8. SCALE MONITOR THERMOCOUPLE FAULT: Occurs when the OPERATION switch is ON and the temperatures of the SCALE Monitor, OR the FEED Water, OR the Exhaust Gas thermocouples are less than -122°F for 2 seconds.
 9. POWER FAILURE: Occurs when the COMBUSTION switch is ON and a loss of Voltage occurs for longer than 0.2 seconds.

NOTES:

- a) When this ALARM occurs, the POST PURGE function will not be performed.
 - b) If the power failure is less than 10milli-seconds, the boiler will continue to operate.
 - c) If the power failure is greater than 10 milli-seconds, but less than 0.2 seconds, the boiler will re-start after the PRE PURGE is complete.
 - d) If the power failure is less than 60 seconds, but greater than 0.2 seconds, AND DIP1-3 is up (ON), the boiler will automatically restart.
 - e) If the power failure is greater than 60 seconds, OR DIP1-3 is down (OFF) and the failure was greater than 1 second, then the power failure ALARM will occur.
10. LOW OIL PRESSURE: Occurs if oil pressure falls below the setting of Oil Pressure Switch, 63QL, for more than half second IF the boiler is selected to Oil burning, AND, the Blower is running. This evaluation is not made for the first 5 seconds after the combustion fan starts.
 11. ECONOMIZER DIFFERENTIAL PRESSURE FAULT: Occurs when the Air Pressure Switch, 63A, is ON and the Economizer Differential Pressure switch, 63DA, is OFF for half second.
 12. LOW GAS PRESSURE: Occurs when the Low Gas Pressure switch, 63GL, is OFF (OPEN) for over half second if the boiler is selected for Gas Fuel.
 13. HIGH GAS PRESSURE: Occurs when the High Gas Pressure switch, 63GH, is OFF (OPEN) for over 1 second if the boiler is selected for Gas Fuel.
 14. HIGH WATER LEVEL: Occurs when the OPTIONAL High Water Level Alarm switch, 33WH, is OFF for over half second. This ALARM also opens the OPTIONAL Automatic

Bottom Blowdown valve until the condition clears. The ALARM must still be RESET manually and restarted boiler.

15. FLUE DAMPER FAULT: Occurs when the micro-switch for the Option Flue Damper Proof-of Damper-Open is not ON (SHUT) within 90 seconds of starting the blower for PRE PURGE. The PRE PURGE timer does NOT start until the FLUE DAMPER is verified open. It also occurs during combustion, if this micro-switch is opened for more than 1 second.
16. FGR DAMPER FAULT: Occurs when the option FGR Damper open micro-switch is not ON (switch SHUT) within 30 seconds of the damper open signal. And it also occurs after 30 seconds of the damper open signal has come. When the micro-switch is opened for more than 1 second or the micro-switch is closed for more than 3 seconds after damper close signal has come.
17. FLAME DETECTED: Occurs when protect relay detect flame during post-purge or standby period.

4.4 CAUTION CONDITIONS

1. AIR FILTER CLOGGED: Occurs when the Air Filter Differential Pressure Switch, 63AF, remains ON (SHUT) for more than 10 seconds.
2. HIGH BOARD TEMPERATURE: Occurs when the microcomputer circuit board temperature continues to be above 158°F (70°C) for over 5 minutes when the OPERATION switch is ON.
3. WATER SOFTENER FAULT: Occurs when the Water Softener Alarm/Chemical Low Level alarm input switch is OFF (OPEN) for more than 10 seconds when the OPERATION switch is ON.
4. STEAM PRESSURE SENSOR FAULT: Occurs when the output of the Steam Pressure Sensor is less than 0.3v for more than 2 seconds when the OPERATING switch is ON. If the output returns to normal, 1.0 to 5.0v, the CAUTION is cleared automatically.
5. BLOW TIMING: Occurs when the equivalent High Fire time reaches the time set for BLOW TIME. The water Conductivity is above the HIGH CONDUCTIVITY setting for more than 10 minutes corrected to equivalent High Fire time.

NOTE: The Blowdown Timing will be reset by turn the OPERATION switch from OFF to ON, and the Feed Water pump operates for 30 seconds before the blower motor starts.

6. LOW BATTERY: Occurs when the voltage of the data backup battery falls below 2.4v when power is available to the microcomputer.
7. SURFACE BLOW LINE TROUBLE: Occurs when the measured conductivity is above the set point for Automatic Surface Blowdown for more than 60 minutes when the OPERATION switch is ON.
8. COMMUNICATION ERROR: Occurs when the number of modem communication attempts, to report ALARMS or CAUTIONS, reaches 255.
9. EXHAUST GAS TEMPERATURE SENSOR FAULT: Occurs when the temperature of the Exhaust Gas thermocouple remains less than -122°F for more than 2 seconds when the OPERATION switch is ON.
10. WATER LEVEL CONTROL PROBE FAULT: Occurs when the “M” probe detects dry while “S” probe is detecting water for more than 30 seconds.

11. FEEDWATER TEMPERATURE SENSOR FAULT: Occurs when the temperature of the Feedwater thermocouple remains less than -122°F for more than 2 seconds when the OPERATION switch is ON.