

# Preferred Utilities Mfg Corp

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## JC-43D2 3-Element Drum Level Controller

### Installation & Operation Instructions



The **JC-43D2** 3-Element Drum Level Controller maintains a boilers drum level at setpoint by modulating a 4-20 mA control output with a user selectable 1-element, 2-element, or 3-element PID loop.

The **JC-43D2** can be configured for an alternate offline setpoint mode to account for sink and swell in the boiler drum as the boiler transitions between online and offline. A user-configured warmup and cooldown delay keeps the PID from modulating until the boiler is making steam, and also allows the control valve to continue modulation for a time period after the boiler is shutdown.

The **JC-43D2** can be wired to interface with the burner control to shutdown the burner in the case of a low drum level or high steam pressure condition in addition to external level and pressure switches.

#### Features

- 3-Element PID Drum Level Control
- Low Steam Flow and Low Feedwater Flow Fallback to 1-Element Control
- 11-Point User-Configured Steam Flow Feedforward Curve for 2-Element Control
- High And Low Drum Level Alarms
- High and Low Steam Pressure Alarms
- Steam Pressure Compensation for Drum Level and Steam Flow Inputs
- Level Transmitter Failure Monitoring and Alarm
- Periodic Blowdown Reminder
- Alternate Offline Setpoint for Sink/Swell Compensation
- Warmup and Cooldown Delays before Enabling/Disabling PID Control
- Steam Flow and Feedwater Flow Totalizers

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## **SAFETY**



### **DANGER**

#### **Electric Shock Hazard**

Multiple power sources may be present.

Disconnect all electric power sources, local and remote, before servicing



### **WARNING**

This product is intended for use in Commercial and Industrial installations,  
it is NOT intended for Residential use.

This product is intended to be used by Trained Operators.

Installation, start-up, and troubleshooting is intended to be done by  
Experienced Technicians familiar with Industrial Safety Codes  
and all Safety Codes specific to burners and boilers.



### **WARNING**

This product is NOT a Primary Safety Interlock rated device.

The Relay Outputs should only be used as an  
additional auxiliary Operating limit and should not replace or bypass  
any Primary Safety Interlock devices required by Safety Codes.

A Primary Low Water Cutout switch, Auxiliary Low Water Cutout Switch, High Steam  
Pressure Switch, and High-High Steam Pressure Switch are required  
to be installed and wired into the flame safeguard system.  
Failure to do so can result in equipment damage, injury, or death.

**Incorrect wiring connections to burner/boiler Flame Safeguard controls  
can cause Equipment Damage, Injury, or Death**

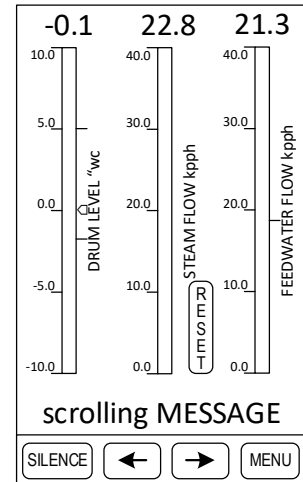
## Operation

### Home Screens

When all three channels are enabled, there are 5 home screens that can be cycled with the left/right arrows. The 5 home screens are: 3-Bargraph screen, single bargraph Drum Level, single bargraph Steam Flow, single bargraph Feedwater Flow, and 3-channel large number screen.

All bargraph scaling can be configured in the setup menus. On the single bargraph draft screen, there is an auto/manual button and an output command for manual operation of the 4-20 mA Control Output.

If a channel is not being used, that channel's bargraph and home screen will not be displayed. The Drum Level input channel cannot be disabled.



### Alarms

The lower left button on all screens indicates one of these three words:

**Silence** or **Alarms** or **History**

When a new Alarm occurs, **Silence** and the bargraph blink, and the Alarm Relay energizes.

Touch **Silence** to stop the blinking and to de-energize the Alarm Relay.

**Alarms** is displayed after silencing (if an Alarm is still active).

**History** is displayed when there are no active Alarms.

### Active Alarms Screen

From any other screen, touch the **Alarms** button to display the Active Alarms Screen.

If there are no active Alarms, **Alarms** will not be displayed on the Home or Menu screens.

All active Alarms are displayed on this screen: High Draft Pressure Alarm, Configuration Errors, Hardware Faults, etc....

When the Alarms screen is displayed, **History** and **Home** are displayed.

Touch **History** to display the History screen.

Touch **Home** return to the Home screen.

Active Alarms		
AIN B0-3: Out Of Range Low ALARM		
	13:47:21	
	4/03	
Drum Level Low Alarm		
-5.0 "wc ALARM	13:45:58	
	4/03	

History Home

### History

Touch **History** to display the History screen.

The History screen displays the Time/Date of the most recent 50 Alarms and Events.

Events include: when an Alarm Clears, a Shutdown Reset, JC-23D2 power-up, etc..

For High Flue Temp alarms, the peak temperature is recorded in the alarm history.

Touch the **Up** or **Down arrow** to advance to the next page of History. Touch **Date** to enter a time/date and then to jump to the nearest History records.

The **Hide Events** and **Show Events** removes or displays Events.

The History memory is retained when powered down. The History can be extracted via the USB port using the free JC\_TG\_Edit Windows App.

History	▲	▼	Date
Drum Level Low Alarm			
-5.0 "wc CLEAR			13:53:48
			4/03
Peak Low Level			
-5.2 "wc			13:53:48
			4/03
AIN B0-3: Out Of Range Low ALARM			
			13:47:21
			4/03
Drum Level Low Alarm			
-5.0 "wc ALARM			13:45:58
			4/03

Silence Hide Events Home

Alarms Show Events

### Menu Screens

To set clock, Alarm Setpoints, and other initial Setup.....See pages 12-15

## **Low Drum Level Alarm and Shutdown Sequence**

The Bargraph and Numeric display continuously indicate the Boiler Drum Level. The Alarm and Shutdown (if used) setpoints are indicated on the bargraph with tic marks. If the drum level signal falls below the low drum level alarm setpoint for more than 10 seconds (user-adjustable) the bargraph blinks, the alarm message is displayed, the common alarm relay energizes, and the current drum level is logged with a time/date stamp. Pressing the ALARM SILENCE button de-energizes the Common Alarm Relay.

If the drum level continues to decrease and falls below the Low Drum Level Shutdown setpoint, the Burner Shutdown Relay de-energizes, the Common Alarm Relay re-energizes, and the current drum level is logged, and time/date stamped. Pressing the ALARM SILENCE button de-energizes the Common Alarm relay. The Burner Running Relay will not re-energize until the low drum level shutdown condition is cleared. The Shutdown Relay can be set as either automatic or manual reset.

If the JC-43D2 Shutdown relay is wired into the burner Start Limits, the burner shuts down. The Shutdown Relay remains de-energized and the SHUTDOWN message remains on the display. After the Drum Level has risen above the “shutdown” setpoint, the shutdown condition will either manually or automatically reset to re-energize the Shutdown relay.

The Common Alarm Relay can be used to activate an external bell or horn. The Common Alarm Relay de-energizes automatically when the Drum Level rises above the Low Alarm setpoint. Alternately, pressing the JC-23D2 Alarm Silence pushbutton will silence the alarm.

## **Level Transmitter Failure Alarm**

If a differential pressure transmitter is not regularly maintained, the sensing lines can become blocked which could cause the transmitter to read out of range. If the Level Sensor Failure alarm option is enabled, the JC-43D2 will detect when this happens, and a Level Sensor Failure alarm will occur.

When enabled, the Level sensor failure alarm will cause the Burner Shutdown relay to open, and the control valve output will be set to 0%. The control output can still be operated in manual during a level sensor failure. If the Control Type is set to ON/OFF, the fill output will de-energize during a level sensor failure alarm. Because the JC-43D2 only activates this alarm when the boiler is online, the Burner Running Input option must be enabled to use the Level Transmitter Failure alarm option.

## **Level Setpoint Selection**

There are two Drum Level Setpoint parameters: Primary Level Setpoint and Secondary Level Setpoint. If the Secondary Level Setpoint option is disabled, the JC-43D2 will only use the Primary Level Setpoint for PID control. If the Secondary Level Setpoint option is enabled, the PID will use the Primary Level Setpoint when the burner is running and will use Secondary Level Setpoint when the burner is not running. Generally, the Secondary Level Setpoint will be set lower than the Primary Level Setpoint as the boiler drum level will “sink” when the burner is OFF and will “swell” when the burner turns back ON.

The Burner Running Input option must be enabled to use the Secondary Level Setpoint option. If the Burner Running Input is enabled, but the Secondary Level Setpoint option is not enabled, the JC-43D2 will use the Warmup Delay and Cooldown delay to enable/disable the PID control when the burner is not running. In this case, when burner starts, there will be a delay before the PID is released to modulate the control output, and when the burner stops there will be a delay before the PID stops modulating and sets the control output to 0%.

## **PID Mode Selection**

The normal operating PID mode can be selected based on the system needs and available AINs. The default is 3-Element PID. If there is no Feedwater Flow signal available, 2-Element PID mode can be selected. If there is no Steam Flow signal available, 1-Element PID mode can be selected.

There is also a parameter for 1-Element fallback for when the Steam Flow or Feedwater Flow signals are low.

## **ON/OFF Control**

When the Control Type parameter is set to ON/OFF, The PID and 4-20 mA control outputs are disabled and the JC-43D2 uses the ON setpoint and OFF setpoint to control a relay output ROUT 1-1.

### **Channel Enable/Disable**

The transmitter AIN channels can be disabled if not installed. The Home Screens will adapt to these selections and will not display input channels that are not enabled.

The Steam Flow transmitter option must be enabled to use the 2-Element PID option. The Steam Flow and Feedwater Flow transmitter options must both be enabled to use the 3-Element PID option. The Steam Pressure transmitter option must be enabled to use the Pressure Compensation feature for the Drum Level and Steam Flow inputs.

### **Steam Flow Feedforward**

When the JC-43D2 is set to 3-Element PID mode, the Feedforward Type parameter must be set to "Linear Gain" and the Steam Flow Feedforward Curve is not used.

When the controller is set to 2-Element mode, the Feedforward Type parameter can be set to either "Linear Gain" or to "Curve". When the feedforward is set as "Curve" the user can enter up to 11 points for the control valve output at 0, 10, 20, 30, ...etc percent steam flow.

To set up the Feedforward Curve, have the burner running and producing Steam Flow within 2% of one of the curve points. Place the Control Output into Manual and adjust it to where the Drum Level is stable. Press "Store" to save this output value to the closest steam flow percent point.

### **AOUT 0-2 Configuration**

The JC-43D2 has a second 4-20 mA output which is user configurable to retransmit any of the four transmitter signals: Drum Level, Steam Flow, Feedwater Flow, Steam Pressure.

### **ROUT 0-2 Configuration**

The JC-43D2 has a second SPDT relay output which is user configurable to the following options: Disabled, High Level Alarm, Low Level Alarm, Burner Shutdown, Level Sensor Failure Alarm.

### **Blowdown History**

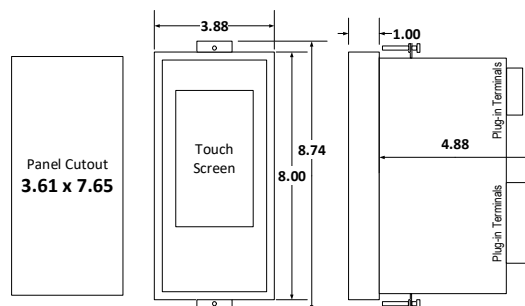
The JC-43D2 can be set up to track when the blowdown bypass pushbutton is pressed, indicating that a water column blowdown has been performed. This event is logged in the Blowdown History page in the JC-43D2's menu. The last 60 blowdown events are stored along with a time and date. After the blowdown bypass button is pressed, there is a 5-minute window where the JC-43D2 will not register a blowdown event to prevent multiple logs for the same event.

## **Installation**

### **JC-43D2 Controller Mounting:**

The JC-43D2 Controller is designed for flush mounting in an enclosure located rated NEMA 12 or better.

The JC-43D2 should not be subjected to excessive vibration.  
Continuous operation is guaranteed over the 32-131 F (0-55C) ambient operating range.



### **Wiring Requirements**



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and all Safety Codes specific to burners and boilers.

This product is NOT a Primary Safety Interlock rated device.  
The Relay Outputs should only be used as an  
additional auxiliary Operating limit and should not replace or bypass  
any Primary Safety Interlock devices required by Safety Codes.

A Primary Low Water Cutout switch, Auxiliary Low Water Cutout Switch, High Steam  
Pressure Switch, and High-High Steam Pressure Switch are required  
to be installed and wired into the flame safeguard system.  
Failure to do so can result in equipment damage, injury, or death.

**Incorrect wiring connections to burner/boiler Flame Safeguard controls  
can cause Equipment Damage, Injury, or Death**

### **BEFORE installing the wiring:**

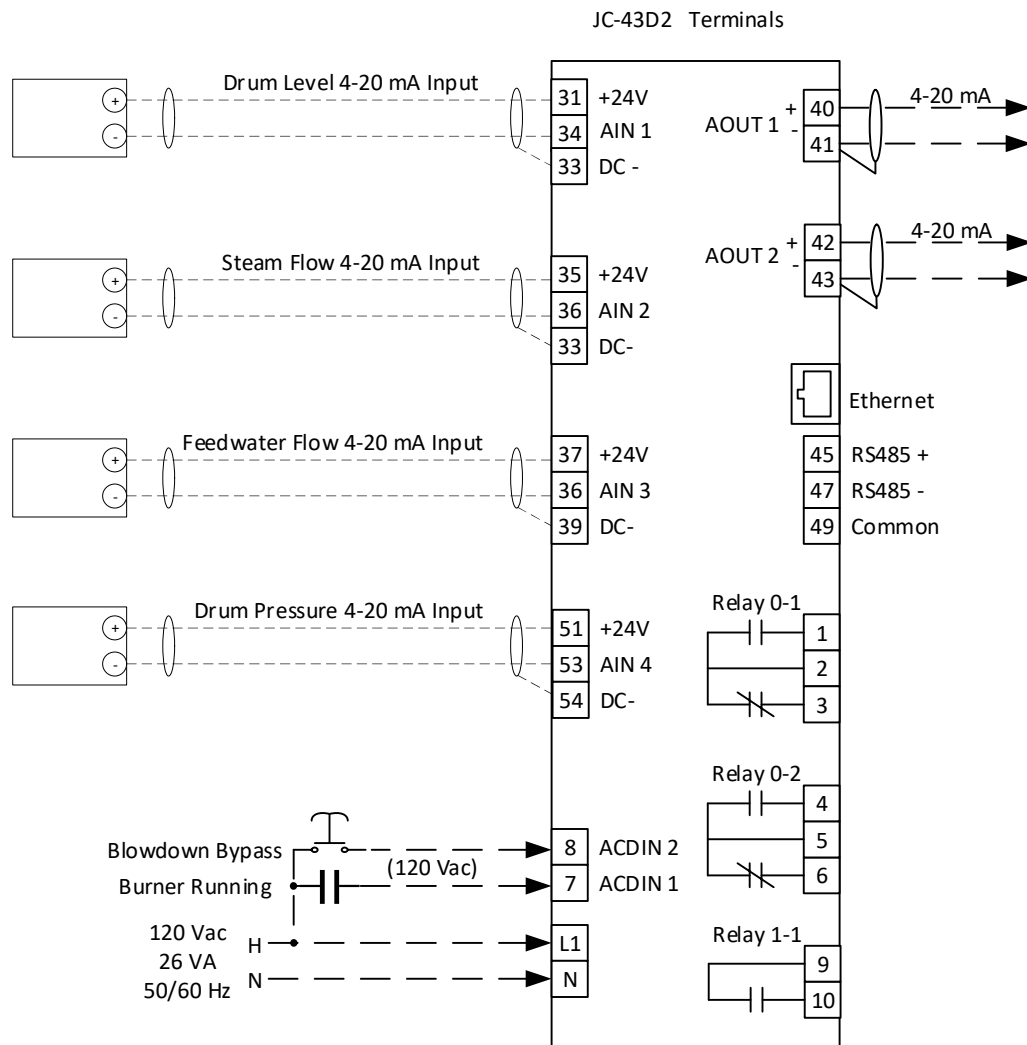
Consult with the burner control system designer to determine which wiring options on the following pages  
should be installed.

## Wiring Requirements (Continued)

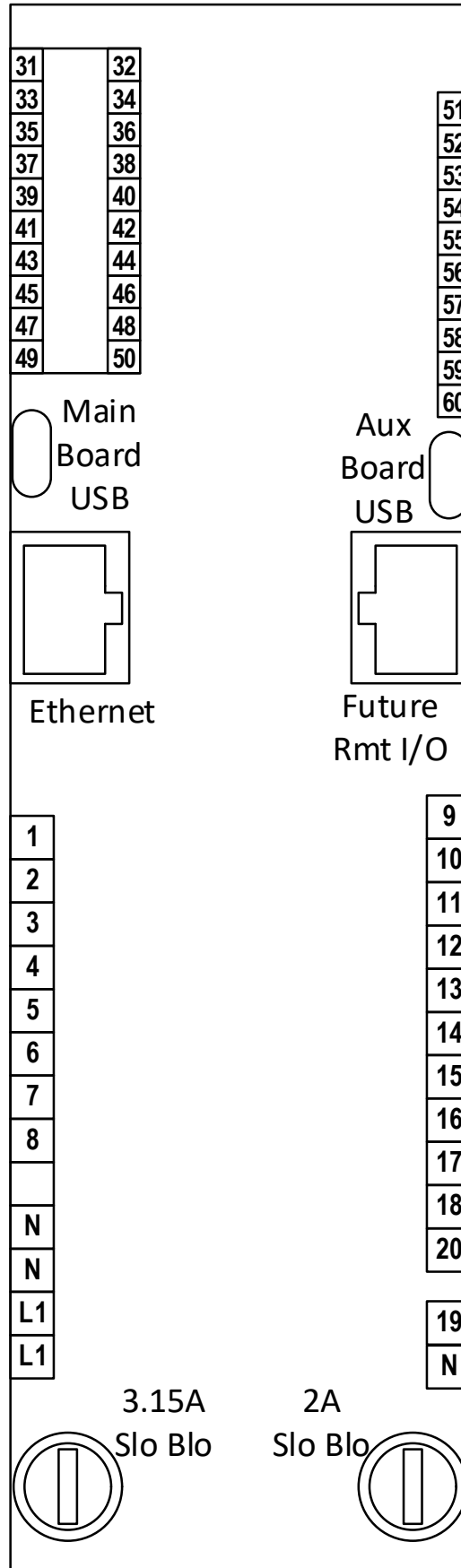
- All wiring must comply with all local and national electrical codes. Tighten all terminals to 4.4 in-lb. Wire must be stranded copper, 12-24 ga., 150V / 75 C insulation minimum.
- AC and DC wiring must be separated and must not be run in the same conduit to prevent electrical noise coupling.
- Use shielded cables where shown, connect shields only where shown, insulate to prevent shield grounding.
- Ignition transformer and motor VFD wiring are particularly noisy and should be kept away from all AC and DC wiring.
- Relay contacts are rated: 10 A resistive, 9 FLA / ½ Hp / 120 Vac
- RS485 is electrically Isolated from all other DC and AC wiring.
- All DC 'I', terminals are connected together internally.
- Terminals 1-20 are Line Voltage AC. Terminals 31-60 are low voltage DC.
- An external Line Voltage supply switch or circuit breaker, marked as the disconnect for this instrument, suitably located and easily reached, and complying with IEC 60947-1 and -3 must be provided.

**Fuse:** 3.15 amp Slo-Blo, 250 V, 5x20mm (Littlefuse 02393.15HXP, Belfuse 5TT 3.15-R, Preferred Utilities 16740-3.15S)  
2 amp Slo-Blo, 250 V, 5x20mm (Littlefuse 0239002.HXP, Belfuse 5TT 2-R, Preferred Utilities 16740-2S)

**Caution:** To reduce the risk of fire, only replace fuses with the same type.



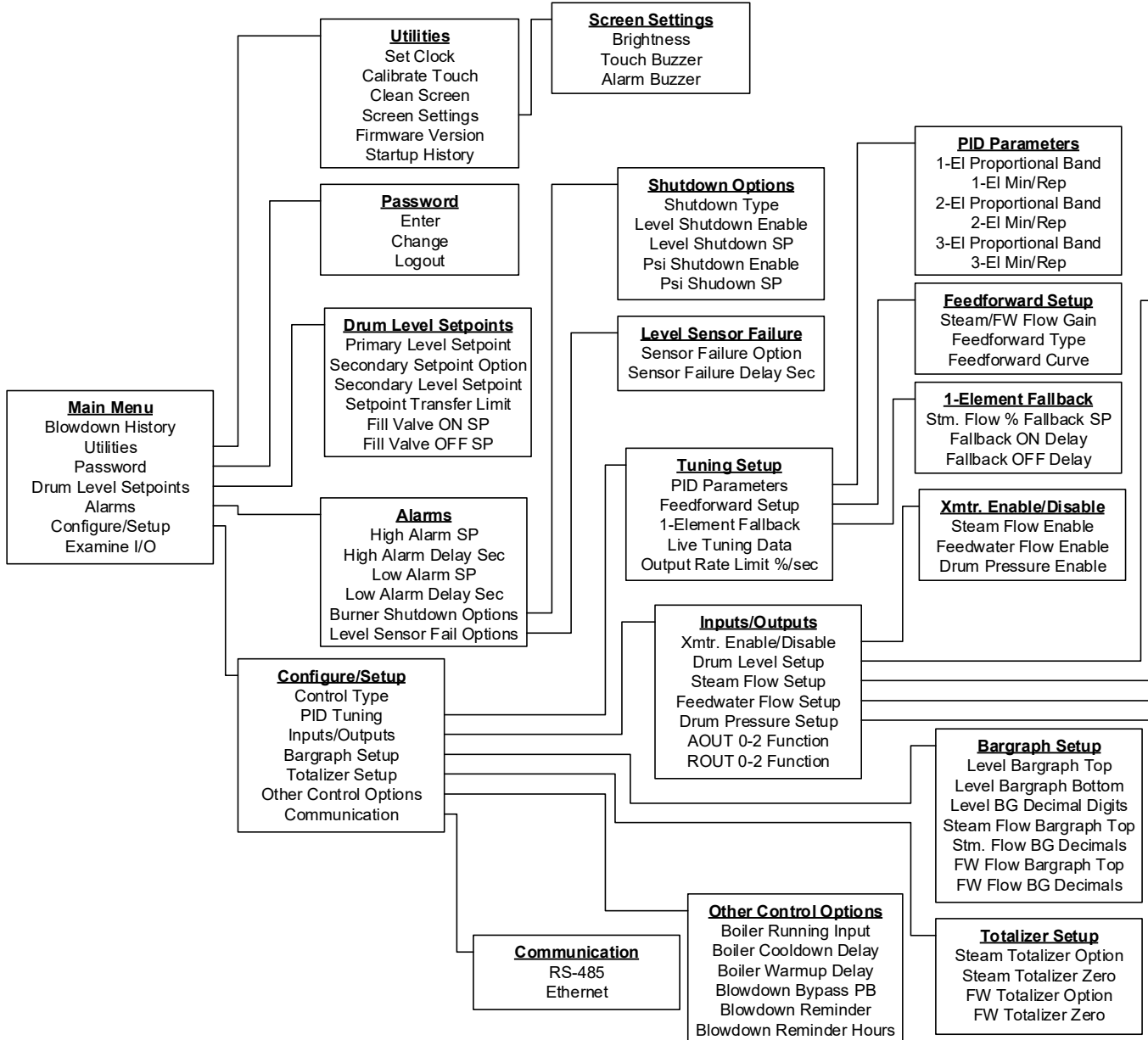
# Terminal Layout and Wiring Diagrams





## Parameters / Menu Map

From the Home screen, touch **Menu** to display the Main Menu.



## Parameters

### Screen Settings

Parameter	Default	Max.	Min.	Goto: Menu > Utilities > Screen Settings
1	Disable	Enable	Disable	<b>Touch Buzzer Enable</b> Activates faceplate Tone when a screen item is touched
2	Disable	Enable	Disable	<b>Alarm Buzzer Enable</b> Activates faceplate Tone when an Alarm is triggered.

### Drum Level Setpoint Parameters

Parameter	Default	Max.	Min.	Goto: Menu > Drum Level Setpoints
3	0.0	99.0	-50.0	<b>Drum Level Setpoint ("wc)</b> This is the Primary Drum Level Setpoint. If the Offline Setpoint option is not used, this will be the only setpoint the JC-43D2 uses for PID control.
4	Disabled	Enabled	Disabled	<b>Offline Setpoint Option</b> Enabling this parameter allows the JC-43D2 to use a secondary drum level setpoint when the burner is not running. When the burner shuts off, the PID will maintain the drum level at this secondary (typically lower) setpoint. The Burner Running Input option must be enabled to use this feature.
5	-2.0	99.0	-50.0	<b>Offline Level Setpoint ("wc)</b> This is the Secondary Drum Level Setpoint. If the Offline Setpoint option and the Burner Running Input options are enabled, when the burner shuts down, the PID will control the 4-20 output to maintain this setpoint until the burner starts again.
6	0.50	1.00	0.00	<b>Setpoint Transfer Limit ("wc/sec)</b> The Setpoint Transfer Limit parameter adjusts how quickly the drum level can change, whether manually or when transitioning between primary/secondary level setpoints. Setting this parameter to 0.00 will disable the transfer limit.
7	-50.0	99.0	-50.0	<b>Fill Valve ON SP</b> The setpoint for when Relay Output 1-1 should close.
8	99.0	99.0	-50.0	<b>Fill Valve OFF SP</b> The setpoint for when Relay Output 1-1 should open. Must be greater than the Fill Valve ON SP.

### Alarm Setup

Parameter	Default	Max.	Min.	Goto: Menu > Alarms
9	99.0	99.0	-50.0	<b>High Alarm SP ("wc)</b> Setpoint for the High Drum Level Alarm. Setting this to 99.0 disables the alarm.
10	10	90	0	<b>High Alarm Delay Seconds</b> The amount of time that must pass after going above the High Alarm Setpoint before the High Level Alarm is activated.
11	-50.0	99.0	-50.0	<b>Low Alarm SP ("wc)</b> Setpoint for the Low Drum Level Alarm. Setting this to -50.0 disables the alarm.
12	10	90	0	<b>Low Alarm Delay Seconds</b> The amount of time that must pass after going below the Low Alarm Setpoint before the Low Level Alarm is activated.

### Burner Shutdown Options

Parameter	Default	Max.	Min.	Goto: Menu > Alarms > Burner Shutdown Option
13	Manual	Auto	Manual	<b>Shutdown Type</b> This selects if a Burner Shutdown condition is manual reset or auto reset.
14	Disabled	Enabled	Disabled	<b>Low Level Shutdown</b> If this option is Enabled, the Burner Shutdown Relay will de-energize when the Drum Level is below the Low Level Shutdown Setpoint.
15	-50.0	99.0	-50.0	<b>Low Level Shutdown Setpoint ("wc)</b> Level setpoint for the Low Drum Level Shutdown condition.
16	Disabled	Enabled	Disabled	<b>High Steam Shutdown</b> If this option is Enabled, the Burner Shutdown Relay will de-energize when the Steam Pressure is above the High Steam Shutdown Setpoint.
17	40	100	20	<b>High Steam Shutdown SP (psi)</b> Pressure setpoint for the High Steam Pressure Shutdown condition.

#### Level Sensor Failure Options

Parameter	Default	Max.	Min.	Go to: Menu > Alarms > Level Sensor Fail Option
18	Disabled	Enabled	Disabled	<b>Sensor Failure Option</b> If this option is enabled, the JC-43D2 will detect level sensor failures when the burner is running.
19	10	60	5	<b>Sensor Failure Delay</b> The amount of time that the JC-43D2 does not register a change from the drum level input before the Level Sensor Failure alarm is activated.

#### Control Type

Parameter	Default	Max.	Min.	Go to: Menu > Configure/Setup
20	3-Element	ON/OFF	1-Element	<b>Control Type</b> When not in the 1-Element Fallback condition, the JC-43D2 will use this PID control. Setting to ON/OFF disables the PID loop and 4-20 mA control output.

#### Tuning Parameters

Parameter	Default	Max.	Min.	Goto: Menu > Configure/Setup > Tuning
21	1.0	10.0	0.1	<b>Output Rate Limit (%/sec)</b> The Output Rate Limit limits the rate at which PID can change the 4-20 mA control output when in automatic. This limit does not apply when the control output is in manual.

#### PID Parameters

Parameter	Default	Max.	Min.	Goto: Menu > Configure/Setup > Tuning > PID Parameters
22	5.00	25.00	0.03	<b>1-EI Proportional Band</b> This parameter sets the Proportional Band for the 1-Element PID control mode. A lower proportional band increases the PID gain.
23	2.0	30.0	0.5	<b>1-EI Minutes/Repeat</b> This parameter sets the Minutes/Repeat for the 1-Element PID control mode. A lower Repeats/Minute increases the PID reaction.
24	7.00	25.00	0.03	<b>2-EI Proportional Band</b> This parameter sets the Proportional Band for the 2-Element PID control mode. A lower proportional band increases the PID gain.
25	6.50	15.00	2.00	<b>2-EI Minutes/Repeat</b> This parameter sets the Minutes/Repeat for the 2-Element PID control mode. A lower Repeats/Minute increases the PID reaction.
26	150.0	320.0	100.0	<b>3-EI Proportional Band</b> This parameter sets the Proportional Band for the 3-Element PID control mode. A lower proportional band increases the PID gain.
27	0.200	0.500	0.100	<b>3-EI Minutes/Repeat</b> This parameter sets the Minutes/Repeat for the 3-Element Flow PID control mode. A lower Repeats/Minute increases the PID reaction.

#### Feedforward Setup

Parameter	Default	Max.	Min.	Goto: Menu > Configure/Setup > Tuning > Feedforward Setup
28	Linear Gain	Curve	Linear Gain	<b>Feedforward Type</b> This parameter selects how the steam flow feedforward is to be used when in 2-Element PID mode. If set to Curve, the 11-point Feedforward Curve will be used. If set to Linear Gain, the JC-43D2 will use the Steam Flow as a direct 0-100% feedforward for the control output. If 3-Element PID control is being used, this parameter will automatically be set to Linear Gain and the JC-43D2 will use the Feedwater Flow and Steam Flow Spans to Scale the flow Feedforward.
		100	0	<b>Feedforward Curve</b> This is the 11-point Feedforward Curve. See "Steam Flow Feedforward" section on page 6 for setup and operation.

#### 1-Element Fallback

Parameter	Default	Max.	Min.	Goto: Menu > Configure/Setup > Tuning > 1-Element Fallback
29	2.0	25.0	0.0	<b>1-El Stm Flow % Fallback</b> If the boiler steam flow is low or close to zero, the steam flow feedforward may not work accurately, and the JC-43D2 will revert to 1-Element PID control until the Steam Flow % is above this setpoint.
30	10	30	2	<b>Fallback ON Delay Sec</b> This is the amount of time the Steam Flow % must be below the fallback Setpoint before reverting to 1-Element PID mode.
31	10	30	2	<b>Fallback OFF Delay Sec</b> This is the amount of time the Steam Flow % must be above the Fallback Setpoint before returning to 2-Element or 3-Element PID control mode.

#### Inputs/Outputs

Parameter	Default	Max.	Min.	Go to: Menu > Configure/Setup > Inputs/Outputs
32	Drum Level	Steam Pressure	Drum Level	<b>AOUT 0-2 Function</b> This selects which input signal is re-transmitted to 4-20 mA AOUT 2
33	Disabled	Level Sensor Failure	Disabled	<b>ROUT 0-2 Function</b> This selects Which alarm is associated with Relay Output 2

#### Xmtr. Enable/Disable

Parameter	Default	Max.	Min.	Go to: Menu > Configure/Setup > Inputs/Outputs > Xmtr. Enable/Disable
34	Enabled	Enabled	Disabled	<b>Steam Flow Xmtr Enable</b> This must be enabled to use 2-Element or 3-Element PID control.
35	Enabled	Enabled	Disabled	<b>Feedwater Flow Xmtr</b> This must be enabled to use 3-Element PID control.
36	Enabled	Enabled	Disabled	<b>Steam Pressure Xmtr</b> This must be enabled to use pressure compensation on the Drum Level and Steam Flow signals.

#### Drum Level Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure/Setup > Inputs/Outputs > Drum Level Setup
37	-10.0	99.0	-50.0	<b>Level Xmtr @ 20 mA = ("wc)</b> This sets what the JC-43D2 interprets 20 mA to be for the Drum Level signal.
38	10.0	99.0	-50.0	<b>Level Xmtr @ 4 mA = ("wc)</b> This sets what the JC-43D2 interprets 4 mA to be for the Drum Level signal.
39	1	2	1	<b>Level Decimal Digits</b> The number of decimal places that will be displayed for the Drum Level signal.
40	1.0	6.0	0.5	<b>Level Filter Seconds</b> This parameter determines how long of a time-averaging filter is applied to the Drum Level signal to smooth out fluctuations from the transmitter.
41	Disabled	Enabled	Disabled	<b>Drum Level Density Comp</b> This option allows for the Drum Pressure signal to be used to adjust the Drum Level for changes in pressure.
42	1.030	1.350	0.850	<b>Drum Level Adjust</b> Use this adjustment to account for calibration drift in the drum level transmitter.

#### Steam Flow Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure/Setup > Inputs/Outputs > Steam Flow Setup
43	-10.0	99.0	-50.0	<b>Stm Flow kpph @ 20 mA =</b> This sets what the JC-43D2 interprets 20 mA to be for the Steam Flow signal.
44	2	3	1	<b>Stm Flow Decimal Digits</b> The number of decimal places that will be displayed for the Steam Flow signal.
45	1.00	20.00	0.00	<b>Low Stm Flow % Cutoff</b> This parameter sets the low steam flow cutoff setpoint. Any steam flow reading below this percentage of the transmitter span will be displayed as 0.00.
46	1.0	6.0	0.5	<b>Stm Flow Filter Seconds</b> This parameter determines how long of a time-averaging filter is applied to the Steam Flow signal to smooth out fluctuations from the transmitter.
47	Disabled	Enabled	Disabled	<b>Stm Flow Square Root</b> This option enables a square root calculation on the Steam Flow transmitter signal.
48	Disabled	Enabled	Disabled	<b>Stm Flow Pressure Comp</b> This option allows for the Drum Pressure signal to be used to adjust the Steam Flow for changes in pressure.
49	1.030	1.350	0.850	<b>Stm Flow Design Pressure</b> Enter the Steam Flow transmitter calibrated design pressure to be used for the signal's pressure compensation.

#### Feedwater Flow Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure / Setup > Inputs/Outputs > Feedwater Flow Setup
50	-10.0	99.0	-50.0	<b>FW Flow @ 20 mA =</b> This sets what the JC-43D2 interprets 20 mA to be for the Feedwater Flow signal.
51	2	3	0	<b>FW Flow Decimal Digits</b> The number of decimal places that will be displayed for the Feedwater Flow signal.
52	1.00	20.00	0.00	<b>Low FW Flow % Cutoff</b> This parameter sets the low feedwater flow cutoff setpoint. Any feedwater flow reading below this percentage of the transmitter span will be displayed as 0.00.
53	1.0	6.0	0.5	<b>FW Flow Filter Seconds</b> This parameter determines how long of a time-averaging filter is applied to the Feedwater Flow signal to smooth out fluctuations from the transmitter.
54	Disabled	Enabled	Disabled	<b>FW Flow Square Root</b> This option enables a square root calculation on the Feedwater Flow transmitter signal.
55	kpph	gph	kpph	<b>Feedwater Flow Units</b> Selects the units for the Feedwater Flow signal. These units will affect the Feedwater Flow Totalizer calculation.

#### Drum Pressure Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure / Setup > Inputs/Outputs > Drum Pressure Setup
56	200.0	1000.0	0.0	<b>Steam Pressure Span</b> This sets what the JC-43D2 interprets 20 mA to be for the Drum Pressure signal.
57	0.0	1000.0	0.0	<b>Steam Pressure Zero</b> This sets what the JC-43D2 interprets 4 mA to be for the Drum Pressure signal.

#### Bargraph Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure / Setup > Bargraph Setup
58	10.0	99.0	-50.0	<b>Level at Bargraph Top</b> This sets the scaled value at the top of the Drum Level bargraph
59	-10.0	99.0	-50.0	<b>Level at Bargraph Bottom</b> This sets the scaled value at the bottom of the Drum Level bargraph
60	10.0	99.0	0.0	<b>Stm Flow at Bargraph Top</b> This sets the scaled value at the top of the Steam Flow Bargraph
61	10.0	9999.0	0.0	<b>FW Flow at Bargraph Top</b> This sets the scaled value at the top of the Feedwater Flow bargraph

### Totalizer Setup

Parameter	Default	Max.	Min.	Go to: Menu > Configure / Setup > Totalizer Setup
62	Disabled	Enabled	Disabled	<b>Steam Totalizer Option</b> This enables the steam flow totalizer on the non-bargraph home screen. The steam flow totalizer units are always in lbs.
63	Disabled	Enabled	Disabled	<b>Steam Totalizer Zero</b> This enables the “zero” button for the steam flow totalizer. If the steam flow totalizer is disabled, this button will not appear.
64	Disabled	Enabled	Disabled	<b>FW Totalizer Option</b> This enables the feedwater flow totalizer on the non-bargraph home screen. The feedwater flow totalizer units can be either gallons or lbs based on what the feedwater flow transmitter units are.
65	Disabled	Enabled	Disabled	<b>FW Totalizer Zero</b> This enables the “zero” button for the feedwater flow totalizer. If the feedwater flow totalizer is disabled, this button will not appear.

### Other Control Options

Parameter	Default	Max.	Min.	Go to: Menu > Configure / Setup > Draft Setup > Inputs / Outputs > Draft Xmtr
66	Disabled	Enabled	Disabled	<b>Burner Running Input</b> Enabling this parameter allows the JC-43D2 to use ACDIN 1 as a Burner Running input. 120VAC is interpreted as Running. This option is required if the Offline Setpoint or Level Sensor Failure Alarm options are being used.
67	30	1800	0	<b>Cooldown Delay Seconds</b> If the Burner Running Input option is enabled and the Offline Setpoint option is disabled, the JC-43D2 will use this parameter to determine when to allow the PID to control the drum level. When the Burner Running input goes from ON to OFF, the controller will wait for this number of seconds before disabling the PID and setting the control output to 0%.
68	30	300	0	<b>Warmup Delay Seconds</b> If the Burner Running Input option is enabled and the Offline Setpoint option is disabled, the JC-43D2 will use this parameter to determine when to allow the PID to control the drum level. When the Burner Running input goes from OFF to ON, the controller will wait for this number of seconds to pass before enabling the PID and allowing the control output to modulate. This parameter should typically be set for longer than the time needed to get through purge and ignition to allow the burner to light-off and let the drum level swell.
69	Disabled	Enabled	Disabled	<b>Bypass PB Input Enable</b> Enabling this parameter allows the JC-43D2 to use ACDIN 2 as a Blowdown Bypass input. 120VAC is interpreted as Bypass. If this input is ON, the Low Level Shutdown Relay will not de-energize. If this input is ON for more than 120 seconds, it is assumed to be defective or jumped out and a “Blowdown Bypass Pushbutton Defective” alarm will occur and the Low Level Shutdown relay will behave normally.
70	Disabled	Enabled	Disabled	<b>Blowdown Reminder</b> This enables the recurring Blowdown Reminder Alarm. If the Bypass Pushbutton option is enabled, applying 120V to ACDIN 2 will clear this alarm until it occurs again. If the Bypass Pushbutton option is disabled, the alarm will need to be manually reset from the touchscreen by pressing “Reset”.
71	8	168	1	<b>Blowdown Reminder Hours</b> This parameter sets how many hours must pass between Blowdown Reminder Alarms.

## Controller Tuning Screens

### Steam Flow Feedforward Curve Screen

With a Tech level password, Feedforward Curve data can be manually entered/edited at any time (burner firing, or not firing), just touch one of the feedforward values. The control output must be in manual to change any of the feedforward curve values.

#### Store Button method

When the Manual/Auto button is in Auto, the controller moves the output until the Drum Level is within the Setpoint Deadband. In Manual the User enters the "% output" value.

- Put the Burner controller in Manual steam flow within +/- 2% of any Curve Steam Flow %, and keep the burner fixed at that firing rate.
- \*\* is displayed when within +/-2%. --- is displayed when NOT within +/-2%
- When the Drum Level is near the Drum Level Setpoint, change the Auto/Manual button to Manual to hold the control output at a fixed position
- Press Store to save that output position in the curve
- Repeat

### Live Tuning Data Screen

This screen allows you to watch how the Proportional, Integral (aka "Reset") and feedforward settings affect the Drum Level control. Each PID mode (1-Element, 2-Element, 3-Element) has its own Live Tuning Data screen. Only the Live Tuning Data for the active PID mode will be displayed. See the descriptions for each of the tuning parameters, and how it affects the tuning on page 10.

After making a tuning value change these two methods should both be used to test the drum level control tuning:

- Leave the control output in Auto and make the burner firing rate change (at a realistic ramp rate).
- Put the control output in Manual, increase the output by 5-15% for 10-15 sec, and then put the output back in Auto.

If control is sluggish control (slow return to Setpoint without overshoot), gradually decrease the Proportional Band.

If control is overly aggressive control (Level overshoots the setpoint and cycles excessively before settling), gradually increase the Proportional Band.

If the burner firing rate is not changing, and the output is hunting, gradually increase the Deadband.

If the burner firing rate is not changing and the control output is in Manual (not moving), and the drum level xmtr signal is jumping excessively, increase the filter seconds gradually. If the drum level signal is not jumping much at all, the Filter Seconds must be decreased because excessive Filter seconds will cause the controller to overshoot.

Steam Flow Feedforward			
-0.1 "wc	Level	+0.0	Setpoint
53%	Output Cmd		Auto
22.8 kpph	58 % Steam Flow		
Steam Flow %	Feedforward		
0	0		
10	15		
20	21		
30	26		
40	32		
50	39		
60**	53		Store
70	58		
80	64		
90	71		
100	82		
...Status MESSAGE (Shutdown,etc.)....			
Silence		Back	Home

Alarms

History

Live Tuning Data			
Drum Level	-0.1		
Setpoint	+0.0		
Error	-0.100		
Deadband/Gap	+/-0.050		
Level Prop. Term	-14.8		Auto
Level Integral	+29.5		
Steam Flow %	61	Command	
Feedforward	52	53	
FW Flow	-0.1		
FW Flow SP	+0.0		
FW Flow Error	-0.100		
Deadband/Gap	+/-0.050		
Flow Prop. Term	-14.8		
Flow Integral	+29.5		
Control Output	53		
...Status MESSAGE (Shutdown,etc.)....			
Silence		Back	Home

Alarms

History

## Modbus

RS485: Baud: 4800, 9600, 19200, 38400, 57600 Parity: Odd, Even, None Stop Bits: 1, 2  
 Ethernet: 10/100 Mb/s  
 Protocol: RTU, TCP/IP  
 Address: 1-247  
 Register Formats: 16 bit Signed Integer  
 32 bit Floating Point (register below = High bytes (exponent), register+1 = Low bytes (mantissa)  
 Modbus Commands: 01 Read Coils, 03 Read Registers, 05 Write Single Coil, 06 Write Single Register,  
 16 Write Multiple Registers (2 registers max)  
 Max Poll Size: 120 coils or registers (except Code 16)

Coil		0 =	1 =	Description
98	WO		Alarm Silence	Remote Alarm Silence
99	RO	No Alarm	Alarm	Common Alarm
100	RO		Alarm	High Drum Level Alarm
101	RO		Alarm	Low Drum Level Alarm
102	RO		Shutdown	Burner Shutdown Relay
103	RO		Alarm	Level Sensor Fail Alarm
104	RO		Alarm	Blowdown Reminder Alarm
Register		Type		Description
40116	RW	FLOAT		Primary Level Setpoint
40118	RW	FLOAT		Offline Level Setpoint
40120	RO	FLOAT		Current Level Setpoint
40122	RO	FLOAT		Scaled Drum Level
40124	RO	FLOAT		Scaled Steam Flow
40126	RO	FLOAT		Scaled Feedwater Flow
40128	RO	FLOAT		Scaled Drum Pressure
40130	RW	FLOAT		Control Output Command
40132	RO	UINT32		Steam Flow Total
40134	RO	UINT32		Feedwater Flow Total
40136	RW	FLOAT		Fill Valve ON SP
40138	RW	FLOAT		FILL Valve OFF SP

RO = Read Only

WO = Write Only

RW = Read/Write



## Parts List

Part Number	Description
JC-43D2	3-Element Drum Level Controller
16740-2S	Fuse, 2 A, Slo-Blo, 250 V, 5x20mm
16740-3.15S	Fuse, 3.15 A Slo-Blo, 250 V, 5x20mm
90437-KIT	JC-xxD2 Panel Mounting Clip (2)
90434	JC-xxD2 Panel Mounting Gasket
92791	8 pt Terminal Block, line voltage, 5.08mm
92794	5 pt Terminal Block, line voltage, 5.08mm
92795	10 pt Terminal Block, low voltage, 3.81mm
92799	2 pt Terminal Block, line voltage, 5.08mm
92800	10 pt Terminal Block, line voltage, 5.08mm
96059-KIT	RC Snubber (for AC electrical noise reduction)
107362-D2-1	JC-xxD2 Single Unit, Wall Mount Enclosure, 12h x10w x 8d
107362-D2-2	JC-xxD2 Dual Unit, Wall Mount Enclosure, 14h x12w x 8d
107362-D2-3	JC-xxD2 Three Unit, Wall Mount Enclosure, 14h x16w x 8d
190751-D2	JC-xxD2 or TG-EL-D4B Adapter Plate, Panel Cutout: 7.5" X 7.6"
190753-D2	JC-xxD2 or TG-EL-D4B Adapter Plate, Panel Cutout: 8.00" X 10.75"
SDA-VB	Audible/Visual External Alarm
SDA-B6	6" Alarm Bell, 120V, 85 db

## Specifications

### **Mechanical:**

Enclosure: Nema 12 Faceplate, Indoor Locations  
 Bezel: 3 7/8 w x 8 h x 1 d  
 Rear Case: 3 1/2 w x 7 9/16 h x 4 7/8 d  
 Panel Cutout: 3.61 w x 7.65 h  
 Weight: 2 lbs  
 Ambient: 32-131 F (0-55 C)  
 Altitude: 6560 feet (2000 meters)

### **Electrical:**

Input Power: 120Vac +/-15%, 50/60 Hz, 26 VA  
 Output Power: 24 Vdc, 300mA max combined load  
 Terminals: 31,35,37,40,42

### **Analog Inputs**

(4) 4-20 mA, 16 bit, 5 samples/sec, 50/60Hz filter: -90db

### **Analog Output**

(2) 16 bit, 4-20mA, max 650 ohm load  
 Servo/VSD Command

### **AC Discrete Inputs**

(2) 120 Vac, 13 mA typ/ch., opto-isolated  
 Burner Running, Blowdown Bypass PB

### **DC Discrete Inputs**

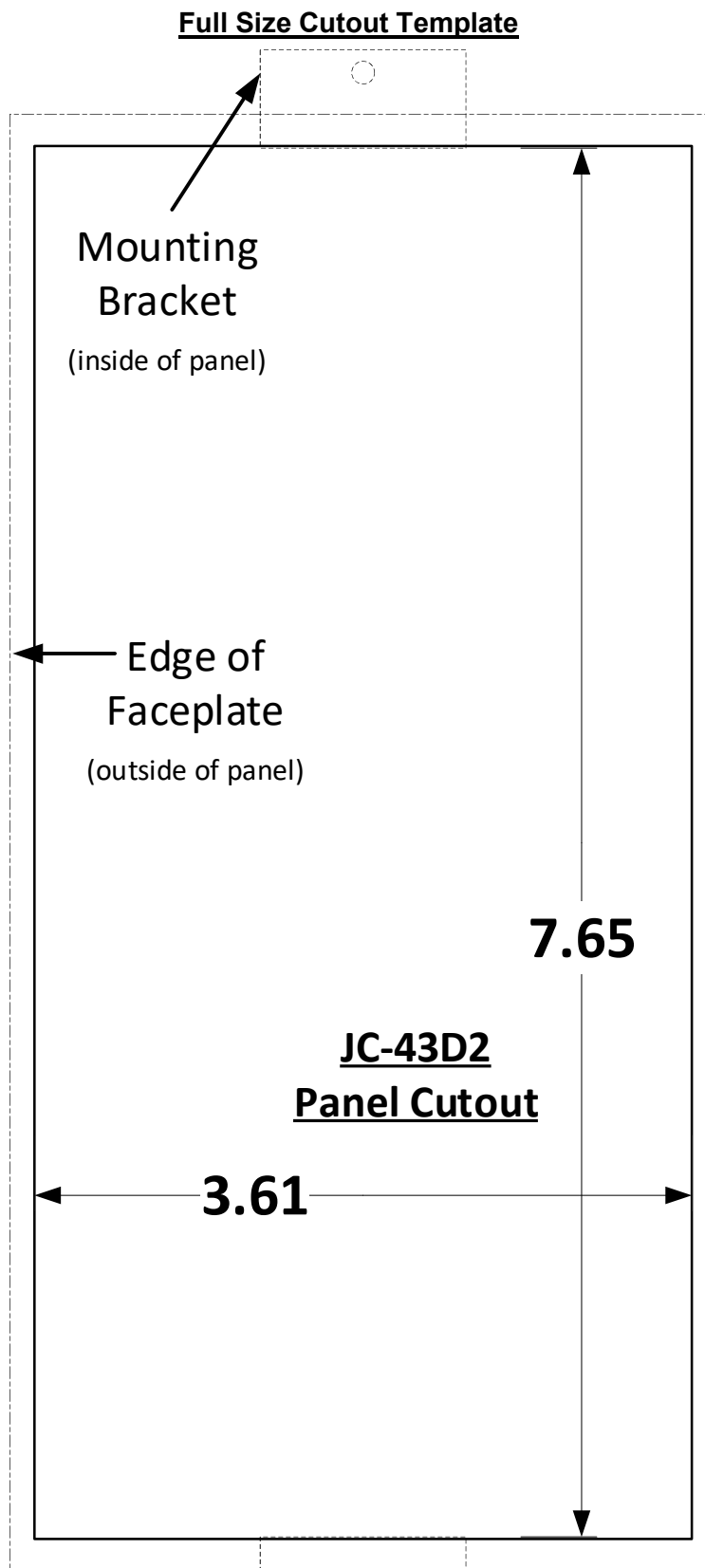
(2) Sinking, 33k / 24V internal pull-up

### **Relay Outputs**

(2) SPDT, (2) SPST, 120Vac, 10 A

### **Communications**

USB: JC\_TG\_Edit config & Firmware Flashing  
 RS485: Isolated, 4.8 - 57.6k baud, Modbus RTU  
 Ethernet: 10/100 Mb/s, Modbus/TCP



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