spirax sarco

B850-W and B850-P
Boiler House Energy Monitor
Quickstart Guide

B850-W-2

B850-P-2

Please note that this is the 'Quickstart Guide' and that all relevant Sections for this product are contained in the main Installation and Maintenance Instructions IM-P408-03, which is located on the electronic memory stick supplied.

First for Steam Solutions

E X P E R T I S E | S O L U T I O N S | S U S T A I N A B I L I T Y

2. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see the following sections) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

In the UK, your attention is drawn to IEE Regulations (BS 7671). Elsewhere, other regulations will normally apply.

All wiring materials and methods shall comply with relevant EN and IEC standards where applicable.

This product must be installed indoors only

Warning

This product is designed and constructed to withstand the forces encountered during normal use. Use of the product other than as a steam energy monitor, or failure to install the product in accordance with these Instructions, product modifications or repair could:

- Cause damage to the product / property.
- Cause injury or fatality to personnel.
- Invalidate the $C \in \overset{UK}{CA}$ mark.

Isolate the mains supply before opening the product as hazardous voltages may be exposed.

These instructions must be stored in a safe place near the installation of the steam energy monitor at all times.

Warning

This product complies with the requirements of the following directives and harmonized standards:

Low Voltage Directive by meeting the standards of:

- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use.

Electromagnetic Compatibility Directive by meeting the standards of:

- Immunity EN 61326-1 Table 2
- Radiated and conducted emissions EN 61326-1 Group 1 Class B.

The product may be exposed to interference above the limits of EN 61326 if:

- **The product or its wiring is located near a radio transmitter.**

- **Excessive electrical noise occurs on the mains supply. Power line protectors (ac) should be installed if mains supply noise is likely. Protectors can combine filtering, suppression, surge and spike arrestors.**

- **Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.**

2.1 Intended use

i) **Check that the product is suitable for use with the application.**

ii) **Determine the correct installation situation and direction of fluid flow.**

iii) **Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.**

2.2 Access
Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product.

2.3 Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required.

2.4 Hazardous environment around the product
Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

2.5 The system
Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?
Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

2.6 Tools and consumables
Before starting work ensure that you have suitable tools and / or consumables available.

2.7 Protective clothing

Consider whether you and / or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

2.8 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions. Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.
Post 'warning notices' if necessary.

2.9 Handling

Manual handling of large and / or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done. Arrange suitable lifting gear if required.

2.10 Disposal

The B850 contains a battery. On disposal of the unit or component, appropriate precautions should be taken in accordance with Local / National regulations.

Unless otherwise stated in the Installation and Maintenance Instructions, with the exception of the battery, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

2.11 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

The symbols, used on the product, mean:

**Equipment protected throughout by double insulation or reinforced insulation.**

Functional earth (ground) terminal, to enable the product to function correctly.
Not used to provide electrical safety.

Caution, risk of electric shock.

Caution, risk of danger, refer to accompanying documentation.
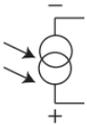
Optically isolated current source or sink.

Caution, Electrostatic Discharge (ESD) sensitive circuit. Do not touch or handle without proper electrostatic discharge precautions.

ac - alternating current

dc - direct current

3. General product and delivery information

The B850 is a flexible and easy to use Boiler House Energy Monitor that accurately calculates the effieciency of the boiler based on measured inputs from fuel, feedwater, steam output, condensate return and blowdown.

This Quickstart Guide will enable the rapid connection and commissioning of the energy monitor

- All the details for this are displayed in a simple and easy to read format.

Warning: This Guide is not intended as a substitute for the full Installation and Maintenance Instructions IM-P408-03 that needs to be read by the person responsible for installing the unit.

3.1 Equipment delivery, handling and storage

Factory shipment

Prior to shipment, the Spirax Sarco B850 is tested, calibrated and inspected to ensure proper operation.

Receipt of shipment

Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip. Each carton should be unpacked carefully and its contents checked for damage:

Content of B850-P-2

1 x   Energy monitor B850-P-2

2 x   Fixing clamps

1 x   Printed Quick Start Guide

1 x   USB (Full installation and maintenance instructions, configuration software)

1 x   Set of terminal blocks

1 x   Carton package

Content of B850-W-2 and B850-W-2-UL

1 x   Energy monitor B850-W-2 or B850-W-2-UL

1 x   Printed Quick Start Guide

1 x   USB (Full installation and maintenance instructions, configuration software)

1 x   Carton package

If it is found that some items have been damaged or are missing, notify Spirax Sarco immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

Storage

If a energy monitor is to be stored for a period prior to installation, the environmental storage conditions should be at a temperature between -30 °C and 70 °C (-22 °F and 158 °F), and between 5% and 95% relative humidity (non-condensing).
Before installing and connecting the power ensure there is no condensation within the unit.

3.5 Asssistance, service, returns and decommissioning

3.5.1 For technical assistance

Contact your local Spirax Sarco representative.

Details can be found on order/delivery documentation or on our web site: www.spiraxsarco.com

3.5.2 Service, Maintenance & Cleaning

No special servicing, preventative maintenance or inspection of the product is required.
For cleaning, use a dry cloth. Do not use detergent or water.

3.5.3 Serviceable parts

There are no user serviceable parts, battery is good for the life of the product.

3.5.4 Returning faulty equipment

Please return all items to your local Spirax Sarco representative. Please ensure all items are suitably packed for transit (preferably in the original cartons).
Please provide the following information with any equipment being returned:

1. Your name, company name, address and telephone number, order number and invoice and return delivery address.

2. Description and serial number of equipment being returned.

3. Full description of the fault or repair required.

4. If the equipment is being returned under warranty, please indicate:

    -   Date of purchase.

    -   Original order number.

3.5.5 Decommissioning

If the product is to be decomissioned please pay full attention to all sections of Section 2. Safety Information.

7. Technical information B850-W and B850-P

I type (0 / 4-20 mA current loop analog inputs)	
Transmitters supply	24 Vdc +10% / -20%; max 22 mA per channel (protected with PTC 50 mA fuse and 100 Ω resistor in series)
Maximum input voltage	±40 Vdc/SELV
RTD type (3 analog inputs for temperature sensors)	
Max input voltage	±40 Vdc/SELV
PULS type inputs (binary / pulse / frequency)	
Maximum input voltage	±40 Vdc/ SELV
4-20 mA analog outputs	
Maximum loop power supply voltage	28 Vdc/SELV
Binary outputs (B850-W-2 and B850-W-2-UL)	
Number of outputs	4
Type of outputs	3 pole (COM, NO, NC) electromechanical relay
Contact rating (resistive load)	3 A at 85 .. 250 Vac / 30 Vdc
Maximum switching voltage	250 Vac / 125 Vdc
Maximum switching power	750 VA / 90 W
Over voltage category	CAT III
Binary outputs (B850-P-2)	
Number of outputs	4
Type of outputs	2 pole Solid State Relay
Contact rating (resistive load)	0.1 A at 24 Vac/dc (max 42 Vac or 60 Vdc) /SELV
Maximum ON resistance	20 Ω
Galvanic isolation (optoisolation)	250 Vac continuous; 1 500 Vac for 1 minute
RS-485 / 422	
Maximum bus terminal voltages	-8 V … +13 V/SELV
Ethernet port	
Connection type	RJ-45/SELV

Power supply (B850-W-2 and B850-W-2-UL)	
Rated supply voltage	100-240 Vac; 50/60 Hz ∿
Supply voltage range	85 to 264 Vac; 47 .. 63 Hz ∿
Power consumption	Maximum 20 VA
Over voltage category	CAT III

Power supply (B850-P-2)	
Rated supply voltage	24 Vdc ⎓ (SELV and Limited Energy Supply)
Supply voltage range	18 .. 36 Vdc ⎓
Power consumption	Maximum 8 W

Enclosure (B850-W-2 and B850-W-2-UL)	
Protection class	IP65 (not UL evaluated)

Enclosure (B850-P-2)	
Protection class (front / rear)	IP65/IP20 (not UL evaluated)

Environmental conditions	
Ambient temperature	0 .. +55°C (32 .. 131°F)
Relative humidity	5 .. 95% (non-condensing)
Altitude	≤ 2000 m (6 562 ft) above sea level
Pollution degree	3 Panel version (when installed in an enclosure) 3 Wall version
Electrical safety	EN 61010-1 UL 61010-1, 3rd Edition CAN/CSA-C22.2 No. 61010-1, 3rd Edition
EMC	Immunity EN 61326-1 Table 2 Radiated and conducted emissions EN61326-1 Group 1 Class B
Installation location	Indoor use only

8. Mechanical installation

Note: Before actioning any installation observe the 'Safety information' in Section 2.

B850

The B850 is available for **wall mounting** B850-W-2 and B850-W-2-UL or for **panel mounting** B850-P-2.
Note: All versions must be fitted away from sources of excessive heat, electrical interference and from all areas liable to flooding.

Safety note - product specific

This product **must** be installed indoors only in one of the following ways:

Wall mounting

Fit cable glands/conduit with a minimum IP65 rating or install in a clean dry room to provide a pollution degree 3 environment in accordance with EN 60529 (Specification for degrees of protection provided by enclosures - IP code).

- Any unused cable glands/conduit entries **must** be sealed with an appropriate IP blind grommet.

Panel mounting

The panel mount version of the B850 is supplied with an IP65 rated seal to be fitted between the energy monitor and the panel it is to be mounted into.

Fig. 12 Panel mounting
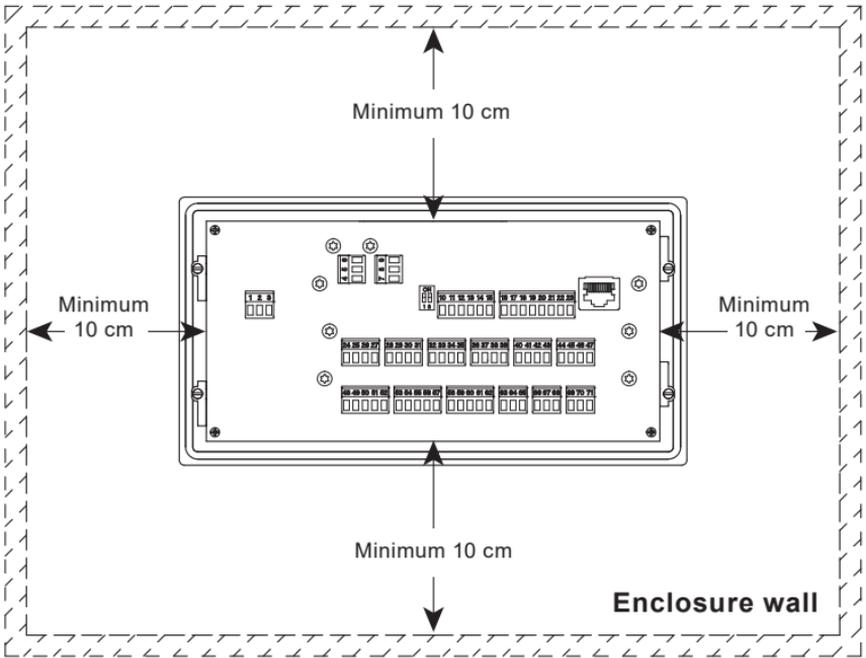
Fig.13 Panel unit rear view

Environmental conditions

The energy monitor should be located in an environment that minimises the effects of heat, vibration, shock and electrical interference.

The energy monitor should also be installed away from external magnetic fields, such as those generated from electric motors and large transformers.

Other considerations

Be sure to allow sufficient clearance for:

- Installation of conduit/wiring.

- Viewing of the display.

8.1
Mounting instructions for the wall mounted B850-W:

1. Using the dimensions shown in Figure 13, drill 3 holes suitable for accepting 5 mm (No. 10) screws.

2. Remove the terminals enclosure cover to expose the bottom mounting holes.

**3 x 5 mm (0.20")
Mounting
points**
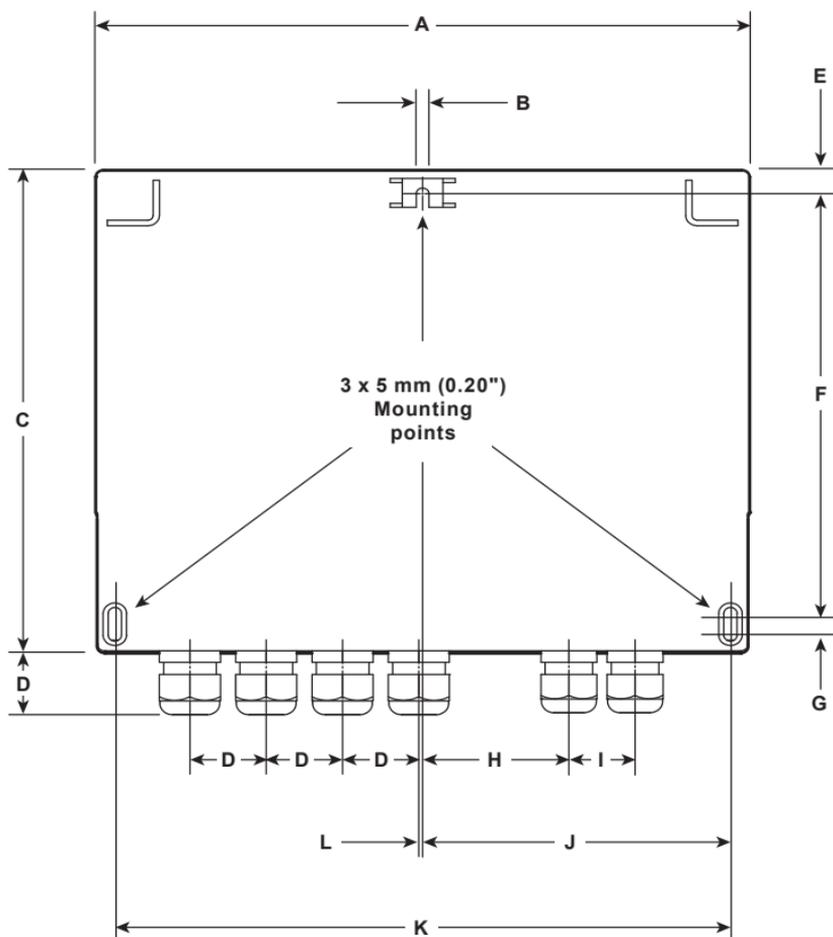
Dimensions (approximate in mm and inches) - B850-W (non cULus version)

A	B	C	D	E	F	G	H	I	J	K	L
257.00 mm	5.00 mm	217.00 mm	30.00 mm	10.60 mm	189.50 mm	10.00 mm	57.50 mm	26.00 mm	121.00 mm	242.00 mm	1.50 mm
10.12"	0.20"	8.54"	1.18"	0.42"	7.46"	0.40"	2.26"	1.02"	4.76"	9.53"	0.06"

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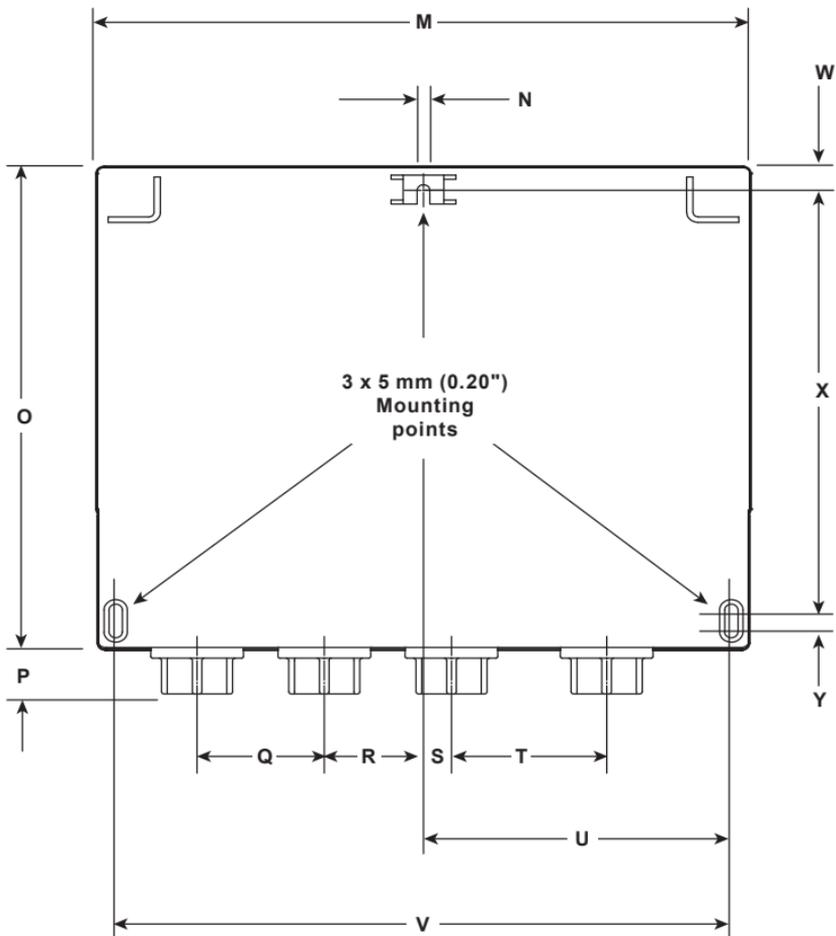
Dimensions (approximate in mm and inches) - B850-W (cULus version)

M	N	O	P	Q	R	S	T	U	V	W	X	Y
257.00 mm	5.00 mm	217.00 mm	21.00 mm	50.00 mm	39.00 mm	11.00 mm	61.00 mm	121.00 mm	242.00 mm	11.00 mm	189.50 mm	10.00 mm
10.12"	0.20"	8.54"	0.83"	1.97"	1.54"	0.43"	2.40"	4.76"	9.53"	0.43	7.46"	0.39"

B850-W and B850-P Boiler House Energy Monitor

Fig. 14 B850-W-2

Bottom mounting eyelet (access through the terminal compartment)

Fig. 15 B850-W-2-UL

Bottom mounting eyelet (access through the terminal compartment)

B850-W and B850-P Boiler House Energy Monitor

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3. Fix an M5 (No. 10) screw to the surface for the top mounting. Leave the head of the screw proud of the surface, just enough to allow the top mounting lug of the B850 to slide over.
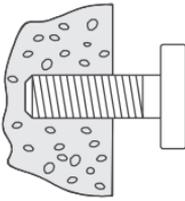
Mounting screw left proud of surface to slot top mounting of B850 over.

4. Slide the top mounting lug over the proud screw.

5. Line up, and fit the screws to the bottom mounting holes.

6. Refit the terminals enclosure cover.

Note: Before actioning any installation observe the 'Safety information' in Section 2.

Top mounting lug (external)

Fig. 16

B850-W and B850-P Boiler House Energy Monitor
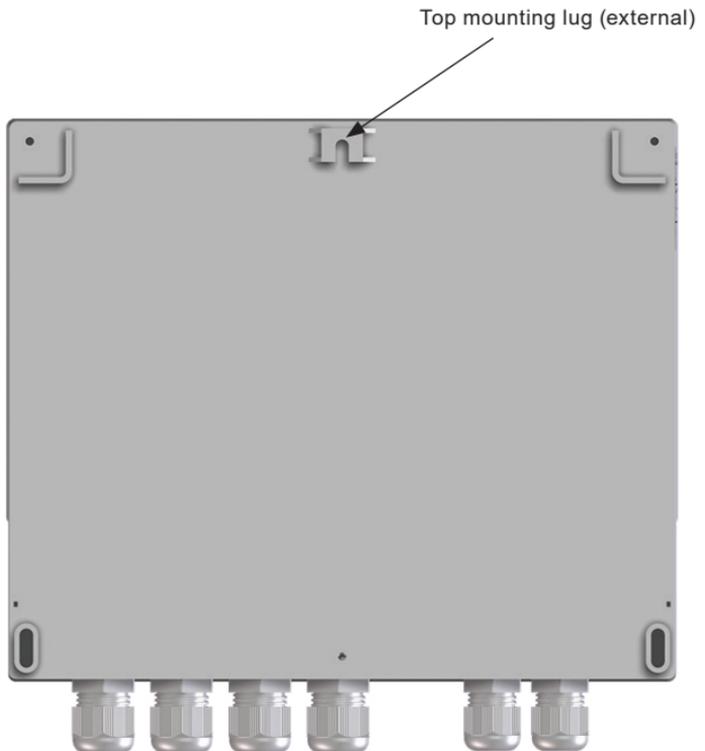
8.2 Mounting instructions for the panel mounted B850-P:

1. A rectangle aperture 186 mm (7⅜") wide x 92 mm (3⅝") high is required to mount the panel mounted version of the B850 energy monitor.

2. Push the B850 through the aperture ensuring that the seal is fitted correctly.

3. From the reverse side of the panel, using the mounting points on the sides of the B850, assemble the fixing clamps to the body.

4. Carefully wind in the clamps using the screwdriver slots to tighten the energy monitors to the panel.

Note: Screw clamps removed for clarity

Side view

Bottom view

Clamp screw

Clamp screw

Fig. 17

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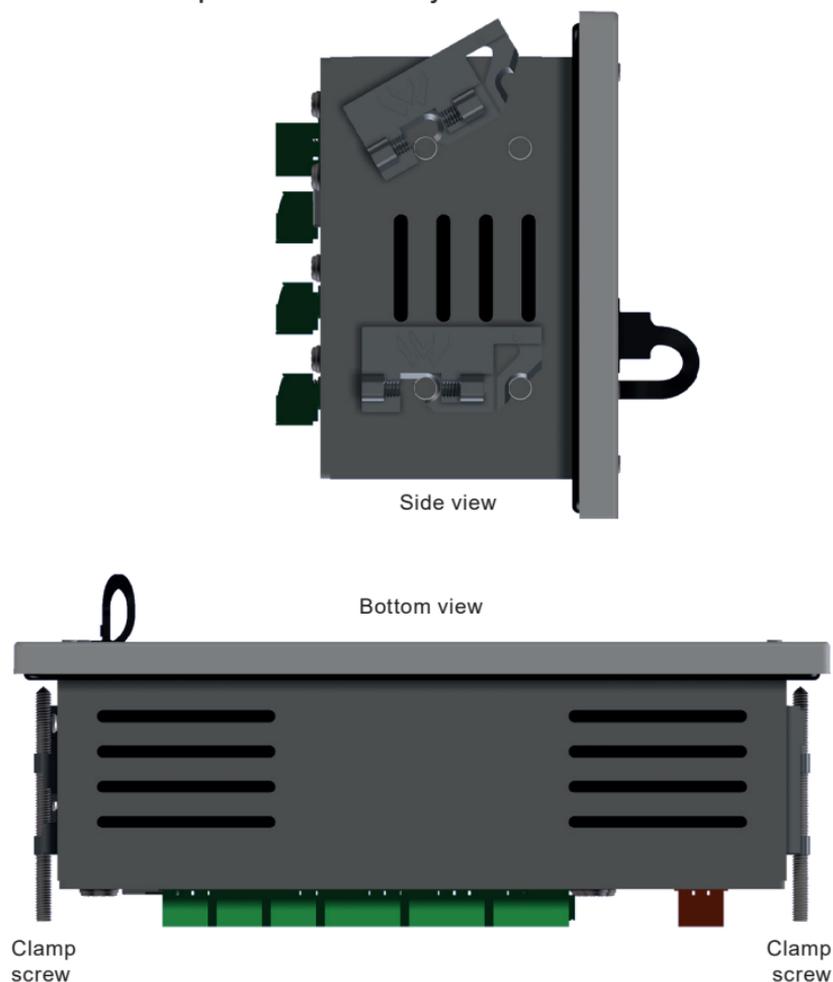
9. Electrical installation

Note: Before actioning any installation observe the 'Safety information' in Section 2.

9.1 Important -
please read the following general wiring notes:

Every effort has been made during the design of the energy monitor to ensure the safety of the user but the following precautions must be followed:

1. Installation personnel must be suitably qualified in working with equipment containing hazardous live voltages.

2. Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this manual.

3. Always isolate the energy monitor from the mains supply before opening the unit.

4. The design of the energy monitor relies on the building installation for overcurrent protection and primary isolation.

5. Overcurrent protection devices rated at 1 amp must be included in all phase conductors of the installation wiring. If overcurrent protection is included in both supply wires then the operation of one must also cause the operation of the other. Refer to IEC 60364 (Electrical Installations of Buildings) or prevalent local standard for full details of requirements for overcurrent protection.

6. Overcurrent protection devices must be fitted to the relay circuit and appropriately rated for the given loads stated in the technical data.

7. Relay contacts must be supplied at the same phase as the product's mains supply.

8. The wall energy monitor (B850-W) is designed as an installation category III product.

9. Install wiring in accordance with:

    -   IEC 60364 - Low-voltage electrical installation.

    -   National and Local Electrical Code (NEC) or Canadian code CEC) for the US and Canadian markets. Note; use NEC Class 1 wire with a temperature rating greater than 75°C. If the cable is to be exposed to a higher temperature, then a higher temperature rating needs to be selected.

10. All external circuits must meet and maintain the requirements of double/ reinforced installation as stated in IEC 60364 or equivalent.

11. Additional protection must be provided to prevent accessible parts (e.g. signal circuits) from becoming Hazardous Live if a wire or screw is accidentally loosened or freed. Ensure all wires are secured to at least one other wire from the same circuit. The attachment must be as close to the terminal block as possible but must not apply undue stress on the connection. Example, use a cable tie to secure the live and neutral wire together. If one wire becomes loose the other wire will prevent it from touching accessible parts.

B850-W and B850-P Boiler House Energy Monitor

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12. A disconnecting device (switch or circuit breaker) must be included in the building installation. It must:

- Have a rating with sufficient breaking capacity.

- Be in close proximity to the equipment, within easy reach of the operator but not cause difficulty in operating.

- Disconnect all phase conductors.

- Be marked as the disconnecting device for the energy monitor.

- Not interrupt a protective earth conductor.

- Not be incorporated into a mains supply cord.

- Comply with the requirements for a disconnecting device specified in IEC 60947-1 or UL 60947-1 (Specification for low-voltage switchgear and controlgear - General rules) and IEC 60947-3 or UL 60947-3 (Switches, disconnectors, switch-disconnectors and fuse-combination units).

13. It is important that the cable screens are connected as shown in order to comply with the electromagnetic compatibility requirements.

14. To keep the integrity of the IP rating, consideration must be taken when planning the installation of the wiring between the B850 and the various sensors and meters. It is recommended that one or more electrical junction boxes are used. Multicore cabling can be used between junction boxes to make the installation more efficient.

9.2 Important -
Please read the following general mains wiring notes:

1. The wiring connections are identified on the label inside the terminal cover of the wall mounting version.

2. Fuses should be installed in all live conductors.

Disconnect device conforming to IEC 60947-1 and IEC 60947-3 or UL 60947-1 and UL 60947-3
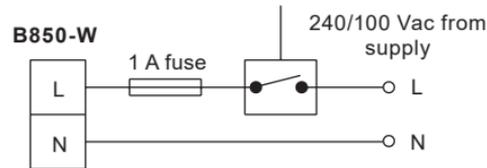
B850-W

240/100 Vac from supply

L — 1 A fuse — ⟋ — ○ L

N ——————— ○ N

⚡

Disconnect device conforming to IEC 60947-1 and IEC 60947-3 or UL 60947-1 and UL 60947-3

B850-W

240/100 Vac from supply

L — 1 A fuses — ○ L1

N ——————— ○ L2

⚡
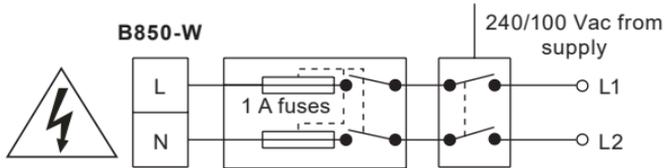
Single phase supply with neutral at earth potential

3. Double or reinforced insulation must be maintained between:

    -   Hazardous live conductors (mains and relays circuits)

    and

    -   Safety extra low voltages
        (All other components/connectors/conductors).

4. The wiring diagrams show relays and switches in the power off position.

Mains and signal wiring:
For cable/wire recommendations see IM-P408-03 Boiler House Energy Monitor Installation and Maintenance Instructions.

Screen connection
An earth current loop is created if a wire or screen is connected between two earth points, which are at different potential (voltage). If the instructions are followed correctly, then the screen will only be connected to the earth at one end.

The earth terminal is a functional earth rather than a protective earth.

A protective earth provides protection from electric shock under a single fault condition. This product has double insulation and therefore does not require a protective earth. A functional earth is used in order for the product to operate. In this application, the earth is used as a sink or drain for any electrical interference. The screens must be connected to the earth terminal in order to conform to the EMC directive.


Wall mounted B850-W boiler house energy monitor

Wiring diagram
from
Section 15, Appendix, IM-P408-03

Terminal	Signal	Description
25		
28	IN 1 +24 V	0/4 - 20 mA
29	IN 1 I +	ILVA flowmeter for steam
30		(m bar or psi)

26		
31	IN 2 +24 V	0/4 - 20 mA
32	IN 2 I +	EL2600 pressure sensor
33		for steam pressure, (bar g or psi g)

27		
34		0/4 - 20 mA
35	IN 3 I +	ELM flowmeter for feedwater
36	IN 3 I -	(m^3/h or gal/m)

46		
37		0/4 - 20 mA
38	IN 4 I +	ELM flowmeter for make-up
39	IN 4 I -	water (m^3/h or gal/m)

47		
40		0/4 - 20 mA
41	IN 5 I +	MTL10 flowmeter for GAS
42	IN 5 I -	(m^3/h or ft3/m)

49	IN 7 I +	
50	IN 7 I -	PRT
52	IN 7 U +	EL2270 temperature probe for
53	IN 7 U -	feedwater temperature
51/54		

55	IN 8 I +	
56	IN 8 I -	PRT
58	IN 8 U +	EL2270 temperature probe for
59	IN 8 U -	condensate return temperature
57/60		

67	IN 10 F +	
68	IN 10 F -	State
69		TDS blowdown valve '0 Volt' contact

70	IN 11 F +	
71	IN 11 F -	State
72		BBD blowdown valve '0 Volt' contact

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Panel mounted B850-P boiler house energy monitor

Terminal	Label	Connection
1	+	
2	−	24 Vdc 8 W maximum
3	⏚	
16	Relay 1 (of 4)	
17	Relay 1 (of 4)	Solid state relay 24 V 0.1 A
13	RS-485	A(+)
14	RS-485	B(-) Modbus RTU slave
15	RS-485	GND
19	Out 1 (of 2)	I+
5	Out 1 (of 2)	I- 4 - 20 mA Output
4		
	RJ-45	Ethernet LAN

Wiring diagram
from
Section 15, Appendix, IM-P408-03

Terminals	IN	Signal	Description
27 24 25 26	IN 1 / IN 1	+24 V / I +	0/4 - 20 mA ILVA flowmeter for steam (m bar or psi)
31 28 29 30	IN 2 / IN 2	+24 V / I +	0/4 - 20 mA EL2600 pressure sensor for steam pressure, (bar g or psi g)
35 32 33 34	IN 3 / IN 3	I + / I -	0/4 - 20 mA ELM flowmeter for feedwater (m^3/h or gal/m)
39 36 37 38	IN 4 / IN 4	I + / I -	0/4 - 20 mA ELM flowmeter for make-up water (m^3/h or gal/m)
43 40 41 42	IN 5 / IN 5	I + / I -	0/4 - 20 mA MTL10 flowmeter for GAS (m^3/h or ft3/m)
48 51 49 50 52	IN 7 / IN 7 / IN 7 / IN 7	I + / I - / U + / U -	PRT EL2270 temperature probe for feedwater temperature
53 56 54 55 57	IN 8 / IN 8 / IN 8 / IN 8	I + / I - / U + / U -	PRT EL2270 temperature probe for condensate return temperature
63 64 65	IN 10 / IN 10	F + / F -	State TDS blowdown valve '0 Volt' contact
66 67 68	IN 11 / IN 11	F + / F -	State BBD blowdown valve '0 Volt' contact

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10. Commissioning

10.19 B850 energy monitor commissioning using PC software for quick start-up

The B850 energy monitor can be commissioned via the key pad on the front panel of the unit itself, or via separate PC software.

The B850 is supplied with a USB memory stick which contains the PC software, product manuals and associated files.

For quick start commissioning the PC software is used and illustrated in this manual.

1. Plug the memory stick into a suitable empty USB connection on your PC / laptop.

2. Using the windows operating sytem locate the PC Software on the memory stick (the file name is '850 vX.00.00_RC', where X is the version number).

The icon looks like

The software can be run from the memory stick or copied onto your PC / laptop.

3. Double click on the icon to run the software. If presented with security warnings say yes to continue, or contact your IT administrator for guidance.

4. Select the language you wish the software to use (English, French, German, Spanish, Portugese or Polish).
 Click' OK

10.20 Units and fuel selection

A grey screen will appear.

To create a new BEM configuration 'Click' on File/New Settings and select either imperial or metric units, a pop up will appear allowing you to choose your fuel type.

This Quickstart IM has been written to be used in conjuction with the 'Gas-Quickstart' option, choose 'Custom' options if you requiring a different configuration.
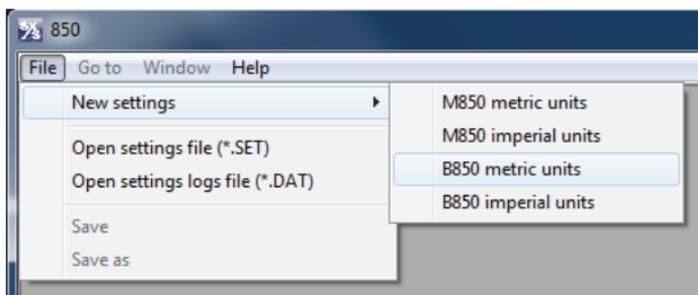
Select units and then 'Gas - Quickstart' or 'fuel type - custom'.
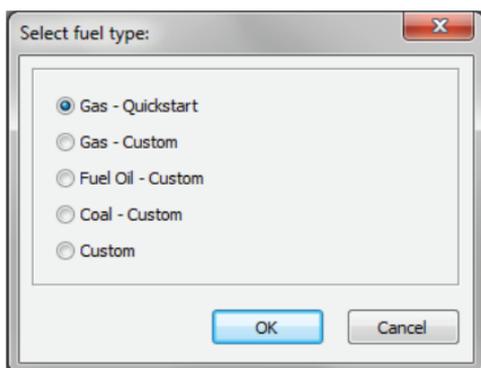
To open an existing BEM configuration 'Click' on File / Open Settings file (*.SET).

B850-W and B850-P Boiler House Energy Monitor
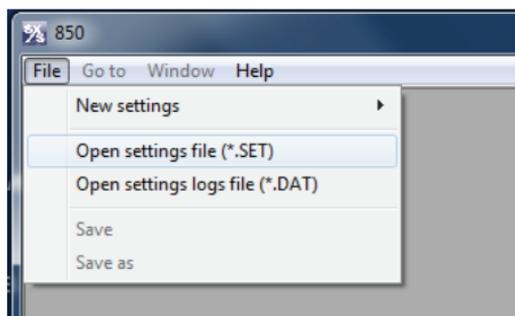
Use the windows operating system to locate and load the desired configuration file.
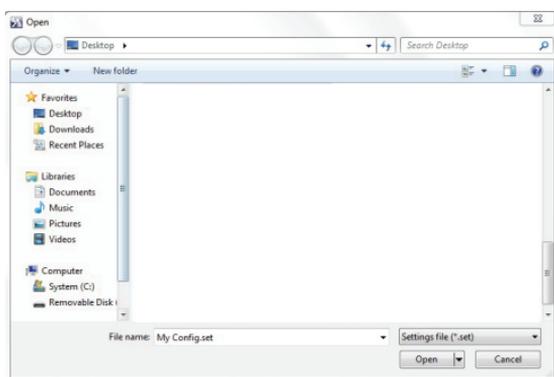
Select fuel type that the configuration was designed for and click OK.
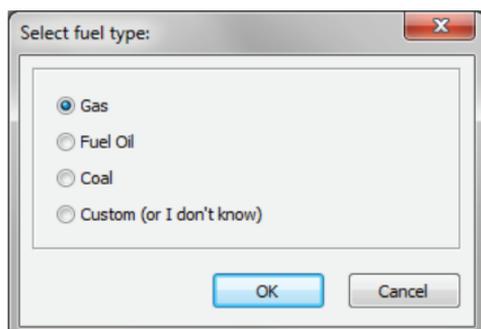
10.21 BEM gas configuration quick start

A partly configured BEM configuration will be presented.
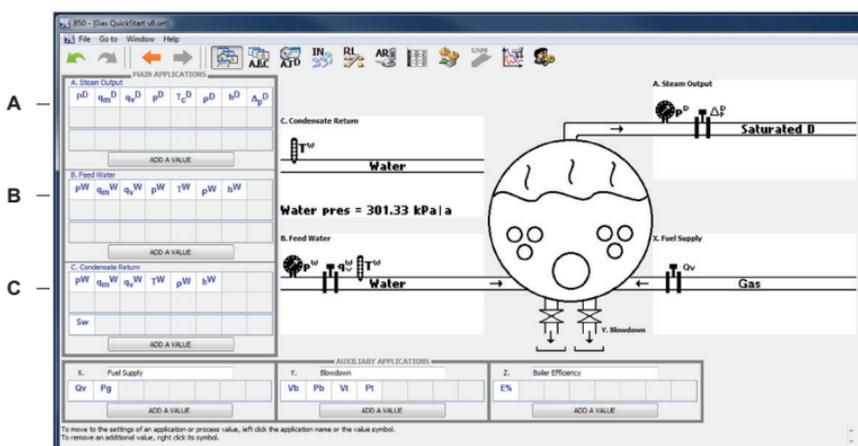
Main applications

The process values and inputs have been partly pre-configured for the following applications:

A. Steam output.

B. Feedwater.

C. Condensate return.
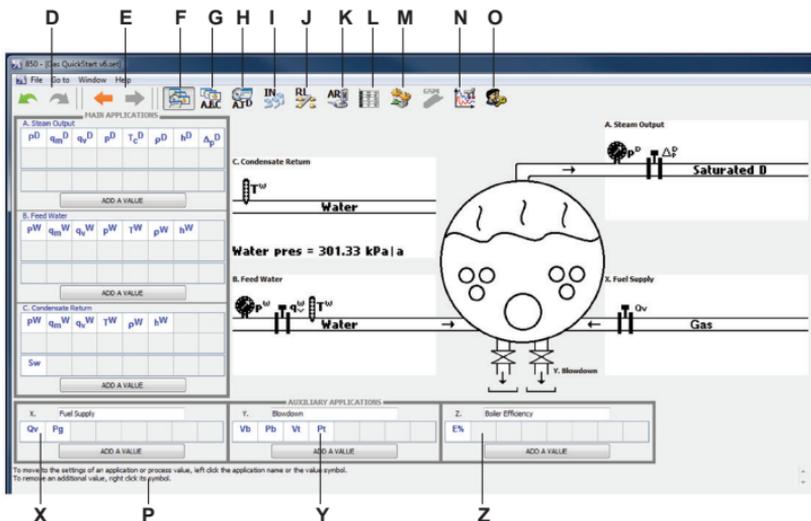
Control buttons:

D. Undo / Redo Arrows - Allows you to undo and redo your last changes.

E. Forward and Back - Returns to the previous screen and moves back to the most recent screen.

F. Returns you to the main application and its process values.

G. Click for main applications.

H. Click for process values.

I. Set up for inputs.

J. Set up for Relay Outputs.

K. Configure Archives.

L. Click to configure how data is displayed on the B850's display.

M. Setup the communications outputs.

N. Media and characteristic manager.

O. Admin and User configuration.

P. Help and Comments appear throughout the software application.

Auxiliary applications
Calculations and inputs have been partly pre-configured for the following auxiliary applications:

X. Fuel supply.

Y. Blowdown.

Z. Boiler efficiency.

10.22 BEM configuration parameters

The following table in conjunction with Sections 10.23 to 10.37 are the recommended order of stages for setting up the BEM. The table lists out the required values that will need to be entered into each stage. The table can be used as a check list and ticked off at each stages completion. Save the configuration at each stage to minimise the risk of data loss. This Quick Start instruction must be used with the B850 Boiler House Energy Monitor Installation and Maintenance Instruction IM-P408-03.

Tick when complete

10.23 Steam output (see Section 10.23)

Type		V		
Size		W		
Max F		X		
Steam dryness		Y		
Ref pres		Z		
Ref temp				

10.24 Feedwater (see Section 10.24)

	Value	**Units**	
Ref pres			
Ref temp			

10.25 Condensate return (see Section 10.25)

	Value	**Units**	
Nom pres			
Ref pres			
Ref temp			

10.26 Inputs, continued from page 32

	Value	Units	Tick when complete
IN1 - Other			
IN2 - 4 mA			
IN2 - 20 mA			
IN2 - Alarm			
IN2 - Other			
IN3 - 4 mA			
IN3 - 20 mA			
IN3 - Alarm			
IN3 - Other			
IN4 - 4 mA			
IN4 - 20 mA			
IN4 - Alarm			
IN4 - Other			
IN5 - 4 mA		m³/h or ft³/m	
IN5 - 20 mA		m³/h or ft³/m	
IN5 - Alarm			
IN5 - Other			
IN7 - Adjustment			
IN7 - Alarm			
IN7 - Other			
IN8 - Adjustment			
IN8 - Alarm			
IN8 - Other			
IN10 - Mode			
IN10 - Unit			
IN10 - Low Hz			
IN10 - High Hz			
IN10 - Other			
IN11 - Mode			
IN11 - Unit			
IN11 - Low Hz			
IN11 - High Hz			
IN11 - Other			

Tick when
complete

10.27 Steam output process values (see Section 10.27)

Alarm	
Threshold	
Other	

10.28 Feedwater process values (see Section 10.28)

Alarm	
Threshold	
Other	

10.29 Condensate return process values (see Section 10.29)

Alarm	
Threshold	
Other	

10.30 Fuel input (see Section 10.30)

Alarm	
Other	

10.30.2 Fuel input calculation (see Section 10.30.2)

Calorific Value	

10.31 Blowdown and TDS (see Section 10.31)

10.31.1 Bottom blowdown calculation (see Section 10.31.1)

Flow co-efficient K_V / C_V	
Enthalpy	
Density	

10.31.2 TDS calculation (see Section 10.31.2)

Flow co-efficient K_V / C_V	
Enthalpy	
Density	

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Tick when
complete

10.32 Boiler efficiency (see Section 10.32)

Filter	
Alarm	
Threshold	
Other	

10.33 Relay outputs (see Section 10.33)

RL1	
RL2	
RL3	
RL4	

10.35 4-20 mA output and other settings (see Section 10.35)

10.23 Steam output

Click on main applications, the Steam Output application will be displayed.

Enter Max F and coefficients from the flowmeter calibration certificate (this screen shot shows ILVA)*
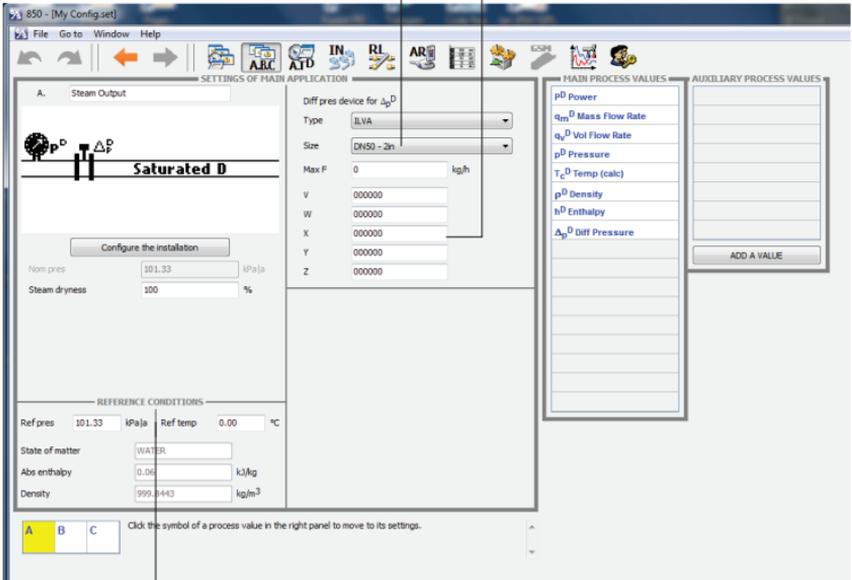
Set flowmeter size

Set reference conditions, typically not required.

Please refer to the flowmeter manual (in this case ILVA) for mechanical installation and Appendix 1 - BEM Typical Wiring Diagrams.

*ILVA flowmeters require V, W, X, Y and Z coefficient values.
*GILFLO flowmeters require A, B, C, D and E coefficient values.

10.24 Feedwater
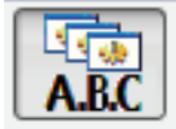
Click on main applications, then B, the feedwater
application will be displayed.
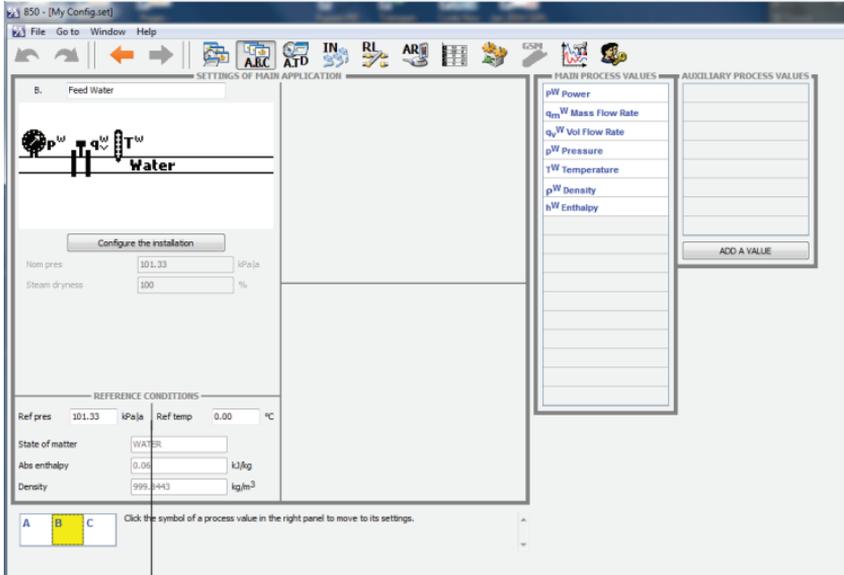
Set reference conditions, typically not required.

Please refer to the flowmeter manual (in this case ELM) for mechanical installation, and
set up of its 4-20 mA output and Appendix 1 - BEM Typical Wiring Diagrams.

10.25 Condensate return

Click on main applications, then C, the condensate return
application will be displayed.

The nominal pressure must be determined and entered.
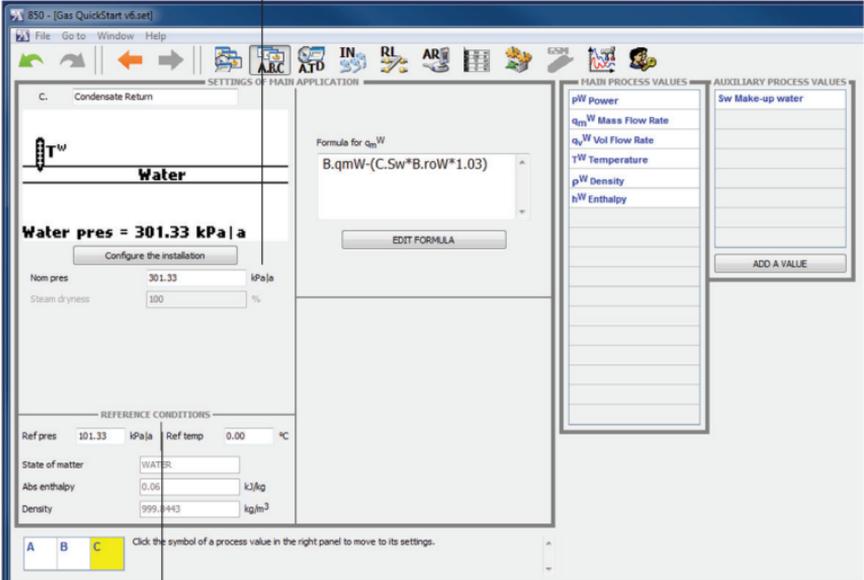
Set reference conditions.

Please refer to the flowmeter manual (in this case ELM) for mechanical installation, and
set up of its 4-20 mA output and pages 13 to 16 for the Wiring Diagrams.

10.26 Inputs

Configure inputs.

Assigned inputs to process values.
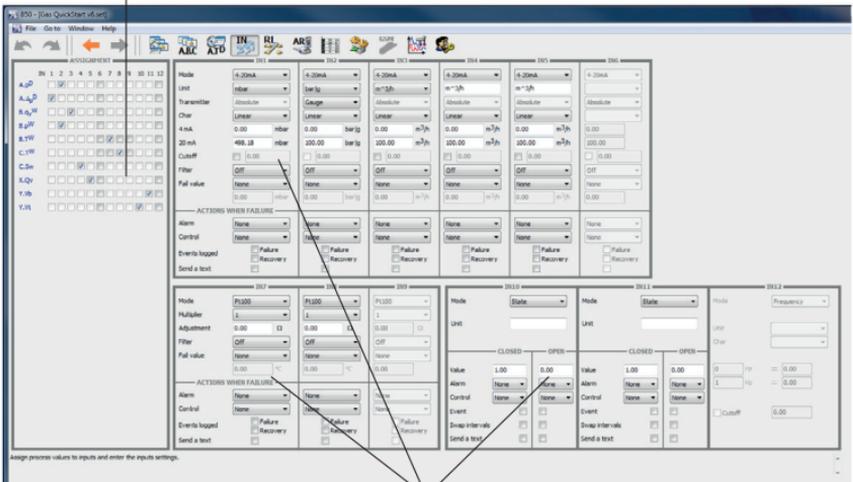
Select input parameters

Steam inputs

A.P^D input 2 for the steam pressure sensor, range 4-20 mA input, or may be configured for temperature sensor.

A.Δp^D input 1 ILVA steam flowmeter, range 4-20 mA input.

Feedwater inputs

B.q$_v$^{W} input 3 for the feedwater ELM flowmeter, range 4-20 mA input.

B.p ^{W} input 2 taken from the Steam Output is used to give a pressure figure for the feedwater input.

B.T ^{W} input 7 for the feedwater temperature, set Pt100 parameters.

Condensate Return inputs

C. S^W input 4 for the make-up water ELM flowmeter, range 4-20 mA input.

C.T ^{W} input 8 for the condensate return temperature, set Pt100 parameters.

GAS Flow inputs

X.Qv input 5 for GAS MTL10 flowmeter, range 4-20 mA input.

Blowdown

Y.Vb input 11 for BBD valve input, set its ranges.

Y.Vt input 10 for TDS valve input, set its ranges.

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Range the 4 - 20 mA inputs for the flowmeters on inputs 1, 3, 4 and 5 and pressure sensor on input 1.

	IN1		IN2		IN3		IN4		IN5	
Mode	4-20mA		4-20mA		4-20mA		4-20mA		4-20mA	
Unit	mbar		bar|g		m^3/h		m^3/h		m^3/h	
Transmitter	Absolute		Gauge		Absolute		Absolute		Absolute	
Char	Linear		Linear		Linear		Linear		Linear	
4 mA	0	mbar	0	bar|g	0.00	m³/h	0.00	m³/h	0.00	m³/h
20 mA	498.18	mbar	49.818	bar|g	100.00	m³/h	100.00	m³/h	100.00	m³/h
Cutoff	☐ 0.00		☐ 0.00		☐ 0.00		☐ 0.00		☐ 0.00	
Filter	Off		Off		Off		Off		Off	
Fail value	None		None		None		None		None	
	0.00	mbar	0.00	bar|g	0.00	m³/h	0.00	m³/h	0.00	m³/h
ACTIONS WHEN FAILURE										
Alarm	None		None		None		None		None	
Control	None		None		None		None		None	
Events logged	☐ Failure ☐ Recovery		☐ Failure ☐ Recovery		☐ Failure ☐ Recovery		☐ Failure ☐ Recovery		☐ Failure ☐ Recovery	
Send a text	☐		☐		☐		☐		☐	

Set Pt100 parameters for input 7 and 8.

	IN7		IN8	
Mode	Pt100		Pt100	
Multiplier	1		1	
Adjustment	0.00	Ω	0.00	Ω
Filter	Off		Off	
Fail value	None		None	
	0.00	°C	0.00	°C
ACTIONS WHEN FAILURE				
Alarm	None		None	
Control	None		None	
Events logged	☐ Failure ☐ Recovery		☐ Failure ☐ Recovery	
Send a text	☐		☐	

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Set ranges for BBD and TDS controller inputs on input 10 and 11.

Valve	Circuit	Value
Open	closed	1
Closed	open	0

PULS – type inputs: IN10, IN11 and IN12 may be set as '0' volt contacts for automated TDS Blowdown and Bottom Blowdown systems. Ensure voltage does not exceed 40 V.

10.27 Steam output process values

Click on process values, and the steam output process values will be displayed.

Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Steam Output Process, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

It is recommended that at least 1 totaliser for Steam Output Process is configured.

10.28 Feedwater process values

Click on process values, then B, the feedwater process values will be displayed.

Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Feedwater Process, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03. The Quickstart Configuration is pre-configured with suitable settings.

The Quickstart Configuration is pre-configured with suitable settings.

It is recommended that at least 1 totaliser for the Feedwater Process is configured.

10.29 Condensate return process values

Click on process values, then C, the condensate return process values will be displayed.
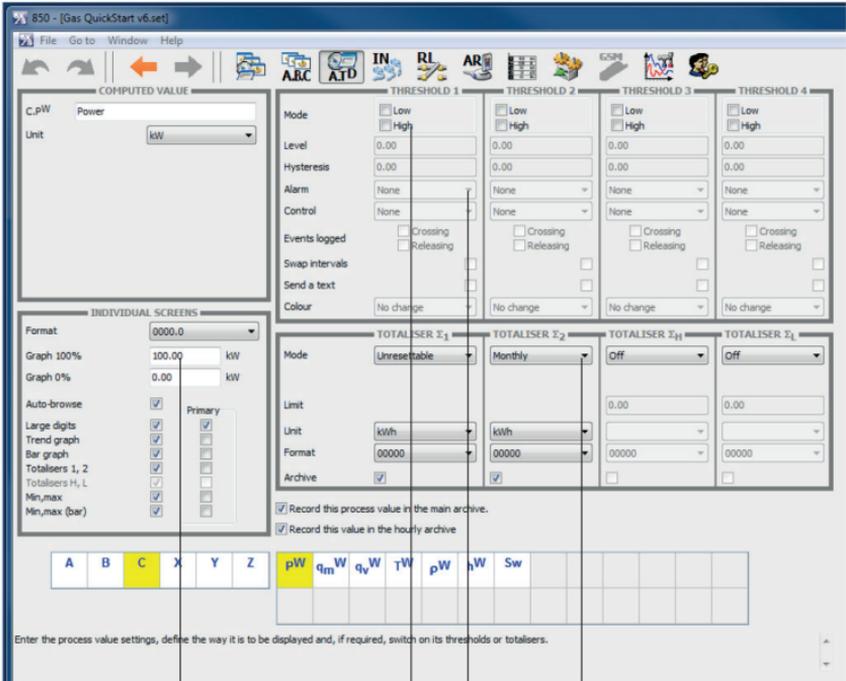
Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Condensate Return, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

It is recommended that at least 1 totaliser for Condensate Return is configured.

10.30 Fuel input

10.30.1 Fuel input flowrate

Click on process values, then X, the boiler efficiency calculation will be displayed.
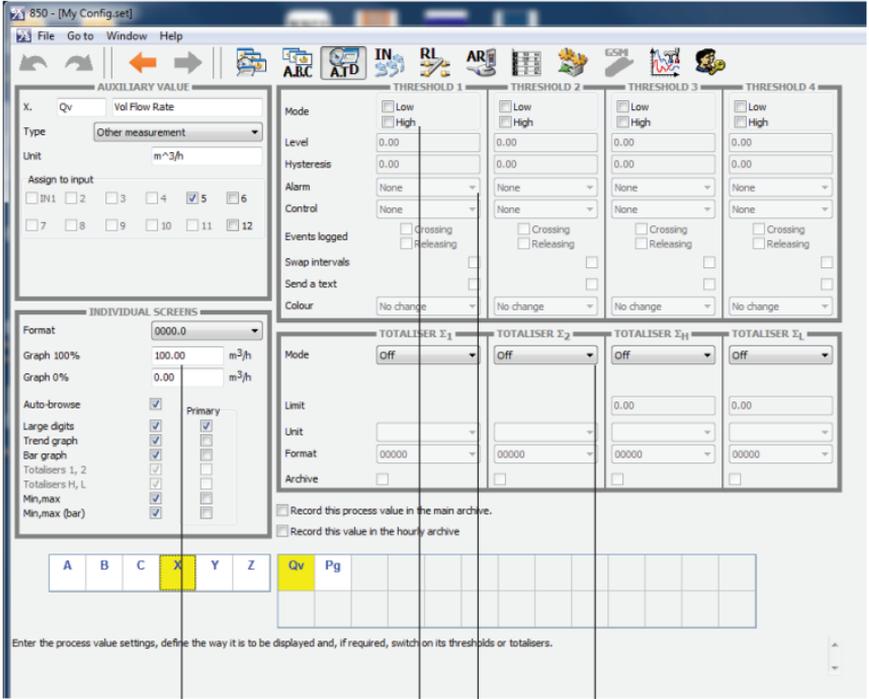
Click on the process values.

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Fuel Input Flowrate, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

Please refer to the flowmeter manual (in this case MTL10) for mechanical installation, and set up of its 4-20 mA output and pages 15 to 18 for the Wiring Diagrams.

10.30.2 Fuel input calculation

Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Fuel Input Calculation, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

It is recommended that at least 1 totaliser for Fuel Input Calculation is configured.

When you enter this screen a pop-up will be displayed to remind you to enter the calorific value (CV), click enter to clear the pop-up. Once you have entered a value the pop-up will not re-appear.

IMPORTANT, USER INPUT REQUIRED
Reference formula in Auxiliary value field
X.Qv*1/3600
Replace **1** with Gas Calorific Value
Please consult Installation Manual for more detailed information

[OK]
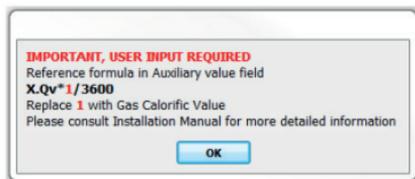
Calculation for Metric (kW)

$$X.Qv*1/3600$$

A calorific value (CV) for the fuel must be entered into the calculation.

Click on:

[EDIT FORMULA]

Edit the '1' in the above calculation and add the calorific value for your fuel type.

The calorific value (CV) must be entered in units of kJ/m**3**.

Q_V = Flowrate measured on Input 5 in m³/hr

Depending on the output of the fuel flow meter a unit correction may be required to convert the calculation into seconds. For example, Qv*CV/3600. Where 3600 converts from/h to/sec

Calculation for Imperial (MBtu/h)

$$X.Qv*1*60/1000$$

A calorific value (CV) for the fuel must be entered into the calculation.
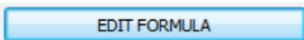
Click on:

[EDIT FORMULA]

Edit the '1' in the above calculation and add the calorific value for your fuel type.

The calorific value (CV) must be entered in units of Btu/ft**3**.

Q_V = Flowrate measured on Input 5 in ft³/m

Depending on the output of the fuel flowmeter a unit correction may be required to convert the calculation into hours. For example, Qv*CV *60. Where 60 converts from/m to/h

10.31 Blowdown and TDS

10.31.1 Bottom blowdown calculation
Click on process values 'Y' then Pb the BBD valve input calculation will then be displayed, input values required.

Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Bottom Blowdown Calculation, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

When you enter this screen a pop-up will be displayed to remind you to enter the Flow co-efficient, Enthalpy and Density, click enter to clear the pop-up. Once you have entered a value the pop-up will not re-appear.

Calculation for Metric (kW)

                    Kv   Enthalpy   Density

(Y.Vb**1*1*1***s qr t((A .p D * 0. 9)*10 0 0/1))
————————————————————————————————
                    3600

Click on

EDIT FORMULA

Edit each '1' in the above calculation to add the following values:

Flow co-efficient - K_V - Value must be taken from the technical documentation of the BBD Valve.

Enthalpy (kJ / kg) - Derive the value for your boiler from the look up tables in Section 10.31.3

Density (kg / m³) - Derive the value for your boiler from the look up tables in Section 10.31.3

Other measured units: Pressure (bar) and Relative Density (kg / m³).

It is assumed that there will be a backpressure of 10%, so a factor of 0.9 can be seen in the calculation. If backpressure is different adjust formula accordingly.

Calculation for Imperial (MBtu / h)

            Cv   **Enthalpy**   **Density**

$$\frac{(\ Y.Vb*1*1*1*8.020833*s\ qr\ t\ ((A\ .\ p\ D\ *\ 0.\ 9)*\ 6\ 2\ .\ 4279\ 6/1))}{1000}$$

Click on

                        EDIT FORMULA

Edit each '1' in the above calculation to add the following values:

Flow co-efficient - C_V - Value must be taken from the technical documentation of the BBD Valve ($C_V = K_V$ x 1.156).

Enthalpy (Btu / lb) - Derive the value for your boiler from the look up tables in Section 10.31.3

Density (lb / ft³) - Derive the value for your boiler from the look up tables in Section 10.31.3

Other measured units: Pressure (psi) and Relative Density (lb / ft³).

It is assumed that there will be a backpressure of 10%, so a factor of 0.9 can be seen in the calculation. If backpressure is different adjust formula accordingly.

10.31.2 TDS calculation

Click on process values 'Y' then Pt the BBD valve input calculation
will then be displayed, input values required.

Click on the process values

Thresholds (**T**), totalisers (**t**), alarms (**A**) and graph settings (**G**) can be set up for the Bottom Blowdown Calculation, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

The Quickstart Configuration is pre-configured with suitable settings.

10.31.3 Tables for TDS and BBD

Typical boiler pressures	Density	Enthalpy
bar g	kg/m³	kJ/kg
5	915.3	640.0
10	887.2	762.3
15	886.8	844.3
20	849.9	908.2

Typical boiler pressures	Density	Enthalpy
psi g	lb/ft³	Btu/lb
100	56.39	298.49
150	55.29	330.58
200	54.39	355.45
250	53.61	376.18
300	52.92	394.02

When you enter this screen a pop-up will be displayed to remind you to enter the Flow co-efficient, Enthalpy and Density, click enter to clear the pop-up. Once you have entered a value the pop-up will not re-appear.

Calculation for Metric (kW)

Kv Enthalpy Density

$$\frac{(\text{Y.Vt}*\textbf{1}*\textbf{1}*\textbf{1}*s\ qr\ t((A\ .p\ D * 0.\ 9)*10\ 0\ 0/1))}{3600}$$

Click on

EDIT FORMULA

Edit each '1' in the above calculation to add the following values:

Flow co-efficient - K_V - Value must be taken from the technical documentation of the BBD Valve.

Enthalpy (kJ / kg) - Derive the value for your boiler from the look up tables in Section 10.31.3

Density (kg / m³) - Derive the value for your boiler from the look up tables in Section 10.31.3

Other measured units: Pressure (bar) and Relative Density (kg / m³).

It is assumed that there will be a backpressure of 10%, so a factor of 0.9 can be seen in the calculation. If backpressure is different adjust formula accordingly.

Calculation for Imperial (MBtu / h)

         Cv   Enthalpy   Density

$$\frac{(\ Y.Vt*1*1*1*8.020833*sqrt((A.pD*0.9)*62.42796/1))}{1000}$$

Click on   [EDIT FORMULA]

Edit each '1' in the above calculation to add the following values:

Flow co-efficient - C_V - Value must be taken from the technical documentation of the BBD Valve (C_V = K_V x 1.156).

Enthalpy (Btu / lb) - Derive the value for your boiler from the look up tables in Section 10.31.3

Density (lb /ft³) - Derive the value for your boiler from the look up tables in Section 10.31.3

Other measured units: Pressure (psi) and Relative Density (lb / ft³).

It is assumed that there will be a backpressure of 10%, so a factor of 0.9 can be seen in the calculation. If backpressure is different adjust formula accordingly.

10.32 Boiler efficiency

Click on process values, then Z, the boiler efficiency calculation will be displayed.

G

T

A

Click on the process values

Check / Select filter and set to 30 mins

Thresholds (**T**), alarms (**A**) and graph settings (**G**) can be set up for the Boiler Efficiency, for full details see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03.

10.33 Relay outputs

Click on relay outputs.

Four relay outputs can be configured.

If you have set a requirement for a relay output in the threshold settings of Section 10.27 to Section 10.32 you can set the relay activity, they can also be ascociated with Alarms.

10.34 Display screen settings

Click on screen settings.

Adding information to the B850 display.
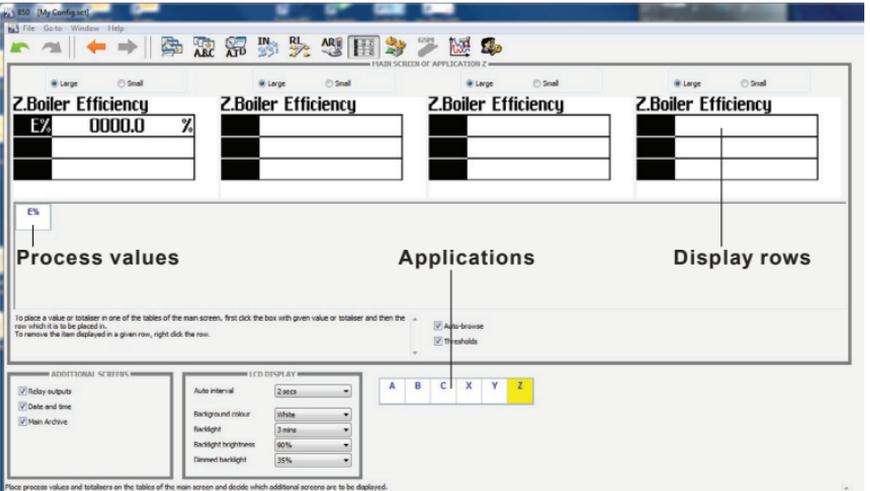
Click on applications to select process values.

Click to highlight process value desired and then click in desired row of display.

To remove a process value from the display, right click on the display row and click remove.

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10.35
4 - 20 mA output and other settings

Click on relay outputs.

Select required serial communication protocol (ASCII, GSM, Modbus RTU, BACnet) and parameters.

Communication with a computer system.

The unit can be connected to the master computer system by:

- Built-in serial RS-485 port; available is ASCII own protocol, Modbus RTU protocol and BACnet MSTP.

- Ethernet port, available is web server, Modbus TCP protocol and BACnet IP.

- In addition, the RS-485 port can be used to connect the GSM module, it enables transfer of information about failures, alarms and measurement values in the form of SMS text messages.

For further details on the Sections listed above and for functions 'Media and Characteristic Manager' and 'Administrative Data', see B850 Boiler House Energy Monitor Installation and Maintenance Instructions IM-P408-03, located on the memory stick supplied with the product.

10.36 Saving your configuration

The configuration can now be saved. You can save to either the PC / laptop or memory stick if you require to configure the system further.

Save the configuration onto the memory stick if you wish to load it onto the B850.
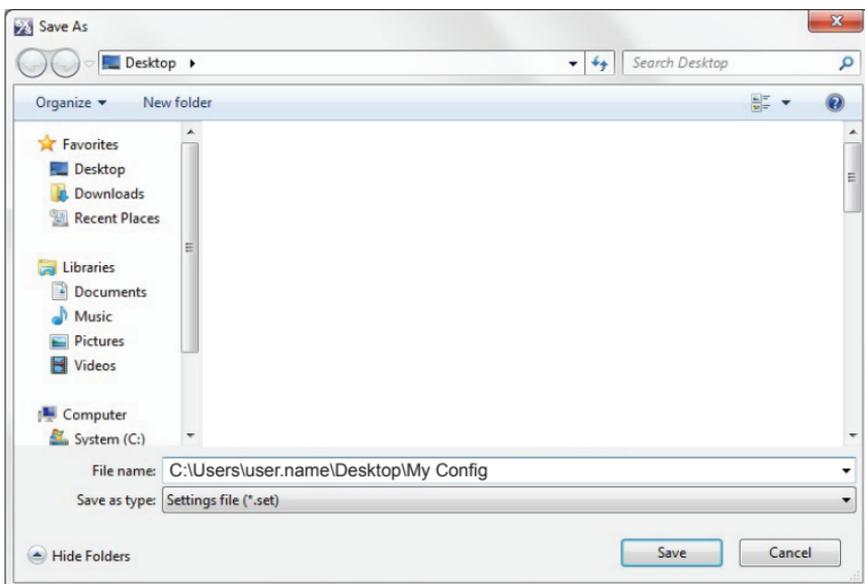
It may be useful to limit your file name to 8 characters in length as the B850 will truncate longer file names when displaying them on its screen.

10.37 Loading your configuration onto the B850

The configuration needs to be saved onto a suitable memory stick and the B850 powered up and operational. Remove the dust plug from the USB terminal on the front of the B850 and plug in the memory stick.

→ MAIN MENU → Load or Save settings → Load

Highlight your file and click LOAD button, you configuration will now be loaded. You will be asked to confirm the action click YES.

If you are not already logged in you will be asked to enter a password (see IM-P408-03 Installation and Maintenance Instructions for ADMIN password if required), click OK.

Do you want to load new settings from the file? The current settings and passwords will be irretrievably lost.

YES   NO

The command attempted is only allowed for admin.

Enter password: ●

1,2,3   4,5,6   7,8,9

OK

The new settings have been loaded. The device will now restart.

OK

Click OK and the unit will restart with the configuration loaded.

15. Appendix

15.1 Process values

List of process values used in the BEM:

Application A (Section 10.23 and Section 10.27)

P^D Steam heat flowrate.

qm^D Mass flowrate of steam.

qv^D Volume flowrate of steam.

p^D Steam measured pressure (only for superheated or saturated steam with pressure measurement).

T_c^D Saturated steam temperature based on saturation curve (only for saturated steam with pressure measurement).

ρ^D Steam density.

h^D Steam enthalpy.

$\triangle p^D$ Pressure difference at orifice in differential pressure device (only if differential pressure device was chosen).

Applications B (Section 10.24 and 10.28)

P^W Feedwater heat flowrate.

q_m^W Feedwater mass flowrate.

q_v^W Feedwater volume flowrate.

T^W Feedwater temperature.

ρ^W Feedwater density.

h^W Feedwater enthalpy.

Applications C (Section 10.25 and Section 10.29)

P^W Condensate heat flowrate.

q_m^W Condensate mass flowrate.

q_v^W Condensate volume flowrate.

T^W Condensate temperature.

ρ^W Condensate density.

h^W Condensate enthalpy.

h^W Condensate enthalpy.

S^W Make-up water volume flow rate

Application X (Section 10.30)

Qv   Gas mass flowrate.

Pg   Computed value

Application Y (Section 10.31)

Vb   Measurement bottom blowdown valve input.

Pb   Computed value bottom blowdown.

Vt   Measurement TDS valve input.

**Pt**   Computed value TDS blowdown.

Application Z (Section 10.32)

E%   Computed value boiler efficiency.

15.2 Spare inputs

Wall mounted B850-W boiler house energy monitor

Terminal		Label		
48	⊘			
43	⊘	In 6	+24 V	
44	⊘	In 6	I +	0/4 - 20 mA input
45	⊘	In 6	I -	
61	⊘	In 9	I +	
62	⊘	In 9	I -	RTD input
64	⊘	In 9	U +	
65	⊘	In 9	U -	
63/66	⊘			
73	⊘	In 12	F +	PULSE input
74	⊘	In 12	FIN	
75	⊘			

Panel mounted B850-P boiler house energy monitor

Terminal		Label		
47	⊘			
44	⊘	In 6	+24 V	
45	⊘	In 6	I +	0/4 - 20 mA input
46	⊘	In 6	I -	
58	⊘	In 9	I +	
61	⊘	In 9	I -	RTD input
59	⊘	In 9	U +	
60	⊘	In 9	U -	
62	⊘			
69	⊘	In 12	F +	PULSE input
70	⊘	In 12	FIN	
71	⊘			
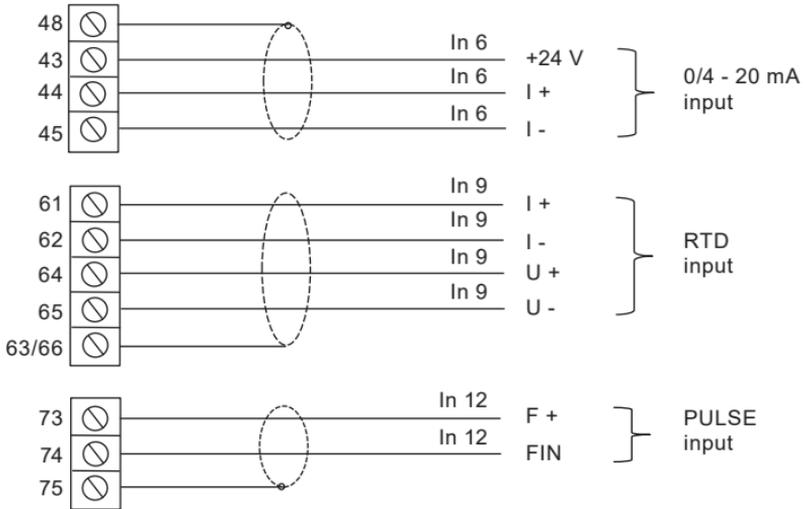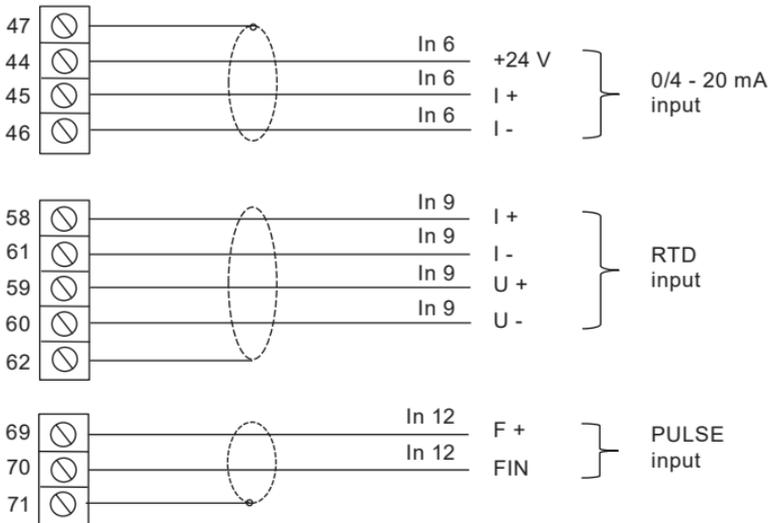
15.3 Failure notification of measurement inputs

Failures associated with particular channels are marked with appropriate symbols on the display.

Symbols of failure:

- -F- RTD sensor failure.

- -||- 4-20 mA transducer failure, current below 3.6 mA.

- -E- 4-20 mA transducer failure, current above 22 mA.

- -S- steam parameters below saturation curve (only when detection of steam saturation is on).

- -R- exceeding the range.

- -W- wait (after power on, when data is not ready.

- -C- internal communication error.

Symbols of failure are displayed instead of the result for all related channels, e.g. for measurement input and the calculation channel in which the result is used.

No signal from the sensor assigned to the particular input is treated as a failure and marked on the display with the '-F' (failure) symbol. Detection of a failure may trigger displaying the appropriate message and then require confirmation by the user even if the cause of the failure ended earlier. Depending on the settings during programming the device, a failure may cause the excitation of corresponding output relay till the confirmation or for the entire duration of failure. Failure and its disappearance may be recorded in the Event log.

If a GSM module is connected to the RS-485 port, failure information can be sent via text message to specified phone numbers.