POWERFLOW

ERS
Energy Recovery System

Important Information for your PowerFlow:
ERS **MINI**

- **Installation and User Manual**

IMPORTANT SAFETY INFORMATION, PLEASE READ AND UNDERSTAND THIS MANUAL BEFORE COMMENCING WORK

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technology®

Made in England

Thank you for choosing PowerFlow

PowerFlow's Mission is to continually develop efficient energy storage technologies in order to increase the availability of low carbon generated power. This will contribute to CO2 reduction and help to protect our planet for future generations, something all of us at PowerFlow are very passionate about.

Over five decades of combined experience has been deeply integrated into your PowerFlow product. From its class leading efficiency, to the highest of safety standards, every component has been carefully considered to ensure long lasting reliable operation. All of our products are fully designed and 100% manufactured in the UK at our factory in Herefordshire, helping to support Great British manufacturing. By purchasing PowerFlow Products, you are supporting the development of this important technology so future generations can benefit and prosper from cleaner, greener more sustainable energy.

Ian Murray: Managing Director
PowerFlow Energy Ltd

Register Your Product.

Don't forget to register your product on the PowerFlow website. Should you have a problem within the 2 year warranty period or beyond, this will help PowerFlow to service your enquiry.

Visit: www.powerflowenergy.com/warrantyregistration

Contact Us

If you have any questions about our products, our website is designed to provide support. Should you not find what you are looking for, you can contact us using the details below.

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Made in England

Manual Version V1.5

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1. Introductory Information

1.1 Validity

Read fully and understand this manual before commencing work

This manual is for electrically skilled persons. The tasks described in this manual may be performed by electrically skilled persons only. It describes the installation, commissioning, maintenance and warranty procedures for the following PowerFlow Energy Recovery Systems:

- PowerFlow E.R.S MINI (ERS-MINI)

1.2 Additional Information

You can find additional information on the design of the complete Energy Recovery system at www.powerflowenergy.com. For electrical design information such as MCB, RCD and cable sizing, please reference BS7671.

1.3 Country Grid Parameters

Using E.R.S MINI Inside and Outside the UK

E.R.S MINI is designed to be connected to an AC supply network with a nominal supply of 230V / 50Hz. ERS MINI is designed to work alongside a grid connected renewable generator such as a wind or solar system. E.R.S MINI does not connect directly to the generation system and therefore will not effect its operation or any tariff rate that may be associated with it. In addition, it does not effect any grid connection standards associated with the generation equipment.

E.R.S MINI can be used outside of the UK provided it is connected to the above stated network supply standard and complies with any other local electrical standards required for connection.
Please note that if E.R.S MINI is connected to a supply network which is outside of its scope of operation it will cause irrefutable damage to the device and will not be covered by any factory warranty.
It is important to ensure that the supply voltage and frequency are suitable before connection.

2. Safety Information

2.1 Appropriate Usage

PowerFlow E.R.S MINI is a grid connected energy flow controller diverter designed solely to be used together with any grid connected solar PV or wind generation system. It can be used in energy battery back up or off grid systems provided the electricity network complies to the appropriate grid standard.

Do not use E.R.S MINI for any other purpose other than described in this manual. Alternative uses or modifications to the product are expressly NOT permitted. Any other use will void any warranty claims and operation permissions.

2.2 Safety Instructions

The following terms will be used throughout this manual. Please observe the safety instructions.

DANGER: **Danger to life due to high voltages.**

- All work detailed by this instruction MUST be carried out by an electrical professional.
- Children may not play with or have access to ERS

WARNING: **Risk of injury, illness or damage to property.**

- All work detailed by this instruction should be carefully considered.
- Children may not play with or have access to ERS

IMPORTANT: Recommendations or advice that if not followed correctly may cause installation or system problems and may result in additional product support or damage.

2.3 IMPORTANT: Safety and Legionella Advice

IMPORTANT SAFETY INFORMATION

WARNING: Please take note of the following:

1. **Risk of burns due to hot enclosure.**
   During operation the ERS enclosure may become hot to touch. Always use caution when touching the enclosure after long periods of operation.
2. **DO NOT place objects over the enclosure.**
   PowerFlow ERS uses the metal enclosure to dissipate heat. Covering the enclosure may cause product failure. Please ensure
   adequate ventilation is provided.
   For further information refer to the installation guide.
3. **DO NOT disassemble the ERS unit at any time.**
   PowerFlow ERS contains live parts inside, never disassemble the system.

Important: Legionella Advice

Legionella is a bacteria that can grow in water below 60ºC. It is common practice for hot water and heating systems to raise the water temperature on a weekly basis over 60ºC in order to kill any bacteria growth. Due to the very nature of ERS it is possible during periods of low energy export to partially heat the water. In systems without a second heating source such as a boiler to 'top up' the water temperature, it is possible that unused warm water could remain in a temperature range where bacteria can grow. Because the particulars of each installation are different, PowerFlow Energy cannot take responsibility for controlling the risk of legionella. It is the installers responsibility to ensure that this risk is controlled. Adequate water exchange and/or additional heating must be supplied in order to raise the water temperature above 60ºC on a minimum of a weekly basis. This can be achieved in all electric homes by using the external timer function to override the ERS system once per week. Further advice on Legionella can be found at www.hse.gov.uk/legionnaires

3. Product Description

PowerFlow E.R.S MINI is a grid connected energy diversion system which converts surplus AC electrical energy, or export, from any grid connected solar or wind generator into heat via a hot water or space heating resistive load element. By performing this function, surplus energy generation, which is unable to be used, can be stored and used at a later time when demand for hot water or heating is required. This results in less energy consumption and in turn leads to cost savings.

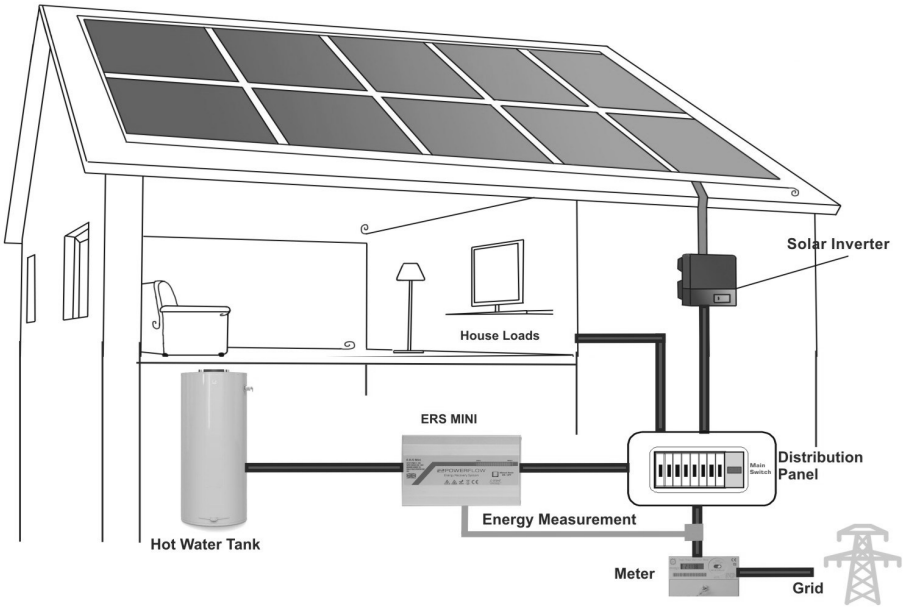
E.R.S MINI is completely independent from the solar or wind generator other than it uses a current measurement device or CT to calculate in which direction energy is flowing and how much energy is available for storage. E.R.S MINI performs energy capture purely based on this measurement alone. This enables E.R.S MINI to work during any time of the day and, together with the solar or wind generator, to ensure that maximum energy capture is possible.

During times when export occurs, the amount of energy available continually changes due to changes in generation and changes in building demand. E.R.S MINI automatically adjusts it's output power level input every 200 milliseconds to match export levels ensuring that only surplus energy is sent to the heating load.

This method of fast accurate power measurement, combined with fast reacting automated self adjusting output power makes E.R.S MINI unique. By utilising these control techniques, the maximum possible self consumption can be achieved through the system.

Only a single E.R.S MINI device can be used on a single phase. For three phase installation, three devices can be used on each independent phase. E.R.S MINI has also be designed to be used in conjunction with the PowerFlow Sundial battery storage system.

The diagram below illustrates a typical system layout.



4: Unpacking

Thank you for purchasing the PowerFlow Energy Recovery System, E.R.S MINI. Please read fully, and take note of, the required installation conditions set out by this installation guide, before commencing work. If you are unsure about installation, further design and installation advice can be found in the full technical manual available for download at **www.powerflowenergy.com**. All electrical work should be carried out by a competent, qualified person and all relevant building regulations should be considered prior to installation.

4.1 Scope of Delivery

Please check the delivery for completeness and for any visible external damage. Contact your supplier if anything is damaged or missing. Ensure that the Product Identification Documentation is retained.

The following components should be included:

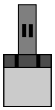
A

B

C

D

E



F

G

H

Object	Quantity	Description
A	1	E.R.S MINI Device with integral mounting brackets
B	1	Current measurement clamp (CT)
C	1	1 x 3 PIN IEC Male power OUT connector
D	1	1 x 3 PIN IEC Female power IN connector
E	1	1 x Current clamp connector & zip tie
F	2	16A 4.0mm 2 pin push fit through connector with lever
G	1	M6 wall fixing set
H	1	Installation and User Manual.

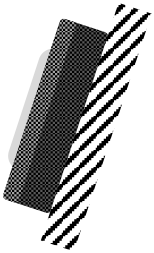
5. Mounting

5.1 Selecting a Suitable Mounting Location

IMPORTANT: E.R.S MINI is rated to IP20. It is suitable for indoor installations only. It is also suitable for damper environments such as un-heated garages or out buildings. Do not mount sundial in direct sunlight due to heat absorption. The device will run hotter and become less efficient.

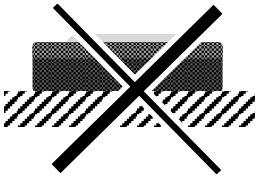
- The mounting method and location must be suitable for E.R.S MINI's weight and dimensions. It has been designed for wall mounting only in a near vertical orientation. Ensure suitable ventilation.
- The mounting location would normally be close to the main consumer distribution board.
- Only mount on a solid surface and take into account cable runs from the device.
- The mounting location must at all times be clear and safely accessible without the use of additional equipment such as scaffolding or lifting platforms. Non-compliance with this recommendation may restrict servicing.

Vertical Mounting



Titled backwards no more than 15°

Never mount E.R.S MINI with a forward tilt



Never mount E.R.S MINI Horizontally

Extended Mounting Criteria

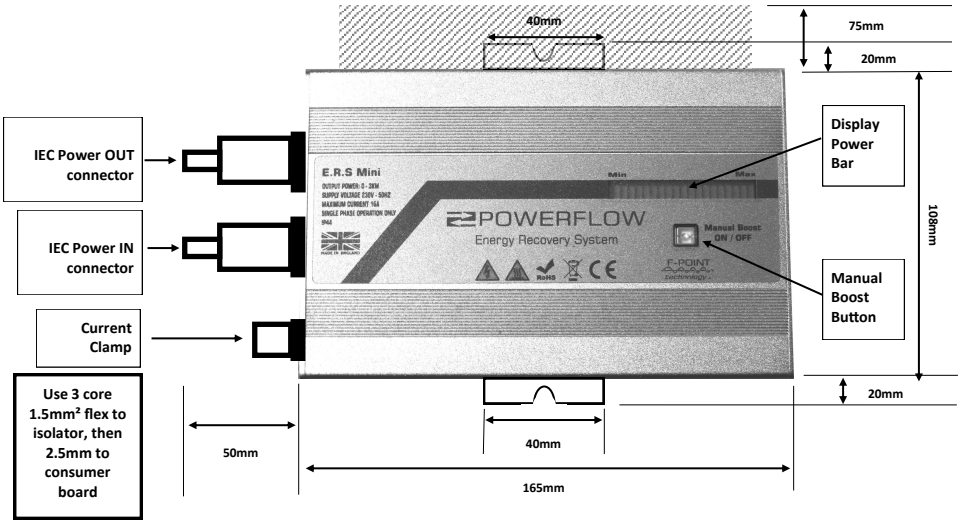
- The connection panels must always face horizontally DO NOT MOUNT UPSIDE DOWN!
- Never mount with a sideways tilt
- If possible install E.R.S MINI at eye level due to the accessibility of the LED display. If future service is required, this will also facilitate service work.

IMPORTANT

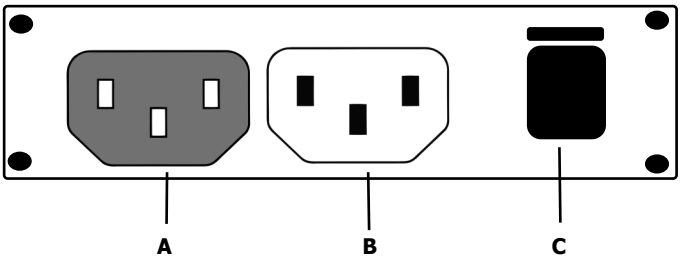
Temperature Considerations
Do not expose E.R.S MINI to direct sun light, as this can cause excessive internal heating

It is strongly recommended NOT to install E.R.S MINI into loft spaces due to increased heat during Summer months. Installations in locations which can exceed 40°C will reduce the ability to operate efficiently and could reduce the life span of the device. Note: Any manufacturers warranty will be void if devices are mounted in unsuitable locations.

5.2 Product Dimensions



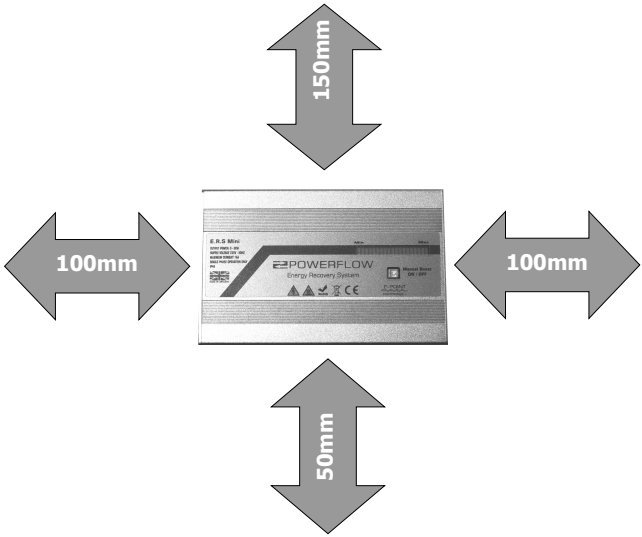
5.3 Overview of Connection Panel



Object	Description
A	Main Power OUT connector
B	Main Power IN connector
C	Current Clamp connector

5.4 Ventilation Mounting Clearances

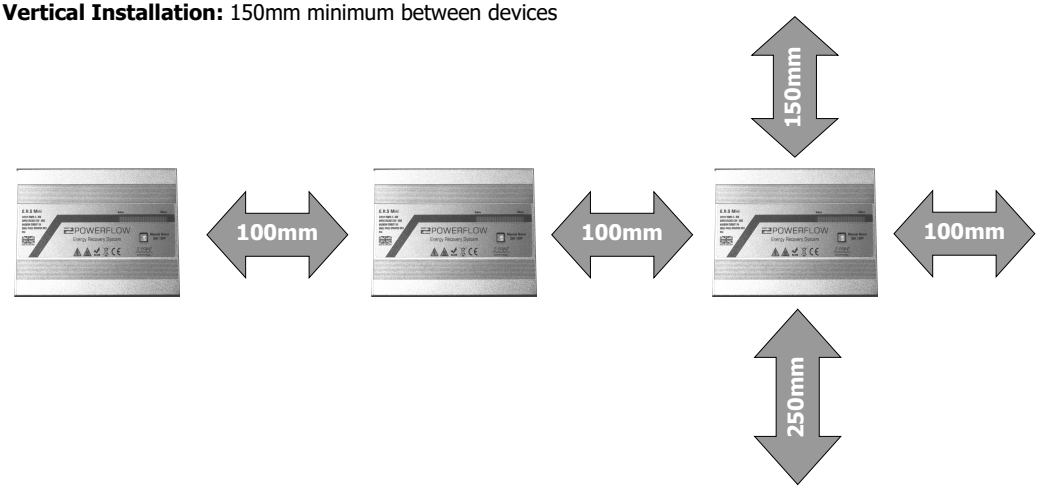
CAUTION:
Observe the minimum clearance to walls and other devices.
This is to ensure that there is sufficient and suitable space for heat dissipation



5.5 Mounting Clearances for Multiple Devices

Horizontal Installation: 100mm minimum between devices

Vertical Installation: 150mm minimum between devices



6. System Design

It is important to take note of the following notices. Failure to do so may result in danger to persons, damage to property, or invalidation of the device warranty. All electrical work referenced in this section should be carried out by an electrical professional.

Take note of the following warnings:

DANGER: Risk of electric shock

PowerFlow E.R.S MINI is designed to be fully integrated and simple to install. It is recommended however, that all electrical work is carried out by a competent electrical professional and all local electrical standards such as BS7671 are observed prior to installation.

DANGER: E.R.S MINI has an aluminium enclosure and is considered to be an exposed conductive part. There MUST be an earth connection terminated at all times.
Ensure an earth continuity check between the PE supply and the case has been carried out prior to commissioning.

WARNING: Risk of damage to the Device

E.R.S MINI **MUST NOT** be installed in conjunction with Voltage Optimization or power factor correction equipment. Doing so may damage the device. Failure to ensure that no voltage or power factor correction devices of any type are installed on the premises prior to installation will result in the warranty being void. For further information, please refer to the warranty documentation.

6.1 AC Circuit Protection Design

The E.R.S MINI device contains a single output connection, capable of outputting modulated power levels to a connected resistive load of up to 3000W

During operation it is possible for E.R.S MINI to pull a load current of up to 16 Amps, therefore the supply circuit must be suitably designed to cope with this level of load current.

A maximum value of a 16A type B MCB should be observed for overcurrent and short circuit protection in this instance with a minimum supply conduction size of 2.5mm.

Recommended AC connection method

Connection method:	A New Final Circuit is used to supply E.R.S MINI
Cable Size:	2.5mm²
MCB Size:	16A Type B max
Protection and isolation method:	30mA RCD protection provided.

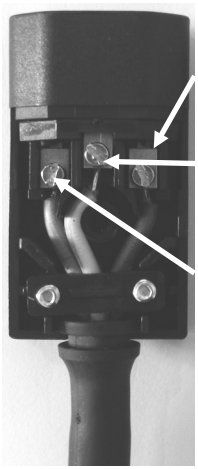
7. Connector Assemblies

The power connections for E.R.S MINI are supplied pre wired, connections for the current clamp connector require termination.

Refer to the below pin out references should the connectors require re assembly.

7.1 Power Connections

3 PIN IEC Power OUT Connector (C)
PFM-PC-03-M
(Recommended cable: 1.5mm² 3 core flex)



PIN 1: ERS Live OUT (brown)

PIN 2: Earth (Green/ Yellow)

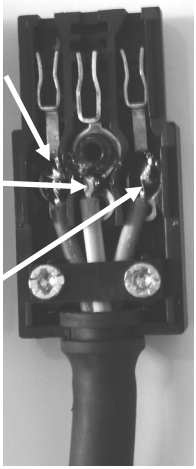
PIN 3: Neutral OUT (Blue)

3 PIN IEC Power IN Connector (D)
PFM-PC-03-FM
(Recommended cable: 1.5mm² 3 core flex)

PIN 1: ERS Live IN (Brown)

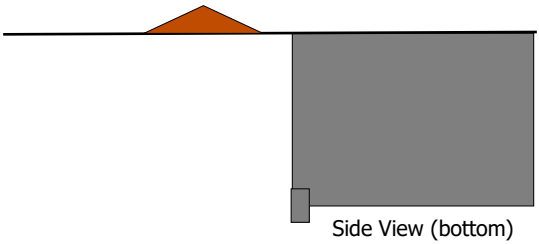
PIN 2: Earth (Green/ Yellow)

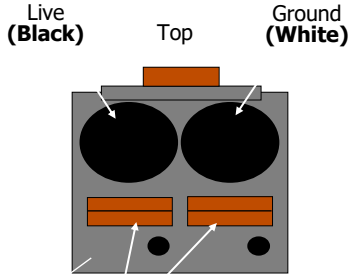
PIN 3: Neutral IN (Blue)



7.2 Current Clamp Connections

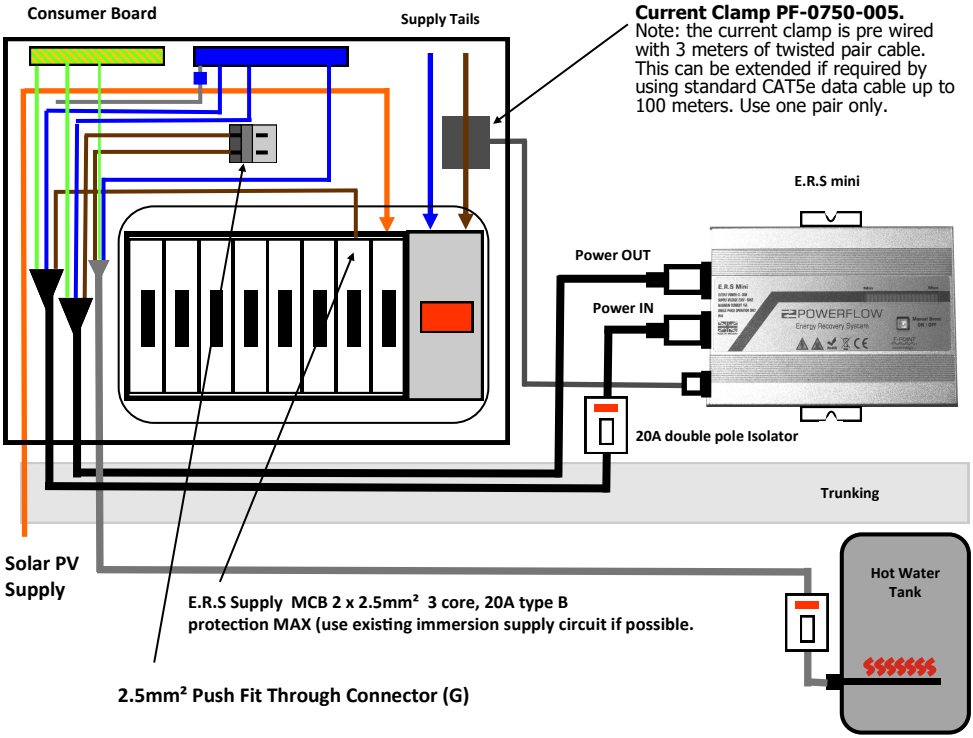
Current Clamp Connector:
(orientate connector with picture)





Push to open using a small flat bladed screwdriver, insert wire and release.

8. Wiring Diagram: Typical wiring configuration for E.R.S MINI Edition



IMPORTANT

1: Terminate the Live, Neutral and Earth conductor of the pre wired POWER IN cable/connector to the load side of the 20A double pole isolation switch.
2: Run a 16A supply circuit using 2.5mm cable to the supply side of the 20A double pole isolation switch.
3: Terminate the Live conductor of the pre wired POWER OUT cable/connector to supplied push fit through connector located inside the distribution board **(G)**
4: Terminate the immersion or load circuit to be driven by ERS into the remaining side of the supplied push fit connector inside the distribution board **(G)**
5: Terminate the Neutral and Earth conductors of the pre wired POWER OUT cable/connector to the respective Neutral and Earth bars within the distribution board.
NOTE: It is essential that there are no other loads or electrical connections other than resistive heating element connected to the ERS driven circuit. Failure to observe this will result in damage.

IMPORTANT

It is essential that the current clamp (CT) is connected between the main (primary) distribution board and the building's supply meter and has been positioned the correct way. Observe the silver label on the CT for correct fitment.

It must be connected in this location in order for ERS MINI to function correctly. Failure to observe this will result in incorrect operation which may result in energy import. PowerFlow will not be responsible for any costs incurred by incorrect installation.

9. Display and Control Elements: Take note of all control elements before first commissioning.

The serial number is located on the left had end plate

Manual Boost Button

20 LED Power Bar Indicator

9.1 Switch ON and OFF

During installation, a 20A double pole switch with neon should be installed close to the ERS device. This acts as an isolation switch should the user wish to isolate the ERS unit from the mains supply. Ensure the supply MCB is in the ON position, then switch the isolator to the ON position. The blue LED in the boost button will flash 5 times indicating ERS is booting up. During boot up ERS is performing an auto calibration procedure and is ready to use once the LED stops flashing. Ensure that the heating load is switch to the ON position, if export is detected ERS will begin to operate automatically.
To switch off ERS, turn the isolation switch to the OFF position.

9.2 LED status Indicators

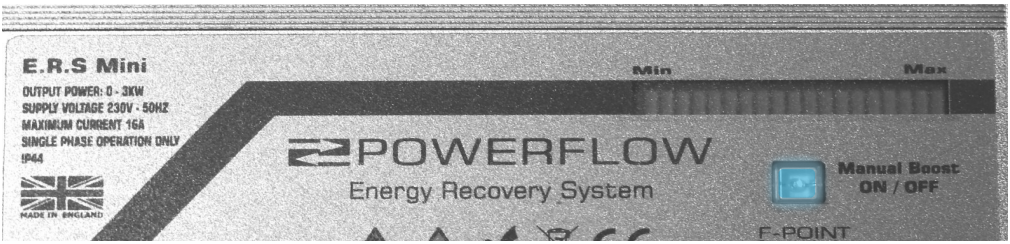
20 LED Power Bar
The power bar will only operate when savings are being made. The power bar indicates when ERS is diverting energy to the load. The more LEDs illuminated, from left to right, the more power is being diverted. When the two outer LEDs are illuminated, the load is switched off. This could indicate, for example, that the water is now hot. If an over temperature situation occurs, the 3 centre LEDs above the boost button will illuminate. ERS will stop operation for 2 minutes before automatically re-booting. Should the over temperature situation still exist, the process will repeat until the internal temperature has fallen. During this period, ERS will not drive the load.

Boost button LED
On start up, the LED on the boost button will flash five times. During manual boost operation, the LED will be permanently illuminated. This will switch off automatically after the timed period. The power bar will not illuminate during manual boost operation.

9.3 Using the Manual Boost Button

The manual boost button is designed to enable the user to provide supplementary power to the heating load should it be required. To enable the manual boost, push the button once, an audible 'click' can be heard and the LED will turn on indicating the manual boost has been started. At this point a 90 minute timer will start counting down allowing enough time for the majority of hot water tanks to fully heat the water. At the end of the timed period, the manual boost will automatically stop, the LED will turn off and ERS will revert to normal operation. During the timed operation, with the LED illuminated, the timed period can be manually stopped by pressing the button once. Take note that during manual boost operation ERS will supply the load with 100% power irrespective of export levels. If no generation is occurring this will result in importing energy during the timed period. During manual boost, the power bar will not illuminate.

The illustration below demonstrates how the manual boost button would appear in the above example.



9.4 Operation During Energy Recovery

The 20 segment LED display is referred to as the power bar. The power bar shows live information about changes in the amount of power being diverted to the load. When no export is available and therefore no power is being diverted, such as at night, the power bar will not illuminate. Each LED represents a step change of 5% of the heating load. For example, if 10 LEDs are illuminated, with a heating load of 3kW, this would represent 1500 watts of diversion. i.e. 5% of 3000 watts = 150 watts x 10 = 1500 watts.

The illustration below demonstrates how the power bar would appear in the above example.

9.5 Operation During No Load

If the ERS attempts to drive a heating load that has been switched off, either manually or by a thermostat, it will progressively illuminate 6 LEDs in order to search for a connected load. If no load is detected at this point, or if the load is switched off during energy recovery operation the two end LEDs will illuminate, indicating that the heating load is switched off. For example: This would give an indication that the water has reach temperature and the immersion element has switched off.

The illustration below demonstrates how the display would appear in the above example.

9.6 Over Temperature

ERS MINI has an internal temperature sensor for safety. If an over temperature situation occurs, the centre 3 LEDs will illuminate and ERS will shut down for 2 minutes. After this period, ERS will attempt to re-start automatically. If the over temperature event still exists, ERS will continue this 2 minute loop until the temperature is reduced to a safe operating level. During this period, ERS will not drive the heating load. If this situation occurs, ensure that ERS has adequate ventilation and has not been covered.

The illustration below demonstrates how the display would appear in the above example.

10. Commissioning

10.1 Energising for the first time

Before switching on for the first time, check that the following has been completed.

1. E.R.S MINI has been mounted to a secure surface, the correct way up and with adequate ventilation.
2. All cable runs are correctly fixed and supported and an AC isolator has been installed.
3. The main power cable has been terminated observing the correct pin numbers.
4. Ensure all the terminations inside the consumer unit are correct and the terminals have been tightened.
5. Ensure earth continuity between the earthing bar inside the consumer unit and one of the cover fixing screws on the device.
6. Carry out all circuit tests in accordance with BS7671.
7. Ensure the current clamp connector has been terminated observing the correct pin numbers and is securely clamped around the incoming live supply conductor in the correct location.
8. Check the orientation of the current clamp to ensure the label faces the incoming supply and that it is installed between the main meter position and the main consumer board.
9. Ensure any safety labelling has been securely fitted in the correct locations.
10. Ensure the customer has been issued with a user manual and has been given an overview of how their system works and how to use it.

Only energise the system once all of the above has been completed.

10.2 System Testing

PowerFlow E.R.S MINI is an intelligent device with no initial setup required. It automatically detects the import/export voltage and current, and the size of the connected loads making commissioning simple.

To check correct operation, should there be no export energy at the time of commissioning, remove the installed CT and re-install it back to front. This will cause ERS to operate backwards, i.e import will be measured as export and vice versa.

Turn a large load on such as a kettle to simulate export, ERS will detect this, as export, and start to drive the load connected from the main POWER OUT connection. Ensure this is on and/or calling for heat. The LED bar should start to illuminate progressively demonstrating operation. Allow the kettle to boil and switch off, you should observe the display LEDs on ERS MINI switch off.
This is an indication that the device is working correctly.

REMEMBER: Do not forget to change the CT back to the correct orientation following the test

10.3 Adjusting the existing heating system

IMPORTANT:
For use with immersion heaters where hot water is currently heated by gas or oil boilers:

All default settings are optimised for installations containing gas or oil boilers.
To maximise savings, it is advised to re-time the boilers domestic hot water timer to come on after sunset to allow the E.R.S MINI to heat or pre-heat the hot water. This will allow maximum energy capture and lead to maximum savings.

IMPORTANT:
For use with immersion heaters where this is the only method of heating the water tank.

If the water is currently heated using the immersion element, when solar generation is low, there will not be enough export energy to heat the water tank fully. In this instance there must be an alternative method of over riding the immersion element automatically, once per week, in order to eliminate the risk off legionella. See page 4 for further information.

IMPORTANT: ERS MINI does not have the ability to be over ridden in this way and is therefore not suitable for this application. It is advised to use the ERS PRO product with a connected external timer so as this essential override function can be performed.

10.4 Troubleshooting

Question	Answer
ERS MINI does not appear to be heating the water, The LED display illuminates 6 bars and then shows LOAD OFF	The immersion switch next to the hot water tank must be left in the ON position. Power will only be sent to the immersion heater when export energy is available. Ensure there is enough export energy. ERS will not start operation until 200 watts of export is available. Ensure the water is not already hot. i.e. heated by another source. Re-time the boiler to heat water in the evening rather than the morning. This will give ERS opportunity during the day to heat or pre heat the water. This will ensure maximum savings are achieved.
ERS appears to be running the heating load even when there is no export.	Check that the current clamp has not been installed back to front. The label on the clamp must be facing the electricity meter, i.e. the incoming grid supply. Check the current clamp has not been incorrectly connected, refer to section 7.2 Check that the current clamp has not been installed in an incorrect location. Refer to section 10.2 for testing procedure.
ERS does not switch ON?	Ensure both the MCB (trip switch) supplying the ERS and the 20A double pole isolator is in the ON position. If all of the above is correct, contact PowerFlow.
How does the manual boost function work?	Pressing BOOST ON will override ERS at any time and switch the heating device on to full. A countdown timer of 90 minutes will start . After the timed period has completed, ERS will revert to normal operation.
Where can I find more information 17	Please visit **www.powerflowenergy.com** for more service information

6: Technical Specification

TECHNICAL DATA	POWERFLOW ERS mini Edition
Output power: Max / Nominal	3200 / 3000 Watts
Output current: Max / Nominal	13A / 12.5A
Phase Operation	Single Phase
Voltage range / frequency	206-262V / 50 Hz
Fuse Protection (replaceable)	16A
Compatible Generator Type	Solar PV / Wind / Hydro
Recommended renewable generator size	2.0kW +
Output load	Resistive Only
Output control range	5% - 100%
Minimum output load	300 W
Minimum export power level / Export tracking range	25W / 25-200W

General Data

Dimensions (without connectors) (W / H / D) mm	160 / 109 / 45
Weight	1.1kg
Noise emissions	<10dBA
Self-consumption (night)	8mA
Degree of protection	IP20
Operating temperature range	-10 ºC to +60 ºC
Cooling concept	Convective Cooling
Efficiency	99%
Compliant Standards	CE / RoHs / BS EN: EMC / LVD

POWERFLOW

www.powerflowenergy.com