

## Save Energy with Intelligence

### INTELLIGENT IMMERSION

**Do you have solar panels or a wind or water turbine? Now you can heat your water free.**

The Intelligent Immersion model I2 is a small all electronic device for your home that, rather than exporting your surplus power to the grid, diverts electricity from a microgenerator such as solar PV or wind/water turbine to an immersion heater or other heating load. Using clever software it modulates the heater current to constantly match the house load and PV generation, thus delivering maximum power into the heater and minimum power to the grid. It responds to changes in house demand or generation in seconds so is always matching what the house is doing. It is fully automatic and needs no owner adjustment or interaction. Indicator lights on the unit tell you what it is doing and how much electricity is passing to the load and the grid. The thermostat in your immersion keeps the water to the right temperature.

As this unit modulates the heater current it will not import electricity for heating or export when not required. The unit has a useful override switch to turn the heater fully on for a short period using grid power if your hot water needs a quick boost on a dull day.

An extra relay inside the unit enables an output to be made to second loads when the first load has got up to temperature, such as a second immersion heater, storage heater or towel rail. It can also switch a load when a fixed export threshold is reached, which is useful for heat pumps and switching washing machines on for a fixed period of time. Circulation pumps can be controlled and it can also switch signal level inputs and indicator lamps.

Typically you can generate enough hot water for a family of 3-4 for half the year and contribute towards it in the winter too, thus saving much of the normal fuel you use to heat your water. You save further by turning your boiler and its pilot light off completely for the summer. Also you could use the device to heat up a towel rail or under floor heating.

Many have been installed already and have proved very successful and reliable. There are no parts that will wear out or displays to fade. Compared with similar

products it is much more robustly constructed so will last well.

It is simple to install, needing only two wires connecting into your immersion circuit and no changes to the main house wiring. A sensor clips around one of the main wires near your meter or consumer unit. It uses your existing 3kW immersion so there is no expense needed to change it.

*"I have looked at similar products and there is no comparison. The I<sup>2</sup> is of much higher quality construction. Very easy to install" TC from a London PV installer.*



The price is around the same as some products offering a reduced performance or quality of construction. Typical payback time in UK is 2-3 years if you normally use gas water heating or 1-2 years if you have oil, LPG or full price electric water heating. For the more expensive fuels a typical UK family house with a 4kW PV array might save £200 off your annual water heating bill.

**Intelligent Immersion Ltd**

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*"My I<sup>2</sup> provided enough hot water each day for most months in 2012, without resorting to switching on the gas water heating. It never imports when loads or generation change. Once installed you just forget it is there and it needs no user intervention I highly recommend the I<sup>2</sup> device to anyone. It does exactly what it says on the tin and at a cost which makes sense from a returns point of view." KH of South Yorks*  
*"What exemplary customer service, by the way. Truly your dedication is impressive." RM of Cumbria.*

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### HOW DOES IT PERFORM?

These daily graphs are taken from an installation in Hampshire in winter with a 4kW PV system. The vertical axis is watts. At 8.15 there was enough sun (yellow line) to exceed the house load (red line) and the immersion (green line) turned on. It stayed on till 14.45. The export (blue line) during this period was steady just above the zero line at a mere 30W.

Most of generation goes into the immersion, a tiny amount was exported and the rest fed the house load. The device has not imported any electricity to feed the immersion as the only import (blue line below zero) is when the sun is too low to feed the house load.



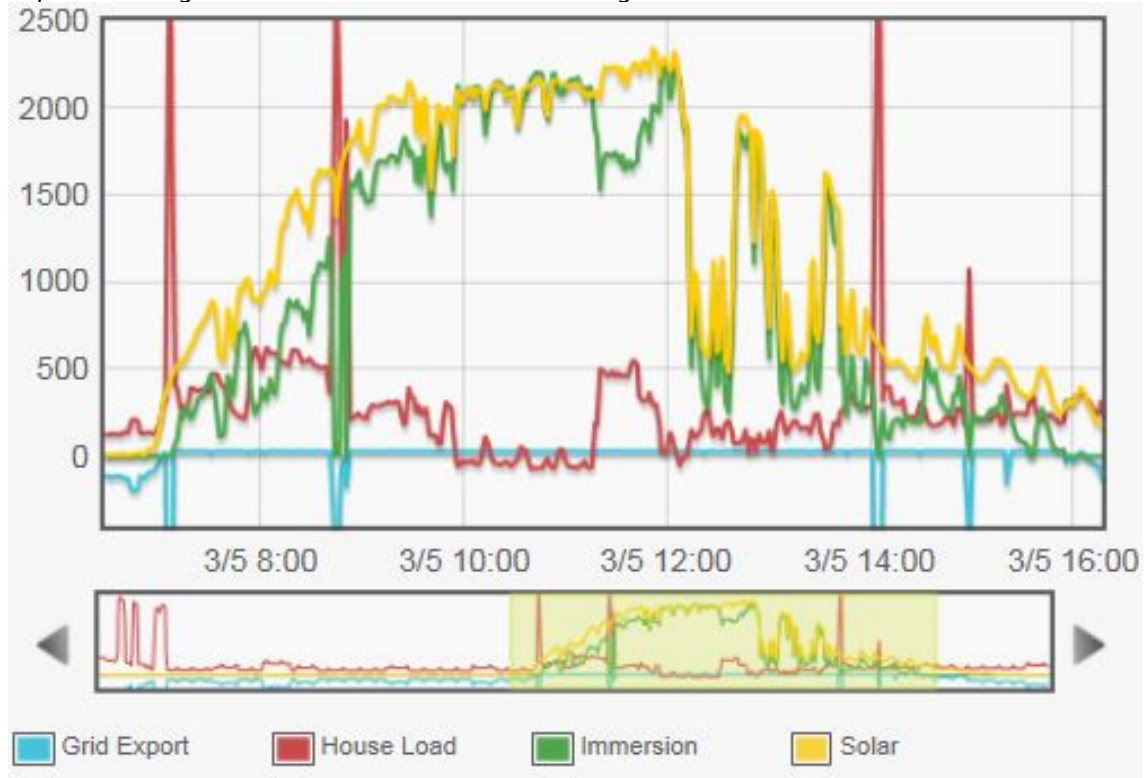
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*"I purchased a pre-production box it works very well with no light flickering and a low switching margin. I find them very straight and knowledgeable." JU of Herts*

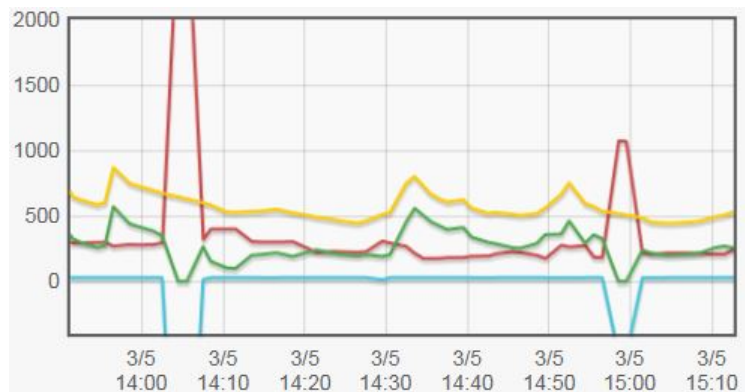
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Even on days when the sun and the house load is less steady the blue line still shows tiny export showing how fast the device reacts to changes in conditions.



In this case there has been some import when kettles have been boiled (large red spikes) but the immersion was immediately turned off by the device during these so no import fed the immersion as seen in this expanded view.

In summer the days are longer and the sun more intense so although the graphs look similar the energy into the immersion increases.



These graphs are generated by our Wi-Fi model the I2W which performs exactly the same but adds connections to the internet to enable control and monitoring by smartphones, tablets and laptops. See the I2W datasheet for further details.

"I purchased a pre production box i works very well with no light flickering and a low switching margin. I find them very straight and knowledgeable." JU of Herts

### SPECIFICATION

Parameter	Data	Notes
Voltage range	210-250VAC, 50+/-2 Hz	
Load rating of variable output	3.0kW max resistive	Do not use inductive (e.g. motor) or capacitive loads
Load rating of fixed relay output	250VAC, 14A. Volt free single pole changeover contact	Derate for inductive or capacitive loads
Terminals	DIN terminals for 2.5 or 4mm <sup>2</sup> cable	One 3 core cable to MCB/RCBO One 3 core to load

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Parameter	Data	Notes
	Terminal strip for current sensor	Sensor to near consumer unit or DNO meter
Cable entry points	Two 20mm diameter holes in end wall of enclosure	Suitable for connection to conduit, fitting cable glands or using without extras
Turn on threshold	30W of export to grid	Default value can be easily altered by user down to zero
Quiescent power	0.5W	
Power consumption in unit	0.5W+ 0.5% of load power	
Efficiency (% input power transferred to hot water)	>99% (for power more than 500W)	Gas and oil boilers are around 50 - 70% for short water heating cycles
Case	Cast aluminium with pale grey coloured enamel coating	
Thermal rise of case at a delivered 2kW	<15C	In free air
Time to stabilise load power after an instantaneous step in generation or house load	<0.5 sec	
Temperature range - operating	-10 to 50C	Assumes a free flow of cooling air around unit
Temperature range - storage	-30 to 70C	
Humidity	Non condensing	
Dust and water protection	IP50	Semi sealed. Keep away from dripping water, not for outdoor use.
Sensor	One clip-on current sensor around incoming mains supply	
Sensor cable length	2 m	Can be extended up to 30m and more if slight performance degradation is accepted
Front panel controls	Switch for load off, automatic operation, load fully on, one hour top up	Can override permanently or set a one hour top up at full load power
Indicators	LEDs for unit on, power level to load, import power level, export power level	LEDs' brightness or flash rate indicates level of power
Enclosure size	220 x 145 x 55mm	
Weight	1.5kg	
External wiring	2.5 or 4mm <sup>2</sup> twin and earth recommended	Must be earthed
Mounting	3 holes in back plate for screws. Mount in free air. Any orientation allowed.	Recommended to mount near consumer unit
Protection	20A and 1A fuses, Surge suppressor, EMC filter	
EMC and Approvals	CE marked EMC and Low Voltage Directives 2004/108/EC and 2006/95/EC BS EN 61000-6-1 Generic Immunity BS EN 61000-6-3 Generic Emissions to EN55022 class B domestic level BS EN 61000-4-3 Immunity to radiated emissions BS EN 61000-4-14 Flicker	For UK/EU use only  Does not use Burst Firing to control power so no risk of causing owner's and neighbours' lights to flicker

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Parameter	Data	Notes
Warranty	3 year return to base	Made in UK
Expected life	20 years	No moving parts apart from occasionally used switch
Predicted MTBF	>200,000 hours	
Supplied with	Current sensor and cable User manual Installation manual	No additional parts apart from wall screws and mains cable are needed to fit the unit
<b>Indicative performance with a 4kW PV system in London (Note 1)</b>		
Indicative annual input to immersion heater	1200-1700kWh	Assumes a 4 person household. Realistic maximum is around 2000kWh
Maximum daily input to immersion heater	15kWhr in summer	Can be up to 20kWh if house load is very low
Payback time with gas or Economy 7 water heating	2-3 years	Not including installation cost
Payback time with oil/LPG/full rate electricity water heating	1-2 years	Not including installation cost

Note 1: Performance and payback times are not guaranteed. Because every house is different in its amount of sunshine, size of PV system, use of hot water and electricity, etc. we can only provide indicative figures. We can say though that the I<sup>2</sup> performance is as good as or better than any other proportional diversion controller currently available and much better than any that only switch the load fully on and off. London is reasonably representative of average English and Welsh sunshine, but the North of England and Scotland will have less in most locations.

### THE COMPANY

Who is behind Intelligent Immersion Ltd?

#### **Director Paul McAllister MSc Dip Eng BSc CEng MIET**

Paul is a measurement specialist having previously worked for many years in test equipment design and the space industry developing novel measurement techniques some of which are incorporated in the I2

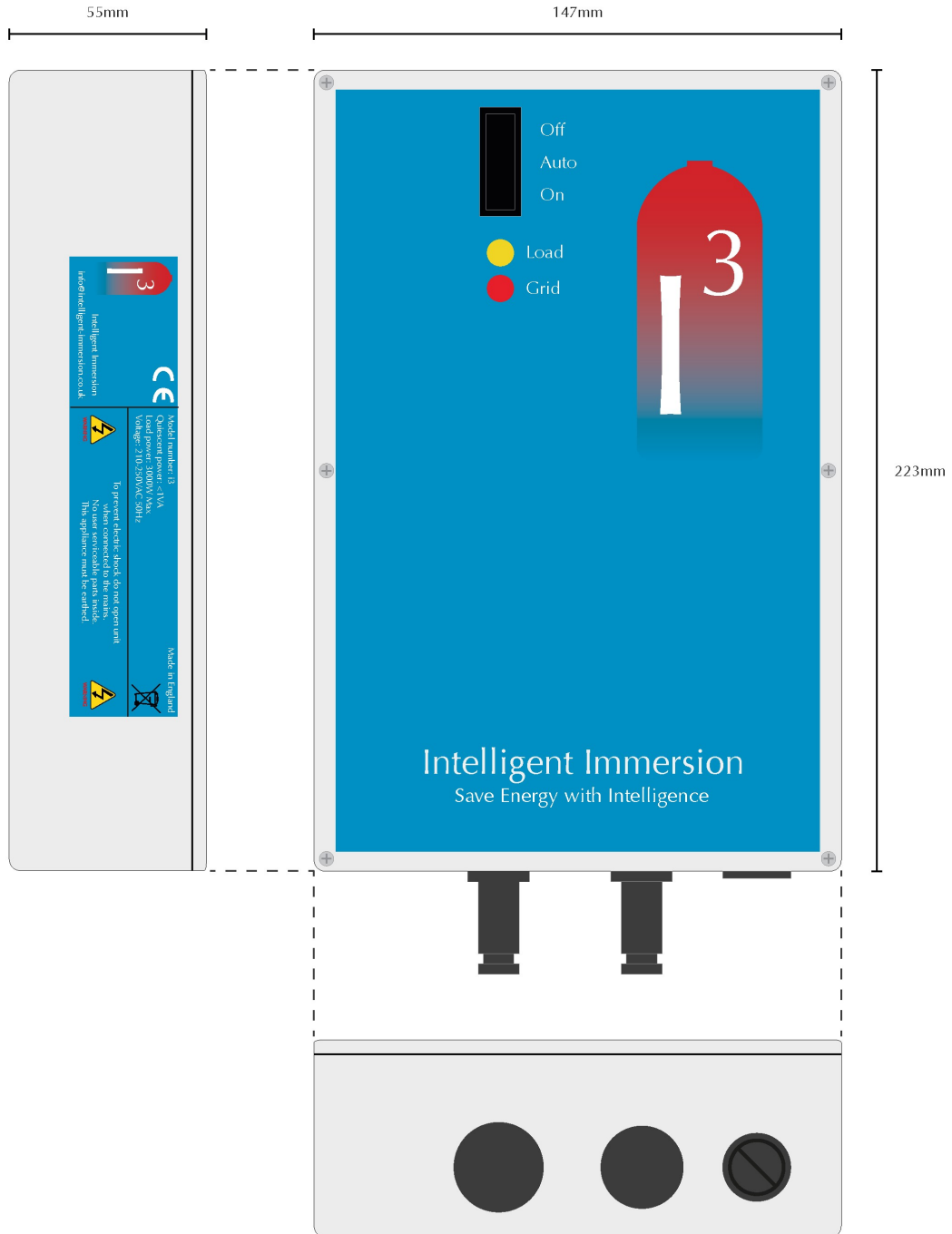
#### **Director Dr Ed Derbyshire MBA DBA**

Ed is a business specialist with a strong track record in business development. He has spent over thirty years in the space industry developing system design and test and measurement. He has set up two green field businesses driving turnover to £2M in three years.

Manufacture is subcontracted out to competent UK companies. Final testing and quality control is performed in house to ensure you receive a perfect product.

# Save Energy with Intelligence

I2 and I2W drawing. I2W has an added stub aerial on the front lid, not shown here, otherwise details are the same. Later units have the fuse holder internal.



## **Save Energy with Intelligence**