

Energy Management Mk II

giving you

The Power to be in Control

Yes, now you can have complete control over your remote power system from near and from afar. The Energy Management MKII has the ability to read, log, regulate and control your system from either the front panel of your SE inverter, a remote keypad, or remote computer, via a phone line and modem.

The features in the Selectronic Energy Management MKII are so advanced, you will automatically be convinced that your management system will be state of the art well into the 21st century.

The Selectronic Energy Management MKII can be installed into the SE22 inverter, and will provide you with the following features:-

- Four general purpose outputs
- Two general purpose analogue inputs
- Inverter control
- Three external current shunt inputs
- Modem and serial interface
- Logging functions
- Remote keypad interface
- Electrical Specifications
- Control functions and settings

Four General Purpose Outputs

Each of these outputs have the ability to drive a relay that can be used to control appliances, regulate a solar panel or wind generator, control a generator etc. Each output can be separately set to operate a N/O or N/C relay and can be programmed to function as follows:

Regulator

One or more of the outputs can be programmed as a regulator. In this mode the output acts as a 2 stage regulator with boost, float and equalize. This allows the voltage on the batteries to rise to a boost voltage, after which the battery voltage is reduced to a float voltage. Once each week the regulator goes into equalize mode which allows the voltage to rise to a higher voltage than boost to enable the equalization of the battery bank. The boost, float and equalize voltage points are

fully programmable so they can be set to suit your batteries.

When in "Regulator" mode the output can also be set to shunt mode causing the output to act as a shunt regulator. This allows you to load dump the excess solar energy or regulate a wind generator.

With more than one output set to regulator mode, each set to a slightly different voltage, a multistage regulator can be created with just a few relays.

A range of optional solid state PWM switches is also available which will interface to this output to give you a PWM controlled regulator.

Generator Control

In this mode the output 1 is used to control your generator. The generator is controlled by the following conditions:-

a) **Low charge in batteries:** Output 1 will start the generator when the percentage charge in the batteries drops to a "LOW" level or the battery voltage drops below a set "LOW" voltage setting. A low battery voltage will only start the generator after a preset delay. This will ensure the generator will not start due to temporary drop in battery voltage due to momentary high loads or surge currents. All the levels and the delay are user programmable.

b) **High charge in battery:** When the percentage charge in the batteries rises again to a set "HIGH" level or the voltage of the batteries rises above a set "HIGH" voltage level, the output will turn off the generator. The voltage on the batteries must rise above the high voltage setting for a set amount of time before the generator is turned off. All the levels and the delay are user programmable.

c) **Generator run time limits:** If required, the generator can be set to operate for a minimum time once it has been started.

d) **Lock out times:** The generator will not start within the times that have been set. This ensures you are not disturbed by the generator at times you want peace and quiet.

Change over control

This function can be set when the "generator control" is selected and can be used to drive a relay to automatically perform the change over switching from the inverter 240V supply to the generator 240V supply. Once the generator is started, the Selectronic Energy management MK II can be programmed to wait a preset delay before switching the generator output to the load. The 240V output of the generator can also be used to control the change over output. This is achieved by connecting the output of the generator, via a simple plug pack, into the INPUT 1 of the Energy

management. In this way the change over relay can be programmed to switch back to inverter if the generator fails to start, or runs out of fuel.

General purpose programming

Each output may be programmed to turn **ON**, by one of the following conditions:

a) **Input 1:** The output will turn on when input 1 voltage goes higher, or lower than a preset point. The user can also set a programmable delay after which the output will turn on. As an example, if the level on input 1 is set to 1 volt, the sense is set to "low" and the delay is set to 5 minutes, the output will turn on after the voltage on input 1 goes below 1 volt for 5 minutes. If the voltage on input 1 goes above 1V again before the 5 minute delay is up, then the delay is reset and the voltage level must go below 1 volt for 5 minutes before the output is turned on.

This is useful in controlling the output from a limit switch on a water tank, a solar radiation level indicator, generator warning lamps etc.

b) **Input 2 :** Same as for input 1

c) **Charge in battery:** The output will come on when the charge in the batteries drops below, or goes above a preset point. E.g. If the charge level is set to 70% and the sense is set to "high", the output will come on when the charge in the batteries goes above 70%. If in the above case the sense was set to "low", then the output would come on when the charge in the batteries drops below 70%.

d) **Battery volts:** The output will come on when the battery volts drops below, or goes above a preset point. The user can also set a programmable delay after which the output will turn on. As an example, if the level is set to 12.5 volts, the sense is set to "low" and the delay is set to 3 minutes, the output will turn on after the voltage on the batteries goes below 12.5 volts for 3 minutes. If the voltage on the batteries goes above 12.5V again before the 3 minute delay is up, then the delay is reset and the voltage level must go below 12.5 volts for 3 minutes before the output is turned on.

e) **Time of day:** The output will turn on at a set time and a set day.

The output may be programmed to turn **OFF** with one of the following conditions. If the condition that brought the output ON still exists, then the output will stay on until the condition ends. For example, if the output is set to come on with low battery charge and switch off after a duration, and if after this duration the battery charge is still low, the output will stay on until the charge goes back above the low charge point:

Input 1: This is the same as the input "ON" setting, except the output is turned off by the input 1 level.

Input 2 : Same as input 1.

Charge in battery: The output will switch off when the charge in the batteries drops below, or goes above a preset point.

Battery volts: The output will switch off when the battery volts drops below, or goes above a preset point, with a preset delay, as per the battery voltage "ON" condition.

Time of day: The output will switch off at a set time and day.

Duration: The output will stay on for a preset duration, after which it will turn off.

Two General Purpose Analogue Inputs

The voltage level on these inputs can be used to control any of the four outputs or control the inverter. Each of these inputs is also logged for four weeks allowing the user to log such parameters as solar radiation, temperature, wind speed and more.

Inverter Control

The inverter can be controlled to come ON with the following:

- **Time:** The inverter can be programmed to turn on at a particular time and day.
- **Charge in battery:** Inverter will turn on when the charge in the batteries reaches a preset high point.
- **Input 1:** Inverter "ON" is controlled by the voltage level on input 1, this is the same as the output control.
- **Input 2:** Inverter is controlled by the voltage level on input 2 as per input 1.

The inverter can be programmed to turn **OFF** by the following:

- **Time:** The inverter can be programmed to turn off at a particular time and day.
 - **Charge in battery:** Inverter will turn off when the charge in the batteries reaches a preset low point.
 - **Input 1 :** Inverter off is controlled by the voltage level on input 1, this is the same as the output control with a level setting, sense setting and delay.
 - **Input 2:** Inverter is controlled by the voltage level on input 2 as per input 1.
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Current Shunt Inputs

The Selectronic Energy Management MKII can interface to one, two or three external current shunts. Shunt input one is able to measure both charge and discharge current at the same time which means only one external shunt is required in a basic system. This input can interface to either a 100A 75mV or 200A 75mV current shunt. If you wish to take a separate measurement of your charging sources (e.g. Solar, wind or Hydro) or keep track of the power used by a particular DC load, then shunt inputs 2 and/ or 3 may be used. These shunt inputs can be individually programmed to measure either a load or a charging source, and can interface to either a 50A, 100A or 200A 75mV current shunt.

Logging functions

Four weeks of information is logged within the Selectronic Energy Management MKII and can be downloaded via the serial or modem connection onto a computer. The following parameters are logged.

- Load profile or charge profile from each of the current shunt inputs. The average current is logged every hour for 28 days. If the current is a load, the value logged is a positive current. If the current is a charge current then the number logged is negative.
 - State of charge of the battery. The percentage charge in the battery is logged every hour for 28 days.
 - The voltage level on Input 1. The average voltage on input 1 is logged every hour for 28 days.
 - The voltage level on Input 2. The average voltage on input 2 is logged every hour for 28 days.
 - Generator run time, hours per day. This is logged every day for 28 days.
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Modem & Serial Interface

The Selectronic Energy Management MKII has a DB9 outlet which can be directly connected to either a computer serial port or a standard Hayes compatible modem with "sleep" mode. The inverter has a DC output suitable for operating many modern modems. This eliminates the need to run the modem from an AC plug pack, allowing the modem to operate even when the inverter is not supplying output. Via the Energy Management MKII the modem is programmed to answer the phone line between 2 and 19 rings and set to go into "sleep" mode after sixty seconds of inactivity. The modem therefore may be left permanently connected, resulting, when not in use, in a small amount of power being drawn from the system. All parameters and full inverter control

is available over the serial or modem connection.

The "**Remote Link**" software will allow users to communicate with the Energy Management MKII via their personal computer, running under Microsoft Windows 95/98™. Once connected the user can view and control the inverter in the same way as a keypad, as well as down load any of the logged profiles into a comma delimited file.

These profiles can be directly imported into many spread sheet packages such as Microsoft Excel™ for graphing or manipulation of the data.

Remote Keypad Interface

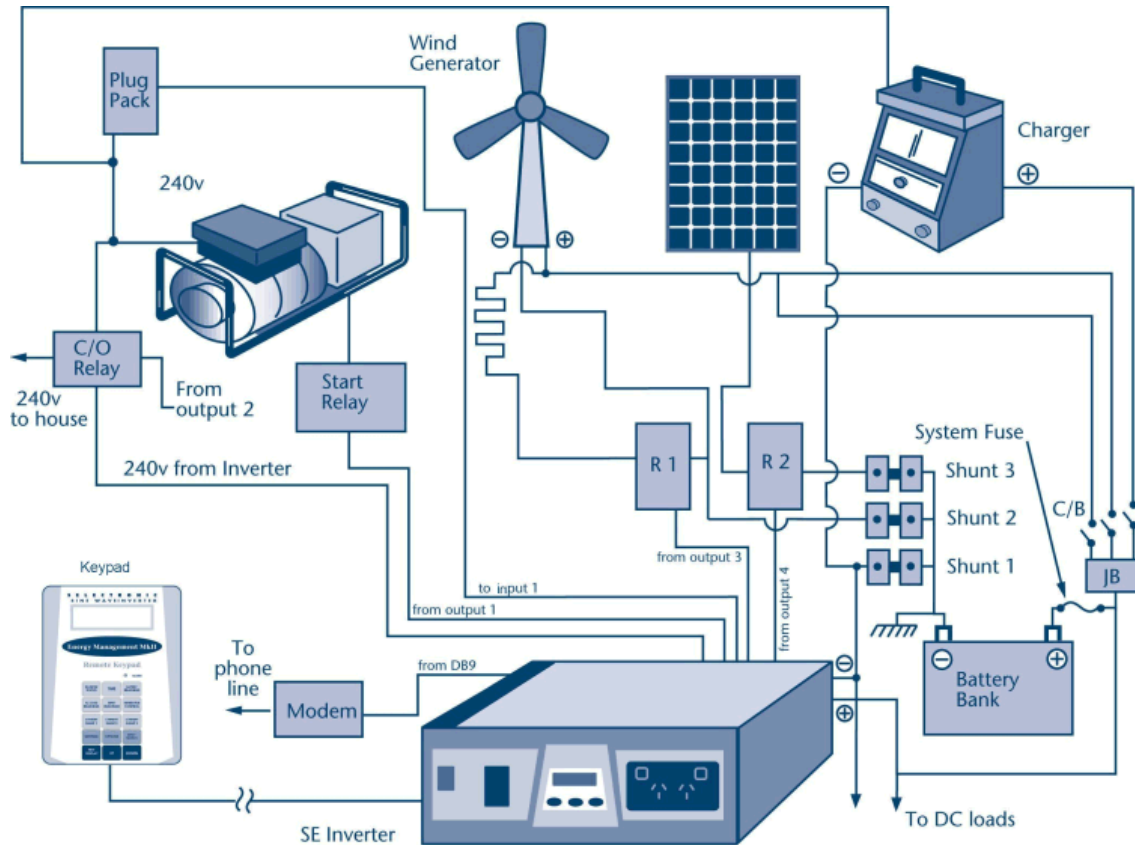
The Selectronic Energy Management MKII can be connected to a remote keypad to allow you to have all your energy information at your fingertips. You can also control the generator from the keypad, turning it off or on as required or set to auto to allow your energy management to take control.

Typical Application

The following diagram gives an indication of how a Selectronic SE series inverter with Energy management MKII can be incorporated into a typical power system.

In this system the Energy Management MKII performs the following functions.

1. Regulates the solar power input to the batteries via a normally closed relay, or a Selectronic PWM control switch.(R2).
2. Regulates the wind generator via a normally open relay or a Selectronic PWM control switch (R1).
3. Uses current shunts 2 and 3 to measure and log, separate charge currents for the wind generator and the solar array.
4. Uses current shunt 1 to measures and log, the battery current used by the inverter and other DC loads.
5. Control the petrol (or diesel) generator automatically or manually via the keypad or modem link. The generator would normally be set to start automatically if the battery state of charge reaches a minimum acceptable level, recharging the batteries via the charger.



Electrical Specifications

Parameter	Energy Management MKII
Sink current on Outputs 1 – 4 (Relay coil current)	100mA maximum
Voltage on Outputs 1 – 4 (Relay coil voltage)	65V maximum
Operating voltage range on inputs 1 and 2	0-2.5VDC
Maximum voltage on inputs 1 and 2 without damage	+/- 30V
Modem communication interface	RS232 via DB9 connector
Current capability of the 8V power supply for the modem	0.4A maximum
Keypad communication interface	RS422
Keypad power supply	Via 8V modem supply
Shunt 1 input voltage	- 47.5mV to 150mV
Shunt 2 and 3 input voltage	0 to 75mV

Year 2000 compliance

Fully compliant.

Control functions and settings

Parameter		Range	Steps/resolution
¹ Delay settings for inputs 1 and 2 when programmed to control outputs 1 - 4 or inverter on/off.		0 - 40 minutes	1 minute
¹ Delay settings for battery voltage when programmed to control outputs 1 - 4 or inverter on/off.		0 - 40 minutes	1 minute
¹ State of charge in batteries setting when programmed to control outputs 1 - 4 or inverter on/off.		0 – 101%	1%
² Regulator boost, float & equalize voltage setting	12V battery	13.0 - 16.8 V	0.1V
	24V battery	26.0 - 33.6 V	0.1V
	48V battery	52.0 - 67.2V	0.1V
Generator change over delay setting		0 – 250 sec	10 sec
Minimum generator run time setting		0 – 40 minutes	1 minute
Lockout start time setting		0:00 to 23:00	1:00 (1hr)
Lockout end time setting		0:00 to 23:00	1:00 (1hr)
¹ "Time of day" time settings when programmed to control outputs 1 – 4 or inverter on/off.		0:00 to 23:00	0:01 (1 minute)
¹ "Time of day" day settings when programmed to control outputs 1 – 4 or inverter on/off.		Sun to Sat and ALL (every day)	
³ Current readings on shunt 1	200A shunt	100A to 200A (400A surge)	0.2A
	100A shunt	50A to 100A (200A surge)	0.1A

³ Current readings on shunt 2 and 3	200A shunt	0 to 200A	0.2A
	100A shunt	0 to 100A	0.1A
	50A shunt	0 to 50A	0.1A

Notes:

1. These can be programmed separately for each of the four outputs and the inverter control
2. Each output may be programmed to a different boost and float voltage.
3. All current shunts are 75mV.