



# **Evoco EMC GSM Logger**

## **Installation and Advanced Users Guide**

### **\*\*\*IMPORTANT SAFETY NOTICE\*\*\***

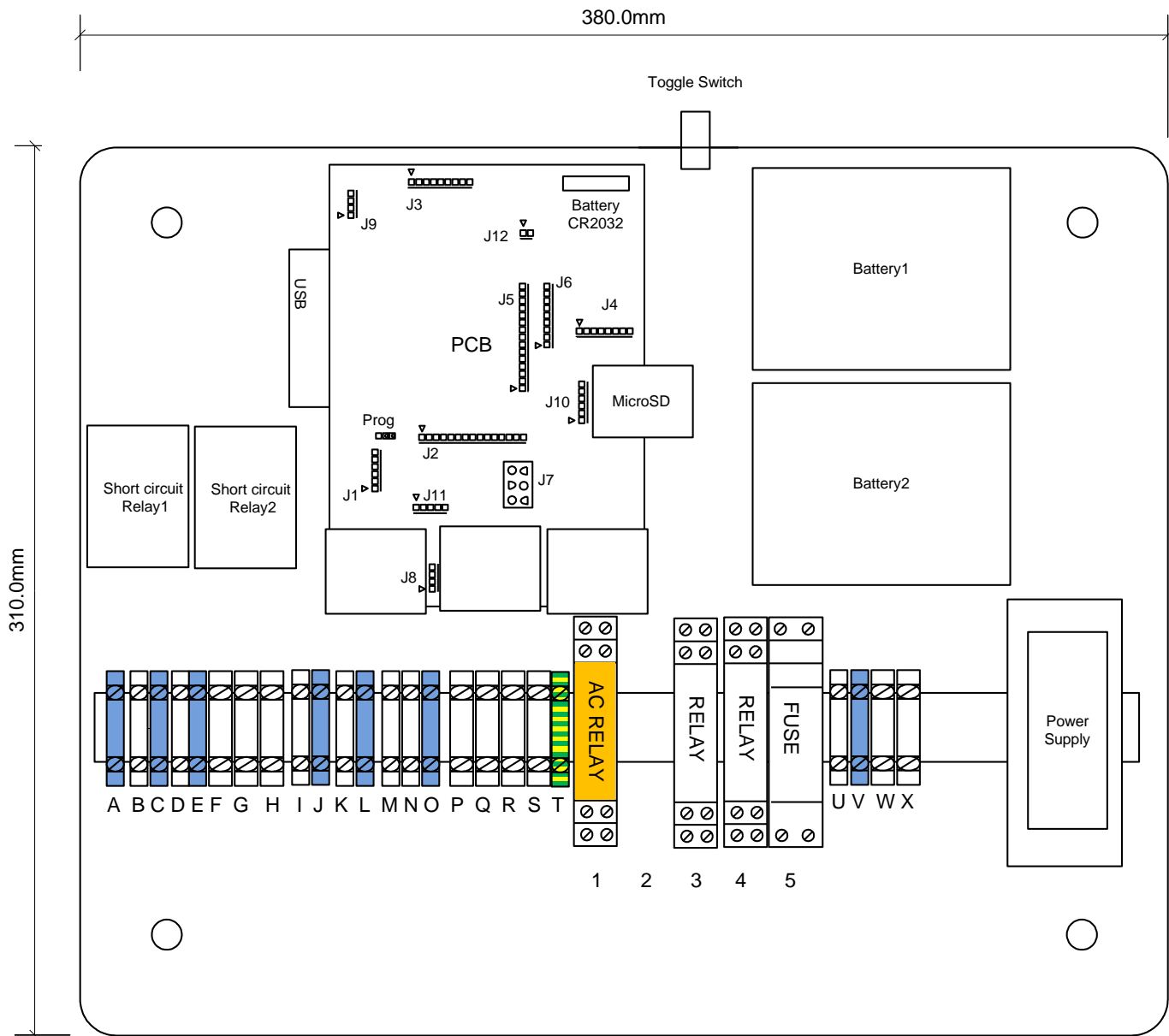
This manual has not included safety precautions. The unit should only be opened and handled by electricians or electronics engineers. Dangerous grid, turbine and DC voltage are present inside this unit. The unit should be stickered with "Dual Supply" warning stickers on commissioning the system.

If you use transformerless inverters, there is a degree of leakage between the DC from the turbine and the grid. This is known as iLeak and is permitted up to a level of 20mA.

As a result, the DC ground on the controller is floating, and carries potential from the grid. This also applies to battery ground, battery +24V and all other voltages within the system. Laptop computers should only be connected via an isolator on the USB.

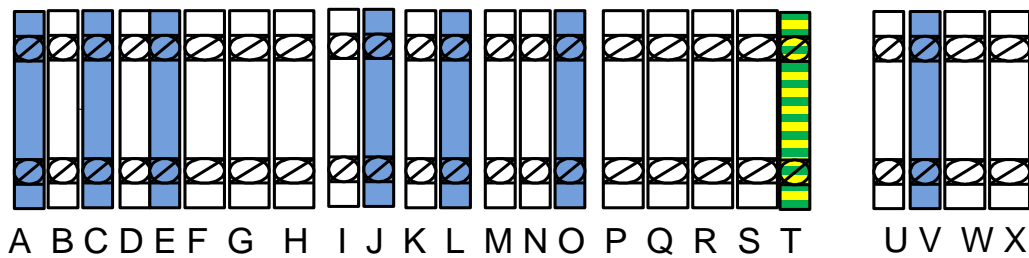
# Panel Connections

Below is a picture of the controller showing the position of components and connections.



Control Panel Layout

## Connections



A:	IGBT	M:	Anemo 24V+	1:	AC Detect
B:	IGBT GND	N:	Anemo -	2:	
C:	Dump Load(B2)	O:	Anemo Sig	3:	Battery Power Relay
D:	Turbine DC-	P:	AC L3	4:	Main Power Relay
E:	Turbine DC+	Q:	AC L2	5:	6A 10x38 Fuse
F:	Phase1	R:	AC L1		
G:	Phase2	S:	AC N1		
H:	Phase3	T:	Earth		
I:	Meter+(C)				
J:	Meter- (E)				
K:	RS485A				
L:	RS485B				



### Tower Connections

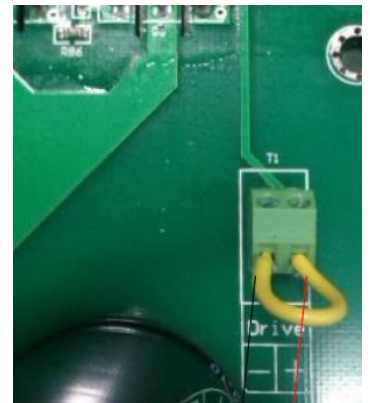
U:	Act. S/C Relay
V:	Act. Relay
W:	DC +
X:	DC -

**A,B: IGBT Driver & GND** – connect to the terminal in the modified Ginlong Controller. A goes to the GATE of the IGBT, and B to the ground in that controller. This should be wired using shielded twisted pair cable with no other cores used. The shield should also be connected to ground (connector B) but should not be connected at the Ginlong controller.

When connecting this to the controller, remove the link on the PCB and attach to the terminals shown on connector T1 on the PCB (right).

Please note;

- The connection to the IGBT must be made using shielded twisted pair wire.
- The screen **MUST** be connected to 0V DC at the M&C and be unconnected at the other end
- Please route this cable away from other high voltage cables where possible
- Please keep the cable as short as possible.
- Clip the screen back at the Ginlong controller for just 1cm or less from the connection block in the Ginlong controller.



**Important.** If you do not have shielded cable, please do not use this connection. Leave the link in place on the Ginlong PCB.

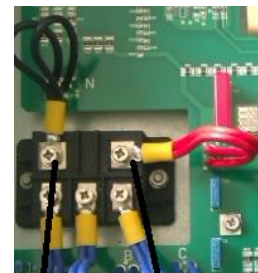
**C: Dump Load +** This is a signal wire which should be connected to one of the brake loads used to measure voltage on the dump load resistor (to check if the resistor and IGBT are working)

It connects to a terminal marked R1- or R2- on the new PCB (on the right side of the PCB). It must not be connected to either R1+ or R2+ - **it connects to the negative.**



**D, E: Turbine DC – and +** Signal wires (not carrying load) from the Ginlong controller. Can be light gauge but should be capable of carrying up to 600V DC. These can be connected using lugs directly to the rectifier on the controller, or to the DC output to the inverters (DC- and DC+). See rectifier diagram (right)

**F, G, H –** Three phase from the turbine. This is load carrying and should be wired in 10mm. There is a reverse-direction sensing circuit. Check this using the screen to see if there is a “RD error”, or if you find that the turbine is constantly stopping and then re-starting at boot up. Either would suggest that you need to swap two of these phases.



DC-ve DC+ve  
Connect using crimp on lugs to the rectifier

**I, J –** connections for pulse from the production meter. It is best if this is connected using shielded twisted pair cable with the shield connected to ground. The ground can be taken from connection N. The pulse output of the meter is usually a transistor. I (+) is connected to the transistor collector, while J (-) is connected to the emitter. This is described differently on different meters, but usually as + and -.

**K, L –** RS485 to Ginlong Inverters – should be twisted pair. View in diagram is as seen from beneath the inverter. K going to 1 (yellow) and L to 2 (blue)



**M,N,O -** Connections for Anemometer if present. Please note - on sites where there is an anemometer, we need to ground the armour on the cable going from the M&C to the turbine tower. This armour should be connected to DC- at the M&C. IT MUST NOT BE CONNECTED TO ANY GROUND AT THE OTHER END.

Some sites will have two-wire anemometers. In this case, only GND and Signal should be wired. (N&O)

The cable carrying the anemometer signal up the tower should also be shielded and the shield on this should be connected to DC- at the turbine base, but not connected to anything at the top of the tower.

There must never be a connection between the tower ground and anything coming back to the plant room.

### **P,Q, R, S,T. Grid supply (3 phase or single phase)**

**Single Phase sites –** on single phase sites, live should be connected to three terminals; P. Q & R. Neutral should be connected to S. T is Earth.

**Three phase sites -** on sites with 3 phase grid, this requires a low current three phase supply which should be supplied from a low current 3~ MCB. You will require all three phases and neutral. Connect the phases to P. Q & R and connect neutral to S. T is Earth.

**Two phase sites** – on sites with two phases, connect phase 1 to P&Q , phase 2 to R and neutral to S. Earth to T.

**U - No longer used.** Actuator short circuit relay to short circuit relay at base of tower.

**V** – Actuator relay signal to actuator relay at base of tower.

**W, X** - these are for connecting 24V DC from the battery in the unit at the base of the tower. On long cable runs, to reduce voltage drop, you will need to connect multiple pairs to reduce voltage drop. Please check polarity carefully and ensure that the + from the battery at the base of the tower is connected to the +.

**Battery Connections:** There is a red and black connection with spade connectors for the batteries. **This is no longer used on sites where there is a battery already in place at the tower base.**

## **Replacing Ginlong Controller PCB**

On most sites, you will need to replace the Ginlong Controller PCB. This requires the removal of the mounting screws for the PCB and the five connections to the rectifier in the centre left of the unit. You then need to remove three clips holding down IGBTs and diodes to a heatsink. There is a plastic backing sheet on this heatsink which must be preserved.

Fit the new PCB, replacing the backing sheet on the heatsink behind the four new IGBTs. You may have to split the three clips between the four IGBTs by using one clip across two IGBTs to secure them to the heatsink.

The wiring circuit is as follows;



**IN1, IN2, IN3** – three phase AC from turbine

**E1** – Earth connection from Dump loads

**R1+, R2+, R1-, R2-** - The dump loads should have one wire going to + and one to -. So one dump load is wired to R1+ and R1-, and the second dump load is wired to R2+ and R2-. When finished, the resistance across R1+ to R2- should be about 15 ohms. Please check that this is correct.

**DC+, DC-** DC feed to inverters.

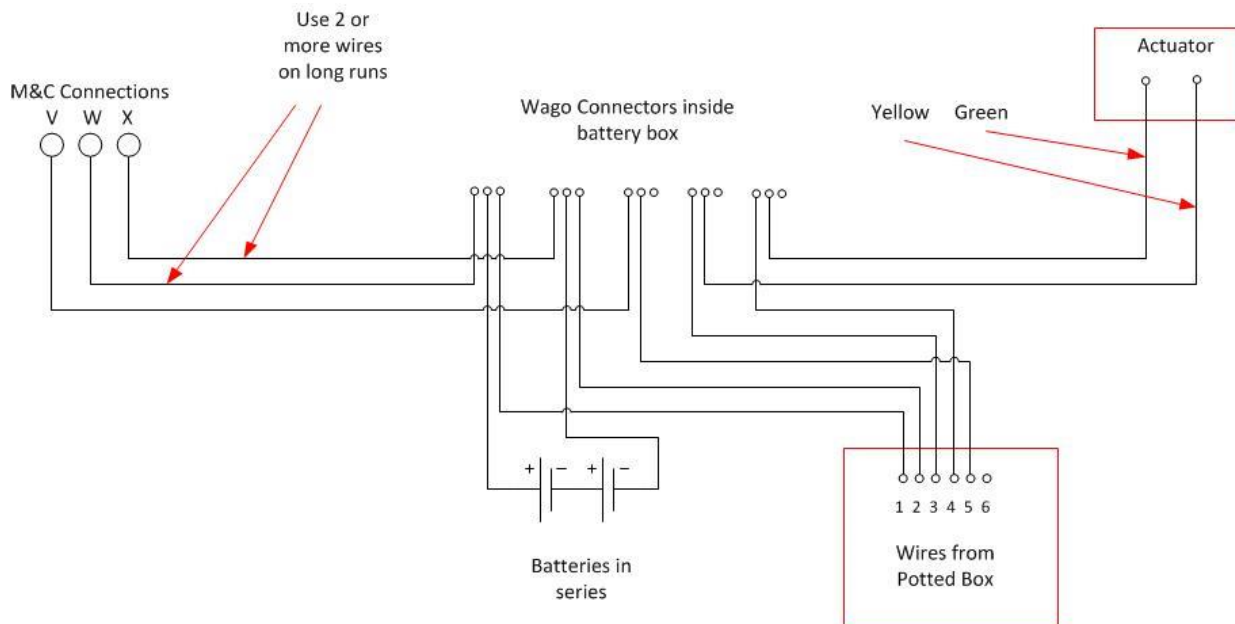
**E2** – Earth connection to inverters.

# Batteries and relays at base of tower

There is a potted enclosure at the base of the tower with relays for managing the actuator. The following wire numbers are used;

- 1) Battery positive – connected to battery +, and to +24V from M&C (which may use multiple wires). Connected using Wago 5 way connector
- 2) Battery negative – connected to battery -, and to -24V from M&C (which may use multiple wires). Connected using Wago 5 way connector.
- 3) Yellow actuator – connected to yellow actuator wire. Connected using Wago 2 way connector.
- 4) Green actuator – connected to green actuator wire. Connected using Wago 2 way connector.
- 5) Signal from M&C – connected to terminal V on M&C. Connected using Wago 2 way connector.

These should be connected using Wago connectors inside a battery box. Before commissioning system, you should check by texting the M&C with the stop button on the M&C released. Texting “Stop” should cause the actuator to contract. Then texting “Start” should, after about 1 minute, result in it extending.



## Fault Finding

When the unit is wired up terminal V should normally be 0V to allow the turbine to run (actuator extended)

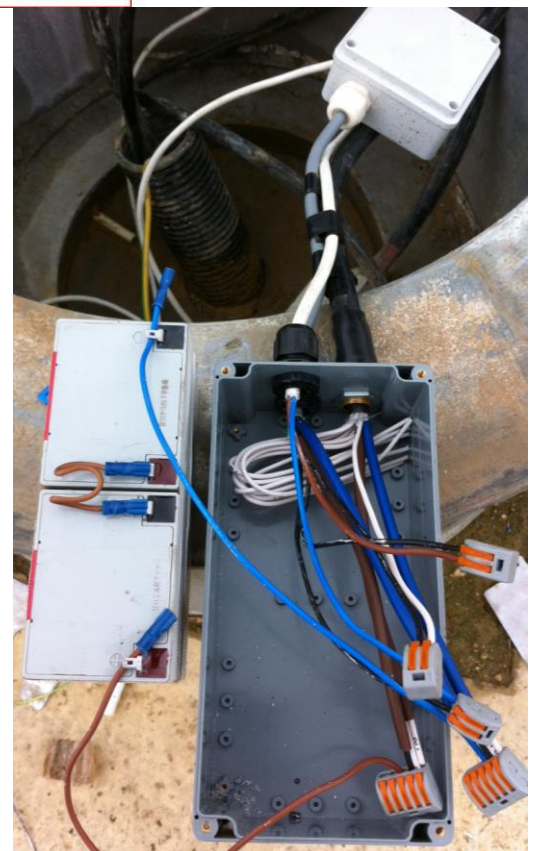
If you press the stop button, or text “Stop” to the unit;

- Terminal V should go to 27V
- The connections to the actuator should go to 24V for about 30 seconds, then fall to zero volts
- The actuator should contract, pitching the turbine

If you release the stop button or text “Start” to the unit;

- Terminal V should fall to zero volts
- The connections to the actuator should go to 24V in the opposite polarity for 30 seconds, then fall to zero volts
- The actuator should extend, allowing the turbine to run.

Picture (right) shows cables glanded and connected prior to putting batteries inside the box and closing lid.



# **Stopping the Turbine**

Please observe the following procedure for stopping the turbine. Either

- Send the machine an SMS in advance so that it will have stopped when you arrive
- Press the emergency stop button and wait for the machine to stop
- If the above is not possible, do the following;
  - Ensure that the emergency stop button is not on and the M&C is not trying to stop the turbine
  - Wait for a lull in the frequency and apply the short circuit brake
  - Wait for approx 30 seconds and see if the turbine has stopped.
  - If not, release the brake, wait a minute or more, and try again.

## **Emergency Brake Switch**

**Installing switch:** Switch should be fitted to panel on arrival if it has not already been installed. The two wires for this are connected to the normally closed contacts (21 & 22 on switch)

**Operation:** When switch is switched pressed down, it simulates a grid failure. The controller will release the actuator relay and apply the dump load to slow the turbine. After a short period, a short circuit will be applied across the three phases from the turbine once the turbine speed and voltage has fallen below the programmed levels using short circuit relay #2



## Panel Screen & SD Card Logging

### Plugging in a Screen

The screen should only be plugged in with the unit powered off by opening the fuse-breaker. The unit should not be plugged into a computer at the time. Installers should carry a spare screen to use with the lid off the M&C

**MicroSD card logging:** Located above the printed circuit board. MicroSD memory card should be formatted as FAT32. A new file is created every night at midnight. A log file older than X days (1-254) will also be deleted each day. ***The number of days should be set to less than 40 days in the configuration software as the card may become full and cause an error.***

**LCD Display:** The bottom line of the display shows Voltage V, and RPM.



The top line indicates machine and GSM status as follows;

**"Ready to Start"** No errors, counting down to release turbine. Short circuit still on.

**"Starting"** S/C off, IGBT dump load on doing soft start

**"Running"** S/C off, Actuator Off, IGBT off, No errors

**"Stopping"** Trying to stop, S/C off, Actuator On, IGBT and dump load On

**"Stopped"** S/C on, Actuator On

**GSM:** - the GSM status is at the top right of display and shows as follows;

LCD	RSSI dBm	Condition		LCD	RSSI dBm	Condition		LCD	RSSI dBm	Condition
-		Not connected		10	-93	OK		21	-71	Excellent
0	-113			11	-91	OK		22	-69	Excellent
1	-111			12	-89	OK		23	-67	Excellent
2	-109	Marginal		13	-87	OK		24	-65	Excellent
3	-107	Marginal		14	-85	OK		25	-63	Excellent
4	-105	Marginal		15	-83	Good		26	-61	Excellent
5	-103	Marginal		16	-81	Good		27	-59	Excellent
6	-101	Marginal		17	-79	Good		28	-57	Excellent
7	-99	Marginal		18	-77	Good		29	-55	Excellent
8	-97	Marginal		19	-75	Good		30	-53	Excellent
9	-95	Marginal		20	-73	Excellent		31	-51	dBm or greater
								99		not known/detectable



## Error Messages

"Over-Curr Error"	Dump load has been running over-current
"Over-Volt Error"	Turbine has exceeded its permitted voltage
"Over-Freq Error"	Turbine has exceeded its permitted RPM
"Dump Load Error"	Either the IGBT has failed or the heater has failed.
"Perm Stoppage"	Extreme voltage or frequency error requires permanent shut down
"Inverter Error"	
"Windspeed Error"	Wind speed has been exceeded
"Reverse Error"	Reverse direction detected
"HardStop Error"	Unit has carried out a hard stop, usually only in the event of an heater failure.
"GSM Error "	IMEI mismatch – the module does not match the controller
"GSM Lock "	Unit has been shut down by an SMS message
"Exercise Error"	Unit failed its regular exercise routine.
"Grid Er/EM Stop"	Grid failure or emergency stop button has been pressed
"Bat Voltage Low"	Battery below permitted voltage – system shutting down.



**Inverter Status:** Inverter status codes as recorded by controller are shown below. These can be found on the website, described as “inverter state”. An inverter state above 1000 on any inverter will cause the system to stop.

**1** = Generating

**2** = Low wind

**3** = At startup Initializing

**4112** = Grid over voltage OV-G-V

**4113** = Grid under voltage UN-G-V

**4114** = Grid over frequency OV-G-F

**4115** = Grid under frequency UN-G-F

**4116** = Grid impedance over G-IMP

**4117** = No grid NO-G

**4128** = DC over voltage OV-DC

**4129** = DC bus over voltage OV-BUS

**4130** = DC bus unbalance UNB\_BUS

**4131** = DC bus under voltage UN\_BUS

**4132** = DC bus unbalance 2 UNB2\_BUS

**4144** = Short circuit protection SHORT-PRO

**4145** = The initial protection INI-PRO

**4146** = Temperature protection TEM-PRO

**4147** = Ground fault GROUND-PRO

## **Inverter Data**

**The inverters must be configured to give them individual addresses on the common RS485 connection.**

This can be done from the front screen of the inverter. We suggest using addresses 1 to 6 for six inverter systems as this is how the software is configured by default.

**Notes on Active / Released relays** – as a failsafe, a number of relays carry out their working function while in the de-energised position. Thus for example, the actuator PITCHES the turbine when it is de-energised. Likewise the red short circuit relay short circuits the turbine when de-energised. The only exception to this is the large black short circuit relay which shorts the turbine when activated.

## **Start-up Sequence**

To protect the battery from being completely depleted during a grid outage, the third small relay disconnects the controller if battery voltage falls below 22.5V (programmed in config software). If controller detects a battery voltage above the programmed setting it will energise relay 3 and keep it in this state until battery voltage is disconnected or the battery voltage level falls below the programmed setting. The grid will operate the yellow relay to restart the controller.

If all parameters are within the programmed limits and there is no actuator lock set in memory (because of incoming SMS message), the controller will start counting down the actuator unlock time (default is 50 seconds). When this reaches zero, the actuator relay will be energised to unpitch the turbine, and the actuator short circuit relay will be released.

## **Conditions that will cause the Actuator relay to release (pitching the turbine)**

- Wind speed above a certain threshold for a certain period of time
- Loss of AC mains power, or voltage loss detected on second or third AC phase
- Turbine Frequency or DC Voltage or Dump Load Current above programmed threshold
- GSM SMS or phone command
- Inverter state of value greater than or equal to 1000H
- Emergency brake switch

## **Conditions that must be met to allow Actuator relay to re-energise**

- Wind speed must remain below a lower limit for a certain period of time (in config software)
- AC power must be present
- Turbine Frequency, DC voltage and Dump Load Current below their programmed limits and any respective timeout reached if actuator relay release was triggered by turbine Over Frequency or DC Over Voltage or Dump Load Over Current
- Actuator relay lock cleared if it has been set by GSM command
- Inverter state of particular Inverter which triggered actuator relay release must return to below 1000H for certain period.

Disconnecting power to the controller will clear all of the above except an actuator relay lock set by GSM command (this needs to be unlocked by GSM command or programmer).

# GSM Commands

**SMS**, text message formatted as below can be used to communicate with the controller;

- **“Stop”**: Actuator relay disabled, relay locked off
- **“Start”**: Actuator relay enabled
- **“RST”**: Reset controller (to restart after a shutdown caused by an error)
- **“HRS”**: Complete Hardware Reset
- **“IME”**: Returns the IMEI number of the GSM card.
- **“VER”**: Request version of M&C Software
- **“CID”**: Toggle Caller ID On or Off

**You can also use this to set the APN settings for the SIM Card;**

- **APN**: Set apn by SMS, format “APN{APN},{APN username},{APN password}”  
(E.g. APNpayandgo.o2.co.uk, payandgo,password)

**You can also use this to set the Phone numbers settings for the M&C;**

- **PH1**: Set phone number 1 by SMS, format “PH1{PhoneNo.}”  
(E.g. PH144987654321 would set phone number 1 to 44987654321)
- PH2,PH3**: as above.

## Phone Call

- **1-2 Rings before controller hangs up**: Actuator relay locked in off state
- **3-4 Rings before controller hangs up**: Actuator relay unlocked

If Caller ID “CID Lock” setting in programmer, controller will only accept commands from set of pre-programmed phone numbers

## Resetting the Controller

A software reset can be carried out using the SMS “HRS” command.

For a complete reset of the system the main fuse holder in the controller (5) should be opened for 10 seconds so the system turns off. If the system is connected by USB to a computer this should be disconnected. When the fuse is closed again the system should restart.

If software reset is not working, check that the programming jumper is in the correct position as shown on last page of manual and that phone numbers are programmed correctly.

**\*\*\*IMPORTANT NOTE ABOUT CONNECTING A COMPUTER TO THIS SYSTEM\*\*\***

**USB Port Isolation**

If you are using a transformerless inverter, there is a degree of leakage between the DC from the turbine and the grid. This is known as iLeak and is permitted up to a level of 20mA.

As a result, the DC ground on our controller is floating, and carries potential from the grid. This also applies to battery ground.

For this reason, programming and monitoring of the controller through a USB or serial port should never be carried out while the inverter is connected. If you wish to connect a laptop to the controller while the inverter is running, you should do so through an isolated USB connector such as [this unit](http://electronics-shop.dk/?id=1038) (<http://electronics-shop.dk/?id=1038>)

Failure to isolate the USB connection may result in damage to the USB port on your computer and to the controller.

Some old computers and laptops have galvanic isolation on their power supply (and no earth wire). Usually such computers are not affected.

The computer may also be connected if it is not plugged into its charger at the same time.

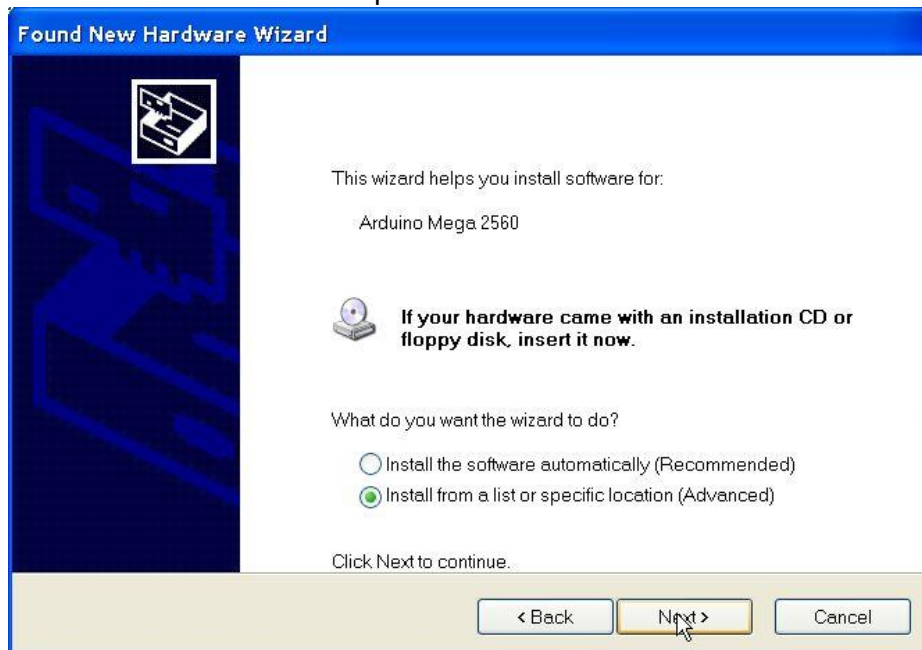
## CONFIGURING YOUR COMPUTER TO COMMUNICATE WITH THE M&c

### Driver installation

1. Power off panel
2. Connect USB cable to computer.
3. When prompted that new hardware found, select “No, not this time” and click Next



4. Select “install from a list or specific location” and click Next



5. Browse to the driver folder on the supplied media or download.



6. If a warning is displayed, press "Continue Anyway"



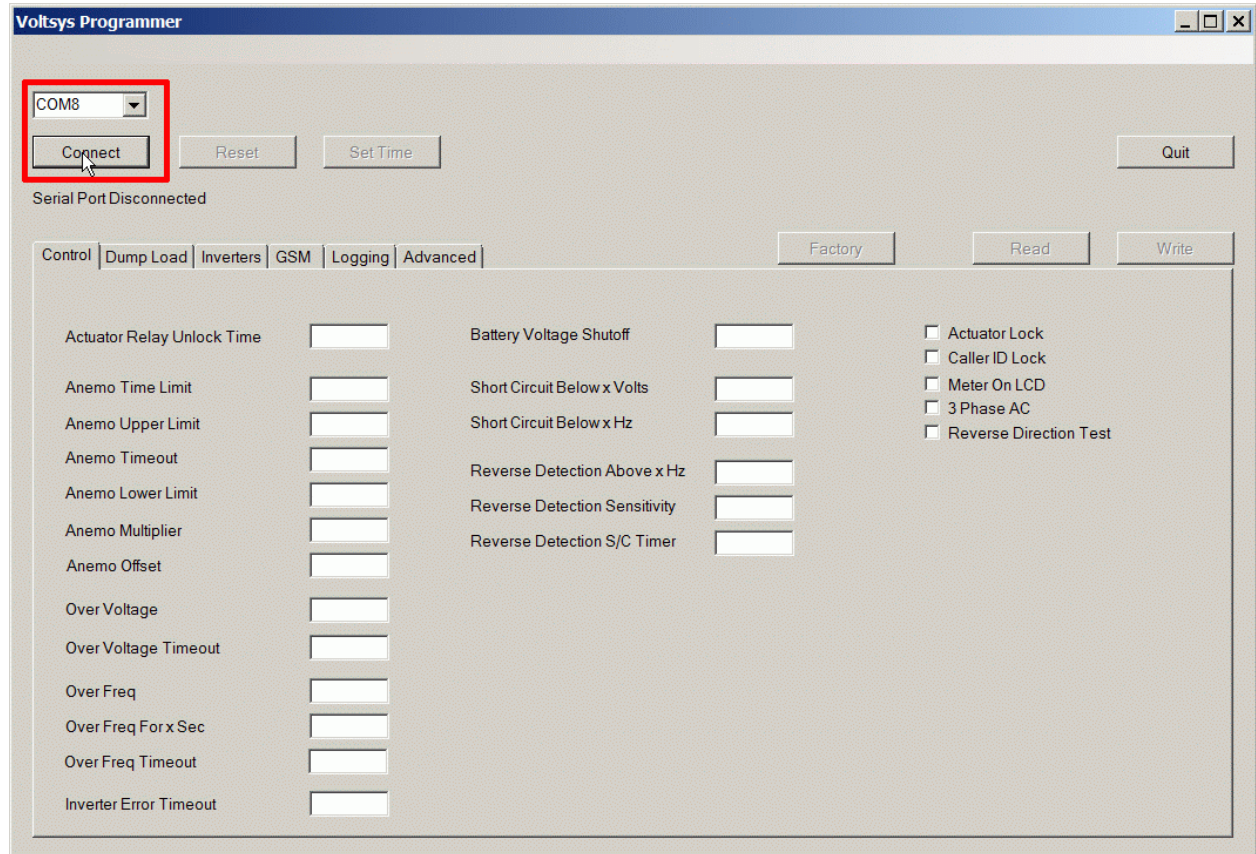
7. Click Finish to complete the driver installation.





## Programming Settings

1. Turn off power supply to panel
2. **IMPORTANT** - Either use a USB isolator, or disconnect the wind inverters from the grid or plug out laptop charger
3. Connect USB cable from panel to computer
4. Run programmer file
5. Select panel COM Port and click "Connect". If you do not know which com port is connected, you can find this under ports in the computer's device manager



6. "Serial Port Connected" should be shown below the Connect button
7. To set the Control Panel Time and Date from the computer clock, click the "Set Time" button
8. To read the current control panel settings click the "Read" button and wait for settings to be read (note: this will take a minute or two, please wait for settings to appear)
9. To write changes to the control panel settings click the "Write" button and wait for the control panel to restart.
10. Disconnect USB
11. Turn on power supply to panel

# System Configuration Menu Settings

## Control Tab

**Actuator Unlock Time:** Time delay in seconds before the controller (after all programmed conditions met) will energise the actuator relay on. (Note that actuator relay *ON* means that the pitching will be off)

**Anemo Time Limit:** Time in Seconds anemometer wind speed must remain above

**Anemo Upper Limit,** for Actuator relay to be released, pitching the turbine.

**Anemo Upper Limit:** See above. This is expressed as m/sec.

**Anemo Timeout:** Time in seconds that anemometer wind speed must remain below **Anemo Lower Limit**, before controller will energise the actuator relay to unpitch the turbine.

**Anemo Lower Limit:** See above.

**Anemo Multiplier:** Anemometer transfer function, slope. Convert frequency from anemometer into wind speed reading. E.g. 0.765 m/s/Hz

**Anemo Offset:** Anemo transfer function offset.

**Inverter Error Timeout:** Time in seconds after inverter state reports “No Alarm” for controller to clear the Inverter Error and allow the controller to energise the actuator relay.

**Over Voltage:** If controller measures a DC turbine voltage above this, actuator relay will be released, pitching the turbine. Default is 450 to 500V depending on turbine type

**Over Voltage Timeout:** Time in seconds DC turbine voltage must remain below **Over Voltage** setting for controller to clear the Over Voltage state and allow the controller to energise the actuator relay. This should generally be set to 2550 on sites with no anemometer present.

**Over Freq:** If controller measures a turbine frequency above this for x seconds (**Over Freq for x Sec**), actuator relay will be released. This should be set to 30Hz.

**Over Freq for x Sec:** This should be set to 5 seconds.

**Over Freq Timeout:** Time in seconds, turbine frequency must remain below **Over Freq** setting for controller to clear the Over Freq state and allow the controller to energise the actuator relay. This should be set to 2550 on sites with no anemometer present.

**Battery Voltage Shutoff:** If AC power from the grid is lost, controller will continue to operate until battery voltage is measured below this value. The controller will restart when the AC power from the grid returns.

**Short Circuit Below x Volts:** Voltage below which the short circuit relay is allowed to operate during pitching or a system shutdown.

**Short Circuit Below x Hz:** Turbine frequency below which the short circuit relay is allowed to operate during pitching or a system shutdown. This should be set to 10hz

**Reverse Detection Above x Hz:** Turbine frequency above which controller produces reliable frequency readings (should be less than **Short Circuit Below x Hz** setting) – should be set to 4 Hz.

The screenshot shows the 'Voltsys Programmer' software window. At the top, there's a 'COM26' dropdown and a 'Refresh' button. Below that are 'Disconnect', 'Reset', 'Set Time', and 'Quit' buttons. A status bar indicates 'Serial Port Connected'. The main interface has tabs for 'Control', 'Dump Load', 'Inverters', 'GSM', 'Logging', and 'Advanced'. The 'Control' tab is active, showing various settings in a grid. On the right, there are checkboxes for 'Actuator Lock', '3 Phase AC', 'Reverse Direction Test', 'Status Bits Hidden', 'Show Only Status Bits', 'Freq on LCD (Unchecked RPM)', and 'Freq to Website or RPM'. An 'RPM Multiplier' field is set to 5.5.

Control	Dump Load	Inverters	GSM	Logging	Advanced
Actuator Relay Unlock Time	50	Battery Voltage Shutoff	22.5		
Anemo Time Limit	5	Short Circuit Below x Volts	100		
Anemo Upper Limit	30	Short Circuit Below x Hz	6		
Anemo Timeout	600	Reverse Detection Above x Hz	3		
Anemo Lower Limit	28	Reverse Detection Sensitivity	5		
Anemo Multiplier	0.765	Reverse Detection S/C Timer	1200		
Over Voltage	450	Reverse Det Actuator Period	600		
Over Voltage Timeout	600	Reverse Det Actuator Timer	100		
Over Freq	27	Actuator S/C Timer	60		
Over Freq For x Sec	25	3Phase S/C Timer	2550		
Over Freq Timeout	600	Over Freq 2	30		
Inverter Error Timeout	90	Over Freq 2 For x Sec	2		

**Reverse Detection Short Circuit Timer:** Length of time in seconds to operate the short circuit relay if turbine detected spinning backwards.

**Direction Sensitivity:** Increasing this setting reduces the sensitivity of the turbine direction circuit

**Actuator S/C Timer:** Time in seconds after actuator pitches turbine to short circuit actuator

**3-Phase S/C Timer:** Time in seconds after actuator pitches turbine to short circuit turbine three phase if voltage and frequency haven't fallen below levels **Short Circuit Below X volts/Hz**

## 2<sup>nd</sup> Frequency Limit

As Over Freq, but provides a second set of limits, usually a higher frequency for a shorter period

### Checkboxes:

- **Actuator Lock:** Set if Actuator Relay locked in off state by GSM. Actuator relay will not energise unless this is set unchecked or GSM command used to unlock.
- **3 Phase AC:** should be checked in order to detect a mains failure on an AC phase being monitored. The AC grid input on single phase installs should be looped to all three phases, so this is only used in the event of a fault with the M&C unit.
- **Reverse Direction test:** If checked, turbine direction sensing will be reversed. For best results leave unchecked and reconfigure order which turbine 3 phase is connected to controller if needed.
- **Status bits hidden:** Hide status bits (default) – you can untick this if you want to do diagnostic work and read the status of the unit
- **Show Only status bits** – if both the above and this box are unticked, the screen will toggle between status bits and error messages
- **Freq on LCD** – Will show frequency rather than RPM on screen
- **Freq to website or RPM.** If ticked, will send frequency rather than RPM to the website
- **RPM Multiplier** – amount to multiply frequency by to get RPM.

The screenshot shows the 'Voltsys Programmer' software window. At the top, there's a dropdown menu set to 'COM26' and a 'Refresh' button. Below that are 'Disconnect', 'Reset', 'Set Time', and 'Quit' buttons. A status bar indicates 'Serial Port Connected'. The main interface has tabs for 'Control', 'Dump Load', 'Inverters', 'GSM', 'Logging', and 'Advanced'. The 'Advanced' tab is selected, showing a grid of settings. On the right, there are 'Factory', 'Read', and 'Write' buttons. The settings include:

Parameter	Value
Actuator Relay Unlock Time	50
Anemo Time Limit	5
Anemo Upper Limit	30
Anemo Timeout	600
Anemo Lower Limit	28
Anemo Multiplier	0.765
Over Voltage	450
Over Voltage Timeout	600
Over Freq	27
Over Freq For x Sec	25
Over Freq Timeout	600
Inverter Error Timeout	90
Battery Voltage Shutoff	22.5
Short Circuit Below x Volts	100
Short Circuit Below x Hz	6
Reverse Detection Above x Hz	3
Reverse Detection Sensitivity	5
Reverse Detection S/C Timer	1200
Reverse Det Actuator Period	600
Reverse Det Actuator Timer	100
Actuator S/C Timer	60
3Phase S/C Timer	2550
Over Freq 2	30
Over Freq 2 For x Sec	2

On the right side, there are checkboxes for:

- ☐ Actuator Lock
- ☐ 3 Phase AC
- ☐ Reverse Direction Test
- ☒ Status Bits Hidden
- ☐ Show Only Status Bits
- ☐ Freq on LCD (Unchecked RPM)
- ☒ Freq to Website or RPM

Below these is an 'RPM Multiplier' field set to 5.5.



# Dump Load Tab

**Dump Load Ohms:** Resistance of dump load – should be set to 15 ohms normally

**Over Current 1 Sec Limit:** Max KW through dump load allowed over 1 Second period. Should be set to 30kw

**Over Current 10 Sec Limit:**

Max KW through dump load allowed over 10 Second period. Should be set to 20kw

**Over Current 100 Sec**

**Limit:** Max KW through dump load allowed over 100 Second period. Should be set to 10kw

**Over Current S/C after x**

**Seconds:** If any of the above limits are exceeded the dump load will remain active for period of x seconds while actuator is engaged to pitch turbine. If turbine frequency hasn't dropped below programmed settings (e.g. **Short Circuit Below x Hz**) within this period, the

short circuit relay is energised. Set to 60 seconds by default

Voltsys Programmer	
COM26	Refresh
Disconnect	Reset
Set Time	Quit
Serial Port Connected	
Control	Dump Load
Inverters	GSM
Logging	Advanced
Factory	
Read	
Write	
Dump Load Ohms	15
Over Current 1Sec Limit	255
Over Current 10Sec Limit	255
Over Current 100Sec Limit	255
Over Current S/C after x Sec	10
Over Current Recover Time	600
Dump Load On Voltage	400
Dump Load Off Voltage	320
Crowbar Short Circuit Voltage	550
Crowbar Short Circuit Frequency	35
Crowbar Short Circuit Freq Time	1
<input type="checkbox"/> Crowbar S/C Enable	
Soft Start Time	60

**Dump Load On Voltage:** If voltage rises above this setting, the Dump Load will be turned on until the voltage has dropped below **Dump Load Off Voltage**. We are not currently using this function, so to disable this, set this to 650V

**Dump Load Off Voltage:** See above. As this is not currently used, set this to 600V.

**Crowbar Short Circuit Voltage:** Voltage above which Short Circuit relay is energised to short circuit the turbine and protect the controllers and inverters. This should be set above **Dump Load On Voltage**. Default is 550V

**Crowbar S/C Enable** – if this is unticked, then the crowbar settings will not be applied – no hard stop is possible.

**Soft Start Time** - time (seconds) that IGBT is applied during startup of the turbine after a reset.

# Inverter Tab

**Number of Inverters:** Number of inverters connected

**Inverter Addresses:** RS485 Addresses of inverters connected.

If only one inverter present its address should be entered in "Inverter 1" text box. "Inverter 2" text box should be set at zero. For multiple inverters, their addresses should occupy the lowest free slot, e.g. for four inverters their address should be entered in Inverter 1-4 text boxes, with "Inverter 5" text box set to zero

## GSM TAB

**APN:** GPRS access point name of mobile carrier of inserted SIM card.

**APN User:** GPRS apn username setting of mobile carrier of inserted SIM card.

**APN Password:** GPRS apn password setting of mobile carrier of inserted SIM card.

**Orange**                      orangewl.com or wlapn.com

**Vodafone**                  wlapn.com

**02**                              gprs.mywasp.ws

**Username**                  evoco

**Password**                  evoco

**Phone Numbers:** SMS messages will be sent to Phone number 1,

GSM commands accepted from phone numbers 1-3 if caller ID lock set on.

If caller ID lock is not set on, the unit will accept text commands from any phone

**GSM Reset Timer:** Resets GSM card after X seconds if error detected.

**GSM Reset After X Seconds:** Resets the GSM card after a period of X seconds whether or not error encountered.

### Checkboxes

- SMS on Anemometer: SMS sent if wind speed triggers release of actuator relay
- SMS on Inverter Alarm: SMS sent if Inverter Alarm triggers release of actuator relay
- SMS on Over Frequency: SMS sent if Over Freq triggers release of actuator relay
- SMS on Over Voltage: SMS sent if Over Voltage triggers release of actuator relay

- Caller ID Lock: Prevents controller accepting remote commands except from recognised phone numbers

# Logging Tab

**Log to Serial:** Parameter to send to controller serial port.

**Log to SD card:** Parameters to log to SD Card

**Log to Web:** Parameters to log to website.

If checked Time, Wind speed, Turbine Frequency, DC Turbine voltage will be sent to website in every packet transmitted.

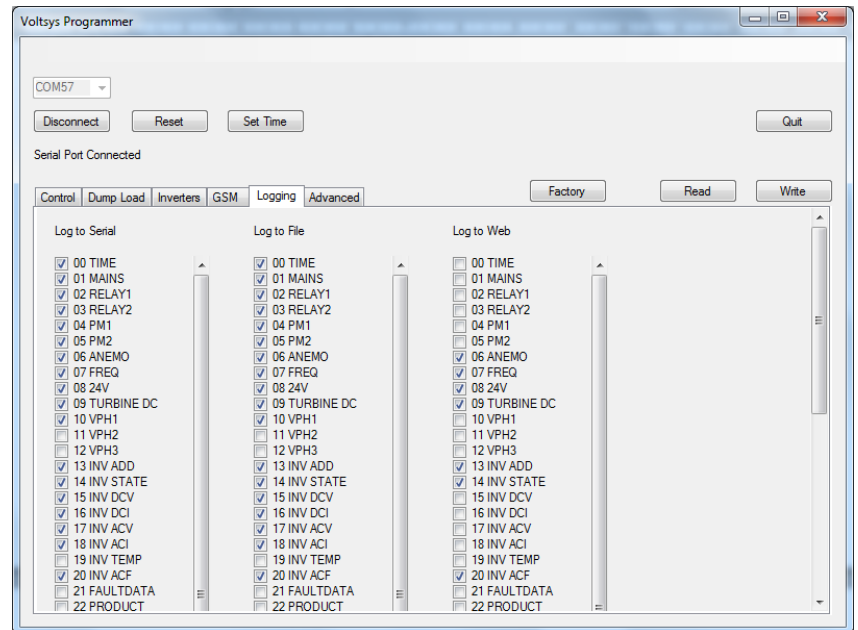
Inverter Parameters (if checked) are sent every second packet.

Other controller parameters (if checked) are sent every second packet.

If more parameters selected than a data packet can accommodate, parameters may be dropped.

**The following is an outline of the parameters;**

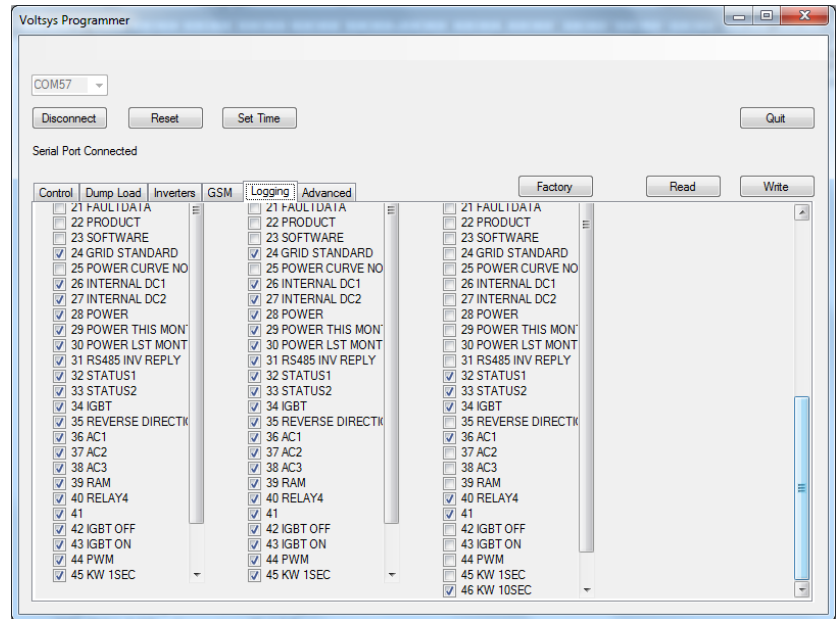
- 00) Time – Time stamp on each log
- 01) Mains – Detection of mains error
- 02) Relay1 – Position of pitching actuator relay
- 03) Relay 2 – Position of short circuit relay
- 04) PM1 – Meter pulse count
- 05) PM2 – not used
- 06) Anemo – Anemometer speed (tick if anemometer present)
- 07) Freq – Turbine frequency (to read RPM)
- 08) 24V – Battery Voltage
- 09) Turbine DC – Turbine DC voltage measured by M&C
- 10) VPH1 – Phase one turbine voltage
- 11) VPH2 – Phase two turbine voltage
- 12) VPH3 – Phase three turbine voltage
- 13) Inv Add – Address of inverter currently being read
- 14) Inv State – State (alarms conditions) of inverter currently being read
- 15) INV DCV – DC voltage as measured by inverter
- 16) INV DCI – DC Current as measured by inverter
- 17) INV ACV – Grid voltage as measured by inverter
- 18) INV ACI – Grid current (export current)
- 19) INV Temp – Inverter temperature
- 20) INV ACF – Inverter Grid Frequency
- 21) FAULTDATA – Inverter fault data
- 22) Product – Inverter product info





## Logging Tab (Contd..)

- 23) Software – Inverter Software Version
- 24) Grid Standard (G83 etc.)
- 25) Power Curve Number Inverter is using
- 26) Internal DC1 (bulk voltage)
- 27) Internal DC2 (bulk voltage)
- 28) Power
- 29) Power this month
- 30) Power last month
- 31) RS485 Inv Reply – Confirming response from inverter when it's polled
- 32) Status 1 – this is an important status code which gives a range of information – see separate description of this
- 33) Status 2 – see above
- 34) IGBT – State of IGBT controlled by M&C
- 35) Reverse Direction – Indicates if turbine is spinning backwards
- 36) Grid AC Voltage phase 1
- 37) Grid AC Voltage phase 2
- 38) Grid AC Voltage phase 3
- 39) RAM – memory remaining free in processor
- 40) Relay 4 – condition of actuator s/c relay
- 41) Not used
- 42) IGBT OFF – Would log programmed **Dump Load Off Voltage** if needed
- 43) IGBT ON – as above for Dump Load On Voltage
- 44) PWM – not used
- 45) Kw 1 sec – energy used in dump load in last 1 second
- 46) Kw 10 sec - energy used in dump load in last 10 seconds
- 47) Kw 100 sec - energy used in dump load in last 100 seconds
- 48) STAT Txt – Logs addition text to log file to help with debugging



# Advanced Tab

**Pulse Meter Adjust:** Time in milliseconds for Min Pulse width, Max Pulse width and Minimum time between pulses. This is to filter false pulse readings caused by spike signals from neighbouring wires. Leave these at default settings unless there are problems with reliable reading of energy production on a site.

**Server Config:** Server and data packet configuration. This determines the web page to which data will be sent.

**Log interval:** Sets how often data is logged and written to the micro SD card. An entry of 1 will log every 1/10<sup>th</sup> of a second, which may be useful for diagnostic purposes.

**Log File Age:** At power up or mid-night, the controller will delete any log file that was created this number of days ago

**Actuator Exercise period:** This is a periodic check of the actuator to ensure that it is working. Default is 3. Every three days the system will attempt a shutdown of the turbine by pitching the turbine and short circuiting it. Should this test fail, it will send a text message indicating a failure. You can change here the time in days between operating the actuator. Value of zero will disable

**Exercise Hour** – Hour of the day when the exercise should be performed. This can be night time or daytime as considered appropriate for the site.

**Exercise Run Length** – Length of time to shut down turbine (should be set to 2 minutes).

The screenshot shows the 'Voltsys Programmer' window with the 'Advanced' tab selected. The window has a title bar with standard Windows controls. Below the title bar, there's a dropdown menu for 'COM57' and three buttons: 'Disconnect', 'Reset', and 'Set Time'. A 'Quit' button is in the top right. Below these is a 'Serial Port Connected' status indicator. The main area is divided into two columns of settings. The left column includes 'Pulse Meter Adjust' (with sub-settings for Meter 1 and 2: Min, Max, Space), 'Server Config' (with sub-settings for IP, Port, Header 1, Header 2, and Data Buffer Limit), and 'Debug' (a checkbox). The right column includes 'Log Interval', 'Delete Log Age', 'Exercise Period (days)', 'Exercise Turbine Freq. > X hz', 'Exercise Run Length (minutes)', 'Exercise Hour (24hr)', 'IGBT Test Voltage', 'AC1 Calibrate', 'AC2 Calibrate', and 'AC3 Calibrate'. Each setting has a corresponding input field or checkbox.

Setting	Value
COM57	COM57
Disconnect	Button
Reset	Button
Set Time	Button
Quit	Button
Serial Port Connected	Status
Control	Tab
Dump Load	Tab
Inverters	Tab
GSM	Tab
Logging	Tab
Advanced	Tab
Factory	Button
Read	Button
Write	Button
Pulse Meter Adjust	Section Header
Meter 1 Pulse Min	90
Meter 1 Pulse Max	140
Meter 1 Pulse Space	200
Meter 2 Pulse Min	90
Meter 2 Pulse Max	140
Meter 2 Pulse Space	200
Server Config	Section Header
Server IP	216 52 233 121
Server Port	80
Header 1	
Header 2	
Data Buffer Limit	85
Log Interval	10
Delete Log Age	30
Exercise Period (days)	0
Exercise Turbine Freq. > X hz	255
Exercise Run Length (minutes)	255
Exercise Hour (24hr)	255
IGBT Test Voltage	50
Debug	<input type="checkbox"/>
AC1 Calibrate	235
AC2 Calibrate	158
AC3 Calibrate	154

**Actuator Exercise Turbine Freq. > X Hz:** Wait for turbine speed to rise above this value before cycling actuator relay. This should be set to 20.

**IGBT Test Voltage:** When IGBT switches on, IGBT voltage should fall below this programmed voltage for test to pass. When IGBT switched off the controller tests that the IGBT voltage is greater than 20V when Turbine voltage is between 50 & 200V. Set to 50V by default. Set to Zero disables all IGBT tests, or set very high to only test IGBT off condition between 50 & 200V DC

**Debug:** Used for troubleshooting. Additional data is sent to Serial port. This should be unchecked.

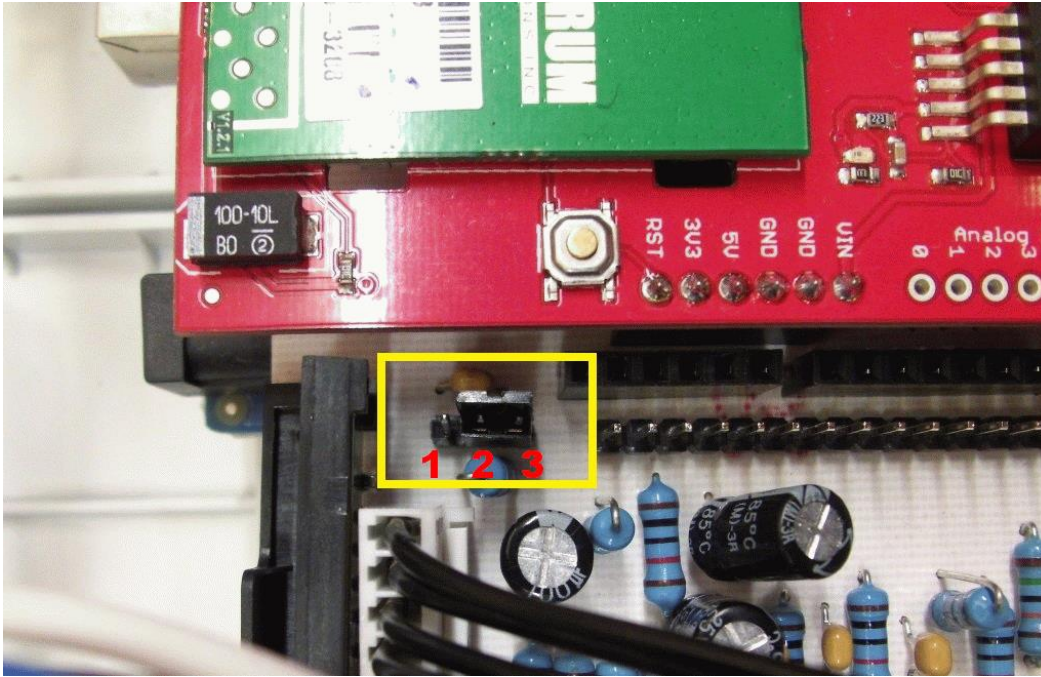
**AC 1/AC2/AC3 Calibration:** Adjusts calibration of PCB transformers (should not need to be adjusted unless circuit parts such as transformers have been changed)

**Headers** – used for programming in data for website. (only under advice...)

### Re-programming Jumper:

There is a jumper in place which is required for normal operation of the system. On later units this is replaced with a DIP switch. The Jumper or DIP switch should be set to the right as pictured below for normal operation.

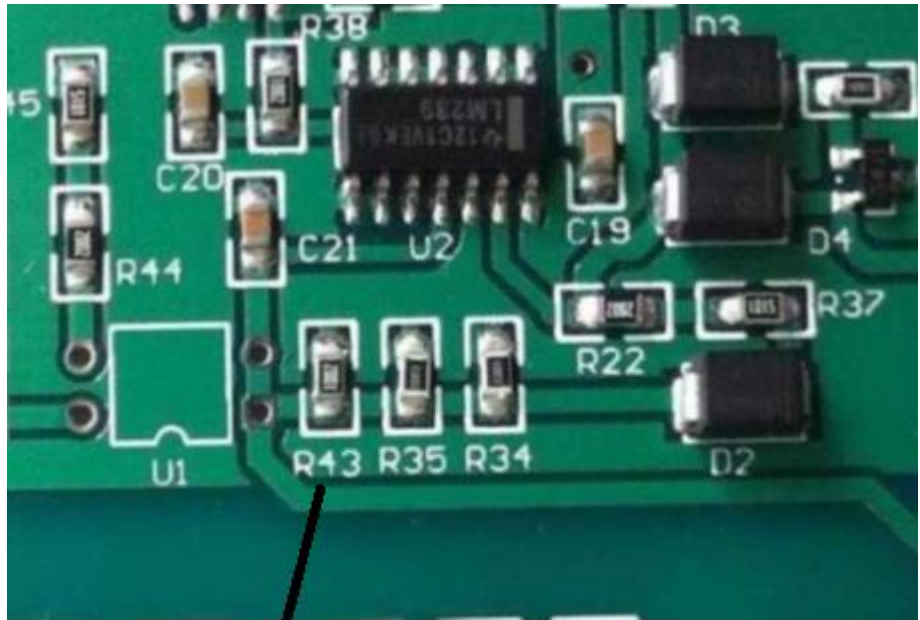
If the software is being updated, this jumper should be changed. This is NOT required for any procedure above in changing settings – only for a major software upgrade.



# Ginlong Controller Settings

There are two versions of the Ginlong controller. This controller provides the following functions;

- Converts wild 3 phase AC from the turbine into DC
- Smooths the DC using capacitor to make it usable in the inverters
- Uses IGBTs to switch on a dump load resistor. This resistor gets switched on and off at different voltages, depending on the setting of two DIP switches.



Resistor R43 just to the right of the DIP switches (not shown) should be marked "1402" on new controllers

The following are the DIP switch settings;

DIP Switches	Old Model Controller Switches dump load		New model controller Switches dump load	
	On	Off	On	Off
Both ON	600	500	480	400
One on, one off	500	400	410	330
Both off	400	300	320	240

We generally want the dump load to come on at about 410V and off at 330V. However, it is acceptable to use the old controller with both DIP switches off.

## Identifying the controller type

There are two identifying features;

The serial number. – the third fourth fifth and sixth digits are the year and month of manufacture, so serial number 421109089 will have been made in September 2011. Any inverter later than that is a new model.

To the right of the DIP switch is a resistor number R43. On new controllers this is marked **1402**

## Wiring in Brake Resistors

There are two terminals marked B1 and two terminals marked B2. It would be easy to make the mistake of wiring brake 1 to B1 and brake 2 to B2, but this is incorrect. One wire from each resistor should go into B1 and one wire from each resistor should go to B2.

When this has been done, measure the resistance from B1 to B2. It should be approximately 15 ohms.

## **Inverter Settings**

### **Setting inverter grid standard;**

You should first read the incoming voltage to the transformer and the outgoing voltage.

Call me when you have the figures for the incoming and outgoing voltage and I will give you the correct OV and UV settings.

### **Setting the inverter:**

On the inverter keypad, press Enter

Press Down 3 times to bring up "Advanced settings"

Press enter Enter

Password shows 0000

Press down down up to change password to 0010

Press enter

Press Down to Select standard

Should say

*Yes= ENT No = ESCD*

*Standard: User-def*

Press enter

OV – V is the overvoltage settings

UN-V is the undervoltage setting.

# Retrofit Kits

There are two retrofit kits for the M&Cs numbered 1 to 25.

- 1) A capacitor / diode kit, which is designed to ensure that the turbine gets braked in the event of the 24V PSU failing, and
- 2) A relay replacement kit which replaces the piggy-back spade connectors. ***The black relay should be replaced when retrofitting this part.***

The black relay is mounted using 3mm bolts. Using these will require the removal of the M&C from the wall. You may prefer to bring self-tapping or other screws for mounting the black relay.

## Capacitor / Diode Kit

This consists of two parts – a small loop link and the main cap/resistor/diode.



**Insert the loop on the relay second to the left of the fuse block.**

The relay has three terminals marked NO (normally open) NC (normally closed) and COM (common).

The short loop goes between the two COM terminals on the relay. You will need to remove the wire from the NO terminal above this to gain access.

Then put the loop in place and replace the wire which originally was in the connection



NO





### **Insert the Resistor**

Shorten the lead on the resistor and insert it into the NO contact on the left side of the relay which was previously unused.



### Connect the Ground Pin

The capacitor has a black ground connection. This goes into white molex connector at the top left side of the printed circuit board.

This molex connector only has one wire connected to the bottom connection.



a

You should remove this white connector, insert the black wire with its crimp pin into the next connector in line.

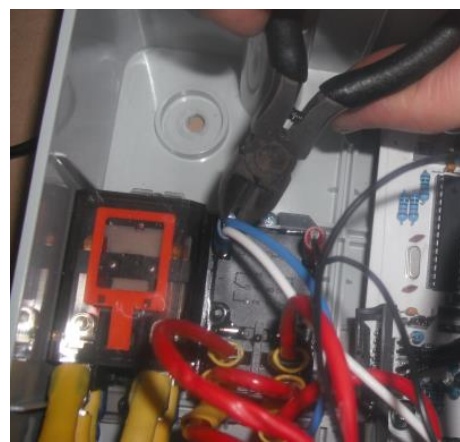
Now replace the molex connector onto the PCB.

### Connect the Relay Power Connection

The coil on the red relay presently gets its positive connection from a cable daisy-chained to the coil on the black relay. This goes from one of the bottom pins on the red relay to one of the top pins on the black one.

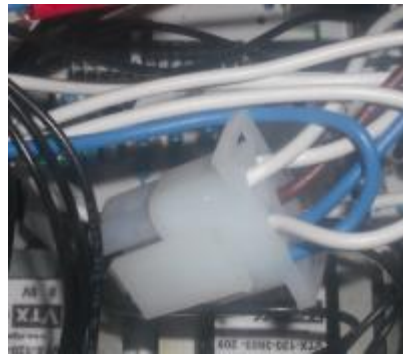
Follow this lead from the red relay and break this connection at the black relay. Use a crimp connector to join the wire to the red connection from the capacitor.

Use cable ties to attach the capacitor etc.



## Retrofit of Power Relay Connections

The short circuit relay connectors in early models used piggyback connectors. Also, during early use of the M&C without actuators, relays and associated wiring have been used excessively. This replace the black relay, piggyback connectors and wiring with robust wiring.



spade  
some of the  
retrofit is to  
new more

Remove the three phase connections to the relay, and remove the large white plug from the centre of the PCB.

Of the six wires on this plug, three go to the phases, one goes to a ground connection, and the other two go to terminals C and E (IGBT and Turbine DC+). Remove the wires from terminals C and E, but break the ground connection as you will need to rejoin this to the new harness.

## Power Connections

On the red relay, we use the bottom and top spades, but not the middle ones. (COM and NC)

On the black relay, we use the bottom and middle space connectors (COM and NO)

The new harness is connected as follows;

**Phase 1 Orange –** Goes to top left spade on red relay, and middle right spade on black relay

**Phase 2 Yellow -** Goes to top right spade on red relay and middle left spade on black relay

**Phase 3 Brown -** Goes to bottom two connections on red relay, and bottom two connections on black relay.

## Other connections on white connector

The connections are as follows, going anti-clockwise from the top left terminal

- 1) Turbine DC Plus – goes to connector E (as before)
- 2) GND – join to original GND connection

- 3) IGBT voltage – goes to connector C (as before)
- 4) Phase 1 – to relays etc.
- 5) Phase 2 – to relays etc.
- 6) Phase 3– to relays etc.