OpenPMU

Open Source Phasor Measurement Unit

Enclosure Assembly

(19" Rack Form Factor)

Document Version: V1.1 2012-05-29

Abstract:

This document provides instructions on the assembly of an OpenPMU device using the National Instruments USB-6009-OEM data acquisition card and an Acer Revo PC.

Authors:

Paul Brogan

David Laverty

Document History:

2012-05-29   V1.1   Updated Title and Logo (This Version)

2012-05-28   V1.0   Original Version

Required Tools

Drill with HSS metal bit, 4mm.

Screwdriver and spanner, to fit bolts.

Electrical screwdriver to fit DIN rail terminals

Crimper

Optional

Glue gun

Cables

230V mains electrical cable, with plug or appropriate fitting, cable supplied with PC was cut and used in this circumstance.

$1.5mm^2$ cable (Tri rated recommended) Red and black cable approx. 1m of each, yellow and blue cable approx. 600mm of each, yellow/green earth cable approx. 20mm.

Spade connector for grounding enclosure.

Ethernet Cat5 (or above) cable – sufficient length to reach router plus 500mm internal.

GPS antenna cable – sufficient to place GPS antenna in suitable location where GPS signals can be received plus 500mm internal.

Additional

14 bolts, 3.5mm/6 Gauge (ideally with low profile heads) and nuts; to attach PCB, DIN rail, PC mount and PC power supply to enclosure; also 3 shock absorbing washers for use with PCB.
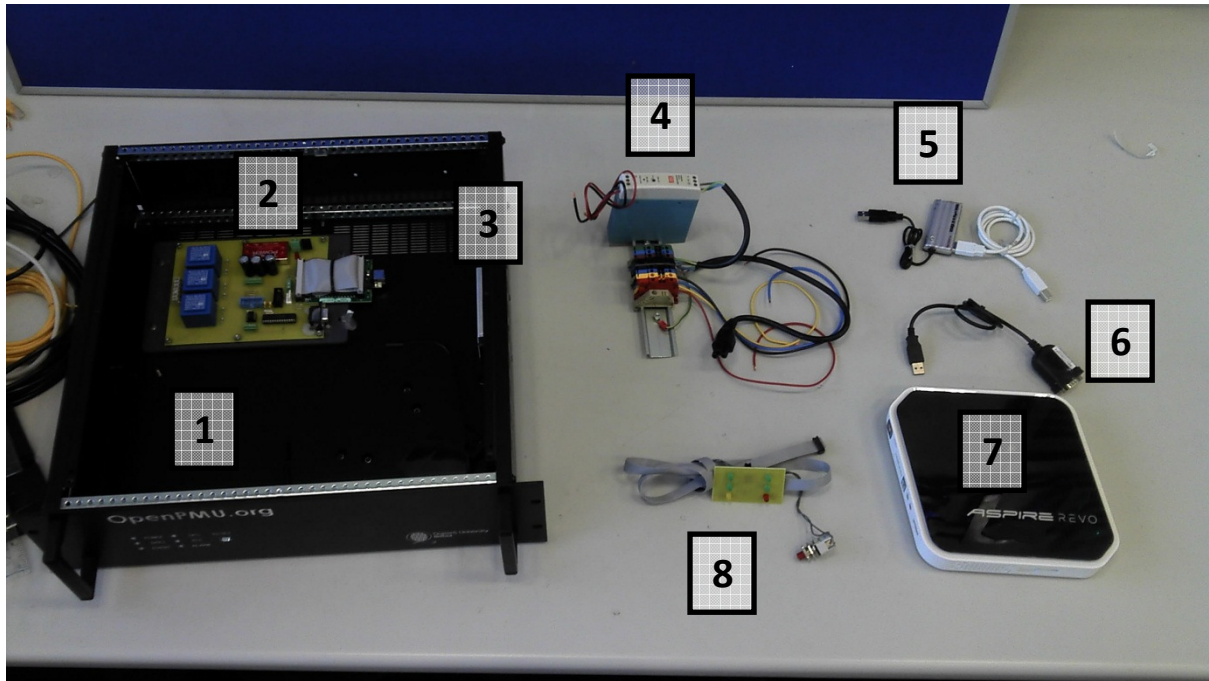
4mm – Ring Terminal/eyelet

Fig 1 Necessary Components – one of each

1. 19'' Rack enclosure, or similar enclosure fit for purpose.
2. Populated PCB and LabView DAQ, USB-6009-OEM.
3. Power supply for laptop (230VAC to 19VDC in this case) and mounting bracket (or cable ties)
4. 200mm of DIN rail, along with 7 DIN rail terminals, 3 DIN rail clamps and a 12VDC power supply.
5. USB hub/switch and USB to USB connector.
6. Serial to USB converter.
7. Acer Aspier Revo, Veriton or similar computer with suitable performance.
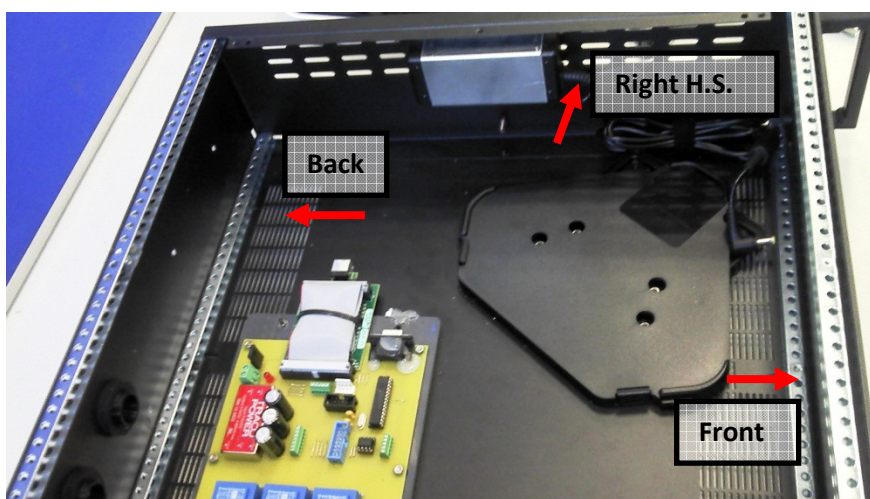8. Front LED display, with reset switch and ribbon cable.

Fig 2

Bolt both the PCB and Acer mount to the base of the enclosure, bolt the PC power supply to the top, right hand side (alternatively cable tie utilising ventilation holes) drill holes to mount DIN rail. This procedure will require drilling with a 4mm HSS metal drill bit.

Place PCB and PC mount in position, leave 40mm clearance between enclosure and object, orientate the so the connections are to the right hand side, as shown - mark holes. Separately place DIN rail in

position, back right of enclosure, equal distance from top and bottom - Mark holes. Likewise with power supply bracket, place in the middle on the right at the top (as shown in Fig 2), ventilation holes can be utilised. Now drill all marked holes, 4mm. Bolt the PC mount and power supply; the bolt is fed in from the outside (low profile heads) and the nut is put on and tightened from the inside. For the PCB, place shock absorbing washers on the bolts between the enclosure and PCB. (The DIN rail must be populated before attachment)

Note! A bolt protruding beside the serial port will prevent connection, glue can be used.
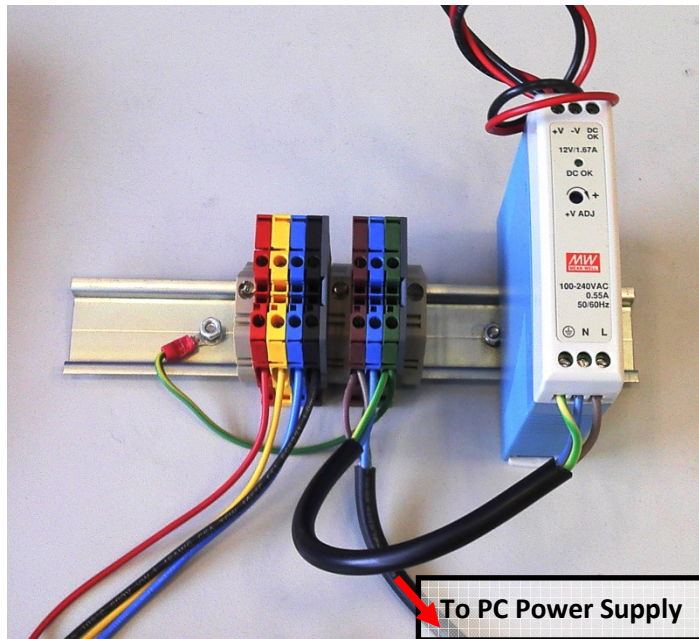

To PC Power Supply

Fig 3

Populate the DIN rail as shown in the picture.

From left to right, DIN rail clamp then red, yellow, blue and black DIN rail terminals, 2nd clamp, then, Brown, Blue, Green DIN rail terminals, then final clamp; finally the 12VDC power supply.

Firmly connect 600mm of red, yellow blue and black 1.5mm cable into the DIN rail terminals on the left that match their colour. (All connections to the bottom of the DIN rail terminals)

Connect 100mm of 3 core mains cable into the power supply as shown, earth, neutral, live. The brown, blue and green (live, neutral and ground) DIN rail terminals in the middle must house the power cord to the 12VDC supply and the PC power supply – additionally 20mm of earth cable to be placed in the green terminal and a ring terminal crimped on the end, this will be bolted to the DIN rail and enclosure. All wires go into the underside; test for lose connections!
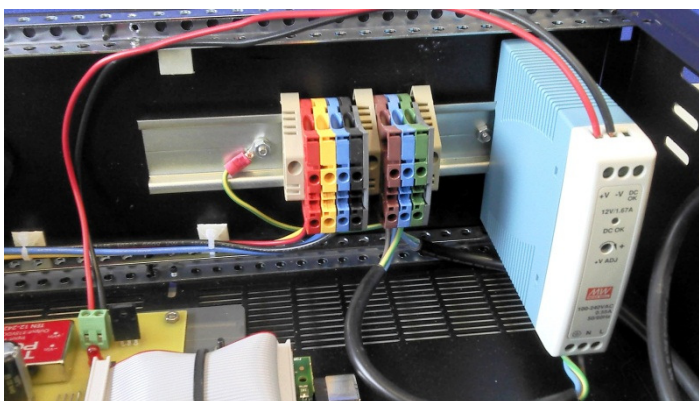

Fig 4

Connect power lead to PC transformer. Bolt the populated DIN rail to the back right of the enclosure, making sure to place ring terminal between the nut and DIN rail – thereby grounding the enclosure.

Place 400mm red wire into the +V output from the power supply, place 400mm of black wire into the -V output from the power supply. This is the power supply for the PCB and is attached as shown; attach the red, positive lead to the left hand side of the terminal and the black, negative side to the right.
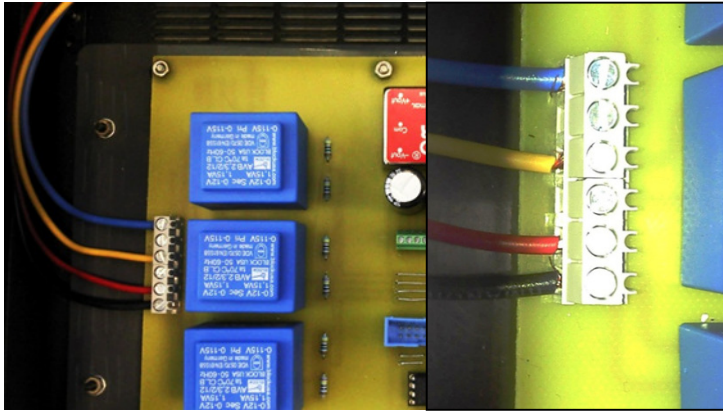
Fig 5

<u>Attach the black, red, yellow and blue wires to the PCB as shown</u>. These are the stat wires with black serving as the reference or neutral in star formation.

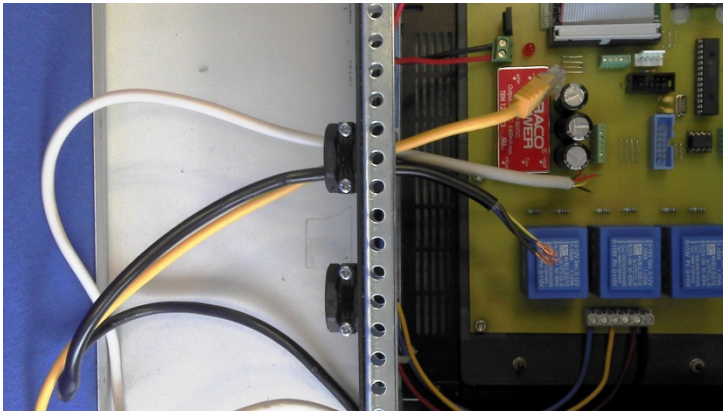The terminal block is wired, from <u>front to back – 1 black, 2 red, 3 empty, 4 yellow, 5 empty, 6 blue</u>.

Fig 6

Bring <u>Ethernet Cat5 cable, 3 core mains</u> power cable <u>and GPS antenna cable, into the enclosure</u> via the <u>gland on the right</u> (as viewed from the front).
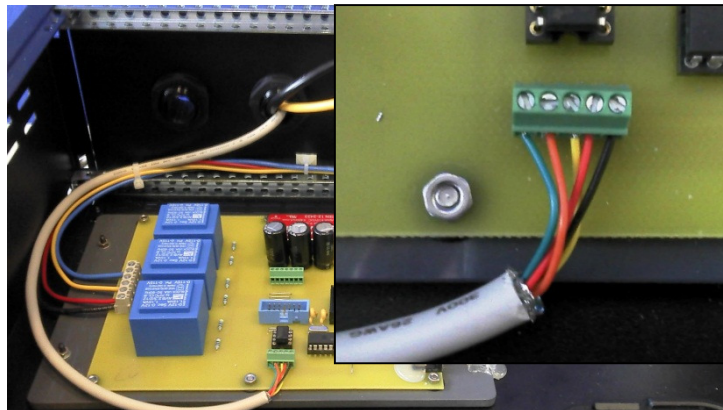

Fig 7

<u>Connect GPS antenna</u> cable, as shown, to terminal on the front of PCB. <u>1 blue, 2 orange, 3 yellow, 4 red, 5 black.</u>
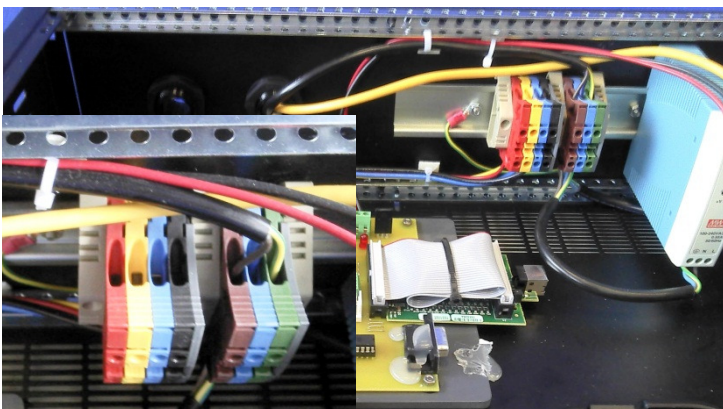

Fig 8

<u>Attach mains power</u> lead to top terminals on DIN rail, as shown.

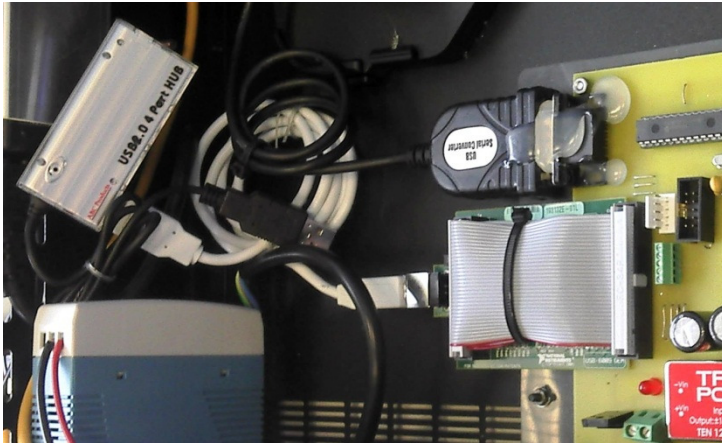Brown to brown (live), blue to blue (neutral) and green/yellow to green (ground).

Fig 9

Insert serial to USB connection into RS232 slot on the PCB. Insert USB lead into DAQ, insert USB into USB hub.

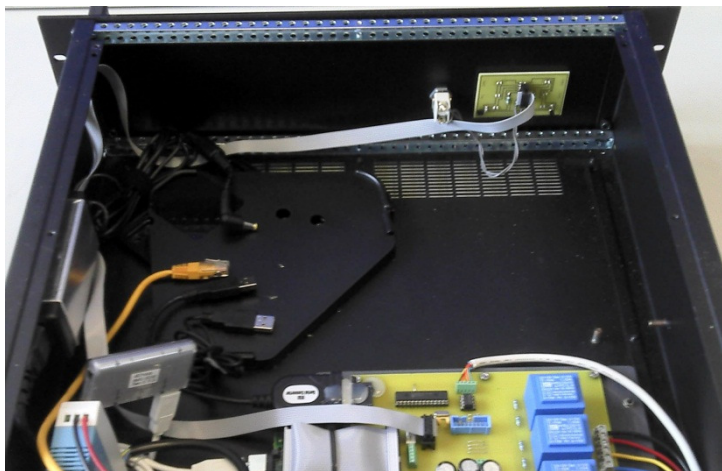(serial connection can be glued, especially if the unit may be subject to vibration)

Fig 10

Push front LED display into machined holes, (Red LED to bottom left-Alarm) it should push in and hold securely.

Insert the reset button - unscrew nut before feeding through from the inside and rethreading nut.

Fit ribbon cable between display and PCB – top most pins on display connects to front pins on PCB.

Fig 11

Insert Cat5 cable, USBs from hub and USB to serial connector finally the power cable.

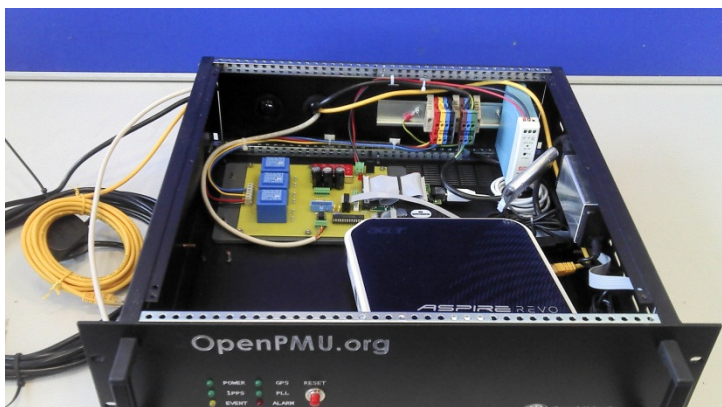Securely fit PC to its mount, it should be very secure and not pull off.

Fig 12

Tidy up lose cables with cable ties.

Excess Cat5, GPS antenna and mains power cable should be taken out through the gland and the cables clamped in position.

Finally place lid on enclosure and screw down, Fig 13

Disclaimer

These notes are given as guidance for the assembly of the open PMU, fitted in a 19'' rack. A very similar procedure will be followed if a different enclosure is to be used.

If you are assembling this unit it is assumed that you or a person involved is familiar with electrical equipment and electrical safety; the designers of the OpenPMU will accept no liability for injury, property damage, loss of data or income that may arise in the production, fitting and operation of this product.

Further documentation can be found at www.openpmu.org , have fun and get involved.