

Flexible Networks for a Low Carbon Future



Installation, Setup and removal of GridKey

- Low voltage substation
monitoring equipment
in secondary substations.

September 2015

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This document details the procedure for installation and removal of the GridKey low voltage substation monitor. GridKey is a Low Voltage substation monitoring system that can be fitted to the feeders of an LV substation without interrupting supply to customers. It provides continuous remote monitoring of the substations as well as timely warnings, status and loading information.

The system consists of a number of current sensors and a Metrology and Communications Unit (MCU). An integrated GSM/GPRS radio communicates data to a web site or any existing communications and data management system.

1. Safety requirements:

All installation work on this project shall comply with the Scottish Power Safety rules, the Power Systems Safety Instructions (in particular PSSI 12 - Low Voltage Apparatus) and the Power Systems Live Working Manual. However particular safety measures are reiterated below.

Authorisations

The persons of the work team carrying shall hold the appropriate Scottish Power authorisations for the work procedures being undertaken, these will include WL-1, WL1.05, with a minimum of WL-2 for the designated accompanying person.

Risk Assessment

Prior to the commencement of all installations a START safety risk assessment shall be undertaken.

Personal Protective Equipment

During the work the appropriate PPE shall be worn and specifically insulated rubber gloves during the making of connections, routing of leads or any work in close proximity to exposed live equipment. During the installation and connection of the monitors light eye protection is to be worn to avoid the possibility of loose lead ends catching a person in the eye.

Accompaniment

At all times during the installation work the persons engaged in the work shall be accompanied.

Tools & Equipment

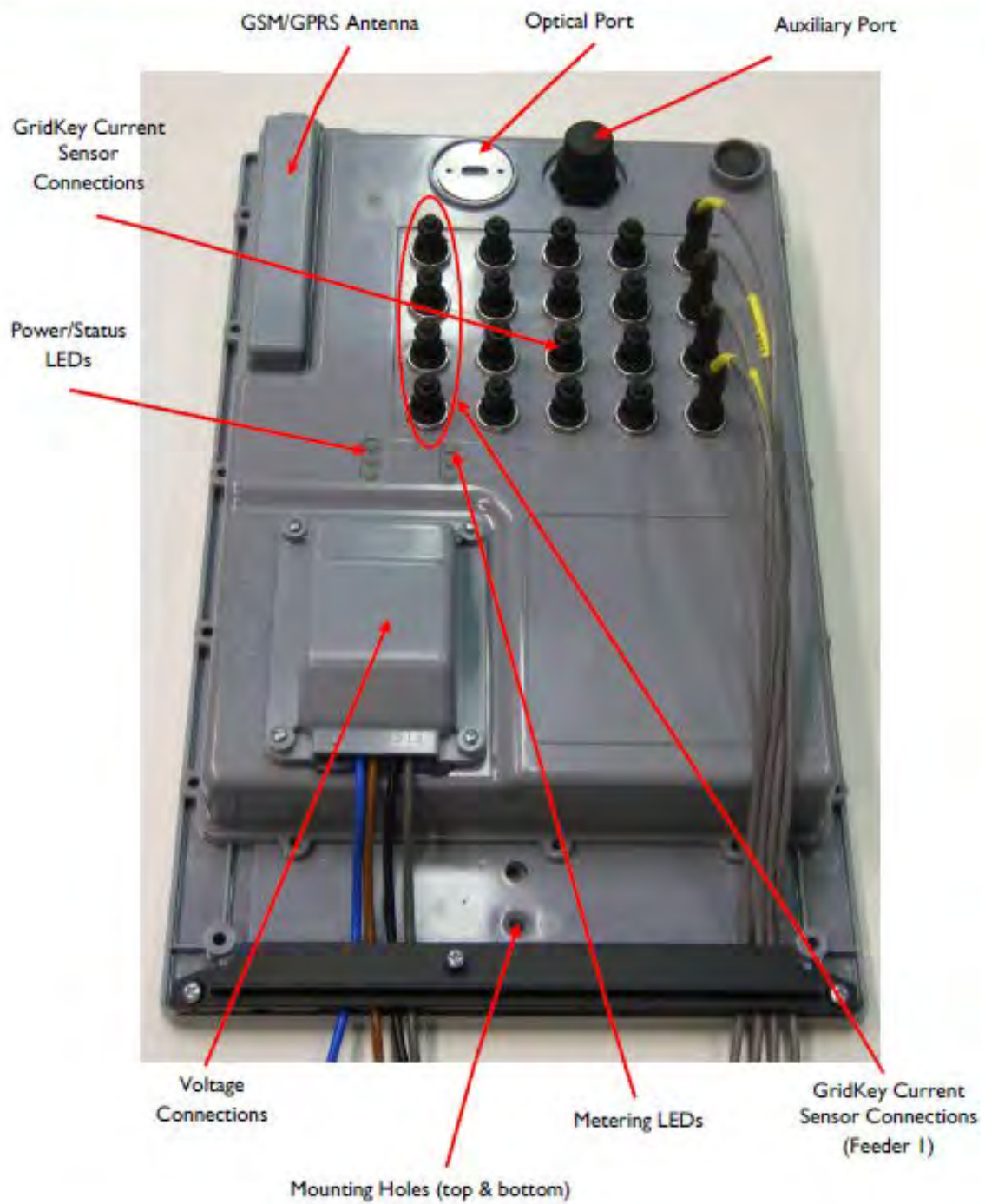
All tools and equipment used for the installations shall be Scottish Power approved.

2. Equipment

Illustrated Parts List



MCU Components



3. Installation guide



Mount the MCU

1. Record all required details on the install sheet.
2. Remove the front cover from the MCU (the grey box) by unscrewing the security fixings and lifting the cover.
3. Select a suitable location for mounting the GridKey monitor. The following factors should be considered when selecting a location:
 - Avoiding the unit being exposed to physical damage due to the movement of plant, equipment or persons within the substation or enclosure.
 - Ensuring the unit does not interfere with or restrict operational access to substation apparatus.
 - Avoiding mounting the unit where it may obstruct the installation or take-up the space normally provided for future substation apparatus.
 - Providing ease of future access to the unit, whilst minimising the risk of unauthorised interference.
 - Minimising the lead lengths from the unit to the sensors/connections.
 - Minimising the close proximity risk from adjacent exposed live apparatus whilst attending to the unit.
 - To avoid 'cross-connection' of separated HV and LV earthing systems.
4. Mount the unit.

Install the current sensors – Gridhound Sensors.

5. Assess the best location to install the current sensors. The sensors provided are a type of directional current transducer. In most cases they can be installed around each cable phase conductor however this is not always possible and the sensor therefore needs to be mounted in a position so that it will have the same effect. Care should be taken to ensure that the sensor is connected with the correct polarity. This is shown with an arrow marked load and source printed onto the side.



Install the current sensors – Rogowski Coils

6. In some cases it is not possible to install Gridhound sensors due to the size of the conductor (for example L.V. Busbars) and in these cases the Rogowski Coil type transducer should be used. As these sensors are less accurate than the Gridhound sensors it is recommended that the Gridhound sensors are used wherever possible.

To install the sensors:

Unclip the green flexible coil from the housing. The removable end is indicated by the green band.



The GridKey Flexible Rogowski sensor is marked to indicate the direction of the current in the conductor to be monitored. Ensure that the sensor is orientated with the arrow pointing towards the load of the circuit to be monitored. In most substation installations this will be with the sensor cable exit facing to the left and the arrow downwards



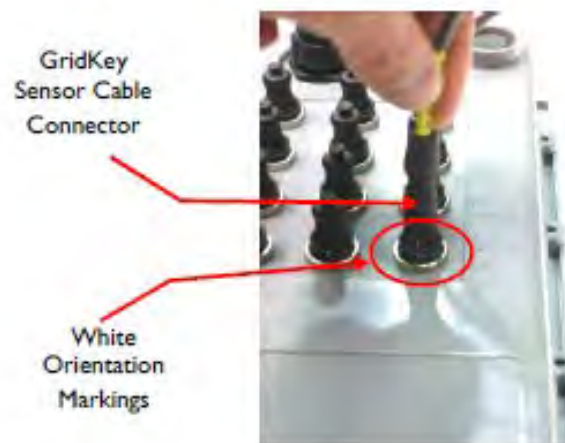
Figure 12 – Arrow on Housing Pointing to Load

Cable length

The cables connected to both types of sensor are of a fixed length. Some time should be taken to assess what lengths should be used for each sensor in order to keep cable lengths as short and neat as possible.

Route the cables

7. Run the cables from the current sensors towards the GridKey unit one at a time. Care should be taken to avoid any sharp edges that may abrade the insulation of the cables. The cables should avoid contact with non insulated conductors wherever possible. Keep the cable runs as neat as possible, using cable ties or other fixings where necessary.
8. Plug each cable into the corresponding position on the unit; the front of the GridKey unit should mirror the position of the feeders on the LV board i.e. the feeder on the right of the board goes on the right of the unit. There are white alignment markings on the sensor connector and the MCU sockets to aid correct orientation. The alignment markings on the MCU sockets are all at the 6 o'clock position. Ensure connectors are firmly pushed home in order to maintain the unit's IP65 weatherproof rating.
9. All unused sockets on the front of the MCU should have the sensor connector caps fitted



Connect the voltage supply.

10. Open the small cover on the front of the MCU and remove the top half of the sticky weather seal. Place it to one side and ensure that it remains clean and dry.



11. Slide the power supply connector down in order to remove it from the unit.
12. Strip approximately 12mm of insulation off the end of each of the voltage supply leads.



13. Wire in the 3 phase and neutral leads into their corresponding position in the connector. This is achieved by inserting a small screwdriver into the slot on the top of the connector and sliding the bared end into its position, when the screwdriver is removed the connector should grip the cable firmly. The leads are usually coloured in the standard EU colour coding as follows:

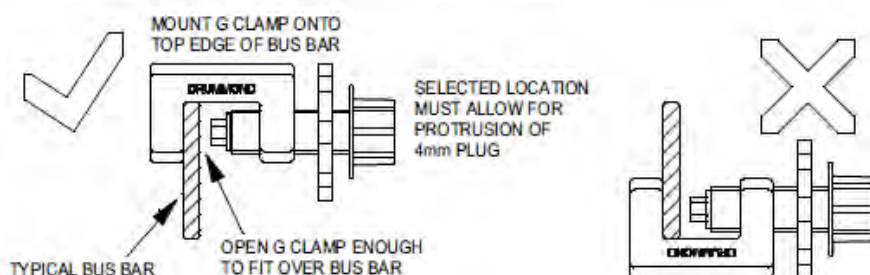
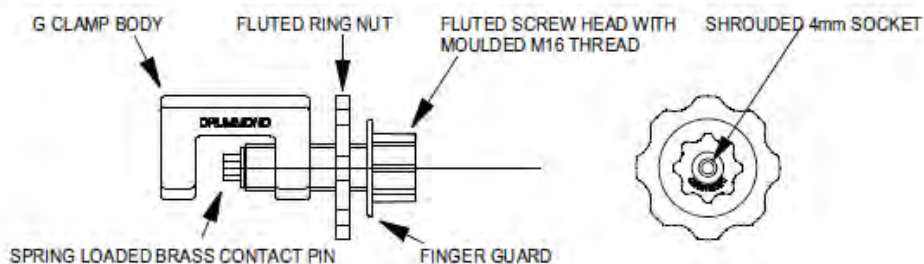
- Brown – L1
- Black – L2
- Grey – L3
- Blue – Neutral



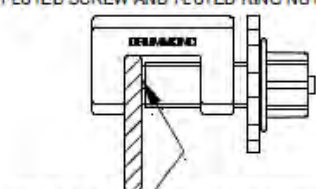
14. Slide the connector back into position and replace the top half of the weather seal onto the cables.
15. Replace the power connector cover.
16. Remove the middle and left hand screws holding on the black bar at the bottom of the unit and loosen the third. Swing the bar out of the way enough to start placing the cables into the grooves below. Use the black bar to stop the cables falling out as you work.
17. Re-secure the cable retaining bar.

Install the busbar clamps

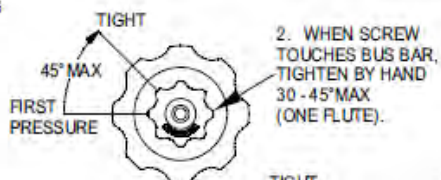
18. Install the four busbar voltage clamps onto each phase busbar and the neutral.
Consideration should be taken to ensure that the clamps or the cables that will be connected to them will not interfere with normal substation operations e.g. removing fuses. The clamps should always be installed over the busbar, not underneath. To install unscrew the thumbwheel and place onto busbar, tighten up the thumbwheel and then tighten the larger lock nut. See overleaf for further details.



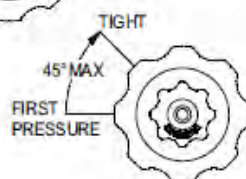
1. HOLD G CLAMP FIRMLY WHILE TIGHTENING FLUTED SCREW AND FLUTED RING NUT



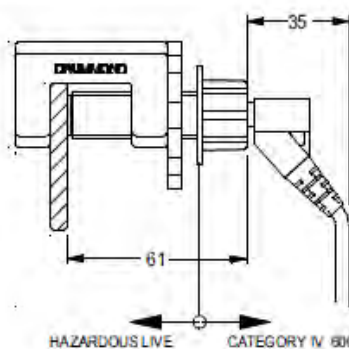
BRASS CONTACT IS FULLY COMPRESSED WHEN MOULDED SCREW TOUCHES BUS BAR. ELECTRICAL CONTACT FORCE = 40N +/- 5N



2. WHEN SCREW TOUCHES BUS BAR, TIGHTEN BY HAND 30 - 45° MAX (ONE FLUTE).

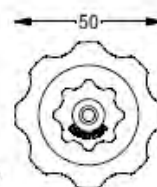


3. WHEN RING NUT TOUCHES CLAMP BODY, TIGHTEN BY HAND 30 - 45° MAX (ONE FLUTE).



ALLOW AT LEAST 35mm CLEARANCE FOR DRUMMOND 4mm PLUG.

NOTE THAT OTHER DESIGNS OF 4mm PLUG MAY REQUIRE CONSIDERABLY MORE CLEARANCE



19. Connect the voltage leads to the busbar clamps starting with the neutral and then L1, L2 and L3. Care should be taken to ensure correct connection as failure to do so could damage the unit. The unit should now power up.

Record installation details

20. Record installation and site details on the installation sheet provided. Note: the MCU Serial Number is the twelve digit number (starting 000) located on the enclosure left hand side.

4. Configuration

Check that the MCU has powered up and is operating correctly by monitoring the POWER/STATUS and METERING LEDs. The following operation should be seen:

Indication	Status Interpretation
Power/Status LEDs	
Steady Green	System Good
Flashing Green	Start-Up
Steady Red	System Fault
Flashing Red	Communication Problem – clears when communications succeed
Momentary Flashing Yellow	Data Storage
Metering LEDs	
Flashing Red	100Wh/1kWh Energy
Momentary Flashing Yellow	Inter Processor communications
Steady Green	Power up tests passed (voltage phase rotation ok.)

In particular check the following:

- The green Metering LED should be on indication the voltage phases have been connected correctly.
- The red Metering LED should flash periodically determined by the total power being measured. In highly loaded substations it is possible that the LED is on continuously.
- The green Power/Status LED should flash initially then go solid green when the unit has received its time reference over the GSM/GPRS
- The two yellow LEDs should flash at about 1Hz indicating internal activity.

5. Removal

Disconnect and remove the voltage supply

1. Disconnect the voltage leads by first removing L1, L2 and L3 plugs from the busbar clamps. Then remove the neutral.
2. Remove the Busbar clamps from the busbars.
3. Remove any cable fixings from the Voltage leads.
4. Remove the front cover from the unit by removing the two anti tamper Torx bolts.
5. Undo the 2 screws holding on the voltage connector cover and remove.
6. Slide out the voltage connector from the unit.
7. Remove 2 of the screws from the cable retaining bar and loosen the third. Swing the bar out of the way and remove the voltage connector and cables from the unit.
8. Replace the voltage connector cover.

Disconnect and remove the current sensors

9. Remove any cable fixings securing the current sensor cables, taking care not to damage the conductor insulation or cable sleeving.
10. Remove the current sensors from the cables/busbars they are installed around.
11. Disconnect the sensor cable from the MCU by pulling the connector and remove the sensor and cable entirely.

Remove the MCU

12. Unscrew the MCU from its mounting position.
13. Coil the cables and pack the unit in a suitable container and store in a dry place.

Record removal

14. Record the removal of the unit on the data sheet.