

# Flexible Networks for a Low Carbon Future



## Installation, Setup and removal of Subnet

- Low voltage substation monitoring equipment in secondary substations.

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This document details the procedure for installation and removal of the Subnet low voltage substation monitor. Sub.net is a substation monitoring system that can be fitted to the feeders of an LV substation. It provides continuous remote monitoring of the substations as well as timely warnings, status and loading information.

The system consists of a monitoring system contained within an ABS enclosure and a number of current and voltage sensors. 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**

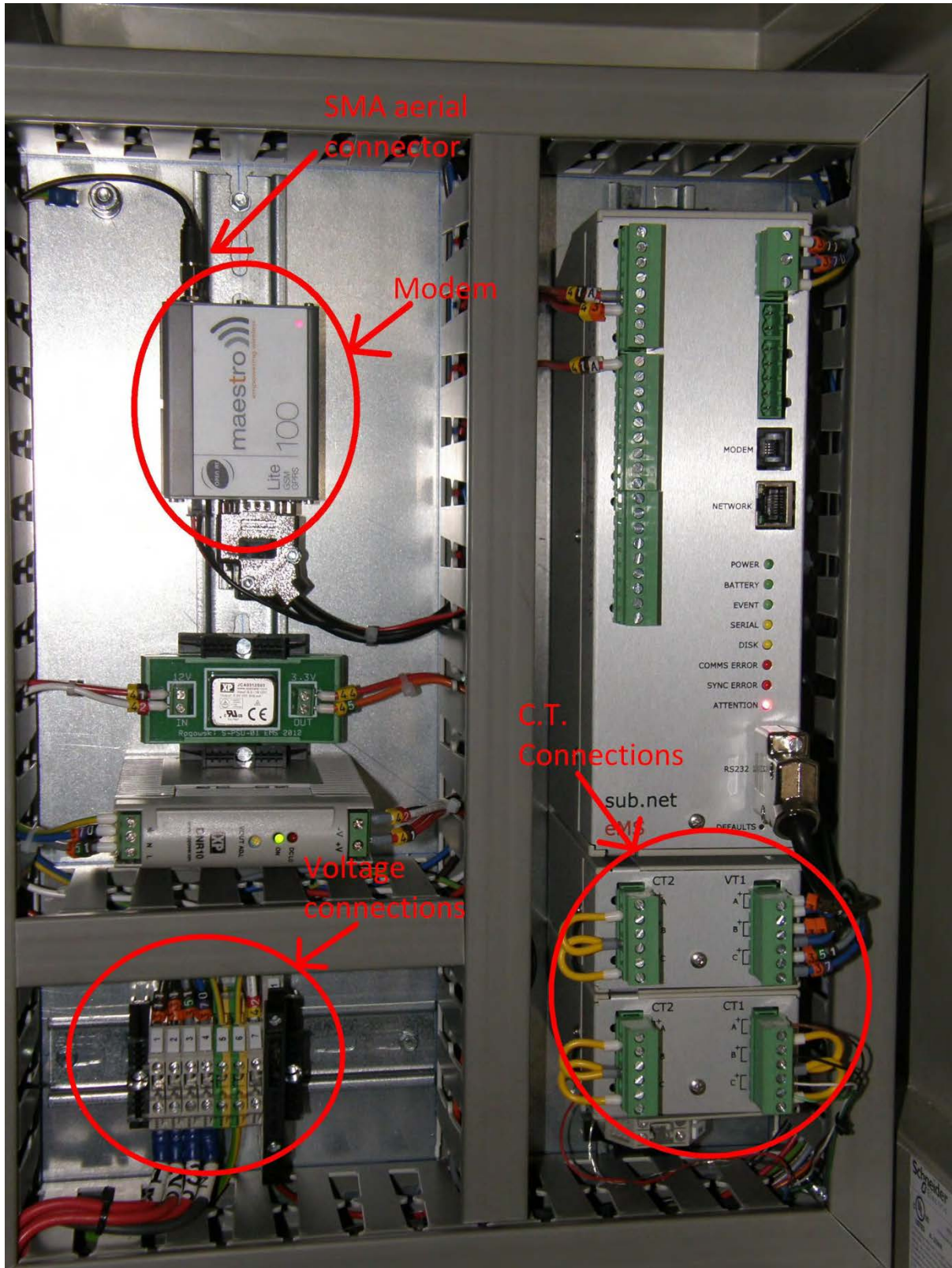
At all times during the installation work the persons engaged in the work shall be accompanied.

### **Tools & Equipment**

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

## 2. Equipment

- Sub.net monitoring unit: Mounted within ABS enclosure
- Current sensors: Rogowski coil type current transducers with integrator
- Drummond Busbar Clamps
- Voltage connection cables
- GSM/GPRS Aerial
- Cable hole blank/grommet





### 3. Installation guide



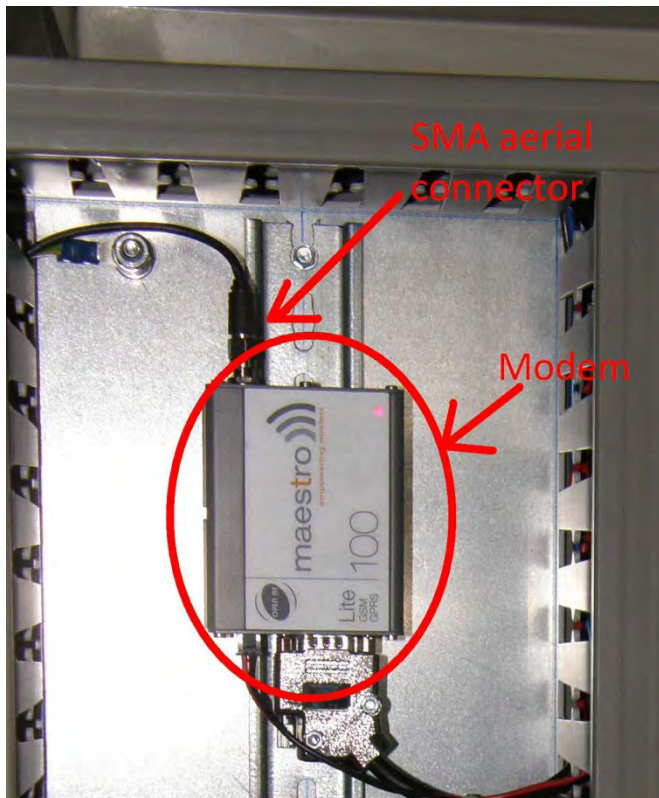
#### Mount the Monitoring Unit

1. Record all required details on the install sheet.
2. Select a suitable location for mounting the Subnet 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.
3. Mount the unit.

#### GPRS Aerial

4. Install the aerial mounting bracket in a suitable location, for example onto one of the mounting screws of the Subnet monitor. Place the aerial on top of this bracket; it has a magnetic base.
5. Drill a hole in the bottom of the unit large enough to fit the aerial cable connector through

6. Run the aerial cable through the hole and screw the SMA connector into the socket on the top of the modem (the component in the top left corner of the unit)



#### Install the Integrator inside the Subnet enclosure

7. Drill a hole of 50mm diameter in the bottom of the metering unit ensuring no damage is caused to any cable or components inside.
8. Run the current sensors from the inside of the box, through the hole until all of the cable is pulled through and the integrator remains inside the box.
9. Fit the grommet into the hole, around the cables.

#### Install the current sensors – Rogowski Coils

The sensors provided are a type of directional current transducer known as a Rogowski coil.

10. Assess the best location to install the current sensors. The current sensors will be installed either around the transformer LV bars, and/or around any of the circuit phases. To install the sensors:
11. Unclip the green flexible coil from the housing. The removable end is indicated by the green band.



The Subnet 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.

12. Wrap the coil around the conductor to be monitored

### **Cable length**

The cables connected to the sensors 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**

13. Run the cables from the current sensors towards the Sub.net monitor. 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. Leave any slack inside the Subnet unit.

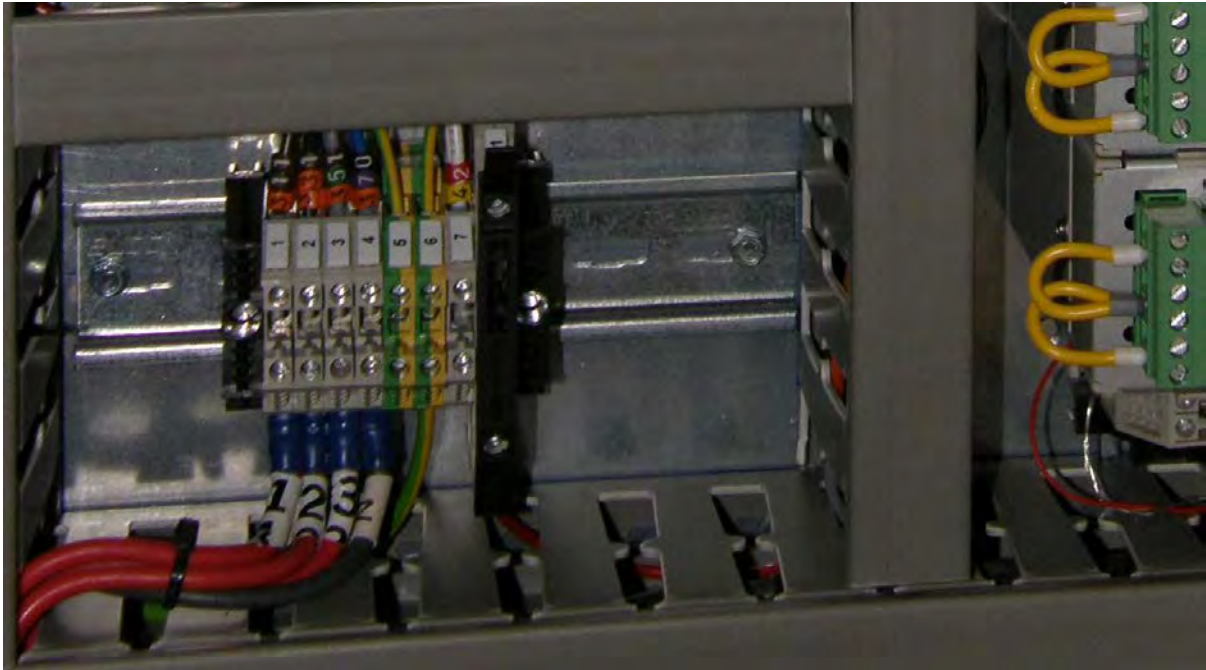
### **Wire the comparator**

14. Wire the cable coming from the comparator into the relevant C.T. unit in the Sub.net monitor as per the wiring diagram provided.

### **Connect the voltage supply.**

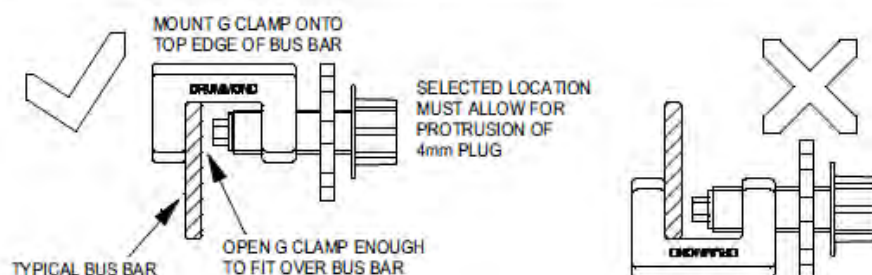
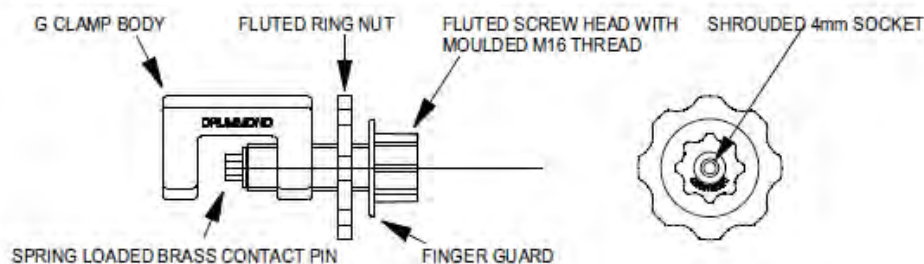
15. Run the 3 phase and neutral leads through the bottom of the box and wire them into their respective locations as shown on the wiring diagram. See picture below



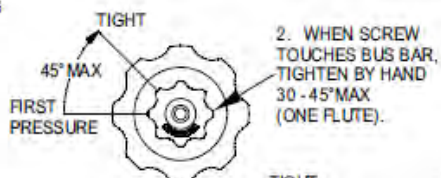
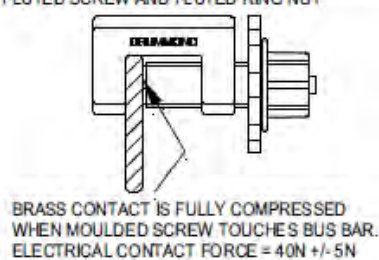


### **Install the busbar clamps**

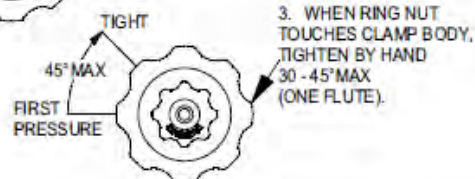
16. Install the four busbar voltage clamps onto each phase busbar and the neutral.  
Consideration should be taken to ensure that the clamps or the cables that will be connected to them will not interfere with normal substation operations e.g. removing fuses. The clamps should always be installed over 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.



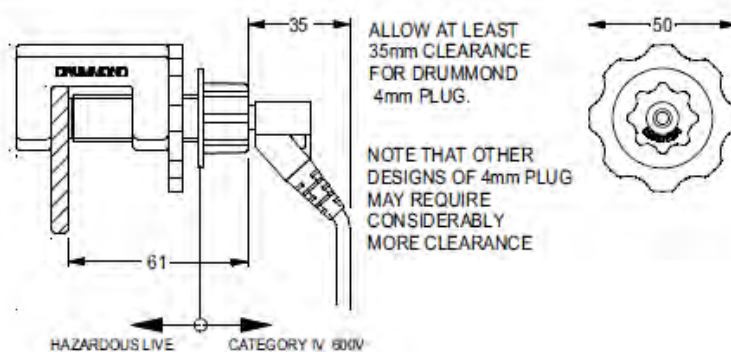
1. HOLD G CLAMP FIRMLY WHILE TIGHTENING FLUTED SCREW AND FLUTED RING NUT



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).



17. 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**

18. 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 Subnet unit has powered up and is operating correctly by monitoring the POWER/STATUS LEDs.

## **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. Disconnect the wiring inside the subnet enclosure and remove.

#### **Disconnect and remove the current sensors**

5. Remove any cable fixings securing the current sensor cables, taking care not to damage the conductor insulation or cable sleeving.
6. Remove the current sensors from the cables/busbars they are installed around.
7. Remove the cable grommet and pull the current sensors through the hole. Replace the cable grommet.
8. Disconnect the sensor cable from the unit and remove the sensors, integrator and cable entirely.

#### **Remove the Subnet unit**

9. Unscrew the Subnet unit from its mounting position.
10. Coil the cables and pack the unit in a suitable container and store in a dry place.

#### **Record removal**

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

6. **Appendix 1 Subnet wiring diagram**