



## Code of Practice 303

Issue 1

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# Installation, Maintenance and Removal of Monitoring and Measuring Equipment

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**Approved for issue by the  
Technical Policy Panel**

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Issue and Amendment Summary

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<p>0 01/03/2013</p>	<p>Issue 1</p> <p>First issue – Procedures for installing monitoring equipment.</p> <p>Prepared by: Geraldine Bryson</p> <p>Approved by the Technical Policy Panel and signed on its behalf by: Paul Whittaker</p>



## **INSTALLATION, MAINTENANCE AND REMOVAL OF MONITORING AND MEASURING EQUIPMENT**

### **1. INTRODUCTION**

This code of practice covers the installation, maintenance and removal of monitoring and measuring equipment on the low voltage network owned and operated by Electricity North West Limited (hereinafter referred to as Electricity North West).

### **2. SCOPE**

Measuring equipment in this context implies a system consisting of current sensors and voltage connections to the low voltage network which enable a data concentrator to record and calculate electrical energy parameters over a period of time.

Electricity North West is using two different manufacturers of monitoring systems, namely Grid Key and Nortech. Although the procedures are similar for both systems there are important differences which are highlighted within this document.

### **3. SAFETY AND PRECAUTIONS**

Appropriate personal protective equipment shall be used at all times. Personnel shall be trained in its use and shall ensure it is in good condition.

To reduce the risks, all work shall be carried out in compliance with:

- Electricity Safety, Quality and Continuity Regulations 2002.
- Electricity at Work Regulations 1989.
- Electricity North West Electricity (Distribution) Safety Rules.
- Workplace (Health, Safety and Welfare) Regulations 1992.
- Personal Protective Equipment Regulations 1992.
- Electricity North West Code of Practice 606.

Use of the criteria from this documentation shall ensure the safety of staff and the public and the security of supplies, plant and equipment.

### **4. TRAINING AND AUTHORISATION**

#### **4.1 Personnel**

Only competent persons with appropriate Electricity North West authorisations shall carry out this work. All work shall be done in accordance with Electricity North West safety rules and procedures. The working party shall consist of at least one competent person whilst maintaining or removing the monitoring equipment and at least two competent persons for installation.

#### **4.2 Authorisations**

The installation of measuring equipment involves a number of activities which will require an appropriate operational authorisation.

Persons connecting the current and voltage sensors direct to low voltage cables or switchgear shall require the appropriate low voltage authorisations.

In indoor substations any exposed low voltage boards shall be screened by an appropriately authorised person to allow the fixing (only) of the data concentrator to an adjacent wall.

Persons installing monitoring equipment where it is necessary to exit the current and voltage leads through the bottom of a take off chamber or pillar and adjust/remove the bottom grill / plate shall be allowed to do this but no other work shall be permitted. Any gap left by the adjustment of the bottom grill to exit the wires shall be made good by the use of a strong tape or similar to prevent the entry of vermin. Due regard shall be paid to the condition of the equipment and its environment particularly when doing this work outdoors.

Approved insulated tools shall be used.

## **5. SITE SAFETY PROCEDURES AND LIMITATIONS**

- 5.1 When a data concentrator is to be fixed, e.g. screwed to a wall or pole, all exposed live low voltage conductors shall be screened or shrouded from the work area to prevent inadvertent contact.
- 5.2 Leads between any sensors or voltage connections and a data concentrator shall be held in place by cable ties or protected in plastic tubing or trunking.
- 5.3 Holes shall not be made (either by drill or screw) into any part of switchgear or transformer.
- 5.4 In ground mounted outdoor substations the leads shall be run in protective trunking and laid just under the surface. Any paving disturbed shall be replaced. No impact tools shall be used. The persons carrying out this work shall be trained in cable avoidance techniques and carry cable plans of the particular substation involved.
- 5.5 All trailing wires shall be tied (plastic cable ties or similar) in place to ensure tidiness and safety.
- 5.6 Staff shall have received on job training on the installation of the monitoring equipment and this process.
- 5.7 The current sensors for the different systems (Grid Key or Nortech) shall not be mixed.
- 5.8 The voltage leads have an internal fuse which will be different depending upon the system being installed (Grid Key or Nortech). The voltage leads for the different systems shall not be mixed.

## **6. PRE INSTALLATION**

- 6.1 In all instances of installing monitoring equipment an appropriate risk assessment shall be carried out. Any unsafe situation shall be reported immediately to the associated supervisor or the Electricity North West control engineer.
- 6.2 A survey shall be carried out, as required, prior to attending the site to determine methodology and materials required. A final on site check of the intended installation methodology shall be made before the work is started

## **7. INSTALLATIONS IN GROUND MOUNTED SUBSTATIONS**

### **7.1 General**

Any necessary safety procedures including safety documentation, shrouding or screening of exposed live equipment shall be carried out before work starts.

The work shall proceed in a safe logical manner taking into account all the tasks to be undertaken. The work shall be planned with particular emphasis being taken on the safe positioning and connecting of the current sensors and voltage leads.

Current sensors shall normally be fixed on each core of each cable (including the neutral) near the crutch of the cable. Notice shall be taken of the condition of the insulation of each core around which the sensors are to be fixed. The sensors shall not be fixed around any insulation which shows any sign of excessive deterioration. Where current sensors cannot be fixed adjacent the crutch position they may be fixed further up the core or on the fuse contact or soldier. Attention shall be paid to ensure the normal fuse withdrawal and replacement is not impeded in any way.

Voltage sensor connections may be achieved in one of the following ways:

- a. Direct from the busbars using the approved insulated 'G' clamps which are applied by hand using approved insulating gloves to each busbar in turn and connected to the data concentrator by an approved fused lead. The clamps are simply offered to the busbar and tightened by turning the notched screw. The circular locking wheel is then tightened.
- b. Using the manufacturers fused voltage terminals on the auxiliary panel. The voltage leads will be the approved fused leads.
- c. Replace a set of low voltage fuse carriers with the Schneider YW6 fuse handle assembly with auxiliary fuse and socket. The voltage lead will need a 4mm plug at one end and a solid crimp for the Grid Key data concentrator or the appropriate assembly for the Nortech data concentrator. Once the 4mm banana plug has been connected to the replacement fuse handle the cable shall be cable tied to the handle to prevent inadvertent removal or adverse strain on the socket.

Note: **The use of the 4mm test sockets installed in Bonar Long, ABB Nitran and ABB boards and cabinets is prohibited.** Where any damaged sockets are found during routine inspections an urgent outage shall be planned to disconnect the sockets as outlined in operational instruction 202. Any failure of any other manufacturers 4mm test socket during the installation of the monitoring equipment shall be reported using the defect reporting procedure in Code of Practice 305.

## 7.2 Installation Procedure:

- 7.2.1 The position of a data concentrator shall take into account the maximum length of the leads and the route the leads will take. Position the data concentrator and, if necessary, fix in place.
- 7.2.2 Install any trunking to carry the leads. This may include installing trunking below ground level in an outdoor substation.
- 7.2.3 Install the current sensors on each core of each cable including the neutral ensuring the correct polarity. For Grid Key sensors the arrow shall point towards the load but for Nortech sensors the arrow shall point towards the source. The leads shall be taken through any trunking or tied together and plugged into the data concentrator, taking care to get the way number and phasing correct.
- 7.2.4 Connect the fused voltage leads to the low voltage equipment. The leads shall be taken through trunking or tied in position and plugged into the data concentrator. Care shall be taken to get the phasing correct. Where voltage leads are installed in outdoor substations they shall be enclosed in earthed metal sheathed conduit.

- 7.2.5 The data concentrator shall be commissioned using the procedure in section 10 or 11 of this document depending on the system installed.

The Grid Key data concentrators contain five current sensor ways. Where the number of current sensor ways required exceeds five, two data concentrators are required.

The Nortech data concentrator is built and configured for a predefined number of low voltage ways. It can only be installed in a substation with this or a smaller number of low voltage ways and its location shall be recorded upon installation.

- 7.2.6 Prior to final commissioning a check shall be made to ensure that the current sensors and voltage sensors are reading the correct polarity and phase. If they are incorrect the voltage leads shall be disconnected from the low voltage switchgear before changing the sensor installation.
- 7.2.7 A notice shall be prominently displayed indicating that monitoring equipment has been installed, warning against interference and providing contact details in case of emergency.
- 7.2.8 This procedure may be varied on site to ensure a safe and efficient installation methodology.
- 7.2.9 On completion of the work all equipment in the substation shall be left safe and tidy.

### **7.3 Maintenance**

Before any maintenance is carried out on the monitoring system the voltage leads shall be disconnected from the low voltage switchgear to de-energise the data concentrator.

The voltage leads shall only be reconnected once all work has been completed and the data concentrator needs to be energised again.

### **7.4 Removal**

- 7.4.1 Disconnect the voltage leads from the low voltage switchgear.
- 7.4.2 Disconnect the voltage leads from the data concentrator.
- 7.4.3 Disconnect the current leads from the data concentrator.
- 7.4.4 Remove the current sensors from each cable core.
- 7.4.5 Carefully remove all current and voltage wiring from its situation and any associated cable ties and trunking. Trunking installed underground in outdoor substations may be left in position where it is safe and appropriate to do so.
- 7.4.6 Remove the data concentrator from its fixing and store the whole kit in a suitable storage box. All exposed conductors shall be screened or shrouded to prevent inadvertent contact whilst the removal takes place.

## **8. INSTALLATIONS ON THE OVERHEAD NETWORK**

### **8.1 General**

Any necessary safety procedures including safety documentation, shrouding or screening of exposed live equipment shall be carried out before work starts. Care shall be taken for live work to be done outside any pole mounted transformer high voltage zone (i.e. provide adequate clearance). This may be achieved by working one pole length away from the pole mounted transformer.



The work shall proceed in a safe logical manner taking into account all the tasks to be undertaken. The work shall be planned with particular emphasis being taken on the safe positioning and connecting of the current sensors and voltage leads. The work shall be carried out by adequately authorised overhead linemen.

The current sensors shall be fixed on each overhead conductor (including the neutral) taking note that they are mounted using the correct polarity. For Grid Key sensors the arrow shall point towards the load but for Nortech sensors the arrow shall point towards the source.

Attention shall be paid to ensure that overhead switchgear and apparatus is not impeded by the monitoring equipment.

A fused low voltage connection is achieved via direct connection to the overhead conductors using Insulation Piercing Connectors or Line Taps. Any metal monitoring equipment shall be adequately earthed.

## **8.2 Installation Procedure**

Installation shall be carried out in accordance with Module 661 of CP423.

## **8.3 Maintenance**

Before any maintenance is carried out on the monitoring system the voltage leads shall be disconnected from the overhead line to de-energise the data concentrator.

The voltage leads shall only be reconnected once all work has been completed and the data concentrator needs to be energised again.

## **8.4 Removal**

8.4.1 Disconnect the voltage leads from the overhead conductors.

8.4.2 Disconnect the voltage leads from the data concentrator.

8.4.3 Remove the current sensors from each overhead conductor.

8.4.3 Disconnect the current leads from the data concentrator.

8.4.4 Carefully remove all current and voltage wiring from its situation and any associated cable ties and trunking.

8.4.6 Remove the data concentrator from its fixing and store the whole kit in a suitable storage box. All exposed conductors shall be screened or shrouded to prevent inadvertent contact whilst the removal takes place.

# **9. INSTALLATIONS ON THE CABLE NETWORK**

## **9.1 General**

Any necessary safety procedures including safety documentation shall be carried out before work starts.

The work shall proceed in a safe logical manner taking into account all the tasks to be undertaken. The work shall be planned with particular emphasis being taken on the safe connecting of the current sensors and voltage leads.

The current sensors shall be fixed on each core of the cable as per the relevant jointing procedure.

The voltage connection is achieved using a standard 3 phase service breech joint.

## **9.2 Installation Procedure:**

- 9.2.1 Install monitoring pillar, voltage and current sensor joints as per jointing procedure 3/501 in Code of Practice 411 taking the following into account.
- (i) The length of the current sensor leads is limited. Therefore the joint and the pillar can be no further apart than the length of these leads minus the lengths taken up in the joint and the pillar.
  - (ii) Before installing the current sensors the phases in the LV cable shall be correctly identified. This can usually be achieved by the use of the 'Kelvatek Retrace Phase and Feeder Identifier' or by any other approved means.
  - (iii) The current sensors shall be installed to ensure correct polarity measurements. For Grid Key sensors the arrow shall point towards the load but for Nortech sensors the arrow shall point towards the source.
- 9.2.2 On completion of the work all equipment will be left safe and tidy and a distribution substation door padlock as per ES309 shall be applied to the monitoring pillar.

## **9.3 Maintenance**

Before any maintenance is carried out on the monitoring system the fuses shall be removed from the cut out to de-energise the data concentrator.

The fuses shall only be inserted once all work has been completed and the data concentrator needs to be energised again.

## **9.4 Removal**

- 9.4.1 Remove the fuses from the cut-out.
- 9.4.2 Disconnect the voltage leads from the data concentrator.
- 9.4.3 Disconnect the current leads from the data concentrator.
- 9.4.4 Cut joint from system and replace with standard straight joint.
- 9.4.5 Carefully remove all current and voltage wiring from its situation and any associated cable ties and trunking.
- 9.4.6 Remove the cabinet.
- 9.4.6 Remove the data concentrator from its fixing and store the whole kit in a suitable storage box.

## **10. COMMISSIONING OF GRID KEY SYSTEMS**

The team at Linley House shall be informed one week in advance of the installation taking place. They can be contacted 0161 247 0643, 0161 247 0703 or 0161 247 0681.

On the day of commissioning, prior to installation the team at Linley House shall be informed of the site name, Ellipse reference, Grid Key data concentrator serial number and the number of ways to be used on the data concentrator.

Whilst the installation is taking place iHost can be configured. When the data concentrators are energised they automatically commence to stream data to the iHost server

When the Grid Key units are energised the LED lights on the front will go through a start up process. Correct operation is when the top left hand light (red) is not illuminated and the middle left light (green) is solidly illuminated. This should occur within 10 minutes of power up.

A check shall be made on the data being received at Linley House to ensure correct polarity of the current. If this shows an incorrect polarity the sensors shall then be re-installed to ensure the currents are reading correctly. IMPORTANT – On cable installations this check shall be done on completion of the installation, but before the joint is filled with resin.

An alternative way to check the correct operation of the data concentrator is by connecting a laptop and magnetic IR puck using the Grid Key installation software. The data concentrator can be connected using the “Set Up page”, configured using the “Configuration” page, and the installation and operation checked using the “Measurements” page (select Basic Measurements) and finally the settings can be saved to the data concentrator using the Summary page.

Should there be any issues with the installation or correct operation of the Grid Key system call the Grid Key technical helpline on 01268 887765.

At the end of the installation work the data team at Linley House shall be contacted to confirm completion.

A ‘LV monitor installation’ record as shown in Appendix A shall be completed for each data concentrator and sent to Lawrence Pautz at Linley House.

## **11. COMMISSIONING OF NORTECH SYSTEMS**

The team at Linley House shall be informed one week in advance of the installation taking place. They can be contacted 0161 247 0643, 0161 247 0703 or 0161 247 0681.

On the day of commissioning, prior to installation the team at Linley House shall be informed of the site name, Ellipse reference, Nortech data concentrator serial number and the number of ways to be used on the data concentrator.

Whilst the installation is taking place iHost can be configured. When the data concentrators are energised they automatically commence to stream data to the iHost server

When the Nortech units are started, a check may be made of the polarity of the sensor connections by reviewing the display on the internal meter.

A check shall be made on the data being received at Linley House to ensure correct polarity of the current. If this shows an incorrect polarity the sensors shall then be re-installed to ensure the currents are reading correctly. IMPORTANT – On cable installations this check shall be done on completion of the installation, but before the joint is filled with resin.

At the end of the installation work the data team at Linley House shall be contacted to confirm completion.

A ‘LV monitor installation record’ as shown in Appendix A shall be completed for each data concentrator and sent to Lawrence Pautz at Linley House.

## 12. DOCUMENTS REFERENCED

Electricity Safety, Quality and Continuity Regulations 2002

Electricity at Work Regulations 1989

Workplace (Health, Safety and Welfare) Regulations 1992

Personal Protective Equipment Regulations 1992

Electricity North West Electricity (Distribution) Safety Rules

ES309            Substation Locking

CP305           Reporting and Investigation of Network Equipment Defects - Procedures

CP411           Cable Jointing up to and Including 1000Volts

CP423           Linesmen's Manual Live Line Working

CP606           Operations Manual

## 13. KEYWORDS

Voltage; Current; Monitoring

## APPENDIX A –INSTALLATION RECORD

<b>Electricity North West LV Monitor Installation Record</b>
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<b>Manufacturer of System Installed</b>	
<b>Location</b>	
<b>Ellipse Reference Number</b>	
<b>Serial number of Data Concentrator</b>	
<b>IP Address (Nortech Only)</b>	
<b>Equipment installed by</b>	
<b>Date of Installation</b>	
<b>Data Concentrator Location</b>	
<b>LV Ways Fitted (will be 1 for cable installations).</b>	
<b>Transformer temperature sensor fitted (Nortech only)</b>	
<b>Grid Reference</b>	

Way Number	LV Way Label Name	Feature Number	Neutral Measured	Grid Hound or flexi Sensor Installed	Grid Hound or flexi Sensor Serial Number (if available)
1					
2					
3					
4					
5					
5					
7					
8					
9					
10					

<u>Comments</u>
<p>This section may be used to point out actual differences on-site as opposed to the planned information</p>